Geophysical Research Abstracts
Vol. 19, EGU2017-382-1, 2017
EGU General Assembly 2017

Towards mapping soil carbon landscapes: issues of sampling scale and transferability

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The conversion of point observations to a geographic field is a necessary step in soil mapping. For pursuing goals of mapping soil carbon at the landscape scale, the relationships between sampling scale, representation of spatial variation, and accuracy of estimated error need to be considered. This study examines the spatial patterns and accuracy of predictions made by different spatial modelling methods on sample sets taken at two different scales. These spatial models are then tested on independent validation sets taken at three different scales. Each spatial modelling method produced similar, but unique, maps of soil organic carbon content (SOC%). Kriging approaches excelled at internal spatial prediction with more densely spaced sample points. Because kriging depends on spatial autocorrelation, kriging performance was naturally poor in areas of spatial extrapolation. In contrast, the spatial regression approaches tested could continue to perform well in spatial extrapolation areas. However, the problem of induction allowed the potential for problems in some areas, which was less predictable. This problem also existed for the kriging approaches. Spatial phenomena occurring between sampling points could also be missed by kriging models. Use of covariates with kriging can help, but the requirement of capturing the full feature space in the map remains. Methods that utilize spatial association, such as spatial regression, can map soil properties for landscape scales at a high resolution, but are highly dependent on the inclusion of the full attribute space in the calibration of the model and the availability of transferable covariates.