Hydrology and Earth System Sciences Discussions

Interactive
Comment

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

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AC: Author comment RC: Reviewer comment

AC: We would like to sincerely thank you for your valuable comments and suggestions. Here is our response to all specific comments raised:

RC: The authors have used a simple way to further puzzle apart sub-grid effects on overland flow. Unfortunately, the exercise is (almost 100%) in silicon but some interesting findings are here nevertheless. The most interesting one is the threshold like behavior of connectivity. This is what one would intuitively expect but it is interesting and good to see that that is shown in this analysis.

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RC1: Major comment What we probably would like to have for this effect is a dimensionless analysis with a strong predictive power with respect to the threshold. The authors go in that direction with the normalization but it is not a formal approach. So, what is the effect of slope? What of the Range & Sill (probably another spatial variability characterization than Kriging would be more open to a formal analysis)? The scaling lengths chosen are reasonable but the choices are not really well substantiated. They may want to consider doing that (=formal dimensional analysis) and writing the definitive paper. Alternatively, they maintain the present presentation but it would not be very strong if we then get a whole string of papers like "Effect of slope on connectivity". It is good to have this out in the open after which the community will hopefully do the rest. (Apologies for this late review, which did not help speed things up.)

AC1: The prediction of the percolation threshold is a very interesting question that we have left open since we have still not been able to completely relate the characteristics of the field with the values (Ratio of area connected and relative depression storage) that define this threshold. We are currently working on that subject and hopefully we will manage to link structural connectivity and functional connectivity by this threshold. Anyways, we have added some more specific information about this issue in the current paper, so the link between the percolation threshold and the characteristics of the field becomes clearer.

Regarding the suggested dimensionless analysis, we will maintain the current presentation due to the time constrains to submit the reviewed manuscript and also because we believe that the current format is still valid. However, we find the dimensionless analysis as a very interesting suggestion so we would like to apply it for future studies of connectivity and if possible, begin a collaboration with the reviewer in order undertake it.

RC2: Equation 1 is a very bad choice because you will always end up with a large (k) and a small scale factor. The scale factor is arbitrarily chosen. That is all just not a good idea. I see why it works but it is very far from elegant. Especially because

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the equation is (almost) exactly the same as b/w, with b=k * scale factor (really!). Not only do you get rid of the scale factor and get decent numbers for k, but this shows as well that you actually have a beautiful Pareto distribution! Given that depressions (well, at least lakes) are Pareto distributed we are maybe opening the direction of a more general analysis in that way.

AC2: Thank you for this valuable suggestion, we have accordingly modified the equation, obtaining the results that you have commented.

RC3: Minor comments p. 7879 l. 22: The real world is more complicated because the conductivity is spatially organized: rills tend to have low infiltration capacity and the runoff producing areas have a higher infiltration capacity. I understand that is not the topic of this article but it should be mentioned in the introduction, which is actually a bit verbose and not as to-the-point as one would want. Good work on this was done "across the road" and it would be good to mention it (for example, Langhans, doi: 10.1016/j.jhydrol.2011.01.005).

AC3: We have added a new reference in order to reflect this influence of surface morphology on the hydraulic conductivity of the soil.

RC4: p. 7880 l.10-11: Please take out the remark that calibration leads to equifinality. Poor science may lead to equifinality or lack of balance between data and model complexity. This statement is simply not correct. Also the wording about Manning etc. is far from the mark and it is very well understood how that all works from a hydraulic point of view. I understand that you want to make the case for your approach but you cannot do that by showing that you perhaps do not quite understand what the strengths and weaknesses of the other approaches are. You really do not have to put down other methods. You have a nice argument in your favor: Your method is simple and gives some nice results and the rest of us something to think about.

AC4: Thank you for this comment; we agree to remove this incorrect statement.

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RC5: The "C" mentioned first is not quite the same as the runoff coefficient because you do not take infiltration and flow dynamics into account. Better state that differently/make that very clear around l.15 on p. 7881

AC5: We agree to remove the reference to "C" as runoff coefficient.

RC6: p. 7883 l.10: The geostatistical parameters are different (natural vs artificial). Also here: The "definition" of connectivity pattern seems a bit circular/not very helpful.

AC6: We have modified this part in order to make clear that the parameters are equal for the artificial fields and to avoid the circular definition of connectivity.

RC7: p. 7883 l.25: Reader does not have an idea what normalization is. Very unclear part.

AC7: We have removed this part since it does not add useful information for the reader, the complete methodology is explained in the references (Zinn and Harvey, 2003; Antoine et al, 2009).

RC8: p. 7887 l.3 "width" instead of "with"

RC9: p. 7891 The analysis is bit too descriptive and repetitive with respect to other parts. Perhaps try strengthening the wording and shortening the text.

AC9: We have reduced the descriptive part.

RC10: p 7894, l. 20 leave out "have"

RC11: In addition to the sum of squares in Tables 2&3, also have a pseudo-R2, comparing modeled with measured because that is easier to interpret.

AC11: We have added this new value in the tables.

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