

EGU2020-2973

<https://doi.org/10.5194/egusphere-egu2020-2973>

EGU General Assembly 2020

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Database of major European heat waves from 1950 to present

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Europe experienced several major heat waves in the recent summers, substantially affecting human society and environment. Heat waves are generally related to joint effect of perturbed atmospheric circulation and anomalies in surface energy budget, and they are often linked to hydrological preconditioning. Contributions of these driving mechanisms, however, vary across European climatic zones. Climate models struggle to simulate the spatial differences properly, ultimately leading to large uncertainties in future heat waves' characteristics. As the first step towards identifying spatial patterns of differences between driving mechanisms of temperature extremes, a pan-European database of observed major heat waves has been created. Heat waves are studied using the E-OBS 20.0e dataset in 0.1° horizontal grid spacing, which is analogous to that used in the ERA5 reanalysis and CORDEX regional climate models. Magnitude of heat waves is defined with respect to local daily maximum temperature (Tmax) variance, using multiples of standard deviation of Tmax summed across individual events. For each heat wave, circulation conditions and surface energy fluxes are analysed using the ERA5 reanalysis, in order to study their links to the heat wave magnitude and geographical location. In the next step, these findings are used for analyzing spatial patterns of heat wave mechanisms and as a source of reference data for evaluation of relevant processes in climate models.