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Geostatistical Analsysis of near-range soil DEMs

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Soil surface roughness, and its change over time reflect the size and stability of aggregates, and thus give an indication of the quality of the soil structure. Traditionally, random roughness is used as an index for soil surface structure and microtopography. However, random roughness ignores the spatial patterns of aggregate breakdown and crusting. This can lead to serious errors in assessing the change of roughness and soil condition over time and in erosion models. In this study, surface DEMs obtained with a laser profilometer were analysed geostatistically to identify more appropriate indices for roughness patterns on soil surfaces.

Soil sampled in the field after tillage was sieved and dry aggregate ranging from 2 to 10 mm in diameter were placed in free-draining trays and set at an angle of 10 degrees for the application of artificial rainfall. The trays were exposed to artificial rainfall for 5 minutes to 60 minutes. Following one week of drying at 25^{o}C, the microtopography of each tray was measured (2 mm intervals) using a laser profilometer. Based on these measurements digital surface models were generated and subsequently analysed using variograms (sill variance and range), while also being used to generate measures of random roughness. The aim of the geostatistical analyses was to determine the level of spatial dependence in the microtopography of each of the soil surfaces in question.

Randon roughness showed similar values before the rainfall was applied and after 60 minutes, with a marked increase at 5 minutes of rainfall. Variogram range reached a peak after 15 minutes of rainfall of rainfall, indicating that the soil surface showed the greatest degree of spatial clustering at this stage of the crusting process. In the later stages of crust formation, sample variograms returned to a similar spatial character as that before the rainfall. Range declined during the 60 minutes of rainfall. These developments of sill variance and range distingusih the more homogenous na-

ture of the control surface (no rainfall) and the soil in its crusted form, as opposed to its heterogeneous intermediate form. Random roughness was not sensitive to these changes in crust condition over time. The sensitivity of sill variance and range to theses differences in spatial patterns makes them therefore much better suited than random roughness to describe the dynamics of soil surface conditions during crusting. Next steps involve the use of roughness parameters derived from sill variance and range in interrill erosion models.