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Impact of human activity on streamflow in the Huaihe River Basin, China: analysis and simulation

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Abstract A distributed hydrological model coupled with a coarse grid land surface model is set up to simulate hydrological processes in the Huaihe River Basin, China. Parameters of the land surface model are interpolated from global soil and vegetation data sets. The characteristics of the basin, including topography, river networks and aquifer geology, are derived from a digital elevation model (DEM) and a national geological survey atlas. The NCEP/NCAR re-analysis data set and observed precipitation data are used as meteorological inputs. The coupled model is firstly calibrated and validated by using observed streamflow over the period 1980–1987. A long-term continuous simulation is then carried out for 1980–2003 forced with observed rainfall data. Results indicate that streamflow is over-estimated for dry years since the 1990s when water withdrawal increased substantially due to the growing industrial activities and the development of water projects. Two methods are proposed to study the human dimension in the hydrological cycle. One is to reconstruct the natural streamflow series using local volumes of withdrawals. The simulated results are consistent with the reconstructed hydrographs. The other method is to integrate a designed modular into the coupled model to represent the impact of human activities. This method can significantly improve the model's performance in streamflow simulation. This study shows that the coupling of hydrological and atmospheric models is a powerful tool for studying the human impact on the hydrological cycle.

Key words streamflow; human activity; hydrology model; withdrawal; Huaihe River, China