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The importance of parent material information derived from globally available small scale legacy data for soil mapping at medium scale

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Up to now, harmonized global soil information is solely available from the FAO-Unesco Soil map of the world at 1:5M scale (FAO-Unesco 1974-1981). However, for monitoring global environmental changes and sustainable land resource management, higher resolution soil maps are urgently needed. At the global scale, the soil forming factors climate, soil parent material (SPM) and topography can be considered the most important parameters for spatial prediction of soil associations and their properties. While topographic and climatic information is available at high spatial resolutions, SPM information can only be derived from small-scale geological maps or soil maps. The objective of this study is to investigate the potential of commonly available SPM data derived from small scale soil and geological maps for soil mapping at the 1:250k scale. The study was conducted for a test site in Southern Saxony, Germany, 140*85 km wide, representing diverse soil landscapes. Additionally, SPM maps were derived from a reclassification of the geological overview map of Germany at 1:1M scale, and the European Soil database. The proposed SPM classification, developed in the framework of the EU-FP7 eSOTER project, is based on the degree of SPM consolidation, its geochemical character, and the major bedrock types. In addition, SPM-related surface processes are characterized since SPM is defined here as the original lithological material before the onset of weathering and soil formation processes.

To assess the potential of SPM data for the spatial delineation of soil associations, random forest-based predictions of soils and its properties were carried out using relief attributes from digital elevation model data. Model runs were performed (i) with and (ii) without spatial information on SPM properties. The outputs were compared with independent soil information of model validation areas. Training and validation point data was selected from a comprehensive dataset representing more than 14.000 samples. The data mainly includes information on soil types and their substrates. For more than 800 sample sites, additional soil data on texture, pH, exchangeable cations, nutrients, and efficient cation exchange capacity are available. Our study demonstrates the extend SPM information derived from legacy data is capable to enhance the spatial prediction of soil associations and their properties as e.g. texture or cation exchange capacity. We conclude discussing potentials and limitations of SPM information derived from small-scale geological and soil maps.