Geophysical Research Abstracts
Vol. 15, EGU2013-11199, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Spatial resolution effects on the assessment of evapotranspiration in olive orchards using high resolution thermal imagery

Cristina Santos (1), Pablo J. Zarco-Tejada (2), Ignacio J. Lorite (1), and Richard G. Allen (3)

(1) IFAPA-Alameda del Obispo, Natural Resources Department, Córdoba, Spain, (2) IAS-CSIC, Córdoba, Spain, (3) Universiy of Idaho, Kimberly, USA

The use of remote sensing techniques for estimating surface energy balance and water consumption has significantly improved the characterization of the agricultural systems by determining accurate information about crop evapotranspiration and stress, mainly for extensive crops. However the use of these methodologies for woody crops has been low due to the difficulty in the accurate characterization of these crops, mainly caused by a coarse resolution of the imagery provided by the most widely used satellites (such as Landsat 5 and 7). The coarse spatial resolution provided by these satellite sensors aggregates into a single pixel the tree crown, sunlit and shaded soil components. These surfaces can each exhibit huge differences in temperature, albedo and vegetation indexes calculated in the visible, near infrared and short-wave infrared regions.

Recent studies have found that the use of energy balance approaches can provide useful results for non-homogeneous crops (Santos et al., 2012) but detailed analysis is required to determine the effect of the spatial resolution and the aggregation of the scene components in these heterogeneous canopies.

In this study a comparison between different spatial resolutions has been conducted using images from Landsat 7 (with thermal resolution of 60m) and from an airborne thermal (with resolution of 80 cm) flown over olive orchards at different dates coincident with the Landsat overpass. The high resolution thermal imagery was resampled at different scales to generate images with spatial resolution ranging from 0.8 m up to 120m (thermal resolution for Landsat 5 images).

The selection of the study area was made to avoid those areas with missing Landsat 7 data caused by SLC-off gaps. The selected area has a total area of around 2500 ha and is located in Southern Spain, in the province of Malaga. The selected area is mainly cultivated with olive orchards with different crop practices (rainfed, irrigated, high density, young and adult olive, etc.). The METRIC surface energy balance approach (Allen et al., 2007) was applied for evapotranspiration assessment using the data provided by Landsat 7 and using the images from the airborne flights for three days during the summer of 2012. The flights and the Landsat 7 dates were coincident in order to avoid any difference in temperature or crop characteristic. The application of METRIC was made using detailed information from the olive orchards (mainly evapotranspiration and stress indexes) at different spatial resolutions to determine the errors generated by the aggregation process required when satellite images are considered in these studies. Recommendations are given on how to decompose the bulk surface temperature of Landsat into the component crown and soil (shaded and sunlit) components.

References

Allen RG, Tasumi M, Trezza R (2007) Satellite-based energy balance for mapping evapotranspiration with internalized calibration (METRIC) – Model. Journal of Irrigation and Drainage Engineering ASCE 133(4):380-394

Santos C, Lorite IJ, Allen RG, Tasumi M (2012) Aerodynamic Parameterization of the Satellite-Based Energy Balance (METRIC) Model for ET Estimation in Rainfed Olive Orchards of Andalusia, Spain. Water Resources Management 26:3267-3283