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Effects of climate change on water requirements and phenological period of major crops in Heihe River basin, China—Based on the accumulated temperature threshold method

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In recent years, global climate change has significantly caused a serious crisis of water resources throughout the world. However, mainly through variations in temperature, climate change will affect water requirements of crop. It is obvious that the rise of temperature affects growing period and phenological period of crop directly, then changes the water demand quota of crop. Methods including accumulated temperature threshold and climatic tendency rate were adopted, which made up for the weakness of phenological observations, to reveal the response of crop phenological change during the growing period. Then using Penman-Menteith model and crop coefficients from the United Nations Food& Agriculture Organization (FAO), the paper firstly explored crop water requirements in different growth periods, and further forecasted quantitatively crop water requirements in Heihe River Basin, China under different climate change scenarios. Results indicate that: (i) The results of crop phenological change established in the method of accumulated temperature threshold were in agreement with measured results, and (ii) there were many differences in impacts of climate warming on water requirement of different crops. The growth periods of wheat and corn had tendency of shortening as well as the length of growth periods. (ii)Results of crop water requirements under different climate change scenarios showed: when temperature increased by 1°C, the start time of wheat growth period changed, 2 days earlier than before, and the length of total growth period shortened 2 days. Wheat water requirements increased by 1.4mm. However, corn water requirements decreased by almost 0.9mm due to the increasing temperature of 1°C. And the start time of corn growth period become 3 days ahead, and the length of total growth period shortened 4 days. Therefore, the contradiction between water supply and water demands are more obvious under the future climate warming in Heihe River Basin, China.