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Broad-scale digital soil mapping with geographically disparate geophysical data: a Swedish example

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Digital soil maps are produced by deriving functional relationships between soil point data ('measured) and spatially contiguous ancillary data sources (e.g. elevation, gamma radiometrics) using a multitude of data mining methods. However, it is often the case that ancillary data sources occupy differing spatial extents within the area of study, which results either in the exclusion of ancillary data sources with limited spatial coverage or a constriction of the area study in accordance with the coverage of the ancillary data. Here we present an example of a DSM application utilizing geophysical data with greatly differing geographical extents.

The work focuses on the provision of spatial estimates (and their uncertainties) of soil properties affecting pesticide leaching (e.g. texture, organic carbon). The study area encompasses all arable land in the southern half of Sweden. The point data comprises 2,200 topsoil (0-30cm) samples, with a sampling density proportional to the arable land coverage. Aerial prospecting (Geological Survey of Sweden) has yielded a number of geophysical data sources (γ radiometrics, magnetic susceptibility, electromagnetic induction (EMI) etc) which are available with greatly differing spatial coverage (γ – radiometrics $\sim$100% coverage vs. EMI $\sim$ 40% coverage). Terrain attributes and a digital elevation model (50m x 50m) were also available for calibration against point data. Using the estimates of topsoil texture and organic matter content, combined with existing parent material (quaternary geology) maps for the subsoil at a scale of 1:50,000 (with near-complete coverage), each pixel was probabilistically classified according to a simple hydropedological scheme that groups soils according to the risk of pesticide leaching. The ultimate goal is to link this hydropedological map to a GIS-based pesticide fate model currently under development in order to predict leaching risks at scales ranging from small catchments to the entire country.