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Driving mechanisms of major heat waves over Central Europe in EURO-CORDEX RCMs

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Increased frequency and severity of heat waves is among the main concerns with respect to the ongoing climate change. Since climate models suffer from errors and biases that may lower creditability of future projections, it is important to understand whether heat waves in simulations for the recent climate occur for the same reasons as they do in nature (Fischer 2014). The main aim of this study is to evaluate the capability of EURO-CORDEX regional climate models (RCMs) to simulate driving mechanisms of major heat waves in Central Europe. Three reference major heat waves (1994, 2006, and 2015) were identified in observed data (E-OBS data set), based on their temperature characteristics, length and spatial extent. Atmospheric circulation, precipitation, net shortwave radiation, and evaporative fraction anomalies during these events were examined using the ERA-Interim reanalysis. Simulated analogous major heat waves and their links to the aforementioned meteorological factors were analysed in an ensemble of EURO-CORDEX RCMs driven by various global climate models in the 1970–2016 period.

All three observed major heat waves were related to favourable circulation conditions, precipitation deficit, reduced evaporative fraction and increased net shortwave radiation. This joint contribution of large-scale circulation and land–atmosphere interactions is simulated with difficulties in majority of the RCMs, which affects the magnitude of modelled major heat waves (Lhotka et al. 2018). In some cases, the seemingly good simulation of major heat waves' magnitude is erroneously achieved through extremely favourable circulation conditions compensated by a substantial surplus of soil moisture or vice versa. These findings point to different driving mechanisms of major heat waves in some RCMs compared to observations, which should be taken into account when analysing and interpreting future projections of these events.

References:

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