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Matching legacy estimation of soil organic carbon changes from non-paired data with measured values in paired soil samples after two decades: a case study

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Legacy data are frequently unique sources of data for the estimation of past soil properties. With the rising concerns about greenhouse gases (GHG) emission and soil degradation due to intensive agriculture and climate change effects, soil organic carbon (SOC) concentration might change heavily over time.

When SOC changes is estimated with legacy data, the use of soil samples collected in different plots (i.e., non-aligned data) may lead to biased results. The sampling schemes adopted to capture SOC variation usually involve the resampling of the original sample using a so called paired-site approach.

In the present work, a regional (Sicily, south of Italy) soil database, consisting of N=302 georeferenced soil samples from arable land collected in 1993 [1], was used to select coinciding sites to test a former temporal variation (1993-2008) obtained by a comparison of models built with data sampled in non-coinciding locations [2]. A specific sampling strategy was developed to spot SOC concentration changes from 1994 to 2017 in the same plots at the 0-30 cm soil depth and tested.

To spot SOC changes the minimum number of samples needed to have a reliable estimate of SOC variation after 23 years has been estimated. By applying an effect size based methodology, 30 out of 302 sites were resampled in 2017 to achieve a power of 80%, and an a=0.05.

After the collection of the 30 samples, SOC concentration in the newly collected samples was determined in lab using the same method

A Wilcoxon test applied to the variation of SOC from 1994 to 2017 suggested that there was not a statistical difference in SOC concentration after 23 years (Z = -0.556; 2-tailed asymptotic

significance = 0.578). In particular, only 40% of resampled sites showed a higher (not always significant) SOC concentration than in 2017.

This finding contrasts with a previous SOC concentration increase that was found in 2008 (75.8% increase when estimated as differences of 2 models built with non-aligned data) [2], when compared to 1994 observed data (Z = -9.119; 2-tailed asymptotic significance < 0.001).

Such a result implies that the use of legacy data to estimate SOC concentration changes need soil resampling in the same locations to overcome the stochastic model errors. Further experiment is needed to identify the percentage of the sites to resample in order to align two legacy datasets in the same area.

Bibliography

[1]Schillaci C, et al.,2019. A simple pipeline for the assessment of legacy soil datasets: An example and test with soil organic carbon from a highly variable area. CATENA.

[2]Schillaci C, et al., 2017. Spatio-temporal topsoil organic carbon mapping of a semi-arid Mediterranean region: The role of land use, soil texture, topographic indices and the influence of remote sensing data to modelling. Sci Total Environ.