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Towards a better initialization of surface and soil properties in the WRF model: the use of HRLDAS and high-resolution satellite data

Manel Bravo, Jordi Moré, Jordi Mercader, and Abdel Sairouni
SMC-Meteorological Service of Catalonia, Area of Applied Research and Modelling, Spain (manel.bravob@gencat.cat)

Numerical weather prediction models (NWP) are continuously increasing their horizontal resolution. However, one of the challenges they face is the initialization of soil temperature and humidity as well as other surface parameters. This is a source of uncertainty as these parameters usually come from low resolution estimates or other NWP models that may use different surface characteristics and approximations than the ones used in a high-resolution NWP model.

We evaluate the use of the High-Resolution Land Data Assimilation System (HRLDAS) as a pre-processor to the operational WRF model simulation that runs in the Meteorological Service of Catalonia (SMC) in order to initialize the soil moisture and soil temperature. HRLDAS uses the same grid, land surface model and static parameters present in our WRF configuration, therefore we expect to eliminate or reduce the inconsistencies between the initial conditions and our NWP model.

The main problem we face is obtaining input data. For this reason, we explore three different sources: past forecasts of the same WRF model, the Global Land Data Assimilation System (GLDAS) and a mixture of WRF model and observational data created with the Space and Time Multiscale Analysis System (STMAS). We measure their relative impact on the near surface specific humidity and air temperature over Catalonia (NE of the Iberian peninsula), a region with a dense network of observational data.

Additionally, we study the impact of modifying albedo and leaf area index that the WRF model considers as a static or seasonal field. In particular, we use derived data from Moderate Resolution Imaging Spectroradiometer imagery (MODIS) to ingest the last 15 days average of those parameters on the initialization of the WRF model and measure their relative impact on the temperature, wind and humidity forecasts.