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Quantitative assessment of climate change and human activities impact on the designed annual runoff

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Abstract: In recent years, more and more researchers study the impact of climate change and human activities on runoff in the flood context. In this study, we propose a novel statistical method to quantitatively analyze the contribution of climate change and human activities to runoff change. The method is based on the assumption that if a given x-year designed precipitation is input to the hydrological model, the return period of corresponding output runoff also is x-year. The assumption has been widely used in the hydrological field when precipitation data is used to estimate the deigned flood with a given horizon. Compared to most of the current studies using the hydrological model to simulate the change, the proposed method needs less data, which makes it easy to implement. The method is employed to analyze the impact of climate change and human activities on different-designed-horizon annual runoff in the upper basin of Tangnaihai station. The M-K test result shows that the annual runoff series has the decreasing trend. The quantitative impact assessment results show that in terms of 1000-, 100-, and 50-year return period, the designed annual runoff after 1989 reduced by 24.8%, 24.6% and 24.2% respectively compared to that before 1989. The climate change accounts for 71.1%, 65.7% and 63.2% of the decrease of 1000-, 100-, and 50-year designed annual runoff respectively, while the human activities account for 28.9%, 34.3% and 36.8% respectively. Overall, the impact of climate change on annual runoff is higher than that of human activities.
Keywords: annual runoff; climate change; human activities; impact assessment