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Interactive comment on "Simulated and observed horizontal inhomogeneities of optical thickness of Arctic stratus" *by* Michael Schäfer et al.

Anonymous Referee #3

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Review of the article titled "Simulated and observed horizontal inhomogeneities of optical thickness of Arctic stratus" by Schafer and coauthors in the Atmospheric Chemistry and Physics.

The authors have used the data collected during the VERDI field campaign to derive optical thickness of mixed phased clouds. Then they have used the COSMO model to simulate the observed clouds with a goal of determining whether the model is able to simulate the observed inhomogeneity of cloud field and why. They conclude that the differences in the observed and simulated cloud fields are mostly due to differences in the wind speeds. The manuscript is well-written and will be of interest to the general meteorological community, and especially to those studying mixed-phase clouds. Below are some of my concerns regarding the manuscript.

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Discussion paper

Major Issues: The introduction is too long. Even after reading the second page, I am not sure why we should worry about the inhomogeneity in the cloud radiation properties aka optical depth. Is it because we need better sub-grid characterization of radiative properties in global climate models? It will be better if the authors explicitly state the specific objective of the study.

It is unclear why you chose wind speed as a tuning parameter. By increasing wind speeds you are simple changing the fluxes in the boundary layer and hence the turbulence. So essentially your results are suggesting that we greater turbulence produces higher inhomogeneity, which makes sense. It will be better if the authors can probe this. One way to tackle this would be to make some simulations where the winds are the same, but you increase the surface fluxes.

Lastly, the authors should show the comparison between the model reported liquid water paths, and cloud boundaries with those observed during the campaign. I think this will make the article complete. Thanks.

Minor Issues:

Line 58: Need reference to justify that sentence.

Line 101-102: I would simply say that the cloud fraction decreased. The word "dissolved" seems inappropriate in terms of clouds.

Line 121: By "ten fields" I believe you mean ten snapshots?

Section 3.1: Please describe the radiation and cloud schemes used in the model. Since you are evaluating optical depth, which is a radiative property, it is important to know this. Also mention how often the two schemes are talking to each other. Thanks.

Line 273-279: Please rephrase these sentences. It is confusing to read "large resolution" etc. thanks.

Figure 5e and 5f: There is no "grey dotted line" in the plot.

Figure 7a: the plot is showing mean and standard deviation, however there are two blue dots for each resolution? If you are showing mean+std and mean-std, then I suggest you show vertical error-bars.