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Climate change impacts on carbon stocks of Mediterranean soils: a CarboSOIL model application

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The Mediterranean area is among the most sensible regions to climate change and large increases in temperature as well as drought periods and heavy rainfall events have been forecasted in the next decades. Soil organic C (SOC) prevents from soil erosion and desertification and enhances bio-diversity. Therefore, soil C accumulation capacity should be considered regarding to adaptation strategies to climate change in view of the high resilience of soils with an adequate level of organic C to a warming, drying climate. In this research we propose a new methodology to predict SOC contents and changes under different climate change scenarios: CarboSoil model. CarboSOIL model is part of the land evaluation decision support system MicroLEIS DSS and was designed as a GIS tool to predict SOC stored at different depths (0-25, 25-50, 50-75 and 0-75 cm). The model includes site, land use, climate and soil variables, and was trained and validated in two Mediterranean areas (Andalusia, S Spain, and Valencia, E Spain, respectively) and applied in different IPCC scenarios (A1B, A2 and B1) according to different Global Climate Models (BCCR-BCM2, CNRMCM3 and ECHAM5) downscaled for the region of Andalusia. Output data were linked to spatial datasets (soil and land use) and spatial analysis was performed to quantify organic C stocks for different soil types under a range of land uses. Results highlight the negative impact of climate change on SOC. In particular, SOC contents are expected to decrease severely in the medium-high emissions A2 scenario by 2100. There is an overall trend towards decreasing of organic C stocks in the upper soil sections (0-25 cm and 25-50 cm) of most soil types. In Regosols under “open spaces” 80.4% of the current SOC is predicted to be lost in 2100 under the A2 scenario. CarboSOIL has proved its ability to predict the short, intermediate and long-term trends (2040s, 2070s and 2100s) of SOC dynamics and sequestration under projected future scenarios of climate change.