Future drought risk assessment under CMIP6 GCMs scenarios

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Abstract

A better approach for assessing meteorological drought occurrences is increasingly important in mitigating and adapting to the impacts of climate change, as well as strategies for developing early warning systems. The present study defines meteorological droughts as a period with an abnormal precipitation deficit based on monthly precipitation data of 18 gauging stations for the Han River watershed in the past (1974-2015). This study utilizes a Bayesian parameter estimation approach to analyze the effects of climate change on future drought (2025-2065) in the Han River Basin using the Coupled Model Intercomparison Project Phase 6 (CMIP6) with four bias-corrected general circulation models (GCMs) under the Shared Socioeconomic Pathway (SSP)2-4.5 scenario. Given that drought is defined by several dependent variables, the evaluation of this phenomenon should be based on multivariate analysis. Two main characteristics of drought (severity and duration) were extracted from precipitation anomalies in the past and near-future periods using the copula function. Three parameters of the Archimedean family copulas, Frank, Clayton, and Gumbel copula, were selected to fit with drought severity and duration. The results reveal that the lower parts and middle of the Han River basin have faced severe drought conditions in the near future. Also, the bivariate analysis using copula showed that, according to both indicators, the study area would experience droughts with greater severity and duration in the future as compared with the historical period.

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