

Interactive comment on “Non-stationary analysis of water level extremes in Latvian waters, Baltic Sea, during 1961–2018” by Nadezhda Kudryavtseva et al.

Anonymous Referee #1

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NHESS-2020-100 review report:

Non-stationary analysis of water level extremes in Latvian waters, Baltic Sea, during 1961–2018. Authors: N. Kudryavtseva, T. Soomere, R. Männikus

This paper deals with analysis of water level extremes in the eastern Baltic Sea using various statistical procedures (GEV, non-stationary and regime shift analysis). The topic is significant in the era of climate change and sea level rise. The paper seems to be an extension to some recent papers by the same authors (e.g.: Identification of mechanisms that drive water level extremes from in situ measurements in the Gulf of Riga during 1961–2017 by Männikus, Soomere, Kudryavtseva in Cont Shelf Res 2019;

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Non-stationary Modeling of Trends in Extreme Water Level Changes Along the Baltic Sea Coast by Kudryavtseva, Pindsoo, Soomere in *J Coastal Res* Special Issue 2018; Variations in parameters of extreme value distributions of water level along the eastern Baltic Sea coast by Soomere, Eelsalu, Pindsoo in *Estuarine Coast Shelf Res*, 2018). Nevertheless, the new article includes plenty of new insight into the subject of the Gulf of Riga water level maxima and therefore deserves publication.

The paper is well written, adequately organized and well-illustrated with figures. I suggest publication with medium to minor corrections.

Comments

1) Please clarify the study area. In L. 83-85 it is said that the study focusses on Gulf of Riga. A bit later (line 97) it said that “The study area – the shores of Latvia with a total length of about 500 km...” I think that neither is fully correct: Besides Gulf of Riga, also Latvian coasts in the Baltic Proper are considered. Secondly, large part of the discussed Gulf of Riga actually belongs to Estonia, including one station where the data come from (Pärnu). Also the paper title says that the study area is “Latvian waters”. I understand that it is difficult to conveniently introduce such details in the title. But the fact about Pärnu and Estonia should be stated possibly earlier in the paper. Currently it is hidden to far quarters of the manuscript.

2) L.110 “...may increase the average sea level in the entire Baltic Sea by almost 1 m for several months (Soomere and Pindsoo, 2016)”. I believe this 1 m is exaggerated for the entire Baltic. Soomere and Pindsoo (2016) said “...raise the average sea level by almost 1 m for a few weeks”. Weeks - and it was probably for the eastern part of the sea. But then, sea level must be lower in other parts. Johansson and Kahma (Boreal Env Res, 2016, 21), say on p.34 with monthly-based analysis: “The Baltic Sea average level Hd ranged from -43 to +51 cm in 1933–2012”. One month 51 cm, one month 45-50 cm. L.118 Considering the above-said, also this 1+1+1 m quantification does not quite hold.

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3) L.130, Table 1. I wonder, in three stations the hourly data completeness is 30% and in other three 99%. Please ensure shortly that it does not influence the statistics (distribution parameters) – particularly considering the potential completeness changes over years in these 30% stations.

4) Were the data 1961-2018 detrended before analysis, or perhaps, it is not a problem? I.e., is there a possible influence of local uplift/subsidence or global sea level rise to e.g. variations in location parameter?

5) L. 320- Major regime shift in the Baltic region in 1989/90 is well known indeed. However, how to explain this odd shift in the form of “dent” in the shape parameter inside the Gulf of Riga in 1984-90? Seems like an artefact. In L.430- it is shortly discussed on the basis of changes in average air flow speed (Keevallik and Soomere 2014), possibly including regime shifts in 1987 (up) and 1993 (down) above the Gulf of Finland. How about changes in wind direction? For instance, Fig.7e,g,h by Suursaar (<http://dx.doi.org/10.3176/earth.2013.05>) shows variations in annual resulting wind direction at stations near Gulf of Riga. In 1985-94, the direction was quite stable 230-250 deg (good direction for inflow through Irbe Strait), while before and after it fluctuated plus-minus off that direction. Just a guess.

6) Fig.8. If the numbers in brackets mark the range in centimetres (134,141), why not express it 136-141? What does this range mean anyway - neither explained in the text nor in legend. What does Pärnu 50-yr return value 211,220 mean? Pärnu had measurements 253 cm and 275 cm within 39 years.

Minor/technical comments

L.23 too many (9) keywords, some repeating title words

L.31 This highlight “Best fit in terms of step-like approximation for shape parameter established” makes no sense as a highlight. Also the third highlight misses something.

L.39 Mudersbach and Jensen

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L.58 easternmost Baltic Sea – feels weird

L.78 open coast of Latvia – feels weird

L.105 (100, etc) Väinameri (Moonsund) sub-basin in the Western Estonian archipelago
-> West Estonian Archipelago Sea

Please unify units in the Fig. axes (commas, parentheses): Water level, cm; Return period, year; Time [yr]; Time [yrs] etc.

L.205 hrs – not much shorter than hours

L.443 Klevanny -> Klevannyy

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2020-100>, 2020.

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