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EVASPA (EVapotranspiration Assessment from SPAce) tool: overview and first assessments

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Evapotranspiration (ET) is a fundamental variable of the hydrological cycle which plays a major role on surface water and energy balances. ET estimation is required for irrigation management, water resources planning and environmental studies. At the local scale ET can be accurately determined from detailed ground observations (eddy covariance towers, lysimeters) but at regional scale, numerous time-consuming and expensive installations would be required. Remote sensing provides spatially distributed cost-effective information for ET maps production at regional scale.

EVASPA (EVapotranspiration Assessment from SPAce) tool has been developed to produce ET maps at relevant spatial and time scales for hydrological or agronomical purposes. The tool includes several ET estimation methods (S-SEBI method, the triangle approach and aerodynamic equations) and various equations for estimating the required input information (albedo, net radiation, ground heat flux...). Highlighted features of this tool are: (i) the possibility of integrating data from various remote sensing sensors, (ii) to be easily adapted to new sensors, (iii) to provide an estimation of uncertainties (thanks to the combination of the various ET estimates) and (iv) to produce continuous daily ET maps even for days without available remote sensing images (by means of interpolation techniques).

To test the tool, ET maps have been produced for the Crau-Camargue pilot site in south-eastern France. This site is a flat region characterized by highly contrasted wet and dry areas, with a high diversity of surfaces: irrigated meadows, dry grasslands (steppic area), saltmarsh scrubs, paddy fields, orchards, etc. Daily ET maps at kilometric spatial resolution are produced from MODIS data (Moderate Resolution Imaging Spectroradiometer, platforms Terra and Aqua) and high resolution ET maps with a hectometric resolution from ETM+ (Enhanced Thematic Mapper Plus, Landsat 7 platform) when images of the study area are available. Ground data from several surface energy balance stations deployed in contrasted areas of the pilot site are used to assess the performance of EVASPA simulations. First evaluations were performed by (i) comparing net radiation estimation from ETM+ to ground data with errors lower than 20 Wm^{-2}, (ii) assessing the performances of the procedure used to interpolate daily ET for days without images with errors around 0.35 mm d^{-1}, and (iii) comparing evolution of daily ET for the different ecosystems to ground station measurements showing that estimates were closely following ecosystem ET (error around 0.5 mm d^{-1}), for some of them in relation to the level of the water table below.

EVASPA tool is a prototype software developed in MATLAB within the frame of the European project SIRRIMED[1] and with the support of CNES[2] through the TOSCA[3] research calls.

[1] SIRRIMED: Sustainable use of IRRIgation water in the MEDiterranean region, FP7, European Commission
[2] CNES : Centre National d'Etudes Spatiales (France)
[3] TOSCA: Earth, Ocean, Continental Surfaces and Atmosphere