Simulation of the water balance of the NE Iberian Peninsula with a distributed hydrological model.

P. Quintana-Seguí (1), M.C. Llasat (2), E. Martin (3), M. Turco (2), J.J. Salas-Pérez (1)
(1) OE
(2) GAMA
(3) CNRM-GAME

The HyMeX project is promoting the study of the continental hydrological cycle in the Mediterranean. This cycle will be studied at different scales, from the plot scale to the whole Mediterranean basin. At the scale of large basins, there are already some mature models, for example, SIM in France (Habets et al., 2008) and ISBA/MODCOU on the Maritsa (Artinyan et al, 2008). Here we present the efforts to build a distributed land surface model on the NE of the Iberian Peninsula (including the Ebro river basin, a major basin of Spain).

Our area of study is very heterogeneous (being both influenced by both the Atlantic and the Mediterranean systems), which causes a great variability in precipitation (from 300 to more than 2000 mm/y), vegetation and land uses. The east of the area of study is often affected by Mediterranean intense events (Llasat, 2009). In addition, snow plays an important role in the functioning of the Ebro basin, as on the north it is limited by the Pyrenees. Furthermore, the Ebro is severely influenced by human activities. Due to these features, the Ebro basin is a demanding test for any hydrological modelling system.

Our model is based on the ISBA soil-vegetation-atmosphere transfer scheme (Noilhan and Planton, 1989; Mahfouf and Noilhan 1996), which is integrated in the SURFEX suite. Within HyMeX, ISBA is also used in France and Bulgaria and will also be used in the Mediterranean Land Data Assimilation System (MELDAS). The role of ISBA is to calculate all the water and energy fluxes between the soil and the atmosphere. It also calculates the soil moisture and the runoff produced at each grid point.

To force SURFEX/ISBA, we implemented the meteorological analysis SAFRAN (Durand et al., 1993; Quintana-Seguí et al., 2008). Using the output of a the HIRLAM meteorological model and all available screen-level observations, SAFRAN analyses the screen-level atmospheric variables using optimal interpolation and creates a gridded dataset at a spatial resolution of ~5 km and a temporal resolution of 1h. It is the first time that this system is implemented over such a large area outside France. We found that SAFRAN does perform well in our area of study.

In collaboration with AEMET, the Spanish meteorological office, the SAFRAN system is currently being validated against independent observations and compared to the SPAN analysis system. SPAN is also based on the optimal interpolation algorithm. The objective is to do an inter-comparison between both analysis systems.

Once validated, this system will have several interesting applications within and outside the

HyMeX project. The SAFRAN gridded data-set, once run over a long period of time, will be of great value to understand the climate of the area of study, downscale climate models, obtain derivative products like the potential evapotranspiration, drought indices, forest fire indices, etc. The coupled SAFRAN-SURFEX will allow to study the water balance of NE Iberian Peninsula, with applications on water resources, drought, agriculture, climate change impact studies, etc. Within HyMeX, in collaboration with the French National Center for Meteorological Research (CNRM-GAME, Météo-France CNRS), we will be able to compare the water balance of our area of study with other neighbouring basins, like the Rhône in France and our system will also be used to benchmark MELDAS on Spain.

In the future, we plan to couple SAFRAN-SURFEX with a routing scheme, to simulate river discharge and, therefore, obtain a complete distributed hydrological model, nevertheless, this task will be challenging due to the high degree of human influence on the Ebro river basin.

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