

Consideration of Climate Conditions in Reservoir Operation Using Fuzzy Inference System (FIS)

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Abstract:

In this paper, the Fuzzy Inference System is used for developing an operation model for the Zayandeh-Rud Dam and for planning downstream agricultural crop farms under different climatic conditions. The model consists of three stages: in the first, the storage volume of the reservoir in March is predicted based on both the inflow into the reservoir during the last three months and the Southern Oscillation Index (SOI) using the Adaptive Network-based Fuzzy Inference System (ANFIS). The second stage involves forecasting the annual release in the following year as the model output using both the reservoir storage in the last month of the previous year and the amount of Snow Water Equivalent (SWE) as FIS inputs. As the annual release from the reservoir has definitive effects on the cropping schedule, it may be regarded as a defining factor for climate conditions. The optimized planning of crops for the following year is developed based on the annual release from the dam as forecasted by the fuzzy rules in the third stage of the model. Comparison of observed data and FIS estimations shows that the method developed here is capable of making reasonable decisions about land use and improved crop patterns based on climate conditions. The results also show that the Mean Average Error (MAE) for calculating the water demand is lower than 4.0 percent and, further, that in the case of predicting the cropping area, this error is lower than 2.0 percent.

Keywords:

Fuzzy inference system; Reservoir operation; Southern oscillation index (SOI); Crop planning.

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