Anonymous Referee #2, 08 Mar 2022

The paper proposes a very relevant and interesting approach due to the concomitant approach of two processes that are usually analysed separately and in isolation: the seismic component and the hydrodynamic component of the tsunami.

The reader will find a new methodological approach to better understand and assess in more detail the possible infrastructural impacts occurring in an area exposed to seismic and tsunami events.

The paper is clear and well ordered, however there are certain aspects in the discussion and presentation of results that need to be improved in order to provide greater clarity in the research. I therefore consider that the paper should be accepted once the following (minor / technical) changes are corrected and the explanation extended.

1.- A) The title of the paper is too general as it may confuse the reader that the methodology presented is suitable (or may be suitable) for any "urban transport infrastructure", when in fact it applies to a very particular typology called "road embankment" which is a perimeter-oriented exposed on the coast, therefore I recommend changing the title of the paper to "Modelling the sequential earthquake-tsunami response of coastal road embankment infrastructure".

AC: The title of the paper was modified as “Modelling the sequential earthquake-tsunami response of coastal road embankment infrastructure”.

2.- B) For the tsunami wave simulation part, the authors do not explain in sufficient detail general aspects of the model set-up, the definition of the theoretical vs. real forcing wave, mesh resolution vs. bathymetry, the use of very low resolution bathymetry such as GEBCO, and the transient and 3D processes that the tsunami wave would experience on the coast under study. The authors are therefore invited to make a more detailed discussion of these aspects, especially the implication of approximating the analysis to a single coastal profile in a markedly 3D environment, what considerations/hypotheses are taken into account, is the 2D approximation sufficient, can the bathymetry used adequately represent these detailed processes, is the 2D approximation sufficient, and can the bathymetry used adequately represent these detailed processes? Is the error committed by the use of low resolution bathymetry greater than the quantified results of the simultaneous earthquake+tsunami process? For example.

AC: The following lines were added for clarification.

“The soil-embankment system was modeled using a three-dimensional approach where the selected coastal profile was considered uniform in a 20 m segment. This was considered the most critical condition of the road because of the embankment height and slope.”

“The tsunami simulation was carried out using the model implemented in the GeoClaw code (Berger et al., 2011), which is based on solving the non-linear shallow water equations through the numerical method of finite volumes, using adaptive mesh refinement to model small-scale features of the bathymetry as well as structures and coastal elements on scale of meters (LeVeque 2011). The shallow water equations are the standard model used for transoceanic tsunami propagation as well as for local inundation: e.g., Yeh, Liu, Briggs and Synolakis (1994) and Titov and Synolakis (1995, 1998). In one space dimension these are:

$$h_t + (hu)_x = 0,$$

$$(hu)_t + \left(hu^2 + \frac{1}{2}gh^2\right)_x = -ghB_x,$$

where *g* is the gravitational constant, *h(x, t)* is the fluid depth, *u(x, t)* is the vertically averaged horizontal fluid velocity. The function *B(x)* is the bottom surface elevation relative to mean sea level. Where $B < 0$ this corresponds to submarine bathymetry and where $B > 0$ to topography. GeoClaw code implementation allows the bathymetry and topography to be time-dependent by solving the two-dimensional shallow water equations:

$$h_t + (hu)_x + (hv)_y = 0,$$

$$(hu)_t + (hu^2 + \frac{1}{2}gh^2)_x + (huv)_y = -ghB_x,$$

$$(hv)_t + (huv)_x + (hv^2 + \frac{1}{2}gh^2)_y = -ghB_y,$$

where *u(x, y, t)* and *v(x, y, t*) are the depth-averaged velocities in the two horizontal directions, *B(x, y, t)* is the topography.

The bathymetric and topographic information used was obtained from the GEBCO database, with a resolution of 15 arc seconds. A mesh of 129,600 cells was used, applying 3 levels for mesh refinement, with the finest grids used near the embankment segment, where the grid resolution was 210 m. Considering the characteristics of the fault mechanism of the 1995 Manzanillo earthquake, Table 9, the (Okada, 1995) fault model was used to estimate the vertical displacement on the seabed caused by the seismic event.

Based on the calculated deformations and the characteristics of the earthquake, a tsunami-wave propagation model was run for a simulation period of 1 hour, beginning 15 minutes after the start of the earthquake. Figure 23 shows the simulation results for 1 min. A one-hour simulation period was found for the case study analysed according to records of the duration of the event regarding the wave arriving times (García et al. 1997; Borrero et al. 1997). However, for other cases, longer simulation times could be considered, such as those recommended by ASCE (Robertson, 2017). The authors acknowledge that the grid resolution of the propagation model is a possible research topic for the future. However, a higher resolution was not possible at the time the model was developed. The improvement in the grid spacing would help to reduce uncertainties in the expected flood elevations."

3.- C) In the final discussion of the paper, the authors do not really make clear or quantify what improvement is achieved by considering the simultaneous seismic+tsunami methodology, compared to a more traditional, decoupled approach. There is a description that attempts to clarify this point, but it is not entirely clear. Please include an in-deep discussion and a quantification of these effects.

AC: The following paragraph was added:

"The sequential approach presented allows soil displacements and strength to be accurately quantified, as well as pore pressure increase derived from an earthquake. The effects also couple with the tsunami arrival, which is not captured in decoupled models. The evaluation of these potential cumulative impacts provides additional information for the design and planning of more sustainable and resilient transportation infrastructure."

4.- D) Finally, the authors do not carry out any self-critical work on the method in relation to the limitations it may have, when trying to apply it to different places in the world, with different coastal protection structures, in markedly 3D environments, etc. If no comment is included in this regard it would seem that the method can only be applied to Manzanillo or areas of the world that are similar in infrastructure (?).

AC: The following paragraph was added:

"The method presented is applicable to any coast, as long as there is sufficient information to characterize the site and structures, such as the seismic environment, geotechnics, bathymetry and structural systems. The degree of detail of the information required is of great importance to reduce uncertainty in the results."

<u>**Minor changes:**</u>

5.- Figure 3 is not referenced within the text.

AC: Figure reference was included in the text.

6.- Figures 6 and 7, could be merged into 1, this would be better understood.

AC: Figures were merged into one.

7.- Figure 26. Not clear what the colours are?

AC: Figure was improved to clarify that colours refer to soil and embankment layers.