

Interactive comment on “The impact of earthquakes on orogen-scale exhumation” by Oliver R. Francis et al.

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Received and published: 10 January 2020

This is an innovative manuscript that attempts to develop a model of regolith generation and evacuation in a mountain belt, in order to understand the competing effects of earthquakes, aseismic deformation, and landsliding in causing topographic and bedrock surface uplift. Given the advances in our understanding of these different processes over the last few years, this is a timely and appropriate exercise, and the authors use their approach to demonstrate some interesting and provocative results. I think this manuscript will eventually make a strong contribution to the journal and an important step in this field; while we don't yet have all the components to really understand the relationships between these processes at the orogen scale, this kind of 0-d model is a very useful way forward.

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I have made a number of comments and queries directly on the manuscript PDF, and I won't repeat them all here. I found parts of the manuscript confusing and hard to follow - in part because of some repetition of ideas between different sections, but also because of some inconsistencies in usage and units of the various parameters that the authors are tracking. I would urge them to consider a cartoon figure of the model and a list of symbols, with units, as well as a rigorous check that their usage is consistent across text, figures, and captions. The current Fig 1, while appealing, doesn't really convey very much information, and a cartoon depiction of their model, with appropriate labels and perhaps a couple of case-study examples of how it could evolve over time, would really help to clarify what they are trying to do. Despite their statement fairly early on about the use of rigorous definitions, some elements of the work only become clear later in the manuscript - for example, their distinction between weathering and erosion in earthquakes, and the corresponding assumption about transport lengths in landslides. I don't disagree with what the authors have done, but it took me awhile to understand it. Related to this, I think it would be helpful for the authors to make a clear statement about what specific questions they are addressing or what specific experiments they are running. This information is there but is scattered in a few different places, making it hard to move from the high-level ambitions of the manuscript to a clear understanding of what they're going to look at in section 3. Without this clear statement, it's a little hard to assess the overall contribution that the manuscript is making, because I'm left to guess a little bit at what the authors think is the main novelty of their work. It would be great to see this brought to the fore.

Finally, there are some minor typos and errors or inconsistencies in the text and figures, although these should be easy for the authors to sort out.

Please also note the supplement to this comment:

<https://www.earth-surf-dynam-discuss.net/esurf-2019-64/esurf-2019-64-RC1-supplement.pdf>

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