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Viability of Below-Canopy Eddy Covariance Measurements in Herbaceous-free and Herbaceous-cover Mediterranean olive crop

Sergio David Aguirre García[1,3], José Ángel Callejas Rodelas[2], **Sergio Aranda Barranco**[1,3], Enrique P. Sánchez-Cañete[2,3], Andrew S. Kowalski[2,3], and Penélope Serrano Ortiz[1,3]

[1]University of Granada, Ecology Department, 18072 – Granada, Spain (sergiodag@ugr.es)
[2]University of Granada, Applied Physics Department, 18072 – Granada, Spain
[3]Andalusian Institute Earth System Research IISTA–CEAMA, 18006 – Granada, Spain

The Mediterranean region has a great surface of olive crops where about 98% of the world's olive agricultural area is represented. Of these lands, 2.7 Mha are in Spain with more than half concentrated in the Southeastern Iberian Peninsula. In this type of crop, the maintenance of natural herbaceous-cover in the alleys from autumn to spring is a common practice to protect the soil against erosion, but little is known yet about its contribution to CO_2 and H_2O fluxes and their seasonal variability. The eddy covariance technique is used worldwide to measure GHG fluxes at the ecosystem level. Additionally, this technique has been used successfully to measure fluxes below the canopy in closed forests and pastures. In this regard, continuous monitoring of eddy covariance CO_2/H_2O fluxes above and below the trees canopy was carried out in an irrigated olive grove (*Olea europaea L.*) in the Southeastern Iberian Peninsula in the hydrological year 2020-2021. The olive trees are distributed in a plantation frame of 12×12 m and the area is divided into two plots: 1) with natural herbaceous-cover from autumn to spring, then cut and left on the surface (hereafter HC); and 2) kept herbaceous-free by glyphosate-based herbicide application (hereafter HF). Each plot has two eddy covariance towers, one above the canopy (ecosystem tower) and the other below the canopy (subcanopy tower).

A comparison between fluxes measured with the subcanopy towers and those measured with ecosystem towers showed the need for wind-direction filtering of the fluxes measured at the subcanopy level. Results show the relevance of selecting those fluxes coming from wind directions where the alleys are located in order to get accurate subcanopy CO_2/H_2O fluxes, avoiding those eddies coming from the olives. Regarding seasonal variability of the CO_2/H_2O fluxes measured at the subcanopy level, preliminary results showed that the HC plot behaved as a C light sink in winter (Dec., Jan., Feb.), being February the month with the most absorption averaging around 1.5 g C m^{-2} day^{-1} while HF behaved as C neutral. In the month before mowing (March), HC behaved as a sink, absorbing, on average, around 2.5 g C m^{-2} day^{-1}, while HF acted as a light source emitting around 0.2 g C m^{-2} day^{-1}. After mowing (from April to June) both HC and HF acted as sources, with HC yielding the largest values in April (around 2.1 g C m^{-2} day^{-1}). Finally, in summer and autumn (from July to Nov.) both HC and HF appear to behave as weak C sources at the subcanopy level.