Spatio-temporal Variation Of Drought In China During The Past Half Century

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Drought is a spatio-temporal dynamic process, usually characterized by its duration, spatial extent, and severity. Understanding the spatial and temporal variation of drought is essentially important in drought assessment. However, the spatial extent is scarcely considered in previous studies, due to the fact that drought event is usually identified either for a fixed spatial scale or for a fixed temporal scale. For better understand how drought changes have taken place in China during the past half-century, we carried out a comprehensive analysis of their spatio-temporal variation based on multiple drought indices from a climatic perspective. A 3-dimensional clustering method is developed to identify drought events in China from 1961 to 2012. Drought events are further characterized by five parameters: duration, affected area, severity, intensity, and centroid, and the spatio-temporal variation of drought in China has been analyzed. Based on the the analysis of drought spatio-temporal variations, we develop a trivariate copulas by considering the spatio-temporal variations of drought events to calculate drought frequency. A variety of probability distribution functions and copula functions are used as candidate choices, and the most appropriate ones are selected based on goodness of fit using different methods. The robustness of drought frequency analysis is then evaluated and discussed. The results show that drought frequency analysis needs to fully consider the three characteristic parameters (duration, affect area, and severity) reflecting drought sptatio-temporal variability. And the drought return period estimated by the copula-based trivariate frequency analysis appropriately integrates the effects of drought duration, affect area and severity, which is a reliable drought statistical measurement.