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European drought during the last two millennia from reconstructions and model simulations

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The spatial and temporal variability of droughts in the Euro-Mediterranean area during the last two millennia has been analyzed by comparing the Old World Drought Atlas (OWDA) dendrochronological based reconstruction and 13 simulations including a complete set of natural and anthropogenic forcings from the Community Earth System Model- Last Millennium Ensemble (CESM-LME). The OWDA represents scPDSI estimates, whereas for the CESM-LME soil moisture is used. A clustering into regions of objectively different behavior is achieved through rotation of principal components and the resulting regionalizations of the OWDA and the CESM-LME are compared.

The resulting regions from the reconstructions and model are overall consistent. Some regions are coincident in both and in some cases model regions are a combination of the reconstructed ones. The resulting classification is also robust across the model ensemble, although it is found that the definition of some hydroclimatic regions shows some sensitivity to internal variability.

The temporal variability of drought within each region is analyzed. Differences are found in the level of low frequency variability among regions with implications for the probability of having long intense droughts in different areas. Megadroughts have been found to exist both in the reconstructions and in the simulations and their occurrence suggest rather internal variability dependences rather than responses to external forcing.