OpenET for California Avocados:

What Growers Need to Know

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Efficient irrigation is one of the most important management decisions in California avocado production. Applying too little water reduces tree growth, yield and fruit quality, whereas excessive irrigation wastes water, increases production costs and may increase the risk of root diseases and nutrient leaching. Because avocado trees are highly sensitive to both water deficit and over-irrigation, accurate irrigation scheduling is essential for maintaining healthy orchards, maximizing productivity and improving water use efficiency.

One of the most effective ways to estimate orchard water requirements is through crop evapotranspiration (ET), which represents the combined water lost through soil evaporation and plant transpiration. Replacing the water lost through ET helps growers better match irrigation with crop water demand while avoiding both under- and over-irrigation.

Traditionally, ET-based irrigation scheduling has relied on weather station data, crop coefficients and field observations. More recently, satellite technology has made it possible to estimate crop water use directly for individual orchards. One example is OpenET (https://openetdata.org), a free, publicly available platform that provides field-scale ET estimates using satellite imagery, weather data and multiple scientifically validated evapotranspiration models. OpenET allows growers to monitor orchard water use throughout the season without installing specialized field instrumentation.

Like any irrigation decision-support tool, OpenET should be understood before it is relied upon for irrigation scheduling. This article summarizes findings from a recently published, peer-reviewed study (Montazar et al., 2026) that evaluated OpenET performance in four mature California avocado orchards and explains what the results mean for irrigation management.

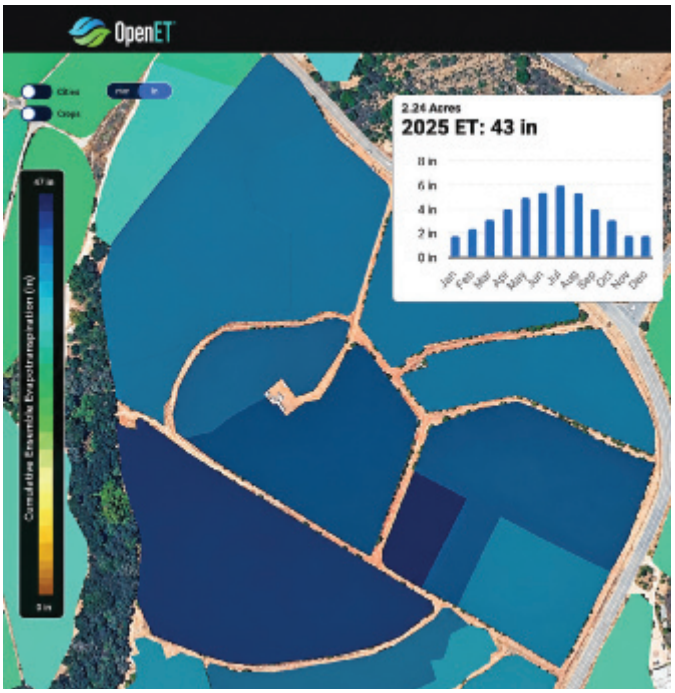


Figure 1. Example of the OpenET platform showing field-scale crop evapotranspiration (ET) estimates for commercial avocado orchards. The inset shows the annual ET total and monthly ET distribution for a selected orchard block.

How Does OpenET Estimate Orchard Water Use?

OpenET estimates crop evapotranspiration by combining satellite imagery with weather data and scientifically validated remote-sensing models. Satellite observations provide information about field and canopy conditions, while weather data describe the atmospheric conditions that drive water loss through soil evaporation and plant transpiration. OpenET combines estimates from multiple ET models to provide an integrated estimate of crop water use.

For growers, OpenET provides daily, monthly and annual ET estimates for individual orchard blocks without requiring specialized field instrumentation. These estimates can be useful for tracking changes in orchard water use throughout the season, comparing water use among orchard blocks or years, and supporting irrigation planning.

An important distinction, however, is that OpenET estimates rather than directly measures ET. Its accuracy depends on how well satellite observations, weather data and the underlying models represent conditions within a particular orchard. Therefore, evaluating OpenET against field-measured ET is important for understanding how its estimates can best be used for irrigation management in California avocado orchards.

How We Evaluated OpenET

OpenET was evaluated using field measurements collected from four mature commercial avocado orchards in Southern California between 2022 and 2025. The orchards, identified here as Sites A–D, represented different avocado-growing environments, including coastal, inland and transitional production regions.

Actual orchard evapotranspiration was measured using the eddy covariance (EC) method, a well-established technique for directly measuring field-scale ET (Figure 2). These measurements provided the field reference for evaluating OpenET estimates. Daily OpenET estimates were compared with corresponding field-measured ET to determine how closely OpenET tracked actual orchard water use. Daily differences also were examined over time to determine whether relatively small differences accumulated and resulted in meaningful differences in seasonal ET.

How Well Did OpenET Estimate Orchard Water Use?

Daily comparisons showed that OpenET generally tracked measured orchard ET well across all four avocado orchards. As shown in Figure 3, most daily differences between OpenET-estimated and field-measured ET were relatively small, with the majority of observations falling within approximately ±0.05 inch per day and centered near zero. OpenET generally estimated slightly higher ET than the field measurements, although day-to-day differences were modest.



Figure 2. Eddy covariance instrumentation installed above the avocado canopy in a commercial California avocado orchard. The system continuously measures actual orchard ET, providing the field reference for evaluating OpenET estimates.

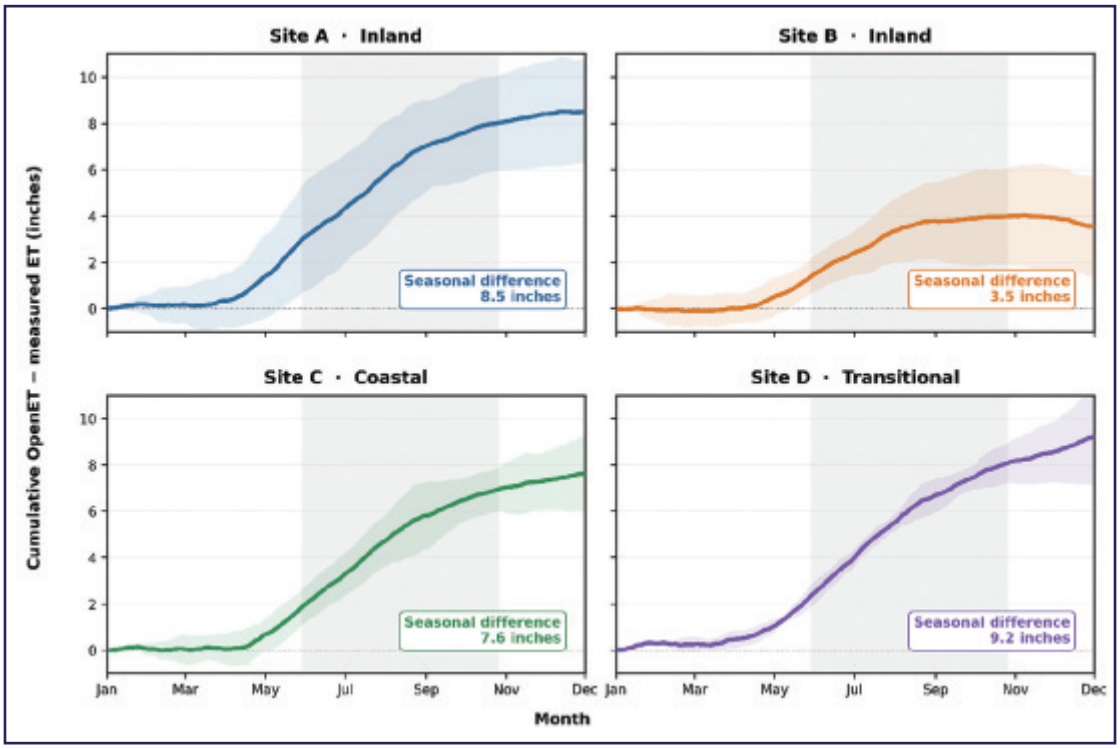


Figure 3. Distribution of daily differences between OpenET-estimated and field-measured ET across four commercial California avocado orchards. Each point represents one daily observation; boxes show the interquartile range (25th–75th percentiles), median and 10th–90th percentiles. Positive values indicate that OpenET estimated higher ET than measured ET.

Small daily differences can become important when they persist over an irrigation season. Irrigation decisions are typically based on water use accumulated over days, weeks and months rather than on a single day's ET. As a result, relatively small differences in daily ET can accumulate into much larger differences in estimated seasonal water use.

This pattern is clearly shown in Figure 4. Differences between cumulative OpenET and field-measured ET remained relatively small during winter and early spring, when orchard water use was low, but increased during late spring and summer as crop water use increased. By the end of the measurement period, cumulative ET overestimation averaged approximately 8.5 inches at Site A, 3.5 inches at Site B, 7.6 inches at Site C and 9.2 inches at Site D.

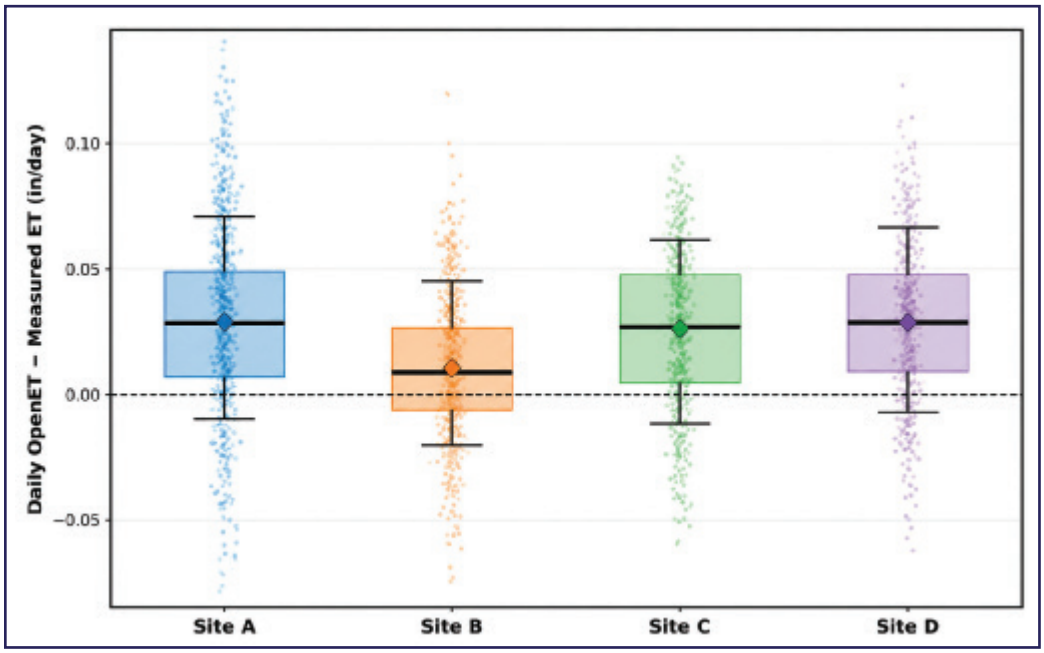


Figure 4. Seasonal accumulation of differences between OpenET-estimated and measured ET across four commercial California avocado orchards. Solid lines represent the multi-year average, and shaded areas indicate year-to-year variability. Although daily differences were generally small, they accumulated throughout the irrigation season.

These results show that OpenET successfully captured seasonal changes in orchard water use across the four orchards, but small daily differences accumulated over time and resulted in higher seasonal ET estimates than the field measurements. This distinction is important for irrigation management: OpenET can provide valuable information on seasonal water-use patterns, but its ET estimates should not automatically be treated as the exact amount of irrigation water that needs to be applied.

Differences between OpenET estimates and field measurements are expected because the two approaches represent ET differently. OpenET combines periodic Landsat satellite observations with weather data to estimate ET at a 30 × 30 m (approx. 100 x 100 ft.) spatial resolution, while the field reference was based on continuous eddy covariance measurements within each orchard. Orchard characteristics such as canopy cover, exposed soil, topography, irrigation practices and local microclimate also may contribute to differences between satellite-estimated and field-measured ET.

Using OpenET Effectively

The results of this study show that OpenET can be a practical tool for monitoring water use in California avocado orchards. It can help growers track seasonal changes in orchard water use, compare ET among orchard blocks or years, and support irrigation planning without requiring specialized field instrumentation.

OpenET is most useful when its estimates are interpreted as a guide rather than as an exact irrigation requirement. For example, an OpenET estimate of one inch of ET should not necessarily be interpreted to mean that exactly one inch of irrigation needs to be applied. The results from the four orchards evaluated in this study demonstrate that relatively small daily differences between OpenET-estimated and measured ET can accumulate into several inches during a season.

Irrigation decisions should therefore consider orchard-specific conditions in addition to OpenET estimates. Irrigation records, soil moisture information, weather conditions and observations of orchard conditions can provide important context for interpreting satellite-based ET estimates. When used together with this field information, OpenET can help growers better understand seasonal orchard water use and make more informed irrigation management decisions.

Key Take-Home Messages

- OpenET effectively tracked seasonal patterns of water use across the four California avocado orchards evaluated but generally estimated higher ET than field measurements.
- Small daily differences accumulated over time, resulting in seasonal ET overestimation ranging from approximately 3.5 to 9.2 inches among the four orchards.
- OpenET is most useful as a decision-support tool for tracking orchard water use and supporting irrigation planning rather than as an exact measure of irrigation requirement.
- OpenET estimates should be interpreted together with orchard-specific information, such as irrigation records, soil moisture, weather conditions and field observations, when making irrigation management decisions.

Learn More

This article highlights the practical findings of our research for California avocado growers. For a detailed description of the field measurements, data analysis, and scientific interpretation, see:

Montazar, A., Faber, B., Daccache, A. (2026). Persistent daily OpenET bias drives seasonal water-use divergence in California avocado orchards. *Agricultural Water Management*, 333, 110651. https://doi.org/10.1016/j.agwat.2026.110651