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Discussions

Interactive comment on "Effect of retreating sea ice on Arctic cloud cover in simulated recent global warming" *by* Manabu Abe et al.

Anonymous Referee #2

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Overview Overall, there are some interesting climate connections and feedbacks eluded to in this manuscript. Unfortunately, the major deficiency lies in both the conclusions drawn and their communication. I agree with previous reviewers that the additional analysis has improved the paper substantially, but feel it is tacked on (which I guess is technically true as it's the entirety of the Appendix). This is great work and a nice analysis, but this manuscript needs major revisions before it should be accepted for publication in ACP.

Major comments First and most importantly, there is too much narrator-like reporting of model output. While necessary, this should not be the focus of a paper of this nature. A more appropriate approach would be to describe the climate relationships and features of the model first, and then use figures to support your statements. This is especially true for the Results section, which as is is a difficult read.

Secondly, I feel that the emphasis should be shifted from MIROC model output to the lead-lag correlation analysis and the sensitivity simulations currently included in the Appendix. These are the most compelling aspects of this paper but are overshadowed by an overabundance of standard model output discussion. My suggestion is to move the lead-lag and correlation analysis to its own section. I feel that the sensitivity results should also be in the main body. After a brief introduction on how the model performs compared to observations, then discuss the correlation between sea ice and cloud fraction, and finally reinforce those correlations with results from the sensitivity analysis.

Minor comments -The Introduction is often redundant due to organizing the discussion by "data type". This way, each process is discussed multiple times but from different perspectives, leading to reader confusion about what the actual state of knowledge on sea ice – atmosphere interaction is. For example, Schweiger et al., 2008 shows up multiple times in the introduction, sometimes in agreement and sometimes not.

-Nearly every paragraph starts with "Figure X shows...", leading to a figure-driven discussion. While this nicely walks the reader through the figures, it requires themselves to make the connections between the climate components.

-There is a lot of discussion of low-cloud versus total cloud. This tends to be confusing, but am also skeptical of climate models ability to delineate these different cloud types.

-Figures 4 is the most compelling result of the main text. As such, I would split it into two, separating the autocorrelation and the sea ice-cloud correlation, and give this analysis its own section in the paper. Similarly, Figure 6 and the attending text is a very nice result but currently somewhat buried.

-For myself, Figures A1 and A2 are some of the most interesting of the paper. Really try to get these featured more prominently (and definitely in main text).

Specific comments Page 1 Line 17: "not a minimum" – more precise language needed

Page 3 Line 6-7: "Therefore . . ." – many sentences in the introduction take the form "the

disagreement in the literature imply we don't know anything and need more studies", but only one is needed.

Page 3 Line 16-17: "... enhanced DLR..." – is there a reference for this?

Page 4 Line 4-5: "Recent ship observatins..." - is there are reference for this?

Page 6 Line 14: "...divided..." – this sentence is not clear. How are they divided? Spatially? Categorically?

Page 6 Line 21-26: "Historical..." - each of the first three sentences start exactly the same.

Page 7 Line 10-23: I feel like this paragraph and some of the next do not fit in the Results section.

Page 9 Line 6: "agrees" – in what way does this agree with the cited studies?

Page 9 Line 22: "narrow" – what do you mean by this?

Page 10 Line 3: "(not shown)" – all of these "not shown"s are fine if they are a natural part of the story, but as is these only muddle the message by referring to unimportant model results.

Page 11 Line 23: - this lead/lag result is nice finding and a highlight of the paper but here is buried at the end of a paragraph!

Page 13 Line 7: "delta ai+" - this nomenclature is confusing. A more wordy alternative might be appropriate. Also, the explanation for these two metrics can be clarified.

Page 14 Line 22: This discussion of the lapse rate is quite lengthy and really only making a few points. You don't need to discuss every detail of the model results. In fact it detracts from the paper. Your job as author is to interpret your results and then distill your findings down for the reader.

Page 14 Line 24: "lapse rate of specific humidity" – is this a real thing?

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Discussion and Summary: This section is quite nice. It also reads well. This is a good model for the other sections.