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Hydrological modelling of the Iberian Peninsula using MOHID-Land

Ana Oliveira (1), Tiago Ramos (1), Lucian Simionesei (1), Maria Gonçalves (2), and Ramiro Neves (1)

(1) Universidade de Lisboa, Instituto Superior Técnico, MARETEC, Portugal (anaramosoliveira@tecnico.ulisboa.pt), (2) Instituto Nacional de Investigação Agrária e Veterinária, Oeiras, Portugal

The Iberian Peninsula is affected by different levels of water scarcity due to extensive droughts that frequently occur, creating conflicts between Portugal and Spain, and even between Spanish autonomic regions. As such, the available water resources need to be more efficiently used to fulfil the multiple demand from different uses (urban consumption, agriculture, industries, tourism), meaning that better management tools are required for that purpose. This study aims to quantify water resources availability in the Iberian Peninsula using the physically-based, fully-distributed MOHID-Land model. This model considers four compartments or mediums (atmosphere, porous media, soil surface and river network), computing water dynamics through the different mediums using mass and momentum conservation equations.

The model was implemented in the simulation domains with a resolution of 5 km. Data inputs included the digital terrain model from Shuttle Radar Topography Mission of NASA with a resolution of 90 m; the soil map from the European Soil Data Centre (1:1,000,000); the Corine land cover map from 2012 with a resolution of 100 m; the soil hydraulic properties from the HYPRES class pedotransfer functions; the hourly weather data (precipitation, wind velocity, relative air humidity, solar radiation and surface air temperature) from the SAFRAN model with a resolution of 8 km; the reservoir discharge data from governmental and regional agencies.

Simulations were run from October 1979 to June 2014, with model warm-up being set from 1979 to 1985, model calibration from 1985 to 2004, and model validation from 2004 to 2014. The calibration and validation process focused on the comparison of simulated flows with those measured in hydrometric stations (81 stations) with no reservoir influence, and those estimated using satellite products.

Four statistical parameters (R2, RMSE, PBIAS and NSE) were used to evaluate model performance. Results differed substantially along the domain, with better results being obtained in the northern region of the Iberian Peninsula when compared with the southern region. This highlight the need for better include information related to water transfers between different catchments in the model. Additionally, information related to reservoir management needs to be included to improve the reliability of model predictions in the downstream areas. Nonetheless, considering the coarse scale of simulation domain, model performance was considered to be generally good considering the scale of the application.