Interactive comment on "Scale effect on overland flow connectivity at the plot scale" *by* A. Peñuela et al.

Anonymous Referee #1

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General comments

The paper concentrates on a Relative Surface Connection (RSC) function to express the connectivity to the outlet (or outlet boundary in their rectangular fields) in function of the depression storage. The authors point out that distributed models use relatively large grid-cells and that most hydrological models assumed a maximum depression storage as a threshold before overland flow generation. This often leads to underestimation of the low flows at the initiation of the hydrographs. The paper focuses on scales from 0.18 to 36 m^2 for different width and length of rectangular fields. The results are based on simulations for one "real" field (Lidar measured high accuracy microtopography) and 3 alternative types micro-topography for synthetic fields. The title mentions a

plot scale, which also partially justifies the choice for rectangular fields. Unfortunately the maximum field length of 9 meter is low. It is not clear why the study did not try to incorporate larger lengths (like 100 m or more). Now this question is left open in the final paragraph of the conclusions. The concept of minimal representative scale (0.4 to 2.5 m depending on the case) is introduced. This appears logical and correct but for practical applications of the paper there is more interest in the larger scales (going up to the grid-cells, often in the order of magnitude of hectares or more, as used in distributed models). Moreover the small scale (maximum length of 3m) comes close to the minimal representative scale.

The calculation is based on a filling algorithm without considering infiltration and with an infinite velocity of flow. In this way the "routing" is instantaneous and they estimate the RSC directly as what they call a simplified hydrograph. A Maximum Depression Storage (MDS) is defined as a function of width. The "representative" width is defined as the width at which the MDS crosses the MDS value at infinite width + 10%. In a similar way a "representative" length is defined (be it at -10%). No explanation is given why 10 % and not any other value. Especially Figure 2 is quite informative showing the RSC function and the connectivity within the plots to the downstream outlet boundary. However, the discussion of this interesting phenomenon is only present in section 2.2 (Material and methods). This effect could have been more elaborated during the discussion.

It is shown that the same semi-variogram but with a different micro-topography pattern can lead to a different RSC function. This is an important conclusion. As expected the length has a major effect. The width had border effects but less scale effects. Border effects are probably the consequence of a rather artificial rectangular setting.

The major unanswered question is whether at larger lengths (25, 50 , 100 and more) the RSC functions are starting to converge or not. It would make the paper more interesting and with relevant practical consequences for distributed modeling if such larger scales were included. On synthetic plots this should not form a lot of extra work.

Specific comments

Structure of the paper could improve: as an example the definition of MDS and representative widths and lengths should not be presented within the results section. In the results section for synthetic fields no mention is made for results for the three types of surfaces.

Figure 1 (page 7902) is not informative in its current form. Possibly a longitudinal transect would make the concept of River versus Crater more clear.

There could be reduction in Figures. At this moment there are 17 moreover including composed figures.

The objective of introducing connectivity within a grid-cell for improving distributed modeling could be elaborated more so that the paper becomes more relevant in a general context.

The number of the references is relatively limited but appropriate for the content.

Technical corrections

The paper is in general well-edited.

Pag 7885 line 21: Formula 1 mentions that the plot width is in m however it appears in Table 2 (page 7900) that mm's are used. Please ensure consistency in units between the formula and the table.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 7877, 2012.