The utility of SAFRAN as analysis of near-surface atmospheric variables: the case of the snowstorm in Catalonia on 8th March 2010

M. Turco (1), P. Quintana-Seguí (2), M. C. Llasat (1)
1: GAMA Team, Dept. of Astronomy and Meteorology, Fac. of Physics, Universitat de Barcelona, Spain.
2: Observatori de l’Ebre (Universitat Ramon Llull – CSIC), Spain.

Introduction

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 climatologically homogeneous zones (areas where spatial gradients of meteorological variables are not very relevant) and it 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/FRT).

We have implemented SAFRAN on the NE of the Iberian Peninsula (SAFRAN/NEP). 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.

SAFRAN Meteorological Analysis

Heavy precipitation occurred on 8th March 2010 in Catalonia (in the northeast of Spain), with total amounts that locally exceeded 100 mm and snowfall amount of more than 40 cm measured in many places. In the Barcelona city as well as in the Girona province, this precipitation were joint to thunderstorm and strong gusts.

Synoptic conditions: analysis of the geopotential at 500 hPa (ECMWF model) and images from Meteosat. Source: www.safiranonline.org

Analysis of the snowstorm

This event had an high impact in Catalonia since it created hazardous road conditions and important problems in the electrical supply in the Girona province. The regional government approved funds of 21.4 millions of Euros to mitigate the damage caused by this snowfall. The precipitation was unusual due to combination of low snow level for this month and the presence of thunderstorms. In particular this event was characterized by "wet snow", a kind of snow that favours the accretion on the electric lines and may cause the breaking of the line and often an electrical failure.

Analysis of SAFRAN for the snowstorm

We test a new risk index following a simple approach, taking into account the uncertainties of the input data. This map correlates well with the areas of the highest impacts.

Summary and conclusions

SAFRAN has been successfully implemented on the NE of the Iberian Peninsula.
- Our results are still preliminary: more data of some variable (e.g. wind) is needed.
- The choice of SAFRAN for this area of study is pertinent, as it performs similarly as it does in France, where it is operationally used in many contexts.
- The meteorological alarm zones are generally homogeneous, nevertheless, our preliminary results show that the division in basins (eurocatchment) is better, mainly for precipitation

The analysis is done over irregular zones which are "climatologically homogeneous".

Ideally, within each zone, the spatial gradients are only due to differences in topography (altitude). There must be observations within each zone.

There is one analysis for each zone and level (there is a level every 300 m). The method is well adapted to mountainous areas (common in NE of Iberian Peninsula), as it deals very well with vertical gradients.

Long and short wave radiation is calculated with a radiation scheme due to the lack of observations.

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References