



Climate-informed Drought Risk Assessment Using a Joint Drought Management Index

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As the hydro-meteorological characteristics in Korea have been changing due to the climate change effect, it is necessary to re-evaluate the regional water supply capacity, which almost rely on precipitation. However, if the nonstationary characteristics of hydrological variables induced by the climate change is not fully considered, the re-evaluation results would be invalid in the practice. Therefore, we proposed a climate-informed drought risk index, which called Joint Drought Management Index (JDMI). The JDMI was developed using reliability and vulnerability that are commonly used in water supply system performance analysis, assuming that the water supply failure is equivalent to the hydrological drought. Using the 5-year moving window of daily streamflow during 1976 to 2099, the reliability and vulnerability index were calculated for observed streamflow and RCP 8.5 scenario-based simulated streamflow. The association between reliability and vulnerability was characterized using their joint probability distribution ascertained using a time-dependent copula model. The nonstationary copula model was constructed based on time-varying marginal distributions using GAMLSS (Generalized Additive Model for Location, Scale, and Shape) framework. Finally, the JDMI was estimated based on the joint cumulative distribution function (CDF) of the time-dependent copula model, thus the effects of the climate change in the hydrological time series data could be presented. In addition, the JDMI represents the 5-year average duration and magnitude of hydrological drought that would cause the water shortage, since reliability and magnitude are calculated from the water supply failure duration and the total volume of the deficit, respectively. Therefore, it is possible to forecast the future drought occurrences as well as the characteristics of droughts based on the JDMI. The overall results indicated that there would be the highest drought risk during 2041-2070.

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