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Future projections of heat waves and cold spells and their links to atmospheric circulation in EURO-CORDEX RCMs

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We study projected changes in frequency and persistence of heat waves and cold spells in an ensemble of EURO-CORDEX RCMs in Central Europe. The role of atmospheric circulation and its changes in the projected characteristics of temperature extremes is also evaluated. We focus on the 2070–2099 period and model simulations forced by the RCP4.5 and RCP8.5 emission scenarios. The results are compared against characteristics obtained for the historical runs (1980–2005).
Atmospheric circulation is represented by circulation indices derived from daily gridded mean sea level pressure data, and by circulation types derived from the indices. We examine simulated temporal characteristics of hot and cold days (defined as days with temperature anomaly above/below the 90th/10th quantile of their empirical distributions in summer/winter) and heat waves and cold spells (defined as periods of at least three hot/cold days in summer/winter), focusing on their links to the persistence of atmospheric circulation, especially those circulation types significantly conducive to heat waves and cold spells. We study possible changes in the detected links between stable circulation patterns and duration of simulated heat waves/cold spells. Since climate model projections indicate a more frequent zonal flow, weaker easterly flow and an increase in persistence of anticyclonic types over Central Europe in winter, we analyse and quantify the expected decrease of cold extremes. For summer heat waves, the projected changes in conducive circulation types are linked to the changes in heat wave characteristics in the RCMs. We analyse also the inter-model spread in order to quantify uncertainties in the future projections.