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Real time flood forecasting in the Nan Basin, Thailand, by using a distributed Xin'anjiang Model

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Taking Nan basin in Thailand as a research case, on the basis of DEM, this paper extracts the digital information of Nan basin and divides it into ten sub-basins, considering the land usage and terrain distribution, to construct the distributed Xinanjiang model. Before the model simulation, various digital basin information is established involving elevation matrix, river net matrix, direction matrix and so on. The three-water-source Xinanjiang model is adopted in the grids to calculate the runoff yield under a specific precipitation in grids, and then all the water flows of the grids are convoluted to the sub-basin's outlet to synthesize the runoff process of a subbasin. Eventually the subbasin runoff is routed to the basin outlet to obtain runoff process of the whole basin with real-time correction. The model parameters are calibrated by using the trial and error method. The sensitivity and uncertainty of the parameters are analyzed. The main achievements of this paper are as follows.
(1) The basin information is extracted and the digital NAN basin is constructed on the basis of DEM data. As a result, a series of basin information matrix and digital Nan basin are generated.
(2) The constant flow in grids and isochrones concept are used to replace the unit hydrograph of sub-basins. The basin discharge process is obtained through calculating the grid runoff yield and subbasin runoff convolution and routing the subbasin runoffs to the basin outlet.
(3) The model is calibrated on more than 50 historical flood processes. The sensitivity and uncertainty of model parameters are analyzed by the perturbation analysis method, showing that some parameters, including KC, KKG, KKSS, WUM, KG, WLM, KSS and WDM are more sensitive. At the same time, the model uncertainty is analyed by the GLUE method and the results illustrate that the simulation effect depends on the values of parameter group while the observed runoff is in the uncertainty range.
(4) The calculated discharge process is adaptively corrected by Attenuation memory least squares method to obtain final forecasting flood process. Verifications of this real-time flood forecasting model show high precision and the model system has been practically used in Thailand.