Estimation the olive trees traits combining Bayesian calibration, model and climatic drivers

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Plants can respond differently to different biotic or abiotic factors and their combinations. Their traits are integrated into vegetation models as parameters and their values are defined by measurements and/or by expert judgment and then reported in literature. One of the aims of the models is to represent the processes by mathematical formulations and to assess the response of ecosystems to biotic or abiotic drivers. To estimate the olive trees traits we have combined Bayesian calibration, model and different climatic conditions. Olive tree (Olea europaea L.) has been chosen because is one of the most widespread cultivated arboreal species in the Mediterranean basin and the olive production has recently expanded into some non-traditional areas (South Africa, New Zealand, Australia, Chile, China, etc.). Furthermore the olive trees are important to the positive contribution of the carbon sequestration, mitigation and adaptation to climate change recognizing the long-term carbon storage capacity in soil and woody compartments (Nieto et al., 2010). The Bayesian calibration is one of the most utilized statistical tool to define the best set of the parameters (posteriors) using: a set of initial parameter values (prior) and their range of variability; a set of data measured; a likelihood function to link the prior and posterior; a model to simulate the data measured; and an input dataset to launch the simulations. In this work we have applied the Bayesian calibration framework on the 3D-CMCC-OLIVE model (a modified version of the 3D-CMCC-CNR model (Collalti et al., 2018a; 2018b) calibrated for olive trees and which also includes pruning and irrigation schemes). The 3D-CMCC-OLIVE model parameters was calculated by the Bayesian calibration and using the daily Net Primary Production (NPP; g C m-2 day-1), simulated by a different model in a olive grove located in Central Italy ($42°56'$N, $10°46'$E) (Brilli, et al., 2018). Meteorological conditions in the olive grove differed in the three studied years (2010-2012). The first year was markedly wetter than the second, the third year was intermediate to the two previous. To estimate the effects of different climatic conditions in the model parameters (and olive trees traits), the calibration is applied with different datasets: one-year-at-time, two-years-at-time, all time series. At the end of the calibrations each set of posterior has been applied and the performance of the 3D-CMCC-OLIVE was evaluated.

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