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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Assessing the effect of lithological setting, block characteristic and slope topography on the runout length of rockfalls in the Alps and on the La Réunion island" *by* Kerstin Wegner et al.

Anonymous Referee #2

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The presented manuscript deals with the four analysed talus slopes and a thorough mapping of lithological characteristics, being deposited rock shapes and sizes and its influence on runout length. The manuscript presents itself thoroughly written and elaborated. The presented data is of very good quality and meticulously analysed.

The findings corroborate a complex interaction between analysed parameters such as rock shape, sphericity, slope characteristics, above all surface roughness. The authors aim to contrast the findings in previous work, which is highly favourable. As the findings are complex to trim into existing results, they fail to a certain extent to present the new

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aspects in a consistent way.

Main concerns: 1) Rockfall source and site consistency: The reasoning for the selection of the presented sites was not argued for. The impression, that those were randomly chosen sites due to logistic reason rather than careful scientific screeing is imminent. The authors state, that “For the two study sites PF and ZBT the blocks cannot be assigned to one single rockfall. Whereas the blocks of the other two study sites GA and DTS can be assigned to a rockfall event”. This is a key difference between the sites as the processes are significantly different. Single block fall as opposed to block fall with fragmentation as opposed to rock avalanches – here we would need to differentiate within the volume classes again – are governed by different kinematic behaviour. The authors are strongly urged to focus on these differences between their sites and comparing it to respective previous literature. Was gravitational sorting only seen on “single rockfall” talus slopes? Is the data quality good enough to argue for or against it?

2) Key finding: Altough it is highly appreciated to publish work not in line with previous findings, the discrepancies, differences, etc. are to be highlighted in a more consistent manner. Purely publishing a scientific “it’s complicated” is insufficient. The impression is that they applied plotting schemes and analysis methodologies found in previous literature in order to make comparison easier. This is certainly done with good intentions, but the meandering presentation of the results is suboptimal.

3) Link to surface roughness: The authors posess excessive data sets and high resolution DEM in particular. The publication quality would gain significance and make use of the available data set if sections 4.1 and 4.2 would be linken in a meaningful way. The link between surface roughness and block size/shape and runout length is a key factor in talus slopes. The naïve understanding of a rockfall propagating on a talus slope is, that as long as the roughness dimension, i.e. lying boulders, etc. is smaller than the travelling block axis length, the breaking effect is rather small. This data set would provide a perfect investigation basis for those dependencies. Runout length

vs. surface roughness, coupled with different shape classes, different masses. Rather then presenting a plain characteristicss of the talus slopes as in Fig. 5, the extracted correlations - if there are any – would be of interest for the NHESS community. In this line, the presentation of the analyses, in particular Figure 5 and 7 should be revised.

Generally, the presented manuscript might merit publication if the main concerns are addressed and presented in a consistent analysis. Contrasting results are desirable as they lead to a discussion in the community but a sound reasoning is a pre-requisite.

In the following there are some minor/technical/content corrections with might become obsolete after major revisions:

General comment on the use of parentheses: Clearly a matter of writing style, however, IMHO the excessive use of parentheses hinders the reading flow. Personal guidance is: if it's important, rephrase it into the written sentences, if it does not merit being included in the text, remove it. The authors might check their use of parentheses with this in mind, or discard it as the referee's spleen. Does not hold for introduction of acronyms, of course.

Figure font sizes: Revise the font size and general sizing of heavily loaded figures.

Abstract: l15: is explanation of LiDAR in abstract necessary? l19: no parantheses – if necessary, add it to text "... and longitudinal profile curves" l19-20: Start concluding sentences with what could be confirmed. l23,23: no acronyms in abstract.

1. Introduction L30: can be deposited on storage landforms such as talus slopes. If playing the devil's advocate one could argue that all rockfalls, which have space to be deposited on a storage landform are from a natural hazard's perspective irrelevant, as they do not threaten any infrastructure. l31ff Although citing relevant articles is a form of contemplating on previous work and arranging the presented work in the current state of the art research, citing it after a common senses statement like " a falling rock is dangerous" should be omitted. Rather cite something specific, if at all necessary to

include in such a general introduction. l39 probably “global climate change”, but is it really? Isn’t just the development pressure by increasing land use and a diminishing risk tolerance in societies in general the leading factors why natural hazards have to be mapped ever more accurately? And of course because the technical means improve constantly. . . L53 “conditions of the talus cone” → soil characteristics in general. The presented study focuses on runout on talus cones, but rockfall runout happens on more terrains than talus. L55: runout trajectory is predominantly governed by the impact conditions, geometrical boundary conditions and soil-rock interaction. Thus, the moment of inertia plays a role on the specific kinematical properties – meaning how fast can a rock spin, how reactive is a rock to slope ruggedness, etc - but ultimately does not alter significantly as a single leading factor the runout trajectory. L70 introduce the test sites with names and acronyms here.

2. Study Sites l85 Figure1: Are there aerial maps available for all sites? Or photographs in the same aspect ratio? The acessebilty of the image would improve if consistency with respect to aspect ratio, presentation style (arial with indicated releasa and depsostion area – or 1 photograph per site with a similar viewing angle. l90 Figure 2: Is a consistent presentation in one figure possible? L100 delete “show” or “ indicate” Table 1: totally aware, that formatting tables is a nightmare, but “centered” titles columns would improve readability. L135 x,y, z are variables – use italic font L137 z is a variabl, use italic font L139 points/m2 → pts/m2 as used in the table. Table 3: spaces in between the scan resolution values, referencing precision, use \cdot or similar for Number of points raw data set or 1.5e6 notation.

3. Determination of block size, block shape and runout length l144: a,b and c are parameters use italic font l146 every block with c > 0.5 m? Shortest axis large than 0.5 m? l150 Figure 3: I basically see a cuboid. If you really want to show how the bounding box of a given rock is defined, show a bounding box with labels around a rock. Wasting a figure to print a cuboid is a bit questionable. The NHESS reader should be able to imagine a bounding box around a rock though. L163: normalization of runout: is

the interval [0,1] defined as minimal, maximal runout or is it 0 = no runout meaning stopping in release area (which probably is not possible) and 1 is maximal measured runout?

4. Results and Discussionl L186 longest axis greater than 0.5 m? In the plot c is the shortest axis.. Clarify? A criteria on the resolution boundary, i.e. the smallest axis would make more sense. l217: Add labelling (1),(2), . . ., (6) in all subpanels. Figure 6: Are the depicted areas only the talus fan? Could some surrounding be included and the talus extent be marked with a dashed line equivalently as in Fig. 1? Colour code and scale range make the talus slope look quite uniform. Could the range be shortened and thus differences in the main talus deposition become more obvious? What is the slope inclination grid size base raster? Could the indications of steepness classes help the reader to classify the slopes visually more easily? L297ff Rockfall source apparently are two different processes: single block fall and rock avalanches. This fact changes the entire approach. Are differences due to this fact?

5. Conclusion L357 boulders with low axial ratios do also have a predominant rotation axis, as a perfect symmetric rock does not exist in nature. It rather has no large flat areas, hindering a re-acceleration after a landing on such a flat surface.

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