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Comparing sequential Gaussian simulation and turning bands algorithms for modelling spatial uncertainty of organic carbon in forest soils.

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Soil organic carbon (SOC) provides multiple functions and the main soil ecosystem services are associated with its content. Mapping SOC spatial distribution and modelling its spatial uncertainty are critical research issues. Geostatistical simulation is largely used for the assessment of spatial uncertainty generating a set of alternative maps (possible realities or realizations) of SOC that honour sample information but also attempt to reproduce its spatial variability (Deutsch and Journel, 1998; Heuvelink, 2018). However, there are several geostatistical simulation algorithms and each of them requires specific assumptions and simplifications with different advantages and disadvantages. Therefore, choosing the most appropriate simulation algorithm for the case under study is neither trivial nor simple. Consequently, it is essential to validate the quality of the simulation algorithms. Within this perspective, the study was aimed to evaluate the performance of sequential Gaussian simulation and turning bands algorithms for modelling the spatial uncertainty of soil organic carbon in a forest catchment in southern Italy. The study area is a 139 ha catchment on granitic parent material and subordinately alluvial deposits, where soils are classified as Typic Xerumbrepts and Ultic Haploxeralf crop out. Soils samples were collected at 135 locations (up to a depth of 0.20 m) and the sample design was developed using a spatial simulated annealing algorithm. In the laboratory, SOC concentration was measured using a Shimadzu TOC-L analyzer with a SSM-5000A solid sample module. Statistical testing and graphical validation were applied to check for the two algorithms, the reproduction of data, summary statistics, and variogram.

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