

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

Dear Reviewer #1: Please find below our replies to all your comments. Since some of them suggested the need to add paragraphs or reorder some text sections, we are also uploading a complete new revised version (**R1**) of the paper. All our replies refer to Page-Line of the **R1**.

Notes: **RC** = Review comment, **AC** = Author comment. References to Current Version (**CV**) within P5837-5869.

***RC:** *"The language could be made more fluent and precise."* **AC:** All style suggestions were carefully considered in preparing the **R1**. ***RC:** *"...some fundamental information is lacking. For example, the DEM resolution is not stated."* **AC:** Detailed information about the DEM is given (see below). ***RC:** *"...greater effort could be made to place the study into context by discussing similar field and laboratory experimental work."* **AC:** See detailed **ACs** to specific points below. ***RC:** *"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?"* **AC:** See new section 5.1. ***RC:** *"further description of the process of calculating surface depressional storage would be appropriate."* **AC:** Done. See **P9L29-P10L2**. ***RC:** *"Title. This needs a tighter focus reflecting the main thrust of the paper, beyond the rather uninformative 'overland flow metrics'."* **AC:** Title reformulated, metrics identified.

***RC:** *"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"* **AC:** Abstract reformulated to address novelty, detail on specific results and water supply issues. ***RC:** *"L2 - WIOF is introduced here, but only used once more in the entire paper (two lines later). This seems unnecessary."* **AC:** WIOF dropped. ***RC:** *"L4 - relevance of overland flow. This is just one aspect of the relevance of overland flows."* **AC:** Reformulated. See **P2L2-L4** ***RC:** *"L8 - remove 'descriptive'."* **AC:** Done **P2L7**. ***RC:** *"L16 - Chezy rather than Chezy's"* **AC:** Done **P2L15**. ***RC:** *"L19 - what exactly is depression storage intensity?"* **AC:** Reformulated as depression storage areas **P2L17-L18**. ***RC:** *"L20 - again, why infiltration 'intensity'?"* **AC:** Reformulated as "rate" **P2L19**. ***RC:** *"L22 - shift from semiarid to arid regions"* **AC:** Both are considered. See section 2.1. ***RC:** *"L22 - overland flow velocities modelled here, but 'speed' mentioned on L17"* **AC:** Reformulated as "velocity" throughout **R1** ***RC:** *"L22 - replace 'as well as' with 'and'"* **AC:** Done. **P2L24** ***RC:** *"L25 - what exactly is meant by 'theoretical' here?"* **AC:** Detail of variables given. **P2L21-L22**. ***RC:** *"L27 - specify what is meant by 'measurable characteristics of the surface soil and overland flow kinetics'. Perhaps specifics would illuminate this."* **AC:** Reformulated, specifics included. **P2L21-L22**. ***RC:** *"L27 - point (3) is not a finding"* **AC:** Reformulated. ***RC:** *"L2 - 'probably relevant'? Suggest deletion from (3) onwards."* **AC:** Relevance justified through biogeography similarity. See Section 2.1.

***RC: P5839 "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." **AC:** References were considered, and inserted where pertinent. Novelty and purpose discussed in Abstract and section 5.1 of the **R1**. Specific purposes see **P6L11-L14** ***RC:** "L6 - 'some of the upper soil properties' is vague". **AC:** Reformulated (microtopography) **P3L2**. ***RC:** "L8 - Köhne is missing an e." **AC:** Done. **P3L6** ***RC:** "L20 - 'from the same variables'. Although most readers will be familiar, stating which variables will add clarity". **AC:** Done. **P3L18-L19. P5840** ***RC:** "L7 - sentence does not make sense". **AC:** Reformulated **P4 L1-L3**. ***RC:** "L22 - Be clear that Latron and Gallart study is not in Mexico but was conducted in the Pyrenees". **AC:** Cleared. **P4L17**. ***RC:** "L25 - Cammeraat (2002) ESPL 27, 1201-1222 has done some interesting work on this". **AC:** Reference included **P4L19. P5841**. ***RC:** "L4 -no need for 'topographically' (also L5)" **AC:** Dropped **P4L27, L28**. ***RC:** "L8 - reword 'several evidences' ". **AC:** Reworded **P4L30**. ***RC:** "L14 - 'the' Richards equn" **AC:** Done **P5L3**. ***RC:** "L16 - Green-Ampt rather than Ampt's (also below for Saint-Venant)" **AC:** Done **P5L5, L10**. ***RC:** "L18 - last sentence in paragraph seems out of place" **AC:** Please clarify your point. The whole § is about infiltration. ***RC:** "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". **AC:** References included in Discussion, see **P19 L12, L31. P5842**. ***RC:** "L8 - plot experiments 'are' often used" **AC:** Done. **P5L25** ***RC:** "L11.Darboux et al. (2001) Catena 46, 125-139 examines exactly this". **AC:** Reference included. **P5L28**. ***RC:** "L11 - remove 'would predominantly' and second 'would' in sentence" **AC:** Done. ***RC:** "L15 -...or various studies estimating DS from surface roughness measurements" **AC:** Reformulated **P5L31-32**. ***RC:** "L24- ... 'that' can be quantitatively... " **AC:** Done. **P6L8**. ***RC:** "L25 - overland flow movement?" **AC:** Reworded **P6L9** ***RC:** "L25 - the purpose of the study is a little vague here" **AC:** Section reformulated See **P6L7-14**. ***RC:** "L28 - '...microtopography on plot-scale infiltration-overland...' ". **AC:** Reformulated **P6L12**. ***RC:** "L29 - again, exactly what you are estimating and why remains too vague. **AC:** Parameters specified **P6L12-13**. ***RC:** **P5843** - I would remove this last sentence. **AC:** Done.

Field Experiments. ***RC:** "Ten plot-scale experiments... do they represent a range of conditions or are they suggested to be equivalent?".**AC:** Plot description reformulated. See **P7L23-27**. ***RC:** "The geometry of the experimental setup needs clarification. 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? **AC:** Geometry of setup further clarified See **P7L27 to P8L3**. ***RC:** "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?" **AC:** See sec. 2.1 (Rainfall regime) for justification of the range selected and **P8L1-3**. ***RC:** "... insufficient detail is afforded to this process (stereophotogrammetry) in this paper. ... the resolution of the resulting DEM is not stated... there is little description of the validation method... ('optical level/staff procedure' How reliable this method is, how the two methods compare and even the number of elevation validation points acquired are not given." **AC:** DEM resolution informed at **P9L5**, details on the optical level/staff method included **P9L9-14**. A reference for the full description of the method in a specialized journal is also given **P9L3**. ***RC:** "L24 - 'on' days with" **AC:** Done **P7L25. P5844**. ***RC:** "L4 - what are these algorithms? ". **AC:** Details given **P8L2-3**. ***RC:** "L5 - 'at the mentioned spatial scale'?" **AC:** See DEM resolution **P9L5**. ***RC:** "L9 - what was the surface area covered in the images? **AC:** See setup description **P8L6** ***RC:** "L10 - a 'zero discharge condition'?" **AC:** Correct. No discharge occurred from the plot microbasin. All run-off turned into run-on at the end of the experiments. See **P8L9-10**

***RC:** "L14 - what is a proper angle?" **AC:** Reworded **P8L13**. ***RC:** "L15 - 'and neighbouring dry points.'" **AC:** Done **P8L14 P5845**. ***RC:** "L2 - parameters need to be defined". **AC:** Parameters defined **P8 L29-32**. ***RC:** "L12 - 'further to a kriging algorithm' - reword this (also, 'kriging')". **AC:** Done **P9L8**. ***RC:** "L16 -... . Nowhere is the time interval used at each plot presented... ". **AC:** Time intervals specified **P9L15-21**. ***RC:** "L17 - are there any reported errors for ortho-rectification?" **AC:** RMSE reported. See **P9L23**. ***RC:** "L25 - this ratio is rather unclear. How was DS measured?". **AC:** reformulated **P9L27 to P10L2**. **P5846**. ***RC:** "L7 - O(t) - out of where?" **AC:** "O" stands for "overland", (not "out") please re-read term definitions below the formula **P10L19**. ***RC:** "L16 - change with time" **AC:** Done **P10L23**. **P5847**. ***RC:** "L7 - I would not normally include the multiplication sign in equations" **AC:** This is probably an editorial issue to be handled at due time by the editorial house. ***RC:** "L10 - (and all other equations) define parameters using sentences rather than listing in parentheses". **AC:** Done throughout **R1**. ***RC:** "L11 - why state H2O?" **AC:** Dropped. ***RC:** "L24 - 'instantaneously stored at the overland flow'?" **AC:** Reworded **P12L7**. **P5848**. ***RC:** "L13 - what boundary conditions?". **AC:** Reformulated **P12L24**. ***RC:** "L17 - number sub-section" **AC:** Done. ***RC:** L23 - 'which were used as model input'. I do not follow this. Is this not discussing model validation? **AC:** Yes. ***RC:** "L24 - rather than 'variable 9/10', why not state the variable itself?". **AC:** Done **P13L6-L8**. **P5849**. ***RC:** "L25 - again, the text is difficult to follow around these equations". **AC:** Suggestion to P5847 L10 followed throughout. ***RC:** "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?". **AC:** Meaning described below eq. 12. Typo corrected. **P 5850** ***RC:** "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?". **AC:** Formulation expanded to make variable explicit. Your interpretation is correct. This is now explicitly stated at the text **P14L11-12**. ***RC:** "L9 - why is there a reference to Figure 2 here? **AC:** Reference dropped. **P 5851** ***RC:** "L27 - define the meaning of asterisks". **AC:** Statistical significance explained in text **P15L28**.

Results P5850. ***RC:** "L25 - is this not validation rather than calibration?" **AC:** Reformulated **P15L3**. **P5851** ***RC:** "L1 - what kind of precision could you expect with the optical level?" **AC:** See **P9 L12-14**. ***RC:** "L15 - is the equation necessary? Really this defines concordance rather than correlation". **AC:** Note that eq. corresponds to the null hypothesis H0. The actual fit is obtained through least squares regression of Type I. The procedure does not involve concordance evaluation (Lin, 1989, Biometrics 45:255-268) **P5852** ***RC:** "L13 - is there not circularity in the re-d* relationship, since d* is involved in the calculation of Re?". **AC:** No circularity is involved. The independent variable v* is also involved in Re calculation (see Table 3). ***RC:** "L16 - why is 'standardized variables' in parentheses? **AC:** The relations described correspond to standardized transformed variables.

Discussion ***RC:** "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. **AC:** Please clarify your comment. Statistical relations are not presented in 5.2 but in 4, and discussed in 5.2. **P5853** ***RC:** "L2 - has the effect of spatial variability of microtopography really been addressed here? **AC:** Yes, but please clarify your comment. ***RC:** Also, what is meant by infiltration-overland flow intensities?" **AC:** "Intensity" replaced through "rates" throughout **R1**. ***RC:** "L17 - 'Abrahams'" **AC:** Done **P18L25**. ***RC:** "L21 - 'those would behave' - reword. Suggest changing the regular use of 'would' here". **AC:** Sentence reworded **P18L30**. **P5854** ***RC:** "L14 - 'over all the'" **AC:** Done **P19L18-19**. **P5855** ***RC:** "L1 - clearly these are unsteady flows being described?" **AC:** Yes ***RC:** "L5 - in a statistical sense" **AC:** Done **P20L5**. ***RC:** "L10 - perhaps clarify the exact meaning of C again here." **AC:**

Done **P19L28** ***RC:** "L18- semi-arid is hyphenated here, but one word elsewhere." **AC:** "Semi-arid" throughout. ***RC:** "L19 - 'type of environment'" **AC:** Done **P20L19**

***RC: Conclusions** "Again, (3) is not a finding". **AC:** Number 3 dropped

Tables and Figures

***RC:** "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. **AC:** See **AC** on concordance issue to ***RC P5851** "L15" above. Meaning of asterisks now explained in Table legend. ***RC:** "Table 2 - this presents a lot of data. While I can follow this, any simplification would be appreciated. 'Average run of speed'? , **AC:** Will be glad to follow suggestions on simplifying Table 2, Typo corrected. ***RC:** "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?" **AC:** Fig 1a inset re-designed. ***RC:** "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?. **AC:** See **P9L5** for DEM resolution. Note that there is no consistent bias of z related to elevation. ***RC:** "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". **AC:** y-ordinate expressed in mm. We believe that field core photos are preferable to sketches. Lateral variation cannot be computed with CHEMFLO-2000 (one-dimensional model). ***RC:** "Figure 5 is out of sequence and should become Figure 3" **AC:** Reference to Figure 5 reordered in the text **P16L8**. ***RC:** "Rather than using arrows, I would state which symbol corresponds to which variable in the legend." **AC:** Please note that symbol-variable correspondence is already indicated, arrows are nevertheless still required to identify the proper axis for each variable. ***RC:** "Figure 6 - state meaning of asterisks in caption" **AC:** Done

Thank you for your comments and suggestions,

J. Rossi - J. Ares