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Response of water budget to recent climatic changes in the source region of the Yellow River

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The variation of surface water budget in the source region of the Yellow River is investigated. It is found that the spatial pattern of precipitation change is an important factor except precipitation amount itself and its intensity to determine the response of runoff change to precipitation change. Discharge in the source region had a significant decline after 1990; precipitation was low in the 1990s and in agreement with runoff, but it returned above normal after 2002 for more increase occurred in the dry area. The source region was experiencing rapid changes including decadal warming, wetting and wind speed decaying in recent decades. Surface water budget at the CMA stations within and surrounding the source region was simulated during 1960-2006 with an improved land surface model. The results indicated that evaporation was mainly limited by water availability in the dry area and thus most of precipitation increase was evaporated. By contrast, energy availability was a more important factor to determine evaporation in the wet area, and therefore, more evaporation occurred due to rapid warming although precipitation amount partly decreased, which contributed to the decrease of runoff generation after 2002. This mechanism controlling evaporation and its response together with the changed spatial pattern of precipitation led to water budget unfavorable for runoff generation in the source region during recent years.