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Scenarios of subseasonal European heat waves and their relationship to changes in the seasonal cycle and daily temperature variability

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Recent European heat waves have demonstrated that severe societal, economic and ecological impacts typically occur on monthly or weekly time scales. Yet much of the available literature on climate change induced heat waves addresses seasonal indicators. Here we analyse scenarios of subseasonal heat waves using daily output of 10 RCMs of the PRUDENCE multi-model experiment driven by the IPCC SRES A2 scenario for control (1961–1990) and scenario (2071–2100) conditions. All models project a distinct increase in frequency, amplitude and duration of heat waves. Maximum changes are simulated over southern Europe and to a somewhat smaller extent over the transitional climate zone between the Mediterranean and the Baltic Sea.

We analyse the sensitivity of simulated heat wave changes to the following factors: mean warming, increase in intraseasonal (up to daily) temperature variability, interannual temperature variability, and changes in the seasonal cycle within the summer season. The role of these factors varies between the different regions. Substantial changes in the seasonal cycle are identified over western and central Europe. The models simulate a progressive warming within the summer season with the projected temperature change in August exceeding that in June by 2–3K. Thus, the most distinct warming is superimposed upon the maximum of the seasonal cycle of the current climate. This leads to a pronounced increase in extremes and an extension of the summer period, enabling extreme temperatures and heat waves even in September. The mechanisms underlying the changes in the seasonal cycle mainly relate to a progressive depletion

of soil moisture within the summer season.