A multiobjective risk management model for real-time reservoir flood control operation

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Many uncertainties exit in the real-time reservoir flood control operation and bring risks to flood control decisions. A multiobjective optimization model is developed for the real-time risk management for the flood control operation of a reservoir system considering multiple uncertainties such as inflow forecast errors and outflow errors. The two competing objectives considered are: (1) minimizing the risk of reservoir upstream flooding and (2) minimizing the risk of downstream flooding. The optimization model seeks to find the operation schedules that satisfy the flood control objectives and simultaneously minimize the overall risks. The decision variables are the hourly reservoir releases. The formulated multiobjective optimization problem is nonlinear and non-convex, and is solved with an improved Non-dominated Sorting Genetic Algorithm-II (INSGA-II). We use a filtering algorithm to select representative non-dominated solutions from the Pareto front generated by INSGA-II to assist in real-time decision making. The proposed risk management model is applied to the Foziling reservoir in Huaihe river basin of China. The results show that the proposed method can provide a practical way to optimize the real-time flood control operation for risk management of a reservoir.

Keywords: Flood, Reservoir, Flood control operation, Risk assessment, Multiobjective optimization