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Interactive comment on "Brief communication: Antarctic sea ice gain does not compensate for increased solar absorption from Arctic ice loss" *by* Christian Katlein et al.

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General comments

In their brief communication, the authors focus on the surface short-wave balance in high latitudes. They use a new observational dataset (APP-x) to analyse trends over the recent decades and analyse the reasons behind these trends. I consider the format of a brief communication and the journal as a suitable choice to publish these results. Also, in the light of the large ongoing changes in the Arctic, the topic is of high relevance for science and the public. The general outline of the analysis is clear, and the relevant steps are explained.

However, I also see two major issues that in my opinion should be addressed before the paper can be published:

1. General motivation for this paper

I had some problems to understand the motivation behind this analysis. This is related to the fact that the authors aim to compare the hemispheres to each other. I am wondering why exactly the comparison of the hemispheres is useful or relevant. Is there anything we can learn about how the energy balance works? Or are there implications for predictions or other practical aspects? The analysis of trends in sea-ice albedo, sea-ice area (or extent) and cloud cover, and their combined effect on the short-wave (SW) absorption at the heart of this study. This is done individually for both hemispheres, and important differences are mentioned. The authors make the interesting point that SW absorption increases in the Southern Ocean, despite the slight increase in sea-ice area. To my taste, this could be communicated as the main result (if it is new) in title and abstract because it is much more straightforward than comparing hemispheres. Although the authors do not add energy balance terms from both hemispheres together, their wording sometimes suggests this. I suggest to not say that solar absorption in one hemishere "does not compensate" what is going on in the other hemisphere. I find this formulation confusing. I expect different effects at a certain location to be able to compensate each other, but not in two very remote regions that do not communicate directly. Another problem with the title is that it even suggests a comparison of two unrelated processes or units. This is of course not true but confronting "sea ice gain" in one hemisphere with "increased solar absorption" in the other hemisphere is unfortunate in my opinion. Alternatives for the title could be "Increasing short-wave absorption in southern high latitudes despite increasing sea ice area" or "Short-wave absorption is increasing over both of Earth's poles" or something similar. In general, the implications of this finding could be made clearer.

2. There seems to be a problem with the numbers, at least in Fig. 1b and the associated text. As pointed out in the interactive comment by W. Eschenbach, the short-wave

absorption values are not in agreement with other datasets. Some error might have been made in the calculations? The authors should correct it and check if their claims still hold.

Specific comments

1. Abstract: I think that it can be written more clearly (also see main comment 1).

2. Fig. 1: Also as pointed out by W. Eschenbach, the temporal evolution of the fluxes in Fig. 1b is surprising. I understand from Fig. 3 that despite the low sea ice in specific years, we cannot automatically assume a large peak in SW absorption in these years, mainly because of confounding effects of cloud cover fluctuations? However, I am also wondering about the peculiar oscillation-like pattern in the Arctic time series, with a rapid increase every 5 years, followed by an accelerating decrease. This pattern is repeated several times with increasing magnitude. The authors may want to check if this behaviour is real.

3. Fig. 3: The peaks in Fig. 3c seem to not coincide with those in Fig. 1b, or are at least shifted in time. For example, in Fig. 1b, 2000 is a year with low absorption in the Arctic and 2001 is a year with high absorption. But in Fig. 3c, both years have negative anomalies, whereas 2002 has a positive anomaly. Also, year 1994 is missing. I understand from the text why it is missing in the southern hemisphere, but it could be included in the analysis of the northern hemisphere.

4. What is the reason for the increased downwelling SW radiation over the Southern Ocean? The authors could elaborate a bit on the role of cloud cover. Is this signal expected in the light of anthropogenic climate change, or is it random (internal variability)? So, what could be expected for the future?

5. Methods: Why is it necessary to first calculate the cumulative absorbed energy in the whole region over one year and then convert it into fluxes again for the figures? The dataset already seems to contain fluxes. The potential calculation error mentioned

above may be related to this. Is there any good reason why the sea ice extent is defined differently than in other studies?

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