Dear Dr. Casalbore,

Thank you for giving us the opportunity to submit a revised version of our work, together with the improved figures. We appreciate the time and effort that you have dedicated to providing your valuable feedback on our manuscript. We have been able to incorporate the changes suggested, and we are writing you to explain all these changes in detail. We have also taken into account the additional comments from the PDF file. You will find your comments reported here, for your convenience, followed by our replies detailing how we addressed the issues.

We hope that you will find the improved interpretation of our data to be suitable for publication through our revised work, and we trust that you will find this contribution to be of interest to the readers of this journal.

The original comments are reported in italic and blue.

***RC-1 (Dr. Casalbore)**:*

The paper "Simulation of tsunami induced by a submarine landslide in a glaciomarine margin: the case of Storfjorden SL1 landslide (Southwestern of the Svalbard Islands)" of María Teresa Pedrosa-González et al. Is an interesting study showing the tsunami features generated by a relatively large submarine landslide (40 km^3) occurring in the northern high-latitude margin. I'm a marine geologist so I cannot fully assess the reliability of the presented Landslide L-ML-HySEA numerical model, even if it seems accurate and reliable based on my previous experience with other tsunami models. However, each model should rely on the landslide's morphological, stratigraphic, and geotechnical features. In this sense, I found different inconsistencies throughout the manuscript, which should be explained by the authors:

Issues:

"RC-1 (Dr. Casalbore), comment 1: The presented thickness of the landslide obtained as the difference between pre-(reconstructed) and post slide bathymetries are expressed as displaced sediment volume (m^3) in Fig. 4b, but it is not clear the meaning of this value. Moreover, these values are very different from the maximum thickness (T) of 0,375 km reported in table 1. In addition, such value is not comparable with the value reported in literature (35 m) according to seismic profiles by Llopart et al. (2015). In the table1, it is also unclear the T (km) base R1 to the top, which should be better explained by the authors."

Response: we would like to thank the reviewer for their thoughtful comments. The following is an explanation of the errors that were identified and how we have corrected them.

The sediment thicknesses parameter in Fig. 4b was wrong. It was a mistake. The same parameter is now expressed in metres (m).

In response to the second question, the value of 0,375 km previously reported in table 1 has also been corrected. The average thickness of the landslide deposits obtained from the model (Fig. 4b) in proximal area (T_p) is 35 m, consistent with the value of sediment thickness calculated by Llopart et al. (2015).

We have deleted the depth T (km) base R1 to the top, that is not necessary to constraint the modelling. Anyway, as it was also suggested by RC2 and to clarify this matter, we added a seismic profile and its trace in Fig. 3c. The seismic profile was modified from Fig. 7, Rebesco et al. (2014). The interpretation of seismic units has been modified from Fig. 4, Llopart et al. (2015). In Fig. 3d we have added a table to detail seismic units, ages and their lithologies; this information comes from Rebesco et al. (2014), Pedrosa et al. (2011) and Llopart et al. (2015).

"RC-1 (Dr. Casalbore), comment 2: The authors say that the landslide occurs as a single failure. However, in my opinion it is quite clear from the map in Fig. 4a and by landslide morphology that a secondary landslide scar occurred in the mid-distal part of the main landslide. At least the authors should consider this possibility."

Response: the scarcity of seismic profiles crossing the location of the landslide makes it difficult to find clear evidence that slope failure might have occurred in multiple phases. In fact, previous literature (e.g. Pedrosa et al., 2011; Rebesco et al., 2012; Lucchi et al., 2012; Rebesco et al., 2014; Llopart et al., 2015) considers the Storfjorden LS-1 to be a single event. However, looking at the multibeam bathymetry in detail, we observe that the southeastern flank shows seafloor downslope irregularities at mid-slope (~1600 m deep) that, tentatively, could point at the occurrence of local and small-scale slope failures. These irregularities could suggest secondary slope failures after the main landslide event. In any case, since they are local and small in scale, we did not consider them to be significant for the modelling of the main landslide event, given their low potential to transfer deformation to the water column. Nevertheless, their occurrence is mentioned in the text, in the line 343: "A few local and small scale slope failures seem to occur on the southeastern flank in the mid slope (~1600 m deep), but they wouldn't be significant in the modelling of the main landslide event, whereby its low potential to transfer deformation to the water column"

"RC-1 (Dr. Casalbore), comment 3: the authors state that the numerical landslide rupture simulation shows that the moving mass was comprised of two domains with different behavior, based on the velocity pattern. However, the velocity pattern has never been shown in the presented figures (only in the video is perceivable), and no morphological or seismic evidence supports this inference. This point should be better clarified in the text."

Response: we have provided a new figure (Fig. 6) showing the evolution of the velocity vectors of Storfjorden LS-1 at different frames (1, 4, 20 and 25 minutes).

"RC-1 (Dr. Casalbore), comment 4: According to the previous comments, I don't understand the images (a) in Fig. 6, which should show the progressive evolution of the landslide through time slices. However, the final sediment thickness displaced in the last step (12) of Fig. 6 is different from what was reconstructed in Fig. 4b through the difference of pre- and post-slide bathymetries, how is this possible?. Differently, this thickness map seems very similar to those present in the first steps. Perhaps, I haven't understood some of these images and/or the text, but also in this case the authors should be more clear."

Response: what was figure 6 is now figure 7, due to the revision changes. Figure 7a represents the thickness of the sediments that are available to be displaced in each stage. In general, all models are a simplification of real processes, and the same applies to the case of tsunamigenic landslide modelling. Considering all the sediments available to be displaced (Fig 4b and 7 step 1), the main landslide event mostly affects the upper and middle sectors, and in those regions the final bathymetry is very close to the real bathymetry.

"RC-1 (Dr. Casalbore), comment 5: Another main problem of the paper is the discussion, which is mainly formed by general sentences or repetitions from the previous parts. The discussions need a strong reorganization; focusing on topics useful for a broader audience otherwise it seems like a local study. For instance, the comparison with other landslide-related tsunamis in the northern margins is just mentioned in a section, then slightly discussed in another one, while it deserves to be discussed in a specific section, mainly in consideration of the aim of the paper, i.e. tsunami hazard assessment in consideration of the possibility of future landslides occurring in this area, favoured by climatic changes and associated consequences (earthquakes, dissociation of gas hydrates and so on)."

Response: the discussion was edited according to reviewer RC1's suggestions. We have compared the characteristics of the tsunami in our case study with others examples of case studies in the North Atlantic.

In addition, a new section 5.4 "Comparison with other landslide tsunamis: hazard assessment for the northern glaciated margins" was added.

"RC-1 (Dr. Casalbore), comment 6: Besides these main comments, several sentences are unclear or need to be rephrased. Even if I'm not a mother tongue, some sentences are too wordy and convoluted as highlighted in the annotated manuscript."

Response: we appreciate the grammar revisions suggested by RC1. All the changes have been accepted. They can be found listed in the "Minor Issues" section below

"The figures and associated captions should be improved, and better related to the text. For instance, several velocity values are given in the text without a reference figure. Figure 4 is very similar to Fig. 7 of Pedrosa et al. 2011, so I would suggest changing the color scale or clearly referring to this paper in the caption. Some seismic profiles showing the architecture of landslide deposits would be useful."

Response: the figures were improved according to the changes suggested by the reviewer. A new figure (Fig.6) corresponding to the slide velocities value in several frame has been inserted in the text. A new figure 4 has been made so that it is no longer the same as figure 7 of Pedrosa et al. (2011). A seismic profile and its trace have been added to show the architecture of the landslide deposits (Fig 3c).

"I think that if the authors are able to rearrange the text and figures, clarifying their results and interpretation, this paper can be a significant contribution to a better understanding of tsunami hazard assessment in northern margins, where several offshore and coastal infrastructures are located."

Response: We followed the suggestions and proceeded to make all the changes referred to by the reviewers in order to improve this study.

Minor issues:

“Line 25 RC1: I don't think that it is correct to use negative and positive values for introducing amplification and shoaling effects, because they are referred to the trough and crest of the tsunami waves, respectively.”

We agree with the reviewer and deleted the negative. All amplitude values are now expressed as positive.
The errors in lines 33, 34, 36, 37, 41, 42 and 46 were corrected.

“Line 47: “you could delete this sentence and move this example in the upper part or viceversa move the previous part here to avoid partial repetition”. It has been moved to line 37 as suggested by the first reviewer.
The errors in lines 49, 51, 52, 53, 56, 57, 59, and from 61 to 68 were corrected.

Line 79: the term “figure” was changed to “fig.” in the whole text, for uniformity.
The errors in line 81 and 87 were corrected.
Line 94: “is draped by a regional 100ms…” was corrected to “8m thick, considering 1600 m/s sediment velocity”.
Figure 1 was corrected.
Figure 2 was corrected.
Line 137: a ~1.3° critical slope repose angle is a necessary value for modelling, and it represents the maximum angle at which the slope is stable. Therefore, the real values obtained for the slope (2˚ – 3˚) confirm that it is an unstable area and, therefore, it is suitable to trigger the slide. In order to avoid confusion, the former one is called the ”critical slope repose angle”, and in the results section we describe the measured ”seafloor gradients”.
Figure 3 was changed with respect to Fig.7 in Pedrosa et al., 2011.
The errors in line 184 and 185 were corrected.
Line 186: the references have been introduced.
The errors in line 188, 189, 200 were corrected.
Figure 4: The suggested changes in the figure caption have been accepted and applied.
Figure 5. The meaning of the different parameters have been explained in the caption.
Line 325 has been reviewed and corrected, and the sediment thickness value (35 m) obtained in our model in the first minute (suppl. video 1) is in line with the one obtained from SV-06 seismic profile of 35 m (Llopart et al., 2015).
The error in line 321 was corrected.
Line 334, 335 were better explained.
Line 328. The multichannel seismic line (EG-06) modified from Rebesco et al. (2013) was added as well as its trace line showing the seismic units defined by Llopart et al. (2015). It corresponds to the Fig. 3c.
Line 330: a new figure (Fig. 6) concerning the velocity pattern of the landslide at different frames (1, 4, 20 and 25 minutes) has been incorporated. Therefore, the velocity values have been corrected as well as the thickness of the displaced sediments, which are expressed in meters and not in cubic meters. We’re sorry for this mistake.
Line 365: Fig. 6 becomes Fig. 7 (after revision). Please, note that in Fig. 7 b the amplitude values in meters is from crests and troughs. For this reason, no isobaths values are required.

"Line 393. RC1: explain better how are the features of the refraction in a syntethic marigrams."

Response: "The synthetic marigrams records the refraction clearly due to an irregular variation in the general amplitude pattern (Fig. 9d, station 3)" (in line 442).

"Line 400. RC1: actually, according to your model it seems that two landslides occurred, one in the upper slope and one in the lower slope, merging after a certain time of period, isn't it?"

Response: the explanation for this has been introduced in the figure capture.

"Main frame composition in twelve consecutive frames. (a) Evolution of the landslide, where two sediment sliding masses can be distinguished in the firsts 25 minutes, one in the upper slope (Sl1-U) and the other in the lower slope (SL1-M), which are merged in a single one past 25 min" (in line 452).

Line 402: change accepted.

Line 404. RC1: differences in tsunami arrival times are observed based on the propagation direction toward the coast. The tsunami waves are slower moving toward the north and northeast (vn= 46.6 m/s), than they are moving toward the east (ve= 51.6 m/s).

"(Fig.7) not clear for me, if I see the step 5, data show that the maximum extent of the wave is along the NE direction, isn't it?"

Please note that Fig. 7 now corresponds to Fig. 8. This part has changed and we agree with RC1 that the arrival time of the tsunami waves are 50 min in both Spitsbergen Island and Bear Island. Although, different velocity values were recorded (in line 456).

"Line 407. RC1: not clear from the step 5 it seems occurring simultaneously in both locations. also in the text you write that the waves affect at 50 m both location."

It has been corrected: "The tsunami arrival times are observed based on the propagation direction toward the coast. The impact of tsunami waves affects the Sørkappøya at 50 min (southern Spitsbergen), with a trough amplitude value of 0.3 m, increasing to a crest amplitude value of 0.2 m at 75 min (Figs. 8 step 5 and 9h). At the same time at the 50 min mark, the impact occurs at Kapp Dunnér (northwest Bear Island). This other impact has a crest amplitude value of 0.3 m, at 50 min, which increases to a crest amplitude value of 0.5 m at 53 min (Fig. 8 step 5 and suppl. video 2)" (from 456 to 460 lines)

"Line 413. RC1: why this specification here?"

It has been deleted.

"Fig. 7. RC1: why are the time steps different from the previous figure. I understand that you can add more time steps in a figure rather than in the other ones, but at least most steps should be the same (4, 9, 25)."

Please note that now fig. 7 corresponds to fig. 8.

"We put our focus on highlighting the most relevant stages of the wave propagation and its effects, which do not coincide with those of figure 7, where we wanted to recreate the dynamics of the landslide and the effects that it generated in the water column".

"Line 437. RC1: what do you mean? i see a large variability of wave amplitudes and associated landslide parameters. Therefore I sugget to delete this sentence or better explaining its comparison with other landslide-generated tsunamis."

Following other suggestions as well, we have changed the discussion and deleted most of this section.

Line 425. RC1: The changes were accepted in the figure caption (Fig. 8).

“Line 460. RC1: The L-ML-HySEA model indicates that the 40 km3 of displaced volume of the Storfjorden SL1 landslide is enough to a trigger tsunami. Repetition with a previous pagraph.”

The phrase has been deleted.

“Line 460. RC1: translational is usually associated with the term slide. Also the geometry of your landslide scar suggests a translational slide rather than a slump.”

The change has been accepted.

“Paragraph from line 465 to 470. RC1: single, unique slope failure?, I'm not sure that the occurrence of a single event means that velocity is high. For instance, there are different landslides that move shortly from the source area as single event but with low velocity. Explain better what do you mean?”

The suggestion has been accepted and discussed in one previous comment.

Paragraph from line 470 to 480. RC1:

the discussion has been improved according to the suggestions in the comments.

Line 485. RC1: the caption of fig. 3 has been corrected according to the suggestions.

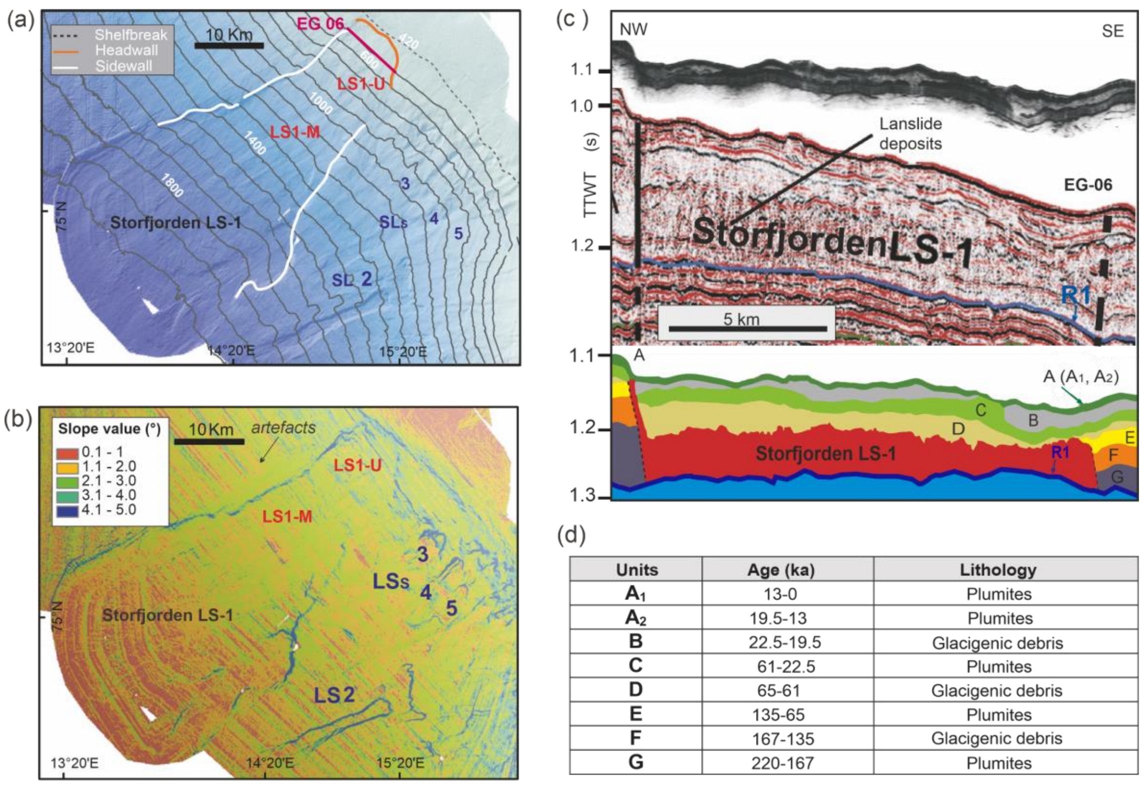
Line 495. RC1: the sediment thickness value has been corrected.

Line 515. RC1: the suggested corrections have been accepted.

Line 525. RC1: the mistake has been corrected. “induce a shoaling effect with wave refraction that produce variations in the amplitude of the tsunami waves”, (line 549).

Line 532. RC1: the suggestion has been accepted (in line 553).

Figures:



Units	Age (ka)	Lithology
A_1	13-0	Plumites
A_2	19.5-13	Plumites
B	22.5-19.5	Glacigenic debris
C	61-22.5	Plumites
D	65-61	Glacigenic debris
E	135-65	Plumites
F	167-135	Glacigenic debris
G	220-167	Plumites

Figure 3. Storfjorden and Kveithola interfan TMFs. (a) The shade relief colour map of the southwestern continental slope of the Storfjorden and Kveithola TMFs and others minor and secondary landslide (Sls 2, 3, 4, 5) (modified from Pedrosa et al., 2011). The orange line marks the headwall and the white lines indicate its sidewalls. The red line corresponds with

multichannel seismic profile (EG-06) acquired during EGLACOM cruise. (b) Slope gradient values, artefacts are induced by slope parallel the ship tracks. (c) The top corresponds with the subbottom profile (modified from Llopart et al., 2015) and multichannel seismic profile (EG-06, modified from Rebesco et al., 2014), acquired during SVAIS cruise. The sub-bottom profile is displayed at the same horizontal and vertical scale to show matching of acoustic facies between Airgun MCS and TOPAS parametric 3.5 kHz profiles. At the bottom, interpretation of this cross section where R1 reflector (in blue) is the base of Storfjorden LS-1 and its top is the unit D (Pedrosa et al., 2011; Rebesco et al., 2014; Llopart et al., 2015). (d) Table with the seismic units, ages and their lithologies (modified from Llopart et al., 2015).

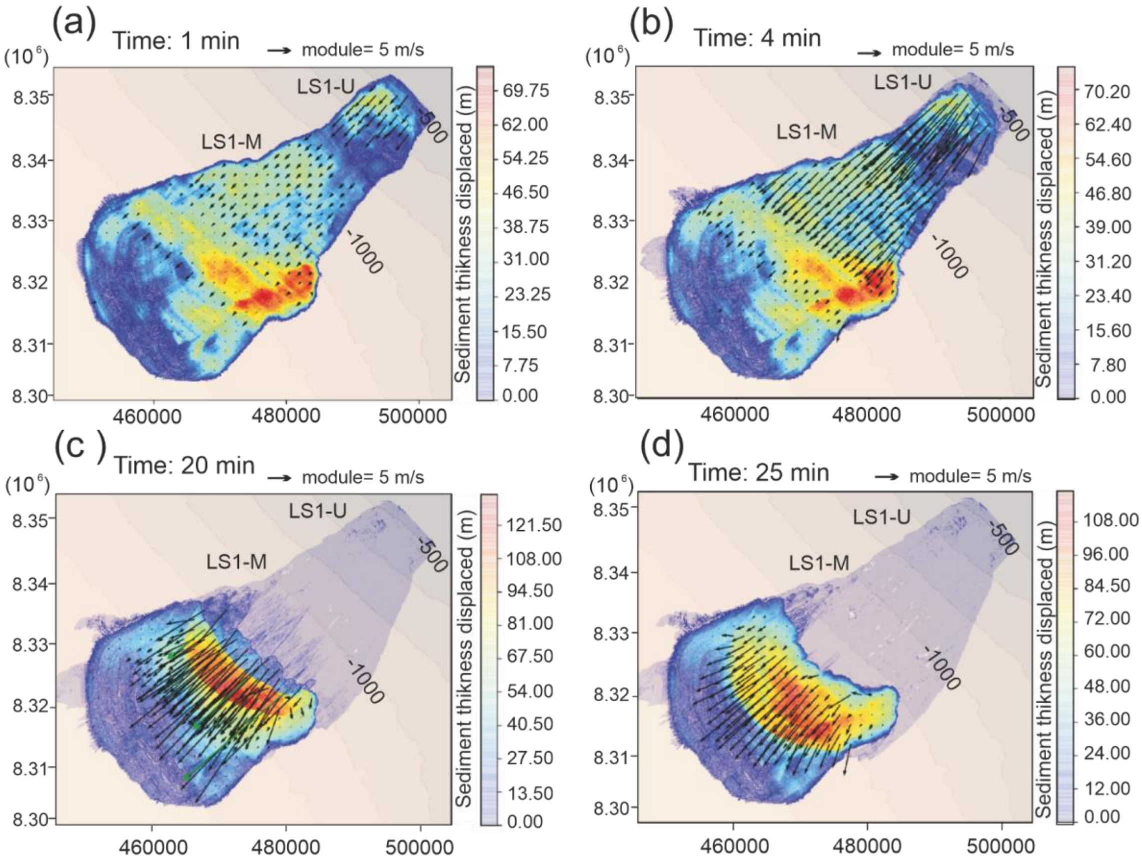


Figure 6. Velocity pattern of landslide in different frames and the sediment thickness displaced. (a) 1-min frame, in where upper slope domain (LS1-U, ~500 m water depth, 3º slope gradient) with average velocity is v_u=5 m/s contrast versus the mid slope domain (LS1-M, ~1000 m water depth; 2º slope gradients) with velocity average v_m=1 m/s. (b) 4-min frame, with a progressive velocity increase in both areas (v_u=30 m/s and v_m=22 m/s respectively). (c) 20-min frame, velocity is maximum in the frontal area v_f = 20 m/s that coincided with maximum sediment thickness displaced (122-108 m) and decreasing towards the sides v_s= 15 m/s. (d) 25-min frame, both moving masses are joined with central velocity v_f = 10 m/s and lateral v_s = 2-5 m/s in distal area (~1500 m water depth).