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The effect of 3DVAR data assimilation and Noah land surface model over the Iberian summer surface temperature simulated by WRF

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The configuration of a model is an important part of the design of a regional simulation. The use of the Noah Land Surface Model (LSM) in climate modeling has increased during the last decades, while data assimilation is not so commonly used. Thus, this study focuses on the impact of both options during the creation of dynamically downscaled simulations, and how they affect the summer surface temperature simulated by WRF over the Iberian Peninsula.

For that purpose, a numerical downscaling exercise over the Iberian Peninsula was run nesting the WRF model inside ERA-Interim. Four different configurations of the model were run during 2010-2014 after a one-year spin-up (2009). These options are based on the use of the Noah LSM or the 3DVAR data assimilation step within the WRF model. In the first experiment (N), including the Noah LSM for the calculation of the soil temperature and moisture, the boundary conditions drive the model after the initialization. The second experiment (D) includes also the LSM, but the 3DVAR data assimilation step is run every six hours (00Z, 06Z, 12Z and 18Z). The third and fourth experiments (S and C respectively) present the same configurations as the previous experiments, but without the Noah LSM.

The domain covers the Iberian Peninsula with a 15 x 15 km2 grid and 51 vertical levels. The sea surface temperature is updated daily and observations from the PREPBUFR dataset (NCEP ADP Global Upper Air and Surface Weather Observations) are assimilated inside a 120-minute window centered at the analysis times in the 3DVAR assimilated runs (C and D).

Results show that the experiment including the data assimilation and the Noah LSM (D) produces the best correlations and the smallest RMSE. The D and N experiments (both including the Noah LSM) showed similar biases, but the RMSE obtained by N is not as good as that from D. A larger bias is obtained by the C experiment (with data assimilation but without the LSM), but not as remarkable as that from the experiment without both options (S). However, the correlations obtained by C are comparable to those from D. According to these results, the effect of the Noah LSM in temperature is more important than that derived from the data assimilation scheme but, in any case, the latter is not negligible.