**Natural Hazards
and Earth System
Sciences**

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Discussions

Interactive comment on "Scenario-based assessment of buildings damage and population exposure due to tsunamis for the town of Alexandria, Egypt" *by* G. Pagnoni et al.

G. Pagnoni et al.

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We thank the reviewer for his/her comments to which we provide distinct replies here below. We are also uploading an annotated version of the paper, where replies to comments by Referee 1 are highlighted in yellow (in green comments by Referee 2).

General Reviewer's comment Although the methods applied to this study is common but their results are important for tsunami damage assessment in a specific location, in this case, Alexandria, Egypt. Please consider my comments shown below especially for the effect of tide, coastal structures and making building and fishing boat damage map which I believe that they will add value to the manuscript and also useful in prac-

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tice.

Specific Comments - Title: Please consider to mention in your title that your study only focused on the earthquake-generated tsunamis. Accepted.

- Introduction: Please include geographical information of the study area such as average land elevation, bay shape, coastal defense facilities (seawalls, breakwaters), etc. We modified the introduction to include some more data.

You may also mention roughly the tsunami height by the two major historical events. What is known of the major historical tsunamis concerning inundation was already reported in the paper.

You should better state clearly the objectives or final goals/expected results of this study. Accepted. Though we think that paper objectives were clear from the title and abstract, we added a sentence at the beginning of the paper, where objectives are specified.

- WCTSA: I suggest to move this section after section 3. After you review both earthquake and landslide sources. We believe that in the structure of the paper, this section is placed in the right position. We introduce the method, and then we apply it by selecting the appropriate tsunamigenic sources.

- The selected tsunamigenic sources: I suggest to make use of bullets to separate earthquake and landslide sources. Since we pointed out that we focus on seismic sources there is no need to separate tsunamigenic sources with bullets. The reader knows that the attention is focus on earthquake-induced tsunamis. We mention also occurrences of tsunamigenic landslides for completeness.

You may then add the explanations similar to your conclusion for the reason why you did not consider landslide generated tsunami. We don't like to put too much emphasis on this subject since it is not the core of the paper.

- Tsunami simulations: What is the tidal range in the study area? Tsunami hit during

the high tide probably cause larger inundation extent. Accepted. Tidal oscillations are limited to some tens of cm in Alexandria. We used values estimated by El-Geziry and Radwan (2012) who estimated a 62 cm range between minimum low and maximum high in the decade 1996-2005. Therefore we considered a high-tide level exceeding the mean sea level by 30 cm. We compute all the simulations also for the high-tide condition, we computed the aggregate scenarios, the damage and the population exposed. This implied changing the text in several parts, including figure captions and conclusions. Specific high-tide results are given in the Appendix A2. The main difference is that the inundation area increases from 15.6 km2 to 16.4 km2, that inundation affects more structures (from 12,398 to 13,371) and about 10% more people (153,916 -> 165,993).

What are the heights of seawalls and breakwaters in the study area? Effect from with and without these coastal defense structures is also interesting. This is to see for the worst case if these structures were totally destroyed and might cause higher tsunami impact. We used the value of 3 m as the height of numerical breakwaters, which is an average value, appropriate to the selected simulation grid resolution. Repeating simulations with no breakwater is certainly interesting, but it is out of the scope of this paper. Indeed, the possibility that breakwaters can be destroyed by the incoming tsunami front in such a way that the following tsunami waves attack the coast with no breakwater protection anymore could be considered an improbable occurrence, given the calculated height of the tsunami wave.

- In my opinion, similar figures such as Figs 5,9,13, Figs 6, 10, 14 and Figs 7, 11, 15 should be put together for better virtual comparison and reduce the space. For the sake of clarity, it is our opinion that separate Figures are better for the reader.

- Exposure and vulnerability and building damage assessment: Please consider to move the first paragraph of these two sections to the introduction part as data and method part and only focus on your own results. The paper is structured in such a way that we present methods and application together step by step. We think this

organization is fine and we will keep it.

– Because you have the simulated flow velocity, you may apply this recently published works for the assessment of marine vessels based on the actual damage data from the 2011 Japan tsunami. By doing this, you can also make an onshore tsunami hazard map for fishing boats. Muhari, A., Charvet, I., Futami, T., Suppasri, A. and Imamura, F. (2015) Assessment of tsunami hazard in port and its impact on marine vessels from tsunami model and observed damage data, Natural Hazards (Published online) Suppasri, A., Muhari, A., Futami, T., Imamura, F. and Shuto, N. (2014) Loss functions of small marine vessels based on surveyed data and numerical simulation of the 2011 Great East Japan tsunami, Journal of Waterway, Port, Coastal and Ocean Engineering-ASCE, 140 (5), 04014018. We thank the authors for the valuable suggestions and the interesting references. We will leave this for further studies.

- Although the project SCHEMA has modified the damaged building data surveyed in Indonesia to the European standard, could you please add some explanations for an argument that even in the Europe and adjoin region, the building properties should be different. Or in SCHEMA has modification for all countries in the region? In the project SCHEMA the damage matrix was built from a data set where the minimum inundation level was 1.8 m. Changes to the SCHEMA matrix are mainly meant to fill this gap. We have quoted papers where damage to light structures due to small inundation levels were found to be substantial in several cases. We believe that what is explained already in the paper is clear.

- Building damage analysis: I suggest to use bullets to separate the explanations of each step. Done.

Again, I feel that the first paragraph is more proper as introduction. For the way we conceived our paper, the right paragraph place is where it is now.

- What kind of image you used for the visual building inspection and their photo taken date? We used satellite Google Earth images taken on 20 January 2015 and on 18

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April 2015 and also pictures. We added a figure made of a collection of pictures taken from the Google Earth database, where typical structures from classes A to E are portrayed. See the reply to the following comment.

Please also make one figure showing examples of building image in your study for each class. Done. We added Figure 21 and modified accordingly the subsequent Figures numbering.

Please consider making use of Fig. 20 to create a building damage map by plotting the expected building damage state of each cell. I believe that will be very useful for the local government or any planners. This is not possible because there is not a unique correspondence between cells and building types. Many cells of the tessellation contain several constructions, usually of different classes.

- Population exposure analysis: The first and second paragraphs may better move as introduction of the data and method. As already replied to similar comments before, we preferred organizing the paper in such a way that methods and specific applications are given together.

- Fig. 17: Please draw the coastline Done.

- Conclusion: I suggest to add some comments on the specific critical facilities even though the study show that the impact is minor. You may say that based on this study conditions, xxx plant might be affected that by xxx tsunami. We thank the reviewer for the suggestion. We remarked already in the text and in the figures where the main industrial plants are located. Our simulations and inundation data allows us to make inferences on some critical facilities. However, our paper is mainly focused on the residential areas and resident people and we did not make sufficient efforts to compile a complete dataset of critical facilities for the area. Therefore we do not believe appropriate to add information on critical facilities in the conclusions.

Please also note the supplement to this comment:

http://www.nat-hazards-earth-syst-sci-discuss.net/3/C2379/2015/nhessd-3-C2379-2015-supplement.pdf

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 3, 5085, 2015.

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