

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC1  
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## Reply on RC1

Braden Walsh et al.

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Author comment on "Characterizing the evolution of mass flow properties and dynamics through analysis of seismic signals: Insights from the 18 March 2007 Mt. Ruapehu lake-breakout lahar" by Braden Walsh et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2022-31-AC1>, 2022

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**Addressing Reviewer Comments:** Reviewer in **bold** text and response in regular text.

### Major comments:

**At that point I confirm myself that to draw valid conclusions the authors have to take into account the amplitude of the frequency peaks At that point I confirm myself that to draw valid conclusions the authors have to take into account the amplitude of the frequency peaks**

While the amplitude of each frequency range of the signal will yield differing content and the contribution amount will be different, the results and especially the discussion section of this manuscript are still valid. The use of PSF or dominant frequencies has been used by numerous studies on a variety of mass flows (of which many are cited in the manuscript) to estimate the dynamics. The "contribution" of the PSF or difference between the spectral centroid yields the same results and is also an indicator of dynamics based on frequency (i.e. when PSF is bimodal/"spread" is large (contribution small), multiple processes are occurring). That said we added a section in the discussion looking at the normalized spectrograms as well as the centroidal frequency to show when and where the PSF is most dominant.

**Authors must include data processing section/subsection as well as an explanation of how the data results are obtained.**

All of this information is already in the manuscript. Most is in the "Data" section as well as Lines 164-169 in the "Results" section. As for equations, we believe it is not necessary to include basic equations for converting to frequency domain or directionality (simple division). For the new SCF analysis we included equations, see new section 4.1.

**To facilitate the interpretation of the results the authors must include a table**

**with the values and characteristics observed in the figures as well as indicate in the figures the different parts described in them.**

We describe and include multiple images from the lahar in figure 2 as well as created a model in figure 8 referencing the seismic data with the observations. Furthermore, throughout the discussion we reference each figure multiple times while explaining the results. See lines 367-377, 386-388 for example.

**Line by line comments:**

**Line 68: seismic instruments have been used since 1998, I do not consider it relatively young.** Changed to "However, in order to fully utilize these instruments, improved interpretation, comprehension, assessment, and universality is needed."

**Line 69: specify. There are more geophysical instruments, you are only referring to those relating to vibrations.** See change for Line 68

**Line 83: you must include the purpose of this contribution because the previous ones also deal with this topic.** The inclusion of section 1.1 is to give the audience an introduction on the details of the parts of the conceptual lahar model on Mt. Ruapehu. Which then transitions into section 1.2 which talks about the 2007 event. The first paragraph in the manuscript is a brief introduction on mass flows and why it is important to monitor them.

**Line 130: Homogenize or clarify the terms channel, river according to the figure also throughout text.** We homogenized the wording throughout.

**Line 144: change the sentence.** Changed to "supplementary measurements"

**Line 155: in the instrument setup is the vertical component of the instrument orthogonal to the slope or zenith direction. In our studies we have observed that the results are different. Indicate, at least the angle of the slope where the sensors are installed.** Added "Furthermore, the seismometers were installed normal to horizontal to lessen the degree of vertical energy transfer to the horizontal components."

**Line 162: Are other instruments co-located with the seismometer? How are the average speeds determined. Also explain the arrival times of the lahar.** Added "Arrival times are based off of images and eye witnesses at each of the monitoring stations. The flow velocity at RTMT and COLL were estimated from imagery and at TRAN from a flow meter."

**Line 193: in some cases, the event passes over the station, this is not the case. The lahar passes closer to the station, in fact it is the record at the station of the waves generated by the passage of the lahar.** Deleted "passing the station"

**Line 236: Are you considering amplitude of the signal or the energy.** Changed to "amplitude"

**Line 250: note that it is shorter in RTMT than in TRAN.** Noted in text

**Line 251: notice that there is a bend in both curves of the same wavelength but shifted in time. Note the similar concave behavior at RTMT and TRAN.** Further

analysis has shown no correlation with this “curve” in DR at RTMT and TRAN.

**Line 254: Describe properly minute 7.** Minute seven is described on lines 252-253

**Line 568: fix citation for Lube et al., 2012:** Fixed citation