

Review of
"Very high-resolution terrain surveys of the Cha das Caldeiras
lava fields (Fogo Island, Cape Verde)"
by Vieira et al.

Bianca Wagner, Geoscience Centre, University of Göttingen, Germany

January 26, 2021

Contents

| | |
|---|----------|
| 1 Data | 2 |
| 1.1 Data representation and accessibility | 2 |
| 1.2 Data quality | 2 |
| 1.3 Uniqueness | 2 |
| 1.4 Usefulness | 3 |
| 1.5 Completeness | 3 |
| 1.6 Reproducibility | 3 |
| 1.7 General comments | 3 |
| 2 Standards and Metadata | 4 |
| 3 Methods | 4 |
| 3.1 Uniqueness | 4 |
| 4 Publication | 5 |
| 4.1 General comments | 8 |

1 Data

1.1 Data representation and accessibility

Is the data presented readily and accessible for inspection and analysis?

Yes, the data is readily available on ZENODO. The authors used standard file formats, such as shp, tiff and pdf.

Is the data set accessible via the given identifier?

No, the data set can not be accessed via "http://doi.org/10.5281/zenodo.40350338" from a standard browser and has therefore been searched manually in ZENODO. Why was no other more discipline-specific repository chosen, such as PANGAEA or OpenTopography to make the data more visible within the community? Some data are provided on request, but such information is not given for the mesh (*.fbx) file. An explanation for this particular case would be helpful.

1.2 Data quality

Is the data set itself of high quality?

The quality of the DSM and the orthoimage mosaic is high due to the very high resolution. But the data set has some limitations (varying quality, blur), resulting from gaps in the original point cloud. Furthermore, the authors did not describe, why the provided products cover just a part of the volcano or the volcanic island. The overall accuracy of the DSM in z-direction might not be sufficient enough to analyse small changes in elevation due to shrinking, erosion or compaction in the range of mm to cm.

Does the claimed findings and its factors - individually and as a whole - are plausible and do not contain detectable faults?

Yes, the claimed findings are plausible. More details about the results would be helpful, such as the number of points of the point cloud or the spatial distribution of the point density.

Are there any inconsistencies within these, implausible assertions or data, or noticeable problems which would suggest the data are erroneous (or worse)?

No, there are no inconsistencies, just missing information (see 3.1) *Are error estimates and sources of errors given (and discussed in the article)?*

Yes, there is an error estimation of the GCP accuracy provided in the article and some further details in the supplemented report. *If possible, apply tests (e.g. statistics)?*

The values in the table were checked visually.

Unusual formats or other circumstances which impede such tests in your discipline may raise suspicion.

There are no unusual formats.

1.3 Uniqueness

Are the data presented new?

Yes, the data are new for this particular region, but a lot of other investigations dealing with spatial analysis and remote sensing were performed in the same region. An overview map showing the outline of the former investigation areas would be extremely helpful for future users. Beside this, a simple, but well-structured table could be used to present the various details given between lines 71 and 94

Is it possible to replicate the experiment or observation on a routine basis?

It would not be possible to replicate exactly this data set on a routine base due to the unique weather and illumination conditions as well as the time efforts and costs.

Is a variable of the data set supposed or suspected to reflect changes in the Earth system?

Yes, the data set reflects the changes of the flank of the volcano. *Is it a cost-intensive data set which will not be replicated due to financial reasons?*

Yes, it is cost-intensive in terms of human resources, accessibility and weather conditions.

1.4 Usefulness

Is the data set usable in its current format and size?

Yes, the data set is usable in the provided format and size. *Is there any potential of the data being useful in the future?*

Yes, the data set could be used for morphological studies and for the comparison of different volcanic land forms, for mass estimations and for teaching purposes. Beside this, it could be utilized for the technical/methodological comparison of different UAV approaches or photogrammetry software packages.

Would you be able to understand and (re-)use the data set in the future?

Yes, the data are easily to understand, because the main outcome is the well-known representation of elevation data (DSM). *It is plausible that the data, alone or in combination with other data sets, can be used in future interpretations, for the comparison to model output or to verify other experiments or observations?*

Yes, there are several opportunities to use the data alone or with other data sets. *Are other possible uses mentioned by the authors that can be considered?*

Yes, there are some applications mentioned, especially in the field of volcanology.

1.5 Completeness

Is the data set complete?

The answer of this questions depends on the definition of completeness. The file themselves are complete. But the mentioned UAV images, the point cloud (raw, ...) as well as the textured mesh(es) are not provided.

Does the data set contain all data, thus can be reviewed without unnecessary increase of workload for reuse in another context?

The currently available data set can be easily reused for several applications. In case of more quantitative or qualitative studies, further metadata about the processing steps and/or some of the other results are necessary.

Is the data set or collection split intentionally, for example, to increase the possible number of publications?

There are no obvious signs of intentional splitting of the data set.

1.6 Reproducibility

1.7 General comments

Is the data set significant - unique, useful, and complete?

The data set has a medium significance, is unique for this particular region and is useful for a number of applications. It can be rated as complete for more general studies, if just the DSM and the ortho-image mosaic are needed (visual morphological interpretations).

2 Standards and Metadata

Are the formal metadata appropriate?

There are no formal metadata provided. *Are common standards used for comparison?*

There are a few standards used, such as file formats.

3 Methods

3.1 Uniqueness

Is the method rated as new or improved?

In general, the described methods are not new. But the application of these methods in this region can be rated as new.

Are methods and materials described in sufficient detail?

No, whether methods nor materials are described in sufficient detail for these reasons:

- Please include a more clear description of the settings and steps performed for point cloud-generation as in the text just a lot of software-specific terms are listed.
- How did you avoid the bowl effect?
- Please replace the story-like writing style in some paragraphs
- Why are many important numbers and facts hidden in the text and not presented in tables or figures)
- Was the UAV equipped with an internal GPS?
- Which exact weather conditions occur per day and/or per flight?
- Which flight planning software was used?
- How large was the image overlap in both directions?
- Which coordinate system was used (just mentioned at the end of the publication)?
- Which reference services were used for the RTK?
- Why were the GCPs measured in 2017 and 2018, but not in 2016?
- Which pre-processing steps were performed on the images? (such us color correction, sharpening, selection)
- What is the total number of images? Could all images be used for the point-cloud creation?
- If yes, which selection criteria were applied?
- Was the point cloud clipped, cleaned, noise-reduced?
- What is the definition of a 2D and a 3D GCP?
- Which camera calibration was used?
- How did the authors fill the gaps of the point cloud or mesh?
- What about the 10cm DSM? It is just mentioned in the text, but seems to be one major outcome. How was it generated?

Are the accuracy, calibration, processing, etc. state of the art?

the description is not detailed enough to evaluate this question satisfactorily.

Does its claimed accuracy, the instrumentation employed, and methods of processing reflect the "state of the art" or "best practice"?

Yes, in general reflects the deployment of a fixed-wing UAV in concert with the PIX4D software one best practice option. *Are all theses claims and factors mutually consistent?*

Yes.

4 Publication

Is the article itself appropriate to support the publication of a data set?

In general, the article itself is appropriate to support the publication of the data set, but has some limitations. For instance, the authors did not mention possible disadvantages and potential errors of UAV surveys. This information could support the decisions of future users to select the best data set for their investigations. Furthermore, the text gives the impression that UAV surveys are a synonym for air-borne photogrammetry, which is not the case. The authors should differentiate in more detail, if the UAV campaigns in the cited publications were used for VIS photogrammetry or for other kinds of surveys, such as laser scanning or ash sampling. There is an ambiguity between the term "very high-resolution" in the title and the term "ultra high-resolution" in the text. Are these terms synonyms? Could just one be used? Parallel to this, the title is ambiguous. The phrase "terrain surveys" could describe any kind of spatial data acquisition in the field and describes two surveys. Why is the term UAV not mentioned?

In the abstract, the final products that are uploaded on ZENODO, are not clearly mentioned. Therefore, the abstract as well as the title give the impression that the 3D point-cloud, the textured 3D mesh and the images are available, too.

Very important details about the methods and the workflow are listed in the supplemented pdf-document. But this information should be the major content of a data publication. Otherwise, the future reader has to read at least two documents to gather all the relevant details.

*Does the article express clearly **what** has been found, **where**, **when**, and **how**?*

The description of the results (what), the location (where) and the timing (when) are sufficient, but there is information about the methods (how) missing (see other answers).

Is the overall structure of the article well structured and clear?

Most sections and paragraphs show a clear and common structure, apart from those:

- Section 1: The introductory part on page 4 is a mixture of technical description and geological observations and facts. It makes it hard for the reader to separate the information and to compare or evaluate the mentioned campaigns
- Section 2:
 - The relevance of line 120 to 128 is not obvious.
- Section 3:
 - The paragraph starting with line 205 should be placed behind line 194 to merge the information about the depression.
- Section 3.1:

- 249-250 - transfer to acknowledgments
- 258-261 - redundant to 251-254
- 274-282 - redundancy to previous paragraphs
- Section 3.3:
 - 298-305 - move to introduction
- Section 4.2:
 - 345-348 - transfer to methods
 - 354-357 - transfer to methods
 - It has in general a poor structure, which is a mixture of technical results and volcanic interpretation.
 - The definition of "quality zones" is still questionable.
- Section 4.5:
 - 431-433 - move to methods

Check the publication: Is the length of the article appropriate?

There is an imbalance between the general geographic, geologic and volcanic information on the one hand side and the description of the data and methods on the other side. Although the latter are the core information of the paper, it's not complete. Furthermore:

- Sections 1 and sections 2 are quite long.
- Section 4 (especially 4.1) is very short in comparison with other parts of the text. As the main outcome of the study - the point cloud - is the object of this part, more information should be provided.

Is the language consistent and precise?

In most parts of the text the language is consistent. There are just some typing mistakes (vulcanic - line 68, flow flow - line 41) and repeated usage of the same verb (conducted: 246-263). The word "kipukas" is mentioned at the beginning of the paragraph, but not explained. There are some "story-like" sentences, especially in 246-257 and 267-271 that could be expressed more formal.

Are figures and tables correct and of high quality?

The quality of the figures can be rated between good and medium. The coordinates of the maps are too small and hard to read. Some scales are not recognizable, and some maps could be enlarged to show more details. A lot of space is covered by quite large, but unimportant photographs. These recommendations could be used to improve the figures:

- Figure 1:
 - The space in the lower left corner is wasted.
 - There are no coordinates.
 - The outline of the mentioned eruption could be shown.
 - The resolution of the scales is poor.
 - Major locations (Bordaira, Boca Fonte) or geological features that are mentioned in the text are not presented, such as "the fissure", vents (line 204) or the depression itself.
 - The ocean around the island is invisible. Therefore, the reader needs an additional map to understand the investigation area fully.
 - I would like to recommend to replace figure 1 by two new maps - one that contains all the major geographical and technical locations and objects (and a small overview map with all Cap Verde islands) and a second one that shows the geology and the mentioned features.

- Figure 2:
 - The figure is not very helpful (too large, blurry).
 - It could be removed or improved by adding some explanatory lines and labels.
- Figure 3:
 - Add starting and landing points.
 - Colourize flights by days or weather conditions.
 - Add a legend to explain black line and points.
 - The figure could be the base for a technical map.
 - Add reference stations.
 - Add the GCPs listed in table 1.
 - Increase the size of the figure.
- Figure 4:
 - The figure is not very useful, because it includes just large pictures of men holding a pole.
- Figure 5:
 - The image is of low quality.
 - The location of this figure in a larger map is not clear (e.g. Figure 7).
 - Switch off the tie points for better visibility.
 - Provide some information about distances and dimensions.
- Figure 6:
 - The figure is quite small.
 - The sub figure B is not very informative.
- Figure 7:
 - Include the locations of figures 8, 9, 10, 11.
- Figure 8:
 - The contour lines are not very useful.
- Figure 9:
 - There are different representations of the sub figures, e.g. in B: contour lines and DSM, others just with contour lines.
 - The scale is hard to detect.
 - The sub figure C would be better without contour lines.
- Figure 10:
 - The figure is not very useful.
 - There are different representations of the sub figures of figures 8, 9, 10, 11, e.g. in B: contour lines and DSM.
- Figure 11:
 - Which areas are of low quality? Please mark them.
- Figure 12:
 - Please give explanations for the stripes in NW-SE direction.
 - Please add reasons for blurry patches (similar to low-quality areas?).

- Figure 13:
 - Some information about the direction could be added
 - Some points, places, features for reader's orientation would help a lot.
- Ideas and suggestions for additional or updated figures:
 - Add a schematic workflow showing the major processing steps.
 - Add an additional map: see details in paragraph 1.2.
 - Add a map of the interpreted, mapped lava types (could be included in a geological map).
 - Add some more technical figures from the report (pdf-document) or provide more references to the report.
- Tables:
 - The layout of the table is poor.
 - The landing positions on page 10 (number in text) could be added to a table or to figure 3.
 - Further comments see details in paragraph 1.2 (additional figure).

Are mathematical formulae, abbreviations, and units correctly defined and used?

The units should be presented in a correct way (km^2 instead of km2). The differences in the number of decimal places of the same quantity imply different levels of accuracy. The style of the larger numbers (with or without separation) is not homogeneous (e.g. in line 181 versus line 185).

Are any references/citations to other data sets or articles missing or inappropriate?

In the cited publication of Richter et al. (2016), TLS and photogrammetry was used. Did those authors produce comparable products? Further details are missing to compare those results with the recent ones (quality, resolution?).

4.1 General comments

Is the data set publication, as submitted of high quality?

The current version of the publication is rated as "medium", as several details of the methods and workflow are missing and the quality of figures and tables needs to be improved. At the moment, the reader needs time to compile all relevant data for a comprehensive comparison, evaluation and usage of the data.