

Investigating aerosol optical properties using ATLID and CAMS forecast



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Introduction

Aerosols play a key role in cooling the global atmosphere, but their impact varies with composition. Understanding the global distribution and properties of different aerosol types is essential for improving climate model predictions.

The ATmospheric LIDar (ATLID) lidar onboard EarthCARE provides unprecedented vertical profiles of aerosol properties from space. The Target Classification (TC) product further identifies aerosol (sub-)types within each atmospheric layer and provide insights into their effects on climate.

Objective

We aim to evaluate the global aerosol optical properties measured by ATLID, compare the validated results with CAMS forecast and identify key factors to improve aerosol prediction.

Methods

We combine the ATLID lidar measurements with TC products, compare the **aerosol** extinction coefficient and optical depth (AOD) with CAMS (Copernicus Atmosphere Monitoring Service) forecast.

Results

1. ATLID vs ground observations

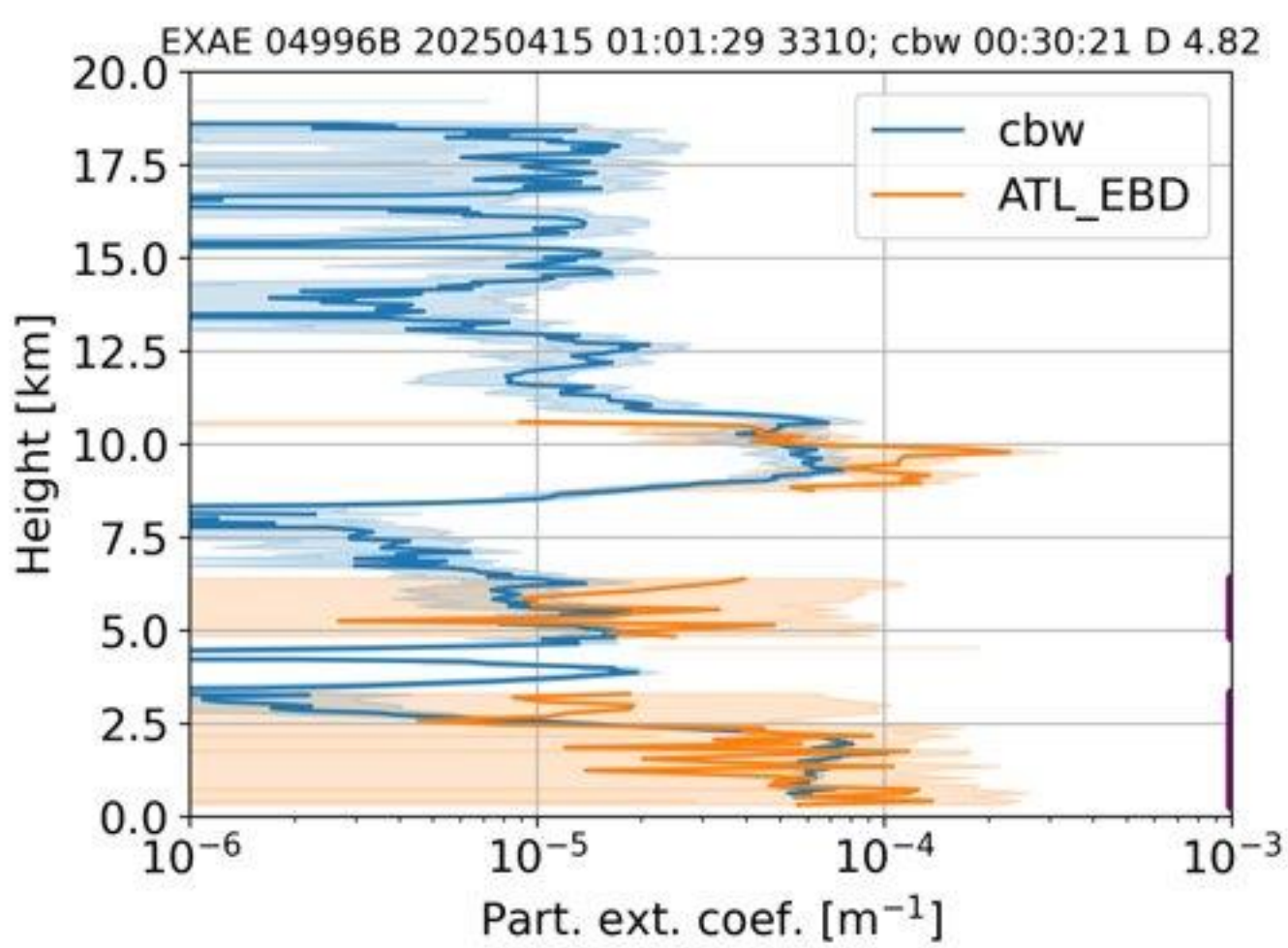


Fig. 1 Profiles of particle extinction coefficient from Cabauw (blue) and ATLID (orange) for orbit 4996B. Curtsey to Dr. Ping Wang (KNMI).

ATLID agrees well with the observations from the Cabauw tower (51.9°N, 4.9°E).

2. ATLID vs CAMS: global AOD at 2° resolution

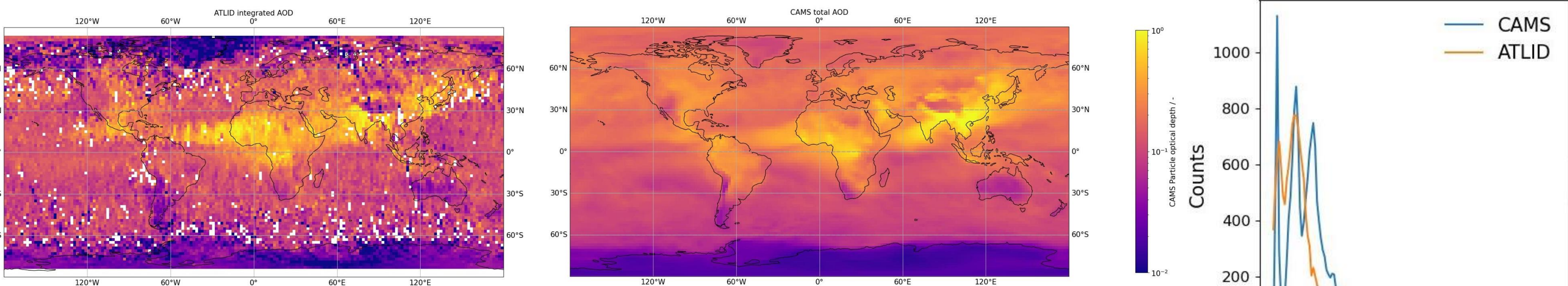


Fig. 2 Global AOD integrated from the extinction coefficient measured by ATLID and global AOD at 355 nm from CAMS forecast in May 2025.

ATLID data has been filtered using TC products so that only aerosol are included. Columns with liquid clouds are not included. This filtering applies to all results in this poster.

The global distribution of AOD is similar between ATLID and CAMS forecast (Fig. 2). ATLID has an overall lower AOD than CAMS. The global mean AOD at 355 nm is 0.14 for ATLID and 0.18 for CAMS. The histograms show bias of AOD around 0.15-0.25 between the two datasets.

3. ATLID vs CAMS: global sea salt AOD (preliminary)

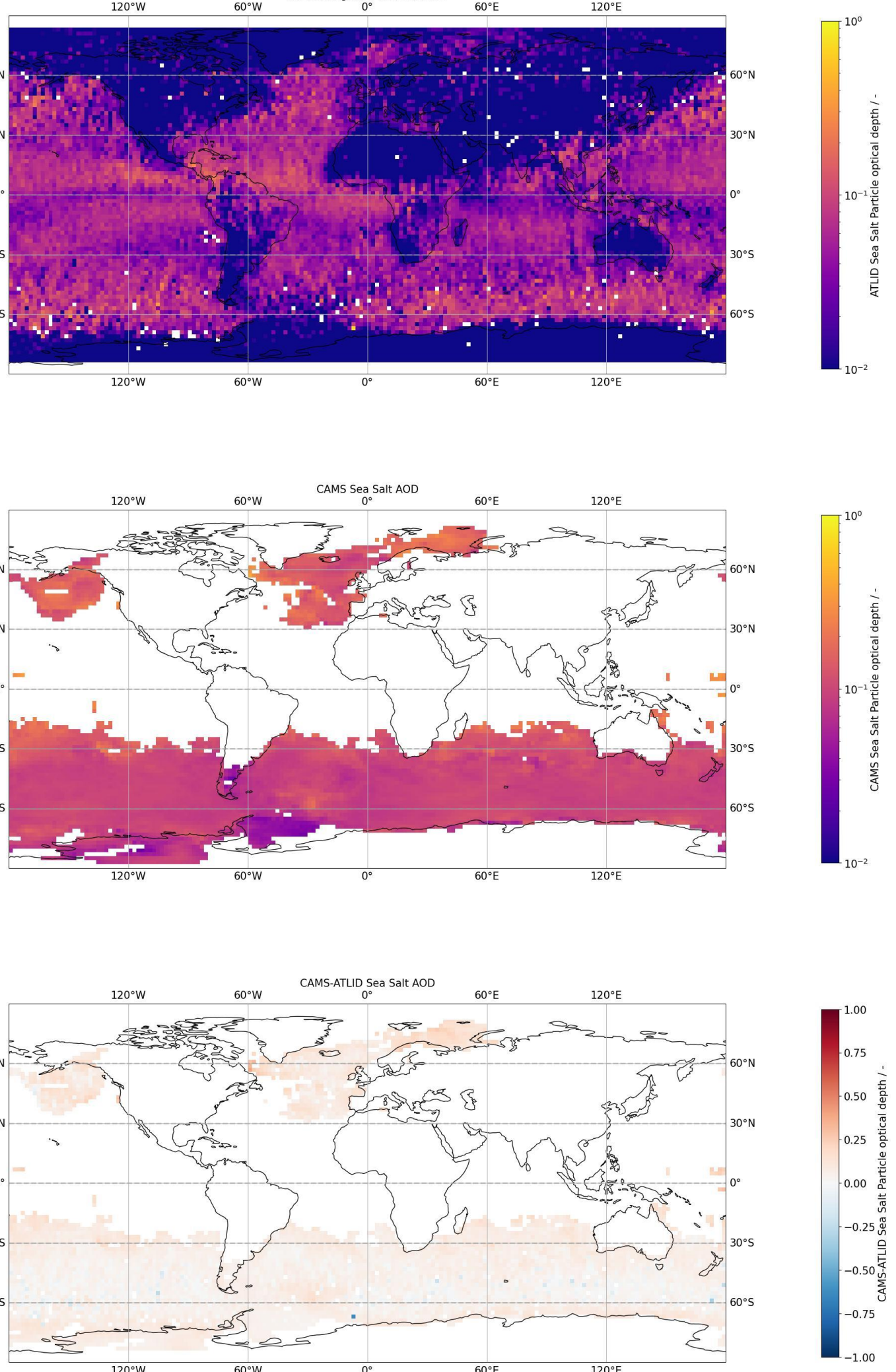


Fig. 4 Global sea salt AOD in ATLID, CAMS, and the differences (CAMS minus ATLID) in May 2025. CAMS total AOD is assigned to sea salt where sea salt is the dominant mass species per column.

CAMS sea salt AOD is around a factor of 2 higher than ATLID over the ocean. This is expected because of the method to derive AOD, which will be improved later.

4. ATLID vs CAMS: orbit 4795A

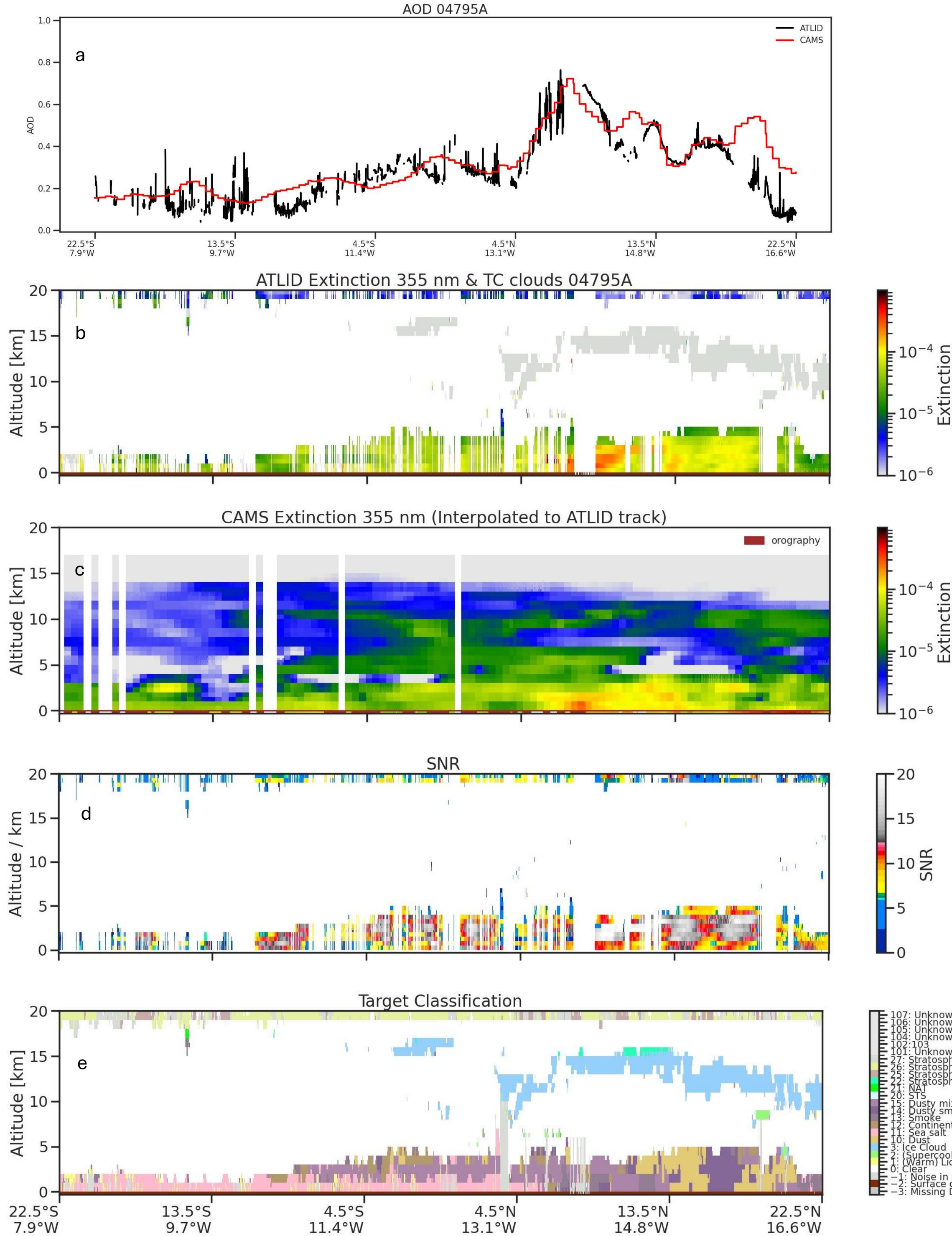


Fig. 5 Time series of co-located AOD from ATLID and CAMS (a; grey represents ice and liquid clouds), extinction coefficient in ATLID (b) and CAMS (c), extinction coefficient signal-to-noise ratio in ATLID (d), and TC in ATLID (e). The vertical white bars in b, c and d show where liquid clouds cause fully attenuated signal.

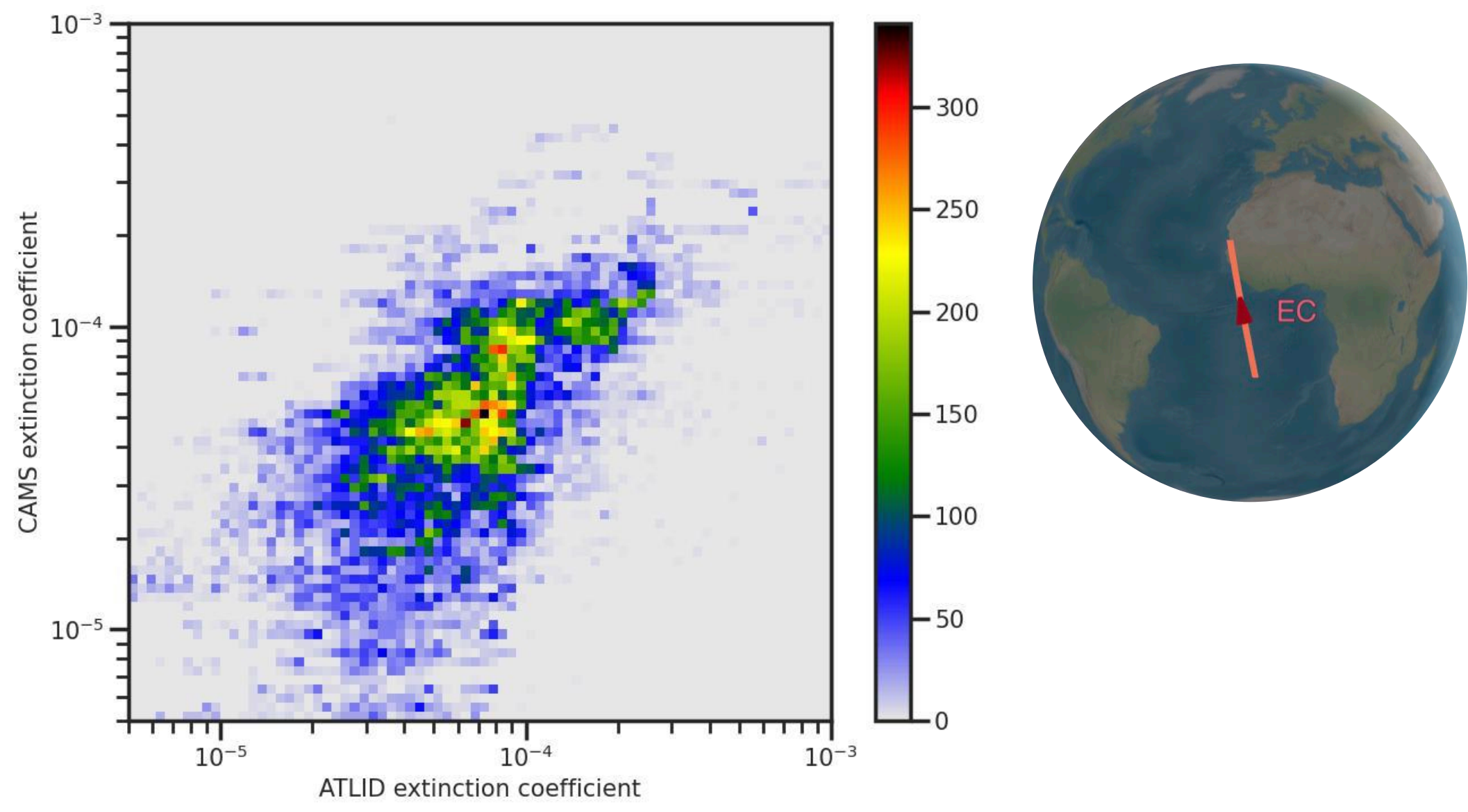


Fig. 6 Histograms of extinction coefficients from ATLID and CAMS for orbit 4795A.

We selected the orbit 4795A (west of Africa) to investigate the co-located data between ATLID and CAMS.

The timeseries in Fig. 5 and histogram in Fig. 6 show that ATLID and CAMS have similar aerosol extinction coefficients where data is available.

Conclusions and future analysis

1. ATLID has in general good agreement with other datasets with some discrepancies.
2. Extinction coefficients from other species (dust, smoke etc.) will be investigated.
3. Future analyses will include comparison to AERONET to consolidate the results.