Analysis of near-surface atmospheric variables on the NE of the Iberian Peninsula

P. Quintana-Seguí (1), J.J. Salas-Pérez (1), M. Turco (2)

SAFRAN (Durand et al., 1993; Quintana-Seguí et al. 2008) is a mesoscale atmospheric analysis system for screen-level variables. It produces a meteorological analysis at the hourly time step using all available ground data observations and the outputs of a meteorological model, by means of optimal interpolation. One of its main features is that it is based on climatically homogeneous zones (areas where spatial gradients of meteorological variables are not very relevant) and is able to reliably take vertical variations into account. Originally intended for mountainous areas, it was later extended to cover the whole of France (SAFRAN/F).

We have implemented SAFRAN on the NE of the Iberian Peninsula (SAFRAN/NEIP). SAFRAN/NEIP belongs to our effort to build a distributed hydrological model for this area, which is currently being developed within the context of HyMeX. This model is inspired by the French SIM (Habets et al., 2008).

Our objectives are to implement the analysis system, to validate it and to compare it to SPAN, which is a similar meteorological analysis system developed by AEMET (the Spanish meteorological office).

Currently, this project is being done in collaboration with AEMET, which provides us with all the available data from their synoptic and climatological networks and with the outputs of the HIRLAM meteorological model, to use as first guess. We have adopted the same grid as HIRLAM (~5 km of resolution). The first prototype of the system was implemented for the hydrological year September 2009 - August 2010.

Before applying SAFRAN to the area of study, it is necessary to divide it in climatologically homogeneous zones. Two different sets of zones have been tested. The first one is based on the meteorological alert zones of AEMET. This choice is the same done previously in France, where the French meteorological alert zones are used (Symposium). The second one is the European river catchments dataset (ERC), from the European Environmental Agency. We found that, for most variables, the performance is similar using both sets of zones, but that catchments are better for precipitation, which was expected, as catchments are the natural spatial unit of hydrology.

We also compared the bias and RMSE of SAFRAN/NEIP, compared to the stations used to perform the analysis. Our study shows that the performances are very comparable to those of SAFRAN/F, which leads us to conclude that SAFRAN is well adapted to the climate of the region of study.

We plan to validate the system using independent data and to compare it to the meteorological model used as first guess and also to SPAN. The comparison will include the analysis of a set of case studies, which include some extreme events that took place during 2009/2010, this will allow us to assess the performance of SAFRAN during events that might be difficult for SAFRAN due to, for example, their small scale and intensity. The comparison with SPAN will allow us to learn which are the strengths and weaknesses of each system.

In the future, we plan to feed SAFRAN/NEIP with data covering a long period of time, which will allow us to use it as an observational database for statistically downscaling climate simulations. This long database will also be used to force the SURFEX land surface model over the same period, obtaining a long dataset of the whole water balance. The combination of the downscaled climate scenarios and SURFEX wil allow us to study the impacts of climate change. Finally, SAFRAN/NEIP will also be useful for studies related to the land-surface or that need a good spatial description of screen level meteorological variables: this includes studies on drought, agronomy, forest fires, etc.

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