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Reconsidering the role of soil moisture in summer predictability over Europe

Constantin Ardilouze, Lauriane Batté, and Michel Déqué
CNRM UMR 3589, Météo-France/CNRS, Toulouse, France (constantin.ardilouze@meteo.fr)

Soil moisture is acknowledged as one of the slowly evolving components of the earth system that impact the surface continental climate in summer. An improved initialization of the spring soil moisture in forecast systems generally leads to better near-surface temperature predictive skill at sub-seasonal to seasonal time scales. This has been hypothesized and partly proven over regions usually referred to as hotspots of land-atmosphere coupling, such as South-East Europe for example. Over these transitional regions between wet and arid climate, evapotranspiration is mainly controlled by soil moisture.
In order to assess the potential predictability related to this land component, we have carried out a set of idealized global and regional summer re-forecast experiments with soil moisture prescribed daily over the full domain. The skill for summer temperature and precipitation was compared to reference simulations with free running soil moisture.
The correlations for near surface temperature anomalies are greatly increased over almost all Europe, including the wettest regions, where soil moisture is usually considered unlimited. Even more unexpected, large parts of Europe including Atlantic regions, Scandinavia or Western Russia show significantly higher correlation for summer precipitation. These results contrast with previous studies on land-atmosphere coupling limiting the potential benefit of soil moisture initialization to the above-mentioned hotspots. Although our experimental framework leads to improved predictive skill for seasonal total precipitation, it is not the case for the dry spell duration, which suggests that prescribed soil moisture influences precipitation intensity rather than frequency. Results on the seasonal prediction of extreme heat events such as those of 2003 and 2010 summers will be discussed in the light of this study.