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River Discharge Predictions for Heavy Floods in 2004 and 2005 in Japan and Predictions in Ungauged Basins

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In 2004, severe rainfall fronts and ten typhoons hit Japan caused heavy rainfall disasters with 232 casualties. In 2005, a typhoon with more than 1000mm rainfall in three days brought severe damage to a east part of the Kyushu region in Japan. These rainfall disasters mainly occurred at tributary catchments with several hundreds square km in mountainous areas. River managements of these river catchments are organized by local governments; and in most situations, the river improvements still do not attain a designed safety level. In the future it is still not easy to achieve high river improvements. In these catchments, to assess the safety level of river improvements at present time is the basis to design a future river development program. Also, to develop a real-time flood runoff prediction system to issue a flood warning is an urgent task to save lives. To achieve these purposes, hydrologic prediction by a reliable rainfall-runoff model is a fundamental work in flood managements. While especially for small scale catchments with several hundreds square km, accumulations of hydrologic data are usually quite insufficient. Generally, the shape of a flood hydrograph at small scale basins is sensitive to space and especially time distributions of rainfall patterns. Therefore flood runoff predictions at small scale mountainous catchments request more detailed information of rainfall distribution patterns than at large scale basins with more than several thousand square km. In addition, the flood data with the magnitude of a design flood level or above the level does not exist in most situations. In this sense, rainfall-runoff models are not validated for estimating a flood with a magnitude of a design level. To examine the performance of a rainfall-runoff model for the historical 2004 and 2005 flood in Japan is a good test to understand the behaviors and predictability of a rainfall-runoff model and this gives knowledge to improve the prediction of a runoff model. In this presentation, we use a physically based distributed rainfall-runoff model based on topographic representations by grid based DEMs and kinematic flow routing; and apply the rainfall-runoff model to four mountainous catchments with 210, 351, 1115, and 1880 km2 area; then examine the predictability of the model for historical floods at these catchments in 2004 and 2005; and finally discuss the sources of flood prediction uncertainty and a direction to reduce the uncertainty and enhance the reliability of flood discharge prediction in mountainous catchments.