GENERAL COMMENTS

Assessing qualitative long-term volcanic hazards is essential for a long term management. And when dealing with different types of hazards that may affect human infrastructure, this is even more the case. This is why, Lanzarote seems a good study case.

A lot of effort has been made to give a general overview of the geological context of the Island as well as to collect information on the volcanism history of the Island. The authors are giving a good description.

When starting the assessment of hazards and defining scenario, the authors focused on specific scenarios (especially for the fallout). Regarding the available data, the susceptibility map for the whole island, wouldn't it more suitable to make a hazard assessment on the whole island and to integrate the hazards simulation in one global map? The scoop of the paper is describe in the title "scenarios" but the data seem to exist to extend it to the whole island and if used it would give even more reliable output.

The work that has been done is also an interesting application of VORIS which will surely allow further researches.

SPECIFIC COMMENTS

- How do you explain the difference that can be noticed between this manuscript and the susceptibility map published in 2013 by Bartolini et al.? Why did you had to produce a new version?
- Explain why it has been decided to only focus, for some hazards, to specific scenarios instead of hazard assessment on the whole island. The ash fallout is in the paper limited on one specific scenario meanwhile the susceptibility map could be used to extent the analysis to the whole island. Lava flows have been simulated for the whole island.
- How would you combine all the hazards together?
- What is the added value of fig 5a? VORIS has already been presented previously and there is no need to prove how this is working. Focus on the new information given by this paper.
- Moreover, propose an integration of the fallout simulation. For the moment they are overlapping themselves and all simulations have the same probability where as it is clearly stated that some dominant wind are present on the island.

Conclusion:

- What could be the social impact of the hazards that are presented in the paper?
- Could you make a general conclusion regarding all the hazards?

TECHNICAL CORRECTIONS/TYPING ERRORS

Title

- wouldn't it more suitable to write "hazards". Three different hazards are studied in the paper.

Manuscript

L13-14: Lanzarote is an active volcanic island that has hosted the largest (>1.5 km3 DRE) and longest (6 years) eruption, the Timanfaya eruption, on the Canary Islands in historical times (last 600 years):

- the largest and the longest compared to?

L14: the Timanfaya eruption

- give the exact date of the eruption

L21: rational land planning

- would you mean rational or national?

L24: … the main aspects…

- give more information about what you mean with "main aspect"

L27: … in those places…:

- is Lanzarote also included in the THOSE places? If not I would suggest to skip the "those"

L30: … due to the increase of exposition of most places …

- due to urban sprawl

L33: … despite having hosted 15 eruptions in historical times

- you might refer to your table 1 and to add, in this table, information about the years of these eruptions.

L34: … one of the most important touristic destinations

- what is your reference? Wouldn't it better to be more general and say that "Lanzarote is an important touristic destination"?

L35: … has abandoned some traditional livelihoods

- Was the traditional livelihood more adapted to the volcano to mention this in the paper?

L35-38: Tourism has had a considerable economic impact on the region that has abandoned some traditional livelihoods and has suffered a tremendous demographic expansion. The latter, not always well planned and without considering potential natural hazards, may now interfere with the effective management of future volcanic crisis.

- It would be great to support your statement of growth with some numbers or with a map where you would see the urban sprawl. So we can have an idea of the importance of the change (big/small change)

L38-42: The last eruption, that occurred in El Hierro (Fig. 1 Inset) in 2011-2012, is a good example of the implications of not having conducted a previous hazard assessment…

- The link with the demographic expansion is not clear enough. Could you please give us additional information: did the urban expansion mainly occurred in the last eruption period? Did the

eruption caused socio-economic disaster because no plan was existing? What was the human component/implications/problems of this eruption on the Island?

L55: Timanfaya type eruption

- Define the Timanfaya type eruption

L57: …the first susceptibility map

- …the first volcanic eruption susceptibility map

L59: … a spatial probability map:

- Of what?

L61: …these previous studies tackles a proper volcanic hazard

- What do you mean with "proper"

L65: based on a review of these previous studies…

- Did you only used the above mentioned studies or did you used also additional information. If so, I would suggest to delete the word "previous".

L66: Matri et al (2016a)

- et al.

L68 : due to the scarce available information

- Gives a "bad" impression. Wouldn't it more suitable to present the think like if there are out of the scoop of this paper for example

L70 : recognised in the Holocene

- recorded ? in the holocene

L84-L89:

- Does this paragraph give an added value to this work?

L95: a really high eruptive rate …. L105: eruptive rates of 0.013-0.027 km³/ka

- Pay attention to the fact that the second eruptive rate is higher than the first one that you mention. Maybe chould it be a good idea to avoid the use of "really high" for the first eruptive rate or to also give this impression for the second one.

L108: Tao, Nuevo Fuego and Tinguaton eruption

- To keep as singular or to put as a plural?

L115: Methodology

- Isn't this paragraph more related to the data that you are using?

L116: the first step in any long-term…

- Could you mention more precisely why you are collecting your data "to produce a volcanic susceptibility map"?

L117: Holocene period

- Justify the choice of this period in the frame of your work.

L120: "we"

- It is a personal choice but may I suggest to use an impersonal form in the whole manuscript. To avoid the use of "we" and to adapt the sentence like this "Previous geological … have been taken into account".

L127: … in the computation of volcanic susceptibility

- State clearly why the previous volcanic susceptibility maps that have been realized in Lanzarote have to be updated for this work.

L129: previous information

- Please, provide additional information about which previous information you are talking about

L132: for the spatial analysis (volcanic susceptibility).

- Are you producing one susceptibility map or are you making a distinction between lava flows and explosive eruptions? I guess the probability to have these kind of eruption differ within the island (presence or not of water).

L133:… to simulate lava flows, fallout and pyroclastic…

- Use the same sequence as the one presented in the manuscript.

L115-L134:

- When stating the data that you are using, I think you forgotten to mention the wind information you've collected.

L140: most sub-historical

- What do you mean with this?

L141: Guatiza map)

- No parenthesis needed

L146: Guatiza map)

- No parenthesis needed

L140-L146 and L157-L166:

- Clearly state the difference between both paragraphs.

L163: 226km² of the Lanzarote's surface

- Replace with 226km³ of Lanzarote surface

L165: Some of the stages…

- Simply refer to these studies

L167: the consequences of 6 years

- All number under 10 have to be completely spelled. Replace with "six years"

L173: 14km in length

- Where is it on the map?

L174: …the SW coast

- Isn't it the NW coast?

L190: …we obtained Miocene-Pliocene, Pleistocene

- Give some arguments why are you here extending your time frame.
- Be consistent with your figures and give the same terminology in your text and on your figures (table 2= mio-pliocene)

L199: …eruption will start…

- Replace "will" with "may". Susceptibility maps are still probabilities and some nuance has to be given to this sentence.

L201: This volcano-structural information…

- Based on the premise that new vents will not form far from the previous ones, this volcano-structural information is used…

L214: …the distribution of volcanism…

- Replace with: the volcanism distribution

L216: … taking into consideration Geyer et al. (2016)

- the contribution of Geyer et al. (2016) is not clear enough. If I'm right, they produced the regional stress field. Refer to them after mentioning the regional stress field or state clearly that they produced it: "the regional stress field produced by… "

L218: to generate quantitative … in the island

- to generate a quantitative… on the island

L219: …method that uses the calculation of a …

- method that calculates a kernel function…

L220: The method is based on the distance…

- rephrase your sentence. It has the exact same structure as the previous one.

L223: onshore and offshore

- it is quite confusing, you are giving us the impression that offshore eruptive fissures may be observed and used but later on you state that they can't be used for the analysis (L315). The information present on line 315 has to be given before to clearly state that even though offshore eruption are highly probable, they can't for the moment be included.

L224: …and reliability values

- refer to table 3

L225: GVB-CSIC

- define the acronym

L227: LSCV:

- define the acronym

L225 and L228:

- avoid repetition of a same information or clearly state the difference between both panels. Elicitation of expert judgment procedure … meanwhile a group of expert…

L217-239:

- the sequence of the manipulation is not clear. It give a repetition feeling. Restructure the paragraph.

L231: the bandwith parameter

- could I advise to be consistent in the terminology that you choose. Pick up one word: smoothing parameter or bandwidth parameter.

L235: considering the regional stress field model

- clearly state that the stress field is not use as input in QVAST.

L249: …size were inferred from data published from historical eruptions

- replace with … inferred from the historical eruptions published data.

L250: … and references therein

- please provide all main references you are using.

L251: …parameters of 1824

- replace with: "parameters as the 1824… "

L252: …since this scenario can be…

- since these parameters can be?

L260-264:

- wouldn't this be more suitable for a caption?

L258: … the entire wind rose directions and for the NE direction…

- refer to the figures (Fig. 5b) and (Fig. 5a)

L260: figure 5A

- Please provide, such as for figure 5B, the parameters that have been used.

L269: … as single vent scenarios reproducing lava flows of 1730

- I don't see the added value of showing these results. Where you calibrating the model using these lava flows? The overall map is more interesting.

LL273: …35km, since 1730-36 eruption poured out lavas… 25km.

- Not clear which final length you are using for the simulation. Two length are mentioned. Which has been used to model the lava flows? The parameters used for the simulation could be added in the caption of the figure.

L286: …in areas close to the previous

- Are you still using the susceptibility map?

L295: in the range of around 5-29°

- Be more precise

L296: …areas with different Heim

- Heim?
- Give the exact values that you used.

L300: … has hosted important eruptive

- Has hosted an important…

L321: … Timanfaya eruption

- Reference to fig 4

L322: …in this zone (Figs 1,4)

- Reference only to figure 3

L326-328:

- The argument that is given is weak. Give more arguments. State clearly how does that method of Cappello et al. have been proved.

L329-333:

- Keep in mind that the conclusion that is made is only valid for one case scenario.

L338: …National Park and Natural Park

- Show these area on a map

L341: …would be practically unaffected by lava flows

- Would have a lower chance to be inundated by lava flows.

L343: … to areas close to the coast

- All areas in Lanzarote are close from the coast.

TABLES:

Table 1: add the starting and end year of each eruptions

Table 2: Are the faults onshore or offshore

Table 2-3: use similar names

Table 4:

- The mean is usually associated with one value. Clearly state which is your mean length: 5 or 7.
- Put the table in the same sequence as the manuscript
- Column height: which is the unit of it?
- Size particles: unit?

FIGURES:

GENERAL REMARQUES

- Put the names of the islands, cities, volcanoes, parks that you mention on a map
- Use colorbrewer2.org to pick up colors that have a good contrast. Sometimes, some colors have not been selected properly provoking some confusion in the figure.
- Writing "legend" as title of the legend is not really needed. People knows that the symbols are the legend.

Figure 1

- The 2011-12 eruption is quite hard to see on your map. Make the symbol or the frame bigger.
- colorbrewer2.org
- "historical eruprions 1824" to be replaced with eruption
- Use in the sea the same blue as the one used in figure 2. The blue that is use for the moment make the message more difficult to see. The geological information is the message of this figure and not the sea.
- Source: http…. : wouldn't it adapted to propose your own version of the map?

Figure 2:

- Historical eruprtions 1824: to replace with eruption
- If a name is associated to some eruptions, I would suggest to add the names in the legend.
- colorbrewer2.org

- Some elements of the map are not present in the legend (the symbol of how the pictures have been taken for example)
- Show only the elements you mention in the text. Some cones and eruptions that are present in the figure are never mentioned in the text: remove them from the figure.

Figure 3:

- colorbrewer2.org
- Use similar colors for the vents and fissures of one same period.

Figure 4:

- Susceptibility? Give more information: susceptibility of…
- "Value" can be removed
- The colors of the legend are not the same as the one in the figure
- Timanfaya park: where is the park?

Figure 5:

- Scale: put everything to 10km and use the same extent for 5a and 5b.

Figure 6:

- Remove the "legend" title and the "lava_35km", "lava_7km", "value", "lava flows.tif"
- For a and b: place the eruption location you used for the simulation
- Inform the reader the values are probabilities to be inundated by lava flows.
- For c: Color choices: Look at Thompson et al. (2015). She is giving useful tips for the selecting the right color range for maps. Use the same color range as for a and b or adapt all of them based on Thompson et al. Green is usually considered as safe however, you have still some probabilities.

Figure 7:

- VEI: no additional information is given about that in your text
- Give some extra information about all the symbols of your map. What are the lines for?