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Optimal trade-off for operation of multi-purpose reservoir in the dry season

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Several optimisation models have been applied for optimising reservoir operations throughout the past decades. However, due to the limitations of each approach, the complexity of the system, and the conflict of combining purposes, reservoir operation evaluation and improvement remain classical. In this study, we apply a Genetic Algorithm model to generate a trade-off curve that presents alternative optimal strategies for the Hoa Binh reservoir in Vietnam. The study focuses on two goals: downstream water demand in the Red River Delta (RRD) and hydropower production in the dry season. Even though water availability in RRD is projected to be more plentiful until the mid-century, drought duration and intensity are also expected to increase. Thus, developing effective operation rules during the dry season is crucial for water security and the regional economy. The findings indicate that an optimised regulation can be developed to close the imbalance between water supply and demand while maintaining a high rate of energy generation. The optimisation criteria will also preliminarily consider the impact of the sediment transport reduction induced by trapping sediments generated by reservoirs: the enhanced erosion capacity of more clear streamflow water causes scouring of the riverbed, thus requiring more water release to meet the irrigation demand at the intake of the irrigation channels. In the future, reservoir management policies might also need to integrate the geomorphological changes induced by climatic and anthropic factors.