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Comment on nhess-2022-200

Anonymous Referee #2

Referee comment on "The characteristics of the 2022 Tonga volcanic tsunami in the Pacific Ocean" by Gui Hu et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-200-RC2, 2022

In this study, authors conducted wavelet analyses to investigate the characteristics of the 2022 Tonga volcanic tsunami, which is, to date, the most important event in the geoscience field in 2022. The MS presents some interesting results. Nevertheless, there are still many flaws, which need to be further polished, clarified, and validated with deep and serious thinking. My comments include,

- Line 21, Lamb wave with ~30-40 min period? So long?
- Lines 107-108, Why using cut-off frequency of ~8 hr could remove the tidal components? There are various tidal components.
- Line 110, Why ignore such small tsunami height data?
- 2, Please specify the azi definition in the figure caption, specify the unit of distance. Please also add the magnitude of the ordinate to quantitatively specify the sea level.
- Line 134, Why Gaussian-shaped initial sea level displacement is used? Can it mimic the volcano eruption induced gravity wave propagation?
- Line 144, Why Morlet mother function is selected?
- Line 149, Why moving time window is selected as 20 min?
- Lines 163-164, This could not be observed in Fig. 1. Please specify the theoretical (gravity wave) tsunami speed in Fig. 1 to show that Lamb wave is faster.
- Lines 164-165, Why Fig. 2 could not detect the Lamb wave related tsunami signals?
- Line 165, Lamb, L should be capital. Please double check this throughout the entire MS.
- Lines 168-169, Why such definition? In data pretreatment, data with the maximum tsunami height less than 0.2 m have been deleted? Nevertheless, a very small value of 0.1 mm (could be recording error in many data) is considered here?
- Line 178, In Eq. 2, temperature is for low elevation or high elevation? If low, then moving towards North Pole is accompanied with the decease of temperature, thus the decreased Lamb wave speed. However, if it is temperature at high elevation, the above explanation fails.
- Line 181, CL, L should be subscript.
- 3, How the black lines are obtained? They are very much sensitive. Please add wave height elevation information in Fig. 3.
- Line 196, Can not confirm the complex geometries of the coastlines in Fig. 4a.
- Line 198, Can not see the bay shape in Chanaral.

- Lines 206-207, Why interaction between tsunami and bathymetry could delay the arrival of maximum tsunamis? There are always interactions between bathymetry and tsunami propagation. It is inherent.
- Lines 211-214, Why the first waves in DART are supposed to be the maximum? The first wave is induced by the Lamb wave, it is small (should be only about 2 cm corresponding to 2 hPa), whereas the maximum waves should come from other mechanisms.
- Lines 233-234, Why not in sequence? These bands cover almost all time period in Fig. 5.
- Lines 234-235, Please be specified.
- Lines 235-236, Please be specified.
- Lines 256-260, No need since these have be specified in the figure caption.
- Line 263, There is no Hawaii in Fig. 5. In fact, the 80-100 min wave energy in these two regions on the left of the vertical white line is rather small, and no clear difference from other points.
- 7, why the signals are filtered between 30 min and 150 min, whereas the period band is ~80-100 min in line 261. Why different?
- Lines 269-272, Hard to identify this in Fig. 7. There are no clear difference between the left and right two columns regarding the signals around the vertical solid green line.
- Lines 285-286, The large energy of the air pressure of 10-30 min band in Fig. 8 only appears around the arrival of Lamb wave, while large energy of tsunami wave of 10-30 min band shows a much longer duration in the volcano near field in Fig. 5 (after the arrival of Lamb wave), and a relatively short duration in the volcano far field in Fig. 6 (after the arrival of Lamb wave). I do not think Figs. 5, 6 and 8 are consistent with respect to this point. Appreciate if authors could further dig out the physical insights behind.
- 5, The colorbar seems strange. It should represent the energy. Why negative values? what is the meaning of dB? As for the left and right ordinates of each sub-figure, their scales are different, left around 10^3, while right around 10^1. Why? As for the wavelet results, why there is no blanked-out peripheral area of the spectrum, i.e., 'cone of influence', the portion of the spectrum sensitive to the end-effects. These areas should be blanked where results may be artificially affected. Similar problems for the entire wavelet analyses.
- How Eq. 4 is obtained?
- Lines 361-362, How are these factors specified from the present study?
- 10b, atmospheric and tsunami wave forms are also not mentioned in the context, these sub-figures could be deleted.
- Lines 374-378, Lamb wave speed is rather fast, even it circles the earth multiple times, it should not or less contribute to the 3 days tsunami event, especially considering that after circling, the Lamb wave energy decays.
- Line 379, what is the meaning of resonance between ocean and atmospheric waves? They have very much different frequency, how can resonance between these two be triggered?
- Line 380, What is the difference among atmospheric gravity wave, Lamb wave, and shock wave? These concepts must be clarified in the context.
- Line 385, Please specify what kind of tsunami speed here mentioned?
- Line 387, Proudman resonance is a well-known and old concept. No need to refer 2022 papers. Why continuously? the deep trench is generally rather narrow, while the Lamb wave speed is very fast and it only need short duration for Lamb wave passing through the trench.
- Lines 393-394, Why a 2005 paper is referred for the 2021 Tonga event??
- Line 396, only 70 km from the source??
- Line 429-430, Resonance effect can only amplify the tsunami height, no the duration. The description here is not serious.
- Lines 433-435, Fig. 11 indicate that the long-lasting of HTHH tsunami is not related to the Lamb wave induced tsunamis, but related to the subsequently gravity wave and its

interaction with the coastal bathymetry and coastal configuration. In other words, interactions between the Lamb wave induced tsunamis and coastal bathymetry/coastal configuration are negligible.

- Please specify the meanings of different white dashed lines in Fig. 11 caption.
- Lines 454-455, Generally, I do not think Proudman resonance from the Lamb wave is the reason for the large coastal tsunami height since the ocean is still too shallow and the deep trench only exists within a narrow area being generally perpendicular to the tsunami propagation direction.
- Lines 456-463, There have been well-known from the previous studies. The trapping effect in the coastal region should be considered for tsunami warning, e.g., edge wave and so on. The resonance effect can only amplify the tsunami wave height, which may indirectly leads to the long lasting of tsunami event.
- Conclusions should be amended following the aforementioned comments.