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Estimating evapotranspiration by using canopy conductance models with Sentinel-2 data in irrigated crops in California and Australia

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Deriving evapotranspiration is crucial for determining the water requirements of crops and for efficiently allocating water resources for irrigation. Various experiments and methods have proven that earth observation (EO) is a useful tool for estimating evapotranspiration and supporting irrigation and water resource management at different scales.

This study presents a framework based on the Penman-Monteith big leaf model and Shuttleworth-Wallace sparse canopy model for estimating the evapotranspiration in irrigated crops with partial and full-canopy conditions.

The approach fully utilizes the high-resolution and multi-spectral capabilities of the Sentinel-2 (S2) sensors for the derivation of surface parameters such as hemispherical shortwave albedo(α), Leaf Area Index (LAI), and the water status of the soil-canopy ensemble by using the OPTRAM model. Proposed by Sadeghi [1], the OPTRAM model uses the pixel distribution in the Shortwave Infrared Transformed Reflectance (STR)-NDVI space, where the water content of the soil-canopy system is linearly correlated to the STR index.

In detail, the proposed approach estimates the contributions of soil and canopy to the total evapotranspiration by incorporating the OPRAM model to assess the water status of the surface and adjust the resistance terms in the combination equation [2]

The results are validated by using Eddy Covariance data collected during the GRAPEX (Grape Remote Sensing Atmospheric Profile Evapotranspiration eXperiment) project [3], T-REX (Tree crop Remote sensing of Evapotranspiration eXperiment) project, and COALA (COpernicus Applications and services for Low impact agriculture in Australia) project [4]. These projects are conducted respectively in irrigated vineyards and almond orchards in California, and in irrigated maize and alfalfa in Australia.

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