Assessing the Impacts of Climate Change and Land Use/Cover Change on Runoff Based on Multiple Water-Energy Balance Models

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The runoff in river systems has been significantly changed by climate change and land use/cover change (LUCC), while the magnitude and patterns vary because of the factors. Investigating the major factor impacting runoff variation is necessary for water resource management. In this work, five different water-energy balance models are used to analyze the cause of runoff variations; of these models, three are based on the Budyko framework and two are based on the ecohydrological conceptual framework. The approach is demonstrated using the upper-midstream of the Heihe Rivers. The results suggest LUCC is the dominant cause of runoff change in the range of 59.92% - 65.14%. The estimated impacts of climate change and LUCC are consistent among the five models. Cropping is the major human activity resulting in LUCC at the upper-midstream of the Heihe River. Meanwhile, the change in runoff is more sensitive to precipitation than to potential evapotranspiration. Our work summarizes five widely used water-energy balance models used to explain the impacts of climate change and LUCC on runoff, which may be of importance in explaining the mechanism of runoff change.