

Stochastic modeling and risk management for water resources systems under changing climatic conditions

In this research, a spectrum of methods have been developed to deal with the stochastic modeling and risk-based management problems for water resources systems. These methods include: (i) a Stepwise Clustered Hydrological Inference model that can establish the complex nonlinear relationships between climatic conditions and streamflow for hydrological forecasting; (ii) a SCA-based Probabilistic Collocation Expansion method for the stochastic simulation and forecast of hydrologic time series; and (iii) an Interval-parameter Two-stage Fuzzy Stochastic Integer Programming model for risk-based flood diversion management under multiple uncertainties. The proposed methods have been applied to the Xiangxi River Watershed in China and the Grand River Watershed in Canada, in order to demonstrate their capabilities and performances in precipitation-runoff modeling, climate change impact analysis, uncertainty quantification, frequency analysis, and systematic water resources and risk management.