

Letter to the editor and reviewers

Thanks to have taken into consideration our manuscript. Please find below our responses and modifications that we have done following the interesting reviewers suggestions.

1) The structure of the paper needs to be reorganized. The current sections 2, 3, and 4 are provided according to the methodological topics (UAS, field mapping, and InSAR), but each is the mixture of methods and results (and sometimes general facts by previous studies). The method and result would be better described separately for the clarity of the paper. I would recommend making separate sections of Methods, and Results, under which the individual topics (UAS, field mapping, InSAR etc.) are provided. The general geology and geomorphology (that are not derived from this study) can be described in Study area before Methods.

We understand this suggestion to modify the plan of our paper. But the methodology in this case will deal with very different techniques without common points: DEM acquisition and processing, morphostructural interpretation as well as INSAR processing. As all these methodologies are so different, we may have a mixed in the methodologies.

For the plan of our paper and in order to be clearer, we propose to follow the "classical geological way" which is to focus first on the location of active faults by the high resolution of UAS DEM processing, and using morphostructural interpretation then to focus with a different paragraph on the characterization followed by the quantification of the active fault displacements toward the LOS by using independent INSAR results. We did not insist that much on the INSAR processing as it is already given by other authors. Moreover, using our plan we avoid many repetition.

2) The originality of this study needs to be clarified. As noted in the specific comments P4 L26 below, the originality of the identification of a mud volcano needs to be clarified. Also, there is an inconsistency of the extent of the study area in Figures 1, 8 and 2, 6, 9. Please confirm that the work outside of the area of interest in Figure 1 is actually carried out by the authors.

The originality of this study is to highlight the interest of UAS High Resolution DTM to get new active tectonic structures in the Hengchun fault area. We modified locally the text in order to insist on this topic.

We clarified also the way to identify a mud volcano from morphostructural analyses.

Dealing with the extension of the study area, we process this ALOS INSAR work during the 2008-2011 period through a common work with Johann Champenois in his PhD work. But at that time numerous political conflicts with the TaiPower Nuclear power plant n°3 prevail and our Taiwanese scientist co-authors asked us not to publish any documents on that area. That is why we limit our study in the PhD to the central and northern part of the Hengchun fault (Fig.8). Since that time, it appears nowadays that it is now possible from a political point of view to publish this major INSAR dataset. That explains the different cover of the figures. Of course, we confirm herein our interest to work in the NHESS paper on the whole onshore Hengchun Fault area that is covered by the UAV survey. For instance, the leveling lines 2 (Fig 9) confirm the LOS INSAR displacement of the Hengchun Fault in the southern part.

Specific comments:

P1 L14: "Characterize" --> "Characterizing"; including this point, the English should be better further corrected throughout the manuscript.

Done

P2 L5: "see Fig. 1" --> "Fig. 1" **Done**

P2 L10: Clarify or remove "by previous authors". Also, use "e.g.," instead of "; among others" **Done**

P2 L11: Avoid using "..." (also for the other portions in the manuscript) **Done**

P2 L20: Explain "PS-InSAR" here. Particularly, the definition of "PS" is missing throughout the manuscript (c.f. P5 L21, 22). **Done**

P2 L23: "few" could be "a few" **Done**

P2 L27: "widly" --> "widely" : **Done**

P3 L4-: Insert a space between the number and unit (e.g., 8cm --> 8 cm). **Done**

P3 L8: "extracted from airborne LiDAR dataset" Please provide details of this procedure including the location (distribution) and characteristics (what sort of materials) of the ground control points, because this is crucial for the accuracy description. Also, please clarify what does "the open bar ground area" (L10) stand for. Is it a small area for the comparison, or a wide area covering entire dataset? If the former, how is it close to the GCPs?

We have improved the description and the fig 2, as indicate as follows :

18 ground control points are extracted from airborne LiDAR dataset and from the airborne LiDAR associated 25 cm resolution orthorectified image. Most of the ground

control points situated on the crossroads, targeted and georeferenced from orthorectified image and elevation from the airborne LiDAR data, respectively. The comparison of the UAS DTM with airborne LiDAR data gives a root-mean-square deviation (RMSD) of 4.1 cm with maximum error of 42.5 cm from 26 sites of open bare ground area, e.g. roads, school playgrounds, unvegetated terrains, and parking lots. The elevation of the check point is averaged from an area of 4 m², equal to the grid size of airborne LiDAR data. The distribution of the ground control points and check points indicate on Fig 2b.

P3 L27: "e.g.," instead of "among others" **Done**

P4 L5: "work in progress" This wording often appears in this manuscript, but it may not be suitable to regard it as something like a citation. Better to be removed and clarified as a future issue.

We removed the (only) two "work in progress" written in this paper...

P4 L26: Please clarify how the mud volcanoes were identified. If they are based on some literature (e.g., Giletycz 2015, NCU dissertation), the original work should be properly taken into account and cited.

We clarified the way the mud volcano were identified from the DTM (Line 29-31 page 4) and we cited Giletycz PhD dissertation 2015. Done

P5 L26: Be consistent to use the shortened term "HeF": if this is used, it should appear on the former side of this manuscript and thereafter the use of "Hengchun Fault" should be avoided. However, I personally think "HeF" may not be necessarily introduced in the manuscript text (better to be in the Figures only). The term "Hengchun Fault" is not so long.

As suggested, we use Hengchun Fault in the manuscript (HeF in the 2 figures).

P6 L1: The methodological description of "GPS measurement" is missing.

We precise the GPS data used to validate our PS-InSAR results.

P6 L28: "StaMPS" or "STAMPS"? Be consistent.

modification done for StaMPS

Figure 1 caption: "Figure 1a:" --> "(a)", also for b and c. **Done**

Figure 1 GPS station: The displacements of the HENC GPS station indicates an uplift in Figure 1, but why is that in Figure 8 negative? If Z component is positive (uplift), the LOS component should also be positive. Please clarify together with the methodological description of the GPS measurements as suggested above.

Firstly, we replace fig. 8B by a new figure 8B without the GPS arrows (mistake that we have not seen)...

But within the Hengchun valley there is both subsiding and uplifting places :

1. The Hengchun valley is not homogenous along the Hengchun Fault that lead to relative local subsidence (see north of Hengchun city) and local small uplifts.

2. One may note that PS-InSAR results give a relative displacement contrasting to the absolute displacements given by the GPS measurements. The displacement of GPS HENC station correspond to the absolute displacement which is compared to a PS network referenced toward the chosen PS base (black and white star situated close to Haikou - in the north of the Hengchun Valley). The PS base is chosen with the fewer variability of displacements within the InSAR monitoring time period and appear consequently the more stable area. Anyway this base might be submitted to small continuous uplift or subsidence that may explains local discrepancies with the GPS average annual displacement.

Figure 1 Area of Interest: The area of interest shown in Figure 1 seems to correspond to that of Figure 8, but in Figures 2 and 6 the study area is much wider including the southern coast. In particular, the mud volcano is located out of the range of the area of interest in Figure 1, and it is unclear whether this was investigated by the authors or derived from something else (see the comments for P4 L26). Moreover, the whole leveling line 2 and the eastern half of line 1 are apparently out of the extent of Figure 8, and it is unclear how the PS values were obtained for these areas. These inconsistencies should be clarified.

Our study area correspond to the onshore Hengchun Fault covered by the UAS survey acquired and shown in Fig. 2. Some figures present a smaller extension due to potential political conflicts with sensitive Taiwan infrastructures (Nuclear PowerPlant N°3).

Figure 2: Put (a) and (b) in the panels. Avoid using "Right" or "Left" in the caption.

Done

Figure 3: Put (a)-(i) in all the panels. The scale and north direction are missing.

Done

Figure 4: Put (a)-(c) in the panels. Better to show the photo location and direction in Figure 2.

Done

Figure 5: The red lines are too thick to prohibit viewing the cracks in the photo. Can they be thinned or set higher transparency?

Done

Also, "Fang-Shan village" is not shown in Figure 1.

GPS data was and is still given in the legend.

Figure 6: It would be better to show the rectangular extents of the example areas of Figure 3 (same as in Figure 1). Red (2) and pink (8) lines are hard to differentiate.

This important figure 6 is difficult to read and we would like to avoid to

add too many things on it not directly linked to the thematic... that is why we have chosen to draw the quadrangle on Fig. 2.

Figure 8: If the current A and B show the same displacements, the left one can be omitted. The schematic model of LOS (graphic description including satellite) should be placed in a separate panel, and the flight direction and LOS could be placed in the map panel (like Figure 1).

Ok we remove the Fig 8A, we redraw that figure

Figure 9: Put (a)-(c). Explain in caption what the pink area indicates.

Pink area correspond to the error bar of the leveling data, and denoted on the fig caption, accordingly.

Thanks to take into careful consideration those modifications of our original manuscript.

Chang Kuo-Jen (and Benoit Deffontaines),