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Earth Surface Dynamics Discussions
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Interactive comment on "Reconstruction of three-dimensional rockfall trajectories using remote sensing and rock-based accelerometers and gyroscopes" *by* Andrin Caviezel et al.

Anonymous Referee #1

Received and published: 7 November 2018

General comments:

Caviezel et al. present the results of a series of empirical rock fall experiments, and present a new method for reconstructing 4D rock fall trajectories using a combination of photogrammetry and videogrammetry. The research is evidently well-planned and executed (and, as an aside, sounds like a lot of fun!). The paper is generally well-written, methods are (mostly) comprehensively described, the figures are of high quality, and the discussion is coherent. I recommend its acceptance subject to minor revisions.

As well as addressing my comments below, the authors should consider expanding the discussion to include consideration of the wider implications of the work. The work

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essentially showcases the results of a largely self-contained, manageable field experiment. But how well might the approach scale? Is it feasible, or might it be in the future, to upscale this to rockfall monitoring for an entire mountainside, and over an extended period of time, for example?

The paper is also light on references - the Discussion, for example, only contains a single citation. The authors should revisit this section, and discuss their findings in the context of the current literature and include additional references as appropriate.

Line-specific comments:

Title - I'd change 'three-dimensional' to 'four-dimensional', since the temporal aspect of the rockfall reconstruction is something that you have quantified, and spend a large portion of the paper describing and discussing.

Abstract – first line – not just useful for engineering hazard analysis, also valuable for investigating wider sediment cascade problems in steep terrain. The paper in general is written with the focus on rockfall hazard assessment, which is perfectly valid, but the implications of the work go further. The authors should acknowledge this, and spend a little time elaborating on the wider landscape evolution context in which the research sits - perhaps in the discussion.

P3, L6 – what were the forward and side overlaps for the UAV photography? What was the mean flying height or UAV-ground separation distance?

Discrepancy between detail provided for videogrammetric analysis (next para), and DSM derivation – need to expand former. How many photographs, what photogrammetry software, etc etc.

P4, L19 – this is a key sentence for the paper as a whole and should come much earlier, ideally in the introduction. It would even be an appropriate sentence to begin the entire paper with.

P7, L2 – OK, so WHY would someone want/need to reconstruct the flight parabola

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component of the rockfall trajectory? Expand this sentence a little to make this clear. You make reference to the use of jump heights for rockfall engineering in the Conclusion, but I'd suggest introducing this here.

Figure 3 – very nice, I like this a lot!

P7, L21 – sentence requires supporting references.

P8, L1 – for consistency, this is the level of detail you should go into earlier with regard to photogrammetric derivation of the slope topography. Please also include a reference to the precise version of PhotoScan that you used – perhaps place this reference earlier.

Also, were all photographs used to build a single, dense 3D point cloud, or were multiple point clouds generated (e.g. one per run)? It seems as though you only generate a single cloud, but this needs clarifying in the text. I'm a little confused on this part of the workflow, and readers may be too. It's impressive stuff, though, given the data volume.

Technical corrections:

- No technical corrections identified, aside from some careful proof-reading to improve the written English in a handful of places.

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