Geophysical Research Abstracts
Vol. 17, EGU2015-3701, 2015
EGU General Assembly 2015

An objective and reproducible landform and topography description approach based on digital terrain analysis used for soil profile site characteristics

Fabian E. Gruber, Jasmin Baruck, Richard Hastik, and Clemens Geitner

University of Innsbruck, Institute of Geography, Faculty of Geo- and Atmospheric Sciences, Innsbruck, Austria (fabian.gruber@uibk.ac.at)

All major soil description and classification systems, including the World Reference Base (WRB) and the German Soil description guidelines (KA5), require the characterization of landform and topography for soil profile sites. This is commonly done at more than one scale, for instance at macro-, meso- and micro scale. However, inherent when humans perform such a task, different surveyors will reach different conclusions due to their subjective perception of landscape structure, based on their individual mind-model of soil-landscape structure, emphasizing different aspects and scales of the landscape. In this study we apply a work-flow using the GRASS GIS extension module r.geomorphon to make use of high resolution digital elevation models (DEMs) to characterize the landform elements and topography of soil profile sites at different scales, and compare the results with a large number of soil profile site descriptions performed during the course of forestry surveys in South and North Tyrol (Italy and Austria, respectively).

The r.geomorphon extension module for the open source geographic information system GRASS GIS applies a pattern recognition algorithm to delineate landform elements based on an input DEM. For each raster cell it computes and characterizes the visible neighborhood using line-of-sight calculations and then applies a lookup-table to classify the raster cell into one of ten landform elements (flat, peak, ridge, shoulder, slope, spur, hollow, footslope, valley and pit). The input parameter search radius (L) represents the maximum number of pixels for line-of-sight calculation, resulting in landforms larger than L to be split into landform components.

The use of these visibility calculations makes this landform delineation approach suitable for comparison with the landform descriptions of soil surveyors, as their spatial perception of the landscape surrounding a soil profile site certainly influences their classification of the landform on which the profile is situated (aided by additional information such as topographic maps and aerial images). Variation of the L-value furthermore presents the opportunity to mimic the different scales at which surveyors describe soil profile locations.

We first illustrate the use of r.geomorphon for site descriptions using exemplary artificial elevation profiles resembling typic catenas at different scales (L-values). We then compare the results of a landform element map computed with r.geomorphon to the relief descriptions in the test dataset. We link the surveyors' landform classification to the computed landform elements. Using a multi-scale approach we characterize raster cell locations in a way similar to the micro-, meso- and macroscale definitions used in soil survey, resulting in so-called geomorphon-signatures, such as "pit (meso-scale) located on a ridge (macro-scale)". We investigate which ranges of L-values best represent the different observation-scales as noted by soil surveyors and discuss the impacts of using a large dataset of profile location descriptions performed by different surveyors. Issues that arise are possible individual differences in landscape structure perception, but also questions regarding the accuracy of position and resulting topographic measurements in soil profile site description.