

Response to Referee #1

RC1: 'Comment on manuscript by Horváth et al. (egusphere-2026-3997)', Anonymous Referee #1, 30 Aug 2026

In a single sentence, the manuscript provides a thorough characterization of the atmospheric waves that kept circling the Earth for a few days after an unusually powerful volcano eruption.

I found the paper not only informative, scientifically sound and valuable, but, at parts, outright fascinating to read. I appreciated the well-presented results and the clear explanations, and even the highly relevant and helpful YouTube videos referenced in the paper.

A key strength of the study is its comprehensive, integrated approach: It combines observations from multiple sources (ranging from ground-based cameras and barometers to imagers on multiple satellites) and examines multiple effects of the atmospheric waves (their impacts on atmospheric pressure, and on the reflectance and brightness temperature of clouds). It also includes clear and reasonable physical explanations for the observed behaviors.

While I have a high opinion of the manuscript and I believe it is worthy of publication, I still recommend a few minor refinements. Please find my specific comments below.

We thank Referee #1 for his/her constructive and positive review. Our answers to the specific comments are given in blue below.

Line 90: It would be helpful to explain in a few words what minor arc and major arc passages are (e.g., waves reaching a point along the short or the long way, covering less than or more than 180°, etc.).

We have clarified the description of the wave passage naming convention as follows:

"We use seismic-style naming conventions to track the multi-orbit Lamb wave passages. Odd-numbered arrivals (L1, L3, L5) correspond to the minor-arc wavefront traveling along the shortest direct path from the source; L1 is the first direct passage, whereas L3 and L5 represent the second and third passages following full global circuits. Similarly, even-numbered arrivals (L2, L4, L6) denote the major-arc wavefront traveling in the opposite direction along the longest path from the source. L2 represents the initial major-arc arrival, and subsequent even phases mark the completion of successive full laps around the globe."

Line 103: I recommend deleting the comma after “method”.

Done.

Line 111: It would help to explain briefly how exactly the frequency of a Lamb wave is calculated. Is it perhaps 1 over the time difference between the two minimums (before and after the main peak) in Figure 2, or is it something else?

Lamb waves can theoretically exist at all periods between a few minutes to ~1 day. The specific frequencies that are actually excited depend on the physical characteristics of the source. In the case of Hunga, the massive size and long duration (several minutes) of the initial energy release excited long-period, low-frequency waves. The spectral analysis of the Hunga barograph records shows a dominant, broad energy maximum at periods of 30–50 min. In some studies, the Lamb period is estimated simply as the time difference between the main peak and the first trailing peak; for the pressure records in Figure 2, this yields a period of ~31 min. Studies that approximate the main pulse as a classic N-wave usually refer to the total pulse duration as the “period” of the pressure anomaly; this is also on the order of tens of minutes.

We have clarified this in paragraph 3 of section 2.1—where we first mention the Lamb wave period—by adding the following sentences:

“The spectral analysis of Hunga barograph records indicates a primary, broad energy maximum at periods of 30–50 min (e.g., Horváth et al., 2024; Matoza et al., 2022; Vergoz et al., 2022). A first-order estimate based on the time difference between the main peak and the first trailing peak yields a Lamb period of 31 min for the pressure data in Fig. 2.”

Line 289: I recommend inserting the word “white” in front of “arrow”, as the arrow in the figure is white (and not black, as the illustration in Line 289 suggests).

Done. We have also replaced the solid arrow with a hollow (outline) arrow in the text.

Figure 3: The times after 05:07 UTC mentioned in the caption don’t appear in the figure. Perhaps some figure panels are missing, or some time values are mistaken? Also, it would help to change the color and/or the pattern for two of the three ovals that are shown with a dotted red line (1st and 2nd peaks and recovery), just to avoid confusion and to make the identification easier. For example, using green or orange colors and/or using dashed lines could work. (Of course, the main text should be updated accordingly, for example in Line 337.)

The times after 05:07 UTC mentioned in the caption correspond to the arrival times of the pressure waveform features at Nu'uuli (~850 km or ~45 minutes from Hunga). The locations of these Nu'uuli waveform features were then back-propagated to the earlier imaging times of the four FD snapshots plotted in the figure. As shown below, we have clarified this in the revised Figure 3 caption and changed the color of the 1st peak, 2nd peak, and recovery to light orange, orange, and green, respectively.

"... The curves indicate the positions of select features of the Nu'uuli pressure anomaly (Fig. 2) back-propagated to the FD imaging times. The features are identified by their arrival times at Nu'uuli: 1st peak at 05:01 UTC (dotted light orange), 2nd peak at 05:07 UTC (dotted orange), main peak at 05:15 UTC (solid red), zero-crossing at 05:21 UTC (dotted black), main trough at 05:27 UTC (solid blue), and recovery at 05:46 UTC (dotted green) ..."

We have also changed the color of the 1st and 2nd peaks in Figure 6, and updated the figure caption as well as the main text accordingly.

Lines 964-965: Clicking on the links to the supplements does not seem to work for me.

The zenodo archive containing the supplements was restricted. However, we provided a private link to the archive in the Cover Letter at submission. Apparently, this private link (see below) was not communicated to the Reviewers.

https://zenodo.org/uploads/20591199?token=eyJhbGciOiJIUzUxMiJ9.eyJpZCI6ImRlYWUwMmQxLTllYTltNDBkYi04OTFiLWlzNzY5MTkxODdhNSIsImRhdGEiOnt9LCJyYW5kb20iOiI2MzdjYjRiYjM4NWYwNWlzMjlmNGRiNmI3ZDc1ZjliNyJ9.VyNyjpg-KqFtpLD4Km04xa7-0BN38Z0FauhFtn-wV6Dt-B9Ag8KRRh_4XZVaMiiHUjP8kWhoXjWK7hvQQID2Cw

We have made the zenodo archive public.

<https://doi.org/10.5281/zenodo.20591199>

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