

Review for the manuscript titled Seismo-acoustic and GNSS monitoring of a record-breaking storm in the Black Sea: Evidence of climate change and intensifying natural hazards

The manuscript describes a multidisciplinary approach for monitoring storms. The authors include seismic, infrasound and GNSS data alongside with meteorological data and examine a record-breaking event that occurred in August 2024 at the Black Sea. The concept is strong, the research is interesting and the manuscript is well organized. Compared to the original paper, it has been greatly improved during previous review, although some questions arise. My questions are mainly related to infrasound data processing and interpretation.

General comments

In your response to the Reviewers, you mention that: *elements of the methodology are already being incorporated into ongoing projects and operational platforms*. Looking at the links therein I found a set of very interesting resources. Have they been published elsewhere? If not, would you include them here in the discussion for example?

Overall, I found the figures to be informative, and they indeed help the understanding, however some standardization could be done to improve them.

- Please standardize date and time formatting as currently a variety of them is in use. They even vary in the same figure, for instance see Figure 10.b and 10.c.
- In Figure 10. the color-coding by azimuth seems to be redundant.
- Also, in Figure 10.a and 10.b the term azimuth is used, whereas the y label in 10.c is BAZ which is used throughout the main text. (Also, I found back-azimuth and backazimuth in the text.) Please stick to any of them.
- Some subfigures within a figure seem to be misaligned horizontally, even when they share the x axis for comparison. (Figure 4., 9., 12.)
- What do the colors mean in Figure 12? Is the color bar the same as is in Figure 11?
- $1e-7$ is rather tiny in Figure 4. c. Could you update the y axes (and the label accordingly) to nanometer or micrometer?
- In Figure 6. the bottom right subfigure seems to be misaligned. The Period [s] above that is not completely visible.
- In Figure 1. c. ticklabels are hardly readable.
- Figure 2. b and caption. Is the time given in local time or UTC?

Infrasound

As far as I understood, the feature extraction and K-means clustering are a key part of the manuscript as such investigation has not been made in infrasound research to analyze thunderstorms, therefore both methodology and interpretation should be slightly more detailed.

You separate single-station and array analysis in Section 3.2 and 4, but as I understand in both subsections (4.2.1 and 4.2.2) a single-station approach is used as you only processed the data from one station, namely AGIR. Please clarify these two. In the unsupervised machine learning part did you use only one selected array element? Or were all sensor's data utilized and averaged, or was a beam calculated?

Could you please add definition to the used features with equations?

Is it possible to involve lightning data as well in the interpretation besides windspeed and precipitation? For instance, to plot number of lightning strikes within 50 km range as a function of time (Figure 9.)? Maybe even provide a proxy for wind noise level such as present in the cited paper Listowski et al., 2022 (Remote monitoring of Mediterranean hurricanes using infrasound).

(Did other infrasound station in Romania (or in the region) detect the event?)

Infrasound and satellite observations

Is the efficiency of MTG Lightning Imager known?

line 280-284: *where ddd is the distance* should simply be d? What causes uncertainty in the travel time estimation? Is the accuracy of the lightning strike locations known?

Minor comments:

line 144: *Bromirski et al. 2002;*

line 193: Do you mean Campus and Christie, 2010?

line 298: *Iliescu et al., 2019* (two dots)

line 375: *Figure 5 shows three snapshots...* Four snapshots?

line 472: *Figure 10A...* to a