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Land surface Interactions with the Atmosphere over the Iberian Semi-arid Environment project (LIAISE): results for the 1st modelling inter-comparison

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Land surface-atmosphere interactions determine the atmospheric boundary layer (ABL) features, and in the case of semi-arid regions the water availability in the upper ground strongly conditions the surface energy balance and in general the observed dominant processes. In the Land surface Interactions with the Atmosphere over the Iberian Semi-arid Environment project (LIAISE, Boone et al. 2021), an observational campaign took place in the eastern Ebro river sub-basin between spring and fall 2021 to study the land/atmosphere interactions and the effect of the surface heterogeneities on the ABL in a semi-arid environment, enclosing a large irrigated area in summer. The combined analysis of the ground-based observations, ABL atmospheric measurements (including aircraft and remote-sensing data) and modelling is expected to improve the understanding of processes affecting exchange fluxes between the surface and the atmosphere, especially evapotranspiration, and to allow exploring the local and mesoscale circulations induced by the surface heterogeneities.

A first mesoscale modelling inter-comparison for a summer event in the LIAISE area is intended to evaluate the performance of the participating models compared to the observations and explore the differences between them. Participant models are run at their standard configurations to evaluate the representation of the surface features in the numerical models and its impact in the organisation of the flow at lower levels. Besides, some sensitivity tests are made (initial and lateral boundary conditions, resolution or representation of the surface features, among others) to identify the importance of some model parameters in the model results.

Four models participate in the inter-comparison: MesoNH, WRF, UKMO Unified Model and MOLOCH. They are run with similar horizontal (2km x 2km and 400m x 400m for the outer and inner domains) and vertical (2m at lower levels and stretched above) grid meshes. A 48-h integration is made between 16 and 18 July 2016 for a case under a high-pressure system centred

over NW France, with well-developed thermally-driven circulations in the Ebro Basin. Sea breezes are found at the coast and seem to reach the basin after surmounting the mountain coastal range.

Model results are validated using data from the surface stations of the Servei Meteorològic de Catalunya network (very dense in the studied region). It is found that each model has a different representation of the surface heterogeneities affecting the grid values of the surface fluxes. Nevertheless, the mesoscale circulations generated by the models are very close being the differences lying mostly at smaller scales, namely the ABL characteristics, the values of the exchange fluxes at the surface or the state of the surface and the soil. The challenge at this point is to relate the model biases to the particularities of the parameterisations and of the physiographic data bases used by each model. This model inter-comparison is expected to point improvements in the definitions of the setup of each model for a later phase, when the model simulations will be validated using observations from the recent LIAISE experimental field campaign.