EMS Annual Meeting Abstracts
Vol. 14, EMS2017-203, 2017

Evaluation of meteorological factors associated with recent severe heat waves and cold spells in EURO-CORDEX RCMs over Central Europe

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Central Europe was recently affected by a major heat wave in August 2015, which was linked to persistent atmospheric blocking, precipitation deficit, reduced evaporative fraction, and increased net shortwave radiation. Favourable circulation conditions were also present during a harsh February 2012 cold spell, along with reduced cloud cover and above-average snow amount. We evaluate simulation of analogously severe heat waves and cold spells in historical runs of high-resolution (0.11°) EURO-CORDEX regional climate models (RCMs) in the 1970–2016 period. Observed data was taken from the E-OBS gridded data set and the ERA-Interim reanalysis. A focus is given on the meteorological factors associated with severe heat waves and cold spells, because it is important to understand whether these events in models occur for the same reasons that they do in nature.

The magnitude of severe heat waves varies among individual RCMs and is linked to the representation of large-scale circulation and land–atmosphere interactions. Overestimation was related to a combination of strong south-eastern advection and depletion of soil moisture, while underestimation was mainly associated with too-moist summertime conditions. In some cases, a seemingly good reproduction of severe heat waves is erroneously achieved through too-weak advection compensated by substantially reduced soil moisture or vice versa. Analogous analysis is being performed for cold spells that seem to be associated with advective processes more tightly than heat waves. The results pointed to different driving mechanisms of temperature extremes in some RCMs in comparison to the observed data, which should be taken into account when analysing future projections of these events.