2025 DRAGON 6 SYMPOSIUM

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[PROJECT ID. 95376]

[CALIBRATION, VALIDATION AND DATA ASSESSMENT FOR CHINESE AND EUROPEAN SPACEBORNE HIGH SPECTRAL RESOLUTION LIDARS: ACDL/DQ-1, ATLID/EARTHCARE AND ALADIN/AEOLUS]







2025 Dragon 6 Symposium

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PRESENTED BY: SONGHUA WU

Background and objectives



- Global observations of atmospheric wind profiles and aerosol profiles are significant for NWP, radiative forcing and air quality. Spaceborne Doppler Wind Lidars (DWLs) and High Spectral Resolution Lidars (HSRLs) are capable of measuring global wind and aerosol profiles. Before the operational application of spaceborne lidar systems, dedicated and strict calibrations and validations (CAL/VAL) activities have to be conducted.
- This project will focus on the CAL/VAL and data assessment of three spaceborne lidar missions:
  - **ESA-ALADIN (Atmospheric Laser Doppler Instrument)** onboard Aeolus
  - **CHINA-ACDL (Aerosol and Carbon Detection Lidar)** onboard DQ (Daqi)-1
  - **ESA-ATLID (Atmospheric Lidar)** onboard EarthCARE (Earth Cloud, Aerosol and Radiation Explorer)
- To guarantee the data quality and refine the retrieval algorithms, **the assessment of Aeolus' reprocessed data** needs to be conduct, whereas **CAL/VAL campaigns for ATLID and ACDL products** needs to be implemented.

Information about the Aeolus mission

The Aeolus wind lidar mission

Objective:
Improve numerical weather prediction (NWP) and advance understanding of atmospheric dynamics and climate processes

Orbit:
polar, sun-synchronous
7 day repeat cycle with
111 orbits ≈ 16 orbits / day



Geometry:
Altitude: 308 km
Angle: 35°

Operations
August 2018 to July 2023

Horizontal resolution:

Raw data:	3-4 km
Mie wind:	10-20 km
Rayleigh wind:	90 km

Vertical resolution:

Max. altitude:	≈ 30 km
Number of bins:	24
Bin thickness:	0.25 – 2 km

Observations:
≈ 7000 line-of-sight (LOS) wind and aerosol/cloud optical profiles per day (≈ 5-6 times more than radiosondes)

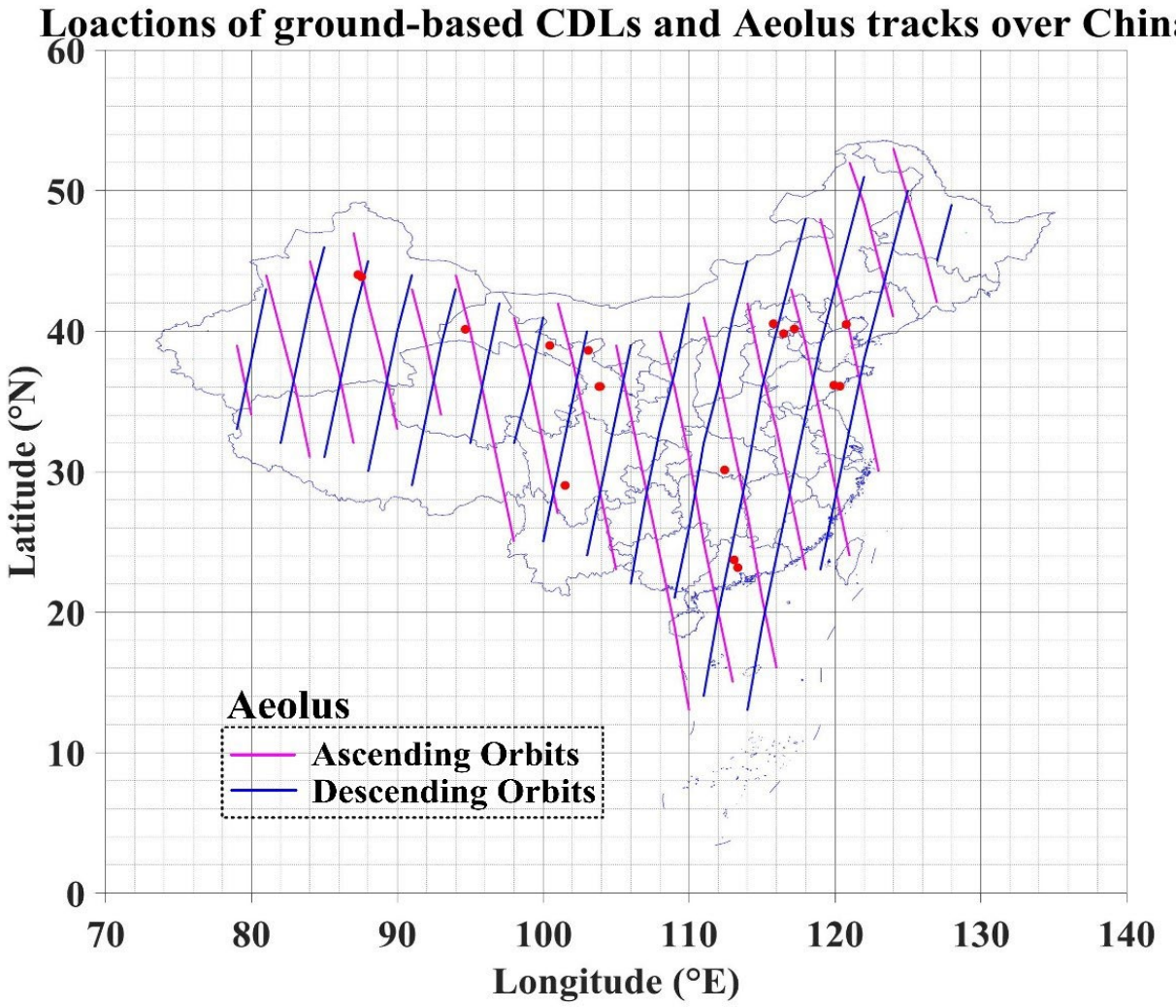
Wind requirements (HLOS)

random error:	1 – 2.5 m/s
systematic error:	< 0.7 m/s

Credit: ESA/ATG medialab

Aeolus L2B B16 products re-validation with ground-based CDLs net over China

Validation campaign overview



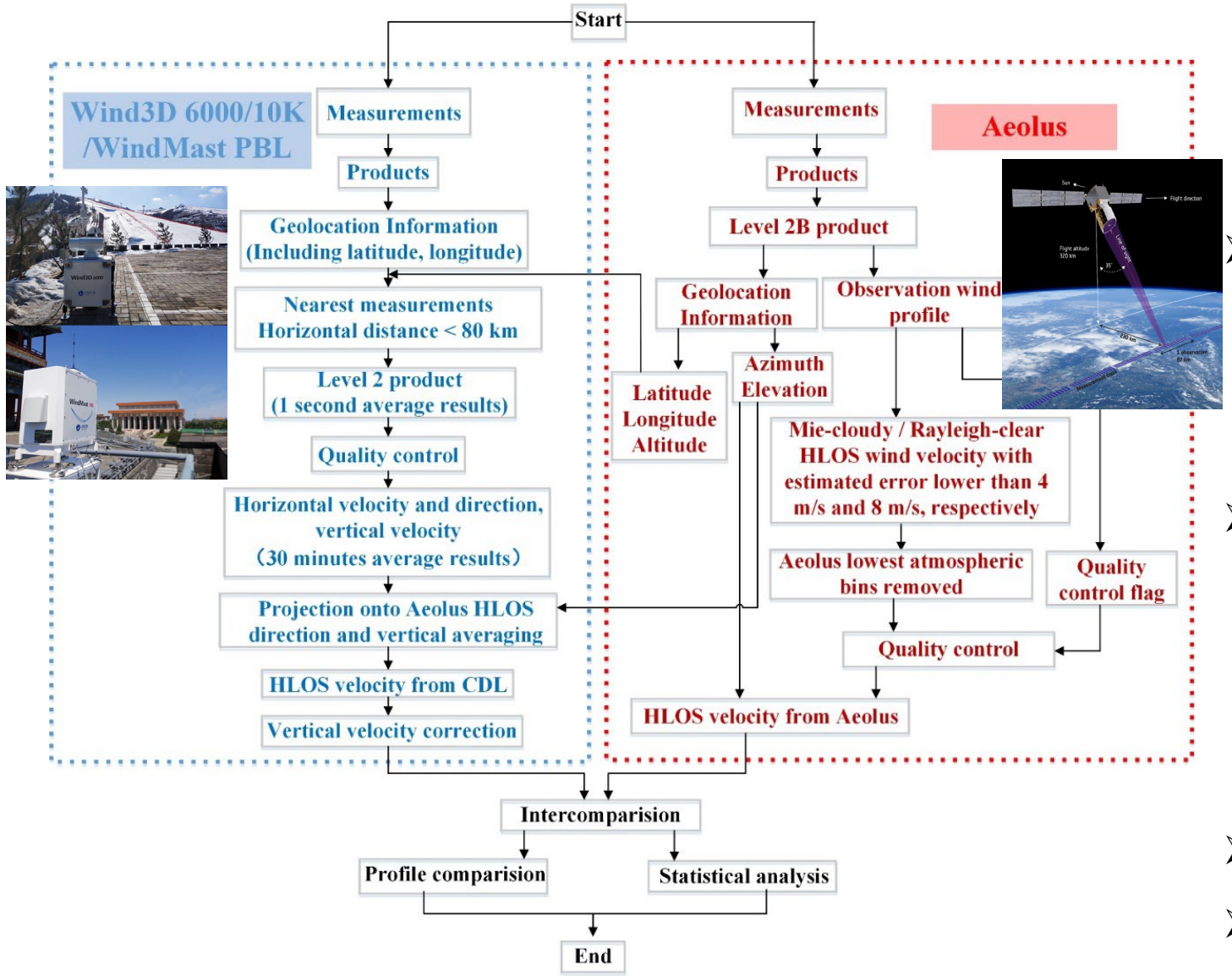
Wu, S., Sun, K., Dai, G., Atmos. Meas. Tech., 2021.

from January to December 2020

Location	Latitude, Longitude, Altitude	Measurement period	Instrument type	Measurement mode
Dunhuang	40.12°N, 94.66°E 1.15 km	From 07 Jan. 2020 to 29 Dec. 2020	WindMast PBL	DBS
Lanzhou	36.05°N, 103.91°E 1.51 km	From 07 Jan. 2020 to 29 Dec. 2020	WindMast PBL	DBS
Zhangye	38.97°N, 100.45°E 1.46 km	From 05 Jan. 2020 to 27 Dec. 2020	WindMast PBL	DBS
Jingzhou	30.11°N, 112.44°E 0.03 km	From 24 June 2020 to 22 July 2020	Wind3D 6000	DBS
Pinggu, Beijing	40.15°N, 117.22°E 0.05 km	From 21 Apr. 2020 to 02 June 2020	Wind3D 6000	DBS
Changji	44.01°N, 87.30°E 0.58 km	03 Dec. 2020	Wind3D 6000	DBS
Jiulong, Sichuan	29.01°N, 101.50°E 2.90 km	From 24 Oct. 2020 to 29 Nov. 2020	Wind3D 6000	DBS
Jiaozhou, Shandong	36.14°N, 119.93°E 0.02 km	21 Dec. 2020	Wind3D 6000	DBS
Qingyuan, Guangdong	23.71°N, 113.09°E 0.03 km	From 12 May 2020 to 27 Aug. 2020	Wind3D 6000	DBS
Xidazhuangke, Beijing	40.52°N, 115.78°E 0.91 km	From 7 Jan. 2020 to 31 Mar. 2020	Wind3D 6000	DBS
Yizhuang, Beijing	39.81°N, 116.48°E 0.04 km	From 07 Apr. 2020 to 25 Aug. 2020	Wind3D 6000	DBS
Huludao	40.47°N, 120.78°E 0.10 km	From 01 Nov. 2020 to 28 Dec. 2020	Wind3D 6000	DBS
Wuwei	38.62°N, 103.09°E 1.37 km	From 11 Apr. 2020 to 26 Dec. 2020	Wind3D 6000	DBS
Lanzhou	36.05°N, 103.83°E 1.53 km	From 04 Jan. 2020 to 26 Dec. 2020	Wind3D 6000	DBS
South China University of Technology	23.16°N, 113.34°E 0.03 km	From 13 Oct. 2020 to 29 Dec. 2020	Wind3D 6000	DBS
Urumqi	43.85°N, 87.55°E 0.84 km	From 14 Oct. 2020 to 24 Dec. 2020	Wind3D 6000	DBS
Qingdao	36.07°N, 120.34°E 0.04 km	From 02 Nov. 2020 to 28 Dec. 2020	Wind3D 6000	DBS

Aeolus L2B B16 products re-validation with ground-based CDLs net over China

Intercomparison methodology

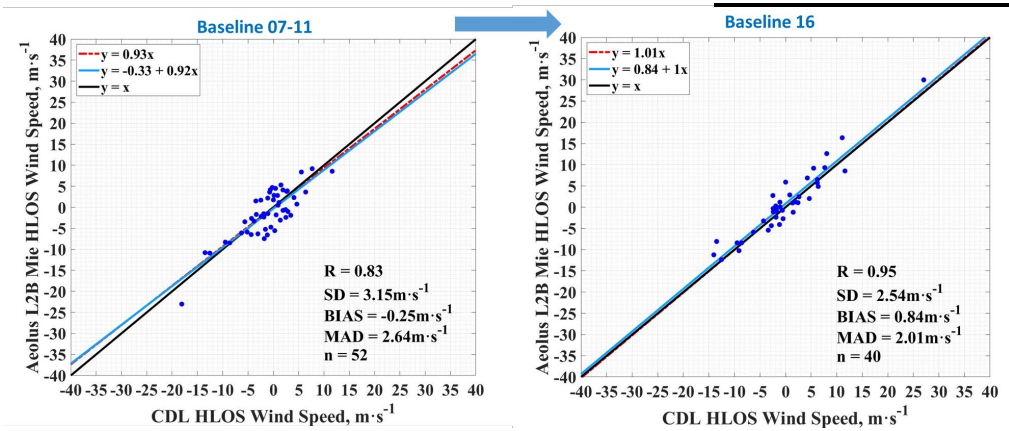


- **Profiles match**
  - Temporal simultaneous
  - horizontal distance between the locations of CDLs and the Aeolus footprints must be less than 80 km
- **Quality control**
  - CDL: SNR>-10dB
  - Aeolus: “validity flag” is ‘true’; Level 2B Rayleigh-clear error<8m/s; Level 2B Mie-cloudy error<4m/s
- **Average of CDL wind profiles (time and vertical)**
  - Temporal: 30 mins average (±15 mins of Aeolus pass time)
  - Vertical: Vertical averaging of the CDL winds to Aeolus range bins
- **CDL wind switching to HLOS wind**
- **Profile comparison and statistical analysis**

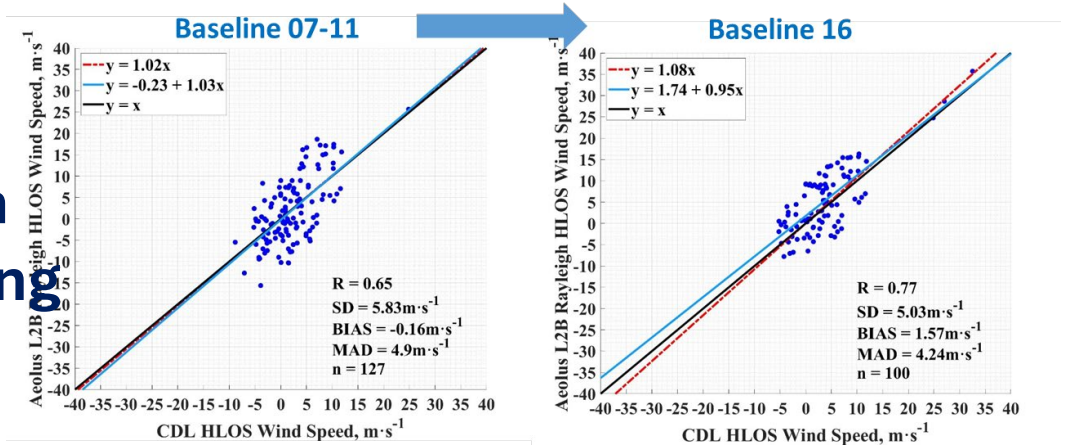
Aeolus L2B B16 products re-validation with ground-based CDLs net over China

Statistical analysis

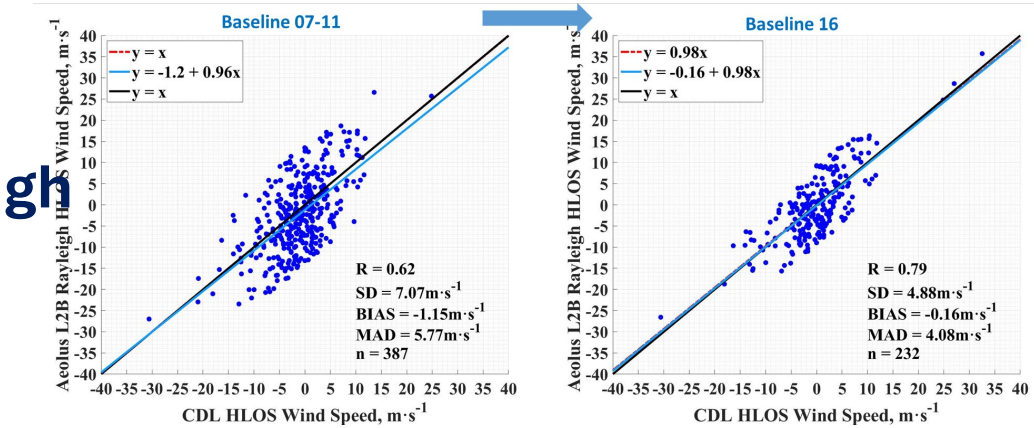
Mie



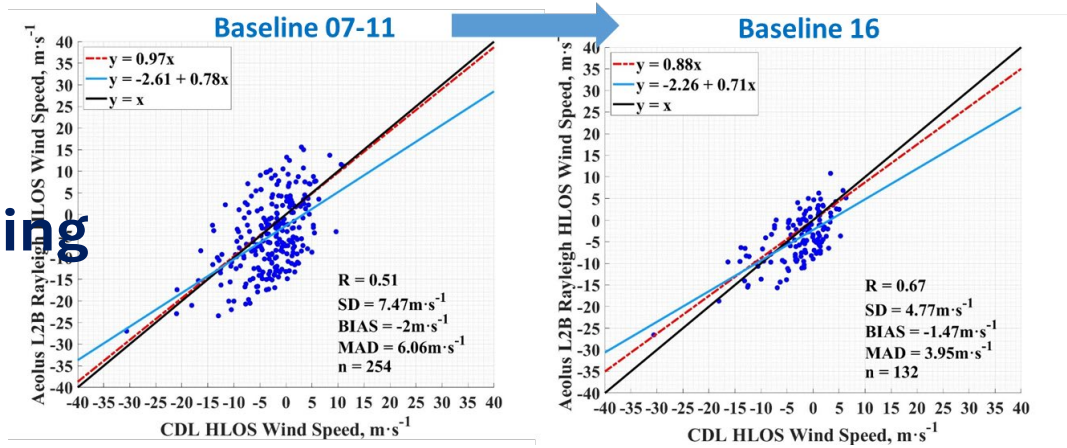
Rayleigh ascending



Rayleigh



Rayleigh descending

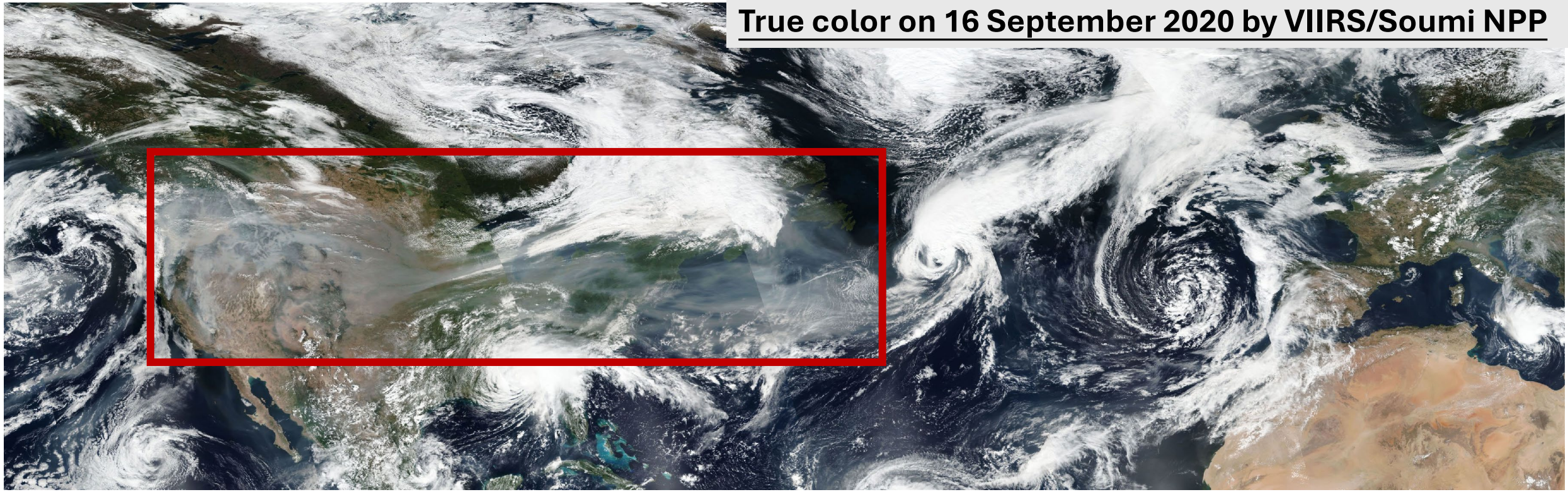


- For the Mie wind, generally, the statistical analysis result with CDL are better of B16 than that of B07-11 (R 0.83 to 0.95, SD 3.15 m/s to 2.54 m/s, MAD 2.64 m/s to 2.01 m/s), except BIAS (-0.25 m/s to 0.84 m/s), while the comparison pairs reduced from 52 to 40.
- For the Rayleigh wind, the statistical analysis result with CDL are better of B16 than that of B07-11 (R 0.62 TO 0.79, SD 7.07 m/s to 4.88 m/s, BIAS -1.15 m/s to -0.16 m/s, MAD 5.77 m/s to 4.08 m/s), while the comparison pairs reduced from 387 to 232 by 155.
- For the ascending group of Rayleigh wind, the BIAS become larger (-0.16 m/s to 1.57 m/s); for the descending group of Rayleigh wind, the comparison pairs reduce from 254 to 132 by 122.

Characterization of smoke transport event using Aeolus B16 data

Background

True color on 16 September 2020 by VIIRS/Soumi NPP



In September 2020, **massive wildfires in the western United States** emitted vast quantities of **smoke aerosols**. These aerosols were lofted into the free troposphere and **transported across continents**.

Leveraging the unique capabilities of the **high spectral resolution lidar ALADIN** onboard Aeolus satellite, this study focus on

1) **the identification of the smoke transport process,**
2) **methodology to derive smoke optical properties from Aeolus Baseline16 products,**
3) **characterization of the smoke plumes via extinction coefficients and lidar ratios**.

Characterization of smoke transport event using Aeolus B16 data

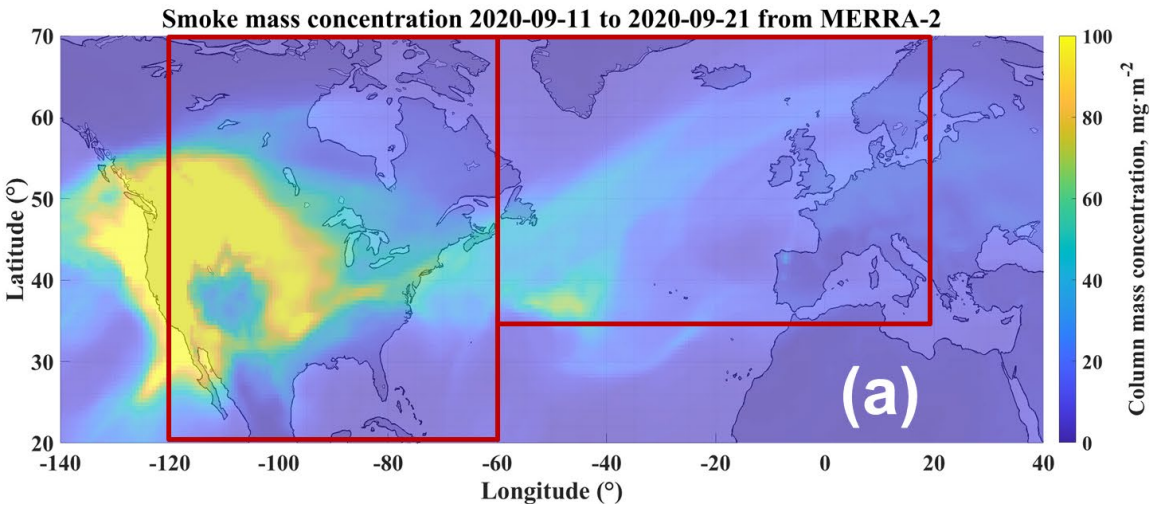
Data/model used

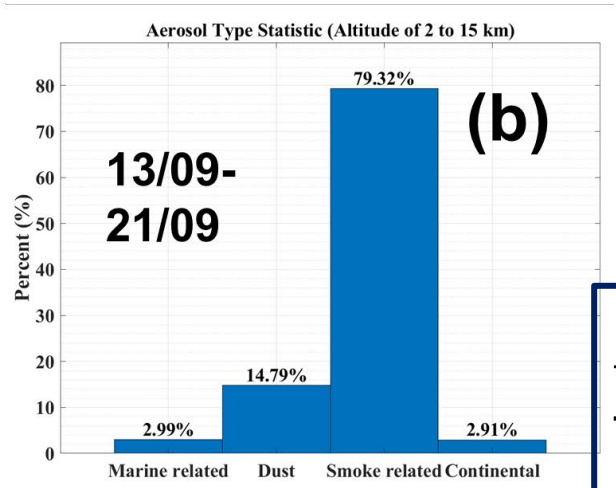
Data source	Products
ALADIN/Aeolus (Measurements)	L2A product (**Particle optical properties**, etc.)
CALIOP/CALIPSO (Measurements)	L2 VFM product (**Aerosol subtypes**)
MODIS/Aqua&Terra (Measurements)	**AOD**@550 nm (daily)
MERRA-2 (Model)	**Column mass concentration (CMC)** of organic carbon, black carbon and dust (hourly)

Methodology

- **Step 1-Determine the general region and period of the smoke transport:**
  - 1.1 using temporal-averaged smoke CMC from MERRA-2
  - 1.2 verified by smoke aerosol dominant examination using Aerosol subtypes statistical analysis from CALIOP
- **Step 2-Select the Aeolus tracks crossing the smoke plumes from the beginning of the transport to the end**, with the assistance of houly CMC from MERRA-2.
- **Step 3-derive smoke data from Aeolus products:**
  - 3.1 **Quality control**: 1) use “bin-1-clear“ flag, 2) outlier elimination (backscatter coefficient (β) > 30 $Mm^{-1}sr^{-1}$, extinction coefficient (α)>600 Mm^{-1})
  - 3.2 **Cloud screening**: cloud flag (RH>80% or Rb=β/βm>2.5)
  - 3.3 **Smoke data selection**: retain data with 1) CMC-smoke>15mg/m2, 2) CMC-smoke/CMC-all>0.6
  - 3.4 β correction: with circular depolarization ratio (δ) of 0.22 derived from linear δ of 0.1
  - 3.5 Smoke α and β extension: using 1) original α and β, 2) averaged lidar ratio (LR) of one smoke cross-section (only within the range of 40 sr to 120 sr)

Characterization of smoke transport event using Aeolus B16 data

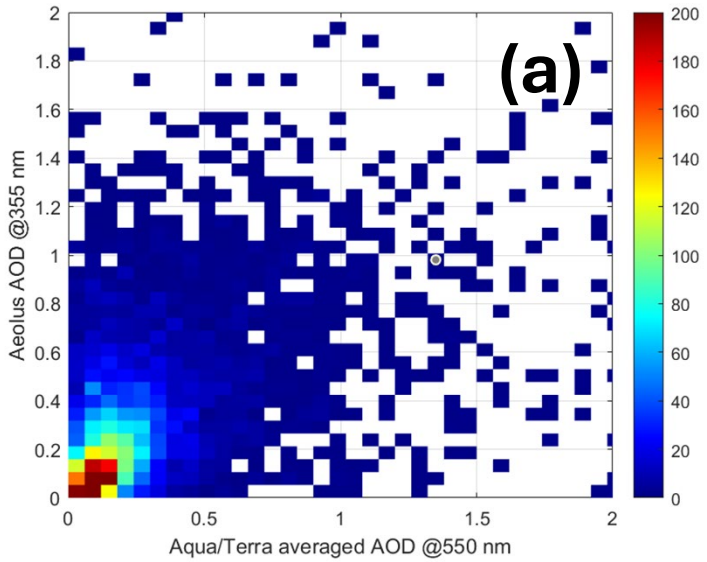


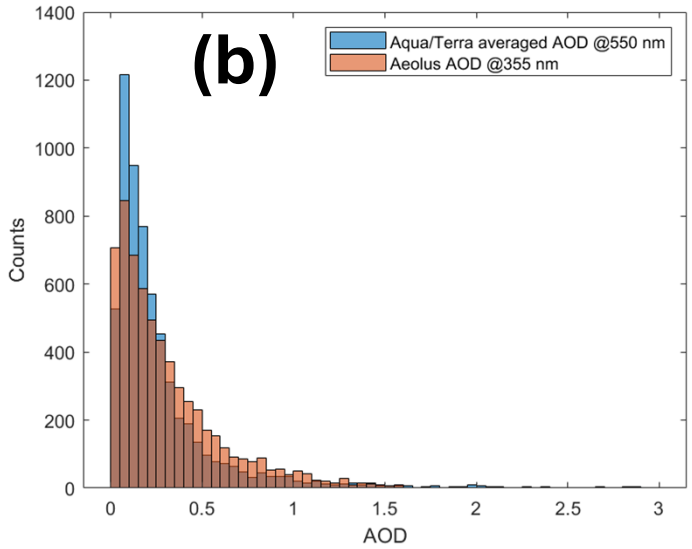


Identification of smoke region

(a) Integrated **smoke column mass concentration** in America-Altlantic-Europe region from **11st to 21st September 2020**
(b) Statistical analysis of **aerosol type** in the red-box region

Red-box region can be identified to be the **main region of the smoke transport event**, which was dominated by **smoke aerosol (around 80%)**.





Validation of aerosol optical depth (AOD)

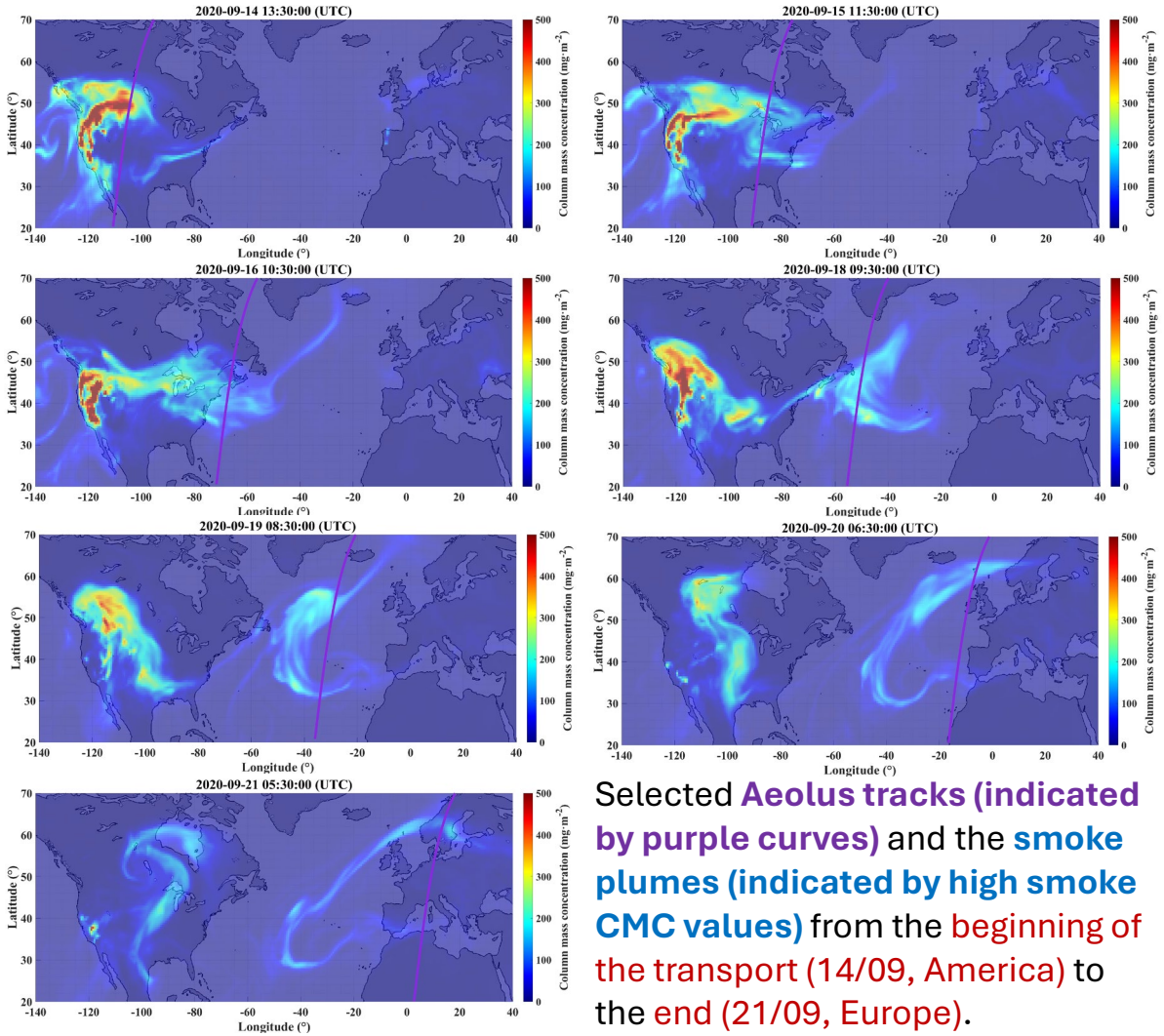
AOD Comparisons in the region and the period of smoke transport:
(a) scatter: **x axis - MODIS; y axis - Aeolus**
(b) Histogram: blue - MODIS; red – Aeolus

Considering
- ☐ **Different wavelength** (Aeolus @355 nm , MODIS @550 nm)
- ☐ **Different method** (Aeolus - active, MODIS - passive)

Consequently
- ➢ Aeolus AOD and MODIS AOD **fit well**
- ➢ Aeolus AOD is reasonable and **can be used for smoke transport observation**

Characterization of smoke transport event using Aeolus B16 data

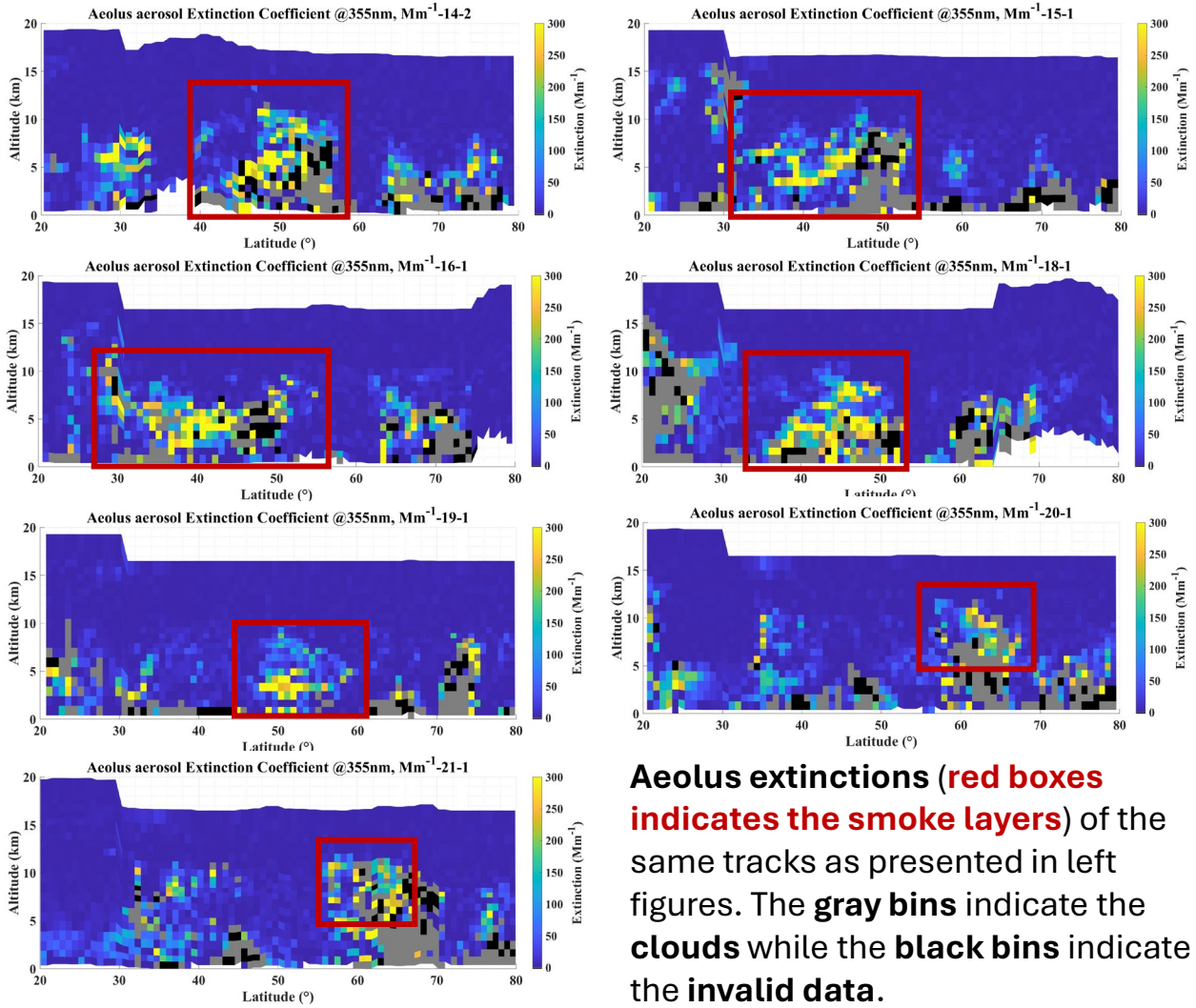
Aeolus tracks selection



Selected **Aeolus tracks (indicated by purple curves)** and the **smoke plumes (indicated by high smoke CMC values)** from the beginning of the transport (14/09, America) to the end (21/09, Europe).

The selected Aeolus tracks (all descending) crossed the smoke plumes, have potential to capture and observe the smoke layers.

Aeolus extinction coefficients along the selected tracks

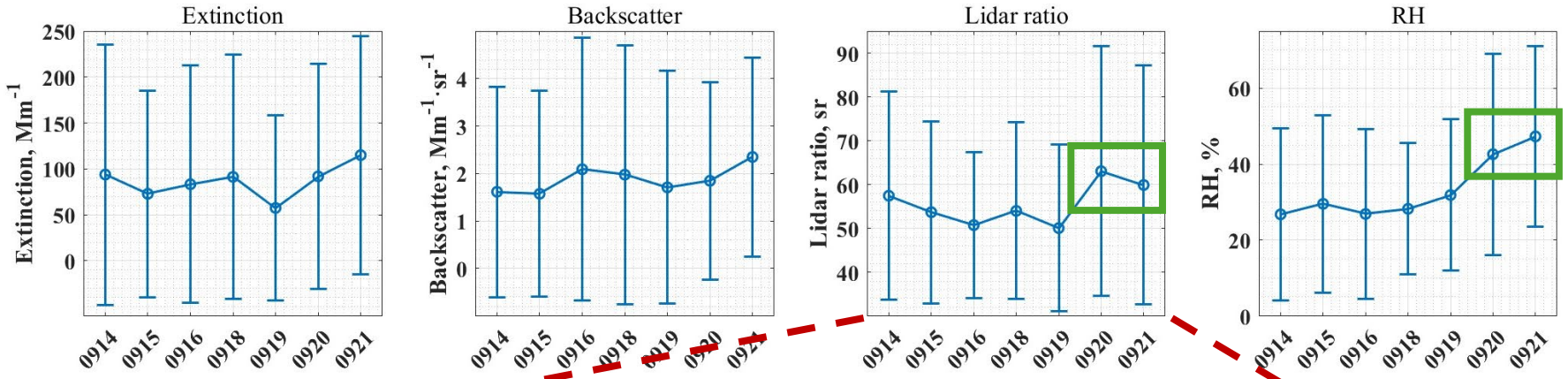


Aeolus extinctions (**red boxes indicates the smoke layers**) of the same tracks as presented in left figures. The **gray bins** indicate the **clouds** while the **black bins** indicate the **invalid data**.

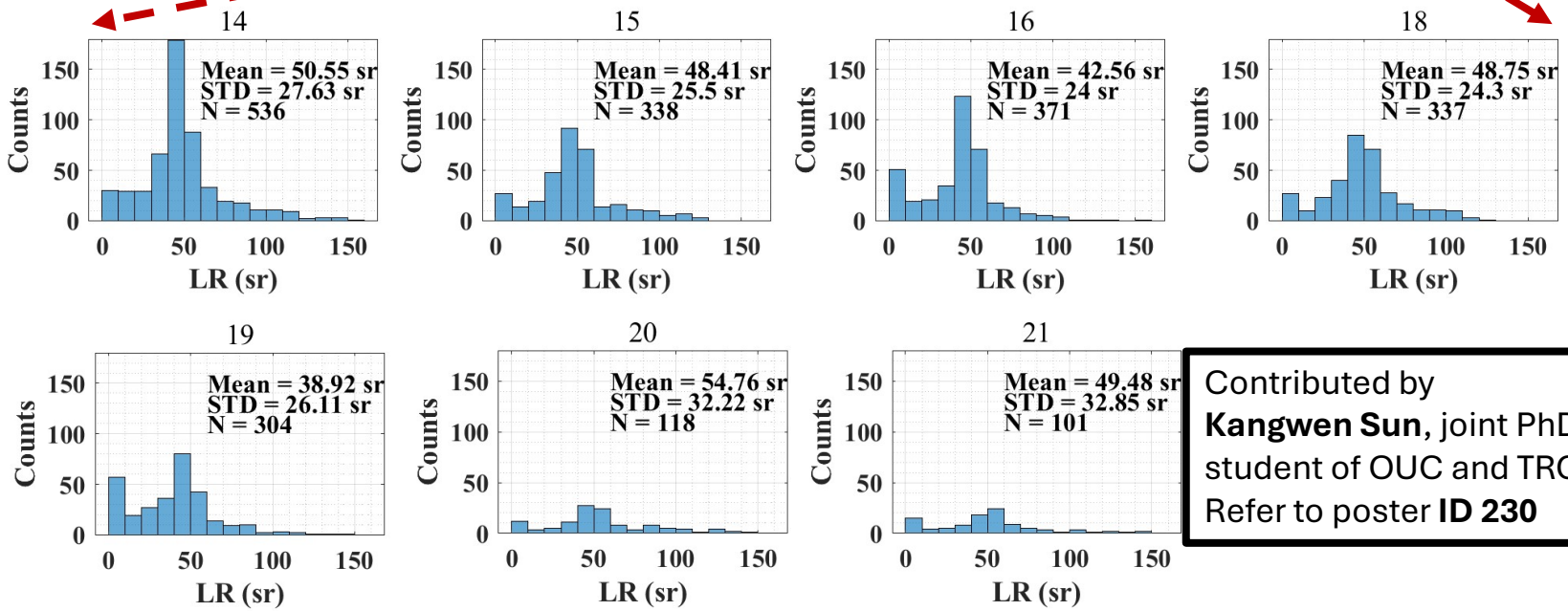
- **Presenting smoke layers distributions in different transport phases.**
- **On 14th to 19th, the aerosol layers were mostly beside the clouds, while they might be elevated to be above the clouds on 20th and 21st.**

Characterization of smoke transport event using Aeolus B16 data

Statistical results of the Aeolus smoke data during transport



- The variations of **extinction, backscatter, lidar ratio and RH** during the whole transport.
  - The **increased lidar ratios** in the end of the transport (20th and 21st) may be relevant with **the enhancements of RH** (**shown in the green boxes**).

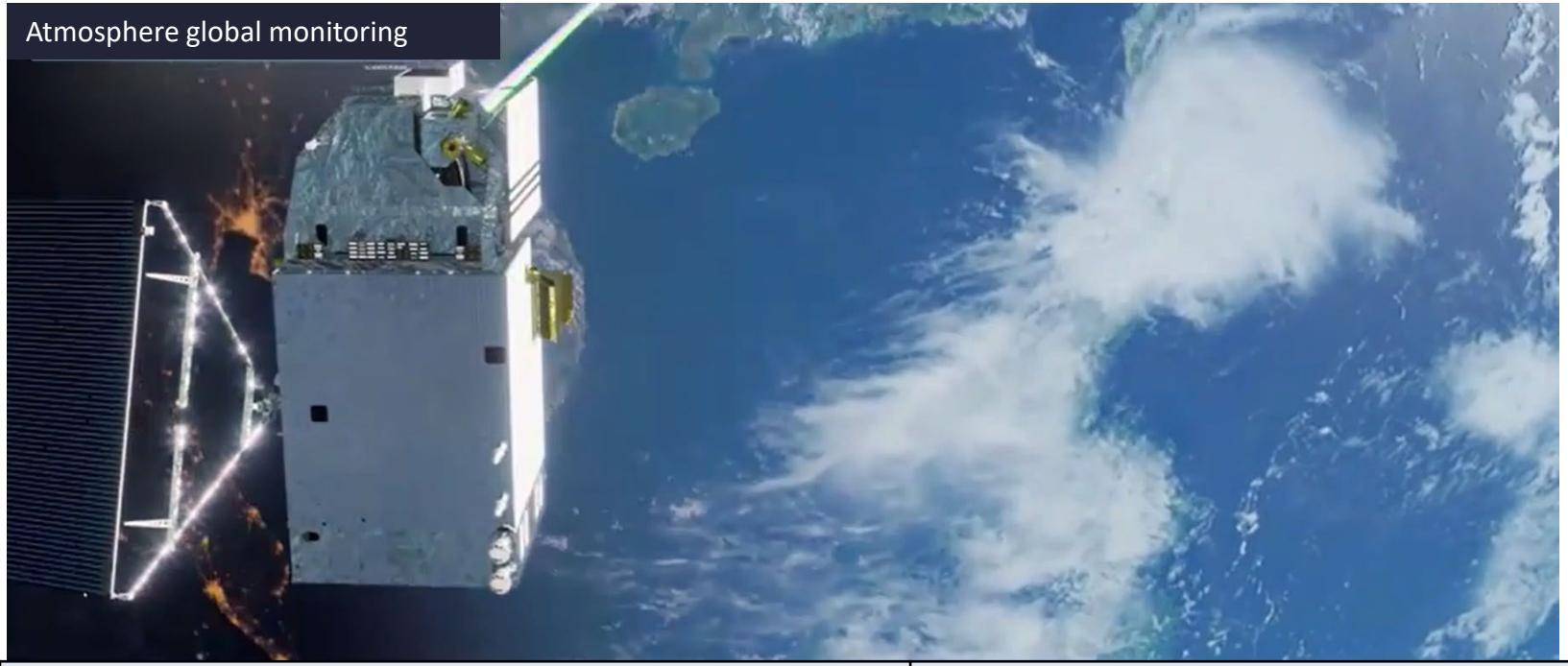


Zoom in the lidar ratios (LR):

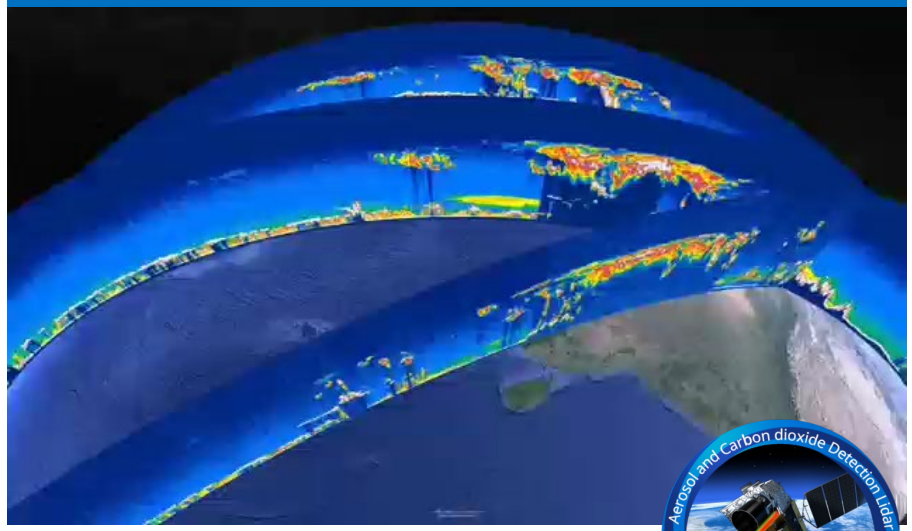
- LR distributions during the smoke transport, indicates the **aging of the smoke**.
  - Smoke LR mean values are within the **reasonable range (55±20 sr)** and expected **decreasing tendency for aged smoke (14th to 19th)**.

Contributed by **Kangwen Sun**, joint PhD student of OUC and TROPOS, Refer to poster **ID 230**

Information about the DQ-1 mission



ACDL/DQ-1: launched at 16 April 2022

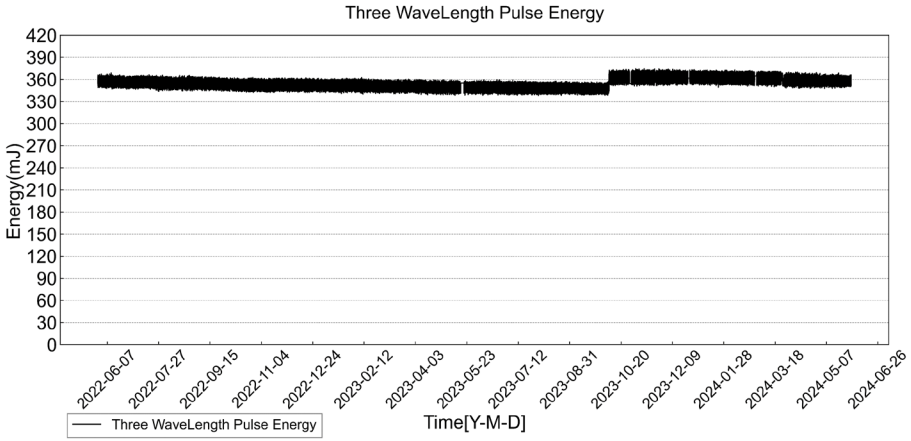


Sensor	Observed object
【main instrument】 **Aerosol and Carbon Detection Lidar (ACDL)**	Global column CO_2; **Global aerosols and clouds profile;** **Global pollutant distribution PM2.5 etc.**
Particulate Observing Scanning Polarimeter (POSP)	Aerosols and clouds, PM2.5
Directional Polarization Camera (DPC)	Aerosols and clouds, PM2.5
Environmental trace gas Monitoring Instrument (EMI)	NO_2, SO_2, O_3 etc.
Wide Swath Imaging system (WSI)	Temperature and humidity, aerosols and clouds

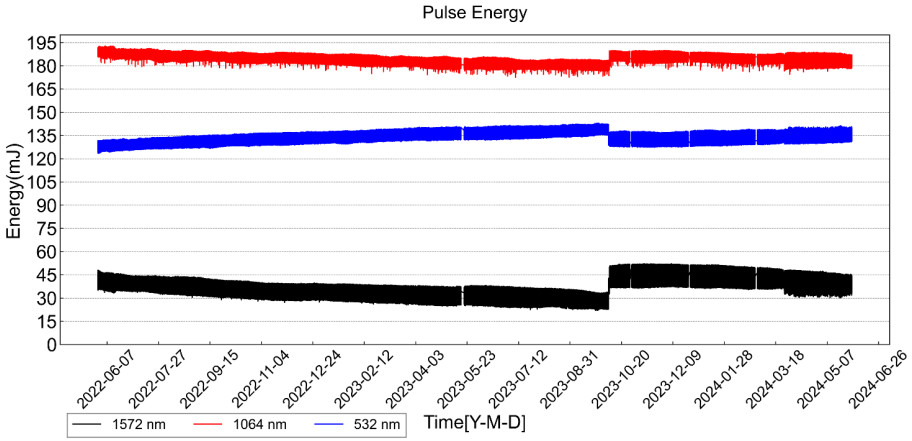
Parameter	Value
Orbit	705 km, sun-synchronous orbit
Revisit interval	~ 51 day
Weight	2.8 t
durable years	＞ 8 years

ACDL laser monitoring

ACDL on-orbit pulse energy monitoring



Laser total energy



Laser three wavelength energy

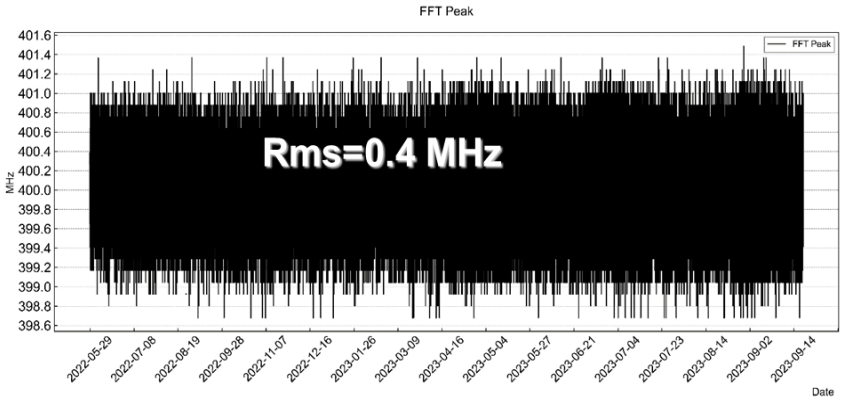
ACDL is operated from May 20th 2022:Continuous operation **> 3 years**.

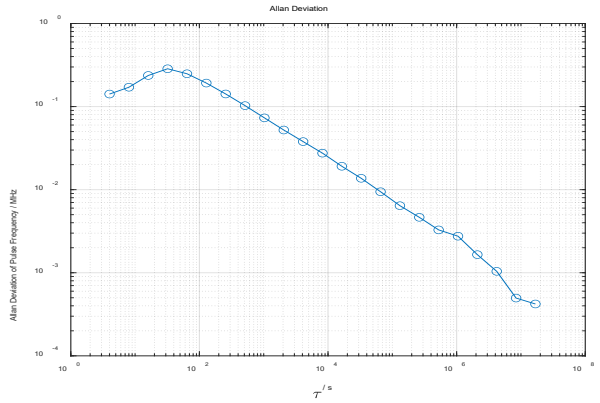
The laser amplifier was adjusted to increase 1572 nm pulse energy on Oct. 7, 2023.

The total laser energy decreases slowly with only -8 mJ/year.

The laser energy drop rate is relatively large at 1572nm, and the laser energy slowly increases at 532 nm.

Frequency stability of 1572 nm pulsed laser





Standard deviation less than **0.5MHz**

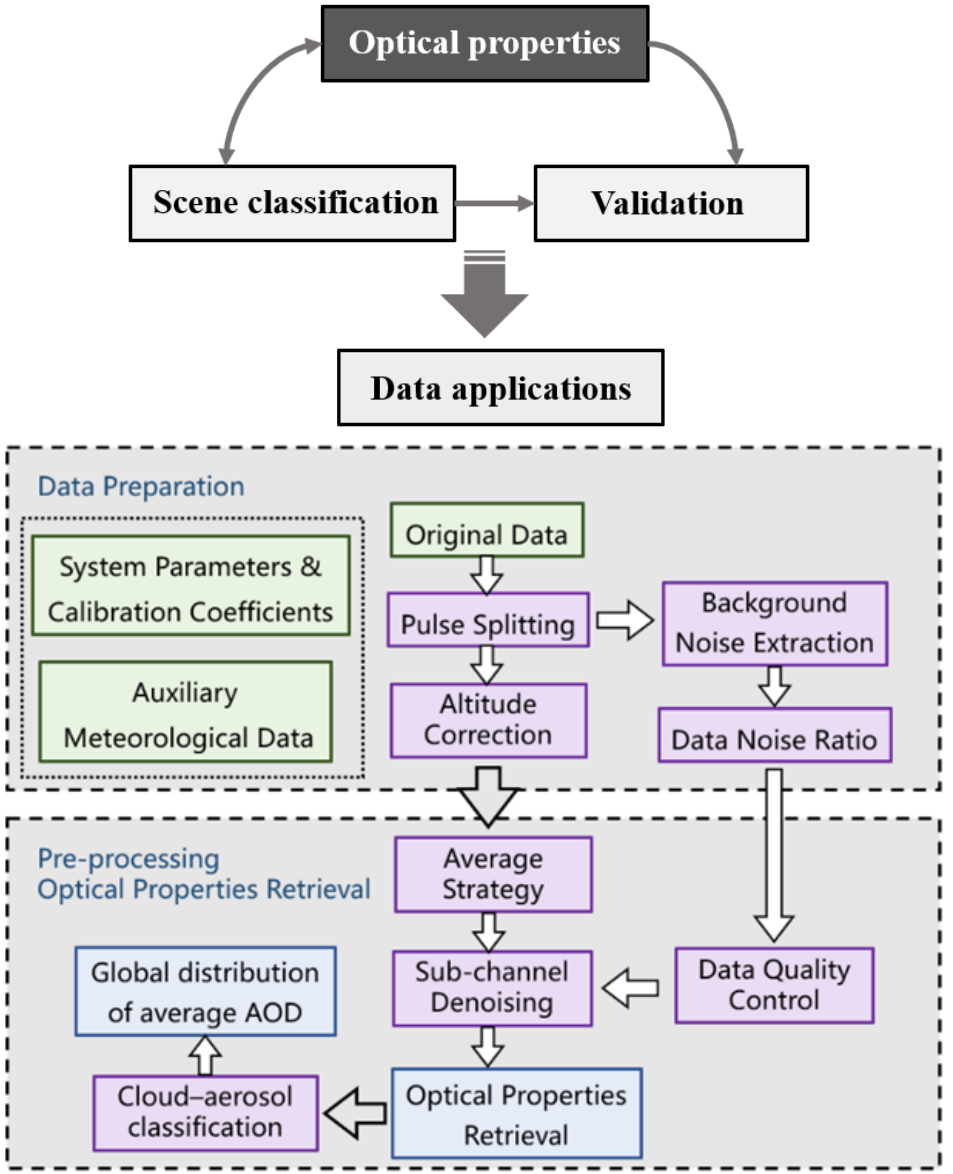
Allen deviation less than **30kHz@10000s**

	Allan variance (required) / MHz(@10000s)	Allan deviation (testing) / MHz(@10000s)
1572 nm pulse laser frequency	**< 0.6**	**< 0.03**

ACDL-A aerosols and clouds data production chain

- A data processing and optical properties retrieval method adapted to the specific characteristics of ACDL-A global observation dataset

Version	Update	Data	Available data
Baseline01	2022/09	In-orbit test data	Only for test
Baseline02	2022/11	2022/06/01~2022/08/04	2022/12/10
Baseline03	2023/11	2022/06/01~2022/12/31	2024/01/31
Baseline04	2024/08	2022/06/01~2022/12/31 2023/10/~ongoing	Continuing @ OUC @ NSMC
Baseline05	2025/07	2022/06/01~ongoing 2025/3/24 ~ongoing	Continuing @ OUC



Dai, G., Wu, S., Long, W., Atmos. Meas. Tech., 2024.

ACDL data classification

level	Data processing	Data products	Format
Level 0	The observation data obtained by downlinking multi-packet data integrity inspection and data splicing through the two channels of the satellite.	Raw data	RAW
Level 1A	Process the level 0 aerosol data, obtain the profiles of 532 nm and 1064 nm channels, with the geographic location and height corrected.	Profiles data of 532 nm and 1064 nm channels	HDF5
Level 1B	Process the level 0 CO2 data, obtain the profiles of 1572 nm channel, with the geographic location and height corrected.	Profiles data of 1572 nm channel	HDF5
Level 2A	Attenuated backscatter coefficient with systematic constant correction	Attenuated backscatter coefficient	HDF5
Level 2B	Differential Absorption Optical Depth (DAOD) products	DAOD	HDF5
Level 2C	Cloud and aerosol products including extinction coefficient, backscatter coefficient, depolarization ratio, AOD, lidar ratio and color ratio	Cloud and aerosol optical properties	HDF5
Level 2D	XCO2	XCO2	HDF5

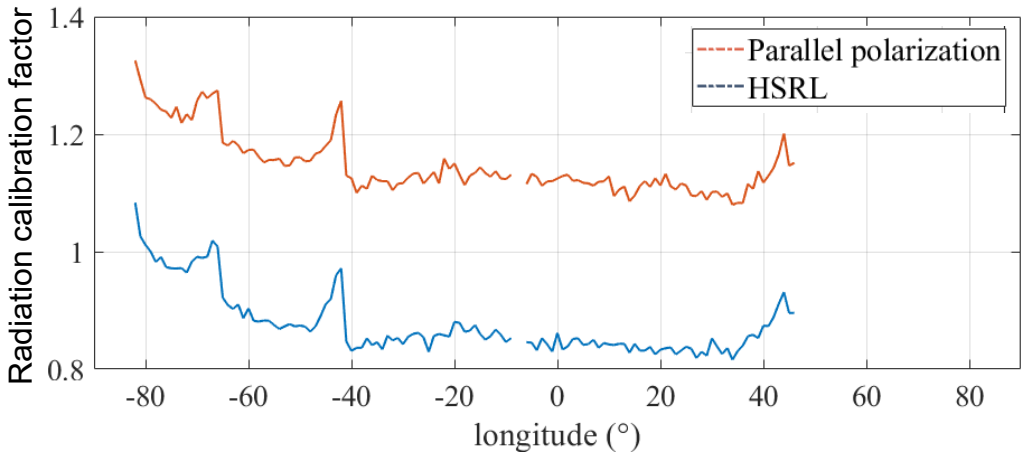
ACDL radiation monitoring

In the latest version of the Baseline05 processing algorithm, calibration corrections along latitude are performed periodically.

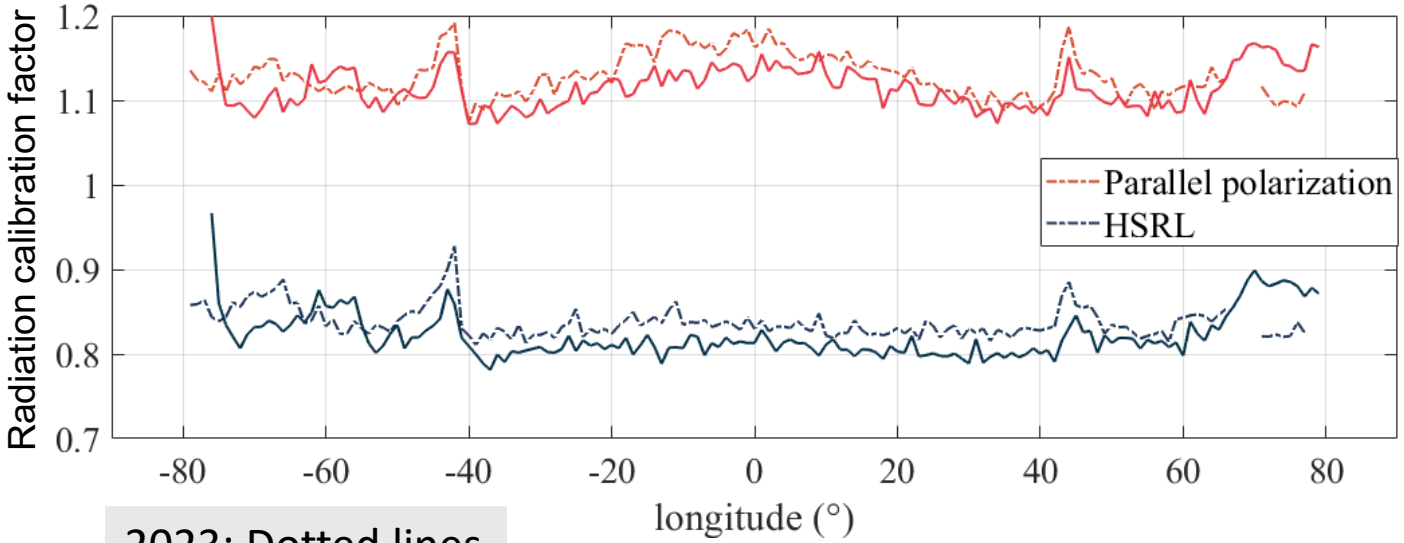
The calibration coefficients for the individual channels are mainly affected by the angle of the sun in the different latitude bands and by energetic radiation events.

ACDL has been operating in orbit in a stable state for more than three years.

2022/07



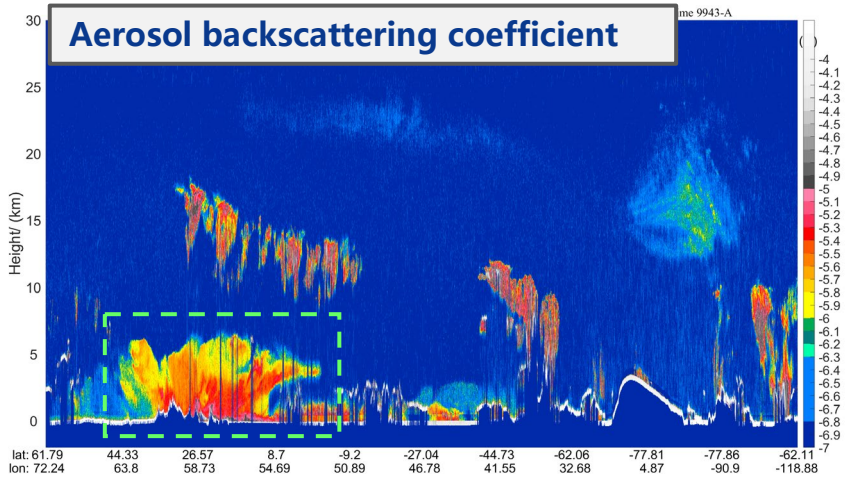
2023/03 ----> 2025/03

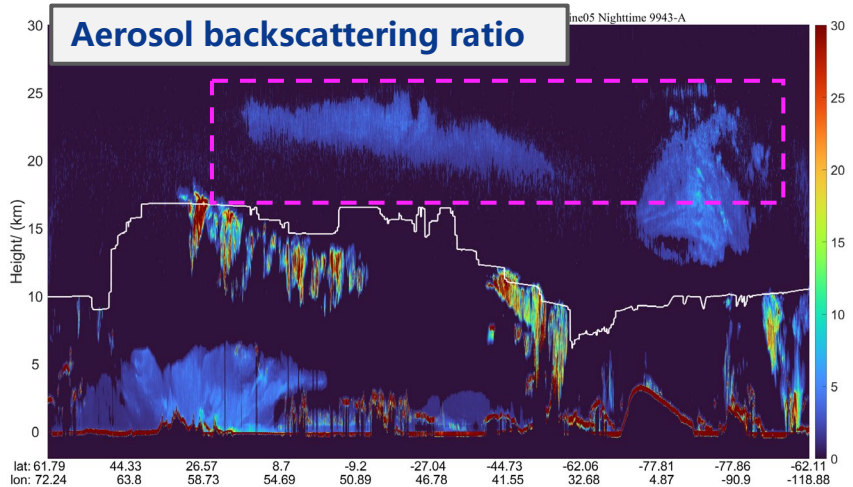


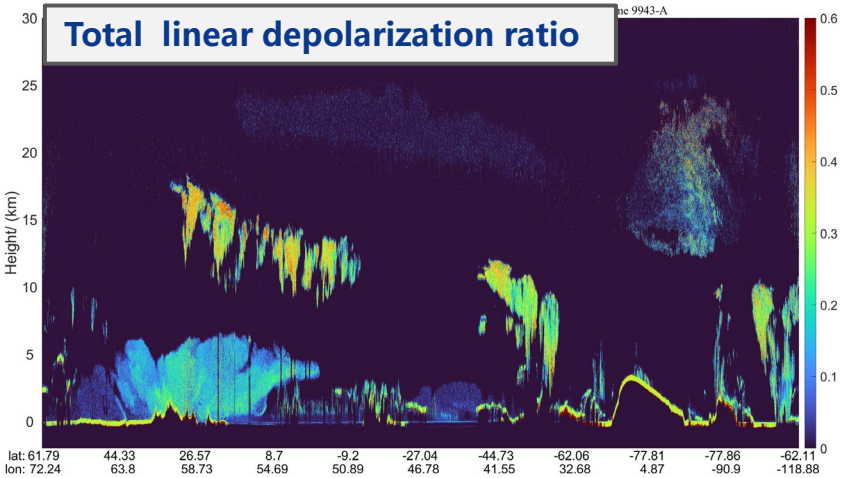
2023: Dotted lines
2025: Solid lines

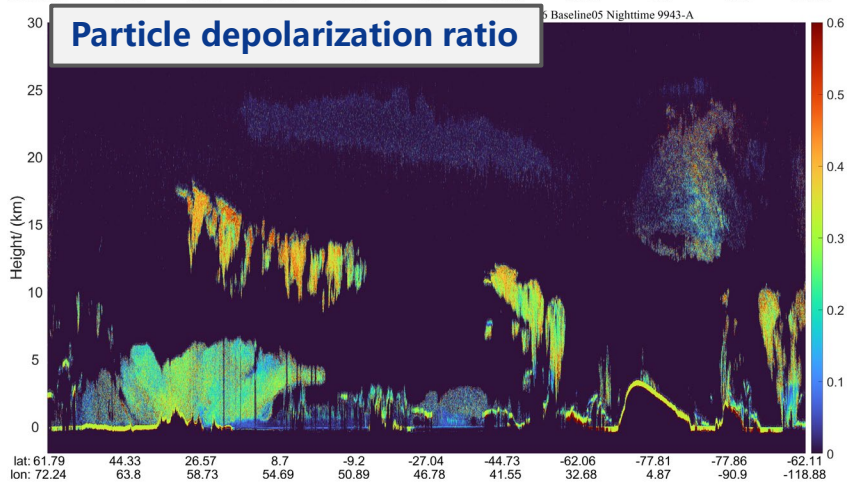
Observation case of Baseline05 - ACDL

ACDL observation case - Central Asian dust



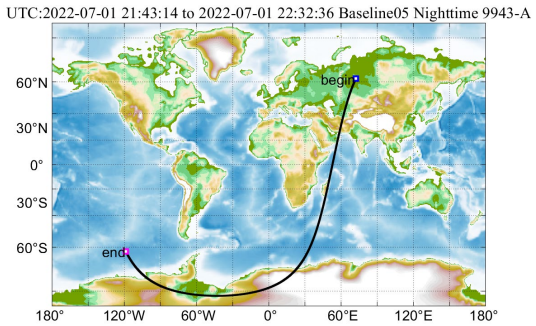






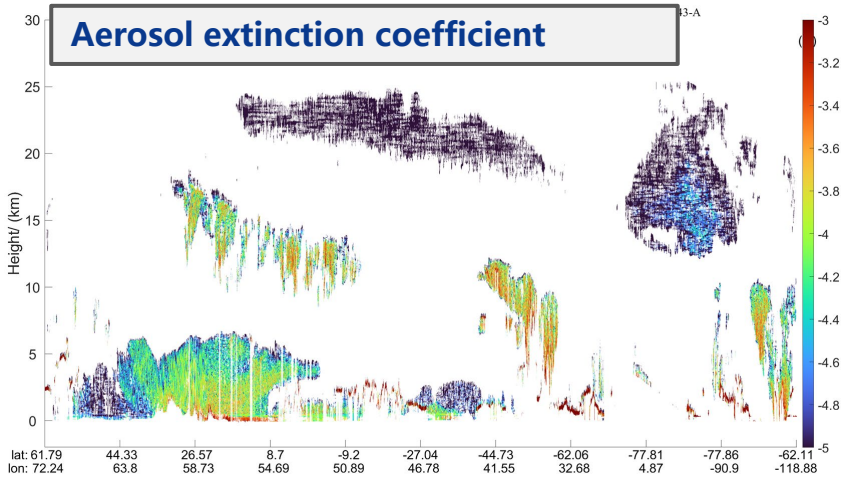
Large-scale outbreaks and transport of dust in Central Asian

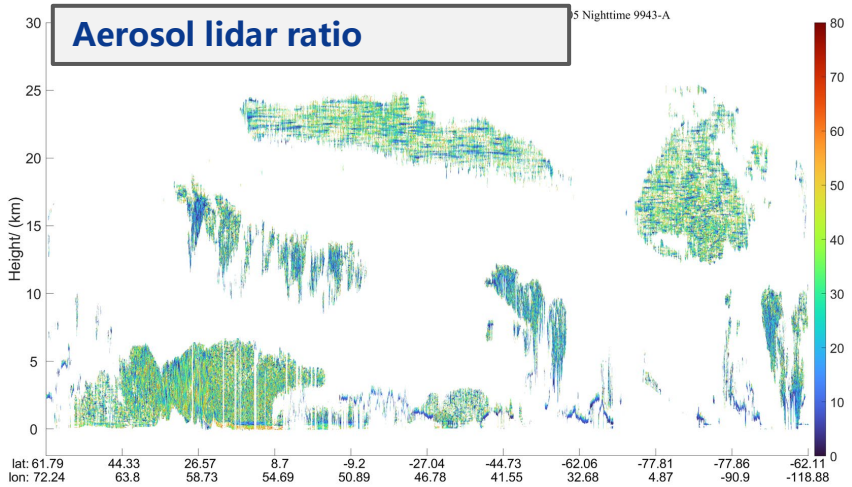
Due to advances in weak-signal and noise processing algorithms, the Baseline05 performs great in stratospheric and high-latitude observations.

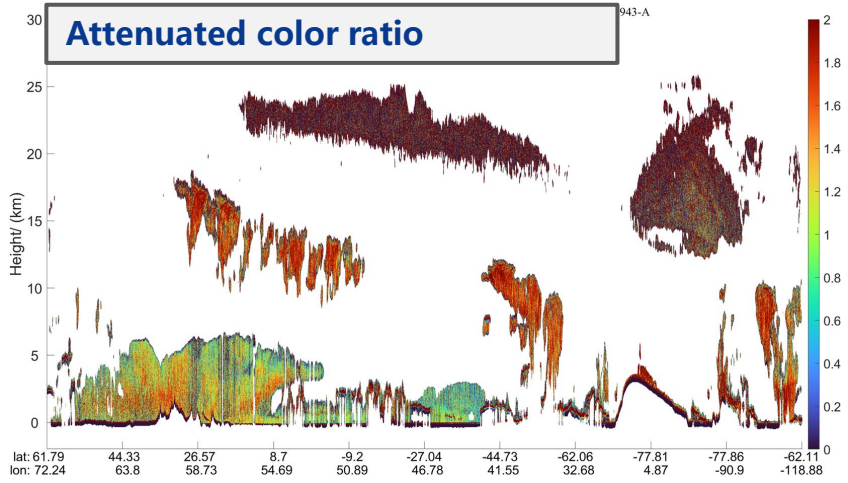


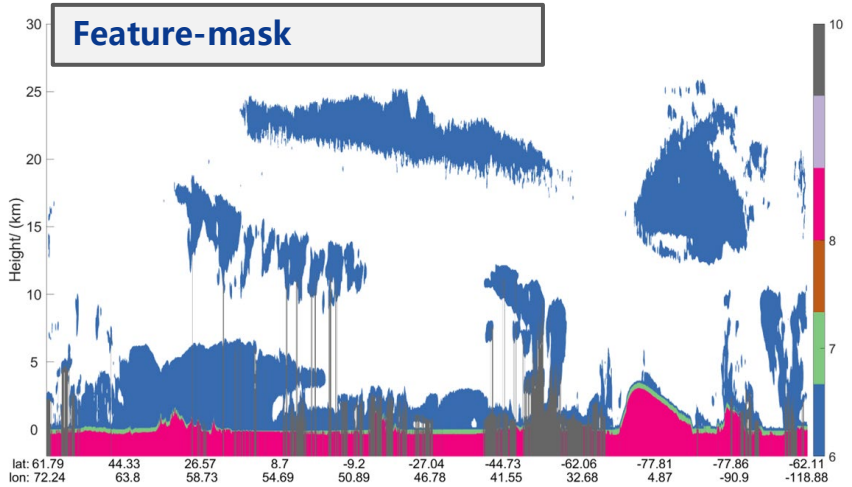
Observation case of Baseline05 - ACDL

ACDL observation case - Central Asian dust



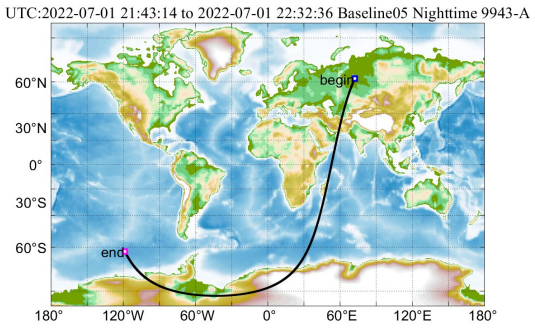






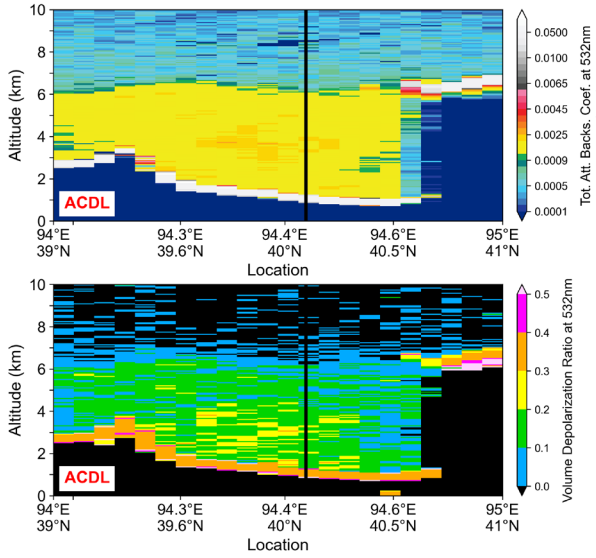
nighttime
- Horizontal resolution 3.3km
- Vertical resolution 50m

daytime
- Horizontal resolution 6.6km
- Vertical resolution 50m

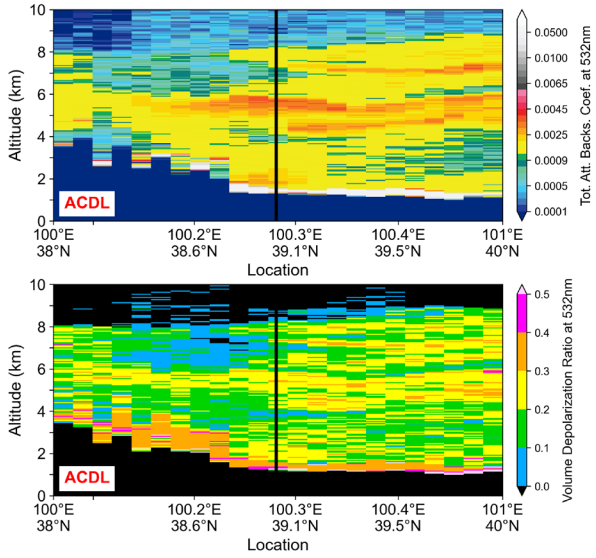


Validation of ACDL data products

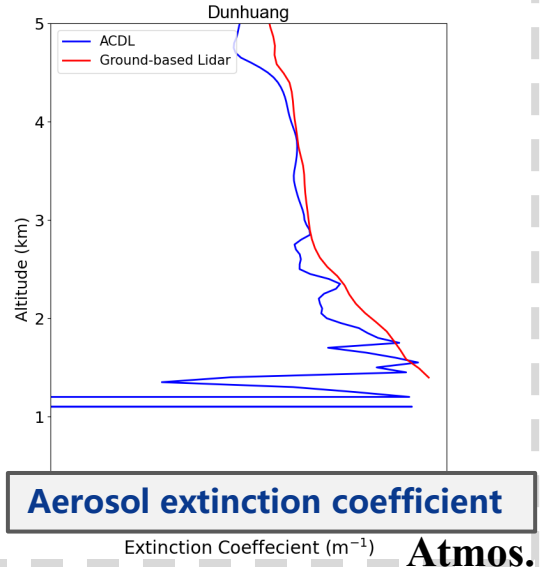
ACDL-20220629



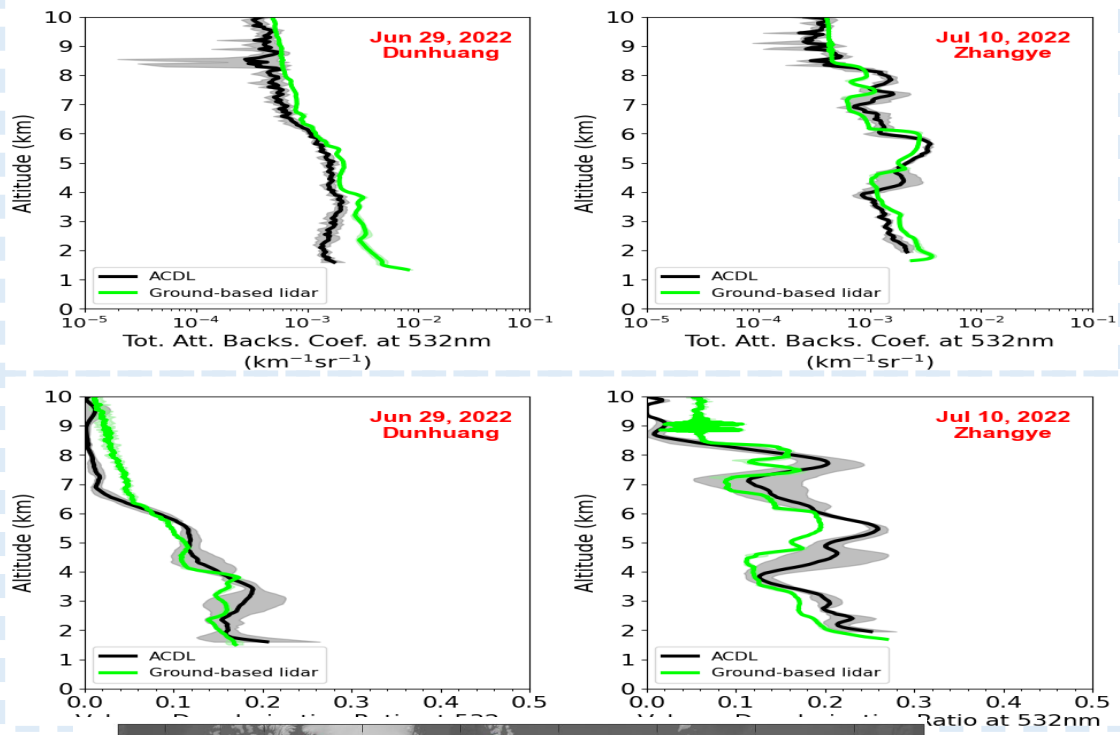
ACDL-20220710

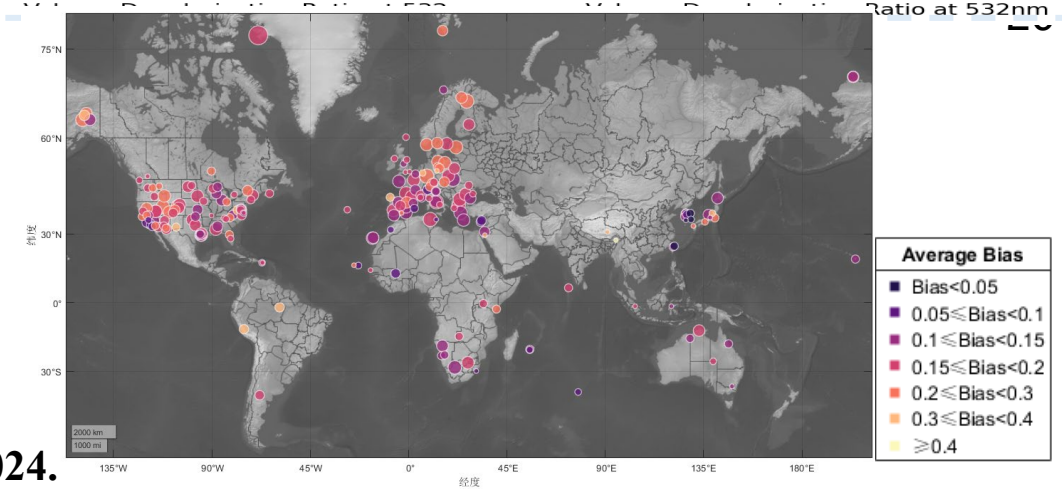






Aerosol extinction coefficient





Atmos. Meas. Tech., 2024.

Information about the EarthCARE mission

Cloud, aerosol and radiation interactions are still the largest source of uncertainty in projections of the future climate, making them critical to improve numerical weather predictions and climate modelling.

EarthCARE observes:

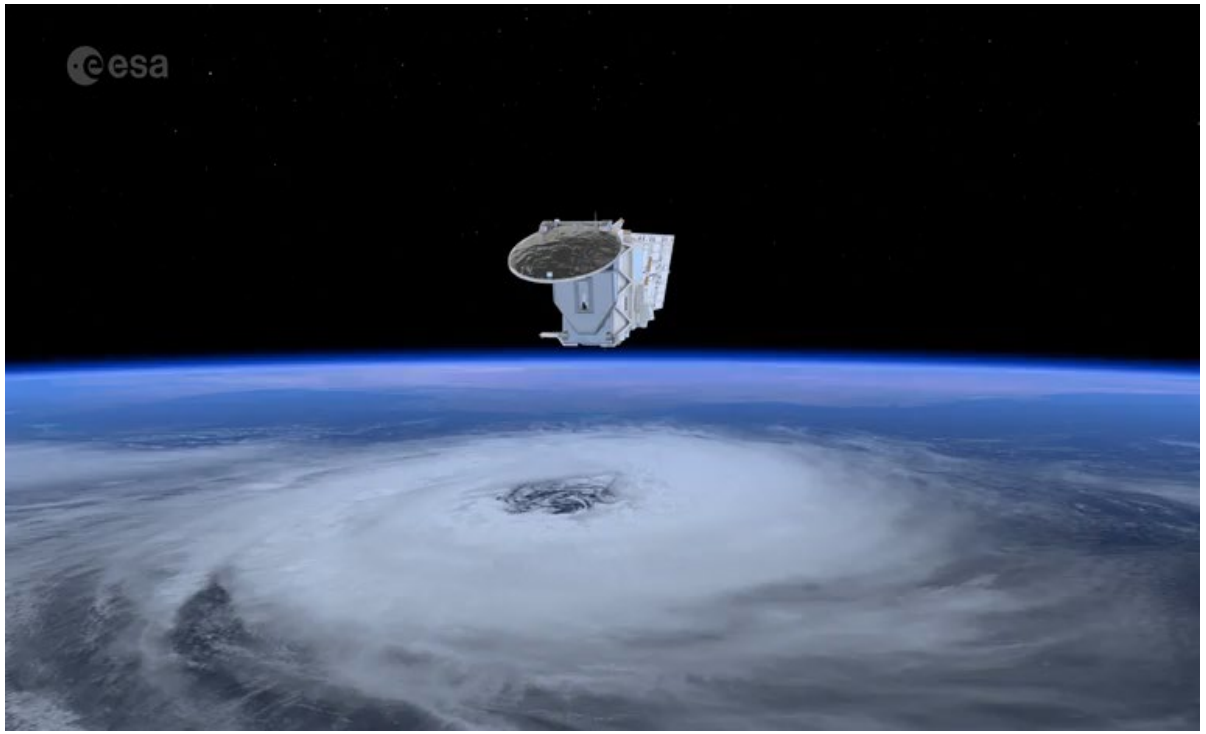
- Cloud profiles (ice, liquid, mixed phase)
- Cloud coverage and overlap
- Precipitation profiles
- Type-resolved aerosol profiles and spectral AOT
- Broad-band solar & thermal radiation

EarthCARE carries four instruments:

- **High-spectral-resolution & polarization lidar @355 nm**
- Cloud-profiling radar with Doppler capability @94 GHz
- Multi-spectral imager (VIS, NIR, SWIR, TIR)
- Broad-band radiometer (3-view SW, LW)

EarthCARE observation goal:

- Radiative closure at TOA within 10 Wm^{-2}



Largest and most complex Earth Explorer to date
Sun-synchronous orbit @ 393 km, 14:00 hours descending node

EarthCARE data production model



CSTEC 中国科学技术交流中心 China Science and Technology Exchange Center

esa → THE EUROPEAN SPACE AGENCY

CPR Level 1b (JAXA)
Radar reflectivity and Doppler velocity profiles

ATLID Level 1b (ESA)
Attenuated backscatter in
- Rayleigh channel
- Co-polar Mie channel
- Cross-polar Mie channel

MSI Level 1b/c (ESA)
TOA radiances for four solar channels, TOA brightness temperatures for three thermal channels

BBR Level 1b (ESA)
Filtered TOA short-wave and total-wave radiances

CPR Level 2a
Radar echo product, feature mask, cloud type, liquid and ice cloud properties, vertical motion, rain and snow estimates, ...

ATLID Level 2a
Feature mask and target classification, extinction, backscatter & depol. profiles, aerosol properties, ice cloud properties, ...

MSI Level 2a
Cloud mask, cloud micro-physical parameters, cloud top height, aerosol parameters, ...

BBR Level 2a
Unfiltered top-of-atmosphere radiances, short-wave and long-wave fluxes
BBR Level 2b: enhanced products using MSI

Synergistic Level 2b
1. Target classification
2. Cloud & aer. prof. at x-sec

EarthCARE Data Production Model

3D Scenes Construction
Expand syn. retrievals across-track using MSI; ≈40 km wide

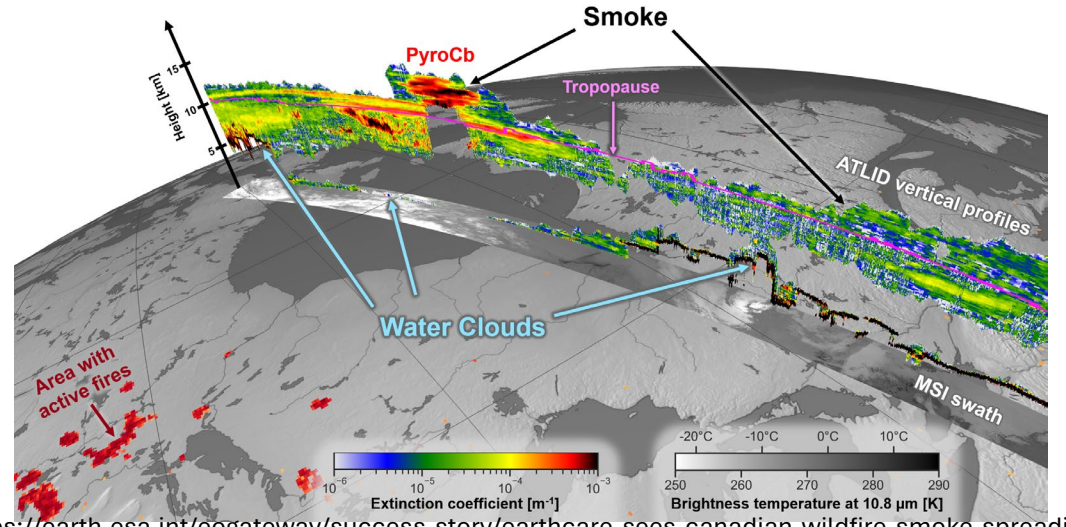
Radiative Transfer Products
calculated radiances, fluxes, heating rate profiles

Assessment
Comparison of calculated fluxes and radiances to BBR observations

Eisinger et al.: The EarthCARE Mission: Science Data Processing Chain Overview, AMT 2024

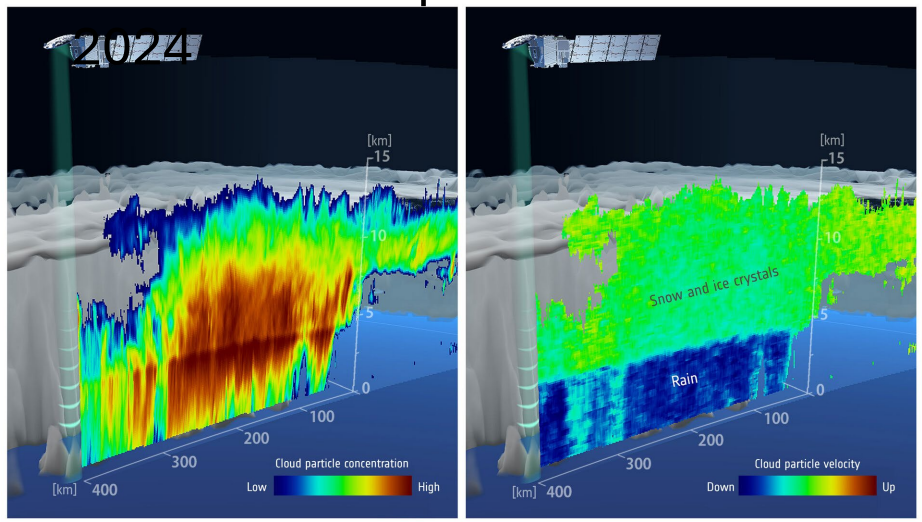
Measurements of EarthCARE

ATLID over wildfire smoke in Canada on 1 June 2025

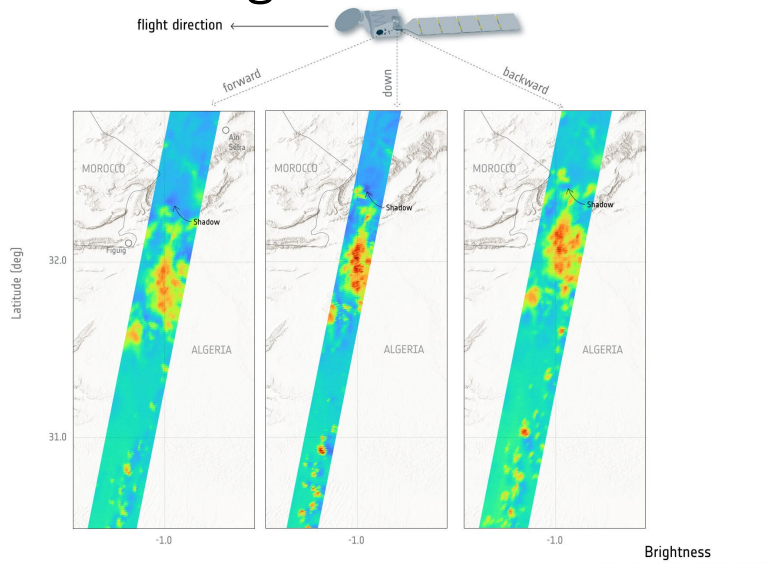


https://earth.esa.int/eogateway/success-story/earthcare-sees-canadian-wildfire-smoke-spreading-over-the-northern-hemisphere

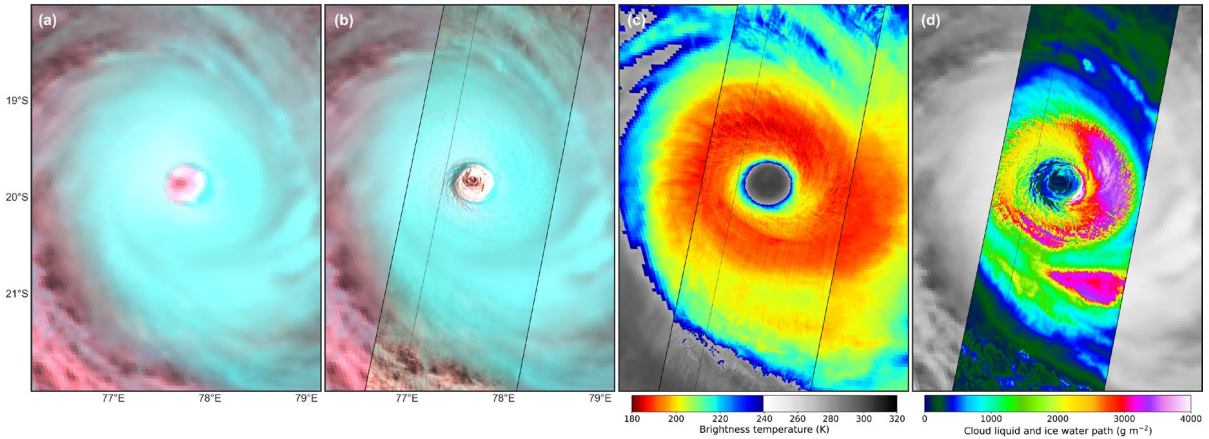
CPR east of Japan on 13 June



BBR over Algeria on 18 June2024



MSI captures Tropical Cyclone Vince on 7 February 2025 over the South-West Indian Ocean. Credit: Sebastian Bley, TROPOS

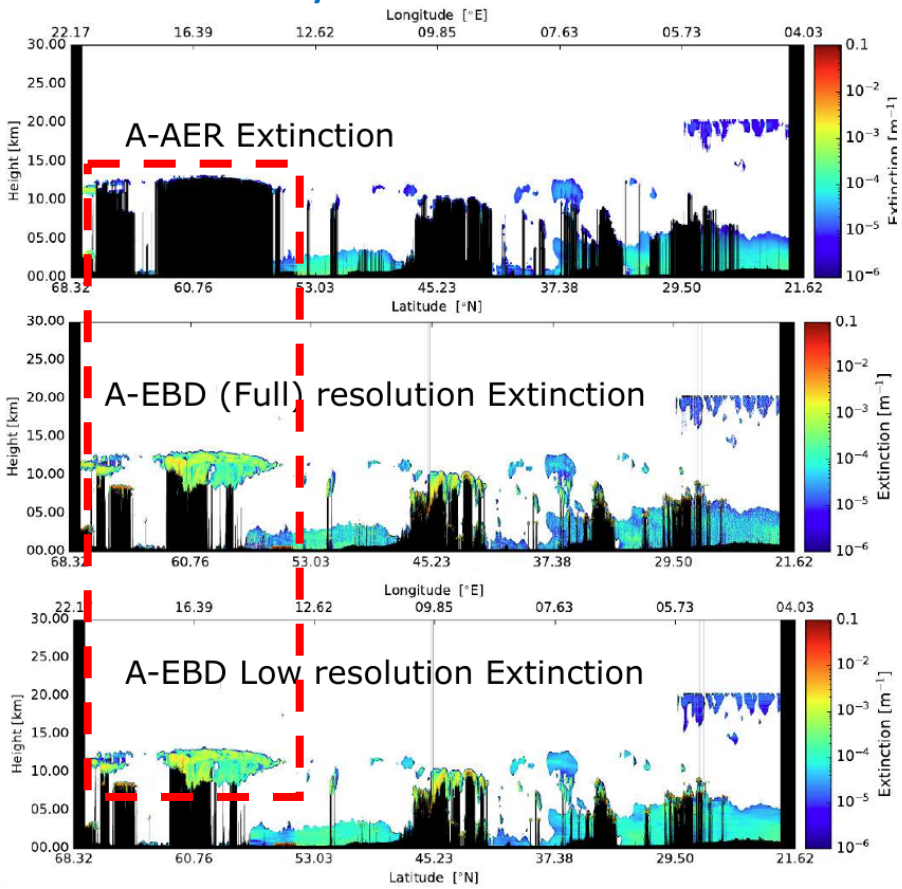


https://earth.esa.int/eogateway/success-story/earthcare-stares-into-the-eye-of-tropical-cyclone-vince

ATLID Level 2A product

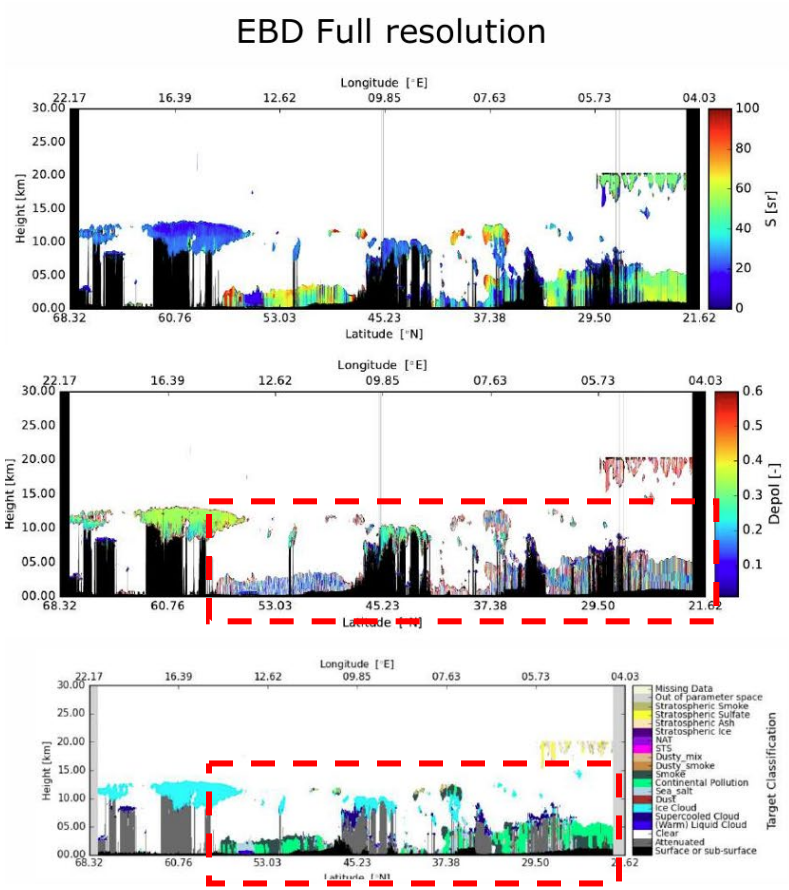
Extinction from A-AER and A-EBD:

A-EBD has more cloud information (shown in red dashed box)



Difference between full resolution and low resolution of A-EBD

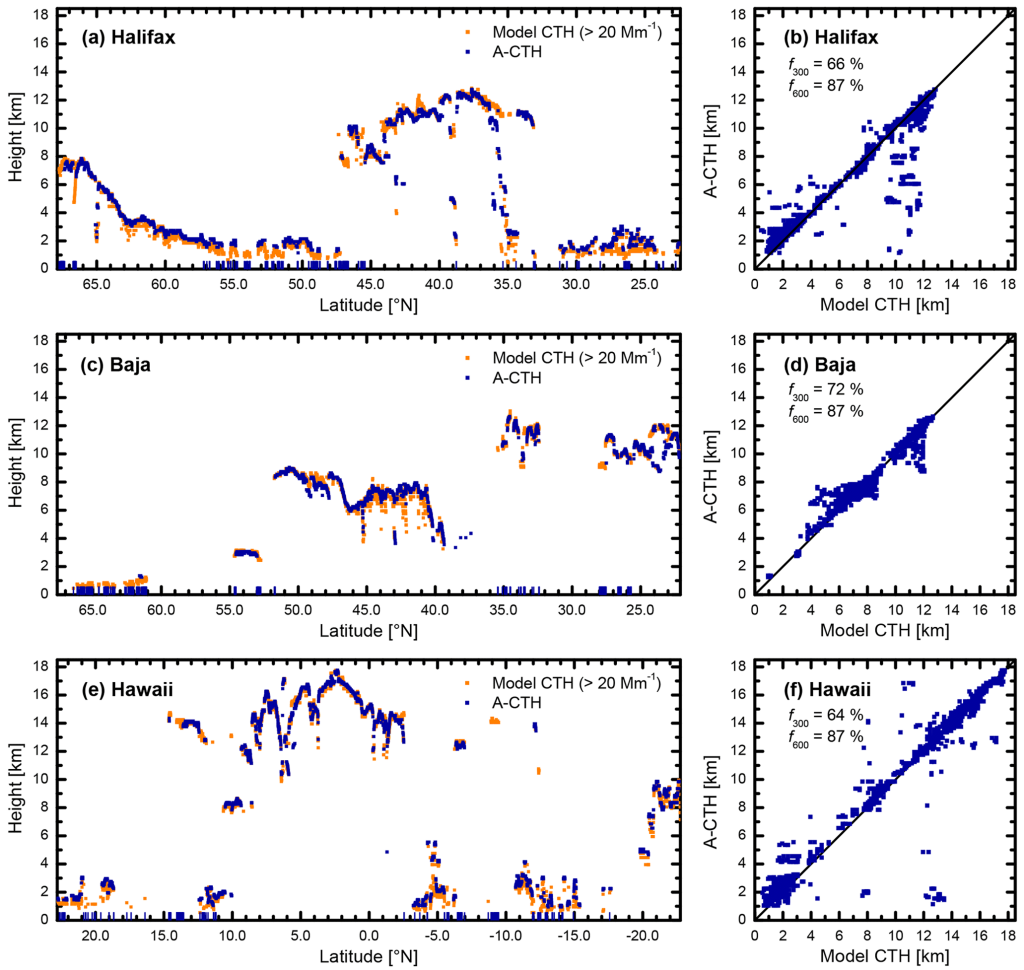
Depolarization ratios are less noisy in low resolution, leading to that the target classifications are more accurate (shown in red dashed boxes)



Donovan et al., 2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop

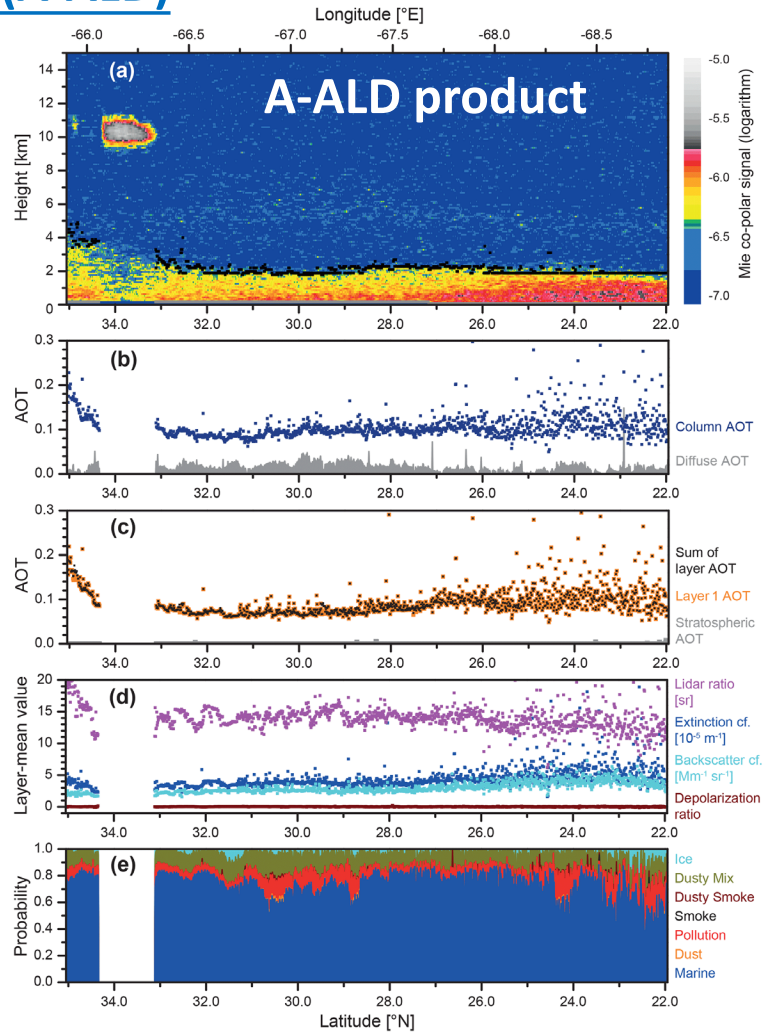
ATLID Level 2A product

ATLID Cloud Top Height (A-CTH) and ATLID Aerosol Layer Descriptor (A-ALD)



A-CTH: Cloud top heights based on wavelet covariance transform

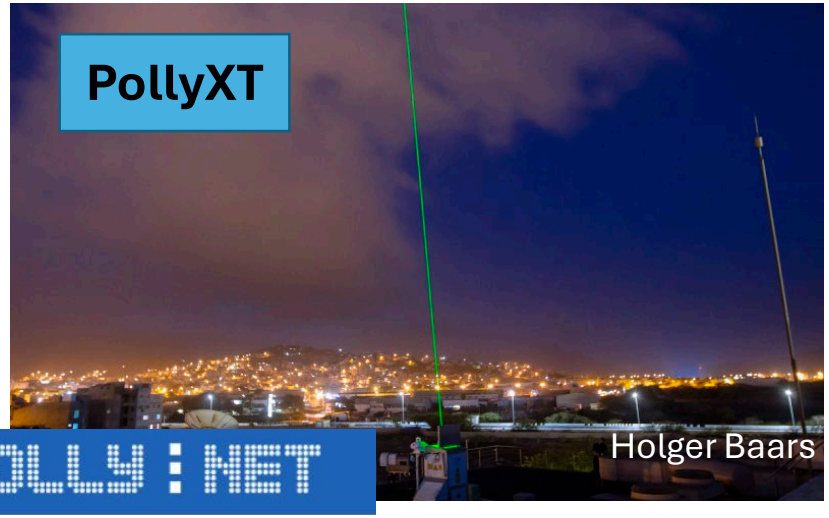
Wandinger et al., Atmos. Meas. Tech., 2023.



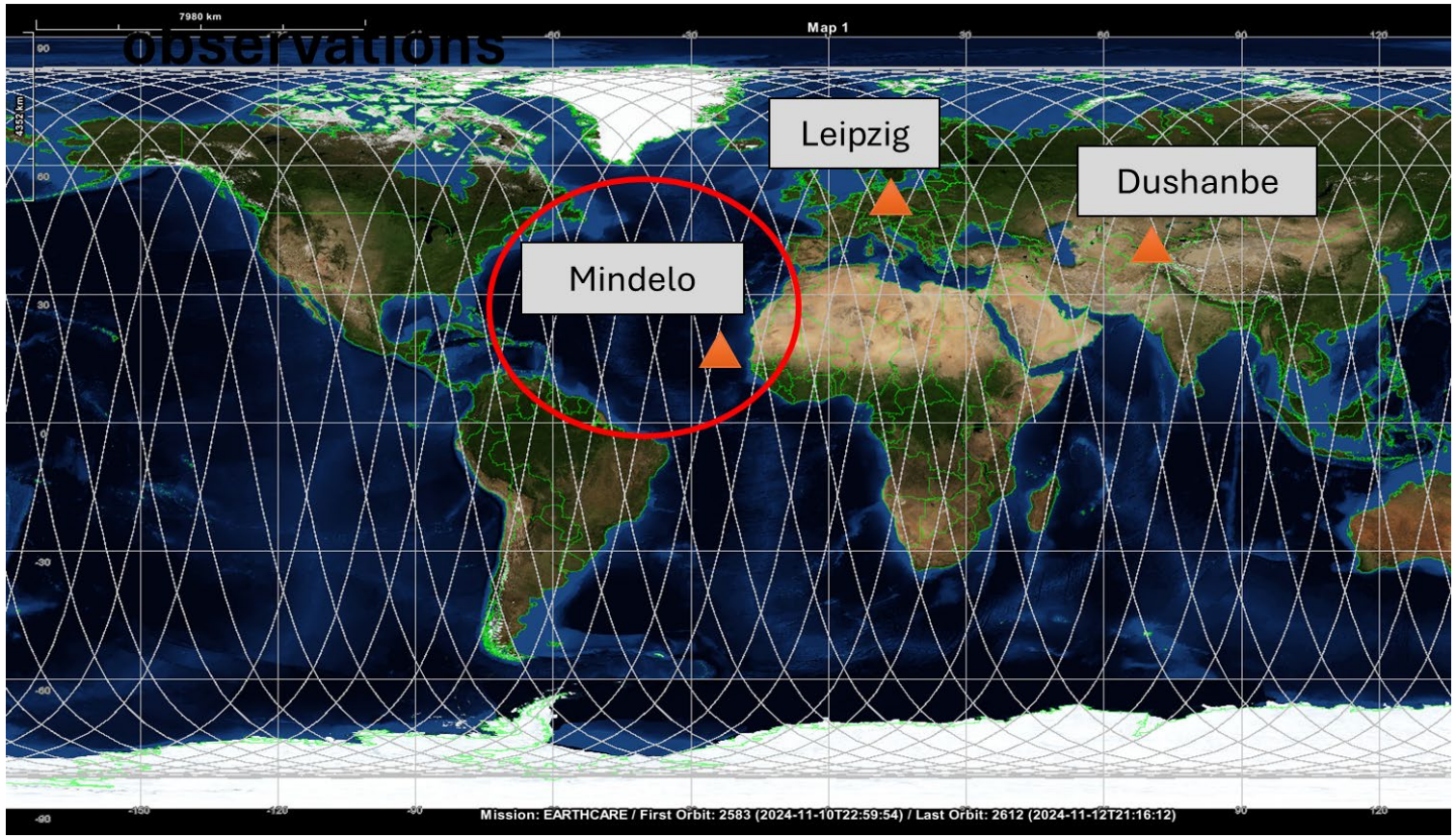
A-ALD: Presenting aerosol layer features, including aerosol optical thickness, lidar ratio, extinction, backscatter, depolarization ratio

Validation of ATLID





Validation with ground-based observations



Validation of ATLID

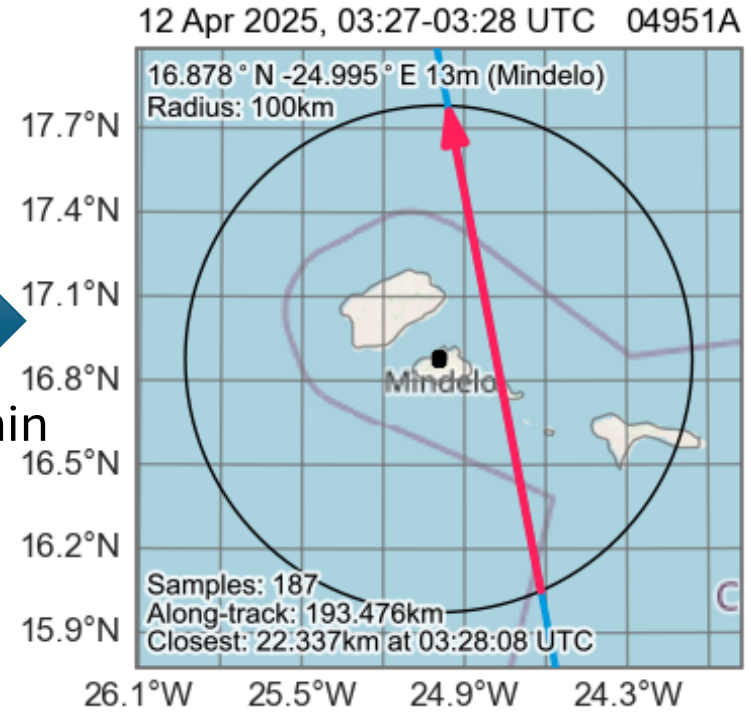
Validation strategy

PollyXT



backscatter + extinction, lidar ratio, particle depol at **355**, 532, 1064 nm

±90 min



100 km radius

quantitative comparison:

- RMSE
- mean difference (mean diff)
  - → Polly **minus** ATLID
  - → >0 underestimation
  - → <0 overestimation

Now: case studies

Later: statistical validation

- cloud-free conditions
- automatically-retrieved Raman/Klett profiles

no direct overpasses, usually 20-80 km distance

Validation of ATLID

Case study: Mindelo, 1 June 2025

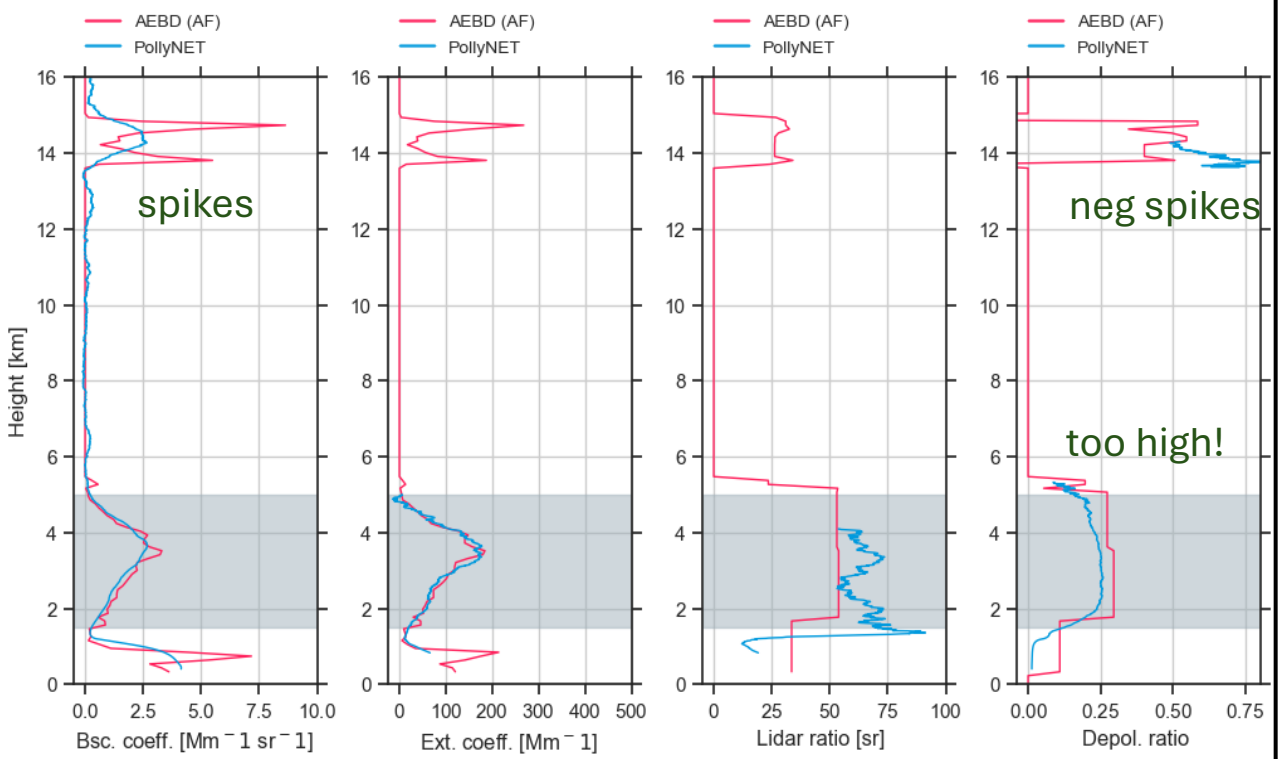
- medium resolution mainly better than low resolution
- A-EBD overestimates backscatter, extinction, depol

ATLID A-EBD
Baseline AF

Contributed by **Henriette Gebauer**,
Refer to **poster ID 239**

Frame 05729A low resolution: 100 km horizontal smoothing

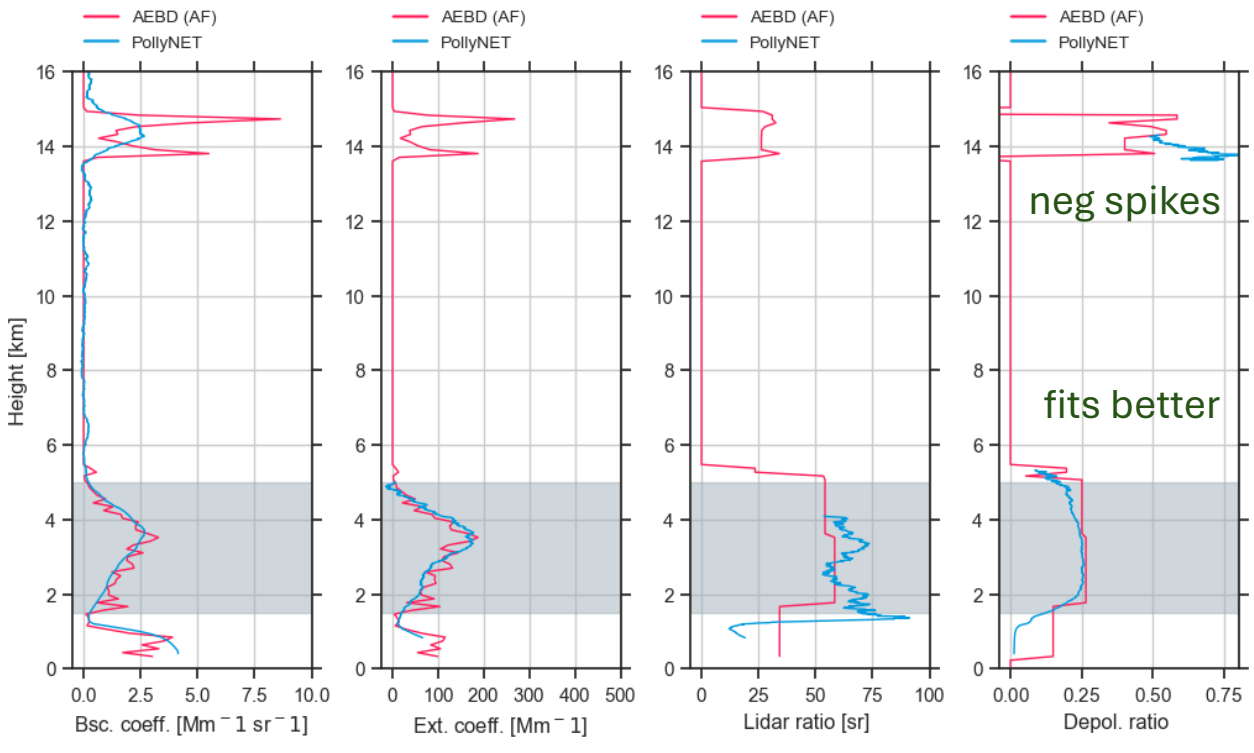
backscatter | extinction | lidar ratio | depol ratio



	backscatter	extinction	lidar ratio	depol ratio
RMSE:	0.31	14	14	0.056
mean diff:	-0.16	-15	9	-0.047

medium resolution: 10 km horizontal smoothing

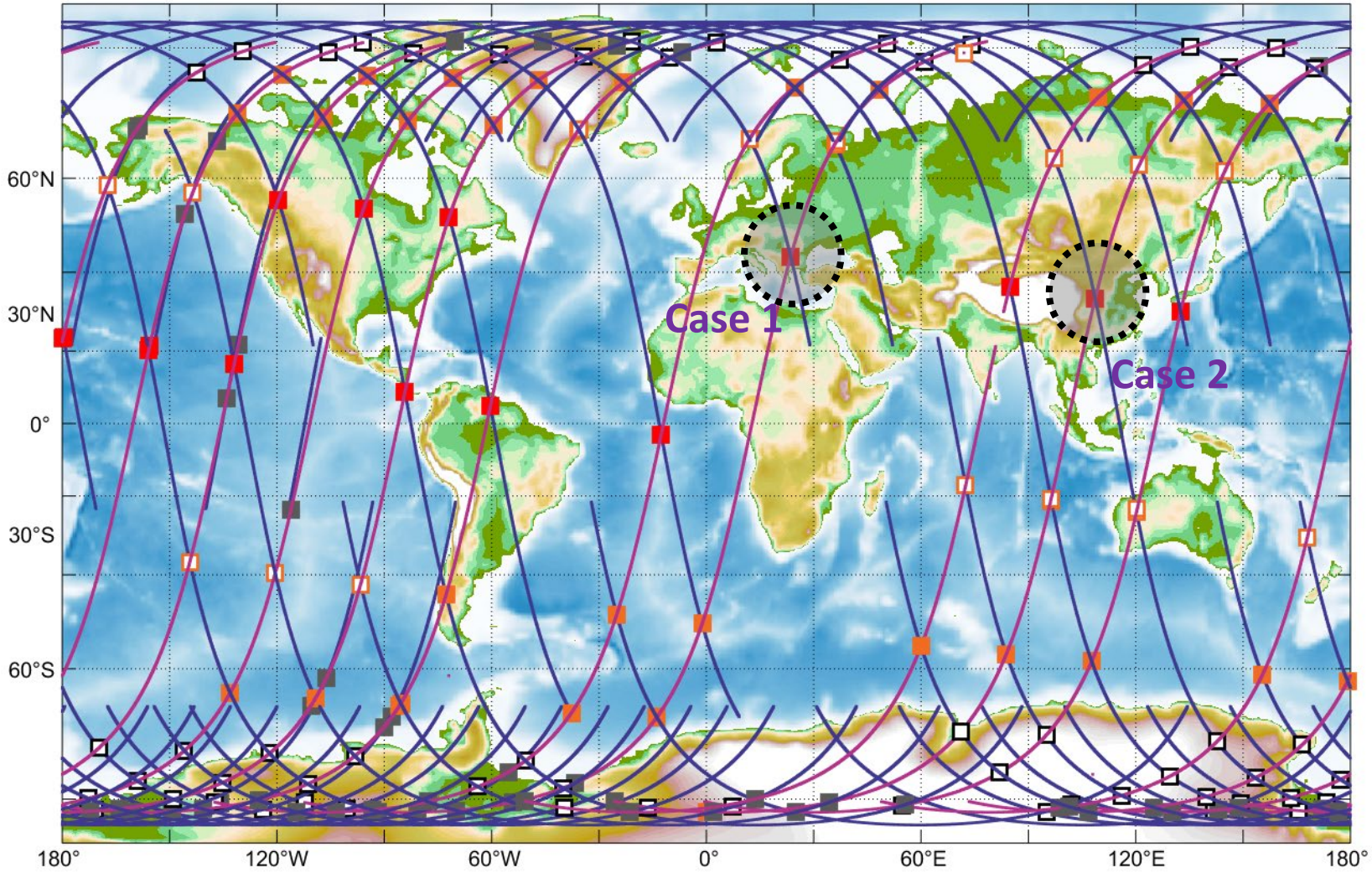
backscatter | extinction | lidar ratio | depol ratio



	backscatter	extinction	lidar ratio	depol ratio
	0.47	28	12	0.032
	-0.12	-3	6	-0.024

China-ACDL and ESA-ATLID: the inter-comparison

Night-time track matching in one day (2025/03/24)



- The inter-comparison and cross-validation between ACDL/DQ-1 and ATLID/EarthCARE.
- The orbital design makes ACDL and ATLID well suited for combined observation (ATLID at 355 nm, ACDL at 532 nm and 1064 nm):

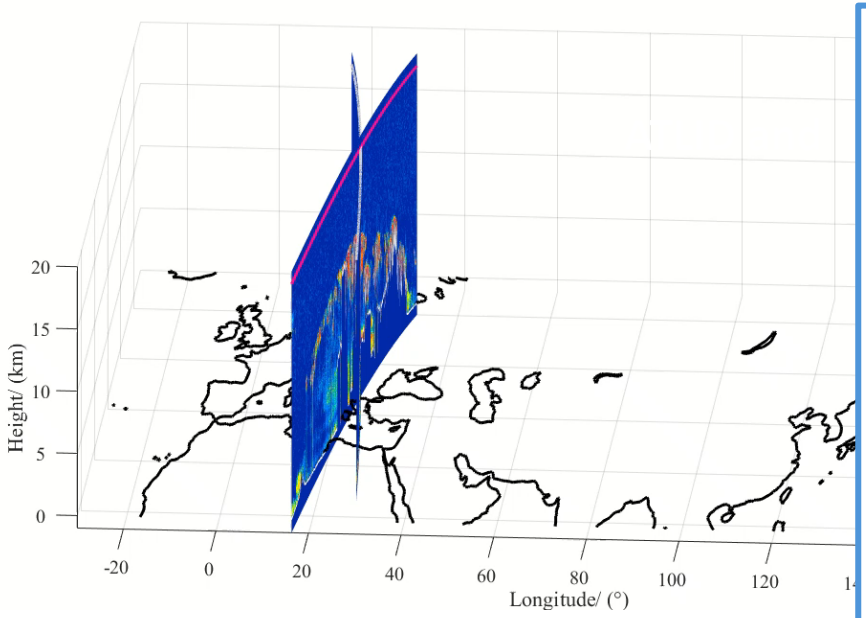
- >8h
- 4~8h
- 2~4h
- 1~2h
- <1h

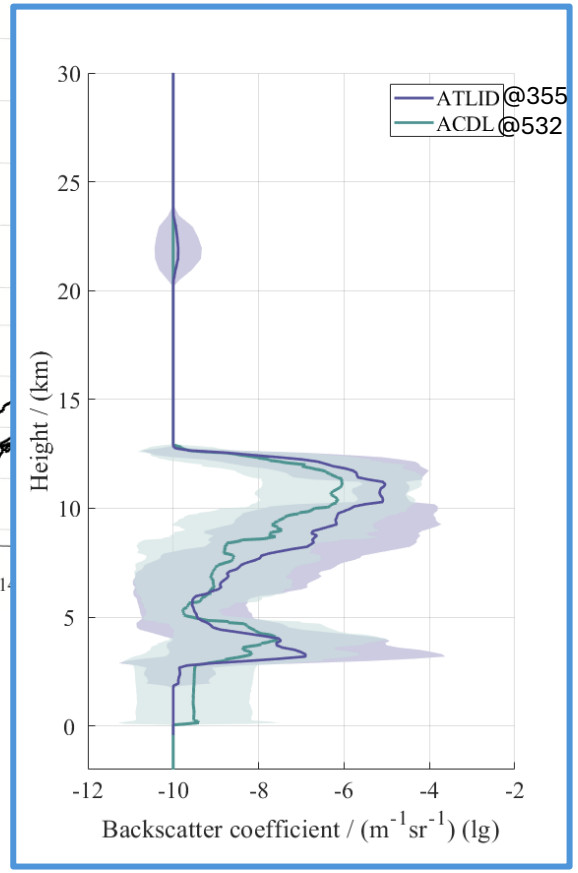
The inter-comparison of ACDL and ATLID

European case :

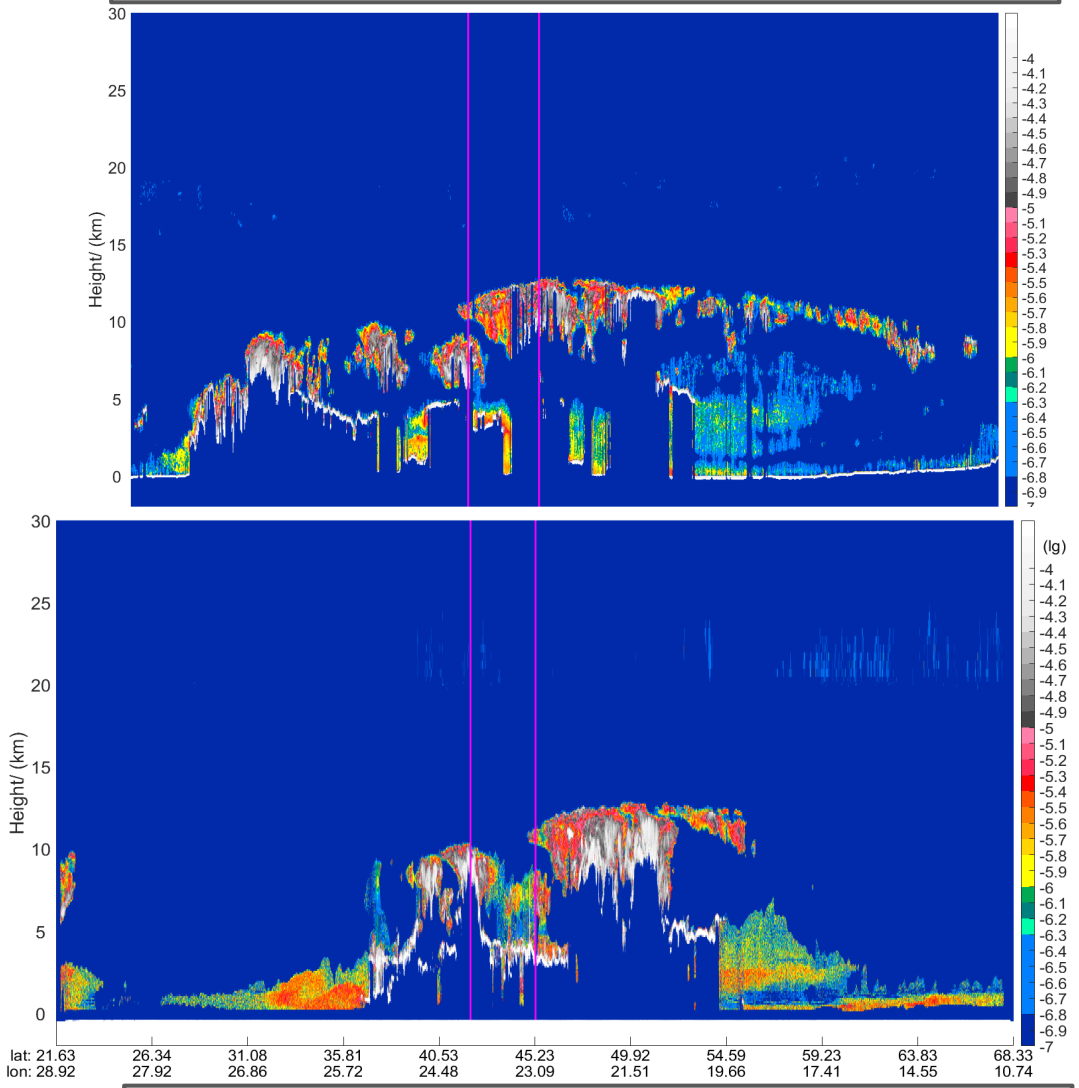
Time difference : ~20 min

Distance range : <80km





ACDL : 532 nm aerosol backscattering coefficient



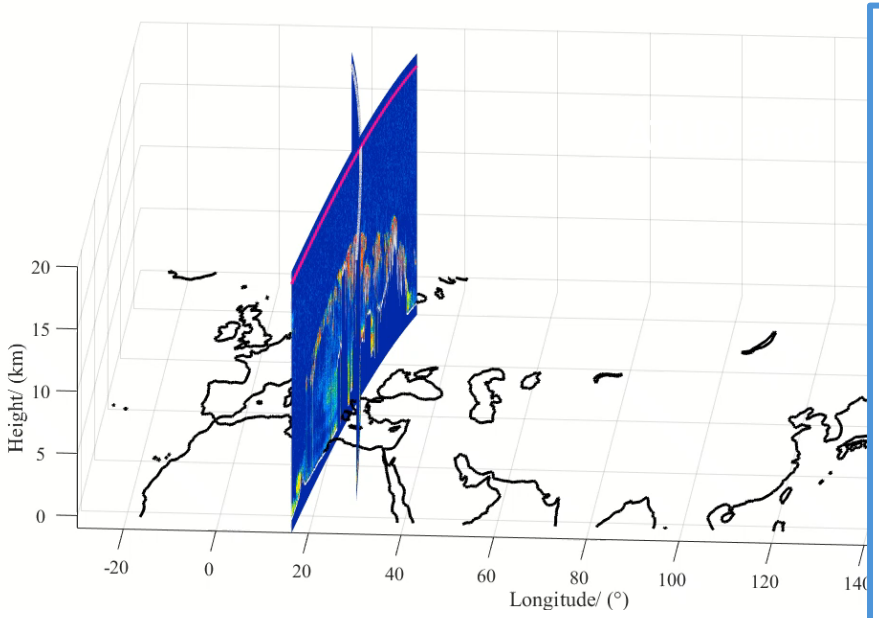
ATLID : 355 nm aerosol backscattering coefficient

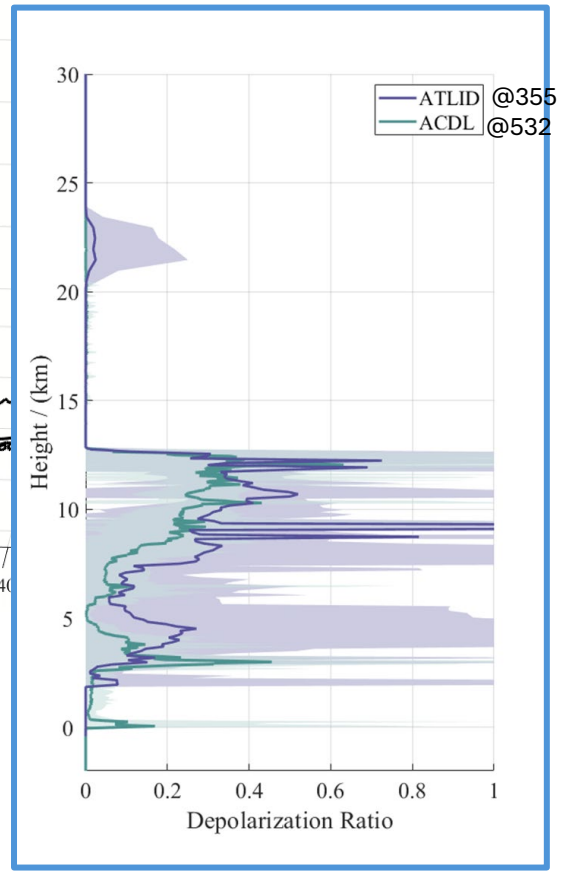
The inter-comparison of ACDL and ATLID

European case :

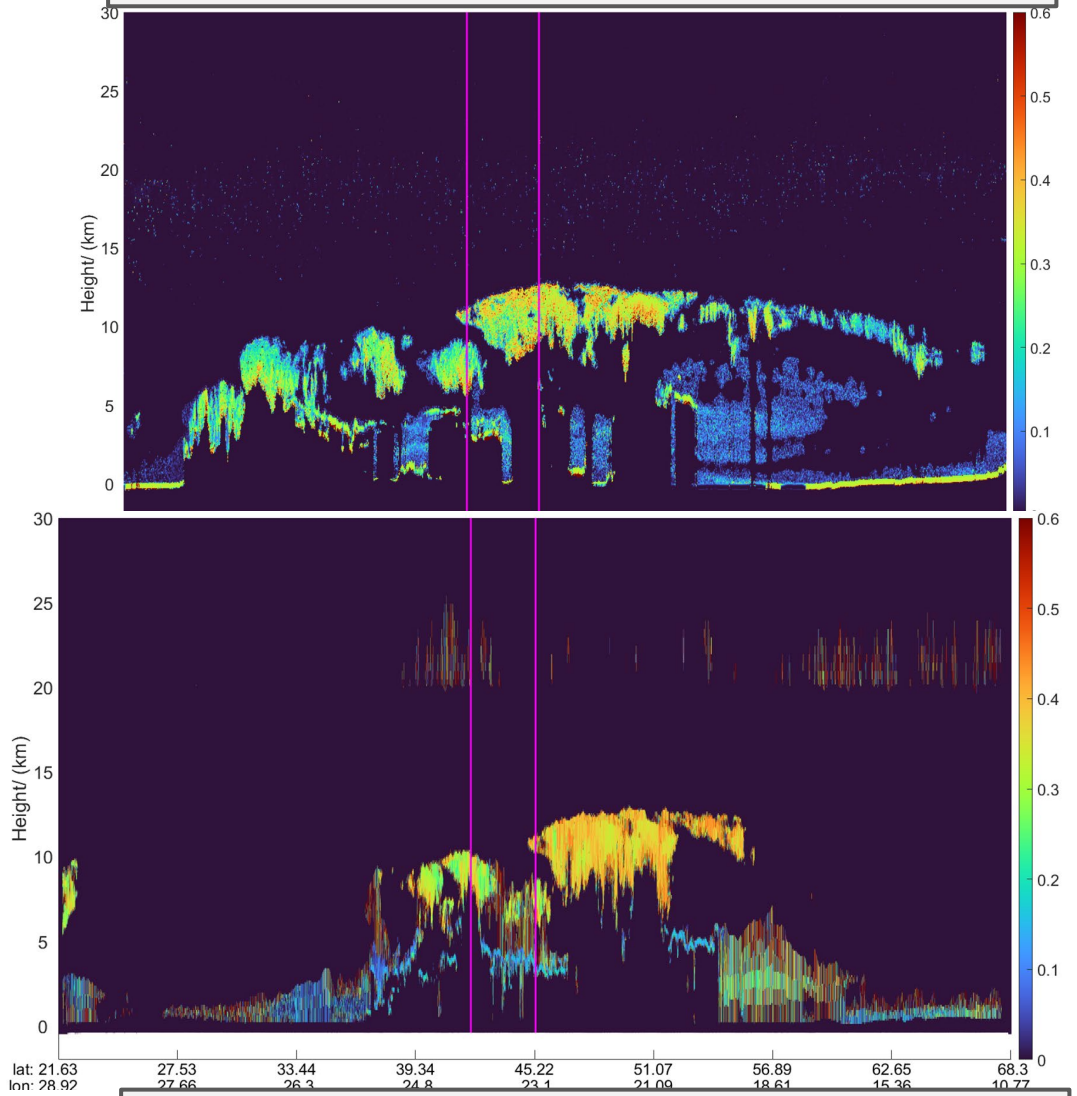
Time difference : ~20 min

Distance range : <80km





ACDL : 532 nm linear depolarization ratio



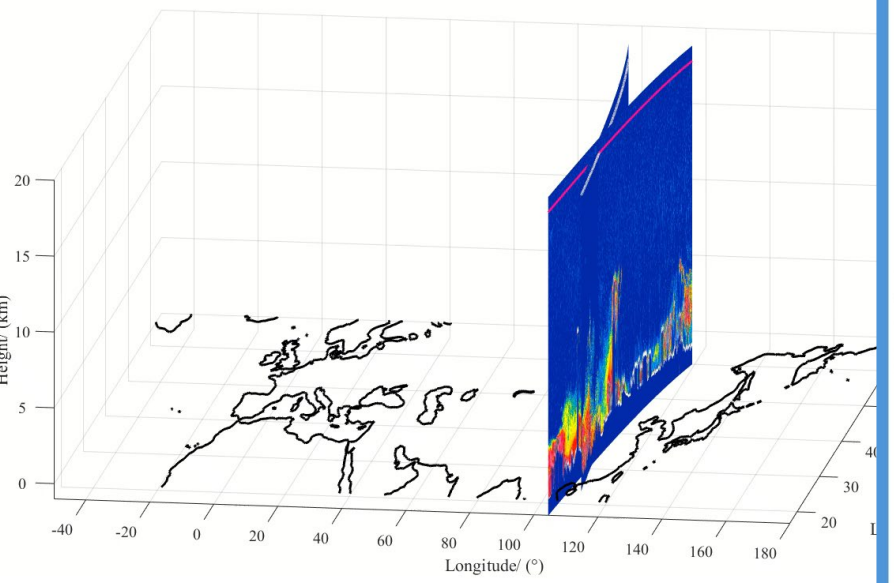
ATLID : 355 nm linear depolarization ratio

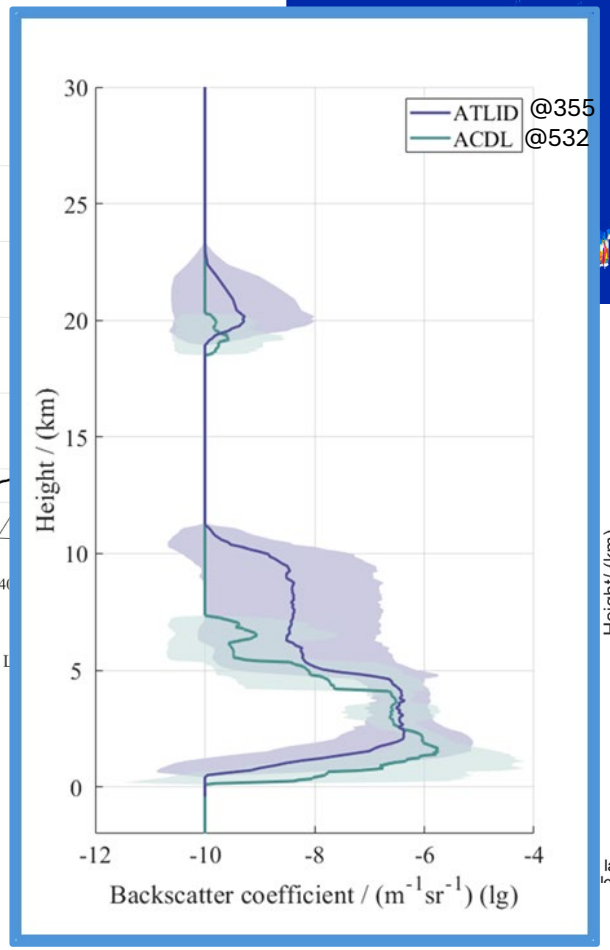
The inter-comparison of ACDL and ATLID

China case :

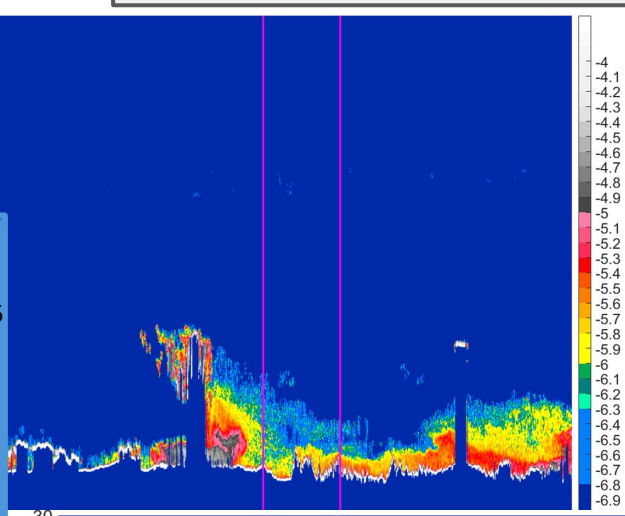
Time difference : <3 min

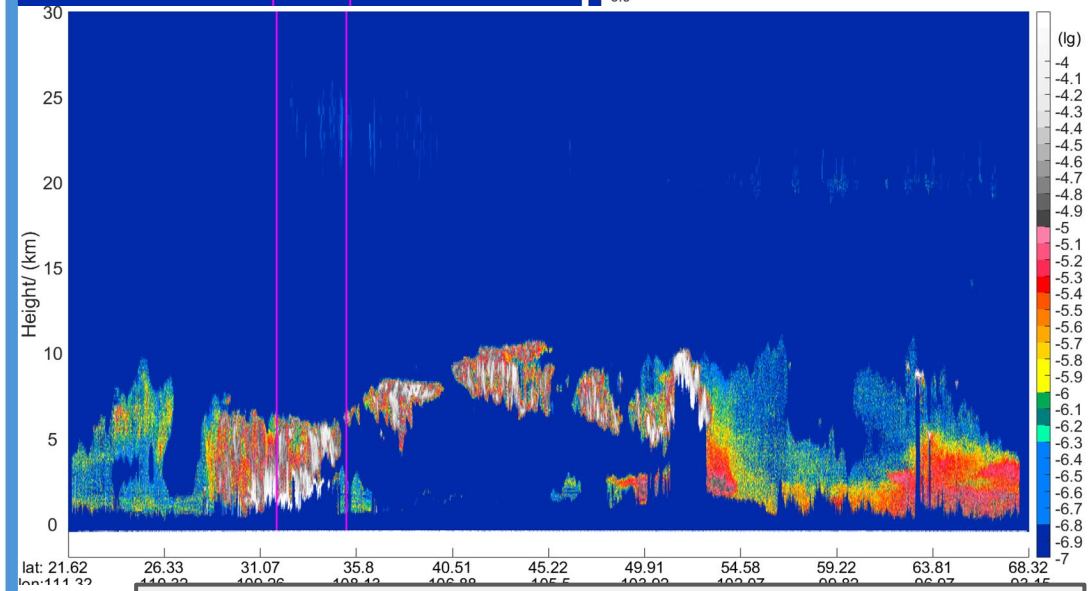
Distance range : <80km





ACDL : 532 nm aerosol backscattering coefficient





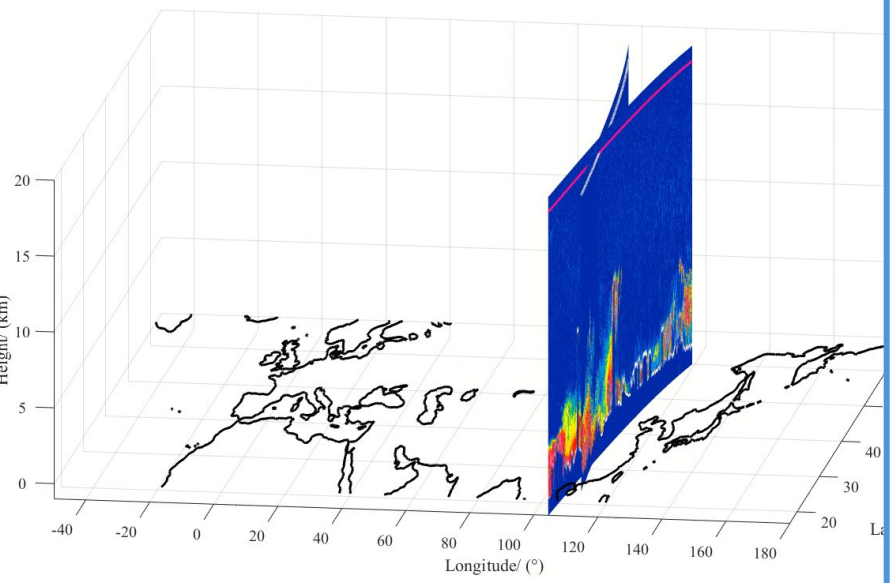
ATLID : 355 nm aerosol backscattering coefficient

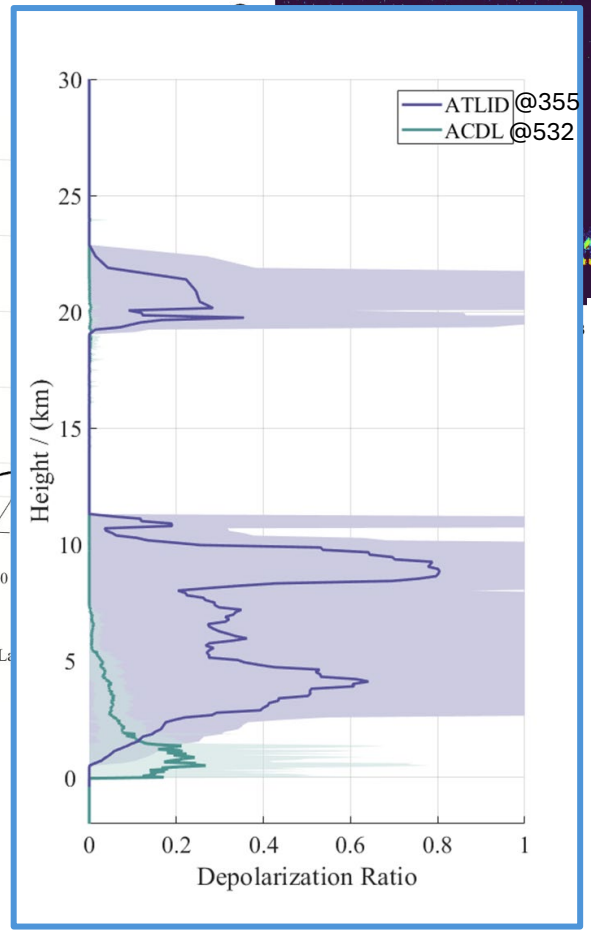
The inter-comparison of ACDL and ATLID

China case :

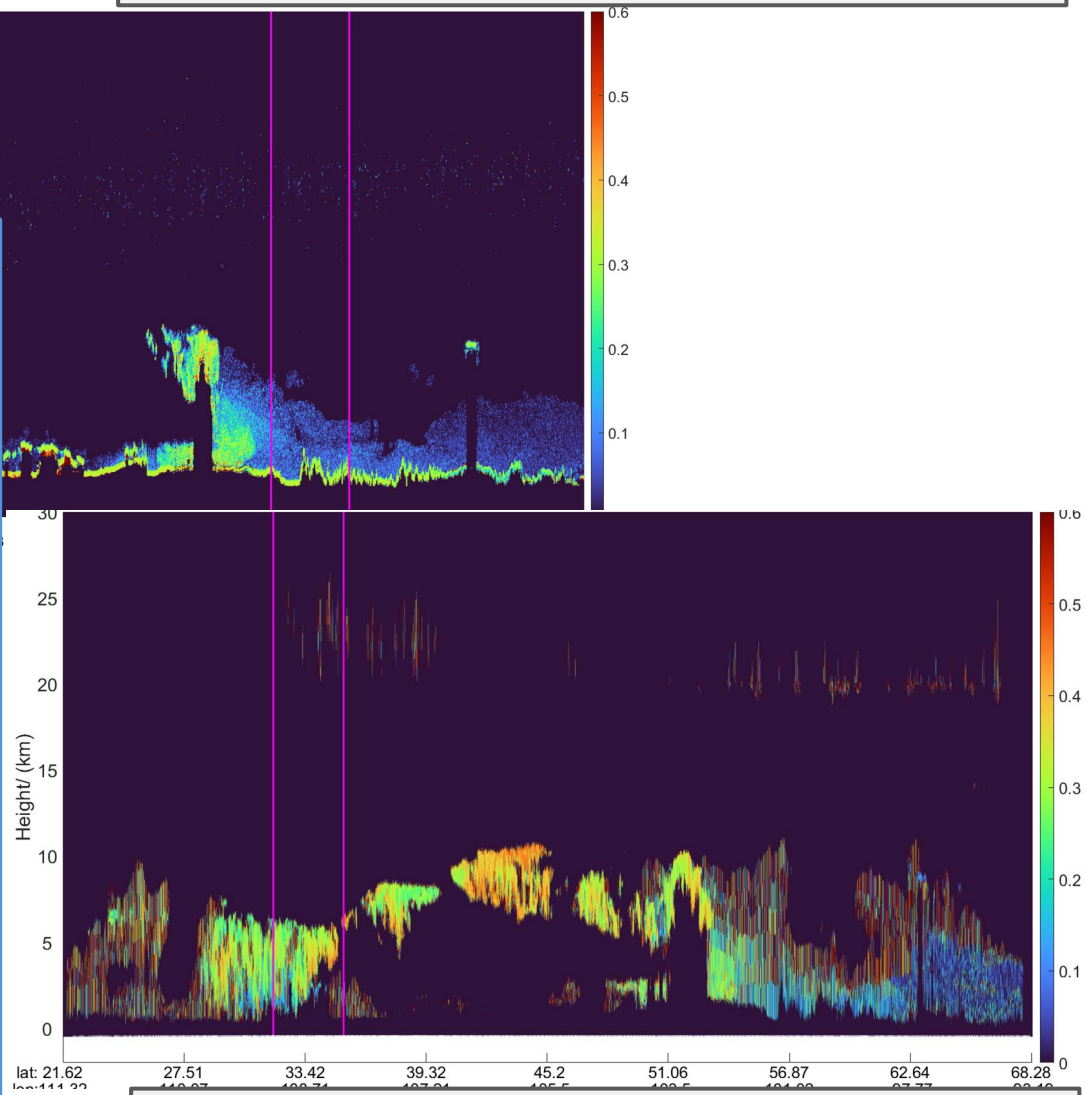
Time difference : <3 min

Distance range : <80km





ACDL : 532 nm linear depolarization ratio



ATLID : 355 nm linear depolarization ratio

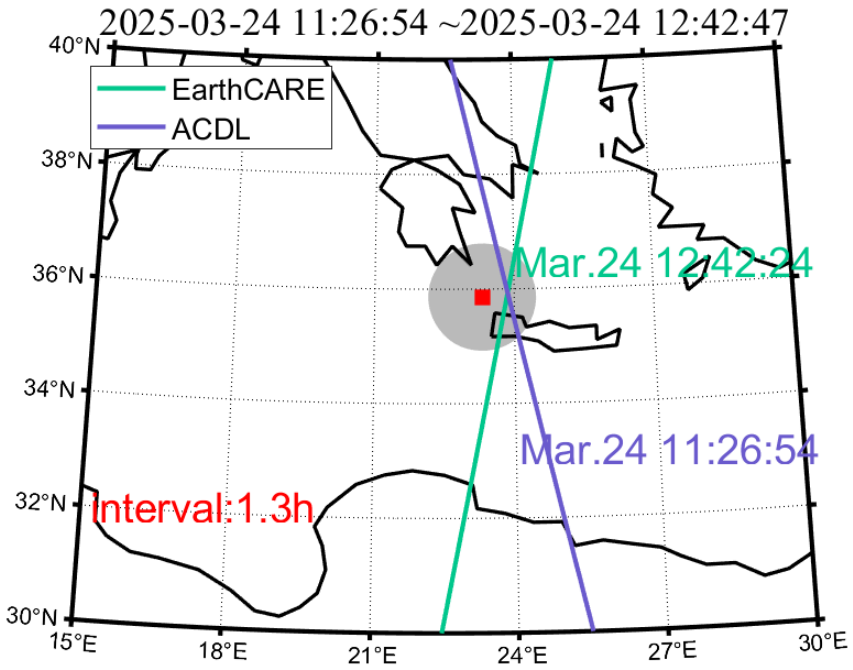
Contributed by **Wenrui Long**,
Refer to **poster ID 247**

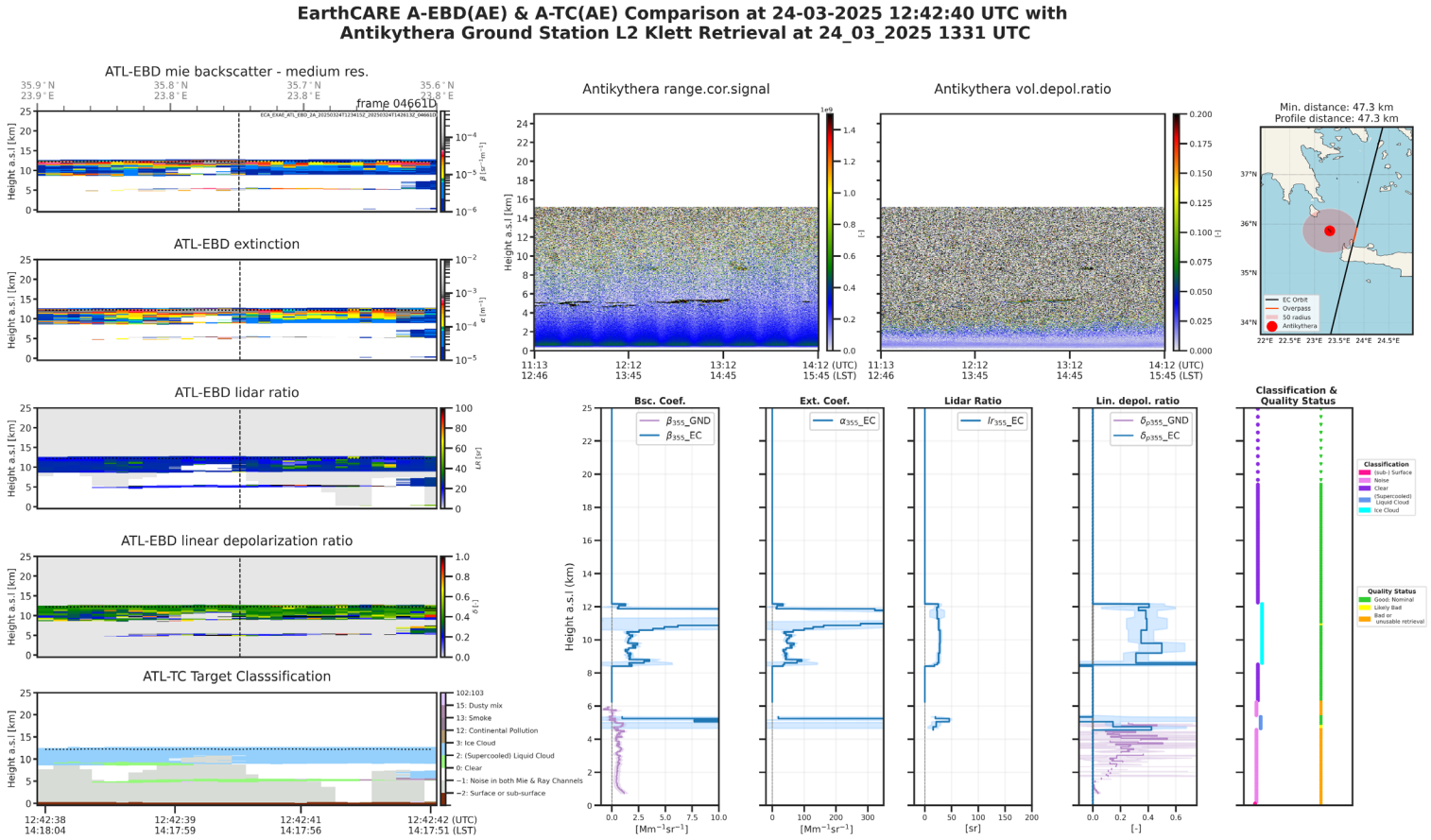
ACDL joint overpasses over AKY NOA

24/3/2025

Overpass difference ~ 1h

BAD CASE due to attenuated ATLID signal



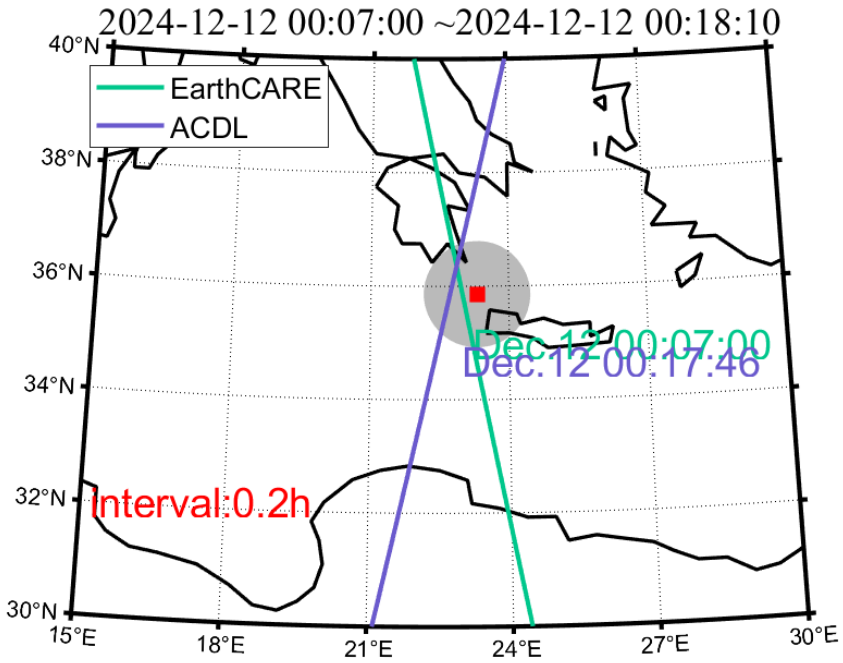


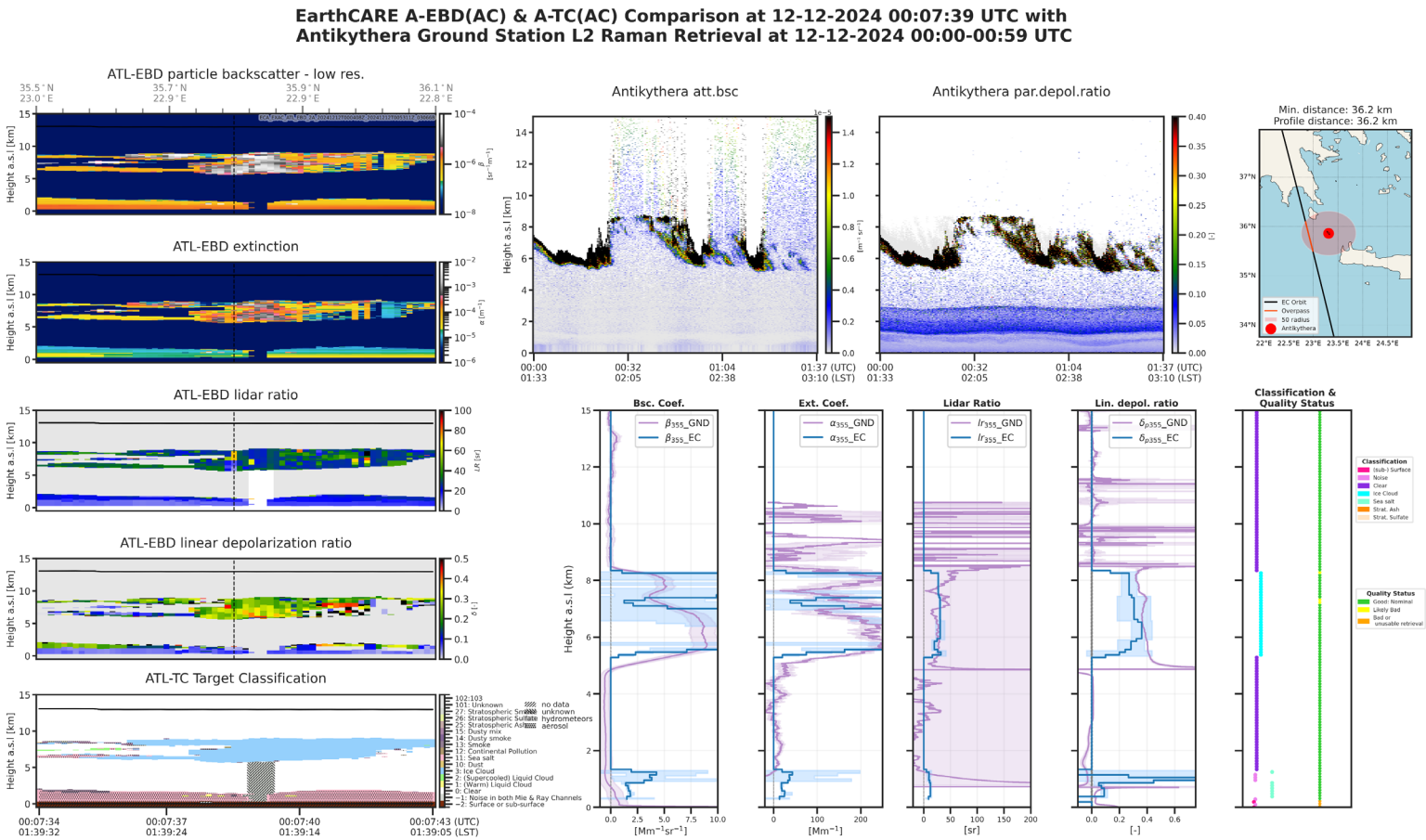
ACDL joint overpasses over AKY NOA

12/12/2024

Overpass difference ~ 0.2h

GOLDEN CASE





Contributed by **Andreas Karipis**,
Refer to **poster ID 202**

Key milestones

M1. Preparation phase: The ground-based, airborne and shipborne lidars will be adjusted (if needed and feasible) to meet the requirements for future the validation campaigns (for ATLID and ACDL). **The reprocessing of Aeolus data with laser FM-B will be finished. The ACDL and ATLID data will begin to be continuously produced and released.** These works will be finished in the end of 2024.

M2. Experiment execution: **Implement campaigns** using EARLINET, PollyNet, the direct-detect Doppler lidar/HSRL, coherent Doppler wind lidar, and Raman polarization lidar **according to ACDL/DQ-1 and ATLID/EarthCARE Overpass schedule**.

M3. Result analysis: Compare **historic measurement data with released reprocessed ALADIN/Aeolus data products**, and **the novel experiment data (see M2) for comparison to ACDL/DQ-1 and ATLID/EarthCARE products to obtain an assessment for each instrument**. We will deliver results after analysis and disposal every 3 months (if required and feasible) and within the annual report.

M4. End of validation activities once anticipative data quality for the space-borne lidars has been achieved and/or time series of reference data is long enough to be able to perform long-term statistics. Afterwards, the emphases will be on re-analysis of the data. Last but not least, **a collective assessment report for the long-term comparison will be delivered evaluating the ALADIN/Aeolus reprocessed data assessment and the CAL/VAL of ACDL/DQ-1 and ATLID/EarthCARE**.

Schedule

end 2024-mid 2025: preparation phase

The launch of ATLID/EarthCARE. The data reprocessing of ALADIN/Aeolus. Survey on historical data available for validation of Aeolus. The algorithm improvements and data production of ACDL/DQ-1 and ATLID/EarthCARE.

2025-end 2026: CAL/VAL campaign phase

Performance of 4 ground-based campaigns (2 campaigns conducted in Europe and 2 campaigns conducted in China) and 1 airborne campaign conducted in China.

mid 2025-2027: Data acquisition and preliminary analysis phase

Data comparison, statistical analysis.

2027-2028: Analysis and conclusion phase

Finalization of data analysis and final conclusions, preparation of final report.

Dragon 6 EO Data Delivery

Data Request

ESA /Copernicus Missions	Data
1. Aeolus	• Level 2B: Scientific wind product for users • Level 2A: Scientific aerosol/cloud profile product • Level 2C: Aeolus assisted wind fields resulting from NWP (Numerical Weather Prediction) assimilation processing
2. EarthCARE	• L1:ATLID attenuated backscatter coefficient • L2: ATLID aerosol products

Chinese Mission	Data
1.DQ-1	• L2A: ACDL attenuated backscatter coefficient • L2C: ACDL cloud and aerosol products • Baseline03-Baseline05

Young Scientists contributions in Dragon 6

Name	Institution	Poster title	Contribution including period of research
Wenrui Long	OUC	Aerosol and Cloud Classification and Comparison Based on Chinese and European Spaceborne High Spectral Resolution Lidar: ACDL/DQ-1 and ATLID/EarthCARE	Data processing and optical properties retrieval algorithm development of ACDL. The inter-comparison and combined observation of ACDL and ATLID
Kangwen Sun	OUC	Cross-validation For Chinese And European Spaceborne High Spectral Resolution Lidars: ACDL/DQ-1, ATLID/EarthCARE And ALADIN/Aeolus	The validation and assessment of Aeolus reprocessed data, and participate in the CAL/VAL of EarthCARE
Henriette Gebauer	TROPOS	PANGEA Observatory for the Validation of Aeolus, EarthCARE, and DQ1 Aerosol Products	The validation and application of EarthCARE aerosol data
Andreas Karipis	NOA	PANGEA observatory for the validation of Aeolus, EarthCARE & DQ1 Aerosol Products	Use of PANGEA observatory and ESA eVe reference system for the Cal/Val of Aeolus, EarthCARE and DQ1 satellite lidar products.

Team members



Songhua Wu



Guangyao Dai



Kangwen Sun



Wenrui Long



Fanqian Meng



Weibiao Chen



Jiqiao Liu



Na Xu

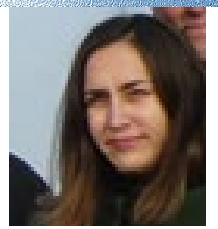


Xiaochun Zhai

TROPOS



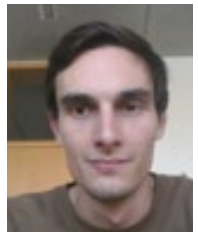
Ulla Wandinger



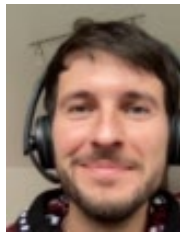
Athena Augusta Floutsi



Holger Baars



Dimitri Trapon



Sebastian Bley



Henriette Gebauer



Vassilis Amiridis





Maria Tsichla



Eleni Marinou



Konstantinos Rizos



Ioanna Tsikoudi



Kelly Voudouri



Alexandra Tsekeri



Andreas Karipis



Peristera Paschou



Oliver Reitebuch



Andreas Fix



Benjamin Witschas

THANK YOU!