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Using regional pedological map to compare the European soil organic carbon data from LUCAS with legacy data

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European Soil Data Centre has recently carried out an extensive soil survey (Land Use/Land Cover Area Frame Survey, LUCAS, in 2009-2012) collecting circa 45000 samples, 43% of which from croplands [1]. The soil organic carbon (SOC) content is expressed as g kg-1. Such an area corresponds to approximately 34% of the EU-24 cropland. Nonetheless, there is a parallel wealth of information that each country/region collected independently during the last decades and that is acknowledged as legacy dataset. In Italy, Lombardy is one of the most intensively cropped regions and for this reason, several soil surveys have been carried out in the past. A regional soil database (Sistema Informativo dei Suoli di Regione Lombardia, LOSAN) was developed to build a detailed pedological map (Lombardy pedological map 1:50.000, ERSAF); it includes more than 6000 soil observations at various depths. LOSAN has a big potential for spatial modelling of soil properties; however, it is not harmonized yet. The highly cropped area within Lombardy southern plain, with about 1400 samples harbours soils from 6 USDA orders: Alfisols (42.7% of the data), Inceptisols (40.2%), Entisols (10.3%), Vertisols (3.3%), Mollisols (2.2%), Ultisols (1.3%). However, the variability of the most important climatic predictors (such as temperature and rainfall) of soil properties in this area is scarce, and this, jointly with the lack of database harmonization, hampers the SOC accounting procedures by increasing the uncertainty of any in-situ models. Thus, there is a need to collate this information and to assess the potential use of the regional data as ensemble with LUCAS as a wider benchmark for mapping the local soil properties. Among soil properties, SOC plays a pivotal role in maintaining the soil fertility and ecosystem services. As expected, LUCAS sampling sites rarely match with LOSAN ones, and this does not allow for direct per-situ comparison of SOC. In the present work, the cropland average SOC contents of LUCAS and LOSAN data were compared by soil order (Lombardy pedological map 1:50.000) by means of spatial analysis in GIS, in order to better to provide detailed estimates. The direct comparison between LOSAN (14.8 g kg-1$\pm$0.192 on 1407 data) and LUCAS (17.5 g kg-1$\pm$0.139 of 69 data) grand mean of the cropland SOC showed a difference equal to 2.7g kg-1. Unstandardized residuals of the LOSAN and LUCAS SOC values on aggregated soil orders were even lower: Alfisols (2.0 g kg-1), Inceptisols (2.2 g kg-1), Entisols (7.2 g kg-1), Vertisols (4.2 g kg-1), Mollisols (6.3 g kg-1), Ultisols (12.7 g kg-1). Further analysis will enhance the knowledge on legacy data and their utilization in soil accounting and monitoring procedures at local and national scale. The spatial analysis was the first step of a comprehensive study that will encompass the geostatistic analysis of the two databases using other environmental spatial data. Further steps will focus on improving SOC estimates by integrating regional legacy inventories with European soil surveys.

[1] Orgiazzi et al., 2017. LUCAS Soil, the largest expandable soil dataset for Europe: a review. Eur. J. Soil Sci. doi:10.1111/ejss.12499