

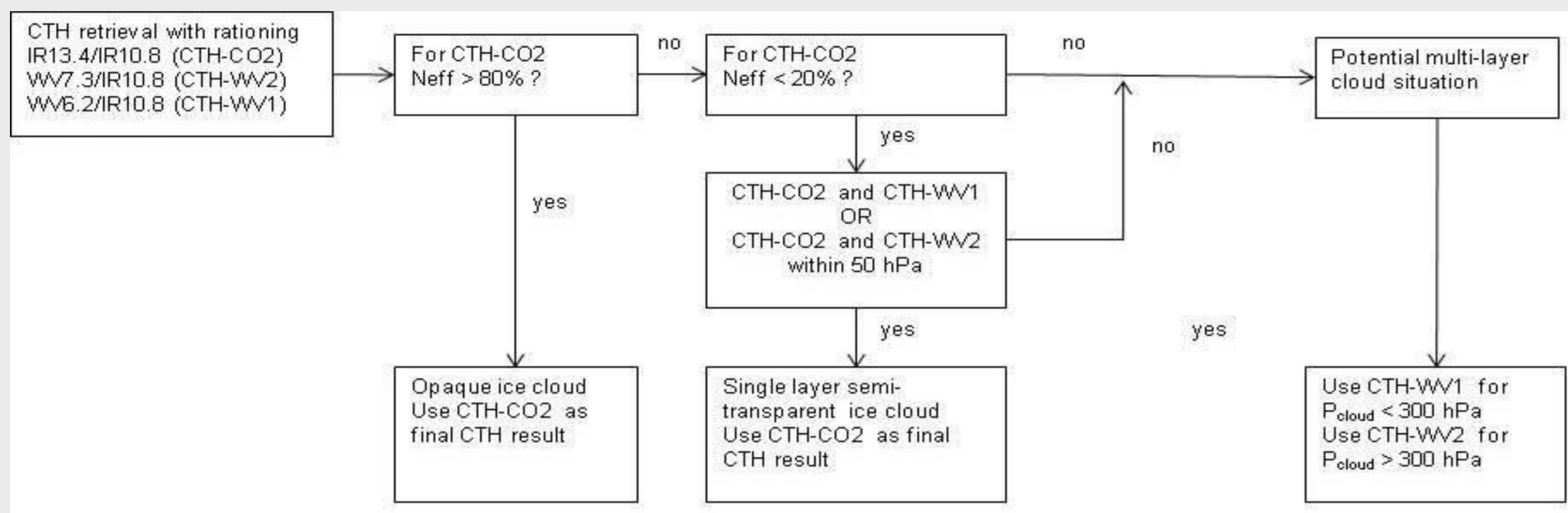
Detection of multi-layer cloud situations

Hans-Joachim Lutz, Phil D. Watts, Sauli M. Joro



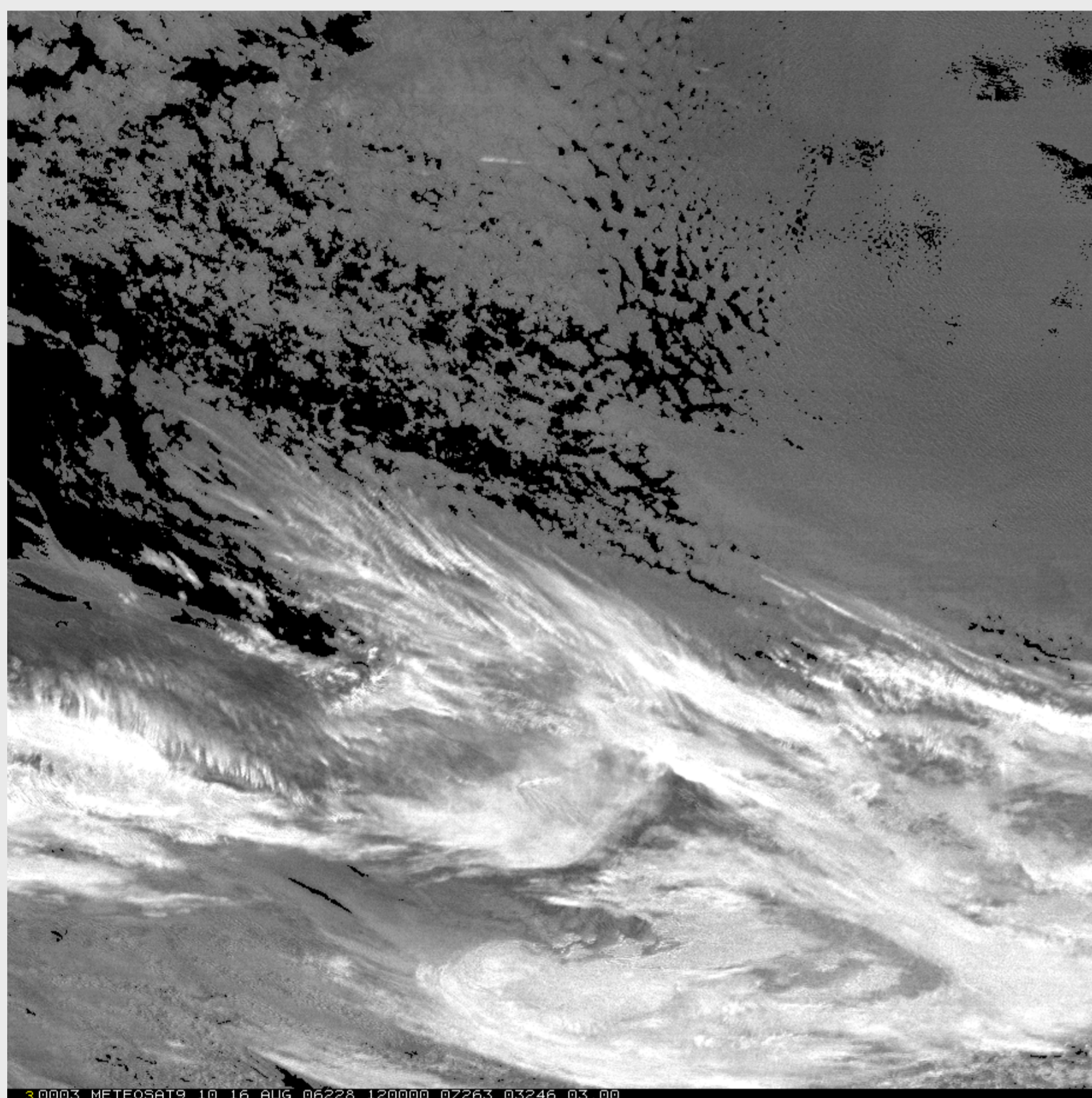
Abstract

A major step in the derivation of the cloud top pressure (CTP) is the identification of multi-layer cloud situations. Within the cloud analysis (CLA) algorithm different methods to derive the CTP are applied (IR10.8 method, WV ratioing method with WV6.2 and WV7.3, CO-2 rationing method with IR13.4). The results of the different methods are analysed and compared. An inconsistency in the estimated heights together with the analysis of the effective cloud amount and the cloud phase implies the presence of multi-layer cloud. From this analysis a multi-layer cloud flag is derived and the final CTP is derived. The CLA multi-layer cloud flag has the potential to serve as an input to the Optimal Estimation (OE) retrieval. The results of the CLA – CTP have been compared to those from the optimal cloud analysis (OCA) estimates. In addition the multi-layer cloud flag has been compared to the OCA flag and to the OCA diagnostic solution cost.

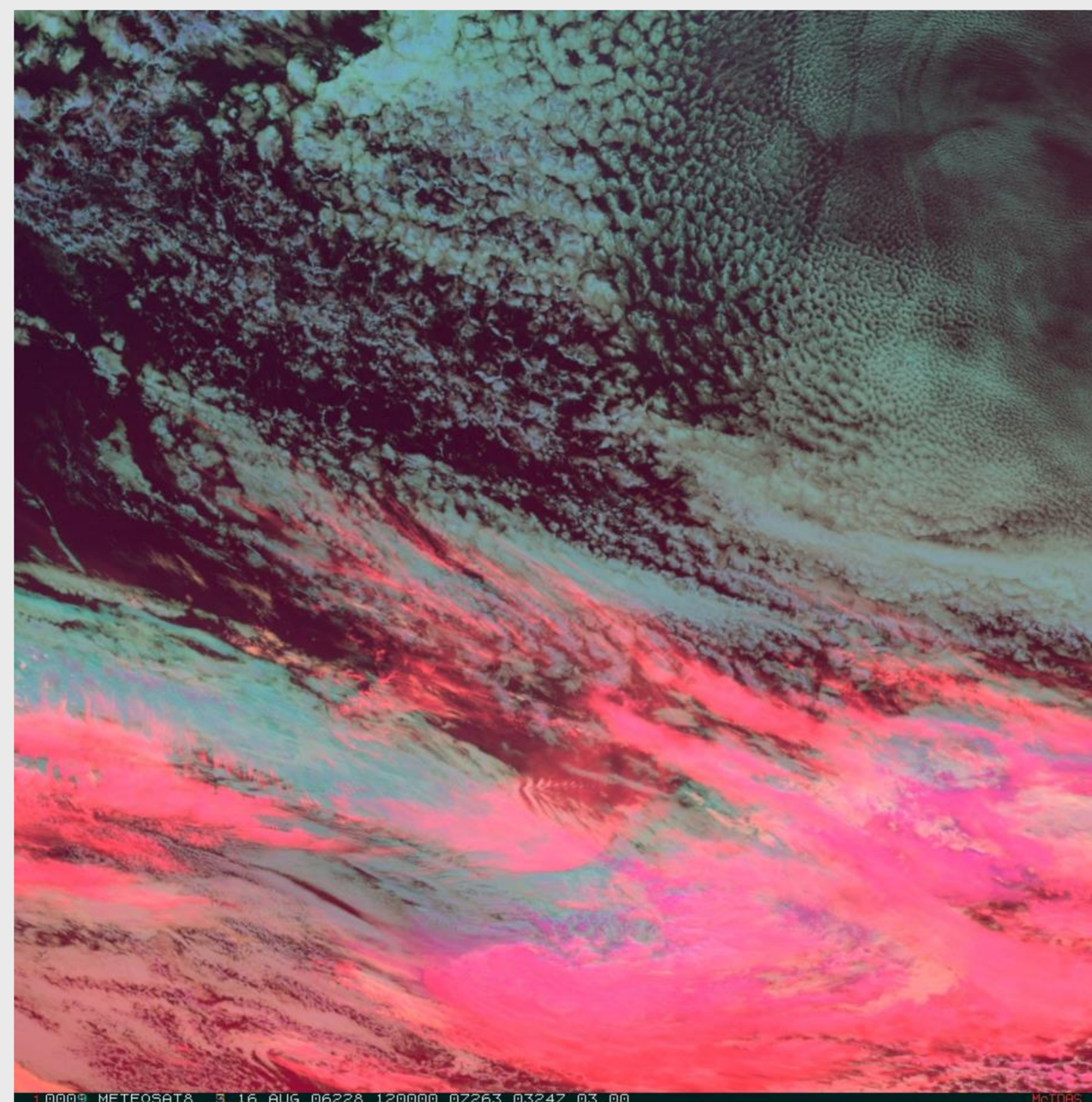


Basic principle

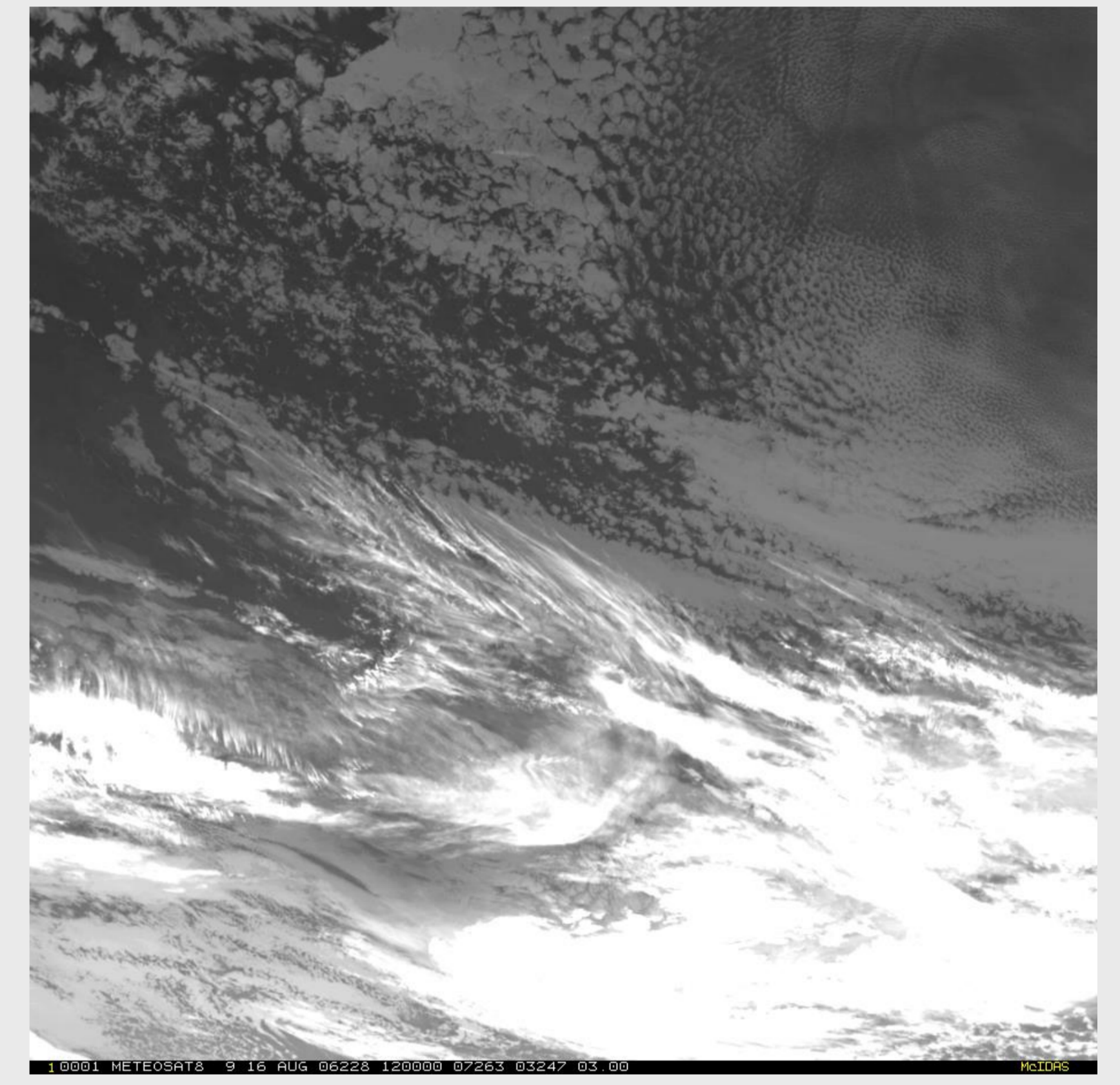
The brightness temperature (BT) of channel IR10.8 and the BT-difference (IR10.8-IR8.7) is used to derive the cloud phase. For ice phase clouds three different types are identified, i.e. opaque, single-layer semi-transparent and multi-layer clouds. The processing steps are explained in the diagram at the left side.



BT difference IR10.8-IR8.7
Ice clouds appear white.



RGB with VIS0.6 red, NIR1.6 green and
radiance IR10.8 blue



Brightness temperature IR10.8

Results

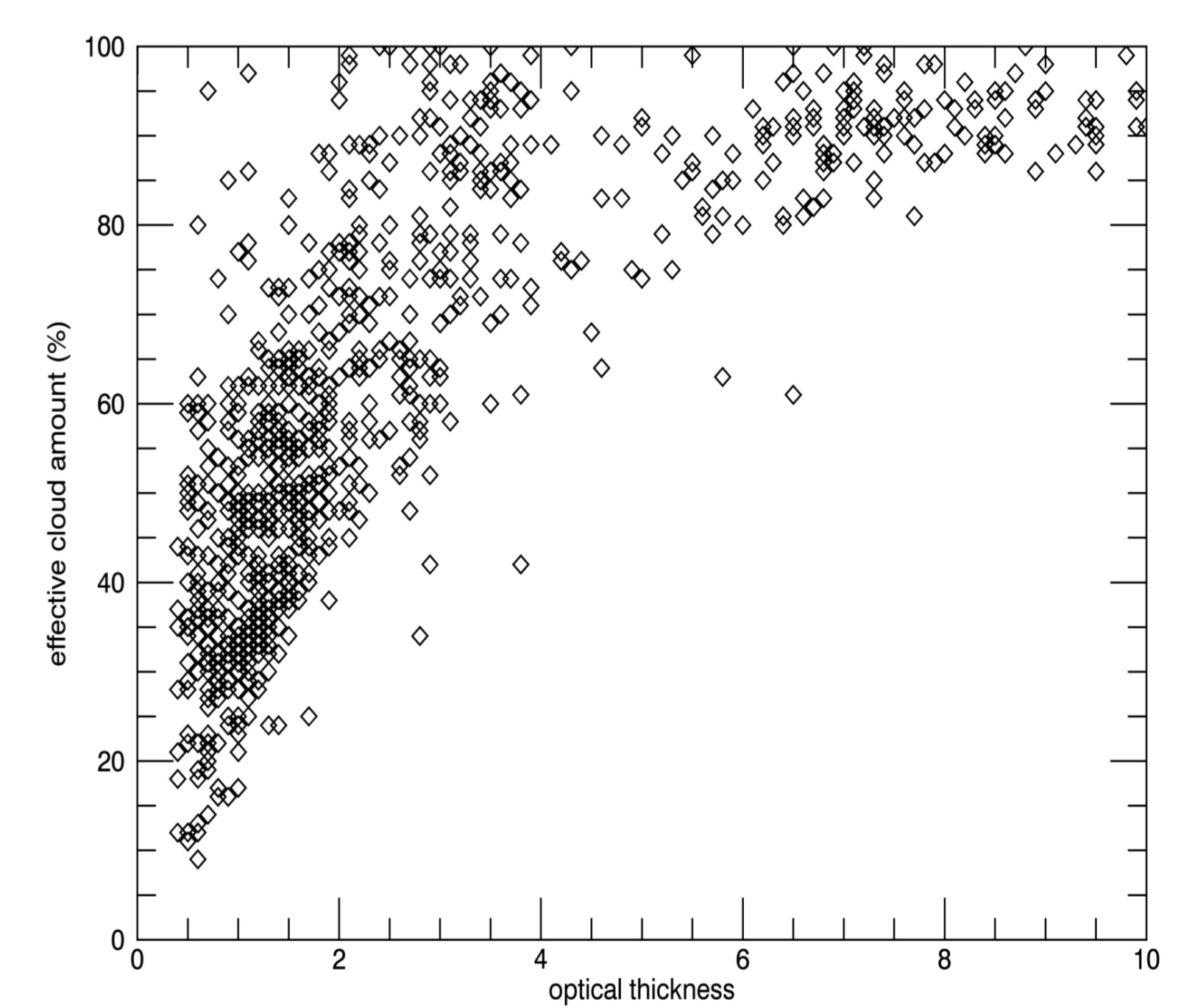
A case from 16 August 2006 12:00 UTC is shown. The results of the CLA algorithm are compared to OCA.

Cloud phase

The derived cloud phase is shown on the left with:
Blue – clear ocean
Grey – water phase (CLA and OCA)
White – ice phase (CLA and OCA).
Red - ice phase CLA, water phase OCA
Green – water phase CLA, ice phase OCA

Effective cloud amount

The effective cloud amount (CLA) is compared to the optical thickness.(OCA) at the right. The CLA threshold for optically thick clouds was set to 80%.



Multi-layer cloud results

The multi-layer cloud results are shown on the left with:
Blue – clear ocean
Grey – water phase
White – opaque ice phase (CLA and OCA).
Orange – multi-layer cloud (CLA and OCA)
Red - single-layer CLA, multi-layer OCA
Green – multi-layer CLA, single-layer OCA

Cloud top pressure results

The differences in cloud top height are shown on the right with:
Blue – clear ocean
Grey – water phase
White – CTP is within 50 hPa for CLA and OCA
Red - CTP (CLA-OCA) > 50 hPa
Green – CTP (CLA-OCA) < -50 hPa

