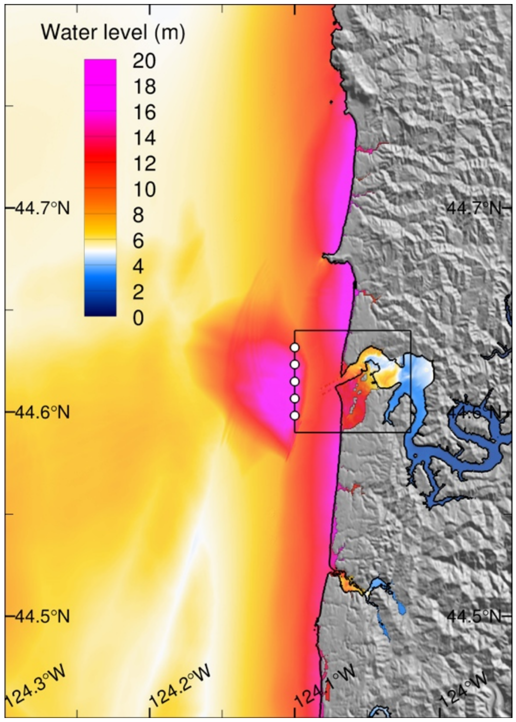
This is our response (texts in blue) to RC3 on "Concerning the tsunami modelling results, the figures exhibit clearly a modelling problem due to boundary effect. It should absolutely be fixed to be sure that this problem does not have consequences on both the inundation extent from the shoreline and the flow speed. It would be interesting to see the results of maximum water level and flow speed on the other nested grids to proof there is a correct junction between them. Also, it would be a good thing to add the version of MOST that has been used, with the related references (there are more recent ones available than the 1997 paper from Titov and Gonzalez). Also, as further indicated, the friction choice to set land and sea with the same value must be explained with references"

We agree with the reviewer #3's comments regarding "the modeling problem due to boundary effect" as we also noticed some clustering of max wave amplitude close to the west boundary of the level-4 domain. To address this issue, we have carefully inspected the modeling results at level 3 and level 4, and identified the causes of the boundary effect. This seemly "unnatural" clustering of high wave amplitudes actually is due to the formation of a few short-period (periods < 1 min) waves with high amplitudes between 38-40 minutes after the earthquake origin time. These high-frequency and high-amplitude waves are often referred as "wave fissions", which can be much better simulated by Boussinesq models than by integrated shallow water equations.

As we indicated in the manuscript, our tsunami modeling is performed based on 4-level telescoped model grids. The MOST model is used only in level-1 grid and provides boundary conditions for the Boussinesq model computations in level-2, -3, and -4 grids. The boundary conditions at an inner grid level are provided along the inner-grid boundaries at grid points coinciding with their outer-grid nodes. The feeding of boundary conditions from an outer grid is done through linear interpolation in time and space of the model results in the outer grid. For example, the grid points along the boundaries of level-4 grid are provided with boundary conditions from the level-3 grid. Previously, we feed the leve-4 grid with boundary conditions at every 15 seconds. After we inspected the model results in level-3 and identified those short waves (wave fissions), we immediately realized that boundary conditions at every 15 seconds are probably too coarse for level-4 grid to fully resolve those short waves in terms of the temporal interpolation. To solve this issue, we reduced the feeding frequency of the level-3 boundary conditions into level-4 grid from every 15 seconds to every 3 seconds. This modification has greatly improved the level-4 model results and totally eliminated those "clustering" patterns close to the west boundary.

Fig. 1a shows the max tsunami amplitude in level-3 grid, where the black box indicates the domain coverage of level-4 grid. One can clearly observe large wave amplitudes (purple color) along the west boundary of level-4 grid that are produced by large short-period waves between 38 and 40 minutes after the earthquake origin time as shown in Fig. 1b.

(a)



(b)

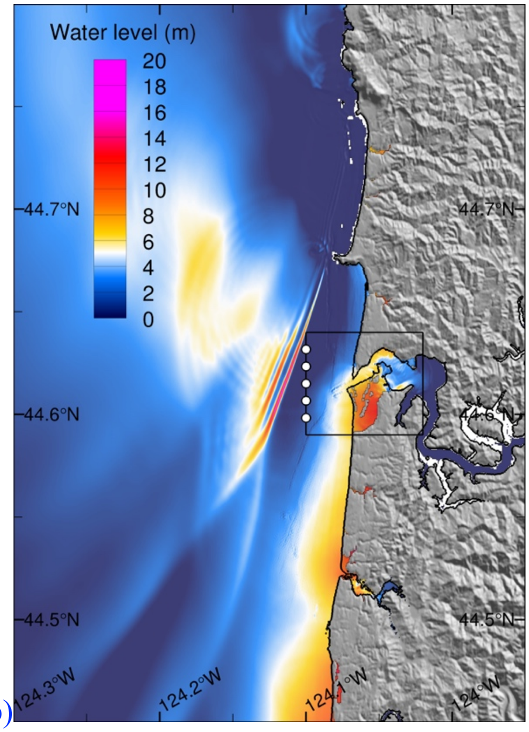


Figure 1. (a) Maximum tsunami amplitude computed in level-3 grid; (b) A snapshot of the water level at 36 min after the earthquake origin time when a series of short-period waves are arriving at the west boundary of the level-4 grid.

To follow the reviewer's suggestions on seeing the results on the other nested grid to proof there is a correct junction between them, here in Fig. 2 we compare the level-3 and level-4 modeled time series at five points along the west boundary of level 4 (white dots in Fig. 1). In Fig. 2, one can see 2 to 3 short-period waves with high amplitudes between 10 and 15 m reaching the west boundary of level-4 grid between 38 and 40 minutes. The time series at all five points are nearly identical between level-3 and level-4 computations, particularly before the short-period waves appear. The level-4 computed time series show slightly larger amplitudes for those short-period waves, and this could be attributed to higher grid resolution (1/6 arc sec, or ~5 m) in level 4.

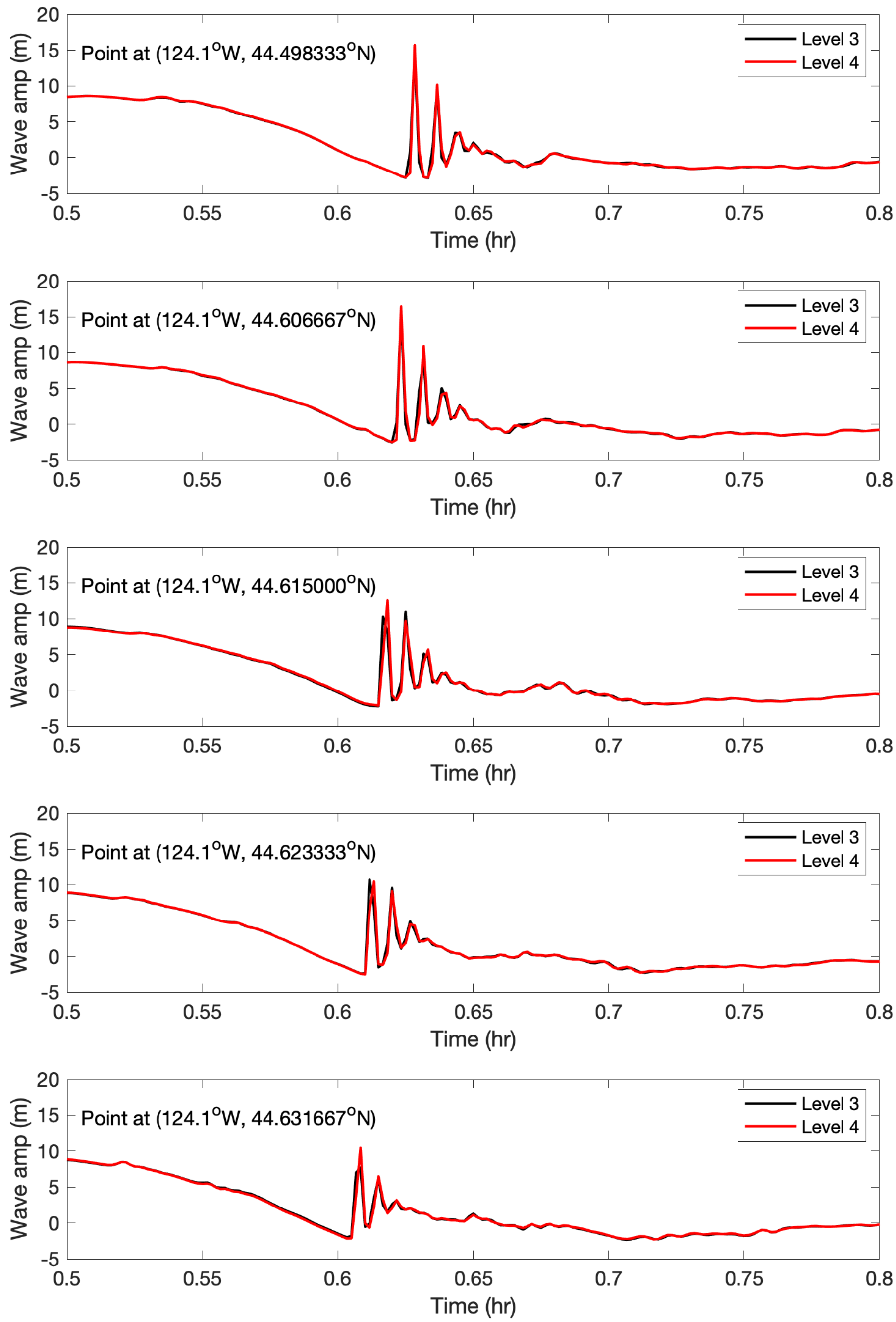


Figure 2. Comparison of time series of tsunami wave amplitude between level-3 and level-4 computations at points along the west boundary of level-4 grid.

Figure 3 shows the updated (a) the max tsunami wave amplitude and (b) the max flow speed computed in level-4 grid. One can see that the updated modeling totally eliminated the clustering pattern of the wave amplitude close to the boundary, and Fig. 3(a) shows the high-wave-amplitude zone along the level-4 boundary that is highly consistent with the level-3 results shown in Fig. 1. We can also see that the max tsunami amplitude and max flow speed remain similar to our previous results in most of the areas in level 4, except the new results show higher wave amplitudes inside the bay, particularly in the inner bay.

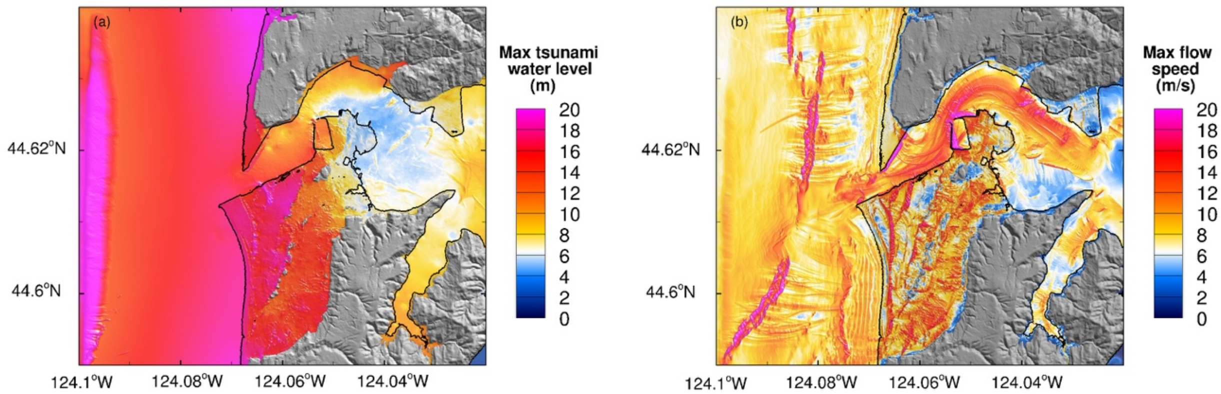


Figure 3. Updated model of tsunami (a) inundation level and (b) flow speed for South Beach assuming the "L" or large sized earthquake (Mw 9.0) for the A.D. 1700 event.

The present MOST code (version 3752) utilizes the Graphics Processing Unit (GPU) technology that has led to significant reduction of computational time.

Regarding the friction factor, it is common to use a Manning's coefficient between 0.025 and 0.033 for coastal and riverine areas, and 0.03-0.04 for land surface (Chow, 1959). Presently, both MOST and the Boussinesq model of Zhou et al. are only allowed to use one constant Manning's coefficient throughout the model computation. We therefore chose an average Manning's coefficient 0.03 in our models. Our modeling experience over the years have shown that 0.03 is a reasonable approximation of the ocean bottom in deep water and the land surface. It is used in MOST-based tsunami forecast system (Titov et al., 2009; Tang et al. 2013; Wei et al, 2007 and 2013; Zhou et al., 2014). It's worth pointing out that, to be conservative, the Oregon tsunami inundation maps were developed based on a tsunami model without considering the surface roughness at all.

Detailed comments:
3.0 Model of AD 1700 tsunami

- *98: provide the coseismic subsidence value from Satake et al.*

  It looks like the Satake et al. (2003) subduction at South Beach is between 0.5 and 1 m (and very close to the 1-m contour) for their Splay fault 9.0 scenario, approximated from Figure 8b in Satake et al. (2003). The Splay Fault L1 scenario produces slightly larger subsidence at South Beach. We've added Satake et al. (2003)'s estimated to the text.

- *104: prefer "nested" or "imbricated" to "telescoped"*

  We've changed the wording to "one-way nested" instead of "telescoped"

- *105: "The tsunami simulation model MOST (Method of Splitting Tsunami; Titov...) used in this study is based ..."*

  We agree and explained the MOST acronym here.

- *106: "wave generation and propagation".*

  We added this to the text.

- *108: "wave dispersion"*

  We added "wave" to the text and removed "frequency".

- *109-110: "the digital elevation model (DEM)" ... (last grid level)*

  We add this to text

- *111: the spatial resolution is already indicated L.105*

  We removed repeated spatial resolution.

- *113-116: not really clear – try to make it simple or add a scheme*

  We tried to simplify text.

- *115: "above the actual MSL"*

We added this to text.

- *124: why is the Manning's coefficient chosen identical for sea and land as it should be different. Also provide reference for the 0.03 value.*

This is explained in our earlier response to the specific comments on modeling. References are also added.

- *128: is that possible to present a ancient map or drawing of the coast showing the lack of jetties or a document justifying your choice to remove them?*

  We are not aware of detailed ancient maps of the Oregon coast that might be useful in this context.

- *134: the elevation reached by sea water is commonly called "run-up height" and not "tsunami water level"*

  We made these corrections

- 142: "than in most"

- *144-145: please refer to the articles dealing with the impact of current on trees, especially in Japan during the 2011 Tohoku tsunami*

We added the references on tsunami current here

- *147-153: you discuss about the splay fault but do not indicate if they are considered or not in your modelling finally; this is not clear.*

The splay fault is already included in the L1 source scenario (Witter et al., 2011).