Review response (2nd round): Enabling dynamic modelling of coastal flooding by defining storm tide hydrographs

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Reviewer #1 (Comments):

First of all, I would like to thank the authors for taking time addressing my comments and making the corresponding changes in the manuscript. However, I am not fully satisfied with the little change made to address the limitation of this method to account for the variability of hydrographs at each time step (both tidal and non-tidal) and thus the uncertainties related to the generated mean hydrograph. I believe this is an important factor that can affected the estimated flooding as affects not only the volume of water that can propagate inland, but also other factors such as flood velocities, which can be important for assessing damages and warning systems. I agree with the authors that the short period of the data used also limits the analysis of the variability of extreme storm surge hydrographs. However, I think the authors could have provided a first estimation of this variability at global scale (with not much effort as it is shown for two locations), which could also be used to geographically assess in which areas the variability of hydrographs is large and flood assessments would benefit from including it.

I also still believe that the work presented in this manuscript would have been benefited from providing a different perspective on the lack of information about hydrographs, which is need at all scales for dynamical flood modeling, rather than focusing on continental to global scales, for which the main limitation is still the computational time required to run dynamic flood models.

Saying this, I think the work presented in this manuscript provides a first step on the generation of storm tide hydrographs at global scale and I recommend that it can be accepted.

Authors' response

We would like to thank the reviewer for the time taken to review our manuscript for a second time. We are pleased to read that the reviewer recommends the manuscript to be accepted after revisions. Following the reviewer's suggestions, we have revised our manuscript. We feel that these extra revisions have further improved our manuscript.

1) *Variability of the hydrographs:*
   To provide a better global view of the hydrograph variability we have added two figures to the manuscript. Figure 7c shows the difference in surge hydrograph duration (computed as POT99.5-POT98) in hours at a normalized surge level of 0.5. This figure confirms our previous conclusion: the width of the hydrograph in areas prone to tropical cyclones is smaller when using a higher POT threshold for selecting surge events. To explain this we added the following sentences to the manuscript: "At the global scale, it can be observed that the surge hydrograph duration (at the unitless 0.5 level) is typically shorter in the Caribbean and northwest Pacific Ocean when only using the more extreme surge events (i.e. POT99.5 relative to POT98) for generating a surge hydrograph (Fig. 7c). Outside TC prone areas the variability in surge hydrograph duration, either positive or negative, is less pronounced." In addition, Figure A1 (part of the Appendices) shows the ratio of the surge hydrograph duration of the 25th and 75th percentile at the normalized surge height 0.75. The ratio is computed by dividing the 25th percentile value by the 75th percentile value. As suggested by the reviewer, this figure could

be used to geographically assess in which areas the variability of the hydrograph is large and flood assessments would benefit from including it. This is also emphasized in the manuscript section 4.1 which now reads as follows: "Last, we computed the difference in surge hydrograph duration between the 25th and 75th percentile at a normalized surge height of 0.75 (App. Fig. A1). This can provide some insights in the variability of flood duration, assuming that inundation might starts to occur around the 0.75 normalized surge height."

2) *Perspective of spatial scales:*
   Following the reviewer's suggestion we have changed the perspective of the spatial scale at which our hydrograph method could be applied. Most importantly, we have removed the word 'global' from the title. In addition, we have made multiple adjustments throughout the manuscript to highlight that the developed hydrograph method is not necessarily only applicable at larger scales. Instead, coastal flood modelling assessments at smaller scales would also benefit from including the time component. For example, line 85 (introduction section) now reads as follows: "The aim of this study is to address this research gap by developing and applying a globally-applicable method (HGRAPHER) to generate hydrographs. In doing so, we pave the way for coastal flood mapping using dynamic models across different spatial scales."