

Review of

Sources of 21st century regional sea level rise along the coast of North-West Europe

By Howard et al.

This paper describes and quantifies the different (main) contributors to changes in extreme sea levels along the densely populated coastline of North-West Europe. The authors focus on the A1B emissions scenario and use primarily projections from process-based models. The work presented is very interesting and highly relevant to researchers from various disciplines including coastal managers and planners. The results highlight that many distinct physical processes may affect future changes in extreme sea levels other than global mean sea level rise alone (which is unfortunately often the only contributor considered in deriving design parameters for coastal structures with anticipated life-times of up to 100 years). For some of the contributors the authors rely on results from earlier studies but tie this in with new results which have been developed particularly for the present work. The applied methodology is sound and the text is well written and (once familiar with the many abbreviations) easy to read. Overall, I have a favorable view on the manuscript and no major objections to publish it with Ocean Science. I provide some minor comments below which should be taken into account before the paper is ready for publication. Several of these comments are related to potential changes in the ocean tides, one of the most important components of extreme total still water levels in the North Sea and not mentioned in the manuscript.

p. 2434, l. 7: storm surge is a better and more widely used term than storm tide

p. 2434, l. 26: ...in the rates of...

p. 2435, l. 27: Here, and at several other places in the manuscript 'storm' is used synonymously with 'storm surge'. The focus in this study is on changes in the 50yr storm surge height (not the 'storm height' or the height of a storm). Please check the manuscript and change where necessary.

p. 2436, l. 20: In a recent paper, Mudersbach et al. (Trends in high sea levels of German North Sea gauges compared to regional mean sea level changes, Cont. Shelf Res.) the authors show that in the south-eastern North Sea, a region that is part of the investigation area of the present study, changes in mean and extreme sea levels have been different throughout the second half of the 20th century. These differences are partly a result of changes of the tidal constituents.

p. 2437, l. 2: avoid the term 'absolute sea level' and use 'geocentric' instead

p. 2437, l. 6: NW has not been defined

p. 2437, l. 15: There are other factors that might influence storm surge statistics but are not included in the study: tides (see my comment above and for example Woodworth (2010): “A survey of recent changes in the main components of the ocean tide” or Müller et al. (2011): “Secular trends in ocean tides: Observations and model results”), and also changes in the seasonal cycle (e.g. Wahl et al. 2014, Rapid changes in the seasonal sea level cycle along the US Gulf coast from the late 20th century). These should at least be mentioned for completeness.

p. 2437, l. 11: above it was Northwest and NW and North-West in the title, this should be consistent

p. 2437, l. 23: Even if it is a side note in brackets, I would try to make it a real sentence, e.g. (the masked region is shown in Fig. 2; the values are very similar when using a masked region of half this width)

p. 2439, l. 19: Pickering (2012) (for example) showed that SLR leads to an increase in the tidal range, which in turn affects total storm surge water levels. Does the model run conducted for the present study implicitly include this effect or is it run without tidal forcing?

p. 2440, l. 1-5: What is the time period covered by the model experiment?

p. 2440, l. 11: The authors use the r-largest approach with $r = 5$, why exactly 5, is this decision based on any tests or on the available literature or randomly chosen?

p. 2441, l. 2: MME has been defined before (as multi-model ensemble)

p. 2441, l. 5: What is exactly meant with ‘local spatial mean’? It sounds weird.

p. 2441, l. 25: Are the values of 20 and 50 cm used for the entire region?

p. 2443, l. 13: In low agreement with what? With each other, with observations, or with process-based model projections?

p. 2445, l. 7: add comma before e.g.

p. 2445, l. 24: Delete ‘for the Dutch coast’, it’s mentioned in the sentence before.

p. 2445, l. 25: I would suggest using ‘Den Haag’ throughout the paper; people are much more familiar with that

Figure 1: At least in this figure I suggest showing lon/lat values; this makes orientation easier for people not so familiar with the region. Also, you mention a specific grid point (5°E, 55°N) somewhere in the manuscript, which cannot be found without this information on the axes.

Figure 4: I find the caption confusing. It says that the figure is “showing the 21st century change in 50 yr storm height”, whereas I think it shows the results from quantifying the contributions of different variables to changes in the total water levels associated with a 50 yr storm surge event.

Figure 5: Again, I would make the end of the caption a real sentence: Further details are explained in the text.