Review of "Non-stationary analysis of water level extremes in Latvian waters, Baltic Sea, during 1961–2018."

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This paper explores the temporal changes in the parameters of the General Extreme Value (GEV) distribution for water level extremes in the Gulf of Riga and Liepaja (eastern Baltic Sea). Temporal changes in GEV parameters are assessed for the seven locations by fitting a stationary GEV distribution to observed sea level data separated into a 30-year sliding window. Also, a non-stationarity GEV distribution is fitted to the water level extreme data.

Results show that changes in the GEV parameters, as well as the significance level of these changes, vary across sites, with higher differences when comparing those stations located in and out the Gulf of Riga. Consistent results are obtained for changes in the shape parameter at those sites located in the interior of the Gulf of Riga: a significant drop around 1986 and a posterior return by 1990. A step-function is fitted to these water level extremes, obtaining similar results. This behavior is not found at those sites affected by the water level in the Baltic Sea (Kolka and Liepāja). For these, some GEV parameters are found to follow a linear trend: location and shape in Kolka and location and scale in Liepāja.

General comment

I have read the MS with great interest, the paper is well-written, and the organization is good. The study provides updated knowledge of extreme water levels in the Gulf of Riga, which seems to be significantly different from those found in the Baltic Sea. It is also interesting the temporal behavior of the shape parameter in those tide gauges located in the interior of the Gulf.

Despite I operate outside this study area, it seems like many efforts have already been done in the literature to explain changes in mean sea level, extreme sea levels, and distribution parameters in the Baltic Sea and the Gulf of Riga. For instance, changes in extreme events as well as changes in extreme value distributions have been studied at Parnü (Suursay 2007, Eelsalu 2014, Ekman 1996, among others). Also, spatial variations in extreme sea level distributions have been studied along the eastern coast of the Baltic Sea (Soomere 2018, Ekman 1996). I, therefore, believe that the paper would require more work to create additional value to the existing literature, for example, by extending the study to the possible causes of the temporal changes in the tail distribution of the extreme

water levels. For instance, previous works have found significant correlations between winter months sea level changes and changes in wind and pressure changes as well as with the North Atlantic Oscillation index in the Baltic Sea and at Parnü (Anderson 2002, Suursay 2007, among others). Although in a different study area, Tsimplis et al. (2005) found that NAO contributes both to changes in the mean and extreme water levels in the North Sea. Correlation between climate indexes and GEV distribution parameters were previously assessed in other areas (for instance, Méndez et al 2006).

Other comments

- Sometimes in the text, Fig and Figure are used indistinctly.
- Line 190. Figure 4 is called before figure 3 in the main text.
- Line 220/225. In order to assure reproducibility, I would recommend indicating the equations, functions, or tools used in Matlab as well as a quick description of *Hydrognomon*, for those who are not familiar with it.
- In the same sense, I recommend an extension of the explanation about the water level data processing before performing the distribution fitting. By doing so, the reader can reproduce and understand how the data have been processed to obtain the extreme water level from the tide gauge records.
- Figures. The overall quality of the figures should be improved, for instance, by matching the font size and font name with the main text.
- Line 260. I would recall here, as the authors do in section 2.3, that changes in the shape parameter have consequences in the tail of the distribution, determining the behavior of the events with very low frequency.
- Line 270, figure 5. It would be good to see results for all other locations, as in figure 7. Same for the results of scale parameters (figure 6).
- Line 290. *"As the 95% confidence intervals of estimates of this parameter for single years mostly overlap, it is safe to say that the location parameter of the GEV distribution of water level extremes has not experienced any substantial changes in Latvian waters since the 1960s".* I'm curious about changes in the location parameter at Skulte, these changes appear significant when comparing the location parameter obtained by ~2000 vs ~1975. Also, including a grid in the figures would improve the comparison across years. I recommend also to further explain how the statistical significance has been calculated.

- Line 415. *"… observed and measured water maxima in…"*. Aren't they the same?

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