Session: B2 Oral presentation

On the predictability of the extreme summer 2003 over Europe

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The European summer 2003 is a prominent example for an extreme hot and dry season. In August 2003, record-breaking temperatures raged across much of Europe. In France, maximum temperatures of 37oC (99oF) persisted for 9 days straight, the longest such stretch since 1873. In the end, 40,000 deaths (14,000 in France alone) were attributed to the extreme heat and low humidity. The main mechanisms that contributed to the growth of the heat wave are still disputed and despite a concerted effort, state-of-the-art climate models have difficulty to realistically simulate the extreme conditions. The overall predictability of hot summers over Southern Europe estimated from retrospective seasonal forecasts is relatively high and can partly be explained by the recent warming trend. Yet re-forecasts from ECMWF's operational seasonal forecast system were not able to simulate the record heat summer 2003. Here we analyse simulations using recent versions of the ECMWF seasonal ensemble forecasting system and present, for the first time, retrospective forecasts which simulate accurately not only the abnormal warmth but also the observed precipitation and mid-tropospheric circulation patterns. The model version includes improved representations of a number of physical processes and systems, like atmospheric convection, land surface and soil characteristics, and radiation transfer. By systematically analysing the impact of these major physical parameterisation packages, it is found that while the land surface hydrology plays a crucial role, the successful simulations also required revised formulations of the radiative and convective parameterizations. Our results indicate that dry soil moisture anomalies persisted through interactions with the local circulation patters were central to understanding the predictability of this event. In order to predict it well, a climate model needs sophisticated formulations of land surface hydrology, radiation and convection. In our case, the combination of all three proved key to the successful retrospective predictions of this record breaking event.