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Atmospheric and soil impacts on the evapotranspiration of a wild olive-based Mediterranean ecosystem under water limited conditions.

Matteo Curreli (1), Nicola Montaldo (1), and Ram Oren (2)

(1) Dipartimento di Ingegneria Civile, Ambientale e Architettura, Università degli Studi di Cagliari, Cagliari, Italy (mat.curreli@unica.it), (2) Nicholas School of the Environment, Duke University, Durham, NC, USA

Mediterranean water limited ecosystems are characterized by an heterogeneous spatial distribution of different plant functional types (PFT), such as grass and trees, competing for water use. We demonstrate that in these ecosystems the combined use of sap flow measurements, based on Granier's thermo-dissipation probes, and eddy covariance technique provides a robust estimation of evapotranspiration (ET). The study has been performed in the Orroli site in Sardinia (Italy), where landscape is a mixture of Mediterranean patchy vegetation types: wild olives and herbaceous species. This ecosystem, during the dry summers, is characterized by a simple dual PFTs system with strong drought-resistant woody vegetation and bare soil, since grass died. An eddy covariance micrometeorological tower has been installed since 2003 and 33 thermo-dissipation probes were installed into 15 wild olives clumps with different characteristics in terms of tree size, exposition to solar radiation, orientation and soil depth. For the first time interesting allometric relationships of the wild olives have been estimated. The use of many sap flow sensors allow to estimate the impact on ET of soil depth (which is variable in the field site), tree diameter, radiation and vapor pressure deficit. Sapflow drastically change according the tree position in the clump and the tree orientation in response of stomatal conductance to photosynthetically active radiation. The sap flow of trees with south orientation doubled the sap flow of trees with north orientation.
Comparing sap flow and eddy covariance measurements we were able to well evaluate and distinguish ecosystem ET and tree transpiration relationships with soil moisture. The relationship between tree sapflow and soil moisture highlights the strong resistance to water deficit of the wild olives, which can survive to extremely dry conditions. A network of 23 soil moisture sensors has also been installed to monitoring soil moisture spatial and temporal dynamics and their spatial correlation with trees transpiration and vegetation density.