

Thank you for your valuable comments. Please find below a point-by-point reply to the questions you have raised in your comment.

- (1) It is not clear if CLAAS-3 is a reliable reference against which the CTH retrievals with Solijan et al. 2024 can be compared. Especially because CLAAS-3 retrieves CTH using a Neural network based algorithm and does not represent ground truth. Why not use ground-based ceilometer measurements as reference ?**

Active sensors - particularly profiling lidar - provide the most accurate reference for CTH validation in the scientific community. While no absolute 'ground truth' exists for cloud detection, CloudSat-CALIPSO lidar-radar data offer the most reliable assessment of retrieval methods and are frequently used to train and validate approaches like CLAAS-3. This study uses CloudSat-CALIPSO as the primary reference, supplemented by imaging instruments, and treats CLAAS-3 only as a benchmark and reference - never as 'ground truth' (hence the term does not appear in the paper).

Regarding ground-based ceilometer measurements, their use is physically impractical for two fundamental reasons: (1) ceilometers sense cloud base height, whereas this study focuses on cloud top height; (2) the study examines optically thick deep convective clouds, which prevent a lidar signal from penetrating from the Earth's surface to the cloud top and returning. Therefore, spaceborne lidar-radar observations remain the only physically viable reference for validating CTH retrievals of deep convective clouds.

- (2) Why is ICAO standard atmosphere, which is a static profile under an idealized condition, used for converting cloud top pressure to height ? Could it be more accurate or more closer to reality when profiles from NWP or Reanalysis are used ?**

Absolutely true. The ICAO atmosphere can be replaced by any other atmospheric model of interest, including reanalysis, numerical weather prediction (NWP), or rawinsonde observations to represent more realistic and site-specific conditions. There are two reasons the ICAO standard atmosphere is used here. First, employing a single predefined atmospheric profile simplifies and accelerates the computational process, especially when the algorithm is applied to large datasets (e.g., multidecadal time series of full-disk Meteosat imagery). Second, the ICAO atmosphere was originally implemented by Šoljan et al. (2024), who focused on fast CTH retrieval for aviation applications. The goal of this study was to validate the Šoljan et al. (2024) approach; therefore, the original setup was maintained. Future work can test whether using a local atmospheric model impacts the accuracy of CTH estimation.

- (3) There is a lack of reliable ground truth for assessing the accuracy of the parallax correction using the different CTH sources. Would it make sense to look at some surface parameters such as precipitation, direct solar irradiance, lightning, etc. that are directly impacted by the location of the DCC ?**

The suggested approach would be quite interesting if manageable. Unfortunately, all the mentioned weather phenomena and variables (precipitation, direct solar irradiance, lightning) come with some degree of uncertainty in their spatial location (and co-location). For instance, precipitation estimates may be derived from satellite imagery and then validated against ground-based radar or rain gauges (e.g. Roebeling and Holleman, 2009; 10.1029/2009JD012102). However, radar products are known to have limitations related to accuracy and reliability that decrease with distance from the radar location (e.g., Sharif et al. 2002, 10.1029/2001WR000525; Green et al. 2024, 10.5194/hess-28-4539-2024), while rain gauges offer sparse coverage compared to the dense grid of satellite pixels. As mentioned in the answer to comment (1), space-borne lidar cloud-top height (CTH) is acknowledged as the most reliable CTH dataset currently available and provides the most accurate relationship between Šoljan et al. (2024) estimates and actual CTH. Other CTH sources are used

only to demonstrate whether it is possible to achieve the same level of parallax correction with Šoljan et al. (2024) method as would be achievable with operational products (especially geostationary-based CLAAS-3).

- (4) Section 5.1. Lines 350-355. The mean displacement vector length for parallax may not be very informative. As the author himself noted, parallax displacement is heavily dependent on the viewing satellite zenith angle (SZA). Therefore, it could be more intuitive to have the mean displacement vector and standard deviation for different SZA ranges.**

Thank you for that comment and for pointing out the limited use of parallax displacement expressed in metric length. It is correct to conclude that the satellite zenith angle makes the interpretation of parallax displacement challenging. This is why the metric lengths have been normalized by SZA - indirectly, using pixel size (a SZA-dependent measure) to report parallax displacement in pixels rather than meters (sec. 5.2 vs sec. 5.1). Obviously, as the SZA increases, the mean metric length of a parallax displacement per SZA bin also increases.