Geophysical Research Abstracts
Vol. 18, EGU2016-1327, 2016
EGU General Assembly 2016

A multivariate joint hydrological drought indicator using vine copula

Zhiyong Liu and Lucas Menzel
Heidelberg University, Institute of Geography, Heidelberg, Germany (zhiyonglau@gmail.com)

We present a multivariate joint hydrological drought indicator using the high-dimensional vine copula. This hydrological indicator is based on the concept of the standardized index (SI) (the version of this algorithm for streamflow is called the standardized streamflow index, simply the SSI). Unlike the single SSI n-month scales (e.g., SSI 1-month or 6-month), this indicator is done without focusing on a certain time window. This means that all different time windows from 1- to 12-months (i.e. the SSI-1 month, SSI 2-month, ..., SSI 12-month) are considered together when developing this hydrological drought indicator. Therefore, in this study, a 12-dimensional joint function is modeled to join the multivariate margins (the distribution functions of the SSI-1 month, SSI 2-month, ..., SSI 12-month) for all time windows based on the copula algorithm. We then used the C-vine copulas to construct the joint dependence of the multivariate margins with window sizes from 1-month to 12-months. To construct the C-vine copula, five bivariate copulas (i.e. Gaussian, Clayton, Frank, Gumbel, and Joe copulas) were considered as the potential pair-copulas (building blocks). Based on well-fitted marginal distributions, a 12-d C-vine copula was used to join the margins, model the joint dependence structure and generate this 12-variate hydrological indicator (named joint streamflow drought indicator, simply JSDI). We tested the performance of this indicator using two hydrological stations in Germany. The results indicate that the JSDI generally combines the strengths of the short-term drought index in capturing the drought onset and medium-term drought index in reflecting the drought duration or persistence. Therefore, it provides a more comprehensive assessment of drought and could be more competitive than other traditional hydrological drought indices (e.g., the SSI). This attractive feature is attributed to the fact that the JSDI describes the overall drought conditions based on the joint temporal dependence structure.