Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC2
https://doi.org/10.5194/nhess-2021-63-RC2, 2021

Comment on nhess-2021-63

Anonymous Referee #2

Referee comment on "Probabilistic, high-resolution tsunami predictions in North Cascadia by exploiting sequential design for efficient emulation" by Dimitra M. Salmanidou et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-63-RC2, 2021

General comments

This study provides the application of the statistical surrogate models to predict tsunami hazards from earthquakes at CSZ. The study employs the emulation approach to quantify the tsunami hazard, particularly the maximum onshore tsunami height at Victoria, British Columbia, considering varied conditions of seabed displacement over CSZ. Overall, the formats and writing are acceptable, but I have major comments on the novelty of this work and descriptions, including the model validation, fitting process, and conclusions. Therefore, I recommend revising the manuscript and resubmit for publication.

Specific comments

1. For the novelty of this work.

The application of the emulator for tsunami hazard modeling in CSZ tsunami, particularly in Victoria, British Columbia, is already published by the third author (Guillas et al., 2018). It is indeed the first time to check the maximum onshore tsunami height using the surrogate model, as noted by the authors. Still, the model domain seems quite similar to the previous work. The fundamentals are already provided from other references except showing the surrogate model results at a specific area in British Columbia.

I think, the authors could earn more novelty from chapter 4, which is the model validation and fitting. Still, the process is relatively limited and needed to improve to get a novelty. Here are the related comments below.

2. For model “initial validation” (Line 195).

In general, it is hard to validate numerical tsunami model results, including the generation and propagation process, due to the lack of real observed data of CSZ events. The authors conclude that the maximum water elevation at a specific point shows good agreement with Fine et al. (2018) and other references and justify the current approach. However, the current comparisons are not clear and need to be improved. To specific, the authors pick scenario 24 for the validation, which shows the best agreement(?) to others works. If scenario 24 is chosen, it is better to show more detailed comparison results using figures or tables. The current comparison results describe the match at a particular point, but the authors need to show a spatial (map) comparison to justify the model to others. Also, it is better to provide detailed tsunami generation conditions of each reference and justify why the author chose scenario 24.

3. For model "Fitting" (line 225)

a) As I understand, the emulator was trained from the single point in Fig. 8 (star). Need some explains why chose this point and any sensitivities on training and resutls.
b) Figure 9 shows the performance of the prediction from the emulator at three different points as the authors noted that the surrogate model couldn't capture the pattern well at location 2 but show good agreement at location 3. Can authors explain why they are so different?
c) Due to the small number of comparisons and fluctuation, those three points are not enough to represent the overall performance of the emulator. It is questionable that location 001 (I think it is location 01) could represent the general pattern of RMSE error of the emulator index (Fig. 9d). It is hard to conclude that 50 and 60 are good enough for your hazard results in Fig. 12. It is recommended to show more comparison results (somewhat similar to Fig. 9a,b,c but more efficiently) at different locations. We can observe a spatial variation of wave height at the shoreline in Fig. 12. The authors may consider checking the variance of RMSE for the emulator index at different locations.

4. About Probabilistic tsunami hazard,

One of the conclusions (at line 326) is that the emulator allows probabilistic hazard maps. Fig. 11 and 12 are not a typical probabilistic hazard map, which is not commonly accepted. The probabilistic tsunami hazard map provides the map (spatial distributions) of tsunami intensity measures (e.g., maximum tsunami flow depth) at a specific recurrence interval such as 500 yr, 1,000 yr, and 2,500 yr through a probabilistic tsunami hazard analysis (PTHA). The authors need to clarify that the current work from the typical probabilistic hazard map. Also, it is hard to agree that the current work is a kind of alternative format of hazard map as described in line 328. It is misleading to readers.

No technical comments.