Reservoir Operation Rules of the Bhumibhol and Sirikit Dams

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The Chao Phraya River is the principal surface−water resource for various water−use activities (e.g., irrigation, hydropower generation, water supply, and industry) on the central plain of Thailand. In general, the river basin has been managed by the multipurpose Bhumibhol and Sirikit Dams. Recently, inflows to the reservoirs have been diminishing due to the increase of water diversions in their upstream watershed areas [1]. Consequently, this results in the limited amount of capital water during dry season (January−April) and causes people in the downstream areas to often face a serious drought.

A necessary and permanent solution for the recent water shortage problem is to divert the amount of excess available water from the Salawin watershed area to the Bhumibhol Dam and that from the Kok and Ing drainage basins to the Sirikit Reservoir. The projects was planned to raise the living standards of Thai farmers during the last few decades. They steadily progressed on their planning and design but stalled on their implementation because of their requirements for large capital investment on project construction.

Therefore, it is perhaps appropriate to only mitigate the water deficit problem. A few drought mitigation measures, such as cloud seeding, crop pattern adjustment, and reservoir operation improvement, can be used. The application of the cloud seeding technique has been the most popular measure for the water shortage alleviation in the river basin because the technique is inexpensive and is able to relieve the localized drought problem immediately after its favorable conditions become available. [2] has shown that its application is feasible for the water shortage mitigation during the period of dry spells in rainy season (July). Unfortunately, it is unsuitable for the dry season problem. [3] has analyzed the water balance for the watershed area and adjusted the crop pattern that suits to the amount of limited available water in the dry period.

This paper aims to alleviate the water shortage problem by improving reservoir operation. A reservoir operation rule searched using a robust optimization technique (i.e., genetic algorithm) is proposed to raise the level of reservoir operation performance. It is shown that the proposed rule based on the minimization of average drought magnitude or of water shortage frequency is better than that of maximum water deficit amount because their drought durations are shorter. Moreover, the proposed superior rules have indicated their advantageous over a few existing ones

because their amounts of water shortage magnitudes and quantities of excess water releases are smaller.

Keywords: Water resources; management; optimization; genetic algorithm (GA); reservoir operation.

References

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