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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Combining temporal 3D remote sensing data with spatial rockfall simulations for improved understanding of hazardous slopes within rail corridors" *by* Megan van Veen et al.

Anonymous Referee #2

Received and published: 1 May 2018

Dear Editor, dear Authors,

this is an interesting and well written paper describing a methodology to make use of multi-temporal remote sensing data and rockfall simulations to create and refine magnitude-frequency relationships for rockfalls. The results can be used to determine the likelihood of hazardous events for different volumes and source zone locations. The methodology is applied to a rock slope along railway corridor to show its applicability. Nevertheless I see some points which could be improved in the manuscript (see specific comments below). In general I think the introduction could be elaborated

– references to previous studies/approaches and some comments in which aspects this paper goes beyond. A minor comment: you mostly write "frequency-magnitude" relationship throughout the text, but also use "magnitude-cumulative frequency (MCF) curve". I think the usage of "magnitude-frequency" relationship is more common, so it might be worth to homogenize this throughout the manuscript.

With best regards.

Specific comments

Section 2.1:

Please give some more information on the point cloud data like scan settings, achieved point density and alignment error. I expect that TLS and ALS data show quite different point densities.

You talk about the creation of a surface/slope model. From Fig. 2 it seems it is a raster model. Please add more information about how this model was created (interpolation method) and which cell size was used.

The same applies to the photogrammetric model, please add details.

Section 2.2:

You cite Jolivet et al. (2015) regarding the methods used for classification. Please add some more information on what these methods are, especially as this report seems to be difficult to access.

Figure 4: why are there gaps in the maps?

Section 2.3:

You cite van Veen et al. (2017) regarding the applied (semi-automatic) change detection methods. Please add some more information: which method was used to calculate distances/volumes (2D/3D, raster or point based)? How were individual locations de-

tected/delimited? Again, it would be interesting on which cell size these operations were performed (see above).

Please provide a small note (and not only in the discussion) that such a short time period of only 18 months may be problematic in order to establish a magnitude-frequency relationship. This also applies to the differences seen compared to the historical inventory (large events may be missing).

Regarding the high number of small events in the TLS data – might this be related to the alignment accuracy of the datasets (see above)? Did you apply a level of detection (LOD) threshold to distinguish between real change and measurement error?

Regarding rockfall locations and volume: are there any relationships between volume and GSI?

Section 3.3:

Figure 8: why do you show the minimum deposited volume (and not the worst case)? To make the differences in travel length with regard to block size more obvious? Please comment.

Figure 9: there seems to be a more or less strict order regarding the distance of the source zone from the track and the percentage of rockfalls deposited. Did you investigate if this could be related to the simulation model assumptions? I would have expected that GSI/roughness and changes in slope could result in a more heterogeneous result. Is it really just that there are only fewer complex geometrical features and fewer zones of talus present in the nearer sections?

Section 4.1:

How did you determine the bin size? In the example for the 0.1m3 volume class you use a bin range from 0.05m3 to 0.5m3. How does that match with your statement that the modelled volume is the central point of each bin? Is the bin size constant or differs the size for each modelled volume? Please comment.

Section 5/6:

Regarding rockfall fragmentation: from change detection you also know at which locations material has been accumulated. Did you balance the erosion / deposition volumes, and if so, how much do they differ? Did you compare the total area covered by either erosion or deposition? That might give a hint on fragmentation.

Technical corrections:

p. 8, l. 31: I think the “and” should be removed

p.12, l. 30: add missing line break

p. 13, l. 17: fix typo in “frequency”

Figure 1b: please add a scale bar

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