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The Evolution of Vegetation Dynamics and Hydrological Response Characteristics of Inland River Basins under Climate Change

Xuelei Zhang, Weihua Xiao, Yicheng Wang, Yan Wang, Hejia Wang, Heng Yang, and Lishan Zhu
China Institute of water resources and hydropower research, Beijing, China (18215106336@163.com)

Dual impacts from climate change and human activities have led to variations in regional hydrology and have made hydrologic processes and ecological patterns more complex. Analyses of the possible mechanisms and relationships between ecological patterns and hydrological processes that combine water and ecology have both theoretical and practical implications for maintaining the ecological and environmental health of a region and achieving sustainable economic and social development. We select the Shiyang River Basin as the study area. Our study evaluates the variations in regional hydrometeorology and land use/cover (LUC) along with the variability of the mountainous discharges and dynamics of the underground system in plain areas under irrigation regulations. Based on the above, the hydrological variability in the basin, along with its water-ecological effectiveness, was comprehensively discussed to assist with adaptive water resource management in the arid water-limited region of China's inland river basins. The LUC classification across the basin resulted in satisfactory precision, with an average accuracy of 81% and a kappa coefficient of 0.76. From 2001 to 2015, the LUC areas of forest and grassland in the upper mountains and the arable land areas in the middle oasis and transition zones in the middle and lower plains increased, while the arable land area in the lower oasis and the desert area in the middle and lower plains decreased. Although the strengthened vegetation dynamics led to an increase in the regional actual evapotranspiration (AET), the increased precipitation offset this increase, and the mountainous discharge increased. Excess extraction resulted in the continuous decline of the groundwater level and a decrease in amplitude. Desert areas became greener, which benefited from the ecological effects of the increased precipitation in the area. As we understand it, a modest reduction in the scale of cultivated land is the fundamental way to maintain the sustainable economic and social development of the basin.