

Reply on RC3

Giuseppe Esposito and Fabio Matano

Author comment on "A geodatabase of historical landslide events occurring in the highly urbanized volcanic area of Campi Flegrei, Italy" by Giuseppe Esposito and Fabio Matano, Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-267-AC3>, 2022

General comments

Reviewer comment: The paper presents an Inventory of historic landslides from a region in Italy based on a compilation of various datasets such as previously published landslide inventories and historic sources. The paper is well written and the landslide inventory is undoubtedly relevant for local planning and mitigation purposes. However, i'm not sure if the area/scope of the database is of relevance to a general geoscience community as is the scope of ESSD "high-quality data of benefit to Earth system sciences". Either the authors needs to thourroughly make the relevance much clearer or the paper is not fit for publishing in ESSD. Furthermore the database needs more explanation and documentation/discussion as mentioned below and in the specific comments which means it also has short commings both within "well-documented and highly useful data products".

Author response: We are grateful to the Reviewer #3 for his/her careful review of our manuscript and for the valuable comments. In accordance with the provided suggestions, in the "summary and conclusions" section we have remarked the relevance of the CAFALAG geodatabase for both local and international geoscience community. In particular, as also explained in the following comments, this geodatabase may have a significant importance to enhance the scientific knowledge on the role played by landslides in the geomorphic evolution of volcanic landscapes, and on processes that lead to slope failures and control their spatial variations. For example, data reported within this geodatabase may be useful for: i) geomorphologists and engineering geologists focusing their research on numerical models aimed to understand relationships between landslides and topographic, geotechnical and other environmental factors controlling the stability of hillslopes, in this case made by volcanic rocks, for prediction purposes; ii) scientists interested in evaluating the role played by marine factors (e.g., sea wave action) in triggering failures of coastal slopes, that in volcanic islands represent a major hazard also because of the possible cascading tsunami processes. In order to inform the reader about potentialities and limitations of the CAFLAG geodatabase, we have added a new section explaining this. Information included in this section will be essential to make the reader aware of the possible uses of this dataset. In addition, we would also remark that as pointed out by Guzzetti et al. (2012), it has been estimated that landslide inventory mapping in terrestrial settings covers only around 1% of the land surface. This situation also pushed us to publish a landslide geodatabase on a public repository, and hopefully on ESSD, with the aim of providing a scientific support to both a broad research community

and local public bodies engaged in the landslide risk assessment and mitigation.

Reviewer comment: We need a discussion of biases in the dataset: temporal (old slides might be under reported??) volumetric: (large landslides might be overrepresented) etc.

Author response: In accordance with the Reviewer's suggestion, we have added the new section 4.5 "Limitations of the CAFLAG geodatabase" providing a discussion of biases in the dataset.

Reviewer comment: How complete is the landslide? what is your estimate, can you quantify.

Author response: Please, see the previous comment. In the new section 4.5 we have provided some information about the completeness of the geodatabase, and a comparison with other historical databases available in the world. We have remarked that the CAFLAG geodatabase is characterized by a relatively high spatial completeness, compared to other databases covering comparable time ranges and spatial extents even larger. It has not been possible to provide an objective quantification of the completeness due to the lack of another independent and confirmed complete inventory, or a theoretical landslide probability density function for statistical comparison.

Reviewer comment: Compare dataset to other datasets/landslides published in ESSD and elsewhere.

Author response: Please, see the previous comment. In addition, we would like to remark that in ESSD we have not found historical landslide databases based on literature and archive sources comparable with the CAFLAG one.

Reviewer comment: you mention climate ongoing climate change in the abstract but not in the text. You need to explain why/how climate change will affect landslides in your area and how your database can be applied to mitigate this (if possible). Alternatively remove the mention of climate change. ut i think that would be a shame not to include.

Author response: We thank the Reviewer for this comment and for inviting us to explain this point in the article. However, we have decided to do not address the effects of the climate change on landslides here, but within a further article that we would like to publish throughout the next year. Therefore, we propose to remove the mention of climate change from the abstract.

Reviewer comment: You need to explain/justify (much more) why this dataset is relevant to a wider geoscience community (outside a purely local audience).

Author response: As requested, in the discussion section we have added more text to explain how this dataset could be exploited by both local and broad geoscience community. Specifically, we have pointed out that the CAFLAG geodatabase could be used to: i) enhance scientific knowledge about the role played by landslides in the geomorphic evolution of volcanic landscapes, and on processes that lead to slope failures and control their spatial distribution; ii) calibrate and validate statistically-based landslide susceptibility models; iii) assess risk conditions and support the planning of mitigation measures.

Specific comments

Abstract

Reviewer comment: Line 6: Very important point in deed.

Author response: Thanks.

Reviewer comment: Line 13: formation?

Author response: We prefer to use "modification".

Reviewer comment: Lines 20-21: Is this real or a bias of the data? discuss in the paper.

Author response: This is a bias of the data. Accordingly, we have corrected both this sentence and the related paragraph into the "Temporal distribution" section. Please, see also the responses to the previous comments related to the bias and completeness of the data.

Reviewer comment: Lines 22-23: As one would expect the record of landslide fatalities to be more complete than the record of all landslides maybe this demonstrates that there is a bias in the dataset skewing the data towards more recent landslides? see my previous comment.

Author response: Please, see the responses to the previous and following comments about the bias in the dataset. This issue has been discussed in the new section 4.5 "Limitations of the CAFLAG geodatabase".

Reviewer comment: Line 25: how do you propose this is done?

Author response: Please, see the previous comment.

Reviewer comment: Line 29: maybe "especially" instead?

Author response: The suggested correction has been applied.

Reviewer comment: Lines 33-38: You don't mention, report or discuss lahars in this paper so I don't think it is relevant to include this here.

Author response: In this section, we are presenting all the possible mass wasting processes occurring in volcanic settings. Even though we do not report lahars in the presented geodatabase, we believe that it is important to mention these processes since they are expected both in the Campi Flegrei and in other parts of the region in case of eruption. For this reason, we propose to do not remove this part.

Reviewer comment: Line 41: population number or density?

Author response: We have substituted "highly" with the more suitable "densely" term.

Reviewer comment: Line 46: I guess since pre historical times?

Author response: The sentence has been rephrased because of mistakes in the used terms.

Reviewer comment: Line 48: place name on fig 1

Author response: This locality is not included within the Figure 1.

Reviewer comment: Line 49: place name on fig 1

Author response: The suggested correction has been applied.

Reviewer comment: Line 50: place name on fig 1

Author response: The suggested correction has been applied.

Reviewer comment: Line 68: "a GIS"

Author response: The suggested correction has been applied.

Reviewer comment: Figure 1: Make the map bigger and the Italy inset smaller. Harmonize with place names in text. Show absolute elevation (100 m contours or so) Maybe show simplified geology as background to support the setting paragraph. Show also an outline of what the study area is (Campi Flegrei) I guess it is not defined by the map extent?

Author response: In accordance with the Reviewer's suggestions, the Figure 1 has been modified as follows: 1) Italy has been placed in a smaller inset; 2) we have inserted the place names cited throughout the article; 3) we have added a colour scale to represent elevation data, and blue lines to highlight the drainage network; 4) UTM coordinates have been plotted on the map. It is worth noting that the map extent defines the Campi Flegrei study area.

Reviewer comment: Line 106: Why a point shapefile? dataset would have been much more useful if you had digitized the area of the landslide where possible.

Author response: We agree with the Reviewer's comment. Landslides represented by polygons are certainly better than points. In this case, however, most of the used data sources did not provide polygons but only coordinates of the landslide-affected sites. In order to do not generate bias in the landslides location and extent (e.g., with polygon larger or smaller than the real affected area), we decided to use a point shapefile and to do not digitize uncertain areas.

Reviewer comment: Table 1: what about areas? Affected area (total area) Scarp area deposit area. These are very important to determine the magnitude/consequence of the event.

Author response: Please, see the previous comment.

Reviewer comment: Table 1: how estimated? what are the errors? from fig 6 it looks like the volumes are binned (fx 90 or so in the 10m³ size but this might of course be because the x axis is log.

Author response: In this work, we did not estimate areas and volumes of landslides. We only collected information already available from the used data sources. For this reason, we are not able to provide errors associated with the reported volumes. However, volumetric information displayed in Figure 6 is consistent with the order of magnitude of rock volumes displaced by landslides in the study area. Esposito et al. (2020), for example, analysed failures affecting a coastal cliff in a time span of three years. They estimated that 90th percentile of the volumetric distribution related to the detached rock blocks was equal to 2.35 m³, and quantified in 150 m³ the largest displaced block, in line with volumetric data shown in Figure 6.

Reviewer comment: Table 1: just out of interest: can you always assign a trigger with high confidence?

Author response: Triggering factors were indicated for a few records only, such as when the available information was so accurate to be reported (e.g., from scientific articles or

field surveys).

Reviewer comment: Table 1: Could be interesting with a column stating the preconditioning factor (type of weak geology etc.)

Author response: We thank the Reviewer for this suggestion. In the geodatabase, we have included geotechnical properties for many landslide-affected sites, as well as the degree of landslide hazard or susceptibility.

Reviewer comment: Line 149: show on fig 1 (is it the Gulf of Pozzuoli? use same name)

Author response: Thanks for this comment. We have changed "Gulf of Pozzuoli" to "Pozzuoli Bay" within the Figure 1.

Reviewer comment: Line 150: Show on map?

Author response: We have removed this sentence because irrelevant in the description of the study area.

Reviewer comment: Line 168: result

Author response: The suggested correction has been applied

Reviewer comment: Line 169: ravine

Author response: The suggested correction has been applied

Reviewer comment: Line 181: write out for clarity "maximum 10 minutes..."

Author response: The suggested correction has been applied

Reviewer comment: Figure 2: It is quite self evident just from the map distribution whether they are coastal or inner slope. and thus a bit irrelevant. It would be more interesting to display the type of landslide and maybe also the magnitude (vol) with the point size. This would make one start tinkering and highlight the appeal of your dataset for others.

Author response: We agree with the Reviewer's suggestion to display the type of landslide movement in the Figure 2. Given that the volumetric information was available for only 277 out of the 2302 catalogued landslides, we prefer to do not represent this incomplete information.

Reviewer comment: Figure 2: show absolute elevation (maybe as a colour range behind the hillshade?)

Author response: We thank the Reviewer for this suggestion. We have tried to represent elevation by using different sets of colour ranges behind the hillshade, as suggested. In all cases, the coloured background has weakened visibility of points generating confusion in the map readability. For this reason, we propose to do not add coloured layers to the grayscale hillshade. Information on the absolute elevation can be achieved from the new version of Figure 1.

Reviewer comment: Figure 3: is the "unknown" binned with the complex or what? do you always know the kinematic of a historic slide?

Author response: As already explained into the text (lines 195-198), data sources

provide information on the movement type for all the 2302 catalogued landslides (i.e., fall, flow, slide, complex). However, among the complex landslides (1115), information on the partial movement (e.g., debris slide + flow) is available for only 343 out of the 1115 complex landslides. In other words, data sources of 772 complex events do not report further information besides the complex typology. For this reason, we have decided to split the complex landslides in two categories: "complex" and "complex (with info)". This has allowed us to do not discard information available for the 343 complex events.

Reviewer comment: Figure 4: show on fig 1 or 2

Author response: As suggested, the affected localities have been indicated in Fig. 1

Reviewer comment: Figure 5: indicate position on fig 1 or 2

Author response: As suggested, the affected localities have been indicated in Fig. 1

Reviewer comment: Line 220: "of the 277 landslides"

Author response: The suggested correction has been applied.

Reviewer comment: Figure 6: so i guess this means that a lot of the landslides were estimated to be c. 10m³?

Author response: The graph shows that 90% of the landslides were estimated to displace rock volumes within 200 m³

Reviewer comment: Figure 6: I think this fig would be a lot easier if the x axis was not log. I dont know if there is a reason to make i log (convention or such) but otherwise change it. Change caption to "... of the 277 landslides with volumetric data"

Author response: We agree with the Reviewer's comment. Accordingly, we have changed the format of the x-axis and the caption. The new graph shows, in addition, that landslides with volumes below 10 m³ are strongly underreported.

Reviewer comment: Lines 229-230: i guess this also is to do with the aspect/area distribution in the field area? or what? is the aspect completely evenly distributed in the area? this should be mentioned discussed.

Author response: We agree with the Reviewer's comment. Accordingly, we have calculated the density of the landslides with respect to both aspect and slope distributions in the study area, in terms of events/km². Both the Figure and related text have been updated accordingly.

Reviewer comment: Line 255: does this mean that the remaining of te 2200+ landsldies mapped are much older than the 1820ies or are they all from within the period of the database?

Author response: This means that the remaining landslides are all from within the period of the database but without an accurate indication of the year of occurrence.

Reviewer comment: Lines 256-257: this is not what I see in Fig. 10A. there is definitely a bias towards more recent landslides being reported as i see it. This paragraph needs much more discussion of biases etc. I dont doubt that 86,97 and 05 are years of extreme events, but you really need to discuss the completeness of the landslide db

Author response: Please, see the responses to the previous comments on the

geodatabase completeness. We remark that this point has been discussed in the new section 4.5 "Limitations of the CAFLAG geodatabase".

Reviewer comment: Line 266: How about further back than the 1900? i would expect you could find records of fatalities in newspapers which should be available further back?

Author response: In this research, we have decided to do not go back further than 1900 in order to avoid collecting biased data affected by high uncertainty.