

# EVALUATION OF CM-SAF ARCTIC CLOUD PRODUCTS USING CALIPSO-CALIOP AND MODIS CLOUD OBSERVATIONS

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## ABSTRACT

A thorough investigation of CM-SAF cloud products over the Arctic region has been carried out using various reference observations. The most important component in this evaluation was the comparison to cloud information provided by CALIPSO-CALIOP measurements but also MODIS cloud mask information along the CALIPSO track and MODIS Level 3 products (Collection 5) were utilised.

The study focused on four selected months in 2007: June, July, August and December. 142 CALIPSO matchup cases for individual NOAA-17, NOAA-18 and Metop-2 satellite overpasses over the Arctic area resulted in an overall matchup dataset of almost 400000 individual pixel matchups almost evenly distributed over the four selected months. Studied products were cloud amount (i.e., accuracy in cloud detection), cloud type and cloud top height. A very useful feature was the access to the CALIOP Vertical Feature Mask product which enabled a thorough evaluation of AVHRR cloud type information and a deeper study of the quality of cloud top height retrievals for different cloud type categories.

The study revealed very encouraging results for the polar summer months, especially for cloud amount estimations. On the other hand, it is clear that cloud retrievals from AVHRR imagery are still very challenging under polar winter conditions. A systematic underestimation of cloud amounts was revealed in December 2007 indicating that predominantly thin clouds regardless of cloud altitudes were missed. MODIS results were significantly better but high RMS differences revealed some tendency for the MODIS algorithm to also produce some overestimation of winter-time cloud amounts. AVHRR cloud top retrievals showed a general underestimation of cloud tops for high-level clouds but this feature seems to be common to also other methods (e.g. especially MODIS retrievals). However, a specific feature was a substantial overestimation of cloud tops for fog or near-surface stratus clouds, especially during the studied polar summer months. More careful studies revealed that this was caused by insufficient details (i.e., too weak temperature inversions) in the used reference temperature profile from the used atmospheric model. Nevertheless, since Arctic polar summer temperatures show a very small range and variation from the surface up to a height of 2-3 km, it means that Arctic cloud height retrievals based on the matching of measurements to reference profiles will be very difficult even in the case of having access to improved quality of profiles.

This study is reported in detail by Karlsson and Dybbroe (2009) and the interested reader is referred to this publication.

## REFERENCES

Karlsson, K.-G. and A. Dybbroe, 2009: Evaluation of Arctic cloud products from the EUMETSAT Climate Monitoring Satellite Application Facility based on CALIPSO-CALIOP observations, *Atmos. Chem. Physics D.*, acp-2009-298.