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Using landform classification to improve the interpolation of soil taxation point data

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This research examines an approach to use soil taxation point data to create improved soil quality maps at high resolution for applications such as precision farming or site-specific research.

In Austria, a systematic soil quality survey with the goal to guarantee a uniform base for taxation purposes is carried out by the fiscal authorities; these data offer detailed soil information on all agricultural areas in Austria at high resolution (about 50x50m sample raster). The data acquisition process consists in collecting soil samples at the defined raster, rating them, and extracting areas of homogenous soil quality classes based on expert knowledge and relief. As the whole nationwide dataset is based on a standardised data collection and rating method, it can be very useful for applications other than taxation. However, usually only the generalised areal (polygon) data are being used, while the potential of the original point data has not yet been fully utilised. This is particularly critical, as the polygon maps suggest discontinuities between soil classes where in reality there are continuous gradients.

The study area is located about 7km east of Vienna in the village of Rutzendorf (municipality Groß-Enzersdorf, Lower Austria) in the Marchfeld area, an alluvial plain of the Danube River. Although very flat, with only 4m elevation difference within the 150 ha study area, and homogeneous in terms of parent material, the area shows large differences in soil quality, ranging from 32 to 96 index points on a scale from 0 to 100

in the Austrian soil quality index for cropping ("Ackerzahl").

A digital terrain model at 1x1m resolution was derived from stereo aerial photos. Terrain parameters such as slope, profile curvature, relative elevation and topographic wetness index were used as auxiliary data for spatial interpolation of the point data.

Terrain data was also segmented and classified following a methodology previously developed, which was adapted to the characteristics of the study area. The following terrain classes were retained for further analyses: (1) Summit; (2) Shoulder; (3) Gentle slope; (4) Inclined slope; and (5) Footslope.

Two Universal Kriging models have been developed, one using only the above mentioned terrain parameters and the other also integrating the landform classification. The latter yielded in much better results and was comparable to manual interpretation.