

Reviewer 1 minor comments on revised version of Hünerbein et al.

- L30: The year for Platnick et al. (2016) is 2017 according to <https://ieeexplore.ieee.org/document/7707459>.

- L33: Suggest slight editing for the following (green highlights are edited text):

“fundamental principle: the reflection of clouds in the visible/near-infrared wavelength region, specifically in a non-absorbing channel, is primarily determined by cloud optical thickness. In contrast, the reflection function at the absorbing channels in the shortwave and midwave-infrared region primarily relies strongly depends on cloud particle size.”

Note that SWIR/MWIF not necessarily “primarily” depending on REF, e.g., optically thin clouds (and depending on spectral channel).

- In regard to Table 1, I previously asked “To what extent is the SZA/VZA and azimuthal resolution capable of resolving cloud glory and cloudbow features in the backscattered reflectance? Does it matter?” The response was: “We did not analyze ... cannot answer the question.”

Then please state in the manuscript that the algorithm’s angular resolution has not been evaluated for its ability to resolve liquid water cloudbow and glory phase function features in the reflected signal.

- L53

From my previous review, the authors response was: “We changed the sentence to: “MSI will have a swath width of 150 km, asymmetrically tilted away from the sun and covering 35 km to right side and 115 km to the left side of nadir. no fixed time given in the paper, we can not specify the MLT of EarthCARE.”

Either use “east” and “west” instead right/left, or define how right/left is defined. And according to Wehr et al. 2023 (<https://doi.org/10.5194/amt-16-3581-2023>) the MLT is known (1400 LT descending, see Sect. 6).

- L93

“Once the forward model output of the assumed state vector, and the observation vector satisfies the requirement of the minimization of a cost function, the retrieval process is considered successful. This state vector represents then the solution.”

Try: “Once the forward model output of the assumed state vector and the observation vector satisfy the requirement of the minimization of a cost function, the retrieval process is considered successful. This state vector then represents the solution.”

- In response to “Does the simulator uses different cloud particle scattering models for ice than M-COP? Different radiative transfer code?” the author’s reply:

“Yes. M-COP used the General habit model from Baum et al. 2014. The EarthCARE End- to End Simulator the phase function from ice and snow are adapted from Baum et al. 2014, but for cloud ice

and snow the aggregated solid columns properties were used (detailed description given in Donovan et al. 2022), which are different. Further the used radiative transfer code for the MSI forward model in the EarthCARE End-to End Simulator frame based on DISORT (discrete ordinate algorithm, Stamnes et al. 1998) as the LUT for M-COP used DAK.”

Even if it's assumed that DISORT and DAK provide identical reflectances, it's not correct to compare M-COP ice cloud retrievals with the simulation if they use different particle scattering assumptions. Do you agree? If so, please comment on this apple-to-orange comparison in the manuscript text. Note that this is similar to the comment about “Fig. 7” below.

- Fig. 7 (Fig. 6 in original manuscript): Author's reply:

“Yes, we agree the ice phase radius differences may be due to the different ice model LUT. We choose the MODIS, MOD06_L2 REF at 1.6 μ m as M-REF also retrieved at 1.6 μ m. We have to investigate this further more with real data. We mention all MODIS channels which we need for the whole processor (M-CLD), which are imprecise as for the M-COP we need only 3 MODIS channels. We are not using the 2.25 μ m channel and we also did not use the standard effective radius from MODIS MOD06_L2. We have chosen the effective radius_1.6 to be comparable.” We added the sentence. “The three MODIS channels 1, 6 and 31 are used for the M-COP retrieval.” We added at the figure capture, which cloud product used and in section 3.2 and data availability the reference: MODIS L2 products (MOD06_L2, Platnick et al. (2015b)).”

From what I can tell of the response, the manuscript doesn't tell the reader that the REF comparisons are for different ice particle scattering models. Please mention this in the text (e.g., after the “robustness” sentence).

- L340 etc.

For Platnick et al. 2015a and 2015b, the links in the reference gave a 404 error. It looks like it will work if you remove the first occurrence of “doi.org/” in both URLs. Are you sure you downloaded and analyzed Collection 6.0 files instead of the more recent Collection 6.1 data that completed reprocessing in 2017/2018?