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Hydrology and Earth System Sciences Discussions

Interactive comment on "Estimation of overland flow metrics at semiarid condition: Patagonian Monte" *by* M. J. Rossi and J. O. Ares

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General Comments This paper combines field-based plot experiments with hydrological models in an attempt to understand changing conditions at the soil-water interface and derive overland flow parameters; a study within the scope of HESS. An intensive series of measurements was undertaken on ten small plots. Measurements were compared with modelling results, simulating movement of water through the soil-water interface. The study of overland flows in such semi-arid environments is central to attempts to understand hydrological fluxes over these complex surfaces, with substantial impacts for ecological processes and water resource management.

The main findings of this paper are not completely clear. While there does appear to be some novel aspects, these are difficult to elucidate on first reading. This is not

helped by unclear field descriptions and rather vague descriptions of the modelling technique in places. The language could be made more fluent and precise. Most seriously, some fundamental information is lacking. For example, the DEM resolution is not stated. The combined effect of vague description and missing information is to leave the reader unsure as to the significance of the stated findings. Additionally, greater effort could be made to place the study into context by discussing similar field and laboratory experimental work. Field experiments focus on water supplied to a single point and examine the presumably unsteady flows emanating from this point - what does this tell us about overland flows in general? What are the limitations of this field method? Such questions are not addressed in the manuscript.

The paper describes the balance between saturated and unsaturated infiltration over the experimental plots and highlights the importance of depressional storage in determining this balance. Given this result, further description of the process of calculating surface depressional storage would be appropriate. Statistical relationships are also identified, but I am uncertain of their significance without further explanation. Specific comments on each section are provided below.

Title This needs a tighter focus reflecting the main thrust of the paper, beyond the rather uninformative 'overland flow metrics'.

Abstract This needs tightening up with a greater focus on the novelty of the study. More specific results should be introduced. It is unclear what exactly the field experiments consist of (especially with regard to water supply), while results are only briefly and vaguely presented at the end.

P5838 L2 - WIOF is introduced here, but only used once more in the entire paper (two lines later). This seems unnecessary. L4 - relevance of overland flow. This is just one aspect of the relevance of overland flows. L8 - remove 'descriptive' L16 - Chezy rather than Chezy's L19 - what exactly is depression storage intensity? L20 - again, why infiltration 'intensity'? L22 - shift from semiarid to arid regions. L22 - overland flow

velocities modelled here, but 'speed' mentioned on L17. L22 - replace 'as well as' with 'and' L25 - what exactly is meant by 'theoretical' here? L27 - specify what is meant by 'measurable characteristics of the surface soil and overland flow kinetics'. Perhaps specifics would illuminate this. L27 - point (3) is not a finding P5839 L2 - 'probably relevant'? Suggest deletion from (3) onwards.

Introduction Overall, this provides a sound background to the study. Some key overland flow plot experiments (both in laboratory and field settings) are not discussed, which would be helpful to contextualise the study. These include:

Dunkerley 2004. ESPL 29, 1011-1026. Gimenez et al., 2004 ESPL 29, 105-114 Various high-resolution lab experiments reported by Huang Legout et al. 2012 ESPL DOI: 10.1002/esp.3220 Smith et al. 2011. Hydrological Processes 25, 842-860. Tatard et al., 2008 J Hydrology 348, 1–12 Various field experiments by Abrahams and Parsons (two are cited)

Other relevant references have been mentioned in specific points below. Another issue is that the purpose and novelty of the study, and the intended outcomes require substantial clarification.

L6 - 'some of the upper soil properties' is vague L8 - Köhne is missing an e. L20 - 'from the same variables'. Although most readers will be familiar, stating which variables will add clarity. P5840 L7 - sentence does not make sense L22 - Be clear that Latron and Gallart study is not in Mexico but was conducted in the Pyrenees. L25 - Cammeraat (2002) ESPL 27, 1201-1222 has done some interesting work on this. P5841 L4 - no need for 'topographically' (also L5) L8 - reword 'several evidences' L14 - 'the' Richards equn L16 - Green-Ampt rather than Ampt's (also below for Saint-Venant) L18 - last sentence in paragraph seems out of place L24 - some recent work on modelling depth distributions of overland flows includes Parsons and Wainwright (2006) HP 20, 1511-153 and Smith et al. 2011 Geomorph. 125 402-413. P5842 L8 - plot experiments 'are' often used L11. Darboux et al. (2001) Catena 46, 125-139 examines exactly

this. L11 - remove 'would predominantly' and second 'would' in sentence L15 - ...or various studies estimating DS from surface roughness measurements L24- ...'that' can be quantitatively... L25 - overland flow movement? L25 - the purpose of the study is a little vague here L28 - '...microtopography on plot-scale infiltration-overland...' L29 - again, exactly what you are estimating and why remains too vague. P5843 - I would remove this last sentence.

Field Experiments

Ten plot-scale experiments are described. While these take place along a transect and we are supplied with co-ordinates, a map of the geographical relationship between these would be instructive. do they represent a range of conditions or are they suggested to be equivalent? Although pictures are provided, these are not especially clear. The geometry of the experimental setup needs clarification; perhaps a schematic diagram would achieve this. Was the input nozzle above the soil or resting on the soil? Why choose a single point water supply? How does this compare with rainfall simulations? A large range of input flow rates were applied. Why was this? Table two reveals that most inflow rates are clustered at either end of this range, leaving a gap of an order of magnitude. What was the rationale for choosing the inflow rate at each plot? As these comments suggest, the overall sampling design is rather unclear.

The method describes the acquisition of a high-resolution topographic dataset using stereophotogrammetry. Although a reference is cited here, insufficient detail is afforded to this process in this paper. At a most basic level, the resolution of the resulting DEM is not stated. Validation of the DEM extraction technique is noted, but again, there is little description of the validation method ('optical level/staff procedure' is all we are told). How reliable this method is, how the two methods compare and even the number of elevation validation points acquired are not given.

L24 - 'on' days with P5844 L4 - what are these algorithms? Further details are required here. L5 - 'at the mentioned spatial scale'?? L9 - what was the surface area covered

in the images? L10 - a 'zero discharge condition'? L14 - what is a proper angle? L15 - 'and neighbouring dry points.' P5845 L2 - parameters need to be defined L12 - 'further to a krigging algorithm' - reword this (also, 'kriging') L16 - rather a range of time intervals here. Nowhere is the time interval used at each plot presented, so all we know is that it is somewhere between 6 seconds and four minutes! L17 - are there any reported errors for ortho-rectification? L25 - this ratio is rather unclear. How was DS measured? A rather fundamental point - this needs substantial expansion. I'm not sure what the reference to Antoine et al. (2011) represents here. Surely there would be more DS than represented by upward-advancing wet areas at these time steps? Perhaps not at this scale...

Model This is generally clearly described, although I find the notation rather confusing in places.

P5846 L7 - O(t) - out of where? L16 - change with time P5847 L7 - I would not normally include the multiplication sign in equations L10 - (and all other equations) define parameters using sentences rather than listing in parentheses L11 - why state H2O? L24 - 'instantaneously stored at the overland flow'? P5848 L13 - what boundary conditions? L17 - number sub-section L23 - 'which were used as model input'. I do not follow this. Is this not discussing model validation? L24 - rather than 'variable 9/10', why not state the variable itself? P5849 L25 - again, the text is difficult to follow around these equations L28 - equation (12) - what does this calculate exactly? and why? Variable on l.h.s. is different to that in the notation after the equation. Is that correct? P 5850 L4 - is the variable of integration missing from equ (13)? Rather than representing a runoff coefficient, this includes all water stored in depressions - is that correct? L9 - why is there a reference to Figure 2 here? L27 - define the meaning of asterisks.

Results The description of results is free from interpretation and is reasonably clearly described.

P5850 L25 - is this not validation rather than calibration? P5851 L1 - what kind of pre-

cision could you expect with the optical level? L15 - is the equation necessary? Really this defines concordance rather than correlation. P5852 L13 - is there not circularity in the re-d* relationship, since d* is involved in the calculation of Re? L16 - why is 'standardized variables' in parentheses? i'm not sure of the meaning of some of these relationships (the v* relationship seems quite obvious).

Discussion The meaning and usefulness/significance of the statistical relationships presented in 5.2 is still unclear to me. Perhaps this could be further expanded upon.

P5853 L2 - has the effect of spatial variability of microtopography really been addressed here? Also, what is meant by infiltration-overland flow intensities? L17 - 'Abrahams' L21 - 'those would behave' - reword. Suggest changing the regular use of 'would' here. P5854 L14 - 'over all the' P5855 L1 - clearly these are unsteady flows being described? L5 - in a statistical sense L10 - perhaps clarify the exact meaning of C again here. L18 - semi-arid is hyphenated here, but one word elsewhere. L19 - 'type of environment'

Conclusions Again, (3) is not a finding.

Tables and Figures

Table 1 - So the linear regression model with these parameters is really a test of concordance rather than correlation? What do the asterisks represent? Compartments require a little explanation.

Table 2 - this presents a lot of data. While I can follow this, any simplification would be appreciated. 'Average run of speed'?

Figure 1 - Images in this version are quite pixelated and difficult to see, (b) are flow arrows simply derived from the DEM? Which algorithm is used?

Figure 2 - This appears rather smoothed, especially when compared with the clearly rough surface in Figure 1. Again, the resolution of the DEM would be illuminating here. The spatial distribution of z errors seems rather related to elevation and is especially related to the two areas of high elevation in the plot. Is there an occlusion issue or

something here? Or is it more related to gradient?

Figure 3 - this is especially clear and informative.

Figure 4 - Depth is in cm which conflicts with mm used elsewhere in the paper. Perhaps restate that zf is the infiltration depth for clarity. The core pictures are quite poor. A sketch of the depth (and lateral variation) might lead to a more professional figure.

Figure 5 is out of sequence and should become Figure 3. Rather than using arrows, I would state which symbol corresponds to which variable in the legend.

Figure 6 - state meaning of asterisks in caption.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 5837, 2012.