Integrating optical and thermal satellite data for daily evapotranspiration estimation and crop water requirements: IRRISAT & OpenET Frameworks.

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Improving evapotranspiration (ET) estimation in agricultural systems can benefit from the consistent integration of multi-satellite and multi-model approaches capable of reducing structural uncertainties. In this context, the OpenET framework [1] has represented a significant advance, combining an ensemble of six models (mainly based on thermal data) to provide robust ET estimates [2].

This study proposes integrating the IRRISAT methodology into this framework. IRRISAT, originally developed as an operational irrigation advisory service in Campania [3,4], has recently been updated through the implementation of a Penman–Monteith model enriched with the OPTRAM approach [5]. Specifically, the introduction of an indicator of the degree of saturation of the soil-plant system allows for dynamic modulation, in space and time, of canopy stomatal resistance, exploiting the full capabilities of the Sentinel-2 multispectral data.

The integrated approach was tested on irrigated crops in Bouldin Island Reclamation District 756, located within the Sacramento-San Joaquin Delta in San Joaquin County, California (USA). Performance was evaluated at the field scale using independent observations from AmeriFlux towers on alfalfa (US-Bi1) [6] and maize (US-Bi2) [7]. A further comparison was conducted at the district scale, providing an overview of the models' performance and their ability to support irrigation practices at different spatial scales.

[1] OpenET. https://etdata.org/

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[3] IRRISAT. https://www.irrisat.com/

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[7] Camilo Rey-Sanchez, Carlos Tianxin Wang, Daphne Szutu, Kyle Hemes, Joseph Verfaillie, Dennis Baldocchi (2026), AmeriFlux FLUXNET-1F US-Bi2 Bouldin Island corn, Ver. v1.3_r1, AmeriFlux AMP, (Dataset). https://doi.org/10.17190/AMF/1871135