

## ***Interactive comment on “Using Seismic Attributes in seismotectonic research: an application to the Norcia’s Mw = 6.5 earthquake (30th October 2016) in Central Italy” by Maurizio Ercoli et al.***

### **Anonymous Referee #2**

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General comments on Ercoli et al. Submitted to Solid Earth journal

The manuscript “Using Seismic Attributes in seismotectonic research: an application to the Norcia’s Mw=6.5 earthquake (30th October 2016) in Central Italy” by Maurizio Ercoli et al. submitted to Solid Earth proposes the use of seismic attribute analysis approach on three vintage reflection seismic profiles acquires across the Norcian and Castellucio di Norcia basins to determine the extension and geometry of the geological structures. This region was the epicentral area of the 2016-2017 seismic crisis in central Italy.

This manuscript could be of interest to geologists and geophysicists working in active

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tectonics and using reflection seismic data. However, in my opinion, it needs still some work in the structure of the writing and, most important, more work in the interpretation of the data or, at least, it needs to show more clearly all the interpretations the authors are doing. I am not an expert in the analysis of this type of data (onshore seismic data across rocky regions) but I have many difficulties to identify the same structures the authors are interpreting. At the end, I have had the impression that the authors have extended the surface map structures in depth following some possible alignments. My question is, would have they interpreted the same structures without the surface information? To me, there is a high uncertainty in the interpretation of the alignments in the seismic profiles that, then, I have problems to believe the final structural model proposed in the manuscript.

Following there are some general comments on the different sections. I also provide a commented manuscript that hope will help to improve the quality of the manuscript and the presented results. Despite my criticism, to be intended solely as constructive, I warmly encourage the authors to make any effort for the publication of this manuscript, because of the relevance of the proposed approach and objectives.

### 1.Introduction

I think that in general the introduction needs to be restructured to emphasize the main aspects of what authors wants to expose. It is a very confusing introduction. I am not a native English speaker and I have found some errors, so I think that a native English speaker should review the final version of the manuscript.

Some specific comments:

Paragraph from lines 69 to 104 is a long paragraph that jumps from one idea to another and then back on. It is confusing and needs to be rewritten. Why mention 2D data vs 3D data various times? Just need to stress the differences and then stress the information and advantages of using 2D dataset, mainly which it is available and ready to work on. In addition, sentences like the one in lines 82-84 are out of sense in that

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paragraph.

The stated between lines 85 and 98 is confusing. This may be rewritten, but also I think that it make no sense to explain all this in the introduction.

## 2.Geological framework

This section of the manuscript is a little bit confusing and difficult to follow. The authors jump from one topic to another in some paragraphs and is difficult to understand the geological structure of the area. I think it is necessary some organization. Begin for the big geological units, as done. Then, explain the structures, the fault systems in the area. Continue with the basins object of study. Finally talk about the seismicity in the area and the recent earthquakes and the faults that show surface rupture. In addition, I recommend the authors to be consistent with the names of the units, faults, for example, the Laga foredeep domain is referred in three or four different ways, and that is confusing.

## 3.Data

The authors mention a couple of times the supporting information, but in fact the information is provided in tables and figures in the manuscript.

Also the figures in the supporting information are not correctly identified and some errors of profiles identifications are present and must be corrected.

## 4.Methods

Authors comments that they have tested several post-stack attributes, but it is not clear at all why they select ones and not others. Maybe it is not necessary to explain this? I am not an expert in seismic attribute analysis.

## 5.Results

To me it is necessary to include in the supplementary information the profiles (original and attribute analysis) without any interpretation and each one on one page at a bigger

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scale. The profiles on the manuscript show arrows pointing to specific features that attract the attention towards the author's interpretation. For example, in Fig2c the authors points with red arrows to some discontinuity (?) but at the same time the arrows mask reflectors around. I could point to similar features (orange arrow in the corresponding figure on my commented manuscript) that could point to a normal fault dipping to the W? That suggests me that the authors are just looking for structures that have been recognized at surface and not for all the other possible structures in the area/profiles. But again, without the un-interpreted profiles it is difficult to compare observations.

I would recommend to describe each profile independently pointing to the observations done in each attribute profile and follow the same structure from one profile to the other. Begin with the seismic section and describe what you see and what is or could correspond the observed artefacts, then, the EN section with the specific observations, after, the EG section and, finally, the PR section. This makes things easy to the reader and not necessary to jump from one profile to the other and return. I suggest to identify the different high-dipping lineaments in the figures with letters (e.g., L1, L2,...) and then refer to them in the text. It would be much easier for the reader to understand to which lineament the authors are referring.

In profile NOR02 the relationship between horizons T, H and the west-dipping lineament interpreted as bounding the CNb is not clear. In lines 256-259 it is said that horizon H is interrupted by horizon T, which crosses all the profile from east to west and dipping to the west. Later on, in lines 275-276 it is said that a west-dipping lineament truncates and disrupts horizons (discontinuities) T and H. In general to me is very difficult to interpret the lineaments in all the profiles (as pointed in a number of comments in the manuscript) but in that case I think that the authors are proposing different interpretations for the same observations. This needs to be clarified.

## 6. Discussion and conclusions

As said in various comments I have problems to interpret the steep discontinuities on

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the different seismic profiles (amplitude and attributes). All the discussion is based on the authors interpretation and since I cannot interpret the same things I cannot support it. But, I am not a specialist in this type of seismic interpretations.

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2019-108/se-2019-108-RC2-supplement.pdf>

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