

Reviewer 2 :

1. Referee comment: *This manuscript tells the story of how has been developed a webgis system, as part of the MIAVITA project, dedicated to communication to the authorities and to the population of the various issues related to natural hazards in the area of Mount Cameroon. The text analyzes the development of the idea through a large number of blockdiagrams and it perfectly captures the major limitations and drawbacks. In general, the manuscript is not very interesting, because the idea is not innovative and webgis systems that deal with hazards are already in use in various governative institutions in the world.*

We thank you for your review. However, we disagree on the fact that there is no innovation in our approach:

- we remind that previous GIS tools developed to volcanoes have either targeted a specific hazards or the dissemination of data that do not characterize the hazard himself, (lines 11 to 24 page 5755 in the NHSSD manuscript).
- Here, we developed a tool able to manage any kind of hazard and risk information in an organized way, to display it simply and to manage priorities among the different users during the prevention, preparedness and crisis phases.

To our knowledge, this type of application did not exist at the time of the project.

We think the topic addressed by this paper deserves some attention: one essential point to address seriously to significantly reduce the risks is “to manage boundaries between knowledge and action” (Cash et al., 2003), which implies for users and scientists to co-produce common knowledge and “boundary objects” such as the one proposed here.

2. Referee comment: *This system has also a limited applicability, as recognized by the authors themselves, in the abstract.*

We don't understand this comment. The abstract does not mention that the system has limited applicability. On the contrary, it has been designed to be applicable for the vast majority of cases (see also response to comment 4).

3. the text is also full of jargons that only experts in computer science or management of information systems can easily understand. This makes the text quite complicated to follow and probably not of interest to a broad audience.

We have reformulated or redefined technical terms where appropriate. Nevertheless, it seems difficult to avoid any technical IT terms when presenting a WebGIS development.

4. Referee comment: Furthermore, it is also not clear how this system can be applied to other volcanoes, where risk management and the civil protection authorities are differently organized. As an example, in many organizations fundamental data layers are protected by copyrights and cannot be freely distributed.

We disagree: we were fully aware of this fundamental issue of data legal property. In this respect, we designed the system in such a way that it addresses different kind of data policy, e.g. by including the possibility to manage access right precisely. We also involved other national volcanological surveys as well as European Civil Protection agencies (all partners of MIAVIATA project) in the definition of objectives in addition to the Cameroonian ministry, in order to make the system as flexible and transportable as possible.

5. Referee comment: What I've found interesting is that the failure of this system is probably related to the fact that the authors started from the wrong point. In fact, from the text it seems that the set up of the system didn't start from a specific request of the local authorities that manage the risk. As a consequence it was created a product which was apparently unsolicited and perhaps even not appreciated by end-users because of its relative complexity.

We disagree.

First, the problem that the GIS database was only accessible to the few Mapinfo users was well identified in Cameroon before the project. This was one of the primary reasons for undertaking this project.

Secondly, the situation in which user requirements are very well formalized from the starting point never happens in practice in case of innovative developments. There are many examples (see e.g. development of GMES, GEOSS, etc., and actually most of IT systems). On the contrary, for complex and unformulated needs, one way to converge to an efficient solution is to proceed as we did, with a group of experts, to formalize progressively the requirements. We agree with the reviewer that this point can be often discarded and may cause the system being unused. However, in our case, the cause for the system not being operationalized is well identified and is very different: this is due to the general difficulty of sustaining capacity in some developing countries (sectorial and geographical brain drain).

Finally, the fact that the WebGIS was requested by 3 of the 4 volcanological observatories of the Miavita project is an indicator that our approach may prove useful for actual disaster risk reduction.

6. Referee comment: In detail: In the text there are several misspelling errors and many sentences are unclear. I directly made some changes; however, I suggest a massive intervention in the eventual re-writing of this manuscript. I also suggest

to considerably shortening the text by cutting off parts of little functionality (e.g. the description of the work by Thierry et al. 2008). All figures need clarity; in fact used characters are too small. However, most of the figures are difficult to interpret or are even useless.

As requested by the reviewer, we have indeed shortened the paper - the NHESSD paper remaining accessible for more details. For scientists and developers involved in the practical implementation of such systems, this enables to access to some figures that could actually prove useful.

7. Referee comment: *As an example Figure 8 clearly shows a remarkable complexity for a non-expert GIS.*

Figure 8 is the interface of the system. The test phase of the system revealed that most of the functionalities of this interface were usable by individuals with moderate GIS and IT expertise. The point which requires some expertise is to sustain the IT structure and update the database.

8. Referee comment: *It seems clear that a politician does not know what to do with a similar item. However, it is very likely that a similar conclusion would be reached in any other country in the world.*

Figure 5 depicts the different types of users considered in our project. The type of users mentioned by the reviewer could be classified as decision making authorities or concerned communities. We continuously experience that they are able to take decision based on geospatial information. The role to manage the system is not devoted to them, but to the local volcano observatory or the national volcanological survey.

9. Referee comment: *Abstract: The abstract is poorly clear, it must be completely rewritten. Possibly it would be the case to better analyze in greater detail and more critically the strategic errors committed both at the planning stage, and at the testing phase. In this way, the scientific community could benefit from your experience.*

We disagree (see response to comment 5). Of course we make errors, but contrary to the reviewer, we think that we manage quite well the planning and testing phase (see again papers from Cash et al., 2003; Nies and Pelayo, 2010). However, (also referring to comment 4) we acknowledge that our paper is may be too cautious in several points (e.g. pages 5764) and needs some revisions to better highlight the transportability of the system. We hope the shortened version of the manuscript will make these points more clear.

10. Introduction: This chapter is weak and the issues are not properly addressed. The necessity to develop a WebGIS does not apparently justify an article.

There are two issues noticed by the reviewer: (1) is it useful to take seriously the question of “boundary objects between science and action” (Cash et al. (2003) in order to reduce risks? (2) is this a research issue? It appears that the reviewer and ourselves do not agree on these two points. We hope that the revisions brought to the paper can somehow respond to this comment.

11. Referee comment: Basically is only described how this webgis has been assembled and not its content.

This is the purpose of part 2. Our modifications to this part may have further clarified this point.

12. Referee comment: There is no reference to layers that have been entered into this system (e.g. the scale of the maps, their detail, the types of hazard, their probability of occurrence: : :). It seems to me much more interesting, for anyone working in this area, to understand the delicate steps that lead to the certification of the informative layers to be included in this container.

This is of course possible, but from our point of view, this is not a research issue. The full structure of the Mt Cameroon dataset is explained in Thierry et al. (2008), and the IT system described here can be adapted owing to the flexibility of the system. The certification of the data is one of the responsibilities of the local volcano observatory, and, in the case presented in the paper, it has been endorsed by the ministry of mines in the case of mount Cameroun.

13. Referee comment: As an example, for what concerns the hazard related to lava flows inundation: a) are simulations of lava flow paths already included as separate layers or b) is there a lava flow simulator included in the system? In case a) who has certified the quality of the input data?

There are historical lava flows and maps of the lava flow hazard in the database. Both have been elaborated by geologists based on historical eruptions' knowledge, field evidences and GIS data. Lava flow simulators are very valuable tools, but it is necessary for these tools to consider the actual eruption vents, in particular in the case of Mt Cameroon. For this topic, which is outside the scope of this paper, the reviewer may refer to the debate on lava flow hazard assessment in Mount Cameroon (see Favalli et al., 2012, Bull Volcanol). The latest paper clearly shows the advantage of using a lava flow simulator for lava assessment compared to previous exercises (e.g. Bonne et al., 2008, Int J Rem. Sens.), but we kept our hazard map because we think some more simulations would be necessary to take all the possibilities of vents which we identified on the field. Still, we agree with the reviewer that lava flow simulators are very valuable

tools, this is very well demonstrated in the paper by Favalli et al. (2012), but updating the official lava flow hazard map has not been considered at present, and this is outside the scope of this paper.

14. Was it a single person or a small group which took the responsibility to validate them or was it the international scientific of MIAVITA project?

The question of data validation is within the paper Thierry et al. (2008). At present, this remains the basis for the official hazard map in Mt Cameroon.

15. In case b) it is obvious that an end-user who is not an expert volcanologist cannot properly use a lava flow simulator, due to poor knowledge of the input parameters to use.

We did not design a lava flow simulator. We designed a WebGIS, in order to facilitate the dissemination of a complex hazard and risk geographical database. Lava is just one of the hazards to consider, and the elements at risk and their vulnerability is also part of the information to display.

16. Referee comment Other issues: I have observed that in this system the main information media, such as televisions and radios, are not included among the end-user of the information of the second level. This thing is not feasible in the Western world, where the media and social networks have free access to all information.

From our experience, messages broadcasted by medias play a key role in crisis management. However, we are sorry but we did not understand this comment in the context of our study.

17. What does the system in the event of a collapse of the Internet during a crisis?

As highlighted by the reviewer: in case of the collapse of the Internet (whatever the cause) any system based on Internet will be inefficient.

It seems to us that the question behind this comment is to elaborate scenarios of communications networks collapse during a volcanic crisis: possible scenarios include:

(1) direct impact of adverse events (e.g. the destruction of part of the communication network infrastructure: we agree that there is the possibility for several telecom stations at Mount Cameroon to be affected by adverse events – which does not mean that the entire system will collapse.

(2) indirect impacts of adverse events (e.g. effects of ash or pyroclastic flows on transmissions): there is a lack of knowledge on this, but according to our experience (e.g. Merapi eruption in 2010 - see Suroño et al., 2012, JVGR), IT networks can keep the required quality of service for our application.

(3) a fragility of the network itself, possibly exacerbated by too intensive use of the communication networks or poor IT coverage or capacities to use (see the paper by Fonseca et al., NHESS in this issue): in this case, the mobile use of the system is

obviously not possible and the system remains dedicated to its primary usage, that is to provide a tool to visualize data in facilities with IT access (e.g. in the facilities of the responsible authorities)

(4) too intensive use of the system itself: we ensured that during the crisis, the priority of use of the system is given to the civil security and to decision making authorities (NHESD paper).

As noticed by the reviewer, in the design of the system, we only have the possibility to address the 4th scenario directly.

We first would like to remain that the system is designed not only for crisis, but also for preparedness and prevention.

18. Referee comment To conclude, this manuscript is nothing more than a report as it is currently written and the theme dealt. I suggest two possible options to the authors: a) To fully re-thought and rewrite this manuscript as a function of the purposes of the journal. The new ms must necessarily include a scientific analysis of the experience and show its practical applicability or to other volcanic systems in the world, or to other categories of natural hazards (e.g. floods, erosion of coastlines, severe weather conditions); b) To rewrite this manuscript in a more technical way and to submit it to a journal that deals with GIS or computer geoscience.

Following this suggestions, we have shortened the paper as suggested. Still, we think that the introduction in the NHESD paper clearly indicates the research dimension of this work (see e.g. comment 1, 9, 10). We note that NHESD published papers on “the design, development, experimentation and validation of new techniques, methods and tools for the detection, mapping, monitoring and modeling of natural hazards and their human, environmental and societal consequences”. We understand that this encourages studies on the topic of this paper.