Synergistic use of spectral information from Landsat and Sentinel-2 data for modeling near real-time crop water status across California vineyards

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Abstract

Landsat-based monitoring of seasonal and near real-time evapotranspiration (ET) in California vineyards is currently challenged by its low temporal revisit period and missing data under cloudy conditions. Gap-filling approaches, such as data fusion with high-temporal resolution images (e.g., MODIS) and interpolation of actual to potential ET ratio (ET/ETo) between image acquisition dates are now commonly used to overcome this challenge. However, these methods may not fully capture non-linear changes in crop condition due to scheduled irrigation, and other management decisions affecting ET during days when satellite images are unavailable and can lead to biased ET estimates. In this study, we combined Landsat-8 and Sentinel-2 data to develop a Shuttleworth-Wallace (SW) based near real-time ET modeling framework for mapping daily ET across three California Vineyard sites. In addition, we utilized daily Leaf area index (LAI) products derived from the Harmonized Landsat and Sentinel-2 (HLS) surface reflectance and MODIS LAI data products to constrain key resistance parameters in the SW model and tested the model across nine flux towers covering three vineyard sites in California. Results suggest that compared to the linear interpolation-based ET/ETo approach, this framework can help reduce biases and root mean squared error of estimated daily ET by over 10%. Results point to a potential utility of the combined Landsat-8 and Sentinel-2 based approach to monitor near real-time ET and complement ongoing thermal remote sensing-based ET modeling approaches to better characterize near real-time crop water status in California vineyards.

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Synergistic use of spectral information from Landsat and Sentinel-2 data for modeling near real-time crop water status across California vineyards

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