



EGUsphere, referee comment RC1
<https://doi.org/10.5194/egusphere-2022-1217-RC1>, 2023
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Comment on egusphere-2022-1217

Matthew Lebsock (Referee)

Referee comment on "The classification of atmospheric hydrometeors and aerosols from the EarthCARE radar and lidar: the A-TC, C-TC and AC-TC products" by Abdanour Irbah et al., EGUsphere, <https://doi.org/10.5194/egusphere-2022-1217-RC1>, 2023

This paper describes the target classification products for EarthCARE using lidar, radar, and synergy lidar and radar algorithms. The paper provides a needed reference for the at launch algorithms for EarthCARE. There are elements of the paper which are written in too general a fashion. The specific instances that I noticed that require more detail are listed below. In general, only minor revisions are required to this manuscript.

Line 19: Nobody outside of EarthCARE knows what the Halifax scene refers to. Provide some description of what the Halifax scene is – i.e. a cloud resolving simulation.

Line 104: What is the Beta threshold?

Section 2.2: How are the layer integrated depol and attenuated backscatter used? Thresholds? If so what are they?

Line 146: Describe the median filter resolution.

Line 162: use actual CloudSat and CALIPSO references:

- Marchand, R., Mace, G. G., Ackerman, T., & Stephens, G. (2008). Hydrometeor Detection Using Cloudsat—An Earth-Orbiting 94-GHz Cloud Radar, *Journal of Atmospheric and Oceanic Technology*, 25(4), 519-533.
- Mace, G. G., and Zhang, Q.(2014), The CloudSat radar-lidar geometrical profile product (RL-GeoProf): Updates, improvements, and selected results, *Geophys. Res. Atmos.*, 119, 9441– 9462, doi:10.1002/2013JD021374.

Line 195: Is the reflectivity attenuation corrected?

Line 219: Add () around H.

Line 225: change 'no' to 'non'

Line 235: *'The observed pixels above land and below 3 km altitude with reflectivity between -20 and -15 dBZ and temperatures not lower than 15°C are classified as insects and/or artifacts.'* I don't understand why these couldn't be fair-weather Cu. Can you explain?

Line 275: I can't track the claim that the radar will only see effective radii > 15 micron. If you look at Eq 5 in Matrosov et al., 2004, we see that assuming a log-normal DSD an expression for effective radius is $r_e = aZ^{1/6}$ with $a = (2\exp(0.5\sigma^2 N^{1/6}))^{-1}$. Plugging in the reasonable values of $\sigma = 0.38$ and $N = 100 \text{ cm}^{-3}$, and radar sensitivity of $Z = -35 \text{ dBZ}$, I get $r_e = 5.6 \text{ micron}$.

- Matrosov, S. Y., Uttal, T., & Hazen, D. A. (2004). Evaluation of Radar Reflectivity-Based Estimates of Water Content in Stratiform Marine Clouds, *Journal of Applied Meteorology*, 43(3), 405-419.

Line 282: Is 'traded' meant to be 'introduced'?

Sections 4.5 and 4.6: Because the radar footprint is much larger than the lidar footprint (Across track) there may be instances where the radar detects a cloud edge that does not fill the radar footprint and is undetected by the narrower lidar beam. It seems the decision tree discounts this possibility.

Line 327: I have no idea what this sentence means: *'Concerning the clutter situation, it essentially relies on a specific processing of the radar reflectivity signal coming from areas assumed to be close to the ground. It will therefore be treated thanks to the obtained results and reported here using C-TC.'*

Figure 3: Several things about this figure bother me. (1) There is something wrong with the radar noise in the top left of the panel F, (2) can you add two panels to separate the cloud/precipitation from the aerosol in panels A and B, (3) The labels are very small and difficult to read.

366: 'low resolution' has not been defined anywhere. Nor has medium or high.

Line 385: I don't think the other two test scenes have been described in Section 5. Please provide some description.