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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "From regional to local SPTHA: efficient computation of probabilistic inundation maps addressing near-field sources" *by* Manuela Volpe et al.

Anonymous Referee #2

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##General comments##

This paper addresses an important topic, namely the development of onshore probabilistic tsunami hazard assessments and overcoming the related computational challenges. It builds on the work of Lorito et al. 2015 and Selva et al. 2016. A key innovation in this study is efficient filtering of near-field sources based on coseismic deformation, rather than offshore tsunami wave height. Overall, the paper is well written and concisely explains the issues and methods used to overcome them, and is suitable for publication in NHESS with some minor revisions.

In reviewing the paper, my main suggestions (details given below) are:

1. Siting the introduction more broadly in the PTHA literature. While this paper builds directly on the work of Lorito et al. 2015 and Selva et al. 2016, which is heavily relied upon in the introduction, along with the review paper by Grezio et al 2017, there are a number of additional relevant papers related to PTHA problems that could be cited. In my opinion, this would more neatly place this paper within the broader context of PTHA literature, widening the appeal of the paper. I.e. this paper should be framed as a step forward in PTHA in general, not just an update of the Lorito and Selva methods (although it is that too).

2. Some assessment of the sensitivity to the choices made in the filtering process (i.e. choice of thresholds etc) and whether this has any implication to the broader conclusions. Also whether it is possible for biases to be introduced in this process.

3. Some comment on whether other metrics besides maximum tsunami height or coseismic deformation could be relevant in assigning events to clusters.

In addition, there are several minor areas for clarification to improve the communication of the results, and a few grammatical errors.

##Specific comments##

1. Introduction

As mentioned above, this could benefit from reference to broader PTHA literature, specifically:

P2L4: Should also cite other PTHA studies as incremental gains in uncertainty quantification have been made over the past decade or so. Include Burbidge et al 2008; Gonzalez et al 2009; Horspool et al 2014; Davies et al 2017, Power et al 2017 (there may be others).

P2L7-8: These references (Geist and Lynett 2014; Grezio et al 2017) are not the first to emphasise computational approaches to PTHA – see additional references suggested in the above point.

P2L10: Should also reference Davies et al. 2017 regarding uncertainty quantification.

P2L13: Gonzalez et al 2009 should be cited in reference to challenges of PTHA for inundation.

P2L16: Geist 2002 should also be mentioned here.

P2L17. Mueller et al 2014 and Griffin et al. 2015 have both undertaken onshore tsunami hazard assessments considering heterogeneous earthquake rupture; although neither was fully probabilistic, they should be mentioned here as first steps towards quantifying this uncertainty for inundation hazard. Both also discuss the effect of coesismic displacement on onshore hazard and how this can vary locally, as discussed on P3L2. Here (P3L2) the discussion could be expanded to provide greater justification to your methodological approach to near field hazard.

Other comments on the introduction

P1L20: This isn't true. In practice many inundation assessments also use 'representative scenarios' for a range of return periods, not just 'worst credible'.

P1L22: One or a limited range of inundation scenarios get used for much more than 'a first screening' by emergency managers. These scenarios regularly get used to develop emergency management plans, evacuation plans, undertake impact assessments and so on. In my opinion this paragraph severely underplays the utility of scenario hazard assessments. The main problem is that we can't translate the offshore probability to an onshore probability. I expect that even with probabilistic inundation hazard maps, single event scenarios will still be used for a range of emergency management scenario planning purposes – we'll just be in a position to actually say what the probability of the event in terms of inundation hazard is.

P2L20: Need to clarify that this is talking about onshore PTHA – offshore PTHA are in general computationally affordable (though not cheap!) these days.

P2L30: 'while solving all the emerging technical and scientific issues'. This seems a

fairly bold claim! Perhaps rephrase.

2. Method outline This section is clear and well-written

3. Implementation of an improved filtering methodology

P5L4-5: How confident are you in the assumption that similar wave heights lead to similar onshore hazard? What about other wave properties such as period, which may be significant in determining onshore behaviour. E.g. Satake et al 2013 showed how inundation from the Tohoku tsunami was variably controlled by long-period components on flat coastal plains and shorter-period peaks in steep coastal areas. While set within a tsunami warning context rather than hazard assessment context, Gusman et al 2014 used two cycles of a tsunami waveform in identifying 'similar' tsunami. I think some of the issues are resolved for near field tsunami in your coseismic deformation filtering approach presented following, but it could still be good to comment on this issue here.

P6L30-35: It is not entirely clear how the distance is measured across the grid of coseismic deformation points, and how the spatial component is handled – perhaps also write the relevant equation to ensure clarity.

4. The Milazzo oil refinery

P8L28: The abbreviation Mmax is very commonly used to mean the maximum magnitude for a given earthquake source in seismic and tsunami hazard assessment. I would suggest changing this to something else to avoid confusion.

P9L11: This should be 'overestimates the probability for a given Hmax relative to STEP (3b).

P9L23: Should these be >=, not =, if you're talking about probabilities of exceedance?

P9L26-30: Use of phrase 'postitive' and 'negative differences' is confusing and makes the meaning of the paragraph somewhat ambiguous. Better to rephrase stating more explicitly which model gives relatively higher/lower hazard etc. Also, the difference between results far inland, near the coast and offshore in Figure 4a need to be explained. Why the shift from negative to postitive differences at some distance inland from the coast?

P10L5: Can anything additional be said about possible biases in the sampling process? Why is it likely that the sampling produced a non-representative selection of the important scenarios? How does this overall affect the strength of you conclusions in comparing the two methods (i.e. could the differences be random rather than systematic).

5. Conclusions P10L10: The statement around the definition of the source scenarios seems a bit strong. I'd suggest removing the word 'fully' as I doubt this has really been done. Aleatory uncertainty applies to both the rate model and the source location, geometry, maximum magnitude etc. I'd suggest putting 'and their mean annual rates' prior to 'exploring source uncertainty'.

P10L19: Suggest 'from offshore wave amplitudes alone'. Also, what about other parameters such as period for non near-field tsunami? This links back to my comments on Section 3.

Figures:

Figure 1: Step 2 should read 'tsunami propagation to offshore points'

Figures 3-5 need labels for parts a), b) etc.

##Technical corrections##

Throughout: Why use STEP instead of Step?

P1L11: demonstrate not demonstrated

P2L25: Rephrase to 'This allows identification of a subset of. . .'

P2L29: Rephrase to 'Here we merge the two approaches of Lorito et al. . ..'

P3L21: Change 'resume' to 'summarise'. Also P10L9

P4L8: Change 'enough representative' to representative enough'

P6L10: Change 'and a separate modelling' to 'and separate modelling'

P6L34-35: Change to 'while the stopping criterion is based on the Euclidian distance'

P7L16: Mediterranean Sea (not sea)

P8L1: Replace 'Namely' with 'That is'; delete 'even'

P8L25: Please specify the shear modulus used for the Okada calculations

P9L15: Remove 'supposedly'

P10L24: Change 'has not to be' to 'is not'.

P11L3-4: I think this should read 'As a consequence, the effect of coastal deformation on tsunami hazard can not be deduced. . .'

P11L14: Change to '. . .the approach developed here allows consideration of a very high number. . .'

References

References mentioned above not already in the manuscript:

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Gusman, A.R., Tanioka, Y., MacInnes, B.T. and Tsushima, H., 2014. A methodology for nearâĂŘfield tsunami inundation forecasting: Application to the 2011 Tohoku tsunami. Journal of Geophysical Research: Solid Earth, 119(11), pp.8186-8206.

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