Dear Dalia Burešová,

I have prepared my responses to the reviewer and made appropriate changes to the manuscript marked in green.

Yours sincerely,

Prof. Leonid F. Chernogor
August 17, 2024

Reply to Anonymous Referee #3's comments

Dear Anonymous Referee #3,

Thank you very much for your comments. Author's reply and changes in the manuscript are marked in green.

The author has added some material to the manuscript in this revision, but in my opinion some of the main questions still remain to be addressed before the paper can be accepted for publication. In particular, the analysis presented at the very end of section 7, including figures 24 and 25, is more convincing with regards to identifying the onset time of disturbances. However, this seems to be added in here as an afterthought without much relation to the rest of the manuscript.

Dear Anonymous Referee #3, Thank you very much for this comment. Indeed, you are right. The paragraph discussing the analysis including Figures 24 and 25 lacks a proper topic sentence. We are sorry. Now, this paragraph begins as follows.

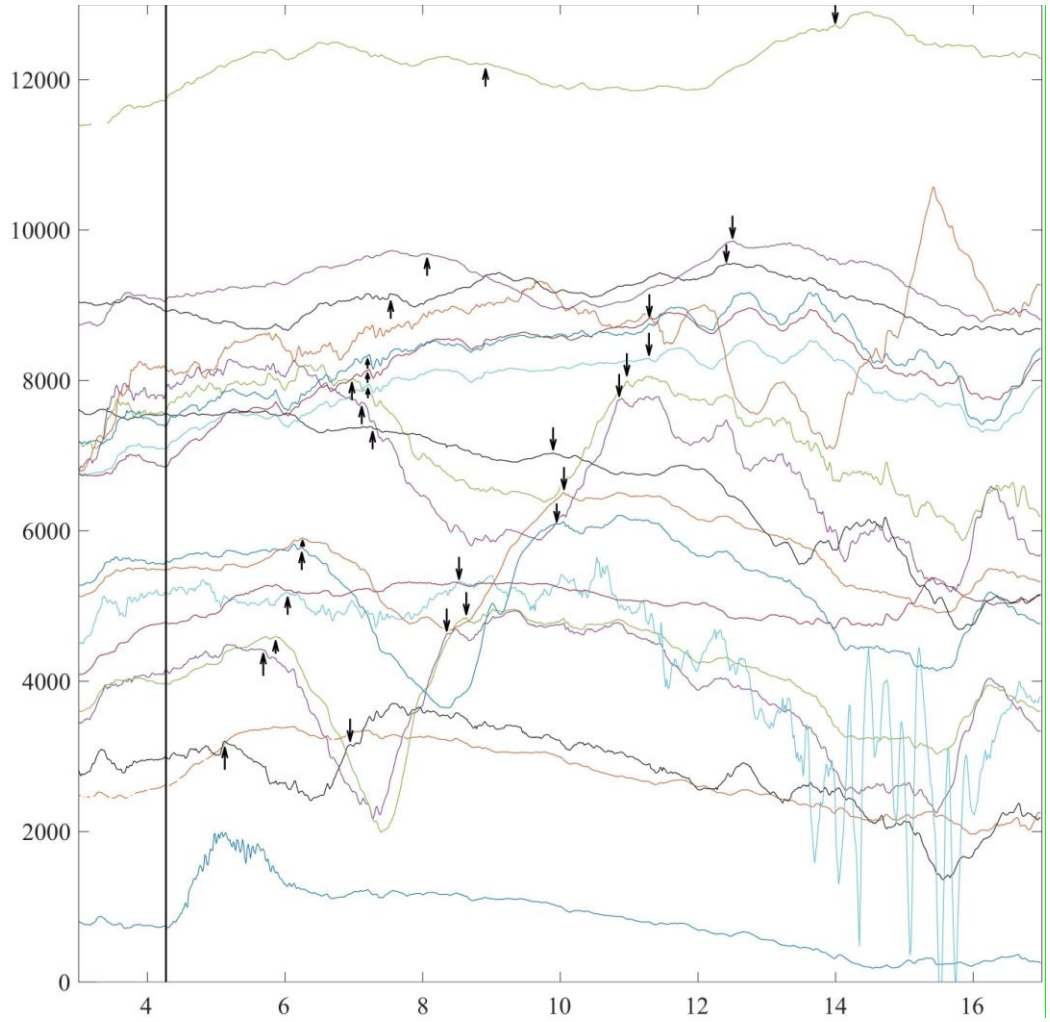
Standing sound waves generated near the volcano produce a very important quasi-periodic effect of Tonga volcano termed the acoustic resonance (Chernogor, 2023d). This effect occurs only in the vicinity of the volcano, as well as in the magnetically conjugate region, albeit insignificantly. The magnetic effects of the Tonga volcano explosion observed at other magnetic stations have other physical nature, which is attested by the propagation speeds revealed in this study, and which unambiguously indicate the type of the wave transporting the disturbance.

1) Considering figures 6 & 7: the arrows on these figures are supposed to indicate the onset of disturbances that are possibly the result of the eruption. However, it is still not clear how these arrows are positioned. In the plots, there seems to be nothing special occurring at the marked times.

Dear Anonymous Referee #3, Thank you very much for this comment. Regarding Figures 6 & 7, the algorithm for finding the geomagnetic field response to Tonga volcanic explosion is described in detail in Line 114–130. Line 162 tells that: "on Figures 6 and 7 the arrows mark the possible start and end times of the geomagnetic field response." Naturally, the effect magnitude is relatively small, even for the API station. A particular magnetogram does not permit us to state with confidence that this particular variation is caused by the volcano. Confidence appears as a result of (1) common (systems) analysis of all magnetograms, (2) estimating expected propagation speed of the disturbance, (3) determination of the type of the wave transporting this disturbance. In addition, intercomparisons between the data for 15 January 2022 and the quiet time data exhibits two principle features (easily seen in Figures 6&7). First, the tendency for increasing time delay with increasing distance between the volcano and the magnetometer station. Second, the tendency for increasing the duration of the bay-like disturbances is observed with increasing distance between the volcano and the magnetometer station. Disturbances observed during quiet time period were virtually synchronous.

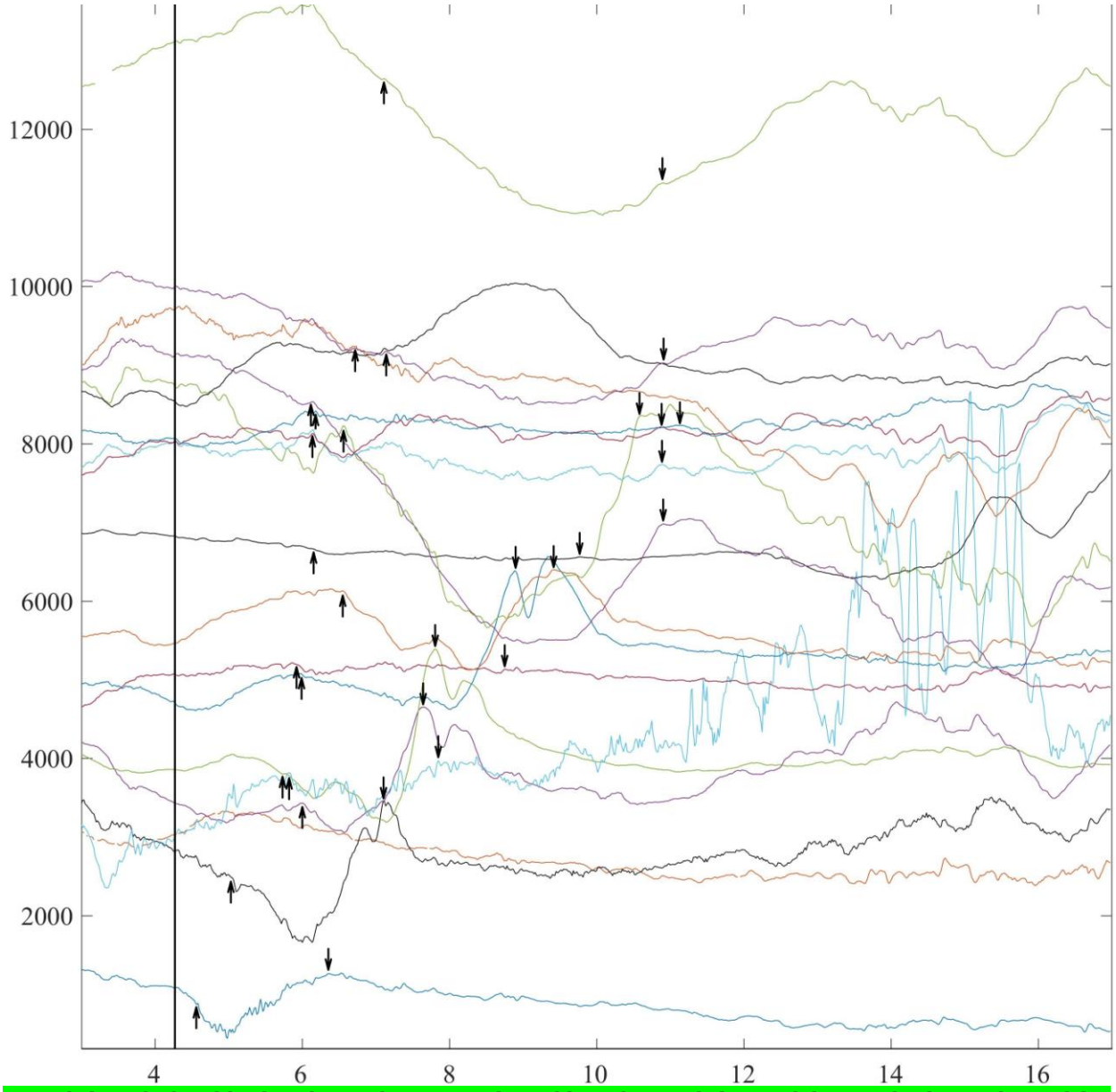
Regarding the plots, one has to notice that the plots in Figures 6 & 7 are drawn to scale and present the data on bay-like disturbances acquired over a range of distances increasing fifteen-fold, from ~840 km to ~12 000 km. As a result, the weak strength effects are masked against the background of strong strength effects. This is the manifestation of the well-known misleading representation of data (see, e.g., figures 3 & 4 at https://topdrawer.aamt.edu.au/Statistics/Misunderstandings/Misleading-graphs/Misleading-scales). Therefore, only one of the nineteen plots in Figures 6&7 could be correctly represented.

We have arbitrarily changed the scales in Figures 6 for Anonymous Referee #3, and the result is a complete mess:



Nevertheless, the bay-like disturbances became easily visible to the unaided eye, while even the distorted time delay of the effect shows tendency for increasing with increasing distance between the volcano and the magnetometer station, and the distorted duration of the bay-like disturbances exhibits tendency for increasing with increasing distance between the volcano and the magnetometer station.

We have arbitrary changed the scales in Figures 7 in the same way and the result is also a complete mess:



Nevertheless, the bay-like disturbances became easily visible to the unaided eye, while even the distorted time delay of the effect shows tendency for increasing with increasing distance between the volcano and the magnetometer station, and the distorted duration of the bay-like disturbances exhibits tendency for increasing with increasing distance between the volcano and the magnetometer station.

2) Figures 15 & 16: It is not evident that the disturbances circled on these figures are more significant than other variations at the same observatory. For instances: for the EYR station in Figure 15 the variation marked after 10 UT are very small compared to those at other times; similar for KDU in Figure 16 around 12 UT; and so on.

Dear Anonymous Referee #3, Thank you very much for this comment. Figure 15 clearly shows that the amplitude and period during period 10:10–11:05 UTC are sharply different from those observed at other moments of time. Regarding the KDU station, the amplitude and period observed during the interval ~10:00–~13:00 UTC are significantly different from the amplitude and period observed during ~13:00–14:45 UTC. It is the last oscillation that is most likely caused by the volcano.

While analyzing temporal variations in the strength of the geomagnetic field, one ought to remember that many energy sources affect the geomagnetic field. Therefore, the systems approach, which has been employed in this study, is a sole approach permitting the disturbances accompanying a particular source to be determined.

3) It is also not entirely clear how the strengths of fluctuations shown in figures 15 & 16 were obtained. Was this done by removing a running average, subtracting a long term median, ...?

Dear Anonymous Referee #3, Thank you very much for this comment. To reveal the rapid fluctuations and oscillations, the slow trend, determined as moving average, is subtracted from the raw data (see Line 135–136: To

discern rapid fluctuations and oscillations, the 120-min moving average (trend) was calculated in a 1-min step first. Further, this trend was subtracted from the raw data temporal dependences.).

4) Because it is still not clear how the onsets of various disturbances at the different stations are determined, it is also not clear how the statistics in sections 6 and 7 were obtained. However, this is not an independent issue: if the previous points are resolved the statistics should become clear as well.

Dear Anonymous Referee #3, Thank you very much for this comment. Thus, Points 1 and 2 explain how the statistics is obtained.

The author is grateful to Anonymous Referee #3 for the valuable comments that have helped Author greatly improve the draft of his paper.

Sincerely,
Leonid Chernogor.