

## ***Interactive comment on “Long-term volcanic hazard assessment on El Hierro (Canary Islands)” by L. Becerril et al.***

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### Overall impressions

Becerril et al.’s paper entitled “Long-term volcanic hazard assessment on El Hierro (Canary Islands)” is a well-organised presentation of a strong volcanic hazard investigation. The study is a positive example of how robust quantitative hazard analyses done using probabilistic tools such as HASSET and VORIS can be used to support and validate qualitative scenario-based hazard assessments that are valuable for use in emergency management.

Their structured approach to creating a volcanic hazard assessment for El Hierro is methodologically strong and concisely explained in the text, although in a few places

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some more detail would help the reader (I have outlined suggestions below). Justification for parameter choices, weighting, and limitations are clearly described throughout, although the implications of some choices (e.g. using the full Canary Islands historical record) could be explored further. The authors thoroughly address many outcomes, including consideration of phreatomagmatic and geothermal eruption potential. The paper is generally well written although there are some minor issues with spelling and grammar which are outlined below. Attractive, simple, legible figures support the text, although the figure captions could include more detail.

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### General comments

1. The use of “susceptibility” map requires further explanation as this is not a common name for maps in volcanology. An explanation of what information was used to determine the zones on the susceptibility map would be helpful; it would also be interesting to see some structures on the susceptibility map, such as faults and rift axes. I acknowledge that the authors do cite Becerril et al. (2013) for this information, but at least a brief explanation should be presented here.

2. The Malpaso Member adds interesting complexity to the hazard analysis, and is appropriately addressed in the body text, but could be mentioned again the discussion’s reference to the completeness of the catalogue of eruptions on El Hierro.

3. Some potential questions that could be addressed regard the temporal analysis dataset and the visual complexity of the resulting qualitative map:

• The authors use the historical dataset for the whole of the Canary Islands. What are the implications of this choice?

• The qualitative map is very complex with many small discrete hazard zones – how would this affect how the map is used in emergency management?

### Specific comments

1. In the authors' addresses – should Becerril's address be "Volcanology Group" rather than "Group of Volcanology"?
2. Abstract line 2: "To ensure qualitative results" Is that really what you want to say??? Should 'qualitative' be replaced with 'robust'?
3. Abstract Line 2: Consider changing "territorial planning" to "land-use planning"
4. Abstract Line 12: The sentence starting: "We analyse the past eruptive activity. . . . ." is a bit awkward. Maybe change to: "We analyze the past eruptive activity to determine the spatial and temporal probability and likely style (i.e. the where, when and how) of a future eruption on the island".
5. Abstract line 17: ".the first qualitative volcanic hazard map". Is "qualitative" really what you mean? Do you mean "the first qualitative integrated volcanic hazard map"? What exactly do you mean here? Do you mean an "all volcanic hazards" or "integrated scenario-based all-volcanic-hazards" map? What does "total qualitative" mean? This is not a commonly used term. Might be good to explain what you mean.
6. Introduction line 20: "preventative" is spelled wrong. Not only that – it is probably the wrong word choice here. I suggest "mitigative" instead of "preventative".
7. Introduction line 21: add comma after "risk" and "analysis", and change "analysis" to "analyses".
8. Introduction line 23: Territorial planning: consider changing to "land-use planning", and insert an "and" before "emergency management, and then delete the "etc" at the end of the sentence
9. Page 1801 line 11: "consists of", not "consists in"
10. Page 1801 line 12: By "further" do you mean "future?"

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11. Page 1801 line 14: What do you mean by "structural data"? You need to expand here. Structural data can mean different things to different readers, (fault and folds vs tectonic setting and everything in between). It would be good to expand on what you mean. Surely this must include things like the underlying geology, zones of weakness in the crust, depth of melting etc? Locus of past events? Be more specific.
12. Page 1801 line 23: ". . .some authors use statistical methods. . . ." What do others use? Do you mean "most authors use. . ."?
13. Page 1802 line 8: This list of volcanic hazard studies directly contradicts what you said in the abstract, i.e. that no systematic hazard assessment has ever been carried out for the Canary islands.
14. Page 1803 line 7: "Atlas"??????
15. Page 1803 line 14: After introducing the islands refer to Fig 1.
16. Page 1803 line 14-15: maybe change to: ". . .historical eruptive activity has produced mafic eruptions ranging in intensity from Hawaiian to violent strombolian, and . . ."
17. Page 1803 line 18: State what island the Timanfaya eruption occurred on.
18. Page 1803 line 20: Maybe change "extruded" to "erupted"
19. Page 1803 line 22: just confirming – all historical eruptions at Teide and surrounds have been monogenetic?
20. Page 1804 line 4 change "emerged" to "emergent"
21. Page 1804 line 15: give age of the Tanganasoga eruption
22. Page 1805 line 1: What do you mean by structural data? Be more specific.
23. Page 1805 line 7: Name the "three parts", it is unclear what you mean.
24. Page 1805 Characterisation of the eruptions. Make sure the eruption record is

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clearly presented (for example, make sure you refer to Table 1).

25. Page 1805 line 15: change to: "Some felsic components of dikes and lava flows associated with. . . ." or just: "Some felsic dikes and lava flows. . ."

26. Page 1805 line 19: Give age of El Golfo, and delete "and" after "El Golfo".

27. Page 1805 line 21: This sentence doesn't make sense. Do you mean: "Eruptions typically occur from fissures, and produce proximal fallout, ballistic ejecta and lava flows" ???

28. Page 1805 line 24: "but only generate secondary products when compared to other deposits" doesn't make sense.

29. Page 1806 line 18: Explain in more detail what you mean by "susceptibility maps".

30. Page 1806 line 22: Change "elaborated" to "presented" or "developed"

31. Page 1807 line 4: How were susceptibility values derived? What do the 5 sectors mean?

32. Page 1807 line 10: Change "field revision" to "field work".

33. Page 1807 lines 17-18: It is a little confusing to say you used the whole data set from the Canary islands for the historical period because not all of the eruptions that have occurred in this period have been identified or dated. Surely this part of the record for El Hierro would be the best documented? If not – explain why. Also – explain clearly what the implications are of using the data set of historical eruptions from the whole of the Canary islands. Surely by applying this to temporal recurrence at El Hierro the rate will be higher than it actually is? I think this needs more explaining.

34. Page 1807 line 23: Perhaps provide some more detail on the seismic unrest episode. In fact, somewhere there should be a more detailed explanation about both historical unrest episodes on the island.

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35. Page 1810 line 12, Again – how were these 5 zones established? "based on structural susceptibility" is very vague. Please give more detail.

36. Page 1813 Node 8 extent: Explain in more detail how this was determined. Was each hazard considered separately?

37. Page 1813 line 19: Do you mean "THE" episode of seismic unrest? (give year)

38. Page 1815 line 26: Change "deposited" to "exposed"

39. Page 1817 Total hazard map: How were the different hazards combined to generate the total hazard map? I think more detail is needed to explain this. Note that this is an approach similar to that taken by Lindsay et al (2005) for the "integrated hazard maps" in the Volcanic Hazard Atlas of the Lesser Antilles.

40. Page 1818 page 8: rewrite as: "In Fig 7a the most likely scenarios. . . .are presented together"

41. Page 1818 line 12: This sentence doesn't really make sense, given that "hazard" incorporates a probability of occurrence. Maybe change the beginning to "hazard intensities"

42. Page 1819 line 10: Give some examples and reference the source of your information regarding "unnecessary over-protective decisions".

43. In the discussion perhaps mention how the approach taken here differs from other approaches, e.g. BET-VH.

44. Figure 1 caption, provide more detail, e.g.: Geological map of the island of El Hierro, the southwestern most island in the Canary island archipelago (see inserts). LP =, LG = etc

45. Figure 2 caption. Susceptibility to WHAT?? Explain.

46. Figure 3 caption. What do the zones refer to?? How were they defined? Describe

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in the caption.

47. Figure 4 caption. Provide more detail! Lava flows from which vents? What do the colours really mean?? Why is the scale a log scale?

48. Figure 5 caption: What is a Heim coefficient? Not explained here or in the text. What do you mean by "coverage area"??

49. Figure 6 caption. What type of scenarios? Using what model? Expand the caption.

50. Figure 7: explain how the hazards were combined to form the qualitative hazard map. How many hazards superimpose in each zone?

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/2/C277/2014/nhessd-2-C277-2014-supplement.pdf>

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