EGUsphere, referee comment RC3
https://doi.org/10.5194/egusphere-2022-644-RC3, 2022

Comment on egusphere-2022-644

Anonymous Referee #3

Referee comment on "Subaerial and subglacial seismic characteristics of the largest measured jökulhlaup from the Eastern Skaftá cauldron, Iceland" by Eva P. S. Eibl et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-644-RC3, 2022

The manuscript “Seismic Characteristics of the Largest Measured Subglacial Flood from the Eastern Skaftá cauldron, Iceland'' presents seismic, GPS and hydrological data, collected during a subglacial flood event in Iceland. The authors found two different types of glacial tremors. Both are related to the flood event. Type 1 tremor originates due to the glacier uplift, leading to icequakes. In the manuscript, the authors show the propagation of the tremor towards the glacier terminus by calculating the back azimuth and comparing these results with GPS and hydrological measurements. Additionally to the tremor caused by icequakes (type 1), a second tremor type caused by boiling water, called type 2, is presented. After emptying the subglacial lake, the pressure at the glacier bed decreases and allows the water in the volcanic hydrothermal system to boil. Seismometers can see the exploding water bubbles, which show up as type 2 tremor. The authors also present the typical frequency band of both tremor types.

The study of interactions between solid, fluid and gaseous water is unique. In my opinion, the topic of this manuscript is important to understand the hazardous flooding events but also the heat exchange between rock and ice better. Nevertheless, to me the manuscript does not include enough new findings, compared to Eibl et al., 2020, to be presented as a self-standing paper. The manuscript seems to me more like supplementary information to Eibl et al., 2020 because most of the figures and the results are already presented in Eibl et al., 2020. Based on my findings, I do not recommend this manuscript for publication in the current state.

Adding new methods to the same dataset would help to make this manuscript a self-standing paper. For example, Eibl et al., 2020 proposed an early-warning approach using tremor type 1, which could be tested in this manuscript. Increasing the warning time and reaching as few false alarms as possible would be a beneficial application of the findings shown. Another further application would be to train machine learning algorithms to cluster the tremor types automatically by analyzing different tremor features in the time and frequency domain. The seismic dataset seems robust and can help to classify tremors in less studied areas. Also trying to reproduce the measured seismic data with a physical

model would improve the manuscript and make it a self-standing paper. A physical model would help to understand the complicated processes at the glacier ice, glacier bed, and englacial lake interface, including the volcanic heat fluxes. However, based on the above-mentioned reasons I can not recommend accepting this manuscript for publication in Earth Surface Dynamics.

Reference:

Eibl, E. P. S., Bean, C. J., Einarsson, B., Pàlsson, F., & Vogfjörd, K. S. Seismic ground vibrations give advanced early-warning of subglacial floods. Nature Communications 11, 2504 (2020). https://doi.org/10.1038/s41467-020-15744-5