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Spatiotemporal Variability of Potential Evaporation in Heihe River Basin Influenced by Irrigation

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Spatiotemporal Variability of Potential Evaporation in Heihe River Basin Influenced by Irrigation

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Abstract: Potential evaporation is a key factor in crop water requirement estimation and agricultural water resource planning. The spatial pattern and temporal changes of potential evaporation calculated by Penman equation (E_{pen}) (1970-2017) in Heihe River Basin (HRB), Northwest China were evaluated by using data from 10 meteorological stations, with a serious consideration of the influences of irrigation development. Results indicated that the spatial pattern of annual E_{pen} in HRB was significantly different, among which the E_{pen} of agricultural sites (average between 1154 mm and 1333 mm) was significantly higher than that of natural sites (average between 794 mm and 899 mm). Besides, the coefficient of spatial variation of the aerodynamic term (E_{aero}) was 0.4, while that of the radiation term (E_{rad}) was 0.09. The agricultural irrigation water withdrawal increased annually before 2000, but decreased significantly after 2000 which was influenced by the agricultural development and the water policy. Coincidentally, the annual variation of E_{pen} in agricultural sites decreased at -40 mm/decade in 1970-2000 but increased at 60 mm/decade in 2001-2017, while that in natural sites with little influence of irrigation, only decreased at -0.5mm/decade in 1970-2000 but increased at 11 mm/decade in 2001-2017. So it was obvious that irrigation influenced E_{pen} significantly and the change of E_{pen} was mainly caused by the aerodynamic term. The analysis of the main meteorological factors that affect E_{pen} showed that wind speed had the greatest impact on E_{pen} of agricultural sites, followed by relative humidity and average temperature, while the meteorological factors that had the greatest impact on E_{pen} of natural sites were maximum temperature, followed by wind speed and relative humidity.

