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Towards operational high temporal and spatial resolution soil moisture for crop irrigation management by multi-sensor remote sensing approach

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Modern irrigation agencies rely on in situ root-zone soil moisture measurements to detect the onset of crop water stress and to trigger irrigations. However, in situ point measurements are costly, are not available over extended areas and may not be representative at the field scale. Remote sensing is a cost-effective technique for mapping and monitoring broad areas. However, an operational remote sensing algorithm dedicated to root zone soil moisture monitoring at the parcel scale still needs to be developed.

By taking advantage of recent multi-sensor remote sensing developments, the REC project proposes a solution to the need of root-zone soil moisture at the field scale for irrigation management. It is based on an innovative and operational algorithm that will allow for the first time to: 1) to map root zone soil moisture on a daily basis at the field scale and 2) to quantitatively evaluate the different components of the water budget at the field scale from readily available multi-sensor remote sensing data.
The methodology relies on the coupling between a surface model representing the water fluxes at the land surface-atmosphere interface (infiltration, evaporation, transpiration) and in the soil (drainage), and remote sensing data including land surface temperature, multi-spectral surface reflectances, and the near-surface soil moisture retrieved from microwave radiometers and radars. These modelling and remote sensing tools will be integrated in an irrigation management system that will be used to trigger irrigation.

REC proposes an innovative approach to take advantage of the complementarity between thermal-disaggregated SMOS/SMAP Soil Moisture (SM) (no need for calibration) and radar derived SM (with a need for calibrating the radiative transfer model) at 100 m resolution. On the cloud free days when thermal data are available at approximately the same time as the SAR data, we calibrate the inversion algorithm of radar data from the SM data estimated at similar spatial resolution by the thermal-based disaggregation method of SMOS/SMAP SM. As a result, we are able to provide high-resolution SM every 3 days in all weather conditions.
REC purpose is to develop a Land Surface Model (LSM) driven by multi-sensor remote sensing and meteorological data to map root-zone SM (RZSM) at the daily and parcel scales. The LSM will be used to estimate RZSM at the daily time scale and to forecast irrigation schedules.

The project, awarded a H2020-MSCA-RISE-2014 grant, is being implemented and validated over two sites: the modern irrigated area of Segarra- Garrigues in Lleida, Catalonia, Spain and an irrigated perimeter of the Haouz Plain in the Tensift watershed, Morocco.