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Earth Surface Dynamics Discussions

Interactive comment on "Enhanced rockwall retreat and modified rockfall magnitudes/frequencies in deglaciating cirques from a 6-year LiDAR monitoring" *by* Ingo Hartmeyer et al.

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I greatly enjoyed reading this paper, especially the well referenced introduction that reminded me of the wide-ranging aspects of this challenging problem – quantifying rockwall retreat and erosion rates of headwalls above glaciers. The approach taken here is innovative and interesting and the results presented are compelling, though perhaps not as robust and broadly applicable as the authors assert. I believe that with relatively easy edits this will be a widely cited paper in studies tackling hazard implications of climate change as well studies tackling how quickly bedrock faces erode.

The journal is suitable and the paper is in pretty good shape.

A few suggestions that will make it a stronger contribution, I believe.

Firstly, this is a study compiling 6 years' worth of repeat LIDAR scans of the same glacial features. This needs to be explicitly addressed and acknowledged in the discussion of results as well as in the introduction. In the introduction, I suggest including a section distinguishing between long term average studies (e.g. ones that use cosmogenic nuclides in one way or another like Greg Stock's extensive work in Yosemite or the approach of Heimsath and McGlynn (Geomorphology, 2008)) and the shorter time scale ones that are reporting results from monitoring studies such as this one (note that the Alaska paper of O'Farrell, Heimsath et al. (ESPL 07) had a short section of converting scree deposit to rock retreat rates as an example of short term studies). In the discussion section, it would be helpful to have a more thorough examination of the inferred frequency magnitude curves given limits in the data. Extensive examples from the hydrological sciences address the time scale issue and perhaps some can be used as template for framing this discussion (apologies, while I remember reading such papers I don't remember who they were by – I was better versed in this literature years ago).

Second, I think a conceptual sketch/model to accompany Figure 2 would help a lot for visualizing how the authors tackle this problem. I found Figure 2 almost incomprehensible and if it had a sketch accompanying it that showed how measurements made in this study resulted in the inference of a retreat rate that would be great.

To this end, there really needs to be a better explanation of how these data are used to infer headwall retreat rates. Which areas were used and how exactly were the calculations done? What's the uncertainty on those calculations and what are the assumptions and simplifications? All of these questions could be illustrated in some way in a good conceptual model.

Similarly, I think there needs to be better justification for the log binning approach.

Given the short methods sentence addressing this I have no way to evaluate how good it is and whether it is justified. Does it introduce some bias? Convince me better that it does not with more analyses. The key question is whether it would make the reporting of results based on percentage of total rockfall volume quite different depending on how the sizes were binned?

Finally, the distinctions between this paper and its companion paper could be made more clearly.

Let me know if I can help clarify any of these points and I hope the above is helpful.

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