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Interactive comment on "Tsunami hazard warning and risk prediction based on inaccurate earthquake source parameters" *by* K. Goda and K. Abilova

Anonymous Referee #2

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This manuscript develops and demonstrates a tsunami-risk assessment methods based on stochastic treatment of the tsunami genesis and probabilistic information about a building portfolio (including fragility and damage-cost models). Importantly, the stochastic treatment of the source allows for more rigorous estimation of damage probabilities. Candidate sources are sampled probabilistically assuming a von Karman wavenumber spectrum and several empirical scaling relationships. A compelling case study is presented for the 2011 Tohoku earthquake. The manuscript is presented well, straightforward to follow and addresses the important issue of accounting for source uncertainties in inundation and loss predictions. I recommend publication with minor/optional revisions.

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Interactive Discussion
Discussion Paper

Comments/Questions: Some of the early magnitude estimates for the 2011 Tohoku earthquake were unfortunately poor and exhibited high variability. However, since then much more rapid and advanced methods based in W-phase and geodetic data have been developed [e.g., 1, 2] and some are now widely applied. It may be good to briefly mention such advances here since they will hopefully contribute to lowering the uncertainty in inundation prediction. In particular, it would reduce the seemingly "hopeless" spread in loss estimates which are estimates as >100x on P7504.

Monte Carlo simulation includes 100 models per target magnitude. How was that number chosen, is it sufficiently high? It would be useful if this was justified. It may be useful to see how well the parameters in Table 1 are represented by this number of samples.

It would be interesting to see how the various constraints (P7494) affect the probability densities in Table 1. E.g., log10(Dmax)$\sim$N(0,0.1) with constraint Dmax>1.5Dave and log10(Dave)$\sim$N(0,0.2148). It may be useful to plot the final PDF for Dmax to visualize this.

An important assumption appears to be that slip distributions are representable by a von Karman spectrum. Mai & Beroza (2002) used a data base of Mw<8 events, does the von Karman spectrum scale to Mw 9 events? It seems to work for the Tohoku event, has it been considered for other events?

On P7496L21, it is not clear to me what "further adjusted" means here for Dave (the resampling of values >Dmax is clear). I may just be misreading the sentence.

Are the results sensitive to the weighting of the hypo centres (factors 0.2 and 0.4 on P7497)?

For context, it may be useful to provide other examples on hypo centre estimate quality (other events; is it often this bad?).

P7498: Do the candidate source models contain many instances where slip is concentrated near the trench, such as often inferred for the 2011 and 1896 Sanriku events?

Some additional questions: How strongly does the within-scenario variability (factor 100) depend on the choice of wavenumber spectrum and the choices of the empirical relationships? Could this variability be reduced with improved knowledge about rupture processes? Would this variability be different in other subduction zones?

[1] Kanamori, H., Rivera, L., 2008. Source inversion of W phase: speeding up seismic tsunami tsunami warning. Geophys. J. Int. 175, 222–238. [2] Melgar, D., B. W. Crowell, J. Geng, R. M. Allen, Y. Bock, S. Riquelme, E. M. Hill, M. Protti, and A. Ganas (2015), Earthquake magnitude calculation without saturation from the scaling of peak ground displacement, Geophys. Res. Lett., 42, 5197–5205, doi:10.1002/2015GL064278.

Minor typos, suggestions etc: P7488L12: remove "with" P7489L3: were->was P7489L9: remove "the" P7490L8: tsunami->tsunamis P7490L18: follow->follows P7490L29: remove "with" P7493L11: sallower->shallower P7493L27: parameter->parameters P7498L11: seismic loss->tsunami loss? P7504L13: definitely->definitively?

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 7487, 2015.