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The 2010 eastern European heat wave in a future climate

Lucinda Rasmijn (1), Gerard van der Schrier (1), Jan Barkmeijer (1), Andreas Sterl (1), Wilco Hazeleger (1,2)
(1) Royal Netherlands Meteorological Institute, De Bilt, Netherlands, (2) Wageningen University, Wageningen, Netherlands

The 2010 heatwave hitting eastern Europe and Russia ranks among the hottest event ever recorded in the region. The excessive summer warming was related to an anomalously widespread and intense quasi-stationary blocking high over western Russia and was further amplified by a lack of soil moisture. Normally, high soil moisture levels and strong surface evaporation tend to cap maximum summer temperatures. When spring soil moisture levels are depleted, like in 2010, surface temperatures can strongly increase, and this process is generally thought to be the main driver of accelerating future summer warming in the midlatitudes. Using climate modelling and a newly developed data-assimilation technique we effectively 'transpose' the 2010 Eurasian heat wave into a future climate. We find that the present-day spring soil moisture constraint on summer warming is no longer active in the future climate. Exceptionally strong surface evaporation preceding and during future heat waves effectively diminishes the limiting effect of spring soil moisture levels on summer warming. This implies that future midlatitude heat waves will become even more extreme than previously thought. Intense heat waves, like the 2010 event, in the future climate will see see stronger societal consequences than currently anticipated.