Dr. Giovanni Macedonio,
Editor
Natural Hazards and Earth System Sciences

Dear Giovanni Macedonio,

Please find enclosed the revised manuscript submitted for Natural Hazards and Earth System Sciences entitled "Lava flow hazard modelling during the 2021 Fagradalsfjall eruption, Iceland: Applications of MrLavaLoba" by Gro B. M. Pedersen, Melissa A. Pfeffer, Sara Barsotti, Simone Tarquini, Mattia de´ Michieli Vitturi[3], Bergrún A. Óladóttir and Ragnar Heiðar Þrastarson.

The manuscript has been thoroughly revised and benefitted significantly from reviewer 1 and the editor and the authors would like to thank them for thorough, and helpful comments.
Overall, the changes can be divided into changes of the manuscript and changes of figures and tables. These changes are based on the general and detailed comments from reviewer 1 (see in detail below):

Changes to the manuscript:
As a response to reviewer 1 the manuscript has been through many iterations to shorten and simplify the main text, which is 100 lines shorter (approximately 3 pages) and is now 540 lines. As can be seen in the manuscript with track changes all sections have been thoroughly revised to ensure that the scientific motivations for the different modelling approaches during this changeable 6-month long eruption are conveyed better.

Furthermore, a new appendix B has been added providing technical information on the code changes implemented during and post 2021 Fagradalsfjall eruption.

Figure & table changes:
In response to reviewer 1 new figures were added to help the reader and to condense the text. This includes:
New Figure 2: Illustration of the temporal development of the volcanic unrest, the simulations performed addressing these developments and the identified simulation challenges.
New Figure 3: Flow chart for the lava flow simulations performed during the Fagradalsfjall 2021 volcanic unrest.
Table 1, 2, A1 was revised for spelling mistakes and consistency.

General comments:
Response to general comments from reviewer 1 (RS 1) can be found below. The authors have responded to the general comments from RS1 section by section. The bold text is comments made by RS1 and the regular text is our response to the comment above.

Detailed response
Since the NHESS system does not allow to have more than file uploaded under authors response, the authors will refer to the detailed response to reviewer 1 has previously been submitted to the journal.

As the corresponding author for this manuscript, I can be reached at the following address:

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Thank you for your consideration of this contribution.

Best regards,
Gro Birkefeldt Møller Pedersen

RC1: 'Comment on nhess-2022-166', Anonymous Referee #1, 07 Dec 2022:
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The paper is a chronological narration of how the software MrLavaLobe was used and modified during the 2021 Fagradalsfjall eruption occurred in the Reykjanes peninsula, Iceland. The manuscript is really interesting, and some sections are also compelling.

Thanks.

But the text has some problems. In the manuscript, the authors initially describe the eruption, referring to a work in press, and this description seems a summary of the cited work.

It is correct that we in the initial manuscript only reference the Pedersen et al. (in press) paper for the eruption evolution. Upon submission this was the only paper "in press" describing this eruption and is therefore the only paper cited. This has now been improved because more papers have been published (see section 2 and 2.1).

Then they describe the software without focusing on input parameters and procedures but describing the functionality with a qualitative approach.

We choose to cite the paper (de' Michieli Vitturi and Tarquini, 2018) which was published with the release of the software instead of describing the technical details in this paper. We want to emphasize the usage of this code during the Fagradalsfjall 2021 eruption. In table 1 we do provide an overview of procedures applied, their goal, the approach and key input parameters. The purpose of having these together in a table is exactly to describe the functionality in a qualitative way that enables the reader to both understand the motivation and process and to be able to duplicate our work. Table A1 (in the appendices) provides all input parameters (or input parameter ranges). We do agree that the code changes made during this eruption must be described better, and not only in the qualitative fashion as done in this manuscript. We have therefore added appendix B describing the exact changes in the code. We have also done a better job of referring to the tables, so this is much clearer for the reader.

Then narrate the eruptive crisis and the results of the software used in real time. Finally, they describe the modification and the improvements to the software that were necessary to communicate with the stakeholders and predict lava inundation in a future eruption. The manuscript is too long and, while reading, the scientific motivations of the work are lost.

We do agree that the initial manuscript was too long and it has been shortened, repetitions have been deleted, and the text is now more concise ensuring that the motivation for the different modelling approaches is conveyed better. This has partly been done by adding a new figure (New fig. 2) that show the evolution of the eruption, how the different activity phases and styles required different approaches to the modelling and what we did to achieve our objectives (code changes or changes in how the code was implemented and/or results were displayed). We have also made sure that figures and tables are better referenced since lots of information that RS1 requests can be found there (especially in the tables).

The manuscript also lacks a clear introduction to the software and this lack impedes a full understanding of the reported improvements if not by reading the original paper and making comparison with this one.

We have improved the introduction to the software in section 3 and provided more technical information about software changes in appendix B. However, the goal in this manuscript is to apply an already published code to the Fagradalsfjall 2021 eruption and we therefore think it is logical that the reader may need to read the de' Michieli Vitturi and Tarquini (2018) to get the full overview of what the code does. Otherwise, this already too long paper gets even longer, and we think that our goal of the paper to show the usage of the code gets further lost in describing the code itself. However, we have made sure that all changes made in the code during this volcanic crisis (and thus changes in the code from when it was published in 2018) will be described better, both in the paper itself and with substantial detail in appendix B.

I found the manuscript having a journalistic approach, not suitable for a scientific journal. Otherwise, if the authors intended to publish a technical report about the software improvements due to a real time application, then they should remove the chronological description of the happenings and concentrate on the technical improvements of the software and its application to the 2021 Fagradalsfjall eruption.

We think this critique derives from our goals for the paper not coming through well enough. This paper is not intended to be a technical report focusing on the code changes, - but rather it should be addressing how evolving lava hazards of the Fagradalsfjall 2021 eruption led to changing demands to the team providing the model results, which were addressed through changes in the MrLavaLoba code and how it was implemented. We want to highlight how MrLavaLoba code can be used in an ongoing effusive eruption, to show all the novel aspects of this interplay between the needs of end users and the potential of the scientific tool that has not been described before. Furthermore, we wish to highlight the caveats as of now and improvements that should be emphasized in the future. We will make sure that these goals are clearer in the abstract, introduction and conclusion of this paper, so the reader is clear on the goals of the paper.

The authors think the chronical narrative is necessary since the changing in activity led to different ways of implementing the code and to code changes. The way this was done, was very much a consequence of the eruption evolution and doing this during this eruption. Many of the tasks we were trying to address to provide information to the hazard assessment would have been done differently post-eruption and many of them we could not have imagined in the pre-eruption phase prior to the Fagradalsfjall 2021 eruption. Since the eruption lasted half a year and the activity changed multiple times during this eruption, it is obviously a complex task and we tried to convey this message better in the new version of the manuscript.

I appreciated the paper that is well organized in sections but it is too long and the text gets lost in long explanations that could be summarized and made simpler. Moreover, in the manuscript I found some repeated sentences that authors should eliminate. The English is somewhere not fluent and I requested to rewrote some sentences. Sentences are often too long and dispersive; verbs are somewhere used in the wrong way.

We fully agree with this statement. It is clear that our message was a bit lost in this lengthy initial manuscript and we need to improve the text. We have described numerous ways of how to do this in the detailed comments to RS1, that we also want to thank for taking the time to point out these weaknesses. We refer to the manuscript with track changes to see exactly how this has been done, since substantial changes can be found in every section of the manuscript.

I also found that figures are not correctly cited and in section 2 a figure or a citation to a figure is missing. Fig.1a and 1b are never cited in the text, while the paragraphs 2 and 2.1 need reference to figures to understand the geography and the eruptive history. The same occurs for other figures. I suggest inserting in the text the right citations of all the figures by indicating also the figure boxes useful in the text.

We fully agree, we have improved how all figures and tables are referenced.

I attached the pdf of the manuscript where I put my comments with suggestions and critical points, but the list is not exhaustive. I think that the authors should do an effort to re-reading the manuscript and re-writing the longer and twisted sentences and eliminate repetitions. The authors should also rethink the qualitative setting given to their paper substituting the long descriptive part with short quantitative sentences. For these reasons I suggest a major revision.

Thanks again for these comments, we have gone through them all agree with many of them. Those where we disagree, we have explained why. We have shortened the text substantially, deleted repetitions, and improved the language.