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Sensitivity of WRF precipitation field to assimilation sources in northeastern Spain

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Numerical weather prediction (NWP) of precipitation is a challenge. Models predict precipitation after solving many physical processes. In particular, mesoscale NWP models have different parameterizations, such as microphysics, cumulus or radiation schemes. These facilitate, according to required spatial and temporal resolutions, precipitation fields with increasing reliability. Nevertheless, large uncertainties are inherent to precipitation forecasting. Consequently, assimilation methods are very important.

The Atmospheric Physics Group at the University of León in Spain and the Castile and León Supercomputing Center carry out daily weather prediction based on the Weather Research and Forecasting (WRF) model, covering the entire Iberian Peninsula. Forecasts of severe precipitation affecting the Ebro Valley, in the southern Pyrenees range of northeastern Spain, are crucial in the decision-making process for managing reservoirs or initializing runoff models. These actions can avert floods and ensure uninterrupted economic activity in the area.

We investigated a set of cases corresponding to intense or severe precipitation patterns, using a rain gauge network. Simulations were performed with a dual objective, i.e. to analyze forecast improvement using a specific assimilation method, and to study the sensitivity of model outputs to different types of assimilation data. A WRF forecast model initialized by an NCEP SST analysis was used as the control run. The assimilation was based on the Meteorological Assimilation Data Ingest System (MADIS) developed by NOAA. The MADIS data used were METAR, maritime, ACARS, radiosonde, and satellite products. The results show forecast improvement using the suggested assimilation method, and differences in the accuracy of forecast precipitation patterns varied with the assimilation data source.