

Interactive comment on “Cosmogenic ¹⁰Be in river sediment: where grain size matters and why” by Renee van Dongen et al.

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Received and published: 21 December 2018

This paper combines analysis of new data from four catchments with a meta-analysis of previously published data to understand how and when in situ ¹⁰Be concentration is different in different grain size fractions from the same site. In line with previous, more local studies on this topic, the authors find that in areas with large deep seated landslides, grain size differences can be significant. They also identify sediment travel time and higher rainfall rates as reasons for increased differences in concentrations for different grain size fractions.

Overall I found the paper to be well written and thoughtfully analyzed. The authors figured out creative ways to quantitatively compare differences in grain size fractions

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across a large dataset of previously published data. I have a few minor concerns that I think could probably easily be addressed and make the manuscript acceptable for publication.

1) The paper is relatively undercited. For example, a few times the use of in situ ¹⁰Be is mentioned for calculating background erosion rates and only two of the original three papers are cited. Given that all three groups did this work relatively independently and published at the same time, it is courteous to cite Brown et al. (1995), Granger et al. (1996), and Bierman and Steig (1996) any time the technique is brought up as a way to get long-term background erosion rates. All papers address the same assumptions underlying the technique. Another example is that papers by Gonzalez et al. (2016) in *Geomorphology* (one on Brazil, one on Panama) address the issue of grain size dependency in in situ ¹⁰Be for tropical locations. They conclude that differences are significant in tropical locations with deep seated landslides. Engaging with this literature would be a good idea (and this should happen at several points in the manuscript since it is quite relevant prior work). A third example is on line 60 on page 3 when the authors suggest that the larger analysis area makes it harder to distinguish trends due to increases in other variations. Portenga and Bierman suggest this exact point with their *GSA Today* paper and should probably be cited. Likewise, on line 318, I think it would be a good idea to cite Larsen's work on threshold hillslopes and erosion.

2) I wonder if the authors are overselling their results. I see a lot of points that overlap with the grey mean area on figure 4. Are there statistical tests that show that these differences are statistically significant? Is it because the difference between the 0.5-1 mm fraction is so different from the coarser fractions that suggests that there may be a problem? I didn't get that clearly from the figure.

3) I found the figures really confusing. Many of the figures are quite complex and have lots of data packed into them. The captions are short and don't really connect to how the figures were created, particularly for the ones with quote abstract scales (like normalized ¹⁰Be concentration). Clearly the authors have thought extensively

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about how to display the data, but it is important to make sure that readers also have the benefit of those hours of thought. I think that some more clarification and a bit of improved plotting could help the figures significantly. Some kind of a summary figure showing differences across grain sizes for the meta analysis would make it much easier to interpret.

4) Pretty minor, but I'd like to see more connection back to the soil pits in the interpretation of the data. For example, in the paragraph starting on line 300, you talk about processes going on, and you have the soil pit figure, but you don't explicitly connect to the soil pits in the discussion.

5) Another minor thing - I am concerned that discussion of data interpretation but no input into writing doesn't really merit authorship. It seems like all authors should at least contribute to editing the ms before it gets published. I expect that they all did, but this should be noted in the contributions.

Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2018-83>, 2018.