

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

**Anonymous Referee #2**

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This study develops a novel and creative 0 dimensional model to investigate the absence of evidence of large earthquakes in the sedimentary archive. It makes use of empirical scaling laws for earthquake induced uplift, landsliding and other inputs and outputs of bedrock and regolith through the system to model the evolution of regolith on a hillslope and how this is perturbed by earthquakes. It also tracks cosmogenic nuclide concentrations within the bedrock and regolith through time enabling calculation of cosmogenic erosion rates and how these vary with earthquake activity. There are some really interesting and intriguing results e.g. regarding the timescales over which it is possible to detect the influence of large earthquakes on erosion rates. However, I did find the manuscript quite difficult to follow and some of the assumptions and terminology used are confusing. I have commented extensively on the PDF version of

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the manuscript but some general comments/concerns are: I think you could do with a model schematic to help visualize what is going on and need to distinguish more between results from your modelling and results from other studies throughout. The research questions and experiments you conduct to address these need to be much clearer throughout and the use of terminology and symbols needs to be consistent. I don't think it is correct to refer to the production of regolith by landslides as weathering. I can see that the production of regolith by earthquakes, i.e. a kind of earthquake preconditioning, is logical but as I understand it, landslides inherently remove regolith and bedrock, rather than producing regolith. The mechanism by which landslides produce regolith needs more evidence and explanation. Another assumption is that the amount of regolith production by landslides is limited by the regolith already on the hillslope. Why? Does this somehow dampen the shaking caused by an earthquake? I think this paper is worthy of publication in this journal but with some restructuring and clarification throughout.

Please also note the supplement to this comment:

<https://www.earth-surf-dynam-discuss.net/esurf-2019-64/esurf-2019-64-RC2-supplement.pdf>

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2019-64>, 2019.

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