

***Interactive comment on “Erosion after an extreme storm event in an arid fluvial system of the southern Atacama Desert: an assessment of magnitude, return time, and conditioning factors of erosion caused by debris flows” by G. Aguilar et al.***

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Dears reviewer and editor, following I include specific responses to your comments and corrections. Attached pdf file is the corrected manuscript include all modifications. Thank you very much for your great contribution in ours manuscript. Best Wishes German Aguilar

Specific Answers to Reviewer 1

C1

Title: "erosion caused by debris flows": is it really the debris flows which caused the erosion, or is it the reverse way, or both?

[Reply] We change to « Erosion after an extreme storm event in an arid fluvial system of the southern Atacama Desert: an assessment of magnitude, return time, and conditioning factors of erosion and debris flows generation»

P2, L32: "On the other hand ...": Something is wrong with the structure of this sentence, please reformulate.

[Reply] Delete "On the other hand ..."

P3, L4f: How do you know about the different rheologies? Analysis of deposits, interviews with witnesses, ...?

[Reply] We change to « Analysis of deposits showed different rheologies of debris flows ranging from cohesive debris flows and hyper-concentrated flows to mud flows.»

P3, L7: lectors -> readers

[Reply] Change for "Readers"

P5, L2: time return -> return time

[Reply] Change for "return time

P5, L11f: If no debris flows were reported, does it really mean that no sediment was delivered to the trunk valley? Even though you use a rather broad definition of debris flow, there might still be some fluvial sediment transport.

[Reply] We include a threshold values of debris flow deposit: «Debris flows that reached the tributary junctions with the trunk valley and produced deposit greater to 500 m<sup>3</sup> of sediment during the March 2015 event were reported in forty-nine of one hundred twenty-four catchments (Fig. 4). The remaining seventy-five catchments did not yield debris flows deposits greater to 500 m<sup>3</sup> of sediments in the tributary junctions»

C2

tions»

P3, L24: Rills and gullies are not processes, but landforms - better replace "processes" by "indicators".

[Reply] Change for "indicators"

P5, L22f: What is the difference between slope and gradient?

[Reply] Gradient is the inclination of length between tributary outlets and its more distant point of catchment. Slope refer to average slope within a catchment. We include modification to clarify:

P3, L28,29: « Area, Length (straight-line between tributary outlets and its more distant point), Maximum elevation, Gradient (inclination of length), Average Slope, ..... »

P5, L21: « Group 2 integrates the catchment relief and includes Average Slope (S), Gradient (G) and Melton ratio (M). »

P6, L10: « The six topographic attributes (Area, Length, Strahler Order, Average Slope, Gradient, and Melton ratio) »

P5, L23: lineal -> linear

[Reply] Change for "linear"

P6, L12: "is added" should be removed.

[Reply] Removed "is added"

P6, L22-29: This paragraph should be moved to the section on the study area, as it represents some general information, not the results of the study.

[Reply] We include a subsection "Study area" in the corrected manuscript that contain this paragraph. This section contain others information to answer comments of R2 (T. Jordan) about the lack of geological and geomorphological context.

### C3

P7, L16: "Andean catchments": the Andes are thousands of kilometres long, please be more precise ("arid Andes of northern Chile", or whatever is suitable).

[Reply] We change to « Debris flows, hyper-concentrated flows and mud flows in arid and semiarid Andes of northern Chile during intense rainfalls are usually linked to an increase in the pore pressure of the surficial loose debris layer generating a shallow-slide in the hillslopes of catchments.»

P7, L21 and some other places in the manuscript: alluviated -> alluvial

[Reply] Change for "alluvial" in the whole manuscript

P8, L5f: "high latitude rainfalls": please mention to which region you refer exactly (Patagonia?)

[Reply] We change to « .....and rainfalls of southern Chile that exceed the accumulated rainfall during the March 2015 event in the Atacama Desert by ten times....»

P9, L4: "first phase of risk study inhabited areas": I don't understand this formulation.

[Reply] We change to « Susceptibility assessment to debris flow generation must be evaluated in hydro-meteorological hazard studies in populated area. »

P9, L10: Only in Chile, or is it relevant in mountain areas worldwide?

[Reply] We include «..... and in mountain areas worldwide (Mountain Research Initiative EDW Working Group, 2015).»

Mountain Research Initiative EDW Working Group. Elevation-dependent warming in mountain regions of the world. Nature Climate Change volume 5, 424–430, <https://doi.org/10.1038/nclimate2563>, 2015.

P9, L21: The recurrence time decreased (it is the frequency which increased).

[Reply] Change for "decreased"

P9, L33f: "The integration ...": I do not understand this sentence, please reformulate.

### C4

[Reply] We change to « The time period of denudation rates calculated by Aguilar et al. (2014) is between 20 ka for sand and 12 ka for gravels. »

P10, L27f: But how does the sediment get into the channels? On long (geological) time scales, hillslope processes probably play a role?

[Reply] We think that long-term geomorphological processes of catchments is not the subject of this specific work. We observed that the filling of some channel develops rapidly in some years after the storm based on observations made in a subsequent storm occurred in May 2017. So, it is not necessary so much time, since the slopes have enough sediment to fill the canals in a short time, in particular from sediment stored in the "flat" slopes of the head of the catchments, mainly from upstream the knickpoints. We think that this is another manuscript that need more long-term data (TCN and provenance studies).

Fig. 5 and Fig. 8: It could be interesting to see the R<sup>2</sup> -values in each of the diagrams.

[Reply] We include the R<sup>2</sup> of data in figures.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-239/nhess-2019-239-AC4-supplement.pdf>

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2019-239>, 2019.