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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Summer Sea Ice Albedo in the Arctic in CMIP5 models" *by* T. Koenigk et al.

Anonymous Referee #1

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This manuscript is concerned with the comparison of Arctic sea ice observed in the satellite record (CLARA-SAL) with Arctic sea ice simulated by the various GCMs in the CMIP5 GCM model comparison. There is some general comparison for surface albedo, sea ice concentration, and sea ice thickness. The manuscript then explicitly considers the albedo of just the ice covered portion of each grid cell for the two records. Comparisons are made that illustrate summertime trends in sea ice albedo between the observed satellite record and model record and that consider how surface air temperature and snow depth might control the albedo.

This work is relevant and timely. There is enough insight generated by the discussion of this comparison to warrant publication in ACP. The paper would benefit from increased clarity in the language, as noted in the detailed comments below. I recommend this paper be accepted for publication once the following minor issues are addressed.

One question that concerns the discussion throughout the paper involves comparisons made with the CMIP5 ensemble mean. If I understand correctly, this is the average over all of the models, and it is not clear to me why anyone would ever consider this average. Each ensemble run is based on the physics specified in that model, but the ensemble mean responds to no one single set of consistent physics. I think it misleading to consider comparison with this quantity.

To help streamline the title, I would suggest the authors consider renaming the manuscript "Summer Arctic sea ice albedo in CMIP5 models"

25221 L22-23: The wording of this sentence seems rather awkward. I can't tell whether it is merely stating something obvious, or whether there is something more important to be communicated here. It needs to be rewritten for clarity.

25225 L6-9: The authors refer to two cases of interest. It would be helpful if they stated which models are examples of the two points they make.

25225 L10: This is the only sentence in this paragraph?

25225 L15: As in earlier comment, it would be helpful to point out which models are the "few models".

25225 L22: This sentence is not clear, please rewrite.

25226 L18-20: "no clear relation between ice concentration and surface albedo across models"? I do not understand what this means. What was the correlation that was performed?

25226 L21: what kind of gradient? I assume it is "spatial gradient", but this is not specified. Also, this single sentence should not really be a stand-alone paragraph.

25227 L9: Is this 0.5 and 0.6 for grid cell albedo or ice albedo? What does "smaller spatial variations as in June and July" mean?

25227 L10-12: This sentence is not clear. I assume 0.3 and 0.75 are variations in

albedo, as in largest – smallest albedo over the basin, but it is not clear what is meant.

25227 L16: "the surface albedo depends substantially. . ." I don't think this is just a possibility, it is fact.

25227 L26-27: This sentence is not clear. Please rewrite.

25228 L6: "relatively high ice albedos"?

25228 L25-27: Please rewrite this sentence for clarity.

25229 L1: "less sensitively"

25229 L26-28: Why is this "not shown"? It would be very insightful to see this. Please consider adding this as a figure.

25232 L1: "Warren et al.'s results are. . ."

25232 L9, L11, L11: Three instances in this paragraph (also legend and caption, Fig. 10) where reference is made to "net surface solar radiation". I think these should be references to "net surface solar radiation flux".

25232 L20: "has also" should be "also has"

25232 L23: This paragraph describes what could be considered a chicken and egg problem. I can also think of reasons to suggest that areas with low ice concentration should promote lower ice albedo, although the discussion here makes it sound like lower albedo is thought to drive lower ice concentration.

25232 L24: "could show"? or "showed"?

25233 L3-4: I don't follow why models with extremely low ice albedo would tend to simulate thick ice (nor high ice albedo would promote thin ice). Hodson's comparison apparently included ice concentration, not just ice thickness.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 25219, 2013.