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A generic open-source toolbox to help long term irrigation monitoring for integrated water management in semi-arid Mediterranean areas.

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In semi arid areas, irrigated plains are often the major consumer of water well beyond other water demands. Traditionally fed by surface water, irrigation has massively shifted to a more reliable resource: groundwater. This shift occurred in the late thirty years has also provoked an extension and intensification of irrigation, often translated into impressive groundwater table decreases. Integrated water management needs a systematic and robust way to estimate the water demands by the agricultural sector.
We propose a generic toolbox based on the FAO-56 method and the Crop Coefficient/NDVI approach used in Remote Sensing. The toolbox can be separated in three main areas: 1) It facilitates the preparation of different input datasets: download, domain extraction, homogenization of formats, or spatial interpolation. 2) A collection of algorithms based on the analysis of NDVI time series is proposed: Separation of irrigated vs non-irrigated area, a simplified annual land cover classification, Crop Coefficient, Fraction Cover and Efficient Rainfall. 3) Synthesis against points or areas produces the output data at the desired spatial and temporal resolution for Integrated Water Modeling or data analysis and comparison.
The toolbox has been used in order to build a WEAP21 model of the Merguellil basin in Tunisia for the period of 2000-2014. Different meteorological forcings were easily used and compared: WFDEI, AGRI4CAST, MED-CORDEX. A local rain gauges database was used to produce a daily rainfall gridded dataset. MODIS MOD13Q1 (16 days, 250m) data was used to produce the NDVI derived datasets (Kc, Fc, RainEff). Punctual evapotranspiration was compared to actual measurements obtained by flux towers on wheat and barley showing good agreements on a daily basis (r2=0.77). Finally, the comparison to monthly statistics of three irrigated commands was performed over 4 years. This late comparison showed a bad agreement which led us to suppose two things: First, the simple approach of (Evapotranspiration minus Efficient Rainfall) to estimate Irrigation at the monthly time step is not pertinent because only a subset of the irrigated commands is actually irrigated. Hence, a higher spatial resolution of remote sensing imagery is needed. Second, in this particular area, farmers have a different rationale about rainfall and irrigation water needs. Those two aspects need to be further investigated.
The toolbox has proven to be an interesting tool to integrate different sources of data, efficiently process them and easily produce input data for the WEAP1 model on a long term range. Yet some new challenges have been raised.