

Reply to the Comments (RC1) of Reviewer No.1

Dear reviewer,

We sincerely acknowledge the reviewer for the careful reading, helpful comments, and constructive advises. The manuscript would be revised according to all the suggestions in order to improve the quality. Responses to each comment could be found in the following part.

Major comment:

In my opinion, a brief but exhaustive description of the IIA method in section 2 is required. Indeed, there is no description about the way in which the maximum elevations are calculated starting from the unit sources. All the references to previous works based on this method (Chung, 2018; Lee, 2014; Wu, 2017), as reported in the text, are in Chinese language only. If this method is unpublished in international peer-reviewed journals, it should be exhaustively described here.

Reply: We acknowledge the reviewer for reminding the necessity of introducing the IIA method comprehensively for publishing in the international peer-reviewed journal. Follow the reviewer's suggestion, the section 2.1 would then be enlarged with descriptions of the IIA method in greater detail in the new revision.

Moderate comments:

1) I recommend to clarify already in the abstract that these two events are tricky not only for the difficulties in interpreting the existing documentation of both, but also because they resulted close enough in time and location to have raised the suspect, in some researchers, to be the same event.

This, at least to me, would make clearer also why the authors presented the two events together.

A short sentence before "Reasoning these historical events [...]" in the abstract could serve the scope.

Reply: We thank the reviewer for the recommendation. Pointing out in the abstract that these two events were close in time and location would certainly help explain why we present them together in this study. As the reviewer suggested, the sentence “These two events seem to be close enough in time and location that, to some researchers, they are considered as the same event” would be added before “Reasoning these historical events [...]” in the abstract.

2) I recommend to add a Figure (a new Figure 1) to introduce the area of study, with a zoom in the two targets, in order to make the reader aware, since the beginning, of the regional context and the distances between the two sites. In this new figure, I suggest also to include the location of some features described later on in the text (canyons, faults, etc) in order to provide a reference between the real geography of the area and what described in the text.

Reply: We agree with the reviewer and apologize for not being thoughtful enough to the readers. A new Figure 1, which includes the submarine features off southwest Taiwan and the zoom-ins of the two study areas, would be added.

3) The references for the bathymetry data with resolution 100 m used for the two near-field models should be provided (line 96). I suppose (but I am not sure) that this is different from what described for the data used with the nested-grids in COMCOT (lines 173-179).

Reply: We thank the reviewer for the reminder. The bathymetry data with resolution 100 m (line 96 and line 169) provided by Prof. Shu-Kun Hsu, one of the co-authors, are gained fundamentally through compilations of data from different marine cruises. They differ from the bathymetric data used for the nested-grids in COMCOT (lines 173-179).

Hsu, S.-K., Sibuet, J.-C., Monti, S., Shyu, C.-T. and Liu, C.-S.: Transition between the Okinawa trough backarc extension and the Taiwan collision: new insights on the southernmost Ryukyu subduction zone, *Mar. Geophys. Res.*, 18(2), 163-187, doi: <https://doi.org/10.1007/BF00286076>, 1996.

Hsu, S.-K., Liu, C.-S., Shyu, C.-T., Liu, S.-Y., Sibuet, J.-C., Lallemand, S., Wang, C. and Reed, D.: New gravity and magnetic anomaly maps in the Taiwan-Luzon region and their preliminary interpretation, *Terr. Atmos. Ocean. Sci.*, 9(3), 509-532, doi: 10.3319/TAO.1998.9.3.509(TAICRUST), 1998.

4) I did not understand why the high-resolution IIA (Figure 3) is shown for the Jiateng target only. What about Tainan?

Reply: According to the descriptions of historical reports and the previous study of Li et al. (2015), a local submarine mass failure could also be responsible for the Jiateng Harbor Flooding. We then performed 378 unit-source tsunamis scenarios, where high-resolution bathymetry is required in order to better describe the regional submarine features, to form the near-field IIA. On the other hand, the descriptions of 1782 Tsunami Event is different in the severity that the ocean waves “covered the whole of the submerged island so that no part of the flooded island remains visible except for the foot of the mountains” (Jäger, 1784). Referring to the historical report above, it seemed that the 1782 Tsunami Event was affecting the whole island of Formosa instead of being limited to the local area of Tainan. Therefore, we applied IIA method in larger areas (the southwestern coast and the far-field one).

5) What the sentence "the asperity effect was also applied" (line 155) means in practice? At least a brief sentence about this should be provided.

Reply: We thank the reviewer sincerely for the comment. According to Somerville et al. (1999), “An asperity is a region on the fault rupture surface that has large slip relative to the average slip on the fault”. Wu (2012) mentioned that “the asperity is not directly connected to the tsunami earthquake. However, the tsunami height will be enlarged, if the asperity is located in an offshore area or on the tsunami ray”. In order to assess the worst-case tsunami hazard of Taiwan, Wu (2012) applied then the asperity effect to some of the tsunami sources in his study, including T02, the one we selected and used in this study.

The sentence of line 156 would be rephrased as below:

For the worst-case tsunami hazard assessment, Wu (2012) also applied the asperities, which are regions on the fault that have larger slips compared to the average slip on the rupture area (Somerville et al., 1999) in some of the tsunami sources in his study.

With the following reference of Somerville et al. (1999) added.

Somerville, P., Irikura, K., Graves, R., Sawada, S., Wald, D., Abrahamson, N., Iwasaki, Y., Kagawa, T., Smith, N. and Kowada, A.: Characterizing crustal earthquake slip models for the prediction of strong ground motion. *Seismol. Res. Lett.*, 70(1), 59-80, doi: 10.1785/gssrl.70.1.59, 1999.

6) At line 170, it seems that nonlinear equation were used for SMF only, but I guess that they have been used for the seismic sources as well. Authors should better clarify this point. Also, what is the reason for the selected Manning coefficient value (line 171)? 0.013 is a quite low friction, often used in presence of plain surfaces and no obstacles.

Reply: We thank the reviewer for the comment and apologize sincerely for missing this key information for the seismic tsunami sources. The nonlinear shallow water equations were indeed used for the seismic tsunami scenarios as well. We would add the clarification and more information in this paragraph (line 169-179).

Indeed, just like the reviewer points out, 0.013 is a Manning coefficient value relatively low. We are using this value as a conservative estimate since we don't really know what happened in the historical events, yet it seems to us a bit reckless not to apply any friction or higher friction values for the tsunami simulations. Also, most of the southwest coast of Taiwan are fine-sand beaches. Finally, the locations of Jiateng Harbor and Tainan are close to the lagoons which exist already in the Qing Dynasty. According to the reasons above, we conservatively selected the Manning coefficient value 0.013 for the numerical simulations of this part.

7) At line 183 is reported: "1 zhang approximately equals to 3 - 1/3 m" but I am not sure to have understood which is the exact correspondence in meters.

Reply: We thank the reviewer for raising this question. Actually, the length unit mentioned here confused us as well, though the original historical report is written in

Mandarin (Li et al., 2015). Therefore, we suggest here using the villagers' houses and the bamboos as the height reference for estimating the tsunami height impacting the Jiating Harbor.

Since "the rafters of the thatched roofs were all gone" (Li et al., 2015), and most of the residents at that time live in one-floor houses, the tsunami height was estimate to be higher than the houses of the villagers. Then according to Yu (1994) and the English translation of the supplementary element of Li et al. (2015), people were climbing upward (in the text, we know people climbed up the bamboos) as the water level rises. Supposing that the reaction time and the climbing-up time was probably very limited for the residents, and after the flooding there was "One strong man jumped to ground, and helped others getting down" (Li et al., 2015), with the height that villagers could climb up within the limited reaction time and the height that one can jump down safely, the possible tsunami height estimated from the description is about two meters or higher in this study.

8) Section 3.1: I suggest to provide some more details on the position of the numerical gauge, as the water depth of the point and a zoomed map with the position respect with the coastline (an inset in Figure 5 could be enough)

Reply: We acknowledge the reviewer for the suggestion. Considering that the gauge locations are mentioned already in the section 2.1, we would add two zoom-in maps with the water depth of the gauge points to the "current" Figure 1 since it is equally important to show more information of both the numerical gauges of the Jiateng Harbor and Tainan.

9) At line 235 I suggest to change the sentence in "[...] COMCOT seems to confirm [...]".

I would be more prudent on what the modelling results are indicating, since the parameters of the potential sources are quite uncertain for these events of the past. Modelling a few scenarios can help to support some hypotheses in broad terms, but I would be careful in drawing definitive conclusions.

Reply: We thank the reviewer for the suggestion. We should be more careful while making the conclusion. The sentence of line 235 would be rephrased as "The results

of numerical simulations performed with COMCOT seem to indicate that the 1781 Jiateng Harbor Flooding and the 1782 Tsunami are two different events”.

Minor suggestions:

line 12: "[...] , titled Taiwan Interview Catalogue, [...]"

Reply: We thank the reviewer for the comment. The sentence in the abstract would be rephrased as “The 1781 Jiateng Harbor Flooding, recorded by the Chinese historical document, titled Taiwan Interview Catalogue, took place on the southwest coast of Taiwan”.

line 70-74: I suggest to slightly rephrase these sentences, since it seems to me that the reader could be a bit confused. I suggest something similar to the following: "Second, from the words “Voici ce que je lis dans J. L. Ab Indagine L. M.” (i.e., "Here is what I read from J. L. Ab Indagine L. M.") in Perrey (1862), it is reasonable to believe that most of the content in that document is quoted from the German report Philosophisch und physikalische Abhandlungen (Jäger, 1784). After examining these two documents, it is also suspected that the date of a second letter sent from Beijing to Versailles was reported with a typographical error about the year. Indeed, the date “En décembre 1682” is found in Perrey's [...]"

Reply: We agree with the reviewer and sincerely acknowledge the reviewer for the helpful suggestion. The sentences would be rephrased accordingly.

line 106: "[...] where the submarine structures are located, [...]" ?

Reply: We thank the reviewer for the comment. The sentence in line 106 would be rephrased as “The areas where the submarine structures are located, [...]" as the reviewer suggested.

line 120: "broader"?

Reply: We apologize for the typo. The sentence would be corrected accordingly.

line 167: I suggest to use quotation marks for the sentence ("subterranean movements causing the whole island to shake and be devastated; the earthquake lasted for 8 hours"), in order to emphasize the quotation.

Reply: We acknowledge the reviewer for the suggestion. The quotation marks would be added to the sentence for emphasizing the quotation.

line 242: If I understand the sentence, I would rephrase as "Moreover, it is unlikely that a severe tsunami in 1782 was not reported by any Chinese document."

Reply: We thank the reviewer for rephrasing the sentence, which makes the sentence much more understandable. The sentence would be rephrased accordingly.

line 244: "[...] the French record as reported by Perry (1862) [...]"

Reply: As the reviewer suggested, the sentence of line 244 would be rephrased as "Li et al. (2015) were the first group who read, translated and reported the French record as reported by Perrey (1862)".

line 245: "[...] the historical documents cited by Perry [...]"

Reply: Following the reviewer's suggestion, the sentence would be rephrased as "In this study, it is the first time that the historical documents (Gazette de France, 1783; Jäger, 1784) cited by Perrey (1862) are fully translated and reported together".