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Impacts of precipitation and agricultural land uses on streamflow in a water-limited basin at the northern edge of Tibetan Plateau

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Alterations in streamflow and its associated impacts on water availability of ecosystem in lower reaches of river basins have been strongly related to changes in land uses and meteorological factors such as precipitation. The impact of variations in precipitation and agricultural land uses on streamflow in the Heihe River basin, located at the northern edge of Tibetan Plateau, has been assessed in the present study. The evaluation was carried out by employing statistically testing (the changes in the slope and intercept of the relationship between annual streamflow and precipitation), model residual approach and sensitivity analysis on the basis of Budyko-type equations, based on streamflow, precipitation and land uses data from 1979 to 2010 in the Heihe River basin. Results showed that: (1) annual streamflow time series could be divided into two periods, namely pre-change period and post-change period with the abrupt changing point around 1989; (2) significant changes in both slope and intercept of the streamflow-precipitation relationship during post-change period were detected, which was an indication of land use changes in the Heihe River basin during post-change period; (3) no obvious shift was detected in the relationship of pre-change period, which means that variations in precipitation led to the changes in streamflow in this time period; (4) quantitatively, precipitation contributes more than 70% to variations in streamflow during the pre-change period, while agricultural land use changes contributed more (about 60%) during the post-change period.