Thank you for your valuable comments. Our responses are summarized below.

> This paper examines how tsunami impact can be predicted rapidly using mode decomposition of the results from 2D (shallow-water) propagation modelling coupled with 3D (Navier-Stokes) inundation modelling. The surrogate model with mode decomposition reproduces quite well the time-series and maps of run-up and impulses. The mini work-flow of how the mode decomposition surrogate model is clearly presented in Figure 1. What is a little more unclear to me is the overall workflow and purpose of the work. The title uses the term "Real-time" which, in my world, is reserved for urgent or situation computations where the process is initiated by a real-world trigger (observational data or human intervention) and that the computations are running against a real-world clock. Is this the case? Otherwise, "Rapid" is probably a better term – that indicates fast computation.

Our final goal is to predict the damage caused by tsunamis in the city using real-time observational data and to provide the extent of damage as soon as possible. However, as pointed out by the reviewer, such a prediction is not synchronized with the tsunami events and rather a rapid action in the limited condition. So, we would like to consider the use of the term "Rapid" instead of "real-time", including the title.

> With regards to the total workflow, is it the intention that the full numerical simulations are calculated beforehand and the surrogate model saved for application when a new tsunami event occurs? Or are all the calculations performed in a new event and the surrogate model used to interpolate the outcome to different parts of the parameter space to those calculated in the 2D/3D simulations?

In the framework proposed in this study, an expected limited number of scenarios are obtained beforehand by conducting a series of numerical simulations with selected sets of fault parameters, and then a surrogate model is constructed based on those results. Then, when an actual tsunami event occurs, the actual fault parameters are given so that the POD coefficients in the surrogate model can be interpolated in the parameter space.

> In any case, there will be a significant variability of the tsunami impact as the source parameters vary (c.f. Table 1) – how is the decision made as to which are the appropriate parameters to be looking at when interpolating the predicted impact using the surrogate model? Is it by real-time comparison between observations and predictions?
>
> Answering the above questions in the paper would help enormously in making the context of these calculations clear.

As explained above, this study stands on the assumption that the fault parameters are given when an actual tsunami event occurs. Because this point is not clearly mentioned in the manuscript, we would like to add the explanation in the revised manuscript.

What exactly do the "data vectors" in Equation (8) contain? ("data arranged according to a certain rule") – is it wave heights at the different grid points? Velocities? It would be useful to know which values are stored for each grid point (h,ux,uy?)

The data vector in Equation (8) contains the physical quantities that are used to construct a surrogate model. Specifically, in this study, the tsunami force and inundation depth at each grid point are contained in the data vector. In order to describe the point clearly, we would like to add an more clear and specific explanation around Equation (20).

Can you comment on the boundary between the 2D analysis and 3D analysis?

It is typical to specify a given water depth at which the 3D-analysis would take over but the line indicated in Figure (6) cuts across a bay very close to the inundation area with very shallow water on each side. How does the transition from 2D to 3D happen on such a boundary? Would it have been feasible to take the boundary further out to sea?

The time history data of two-dimensional simulation results, that are specifically the water depth and average flow velocity, on the boundary are stored and transferred to the three-dimensional numerical analysis. Since the time interval in the 2D calculation differs from that in the 3D one, the 2D results are linearly interpolated in the time domain, and the interpolated values are given to the 3D analysis as input data.

Regarding the interface between the 2D and 3D domains, as pointed out by the reviewer, there might be a suitable position in more offshore area. However, this would increase the 3D analysis area and at the same time increase the computational cost. Therefore, we selected the current position of the boundary line for feasible 3D analysis. As need arises, some comments on this might be added somewhere in the revised manuscript.

In Figure 8, it would be helpful to have an indication of scale on each of the panels. Is each panel a zoom-in of the previous panel? Does Figure 12 show us something fundamentally different to Figure 8? If so, it would be very valuable to know what is fundamentally different. It looks like there are triangular elements in Figure 12 but not in Figure 8. Is this significant?

Thank you for pointing out the flaw in Figure 8. We would like to add the scale in Figure 8 as suggested.

Regarding the difference between Figs 8 and 12, we would like to say as follows: Figure 8 shows the overall image of the mesh of the target area, while Figure 12 shows 10-meter mesh that is generated to define the sub-area in which the tsunami force is evaluated. Both of them are the same, but the latter is shown to illustrate how the tsunami force is evaluated. Please note that the evaluation of tsunami force is dome by averaging in each of these sub-domains but not for each building. Hence, this is significant. Since the explanation for the structured grid in Figure 12 seems to have been insufficient, we would like to improve the description about it in the revised manuscript.

In Figure 7, the colour scheme is a little unfortunate with low-lying areas coloured in blue. Whenever I see this Figure, I assume that I am seeing tsunami inundation with the blue areas representing the region with inundation. Would it be possible to have blue at sea level and below and non-blue for the region above land – or at least a clear line indicating the pre-tsunami coastline?

The confusion continues into Figure 9 where I guess it is the white which represents the inundation.

As pointed out by the reviewer, the blue area may look like a tsunami inundation area. We would like to modify the color in Figs 7 and 9 so that they would not give an erroneous impression.

It would be nice to have the link to the inundation height observations in the caption to Figure 10. This is for the journal to decide I guess.

We would like to add the information about the website in the caption.

Is the data matrix X in Equation (19) the same as the data matrix X in Equation (8)? I am guessing not as I see the matrix in Equation 8 being a spatial discretization of simulation parameters (time-dependent or not time-dependent?) Is the matrix X time-series for a single metric at one point evaluated for different slip and rake as a function of time? What about the X in Equation (8)? This is something evaluated for many points. I think all of this needs clearing up.

The matrix in equation (19) is different from that in equation (8). The equation (19) is a matrix containing the time series data for one scenario and then the data matrix is defined as shown in equation (20) that contains all the scenario data. Therefore, Equation (8) corresponds to Equation (20).

Note that, in the case of time-space mode decomposition, a data matrix is defined by storing the time series data obtained for all the scenarios in the column direction and separately prepared according to the parameter variation. Because this point was not adequately mentioned in the original manuscript, we would like to add the explanation around the equations (8), (9), and (20).

What is the quantity we are seeing in Figure 13? It goes from 1 to -1 – it is a fully-normalized data vector? So there is no direct physical interpretation of these numbers? This should be made clear in the figure caption.

Figure 13 shows a normalized representation of the spatial modes. As for the mode numbers, the low-order modes have high contributions with respect to the original data (simulated results) and high-order modes express minor effects. Because the physical meanings are not sufficiently explained in the original manuscript, we would like to add the explanation.

There are very many figures and I think a lot of care needs to be taken to make it clear in the caption what is different for each figure from similar figures. (e.g. Figure 17 has a map with the locations of evaluation points and we do not see until Figure 26 where these are applied. There are 29 figures in total and I would ask as to whether all are necessary. The reader struggles to understand the significance of each of them. (e.g. Figures 28 and 29 are almost identical – we get the point.)

We would like to reconsider the arrangements of the figures and their captions to make them more easily understand for potential readers.