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Comment on nhess-2021-118

Anonymous Referee #1

Referee comment on "Distribution of coastal high water level during extreme events around the UK and Irish coasts" by Julia Rulent et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-118-RC1, 2021

This paper presents an analysis of the distribution of total water levels (TWL) and its major components (waves, tides, and surges) along the British and Irish coast during the extreme winter 2013/2014. The authors used a regional coupled environmental prediction system with high spatial resolution (1.5 km) to obtain the necessary data. In general, the paper is well structured and well written. More information should be provided on the model setup. Some other minor concerns are summarized below.

- P2L36 Might be also interesting to mention that an individual storm (in this case Xaver) is able to increase the water level estimates for a 1 in 200 years event by up to 40 cm (see Dangendorf et al., 2016, https://doi.org/10.1088/1748-9326/11/5/054001). This study is also interesting regarding the estimation of worst-case scenarios.
- P2L46 Delete 'coastal' at '... the coastal distribution ...' as you already say along the UK coast afterward
- P2L53 Delete reference to Fig 1; one cannot see that 2013/2014 was an extreme winter from this Fig
- P3L55 Would be interesting to compare not only the 2013/2014 90th percentile values for Hs and surge but also if/where winter 2013/2014 exhibits maximum values for Hs and surge in comparison to the climatology
- P3L62 More information about the model setup is necessary: What are the initial and boundary conditions for the atmosphere and ocean? How often are boundary conditions updated? Is there only 1 domain (1.5km) or any nesting to reach such a high resolution (also depends on the resolution of input data)? What about model spin-up time? The first event (Xaver) occurred on Dec 5th/6th; so is the model already in balance or would more spin-up be necessary?
- P3L82 'higher temporal frequency than model output': where is this used in the study?
- P13L115 Based on the Figures, it looks like surge increased much more than Hs; in the text, it says Hs is 138% higher on average, surge is 120% higher on average. Since the color bar (for the positive percentages) seems to be the same, the much more reddish shades in Fig 4 conclude a much stronger average increase in surge. Please check and verify.
- P13L134 The curve representing simultaneous Hs and surges seem to be mostly influenced by surge; the effect of Hs seems negligible.

- P13 L145 A bit more interpretation of HP would de helpful: what does a value of 1.8m mean? It is calculated as SSH + 1/2Hs, where SSH is sea surface height including astronomical tides and surges. I'm having a problem how to interpret the HP value; maybe a bit more information should be added.
- P14L156 'which of these are significant': have you applied any significance test? Otherwise, you should not use the word significant here?
- P14L163 Based on your results (having the climatology and the 2013/2014) case: can you make any assumption about worst-case scenarios.
- Figure 1 Is there a reason why you use mean atmospheric pressure as background? Why not topography/bathymetry?
- Figure 2 The dark blue boxes highlight the periods, where HS and surge are both above the 90th percentile. Seems that the surge falls below the 90th percentile already at hour 35. Please verify.
- Figure 4 'Note that the colour scales are different between figures 2-3.' Should be Figure 3 and 4, correct?
- Figure 5 How do Hs and surge maxima look like in the climatology? Would probably also show the benefit of the high resolution in UK4.
- Figure 8 Add blank between HP and max in (b)