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Optimal coordination strategies for flood control and hydropower generation of reservoir

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During flood seasons, the water head of the reservoir is kept in flood limited water level (FLWL) to satisfy the flood control objective, but this runs counter to the need for hydropower generation to maintain a high water-head. This paper focuses on the optimal hedging rules by setting an appropriate FLWL to maximize the benefit of hydropower without increasing the flood damage and raise the water level at the end of flood for non-flood season/future use. Two-stage hydropower functions considering the constraint conditions which include the downstream environmental flow and installed capacity are built. On the basis of studying the marginal utilities of the two-stage hydropower functions, the competitive and collaborative relationships between flood damage and hydropower benefit were analyzed qualitatively. A two-stage reservoir operation model with two objectives that are minimum flood damage and maximum hydropower generation is developed, which considers streamflow forecast uncertainty and acceptable flood risk. The derived OHR from the model can be used to make trade-offs between flood damage and hydropower benefit under different levels of streamflow forecast uncertainty or acceptable risk. Finally, the analysis is applied to the Nierji Reservoir in the north of China. The results indicate that the OHR can increase hydropower generation 1.57x106kw·h and decrease the volume of abandoned water30.04x106m3 average annual.