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A study coupling a large-scale hydrological model with a regional climate model

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Abstract On the basis of the improved SIMTOP runoff parameterization scheme and the three-layer soil moisture balance calculating method in the Xinanjiang model, this paper develops a simple, but highly-efficient, large-scale hydrological model (TOPX), which can provide the function for scaling transformation on the topographic index. Although the TOPX model has less data input and minimum parameters for calibrating, it can better describe two-dimensional hydrological processes. TOPX was coupled with the regional integrated environment modelling system (RIEMS) to use its ability of numerical simulation for the runoff in large-scale watersheds. The results of the off-line test performed at Youshui River catchment show that the TOPX model produced better simulations of daily runoff in small-sized catchments and it can capture the major characteristics of various hydrological processes. The RIEMS and TOPX coupled model was tested on-line in the Jinghe watershed. By means of the scale transformation scheme on topographic index and the yield and runoff routing theory, the coupling model used meteorological data simulated by a regional climate model to drive the hydrological model for predicting the daily runoff at the large-scale watershed. A further analysis revealed that the accuracy of the distributed rainfall data simulated by the regional climate model (RIEMS) is the critical factor affecting the modelled runoff in the coupled model (RIEMS+TOPX).

Key words topographic index; TOPMODEL; DEM; multiple flow direction algorithm