Simulating operating rules for effective reservoir operation using system dynamics approach: a case study of TGR reservoir, China

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Abstract

Operating rules have been used widely to guide reservoir system operators to make operating decisions, duo to the capacity of coping with inflow uncertainty and characteristics of easy implementation. However, the problem faced by reservoirs managers is how to make and select an effective operating rule properly. This study focuses on identifying an effective and reliable operating rule using system dynamics (SD) approach. A stochastic hydrological model of reservoir inflow time series is used to generate a large number of inflow scenarios. A deterministic optimization operation model of reservoir is established, and then resolved using dynamic programming (DP) algorithm. Simultaneously, two linear operating rules are derived using the linear fitting method. Finally, the better of the two operating rules are identified based on SD simulation. The Three Gorges Reservoir (TGR) in central China is used as a case study. The results show that the SD simulation is an effective way to simulate a complicated reservoir system with feedback and causal loops. Moreover, it can directly and efficiently guide reservoir managers to make and identify better operating rules.

Keywords SD simulation. Linear operating rules. Reservoir operation. Three Gorges Reservoir

1 Introduction

1) A SD simulation model of long-term power generation operation for TGR is established by taking advantages of feedback loops in SD, including causal loop diagram and stork flow diagram.
2) Two operating rules are simulated by using SD model, one considering predicted inflow of reservoir for the current time period (operating rule A) and the other considering actual inflow of reservoir in the last time period (operating rule B), and the better one, operating rule A, is identified.