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The hydrological response of soil water storage capacity to human activities: A case study in the upper Yangtze River Basin, China

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The intensification of climate change and human activities can lead to non-stationarity of hydrological model parameters, which in turn affects the correctness of model simulation results. Previous studies mainly focus on impacts of climate change, while catchment hydrological responses to human activities require detailed investigation for sustainable water management. This study evaluates anthropogenic impacts on soil water storage capacity of the upper Yangtze River Basin by representing hydrological parameters as functions of human activity indicators. The Xinanjiang (XAJ) model is used since its parameter WM accounts for soil water storage capacity. In this study, time-variations of WM are identified by the split-sample calibration based on dynamic programming (SSC-DP). The variations are further related to ten indicators of human activities from five aspects: population, gross domestic product, farming, irrigation and reservoir construction. Then, the proposed WM functional form is selected by comparing the performance of a set of parameter functions of the identified human activity indicators during the validation period. The study shows that WM increases in 1976-2000, while a relatively high relationship is detected between WM and some indicators such as agricultural acreage, population and reservoir construction. It is further demonstrated that agricultural population has the greatest impact on soil water storage capacity and its linear functional form for WM is validated to be effective in 2001-2010 with best streamflow simulation, especially for low streamflow. These results can help understand the hydrological response to the increasing human development and contribute to adaptive development strategies for future water resource management.