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Use of a surface energy balance model and remote sensing data fusion for continuous evapotranspiration monitoring over a dehesa landscape

Elisabet Carpintero (1), Martha C. Anderson (2), Christopher Hain (3), Feng Gao (2), Ana Andreu (1,4), Pedro J. Gómez-Giráldez (1), William P. Kustas (2), and María P. González-Dugo (1)

(1) IFAPA-Centro Alameda del Obispo, Apdo. 3092 14080 Cordoba, Spain (elisabet.carpintero@juntadeandalucia.es), (2) Hydrology and Remote Sensing Laboratory, USDA ARS, Bldg. 007. BARC West Beltsville, MD 20750. United States, (3) Earth System Science Interdisciplinary Center, U Maryland, College Park, MD, USA, (4) University of California, Berkeley, Department of Environmental Science, Policy and Management, Berkeley (US)

Remote sensing based energy balance models estimate evapotranspiration (ET) at different spatio-temporal scales depending on input sensor characteristics. The use of data fusion methods from different satellites may improve the resolution of these estimates, providing a more detailed ET monitoring for hydrological purposes. This information is crucial in water-controlled ecosystems, such as the Mediterranean oak savanna or dehesa.
ET has been monitored during three years (2013-2015) with a fine spatio-temporal resolution over the Martin Gonzalo watershed (Southern Spain) with predominant dehesa landscape. This is an agroforestry system with a complex canopy structure, composed of widely-spaced oak trees combined with crops, pasture and shrubs. A global and daily ET product at 5 Km resolution, developed with the ALEXI model and using MODIS day-night temperature difference, has been used in this work. The associated flux disaggregation scheme, DisALEXI, was later applied to constrain higher resolution ET estimations from both MODIS and Landsat 7/8 images. The Climate Forecast System Reanalysis (CFSR) provided the meteorological data. Finally, the data fusion technique STARFM was applied to fuse MODIS and Landsat ET maps in order to obtain daily estimations at 30 m resolution.
Energy fluxes measurements provided by an eddy covariance tower installed in a dehesa site (38 ° 12 'N, 4 ° 17' W, 736 m a.s.l.) were used to validate the results of this modelling approach. The results were also compared with globally available ET products. It supported the ability of ALEXI/DisALEXI model to accurately estimate turbulent and radiative fluxes over this landscape, both at 1 Km and at 30 m spatial resolution. The STARFM technique has proved a significant improvement for capturing ET values heterogeneity, which provided new insights about the hydrological processes at watershed scale.