

Weather Clim. Dynam. Discuss., referee comment RC1  
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## Comment on wcd-2021-44

Anonymous Referee #1

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Referee comment on "Characteristics of extratropical cyclones and precursors to windstorms in northern Europe" by Terhi K. Laurila et al., Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2021-44-RC1>, 2021

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### General Comments

The paper uses the ERA5 reanalysis dataset to obtain 40 years worth of Lagrangian meteorological fields for extratropical cyclones crossing into Northern Europe. Since the paper uses a new reanalysis data set to examine extratropical cyclones and their precursors over Northern Europe, it is novel. I find the composite results interesting and useful not only for specialists in the field, but also for a more general audience.

In the paper, composite analysis is used to characterize and understand Northern European extratropical cyclones, while ensemble sensitivity analysis is used to find correlations between precursor fields and the selected response functions: Minimum Mean Sea-Level Pressure (MSLP) and 10m wind gusts. Four precursor fields were selected: 850 hPa potential temperature, total column water vapor, and 300 hPa wind speed and potential vorticity. Regressions were computed for 1, 2, and 3 days before extrema in MSLP and 10m wind gusts.

The results are presented in a series of 18 figures that are legible, well-labeled, and generally of a high quality. Some notable results in the context of cyclones affecting Northern Europe include; no significant trends in cyclones were found over the 1980-2019 period; summer cyclones are less intense than winter ones; 1995-2005 lull in cyclone activity, which can be attributed to anomalously lower numbers of windstorms over the period; windstorms are more common in the winter; overall, numbers of cyclones do not show an appreciable seasonal cycle over Northern Europe; windstorms have distinct genesis regions compared to non-windstorm cyclones; windstorms preferentially genesis over the sea while non-windstorms that affect Northern Europe genesis over Northern Europe; summer tracks are further poleward than winter tracks, and summer cyclones live longer.

The paper reads well, and it also establishes the scientific relevance of the study well. The paper also embeds its results in the established literature. I can recommend this paper for publication after some major revisions are made.

### Major Comments

While the nature and characteristics of extratropical cyclones are of interest to practitioners and specialists in the field, I found the ensemble sensitivity part of the paper quite weak. The paper makes causal inferences when the method as is does not support causal inferences. The causal inferences from the Dacre et al., 2019 study were valid because the authors isolated the precursor fields from the effects of the cyclone itself before the regression. In the present study, all that can be said is that stronger baroclinic and moisture conditions in a developing cyclone are associated with stronger maximum cyclones. When put like that, the results of the ensemble sensitivity analysis don't seem as exciting. Thus all causal inferences (like L328 or L339-L342) should be removed prior to publication. Changing "leads to" or "causes" to "is associated with" may address this problem, but a broader rethink of how the method is used could lead to a far superior manuscript.

### Minor Comments

Figure 2 a,c,e: Make the origin non-zero so that the bars aren't unusually long and so that the variation among bars, not length of bars, is emphasized.

Figure 3: Label the y-axis in the figure.

L209: A citation is required for the Mann-Kendall reference.

L210-211: I would end the discussion at no statistically significant trend was found because this line reads as if the experimenter is beholden to a particular finding.

Is there any explanation for the drop in windstorms between the years 1995 and 2000?

Section 6. It may be helpful to indicate the direction of cyclone propagation on figures 7 and 8 (left to right?).

L322: This causal statement does not follow from the results presented.

L325: This causal statement does not follow from the results presented.

L326: This causal statement does not follow from the results presented.

L329: This causal statement does not follow from the results presented.

L337: This causal statement does not follow from the results presented.

L357: This causal statement (and the others that follow) does not follow from the results presented.

L430: less -> fewer

L456: Sentence unclear