The 2015 heat wave in Central Europe: meteorological factors and mortality impacts

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The 2015 summer was the warmest summer ever observed in Central Europe according to heat wave severity. We evaluate its climatological characteristics and study in detail the most severe and persistent heat wave that lasted for almost two weeks in the first half of August 2015. By analysing severity and duration of past major heat waves in the E-OBS data (since 1950) and examining their meteorological factors (atmospheric circulation, precipitation, net short-wave radiation, and soil moisture), we show that both favourable and persistent circulation conditions and soil moisture deficits contribute to development of major heat waves. In the following step, we evaluate the simulation of major heat waves in Central Europe and their links to the meteorological factors in historical runs of EURO-CORDEX regional climate models (RCMs). We discuss characteristics of atmospheric circulation, net short-wave radiation and soil moisture (characterized by precipitation deficits and evaporative fraction) during and before these events, and differences between the observed and RCM-simulated major heat waves. We show that underestimation of the frequency and severity of these events in RCMs is related to too high values of evaporative fraction, underestimated net short-wave radiation and overestimated precipitation, while severity of major heat waves is overestimated in those RCMs that simulate too dry soil and stronger easterly flow. The results highlight the importance of atmospheric circulation and land-atmosphere coupling for realistic simulation of major heat waves in climate models. In the last part of the study, we show that human mortality impacts of the 2015 heat wave in the population of the Czech Republic were similar to previous major heat waves (e.g. in 1994), which suggests that declining trends in heat-related mortality, reported in many parts of the developed world over recent decades, may be associated primarily to ‘average’ heat waves. Major events such as the 2015 heat wave in Central Europe still remain the deadliest weather-related disasters in mid-latitudes as to the overall number of fatalities.

Keywords: heat wave, climate variability, atmospheric circulation, land-atmosphere coupling, human mortality

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