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Interactive comment on "Development of a methodological framework for the assessment of seismic induced tsunami hazard through uncertainty quantification: application to the Azores-Gibraltar Fracture Zone" *by* Vito Bacchi et al.

Anonymous Referee #2

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General comments

Quantification of uncertainty is an important aspect in tsunami hazard assessment (THA) using deterministic or scenario-based methods—an aspect that is often overlooked. The authors of "Development of a methodological framework for the assessment of seismic induced tsunami hazard through uncertainty quantification: application to the Azores-Gibraltar Fracture Zone" describe sophisticated methods for uncertainty

quantification and sensitivity analysis and show how the methods can be applied for THA using potential earthquake sources along that Azores-Gibraltar Fracture Zone and targets along the French Atlantic coast. The authors provide an extensive background for the study with numerous citations. The main weakness in the paper, as described below, is the confusing description of all the different methods and how they are related. The parameters of the case study may lack some realism (as acknowledged by the authors on the bottom of pg. 10), but I believe the main objective of the case study is to demonstrate how the statistical methods can be applied.

Specific comments:

(1) This study actually discusses two aspects associated with THA: uncertainty quantification and sensitivity analysis (the latter, not included in the title of the paper). The relationship between these two aspects is confusing. Part of the problem is Figure 1 where they are related through "Promethee". "Promethee" is not mentioned until pg. 11, and only then if very briefly described. It would be much better of the reader if Figure 1 was simplified and modified to include how the methods described by authors (i.e., kriging meta-model) are incorporated into both aspects of THA (top of pg. 8). It might be better to move the meta-model explanation (Sec. 2.4) to the beginning of Section 2 and then show how uncertainty quantification and sensitivity analyses are determined from the meta-model.

(2) In the development and application of their method, the authors make several jumps in approximation without much explanation or validation:

a. To start with, it appears to be given that tsunami-modeling results can be uniquely decomposed according to Eqn. 5. Is this so, especially considering the inclusion of nonlinear advection?

b. On pg. 6 (top), the meta-model is preferred over Monte Carlo sampling because "...a large amount of simulations are necessary", even though the design database for the meta-model also includes a large number of simulations. In this case, is there an

advantage to using the meta model? Convergence appears to be achieved just with the number of starting simulations in the design database (Fig. 6).

c. On page 7, calculation of Sobol indicies jumps to total indicies to extended-Fast method to Janssen method (implemented in R) , all because of computational reasons. Is accuracy of statistical measures preserved at each step? Unclear what the variables are in the simulation cost (end of Sec. 2.3).

d. LHS is replaced by using the results from a previous modeling study. What is lost by doing this?

(3) The design database is an important part of this study. Although it looks like the essential aspects of the modeling are described in Section 3.2, the actual work is described only in abstracts (Antoshchenkova et al., 2016; Imbert et al., 2015). Is there a publication or report the fully documents the numerical modeling?

(4) The authors frequently use generic variables, whereas relating these variables to ones specific to the tsunami problem would greatly aid the reader. Please be more specific on the definition of y (pg. 5), rather than just "quantitities of interest". See also Figure 1, Eqn. 5, pg. 9, Appendix, etc.

(5) Figure 4: Indicate "residuals" of what?

(6) Although the English is definitely understandable, the manuscript could use the services of a copy editor during revision.

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