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Olive yield as a function of soil moisture dynamics

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Olive (Olea europaea L) is one of the most characteristic tree crops from the Mediterranean. The drought tolerance of olive trees makes this species important for economic reasons but also for minimizing erosion and desertification, and for improving the carbon balance of these areas. The production of olive tree crops is dependent on water availability given by the winter rainfall or the irrigation and this is particularly true in the Mediterranean area where the climate is typically characterized by high potential evaporation and low rainfall during the growing season.

The aim of this work is to quantitatively link the olive yield to climate using an ecohydrological approach. Numerical model describing soil moisture and assimilation dynamics in Mediterranean areas has been developed. Daily evapotranspiration in well watered conditions is calculated with the Penmann-Montheith equation while the maximum daily conductance is evaluated with the Jarvis formulation. The Farquar's model allows to calculate the assimilation in well watered conditions. Using daily stepwise function relating soil moisture condition to actual evapotranspiration and assuming that this relation is also valid for the assimilation, it is evaluated the actual evapotranspiration and the assimilation as a function of the same climate and soil moisture conditions. Assimilation is then divided in plant organs, roots, stems, leaves and fruits components using a static partitioning. Integrating daily assimilation over the growing season it is possible to evaluate olive yield.

The results of the numerical model were compared with real yield data collected in a farm located in Trapani (Sicily, Italy). Finally the effects of climate change on Mediterranean olive orchards in terms of water stress and productivity were evaluated by mod-

eling the rainfall and the temperature in accordance with IPCC previsions. It is also taken into account the effects of increased CO2 recalculating the conductance, which in turns influences the transpiration rate.