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On the hydrological performance in preparation for fully coupled climate-hydrology modelling in a data-sparse region

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Within the recently emerging field of research employing a dynamical coupling between existing advanced atmosphere-hydrology model codes lays a demand for a wide range of data. The data are needed to both drive and validate the models and need to be of a high quality in terms of spatial coverage, temporal resolution, representation of local attributes and data selection. As a consequence, most studies have been performed over regions of vast data coverage. Although good data coverage is mainly seen in regions of more economically developed countries, the advantages of the coupled models could be of at least equal relevance in lesser developed regions.
We here evaluate the prediction capabilities of the joint MIKE SHE-SWET hydrology and land surface model which has recently been employed in a dynamical coupling with the HIRHAM regional climate model (RCM). As a test case, we use the Crati River catchment in Southern Italy. The catchment is used due to: 1) A reasonable availability of data in terms of discharge, a flux tower station, climate stations and gridded data products such as ERA-I, E-OBS, SWBM and RCM output (e.g. MED-CORDEX) albeit with problems resembling those of data sparse regions (lack of temporal overlap, gap filling, availability, hydrogeological interpretations and land use). 2) The location (the Mediterranean) has previously been shown to exhibit substantial biases which potentially could be reduced the future coupling. 3) The Mediterranean highlands with large variations in orography provide an interesting test case as this is poorly represented in models. And 4) Model runs using the WRF-Hydro model have been performed enabling the basis for valuable comparison studies. In the present study the model is parameterized through inverse calibration using variations of the available data to highlight the influence of data quality and availability on the model outcome and assets/disadvantages of individual products.