

***Interactive comment on* “Structural and functional control of surface-patch to hillslope-scale runoff and sediment connectivity in Mediterranean-dry reclaimed slope systems” by Mariano Moreno-de-las-Heras et al.**

**Anonymous Referee #1**

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**General comments:**

In this paper presents a promising way to put the theoretical concept of structural and functional hydrological connectivity into practice by evaluating the connectivity between patch- and hillslope-scale with innovative measures for hydrological connectivity. Definition and measures of hydrological connectivity is an important field of hydrological research and offers additional value for sedimentological and geomorphological research. This study uses a threshold for vegetation cover combined with a high resolution digital elevation model to derive a measure for structural connectivity. Func-

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tional connectivity was determined for a defined precipitation event as the ratio of runoff/sediment contributions from the hillslope scale to the corresponding contributions on a virtual hillslope represented the integrated patch-scale contributions. Functional hydrological and sedimentological connectivity was successfully modeled using a generalized linear model. Model predictors included various measures of precipitation data as well as the structural connectivity measure. Surveyed data, methods and results contribute to the understanding of hydrological processes and the practical use of the hydrological connectivity concept in the Mediterranean-dry. Thus, I recommend the publication after the revision of this manuscript.

Specific comments:

Line 14: The first sentence is very general: “multiple factors”, “variety of spatial scales”, “variable degrees of connection”. The sentence is also closely related to the second sentence. I suggest to merge the content in one precise sentence. You may also introduce the “Mediterranean-dry reclaimed mining slope systems” here to avoid confusion with the term “systems” later and also introduce an abbreviation for the full term for later in the text.

Line 15: Connection or connectivity?

Line 15: “In these systems” – there are no systems defined before.

Line 16: movement of water, runoff is already moving water.

Line 18: The sub-sentence beginning with “or the extent to which...” interrupts the reading flow, I suggest to transfer the sub-sentence into a second sentence.

Line 21: Same as line 18, better breaking the sentence into two parts, or leaving out the sub-sentence “determined as...”. This leaves space to mention the GLM model in the abstract.

Line 21: “...was further explored...” may be changed to e.g. “...was calculated as...”.

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Line 22: The sentence may be rephrased like “Functional hydrological connectivity during precipitation events was found to be dynamically controlled by antecedent precipitation conditions and rainfall intensity and further strongly modulated by the structural connectivity of the slopes”

Line 24: “On slopes without rill networks, both runoff. . .

Line 25: “analyzed systems”: there are no defined systems, may use e.g. hillslopes or research slopes

Line 29: transference of both “water” and sediment (without yield).

Line 34-40: These sentences are very close to the first sentences of the abstract. Rephrase either of them.

Line 36: Connection or connectivity? See also line 15. Please be specific about the terminology and definition of hydrological connectivity (also line 42).

Line 46: could be misread as “transfer of sediment fluxes”. Better just “transfer of water and sediments” or “fluxes of water and sediment”.

Line 47: I suggest to use: “the activation of connections of runoff. . .”

Line 47: I suggest not to write “In the case of runoff. . .” but “Functional connectivity of runoff depends on the dynamics. . .”. Also I suggest to split this sentence to have one sentence for the runoff sub-sentence and one for the sedimentological.

Line 52: Leave out the “For example,”

Line 55: Leave out the “In fact,”

Line 56: In stead of “terraces) controls” may use “ were shown to control” also: “from a structural connectivity perspective”

Line 63: This sentence may needs to be rephrased. The strength of the transport vector may be important for the sedimentological functional connectivity for pure hydrological

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connectivity the establishment of a water flux between the patches of the landscape already represent fully functional connectivity between those patches no matter how big the flux is.

Line 65: “to determine the initiation of runoff and thus, the transport of water and sediments. . .”

Line 76: You could make use of an abbreviation from line 14 here.

Line 81: to my understanding the routing of runoff is part of the structural connectivity while the processes which cause infiltration/excess of water to initialize, maintain or interrupt the flow of water is part of the functional hydrological connectivity.

Line 84/88/91/95: Use abbreviation for the slope system.

Line 91: “transference of water. . .” Either Line 101 or as is in Line 129: Add a short sentence like: “The field work was accomplished between October 2007 and November 2008.” After mentioning the dates of the survey no need for further repetition of the dates during the methods/results/discussion e.g. line 124/126. . .

Line 103: Sentence is incomplete and does not make sense.

Line 105: Just: “Remarkable is. . .”

Line 115: This sentence suggests that Slope 2 also has significant amounts of overland flow and erosion, which to my understanding is not the case.

Line 121-125: This may also part of the results section.

Line 127: Already mentioned that in the abstract and introduction. No need to have that long introduction here for the methods.

Line 130: “...Merino-Martin et al., 2012a), that included naturally delimited runoff/erosion plots distributed at the (i) hillslope and the (ii) surface-patch scale.”

Line 136-139: You mention Fig. 1d and 1f but not 1e. Usually the parts of the figures

are described according to their alphabetic order. Either restructure the text or the figure.

Line 140-143 & fig. 1f: Categories for the species would increase direct readability of the figure. E.g. *Medicago sativa* (Ms – A), *Dactylis glomerata* (Dg - B), *Santolina chamaecyparissus* (Sch - B),...

Line 150-151: Sedimentological methods, may adjust header of the chapter to field measurements.

Line 153-169: Climatological, soil hydrological and statistical analytical methods mixed. I suggest to split the statistical part from the pure data acquisition part. A table showing an overview of the climatological statistics would be beneficial also for the introduction of the predictors for the GLM later on.

Line 171: “Previous research carried out...” (References missing!).

Line 172: Why using a range here when a non-dynamic threshold of 50% is applied?

Line 179: (0.5m resolution)

Line 184: “To this end,” is a fill word and can be deleted.

Line 199: Maybe better: “...until a sink (i.e. >50% vegetation cover) or the outlet of the system is reached.” And “outlet of the system is reached” is unclear which system patch or hillslope? In general, introducing a figure to illustrate the different steps of the calculation and also the use of mathematical symbols and equations to clarify the calculated ratio in line 201 could help to increase understanding for the reader.

Line 206: “Mean  $Sc$  values ( $(Sc) \bar{I\ddot{E}}$ )...”: The mean should be indicated by a dash above the whole symbol of which the mean is calculated.

Line 209-214: Again a repetition of the introduction sentences. It would be sufficient to leave it to very short general introduction sentences for the sub-headers in the methods.

Line 213: I recommend to stick with functional connectivity to stay within the framework of hydrological connectivity and not switch between spatial continuity and functional connectivity. Within the methods functional connectivity should be defined for this study.

Line 214-220: Same as for structural connectivity: Figure and mathematical structure could help to increase understanding. Both connectivity measures could be visualized next to each other in one figure.

Line 233-238: This may not belong in the section under the header functional connectivity but in a section of statistical analysis.

Line 234: No need to mention the dates of the study period again.

Line 239: Same header as previous sub-section. Needs to state the statistical modeling/analysis.

Line 240-248: Have you checked for correlations among the predictors. The predictor set used in a GLM should not have high correlated predictors.

Line 240: As stated above (line 153-169) a table for the predictors would be helpful. This could be referenced here instead of “(Dp, Rd, I15, I30, and Im)”

Line 243: I suggest: “We modeled Cr and Cs using a generalized linear model (GLM, Christensen, 2002) approach with an automated stepwise backward model selection.” Which link function did you use? Which program was used to implement the model and model selection?

Line 259: “This fact violates...” the relation of the “this fact” is unclear. I guess you mean the values of  $>1$  for Cs. But the sentence ends with the values  $<1$  for Cr which is not a violation against the GLM assumptions.

Line 260: either reference the suggested table again or may write “...transformation to the climatological co-variables...”

Line 263/265: no need to mention the vegetation cover again as it is defined in the

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methods.

Line 269/276/279: “not physically linked”/ “physical contiguity” you mean “were not connected”/ “structural (functional) connectivity”?

Line 271: “...largely interfering the structural connection...”

Line 277: “almost 50%”?

Line 278: “...lower (12% for Slope 2 and <1% for Slope 3)...”

Line 283: “Functional connectivity of runoff across scales showed important differences...” The information in between was previous mentioned in the methods.

Line 285: “... decreased from the [...] hillslope-scale from Slope 1 to Slope 3 (Figure 3a)”.

Line 288: “that 72% of...”

Line 289: “...of the system and 28% of the runoff was redistributed or re-infiltrated.”

Line 290: Please just use the precise numbers here and not “less than” etc.

Line 305: “(Cs=0)”

Line 306: “...other events at Slope 1 hillslope-scale...”

Line 369: could be use of the abbreviation for Mediterranean-dry r.s.s.

Line 382: The large differences between Slope 2 and 3 were not pointed out in the results.

Line 424: “... largely controls the functional connectivity of the runoff responses...”

Line 461-463: The differences might also be explained by differences in temporal resolution of the precipitation measurements.

Line 497: “...movement of water...”

Line 502: This sentence has a very complicated structure. I suggest to re-write the sentence and may break it into two. You also mention rills as “preferential pathways” in your conclusions. This topic could be a little bit more emphasized in the discussion as it is a dominant element for the generation of runoff and sediment fluxes.

Technical corrections:

Line 43: “were proposed” instead of “have been proposed”

Line 68: “Several research approaches were applied. . .”

Line 696: Year missing. Link of public access of the review available?

Fig. 4: versus in captions needs to not italic

Tables:

A table summarizing predictor variables for the GLM would be beneficial. Figures:

Fig. 1a: The local map could be enlarged compared to the overview map of Spain.

Fig. 1e: The setup is hard to see in the images. Taking the lower part of the left image may would be sufficient. Adding a schematic may would be helpful.

Fig. 1f: Colored classes or class indication with capital letters for the dominant species of the three hillslopes could help to connect the species to the related hillslopes. If colors are used they can be also used to indicate the corresponding slopes in Fig. 1b and d.

Fig. 2-5: Please adjust the color scheme to suit the needs of colorblind. Testing the figures can be done by e.g. <https://www.color-blindness.com/coblis-color-blindness-simulator/>

Fig. 4/5: Abbreviations do not necessarily be explained in the captions.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019->

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