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Impact of Soil Moisture Initialization on Temperature Extreme Detection in the context of Regional Climate Modeling

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Land surface-related processes play an essential role in the climate conditions at a regional scale. In this study, the impact of soil moisture (SM) initialization on regional climate modeling has been explored by using a dynamical downscaling experiment. To this end, the Weather Research and Forecasting (WRF) model was used to generate a set of high-resolution climate simulations driven by the ERA-Interim reanalysis for a period from 1989 to 2009. As the spatial configuration, two one-way nested domains were used, with the finer domain being centered over the Iberian Peninsula (IP) at a spatial resolution of about 10 km, and nested over a coarser domain that covers the Euro-CORDEX region at 50 km of spatial resolution.

The sensitivity experiment consisted of two control runs (CTRL) performed using as SM initial conditions those provided by ERA-Interim, and initialized for two different dates times (January and June). Additionally, another set of runs was completed driven by the same climate data but using as initial conditions prescribed SM under wet and dry scenarios.

The study is based on assessing the WRF performance by comparing the CTRL simulations with those performed with the different prescribed SM, and also, comparing them with the observations from the Spanish Temperature At Daily scale (STEAD) dataset. In this sense, we used two temperature extreme indices within the framework of decadal predictions: the warm spell index (WSDI) and the daily temperature range (DTR).

These results provide valuable information about the impact of the SM initial conditions on the ability of the WRF model to detect temperature extremes, and how long these affect the regional climate in this region. Additionally, these results may provide a source of knowledge about the mechanisms involved in the occurrence of extreme events such as heatwaves, which are expected to increase in frequency, duration, and magnitude under the context of climate change.

Keywords: soil moisture initial conditions, temperature extremes, regional climate, Weather Research and Forecasting model

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