Influence of Meteorological Factors on the Potential Evapotranspiration in Yanhe River Basin, China

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Abstract

Potential evapotranspiration (ET_0) is an essential component of the hydrological cycle, and quantitative estimation of the influence of meteorological factors on ET_0 can provide a scientific basis for studying the impact mechanisms of climate change. In the present research, the Penman-Monteith method was used to calculate ET_0. The Mann-Kendall statistical test with the inverse distance weighting were used to analyze the spatiotemporal characteristics of the sensitivity coefficients and contribution rates of meteorological factors to ET_0 to identify the mechanisms underlying changing ET_0 rates. The results showed that the average ET_0 for the Yanhe River Basin, China from 1978–2017 was 935.92 mm. Save for a single location (Ganquan), ET_0 increased over the study period. Generally, the sensitivity coefficients of air temperature (0.08), wind speed at 2 m (0.19), and solar radiation (0.42) were positive, while that of relative humidity was negative (-0.41), although significant spatiotemporal differences were observed. Increasing air temperature and solar radiation contributed 1.09% and 0.55% of the observed rising ET_0 rates, respectively; whereas decreasing wind speed contributed -0.63%, and relative humidity accounted for -0.85%. Therefore, it was concluded that the decrease of relative humidity did not cause the observed ET_0 increase in the basin. The predominant factor driving increasing ET_0 was rising air temperatures, but this too varied significantly by location and time (intra- and interannually). Decreasing wind speed at Ganquan Station decreased ET_0 by -9.16%, and was the primary factor underlying the observed, local "evaporation paradox." Generally, increases in ET_0 were driven by air temperature, wind speed and solar radiation, whereas decreases were derived from relative humidity.

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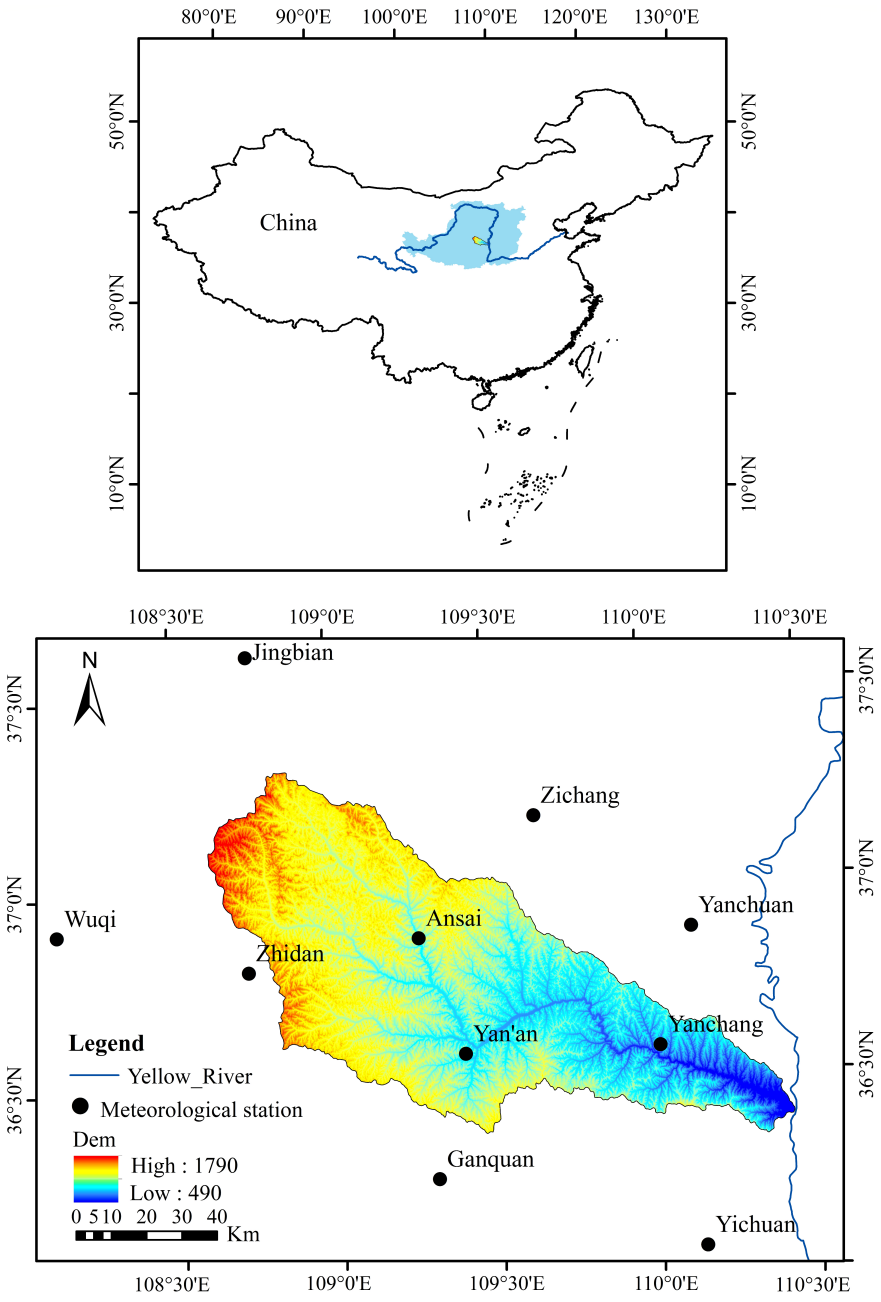

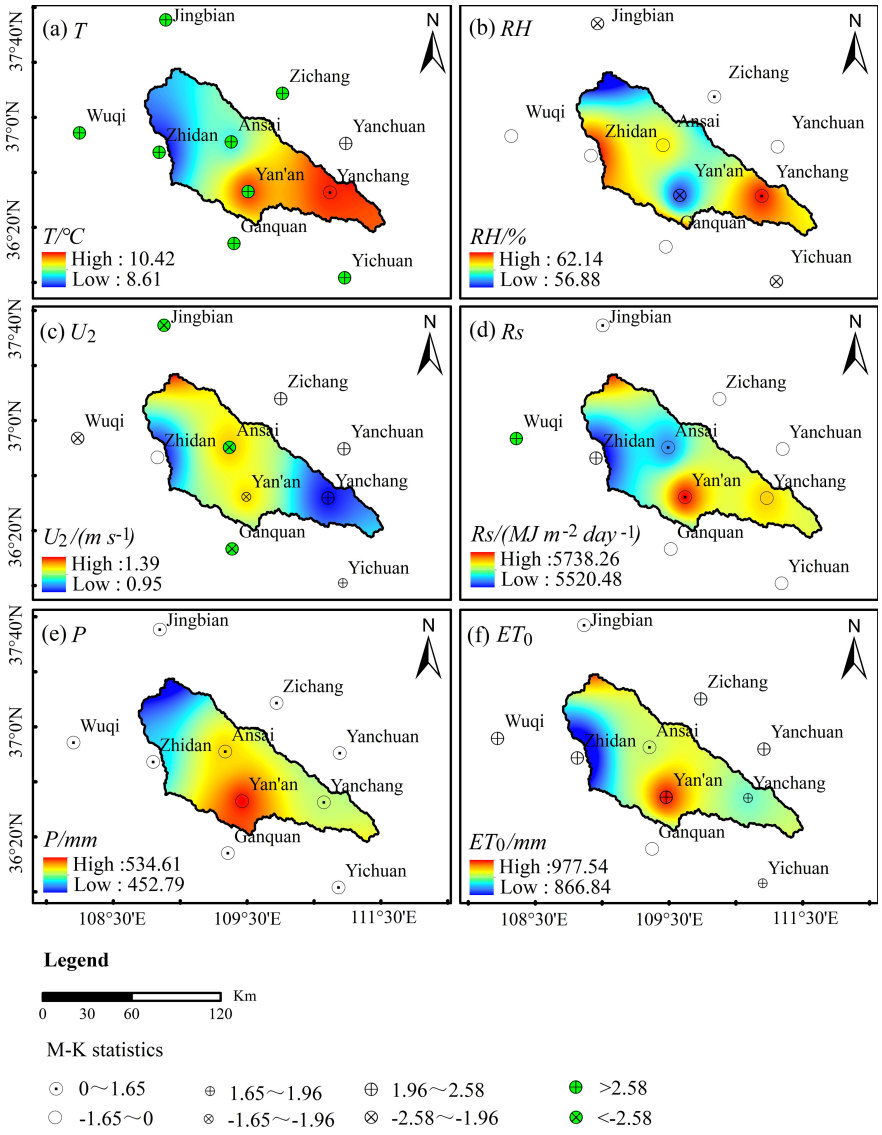

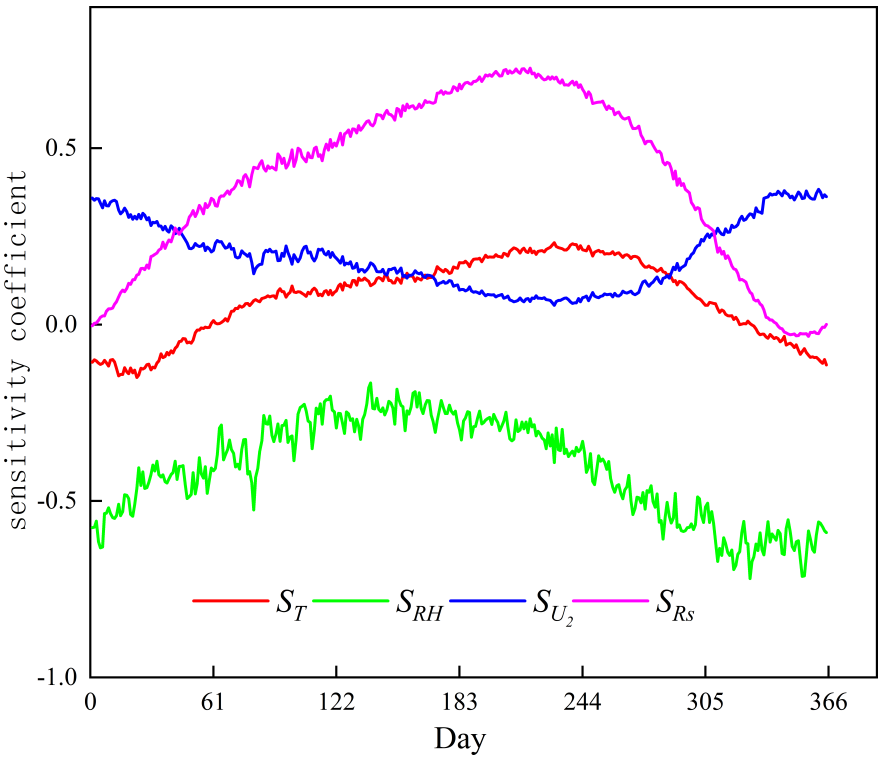

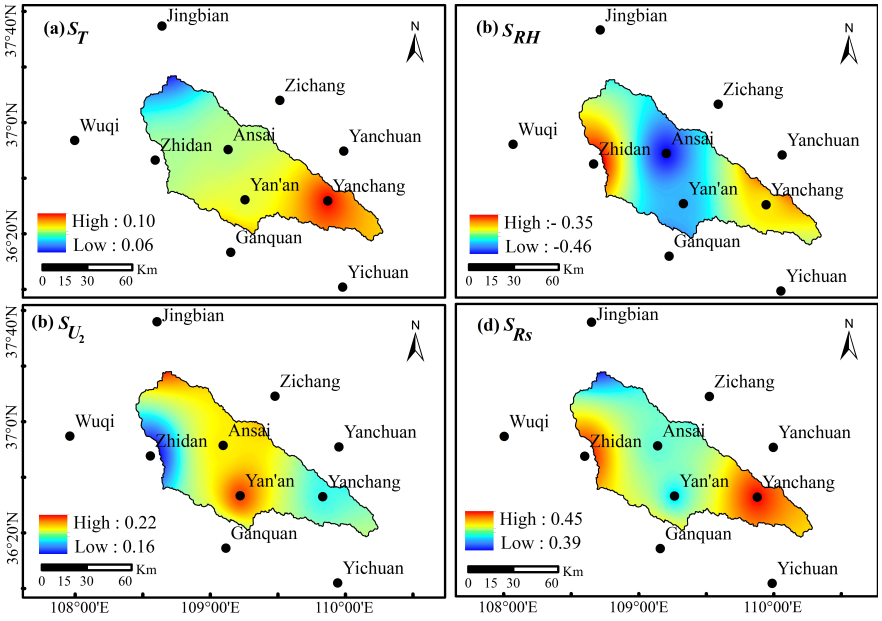

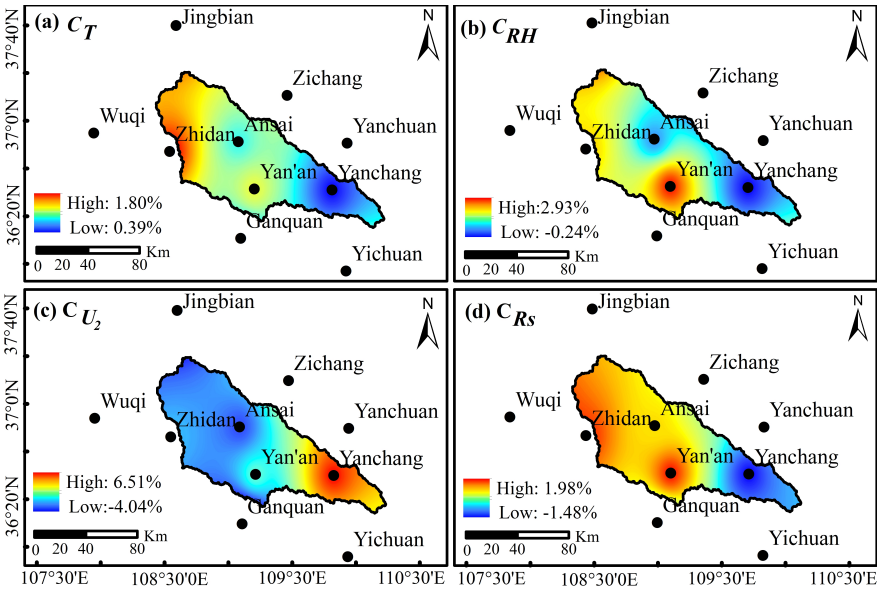

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