Dear Editor,

Thank you for the time and sending us your decision. We have made responses and corrections to reviewers' comments and suggestions as shown below. Corrections made based on comments and suggestions are shown in red.

Reply to reviewer no. 1

We highly appreciate your time spent in reviewing the manuscript as well as your valuable comments and suggestions. We are glad that you are interested in our work and your positive feedback. Please find our line-by-line responses and corrections to your comments and suggestions. All responses, corrections and improvements are shown in red in the revised manuscript.

Reply to general comments
Thank you very much for pointing out these important issues. We totally agreed that the sensitivity and variability aspects of the source models and the bathymetry should be sufficiently discussed, Also, additional investigations should be applied to strengthen the conclusion related to tsunami wave trapping. In order to this, we have applied additional analyses mainly in **section 2.4, 2.5 and 2.6,** and related **sections 5.1**, 5.**2** and 5.**3.** In addition, to improve the clarity of the text, we have added more explanations to s**ection 2.3, 6.1, 6.2, 6.3,** as well as additional Tables and Figures to support the explanations. The manuscript was carefully re-written, and the English spellings were to our best to be improved (i.e., by hiring the service of professional editing companies). Please see more details below on our answers and responses.

Reviewer comments	**Our answers**	**Corrected manuscript**
Line 15: Please remove 'for the first time'	We thank the reviewer for pointing this out. We corrected it by removing the word.	**Line 14:** A small tsunami was generated, and recorded at tide gauge stations ~~for the first time~~.
Line 44: I suggest putting in a reference to Figure 1 already here.	We thank and agree with the reviewer. We corrected it by linking a reference to Figure 1.	**From line 48 to line 49:** The locations of Hengchun Peninsula and the epicenters of the successive earthquakes are shown in Figure 1.
Line 51: The Lay and Kanamori refence is general but the way the	We thank the reviewer for pointing this out. The sentence	**From line 50 to line 56:** The respective magnitudes of

sentence reads it sounds like the paper refers to this event. Please rephrase, and include a specific reference work (e.g. from seismology) that consider the 2006 event in particular.	was rephrased, and additional references about earthquakes doublet in seismological perspective of view were included.	these two earthquakes were suggested to be M_L = 7.0 (M_w = 7.0 in the Global CMT catalog) for the former, and M_L = 7.0 (M_w = 6.9 in the Global CMT catalog) for the latter. From seismological perspective of view, pairs of large earthquakes with equivalent rupture size and occurred in a similar spatial and temporal proximity were specified as doublet (Lay and Kanamori, 1980; Kagan and Jackson, 1999). Sharing comparable earthquake magnitudes, and very close epicenters and occurrence times, the successive earthquakes are referred as an event of doublet (Ma and Liang, 2008; Wu et al., 2009).
Line 51: 'Casualties', do you mean 'fatalities'? The former also refer to injuries, the latter only to loss of life.	Thank you very much for the suggestion. According to the report of National Disaster prevention and Protection Commission, R.O.C., 2007, the 26 December 2006 earthquakes caused 44 injuries, including 2 fatal ones, 3 building collapse, and massive damages of submarine communication cables. To that sense, we considered to use the vocabulary 'Casualties' here.	
Line 57: 'propagated toward' à 'propagated towards'	We are very sorry for making this spelling mistake. We	**Line 61:** A small tsunami was generated

	corrected it.	after the successive strong motions of these earthquakes. The tsunami propagated towards, and reached the western coast of southern Taiwan immediately after the earthquakes.
Line 60: Rephrase sentence, my suggestion 'as it was rare because it was generated by earthquakes in short succession'.	We thank and agreed with the reviewer. We corrected it by rephrasing the sentence.	**Line 64-66:** The December 2006 tsunami was an important event and attracted public interest, as it was rare because it was generated by earthquakes in short succession, and was a new issue among social communities and ordinary persons in Taiwan about tsunamis.
Line 62: 'heightens' à 'increased'	We thank the reviewer for pointing this out. We corrected it.	**Line 67:** This recent tsunami not only corroborates the tsunami risk in Taiwan, but also increased the awareness of disaster risk management, such as preparedness, and mitigation countermeasures for the next tsunamis.
Line 65: Several repeats of the above in this paragraph, I suggest shortening.	We thank the reviewer for pointing this out. We shortened the paragraph.	Please see **line 69**. The tsunami observations reported following the 26 December 2006 tsunami also opened some questions.
Line 67: Please delete sentence starting with 'It has been common understanding…'. This can certainly be disputed and the scientific community is	We thank the reviewer for pointing this out. The sentence starting with 'It has been common understanding…' have been deleted, and the sentences	**Line 70:** First, the first tsunami wave crest was not shown as the largest in some stations.

definitely aware that later wave arrivals can be larger than the first.	were rephrased.	
Line 71: 'prolonged'? Prolonged compared to what?	We apologize for our confusing expression. We meant that some stations recorded the tsunami durations for more than 6 hours during the 2006 earthquake tsunami. We have removed the word 'prolonged', and rephrased the sentence to improve the lack clarity.	**Line 72 to line 73:** Second, tsunami durations for more than 6 h were recorded at some stations following the earthquakes.
Lines 80-81: Something is missing in these statements, please rephrase so the meaning is more apparent.	We thank the reviewer for pointing this out. We rephrase the sentences and the meaning.	**Please see line 77-88** The other issue was that which source models could better explain the successive tsunamis to the recorded observations in southern Taiwan. Wu et al., 2008 simulated the tsunami from this event using single fault models. They numerically computed the tsunami propagation on a nested grid system with finest grids of 0.125 min resolution bathymetry data and compared their results with observation data from tide gauge stations. Although the source models to this tsunami event have been specified and modeled in previous study, the uncertainty and variability aspects of the source models and bathymetry have not been investigated thoroughly. Such uncertainties in earthquake fault parameters and significant

		difference among the open-source bathymetries can exaggerate the modeled results rather than the predictions from previous study to the 2006 tsunami. Therefore, it is critical to discuss such model's performances from viewpoint of sensibility perspective because it is desirable to obtain a tsunami source model and to understand the reliability of bathymetry data utilized for numerical simulation for reasonably estimating the tsunami wave activities during the 2006 tsunami.
Line 91: 'justify' à 'hindcast'	We thank the reviewer for pointing this out. We rephased the sentence.	**Line 98 to line 101:** The December 2006 earthquake tsunami represents a unique and recent incident in Taiwan; therefore, these findings could not only help further clarify tsunami generation and the important behaviors responsible for tsunami hazards facing the island of Taiwan but also have implications for tsunami warning and disaster risk management.
Line 99: Please delete 'In general', and replace the statement 'possible method to study' with 'one source of information we can use to study'. The point is that it can only be supplementary to other methods,	We thank and agreed with the point of view of the reviewer. We corrected it by rephrasing the sentence.	**Line 105 to line 106:** Time history data of sea levels recorded at coastal sites provide one source of information that we can use to study tsunami patterns.

it is usually not enough by itself.		
Line 112: 'represent the duration' à 'represent the observation' (duration written twice in sentence)	We thank the reviewer for pointing this out. We corrected it.	**Line 118:** The tsunami durations represent the observation time of high-energy tsunami waves persisting in a coastal site of observation.
Line 113: Remove 'of observation'. 'duration' à 'durations', and 'was' à 'were'	We thank the reviewer for pointing this out. We corrected it.	**Line 118 to line 121:** The tsunami durations represent the observation time of high-energy tsunami waves persisting at a coastal site. The tsunami durations at all the stations were identified based on a calculation of root mean square (RMS) sea levels, indicating the elapsed time of the wave amplitude above the normal oscillation level before the tsunami wave arrived (Heidarzadeh, 2021).
Line 127: 'The' Fourier analysis …	We thank the reviewer for pointing this out. We corrected it.	**Line 132-136:** The Fourier analysis and the wavelet (time-frequency) analysis. The Fourier analysis is based on the fast Fourier transform (FFT) algorithm, applied based on the updated open-source library Numpy in the Python package (Harris et al., 2020). The Fourier analysis was performed to estimate the spectral components of the time history data of the tsunami waveform.
Line 137: 'the' wavelet analysis …	We thank the reviewer for pointing this out. We corrected it.	**Line 133:** The Fourier analysis and the wavelet (time-frequency)

		analysis.
Line 144: The first sentence in the paragraph is somewhat misleading. I would rather say it is a computer-based method describing the equations of motion for the tsunami wave propagation. You could also add that there are various methods, but that the shallow water model is most used, although dispersive models are more and more used as well.	Thank you very much for the valuable comments. We rephrased it to improve the clarity of the numerical methods.	Please see **section 2.3 (from line 149-177)**
Line 149: I would say that TUNAMI also cover far-field tsunamis, with limitations of course.	Thank you very much for the valuable comments. We add additional information to this part.	Please see **section 2.3 (from line 149 to 177)**
Line 155: You do not describe mesh refinement anywhere. How do you ensure convergence? What is your grid resolution, and what exactly is the CFL number? It should be a minimum to test convergence at least with two different (optimally three) mesh sizes.	We simulated the tsunami propagation using a 450 m bathymetric grid. The mesh size in x and y directions are 538 and 631. The CFL condition is presented as: $\Delta t \leq \frac{\Delta x}{\sqrt{2gh_{max}}}$ Where the Δt is the time interval, Δx is the grid spacings, and h_{max} is the maximum water depth in the model domain.	Please see **section 2.3 (from line 149 to 177)**
Line 160: You have stated this before. I suggest to delete this sentence that only repeats what is already written in the intro.	We thank and agreed with the reviewer. We deleted the sentence.	
Line 168: Are you simulating with uniform slip? Could you gain anything with adding non-	Thank you very much for the valuable suggestions. The tsunami sensitivity to non-	For the approach, please see section 2.4.2 (**from line 220 to 248**) and for the results of

uniform slide and simulate different realisations of the slip distribution? This deserves to be discussed more.	uniform fault slip distribution is evaluated.	sensitivity analysis, please see section 5.2 (**from line 464 to 478**)
Line 186: 'horizontal effect' à 'horizontal deformation contribution to tsunami generation'	We appreciated the reviewer for the correction. The sentence was revised.	**Please see line 175-176:** The horizontal deformation contribution to tsunami generation on the steep bathymetric slopes (Tanioka and Satake, 1996) was included.
Line 191: Why could this not have been caused by landslides? Please elaborate / substantiate, or otherwise skip this statement if you cannot back it up more explicitly.	The statement was skipped.	
Line 193: Add 'simulated' before 'initial'.	The vocabulary was revised.	**Please see line 173-174:** As the simulated initial condition inputted for numerical tsunami simulation, the initial water level distribution is calculated from the earthquake fault parameters using the theory of Okada, 1985.
Line 203: You may need to elaborate what you mean by 'two bathymetric scenarios'. You probably mean tsunami simulations applying two different bathymetries. You may motivate your work by mentioning how wrong the open source bathy was for 2018 Palu. Similar for 2018 Anak Krakatoa (e.g. Zengaffinen et al., 2021).	For the bathymetric scenarios stated here, we meant the actual and manipulated bathymetries used in numerical simulations to examine the how bathymetry can influence the tsunami wave directivity and wave trapping. In addition, the variability aspects of open source bathymetry to model results was examined.	For the clarity of bathymetric scenarios, please see **section 2.6 (from line 276 to 291).** The details of actual and manipulated bathymetries used in numerical simulations were summarized in **Table 5**. For the examination of tsunami sensitivity to open source bathymetry, the 2018 Palu and the 2018 Anak Krakatoa tsunami were referred as backgrounds

		and the approach and results could be found in **section 2.5 (from line 250 to 274)** and **section 5.3 (from 480 to 502)**, respectively.
Line 207: Both are scenarios in a way. I would rephrase, and rather say 'manipulated bathymetry' rather than 'hypothetical scenario'.	We appreciated the reviewer for the comments. The sentences were rephrased.	Please see **section 2.6 (from line 276-291)**.
Line 211: You only investigate two different bathymetries, and this might be a bit thin to conclude in general. I suggest that the uncertainty related to the bathymetry is discussed more.	Thank you very much for the valuable suggestions. We agreed with the reviewer. In addition to the two different bathymetries (i.e., actual and manipulated bathymetry by replacing sea depths larger than 500 m to 500 m), a rather hypothetical situation was examined using the manipulated bathymetry of flatted sea bottom of 500 m depth.	Please see **section 2.6 (from line 276-291)** and **section 6.1 (from line 505-535).**
Line 231: Please rephrase 'different mechanism of tsunami waves was' à 'different propagation effects were'	We appreciated the reviewer for pointing this out. The sentence was revised.	**Please see line 307 top line 308:** These results suggest that the different propagation effects were active at these coastal sites during the passage of the 2006 tsunami.
Line 237: The aspects of the wave recordings should be move more up front, at least within this subsection, it is important background.	We appreciated the reviewer for the valuable comments. The aspects of the wave recordings were moved and considered as important background for simulating scenarios with non-uniform fault slip distributions.	**Please see line 455-462.** While the single fault models can produce the simulated tsunami waveforms well consistent to the observations, the badly sampled (i.e., 6 min interval) signals recorded in coastal stations also raise some

		questions, as one would expect some potential high tsunami waves behind the observed signals. To that sense, overestimation of modeled results was expected, but the simulated tsunami waveforms using single fault models present the opposite. This indicates that the single fault models (i.e., with uniform fault slip) may not be sufficient and the asperity area (i.e., with large fault slip) on the fault should be evaluated. The tsunami sensitivity to asperity locations of multiple fault models will be discussed in next section.
Line 254: You say 'abnormally long', but compared to what?	We apologize for our confusing expression. We meant that Kaohsiung and Houbihu station recorded the tsunami durations for more than 6 hours during the 2006 tsunami. We have removed the word 'prolonged', and rephrased the sentence to improve the lack clarity.	**Please see line 326-328** The calculated tsunami duration at Dongkung was as much as 3.9 h, while the tsunami continued for more than 6 h in Kaohsiung and Houbihu.
Line 271: What does the background spectra contain? Are they de-tided? Please clarify.	We apologize for our lack expression. The background spectra are the spectral components calculated from de-tided observed data of 5 h before the tsunami arrival.	**Please see line 346 to line 350** The background spectra are the spectral components calculated from de-tided observed data of 5 h before the tsunami arrival, and the spectral components of the observed tsunami waveform were computed using 5 h data recorded at tide gauge after

		tsunami wave arrived.
Line 293: I think this is stating the obvious, and it could perhaps be skipped?	Thank you very much for pointing this out. We skipped this statement.	
Line 329: 'determined' à 'estimated'	Thank you very much for pointing this out. The vocabulary was revised.	**Please see line 388** Assuming the mean sea depths around tsunami source region is 300 m, the fault rupture dimensions for the two earthquakes could be estimated to 20- 40 km.
Line 372: I would say it is the opposite: The data can be used to validate the numerical simulations.	Thank you very much for the valuable comments. The sentence was rephrased.	**Please see line 181-184** Multiple forward tsunami simulations were conducted using single fault models with different fault depths and fault orientations. The main goal of the multiple forward tsunami simulations was to find a single fault model that could produce tsunami waveforms that were highly consistent with the tide gauge station observations in southern Taiwan.
Line 377: If there is undersampling, you would normally expect the numerical simulations to overestimate the wave measurements, because the measurements would miss out on larger amplitude waves. Here it seems to be the other way around, implying that the simulations are lower than you would expect from the	We appreciate the reviewer for the valuable suggestions on this issue. We established and simulated the non-uniform slip scenarios to examine whether the measurements have missed out on larger amplitude waves.	**Please see section 2.4.2 (from line 220 to 248) for the approach and section 5.2 (from line 464 to 478) for the results.**

measurements. The authors need to elaborate on this. For instance, why was not alternative scenarios or random / heterogeneous slip investigated with several scenarios?		
Line 388: Replace 'It is commonly understood that' with 'The longest wave component'. Then add an 'a' ahead of 'velocity'.	Thank you very much for the valuable comments. The vocabulary was revised, and sentence was rephrased.	**Please see line 499** The longest wave component of tsunami travel with a velocity that is mainly governed by seafloor depths.
Line 390: Add 'through diffraction' after 'wave direction'.	We appreciate the reviewer for the correction. The vocabulary was added.	**Please see line 507 to 508** The significant change in propagation speed allows the tsunami to change its wave direction through diffraction.
Line 391: 'of the' à 'using'	Thank you very much for the suggestion. The vocabulary was revised.	**Please see line 511 to line 512** Simulated snapshots of tsunami wave propagation using actual (MS) bathymetry are shown in Figure 21.
Line 395: I found it difficult to follow the authors in this paragraph. I suggest that the authors review the text and try to rephrase it, at least the first 6-7 lines.	We apologize for the confusing expression in this paragraph. The paragraph was re-written.	Please see **section 6.1 (from line 505 to 535).**
Line 422: I suggest to comment on previous studies investigating fits and misfits using open source bathymetry and topography data, e.g. Griffin et al., (2015).	Thank you very much for this valuable suggestion. We examined the misfits of modeled results using open-accessible bathymetry and topography.	Please see **section 5.3 (from line 480 to 502)**
Line 426: The sentence starting with 'These results further confirmed …' I found was	We appreciate the reviewer for the valuable comments. To strength the conclusion related to	Please see **section 6.2** and **6.3 (from line 537 to 573)**

formulated too conclusive. The number of investigations are rather limited, and there should be room for additional investigations to strengthen the conclusion related to wave trapping.	wave trapping, we applied additional analysis including energy trapping ratio, and the comparison of calculated waveforms.	
Line 439-441: What the authors write here is not clear from the figures. If there is additional not shown that back this up please state this explicitly.	We apologize for the unclarity of the figure. We replotted the figure and rephased the statement in this paragraph.	Pease see **section 6.4 (from line 575 to 608)** and **Figure 27.**
Line 482: 'characterized' à 'analyzed'	Thank you very much for the suggestion. The vocabulary was revised.	Please see line 617 The physical characteristics of tsunami waveforms in all three tide gauge stations in southern Taiwan during the December 2006 tsunami were analyzed.

Reply to reviewer no. 2

We highly appreciate your time spent in reviewing the manuscript as well as your valuable comments and suggestions. We are glad that you are interested in our work and your positive feedback. Please find our line-by-line responses and corrections to your comments and suggestions. All responses, corrections and improvements are shown in red in the revised manuscript.

Reply to general comments
We apologize for the English issues and spelling errors on the manuscript. In order to this, the manuscript was carefully re-written, and the English spellings were to our best to be improved (i.e., by hiring the service of professional editing companies). Please see more detail below on our answers and responses. The revised English in the article will be shown in the revised manuscript.

Reviewer comments	Our answers	Corrected manuscript
Title: As the two earthquakes have different magnitudes (M6.9 and M7.0), I think they cannot be called doublet. Usually doublet us used for two earthquakes with the same size that occur with short interval. You can simply say "…by two Mw6.9 and Mw7.0 consecutive earthquakes".	We apologize for our confusing expression. We added some more information in seismological perspective of view to improve the clarity. The two successive earthquakes are suggested to be M_L = 7.0 (M_w = 7.0 in the Global CMT catalog) for the former, and M_L = 7.0 (M_w = 6.9 in the Global CMT catalog) for the latter. From seismological perspective of view, pairs of large earthquakes with equivalent rupture size and occurred in a similar spatial and temporal proximity were specified as doublet (Lay and Kanamori, 1980; Kagan and Jackson, 1999). Sharing comparable earthquake magnitudes, and very close epicenters and occurrence times, the successive earthquakes are referred as an event of doublet (Ma and Liang, 2008; Wu et al., 2009).	**From line 50 to line 56:** The respective magnitudes of these two earthquakes were suggested to be M_L = 7.0 (M_w = 7.0 in the Global CMT catalog) for the former, and M_L = 7.0 (M_w = 6.9 in the Global CMT catalog) for the latter. From seismological perspective of view, pairs of large earthquakes with equivalent rupture size and occurred in a similar spatial and temporal proximity were specified as doublet (Lay and Kanamori, 1980; Kagan and Jackson, 1999). Sharing comparable earthquake magnitudes, and very close epicenters and occurrence times, the successive earthquakes are referred as an event of doublet (Ma and Liang, 2008; Wu et al., 2009).
L16: waveforms and conducted numerical simulations…	We apologized for the English errors made in the manuscript. We corrected it.	Please see **Line 16 to 17.** This study analyzed tide gauge tsunami waveforms and conducted numerical simulations to understand the source characteristics and resulting tsunami behaviors.
L39: and to cause severe ….	We apologized for the English	The Manila Trench and Ryukyu

	errors made in the manuscript. We corrected it.	Trench are located offshore Taiwan, and have been identified as hazardous tsunamigenic regions, as both have the potential to generate megathrust earthquakes and to cause severe tsunami impacts on coast plains (Liu et al., 2009; Megawati et al., 2009; Wu and Huang, 2009; Li et al., 2016; Sun et al., 2018; Qiu et al., 2019).