

Compound drought and heatwave identification: daily-scale, extreme, independent events based on 120-year observation in Uccle, Belgium

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Compound drought and heatwaves (CDHW) events could incur intensified damage to the ecosystem, economy, and society, especially on a warming planet. In this study, we propose a method to identify CDHW events on a daily scale and across four seasons.

To overcome limitations of CDHW events identification arising from the scale inconsistency (monthly drought with daily heatwave) and coarse resolution (monthly or weekly drought), we identify drought and heatwave events based on consistent and daily basis indices: daily SPI (standardized precipitation index) and daily SHI (standardized heatwave index).

In order to get the statistically extreme and independent drought and heatwave events, we propose an objective, convenient method for removing small-scale events and merging proximate events. Thresholds of removing and merging are found by assuming the severity of the events to follow a generalized extreme value (GEV) distribution and their arrivals to follow a Poisson process. Finally, we introduce four possible ways of identifying compound events (union, conditioned on drought, conditioned on heatwave, and intersection).

To demonstrate our methodology, we make use of 120 years of daily precipitation and daily average temperature observed at the Belgian meteorological institute in Uccle, near Brussels. Results show more accurate onset and end dates for droughts and heatwaves and allow better identification of CDHW events. What's more, the method for removing and merging indicates a good robustness thus showing the potential to identify droughts, heatwaves, and CDHW events for other stations.