

## ***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.***

### **Anonymous Referee #1**

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The paper by Leva et al. (NHES 2020-225), at its stage, focus on an important issue, which is the recognizing the precursors of intruding magma at crustal levels, and also the fact the Brava might be a dormant volcano, thus a contribution for the volcanic risk reduction. Despite the good approach, I have nevertheless some comments and remarks, which are the following: In line 6 it is stated that a seismic crisis occurred on Brava during the first two days of August, and in line 10 that the experiment started about only 10 month before. Which seismic baseline do you have before October 2015? Was the crisis already occurring in or before October 2015? Was the first two days just a culmination of the crisis? The total number of earthquakes mentioned in line 11 is the total recorded by the array during the experiment, including those of Fogo

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and Brava, or just those of Brava? In lines 15 and 34 you pretend to show that a remote array (35 km away from the epicenters) is suitable to monitor a volcanic seismic crisis. However, in lines 155 to 157 it is mentioned the results of others authors that recorded tremors and long-period events, which the array used in this experiment wasn't able to record because it was too far away. It seems that this is a contradiction, because one of the crucial signals to be recorded in order to monitor a volcano is both long-periods events and tremors episodes. If a network/array is unable to record those signals there is no advantage to use them. The depths of hypocentres reported by Faria and Fonseca (NHES, 2014) beneath Brava are mostly variable and there is no evidence that they are clustered at 5 km. Thus, instead of fixing the depths of all the earthquakes to 5 km (line 90), why was it not tried several depths in order to minimize the errors ellipses, which are already quite big as suggested by the figure 5 (b). In lines 127 and 128 it is stated that “Most of the volcanic-tectonic earthquakes occurred beneath the southern part of Brava”. It is most appropriate to say “located” instead of occurred, because yours locations are not so precise. What is the relevance for this paper to include the results of the paper about Fogo (lines 132-134)? Line 143 (pag. 5): please precise if the observation “. . . periods with elevated seismicity frequently occur beneath and around Brava.” refers to the period of the experiment. If so (which seems not to be the case because your data spans only two years, or otherwise include a reference), it is more suitable to state “. . . periods with elevated seismicity frequently occurred beneath and around Brava during the experiment.” The first phrase in line 149 (pag. 5) refers to a period during the time span by your experiment or is a general characteristic of Brava seismicity? If it is the former, please precise, otherwise include a reference. It is not clear in the first reading about the exact timing of the evolution of the seismic activity recorded on Brava during the experiment (e.g. lines 180 to 185 pag. 6). I recommend ordering it in time (and just mention it afterwards if necessary). In line 181 (pag. 6) it is stated: “. . . movement of the earthquake locations is related to magmatic processes.”, please justify or include a reference. Distinction between offshore or around Brava (which appears in several parts of the text) and underneath Brava must be clearer,

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since a volcanic island must be seen as a whole including the submarine part of its edifice. I suggest to include in the maps a profile of the topography/bathymetry as it may help to make clearer whether the earthquakes were really offshore or (when located in the sea) on the submarine roots of the island. It is stated all along the text the terms migration, movement, shift of the seismicity. I have two observations concerning the use of those terms: 1- the uncertainties of the locations are too big (fig 5b), thus it may be that the cause of the migration/shift/movement it is just due to the random errors of the locations. 2-Examining figures 4 (a-b) and 5 (a) it seems that seismic activity was present at several places at the same time, although more intense in one zone than others. So, instead of using those terms, isn't it more suitable to say that likely (due to big errors ellipses) the seismic activity became more intense (in terms of rate ) in a certain zone than others? Final remarks: the geological setting and geotectonic of Brava were not taken in account during the discussion and/or conclusions. Why was the possibility of the movement of the faults (Madeira et al., 2010) ruled out? Or why a process of uplift episode of the island (Ramalho, 2010) was not discussed? How often the CO2 fluxes measurements were done? Were they sporadic or continually? Please specify when exactly in 2016 the anomalous CO2 emission was observed? Anyway I recommend a better fundamentation volcanic nature of the seismic crisis hypothesis. Why the potential Brava volcanic hazards were not included (lines 198 to 201) or mentioned in the introduction. This would reinforce the importance of the volcanic monitoring on Brava and better fit the NHESS spirit. I recommend adding a color scale to figure 1, and to make bathymetry clearer (it is hard from this figure to have an idea how the bathymetry is in vicinity of Brava is).

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