

Leveraging Satellite-Based Evapotranspiration to Support Water Management

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Forrest Melton | NASA-ARC

on behalf of OpenET consortium

Connecting the Drops
May 28, 2026

OPENET

The OpenET Team

<https://github.com/Open-ET/>

NASA, DRI, Habitat Seven (Multi-model Development, Integration, API, UI)

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Chapman University, JPL (PT-JPL) Josh Fisher, Gregory Halverson

NASA Ames, CSUMB (SIMS) Forrest Melton, AJ Purdy, Conor Doherty, Alberto Guzman, Lee Johnson, Robin Fishman, Jose Rodriguez

Universidade Federal do Rio Grande do Sul (geeSEBAL) Anderson Ruhoff, Bruno Comini, Leonardo Laipelt

OpenET, Inc. (non-profit) Sara Larsen, Lydia Bleifuss

Google Earth Engine Karin Tuxen-Bettman



What is evapotranspiration (**ET**) & why is **ET** important?



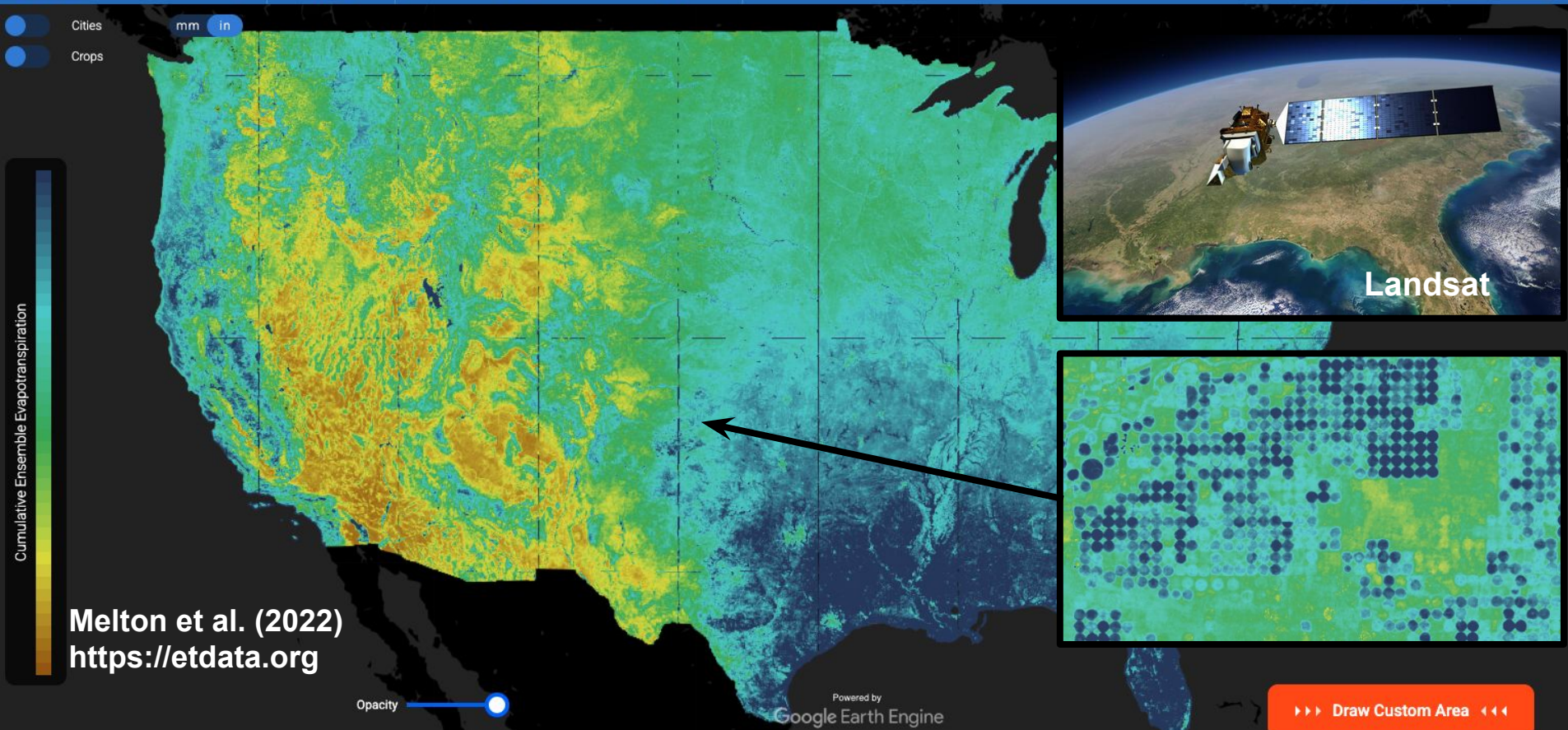
ET: Evaporation + Transpiration

ET provides a measure of the consumptive water use

OpenET: Field-scale Evapotranspiration Data for Water Resources Management



Search Select Year 2025 Raster View Field View Version 2.1 [New Here? Take a Tour!](#)



Maricopa, AZ, USA



Select Year
2025

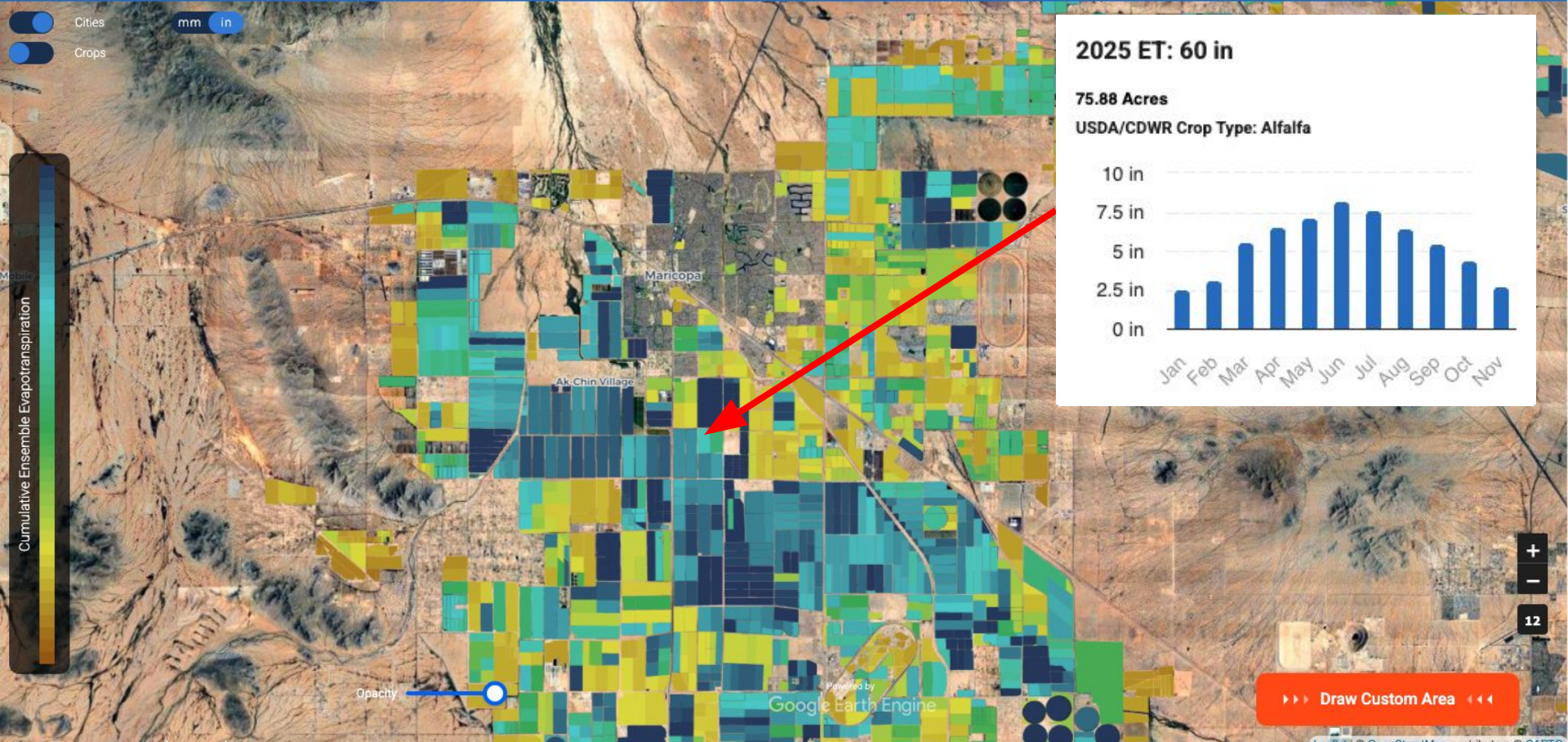
Raster View Field View

[New Here? Take a Tour!](#)

Cities

mm in

Crops



2025 ET: 60 in

75.88 Acres

USDA/CDWR Crop Type: Alfalfa

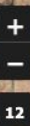


Opacity



Google Earth Engine

[Draw Custom Area](#)



12

Maricopa, AZ, USA



Select Year
2025

Raster View Field View

[New Here? Take a Tour!](#)

Cities

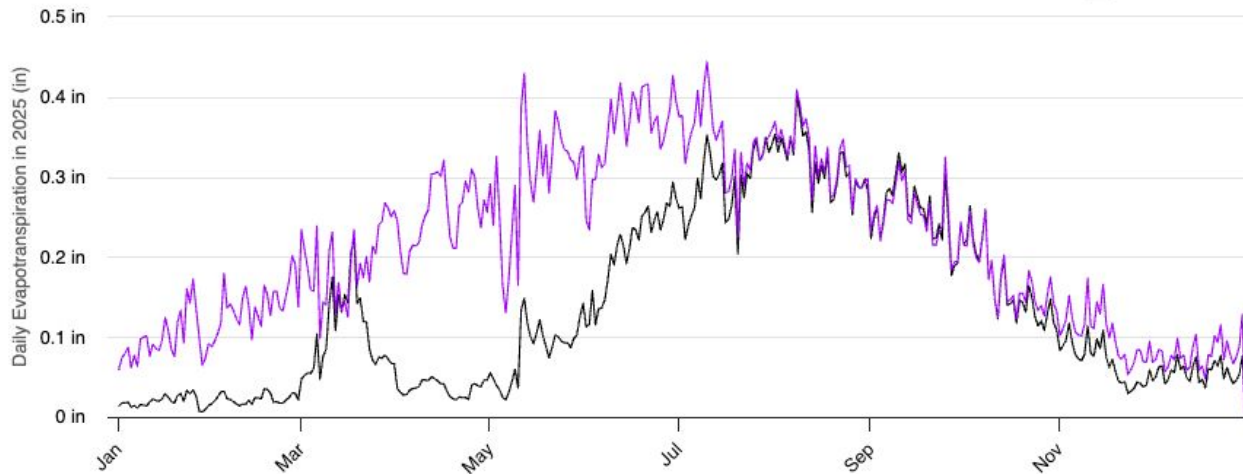
mm in

Crops

Monthly Cumulative **Daily** 2025

Daily Evapotranspiration in 2025 (in)

[Download Data](#)



● Ensemble ET ● Reference ET (ETo)

Highcharts.com

Daily Data Options

ET [>](#)

ET Fraction [>](#)

Additional Variables [v](#)

Precip (gridMET) [?](#)

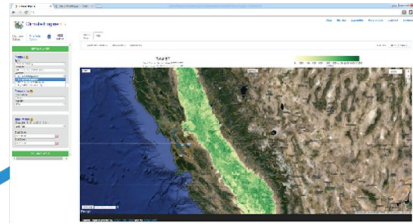
ETo [?](#)

NDVI [?](#)

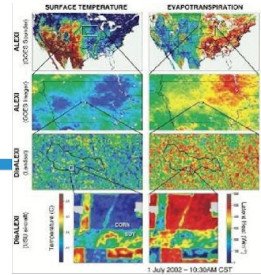
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[Draw Custom Area](#)

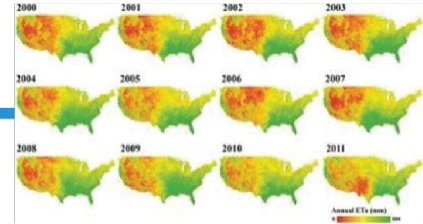
OpenET Ensemble of Models



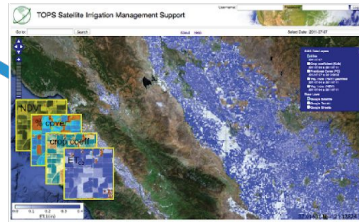
EE METRIC
University of Nebraska,
University of Idaho



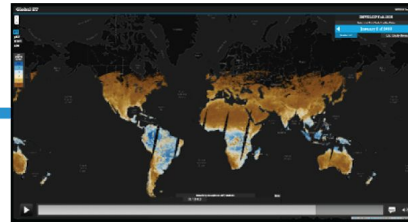
ALEXI/DisALEXI
USDA, NASA, University of Maryland,
University of Wisconsin



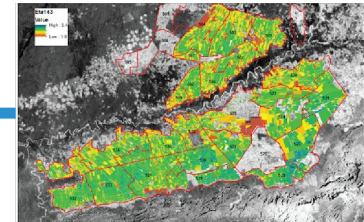
SSEBop
USGS



SIMS
NASA, CSUMB, Stanford University

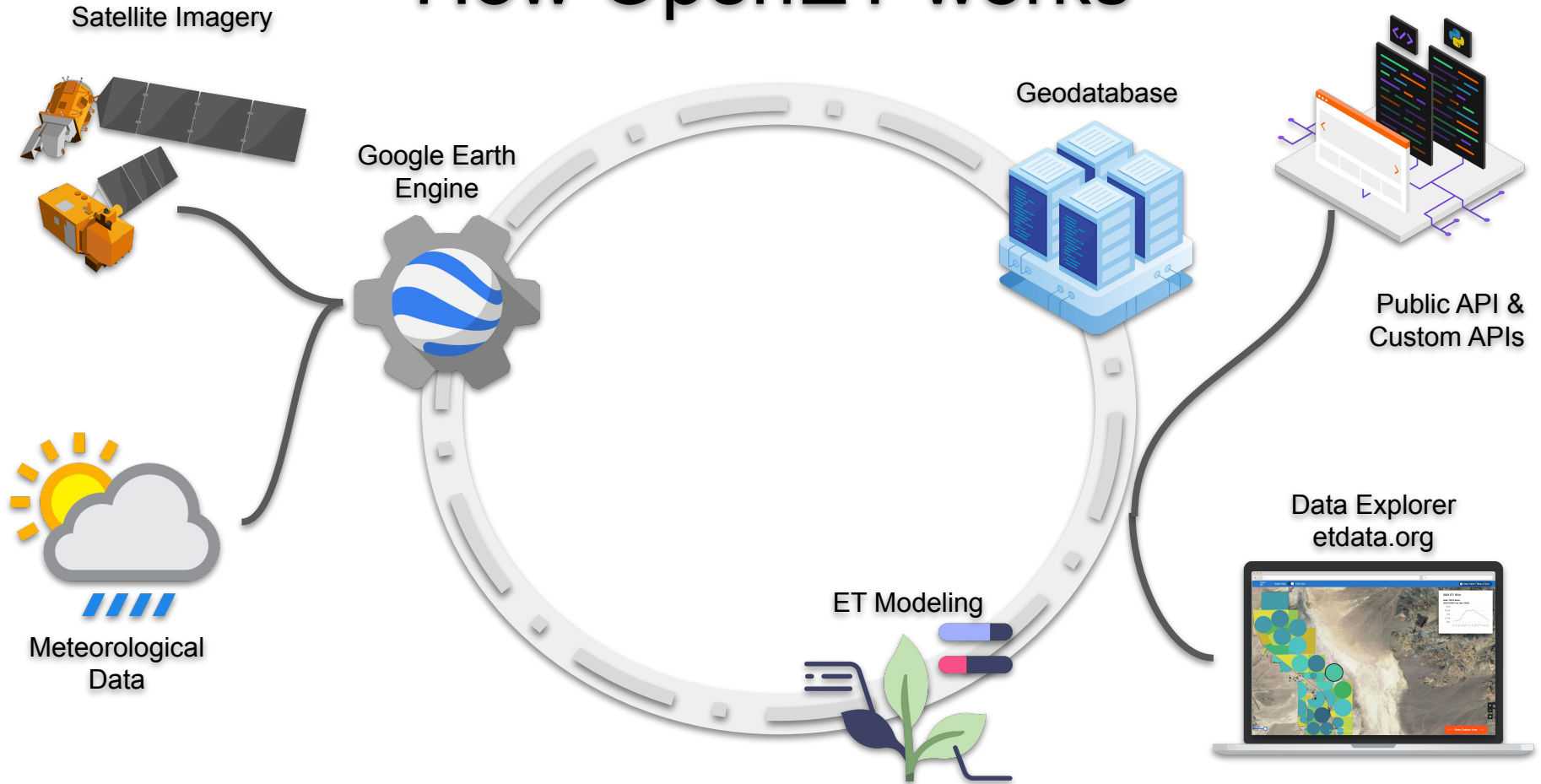


PT-JPL
NASA



SEBAL
Universidade Federal
do Rio Grande do Sul

How OpenET works



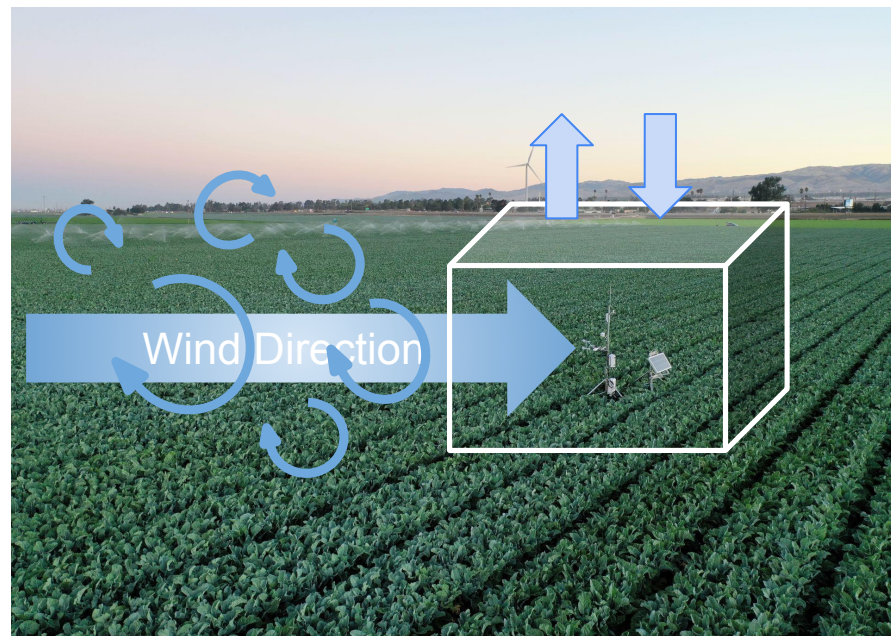
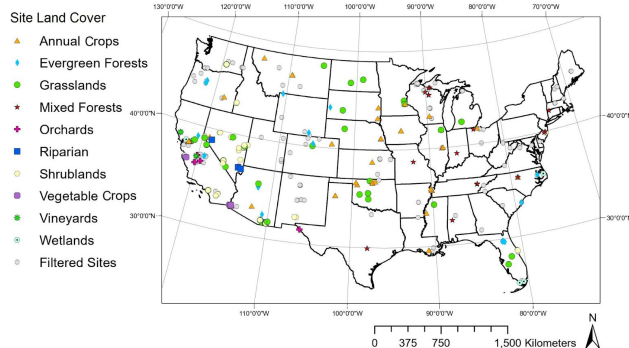
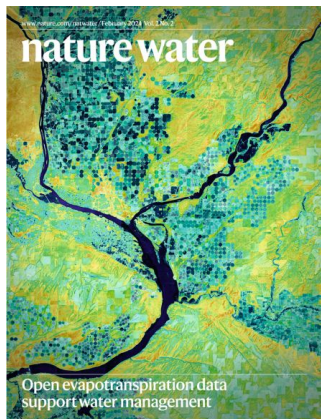
Broad adoption requires **building trust** through transparent assessment

~150 flux tower sites

70 ag sites

Monthly Bias = -5.8%

Water Year MAE = 8.9%



Quality control & post-processing following Flux Data QAQC & matching OpenET values to flux footprints

docs passing Automated tests passing

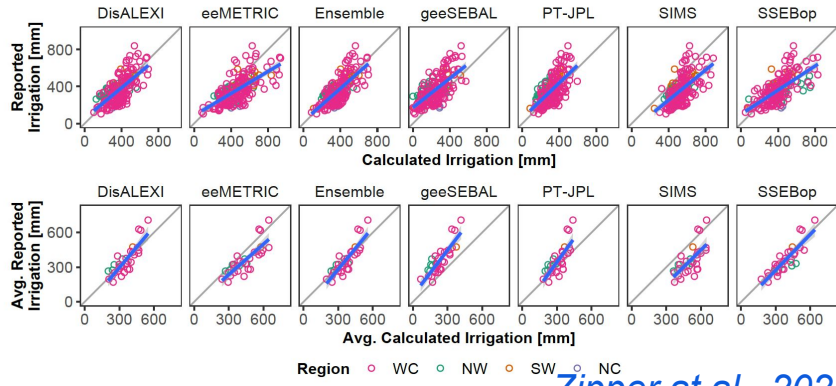
flux-data-qaqc

flux-data-qaqc provides a framework to create reproducible workflows for validation and analysis of eddy covariance data. The package is intended for those who need to post-process flux data, particularly for generating daily and monthly evapotranspiration (ET) timeseries estimates with energy balance closure corrections applied. Applications where this software may be useful include analysis of eddy covariance data, hydrologic or atmospheric model validation, and irrigation and water consumption studies.

Volk et al., 2021; 2024
Melton et al., 2021

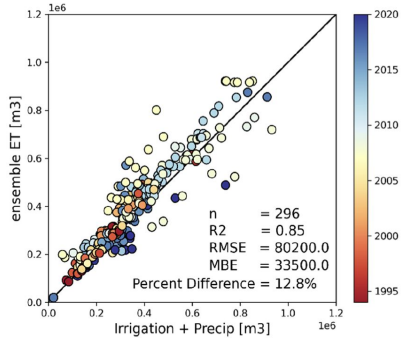
Additional OpenET Comparisons

OpenET ETaw vs. Applied Irrigation in KS



Zipper et al., 2024

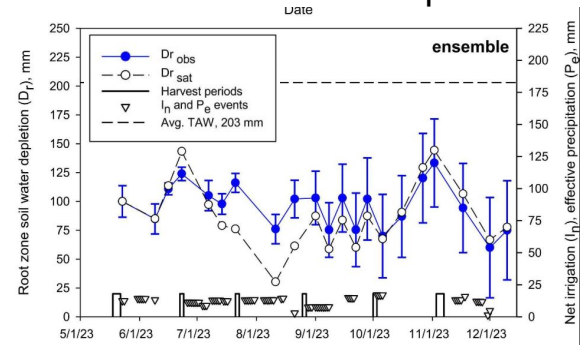
OpenET ETa vs. Irrigation + Precip in Almonds



- 148 almond orchards in CA, 2021-2022
- MAD = 12.8%

Knipper et al., 2024

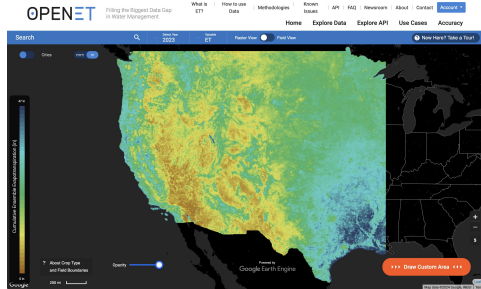
OpenET ET vs. soil water depletion in AZ



Attalah et al., 2026

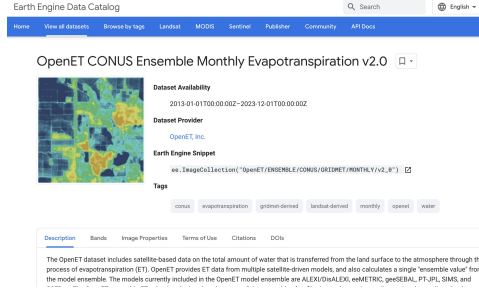
Many more independent comparisons
 Nasar et al., (2023); Sabiston et al. (2024);
 Tawelbeh et al. (2024); Wagle et al., (2026);

OpenET: Open Data and Open Science



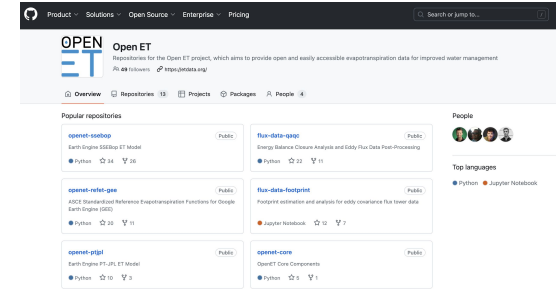
OpenET Data Explorer

<https://explore.etdata.org>



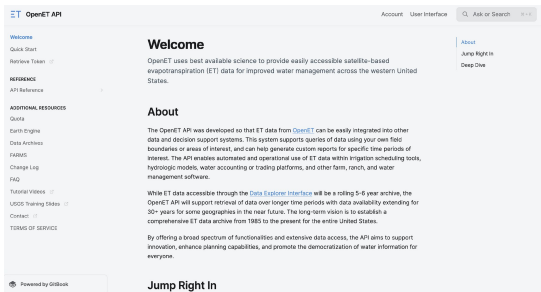
OpenET GEE Data Catalog

<https://developers.google.com/earth-engine/datasets> (search for 'OpenET')



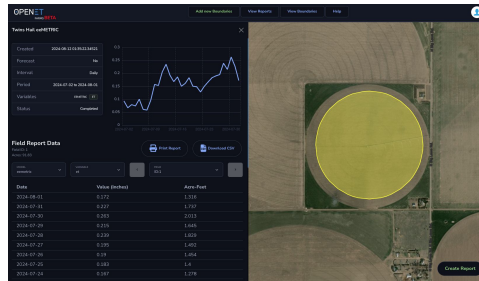
OpenET Open Source Repositories

<https://github.com/Open-ET/>



OpenET API

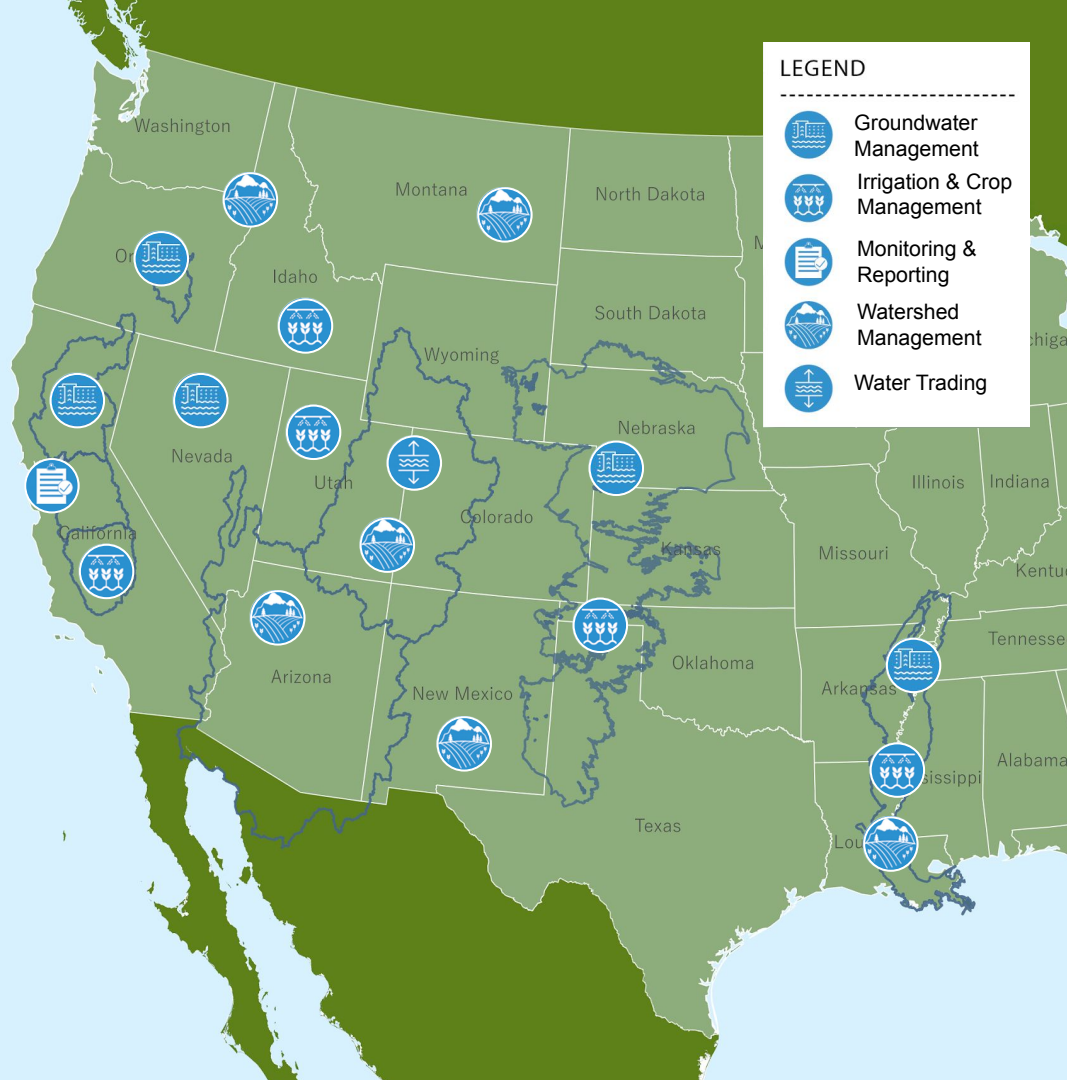
<https://openet.gitbook.io/docs>



OpenET FARMS user interface

<https://farms.etdata.org/>

- > 15,500 users
- > 880,000 data retrievals
- Supported by dedicated science and software engineering team



Examples of OpenET Applications

- Utah, Wyoming, Colorado, New Mexico, Arizona, Nevada and California are using OpenET to save water and plan for future drought events in the Colorado River Basin
- Kansas, Oklahoma and Texas are using OpenET to support farmers that rely on irrigation from groundwater and to extend the life of the Ogallala Aquifer
- Nebraska uses OpenET to improve groundwater management and water accounting in the Twin Platte District
- Montana and Idaho use OpenET to quantify consumptive use for water accounting
- Nevada and Oregon use OpenET for groundwater management in locations including Diamond Valley (NV) and the Harney Basin (OR)
- California uses OpenET for water use reporting, groundwater management, and irrigation scheduling
 - Used by multiple groundwater sustainability agencies in water budgeting
 - Provided regulatory relief savings for farmers through alternative water use reports in the Delta
 - Integration into DWR and GSA hydrological models in Central Valley to provide reliable magnitudes and spatial distribution of consumptive use



Comparing ET to Irrigation

ET \neq Irrigation

$$ET \leq \text{Irrigation} + \text{Precipitation} + \Delta S$$

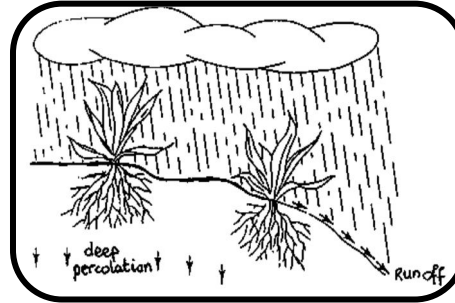
Collecting quality
meter data



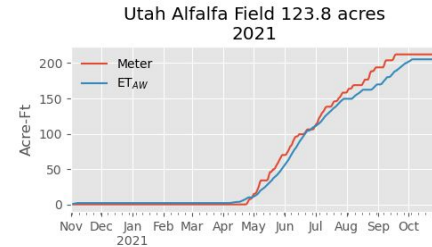
Matching place of use
to ET time series



Accounting for
effective precipitation

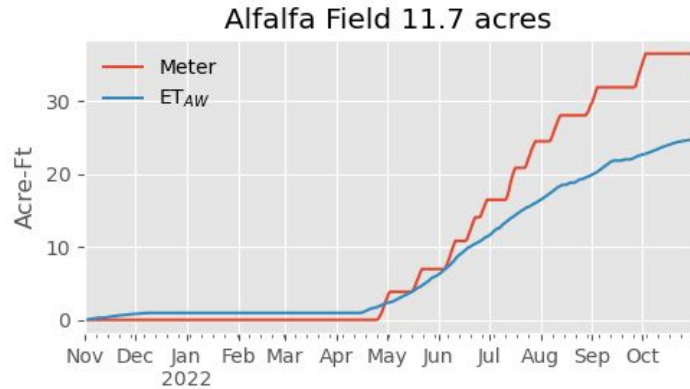


= Useful Comparison

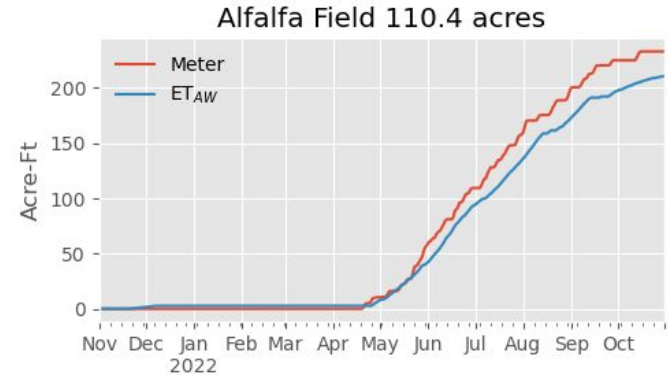


OpenET data represents all water sources: precipitation, access to shallow groundwater, soil moisture, irrigation

Pairing ET with meter data can maximize value



Lower Crop Use Efficiency

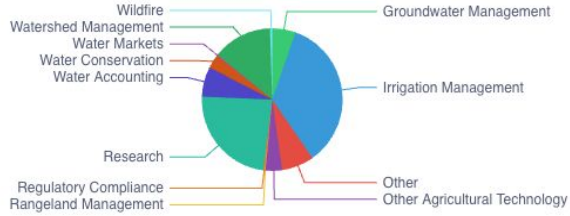


Higher Crop Use Efficiency

Crop Water Use Efficiency (CWUE) = $ET \text{ of Applied Water} / \text{Irrigation (metered)}$

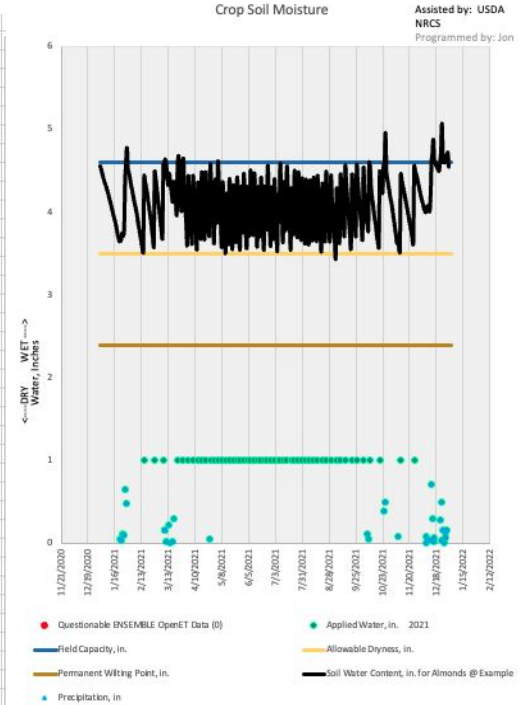
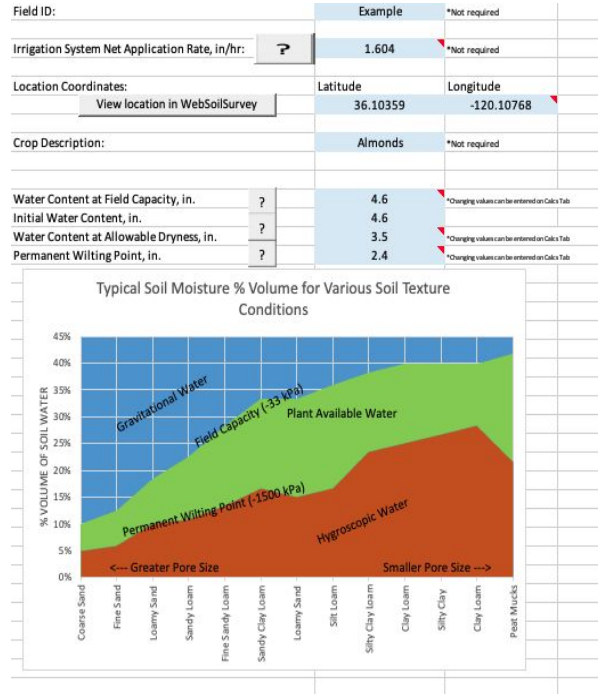
Differences can be explained by irrigation system efficiency and salt management.

Irrigation Scheduling



Support platforms (both public and private) that use the data for optimal operation (NRCS, CropManage, AgMonitor)

Credit: Jon Chilcote, NRCS



Key Lessons Learned and Takeaways

- OpenET illustrates how satellite data and open science can advance hydrologic mapping *and* sustainable water management at continental scales
- User-driven co-development of data products and focused use cases are essential to transforming data into actionable information.
- Strong interagency and public-private partnerships, with backing from federal, state and philanthropic support, are key to *scaling* and *sustaining* systems like OpenET
- Dedicated science and technical teams ensures accurate, reproducible, and accessible ET data



2024 OpenET User Applications Conference

- 249 attendees
- 156 different organizations
- 32 different states
- 3 individual countries



OpenET Applications Conference

Nov 17-18, 2026

Salt Lake City, UT