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Mapping soil texture targeting predefined depth range or synthetizing from standard layers?

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There are increasing demands nowadays on spatial soil information in order to support environmental related and land use management decisions. Physical soil properties, especially particle size distribution play important role in this context. A few of the requirements can be satisfied by the sand-, silt-, and clay content maps compiled according to global standards such as GlobalSoilMap (GSM) or Soil Grids. Soil texture classes (e. g. according to USDA classification) can be derived from these three fraction data, in this way texture map can be compiled based on the proper separate maps.

Soil texture class as well as fraction information represent direct input of crop-, meteorological- and hydrological models. The model inputs frequently require maps representing soil features of 0-30 cm depth, which is covered by three consecutive depth intervals according to standard specifications: 0-5 cm, 5-15 cm, 15-30 cm. Becoming GSM and SoilGrids the most detailed freely available spatial soil data sources, the common model users (e. g. meteorologists, agronomists, or hydrologists) would produce input map from (the weighted mean of) these three layers. However, if the basic soil data and proper knowledge is obtainable, a soil texture map targeting directly the 0-30 cm layer could be independently compiled.

In our work we compared Hungary's soil texture maps compiled using the same reference and auxiliary data and inference methods but for differing layer distribution. We produced the 0-30 cm clay, silt and sand map as well as the maps for the three standard layers (0-5 cm, 5-15 cm, 15-30 cm). Maps of sand, silt and clay percentage were computed through regression kriging (RK) applying Additive Log-Ratio (alr) transformation. In addition to the Hungarian Soil Information and Monitoring System as reference soil data, digital elevation model and its derived components, soil physical property maps, remotely sensed images, land use -, geological-, as well as meteorological data were applied as auxiliary variables.

We compared the directly compiled and the synthetized clay-, sand content, and texture class maps by different tools. In addition to pairwise comparison of basic statistical features (histograms, scatter plots), we examined the spatial distribution of the differences. We quantified the taxonomical distances of the textural classes, in order to investigate the differences of the map-pairs.

We concluded that the directly computed and the synthetized maps show various differences. In the case of clay-, and sand content maps, the map-pairs have to be considered statistically different. On the other hand, the differences of the texture class maps are not significant. However, in all cases, the differences rather concern the extreme ranges and categories. Using of synthetized maps can intensify extremities by error propagation in models and scenarios. Based on our results, we suggest the usage of the directly composed maps.