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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "High-resolution modeling of tsunami run-up flooding: A case study of flooding in Kamaishi City, Japan, induced by the 2011 Tohoku Tsunami" *by* Ryosuke Akoh et al.

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GENERAL COMMENTS: The topic is suitable for the journal since it addresses an issue which could be of interest to the scientific community. The document is up to the international standards and the length of the paper is adequate. High-resolution modeling of tsunami run-up flooding: A case study of flooding in Kamaishi City, Japan, induced by the 2011 Tohoku Tsunami has been analysed with interesting conclusions. The results obtained with the developed numerical modelãĂĂpresent an interesting replication of the recorded data. However, some more explanations are needed in some chapters, in order make it easier the reading and understanding of the study. In

addition, the introduced indicator Z, is here discussed. The reviewer would like to give some comments and suggest corrections in order to increase its overall significance.

Abstract: Although the use of U to represent the flow velocity is quite common and it is explained in the chapter 5.2, the abstract must be standalone and thus, the definition of Hmax and Umax must be given. The presence of the results of numerical simulations (lines 18-20) must be adequately presented. The addition of a sentence like "As a possible mitigation measure, the influence of the buildings in the flowing has been addressed. . ." would increase the text flow.

[Reply]

We will add the explanation of the definition of Hmax and Umax.

We will revise the sentence about the results by following your suggestion.

1.-Introduction: The building array treatments are widely explained. But this wide explanation distract from the objective of the paper. A briefer explanation is suggested since the references are enough to study it if necessary. In addition, and this is something common all along the paper, the structure of the chapters is not clear. The inclusion of a paragraph explaining what the reader is going to find on each chapter is needed to improve the understanding. If not, although each part is well explained the reader lose their sense of the bigger picture. In the introduction it is not mentioned that the model has been applied as well to study the influence of the concrete buildings. One of the main points of the study is the application of an alternative mitigation measure (not just a seawall) to reduce the tsunami action and to allow, at the same time, the normal work on marine industries.

[Reply]

In order to clarify the position of the present research, we think it is necessary to widely introduce the building array treatments. However, to avoid obscuring the purpose of this research, we will simplify the introduction of the previous study in the new manuscript.

As you pointed out, the contents discussed in 5.3 and the structure of the chapter were not described in the introduction. In the revised manuscript, we will add these description.

3.- Methods and materials: An introduction must be included (between 3 and 3.1) to explain to the reader what they are about to find in this chapter. The characteristics of the model are well explained and referred. Is this model new or has it been presented before? If it is new it should be said clearly, or even named. In this chapter the characteristic of the numerical model, the application case data sources, and verification data sources are presented together.. These 3 different parts should be separated in order to make it easier the understanding, because they present independent parts of the study. In addition the verification data and the results can be explained together what would improve the overall understanding. This reviewer suggests the change of the structure of chapters 3 and 4 to: Chapter 3. The numerical model (including chapters 3.1 and 3.2) Chapter 4. Application case: Kamaishi port under 2011 event. Introduction explaining the 2011 event 4.1 Mesh generation (including 3.3.1, 3.3.2, and 3.3.3) 4.2 Calculation condition (including 3.4) Chapter 5. Validation of the results. Include an introduction explaining that the results of the numerical simulations presented in the previous chapter are here presented and compared to those real data recorded. 3 comparisons: o 5.1 Tsunami wave height near the coast (including 3.5.1 and 4.1) 5.2 Local highest water surface (including 3.5.2 and 4.2) 5.3 Wave front propagation on streets (including 3.5.3 and 4.3)

[Reply]

Thank you for your suggestion. According to your proposal, we will change the composition of the paper. In addition, we will ask to proofread the new manuscript to a native speaker.

Again, each chapter must contain an introduction.

5.- Discussion: An introduction explaining the 2 aspects that are in this chapter (C and

Z) is needed.

[Reply]

We will add the introduction explaining of permeability coefficient and flow intensity indicator.

5.2. Here the indicator Z=U max*Hmax is presented. This is the product of the maximum inundation depth and the maximum flow velocity during the flood. However, the maximum water depth and the maximum flow velocity are not always simultaneous. The value that should be considered is Z=(U*H)max, which is the real maximum value of the product. The indicator must be recalculated or an explanation is needed to maintain the original expression. This product is used to estimate the human instability hazard (Jonkman et al., 2008) Jonkman, S., Vrijling, J., and Vrouwenvelder, A.: Methods for the estimation of loss of life due to floods: a literature review and a proposal for a new method, Nat. Hazards, 46, 353–389, doi:10.1007/s11069-008-9227-5, 2008.

[Reply]

We know that the maximum water depth (hmax) and maximum flow velocity are not always simultaneous. In the old manuscript, the product of the respective maximum values was used as the indicator of flow so that the value becomes large when the hmax or umax is large. Howerver, as mentioned in the reply for the comment #2 of reviewer-1, we adopted the momentum fulx (huˆ2) as the indicator in the new manuscript. In addition, it seems better to use (hmax*umaxˆ2) than (h*uˆ2)max as the maximum momentum flux. Therefore, we adopt the spatial distribution of (huˆ2)max in the new manuscript. Because the new indicator showed the same tendency as the former one, the discussion in Section 5.2 was kept in the new manuscript.

In addition, we will add the Jonkman's paper to the reference list.

SPECIFIC COMMENTS Page 1 Line 10: shallow water equations

[Reply]

We will correct the mistake in the new manuscript.

Page 1 Line 39: The reference Gallinen must be Gallien

[Reply]

We will correct the mistake in the new manuscript.

Page 2 Line 34: permeability constant, C (from..

[Reply]

We will revised in the new manuscript.

Page 6 Line 7: It is not included in the text the reference of the survey. In the reference chapter it is included the 2011 tohoku earthquake tsunami joint survey, but it must be referred in the text.

[Reply]

We will cite their work in the new manuscript and add the website to the reference list.

Page 6 Line 30: The influence of the port in the flooding was cited by Tomita in T. Tomita, G.-S. Yeom, M. Ayugai, T. Niwa, Breakwater Effects on Tsunami Inundation Reduction in the 2011 off the Pacific Coast of Tohoku Earthquake, J. Japan Soc. Civ. Eng. Ser. B 2(Coastal Eng. 68 (2012) 4–8. In view of this a comment on the no-consideration of the port in the simulation, as well as the citation of Tomita′s paper must be included.

[Reply]

As mentioned in the reply of 1st reviewer's comment-7, in order to make sure our consideration for the influence of the breakwater, we will add the following sentence at the beginning of section 3.5.1 and cite Tomita's paper.

[Revised]:

As mentioned earlier, the breakwater at the bay mouth was not considered in the calculation due to the uncertainty of its destruction process. In this study, therefore, time series of tsunami wave height near the coast line were obtained by image analysis was carried out using digital photographs taken by residents in order to examine the calculated time series near the coast line could be used for the run-up calculation in the city center area.

Page 7 Line 10: Is this video available on the internet? If so, a reference would be interested.

[Reply]

We will add the URL of the website to the reference list.

Page 8 Line 1: The expression includes hmax, but in the rest of the manuscript it is called Hmax.

[Reply]

We will correct the mistake in the new manuscript.

FIGURES: Figure 11 is called for the first time in page 6 line10, but the symbols contained in it are not explained until Figure 15 is called in line 34. They should be explained in the foot of the figure.

[Reply]

We will add the explanation of the symbols in the foot of the figure.

Figure 14a. In this figure are depicted the water levels at 4 points, but just the results of the model for the P3 are represented. However there are just 3 points photographed in P3. Other points have many more dots so it seems logical to depict other point time series instead of P3. In addition, the fact that all the dots (even those from other points like P1, P2 and P4) agreed fairly well in the P3 time series is important as to be highlighted.

[Reply]

Because the center of 4 points is close to P3, we showed the calculation result at P3. In the new manuscript, we will explain the reason for using the calculation result at P3, and emphasize that the calculation results are fairly well at all 4 points.

REFERENCES: In page 11 line17 the reference of Water and Disaster management Bureau is not included in the manuscript text

[Reply]

The reference was cited to use the value of the Manning's roughness coefficient. However, in the new manuscript, we changed the value proposed by Bunya(2010), due to the suggestion from Reviewer-1. Therefore we add the following paper and delete the above reference from list.

In page 5 line 23 the reference called here Central disaster prevention council, is not included in the references list.

[Reply]

We will add the reference of Central disaster prevention council to the reference list.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2017-222, 2017.

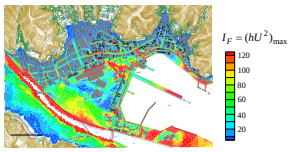

Fig. 20: I_F -value mapping for the original building array (C = 0.01).

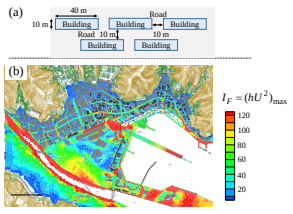

Fig. 21: I_F-value mapping for the testing building plot (C = 0.01): (a) building plot and (b) I_F -value mapping.

Fig. 1.