Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-225-RC2, 2020

Natural Hazards and Earth System Sciences
Discussions
Open Access
EGU

Interactive comment on "Remote monitoring of seismic swarms and the August 2016 seismic crisis of Brava, Cape Verde, using array methods" *by* Carola Leva et al.

Carmen López (Referee)

clmoreno@fomento.es

Received and published: 19 October 2020

I find the paper by Leva et al. (2020) of great interest, since it shows how precursory volcanic activity behaves in oceanic islands; there are not many scientific papers of this type. In oceanic islands, volcanic activity monitoring involves great difficulty due to out-of-network seismic occurrence and poor network coverage, which does not facilitate the full study of the precursor phenomena. Tracking the seismic activity that accompanies the unrest is truly challenging, thus I find this paper of interest. I will now provide some recommendations and comments that I hope will be useful. Authors propose an intelligent approach, which is increasingly used in oceanic islands

Printer-friendly version

Discussion paper

and submarine volcanism, the use of seismometer arrays, which by decreasing the signal-to-noise ratio can detect low amplitude signals, even below the ambient noise. These arrays are optimal for detection, but not so good for localization, giving notable errors in azimuth and distance, especially in the case of no calibrated array and also in the case of using plane wave front approximation instead of a spherical one. Sections describing the methodology are well developed with a careful application to data and errors estimation. Array analysis was performed in the time domain, being able to locate volcano tectonic (VT) events. I wonder, if an additional analysis in the frequency domain (F-K analysis) had been carried out, whether it would have also characterized low frequency tremor or LP signals, which have not been included in the study. In fact (line 29) according to data recorded by a permanent seismic monitoring network (Faria and Day, 2017), the crisis comprised about 1000 shallow earthquakes and tremors. The localized events set their depth at 5 km, without assessing the error associated with this setting. I think other depths should be tested to know its impact on location. I think it would be desirable to get additional data, mainly about gas emissions and surface deformations, or additional seismic information for the better identification of the different stages. At this regard, it would be useful to include in Figure 3 the accumulated number of events. The variations of the "b" parameter should be discussed in more detail. During eruptive unrest phenomena, in other volcanic islands, strong variations of the "b" parameter have been observed, from values greater than 2, to close to 1, and in all cases reflecting precursory dynamic activity with swarms of VT-type events. It would also be necessary to add a figure with the temporal evolution of the "b" value. Figures show that seismicity fluctuates almost constantly, and only in certain periods is concentrated in-land, always showing dispersion. It is very possible that the dispersion is partly a product of the limitation of the array, in fact, a radial distribution of the epicenters with centre in the array is observed, showing that the semi-major axis of the error coincides with the geometry of the event cloud (fig. 6b). In this regard, if possible, it would be desirable to include the error ellipses in all locating figures (Figure 5 a, b,; Figure 6a, Figure 8 a, b, Figure 9). The

authors state that they do not observe tremor or LP signals, but the array technique used (beamforming in time) is not the best for these type of low frequency events, so I think their existence cannot be ruled out, please it can be included a clarification. I believe a further discussion about the interpretation of the phenomena is needed. The authors state “We conclude that the seismic crisis might be an example of a failed eruption, likely caused by the transport of magma and / or CO2 into the upper crust, as it has been suggested by the observed changes on diffuse CO2 degassing surveys ”, lines 230-232. To state that, it would be necessary to analyse results with data from local monitoring networks, including gas emission and, if it was the case, deformation, occurring during the studied period. In addition, an interpretation based on the knowledge of the structure and the geological frame would be recommended.

Please also note the supplement to this comment:
https://nhess.copernicus.org/preprints/nhess-2020-225/nhess-2020-225-RC2-supplement.pdf

---

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-225, 2020.