Natural Hazards
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Discussions

Interactive comment on "Quaternary lava tubes distribution in Jeju Island and their potential deformation risks" *by* Jungrack Kim et al.

Anonymous Referee #2

With interest is was reading the manuscript by Kim et al, submitted for publication in NHESS. The topic of lava bodies showing a post-emplacement deformation is debated amongst volcanologists since decades. Different ideas and hypothesis have been considered, such as loading effects, pore space reduction, viscoelastic and poroelastic subsidence and brittle deformation over cavities. A large number of observations worldwide, mainly from low viscous basaltic volcanoes, provides evidence for slow to spontaneous collapse into cavities and related hazards. The work by Kim et al. aims at adressing this topic at the Jeju Island, a unique place on earth where numerous lava tubes allow studying their post-emplacement deformation fields. The study uses mainly InSAR time series, but also some terrestrial laser scanning results to analyse deformation characteristics. While i agree that the topic of lava tubes and the potential

of InSAR time series and the applied methods are well suited (and possibly correctly applied), i can not recommend publication of the work as is. I strongly recommend to consider the following main points: 1) The language is awkward and make the text and many sentences hard to understand. If there were a limited number of language deficiencies, i would try correcting this (even though i am not a native speaker myself). But as almost every sentence has deficiencies and awkward and also improper wordings, i would suggest the authors let the language correct. The way it is now is simply unacceptable. 2) Improper terminologies are spread over the work. It even starts in the title, where "risks" is confused with "hazards", what is the difference between volcanic tubes and lava tubes, and so on. 3) logic organization missing. I recommend restructuring the work. First, the abstract shall provide a summary of the methods, work and findings. Presently the abstract focusses on InSAR, but does not even mention the TLS work carried out. The abstract highlights machine learning, which then is not even mentioned in the following introduction and data/methods sections. Please make sure the abstract is really a summary of the work provided. 4) Clearly distinguish earlier data published by others, and own original results. For instance, geology maps (Fig. 1) are not referenced in the figure caption, similarly the distribution of lava tubes (fig. 3) is unclear where this data is coming from (i assume from literature? Maybe from Son et al. 2019?). 5) Please clarify why the PS was realized on a 2 year dataset and 75 images, whereas the SBAS on a 0.5 year dataset and 13 images only. I am not convinced by the statement in L 148. 6) In the chapter "results" i would expect to see results. Instead, authors start with a general introduction on the historical records and published tube maps and distribution, followed by a detailed methods section outlining the background of the PS and SBAS algorithms and so on. Despite the fact that this all should go to the methods section, it is hard to understand which Insar and PS processor have been used (Stamps?). But where are the results in the results section? 7) Results figures are described very brief only. Fig. 4 shows the PS results over the entire island, but actually all velocities (in LOS i assume?) are below 1 mm/ year only. This is very low and i would expect a more critical assessment. 8) I would suggest to first demonstrate

the workflow on a smaller area before showing the entire island region. NSBAS results look different to the SBAS results, and for the reader it is very hard to understand relevance of the changes and colors seen. 9) All location names provided in the text must be shown in figures. For many of the sites and caves mentioned, i actually have no idea where to find it on the maps. 10) The exemplary analysis of the Manjang cave is very interesting. But this part of the analysis is only found in the discussion, not in the results. The TLS application and coverage is not even mentioned in the methods section. 11) Finally, a suggest the authors first to better structure their text and findings. Please provide an abstract that gives a good summary of all highlights. Provide an introduction that puts the approach and topic into larger context, and most importantly, review the available publications on collapsing and subsiding lava tubes elsewhere (on Hawaii, Iceland etc). Provide a data and methods section, where all data and methods are summarized. Provide a results section that is free from literature overview, referencing and speculation; results only, for both large scale and local scale studies, for InSAR, PS, SBAS, TLS and machine learning. Lastly, provide a critical discussion and study risks (or better hazards). I hope these comments help improving the work. There is a lot to improve, but as i feel the very core of the manuscript is of potential interest for a broad readership, and as the methods used are on a high level, i am convident this might become a valuable publication. Major revisions required.