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Towards reliable ET estimates in the semi-arid Júcar region in Spain.

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Current research indicated the potential for improving evapotranspiration (ET) estimates in state-of-the-art hydrologic models such as the mesoscale Hydrological Model (mHM, www.ufz.de/mhm). Most models exhibit deficiencies to estimate the ET flux in semi-arid regions. Possible reasons for poor performance may be related to the low resolution of the forcings, the estimation of the PET, which is in most cases based on temperature only, the joint estimation of the transpiration and evaporation through the Feddes equation, poor process parameterizations, among others.

In this study, we aim at sequential hypothesis-based experiments to uncover the main reasons of these deficiencies at the Júcar basin in Spain. We plan the following experiments: 1) Use the high resolution meteorological forcing (P and T) provided by local authorities to estimate its effects on ET and streamflow. 2) Use local ET measurements at seven eddy covariance stations to estimate evaporation related parameters. 3) Test the influence of the PET formulations (Hargreaves-Samani, Priestley-Taylor, Penman-Montheith). 4) Estimate evaporation and transpiration separately based on equations proposed by Bohn and Vivoni (2016) 5) Incorporate local soil moisture measurements to re-estimate ET and soil moisture related parameters.

We set-up mHM for seven eddy-covariance sites at the local scale (100×100 m^2). This resolution was chosen because it is representative for the footprint of the latent heat estimation at the eddy-covariance station. In the second experiment, for example, a parameter set is to be found as a compromised solution between ET measured at local stations and the streamflow observations at eight sub-basins of the Júcar river.

Preliminary results indicate that higher model performance regarding streamflow can be achieved using local high-resolution meteorology. ET performance is, however, still deficient. On the contrary, using ET site calibrations alone increase performance in ET but yields in poor performance in streamflow. Results suggest the need of multi-variable, simultaneous calibration schemes to reliable estimate ET and streamflow in the Júcar basin. Penman-Montheith appears to be the best performing PET formulation.

Experiments 4 and 5 should reveal the benefits of separating evaporation from bare soil and transpiration in semi-arid regions using mHM. Further research in this direction is foreseen by incorporating neutron counts from Cosmic Ray Neutron Sensing technology in the calibration/validation procedure of mHM.