Geophysical Research Abstracts
Vol. 12, EGU2010-4036, 2010
EGU General Assembly 2010

A gradient-based approach for clod segmentation

olivier chimi (1), edwige vannier (1), odile taconet (1), richard dusseaux (1), and sylvie le hégarat-mascle (2)
(1) LATMOS, Université de Versailles-St Quentin, IPSL, Vélizy, 78140, France (edwige.vannier@latmos.ipsl.fr), (2) IEF/Université Paris-Sud, 91405 Orsay, France (sylvie.le-hegarat@u-psud.fr)

It is acknowledged that surface micro-topography has a large impact on soil properties. Therefore a few studies have focused on surface roughness, soil height changes, and soil cloddiness characterization. The parameters estimated on soil measurements are mostly based on statistics characterizing the surface as a whole. The shortcoming of such approach is to miss some local soil height changes and non-stationarities.
The present study introduces a new method to identify clods on a seedbed surface digital elevation model (DEM). It relies on the search of a specific kind of object with a priori known properties. An individual clod, immediately after tillage, is assumed to be represented by a bump, with highest gradients located on the edges, more or less near its base, depending on its shape. Given that we work with an image of heights (DEM image), then clods are recognizable as structures presenting rather medium or high grey level values, but inside clods grey level values are non homogeneous. Therefore, classical approaches of segmentation based on the search of homogeneous regions fail. Methods based on edge detection or combining both approaches in a global criterion fail as well since these edges are present not only at clod base but also inside clods. Thus, a specific algorithm was developed to search the clods on a DEM. The first step is the selection of the pixels of highest gradient values using the hypothesis that plausibly clod boundaries would go through some of these points. The second step is the hierarchy of the elevation contours. Clod boundaries are the biggest level lines, according to inclusion ordering, including only one smallest inner contour.
This method of clods segmentation was assessed with the help of a soil scientist and was applied to compute clods characterizing parameters. Two kinds of tilled soil surfaces were included in this study: an artificial surface made in the laboratory to have a controlled roughness and a real seedbed surface made by tillage operations in the field. We also studied the impacts of the main parameters of the method. Indeed, two main parameters (number of selected pixels and minimum length of the elevation contour) have an influence on the identification performance and on computer time. A compromise needs to be found between a moderate computer time, a good detection rate and a low false positive rate. Furthermore, the method is also sensitive to the three dimensional height gradient computations (with first- and second-order errors) and the performance of the algorithm is assessed according to computation choice. The algorithm does not seem to be applicable to the identification of aggregates smaller than 7 mm on DEMs of 1mm sampling, which surely contain some noise measurement.
The main limit of the proposed method is the failure to identify clods embedded within another piece of relief that can be a greater clod or a hollow border. Indeed, the presupposition sustaining the segmentation is that the clods have an almost horizontal basis, around which it is possible to get a closed elevation contour. Its main interest is to provide a map of clods location and to enable shape measurements in order to characterize the clods.