

First Intercomparison of EarthCARE's ATLID Level 1 and Level 2 Aerosol Products with Ground-Based Lidar Observations in Thessaloniki, Greece

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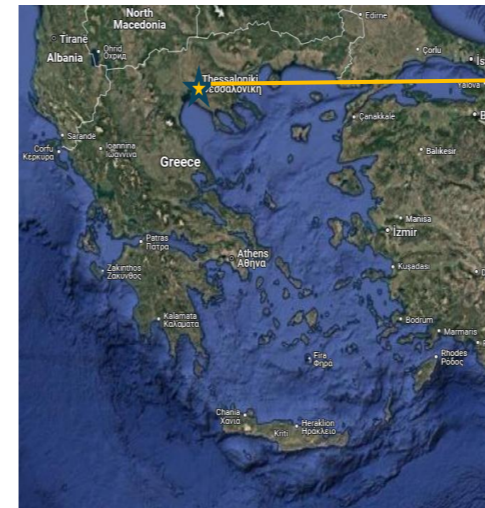
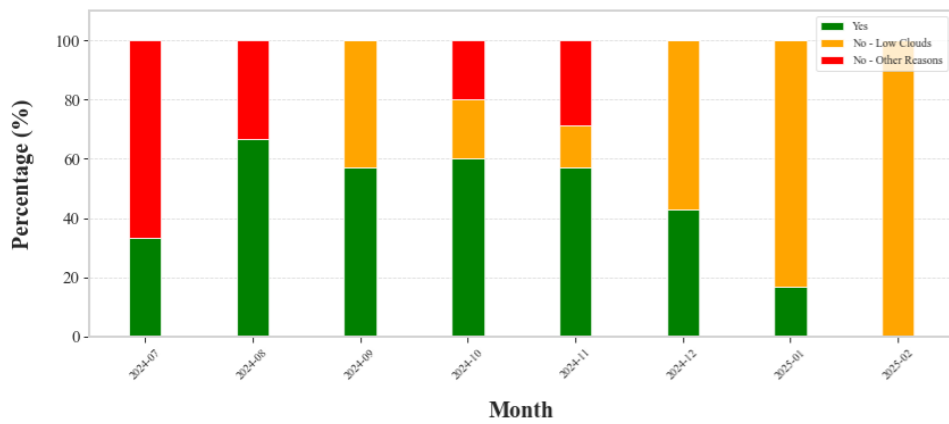


Aim: This study presents preliminary results from the comparison analysis of aerosol Level 1 (L1) and Level 2 (L2) retrievals obtained from the EarthCARE satellite's Atmospheric Lidar (ATLID) with ground-based measurements from Thessaloniki's Lidar System (THELISYS), part of the European Aerosol Research Lidar Network (EARLINET). ATLID is a high spectral resolution atmospheric backscatter Light Detection and Ranging instrument, which detects cloud boundaries and profiles optically thin clouds and aerosols. The instrument transmitter emits short laser pulses at 355 nm. The L1 comparisons proceed with ATLID CCT simulator using averaged EC profiles at **100km radius** and the L2 comparisons using single EC profiles at **distance < 45 km**.

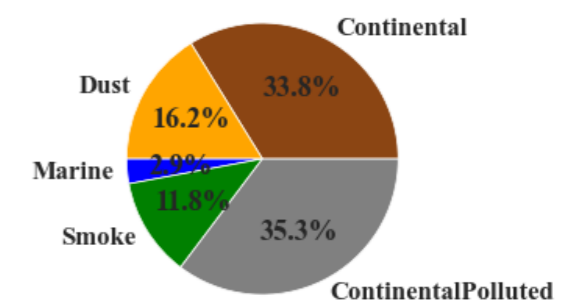
THELISYS Dataset

- Approximately 8 daytime and nighttime overpasses per month have occurred over Thessaloniki
- Ground-based observations using THELISYS were performed during about half of these overpasses, depending on weather conditions.

Measurement Status of THELISYS Overpasses per Month



Thessaloniki Urban site
Typical obs.: aerosols: Continental + Polluted continental in PBL; other types elevated/transported



Measurements:
bp, ap 355nm
bp, ap, dp 532nm
bp 1064nm

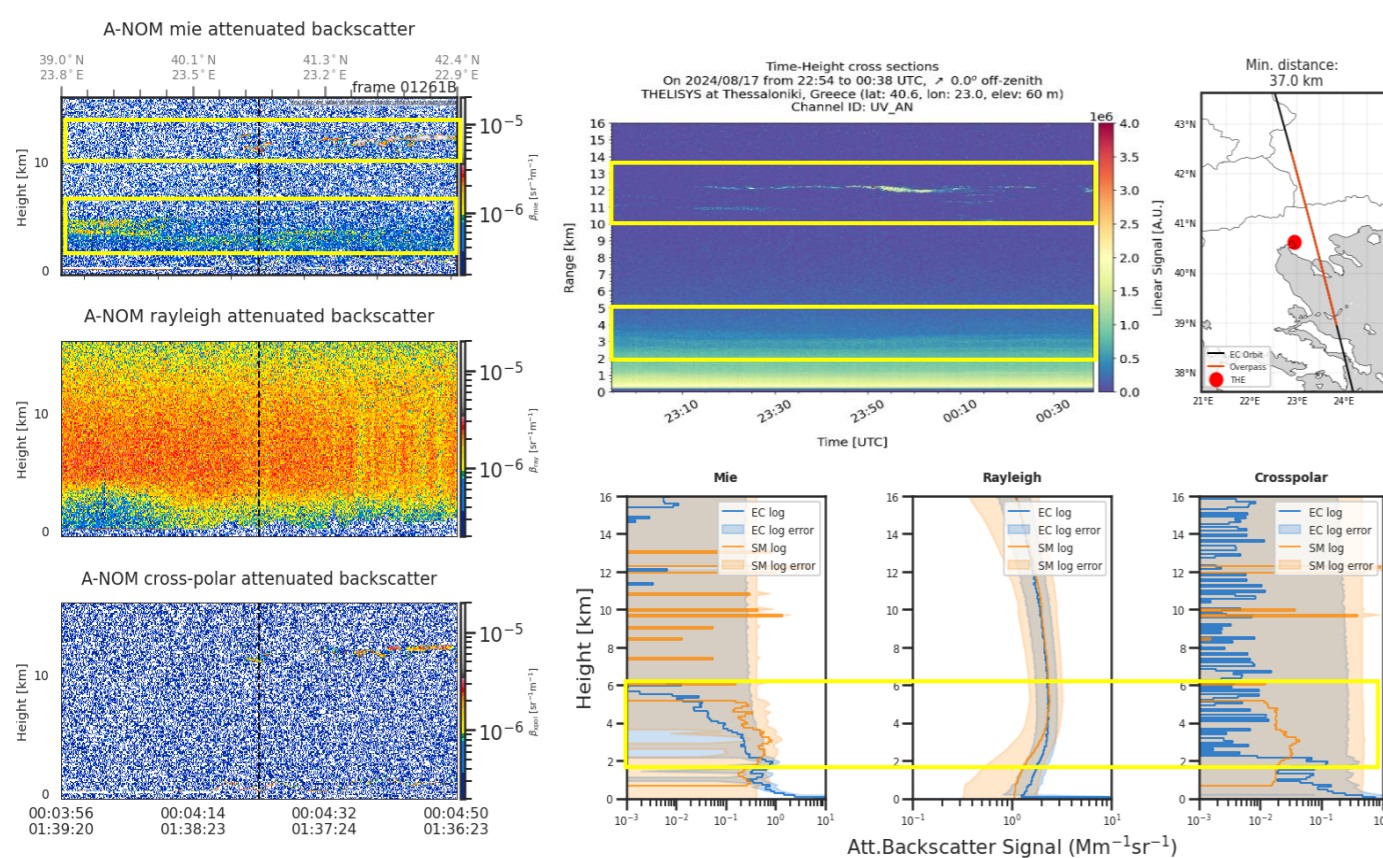
Depolarization measurements @ 532nm -> converted to 355nm
 $Dp_{355} = Dp_{532} * 0.89$
reference:
DEDICATE EarthCARE-related conversion factors

L1 comparisons

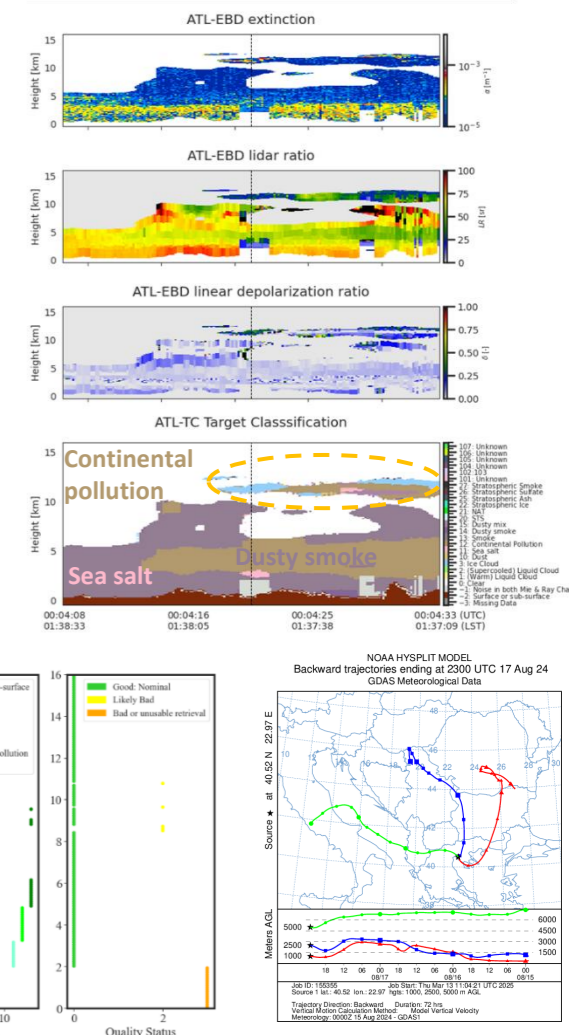
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L2 comparisons

A-NOM Mie and Rayleigh profiles: Great agreement!
A-NOM Crosspolar: noisy



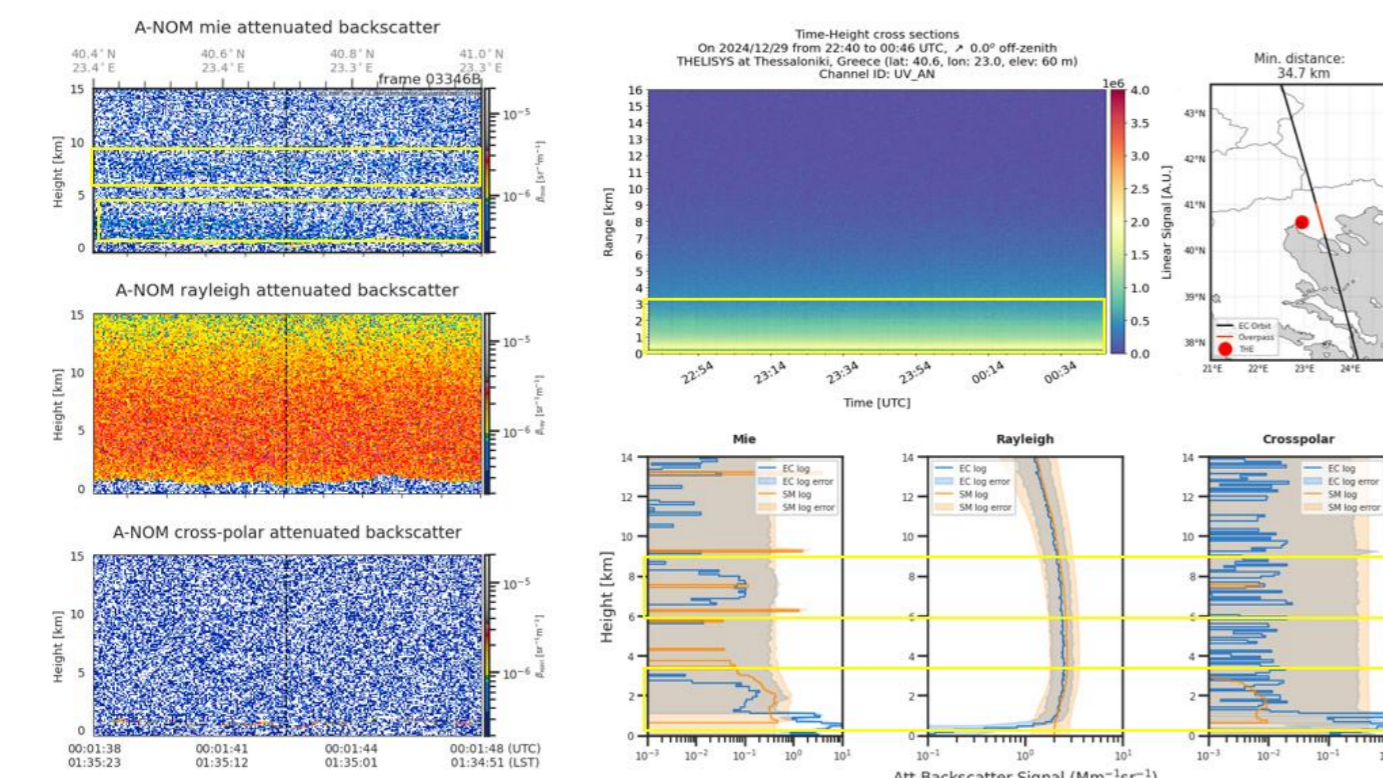
- The backscatter and extinction coefficients align at 2-6 km.
- Discrepancies are observed in the lidar ratio and particle depolarization ratio within the layers.
- The EC lower values below 2 km could be attributed to broken clouds.
- The ATL-TC product classifies the elevated layers as *continental polluted*, which aligns with the general conditions at Thessaloniki station, and *smoke*. The lower level is characterized as an *ice cloud*.



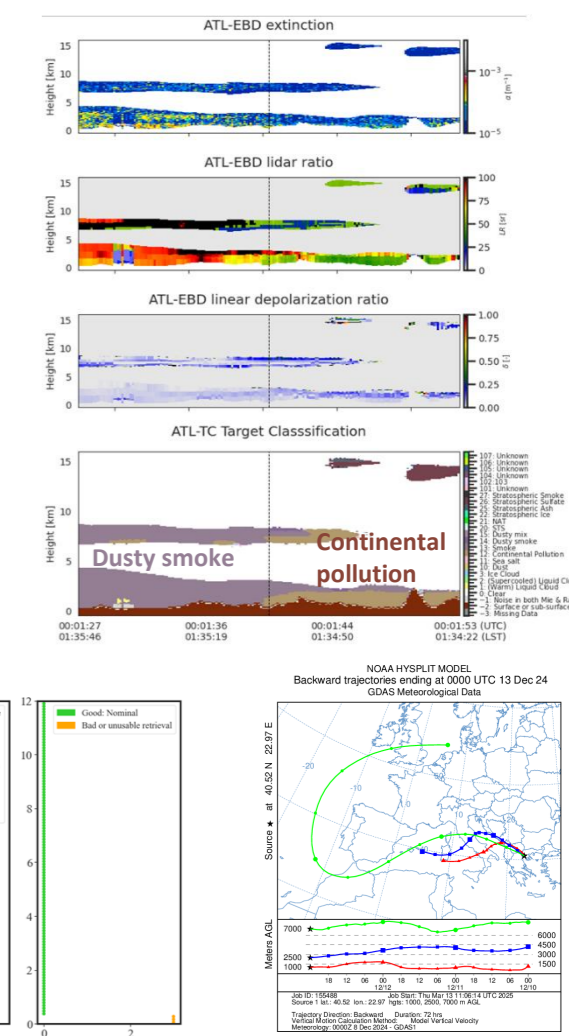
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Aerosol layer up to 3km observed from both lidars.
EC aerosol layer at 7-9km not observed in THELISYS.

A-NOM Mie underestimation down to 1km
A-NOM Crosspolar noisy signals
A-NOM Mie and Crosspolar: higher values below 1km



- Better agreement is observed for the backscatter coefficient
- Discrepancies in the extinction coefficient are found below 3 km.
- The lidar ratio and the particle depolarization ratio are in a general agreement within the layers.
- The ATL-TC product classifies the layers as *smoke* and *continental polluted*, which aligns with the general conditions at Thessaloniki station.



Next steps:

- Continuing collecting collocated lidar measurements from Thessaloniki station.
- Identification of compatibility in cases of dust, smoke, pollen.
- Synergy with current and upcoming satellite missions.

Acknowledgements:

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