Review - Enabling dynamic modelling of global coastal flooding by defining storm tide hydrographs

Summary

The article by Dullaart et al. presents a method for the generation of storm tide hydrographs on a global scale using a new tool called HGRAPHER. Building on previous work by Chbab (2015), HGRAPHER generates storm tides for specific return periods specified by the user.
The paper is generally well-written and the methods described are resonably justified. While improvements to the work can be made, these are identified and presented by the authors. The authors state the work represents a first step to bringing storm tide hydrographs to global analyses of coastal flooding using hydrodynamic models, and I agree. I recommend acceptance of this article after some revision.

General comments

- While I had some initial comments regarding the handling of the hydrograph temporal evolution, much of these were discussed in Section 6. While it is suggested in the manuscript that the storm tide duration can influence flooding, I found no references to this fact. Perhaps the authors could include either Santamaria-Aguilar et al. (2017: https://doi.org/10.1002/2016JC012579) or Quinn et al. (2014: https://doi.org/10.1002/2014JC010197) in their explanation of why storm tide duration should be considered?

Specific comments

(Line numbers are specified for each comment)

Abstract

11. This first sentence makes me think that coastal flooding can occur under high tides alone, which is not the case. I think the use of "or" implies that

storm surges are not required to drive coastal flooding.
12. tropical and extratropical ... cyclones?

1. Introduction
27. "as a result of increasing exposure" - increased exposure is the result of physical and socioeconomic changes, not the other way around.

2. Available methods to generate hydrographs
156. While I understand that the method by MacPherson et al. (2019) is not applicable on a global scale, it is still applicable at larger scales, including the entire Baltic Sea and other regions of low tides.

3.2.2 Average and spring tide signal
220. I would like a bit more clarification on this point. You extract all tidal cyles of 24 hours and 50 minutes (presumably because this is the phase of the M2 tidal component?) but I am not sure what this really entails. Do you split the tidal series up into segments that are each 24 hours and 50 minutes long, and take the mean of all these segments? Then in figure 3b there are tidal signals that are 72 hours in length. Are these related? I think a clearer description of this process is needed.

4.2. Average (spring) tide signal
288. - 292. Regarding the choice of maximum average or spring tide, I am not sure why a random tide is not considered. The example given is that in northwestern Australia, the spring tide is much larger than the average maximum tide, and therefore an extreme storm tide is more likely to occur during a spring tide. However, this ignores the fact that spring tides occur less often than tides of height equal to the average maximum, and that the region is prone to tropical cyclones which can cause storm surges significantly larger than events produced by extratropical events. What is unclear to me, is why a simple statistical analysis of tides was not performed, providing a distribution of tidal water levels at the time of the storm tide maximum? HGRAPHER could then produce a tidal signal of a given height, rather than rely on either the average maximum of spring tide. I can only think that the authors wanted to produce events with similar tidal regimes spatially and across different return water levels. If this is the case, it should be stated in the methods.

4.4 Assumptions underlying the hydrograph

311. - 330. This is an important paragraph which answers much of my qestions regarding the performance of the method in simulating the storm tide temporal evolution. The authors state the choice of threshold could be used to better model events of specific heights (i.e. TC events can be better modelled with higher thresholds, lower events with lower thresholds). I would be interested in the performance of the model if a double threshold approach was considered, where a lower threshold is used to rule out events below a desired level and an upper threshold is introduced to rule out events above a certain level. For example, if I was interested in a RP100 water level at some specific site, perhaps I could set a lower threshold equal to RP100-0.25m and and an upper threshold equal to RP100+0.25m. This would ensure HGRAPHER only considers events equal in magnitude to my desired water level.