First Insights into ATLID Level 2A Products: Comparisons with ACTRIS/EARLINET observations as part of EVID05

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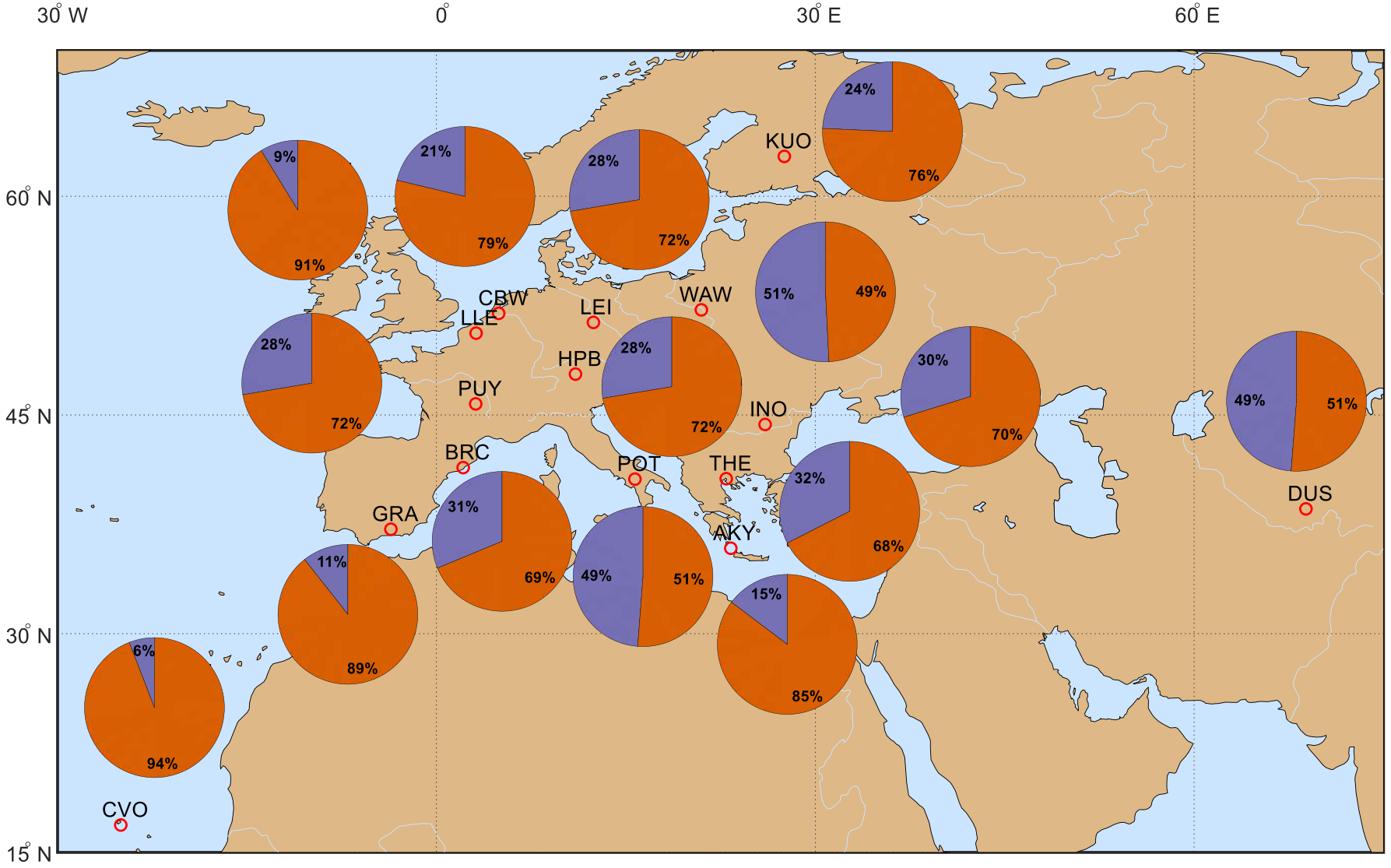
2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop

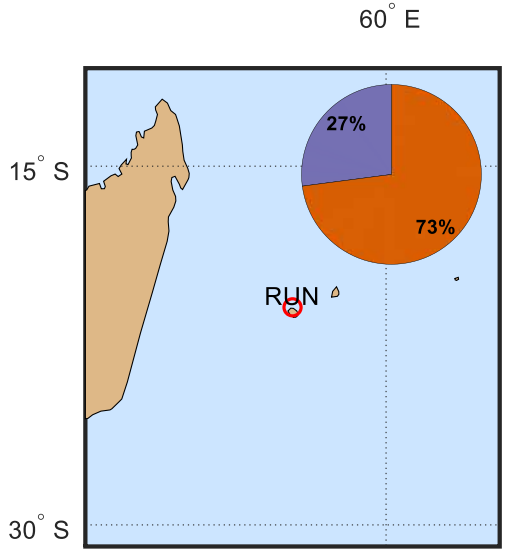
17 – 20 March 2025 | ESA-ESRIN | Frascati (Rome), Italy



Overpass-related available optical product at 355 nm [10 Aug – 28 Feb]

Yes

No



ATLID L2A Products:

A-AER

A-EBD
(high resolution)

A-TC
(high resolution)

Screening:

Quality Status

Additional Quality Status (extended)

Good and likely good data

ARES (ACTRIS-Aerosol Remote Sensing):
Comparison with **ACTRIS-EARLINET** ground-based lidar data at 355 nm

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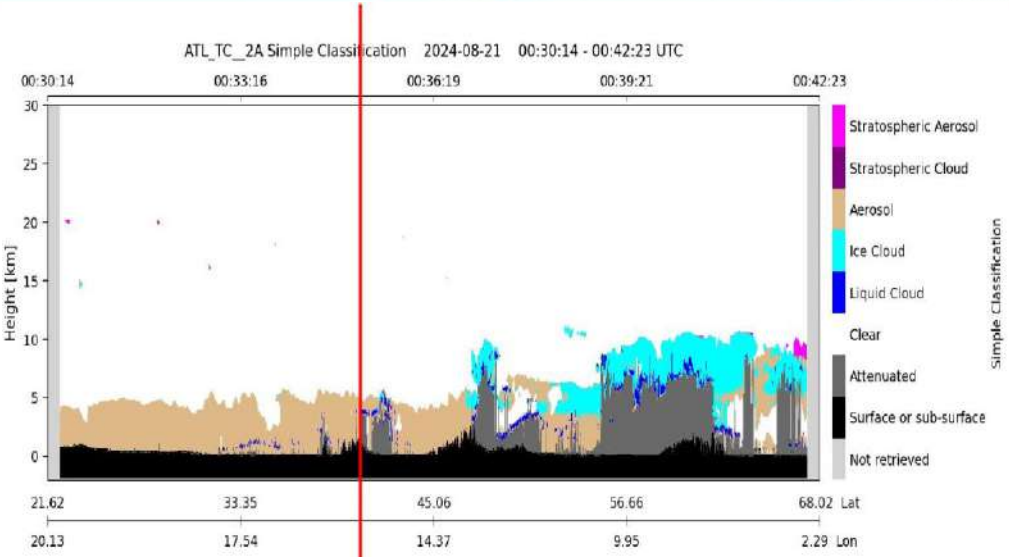
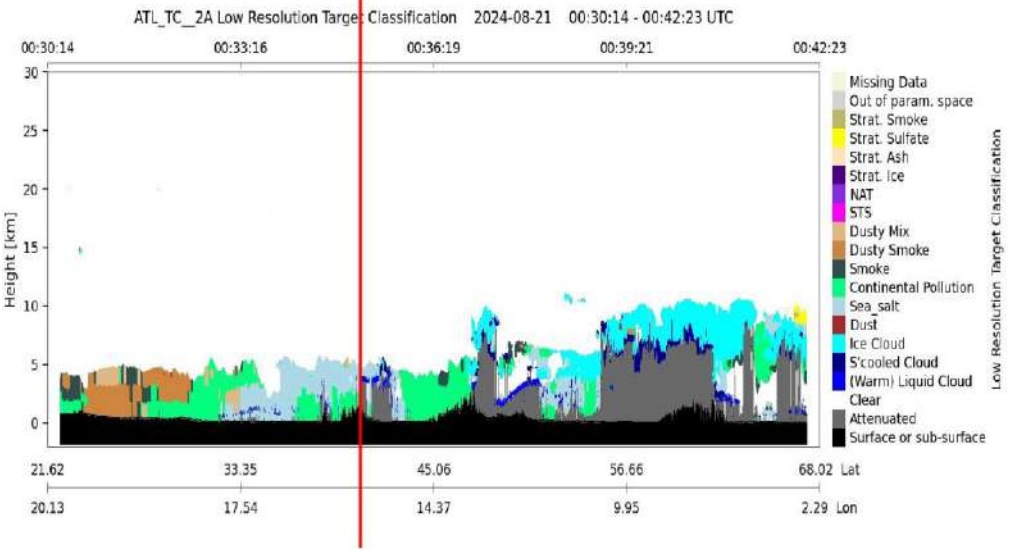
b_{aer}, a_{aer}, LR, PLDR

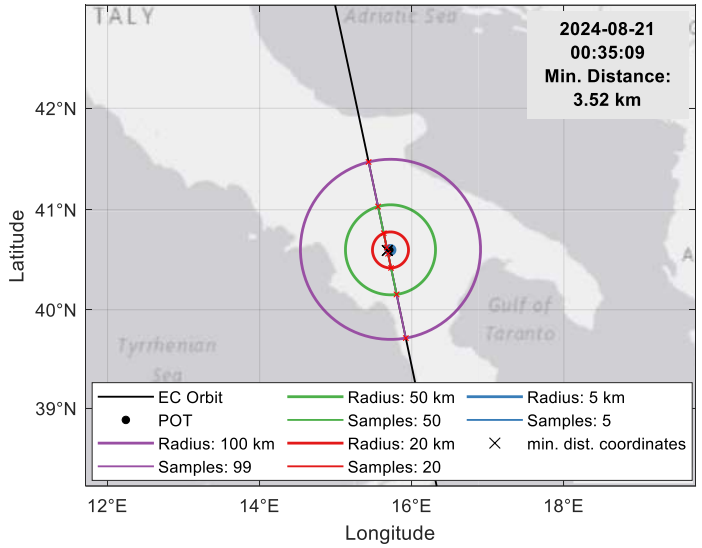
For the analysis, we considered overpasses:

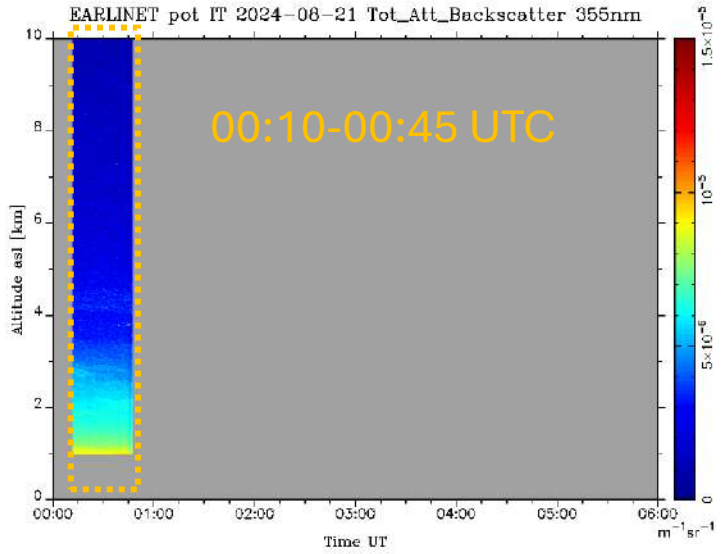
- Up to 100 km minimum distance
- Ground-based data collected within a ±1.5-hour window

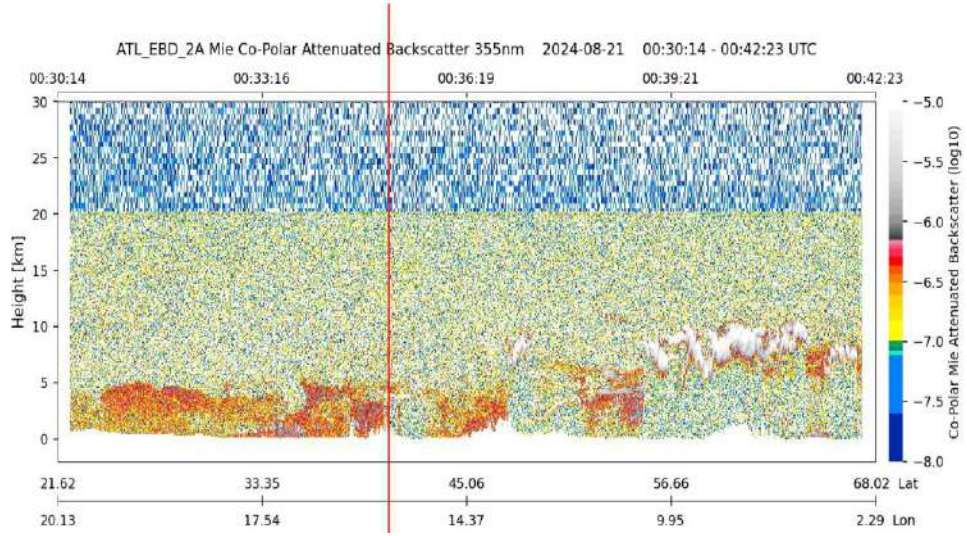
pot-2024/08/21-01308B-AC

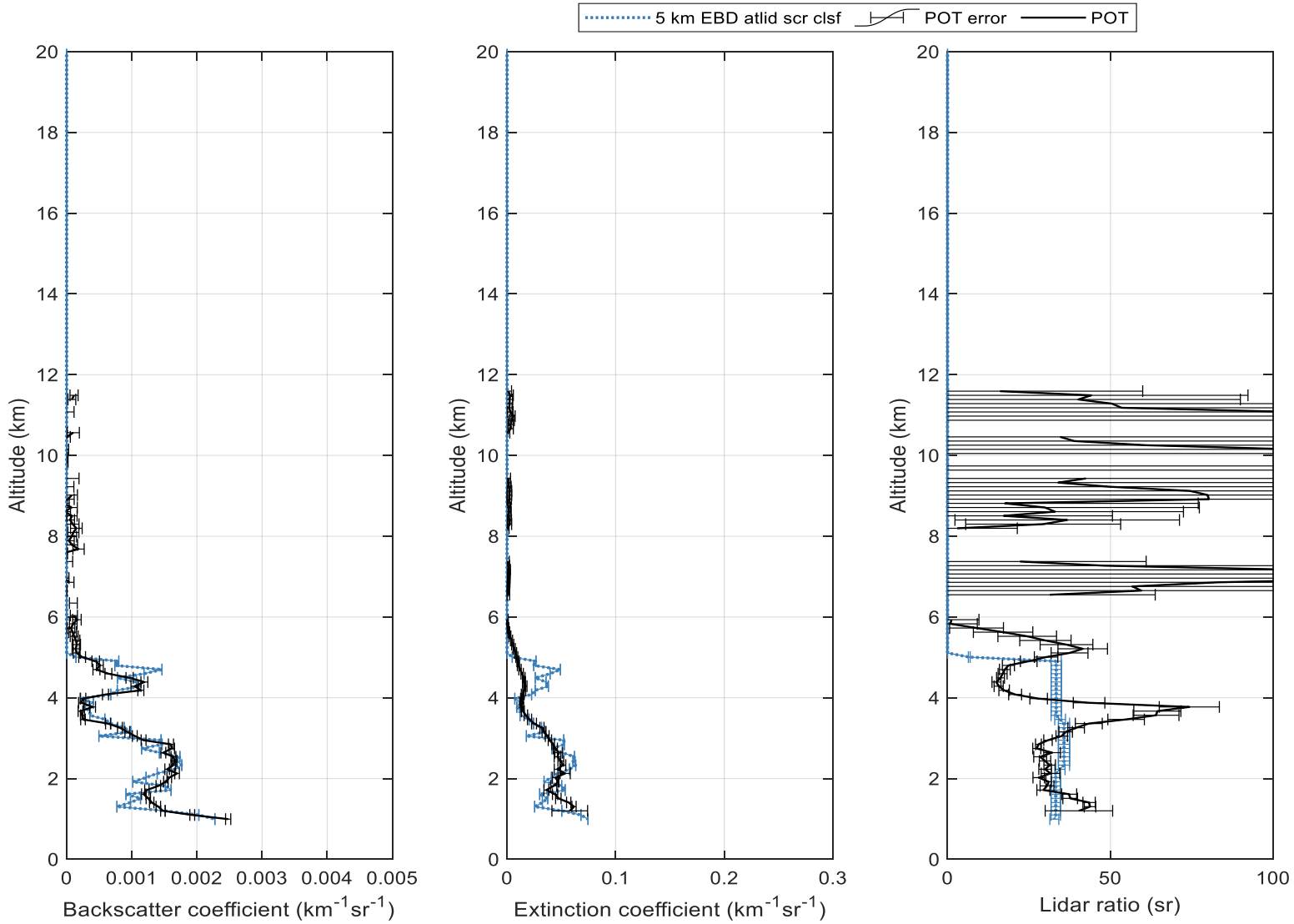


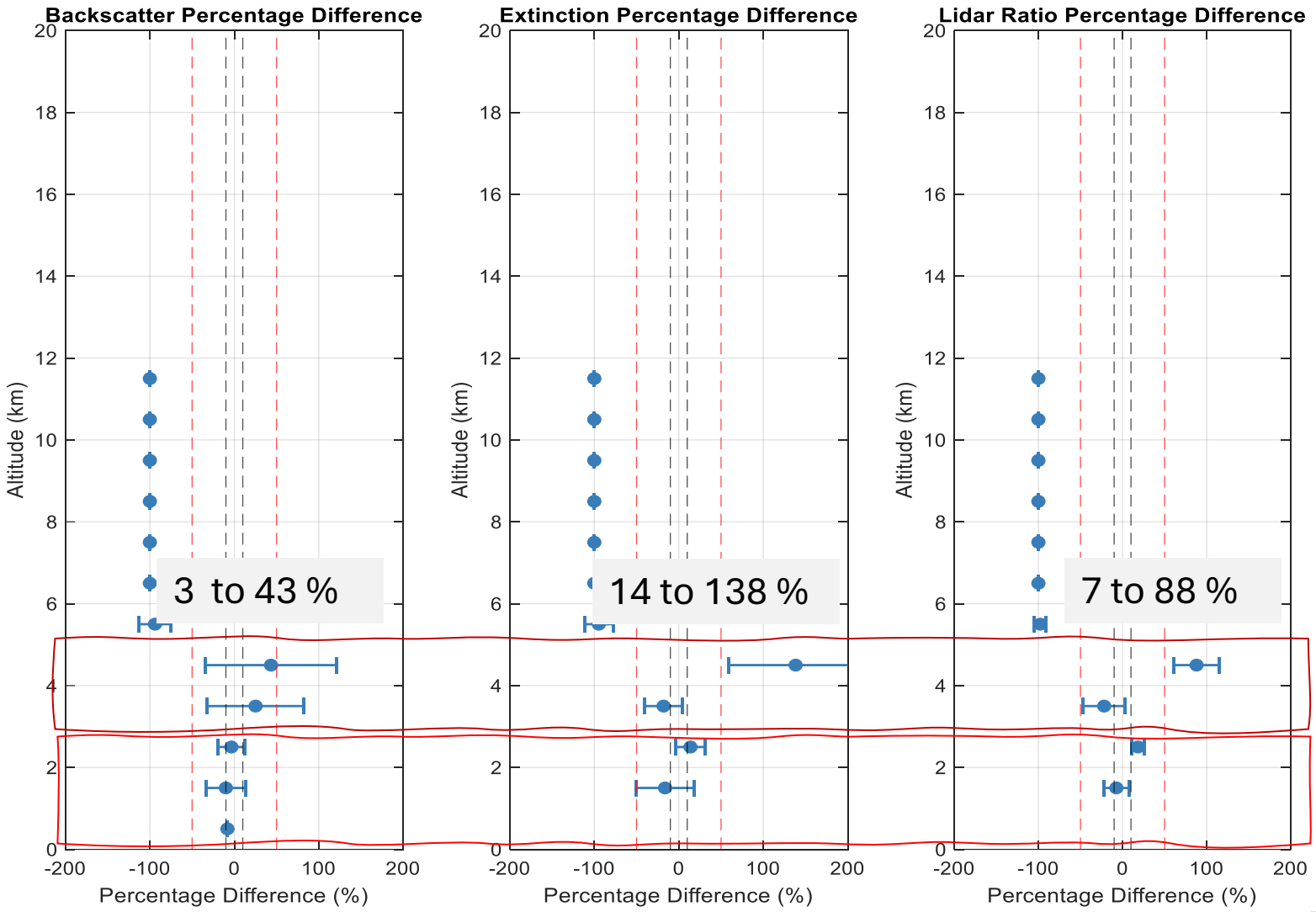




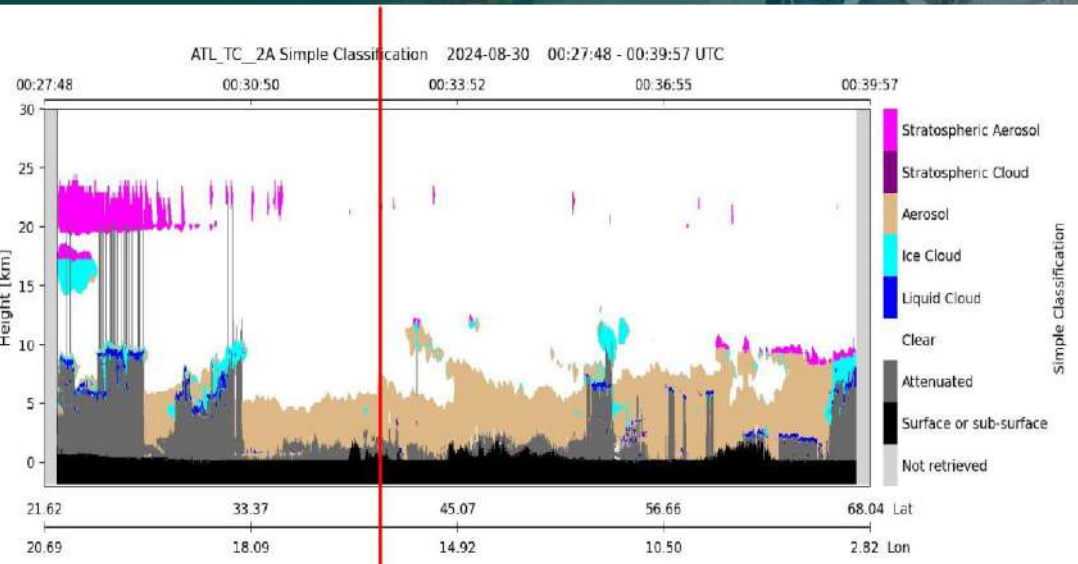


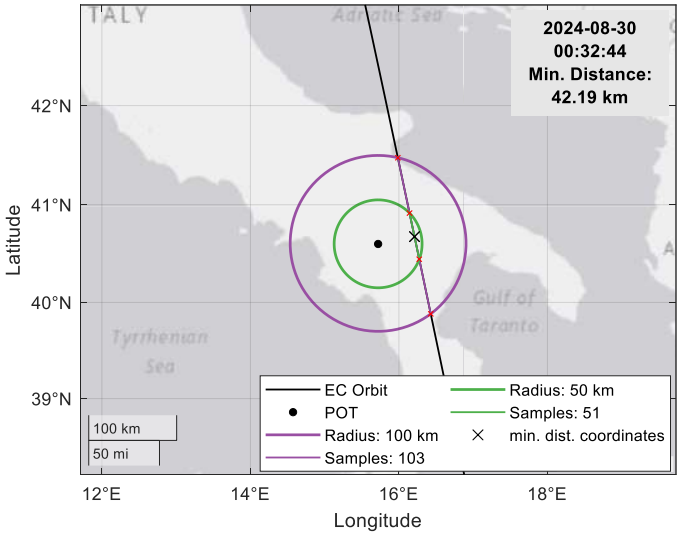


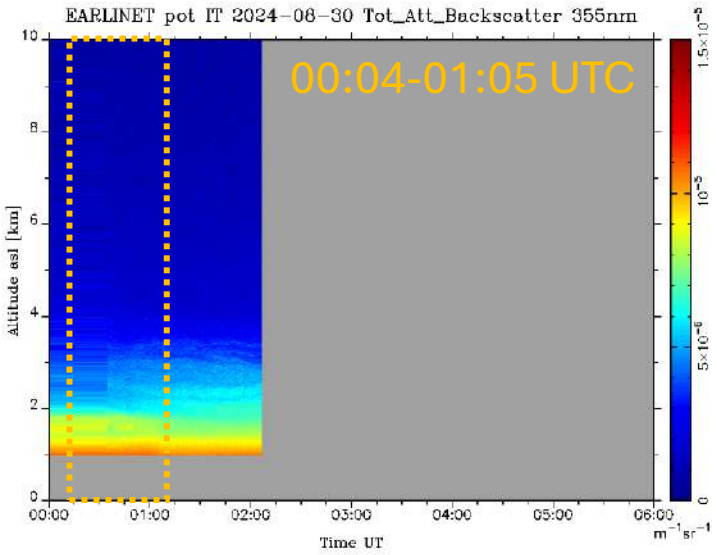

5 km EBD atlid scr clsf
POT error
POT
Altitude (km)
Backscatter coefficient (km-1sr-1)
Extinction coefficient (km-1sr-1)
Lidar ratio (sr)

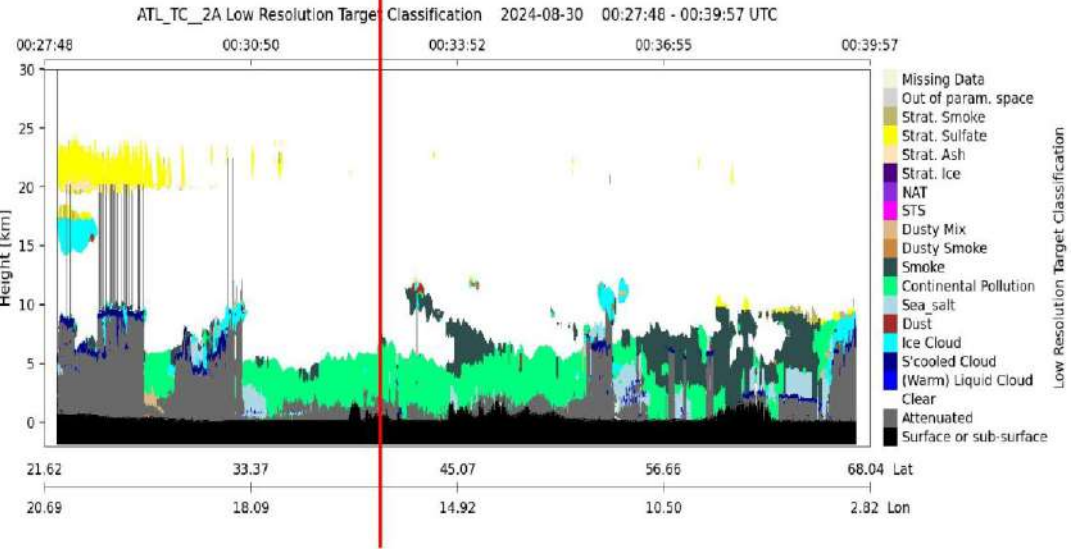

Backscatter Percentage Difference
Extinction Percentage Difference
Lidar Ratio Percentage Difference
Altitude (km)
Percentage Difference (%)
3 to 43 %
14 to 138 %
7 to 88 %

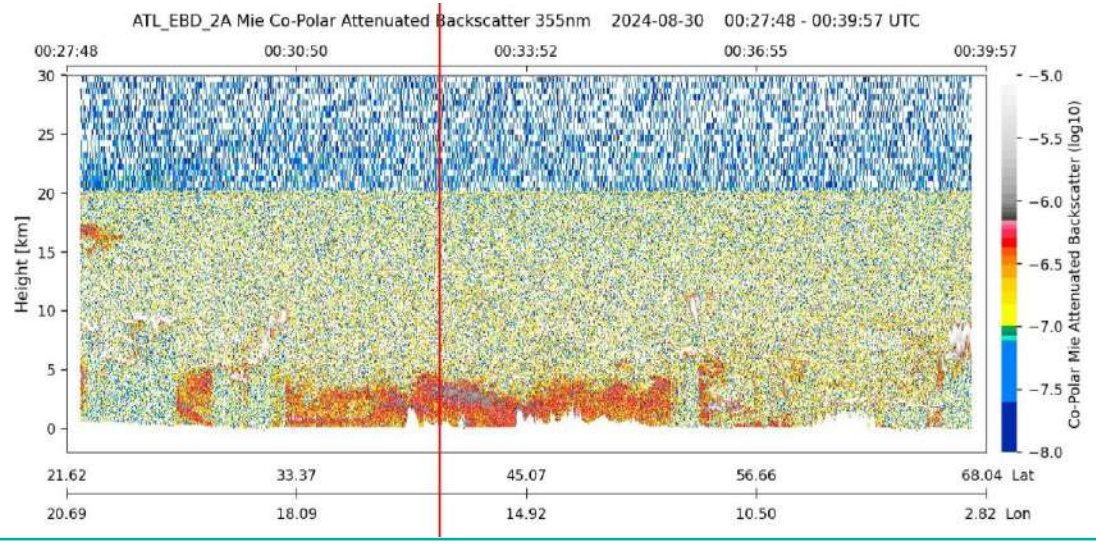
pot-2024/08/30-01448B-AC

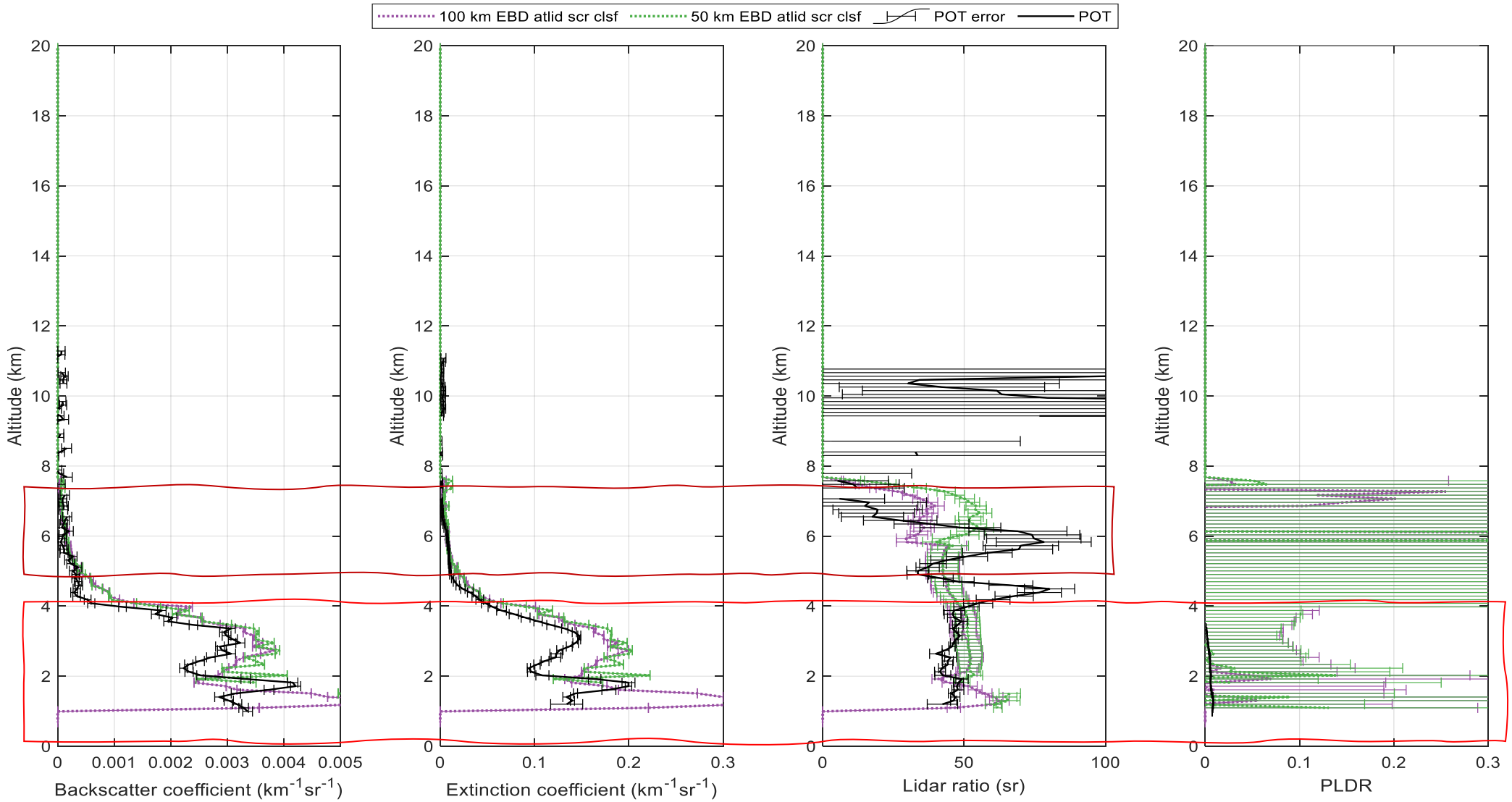


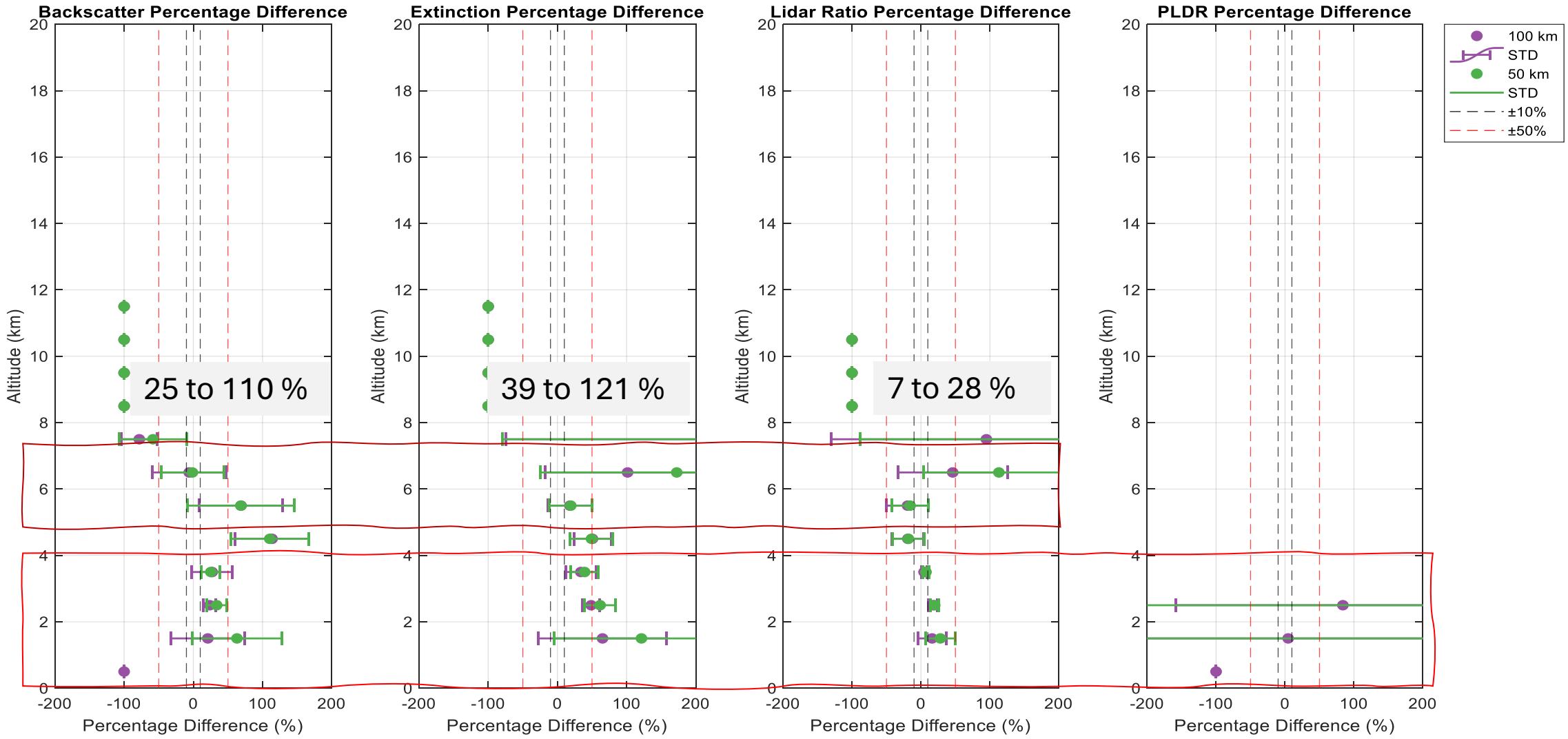




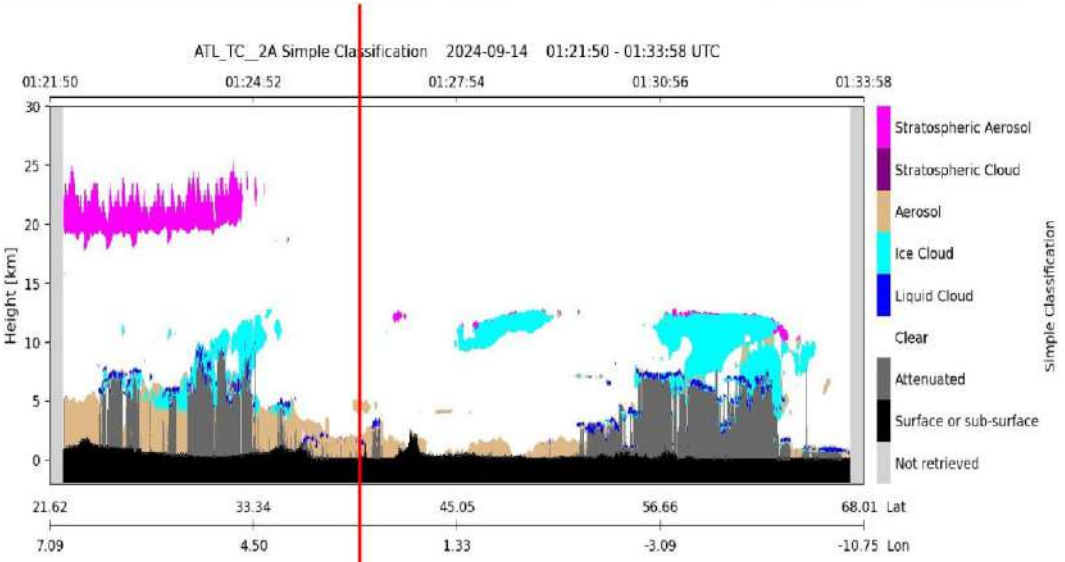


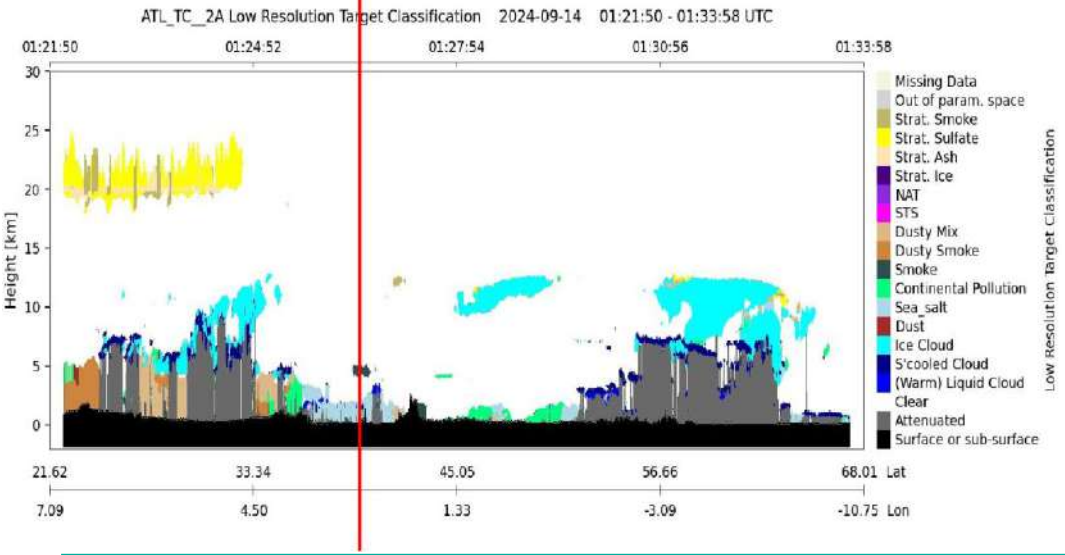


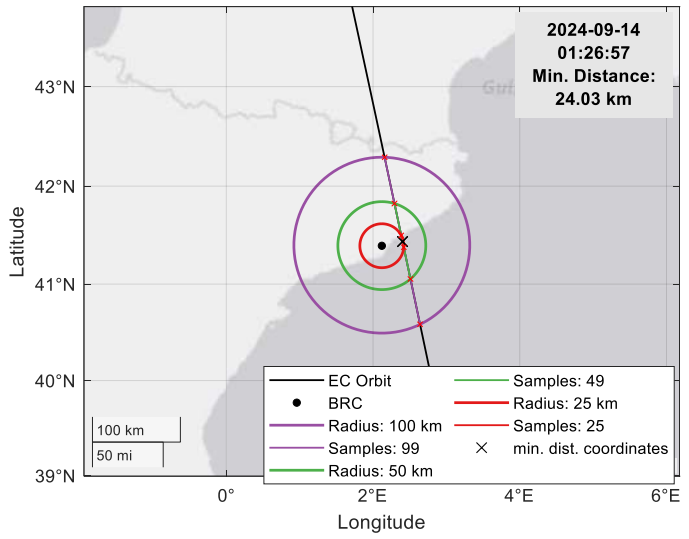

100 km EBD atlid scr clsf
50 km EBD atlid scr clsf
POT error
POT
Altitude (km)
Backscatter coefficient (km^{-1}sr^{-1})
Extinction coefficient (km^{-1}sr^{-1})
Lidar ratio (sr)
PLDR

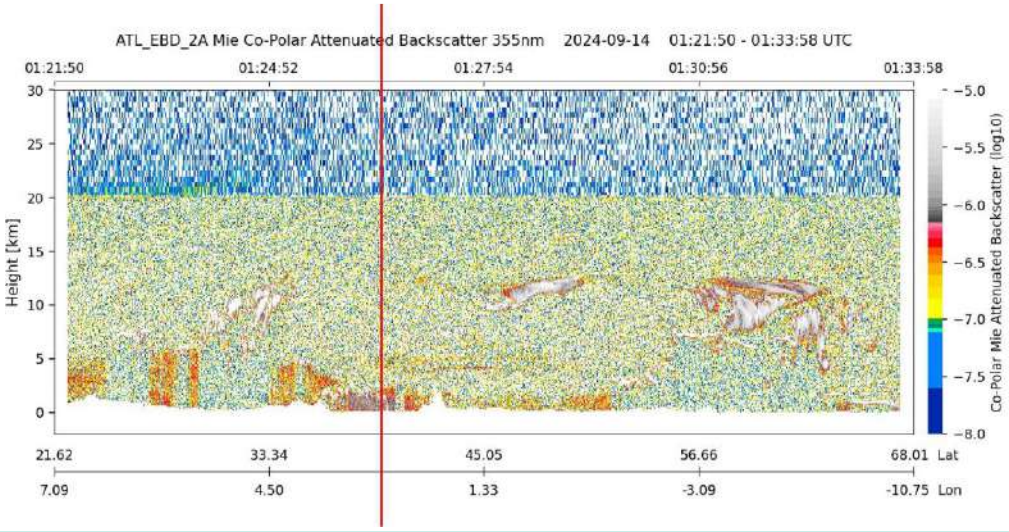

Backscatter Percentage Difference
Extinction Percentage Difference
Lidar Ratio Percentage Difference
PLDR Percentage Difference
25 to 110 %
39 to 121 %
7 to 28 %
Altitude (km)
Percentage Difference (%)
100 km
STD
50 km
STD
±10%
±50%

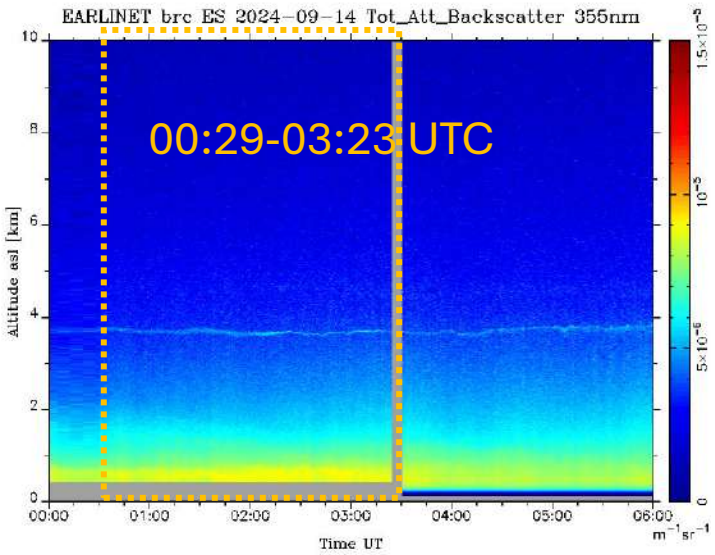
brc-2024/09/14-01682B-AC

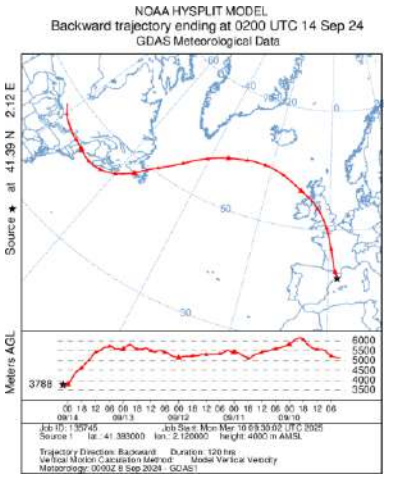


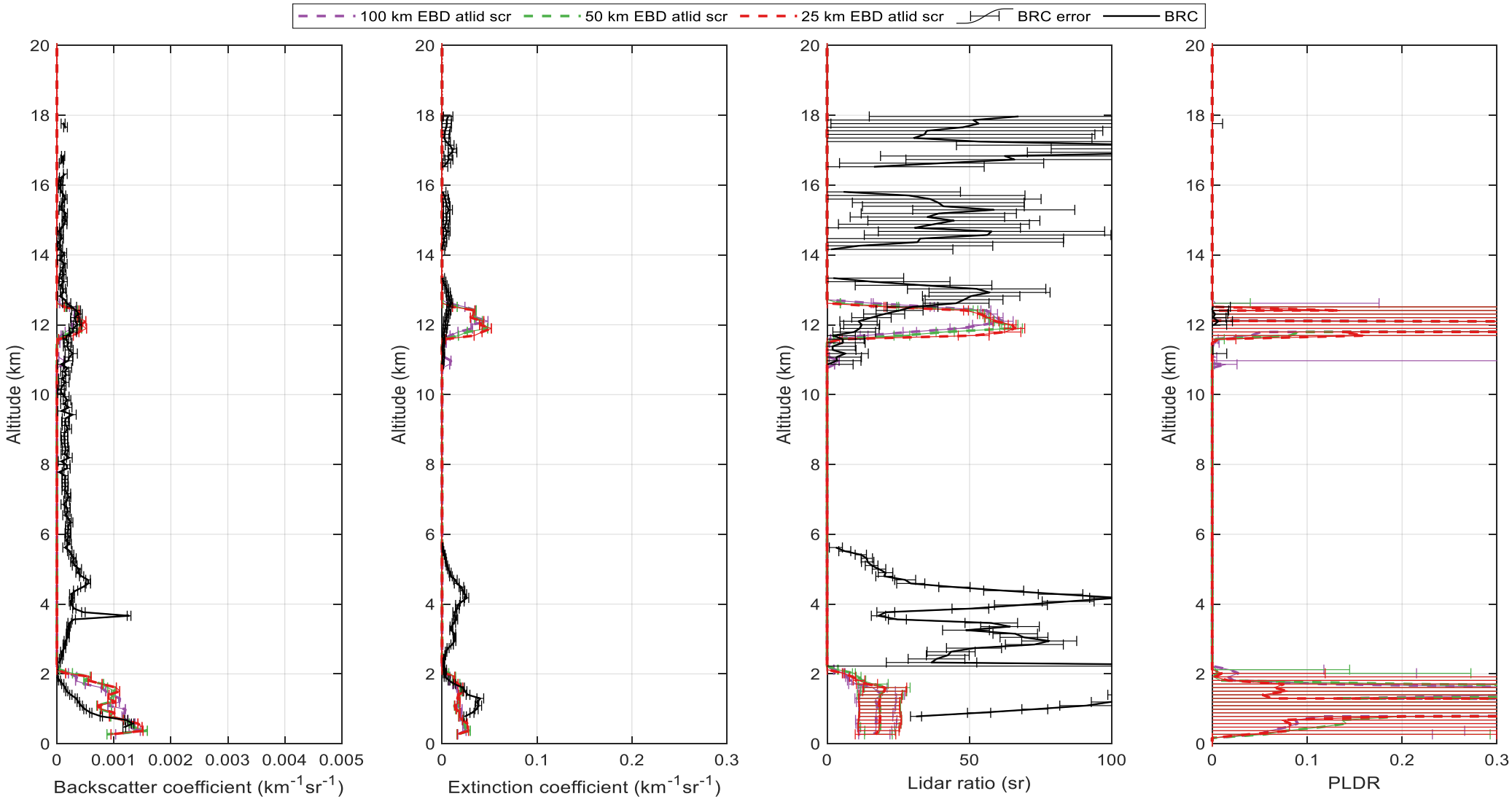


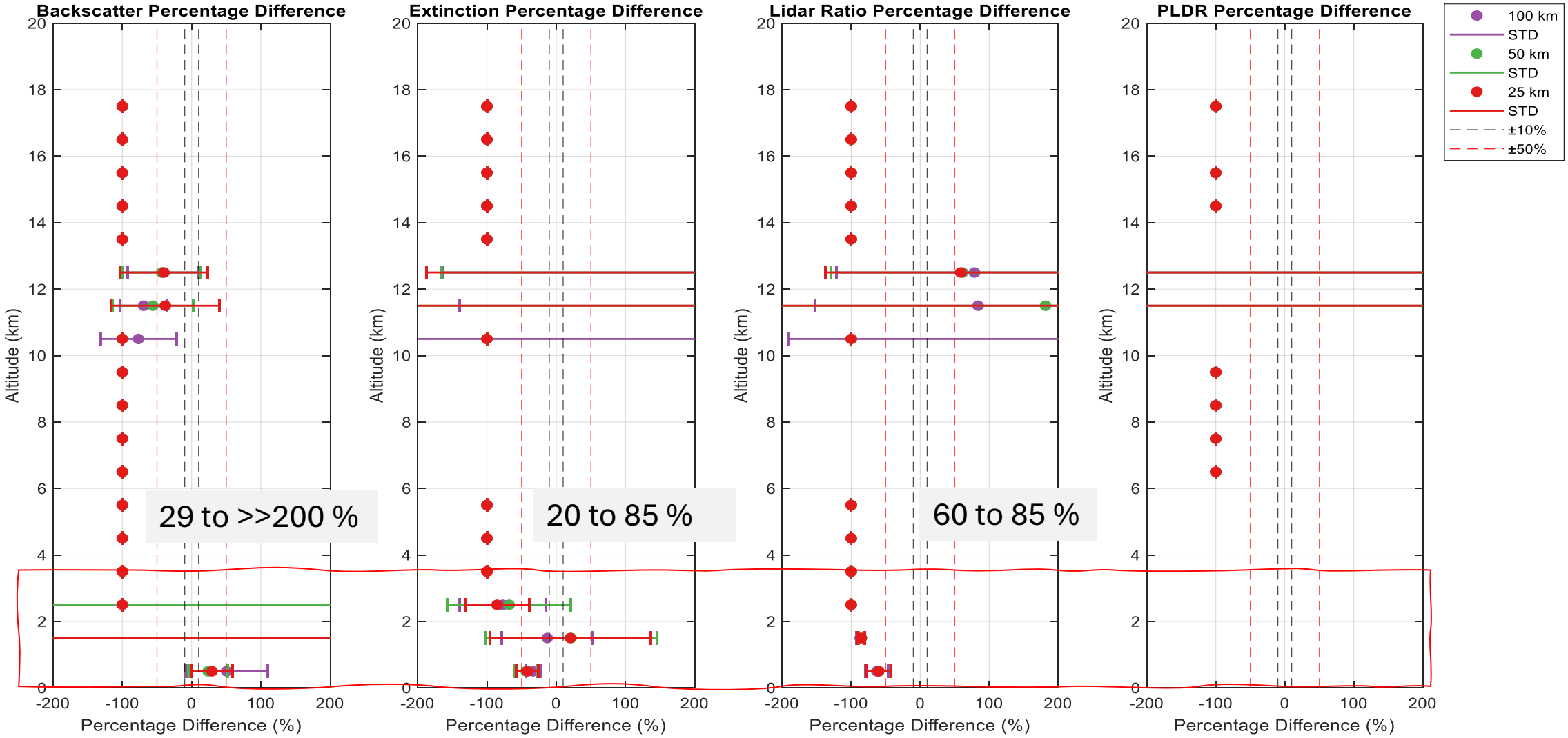




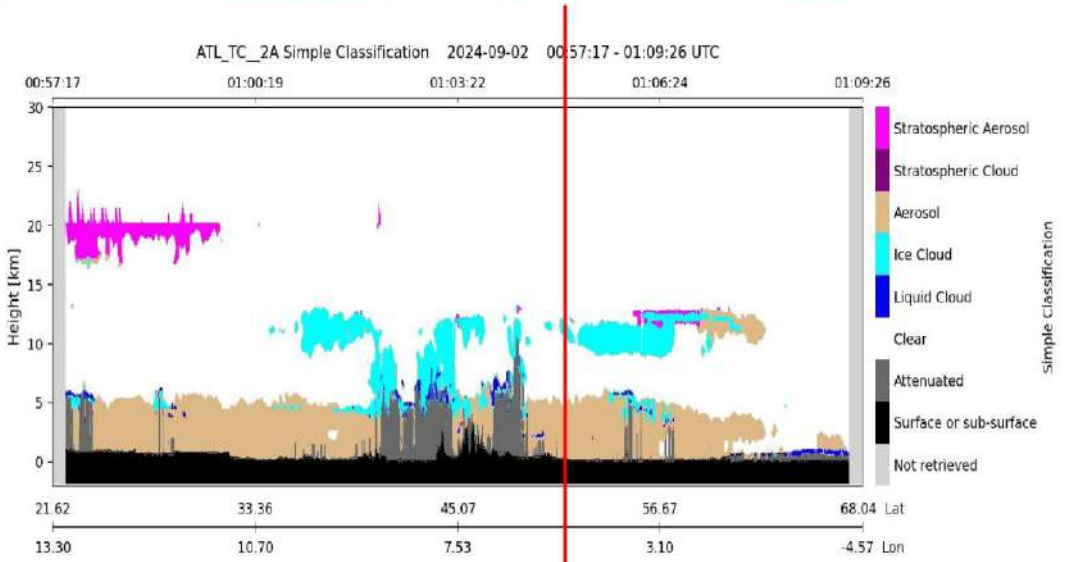


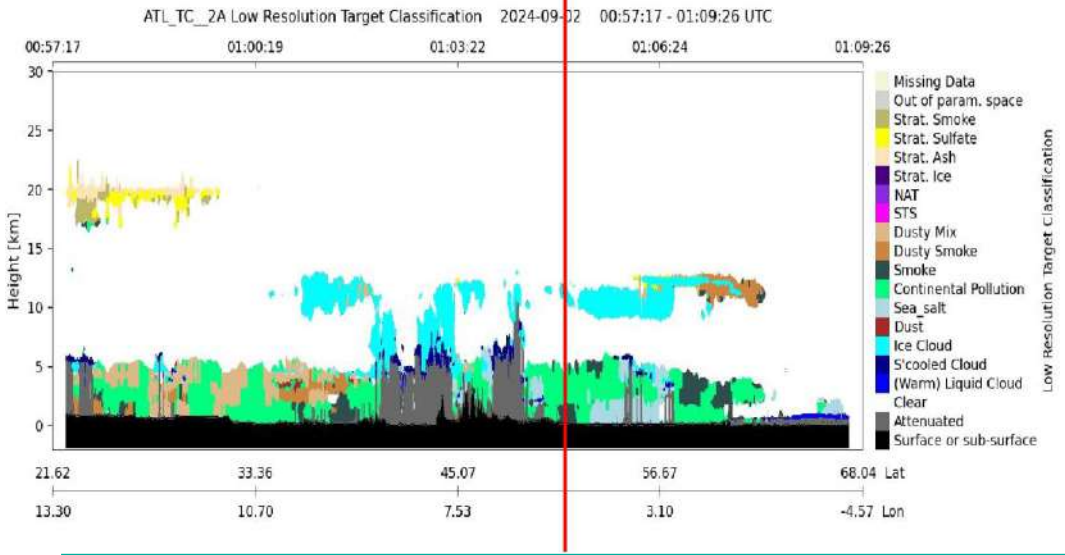


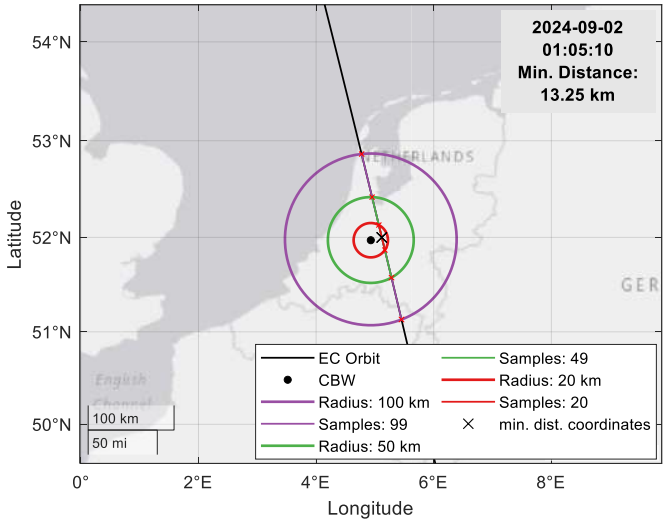

100 km EBD atlid scr
50 km EBD atlid scr
25 km EBD atlid scr
BRC error
BRC
Altitude (km)
Backscatter coefficient (km^{-1}sr^{-1})
Extinction coefficient (km^{-1}sr^{-1})
Lidar ratio (sr)
PLDR

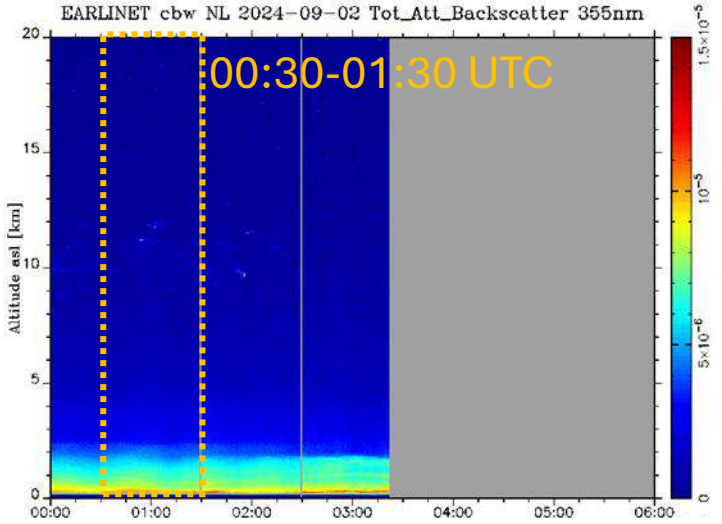

Backscatter Percentage Difference
Extinction Percentage Difference
Lidar Ratio Percentage Difference
PLDR Percentage Difference
Altitude (km)
Percentage Difference (%)
29 to >>200 %
20 to 85 %
60 to 85 %
100 km
STD
50 km
STD
25 km
STD
±10%
±50%

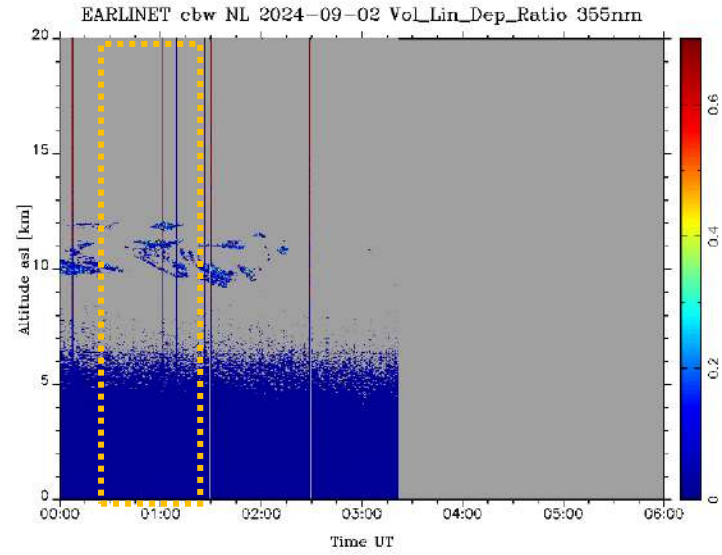
cbw-2024/09/02-01495B-AC



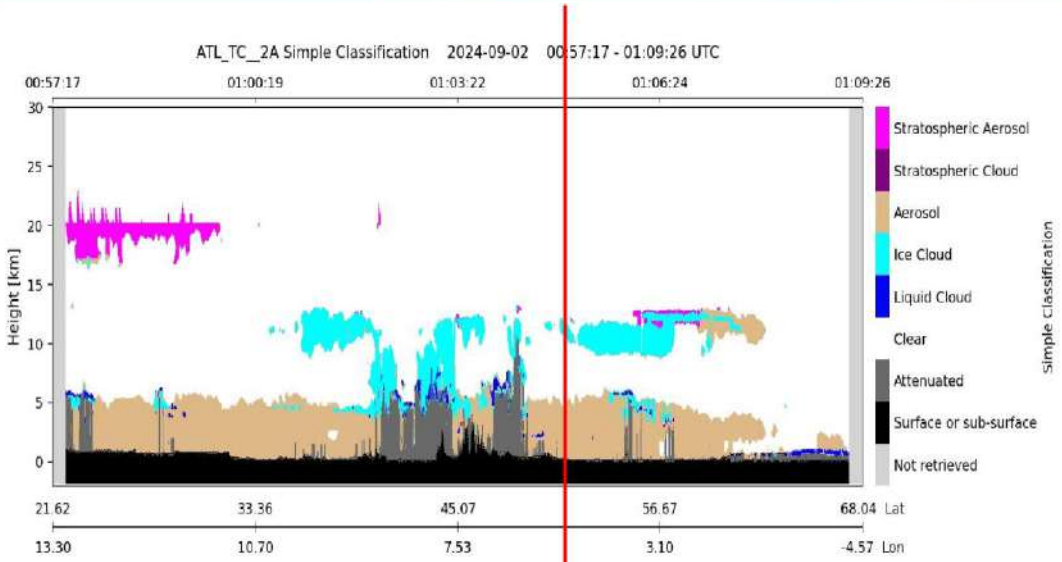


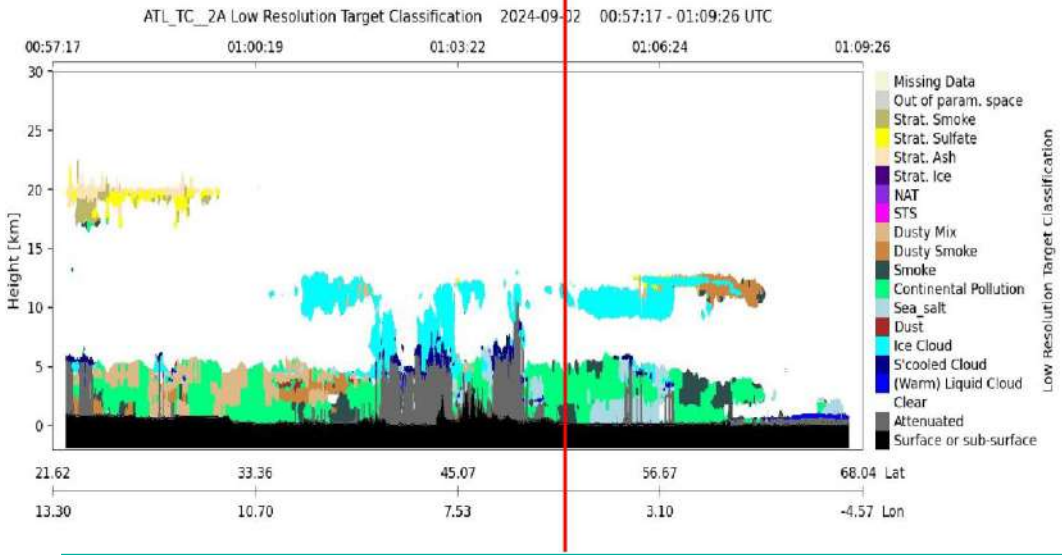


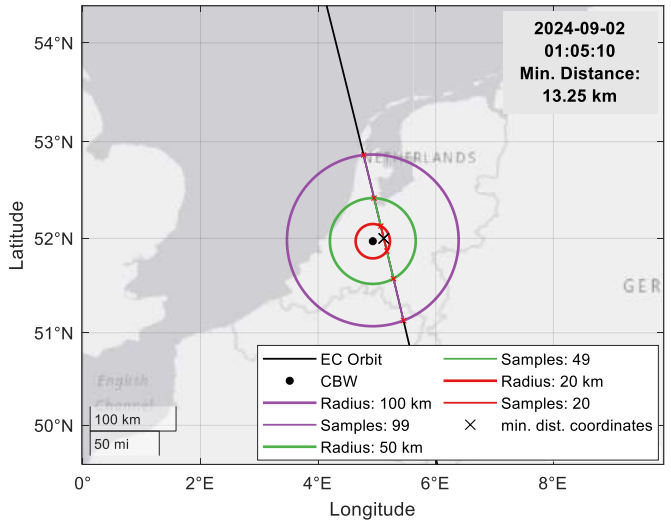


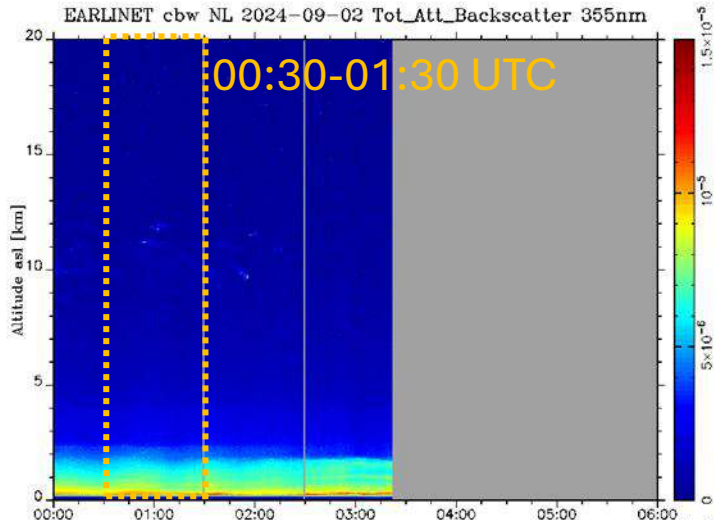


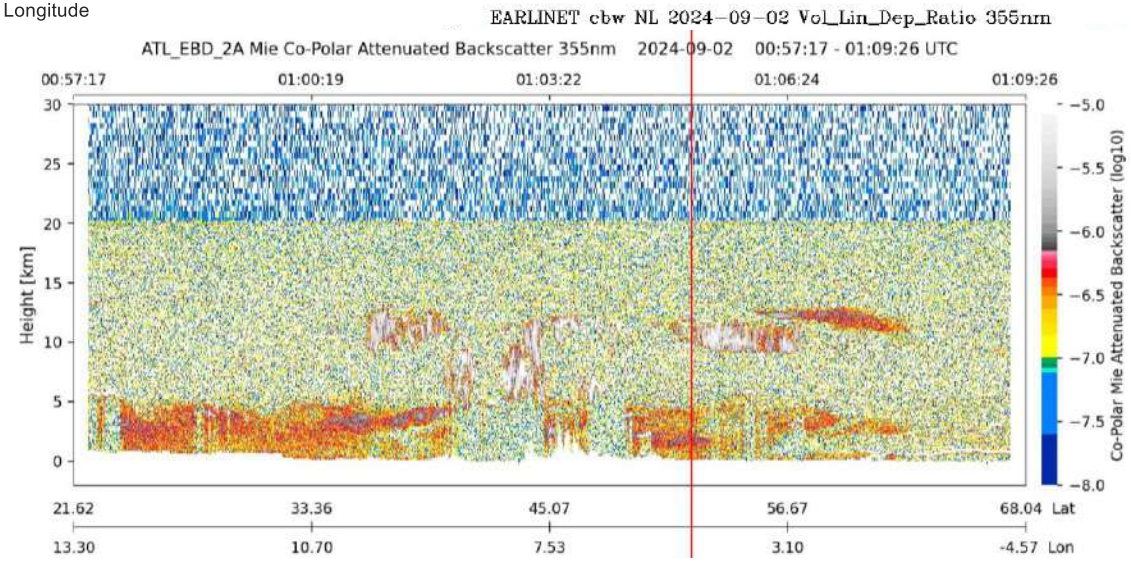
cbw-2024/09/02-01495B-AC

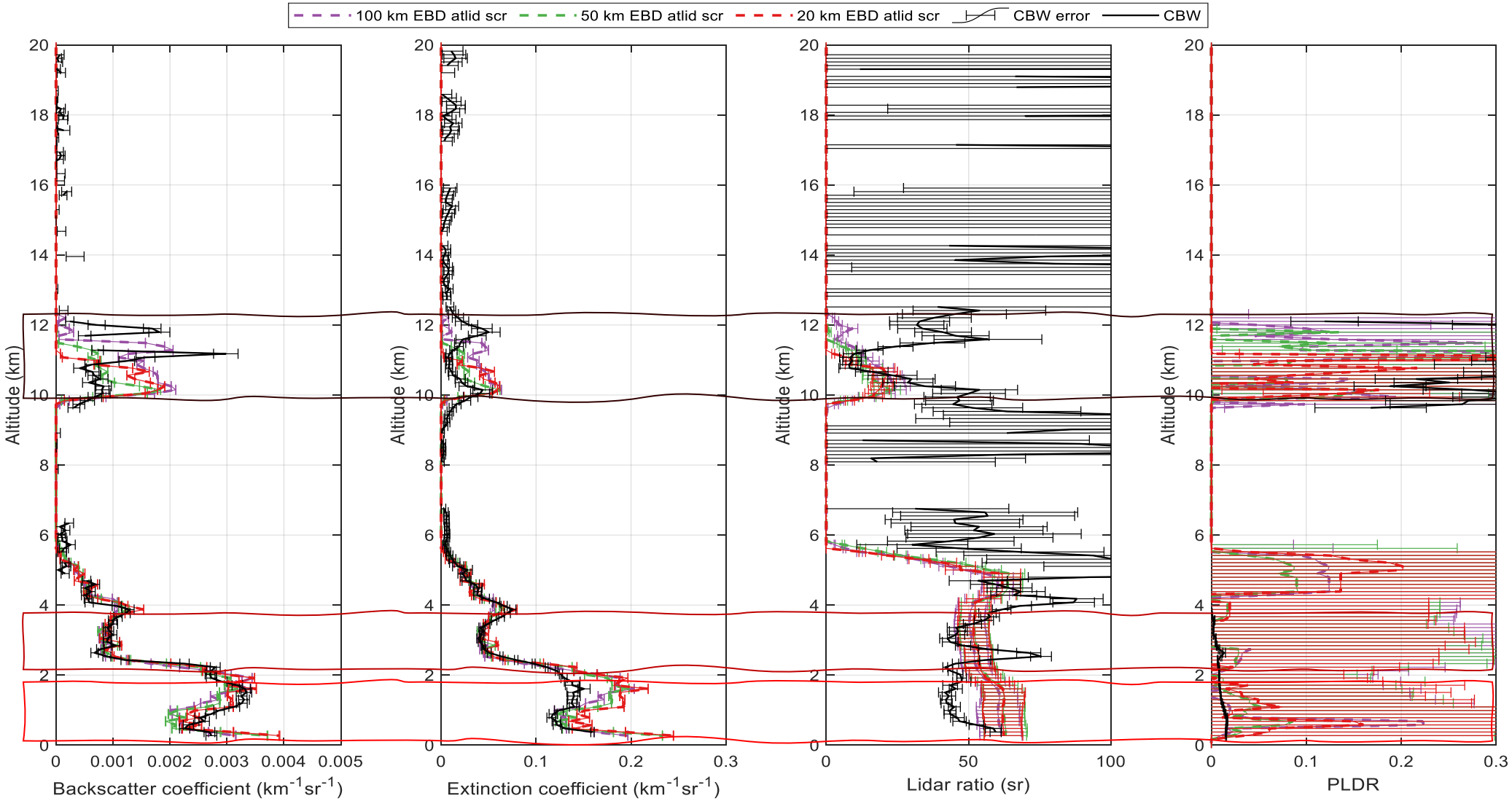


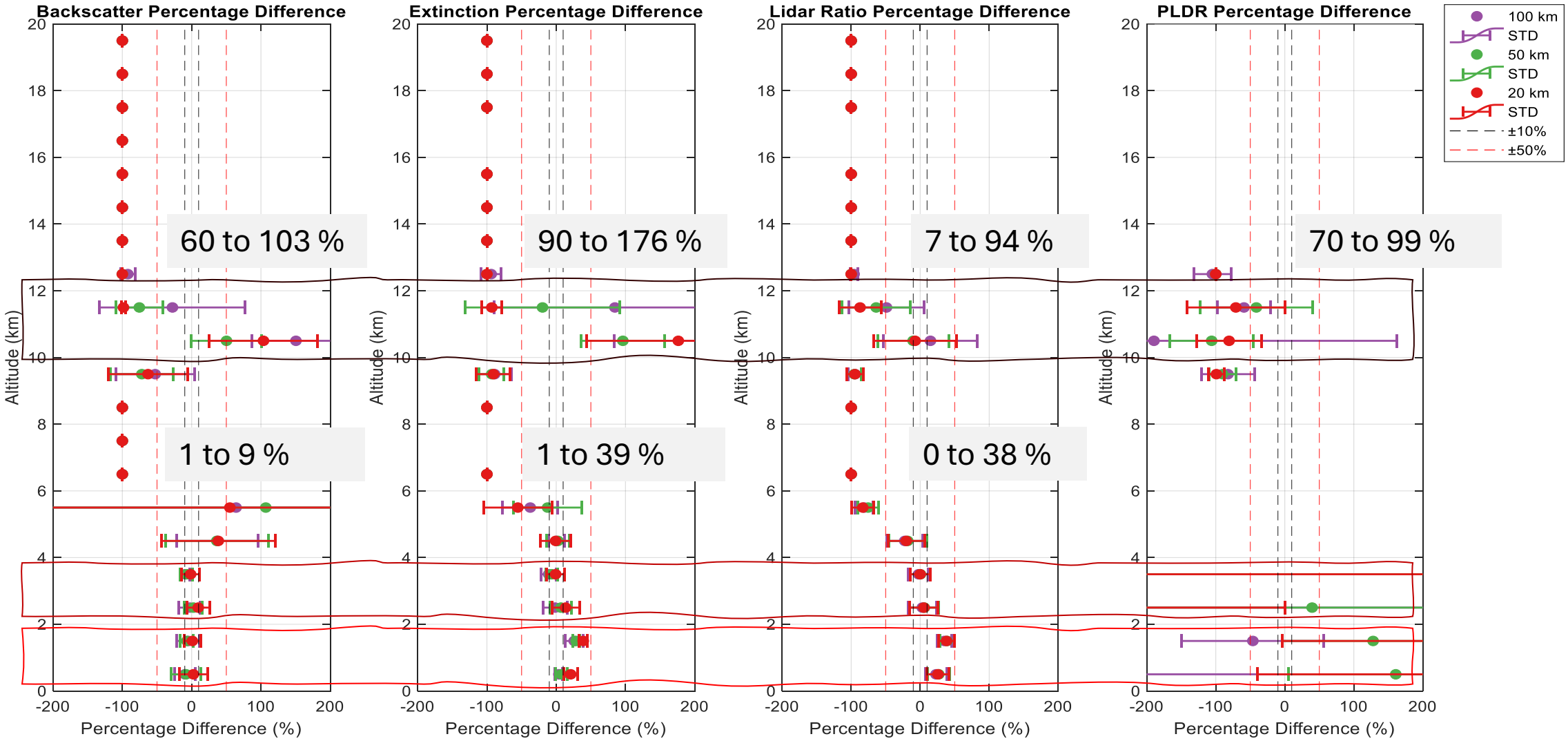




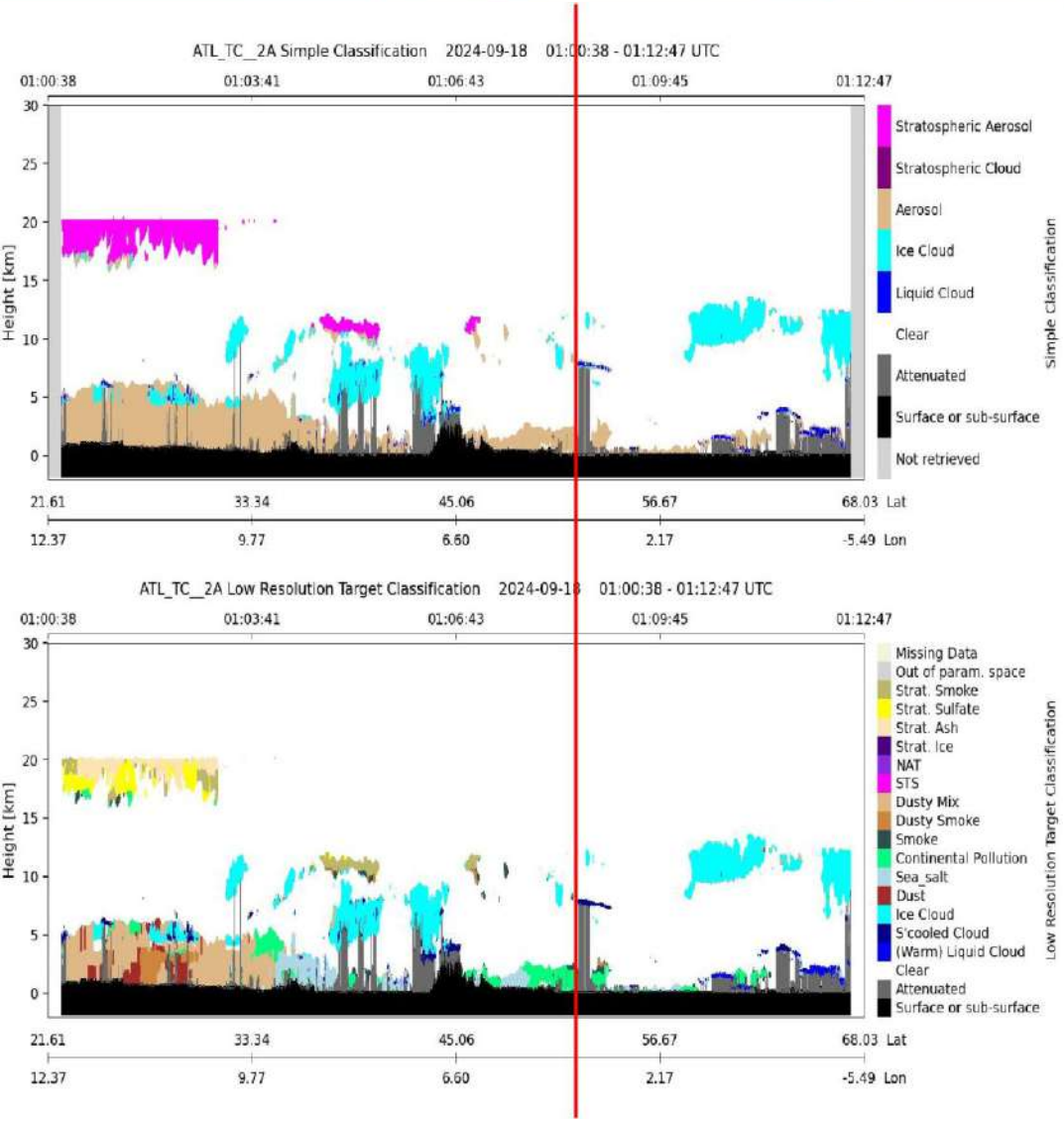


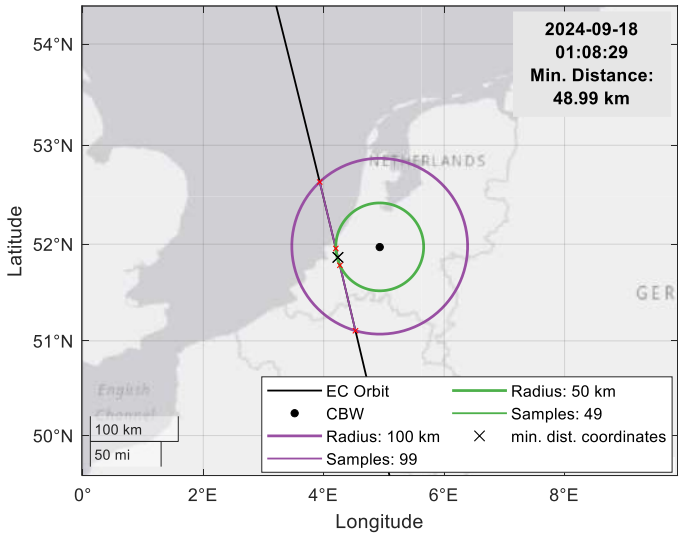


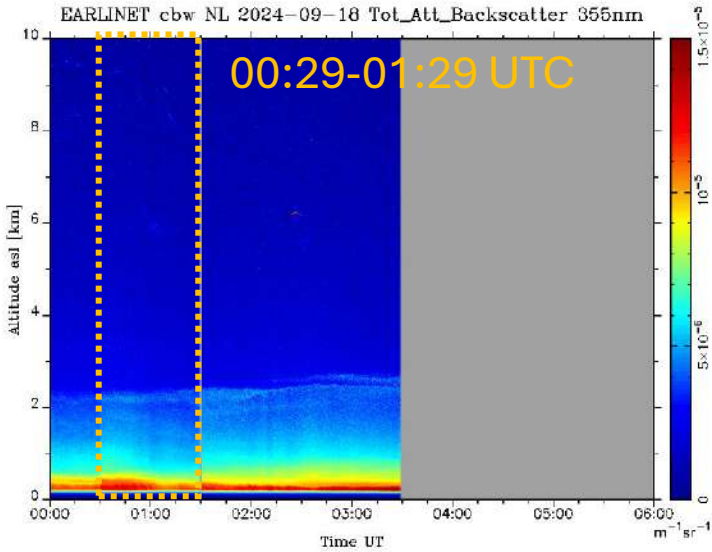

100 km EBD atlid scr
50 km EBD atlid scr
20 km EBD atlid scr
CBW error
CBW
Altitude (km)
Backscatter coefficient (km^{-1}sr^{-1})
Extinction coefficient (km^{-1}sr^{-1})
Lidar ratio (sr)
PLDR

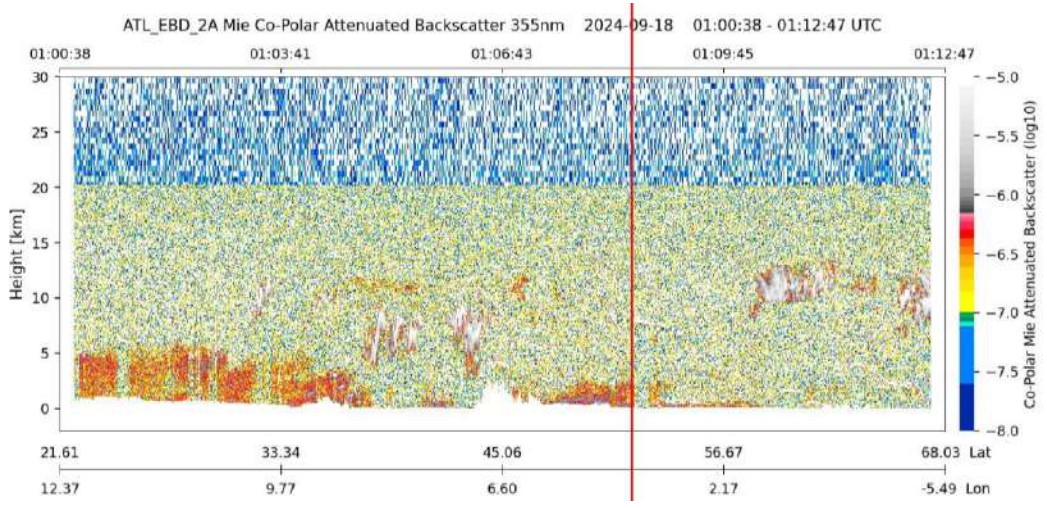

Backscatter Percentage Difference
Extinction Percentage Difference
Lidar Ratio Percentage Difference
PLDR Percentage Difference
60 to 103 %
90 to 176 %
7 to 94 %
70 to 99 %
1 to 9 %
1 to 39 %
0 to 38 %
100 km
STD
50 km
STD
20 km
STD
±10%
±50%
Altitude (km)
Percentage Difference (%)

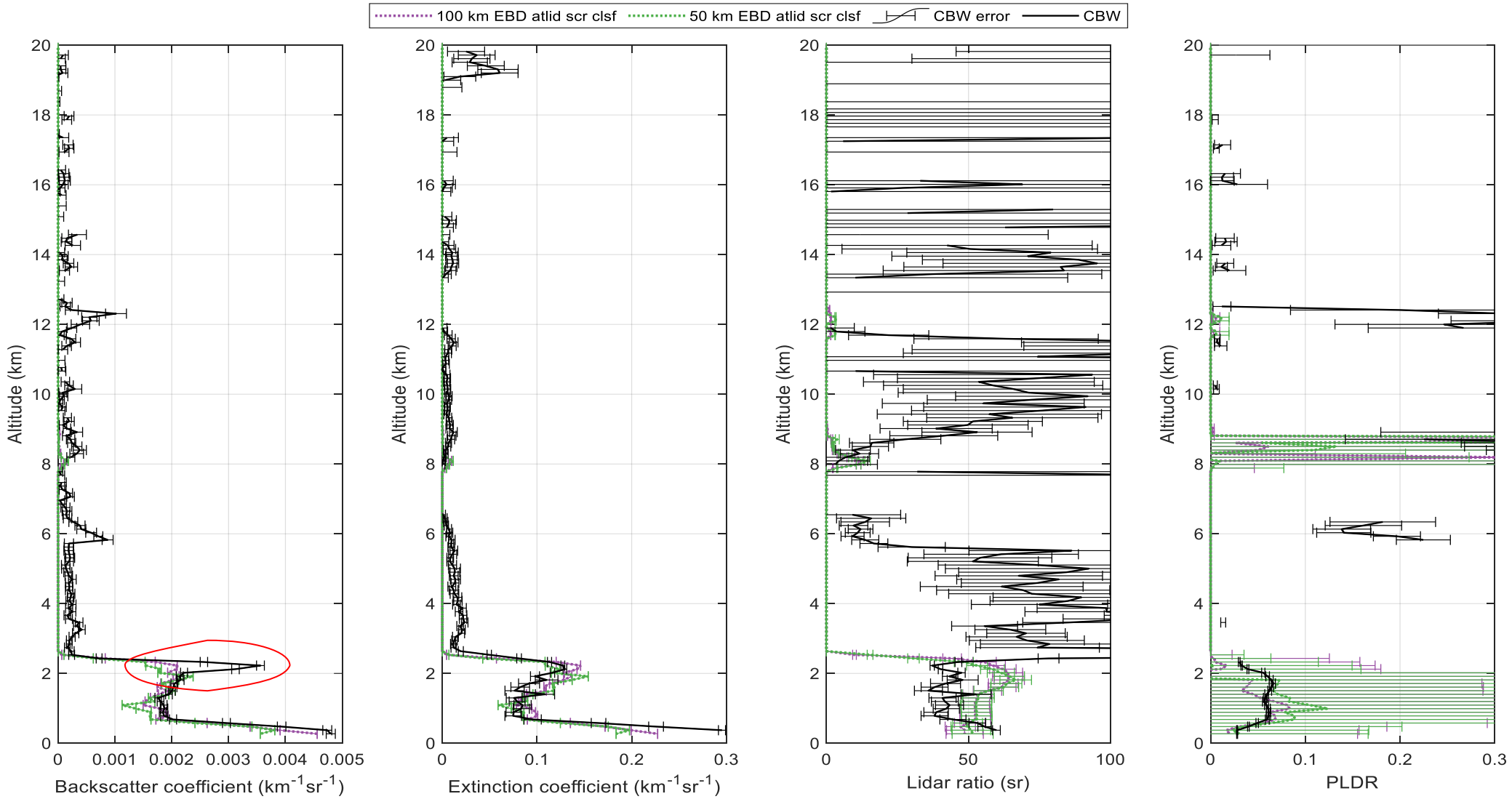
cbw-2024/09/18-01744B-AC

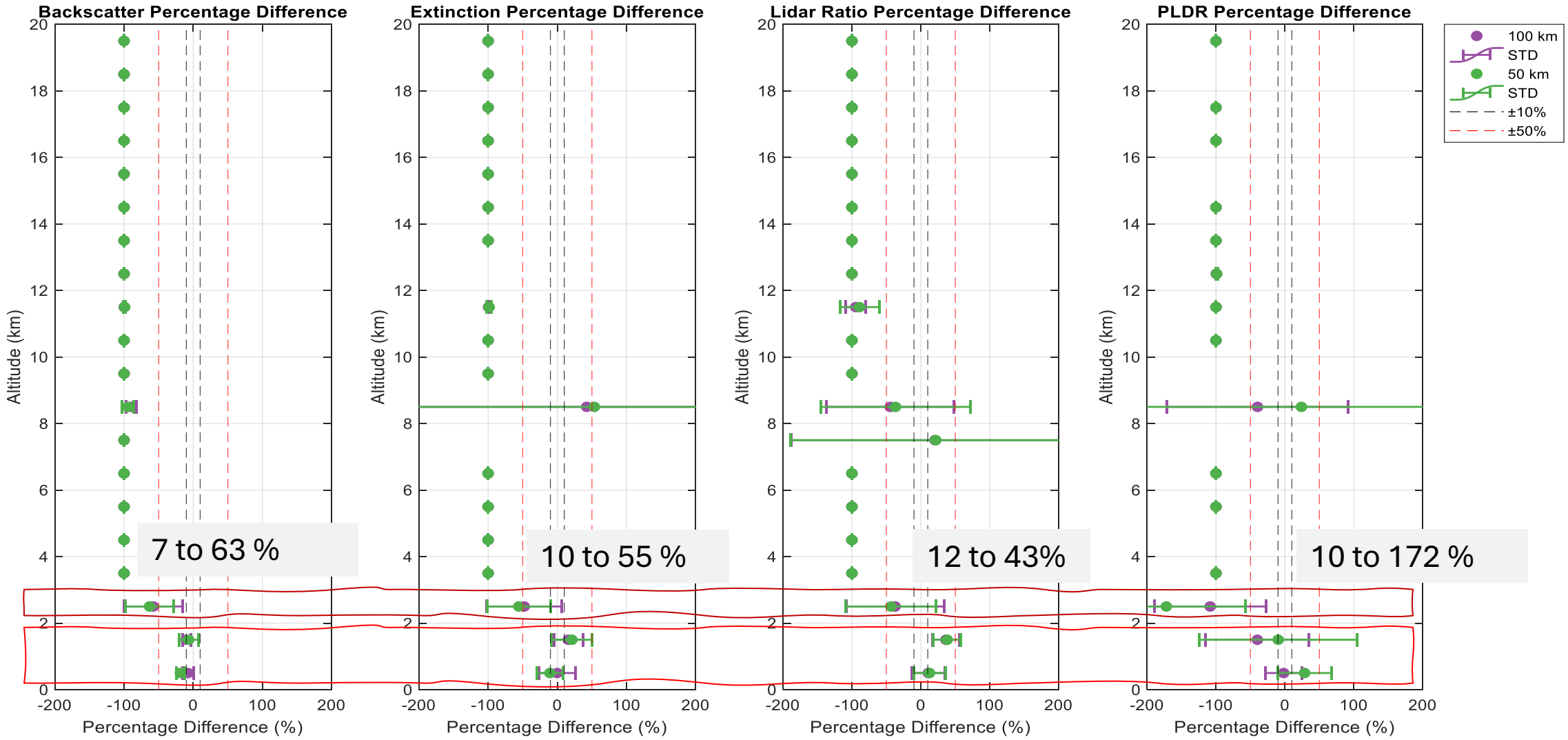









100 km EBD atlid scr clsf
50 km EBD atlid scr clsf
CBW error
CBW
Altitude (km)
Backscatter coefficient (km^{-1}sr^{-1})
Extinction coefficient (km^{-1}sr^{-1})
Lidar ratio (sr)
PLDR


Backscatter Percentage Difference
Extinction Percentage Difference
Lidar Ratio Percentage Difference
PLDR Percentage Difference
Altitude (km)
Percentage Difference (%)
100 km
STD
50 km
STD
±10%
±50%
7 to 63 %
10 to 55 %
12 to 43%
10 to 172 %

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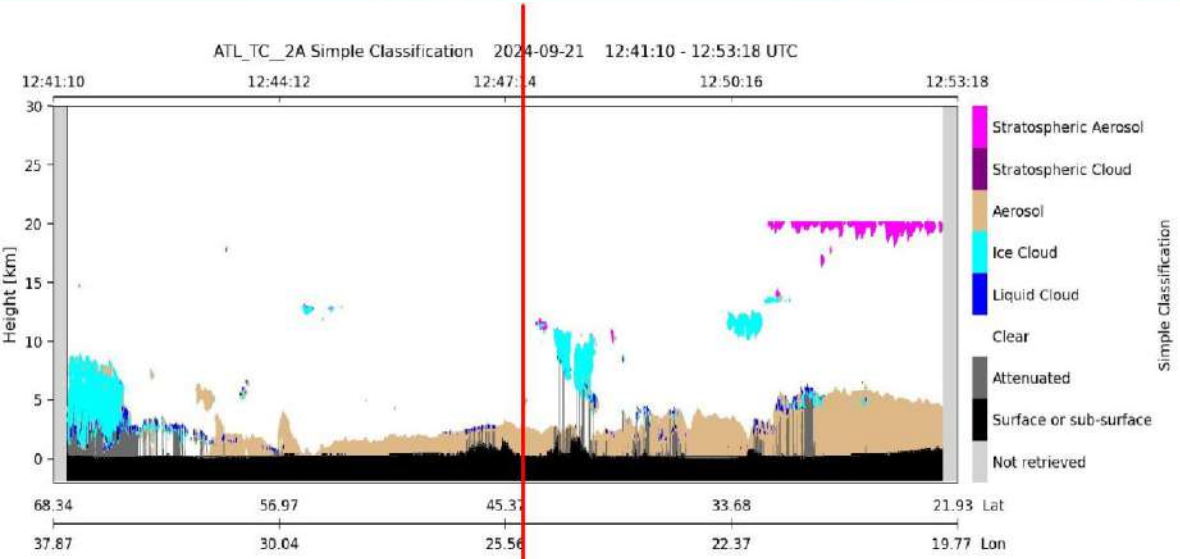
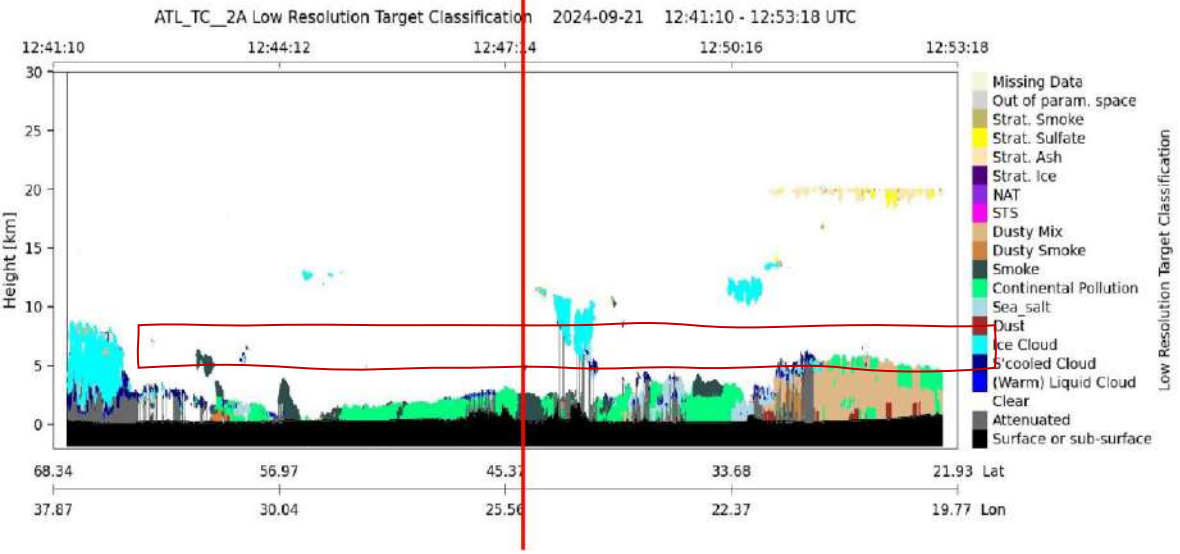
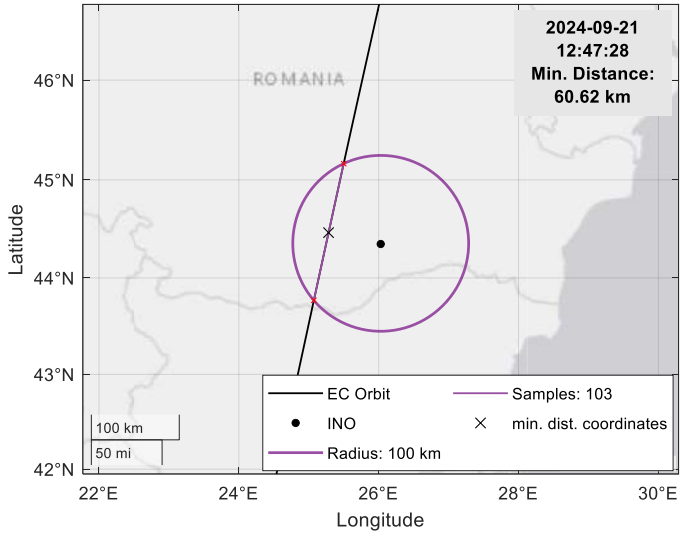
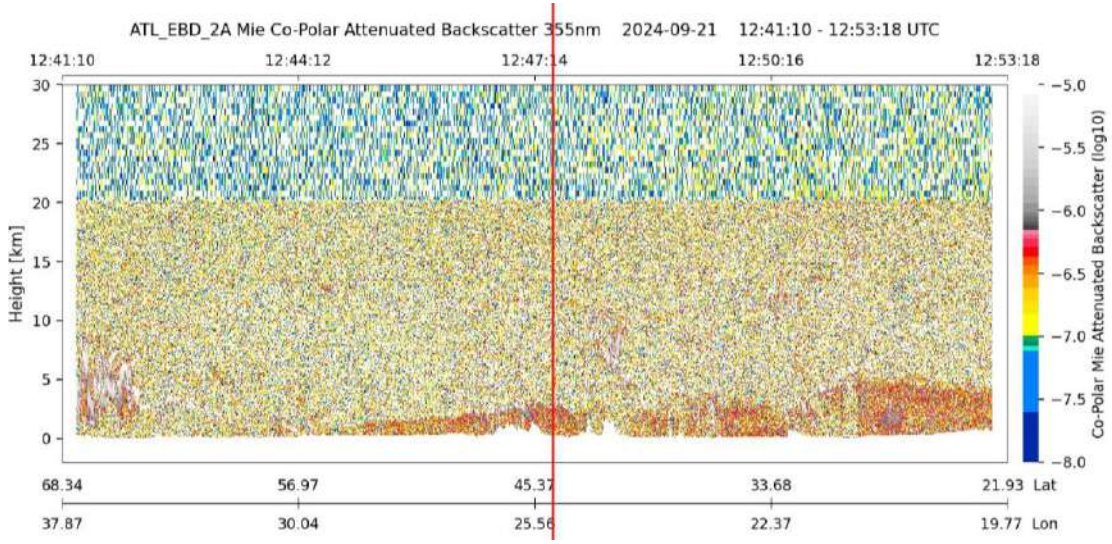






No quicklook available.
Measurement time
11:31-12:29 UTC
Time difference of 18 min
with the overpass



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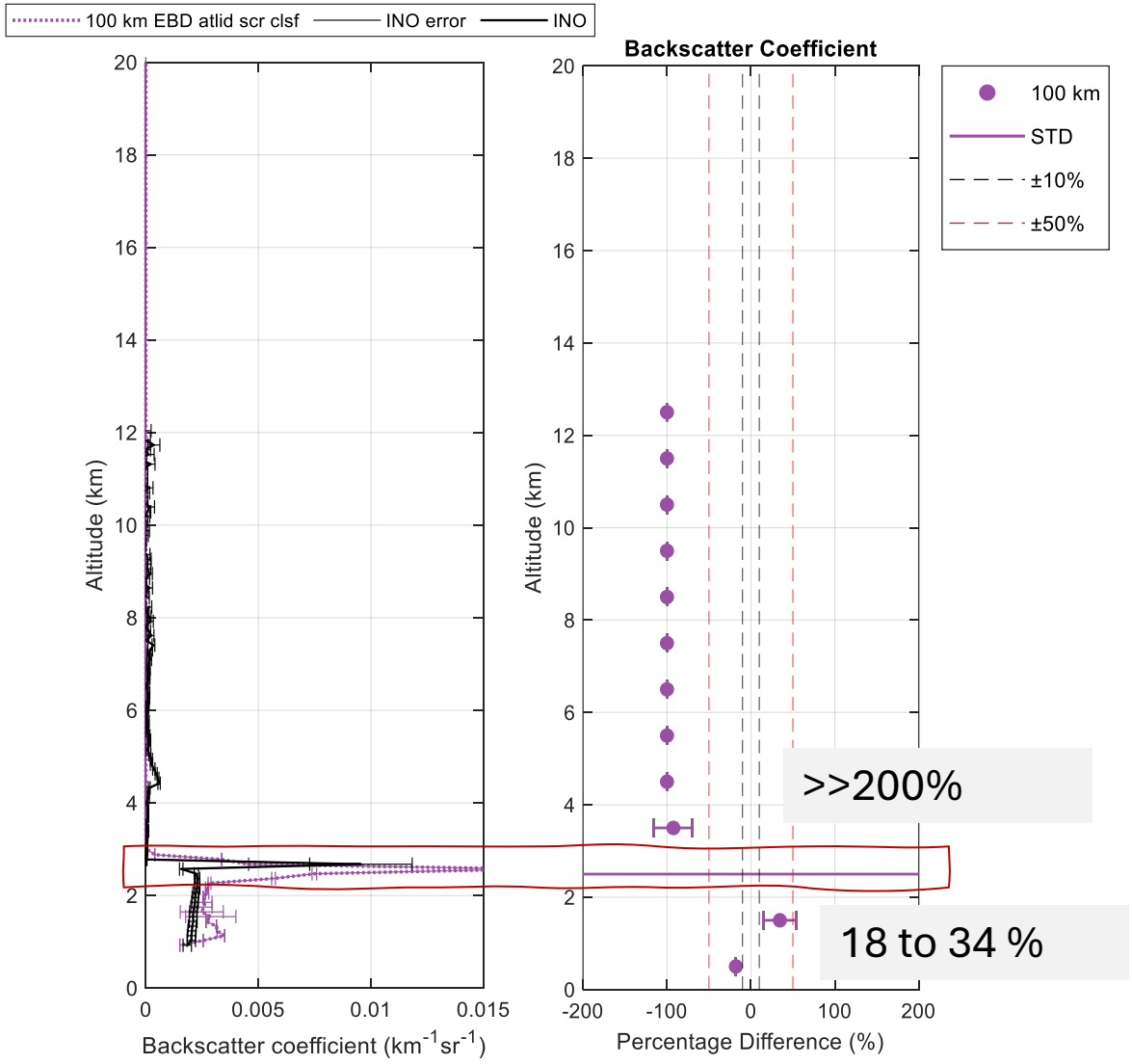
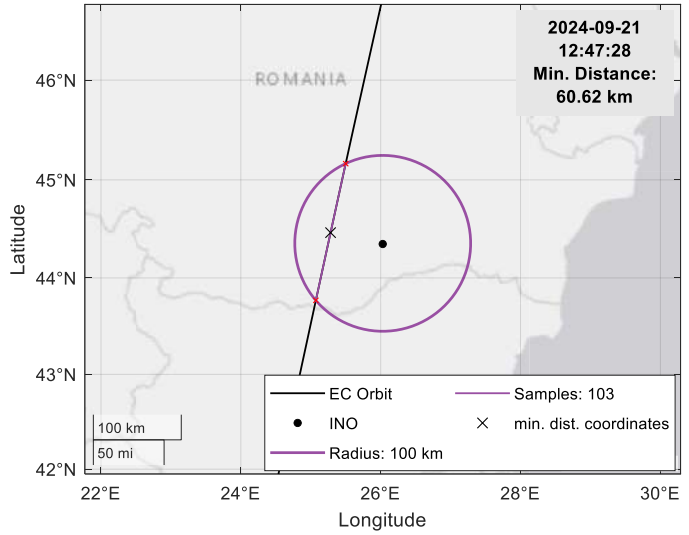
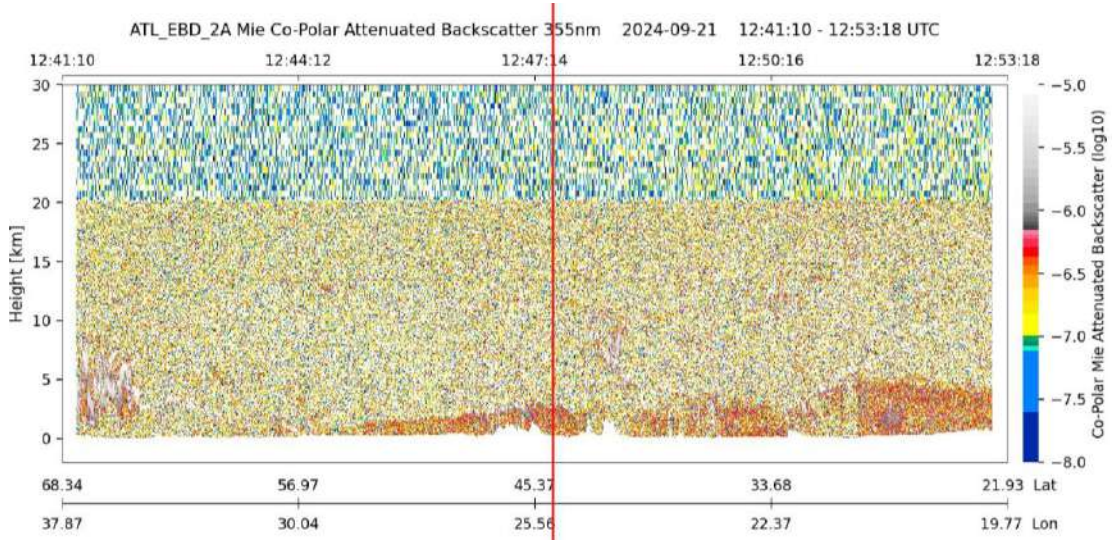




No quicklook available.
Measurement time
11:31-12:29 UTC
Time difference of 18 min
with the overpass



- Collected all corresponding EarthCARE overpasses and relative measurements for these 16 ACTRIS/EARLINET stations from August to end of February
  - **180 ACTRIS/EARLINET measurements**
  - **93 night-time & 87 day-time**

- Overall, the results show a good degree of agreement between ATLID and ground-based lidars, the **median** percentage differences during night-time and day-time overpasses for the **first 3 km**, for all stations:

EBD Product Properties/ Hor. averaging	Backscatter coef.		Extinction coef.		Lidar Ratio		PLDR	
	day	night	day	night	day	night	day	night
[5km]	20.1	55.9		44.2		23.1	72.1	152.8
[20km]	88.6	43.1		56.7		38.9	100.0	100.1
[50km]	88.8	38.9		61.9		53.0	100.0	93.6
[100km]	95.8	50.8		63.6		55.1	100.0	100.0

- Further investigation is needed for depolarization measurement comparisons, particularly during Saharan dust intrusion periods when values are expected to be higher; **use an extinction-weighted averaging!**
- In the case of BRC, a thin aerosol layer in the lower troposphere appears to be undetected by ATLID, same for the CBW station layer.
- The greater the distance, the larger the differences—but not always the case (INO).
- Continue gathering data — including low- and medium-resolution variables— for validation of ATLID using as many ground-based stations as possible from ARES side.

Consiglio Nazionale delle Ricerche

imaa
ISTITUTO DI METODOLOGIE PER L'ANALISI AMBIENTALE

ACTRIS

EARLINET