

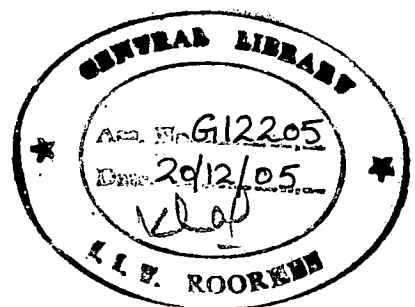
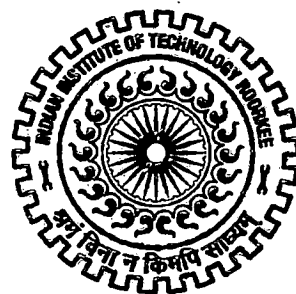
FUZZY RULE BASE MODELING FOR RESERVOIR OPERATION

A DISSERTATION

*Submitted in partial fulfillment of the
requirements for the award of the degree
of*
MASTER OF TECHNOLOGY
in
WATER RESOURCES DEVELOPMENT

By

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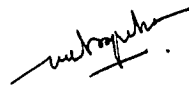
CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the dissertation entitled, "**Fuzzy Rule Base Modeling for Reservoir Operation**" in partial fulfillment of the requirement for the award of Degree of Master of Technology in WRD (CIVIL) submitted in the Department of Water Resources Development and Management, Indian Institute of Technology Roorkee, Roorkee is an authentic record of my own work carried out during the period July, 2004 till the date of submission under supervision of **Dr. ML Kansal**, Associate Professor, Department of WRD&M, Indian Institute of Technology Roorkee, India.

I have not submitted the matter embodied in this dissertation for the award of any other degree.

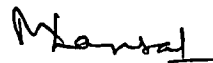
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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.



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ABSTRACT

Reservoir operation to find an optimal release has been researched for many years. Various techniques have been developed and adopted for reservoir operation rule incorporating the uncertainty due to stochastic nature of objectives in the reservoir operation and due to imprecise goal values in the reservoir purposes.

Relatively little of the research on reservoir operating procedures has found its way into actual practice. One reason is that operators are uncomfortable with complex optimization models and reluctant to use procedures that they do not fully understand. Fuzzy logic approach seems to offer a way to improve on existing operating practices, which is relatively easy to explain and understand.

In the present study, fuzzy stochastic dynamic programming model is used to calculate an optimal release from the operation of multipurpose single reservoir. Fuzzy stochastic dynamic programming uses a fuzzy approach to reflect an imprecise information in goals. In fuzzy approach a membership function is used which has the capability to incorporate the uncertainty involved in the objective. Markov chain process is adopted to generate transition probability matrices that are used by fuzzy stochastic dynamic programming. Transition probability matrices are derived from generated inflow data to the reservoir on monthly basis. The methodology is applied for suggesting the reservoir operation rules for Bendo reservoir system.

To derive operation rule for a multipurpose single reservoir a fuzzy rule base model is constructed. Operation rule are generated based on optimal release for reservoir operation resulted from fuzzy stochastic dynamic programming method. The fuzzy rule base model operates on an "IF-THEN" principle, where the "IF" is a vector of fuzzy explanatory variable or premises and "THEN" of fuzzy consequences. The reservoir storage volume, estimated inflows, and demand are used as the premise and release from the reservoir is taken as consequences.

Fuzzy associative memory (FAM) method is used in this study to derive a IF-THEN fuzzy rule base. Fuzzy associative memory used a fuzzy stochastic dynamic programming result as input-output data and a set of triangular membership function of storage, inflow, demand and release to derive a fuzzy rule base. The fuzzy rule base is constructed for the three set of membership function.

Fuzzy rule base operation procedures for reservoir that developed by fuzzy associative memory are simulated with the principle of water balance equation. After that, the results from the simulation are compared and evaluated. Performance indices namely reliability, repairability, incident period and vulnerability are used to evaluate performance of the reservoir operation rules. As comparison, the result of fuzzy stochastic dynamic programming is also simulated and evaluated with same procedure.

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CHAPTER I

INTRODUCTION

1.1 GENERAL

Reservoirs are the most important elements of complex water resource systems. They are used for spatial and temporal redistribution of water quantity. By building the dam, storage created may be used for flood control, hydroelectric power generation, recreation, and water conservation such as municipal, industrial and agricultural water supply.

Multipurpose reservoir operation involves various interactions and trade-offs between purposes, which are sometimes complementary but often competitive or conflicting. Reservoir operation may be based on the conflicting objectives of maximizing the amount of water available for conservation purposes and maximizing the amount of empty space available for storing future flood waters to reduce the downstream damages.

A real world reservoir operation model can be very complex. It has to incorporate all the input imprecision, while the output should fulfill all system requirements, such as meeting various demands without violating the physical constraints of the system. An appropriate tool to handle such imprecise elements is fuzzy logic because the uncertainty does not lie in the value of a variable, say inflow (which could be handled by probability), but also in the extent to which this variable belongs to a given imprecise (fuzzy) set, say “large inflows” (Shrestha et al., 1996).

Some studies to apply fuzzy approach for reservoir operation have been introduced. Shrestha et al. (1996) derived fuzzy rules from observed data sets and applied to reservoir operation rules. Russel et al. (1996) applied fuzzy logic to find operating procedures for single purpose hydroelectric project. Tilmant et al. (2002) developed a Fuzzy SDP model and compared with classical SDP model related to optimal release for reservoir operation. Dubrovin (2002) described a real time fuzzy control model for multipurpose reservoir operation. Hasebe and Nagayama (2002) made a comparison between reservoir operation

using fuzzy and neural network system and actual one by operator. Mousavi et al. (2004) introduced fuzzy state SDP in order to better capture and manage some uncertainties in applying SDP for reservoir operation. Karaboga et al. (2004) demonstrate the performance of fuzzy logic control based for the real time operation of spillway gates of a reservoir. In another study, fuzzy theory is provided to address interpreting linguistically described objectives for reservoir management (Owen et al., 1997), (Fontane et al., 1997).

The application of fuzzy rule base for the reservoir operation is presented in this study by derived Fuzzy rule base from the set of input-output data that resulted from the fuzzy stochastic dynamic programming model. Fuzzy SDP is used to derive an optimal release policy for reservoir operation. To derive an optimal release policy, fuzzy SDP used a fuzzy approach to describe objectives function and represented an objective function as a membership function. Markov chain model is used to accommodate a stochastic nature of inflow in SDP. Three variations of membership function are developed to derive fuzzy rule base system. By simulation, the effect of membership function choices in reservoir operation performance indices is shown.

1.2 OBJECTIVES AND ORGANIZATION OF DISSERTATION

The main objectives of the present dissertation are as follows:

- To study the historical inflow data of the Bendo project and to generate statistically similar synthetic data using Thomas-Fiering model.
- To calculate Markov chain transition probabilities from synthetically generated inflow data. These transition probabilities are used in fuzzy stochastic dynamic programming.
- To mathematically formulate the optimal release problem, i.e., derive an objective function, states and constraints, which can be solved using Fuzzy Stochastic Dynamic programming.
- To make the reservoir operating rules with fuzzy logic approach. The fuzzy rule bases are derived from the optimal results of Fuzzy Stochastic Dynamic Programming by using Fuzzy Associative Memory (FAM).
- To simulate and evaluate the reservoir operating rule from the fuzzy rule base. Fuzzy rule base operating rule is simulated for 20 years of synthetic inflow data and evaluated by calculating the performance index of reservoir operation. Performance indices consist of reliability, repairability, vulnerability and incident period.

The organization of dissertation is as follows:

- Chapter 2 explains the basics of reservoir operation, optimization methods for reservoir operation and discusses the study area that is used in this study.
- Chapter 3 describes how to work out the generation of inflow data by the Thomas-Fiering model. The generated data are used to develop transition probability matrices for fuzzy stochastic dynamic programming, which is further used to derive the fuzzy rule base for the reservoir operation.
- Chapter 4 deals with the application of dynamic programming for reservoir operation with Fuzzy Stochastic Dynamic Programming method to find an optimal release for the reservoir operation. Optimal releases are estimated using reservoir storage volume, inflow, and demand states. Markov chain process is used to derive transition probability matrices that describe stochastic process of the inflow. The objective function for model uses a fuzzy approach to reflect a managerial decision rather than monetary decision variables.
- Chapter 5 describes a fuzzy logic approach to work out a fuzzy rule base. A fuzzy rule base reservoir operation is developed in the IF-THEN form. Fuzzy associative memory (FAM) is used to derive a fuzzy rule base which is used in reservoir operation.
- Chapter 6 works out reservoir simulation using the fuzzy rule base and evaluates the performance of reservoir operation.
- Chapter 7 summarizes the conclusion of this study and makes some recommendations for future research.

CHAPTER II

RESERVOIR OPERATION

2.1 INTRODUCTION

Reservoir storage is necessary to use the highly variable water resources of a river basin for beneficial purposes such as municipal and industrial water supply, irrigation, hydroelectric and navigation. Dams and appurtenant structures also regulate rivers to reduce damages caused by floods. Public recreation, water quality, erosion, sedimentation, protection, and enhancement of fish, wildlife and other environmental resources are important considerations in management reservoir systems.

Generally, the total reservoir storage is divided into three principal segments: flood control storage, active storage and dead storage. Flood control storage capacity is used to reduce flood peaks and to minimize potential downstream damage. Active storage capacity is used to regulate streamflows and provide water supply for various purposes. Dead storage capacity is used for sediment control and recreation.

Public needs and objectives and numerous factors affecting reservoir management change over time. Population and economic growth in various regions are accompanied by increased needs for flood control, water supply, energy, recreation and the other services provided by water resources development. With an aging inventory of numerous dams and reservoirs are being operated in an environment of change and intensifying demands on limited resources, operational improvements in the reservoir operating rules are being considered increasingly more frequently.

Some researcher describes the definition of the operating rule. Wurbs (1996) defines a set of rules for determining the quantities of water to be stored and to be released or withdrawn from a reservoir under various conditions. ReVelle (2001) defines an equation or a chart or a look up table that specifies the amount to be released for various purposes as a function of system states and parameters. Typically, a regulation plan includes a set of quantitative criteria

within which significant flexibility exists for operator judgement. The operating rules provide guidance to the water managers who make the actual release decisions. In modelling, the reservoir system analysis model contains some mechanism for making release decisions within the framework of user specified operating rules and/or criteria function.

Reservoir operating rules and the operating decisions made within the framework of these rules involve (Wurbs, 1996):

- Allocating storage capacity and streamflow between multiple water users and types of use.
- Minimizing the risks and consequences of water shortages and flooding.
- Optimizing the beneficial use of water, energy and land resources.
- Managing environmental resources.

2.2 OPTIMIZATION OF RESERVOIR OPERATION

The development of optimal operating rules for reservoirs has been an active area of research for many years, indeed almost since the advent of computers. Many of the techniques have been developed or adopted to reservoir operation optimization. Simonovic et al. (1992) describe that the basic classification of reservoir optimization techniques consists of linear programming (LP), dynamic programming (DP), and nonlinear programming (NLP). Wurbs (1996) explains that linear programming dominates as the most widely applied of the numerous optimization methods, numerous reservoir operation models based on dynamic programming and various other nonlinear programming methods have been used less frequently.

Term optimization is used synonymously to refer to a modelling approach in which a formal algorithm computes values for a set or decision variables that minimize or maximize an objective function subject to constraints (Wurbs, 1996). Mathematical programming models are formulated in a specified format for solution with available standard methods. Although other nonlinear programming techniques have also been adopted, most reservoir system optimization models involve linear or dynamic programming and extension thereof.

In optimization models, the objective function and constraints are represented by mathematical expressions as a function of the decision variables. Reservoir operation models

incorporate a variety of decision variables, which typically include releases and storage volumes. The objective function may be a mathematical representation of a planning or operational objective, or may be a penalty or utility function used to define operating rules based on relative priorities. Constraints reflect mass balance, storage and discharge capacities, and other aspects of the reservoir systems. In the multiple stage optimization approach of dynamic programming, stages often represent time periods tied together by the state variable of storage.

2.3 FUZZY LOGIC BASE RESERVOIR OPERATION

Fuzzy logic and system techniques and the integration of these methods to provide a soft computing solution can now be used to model complex problems in water resources. Fuzzy logic offer real advantages over conventional modelling, including the ability to handle large amounts of dynamic or nonlinear data. Fuzzy logic and system can be especially useful when the underlying relationships are not fully understood (Şen, 2004).

The conventional set theory is based on two valued logic. Thus, there are only two possibilities; something is either a member of the set or not a member. The engineering analysis of uncertainty in real life has been modelled on the basis of binary logic. Nevertheless, many systems in real life strictly do not follow this binary logic. Fuzzy logic allows something to be partly this and partly that, rather than having all belongs to either this or that. The degree of belongingness to a set or a category can be described numerically by a membership grade between 0 and 1. The capability of fuzzy sets to express gradual transitions from a membership to a non membership and vice versa has a broad utility. Fuzzy sets provide not only with a meaningful and powerful representation of measurement uncertainties, but also with a meaningful representation of vague concepts expresses in natural language.

It is found that the various optimization models used for development of optimal operating rules for reservoir are very slow in finding their way into actual practice, particularly at the level of the actual operators. One reason is that operators are not comfortable with complex optimization models and reluctant to use procedures that they do not fully understand. Fuzzy logic seems to offer an improved way over the existing operation practices and is relatively easy to explain and understand (Rules and Campbell, 1996).

The development and adoption of fuzzy logic for planning and management of complex water resources systems is becoming popular in field of water resources engineering. There are various advantages by using fuzzy approach, the logical simplicity of the techniques, its ability to reflect human thinking and decision making process and the performance of operating policies generated by the techniques relative to the performance of operating policies by a traditional deterministic programming formulation.

One source of the complexity in a reservoir operation is attributed to randomness or vagueness involved in certain components of water resources systems. Randomness may be addressed for example in dealing with modelling streamflows while vagueness in dealing with imprecise parameters such as penalty coefficients of loss functions. The randomness and vagueness also characterize some or entire objective of most water resources systems. Water resource projects have an impact on a variety of economic, political, social, and environmental objectives that cannot be converted to monetary terms.

Applications of fuzzy set theory to reservoir operations have been used. Among them, fuzzy rule based (FRB) model have been used to derive IF-THEN operating rules. "IF" contains a vector of fuzzy or crisp explanatory variables that are called premise variables such as inflow, storage and demand, while "THEN" is a fuzzy or crisp consequent like release from the reservoir. Shresta (1996) describes that the fuzzy rule base model is transparent and easy to understand due to its rule based structure, which mimics the human way of thinking.

2.4 RESERVOIR OPERATION STUDY AREA

Bendo reservoir that use in this study is one of reservoir in Bengawan Solo catchment area. It is located in Ngindeng river / Keyang river one of Madiun river tributary that located on Ngindeng village, Ponorogo sub province. Bendo reservoir site can be reached from Ponorogo city about 16 km by road and about 5 km across path of village and forest. Location of the study area is shown in figure 2.1.

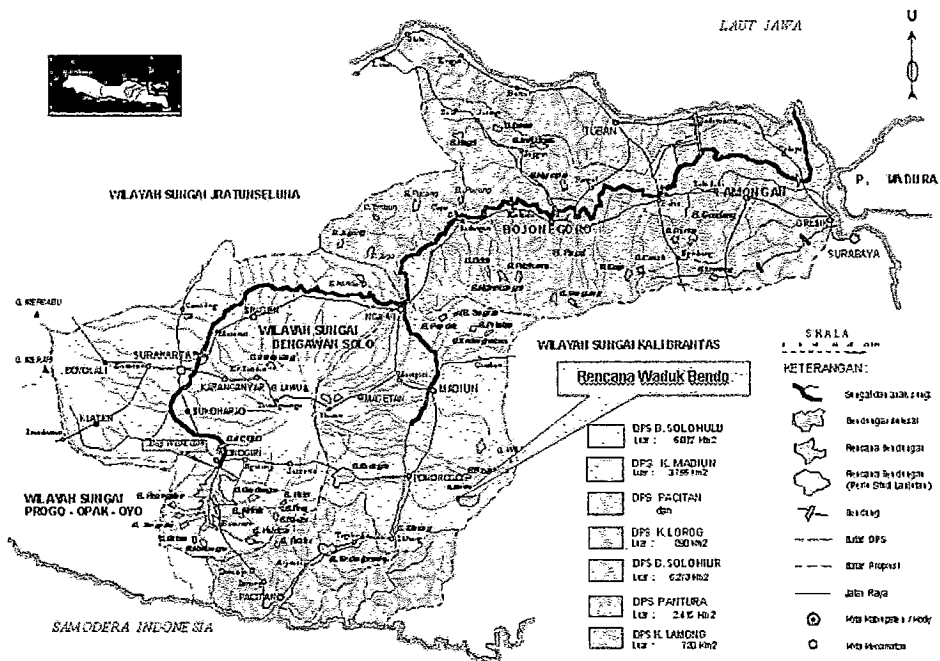


Figure 2.1 Location of Bendo reservoir

The river with an average annual inflow 181.11 million meter cubic (Mm^3) from a drainage basin of 120.63 km^2 enters Bendo reservoir. The reservoir has a usable storage capacity of 27802 Mm^3 with 13530 Mm^3 of dead storage capacity (anonymous, 2003).

This reservoir is expected to regulate the unstable streamflows of the Keyang river and provide water for irrigation and increasing water supply for drinking water and industry beside of flood control purpose. The reservoir irrigates 7799 ha of irrigation area and provides 790 l/sec water supply for Ponorogo city and surrounding areas (Anonymous, 2003). The average inflow and water demand of the system reservoir for every month are shown in table 2.1 and 2.2 respectively.

Table 2.1 Mean Monthly Inflow (Mm³)

Year Month	1997	1998	1999	2000	2001	2002	Average
January	26.36	51.52	28.92	40.99	14.27	67.95	38.33
February	33.95	18.57	13.96	15.60	59.38	23.53	27.50
March	99.28	51.88	15.76	14.08	16.86	22.63	36.75
April	81.73	7.30	3.90	12.14	53.00	23.93	30.33
May	1.34	3.01	11.78	11.70	9.09	3.22	6.69
June	3.86	1.37	4.83	8.57	0.97	0.55	3.36
July	1.28	0.68	0.87	7.59	3.72	0.29	2.40
August	0.72	0.25	1.52	2.46	0.22	0.20	0.90
September	0.45	0.13	0.15	0.32	0.22	0.07	0.23
October	0.62	0.12	0.64	0.41	0.15	0.04	0.33
November	37.90	2.54	2.36	5.26	4.41	3.49	9.33
December	16.02	36.71	2.31	9.93	78.76	6.07	24.97
Total	303.50	174.06	87.02	129.04	241.07	151.98	181.11

Table 2.2 Monthly Water Demand (Mm³)

Month	Water demand
Jan	15.09
Feb	12.80
Mar	11.56
Apr	23.26
May	29.82
June	23.45
July	18.71
Aug	8.51
Sept	15.01
Oct	10.30
Nov	8.09
Dec	10.73
Total	187.32

Our aim is to identify the optimal release policy for this reservoir using the fuzzy logic approach.

CHAPTER III

SYNTHETIC STREAMFLOW GENERATION

3.1 INTRODUCTION

Reservoir studies have provided a primary impetus for development of techniques of stochastic hydrology. Limited historical data may be extended by synthetic generation methods to provide the lengthy sequences required by certain types of reservoir system analysis exercises. Streamflow sequences of any specified length are synthesized based on preserving specified statistical parameter of the historical data, in the sense that the parameter values for an infinitely long sequence of synthetically generated flows would be the same as for the original data. Generated streamflows are called synthetic to distinguish them from historic observations.

Stochastic hydrology deals with the generation of data from an observed set, which would have the same characteristics, such as the mean, standard deviation and the correlation as that of the observed data set (Hmar, 2001). In stochastic dynamic programming that is adopted to reservoir operation study, the generation data are used to generate synthetic sequence of inflows, which are used to develop the transitional probability matrices required for stochastic dynamic programming. The synthetic inflow data are used also in the simulation of reservoir operation to evaluate performance of the reservoir operation rule in next years ahead under the generated data inflow condition.

3.2 THOMAS-FIERING MODEL

Thomas and Fiering used the Markov chain model for generating monthly flows by taking into consideration the serial correlation of monthly flows. The model allows a month to month correlation structure. Since annual values are never dependent with the previous values, the model is not suitable for generating yearly flow series.

The synthetic streamflow generation is illustrated by the lag-1 autoregressive Markov model for synthesizing monthly flows for a single station:

$$Q_{i,j} = Q_{avj} + r_j \left(\frac{S_j}{S_{j-1}} \right) (Q_{i,j-1} - Q_{avj-1}) + t_i S_j \sqrt{1-r_j^2} \quad (3.1)$$

$$Q_{i,j} = Q_{avj} + b_j (Q_{i,j-1} - Q_{avj-1}) + t_i S_j \sqrt{1-r_j^2} \quad (3.2)$$

Where :

- $Q_{i,j}$ = flow in *i*th years and *j*th months
- $Q_{i,j-1}$ = flow in *i*th years (*j-1*)th months
- Q_{avj-1} = mean monthly flow during (*j-1*)th months
- S_j = standard deviation for *j*th months
- S_{j-1} = standard deviation for (*j-1*)th months
- r_j = correlation coefficient between *j*th and (*j-1*)th month
- t_i = random numbers with zero mean and unit variance
- i* = year
- j* = month

$$b_j = r_j \left(\frac{S_j}{S_{j-1}} \right) \quad (3.3)$$

$$Q_{avj} = \frac{\sum Q_{i,j}}{N} \quad (3.4)$$

$$S_j = \left[\frac{\sum (Q_{i,j} - Q_{avj})^2}{(N-1)} \right]^{1/2} \quad (3.5)$$

$$r_j = \frac{\sum Q_{i,j} Q_{i,j-1} - (\sum Q_{i,j} \sum Q_{i,j-1}) / N}{\sqrt{\sum Q_{i,j}^2 - (\sum Q_{i,j})^2 / N} \sqrt{\sum Q_{i,j-1}^2 - (\sum Q_{i,j-1})^2 / N}} \quad (3.6)$$

Where :

- N = number of years for historic data

A sequence of flows ($Q_{i,j}$) is synthesized month by month, the flow for each month ($Q_{i,j}$) dependent on the flow just computed for the previous month ($Q_{i,j-1}$).

The stochastic model represented by equation includes deterministic and random components. The model deterministically regress flow in a given month with the flow in previous month

$$Q_{i,j} = Q_{av j} + b_j(Q_{i,j-1} - Q_{av j-1}) \tag{3.7}$$

This expression represents the expected value of the flow in a month, given the flow in the previous month. A random component:

$$t_j S_j \sqrt{1 - r_j^2} \tag{3.8}$$

is added to represent the random deviation of flows independent of the correlation with the previous month's flow.

When Thomas-Fiering model is fitted to monthly streamflows it is observed that some values in the generated sequence become negative. Where negative values are encountered, it is recommended that these values should be retained and used to derive the subsequent values in the sequence. Once the generated sequence is completed, all the negative values in the generated sequence should be replaced by zero (Patra, 2002).

3.3 GENERATION OF SYNTHETIC DATA

Initially a set of six years of monthly data observed was considered. This historical data (from January 1997 to December 2002) are shown in table 3.1.

Table 3.1 Historical Data

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1997	26.36	33.95	99.28	81.73	1.34	3.86	1.28	0.72	0.45	0.62	37.90	1.34
1998	51.52	18.57	51.88	7.30	3.01	1.37	0.68	0.25	0.13	0.12	2.54	3.01
1999	28.92	13.96	15.76	3.90	11.78	4.83	0.87	1.52	0.15	0.64	2.36	2.36
2000	40.99	15.60	14.08	12.14	11.70	8.57	7.59	2.46	0.32	0.41	5.26	9.00
2001	14.27	59.38	16.86	53.00	9.09	0.97	3.72	0.22	0.22	0.15	4.41	7.59
2002	67.95	23.53	22.63	23.93	3.22	0.55	0.29	0.20	0.07	0.04	3.49	6.79
Mean	38.33	27.50	36.75	30.33	6.69	3.36	2.40	0.90	0.23	0.33	9.33	2.40
SD	19.33	17.19	33.73	30.84	4.71	3.07	2.82	0.92	0.14	0.26	14.04	2.82
r (j,j-1)	-0.51	-0.59	0.08	0.67	-0.47	0.58	0.70	0.70	0.37	0.63	0.53	-0.51
b	-0.34	-0.53	0.16	0.61	-0.07	0.38	0.65	0.23	0.06	1.16	28.41	-0.34

From this inflow data, statistical parameters are estimated and used for synthetic generation of data by using Thomas-Fiering model as mentioned earlier. In generation of such synthetic data, normal distribution random numbers as shown in table 3.2 are used. The historical and generated inflow data are shown in table 3.3 and graphically represented in figure 3.1.

Table 3.2 Normal Distribution Random number

2.75551	0.255702	-0.25223	0.128141	0.8599022	-0.34066	1.212429	0.459729	1.026672	-0.17566	0.696039	2.138549
1.258709	-0.69663	1.090991	0.798302	1.1107613	1.655408	0.18826	-1.64911	-0.99681	-2.30151	-1.55069	-0.98469
-0.21042	0.080831	-0.31571	-0.53674	0.2900833	0.341552	0.078376	0.949879	1.215144	0.215508	-0.91421	1.297662
-2.72295	-1.93161	-1.3014	0.310652	1.1435395	-1.78525	-1.36736	1.544613	-1.83813	-0.4107	-0.01105	0.674465
-0.07186	-0.18281	1.997432	-0.7133	0.6312007	1.137673	0.396506	2.208308	0.548704	0.336124	-0.36557	1.306771
1.744233	0.253174	-1.41154	-0.03478	-1.325691	-0.81312	-0.51077	-0.14667	2.016932	-0.4043	-0.31057	-0.74867
-0.55958	-0.32836	0.138328	0.015568	-0.728076	0.119969	1.304979	-1.43107	1.378348	0.225698	0.547903	-0.56478
-0.85802	0.515913	0.061889	-0.04649	-0.047868	0.863783	0.152245	0.013503	-0.37771	-0.39692	0.042355	0.798302
-0.19972	-0.55387	0.156192	-1.61974	-0.454718	0.774435	0.218641	-0.92249	-0.57324	-1.25382	-0.25815	-0.72201
-1.28481	-0.50746	-2.23539	-0.70229	-1.945637	-0.80579	0.514691	0.405958	-0.25807	-1.02383	1.388707	-0.98805
-0.14451	-0.91166	1.079686	0.600958	-0.983321	-2.15075	0.413776	0.091504	0.565051	0.144355	-2.01811	0.762002
-0.95784	-0.80305	-0.36394	0.905184	-1.381918	0.901962	-1.12606	0.957837	0.724292	-0.09266	0.070015	-0.31563
0.406455	1.88259	-1.02447	1.905591	0.6314804	-0.4829	1.07736	-0.85284	-0.43244	0.798616	-0.22523	-0.38585
-0.55681	-0.99004	-1.24448	-0.87136	1.0118833	0.368439	-1.81382	0.885766	-0.95881	1.3506	-1.22886	-1.06757
1.587632	2.341112	0.117966	-1.01495	1.2639612	-0.60261	1.53163	-0.618	0.523444	-0.1125	0.171855	-2.66537
-1.11517	0.419618	-1.00311	-0.21778	1.4205034	0.161228	0.386594	-0.478	-0.98618	0.640282	-0.72668	1.122319
0.568284	-1.35193	-0.72808	0.029801	0.0317903	0.166888	-1.75235	0.875394	-1.03422	-2.10654	0.601324	-0.75395
0.495744	-0.26045	0.023449	-0.35513	-1.470512	-1.00286	0.569544	0.484961	-1.73589	-1.37855	-0.24725	-0.53895
-2.22346	-0.37467	-0.53453	0.587449	0.6571827	-1.21083	-0.83807	-0.41203	-0.63906	-0.42229	0.076228	-0.28905
1.409057	-0.62747	-1.13316	-1.13855	-2.027573	-0.85879	-1.93758	-0.78553	1.138696	1.289188	-0.54054	0.690009
0.586904	-0.0576	0.381488	-1.24448	-0.129529	1.135923	1.787889	2.040897	-0.15472	1.326798	-0.38998	0.906568
0.074157	-1.61804	1.637018	-1.8398	-0.127524	0.643572	-1.17119	-1.27302	0.368439	0.011589	-1.0953	-1.51938
1.310736	0.602884	-1.35691	-0.10719	0.535324	-0.648	-1.15673	-0.82284	0.340498	0.574951	0.532237	0.02452
1.129963	0.600958	2.395391	-0.637	-1.529902	1.183889	-1.36347	-2.22075	0.105342	0.626819	-0.8409	-1.85797
-0.59492	0.144123	-0.04948	-0.04971	-0.088817	-0.88837	0.270194	-0.69594	-0.90865	0.58754	0.956022	-0.16177
1.941089	-0.39105	0.278693	-1.15092	0.9130486	-1.34039	-0.01419	-0.53559	-0.36868	0.680336	-0.19933	0.239295
0.780335	0.990042	-1.45756	1.139429	-0.419118	0.644891	-0.10734	-1.42767	0.73909	1.668495	-0.34269	0.00241
0.515652	0.310009	1.086562	1.586823	-0.634191	-0.85703	-0.10565	0.821021	-2.62731	-0.11319	-1.05201	0.207529
-0.45684	0.561197	1.412991	-2.00309	-0.039752	-0.09696	1.813823	-1.37558	0.05913	-0.68043	-1.03775	-1.18868
-2.69305	-1.56225	-2.59493	0.163553	2.3821485	2.644592	0.9007	-0.52757	-0.89384	0.05844	-2.50431	-1.27268
0.230644	-1.46624	-0.11704	-0.43538	0.3798436	-0.60886	1.332537	-0.51836	-0.76446	0.27615	-0.98593	-0.24733
-0.34447	0.748269	-1.17759	-0.01067	-0.690786	-0.03853	-0.14528	0.316196	-1.00134	-1.37107	1.330682	0.123977
-1.86664	0.425139	-1.03474	-0.9732	-0.504065	-2.21895	1.452045	-0.49921	0.35953	-0.92824	0.206669	-2.69305
-0.5569	1.252815	1.048691	0.428155	0.308645	0.548614	0.460495	-0.51094	0.362061	-2.30042	-0.99179	-0.67908
1.51987	0.953971	-0.37024	-0.18538	1.6605463	0.304876	-2.17131	0.640377	-2.28454	1.00122	1.875442	0.11943
1.861417	0.303435	-0.55209	0.891785	1.3763747	-0.68594	1.223348	1.414653	1.003368	0.953248	0.572335	0.554583
0.408617	1.026283	-0.81152	0.691368	-0.036383	1.314902	-1.05148	-0.20378	0.297432	-0.07071	0.193246	0.565769
-1.52084	1.126928	1.672815	-0.00111	-1.368721	-0.47835	-1.01176	-1.65001	0.276785	-0.59784	0.114808	0.052464
1.678109	1.414446	0.534178	-0.37713	0.6887478	2.210072	-2.08927	-1.12765	0.009142	0.735374	0.766202	1.523276
0.258707	0.239846	1.379735	0.645173	-0.411196	0.010672	-1.45204	0.967198	0.548348	-0.12629	-1.12045	1.047895
-0.15371	0.785635	1.137819	-0.17348	-0.848113	-0.46595	1.420713	2.370543	-0.46475	0.67063	0.338391	0.590452
-2.6817	0.471837	-1.56693	-0.60206	-0.366965	-1.16982	0.496782	-0.89566	-0.74999	0.308405	-1.34133	0.257046
-0.87933	1.457115	-1.31182	-0.56568	0.324651	-0.30961	0.646587	-0.05951	-0.56129	1.022147	0.160841	0.27607
-0.71478	0.006387	-0.17341	-0.14745	0.2995921	-0.90819	0.167663	0.279965	-1.28901	0.352683	1.394346	-1.04499
-0.12621	-0.10334	0.075538	2.745437	-1.145158	1.508079	-1.48005	-1.67561	-0.58618	0.379761	-0.94724	0.613652
-1.30552	-1.39031	0.687392	0.537887	1.1654356	-2.24671	1.707276	0.398409	0.703467	1.931612	1.101173	0.658893
-0.06649	0.202997	0.458879	0.682942	-1.406174	2.160923	-0.0995	-0.21355	-1.69075	-0.69507	-0.97813	-2.01344
0.249463	1.225453	-1.77925	0.767332	0.6871005	-0.05407	-1.19569	2.083871	1.404737	-0.27043	1.428948	0.070935
-0.02574	0.511027	-1.58817	0.835034	-0.448197	-0.54853	0.827361	-0.17248	0.124902	-0.80579	-0.21308	-1.72056
0.046796	-0.65169	-0.44456	-0.26773	-0.155883	1.00476	0.642726	-1.49602	-0.06725	-0.67523	1.733479	-1.01983

mean -0.06808
variance 1.094521

Table 3.3 Historical and Synthetically Generated Inflow Data (Mm³)

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	
1997	26.36	33.95	99.28	81.73	1.34	3.86	1.28	0.72	0.45	0.62	37.90	16.02	Historical
1998	51.52	18.57	51.88	7.30	3.01	1.37	0.68	0.25	0.13	0.12	2.54	36.71	
1999	28.92	13.96	15.76	3.90	11.78	4.83	0.87	1.52	0.15	0.64	2.36	2.31	
2000	40.99	15.60	14.08	12.14	11.70	8.57	7.59	2.46	0.32	0.41	5.26	9.93	
2001	14.27	59.38	16.86	53.00	9.09	0.97	3.72	0.22	0.22	0.15	4.41	78.76	
2002	67.95	23.53	22.63	23.93	3.22	0.55	0.29	0.20	0.07	0.04	3.49	6.07	
2003	90.66	3.50	24.31	25.68	10.60	4.00	5.25	1.85	0.42	0.51	22.83	82.76	
2004	39.84	17.05	71.69	69.99	8.49	8.17	5.88	0.60	0.08	0.00	0.00	6.73	
2005	40.97	27.23	26.09	11.50	9.24	5.18	3.74	1.83	0.44	0.62	6.76	62.99	
2006	0.00	31.38	0.00	11.16	12.82	1.25	0.00	0.98	0.00	0.00	0.00	47.21	
2007	29.64	29.54	104.22	55.13	7.55	6.52	5.24	3.00	0.42	0.62	13.26	61.46	
2008	55.12	22.17	0.00	0.04	3.33	0.05	0.00	0.08	0.45	0.50	10.55	3.10	
2009	36.37	23.98	40.82	33.17	3.45	2.42	4.42	0.41	0.38	0.56	22.26	5.18	
2010	30.70	38.67	40.67	31.66	6.40	5.40	4.02	1.27	0.20	0.22	6.57	48.68	
2011	27.01	25.78	41.71	0.00	7.23	5.49	4.22	0.70	0.14	0.00	0.00	7.84	
2012	22.68	28.71	0.00	0.00	3.00	0.00	1.23	0.90	0.19	0.08	18.73	0.00	
2013	46.37	10.63	70.25	64.58	0.15	0.00	0.00	0.00	0.25	0.39	0.00	53.02	
2014	12.91	29.76	24.89	43.88	0.00	3.04	0.00	0.97	0.33	0.43	12.91	14.91	
2015	48.50	48.24	5.74	55.17	7.55	2.48	4.00	0.70	0.16	0.41	9.05	13.95	
2016	32.76	16.71	0.00	0.00	14.23	7.15	1.22	1.21	0.12	0.48	0.00	0.00	
2017	74.20	41.06	42.95	10.81	13.35	4.39	6.14	1.34	0.32	0.42	13.83	0.00	
2018	45.99	29.28	3.33	4.93	14.42	6.70	5.34	1.25	0.12	0.33	0.79	59.58	
2019	36.14	9.92	9.38	14.31	7.97	4.26	0.00	0.81	0.08	0.00	0.00	5.98	
2020	53.00	16.17	35.67	21.52	1.19	0.00	0.58	0.80	0.00	0.00	0.00	14.61	
2021	4.75	39.99	20.84	34.12	9.16	1.28	0.00	0.00	0.09	0.08	3.19	18.34	
2022	64.07	5.26	0.00	0.00	1.93	0.00	0.00	0.00	0.26	0.64	11.68	44.16	
2023	41.65	24.96	49.15	9.32	7.65	6.55	8.05	3.53	0.35	0.75	16.68	49.02	
2024	31.46	8.69	88.66	19.76	6.91	5.05	1.15	0.00	0.21	0.31	0.00	0.00	
2025	73.68	17.25	0.00	0.00	11.16	3.45	0.14	0.00	0.21	0.43	18.51	23.15	
2026	57.79	25.59	116.94	64.65	0.00	2.95	0.00	0.00	0.12	0.33	0.00	0.00	
2027	45.51	25.72	34.79	28.00	6.49	1.07	1.47	0.23	0.07	0.27	18.90	17.69	
2028	73.16	3.75	42.20	7.22	12.14	2.10	1.56	0.35	0.15	0.38	8.30	32.13	
2029	48.93	35.64	0.00	27.42	5.15	4.38	2.85	0.06	0.28	0.73	16.64	23.03	
2030	47.59	26.93	73.17	89.01	0.00	0.00	0.00	0.69	0.00	0.00	0.00	37.79	
2031	26.39	41.56	86.56	14.73	7.64	3.48	6.11	0.84	0.23	0.20	0.00	0.00	
2032	3.45	24.21	0.00	0.00	20.17	15.08	11.77	2.68	0.21	0.32	0.00	0.00	
2033	51.75	0.12	28.30	15.17	9.35	2.86	4.75	1.09	0.14	0.28	0.00	21.44	
2034	33.78	40.27	0.00	7.21	5.46	2.79	1.75	0.96	0.10	0.00	12.88	27.56	
2035	6.33	50.24	5.72	0.00	7.54	0.00	1.96	0.47	0.25	0.17	7.13	0.00	
2036	54.95	36.12	73.42	62.55	5.68	4.34	3.96	0.91	0.27	0.00	0.00	11.91	
2037	68.08	25.06	23.90	18.23	14.47	7.08	0.46	0.87	0.00	0.18	27.45	23.43	
2038	69.89	15.09	16.15	38.24	11.86	3.62	5.02	2.42	0.45	0.78	28.92	35.54	
2039	41.58	40.01	11.54	30.82	6.50	6.56	2.36	0.75	0.26	0.35	12.24	40.44	
2040	7.76	59.21	98.20	67.81	0.00	0.00	0.00	0.00	0.14	0.11	4.31	27.85	
2041	65.35	32.88	55.59	33.17	9.36	9.88	2.42	0.16	0.19	0.43	21.38	65.46	
2042	29.00	35.74	84.48	74.28	1.84	1.54	0.00	0.60	0.28	0.37	0.00	58.45	
2043	24.48	45.68	77.99	51.52	1.65	0.28	3.26	2.65	0.26	0.51	18.52	39.42	
2044	0.00	60.15	0.00	0.00	8.21	1.02	1.89	0.19	0.09	0.23	0.00	37.50	
2045	19.45	57.64	0.00	0.00	10.67	4.10	4.18	1.26	0.17	0.48	15.44	31.23	
2046	24.30	34.97	32.15	24.14	8.38	1.74	1.70	0.92	0.06	0.21	22.37	0.00	
2047	47.57	21.21	38.25	94.30	0.00	3.56	0.00	0.00	0.05	0.20	0.00	46.69	
2048	9.24	23.55	59.20	56.39	9.69	0.00	2.95	1.28	0.34	0.86	37.47	36.19	
2049	33.44	32.89	53.06	55.97	0.00	5.81	3.79	1.07	0.01	0.00	0.00	0.00	
2050	59.91	33.13	0.00	12.02	10.86	4.81	0.95	1.94	0.47	0.56	32.80	20.57	
2051	39.39	34.03	0.00	17.59	5.73	1.63	2.94	0.91	0.24	0.18	2.66	0.00	
2052	55.18	9.60	18.85	13.26	7.26	6.08	5.44	0.61	0.20	0.16	25.15	0.00	
mean	39.51	28.25	34.84	28.61	7.04	3.57	2.65	0.92	0.21	0.32	9.93	25.12	
SD	21.14	14.46	32.88	26.32	4.62	3.00	2.54	0.83	0.13	0.24	10.68	22.82	

Synthetical

Historical

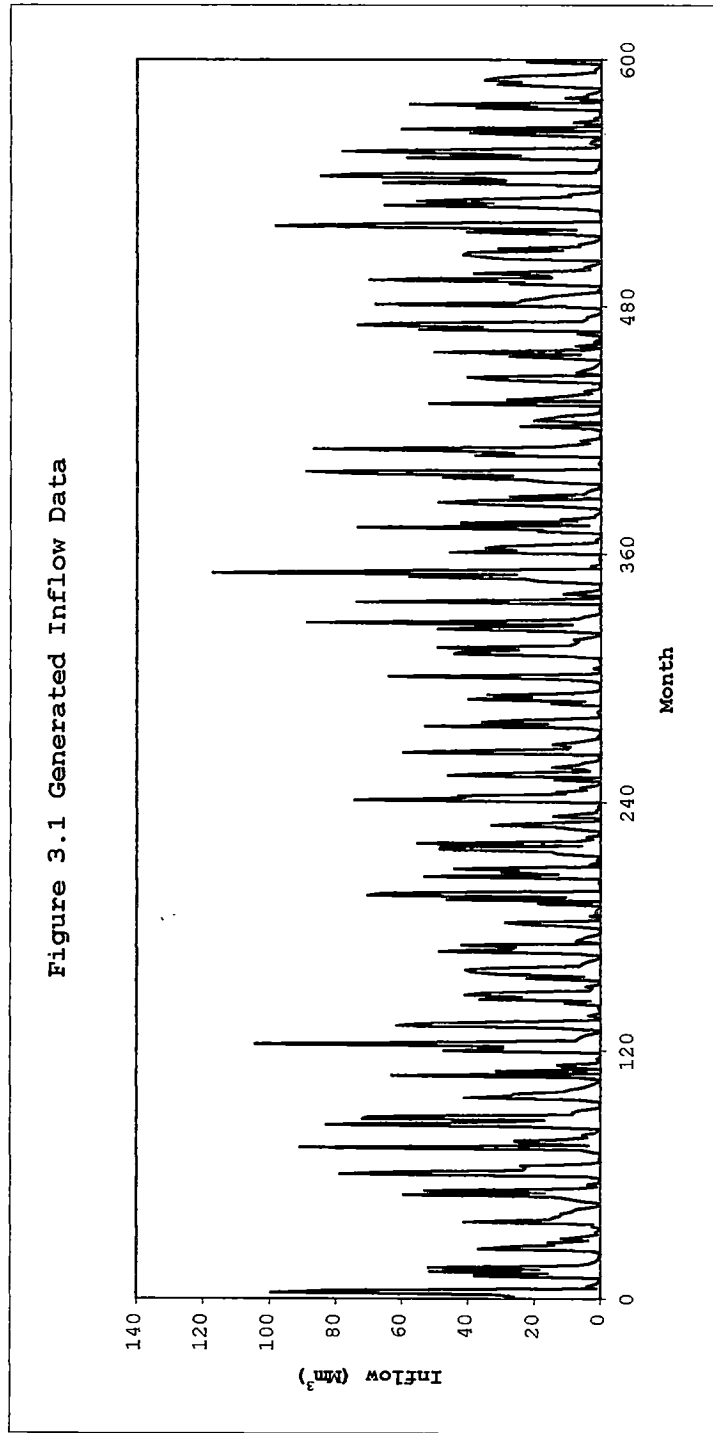


Figure 3.1 Generated Inflow Data

CHAPTER IV

RESERVOIR OPERATION MODELING THROUGH DYNAMIC PROGRAMMING

4.1 INTRODUCTION

Optimization of the reservoir operation is used to refer to a modelling approach in which a formal algorithm computes value for a set of decision variables that minimize or maximize an objective function subject to constraints.

In some cases, the same problem of optimization can be solved by alternative dynamic programming formulations or by either dynamic programming or linear programming. In general, linear programming has the advantage over dynamic programming of being more precisely defined and easier to understand. However, the strict linear form of the linear programming formulation can be significance hindrance. Nonlinear properties of the problem can readily reflected in a dynamic programming formulation. Functional relationship in the objective function and constraints can be nonlinear, nonconvex and discontinuous in dynamic programming. The so called curse of dimensionality is a major consideration in dynamic programming, meaning that increasing the number of state variables greatly increases the computational burden. ReVelle (2001) discusses more detail applications of linear programming for reservoir operation optimization.

Planning reservoir operation is a dynamic multistage decision making problem in which the decision made at a given stage and state has an impact on the future of the system. Dynamic programming and its variants have been implemented to determine efficient operating policies for multipurpose reservoir. Dynamic programming does not require any restriction on the shape of the objective function and can be extended to accommodate the stochastic nature of inflows, as well as the vagueness of some objectives and/or constraints. Fundamentals and applications of dynamic programming from the perspective of water resources planning and management are described in books by Loucks et al. (1981), Kottagoda (1982), and Wurbs (1996).

4.2 DYNAMIC PROGRAMMING

Dynamic programming is not precisely structured algorithm like linear programming, but rather a general approach to solving optimization problems. DP involves decomposing a complex problem into a series of simpler sub problems which are solved sequentially, while transmitting essential information from one stage of the computations to the next using state concepts. DP models have the following characteristics (Wurbs, 1996):

- The problem is divided into a sequence of stages with a decision required at each stage.
- Each stage of the problem must have a finite number of states associated with it. The stages describe the possible conditions in which the system might be at that stage.
- The effect of a decision at each stage of the problem is to transform the current state of the system into a state associated with the next stage.
- A return function indicating the utility or cost of the transformation is associated with each potential state transformation.
- The optimality of the decision required at the current stage is judged in terms of its impact on the return function for the current stage and all subsequent stages.

Dynamic programming is based on the following fundamental principle of optimality:

- No matter in what state of which stage one may be, in order for a policy to be optimal, one must proceed from that stage and state in an optimal manner.
- No matter in what state of which stage one may be, in order for a policy to be optimal, one had to get to that stage and state in optimal manner.

In dynamic programming, the reservoir operation decisions are taken sequentially in time, based on the known state of the system. The state of the system may be defined by the reservoir storage at the beginning of the period and the inflow during the previous period, both of which will be known when a release decision is to be taken. The reservoir operation problem is to decide how much to release during a period when a current state of the system is given, such that the performance measure of the system is optimized. The performance measure may be a cost, a benefit or a physical quantity such as the amount of hydropower generated, the flood mitigated, etc. The performance measure is included in dynamic

programming model through the objective function. Physical condition on the release and limits on storage define the constraints of the model. All variables involved in the decision process, such as the reservoir storage, inflow and release are all discretised into a finite number of class intervals

4.2.1 Deterministic Dynamic Programming

Reservoir operation models can be classified as either deterministic or stochastic based on the manner in which streamflow inflows are represented. Deterministic reservoir system analysis models are based on input streamflow sequences consisting of either adjusted historical period of record streamflows.

A Deterministic Dynamic Programming for reservoir operation is written as follows (Kumar, 1997):

$$f_t^n(S_t) = \text{maximize} [NB_t(S_t, S_{t+1}, R_t) + f_{t+1}^{n-1}(S_{t+1})] \quad (4.1)$$

subject to

$$S_{t+1} = S_t + I_t - R_t$$

$$S_t \leq S_{\max}$$

Where:

S_t = initial storage volume in period t.

S_{t+1} = final storage volume in period t.

R_t = release volume

$NB_t(S_t, S_{t+1}, R_t)$ = net benefit function.

The reservoir operation can be viewed as a multistage decision making process as illustrated in figure 4.1.

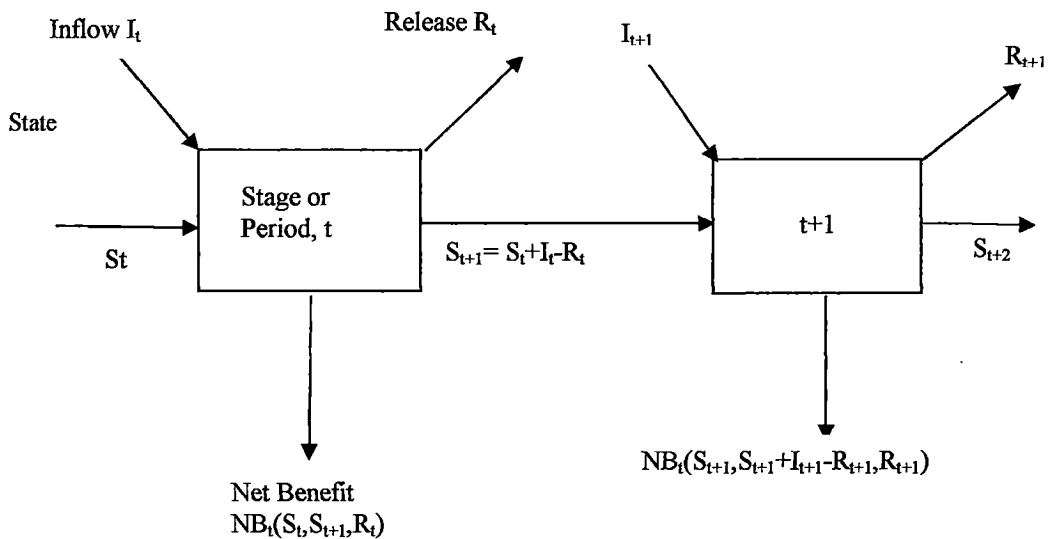


Figure 4.1 DP reservoir operation

4.2.1.1 Computational steps of Deterministic Dynamic Programming

The Deterministic Dynamic Programming involves the following general steps (Wurbs, 1996):

- Formulate the decision variables, recursive objective function, return function, constraints, stages and state variables.
- Solve a single stage optimization problem.
- Solve a two stage optimization problem.
- Solve a three stage optimization problem and so forth until all stages are included.

4.2.2 Stochastic Dynamic Programming

Real world decisions relating to most water resources systems need to be made in the face of hydrologic uncertainty. The hydrologic variables influencing the decisions, such as the rainfall in the command area, the inflows to a reservoir, evapotranspiration of crops that determine the irrigation requirements are all random variables.

The stochastic nature of the inflows is incorporated through a first order Markov chain in the SDP. The assumption of Markov chain implies that the dependence of the inflow during a period on the inflows during all previous periods is completely described by its dependence on the inflow during the previous period alone. Further, the transition probabilities are used to measure the dependence of the inflow during a period on the inflow during the previous period (Mujumdar, 1997).

The stochastic dynamic programming model provides a policy that maximizes the expected benefits of reservoir operation over an infinite planning horizon using the following recursive equation (Tilmant et al. 2002):

$$f_n^*(S_t, H_t) = E_{Q_t|H_t} \left\{ \max_{R_t} \left[B_t(S_t, Q_t, R_t) + E_{H_{t+1}|H_t, Q_t} f_{n-1}^*(S_{t+1}, H_{t+1}) \right] \right\} \quad (4.2)$$

subject to

$$\max(R_{\min}, S_t + Q_t - S_{\max}) \leq R_t \leq \min(R_{\max}, S_t + Q_t - S_{\min})$$

Where :

- n = number of stages remaining until the end of the planning horizon
- t = index of period
- S_t = storage at the beginning of period t
- H_t = hydrologic state variable in period t
- Q_t = inflow during period t
- R_t = release during period t
- $B_t(S_t, Q_t, R_t)$ = immediate benefit of system operation during period t
- $f_n^*(S_t, H_t)$ = expected future return from the optimal operation of the system from the current period t to the end of the planning horizon, given that the system's status in period t is (S_t, H_t)
- $E_{Q_t|H_t}$ = conditional expectation operator for Q_t given a specific hydrologic state H_t

One set of solutions of equation is the cost to go functions $f_n^*(S_t, H_t)$ which represent the value of the system over some planning period for a given volume in storage and a given hydrologic state. The optimal solution is obtained when release decisions generated by the

SDP algorithm reach steady state. The model is said to converge when the change in the cost to go function from one cycle to the next becomes nearly constant for each point of the discrete state space domain. The resulting steady state release policy and cost to go functions constitute the sets of solution that can be used by reservoir operators to derive an optimal release policy.

4.2.2.1 Markov Process

In recognition of hydrologic uncertainty and seasonality, reservoir inflows are described as periodic Markov processes. In the optimization of reservoir operation, the optimal release decisions are determined at the beginning of the current period with the information of the current reservoir storage state and the historical inflow records up to the previous time period. Based on the assumption of Markov dependence to describe the serial correlation of the stochastic inflow process, two state variables, the current inflow and the last period inflow, are involved.

The basic concepts of Markov process can be illustrated by considering the simple system shown in figure 1. In this system two system states are identifiable, being designated 1 and 2, the probabilities of remaining in or leaving a particular state in a finite time are also shown and these probabilities are assumed to be constant for all times into the future.

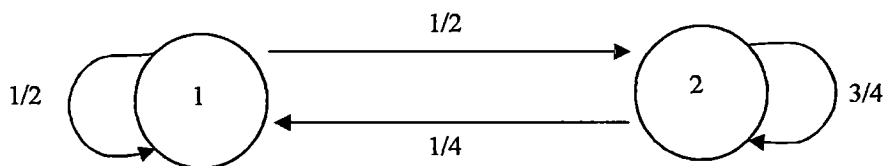


Figure 4.2 A two state system

In Markov process, the value of the random variable x_t depend only its value x_{t-1} for the previous time period $t-1$, but not the values of x that occurred for time periods before $t-1$ (i.e $t-2$, $t-3$, etc). In the other word, Markov process can be applicable if the behaviour of the system characterized by a lack of memory. Assume that the random variable can take on any one of a set of states A , where A consists of n states a_i ($i=1, 2, \dots, n$) then by definition of a Markov process, the probability that x exists in state j if it was in state i in the previous time period is denoted by

$$P(x_t = a_i | x_{t-1} = a_j) \tag{4.3}$$

As the number of states increases, the number of probabilities increases proportionally. For this reason, the transition probabilities are often presented in a square matrix.

$$P = [P_{ij}] = \begin{bmatrix} P_{11} & P_{12} & \dots & P_{1n} \\ P_{21} & P_{22} & \dots & P_{2n} \\ \vdots & \vdots & & \vdots \\ P_{n1} & P_{n2} & \dots & P_{nm} \end{bmatrix}$$

The one step transition probability matrix is subject to the constraint that the sum of probabilities in any row must equal 1.

$$\sum_{j=1}^n P_{ij} = 1 \tag{4.4}$$

The Markov approach can be applied to the random behaviour of systems that vary discretely or continuously with respect to time and space. This discrete or continuous random variation is known as a stochastic process.

When a Markov process generates inflows to the reservoir, Stochastic Dynamic Programming (SDP) is usually adopted to derive reservoir operating policies (Loucks et al., 1981). The SDP model provides release decisions in each time period as a function of both the storage volume at the beginning of the time period and the hydrologic state. The concepts of Markov chain process in hydrologic processes are given in Kottagoda (1982), Loucks et al. (1981), and Wurbs (1996).

4.2.3 Fuzzy Stochastic Dynamic Programming

The inherent imprecision and vagueness that characterize some or the entire objective of most water resources systems require that new approaches be developed. The vagueness may have several origins. Water resource projects have an impact on a variety of economic, political, social and environmental objectives, many of which can not or perhaps should not be converted to monetary terms. Another source of imprecision comes from the fact that benefit

function functions expressing the economic benefit of water based projects are usually constructed from relatively data points.

In classical optimization approaches, the performance of the reservoir resource is usually described through a benefit or loss function, which expresses the economic gains or losses associated with a release decision. Although useful, these approaches present limitations when non-economic objectives have to be taken into account. For example, water resources projects have an impact on a variety of economic, political, social and environmental objectives, whose conversion to monetary terms is still a matter of debate amongst economists (Tilmant et al., 2002).

Fuzzy set theory and fuzzy logic provide mathematical frameworks for dealing with vague object and approximate reasoning. Tilmant et al. developed a fuzzy explicit SDP approach with fuzzy operating objectives and a fuzzy intersection between immediate and future consequences associated with release decisions. Fuzzy criterion represented the degree of satisfaction associated with the states of the system.

Fuzzy Stochastic Dynamic Programming has the following form (Tilmant et al., 2002):

$$\mu_{G_n}^*(S_t, H_t) = E_{Q_t|H_t} \left\{ \max_{R_t} \left[\mu_{C_t}(S_t, Q_t, R_t) \cap E_{H_{t+1}|H_t, Q_t} \mu_{G_{n-1}}^*(S_{t+1}, H_{t+1}) \right] \right\} \quad (4.5)$$

Subject to

$$\max(R_{\min}, S_t + Q_t - S_{\max}) \leq R_t \leq \min(R_{\max}, S_t + Q_t - S_{\min})$$

Where :

- n = number of stages remaining until the end of the planning horizon
- t = index of period
- S_t = storage at the beginning of period t
- H_t = hydrologic state variable in period t
- Q_t = inflow during period t
- R_t = release during period t
- $\mu_{C_t}(S_t, Q_t, R_t)$ = membership grade of the aggregated fuzzy constraints for period t

- $\mu_{G_n}^*(S_t, H_t)$ = expected membership grade from the optimal operation of the system from the current period t to the end of the planning horizon, given that the system's status in period t is (S_t, H_t)
- $E_{Q_t|H_t}$ = conditional expectation operator for Q_t given a specific hydrologic state H_t
- \cap = "fuzzy AND" operator

In the FSDP model, the multiple operating objectives are considered as fuzzy constraints and must be aggregated so as to ensure their simultaneous satisfaction. The decision space is then obtained from the fuzzy intersection between the aggregated fuzzy constraints $\mu_{C_t}(S_t, Q_t, R_t)$ and the fuzzy goal $\mu_{G_{n-1}}^*(S_{t+1}, H_{t+1})$. The latter represents the expected membership grades of optimal future operation and is available only at the grid points of the state space domain. Finally, the optimal decision is chosen so that the membership grade of the expected decision set is maximized.

The aggregation of the fuzzy constraints is carried out by a weighted sum to reflect their relative importance. If nc is the number of operating objectives and ω the weights, then the aggregation operation has the following form (Tilmant et al., 2002):

$$\mu_{C_t}(S_t, Q_t, R_t) = \sum_{i=1}^{nc} \omega_i \mu_{C_t}^i(S_t, Q_t, R_t) \quad (4.6)$$

Where $\sum_{i=1}^{nc} \omega_i = 1$ (4.7)

Logical "AND" does not allow for any compensation since the membership grade of the intersection is independent of the membership grade of the nonminimum intersected sets. To deal with this compensation problem, the logical "AND" is replaced by a "fuzzy AND" operator represented by a parametric function where the compensation parameter γ can be modified so as to adjust the meaning of "AND" from the traditional min-operator to the operative mean (Tilmant et al., 2002):

$$\mu_{C_t} \bar{\cap} \mu_{G_{n-1}}^*(\cdot) = \gamma \min[\mu_{C_t}(\cdot), \mu_{G_{n-1}}^*(\cdot)] + (1 - \gamma) \frac{\mu_{C_t}(\cdot) + \mu_{G_{n-1}}^*(\cdot)}{2} \quad (4.8)$$

Tilmant et al. show that the best system performance essentially the reliability of system operation and reasonable computation time are obtained from the FSDP model with the compensation parameter γ equal to 0.8 (Tilmant et al., 2002).

As with the classical SDP model, the steady state release policy R^* , and membership function $\mu^*_{G_n}$ constitute the two sets of solutions of the FSDP algorithm. The steady state solution is found when the difference between the membership functions for two successive cycles (years) becomes nearly constant for all states and all periods (months).

4.2.3.1 Computational steps of Stochastic Dynamic Programming

The following steps are involved in Stochastic Dynamic Programming and Fuzzy Stochastic Dynamic Programming.

- a. Generate synthetic data inflow from the historic data inflow by using Thomas-Fiering model and convert into unit with discrete ranges.
- b. Compute Markov chain transitional probabilities for data inflows.
- c. Formulate state variables, constraints, recursive objective function and decision variable.
- d. Solve a single stage optimization, second stage optimization problem and so forth until the steady state condition reaches.

The implementation of SDP and FSDP derived policies relies on one of the two sets of solutions obtained from each algorithm. The solution of an SDP model of reservoir provides the optimal policy tables R_t^* and the cost to go functions f_n^* , while for the FSDP model, the solution sets are the optimal policy tables R_t^* and the membership functions $\mu_{G_n}^*$.

4.2.4 Deterministic and Stochastic DP

Various methods has been used in the reservoir operation problem. Among these methods, dynamic programming (DP) has been found a powerful tool, as it well suited to problem that need sequential decision making.

Reservoir system dynamic programming optimization models are classified as deterministic or stochastic depending primarily on the manner in which the streamflow inflows are handled (Wurbs, 1996). Variables other than streamflow can be treated as being stochastic

as well. In a deterministic dynamic programming the inflows for each time interval are given. In a stochastic model, the inflows are treated as a stochastic process rather than as known values. The typical approach is to model inflows as a Markov process represented by transition probability matrices. The inflow in a given time interval can be various discrete values with probabilities conditioned on the flow in the previous time period.

The dynamic programming computational algorithm is similar for either deterministic or stochastic inflows. In deterministic, the objective function is determined for a specified decision based on the known inflow. The difference in stochastic DP is that the expected value of the objective function that reflects the full range of possible inflow with their associated probabilities is determined. For simplicity, the inflows are typically treated as falling in discrete ranges.

As an extension of DP approach and among the optimization methods dealing with uncertainty issues, stochastic dynamic programming has been widely used for optimizing reservoir operations. In stochastic DP model, uncertainty due to random inflows to reservoir is captured by probability functions of inflows. Since uncertainty of inflows is due to random nature of the variable, probabilistic approaches is used in modelling this type of uncertainty.

4.2.5 SDP and Fuzzy SDP

The inherent imprecision and vagueness that characterize some or all the objective of most water resource systems require that new approaches be developed. The fact that benefit function expressing the economic benefit are usually constructed from relatively few data points and some benefit cannot or perhaps should not be converted to monetary terms.

Fuzzy stochastic dynamic programming primary advantage is its ability to explicitly capture water users and manager's preferences, as well as the associated vagueness. This is achieved through construction of the membership function and determination of the weights. Nevertheless, the fact that the objective function is no longer expressed in monetary units might constitute disadvantage of the FSDP model (Tilmant et al., 2002).

4.3 FSDP MODEL FOR BENDO RESERVOIR OPERATION

Fuzzy stochastic dynamic programming is implemented in Bendo reservoir operation optimization. In this study, membership grade, which reflected a satisfaction degree from flood control and water demand objectives, is used instead of cost to go benefit functions.

The following steps of Fuzzy Stochastic Dynamic programming was applied to find an optimal release for the reservoir operation. The active storage of capacity is divided into 16 states and the inflow is divided into 12 states. A Thomas-Fiering model is fitted to the inflow data. The model is used to generate synthetic sequences of reservoir inflows, which are used to develop the transitional probability matrices required for the FSDP model. Transitional probability computes how many events the pair of unit inflow for successive month is coming. For example, the event of 2 unit in May and 1 unit in June is 10, the event of 2 unit in May is 11 so that the Markov chain transition probability for 2 unit in May and 1 unit in June is $10:11 = 0.91$.

Monthly inflows that are used in this model are converted into 12 units. Range units for water demand, storage and releases, water demand unit, inflow data unit and range, and transition probability matrices for every month are shown in table 4.1, 4.2, 4.3 and 4.4 respectively.

Table 4.1 Unit ranges for demand, release and storage

range	unit
1-3	0.2
3.01-5	0.4
5.01-7	0.6
7.01-9	0.8
9.01-11	1
11.01-13	1.2
13.01-15	1.4
15.01-17	1.6
17.01-19	1.8
19.01-21	2
21.01-23	2.2
23.01-25	2.4
25.01-27	2.6
27.01-29	2.8
29.01-31	3
31.01-33	3.2
33.01-35	3.4
35.01-37	3.6
37.01-39	3.8
39.01-41	4
41.01-43	4.2

Table 4.2 Monthly water demand (unit)

Month	Water demand
Jan	1.6
Feb	1.2
Mar	1.2
Apr	2.4
May	3
June	2.4
July	1.8
Aug	0.8
Sept	1.6
Oct	1
Nov	0.8
Dec	1

Table 4.3 Inflow Data in unit

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1997	3	4	10	9	1	1	1	1	1	1	4	2
1998	6	2	6	1	1	1	1	1	1	1	1	4
1999	3	2	2	1	2	1	1	1	1	1	1	1
2000	4	2	2	2	2	1	1	1	1	1	1	1
2001	2	6	2	6	1	1	1	1	1	1	1	8
2002	7	3	3	3	1	1	1	1	1	1	1	1
2003	9	1	3	3	1	1	1	1	1	1	3	9
2004	4	2	8	7	1	1	1	1	1	1	1	1
2005	4	3	3	2	1	1	1	1	1	1	1	7
2006	1	4	1	2	2	1	1	1	1	1	1	5
2007	3	3	11	6	1	1	1	1	1	1	2	7
2008	6	3	1	1	1	1	1	1	1	1	1	1
2009	4	3	4	4	1	1	1	1	1	1	3	1
2010	3	4	4	4	1	1	1	1	1	1	1	5
2011	3	3	5	1	1	1	1	1	1	1	1	1
2012	3	3	1	1	1	1	1	1	1	1	2	1
2013	5	1	7	7	1	1	1	1	1	1	1	6
2014	2	3	3	5	1	1	1	1	1	1	2	2
2015	5	5	1	6	1	1	1	1	1	1	1	2
2016	4	2	1	1	2	1	1	1	1	1	1	1
2017	8	5	5	1	2	1	1	1	1	1	2	1
2018	5	3	1	1	2	1	1	1	1	1	1	6
2019	4	1	1	2	1	1	1	1	1	1	1	1
2020	6	2	4	3	1	1	1	1	1	1	1	2
2021	1	4	2	4	1	1	1	1	1	1	1	2
2022	7	1	1	1	1	1	1	1	1	1	2	5
2023	5	3	5	1	1	1	1	1	1	1	2	5
2024	4	1	9	2	1	1	1	1	1	1	1	1
2025	8	2	1	1	2	1	1	1	1	1	2	3
2026	6	3	12	7	1	1	1	1	1	1	1	1
2027	5	3	4	3	1	1	1	1	1	1	2	2
2028	8	1	5	1	2	1	1	1	1	1	1	4
2029	5	4	1	3	1	1	1	1	1	1	2	3
2030	5	3	8	9	1	1	1	1	1	1	1	4
2031	3	5	9	2	1	1	1	1	1	1	1	1
2032	1	3	1	1	2	2	2	1	1	1	1	1
2033	6	1	3	2	1	1	1	1	1	1	1	3
2034	4	4	1	1	1	1	1	1	1	1	2	3
2035	1	5	1	1	1	1	1	1	1	1	1	1
2036	6	4	8	7	1	1	1	1	1	1	1	2
2037	7	3	3	2	2	1	1	1	1	1	3	3
2038	7	2	2	4	2	1	1	1	1	1	3	4
2039	5	4	2	3	1	1	1	1	1	1	2	4
2040	1	6	10	7	1	1	1	1	1	1	1	3
2041	7	4	6	4	1	1	1	1	1	1	3	7
2042	3	4	9	8	1	1	1	1	1	1	1	6
2043	3	5	8	6	1	1	1	1	1	1	2	4
2044	1	6	1	1	1	1	1	1	1	1	1	4
2045	2	6	1	1	1	1	1	1	1	1	2	4
2046	3	4	4	3	1	1	1	1	1	1	3	1
2047	5	3	4	10	1	1	1	1	1	1	1	5
2048	1	3	6	6	1	1	1	1	1	1	4	4
2049	4	4	6	6	1	1	1	1	1	1	1	1
2050	6	4	1	2	1	1	1	1	1	1	4	2
2051	4	4	1	2	1	1	1	1	1	1	1	1
2052	6	1	2	2	1	1	1	1	1	1	3	1

range	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-121
unit	1	2	3	4	5	6	7	8	9	10	11	12

This study assumes that decision maker's preferences are available. Membership function of the flood control and water demand objectives is implemented with the direct method, where the membership function consists of the most acceptable values whereas assigned to membership degree 1 and least acceptable values whereas receive membership degree 0 of the storage level and the release.

Membership function for storage level regarding to flood control function of the dam is linear from full storage that has membership degree 0 and dead storage with 1 membership degree. In water demand satisfaction level, 1 membership degree is assigned where 100% of water demand is fulfilled by the release and the water demand membership function has a 0 membership degree whereas fulfillment is below 60%. The membership degrees are varying from 0 to 1 in range of 60% up to 100% of water demand fulfillment.

The membership function for storage level in case of flood control function and membership function which is mentioning a satisfied level of water demand regarding to release in every month are shown in figure 4.3.

The FSDP model maximizes the membership grade of the decision set obtained from the combination of the flood control function and water demand. In this case, the flood control has a weight 0.3 and water demand has a weight 0.7. The weight of them reflects an importance function in the reservoir operation.

A FSDP model is written as follows:

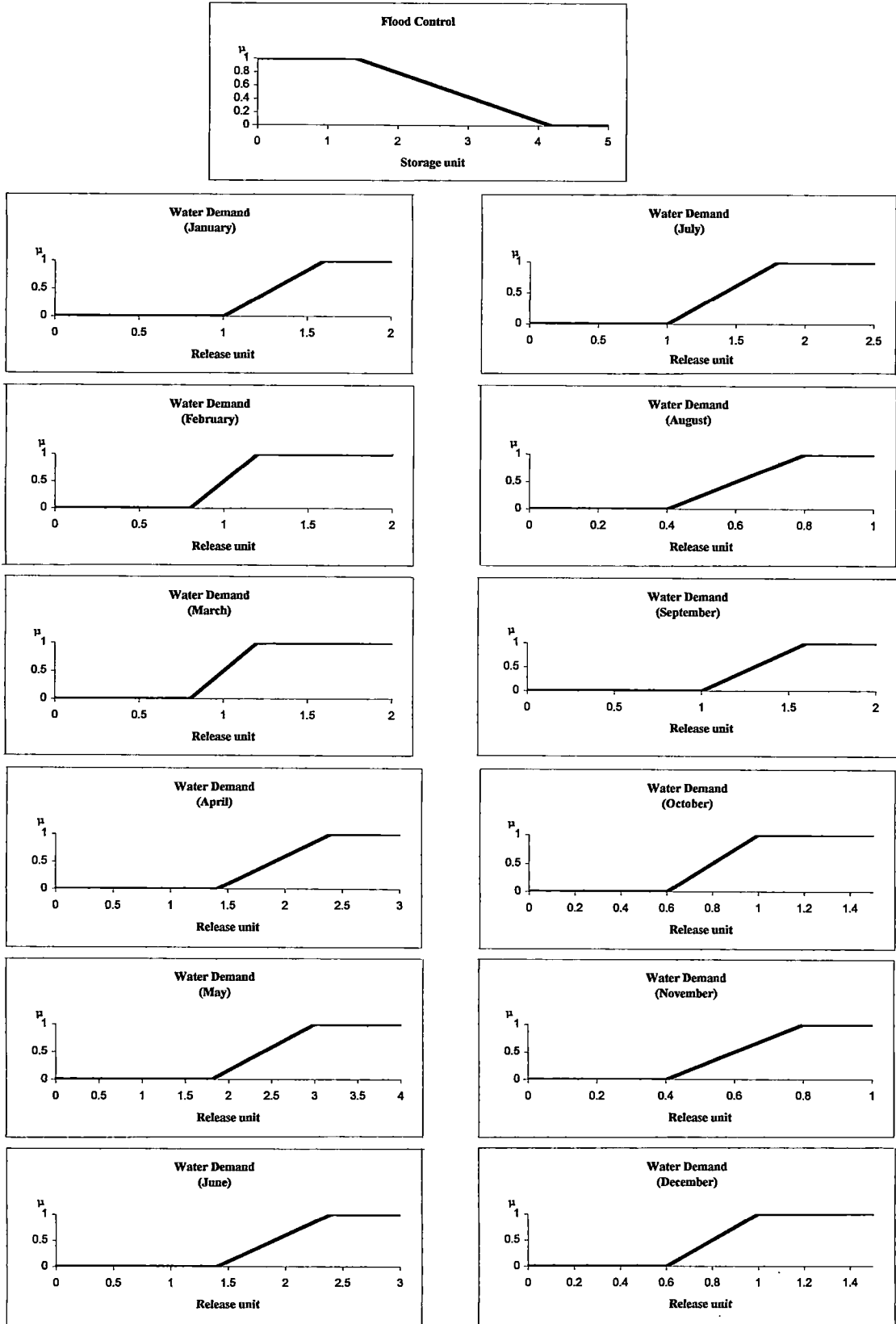
$$\mu_{G_n}^*(S_t, Q_t) = \left\{ \max_{R_t} \left[\mu_{C_t}(S_t, Q_t, R_t) \cap \sum_{Q_{t+1}} P(Q_{t+1} | Q_t) \cdot \mu_{G_{n-1}}^*(S_{t+1}, Q_{t+1}) \right] \right\} \quad (4.9)$$

subject to

$$\max(R_{\min}, S_t + Q_t - S_{\max}) \leq R_t \leq \min(R_{\max}, S_t + Q_t - S_{\min})$$

$$S_{t+1} = S_t + Q_t - R_t$$

Figure 4.3 Membership Function for Flood Control and Water Demand



4.3 RESULTS AND DISCUSSION

Initial conditions for the computation of optimal releases of Bendo reservoir by FSDP for every month are shown in table 4.5. The computation was done recursively and iteration was done until the steady state condition is reached. The final iteration for the fuzzy stochastic dynamic programming can be shown in table 4.6.

Fuzzy stochastic dynamic programming results an optimal release for reservoir operation in every month and states. The final result comes from the highest of Degree Of Fulfillment (DOF) for every states. States in this fuzzy stochastic dynamic programming consist of storage level and inflow whereas as all states and release are shown is unit.

The final results of optimal release for the Bendo reservoir operation by fuzzy stochastic dynamic programming are shown in table 4.7.

Table 4.5 Initial Condition of FSDP Calculation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1.6

January

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ* _{Gn} (St,Qt) [13]	
									Demand [10]	F C [11]			
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000	
						0.4	2	2	0.00	1.00	0.30		
						0.6	1.8	1.8	0.00	1.00	0.30		
						0.8	1.6	1.6	0.00	1.00	0.30		
						1	1.4	1.4	0.00	1.00	0.30		
						1.2	1.2	1.2	0.00	1.00	0.30		
	2	-0.8	0.2	0.2	2	1.6	0.2	3.2	3.2	0.00	1.00	0.30	1.0000
							0.4	3	3	0.00	1.00	0.30	
							0.6	2.8	2.8	0.00	1.00	0.30	
							0.8	2.6	2.6	0.00	1.00	0.30	
							1	2.4	2.4	0.00	1.00	0.30	
							1.2	2.2	2.2	0.33	1.00	0.53	
	3	0.2	0.2	0.2	3	1.6	1.4	2	2	0.67	1.00	0.77	1.0000
							1.6	1.8	1.8	1.00	1.00	1.00	
							0.2	4.2	4.2	0.00	1.00	0.30	
							0.4	4	4	0.00	1.00	0.30	
							0.6	3.8	3.8	0.00	1.00	0.30	
							0.8	3.6	3.6	0.00	1.00	0.30	
4	1.2	1.2	1.2	4	1.6	1	3.4	3.4	0.00	1.00	0.30	1.0000	
						1.2	3.2	3.2	0.33	1.00	0.53		
						1.4	3	3	0.67	1.00	0.77		
						1.6	2.8	2.8	1.00	1.00	1.00		
						1.2	4.2	4.2	0.33	1.00	0.53		
						1.4	4	4	0.67	1.00	0.77		
5	2.2	2.2	2.2	5	1.6	1.6	4.8	4.2	1.00	1.00	1.00	1.0000	
						1.6	5.8	4.2	1.00	1.00	1.00		
6	3.2	3.2	3.2	6	1.6	1.6	5.8	4.2	1.00	1.00	1.00	1.0000	
						1.6	6.8	4.2	1.00	1.00	1.00		
7	4.2	4.2	4.2	7	1.6	1.6	6.8	4.2	1.00	1.00	1.00	1.0000	
						1.6	7.8	4.2	1.00	1.00	1.00		
8	5.2	5.2	5.2	8	1.6	1.6	7.8	4.2	1.00	1.00	1.00	1.0000	
						1.6	8.8	4.2	1.00	1.00	1.00		
9	4.8	4.8	4.8	7.6	1.6	1.6	8.8	4.2	1.00	1.00	1.00	1.0000	
						1.6	8.8	4.2	1.00	1.00	1.00		
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.5119	
						0.4	2.2	2.2	0.00	0.93	0.28		
						0.6	2	2	0.00	0.93	0.28		
						0.8	1.8	1.8	0.00	0.93	0.28		
						1	1.6	1.6	0.00	0.93	0.28		
						1.2	1.4	1.4	0.33	0.93	0.51		
	2	-0.6	0.2	0.2	2.2	1.6	0.2	3.4	3.4	0.00	0.93	0.28	0.9786
							0.4	3.2	3.2	0.00	0.93	0.28	
							0.6	3	3	0.00	0.93	0.28	
							0.8	2.8	2.8	0.00	0.93	0.28	
							1	2.6	2.6	0.00	0.93	0.28	
							1.2	2.4	2.4	0.33	0.93	0.51	
	3	0.4	0.4	0.4	3.2	1.6	1.4	2.2	2.2	0.67	0.93	0.75	0.9786
							1.6	2	2	1.00	0.93	0.98	
							0.4	4.2	4.2	0.00	0.93	0.28	
							0.6	4	4	0.00	0.93	0.28	
							0.8	3.8	3.8	0.00	0.93	0.28	
							1	3.6	3.6	0.00	0.93	0.28	
4	1.4	1.4	1.4	4.2	1.6	1.2	3.4	3.4	0.33	0.93	0.51	0.9786	
						1.4	3.2	3.2	0.67	0.93	0.75		
						1.6	3	3	1.00	0.93	0.98		
						1.4	4.2	4.2	0.67	0.93	0.75		
						1.6	4	4	1.00	0.93	0.98		
						1.6	5	4.2	1.00	0.93	0.98		

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]
									Demand [10]	FC [11]		
	6	3.4	3.4	6.2	1.6	1.6	6	4.2	1.00	0.93	0.98	0.9786
	7	4.4	4.4	7.2	1.6	1.6	7	4.2	1.00	0.93	0.98	0.9786
	8	5.4	5.4	8.2	1.6	1.6	8	4.2	1.00	0.93	0.98	0.9786
	9	4.8	4.8	7.6	1.6	1.6	9	4.2	1.00	0.93	0.98	0.9786
1.8	1	-1.4	0.2	1.4	1.4	0.2	2.6	2.6	0.00	0.86	0.26	0.7238
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.00	0.86	0.26	
						1	1.8	1.8	0.00	0.86	0.26	
						1.2	1.6	1.6	0.33	0.86	0.49	
						1.4	1.4	1.4	0.67	0.86	0.72	
						1.6	1.2	1.2	1.00	0.86	0.96	
						1.6	1.2	1.2	1.00	0.86	0.96	
	2	-0.4	0.2	2.4	1.6	0.2	3.6	3.6	0.00	0.86	0.26	0.9572
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
						0.8	3	3	0.00	0.86	0.26	
						1	2.8	2.8	0.00	0.86	0.26	
						1.2	2.6	2.6	0.33	0.86	0.49	
						1.4	2.4	2.4	0.67	0.86	0.72	
						1.6	2.2	2.2	1.00	0.86	0.96	
						1.6	2.2	2.2	1.00	0.86	0.96	
	3	0.6	0.6	3.4	1.6	0.6	4.2	4.2	0.00	0.86	0.26	0.9572
						0.8	4	4	0.00	0.86	0.26	
						1	3.8	3.8	0.00	0.86	0.26	
						1.2	3.6	3.6	0.33	0.86	0.49	
						1.4	3.4	3.4	0.67	0.86	0.72	
						1.6	3.2	3.2	1.00	0.86	0.96	
						1.6	3.2	3.2	1.00	0.86	0.96	
						1.6	3.2	3.2	1.00	0.86	0.96	
						1.6	3.2	3.2	1.00	0.86	0.96	
4	1.6	1.6	4.4	1.6	1.6	4.2	4.2	1.00	0.86	0.96	0.9572	
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
					1.6	4.2	4.2	1.00	0.86	0.96		
2	1	-1.2	0.2	1.6	1.6	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						1	2	2	0.00	0.79	0.24	
						1.2	1.8	1.8	0.33	0.79	0.47	
						1.4	1.6	1.6	0.67	0.79	0.70	
						1.6	1.4	1.4	1.00	0.79	0.94	
						1.6	1.4	1.4	1.00	0.79	0.94	
2	-0.2	0.2	2.6	1.6	0.2	3.8	3.8	0.00	0.79	0.24	0.9357	
					0.4	3.6	3.6	0.00	0.79	0.24		
					0.6	3.4	3.4	0.00	0.79	0.24		
					0.8	3.2	3.2	0.00	0.79	0.24		
					1	3	3	0.00	0.79	0.24		
					1.2	2.8	2.8	0.33	0.79	0.47		
					1.4	2.6	2.6	0.67	0.79	0.70		
					1.6	2.4	2.4	1.00	0.79	0.94		
					1.6	2.4	2.4	1.00	0.79	0.94		
3	0.8	0.8	3.6	1.6	0.8	4.2	4.2	0.00	0.79	0.24	0.9357	
					1	4	4	0.00	0.79	0.24		
					1.2	3.8	3.8	0.33	0.79	0.47		
					1.4	3.6	3.6	0.67	0.79	0.70		
					1.6	3.4	3.4	1.00	0.79	0.94		
					1.6	3.4	3.4	1.00	0.79	0.94		
					1.6	3.4	3.4	1.00	0.79	0.94		
					1.6	3.4	3.4	1.00	0.79	0.94		
					1.6	3.4	3.4	1.00	0.79	0.94		
4	1.8	1.8	4.6	1.6	1.6	4.4	4.4	1.00	0.79	0.94	0.9357	
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
					1.6	4.4	4.4	1.00	0.79	0.94		
2.2	1	-1	0.2	1.8	1.6	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.00	0.71	0.21	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Cn} (St,Qt) [13]	
									Demand [10]	FC [11]			
	2	0	0.2	2.8	1.6	1	2.2	2.2	0.00	0.71	0.21	0.9143	
						1.2	2	2	0.33	0.71	0.45		
						1.4	1.8	1.8	0.67	0.71	0.68		
						1.6	1.6	1.6	1.00	0.71	0.91		
						0.2	4	4	0.00	0.71	0.21		
						0.4	3.8	3.8	0.00	0.71	0.21		
						0.6	3.6	3.6	0.00	0.71	0.21		
						0.8	3.4	3.4	0.00	0.71	0.21		
						1	3.2	3.2	0.00	0.71	0.21		
	1.2	3	3	0.33	0.71	0.45							
	1.4	2.8	2.8	0.67	0.71	0.68							
	1.6	2.6	2.6	1.00	0.71	0.91							
	1	4.2	4.2	0.00	0.71	0.21							
	1.2	4	4	0.33	0.71	0.45							
	1.4	3.8	3.8	0.67	0.71	0.68							
	1.6	3.6	3.6	1.00	0.71	0.91							
	4	2	2	4.8	1.6	1.6	4.6	4.2	1.00	0.71	0.91		0.9143
	5	3	3	5.8	1.6	1.6	5.6	4.2	1.00	0.71	0.91		0.9143
6	4	4	6.8	1.6	1.6	6.6	4.2	1.00	0.71	0.91	0.9143		
7	5	5	7.8	1.6	1.6	7.6	4.2	1.00	0.71	0.91	0.9143		
8	6	6	8.8	1.6	1.6	8.6	4.2	1.00	0.71	0.91	0.9143		
9	4.8	4.8	7.6	1.6	1.6	9.6	4.2	1.00	0.71	0.91	0.9143		
2.4	1	-0.8	0.2	2	1.6	0.2	3.2	3.2	0.00	0.64	0.19	0.8929	
						0.4	3	3	0.00	0.64	0.19		
						0.6	2.8	2.8	0.00	0.64	0.19		
						0.8	2.6	2.6	0.00	0.64	0.19		
						1	2.4	2.4	0.00	0.64	0.19		
						1.2	2.2	2.2	0.33	0.64	0.43		
						1.4	2	2	0.67	0.64	0.66		
						1.6	1.8	1.8	1.00	0.64	0.89		
						0.2	4.2	4.2	0.00	0.64	0.19		
	0.4	4	4	0.00	0.64	0.19							
	0.6	3.8	3.8	0.00	0.64	0.19							
	0.8	3.6	3.6	0.00	0.64	0.19							
	1	3.4	3.4	0.00	0.64	0.19							
	1.2	3.2	3.2	0.33	0.64	0.43							
	1.4	3	3	0.67	0.64	0.66							
	1.6	2.8	2.8	1.00	0.64	0.89							
	3	1.2	1.2	4	1.6	1.6	4.2	4.2	0.33	0.64	0.43		0.8929
	1.4	4	4	0.67	0.64	0.66							
1.6	3.8	3.8	1.00	0.64	0.89								
4	2.2	2.2	5	1.6	1.6	4.8	4.2	1.00	0.64	0.89	0.8929		
5	3.2	3.2	6	1.6	1.6	5.8	4.2	1.00	0.64	0.89	0.8929		
6	4.2	4.2	7	1.6	1.6	6.8	4.2	1.00	0.64	0.89	0.8929		
7	5.2	5.2	8	1.6	1.6	7.8	4.2	1.00	0.64	0.89	0.8929		
8	6.2	6.2	9	1.6	1.6	8.8	4.2	1.00	0.64	0.89	0.8929		
9	4.8	4.8	7.6	1.6	1.6	9.8	4.2	1.00	0.64	0.89	0.8929		
2.6	1	-0.6	0.2	2.2	1.6	0.2	3.4	3.4	0.00	0.57	0.17	0.8715	
						0.4	3.2	3.2	0.00	0.57	0.17		
						0.6	3	3	0.00	0.57	0.17		
						0.8	2.8	2.8	0.00	0.57	0.17		
						1	2.6	2.6	0.00	0.57	0.17		
						1.2	2.4	2.4	0.33	0.57	0.40		
						1.4	2.2	2.2	0.67	0.57	0.64		
						1.6	2	2	1.00	0.57	0.87		
						0.4	4.2	4.2	0.00	0.57	0.17		
	0.6	4	4	0.00	0.57	0.17							
	0.8	3.8	3.8	0.00	0.57	0.17							
	1	3.6	3.6	0.00	0.57	0.17							
	1.2	3.4	3.4	0.33	0.57	0.40							
	1.4	3.2	3.2	0.67	0.57	0.64							
	1.6	3	3	1.00	0.57	0.87							
	2	0.4	0.4	3.2	1.6	1.6	4.2	4.2	0.00	0.57	0.17		0.8715
	0.6	4	4	0.00	0.57	0.17							
	0.8	3.8	3.8	0.00	0.57	0.17							
1	3.6	3.6	0.00	0.57	0.17								
1.2	3.4	3.4	0.33	0.57	0.40								
1.4	3.2	3.2	0.67	0.57	0.64								
1.6	3	3	1.00	0.57	0.87								

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
	3	1.4	1.4	4.2	1.6	1.4	4.2	4.2	0.67	0.57	0.64	0.8715
	4	2.4	2.4	5.2	1.6	1.6	4	4	1.00	0.57	0.87	0.8715
	5	3.4	3.4	6.2	1.6	1.6	5	4.2	1.00	0.57	0.87	0.8715
	6	4.4	4.4	7.2	1.6	1.6	6	4.2	1.00	0.57	0.87	0.8715
	7	5.4	5.4	8.2	1.6	1.6	7	4.2	1.00	0.57	0.87	0.8715
	8	6.4	6.4	9.2	1.6	1.6	8	4.2	1.00	0.57	0.87	0.8715
	9	4.8	4.8	7.6	1.6	1.6	9	4.2	1.00	0.57	0.87	0.8715
2.8	1	-0.4	0.2	2.4	1.6	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.00	0.50	0.15	
						1.2	2.6	2.6	0.33	0.50	0.38	
						1.4	2.4	2.4	0.67	0.50	0.62	
						1.6	2.2	2.2	1.00	0.50	0.85	
	2	0.6	0.6	3.4	1.6	0.6	4.2	4.2	0.00	0.50	0.15	0.8500
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.00	0.50	0.15	
						1.2	3.6	3.6	0.33	0.50	0.38	
						1.4	3.4	3.4	0.67	0.50	0.62	
						1.6	3.2	3.2	1.00	0.50	0.85	
	3	1.6	1.6	4.4	1.6	1.6	4.2	4.2	1.00	0.50	0.85	0.8500
	4	2.6	2.6	5.4	1.6	1.6	5.2	4.2	1.00	0.50	0.85	0.8500
	5	3.6	3.6	6.4	1.6	1.6	6.2	4.2	1.00	0.50	0.85	0.8500
	6	4.6	4.6	7.4	1.6	1.6	7.2	4.2	1.00	0.50	0.85	0.8500
	7	5.6	5.6	8.4	1.6	1.6	8.2	4.2	1.00	0.50	0.85	0.8500
	8	6.6	6.6	9.4	1.6	1.6	9.2	4.2	1.00	0.50	0.85	0.8500
	9	4.8	4.8	7.6	1.6	1.6	10.2	4.2	1.00	0.50	0.85	0.8500
3	1	-0.2	0.2	2.6	1.6	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.00	0.43	0.13	
						1	3	3	0.00	0.43	0.13	
						1.2	2.8	2.8	0.33	0.43	0.36	
						1.4	2.6	2.6	0.67	0.43	0.60	
						1.6	2.4	2.4	1.00	0.43	0.83	
	2	0.8	0.8	3.6	1.6	0.8	4.2	4.2	0.00	0.43	0.13	0.8286
						1	4	4	0.00	0.43	0.13	
						1.2	3.8	3.8	0.33	0.43	0.36	
						1.4	3.6	3.6	0.67	0.43	0.60	
						1.6	3.4	3.4	1.00	0.43	0.83	
	3	1.8	1.8	4.6	1.6	1.6	4.4	4.2	1.00	0.43	0.83	0.8286
	4	2.8	2.8	5.6	1.6	1.6	5.4	4.2	1.00	0.43	0.83	0.8286
	5	3.8	3.8	6.6	1.6	1.6	6.4	4.2	1.00	0.43	0.83	0.8286
	6	4.8	4.8	7.6	1.6	1.6	7.4	4.2	1.00	0.43	0.83	0.8286
	7	5.8	5.8	8.6	1.6	1.6	8.4	4.2	1.00	0.43	0.83	0.8286
	8	6.8	6.8	9.6	1.6	1.6	9.4	4.2	1.00	0.43	0.83	0.8286
	9	4.8	4.8	7.6	1.6	1.6	10.4	4.2	1.00	0.43	0.83	0.8286
3.2	1	0	0.2	2.8	1.6	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.00	0.36	0.11	
						0.8	3.4	3.4	0.00	0.36	0.11	
						1	3.2	3.2	0.00	0.36	0.11	
						1.2	3	3	0.33	0.36	0.34	
						1.4	2.8	2.8	0.67	0.36	0.57	
						1.6	2.6	2.6	1.00	0.36	0.81	
	2	-1	1	3.8	1.6	1	4.2	4.2	0.00	0.36	0.11	0.8072
						1.2	4	4	0.33	0.36	0.34	
						1.4	3.8	3.8	0.67	0.36	0.57	
						1.6	3.6	3.6	1.00	0.36	0.81	
	3	2	2	4.8	1.6	1.6	4.6	4.2	1.00	0.36	0.81	0.8072

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cn} (St,Qt) [13]
									Demand [10]	F C [11]		
	4	3	3	5.8	1.6	1.6	5.6	4.2	1.00	0.36	0.81	0.8072
	5	4	4	6.8	1.6	1.6	6.6	4.2	1.00	0.36	0.81	0.8072
	6	5	5	7.8	1.6	1.6	7.6	4.2	1.00	0.36	0.81	0.8072
	7	6	6	8.8	1.6	1.6	8.6	4.2	1.00	0.36	0.81	0.8072
	8	7	7	9.8	1.6	1.6	9.6	4.2	1.00	0.36	0.81	0.8072
	9	4.8	4.8	7.6	1.6	1.6	10.6	4.2	1.00	0.36	0.81	0.8072
3.4	1	0.2	0.2	3	1.6	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.00	0.29	0.09	
						1	3.4	3.4	0.00	0.29	0.09	
						1.2	3.2	3.2	0.33	0.29	0.32	
						1.4	3	3	0.67	0.29	0.55	
						1.6	2.8	2.8	1.00	0.29	0.79	
	2	1.2	1.2	4	1.6	1.2	4.2	4.2	0.33	0.29	0.32	0.7858
						1.4	4	4	0.67	0.29	0.55	
						1.6	3.8	3.8	1.00	0.29	0.79	
	3	2.2	2.2	5	1.6	1.6	4.8	4.2	1.00	0.29	0.79	0.7858
	4	3.2	3.2	6	1.6	1.6	5.8	4.2	1.00	0.29	0.79	0.7858
	5	4.2	4.2	7	1.6	1.6	6.8	4.2	1.00	0.29	0.79	0.7858
	6	5.2	5.2	8	1.6	1.6	7.8	4.2	1.00	0.29	0.79	0.7858
	7	6.2	6.2	9	1.6	1.6	8.8	4.2	1.00	0.29	0.79	0.7858
	8	7.2	7.2	10	1.6	1.6	9.8	4.2	1.00	0.29	0.79	0.7858
	9	4.8	4.8	7.6	1.6	1.6	10.8	4.2	1.00	0.29	0.79	0.7858
3.6	1	0.4	0.4	3.2	1.6	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.00	0.21	0.06	
						1	3.6	3.6	0.00	0.21	0.06	
						1.2	3.4	3.4	0.33	0.21	0.30	
						1.4	3.2	3.2	0.67	0.21	0.53	
						1.6	3	3	1.00	0.21	0.76	
	2	1.4	1.4	4.2	1.6	1.4	4.2	4.2	0.67	0.21	0.53	0.7643
						1.6	4	4	1.00	0.21	0.76	
	3	2.4	2.4	5.2	1.6	1.6	5	4.2	1.00	0.21	0.76	0.7643
	4	3.4	3.4	6.2	1.6	1.6	6	4.2	1.00	0.21	0.76	0.7643
	5	4.4	4.4	7.2	1.6	1.6	7	4.2	1.00	0.21	0.76	0.7643
	6	5.4	5.4	8.2	1.6	1.6	8	4.2	1.00	0.21	0.76	0.7643
	7	6.4	6.4	9.2	1.6	1.6	9	4.2	1.00	0.21	0.76	0.7643
	8	7.4	7.4	10.2	1.6	1.6	10	4.2	1.00	0.21	0.76	0.7643
	9	4.8	4.8	7.6	1.6	1.6	11	4.2	1.00	0.21	0.76	0.7643
3.8	1	0.6	0.6	3.4	1.6	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.00	0.14	0.04	
						1	3.8	3.8	0.00	0.14	0.04	
						1.2	3.6	3.6	0.33	0.14	0.28	
						1.4	3.4	3.4	0.67	0.14	0.51	
						1.6	3.2	3.2	1.00	0.14	0.74	
	2	1.6	1.6	4.4	1.6	1.6	4.2	4.2	1.00	0.14	0.74	0.7429
	3	2.6	2.6	5.4	1.6	1.6	5.2	4.2	1.00	0.14	0.74	0.7429
	4	3.6	3.6	6.4	1.6	1.6	6.2	4.2	1.00	0.14	0.74	0.7429
	5	4.6	4.6	7.4	1.6	1.6	7.2	4.2	1.00	0.14	0.74	0.7429
	6	5.6	5.6	8.4	1.6	1.6	8.2	4.2	1.00	0.14	0.74	0.7429
	7	6.6	6.6	9.4	1.6	1.6	9.2	4.2	1.00	0.14	0.74	0.7429
	8	7.6	7.6	10.4	1.6	1.6	10.2	4.2	1.00	0.14	0.74	0.7429
	9	4.8	4.8	7.6	1.6	1.6	11.2	4.2	1.00	0.14	0.74	0.7429
4	1	0.8	0.8	3.6	1.6	0.8	4.2	4.2	0.00	0.07	0.02	0.7215
						1	4	4	0.00	0.07	0.02	
						1.2	3.8	3.8	0.33	0.07	0.25	
						1.4	3.6	3.6	0.67	0.07	0.49	
						1.6	3.4	3.4	1.00	0.07	0.72	
	2	1.8	1.8	4.6	1.6	1.6	4.4	4.2	1.00	0.07	0.72	0.7215
	3	2.8	2.8	5.6	1.6	1.6	5.4	4.2	1.00	0.07	0.72	0.7215
	4	3.8	3.8	6.6	1.6	1.6	6.4	4.2	1.00	0.07	0.72	0.7215

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cm} (St,Qt) [13]
									Demand [10]	F C [11]		
	5	4.8	4.8	7.6	1.6	1.6	7.4	4.2	1.00	0.07	0.72	0.7215
	6	5.8	5.8	8.6	1.6	1.6	8.4	4.2	1.00	0.07	0.72	0.7215
	7	6.8	6.8	9.6	1.6	1.6	9.4	4.2	1.00	0.07	0.72	0.7215
	8	7.8	7.8	10.6	1.6	1.6	10.4	4.2	1.00	0.07	0.72	0.7215
	9	4.8	4.8	7.6	1.6	1.6	11.4	4.2	1.00	0.07	0.72	0.7215
4.2	1	1	1	3.8	1.6	1	4.2	4.2	0.00	0.00	0.00	0.7000
						1.2	4	4	0.33	0.00	0.23	
						1.4	3.8	3.8	0.67	0.00	0.47	
						1.6	3.6	3.6	1.00	0.00	0.70	
						1.6	4.6	4.2	1.00	0.00	0.70	
	2	2	2	4.8	1.6	1.6	4.6	4.2	1.00	0.00	0.70	0.7000
	3	3	3	5.8	1.6	1.6	5.6	4.2	1.00	0.00	0.70	0.7000
	4	4	4	6.8	1.6	1.6	6.6	4.2	1.00	0.00	0.70	0.7000
	5	5	5	7.8	1.6	1.6	7.6	4.2	1.00	0.00	0.70	0.7000
	6	6	6	8.8	1.6	1.6	8.6	4.2	1.00	0.00	0.70	0.7000
	7	7	7	9.8	1.6	1.6	9.6	4.2	1.00	0.00	0.70	0.7000
	8	8	8	10.8	1.6	1.6	10.6	4.2	1.00	0.00	0.70	0.7000
	9	4.8	4.8	7.6	1.6	1.6	11.6	4.2	1.00	0.00	0.70	0.7000

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1.2

February

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{cn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.6500
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
						1	1.4	1.4	0.50	1.00	0.65	
						1.2	1.2	1.2	1.00	1.00	1.00	
	2	-0.8	0.2	2	1.2	0.2	3.2	3.2	0.00	1.00	0.30	1.0000
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.00	1.00	0.30	
						1	2.4	2.4	0.50	1.00	0.65	
						1.2	2.2	2.2	1.00	1.00	1.00	
	3	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	1.00	0.30	1.0000
						0.4	4	4	0.00	1.00	0.30	
						0.6	3.8	3.8	0.00	1.00	0.30	
						0.8	3.6	3.6	0.00	1.00	0.30	
						1	3.4	3.4	0.50	1.00	0.65	
						1.2	3.2	3.2	1.00	1.00	1.00	
	4	1.2	1.2	4	1.2	1.2	4.2	4.2	1.00	1.00	1.00	1.0000
						1.2	5.2	4.2	1.00	1.00	1.00	
						1.2	5.2	4.2	1.00	1.00	1.00	
						1.2	6.2	4.2	1.00	1.00	1.00	
						1.2	6.2	4.2	1.00	1.00	1.00	
						1.2	6.2	4.2	1.00	1.00	1.00	
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
						1	1.6	1.6	0.50	0.93	0.63	
						1.2	1.4	1.4	1.00	0.93	0.98	
	2	-0.6	0.2	2.2	1.2	0.2	3.4	3.4	0.00	0.93	0.28	0.9786
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
						0.8	2.8	2.8	0.00	0.93	0.28	
						1	2.6	2.6	0.50	0.93	0.63	
						1.2	2.4	2.4	1.00	0.93	0.98	
	3	0.4	0.4	3.2	1.2	0.4	4.2	4.2	0.00	0.93	0.28	0.9786
						0.6	4	4	0.00	0.93	0.28	
						0.8	3.8	3.8	0.00	0.93	0.28	
						1	3.6	3.6	0.50	0.93	0.63	
						1.2	3.4	3.4	1.00	0.93	0.98	
						1.2	3.4	3.4	1.00	0.93	0.98	
	4	1.4	1.4	4.2	1.2	1.2	4.4	4.2	1.00	0.93	0.98	0.9786
						1.2	5.4	4.2	1.00	0.93	0.98	
						1.2	5.4	4.2	1.00	0.93	0.98	
						1.2	6.4	4.2	1.00	0.93	0.98	
						1.2	6.4	4.2	1.00	0.93	0.98	
						1.2	6.4	4.2	1.00	0.93	0.98	
1.8	1	-1.4	0.2	1.4	1.2	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.00	0.86	0.26	
						1	1.8	1.8	0.50	0.86	0.61	
						1.2	1.6	1.6	1.00	0.86	0.96	
	2	-0.4	0.2	2.4	1.2	0.2	3.6	3.6	0.00	0.86	0.26	0.9572
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
						0.8	3	3	0.00	0.86	0.26	
						1	2.8	2.8	0.50	0.86	0.61	
						1.2	2.6	2.6	1.00	0.86	0.96	
	3	0.6	0.6	3.4	1.2	0.6	4.2	4.2	0.00	0.86	0.26	0.9572
						0.8	4	4	0.00	0.86	0.26	
						1	3.8	3.8	0.50	0.86	0.61	
						1.2	3.8	3.8	1.00	0.86	0.96	
						1.2	3.8	3.8	1.00	0.86	0.96	
						1.2	3.8	3.8	1.00	0.86	0.96	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cn} (St,Q) [13]
									Demand [10]	F C [11]		
	4	1.6	1.6	4.4	1.2	1.2	3.6	3.6	1.00	0.86	0.96	
	5	2.6	2.6	5.4	1.2	1.2	4.6	4.2	1.00	0.86	0.96	0.9572
	6	3.6	3.6	6.4	1.2	1.2	5.6	4.2	1.00	0.86	0.96	0.9572
2	1	-1.2	0.2	1.6	1.2	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						1	2	2	0.50	0.79	0.59	
						1.2	1.8	1.8	1.00	0.79	0.94	
	2	-0.2	0.2	2.6	1.2	0.2	3.8	3.8	0.00	0.79	0.24	0.9357
						0.4	3.6	3.6	0.00	0.79	0.24	
						0.6	3.4	3.4	0.00	0.79	0.24	
						0.8	3.2	3.2	0.00	0.79	0.24	
						1	3	3	0.50	0.79	0.59	
						1.2	2.8	2.8	1.00	0.79	0.94	
	3	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.79	0.24	0.9357
						1	4	4	0.50	0.79	0.59	
						1.2	3.8	3.8	1.00	0.79	0.94	
						1.2	3.8	3.8	1.00	0.79	0.94	
						1.2	4.8	4.2	1.00	0.79	0.94	
						1.2	5.8	4.2	1.00	0.79	0.94	
4	1.8	1.8	4.6	1.2	1.2	1.2	4.8	4.2	1.00	0.79	0.94	0.9357
					1.2	1.2	5.8	4.2	1.00	0.79	0.94	
					1.2	1.2	6.8	4.2	1.00	0.79	0.94	
					1.2	1.2	6.8	4.2	1.00	0.79	0.94	
					1.2	1.2	6.8	4.2	1.00	0.79	0.94	
					1.2	1.2	6.8	4.2	1.00	0.79	0.94	
2.2	1	-1	0.2	1.8	1.2	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.00	0.71	0.21	
						1	2.2	2.2	0.50	0.71	0.56	
						1.2	2	2	1.00	0.71	0.91	
	2	0	0.2	2.8	1.2	0.2	4	4	0.00	0.71	0.21	0.9143
						0.4	3.8	3.8	0.00	0.71	0.21	
						0.6	3.6	3.6	0.00	0.71	0.21	
						0.8	3.4	3.4	0.00	0.71	0.21	
						1	3.2	3.2	0.50	0.71	0.56	
						1.2	3	3	1.00	0.71	0.91	
	3	1	1	3.8	1.2	1	4.2	4.2	0.50	0.71	0.56	0.9143
						1.2	4	4	1.00	0.71	0.91	
						1.2	4	4	1.00	0.71	0.91	
						1.2	5	4.2	1.00	0.71	0.91	
						1.2	6	4.2	1.00	0.71	0.91	
						1.2	7	4.2	1.00	0.71	0.91	
2.4	1	-0.8	0.2	2	1.2	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.00	0.64	0.19	
						1	2.4	2.4	0.50	0.64	0.54	
						1.2	2.2	2.2	1.00	0.64	0.89	
	2	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	0.64	0.19	0.8929
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.00	0.64	0.19	
						0.8	3.6	3.6	0.00	0.64	0.19	
						1	3.4	3.4	0.50	0.64	0.54	
						1.2	3.2	3.2	1.00	0.64	0.89	
	3	1.2	1.2	4	1.2	1.2	4.2	4.2	1.00	0.64	0.89	0.8929
						1.2	5.2	4.2	1.00	0.64	0.89	
						1.2	6.2	4.2	1.00	0.64	0.89	
						1.2	7.2	4.2	1.00	0.64	0.89	
						1.2	7.2	4.2	1.00	0.64	0.89	
						1.2	7.2	4.2	1.00	0.64	0.89	
2.6	1	-0.6	0.2	2.2	1.2	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.00	0.57	0.17	
						1	2.6	2.6	0.50	0.57	0.52	
						1.2	2.4	2.4	1.00	0.57	0.87	
	2	0.4	0.4	3.2	1.2	0.4	4.2	4.2	0.00	0.57	0.17	0.8715

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{cr} (St,Qt,Rt) [12]	μ_{Gr} (St,Qt) [13]
									Demand [10]	FC [11]		
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.00	0.57	0.17	
						1	3.6	3.6	0.50	0.57	0.52	
						1.2	3.4	3.4	1.00	0.57	0.87	
	3	1.4	1.4	4.2	1.2	1.2	4.4	4.2	1.00	0.57	0.87	0.8715
	4	2.4	2.4	5.2	1.2	1.2	5.4	4.2	1.00	0.57	0.87	0.8715
	5	3.4	3.4	6.2	1.2	1.2	6.4	4.2	1.00	0.57	0.87	0.8715
	6	4.4	4.4	7.2	1.2	1.2	7.4	4.2	1.00	0.57	0.87	0.8715
2.8	1	-0.4	0.2	2.4	1.2	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.50	0.50	0.50	
						1.2	2.6	2.6	1.00	0.50	0.85	
	2	0.6	0.6	3.4	1.2	0.6	4.2	4.2	0.00	0.50	0.15	0.8500
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.50	0.50	0.50	
						1.2	3.6	3.6	1.00	0.50	0.85	
	3	1.6	1.6	4.4	1.2	1.2	4.6	4.2	1.00	0.50	0.85	0.8500
	4	2.6	2.6	5.4	1.2	1.2	5.6	4.2	1.00	0.50	0.85	0.8500
	5	3.6	3.6	6.4	1.2	1.2	6.6	4.2	1.00	0.50	0.85	0.8500
	6	4.6	4.6	7.4	1.2	1.2	7.6	4.2	1.00	0.50	0.85	0.8500
3	1	-0.2	0.2	2.6	1.2	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.00	0.43	0.13	
						1	3	3	0.50	0.43	0.48	
						1.2	2.8	2.8	1.00	0.43	0.83	
	2	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.43	0.13	0.8286
						1	4	4	0.50	0.43	0.48	
						1.2	3.8	3.8	1.00	0.43	0.83	
	3	1.8	1.8	4.6	1.2	1.2	4.8	4.2	1.00	0.43	0.83	0.8286
	4	2.8	2.8	5.6	1.2	1.2	5.8	4.2	1.00	0.43	0.83	0.8286
	5	3.8	3.8	6.6	1.2	1.2	6.8	4.2	1.00	0.43	0.83	0.8286
	6	4.8	4.8	7.6	1.2	1.2	7.8	4.2	1.00	0.43	0.83	0.8286
3.2	1	0	0.2	2.8	1.2	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.00	0.36	0.11	
						0.8	3.4	3.4	0.00	0.36	0.11	
						1	3.2	3.2	0.50	0.36	0.46	
						1.2	3	3	1.00	0.36	0.81	
	2	1	1	3.8	1.2	1	4.2	4.2	0.50	0.36	0.46	0.8072
						1.2	4	4	1.00	0.36	0.81	
	3	2	2	4.8	1.2	1.2	5	4.2	1.00	0.36	0.81	0.8072
	4	3	3	5.8	1.2	1.2	6	4.2	1.00	0.36	0.81	0.8072
	5	4	4	6.8	1.2	1.2	7	4.2	1.00	0.36	0.81	0.8072
	6	5	5	7.8	1.2	1.2	8	4.2	1.00	0.36	0.81	0.8072
3.4	1	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.00	0.29	0.09	
						1	3.4	3.4	0.50	0.29	0.44	
						1.2	3.2	3.2	1.00	0.29	0.79	
	2	1.2	1.2	4	1.2	1.2	4.2	4.2	1.00	0.29	0.79	0.7858
	3	2.2	2.2	5	1.2	1.2	5.2	4.2	1.00	0.29	0.79	0.7858
	4	3.2	3.2	6	1.2	1.2	6.2	4.2	1.00	0.29	0.79	0.7858
	5	4.2	4.2	7	1.2	1.2	7.2	4.2	1.00	0.29	0.79	0.7858
	6	5.2	5.2	8	1.2	1.2	8.2	4.2	1.00	0.29	0.79	0.7858
3.6	1	0.4	0.4	3.2	1.2	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.00	0.21	0.06	
						1	3.6	3.6	0.50	0.21	0.41	

Storage St [1]	Inflow Qt [2]	St+ Qt - S max [3]	Min R [4]	St+ Qt - S min [5]	Max R [6]	Release Rt [7]	St+ Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
	2	1.4	1.4	4.2	1.2	1.2	3.4	3.4	1.00	0.21	0.76	
	3	2.4	2.4	5.2	1.2	1.2	4.4	4.2	1.00	0.21	0.76	0.7643
	4	3.4	3.4	6.2	1.2	1.2	5.4	4.2	1.00	0.21	0.76	0.7643
	5	4.4	4.4	7.2	1.2	1.2	6.4	4.2	1.00	0.21	0.76	0.7643
	6	5.4	5.4	8.2	1.2	1.2	7.4	4.2	1.00	0.21	0.76	0.7643
3.8	1	0.6	0.6	3.4	1.2	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.00	0.14	0.04	
						1	3.8	3.8	0.50	0.14	0.39	
						1.2	3.6	3.6	1.00	0.14	0.74	
	2	1.6	1.6	4.4	1.2	1.2	4.6	4.2	1.00	0.14	0.74	0.7429
	3	2.6	2.6	5.4	1.2	1.2	5.6	4.2	1.00	0.14	0.74	0.7429
4	4	3.6	3.6	6.4	1.2	1.2	6.6	4.2	1.00	0.14	0.74	0.7429
	5	4.6	4.6	7.4	1.2	1.2	7.6	4.2	1.00	0.14	0.74	0.7429
	6	5.6	5.6	8.4	1.2	1.2	8.6	4.2	1.00	0.14	0.74	0.7429
	1	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.07	0.02	0.7215
						1	4	4	0.50	0.07	0.37	
						1.2	3.8	3.8	1.00	0.07	0.72	
4.2	2	1.8	1.8	4.6	1.2	1.2	4.8	4.2	1.00	0.07	0.72	0.7215
	3	2.8	2.8	5.6	1.2	1.2	5.8	4.2	1.00	0.07	0.72	0.7215
	4	3.8	3.8	6.6	1.2	1.2	6.8	4.2	1.00	0.07	0.72	0.7215
	5	4.8	4.8	7.6	1.2	1.2	7.8	4.2	1.00	0.07	0.72	0.7215
	6	5.8	5.8	8.6	1.2	1.2	8.8	4.2	1.00	0.07	0.72	0.7215
	1	1	1	3.8	1.2	1	4.2	4.2	0.50	0.00	0.35	0.7000
4.2	2	2	2	4.8	1.2	1.2	4	4	1.00	0.00	0.70	0.7000
	3	3	3	5.8	1.2	1.2	5	4.2	1.00	0.00	0.70	0.7000
	4	4	4	6.8	1.2	1.2	6	4.2	1.00	0.00	0.70	0.7000
	5	5	5	7.8	1.2	1.2	7	4.2	1.00	0.00	0.70	0.7000
	6	6	6	8.8	1.2	1.2	8	4.2	1.00	0.00	0.70	0.7000
							9	4.2	1.00	0.00	0.70	0.7000

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1.2

March

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,R) [12]	μ^*_{cn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.6500
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
	2	-0.8	0.2	2	1.2	1	1.4	1.4	0.50	1.00	0.65	1.0000
						0.2	3.2	3.2	0.00	1.00	0.30	
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
	3	0.2	0.2	3	1.2	0.8	2.6	2.6	0.00	1.00	0.30	1.0000
						1	2.4	2.4	0.50	1.00	0.65	
						1.2	2.2	2.2	1.00	1.00	1.00	
						0.2	4.2	4.2	0.00	1.00	0.30	
4	1.2	1.2	4	1.2	0.4	4	4	0.00	1.00	0.30	1.0000	
					0.6	3.8	3.8	0.00	1.00	0.30		
					0.8	3.6	3.6	0.00	1.00	0.30		
					1	3.4	3.4	0.50	1.00	0.65		
					1.2	3.2	3.2	1.00	1.00	1.00		
					1.2	4.2	4.2	1.00	1.00	1.00		
					1.2	5.2	4.2	1.00	1.00	1.00		
					1.2	6.2	4.2	1.00	1.00	1.00		
5	2.2	2.2	5	1.2	1.2	1.2	1.2	1.00	1.00	1.00	1.0000	
					1.2	6.2	4.2	1.00	1.00	1.00		
					1.2	7.2	4.2	1.00	1.00	1.00		
					1.2	8.2	4.2	1.00	1.00	1.00		
					1.2	9.2	4.2	1.00	1.00	1.00		
					1.2	10.2	4.2	1.00	1.00	1.00		
					1.2	11.2	4.2	1.00	1.00	1.00		
					1.2	12.2	4.2	1.00	1.00	1.00		
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
	2	-0.6	0.2	2.2	1.2	1	1.6	1.6	0.50	0.93	0.63	0.9786
						1.2	1.4	1.4	1.00	0.93	0.98	
						0.2	3.4	3.4	0.00	0.93	0.28	
						0.4	3.2	3.2	0.00	0.93	0.28	
	3	0.4	0.4	3.2	1.2	0.6	3	3	0.00	0.93	0.28	0.9786
						0.8	2.8	2.8	0.00	0.93	0.28	
						1	2.6	2.6	0.50	0.93	0.63	
						1.2	2.4	2.4	1.00	0.93	0.98	
4	1.4	1.4	4.2	1.2	0.4	4.2	4.2	0.00	0.93	0.28	0.9786	
					0.6	4	4	0.00	0.93	0.28		
					0.8	3.8	3.8	0.00	0.93	0.28		
					1	3.6	3.6	0.50	0.93	0.63		
					1.2	3.4	3.4	1.00	0.93	0.98		
					1.2	4.4	4.2	1.00	0.93	0.98		
					1.2	5.4	4.2	1.00	0.93	0.98		
					1.2	6.4	4.2	1.00	0.93	0.98		
5	2.4	2.4	5.2	1.2	1.2	1.2	1.2	1.00	0.93	0.98	0.9786	
					1.2	6.4	4.2	1.00	0.93	0.98		
					1.2	7.4	4.2	1.00	0.93	0.98		
					1.2	8.4	4.2	1.00	0.93	0.98		
					1.2	9.4	4.2	1.00	0.93	0.98		
					1.2	10.4	4.2	1.00	0.93	0.98		
					1.2	11.4	4.2	1.00	0.93	0.98		
					1.2	12.4	4.2	1.00	0.93	0.98		
1.8	1	-1.4	0.2	1.4	1.2	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	

Storage St [1]	Inflow Qt [2]	St+ Qt - S max [3]	Min R [4]	St+ Qt - S min [5]	Max R [6]	Release Rt [7]	St+ Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cm}^* (St,Qt) [13]
									Demand [10]	F C [11]		
	2	-0.4	0.2	2.4	1.2	0.8	2	2	0.00	0.86	0.26	0.9572
						1	1.8	1.8	0.50	0.86	0.61	
						1.2	1.6	1.6	1.00	0.86	0.96	
						0.2	3.6	3.6	0.00	0.86	0.26	
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
	3	0.6	0.6	3.4	1.2	0.8	3	3	0.00	0.86	0.26	0.9572
						1	2.8	2.8	0.50	0.86	0.61	
						1.2	2.6	2.6	1.00	0.86	0.96	
						0.6	4.2	4.2	0.00	0.86	0.26	
						0.8	4	4	0.00	0.86	0.26	
						1	3.8	3.8	0.50	0.86	0.61	
4	1.6	1.6	4.4	1.2	1.2	3.6	3.6	1.00	0.86	0.96	0.9572	
					1.2	4.6	4.2	1.00	0.86	0.96		
					1.2	5.6	4.2	1.00	0.86	0.96		
					1.2	6.6	4.2	1.00	0.86	0.96		
					1.2	7.6	4.2	1.00	0.86	0.96		
					1.2	8.6	4.2	1.00	0.86	0.96		
5	2.6	2.6	5.4	1.2	1.2	4.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	5.6	4.2	1.00	0.86	0.96		
					1.2	6.6	4.2	1.00	0.86	0.96		
					1.2	7.6	4.2	1.00	0.86	0.96		
					1.2	8.6	4.2	1.00	0.86	0.96		
					1.2	9.6	4.2	1.00	0.86	0.96		
6	3.6	3.6	6.4	1.2	1.2	5.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	6.6	4.2	1.00	0.86	0.96		
					1.2	7.6	4.2	1.00	0.86	0.96		
					1.2	8.6	4.2	1.00	0.86	0.96		
					1.2	9.6	4.2	1.00	0.86	0.96		
					1.2	10.6	4.2	1.00	0.86	0.96		
7	4.6	4.6	7.4	1.2	1.2	6.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	7.6	4.2	1.00	0.86	0.96		
					1.2	8.6	4.2	1.00	0.86	0.96		
					1.2	9.6	4.2	1.00	0.86	0.96		
					1.2	10.6	4.2	1.00	0.86	0.96		
					1.2	11.6	4.2	1.00	0.86	0.96		
8	5.6	5.6	8.4	1.2	1.2	7.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	8.6	4.2	1.00	0.86	0.96		
					1.2	9.6	4.2	1.00	0.86	0.96		
					1.2	10.6	4.2	1.00	0.86	0.96		
					1.2	11.6	4.2	1.00	0.86	0.96		
					1.2	12.6	4.2	1.00	0.86	0.96		
9	6.6	6.6	9.4	1.2	1.2	8.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	9.6	4.2	1.00	0.86	0.96		
					1.2	10.6	4.2	1.00	0.86	0.96		
					1.2	11.6	4.2	1.00	0.86	0.96		
					1.2	12.6	4.2	1.00	0.86	0.96		
					1.2	13.6	4.2	1.00	0.86	0.96		
10	7.6	7.6	10.4	1.2	1.2	9.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	10.6	4.2	1.00	0.86	0.96		
					1.2	11.6	4.2	1.00	0.86	0.96		
					1.2	12.6	4.2	1.00	0.86	0.96		
					1.2	13.6	4.2	1.00	0.86	0.96		
					1.2	14.6	4.2	1.00	0.86	0.96		
11	8.6	8.6	11.4	1.2	1.2	10.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	11.6	4.2	1.00	0.86	0.96		
					1.2	12.6	4.2	1.00	0.86	0.96		
					1.2	13.6	4.2	1.00	0.86	0.96		
					1.2	14.6	4.2	1.00	0.86	0.96		
					1.2	15.6	4.2	1.00	0.86	0.96		
12	9.6	9.6	12.4	1.2	1.2	11.6	4.2	1.00	0.86	0.96	0.9572	
					1.2	12.6	4.2	1.00	0.86	0.96		
					1.2	13.6	4.2	1.00	0.86	0.96		
					1.2	14.6	4.2	1.00	0.86	0.96		
					1.2	15.6	4.2	1.00	0.86	0.96		
					1.2	16.6	4.2	1.00	0.86	0.96		
2	1	-1.2	0.2	1.6	1.2	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						1	2	2	0.50	0.79	0.59	
						1.2	1.8	1.8	1.00	0.79	0.94	
	2	-0.2	0.2	2.6	1.2	0.2	3.8	3.8	0.00	0.79	0.24	0.9357
						0.4	3.6	3.6	0.00	0.79	0.24	
						0.6	3.4	3.4	0.00	0.79	0.24	
						0.8	3.2	3.2	0.00	0.79	0.24	
						1	3	3	0.50	0.79	0.59	
						1.2	2.8	2.8	1.00	0.79	0.94	
3	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.79	0.24	0.9357	
					1	4	4	0.50	0.79	0.59		
					1.2	3.8	3.8	1.00	0.79	0.94		
					1.2	4.8	4.2	1.00	0.79	0.94		
					1.2	5.8	4.2	1.00	0.79	0.94		
					1.2	6.8	4.2	1.00	0.79	0.94		
4	1.8	1.8	4.6	1.2	1.2	7.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	8.8	4.2	1.00	0.79	0.94		
					1.2	9.8	4.2	1.00	0.79	0.94		
					1.2	10.8	4.2	1.00	0.79	0.94		
					1.2	11.8	4.2	1.00	0.79	0.94		
					1.2	12.8	4.2	1.00	0.79	0.94		
5	2.8	2.8	5.6	1.2	1.2	8.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	9.8	4.2	1.00	0.79	0.94		
					1.2	10.8	4.2	1.00	0.79	0.94		
					1.2	11.8	4.2	1.00	0.79	0.94		
					1.2	12.8	4.2	1.00	0.79	0.94		
					1.2	13.8	4.2	1.00	0.79	0.94		
6	3.8	3.8	6.6	1.2	1.2	9.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	10.8	4.2	1.00	0.79	0.94		
					1.2	11.8	4.2	1.00	0.79	0.94		
					1.2	12.8	4.2	1.00	0.79	0.94		
					1.2	13.8	4.2	1.00	0.79	0.94		
					1.2	14.8	4.2	1.00	0.79	0.94		
7	4.8	4.8	7.6	1.2	1.2	10.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	11.8	4.2	1.00	0.79	0.94		
					1.2	12.8	4.2	1.00	0.79	0.94		
					1.2	13.8	4.2	1.00	0.79	0.94		
					1.2	14.8	4.2	1.00	0.79	0.94		
					1.2	15.8	4.2	1.00	0.79	0.94		
8	5.8	5.8	8.6	1.2	1.2	11.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	12.8	4.2	1.00	0.79	0.94		
					1.2	13.8	4.2	1.00	0.79	0.94		
					1.2	14.8	4.2	1.00	0.79	0.94		
					1.2	15.8	4.2	1.00	0.79	0.94		
					1.2	16.8	4.2	1.00	0.79	0.94		
9	6.8	6.8	9.6	1.2	1.2	12.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	13.8	4.2	1.00	0.79	0.94		
					1.2	14.8	4.2	1.00	0.79	0.94		
					1.2	15.8	4.2	1.00	0.79	0.94		
					1.2	16.8	4.2	1.00	0.79	0.94		
					1.2	17.8	4.2	1.00	0.79	0.94		
10	7.8	7.8	10.6	1.2	1.2	13.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	14.8	4.2	1.00	0.79	0.94		
					1.2	15.8	4.2	1.00	0.79	0.94		
					1.2	16.8	4.2	1.00	0.79	0.94		
					1.2	17.8	4.2	1.00	0.79	0.94		
					1.2	18.8	4.2	1.00	0.79	0.94		
11	8.8	8.8	11.6	1.2	1.2	14.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	15.8	4.2	1.00	0.79	0.94		
					1.2	16.8	4.2	1.00	0.79	0.94		
					1.2	17.8	4.2	1.00	0.79	0.94		
					1.2	18.8	4.2	1.00	0.79	0.94		
					1.2	19.8	4.2	1.00	0.79	0.94		
12	9.8	9.8	12.6	1.2	1.2	15.8	4.2	1.00	0.79	0.94	0.9357	
					1.2	16.8	4.2	1.00	0.79	0.94		
					1.2	17.8	4.2	1.00	0.79	0.94		
					1.2	18.8	4.2	1.00	0.79	0.94		
					1.2	19.8	4.2	1.00	0.79	0.94		
					1.2	20.8	4.2	1.00	0.79	0.94		
2.2	1	-1	0.2	1.8	1.2	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.00	0.71	0.21	
						1	2.2	2.2	0.50	0.71	0.56	
						1.2	2	2	1.00	0.71	0.91	
	2	0	0.2	2.8	1.2	0.2	4	4	0.00	0.71	0.21	0.9143
						0.4	3.8	3.8	0.00	0.71	0.21	
						0.6	3.6	3.6	0.00	0.71	0.21	
						0.8	3.4	3.4	0.00	0.71	0.21	
						1	3.2	3.2	0.50	0.71	0.56	
						1.2	3	3	1.00	0.71	0.91	
3	1	1	3.8	1.2	1	4.2	4.2	0.50	0.71	0.56	0.9143	
					1.2	4	4	1.00	0.71	0.91		
					1.2	5	4.2	1.00	0.71	0.91		
					1.2	6	4.2	1.00	0.71	0.91		
					1.2	7	4.2	1.00	0.71	0.91		
					1.2	8	4.2	1.00	0.71	0.91		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cn}^* (St,Qt) [13]
									Demand [10]	F C [11]		
	6	4	4	6.8	1.2	1.2	7	4.2	1.00	0.71	0.91	0.9143
	7	5	5	7.8	1.2	1.2	8	4.2	1.00	0.71	0.91	0.9143
	8	6	6	8.8	1.2	1.2	9	4.2	1.00	0.71	0.91	0.9143
	9	7	7	9.8	1.2	1.2	10	4.2	1.00	0.71	0.91	0.9143
	10	8	8	10.8	1.2	1.2	11	4.2	1.00	0.71	0.91	0.9143
	11	9	9	11.8	1.2	1.2	12	4.2	1.00	0.71	0.91	0.9143
	12	10	10	12.8	1.2	1.2	13	4.2	1.00	0.71	0.91	0.9143
2.4	1	-0.8	0.2	2	1.2	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.00	0.64	0.19	
						1	2.4	2.4	0.50	0.64	0.54	
						1.2	2.2	2.2	1.00	0.64	0.89	
	2	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	0.64	0.19	0.8929
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.00	0.64	0.19	
						0.8	3.6	3.6	0.00	0.64	0.19	
						1	3.4	3.4	0.50	0.64	0.54	
						1.2	3.2	3.2	1.00	0.64	0.89	
	3	1.2	1.2	4	1.2	1.2	4.2	4.2	1.00	0.64	0.89	0.8929
	4	2.2	2.2	5	1.2	1.2	5.2	4.2	1.00	0.64	0.89	0.8929
	5	3.2	3.2	6	1.2	1.2	6.2	4.2	1.00	0.64	0.89	0.8929
	6	4.2	4.2	7	1.2	1.2	7.2	4.2	1.00	0.64	0.89	0.8929
	7	5.2	5.2	8	1.2	1.2	8.2	4.2	1.00	0.64	0.89	0.8929
	8	6.2	6.2	9	1.2	1.2	9.2	4.2	1.00	0.64	0.89	0.8929
	9	7.2	7.2	10	1.2	1.2	10.2	4.2	1.00	0.64	0.89	0.8929
	10	8.2	8.2	11	1.2	1.2	11.2	4.2	1.00	0.64	0.89	0.8929
	11	9.2	9.2	12	1.2	1.2	12.2	4.2	1.00	0.64	0.89	0.8929
	12	10.2	10.2	13	1.2	1.2	13.2	4.2	1.00	0.64	0.89	0.8929
2.6	1	-0.6	0.2	2.2	1.2	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.00	0.57	0.17	
						1	2.6	2.6	0.50	0.57	0.52	
						1.2	2.4	2.4	1.00	0.57	0.87	
	2	0.4	0.4	3.2	1.2	0.4	4.2	4.2	0.00	0.57	0.17	0.8715
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.00	0.57	0.17	
						1	3.6	3.6	0.50	0.57	0.52	
						1.2	3.4	3.4	1.00	0.57	0.87	
	3	1.4	1.4	4.2	1.2	1.2	4.4	4.2	1.00	0.57	0.87	0.8715
	4	2.4	2.4	5.2	1.2	1.2	5.4	4.2	1.00	0.57	0.87	0.8715
	5	3.4	3.4	6.2	1.2	1.2	6.4	4.2	1.00	0.57	0.87	0.8715
	6	4.4	4.4	7.2	1.2	1.2	7.4	4.2	1.00	0.57	0.87	0.8715
	7	5.4	5.4	8.2	1.2	1.2	8.4	4.2	1.00	0.57	0.87	0.8715
	8	6.4	6.4	9.2	1.2	1.2	9.4	4.2	1.00	0.57	0.87	0.8715
	9	7.4	7.4	10.2	1.2	1.2	10.4	4.2	1.00	0.57	0.87	0.8715
	10	8.4	8.4	11.2	1.2	1.2	11.4	4.2	1.00	0.57	0.87	0.8715
	11	9.4	9.4	12.2	1.2	1.2	12.4	4.2	1.00	0.57	0.87	0.8715
	12	10.4	10.4	13.2	1.2	1.2	13.4	4.2	1.00	0.57	0.87	0.8715
2.8	1	-0.4	0.2	2.4	1.2	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.50	0.50	0.50	
						1.2	2.6	2.6	1.00	0.50	0.85	
	2	0.6	0.6	3.4	1.2	0.6	4.2	4.2	0.00	0.50	0.15	0.8500
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.50	0.50	0.50	
						1.2	3.6	3.6	1.00	0.50	0.85	
	3	1.6	1.6	4.4	1.2	1.2	4.6	4.2	1.00	0.50	0.85	0.8500
	4	2.6	2.6	5.4	1.2	1.2	5.6	4.2	1.00	0.50	0.85	0.8500

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cn} (St,Qt) [13]			
									Demand [10]	F C [11]					
	5	3.6	3.6	6.4	1.2	1.2	6.6	4.2	1.00	0.50	0.85	0.8500			
	6	4.6	4.6	7.4	1.2	1.2	7.6	4.2	1.00	0.50	0.85	0.8500			
	7	5.6	5.6	8.4	1.2	1.2	8.6	4.2	1.00	0.50	0.85	0.8500			
	8	6.6	6.6	9.4	1.2	1.2	9.6	4.2	1.00	0.50	0.85	0.8500			
	9	7.6	7.6	10.4	1.2	1.2	10.6	4.2	1.00	0.50	0.85	0.8500			
	10	8.6	8.6	11.4	1.2	1.2	11.6	4.2	1.00	0.50	0.85	0.8500			
	11	9.6	9.6	12.4	1.2	1.2	12.6	4.2	1.00	0.50	0.85	0.8500			
3	1	-0.2	0.2	2.6	1.2	0.2	3.8	3.8	0.00	0.43	0.13	0.8286			
						0.4	3.6	3.6	0.00	0.43	0.13				
						0.6	3.4	3.4	0.00	0.43	0.13				
						0.8	3.2	3.2	0.00	0.43	0.13				
	2	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.43	0.13				
						1	4	4	0.50	0.43	0.48				
						1.2	2.8	2.8	1.00	0.43	0.83				
						1.2	3.8	3.8	1.00	0.43	0.83				
						1.2	4.8	4.2	1.00	0.43	0.83				
						1.2	5.8	4.2	1.00	0.43	0.83				
						1.2	6.8	4.2	1.00	0.43	0.83				
						1.2	7.8	4.2	1.00	0.43	0.83				
3	1.8	1.8	4.6	1.2	1.2	4.8	4.2	1.00	0.43	0.83					
					1.2	5.8	4.2	1.00	0.43	0.83					
					1.2	6.8	4.2	1.00	0.43	0.83					
					1.2	7.8	4.2	1.00	0.43	0.83					
4	2.8	2.8	5.6	1.2	1.2	5.8	4.2	1.00	0.43	0.83					
					1.2	6.8	4.2	1.00	0.43	0.83					
					1.2	7.8	4.2	1.00	0.43	0.83					
					1.2	8.8	4.2	1.00	0.43	0.83					
					1.2	9.8	4.2	1.00	0.43	0.83					
					1.2	10.8	4.2	1.00	0.43	0.83					
					1.2	11.8	4.2	1.00	0.43	0.83					
					1.2	12.8	4.2	1.00	0.43	0.83					
3.2	1	0	0.2	2.8	1.2	0.2	4	4	0.00	0.36	0.11	0.8072			
						0.4	3.8	3.8	0.00	0.36	0.11				
						0.6	3.6	3.6	0.00	0.36	0.11				
						0.8	3.4	3.4	0.00	0.36	0.11				
	2	1	1	3.8	1.2	1.2	3.2	3.2	0.50	0.36	0.46				
						1.2	3	3	1.00	0.36	0.81				
						1.2	4.2	4.2	0.50	0.36	0.46				
						1.2	4	4	1.00	0.36	0.81				
						1.2	5	4.2	1.00	0.36	0.81				
						1.2	6	4.2	1.00	0.36	0.81				
						1.2	7	4.2	1.00	0.36	0.81				
						1.2	8	4.2	1.00	0.36	0.81				
3	2	2	4.8	1.2	1.2	8	4.2	1.00	0.36	0.81					
					1.2	9	4.2	1.00	0.36	0.81					
					1.2	10	4.2	1.00	0.36	0.81					
					1.2	11	4.2	1.00	0.36	0.81					
4	3	3	5.8	1.2	1.2	9	4.2	1.00	0.36	0.81					
					1.2	10	4.2	1.00	0.36	0.81					
					1.2	11	4.2	1.00	0.36	0.81					
					1.2	12	4.2	1.00	0.36	0.81					
					1.2	13	4.2	1.00	0.36	0.81					
					1.2	14	4.2	1.00	0.36	0.81					
					1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
					3.4	1	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	0.29
0.4	4	4	0.00	0.29							0.09				
0.6	3.8	3.8	0.00	0.29							0.09				
0.8	3.6	3.6	0.00	0.29							0.09				
2	1.2	1.2	4	1.2		1.2	3.2	3.2	0.50	0.29	0.44				
						1.2	3.2	3.2	1.00	0.29	0.79				
						1.2	4.2	4.2	1.00	0.29	0.79				
						1.2	4.2	4.2	1.00	0.29	0.79				
						1.2	5.2	4.2	1.00	0.29	0.79				
						1.2	6.2	4.2	1.00	0.29	0.79				
						1.2	7.2	4.2	1.00	0.29	0.79				
						1.2	8.2	4.2	1.00	0.29	0.79				
3	2.2	2.2	5	1.2	1.2	8.2	4.2	1.00	0.29	0.79					
					1.2	9.2	4.2	1.00	0.29	0.79					
					1.2	10.2	4.2	1.00	0.29	0.79					
					1.2	11.2	4.2	1.00	0.29	0.79					
4	3.2	3.2	6	1.2	1.2	9.2	4.2	1.00	0.29	0.79					
					1.2	10.2	4.2	1.00	0.29	0.79					
					1.2	11.2	4.2	1.00	0.29	0.79					
					1.2	12.2	4.2	1.00	0.29	0.79					
					1.2	13.2	4.2	1.00	0.29	0.79					
					1.2	14.2	4.2	1.00	0.29	0.79					
					1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	
					3.4	1	0.2	0.2	3	1.2	0.2	4.2	4.2	0.00	0.29
0.4	4	4	0.00	0.29							0.09				
0.6	3.8	3.8	0.00	0.29							0.09				
0.8	3.6	3.6	0.00	0.29							0.09				
2	1.2	1.2	4	1.2		1.2	3.2	3.2	0.50	0.29	0.44				
						1.2	3.2	3.2	1.00	0.29	0.79				
						1.2	4.2	4.2	1.00	0.29	0.79				
						1.2	4.2	4.2	1.00	0.29	0.79				
						1.2	5.2	4.2	1.00	0.29	0.79				
						1.2	6.2	4.2	1.00	0.29	0.79				
						1.2	7.2	4.2	1.00	0.29	0.79				
						1.2	8.2	4.2	1.00	0.29	0.79				
3	2.2	2.2	5	1.2	1.2	9.2	4.2	1.00	0.29	0.79					
					1.2	10.2	4.2	1.00	0.29	0.79					
					1.2	11.2	4.2	1.00	0.29	0.79					
					1.2	12.2	4.2	1.00	0.29	0.79					
4	3.2	3.2	6	1.2	1.2	10.2	4.2	1.00	0.29	0.79					
					1.2	11.2	4.2	1.00	0.29	0.79					
					1.2	12.2	4.2	1.00	0.29	0.79					
					1.2	13.2	4.2	1.00	0.29	0.79					
					1.2	14.2	4.2	1.00	0.29	0.79					
					1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ^*_{Gt} (St,Qt) [13]	
									Demand [10]	F C [11]			
3.6	1	0.4	0.4	3.2	1.2	0.4	4.2	4.2	0.00	0.21	0.06	0.7643	
						0.6	4	4	0.00	0.21	0.06		
						0.8	3.8	3.8	0.00	0.21	0.06		
	2	1.4	1.4	1.4	4.2	1.2	1	3.6	3.6	0.50	0.21	0.41	0.7643
							1.2	3.4	3.4	1.00	0.21	0.76	
							1.2	4.4	4.2	1.00	0.21	0.76	
							1.2	5.4	4.2	1.00	0.21	0.76	
							1.2	6.4	4.2	1.00	0.21	0.76	
							1.2	7.4	4.2	1.00	0.21	0.76	
							1.2	8.4	4.2	1.00	0.21	0.76	
							1.2	9.4	4.2	1.00	0.21	0.76	
							1.2	10.4	4.2	1.00	0.21	0.76	
1.2	11.4	4.2	1.00	0.21	0.76								
3.8	1	0.6	0.6	3.4	1.2	0.6	4.2	4.2	0.00	0.14	0.04	0.7429	
						0.8	4	4	0.00	0.14	0.04		
						1	3.8	3.8	0.50	0.14	0.39		
	2	1.6	1.6	1.6	4.4	1.2	1.2	3.6	3.6	1.00	0.14	0.74	0.7429
							1.2	4.6	4.2	1.00	0.14	0.74	
							1.2	5.6	4.2	1.00	0.14	0.74	
							1.2	6.6	4.2	1.00	0.14	0.74	
							1.2	7.6	4.2	1.00	0.14	0.74	
							1.2	8.6	4.2	1.00	0.14	0.74	
							1.2	9.6	4.2	1.00	0.14	0.74	
							1.2	10.6	4.2	1.00	0.14	0.74	
							1.2	11.6	4.2	1.00	0.14	0.74	
4	1	0.8	0.8	3.6	1.2	0.8	4.2	4.2	0.00	0.07	0.02	0.7215	
						1	4	4	0.50	0.07	0.37		
						1.2	3.8	3.8	1.00	0.07	0.72		
	2	1.8	1.8	1.8	4.6	1.2	1.2	4.8	4.2	1.00	0.07	0.72	0.7215
							1.2	5.8	4.2	1.00	0.07	0.72	
							1.2	6.8	4.2	1.00	0.07	0.72	
							1.2	7.8	4.2	1.00	0.07	0.72	
							1.2	8.8	4.2	1.00	0.07	0.72	
							1.2	9.8	4.2	1.00	0.07	0.72	
							1.2	10.8	4.2	1.00	0.07	0.72	
							1.2	11.8	4.2	1.00	0.07	0.72	
							1.2	12.8	4.2	1.00	0.07	0.72	
4.2	1	1	1	3.8	1.2	1	4.2	4.2	0.50	0.00	0.35	0.7000	
						1.2	4	4	1.00	0.00	0.70		
						1.2	5	4.2	1.00	0.00	0.70		
	2	2	2	2	4.8	1.2	1.2	6	4.2	1.00	0.00	0.70	0.7000
							1.2	7	4.2	1.00	0.00	0.70	
							1.2	8	4.2	1.00	0.00	0.70	
							1.2	9	4.2	1.00	0.00	0.70	
							1.2	10	4.2	1.00	0.00	0.70	
							1.2	11	4.2	1.00	0.00	0.70	
							1.2	12	4.2	1.00	0.00	0.70	
							1.2	13	4.2	1.00	0.00	0.70	
							1.2	14	4.2	1.00	0.00	0.70	
1.2	15	4.2	1.00	0.00	0.70								

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 2.4

April

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ _{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
						1	1.4	1.4	0.00	1.00	0.30	
	2	-0.8	0.2	2	2	0.2	3.2	3.2	0.00	1.00	0.30	0.7200
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.00	1.00	0.30	
						1	2.4	2.4	0.00	1.00	0.30	
3	0.2	0.2	0.2	3	2.4	0.2	4.2	4.2	0.00	1.00	0.30	1.0000
						0.4	4	4	0.00	1.00	0.30	
						0.6	3.8	3.8	0.00	1.00	0.30	
						0.8	3.6	3.6	0.00	1.00	0.30	
						1	3.4	3.4	0.00	1.00	0.30	
						1.2	3.2	3.2	0.00	1.00	0.30	
						1.4	3	3	0.00	1.00	0.30	
						1.6	2.8	2.8	0.20	1.00	0.44	
						1.8	2.6	2.6	0.40	1.00	0.58	
						2	2.4	2.4	0.60	1.00	0.72	
4	1.2	1.2	1.2	4	2.4	2.2	2.2	2.2	0.80	1.00	0.86	1.0000
						2.4	2	2	1.00	1.00	1.00	
						1.2	4.2	4.2	0.00	1.00	0.30	
						1.4	4	4	0.00	1.00	0.30	
						1.6	3.8	3.8	0.20	1.00	0.44	
						1.8	3.6	3.6	0.40	1.00	0.58	
						2	3.4	3.4	0.60	1.00	0.72	
						2.2	3.2	3.2	0.80	1.00	0.86	
						2.4	3	3	1.00	1.00	1.00	
						2.2	4.2	4.2	0.80	1.00	0.86	
5	2.2	2.2	2.2	5	2.4	2.4	4	4	1.00	1.00	1.00	1.0000
						2.4	5	4.2	1.00	1.00	1.00	
6	3.2	3.2	3.2	6	2.4	2.4	5	4.2	1.00	1.00	1.00	1.0000
7	4.2	4.2	4.2	7	2.4	2.4	6	4.2	1.00	1.00	1.00	1.0000
8	5.2	5.2	5.2	8	2.4	2.4	7	4.2	1.00	1.00	1.00	1.0000
9	6.2	6.2	6.2	9	2.4	2.4	8	4.2	1.00	1.00	1.00	1.0000
10	7.2	7.2	7.2	10	2.4	2.4	9	4.2	1.00	1.00	1.00	1.0000
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.2786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
						1	1.6	1.6	0.00	0.93	0.28	
	2	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.93	0.28	0.8386
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
						0.8	2.8	2.8	0.00	0.93	0.28	
						1	2.6	2.6	0.00	0.93	0.28	
1.2	2.4	2.4	0.00	0.93	0.28							
1.4	2.2	2.2	0.00	0.93	0.28							
1.6	2	2	0.20	0.93	0.42							

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]						
									Demand [10]	F C [11]								
	3	0.4	0.4	3.2	2.4	1.8	1.8	1.8	0.40	0.93	0.56	0.9786						
						2	1.6	1.6	0.60	0.93	0.70							
						2.2	1.4	1.4	0.80	0.93	0.84							
						0.4	4.2	4.2	0.00	0.93	0.28							
						0.6	4	4	0.00	0.93	0.28							
						0.8	3.8	3.8	0.00	0.93	0.28							
						1	3.6	3.6	0.00	0.93	0.28							
						1.2	3.4	3.4	0.00	0.93	0.28							
						1.4	3.2	3.2	0.00	0.93	0.28							
						1.6	3	3	0.20	0.93	0.42							
	4	1.4	1.4	4.2	2.4	1.8	2.8	2.8	0.40	0.93	0.56							
						2	2.6	2.6	0.60	0.93	0.70							
						2.2	2.4	2.4	0.80	0.93	0.84							
						2.4	2.2	2.2	1.00	0.93	0.98							
						1.4	4.2	4.2	0.00	0.93	0.28							
						1.6	4	4	0.20	0.93	0.42							
						1.8	3.8	3.8	0.40	0.93	0.56							
						2	3.6	3.6	0.60	0.93	0.70							
						2.2	3.4	3.4	0.80	0.93	0.84							
						2.4	3.2	3.2	1.00	0.93	0.98							
5	2.4	2.4	5.2	2.4	2.4	4.2	4.2	1.00	0.93	0.98	0.9786							
					6	3.4	3.4	6.2	2.4	2.4	5.2	4.2	1.00	0.93	0.98	0.9786		
					7	4.4	4.4	7.2	2.4	2.4	6.2	4.2	1.00	0.93	0.98	0.9786		
					8	5.4	5.4	8.2	2.4	2.4	7.2	4.2	1.00	0.93	0.98	0.9786		
					9	6.4	6.4	9.2	2.4	2.4	8.2	4.2	1.00	0.93	0.98	0.9786		
					10	7.4	7.4	10.2	2.4	2.4	9.2	4.2	1.00	0.93	0.98	0.9786		
					1.8	1	-1.4	0.2	1.4	1.4	0.2	2.6	2.6	0.00	0.86	0.26	0.2572	
											0.4	2.4	2.4	0.00	0.86	0.26		
											0.6	2.2	2.2	0.00	0.86	0.26		
											0.8	2	2	0.00	0.86	0.26		
1	1.8	1.8	0.00	0.86							0.26							
1.2	1.6	1.6	0.00	0.86							0.26							
1.4	1.4	1.4	0.00	0.86							0.26							
2	-0.4	0.2	2.4	2.4							0.2	3.6	3.6	0.00	0.86	0.26		0.9572
											0.4	3.4	3.4	0.00	0.86	0.26		
											0.6	3.2	3.2	0.00	0.86	0.26		
											0.8	3	3	0.00	0.86	0.26		
											1	2.8	2.8	0.00	0.86	0.26		
						1.2	2.6	2.6	0.00	0.86	0.26							
						1.4	2.4	2.4	0.00	0.86	0.26							
						1.6	2.2	2.2	0.20	0.86	0.40							
						1.8	2	2	0.40	0.86	0.54							
						2	1.8	1.8	0.60	0.86	0.68							
						2.2	1.6	1.6	0.80	0.86	0.82							
						2.4	1.4	1.4	1.00	0.86	0.96							
3	0.6	0.6	3.4	2.4		0.6	4.2	4.2	0.00	0.86	0.26	0.9572						
						0.8	4	4	0.00	0.86	0.26							
						1	3.8	3.8	0.00	0.86	0.26							
						1.2	3.6	3.6	0.00	0.86	0.26							
						1.4	3.4	3.4	0.00	0.86	0.26							
					1.6	3.2	3.2	0.20	0.86	0.40								
					1.8	3	3	0.40	0.86	0.54								
					2	2.8	2.8	0.60	0.86	0.68								
					2.2	2.6	2.6	0.80	0.86	0.82								
					2.4	2.4	2.4	1.00	0.86	0.96								
					4	1.6	1.6	4.4	2.4	1.6	4.2		4.2	0.20	0.86	0.40	0.9572	
										1.8	4		4	0.40	0.86	0.54		
2	3.8	3.8	0.60	0.86						0.68								
2.2	3.6	3.6	0.80	0.86						0.82								
2.4	3.4	3.4	1.00	0.86						0.96								
5	2.6	2.6	5.4	2.4						2.4	4.4	4.2	1.00	0.86	0.96	0.9572		
					6	3.6	3.6	6.4	2.4	2.4	5.4	4.2	1.00	0.86	0.96		0.9572	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ_{Gn} (St,Qt) [13]	
									Demand [10]	F C [11]			
	7	4.6	4.6	7.4	2.4	2.4	6.4	4.2	1.00	0.86	0.96	0.9572	
	8	5.6	5.6	8.4	2.4	2.4	7.4	4.2	1.00	0.86	0.96	0.9572	
	9	6.6	6.6	9.4	2.4	2.4	8.4	4.2	1.00	0.86	0.96	0.9572	
	10	7.6	7.6	10.4	2.4	2.4	9.4	4.2	1.00	0.86	0.96	0.9572	
2	1	-1.2	0.2	1.6	1.6	0.2	2.8	2.8	0.00	0.79	0.24	0.3757	
						0.4	2.6	2.6	0.00	0.79	0.24		
						0.6	2.4	2.4	0.00	0.79	0.24		
						0.8	2.2	2.2	0.00	0.79	0.24		
						1	2	2	0.00	0.79	0.24		
	2	-0.2	0.2	2.6	2.4	1.2	1.8	1.8	0.00	0.79	0.24	0.9357	
						1.4	1.6	1.6	0.00	0.79	0.24		
						1.6	1.4	1.4	0.20	0.79	0.38		
						0.2	3.8	3.8	0.00	0.79	0.24		
						0.4	3.6	3.6	0.00	0.79	0.24		
3		0.8	0.8	3.6	2.4	0.6	3.4	3.4	0.00	0.79	0.24	0.9357	
						0.8	3.2	3.2	0.00	0.79	0.24		
						1	3	3	0.00	0.79	0.24		
						1.2	2.8	2.8	0.00	0.79	0.24		
						1.4	2.6	2.6	0.00	0.79	0.24		
	4	1.8	1.8	4.6	2.4	1.6	2.4	2.4	0.20	0.79	0.38	0.9357	
						1.8	2.2	2.2	0.40	0.79	0.52		
						2	2	2	0.60	0.79	0.66		
						2.2	1.8	1.8	0.80	0.79	0.80		
						2.4	1.6	1.6	1.00	0.79	0.94		
4		1.8	1.8	4.6	2.4	0.8	4.2	4.2	0.00	0.79	0.24	0.9357	
						1	4	4	0.00	0.79	0.24		
						1.2	3.8	3.8	0.00	0.79	0.24		
						1.4	3.6	3.6	0.00	0.79	0.24		
						1.6	3.4	3.4	0.20	0.79	0.38		
	5		1.8	1.8	4.6	2.4	1.8	3.2	3.2	0.40	0.79	0.52	0.9357
							2	3	3	0.60	0.79	0.66	
							2.2	2.8	2.8	0.80	0.79	0.80	
							2.4	2.6	2.6	1.00	0.79	0.94	
							2.4	2.6	2.6	1.00	0.79	0.94	
2.2	1	-1	0.2	1.8	1.8	2.4	4.2	4.2	0.00	0.79	0.24	0.9357	
						2.4	4.6	4.6	0.00	0.79	0.24		
						2.4	5.6	5.6	0.00	0.79	0.24		
						2.4	6.6	6.6	0.00	0.79	0.24		
						2.4	7.6	7.6	0.00	0.79	0.24		
	2	0	0.2	2.8	2.4	2.4	8.6	8.6	0.00	0.79	0.24	0.9143	
						2.4	9.6	9.6	0.00	0.79	0.24		
						2.4	10.6	10.6	0.00	0.79	0.24		
						0.2	4	4	0.00	0.71	0.21		
						0.4	3.8	3.8	0.00	0.71	0.21		
						0.6	3.6	3.6	0.00	0.71	0.21		
						0.8	3.4	3.4	0.00	0.71	0.21		
						1	3.2	3.2	0.00	0.71	0.21		
						1.2	3	3	0.00	0.71	0.21		
						1.4	2.8	2.8	0.00	0.71	0.21		
							1.6	2.6	2.6	0.20	0.71	0.35	
							1.8	2.4	2.4	0.40	0.71	0.49	
							1.8	2.4	2.4	0.40	0.71	0.49	
							2	2.2	2.2	0.60	0.71	0.63	
							2	2.2	2.2	0.60	0.71	0.63	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St+ Qt - S max [3]	Min R [4]	St+ Qt - S min [5]	Max R [6]	Release Rt [7]	St+ Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cm} (St,Qt) [13]
									Demand [10]	F C [11]		
						2.2	2	2	0.80	0.71	0.77	
						2.4	1.8	1.8	1.00	0.71	0.91	
	3	1	1	3.8	2.4	1	4.2	4.2	0.00	0.71	0.21	0.9143
						1.2	4	4	0.00	0.71	0.21	
						1.4	3.8	3.8	0.00	0.71	0.21	
						1.6	3.6	3.6	0.20	0.71	0.35	
						1.8	3.4	3.4	0.40	0.71	0.49	
						2	3.2	3.2	0.60	0.71	0.63	
						2.2	3	3	0.80	0.71	0.77	
						2.4	2.8	2.8	1.00	0.71	0.91	
	4	2	2	4.8	2.4	2	4.2	4.2	0.60	0.71	0.63	0.9143
						2.2	4	4	0.80	0.71	0.77	
						2.4	3.8	3.8	1.00	0.71	0.91	
	5	3	3	5.8	2.4	2.4	4.8	4.2	1.00	0.71	0.91	0.9143
	6	4	4	6.8	2.4	2.4	5.8	4.2	1.00	0.71	0.91	0.9143
	7	5	5	7.8	2.4	2.4	6.8	4.2	1.00	0.71	0.91	0.9143
	8	6	6	8.8	2.4	2.4	7.8	4.2	1.00	0.71	0.91	0.9143
	9	7	7	9.8	2.4	2.4	8.8	4.2	1.00	0.71	0.91	0.9143
	10	8	8	8.6	2.4	2.4	9.8	4.2	1.00	0.71	0.91	0.9143
2.4	1	-0.8	0.2	2	2	0.2	3.2	3.2	0.00	0.64	0.19	0.6129
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.00	0.64	0.19	
						1	2.4	2.4	0.00	0.64	0.19	
						1.2	2.2	2.2	0.00	0.64	0.19	
						1.4	2	2	0.00	0.64	0.19	
						1.6	1.8	1.8	0.20	0.64	0.33	
						1.8	1.6	1.6	0.40	0.64	0.47	
						2	1.4	1.4	0.60	0.64	0.61	
	2	0.2	0.2	3	2.4	0.2	4.2	4.2	0.00	0.64	0.19	0.8929
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.00	0.64	0.19	
						0.8	3.6	3.6	0.00	0.64	0.19	
						1	3.4	3.4	0.00	0.64	0.19	
						1.2	3.2	3.2	0.00	0.64	0.19	
						1.4	3	3	0.00	0.64	0.19	
						1.6	2.8	2.8	0.20	0.64	0.33	
						1.8	2.6	2.6	0.40	0.64	0.47	
						2	2.4	2.4	0.60	0.64	0.61	
						2.2	2.2	2.2	0.80	0.64	0.75	
						2.4	2	2	1.00	0.64	0.89	
	3	1.2	1.2	4	2.4	1.2	4.2	4.2	0.00	0.64	0.19	0.8929
						1.4	4	4	0.00	0.64	0.19	
						1.6	3.8	3.8	0.20	0.64	0.33	
						1.8	3.6	3.6	0.40	0.64	0.47	
						2	3.4	3.4	0.60	0.64	0.61	
						2.2	3.2	3.2	0.80	0.64	0.75	
						2.4	3	3	1.00	0.64	0.89	
	4	2.2	2.2	5	2.4	2.2	4.2	4.2	0.80	0.64	0.75	0.8929
						2.4	4	4	1.00	0.64	0.89	
	5	3.2	3.2	6	2.4	2.4	5	4.2	1.00	0.64	0.89	0.8929
	6	4.2	4.2	7	2.4	2.4	6	4.2	1.00	0.64	0.89	0.8929
	7	5.2	5.2	8	2.4	2.4	7	4.2	1.00	0.64	0.89	0.8929
	8	6.2	6.2	9	2.4	2.4	8	4.2	1.00	0.64	0.89	0.8929
	9	7.2	7.2	10	2.4	2.4	9	4.2	1.00	0.64	0.89	0.8929
	10	8.2	8.2	11	2.4	2.4	10	4.2	1.00	0.64	0.89	0.8929
2.6	1	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.57	0.17	0.7315
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.00	0.57	0.17	
						1	2.6	2.6	0.00	0.57	0.17	
						1.2	2.4	2.4	0.00	0.57	0.17	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{cn} (St,Qt) [13]
									Demand [10]	F C [11]		
						1.4	2.2	2.2	0.00	0.57	0.17	
						1.6	2	2	0.20	0.57	0.31	
						1.8	1.8	1.8	0.40	0.57	0.45	
						2	1.6	1.6	0.60	0.57	0.59	
						2.2	1.4	1.4	0.80	0.57	0.73	
	2	0.4	0.4	3.2	2.4	0.4	4.2	4.2	0.00	0.57	0.17	0.8715
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.00	0.57	0.17	
						1	3.6	3.6	0.00	0.57	0.17	
						1.2	3.4	3.4	0.00	0.57	0.17	
						1.4	3.2	3.2	0.00	0.57	0.17	
						1.6	3	3	0.20	0.57	0.31	
						1.8	2.8	2.8	0.40	0.57	0.45	
						2	2.6	2.6	0.60	0.57	0.59	
						2.2	2.4	2.4	0.80	0.57	0.73	
						2.4	2.2	2.2	1.00	0.57	0.87	
	3	1.4	1.4	4.2	2.4	1.4	4.2	4.2	0.00	0.57	0.17	0.8715
						1.6	4	4	0.20	0.57	0.31	
						1.8	3.8	3.8	0.40	0.57	0.45	
						2	3.6	3.6	0.60	0.57	0.59	
						2.2	3.4	3.4	0.80	0.57	0.73	
						2.4	3.2	3.2	1.00	0.57	0.87	
	4	2.4	2.4	5.2	2.4	2.4	4.2	4.2	1.00	0.57	0.87	0.8715
	5	3.4	3.4	6.2	2.4	2.4	5.2	4.2	1.00	0.57	0.87	0.8715
	6	4.4	4.4	7.2	2.4	2.4	6.2	4.2	1.00	0.57	0.87	0.8715
	7	5.4	5.4	8.2	2.4	2.4	7.2	4.2	1.00	0.57	0.87	0.8715
	8	6.4	6.4	9.2	2.4	2.4	8.2	4.2	1.00	0.57	0.87	0.8715
	9	7.4	7.4	10.2	2.4	2.4	9.2	4.2	1.00	0.57	0.87	0.8715
	10	8.4	8.4	11.2	2.4	2.4	10.2	4.2	1.00	0.57	0.87	0.8715
2.8	1	-0.4	0.2	2.4	2.4	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.00	0.50	0.15	
						1.2	2.6	2.6	0.00	0.50	0.15	
						1.4	2.4	2.4	0.00	0.50	0.15	
						1.6	2.2	2.2	0.20	0.50	0.29	
						1.8	2	2	0.40	0.50	0.43	
						2	1.8	1.8	0.60	0.50	0.57	
						2.2	1.6	1.6	0.80	0.50	0.71	
						2.4	1.4	1.4	1.00	0.50	0.85	
	2	0.6	0.6	3.4	2.4	0.6	4.2	4.2	0.00	0.50	0.15	0.8500
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.00	0.50	0.15	
						1.2	3.6	3.6	0.00	0.50	0.15	
						1.4	3.4	3.4	0.00	0.50	0.15	
						1.6	3.2	3.2	0.20	0.50	0.29	
						1.8	3	3	0.40	0.50	0.43	
						2	2.8	2.8	0.60	0.50	0.57	
						2.2	2.6	2.6	0.80	0.50	0.71	
						2.4	2.4	2.4	1.00	0.50	0.85	
	3	1.6	1.6	4.4	2.4	1.6	4.2	4.2	0.20	0.50	0.29	0.8500
						1.8	4	4	0.40	0.50	0.43	
						2	3.8	3.8	0.60	0.50	0.57	
						2.2	3.6	3.6	0.80	0.50	0.71	
						2.4	3.4	3.4	1.00	0.50	0.85	
	4	2.6	2.6	5.4	2.4	2.4	4.4	4.2	1.00	0.50	0.85	0.8500
	5	3.6	3.6	6.4	2.4	2.4	5.4	4.2	1.00	0.50	0.85	0.8500
	6	4.6	4.6	7.4	2.4	2.4	6.4	4.2	1.00	0.50	0.85	0.8500
	7	5.6	5.6	8.4	2.4	2.4	7.4	4.2	1.00	0.50	0.85	0.8500
	8	6.6	6.6	9.4	2.4	2.4	8.4	4.2	1.00	0.50	0.85	0.8500
	9	7.6	7.6	10.4	2.4	2.4	9.4	4.2	1.00	0.50	0.85	0.8500

Storage St [1]	Inflow Qt [2]	St+Qt - S max [3]	Min R [4]	St+Qt - S min [5]	Max R [6]	Release Rt [7]	St+Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{cn} (St,Qt) [13]	
									Demand [10]	F C [11]			
	10	8.6	8.6	11.4	2.4	2.4	10.4	4.2	1.00	0.50	0.85	0.8500	
3	1	-0.2	0.2	2.6	2.4	0.2	3.8	3.8	0.00	0.43	0.13	0.8286	
						0.4	3.6	3.6	0.00	0.43	0.13		
						0.6	3.4	3.4	0.00	0.43	0.13		
						0.8	3.2	3.2	0.00	0.43	0.13		
						1	3	3	0.00	0.43	0.13		
						1.2	2.8	2.8	0.00	0.43	0.13		
						1.4	2.6	2.6	0.00	0.43	0.13		
						1.6	2.4	2.4	0.20	0.43	0.27		
						1.8	2.2	2.2	0.40	0.43	0.41		
						2	2	2	0.60	0.43	0.55		
	2.2	1.8	1.8	0.80	0.43	0.69							
	2	0.8	0.8	0.8	3.6	2.4	2.4	1.6	1.6	1.00	0.43	0.83	0.8286
							0.8	4.2	4.2	0.00	0.43	0.13	
							1	4	4	0.00	0.43	0.13	
							1.2	3.8	3.8	0.00	0.43	0.13	
							1.4	3.6	3.6	0.00	0.43	0.13	
							1.6	3.4	3.4	0.20	0.43	0.27	
							1.8	3.2	3.2	0.40	0.43	0.41	
							2	3	3	0.60	0.43	0.55	
							2.2	2.8	2.8	0.80	0.43	0.69	
							2.4	2.6	2.6	1.00	0.43	0.83	
	3	1.8	1.8	1.8	4.6	2.4	1.8	4.2	4.2	0.40	0.43	0.41	0.8286
							2	4	4	0.60	0.43	0.55	
							2.2	3.8	3.8	0.80	0.43	0.69	
							2.4	3.6	3.6	1.00	0.43	0.83	
							2.4	4.6	4.2	1.00	0.43	0.83	
							2.4	5.6	4.2	1.00	0.43	0.83	
							2.4	6.6	4.2	1.00	0.43	0.83	
							2.4	7.6	4.2	1.00	0.43	0.83	
							2.4	8.6	4.2	1.00	0.43	0.83	
2.4							9.6	4.2	1.00	0.43	0.83		
2.4	10.6	4.2	1.00	0.43	0.83								
3.2	1	0	0.2	2.8	2.4	0.2	4	4	0.00	0.36	0.11	0.8072	
						0.4	3.8	3.8	0.00	0.36	0.11		
						0.6	3.6	3.6	0.00	0.36	0.11		
						0.8	3.4	3.4	0.00	0.36	0.11		
						1	3.2	3.2	0.00	0.36	0.11		
						1.2	3	3	0.00	0.36	0.11		
						1.4	2.8	2.8	0.00	0.36	0.11		
						1.6	2.6	2.6	0.20	0.36	0.25		
						1.8	2.4	2.4	0.40	0.36	0.39		
						2	2.2	2.2	0.60	0.36	0.53		
	2.2	2	2	0.80	0.36	0.67							
	2.4	1.8	1.8	1.00	0.36	0.81							
	2	1	1	3.8	2.4	1	4.2	4.2	0.00	0.36	0.11	0.8072	
						1.2	4	4	0.00	0.36	0.11		
						1.4	3.8	3.8	0.00	0.36	0.11		
						1.6	3.6	3.6	0.20	0.36	0.25		
						1.8	3.4	3.4	0.40	0.36	0.39		
						2	3.2	3.2	0.60	0.36	0.53		
						2.2	3	3	0.80	0.36	0.67		
						2.4	2.8	2.8	1.00	0.36	0.81		
2						4.2	4.2	0.60	0.36	0.53			
2.2						4	4	0.80	0.36	0.67			
2.4	3.8	3.8	1.00	0.36	0.81								
3	2	2	4.8	2.4	2	4.2	4.2	0.60	0.36	0.53	0.8072		
					2.2	4	4	0.80	0.36	0.67			
					2.4	3.8	3.8	1.00	0.36	0.81			
					3	4.8	4.2	1.00	0.36	0.81			
					4	5.8	4.2	1.00	0.36	0.81			
					5	6.8	4.2	1.00	0.36	0.81			
					6	7.8	4.2	1.00	0.36	0.81			
					7	8.8	4.2	1.00	0.36	0.81			
					8	9.8	4.2	1.00	0.36	0.81			
9	10.8	4.2	1.00	0.36	0.81								

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ_{cn} (St,Qt) [13]
									Demand [10]	FC [11]		
	10	9	9	11.8	2.4	2.4	10.8	4.2	1.00	0.36	0.81	0.8072
3.4	1	0.2	0.2	3	2.4	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.00	0.29	0.09	
						1	3.4	3.4	0.00	0.29	0.09	
						1.2	3.2	3.2	0.00	0.29	0.09	
						1.4	3	3	0.00	0.29	0.09	
						1.6	2.8	2.8	0.20	0.29	0.23	
						1.8	2.6	2.6	0.40	0.29	0.37	
						2	2.4	2.4	0.60	0.29	0.51	
2	1.2	1.2	4	2.4	2.2	4.2	4.2	0.80	0.29	0.65	0.7858	
					2.4	2	2	1.00	0.29	0.79		
					1.2	4.2	4.2	0.00	0.29	0.09		
					1.4	4	4	0.00	0.29	0.09		
					1.6	3.8	3.8	0.20	0.29	0.23		
					1.8	3.6	3.6	0.40	0.29	0.37		
					2	3.4	3.4	0.60	0.29	0.51		
					2.2	3.2	3.2	0.80	0.29	0.65		
					2.4	3	3	1.00	0.29	0.79		
					2.4	4.2	4.2	0.80	0.29	0.65		
3	2.2	2.2	5	2.4	2.4	4	4	1.00	0.29	0.79	0.7858	
					2.4	4	4	1.00	0.29	0.79		
					2.4	5	4.2	1.00	0.29	0.79		
					2.4	6	4.2	1.00	0.29	0.79		
					2.4	7	4.2	1.00	0.29	0.79		
					2.4	8	4.2	1.00	0.29	0.79		
					2.4	9	4.2	1.00	0.29	0.79		
					2.4	10	4.2	1.00	0.29	0.79		
					2.4	11	4.2	1.00	0.29	0.79		
					2.4	11	4.2	1.00	0.29	0.79		
3.6	1	0.4	0.4	3.2	2.4	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.00	0.21	0.06	
						1	3.6	3.6	0.00	0.21	0.06	
						1.2	3.4	3.4	0.00	0.21	0.06	
						1.4	3.2	3.2	0.00	0.21	0.06	
						1.6	3	3	0.20	0.21	0.20	
						1.8	2.8	2.8	0.40	0.21	0.34	
						2	2.6	2.6	0.60	0.21	0.48	
						2.2	2.4	2.4	0.80	0.21	0.62	
2	1.4	1.4	4.2	2.4	2.2	4.2	4.2	1.00	0.21	0.76	0.7643	
					2.4	4.2	4.2	0.00	0.21	0.06		
					1.6	4	4	0.20	0.21	0.20		
					1.8	3.8	3.8	0.40	0.21	0.34		
					2	3.6	3.6	0.60	0.21	0.48		
					2.2	3.4	3.4	0.80	0.21	0.62		
					2.4	3.2	3.2	1.00	0.21	0.76		
					2.4	4.2	4.2	1.00	0.21	0.76		
					2.4	5.2	4.2	1.00	0.21	0.76		
					2.4	6.2	4.2	1.00	0.21	0.76		
3	2.4	2.4	5.2	2.4	2.4	6.2	4.2	1.00	0.21	0.76	0.7643	
					2.4	7.2	4.2	1.00	0.21	0.76		
					2.4	8.2	4.2	1.00	0.21	0.76		
					2.4	9.2	4.2	1.00	0.21	0.76		
					2.4	10.2	4.2	1.00	0.21	0.76		
					2.4	11.2	4.2	1.00	0.21	0.76		
					2.4	12.2	4.2	1.00	0.21	0.76		
					2.4	12.2	4.2	1.00	0.21	0.76		
					2.4	12.2	4.2	1.00	0.21	0.76		
					2.4	12.2	4.2	1.00	0.21	0.76		
3.8	1	0.6	0.6	3.4	2.4	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.00	0.14	0.04	
						1	3.8	3.8	0.00	0.14	0.04	
						1.2	3.6	3.6	0.00	0.14	0.04	
						1.4	3.4	3.4	0.00	0.14	0.04	
						1.6	3.2	3.2	0.20	0.14	0.18	
						1.8	3	3	0.40	0.14	0.32	
						2	2.8	2.8	0.60	0.14	0.46	
						2	2.8	2.8	0.60	0.14	0.46	
						2	2.8	2.8	0.60	0.14	0.46	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St {1}	Inflow Qt {2}	St + Qt - S max {3}	Min R {4}	St + Qt - S min {5}	Max R {6}	Release Rt {7}	St + Qt - R {8}	Storage St+1 {9}	μ		μ _{Ct} (St,Qt,Rt) {12}	μ _{Ga} (St,Qt) {13}
									Demand {10}	F C {11}		
						2.2	2.6	2.6	0.80	0.14	0.60	
						2.4	2.4	2.4	1.00	0.14	0.74	
	2	1.6	1.6	4.4	2.4	1.6	4.2	4.2	0.20	0.14	0.18	0.7429
						1.8	4	4	0.40	0.14	0.32	
						2	3.8	3.8	0.60	0.14	0.46	
						2.2	3.6	3.6	0.80	0.14	0.60	
						2.4	3.4	3.4	1.00	0.14	0.74	
	3	2.6	2.6	5.4	2.4	2.4	4.4	4.2	1.00	0.14	0.74	0.7429
	4	3.6	3.6	6.4	2.4	2.4	5.4	4.2	1.00	0.14	0.74	0.7429
	5	4.6	4.6	7.4	2.4	2.4	6.4	4.2	1.00	0.14	0.74	0.7429
	6	5.6	5.6	8.4	2.4	2.4	7.4	4.2	1.00	0.14	0.74	0.7429
	7	6.6	6.6	9.4	2.4	2.4	8.4	4.2	1.00	0.14	0.74	0.7429
	8	7.6	7.6	10.4	2.4	2.4	9.4	4.2	1.00	0.14	0.74	0.7429
	9	8.6	8.6	11.4	2.4	2.4	10.4	4.2	1.00	0.14	0.74	0.7429
	10	9.6	9.6	12.4	2.4	2.4	11.4	4.2	1.00	0.14	0.74	0.7429
4	1	0.8	0.8	3.6	2.4	0.8	4.2	4.2	0.00	0.07	0.02	0.7215
						1	4	4	0.00	0.07	0.02	
						1.2	3.8	3.8	0.00	0.07	0.02	
						1.4	3.6	3.6	0.00	0.07	0.02	
						1.6	3.4	3.4	0.20	0.07	0.16	
						1.8	3.2	3.2	0.40	0.07	0.30	
						2	3	3	0.60	0.07	0.44	
						2.2	2.8	2.8	0.80	0.07	0.58	
						2.4	2.6	2.6	1.00	0.07	0.72	
	2	1.8	1.8	4.6	2.4	1.8	4.2	4.2	0.40	0.07	0.30	0.7215
						2	4	4	0.60	0.07	0.44	
						2.2	3.8	3.8	0.80	0.07	0.58	
						2.4	3.6	3.6	1.00	0.07	0.72	
	3	2.8	2.8	5.6	2.4	2.4	4.6	4.2	1.00	0.07	0.72	0.7215
	4	3.8	3.8	6.6	2.4	2.4	5.6	4.2	1.00	0.07	0.72	0.7215
	5	4.8	4.8	7.6	2.4	2.4	6.6	4.2	1.00	0.07	0.72	0.7215
	6	5.8	5.8	8.6	2.4	2.4	7.6	4.2	1.00	0.07	0.72	0.7215
	7	6.8	6.8	9.6	2.4	2.4	8.6	4.2	1.00	0.07	0.72	0.7215
	8	7.8	7.8	10.6	2.4	2.4	9.6	4.2	1.00	0.07	0.72	0.7215
	9	8.8	8.8	11.6	2.4	2.4	10.6	4.2	1.00	0.07	0.72	0.7215
	10	9.8	9.8	12.6	2.4	2.4	11.6	4.2	1.00	0.07	0.72	0.7215
4.2	1	1	1	3.8	2.4	1	4.2	4.2	0.00	0.00	0.00	0.7000
						1.2	4	4	0.00	0.00	0.00	
						1.4	3.8	3.8	0.00	0.00	0.00	
						1.6	3.6	3.6	0.20	0.00	0.14	
						1.8	3.4	3.4	0.40	0.00	0.28	
						2	3.2	3.2	0.60	0.00	0.42	
						2.2	3	3	0.80	0.00	0.56	
						2.4	2.8	2.8	1.00	0.00	0.70	
	2	2	2	4.8	2.4	2	4.2	4.2	0.60	0.00	0.42	0.7000
						2.2	4	4	0.80	0.00	0.56	
						2.4	3.8	3.8	1.00	0.00	0.70	
	3	3	3	5.8	2.4	2.4	4.8	4.2	1.00	0.00	0.70	0.7000
	4	4	4	6.8	2.4	2.4	5.8	4.2	1.00	0.00	0.70	0.7000
	5	5	5	7.8	2.4	2.4	6.8	4.2	1.00	0.00	0.70	0.7000
	6	6	6	8.8	2.4	2.4	7.8	4.2	1.00	0.00	0.70	0.7000
	7	7	7	9.8	2.4	2.4	8.8	4.2	1.00	0.00	0.70	0.7000
	8	8	8	10.8	2.4	2.4	9.8	4.2	1.00	0.00	0.70	0.7000
	9	9	9	11.8	2.4	2.4	10.8	4.2	1.00	0.00	0.70	0.7000
	10	10	10	12.8	2.4	2.4	11.8	4.2	1.00	0.00	0.70	0.7000

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 3

May

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ^*_{Cn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
						1	1.4	1.4	0.00	1.00	0.30	
						0.2	3.2	3.2	0.00	1.00	0.30	
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.00	1.00	0.30	
	2	-0.8	0.2	2	2	0.2	3.2	3.2	0.00	1.00	0.30	0.4166
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.00	1.00	0.30	
						1	2.4	2.4	0.00	1.00	0.30	
						1.2	2.2	2.2	0.00	1.00	0.30	
						1.4	2	2	0.00	1.00	0.30	
						1.6	1.8	1.8	0.00	1.00	0.30	
						1.8	1.6	1.6	0.00	1.00	0.30	
2	1.4	1.4	0.17	1.00	0.42							
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.2786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
						1	1.6	1.6	0.00	0.93	0.28	
						1.2	1.4	1.4	0.00	0.93	0.28	
						0.2	3.4	3.4	0.00	0.93	0.28	
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
	2	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.93	0.28	0.5119
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
						0.8	2.8	2.8	0.00	0.93	0.28	
						1	2.6	2.6	0.00	0.93	0.28	
						1.2	2.4	2.4	0.00	0.93	0.28	
						1.4	2.2	2.2	0.00	0.93	0.28	
						1.6	2	2	0.00	0.93	0.28	
						1.8	1.8	1.8	0.00	0.93	0.28	
2	1.6	1.6	0.17	0.93	0.40							
1.8	1	-1.4	0.2	1.4	1.4	0.2	2.6	2.6	0.00	0.86	0.26	0.2572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.00	0.86	0.26	
						1	1.8	1.8	0.00	0.86	0.26	
						1.2	1.6	1.6	0.00	0.86	0.26	
						1.4	1.4	1.4	0.00	0.86	0.26	
						0.2	3.6	3.6	0.00	0.86	0.26	
						0.4	3.4	3.4	0.00	0.86	0.26	
	2	-0.4	0.2	2.4	2.4	0.2	3.6	3.6	0.00	0.86	0.26	0.6071
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
						0.8	3	3	0.00	0.86	0.26	
						1	2.8	2.8	0.00	0.86	0.26	
						1.2	2.6	2.6	0.00	0.86	0.26	
						1.4	2.4	2.4	0.00	0.86	0.26	
						1.6	2.2	2.2	0.00	0.86	0.26	
						1.8	2	2	0.00	0.86	0.26	
2	1.8	1.8	0.17	0.86	0.37							
2	1	-1.2	0.2	1.6	1.6	0.2	2.8	2.8	0.00	0.79	0.24	0.2357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						2.4	1.4	1.4	0.50	0.86	0.61	
						2.4	1.4	1.4	0.50	0.86	0.61	

Storage St {1}	Inflow Qt {2}	St + Qt - S max {3}	Min R {4}	St + Qt - S min {5}	Max R {6}	Release Rt {7}	St + Qt - R {8}	Storage St+1 {9}	μ		μ_{C_1} (St,Qt,Rt) {12}	$\mu^*_{C_n}$ (St,Qt) {13}						
									Demand {10}	F C {11}								
2	2	-0.2	0.2	2.6	2.6	1	2	2	0.00	0.79	0.24	0.7023						
						1.2	1.8	1.8	0.00	0.79	0.24							
						1.4	1.6	1.6	0.00	0.79	0.24							
						1.6	1.4	1.4	0.00	0.79	0.24							
						0.2	3.8	3.8	0.00	0.79	0.24							
						0.4	3.6	3.6	0.00	0.79	0.24							
						0.6	3.4	3.4	0.00	0.79	0.24							
						0.8	3.2	3.2	0.00	0.79	0.24							
						1	3	3	0.00	0.79	0.24							
						1.2	2.8	2.8	0.00	0.79	0.24							
						1.4	2.6	2.6	0.00	0.79	0.24							
						1.6	2.4	2.4	0.00	0.79	0.24							
						1.8	2.2	2.2	0.00	0.79	0.24							
						2	2	2	0.17	0.79	0.35							
						2.2	1.8	1.8	0.33	0.79	0.47							
						2.4	1.6	1.6	0.50	0.79	0.59							
2.6	1.4	1.4	0.67	0.79	0.70													
2.2	1	-1	0.2	1.8	1.8	0.2	3	3	0.00	0.71	0.21	0.2143						
						0.4	2.8	2.8	0.00	0.71	0.21							
						0.6	2.6	2.6	0.00	0.71	0.21							
						0.8	2.4	2.4	0.00	0.71	0.21							
						1	2.2	2.2	0.00	0.71	0.21							
						1.2	2	2	0.00	0.71	0.21							
						1.4	1.8	1.8	0.00	0.71	0.21							
						1.6	1.6	1.6	0.00	0.71	0.21							
	2					0	-1	0.2	1.8	1.8	1.8		1.4	1.4	0.00	0.71	0.21	0.7976
											0.2		4	4	0.00	0.71	0.21	
											0.4		3.8	3.8	0.00	0.71	0.21	
											0.6		3.6	3.6	0.00	0.71	0.21	
											0.8		3.4	3.4	0.00	0.71	0.21	
											1		3.2	3.2	0.00	0.71	0.21	
											1.2		3	3	0.00	0.71	0.21	
											1.4		2.8	2.8	0.00	0.71	0.21	
2.4	1	-0.8	0.2	2	2	0.2					-3.2	3.2	0.00	0.64	0.19	0.3095		
						0.4					3	3	0.00	0.64	0.19			
						0.6					2.8	2.8	0.00	0.64	0.19			
						0.8					2.6	2.6	0.00	0.64	0.19			
						1					2.4	2.4	0.00	0.64	0.19			
						1.2					2.2	2.2	0.00	0.64	0.19			
						1.4					2	2	0.00	0.64	0.19			
						1.6					1.8	1.8	0.00	0.64	0.19			
	2					0.2	-0.8	0.2	2	2	1.8	1.6	1.6	0.00	0.64		0.19	0.8929
											2	1.4	1.4	0.17	0.64		0.31	
											0.2	4.2	4.2	0.00	0.64		0.19	
											0.4	4	4	0.00	0.64		0.19	
											0.6	3.8	3.8	0.00	0.64		0.19	
											0.8	3.6	3.6	0.00	0.64		0.19	
											1	3.4	3.4	0.00	0.64		0.19	
											1.2	3.2	3.2	0.00	0.64		0.19	
2	0.2	-0.8	0.2	2	2	1.4					3	3	0.00	0.64	0.19	0.8929		
						1.6					2.8	2.8	0.00	0.64	0.19			
						1.8					2.6	2.6	0.00	0.64	0.19			
						2					2.4	2.4	0.17	0.64	0.31			
						2.2					2.2	2.2	0.33	0.64	0.43			
						2.4					2	2	0.50	0.64	0.54			

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		F _{Ct} (St,Qt,Rt) [12]	μ^*_{Cn} (St,Qt) [13]
									Demand [10]	F C [11]		
						2.6	1.8	1.8	0.67	0.64	0.66	
						2.8	1.6	1.6	0.83	0.64	0.78	
						3	1.4	1.4	1.00	0.64	0.89	
2.6	1	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.57	0.17	0.4047
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.00	0.57	0.17	
						1	2.6	2.6	0.00	0.57	0.17	
						1.2	2.4	2.4	0.00	0.57	0.17	
						1.4	2.2	2.2	0.00	0.57	0.17	
						1.6	2	2	0.00	0.57	0.17	
	2	0.4	0.4	3.2	3	2.2	1.4	1.4	0.33	0.57	0.40	
						0.4	4.2	4.2	0.00	0.57	0.17	
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.00	0.57	0.17	
						1	3.6	3.6	0.00	0.57	0.17	
						1.2	3.4	3.4	0.00	0.57	0.17	
						1.4	3.2	3.2	0.00	0.57	0.17	
						1.6	3	3	0.00	0.57	0.17	
2.8	1	-0.4	0.2	2.4	2.4	0.2	3.6	3.6	0.00	0.50	0.15	0.5000
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.00	0.50	0.15	
						1.2	2.6	2.6	0.00	0.50	0.15	
						1.4	2.4	2.4	0.00	0.50	0.15	
						1.6	2.2	2.2	0.00	0.50	0.15	
	2	0.6	0.6	3.4	3	1.8	2	2	0.00	0.50	0.15	
						2	1.8	1.8	0.17	0.50	0.27	
						2.2	1.6	1.6	0.33	0.50	0.38	
						2.4	1.4	1.4	0.50	0.50	0.50	
						0.6	4.2	4.2	0.00	0.50	0.15	
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.00	0.50	0.15	
						1.2	3.6	3.6	0.00	0.50	0.15	
3	1	-0.2	0.2	2.6	2.6	0.2	3.8	3.8	0.00	0.43	0.13	0.5952
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.00	0.43	0.13	
						1	3	3	0.00	0.43	0.13	
						1.2	2.8	2.8	0.00	0.43	0.13	
						1.4	2.6	2.6	0.00	0.43	0.13	
						1.6	2.4	2.4	0.00	0.43	0.13	
	2	0.4	0.4	3.2	3	1.8	2.2	2.2	0.00	0.43	0.13	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St+Qt -S max [3]	Min R [4]	St+Qt -S min [5]	Max R [6]	Release Rt [7]	St+Qt -R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ_{On} (St,Qt) [13]
									Demand [10]	FC [11]		
						2	2	2	0.17	0.43	0.25	
						2.2	1.8	1.8	0.33	0.43	0.36	
						2.4	1.6	1.6	0.50	0.43	0.48	
						2.6	1.4	1.4	0.67	0.43	0.60	
	2	0.8	0.8	3.6	3	0.8	4.2	4.2	0.00	0.43	0.13	0.8286
						1	4	4	0.00	0.43	0.13	
						1.2	3.8	3.8	0.00	0.43	0.13	
						1.4	3.6	3.6	0.00	0.43	0.13	
						1.6	3.4	3.4	0.00	0.43	0.13	
						1.8	3.2	3.2	0.00	0.43	0.13	
						2	3	3	0.17	0.43	0.25	
						2.2	2.8	2.8	0.33	0.43	0.36	
						2.4	2.6	2.6	0.50	0.43	0.48	
						2.6	2.4	2.4	0.67	0.43	0.60	
						2.8	2.2	2.2	0.83	0.43	0.71	
						3	2	2	1.00	0.43	0.83	
3.2	1	0	0.2	2.8	2.8	0.2	4	4	0.00	0.36	0.11	0.6905
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.00	0.36	0.11	
						0.8	3.4	3.4	0.00	0.36	0.11	
						1	3.2	3.2	0.00	0.36	0.11	
						1.2	3	3	0.00	0.36	0.11	
						1.4	2.8	2.8	0.00	0.36	0.11	
						1.6	2.6	2.6	0.00	0.36	0.11	
						1.8	2.4	2.4	0.00	0.36	0.11	
						2	2.2	2.2	0.17	0.36	0.22	
						2.2	2	2	0.33	0.36	0.34	
						2.4	1.8	1.8	0.50	0.36	0.46	
						2.6	1.6	1.6	0.67	0.36	0.57	
						2.8	1.4	1.4	0.83	0.36	0.69	
	2	1	1	3.8	3	1	4.2	4.2	0.00	0.36	0.11	0.8072
						1.2	4	4	0.00	0.36	0.11	
						1.4	3.8	3.8	0.00	0.36	0.11	
						1.6	3.6	3.6	0.00	0.36	0.11	
						1.8	3.4	3.4	0.00	0.36	0.11	
						2	3.2	3.2	0.17	0.36	0.22	
						2.2	3	3	0.33	0.36	0.34	
						2.4	2.8	2.8	0.50	0.36	0.46	
						2.6	2.6	2.6	0.67	0.36	0.57	
						2.8	2.4	2.4	0.83	0.36	0.69	
						3	2.2	2.2	1.00	0.36	0.81	
3.4	1	0.2	0.2	3	3	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.00	0.29	0.09	
						1	3.4	3.4	0.00	0.29	0.09	
						1.2	3.2	3.2	0.00	0.29	0.09	
						1.4	3	3	0.00	0.29	0.09	
						1.6	2.8	2.8	0.00	0.29	0.09	
						1.8	2.6	2.6	0.00	0.29	0.09	
						2	2.4	2.4	0.17	0.29	0.20	
						2.2	2.2	2.2	0.33	0.29	0.32	
						2.4	2	2	0.50	0.29	0.44	
						2.6	1.8	1.8	0.67	0.29	0.55	
						2.8	1.6	1.6	0.83	0.29	0.67	
						3	1.4	1.4	1.00	0.29	0.79	
	2	1.2	1.2	4	3	1.2	4.2	4.2	0.00	0.29	0.09	0.7858
						1.4	4	4	0.00	0.29	0.09	
						1.6	3.8	3.8	0.00	0.29	0.09	
						1.8	3.6	3.6	0.00	0.29	0.09	
						2	3.4	3.4	0.17	0.29	0.20	
						2.2	3.2	3.2	0.33	0.29	0.32	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
						2.4	3	3	0.50	0.29	0.44	
						2.6	2.8	2.8	0.67	0.29	0.55	
						2.8	2.6	2.6	0.83	0.29	0.67	
						3	2.4	2.4	1.00	0.29	0.79	
3.6	1	0.4	0.4	3.2	3	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.00	0.21	0.06	
						1	3.6	3.6	0.00	0.21	0.06	
						1.2	3.4	3.4	0.00	0.21	0.06	
						1.4	3.2	3.2	0.00	0.21	0.06	
						1.6	3	3	0.00	0.21	0.06	
	2	1.4	1.4	4.2	3	1.8	2.8	2.8	0.00	0.21	0.06	0.7643
						2	2.6	2.6	0.17	0.21	0.18	
						2.2	2.4	2.4	0.33	0.21	0.30	
						2.4	2.2	2.2	0.50	0.21	0.41	
						2.6	2	2	0.67	0.21	0.53	
						2.8	1.8	1.8	0.83	0.21	0.65	
						3	1.6	1.6	1.00	0.21	0.76	
3.8	1	0.6	0.6	3.4	3	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.00	0.14	0.04	
						1	3.8	3.8	0.00	0.14	0.04	
						1.2	3.6	3.6	0.00	0.14	0.04	
						1.4	3.4	3.4	0.00	0.14	0.04	
						1.6	3.2	3.2	0.00	0.14	0.04	
						1.8	3	3	0.00	0.14	0.04	
	2	1.6	1.6	4.4	3	2	2.8	2.8	0.17	0.14	0.16	0.7429
						2.2	2.6	2.6	0.33	0.14	0.28	
						2.4	2.4	2.4	0.50	0.14	0.39	
						2.6	2.2	2.2	0.67	0.14	0.51	
						2.8	2	2	0.83	0.14	0.63	
						3	1.8	1.8	1.00	0.14	0.74	
						1.6	4.2	4.2	0.00	0.14	0.04	
4	1	0.8	0.8	3.6	3	1.8	4	4	0.00	0.14	0.04	0.7215
						2	3.8	3.8	0.17	0.14	0.16	
						2.2	3.6	3.6	0.33	0.14	0.28	
						2.4	3.4	3.4	0.50	0.14	0.39	
						2.6	3.2	3.2	0.67	0.14	0.51	
						2.8	3	3	0.83	0.14	0.63	
						3	2.8	2.8	1.00	0.14	0.74	
	2	1.8	1.8	4.6	3	0.8	4.2	4.2	0.00	0.07	0.02	0.7215
						1	4	4	0.00	0.07	0.02	
						1.2	3.8	3.8	0.00	0.07	0.02	
						1.4	3.6	3.6	0.00	0.07	0.02	
						1.6	3.4	3.4	0.00	0.07	0.02	
						1.8	3.2	3.2	0.00	0.07	0.02	
						2	3	3	0.17	0.07	0.14	
2	1.8	1.8	4.6	3	2.2	2.8	2.8	0.33	0.07	0.25	0.7215	
					2.4	2.6	2.6	0.50	0.07	0.37		
					2.6	2.4	2.4	0.67	0.07	0.49		
					2.8	2.2	2.2	0.83	0.07	0.60		
					3	2	2	1.00	0.07	0.72		
					1.8	4.2	4.2	0.00	0.07	0.02		
					2	4	4	0.17	0.07	0.14		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St {1}	Inflow Qt {2}	St + Qt - S max {3}	Min R {4}	St + Qt - S min {5}	Max R {6}	Release Rt {7}	St + Qt - R {8}	Storage St+1 {9}	μ		μ_{Ct} (St,Qt,Rt) {12}	μ_{Gn} (St,Qt) {13}
									Demand {10}	F C {11}		
						2.2	3.8	3.8	0.33	0.07	0.25	
						2.4	3.6	3.6	0.50	0.07	0.37	
						2.6	3.4	3.4	0.67	0.07	0.49	
						2.8	3.2	3.2	0.83	0.07	0.60	
						3	3	3	1.00	0.07	0.72	
4.2	1	1	1	3.8	3	1	4.2	4.2	0.00	0.00	0.00	0.7000
						1.2	4	4	0.00	0.00	0.00	
						1.4	3.8	3.8	0.00	0.00	0.00	
						1.6	3.6	3.6	0.00	0.00	0.00	
						1.8	3.4	3.4	0.00	0.00	0.00	
						2	3.2	3.2	0.17	0.00	0.12	
						2.2	3	3	0.33	0.00	0.23	
						2.4	2.8	2.8	0.50	0.00	0.35	
						2.6	2.6	2.6	0.67	0.00	0.47	
						2.8	2.4	2.4	0.83	0.00	0.58	
						3	2.2	2.2	1.00	0.00	0.70	
	2	2	2	4.8	3	2	4.2	4.2	0.17	0.00	0.12	0.7000
						2.2	4	4	0.33	0.00	0.23	
						2.4	3.8	3.8	0.50	0.00	0.35	
						2.6	3.6	3.6	0.67	0.00	0.47	
						2.8	3.4	3.4	0.83	0.00	0.58	
						3	3.2	3.2	1.00	0.00	0.70	

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 2.4

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Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ [*] _{Gn} (St,Qt) [13]
									Demand [10]	FC [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
						1	1.4	1.4	0.00	1.00	0.30	
						2	0.2	3.2	3.2	0.00	1.00	
	2	-0.8	0.2	2	2	0.4	3	3	0.00	1.00	0.30	0.7200
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.00	1.00	0.30	
						1	2.4	2.4	0.00	1.00	0.30	
						1.2	2.2	2.2	0.00	1.00	0.30	
						1.4	2	2	0.00	1.00	0.30	
						1.6	1.8	1.8	0.20	1.00	0.44	
						1.8	1.6	1.6	0.40	1.00	0.58	
2	1.4	1.4	0.60	1.00	0.72							
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.2786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
						1	1.6	1.6	0.00	0.93	0.28	
						1.2	1.4	1.4	0.00	0.93	0.28	
	2	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.93	0.28	0.8386
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
						0.8	2.8	2.8	0.00	0.93	0.28	
						1	2.6	2.6	0.00	0.93	0.28	
						1.2	2.4	2.4	0.00	0.93	0.28	
						1.4	2.2	2.2	0.00	0.93	0.28	
						1.6	2	2	0.20	0.93	0.42	
1.8	1.8	1.8	0.40	0.93	0.56							
2	1.6	1.6	0.60	0.93	0.70							
2.2	1.4	1.4	0.80	0.93	0.84							
1.8	1	-1.4	0.2	1.4	1.4	0.2	2.6	2.6	0.00	0.86	0.26	0.2572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.00	0.86	0.26	
						1	1.8	1.8	0.00	0.86	0.26	
						1.2	1.6	1.6	0.00	0.86	0.26	
	2	-0.4	0.2	2.4	2.4	1.4	1.4	1.4	0.00	0.86	0.26	0.9572
						0.2	3.6	3.6	0.00	0.86	0.26	
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
						0.8	3	3	0.00	0.86	0.26	
						1	2.8	2.8	0.00	0.86	0.26	
						1.2	2.6	2.6	0.00	0.86	0.26	
						1.4	2.4	2.4	0.00	0.86	0.26	
1.6	2.2	2.2	0.20	0.86	0.40							
1.8	2	2	0.40	0.86	0.54							
2	1.8	1.8	0.60	0.86	0.68							
2.2	1.6	1.6	0.80	0.86	0.82							
2.4	1.4	1.4	1.00	0.86	0.96							
2	1	-1.2	0.2	1.6	1.6	0.2	2.8	2.8	0.00	0.79	0.24	0.3757
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						2.2	2.2	2.2	0.00	0.79	0.24	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St {1}	Inflow Qt {2}	St + Qt - S max {3}	Min R {4}	St + Qt - S min {5}	Max R {6}	Release Rt {7}	St + Qt - R {8}	Storage St+1 {9}	μ		μ_{ct} (St,Qt,Rt) {12}	μ_{gn} (St,Qt) {13}
									Demand {10}	FC {11}		
2	2	-0.2	0.2	2.6	2.4	1	2	2	0.00	0.79	0.24	0.9357
						1.2	1.8	1.8	0.00	0.79	0.24	
						1.4	1.6	1.6	0.00	0.79	0.24	
						1.6	1.4	1.4	0.20	0.79	0.38	
						0.2	3.8	3.8	0.00	0.79	0.24	
						0.4	3.6	3.6	0.00	0.79	0.24	
						0.6	3.4	3.4	0.00	0.79	0.24	
						0.8	3.2	3.2	0.00	0.79	0.24	
						1	3	3	0.00	0.79	0.24	
						1.2	2.8	2.8	0.00	0.79	0.24	
						1.4	2.6	2.6	0.00	0.79	0.24	
						1.6	2.4	2.4	0.20	0.79	0.38	
						1.8	2.2	2.2	0.40	0.79	0.52	
						2	2	2	0.60	0.79	0.66	
						2.2	1.8	1.8	0.80	0.79	0.80	
2.4	1.6	1.6	1.00	0.79	0.94							
2.2	1	-1	0.2	1.8	1.8	0.2	3	3	0.00	0.71	0.21	0.4943
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.00	0.71	0.21	
						1	2.2	2.2	0.00	0.71	0.21	
						1.2	2	2	0.00	0.71	0.21	
						1.4	1.8	1.8	0.00	0.71	0.21	
						1.6	1.6	1.6	0.20	0.71	0.35	
						1.8	1.4	1.4	0.40	0.71	0.49	
						0.2	4	4	0.00	0.71	0.21	
						0.4	3.8	3.8	0.00	0.71	0.21	
						0.6	3.6	3.6	0.00	0.71	0.21	
						0.8	3.4	3.4	0.00	0.71	0.21	
						1	3.2	3.2	0.00	0.71	0.21	
						1.2	3	3	0.00	0.71	0.21	
1.4	2.8	2.8	0.00	0.71	0.21							
1.6	2.6	2.6	0.20	0.71	0.35							
1.8	2.4	2.4	0.40	0.71	0.49							
2	2.2	2.2	0.60	0.71	0.63							
2.2	2	2	0.80	0.71	0.77							
2.4	1.8	1.8	1.00	0.71	0.91							
2.4	1	-0.8	0.2	2	2	0.2	3.2	3.2	0.00	0.64	0.19	0.6129
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.00	0.64	0.19	
						1	2.4	2.4	0.00	0.64	0.19	
						1.2	2.2	2.2	0.00	0.64	0.19	
						1.4	2	2	0.00	0.64	0.19	
						1.6	1.8	1.8	0.20	0.64	0.33	
						1.8	1.6	1.6	0.40	0.64	0.47	
						2	1.4	1.4	0.60	0.64	0.61	
						0.2	4.2	4.2	0.00	0.64	0.19	
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.00	0.64	0.19	
						0.8	3.6	3.6	0.00	0.64	0.19	
						1	3.4	3.4	0.00	0.64	0.19	
1.2	3.2	3.2	0.00	0.64	0.19							
1.4	3	3	0.00	0.64	0.19							
1.6	2.8	2.8	0.20	0.64	0.33							
1.8	2.6	2.6	0.40	0.64	0.47							
2	2.4	2.4	0.60	0.64	0.61							
2.2	2.2	2.2	0.80	0.64	0.75							
2.4	2	2	1.00	0.64	0.89							
2.6	1	-0.6	0.2	2.2	2.2	0.2	3.4	3.4	0.00	0.57	0.17	0.7315
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{C_i} (St,Qt,Rt) [12]	μ_{G_n} (St,Qt) [13]
									Demand [10]	F C [11]		
2.8	2	0.4	0.4	3.2	2.4	0.8	2.8	2.8	0.00	0.57	0.17	0.8715
						1	2.6	2.6	0.00	0.57	0.17	
						1.2	2.4	2.4	0.00	0.57	0.17	
						1.4	2.2	2.2	0.00	0.57	0.17	
						1.6	2	2	0.20	0.57	0.31	
						1.8	1.8	1.8	0.40	0.57	0.45	
						2	1.6	1.6	0.60	0.57	0.59	
						2.2	1.4	1.4	0.80	0.57	0.73	
						0.4	4.2	4.2	0.00	0.57	0.17	
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.00	0.57	0.17	
						1	3.6	3.6	0.00	0.57	0.17	
						1.2	3.4	3.4	0.00	0.57	0.17	
						1.4	3.2	3.2	0.00	0.57	0.17	
						1.6	3	3	0.20	0.57	0.31	
						1.8	2.8	2.8	0.40	0.57	0.45	
2	2.6	2.6	0.60	0.57	0.59							
2.2	2.4	2.4	0.80	0.57	0.73							
2.4	2.2	2.2	1.00	0.57	0.87							
2.8	1	-0.4	0.2	2.4	2.4	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.00	0.50	0.15	
						1.2	2.6	2.6	0.00	0.50	0.15	
						1.4	2.4	2.4	0.00	0.50	0.15	
						1.6	2.2	2.2	0.20	0.50	0.29	
						1.8	2	2	0.40	0.50	0.43	
						2	1.8	1.8	0.60	0.50	0.57	
						2.2	1.6	1.6	0.80	0.50	0.71	
						2.4	1.4	1.4	1.00	0.50	0.85	
						0.6	4.2	4.2	0.00	0.50	0.15	
						0.8	4	4	0.00	0.50	0.15	
						1	3.8	3.8	0.00	0.50	0.15	
						1.2	3.6	3.6	0.00	0.50	0.15	
1.4	3.4	3.4	0.00	0.50	0.15							
1.6	3.2	3.2	0.20	0.50	0.29							
1.8	3	3	0.40	0.50	0.43							
2	2.8	2.8	0.60	0.50	0.57							
2.2	2.6	2.6	0.80	0.50	0.71							
2.4	2.4	2.4	1.00	0.50	0.85							
3	1	-0.2	0.2	2.6	2.4	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.00	0.43	0.13	
						1	3	3	0.00	0.43	0.13	
						1.2	2.8	2.8	0.00	0.43	0.13	
						1.4	2.6	2.6	0.00	0.43	0.13	
						1.6	2.4	2.4	0.20	0.43	0.27	
						1.8	2.2	2.2	0.40	0.43	0.41	
						2	2	2	0.60	0.43	0.55	
						2.2	1.8	1.8	0.80	0.43	0.69	
						2.4	1.6	1.6	1.00	0.43	0.83	
						0.8	4.2	4.2	0.00	0.43	0.13	
						1	4	4	0.00	0.43	0.13	
						1.2	3.8	3.8	0.00	0.43	0.13	
						1.4	3.6	3.6	0.00	0.43	0.13	
1.6	3.4	3.4	0.20	0.43	0.27							
1.8	3.2	3.2	0.40	0.43	0.41							
2	3	3	0.60	0.43	0.55							
2.2	2.8	2.8	0.80	0.43	0.69							
2.4	2.6	2.6	1.00	0.43	0.83							
3	2	0.8	0.8	3.6	2.4	0.8	4.2	4.2	0.00	0.43	0.13	0.8286
						1	4	4	0.00	0.43	0.13	
						1.2	3.8	3.8	0.00	0.43	0.13	
						1.4	3.6	3.6	0.00	0.43	0.13	
						1.6	3.4	3.4	0.20	0.43	0.27	
						1.8	3.2	3.2	0.40	0.43	0.41	
						2	3	3	0.60	0.43	0.55	
						2.2	2.8	2.8	0.80	0.43	0.69	
						2.4	2.6	2.6	1.00	0.43	0.83	

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Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ci} (St,Qt,Rt) [12]	μ^*_{cm} (St,Qt) [13]						
									Demand [10]	F C [11]								
3.2	1	0	0.2	2.8	2.4	0.2	4	4	0.00	0.36	0.11	0.8072						
						0.4	3.8	3.8	0.00	0.36	0.11							
						0.6	3.6	3.6	0.00	0.36	0.11							
						0.8	3.4	3.4	0.00	0.36	0.11							
						1	3.2	3.2	0.00	0.36	0.11							
						1.2	3	3	0.00	0.36	0.11							
						1.4	2.8	2.8	0.00	0.36	0.11							
						1.6	2.6	2.6	0.20	0.36	0.25							
						1.8	2.4	2.4	0.40	0.36	0.39							
	2	2.2	2.2	0.60	0.36	0.53												
	2.2	2	2	0.80	0.36	0.67												
	2.4	1.8	1.8	1.00	0.36	0.81												
	2	1	1	1	3.8	2.4	1	4.2	4.2	0.00	0.36		0.11					
							1.2	4	4	0.00	0.36		0.11					
							1.4	3.8	3.8	0.00	0.36		0.11					
							1.6	3.6	3.6	0.20	0.36		0.25					
							1.8	3.4	3.4	0.40	0.36		0.39					
							2	3.2	3.2	0.60	0.36		0.53					
2.2							3	3	0.80	0.36	0.67							
2.4							2.8	2.8	1.00	0.36	0.81							
3.4							1	0.2	0.2	3	2.4	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
0.4	4	4	0.00	0.29	0.09													
0.6	3.8	3.8	0.00	0.29	0.09													
0.8	3.6	3.6	0.00	0.29	0.09													
1	3.4	3.4	0.00	0.29	0.09													
1.2	3.2	3.2	0.00	0.29	0.09													
1.4	3	3	0.00	0.29	0.09													
1.6	2.8	2.8	0.20	0.29	0.23													
1.8	2.6	2.6	0.40	0.29	0.37													
2	2.4	2.4	0.60	0.29	0.51													
2.2	2.2	2.2	0.80	0.29	0.65													
2.4	2	2	1.00	0.29	0.79													
2	1.2	1.2	1.2	4	2.4	1.2		4.2	4.2	0.00	0.29	0.09						
						1.4		4	4	0.00	0.29	0.09						
						1.6		3.8	3.8	0.20	0.29	0.23						
						1.8		3.6	3.6	0.40	0.29	0.37						
						2		3.4	3.4	0.60	0.29	0.51						
						2.2		3.2	3.2	0.80	0.29	0.65						
						2.4	3	3	1.00	0.29	0.79							
						3.6	1	0.4	0.4	3.2	2.4	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6						4	4	0.00	0.21	0.06		
0.8	3.8	3.8	0.00	0.21	0.06													
1	3.6	3.6	0.00	0.21	0.06													
1.2	3.4	3.4	0.00	0.21	0.06													
1.4	3.2	3.2	0.00	0.21	0.06													
1.6	3	3	0.20	0.21	0.20													
1.8	2.8	2.8	0.40	0.21	0.34													
2	2.6	2.6	0.60	0.21	0.48													
2.2	2.4	2.4	0.80	0.21	0.62													
2.4	2.2	2.2	1.00	0.21	0.76													
2	1.4	1.4	1.4	4.2	2.4	1.4		4.2	4.2	0.00	0.21	0.06						
						1.6		4	4	0.20	0.21	0.20						
						1.8		3.8	3.8	0.40	0.21	0.34						
						2		3.6	3.6	0.60	0.21	0.48						
						2.2		3.4	3.4	0.80	0.21	0.62						
						2.4		3.2	3.2	1.00	0.21	0.76						
						3.8		1	0.6	0.6	3.4	2.4	0.6	4.2	4.2	0.00	0.14	
						0.8	4						4	0.00	0.14	0.04		
						1	3.8						3.8	0.00	0.14	0.04		
1.2	3.6	3.6	0.00	0.14	0.04													
1.4	3.4	3.4	0.00	0.14	0.04													
1.6	3.2	3.2	0.20	0.14	0.18													

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ^*_{Cn} (St,Qt) [13]						
									Demand [10]	F C [11]								
	2	1.6	1.6	4.4	2.4	1.8	3	3	0.40	0.14	0.32	0.7429						
						2	2.8	2.8	0.60	0.14	0.46							
						2.2	2.6	2.6	0.80	0.14	0.60							
						2.4	2.4	2.4	1.00	0.14	0.74							
						1.6	4.2	4.2	0.20	0.14	0.18							
						1.8	4	4	0.40	0.14	0.32							
						2	3.8	3.8	0.60	0.14	0.46							
						2.2	3.6	3.6	0.80	0.14	0.60							
						2.4	3.4	3.4	1.00	0.14	0.74							
						4	1	0.8	0.8	3.6	2.4		0.8	4.2	4.2	0.00	0.07	0.02
1	4	4	0.00	0.07	0.02													
1.2	3.8	3.8	0.00	0.07	0.02													
1.4	3.6	3.6	0.00	0.07	0.02													
1.6	3.4	3.4	0.20	0.07	0.16													
1.8	3.2	3.2	0.40	0.07	0.30													
2	3	3	0.60	0.07	0.44													
2.2	2.8	2.8	0.80	0.07	0.58													
2.4	2.6	2.6	1.00	0.07	0.72													
2	2	1.8	1.8	4.6	2.4	1.8						4.2	4.2	0.40	0.07	0.30	0.7215	
2						4	4	0.60	0.07	0.44								
2.2						3.8	3.8	0.80	0.07	0.58								
2.4						3.6	3.6	1.00	0.07	0.72								
4.2						1	1	1	3.8	2.4	1	4.2	4.2	0.00	0.00	0.00		0.7000
1.2											4	4	0.00	0.00	0.00			
1.4	3.8	3.8	0.00	0.00	0.00													
1.6	3.6	3.6	0.20	0.00	0.14													
1.8	3.4	3.4	0.40	0.00	0.28													
2	3.2	3.2	0.60	0.00	0.42													
2.2	3	3	0.80	0.00	0.56													
2.4	2.8	2.8	1.00	0.00	0.70													
2	2	2	2	4.8	2.4	2	4.2	4.2	0.60	0.00	0.42	0.7000						
2.2						4	4	0.80	0.00	0.56								
2.4						3.8	3.8	1.00	0.00	0.70								

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1.8

July

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]								
									Demand [10]	FC [11]										
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000								
						0.4	2	2	0.00	1.00	0.30									
						0.6	1.8	1.8	0.00	1.00	0.30									
						0.8	1.6	1.6	0.00	1.00	0.30									
						1	1.4	1.4	0.00	1.00	0.30									
						1.2	1.2	1.2	0.25	1.00	0.48									
	2	-0.8	0.2	0.2	2	1.8	0.2	3.2	3.2	0.00	1.00	0.30	1.0000							
							0.4	3	3	0.00	1.00	0.30								
							0.6	2.8	2.8	0.00	1.00	0.30								
							0.8	2.6	2.6	0.00	1.00	0.30								
							1	2.4	2.4	0.00	1.00	0.30								
							1.2	2.2	2.2	0.25	1.00	0.48								
							1.4	2	2	0.50	1.00	0.65								
							1.6	1.8	1.8	0.75	1.00	0.83								
							1.8	1.6	1.6	1.00	1.00	1.00								
							1.6	1	-1.6	0.2	1.2	1.2		0.2	2.4	2.4	0.00	0.93	0.28	0.4536
														0.4	2.2	2.2	0.00	0.93	0.28	
														0.6	2	2	0.00	0.93	0.28	
0.8	1.8	1.8	0.00	0.93	0.28															
1	1.6	1.6	0.00	0.93	0.28															
1.2	1.4	1.4	0.25	0.93	0.45															
2	-0.6	0.2	0.2	2.2	1.8	0.2		3.4	3.4	0.00	0.93	0.28	0.9786							
						0.4		3.2	3.2	0.00	0.93	0.28								
						0.6		3	3	0.00	0.93	0.28								
						0.8		2.8	2.8	0.00	0.93	0.28								
						1		2.6	2.6	0.00	0.93	0.28								
						1.2		2.4	2.4	0.25	0.93	0.45								
						1.4		2.2	2.2	0.50	0.93	0.63								
						1.6		2	2	0.75	0.93	0.80								
						1.8		1.8	1.8	1.00	0.93	0.98								
						1.8		1	-1.4	0.2	1.4	1.4		0.2	2.6	2.6	0.00	0.86	0.26	0.6072
														0.4	2.4	2.4	0.00	0.86	0.26	
														0.6	2.2	2.2	0.00	0.86	0.26	
0.8	2	2	0.00	0.86	0.26															
1	1.8	1.8	0.00	0.86	0.26															
1.2	1.6	1.6	0.25	0.86	0.43															
2	-0.4	0.2	0.2	2.4	1.8		0.2	3.6	3.6	0.00	0.86	0.26	0.9572							
							0.4	3.4	3.4	0.00	0.86	0.26								
							0.6	3.2	3.2	0.00	0.86	0.26								
							0.8	3	3	0.00	0.86	0.26								
							1	2.8	2.8	0.00	0.86	0.26								
							1.2	2.6	2.6	0.25	0.86	0.43								
							1.4	2.4	2.4	0.50	0.86	0.61								
							1.6	2.2	2.2	0.75	0.86	0.78								
							1.8	2	2	1.00	0.86	0.96								
							2	1	-1.2	0.2	1.6	1.6		0.2	2.8	2.8	0.00	0.79	0.24	0.7607
														0.4	2.6	2.6	0.00	0.79	0.24	
														0.6	2.4	2.4	0.00	0.79	0.24	
0.8	2.2	2.2	0.00	0.79	0.24															
1	2	2	0.00	0.79	0.24															
1.2	1.8	1.8	0.25	0.79	0.41															
2	-0.2	0.2	0.2	2.6	1.8	0.2		3.8	3.8	0.00	0.79	0.24	0.9357							
						0.4		3.6	3.6	0.00	0.79	0.24								
						0.6		3.4	3.4	0.00	0.79	0.24								
						0.8		3.2	3.2	0.00	0.79	0.24								
						1		3	3	0.00	0.79	0.24								
						1.2		2.8	2.8	0.25	0.79	0.41								
						1.4		2.6	2.6	0.50	0.79	0.59								
						1.6		2.4	2.4	0.75	0.79	0.76								
						1.8		2.2	2.2	1.00	0.79	0.93								

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{cn} (St,Qt) [13]	
									Demand [10]	F C [11]			
						0.6 0.8 1 1.2 1.4 1.6 1.8	3.4 3.2 3 2.8 2.6 2.4 2.2	3.4 3.2 3 2.8 2.6 2.4 2.2	0.00 0.00 0.00 0.25 0.50 0.75 1.00	0.79 0.79 0.79 0.79 0.79 0.79 0.79	0.24 0.24 0.24 0.41 0.59 0.76 0.94		
2.2	1	-1	0.2	1.8	1.8	0.2	3	3	0.00	0.71	0.21	0.9143	
						0.4	2.8	2.8	0.00	0.71	0.21		
						0.6	2.6	2.6	0.00	0.71	0.21		
						0.8	2.4	2.4	0.00	0.71	0.21		
						1	2.2	2.2	0.00	0.71	0.21		
						1.2	2	2	0.25	0.71	0.39		
						1.4	1.8	1.8	0.50	0.71	0.56		
	1.6	1.6	1.6	0.75	0.71	0.74							
	1.8	1.4	1.4	1.00	0.71	0.91							
	2	0	0.2	2.8	1.8	0.2	4	4	0.00	0.71	0.21		0.9143
						0.4	3.8	3.8	0.00	0.71	0.21		
						0.6	3.6	3.6	0.00	0.71	0.21		
						0.8	3.4	3.4	0.00	0.71	0.21		
						1	3.2	3.2	0.00	0.71	0.21		
1.2						3	3	0.25	0.71	0.39			
1.4						2.8	2.8	0.50	0.71	0.56			
1.6	2.6	2.6	0.75	0.71	0.74								
1.8	2.4	2.4	1.00	0.71	0.91								
2.4	1	-0.8	0.2	2	1.8	0.2	3.2	3.2	0.00	0.64	0.19	0.8929	
						0.4	3	3	0.00	0.64	0.19		
						0.6	2.8	2.8	0.00	0.64	0.19		
						0.8	2.6	2.6	0.00	0.64	0.19		
						1	2.4	2.4	0.00	0.64	0.19		
						1.2	2.2	2.2	0.25	0.64	0.37		
						1.4	2	2	0.50	0.64	0.54		
	1.6	1.8	1.8	0.75	0.64	0.72							
	1.8	1.6	1.6	1.00	0.64	0.89							
	2	0.2	0.2	3	1.8	0.2	4.2	4.2	0.00	0.64	0.19		0.8929
						0.4	4	4	0.00	0.64	0.19		
						0.6	3.8	3.8	0.00	0.64	0.19		
						0.8	3.6	3.6	0.00	0.64	0.19		
						1	3.4	3.4	0.00	0.64	0.19		
1.2						3.2	3.2	0.25	0.64	0.37			
1.4						3	3	0.50	0.64	0.54			
1.6	2.8	2.8	0.75	0.64	0.72								
1.8	2.6	2.6	1.00	0.64	0.89								
2.6	1	-0.6	0.2	2.2	1.8	0.2	3.4	3.4	0.00	0.57	0.17	0.8715	
						0.4	3.2	3.2	0.00	0.57	0.17		
						0.6	3	3	0.00	0.57	0.17		
						0.8	2.8	2.8	0.00	0.57	0.17		
						1	2.6	2.6	0.00	0.57	0.17		
						1.2	2.4	2.4	0.25	0.57	0.35		
						1.4	2.2	2.2	0.50	0.57	0.52		
	1.6	2	2	0.75	0.57	0.70							
	1.8	1.8	1.8	1.00	0.57	0.87							
	2	0.4	0.4	3.2	1.8	0.4	4.2	4.2	0.00	0.57	0.17		0.8715
						0.6	4	4	0.00	0.57	0.17		
						0.8	3.8	3.8	0.00	0.57	0.17		
						1	3.6	3.6	0.00	0.57	0.17		
						1.2	3.4	3.4	0.25	0.57	0.35		
1.4						3.2	3.2	0.50	0.57	0.52			
1.6						3	3	0.75	0.57	0.70			
1.8	2.8	2.8	1.00	0.57	0.87								
2.8	1	-0.4	0.2	2.4	1.8	0.2	3.6	3.6	0.00	0.50	0.15	0.8500	
						0.4	3.4	3.4	0.00	0.50	0.15		

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ci} (St,Qt,Rt) [12]	μ^*_{on} (St,Qt) [13]							
									Demand [10]	FC [11]									
2	0.6	0.6	0.6	3.4	1.8	0.6	3.2	3.2	0.00	0.50	0.15	0.8500							
						0.8	3	3	0.00	0.50	0.15								
						1	2.8	2.8	0.00	0.50	0.15								
						1.2	2.6	2.6	0.25	0.50	0.33								
						1.4	2.4	2.4	0.50	0.50	0.50								
						1.6	2.2	2.2	0.75	0.50	0.68								
						1.8	2	2	1.00	0.50	0.85								
						0.6	4.2	4.2	0.00	0.50	0.15								
						0.8	4	4	0.00	0.50	0.15								
						1	3.8	3.8	0.00	0.50	0.15								
						1.2	3.6	3.6	0.25	0.50	0.33								
						1.4	3.4	3.4	0.50	0.50	0.50								
						1.6	3.2	3.2	0.75	0.50	0.68								
						1.8	3	3	1.00	0.50	0.85								
						3	1	-0.2	0.2	2.6	1.8		0.2	3.8	3.8	0.00	0.43	0.13	0.8286
0.4	3.6	3.6	0.00	0.43	0.13														
0.6	3.4	3.4	0.00	0.43	0.13														
0.8	3.2	3.2	0.00	0.43	0.13														
1	3	3	0.00	0.43	0.13														
1.2	2.8	2.8	0.25	0.43	0.30														
1.4	2.6	2.6	0.50	0.43	0.48														
1.6	2.4	2.4	0.75	0.43	0.65														
1.8	2.2	2.2	1.00	0.43	0.83														
0.8	4.2	4.2	0.00	0.43	0.13														
1	4	4	0.00	0.43	0.13														
1.2	3.8	3.8	0.25	0.43	0.30														
1.4	3.6	3.6	0.50	0.43	0.48														
1.6	3.4	3.4	0.75	0.43	0.65														
1.8	3.2	3.2	1.00	0.43	0.83														
3.2	1	0	0.2	2.8	1.8	0.2	4	4	0.00	0.36	0.11	0.8072							
						0.4	3.8	3.8	0.00	0.36	0.11								
						0.6	3.6	3.6	0.00	0.36	0.11								
						0.8	3.4	3.4	0.00	0.36	0.11								
						1	3.2	3.2	0.00	0.36	0.11								
						1.2	3	3	0.25	0.36	0.28								
						1.4	2.8	2.8	0.50	0.36	0.46								
						1.6	2.6	2.6	0.75	0.36	0.63								
						1.8	2.4	2.4	1.00	0.36	0.81								
						1	4.2	4.2	0.00	0.36	0.11								
						1.2	4	4	0.25	0.36	0.28								
						1.4	3.8	3.8	0.50	0.36	0.46								
						1.6	3.6	3.6	0.75	0.36	0.63								
						1.8	3.4	3.4	1.00	0.36	0.81								
						3.4	1	0.2	0.2	3	1.8		0.2	4.2	4.2	0.00	0.29	0.09	0.7858
0.4	4	4	0.00	0.29	0.09														
0.6	3.8	3.8	0.00	0.29	0.09														
0.8	3.6	3.6	0.00	0.29	0.09														
1	3.4	3.4	0.00	0.29	0.09														
1.2	3.2	3.2	0.25	0.29	0.26														
1.4	3	3	0.50	0.29	0.44														
1.6	2.8	2.8	0.75	0.29	0.61														
1.8	2.6	2.6	1.00	0.29	0.79														
1.2	4.2	4.2	0.25	0.29	0.26														
1.4	4	4	0.50	0.29	0.44														
1.6	3.8	3.8	0.75	0.29	0.61														
1.8	3.6	3.6	1.00	0.29	0.79														
3.6	1	0.4	0.4	3.2	1.8							0.4	4.2	4.2	0.00	0.21	0.06	0.7643	
												0.6	4	4	0.00	0.21	0.06		
						0.8	3.8	3.8	0.00	0.21	0.06								
						1	3.6	3.6	0.00	0.21	0.06								
						1.2	3.4	3.4	0.25	0.21	0.24								
						1.4	3.2	3.2	0.50	0.21	0.41								

Storage St {1}	Inflow Qt {2}	St + Qt - S max {3}	Min R {4}	St + Qt - S min {5}	Max R {6}	Release Rt {7}	St + Qt - R {8}	Storage St+1 {9}	μ		μ _{ci} (St,Qt,Rt) {12}	μ* _{cn} (St,Qt) {13}
									Demand {10}	F C {11}		
	2	1.4	1.4	4.2	1.8	1.6 1.8 1.4 1.6 1.8	3 2.8 4.2 4 3.8	3 2.8 4.2 4 3.8	0.75 1.00 0.50 0.75 1.00	0.21 0.21 0.21 0.21 0.21	0.59 0.76 0.41 0.59 0.76	0.7643
3.8	1	0.6	0.6	3.4	1.8	0.6 0.8 1 1.2 1.4 1.6 1.8	4.2 4 3.8 3.6 3.4 3.2 3	4.2 4 3.8 3.6 3.4 3.2 3	0.00 0.00 0.00 0.25 0.50 0.75 1.00	0.14 0.14 0.14 0.14 0.14 0.14 0.14	0.04 0.04 0.04 0.22 0.39 0.57 0.74	0.7429
	2	1.6	1.6	4.4	1.8	1.6 1.8	4.2 4	4.2 4	0.75 1.00	0.14 0.14	0.57 0.74	0.7429
4	1	0.8	0.8	3.6	1.8	0.8 1 1.2 1.4 1.6 1.8	4.2 4 3.8 3.6 3.4 3.2	4.2 4 3.8 3.6 3.4 3.2	0.00 0.00 0.25 0.50 0.75 1.00	0.07 0.07 0.07 0.07 0.07 0.07	0.02 0.02 0.20 0.37 0.55 0.72	0.7215
	2	1.8	1.8	4.6	1.8	1.8	4.2	4.2	1.00	0.07	0.72	0.7215
4.2	1	1	1	3.8	1.8	1 1.2 1.4 1.6 1.8	4.2 4 3.8 3.6 3.4	4.2 4 3.8 3.6 3.4	0.00 0.25 0.50 0.75 1.00	0.00 0.00 0.00 0.00 0.00	0.00 0.18 0.35 0.53 0.70	0.7000
	2	2	2	4.8	1.8	1.8	4.4	4.2	1.00	0.00	0.70	0.7000

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 0.8

August

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ* _{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	0.8	0.2	2.2	2.2	0.00	1.00	0.30	1.0000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.50	1.00	0.65	
						0.8	1.6	1.6	1.00	1.00	1.00	
1.6	1	-1.6	0.2	1.2	0.8	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.50	0.93	0.63	
						0.8	1.8	1.8	1.00	0.93	0.98	
1.8	1	-1.4	0.2	1.4	0.8	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.50	0.86	0.61	
						0.8	2	2	1.00	0.86	0.96	
2	1	-1.2	0.2	1.6	0.8	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.50	0.79	0.59	
						0.8	2.2	2.2	1.00	0.79	0.94	
2.2	1	-1	0.2	1.8	0.8	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.50	0.71	0.56	
						0.8	2.4	2.4	1.00	0.71	0.91	
2.4	1	-0.8	0.2	2	0.8	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.50	0.64	0.54	
						0.8	2.6	2.6	1.00	0.64	0.89	
2.6	1	-0.6	0.2	2.2	0.8	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.50	0.57	0.52	
						0.8	2.8	2.8	1.00	0.57	0.87	
2.8	1	-0.4	0.2	2.4	0.8	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.50	0.50	0.50	
						0.8	3	3	1.00	0.50	0.85	
3	1	-0.2	0.2	2.6	0.8	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.50	0.43	0.48	
						0.8	3.2	3.2	1.00	0.43	0.83	
3.2	1	0	0.2	2.8	0.8	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.50	0.36	0.46	
						0.8	3.4	3.4	1.00	0.36	0.81	
3.4	1	0.2	0.2	3	0.8	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.50	0.29	0.44	
						0.8	3.6	3.6	1.00	0.29	0.79	
3.6	1	0.4	0.4	3.2	0.8	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.50	0.21	0.41	
						0.8	3.8	3.8	1.00	0.21	0.76	
						0.6	4.2	4.2	0.50	0.14	0.39	
3.8	1	0.6	0.6	3.4	0.8	0.8	4	4	1.00	0.14	0.74	0.7429
						0.8	4	4	1.00	0.14	0.74	
4	1	0.8	0.8	3.6	0.8	0.8	4.2	4.2	1.00	0.07	0.72	0.7215
4.2	1	-1	1	3.8	0.8	0.8	4.4	4.2	1.00	0.00	0.70	0.7000

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1.6

September

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{C1} (St,Qt,Rt) [12]	μ_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	0.3000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.00	1.00	0.30	
						1	1.4	1.4	0.00	1.00	0.30	
1.6	1	-1.6	0.2	1.2	1.2	0.2	2.4	2.4	0.00	0.93	0.28	0.5119
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.00	0.93	0.28	
						1	1.6	1.6	0.00	0.93	0.28	
1.8	1	-1.4	0.2	1.4	1.4	0.2	2.6	2.6	0.00	0.86	0.26	0.7238
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.00	0.86	0.26	
						1	1.8	1.8	0.00	0.86	0.26	
2	1	-1.2	0.2	1.6	1.6	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.00	0.79	0.24	
						1	2	2	0.00	0.79	0.24	
2.2	1	-1	0.2	1.8	1.6	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.00	0.71	0.21	
						1	2.2	2.2	0.00	0.71	0.21	
2.4	1	-0.8	0.2	2	1.6	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.00	0.64	0.19	
						1	2.4	2.4	0.00	0.64	0.19	
2.6	1	-0.6	0.2	2.2	1.6	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.00	0.57	0.17	
						1	2.6	2.6	0.00	0.57	0.17	
2.8	1	-0.4	0.2	2.4	1.6	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.00	0.50	0.15	
						1	2.8	2.8	0.00	0.50	0.15	

Storage St [1]	Inflow Qt [2]	St+Qt - S max [3]	Min R [4]	St+Qt - S min [5]	Max R [6]	Release Rt [7]	St+Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ^*_{Cn} (St,Qt) [13]
									Demand [10]	F C [11]		
						1.2 1.4 1.6	2.6 2.4 2.2	2.6 2.4 2.2	0.33 0.67 1.00	0.50 0.50 0.50	0.38 0.62 0.85	
3	1	-0.2	0.2	2.6	1.6	0.2 0.4 0.6 0.8 1 1.2 1.4 1.6	3.8 3.6 3.4 3.2 3 2.8 2.6 2.4	3.8 3.6 3.4 3.2 3 2.8 2.6 2.4	0.00 0.00 0.00 0.00 0.00 0.33 0.67 1.00	0.43 0.43 0.43 0.43 0.43 0.43 0.43 0.43	0.13 0.13 0.13 0.13 0.13 0.36 0.60 0.83	0.8286
3.2	1	0	0.2	2.8	1.6	0.2 0.4 0.6 0.8 1 1.2 1.4 1.6	4 3.8 3.6 3.4 3.2 3 2.8 2.6	4 3.8 3.6 3.4 3.2 3 2.8 2.6	0.00 0.00 0.00 0.00 0.00 0.33 0.67 1.00	0.36 0.36 0.36 0.36 0.36 0.36 0.36 0.36	0.11 0.11 0.11 0.11 0.11 0.34 0.57 0.81	0.8072
3.4	1	0.2	0.2	3	1.6	0.2 0.4 0.6 0.8 1 1.2 1.4 1.6	4.2 4 3.8 3.6 3.4 3.2 3 2.8	4.2 4 3.8 3.6 3.4 3.2 3 2.8	0.00 0.00 0.00 0.00 0.00 0.33 0.67 1.00	0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29	0.09 0.09 0.09 0.09 0.09 0.32 0.55 0.79	0.7858
3.6	1	0.4	0.4	3.2	1.6	0.4 0.6 0.8 1 1.2 1.4 1.6	4.2 4 3.8 3.6 3.4 3.2 3	4.2 4 3.8 3.6 3.4 3.2 3	0.00 0.00 0.00 0.00 0.33 0.67 1.00	0.21 0.21 0.21 0.21 0.21 0.21 0.21	0.06 0.06 0.06 0.06 0.30 0.53 0.76	0.7643
3.8	1	0.6	0.6	3.4	1.6	0.6 0.8 1 1.2 1.4 1.6	4.2 4 3.8 3.6 3.4 3.2	4.2 4 3.8 3.6 3.4 3.2	0.00 0.00 0.00 0.33 0.67 1.00	0.14 0.14 0.14 0.14 0.14 0.14	0.04 0.04 0.04 0.28 0.51 0.74	0.7429
4	1	0.8	0.8	3.6	1.6	0.8 1 1.2 1.4 1.6	4.2 4 3.8 3.6 3.4	4.2 4 3.8 3.6 3.4	0.00 0.00 0.33 0.67 1.00	0.07 0.07 0.07 0.07 0.07	0.02 0.02 0.25 0.49 0.72	0.7215
4.2	1	1	1	3.8	1.6	1 1.2 1.4 1.6	4.2 4 3.8 3.6	4.2 4 3.8 3.6	0.00 0.33 0.67 1.00	0.00 0.00 0.00 0.00	0.00 0.23 0.47 0.70	0.7000

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1

October

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ* _{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	1.0000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
						0.8	1.6	1.6	0.50	1.00	0.65	
						1	1.4	1.4	1.00	1.00	1.00	
1.6	1	-1.6	0.2	1.2	1	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
						0.8	1.8	1.8	0.50	0.93	0.63	
						1	1.6	1.6	1.00	0.93	0.98	
1.8	1	-1.4	0.2	1.4	1	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
						0.8	2	2	0.50	0.86	0.61	
						1	1.8	1.8	1.00	0.86	0.96	
2	1	-1.2	0.2	1.6	1	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.50	0.79	0.59	
						1	2	2	1.00	0.79	0.94	
2.2	1	-1	0.2	1.8	1	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.50	0.71	0.56	
						1	2.2	2.2	1.00	0.71	0.91	
2.4	1	-0.8	0.2	2	1	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.50	0.64	0.54	
						1	2.4	2.4	1.00	0.64	0.89	
2.6	1	-0.6	0.2	2.2	1	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.50	0.57	0.52	
						1	2.6	2.6	1.00	0.57	0.87	
2.8	1	-0.4	0.2	2.4	1	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.50	0.50	0.50	
						1	2.8	2.8	1.00	0.50	0.85	
3	1	-0.2	0.2	2.6	1	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.50	0.43	0.48	
						1	3	3	1.00	0.43	0.83	
3.2	1	0	0.2	2.8	1	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.00	0.36	0.11	
						0.8	3.4	3.4	0.50	0.36	0.46	
						1	3.2	3.2	1.00	0.36	0.81	
3.4	1	0.2	0.2	3	1	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.50	0.29	0.44	
						1	3.4	3.4	1.00	0.29	0.79	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
3.6	1	0.4	0.4	3.2	1	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.50	0.21	0.41	
						1	3.6	3.6	1.00	0.21	0.76	
3.8	1	0.6	0.6	3.4	1	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.50	0.14	0.39	
						1	3.8	3.8	1.00	0.14	0.74	
4	1	0.8	0.8	3.6	1	0.8	4.2	4.2	0.50	0.07	0.37	0.7215
						1	4	4	1.00	0.07	0.72	
4.2	1	1	1	3.8	1	1	4.2	4.2	1.00	0.00	0.70	0.7000

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 0.8

November

Storage St [1]	Inflow Qt [2]	St+ Qt - S max [3]	Min R [4]	St+ Qt - S min [5]	Max R [6]	Release Rt [7]	St+ Qt - R [8]	Storage St+1 [9]	μ		μ _{ct} (St,Qt,Rt) [12]	μ* _{gn} (St,Qt) [13]	
									Demand [10]	F C [11]			
1.4	1	-1.8	0.2	1	0.8	0.2	2.2	2.2	0.00	1.00	0.30	1.0000	
						0.4	2	2	0.00	1.00	0.30		
						0.6	1.8	1.8	0.50	1.00	0.65		
						0.8	1.6	1.6	1.00	1.00	1.00		
	2	-0.8	0.2	2	0.8	0.2	3.2	3.2	0.00	1.00	0.30	1.0000	
						0.4	3	3	0.00	1.00	0.30		
						0.6	2.8	2.8	0.50	1.00	0.65		
						0.8	2.6	2.6	1.00	1.00	1.00		
	3	0.2	0.2	3	0.8	0.2	4.2	4.2	0.00	1.00	0.30	1.0000	
						0.4	4	4	0.00	1.00	0.30		
						0.6	3.8	3.8	0.50	1.00	0.65		
						0.8	3.6	3.6	1.00	1.00	1.00		
	4	1.2	1.2	4	0.8	0.8	4.6	4.2	1.00	1.00	1.00	1.0000	
	1.6	1	-1.6	0.2	1.2	0.8	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
							0.4	2.2	2.2	0.00	0.93	0.28	
							0.6	2	2	0.50	0.93	0.63	
0.8							1.8	1.8	1.00	0.93	0.98		
2		-0.6	0.2	2.2	0.8	0.2	3.4	3.4	0.00	0.93	0.28	0.9786	
						0.4	3.2	3.2	0.00	0.93	0.28		
						0.6	3	3	0.50	0.93	0.63		
						0.8	2.8	2.8	1.00	0.93	0.98		
3		0.4	0.4	3.2	0.8	0.4	4.2	4.2	0.00	0.93	0.28	0.9786	
						0.6	4	4	0.50	0.93	0.63		
						0.8	3.8	3.8	1.00	0.93	0.98		
						0.8	4.8	4.2	1.00	0.93	0.98		
4		1.4	1.4	4.2	0.8	0.8	4.8	4.2	1.00	0.93	0.98	0.9786	
1.8		1	-1.4	0.2	1.4	0.8	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
							0.4	2.4	2.4	0.00	0.86	0.26	
							0.6	2.2	2.2	0.50	0.86	0.61	
	0.8						2	2	1.00	0.86	0.96		
	2	-0.4	0.2	2.4	0.8	0.2	3.6	3.6	0.00	0.86	0.26	0.9572	
						0.4	3.4	3.4	0.00	0.86	0.26		
						0.6	3.2	3.2	0.50	0.86	0.61		
						0.8	3	3	1.00	0.86	0.96		
	3	0.6	0.6	3.4	0.8	0.6	4.2	4.2	0.50	0.86	0.61	0.9572	
						0.8	4	4	1.00	0.86	0.96		
						0.8	5	4.2	1.00	0.86	0.96		
						0.8	4.2	4.2	1.00	0.86	0.96		
	4	1.6	1.6	4.4	0.8	0.8	5	4.2	1.00	0.86	0.96	0.9572	
	2	1	-1.2	0.2	1.6	0.8	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
							0.4	2.6	2.6	0.00	0.79	0.24	
							0.6	2.4	2.4	0.50	0.79	0.59	
0.8							2.2	2.2	1.00	0.79	0.94		
2		-0.2	0.2	2.6	0.8	0.2	3.8	3.8	0.00	0.79	0.24	0.9357	
						0.4	3.6	3.6	0.00	0.79	0.24		
						0.6	3.4	3.4	0.50	0.79	0.59		
						0.8	3.2	3.2	1.00	0.79	0.94		
3		0.8	0.8	3.6	0.8	0.8	4.2	4.2	1.00	0.79	0.94	0.9357	
						0.8	4.2	4.2	1.00	0.79	0.94		
						0.8	5.2	4.2	1.00	0.79	0.94		
						0.8	4.2	4.2	1.00	0.79	0.94		
4		1.8	1.8	4.6	0.8	0.8	5.2	4.2	1.00	0.79	0.94	0.9357	
2.2		1	-1	0.2	1.8	0.8	0.2	3	3	0.00	0.71	0.21	0.9143
							0.4	2.8	2.8	0.00	0.71	0.21	
							0.6	2.6	2.6	0.50	0.71	0.56	
	0.8						2.4	2.4	1.00	0.71	0.91		
	2	0	0.2	2.8	0.8	0.2	4	4	0.00	0.71	0.21	0.9143	
						0.4	3.8	3.8	0.00	0.71	0.21		
						0.6	3.6	3.6	0.50	0.71	0.56		
						0.8	3.4	3.4	1.00	0.71	0.91		
	3	1	1	3.8	0.8	0.8	4.4	4.2	1.00	0.71	0.91	0.9143	
						0.8	4.4	4.2	1.00	0.71	0.91		
						0.8	4.4	4.2	1.00	0.71	0.91		
						0.8	4.4	4.2	1.00	0.71	0.91		

Storage St [1]	Inflow Qt [2]	St+Qt -Smax [3]	Min R [4]	St+Qt -Smin [5]	Max R [6]	Release Rt [7]	St+Qt -R [8]	Storage St+1 [9]	μ		μ_{Cr} (St,Qt,Rt) [12]	μ^*_{Ga} (St,Qt) [13]
									Demand [10]	FC [11]		
	4	2	2	4.8	0.8	0.8	5.4	4.2	1.00	0.71	0.91	0.9143
2.4	1	-0.8	0.2	2	0.8	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.50	0.64	0.54	
						0.8	2.6	2.6	1.00	0.64	0.89	
	2	0.2	0.2	3	0.8	0.2	4.2	4.2	0.00	0.64	0.19	0.8929
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.50	0.64	0.54	
						0.8	3.6	3.6	1.00	0.64	0.89	
3	1.2	1.2	4	0.8	0.8	4.6	4.2	1.00	0.64	0.89	0.8929	
					0.8	5.6	4.2	1.00	0.64	0.89		
2.6	1	-0.6	0.2	2.2	0.8	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.50	0.57	0.52	
						0.8	2.8	2.8	1.00	0.57	0.87	
	2	0.4	0.4	3.2	0.8	0.4	4.2	4.2	0.00	0.57	0.17	0.8715
						0.6	4	4	0.50	0.57	0.52	
						0.8	3.8	3.8	1.00	0.57	0.87	
						0.8	4.8	4.2	1.00	0.57	0.87	
3	1.4	1.4	4.2	0.8	0.8	5.8	4.2	1.00	0.57	0.87	0.8715	
					0.8	5.8	4.2	1.00	0.57	0.87		
2.8	1	-0.4	0.2	2.4	0.8	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.50	0.50	0.50	
						0.8	3	3	1.00	0.50	0.85	
	2	0.6	0.6	3.4	0.8	0.6	4.2	4.2	0.50	0.50	0.50	0.8500
						0.8	4	4	1.00	0.50	0.85	
						0.8	5	4.2	1.00	0.50	0.85	
						0.8	6	4.2	1.00	0.50	0.85	
3	1	-0.2	0.2	2.6	0.8	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.50	0.43	0.48	
						0.8	3.2	3.2	1.00	0.43	0.83	
	2	0.8	0.8	3.6	0.8	0.8	4.2	4.2	1.00	0.43	0.83	0.8286
						0.8	5.2	4.2	1.00	0.43	0.83	
						0.8	6.2	4.2	1.00	0.43	0.83	
						0.8	6.2	4.2	1.00	0.43	0.83	
3.2	1	0	0.2	2.8	0.8	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.50	0.36	0.46	
						0.8	3.4	3.4	1.00	0.36	0.81	
	2	1	1	3.8	0.8	0.8	4.4	4.2	1.00	0.36	0.81	0.8072
						0.8	5.4	4.2	1.00	0.36	0.81	
						0.8	6.4	4.2	1.00	0.36	0.81	
						0.8	6.4	4.2	1.00	0.36	0.81	
3.4	1	0.2	0.2	3	0.8	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.50	0.29	0.44	
						0.8	3.6	3.6	1.00	0.29	0.79	
	2	1.2	1.2	4	0.8	0.8	4.6	4.2	1.00	0.29	0.79	0.7858
						0.8	5.6	4.2	1.00	0.29	0.79	
						0.8	6.6	4.2	1.00	0.29	0.79	
						0.8	6.6	4.2	1.00	0.29	0.79	
3.6	1	0.4	0.4	3.2	0.8	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.50	0.21	0.41	
						0.8	3.8	3.8	1.00	0.21	0.76	
						0.8	4.8	4.2	1.00	0.21	0.76	
	2	1.4	1.4	4.2	0.8	0.8	5.8	4.2	1.00	0.21	0.76	0.7643
						0.8	6.8	4.2	1.00	0.21	0.76	
						0.8	6.8	4.2	1.00	0.21	0.76	
						0.8	6.8	4.2	1.00	0.21	0.76	
3.8	1	0.6	0.6	3.4	0.8	0.6	4.2	4.2	0.50	0.14	0.39	0.7429
						0.8	4	4	1.00	0.14	0.74	
						0.8	5	4.2	1.00	0.14	0.74	
						0.8	6	4.2	1.00	0.14	0.74	
	2	1.6	1.6	4.4	0.8	0.8	7	4.2	1.00	0.14	0.74	0.7429
						0.8	7	4.2	1.00	0.14	0.74	
						0.8	7	4.2	1.00	0.14	0.74	
						0.8	7	4.2	1.00	0.14	0.74	
4	1	0.8	0.8	3.6	0.8	0.8	4.2	4.2	1.00	0.07	0.72	0.7215
						0.8	5.2	4.2	1.00	0.07	0.72	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
	3	2.8	2.8	5.6	0.8	0.8	6.2	4.2	1.00	0.07	0.72	0.7215
	4	3.8	3.8	6.6	0.8	0.8	7.2	4.2	1.00	0.07	0.72	0.7215
4.2	1	1	1	3.8	0.8	0.8	4.4	4.2	1.00	0.00	0.70	0.7000
	2	2	2	4.8	0.8	0.8	5.4	4.2	1.00	0.00	0.70	0.7000
	3	3	3	5.8	0.8	0.8	6.4	4.2	1.00	0.00	0.70	0.7000
	4	4	4	6.8	0.8	0.8	7.4	4.2	1.00	0.00	0.70	0.7000

Fuzzy Rule Base Modeling for Reservoir Operation

S min = 1.4
 S max = 4.2
 R min = 0.2
 R max = 1

December

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ [*] _{Cn} (St,Qt) [13]
									Demand [10]	F C [11]		
1.4	1	-1.8	0.2	1	1	0.2	2.2	2.2	0.00	1.00	0.30	1.0000
						0.4	2	2	0.00	1.00	0.30	
						0.6	1.8	1.8	0.00	1.00	0.30	
	2	-0.8	0.2	2	1	0.8	1.6	1.6	0.50	1.00	0.65	1.0000
						1	1.4	1.4	1.00	1.00	1.00	
						0.2	3.2	3.2	0.00	1.00	0.30	
						0.4	3	3	0.00	1.00	0.30	
						0.6	2.8	2.8	0.00	1.00	0.30	
						0.8	2.6	2.6	0.50	1.00	0.65	
	3	0.2	0.2	3	1	1	2.4	2.4	1.00	1.00	1.00	1.0000
						0.2	4.2	4.2	0.00	1.00	0.30	
						0.4	4	4	0.00	1.00	0.30	
	4	1.2	1.2	4	1	0.6	3.8	3.8	0.00	1.00	0.30	1.0000
						0.8	3.6	3.6	0.50	1.00	0.65	
						1	3.4	3.4	1.00	1.00	1.00	
						1	4.4	4.2	1.00	1.00	1.00	
						1	5.4	4.2	1.00	1.00	1.00	
						1	6.4	4.2	1.00	1.00	1.00	
5	2.2	2.2	5	1	1	7.4	4.2	1.00	1.00	1.00	1.0000	
					1	8.4	4.2	1.00	1.00	1.00		
					1	9.4	4.2	1.00	1.00	1.00		
					1	10.4	4.2	1.00	1.00	1.00		
					1	11.4	4.2	1.00	1.00	1.00		
					1	12.4	4.2	1.00	1.00	1.00		
1.6	1	-1.6	0.2	1.2	1	0.2	2.4	2.4	0.00	0.93	0.28	0.9786
						0.4	2.2	2.2	0.00	0.93	0.28	
						0.6	2	2	0.00	0.93	0.28	
	2	-0.6	0.2	2.2	1	0.8	1.8	1.8	0.50	0.93	0.63	0.9786
						1	1.6	1.6	1.00	0.93	0.98	
						0.2	3.4	3.4	0.00	0.93	0.28	
						0.4	3.2	3.2	0.00	0.93	0.28	
						0.6	3	3	0.00	0.93	0.28	
						0.8	2.8	2.8	0.50	0.93	0.63	
	3	0.4	0.4	3.2	1	1	2.6	2.6	1.00	0.93	0.98	0.9786
						0.4	4.2	4.2	0.00	0.93	0.28	
						0.6	4	4	0.00	0.93	0.28	
	4	1.4	1.4	4.2	1	0.8	3.8	3.8	0.50	0.93	0.63	0.9786
						1	3.6	3.6	1.00	0.93	0.98	
						1	4.6	4.2	1.00	0.93	0.98	
						1	5.6	4.2	1.00	0.93	0.98	
						1	6.6	4.2	1.00	0.93	0.98	
						1	7.6	4.2	1.00	0.93	0.98	
5	2.4	2.4	5.2	1	1	8.6	4.2	1.00	0.93	0.98	0.9786	
					1	9.6	4.2	1.00	0.93	0.98		
					1	10.6	4.2	1.00	0.93	0.98		
					1	11.6	4.2	1.00	0.93	0.98		
					1	12.6	4.2	1.00	0.93	0.98		
					1	13.6	4.2	1.00	0.93	0.98		
1.8	1	-1.4	0.2	1.4	1	0.2	2.6	2.6	0.00	0.86	0.26	0.9572
						0.4	2.4	2.4	0.00	0.86	0.26	
						0.6	2.2	2.2	0.00	0.86	0.26	
	2	-0.4	0.2	2.4	1	0.8	2	2	0.50	0.86	0.61	0.9572
						1	1.8	1.8	1.00	0.86	0.96	
						0.2	3.6	3.6	0.00	0.86	0.26	
						0.4	3.4	3.4	0.00	0.86	0.26	
						0.6	3.2	3.2	0.00	0.86	0.26	
						0.8	3	3	0.50	0.86	0.61	
	3	0.6	0.6	3.4	1	1	2.8	2.8	1.00	0.86	0.96	0.9572
						0.6	4.2	4.2	0.00	0.86	0.26	
						0.8	4	4	0.50	0.86	0.61	
	4	1.6	1.6	4.4	1	1	3.8	3.8	1.00	0.86	0.96	0.9572
						1	4.8	4.2	1.00	0.86	0.96	
						1	5.8	4.2	1.00	0.86	0.96	
						1	6.8	4.2	1.00	0.86	0.96	
						1	7.8	4.2	1.00	0.86	0.96	
						1	8.8	4.2	1.00	0.86	0.96	

Storage St [1]	Inflow Qt [2]	St + Qt - S max [3]	Min R [4]	St + Qt - S min [5]	Max R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ_{Ct} (St,Qt,Rt) [12]	μ_{Cn} (St,Qt) [13]
									Demand [10]	FC [11]		
	5	2.6	2.6	5.4	1	1	5.8	4.2	1.00	0.86	0.96	0.9572
	6	3.6	3.6	6.4	1	1	6.8	4.2	1.00	0.86	0.96	0.9572
	7	4.6	4.6	5.6	1	1	7.8	4.2	1.00	0.86	0.96	0.9572
	8	5.6	5.6	6.6	1	1	8.8	4.2	1.00	0.86	0.96	0.9572
	9	6.6	6.6	9.4	1	1	9.8	4.2	1.00	0.86	0.96	0.9572
2	1	-1.2	0.2	1.6	1	0.2	2.8	2.8	0.00	0.79	0.24	0.9357
						0.4	2.6	2.6	0.00	0.79	0.24	
						0.6	2.4	2.4	0.00	0.79	0.24	
						0.8	2.2	2.2	0.50	0.79	0.59	
						1	2	2	1.00	0.79	0.94	
	2	-0.2	0.2	2.6	1	0.2	3.8	3.8	0.00	0.79	0.24	0.9357
						0.4	3.6	3.6	0.00	0.79	0.24	
						0.6	3.4	3.4	0.00	0.79	0.24	
						0.8	3.2	3.2	0.50	0.79	0.59	
						1	3	3	1.00	0.79	0.94	
	3	0.8	0.8	3.6	1	0.8	4.2	4.2	0.50	0.79	0.59	0.9357
						1	4	4	1.00	0.79	0.94	
	4	1.8	1.8	4.6	1	1	5	4.2	1.00	0.79	0.94	0.9357
	5	2.8	2.8	5.6	1	1	6	4.2	1.00	0.79	0.94	0.9357
	6	3.8	3.8	6.6	1	1	7	4.2	1.00	0.79	0.94	0.9357
	7	4.8	4.8	7.6	1	1	8	4.2	1.00	0.79	0.94	0.9357
	8	5.8	5.8	8.6	1	1	9	4.2	1.00	0.79	0.94	0.9357
	9	6.8	6.8	9.6	1	1	10	4.2	1.00	0.79	0.94	0.9357
2.2	1	-1	0.2	1.8	1	0.2	3	3	0.00	0.71	0.21	0.9143
						0.4	2.8	2.8	0.00	0.71	0.21	
						0.6	2.6	2.6	0.00	0.71	0.21	
						0.8	2.4	2.4	0.50	0.71	0.56	
						1	2.2	2.2	1.00	0.71	0.91	
	2	0	0.2	2.8	1	0.2	4	4	0.00	0.71	0.21	0.9143
						0.4	3.8	3.8	0.00	0.71	0.21	
						0.6	3.6	3.6	0.00	0.71	0.21	
						0.8	3.4	3.4	0.50	0.71	0.56	
						1	3.2	3.2	1.00	0.71	0.91	
	3	1	1	3.8	1	1	4.2	4.2	1.00	0.71	0.91	0.9143
	4	2	2	4.8	1	1	5.2	4.2	1.00	0.71	0.91	0.9143
	5	3	3	5.8	1	1	6.2	4.2	1.00	0.71	0.91	0.9143
	6	4	4	6.8	1	1	7.2	4.2	1.00	0.71	0.91	0.9143
	7	5	5	7.8	1	1	8.2	4.2	1.00	0.71	0.91	0.9143
	8	6	6	8.8	1	1	9.2	4.2	1.00	0.71	0.91	0.9143
	9	7	7	9.8	1	1	10.2	4.2	1.00	0.71	0.91	0.9143
2.4	1	-0.8	0.2	2	1	0.2	3.2	3.2	0.00	0.64	0.19	0.8929
						0.4	3	3	0.00	0.64	0.19	
						0.6	2.8	2.8	0.00	0.64	0.19	
						0.8	2.6	2.6	0.50	0.64	0.54	
						1	2.4	2.4	1.00	0.64	0.89	
	2	0.2	0.2	3	1	0.2	4.2	4.2	0.00	0.64	0.19	0.8929
						0.4	4	4	0.00	0.64	0.19	
						0.6	3.8	3.8	0.00	0.64	0.19	
						0.8	3.6	3.6	0.50	0.64	0.54	
						1	3.4	3.4	1.00	0.64	0.89	
	3	1.2	1.2	4	1	1	4.4	4.2	1.00	0.64	0.89	0.8929
	4	2.2	2.2	5	1	1	5.4	4.2	1.00	0.64	0.89	0.8929
	5	3.2	3.2	6	1	1	6.4	4.2	1.00	0.64	0.89	0.8929
	6	4.2	4.2	7	1	1	7.4	4.2	1.00	0.64	0.89	0.8929
	7	5.2	5.2	8	1	1	8.4	4.2	1.00	0.64	0.89	0.8929
	8	6.2	6.2	9	1	1	9.4	4.2	1.00	0.64	0.89	0.8929
	9	7.2	7.2	10	1	1	10.4	4.2	1.00	0.64	0.89	0.8929
2.6	1	-0.6	0.2	2.2	1	0.2	3.4	3.4	0.00	0.57	0.17	0.8715
						0.4	3.2	3.2	0.00	0.57	0.17	
						0.6	3	3	0.00	0.57	0.17	
						0.8	2.8	2.8	0.50	0.57	0.52	
						1	2.6	2.6	1.00	0.57	0.87	

Storage St [1]	Inflow Qt [2]	St+ Qt - S max [3]	Min R [4]	St+ Qt - S min [5]	Max R [6]	Release Rt [7]	St+ Qt - R [8]	Storage St+1 [9]	μ		μ_{ct} (St,Qt,Rt) [12]	μ^*_{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
	2	0.4	0.4	3.2	1	0.4	4.2	4.2	0.00	0.57	0.17	0.8715
						0.6	4	4	0.00	0.57	0.17	
						0.8	3.8	3.8	0.50	0.57	0.52	
						1	3.6	3.6	1.00	0.57	0.87	
	3	1.4	1.4	4.2	1	1	4.6	4.2	1.00	0.57	0.87	0.8715
	4	2.4	2.4	5.2	1	1	5.6	4.2	1.00	0.57	0.87	0.8715
	5	3.4	3.4	6.2	1	1	6.6	4.2	1.00	0.57	0.87	0.8715
	6	4.4	4.4	7.2	1	1	7.6	4.2	1.00	0.57	0.87	0.8715
	7	5.4	5.4	8.2	1	1	8.6	4.2	1.00	0.57	0.87	0.8715
8	6.4	6.4	9.2	1	1	9.6	4.2	1.00	0.57	0.87	0.8715	
9	7.4	7.4	10.2	1	1	10.6	4.2	1.00	0.57	0.87	0.8715	
2.8	1	-0.4	0.2	2.4	1	0.2	3.6	3.6	0.00	0.50	0.15	0.8500
						0.4	3.4	3.4	0.00	0.50	0.15	
						0.6	3.2	3.2	0.00	0.50	0.15	
						0.8	3	3	0.50	0.50	0.50	
						1	2.8	2.8	1.00	0.50	0.85	
	2	0.6	0.6	3.4	1	0.6	4.2	4.2	0.00	0.50	0.15	0.8500
						0.8	4	4	0.50	0.50	0.50	
						1	3.8	3.8	1.00	0.50	0.85	
	3	1.6	1.6	4.4	1	1	4.8	4.2	1.00	0.50	0.85	0.8500
4	2.6	2.6	5.4	1	1	5.8	4.2	1.00	0.50	0.85	0.8500	
5	3.6	3.6	6.4	1	1	6.8	4.2	1.00	0.50	0.85	0.8500	
6	4.6	4.6	7.4	1	1	7.8	4.2	1.00	0.50	0.85	0.8500	
7	5.6	5.6	8.4	1	1	8.8	4.2	1.00	0.50	0.85	0.8500	
8	6.6	6.6	9.4	1	1	9.8	4.2	1.00	0.50	0.85	0.8500	
9	7.6	7.6	10.4	1	1	10.8	4.2	1.00	0.50	0.85	0.8500	
3	1	-0.2	0.2	2.6	1	0.2	3.8	3.8	0.00	0.43	0.13	0.8286
						0.4	3.6	3.6	0.00	0.43	0.13	
						0.6	3.4	3.4	0.00	0.43	0.13	
						0.8	3.2	3.2	0.50	0.43	0.48	
						1	3	3	1.00	0.43	0.83	
	2	0.8	0.8	3.6	1	0.8	4.2	4.2	0.50	0.43	0.48	0.8286
						1	4	4	1.00	0.43	0.83	
	3	1.8	1.8	4.6	1	1	5	4.2	1.00	0.43	0.83	0.8286
	4	2.8	2.8	5.6	1	1	6	4.2	1.00	0.43	0.83	0.8286
5	3.8	3.8	6.6	1	1	7	4.2	1.00	0.43	0.83	0.8286	
6	4.8	4.8	7.6	1	1	8	4.2	1.00	0.43	0.83	0.8286	
7	5.8	5.8	8.6	1	1	9	4.2	1.00	0.43	0.83	0.8286	
8	6.8	6.8	9.6	1	1	10	4.2	1.00	0.43	0.83	0.8286	
9	7.8	7.8	10.6	1	1	11	4.2	1.00	0.43	0.83	0.8286	
3.2	1	0	-0.2	2.8	1	0.2	4	4	0.00	0.36	0.11	0.8072
						0.4	3.8	3.8	0.00	0.36	0.11	
						0.6	3.6	3.6	0.00	0.36	0.11	
						0.8	3.4	3.4	0.50	0.36	0.46	
						1	3.2	3.2	1.00	0.36	0.81	
	2	1	1	3.8	1	1	4.2	4.2	1.00	0.36	0.81	0.8072
	3	2	2	4.8	1	1	5.2	4.2	1.00	0.36	0.81	0.8072
	4	3	3	5.8	1	1	6.2	4.2	1.00	0.36	0.81	0.8072
	5	4	4	6.8	1	1	7.2	4.2	1.00	0.36	0.81	0.8072
6	5	5	7.8	1	1	8.2	4.2	1.00	0.36	0.81	0.8072	
7	6	6	8.8	1	1	9.2	4.2	1.00	0.36	0.81	0.8072	
8	7	7	9.8	1	1	10.2	4.2	1.00	0.36	0.81	0.8072	
9	8	8	10.8	1	1	11.2	4.2	1.00	0.36	0.81	0.8072	
3.4	1	0.2	0.2	3	1	0.2	4.2	4.2	0.00	0.29	0.09	0.7858
						0.4	4	4	0.00	0.29	0.09	
						0.6	3.8	3.8	0.00	0.29	0.09	
						0.8	3.6	3.6	0.50	0.29	0.44	
						1	3.4	3.4	1.00	0.29	0.79	
2	1.2	1.2	4	1	1	4.4	4.2	1.00	0.29	0.79	0.7858	
3	2.2	2.2	5	1	1	5.4	4.2	1.00	0.29	0.79	0.7858	
4	3.2	3.2	6	1	1	6.4	4.2	1.00	0.29	0.79	0.7858	
5	4.2	4.2	7	1	1	7.4	4.2	1.00	0.29	0.79	0.7858	

Storage St [1]	Inflow Qt [2]	St + Qt - Smax [3]	Min - R [4]	St + Qt - Smin [5]	Max - R [6]	Release Rt [7]	St + Qt - R [8]	Storage St+1 [9]	μ		μ _{Ct} (St,Qt,Rt) [12]	μ _{Gn} (St,Qt) [13]
									Demand [10]	F C [11]		
	6	5.2	5.2	8	1	1	8.4	4.2	1.00	0.29	0.79	0.7858
	7	6.2	6.2	9	1	1	9.4	4.2	1.00	0.29	0.79	0.7858
	8	7.2	7.2	10	1	1	10.4	4.2	1.00	0.29	0.79	0.7858
	9	8.2	8.2	11	1	1	11.4	4.2	1.00	0.29	0.79	0.7858
3.6	1	0.4	0.4	3.2	1	0.4	4.2	4.2	0.00	0.21	0.06	0.7643
						0.6	4	4	0.00	0.21	0.06	
						0.8	3.8	3.8	0.50	0.21	0.41	
						1	3.6	3.6	1.00	0.21	0.76	
	2	1.4	1.4	4.2	1	1	4.6	4.2	1.00	0.21	0.76	0.7643
	3	2.4	2.4	5.2	1	1	5.6	4.2	1.00	0.21	0.76	0.7643
	4	3.4	3.4	6.2	1	1	6.6	4.2	1.00	0.21	0.76	0.7643
	5	4.4	4.4	7.2	1	1	7.6	4.2	1.00	0.21	0.76	0.7643
	6	5.4	5.4	8.2	1	1	8.6	4.2	1.00	0.21	0.76	0.7643
	7	6.4	6.4	9.2	1	1	9.6	4.2	1.00	0.21	0.76	0.7643
	8	7.4	7.4	10.2	1	1	10.6	4.2	1.00	0.21	0.76	0.7643
	9	8.4	8.4	11.2	1	1	11.6	4.2	1.00	0.21	0.76	0.7643
3.8	1	0.6	0.6	3.4	1	0.6	4.2	4.2	0.00	0.14	0.04	0.7429
						0.8	4	4	0.50	0.14	0.39	
						1	3.8	3.8	1.00	0.14	0.74	
	2	1.6	1.6	4.4	1	1	4.8	4.2	1.00	0.14	0.74	0.7429
	3	2.6	2.6	5.4	1	1	5.8	4.2	1.00	0.14	0.74	0.7429
	4	3.6	3.6	6.4	1	1	6.8	4.2	1.00	0.14	0.74	0.7429
	5	4.6	4.6	7.4	1	1	7.8	4.2	1.00	0.14	0.74	0.7429
	6	5.6	5.6	8.4	1	1	8.8	4.2	1.00	0.14	0.74	0.7429
	7	6.6	6.6	9.4	1	1	9.8	4.2	1.00	0.14	0.74	0.7429
	8	7.6	7.6	10.4	1	1	10.8	4.2	1.00	0.14	0.74	0.7429
	9	8.6	8.6	11.4	1	1	11.8	4.2	1.00	0.14	0.74	0.7429
4	1	0.8	0.8	3.6	1	0.8	4.2	4.2	0.50	0.07	0.37	0.7215
						1	4	4	1.00	0.07	0.72	
	2	1.8	1.8	4.6	1	1	5	4.2	1.00	0.07	0.72	0.7215
	3	2.8	2.8	5.6	1	1	6	4.2	1.00	0.07	0.72	0.7215
	4	3.8	3.8	6.6	1	1	7	4.2	1.00	0.07	0.72	0.7215
	5	4.8	4.8	7.6	1	1	8	4.2	1.00	0.07	0.72	0.7215
	6	5.8	5.8	8.6	1	1	9	4.2	1.00	0.07	0.72	0.7215
	7	6.8	6.8	9.6	1	1	10	4.2	1.00	0.07	0.72	0.7215
	8	7.8	7.8	10.6	1	1	11	4.2	1.00	0.07	0.72	0.7215
	9	8.8	8.8	11.6	1	1	12	4.2	1.00	0.07	0.72	0.7215
4.2	1	1	1	3.8	1	1	4.2	4.2	1.00	0.00	0.70	0.7000
	2	2	2	4.8	1	1	5.2	4.2	1.00	0.00	0.70	0.7000
	3	3	3	5.8	1	1	6.2	4.2	1.00	0.00	0.70	0.7000
	4	4	4	6.8	1	1	7.2	4.2	1.00	0.00	0.70	0.7000
	5	5	5	7.8	1	1	8.2	4.2	1.00	0.00	0.70	0.7000
	6	6	6	8.8	1	1	9.2	4.2	1.00	0.00	0.70	0.7000
	7	7	7	9.8	1	1	10.2	4.2	1.00	0.00	0.70	0.7000
	8	8	8	10.8	1	1	11.2	4.2	1.00	0.00	0.70	0.7000
	9	9	9	11.8	1	1	12.2	4.2	1.00	0.00	0.70	0.7000

Procedure :

- [1] Storage state
- [2] Inflow state
- [3] [1]+[2]-Smax
- [4] max (Rmin,St+Qt-Smax)
- [5] [1]+[2]-Smin
- [6] min (Rmax,St+Qt-Smin)
- [7] [4] ≤ R ≤ [6]
- [8] [1]+[2]-[7]
- [9] Smin ≤ [8] ≤ Smax
- [10] μ of [7] from water demand membership function in related month (figure 4.3)
- [11] μ of [1] from flood control membership function (figure 4.3)
- [12] (0.7 x [10]) + (0.3 x [11])
- [13] max [12] in the same storage and inflow states

Table 4.6 Final Iteration of FSDP Calculation

January

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \mu^*Gn-1$ [9]	$\mu_{Ct} \cap \mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]		
					Demand [6]	F C [7]						
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.60	0.3297	0.3305		
		0.4	2	2	0.00	1.00	0.30	0.60	0.3299			
		0.6	1.8	1.8	0.00	1.00	0.30	0.60	0.3300			
		0.8	1.6	1.6	0.00	1.00	0.30	0.60	0.3302			
	2	1	1	1.4	1.4	0.00	1.00	0.30	0.60	0.3305	0.6390	
			0.2	3.2	3.2	0.00	1.00	0.30	0.59	0.3286		
			0.4	3	3	0.00	1.00	0.30	0.59	0.3288		
			0.6	2.8	2.8	0.00	1.00	0.30	0.59	0.3290		
		2	0.8	2.6	2.6	0.00	1.00	0.30	0.59	0.3292		
			1	2.4	2.4	0.00	1.00	0.30	0.59	0.3295		
			1.2	2.2	2.2	0.33	1.00	0.53	0.60	0.5396		
			1.4	2	2	0.67	1.00	0.77	0.60	0.6150		
	3	1	1.6	1.8	1.8	1.00	1.00	1.00	0.60	0.6390	0.6331	
			0.2	4.2	4.2	0.00	1.00	0.30	0.58	0.3278		
			0.4	4	4	0.00	1.00	0.30	0.58	0.3280		
			0.6	3.8	3.8	0.00	1.00	0.30	0.58	0.3282		
		2	0.8	3.6	3.6	0.00	1.00	0.30	0.58	0.3284		
			1	3.4	3.4	0.00	1.00	0.30	0.59	0.3287		
			1.2	3.2	3.2	0.33	1.00	0.53	0.59	0.5389		
			1.4	3	3	0.67	1.00	0.77	0.59	0.6082		
	4	1.6	2.8	2.8	1.00	1.00	1.00	0.59	0.6331	0.6292		
		1.2	4.2	4.2	0.33	1.00	0.53	0.58	0.5385			
		1.4	4	4	0.67	1.00	0.77	0.59	0.6048			
		1.6	3.8	3.8	1.00	1.00	1.00	0.59	0.6292			
	5	1.6	4.8	4.2	1.00	1.00	1.00	0.58	0.6214	0.6214		
		1.6	5.8	4.2	1.00	1.00	1.00	0.58	0.6255			
	7	1.6	6.8	4.2	1.00	1.00	1.00	0.58	0.6254	0.6254		
		1.6	7.8	4.2	1.00	1.00	1.00	0.57	0.6139			
	9	1.6	8.8	4.2	1.00	1.00	1.00	0.58	0.6194	0.6194		
	1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.59	0.3102	0.5212	
			0.4	2.2	2.2	0.00	0.93	0.28	0.60	0.3104		
			0.6	2	2	0.00	0.93	0.28	0.60	0.3106		
			0.8	1.8	1.8	0.00	0.93	0.28	0.60	0.3107		
		2	1	1	1.6	1.6	0.00	0.93	0.28	0.60	0.3109	0.6362
				1.2	1.4	1.4	0.33	0.93	0.51	0.60	0.5212	
0.2				3.4	3.4	0.00	0.93	0.28	0.58	0.3091		
0.4				3.2	3.2	0.00	0.93	0.28	0.59	0.3093		
2			0.6	3	3	0.00	0.93	0.28	0.59	0.3095		
			0.8	2.8	2.8	0.00	0.93	0.28	0.59	0.3098		
			1	2.6	2.6	0.00	0.93	0.28	0.59	0.3100		
			1.2	2.4	2.4	0.33	0.93	0.51	0.59	0.5202		
3		1	1.4	2.2	2.2	0.67	0.93	0.75	0.60	0.6110	0.6294	
			1.6	2	2	1.00	0.93	0.98	0.60	0.6362		
			0.4	4.2	4.2	0.00	0.93	0.28	0.58	0.3085		
			0.6	4	4	0.00	0.93	0.28	0.58	0.3087		
		2	0.8	3.8	3.8	0.00	0.93	0.28	0.58	0.3090		
			1	3.6	3.6	0.00	0.93	0.28	0.58	0.3092		
			1.2	3.4	3.4	0.33	0.93	0.51	0.59	0.5194		
			1.4	3.2	3.2	0.67	0.93	0.75	0.59	0.6042		
4		1.6	3	3	1.00	0.93	0.98	0.59	0.6294	0.6260		
		1.4	4.2	4.2	0.67	0.93	0.75	0.58	0.6007			
		1.6	4	4	1.00	0.93	0.98	0.59	0.6260			
		1.6	5	4.2	1.00	0.93	0.98	0.58	0.6193			
6		1.6	6	4.2	1.00	0.93	0.98	0.58	0.6234	0.6234		
		1.6	7	4.2	1.00	0.93	0.98	0.58	0.6233			
8		1.6	8	4.2	1.00	0.93	0.98	0.57	0.6117	0.6117		
		1.6	9	4.2	1.00	0.93	0.98	0.58	0.6173			
1.8		1	0.2	2.6	2.6	0.00	0.86	0.26	0.59	0.2907	0.6166	
			0.4	2.4	2.4	0.00	0.86	0.26	0.59	0.2909		
			0.6	2.2	2.2	0.00	0.86	0.26	0.60	0.2911		
			0.8	2	2	0.00	0.86	0.26	0.60	0.2913		
		2	1	1	1.8	1.8	0.00	0.86	0.26	0.60	0.2914	0.6321
				1.2	1.6	1.6	0.33	0.86	0.49	0.60	0.5017	
				1.4	1.4	1.4	0.67	0.86	0.72	0.60	0.6166	
				0.2	3.6	3.6	0.00	0.86	0.26	0.58	0.2896	
	2		0.4	3.4	3.4	0.00	0.86	0.26	0.58	0.2898		
			0.6	3.2	3.2	0.00	0.86	0.26	0.59	0.2900		
			0.8	3	3	0.00	0.86	0.26	0.59	0.2903		
			1	2.8	2.8	0.00	0.86	0.26	0.59	0.2905		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum $\mu \cdot \mu^{*}Gn-1$ [9]	$\mu_{Ct} \cap$ $\mu \cdot \mu^{*}Gn-1$ [10]	$\mu^{*}Gn$ (St,Qt) [11]		
					Demand [6]	F C [7]						
1	3	1.2	2.6	2.6	0.33	0.86	0.49	0.59	0.5007	0.6254		
		1.4	2.4	2.4	0.67	0.86	0.72	0.59	0.6075			
		1.6	2.2	2.2	1.00	0.86	0.96	0.60	0.6321			
		0.6	4.2	4.2	0.00	0.86	0.26	0.58	0.2892			
		0.8	4	4	0.00	0.86	0.26	0.58	0.2895			
		1	3.8	3.8	0.00	0.86	0.26	0.58	0.2897			
		1.2	3.6	3.6	0.33	0.86	0.49	0.58	0.4999			
		1.4	3.4	3.4	0.67	0.86	0.72	0.59	0.6003			
		1.6	3.2	3.2	1.00	0.86	0.96	0.59	0.6254			
	4	1.6	4.2	4.2	1.00	0.86	0.96	0.58	0.6219	0.6219		
		1.6	5.2	4.2	1.00	0.86	0.96	0.58	0.6172	0.6172		
		1.6	6.2	4.2	1.00	0.86	0.96	0.58	0.6213	0.6213		
		1.6	7.2	4.2	1.00	0.86	0.96	0.58	0.6212	0.6212		
		1.6	8.2	4.2	1.00	0.86	0.96	0.57	0.6096	0.6096		
		1.6	9.2	4.2	1.00	0.86	0.96	0.58	0.6151	0.6151		
		2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.59	0.2712	0.6378
				0.4	2.6	2.6	0.00	0.79	0.24	0.59	0.2714	
				0.6	2.4	2.4	0.00	0.79	0.24	0.59	0.2717	
0.8	2.2			2.2	0.00	0.79	0.24	0.60	0.2718			
1	2			2	0.00	0.79	0.24	0.60	0.2720			
1.2	1.8			1.8	0.33	0.79	0.47	0.60	0.4821			
2	1.4		1.6	1.6	0.67	0.79	0.70	0.60	0.6120	0.6287		
	1.6		1.4	1.4	1.00	0.79	0.94	0.60	0.6378			
	0.2		3.8	3.8	0.00	0.79	0.24	0.58	0.2701			
	0.4		3.6	3.6	0.00	0.79	0.24	0.58	0.2703			
	0.6		3.4	3.4	0.00	0.79	0.24	0.58	0.2705			
	0.8		3.2	3.2	0.00	0.79	0.24	0.59	0.2708			
3	1		3	3	0.00	0.79	0.24	0.59	0.2710	0.6215		
	1.2		2.8	2.8	0.33	0.79	0.47	0.59	0.4812			
	1.4		2.6	2.6	0.67	0.79	0.70	0.59	0.6034			
	1.6		2.4	2.4	1.00	0.79	0.94	0.59	0.6287			
	0.8		4.2	4.2	0.00	0.79	0.24	0.58	0.2700			
	1		4	4	0.00	0.79	0.24	0.58	0.2702			
4	1.2	3.8	3.8	0.33	0.79	0.47	0.58	0.4804	0.6198			
	1.4	3.6	3.6	0.67	0.79	0.70	0.58	0.5962				
	1.6	3.4	3.4	1.00	0.79	0.94	0.59	0.6215				
	1.6	4.4	4.2	1.00	0.79	0.94	0.58	0.6198				
	1.6	5.4	4.2	1.00	0.79	0.94	0.58	0.6150				
	1.6	6.4	4.2	1.00	0.79	0.94	0.58	0.6191				
	1.6	7.4	4.2	1.00	0.79	0.94	0.58	0.6190				
	1.6	8.4	4.2	1.00	0.79	0.94	0.57	0.6075				
	1.6	9.4	4.2	1.00	0.79	0.94	0.58	0.6130				
2.2	1	0.2	3	3	0.00	0.71	0.21	0.59	0.2517	0.6332		
		0.4	2.8	2.8	0.00	0.71	0.21	0.59	0.2520			
		0.6	2.6	2.6	0.00	0.71	0.21	0.59	0.2522			
		0.8	2.4	2.4	0.00	0.71	0.21	0.59	0.2524			
		1	2.2	2.2	0.00	0.71	0.21	0.60	0.2525			
		1.2	2	2	0.33	0.71	0.45	0.60	0.4628			
		2	1.4	1.8	1.8	0.67	0.71	0.68	0.60		0.6078	0.6246
			1.6	1.6	1.6	1.00	0.71	0.91	0.60		0.6332	
			0.2	4	4	0.00	0.71	0.21	0.58		0.2506	
			0.4	3.8	3.8	0.00	0.71	0.21	0.58		0.2508	
			0.6	3.6	3.6	0.00	0.71	0.21	0.58		0.2511	
			0.8	3.4	3.4	0.00	0.71	0.21	0.58		0.2513	
	3	1	3.2	3.2	0.00	0.71	0.21	0.59	0.2515	0.6174		
		1.2	3	3	0.33	0.71	0.45	0.59	0.4617			
		1.4	2.8	2.8	0.67	0.71	0.68	0.59	0.5993			
		1.6	2.6	2.6	1.00	0.71	0.91	0.59	0.6246			
		1	4.2	4.2	0.00	0.71	0.21	0.58	0.2507			
		1.2	4	4	0.33	0.71	0.45	0.58	0.4609			
		4	1.4	3.8	3.8	0.67	0.71	0.68	0.58		0.5921	0.6176
			1.6	3.6	3.6	1.00	0.71	0.91	0.58		0.6174	
			1.6	4.6	4.2	1.00	0.71	0.91	0.58		0.6176	
			1.6	5.6	4.2	1.00	0.71	0.91	0.58		0.6129	
			1.6	6.6	4.2	1.00	0.71	0.91	0.58		0.6170	
			1.6	7.6	4.2	1.00	0.71	0.91	0.58		0.6169	
	2.4	1	1.6	8.6	4.2	1.00	0.71	0.91	0.57	0.6053	0.6289	
			1.6	9.6	4.2	1.00	0.71	0.91	0.58	0.6108		
			0.2	3.2	3.2	0.00	0.64	0.19	0.59	0.2322		
			0.4	3	3	0.00	0.64	0.19	0.59	0.2325		
			0.6	2.8	2.8	0.00	0.64	0.19	0.59	0.2327		
			0.8	2.6	2.6	0.00	0.64	0.19	0.59	0.2329		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \rho(\mu^*Gn-1)$ [9]	μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]		
					Demand [6]	F C [7]						
	2	1.2	2.2	2.2	0.33	0.64	0.43	0.60	0.4433	0.6205		
		1.4	2	2	0.67	0.64	0.66	0.60	0.6047			
		1.6	1.8	1.8	1.00	0.64	0.89	0.60	0.6289			
		0.2	4.2	4.2	0.00	0.64	0.19	0.58	0.2311			
		0.4	4	4	0.00	0.64	0.19	0.58	0.2313			
		0.6	3.8	3.8	0.00	0.64	0.19	0.58	0.2316			
		0.8	3.6	3.6	0.00	0.64	0.19	0.58	0.2318			
		1	3.4	3.4	0.00	0.64	0.19	0.58	0.2320			
		1.2	3.2	3.2	0.33	0.64	0.43	0.59	0.4422			
	3	3	1.4	3	3	0.67	0.64	0.66	0.59	0.5953	0.6133	
			1.6	2.8	2.8	1.00	0.64	0.89	0.59	0.6205		
			1.2	4.2	4.2	0.33	0.64	0.43	0.58	0.4414		
		1.4	4	4	0.67	0.64	0.66	0.58	0.5881			
		1.6	3.8	3.8	1.00	0.64	0.89	0.58	0.6133			
		4	1.6	4.8	4.2	1.00	0.64	0.89	0.58	0.6155		0.6155
		5	1.6	5.8	4.2	1.00	0.64	0.89	0.58	0.6107		0.6107
		6	1.6	6.8	4.2	1.00	0.64	0.89	0.58	0.6148		0.6148
		7	1.6	7.8	4.2	1.00	0.64	0.89	0.58	0.6147		0.6147
2.6	1	1.6	8.8	4.2	1.00	0.64	0.89	-0.57	0.6032	0.6032		
		9	1.6	9.8	4.2	1.00	0.64	0.89	0.58	0.6087	0.6087	
		0.2	3.4	3.4	0.00	0.57	0.17	0.58	0.2127	0.6259		
		0.4	3.2	3.2	0.00	0.57	0.17	0.59	0.2130			
		0.6	3	3	0.00	0.57	0.17	0.59	0.2132			
		0.8	2.8	2.8	0.00	0.57	0.17	0.59	0.2134			
		1	2.6	2.6	0.00	0.57	0.17	0.59	0.2136			
		1.2	2.4	2.4	0.33	0.57	0.40	0.59	0.4238			
		1.4	2.2	2.2	0.67	0.57	0.64	0.60	0.6007			
2	2	1.6	2	2	1.00	0.57	0.87	0.60	0.6259	0.6164		
		0.4	4.2	4.2	0.00	0.57	0.17	0.58	0.2118			
		0.6	4	4	0.00	0.57	0.17	0.58	0.2121			
		0.8	3.8	3.8	0.00	0.57	0.17	0.58	0.2123			
		1	3.6	3.6	0.00	0.57	0.17	0.58	0.2125			
		1.2	3.4	3.4	0.33	0.57	0.40	0.58	0.4227			
		1.4	3.2	3.2	0.67	0.57	0.64	0.59	0.5912			
		1.6	3	3	1.00	0.57	0.87	0.59	0.6164			
		1.4	4.2	4.2	0.67	0.57	0.64	0.58	0.5840		0.6093	
3	3	1.6	4	4	1.00	0.57	0.87	0.58	0.6093	0.6134		
		4	1.6	5	4.2	1.00	0.57	0.87	0.58		0.6134	
		5	1.6	6	4.2	1.00	0.57	0.87	0.58		0.6086	
		6	1.6	7	4.2	1.00	0.57	0.87	0.58		0.6127	
		7	1.6	8	4.2	1.00	0.57	0.87	0.58		0.6126	
		8	1.6	9	4.2	1.00	0.57	0.87	0.57		0.6010	
		9	1.6	10	4.2	1.00	0.57	0.87	0.58		0.6065	
		0.2	3.6	3.6	0.00	0.50	0.15	0.58	0.1932		0.6219	
		0.4	3.4	3.4	0.00	0.50	0.15	0.58	0.1935			
2.8	1	0.6	3.2	3.2	0.00	0.50	0.15	0.59	0.1937	0.6124		
		0.8	3	3	0.00	0.50	0.15	0.59	0.1939			
		1	2.8	2.8	0.00	0.50	0.15	0.59	0.1941			
		1.2	2.6	2.6	0.33	0.50	0.38	0.59	0.4043			
		1.4	2.4	2.4	0.67	0.50	0.62	0.59	0.5971			
		1.6	2.2	2.2	1.00	0.50	0.85	0.60	0.6219			
		0.6	4.2	4.2	0.00	0.50	0.15	0.58	0.1926			
		0.8	4	4	0.00	0.50	0.15	0.58	0.1928			
		1	3.8	3.8	0.00	0.50	0.15	0.58	0.1930			
	2	2	1.2	3.6	3.6	0.33	0.50	0.38	0.58	0.4032	0.6052	
			1.4	3.4	3.4	0.67	0.50	0.62	0.58	0.5871		
			1.6	3.2	3.2	1.00	0.50	0.85	0.59	0.6124		
			1.6	4.2	4.2	1.00	0.50	0.85	0.58	0.6052		
			4	1.6	5.2	4.2	1.00	0.50	0.85	0.58		0.6112
			5	1.6	6.2	4.2	1.00	0.50	0.85	0.58		0.6065
			6	1.6	7.2	4.2	1.00	0.50	0.85	0.58		0.6106
			7	1.6	8.2	4.2	1.00	0.50	0.85	0.58		0.6104
			8	1.6	9.2	4.2	1.00	0.50	0.85	0.57		0.5989
3	1	9	1.6	10.2	4.2	1.00	0.50	0.85	0.6044	0.6044		
		0.2	3.8	3.8	0.00	0.43	0.13	0.58	0.1737	0.6183		
		0.4	3.6	3.6	0.00	0.43	0.13	0.58	0.1740			
		0.6	3.4	3.4	0.00	0.43	0.13	0.58	0.1742			
		0.8	3.2	3.2	0.00	0.43	0.13	0.59	0.1744			
		1	3	3	0.00	0.43	0.13	0.59	0.1746			
		1.2	2.8	2.8	0.33	0.43	0.36	0.59	0.3848			
		1.4	2.6	2.6	0.67	0.43	0.60	0.59	0.5931			
		1.6	2.4	2.4	1.00	0.43	0.83	0.59	0.6183			
3	2	0.8	4.2	4.2	0.00	0.43	0.13	0.58	0.1733	0.6083		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St+Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum μ^*Gn-1 [9]	$\mu_{Ct} \cap$ μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]		
					Demand [6]	F C [7]						
		1	4	4	0.00	0.43	0.13	0.58	0.1735			
		1.2	3.8	3.8	0.33	0.43	0.36	0.58	0.3837			
		1.4	3.6	3.6	0.67	0.43	0.60	0.58	0.5830			
		1.6	3.4	3.4	1.00	0.43	0.83	0.58	0.6083			
		3	1.6	4.4	4.2	1.00	0.43	0.83	0.58	0.6030	0.6030	
		4	1.6	5.4	4.2	1.00	0.43	0.83	0.58	0.6091	0.6091	
		5	1.6	6.4	4.2	1.00	0.43	0.83	0.58	0.6043	0.6043	
		6	1.6	7.4	4.2	1.00	0.43	0.83	0.58	0.6084	0.6084	
		7	1.6	8.4	4.2	1.00	0.43	0.83	0.58	0.6083	0.6083	
8	1.6	9.4	4.2	1.00	0.43	0.83	0.57	0.5967	0.5967			
9	1.6	10.4	4.2	1.00	0.43	0.83	0.58	0.6023	0.6023			
3.2	1	0.2	4	4	0.00	0.36	0.11	0.58	0.1542	0.6143		
		0.4	3.8	3.8	0.00	0.36	0.11	0.58	0.1545			
		0.6	3.6	3.6	0.00	0.36	0.11	0.58	0.1547			
		0.8	3.4	3.4	0.00	0.36	0.11	0.58	0.1549			
		1	3.2	3.2	0.00	0.36	0.11	0.59	0.1551			
		1.2	3	3	0.33	0.36	0.34	0.59	0.3653			
		1.4	2.8	2.8	0.67	0.36	0.57	0.59	0.5755			
		1.6	2.6	2.6	1.00	0.36	0.81	0.59	0.6143			
		2	1	4.2	4.2	0.00	0.36	0.11	0.58	0.1540	0.6042	
		1.2	4	4	0.33	0.36	0.34	0.58	0.3642			
		1.4	3.8	3.8	0.67	0.36	0.57	0.58	0.5744			
		1.6	3.6	3.6	1.00	0.36	0.81	0.58	0.6042			
		3	1.6	4.6	4.2	1.00	0.36	0.81	0.58	0.6009	0.6009	
		4	1.6	5.6	4.2	1.00	0.36	0.81	0.58	0.6069	0.6069	
		5	1.6	6.6	4.2	1.00	0.36	0.81	0.58	0.6022	0.6022	
		6	1.6	7.6	4.2	1.00	0.36	0.81	0.58	0.6063	0.6063	
		7	1.6	8.6	4.2	1.00	0.36	0.81	0.58	0.6062	0.6062	
		8	1.6	9.6	4.2	1.00	0.36	0.81	0.57	0.5946	0.5946	
9	1.6	10.6	4.2	1.00	0.36	0.81	0.58	0.6001	0.6001			
3.4	1	0.2	4	4	0.00	0.29	0.09	0.58	0.1347	0.6102		
		0.4	4	4	0.00	0.29	0.09	0.58	0.1350			
		0.6	3.8	3.8	0.00	0.29	0.09	0.58	0.1352			
		0.8	3.6	3.6	0.00	0.29	0.09	0.58	0.1354			
		1	3.4	3.4	0.00	0.29	0.09	0.58	0.1356			
		1.2	3.2	3.2	0.33	0.29	0.32	0.59	0.3458			
		1.4	3	3	0.67	0.29	0.55	0.59	0.5560			
		1.6	2.8	2.8	1.00	0.29	0.79	0.59	0.6102			
		2	1.2	4.2	4.2	0.33	0.29	0.32	0.58	0.3447	0.6002	
		1.4	4	4	0.67	0.29	0.55	0.58	0.5549			
		1.6	3.8	3.8	1.00	0.29	0.79	0.58	0.6002			
		3	1.6	4.8	4.2	1.00	0.29	0.79	0.58	0.5988	0.5988	
		4	1.6	5.8	4.2	1.00	0.29	0.79	0.58	0.6048	0.6048	
		5	1.6	6.8	4.2	1.00	0.29	0.79	0.58	0.6000	0.6000	
		6	1.6	7.8	4.2	1.00	0.29	0.79	0.58	0.6041	0.6041	
		7	1.6	8.8	4.2	1.00	0.29	0.79	0.58	0.6040	0.6040	
		8	1.6	9.8	4.2	1.00	0.29	0.79	0.57	0.5925	0.5925	
		9	1.6	10.8	4.2	1.00	0.29	0.79	0.58	0.5980	0.5980	
3.6	1	0.4	4	4	0.00	0.21	0.06	0.58	0.1155	0.6061		
		0.6	4	4	0.00	0.21	0.06	0.58	0.1157			
		0.8	3.8	3.8	0.00	0.21	0.06	0.58	0.1159			
		1	3.6	3.6	0.00	0.21	0.06	0.58	0.1161			
		1.2	3.4	3.4	0.33	0.21	0.30	0.58	0.3263			
		1.4	3.2	3.2	0.67	0.21	0.53	0.59	0.5365			
		1.6	3	3	1.00	0.21	0.76	0.59	0.6061			
		2	1.4	4.2	4.2	0.67	0.21	0.53	0.58	0.5354	0.5961	
		1.6	4	4	1.00	0.21	0.76	0.58	0.5961			
		3	1.6	5	4.2	1.00	0.21	0.76	0.58	0.5966	0.5966	
		4	1.6	6	4.2	1.00	0.21	0.76	0.58	0.6026	0.6026	
		5	1.6	7	4.2	1.00	0.21	0.76	0.58	0.5979	0.5979	
		6	1.6	8	4.2	1.00	0.21	0.76	0.58	0.6020	0.6020	
		7	1.6	9	4.2	1.00	0.21	0.76	0.58	0.6019	0.6019	
		8	1.6	10	4.2	1.00	0.21	0.76	0.57	0.5903	0.5903	
		9	1.6	11	4.2	1.00	0.21	0.76	0.58	0.5958	0.5958	
		3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.58	0.0962	0.6020
				0.8	4	4	0.00	0.14	0.04	0.58	0.0964	
1	3.8			3.8	0.00	0.14	0.04	0.58	0.0966			
1.2	3.6			3.6	0.33	0.14	0.28	0.58	0.3068			
1.4	3.4			3.4	0.67	0.14	0.51	0.58	0.5170			
1.6	3.2			3.2	1.00	0.14	0.74	0.59	0.6020			
2	1.6			4.2	4.2	1.00	0.14	0.74	0.58	0.5920	0.5920	
3	1.6			5.2	4.2	1.00	0.14	0.74	0.58	0.5945	0.5945	
4	1.6			6.2	4.2	1.00	0.14	0.74	0.58	0.6005	0.6005	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum μ^*Gn-1 [9]	$\mu_{Ct} \cap$ μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
	5	1.6	7.2	4.2	1.00	0.14	0.74	0.58	0.5957	0.5957
	6	1.6	8.2	4.2	1.00	0.14	0.74	0.58	0.5998	0.5998
	7	1.6	9.2	4.2	1.00	0.14	0.74	0.58	0.5997	0.5997
	8	1.6	10.2	4.2	1.00	0.14	0.74	0.57	0.5882	0.5882
	9	1.6	11.2	4.2	1.00	0.14	0.74	0.58	0.5937	0.5937
4	1	0.8	4.2	4.2	0.00	0.07	0.02	0.58	0.0769	0.5980
		1	4	4	0.00	0.07	0.02	0.58	0.0771	
		1.2	3.8	3.8	0.33	0.07	0.25	0.58	0.2873	
		1.4	3.6	3.6	0.67	0.07	0.49	0.58	0.4976	
	2	1.6	3.4	3.4	1.00	0.07	0.72	0.58	0.5980	0.5899
		1.6	4.4	4.2	1.00	0.07	0.72	0.58	0.5899	
		1.6	5.4	4.2	1.00	0.07	0.72	0.58	0.5923	
		1.6	6.4	4.2	1.00	0.07	0.72	0.58	0.5984	
		1.6	7.4	4.2	1.00	0.07	0.72	0.58	0.5936	
3	1.6	8.4	4.2	1.00	0.07	0.72	0.58	0.5977	0.5977	
	1.6	9.4	4.2	1.00	0.07	0.72	0.58	0.5976	0.5976	
	1.6	10.4	4.2	1.00	0.07	0.72	0.57	0.5860	0.5860	
	1.6	11.4	4.2	1.00	0.07	0.72	0.58	0.5916	0.5916	
4.2	1	1	4.2	4.2	0.00	0.00	0.00	0.58	0.0576	0.5939
		1.2	4	4	0.33	0.00	0.23	0.58	0.2678	
		1.4	3.8	3.8	0.67	0.00	0.47	0.58	0.4780	
	2	1.6	3.6	3.6	1.00	0.00	0.70	0.58	0.5939	0.5877
		1.6	4.6	4.2	1.00	0.00	0.70	0.58	0.5877	
		1.6	5.6	4.2	1.00	0.00	0.70	0.58	0.5902	
		1.6	6.6	4.2	1.00	0.00	0.70	0.58	0.5962	
		1.6	7.6	4.2	1.00	0.00	0.70	0.58	0.5914	
		1.6	8.6	4.2	1.00	0.00	0.70	0.58	0.5955	
		1.6	9.6	4.2	1.00	0.00	0.70	0.58	0.5954	
		1.6	10.6	4.2	1.00	0.00	0.70	0.57	0.5839	
		1.6	11.6	4.2	1.00	0.00	0.70	0.58	0.5894	

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Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\mu \cdot \mu^{*Gn-1}$	$\mu_{Ct} \cap$ $\mu \cdot \mu^{*Gn-1}$	μ^{*Gn} (St,Qt)	
					Demand	F C					
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.55	0.3254	0.5378	
		0.4	2	2	0.00	1.00	0.30	0.54	0.3241		
		0.6	1.8	1.8	0.00	1.00	0.30	0.54	0.3240		
		0.8	1.6	1.6	0.00	1.00	0.30	0.54	0.3240		
	2	1	1	1.4	1.4	0.50	1.00	0.65	0.53	0.5378	0.5982
			0.2	3.2	3.2	0.00	1.00	0.30	0.57	0.3270	
			0.4	3	3	0.00	1.00	0.30	0.57	0.3266	
			0.6	2.8	2.8	0.00	1.00	0.30	0.56	0.3263	
		2	0.8	2.6	2.6	0.00	1.00	0.30	0.56	0.3259	
			1	2.4	2.4	0.50	1.00	0.65	0.55	0.5636	
			1.2	2.2	2.2	1.00	1.00	1.00	0.55	0.5982	
			0.2	4.2	4.2	0.00	1.00	0.30	0.57	0.3270	
	3	1	0.4	4	4	0.00	1.00	0.30	0.57	0.3268	0.6098
			0.6	3.8	3.8	0.00	1.00	0.30	0.57	0.3268	
			0.8	3.6	3.6	0.00	1.00	0.30	0.56	0.3263	
			1	3.4	3.4	0.50	1.00	0.65	0.56	0.5729	
	4	1	1.2	3.2	3.2	1.00	1.00	1.00	0.57	0.6098	0.6167
			1.2	4.2	4.2	1.00	1.00	1.00	0.57	0.6167	
			1.2	5.2	4.2	1.00	1.00	1.00	0.53	0.5772	
			1.2	6.2	4.2	1.00	1.00	1.00	0.56	0.6012	
	1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.55	0.3062	0.5707
			0.4	2.2	2.2	0.00	0.93	0.28	0.55	0.3062	
			0.6	2	2	0.00	0.93	0.28	0.54	0.3048	
			0.8	1.8	1.8	0.00	0.93	0.28	0.54	0.3047	
2		1	1	1.6	1.6	0.50	0.93	0.63	0.54	0.5489	0.5965
			1.2	1.4	1.4	1.00	0.93	0.98	0.53	0.5707	
			0.2	3.4	3.4	0.00	0.93	0.28	0.57	0.3077	
			0.4	3.2	3.2	0.00	0.93	0.28	0.57	0.3077	
		2	0.6	3	3	0.00	0.93	0.28	0.57	0.3073	
			0.8	2.8	2.8	0.00	0.93	0.28	0.56	0.3071	
			1	2.6	2.6	0.50	0.93	0.63	0.56	0.5662	
			1.2	2.4	2.4	1.00	0.93	0.98	0.55	0.5965	
3		1	0.4	4.2	4.2	0.00	0.93	0.28	0.57	0.3078	0.6058
			0.6	4	4	0.00	0.93	0.28	0.57	0.3076	
			0.8	3.8	3.8	0.00	0.93	0.28	0.57	0.3075	
			1	3.6	3.6	0.50	0.93	0.63	0.56	0.5700	
4		1	1.2	3.4	3.4	1.00	0.93	0.98	0.56	0.6058	0.6146
			1.2	4.4	4.2	1.00	0.93	0.98	0.57	0.6146	
			1.2	5.4	4.2	1.00	0.93	0.98	0.53	0.5751	
			1.2	6.4	4.2	1.00	0.93	0.98	0.56	0.5991	
1.8		1	0.2	2.6	2.6	0.00	0.86	0.26	0.56	0.2872	0.5818
			0.4	2.4	2.4	0.00	0.86	0.26	0.55	0.2869	
			0.6	2.2	2.2	0.00	0.86	0.26	0.55	0.2869	
			0.8	2	2	0.00	0.86	0.26	0.54	0.2856	
	2	1	1	1.8	1.8	0.50	0.86	0.61	0.54	0.5465	0.5991
			1.2	1.6	1.6	1.00	0.86	0.96	0.54	0.5818	
			0.2	3.6	3.6	0.00	0.86	0.26	0.57	0.2883	
			0.4	3.4	3.4	0.00	0.86	0.26	0.57	0.2884	
		2	0.6	3.2	3.2	0.00	0.86	0.26	0.57	0.2884	
			0.8	3	3	0.00	0.86	0.26	0.57	0.2880	
			1	2.8	2.8	0.50	0.86	0.61	0.56	0.5677	
			1.2	2.6	2.6	1.00	0.86	0.96	0.56	0.5991	
	3	1	0.6	4.2	4.2	0.00	0.86	0.26	0.57	0.2885	0.6029
			0.8	4	4	0.00	0.86	0.26	0.57	0.2883	
			1	3.8	3.8	0.50	0.86	0.61	0.57	0.5720	
			1.2	3.6	3.6	1.00	0.86	0.96	0.56	0.6029	
	4	1	1.2	4.6	4.2	1.00	0.86	0.96	0.57	0.6124	0.6124
			1.2	5.6	4.2	1.00	0.86	0.96	0.53	0.5729	
			1.2	6.6	4.2	1.00	0.86	0.96	0.56	0.5969	
			1.2	6.6	4.2	1.00	0.86	0.96	0.56	0.5969	
	2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.56	0.2681	0.5793
			0.4	2.6	2.6	0.00	0.79	0.24	0.56	0.2679	
			0.6	2.4	2.4	0.00	0.79	0.24	0.55	0.2677	
			0.8	2.2	2.2	0.00	0.79	0.24	0.55	0.2676	
2		1	1	2	2	0.50	0.79	0.59	0.54	0.5456	0.6006
			1.2	1.8	1.8	1.00	0.79	0.94	0.54	0.5793	
			0.2	3.8	3.8	0.00	0.79	0.24	0.57	0.2695	
			0.4	3.6	3.6	0.00	0.79	0.24	0.57	0.2690	
		2	0.6	3.4	3.4	0.00	0.79	0.24	0.57	0.2691	
			0.8	3.2	3.2	0.00	0.79	0.24	0.57	0.2691	
			1	3	3	0.50	0.79	0.59	0.57	0.5679	
			1.2	2.8	2.8	1.00	0.79	0.94	0.56	0.6006	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St, Qt, Rt) [8]	\sum $\mu \cdot \mu^{*Gn-1}$ [9]	$\mu_{Ct} \cap$ $\mu \cdot \mu^{*Gn-1}$ [10]	μ^{*Gn} (St, Qt) [11]
					Demand [6]	F C [7]				
	3	0.8	4.2	4.2	0.00	0.79	0.24	0.57	0.2692	0.6049
		1	4	4	0.50	0.79	0.59	0.57	0.5699	
	4	1.2	3.8	3.8	1.00	0.79	0.94	0.57	0.6049	0.6103
		1.2	4.8	4.2	1.00	0.79	0.94	0.57	0.6103	
		1.2	5.8	4.2	1.00	0.79	0.94	0.53	0.5708	
		1.2	6.8	4.2	1.00	0.79	0.94	0.56	0.5948	
2.2	1	0.2	3	3	0.00	0.71	0.21	0.56	0.2489	0.5785
		0.4	2.8	2.8	0.00	0.71	0.21	0.56	0.2488	
		0.6	2.6	2.6	0.00	0.71	0.21	0.56	0.2486	
		0.8	2.4	2.4	0.00	0.71	0.21	0.55	0.2484	
		1	2.2	2.2	0.50	0.71	0.56	0.55	0.5552	
		1.2	2	2	1.00	0.71	0.91	0.54	0.5785	
	2	0.2	4	4	0.00	0.71	0.21	0.57	0.2503	0.6007
		0.4	3.8	3.8	0.00	0.71	0.21	0.57	0.2502	
		0.6	3.6	3.6	0.00	0.71	0.21	0.57	0.2497	
		0.8	3.4	3.4	0.00	0.71	0.21	0.57	0.2498	
		1	3.2	3.2	0.50	0.71	0.56	0.57	0.5648	
		1.2	3	3	1.00	0.71	0.91	0.57	0.6007	
	3	1	4.2	4.2	0.50	0.71	0.56	0.57	0.5649	0.6028
		1.2	4	4	1.00	0.71	0.91	0.57	0.6028	
		1.2	5	4.2	1.00	0.71	0.91	0.57	0.6081	
		1.2	6	4.2	1.00	0.71	0.91	0.53	0.5686	
		1.2	7	4.2	1.00	0.71	0.91	0.56	0.5926	
		1.2	7	4.2	1.00	0.71	0.91	0.56	0.5926	
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.56	0.2296	0.5881
		0.4	3	3	0.00	0.64	0.19	0.56	0.2296	
		0.6	2.8	2.8	0.00	0.64	0.19	0.56	0.2295	
		0.8	2.6	2.6	0.00	0.64	0.19	0.56	0.2293	
		1	2.4	2.4	0.50	0.64	0.54	0.55	0.5441	
		1.2	2.2	2.2	1.00	0.64	0.89	0.55	0.5881	
	2	0.2	4.2	4.2	0.00	0.64	0.19	0.58	0.2312	0.6019
		0.4	4	4	0.00	0.64	0.19	0.57	0.2310	
		0.6	3.8	3.8	0.00	0.64	0.19	0.57	0.2310	
		0.8	3.6	3.6	0.00	0.64	0.19	0.57	0.2304	
		1	3.4	3.4	0.50	0.64	0.54	0.57	0.5455	
		1.2	3.2	3.2	1.00	0.64	0.89	0.57	0.6019	
	3	1.2	4.2	4.2	1.00	0.64	0.89	0.57	0.6026	0.6026
		1.2	5.2	4.2	1.00	0.64	0.89	0.57	0.6060	
		1.2	6.2	4.2	1.00	0.64	0.89	0.53	0.5665	
		1.2	7.2	4.2	1.00	0.64	0.89	0.56	0.5905	
		1.2	7.2	4.2	1.00	0.64	0.89	0.56	0.5905	
		1.2	7.2	4.2	1.00	0.64	0.89	0.56	0.5905	
2.6	1	0.2	3.4	3.4	0.00	0.57	0.17	0.56	0.2102	0.5866
		0.4	3.2	3.2	0.00	0.57	0.17	0.56	0.2104	
		0.6	3	3	0.00	0.57	0.17	0.56	0.2104	
		0.8	2.8	2.8	0.00	0.57	0.17	0.56	0.2102	
		1	2.6	2.6	0.50	0.57	0.52	0.56	0.5250	
		1.2	2.4	2.4	1.00	0.57	0.87	0.55	0.5866	
	2	0.4	4.2	4.2	0.00	0.57	0.17	0.58	0.2119	0.5995
		0.6	4	4	0.00	0.57	0.17	0.57	0.2117	
		0.8	3.8	3.8	0.00	0.57	0.17	0.57	0.2117	
		1	3.6	3.6	0.50	0.57	0.52	0.57	0.5262	
		1.2	3.4	3.4	1.00	0.57	0.87	0.57	0.5995	
		1.2	3.4	3.4	1.00	0.57	0.87	0.57	0.5995	
	3	1.2	4.4	4.2	1.00	0.57	0.87	0.57	0.6005	0.6005
		1.2	5.4	4.2	1.00	0.57	0.87	0.57	0.6038	
		1.2	6.4	4.2	1.00	0.57	0.87	0.53	0.5644	
		1.2	7.4	4.2	1.00	0.57	0.87	0.56	0.5884	
		1.2	7.4	4.2	1.00	0.57	0.87	0.56	0.5884	
		1.2	7.4	4.2	1.00	0.57	0.87	0.56	0.5884	
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.56	0.1909	0.5864
		0.4	3.4	3.4	0.00	0.50	0.15	0.56	0.1909	
		0.6	3.2	3.2	0.00	0.50	0.15	0.56	0.1911	
		0.8	3	3	0.00	0.50	0.15	0.56	0.1911	
		1	2.8	2.8	0.50	0.50	0.50	0.56	0.5059	
		1.2	2.6	2.6	1.00	0.50	0.85	0.56	0.5864	
	2	0.6	4.2	4.2	0.00	0.50	0.15	0.58	0.1927	0.5966
		0.8	4	4	0.00	0.50	0.15	0.57	0.1924	
		1	3.8	3.8	0.50	0.50	0.50	0.57	0.5074	
		1.2	3.6	3.6	1.00	0.50	0.85	0.57	0.5966	
		1.2	4.6	4.2	1.00	0.50	0.85	0.57	0.5984	
		1.2	5.6	4.2	1.00	0.50	0.85	0.57	0.6017	
	3	1.2	6.6	4.2	1.00	0.50	0.85	0.53	0.5622	0.5622
		1.2	7.6	4.2	1.00	0.50	0.85	0.56	0.5862	
		1.2	7.6	4.2	1.00	0.50	0.85	0.56	0.5862	
		1.2	7.6	4.2	1.00	0.50	0.85	0.56	0.5862	
		1.2	7.6	4.2	1.00	0.50	0.85	0.56	0.5862	
		1.2	7.6	4.2	1.00	0.50	0.85	0.56	0.5862	
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.56	0.1721	0.5859
		0.4	3.6	3.6	0.00	0.43	0.13	0.56	0.1716	
		0.6	3.4	3.4	0.00	0.43	0.13	0.56	0.1716	
		0.8	3.2	3.2	0.00	0.43	0.13	0.56	0.1718	
		1	3	3	0.50	0.43	0.48	0.56	0.4868	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum μ^*Gn-1 [9]	$\mu_{Ct} \cap$ (μ^*Gn-1) [10]	μ^*Gn (St,Qt) [11]	
					Demand [6]	F C [7]					
	2	1.2	2.8	2.8	1.00	0.43	0.83	0.56	0.5859	0.5990	
		0.8	4.2	4.2	0.00	0.43	0.13	0.58	0.1734		
	1	4	4	0.50	0.43	0.48	0.57	0.4881			
	1.2	3.8	3.8	1.00	0.43	0.83	0.57	0.5990			
	3	1.2	4.8	4.2	1.00	0.43	0.83	0.57	0.5962		
	4	1.2	5.8	4.2	1.00	0.43	0.83	0.57	0.5996		
3.2	1	1.2	6.8	4.2	1.00	0.43	0.83	0.53	0.5601	0.5962	
		1.2	7.8	4.2	1.00	0.43	0.83	0.56	0.5841		
		0.2	4	4	0.00	0.36	0.11	0.56	0.1528		
		0.4	3.8	3.8	0.00	0.36	0.11	0.56	0.1528		
	0.6	3.6	3.6	0.00	0.36	0.11	0.56	0.1523			
	0.8	3.4	3.4	0.00	0.36	0.11	0.56	0.1524			
2	1	3.2	3.2	0.50	0.36	0.46	0.56	0.4675	0.5971		
	1.2	3	3	1.00	0.36	0.81	0.56	0.5851			
3.4	3	1	4.2	4.2	0.50	0.36	0.46	0.58	0.4691	0.5941	
		1.2	4	4	1.00	0.36	0.81	0.57	0.5971		
	1.2	5	4.2	1.00	0.36	0.81	0.57	0.5941			
	1.2	6	4.2	1.00	0.36	0.81	0.57	0.5974			
	5	1.2	7	4.2	1.00	0.36	0.81	0.53	0.5579		
	6	1.2	8	4.2	1.00	0.36	0.81	0.56	0.5819		
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.57	0.1338	0.5830	
		0.4	4	4	0.00	0.29	0.09	0.56	0.1335		
		0.6	3.8	3.8	0.00	0.29	0.09	0.56	0.1335		
		0.8	3.6	3.6	0.00	0.29	0.09	0.56	0.1330		
	1	3.4	3.4	0.50	0.29	0.44	0.56	0.4481			
	1.2	3.2	3.2	1.00	0.29	0.79	0.56	0.5830			
2	1.2	4.2	4.2	1.00	0.29	0.79	0.58	0.5972	0.5972		
	1.2	5.2	4.2	1.00	0.29	0.79	0.57	0.5919			
3.6	3	1.2	6.2	4.2	1.00	0.29	0.79	0.57	0.5953	0.5953	
		1.2	7.2	4.2	1.00	0.29	0.79	0.53	0.5558		
	1.2	8.2	4.2	1.00	0.29	0.79	0.56	0.5798			
	1	0.4	4.2	4.2	0.00	0.21	0.06	0.57	0.1145		0.5795
	0.6	4	4	0.00	0.21	0.06	0.56	0.1142			
	0.8	3.8	3.8	0.00	0.21	0.06	0.56	0.1142			
1	3.6	3.6	0.50	0.21	0.41	0.56	0.4287				
1.2	3.4	3.4	1.00	0.21	0.76	0.56	0.5795				
1.2	4.4	4.2	1.00	0.21	0.76	0.58	0.5950				
3.8	4	1.2	5.4	4.2	1.00	0.21	0.76	0.57	0.5898	0.5950	
		1.2	6.4	4.2	1.00	0.21	0.76	0.57	0.5931		
	5	1.2	7.4	4.2	1.00	0.21	0.76	0.53	0.5536		
	6	1.2	8.4	4.2	1.00	0.21	0.76	0.56	0.5776		
	1	0.6	4.2	4.2	0.00	0.14	0.04	0.57	0.0952		0.5767
	0.8	4	4	0.00	0.14	0.04	0.56	0.0950			
1	3.8	3.8	0.50	0.14	0.39	0.56	0.4099				
1.2	3.6	3.6	1.00	0.14	0.74	0.56	0.5767				
2	1.2	4.6	4.2	1.00	0.14	0.74	0.58	0.5929			
3	1.2	5.6	4.2	1.00	0.14	0.74	0.57	0.5876			
4	4	1.2	6.6	4.2	1.00	0.14	0.74	0.57	0.5910	0.5910	
		1.2	7.6	4.2	1.00	0.14	0.74	0.53	0.5515		
	6	1.2	8.6	4.2	1.00	0.14	0.74	0.56	0.5755		
	1	0.8	4.2	4.2	0.00	0.07	0.02	0.57	0.0759		0.5791
	1	4	4	0.50	0.07	0.37	0.56	0.3907			
	1.2	3.8	3.8	1.00	0.07	0.72	0.56	0.5791			
2	1.2	4.8	4.2	1.00	0.07	0.72	0.58	0.5908			
3	1.2	5.8	4.2	1.00	0.07	0.72	0.57	0.5855			
4	1.2	6.8	4.2	1.00	0.07	0.72	0.57	0.5888			
4.2	5	1.2	7.8	4.2	1.00	0.07	0.72	0.53	0.5494	0.5888	
		1.2	8.8	4.2	1.00	0.07	0.72	0.56	0.5734		
	6	1.2	9	4.2	1.00	0.07	0.72	0.56	0.5734		
	1	1	4.2	4.2	0.50	0.00	0.35	0.57	0.3716		0.5771
	1.2	4	4	1.00	0.00	0.70	0.56	0.5771			
	2	1.2	5	4.2	1.00	0.00	0.70	0.58	0.5886		
3	1.2	6	4.2	1.00	0.00	0.70	0.57	0.5833			
4	1.2	7	4.2	1.00	0.00	0.70	0.57	0.5867			
5	1.2	8	4.2	1.00	0.00	0.70	0.53	0.5472			
6	1.2	9	4.2	1.00	0.00	0.70	0.56	0.5712			

Fuzzy Rule Base Modeling for Reservoir Operation

March

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*Gn-1	$\mu_{Ct} \cap$ μ^*Gn-1	μ^*Gn (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.39	0.3085	0.3750
		0.4	2	2	0.00	1.00	0.30	0.38	0.3079	
		0.6	1.8	1.8	0.00	1.00	0.30	0.33	0.3031	
		0.8	1.6	1.6	0.00	1.00	0.30	0.34	0.3037	
	2	1	1.4	1.4	0.50	1.00	0.65	0.34	0.3750	0.5331
		0.2	3.2	3.2	0.00	1.00	0.30	0.53	0.3226	
		0.4	3	3	0.00	1.00	0.30	0.52	0.3222	
		0.6	2.8	2.8	0.00	1.00	0.30	0.52	0.3218	
	3	1	2.4	2.4	0.50	1.00	0.65	0.49	0.5088	0.5587
		0.2	4.2	4.2	0.00	1.00	0.30	0.48	0.5331	
		0.4	4	4	0.00	1.00	0.30	0.58	0.3282	
		0.6	3.8	3.8	0.00	1.00	0.30	0.55	0.3255	
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.40	0.2905	0.4078
		0.4	2.2	2.2	0.00	0.93	0.28	0.39	0.2893	
		0.6	2	2	0.00	0.93	0.28	0.38	0.2887	
		0.8	1.8	1.8	0.00	0.93	0.28	0.33	0.2838	
	2	1	1.6	1.6	0.50	0.93	0.63	0.34	0.3660	0.5416
		1.2	1.4	1.4	1.00	0.93	0.98	0.34	0.4078	
		0.2	3.4	3.4	0.00	0.93	0.28	0.54	0.3047	
		0.4	3.2	3.2	0.00	0.93	0.28	0.53	0.3034	
	3	0.6	3	3	0.00	0.93	0.28	0.52	0.3030	0.5837
		0.8	2.8	2.8	0.00	0.93	0.28	0.52	0.3026	
		1	2.6	2.6	0.50	0.93	0.63	0.51	0.5176	
		1.2	2.4	2.4	1.00	0.93	0.98	0.49	0.5416	
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.41	0.2724	0.3989
		0.4	2.4	2.4	0.00	0.86	0.26	0.40	0.2712	
		0.6	2.2	2.2	0.00	0.86	0.26	0.39	0.2700	
		0.8	2	2	0.00	0.86	0.26	0.38	0.2694	
	2	1	1.8	1.8	0.50	0.86	0.61	0.33	0.3586	0.5505
		1.2	1.6	1.6	1.00	0.86	0.96	0.34	0.3989	
		0.2	3.6	3.6	0.00	0.86	0.26	0.55	0.2865	
		0.4	3.4	3.4	0.00	0.86	0.26	0.54	0.2854	
	3	0.6	3.2	3.2	0.00	0.86	0.26	0.53	0.2841	0.5902
		0.8	3	3	0.00	0.86	0.26	0.52	0.2837	
		1	2.8	2.8	0.50	0.86	0.61	0.52	0.5273	
		1.2	2.6	2.6	1.00	0.86	0.96	0.51	0.5505	
4	0.6	4.2	4.2	0.00	0.86	0.26	0.59	0.2901	0.6366	
	0.8	4	4	0.00	0.86	0.26	0.58	0.2896		
	1	3.8	3.8	0.50	0.86	0.61	0.55	0.5602		
	1.2	3.6	3.6	1.00	0.86	0.96	0.55	0.5902		
	1.2	4.6	4.2	1.00	0.86	0.96	0.60	0.6366		
	1.2	5.6	4.2	1.00	0.86	0.96	0.47	0.5214		
6	1.2	6.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum $\rho(\cdot)\mu^*Gn-1$ [9]	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]	
					Demand [6]	F C [7]					
	7	1.2	7.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	
	8	1.2	8.6	4.2	1.00	0.86	0.96	0.58	0.6202	0.6202	
	9	1.2	9.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	
	10	1.2	10.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	
	11	1.2	11.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	
	12	1.2	12.6	4.2	1.00	0.86	0.96	0.60	0.6340	0.6340	
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.42	0.2546	0.3999	
		0.4	2.6	2.6	0.00	0.79	0.24	0.41	0.2532		
		0.6	2.4	2.4	0.00	0.79	0.24	0.40	0.2520		
	2	1	0.8	2.2	2.2	0.00	0.79	0.24	0.39	0.2507	0.5602
			1	2	2	0.50	0.79	0.59	0.38	0.3999	
			1.2	1.8	1.8	1.00	0.79	0.94	0.33	0.3915	
		0.2	3.8	3.8	0.00	0.79	0.24	0.55	0.2676		
		0.4	3.6	3.6	0.00	0.79	0.24	0.55	0.2672		
		0.6	3.4	3.4	0.00	0.79	0.24	0.54	0.2661		
	3	1	0.8	3.2	3.2	0.00	0.79	0.24	0.53	0.2648	0.5931
			1	3	3	0.50	0.79	0.59	0.52	0.5288	
			1.2	2.8	2.8	1.00	0.79	0.94	0.52	0.5602	
0.8		4.2	4.2	0.00	0.79	0.24	0.59	0.2708			
1		4	4	0.50	0.79	0.59	0.58	0.5821			
1.2		3.8	3.8	1.00	0.79	0.94	0.55	0.5931			
4	1.2	4.8	4.2	1.00	0.79	0.94	0.60	0.6344	0.6344		
5	1.2	5.8	4.2	1.00	0.79	0.94	0.47	0.5193	0.5193		
6	1.2	6.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
7	1.2	7.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
8	1.2	8.8	4.2	1.00	0.79	0.94	0.58	0.6180	0.6180		
9	1.2	9.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
10	1.2	10.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
11	1.2	11.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
12	1.2	12.8	4.2	1.00	0.79	0.94	0.60	0.6319	0.6319		
2.2	1	0.2	3	3	0.00	0.71	0.21	0.43	0.2355	0.4327	
		0.4	2.8	2.8	0.00	0.71	0.21	0.42	0.2353		
		0.6	2.6	2.6	0.00	0.71	0.21	0.41	0.2339		
	2	1	0.8	2.4	2.4	0.00	0.71	0.21	0.40	0.2327	0.5616
			1	2.2	2.2	0.50	0.71	0.56	0.39	0.4031	
			1.2	2	2	1.00	0.71	0.91	0.38	0.4327	
		0.2	4	4	0.00	0.71	0.21	0.57	0.2500		
		0.4	3.8	3.8	0.00	0.71	0.21	0.55	0.2483		
		0.6	3.6	3.6	0.00	0.71	0.21	0.55	0.2479		
	3	1	0.8	3.4	3.4	0.00	0.71	0.21	0.54	0.2468	0.6150
			1	3.2	3.2	0.50	0.71	0.56	0.53	0.5301	
			1.2	3	3	1.00	0.71	0.91	0.52	0.5616	
1		4.2	4.2	0.50	0.71	0.56	0.59	0.5665			
1.2		4	4	1.00	0.71	0.91	0.58	0.6150			
1.2		5	4.2	1.00	0.71	0.91	0.60	0.6323	0.6323		
5	1.2	6	4.2	1.00	0.71	0.91	0.47	0.5171	0.5171		
6	1.2	7	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
7	1.2	8	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
8	1.2	9	4.2	1.00	0.71	0.91	0.58	0.6159	0.6159		
9	1.2	10	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
10	1.2	11	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
11	1.2	12	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
12	1.2	13	4.2	1.00	0.71	0.91	0.60	0.6297	0.6297		
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.43	0.2162	0.4360	
		0.4	3	3	0.00	0.64	0.19	0.43	0.2162		
		0.6	2.8	2.8	0.00	0.64	0.19	0.42	0.2160		
		0.8	2.6	2.6	0.00	0.64	0.19	0.41	0.2146		
	2	1	1	2.4	2.4	0.50	0.64	0.54	0.40	0.4124	0.5629
			1.2	2.2	2.2	1.00	0.64	0.89	0.39	0.4360	
			0.2	4.2	4.2	0.00	0.64	0.19	0.58	0.2312	
		0.4	4	4	0.00	0.64	0.19	0.57	0.2307		
		0.6	3.8	3.8	0.00	0.64	0.19	0.55	0.2290		
		0.8	3.6	3.6	0.00	0.64	0.19	0.55	0.2286		
	3	1	1	3.4	3.4	0.50	0.64	0.54	0.54	0.5400	0.6172
			1.2	3.2	3.2	1.00	0.64	0.89	0.53	0.5629	
1.2			4.2	4.2	1.00	0.64	0.89	0.59	0.6172		
4		1.2	5.2	4.2	1.00	0.64	0.89	0.60	0.6302	0.6302	
5		1.2	6.2	4.2	1.00	0.64	0.89	0.47	0.5150	0.5150	
6		1.2	7.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276	
7	1.2	8.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276		
8	1.2	9.2	4.2	1.00	0.64	0.89	0.58	0.6137	0.6137		
9	1.2	10.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276		
10	1.2	11.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276		

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*Gn-1	$\mu_{Ct} \cap$ μ^*Gn-1	μ^*Gn (St,Qt)		
					Demand	F C						
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]		
2.6	11	1.2	12.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276		
	12	1.2	13.2	4.2	1.00	0.64	0.89	0.60	0.6276	0.6276		
	1	0.2	3.4	3.4	0.00	0.57	0.17	0.43	0.1975	0.4453		
		0.4	3.2	3.2	0.00	0.57	0.17	0.43	0.1969			
		0.6	3	3	0.00	0.57	0.17	0.43	0.1969			
		0.8	2.8	2.8	0.00	0.57	0.17	0.42	0.1967			
		1	2.6	2.6	0.50	0.57	0.52	0.41	0.4211			
		1.2	2.4	2.4	1.00	0.57	0.87	0.40	0.4453			
	2	0.4	4.2	4.2	0.00	0.57	0.17	0.58	0.2119		0.5728	
		0.6	4	4	0.00	0.57	0.17	0.57	0.2114			
		0.8	3.8	3.8	0.00	0.57	0.17	0.55	0.2098			
		1	3.6	3.6	0.50	0.57	0.52	0.55	0.5243			
	1.2	3.4	3.4	1.00	0.57	0.87	0.54	0.5728				
3	1.2	4.4	4.2	1.00	0.57	0.87	0.59	0.6151	0.6151			
4	1.2	5.4	4.2	1.00	0.57	0.87	0.60	0.6280				
5	1.2	6.4	4.2	1.00	0.57	0.87	0.47	0.5129				
6	1.2	7.4	4.2	1.00	0.57	0.87	0.60	0.6255				
7	1.2	8.4	4.2	1.00	0.57	0.87	0.60	0.6255				
8	1.2	9.4	4.2	1.00	0.57	0.87	0.58	0.6116				
9	1.2	10.4	4.2	1.00	0.57	0.87	0.60	0.6255				
10	1.2	11.4	4.2	1.00	0.57	0.87	0.60	0.6255				
11	1.2	12.4	4.2	1.00	0.57	0.87	0.60	0.6255				
12	1.2	13.4	4.2	1.00	0.57	0.87	0.60	0.6255				
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.46		0.1814	0.4539	
		0.4	3.4	3.4	0.00	0.50	0.15	0.43		0.1782		
		0.6	3.2	3.2	0.00	0.50	0.15	0.43	0.1776			
		0.8	3	3	0.00	0.50	0.15	0.43	0.1776			
		1	2.8	2.8	0.50	0.50	0.50	0.42	0.4318			
		1.2	2.6	2.6	1.00	0.50	0.85	0.41	0.4539			
	2	0.6	4.2	4.2	0.00	0.50	0.15	0.58	0.1926	0.5801		
		0.8	4	4	0.00	0.50	0.15	0.57	0.1921			
		1	3.8	3.8	0.50	0.50	0.50	0.55	0.5055			
		1.2	3.6	3.6	1.00	0.50	0.85	0.55	0.5801			
	3	1.2	4.6	4.2	1.00	0.50	0.85	0.59	0.6129			0.6129
	4	1.2	5.6	4.2	1.00	0.50	0.85	0.60	0.6259			
5	1.2	6.6	4.2	1.00	0.50	0.85	0.47	0.5107				
6	1.2	7.6	4.2	1.00	0.50	0.85	0.60	0.6233				
7	1.2	8.6	4.2	1.00	0.50	0.85	0.60	0.6233				
8	1.2	9.6	4.2	1.00	0.50	0.85	0.58	0.6094				
9	1.2	10.6	4.2	1.00	0.50	0.85	0.60	0.6233				
10	1.2	11.6	4.2	1.00	0.50	0.85	0.60	0.6233				
11	1.2	12.6	4.2	1.00	0.50	0.85	0.60	0.6233				
12	1.2	13.6	4.2	1.00	0.50	0.85	0.60	0.6233				
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.47	0.1632	0.4646		
		0.4	3.6	3.6	0.00	0.43	0.13	0.46	0.1621			
		0.6	3.4	3.4	0.00	0.43	0.13	0.43	0.1589			
		0.8	3.2	3.2	0.00	0.43	0.13	0.43	0.1583			
		1	3	3	0.50	0.43	0.48	0.43	0.4310			
		1.2	2.8	2.8	1.00	0.43	0.83	0.42	0.4646			
	2	0.8	4.2	4.2	0.00	0.43	0.13	0.58	0.1734		0.5818	
		1	4	4	0.50	0.43	0.48	0.57	0.4878			
		1.2	3.8	3.8	1.00	0.43	0.83	0.55	0.5818			
	3	1.2	4.8	4.2	1.00	0.43	0.83	0.59	0.6108			0.6108
	4	1.2	5.8	4.2	1.00	0.43	0.83	0.60	0.6237			
	5	1.2	6.8	4.2	1.00	0.43	0.83	0.47	0.5086			
6	1.2	7.8	4.2	1.00	0.43	0.83	0.60	0.6212				
7	1.2	8.8	4.2	1.00	0.43	0.83	0.60	0.6212				
8	1.2	9.8	4.2	1.00	0.43	0.83	0.58	0.6073				
9	1.2	10.8	4.2	1.00	0.43	0.83	0.60	0.6212				
10	1.2	11.8	4.2	1.00	0.43	0.83	0.60	0.6212				
11	1.2	12.8	4.2	1.00	0.43	0.83	0.60	0.6212				
12	1.2	13.8	4.2	1.00	0.43	0.83	0.60	0.6212				
3.2	1	0.2	4	4	0.00	0.36	0.11	0.49	0.1460	0.4639		
		0.4	3.8	3.8	0.00	0.36	0.11	0.47	0.1439			
		0.6	3.6	3.6	0.00	0.36	0.11	0.46	0.1428			
		0.8	3.4	3.4	0.00	0.36	0.11	0.43	0.1397			
		1	3.2	3.2	0.50	0.36	0.46	0.43	0.4289			
		1.2	3	3	1.00	0.36	0.81	0.43	0.4639			
	2	1	4.2	4.2	0.50	0.36	0.46	0.58	0.4691		0.5944	
		1.2	4	4	1.00	0.36	0.81	0.57	0.5944			
	3	1.2	5	4.2	1.00	0.36	0.81	0.59	0.6086			
	4	1.2	6	4.2	1.00	0.36	0.81	0.60	0.6216			
	5	1.2	7	4.2	1.00	0.36	0.81	0.47	0.5064			

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		$\mu_{Ct} (St, Qt, Rt)$	$\sum \mu^*Gn-1$	$\mu_{Ct} \cap \mu^*Gn-1$	$\mu^*Gn (St, Qt)$
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	6	1.2	8	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
	7	1.2	9	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
	8	1.2	10	4.2	1.00	0.36	0.81	0.58	0.6052	0.6052
	9	1.2	11	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
	10	1.2	12	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
	11	1.2	13	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
	12	1.2	14	4.2	1.00	0.36	0.81	0.60	0.6190	0.6190
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.51	0.1284	0.4618
		0.4	4	4	0.00	0.29	0.09	0.49	0.1267	
		0.6	3.8	3.8	0.00	0.29	0.09	0.47	0.1246	
		0.8	3.6	3.6	0.00	0.29	0.09	0.46	0.1236	
		1	3.4	3.4	0.50	0.29	0.44	0.43	0.4323	
		1.2	3.2	3.2	1.00	0.29	0.79	0.43	0.4618	
	2	1.2	4.2	4.2	1.00	0.29	0.79	0.58	0.5970	0.5970
	3	1.2	5.2	4.2	1.00	0.29	0.79	0.59	0.6065	0.6065
	4	1.2	6.2	4.2	1.00	0.29	0.79	0.60	0.6194	0.6194
	5	1.2	7.2	4.2	1.00	0.29	0.79	0.47	0.5043	0.5043
	6	1.2	8.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
	7	1.2	9.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
	8	1.2	10.2	4.2	1.00	0.29	0.79	0.58	0.6030	0.6030
	9	1.2	11.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
	10	1.2	12.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
	11	1.2	13.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
	12	1.2	14.2	4.2	1.00	0.29	0.79	0.60	0.6169	0.6169
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.51	0.1091	0.4652
		0.6	4	4	0.00	0.21	0.06	0.49	0.1074	
		0.8	3.8	3.8	0.00	0.21	0.06	0.47	0.1053	
		1	3.6	3.6	0.50	0.21	0.41	0.46	0.4193	
		1.2	3.4	3.4	1.00	0.21	0.76	0.43	0.4652	
	2	1.2	4.4	4.2	1.00	0.21	0.76	0.58	0.5949	0.5949
	3	1.2	5.4	4.2	1.00	0.21	0.76	0.59	0.6043	0.6043
	4	1.2	6.4	4.2	1.00	0.21	0.76	0.60	0.6173	0.6173
	5	1.2	7.4	4.2	1.00	0.21	0.76	0.47	0.5021	0.5021
	6	1.2	8.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
	7	1.2	9.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
	8	1.2	10.4	4.2	1.00	0.21	0.76	0.58	0.6009	0.6009
	9	1.2	11.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
	10	1.2	12.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
	11	1.2	13.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
	12	1.2	14.4	4.2	1.00	0.21	0.76	0.60	0.6147	0.6147
3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.51	0.0898	0.4917
		0.8	4	4	0.00	0.14	0.04	0.49	0.0881	
		1	3.8	3.8	0.50	0.14	0.39	0.47	0.4011	
		1.2	3.6	3.6	1.00	0.14	0.74	0.46	0.4917	
	2	1.2	4.6	4.2	1.00	0.14	0.74	0.58	0.5928	0.5928
	3	1.2	5.6	4.2	1.00	0.14	0.74	0.59	0.6022	0.6022
	4	1.2	6.6	4.2	1.00	0.14	0.74	0.60	0.6152	0.6152
	5	1.2	7.6	4.2	1.00	0.14	0.74	0.47	0.5000	0.5000
	6	1.2	8.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
	7	1.2	9.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
	8	1.2	10.6	4.2	1.00	0.14	0.74	0.58	0.5987	0.5987
	9	1.2	11.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
	10	1.2	12.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
	11	1.2	13.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
	12	1.2	14.6	4.2	1.00	0.14	0.74	0.60	0.6126	0.6126
4	1	0.8	4.2	4.2	0.00	0.07	0.02	0.51	0.0705	0.4991
		1	4	4	0.50	0.07	0.37	0.49	0.3838	
		1.2	3.8	3.8	1.00	0.07	0.72	0.47	0.4991	
	2	1.2	4.8	4.2	1.00	0.07	0.72	0.58	0.5906	0.5906
	3	1.2	5.8	4.2	1.00	0.07	0.72	0.59	0.6001	0.6001
	4	1.2	6.8	4.2	1.00	0.07	0.72	0.60	0.6130	0.6130
	5	1.2	7.8	4.2	1.00	0.07	0.72	0.47	0.4979	0.4979
	6	1.2	8.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
	7	1.2	9.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
	8	1.2	10.8	4.2	1.00	0.07	0.72	0.58	0.5966	0.5966
	9	1.2	11.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
	10	1.2	12.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
	11	1.2	13.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
	12	1.2	14.8	4.2	1.00	0.07	0.72	0.60	0.6105	0.6105
4.2	1	1	4.2	4.2	0.50	0.00	0.35	0.51	0.3662	0.5154
		1.2	4	4	1.00	0.00	0.70	0.49	0.5154	
	2	1.2	5	4.2	1.00	0.00	0.70	0.58	0.5885	0.5885
	3	1.2	6	4.2	1.00	0.00	0.70	0.59	0.5979	0.5979

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*G_{n-1}	$\mu_{Ct} \cap$ μ^*G_{n-1}	μ^*G_n (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	4	1.2	7	4.2	1.00	0.00	0.70	0.60	0.6109	0.6109
	5	1.2	8	4.2	1.00	0.00	0.70	0.47	0.4957	0.4957
	6	1.2	9	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083
	7	1.2	10	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083
	8	1.2	11	4.2	1.00	0.00	0.70	0.58	0.5944	0.5944
	9	1.2	12	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083
	10	1.2	13	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083
	11	1.2	14	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083
	12	1.2	15	4.2	1.00	0.00	0.70	0.60	0.6083	0.6083

April

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Cr} (St,Qt,Rt)	\sum μ^*Gn-1	$\mu_{Cr} \cap$ μ^*Gn-1	μ^*Gn (St,Qt)		
					Demand	F C						
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]		
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.34	0.3035	0.3046		
		0.4	2	2	0.00	1.00	0.30	0.33	0.3034			
		0.6	1.8	1.8	0.00	1.00	0.30	0.34	0.3041			
		0.8	1.6	1.6	0.00	1.00	0.30	0.34	0.3045			
		1	1.4	1.4	0.00	1.00	0.30	0.35	0.3046			
		2	0.2	3.2	3.2	0.00	1.00	0.30	0.45		0.3149	0.3759
			0.4	3	3	0.00	1.00	0.30	0.43		0.3131	
			0.6	2.8	2.8	0.00	1.00	0.30	0.41		0.3109	
			0.8	2.6	2.6	0.00	1.00	0.30	0.40		0.3097	
			1	2.4	2.4	0.00	1.00	0.30	0.35		0.3050	
	1.2		2.2	2.2	0.00	1.00	0.30	0.31	0.3011			
	1.4		2	2	0.00	1.00	0.30	0.32	0.3016			
	1.6		1.8	1.8	0.20	1.00	0.44	0.33	0.3381			
	1.8		1.6	1.6	0.40	1.00	0.58	0.33	0.3586			
	2		1.4	1.4	0.60	1.00	0.72	0.34	0.3759			
	3	0.2	4.2	4.2	0.00	1.00	0.30	0.59	0.3287	0.3725		
		0.4	4	4	0.00	1.00	0.30	0.52	0.3221			
		0.6	3.8	3.8	0.00	1.00	0.30	0.51	0.3210			
		0.8	3.6	3.6	0.00	1.00	0.30	0.42	0.3124			
		1	3.4	3.4	0.00	1.00	0.30	0.41	0.3108			
		1.2	3.2	3.2	0.00	1.00	-0.30	0.38	0.3078			
		1.4	3	3	0.00	1.00	0.30	0.37	0.3068			
		1.6	2.8	2.8	0.20	1.00	0.44	0.36	0.3670			
		1.8	2.6	2.6	0.40	1.00	0.58	0.35	0.3725			
		2	2.4	2.4	0.60	1.00	0.72	0.31	0.3536			
	4	2.2	2.2	2.2	0.80	1.00	0.86	0.26	0.3215	0.4878		
		2.4	2	2	1.00	1.00	1.00	0.28	0.3529			
		1.2	4.2	4.2	0.00	1.00	0.30	0.60	0.3296			
		1.4	4	4	0.00	1.00	0.30	0.54	0.3238			
		1.6	3.8	3.8	0.20	1.00	0.44	0.55	0.4507			
		1.8	3.6	3.6	0.40	1.00	0.58	0.48	0.4878			
		2	3.4	3.4	0.60	1.00	0.72	0.46	0.4866			
		2.2	3.2	3.2	0.80	1.00	0.86	0.43	0.4730			
		2.4	3	3	1.00	1.00	1.00	0.41	0.4731			
		2.2	4.2	4.2	0.80	1.00	0.86	0.59	0.6141			
	5	2.4	4	4	1.00	1.00	1.00	0.52	0.5691	0.6141		
		2.4	5	4.2	1.00	1.00	1.00	0.59	0.6281			
		2.4	6	4.2	1.00	1.00	1.00	0.59	0.6281			
		2.4	7	4.2	1.00	1.00	1.00	0.59	0.6281			
		2.4	8	4.2	1.00	1.00	1.00	0.59	0.6281			
2.4		9	4.2	1.00	1.00	1.00	0.59	0.6281				
2.4		9	4.2	1.00	1.00	1.00	0.59	0.6281				
1.6		1	0.2	2.4	2.4	0.00	0.93	0.28	0.37		0.2877	0.2877
0.4			2.2	2.2	0.00	0.93	0.28	0.34	0.2843			
0.6			2	2	0.00	0.93	0.28	0.33	0.2842			
0.8	1.8		1.8	0.00	0.93	0.28	0.34	0.2848				
1	1.6		1.6	0.00	0.93	0.28	0.34	0.2852				
1.2	1.4		1.4	0.00	0.93	0.28	0.35	0.2853				
2	0.2		3.4	3.4	0.00	0.93	0.28	0.48	0.2987	0.3878		
	0.4		3.2	3.2	0.00	0.93	0.28	0.45	0.2956			
	0.6		3	3	0.00	0.93	0.28	0.43	0.2939			
	0.8		2.8	2.8	0.00	0.93	0.28	0.41	0.2917			
	1	2.6	2.6	0.00	0.93	0.28	0.40	0.2904				
	1.2	2.4	2.4	0.00	0.93	0.28	0.35	0.2858				
	1.4	2.2	2.2	0.00	0.93	0.28	0.31	0.2818				
	1.6	2	2	0.20	0.93	0.42	0.32	0.3265				
	1.8	1.8	1.8	0.40	0.93	0.56	0.33	0.3500				
	2	1.6	1.6	0.60	0.93	0.70	0.33	0.3705				
3	2.2	1.4	1.4	0.80	0.93	0.84	0.34	0.3878	0.3843			
	0.4	4.2	4.2	0.00	0.93	0.28	0.59	0.3094				
	0.6	4	4	0.00	0.93	0.28	0.52	0.3029				
	0.8	3.8	3.8	0.00	0.93	0.28	0.51	0.3017				
	1	3.6	3.6	0.00	0.93	0.28	0.42	0.2931				
	1.2	3.4	3.4	0.00	0.93	0.28	0.41	0.2916				
	1.4	3.2	3.2	0.00	0.93	0.28	0.38	0.2885				
	1.6	3	3	0.20	0.93	0.42	0.37	0.3735				
	1.8	2.8	2.8	0.40	0.93	0.56	0.36	0.3789				
	2	2.6	2.6	0.60	0.93	0.70	0.35	0.3843				
4	2.2	2.4	2.4	0.80	0.93	0.84	0.31	0.3655	0.5485			
	2.4	2.2	2.2	1.00	0.93	0.98	0.26	0.3334				
	1.4	4.2	4.2	0.00	0.93	0.28	0.60	0.3104				
	1.6	4	4	0.20	0.93	0.42	0.54	0.4306				

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*Gn-1	$\mu_{Ct} \cap$ μ^*Gn-1	μ^*Gn (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
		1.8	3.8	3.8	0.40	0.93	0.56	0.55	0.5485	
		2	3.6	3.6	0.60	0.93	0.70	0.48	0.4996	
		2.2	3.4	3.4	0.80	0.93	0.84	0.46	0.4985	
		2.4	3.2	3.2	1.00	0.93	0.98	0.43	0.4848	
	5	2.4	4.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
	6	2.4	5.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
	7	2.4	6.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
	8	2.4	7.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
	9	2.4	8.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
	10	2.4	9.2	4.2	1.00	0.93	0.98	0.59	0.6260	0.6260
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.42	0.2735	0.2735
		0.4	2.4	2.4	0.00	0.86	0.26	0.37	0.2684	
		0.6	2.2	2.2	0.00	0.86	0.26	0.34	0.2650	
		0.8	2	2	0.00	0.86	0.26	0.33	0.2649	
		1	1.8	1.8	0.00	0.86	0.26	0.34	0.2655	
		1.2	1.6	1.6	0.00	0.86	0.26	0.34	0.2659	
		1.4	1.4	1.4	0.00	0.86	0.26	0.35	0.2661	
	2	0.2	3.6	3.6	0.00	0.86	0.26	0.50	0.2811	0.3996
		0.4	3.4	3.4	0.00	0.86	0.26	0.48	0.2794	
		0.6	3.2	3.2	0.00	0.86	0.26	0.45	0.2763	
		0.8	3	3	0.00	0.86	0.26	0.43	0.2746	
		1	2.8	2.8	0.00	0.86	0.26	0.41	0.2724	
		1.2	2.6	2.6	0.00	0.86	0.26	0.40	0.2711	
		1.4	2.4	2.4	0.00	0.86	0.26	0.35	0.2665	
		1.6	2.2	2.2	0.20	0.86	0.40	0.31	0.3192	
		1.8	2	2	0.40	0.86	0.54	0.32	0.3383	
		2	1.8	1.8	0.60	0.86	0.68	0.33	0.3619	
		2.2	1.6	1.6	0.80	0.86	0.82	0.33	0.3824	
		2.4	1.4	1.4	1.00	0.86	0.96	0.34	0.3996	
	3	0.6	4.2	4.2	0.00	0.86	0.26	0.59	0.2901	0.3962
		0.8	4	4	0.00	0.86	0.26	0.52	0.2836	
		1	3.8	3.8	0.00	0.86	0.26	0.51	0.2824	
		1.2	3.6	3.6	0.00	0.86	0.26	0.42	0.2739	
		1.4	3.4	3.4	0.00	0.86	0.26	0.41	0.2723	
		1.6	3.2	3.2	0.20	0.86	0.40	0.38	0.3799	
		1.8	3	3	0.40	0.86	0.54	0.37	0.3853	
		2	2.8	2.8	0.60	0.86	0.68	0.36	0.3908	
		2.2	2.6	2.6	0.80	0.86	0.82	0.35	0.3962	
		2.4	2.4	2.4	1.00	0.86	0.96	0.31	0.3773	
	4	1.6	4.2	4.2	0.20	0.86	0.40	0.60	0.4171	0.5604
		1.8	4	4	0.40	0.86	0.54	0.54	0.5373	
		2	3.8	3.8	0.60	0.86	0.68	0.55	0.5604	
		2.2	3.6	3.6	0.80	0.86	0.82	0.48	0.5115	
		2.4	3.4	3.4	1.00	0.86	0.96	0.46	0.5103	
	5	2.4	4.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
	6	2.4	5.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
	7	2.4	6.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
	8	2.4	7.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
	9	2.4	8.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
	10	2.4	9.4	4.2	1.00	0.86	0.96	0.59	0.6238	0.6238
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.44	0.2557	0.3491
		0.4	2.6	2.6	0.00	0.79	0.24	0.42	0.2542	
		0.6	2.4	2.4	0.00	0.79	0.24	0.37	0.2491	
		0.8	2.2	2.2	0.00	0.79	0.24	0.34	0.2457	
		1	2	2	0.00	0.79	0.24	0.33	0.2456	
		1.2	1.8	1.8	0.00	0.79	0.24	0.34	0.2463	
		1.4	1.6	1.6	0.00	0.79	0.24	0.34	0.2467	
		1.6	1.4	1.4	0.20	0.79	0.38	0.35	0.3491	
	2	0.2	3.8	3.8	0.00	0.79	0.24	0.56	0.2683	0.3942
		0.4	3.6	3.6	0.00	0.79	0.24	0.50	0.2619	
		0.6	3.4	3.4	0.00	0.79	0.24	0.48	0.2601	
		0.8	3.2	3.2	0.00	0.79	0.24	0.45	0.2571	
		1	3	3	0.00	0.79	0.24	0.43	0.2553	
		1.2	2.8	2.8	0.00	0.79	0.24	0.41	0.2531	
		1.4	2.6	2.6	0.00	0.79	0.24	0.40	0.2518	
		1.6	2.4	2.4	0.20	0.79	0.38	0.35	0.3529	
		1.8	2.2	2.2	0.40	0.79	0.52	0.31	0.3311	
		2	2	2	0.60	0.79	0.66	0.32	0.3502	
		2.2	1.8	1.8	0.80	0.79	0.80	0.33	0.3737	
		2.4	1.6	1.6	1.00	0.79	0.94	0.33	0.3942	
	3	0.8	4.2	4.2	0.00	0.79	0.24	0.59	0.2708	0.4080
		1	4	4	0.00	0.79	0.24	0.52	0.2643	
		1.2	3.8	3.8	0.00	0.79	0.24	0.51	0.2631	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	Σ $\mu(\cdot)\mu^*Gn-1$ [9]	$\mu_{Ct} \cap$ $\mu(\cdot)\mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]		
					Demand [6]	F C [7]						
	4	1.4	3.6	3.6	0.00	0.79	0.24	0.42	0.2546	0.5722		
		1.6	3.4	3.4	0.20	0.79	0.38	0.41	0.3790			
		1.8	3.2	3.2	0.40	0.79	0.52	0.38	0.3918			
		2	3	3	0.60	0.79	0.66	0.37	0.3972			
		2.2	2.8	2.8	0.80	0.79	0.80	0.36	0.4026			
		2.4	2.6	2.6	1.00	0.79	0.94	0.35	0.4080			
		1.8	4.2	4.2	0.40	0.79	0.52	0.60	0.5238			
		2	4	4	0.60	0.79	0.66	0.54	0.5501			
		2.2	3.8	3.8	0.80	0.79	0.80	0.55	0.5722			
		2.4	3.6	3.6	1.00	0.79	0.94	0.48	0.5233			
	5	2.4	4.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.4	5.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.4	6.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.4	7.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.4	8.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.4	9.6	4.2	1.00	0.79	0.94	0.59	0.6217	0.6217		
		2.2	1	0.2	3	3	0.00	0.71	0.21	0.46	0.2392	0.3609
				0.4	2.8	2.8	0.00	0.71	0.21	0.44	0.2364	
				0.6	2.6	2.6	0.00	0.71	0.21	0.42	0.2350	
				0.8	2.4	2.4	0.00	0.71	0.21	0.37	0.2298	
1	2.2			2.2	0.00	0.71	0.21	0.34	0.2264			
1.2	2			2	0.00	0.71	0.21	0.33	0.2263			
1.4	1.8			1.8	0.00	0.71	0.21	0.34	0.2270			
1.6	1.6			1.6	0.20	0.71	0.35	0.34	0.3459			
1.8	1.4			1.4	0.40	0.71	0.49	0.35	0.3609			
0.2	4			4	0.00	0.71	0.21	0.54	0.2473	0.3856		
0.4	3.8	3.8	0.00	0.71	0.21	0.56	0.2490					
0.6	3.6	3.6	0.00	0.71	0.21	0.50	0.2426					
0.8	3.4	3.4	0.00	0.71	0.21	0.48	0.2409					
1	3.2	3.2	0.00	0.71	0.21	0.45	0.2378					
1.2	3	3	0.00	0.71	0.21	0.43	0.2360					
1.4	2.8	2.8	0.00	0.71	0.21	0.41	0.2338					
1.6	2.6	2.6	0.20	0.71	0.35	0.40	0.3586					
1.8	2.4	2.4	0.40	0.71	0.49	0.35	0.3648					
2	2.2	2.2	0.60	0.71	0.63	0.31	0.3429					
	3	2.2	2	2	0.80	0.71	0.77	0.32	0.3621	0.4168		
		2.4	1.8	1.8	1.00	0.71	0.91	0.33	0.3856			
		1	4.2	4.2	0.00	0.71	0.21	0.59	0.2516			
		1.2	4	4	0.00	0.71	0.21	0.52	0.2450			
		1.4	3.8	3.8	0.00	0.71	0.21	0.51	0.2439			
		1.6	3.6	3.6	0.20	0.71	0.35	0.42	0.3613			
		1.8	3.4	3.4	0.40	0.71	0.49	0.41	0.4168			
		2	3.2	3.2	0.60	0.71	0.63	0.38	0.4036			
		2.2	3	3	0.80	0.71	0.77	0.37	0.4090			
		2.4	2.8	2.8	1.00	0.71	0.91	0.36	0.4145			
	4	2	4.2	4.2	0.60	0.71	0.63	0.60	0.6001	0.6001		
		2.2	4	4	0.80	0.71	0.77	0.54	0.5619			
		2.4	3.8	3.8	1.00	0.71	0.91	0.55	0.5841			
		2.4	4.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	5.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	6.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	7.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	8.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	9.8	4.2	1.00	0.71	0.91	0.59	0.6196		0.6196	
		2.4	1	0.2	3.2	3.2	0.00	0.64	0.19		0.48	0.2221
0.4	3			3	0.00	0.64	0.19	0.46	0.2199			
0.6	2.8			2.8	0.00	0.64	0.19	0.44	0.2171			
0.8	2.6			2.6	0.00	0.64	0.19	0.42	0.2157			
1	2.4			2.4	0.00	0.64	0.19	0.37	0.2105			
1.2	2.2			2.2	0.00	0.64	0.19	0.34	0.2071			
1.4	2			2	0.00	0.64	0.19	0.33	0.2070			
1.6	1.8			1.8	0.20	0.64	0.33	0.34	0.3337			
1.8	1.6			1.6	0.40	0.64	0.47	0.34	0.3578			
2	1.4			1.4	0.60	0.64	0.61	0.35	0.3728			
2	0.2		4.2	4.2	0.00	0.64	0.19	0.60	0.2336	0.4043		
	0.4		4	4	0.00	0.64	0.19	0.54	0.2281			
	0.6		3.8	3.8	0.00	0.64	0.19	0.56	0.2297			
	0.8		3.6	3.6	0.00	0.64	0.19	0.50	0.2233			
	1		3.4	3.4	0.00	0.64	0.19	0.48	0.2216			
	1.2		3.2	3.2	0.00	0.64	0.19	0.45	0.2185			
	1.4		3	3	0.00	0.64	0.19	0.43	0.2167			
	1.6		2.8	2.8	0.20	0.64	0.33	0.41	0.3405			
	1.8		2.6	2.6	0.40	0.64	0.47	0.40	0.4043			

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*Gn-l	$\mu_{Ct} \cap$ μ^*Gn-l	μ^*Gn (St,Qt)			
					Demand	FC							
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]			
	3	2	2.4	2.4	0.60	0.64	0.61	0.35	0.3766	0.4289			
		2.2	2.2	2.2	0.80	0.64	0.75	0.31	0.3548				
		2.4	2	2	1.00	0.64	0.89	0.32	0.3739				
		1.2	4.2	4.2	0.00	0.64	0.19	0.59	0.2323				
		1.4	4	4	0.00	0.64	0.19	0.52	0.2257				
		1.6	3.8	3.8	0.20	0.64	0.33	0.51	0.3506				
		1.8	3.6	3.6	0.40	0.64	0.47	0.42	0.4289				
		2	3.4	3.4	0.60	0.64	0.61	0.41	0.4287				
		2.2	3.2	3.2	0.80	0.64	0.75	0.38	0.4155				
		2.4	3	3	1.00	0.64	0.89	0.37	0.4209				
	4	2.2	4.2	4.2	0.80	0.64	0.75	0.60	0.6119	0.6119			
		2.4	4	4	1.00	0.64	0.89	0.54	0.5738				
		2.4	5	4.2	1.00	0.64	0.89	0.59	0.6174				
		6	2.4	6	4.2	1.00	0.64	0.89	0.59		0.6174		
		7	2.4	7	4.2	1.00	0.64	0.89	0.59		0.6174		
		8	2.4	8	4.2	1.00	0.64	0.89	0.59		0.6174		
		9	2.4	9	4.2	1.00	0.64	0.89	0.59		0.6174		
		10	2.4	10	4.2	1.00	0.64	0.89	0.59		0.6174		
		2.6	1	0.2	3.4	3.4	0.00	0.57	0.17		0.52	0.2059	0.3847
				0.4	3.2	3.2	0.00	0.57	0.17		0.48	0.2028	
0.6	3			3	0.00	0.57	0.17	0.46	0.2007				
0.8	2.8			2.8	0.00	0.57	0.17	0.44	0.1978				
1	2.6			2.6	0.00	0.57	0.17	0.42	0.1964				
1.2	2.4			2.4	0.00	0.57	0.17	0.37	0.1913				
1.4	2.2			2.2	0.00	0.57	0.17	0.34	0.1879				
1.6	2			2	0.20	0.57	0.31	0.33	0.3137				
1.8	1.8			1.8	0.40	0.57	0.45	0.34	0.3520				
2	1.6			1.6	0.60	0.57	0.59	0.34	0.3696				
	2	2.2	1.4	1.4	0.80	0.57	0.73	0.35	0.3847	0.4162			
		0.4	4.2	4.2	0.00	0.57	0.17	0.60	0.2143				
		0.6	4	4	0.00	0.57	0.17	0.54	0.2088				
		0.8	3.8	3.8	0.00	0.57	0.17	0.56	0.2104				
		1	3.6	3.6	0.00	0.57	0.17	0.50	0.2040				
		1.2	3.4	3.4	0.00	0.57	0.17	0.48	0.2023				
		1.4	3.2	3.2	0.00	0.57	0.17	0.45	0.1992				
		1.6	3	3	0.20	0.57	0.31	0.43	0.3234				
		1.8	2.8	2.8	0.40	0.57	0.45	0.41	0.4136				
		2	2.6	2.6	0.60	0.57	0.59	0.40	0.4162				
	3	2.2	2.4	2.4	0.80	0.57	0.73	0.35	0.3885	0.4573			
		2.4	2.2	2.2	1.00	0.57	0.87	0.31	0.3666				
		1.4	4.2	4.2	0.00	0.57	0.17	0.59	0.2130				
		1.6	4	4	0.20	0.57	0.31	0.52	0.3324				
		1.8	3.8	3.8	0.40	0.57	0.45	0.51	0.4573				
		2	3.6	3.6	0.60	0.57	0.59	0.42	0.4408				
		2.2	3.4	3.4	0.80	0.57	0.73	0.41	0.4406				
		2.4	3.2	3.2	1.00	0.57	0.87	0.38	0.4273				
		4	2.4	4.2	4.2	1.00	0.57	0.87	0.60		0.6238		
		5	2.4	5.2	4.2	1.00	0.57	0.87	0.59		0.6153		
	4	2.4	6.2	4.2	1.00	0.57	0.87	0.59	0.6153	0.6153			
		7	2.4	7.2	4.2	1.00	0.57	0.87	0.59		0.6153		
		8	2.4	8.2	4.2	1.00	0.57	0.87	0.59		0.6153		
		9	2.4	9.2	4.2	1.00	0.57	0.87	0.59		0.6153		
		10	2.4	10.2	4.2	1.00	0.57	0.87	0.59		0.6153		
		2.8	1	0.2	3.6	3.6	0.00	0.50	0.15		0.53	0.1884	0.3965
				0.4	3.4	3.4	0.00	0.50	0.15		0.52	0.1867	
				0.6	3.2	3.2	0.00	0.50	0.15		0.48	0.1835	
				0.8	3	3	0.00	0.50	0.15		0.46	0.1814	
				1	2.8	2.8	0.00	0.50	0.15		0.44	0.1786	
1.2	2.6			2.6	0.00	0.50	0.15	0.42	0.1771				
1.4	2.4			2.4	0.00	0.50	0.15	0.37	0.1720				
1.6	2.2			2.2	0.20	0.50	0.29	0.34	0.2946				
1.8	2			2	0.40	0.50	0.43	0.33	0.3438				
2	1.8			1.8	0.60	0.50	0.57	0.34	0.3639				
	2	2.2	1.6	1.6	0.80	0.50	0.71	0.34	0.3815	0.4302			
		2.4	1.4	1.4	1.00	0.50	0.85	0.35	0.3965				
		0.6	4.2	4.2	0.00	0.50	0.15	0.60	0.1950				
		0.8	4	4	0.00	0.50	0.15	0.54	0.1895				
		1	3.8	3.8	0.00	0.50	0.15	0.56	0.1911				
		1.2	3.6	3.6	0.00	0.50	0.15	0.50	0.1847				
		1.4	3.4	3.4	0.00	0.50	0.15	0.48	0.1830				
		1.6	3.2	3.2	0.20	0.50	0.29	0.45	0.3059				
		1.8	3	3	0.40	0.50	0.43	0.43	0.4302				
		2	2.8	2.8	0.60	0.50	0.57	0.41	0.4255				

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $(\mu \cdot G_n - I_p)$	$\mu_{Ct} \cap$ $(\mu \cdot G_n - I_p)$	$\mu \cdot G_n$ (St,Qt)	
					Demand [6]	F C [7]					
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
	3	2.2	2.6	2.6	0.80	0.50	0.71	0.40	0.4281	0.5158	
		2.4	2.4	2.4	1.00	0.50	0.85	0.35	0.4003		
		1.6	4.2	4.2	0.20	0.50	0.29	0.59	0.3197		
		1.8	4	4	0.40	0.50	0.43	0.52	0.4392		
		2	3.8	3.8	0.60	0.50	0.57	0.51	0.5158		
		2.2	3.6	3.6	0.80	0.50	0.71	0.42	0.4526		
		2.4	3.4	3.4	1.00	0.50	0.85	0.41	0.4524		
		2.4	4.4	4.2	1.00	0.50	0.85	0.60	0.6216		0.6216
		2.4	5.4	4.2	1.00	0.50	0.85	0.59	0.6131		0.6131
		2.4	6.4	4.2	1.00	0.50	0.85	0.59	0.6131		0.6131
2.4	7.4	4.2	1.00	0.50	0.85	0.59	0.6131	0.6131			
2.4	8.4	4.2	1.00	0.50	0.85	0.59	0.6131	0.6131			
2.4	9.4	4.2	1.00	0.50	0.85	0.59	0.6131	0.6131			
2.4	10.4	4.2	1.00	0.50	0.85	0.59	0.6131	0.6131			
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.59	0.1745	0.3934	
		0.4	3.6	3.6	0.00	0.43	0.13	0.53	0.1692		
		0.6	3.4	3.4	0.00	0.43	0.13	0.52	0.1674		
		0.8	3.2	3.2	0.00	0.43	0.13	0.48	0.1642		
		1	3	3	0.00	0.43	0.13	0.46	0.1621		
		1.2	2.8	2.8	0.00	0.43	0.13	0.44	0.1593		
		1.4	2.6	2.6	0.00	0.43	0.13	0.42	0.1578		
		1.6	2.4	2.4	0.20	0.43	0.27	0.37	0.2787		
		1.8	2.2	2.2	0.40	0.43	0.41	0.34	0.3427		
		2	2	2	0.60	0.43	0.55	0.33	0.3557		
2.2	1.8	1.8	0.80	0.43	0.69	0.34	0.3757				
2.4	1.6	1.6	1.00	0.43	0.83	0.34	0.3934				
2.4	4.2	4.2	0.00	0.43	0.13	0.60	0.1757	0.4430			
1	4	4	0.00	0.43	0.13	0.54	0.1702				
1.2	3.8	3.8	0.00	0.43	0.13	0.56	0.1719				
1.4	3.6	3.6	0.00	0.43	0.13	0.50	0.1654				
1.6	3.4	3.4	0.20	0.43	0.27	0.48	0.2897				
1.8	3.2	3.2	0.40	0.43	0.41	0.45	0.4126				
2	3	3	0.60	0.43	0.55	0.43	0.4430				
2.2	2.8	2.8	0.80	0.43	0.69	0.41	0.4374				
2.4	2.6	2.6	1.00	0.43	0.83	0.40	0.4399				
1.8	4.2	4.2	0.40	0.43	0.41	0.59	0.4264		0.5276		
2	4	4	0.60	0.43	0.55	0.52	0.5239				
2.2	3.8	3.8	0.80	0.43	0.69	0.51	0.5276				
2.4	3.6	3.6	1.00	0.43	0.83	0.42	0.4645				
2.4	4.6	4.2	1.00	0.43	0.83	0.60	0.6195	0.6195			
2.4	5.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
2.4	6.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
2.4	7.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
2.4	8.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
2.4	9.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
2.4	10.6	4.2	1.00	0.43	0.83	0.59	0.6110	0.6110			
3.2	1	0.2	4	4	0.00	0.36	0.11	0.56	0.1521	0.3876	
		0.4	3.8	3.8	0.00	0.36	0.11	0.59	0.1552		
		0.6	3.6	3.6	0.00	0.36	0.11	0.53	0.1499		
		0.8	3.4	3.4	0.00	0.36	0.11	0.52	0.1481		
		1	3.2	3.2	0.00	0.36	0.11	0.48	0.1450		
		1.2	3	3	0.00	0.36	0.11	0.46	0.1428		
		1.4	2.8	2.8	0.00	0.36	0.11	0.44	0.1400		
		1.6	2.6	2.6	0.20	0.36	0.25	0.42	0.2645		
		1.8	2.4	2.4	0.40	0.36	0.39	0.37	0.3712		
		2	2.2	2.2	0.60	0.36	0.53	0.34	0.3546		
2.2	2	2	0.80	0.36	0.67	0.33	0.3675				
2.4	1.8	1.8	1.00	0.36	0.81	0.34	0.3876				
2.4	4.2	4.2	0.00	0.36	0.11	0.60	0.1564	0.4567			
1.2	4	4	0.00	0.36	0.11	0.54	0.1509				
1.4	3.8	3.8	0.00	0.36	0.11	0.56	0.1526				
1.6	3.6	3.6	0.20	0.36	0.25	0.50	0.2722				
1.8	3.4	3.4	0.40	0.36	0.39	0.48	0.3964				
2	3.2	3.2	0.60	0.36	0.53	0.45	0.4567				
2.2	3	3	0.80	0.36	0.67	0.43	0.4549				
2.4	2.8	2.8	1.00	0.36	0.81	0.41	0.4492				
2	4.2	4.2	0.60	0.36	0.53	0.59	0.5331		0.5395		
2.2	4	4	0.80	0.36	0.67	0.52	0.5358				
2.4	3.8	3.8	1.00	0.36	0.81	0.51	0.5395				
2.4	4.8	4.2	1.00	0.36	0.81	0.60	0.6174	0.6174			
2.4	5.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
2.4	6.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
2.4	7.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
2.4	8.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
2.4	9.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
2.4	10.8	4.2	1.00	0.36	0.81	0.59	0.6088	0.6088			
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.61	0.1378	0.3831	
		0.4	4	4	0.00	0.29	0.09	0.56	0.1328		
		0.6	3.8	3.8	0.00	0.29	0.09	0.59	0.1359		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\rho(\cdot)\mu^*G_{n-1}$	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*G_{n-1}$	μ^*G_n (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
		0.8	3.6	3.6	0.00	0.29	0.09	0.53	0.1306	
		1	3.4	3.4	0.00	0.29	0.09	0.52	0.1288	
		1.2	3.2	3.2	0.00	0.29	0.09	0.48	0.1257	
		1.4	3	3	0.00	0.29	0.09	0.46	0.1235	
		1.6	2.8	2.8	0.20	0.29	0.23	0.44	0.2467	
		1.8	2.6	2.6	0.40	0.29	0.37	0.42	0.3713	
		2	2.4	2.4	0.60	0.29	0.51	0.37	0.3831	
		2.2	2.2	2.2	0.80	0.29	0.65	0.34	0.3665	
		2.4	2	2	1.00	0.29	0.79	0.33	0.3794	
	2	1.2	4.2	4.2	0.00	0.29	0.09	0.60	0.1372	0.4823
		1.4	4	4	0.00	0.29	0.09	0.54	0.1316	
		1.6	3.8	3.8	0.20	0.29	0.23	0.56	0.2593	
		1.8	3.6	3.6	0.40	0.29	0.37	0.50	0.3789	
		2	3.4	3.4	0.60	0.29	0.51	0.48	0.4823	
		2.2	3.2	3.2	0.80	0.29	0.65	0.45	0.4686	
		2.4	3	3	1.00	0.29	0.79	0.43	0.4668	
	3	2.2	4.2	4.2	0.80	0.29	0.65	0.59	0.5927	0.5927
		2.4	4	4	1.00	0.29	0.79	0.52	0.5476	
	4	2.4	5	4.2	1.00	0.29	0.79	0.60	0.6152	0.6152
	5	2.4	6	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
	6	2.4	7	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
	7	2.4	8	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
	8	2.4	9	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
	9	2.4	10	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
	10	2.4	11	4.2	1.00	0.29	0.79	0.59	0.6067	0.6067
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.61	0.1185	0.4272
		0.6	4	4	0.00	0.21	0.06	0.56	0.1135	
		0.8	3.8	3.8	0.00	0.21	0.06	0.59	0.1166	
		1	3.6	3.6	0.00	0.21	0.06	0.53	0.1113	
		1.2	3.4	3.4	0.00	0.21	0.06	0.52	0.1095	
		1.4	3.2	3.2	0.00	0.21	0.06	0.48	0.1064	
		1.6	3	3	0.20	0.21	0.20	0.46	0.2302	
		1.8	2.8	2.8	0.40	0.21	0.34	0.44	0.3534	
		2	2.6	2.6	0.60	0.21	0.48	0.42	0.4272	
		2.2	2.4	2.4	0.80	0.21	0.62	0.37	0.3949	
		2.4	2.2	2.2	1.00	0.21	0.76	0.34	0.3783	
	2	1.4	4.2	4.2	0.00	0.21	0.06	0.60	0.1179	0.4942
		1.6	4	4	0.20	0.21	0.20	0.54	0.2384	
		1.8	3.8	3.8	0.40	0.21	0.34	0.56	0.3660	
		2	3.6	3.6	0.60	0.21	0.48	0.50	0.4856	
		2.2	3.4	3.4	0.80	0.21	0.62	0.48	0.4942	
		2.4	3.2	3.2	1.00	0.21	0.76	0.45	0.4804	
	3	2.4	4.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	4	2.4	5.2	4.2	1.00	0.21	0.76	0.60	0.6131	0.6131
	5	2.4	6.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	6	2.4	7.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	7	2.4	8.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	8	2.4	9.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	9	2.4	10.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
	10	2.4	11.2	4.2	1.00	0.21	0.76	0.59	0.6046	0.6046
3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.61	0.0992	0.4390
		0.8	4	4	0.00	0.14	0.04	0.56	0.0943	
		1	3.8	3.8	0.00	0.14	0.04	0.59	0.0973	
		1.2	3.6	3.6	0.00	0.14	0.04	0.53	0.0920	
		1.4	3.4	3.4	0.00	0.14	0.04	0.52	0.0902	
		1.6	3.2	3.2	0.20	0.14	0.18	0.48	0.2131	
		1.8	3	3	0.40	0.14	0.32	0.46	0.3369	
		2	2.8	2.8	0.60	0.14	0.46	0.44	0.4380	
		2.2	2.6	2.6	0.80	0.14	0.60	0.42	0.4390	
		2.4	2.4	2.4	1.00	0.14	0.74	0.37	0.4068	
	2	1.6	4.2	4.2	0.20	0.14	0.18	0.60	0.2246	0.5076
		1.8	4	4	0.40	0.14	0.32	0.54	0.3451	
		2	3.8	3.8	0.60	0.14	0.46	0.56	0.4727	
		2.2	3.6	3.6	0.80	0.14	0.60	0.50	0.5076	
		2.4	3.4	3.4	1.00	0.14	0.74	0.48	0.5061	
	3	2.4	4.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	4	2.4	5.4	4.2	1.00	0.14	0.74	0.60	0.6109	0.6109
	5	2.4	6.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	6	2.4	7.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	7	2.4	8.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	8	2.4	9.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	9	2.4	10.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
	10	2.4	11.4	4.2	1.00	0.14	0.74	0.59	0.6024	0.6024
4	1	0.8	4.2	4.2	0.00	0.07	0.02	0.61	0.0800	0.4509
		1	4	4	0.00	0.07	0.02	0.56	0.0750	
		1.2	3.8	3.8	0.00	0.07	0.02	0.59	0.0781	
		1.4	3.6	3.6	0.00	0.07	0.02	0.53	0.0727	
		1.6	3.4	3.4	0.20	0.07	0.16	0.52	0.1970	
		1.8	3.2	3.2	0.40	0.07	0.30	0.48	0.3198	
		2	3	3	0.60	0.07	0.44	0.46	0.4437	
		2.2	2.8	2.8	0.80	0.07	0.58	0.44	0.4498	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		$\mu_{Ct}(St, Qt, Rt)$ [8]	$\sum \mu^*Gn-1$ [9]	$\mu_{Ct} \cap \mu^*Gn-1$ [10]	$\mu^*Gn(St, Qt)$ [11]
					Demand [6]	F C [7]				
	2	2.4 1.8 2 2.2 2.4	2.6 4.2 4 3.8 3.6	2.6 4.2 4 3.8 3.6	1.00 0.40 0.60 0.80 1.00	0.07 0.07 0.07 0.07 0.07	0.72 0.30 0.44 0.58 0.72	0.42 0.60 0.54 0.56 0.50	0.4509 0.3313 0.4518 0.5631 0.5194	0.5631
	3	2.4	4.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	4	2.4	5.6	4.2	1.00	0.07	0.72	0.60	0.6088	0.6088
	5	2.4	6.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	6	2.4	7.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	7	2.4	8.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	8	2.4	9.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	9	2.4	10.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
	10	2.4	11.6	4.2	1.00	0.07	0.72	0.59	0.6003	0.6003
4.2	1	1 1.2 1.4 1.6 1.8	4.2 4 3.8 3.6 3.4	4.2 4 3.8 3.6 3.4	0.00 0.00 0.00 0.20 0.40	0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.14 0.28	0.61 0.56 0.59 0.53 0.52	0.0606 0.0556 0.0587 0.1794 0.3036	0.4730
	2	2 2.2 2.4	3.2 3 2.8	3.2 3 2.8	0.60 0.80 1.00	0.00 0.00 0.00	0.42 0.56 0.70	0.48 0.46 0.44	0.4265 0.4730 0.4617	
	3	2	4.2	4.2	0.60	0.00	0.42	0.60	0.4380	0.5750
	4	2.2	4	4	0.80	0.00	0.56	0.54	0.5461	
	5	2.4	3.8	3.8	1.00	0.00	0.70	0.56	0.5750	
	6	2.4	4.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	7	2.4	5.8	4.2	1.00	0.00	0.70	0.60	0.6066	0.6066
	8	2.4	6.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	9	2.4	7.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	10	2.4	8.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	11	2.4	9.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	12	2.4	10.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981
	13	2.4	11.8	4.2	1.00	0.00	0.70	0.59	0.5981	0.5981

Fuzzy Rule Base Modeling for Reservoir Operation

May

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum μ^*Gn-1 [9]	$\mu_{Ct} \cap$ μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]	
					Demand [6]	F C [7]					
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.51	0.3212	0.3212	
		0.4	2	2	0.00	1.00	0.30	0.41	0.3105		
		0.6	1.8	1.8	0.00	1.00	0.30	0.31	0.3008		
		0.8	1.6	1.6	0.00	1.00	0.30	0.33	0.3026		
	2	1	1.4	1.4	1.4	0.00	1.00	0.30	0.34		0.3043
		0.2	3.2	3.2	3.2	0.00	1.00	0.30	0.63		0.3327
		0.4	3	3	3	0.00	1.00	0.30	0.57		0.3271
		0.6	2.8	2.8	2.8	0.00	1.00	0.30	0.69		0.3393
		0.8	2.6	2.6	2.6	0.00	1.00	0.30	0.68		0.3383
		1	2.4	2.4	2.4	0.00	1.00	0.30	0.63		0.3332
		1.2	2.2	2.2	2.2	0.00	1.00	0.30	0.54		0.3236
		1.4	2	2	2	0.00	1.00	0.30	0.44		0.3140
		1.6	1.8	1.8	1.8	0.00	1.00	0.30	0.35		0.3050
		1.8	1.6	1.6	1.6	0.00	1.00	0.30	0.37		0.3066
2	1.4	1.4	1.4	0.17	1.00	0.42	0.38	0.3817			
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.62	0.3126	0.3126	
		0.4	2.2	2.2	0.00	0.93	0.28	0.51	0.3019		
		0.6	2	2	0.00	0.93	0.28	0.41	0.2913		
		0.8	1.8	1.8	0.00	0.93	0.28	0.31	0.2815		
	2	1	1.6	1.6	1.6	0.00	0.93	0.28	0.33		0.2833
		1.2	1.4	1.4	1.4	0.00	0.93	0.28	0.34		0.2851
		0.2	3.4	3.4	3.4	0.00	0.93	0.28	0.65		0.3161
		0.4	3.2	3.2	3.2	0.00	0.93	0.28	0.63		0.3134
		0.6	3	3	3	0.00	0.93	0.28	0.57		0.3078
		0.8	2.8	2.8	2.8	0.00	0.93	0.28	0.69		0.3200
		1	2.6	2.6	2.6	0.00	0.93	0.28	0.68		0.3191
		1.2	2.4	2.4	2.4	0.00	0.93	0.28	0.63		0.3139
		1.4	2.2	2.2	2.2	0.00	0.93	0.28	0.54		0.3043
		1.6	2	2	2	0.00	0.93	0.28	0.44		0.2947
1.8	1.8	1.8	1.8	0.00	0.93	0.28	0.35	0.2858			
2	1.6	1.6	1.6	0.17	0.93	0.40	0.37	0.3686			
2.2	1.4	1.4	1.4	0.33	0.93	0.51	0.38	0.3913			
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.68	0.2991	0.2991	
		0.4	2.4	2.4	0.00	0.86	0.26	0.62	0.2933		
		0.6	2.2	2.2	0.00	0.86	0.26	0.51	0.2826		
		0.8	2	2	0.00	0.86	0.26	0.41	0.2720		
	2	1	1.8	1.8	1.8	0.00	0.86	0.26	0.31		0.2622
		1.2	1.6	1.6	1.6	0.00	0.86	0.26	0.33		0.2640
		1.4	1.4	1.4	1.4	0.00	0.86	0.26	0.34		0.2658
		0.2	3.6	3.6	3.6	0.00	0.86	0.26	0.68		0.2992
		0.4	3.4	3.4	3.4	0.00	0.86	0.26	0.65		0.2968
		0.6	3.2	3.2	3.2	0.00	0.86	0.26	0.63		0.2941
		0.8	3	3	3	0.00	0.86	0.26	0.57		0.2885
		1	2.8	2.8	2.8	0.00	0.86	0.26	0.69		0.3008
		1.2	2.6	2.6	2.6	0.00	0.86	0.26	0.68		0.2998
		1.4	2.4	2.4	2.4	0.00	0.86	0.26	0.63		0.2947
1.6	2.2	2.2	2.2	0.00	0.86	0.26	0.54	0.2851			
1.8	2	2	2	0.00	0.86	0.26	0.44	0.2754			
2	1.8	1.8	1.8	0.17	0.86	0.37	0.35	0.3527			
2.2	1.6	1.6	1.6	0.33	0.86	0.49	0.37	0.3781			
2.4	1.4	1.4	1.4	0.50	0.86	0.61	0.38	0.4008			
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.69	0.2810	0.2810	
		0.4	2.6	2.6	0.00	0.79	0.24	0.68	0.2798		
		0.6	2.4	2.4	0.00	0.79	0.24	0.62	0.2740		
		0.8	2.2	2.2	0.00	0.79	0.24	0.51	0.2634		
	2	1	2	2	2	0.00	0.79	0.24	0.41		0.2527
		1.2	1.8	1.8	1.8	0.00	0.79	0.24	0.31		0.2429
		1.4	1.6	1.6	1.6	0.00	0.79	0.24	0.33		0.2447
		1.6	1.4	1.4	1.4	0.00	0.79	0.24	0.34		0.2465
		0.2	3.8	3.8	3.8	0.00	0.79	0.24	0.73		0.2851
		0.4	3.6	3.6	3.6	0.00	0.79	0.24	0.68		0.2799
		0.6	3.4	3.4	3.4	0.00	0.79	0.24	0.65		0.2775
		0.8	3.2	3.2	3.2	0.00	0.79	0.24	0.63		0.2748
		1	3	3	3	0.00	0.79	0.24	0.57		0.2693
		1.2	2.8	2.8	2.8	0.00	0.79	0.24	0.69		0.2815
1.4	2.6	2.6	2.6	0.00	0.79	0.24	0.68	0.2805			
1.6	2.4	2.4	2.4	0.00	0.79	0.24	0.63	0.2754			
1.8	2.2	2.2	2.2	0.00	0.79	0.24	0.54	0.2658			
2	2	2	2	0.17	0.79	0.35	0.44	0.3611			
2.2	1.8	1.8	1.8	0.33	0.79	0.47	0.35	0.3622			
2.4	1.6	1.6	1.6	0.50	0.79	0.59	0.37	0.3876			

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	Σ μ^*Gn-1 [9]	$\mu_{Ct} \cap$ μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
2.2	1	2.6	1.4	1.4	0.67	0.79	0.70	0.38	0.4103	0.2617
		0.2	3	3	0.00	0.71	0.21	0.55	0.2484	
		0.4	2.8	2.8	0.00	0.71	0.21	0.69	0.2617	
		0.6	2.6	2.6	0.00	0.71	0.21	0.68	0.2605	
		0.8	2.4	2.4	0.00	0.71	0.21	0.62	0.2547	
		1	2.2	2.2	0.00	0.71	0.21	0.51	0.2441	
		1.2	2	2	0.00	0.71	0.21	0.41	0.2334	
		1.4	1.8	1.8	0.00	0.71	0.21	0.31	0.2236	
		1.6	1.6	1.6	0.00	0.71	0.21	0.33	0.2254	
		1.8	1.4	1.4	0.00	0.71	0.21	0.34	0.2272	
	2	0.2	4	4	0.00	0.71	0.21	0.72	0.2649	0.4408
		0.4	3.8	3.8	0.00	0.71	0.21	0.73	0.2658	
		0.6	3.6	3.6	0.00	0.71	0.21	0.68	0.2607	
		0.8	3.4	3.4	0.00	0.71	0.21	0.65	0.2582	
		1	3.2	3.2	0.00	0.71	0.21	0.63	0.2556	
		1.2	3	3	0.00	0.71	0.21	0.57	0.2500	
		1.4	2.8	2.8	0.00	0.71	0.21	0.69	0.2622	
		1.6	2.6	2.6	0.00	0.71	0.21	0.68	0.2612	
		1.8	2.4	2.4	0.00	0.71	0.21	0.63	0.2561	
		2	2.2	2.2	0.17	0.71	0.33	0.54	0.3514	
2.4	1	2.2	2	2	0.33	0.71	0.45	0.44	0.4408	0.3129
		2.4	1.8	1.8	0.50	0.71	0.56	0.35	0.3718	
		2.6	1.6	1.6	0.67	0.71	0.68	0.37	0.3972	
		2.8	1.4	1.4	0.83	0.71	0.80	0.38	0.4198	
		0.2	3.2	3.2	0.00	0.64	0.19	0.62	0.2354	
		0.4	3	3	0.00	0.64	0.19	0.55	0.2291	
		0.6	2.8	2.8	0.00	0.64	0.19	0.69	0.2424	
		0.8	2.6	2.6	0.00	0.64	0.19	0.68	0.2412	
		1	2.4	2.4	0.00	0.64	0.19	0.62	0.2355	
		1.2	2.2	2.2	0.00	0.64	0.19	0.51	0.2248	
	2	1.4	2	2	0.00	0.64	0.19	0.41	0.2141	0.4503
		1.6	1.8	1.8	0.00	0.64	0.19	0.31	0.2044	
		1.8	1.6	1.6	0.00	0.64	0.19	0.33	0.2062	
		2	1.4	1.4	0.17	0.64	0.31	0.34	0.3129	
		0.2	4.2	4.2	0.00	0.64	0.19	0.70	0.2437	
		0.4	4	4	0.00	0.64	0.19	0.72	0.2456	
		0.6	3.8	3.8	0.00	0.64	0.19	0.73	0.2465	
		0.8	3.6	3.6	0.00	0.64	0.19	0.68	0.2414	
		1	3.4	3.4	0.00	0.64	0.19	0.65	0.2389	
		1.2	3.2	3.2	0.00	0.64	0.19	0.63	0.2363	
2.6	1	1.4	3	3	0.00	0.64	0.19	0.57	0.2307	0.3494
		1.6	2.8	2.8	0.00	0.64	0.19	0.69	0.2429	
		1.8	2.6	2.6	0.00	0.64	0.19	0.68	0.2419	
		2	2.4	2.4	0.17	0.64	0.31	0.63	0.3418	
		2.2	2.2	2.2	0.33	0.64	0.43	0.54	0.4372	
		2.4	2	2	0.50	0.64	0.54	0.44	0.4503	
		2.6	1.8	1.8	0.67	0.64	0.66	0.35	0.3813	
		2.8	1.6	1.6	0.83	0.64	0.78	0.37	0.4067	
		3	1.4	1.4	1.00	0.64	0.89	0.38	0.4294	
		0.2	3.4	3.4	0.00	0.57	0.17	0.65	0.2191	
	2	0.4	3.2	3.2	0.00	0.57	0.17	0.62	0.2161	0.5229
		0.6	3	3	0.00	0.57	0.17	0.55	0.2098	
		0.8	2.8	2.8	0.00	0.57	0.17	0.69	0.2231	
		1	2.6	2.6	0.00	0.57	0.17	0.68	0.2219	
		1.2	2.4	2.4	0.00	0.57	0.17	0.62	0.2162	
		1.4	2.2	2.2	0.00	0.57	0.17	0.51	0.2055	
		1.6	2	2	0.00	0.57	0.17	0.41	0.1948	
		1.8	1.8	1.8	0.00	0.57	0.17	0.31	0.1851	
		2	1.6	1.6	0.17	0.57	0.29	0.33	0.2918	
		2.2	1.4	1.4	0.33	0.57	0.40	0.34	0.3494	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum $\rho(\cdot)\mu^*Gn-1$ [9]	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
2.8	1	3	1.6	1.6	1.00	0.57	0.87	0.37	0.4162	0.3589
		0.2	3.6	3.6	0.00	0.50	0.15	0.68	0.2026	
		0.4	3.4	3.4	0.00	0.50	0.15	0.65	0.1998	
		0.6	3.2	3.2	0.00	0.50	0.15	0.62	0.1968	
		0.8	3	3	0.00	0.50	0.15	0.55	0.1905	
		1	2.8	2.8	0.00	0.50	0.15	0.69	0.2038	
		1.2	2.6	2.6	0.00	0.50	0.15	0.68	0.2027	
		1.4	2.4	2.4	0.00	0.50	0.15	0.62	0.1969	
		1.6	2.2	2.2	0.00	0.50	0.15	0.51	0.1862	
		1.8	2	2	0.00	0.50	0.15	0.41	0.1756	
	2	1.8	1.8	0.17	0.50	0.27	0.31	0.2707		
	2.2	1.6	1.6	0.33	0.50	0.38	0.33	0.3313		
	2.4	1.4	1.4	0.50	0.50	0.50	0.34	0.3589		
	2.6	4.2	4.2	0.00	0.50	0.15	0.70	0.2052	0.5441	
	0.8	4	4	0.00	0.50	0.15	0.72	0.2070		
	1	3.8	3.8	0.00	0.50	0.15	0.73	0.2080		
	1.2	3.6	3.6	0.00	0.50	0.15	0.68	0.2028		
	1.4	3.4	3.4	0.00	0.50	0.15	0.65	0.2004		
	1.6	3.2	3.2	0.00	0.50	0.15	0.65	0.1977		
	1.8	3	3	0.00	0.50	0.15	0.57	0.1921		
2	2.8	2.8	0.17	0.50	0.27	0.69	0.3093			
2.2	2.6	2.6	0.33	0.50	0.38	0.68	0.4133			
2.4	2.4	2.4	0.50	0.50	0.50	0.63	0.5132			
2.6	2.2	2.2	0.67	0.50	0.62	0.54	0.5441			
2.8	2	2	0.83	0.50	0.73	0.44	0.4693			
3	1.8	1.8	1.00	0.50	0.85	0.35	0.4003			
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.73	0.1891	0.3685
		0.4	3.6	3.6	0.00	0.43	0.13	0.68	0.1833	
		0.6	3.4	3.4	0.00	0.43	0.13	0.65	0.1805	
		0.8	3.2	3.2	0.00	0.43	0.13	0.62	0.1775	
		1	3	3	0.00	0.43	0.13	0.55	0.1712	
		1.2	2.8	2.8	0.00	0.43	0.13	0.69	0.1846	
		1.4	2.6	2.6	0.00	0.43	0.13	0.68	0.1834	
		1.6	2.4	2.4	0.00	0.43	0.13	0.62	0.1776	
		1.8	2.2	2.2	0.00	0.43	0.13	0.51	0.1669	
		2	2	2	0.17	0.43	0.25	0.41	0.2612	
	2.2	1.8	1.8	0.33	0.43	0.36	0.31	0.3130		
	2.4	1.6	1.6	0.50	0.43	0.48	0.33	0.3408		
	2.6	1.4	1.4	0.67	0.43	0.60	0.34	0.3685	0.5989	
	0.8	4.2	4.2	0.00	0.43	0.13	0.70	0.1859		
	1	4	4	0.00	0.43	0.13	0.72	0.1877		
	1.2	3.8	3.8	0.00	0.43	0.13	0.73	0.1887		
	1.4	3.6	3.6	0.00	0.43	0.13	0.68	0.1835		
	1.6	3.4	3.4	0.00	0.43	0.13	0.65	0.1811		
	1.8	3.2	3.2	0.00	0.43	0.13	0.63	0.1784		
	2	3	3	0.17	0.43	0.25	0.57	0.2778		
2.2	2.8	2.8	0.33	0.43	0.36	0.69	0.3950			
2.4	2.6	2.6	0.50	0.43	0.48	0.68	0.4990			
2.6	2.4	2.4	0.67	0.43	0.60	0.63	0.5989			
2.8	2.2	2.2	0.83	0.43	0.71	0.54	0.5536			
3	2	2	1.00	0.43	0.83	0.44	0.4789			
3.2	1	0.2	4	4	0.00	0.36	0.11	0.72	0.1689	0.3780
		0.4	3.8	3.8	0.00	0.36	0.11	0.73	0.1698	
		0.6	3.6	3.6	0.00	0.36	0.11	0.68	0.1640	
		0.8	3.4	3.4	0.00	0.36	0.11	0.65	0.1612	
		1	3.2	3.2	0.00	0.36	0.11	0.62	0.1582	
		1.2	3	3	0.00	0.36	0.11	0.55	0.1520	
		1.4	2.8	2.8	0.00	0.36	0.11	0.69	0.1653	
		1.6	2.6	2.6	0.00	0.36	0.11	0.68	0.1641	
		1.8	2.4	2.4	0.00	0.36	0.11	0.62	0.1583	
		2	2.2	2.2	0.17	0.36	0.22	0.51	0.2526	
	2.2	2	2	0.33	0.36	0.34	0.41	0.3469		
	2.4	1.8	1.8	0.50	0.36	0.46	0.31	0.3225		
	2.6	1.6	1.6	0.67	0.36	0.57	0.33	0.3504		
	2.8	1.4	1.4	0.83	0.36	0.69	0.34	0.3780	0.6379	
	1	4.2	4.2	0.00	0.36	0.11	0.70	0.1666		
	1.2	4	4	0.00	0.36	0.11	0.72	0.1684		
	1.4	3.8	3.8	0.00	0.36	0.11	0.73	0.1694		
	1.6	3.6	3.6	0.00	0.36	0.11	0.68	0.1642		
	1.8	3.4	3.4	0.00	0.36	0.11	0.65	0.1618		
	2	3.2	3.2	0.17	0.36	0.22	0.63	0.2641		
2.2	3	3	0.33	0.36	0.34	0.57	0.3635			
2.4	2.8	2.8	0.50	0.36	0.46	0.69	0.4807			

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum μ^*Gn-1	$\mu_{Ct} \cap$ μ^*Gn-1	μ^*Gn (St,Qt)	
					Demand	F C					
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
		2.6	2.6	2.6	0.67	0.36	0.57	0.68	0.5847		
		2.8	2.4	2.4	0.83	0.36	0.69	0.63	0.6379		
		3	2.2	2.2	1.00	0.36	0.81	0.54	0.5632		
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.71	0.1477	0.4082	
		0.4	4	4	0.00	0.29	0.09	0.72	0.1496		
		0.6	3.8	3.8	0.00	0.29	0.09	0.73	0.1505		
		0.8	3.6	3.6	0.00	0.29	0.09	0.68	0.1448		
		1	3.4	3.4	0.00	0.29	0.09	0.65	0.1420		
		1.2	3.2	3.2	0.00	0.29	0.09	0.62	0.1389		
		1.4	3	3	0.00	0.29	0.09	0.55	0.1327		
		1.6	2.8	2.8	0.00	0.29	0.09	0.69	0.1460		
		1.8	2.6	2.6	0.00	0.29	0.09	0.68	0.1448		
	2	2	2.4	2.4	0.17	0.29	0.20	0.62	0.2440	0.6705	
		2.2	2.2	2.2	0.33	0.29	0.32	0.51	0.3383		
		2.4	2	2	0.50	0.29	0.44	0.41	0.4082		
		2.6	1.8	1.8	0.67	0.29	0.55	0.31	0.3320		
		2.8	1.6	1.6	0.83	0.29	0.67	0.33	0.3599		
		3	1.4	1.4	1.00	0.29	0.79	0.34	0.3875		
		1.2	4.2	4.2	0.00	0.29	0.09	0.70	0.1473		
		1.4	4	4	0.00	0.29	0.09	0.72	0.1492		
		1.6	3.8	3.8	0.00	0.29	0.09	0.73	0.1501		
3.6	1	1.8	3.6	3.6	0.00	0.29	0.09	0.68	0.1450	0.4240	
		2	3.4	3.4	0.17	0.29	0.20	0.65	0.2475		
		2.2	3.2	3.2	0.33	0.29	0.32	0.63	0.3498		
		2.4	3	3	0.50	0.29	0.44	0.57	0.4492		
		2.6	2.8	2.8	0.67	0.29	0.55	0.69	0.5664		
		2.8	2.6	2.6	0.83	0.29	0.67	0.68	0.6705		
		3	2.4	2.4	1.00	0.29	0.79	0.63	0.6474		
		0.4	4.2	4.2	0.00	0.21	0.06	0.71	0.1284		0.6915
		0.6	4	4	0.00	0.21	0.06	0.72	0.1303		
	0.8	3.8	3.8	0.00	0.21	0.06	0.73	0.1313			
1	3.6	3.6	0.00	0.21	0.06	0.68	0.1255				
1.2	3.4	3.4	0.00	0.21	0.06	0.65	0.1227				
1.4	3.2	3.2	0.00	0.21	0.06	0.62	0.1197				
1.6	3	3	0.00	0.21	0.06	0.55	0.1134				
1.8	2.8	2.8	0.00	0.21	0.06	0.69	0.1267				
2	2.6	2.6	0.17	0.21	0.18	0.68	0.2305				
2	2.2	2.4	2.4	0.33	0.21	0.30	0.62	0.3297	0.5098		
	2.4	2.2	2.2	0.50	0.21	0.41	0.51	0.4240			
	2.6	2	2	0.67	0.21	0.53	0.41	0.4178			
	2.8	1.8	1.8	0.83	0.21	0.65	0.31	0.3416			
	3	1.6	1.6	1.00	0.21	0.76	0.33	0.3694			
	1.4	4.2	4.2	0.00	0.21	0.06	0.70	0.1280			
	1.6	4	4	0.00	0.21	0.06	0.72	0.1299			
	1.8	3.8	3.8	0.00	0.21	0.06	0.73	0.1308			
	2	3.6	3.6	0.17	0.21	0.18	0.68	0.2306			
	2.2	3.4	3.4	0.33	0.21	0.30	0.65	0.3332			
3.8	1	2.4	3.2	3.2	0.50	0.21	0.41	0.63	0.4355	0.6981	
		2.6	3	3	0.67	0.21	0.53	0.57	0.5349		
		2.8	2.8	2.8	0.83	0.21	0.65	0.69	0.6521		
		3	2.6	2.6	1.00	0.21	0.76	0.68	0.6915		
		0.6	4.2	4.2	0.00	0.14	0.04	0.71	0.1091		
		0.8	4	4	0.00	0.14	0.04	0.72	0.1110		
		1	3.8	3.8	0.00	0.14	0.04	0.73	0.1120		
		1.2	3.6	3.6	0.00	0.14	0.04	0.68	0.1062		
		1.4	3.4	3.4	0.00	0.14	0.04	0.65	0.1034		
	2	1.6	3.2	3.2	0.00	0.14	0.04	0.62	0.1004	0.5212	
1.8		3	3	0.00	0.14	0.04	0.55	0.0941			
2		2.8	2.8	0.17	0.14	0.16	0.69	0.2124			
2.2		2.6	2.6	0.33	0.14	0.28	0.68	0.3162			
2.4		2.4	2.4	0.50	0.14	0.39	0.62	0.4154			
2.6		2.2	2.2	0.67	0.14	0.51	0.51	0.5098			
2.8		2	2	0.83	0.14	0.63	0.41	0.4273			
3		1.8	1.8	1.00	0.14	0.74	0.31	0.3511			
1.6		4.2	4.2	0.00	0.14	0.04	0.70	0.1088			
1.8		4	4	0.00	0.14	0.04	0.72	0.1106			
2	3.8	3.8	0.17	0.14	0.16	0.73	0.2165				
2.2	3.6	3.6	0.33	0.14	0.28	0.68	0.3163				
2.4	3.4	3.4	0.50	0.14	0.39	0.65	0.4189				
2.6	3.2	3.2	0.67	0.14	0.51	0.63	0.5212				
2.8	3	3	0.83	0.14	0.63	0.57	0.5765				
3	2.8	2.8	1.00	0.14	0.74	0.69	0.6981				
4	1	0.8	4.2	4.2	0.00	0.07	0.02	0.71	0.0898	0.5212	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \mu^*Gn-1$ [9]	$\mu_{Ct} \cap (\mu^*Gn-1)$ [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
	2	1	4	4	0.00	0.07	0.02	0.72	0.0917	0.6070
		1.2	3.8	3.8	0.00	0.07	0.02	0.73	0.0927	
		1.4	3.6	3.6	0.00	0.07	0.02	0.68	0.0869	
		1.6	3.4	3.4	0.00	0.07	0.02	0.65	0.0841	
		1.8	3.2	3.2	0.00	0.07	0.02	0.62	0.0811	
		2	3	3	0.17	0.07	0.14	0.55	0.1798	
		2.2	2.8	2.8	0.33	0.07	0.25	0.69	0.2981	
		2.4	2.6	2.6	0.50	0.07	0.37	0.68	0.4019	
		2.6	2.4	2.4	0.67	0.07	0.49	0.62	0.5011	
		2.8	2.2	2.2	0.83	0.07	0.60	0.51	0.5212	
		3	2	2	1.00	0.07	0.72	0.41	0.4368	
		1.8	4.2	4.2	0.00	0.07	0.02	0.70	0.0895	
		2	4	4	0.17	0.07	0.14	0.72	0.1963	
		2.2	3.8	3.8	0.33	0.07	0.25	0.73	0.3022	
		2.4	3.6	3.6	0.50	0.07	0.37	0.68	0.4021	
2.6	3.4	3.4	0.67	0.07	0.49	0.65	0.5046			
2.8	3.2	3.2	0.83	0.07	0.60	0.63	0.6070			
3	3	3	1.00	0.07	0.72	0.57	0.5860			
4.2	1	1	4.2	4.2	0.00	0.00	0.00	0.71	0.0705	0.5868
		1.2	4	4	0.00	0.00	0.00	0.72	0.0724	
		1.4	3.8	3.8	0.00	0.00	0.00	0.73	0.0734	
		1.6	3.6	3.6	0.00	0.00	0.00	0.68	0.0676	
		1.8	3.4	3.4	0.00	0.00	0.00	0.65	0.0648	
		2	3.2	3.2	0.17	0.00	0.12	0.62	0.1667	
		2.2	3	3	0.33	0.00	0.23	0.55	0.2654	
	2.4	2.8	2.8	0.50	0.00	0.35	0.69	0.3838		
	2.6	2.6	2.6	0.67	0.00	0.47	0.68	0.4876		
	2.8	2.4	2.4	0.83	0.00	0.58	0.62	0.5868		
	3	2.2	2.2	1.00	0.00	0.70	0.51	0.5307		
	2	4.2	4.2	0.17	0.00	0.12	0.70	0.1751		
	2.2	4	4	0.33	0.00	0.23	0.72	0.2819		
	2.4	3.8	3.8	0.50	0.00	0.35	0.73	0.3879		
	2.6	3.6	3.6	0.67	0.00	0.47	0.68	0.4877		
2.8	3.4	3.4	0.83	0.00	0.58	0.65	0.5903			
3	3.2	3.2	1.00	0.00	0.70	0.63	0.6342			

June

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $(\mu \cdot \mu^*Gn - Lp)$	$\mu_{Ct} \cap$ $(\mu \cdot \mu^*Gn - 1)$	μ^*Gn (St,Qt)	
					Demand	F C					
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.73	0.3433	0.3433	
		0.4	2	2	0.00	1.00	0.30	0.67	0.3366		
		0.6	1.8	1.8	0.00	1.00	0.30	0.61	0.3312		
		0.8	1.6	1.6	0.00	1.00	0.30	0.47	0.3174		
	2	1	1	1.4	1.4	0.00	1.00	0.30	0.34	0.3045	0.7239
			2	3.2	3.2	0.00	1.00	0.30	0.69	0.3390	
		0.4	3	3	0.00	1.00	0.30	0.70	0.3400		
		0.6	2.8	2.8	0.00	1.00	0.30	0.71	0.3410		
		0.8	2.6	2.6	0.00	1.00	0.30	0.72	0.3421		
		1	2.4	2.4	0.00	1.00	0.30	0.73	0.3431		
		1.2	2.2	2.2	0.00	1.00	0.30	0.74	0.3441		
		1.4	2	2	0.00	1.00	0.30	0.75	0.3452		
		1.6	1.8	1.8	0.20	1.00	0.44	0.76	0.4722		
		1.8	1.6	1.6	0.40	1.00	0.58	0.77	0.5992		
2	1.4	1.4	0.60	1.00	0.72	0.76	0.7239				
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.75	0.3255	0.3255	
		0.4	2.2	2.2	0.00	0.93	0.28	0.73	0.3240		
		0.6	2	2	0.00	0.93	0.28	0.67	0.3173		
		0.8	1.8	1.8	0.00	0.93	0.28	0.61	0.3119		
	2	1	1	1.6	1.6	0.00	0.93	0.28	0.47	0.2981	0.7667
			2	3.4	3.4	0.00	0.93	0.28	0.34	0.2852	
		0.4	3.2	3.2	0.00	0.93	0.28	0.68	0.3187		
		0.6	3	3	0.00	0.93	0.28	0.69	0.3197		
		0.8	2.8	2.8	0.00	0.93	0.28	0.70	0.3207		
		1	2.6	2.6	0.00	0.93	0.28	0.71	0.3218		
		1.2	2.4	2.4	0.00	0.93	0.28	0.72	0.3228		
		1.4	2.2	2.2	0.00	0.93	0.28	0.73	0.3238		
		1.6	2	2	0.20	0.93	0.42	0.74	0.3249		
		1.8	1.8	1.8	0.40	0.93	0.56	0.75	0.4519		
2	1.6	1.6	0.60	0.93	0.70	0.76	0.5790				
2.2	1.4	1.4	0.80	0.93	0.84	0.77	0.7059				
2.4	1.4	1.4	0.80	0.93	0.84	0.76	0.7667				
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.76	0.3076	0.3076	
		0.4	2.4	2.4	0.00	0.86	0.26	0.75	0.3063		
		0.6	2.2	2.2	0.00	0.86	0.26	0.73	0.3047		
		0.8	2	2	0.00	0.86	0.26	0.67	0.2980		
	2	1	1	1.8	1.8	0.00	0.86	0.26	0.61	0.2926	0.7786
			2	3.6	3.6	0.00	0.86	0.26	0.34	0.2659	
		0.4	3.4	3.4	0.00	0.86	0.26	0.67	0.2985		
		0.6	3.2	3.2	0.00	0.86	0.26	0.68	0.2994		
		0.8	3	3	0.00	0.86	0.26	0.69	0.3004		
		1	2.8	2.8	0.00	0.86	0.26	0.70	0.3015		
		1.2	2.6	2.6	0.00	0.86	0.26	0.71	0.3025		
		1.4	2.4	2.4	0.00	0.86	0.26	0.72	0.3035		
		1.6	2.2	2.2	0.20	0.86	0.40	0.73	0.3046		
		1.8	2	2	0.40	0.86	0.54	0.74	0.4316		
2	1.8	1.8	0.60	0.86	0.68	0.75	0.5587				
2.2	1.6	1.6	0.80	0.86	0.82	0.76	0.6857				
2.4	1.4	1.4	1.00	0.86	0.96	0.77	0.7763				
2.4	1.4	1.4	1.00	0.86	0.96	0.76	0.7786				
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.75	0.2873	0.4052	
		0.4	2.6	2.6	0.00	0.79	0.24	0.75	0.2870		
		0.6	2.4	2.4	0.00	0.79	0.24	0.73	0.2854		
		0.8	2.2	2.2	0.00	0.79	0.24	0.67	0.2788		
	2	1	1	2	2	0.00	0.79	0.24	0.61	0.2734	0.7882
			2	3.8	3.8	0.00	0.79	0.24	0.47	0.2595	
		0.4	3.6	3.6	0.00	0.79	0.24	0.47	0.2595		
		0.6	3.4	3.4	0.00	0.79	0.24	0.34	0.2467		
		0.8	3.2	3.2	0.00	0.79	0.24	0.67	0.4052		
		1	3	3	0.00	0.79	0.24	0.66	0.2782		
		1.2	2.8	2.8	0.00	0.79	0.24	0.67	0.2792		
		1.4	2.6	2.6	0.00	0.79	0.24	0.68	0.2802		
		1.6	2.4	2.4	0.20	0.79	0.38	0.69	0.2811		
		1.8	2.2	2.2	0.40	0.79	0.52	0.70	0.2822		
2	2	2	0.60	0.79	0.66	0.71	0.2832				
2.2	1.8	1.8	0.80	0.79	0.80	0.72	0.2842				
2.4	1.6	1.6	1.00	0.79	0.94	0.73	0.4113				
2.4	1.6	1.6	1.00	0.79	0.94	0.74	0.5383				
2.4	1.6	1.6	1.00	0.79	0.94	0.75	0.6654				
2.4	1.6	1.6	1.00	0.79	0.94	0.76	0.7658				
2.4	1.6	1.6	1.00	0.79	0.94	0.77	0.7882				

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St+ Qt -Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum $\mu \cdot Gn - \mu \cdot Gn - 1$ [9]	$\mu_{Ct} \cap$ $\mu \cdot Gn - 1$ [10]	$\mu \cdot Gn$ (St,Qt) [11]
					Demand [6]	FC [7]				
2.2	1	0.2	3	3	0.00	0.71	0.21	0.74	0.2670	0.5119
		0.4	2.8	2.8	0.00	0.71	0.21	0.75	0.2681	
		0.6	2.6	2.6	0.00	0.71	0.21	0.75	0.2677	
		0.8	2.4	2.4	0.00	0.71	0.21	0.73	0.2661	
		1	2.2	2.2	0.00	0.71	0.21	0.67	0.2595	
		1.2	2	2	0.00	0.71	0.21	0.61	0.2541	
		1.4	1.8	1.8	0.00	0.71	0.21	0.47	0.2403	
		1.6	1.6	1.6	0.20	0.71	0.35	0.34	0.3458	
		1.8	1.4	1.4	0.40	0.71	0.49	0.67	0.5119	
	2	0.2	4	4	0.00	0.71	0.21	0.66	0.2585	0.7776
		0.4	3.8	3.8	0.00	0.71	0.21	0.66	0.2589	
		0.6	3.6	3.6	0.00	0.71	0.21	0.67	0.2599	
		0.8	3.4	3.4	0.00	0.71	0.21	0.68	0.2609	
		1	3.2	3.2	0.00	0.71	0.21	0.69	0.2619	
		1.2	3	3	0.00	0.71	0.21	0.70	0.2629	
		1.4	2.8	2.8	0.00	0.71	0.21	0.71	0.2639	
		1.6	2.6	2.6	0.20	0.71	0.35	0.72	0.3910	
		1.8	2.4	2.4	0.40	0.71	0.49	0.73	0.5180	
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.73	0.2467	0.6186
		0.4	3	3	0.00	0.64	0.19	0.74	0.2477	
		0.6	2.8	2.8	0.00	0.64	0.19	0.75	0.2488	
		0.8	2.6	2.6	0.00	0.64	0.19	0.75	0.2484	
		1	2.4	2.4	0.00	0.64	0.19	0.73	0.2469	
		1.2	2.2	2.2	0.00	0.64	0.19	0.67	0.2402	
2	1.4	2	2	0.00	0.64	0.19	0.61	0.2348	0.7662	
	1.6	1.8	1.8	0.20	0.64	0.33	0.47	0.3470		
	1.8	1.6	1.6	0.40	0.64	0.47	0.34	0.3577		
	2	1.4	1.4	0.60	0.64	0.61	0.67	0.6186		
	0.2	4.2	4.2	0.00	0.64	0.19	0.65	0.2390		
	0.4	4	4	0.00	0.64	0.19	0.66	0.2392		
	0.6	3.8	3.8	0.00	0.64	0.19	0.66	0.2396		
	0.8	3.6	3.6	0.00	0.64	0.19	0.67	0.2406		
	1	3.4	3.4	0.00	0.64	0.19	0.68	0.2416		
	1.2	3.2	3.2	0.00	0.64	0.19	0.69	0.2426		
	1.4	3	3	0.00	0.64	0.19	0.70	0.2436		
	1.6	2.8	2.8	0.20	0.64	0.33	0.71	0.3706		
2.6	1	1.8	2.6	2.6	0.40	0.64	0.47	0.72	0.4977	0.7544
		2	2.4	2.4	0.60	0.64	0.61	0.73	0.6247	
		2.2	2.2	2.2	0.80	0.64	0.75	0.74	0.7426	
		2.4	2	2	1.00	0.64	0.89	0.75	0.7662	
		0.2	3.4	3.4	0.00	0.57	0.17	0.72	0.2264	
		0.4	3.2	3.2	0.00	0.57	0.17	0.73	0.2274	
		0.6	3	3	0.00	0.57	0.17	0.74	0.2285	
		0.8	2.8	2.8	0.00	0.57	0.17	0.75	0.2295	
		1	2.6	2.6	0.00	0.57	0.17	0.75	0.2291	
		1.2	2.4	2.4	0.00	0.57	0.17	0.73	0.2276	
		1.4	2.2	2.2	0.00	0.57	0.17	0.67	0.2209	
		1.6	2	2	0.20	0.57	0.31	0.61	0.3415	
2	1.8	1.8	1.8	0.40	0.57	0.45	0.47	0.4537	0.6881	
	2	1.6	1.6	0.60	0.57	0.59	0.34	0.3695		
	2.2	1.4	1.4	0.80	0.57	0.73	0.67	0.6763		
	0.4	4.2	4.2	0.00	0.57	0.17	0.65	0.2197		
	0.6	4	4	0.00	0.57	0.17	0.66	0.2199		
	0.8	3.8	3.8	0.00	0.57	0.17	0.66	0.2203		
	1	3.6	3.6	0.00	0.57	0.17	0.67	0.2213		
	1.2	3.4	3.4	0.00	0.57	0.17	0.68	0.2223		
	1.4	3.2	3.2	0.00	0.57	0.17	0.69	0.2233		
	1.6	3	3	0.20	0.57	0.31	0.70	0.3503		
	1.8	2.8	2.8	0.40	0.57	0.45	0.71	0.4774		
	2.8	1	2	2.6	2.6	0.60	0.57	0.59		0.72
2.2			2.4	2.4	0.80	0.57	0.73	0.73	0.7311	
2.4			2.2	2.2	1.00	0.57	0.87	0.74	0.7544	
0.2			3.6	3.6	0.00	0.50	0.15	0.71	0.2060	
0.4			3.4	3.4	0.00	0.50	0.15	0.72	0.2071	
0.6			3.2	3.2	0.00	0.50	0.15	0.73	0.2081	
2	0.8	3	3	0.00	0.50	0.15	0.74	0.2092	0.6881	
	1	2.8	2.8	0.00	0.50	0.15	0.75	0.2102		
	1.2	2.6	2.6	0.00	0.50	0.15	0.75	0.2098		
	1.4	2.4	2.4	0.00	0.50	0.15	0.73	0.2083		
	1.6	2.2	2.2	0.20	0.50	0.29	0.67	0.3276		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \mu \cdot G_{n-1}$ [9]	$\mu_{Ct} \cap \mu \cdot G_{n-1}$ [10]	$\mu \cdot G_n$ (St,Q) [11]	
					Demand [6]	F C [7]					
3	2	1.8	2	2	0.40	0.50	0.43	0.61	0.4482	0.7430	
		2	1.8	1.8	0.60	0.50	0.57	0.47	0.4834		
		2.2	1.6	1.6	0.80	0.50	0.71	0.34	0.3814		
		2.4	1.4	1.4	1.00	0.50	0.85	0.67	0.6881		
		0.6	4.2	4.2	0.00	0.50	0.15	0.65	0.2004		
		0.8	4	4	0.00	0.50	0.15	0.66	0.2007		
		1	3.8	3.8	0.00	0.50	0.15	0.66	0.2011		
		1.2	3.6	3.6	0.00	0.50	0.15	0.67	0.2020		
		1.4	3.4	3.4	0.00	0.50	0.15	0.68	0.2030		
		1.6	3.2	3.2	0.20	0.50	0.29	0.69	0.3300		
		1.8	3	3	0.40	0.50	0.43	0.70	0.4570		
		2	2.8	2.8	0.60	0.50	0.57	0.71	0.5841		
		2.2	2.6	2.6	0.80	0.50	0.71	0.72	0.7111		
2.4	2.4	2.4	1.00	0.50	0.85	0.73	0.7430				
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.70	0.1857	0.5549	
		0.4	3.6	3.6	0.00	0.43	0.13	0.71	0.1868		
		0.6	3.4	3.4	0.00	0.43	0.13	0.72	0.1878		
		0.8	3.2	3.2	0.00	0.43	0.13	0.73	0.1888		
		1	3	3	0.00	0.43	0.13	0.74	0.1899		
		1.2	2.8	2.8	0.00	0.43	0.13	0.75	0.1909		
		1.4	2.6	2.6	0.00	0.43	0.13	0.75	0.1905		
		1.6	2.4	2.4	0.20	0.43	0.27	0.73	0.3150		
		1.8	2.2	2.2	0.40	0.43	0.41	0.67	0.4343		
	2	2	2	2	0.60	0.43	0.55	0.61	0.5549	0.7315	
		2.2	1.8	1.8	0.80	0.43	0.69	0.47	0.4953		
		2.4	1.6	1.6	1.00	0.43	0.83	0.34	0.3933		
		0.8	4.2	4.2	0.00	0.43	0.13	0.65	0.1812		
		1	4	4	0.00	0.43	0.13	0.66	0.1814		
		1.2	3.8	3.8	0.00	0.43	0.13	0.66	0.1818		
		1.4	3.6	3.6	0.00	0.43	0.13	0.67	0.1828		
		1.6	3.4	3.4	0.20	0.43	0.27	0.68	0.3097		
3.2	1	1.8	3.2	3.2	0.40	0.43	0.41	0.69	0.4367	0.6175	
		2	3	3	0.60	0.43	0.55	0.70	0.5638		
		2.2	2.8	2.8	0.80	0.43	0.69	0.71	0.6908		
		2.4	2.6	2.6	1.00	0.43	0.83	0.72	0.7315		
		0.2	4	4	0.00	0.36	0.11	0.69	0.1654		
	2	0.4	3.8	3.8	0.00	0.36	0.11	0.70	0.1664		0.7201
		0.6	3.6	3.6	0.00	0.36	0.11	0.71	0.1675		
		0.8	3.4	3.4	0.00	0.36	0.11	0.72	0.1685		
		1	3.2	3.2	0.00	0.36	0.11	0.73	0.1695		
		1.2	3	3	0.00	0.36	0.11	0.74	0.1706		
3.4	1	1.4	2.8	2.8	0.00	0.36	0.11	0.75	0.1716	0.6478	
		1.6	2.6	2.6	0.20	0.36	0.25	0.75	0.2973		
		1.8	2.4	2.4	0.40	0.36	0.39	0.73	0.4217		
		2	2.2	2.2	0.60	0.36	0.53	0.67	0.5411		
		2.2	2	2	0.80	0.36	0.67	0.61	0.6175		
	2	2.4	1.8	1.8	1.00	0.36	0.81	0.47	0.5071		0.7201
		1	4.2	4.2	0.00	0.36	0.11	0.65	0.1619		
		1.2	4	4	0.00	0.36	0.11	0.66	0.1621		
		1.4	3.8	3.8	0.00	0.36	0.11	0.66	0.1625		
		1.6	3.6	3.6	0.20	0.36	0.25	0.67	0.2895		
3.4	1	1.8	3.4	3.4	0.40	0.36	0.39	0.68	0.4165	0.7087	
		2	3.2	3.2	0.60	0.36	0.53	0.69	0.5434		
		2.2	3	3	0.80	0.36	0.67	0.70	0.6705		
		2.4	2.8	2.8	1.00	0.36	0.81	0.71	0.7201		
		0.2	4.2	4.2	0.00	0.29	0.09	0.68	0.1451		
	2	0.4	4	4	0.00	0.29	0.09	0.69	0.1461		0.6478
		0.6	3.8	3.8	0.00	0.29	0.09	0.70	0.1471		
		0.8	3.6	3.6	0.00	0.29	0.09	0.71	0.1482		
		1	3.4	3.4	0.00	0.29	0.09	0.72	0.1492		
		1.2	3.2	3.2	0.00	0.29	0.09	0.73	0.1503		
1.4		3	3	0.00	0.29	0.09	0.74	0.1513			
1.6		2.8	2.8	0.20	0.29	0.23	0.75	0.2784			
1.8		2.6	2.6	0.40	0.29	0.37	0.75	0.4040			
2		2.4	2.4	0.60	0.29	0.51	0.73	0.5284			
2.2		2.2	2.2	0.80	0.29	0.65	0.67	0.6478			
3.4	1	2.4	2	2	1.00	0.29	0.79	0.61	0.6294	0.7087	
		1.2	4.2	4.2	0.00	0.29	0.09	0.65	0.1426		
		1.4	4	4	0.00	0.29	0.09	0.66	0.1428		
		1.6	3.8	3.8	0.20	0.29	0.23	0.66	0.2692		
		1.8	3.6	3.6	0.40	0.29	0.37	0.67	0.3962		
	2	2	3.4	3.4	0.60	0.29	0.51	0.68	0.5232		0.7087
		2.2	3.2	3.2	0.80	0.29	0.65	0.69	0.6502		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	\sum $\rho(\cdot)\mu^*Gn-1$ [9]	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
		2.4	3	3	1.00	0.29	0.79	0.70	0.7087	
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.68	0.1258	0.6758
		0.6	4	4	0.00	0.21	0.06	0.69	0.1268	
		0.8	3.8	3.8	0.00	0.21	0.06	0.70	0.1279	
		1	3.6	3.6	0.00	0.21	0.06	0.71	0.1289	
		1.2	3.4	3.4	0.00	0.21	0.06	0.72	0.1299	
		1.4	3.2	3.2	0.00	0.21	0.06	0.73	0.1310	
		1.6	3	3	0.20	0.21	0.20	0.74	0.2580	
	2	1.8	2.8	2.8	0.40	0.21	0.34	0.75	0.3851	
		2	2.6	2.6	0.60	0.21	0.48	0.75	0.5107	
		2.2	2.4	2.4	0.80	0.21	0.62	0.73	0.6352	
		2.4	2.2	2.2	1.00	0.21	0.76	0.67	0.6758	
		1.4	4.2	4.2	0.00	0.21	0.06	0.65	0.1233	
		1.6	4	4	0.20	0.21	0.20	0.66	0.2495	
		1.8	3.8	3.8	0.40	0.21	0.34	0.66	0.3759	
3.8	1	2	3.6	3.6	0.60	0.21	0.48	0.67	0.5029	
		2.2	3.4	3.4	0.80	0.21	0.62	0.68	0.6299	
		2.4	3.2	3.2	1.00	0.21	0.76	0.69	0.6973	
		0.6	4.2	4.2	0.00	0.14	0.04	0.68	0.1065	
		0.8	4	4	0.00	0.14	0.04	0.69	0.1076	
		1	3.8	3.8	0.00	0.14	0.04	0.70	0.1086	
		1.2	3.6	3.6	0.00	0.14	0.04	0.71	0.1096	
	2	1.4	3.4	3.4	0.00	0.14	0.04	0.72	0.1107	
		1.6	3.2	3.2	0.20	0.14	0.18	0.73	0.2377	
		1.8	3	3	0.40	0.14	0.32	0.74	0.3648	
		2	2.8	2.8	0.60	0.14	0.46	0.75	0.4918	
		2.2	2.6	2.6	0.80	0.14	0.60	0.75	0.6174	
		2.4	2.4	2.4	1.00	0.14	0.74	0.73	0.7337	
		1.6	4.2	4.2	0.20	0.14	0.18	0.65	0.2300	
4	1	1.8	4	4	0.40	0.14	0.32	0.66	0.3562	
		2	3.8	3.8	0.60	0.14	0.46	0.66	0.4826	
		2.2	3.6	3.6	0.80	0.14	0.60	0.67	0.6096	
		2.4	3.4	3.4	1.00	0.14	0.74	0.68	0.6863	
		0.8	4.2	4.2	0.00	0.07	0.02	0.68	0.0872	
		1	4	4	0.00	0.07	0.02	0.69	0.0883	
		1.2	3.8	3.8	0.00	0.07	0.02	0.70	0.0893	
	2	1.4	3.6	3.6	0.00	0.07	0.02	0.71	0.0903	
		1.6	3.4	3.4	0.20	0.07	0.16	0.72	0.2174	
		1.8	3.2	3.2	0.40	0.07	0.30	0.73	0.3444	
		2	3	3	0.60	0.07	0.44	0.74	0.4715	
		2.2	2.8	2.8	0.80	0.07	0.58	0.75	0.5985	
		2.4	2.6	2.6	1.00	0.07	0.72	0.75	0.7241	
		1.8	4.2	4.2	0.40	0.07	0.30	0.65	0.3367	
4.2	1	2	4	4	0.60	0.07	0.44	0.66	0.4630	
		2.2	3.8	3.8	0.80	0.07	0.58	0.66	0.5894	
		2.4	3.6	3.6	1.00	0.07	0.72	0.67	0.6753	
		1	4.2	4.2	0.00	0.00	0.00	0.68	0.0679	
		1.2	4	4	0.00	0.00	0.00	0.69	0.0689	
		1.4	3.8	3.8	0.00	0.00	0.00	0.70	0.0700	
		1.6	3.6	3.6	0.20	0.00	0.14	0.71	0.1970	
	2	1.8	3.4	3.4	0.40	0.00	0.28	0.72	0.3240	
		2	3.2	3.2	0.60	0.00	0.42	0.73	0.4511	
		2.2	3	3	0.80	0.00	0.56	0.74	0.5781	
		2.4	2.8	2.8	1.00	0.00	0.70	0.75	0.7052	
		2	4.2	4.2	0.60	0.00	0.42	0.65	0.4434	
		2.2	4	4	0.80	0.00	0.56	0.66	0.5696	
		2.4	3.8	3.8	1.00	0.00	0.70	0.66	0.6642	

July

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\rho(\cdot)\mu^*Gn-1$	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*Gn-1$	μ^*Gn (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.73	0.3432	0.3449
		0.4	2	2	0.00	1.00	0.30	0.74	0.3441	
		0.6	1.8	1.8	0.00	1.00	0.30	0.75	0.3449	
		0.8	1.6	1.6	0.00	1.00	0.30	0.73	0.3432	
	2	1	1.4	1.4	0.00	1.00	0.30	0.66	0.3355	
		0.2	3.2	3.2	0.00	1.00	0.30	0.69	0.3386	
		0.4	3	3	0.00	1.00	0.30	0.69	0.3395	
		0.6	2.8	2.8	0.00	1.00	0.30	0.70	0.3404	
		0.8	2.6	2.6	0.00	1.00	0.30	0.71	0.3413	
		1	2.4	2.4	0.00	1.00	0.30	0.72	0.3422	
		1.2	2.2	2.2	0.25	1.00	0.48	0.73	0.5007	
		1.4	2	2	0.50	1.00	0.65	0.74	0.6591	
		1.6	1.8	1.8	0.75	1.00	0.83	0.75	0.7565	
		1.8	1.6	1.6	1.00	1.00	1.00	0.73	0.7587	
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.72	0.3230	0.4738
		0.4	2.2	2.2	0.00	0.93	0.28	0.73	0.3239	
		0.6	2	2	0.00	0.93	0.28	0.74	0.3248	
		0.8	1.8	1.8	0.00	0.93	0.28	0.75	0.3256	
	2	1	1.6	1.6	0.00	0.93	0.28	0.73	0.3239	
		1.2	1.4	1.4	0.25	0.93	0.45	0.66	0.4738	
		0.2	3.4	3.4	0.00	0.93	0.28	0.68	0.3184	
		0.4	3.2	3.2	0.00	0.93	0.28	0.69	0.3193	
		0.6	3	3	0.00	0.93	0.28	0.69	0.3202	
		0.8	2.8	2.8	0.00	0.93	0.28	0.70	0.3211	
		1	2.6	2.6	0.00	0.93	0.28	0.71	0.3220	
		1.2	2.4	2.4	0.25	0.93	0.45	0.72	0.4805	
		1.4	2.2	2.2	0.50	0.93	0.63	0.73	0.6389	
		1.6	2	2	0.75	0.93	0.80	0.74	0.7471	
1.8	1.8	1.8	1.00	0.93	0.98	0.75	0.7718			
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.71	0.3028	0.6120
		0.4	2.4	2.4	0.00	0.86	0.26	0.72	0.3037	
		0.6	2.2	2.2	0.00	0.86	0.26	0.73	0.3046	
		0.8	2	2	0.00	0.86	0.26	0.74	0.3055	
	2	1	1.8	1.8	0.00	0.86	0.26	0.75	0.3063	
		1.2	1.6	1.6	0.25	0.86	0.43	0.73	0.4621	
		1.4	1.4	1.4	0.50	0.86	0.61	0.66	0.6120	
		0.2	3.6	3.6	0.00	0.86	0.26	0.67	0.2983	
		0.4	3.4	3.4	0.00	0.86	0.26	0.68	0.2991	
		0.6	3.2	3.2	0.00	0.86	0.26	0.69	0.3000	
		0.8	3	3	0.00	0.86	0.26	0.69	0.3009	
		1	2.8	2.8	0.00	0.86	0.26	0.70	0.3018	
		1.2	2.6	2.6	0.25	0.86	0.43	0.71	0.4603	
		1.4	2.4	2.4	0.50	0.86	0.61	0.72	0.6187	
1.6	2.2	2.2	0.75	0.86	0.78	0.73	0.7368			
1.8	2	2	1.00	0.86	0.96	0.74	0.7624			
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.70	0.2826	0.6660
		0.4	2.6	2.6	0.00	0.79	0.24	0.71	0.2835	
		0.6	2.4	2.4	0.00	0.79	0.24	0.72	0.2844	
		0.8	2.2	2.2	0.00	0.79	0.24	0.73	0.2853	
	2	1	2	2	0.00	0.79	0.24	0.74	0.2862	
		1.2	1.8	1.8	0.25	0.79	0.41	0.75	0.4445	
		1.4	1.6	1.6	0.50	0.79	0.59	0.73	0.6004	
		1.6	1.4	1.4	0.75	0.79	0.76	0.66	0.6660	
		0.2	3.8	3.8	0.00	0.79	0.24	0.66	0.2781	
		0.4	3.6	3.6	0.00	0.79	0.24	0.67	0.2790	
		0.6	3.4	3.4	0.00	0.79	0.24	0.68	0.2798	
		0.8	3.2	3.2	0.00	0.79	0.24	0.69	0.2807	
		1	3	3	0.00	0.79	0.24	0.69	0.2817	
		1.2	2.8	2.8	0.25	0.79	0.41	0.70	0.4401	
1.4	2.6	2.6	0.50	0.79	0.59	0.71	0.5985			
1.6	2.4	2.4	0.75	0.79	0.76	0.72	0.7261			
1.8	2.2	2.2	1.00	0.79	0.94	0.73	0.7521			
2.2	1	0.2	3	3	0.00	0.71	0.21	0.69	0.2624	0.7326
		0.4	2.8	2.8	0.00	0.71	0.21	0.70	0.2633	
		0.6	2.6	2.6	0.00	0.71	0.21	0.71	0.2642	
		0.8	2.4	2.4	0.00	0.71	0.21	0.72	0.2651	
		1	2.2	2.2	0.00	0.71	0.21	0.73	0.2661	
		1.2	2	2	0.25	0.71	0.39	0.74	0.4245	
		1.4	1.8	1.8	0.50	0.71	0.56	0.75	0.5828	
		1.6	1.6	1.6	0.75	0.71	0.74	0.73	0.7326	
		1.8	1.4	1.4	1.00	0.71	0.91	0.66	0.6813	

Fuzzy Rule Base Modeling for Reservoir Operation

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \mu \cdot \mu^{*Gn-1}$ [9]	$\mu_{Ct} \cap \mu^{*Gn-1}$ [10]	μ^{*Gn} (St,Qt) [11]			
					Demand [6]	F C [7]							
	2	0.2	4	4	0.00	0.71	0.21	0.65	0.2580	0.7414			
		0.4	3.8	3.8	0.00	0.71	0.21	0.66	0.2588				
		0.6	3.6	3.6	0.00	0.71	0.21	0.67	0.2597				
		0.8	3.4	3.4	0.00	0.71	0.21	0.68	0.2606				
		1	3.2	3.2	0.00	0.71	0.21	0.69	0.2615				
		1.2	3	3	0.25	0.71	0.39	0.69	0.4199				
		1.4	2.8	2.8	0.50	0.71	0.56	0.70	0.5783				
		1.6	2.6	2.6	0.75	0.71	0.74	0.71	0.7157				
1.8	2.4	2.4	1.00	0.71	0.91	0.72	0.7414						
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.69	0.2422	0.7480			
		0.4	3	3	0.00	0.64	0.19	0.69	0.2431				
		0.6	2.8	2.8	0.00	0.64	0.19	0.70	0.2440				
		0.8	2.6	2.6	0.00	0.64	0.19	0.71	0.2449				
		1	2.4	2.4	0.00	0.64	0.19	0.72	0.2458				
		1.2	2.2	2.2	0.25	0.64	0.37	0.73	0.4043				
		1.4	2	2	0.50	0.64	0.54	0.74	0.5627				
		1.6	1.8	1.8	0.75	0.64	0.72	0.75	0.7210				
	1.8	1.6	1.6	1.00	0.64	0.89	0.73	0.7480					
	2	0.2	4.2	4.2	0.00	0.64	0.19	0.65	0.2385	0.7311			
		0.4	4	4	0.00	0.64	0.19	0.65	0.2387				
		0.6	3.8	3.8	0.00	0.64	0.19	0.66	0.2396				
		0.8	3.6	3.6	0.00	0.64	0.19	0.67	0.2404				
		1	3.4	3.4	0.00	0.64	0.19	0.68	0.2413				
		1.2	3.2	3.2	0.25	0.64	0.37	0.69	0.3997				
		1.4	3	3	0.50	0.64	0.54	0.69	0.5581				
		1.6	2.8	2.8	0.75	0.64	0.72	0.70	0.7054				
		1.8	2.6	2.6	1.00	0.64	0.89	0.71	0.7311				
2.6		1	0.2	3.4	3.4	0.00	0.57	0.17	0.68		0.2220	0.7611	
	0.4		3.2	3.2	0.00	0.57	0.17	0.69	0.2229				
	0.6		3	3	0.00	0.57	0.17	0.69	0.2238				
	0.8		2.8	2.8	0.00	0.57	0.17	0.70	0.2247				
	1		2.6	2.6	0.00	0.57	0.17	0.71	0.2256				
	1.2		2.4	2.4	0.25	0.57	0.35	0.72	0.3840				
	1.4		2.2	2.2	0.50	0.57	0.52	0.73	0.5425				
	1.6		2	2	0.75	0.57	0.70	0.74	0.7009				
	1.8	1.8	1.8	1.00	0.57	0.87	0.75	0.7611					
	2	0.4	4.2	4.2	0.00	0.57	0.17	0.65	0.2192	0.7207			
		0.6	4	4	0.00	0.57	0.17	0.65	0.2194				
		0.8	3.8	3.8	0.00	0.57	0.17	0.66	0.2203				
		1	3.6	3.6	0.00	0.57	0.17	0.67	0.2211				
		1.2	3.4	3.4	0.25	0.57	0.35	0.68	0.3795				
		1.4	3.2	3.2	0.50	0.57	0.52	0.69	0.5379				
		1.6	3	3	0.75	0.57	0.70	0.69	0.6950				
		1.8	2.8	2.8	1.00	0.57	0.87	0.70	0.7207				
		2.8	1	0.2	3.6	3.6	0.00	0.50	0.15		0.67	0.2019	0.7517
0.4				3.4	3.4	0.00	0.50	0.15	0.68		0.2027		
0.6	3.2			3.2	0.00	0.50	0.15	0.69	0.2036				
0.8	3			3	0.00	0.50	0.15	0.69	0.2045				
1	2.8			2.8	0.00	0.50	0.15	0.70	0.2054				
1.2	2.6			2.6	0.25	0.50	0.33	0.71	0.3638				
1.4	2.4			2.4	0.50	0.50	0.50	0.72	0.5223				
1.6	2.2			2.2	0.75	0.50	0.68	0.73	0.6807				
1.8	2		2	1.00	0.50	0.85	0.74	0.7517					
2	0.6		4.2	4.2	0.00	0.50	0.15	0.65	0.1999	0.7104			
	0.8		4	4	0.00	0.50	0.15	0.65	0.2001				
	1		3.8	3.8	0.00	0.50	0.15	0.66	0.2010				
	1.2		3.6	3.6	0.25	0.50	0.33	0.67	0.3594				
	1.4		3.4	3.4	0.50	0.50	0.50	0.68	0.5177				
	1.6		3.2	3.2	0.75	0.50	0.68	0.69	0.6761				
	1.8		3	3	1.00	0.50	0.85	0.69	0.7104				
	3		1	0.2	3.8	3.8	0.00	0.43	0.13		0.66	0.1817	0.7414
				0.4	3.6	3.6	0.00	0.43	0.13		0.67	0.1826	
		0.6		3.4	3.4	0.00	0.43	0.13	0.68		0.1834		
0.8		3.2		3.2	0.00	0.43	0.13	0.69	0.1843				
1		3		3	0.00	0.43	0.13	0.69	0.1852				
1.2		2.8		2.8	0.25	0.43	0.30	0.70	0.3436				
1.4		2.6		2.6	0.50	0.43	0.48	0.71	0.5021				
1.6		2.4		2.4	0.75	0.43	0.65	0.72	0.6605				
1.8		2.2	2.2	1.00	0.43	0.83	0.73	0.7414					
2		0.8	4.2	4.2	0.00	0.43	0.13	0.65	0.1806	0.7001			
		1	4	4	0.00	0.43	0.13	0.65	0.1809				
		1.2	3.8	3.8	0.25	0.43	0.30	0.66	0.3392				
		1.4	3.6	3.6	0.50	0.43	0.48	0.67	0.4976				

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	$\sum \mu \cdot Gn-1$ [9]	$\mu_{Ct} \cap \mu \cdot Gn-1$ [10]	$\mu \cdot Gn$ (St,Qt) [11]	
					Demand [6]	F C [7]					
		1.6	3.4	3.4	0.75	0.43	0.65	0.68	0.6559		
		1.8	3.2	3.2	1.00	0.43	0.83	0.69	0.7001		
3.2	1	0.2	4	4	0.00	0.36	0.11	0.65	0.1616	0.7307	
		0.4	3.8	3.8	0.00	0.36	0.11	0.66	0.1624		
		0.6	3.6	3.6	0.00	0.36	0.11	0.67	0.1633		
		0.8	3.4	3.4	0.00	0.36	0.11	0.68	0.1641		
		1	3.2	3.2	0.00	0.36	0.11	0.69	0.1650		
	2	1.2	3	3	0.25	0.36	0.28	0.69	0.3235	0.6898	
		1.4	2.8	2.8	0.50	0.36	0.46	0.70	0.4819		
		1.6	2.6	2.6	0.75	0.36	0.63	0.71	0.6403		
		1.8	2.4	2.4	1.00	0.36	0.81	0.72	0.7307		
		1	4.2	4.2	0.00	0.36	0.11	0.65	0.1614		
2	1.2	4	4	0.25	0.36	0.28	0.65	0.3191	0.6898		
	1.4	3.8	3.8	0.50	0.36	0.46	0.66	0.4774			
	1.6	3.6	3.6	0.75	0.36	0.63	0.67	0.6358			
	1.8	3.4	3.4	1.00	0.36	0.81	0.68	0.6898			
	1	4.2	4.2	0.00	0.29	0.09	0.65	0.1421		0.7204	
0.4	4	4	0.00	0.29	0.09	0.65	0.1423				
0.6	3.8	3.8	0.00	0.29	0.09	0.66	0.1431				
0.8	3.6	3.6	0.00	0.29	0.09	0.67	0.1440				
1	3.4	3.4	0.00	0.29	0.09	0.68	0.1449				
3.4	1	1.2	3.2	3.2	0.25	0.29	0.26	0.69	0.3033	0.6800	
		1.4	3	3	0.50	0.29	0.44	0.69	0.4617		
		1.6	2.8	2.8	0.75	0.29	0.61	0.70	0.6201		
		1.8	2.6	2.6	1.00	0.29	0.79	0.71	0.7204		
		1.2	4.2	4.2	0.25	0.29	0.26	0.65	0.2996		
	2	1.4	4	4	0.50	0.29	0.44	0.65	0.4573	0.6800	
		1.6	3.8	3.8	0.75	0.29	0.61	0.66	0.6156		
		1.8	3.6	3.6	1.00	0.29	0.79	0.67	0.6800		
		0.4	4.2	4.2	0.00	0.21	0.06	0.65	0.1228		0.7100
		0.6	4	4	0.00	0.21	0.06	0.65	0.1230		
0.8	3.8	3.8	0.00	0.21	0.06	0.66	0.1239				
1	3.6	3.6	0.00	0.21	0.06	0.67	0.1247				
1.2	3.4	3.4	0.25	0.21	0.24	0.68	0.2831				
3.6	1	1.4	3.2	3.2	0.50	0.21	0.41	0.69	0.4415	0.6701	
		1.6	3	3	0.75	0.21	0.59	0.69	0.5999		
		1.8	2.8	2.8	1.00	0.21	0.76	0.70	0.7100		
		1.4	4.2	4.2	0.50	0.21	0.41	0.65	0.4378		
		1.6	4	4	0.75	0.21	0.59	0.65	0.5955		
	2	1.8	3.8	3.8	1.00	0.21	0.76	0.66	0.6701	0.6701	
		0.6	4.2	4.2	0.00	0.14	0.04	0.65	0.1035		0.6997
		0.8	4	4	0.00	0.14	0.04	0.65	0.1037		
		1	3.8	3.8	0.00	0.14	0.04	0.66	0.1046		
		1.2	3.6	3.6	0.25	0.14	0.22	0.67	0.2629		
3.8	1	1.4	3.4	3.4	0.50	0.14	0.39	0.68	0.4213	0.6603	
		1.6	3.2	3.2	0.75	0.14	0.57	0.69	0.5797		
		1.8	3	3	1.00	0.14	0.74	0.69	0.6997		
		1.6	4.2	4.2	0.75	0.14	0.57	0.65	0.5760		
		1.8	4	4	1.00	0.14	0.74	0.65	0.6603		
	2	0.8	4.2	4.2	0.00	0.07	0.02	0.65	0.0842	0.6894	
		1	4	4	0.00	0.07	0.02	0.65	0.0844		
		1.2	3.8	3.8	0.25	0.07	0.20	0.66	0.2428		
		1.4	3.6	3.6	0.50	0.07	0.37	0.67	0.4012		
		1.6	3.4	3.4	0.75	0.07	0.55	0.68	0.5595		
4	1	1.8	3.2	3.2	1.00	0.07	0.72	0.69	0.6894	0.6562	
		1.8	4.2	4.2	1.00	0.07	0.72	0.65	0.6562		
		1.2	4.2	4.2	0.00	0.00	0.00	0.65	0.0649		0.6791
		1.4	4	4	0.25	0.00	0.18	0.65	0.2226		
		1.6	3.8	3.8	0.50	0.00	0.35	0.66	0.3810		
	1.8	3.6	3.6	0.75	0.00	0.53	0.67	0.5393			
	2	1.8	3.4	3.4	1.00	0.00	0.70	0.68	0.6791	0.6540	
		1.8	4.4	4.2	1.00	0.00	0.70	0.65	0.6540		

August

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\mu \cdot G_{n-1}$	$\mu_{Ct} \cap$ $\mu \cdot G_{n-1}$	$\mu \cdot G_n$ (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.72	0.3419	0.6555
		0.4	2	2	0.00	1.00	0.30	0.73	0.3426	
		0.6	1.8	1.8	0.50	1.00	0.65	0.70	0.6555	
		0.8	1.6	1.6	1.00	1.00	1.00	0.53	0.5779	
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.71	0.3219	0.7319
		0.4	2.2	2.2	0.00	0.93	0.28	0.72	0.3226	
		0.6	2	2	0.50	0.93	0.63	0.73	0.6383	
		0.8	1.8	1.8	1.00	0.93	0.98	0.70	0.7319	
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.70	0.3018	0.7488
		0.4	2.4	2.4	0.00	0.86	0.26	0.71	0.3026	
		0.6	2.2	2.2	0.50	0.86	0.61	0.72	0.6184	
		0.8	2	2	1.00	0.86	0.96	0.73	0.7488	
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.70	0.2817	0.7408
		0.4	2.6	2.6	0.00	0.79	0.24	0.70	0.2825	
		0.6	2.4	2.4	0.50	0.79	0.59	0.71	0.5983	
		0.8	2.2	2.2	1.00	0.79	0.94	0.72	0.7408	
2.2	1	0.2	3	3	0.00	0.71	0.21	0.69	0.2617	0.7317
		0.4	2.8	2.8	0.00	0.71	0.21	0.70	0.2624	
		0.6	2.6	2.6	0.50	0.71	0.56	0.70	0.5782	
		0.8	2.4	2.4	1.00	0.71	0.91	0.71	0.7317	
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.68	0.2416	0.7222
		0.4	3	3	0.00	0.64	0.19	0.69	0.2424	
		0.6	2.8	2.8	0.50	0.64	0.54	0.70	0.5581	
		0.8	2.6	2.6	1.00	0.64	0.89	0.70	0.7222	
2.6	1	0.2	3.4	3.4	0.00	0.57	0.17	0.67	0.2215	0.7131
		0.4	3.2	3.2	0.00	0.57	0.17	0.68	0.2223	
		0.6	3	3	0.50	0.57	0.52	0.69	0.5381	
		0.8	2.8	2.8	1.00	0.57	0.87	0.70	0.7131	
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.66	0.2015	0.7040
		0.4	3.4	3.4	0.00	0.50	0.15	0.67	0.2023	
		0.6	3.2	3.2	0.50	0.50	0.50	0.68	0.5180	
		0.8	3	3	1.00	0.50	0.85	0.69	0.7040	
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.66	0.1815	0.6949
		0.4	3.6	3.6	0.00	0.43	0.13	0.66	0.1822	
		0.6	3.4	3.4	0.50	0.43	0.48	0.67	0.4980	
		0.8	3.2	3.2	1.00	0.43	0.83	0.68	0.6949	
3.2	1	0.2	4	4	0.00	0.36	0.11	0.65	0.1615	0.6858
		0.4	3.8	3.8	0.00	0.36	0.11	0.66	0.1622	
		0.6	3.6	3.6	0.50	0.36	0.46	0.66	0.4779	
		0.8	3.4	3.4	1.00	0.36	0.81	0.67	0.6858	
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.64	0.1415	0.6768
		0.4	4	4	0.00	0.29	0.09	0.65	0.1422	
		0.6	3.8	3.8	0.50	0.29	0.44	0.66	0.4579	
		0.8	3.6	3.6	1.00	0.29	0.79	0.66	0.6768	
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.64	0.1222	0.6682
		0.6	4	4	0.50	0.21	0.41	0.65	0.4379	
		0.8	3.8	3.8	1.00	0.21	0.76	0.66	0.6682	
3.8	1	0.6	4.2	4.2	0.50	0.14	0.39	0.64	0.4179	0.6596
		0.8	4	4	1.00	0.14	0.74	0.65	0.6596	
4	1	0.8	4.2	4.2	1.00	0.07	0.72	0.64	0.6511	0.6511
4.2	1	0.8	4.4	4.2	1.00	0.00	0.70	0.64	0.6489	0.6489

September

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St, Qt, Rt)	\sum $\mu \cdot \mu^{*Gn-1}$	$\mu_{Ct} \cap$ $\mu \cdot \mu^{*Gn-1}$	μ^{*Gn} (St, Qt)
					Demand [6]	F C [7]				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.68	0.3378	0.3402
		0.4	2	2	0.00	1.00	0.30	0.68	0.3385	
		0.6	1.8	1.8	0.00	1.00	0.30	0.69	0.3391	
		0.8	1.6	1.6	0.00	1.00	0.30	0.70	0.3397	
		1	1.4	1.4	0.00	1.00	0.30	0.70	0.3402	
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.67	0.3179	0.5310
		0.4	2.2	2.2	0.00	0.93	0.28	0.68	0.3186	
		0.6	2	2	0.00	0.93	0.28	0.68	0.3192	
		0.8	1.8	1.8	0.00	0.93	0.28	0.69	0.3199	
		1	1.6	1.6	0.00	0.93	0.28	0.70	0.3205	
1.2	1.4	1.4	0.33	0.93	0.51	0.70	0.5310			
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.67	0.2980	0.7045
		0.4	2.4	2.4	0.00	0.86	0.26	0.67	0.2987	
		0.6	2.2	2.2	0.00	0.86	0.26	0.68	0.2993	
		0.8	2	2	0.00	0.86	0.26	0.68	0.2999	
		1	1.8	1.8	0.00	0.86	0.26	0.69	0.3006	
1.2	1.6	1.6	0.33	0.86	0.49	0.70	0.5112			
1.4	1.4	1.4	0.67	0.86	0.72	0.70	0.7045			
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.66	0.2781	0.7257
		0.4	2.6	2.6	0.00	0.79	0.24	0.67	0.2788	
		0.6	2.4	2.4	0.00	0.79	0.24	0.67	0.2794	
		0.8	2.2	2.2	0.00	0.79	0.24	0.68	0.2800	
		1	2	2	0.00	0.79	0.24	0.68	0.2806	
1.2	1.8	1.8	0.33	0.79	0.47	0.69	0.4913			
1.4	1.6	1.6	0.67	0.79	0.70	0.70	0.6979			
1.6	1.4	1.4	1.00	0.79	0.94	0.70	0.7257			
2.2	1	0.2	3	3	0.00	0.71	0.21	0.65	0.2582	0.7191
		0.4	2.8	2.8	0.00	0.71	0.21	0.66	0.2589	
		0.6	2.6	2.6	0.00	0.71	0.21	0.67	0.2595	
		0.8	2.4	2.4	0.00	0.71	0.21	0.67	0.2601	
		1	2.2	2.2	0.00	0.71	0.21	0.68	0.2607	
1.2	2	2	0.33	0.71	0.45	0.68	0.4713			
1.4	1.8	1.8	0.67	0.71	0.68	0.69	0.6820			
1.6	1.6	1.6	1.00	0.71	0.91	0.70	0.7191			
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.65	0.2384	0.7114
		0.4	3	3	0.00	0.64	0.19	0.65	0.2390	
		0.6	2.8	2.8	0.00	0.64	0.19	0.66	0.2396	
		0.8	2.6	2.6	0.00	0.64	0.19	0.67	0.2402	
		1	2.4	2.4	0.00	0.64	0.19	0.67	0.2408	
1.2	2.2	2.2	0.33	0.64	0.43	0.68	0.4514			
1.4	2	2	0.67	0.64	0.66	0.68	0.6621			
1.6	1.8	1.8	1.00	0.64	0.89	0.69	0.7114			
2.6	1	0.2	3.4	3.4	0.00	0.57	0.17	0.64	0.2186	0.7033
		0.4	3.2	3.2	0.00	0.57	0.17	0.65	0.2191	
		0.6	3	3	0.00	0.57	0.17	0.65	0.2197	
		0.8	2.8	2.8	0.00	0.57	0.17	0.66	0.2203	
		1	2.6	2.6	0.00	0.57	0.17	0.67	0.2209	
1.2	2.4	2.4	0.33	0.57	0.40	0.67	0.4315			
1.4	2.2	2.2	0.67	0.57	0.64	0.68	0.6422			
1.6	2	2	1.00	0.57	0.87	0.68	0.7033			
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.64	0.1987	0.6955
		0.4	3.4	3.4	0.00	0.50	0.15	0.64	0.1993	
		0.6	3.2	3.2	0.00	0.50	0.15	0.65	0.1998	
		0.8	3	3	0.00	0.50	0.15	0.65	0.2004	
		1	2.8	2.8	0.00	0.50	0.15	0.66	0.2010	
1.2	2.6	2.6	0.33	0.50	0.38	0.67	0.4116			
1.4	2.4	2.4	0.67	0.50	0.62	0.67	0.6223			
1.6	2.2	2.2	1.00	0.50	0.85	0.68	0.6955			
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.63	0.1789	0.6878
		0.4	3.6	3.6	0.00	0.43	0.13	0.64	0.1794	
		0.6	3.4	3.4	0.00	0.43	0.13	0.64	0.1800	
		0.8	3.2	3.2	0.00	0.43	0.13	0.65	0.1806	
		1	3	3	0.00	0.43	0.13	0.65	0.1811	
1.2	2.8	2.8	0.33	0.43	0.36	0.66	0.3917			
1.4	2.6	2.6	0.67	0.43	0.60	0.67	0.6023			
1.6	2.4	2.4	1.00	0.43	0.83	0.67	0.6878			
3.2	1	0.2	4	4	0.00	0.36	0.11	0.63	0.1591	0.6800
		0.4	3.8	3.8	0.00	0.36	0.11	0.63	0.1596	
		0.6	3.6	3.6	0.00	0.36	0.11	0.64	0.1602	
		0.8	3.4	3.4	0.00	0.36	0.11	0.64	0.1607	
		1	3.2	3.2	0.00	0.36	0.11	0.65	0.1613	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	Σ μ^*Gn-1 [9]	$\mu_{Ct} \cap$ μ^*Gn-1 [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
		1.2	3	3	0.33	0.36	0.34	0.65	0.3718	
		1.4	2.8	2.8	0.67	0.36	0.57	0.66	0.5824	
		1.6	2.6	2.6	1.00	0.36	0.81	0.67	0.6800	
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.62	0.1394	0.6723
		0.4	4	4	0.00	0.29	0.09	0.63	0.1398	
		0.6	3.8	3.8	0.00	0.29	0.09	0.63	0.1403	
		0.8	3.6	3.6	0.00	0.29	0.09	0.64	0.1409	
		1	3.4	3.4	0.00	0.29	0.09	0.64	0.1414	
		1.2	3.2	3.2	0.33	0.29	0.32	0.65	0.3520	
		1.4	3	3	0.67	0.29	0.55	0.65	0.5626	
		1.6	2.8	2.8	1.00	0.29	0.79	0.66	0.6723	
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.62	0.1201	0.6647
		0.6	4	4	0.00	0.21	0.06	0.63	0.1205	
		0.8	3.8	3.8	0.00	0.21	0.06	0.63	0.1210	
		1	3.6	3.6	0.00	0.21	0.06	0.64	0.1216	
		1.2	3.4	3.4	0.33	0.21	0.30	0.64	0.3322	
		1.4	3.2	3.2	0.67	0.21	0.53	0.65	0.5427	
		1.6	3	3	1.00	0.21	0.76	0.65	0.6647	
3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.62	0.1008	0.6575
		0.8	4	4	0.00	0.14	0.04	0.63	0.1012	
		1	3.8	3.8	0.00	0.14	0.04	0.63	0.1018	
		1.2	3.6	3.6	0.33	0.14	0.28	0.64	0.3123	
		1.4	3.4	3.4	0.67	0.14	0.51	0.64	0.5229	
		1.6	3.2	3.2	1.00	0.14	0.74	0.65	0.6575	
4	1	0.8	4.2	4.2	0.00	0.07	0.02	0.62	0.0815	0.6504
		1	4	4	0.00	0.07	0.02	0.63	0.0819	
		1.2	3.8	3.8	0.33	0.07	0.25	0.63	0.2925	
		1.4	3.6	3.6	0.67	0.07	0.49	0.64	0.5030	
		1.6	3.4	3.4	1.00	0.07	0.72	0.64	0.6504	
4.2	1	1	4.2	4.2	0.00	0.00	0.00	0.62	0.0622	0.6433
		1.2	4	4	0.33	0.00	0.23	0.63	0.2726	
		1.4	3.8	3.8	0.67	0.00	0.47	0.63	0.4831	
		1.6	3.6	3.6	1.00	0.00	0.70	0.64	0.6433	

October

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	$\sum \mu \cdot \mu^{*Gn-1}$	$\mu_{Ct} \cap \mu^{*Gn-1}$	μ^{*Gn} (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.65	0.3352	0.7024
		0.4	2	2	0.00	1.00	0.30	0.66	0.3357	
		0.6	1.8	1.8	0.00	1.00	0.30	0.66	0.3362	
		0.8	1.6	1.6	0.50	1.00	0.65	0.67	0.6516	
		1	1.4	1.4	1.00	1.00	1.00	0.67	0.7024	
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.65	0.3155	0.6974
		0.4	2.2	2.2	0.00	0.93	0.28	0.65	0.3159	
		0.6	2	2	0.00	0.93	0.28	0.66	0.3164	
		0.8	1.8	1.8	0.50	0.93	0.63	0.66	0.6319	
		1	1.6	1.6	1.00	0.93	0.98	0.67	0.6974	
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.64	0.2958	0.6913
		0.4	2.4	2.4	0.00	0.86	0.26	0.65	0.2962	
		0.6	2.2	2.2	0.00	0.86	0.26	0.65	0.2967	
		0.8	2	2	0.50	0.86	0.61	0.66	0.6121	
		1	1.8	1.8	1.00	0.86	0.96	0.66	0.6913	
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.64	0.2760	0.6846
		0.4	2.6	2.6	0.00	0.79	0.24	0.64	0.2765	
		0.6	2.4	2.4	0.00	0.79	0.24	0.65	0.2769	
		0.8	2.2	2.2	0.50	0.79	0.59	0.65	0.5924	
		1	2	2	1.00	0.79	0.94	0.66	0.6846	
2.2	1	0.2	3	3	0.00	0.71	0.21	0.63	0.2563	0.6783
		0.4	2.8	2.8	0.00	0.71	0.21	0.64	0.2567	
		0.6	2.6	2.6	0.00	0.71	0.21	0.64	0.2572	
		0.8	2.4	2.4	0.50	0.71	0.56	0.65	0.5726	
		1	2.2	2.2	1.00	0.71	0.91	0.65	0.6783	
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.63	0.2366	0.6721
		0.4	3	3	0.00	0.64	0.19	0.63	0.2370	
		0.6	2.8	2.8	0.00	0.64	0.19	0.64	0.2375	
		0.8	2.6	2.6	0.50	0.64	0.54	0.64	0.5529	
		1	2.4	2.4	1.00	0.64	0.89	0.65	0.6721	
2.6	1	0.2	3.4	3.4	0.00	0.57	0.17	0.63	0.2170	0.6659
		0.4	3.2	3.2	0.00	0.57	0.17	0.63	0.2174	
		0.6	3	3	0.00	0.57	0.17	0.63	0.2177	
		0.8	2.8	2.8	0.50	0.57	0.52	0.64	0.5332	
		1	2.6	2.6	1.00	0.57	0.87	0.64	0.6659	
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.62	0.1973	0.6597
		0.4	3.4	3.4	0.00	0.50	0.15	0.63	0.1977	
		0.6	3.2	3.2	0.00	0.50	0.15	0.63	0.1981	
		0.8	3	3	0.50	0.50	0.50	0.63	0.5134	
		1	2.8	2.8	1.00	0.50	0.85	0.64	0.6597	
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.62	0.1776	0.6536
		0.4	3.6	3.6	0.00	0.43	0.13	0.62	0.1780	
		0.6	3.4	3.4	0.00	0.43	0.13	0.63	0.1784	
		0.8	3.2	3.2	0.50	0.43	0.48	0.63	0.4938	
		1	3	3	1.00	0.43	0.83	0.63	0.6536	
3.2	1	0.2	4	4	0.00	0.36	0.11	0.62	0.1580	0.6480
		0.4	3.8	3.8	0.00	0.36	0.11	0.62	0.1584	
		0.6	3.6	3.6	0.00	0.36	0.11	0.62	0.1587	
		0.8	3.4	3.4	0.50	0.36	0.46	0.63	0.4741	
		1	3.2	3.2	1.00	0.36	0.81	0.63	0.6480	
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.61	0.1385	0.6425
		0.4	4	4	0.00	0.29	0.09	0.62	0.1387	
		0.6	3.8	3.8	0.00	0.29	0.09	0.62	0.1391	
		0.8	3.6	3.6	0.50	0.29	0.44	0.62	0.4545	
		1	3.4	3.4	1.00	0.29	0.79	0.63	0.6425	
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.61	0.1192	0.6369
		0.6	4	4	0.00	0.21	0.06	0.62	0.1194	
		0.8	3.8	3.8	0.50	0.21	0.41	0.62	0.4348	
		1	3.6	3.6	1.00	0.21	0.76	0.62	0.6369	
3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.61	0.0999	0.6314
		0.8	4	4	0.50	0.14	0.39	0.62	0.4151	
		1	3.8	3.8	1.00	0.14	0.74	0.62	0.6314	
4	1	0.8	4.2	4.2	0.50	0.07	0.37	0.61	0.3956	0.6258
		1	4	4	1.00	0.07	0.72	0.62	0.6258	
4.2	1	1	4.2	4.2	1.00	0.00	0.70	0.61	0.6218	0.6218

November

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\mu(\mu^*Gn-1)$	$\mu_{Ct} \cap$ $\mu(\mu^*Gn-1)$	μ^*Gn (St,Qt)	
					Demand	F C					
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.64	0.3336	0.6785	
		0.4	2	2	0.00	1.00	0.30	0.64	0.3340		
		0.6	1.8	1.8	0.50	1.00	0.65	0.64	0.6435		
	2	0.8	1.6	1.6	1.00	1.00	1.00	0.64	0.6785	0.6618	
		0.2	3.2	3.2	0.00	1.00	0.30	0.62	0.3316		
		0.4	3	3	0.00	1.00	0.30	0.62	0.3319		
	3	0.6	2.8	2.8	0.50	1.00	0.65	0.62	0.6242	0.6513	
		0.8	2.6	2.6	1.00	1.00	1.00	0.62	0.6618		
		0.2	4.2	4.2	0.00	1.00	0.30	0.60	0.3303		
	4	0.4	4	4	0.00	1.00	0.30	0.61	0.3306	0.6427	
		0.6	3.8	3.8	0.50	1.00	0.65	0.61	0.6136		
		0.8	3.6	3.6	1.00	1.00	1.00	0.61	0.6513		
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.63	0.3140	0.6763	
		0.4	2.2	2.2	0.00	0.93	0.28	0.64	0.3144		
		0.6	2	2	0.50	0.93	0.63	0.64	0.6297		
	2	0.8	1.8	1.8	1.00	0.93	0.98	0.64	0.6763	0.6570	
		0.2	3.4	3.4	0.00	0.93	0.28	0.61	0.3121		
		0.4	3.2	3.2	0.00	0.93	0.28	0.62	0.3123		
	3	0.6	3	3	0.50	0.93	0.63	0.62	0.6195	0.6464	
		0.8	2.8	2.8	1.00	0.93	0.98	0.62	0.6570		
		0.4	4.2	4.2	0.00	0.93	0.28	0.60	0.3111		
	4	0.6	4	4	0.50	0.93	0.63	0.61	0.6087	0.6406	
		0.8	3.8	3.8	1.00	0.93	0.98	0.61	0.6464		
		0.8	4.8	4.2	1.00	0.93	0.98	0.60	0.6406		
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.63	0.2944	0.6718	
		0.4	2.4	2.4	0.00	0.86	0.26	0.63	0.2947		
		0.6	2.2	2.2	0.50	0.86	0.61	0.64	0.6101		
	2	0.8	2	2	1.00	0.86	0.96	0.64	0.6718	0.6524	
		0.2	3.6	3.6	0.00	0.86	0.26	0.61	0.2925		
		0.4	3.4	3.4	0.00	0.86	0.26	0.61	0.2928		
	3	0.6	3.2	3.2	0.50	0.86	0.61	0.62	0.6080	0.6415	
		0.8	3	3	1.00	0.86	0.96	0.62	0.6524		
		0.6	4.2	4.2	0.50	0.86	0.61	0.60	0.6038		
	4	0.8	4	4	1.00	0.86	0.96	0.61	0.6415	0.6385	
		0.8	5	4.2	1.00	0.86	0.96	0.60	0.6385		
		0.2	2.8	2.8	0.00	0.79	0.24	0.63	0.2747		
2	1	0.4	2.6	2.6	0.00	0.79	0.24	0.63	0.2751	0.6663	
		0.6	2.4	2.4	0.50	0.79	0.59	0.63	0.5904		
		0.8	2.2	2.2	1.00	0.79	0.94	0.64	0.6663		
	2	0.2	3.8	3.8	0.00	0.79	0.24	0.61	0.2730	0.6477	
		0.4	3.6	3.6	0.00	0.79	0.24	0.61	0.2732		
		0.6	3.4	3.4	0.50	0.79	0.59	0.61	0.5885		
	3	0.8	3.2	3.2	1.00	0.79	0.94	0.62	0.6477	0.6366	
		0.8	4.2	4.2	1.00	0.79	0.94	0.60	0.6366		
		0.8	5.2	4.2	1.00	0.79	0.94	0.60	0.6363		
	2.2	1	0.2	3	3	0.00	0.71	0.21	0.62	0.2551	0.6609
			0.4	2.8	2.8	0.00	0.71	0.21	0.63	0.2554	
			0.6	2.6	2.6	0.50	0.71	0.56	0.63	0.5708	
2		0.8	2.4	2.4	1.00	0.71	0.91	0.63	0.6609	0.6434	
		0.2	4	4	0.00	0.71	0.21	0.61	0.2535		
		0.4	3.8	3.8	0.00	0.71	0.21	0.61	0.2537		
3		0.6	3.6	3.6	0.50	0.71	0.56	0.61	0.5690	0.6345	
		0.8	3.4	3.4	1.00	0.71	0.91	0.61	0.6434		
		0.8	4.4	4.2	1.00	0.71	0.91	0.60	0.6345		
4		0.8	5.4	4.2	1.00	0.71	0.91	0.60	0.6342	0.6342	
		0.2	3.2	3.2	0.00	0.64	0.19	0.62	0.2355		
		0.4	3	3	0.00	0.64	0.19	0.62	0.2358		
2.4	1	0.6	2.8	2.8	0.50	0.64	0.54	0.63	0.5512	0.6556	
		0.8	2.6	2.6	1.00	0.64	0.89	0.63	0.6556		
		0.2	4.2	4.2	0.00	0.64	0.19	0.60	0.2339		
	2	0.4	4	4	0.00	0.64	0.19	0.61	0.2342	0.6390	
		0.6	3.8	3.8	0.50	0.64	0.54	0.61	0.5494		
		0.8	3.6	3.6	1.00	0.64	0.89	0.61	0.6390		
	3	0.8	4.6	4.2	1.00	0.64	0.89	0.60	0.6324	0.6324	
		0.8	5.6	4.2	1.00	0.64	0.89	0.60	0.6320		
		0.2	3.4	3.4	0.00	0.57	0.17	0.62	0.2159		
	2.6	1	0.4	3.2	3.2	0.00	0.57	0.17	0.62	0.2162	0.6502
			0.6	3	3	0.50	0.57	0.52	0.62	0.5315	
			0.8	2.8	2.8	1.00	0.57	0.87	0.63	0.6502	
2		0.4	4.2	4.2	0.00	0.57	0.17	0.60	0.2147	0.6346	

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		$\mu_{Ct}(St, Qt, Rt)$ [8]	$\sum \mu^*Gn-1$ [9]	$\mu_{Ct} \cap \mu^*Gn-1$ [10]	$\mu^*Gn(St, Qt)$ [11]
					Demand [6]	F C [7]				
	3	0.6	4	4	0.50	0.57	0.52	0.61	0.5299	0.6302
		0.8	3.8	3.8	1.00	0.57	0.87	0.61	0.6346	
		0.8	4.8	4.2	1.00	0.57	0.87	0.60	0.6302	
		0.8	5.8	4.2	1.00	0.57	0.87	0.60	0.6299	
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.61	0.1963	0.6303
		0.4	3.4	3.4	0.00	0.50	0.15	0.62	0.1966	
		0.6	3.2	3.2	0.50	0.50	0.50	0.62	0.5119	
		0.8	3	3	1.00	0.50	0.85	0.62	0.6451	
	2	0.6	4.2	4.2	0.50	0.50	0.50	0.60	0.5104	
		0.8	4	4	1.00	0.50	0.85	0.61	0.6303	
		0.8	5	4.2	1.00	0.50	0.85	0.60	0.6281	
		0.8	6	4.2	1.00	0.50	0.85	0.60	0.6277	
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.61	0.1767	0.6259
		0.4	3.6	3.6	0.00	0.43	0.13	0.61	0.1770	
		0.6	3.4	3.4	0.50	0.43	0.48	0.62	0.4923	
		0.8	3.2	3.2	1.00	0.43	0.83	0.62	0.6399	
	2	0.8	4.2	4.2	1.00	0.43	0.83	0.60	0.6259	
		0.8	5.2	4.2	1.00	0.43	0.83	0.60	0.6259	
		0.8	6.2	4.2	1.00	0.43	0.83	0.60	0.6256	
		0.8	6.2	4.2	1.00	0.43	0.83	0.60	0.6256	
3.2	1	0.2	4	4	0.00	0.36	0.11	0.61	0.1571	0.6238
		0.4	3.8	3.8	0.00	0.36	0.11	0.61	0.1574	
		0.6	3.6	3.6	0.50	0.36	0.46	0.61	0.4727	
		0.8	3.4	3.4	1.00	0.36	0.81	0.62	0.6350	
	2	0.8	4.4	4.2	1.00	0.36	0.81	0.60	0.6238	
		0.8	5.4	4.2	1.00	0.36	0.81	0.60	0.6238	
		0.8	6.4	4.2	1.00	0.36	0.81	0.60	0.6235	
		0.8	6.4	4.2	1.00	0.36	0.81	0.60	0.6235	
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.60	0.1375	0.6216
		0.4	4	4	0.00	0.29	0.09	0.61	0.1378	
		0.6	3.8	3.8	0.50	0.29	0.44	0.61	0.4531	
		0.8	3.6	3.6	1.00	0.29	0.79	0.61	0.6301	
	2	0.8	4.6	4.2	1.00	0.29	0.79	0.60	0.6216	
		0.8	5.6	4.2	1.00	0.29	0.79	0.60	0.6216	
		0.8	6.6	4.2	1.00	0.29	0.79	0.60	0.6213	
		0.8	6.6	4.2	1.00	0.29	0.79	0.60	0.6213	
3.6	1	0.4	4.2	4.2	0.00	0.21	0.06	0.60	0.1182	0.6195
		0.6	4	4	0.50	0.21	0.41	0.61	0.4336	
		0.8	3.8	3.8	1.00	0.21	0.76	0.61	0.6251	
		0.8	4.8	4.2	1.00	0.21	0.76	0.60	0.6195	
	2	0.8	5.8	4.2	1.00	0.21	0.76	0.60	0.6195	
		0.8	6.8	4.2	1.00	0.21	0.76	0.60	0.6192	
		0.8	6.8	4.2	1.00	0.21	0.76	0.60	0.6192	
		0.8	6.8	4.2	1.00	0.21	0.76	0.60	0.6192	
3.8	1	0.6	4.2	4.2	0.50	0.14	0.39	0.60	0.4140	0.6173
		0.8	4	4	1.00	0.14	0.74	0.61	0.6202	
		0.8	5	4.2	1.00	0.14	0.74	0.60	0.6173	
		0.8	6	4.2	1.00	0.14	0.74	0.60	0.6174	
	2	0.8	7	4.2	1.00	0.14	0.74	0.60	0.6170	
		0.8	7	4.2	1.00	0.14	0.74	0.60	0.6170	
		0.8	7.2	4.2	1.00	0.07	0.72	0.60	0.6153	
		0.8	7.2	4.2	1.00	0.07	0.72	0.60	0.6153	
4	1	0.8	4.2	4.2	1.00	0.07	0.72	0.60	0.6153	0.6131
		0.8	5.2	4.2	1.00	0.07	0.72	0.60	0.6152	
		0.8	6.2	4.2	1.00	0.07	0.72	0.60	0.6152	
		0.8	7.2	4.2	1.00	0.07	0.72	0.60	0.6149	
	2	0.8	4.4	4.2	1.00	0.00	0.70	0.60	0.6131	
		0.8	5.4	4.2	1.00	0.00	0.70	0.60	0.6130	
		0.8	6.4	4.2	1.00	0.00	0.70	0.60	0.6131	
		0.8	7.4	4.2	1.00	0.00	0.70	0.60	0.6127	

December

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\mu \cdot \mu_{Gn-1}$	$\mu_{Ct} \cap$ $\mu \cdot \mu_{Gn-1}$	$\mu \cdot \mu_{Gn}$ (St,Qt)
					Demand	F C				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
1.4	1	0.2	2.2	2.2	0.00	1.00	0.30	0.62	0.3318	0.6389
		0.4	2	2	0.00	1.00	0.30	0.62	0.3321	
		0.6	1.8	1.8	0.00	1.00	0.30	0.62	0.3321	
	2	0.8	1.6	1.6	0.50	1.00	0.65	0.62	0.6186	0.6545
		1	1.4	1.4	1.00	1.00	1.00	0.60	0.6389	
		0.2	3.2	3.2	0.00	1.00	0.30	0.61	0.3305	
	3	0.4	3	3	0.00	1.00	0.30	0.61	0.3308	0.6423
		0.6	2.8	2.8	0.00	1.00	0.30	0.61	0.3311	
		0.8	2.6	2.6	0.50	1.00	0.65	0.61	0.6170	
	4	1	2.4	2.4	1.00	1.00	1.00	0.62	0.6545	0.6323
		0.2	4.2	4.2	0.00	1.00	0.30	0.59	0.3293	
		0.4	4	4	0.00	1.00	0.30	0.60	0.3295	
	5	0.6	3.8	3.8	0.00	1.00	0.30	0.60	0.3298	0.6332
		0.8	3.6	3.6	0.50	1.00	0.65	0.60	0.6051	
		1	3.4	3.4	1.00	1.00	1.00	0.60	0.6423	
	6	1	4.4	4.2	1.00	1.00	1.00	0.59	0.6323	0.6319
		1	5.4	4.2	1.00	1.00	1.00	0.59	0.6332	
		1	6.4	4.2	1.00	1.00	1.00	0.59	0.6319	
7	1	7.4	4.2	1.00	1.00	1.00	0.59	0.6346	0.6290	
	1	8.4	4.2	1.00	1.00	1.00	0.59	0.6290		
	1	9.4	4.2	1.00	1.00	1.00	0.59	0.6305		
1.6	1	0.2	2.4	2.4	0.00	0.93	0.28	0.62	0.3123	0.6515
		0.4	2.2	2.2	0.00	0.93	0.28	0.62	0.3126	
		0.6	2	2	0.00	0.93	0.28	0.62	0.3129	
	2	0.8	1.8	1.8	0.50	0.93	0.63	0.62	0.6222	0.6499
		1	1.6	1.6	1.00	0.93	0.98	0.62	0.6515	
		0.2	3.4	3.4	0.00	0.93	0.28	0.60	0.3110	
	3	0.4	3.2	3.2	0.00	0.93	0.28	0.61	0.3113	0.6380
		0.6	3	3	0.00	0.93	0.28	0.61	0.3115	
		0.8	2.8	2.8	0.50	0.93	0.63	0.61	0.6123	
	4	1	2.6	2.6	1.00	0.93	0.98	0.61	0.6499	0.6302
		0.4	4.2	4.2	0.00	0.93	0.28	0.59	0.3100	
		0.6	4	4	0.00	0.93	0.28	0.60	0.3103	
	5	0.8	3.8	3.8	0.50	0.93	0.63	0.60	0.6008	0.6311
		1	3.6	3.6	1.00	0.93	0.98	0.60	0.6380	
		1	4.6	4.2	1.00	0.93	0.98	0.59	0.6302	
	6	1	5.6	4.2	1.00	0.93	0.98	0.59	0.6311	0.6298
		1	6.6	4.2	1.00	0.93	0.98	0.59	0.6298	
		1	7.6	4.2	1.00	0.93	0.98	0.59	0.6324	
7	1	8.6	4.2	1.00	0.93	0.98	0.59	0.6268	0.6324	
	1	9.6	4.2	1.00	0.93	0.98	0.59	0.6268		
	1	9.6	4.2	1.00	0.93	0.98	0.59	0.6283		
1.8	1	0.2	2.6	2.6	0.00	0.86	0.26	0.61	0.2927	0.6551
		0.4	2.4	2.4	0.00	0.86	0.26	0.62	0.2930	
		0.6	2.2	2.2	0.00	0.86	0.26	0.62	0.2933	
	2	0.8	2	2	0.50	0.86	0.61	0.62	0.6086	0.6452
		1	1.8	1.8	1.00	0.86	0.96	0.62	0.6551	
		0.2	3.6	3.6	0.00	0.86	0.26	0.60	0.2915	
	3	0.4	3.4	3.4	0.00	0.86	0.26	0.60	0.2917	0.6336
		0.6	3.2	3.2	0.00	0.86	0.26	0.61	0.2920	
		0.8	3	3	0.50	0.86	0.61	0.61	0.6072	
	4	1	2.8	2.8	1.00	0.86	0.96	0.61	0.6452	0.6281
		0.6	4.2	4.2	0.00	0.86	0.26	0.59	0.2907	
		0.8	4	4	0.50	0.86	0.61	0.60	0.5964	
	5	1	3.8	3.8	1.00	0.86	0.96	0.60	0.6336	0.6290
		1	4.8	4.2	1.00	0.86	0.96	0.59	0.6281	
		1	5.8	4.2	1.00	0.86	0.96	0.59	0.6290	
	6	1	6.8	4.2	1.00	0.86	0.96	0.59	0.6276	0.6303
		1	7.8	4.2	1.00	0.86	0.96	0.59	0.6303	
		1	8.8	4.2	1.00	0.86	0.96	0.59	0.6247	
7	1	9.8	4.2	1.00	0.86	0.96	0.59	0.6262	0.6247	
	1	9.8	4.2	1.00	0.86	0.96	0.59	0.6262		
	1	9.8	4.2	1.00	0.86	0.96	0.59	0.6262		
2	1	0.2	2.8	2.8	0.00	0.79	0.24	0.61	0.2732	0.6527
		0.4	2.6	2.6	0.00	0.79	0.24	0.61	0.2735	
		0.6	2.4	2.4	0.00	0.79	0.24	0.62	0.2737	
	2	0.8	2.2	2.2	0.50	0.79	0.59	0.62	0.5890	0.6407
		1	2	2	1.00	0.79	0.94	0.62	0.6527	
		0.2	3.8	3.8	0.00	0.79	0.24	0.60	0.2719	
	3	0.4	3.6	3.6	0.00	0.79	0.24	0.60	0.2722	0.6293
		0.6	3.4	3.4	0.00	0.79	0.24	0.60	0.2724	
		0.8	3.2	3.2	0.50	0.79	0.59	0.61	0.5877	
4	1	3	3	1.00	0.79	0.94	0.61	0.6407	0.6293	
	1	3	3	1.00	0.79	0.94	0.61	0.6407		
	1	4.2	4.2	0.50	0.79	0.59	0.59	0.5864		

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μCt (St,Qt,Rt) [8]	$\sum \mu(\cdot)\mu^*Gn-1$ [9]	$\mu Ct \cap \mu(\cdot)\mu^*Gn-1$ [10]	μ^*Gn (St,Qt) [11]
					Demand [6]	F C [7]				
	4	1	4	4	1.00	0.79	0.94	0.60	0.6293	
	5	1	5	4.2	1.00	0.79	0.94	0.59	0.6259	0.6259
	6	1	6	4.2	1.00	0.79	0.94	0.59	0.6268	0.6268
	7	1	7	4.2	1.00	0.79	0.94	0.59	0.6255	0.6255
	8	1	8	4.2	1.00	0.79	0.94	0.59	0.6281	0.6281
	9	1	9	4.2	1.00	0.79	0.94	0.59	0.6225	0.6225
	10	1	10	4.2	1.00	0.79	0.94	0.59	0.6240	0.6240
2.2	1	0.2	3	3	0.00	0.71	0.21	0.61	0.2537	
		0.4	2.8	2.8	0.00	0.71	0.21	0.61	0.2539	
		0.6	2.6	2.6	0.00	0.71	0.21	0.61	0.2542	
		0.8	2.4	2.4	0.50	0.71	0.56	0.62	0.5694	
		1	2.2	2.2	1.00	0.71	0.91	0.62	0.6480	
	2	0.2	4	4	0.00	0.71	0.21	0.60	0.2524	0.6362
		0.4	3.8	3.8	0.00	0.71	0.21	0.60	0.2526	
		0.6	3.6	3.6	0.00	0.71	0.21	0.60	0.2529	
		0.8	3.4	3.4	0.50	0.71	0.56	0.60	0.5682	
		1	3.2	3.2	1.00	0.71	0.91	0.61	0.6362	
	3	1	4.2	4.2	1.00	0.71	0.91	0.59	0.6249	0.6249
	4	1	5.2	4.2	1.00	0.71	0.91	0.59	0.6238	0.6238
	5	1	6.2	4.2	1.00	0.71	0.91	0.59	0.6247	0.6247
	6	1	7.2	4.2	1.00	0.71	0.91	0.59	0.6234	0.6234
	7	1	8.2	4.2	1.00	0.71	0.91	0.59	0.6260	0.6260
	8	1	9.2	4.2	1.00	0.71	0.91	0.59	0.6204	0.6204
	9	1	10.2	4.2	1.00	0.71	0.91	0.59	0.6219	0.6219
2.4	1	0.2	3.2	3.2	0.00	0.64	0.19	0.61	0.2341	0.6433
		0.4	3	3	0.00	0.64	0.19	0.61	0.2344	
		0.6	2.8	2.8	0.00	0.64	0.19	0.61	0.2346	
		0.8	2.6	2.6	0.50	0.64	0.54	0.61	0.5499	
		1	2.4	2.4	1.00	0.64	0.89	0.62	0.6433	
	2	0.2	4.2	4.2	0.00	0.64	0.19	0.59	0.2329	0.6317
		0.4	4	4	0.00	0.64	0.19	0.60	0.2331	
		0.6	3.8	3.8	0.00	0.64	0.19	0.60	0.2333	
		0.8	3.6	3.6	0.50	0.64	0.54	0.60	0.5486	
		1	3.4	3.4	1.00	0.64	0.89	0.60	0.6317	
	3	1	4.4	4.2	1.00	0.64	0.89	0.59	0.6228	0.6228
	4	1	5.4	4.2	1.00	0.64	0.89	0.59	0.6216	0.6216
	5	1	6.4	4.2	1.00	0.64	0.89	0.59	0.6225	0.6225
	6	1	7.4	4.2	1.00	0.64	0.89	0.59	0.6212	0.6212
	7	1	8.4	4.2	1.00	0.64	0.89	0.59	0.6238	0.6238
	8	1	9.4	4.2	1.00	0.64	0.89	0.59	0.6182	0.6182
	9	1	10.4	4.2	1.00	0.64	0.89	0.59	0.6198	0.6198
2.6	1	0.2	3.4	3.4	0.00	0.57	0.17	0.60	0.2146	0.6387
		0.4	3.2	3.2	0.00	0.57	0.17	0.61	0.2149	
		0.6	3	3	0.00	0.57	0.17	0.61	0.2151	
		0.8	2.8	2.8	0.50	0.57	0.52	0.61	0.5303	
		1	2.6	2.6	1.00	0.57	0.87	0.61	0.6387	
	2	0.4	4.2	4.2	0.00	0.57	0.17	0.59	0.2136	0.6272
		0.6	4	4	0.00	0.57	0.17	0.60	0.2138	
		0.8	3.8	3.8	0.50	0.57	0.52	0.60	0.5291	
		1	3.6	3.6	1.00	0.57	0.87	0.60	0.6272	
	3	1	4.6	4.2	1.00	0.57	0.87	0.59	0.6206	0.6206
	4	1	5.6	4.2	1.00	0.57	0.87	0.59	0.6195	0.6195
	5	1	6.6	4.2	1.00	0.57	0.87	0.59	0.6204	0.6204
	6	1	7.6	4.2	1.00	0.57	0.87	0.59	0.6191	0.6191
	7	1	8.6	4.2	1.00	0.57	0.87	0.59	0.6217	0.6217
	8	1	9.6	4.2	1.00	0.57	0.87	0.59	0.6161	0.6161
	9	1	10.6	4.2	1.00	0.57	0.87	0.59	0.6176	0.6176
2.8	1	0.2	3.6	3.6	0.00	0.50	0.15	0.60	0.1951	0.6340
		0.4	3.4	3.4	0.00	0.50	0.15	0.60	0.1953	
		0.6	3.2	3.2	0.00	0.50	0.15	0.61	0.1956	
		0.8	3	3	0.50	0.50	0.50	0.61	0.5108	
		1	2.8	2.8	1.00	0.50	0.85	0.61	0.6340	
	2	0.6	4.2	4.2	0.00	0.50	0.15	0.59	0.1943	0.6227
		0.8	4	4	0.50	0.50	0.50	0.60	0.5095	
		1	3.8	3.8	1.00	0.50	0.85	0.60	0.6227	
	3	1	4.8	4.2	1.00	0.50	0.85	0.59	0.6185	0.6185
	4	1	5.8	4.2	1.00	0.50	0.85	0.59	0.6174	0.6174
	5	1	6.8	4.2	1.00	0.50	0.85	0.59	0.6182	0.6182
	6	1	7.8	4.2	1.00	0.50	0.85	0.59	0.6169	0.6169
	7	1	8.8	4.2	1.00	0.50	0.85	0.59	0.6196	0.6196
	8	1	9.8	4.2	1.00	0.50	0.85	0.59	0.6140	0.6140
	9	1	10.8	4.2	1.00	0.50	0.85	0.59	0.6155	0.6155
3	1	0.2	3.8	3.8	0.00	0.43	0.13	0.60	0.1756	0.6298

Storage St [1]	Inflow Qt [2]	Release Rt [3]	St + Qt - Rt [4]	Storage St+1 [5]	μ		μ_{Ct} (St,Qt,Rt) [8]	Σ $\mu \cdot \mu^{*Gn-1}$ [9]	$\mu_{Ct} \cap$ $\mu \cdot \mu^{*Gn-1}$ [10]	μ^{*Gn} (St,Qt) [11]
					Demand [6]	F C [7]				
	2	0.4	3.6	3.6	0.00	0.43	0.13	0.60	0.1758	0.6184
		0.6	3.4	3.4	0.00	0.43	0.13	0.60	0.1761	
		0.8	3.2	3.2	0.50	0.43	0.48	0.61	0.4913	
		1	3	3	1.00	0.43	0.83	0.61	0.6298	
		0.8	4.2	4.2	0.50	0.43	0.48	0.59	0.4900	
		1	4	4	1.00	0.43	0.83	0.60	0.6184	
		1	5	4.2	1.00	0.43	0.83	0.59	0.6163	
		1	6	4.2	1.00	0.43	0.83	0.59	0.6152	
		1	7	4.2	1.00	0.43	0.83	0.59	0.6161	
3.2	1	0.2	4	4	0.00	0.36	0.11	0.60	0.1561	0.6256
		0.4	3.8	3.8	0.00	0.36	0.11	0.60	0.1563	
		0.6	3.6	3.6	0.00	0.36	0.11	0.60	0.1565	
		0.8	3.4	3.4	0.50	0.36	0.46	0.60	0.4718	
		1	3.2	3.2	1.00	0.36	0.81	0.61	0.6256	
		1	4.2	4.2	1.00	0.36	0.81	0.59	0.6141	
		1	5.2	4.2	1.00	0.36	0.81	0.59	0.6142	
		1	6.2	4.2	1.00	0.36	0.81	0.59	0.6131	
		1	7.2	4.2	1.00	0.36	0.81	0.59	0.6140	
3.4	1	0.2	4.2	4.2	0.00	0.29	0.09	0.59	0.1366	0.6213
		0.4	4	4	0.00	0.29	0.09	0.60	0.1368	
		0.6	3.8	3.8	0.00	0.29	0.09	0.60	0.1370	
		0.8	3.6	3.6	0.50	0.29	0.44	0.60	0.4523	
		1	3.4	3.4	1.00	0.29	0.79	0.60	0.6213	
		1	4.4	4.2	1.00	0.29	0.79	0.59	0.6120	
		1	5.4	4.2	1.00	0.29	0.79	0.59	0.6120	
		1	6.4	4.2	1.00	0.29	0.79	0.59	0.6109	
		1	7.4	4.2	1.00	0.29	0.79	0.59	0.6118	
3.6	1	0.2	4.2	4.2	0.00	0.21	0.06	0.59	0.1173	0.6171
		0.6	4	4	0.00	0.21	0.06	0.60	0.1175	
		0.8	3.8	3.8	0.50	0.21	0.41	0.60	0.4327	
		1	3.6	3.6	1.00	0.21	0.76	0.60	0.6171	
		1	4.6	4.2	1.00	0.21	0.76	0.59	0.6098	
		1	5.6	4.2	1.00	0.21	0.76	0.59	0.6099	
		1	6.6	4.2	1.00	0.21	0.76	0.59	0.6088	
		1	7.6	4.2	1.00	0.21	0.76	0.59	0.6097	
		1	8.6	4.2	1.00	0.21	0.76	0.59	0.6084	
3.8	1	0.6	4.2	4.2	0.00	0.14	0.04	0.59	0.0980	0.6128
		0.8	4	4	0.50	0.14	0.39	0.60	0.4132	
		1	3.8	3.8	1.00	0.14	0.74	0.60	0.6128	
		1	4.8	4.2	1.00	0.14	0.74	0.59	0.6077	
		1	5.8	4.2	1.00	0.14	0.74	0.59	0.6078	
		1	6.8	4.2	1.00	0.14	0.74	0.59	0.6066	
		1	7.8	4.2	1.00	0.14	0.74	0.59	0.6075	
		1	8.8	4.2	1.00	0.14	0.74	0.59	0.6062	
		1	9.8	4.2	1.00	0.14	0.74	0.59	0.6088	
4	1	0.8	4.2	4.2	0.50	0.07	0.37	0.59	0.3937	0.6086
		1	4	4	1.00	0.07	0.72	0.60	0.6086	
		1	5	4.2	1.00	0.07	0.72	0.59	0.6055	
		1	6	4.2	1.00	0.07	0.72	0.59	0.6056	
		1	7	4.2	1.00	0.07	0.72	0.59	0.6045	
		1	8	4.2	1.00	0.07	0.72	0.59	0.6054	
		1	9	4.2	1.00	0.07	0.72	0.59	0.6041	
		1	10	4.2	1.00	0.07	0.72	0.59	0.6067	
		1	11	4.2	1.00	0.07	0.72	0.59	0.6011	
4.2	1	1	4.2	4.2	1.00	0.00	0.70	0.59	0.6043	0.6043
		1	4.2	4.2	1.00	0.00	0.70	0.59	0.6043	0.6043

Storage St	Inflow Qt	Release Rt	St + Qt - Rt	Storage St+1	μ		μ_{Ct} (St,Qt,Rt)	\sum $\rho(\cdot)\mu^*G_{n-1}$	$\mu_{Ct} \cap$ $\rho(\cdot)\mu^*G_{n-1}$	μ^*G_n (St,Qt)
					Demand [6]	F C [7]				
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
	2	1	5.2	4.2	1.00	0.00	0.70	0.59	0.6034	0.6034
	3	1	6.2	4.2	1.00	0.00	0.70	0.59	0.6035	0.6035
	4	1	7.2	4.2	1.00	0.00	0.70	0.59	0.6023	0.6023
	5	1	8.2	4.2	1.00	0.00	0.70	0.59	0.6032	0.6032
	6	1	9.2	4.2	1.00	0.00	0.70	0.59	0.6019	0.6019
	7	1	10.2	4.2	1.00	0.00	0.70	0.59	0.6046	0.6046
	8	1	11.2	4.2	1.00	0.00	0.70	0.59	0.5990	0.5990
	9	1	12.2	4.2	1.00	0.00	0.70	0.59	0.6005	0.6005

Procedure

- [1] Storage state
- [2] Inflow state
- [3] column [7] initial condition
- [4] column [8] initial condition
- [5] column [9] initial condition
- [6] column [10] initial condition
- [7] column [11] initial condition
- [8] column [12] initial condition
- [9] $\sum(\rho(Q_{t+1}|Q_t), \mu^*G_{n-1}(S_{t+1}, Q_{t+1}))$
- [10] equation 4.8
- [11] max [10] in the same storage and inflow states

Table 4.7 Optimal Reservoir Operation based on FSDP

January

Storage St	Inflow Qt	Release Rt	DOF μ	Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.3305	3	1	1.6	0.6183
	2	1.6	0.6390		2	1.6	0.6083
	3	1.6	0.6331		3	1.6	0.6030
	4	1.6	0.6292		4	1.6	0.6091
	5	1.6	0.6214		5	1.6	0.6043
	6	1.6	0.6255		6	1.6	0.6084
	7	1.6	0.6254		7	1.6	0.6083
	8	1.6	0.6139		8	1.6	0.5967
	9	1.6	0.6194		9	1.6	0.6023
1.6	1	1.2	0.5212	3.2	1	1.6	0.6143
	2	1.6	0.6362		2	1.6	0.6042
	3	1.6	0.6294		3	1.6	0.6009
	4	1.6	0.6260		4	1.6	0.6069
	5	1.6	0.6193		5	1.6	0.6022
	6	1.6	0.6234		6	1.6	0.6063
	7	1.6	0.6233		7	1.6	0.6062
	8	1.6	0.6117		8	1.6	0.5946
	9	1.6	0.6173		9	1.6	0.6001
1.8	1	1.4	0.6166	3.4	1	1.6	0.6102
	2	1.6	0.6321		2	1.6	0.6002
	3	1.6	0.6254		3	1.6	0.5988
	4	1.6	0.6219		4	1.6	0.6048
	5	1.6	0.6172		5	1.6	0.6000
	6	1.6	0.6213		6	1.6	0.6041
	7	1.6	0.6212		7	1.6	0.6040
	8	1.6	0.6096		8	1.6	0.5925
	9	1.6	0.6151		9	1.6	0.5980
2	1	1.6	0.6378	3.6	1	1.6	0.6061
	2	1.6	0.6287		2	1.6	0.5961
	3	1.6	0.6215		3	1.6	0.5966
	4	1.6	0.6198		4	1.6	0.6026
	5	1.6	0.6150		5	1.6	0.5979
	6	1.6	0.6191		6	1.6	0.6020
	7	1.6	0.6190		7	1.6	0.6019
	8	1.6	0.6075		8	1.6	0.5903
	9	1.6	0.6130		9	1.6	0.5958
2.2	1	1.6	0.6332	3.8	1	1.6	0.6020
	2	1.6	0.6246		2	1.6	0.5920
	3	1.6	0.6174		3	1.6	0.5945
	4	1.6	0.6176		4	1.6	0.6005
	5	1.6	0.6129		5	1.6	0.5957
	6	1.6	0.6170		6	1.6	0.5998
	7	1.6	0.6169		7	1.6	0.5997
	8	1.6	0.6053		8	1.6	0.5882
	9	1.6	0.6108		9	1.6	0.5937
2.4	1	1.6	0.6289	4	1	1.6	0.5980
	2	1.6	0.6205		2	1.6	0.5899
	3	1.6	0.6133		3	1.6	0.5923
	4	1.6	0.6155		4	1.6	0.5984
	5	1.6	0.6107		5	1.6	0.5936
	6	1.6	0.6148		6	1.6	0.5977
	7	1.6	0.6147		7	1.6	0.5976
	8	1.6	0.6032		8	1.6	0.5860
	9	1.6	0.6087		9	1.6	0.5916
2.6	1	1.6	0.6259	4.2	1	1.6	0.5939
	2	1.6	0.6164		2	1.6	0.5877
	3	1.6	0.6093		3	1.6	0.5902
	4	1.6	0.6134		4	1.6	0.5962
	5	1.6	0.6086		5	1.6	0.5914
	6	1.6	0.6127		6	1.6	0.5955
	7	1.6	0.6126		7	1.6	0.5954
	8	1.6	0.6010		8	1.6	0.5839
	9	1.6	0.6065		9	1.6	0.5894
2.8	1	1.6	0.6219				
	2	1.6	0.6124				
	3	1.6	0.6052				
	4	1.6	0.6112				
	5	1.6	0.6065				
	6	1.6	0.6106				
	7	1.6	0.6104				
	8	1.6	0.5989				
	9	1.6	0.6044				

February

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.5378
	2	1.2	0.5982
	3	1.2	0.6098
	4	1.2	0.6167
	5	1.2	0.5772
	6	1.2	0.6012
1.6	1	1.2	0.5707
	2	1.2	0.5965
	3	1.2	0.6058
	4	1.2	0.6146
	5	1.2	0.5751
	6	1.2	0.5991
1.8	1	1.2	0.5818
	2	1.2	0.5991
	3	1.2	0.6029
	4	1.2	0.6124
	5	1.2	0.5729
	6	1.2	0.5969
2	1	1.2	0.5793
	2	1.2	0.6006
	3	1.2	0.6049
	4	1.2	0.6103
	5	1.2	0.5708
	6	1.2	0.5948
2.2	1	1.2	0.5785
	2	1.2	0.6007
	3	1.2	0.6028
	4	1.2	0.6081
	5	1.2	0.5686
	6	1.2	0.5926
2.4	1	1.2	0.5881
	2	1.2	0.6019
	3	1.2	0.6026
	4	1.2	0.6060
	5	1.2	0.5665
	6	1.2	0.5905
2.6	1	1.2	0.5866
	2	1.2	0.5995
	3	1.2	0.6005
	4	1.2	0.6038
	5	1.2	0.5644
	6	1.2	0.5884
2.8	1	1.2	0.5864
	2	1.2	0.5966
	3	1.2	0.5984
	4	1.2	0.6017
	5	1.2	0.5622
	6	1.2	0.5862

Storage St	Inflow Qt	Release Rt	DOF μ
3	1	1.2	0.5859
	2	1.2	0.5990
	3	1.2	0.5962
	4	1.2	0.5996
	5	1.2	0.5601
	6	1.2	0.5841
3.2	1	1.2	0.5851
	2	1.2	0.5971
	3	1.2	0.5941
	4	1.2	0.5974
	5	1.2	0.5579
	6	1.2	0.5819
3.4	1	1.2	0.5830
	2	1.2	0.5972
	3	1.2	0.5919
	4	1.2	0.5953
	5	1.2	0.5558
	6	1.2	0.5798
3.6	1	1.2	0.5795
	2	1.2	0.5950
	3	1.2	0.5898
	4	1.2	0.5931
	5	1.2	0.5536
	6	1.2	0.5776
3.8	1	1.2	0.5767
	2	1.2	0.5929
	3	1.2	0.5876
	4	1.2	0.5910
	5	1.2	0.5515
	6	1.2	0.5755
4	1	1.2	0.5791
	2	1.2	0.5908
	3	1.2	0.5855
	4	1.2	0.5888
	5	1.2	0.5494
	6	1.2	0.5734
4.2	1	1.2	0.5771
	2	1.2	0.5886
	3	1.2	0.5833
	4	1.2	0.5867
	5	1.2	0.5472
	6	1.2	0.5712

March

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.3750
	2	1.2	0.5331
	3	1.2	0.5587
	4	1.2	0.6409
	5	1.2	0.5257
	6	1.2	0.6383
	7	1.2	0.6383
	8	1.2	0.6244
	9	1.2	0.6383
	10	1.2	0.6383
	11	1.2	0.6383
	12	1.2	0.6383
1.6	1	1.2	0.4078
	2	1.2	0.5416
	3	1.2	0.5837
	4	1.2	0.6387
	5	1.2	0.5236
	6	1.2	0.6362
	7	1.2	0.6362
	8	1.2	0.6223
	9	1.2	0.6362
	10	1.2	0.6362
	11	1.2	0.6362
	12	1.2	0.6362
1.8	1	1.2	0.3989
	2	1.2	0.5505
	3	1.2	0.5902
	4	1.2	0.6366
	5	1.2	0.5214
	6	1.2	0.6340
	7	1.2	0.6340
	8	1.2	0.6202
	9	1.2	0.6340
	10	1.2	0.6340
	11	1.2	0.6340
	12	1.2	0.6340
2	1	1	0.3999
	2	1.2	0.5602
	3	1.2	0.5931
	4	1.2	0.6344
	5	1.2	0.5193
	6	1.2	0.6319
	7	1.2	0.6319
	8	1.2	0.6180
	9	1.2	0.6319
	10	1.2	0.6319
	11	1.2	0.6319
	12	1.2	0.6319
2.2	1	1.2	0.4327
	2	1.2	0.5616
	3	1.2	0.6150
	4	1.2	0.6323
	5	1.2	0.5171
	6	1.2	0.6297
	7	1.2	0.6297
	8	1.2	0.6159
	9	1.2	0.6297
	10	1.2	0.6297
	11	1.2	0.6297
	12	1.2	0.6297
2.4	1	1.2	0.4360
	2	1.2	0.5629
	3	1.2	0.6172
	4	1.2	0.6302
	5	1.2	0.5150
	6	1.2	0.6276
	7	1.2	0.6276
	8	1.2	0.6137
	9	1.2	0.6276
	10	1.2	0.6276
	11	1.2	0.6276
	12	1.2	0.6276

Storage St	Inflow Qt	Release Rt	DOF μ
2.6	1	1.2	0.4453
	2	1.2	0.5728
	3	1.2	0.6151
	4	1.2	0.6280
	5	1.2	0.5129
	6	1.2	0.6255
	7	1.2	0.6255
	8	1.2	0.6116
	9	1.2	0.6255
	10	1.2	0.6255
	11	1.2	0.6255
	12	1.2	0.6255
2.8	1	1.2	0.4539
	2	1.2	0.5801
	3	1.2	0.6129
	4	1.2	0.6259
	5	1.2	0.5107
	6	1.2	0.6233
	7	1.2	0.6233
	8	1.2	0.6094
	9	1.2	0.6233
	10	1.2	0.6233
	11	1.2	0.6233
	12	1.2	0.6233
3	1	1.2	0.4646
	2	1.2	0.5818
	3	1.2	0.6108
	4	1.2	0.6237
	5	1.2	0.5086
	6	1.2	0.6212
	7	1.2	0.6212
	8	1.2	0.6073
	9	1.2	0.6212
	10	1.2	0.6212
	11	1.2	0.6212
	12	1.2	0.6212
3.2	1	1.2	0.4639
	2	1.2	0.5944
	3	1.2	0.6086
	4	1.2	0.6216
	5	1.2	0.5064
	6	1.2	0.6190
	7	1.2	0.6190
	8	1.2	0.6052
	9	1.2	0.6190
	10	1.2	0.6190
	11	1.2	0.6190
	12	1.2	0.6190
3.4	1	1.2	0.4618
	2	1.2	0.5970
	3	1.2	0.6065
	4	1.2	0.6194
	5	1.2	0.5043
	6	1.2	0.6169
	7	1.2	0.6169
	8	1.2	0.6030
	9	1.2	0.6169
	10	1.2	0.6169
	11	1.2	0.6169
	12	1.2	0.6169
3.6	1	1.2	0.4652
	2	1.2	0.5949
	3	1.2	0.6043
	4	1.2	0.6173
	5	1.2	0.5021
	6	1.2	0.6147
	7	1.2	0.6147
	8	1.2	0.6009
	9	1.2	0.6147
	10	1.2	0.6147
	11	1.2	0.6147
	12	1.2	0.6147

Storage St	Inflow Qt	Release Rt	DOF μ
3.8	1	1.2	0.4917
	2	1.2	0.5928
	3	1.2	0.6022
	4	1.2	0.6152
	5	1.2	0.5000
	6	1.2	0.6126
	7	1.2	0.6126
	8	1.2	0.5987
	9	1.2	0.6126
	10	1.2	0.6126
	11	1.2	0.6126
	12	1.2	0.6126
4	1	1.2	0.4991
	2	1.2	0.5906
	3	1.2	0.6001
	4	1.2	0.6130
	5	1.2	0.4979
	6	1.2	0.6105
	7	1.2	0.6105
	8	1.2	0.5966
	9	1.2	0.6105
	10	1.2	0.6105
	11	1.2	0.6105
	12	1.2	0.6105

Storage St	Inflow Qt	Release Rt	DOF μ
4.2	1	1.2	0.5154
	2	1.2	0.5885
	3	1.2	0.5979
	4	1.2	0.6109
	5	1.2	0.4957
	6	1.2	0.6083
	7	1.2	0.6083
	8	1.2	0.5944
	9	1.2	0.6083
	10	1.2	0.6083
	11	1.2	0.6083
	12	1.2	0.6083

April

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.3046
	2	2	0.3759
	3	1.8	0.3725
	4	1.8	0.4878
	5	2.2	0.6141
	6	2.4	0.6281
	7	2.4	0.6281
	8	2.4	0.6281
	9	2.4	0.6281
	10	2.4	0.6281
1.6	1	0.2	0.2877
	2	2.2	0.3878
	3	2	0.3843
	4	1.8	0.5485
	5	2.4	0.6260
	6	2.4	0.6260
	7	2.4	0.6260
	8	2.4	0.6260
	9	2.4	0.6260
	10	2.4	0.6260
1.8	1	0.2	0.2735
	2	2.4	0.3996
	3	2.2	0.3962
	4	2	0.5604
	5	2.4	0.6238
	6	2.4	0.6238
	7	2.4	0.6238
	8	2.4	0.6238
	9	2.4	0.6238
	10	2.4	0.6238
2	1	1.6	0.3491
	2	2.4	0.3942
	3	2.4	0.4080
	4	2.2	0.5722
	5	2.4	0.6217
	6	2.4	0.6217
	7	2.4	0.6217
	8	2.4	0.6217
	9	2.4	0.6217
	10	2.4	0.6217
2.2	1	1.8	0.3609
	2	2.4	0.3856
	3	1.8	0.4168
	4	2	0.6001
	5	2.4	0.6196
	6	2.4	0.6196
	7	2.4	0.6196
	8	2.4	0.6196
	9	2.4	0.6196
	10	2.4	0.6196
2.4	1	2	0.3728
	2	1.8	0.4043
	3	1.8	0.4289
	4	2.2	0.6119
	5	2.4	0.6174
	6	2.4	0.6174
	7	2.4	0.6174
	8	2.4	0.6174
	9	2.4	0.6174
	10	2.4	0.6174
2.6	1	2.2	0.3847
	2	2	0.4162
	3	1.8	0.4573
	4	2.4	0.6238
	5	2.4	0.6153
	6	2.4	0.6153
	7	2.4	0.6153
	8	2.4	0.6153
	9	2.4	0.6153
	10	2.4	0.6153
2.8	1	2.4	0.3965
	2	1.8	0.4302
	3	2	0.5158
	4	2.4	0.6216
	5	2.4	0.6131
	6	2.4	0.6131
	7	2.4	0.6131
	8	2.4	0.6131
	9	2.4	0.6131
	10	2.4	0.6131

Storage St	Inflow Qt	Release Rt	DOF μ
3	1	2.4	0.3934
	2	2	0.4430
	3	2.2	0.5276
	4	2.4	0.6195
	5	2.4	0.6110
	6	2.4	0.6110
	7	2.4	0.6110
	8	2.4	0.6110
	9	2.4	0.6110
	10	2.4	0.6110
3.2	1	2.4	0.3876
	2	2	0.4567
	3	2.4	0.5395
	4	2.4	0.6174
	5	2.4	0.6088
	6	2.4	0.6088
	7	2.4	0.6088
	8	2.4	0.6088
	9	2.4	0.6088
	10	2.4	0.6088
3.4	1	2	0.3831
	2	2	0.4823
	3	2.2	0.5927
	4	2.4	0.6152
	5	2.4	0.6067
	6	2.4	0.6067
	7	2.4	0.6067
	8	2.4	0.6067
	9	2.4	0.6067
	10	2.4	0.6067
3.6	1	2	0.4272
	2	2.2	0.4942
	3	2.4	0.6046
	4	2.4	0.6131
	5	2.4	0.6046
	6	2.4	0.6046
	7	2.4	0.6046
	8	2.4	0.6046
	9	2.4	0.6046
	10	2.4	0.6046
3.8	1	2.2	0.4390
	2	2.2	0.5076
	3	2.4	0.6024
	4	2.4	0.6109
	5	2.4	0.6024
	6	2.4	0.6024
	7	2.4	0.6024
	8	2.4	0.6024
	9	2.4	0.6024
	10	2.4	0.6024
4	1	2.4	0.4509
	2	2.2	0.5631
	3	2.4	0.6003
	4	2.4	0.6088
	5	2.4	0.6003
	6	2.4	0.6003
	7	2.4	0.6003
	8	2.4	0.6003
	9	2.4	0.6003
	10	2.4	0.6003
4.2	1	2.2	0.4730
	2	2.4	0.5750
	3	2.4	0.5981
	4	2.4	0.6066
	5	2.4	0.5981
	6	2.4	0.5981
	7	2.4	0.5981
	8	2.4	0.5981
	9	2.4	0.5981
	10	2.4	0.5981

May

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	0.2	0.3212
	2	2	0.3817
1.6	1	0.2	0.3126
	2	2.2	0.3913
1.8	1	0.2	0.2991
	2	2.4	0.4008
2	1	0.2	0.2810
	2	2.6	0.4103
2.2	1	0.4	0.2617
	2	2.2	0.4408
2.4	1	2	0.3129
	2	2.4	0.4503
2.6	1	2.2	0.3494
	2	2.4	0.5229
2.8	1	2.4	0.3589
	2	2.6	0.5441
3	1	2.6	0.3685
	2	2.6	0.5989
3.2	1	2.8	0.3780
	2	2.8	0.6379
3.4	1	2.4	0.4082
	2	2.8	0.6705
3.6	1	2.4	0.4240
	2	3	0.6915
3.8	1	2.6	0.5098
	2	3	0.6981
4	1	2.8	0.5212
	2	2.8	0.6070
4.2	1	2.8	0.5868
	2	3	0.6342

July

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	0.6	0.3449
	2	1.8	0.7587
1.6	1	1.2	0.4738
	2	1.8	0.7718
1.8	1	1.4	0.6120
	2	1.8	0.7624
2	1	1.6	0.6660
	2	1.8	0.7521
2.2	1	1.6	0.7326
	2	1.8	0.7414
2.4	1	1.8	0.7480
	2	1.8	0.7311
2.6	1	1.8	0.7611
	2	1.8	0.7207
2.8	1	1.8	0.7517
	2	1.8	0.7104
3	1	1.8	0.7414
	2	1.8	0.7001
3.2	1	1.8	0.7307
	2	1.8	0.6898
3.4	1	1.8	0.7204
	2	1.8	0.6800
3.6	1	1.8	0.7100
	2	1.8	0.6701
3.8	1	1.8	0.6997
	2	1.8	0.6603
4	1	1.8	0.6894
	2	1.8	0.6562
4.2	1	1.8	0.6791
	2	1.8	0.6540

June

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	0.2	0.3433
	2	2	0.7239
1.6	1	0.2	0.3255
	2	2.2	0.7667
1.8	1	0.2	0.3076
	2	2.4	0.7786
2	1	1.6	0.4052
	2	2.4	0.7882
2.2	1	1.8	0.5119
	2	2.4	0.7776
2.4	1	2	0.6186
	2	2.4	0.7662
2.6	1	2.2	0.6763
	2	2.4	0.7544
2.8	1	2.4	0.6881
	2	2.4	0.7430
3	1	2	0.5549
	2	2.4	0.7315
3.2	1	2.2	0.6175
	2	2.4	0.7201
3.4	1	2.2	0.6478
	2	2.4	0.7087
3.6	1	2.4	0.6758
	2	2.4	0.6973
3.8	1	2.4	0.7337
	2	2.4	0.6863
4	1	2.4	0.7241
	2	2.4	0.6753
4.2	1	2.4	0.7052
	2	2.4	0.6642

August

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	0.6	0.6555
1.6	1	0.8	0.7319
1.8	1	0.8	0.7488
2	1	0.8	0.7408
2.2	1	0.8	0.7317
2.4	1	0.8	0.7222
2.6	1	0.8	0.7131
2.8	1	0.8	0.7040
3	1	0.8	0.6949
3.2	1	0.8	0.6858
3.4	1	0.8	0.6768
3.6	1	0.8	0.6682
3.8	1	0.8	0.6596
4	1	0.8	0.6511
4.2	1	0.8	0.6489

Fuzzy Rule Base Modeling for Reservoir Operation

September

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.3402
1.6	1	1.2	0.5310
1.8	1	1.4	0.7045
2	1	1.6	0.7257
2.2	1	1.6	0.7191
2.4	1	1.6	0.7114
2.6	1	1.6	0.7033
2.8	1	1.6	0.6955
3	1	1.6	0.6878
3.2	1	1.6	0.6800
3.4	1	1.6	0.6723
3.6	1	1.6	0.6647
3.8	1	1.6	0.6575
4	1	1.6	0.6504
4.2	1	1.6	0.6433

October

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.7024
1.6	1	1	0.6974
1.8	1	1	0.6913
2	1	1	0.6846
2.2	1	1	0.6783
2.4	1	1	0.6721
2.6	1	1	0.6659
2.8	1	1	0.6597
3	1	1	0.6536
3.2	1	1	0.6480
3.4	1	1	0.6425
3.6	1	1	0.6369
3.8	1	1	0.6314
4	1	1	0.6258
4.2	1	1	0.6218

November

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	0.8	0.6785
	2	0.8	0.6618
	3	0.8	0.6513
	4	0.8	0.6427
1.6	1	0.8	0.6763
	2	0.8	0.6570
	3	0.8	0.6464
	4	0.8	0.6406
1.8	1	0.8	0.6718
	2	0.8	0.6524
	3	0.8	0.6415
	4	0.8	0.6385
2	1	0.8	0.6663
	2	0.8	0.6477
	3	0.8	0.6366
	4	0.8	0.6363
2.2	1	0.8	0.6609
	2	0.8	0.6434
	3	0.8	0.6345
	4	0.8	0.6342
2.4	1	0.8	0.6556
	2	0.8	0.6390
	3	0.8	0.6324
	4	0.8	0.6320
2.6	1	0.8	0.6502
	2	0.8	0.6346
	3	0.8	0.6302
	4	0.8	0.6299
2.8	1	0.8	0.6451
	2	0.8	0.6303
	3	0.8	0.6281
	4	0.8	0.6277

Storage St	Inflow Qt	Release Rt	DOF μ
3	1	0.8	0.6399
	2	0.8	0.6259
	3	0.8	0.6259
	4	0.8	0.6256
3.2	1	0.8	0.6350
	2	0.8	0.6238
	3	0.8	0.6238
	4	0.8	0.6235
3.4	1	0.8	0.6301
	2	0.8	0.6216
	3	0.8	0.6216
	4	0.8	0.6213
3.6	1	0.8	0.6251
	2	0.8	0.6195
	3	0.8	0.6195
	4	0.8	0.6192
3.8	1	0.8	0.6202
	2	0.8	0.6173
	3	0.8	0.6174
	4	0.8	0.6170
4	1	0.8	0.6153
	2	0.8	0.6152
	3	0.8	0.6152
	4	0.8	0.6149
4.2	1	0.8	0.6131
	2	0.8	0.6130
	3	0.8	0.6131
	4	0.8	0.6127

December

Storage St	Inflow Qt	Release Rt	DOF μ
1.4	1	1	0.6389
	2	1	0.6545
	3	1	0.6423
	4	1	0.6323
	5	1	0.6332
	6	1	0.6319
	7	1	0.6346
	8	1	0.6290
	9	1	0.6305
1.6	1	1	0.6515
	2	1	0.6499
	3	1	0.6380
	4	1	0.6302
	5	1	0.6311
	6	1	0.6298
	7	1	0.6324
	8	1	0.6268
	9	1	0.6283
1.8	1	1	0.6551
	2	1	0.6452
	3	1	0.6336
	4	1	0.6281
	5	1	0.6290
	6	1	0.6276
	7	1	0.6303
	8	1	0.6247
	9	1	0.6262
2	1	1	0.6527
	2	1	0.6407
	3	1	0.6293
	4	1	0.6259
	5	1	0.6268
	6	1	0.6255
	7	1	0.6281
	8	1	0.6225
	9	1	0.6240
2.2	1	1	0.6480
	2	1	0.6362
	3	1	0.6249
	4	1	0.6238
	5	1	0.6247
	6	1	0.6234
	7	1	0.6260
	8	1	0.6204
	9	1	0.6219
2.4	1	1	0.6433
	2	1	0.6317
	3	1	0.6228
	4	1	0.6216
	5	1	0.6225
	6	1	0.6212
	7	1	0.6238
	8	1	0.6182
	9	1	0.6198
2.6	1	1	0.6387
	2	1	0.6272
	3	1	0.6206
	4	1	0.6195
	5	1	0.6204
	6	1	0.6191
	7	1	0.6217
	8	1	0.6161
	9	1	0.6176
2.8	1	1	0.6340
	2	1	0.6227
	3	1	0.6185
	4	1	0.6174
	5	1	0.6182
	6	1	0.6169
	7	1	0.6196
	8	1	0.6140
	9	1	0.6155

Storage St	Inflow Qt	Release Rt	DOF μ
3	1	1	0.6298
	2	1	0.6184
	3	1	0.6163
	4	1	0.6152
	5	1	0.6161
	6	1	0.6148
	7	1	0.6174
	8	1	0.6118
	9	1	0.6133
3.2	1	1	0.6256
	2	1	0.6141
	3	1	0.6142
	4	1	0.6131
	5	1	0.6140
	6	1	0.6126
	7	1	0.6153
	8	1	0.6097
	9	1	0.6112
3.4	1	1	0.6213
	2	1	0.6120
	3	1	0.6120
	4	1	0.6109
	5	1	0.6118
	6	1	0.6105
	7	1	0.6131
	8	1	0.6075
	9	1	0.6090
3.6	1	1	0.6171
	2	1	0.6098
	3	1	0.6099
	4	1	0.6088
	5	1	0.6097
	6	1	0.6084
	7	1	0.6110
	8	1	0.6054
	9	1	0.6069
3.8	1	1	0.6128
	2	1	0.6077
	3	1	0.6078
	4	1	0.6066
	5	1	0.6075
	6	1	0.6062
	7	1	0.6088
	8	1	0.6032
	9	1	0.6048
4	1	1	0.6086
	2	1	0.6055
	3	1	0.6056
	4	1	0.6045
	5	1	0.6054
	6	1	0.6041
	7	1	0.6067
	8	1	0.6011
	9	1	0.6026
4.2	1	1	0.6043
	2	1	0.6034
	3	1	0.6035
	4	1	0.6023
	5	1	0.6032
	6	1	0.6019
	7	1	0.6046
	8	1	0.5990
	9	1	0.6005

CHAPTER V

FUZZY LOGIC PROGRAMMING

5.1. INTRODUCTION

The inherent imprecision and vagueness that characterize some or all of the objectives of most water resource systems require that new approaches be developed. Fuzzy set theory and fuzzy logic provide mathematical frameworks for dealing with vague objects and approximate reasoning.

In reservoir operation model where input incorporate are imprecision, while the output should fulfill all system requirements such as meeting various demands without violating the physical constraints of the system. An appropriate tool to handle such imprecise elements is fuzzy logic because the uncertainty does not only lie in the value of variable, say inflow, but also in the extent to which this variable belongs to a given imprecise (fuzzy) set, say “large inflow”. In fact, a given inflow value may belong simultaneously to more than one fuzzy set, each time to different extent. The fuzzy rule base is approach that operates on an IF-THEN principle, where the IF is a premise and THEN is a consequence.

Zadeh, who pioneered the development of fuzzy logic, introduced the concepts and the name “fuzzy”. Since the original paper, fuzzy logic has been developing and now is being used. The key ideas are that fuzzy logic allows something to be partly this and partly that, rather than having to be either all this or all that, and that the degree of “belongingness” to a set or category can be described numerically by a membership number between 0 and 1.

The guiding principle of fuzzy computing is to exploit the tolerance for imprecision, uncertainty and partial truth to achieve tractability and robustness. What makes fuzzy logic so important is the fact that most of human reasoning and concept formation is linked to the use of fuzzy rules. Here is a list of general observation about fuzzy logic (anonymous, 2002).

- Fuzzy logic is conceptually easy to understand.
- Fuzzy logic is flexible.

- Fuzzy logic is tolerant of imprecise data.
- Fuzzy logic can model nonlinear functions of arbitrary complexity.
- Fuzzy logic can be built on top of the experience of experts.
- Fuzzy logic can be blended with conventional control techniques.
- Fuzzy logic is based on natural language.

Şen (2004) defines a general fuzzy system, as shown in Figure 1. General fuzzy system according to the figure has the components of fuzzification, fuzzy rule base, fuzzy output engine, and defuzzification.

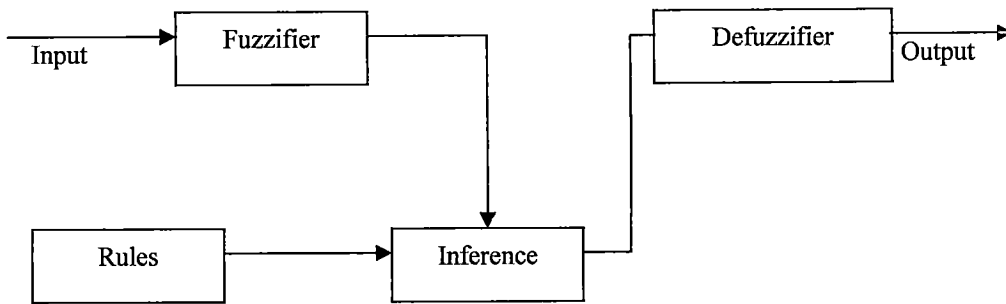


Figure 5.1 Fuzzy logic basic elements

The indication of intensity of belongingness is expressed by the membership function, assigning each element a number from the unit interval $[0, 1]$. Let X be a universal set then A is called the subset of X if A is a set of ordered pairs.

$$A = \{(x, \mu_A(x); x \in X, \mu_A(x) \in [0,1])\} \quad (5.1)$$

Where the function μ_A is the membership function of A . $\mu_A(x)$ is the grade of the membership of x in A .

Nowadays, fuzzy logic has been developed with the availability of computer technology. With the computer, one can undertake time consuming of fuzzy logic based analysis. The

concepts theory and applications of fuzzy logic are given in many textbook, for example Ross (1995), Zimmerman (1996), Jang et al. (1997), Klir et al. (2002), Şen (2004).

5.2 MEMBERSHIP FUNCTION

A fuzzy set is uniquely specified by its membership function. A membership function (MF) is a curve that defines input space is mapped to a membership value (or degree between 0 and 1). Membership function nomenclature describe more specifically as follows (Jang et al., 1997).

- Support

The support of a fuzzy set A is the set of all points x in X such that $\mu_A(x) > 0$

$$Support(A) = \{x | \mu_A(x) > 0\} \quad (5.2)$$

- Core

The core of a fuzzy set A is the set of all points x in X such that $\mu_A(x) = 1$

$$Core(A) = \{x | \mu_A(x) = 1\} \quad (5.3)$$

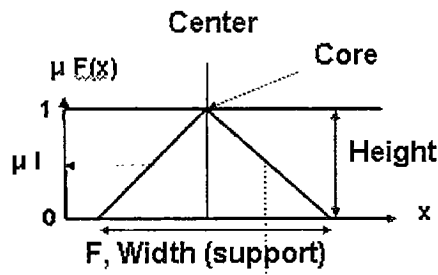


Figure 5.2 Membership Function

- Fuzzy singleton

A fuzzy set whose support is a single point in X is called a fuzzy singleton.

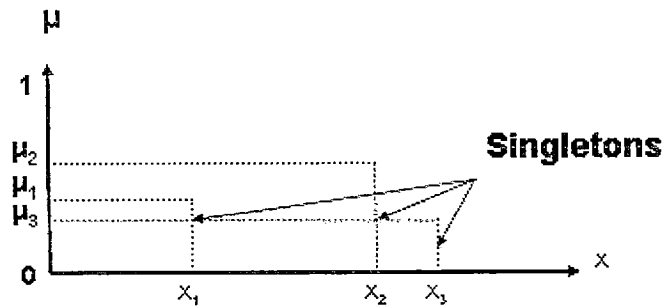


Figure 5.3 Fuzzy Singleton

Assessment of membership function is a crucial point in applying fuzzy methods. A simple and commonly used way of defining a triangular fuzzy number with respect to x consists in estimating three numbers (Shrestha, 1996):

1. The most credible value x^* , which is assigned a membership value of 1.
2. The number x^- which is almost certainly exceeded by the parameter value and is assigned a membership value of 0.
3. The number x^+ , which is almost certainly not exceeded by the parameter value and is also assigned a membership value of 0.

The membership function of triangular fuzzy number is obtained by taking the value 0 outside the interval (x^- and x^+) of its support and a piecewise linear function in between. The resulting membership function is not necessarily symmetrical.

Triangular fuzzy number is a fuzzy number $A = (a_1, a_2, a_3)$ with $a_1 \leq a_2 \leq a_3$ and its membership function can be written in the following form:

$$\mu(x, a_1, a_2, a_3) = \left\{ \begin{array}{ll} 0 & x \leq a_1 \\ \frac{x - a_1}{a_2 - a_1} & a_1 \leq x \leq a_2 \\ \frac{a_3 - x}{a_3 - a_2} & a_2 \leq x \leq a_3 \\ 0 & a_3 \leq x \end{array} \right\} \quad (5.4)$$

Due to their simple formulas and computational efficiency triangular membership function have been used extensively. However, since the membership function are composed of straight line segments, they are not smooth at the corner points specified by the parameter.

5.3 FUZZY RULES BASE

In the field of artificial intelligence there are various ways to represent knowledge. Perhaps the most common way to represent human knowledge is to form it into natural language expression of the type,

IF premise (antecedent) THEN conclusion (consequent)

The form is commonly referred to as the IF-THEN rule based form. It typically expresses an inference such that if known a fact (premise, hypothesis, antecedent) then it can infer or derive, another fact called a conclusion (consequent).

A fuzzy rule based model is a mathematical model based on a fuzzy rule system. A fuzzy rule system is defined as the set of rules which consists of sets of input variable or premises $A_{i,k}$ in the form of fuzzy sets with membership function $\mu_{A_{i,k}}$ and a set of consequences B_i also in the form of a fuzzy set.

$$IF a_1 \text{ is } A_{1,k} \text{ AND } a_2 \text{ is } A_{2,k} \text{ AND } \dots \text{ AND } a_k \text{ is } A_{i,k} \text{ THEN } B_i \quad (5.5)$$

For example in reservoir operation system, premises may consist of storage, inflows, demands and the consequence is volume release to meet a various demand. Assessment of rules is a procedure where knowledge and/or available data are translated or encoded into rules describing. Rule system responses depend on the choice of both combination and defuzzification methods.

Fuzzy rule base modeling is centered around the definition of a rule system. The different methods to do this are follows (Shrestha, 1996):

1. The rules are known by the experts and can be defined directly.
2. The rules can be assessed by the experts directly, but available data should be used to update them.

3. The rules are not known explicitly, but the variables required for the description of the system can be specified by the experts.
4. A rule system has to be constructed to describe the interconnections between the elements of the data set.

In the assessment of fuzzy rule base with the data sets, sets of input data along with the corresponding outputs are provided to the fuzzy system and it learns how to transform a set of inputs to the corresponding set of outputs through a fuzzy associative memory (FAM). A step by step procedure was used for setting up a fuzzy rule base from sets of input and output data. Two input variables x_1 and x_2 and one output variable y , are assumed for this explanation. i is index of the category of x_1 and j an index for x_2 . The FAM (fuzzy associative memory) as follows, is a matrix of output $y_{i,j}$ (Russel and Campbell, 1996).

1. Set up the problem with the minimum number of input variables.
2. Divide the range of each input and output variable into membership categories, each with a triangular or trapezoidal membership function.
3. For each data set m (1 value of x_1 , x_2 , and y) compute the membership values for x_1 ($w_{m,i}$) and x_2 ($w_{m,j}$) in each categories. Set membership values ($w_{m,i}$ and $w_{m,j}$) of less than 0.5 to zero.
4. Compute the weight of each rule i,j for data set m by multiplying the membership values of x_1 and x_2 that correspond to that rule and squaring the result.

$$w_{m,i,j} = [(w_{m,i})(w_{m,j})]^2 \quad (5.6)$$

5. Store the output y_m along with the complete set of rule weights $w_{m,i,j}$
6. Repeat with all the other data sets.
7. Compute output of $y_{i,j}$ from all stored values.

$$y_{i,j} = \frac{\sum (y_m)(w_{m,i,j})}{\sum (w_{m,i,j})} \quad (5.7)$$

8. Store the results in the FAM.

If each of the n inputs is partitioned into a different number of fuzzy partitions, say, X_1 is partitioned into k_1 partitions and X_2 is partitioned into k_2 partitions and so forth, then the maximum number of rules is given by

$$l = k_1 k_2 k_3 \dots k_n \quad (5.8)$$

Fuzzy Associative Memory (FAM) table is a compact graphical form which can be seen represent of general nonlinear mapping from the input space of the fuzzy system to the output space of the fuzzy system. Each rule or each fuzzy relation from input to the output that represents a fuzzy point of data characterizes the nonlinear mapping from the input to the output (Ross, 1995).

5.4 FUZZY INFERENCE SYSTEMS

The fuzzy inference system is a popular computing framework based on the concepts of fuzzy set theory, fuzzy IF-THEN rules and fuzzy reasoning. It has found successful applications in a wide variety of fields, such as automatic control, decision analysis, expert systems and time series prediction. The basic structure of fuzzy inference system consists of three conceptual components: a rule base, which contains a selection of fuzzy rules, a database, which defines the membership functions used in the fuzzy rules, and a reasoning mechanism, which performs the inference procedure upon the rules and given facts to derive a reasonable output or conclusion.

In general, fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. The process of fuzzy inference involves all of the pieces that are described in the previous sections: membership functions, fuzzy logic operators, and IF-THEN rules.

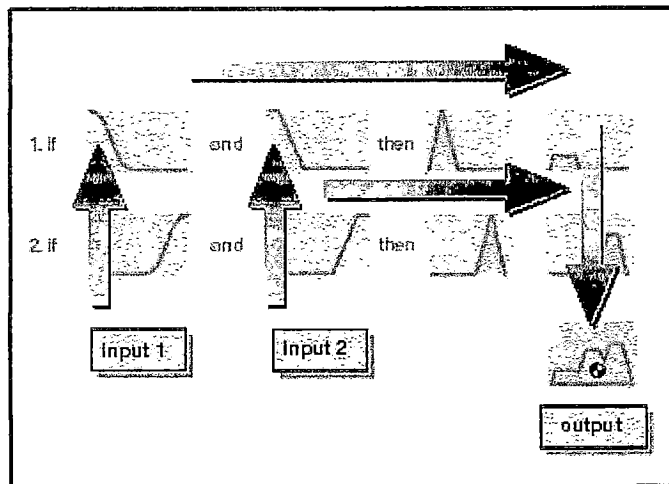


Figure 5.4 Fuzzy Inference System

Fuzzy inference control was first introduced by Mamdani and is based on Zadeh's theory of fuzzy sets. If the mathematical model of a process is deficient or complicated, or if the process is nonlinear or time dependent, or if it is difficult or impossible to control the process with the conventional methods, then fuzzy control is one of the most suitable methods for these types of problem. This control method provides an effective solution for nonlinear and partially unknown processes, mainly because of its ability to combine information from different sources, such as mathematical models, the experience of operators and process measurement (Karaboga et al., 2004).

Mamdani's fuzzy inference method is the most commonly seen fuzzy methodology. Mamdani's method was among the first control systems built using fuzzy set theory. It was proposed in 1975 by Ebrahim Mamdani as an attempt to control a steam engine and boiler combination by synthesizing a set of linguistic control rules obtained from experienced human operators. The advantages of Mamdani methods are (anonymous, 2002):

- It is intuitive.
- It has widespread acceptance.
- It is well suited to human input.

A basic fuzzy inference can be decomposed into four basic components. These are fuzzification, the knowledge base (rule base and database), decision making (inference mechanism) and defuzzification (Karaboga et al., 2004).

These sometimes cryptic and odd names have very specific meaning that will define carefully as step through each of them in more detail below.

➤ **Step 1. Fuzzify Inputs**

The first step is to take the inputs and determine the degree to which they belong to each of the appropriate fuzzy sets via membership functions. In the Fuzzy Logic, the input is always a crisp numerical value limited to the universe of discourse of the input variable and the output is a fuzzy degree of membership in the qualifying linguistic set (always the interval between 0 and 1). Fuzzification of the input amounts to either a table lookup or a function evaluation. Before the rules can be evaluated, the inputs must be fuzzified according to linguistic sets.

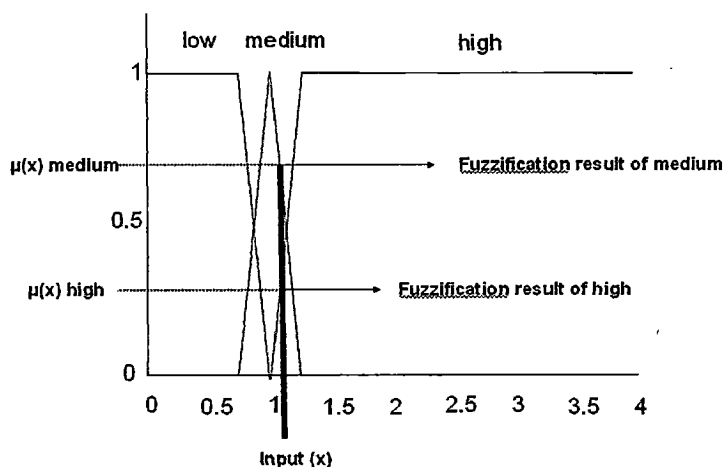


Figure 5.5 Fuzzify input

➤ **Step 2. Apply Fuzzy Operator**

Once the inputs have been fuzzified, we know the degree to which each part of the antecedent has been satisfied for each rule. If the antecedent of a given rule has more than one part, the fuzzy operator is applied to obtain one number that represents the result of the antecedent for that rule. This number will then be applied to the output function. The input to the fuzzy operator is two or more membership values from

fuzzified input variables. The output is a single truth value. Any number of well-defined methods can fill in for the AND operation or the OR operation.

➤ Step 3. Apply Implication Method

Before applying the implication method, we must take care of the rule's weight. Every rule has a weight (a number between 0 and 1), which is applied to the number given by the antecedent. Generally, this weight is 1 and so it has no effect at all on the implication process. From time to time, you may want to weight one rule relative to the others by changing its weight value to something other than 1. Once proper weighting has been assigned to each rule, the implication method is implemented. Naucks (2000) discusses this rule's weight effects in fuzzy systems. A consequent is a fuzzy set represented by a membership function, which weights appropriately the linguistic characteristics that are attributed to it. The consequence is reshaped using a function associated with the antecedent (a single number). The input for the implication process is a single number given by the antecedent, and the output is a fuzzy set. Implication is implemented for each rule.

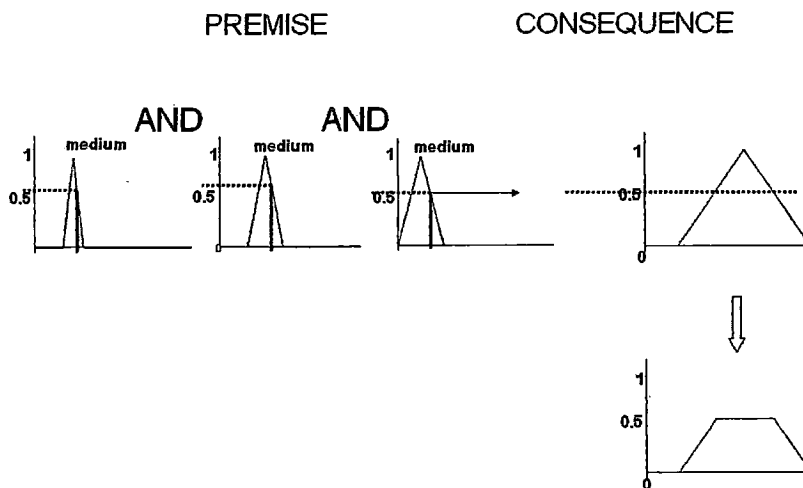


Figure 5.6 Implication method

➤ Step 4. Aggregate All Outputs

Since decisions are based on the testing of all of the rules in an fuzzy inference system, the rules must be combined in some manner in order to make a decision. Aggregation is the process by which the fuzzy sets that represent the outputs of each rule are combined into a single fuzzy set. Aggregation only occurs once for each output

variable. The input of the aggregation process is the list of truncated output functions returned by the implication process for each rule. The output of the aggregation process is one fuzzy set for each output variable. Notice that as long as the aggregation method is commutative (which it always should be), then the order in which the rules are executed is unimportant.

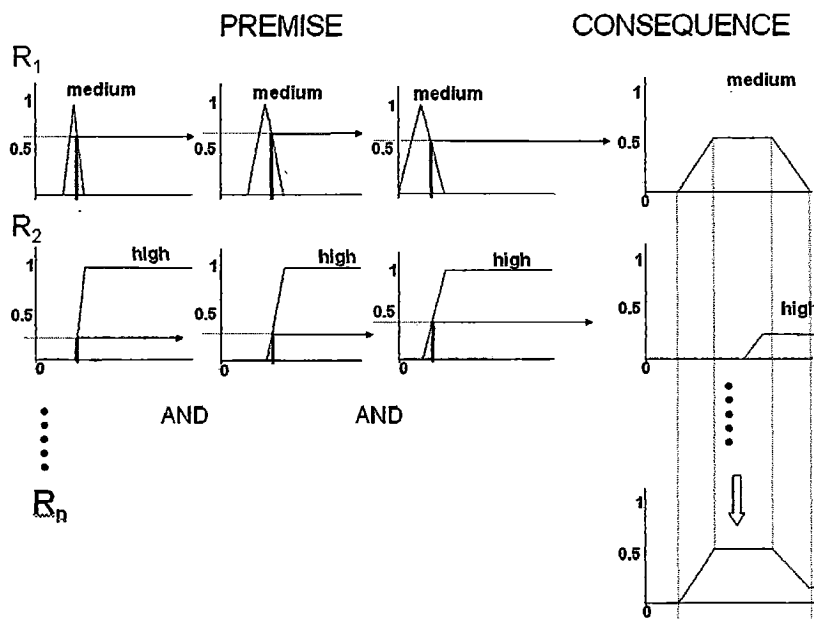


Figure 5.7 Aggregated Inputs

➤ Step 5. Defuzzify

Defuzzification is the reverse process of fuzzification. It converts the confidences in a fuzzy set of word descriptors into a real number. This may be necessary if it is necessary to output a number to the user. For example, in an expert system of runoff prediction it may be necessary to tell the user how many of a certain item is expected to be in m^3/sec . The input for the defuzzification process is a fuzzy set (the aggregate output fuzzy set) and the output is a single number. As much as fuzziness helps the rule evaluation during the intermediate steps, the final desired output for each variable is generally a single number. However, the aggregate of a fuzzy set encompasses a range of output values, and so must be defuzzified in order to resolve a single output value from the set. There are five methods calculations: centroid, bisector, middle of maximum (the average of the maximum value of the output set), largest of maximum, and smallest of maximum.

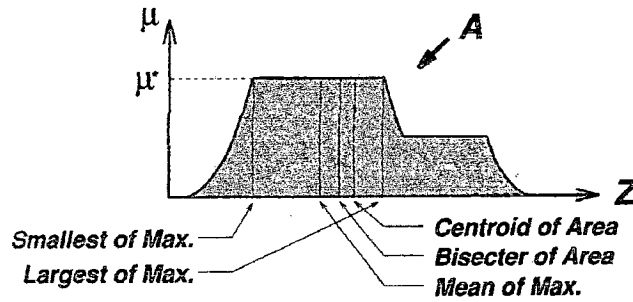


Figure 5.8 Defuzzified Methods Calculation

5.4.1 Fuzzy Logic Toolbox

The Fuzzy Logic Toolbox is a collection of functions built on the MATLAB[®] numeric computing environment. It provides tools to create and edit fuzzy inference systems within the framework of MATLAB. This toolbox relies heavily on graphical user interface (GUI) tools to help accomplish the work. The toolbox provides a number of interactive tools that access many of the functions through a GUI. Together, the GUI based tools provide an environment for fuzzy inference system design, analysis, and implementation.

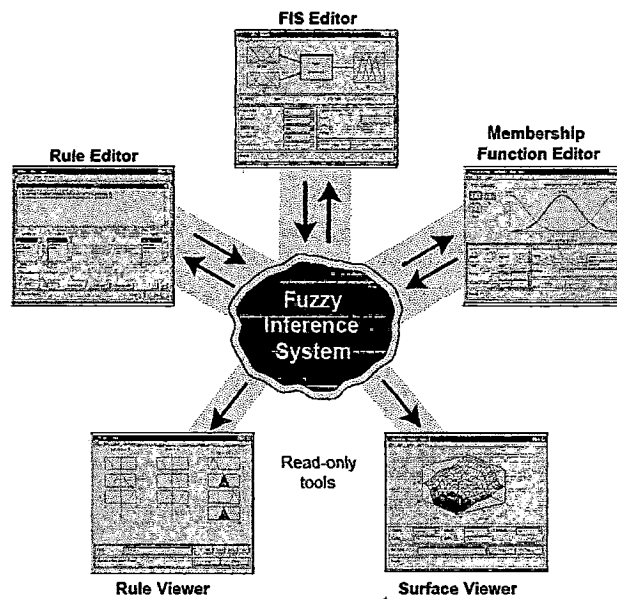


Figure 5.9 Fuzzy Logic Toolbox GUI

The Fuzzy Logic Toolbox allows to do several things, but the most important is create and edit fuzzy inference systems. Fuzzy inference system can be created using graphical tools or command-line functions. In this study, Mamdani type inference is used in fuzzy inference system by fuzzy logic toolbox and defuzzification process for the output of the system used centroid method that resulted a crisp value.

5.5 FUZZY RULE BASE MODELING FOR RESERVOIR OPERATION

Premises for reservoir operation are consists of storage level, inflow, and demand in unit whose are shown in membership function. The consequence is an optimum release from the reservoir which also in unit. The membership functions that are considered for this fuzzy logic programming is triangular which is simple and commonly used in water resources applications. The membership functions that are used in the fuzzy logic programming are shown in figure 5.10, 5.11, 5.12.

In this study, fuzzy rules are derived from data sets that are also called training or calibration set. The data sets are coming from the results of FSDP. The rule systems structure is given as follows

$$\begin{aligned} & \text{IF storage is } A_{i,1} \text{ AND inflow is } A_{i,2} \text{ AND demand is } A_{i,3} \\ & \text{THEN release is } B_i \end{aligned} \quad (5.9)$$

The system or mass balance equation and the physical or boundary condition for reservoir operation also constitute rules, given as follows

System or Mass Balance Equation

$$S_{t+1} = S_t + I_t - R_t \quad (5.10)$$

Physical or Boundary Conditions

$$S_{t,\min} \leq S_t \leq S_{t,\max} \quad (5.11)$$

$$R_{t,\min} \leq R_t \leq R_{t,\max} \quad (5.12)$$

Figure 5.10 FRB-1 Membership Function

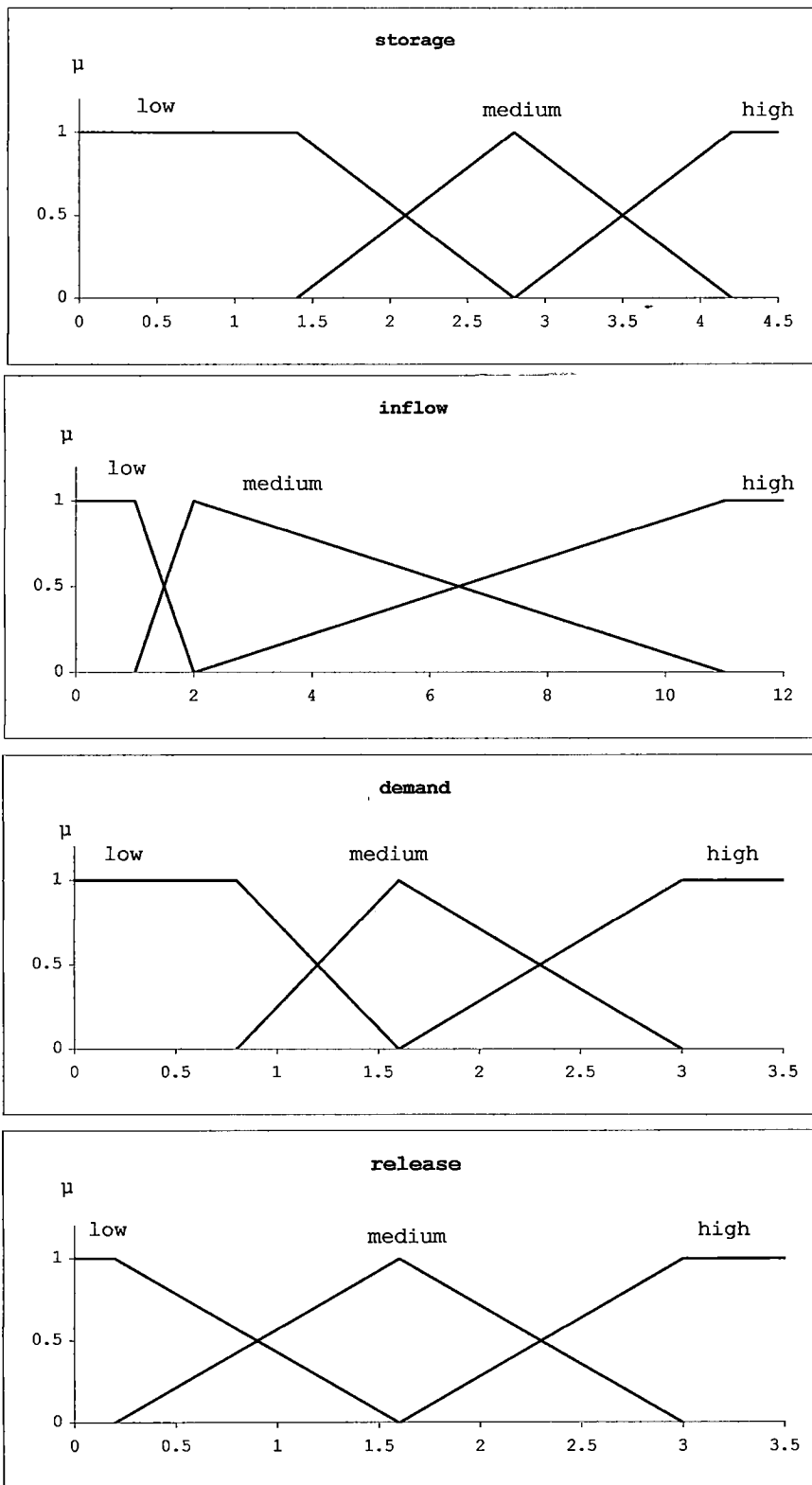


Figure 5.11 FRB-2 Membership Function

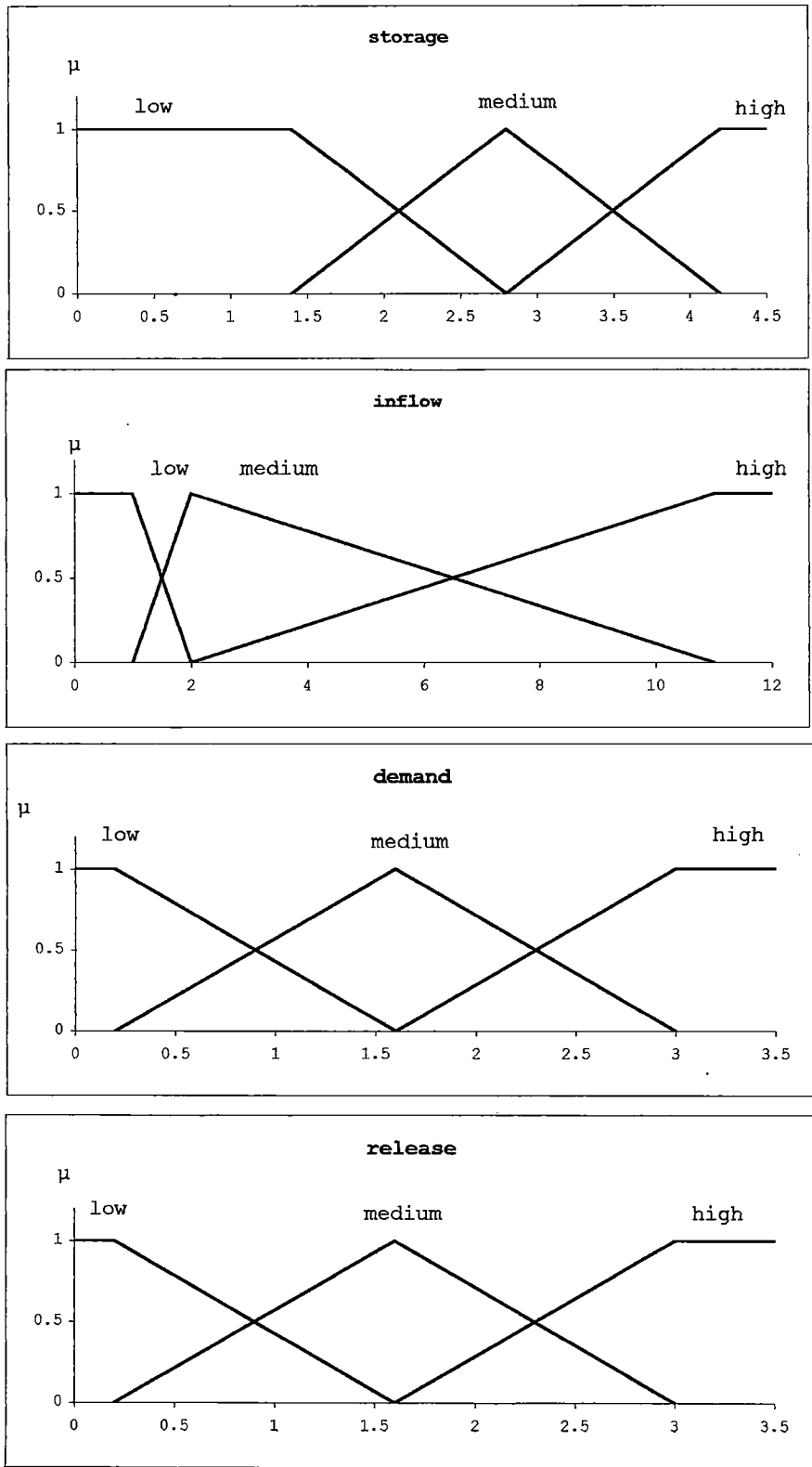
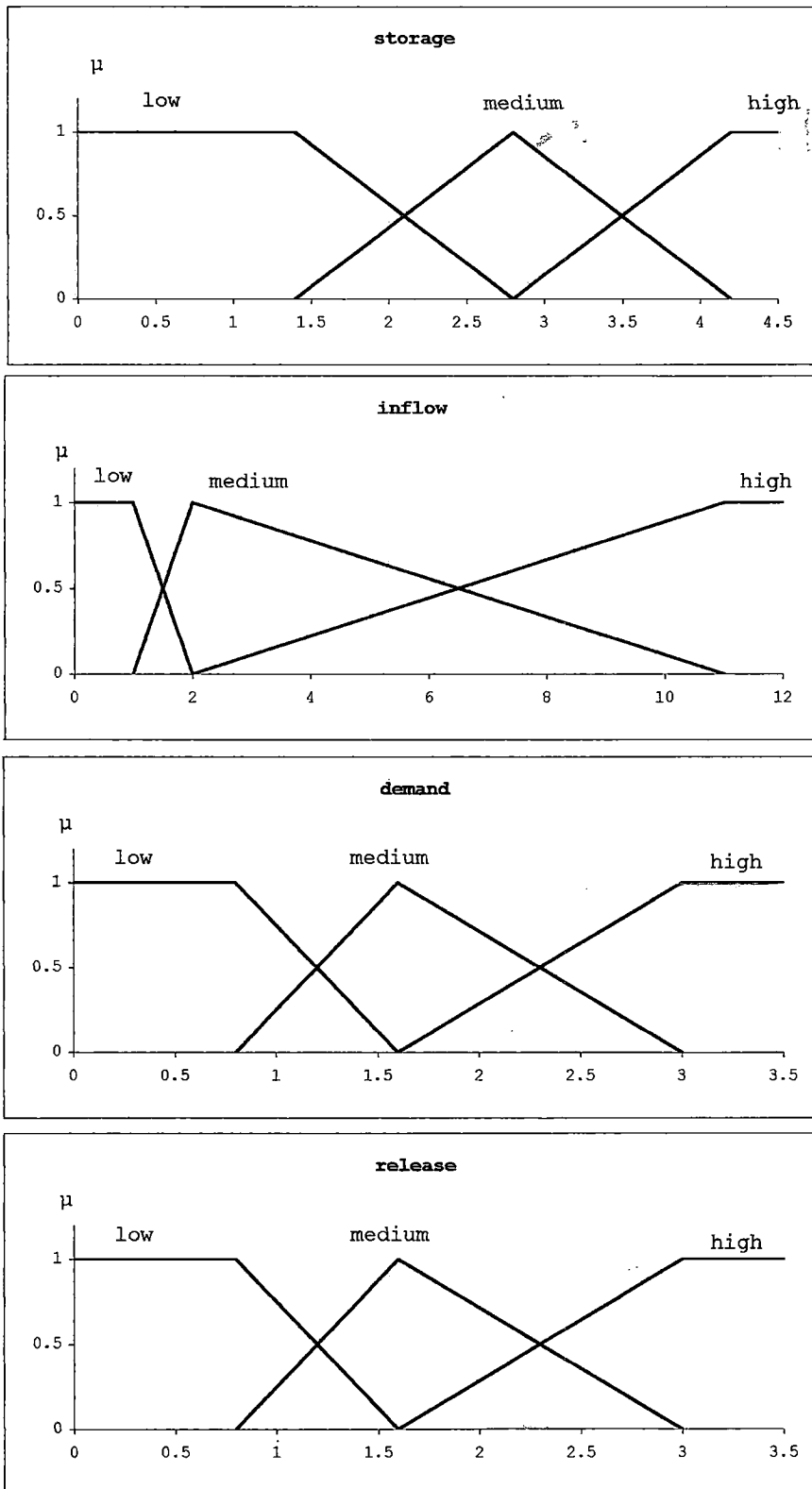


Figure 5.12 FRB-3 Membership Function



5.6 RESULTS AND DISCUSSION

In this study, fuzzy associative memory (FAM) is used to train the fuzzy rule base from a set of input-output data. The data set uses the result of fuzzy stochastic dynamic programming for the reservoir operation optimal releases calculated in the previous chapter. Storage, inflow and demand are considered as an input meanwhile release is considered as an output of the data set.

The application of Fuzzy Associative Memory (FAM) for assessment of fuzzy rule bases is shown in table 5.1, 5.2, 5.3 and the fuzzy rule bases resulted from the fuzzy associative memory (FAM) calculation for FRB-1, FRB-2, and FRB-3 are shown in table 5.4, 5.5, 5.6 respectively.

Table 5.1 Assessment of Fuzzy Rule Base by FAM (FRB-1 membership function)

Storage [1]	Storage Category [2]	μ [3]	Inflow [4]	Inflow Category [5]	μ [6]	Demand [7]	Demand Category [8]	μ [9]	Release [10]	weight [11]	weight * Release [12]	Release [13]	Release Category [14]
1.4	low	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80	0.88	low
1.4	low	1.00	1	low	1.00	0.8	low	1.00	0.6	1.00	0.60		
1.6	low	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.6	low	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.8	low	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
1.8	low	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2	low	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2	low	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
1.4	low	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
1.4	low	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
1.6	low	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
1.6	low	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
1.8	low	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
1.8	low	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2	low	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2	low	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
1.4	low	1.00	1	low	1.00	1.2	low	0.50	1	0.25	0.25		
1.4	low	1.00	1	low	1.00	1.2	low	0.50	1	0.25	0.25		
1.6	low	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.6	low	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
1.8	low	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	1	low	1.00	1.2	low	0.50	1	0.08	0.08		
2	low	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00	1.17	medium
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	1	low	1.00	1.8	medium	0.86	0.6	0.73	0.44		
1.6	low	0.86	1	low	1.00	1.8	medium	0.86	1.2	0.54	0.65		
1.8	low	0.71	1	low	1.00	1.8	medium	0.86	1.4	0.37	0.52		
2	low	0.57	1	low	1.00	1.8	medium	0.86	1.6	0.24	0.38		
1.4	low	1.00	1	low	1.00	2.4	high	0.57	1	0.33	0.33	0.33	low
1.4	low	1.00	1	low	1.00	2.4	high	0.57	0.2	0.33	0.07		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
1.4	low	1.00	1	low	1.00	3	high	1.00	0.2	1.00	0.20		
1.6	low	0.86	1	low	1.00	3	high	1.00	0.2	0.73	0.15		
1.8	low	0.71	1	low	1.00	3	high	1.00	0.2	0.51	0.10		
2	low	0.57	1	low	1.00	3	high	1.00	0.2	0.33	0.07		
1.4	low	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80	0.97	medium
1.6	low	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.8	low	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
2	low	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26		
1.4	low	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.79	0.63		
1.6	low	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
1.8	low	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
2	low	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
1.4	low	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.60	0.48		
1.6	low	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
1.8	low	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
2	low	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
1.4	low	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
1.6	low	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
1.8	low	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
2	low	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
1.4	low	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
1.6	low	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
1.8	low	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
2	low	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
1.4	low	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
1.6	low	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
1.8	low	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
2	low	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.4	low	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
1.6	low	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
1.8	low	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
2	low	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
1.4	low	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
1.6	low	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
1.8	low	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
2	low	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
1.4	low	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.4	low	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.6	low	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
1.8	low	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2	low	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.4	low	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.6	low	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.6	low	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.8	low	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
1.8	low	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2	low	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2	low	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
1.4	low	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.4	low	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.6	low	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.8	low	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
1.8	low	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2	low	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2	low	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
1.4	low	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.4	low	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.6	low	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.8	low	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2	low	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2	low	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
1.4	low	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.4	low	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.6	low	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.6	low	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
1.8	low	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2	low	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2	low	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
1.4	low	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60	1.64	mediu
1.6	low	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
1.8	low	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2	low	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
1.6	low	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
1.8	low	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
2	low	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
1.4	low	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
1.6	low	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
1.6	low	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
1.8	low	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2	low	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65	2.17	mediu
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65		
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
1.4	low	1.00	3	medium	0.89	2.4	high	0.57	1.8	0.26	0.46		
1.6	low	0.86	3	medium	0.89	2.4	high	0.57	2	0.19	0.38		
1.8	low	0.71	3	medium	0.89	2.4	high	0.57	2.2	0.13	0.29		
2	low	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
1.4	low	1.00	4	medium	0.78	2.4	high	0.57	1.8	0.20	0.36		
1.6	low	0.86	4	medium	0.78	2.4	high	0.57	1.8	0.15	0.26		
1.8	low	0.71	4	medium	0.78	2.4	high	0.57	2	0.10	0.20		
2	low	0.57	4	medium	0.78	2.4	high	0.57	2.2	0.06	0.14		
1.4	low	1.00	5	medium	0.67	2.4	high	0.57	2.2	0.15	0.32		
1.6	low	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
1.6	low	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
1.8	low	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	2	medium	1.00	3	high	1.00	2	1.00	2.00		
1.6	low	0.86	2	medium	1.00	3	high	1.00	2.2	0.73	1.62		
1.8	low	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2	low	0.57	2	medium	1.00	3	high	1.00	2.6	0.33	0.85		
1.4	low	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17	1.12	medium
1.6	low	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
1.8	low	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
2	low	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06		
1.4	low	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
1.6	low	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
1.8	low	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
2	low	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
1.4	low	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
1.6	low	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
1.8	low	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
2	low	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
1.4	low	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.6	low	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
2	low	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
1.4	low	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.8	low	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
2	low	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
1.4	low	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.6	low	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.8	low	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
2	low	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
1.4	low	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.6	low	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.8	low	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
2	low	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
1.4	low	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49	1.60	medium
1.6	low	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24	2.40	high
1.6	low	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage [1]	Storage Category [2]	μ [3]	Inflow [4]	Inflow Category [5]	μ [6]	Demand [7]	Demand Category [8]	μ [9]	Release [10]	weight [11]	weight * Release [12]	Release [13]	Release Category [14]
1.8	low	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
1.6	low	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
1.6	low	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
1.8	low	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2	low	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
1.4	low	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
1.6	low	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
1.8	low	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2	low	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.2	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26	0.92	medium
2.2	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.4	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.4	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.6	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.6	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.8	medium	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
2.8	medium	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
3	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
3	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
3.2	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.2	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.4	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
3.4	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.2	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.4	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2.4	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2.6	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
2.6	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
2.8	medium	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
2.8	medium	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
3	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
3	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
3.2	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.2	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.4	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.4	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.4	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.6	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
2.8	medium	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
3	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.2	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.4	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.65	medium
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	1	low	1.00	1.8	medium	0.86	1.6	0.24	0.38		
2.4	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.2	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19	2.22	medium
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2	0.24	0.48		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2.2	0.11	0.23		
2.2	medium	0.57	1	low	1.00	3	high	1.00	0.4	0.33	0.13		
2.4	medium	0.71	1	low	1.00	3	high	1.00	2	0.51	1.02		
2.6	medium	0.86	1	low	1.00	3	high	1.00	2.2	0.73	1.62		
2.8	medium	1.00	1	low	1.00	3	high	1.00	2.4	1.00	2.40		
3	medium	0.86	1	low	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	1	low	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
2.2	medium	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26	0.97	medium
2.4	medium	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.6	medium	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.8	medium	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80		
3	medium	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
3.2	medium	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.4	medium	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.2	medium	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
2.4	medium	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
2.6	medium	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
2.8	medium	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.79	0.63		
3	medium	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
3.2	medium	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
3.4	medium	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
2.2	medium	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
2.4	medium	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
2.6	medium	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
2.8	medium	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.60	0.48		
3	medium	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
3.2	medium	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
3.4	medium	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
2.2	medium	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
2.4	medium	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
2.6	medium	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
2.8	medium	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
3	medium	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
3.2	medium	0.71	2	medium	1.00	1	low	-0.75	1	0.29	0.29		
3.4	medium	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
2.4	medium	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
2.6	medium	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
2.8	medium	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
3	medium	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
3.2	medium	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
3.4	medium	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
2.2	medium	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
2.4	medium	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
2.6	medium	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
2.8	medium	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
3	medium	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
3.2	medium	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
3.4	medium	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
2.2	medium	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
2.4	medium	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
2.6	medium	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
2.8	medium	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
3	medium	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
3.2	medium	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
3.4	medium	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
2.2	medium	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
2.4	medium	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
2.6	medium	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
2.8	medium	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
3	medium	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
3.2	medium	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
3.4	medium	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
2.2	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.4	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.6	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
2.8	medium	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
3	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.2	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.4	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.4	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.4	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.6	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.6	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.8	medium	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
2.8	medium	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
3	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
3	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
3.2	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.2	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.4	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.4	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.4	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.4	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.6	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.6	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
2.8	medium	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
3	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
3.2	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.2	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.4	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.4	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.4	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.4	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.6	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.8	medium	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
3	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
3.2	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.4	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.4	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.4	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.4	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.6	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.8	medium	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
2.8	medium	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
3	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
3	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.2	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.4	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.4	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.64	medium

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
2.4	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.4	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
2.6	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
2.8	medium	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
3.2	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
3.4	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.2	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.4	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.4	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
3.2	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26	2.36	high
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	1.8	0.17	0.30		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2	0.24	0.48		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	1.8	0.33	0.59		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	2	medium	1.00	2.4	high	0.57	2	0.24	0.48		
3	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2	0.17	0.33		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.2	medium	0.57	3	medium	0.89	2.4	high	0.57	1.8	0.08	0.15		
2.4	medium	0.71	3	medium	0.89	2.4	high	0.57	1.8	0.13	0.24		
2.6	medium	0.86	3	medium	0.89	2.4	high	0.57	1.8	0.19	0.34		
2.8	medium	1.00	3	medium	0.89	2.4	high	0.57	2	0.26	0.52		
3	medium	0.86	3	medium	0.89	2.4	high	0.57	2.2	0.19	0.42		
3.2	medium	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	3	medium	0.89	2.4	high	0.57	2.2	0.08	0.19		
2.2	medium	0.57	4	medium	0.78	2.4	high	0.57	2	0.06	0.13		
2.4	medium	0.71	4	medium	0.78	2.4	high	0.57	2.2	0.10	0.22		
2.6	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation.

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.4	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.4	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	2	medium	1.00	3	high	1.00	2.2	0.33	0.72		
2.4	medium	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2.6	medium	0.86	2	medium	1.00	3	high	1.00	2.4	0.73	1.76		
2.8	medium	1.00	2	medium	1.00	3	high	1.00	2.6	1.00	2.60		
3	medium	0.86	2	medium	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	2	medium	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	2	medium	1.00	3	high	1.00	2.8	0.33	0.91		
2.2	medium	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06	1.12	medium
2.4	medium	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
2.6	medium	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
2.8	medium	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17		
3	medium	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
3.2	medium	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
3.4	medium	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06		
2.2	medium	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
2.4	medium	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
2.6	medium	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
2.8	medium	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
3	medium	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
3.2	medium	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
3.4	medium	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
2.2	medium	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
2.4	medium	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
2.6	medium	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
2.8	medium	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
3	medium	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
3.2	medium	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
3.4	medium	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
2.2	medium	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.4	medium	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.6	medium	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.8	medium	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
3	medium	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.4	medium	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.4	medium	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.8	medium	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
3.2	medium	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.4	medium	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.4	medium	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.6	medium	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
3	medium	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
3.2	medium	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.4	medium	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.4	medium	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.6	medium	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.8	medium	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
3	medium	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
3.2	medium	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.4	medium	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3	medium	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16	1.60	medium
2.4	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
2.4	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
3.4	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.4	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2.6	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.4	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2.6	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
2.8	medium	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
3	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
3.2	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.6	high	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26	0.92	medium
3.6	high	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
3.8	high	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.8	high	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
4	high	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
4	high	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
4.2	high	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
4.2	high	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
3.6	high	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.6	high	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.8	high	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.8	high	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
4	high	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
4	high	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
4.2	high	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
4.2	high	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
3.6	high	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.6	high	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.8	high	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
4	high	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage [1]	Storage Category [2]	μ [3]	Inflow [4]	Inflow Category [5]	μ [6]	Demand [7]	Demand Category [8]	μ [9]	Release [10]	weight [11]	weight * Release [12]	Release [13]	Release Category [14]
4.2	high	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.65	medium
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21	2.55	high
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.2	0.33	0.72		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
3.8	high	0.71	1	low	1.00	3	high	1.00	2.6	0.51	1.33		
4	high	0.86	1	low	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	1	low	1.00	3	high	1.00	2.8	1.00	2.80		
3.6	high	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26	0.97	medium
3.8	high	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
4	high	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
4.2	high	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80		
3.6	high	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
3.8	high	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
4	high	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
4.2	high	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.79	0.63		
3.6	high	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
3.8	high	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
4	high	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
4.2	high	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.61	0.48		
3.6	high	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
3.8	high	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
4	high	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
4.2	high	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
3.6	high	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
3.8	high	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
4	high	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
4.2	high	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
3.6	high	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
3.8	high	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
4	high	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
4.2	high	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
3.6	high	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
3.8	high	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
4	high	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
4.2	high	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
3.6	high	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
3.8	high	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
4	high	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
4.2	high	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
3.6	high	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.6	high	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.8	high	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
4	high	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
4.2	high	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.6	high	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.8	high	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.8	high	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
4	high	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
4	high	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
4.2	high	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
4.2	high	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
3.6	high	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.6	high	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.8	high	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.8	high	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
4	high	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
4	high	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
4.2	high	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
3.6	high	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.6	high	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.8	high	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.8	high	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
4	high	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
4.2	high	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
3.6	high	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.6	high	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.8	high	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.8	high	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
4	high	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
4.2	high	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
4.2	high	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
3.6	high	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.64	medium
3.8	high	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
3.8	high	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
4	high	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
4.2	high	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3.6	high	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.61	0.97		
3.6	high	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
3.8	high	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.2	0.11	0.23	2.61	high
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	2	medium	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	2	medium	1.00	2.4	high	-0.57	2.4	0.17	0.40		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	3	medium	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	3	medium	0.89	2.4	high	0.57	2.4	0.26	0.62		
3.6	high	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
3.8	high	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	2	medium	1.00	3	high	1.00	3	0.33	0.98		
3.8	high	0.71	2	medium	1.00	3	high	1.00	3	0.51	1.53		
4	high	0.86	2	medium	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	2	medium	1.00	3	high	1.00	3	1.00	3.00		
3.6	high	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06	1.12	medium

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.8	high	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
4	high	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
4.2	high	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17		
3.6	high	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
3.8	high	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
4	high	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
4.2	high	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
3.6	high	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
3.8	high	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
4	high	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
4.2	high	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
3.6	high	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.8	high	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
4	high	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
4.2	high	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
3.6	high	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.8	high	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
4.2	high	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
3.6	high	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.8	high	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
4	high	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
3.6	high	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.8	high	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
4	high	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
4.2	high	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
3.6	high	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16	1.60	medium
3.8	high	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3.6	high	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
3.8	high	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		

Procedure

- [2],[5],[8] category of [1],[4],[7] respectively from FRB-1 membership function
- [3],[6],[9] membership degree (μ) of [1],[4],[7] respectively from FRB-1 membership function
- [10] release from set of inputs (FSDP result)
- [11] $([3]*[6]*[9])^2$
- [12] $[10]*[11]$
- [13] $(\sum[12] \text{ in the same set of inputs category})/(\sum[11] \text{ in the same set of inputs category})$
- [14] release category of [13] from FRB-1 membership function

Table 5.2 Assessment of Fuzzy Rule Base by FAM (FRB-2 membership function)

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.4	low	1.00	1	low	1.00	0.8	low	0.57	0.8	0.33	0.26	0.76	low
1.4	low	1.00	1	low	1.00	0.8	low	0.57	0.6	0.33	0.20		
1.6	low	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
1.6	low	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
1.8	low	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
1.8	low	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
2	low	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
2	low	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
1.4	low	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
1.4	low	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
1.6	low	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
1.6	low	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
1.8	low	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
1.8	low	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
2	low	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
2	low	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
1.4	low	1.00	1	low	1.00	1.2	medium	0.71	1	0.51	0.51		
1.4	low	1.00	1	low	1.00	1.2	medium	0.71	1	0.51	0.51		
1.6	low	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.6	low	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.8	low	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
1.8	low	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2	low	0.57	1	low	1.00	1.2	medium	0.71	1	0.17	0.17		
2	low	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00	1.13	medium
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	1	low	1.00	1.8	medium	0.86	0.6	0.73	0.44		
1.6	low	0.86	1	low	1.00	1.8	medium	0.86	1.2	0.54	0.65		
1.8	low	0.71	1	low	1.00	1.8	medium	0.86	1.4	0.37	0.52		
2	low	0.57	1	low	1.00	1.8	medium	0.86	1.6	0.24	0.38		
1.4	low	1.00	1	low	1.00	2.4	high	0.57	1	0.33	0.33	0.33	low
1.4	low	1.00	1	low	1.00	2.4	high	0.57	0.2	0.33	0.07		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
1.4	low	1.00	1	low	1.00	3	high	1.00	0.2	1.00	0.20		
1.6	low	0.86	1	low	1.00	3	high	1.00	0.2	0.73	0.15		
1.8	low	0.71	1	low	1.00	3	high	1.00	0.2	0.51	0.10		
2	low	0.57	1	low	1.00	3	high	1.00	0.2	0.33	0.07		
1.4	low	1.00	2	medium	1.00	0.8	low	0.57	0.8	0.33	0.26	0.80	low
1.6	low	0.86	2	medium	1.00	0.8	low	0.57	0.8	0.24	0.19		
1.8	low	0.71	2	medium	1.00	0.8	low	0.57	0.8	0.17	0.13		
2	low	0.57	2	medium	1.00	0.8	low	0.57	0.8	0.11	0.09		
1.4	low	1.00	3	medium	0.89	0.8	low	0.57	0.8	0.26	0.21		
1.6	low	0.86	3	medium	0.89	0.8	low	0.57	0.8	0.19	0.15		
1.8	low	0.71	3	medium	0.89	0.8	low	0.57	0.8	0.13	0.11		
2	low	0.57	3	medium	0.89	0.8	low	0.57	0.8	0.08	0.07		
1.4	low	1.00	4	medium	0.78	0.8	low	0.57	0.8	0.20	0.16		
1.6	low	0.86	4	medium	0.78	0.8	low	0.57	0.8	0.15	0.12		
1.8	low	0.71	4	medium	0.78	0.8	low	0.57	0.8	0.10	0.08		
2	low	0.57	4	medium	0.78	0.8	low	0.57	0.8	0.06	0.05		
1.4	low	1.00	2	medium	1.00	1	medium	0.57	1	0.33	0.33		
1.6	low	0.86	2	medium	1.00	1	medium	0.57	1	0.24	0.24		
1.8	low	0.71	2	medium	1.00	1	medium	0.57	1	0.17	0.17		
2	low	0.57	2	medium	1.00	1	medium	0.57	1	0.11	0.11		
1.4	low	1.00	3	medium	0.89	1	medium	0.57	1	0.26	0.26		
1.6	low	0.86	3	medium	0.89	1	medium	0.57	1	0.19	0.19		
1.8	low	0.71	3	medium	0.89	1	medium	0.57	1	0.13	0.13		
2	low	0.57	3	medium	0.89	1	medium	0.57	1	0.08	0.08		
1.4	low	1.00	4	medium	0.78	1	medium	0.57	1	0.20	0.20		
1.6	low	0.86	4	medium	0.78	1	medium	0.57	1	0.15	0.15		
1.8	low	0.71	4	medium	0.78	1	medium	0.57	1	0.10	0.10		
2	low	0.57	4	medium	0.78	1	medium	0.57	1	0.06	0.06		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.4	low	1.00	5	medium	0.67	1	medium	0.57	1	0.15	0.15		
1.6	low	0.86	5	medium	0.67	1	medium	0.57	1	0.11	0.11		
1.8	low	0.71	5	medium	0.67	1	medium	0.57	1	0.07	0.07		
2	low	0.57	5	medium	0.67	1	medium	0.57	1	0.05	0.05		
1.4	low	1.00	6	medium	0.56	1	medium	0.57	1	0.10	0.10		
1.6	low	0.86	6	medium	0.56	1	medium	0.57	1	0.07	0.07		
1.8	low	0.71	6	medium	0.56	1	medium	0.57	1	0.05	0.05		
2	low	0.57	6	medium	0.56	1	medium	0.57	1	0.03	0.03		
1.4	low	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
1.4	low	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
1.6	low	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.6	low	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.8	low	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
1.8	low	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2	low	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2	low	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
1.4	low	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
1.4	low	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
1.6	low	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
1.6	low	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
1.8	low	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
1.8	low	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
2	low	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2	low	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
1.4	low	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
1.4	low	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
1.6	low	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
1.6	low	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
1.8	low	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
1.8	low	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
2	low	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2	low	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
1.4	low	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
1.4	low	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
1.6	low	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
1.6	low	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
1.8	low	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
1.8	low	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
2	low	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
2	low	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
1.4	low	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
1.4	low	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
1.6	low	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
1.6	low	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
1.8	low	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
1.8	low	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
2	low	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2	low	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
1.4	low	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60	1.38	medium
1.6	low	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
1.8	low	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2	low	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
1.6	low	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
1.8	low	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
2	low	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
1.4	low	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
1.6	low	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
1.6	low	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
1.8	low	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2	low	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65	2.17	medium
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65		
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
1.4	low	1.00	3	medium	0.89	2.4	high	0.57	1.8	0.26	0.46		
1.6	low	0.86	3	medium	0.89	2.4	high	0.57	2	0.19	0.38		
1.8	low	0.71	3	medium	0.89	2.4	high	0.57	2.2	0.13	0.29		
2	low	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
1.4	low	1.00	4	medium	0.78	2.4	high	0.57	1.8	0.20	0.36		
1.6	low	0.86	4	medium	0.78	2.4	high	0.57	1.8	0.15	0.26		
1.8	low	0.71	4	medium	0.78	2.4	high	0.57	2	0.10	0.20		
2	low	0.57	4	medium	0.78	2.4	high	0.57	2.2	0.06	0.14		
1.4	low	1.00	5	medium	0.67	2.4	high	0.57	2.2	0.15	0.32		
1.6	low	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
1.6	low	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
1.8	low	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	2	medium	1.00	3	high	1.00	2	1.00	2.00		
1.6	low	0.86	2	medium	1.00	3	high	1.00	2.2	0.73	1.62		
1.8	low	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2	low	0.57	2	medium	1.00	3	high	1.00	2.6	0.33	0.85		
1.4	low	1.00	7	high	0.56	1	medium	0.57	1	0.10	0.10	1.32	medium
1.6	low	0.86	7	high	0.56	1	medium	0.57	1	0.07	0.07		
1.8	low	0.71	7	high	0.56	1	medium	0.57	1	0.05	0.05		
2	low	0.57	7	high	0.56	1	medium	0.57	1	0.03	0.03		
1.4	low	1.00	8	high	0.67	1	medium	0.57	1	0.15	0.15		
1.6	low	0.86	8	high	0.67	1	medium	0.57	1	0.11	0.11		
1.8	low	0.71	8	high	0.67	1	medium	0.57	1	0.07	0.07		
2	low	0.57	8	high	0.67	1	medium	0.57	1	0.05	0.05		
1.4	low	1.00	9	high	0.78	1	medium	0.57	1	0.20	0.20		
1.6	low	0.86	9	high	0.78	1	medium	0.57	1	0.15	0.15		
1.8	low	0.71	9	high	0.78	1	medium	0.57	1	0.10	0.10		
2	low	0.57	9	high	0.78	1	medium	0.57	1	0.06	0.06		
1.4	low	1.00	7	high	0.56	1.2	medium	0.71	1.2	0.16	0.19		
1.6	low	0.86	7	high	0.56	1.2	medium	0.71	1.2	0.12	0.14		
1.8	low	0.71	7	high	0.56	1.2	medium	0.71	1.2	0.08	0.10		
2	low	0.57	7	high	0.56	1.2	medium	0.71	1.2	0.05	0.06		
1.4	low	1.00	8	high	0.67	1.2	medium	0.71	1.2	0.23	0.27		
1.6	low	0.86	8	high	0.67	1.2	medium	0.71	1.2	0.17	0.20		
1.8	low	0.71	8	high	0.67	1.2	medium	0.71	1.2	0.12	0.14		
2	low	0.57	8	high	0.67	1.2	medium	0.71	1.2	0.07	0.09		
1.4	low	1.00	9	high	0.78	1.2	medium	0.71	1.2	0.31	0.37		
1.6	low	0.86	9	high	0.78	1.2	medium	0.71	1.2	0.23	0.27		
1.8	low	0.71	9	high	0.78	1.2	medium	0.71	1.2	0.16	0.19		
2	low	0.57	9	high	0.78	1.2	medium	0.71	1.2	0.10	0.12		
1.4	low	1.00	10	high	0.89	1.2	medium	0.71	1.2	0.40	0.48		
1.6	low	0.86	10	high	0.89	1.2	medium	0.71	1.2	0.30	0.36		
1.8	low	0.71	10	high	0.89	1.2	medium	0.71	1.2	0.21	0.25		
2	low	0.57	10	high	0.89	1.2	medium	0.71	1.2	0.13	0.16		
1.4	low	1.00	11	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		
1.6	low	0.86	11	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.8	low	0.71	11	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2	low	0.57	11	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
1.4	low	1.00	12	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		
1.6	low	0.86	12	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
1.8	low	0.71	12	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2	low	0.57	12	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
1.4	low	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
1.6	low	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24	2.40	high
1.6	low	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.8	low	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
1.6	low	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
1.6	low	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
1.8	low	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2	low	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
1.4	low	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
1.6	low	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
1.8	low	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2	low	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.2	medium	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09	0.80	low
2.2	medium	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
2.4	medium	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
2.4	medium	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
2.6	medium	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
2.6	medium	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
2.8	medium	1.00	1	low	1.00	0.8	low	0.57	0.8	0.33	0.26		
2.8	medium	1.00	1	low	1.00	0.8	low	0.57	0.8	0.33	0.26		
3	medium	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
3	medium	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
3.2	medium	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
3.2	medium	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
3.4	medium	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
3.4	medium	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
2.2	medium	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
2.2	medium	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
2.4	medium	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
2.4	medium	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
2.6	medium	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
2.6	medium	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
2.8	medium	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
2.8	medium	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
3	medium	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
3	medium	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
3.2	medium	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
3.2	medium	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
3.4	medium	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
3.4	medium	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
2.2	medium	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.4	medium	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.4	medium	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.6	medium	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.6	medium	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.8	medium	1.00	1	low	1.00	1.2	medium	0.71	1.2	0.51	0.61		
2.8	medium	1.00	1	low	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3	medium	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3	medium	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3.2	medium	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.2	medium	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.4	medium	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.4	medium	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.45	medium
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.38		
2.4	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.2	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19	2.22	medium
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2	0.24	0.48		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2.2	0.11	0.23		
2.2	medium	0.57	1	low	1.00	3	high	1.00	0.4	0.33	0.13		
2.4	medium	0.71	1	low	1.00	3	high	1.00	2	0.51	1.02		
2.6	medium	0.86	1	low	1.00	3	high	1.00	2.2	0.73	1.62		
2.8	medium	1.00	1	low	1.00	3	high	1.00	2.4	1.00	2.40		
3	medium	0.86	1	low	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	1	low	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
2.2	medium	0.57	2	medium	1.00	0.8	low	0.57	0.8	0.11	0.09	0.80	low
2.4	medium	0.71	2	medium	1.00	0.8	low	0.57	0.8	0.17	0.13		
2.6	medium	0.86	2	medium	1.00	0.8	low	0.57	0.8	0.24	0.19		
2.8	medium	1.00	2	medium	1.00	0.8	low	0.57	0.8	0.33	0.26		
3	medium	0.86	2	medium	1.00	0.8	low	0.57	0.8	0.24	0.19		
3.2	medium	0.71	2	medium	1.00	0.8	low	0.57	0.8	0.17	0.13		
3.4	medium	0.57	2	medium	1.00	0.8	low	0.57	0.8	0.11	0.09		
2.2	medium	0.57	3	medium	0.89	0.8	low	0.57	0.8	0.08	0.07		
2.4	medium	0.71	3	medium	0.89	0.8	low	0.57	0.8	0.13	0.11		
2.6	medium	0.86	3	medium	0.89	0.8	low	0.57	0.8	0.19	0.15		
2.8	medium	1.00	3	medium	0.89	0.8	low	0.57	0.8	0.26	0.21		
3	medium	0.86	3	medium	0.89	0.8	low	0.57	0.8	0.19	0.15		
3.2	medium	0.71	3	medium	0.89	0.8	low	0.57	0.8	0.13	0.11		
3.4	medium	0.57	3	medium	0.89	0.8	low	0.57	0.8	0.08	0.07		
2.2	medium	0.57	4	medium	0.78	0.8	low	0.57	0.8	0.06	0.05		
2.4	medium	0.71	4	medium	0.78	0.8	low	0.57	0.8	0.10	0.08		
2.6	medium	0.86	4	medium	0.78	0.8	low	0.57	0.8	0.15	0.12		
2.8	medium	1.00	4	medium	0.78	0.8	low	0.57	0.8	0.20	0.16		
3	medium	0.86	4	medium	0.78	0.8	low	0.57	0.8	0.15	0.12		
3.2	medium	0.71	4	medium	0.78	0.8	low	0.57	0.8	0.10	0.08		
3.4	medium	0.57	4	medium	0.78	0.8	low	0.57	0.8	0.06	0.05		
2.2	medium	0.57	2	medium	1.00	1	medium	0.57	1	0.11	0.11		
2.4	medium	0.71	2	medium	1.00	1	medium	0.57	1	0.17	0.17		
2.6	medium	0.86	2	medium	1.00	1	medium	0.57	1	0.24	0.24		
2.8	medium	1.00	2	medium	1.00	1	medium	0.57	1	0.33	0.33		
3	medium	0.86	2	medium	1.00	1	medium	0.57	1	0.24	0.24		
3.2	medium	0.71	2	medium	1.00	1	medium	0.57	1	0.17	0.17		
3.4	medium	0.57	2	medium	1.00	1	medium	0.57	1	0.11	0.11		
2.2	medium	0.57	3	medium	0.89	1	medium	0.57	1	0.08	0.08		
2.4	medium	0.71	3	medium	0.89	1	medium	0.57	1	0.13	0.13		
2.6	medium	0.86	3	medium	0.89	1	medium	0.57	1	0.19	0.19		
2.8	medium	1.00	3	medium	0.89	1	medium	0.57	1	0.26	0.26		
3	medium	0.86	3	medium	0.89	1	medium	0.57	1	0.19	0.19		
3.2	medium	0.71	3	medium	0.89	1	medium	0.57	1	0.13	0.13		
3.4	medium	0.57	3	medium	0.89	1	medium	0.57	1	0.08	0.08		
2.2	medium	0.57	4	medium	0.78	1	medium	0.57	1	0.06	0.06		
2.4	medium	0.71	4	medium	0.78	1	medium	0.57	1	0.10	0.10		
2.6	medium	0.86	4	medium	0.78	1	medium	0.57	1	0.15	0.15		
2.8	medium	1.00	4	medium	0.78	1	medium	0.57	1	0.20	0.20		
3	medium	0.86	4	medium	0.78	1	medium	0.57	1	0.15	0.15		
3.2	medium	0.71	4	medium	0.78	1	medium	0.57	1	0.10	0.10		
3.4	medium	0.57	4	medium	0.78	1	medium	0.57	1	0.06	0.06		
2.2	medium	0.57	5	medium	0.67	1	medium	0.57	1	0.05	0.05		
2.4	medium	0.71	5	medium	0.67	1	medium	0.57	1	0.07	0.07		
2.6	medium	0.86	5	medium	0.67	1	medium	0.57	1	0.11	0.11		
2.8	medium	1.00	5	medium	0.67	1	medium	0.57	1	0.15	0.15		
3	medium	0.86	5	medium	0.67	1	medium	0.57	1	0.11	0.11		
3.2	medium	0.71	5	medium	0.67	1	medium	0.57	1	0.07	0.07		
3.4	medium	0.57	5	medium	0.67	1	medium	0.57	1	0.05	0.05		
2.2	medium	0.57	6	medium	0.56	1	medium	0.57	1	0.03	0.03		
2.4	medium	0.71	6	medium	0.56	1	medium	0.57	1	0.05	0.05		
2.6	medium	0.86	6	medium	0.56	1	medium	0.57	1	0.07	0.07		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Categor.
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
2.8	medium	1.00	6	medium	0.56	1	medium	0.57	1	0.10	0.10		
3	medium	0.86	6	medium	0.56	1	medium	0.57	1	0.07	0.07		
3.2	medium	0.71	6	medium	0.56	1	medium	0.57	1	0.05	0.05		
3.4	medium	0.57	6	medium	0.56	1	medium	0.57	1	0.03	0.03		
2.2	medium	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.4	medium	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.4	medium	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.6	medium	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.6	medium	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.8	medium	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
2.8	medium	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3	medium	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3	medium	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3.2	medium	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.2	medium	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.4	medium	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.4	medium	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2.2	medium	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2.4	medium	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
2.4	medium	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
2.6	medium	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
2.6	medium	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
2.8	medium	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
2.8	medium	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
3	medium	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
3	medium	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
3.2	medium	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
3.2	medium	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
3.4	medium	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
3.4	medium	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2.2	medium	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2.2	medium	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2.4	medium	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
2.4	medium	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
2.6	medium	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
2.6	medium	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
2.8	medium	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
2.8	medium	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
3	medium	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
3	medium	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
3.2	medium	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
3.2	medium	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
3.4	medium	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
3.4	medium	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2.2	medium	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
2.2	medium	0.57	5	medium	0.67	-1.2	medium	0.71	1.2	0.07	0.09		
2.4	medium	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
2.4	medium	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
2.6	medium	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
2.6	medium	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
2.8	medium	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
2.8	medium	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
3	medium	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
3	medium	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
3.2	medium	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
3.2	medium	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
3.4	medium	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
3.4	medium	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
2.2	medium	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2.2	medium	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2.4	medium	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
2.4	medium	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
2.6	medium	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
2.6	medium	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
2.8	medium	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
2.8	medium	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
3	medium	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
3	medium	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
3.2	medium	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
3.2	medium	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
3.4	medium	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
3.4	medium	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2.2	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.38	medium

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
2.4	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.4	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
2.6	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
2.8	medium	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
3.2	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
3.4	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.2	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.4	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.4	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
3.2	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26	2.36	high
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	1.8	0.17	0.30		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2	0.24	0.48		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	1.8	0.33	0.59		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	2	medium	1.00	2.4	high	-0.57	2	0.24	0.48		
3	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2	0.17	0.33		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.2	medium	0.57	3	medium	0.89	2.4	high	0.57	1.8	0.08	0.15		
2.4	medium	0.71	3	medium	0.89	2.4	high	0.57	1.8	0.13	0.24		
2.6	medium	0.86	3	medium	0.89	2.4	high	0.57	1.8	0.19	0.34		
2.8	medium	1.00	3	medium	0.89	2.4	high	0.57	2	0.26	0.52		
3	medium	0.86	3	medium	0.89	2.4	high	0.57	2.2	0.19	0.42		
3.2	medium	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	3	medium	0.89	2.4	high	0.57	2.2	0.08	0.19		
2.2	medium	0.57	4	medium	0.78	2.4	high	0.57	2	0.06	0.13		
2.4	medium	0.71	4	medium	0.78	2.4	high	0.57	2.2	0.10	0.22		
2.6	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.4	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.4	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	2	medium	1.00	3	high	1.00	2.2	0.33	0.72		
2.4	medium	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2.6	medium	0.86	2	medium	1.00	3	high	1.00	2.4	0.73	1.76		
2.8	medium	1.00	2	medium	1.00	3	high	1.00	2.6	1.00	2.60		
3	medium	0.86	2	medium	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	2	medium	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	2	medium	1.00	3	high	1.00	2.8	0.33	0.91		
2.2	medium	0.57	7	high	0.56	1	medium	0.57	1	0.03	0.03	1.32	medium
2.4	medium	0.71	7	high	0.56	1	medium	0.57	1	0.05	0.05		
2.6	medium	0.86	7	high	0.56	1	medium	0.57	1	0.07	0.07		
2.8	medium	1.00	7	high	0.56	1	medium	0.57	1	0.10	0.10		
3	medium	0.86	7	high	0.56	1	medium	0.57	1	0.07	0.07		
3.2	medium	0.71	7	high	0.56	1	medium	0.57	1	0.05	0.05		
3.4	medium	0.57	7	high	0.56	1	medium	0.57	1	0.03	0.03		
2.2	medium	0.57	8	high	0.67	1	medium	0.57	1	0.05	0.05		
2.4	medium	0.71	8	high	0.67	1	medium	0.57	1	0.07	0.07		
2.6	medium	0.86	8	high	0.67	1	medium	0.57	1	0.11	0.11		
2.8	medium	1.00	8	high	0.67	1	medium	0.57	1	0.15	0.15		
3	medium	0.86	8	high	0.67	1	medium	0.57	1	0.11	0.11		
3.2	medium	0.71	8	high	0.67	1	medium	0.57	1	0.07	0.07		
3.4	medium	0.57	8	high	0.67	1	medium	0.57	1	0.05	0.05		
2.2	medium	0.57	9	high	0.78	1	medium	0.57	1	0.06	0.06		
2.4	medium	0.71	9	high	0.78	1	medium	0.57	1	0.10	0.10		
2.6	medium	0.86	9	high	0.78	1	medium	0.57	1	0.15	0.15		
2.8	medium	1.00	9	high	0.78	1	medium	0.57	1	0.20	0.20		
3	medium	0.86	9	high	0.78	1	medium	0.57	1	0.15	0.15		
3.2	medium	0.71	9	high	0.78	1	medium	0.57	1	0.10	0.10		
3.4	medium	0.57	9	high	0.78	1	medium	0.57	1	0.06	0.06		
2.2	medium	0.57	7	high	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2.4	medium	0.71	7	high	0.56	1.2	medium	0.71	1.2	0.08	0.10		
2.6	medium	0.86	7	high	0.56	1.2	medium	0.71	1.2	0.12	0.14		
2.8	medium	1.00	7	high	0.56	1.2	medium	0.71	1.2	0.16	0.19		
3	medium	0.86	7	high	0.56	1.2	medium	0.71	1.2	0.12	0.14		
3.2	medium	0.71	7	high	0.56	1.2	medium	0.71	1.2	0.08	0.10		
3.4	medium	0.57	7	high	0.56	1.2	medium	0.71	1.2	0.05	0.06		
2.2	medium	0.57	8	high	0.67	1.2	medium	0.71	1.2	0.07	0.09		
2.4	medium	0.71	8	high	0.67	1.2	medium	0.71	1.2	0.12	0.14		
2.6	medium	0.86	8	high	0.67	1.2	medium	0.71	1.2	0.17	0.20		
2.8	medium	1.00	8	high	0.67	1.2	medium	0.71	1.2	0.23	0.27		
3	medium	0.86	8	high	0.67	1.2	medium	0.71	1.2	0.17	0.20		
3.2	medium	0.71	8	high	0.67	1.2	medium	0.71	1.2	0.12	0.14		
3.4	medium	0.57	8	high	0.67	1.2	medium	0.71	1.2	0.07	0.09		
2.2	medium	0.57	9	high	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2.4	medium	0.71	9	high	0.78	1.2	medium	0.71	1.2	0.16	0.19		
2.6	medium	0.86	9	high	0.78	1.2	medium	0.71	1.2	0.23	0.27		
2.8	medium	1.00	9	high	0.78	1.2	medium	0.71	1.2	0.31	0.37		
3	medium	0.86	9	high	0.78	1.2	medium	0.71	1.2	0.23	0.27		
3.2	medium	0.71	9	high	0.78	1.2	medium	0.71	1.2	0.16	0.19		
3.4	medium	0.57	9	high	0.78	1.2	medium	0.71	1.2	0.10	0.12		
2.2	medium	0.57	10	high	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2.4	medium	0.71	10	high	0.89	1.2	medium	0.71	1.2	0.21	0.25		
2.6	medium	0.86	10	high	0.89	1.2	medium	0.71	1.2	0.30	0.36		
2.8	medium	1.00	10	high	0.89	1.2	medium	0.71	1.2	0.40	0.48		
3	medium	0.86	10	high	0.89	1.2	medium	0.71	1.2	0.30	0.36		
3.2	medium	0.71	10	high	0.89	1.2	medium	0.71	1.2	0.21	0.25		
3.4	medium	0.57	10	high	0.89	1.2	medium	0.71	1.2	0.13	0.16		
2.2	medium	0.57	11	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.4	medium	0.71	11	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.6	medium	0.86	11	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.8	medium	1.00	11	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3	medium	0.86	11	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3.2	medium	0.71	11	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.4	medium	0.57	11	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	12	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.4	medium	0.71	12	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
2.6	medium	0.86	12	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
2.8	medium	1.00	12	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3	medium	0.86	12	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
3.2	medium	0.71	12	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.4	medium	0.57	12	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
2.2	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.4	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
2.4	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
3.4	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.4	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2.6	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.4	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2.6	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
2.8	medium	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
3	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
3.2	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.6	high	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09	0.80	low
3.6	high	0.57	1	low	1.00	0.8	low	0.57	0.8	0.11	0.09		
3.8	high	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
3.8	high	0.71	1	low	1.00	0.8	low	0.57	0.8	0.17	0.13		
4	high	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
4	high	0.86	1	low	1.00	0.8	low	0.57	0.8	0.24	0.19		
4.2	high	1.00	1	low	1.00	0.8	low	0.57	0.8	0.33	0.26		
4.2	high	1.00	1	low	1.00	0.8	low	0.57	0.8	0.33	0.26		
3.6	high	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
3.6	high	0.57	1	low	1.00	1	medium	0.57	1	0.11	0.11		
3.8	high	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
3.8	high	0.71	1	low	1.00	1	medium	0.57	1	0.17	0.17		
4	high	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
4	high	0.86	1	low	1.00	1	medium	0.57	1	0.24	0.24		
4.2	high	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
4.2	high	1.00	1	low	1.00	1	medium	0.57	1	0.33	0.33		
3.6	high	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.6	high	0.57	1	low	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.8	high	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.8	high	0.71	1	low	1.00	1.2	medium	0.71	1.2	0.26	0.31		
4	high	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4	high	0.86	1	low	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4.2	high	1.00	1	low	1.00	1.2	medium	0.71	1.2	0.51	0.61		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
4.2	high	1.00	1	low	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.45	medium
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21	2.55	high
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.2	0.33	0.72		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
3.8	high	0.71	1	low	1.00	3	high	1.00	2.6	0.51	1.33		
4	high	0.86	1	low	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	1	low	1.00	3	high	1.00	2.8	1.00	2.80		
3.6	high	0.57	2	medium	1.00	0.8	low	0.57	0.8	0.11	0.09	0.80	low
3.8	high	0.71	2	medium	1.00	0.8	low	0.57	0.8	0.17	0.13		
4	high	0.86	2	medium	1.00	0.8	low	0.57	0.8	0.24	0.19		
4.2	high	1.00	2	medium	1.00	0.8	low	0.57	0.8	0.33	0.26		
3.6	high	0.57	3	medium	0.89	0.8	low	0.57	0.8	0.08	0.07		
3.8	high	0.71	3	medium	0.89	0.8	low	0.57	0.8	0.13	0.11		
4	high	0.86	3	medium	0.89	0.8	low	0.57	0.8	0.19	0.15		
4.2	high	1.00	3	medium	0.89	0.8	low	0.57	0.8	0.26	0.21		
3.6	high	0.57	4	medium	0.78	0.8	low	0.57	0.8	0.06	0.05		
3.8	high	0.71	4	medium	0.78	0.8	low	0.57	0.8	0.10	0.08		
4	high	0.86	4	medium	0.78	0.8	low	0.57	0.8	0.15	0.12		
4.2	high	1.00	4	medium	0.78	0.8	low	0.57	0.8	0.20	0.16		
3.6	high	0.57	2	medium	1.00	1	medium	0.57	1	0.11	0.11		
3.8	high	0.71	2	medium	1.00	1	medium	0.57	1	0.17	0.17		
4	high	0.86	2	medium	1.00	1	medium	0.57	1	0.24	0.24		
4.2	high	1.00	2	medium	1.00	1	medium	0.57	1	0.33	0.33		
3.6	high	0.57	3	medium	0.89	1	medium	0.57	1	0.08	0.08		
3.8	high	0.71	3	medium	0.89	1	medium	0.57	1	0.13	0.13		
4	high	0.86	3	medium	0.89	1	medium	0.57	1	0.19	0.19		
4.2	high	1.00	3	medium	0.89	1	medium	0.57	1	0.26	0.26		
3.6	high	0.57	4	medium	0.78	1	medium	0.57	1	0.06	0.06		
3.8	high	0.71	4	medium	0.78	1	medium	0.57	1	0.10	0.10		
4	high	0.86	4	medium	0.78	1	medium	0.57	1	0.15	0.15		
4.2	high	1.00	4	medium	0.78	1	medium	0.57	1	0.20	0.20		
3.6	high	0.57	5	medium	0.67	1	medium	0.57	1	0.05	0.05		
3.8	high	0.71	5	medium	0.67	1	medium	0.57	1	0.07	0.07		
4	high	0.86	5	medium	0.67	1	medium	0.57	1	0.11	0.11		
4.2	high	1.00	5	medium	0.67	1	medium	0.57	1	0.15	0.15		
3.6	high	0.57	6	medium	0.56	1	medium	0.57	1	0.03	0.03		
3.8	high	0.71	6	medium	0.56	1	medium	0.57	1	0.05	0.05		
4	high	0.86	6	medium	0.56	1	medium	0.57	1	0.07	0.07		
4.2	high	1.00	6	medium	0.56	1	medium	0.57	1	0.10	0.10		
3.6	high	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.6	high	0.57	2	medium	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.8	high	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
3.8	high	0.71	2	medium	1.00	1.2	medium	0.71	1.2	0.26	0.31		
4	high	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4	high	0.86	2	medium	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4.2	high	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
4.2	high	1.00	2	medium	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3.6	high	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
3.6	high	0.57	3	medium	0.89	1.2	medium	0.71	1.2	0.13	0.16		
3.8	high	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
3.8	high	0.71	3	medium	0.89	1.2	medium	0.71	1.2	0.21	0.25		
4	high	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
4	high	0.86	3	medium	0.89	1.2	medium	0.71	1.2	0.30	0.36		
4.2	high	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
4.2	high	1.00	3	medium	0.89	1.2	medium	0.71	1.2	0.40	0.48		
3.6	high	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		
3.6	high	0.57	4	medium	0.78	1.2	medium	0.71	1.2	0.10	0.12		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.8	high	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
3.8	high	0.71	4	medium	0.78	1.2	medium	0.71	1.2	0.16	0.19		
4	high	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
4	high	0.86	4	medium	0.78	1.2	medium	0.71	1.2	0.23	0.27		
4.2	high	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
4.2	high	1.00	4	medium	0.78	1.2	medium	0.71	1.2	0.31	0.37		
3.6	high	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
3.6	high	0.57	5	medium	0.67	1.2	medium	0.71	1.2	0.07	0.09		
3.8	high	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
3.8	high	0.71	5	medium	0.67	1.2	medium	0.71	1.2	0.12	0.14		
4	high	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
4	high	0.86	5	medium	0.67	1.2	medium	0.71	1.2	0.17	0.20		
4.2	high	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
4.2	high	1.00	5	medium	0.67	1.2	medium	0.71	1.2	0.23	0.27		
3.6	high	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
3.6	high	0.57	6	medium	0.56	1.2	medium	0.71	1.2	0.05	0.06		
3.8	high	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
3.8	high	0.71	6	medium	0.56	1.2	medium	0.71	1.2	0.08	0.10		
4	high	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
4	high	0.86	6	medium	0.56	1.2	medium	0.71	1.2	0.12	0.14		
4.2	high	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
4.2	high	1.00	6	medium	0.56	1.2	medium	0.71	1.2	0.16	0.19		
3.6	high	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.38	medium
3.8	high	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
3.8	high	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
4	high	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
4.2	high	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3.6	high	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.61	0.97		
3.6	high	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
3.8	high	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.2	0.11	0.23	2.61	high
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	2	medium	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	3	medium	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	3	medium	0.89	2.4	high	0.57	2.4	0.26	0.62		
3.6	high	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
3.8	high	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	2	medium	1.00	3	high	1.00	3	0.33	0.98		
3.8	high	0.71	2	medium	1.00	3	high	1.00	3	0.51	1.53		
4	high	0.86	2	medium	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	2	medium	1.00	3	high	1.00	3	1.00	3.00		
3.6	high	0.57	7	high	0.56	1	medium	0.57	1	0.03	0.03	1.32	medium

Storage [1]	Storage Category [2]	μ [3]	Inflow [4]	Inflow Category [5]	μ [6]	Demand [7]	Demand Category [8]	μ [9]	Release [10]	weight [11]	weight * Release [12]	Release [13]	Release Category [14]
3.8	high	0.71	7	high	0.56	1	medium	0.57	1	0.05	0.05		
4	high	0.86	7	high	0.56	1	medium	0.57	1	0.07	0.07		
4.2	high	1.00	7	high	0.56	1	medium	0.57	1	0.10	0.10		
3.6	high	0.57	8	high	0.67	1	medium	0.57	1	0.05	0.05		
3.8	high	0.71	8	high	0.67	1	medium	0.57	1	0.07	0.07		
4	high	0.86	8	high	0.67	1	medium	0.57	1	0.11	0.11		
4.2	high	1.00	8	high	0.67	1	medium	0.57	1	0.15	0.15		
3.6	high	0.57	9	high	0.78	1	medium	0.57	1	0.06	0.06		
3.8	high	0.71	9	high	0.78	1	medium	0.57	1	0.10	0.10		
4	high	0.86	9	high	0.78	1	medium	0.57	1	0.15	0.15		
4.2	high	1.00	9	high	0.78	1	medium	0.57	1	0.20	0.20		
3.6	high	0.57	7	high	0.56	1.2	medium	0.71	1.2	0.05	0.06		
3.8	high	0.71	7	high	0.56	1.2	medium	0.71	1.2	0.08	0.10		
4	high	0.86	7	high	0.56	1.2	medium	0.71	1.2	0.12	0.14		
4.2	high	1.00	7	high	0.56	1.2	medium	0.71	1.2	0.16	0.19		
3.6	high	0.57	8	high	0.67	1.2	medium	0.71	1.2	0.07	0.09		
3.8	high	0.71	8	high	0.67	1.2	medium	0.71	1.2	0.12	0.14		
4	high	0.86	8	high	0.67	1.2	medium	0.71	1.2	0.17	0.20		
4.2	high	1.00	8	high	0.67	1.2	medium	0.71	1.2	0.23	0.27		
3.6	high	0.57	9	high	0.78	1.2	medium	0.71	1.2	0.10	0.12		
3.8	high	0.71	9	high	0.78	1.2	medium	0.71	1.2	0.16	0.19		
4	high	0.86	9	high	0.78	1.2	medium	0.71	1.2	0.23	0.27		
4.2	high	1.00	9	high	0.78	1.2	medium	0.71	1.2	0.31	0.37		
3.6	high	0.57	10	high	0.89	1.2	medium	0.71	1.2	0.13	0.16		
3.8	high	0.71	10	high	0.89	1.2	medium	0.71	1.2	0.21	0.25		
4	high	0.86	10	high	0.89	1.2	medium	0.71	1.2	0.30	0.36		
4.2	high	1.00	10	high	0.89	1.2	medium	0.71	1.2	0.40	0.48		
3.6	high	0.57	11	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.8	high	0.71	11	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
4	high	0.86	11	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4.2	high	1.00	11	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3.6	high	0.57	12	high	1.00	1.2	medium	0.71	1.2	0.17	0.20		
3.8	high	0.71	12	high	1.00	1.2	medium	0.71	1.2	0.26	0.31		
4	high	0.86	12	high	1.00	1.2	medium	0.71	1.2	0.37	0.45		
4.2	high	1.00	12	high	1.00	1.2	medium	0.71	1.2	0.51	0.61		
3.6	high	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
3.8	high	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3.6	high	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
3.8	high	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		

Procedure

- [2],[5],[8] category of [1],[4],[7] respectively from FRB-2 membership function
- [3],[6],[9] membership degree (μ) of [1],[4],[7] respectively from FRB-2 membership function
- [10] release from set of inputs (FSDP result)
- [11] $([3]*[6]*[9])^2$
- [12] $[10]*[11]$
- [13] $(\Sigma[12] \text{ in the same set of inputs category})/(\Sigma[11] \text{ in the same set of inputs category})$
- [14] release category of [13] from FRB-2 membership function

Table 5.3 Assessment of Fuzzy Rule Base by FAM (FRB-3 membership function)

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.4	low	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80	0.88	low
1.4	low	1.00	1	low	1.00	0.8	low	1.00	0.6	1.00	0.60		
1.6	low	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.6	low	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.8	low	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
1.8	low	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2	low	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2	low	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
1.4	low	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
1.4	low	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
1.6	low	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
1.6	low	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
1.8	low	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
1.8	low	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2	low	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2	low	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
1.4	low	1.00	1	low	1.00	1.2	low	0.50	1	0.25	0.25		
1.4	low	1.00	1	low	1.00	1.2	low	0.50	1	0.25	0.25		
1.6	low	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.6	low	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
1.8	low	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	1	low	1.00	1.2	low	0.50	1	0.08	0.08		
2	low	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00	1.17	low
1.4	low	1.00	1	low	1.00	1.6	medium	1.00	1	1.00	1.00		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.6	low	0.86	1	low	1.00	1.6	medium	1.00	1.2	0.73	0.88		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
1.8	low	0.71	1	low	1.00	1.6	medium	1.00	1.4	0.51	0.71		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2	low	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	1	low	1.00	1.8	medium	0.86	0.6	0.73	0.44		
1.6	low	0.86	1	low	1.00	1.8	medium	0.86	1.2	0.54	0.65		
1.8	low	0.71	1	low	1.00	1.8	medium	0.86	1.4	0.37	0.52		
2	low	0.57	1	low	1.00	1.8	medium	0.86	1.6	0.24	0.38		
1.4	low	1.00	1	low	1.00	2.4	high	0.57	1	0.33	0.33	0.33	low
1.4	low	1.00	1	low	1.00	2.4	high	0.57	0.2	0.33	0.07		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.6	low	0.86	1	low	1.00	2.4	high	0.57	0.2	0.24	0.05		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
1.8	low	0.71	1	low	1.00	2.4	high	0.57	0.2	0.17	0.03		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
2	low	0.57	1	low	1.00	2.4	high	0.57	1.6	0.11	0.17		
1.4	low	1.00	1	low	1.00	3	high	1.00	0.2	1.00	0.20		
1.6	low	0.86	1	low	1.00	3	high	1.00	0.2	0.73	0.15		
1.8	low	0.71	1	low	1.00	3	high	1.00	0.2	0.51	0.10		
2	low	0.57	1	low	1.00	3	high	1.00	0.2	0.33	0.07		
1.4	low	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80	0.97	low
1.6	low	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
1.8	low	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
2	low	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26		
1.4	low	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.73	0.63		
1.6	low	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
1.8	low	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
2	low	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
1.4	low	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.60	0.48		
1.6	low	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
1.8	low	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
2	low	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
1.4	low	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
1.6	low	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
1.8	low	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
2	low	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
1.4	low	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
1.6	low	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
1.8	low	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
2	low	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
1.4	low	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
1.6	low	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
1.8	low	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
2	low	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.4	low	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
1.6	low	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
1.8	low	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
2	low	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
1.4	low	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
1.6	low	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
1.8	low	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
2	low	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
1.4	low	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.4	low	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.6	low	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
1.8	low	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2	low	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.4	low	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.6	low	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.6	low	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.8	low	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
1.8	low	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2	low	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2	low	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
1.4	low	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.4	low	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.6	low	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.8	low	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
1.8	low	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2	low	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2	low	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
1.4	low	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.4	low	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.6	low	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.8	low	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2	low	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2	low	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
1.4	low	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.4	low	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.6	low	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.6	low	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
1.8	low	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2	low	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2	low	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
1.4	low	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60	1.64	medium
1.6	low	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
1.8	low	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2	low	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
1.4	low	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
1.6	low	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
1.8	low	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
2	low	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
1.4	low	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
1.6	low	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
1.6	low	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
1.8	low	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2	low	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65	2.17	medium
1.4	low	1.00	2	medium	1.00	2.4	high	0.57	2	0.33	0.65		
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.6	low	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
1.8	low	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2	low	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
1.4	low	1.00	3	medium	0.89	2.4	high	0.57	1.8	0.26	0.46		
1.6	low	0.86	3	medium	0.89	2.4	high	0.57	2	0.19	0.38		
1.8	low	0.71	3	medium	0.89	2.4	high	0.57	2.2	0.13	0.29		
2	low	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
1.4	low	1.00	4	medium	0.78	2.4	high	0.57	1.8	0.20	0.36		
1.6	low	0.86	4	medium	0.78	2.4	high	0.57	1.8	0.15	0.26		
1.8	low	0.71	4	medium	0.78	2.4	high	0.57	2	0.10	0.20		
2	low	0.57	4	medium	0.78	2.4	high	0.57	2.2	0.06	0.14		
1.4	low	1.00	5	medium	0.67	2.4	high	0.57	2.2	0.15	0.32		
1.6	low	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
1.6	low	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
1.8	low	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	2	medium	1.00	3	high	1.00	2	1.00	2.00		
1.6	low	0.86	2	medium	1.00	3	high	1.00	2.2	0.73	1.62		
1.8	low	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2	low	0.57	2	medium	1.00	3	high	1.00	2.6	0.33	0.85		
1.4	low	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17	1.12	low
1.6	low	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
1.8	low	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
2	low	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06		
1.4	low	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
1.6	low	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
1.8	low	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
2	low	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
1.4	low	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
1.6	low	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
1.8	low	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
2	low	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
1.4	low	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
1.6	low	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
1.8	low	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
2	low	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
1.4	low	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
1.6	low	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
1.8	low	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
2	low	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
1.4	low	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
1.6	low	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
1.8	low	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
2	low	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
1.4	low	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
1.6	low	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
1.8	low	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
2	low	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
1.4	low	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
1.6	low	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
1.8	low	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2	low	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
1.4	low	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49	1.60	medium
1.6	low	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
1.8	low	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2	low	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
1.4	low	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
1.6	low	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
1.8	low	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2	low	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
1.4	low	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
1.6	low	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
1.8	low	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2	low	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
1.4	low	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24	2.40	high
1.6	low	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
1.8	low	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2	low	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
1.4	low	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
1.6	low	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
1.8	low	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2	low	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
1.4	low	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
1.6	low	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
1.8	low	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2	low	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
1.4	low	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
1.6	low	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
1.8	low	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2	low	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.2	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26	0.92	low
2.2	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.4	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.4	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.6	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.6	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.8	medium	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
2.8	medium	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
3	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
3	medium	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
3.2	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.2	medium	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.4	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
3.4	medium	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.2	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.4	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2.4	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
2.6	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
2.6	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
2.8	medium	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
2.8	medium	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
3	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
3	medium	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
3.2	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.2	medium	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.4	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.4	medium	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.4	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.6	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
2.8	medium	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
3	medium	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.2	medium	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.4	medium	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.65	medium
2.2	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.4	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.6	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
2.8	medium	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3	medium	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.2	medium	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.4	medium	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.38		
2.4	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.2	medium	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19	2.22	medium
2.2	medium	0.57	1	low	1.00	2.4	high	0.57	1.8	0.11	0.19		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.4	medium	0.71	1	low	1.00	2.4	high	0.57	2	0.17	0.33		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.6	medium	0.86	1	low	1.00	2.4	high	0.57	2.2	0.24	0.53		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
2.8	medium	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
3	medium	0.86	1	low	1.00	2.4	high	0.57	2	0.24	0.48		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.2	medium	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	1	low	1.00	2.4	high	0.57	2.2	0.11	0.23		
2.2	medium	0.57	1	low	1.00	3	high	1.00	0.4	0.33	0.13		
2.4	medium	0.71	1	low	1.00	3	high	1.00	2	0.51	1.02		
2.6	medium	0.86	1	low	1.00	3	high	1.00	2.2	0.73	1.62		
2.8	medium	1.00	1	low	1.00	3	high	1.00	2.4	1.00	2.40		
3	medium	0.86	1	low	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	1	low	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
2.2	medium	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26	0.97	low
2.4	medium	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
2.6	medium	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
2.8	medium	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80		
3	medium	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
3.2	medium	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.4	medium	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26		
2.2	medium	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
2.4	medium	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
2.6	medium	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
2.8	medium	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.79	0.63		
3	medium	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
3.2	medium	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
3.4	medium	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
2.2	medium	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
2.4	medium	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
2.6	medium	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
2.8	medium	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.60	0.48		
3	medium	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
3.2	medium	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
3.4	medium	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
2.2	medium	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
2.4	medium	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
2.6	medium	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
2.8	medium	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
3	medium	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
3.2	medium	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
3.4	medium	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
2.2	medium	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
2.4	medium	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
2.6	medium	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
2.8	medium	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
3	medium	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
3.2	medium	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
3.4	medium	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
2.2	medium	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
2.4	medium	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
2.6	medium	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
2.8	medium	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
3	medium	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
3.2	medium	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
3.4	medium	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
2.2	medium	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
2.4	medium	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
2.6	medium	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
2.8	medium	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
3	medium	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
3.2	medium	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
3.4	medium	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
2.2	medium	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
2.4	medium	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
2.6	medium	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
2.8	medium	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
3	medium	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
3.2	medium	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
3.4	medium	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
2.2	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.4	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.6	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
2.8	medium	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
3	medium	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.2	medium	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.4	medium	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.4	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.4	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.6	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.6	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.8	medium	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
2.8	medium	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
3	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
3	medium	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
3.2	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.2	medium	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.4	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.4	medium	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.4	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.4	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.6	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.6	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
2.8	medium	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
3	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
3.2	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.2	medium	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.4	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.4	medium	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.4	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.4	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.6	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.8	medium	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
3	medium	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
3.2	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.4	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.4	medium	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.4	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.4	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.6	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.8	medium	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
2.8	medium	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
3	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
3	medium	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.2	medium	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.4	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.4	medium	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.64	medium

Storage [1]	Storage Category [2]	μ [3]	Inflow [4]	Inflow Category [5]	μ [6]	Demand [7]	Demand Category [8]	μ [9]	Release [10]	weight [11]	weight * Release [12]	Release [13]	Release Category [14]
2.4	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
2.6	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
2.8	medium	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3	medium	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
3.2	medium	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.4	medium	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52		
2.2	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.4	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
2.6	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
2.8	medium	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3	medium	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
3.2	medium	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.64		
3.4	medium	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
2.2	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.4	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.4	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
2.6	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
2.8	medium	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3	medium	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
3.2	medium	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
3.4	medium	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26	2.36	high
2.2	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	1.8	0.17	0.30		
2.4	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2	0.24	0.48		
2.6	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	1.8	0.33	0.59		
2.8	medium	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3	medium	0.86	2	medium	1.00	2.4	high	-0.57	2	0.24	0.48		
3	medium	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2	0.17	0.33		
3.2	medium	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2	0.11	0.21		
3.4	medium	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
2.2	medium	0.57	3	medium	0.89	2.4	high	0.57	1.8	0.08	0.15		
2.4	medium	0.71	3	medium	0.89	2.4	high	0.57	1.8	0.13	0.24		
2.6	medium	0.86	3	medium	0.89	2.4	high	0.57	1.8	0.19	0.34		
2.8	medium	1.00	3	medium	0.89	2.4	high	0.57	2	0.26	0.52		
3	medium	0.86	3	medium	0.89	2.4	high	0.57	2.2	0.19	0.42		
3.2	medium	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	3	medium	0.89	2.4	high	0.57	2.2	0.08	0.19		
2.2	medium	0.57	4	medium	0.78	2.4	high	0.57	2	0.06	0.13		
2.4	medium	0.71	4	medium	0.78	2.4	high	0.57	2.2	0.10	0.22		
2.6	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.4	medium	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.4	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	2	medium	1.00	3	high	1.00	2.2	0.33	0.72		
2.4	medium	0.71	2	medium	1.00	3	high	1.00	2.4	0.51	1.22		
2.6	medium	0.86	2	medium	1.00	3	high	1.00	2.4	0.73	1.76		
2.8	medium	1.00	2	medium	1.00	3	high	1.00	2.6	1.00	2.60		
3	medium	0.86	2	medium	1.00	3	high	1.00	2.6	0.73	1.91		
3.2	medium	0.71	2	medium	1.00	3	high	1.00	2.8	0.51	1.43		
3.4	medium	0.57	2	medium	1.00	3	high	1.00	2.8	0.33	0.91		
2.2	medium	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06	1.12	low.
2.4	medium	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
2.6	medium	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
2.8	medium	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17		
3	medium	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
3.2	medium	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
3.4	medium	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06		
2.2	medium	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
2.4	medium	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
2.6	medium	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
2.8	medium	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
3	medium	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
3.2	medium	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
3.4	medium	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
2.2	medium	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
2.4	medium	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
2.6	medium	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
2.8	medium	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
3	medium	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
3.2	medium	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
3.4	medium	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
2.2	medium	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.4	medium	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
2.6	medium	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
2.8	medium	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
3	medium	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
3.2	medium	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.4	medium	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
2.2	medium	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.4	medium	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
2.6	medium	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
2.8	medium	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
3	medium	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
3.2	medium	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.4	medium	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
2.2	medium	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.4	medium	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
2.6	medium	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
2.8	medium	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
3	medium	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
3.2	medium	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.4	medium	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
2.2	medium	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.4	medium	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
2.6	medium	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
2.8	medium	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
3	medium	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
3.2	medium	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.4	medium	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
2.2	medium	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3	medium	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.4	medium	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
2.6	medium	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
2.8	medium	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3	medium	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
3.2	medium	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.4	medium	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
2.2	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16	1.60	medium
2.4	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
2.6	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
2.8	medium	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3	medium	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
3.2	medium	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
3.4	medium	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16		
2.2	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.4	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
2.6	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
2.8	medium	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3	medium	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
3.2	medium	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
3.4	medium	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
2.2	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.4	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
2.6	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
2.8	medium	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3	medium	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
3.2	medium	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
3.4	medium	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
2.2	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
2.4	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
2.6	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
2.8	medium	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3	medium	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
3.2	medium	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
3.4	medium	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08		
2.2	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.4	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
2.6	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
2.8	medium	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3	medium	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
3.2	medium	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
3.4	medium	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
2.2	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.4	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
2.6	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
2.8	medium	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3	medium	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
3.2	medium	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
3.4	medium	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
2.2	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
2.4	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
2.6	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
2.8	medium	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		
3	medium	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
3.2	medium	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
3.4	medium	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.6	high	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26	0.92	low
3.6	high	0.57	1	low	1.00	0.8	low	1.00	0.8	0.33	0.26		
3.8	high	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
3.8	high	0.71	1	low	1.00	0.8	low	1.00	0.8	0.51	0.41		
4	high	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
4	high	0.86	1	low	1.00	0.8	low	1.00	0.8	0.73	0.59		
4.2	high	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
4.2	high	1.00	1	low	1.00	0.8	low	1.00	0.8	1.00	0.80		
3.6	high	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.6	high	0.57	1	low	1.00	1	low	0.75	1	0.18	0.18		
3.8	high	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
3.8	high	0.71	1	low	1.00	1	low	0.75	1	0.29	0.29		
4	high	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
4	high	0.86	1	low	1.00	1	low	0.75	1	0.41	0.41		
4.2	high	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
4.2	high	1.00	1	low	1.00	1	low	0.75	1	0.56	0.56		
3.6	high	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.6	high	0.57	1	low	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.8	high	0.71	1	low	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
4	high	0.86	1	low	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		

Fuzzy Rule Base Modeling for Reservoir Operation

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
4.2	high	1.00	1	low	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.65	medium
3.6	high	0.57	1	low	1.00	1.6	medium	1.00	1.6	0.33	0.52		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
3.8	high	0.71	1	low	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4	high	0.86	1	low	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
4.2	high	1.00	1	low	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	1	low	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	1	low	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	1	low	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	1	low	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2	0.11	0.21	2.55	high
3.6	high	0.57	1	low	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	1	low	1.00	2.4	high	0.57	2.4	0.17	0.40		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4	high	0.86	1	low	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.2	0.33	0.72		
4.2	high	1.00	1	low	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	1	low	1.00	3	high	1.00	2.4	0.33	0.78		
3.8	high	0.71	1	low	1.00	3	high	1.00	2.6	0.51	1.33		
4	high	0.86	1	low	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	1	low	1.00	3	high	1.00	2.8	1.00	2.80		
3.6	high	0.57	2	medium	1.00	0.8	low	1.00	0.8	0.33	0.26	0.97	low
3.8	high	0.71	2	medium	1.00	0.8	low	1.00	0.8	0.51	0.41		
4	high	0.86	2	medium	1.00	0.8	low	1.00	0.8	0.73	0.59		
4.2	high	1.00	2	medium	1.00	0.8	low	1.00	0.8	1.00	0.80		
3.6	high	0.57	3	medium	0.89	0.8	low	1.00	0.8	0.26	0.21		
3.8	high	0.71	3	medium	0.89	0.8	low	1.00	0.8	0.40	0.32		
4	high	0.86	3	medium	0.89	0.8	low	1.00	0.8	0.58	0.46		
4.2	high	1.00	3	medium	0.89	0.8	low	1.00	0.8	0.79	0.63		
3.6	high	0.57	4	medium	0.78	0.8	low	1.00	0.8	0.20	0.16		
3.8	high	0.71	4	medium	0.78	0.8	low	1.00	0.8	0.31	0.25		
4	high	0.86	4	medium	0.78	0.8	low	1.00	0.8	0.44	0.36		
4.2	high	1.00	4	medium	0.78	0.8	low	1.00	0.8	0.61	0.48		
3.6	high	0.57	2	medium	1.00	1	low	0.75	1	0.18	0.18		
3.8	high	0.71	2	medium	1.00	1	low	0.75	1	0.29	0.29		
4	high	0.86	2	medium	1.00	1	low	0.75	1	0.41	0.41		
4.2	high	1.00	2	medium	1.00	1	low	0.75	1	0.56	0.56		
3.6	high	0.57	3	medium	0.89	1	low	0.75	1	0.15	0.15		
3.8	high	0.71	3	medium	0.89	1	low	0.75	1	0.23	0.23		
4	high	0.86	3	medium	0.89	1	low	0.75	1	0.33	0.33		
4.2	high	1.00	3	medium	0.89	1	low	0.75	1	0.44	0.44		
3.6	high	0.57	4	medium	0.78	1	low	0.75	1	0.11	0.11		
3.8	high	0.71	4	medium	0.78	1	low	0.75	1	0.17	0.17		
4	high	0.86	4	medium	0.78	1	low	0.75	1	0.25	0.25		
4.2	high	1.00	4	medium	0.78	1	low	0.75	1	0.34	0.34		
3.6	high	0.57	5	medium	0.67	1	low	0.75	1	0.08	0.08		
3.8	high	0.71	5	medium	0.67	1	low	0.75	1	0.13	0.13		
4	high	0.86	5	medium	0.67	1	low	0.75	1	0.18	0.18		
4.2	high	1.00	5	medium	0.67	1	low	0.75	1	0.25	0.25		
3.6	high	0.57	6	medium	0.56	1	low	0.75	1	0.06	0.06		
3.8	high	0.71	6	medium	0.56	1	low	0.75	1	0.09	0.09		
4	high	0.86	6	medium	0.56	1	low	0.75	1	0.13	0.13		
4.2	high	1.00	6	medium	0.56	1	low	0.75	1	0.17	0.17		
3.6	high	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.6	high	0.57	2	medium	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
3.8	high	0.71	2	medium	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
4	high	0.86	2	medium	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
4.2	high	1.00	2	medium	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.6	high	0.57	3	medium	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.8	high	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
3.8	high	0.71	3	medium	0.89	1.2	low	0.50	1.2	0.10	0.12		
4	high	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
4	high	0.86	3	medium	0.89	1.2	low	0.50	1.2	0.15	0.17		
4.2	high	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
4.2	high	1.00	3	medium	0.89	1.2	low	0.50	1.2	0.20	0.24		
3.6	high	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.6	high	0.57	4	medium	0.78	1.2	low	0.50	1.2	0.05	0.06		

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight *	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.8	high	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
3.8	high	0.71	4	medium	0.78	1.2	low	0.50	1.2	0.08	0.09		
4	high	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
4	high	0.86	4	medium	0.78	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
4.2	high	1.00	4	medium	0.78	1.2	low	0.50	1.2	0.15	0.18		
3.6	high	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.6	high	0.57	5	medium	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.8	high	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
3.8	high	0.71	5	medium	0.67	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
4	high	0.86	5	medium	0.67	1.2	low	0.50	1.2	0.08	0.10		
4.2	high	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	5	medium	0.67	1.2	low	0.50	1.2	0.11	0.13		
3.6	high	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.6	high	0.57	6	medium	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.8	high	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
3.8	high	0.71	6	medium	0.56	1.2	low	0.50	1.2	0.04	0.05		
4	high	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	6	medium	0.56	1.2	low	0.50	1.2	0.06	0.07		
4.2	high	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
4.2	high	1.00	6	medium	0.56	1.2	low	0.50	1.2	0.08	0.09		
3.6	high	0.57	2	medium	1.00	1.6	medium	1.00	1.6	0.33	0.52	1.64	medium
3.8	high	0.71	2	medium	1.00	1.6	medium	1.00	1.6	0.51	0.82		
4	high	0.86	2	medium	1.00	1.6	medium	1.00	1.6	0.73	1.18		
4.2	high	1.00	2	medium	1.00	1.6	medium	1.00	1.6	1.00	1.60		
3.6	high	0.57	3	medium	0.89	1.6	medium	1.00	1.6	0.26	0.41		
3.8	high	0.71	3	medium	0.89	1.6	medium	1.00	1.6	0.40	0.65		
4	high	0.86	3	medium	0.89	1.6	medium	1.00	1.6	0.58	0.93		
4.2	high	1.00	3	medium	0.89	1.6	medium	1.00	1.6	0.79	1.26		
3.6	high	0.57	4	medium	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	4	medium	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	4	medium	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	4	medium	0.78	1.6	medium	1.00	1.6	0.61	0.97		
3.6	high	0.57	5	medium	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	5	medium	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	5	medium	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	5	medium	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	6	medium	0.56	1.6	medium	1.00	1.6	0.10	0.16		
3.8	high	0.71	6	medium	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	6	medium	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	6	medium	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	2	medium	1.00	1.8	medium	0.86	1.8	0.24	0.43		
3.8	high	0.71	2	medium	1.00	1.8	medium	0.86	1.8	0.37	0.67		
4	high	0.86	2	medium	1.00	1.8	medium	0.86	1.8	0.54	0.97		
4.2	high	1.00	2	medium	1.00	1.8	medium	0.86	1.8	0.73	1.32		
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.2	0.11	0.23	2.61	high
3.6	high	0.57	2	medium	1.00	2.4	high	0.57	2.4	0.11	0.26		
3.8	high	0.71	2	medium	1.00	2.4	high	0.57	2.2	0.17	0.37		
3.8	high	0.71	2	medium	1.00	2.4	high	0.57	2.4	0.17	0.40		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.2	0.24	0.53		
4	high	0.86	2	medium	1.00	2.4	high	0.57	2.4	0.24	0.58		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
4.2	high	1.00	2	medium	1.00	2.4	high	0.57	2.4	0.33	0.78		
3.6	high	0.57	3	medium	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	3	medium	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	3	medium	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	3	medium	0.89	2.4	high	0.57	2.4	0.26	0.62		
3.6	high	0.57	4	medium	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	4	medium	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	4	medium	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	4	medium	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	5	medium	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	5	medium	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	5	medium	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	5	medium	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	6	medium	0.56	2.4	high	0.57	2.4	0.03	0.08		
3.8	high	0.71	6	medium	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	6	medium	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	6	medium	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	2	medium	1.00	3	high	1.00	3	0.33	0.98		
3.8	high	0.71	2	medium	1.00	3	high	1.00	3	0.51	1.53		
4	high	0.86	2	medium	1.00	3	high	1.00	2.8	0.73	2.06		
4.2	high	1.00	2	medium	1.00	3	high	1.00	3	1.00	3.00		
3.6	high	0.57	7	high	0.56	1	low	0.75	1	0.06	0.06	1.12	low

Storage	Storage Category	μ	Inflow	Inflow Category	μ	Demand	Demand Category	μ	Release	weight	weight * Release	Release	Release Category
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
3.8	high	0.71	7	high	0.56	1	low	0.75	1	0.09	0.09		
4	high	0.86	7	high	0.56	1	low	0.75	1	0.13	0.13		
4.2	high	1.00	7	high	0.56	1	low	0.75	1	0.17	0.17		
3.6	high	0.57	8	high	0.67	1	low	0.75	1	0.08	0.08		
3.8	high	0.71	8	high	0.67	1	low	0.75	1	0.13	0.13		
4	high	0.86	8	high	0.67	1	low	0.75	1	0.18	0.18		
4.2	high	1.00	8	high	0.67	1	low	0.75	1	0.25	0.25		
3.6	high	0.57	9	high	0.78	1	low	0.75	1	0.11	0.11		
3.8	high	0.71	9	high	0.78	1	low	0.75	1	0.17	0.17		
4	high	0.86	9	high	0.78	1	low	0.75	1	0.25	0.25		
4.2	high	1.00	9	high	0.78	1	low	0.75	1	0.34	0.34		
3.6	high	0.57	7	high	0.56	1.2	low	0.50	1.2	0.03	0.03		
3.8	high	0.71	7	high	0.56	1.2	low	0.50	1.2	0.04	0.05		
4	high	0.86	7	high	0.56	1.2	low	0.50	1.2	0.06	0.07		
4.2	high	1.00	7	high	0.56	1.2	low	0.50	1.2	0.08	0.09		
3.6	high	0.57	8	high	0.67	1.2	low	0.50	1.2	0.04	0.04		
3.8	high	0.71	8	high	0.67	1.2	low	0.50	1.2	0.06	0.07		
4	high	0.86	8	high	0.67	1.2	low	0.50	1.2	0.08	0.10		
4.2	high	1.00	8	high	0.67	1.2	low	0.50	1.2	0.11	0.13		
3.6	high	0.57	9	high	0.78	1.2	low	0.50	1.2	0.05	0.06		
3.8	high	0.71	9	high	0.78	1.2	low	0.50	1.2	0.08	0.09		
4	high	0.86	9	high	0.78	1.2	low	0.50	1.2	0.11	0.13		
4.2	high	1.00	9	high	0.78	1.2	low	0.50	1.2	0.15	0.18		
3.6	high	0.57	10	high	0.89	1.2	low	0.50	1.2	0.06	0.08		
3.8	high	0.71	10	high	0.89	1.2	low	0.50	1.2	0.10	0.12		
4	high	0.86	10	high	0.89	1.2	low	0.50	1.2	0.15	0.17		
4.2	high	1.00	10	high	0.89	1.2	low	0.50	1.2	0.20	0.24		
3.6	high	0.57	11	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	11	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	11	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	11	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	12	high	1.00	1.2	low	0.50	1.2	0.08	0.10		
3.8	high	0.71	12	high	1.00	1.2	low	0.50	1.2	0.13	0.15		
4	high	0.86	12	high	1.00	1.2	low	0.50	1.2	0.18	0.22		
4.2	high	1.00	12	high	1.00	1.2	low	0.50	1.2	0.25	0.30		
3.6	high	0.57	7	high	0.56	1.6	medium	1.00	1.6	0.10	0.16	1.60	medium
3.8	high	0.71	7	high	0.56	1.6	medium	1.00	1.6	0.16	0.25		
4	high	0.86	7	high	0.56	1.6	medium	1.00	1.6	0.23	0.36		
4.2	high	1.00	7	high	0.56	1.6	medium	1.00	1.6	0.31	0.49		
3.6	high	0.57	8	high	0.67	1.6	medium	1.00	1.6	0.15	0.23		
3.8	high	0.71	8	high	0.67	1.6	medium	1.00	1.6	0.23	0.36		
4	high	0.86	8	high	0.67	1.6	medium	1.00	1.6	0.33	0.52		
4.2	high	1.00	8	high	0.67	1.6	medium	1.00	1.6	0.44	0.71		
3.6	high	0.57	9	high	0.78	1.6	medium	1.00	1.6	0.20	0.32		
3.8	high	0.71	9	high	0.78	1.6	medium	1.00	1.6	0.31	0.49		
4	high	0.86	9	high	0.78	1.6	medium	1.00	1.6	0.44	0.71		
4.2	high	1.00	9	high	0.78	1.6	medium	1.00	1.6	0.60	0.97		
3.6	high	0.57	7	high	0.56	2.4	high	0.57	2.4	0.03	0.08	2.40	high
3.8	high	0.71	7	high	0.56	2.4	high	0.57	2.4	0.05	0.12		
4	high	0.86	7	high	0.56	2.4	high	0.57	2.4	0.07	0.18		
4.2	high	1.00	7	high	0.56	2.4	high	0.57	2.4	0.10	0.24		
3.6	high	0.57	8	high	0.67	2.4	high	0.57	2.4	0.05	0.11		
3.8	high	0.71	8	high	0.67	2.4	high	0.57	2.4	0.07	0.18		
4	high	0.86	8	high	0.67	2.4	high	0.57	2.4	0.11	0.26		
4.2	high	1.00	8	high	0.67	2.4	high	0.57	2.4	0.15	0.35		
3.6	high	0.57	9	high	0.78	2.4	high	0.57	2.4	0.06	0.15		
3.8	high	0.71	9	high	0.78	2.4	high	0.57	2.4	0.10	0.24		
4	high	0.86	9	high	0.78	2.4	high	0.57	2.4	0.15	0.35		
4.2	high	1.00	9	high	0.78	2.4	high	0.57	2.4	0.20	0.47		
3.6	high	0.57	10	high	0.89	2.4	high	0.57	2.4	0.08	0.20		
3.8	high	0.71	10	high	0.89	2.4	high	0.57	2.4	0.13	0.32		
4	high	0.86	10	high	0.89	2.4	high	0.57	2.4	0.19	0.45		
4.2	high	1.00	10	high	0.89	2.4	high	0.57	2.4	0.26	0.62		

Procedure

- [2],[5],[8] category of [1],[4],[7] respectively from FRB-3 membership function
- [3],[6],[9] membership degree (μ) of [1],[4],[7] respectively from FRB-3 membership function
- [10] release from set of inputs (FSDP result)
- [11] $([3]*[6]*[9])^2$
- [12] $[10]*[11]$
- [13] $(\Sigma[12] \text{ in the same set of inputs category})/(\Sigma[11] \text{ in the same set of inputs category})$
- [14] release category of [13] from FRB-3 membership function

Table 5.4 Fuzzy Rule Base (FRB-1)

no	storage	inflow	demand	release
1	low	low	low	low
2	low	low	medium	medium
3	low	low	high	low
4	low	medium	low	medium
5	low	medium	medium	medium
6	low	medium	high	medium
7	low	high	low	medium
8	low	high	medium	medium
9	low	high	high	high
10	medium	low	low	medium
11	medium	low	medium	medium
12	medium	low	high	medium
13	medium	medium	low	medium
14	medium	medium	medium	medium
15	medium	medium	high	high
16	medium	high	low	medium
17	medium	high	medium	medium
18	medium	high	high	high
19	high	low	low	medium
20	high	low	medium	medium
21	high	low	high	high
22	high	medium	low	medium
23	high	medium	medium	medium
24	high	medium	high	high
25	high	high	low	medium
26	high	high	medium	medium
27	high	high	high	high

Fuzzy Associative Memories (FAM) matrices

		Storage	Low		
			Inflow		
			Low	Medium	High
Demand	Low	L	M	M	
	Medium	M	M	M	
	High	L	M	H	

		Storage	Medium		
			Inflow		
			Low	Medium	High
Demand	Low	M	M	M	
	Medium	M	M	M	
	High	M	H	H	

		Storage	High		
			Inflow		
			Low	Medium	High
Demand	Low	M	M	M	
	Medium	M	M	M	
	High	H	H	H	

Table 5.5 Fuzzy Rule Base (FRB-2)

no	storage	inflow	demand	release
1	low	low	low	<i>low</i>
2	low	low	medium	<i>medium</i>
3	low	low	high	<i>low</i>
4	low	medium	low	<i>low</i>
5	low	medium	medium	<i>medium</i>
6	low	medium	high	<i>medium</i>
7	low	high	medium	<i>medium</i>
8	low	high	high	<i>high</i>
9	medium	low	low	<i>low</i>
10	medium	low	medium	<i>medium</i>
11	medium	low	high	<i>medium</i>
12	medium	medium	low	<i>low</i>
13	medium	medium	medium	<i>medium</i>
14	medium	medium	high	<i>high</i>
15	medium	high	medium	<i>medium</i>
16	medium	high	high	<i>high</i>
17	high	low	low	<i>low</i>
18	high	low	medium	<i>medium</i>
19	high	low	high	<i>high</i>
20	high	medium	low	<i>low</i>
21	high	medium	medium	<i>medium</i>
22	high	medium	high	<i>high</i>
23	high	high	medium	<i>medium</i>
24	high	high	high	<i>high</i>

Fuzzy Associative Memories (FAM) matrices

		Storage	Low		
			Inflow		
			Low	Medium	High
Demand	Low	L	L	-	
	Medium	M	M	M	
	High	L	M	H	

		Storage	Medium		
			Inflow		
			Low	Medium	High
Demand	Low	L	L	-	
	Medium	M	M	M	
	High	M	H	H	

		Storage	High		
			Inflow		
			Low	Medium	High
Demand	Low	L	L	-	
	Medium	M	M	M	
	High	H	H	H	

Table 5.6 Fuzzy Rule Base (FRB-3)

no	storage	inflow	demand	release
1	low	low	low	<i>low</i>
2	low	low	medium	<i>low</i>
3	low	low	high	<i>low</i>
4	low	medium	low	<i>low</i>
5	low	medium	medium	<i>medium</i>
6	low	medium	high	<i>medium</i>
7	low	high	low	<i>low</i>
8	low	high	medium	<i>medium</i>
9	low	high	high	<i>high</i>
10	medium	low	low	<i>low</i>
11	medium	low	medium	<i>medium</i>
12	medium	low	high	<i>medium</i>
13	medium	medium	low	<i>low</i>
14	medium	medium	medium	<i>medium</i>
15	medium	medium	high	<i>high</i>
16	medium	high	low	<i>low</i>
17	medium	high	medium	<i>medium</i>
18	medium	high	high	<i>high</i>
19	high	low	low	<i>low</i>
20	high	low	medium	<i>medium</i>
21	high	low	high	<i>high</i>
22	high	medium	low	<i>low</i>
23	high	medium	medium	<i>medium</i>
24	high	medium	high	<i>high</i>
25	high	high	low	<i>low</i>
26	high	high	medium	<i>medium</i>
27	high	high	high	<i>high</i>

Fuzzy Associative Memories (FAM) matrices

		Storage	Low	
			Inflow	
		Low	Medium	High
Demand	Low	L	L	L
	Medium	L	M	M
	High	L	M	H
		Storage	Medium	
			Inflow	
		Low	Medium	High
Demand	Low	L	L	L
	Medium	M	M	M
	High	M	H	H
		Storage	High	
			Inflow	
		Low	Medium	High
Demand	Low	L	L	L
	Medium	M	M	M
	High	H	H	H

The Fuzzy Inference System is applied to the Fuzzy rule base by use the fuzzy logic toolbox for determining the output from reservoir operation (release) with the certain inputs (storage, inflow, demand). Some set of inputs are used for predicting the releases from the system and the results are shown in table 5.7.

Table 5.7 Reservoir Operation Releases

Storage	Inflow	Demand	Release FRB-1	Release FRB-2	Release FRB-3
4.2	1	1.6	1.6	1.6	1.6
4.2	1	3	2.8	2.8	2.8
2.4	1	2.4	1.6	1.6	1.8
1.8	1	1.8	1.4	1.4	1.2
1.4	1	0.8	0.6	0.8	0.8
1.4	2	0.8	0.8	0.8	0.8
4.2	4	1.2	1.2	1.2	1.2

CHAPTER VI

RESERVOIR OPERATION SIMULATION

6.1 INTRODUCTION

A simulation model is a representation of a system used to predict its behavior under a given set of conditions. Reservoir operation simulation reproduces the performance of a reservoir system for given hydrologic inputs and operating rules. Simulation is the process of experimenting with a simulation model to analyze the performance of the system under varying conditions (Wurbs, 1996).

Optimization and simulation are two alternative modeling approaches. All optimization models also simulate the system. An optimization approach may involve numerous iterative executions of a simulation model, possibly with the iteration being automated to various degrees. Optimization algorithms are embedded within many reservoir system simulations to perform certain computation.

Simulation has the advantage of generally permitting a more detailed and realistic representation of the complex characteristics of a reservoir system. Since simulation are limited to predicting the system performance for a given decision policy, optimization model have the distinct advantage of being able to search through an infinite number of feasible decision policies to find the optimal policy. Optimization algorithms systematically and automatically search through all feasible decision policies to find the decision policy that minimizes or maximizes a defined objective function. Optimization methods provide useful capabilities for analyzing problems characterized by a need to consider an extremely large number of combinations of value for decision variables.

Significant complexities in developing optimization models are related to model capabilities to satisfy needs for defining and evaluating operation rules and the fact in actual operation future streamflows are unknown at the time a release is made. Optimization techniques tend to naturally fit the format of computing releases which minimize or maximize

a specified objective function for either given sequences of streamflows or stochastic representation of statistical characteristics of streamflows. Many optimization models compute the releases that optimize an objective function without directly using operating rules. Simulation models generally provide mechanism for the user to define and evaluate the operating rules in greater detail. Simulation model also perform computation period by period in such a way that future streamflows are not reflected in release decisions, except for some models that include features for limited short term forecasts.

Simulation and optimization models can be used in combination. An optimization model may be used to determine a reservoir release decision that provides a measure of performance in meeting the water management objectives then used to develop operating rules that appear to be consistent with the sequences of release decisions reflected in the optimization model results. These rules are then tested using a simulation model.

The sequential simulation model in this study are based on mass balance accounting procedures for tracking the movement of water through a reservoir. The computations are repeated sequentially for each time interval of the overall simulation period. A specified water management scenario is combined with a set of streamflow sequences at pertinent location, representing the hydrologic characteristics of the river.

6.2 WATER BALANCE SIMULATION

The conservation of volume equation represents fundamental concepts that are incorporated into the full spectrum of types of reservoir system models. The basic continuity or conservation of volume equation for reservoir is:

$$S_{t+\Delta t} - S_t = I_{vol} - O_{vol} \quad (6.1)$$

where :

S_t = storage volume at the beginning

$S_{t+\Delta t}$ = storage volume at the end

I_{vol} = inflow volume

O_{vol} = outflow volume

Modeling of a reservoir operated is based on a water balance for each time interval expressed as:

$$S_{t+\Delta t} = S_t + \text{all inflow} - \text{all outflow} \quad (6.2)$$

6.3 PERFORMANCE INDICES OF SIMULATION

Performance indices are measures of a system performance of a set of reservoir operating rules. Performance indices can be obtained by using the notion of incident. Let λ be a generalized “load” and ρ be a generalized “resistance”, and then an “incident mode” can be defined as in (Shrestha, 1996):

$$\text{Incident } \mu \text{ occurs if and only if } \lambda > \rho \quad (6.3)$$

In reservoir operation modeling, an incident is calculated in terms of target related parameters. The load here is a demand and the resistance is release through the reservoir. An incident occurs when the release cannot produce enough to meet the demand.

The four different performance indices are reliability, incident period, vulnerability and repairability or resilience. Four different performance indices are described below (Shrestha, 1996):

- The reliability is an estimate of relative frequency that the system (reservoir), denoted by Z , is not in incident mode μ . In term of indicator function $\delta(\mu,t)$

$$\delta(\mu,t) = \begin{cases} 1 & \text{if } Z \text{ is in mode } \mu \text{ at operation } t \\ 0 & \text{otherwise} \end{cases} \quad (6.4)$$

Then the reliability with respect to mode μ and total time of reservoir operation T , is by definition

$$PI^1(\mu, T) = \frac{T+1 - \sum_{i=0}^T \delta(\mu, t)}{T+1} = 1 - \frac{\sum_{i=0}^T \delta(\mu, t)}{T+1} \quad (6.5)$$

- The incident period is the mean interarrival time between entries into mode μ , also known as the average recurrence time. If $d_2(\mu, n)$, $n \geq 1$, denotes the duration of the n th interarrival time, then

$$PI^2(\mu, T) = \frac{1}{N-1} \sum_{n=1}^{N-1} d_2(\mu, n) \quad (6.6)$$

Where $N=N(\mu)$ =number of incidents of mode μ during time horizon T.

- The repairability is the average recovery time from the occurrence of an accident in mode μ given that one has occurred. If $d_3(\mu, n)$, $n \geq 1$ is the duration of the n th mode μ incident ($n = 1, 2, \dots, N$)

$$PI^3(\mu, T) = \frac{\sum_{n=1}^N d_3(\mu, n)}{N} \quad (6.7)$$

The resilience measures “how quickly the system returns to a satisfactory state”. Therefore, it can be defined as the inverse of repairability. A large resilience indicates a quick return to normal state or short residence times in incident mode, a small resilience indicates the opposite phenomenon.

- The vulnerability is magnitude of the largest deficit during time T (Moy, 1986).

6.4 SIMULATION OF BENDO RESERVOIR OPERATION

The simulation is useful in that they provide a means for evaluating systems performance and for conforming optimization and fuzzy rule based results, because simulation models incorporate a more detailed representation of hydrologic conditions.

Simulations were carried out month after month until the end of the streamflow series is reached. Transition from one month to the next is controlled by the continuity equation of the reservoir. The fuzzy logic toolbox is used to determine release from the fuzzy rule bases operating rule.

A simulation for 20 years by a Fuzzy Stochastic Dynamic Programming and Fuzzy Rule Base (FRB-1, FRB-2, FRB-3) operation rules can be shown in table 6.1, 6.2, 6.3 and 6.4 respectively.

Table 6.1 Reservoir Operation Simulation (FSDP)

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
1	Jan	4.2	9	1.6	1.6	4.2	7.4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	3	1.2	1.2	4.2	1.6
	April	4.2	3	2.4	2.4	4.2	0.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	9	1	1	4.2	7.4
2	Jan	4.2	4	1.6	1.6	4.2	2.4
	Feb	4.2	2	1.2	1.2	4.2	0.8
	March	4.2	8	1.2	1.2	4.2	6.8
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0
3	Jan	1.6	4	1.6	1.6	4	0
	Feb	4	3	1.2	1.2	4.2	1.6
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	2	2.4	2.4	3.8	0
	May	3.8	1	3	2.6	2.2	0
	June	2.2	1	2.4	1.8	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	7	1	1	4.2	3.4
4	Jan	4.2	1	1.6	1.6	3.6	0
	Feb	3.6	4	1.2	1.2	4.2	2.2
	March	4.2	1	1.2	1.2	4	0
	April	4	2	2.4	2.2	3.8	0
	May	3.8	2	3	3	2.8	0
	June	2.8	1	2.4	2.4	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	5	1	1	4.2	1.4
5	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	11	1.2	1.2	4.2	9.8
	April	4.2	6	2.4	2.4	4.2	3.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	7	1	1	4.2	4.4
6	Jan	4.2	6	1.6	1.6	4.2	4.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.4	2.6	0
	May	2.6	1	3	2.2	1.4	0
	June	1.4	1	2.4	0.2	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0

Fuzzy Rule Base Modeling for Reservoir Operation

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
7	Jan	1.6	4	1.6	1.6	4	0
	Feb	4	3	1.2	1.2	4.2	1.6
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	1	1	1	3.6	0
8	Jan	3.6	3	1.6	1.6	4.2	0.8
	Feb	4.2	4	1.2	1.2	4.2	2.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	5	1	1	4.2	1.4
9	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	5	1.2	1.2	4.2	3.8
	April	4.2	1	2.4	2.2	3	0
	May	3	1	3	2.6	1.4	0
	June	1.4	1	2.4	0.2	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0
10	Jan	1.6	3	1.6	1.6	3	0
	Feb	3	3	1.2	1.2	4.2	0.6
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.4	2.6	0
	May	2.6	1	3	2.2	1.4	0
	June	1.4	1	2.4	0.2	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	1	1	1	2.6	0
11	Jan	2.6	5	1.6	1.6	4.2	1.8
	Feb	4.2	1	1.2	1.2	4	0
	March	4	7	1.2	1.2	4.2	5.6
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	6	1	1	4.2	2.4
12	Jan	4.2	2	1.6	1.6	4.2	0.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	5	2.4	2.4	4.2	2.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	2	1	1	3.6	0
13	Jan	3.6	5	1.6	1.6	4.2	2.8
	Feb	4.2	5	1.2	1.2	4.2	3.8

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out	
	March	4.2	1	1.2	1.2	4	0	
	April	4	6	2.4	2.4	4.2	3.4	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	2	1.4	0	
	July	1.4	1	1.8	0.6	1.8	0	
	Aug	1.8	1	0.8	0.8	2	0	
	Sept	2	1	1.6	1.6	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	2	1	1	2.6	0	
	14	Jan	2.6	4	1.6	1.6	4.2	0.8
		Feb	4.2	2	1.2	1.2	4.2	0.8
March		4.2	1	1.2	1.2	4	0	
April		4	1	2.4	2.4	2.6	0	
May		2.6	2	3	2.4	2.2	0	
June		2.2	1	2.4	1.8	1.4	0	
July		1.4	1	1.8	0.6	1.8	0	
Aug		1.8	1	0.8	0.8	2	0	
Sept		2	1	1.6	1.6	1.4	0	
Oct		1.4	1	1	1	1.4	0	
Nov		1.4	1	0.8	0.8	1.6	0	
Dec		1.6	1	1	1	1.6	0	
15	Jan	1.6	8	1.6	1.6	4.2	3.8	
	Feb	4.2	5	1.2	1.2	4.2	3.8	
	March	4.2	5	1.2	1.2	4.2	3.8	
	April	4.2	1	2.4	2.2	3	0	
	May	3	2	3	2.6	2.4	0	
	June	2.4	1	2.4	2	1.4	0	
	July	1.4	1	1.8	0.6	1.8	0	
	Aug	1.8	1	0.8	0.8	2	0	
	Sept	2	1	1.6	1.6	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	2	0.8	0.8	2.6	0	
	Dec	2.6	1	1	1	2.6	0	
16	Jan	2.6	5	1.6	1.6	4.2	1.8	
	Feb	4.2	3	1.2	1.2	4.2	1.8	
	March	4.2	1	1.2	1.2	4	0	
	April	4	1	2.4	2.4	2.6	0	
	May	2.6	2	3	2.4	2.2	0	
	June	2.2	1	2.4	1.8	1.4	0	
	July	1.4	1	1.8	0.6	1.8	0	
	Aug	1.8	1	0.8	0.8	2	0	
	Sept	2	1	1.6	1.6	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	6	1	1	4.2	2.4	
17	Jan	4.2	4	1.6	1.6	4.2	2.4	
	Feb	4.2	1	1.2	1.2	4	0	
	March	4	1	1.2	1.2	3.8	0	
	April	3.8	2	2.4	2.2	3.6	0	
	May	3.6	1	3	2.4	2.2	0	
	June	2.2	1	2.4	1.8	1.4	0	
	July	1.4	1	1.8	0.6	1.8	0	
	Aug	1.8	1	0.8	0.8	2	0	
	Sept	2	1	1.6	1.6	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	1	1	1	1.6	0	
18	Jan	1.6	6	1.6	1.6	4.2	1.8	
	Feb	4.2	2	1.2	1.2	4.2	0.8	
	March	4.2	4	1.2	1.2	4.2	2.8	
	April	4.2	3	2.4	2.4	4.2	0.6	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	2	1.4	0	
	July	1.4	1	1.8	0.6	1.8	0	
	Aug	1.8	1	0.8	0.8	2	0	
	Sept	2	1	1.6	1.6	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	2	1	1	2.6	0	
19	Jan	2.6	1	1.6	1.6	2	0	
	Feb	2	4	1.2	1.2	4.2	0.6	
	March	4.2	2	1.2	1.2	4.2	0.8	
	April	4.2	4	2.4	2.4	4.2	1.6	

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	2	1.4	0
	July	1.4	1	1.8	0.6	1.8	0
	Aug	1.8	1	0.8	0.8	2	0
	Sept	2	1	1.6	1.6	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	2	1	1	2.6	0
20	Jan	2.6	7	1.6	1.6	4.2	3.8
	Feb	4.2	1	1.2	1.2	4	0
	March	4	1	1.2	1.2	3.8	0
	April	3.8	1	2.4	2.2	2.6	0
	May	2.6	1	3	2.2	1.4	0
	June	1.4	1	2.4	0.2	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	5	1	1	4.2	2.4

Table 6.2 Reservoir Operation Simulation (FRB-1)

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
1	Jan		9	1.6	1.6	4.2	7.4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	3	1.2	1.2	4.2	1.6
	April	4.2	3	2.4	2.4	4.2	0.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	9	1	1	4.2	7.4
2	Jan	4.2	4	1.6	1.6	4.2	2.4
	Feb	4.2	2	1.2	1.2	4.2	0.8
	March	4.2	8	1.2	1.2	4.2	6.8
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	1	1	1	1.8	0
3	Jan	1.8	4	1.6	1.6	4.2	0
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	2	2.4	2.2	4	0
	May	4	1	3	2.6	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	7	1	1	4.2	3.6
4	Jan	4.2	1	1.6	1.6	3.6	0
	Feb	3.6	4	1.2	1.2	4.2	2.2
	March	4.2	1	1.2	1.2	4	0
	April	4	2	2.4	2.2	3.8	0
	May	3.8	2	3	2.8	3	0
	June	3	1	2.4	1.8	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	5	1	1	4.2	1.6
5	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	11	1.2	1.2	4.2	9.8
	April	4.2	6	2.4	2.4	4.2	3.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	7	1	1	4.2	4.4
6	Jan	4.2	6	1.6	1.6	4.2	4.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.2	2.8	0
	May	2.8	1	3	1.6	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	1	1	1	1.8	0

Fuzzy Rule Base Modeling for Reservoir Operation

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
7	Jan	1.8	4	1.6	1.6	4.2	0
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	1	1	1	3.6	0
8	Jan	3.6	3	1.6	1.6	4.2	0.8
	Feb	4.2	4	1.2	1.2	4.2	2.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	5	1	1	4.2	1.6
9	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	5	1.2	1.2	4.2	3.8
	April	4.2	1	2.4	2.2	3	0
	May	3	1	3	1.8	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	1	1	1	1.8	0
10	Jan	1.8	3	1.6	1.6	3.2	0
	Feb	3.2	3	1.2	1.2	4.2	0.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.2	2.8	0
	May	2.8	1	3	1.6	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	1	1	1	2.6	0
11	Jan	2.6	5	1.6	1.6	4.2	1.8
	Feb	4.2	1	1.2	1.2	4	0
	March	4	7	1.2	1.2	4.2	5.6
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	6	1	1	4.2	2.6
12	Jan	4.2	2	1.6	1.6	4.2	0.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	5	2.4	2.4	4.2	2.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	2	1	1	3.6	0
13	Jan	3.6	5	1.6	1.6	4.2	2.8
	Feb	4.2	5	1.2	1.2	4.2	3.8

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out	
	March	4.2	1	1.2	1.2	4	0	
	April	4	6	2.4	2.4	4.2	3.4	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.6	1.8	0	
	Sept	1.8	1	1.6	1.4	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.6	1.8	0	
	Dec	1.8	2	1	1	2.8	0	
	14	Jan	2.8	4	1.6	1.6	4.2	1
		Feb	4.2	2	1.2	1.2	4.2	0.8
March		4.2	1	1.2	1.2	4	0	
April		4	1	2.4	2.2	2.8	0	
May		2.8	2	3	2.8	2	0	
June		2	1	2.4	1.4	1.6	0	
July		1.6	1	1.8	1.2	1.4	0	
Aug		1.4	1	0.8	0.6	1.8	0	
Sept		1.8	1	1.6	1.4	1.4	0	
Oct		1.4	1	1	1	1.4	0	
Nov		1.4	1	0.8	0.6	1.8	0	
Dec		1.8	1	1	1	1.8	0	
15	Jan	1.8	8	1.6	1.6	4.2	4	
	Feb	4.2	5	1.2	1.2	4.2	3.8	
	March	4.2	5	1.2	1.2	4.2	3.8	
	April	4.2	1	2.4	2.2	3	0	
	May	3	2	3	2.8	2.2	0	
	June	2.2	1	2.4	1.4	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.6	1.8	0	
	Sept	1.8	1	1.6	1.4	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	2	0.8	0.8	2.6	0	
	Dec	2.6	1	1	1	2.6	0	
16	Jan	2.6	5	1.6	1.6	4.2	1.8	
	Feb	4.2	3	1.2	1.2	4.2	1.8	
	March	4.2	1	1.2	1.2	4	0	
	April	4	1	2.4	2.2	2.8	0	
	May	2.8	2	3	2.8	2	0	
	June	2	1	2.4	1.4	1.6	0	
	July	1.6	1	1.8	1.2	1.4	0	
	Aug	1.4	1	0.8	0.6	1.8	0	
	Sept	1.8	1	1.6	1.4	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.6	1.8	0	
	Dec	1.8	6	1	1	4.2	2.6	
17	Jan	4.2	4	1.6	1.6	4.2	2.4	
	Feb	4.2	1	1.2	1.2	4	0	
	March	4	1	1.2	1.2	3.8	0	
	April	3.8	2	2.4	2.2	3.6	0	
	May	3.6	1	3	2.2	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.6	1.8	0	
	Sept	1.8	1	1.6	1.4	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.6	1.8	0	
	Dec	1.8	1	1	1	1.8	0	
18	Jan	1.8	6	1.6	1.6	4.2	2	
	Feb	4.2	2	1.2	1.2	4.2	0.8	
	March	4.2	4	1.2	1.2	4.2	2.8	
	April	4.2	3	2.4	2.4	4.2	0.6	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.6	1.8	0	
	Sept	1.8	1	1.6	1.4	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.6	1.8	0	
	Dec	1.8	2	1	1	2.8	0	
19	Jan	2.8	1	1.6	1.6	2.2	0	
	Feb	2.2	4	1.2	1.2	4.2	0.8	
	March	4.2	2	1.2	1.2	4.2	0.8	
	April	4.2	4	2.4	2.4	4.2	1.6	

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.6	1.8	0
	Dec	1.8	2	1	1	2.8	0
20	Jan	2.8	7	1.6	1.6	4.2	4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	1	1.2	1.2	3.8	0
	April	3.8	1	2.4	2.2	2.6	0
	May	2.6	1	3	1.6	2	0
	June	2	1	2.4	1.4	1.6	0
	July	1.6	1	1.8	1.2	1.4	0
	Aug	1.4	1	0.8	0.6	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	5	1	1	4.2	2.4

Table 6.3 Reservoir Operation Simulation (FRB-2)

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
1	Jan	4.2	9	1.6	1.6	4.2	7.4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	3	1.2	1.2	4.2	1.6
	April	4.2	3	2.4	2.4	4.2	0.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	9	1	1	4.2	7.4
2	Jan	4.2	4	1.6	1.6	4.2	2.4
	Feb	4.2	2	1.2	1.2	4.2	0.8
	March	4.2	8	1.2	1.2	4.2	6.8
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0
3	Jan	1.6	4	1.6	1.6	4	0
	Feb	4	3	1.2	1.2	4.2	1.6
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	2	2.4	2.2	4	0
	May	4	1	3	2.6	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	7	1	1	4.2	3.4
4	Jan	4.2	1	1.6	1.6	3.6	0
	Feb	3.6	4	1.2	1.2	4.2	2.2
	March	4.2	1	1.2	1.2	4	0
	April	4	2	2.4	2.2	3.8	0
	May	3.8	2	3	2.8	3	0
	June	3	1	2.4	1.8	2.2	0
	July	2.2	1	1.8	1.6	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.4	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	5	1	1	4.2	1.4
5	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	11	1.2	1.2	4.2	9.8
	April	4.2	6	2.4	2.4	4.2	3.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	7	1	1	4.2	4.4
6	Jan	4.2	6	1.6	1.6	4.2	4.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.2	2.8	0
	May	2.8	1	3	1.6	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
7	Jan	1.6	4	1.6	1.6	4	0
	Feb	4	3	1.2	1.2	4.2	1.6
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	3	0.8	0.8	3.6	0
	Dec	3.6	1	1	1	3.6	0
8	Jan	3.6	3	1.6	1.6	4.2	0.8
	Feb	4.2	4	1.2	1.2	4.2	2.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	5	1	1	4.2	1.4
9	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	5	1.2	1.2	4.2	3.8
	April	4.2	1	2.4	2.2	3	0
	May	3	1	3	1.8	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	1	1	1	1.6	0
10	Jan	1.6	3	1.6	1.6	3	0
	Feb	3	3	1.2	1.2	4.2	0.6
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.2	2.8	0
	May	2.8	1	3	1.6	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	1	1	1	2.6	0
11	Jan	2.6	5	1.6	1.6	4.2	1.8
	Feb	4.2	1	1.2	1.2	4	0
	March	4	7	1.2	1.2	4.2	5.6
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	6	1	1	4.2	2.4
12	Jan	4.2	2	1.6	1.6	4.2	0.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	5	2.4	2.4	4.2	2.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	2	1	1	3.6	0
13	Jan	3.6	5	1.6	1.6	4.2	2.8
	Feb	4.2	5	1.2	1.2	4.2	3.8

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out	
	March	4.2	1	1.2	1.2	4	0	
	April	4	6	2.4	2.4	4.2	3.4	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.8	1.6	0	
	Sept	1.6	1	1.6	1.2	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	2	1	1	2.6	0	
	14	Jan	2.6	4	1.6	1.6	4.2	0.8
		Feb	4.2	2	1.2	1.2	4.2	0.8
March		4.2	1	1.2	1.2	4	0	
April		4	1	2.4	2.2	2.8	0	
May		2.8	2	3	2.8	2	0	
June		2	1	2.4	1.4	1.6	0	
July		1.6	1	1.8	1.2	1.4	0	
Aug		1.4	1	0.8	0.8	1.6	0	
Sept		1.6	1	1.6	1.2	1.4	0	
Oct		1.4	1	1	1	1.4	0	
Nov		1.4	1	0.8	0.8	1.6	0	
Dec		1.6	1	1	1	1.6	0	
15	Jan	1.6	8	1.6	1.6	4.2	3.8	
	Feb	4.2	5	1.2	1.2	4.2	3.8	
	March	4.2	5	1.2	1.2	4.2	3.8	
	April	4.2	1	2.4	2.2	3	0	
	May	3	2	3	2.8	2.2	0	
	June	2.2	1	2.4	1.4	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.8	1.6	0	
	Sept	1.6	1	1.6	1.2	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	2	0.8	0.8	2.6	0	
	Dec	2.6	1	1	1	2.6	0	
16	Jan	2.6	5	1.6	1.6	4.2	1.8	
	Feb	4.2	3	1.2	1.2	4.2	1.8	
	March	4.2	1	1.2	1.2	4	0	
	April	4	1	2.4	2.2	2.8	0	
	May	2.8	2	3	2.8	2	0	
	June	2	1	2.4	1.4	1.6	0	
	July	1.6	1	1.8	1.2	1.4	0	
	Aug	1.4	1	0.8	0.8	1.6	0	
	Sept	1.6	1	1.6	1.2	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	6	1	1	4.2	2.4	
17	Jan	4.2	4	1.6	1.6	4.2	2.4	
	Feb	4.2	1	1.2	1.2	4	0	
	March	4	1	1.2	1.2	3.8	0	
	April	3.8	2	2.4	2.2	3.6	0	
	May	3.6	1	3	2.2	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.8	1.6	0	
	Sept	1.6	1	1.6	1.2	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	1	1	1	1.6	0	
18	Jan	1.6	6	1.6	1.6	4.2	1.8	
	Feb	4.2	2	1.2	1.2	4.2	0.8	
	March	4.2	4	1.2	1.2	4.2	2.8	
	April	4.2	3	2.4	2.4	4.2	0.6	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.4	1.4	0	
	Aug	1.4	1	0.8	0.8	1.6	0	
	Sept	1.6	1	1.6	1.2	1.4	0	
	Oct	1.4	1	1	1	1.4	0	
	Nov	1.4	1	0.8	0.8	1.6	0	
	Dec	1.6	2	1	1	2.6	0	
19	Jan	2.6	1	1.6	1.6	2	0	
	Feb	2	4	1.2	1.2	4.2	0.6	
	March	4.2	2	1.2	1.2	4.2	0.8	
	April	4.2	4	2.4	2.4	4.2	1.6	

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.4	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	1	0.8	0.8	1.6	0
	Dec	1.6	2	1	1	2.6	0
20	Jan	2.6	7	1.6	1.6	4.2	3.8
	Feb	4.2	1	1.2	1.2	4	0
	March	4	1	1.2	1.2	3.8	0
	April	3.8	1	2.4	2.2	2.6	0
	May	2.6	1	3	1.6	2	0
	June	2	1	2.4	1.4	1.6	0
	July	1.6	1	1.8	1.2	1.4	0
	Aug	1.4	1	0.8	0.8	1.6	0
	Sept	1.6	1	1.6	1.2	1.4	0
	Oct	1.4	1	1	1	1.4	0
	Nov	1.4	2	0.8	0.8	2.6	0
	Dec	2.6	5	1	1	4.2	2.4

Table 6.4 Reservoir Operation Simulation (FRB-3)

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
1	Jan	4.2	9	1.6	1.6	4.2	7.4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	3	1.2	1.2	4.2	1.6
	April	4.2	3	2.4	2.4	4.2	0.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	3	0.8	0.8	3.8	0
	Dec	3.8	9	1	1	4.2	7.6
2	Jan	4.2	4	1.6	1.6	4.2	2.4
	Feb	4.2	2	1.2	1.2	4.2	0.8
	March	4.2	8	1.2	1.2	4.2	6.8
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	1	1	1	1.8	0
3	Jan	1.8	4	1.6	1.6	4.2	0
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	2	2.4	2.4	3.8	0
	May	3.8	1	3	2.6	2.2	0
	June	2.2	1	2.4	1.4	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	7	1	1	4.2	3.6
4	Jan	4.2	1	1.6	1.6	3.6	0
	Feb	3.6	4	1.2	1.2	4.2	2.2
	March	4.2	1	1.2	1.2	4	0
	April	4	2	2.4	2.4	3.6	0
	May	3.6	2	3	2.8	2.8	0
	June	2.8	1	2.4	1.8	2	0
	July	2	1	1.8	1.4	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	5	1	1	4.2	1.6
5	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	11	1.2	1.2	4.2	9.8
	April	4.2	6	2.4	2.4	4.2	3.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	2	0.8	0.8	2.8	0
	Dec	2.8	7	1	1	4.2	4.6
6	Jan	4.2	6	1.6	1.6	4.2	4.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.4	2.6	0
	May	2.6	1	3	1.6	2	0
	June	2	1	2.4	1.4	1.6	0
	July	1.6	1	1.8	1	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	1	1	1	1.8	0

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
7	Jan	1.8	4	1.6	1.6	4.2	0
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	3	0.8	0.8	3.8	0
	Dec	3.8	1	1	1	3.8	0
8	Jan	3.8	3	1.6	1.6	4.2	1
	Feb	4.2	4	1.2	1.2	4.2	2.8
	March	4.2	4	1.2	1.2	4.2	2.8
	April	4.2	4	2.4	2.4	4.2	1.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	5	1	1	4.2	1.6
9	Jan	4.2	3	1.6	1.6	4.2	1.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	5	1.2	1.2	4.2	3.8
	April	4.2	1	2.4	2.4	2.8	0
	May	2.8	1	3	1.8	2	0
	June	2	1	2.4	1.4	1.6	0
	July	1.6	1	1.8	1	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	1	1	1	1.8	0
10	Jan	1.8	3	1.6	1.6	3.2	0
	Feb	3.2	3	1.2	1.2	4.2	0.8
	March	4.2	1	1.2	1.2	4	0
	April	4	1	2.4	2.4	2.6	0
	May	2.6	1	3	1.6	2	0
	June	2	1	2.4	1.4	1.6	0
	July	1.6	1	1.8	1	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	2	0.8	0.8	2.8	0
	Dec	2.8	1	1	1	2.8	0
11	Jan	2.8	5	1.6	1.6	4.2	2
	Feb	4.2	1	1.2	1.2	4	0
	March	4	7	1.2	1.2	4.2	5.6
	April	4.2	7	2.4	2.4	4.2	4.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	6	1	1	4.2	2.6
12	Jan	4.2	2	1.6	1.6	4.2	0.4
	Feb	4.2	3	1.2	1.2	4.2	1.8
	March	4.2	3	1.2	1.2	4.2	1.8
	April	4.2	5	2.4	2.4	4.2	2.6
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	2	0.8	0.8	2.8	0
	Dec	2.8	2	1	1	3.8	0
13	Jan	3.8	5	1.6	1.6	4.2	3
	Feb	4.2	5	1.2	1.2	4.2	3.8

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out	
	March	4.2	1	1.2	1.2	4	0	
	April	4	6	2.4	2.4	4.2	3.4	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.2	1.6	0	
	Aug	1.6	1	0.8	0.8	1.8	0	
	Sept	1.8	1	1.6	1.2	1.6	0	
	Oct	1.6	1	1	1	1.6	0	
	Nov	1.6	1	0.8	0.8	1.8	0	
	Dec	1.8	2	1	1	2.8	0	
	14	Jan	2.8	4	1.6	1.6	4.2	1
		Feb	4.2	2	1.2	1.2	4.2	0.8
March		4.2	1	1.2	1.2	4	0	
April		4	1	2.4	2.4	2.6	0	
May		2.6	2	3	2.6	2	0	
June		2	1	2.4	1.4	1.6	0	
July		1.6	1	1.8	1	1.6	0	
Aug		1.6	1	0.8	0.8	1.8	0	
Sept		1.8	1	1.6	1.2	1.6	0	
Oct		1.6	1	1	1	1.6	0	
Nov		1.6	1	0.8	0.8	1.8	0	
Dec		1.8	1	1	1	1.8	0	
15	Jan	1.8	8	1.6	1.6	4.2	4	
	Feb	4.2	5	1.2	1.2	4.2	3.8	
	March	4.2	5	1.2	1.2	4.2	3.8	
	April	4.2	1	2.4	2.4	2.8	0	
	May	2.8	2	3	2.8	2	0	
	June	2	1	2.4	1.4	1.6	0	
	July	1.6	1	1.8	1	1.6	0	
	Aug	1.6	1	0.8	0.8	1.8	0	
	Sept	1.8	1	1.6	1.2	1.6	0	
	Oct	1.6	1	1	1	1.6	0	
	Nov	1.6	2	0.8	0.8	2.8	0	
	Dec	2.8	1	1	1	2.8	0	
16	Jan	2.8	5	1.6	1.6	4.2	2	
	Feb	4.2	3	1.2	1.2	4.2	1.8	
	March	4.2	1	1.2	1.2	4	0	
	April	4	1	2.4	2.4	2.6	0	
	May	2.6	2	3	2.6	2	0	
	June	2	1	2.4	1.4	1.6	0	
	July	1.6	1	1.8	1	1.6	0	
	Aug	1.6	1	0.8	0.8	1.8	0	
	Sept	1.8	1	1.6	1.2	1.6	0	
	Oct	1.6	1	1	1	1.6	0	
	Nov	1.6	1	0.8	0.8	1.8	0	
	Dec	1.8	6	1	1	4.2	2.6	
17	Jan	4.2	4	1.6	1.6	4.2	2.4	
	Feb	4.2	1	1.2	1.2	4	0	
	March	4	1	1.2	1.2	3.8	0	
	April	3.8	2	2.4	2.4	3.4	0	
	May	3.4	1	3	2.2	2.2	0	
	June	2.2	1	2.4	1.4	1.8	0	
	July	1.8	1	1.8	1.2	1.6	0	
	Aug	1.6	1	0.8	0.8	1.8	0	
	Sept	1.8	1	1.6	1.2	1.6	0	
	Oct	1.6	1	1	1	1.6	0	
	Nov	1.6	1	0.8	0.8	1.8	0	
	Dec	1.8	1	1	1	1.8	0	
18	Jan	1.8	6	1.6	1.6	4.2	2	
	Feb	4.2	2	1.2	1.2	4.2	0.8	
	March	4.2	4	1.2	1.2	4.2	2.8	
	April	4.2	3	2.4	2.4	4.2	0.6	
	May	4.2	1	3	2.8	2.4	0	
	June	2.4	1	2.4	1.6	1.8	0	
	July	1.8	1	1.8	1.2	1.6	0	
	Aug	1.6	1	0.8	0.8	1.8	0	
	Sept	1.8	1	1.6	1.2	1.6	0	
	Oct	1.6	1	1	1	1.6	0	
	Nov	1.6	1	0.8	0.8	1.8	0	
	Dec	1.8	2	1	1	2.8	0	
19	Jan	2.8	1	1.6	1.6	2.2	0	
	Feb	2.2	4	1.2	1.2	4.2	0.8	
	March	4.2	2	1.2	1.2	4.2	0.8	
	April	4.2	4	2.4	2.4	4.2	1.6	

Years	Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
	May	4.2	1	3	2.8	2.4	0
	June	2.4	1	2.4	1.6	1.8	0
	July	1.8	1	1.8	1.2	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	1	0.8	0.8	1.8	0
	Dec	1.8	2	1	1	2.8	0
20	Jan	2.8	7	1.6	1.6	4.2	4
	Feb	4.2	1	1.2	1.2	4	0
	March	4	1	1.2	1.2	3.8	0
	April	3.8	1	2.4	2.4	2.4	0
	May	2.4	1	3	1.6	1.8	0
	June	1.8	1	2.4	1.2	1.6	0
	July	1.6	1	1.8	1	1.6	0
	Aug	1.6	1	0.8	0.8	1.8	0
	Sept	1.8	1	1.6	1.2	1.6	0
	Oct	1.6	1	1	1	1.6	0
	Nov	1.6	2	0.8	0.8	2.8	0
	Dec	2.8	5	1	1	4.2	2.6

6.5 RESULTS AND DISCUSSION

After 20 years reservoir operation simulation is done. The monthly average releases for every operating rule are compared with the target demand for every month and the performance indices are evaluated.

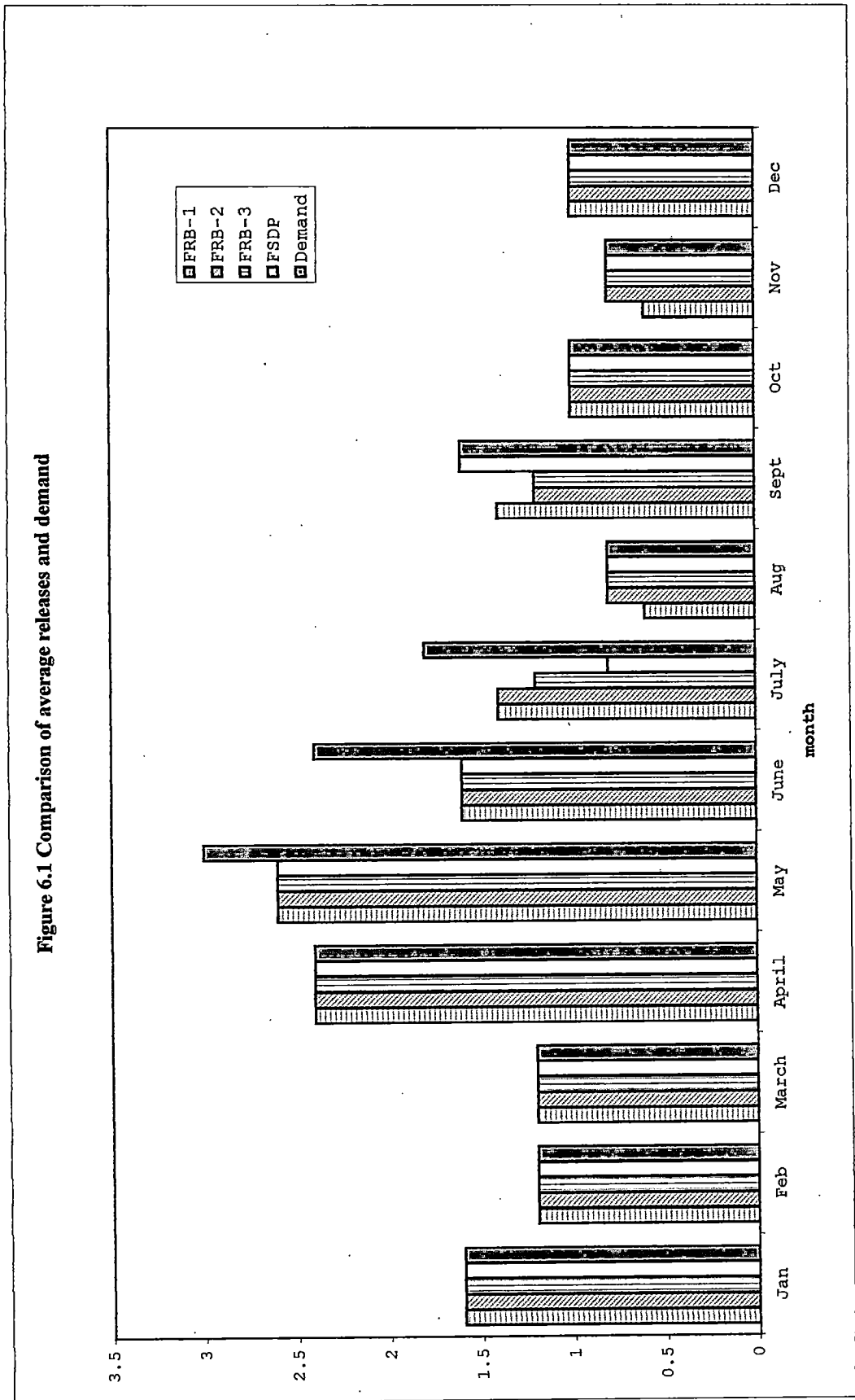
Figure 6.1 and table 6.5 shows the comparison of average releases and demand for every month, and performance indices of the operating rules are shown in table 6.6.

Table 6.5 Comparison of Monthly Average Release and Demand

	FRB-1	FRB-2	FRB-3	FSDP	Demand
Jan	1.6	1.6	1.6	1.6	1.6
Feb	1.2	1.2	1.2	1.2	1.2
March	1.2	1.2	1.2	1.2	1.2
April	2.4	2.4	2.4	2.4	2.4
May	2.6	2.6	2.6	2.6	3
June	1.6	1.6	1.6	1.6	2.4
July	1.4	1.4	1.2	0.8	1.8
Aug	0.6	0.8	0.8	0.8	0.8
Sept	1.4	1.2	1.2	1.6	1.6
Oct	1	1	1	1	1
Nov	0.6	0.8	0.8	0.8	0.8
Dec	1	1	1	1	1

Table 6.6 Performance Indices

	R < D	Reliability	Incident Period	Repairability	Vulnerability
FRB-1	122	0.4938	3.50	3.67	1.40
FRB-2	90	0.6266	3.67	2.25	1.40
FRB-3	80	0.6680	3.92	2.00	1.40
FDSP	67	0.7220	6.92	2.68	2.20



According to the four operation reservoir rules, if initial storage is 3.6 and predicting monthly inflows for next year are 7, 4, 6, 4, 1, 1, 1, 1, 1, 3, 7, decision releases for the next year are shown in table 6.7.

Table 6.7 Decision Releases

FSDP

Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
Jan	3.6	7	1.6	1.6	4.2	4.8
Feb	4.2	4	1.2	1.2	4.2	2.8
March	4.2	6	1.2	1.2	4.2	4.8
April	4.2	4	2.4	2.4	4.2	1.6
May	4.2	1	3	2.8	2.4	0
June	2.4	1	2.4	2	1.4	0
July	1.4	1	1.8	0.6	1.8	0
Aug	1.8	1	0.8	0.8	2	0
Sept	2	1	1.6	1.6	1.4	0
Oct	1.4	1	1	1	1.4	0
Nov	1.4	3	0.8	0.8	3.6	0
Dec	3.6	7	1	1	4.2	5.4

FRB-1

Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
Jan	3.6	7	1.6	1.6	4.2	4.8
Feb	4.2	4	1.2	1.2	4.2	2.8
March	4.2	6	1.2	1.2	4.2	4.8
April	4.2	4	2.4	2.4	4.2	1.6
May	4.2	1	3	2.8	2.4	0
June	2.4	1	2.4	1.6	1.8	0
July	1.8	1	1.8	1.4	1.4	0
Aug	1.4	1	0.8	0.6	1.8	0
Sept	1.8	1	1.6	1.4	1.4	0
Oct	1.4	1	1	1	1.4	0
Nov	1.4	3	0.8	0.8	3.6	0
Dec	3.6	7	1	1	4.2	5.4

FRB-2

Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
Jan	3.6	7	1.6	1.6	4.2	4.8
Feb	4.2	4	1.2	1.2	4.2	2.8
March	4.2	6	1.2	1.2	4.2	4.8
April	4.2	4	2.4	2.4	4.2	1.6
May	4.2	1	3	2.8	2.4	0
June	2.4	1	2.4	1.6	1.8	0
July	1.8	1	1.8	1.4	1.4	0
Aug	1.4	1	0.8	0.8	1.6	0
Sept	1.6	1	1.6	1.2	1.4	0
Oct	1.4	1	1	1	1.4	0
Nov	1.4	3	0.8	0.8	3.6	0
Dec	3.6	7	1	1	4.2	5.4

FRB-3

Month	Storage	Inflow	Demand	Release	Final Storage	Spill out
Jan	3.6	7	1.6	1.6	4.2	4.8
Feb	4.2	4	1.2	1.2	4.2	2.8
March	4.2	6	1.2	1.2	4.2	4.8
April	4.2	4	2.4	2.4	4.2	1.6
May	4.2	1	3	2.8	2.4	0
June	2.4	1	2.4	1.6	1.8	0
July	1.8	1	1.8	1.2	1.6	0
Aug	1.6	1	0.8	0.8	1.8	0
Sept	1.8	1	1.6	1.2	1.6	0
Oct	1.6	1	1	1	1.6	0
Nov	1.6	3	0.8	0.8	3.8	0
Dec	3.8	7	1	1	4.2	5.6

CHAPTER VII

CONCLUSIONS

Reservoir operating rule policy is a set of rules for determining the quantities of water to be released from a reservoir under various conditions. The operating rules provide guidance to the water managers who make release decisions. Reservoir release decision involves storage capacity, demand as a constraint and imprecise incoming inflow to the reservoir.

Fuzzy logic approach has some advantages in the reservoir operating rules. It has ability to reflect human thinking and decision making process. In practice, fuzzy logic offers a way for operators to participate in the development of operation system. Fuzzy logic rule base also can be fine tuned with operating experience or with the help provided by an expert.

Bendo reservoir is a multipurpose reservoir which is supposed to supply water demands besides the flood control function. Fuzzy stochastic dynamic programming model is applied to identify optimum monthly release for the Bendo reservoir. Water demand and flood control objectives are considered as fuzzy with different weights for each objective. The transition probability matrices used in fuzzy stochastic dynamic programming are derived from synthetic inflow data generated by the Thomas-Fiering model. Optimum releases are calculated by fuzzy stochastic dynamic programming for every stage of storage volume and inflow with demand that are fixed for every month.

For the reservoir operation using fuzzy logic programming, three fuzzy rule bases are considered. In the first fuzzy rule base the membership function for release is different than the demand membership function. Second and third fuzzy rule base uses same membership function for demand and release, the differences is that for the second membership function minimum value is taken corresponding to minimum value of demand whereas for the third fuzzy rule base, the minimum value of membership function is taken according to minimum value of release.

Reservoir operation Fuzzy rule base (FRB) is constructed by fuzzy associative memory (FAM) method to derive a fuzzy rule base from the set of input-output data. Input-output data in this study are coming from the results of fuzzy stochastic dynamic programming. By the fuzzy associative memory (FAM) method three fuzzy rule bases are constructed with the variation of its membership function. The fuzzy rule base used IF-THEN operating rule where storage volume, inflow and demand are premises while release is consequence of the model.

From simulation of three fuzzy rule bases, it can be seen that the FRB-3 has reliability 0.6680 which is higher than the FRB-2 (0.6266) and FRB-1 (0.4938). The vulnerability and incident period is relatively same for all fuzzy rule bases. FRB-1, which has the lowest reliability among three fuzzy rule bases, has repairability 3.67 months that is higher than FRB-2 (2.25) and FRB-3 (2.00). Comparing to fuzzy stochastic dynamic programming simulation result, fuzzy rule bases has lower reliability and incident period than FSDP but more better in vulnerability. FSDP operation rule has reliability 0.7220 and 6.92 months for incident period. The vulnerability for all FRB operation rule is 1.40 units and 2.20 units for fuzzy stochastic dynamic programming. The FSDP repairability result from simulation is 2.68 month while FRB-1, FRB-2, FRB-3 get value 3.67, 2.25, 2.00 respectively. Thus, from the reliability and incident period point of view, fuzzy rule base has the lower value than the fuzzy stochastic dynamic programming but it has better vulnerability than fuzzy stochastic dynamic programming operation release.

For fuzzy rule base approach, FRB-3, where the demand membership function is taken same with release membership function and minimum value of membership function is taken according to minimum value of release, has the better value than the FRB-1 and FRB-2. It can be said that the choice of the membership function is very important in the fuzzy rule base operation rules. The choice will improve for the result of the performance indices of fuzzy rule base reservoir operation rules. Participation of operator and knowledge expert will improve the choice of fuzzy rule base operating rules membership function.

Further studies, can be carried out taking stochastic demands and also different method of membership function assessment and training of the fuzzy rule from data. One may study applicability of a fuzzy rule base in the operation of multipurpose multireservoir system.

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