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Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "A retrospective study of the pre-eruptive unrest on El Hierro (Canary Islands): implications of seismicity and deformation in the short-term volcanic hazard assessment" *by* Stefania Bartolini et al.

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Dear NHESS editor, We would like to thank the referee for her/his comments that have been useful to improve some aspects of our manuscript.

In general, we consider that there is a lot of data already published and available to apply the methodology presented in this work. Please, see the IGN web page, http://www.ign.es/web/ign/portal/vlc-serie-hierro, and the publications cited in the manuscript. Also, with respect to the method applied, its description has been published in the previous paper Bartolini et al. (2016). Here, our purpose is to show an example of its application with real data using a retrospective approach.

Here we reply point by point to the referee's comments:

1. We consider repetitive to reproduce again all the mathematical concepts already explained and developed in previous papers that we adequately refer to in this new one. Our choice is also taken with the aim to facilitate the flow of the reading.

2. We have modified Figure 2 and the figure caption to facilitate the understanding of the geological structure described in the paper. (Figure 2. Structural data of El Hierro (vents and fissure onshore and offshore, as in Becerril et al. 2013, 2014) and the evolution of the seismicity during the unrest period (average location of the seismic swarm).)

3. Table 1 is not designed to plot the data. We only show all data used in the analysis. Anyway, we have modified the Table 1 trying to make it more readable.

4. and 5. We have modified Figure 3 and jointly with changes in Table 1 we have improved data visualization. Also, we suggest to see the Supplementary material where the video presented also helps to understand the methodology applied.

6. See the reply in comment 1.

7. and 8. Added some explication in the manuscript:

[...] This tool was applied first to evaluate the smoothing parameters or bandwidths of the dataset analysed, then to evaluate the probability density functions for each dataset, and, finally, to calculate the final susceptibility map (Fig. 3) (see also Figure S1). The bandwidth is a free smoothing parameter included in the kernel function that we used to estimate the corresponding probability density functions and determines how probabilities are distributed in terms of the distance from the volcanic structures or vents (Martí and Felpeto, 2010; Bartolini et al., 2013). In the case of the rift volcanism and the submarine layers, we applied the Least Square Cross Validation Method

(LSCV) (Cappello et al., 2012; Bartolini et al., 2013) to obtain the bandwidth parameter, as it better represents the geometry of the vents distribution, NE-SW elongated (see Becerril et al. (2013)). To determine the influence of seismicity in the spatial analysis, we considered that the most representative result was that obtained using Silverman's Rule of Thumb for the optimal bandwidth (Silverman, 1986). In fact, the result obtained using this method allows describing the spatial seismicity swarm distribution for the entire period, avoiding to underestimate the influence area (located close to the epicentral points) and to overestimate the density estimation (high values of the density distribution caused by small bandwidth values). [...]

9. Modified the sentence in the manuscript:

[...] In the evaluation of the final susceptibility, weights were assigned based on expert opinion and on previously published work (Becerril et al., 2013, 2014), and by taking into account the average depth of the seismicity during the unrest episode. In detail, the relevance and reliability values (Table 3) (Martí and Felpeto, 2010) have been assigned as follow: relevance was given through an elicitation of expert judgment procedure (Aspinall, 2006) among the members of the Group of Volcanology of Barcelona (GVB-CSIC) and external collaborators; reliability was considered as maximum in all the datasets (value of 1). Specifically, up to 7 October we observed no significant variation in the shallow seismicity (Table 1). In this case, we assigned the following weights: 0.5 for seismic events, 0.3 for onshore vents and fissures, and 0.2 for offshore vents and fissures. In the final period (8–10 October), we considered the shallow earthquakes as a separate layer by assigning a different and more consistent weight as follows: 0.6 for shallow seismic events, 0.2 for the remaining seismic events, 0.1 for onshore vents and fissures, and 0.1 for offshore vents and fissures. [...]

10. Changed.

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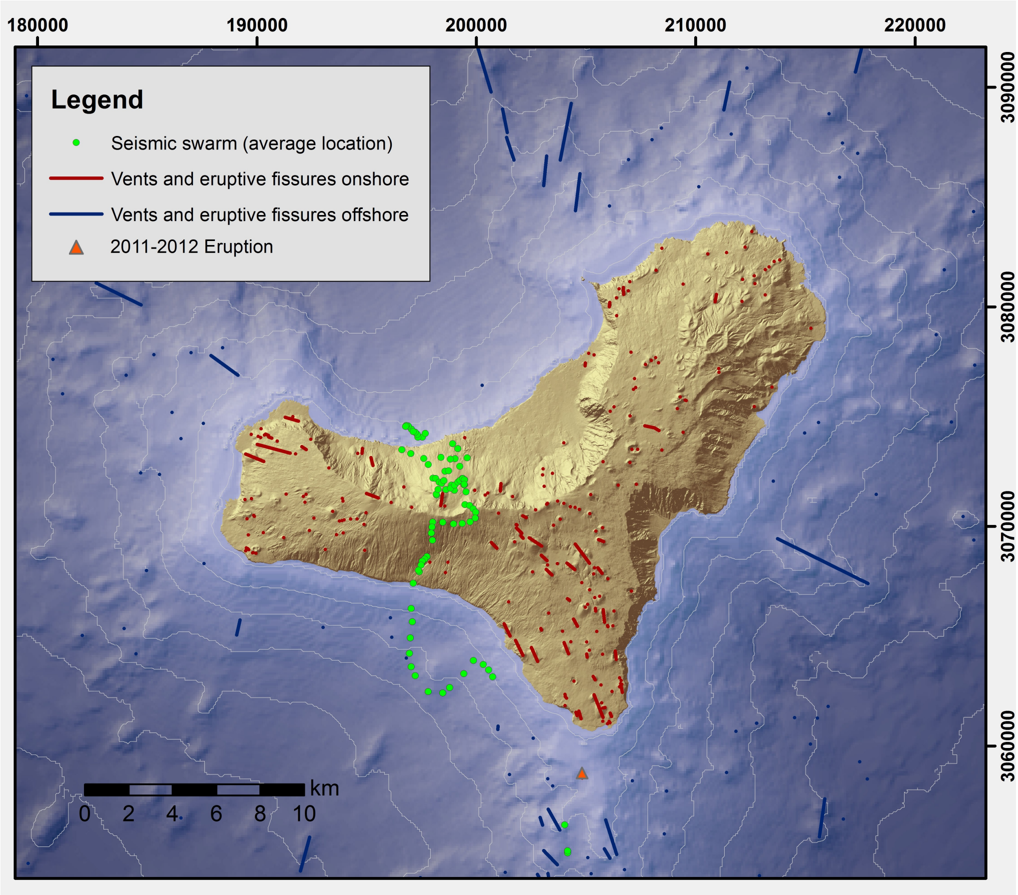

Fig. 1.

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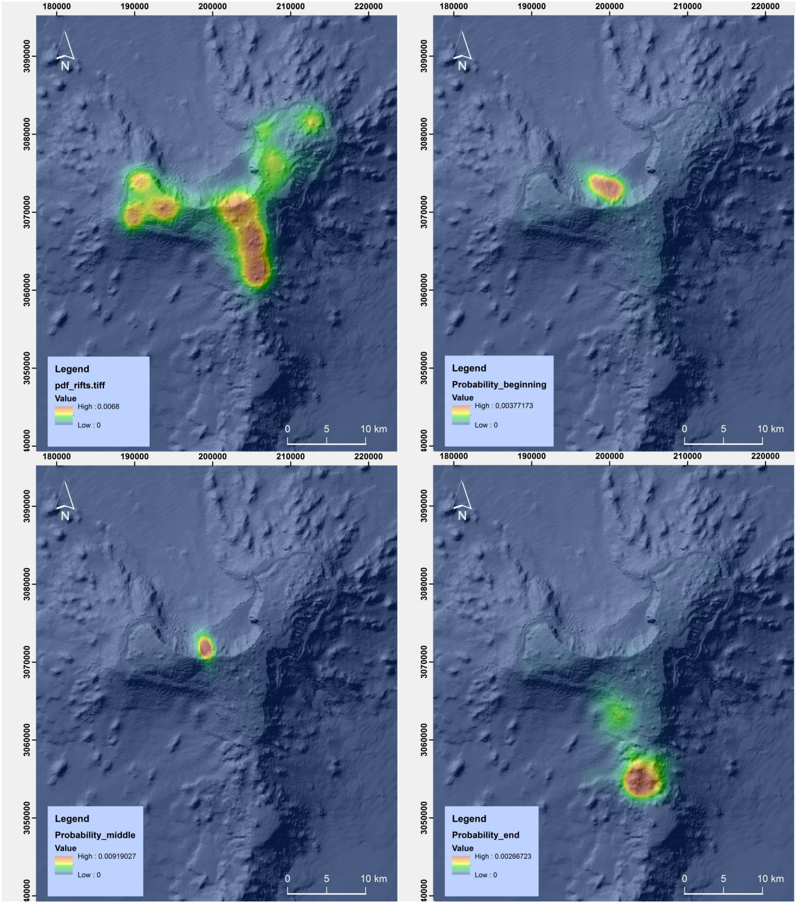

Fig. 2.

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