

The manuscript entitled “Quantifying the changes of soil surface microroughness due to rainfall-induced erosion on a smooth surface” (Reference number NPG-2016-76) authored by B.K.B. Abban, A.N. Papanicolau, C.P. Giannopoulos, D.C. Dermisis, K.M. Wacha, C.G. Wilson, and M. Elhakeem presents results from a simulated rainfall experiment consisting of applying three different intensities to a smoothed bare soil surface. Authors calculated two widely-used indicators of surface roughness and discussed the implications of their results for modelling approaches.

The reported work is interesting and fits within the scope of *Nonlinear Processes in Geophysics*. However, the manuscript has an unusual organization and authors mixed methods with results and discussion. Moreover, relevant information is missing from the Materials and Methods section. Another major concern that I have after reading this manuscript is the feeling that authors overestimated the relevance of their results and reached conclusions that are not sufficiently proven by their data, especially because of the number of events that they experimented (only three, one per rainfall intensity with no replications). Finally, a few English mistakes must be corrected.

In the following lines, I provide the authors with some suggestions in order to improve their manuscript. They must correct them in order that this manuscript achieves the standard quality for being published in *Nonlinear Processes in Geophysics*.

Therefore, I recommend the rejection of this manuscript. However, if the editor feels that the research presented is of interest, I made a great number of comments and suggestions in the following pages.

#### **Specific comments to the authors:**

*Abstract:*

*The abstract must be greatly improved.*

*Page 1, lines 13-14: “in agricultural landscapes”, this is too general and does not describe what you have done. You did not study all agricultural landscapes, even not a few of them, just one and adapted to the smooth surface conditions that you were interested in.*

*Page 1, line 17: “representative intensities”, representative of what? For instance, 75 mm/h is a very high intensity; does it frequently happen in your region?*

*Page 1, line 21: I would remove “for initial microroughness length scales of 2 mm” since this is already stated in line 15 and you did not study any other length scales.*

*Page 1, line 22: How can your results contradict literature when you have said that there is no literature for the surface conditions you have assayed?*

*Page 1, line 23: “Analysis shows”, what analysis?*

*Page 1, lines 23-24: This last sentence must be re-phrased and a conclusion should be added.*

### *Introduction:*

*This section is well-written and provides enough information about the background of the presented work.*

*Page 1, line 29: You could remove “reported in the literature”.*

*Page 2, line 4: “From the outlined above” instead of “From the classes outlined above”.*

*Page 2, line 7: What is “scape”? Is this a mistake? Should it be “scale”?*

*Page 2, line 8: I am not sure if “enhancing” is the right word here.*

*Page 2, line 10: I do not understand why you cite Paz-Ferreiro et al., 2008 here. Besides, according to the reference list, Allmaras (1966) should be Allmaras et al. (1966).*

*Page 2, line 21: “Few to none”? Not sure about this.*

*Page 2, line 22: “This condition”? Do you mean less than 2 mm?*

*Page 2, lines 22-23: Here you say that initial microroughness scales less than 2 mm is the prevalent condition in agricultural hillslopes. However, I am not so sure that this is the prevalent state.*

*Page 2, lines 25-28: This portion of text about the models is not very well linked with the rest of the introduction. Moreover, you cite three studies. Huang and Bradford (1992), Rosa et al. (2012) and Zheng et al. (2014) that stated that RR increased with rainfall, but later you do not discuss your results in the light of these three studies, why?*

*Page 2, lines 29-30: This is already stated in the former paragraph.*

*Page 3, lines 3-9: This is a little bit messy from my viewpoint. Moreover, the two last sentences can be removed.*

### *Materials and Methods:*

*This section lacks from essential information. Do you have any replication of each experiment? Did you perform only one set of measurements per experiment? It is not clear what geostatistical analysis has been performed.*

*Page 3, line 12: Maybe, you should give the geographical coordinates and elevation of your study area.*

*Page 3, line 14: What do you mean by “mixed, superactive”?*

*Page 3, line 18: “to the plots”, how many plots?*

*Page 3, line 25: “widely accepted”, by whom?*

*Page 3, lines 27-29: This statement is too strong, even though rainfall characteristics were similar, other regions may have different soil types than the one studied here. What are the potential biases you are referring to in this sentence?*

*Page 3, line 32: I would substitute “a priori the runs ensured that” for “before the runs confirmed that”.*

*Page 4, line 1: This seems more like a result than materials and methods.*

*Page 4, line 3: What is CCD?*

*Page 3, line 5: I would use “by software” instead of “from the desktop, using a computer program”.*

*Page 4, line 7: Please, provide the names and references for the specific software used.*

*Page 4, line 12: Remove “experimental” before “tests”.*

*Page 4, lines 12-13: Change the sentence to “Rainfall intensities were respectively 30, 60 and 75 mm/h for experiments 1, 2 and 3”.*

*Page 4, line 14: Is the duration of your rainfall events the same of the storms you are referring here? In fact, 75 mm/h during 5 hours means 375 mm in 5 hours, which seems too much. What is the return period of these events? I mean, are these storms really so usual?*

*Page 4, line 15: “Decagon soil moisture sensors”, specify depth, how many and model.*

*Page 4, line 16: What do you mean by 35%? What is the field capacity of this soil? Please, specify.*

*Page 4, line 29: Remove “By definition”.*

*Page 4, line 31: “extracted” instead of “extract”.*

*Page 4, line 32: “were” instead of “are”.*

*Page 5, line 2: What is “its commonality found in the literature”?*

*Page 5, line 3: “was used” instead of “is used”.*

*Page 5, lines 8-12: This is not clear to me. Did you use all these methods? At the end of the sentence you say “among others”, what do you mean? Do you imply that you used more methods than those indicated here?*

*Page 5, line 14: I would split this sentence in two. Instead of “with the advantage of its quantification being scale independent”, I would use a point and then “It has the advantage of being scale independent”.*

*Page 5, line 16: “the semivariogram is a useful...” I do not think this sentence is really needed.*

*Page 5, lines 22-25: it seems rather peculiar that you explain what a semivariogram is but not what the Hurst exponent indicates.*

Page 5, line 28: “and  $0 < H < 1$ ”, this should come before, when you refer to  $H$  and not after the crossover length.

Page 5, lines 32-33: I did not understand this sentence. Please, re-phrase it.

Page 6, lines 1-4: Could you, please, re-phrase this paragraph? I do not understand it properly, it is a bit confusing.

#### *Results:*

Page 6, lines 6-14: This looks more like materials and methods than results.

Page 6, lines 12-14: Have these comparisons been performed against literature data? Did this literature provide ratios?

Page 6, line 20: Have these experiments been performed only once?

Page 6, lines 21-23: Please, re-phrase this. It seems redundant.

Page 7, lines 4-5: How did you check this significance? Only by stating that difference is less than 10%?

Page 7, line 6: “representative semivariogram”, that corresponds to which angle?

Page 7, line 7: “semivariograms” instead of “semivariogram”.

Page 7, lines 10-11: “which is considered sufficient to assume no spatial autocorrelation at the scale examined in this study”, I do not get this; you checked all roughness for the 200 mm, so you should have accounted for lag distances less than 10 mm.

Page 7, lines 16-17: “pre-rainfall values” instead of “pre-rainfall value for all three intensities”.

Page 7, line 18: I would use “events” instead of “precipitation intensities”.

Page 7, line 19-20: Please, check English and re-phrase this sentence.

Page 7, line 22: Remove “in existing literature”.

Page 7, line 24: “reported” instead of “report”.

Page 7, line 25: “found” instead of “in the crossover length reported”.

#### *Conclusions and Discussion:*

This section is very weak and should be greatly improved. Besides, it should be entitled “Discussion and Conclusions”.

Page 8, line 2: Are you sure that these experiments are “unique and novel”. I am also concerned

*about the fact that you state that your experiments “mimic natural rainfall conditions” but you never described those natural rainfall conditions.*

*Page 8, lines 5-6: “which are confirmed as reliable descriptors of microroughness”; this is already known.*

*Page 8, lines 7-9: I have doubts about this, you only performed your experiment once and considered a small surface where raindrop detachment prevails over runoff; were the same conditions in the other studies? Did they consider only raindrop detachment?*

*Page 8, lines 11-12: What are the implications of this?*

*Page 8, line 13: “Roughness residuals infer depression storage residuals”, what do you mean?*

*Page 8, lines 15-20: I am not sure about this. Your results come from a limited number of experiments and you are implying that they have a strong importance in various disciplines and applications... it seems overestimating your findings.*

*Page 8, lines 21-23: This must be further explained, I do not see your point.*

*Page 8, line 24: Remove “study’s”.*

*Page 8, lines 23-25: I really think that you are overestimating your results.*

*Page 8, lines 27-29: Yes, alright but is the initial roughness less than 2 mm? Besides, you indicate that Intensive Managed Landscapes have bare soil 75% of the time; it looks not very intensive...*

*Page 8, line 33: “landscape response to precipitation”; however, your study refers only to 200 mm<sup>2</sup> surface... is this not overestimating your results?*

*Page 9, line 1: Again overestimating the importance of your results. How this slight increase in RR may affect erosion processes?*

*Page 9, line 4: This needs, at least, a reference.*

*Page 9, line 5: “new statistical analyses”, what statistical analyses did you perform?*

*Page 9, line 6: I am not sure about what you mean by “is present a priori”.*

*Page 9, line 7: “in the current paper” instead of “in the paper”.*

*Page 9, line 9: “is improved for current models”, do you mean that is already done in current models?*

*Page 9, lines 11-12: “extension of the experiments in areas such as downslopes where concentrated flow and rilling are of importance” That you did not want to account in your study although you could have done in view of the surface of your experimental plot.*

*References:*

*Eight references are not cited in the text. Please, check them and also edit the reference list according to the journal guidelines.*

*Page 10, lines 17-18: Chu et al. (2012) is not cited in the text.*

*Page 10, lines 20-23: Why did you use upper-case letters for the title of these publications?*

*Page 10, line 27: Why did you use capital letters for CATENA?*

*Page 10, lines 30-31: Why did you use upper-case letters for the title of this publication?*

*Page 11, lines 1-3: Le Bissonais (2016) is not cited in the text.*

*Page 11, lines 4-5, 10 and 17-18: Why did you use upper-case letters for the title of these publications?*

*Page 11, line 23: Why did you use capital letters for SOIL ORGANIC CARBON DYNAMICS?*

*Page 11, line 28: Potter (1990), this reference does not follow the style of the journal; the year of publication should come at the end.*

*Page 11, line 29: Why did you use upper-case letters for the title of this publication?*

*Page 11, line 32: Why did you use capital letters for CATENA? Besides, Römken et al. (2002) is not cited in the text.*

*Page 12, lines 4-5: Remove the quotation marks.*

*Page 12, lines 8-9: Vázquez et al. (2006) is not cited in the text.*

*Page 12, line 11: Remove “European Geo-sciences Union (EGU)”.*

*Page 12, lines 15-17: Vázquez et al. (2010) is not cited in the text.*

*Page 12, lines 18-19 and 25-28: Why did you use upper-case letters for the title of these publications?*

*Page 12, lines 22-28: Zhao et al. (2014), Zhao et al. (2016) and Zheng et al. (2012) are not cited in the text.*

## *Figures*

*Figure 1: Modify the caption to “(a) Types of soil surface microroughness. (b) Experimental plot. The rainfall simulator is placed above the bare soil surface and a base made of wood is put into place to facilitate the movement of the surface-profile laser scanner”.*

*Figure 2: Modify the caption to “Setup of the experimental tests: (a) Rainfall simulators are mounted in series and a pump provides them with water from a tank; (b) rainfall simulators are placed and adjusted at a height of 2.5 m above the experimental plot surface to ensure drop terminal velocity is reached”.*

*Figure 3: Indicate in the caption the interpolation technique that was used.*

*Figure 4: Why not a and b as in the former figures and you used left and right? You should define*

*ROI in the caption. Besides, why “part”? If the whole experimental plot was 7 x 1.2 m is the whole plot what you are representing in the right-hand side of the figure and not only part of it.*

*Figure 5: Remove “considered herein”. I think that you do not need to include experiments 1, 2 and 3 if you indicate the rainfall intensity. Remove the border of the figure and the second decimal from the Y-axis.*

*Figure 6: Remove “Spatial” and “considered herein”. Use “region of interest” instead of “ROI”.*

*Figure 7: Remove “considered herein”. I think that you do not need to include experiments 1, 2 and 3 if you indicate the rainfall intensity. Remove the border of the figure and the second decimal from the Y-axis.*

*Tables:*

*Table 1: Since the only difference amongst experiments was the rainfall intensity, this table can be removed and the information can be included in the text.*

*Table 2: You can use the rainfall intensities instead of the name of the experiments. Did all these authors perform their experiments on soils similar to yours? What were their rainfall intensities? I cannot see how you can compare them if they were different.*

*Table 3: The same comments as figure 2.*