

Earth Surf. Dynam. Discuss., referee comment RC2  
<https://doi.org/10.5194/esurf-2021-41-RC2>, 2021  
© Author(s) 2021. This work is distributed under  
the Creative Commons Attribution 4.0 License.



## Comment on esurf-2021-41

Francis Rengers (Referee)

---

Referee comment on "Temporal changes in the debris flow threshold under the effects of ground freezing and sediment storage on Mt. Fuji" by Fumitoshi Imaizumi et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2021-41-RC2>, 2021

---

### General Comments:

This is a very well written manuscript with useful figures, clear language, and good supporting data. I think the researchers have done a nice job explaining a relatively understudied phenomena that will be of general interest. I have a few general suggestions that I think might help to increase the impact of this paper.

First, for your debris flow thresholds, many people use either a lower limit or an upper limit to separate debris flows from non-debris flows (Staley et al., 2017; Tang et al., 2019). Consider something like for figures 7-9. In addition, consider putting using a dimensionless discharge criteria to see if that helps to separate out your slush avalanches from your debris flows (e.g. Tang et al., 2019).

Second, is that you might want to discuss the influence of aspect on your results (see Tillery and Rengers, 2019 for some general considerations of debris flow thresholds and aspect). You could also use an approach similar to Hales and Roering to estimate/model the temperature effects of aspect, but that might be too much work at this point.

Third, can you address the fact that it probably rains the most when there is less frozen sediment because in the winter it is mostly snow. In addition, you should probably acknowledge that when it rains it will melt some of the ice. If the amount of melt can be estimated, it will help to strengthen your argument.

Fourth, consider making some plots like Figure 4 (b and c) from Staley et al., 2017. I'm wondering if you might see more separation if you focus on a single rainfall intensity.

Finally, I think it'd be nice if you could add some language to the discussion to talk about how warming would effect debris flow generation, this would help to show how your work would be more globally impactful in high alpine areas.

Hales, T., and J. J. Roering (2007), Climatic controls on frost cracking and implications for the evolution of bedrock landscapes, *Journal of Geophysical Research: Earth Surface*, 112(F2), doi:<https://doi.org/10.1029/2006JF000616>.

Tang, H., McGuire, L.A. , Rengers, F., Kean, J.W., Staley, D.M., Smith, J. 2019. Developing and testing physically based triggering thresholds for runoff-generated debris flows. *Geophysical Research Letters*. 46(15), 8830-8839. <https://doi.org/10.1029/2019GL083623>

Tillery, A., Rengers, F. 2019. Controls on debris-flow initiation on burned and unburned hillslopes during an exceptional rainstorm southern New Mexico. *Earth Surface Processes and Landforms*. 45(4), 1051-1066. DOI:10.1002/esp.4761

### **Specific Comments:**

Line 51: I would add this recent reference that discusses debris flow material.

Rengers, F.K., Kean, J.W., Reitman, N.G., Smith, J.B., Coe, J. A., McGuire, L.A. 2020. The Influence of Frost Weathering on Debris Flow Sediment Supply in an Alpine Basin. *Journal of Geophysical Research: Earth Surface*. <https://doi.org/10.1029/2019JF005369>

76: What do you mean by size (depth? Length?)

86: When you say >100mm what time duration are you talking about: hour, week, month, year? Seasonally? For a single storm?

116: Here are you talking about a peak discharge? Or the total discharge over time? If you include units that would help to clarify.

141: Define the degree-day method

238: You might want to explain why this happens somewhere. The temperature should decrease from the surface as you move deeper up to a certain point, but then the temperature will slightly increase with depth due to radioactivity.

271: Make sure to say if this is a topographic difference from lidar or something else.

290: One question people might ask is why rain doesn't melt ice that is between sediment particles, so I think it'd be good if you could address that.

296: Where you say "maximum rainfall intensity", what duration are you using (1 hour, 30 min., etc.?)

389: When you say channel deposits, do you mean the sediment stored in the channel or the sediment that is removed from the channel and deposited downstream?