

## ***Interactive comment on “Reconstructing the dynamics of the highly-similar May 2016 and June 2019 Iliamna Volcano, Alaska ice–rock avalanches from seismoacoustic data” by Liam Toney et al.***

### **Anonymous Referee #1**

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The authors present here a double-case study of very similar ice-rock avalanches on the Iliamna Volcano, Alaska. The comparison of these two cases allows them to validate the inversion method they apply to the generated seismic waveforms to recover the force history of the avalanches. From the force history, they then compute their acceleration, velocity and directionality. Their inversion method is based on the hypothesis of the source being a point-source, spatially static. The main interest of this paper is that it reports two new case studies of avalanches, and that it compares the dynamics reconstructed using seismic signals with visual data (aerial photos, satellite imagery, and elevation data). The authors are giving a nice description of the data. I do not have the expertise to judge the details of the methods used, however it seems

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to me that the methods are well-described and clear. Consequently, I recommend this paper for publication after some moderate revisions.

I have a few minor and moderate comments that I am stating here.

1) The authors should state more clearly what is the novelty of their study, especially in the introduction. I think that it would increase the impact of the paper. In the current shape, it is not clear what this study brings, compared to the references cited in the Introduction and Background sections.

2) In the abstract, the authors are stating: “Seismic and acoustic signals from these often-remote processes, combined with other geophysical observations, can provide key information for monitoring and rapid response efforts and enhance our understanding of event dynamics”. I was expecting more discussion on this point in the main body of the paper. What is this study bringing regarding to this statement?

3) In general, the authors are having a nice discussion on their results, comparing them to other studies, discussing the limitations of the methods they are using. However, I think the paper would be improved by having a more fundamental discussion: what are these results telling us on the events, how can we use them to monitor this kind of events? Maybe the discrepancies between the inversion results for the two very similar events could be more discussed as well. (among other possible discussions)

4) Finally, it is not clear to me what is the use of the acoustic data in this study: the main results on the dynamics of the avalanches come from the seismic data. The acoustic data are occupying a large part in the title and main body. However, considering the output from this data, I would reduce their description, or emphasize better why they are new and important in this study.

Minor points:

1) The Introduction and Background sections are a bit long. They may be grouped?

2) In the legend of Figure 1: add the distances of the 2 closest stations

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3) Line 70: Is there a reference?

4) Lines 188-189 : “The events also produced prodigious long-period energy with a dominant period of 35 s (Fig. 5)” What can be the source of this?

5) Figure 6, acoustic transmission loss: the patterns are pretty different, whereas the authors are stating that the sources are very similar. What can explain this discrepancy? (overall on the western part) I thought it could be due to the addition of acoustic stations in the western region, but these stations did not seem to detect any signal. I would like some discussion on this point.

6) Section 4.1.2, what is the definition of the root mean square pressure?

7) Lines 344-346: “We use the satellite imagery shown in Fig. 2 to estimate the mass for each event. First, we subtract the avalanche source area from the total area, ignore entrainment, and assume a uniform 1.5 m deposit thickness everywhere on the slope to obtain a volume.” Is it not possible to deduce it from the DEMs?

8) Lines 356-368: It is not clear to me how the authors choose the end point.

9) Figure 8: Seismic and acoustic signals are shifted to be aligned on the time 0 of the inversion. But I do not understand why they are shifted for travel time from different points? (point force location for the seismic signals, and avalanche path midpoint for the acoustic signals?) Can the authors explain this choice, since it has an impact on the interpretation (paragraph beginning Line 505)?

10) Line 456: “manifested as a high-frequency”: Indicate the frequency here. (Same Line 460)

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