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# Investigating the impact of soil moisture on European summer climate in seasonal hindcasts

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Due to the limited skill of state-of-the-art prediction systems, high expectations on summer seasonal forecasts over Europe are only marginally fulfilled. A number of studies have shown the prominent impact of soil moisture anomalies on summer mid-latitude climate variability and predictability. However, even the best possible initialization of soil moisture only moderately improves predictive skill, thereby questioning the extent to which European climate variability is sensitive to soil moisture boundary conditions.

The present study aims at addressing this question by comparing idealized ensemble re-forecast-like simulations in which soil moisture conditions are prescribed from the ERA-Interim LAND reanalysis with initialized dynamical re-forecasts in which soil moisture evolves freely. Two regional climate models, namely RACMO and ALADIN-Climat, with domains centered over Europe contribute to these experiments and generate very similar results in spite of being laterally forced by distinct GCM experiments.

Simulations with constrained soil moisture display significantly increased correlation between observed and simulated seasonal anomalies of maximum temperature precipitation and surface solar radiation, as compared to the reference re-forecast. This widespread increase is not restricted to the Mediterranean Europe, a region already known as a hot-spot of land-atmosphere coupling. In spite of a limited change of the ensemble spread, the idealized simulations perform better in capturing anomalies exceeding a defined threshold. A focus on two case studies reveals contrasted results between the 2003 and 2010 heat waves.

These results suggest that soil moisture is an essential boundary condition in summer for the European climate, well beyond regions identified by previous works.