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Application of a developed atmospheric-hydrologic-hydraulic flood forecasting model driven by ensemble weather predictions to Chinese watershed

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A coupled atmospheric-hydrologic-hydraulic ensemble flood forecast model, driven by the 'THORPEX Interactive Grand Global Ensemble' (TIGGE) ensemble weather predictions, was developed for flood forecast purpose of complex watershed with flood diversion and retention areas. Hydrological model is used to forecast rainfall-runoff hydrograph, and hydraulic model is used for channel flood routing. In the case of precipitation, NWPs' corrected precipitation is the input of hydrological model.

The Xinanjiang model was used for the hydrological rainfall-runoff modeling. One-dimension unsteady flow model was applied for main channel flood routing. The nonlinear of the channel without cross-section data was discussed by non-liner Muskingum method. The input flood discharge hydrograph from the main channel to the flood diversion area is estimated with the fixed split ratio of the main channel discharge. The flood flow inside the flood retention area is calculated as a reservoir with the water balance method. Muskingum method was used for flood routing in flood diversion area.

The upper reaches of the Huaihe River above Lutaizi station in China was taken as the test case. The test case, which is a humid watershed, drains an area of 8.86×104 km2, and the length of the channel from Wangjiaba to Lutaizi is 155.16 km. There are three flood diversion areas, four flood retention areas and nine large reservoirs in the test case. There are three large tributaries: the Shi River and Pi River to the south of the Huaihe River, and the Shaying River to the north.

The coupled ensemble flood forecasting model was applied to flood forecasting of the upper reaches of the Huaihe River above Lutaizi station during the 2007 and 2008 flood seasons. A probabilistic discharge and flood inundation forecast was provided as the end product to study the potential benefits of using the TIGGE NWPs. The results demonstrated satisfactory flood forecasting with clear signals of probability of floods up to 10 days in advance, and showed that ensemble weather predictions is a promising tool to forecast flood inundation, comparable with that driven by raingauge observation.

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