Geophysical Research Abstracts
Vol. 19, EGU2017-4238, 2017
EGU General Assembly 2017

A method for optimizing multi-objective reservoir operation upon human and riverine ecosystem demands

Xueshan Ai, Zuo Dong, and Mingzhu Mo

State Key Laboratory of Water Resources and Hydropower Engineering Science, Wuhan University, Wuhan, China(dongzuo4@163.com)

The optimal reservoir operation is in generally a multi-objective problem. In real life, most of the reservoir operation optimization problems involve conflicting objectives, for which there is no single optimal solution which can simultaneously gain an optimal result of all the purposes, but rather a set of well distributed non-inferior solutions or Pareto frontier exists. On the other hand, most of the reservoirs operation rules is to gain greater social and economic benefits at the expense of ecological environment, resulting to the destruction of riverine ecology and reduction of aquatic biodiversity. To overcome these drawbacks, this study developed a multi-objective model for the reservoir operating with the conflicting functions of hydroelectric energy generation, irrigation and ecological protection. To solve the model with the objectives of maximize energy production, maximize the water demand satisfaction rate of irrigation and ecology, we proposed a multi-objective optimization method of variable penalty coefficient (VPC), which was based on integrate dynamic programming (DP) with discrete differential dynamic programming (DDDP), to generate a well distributed non-inferior along the Pareto front by changing the penalties coefficient of different objectives. This method was applied to an existing China reservoir named Donggu, through a course of a year, which is a multi-annual storage reservoir with multiple purposes. The case study results showed a good relationship between any two of the objectives and a good Pareto optimal solutions, which provide a reference for the reservoir decision makers.