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Mapping of complex soil properties at global scale

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Relevant soil information at different scales would greatly help addressing many of the Sustainable Development Goals. Digital Soil Mapping is an established methodology to create maps of soil properties at different resolutions and extents. Many projects across the globe have provided information on primary soil properties, such as soil textural fractions, soil organic carbon content, cation exchange capacity and soil pH. For environmental modelling and assessment, maps of complex soil properties are also important. These can be defined as properties that cannot be measured directly in the laboratory but are derived from primary soil properties, for instance by simple calculations, pedotransfer functions or more advanced spatial analyses. Examples are available water capacity, soil carbon density and stocks, as well as soil erodibility. There are two main approaches to map complex properties: 1) “model first, interpolate later”, where the complex property is first calculated at point locations where the primary properties are known and then mapped; and 2) “interpolate first, model later”, where the complex property is calculated from maps of the primary properties contributing to it.

We present and discuss these two approaches for global applications using legacy data with a non-uniformspatial distribution of observations and the SoilGrids workflow. We compare the results for available water capacity of the 0 to 100 cm depth interval and soil carbon densities for six depth layers. Both properties were derived from a combination of simple calculations for point locations where the input soil properties were available and pedotransfer functions for other point locations where basic soil properties were available. There were substantial differences between the “model first, interpolate later” and “interpolate first, model later” approaches, both in point-wise evaluation metrics and in landscape patterns.