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Observational evidence for soil-moisture impact on hot extremes in Southeastern Europe

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Climate change is not only expected to affect the mean of climatic variables, but also their variability and related extremes such as heat waves. In particular, several modeling studies postulated a possible impact of soil moisture deficit and drought on hot extremes. It was suggested that such effects could be responsible for impending changes in their occurrence and associated impacts in Europe.
Here we show using newly available observational indices that a relationship between soil moisture deficit (as expressed by the standardized precipitation index) and summer hot extremes can indeed be demonstrated in Southeastern Europe. The analyzed data is based on measurements at 275 meteorological stations in Central and Southeastern Europe, and on publicly available gridded observations. The relationship with soil moisture deficit is found to be stronger for the hot tails of the temperature extremes distributions. For the 90th percentile values, the effect of moisture deficit leads to an exacerbation of hot temperatures in Southeastern Europe, with an increase from 4.5% to 43% in the percentage of hot days and a lengthening of the maximum heat wave duration from 1.2 to 6.9 days for moderate to severe drought vs. wet conditions.
Current climate models correctly represent the identified relationship in Southeastern Europe, but overestimate soil moisture impacts on hot extremes in Central Europe. These results are relevant for adaptation measures, particularly for the development of early warning and prediction tools for these extremes, given the persistence associated with soil moisture storage.

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