Biogeosciences Discuss., 7, C2410–C2412, 2010
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Biogeosciences Discussions

Interactive comment on "A multifractal approach to characterize cumulative rainfall and tillage effects on soil surface micro-topography and to predict depression storage" *by* E. Vidal Vázquez et al.

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Received and published: 20 August 2010

We are thankful for your comments and are pleased to present our response. In fact the issues you mention have been somewhat addresses in the DGD manuscript. Now, in the final version the manuscript has been tightened up taken into account your questions. Point-to-point answers to these questions are as follows:

1) Several devices allow measurement of soil microrelief in field conditions at the millimeter scale, in contrast with pin meter, which collects point elevation data sets at the

centimeter scale. Examples are laser scanner and photogrammetric techniques and several works have been published since the 1990′s using data sets measured at the millimeter scale. More recently soil microrelief has been accurately measured using the shadow method Therefore, pin meter is considered now as a low technology device. However, new technologies are not available in many countries and in contrast, there are many data sets collected by pin meter, which is available since the 1960′s all over the world. In this sense, our work manuscript shows the aptitude of multifractal analysis to deal with data sets obtained by pin meter.

2) Data trends in point elevation measurements may be caused by local factors, such as local topography or by tillage tools. The concept of Random Roughness has been introduced by Allmaras et al (1960) to describe the portion of soil surface roughness associated with structural units at the soil surface, such as clods and aggregates, which are thought to be randomly disposed. Random roughness calculated after trend removal for topography and tillage tools allow comparison of data sets collected in different local conditions. There are now advanced methods of trend removal, such as wavelets for example. However the most widely used method of trend removal for tillage effects remain the classical method of Currence and Lovely (1970). We choose this method because it best allows comparison with previous studies of tillage effects in soil surface roughness.

3) We are aware that now in Brazil the most widely used soil management system is no-tillage. This notwithstanding we perform experimental work afyer conventional tillage, because of the associated higher level of roughness and water depression storage. Comparison of contrasting microreliefs such as those resulting from primary tillage and two successive tillage operations allow to asses the relationship between roughness kevels and spectral complexity.

4) The efficiency of temporal storage in depressions (MDS) in decreasing erosion risks depends on infiltration rates, but also on rainfall intensity. The big importance of this factor has been illustrated in Atlantic climatic conditions, considering that MDS may

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reach values as high as 13 mm, whereas most of the rainfall events are characterized by rainfall intensities lower than 10 mm per hour. In tropical and subtropical conditions rain intensities are much higher and, therefore, the impact of MDS as a management system to control soil erosion is thought to be more limited than temperate conditions. It should be taken into account the interactive effect of tillage system and crop residue management, which is of importance for the Brazilian conditions. There is only limited information about this issue and deserves further research. Also there are knowledge gaps on the potential effect of MDS on biogeochemical processes such as element transfer from soil surface to water bodies and partition between runoff losses or entrance into the soil profile of macro- and microelements.

Interactive comment on Biogeosciences Discuss., 7, 2099, 2010.