

General Comments:

Overall, the paper is technically sound and shows how the geo-location and co-registration approaches used for the upcoming EarthCARE mission are mature when compared with other flight missions. Of particular note are the authors interaction with the project CloudSat to understand and guide their analysis. Several technical comments have been provided, but presented to clarify and not take away from the contents of the paper.

Specific Comments:

- 1) Can you please expand on what you mean by 'when the Earth's surface is detected' in Section 2.2? Are you also only using clear air instances like you did for CPR when you say 'absence of clouds to prevent attenuation affects', or using those profiles when the surface is seen (i.e. signal hasn't been attenuated).

The CALIPSO L1-Standard-V4-51 and L2_333mMLay-Standard-V4-51, NASA/LARC/SD/ASDC, products collected from June 12th, 2006, to June 30th, 2023, are used. During this period only profiles collected during nominal science mode and when the Earth's surface is detected are selected.

- 2) Is the Geolocation Evaluation Tool a software package that will be made publicly available?
- 3) In section 3.1.2 was there a specific reason why a threshold of 300m was used to identify those scenes with elevated gradients (some x number of degrees from expected footprint)? Or was this determined as part of the assessment described in section 3.1.1?
- 4) In section 3.2 I don't understand what is meant when you say 'The discrepancy arises from the fact that the values are expressed in decibels (dB)' when describing problems using the CPR? Can you clarify what is meant by that sentence? Is this addressed when later in the paragraph you mention conversion of this parameter into 'linear units'?
- 5) Why was 2008 selected as your analysis year for section 3.2?
- 6) As you note later in the paper (section 5, Figure 13) CALIPSO changed its off nadir-angle from 0.3 to 3.0 degrees in 2007. Presumably, and if I understand correctly how the error analysis was done for that section, the error increased at 3.0. So, would the detection error of 41 m improve using 0.3 degrees, and is that something to note in section 3.2, or is it not relevant?
- 7) In section 3.3 you note that Tanelli et al. 2008 compared the CPR with GTOPO30 using their R04 release. Based on this analysis they updated their DEM for R05 to be a combination of multiple sources, including maps from GTOPO30, ASTER GDEM, Greenland (Griggs and Bamber), Antarctica (DiMarzio), and STRM. Given you used R05 for your analysis I recommend that you note this change. Additionally, based on this CloudSat analysis CALIPSO changed their DEM from GTOPO30 to this blended CloudSat DEM, and again as you use V4.51 CALIPSO data which employs this new DEM I recommend you mention that.
- 8) Recommend re-wording the last sentence of section 5 to indicate that the off-nadir angle at the start of CALIPSO science operations (June 13, 2006) was at 0.3 and was permanently changed to 3.0 to account for observed specular reflection due to ice clouds.

Technical Corrections:

- 1) There is at least one instance in the paper (first paragraph in section 2.2, note below) in which there is a clear distinction between Satellite (CloudSat) and Instrument (CPR) but not followed for CALIPSO; CALIPSO satellite, CALIOP instrument. You've correctly done this in other sections but recommend being consistent throughout to avoid any potential confusion.

The EarthCARE mission is the follow up to NASA's Afternoon constellation (A-train, Stephens et al., 2018). NASA's A-train featured two active remote sensors, a 94-GHz Cloud Profiling Radar (CPR) on the CloudSat mission (Stephens et al., 2002) 75 and the NASA–Centre National d'Études Spatiales (CNES) Cloud–Aerosol lidar and Infrared Pathfinder Satellite Observations (CALIPSO; Winker et al., 2010).

- 2) In section 2.2 the way that you differentiate the vertical resolution between ATLID and CALIOP could be misinterpreted. When describing the difference in wavelength and footprint you put ATLID first (355 nm and 29 m), but vertical resolution you put CALIOP first (30 m). Recommendation for clarity is to say, '*and the higher vertical resolution (100 versus 30)*'. OR you could also put ATLID and CALIOP in each qualifier and say, '*the footprint (29 m for ATLID, 90 m for CALIOP) and the higher vertical resolution (30 m for CALIOP, 100 m for ATLID)*'.

The main differences between the ATLID and CALIOP are the wavelengths (355 nm for ATLID, 532/1064 nm for CALIOP), the footprint (29 versus 90m) and the higher vertical resolution (30 versus 100m).

- 3) To continue on point #2 above, vertical resolution of 30 m for CALIOP is only for the 532 nm channel and only goes from -0.5 to 8.3. 1064 nm uses a 60 m resolution at this low altitude. You may want to designate that the 30 m is only for the 532 nm channel.
- 4) The DOI citation for the CALIPSO 333m Merged Layer product is incorrect.

NASA/LARC/SD/ASDC.: CALIPSO Lidar Level 2 1/3 km Merged Layer, V4-51. NASA Langley Atmospheric Science Data Center DAAC, doi:~~10.5067/CALIOP/CALIPSO/CAL_LID_L2_333mMLay-Standard-V4-5~~, 2022.

Needs to be -> https://doi.org/10.5067/CALIOP/CALIPSO/CAL_LID_L2_333mMLay-Standard-V4-51