

## ***Interactive comment on “Brief Communication Co-seismic displacement on October 26 and 30, 2016 ( $M_w$ 5.9 and 6.5) – earthquakes in central Italy from the analysis of discrete GNSS network” by Giorgio De Guidi et al.***

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This manuscript presents ground deformation data associated with a series of earthquakes in October 2016 in the Central Apennines region of Italy. The researchers placed an array of GNSS stations within a fault zone north of the site of the August 24th, 2016 rupture and fortuitously captured the co-seismic deformation of two later earthquake ruptures in October 2016. The GNSS displacement data is supported by DInSAR observations and appears to indicate the complex activation of a thrust fault to the East and a normal fault to the West of the main MVF fault segment. I believe that

C1

the data is robust, important and timely and therefore recommend that this brief communication is suitable for publication in Natural Hazards and Earth Systems Science following some minor revision.

I have a few main suggestions that I hope will be considered to improve the manuscript as follows: Although there is a concluding remarks section it is difficult to ascertain clearly the main conclusions from this study. Just adding a few sentences after lines 186 where the majority of the displacement data is presented would be good, you might just simply explain the geological significance and structures observed from that data. The discussion regarding the ‘seismic efficiency’ of the Norcia fault system at lines 191-192 is somewhat ambiguous as it is currently presented, can you elaborate on this please?

Reply: We have simplified the discussions relating the displacement data explaining geological significance, see also new shapes of the Figure 1. Furthermore we have reorganised the paper’s figures. removing the Figure 5 which represented a qualitative indicator that must be supported by new data, and splitting the Figure 3.

The quality of Figure 5 is low, in my opinion it is not at the standard of an international publication. The overall look of the figure is poor, the x-axis is missing a label and the legend displays ‘serie 1’ which is not helpful information. Furthermore, there is very little annotation of, for example, the dashed red lines, and so interpreting the figure is almost impossible.

Reply: Figure 5 has been removed

There are some inconsistencies regarding the format of date and time throughout the manuscript, for example, there are at least 3 different date formats used in the abstract alone. At lines 16-17 the format is month and day (full words and with the ordinal indicator), then line 24 uses month and day without an ordinal indicator. Line 28 uses day, month, year (full words). Line 31 uses day-month, year (numeric format). Then finally, line 34 uses the format day of year (doy) format. I think it would be better to pick

C2

one format and use that consistently throughout.

Reply: We corrected date format, we used an unique format

As well as main comments above I also list a series of minor points as follows:

Abstract:

Line 18 – add ‘the’ – ‘: : : boundary between the Marche and Umbria regions: : :’

Line 21 – omit ‘has been’ and replace with ‘was’ – ‘: : : : deformation was recorded at the rear: : :’ Line 28 – add ‘the’ – ‘: : : hypocenter of the major event: : :’

Line 29 – replace ‘points’ with ‘sensors’ or ‘stations’

Line 30 – Define GNSS

Line 38 – Please check the format requirements for entering long hyperlinks. I am not sure about this but in the current form this looks a bit cumbersome.

Reply: we are agree with you but we checked the hyperlink and we found that it is impossible change the format.

Active faults:

Line 50 – replace ‘authors’ with ‘studies’

Line 51 – The choice of the word ‘characterizing’ here makes the sentence and grammar unclear, consider rephrasing this.

Line 83 - Add ‘a’ – ‘Vertical displacement of a few centimetres: : :’

Implementation and analysis

Lines 135-136 – Incorrect using of comma and decimal place. 0,1 ppm, 3,5 ppm etc should be 0.1 ppm and 3.5 ppm etc.

Line 138 – replace ‘have been’ to ‘were’

C3

Line 141 – replace ‘to record the’ with ‘the recording of’

Table 1: Can the abbreviations be written in full? The columns of Height, Ground Distance (elevation?) and Delta Ell. use the incorrect decimal point and comma format as previously discussed, please correct. Reply: we completely modified the table 1

Concluding remarks

Line 170 – Replace ‘based on’ with ‘Using’ and omit ‘a’ and ‘the’ and add ‘which’ omit the part about partial reactivation (or reword the sentence because the grammar is unclear)– ‘Using the GNSS technique detailed monitoring of ground deformation, which occurred in the Mt. Vettore Fault segment, has been carried out.’ Line 175 – Should coseismic be hyphenated as in the title? Line 180 – add ‘of’ – ‘: : :344 mm of eastward horizontal displacement and 34 mm of upward displacement’ etc.

Reply: We are very grateful for your grammatical correction, we followed all your suggestion

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2017-130/nhess-2017-130-AC1-supplement.pdf>

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2017-130>, 2017.

C4