

Solid Earth Discuss., referee comment RC2
<https://doi.org/10.5194/se-2021-52-RC2>, 2021
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Comment on se-2021-52

Anonymous Referee #2

Referee comment on "Multi-array analysis of volcano-seismic signals at Fogo and Brava, Cape Verde" by Carola Leva et al., Solid Earth Discuss.,
<https://doi.org/10.5194/se-2021-52-RC2>, 2021

The manuscript presents an interesting study to locate earthquakes using a number of arrays. Potentially it is a good manuscript for the journal. However, before this I have several comments and concerns that I think will have to be addressed. Especially I have the feeling there are two different ideas here. I am not sure the multi-array analysis is the important part? Or is it? The discussion seems to focus on the events rather than the method. Maybe that makes the manuscript somewhat difficult to read?

The first main point I have is that the manuscript is fairly difficult to read because of the organisation of the text. For example the introduction talks about the methods and results in far too much detail without the necessary background that then comes in the chapters afterwards (but a bit more introduction and references would be useful in the introduction).

In chapter 3.2 the first sentence has nothing to do with the rest of the paragraph, while the remaining paragraph seems to fit better in chapter 3.1. Part of 4.1 should be in methods (it discusses errors of the analysis and should be with methods..). The part on error estimation should follow directly from the methods for better flow before then talking about the locations and the discussion, which focusses on the events rather than the method. Please re-write. Also the discussion introduces new results, so these should be in the results section?

This whole organisation makes the reading hard work. Re-writing would clear up much of this difficulty. Indeed the writing in many places could be much more concise there is often unnecessary detail and repetitions.

Using beamforming, information on the velocity is needed, I am not sure how the authors can say that there is no need for knowledge of a velocity model? Have they tried to run the analysis with a non-fitting velocity model? I assume this would greatly worsen the resolution? This should be shown... (it comes back in line 90, so please comment on the size of these uncertainties and what it means to the location errors.)

Has stacking been done using a plane wavefront or a circular one? Is the wavefront already plane in this distance? Has this been tested?

Has the stacking been done with one backazimuth? How different is the backazimuth for each station? This should be shown.

How much does out-of-plane travelling influence the results? In the presence of strong velocity changes (as possible in volcanic environments), the waves will not travel on the great circle path. Has this influence been tested? This is different from mislocation vectors as discussed later.

The discussion seems to be disconnected from the rest of the manuscript? Where do all the results come from? They were not shown in results? This needs to be better organised as well. Please re-write

What are the systematic aberrations? Is this a mislocation vector? This needs a reference! - ah pages later I find that it is indeed the mislocation vector as given by Krüger and Weber. Please move this part of the manuscript when first discussion aberrations. It is out of place that far back.

Has for the estimation of the mislocation vectors in part 4.3 the topography been taken into account? I assume that the stations are located at different heights? Jacobeit et al., 2013 show that topography has a large influence on the mislocation, not only heterogeneity...

Is the criterion of 10 times wavelength (line 86) given in this case?

How does the chosen filter (which? Please state per event?) influence the resolution?

I am missing a table with station information? Please add to Supp. Mat.

Where are the locations of all events (2709, line 154) comes from? Have they been located before? By whom? or from catalogue? And how much better is this multiple array beaming? Why can only be 112 of 2709 events be located with the new method? How much better do the locations become when using multi-array methods? This could be part of the discussion

Line 149-151: how do you know the events are volcano-tectonic or hybrid? Have they been located and classified before? Where does that information come from? Reference?

Also this part (4. Results) happens abruptly, without much leading into. Has the multi-array method been applied to known events? Or is it used on traces without knowing that there is an event? Please re-write. Much of the discussion seems to have to move to results section for a better flow and a better understanding of what has been done here.

Especially the event in Figure 6 is determined by 2 arrays, why do you need the third one there? How much better becomes the location if using three arrays? How much worse is the result when using classical locations?

In the introduction, the authors mention that the lack of S-waves makes it a good event for multi array analysis. I think it is more like the lack of S-waves makes it difficult for other location methods and that's why multi-array method can help?

The description in 3.2 is confusing, please clarify, refer to the example (e.g. Figure 6?) and explain what it means to intersect the broad beam in steps of 1%...

If the velocity model of Vales et al., 2014 is used for the classical location technique, why is this not used for the other technique? There a simple generic layer model seems to be used?

Technical Points:

I may be wrong but at least one trace (4) in Figure 3a seems to be reversed in polarity. Have the traces been inspected for polarity changes? How much does the waveform complexity in this event influence the energy stacks?

Line 166 needs a reference.

Line 81: I would add local to earthquakes. For teleseismic events this is not necessarily the case.

Figures: Please add the colour bars in slowness-backazimuth plots with relevant information.

Lines 109-111 seems to be irrelevant for the manuscript at this point? it does not fit into the flow and it knowledge that should be known.