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Discussions

Interactive comment on "Probabilistic tsunami inundation assessment of Kuroshio Town,Kochi Prefecture, Japan considering the Nankai-Tonankai megathrust rupture scenarios" *by* Katsuichiro Goda et al.

Reza Amouzgar (Referee)

ramouzgar@uvic.ca

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This work considers a probabilistic tsunami modelling by using the Nankai-Tonankai megathrust rupture scenarios on southwestern Japan to assess the inundation for Kuroshio town, Kochi prefecture. In this regard 1,000 kinematic earthquake rupture models (magnitude ranges M8.7-9.1) are created with stochastic approaches, and simulations are carried out on regional scale and also using high-resolution grid data of 10m to address the gap of the previous study. The results from the stochastic tsunami simulations are verified by a set of tsunami source models (11 tsunami sources) de-

veloped by the CDMC of the Japanese Cabinet Office. It is shown that CDMC models are consistent with stochastic simulation results but CDMC models cannot capture extreme scenarios of local tsunami hazards. The correlations between inundation area metrics and moment magnitude, slip ratio, or tsunami potential energy were examined where the latter found to me an effective tsunami source predictor of both regional and local inundation extents. The safety of two existing vertical evacuation towers in terms of tsunami inundation depths in Ogata and Saga were evaluated, and existing towers were judged to be satisfactory. For these two locations, it was illustrated that extents of local tsunami inundation based on the CDMC model 5 are between 50th and 90th percentile scenarios of M8.9-9.1 cases, and is close or exceed the 90th percentile critical scenario for the cases of M8.7-8.9. I strongly recommend this paper for publication. The probabilistic tsunami modelling using high resolution grids can significantly contribute in this field which is a complement to conventional deterministic tsunami simulations. The outcome of the study is important. Globally, similar investigation to the coastlines which could be hit by tsunamis should be considered for the risk assessments. The paper is well written and the message is clear. Appropriate, sufficient and up to date references used in the literature. The results, analysis, and plotted figures are supporting the methodology properly. However, I would have some few comments for the authors: Page 8, Line 230-231 Authors: The reference elevation of the bathymetry and terrain data is the standard altitude in Japan (Tokyo Peil), and no variation of sea levels is taken into account in the tsunami simulations.

Comment: Is this reference equivalent to mean high water level? (Does it assume the tsunami arrival times coincide with high water mean tide? or it is relative to the mean sea level). If the mean sea level is assumed for the simulations, based on the bathymetry/topography of the region, if the tsunami occurs at a higher tide, how it may affect the physics of the wave and inundation?

Page 12, Line 250-252 Authors: The numerical tsunami calculation is performed for a 3-hour duration which is sufficient to model the most critical phase of tsunami waves for the Nankai-Tonankai scenarios. Comment: That is fine to carry out the simulations with 3 hour duration. But I wanted to know for the area of your study, have you attempted one/or more of the simulations for a longer duration to see the wave interactions with the coast and the effect on local inundation. Sometimes, depending on the location, the amplification of the wave is possible.

Page 14, Line 430-431 Authors: Since the exceedance of the critical inundation depths was rare (i.e. 5 and 1 out of 1,000 cases for the towers in the Ogata and Saga districts, respectively), the exiting two vertical evacuation towers were judged to be satisfactory. Comment: That is outstanding outcome from this approach to show the towers are in a safe elevation except for very rare events. In deterministic approach usually a safety factor of 50% maybe recommended as a typical engineering value, for example, to the tsunami wave heights value because of the uncertainties. How do you relate that in the probabilistic approach? (comparison of deterministic approach with inclusion of a safety factor with the probabilistic approach) Page 21, Figure 5 and Page 22, Figure 6: Comment: In these two figures, at what grid resolution are you presenting the wave profiles and maximum tsunami heights? Is it 10m, 30m, 90m? We know at shallower depth and closer to the coast finer resolutions will better present the wave profile. Have you tried a sensitivity test, to see how the resolution may affect the wave amplitude and phase? Page 24, Figure 8: Comment: In Figure 8 (a), in legend part, the horizontal red dash line (Average of 2012 CDMC models) is intersecting with the histogram. If possible, try to edit that in the final edition. Page 24, Caption of Figure 8: Authors: Figure 8: Histograms of tsunami inundation area in Shikoku and Kuroshio Town for the two magnitude ranges M8.9-9.1 (a,c) and M8.7-8.9 (b,d) (left: Shikoku Island and right: Kuroshio Town). Comment: It might be easier for the reader if as follows: Figure 8: Histograms of tsunami inundation area in Shikoku (a,c) and Kuroshio Town (b,d) for the two magnitude ranges M8.9-9.1 and M8.7-8.9 (left: Shikoku Island and right: Kuroshio Town). Page 25, Line 550, Caption of Figure 9: Authors: Figure 9: Scatter plots of slip ratios in segments Z (Hyuga-nada), A-B (Nankai), and C-E (Tonankai-Tokai) versus tsunami inundation area in Shikoku and Kuroshio Town for the two magnitude ranges

M8.9-9.1 (a,c,e) and M8.7-8.9 (b,d,f). Comment: It might be easier for the reader if as follows: Figure 9: Scatter plots of slip ratios in segments Z (Hyuga-nada), A-B (Nankai), and C-E (Tonankai-Tokai) versus tsunami inundation area in Shikoku (a,c,e) and Kuroshio Town (b,d,f) for the two magnitude ranges M8.9-9.1 and M8.7-8.9. Final Comment: Do you have any comments about the computational time, parallelization, and computer resources for this study? For example, for one hour of simulation considering one scenario what would be the estimated time? There are 1000 of simulations for the regional scale and local resolution which will require significant resources and time. I didn't find in the manuscript, as I understand it is not the scope of this study. TUNAMI code or any model which solves the shallow water equation (SWEs) is computationally more efficient compared to other wave models with more complex physics. This is more important in probabilistic methods which need lots of simulations. Therefore, a code which require less computer resources/time (as used in this work) maybe more practical for this purpose compared to the alternative ones, for example Boussinesq models.

Please also note the supplement to this comment:
https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2020-169/nhess-2020-169-RC5-supplement.pdf

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