Supporting Information for

Enhancing Evapotranspiration Estimates in Composite Terrain Through the Integration of Satellite Remote Sensing and Eddy Covariance Measurements

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Contents of this file

Excel file containing data

Description of Data

This dataset contains multiple evapotranspiration (ET) estimates derived from both ground-based measurements and satellite-based remote sensing models. The data were used to evaluate and enhance ET estimation accuracy across different land-use types in California by integrating flux tower observations with satellite-derived models through an optimization framework.

The dataset includes ET measurements obtained from eddy covariance (EC) flux towers at four distinct locations in California, representing different land uses. These flux towers provide high-precision energy flux data, serving as ground truth for validating remote sensing-based ET models. In addition to EC measurements, the dataset comprises ET estimates from several remote sensing models. The Surface Energy Balance Algorithm for Land (SEBAL) is represented in two forms: SEBAL-OPT, an optimized version incorporating Bayesian inference using the Differential Evolution Adaptive Metropolis (DREAM) algorithm, and SEBAL-ORG, the original model used as a baseline for comparison. SEBAL-OPT integrates EC flux tower data to improve accuracy, whereas

SEBAL-ORG relies on default parameterization. The description of the data in the Excel file for four sites—CAPEX, US-Bi1, US-Bi2, and US-Myb—is as follows. All the data are expressed in millimeters per day (**mm/day**):

- **Eddy Covariance (EC):** Ground-based ET measurements obtained from flux towers at four distinct sites in California, each representing different land uses.

- **SEBAL-OPT (Surface Energy Balance Algorithm for Land - Optimized):** An optimized version of the SEBAL model, calibrated using Bayesian inference with the Differential Evolution Adaptive Metropolis (DREAM) algorithm to integrate EC flux tower data with Landsat 8 and 9 satellite imagery.

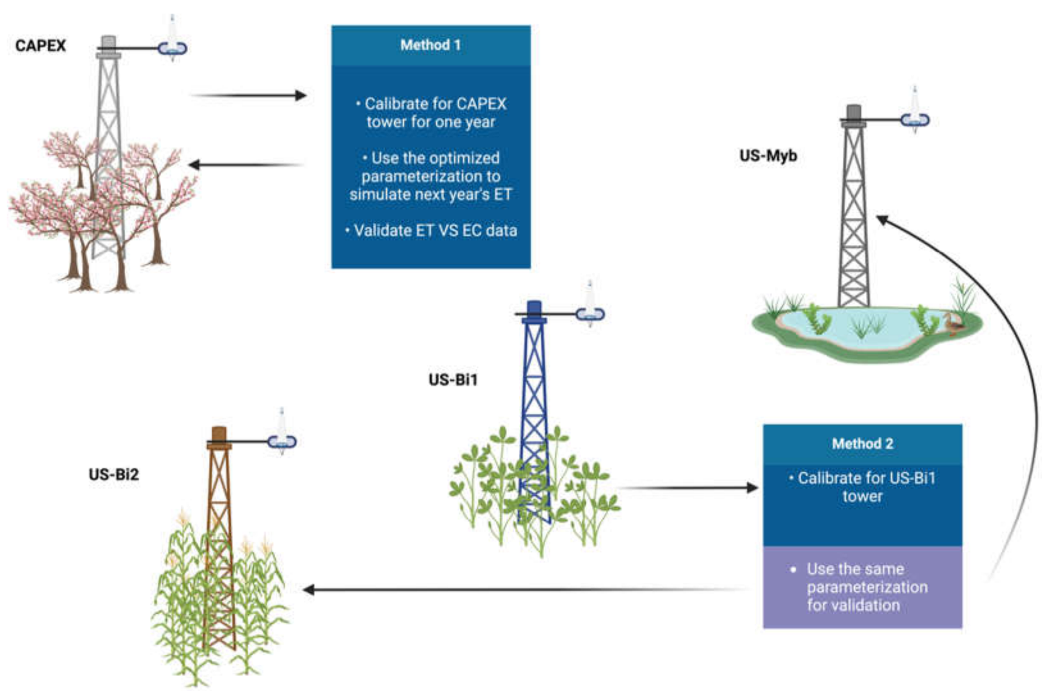

Figure S1. The optimization process for SEBAL-OPT

- **SEBAL-ORG (Surface Energy Balance Algorithm for Land - Original):** The original SEBAL model parameterization used as a baseline for comparison with the optimized version.

- **Ensemble (Open ET):** A composite ET estimate generated by combining multiple model outputs to improve overall accuracy.

- **METRIC (Mapping Evapotranspiration at High Resolution with Internalized Calibration from Open ET):** A remote sensing-based model that estimates evapotranspiration (ET) using the surface energy balance approach. It is an advancement of SEBAL, incorporating an internalized calibration process that adjusts sensible heat flux estimates using ground-based reference ET from weather stations.

- **SSEBop (Simplified Surface Energy Balance operational from Open ET):** simplified energy balance model that estimates ET using a thermal-based approach with pre-defined boundary conditions, making it computationally efficient and suitable for large-scale operational applications.

- **DisALEXI (Disaggregated Atmosphere-Land Exchange Inverse from Open ET):** A multi-scale energy balance model that downscales coarse-resolution ET estimates from the ALEXI model to finer spatial resolutions using thermal remote sensing data from Landsat or similar satellites.

- **PT-JPL (Priestley-Taylor Jet Propulsion Laboratory from Open ET):** A radiation-driven model that estimates ET using the Priestley-Taylor equation, incorporating satellite-derived vegetation indices, land surface temperature, and atmospheric conditions to account for moisture and energy availability

- **SIMS (Satellite Irrigation Management Support from Open ET):** An operational model designed for irrigation management, using satellite-derived vegetation indices and meteorological data to estimate ET at the field scale with a focus on agricultural applications