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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluation of Arctic cloud products from the EUMETSAT Climate Monitoring Satellite Application Facility based on CALIPSO-CALIOP observations" *by* K.-G. Karlsson and A. Dybbroe

Anonymous Referee #2

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The paper seeks to address an important issue for climate studies: the evaluation of the cloud cover obtained by using passive imagery over the Arctic region. Improvement in cloud cover detection and of its properties over this region will allow a better estimate of the atmosphere's summit and surface energy budget. Detection of clouds and of their altitude is not an easy task in regions of high surface reflectivity in the summer and of eternal night during the winter. During the summer season, the difficulty is amplified by the melting ice. Another source of difficulty is the absence of gradient in the temperature profile in the lower troposphere.

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Interactive Discussion
Discussion Paper

The authors evaluate the cloud cover mask, cloud cover type and cloud top altitude retrieved by the CMSAF (Climate Monitoring Satellite Application facility) algorithm applied to data from the AVHRR radiometers on board the NOAA and METOP platforms over the Arctic. The availability of a large data set of active measurements from space given by the lidar CALIOP on board the CALIPSO platform and matched to the AVHRR data, allows the authors to conduct a very significant evaluation. The cloud parameters observed for the same scenes with the MODIS radiometer on board the AQUA platform flying in close formation with the CALIPSO platform are included in the comparison. In this comparative study, the first step, which consist of making the spatial and temporal matching between the data sets, is carefully performed. This allows a comparison of instantaneous cloud cover measurements. The results are clearly presented. However, I have several critiques and recommendations. They are expressed in the following paragraphs.

Four months of data are analyzed, three during the summer and one during the winter. The authors discuss the large decrease in the agreement between the PPS or MODIS cloud cover compared to the CALIOP cloud cover, but they do not discuss the decrease in the agreement already observed between June and August. Does this decrease relate to the increase in the number of nighttime observations between these two months as it could be inferred in the conclusion from the sentence: “Since the later conditions (polar winter) prevail during the entire year over the Greenland ice plateau we also find some problems here in the polar summer”? If yes, this should be discussed in the section 4.

For the cloud summit height comparison for high clouds, giving results separating the thin cirrus cases and the thick high cloud cases would be very valuable for the discussion.

The authors say that “the effect of the small navigation errors for the collocation of the NOAA/Metop AVHRR pixels with CALIPSO/CALIOP measurements will give rise to an equal proportion of falsely detected clouds and undetected clouds”. I do not agree with

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9, C4819–C4821, 2009

this. The proportion of falsely detected clouds and undetected clouds will depend on the spatial repartition of the cloud cover.

In spite of the fact that the METOP platform is not flying in the AQUA-train satellite formation, the simultaneous analysis of the AVHHR versus CALIOP differences and MODIS versus CALIOP differences seems to show that a careful selection of the scenes to compare allows to estimate well the strength and weakness of the PPS cloud cover when using the CALIOP cloud cover as reference. However, in this analysis, often too much focus is given to the MODIS/CALIOP comparison without including information on the quality of the PPS cloud cover. This must be corrected. On the other hand , reference to previous results of MODIS versus CALIOP or other lidar comparison over the Arctic, such as those presented in the Ackerman et al. (2008) and Holz et al (2008), could be introduced. They show the same behavior of a better accord between the passive radiometry and the lidar cloud cover observation during polar summer months as winter months. The main conclusions of the AVHRR/CALIOP and MODIS/CALIOP comparison differences must be included in the conclusion. Once these comments have been taken into account by the authors, I recommend publishing this paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16755, 2009.