The Drought Interest Group: Toward a multi-index drought monitoring system

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Improving our understanding of weather and climate, along with the development of reliable and uninterrupted measurement techniques are essential for the proper assessment of droughts. In this study, a copula-based multivariate model is introduced for describing the drought condition. Copulas are mathematical functions that can describe the dependencies of multiple variables independent of their marginal distributions. The multi-index model, presented here, includes several widely used drought indices including Standardized Precipitation Index (SPI), Crop Moisture Index (CMI), and Palmer Hydrological Drought Index (PHDI). Different drought indices emphasize on various aspects of drought condition based on several indicators. Having a joint distribution function of multiple indices, one can derive the limiting proportion that one index reaches a given threshold conditioned on the fact that the other index has already reached that (or a different) threshold. In other words, a multivariate approach allows obtaining the probability occurrence (risk) of a certain drought condition based upon several indicator variables (e.g., precipitation, soil moisture, water storage). Using several case studies, the application of the multi-index model is illustrated across the continental United States.