

## Anonymous Referee #1

general comments:

The paper copes with the problem of propagating non-symmetrical sea level uncertainty distributions from ice sheet and glacier melting into the combined sea level rise. Since the authors use spatially varying self attraction and loading sea level change patterns, the estimates are furthermore varying in space. Compared to the case where symmetric distributions were used, the authors find mostly positive increases in the median of sea level change, and even larger increases in the higher percentiles of these projections. Furthermore, the authors study the effect of correlated contributors and alternative probability density functions. I found the paper easy to read, with a clear message, and it may possibly be suitable for policymakers. I would therefore recommend the paper for publication. There are however a few minor issues which, when addressed, would improve the paper in my opinion.

1. Explain the link between the combination of theoretical pdf's and the discretized formula's as provided in the paper. For example, eq 1 is a discretized convolution over the domain  $(-\infty, \infty)$  which comes from summing 2 contributions each with a different pdf. By briefly explaining the theoretical origin of eq. 1 (and 6), one could make the paper more accessible to readers not so familiar with probabilistic theory.

*The formula is introduced in more detail in the manuscript now by:*

*"The composed distribution  $P_{com}(x)$  consists for each  $x$  of all contributions of two independent distributions  $P_1(x_1)$  and  $P_2(x_2)$  for which the summed  $x$ -axis values  $x_1$  and  $x_2$  add to  $x$ . Each combination for which applies  $x = x_1 + x_2$  yields a contribution of  $P_1(x_1)$  times  $P_2(x_2)$  to  $P_{com}(x)$ ; i.e. summing over all relevant combinations  $x = x_1 + x_2$  determines  $P_{com}(x)$  for a certain  $x$ :"*

2. Uses of high percentile SLC estimates for coastal defense. This got me admittedly somewhat confused. As far as I understood, and I could be wrong, coastal defense infrastructure is commonly determined from high percentiles values of storm surge from models subjected to prescribed sea level rise, and not so much from the direct high percentile of this sea level rise itself. So my request would be to describe more clearly how these high percentile SLC values enter safety standards, rather than simply saying that they are used to define safety standards.

*The reviewer is correct that normally high percentiles are used as estimate for return levels. However, coastal decision making also requests information on the upper-boundary of possible future sea levels. To stress this following line is added to the manuscript:*

*"Including high-end SLC projections is therefore the logical next step in coastal safety analysis, since coastal decision making also needs information on the upper-boundary of possible future sea level when assessing future extreme events (De Winter and Ruessink, 2017)"*

3. Motivate choice of picking out locations Denmark Strait, New York and East Pacific. Why did the authors choose these locations? I can also imagine that locations in the West Pacific and Indian Ocean where large mega-cities exist will be highly relevant, not to mention that they are in the far field.

*These fields are chosen, because they provide a good insight in how different contributions contribute to the total PDF, hence it is not based on the relevance of the cities involved, but more as an introduction to understand the figures with a global coverage. Nevertheless, we expanded the number of location to have a wider geographical coverage of locations.*

minor remarks:

4. page 2 l19: "is under debate": is it possible to add a reference here to a paper discussing this debate?

*References to Vieli & Payne (2005) , Pattyn et al. (2012) and DeConto and Pollard (2015) are added.*

5. p2 l30 " An asymmetric probability density function for the Greenland .. can also no be included" Why is this? due to instability in the marine terminating glaciers? l30 also no -> also not

*This sentence is extended with "not be excluded due to a rapid decay of marine terminating glaciers (Nick et al. 2013)"*

6. p3 l12 use distribution -> use a distribution

*Thank you for the suggestion, this is changed.*

7. p3 l13 of by Bamber -> from Bamber

*Thank you for the suggestion, this is changed.*

8. p3 l33 are published -> have been published

*Thank you for the suggestion, this is changed*

9. p6 l10 from -1.9 m to +1.03 m -> from -1.09m close to the melting sources to +1.03m in the far field

*Thank you for the suggestion, this is changed to "from -1.90 m close to the location of mass loss to +1.03m in the far field"*

10. p7 l3 -> Adopting an asymmetric -> As mentioned before, adopting ..

*Thank you for the suggestion, the sentence is changed to:*

*"As mentioned before, the globally-average value increases by +0.18m if the ice dynamical contribution is asymmetric compared to symmetric."*

11. p7 l6 Explain \*why\* you corrected the change of the higher percentiles for the local median SLC

*Thank you for this suggestion, we explained in more detail why we did this, by adding the following sentences:*

*"In order to determine whether the increase in sea level of higher percentiles is related to generally higher values (higher median) or to the shape of the distribution, we corrected the..."*

12. p7 l24 Maybe add: as it can potentially narrow down the uncertainty of SLC projections

*In the Discussion section we added that this might also be related to the shape of the input PDF:*

*“Le Bars et al. (2017) concluded, based on symmetric contributions, that the combined PDFs becomes wider, if the contributions are assumed to be correlated, suggesting that the shape of the distribution is also important.”*

13. p8 l17 that when -> that, when

*Thank you for the suggestion, this is changed*

14. p8 l20 SLC projections -> its projections

*Thank you for the suggestion, this is changed*

15. p8 l20-21 "The ratio .. expert judgment" Would it be fair to mention that an increase in temperature in the climate may partly explain such correlations?

*The correlation investigated in this study is between the climate driven components that contribute to sea level rise (which are largely temperature driven) and mass loss due to ice dynamical processes. The correlation factor used in this study is based on an expert judgement analysis. Future research should determine if there is a correlation between those processes. This is mentioned in the manuscript.*

16. fig 2 caption Eest -> East

*Thank you, this is changed*