

# ***Interactive comment on “Coastal flooding: impact of waves on storm surge during extremes. A case study for the German Bight” by Joanna Staneva et al.***

**Joanna Staneva et al.**

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Received and published: 19 October 2016

Answers of the reviewers' comments

Reviewer #3

The manuscript presents a case study analysis of coastal inundation during an extreme extratropical storm event (Xaver) that made its land fall in northwest Europe December 2013), with a considerable impact in the North Sea. The central focus (and goal) of the paper is to show the goodness of having a wave model coupled to a surge model (or a regional ocean model). I consider this study useful and interesting, nevertheless I have some comments regarding the way the study and the results are presented. I make

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some suggestions regarding language, but the authors should read and correct the whole text, since the use of the English language is sometimes far from appropriate.

Authors: We are very thankful for the suggestions regarding the language. We completely agree and carefully revised our English language and grammar.

Abstract The abstract has several flaws that I suggest the authors should address. Please have in mind that the abstract should “survive” (or stand) by itself. Hence it should have concise but complete information so that an educated reader knows (or understands) what to expect in the text body. Please provide information about the models you are using in the abstract.

Authors: We agree and added more information about the model and major results to the Abstract.

P1-L13 (same in L21 and L23): Extremes? What extremes? Extreme storm event? Extreme sea level rise?

Authors: This has been changed to “Extreme storm events”.

P1-L21: replace “enhances significantly” with “is significantly enhanced” Authors: The suggested revision has been made.

P1-L23: replace “area” with “areas” Authors: The suggested revision has been made.

P2-L7: erase “the” before “ocean”. Authors: This sentence has been revised for clarity.

P2-L7: Regarding sentence starting with “The wind-induced...” why is this here? It seems disconnected from the rest of the text (although, of course, being a valuable statement). Authors: This statement has been revised for clarity.

P2-L8: sea surface or ocean surface (mixed) layer? I tend to look at the sea (ocean) surface as a skin layer. Please be clearer. Authors: This statement has been revised for clarity.

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P2-L13: add “a” before “circulation”. Authors: The suggested revision has been made.

P2-L16: I am afraid wave models are not earth system components. Regarding “. . . and further integrating of biogeochemical or morphologic parts” I don't get what you mean; could you please re-phrase it? Authors: The suggested revision has been made and the statements re-phrased.

P2-L20: instead of “wind boundary layer” (which doesn't exist or it is not a valuable geophysical statement) please use “lower marine atmospheric boundary layer”. All references here are from high wind speed regimes, when the highest (deeper) impact actually occurs during light winds and swell regimes. Consider adding some references regarding light winds regime. Authors: We added references regarding weak wind regimes to the introduction.

P2-L22 (and in several other parts of the text): add curly brackets on the years in the references. Authors: The suggested revision has been made.

P2-L26: what do you mean with “radiation stress approach”? Authors: We agree and this has been re-phrased in the revised manuscript.

P2-L27: what is a “practical analysis”. I am afraid this might not be a very scientific statement. Authors: This has been re-phrased in the revised manuscript.

P2-L28: what is “circulation for the ocean state”? Authors: The suggested revisions have been made.

P2-L30: the sentence starting with “The role of. . .” is lost here. No relation with before of after text. Authors: This sentence has been revised. This part is now the start of a new paragraph.

P3-L1: add “a” before “Lagrangian”. “Drift” what drift? Stokes? Wave induced? Authors: The suggested revision has been made. It was also re-phrased making the description clearer.

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P3-L3: replace semicolon with full stop and start new sentence afterwards. No need for this here (here and in other parts of the text). Authors: The suggested revision has been made.

P3-L7: it is a fact that storm surges are meteorologically driven, not a “well accepted” situation. It would be the same as saying that “it is well accepted that ocean surface gravity waves are wind driven”, or that “the thermohaline circulation is driven by water density differences”. Authors: We completely agree and have made the suggested revision throughout the manuscript.

P3-L11: correct tense of sentence starting with “IPCC. . .”. Authors: Following the suggestion of reviewer #1, we removed this paragraph from the introduction.

P3-15: please provide some more explanation on how waves and tides are amplified by the rise of sea level. Authors: More information and explanations are provided including additional references

P3-L16: “could” or “can”? Authors: We changed to “can”.

P3-L17: add “and” after “seawalls”; add “ocean” before “circulation”. Authors: The suggested revision has been made.

P3-L18: add a comma after “Bight”; replace “greatest” with “great”. Authors: The suggested revision has been made.

P3-L19: how can the forecast reduce the damage? Authors: The suggested revision has been made.

P3-L20: add “farms” after “energy”; replace “navigation” with “routing”. Authors: The suggested revision has been made.

P3-L23: sentence starting with “Further. . .” is confusing; please re-write. Authors: The suggested revision has been made.

P3-28: what are external waves? Authors: We corrected this typo mistake.

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P3- L30: replace “substantial” with “a considerable”; replace “for” with “in” Authors: The suggested revision has been made.

P4-L1: erase “cause”. Authors: The suggested revision has been made.

P4-L8: erase “as well as satellite data”; add “and remote sensing” after “in- situ”. Authors: The suggested revision has been made.

P4-L22: “outer model” or “outer domain”? Authors: We corrected this in the revised manuscript.

P4-L28: add “further details.” after “2016)”. Authors: The suggested revision has been made.

P5-L15: “action density” or “wave energy density”? Authors: We modified to “wave energy density”.

P5-L21: there is no “S” in the rhs of equation (2). Authors: The source terms  $S = S(\sigma, \theta, \varphi, \lambda, t)$  on the right hand side of the equation (2) is the net source term expressed in terms of the action density. It is splitted as the sum of a number of source terms representing the effects of wave generation by wind ( $S_{wind}$ ) quadruplet nonlinear wave-wave interactions ( $S_{nl4}$ ), dissipation due to white capping ( $S_{wc}$ ), bottom friction ( $S_{bot}$ ) and wave breaking ( $S_{br}$ ).

P6-L9: “wave motion” is too broad; please provide additional explanation Authors: We agree and provided more explanation including additional references at the end of Section 2.4.

P6-L27: add “wave model” after “by”; the WAM model doesn't “give” data!; all this sentence is inaccurate from a wave model standpoint. Authors: The suggested revision has been made.

P7-L2: add “of” before “GOTM”. Authors: The suggested revision has been made.

P7-L10: replace “causing” with “that caused”. Authors: The suggested revision has

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been made.

P7-L19: replace “has” with “had”. Authors: The suggested revision has been made.

P8-L19: erase double punctuation. Authors: erased.

P9-L5: replace “As an example we present” with “As can be seen in”. Authors: The suggested revision has been made.

P9-L12: sentence starting with “The standard. . .” is confusing; please consider re-writing. Authors: The suggested revision has been made.

P9-L15: “low”?, how much?; replace “analysis on” with “the analysis of”. Authors: “low” was substituted with a quantitative measure, the phrase has been replaced.

P9-L28: you have defined Hs before, hence erase “significant wave height”. Authors: The suggested revision has been made.

P10-L28: replace “demonstrate” with “show”; maybe this reduction should be quantifies here. Authors: The suggested revision has been made. The reduction is quantified and this is demonstrated in Table 2.

P11-L14: reached or reaching? Authors: This sentence has been revised for clarity.

P11-L30: replace “their” with “its”. Authors: The suggested revision has been made.

P12-L3: erase “with”. Authors: The suggested revision has been made.

P12-L17: add “to be” before “important”. Authors: The suggested revision has been made.

P12-L30: correct the tense of the verb. Authors: The suggested revision has been made.

P13-L4: “North-Frisian Wadden Sea” is this correct? Authors: Yes the term “North-Frisian Wadden Sea” can be used also for the North Frisian Islands which a group of islands in the Wadden Sea, a part of the North Sea.

P13-L5: “is due. . .” how do you know? Authors: The suggested revision has been made.

P13-L6: replace “of the” with “to the”. Authors: The suggested revision has been made.

P13-L29: models only could be inappropriate. . .” wrong tense; please re-write. Authors: The suggested revision has been made.

P14-L2: replace “is” with “are”. Authors: The suggested revision has been made.

P14-L3: add “the” before Nederland”. Authors: The suggested revision has been made.

P14-L6: sentence starting with “Recently. . .” is confusing; consider re-writing. Authors: The suggested revision has been made.

P14- L22: replace “with” with “to”. Authors: The suggested revision has been made.

P14-L30: replace “the coastal area” with “coastal areas”. Authors: The suggested revision has been made.

P14-L30: replace “know” with “understand”. Authors: The suggested revision has been made.

P14-L31: “risks and losses”? What do you mean?; replace “increases” with “has increased”. Authors: This sentence has been revised for clarity.

P15-L1: sentence starting with “Although. . .” is confusing; consider re-writing. Authors: The suggested revision has been made.

P15-L4: what “leads”? Authors: This sentence has been revised for clarity.

P15-L6: replace “has” with “have”. Authors: The suggested revision has been made.

P15-L7: replace “cause” with “causes”. Authors: The suggested revision has been made.

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P15-L9: erase “the”. Authors: The suggested revision has been made.

P15- L18: sentence starting with “Nowadays. . .” is confusing; consider re-writing.  
Authors: This sentence has been revised for clarity.

P15-L24: replace “satellite” with “remote sensing”; which products?, please be more specific. Authors: This sentence has been revised for clarity.

P15-L27: add “have after “We”; add “the” after “that”. Authors: This sentence has been revised for clarity.

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2016-227, 2016.

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