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Temporal and spatial characteristics of heat waves in Central Europe in regional climate model simulations

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Heat waves (periods of extremely high air temperature in summer) have severe consequences on natural environment and society. According to model simulations of possible future climate, these events are expected to become more frequent and intense. Although summer temperatures in the tail of their distribution were evaluated by many authors, little attention has been given to evaluation of heat waves as spatial temperature patterns. The present study investigates temporal and spatial characteristics of heat waves in regional climate model (RCM) simulations from the ENSEMBLES project. The observed Central European heat waves (1950-2011) were derived from the high resolution E-OBS dataset in terms of criteria based on daily maximum temperature Tmax (exceedance of the 95% quantile of Tmax distribution in summer), spatial extent and duration. A similar definition was applied to the RCM simulations for the same period to acquire analogous heat wave patterns from the modelled data. Two reference 95% quantiles were used providing two different types of results. In the first approach, Tmax corresponding to the 95% quantile in the E-OBS dataset was applied also in the RCM data. The resulting heat waves reflect rather the bias of modelled Tmax than characteristics of simulated heat waves. In the second approach, the 95% quantile was calculated from the modelled Tmax for each RCM. These results better indicate capability of a RCM to reproduce temporal and spatial characteristics of heat waves over Central Europe. The statistical characteristics derived from simulated heat waves were compared with the observed ones in order to evaluate ability of the RCMs to simulate heat wave patterns. The results extend current knowledge of heat wave simulation and improve possibilities of interpretation of projected changes in heat waves.