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In the Way of Peacemaker Guide Curve between Water Supply and Flood Control for Short Term Reservoir Operation

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Effective management of a controlled reservoir system where it involves multiple and sometimes conflicting objectives is a complex problem especially in real time operations. Yuvacık Dam Reservoir, located in the Marmara region of Turkey, is built to supply annual demand of 142 hm3 water for Kocaeli city requires such a complex management strategy since it has relatively small (51 hm3) effective capacity. On the other hand, the drainage basin is fed by both rainfall and snowmelt since the elevation ranges between 80 – 1548 m.

Excessive water must be stored behind the radial gates between February and May in terms of sustainability especially for summer and autumn periods. Moreover, the downstream channel physical conditions constraint the spillway releases up to 100 m3/s although the spillway is large enough to handle major floods. Thus, this situation makes short term release decisions the challenging task.

Long term water supply curves, based on historical inflows and annual water demand, are in conflict with flood regulation (control) levels, based on flood attenuation and routing curves, for this reservoir. A guide curve, that is generated using both water supply and flood control of downstream channel, generally corresponds to upper elevation of conservation pool for simulation of a reservoir. However, sometimes current operation necessitates exceeding this target elevation. Since guide curves can be developed as a function of external variables, the water potential of a basin can be an indicator to explain current conditions and decide on the further strategies. Besides, releases with respect to guide curve are managed and restricted by user-defined rules.

Although the managers operate the reservoir due to several variable conditions and predictions, still the simulation model using variable guide curve is an urgent need to test alternatives quickly. To that end, using HEC-ResSim, the several variable guide curves are defined to meet the requirements by taking inflow, elevation, precipitation and snow water equivalent into consideration to propose alternative simulations as a decision support system. After that, the releases are subjected to user-defined rules. Thus, previous year reservoir simulations are compared with observed reservoir levels and releases. Hypothetical flood scenarios are tested in case of different storm event timing and sizing. Numerical weather prediction data of Mesoscale Model 5 (MM5) can be used for temperature and precipitation forecasts that will form the inputs for a hydrological model. The estimated flows can be used for real time short term decisions for reservoir simulation based on variable guide curve and user defined rules.