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Contrasting ET-retrieval methods from remote sensing in a semiarid area (Southern Spain)

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The study area of Campo de Cartagena, is located in the Segura River basin (South-East of Spain). This basin is characterized by strong climatic contrasts, frequent droughts and floods. These contrasts, in addition to the progressive increase in water demands associated with economic activities, land use and climate change, contribute to frequent water deficit situations. For these reasons, an important component in the energy and water balance is the evapotranspiration, particularly in these semi-arid areas where water deficiency is a major problem for the economic and sustainable welfare.

Through interpretation of remote sensing data, applied to the Segura River Basin, indices and parameters establishing statistical relationships are identified: albedo, normalized difference vegetation index (NDVI), land surface emissivity and temperature (LST), and actual evapotranspiration (ET), among other variables. The proposed methodology allows the operational estimation of ET from Landsat-5 TM, for wide areas. Several corrections (radiometric and atmospheric) and cloud masks, were applied to the images. By incorporating a Digital Elevation Model (DEM) and topographical attributes, the spatial distribution of instantaneous ET (at satellite overpass) was derived considering a topographical correction of shortwave net radiation.

Two residual algorithms were considered for retrieving ET: (i) a single-source model, based on the direct estimation of the evaporative fraction from the analysis of NDVI-LST space, and (ii) a dual-source model, named 'revised three temperature model' (3T-R model). The results from both methods were validated with flux towers observations at satellite overpass and at daily scale (24h).

The two residual methods had low requirement of input data, making easier the operational assessment and implementation of ET mapping tools over large areas. The information below a GIS environment will allow the identification of spatiotemporal patterns of water stress indicators, visualising the key information on crop behaviour and soil moisture availability. Based on this spatial information, it is possible to identify agricultural areas under stress and to improve decision-making related to crop irrigation scheduling and water allocation in water-stressed regions.