Interactive comment on "Revised earthquake sources along Manila Trench for tsunami hazard assessment in the South China Sea" by Qiang Qiu et al.

We thank Reviewer 2 for the helpful suggestions. In this revised version, we have addressed the questions and highlighted areas where those changes are made. Our point-by-point responses and changes to each comment are given below.

The authors mentioned "Large variability in the results produced by these models underscores the fact that the seismogenic behaviors of the MSZ are still poorly understood". Based on coupling models A and B of Hsu et al. (2016) in which the spatial distribution of slip rate and coupling rate are available, the authors used a return period 1000 years to calculate the slip deficit of great earthquakes. For zones 1 and zone 2 where the coupling ratios and slip rate are relatively better constrained than zone 3. Because the MSZ is poorly understood, the authors think the current status of the Manila subduction zone could be an analog of the Sumatran subduction zone before the 2004 Mw 9.2 Sumatra-Andaman event between Myanmar and Aceh where a paucity of earthquake > Mw 8 precede the 2004 event (Chlieh et al., 2008; Hsu et al., 2012). Based on those assumptions, the scenarios were created. Due to paucity of observations in zone 3, no coupling ratios were resolved. Geologically this zone is much more complicated than zones 1 and 2 (Lin et al., 2009). It is, therefore, crucial but difficult to precisely quantify individual role of the OOSTs and megathrust in tsunami generation. We propose two end-member scenarios, considering different rupture modes in zone 3 with two steps. We first calculate the slip deficit from the slip deficient rate of models A and B between 19N to 20N. We then consider two end-member scenarios in the region from 20N to 21.7N. The first-member is the seismogenic events with rupture depths determined from a collection of GCMT solutions of the world megathrust earthquakes.

This paper made a great contribution on the literature review of the MSZ system. The authors did provide more geological evident for understanding MSZ, but combined the references regarded geological characteristics of the subduction plate, the geometry, and coupling, and state of the subduction interface to propose a series of fault rupture scenarios. Each scenario reaches the earthquake magnitude from Mw 8.5+ to Mw 9+. Most of the cases not only reached but also beyond the upper limits of previous related studies.

Author's response: We are grateful to you for the positive comments.

Because no new geological evident for understanding the MSZ system, the authors shall carefully state background of creating the scenarios, and also emphasis those probably the upper limit case for the regional tsunami.

Author's response: Thanks for the suggestions. The assumption behind our rupture scenarios is that all the accumulated strain will be released within 1000 years. The 1000-year time interval is informed by the available geological evidences. We have explained this

assumption in a clearer way in this revised version. Regarding the upper limit earthquake magnitude, it is challenging to put a specific value due to the fundamental difficulty of determining the actual rupture extent precisely. Nevertheless, we do acknowledge in the paper that the rupture-across-zone earthquake with magnitude ~Mw 9.3 is possible with very low probability. Please see the discussion part in Section 5.

For a scenario with earthquake magnitude greater than 9 and with a return period at 1000 years, geological evident such as tsunami deposit and tsunami boulder shall not so-hard to be found along the coasts of the flooding areas. The authors shall explain this issue.

Author's response: A variety of issues are responsible for the few tsunami deposits in the South China Sea, including intense human activity in the coastal region and the challenge of distinguishing tsunami deposits from storm deposits etc. The intense human activities could explain why all the existing geological evidences are so far only reported in the relatively remote islands inside the SCS. Meanwhile, the coastal area in most part of the SCS is one of the most frequently hit regions by typhoons, therefore, the geological-based interpretation suffers from the challenges of distinguishing tsunami waves from extreme storm surges. With all these difficulties, we still expect that more tsunami deposits are likely to be uncovered at other locations in future studies.

In terms of the numerical model, they look OK to me. Great job.

Author's response: We appreciate your encouraging comments.

Some minor mistakes: Line 822 Figure 1. The "1781/Tainan" shall be "1782/Tainan", or "1781/ Kaohsiung-Pingtung"

Author's change to manuscript: We corrected the event name to "1782/Tainan" in Figure 1.

Line 134: COMCOT solves shallow water equation which is a hydrostatic model.

Author's response: Agreed.

Table S1 is missing. No detail can be found the scenario parameters.

Author's response: Please find Table S1 in the supplementary file and the vertical uplifts grid file are also given in the supplementary data.