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Evaluation of olive grove management on various soils at the micro-catchment scale with the AnnAGNPS model to quantify their impacts on organic carbon

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Soil organic carbon (SOC) stock changes are crucial to identify the risk of desertification in fragile areas such as the Mediterranean Basin and to fulfill environmental protection global conventions. In Spain, 48% of the world's olive oil is produced with 2.6 Mha dedicated to the crop and there is clear concern over the carbon balance in the context of climate change and the resulting loss of productivity. In this work, 108 scenarios were prepared with the model AnnAGNPS in a small catchment of extensive olive groves by considering the impact of soil type and management using 6 different soil types (with textures sandy, S; sandy loam, Slo; loam, L; clay loam, Clo; silty loam clay, SiLoC; clay, C), 3 different managements (no till, NT; conventional tillage, CT, and cover crop, SC), 3 types of fertilization (two organic with different rates, F2 and F3, and another inorganic F1) and 2 contrasting reach organic carbon half-life time (0.1 day-730 days). The consistency of the simulated values of annual OC attached to the sediments and of variations of ground SOC (h=200 mm) were evaluated and compared in the context of the region of Andalusia.

There were significant differences of annual values of the sediment OC for the scenarios of soil and management with a range variation between 0.0 $kg.ha^{-1}$ and 368.9 $kg.ha^{-1}$. In addition, S and SC showed the lowest variability intervals while Clo and NT had the highest sediment OC and variation ranges. For the SOC pools, the effects of soil and fertilization types were more evident than of the management. The combination C-SC-F3 presented the maximum increase of SOC (0.150 mg $OC.g^{-1}soil.y^{-1}$) while the combination Slo-NT-F1 presented the minimum (0.080 mg $OC.g^{-1}soil.y^{-1}$). Despite specific calibrations needed to quantify OC balances, the consistency of the hydrological and erosive parameterization based on the abundance of experimental studies supports the use of AnnAGNPS for simulating the OC loss in agricultural catchments.