Simulation of the water balance of the NE Iberian Peninsula

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Due to the risks associated with the variability of the Iberian climate (flash floods, droughts, forest fires, etc.) and the strong stresses caused by the anthropogenic changes in the water cycle, it is important to have a precise knowledge of the water balance between the land surface (including soil and vegetation) and the atmosphere at high resolution.

Currently, the scientific community is showing a strong interest in the Mediterranean water cycle, including the water balance on the continental surface. The HyMeX[1] project is instigating the development of systems that allow a better understanding of the hydrological cycle in the Mediterranean basin, in fact, it is already planning the simulation of the water balance of Mediterranean basins at different scales (from the whole Mediterranean, to single basins) using a distributed and physically based model (SURFEX).

Under this Mediterranean perspective, the Ebro river basin is a very suitable study area. The Ebro river constitutes a major basin in the Iberian Peninsula and the western Mediterranean, along with the Rhône and the Po. Both the landscape and the precipitation regime of the Ebro show a great variability. In addition, snow plays an important role in the functioning of the basin. Due to these features, the Ebro basin is a demanding test for any hydrological modelling system.

The SCARCE[2] project has selected the Ebro and the Llobregat rivers (among others) as case studies aiming at describing and predicting the relevance of global change impacts on water availability, water quality and ecosystem services, as well as their impacts on the human society and economy.

The Ebro Observatory, together with AEMET, is currently developing a system for simulating the water balance at high resolution (5 km aprox.) in the NE of the Iberian Peninsula, including the Ebro basin and the internal basins of Catalonia. The system in development consists of two main components:

1. The SAFRAN atmospheric analysis system [4, 5, 11, 18] is being implemented into the study area. SAFRAN, using the output of a model and all available observations, analyses the screen-level atmospheric variables (those observed by weather stations) and creates a gridded database of these variables (precipitation, temperature, humidity, wind , etc.) at spatial resolution of ~5 km and a temporal resolution of 1h.

2. The physically based and distributed surface model SURFEX[3], which includes the ISBA land surface scheme [10, 8, 9, 2] will also be applied to the study area. SURFEX, which will be forced by SAFRAN, simulates the water and energy fluxes between the land surface (soil

[1]http://www.hymex.org
[2]http://www.idaea.csic.es/scarceconsolider
[3]http://www.cnrm.meteo.fr/surfex/

and vegetation) and the atmosphere. It also calculates the soil moisture and the runoff produced at each grid point. The resulting system will be validated using all available observations, including *in-situ* observations of soil moisture and data derived from the recently released SMOS satellite.

In France, a very similar system was developed by Météo-France [7, 13], which is being used in research and operations. The system is versatile, and therefore it is used in many contexts. For example, it is used to monitor the soil moisture in France, to forecast the river flows [16, 15], to study the occurrence of droughts [17] and also to assess the impact of climate change on the water resources in major river basins [6, 1, 3] including the Mediterranean basins [14, 12].

The system described, will also be used to study the impact of climate change. This work is done in collaboration with the GAMA[4] group at the University of Barcelona, who are developing a statistical downscaling system especially suited to the Mediterranean region of the Iberian Peninsula. The downscaling system, will use the SAFRAN database as the observational database and will create forcing data suitable for use with SURFEX and any other distributed surface model (including hydrology, agronomy, etc.).

We believe that the SAFRAN gridded database (which include many atmospheric variables of interest), the simulations of the water balance (in the present and future climate) and the atmospheric scenarios described in this summary, may be very useful for the SCARCE community. In addition, the system described, provides the basis for future developments, which may include the simulation of river flows (in present and future climate) and the study of the impact of the changes in land use.

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