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Vis-NIRS sensor fusion for local, regional and global calibrations of SOC content

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The considerable potential of sensor fusion has been recognised and is finding application in soil mapping. Visible-near-infrared (Vis-NIR) diffuse reflectance spectroscopy (DRS) has proven to be an efficient method for measuring soil physical, chemical and biological properties.
The objective of this study was to determine whether a Danish national soil spectral library spiked with local samples can give better SOC predictions than the regional or local calibrations alone.
It was also investigated if the national library developed using a laboratory sensor can be used to predict field-generated data by the mobile sensor platform (MSP).
Local and regional SOC models were based on data obtained from individual fields and from the compilation of the data obtained from six fields in one model, respectively.
The prerequisite for using vis-NIR for soil analysis is the development of a soil spectral library. Such library should be based on representative samples for the future application. We selected 2851 samples from a diverse archive of Danish soils and perform a global calibration. Additionally, the national spectral library was spiked with some local samples obtained from the fields under study. Local, regional and global spiked SOC models were compared. The best results from the partial least squares regression (PLSR) were obtained for the regional calibration (RMSEP=0.39, r2=0.93 and RPD=4), followed by the calibrations from the library spiked with local MSP measurements (RMSEP=0.38, r2=0.84, RPD=2.5). Finally, kriging maps of SOC content were validated. The highest root mean square error of prediction (5.4) was generated by the map based on the regional calibration model. The lowest RMSEP (4.1), however, was found for the map generated from the global library spiked with the local samples acquired by MSP. The results from this study show that the national spectral library established using a laboratory sensor can deliver good predictive abilities of SOC on field-acquired data only after spiking with local data obtained by the MSP.