

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 #1

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Ercoli et alii discuss the use of seismic attributes, applied to vintage seismic reflection data, for enhancing the structural interpretation and faults recognition with seismotectonic purposes. They present a case study by analyzing 3 vintage lines crossing the area interested by the 2016-2017 Central Italy seismic sequence. The study area is provided with updated geological maps, a dense cloud of earthquake foci and some moment tensor solutions following the 2016-2017 earthquake sequence and a dataset of earthquake-related surface ruptures, as well. This manuscript is quite well-written and the dataset worth publication, nevertheless this work needs some major revisions, due to i) a badly addressed paper scope, ii) poor quality of the graphics in their present form and iii) the somehow confusing way the data and interpretations are reported. I’m

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attaching an annotated version of the manuscript with many notes and suggestions; however, the major points of concern are summarized below:

- Data and interpretations are presented in a confusing way. It is really difficult to follow the description of the recognized seismic features by means of a purely qualitative pattern recognition. Graphics are not helpful in this sense and the lack of univocal codes for e.g., faults in all the figures is making things worse. See the annotated text.

- The main point of the paper is that the use of seismic attributes can help in perform a better structural interpretation, in particular if applied to seismotectonic studies. Some seismic features are here described through a qualitative approach and a possible interpretation is proposed. If the main target of the work is to show the usefulness of the seismic attributes an external dataset is needed for validation, but this is presently lacking. The use of seismic attributes allowed to identify a possible set of secondary structures, near the surface, in both the Castelluccio and Norcia basins, and to propose the presence of an antithetic fault bordering the Norcia basin to the west. Such an interpretation is not compared to detailed geological maps (only the main structures are shown but geology is not discussed (e.g., comparing possible offset from surface geology with geophysical data). As a result, the comparison with mapped faults is only qualitative and quite poor. Moreover, the seismotectonic implications of the new interpretation is totally overlooked in the discussion and/or conclusions. In this line, I would suggest changing the title: in the present form your focusing the attention on seismotectonic research it’s a really side story in the present form. A possible way to solve the lack of validation would be to make two different interpretations, with and without attributes, on the same dataset, basing interpretation on objective and declared principles (e.g., cutoff, peculiar seismic facies, direct fault detections, axial surfaces dying out. . . etc.) and finally compare the results with published geological maps and or sections, including the discussion on opposite interpretations in literature.

- Some recent works (see a note in the text – I’m reporting here e.g., Iacopini et al. 2016 - Iacopini, D., Butler, R. W. H., Purves, S., McArdle, N., & De Freslon, N. (2016). Explor-

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ing the seismic expression of fault zones in 3D seismic volumes. Journal of Structural Geology, 89, 54-73.) proposed the use of seismic attributes for fault recognition. One of the advantages of this and other works is that you can produce a quantitative analysis of the wavelet, filtering out, on a statistical basis, the most probable fault plane locations. This could be helpful especially in cases where a direct detection of the seismic features is problematic. Any quantitative approach is lacking in this work: at least you should discuss the attribute range and distribution in the areas where you assume the fault should be located. I would strongly suggest trying a quantitative approach, at least a descriptive one.

In summary, I had the impression that the aim of the work, as presently stated, is only partially achieved if an external dataset is not used for a detailed validation. Conversely, some interesting observations are arising from the Authors' interpretations: the presence of an antithetic fault in the Norcia basin, the deep thick-skinned thrust in NOR-2 section and the amount of possible distributed faults in the two basins. These points would benefit from more detailed discussion and comparison with present proposed models in literature. Finally, you surely have to expand the seismotectonic implications from your new interpretation. I'm sure the Authors will be able to face these criticisms and I hope that these notes will be useful to improve the present manuscript.

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2019-108/se-2019-108-RC1-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-108>, 2019.