Dear Editor,

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

Reply to reviewer no. 1

We highly appreciate the time spent for the review comments from the reviewer especially those minor corrections (our type errors) and pointed out many points that clarifications are needed. We are happy that the reviewer is happy and highly evaluated our manuscript. Please find our responses and corrections as shown below.

Reviewer comments	Our answers	Corrected manuscript
-Title: The title needs to be changed.It does not corresponding to the work and is confusing.	Changed	Investigating beach erosion related with tsunami sediment transport at Phra Thong Island, Thailand caused by the 2004 Indian Ocean tsunami
- All the manuscript: occasional sentences that need to be rewritten(e.g. - Page 16 Line380 and following) and some spelling mistakes as well (e.g. palaotsunami instead of palaeotsunami)	Corrected	Please see the manuscript
- Page 3 Line 94: change "conditions" to "setting"	Corrected	Setting and methods
- Page 10 Line 254 - 256: Move to Methods	Moved(Page Line 254-256, Line 258-259, Line 265-266) to Methods	Please see the Methods(Page 7 Line 194– Page 8 Line 203)
- Page 11 Line 282: delet extra "."	Corrected	
- Page 12 Figure 6: Add scale and North arrow	Added scale. Instead of Fig.6, we added it in Fig.1 and Fig.3.	Please see Page 13 Figure 6, Page 4 Figure 1, Page 6 Figure 3
- I suggest the authors make this clearer to the reader by adding a couple of sentences on this - clear definition of what offshore area is and clear definition of source.	We defined offshore (water depth > 15 m) and nearshore (water depth < 15 m)	Please see Page 10 Line 303
- You explain on the discussion the limitations of this approach but I strongly recommend that you make an attempt with varying grain-sizes according with the sedimentary environment – deep offshore; shallow offshore; beach (emerged and submerged); dune and depositional basin. What will be the changes if the grain-size varies in a way closer to reality – dune sediments are slightly finer	We conducted the sensitive analysis of grain size.	Please see Page 10 Line 297-Line 308, Page 13 Line 372-379, Figs 8, 9,10 and Table 3.

than beach for example. What is the model response.		
- I strongly recommend that you add a couple of sentences and present control tests on varying roughness coefficient. How does it affect the end?	In general, when simulating tsunami sediment transport, it is necessary to determine the roughness coefficient according to land use. However, since there is no land use map before the tsunami on Phra Thong Island, a fixed value was used, similar to previous studies (Yamashita et al., 2017; Yamashita et al., 2018). Sugawara et al. (2014b) showed that the variation in Manning's roughness coefficient for the sand beds may affect the general distribution pattern of sediment deposits and erosions across the artificial topographic features. Therefore, we do not analyze the sensitivity of Manning's roughness because Phra Thong Island has little artificial features.	Please see Page 10 Line277-285
there are ocasional repetitions (e.g. "but that...but that...") that make the text less fluent. All these are minor aspects that should be corrected after detailed proof reading.	Corrected	Please see the manuscript

Dear Editor,

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Reply to reviewer no. 2

We highly appreciate the time spent for the review comments from the reviewer especially those minor corrections (our type errors) and pointed out many points that clarifications are needed. We are happy that the reviewer is happy and highly evaluated our manuscript. Please find our responses and corrections as shown below.

Reviewer comments	Our answers	Corrected manuscript
- Page 2 Line 60-74: in terms of the sediment transport models induced by tsunami waves, the author should give certain credit to previous work (e.g. (Apotsos et al., 2011a; Apotsos et al., 2011b; Li et al., 2014) which use different sediment models while addressing similar problem.	Gave certain credit to previous work	Please see Page 3 Line 83-88 …(Takahashi et al., 1999; Gelfenbaun et al., 2007; Takahashi et al., 2008; Apotsos et al., 2011a; Apotsos et al., 2011b; Apotsos et al., 2011c; Takahashi et al., 2011; Gusman et al., 2012; Li et al., 2012; Takahashi et al., 2012; Li et al., 2014; Morishita & Takahashi, 2014; Yamashita et al., 2015; Yamashita et al., 2016; Arimitsu et al., 2017; Yamashita et al., 2017; Yamashita et al., 2018)…
- Page 2 Line 70: I'm not sure what "the movable bed model" refers to? Does it refer to a specific model or it represents all the sediment models assuming the bed is movable? If it refers to the former, then a definition is required to prepare the readers for the following context.	I made a mistake in the English translation. "Numerical modeling of tsunami sediment transport" is correct.	Please see Page 3 Line 82-83 …In recent years, the numerical modeling of tsunami sediment transport has been developed, …
- Page 3 Line 106-109: the presentation is confusing. Why using "Although…"? The second sentence seems contradictory with the first one.	Corrected.	Please see Page 3 Line 110-112 Due to the largely natural environment, Phra Thong Island is a rare case that is useful for verifying tsunami sediment transport models where few artificial features can generate model uncertainties.
Page 5-6, Section 2.3: about the tsunami source model, many source models have been proposed for the 2004 earthquake (e.g. (Banerjee et al., 2007; Chlieh et al., 2007; Grilli et al., 2007; Ioualalen et al., 2007; Rhie et al., 2007)). Different models could produce quite different tsunami wave heights in the same coastal area. Since the source model is	I wrote explaining why the current model is chosen.	Please see Page 5 Line 154-155 Suppasri et al.'s (2011) source model was focused on the coast of Thailand and accurately reproduced the inundation area and surveyed trace height of the 2004 IOT.

one of the key factors which decide the reliability or accuracy of the simulation results, I feel the author should write a few sentences explaining why the current model is chosen. Does it produce better match with the measured data in this specific coast?		
- Page 7-9 Section 2.4.2: about the "Tsunami movable bed model", two coefficients α and β in formula (7) and (8) play significant role in the simulations, how these coefficients are specified? are the results sensitive to the choice of these coefficient?	Wrote the explaining detail.	Please see Page 9 Line 252 - 261 The grain-size dependent parameter for bed load (α) and exchange rate (β) in Equation (9) and (10) are derived from Equations (12) and (13) based on the hydraulic experiments by Takahashi et al. (2011): $\alpha = 9.8044e^{-3.366d}$ (12) $\beta = 0.0002e^{-6.5362d}$ (13) However, the functions should not be applied when d is outside the 0.166 mm to 0.394 mm range as he validity of extrapolated d values may produce erroneous results.
- Page 10 Section 3.1.1: How to define tsunami trace height?	"Tsunami height" is correct. Unified some expressions.	Please see Page 11 Section 3.1.1
- Page Section 3, I feel the author tend to describe the result qualitatively instead of quantitatively, especially when mentioning the erosion and deposition results. Although the simulation results suffer from many uncertainties, I believe some quantitative explanation is necessary, e.g. the thickness of erosion or deposition Thickness	Added	Please see Page 14 Table 3 and Page 13 Line 354-356. …Although the modelled layer thickness typically overestimates the observed layer thickness by +7%, such low variation suggests a relatively successful reproduction of the observed dataset (Figure 7)…
The figure quality needs to be improved, at least make sure the fontsize is consistent in all figures, not extra large (Figure 7-9) or extra small (Figure 10). Pay attention to the captain of each figure, make sure they are consistent with the legends inside the figure (see Figure 7 and Figure 8).	Revised	Please see all figures

Dear Editor,

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

Reply to reviewer no. 3

We highly appreciate the time spent for the review comments from the reviewer especially those minor corrections (our type errors) and pointed out many points that clarifications are needed. We are happy that the reviewer is happy and highly evaluated our manuscript. Please find our responses and corrections as shown below.

Reviewer comments	Our answers	Corrected manuscript
- All the manuscript: In fact, in the abstract the authors conclude that "Our modelling approach confirms that beaches on Phra Thong Island were significantly eroded by the 2004 tsunami" but the analysis of the results, as displayed in figure 5, also show a lot of shoreline accretion. In fact, in most locations' shoreline seems to have experienced a minor accretion (this is especially clear in figure 5a) while significant erosion is only observed at localized sections of the coast. In fact, the large longshore variability remains mostly unresolved, an should be further discussed in the manuscript.	Our expression was bad. We focused on beach erosion in two areas(region (a) and (b)) that have been locally eroded, but not all beaches in Phra Thong Island.	Please see Page 1 Line33-34 …Our modelling approach suggests that beaches located in two regions on Phra Thong Island were significantly eroded by the 2004 tsunami… Please Page 5 Figure 2 Caption: Figure 2 Terrain data (The black frame shows Region 1 to Region 6, and the black line in Region 6 shows the cross-section where calculation was performed. Dashed squares are the beach where erosion was confirmed from satellite image.)
The first statement of the conclusions "First, it was confirmed by comparing the measured and calculated values of the sediment layer thickness that the location of beach run off identified on Phra Thong Island was reproducible and consistent with sediment transport results", do not seem to have correspondence with the data presented in the paper.	Corrected	Please see Page 21 Line 507-509 First, it was confirmed by comparing simulated results of the shoreline and sediment layer thickness that the location of beach runoff identified on Phra Thong Island was reproducible and consistent with sediment transport results.
In section 3.1.2 "change of shoreline" authors refer that sediment transport models confirm the erosion as portrayed by satellite images, but do not present satellite images before and after the tsunami occurrence. An objective comparison of model performance with satellite date with quantitative error	Thank you for the suggestion. We tried to use images prior the tsunami, but limited resolution of our images caused the difficulty for determing the shoreline. Therefore, shoreline from bathymetry data was added to provide lack information of images.	Please see Page 13 Figure 6 Caption: …satellite image (30 Jan, 2005), which is overlain by the modelled extent of erosion showing that the modelled results closely match the observed changes. The red line is the calculated shoreline after the tsunami, and the blue line is the shoreline before the tsunami…

statistics should also be present (e.g. brier skill score). The display of satellite images just before the tsunamic also would help the reader to have perception if the coastal embayments portrayed in image 6 existed before the tsunami.		
The comparison of tsunami deposit thickness (figures 7 and 8) with the observed sediment layer also casts serious doubts on the model performance. In fact, the locations where the larger deposition were found (> 2000 inland) are the locations where the model predicted no accumulation. Moreover, a scatter plot with estimated layer thickness against observed thickness should be presented, supplemented with objective error statistics. Although authors discuss some discrepancies, this section should be expanded.	We introduced the concept of cumulative sedimentation, and evaluated the scale of the amount of sediment movement generated.	Please see Page 13 Line 350-371 and Figure 7 The line of "volume" show the cumulative deposition expressed at each point by the sediment thickness multiplied by the area of the computational grid. In general, the tsunami deposits are greatly affected by local micro-topography(Sugawara et al., 2014; Jaffe et al., 2016), and it is difficult to fit the modelled layer thickness with the observed layer thickness using DEM averaged in a computational grid. Therefore, we introduced the concept of cumulative sedimentation, and evaluated the scale of the amount of sediment movement generated. Although the modelled layer thickness typically overestimates the observed layer thickness by +7%, such low variation suggests a relatively successful reproduction of the observed dataset (Figure 7).
When comparing the model results with validation data, it seems that it would be more useful to present more detailed data, even though at a single site.	Thank you for your comment.	
Concerning model application, there are lot simplifications that can affect model results that are not properly justified or validated. Sediment transport magnitude and consequent morphological changes are largely dependent on the chosen values for the parameters displayed in table 4 . The assumption that some parameters	In tsunami sediment transport model, uncertainty of those parameters were often simplified for simulation. Based on previous studies, those parameters were generally given by fixed value which were also used in this study. Parameters were justified namely critical friction.	Please see Page 10 Section 2.5. and Table 2.

assume a constant should also be justified namely the friction speed (or is this critical friction?) and bottom slope correction factor.		
- Page1 Line 33: how can authors "confirm" if there is no observational data?	Changed "suggests"	Our modelling approach ~~confirms~~ suggests that beaches …
- Page 1 Line 73: to support the statement "reproducibility has been confirmed by comparison between the calculated and measured values" a reference is needed.	Corrected	Please Page 3 Line 88-89 Yamashita et al., 2015; Yamashita et al., 2016; Arimitsu et al., 2017; Yamashita et al., 2017; Yamashita et al., 2018
- Page 5 Figure 2: a graphical scale or different gridline numbering should ease a better perception of the scale of the figure.	Added	Please Page 5 Figure 2
- Page 9 Line 234: the use of " Manning's roughness coefficient was fixed at n = 0.025" contradicts the recognition (l438) that "bottom surface roughness greatly affects sediment transport"	Thank you for your comment on related issue. Fixed value of coefficient were used in this study because of no land use map were available in this area.	Please see Page 10 Line 277-285
- Page 9 Line 228-239: presents some formatting problems	Corrected	Please see Page 10 Line 270-289
- Page 9 Lines 238: is the "limit Shields" is the critical Shields parameter? The authors should differentiate the Shields parameter from bottom shear stress (eq. 10)	Corrected	The ~~limit~~ Critical Shields number …
- Page 10 Table 2 - The use of significant figures should be improved	Corrected	See Page 11 Table 2

Dear Editor,

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

Reply to reviewer no.4

We highly appreciate the time spent for the review comments from the reviewer especially those minor corrections (our type errors) and pointed out many points that clarifications are needed. We are happy that the reviewer is happy and highly evaluated our manuscript. Please find our responses and corrections as shown below.

Reviewer comments	Our answers	Corrected manuscript
- It is not clear how the TUNAMI N2 and STM were coupled. The authors need to provide more detailed information such as conformity of grid size, time step, and bathymetric-topography data. Furthermore, it is not clear whether the bed level in the TUNAMI N2 were also updated after sediment transport or not.	I wrote the explaining.	Please Page 8 Line 209-211 For each time step, the STM receives the total flow fluxes from TUNAMI-N2 and calculates the change of seafloor and land surface and feeds this to the next time step of the TUNAMI-N2 model.
- The reasons to run the simulation for 6 hours is not clear. Any data show the tsunami propagation at this area lasted in 6 hours? なぜ再現時間 6 時間で計算したのか？	Added the explaining.	Please see Page 10 Line274-276 The simulations were calculated over a 0.05 second increment with a 6 hour period in which the test case with a 12 hour period showed the suspended sediment concentration in the vicinity of the shoreline decreased and stabilized.
- The manning coefficient was treated uniform. Is the coefficient sensitive to the results? No specific sensitivity analysis was done in this research.	Fixed value of coefficient were used in this study sue to land use map are not available in this area. The lack understanding of manning roughness coefficient will be mainly discussed as issue by creating city use maps through field surveys in the future.	Please see Page 10 277-285
This paper also attempts to bring recovery process of the beach, which I do not see where the recovery has taken place. Usually, beach recovery process takes years after a tsunami or storm surges. The impacts of the tsunami was performed by the models, but recovery process of the beach is not..	The terrain recovery after tsunami is determined by the factors of coastal conditions which used as initial conditions for tsunami movement simulation. In this study, we aimed to clarify the types of sediment movement which was caused by tsunami and the correlated initial condition. This study highlighted that out flowing sand was relatively easy to return to shoreline. Whether it has actually returned	

	will be examined in the future using wave / wind data / wave models. And recovery process of the beach will be mainly discussed as an issue in future study.	
- Backwash created deposition at the offshore area instead of erosion in other study area. But, this study revealed the opposite. Author needs to review some more cases that could give different result.	Thank you for your advice. In the future, we plan to study other areas.	
- Diffusion coefficient in Equation 6 has different symbol in the paragraph explaining the equation	Corrected	Tsunami ~~trace~~ height ~~Inundation depth~~ Tsunami height
- Figure 10, three figures in the last row have no clear explanation: to what time these figures were meant to? Please provide sufficient information and discuss this properly.	Added	Please Page 18 Figure 12