First comparisons between ATLID and ATR42 during MAESTRO campaign

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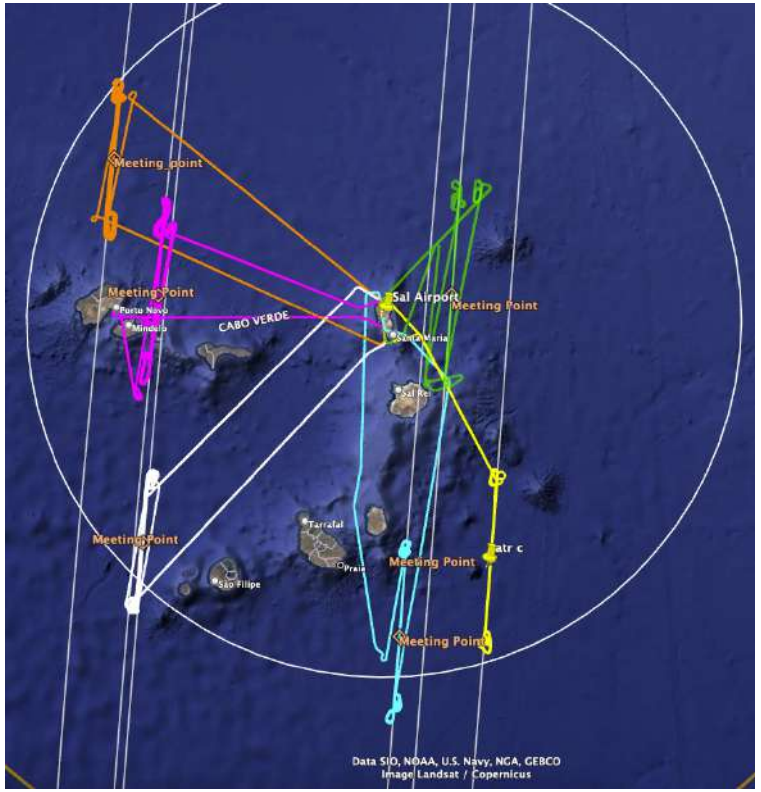
1 : LATMOS
2 : IPSL

1st ESA-JAXA EarthCARE In-Orbit Validation Workshop
14 – 17 January 2025 | VIRTUAL EVENT

Introduction

- MAESTRO campaign (*Mesoscale Organisation of Tropical Convection*, PI: Sandrine Bony LMD)
- Operations out of Sal (Cape Verde), 10 Aug – 10 Sept 2024 → 86 F/H (24 flights)
- 5 legs have been processed (radar targets only available on the 31st of August)

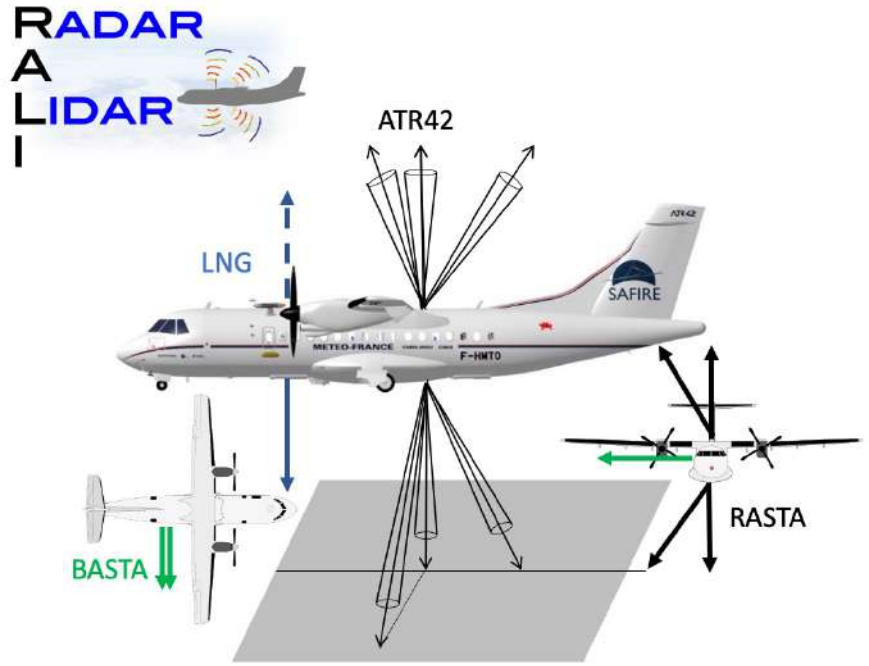


6 flights dedicated to EarthCARE CalVal

Airborne Payload

- RASTA, looking up and down 6 antennas (Doppler W-band)
- **LNG, HRSL 355nm (backscatter 532&1064), 2 pointing directions**
- BASTAir, sideward looking W-band Doppler radar
- aWALI, sideward looking 355nm raman lidar
- Large in-situ payload

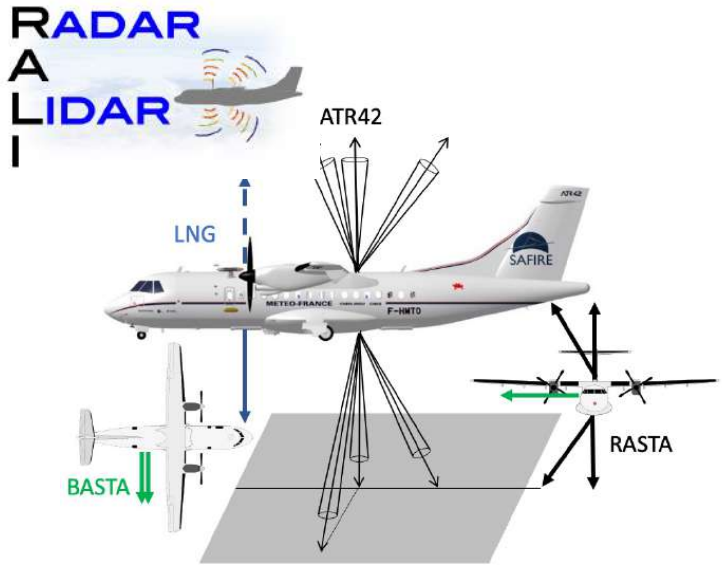
	Instruments \ Objectives	Aerosols	Clouds/precip	Water vapour/ Temp	Wind	Turbulence	Surface
Radar / lidar	LNG				cloud/aerosol		
	RASTA (6 antennas)				cloud/precipitation	cloud/precipitation	
	BASTA				cloud/precipitation	cloud/precipitation	
	aWALI			heterog eneities			
In-situ	FCDP/HVPS/2DS/UHSAS/CVI/NP/FSSP						
	Aircraft's baseline information				clear sky/cloud/aerosol		
Radiometry	CLIMAT						SST
	Pyrano-& pyrgeometers						

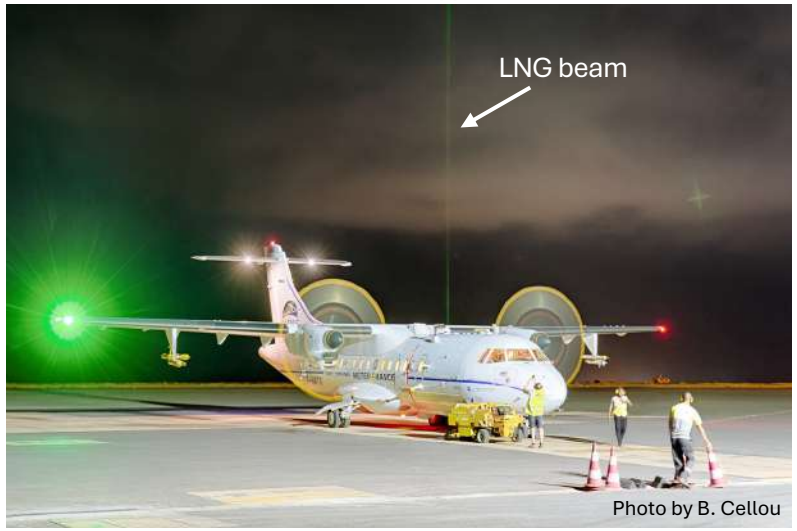


Airborne Lidar : LNG

LNG

- RALI platform → radar-lidar synergy (RASTA/BASTA)
- Upward or downward pointing
- 3 wavelengths : 1064 nm, 532 nm, 355 nm
- **High Spectral Resolution at 355 nm**
  - ↳ Mie attenuated backscatter
  - ↳ Rayleigh attenuated backscatter





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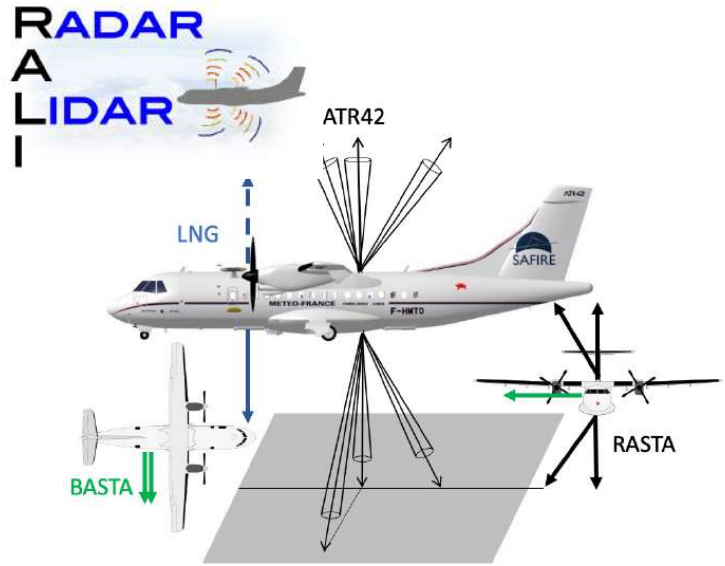


lidars	ATLID	LNG
Vertical resolution	103 m (from the ground to 20 km)	30 m (native 1.8 m)
Horizontal resolution	282 m	400 m (400 shots integrated)
Frequency	51 Hz	100 Hz

L1 ATLID baseline → **ECA_EXAC_ATL_NOM_1B**

Reference altitude : Mean Sea Level

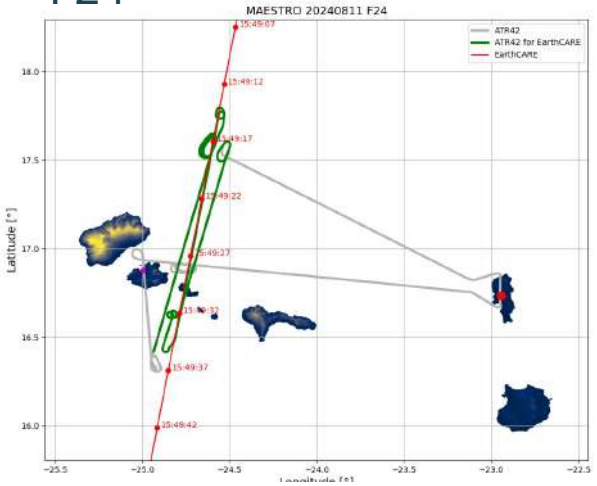
Frame E

Flight summary

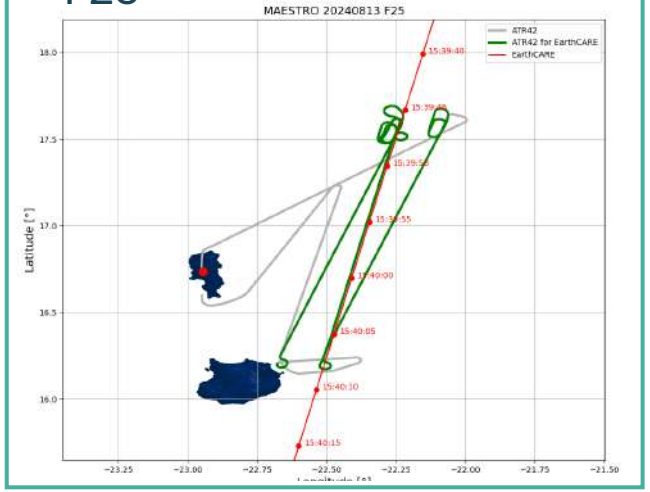
Date	Flight #	Take-off [TO] / Landing [LA]/ Meeting point [MP] times	Legs (convention from MAESTRO)	Comments
20240811	F24	TO 14:33:45.07Z LA 18:13:42.50Z MP 15:49	H1 6466m, time [s]: 54995.0 55718.0 H2 6467m, time [s]: 56379.0 57801.0	• Almost no radar signal (instrument OK) • Issue with LNG-lidar (part of track missing) • In-situ data OK
20240813	F25	TO 14:20:43.95Z LA 17:37:26.19Z MP 15:40	H1 6481m, time [s]: 54246.0 55595.0 H2 6483m, time [s]: 55898.0 57218.0	• Almost no radar signal (instrument OK) • LNG OK, good aerosol layer and tiny liquid clouds • In-situ data OK • Track slightly off due to issue in prediction
20240820	F31	TO 14:03:31.21Z LA 17:33:55.94Z MP 15:50	H1 6477m, time [s]: 56580.0 57480.0	• No radar signal (instrument OK) • LNG OK, good aerosol layer and tiny liquid clouds • In-situ data OK
20240822	F32	TO 13:55:27.23Z LA 17:32:49.48Z MP 15:41	H1 6785m, time [s]: 56040.0 57059.0	• No radar signal (instrument OK) • LNG OK, good aerosol layer and tiny liquid clouds • In-situ data OK
20240829	F38 X	TO 13:52:13.14Z LA 17:40:57.88Z MP 15:49	H1 6478m, time [s]: 56490.0 56894.0 H2 6800m, time [s]: 57140.0 57359.0	• No radar signal (instrument OK) • **No LNG due to computer issue** • In-situ data OK
20240831	F40	TO 13:57:37.89Z LA 17:30:33.43Z MP 15:38	H1 6478m, time [s]: 56490.0 56894.0 H2 6800m, time [s]: 57140.0 57359.0	• Radar and lidar signals • In-situ data OK

Pattern

F24



F25



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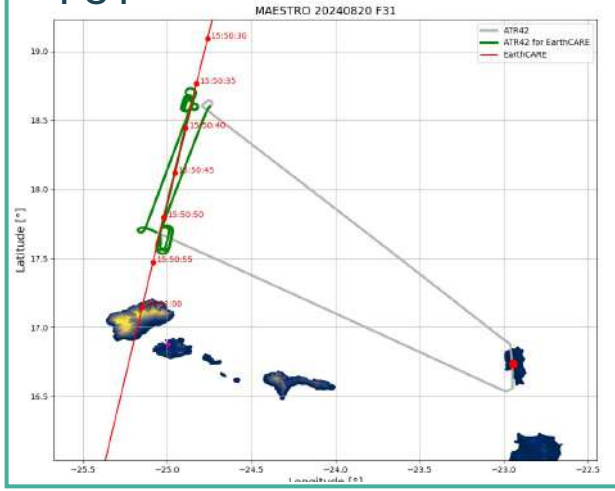
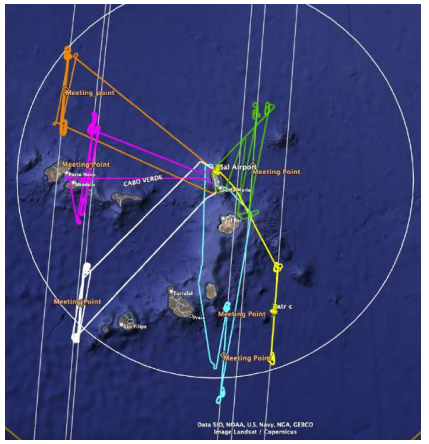
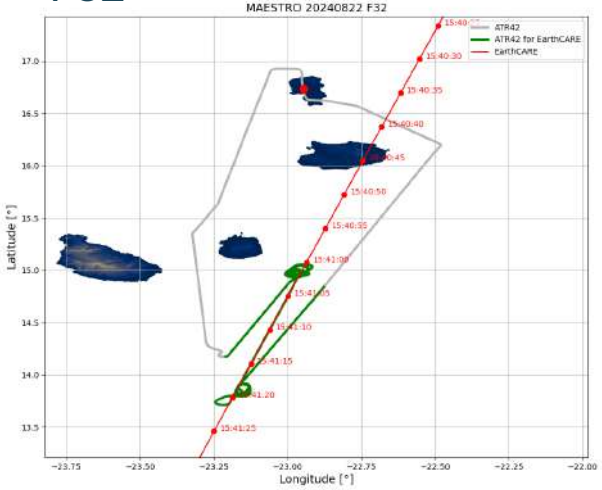


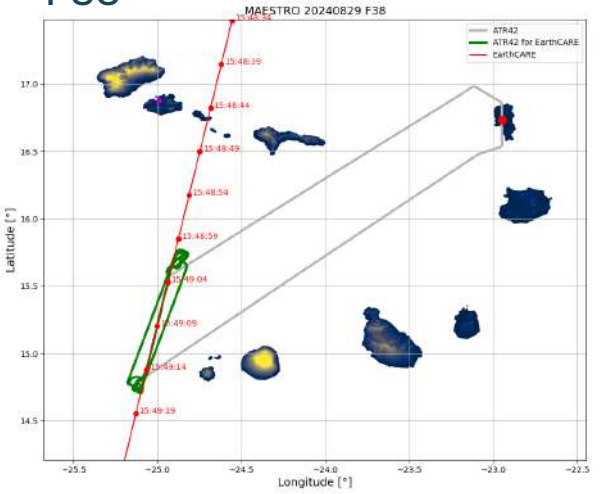


All flights

F32



F38



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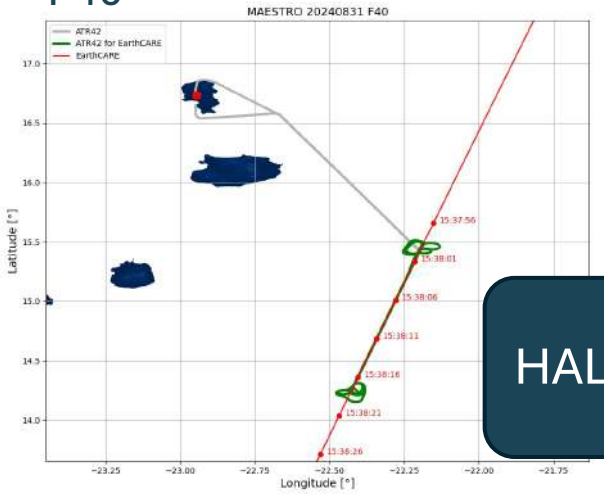
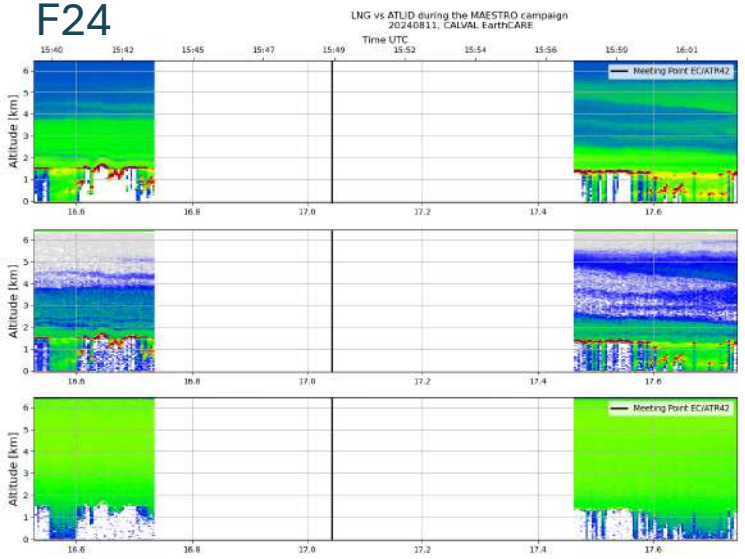


HALO+KingAir+ATR42

F24



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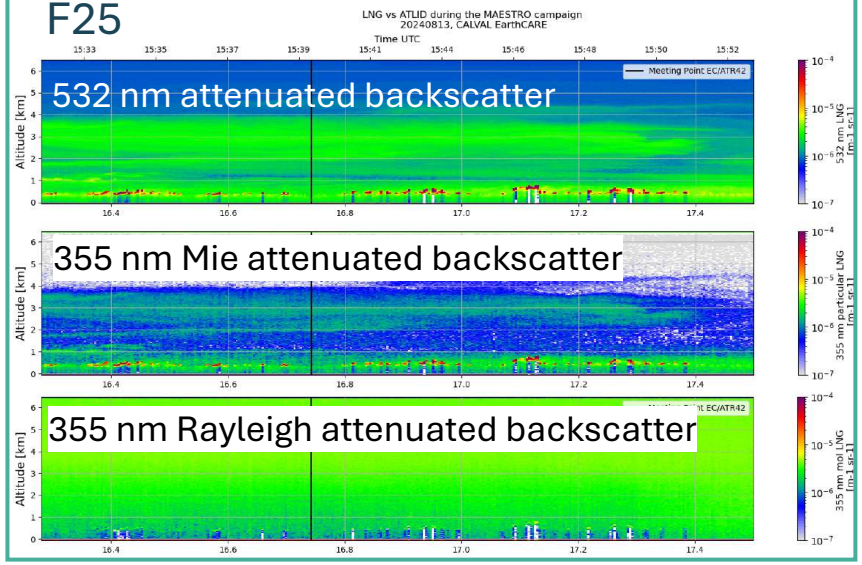

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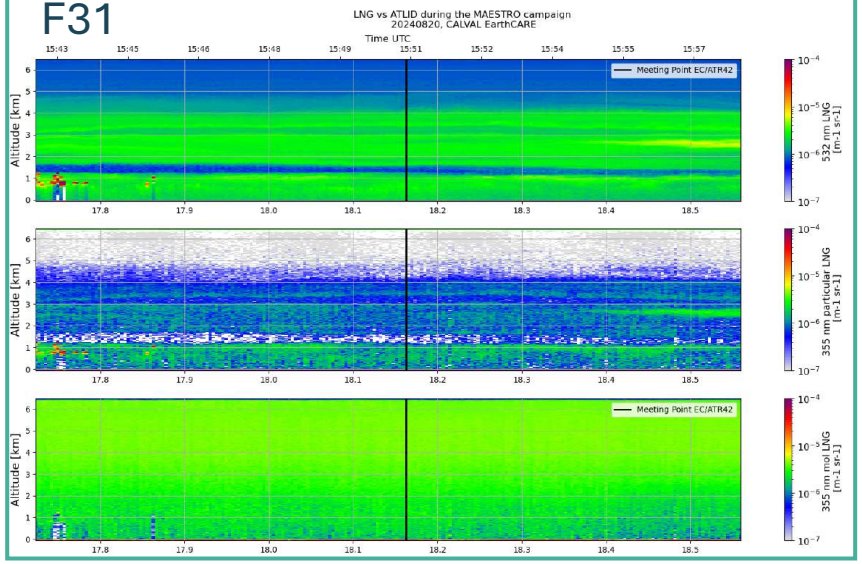

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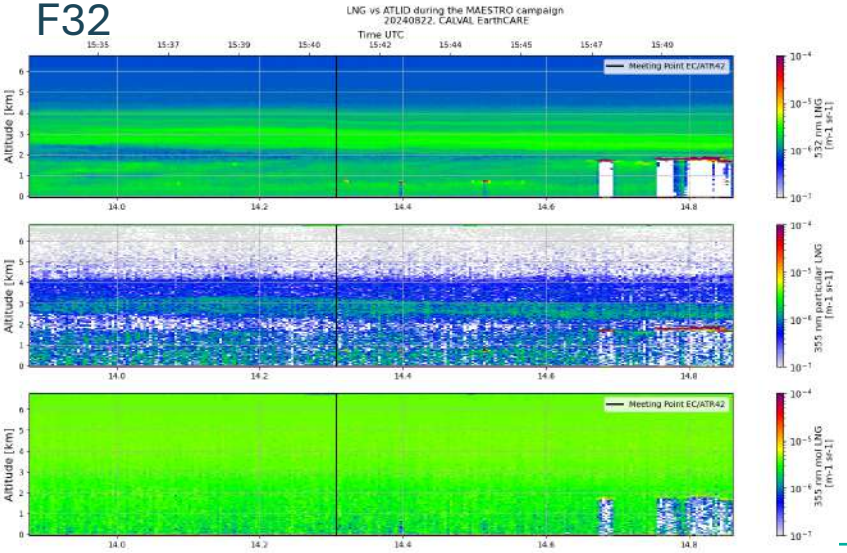
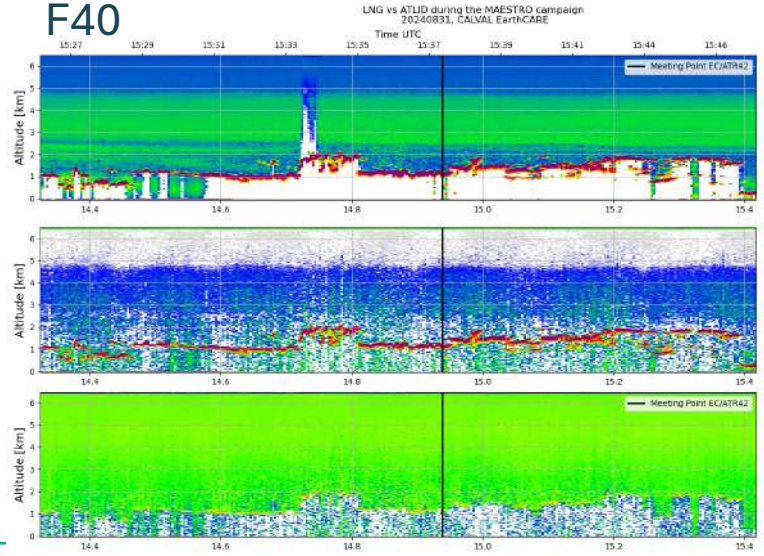


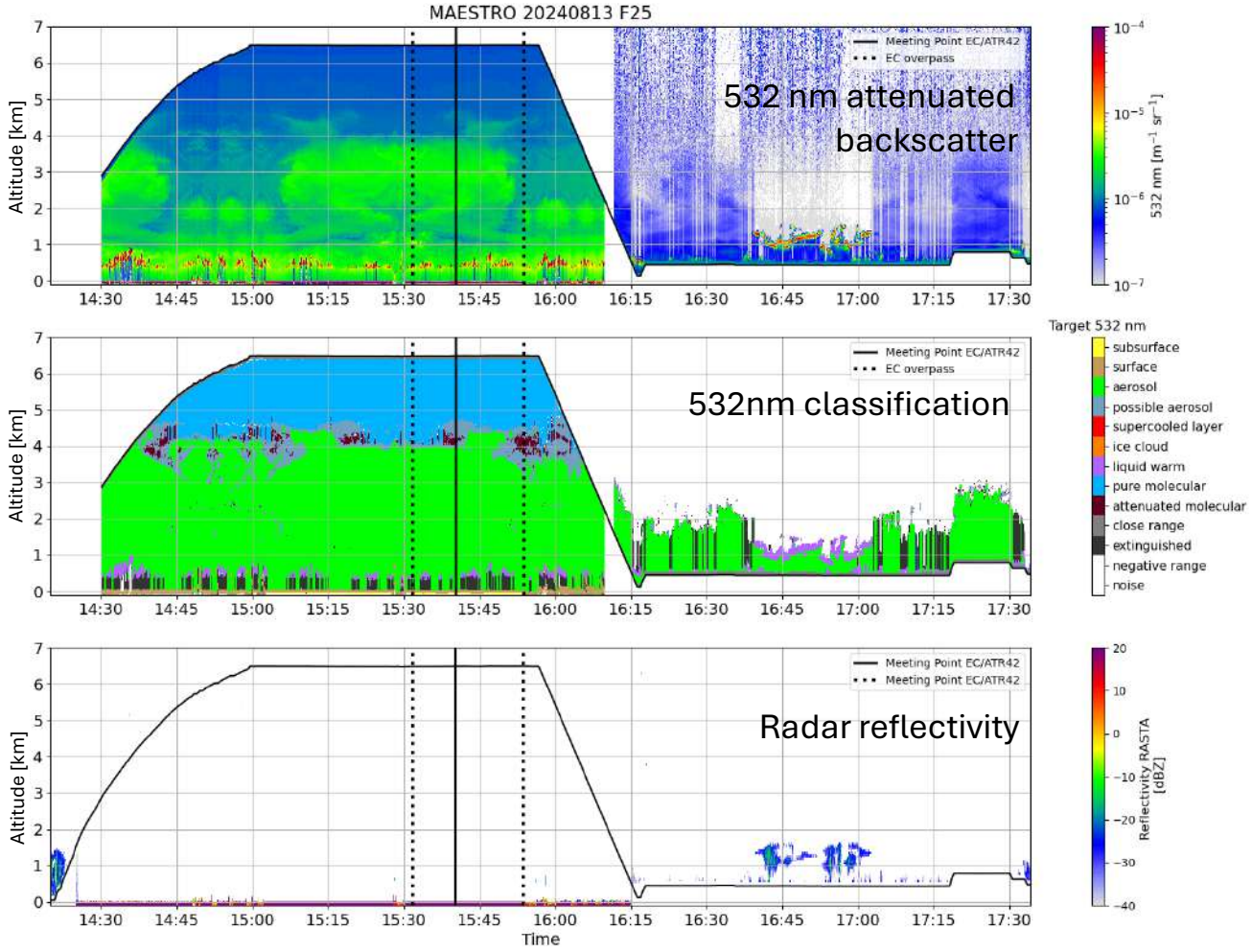
F38

X

F40



F25 2024/08/13



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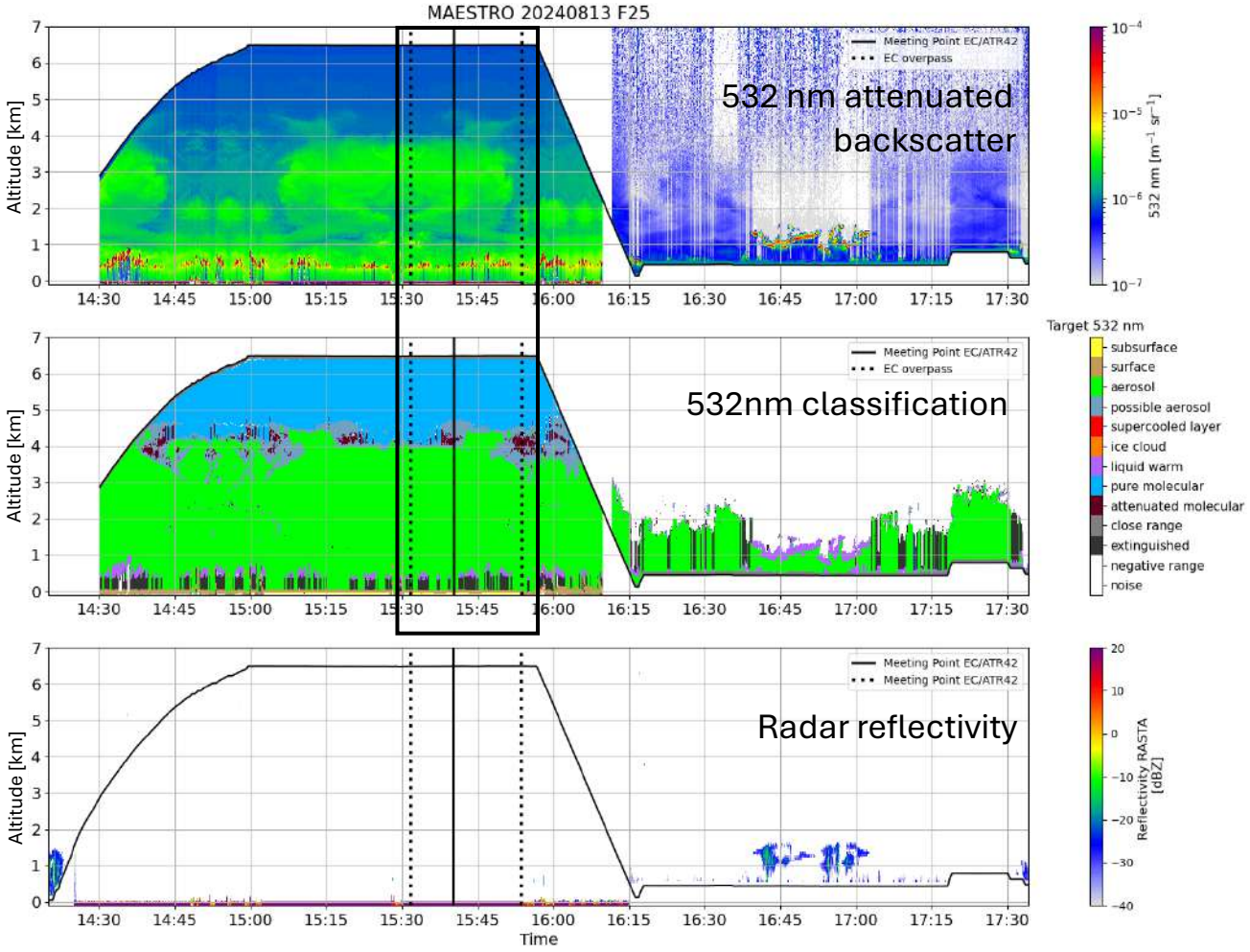
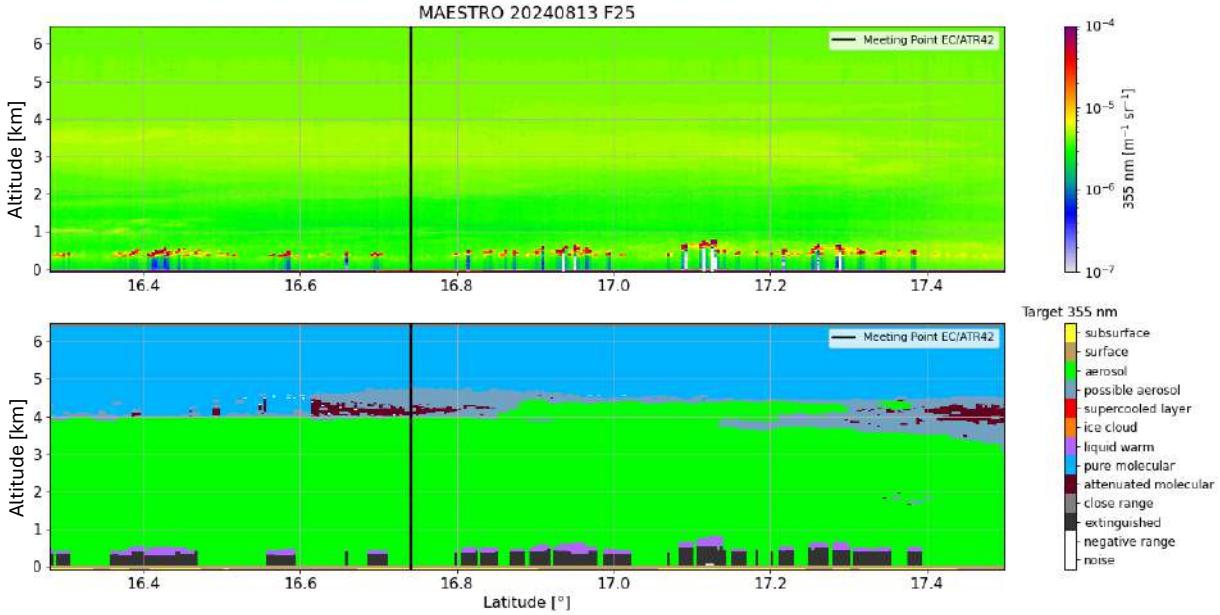


355 nm attenuated backscatter
+ 355 target classification



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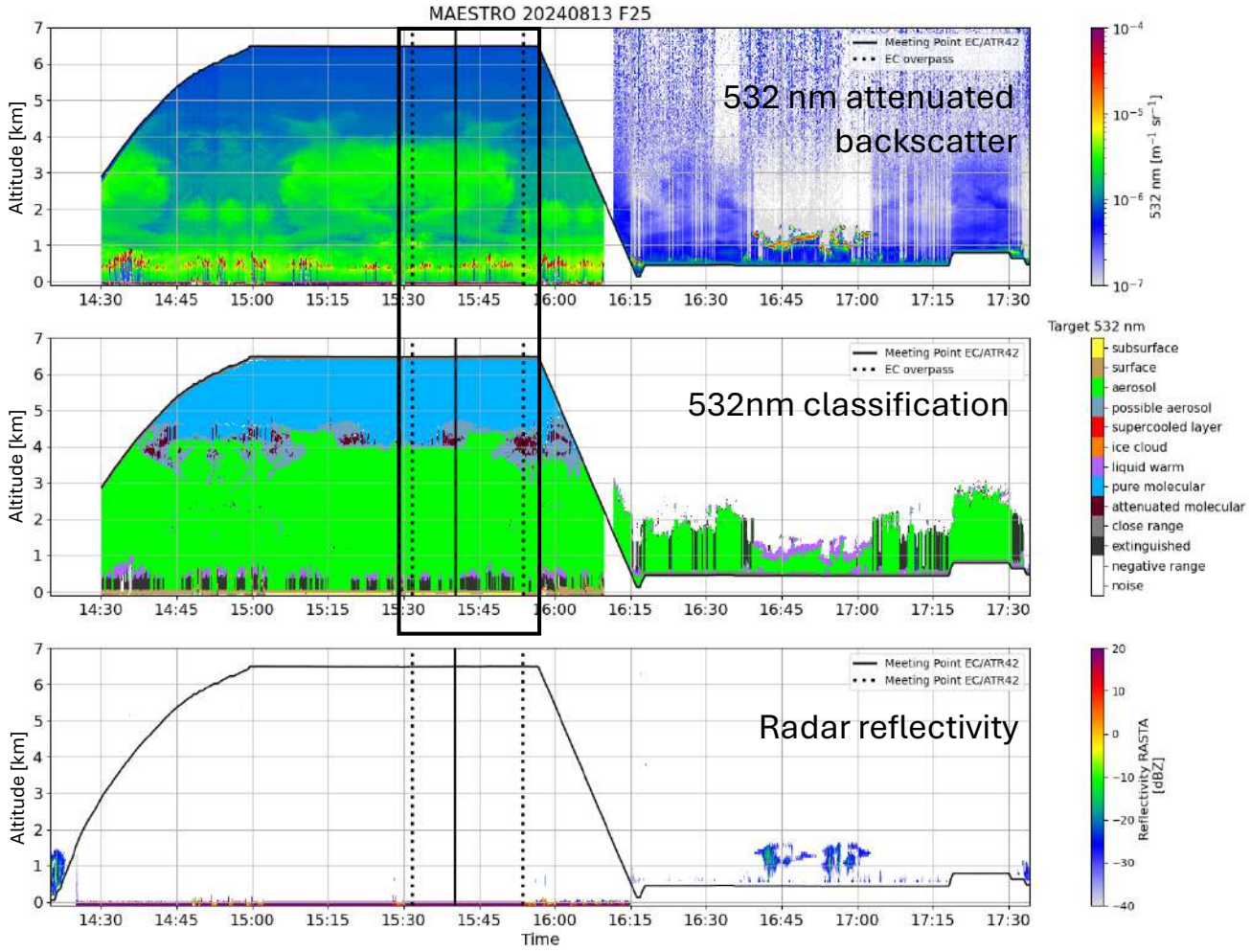

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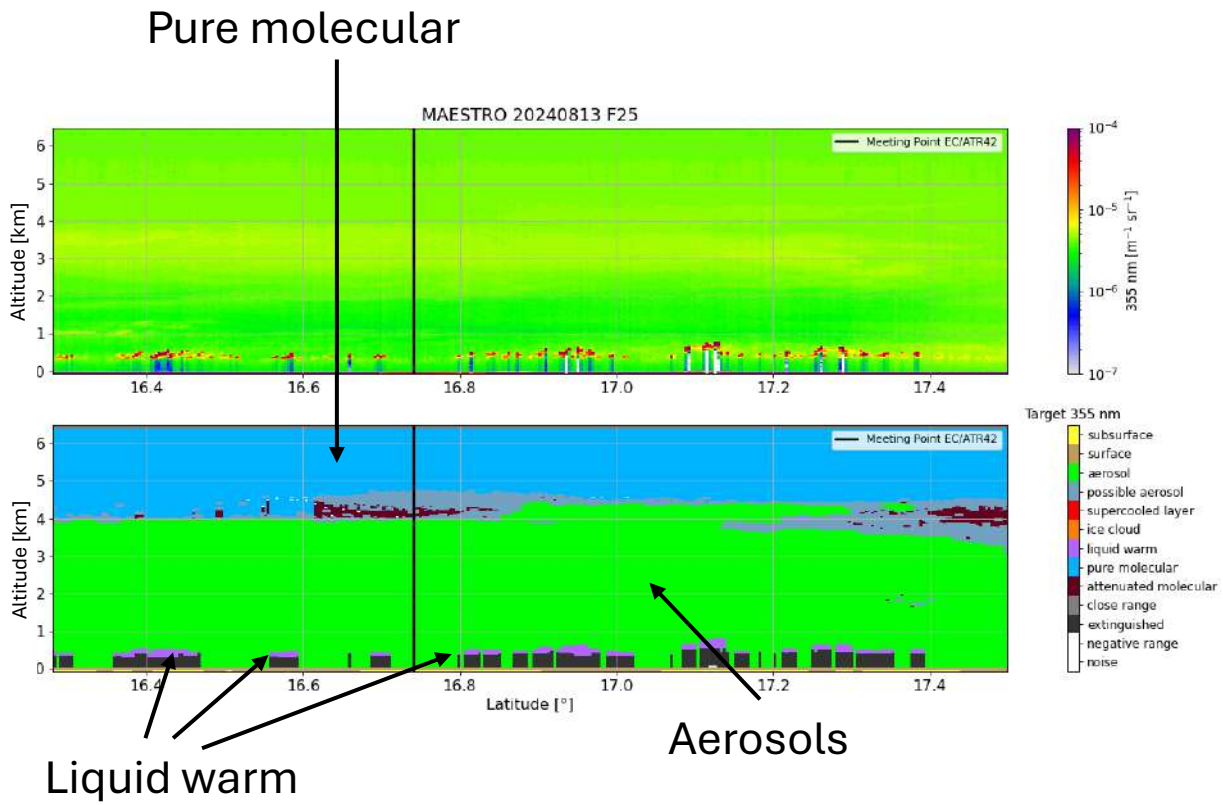
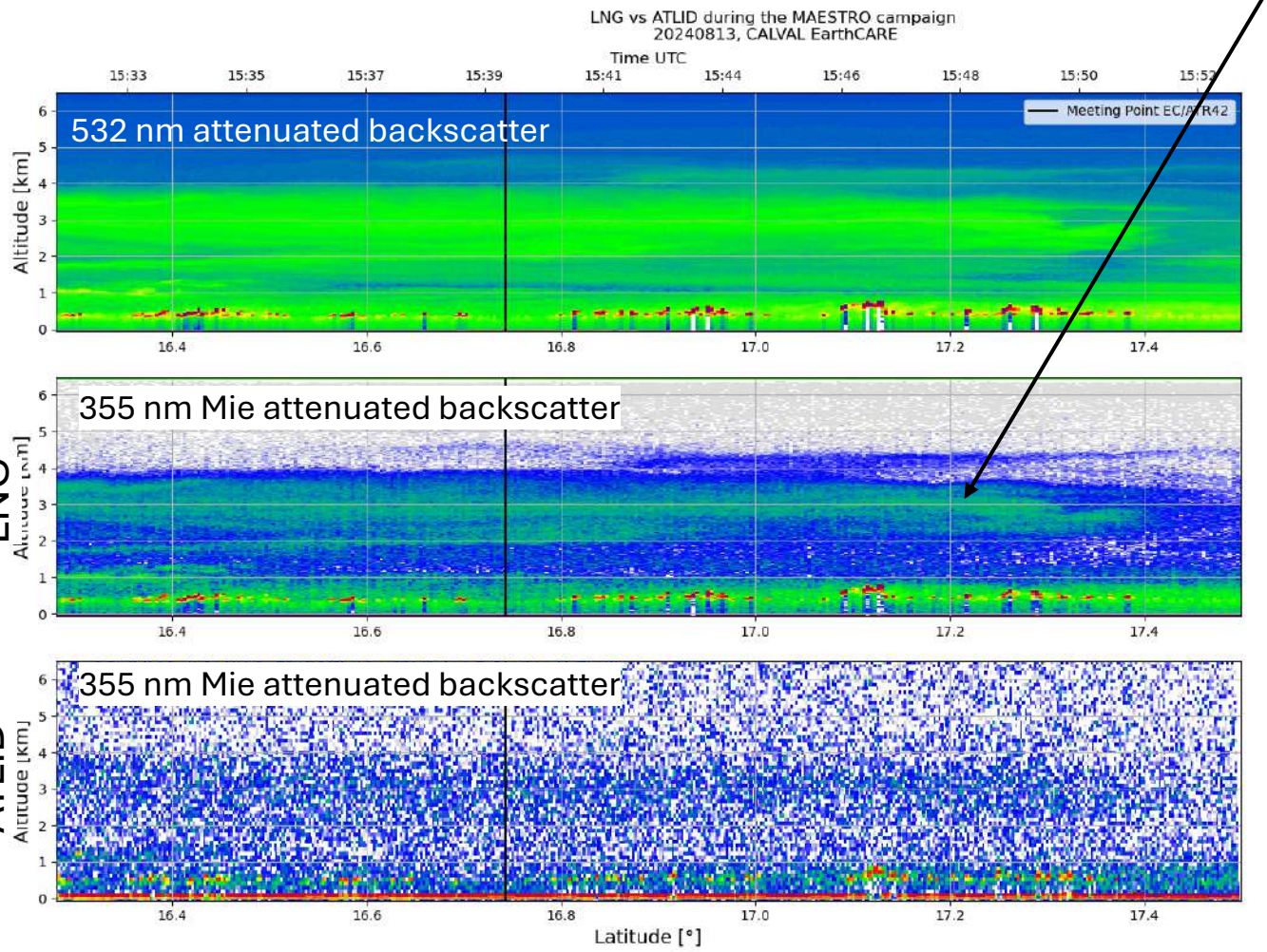


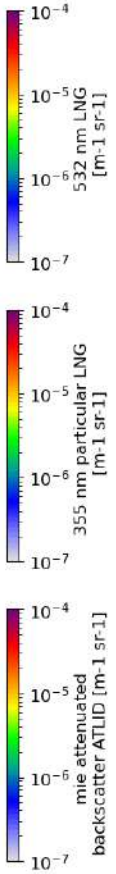
F25 2024/08/13

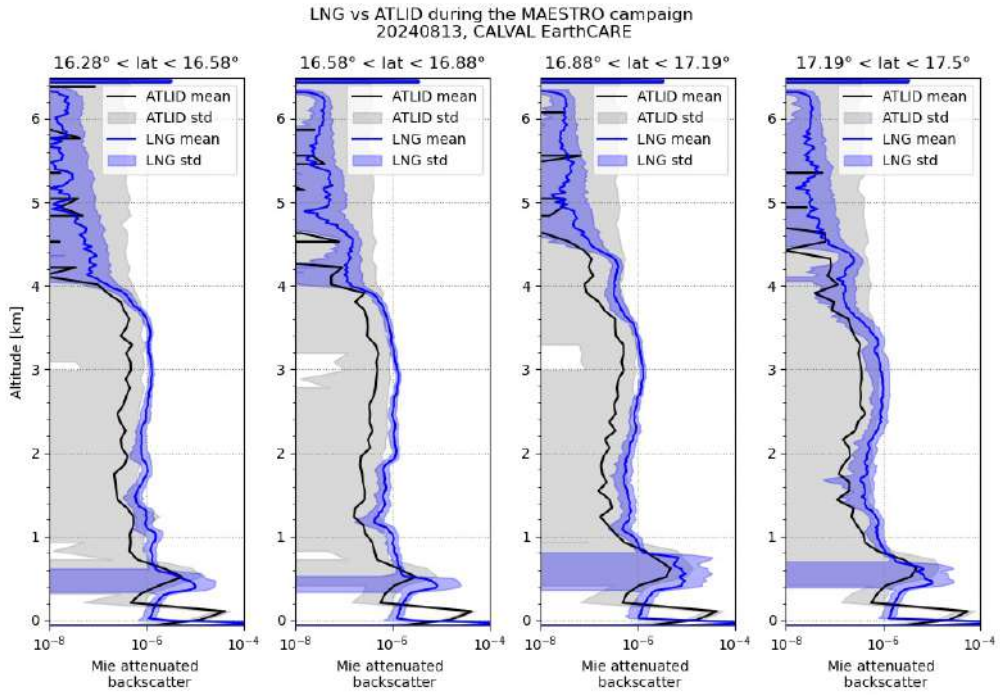
SAL (Saharan Air Layer)

LNG Resolution
- Hor. 400 m
- Vert. 30 m

ATLID Resolution
- Hor. 140 m
- Vert. 103 m







F25 2024/08/13c

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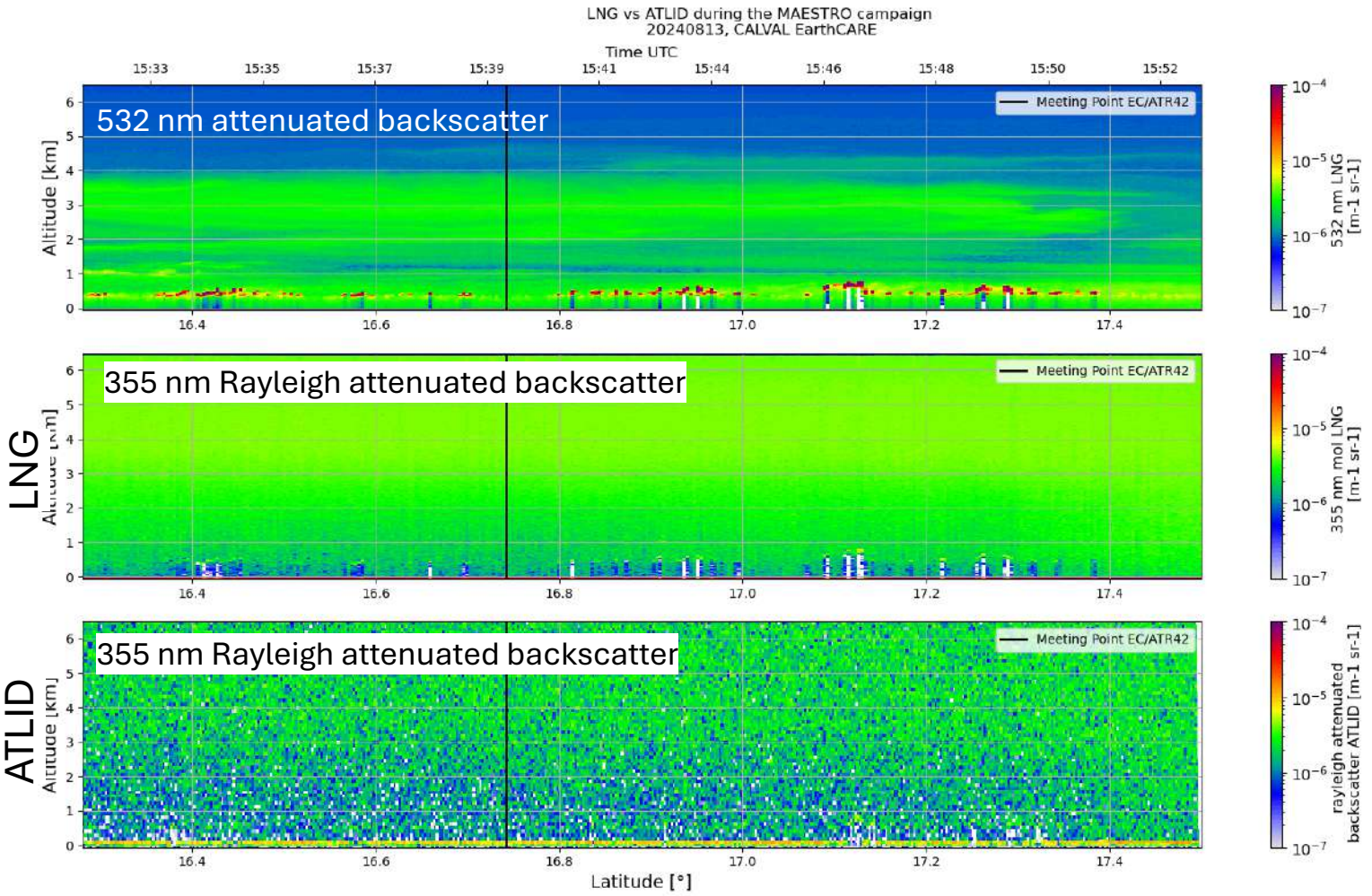
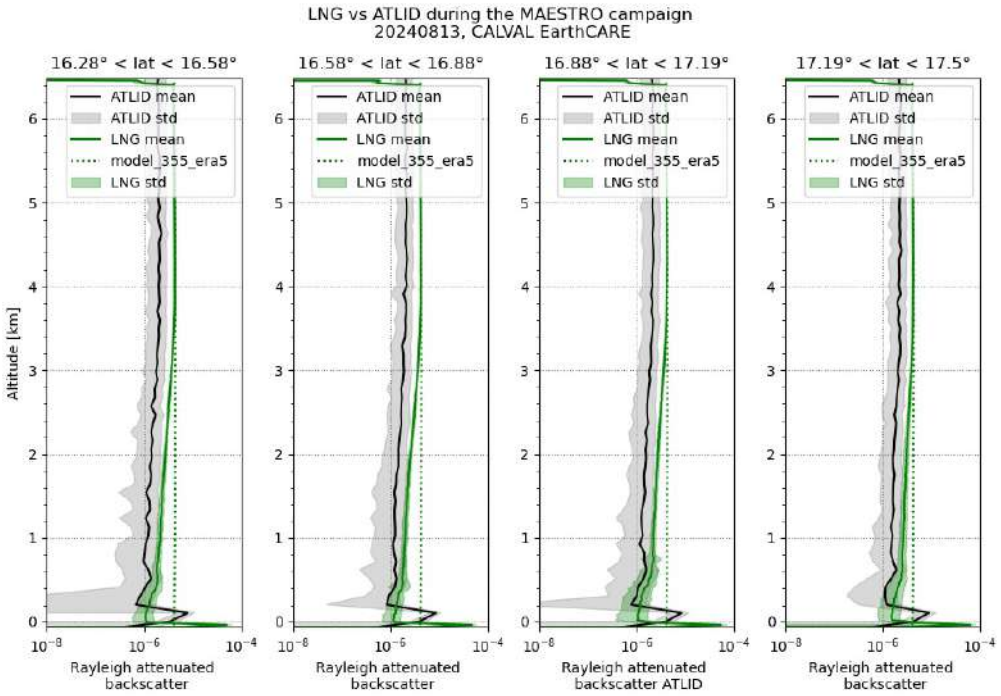
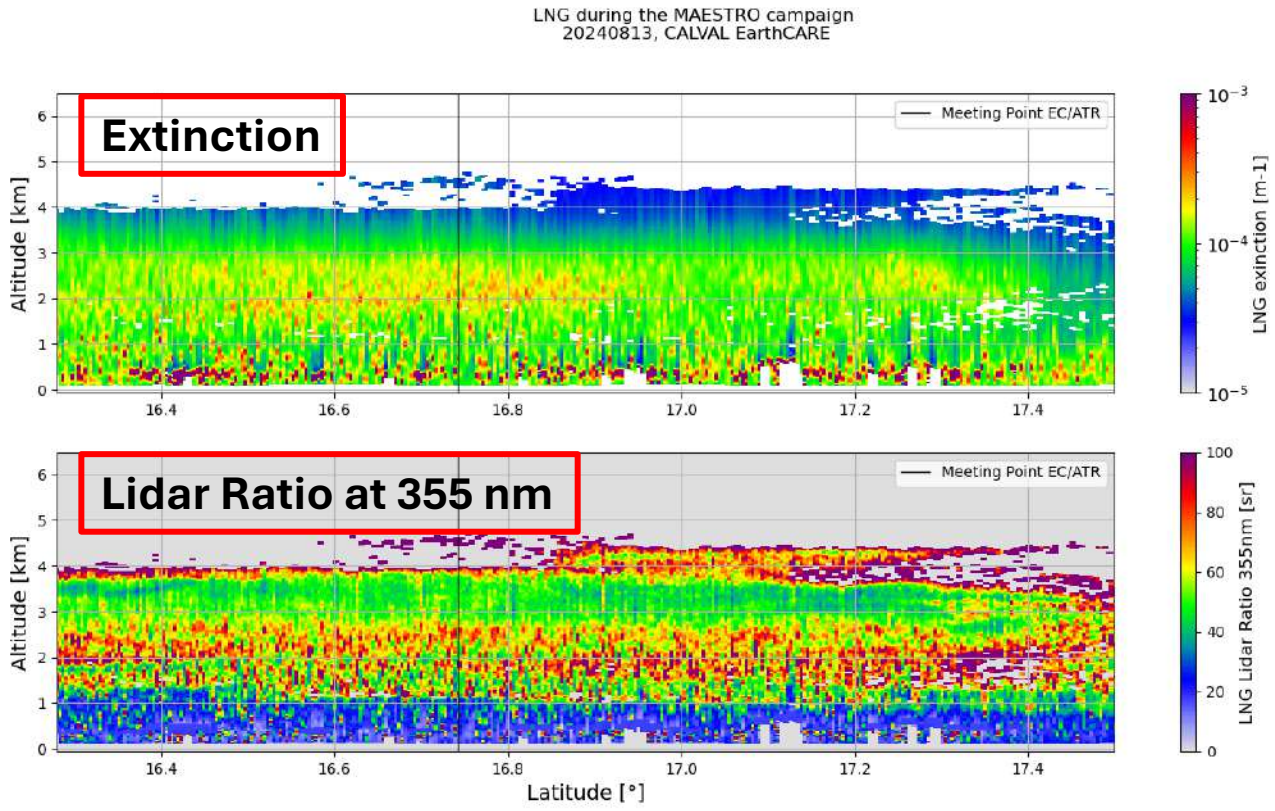




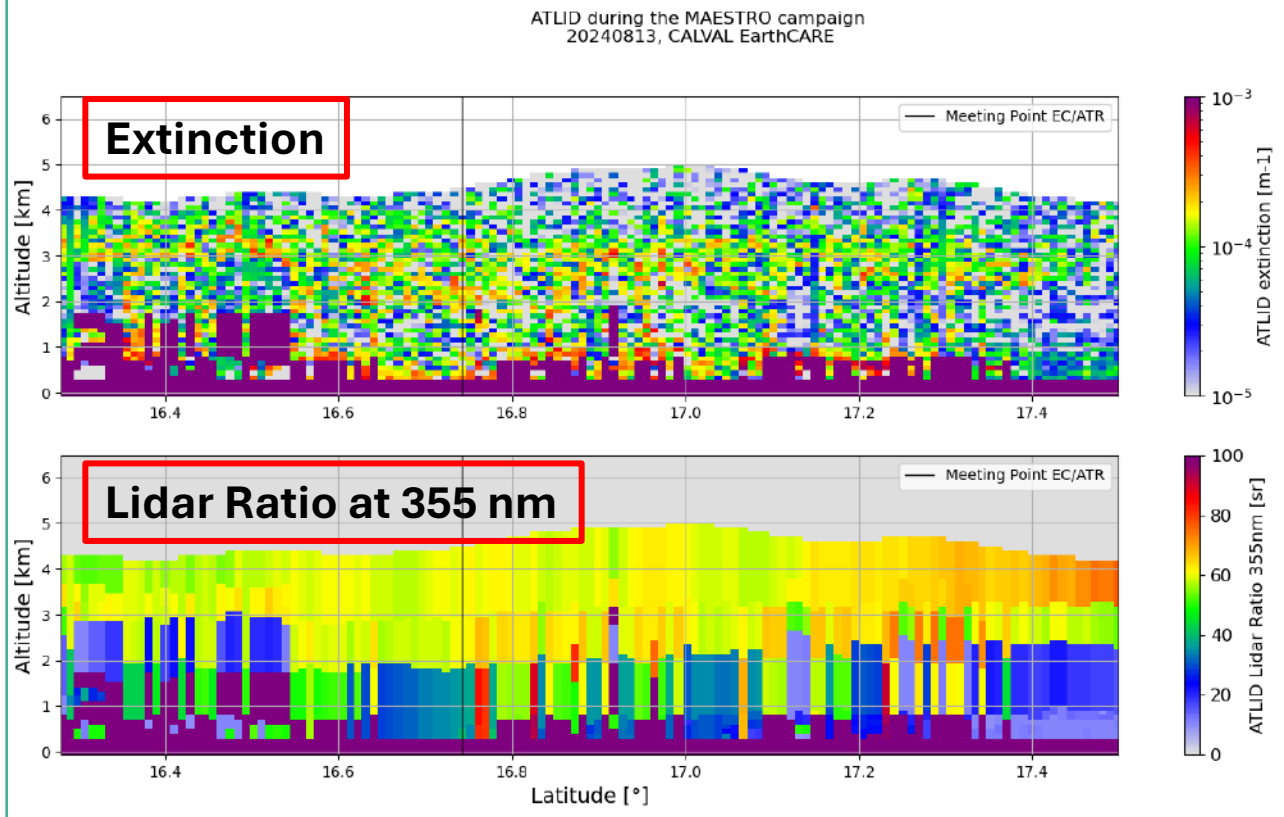
ATLID estimated offset from ERA5 by the cirrus ≈ 49.2 %

Extinction preliminary comparison

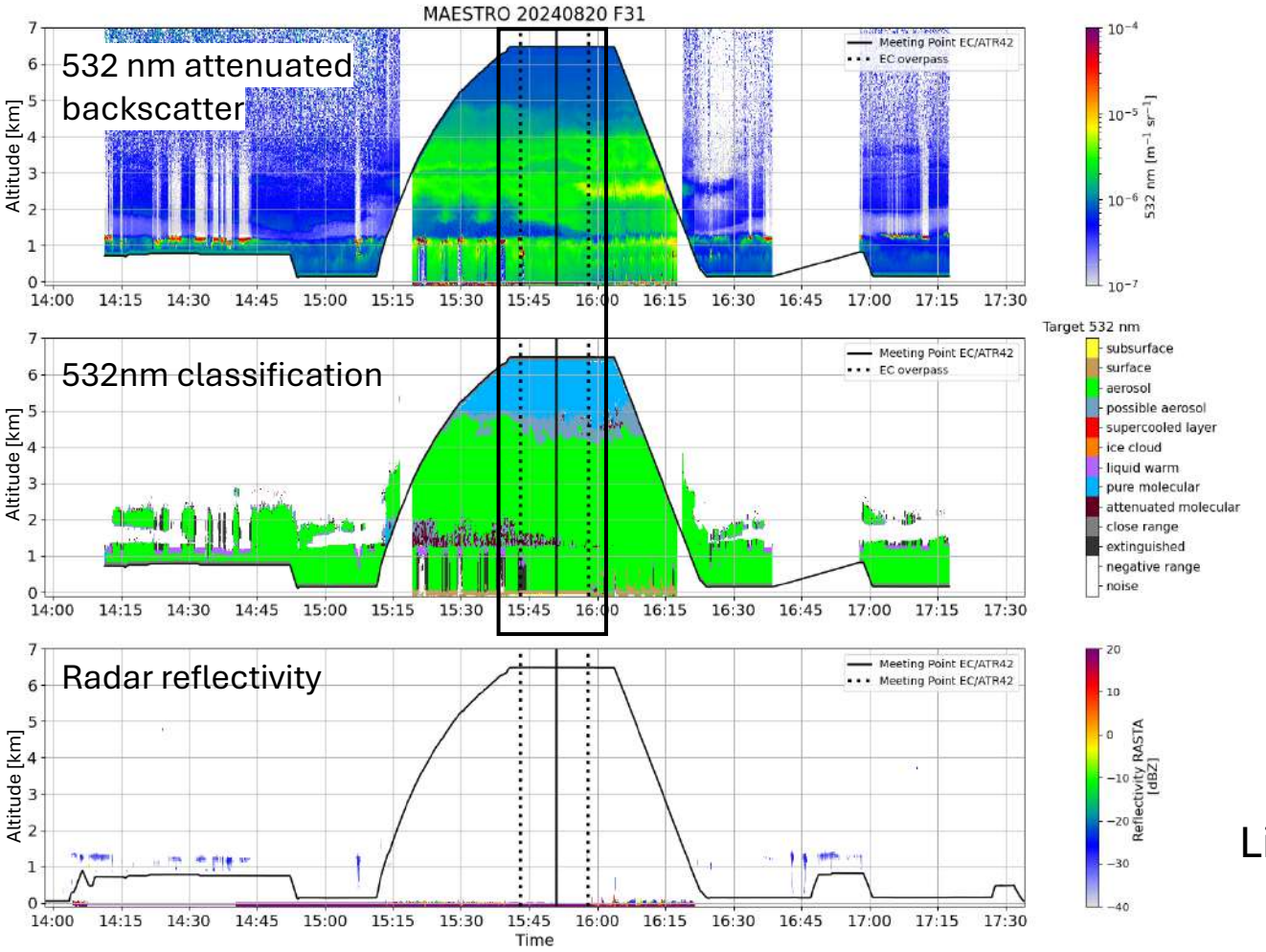
LNG



L2 **ATLID** baseline → **ECA_EXAC_ATL_EBD_2A**



F31 2024/08/20



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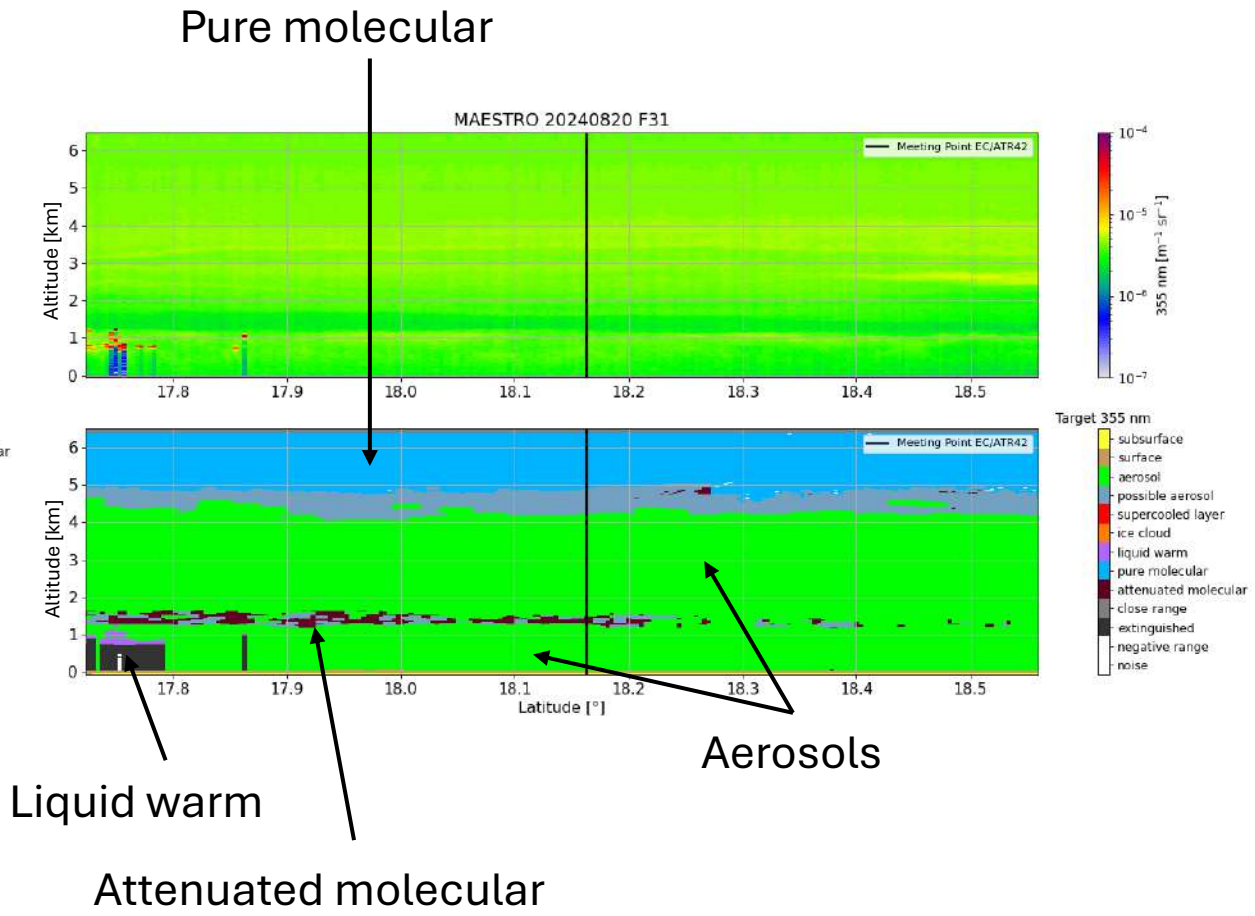

F31 2024/08/20

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ATLID Resolution
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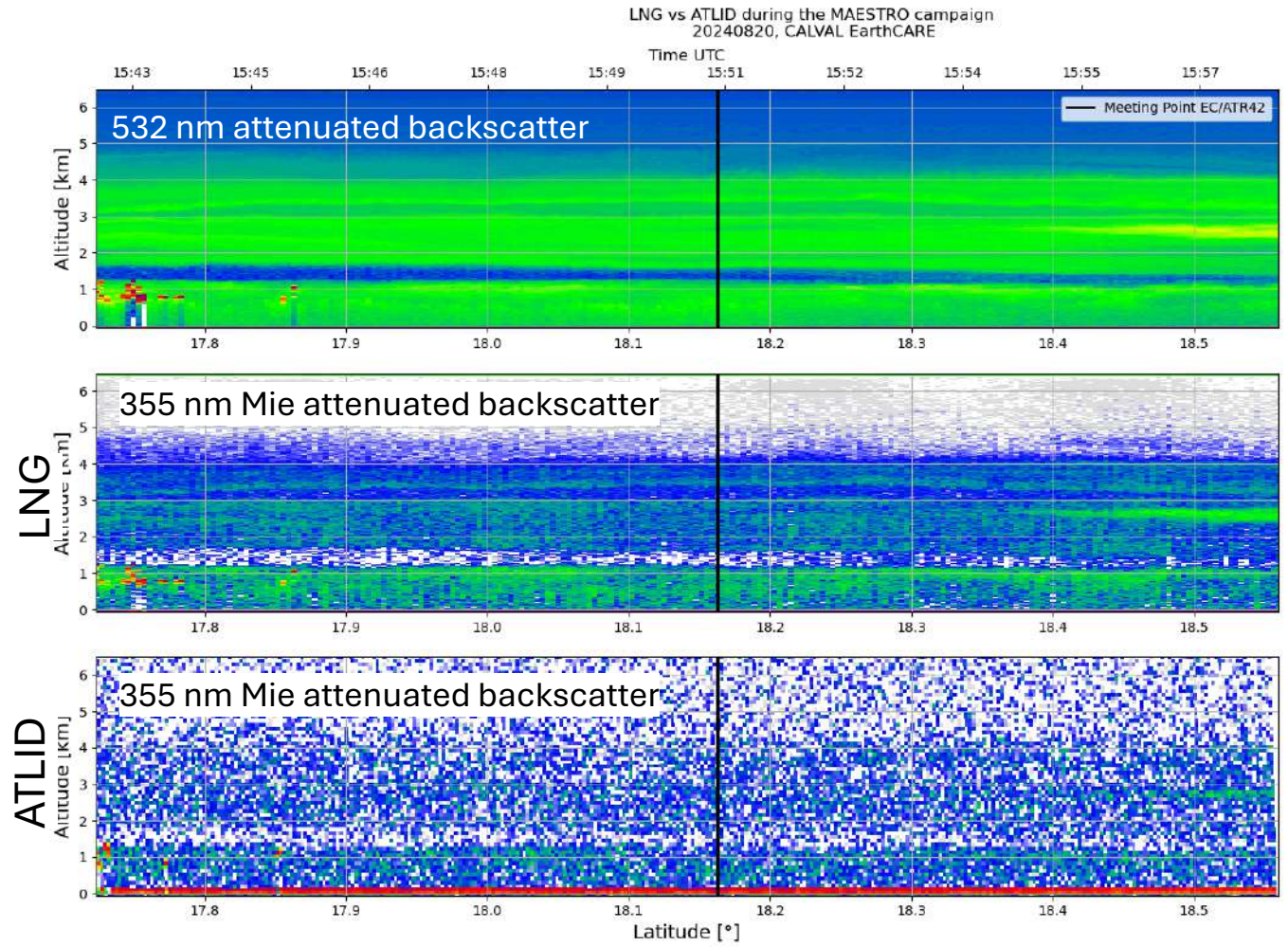

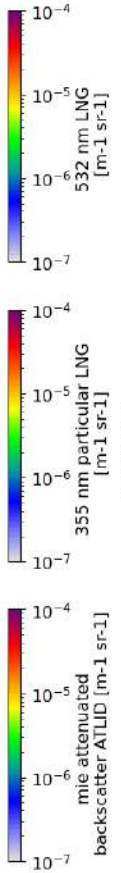

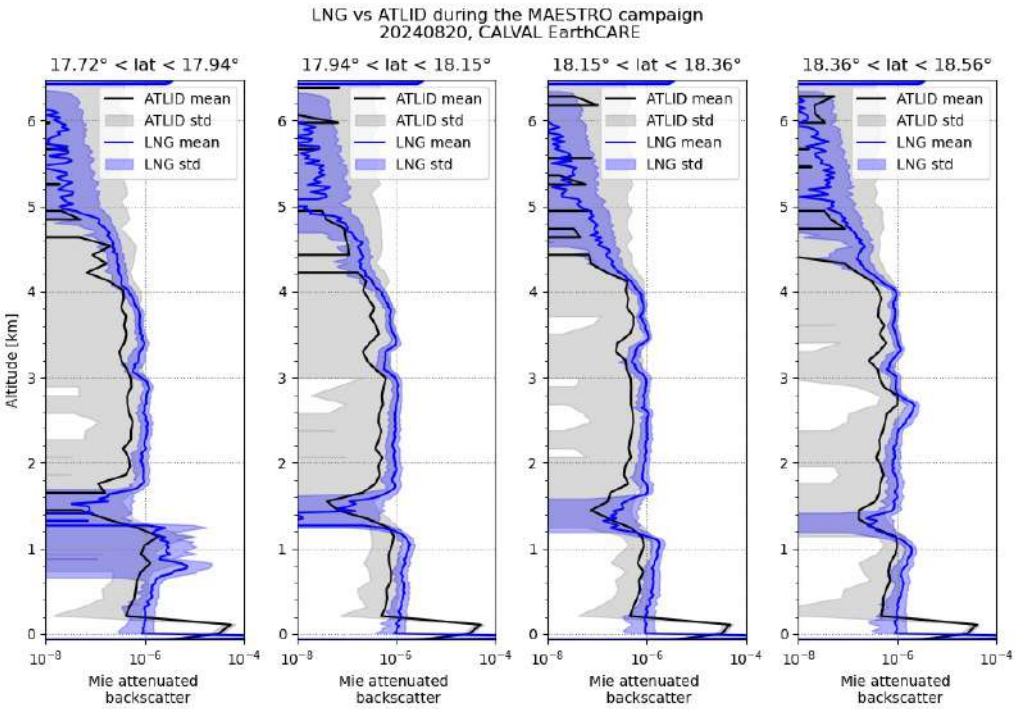

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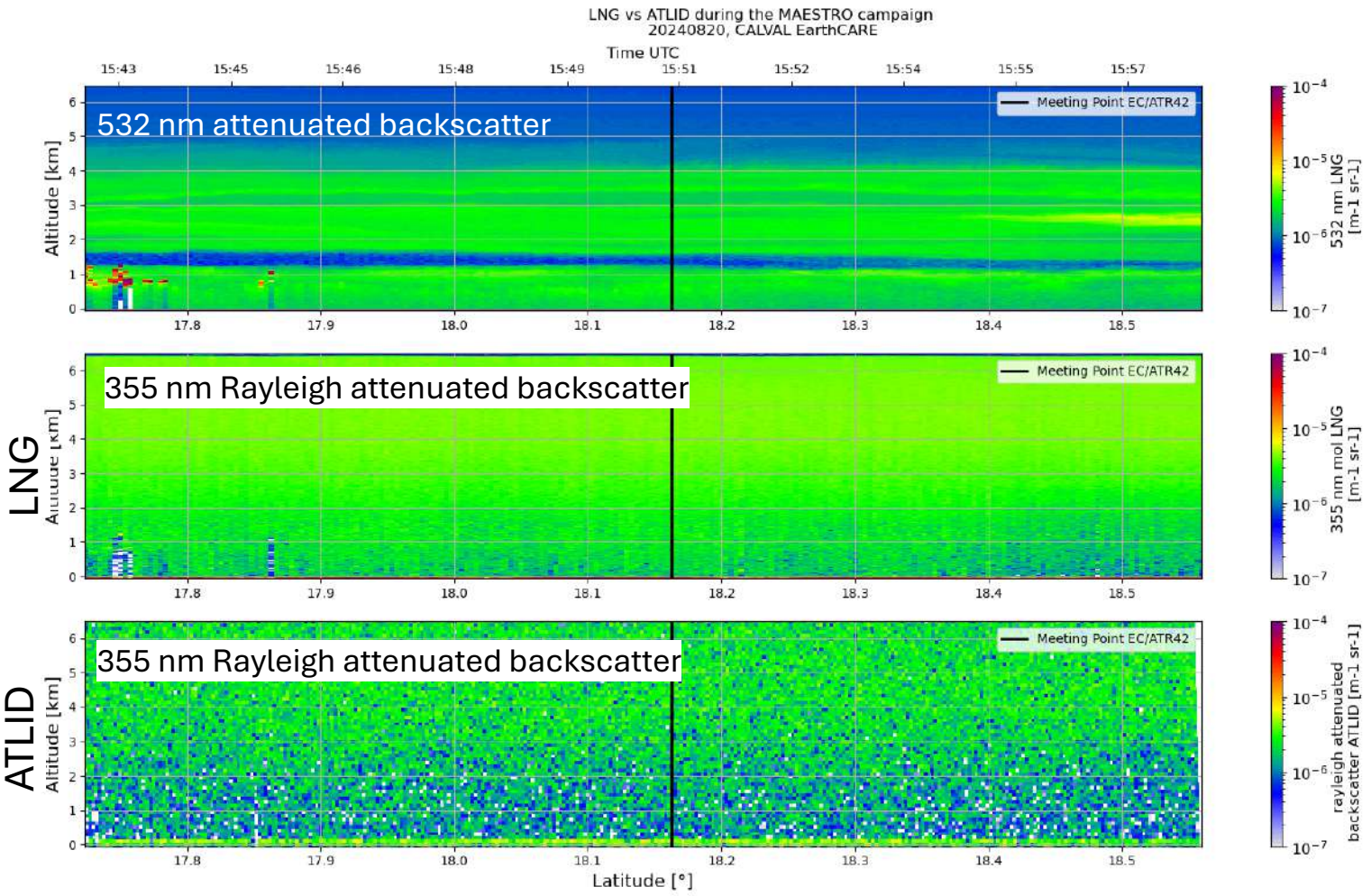
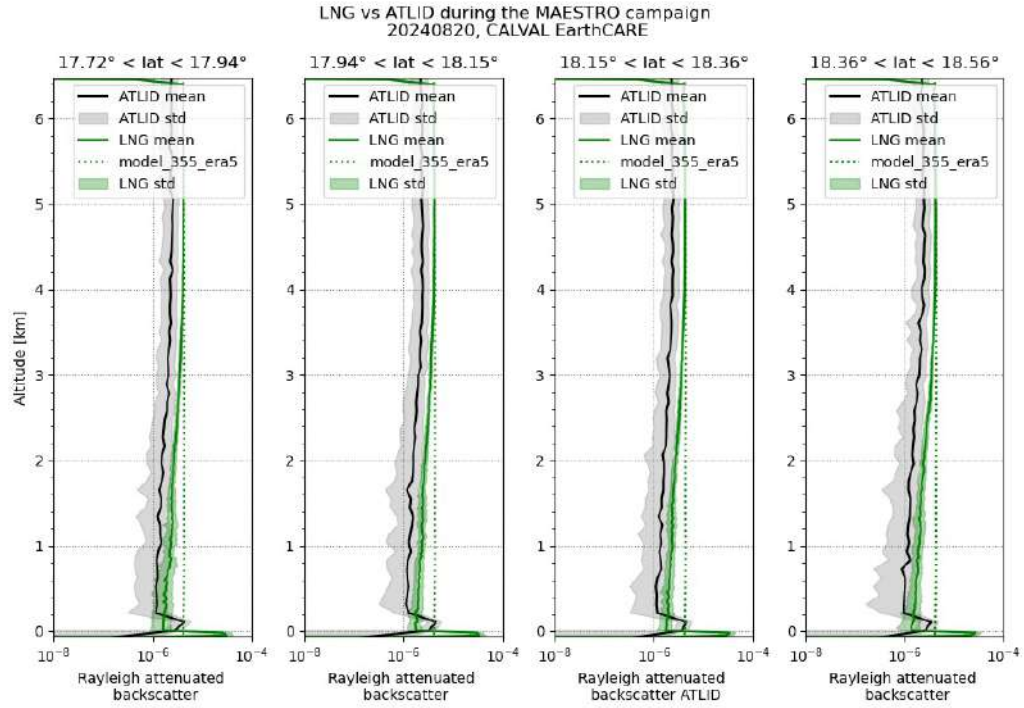
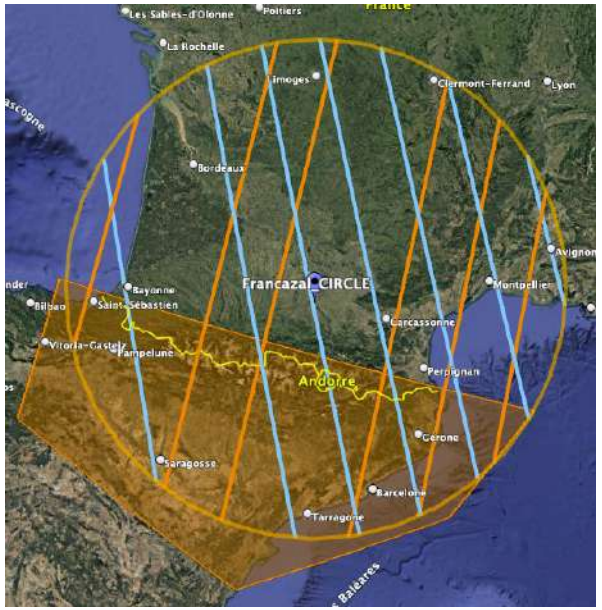




ATLID offset estimated from ERA5 ≈ 42.7 %

Conclusion

- 5 flights for the CalVal
- Globally good agreement between ATLID and LNG measurements during the common legs
- ATLID signals are sometimes attenuated by clouds above the aircraft when compared with LNG



Orbit forecast for MORECALVAL

What's next ?

- ATLID L2 products in investigation (extinction, lidar ratio…)
- Doppler and depolarization retrieval from LNG for comparisons with ATLID
- **MORECALVAL campaign** : Toulouse, 17 March 2025 – 4 April 2025

Thank you for your attention !