Suggestions for revision or reasons for rejection

UAV survey method to Monitoring and analysing geological hazards: The Case study of mud volcano of Villaggio Santa Barbara, Caltanissetta (Sicily)

Fabio Brighenti et al.

1. General Comments

Hereby I want to state that I reviewed this manuscript to my best ability and approached it with interest and with the intention to give suggestions which improve the quality of the work.

The methods used in the paper are interesting and relevant for future studies in order to optimize SfM methods for ground deformation analysis and monitoring.

However, the paper needs reorganization, clarification and rephrasing.

I want to address that the presented manuscript does not contain a Results chapter but instead goes directly from Methods to Discussion. However, the results of the study are presented in both Methods and Discussion. This makes the article confusing and resulting data unclear. I would strongly recommend a reorganization of the content with a clearer separation between Methods, Results and Discussion. Doing this will increase the readability of the work significantly. Furthermore, the first paragraph of the Conclusion would make more sense in the Introduction chapter.

I would as well strongly recommend having this paper proof-read by a native English speaker before the next submission to correct and improve the phrasing. The sentence structure is sometimes too complicated or incorrect so that I think the paper quality would largely benefit from having it proof-read.

2. Specific Comments

Here I refer to issues specific to certain sections. My comment is marked in blue and the part of the text which needs clarification is in yellow. **Bold** means a direct suggestion of a replacement text.

Abstract

> Line 12- 15: "Among all the active geological processes on Santa Barbara mud volcano (Caltanissetta town, Italy), represents a dangerous site because it caused, on 11 August 2008, a paroxysmal event, which determined severe damages to the infrastructures at around to 2 km the paroxysmal event."
> confusing - rephrase this sentence

Introduction

> Line 40 – 44: "The accuracy of 3D information can be significantly ~~increased by the ground control points (GCPs)~~ **by georeferencing the data to ground control points (GCPs).** The GCPs ~~acquisition~~ **acquisition** is a ~~undamental~~ **fundamental** aspect of the georeferencing of the network of images captured by UAV photogrammetry – unclear phrasing. Images are not captured by UAV photogrammetry. Images are captured "for photogrammetry" or "by UAV". In this process a right number of GCPs is required which lead to a greater accuracy of the outcomes (point clouds, 3D grid, orthomosaic or digital surface model (DSM))."
> - rewrite these sentences more concise without repetition. e.g.: "Ground control points (GCPs) are used to improve the accuracy of the resulting data. Therefore, points recognizable on the UAV imagery are measured with a survey device to georeference the data."
>
> Line 46: "In this paperthrough SFM,…"- what do you mean? As well use a consistent acronym for SfM
>
> Line 70 – 73: "This morphometric structure is typical of uplifting areas and therefore relative decrease of the base level. This morphometric evidence suggests uplift processes- repetition of the canopy volcano area- what is that?? that lies above a stagnation chamber that has been carried out for this research project through geophysical investigation- confusing, rewrite this sentence."

Methods

> Line 98: Figure 3 Incomplete Legend
> -what are the other colors and symbols in the map?
> -probably choose different background map.
> -what is the CRS /grid?

Line 117-119: “During the monitoring sessions there has been ongoing research on the best Ground Control Points (GCPs) methods of acquisition. This was aimed at a more detailed indication of the 3D deformation process of the volcanic cap and a vertical and horizontal geometrical resolution of centimetre/subcentimetric order of magnitude.” – confusing. Rewrite those sentences

Line 116 and onwards: Ground Control Points (GCPs)

Please explain the different errors you mention and how they are calculated.

Explain “error”, “total error”, “GCP error” and “average total 3D error”

As well clarify for the reader what the difference between “GCPs”, “Control Points” and “Checkpoints” are.

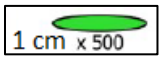
Line 122: “10-1 :10-2 m“- please clarify what this means

Line 127-128: confusing, statistical analysis of what? The whole sentence should be clarified

Line 129-130: “Since 2019 only TST has been used for the GCP survey and according to Tahar et al. (2013) the number of GCPs has been increased (Tab.1) reducing the error to ≈ 1.4 cm and in the last campaign ≈ 0.7 cm.” -are you saying the increase of the GCPs has reduced the GCP error or the fact that only TST was used for the survey? please clarify.

Line 131: “…greater control..”- what do you mean by that? – higher accuracy?

Line 131:”… limit number…”- explain what you mean by this.

Figure 4: it would be beneficial to have a relative scale of the horizontal error below the green ellipse e.g.: 

(in X- direction) or something similar.

Line 151-152: “Photoscan accuracy” – what do you mean? The accuracy of the resulting data? Clarify

Figure 6: what do red and blue mean?

Line 164-165: “25° to 75° percentile” – do you mean 25th to 75th percentile?

Photo Acquisition

Line 173-174: “The camera was oriented in a 90- degree angle”- can be confusing for the reader. Say that “vertical imagery” was acquired

Line 174: explain what a single grid is.

Line 174: Introduce the acronym (ground sampling distance)

Data Processing SfM

Line 189-190: “value” doesn’t seem the right term here. Rather use step/s of the processing chain

Line 203: “measurements of check” -checkpoint measurement??

Line 215: which version of Cloud Compare?

Line 219-220: “This methodology has been chosen having in mind the heterogeneous distribution of the points in the sparse cloud, avoiding holes and thus null values.”
- is this why you chose this interpolation method or is it just something you keep in mind?
- clarify and replace the term "having in mind" with something more precise. eg.: "This method has been chosen "because of"/ "due to" the heterogeneous distribution...."

Line 221: which “measurements” do you mean?

Line 223-224: it would be beneficial to include an illustration of a precision map

Figure 9: Numbers on legends too small

Figure 11 and Line 264-265: “These were used to have an instrumental sensitivity scale of the measures of figure 12. The first and lowest one (~2 cm) was easily detected.”
- what about the others? up to 10 cm? or are you saying that if only one is easily detected the others are not necessary.
If you are not going to talk about the other calipers it should be considered whether figure 11 is necessary.

Discussion

Line 289: „....temporally distant peaks....“ – clarify what you mean by this? Data sets?

Line 299: clarify in the caption which M3C2 distance is shown here (between which datasets)
- explain what processes lead to the M3C2 distance around the edges of the survey area? or is this due to lower precision and/or accuracy in these areas?

Figure 15 and 16: add error bars to the time series. Increase the size of the font on the scale

Conclusion

Line 330-341: this paragraph and references should be part of the introduciton.

Line 351: clarify what kind of interval you mean by „between 30 and 60 g“

Line 352-353: What does this mean for other projects? Is this amount of GCPs scalable for different area sizes?

3. Technical Comments

Here are I point out minor technical suggestions with the same color coding as before.

Line 1: write “monitoring” with lower case m

Line 2: “the case study of **“a”/”the”** mud volcano

Line 16: replace “danger” with “hazards“

Line 18: “for monitoring **of** deformation processes…”

Line 21: Introduce abbreviation SfM

Line 34: “~~The~~ different acquisition methods….”

Line 35 - 36: “~~In this context~~, UAVs therefore offer unprecedented spatial and temporal resolution….”
- repetition of the previous sentence.

Line 38: “…..Lidar, thermal imaging cameras,…..” – add the comma

Line 44: “… is also affected by other ~~features~~, for example….” –insert: **controlled by other variables, such as:**….

Line 44 -45: “~~design and altitude of the flight~~” **flight path and flight altitude**

Line 48- 49: 95% (LoD 95%) Level of Detection - **95% Level of Detection (LoD 95%)**

Line 55: “Ortho-photos generated by UAVs in the area of the Santa Barbara mud volcano.”- **Ortho-photo of the Santa Barbara mud volcano generated from UAV imagery**

Line 58: “….developed since Late Miocene ~~untill~~ the Quaternary” – **“…which developed from the Late Miocene to the Quaternary,….**

Line 59: “…..formed by **a** foreland fold and **a** thrust belt….”

Line 60: “….the clastic sediments deposited….”- “…**the deposition of clastic sediments…”**

Line 60-61: "….during the late Miocene towards the Pleistocene…."- **from the late Miocene to the Pleistocene**

Line 65: "On the mud volcanoes…"- which mud volcanoes??

Line 62: "More hover…." ?

Line 73. Personal communication with who? Which methods where used?

Line 73: **"sill-like"**

Line 74: replace develops with "**sits**" or **"is located**"

Line 74: 50 **meters**

Line 81: "On the surface outcrops deformation structures …" – rewrite

Line 82-83:"… highlighting what high intensity of stress and strain the volcano can generate…" **… highlighting the high stress and strain environment .....**

Line 84-85:"….and we still believe they are active…." .... **and are still believed to be active**,

Line 91: ~~monitoring~~ – **monitor**

Line113: introduce acronym for TST

Line 113: "…TST base local station…" – local base station / local TST base station???

Line 120: Real Time Kinematics **(RTK)**

Line 121: GCP**s**

Line 121: "…(Tab. 2).." – do you mean Table 1??

Line 125: "~~detected~~"-"**measured"**

Table 1: "~~GCPs NUMBER~~" – **GCP NUMBER**

Line 135: "…~~on the table~~…" – **in the table**

Line 141: rephrase the sentence.

Line 152: "…CTN1 point~~s~~ coordinates…"

Line 175: "… a cheap UAV.." – redundant information. Rather mention that it is a quadcopter UAV

Line 175: “…. ~~Fly~~ **flight** altitude……”

Line 176. “The feature of….”- feature is the wrong term here. Just say: The sensor size is…..

Line 193: add “” to the Gradual Selection

Line 196-197: **J**a**mes**, et al…….

Line 210: “Secondly,…” where is the firstly??

Line 248: **s**ignificant **c**hange

Line 275: “…survey techniques~~, they~~ have a very….”

Line 289: „**We**.....“

Line 290: “Data are still…..”- “**The data is still** ….

Line 294: “In literature…” – “**According to literature**….”

Line 360: “In this case more thoroughly monitoring will carried out:…”- rewrite this sentence.