

**Review of « Albedo of the ice-covered Weddell and Bellingshausen sea » by A.I. Weiss et al., submitted to *The Cryosphere***

This paper presents and discusses aircraft measurements of the surface albedo along several flight tracks in the Weddell and Bellingshausen seas, in summer. Comparing albedo and surface temperature measurements, they show that the parameterizations of albedo commonly used in climate models don't work correctly in this region, especially in case of young, thin ice. They propose three linear relationships between albedo and surface temperature for three different areas in this region, corresponding to three "typical" sea ice conditions.

First of all, I must stress that I am not really an expert of sea ice albedo measurement and/or parameterization. Therefore, my comments have to be considered accordingly.

This paper is rather clearly written and, as field measurements of albedo over ice-covered seas in this region are scarce, these data are probably worth publishing. The main conclusion, i.e. the fact that classical albedo parameterizations don't work well in case of young, thin ice, seems quite reasonable (and, actually, not very surprising).

I have however some main concerns: to what extent these measurements performed along several flight tracks during two summers (2007 and 2008) are representative of the sea ice conditions (average as well as associated variability) in this region ? And, consequently, how these results can be used to improve our understanding of sea ice albedo and its parameterization in climate models ? In other words, to what extent the 3 temperature-albedo relationships proposed in table 3 can be used ? The fact that 3 different relationships are proposed for 3 different situations (defined on a geographical basis as well as on some loosely defined ice conditions) seems to be a first answer.

If field measurements of albedo in this region are scarce, I imagine that satellite (e.g. MODIS) data can be used there. Actually, why the authors did not try to compare their data to MODIS data ? This could be a way to deal with the problem of the measurement scale (see below).

The authors stress the fact that surface temperature only explain a small part of the sea ice albedo variability, whereas the ice thickness or snow are likely important factors. But, still, they propose linear temperature-albedo functions considered as "typical".

The authors also insist very much on the difference between Arctic and Antarctic (and stress that albedo measurements in the Antarctic are limited – see my comment above about satellite data). I agree that differences exist between the Arctic and Antarctic sea ice cover (amount of perennial sea ice, boundary conditions, melt ponds, ..) and, once again, I'm not a specialist of sea ice albedo. However, I guess that a significant amount of work has been performed on the relationship between albedo, surface temperature and others factors, in the Arctic. These works are not really discussed in the present manuscript, giving the feeling that Antarctic sea ice is very special in terms of sea ice physics.

#### Other comments

P 3264, L5-15: The field of view of the IRT is given. What about the pyranometer and the video camera ? Are the field of "view" of the pyranometer and the IRT equivalent ? I guess the one of the IRT is much larger (~100 m ?) Later on, on section 2.3, it is indicated that the two fields of view are different. What could be the impact of this difference when correlating albedo and temperature measurements ? Please comment on this, and/or precise if an averaging procedure has been used on IRT data before the comparison with albedo data.

Is the logging frequency high enough to ensure a continuous record along the track (i.e. an overlap of successive fields of view) ?

Section 2.3: Sea ice concentration is deduced using thresholds for surface temperature and albedo. This may have an impact when looking at correlations between sea ice concentration in one hand, and albedo or temperature on the other hand (figure 2). Did the authors try to estimate sea ice concentration from the video record ?

L 13-15: what is the combination used ?

P3268, L27: This seems reasonable, but is not really clear from this figure. Do you have more quantitative arguments ?

Section 4.1: the title of this sub-section seems a bit overstated. Where such “impact” is analyzed ?

Section 4.1: The authors discuss their results in comparison with several albedo parameterizations listed in table 3, OK. It would be interesting to know which kind of parameterizations are used in current climate models (such as those of the CMIP3 or CMIP5 exercises).

Section 4.1: When comparing their measurements to climate model parameterizations, the authors are faced with a problem of spatial scale. In models, albedo or SST are defined at the scale of the grid box, i.e. several orders of magnitude larger than the scale of the measurements. So, a proper upscaling procedure should be used before comparison. A comparison with satellite data (e.g. MODIS has a 250m resolution in the visible spectral range) could be also useful in this respect. See also my general comment about the representativity of the measurements. This is an important problem that should be addressed correctly. To built their albedo-temperature relationships, the authors binned their data in bins of temperature, but did not average spatially.

Section 4.2: How the surface temperature measurements from the IRT can be compared with 10m SSTs of models or re-analyses ?