

Responses to Reviewers' Comments for Manuscript

EGUSPHERE-2024-3713

**The future North Atlantic jet stream and
storm track: relative contributions from sea
ice and sea surface temperature changes**

Addressed Comments for Publication to

Weather and Climate Dynamics

by

Daniel Köhler, Petri Räisänen, Tuomas Naakka, Kalle Nordling, and

Victoria A. Sinclair

Dear Prof. Silvio Davolio,

Please find enclosed the revised version of our previous submission entitled “The future North Atlantic jet stream and storm track: relative contributions from sea ice and sea surface temperature changes” with manuscript number EGUSPHERE-2024-3713. We would like to thank you and the reviewers for the valuable comments which helped improving the quality of our manuscript. In this revision, we have carefully addressed the reviewers’ comments. A detailed point-by-point response to the comments from Reviewers 1 and 2 (following the reviewer numbers in the MS records) are given below. We would like to bring to the editor’s attention that we have modified the acknowledgments during this revision. We added, ‘We thank the two anonymous reviewers for their constructive comments that helped to improve the manuscript.’

Sincerely,

Daniel Köhler, Petri Räisänen, Tuomas Naakka, Kalle Nordling, and Victoria A. Sinclair

Note: To enhance the legibility of this response letter, all the editor’s and reviewers’ comments are typeset in boxes.

Authors' Response to the Editor

General Comments. Please ensure that the colour schemes used in your maps and charts allow readers with colour vision deficiencies to correctly interpret your findings. Please check your figures using the Coblis – Color Blindness Simulator (<https://www.color-blindness.com/coblis-color-blindness-simulator/>) and revise the colour schemes accordingly with the next file upload request. -> Fig. 4

Response: We appreciate your handling of the review process and apologise for the inconsistency with the guidelines for accessibility.

The colour schemes in Fig. 4 and Fig. 14 were adjusted to account for colour vision deficiency. Additionally markers were added in Fig. 4.

Authors' Response to Reviewer 1

General Comments. Review of the manuscript "The future North Atlantic jet stream and storm track: relative contributions from sea ice and sea surface temperature changes" Daniel Köhler, Petri Räisänen, Tuomas Naakka, Kalle Nordling, and Victoria A. Sinclair submitted to WCD (WCD-2024-3713)

I very much appreciate the efforts made by the authors to improve the manuscript, and the very careful and detailed responses to my comments from the last round of review. In particular i value the improved tests of the statistical significance and the related discussions, the shortening of the descriptive part of the manuscript, the inclusion of the discussion section 7 and the improved conclusions.

Response: We thank the reviewer for their constructive comments and are pleased to hear that the reviewer is positive about the improvements to the manuscript.

Minor comments

Comment 1

Although the the descriptive part of the manuscript (sections 4 to 6) has been shortened, it is still long. I would like to ask the authors to prove further shortening, in particular in section 6.

Response: We tried very hard to shorten section 6, however, it proved to be very difficult to do without omitting results, which in our opinion, are of interest to the scientific community. Originally, reviewer 2 also asked us to shorten the manuscript and is now satisfied with the length of results section after the first revision.

We have shortened section 6 by 4 lines, which results in the draft format of section 6 being now only just over 2 pages long.

Comment 2

L44-46: "Smith et al. (2022) showed that models tend to underestimate responses of mid-latitude tropospheric zonal wind due to changes in SIC when constrained by observations of the eddy momentum feedback." Please check this, i understood from the paper, that by using the observed eddy momentum feedback (which is larger than in the climate models) to scale the zonal wind responses in the models results in an increased ensemble mean zonal wind response.

Response: We thank the reviewer for pointing out the inconsistency with Smith et al. (2022).

We reformulated the sentence to reflect the intended meaning - that the tropospheric zonal wind response in climate model is likely to be underestimated as the eddy momentum feedback is too weak in climate models compared to observations.

We changed 'Smith et al. (2022) showed that models tend to underestimate responses of mid-latitude tropospheric zonal wind due to changes in SIC' when constrained by observations of the eddy momentum feedback.' to 'Smith et al. (2022) showed that models tend to underestimate responses of mid-latitude tropospheric zonal wind due to changes in SIC as the eddy momentum feedback is too weak in climate models compared to observations.'

Comment 3

L63: I suggest to also include Ogawa et al., GRL (2018) <https://doi.org/10.1002/2017GL076502>.

Response: We have added Ogawa et al. (2018) in the citation of previous studies conducting simulations with prescribed SST/SIC.

Comment 4

Table 1: I appreciate the table and respective description, but i suggest to skip the SSP 1-2.6 simulations in the table and the text, since they have not been analyzed in the manuscript.

Response: We appreciate the comment of the reviewer, and understand the suggestion to streamline the table and respective description. However, we consider the information about full extent of simulation data set important. It helps to motivate why the study focusses on an extreme warming scenario. The main reason is to allow for an improved detection of sea-ice loss signals. Additionally, the table and text inform the reader about the availability of a data set with a scenario similar to the PAMIP.

Comment 5

L684-685: sentence is not complete.

Response: Thank you for pointing this out. We changed 'Moreover, as this study investigates the mean changes to extratropical cyclones, further work on extreme cyclones and associated extreme events of wind and precipitation.' to 'Moreover, as this study investigates the mean changes to extratropical cyclones, further work on extreme cyclones and associated extreme events of wind and precipitation **is necessary.**'

Authors' Response to Reviewer 2

General Comments. I am happy with the work the authors have put in to revising their manuscript. In particular, the efforts made to place this work in to better context and to strengthen the statistical testing are big improvements. I have very minor, mostly only technical comments, otherwise I am happy for this manuscript to be published.

Response: We thank the reviewer for their comments and are pleased to hear that the reviewer is positive about the improvements to the manuscript.

Minor comments

Comment 1

L69-70. Unclear. What do you mean by 'current' uncertainties? It is also not clear what 'This' at the start of the next sentence refers to. 'us' missing after permits.

Response: We deleted the word 'current'. The following sentence starting in 'This' was reformulated to reflect that studying the underlying physical mechanisms are enabled by the high frequency output of a wide selection of variables.

We changed 'This is enabled by high output frequency of a wide selection of atmospheric variables, which permits to examine the underlying physical mechanisms and identify structural differences in physical mechanisms of the response to projected SIC and SST across the selected models,' to 'Enabled by high output frequency of a wide selection of atmospheric variables, the CRiceS simulations permit to examine the underlying physical mechanisms and identify structural differences in physical mechanisms of the response to projected SIC and SST across the selected models.'

Comment 2

L112. Have showed -> either have shown or showed

Response: We changed 'have showed' to 'have shown'.

Comment 3

L139-140. It's been shown before that not changing SSTs where ice is lost has a minor effect (Singarayer 2006, Deser et al 2010), and it also sounds like the resulting non-linear interactions are arising from that, but I don't think that's what the authors mean to imply.

Response: We clarified that the non-linear interaction arise from changing SSTs and sea ice cover simultaneously. We also inform the reader that the lacking increase in SSTs where sea ice is remove is a minor effect contributing to the differences between ΔFT and $\Delta SST + \Delta SIC$. We included references to earlier studies (Singarayer et al., 2006; Deser et al., 2010).

We changed 'The differences arise from the lack of the effect of changed SSTs where sea ice is removed and resulting non-linear interactions' to 'The differences arise from the non-linear interactions when SIC and SSTs are changed simultaneously. Furthermore, in the SIC simulations, when sea ice is removed SSTs are not changed. The lacking change in SSTs in these locations contributes to the differences, but it has been shown to be a minor effect (Singarayer et al., 2006; Deser et al., 2010).'

Comment 4

L150. no need to capitalise Figures.

Response: We changed 'Figures' to 'figures'.

Comment 5

L330: I think there's a word missing after DeltaSST

Response: The sentence refers to the SST and SIC response in OpenIFS-43r3. The SIC response was missing. We changed 'The ΔSST of zonal wind speed cross-section from the OpenIFS-43r3 simulations are shown in Figure 8a.' to 'The ΔSST and ΔSIC of zonal wind speed cross-section from the OpenIFS-43r3 simulations are shown in Figure 8a and 8b.'.

Comment 6

L336. 'of jet core' -> of the jet core

Response: We changed 'of jet core' to 'of the jet core'.

Comment 7

L393: 'does not show any significant changes' -> is not significant

Response: We changed 'does not show any significant changes' to 'is not significant'.

Comment 8

L398. Last sentence is repetitive

Response: We deleted the repetitive sentence.

Comment 9

L399 & elsewhere: I think 'dominant' rather than 'dominating' is what is meant.

Response: We changed 'dominating' to 'dominant'.

Comment 10

L437. where -> with

Response: We changed 'where' to 'with'.

Comment 11

L473. delete 'is' between which and corresponds.

Response: We deleted the 'is' between which and corresponds.

Comment 12

L594 unfinished sentence

Response: Thank you for pointing this out. We changed 'Moreover, as this study investigates the mean changes to extratropical cyclones, further work on extreme cyclones and associated extreme events of wind and precipitation.' to 'Moreover, as this study investigates the mean changes to extratropical cyclones, further work on extreme cyclones and associated extreme events of wind and precipitation **is necessary.**'

References

- Deser, C., R. Tomas, M. Alexander, and D. Lawrence (2010). “The Seasonal Atmospheric Response to Projected Arctic Sea Ice Loss in the Late Twenty-First Century.” EN. In: *Journal of Climate* 23(2), pp. 333–351. DOI: 10.1175/2009JCLI3053.1.
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- Singarayer, J. S., J. L. Bamber, and P. J. Valdes (2006). “Twenty-First-Century Climate Impacts from a Declining Arctic Sea Ice Cover.” In: *J. Climate* 19(7), pp. 1109–1125. DOI: 10.1175/JCLI3649.1.
- Smith, D. M., R. Eade, M. B. Andrews, H. Ayres, A. Clark, S. Chripko, C. Deser, N. J. Dunstone, J. García-Serrano, G. Gastineau, et al. (2022). “Robust but weak winter atmospheric circulation response to future Arctic sea ice loss.” en. In: *Nature Communications* 13(1), p. 727. DOI: 10.1038/s41467-022-28283-y.