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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Tsunami fragility curve using field data and numerical simulation of the 2015 tsunami in Coquimbo, Chile" *by* Rafael Aránguiz et al.

Anonymous Referee #1

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I congratulated the effort of the authors as it seems that the manuscript was revised before submitting to NHESS. However, there are still some main augments (see sections 3.1-3.3) . Please see all of my comments below I believe that they will help improving the manuscript.

Title: Please consider adding the part "application of the developed fragility curves" in your title. Abstract: Please also specify the earthquake magnitude of both the 2015 and future events as well as add a short explanation about the comparison of the developed curves against Dichato. 1 Introduction: Please make sure that you use the same name, 2015 Illapel earthquake (same in Fig.1) throughout the paper. In the last

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Discussion paper

sentence of this section, your objective is only about two sentences. I would suggest to write them clearly using bullets and separate them from the literature review. There are some recently published works about fragility curves and their application that should be mentioned, Song et al. (2017), Charvet et al. (2017), Macabuag et al. (2016), Suppasri et al. (2016), Fraser et al. (2014) and Wiebe and Cox (2014) 2 Study area: Please also clearly state the topographical characteristic of the study area, plain area similar to Sendai? 3 Developing fragility curve: What kind of the field data used as I can only see the recorded waveforms? Did you also measure inundation heights/depths from the field survey? If so why didn't you used them for your model verification in addition to the recorded waveforms? 3.1 Data: What is the average numbers of stories of these 568 buildings, 1-2 stories? Please add the photo taken date for Fig. 2. What are structures for the two houses in Fig. 2c and 2d? How did you confirm that the surveyed houses are the original damage condition or you evaluated the damage by asking all house owners? Was the almost damage from earthquake because of the retrofit/lesson from the 2010 event? It was possible to developed fragility curves for more than two damage levels. In Suppasri et al. (2012), they developed the curves for four damage levels using less than 200 buildings. You may change the word from "surviving" to other words such as remaining, not destroyed, etc. Buildings are not living things, thus the word "survive" sounds not so suitable in my opinion. Please add some photos of the buildings as example of your damage levels, destroyed and not destroyed. Washed away building should be also included in the "destroyed" damage level. No washed away buildings in this 2015 event? 3.2 Inundation depth: It is confusing if you used your measured inundation heights during the survey for your inundation simulation or just the recorded waveforms for the source verification? If you have all surveyed inundation heights for each building, you can then develop fragility functions using the actual maximum flow depth from the field survey and maximum flow velocity and hydrodynamic force by making use of the numerical simulation. Please make clear about this in this section. Please use the original reference for K and Kappa (Aida, 1978). 3.3 Fragility curves: Similar to section 3.2 that I would like to encourage the

authors to used their simulated maximum flow velocity and hydrodynamic force to also develop the fragility curves as successfully made by previous studies (Koshimura et al, 2009, Suppasri et al., (2011) and Gokon et al., (2014)). These curves using flow velocity and hydrodynamic force can be used to explain in your section 3.4 why your study area have lower damage probability (far and protected by railway embankment). Even if the same flow depth, but you may be able to explain that the flow velocity and hydrodynamic force is much lower in your area. 3.4 The title of the section is wrong? Should be Comparison of the developed fragility curves or something? I suggest to use bullets or subsection to compare your curves with 1) Dichato first, 2) then Okushiri and other part of Japan and 3) other parts of the world (Why didn't you also compare with Samoa and Thailand?) Can you spilt the data and develop another one or two curves for 1-story or 2-story only? Then you can show that the damage of the mix stories is lower than 1-story only or higher than 2-story only. 4.1 Source model: Did the event in 1849 a tsunami earthquake? Why such event is not necessary to include in this study? Please also write that you used earthquake magnitude (8.2-8.5) in the explanation not only in Fig. 9. 4.2 Proposed scenario: It will be very useful for readers if you could add one figure showing the comparison of the simulated flow depth of 2015 tsunami against the proposed scenario. May be the values shown in the map can be the difference between the proposed scenario and the 2015 tsunami (i.e. Fig. 10(center-S1) minus Fig. 7a). Then the readers can be easily seen that where we might expected greatly increase of the flow depth from the future event. Characteristics of the maximum flow velocity and hydrodynamic force can be also discussed and support your explanation at the end of this section 4.3 Tsunami mitigation measures are deeply discussed by Strusińska-Correia. (2017) and Suppasri et al. (2016)

Suggested references Agnieszka Strusińska-Correia. (2017) Tsunami mitigation in Japan after the 2011 TÅ■hoku Tsunami. International Journal of Disaster Risk Reduction 22, 397-411. Online publication date: 1-Jun-2017 Aida, I. (1978) Reliability of a tsunami source model derived from fault parameters, J. Phys. Earth, 26, 57–73. Charvet, I., Macabuag, J., Rossetto, T. (2017) Estimating tsunami-induced building

damage through fragility functions: Critical review and research needs, Front. Built Environ. 3:36. Fraser, S. A., Power, W. L., Wang, X., Wallace, L. M., Mueller, C. & Johnston, D. M. [2014] “Tsunami inundation in Napier, New Zealand, due to local earthquake sources,” Nat. Hazards, 70(1), 415–445. Macabuag, J., Rossetto, T., Ioannou, I., Suppasri, A., Sugawara, D., Adriano, B., Imamura, F. and Koshimura, S. (2016) A proposed methodology for deriving tsunami fragility functions for buildings using optimum intensity measures, Natural Hazards, 84 (2), 1257-1285 Wiebe, D. M. & Cox, D. T. [2014] “Application of fragility curves to estimate building damage and economic loss at a community scale: A case study of Seaside, Oregon,” Nat. Hazards 71(3), 2043–2061. Song, J., De Risi, R. and Goda, K. (2017) Influence of Flow Velocity on Tsunami Loss Estimation, Geosciences 2017, 7(4), 114. Suppasri, A., Latcharote, P., Bricker, J. D., Leelawat, N., Hayashi, A., Yamashita, K., Makinoshima, F., Roeber, V. and Imamura, F. (2016) Improvement of tsunami countermeasures based on lessons from the 2011 great east japan earthquake and tsunami -Situation after five years-, Coastal Engineering Journal, 58 (4), 1640011.

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