

Interactive comment on “Sunlight, Clouds, Sea Ice and Albedo: The Umbrella Versus the Blanket” by Donald K. Perovich

Anonymous Referee #1

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Review of the manuscript entitled ‘Sunlight, Clouds, Sea Ice and Albedo: The Umbrella Versus the Blanket’ by Donald K. Perovich

This is a well-written and concise manuscript that in a very simple and straightforward manner investigates the coupled effects of cloud radiative feedback and ice-albedo feedback on the Arctic Ocean surface radiation budget. Its strength is precisely the simplification that are made that help promote an understanding of the coupled sea ice - atmosphere system, and stimulates ideas for further research. However, these simplifications might result in a fundamental flaw in the interpretation of the results, and it is not clear how to directly translate these results into real-world situations which are dominated by variability. I think the basic problem is that conditions are considered constant, and averaged, over a 24h period, while in fact there are significant diurnal varia-

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tions, especially in the incoming shortwave radiation (see Fig. 2A), but also cloudiness. The interpretation of the 24h-averages is that sunny skies cause less melting of sea ice surfaces than cloudy skies. However, during a clear sky 24h period, the shortwave radiation would promote positive net radiation balance (surface warming/melting) during daytime, and a negative balance (cooling/refreezing) during nighttime. Such day and night differences would have repercussion on what the actual break-even and zero-net albedos would be. The largest melting would appear to occur during situations when the daytime was clear sky and the nighttime was cloud covered. I don’t think it would be so much more work to expand this discussion to include a basic consideration of diurnal effects, and it looks to me that the used dataset would support such analysis without too much added complexity. Furthermore, and I do not think it is necessarily needed to illustrate the point of the manuscript, is to expand it towards a more rigorous statistical analysis by incorporating more surface radiation balance datasets from various locations and time periods. There are quite a few such datasets.

Some specific comments:

Title: I would suggest including ‘radiative budget’ in some way in the title.

Abstract: This is a very short and ‘stoic’ abstract. If allowed by the journal, some more information and explanation could be included to make the abstract more self-explanatory.

page 1, line 25. In addition to cloud and albedo, there are also effects from the solar zenith angle. See e.g. Minnett (1999, doi:10.1175/1520-0442-12.1.147), which could be included as a citations in the manuscript.

Table 1. Instead of ‘na’, consider including the positive or negative ‘net zero albedo’ values.

page 5, line 15. ‘Net radiative cooling’. It would be good to clarify here and elsewhere that this is for a daily average.

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page 6, line 9. 'Five monthly pairs' is a very small dataset to justify Arctic wide conclusions.

page 6, line 22. From 'On the aggregate scale...' to the end of results: Consider moving this into the Discussion section.

page 7, line 3: 'Thus, sunny skies can delay the onset of melt in May and facilitate the onset of freezeup in September.' This general statement might need re-evaluation of diurnal effects are considered.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-47>, 2018.