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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Arctic clouds and surface radiation – a critical comparison of satellite retrievals and the ERA-interim reanalysis" *by* M. Zygmuntowska et al.

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We believe that the main strength of our study is to compare and understand the differences between three popular data products, as they are, off-the-shelf. Such a comparison will be useful for understanding and possibly reconciling divergent process-studies and model-evaluations based on different datasources. We evaluate the strengths and weaknesses in each case for two of the key cloud properties for Arctic studies, total cloud cover and surface cloud radiative effect. The comparison study is done by scientist that are not affiliated with these products, which may be both an advantage and in some respects a disadvantage. In any case, the value of external scrutinizing is

indisputable.

Reviewer 1 mainly criticizes our study for using the currently available version of the 2B-FLXHR dataset, and not an apparently upcoming release. There are identified issues with the current dataset: 1) Open ocean albedo was used even where sea-ice is present, and 2) only clouds detected by CloudSat were included in the radiation transfer calculations, thereby missing the important low-level clouds. The first point was corrected for by our post-processing, while the second cannot be addressed in our study. Both points are highlighted in our study, and we notified NASA of the issues almost two years ago when we first identified them.

3) A third issue, not mentioned by the reviewer, but highlighted in our summary is that 2B-FLXHR uses ERA-Interim water vapor profiles in the radiation calculations, which we have shown to be strongly underestimated during summer. This leads to low-biased clear-sky fluxes, and hence overestimated longwave cloud radiative effect.

It is certainly interesting information that the 2B-FLXHR product is about to be updated, and Reviewer 1 states that this is likely to happen in the spring 2012. As we have shown, neglecting sea ice introduces a zero-order error in the shortwave cloud radiative effect. Further, using CALIPSO-detected clouds in the radiation calculations will, without a doubt, be beneficial to the results. However, even when including the CALIPSO-detected clouds the cloud radiative effect is going to be underestimated because of beam attenuation, affecting mainly the warm low-level cloud detection. The third issue seem to remain unaddressed. Should this data become available to us during the review process, we would be happy to include it in the comparison. Otherwise, we shall mention that such a dataset is underway, and what improvements this may lead to.

- The comment on line 31511 is well taken. We did not intend to claim that ERA-Interim cloud radiative effects are the more plausible. In fact, we believe ERA-Interim cloud radiative effect is high-biased. We will rewrite this statement.

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Additional concerns:

1) Assessing the representativeness of the SHEBA-site and SHEBA-year depends on the purpose and metric. Unfortunately, the SHEBA campaign is unique in providing high-quality ground-based information from the central Arctic ocean for a full annual cycle. Our personal experience from shorter field campaigns in the Arctic in summer near the North Pole is that low-level clouds below 500-1000 m height occur very frequently and confirms cloud fraction in excess of 90 percent. The ERA-Interim data for other years than the SHEBA-year, further shows that year was not unique with respect to cloud cover, at least in the model. Finally, the SHEBA-site does not stick out as particularly unique in the twelve maps shown in Figure 3.

2) We shall mention the increasing use of satellite simulators in the evaluation of climate models against observations. However, there is no point in applying a satellite simulator in this study, and we have no intention of doing so. The fact that CloudSat fails to detect low-level clouds is a major methodological issue, in particular when studying the Arctic. When seeking the 'truth' this must be taken into account. Using a satellite simulator that accounts for this will only teach you this same lesson, once again. We will, however, rewrite and clarify the points raised by the reviewer.

Technical corrections:

1) 'line 16 page 31498. Remove "Clouds are flimsy objects" '

We will remove and rewrite this formulation.

2) 'line 18 page 31500. This is an error. CloudSat was launched in April 2006, not June 2007'

It is indeed right that CloudSat was launched in April 2006, we will correct this mistake

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and thank for this technical correction.

3) 'Is Figure 2 missing AVHRR data for years 2006-2007, 2009? AVHRR doesn't appear to be plotted correctly in this figure.'

The used dataset from CM-SAF for the Arctic region only contains data for the showed period from November 2007 to April 2008 and for 2009. This is already described in line 13-15 page 31502.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 31495, 2011.