

Interactive comment on “Wave climate in the Arctic 1992–2014: seasonality and trends” by Justin E. Stopa et al.

Anonymous Referee #2

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Review of Manuscript tc-2016-37: “Wave climate in the Arctic 1992-2014: seasonality and trends”, submitted by Stopa et al.

Recommendation: Minor to moderate revisions

The manuscript presents a climatology of the wave climate in the Arctic Ocean, for the 1992-2014 period, based on a model hindcast, with buoy and remote sensing altimetry data supporting it. I consider this study as very useful since it addresses a hot topic, regarding the ice cap reduction and the increased open water where waves can be generated. I have some comments and some suggestions that fall into the “minor revisions” category; nevertheless there might be some work ahead. I must admit that I am not satisfied with the writing style. I believe that the first author is an English native speaker, but nevertheless scientific writing has rules and codes that need to

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be followed so that the message is properly conveyed and understood. That goal in my opinion is not met, since the style is for most of the times too loose leaving the message hard to understand. The figures captions “suffer” from the same “problem” and are far from complete. For example Figure 1 caption reads: “Regional seas of the Arctic Ocean colors respond to depth and buoy locations are plotted in magenta”; when it might be more complete “Regional seas of the Arctic Ocean, with bathymetry (background contour) and buoy locations (magenta signals)”. By the way, consider changing the magenta to another color since it is very hard to see against orange. Also consider adding black lines to the contour, since from 0-500 m is almost impossible to distinguish. The “problem” with Figure 1 caption is transversal to almost all captions, hence the authors should consider revising them where appropriate.

I would like to see the manuscript again.

Specific comments:

P1-L15: “moderates” or “modulates”. Either might need revision, since the role of sea ice in the climate system is one of many. P2-L3: replace “manuscript” with “study” (here and hereafter in the text). (It is a manuscript, but it will hopefully be a paper...) P2-L5 (and in the remainder of the paper): you have to be careful with the term “Nordic Seas”. Nordic Seas are, to be precise, the passage from the Atlantic to the Arctic Ocean, and comprise the Greenland and the Norwegian Seas. As far as I understand Semedo et al. (2014) has a different geographic span for the Nordic Seas. P2-L11: “can” or “need to”? P2-L18: delete “from” before “derived”. P2-L19: sentence starting with “The continuous” is confusing; consider re-writing, please. P2-L20: this sentence needs to be revisited, since it is confusing and not correct. Era-Interim is not a wave hindcast but a wave reanalysis itself, since it is produced with a wave-atmosphere coupled model system (the IFS), with data assimilation. You can find more information about ERA-Interim in Dee et al. (2011) in your reference list. You need to correct the references to Era-Interim as a wave hindcast here and in the remainder of the text. P2-L32: replace “give” with “provide”. P3-L1: it is not clear in this section the horizontal resolution

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of the final hindcast nor the resolution of the intermediate hindcasts. Where the wind fields interpolated and how? P3-L2: add “oceans” before “basins”. P4-L4: “validation and observations”; “confusing re-write, please. Models are not validated but evaluated. Consider re-writing here and in the remainder of the text. Sentence starting with “Satellite” is confusing, consider re-writing. P4-L14: “evolves” or “resolves”? P4-L30: replace “average” with “mean”. You have to define the n-th spectral moments or refer to a cited publication (some of the ones in your reference list could do the job well). If m_0 is the zero-th moment then what is m_2 ? You might want to explain why you are using for mean wave period T_{m02} (justify your choice). P5-L31: and “the” and “in” after and before “hindcast”, respectively. P6-L6/7: “generalize sea ice”? P6-L8: the Nordic Sea comprises the Greenland and the Norwegian Seas; hence this statement needs to be made clearer; see comment above. P6-L15: what do you mean here with “exposure to the atmosphere”? P6-L17: add “seasons” after “extremes”. P6-L20: you have to be more precise and accurate: wind waves are a broad concept that usually comprises all wind generated waves (wind waves = surface gravity waves); hence here you mean wind sea waves, no? I believe you make this type of mistake further in the text, so please check. P6-L21: “waves”? Do you mean wind sea wave heights? Be more precise please. P6-L22: how do you know these waves are generated in the basin? P6-L29: replace “flow” with “propagate”. P7-L1: add “mean wave” after “swell” (do the same in the remainder of the text). “storm phases”; what do you mean? P7-L3/4: how do you access the wind sea vs. swell percentages? In which figure(s) can you see this? P7-L9: what do you mean with “corresponding”? P7-L14: sentence starting with “The wave” is confusing; please re-write. P7-L15: sentence starting with “The directions” is confusing; please re-write. Directions of the median? What do you mean? What are the “directions of the median”? P7-L22: suggest deletion of sentence starting with “The percentiles”. Why this statement here? Maybe move it to the discussion section... P7-L25: replace sentence starting with “With the” with: “With the loss of sea ice wave heights are expected to increase”. P8-L2: replace “shows” with “show”. P8-L16: “cs” or “cm/s”? P8-L30: why bring in the southern ocean index

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here? Correlations of what with what? P9-L11: erase “the” after “decreasing”. P9-L13: add reference(s) after processes. P9-L31: replace “creates reduced” with “leads to a reduction of”. P10-L16: this is most probably a polar low; please confirm and correct accordingly. P10-L28: erase “the” before “waves”. P10-L29: erase “the” before “wave”; replace “model” with “models”. P10-L31: “present wave models”? Should it be “as presented (or as parameterized) in present wave models”. P10-L32: you are not comparing the hindcast Hs output with the altimeters but with the “altimeter Hs observations”, no? P11-L22/29: This paragraph seems, to me, speculative. Or the message the authors want to convey need to be made clearer. Where can we see that “the NAO influences the Nordic-Greenland Sea and it is expected to create the negative trend in U10 and Hs which is unique to the rest of the Arctic that has positive trends”. (???) (1) The authors need to add (or replace) to their climate index study the Arctic Oscillation, which is related to the NAO, but plays a much greater role in the higher latitudes. (2) The Nordic-Greenland Sea does not exist; see comment above. (3) The positive and negative phases of the NAO play different roles in the area, and that is never mentioned or dealt with. P12-L7: replace “. And” with “; and”, and erase “as important sea ice driver”. P12-L9: add some references after “studies”. P12-L10: replace “use a” with “used as a”. P12-L11: “climate conditions”? What do you mean? How will your study influence or be a basis for “future climate conditions”? Do you mean “future climate studies”? P12-L11: “the seas” or the “sea states”? P13-L3: replace “is with “was”; add “forcings” after “ERA1”. P13-L4: replace “buoys and altimeters” with “buoy and altimeter observations”. P13-L8: “ground truth”; wave buoys have errors as well. In situ observations are, in principle, the most accurate, but they are not the ground truth”. They might be the close we can get to that, but they are not that. Please consider re-writing. P12-L23: what do you mean by “same pattern”? P12-L24: The Era-Interim is not a model. P13-L1: what do you mean by “creates a correlation”? P14-L3: what do you mean with “residuals”? P14-L4: I get the impression that you are referring to ERAI and CFSR but you mean your hindcasts forced by Era-Interim and CFSR winds, isn’t that so? This should be made clearer because here and in the main body of the

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text is a major source of confusion. P17-23: correlations of what with NAO and PDO?

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