Analysis of water source contribution and its impact on hydrological structural connectivity in urban plain river network area based on stable isotopes

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Abstract

Water sources carry chemicals that can have a significant impact on the water environment of a river network, and understanding the contribution of different water sources to the river network can help to manage the pollution of the river network at its source. Hydrological connectivity of a river network affects the self-purification capacity and flood prevention capacity of the river. Thus an isotope tracer approach was applied to figure out the contribution rate of different water bodies to a river network and hydrological connectivity was quantified by introducing retention rate. Changzhou city was selected as the study area because it is an urbanized city with the characteristics of plain river network and it is faced with poor hydrological connectivity due to artificial constructions (dams and pumps) and human activity (urbanization). River water, well water (shallow groundwater), lake water and rainfall were collected during the flood season and nonflood season, and hydrogen and oxygen isotopes were determined. The temporal and spatial variations in hydrogen and oxygen isotopes in different water bodies and the state of the water cycle in different water bodies were analyzed. IsoSource and MixSIAR models were established to analyze the contribution rate of river network water sources in the study area, and their effectiveness was compared. Results of MixSIAR model were selected to evaluate the hydrological connectivity of the river network in the study area, providing a method to quantify the hydrological connectivity of specific river of the river network in Changzhou. This method could also be applied to other urban plain river network area to study its river connectivity.

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