

Optimal reservoir operation strategy for balancing ecosystem and human needs

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Abstract The frequency of extreme hydrological events varies highly in Taiwan, and increasing attention has been paid to the optimal reservoir operations. This study establishes an optimization model for watershed management through reservoir operations subject to human and ecosystem needs. The Shihmen Reservoir in Taiwan is used as a case study. This study adopts the Taiwan Eco-hydrological Indicator System (TEIS) to classify river flow patterns. We combine the non-dominated sorting genetic algorithm II (NSGA-II) with the self-organizing radial basis network (SORBN) to develop the optimal model of reservoir operation. The results indicate that it is possible to simultaneously satisfy human and ecosystem needs, where ecosystem diversity can be retained in high SI values (1.7–1.9) while human demands can also be highly satisfied (α higher than 0.85). The proposed approach allows decision makers to easily determine the best compromise in water allocation through the trade-off between human and ecosystem needs.

Key words Taiwan Eco-hydrological Indicator System (TEIS); non-dominated sorting genetic algorithm II (NSGA-II); reservoir operation; water resources management; self-organizing radial basis network (SORBN)