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Soil moisture limiting olive orchard evapotranspiration

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Two years of field data concerning soil moisture dynamics and water vapor fluxes over a rainfed olive orchard in Sicily are presented here in order to understand how climate, seasonality, water availability and farming practices drive evapotranspiration in such a peculiar Mediterranean vegetation.
Soil moisture has been measured in two different points characterized by a uniformly sandy soil and at multiple depths up to 1.2 m. The observed dynamics are driven by rainfall inputs, which are frequent during the winter season and rare during the growing season, and by vegetation uptakes, which deplete the water stored in the soil. The top layers soil moisture status is much more time dependent and variable than deeper layers, which instead show a smoother signal.
Water vapor fluxes have been measured with the eddy covariance method using a sonic anemometer and a gas analyzer set above the canopy. The measured fluxes show a seasonal behavior justified by the vegetation growing activities, which start approximately in April. High evaporative demand is satisfied when soil moisture is not a limiting factor: that happens at the beginning of the growing season and in fall when olive trees are still active and the late summer rainfalls have replenished the soil. Moving through the growing season, when soil water is depleted day by day, the evaporative demand is no more satisfied because of a soil moisture limit. Plants have difficulty in extracting water from the soil, and then reduce their activity by closing the stomata with a consequent reduction of the evapotranspirative fluxes. Fluxes have been found to be also dependent on tillage operations, which remove grass from the soil thus eliminating a cause of water depletion.
In this work, soil moisture data and the ratio between actual and potential evapotranspiration has been related in order to depict a single stepwise relation linking water availability in the soil and vegetation evapotranspirative activity.