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Real-Time Distributed Rainfall-Runoff Prediction Considering Flow Regulation by Dam Reservoirs

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In 2004, a series of severe flood disasters killed more than 230 people in Japan. One of the noticeable features of the flood disasters were the concentrations of the damage in middle size river basins and the tributaries of large river basins. Although most of the important river in Japan is well gauged and highly controlled by dam reservoirs, there are still not enough observed data and not enough flood forecasting at internal river sections inside a basin. Predicting river discharge and evaluating its uncertainty at internal locations is one of the most important tasks for hydrological engineering. Furthermore, the alterations of hydrologic cycle caused by human activity such as dam operations indicate historical observed data may not be applicable for future predictions. Developing hydrologic prediction methods that can take into account the anthropogenic impacts on river basins is another important issue. This paper presents the development of a real-time based distributed flood prediction system in a flow-regulated large-scale river basin, the Yodo River basin (7, 281 km2) in Japan. The system is composed of 1) distributed rainfall-runoff models that simulate saturated, unsaturated subsurface and surface rainfall-runoff processes with 250 m spatial resolution, 2) kinematic wave river routing models, and 3) dam operation models applied for eight multi-purpose dams. Inputting quantitative precipitation forecasted by the Japan Meteorological Agencies (2.5 km spatial resolution), the system predicts 6-hr ahead discharge at all the river cross sections on real-time basis. The dam operation models follows operation rules to simulate outflow from a reservoir based the forecasted precipitation as well as predicted inflow to the reservoir. Up-to-date predicted results and the accuracy are presented.