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洮河流域潜在蒸散发的的气候敏感性分析

Sensitive analysis of potential evapotranspiration to key climatic factors in Taohe River Basin

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中文关键词: [蒸散发](#) [气候变化](#) [敏感性分析](#) [Penman-Monteith模式](#) [Beven敏感性公式](#) [洮河流域](#)

英文关键词: [evapotranspiration](#) [climate change](#) [sensitivity analysis](#) [Penman-Monteith module](#) [Beven sensitivity method](#) [Taohe River Basin](#)

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中文摘要:

潜在蒸散发(ET₀)的气候敏感性分析是变化环境下陆表能-水通量过程研究的重要内容,对气候变化背景下区域水文循环和农业水资源有效利用具有重要的理论和实践指导意义。为探讨气候变化对区域潜在蒸散发的可能影响,以洮河流域为研究区,采用Penman-Monteith模式和Beven敏感性公式计算该区ET₀及其对关键气候要素的敏感系数,按Sen斜率和Mann-Kendall方法对敏感系数的变幅和显著性进行检验,基于此,对洮河流域ET₀的气候敏感性进行了综合分析,并探讨了1981—2010年间该区ET₀发生变化的气候原因。结果表明:洮河流域ET₀对关键气候因素的敏感性排序为:净辐射>相对湿度>最高气温>最低气温>风速,其中,净辐射、最高气温和风速的敏感系数与ET₀的相关性较强,特别是前2个要素在敏感性和相关性方面均具有较高系数;1981—2010年间,洮河流域ET₀敏感性以净辐射的降低和最高气温的增强为主,净辐射和气温共同造就了洮河流域ET₀的增加,且气温占主导。

英文摘要:

Abstract: Sensitive analysis of potential evapotranspiration (ET₀) to main climatic factors is an important content of the land surface vapor flux research, which has remarkable theoretical and practical significance for understanding regional hydrological cycle and for effective use of agricultural water resources in the context of climate change. Over the past few decades, many parts of the world experienced a decline of ET₀ under a warming-up background. Relationship between ET₀ and the climatic factors has once again become people's attention. The Taohe River Basin (TRB) is located in the transition zone of the two major geomorphic units of China, the Qinghai-Tibet Plateau and the Loess Plateau. Area of the upstream of the TRB (Gannan Plateau) features an altitudinal cold humid and semi-humid climate, while the downstream of that (Loess Plateau) presents a temperate and semi-arid climate. Natural pattern of the regional climate differentiation provides a good platform for studies on sensitive analysis of ET₀ to climatic factors. In this study, the Penman-Monteith (P-M) equation and the Beven sensitivity method were used to estimate the ET₀ and sensitivity coefficient related to the main climatic factors. The Sen's slope and Mann-Kendall approaches were used to quantitatively test the amplitude and significance of the sensitivity from year 1981 to 2010. Based on above studies, we comprehensively analyzed the sensitivity of ET₀ to climatic factors and discussed the reasons of the ET₀ variability under a changeable regional climate in the TRB over the past 30 years. The P-M module outputs indicated a spatially gradual increase of ET₀ from the upper reaches to the lower reaches of the TRB. The multi-yearly averaged annual ET₀ across the basin was in a range of 633-789 mm. During the period from 1981 to 2010, there was an up-growing tendency of ET₀ at a rate of 3.43 mm per year. In the upper reach area of Gannan Plateau, the increase of ET₀ was less obvious than that in the lower reach area of Loess Plateau, with an increase rate of 3.39 mm per year and 3.54 mm per year, respectively. Application of Beven method resulted in an obvious differences of ET₀ sensitivity to climatic factors. According to the sensitivity coefficients, the sensitive significance was in an order of net solar radiation > relative humidity > maximum air temperature > minimum air temperature > wind speed, while there were relatively high correlation between ET₀ and the sensitivity coefficient of the net solar radiation, the maximum air temperature and the wind speed, respectively. Especially, higher values of sensitivity and correlation coefficients were found with the first two factors. The results showed that given the same increasing amplitude (+1%) of net solar radiation and maximum air temperature, the relative increment of ET₀ due to the net solar radiation was 0.73%, while that due to the maximum temperature was 0.31%. Over the past 30 years, change of net solar radiation (1%) was less than that of the maximum air temperature (5%), thus, the sensitivity of ET₀ to the regional climate was dominated by a weakness to net solar radiation and an enhancement of maximum air temperature. Therefore, the increase of ET₀ during the studied period was mainly due to increment of the air temperature in the area.

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