

## **Study and application of a digital hydrological model of the Chabagou basin in the Yellow River, China**

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**Abstract** The hydrological modelling of semi-arid areas is a difficult but also an important topic. The soil erosion is quite severe in the Yellow River basin, especially in the loess area in the middle part of the basin. In the present study a distributed hydrological model is built and applied to the Chabagou basin, a small experimental watershed with severe soil erosion in the middle part of the Yellow River basin. In the model, the time variant gain flow was used to simulate the runoff generation process in each grid cell, and the digital area–time method was applied for flow routing. The watershed characteristics, such as the flow direction, the flow accumulation, the flow-path length and the slope gradient, were obtained from the DEM. The flow-path length and the slope gradient were especially useful in generating the contour of equal travel time, which is the basis of the area–time routing method. In addition, the lag effect was considered by calculating the lag time in the area–time method, and the discharge attenuation was taken into account by the linear-reservoir regulation. Finally, the digital hydrological model was established by combining the digital runoff generation process and the digital flow concentration process. A number of flood events within the period 1970 to 2000 are selected for model calibration. The relative errors between simulated and observed streamflows were within 30%; the Nash-Sutcliffe efficiency index of the site can reach 76.54%, so the results of model calibration and verification were satisfactory.

**Key words** DEM; distributed hydrological model; time variant gain flow; area–time method; linear-reservoir; Chabagou basin; the Yellow River

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