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Towards an optimization of irrigation parameters to improve land surface model simulations

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Sommario

Improving the knowledge of agricultural water uses is in the spotlight of hydrologic sciences and water management authorities due to an increasing amount of water used for irrigation. An efficient water management system has a crucial role also considering the climate change projections scenario and the large increase in the frequency, duration, and severity of droughts, especially over the Mediterranean basin, which has been recognized as a hotspot of extreme weather events. However, simulating irrigation through large scale land surface models is not trivial, because the simplistic model parameterization do not necessarily resolve field scale conditions. In particular, the main challenge is to reproduce the amount and timing of irrigation applications by farmers, because these are often not physically-based and effectively driven by water policies instead of root zone soil moisture conditions.

Some recent approaches have demonstrated the utility of remote sensing observations to either derive irrigation directly, or indirectly via their assimilation into land surface and hydrological models. Indeed, high resolution remote sensing offers an unprecedented opportunity to observe the soil/vegetation system and to consequently detect irrigation. However, although both methods seem promising, irrigation quantification and detection are still at their infancy due to limitations of both satellite data and models. In particular, recent data assimilation experiments have shown the crucial role of an accurate land surface model parameterization to optimally integrate models and satellite observations.

The aim of this study is to test the benefit of directly optimizing the irrigation parameters of a sprinkler irrigation module embodied in the Noah MP land surface model running within the NASA Land Information System framework. A synthetic calibration experiment is performed over a highly irrigated area in the Po Valley (Italy), using synthetic irrigation and soil moisture benchmark data, at a spatial resolution of 0.01°. The improvement of the poorly-parameterized sprinkler irrigation scheme through a proper calibration is intended to be a valid alternative to quantify agricultural water uses.