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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Very severe storm tides in the German Bight (North Sea) and their potential for enhancement" *by* Iris Grabemann et al.

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Synopsis

The paper investigates possible maximum water levels as resulting form storm surges along the German coast, and especially in the Ems estuary. From a large set of simulations (hydrodynamic model driven by atmosphere model output) the highest events are selected. These events are then re-calculated while changing the phase difference between astronomical tide and storm: What if the storm occurred a bit earlier or later during the tidal cycle? It is shown that a different timing of the storm could increase the water level by up to 0.5 m.

In a second, somehow unrelated, part the development of the water level in the Ems estuary is investigated, thereby including/excluding the existing surge barrier, taking river discharge into account, and increasing the mean sea level by 1 m. Not surprisingly, closing the barrier lowers the water level upstream of the barrier and slightly increases it downstream. River discharge has only a small impact as its volume is small compared to the volume of the estuary. A higher sea level (due to climate change) just adds up to the water level.

Discussion

"What is the highest possible water level due to a storm?" The paper aims to shed some light on this very important question. The authors do so by just shifting the phase between astronomical tide and storm. As the two are independent, the highest wind speed may occur at any moment during a tidal cycle, so by shifting them with respect to each other, one can investigate possible increases of water level without invoking any new physics or improved models. As a comprehensive hydrologic model is used, the (nonlinear) interaction between astronomical tide and storm surge is automatically accounted for. Although not completely new, this approach is a valuable contribution to our knowledge of high water levels.

Detailed comments

language The text should be proof-red by a native speaker.

punctuation A lot of sentences would be easier to understand if they contained some more commas, e.g., p 3, line 78/79: comma before *was used*; or p 5, line 127: comma before *in particular*.

title *Enhancement* means *an increase or improvement in quality, value, or extent*. I do not think that this is meant here. Simply *increase* might be more appropriate.

p 2, l 29 higher water levels - higher than what?

p 2, l 39-41 Please reformulate. I do not understand.

p 4, l 118-120 Are these CORDEX simulations? If so, please mention. I helps the reader to recognize these simulations.

p 5, l 151 *wind speed maximum* - where is the maximum taken? Does it matter, by the way? As far as I understand, you shift the astronomical tide with respect to the whole storm, don't you?

p 5, l 141 chain of events - this criterion should be explained in more detail. What does it mean? The maximum number of storms in a week? The longest storm? Successive storms from different directions?

p 6, bottom For model performance the reader is referred to earlier publications. Fine, but for most readers one or two general sentences about the model quality would remove the necessity to look up those papers.

p 7, l 207-208 the height of the gates was increased from 7 to 8 m in nature to 9 m. – I am confused about the height of the gates. Has the height of the real gates already been increased from 7 to 8 m? Or did you increase them twice in the model?

p 8, l 221 original simulated events – you mean the simulations without shift of lag between tides and storm?

p 8, l 226 Please specify the EC event – how does it look like?

p 8, l 246 15 cm, but previously you mentioned water levels of 3.93 m and 4.88 m, the difference of which is 95 cm. It's a bit confusing. Just reformulate the sentence, and it will become much clearer why the increase is only 15 cm.

p 9, l 158 by only *a* few centimeters

p 9, l 164-266 I do not understand what is meant here

p 11, ll 330 rises → raises

p 12, l 372 it's the *insert* in Figure 7 that you have to look at

p 13, l 411-413 hard to follow, please reformulate

p 14, l 446 last word: there → their

Fig. 3, caption line 3 the data set – which data set? Caption should be comprehensible without reading the main text

p 24, Figs. 7 and 8 the dashed lines (0 m, 1200 m^3/s, and 1 m, 1200 m^3/s) are not visible. Probably, they are covered by the respective solid lines. If so, please mention in the caption.

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