

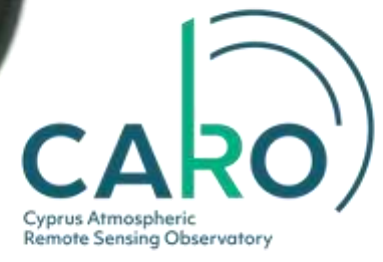


Validation of EarthCARE ATLID L2a aerosol products with PollyXT Lidar Measurements at Limassol ACTRIS National Facility



EUROPEAN SPACE AGENCY

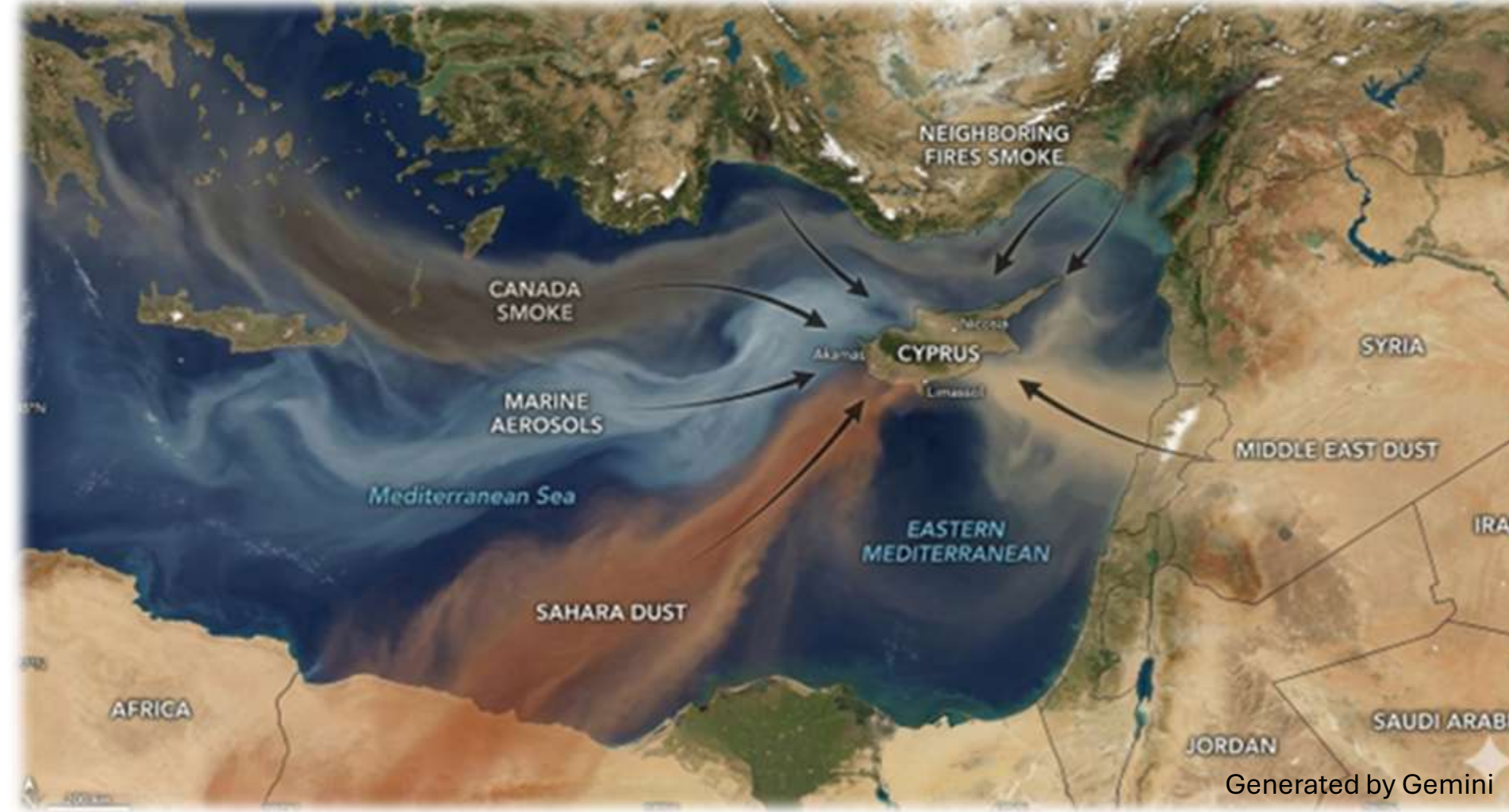
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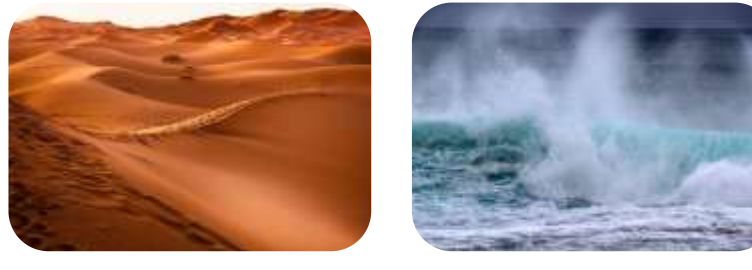


Introduction



To validate the **EarthCARE ATLID A-EBD (BA Baseline)** product utilizing ground-based data, overpasses were classified into **5 major aerosol categories**:

- Dust cases**
- Dust mixtures**
- Wildfire smoke cases**
- Low depolarization ratio cases**
- Cirrus cases**



Additionally, the **HETEAC-Flex algorithm** was applied to evaluate the performance of this aerosol classification.

- FSA:** Fine Spherical Absorbing
- CS:** Coarse Spherical
- FSNA:** Fine Spherical non-Absorbing
- CNS:** Coarse non-Spherical



Study scope: Cyprus actively participates in EarthCARE's calibration/validation (cal/val) activities through the EVID39 CORAL project.

Coordination: Led by the Cyprus Atmospheric Remote Sensing Observatory (CARO) team at the ERATOSTHENES CoE.

Why Cyprus? Its unique geographical location provides an ideal natural laboratory for studying the vertical distribution of various individual and mixed aerosol types.

CARO National Facility



marine particles, desert dust, wildfire smoke, anthropogenic particles

ACTRIS AEROSOL Remote Sensing Observational Platform

- PollyXT Raman LIDAR
- AERONET Sun/sky-photometer

SOLAR Station

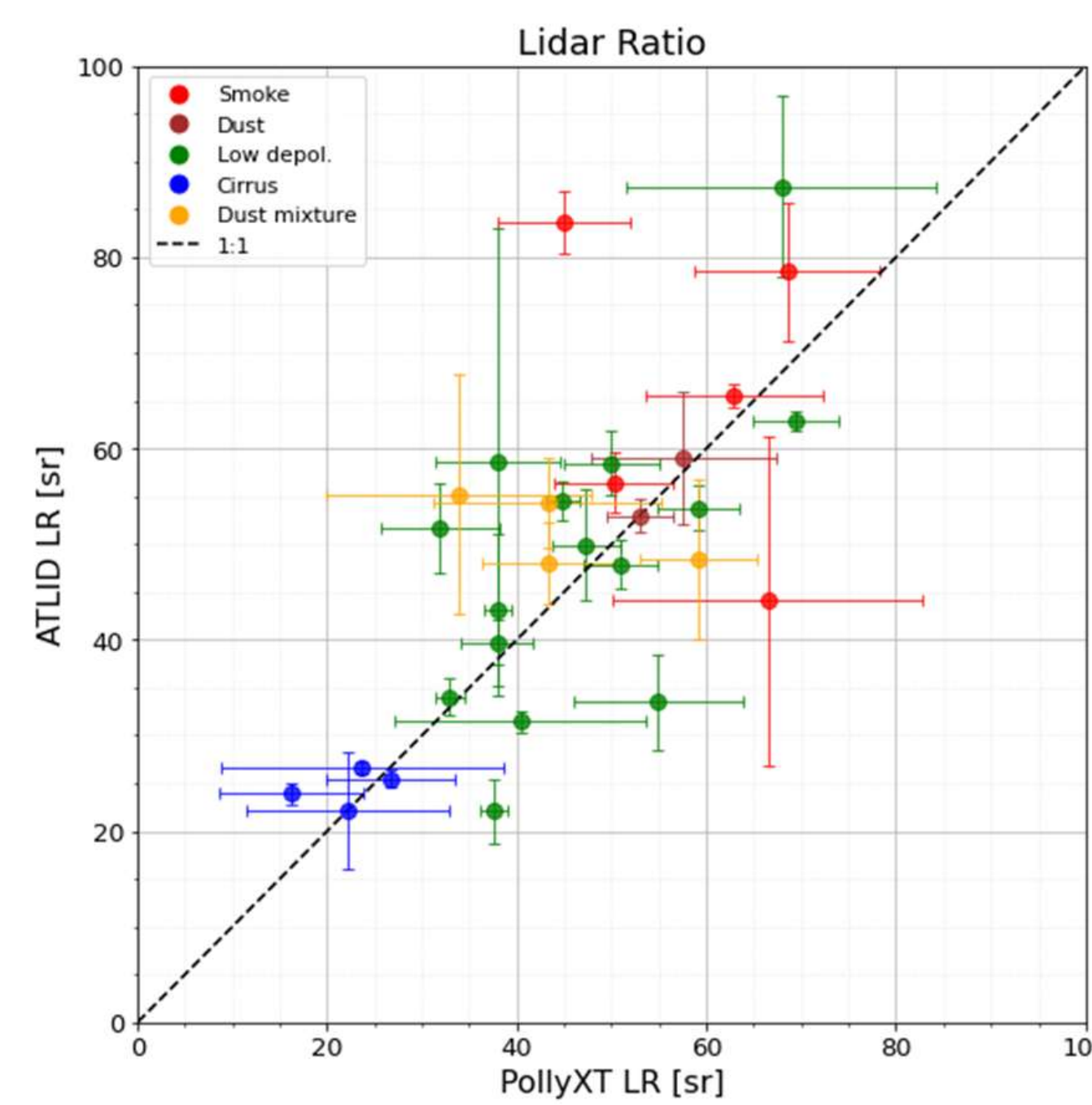
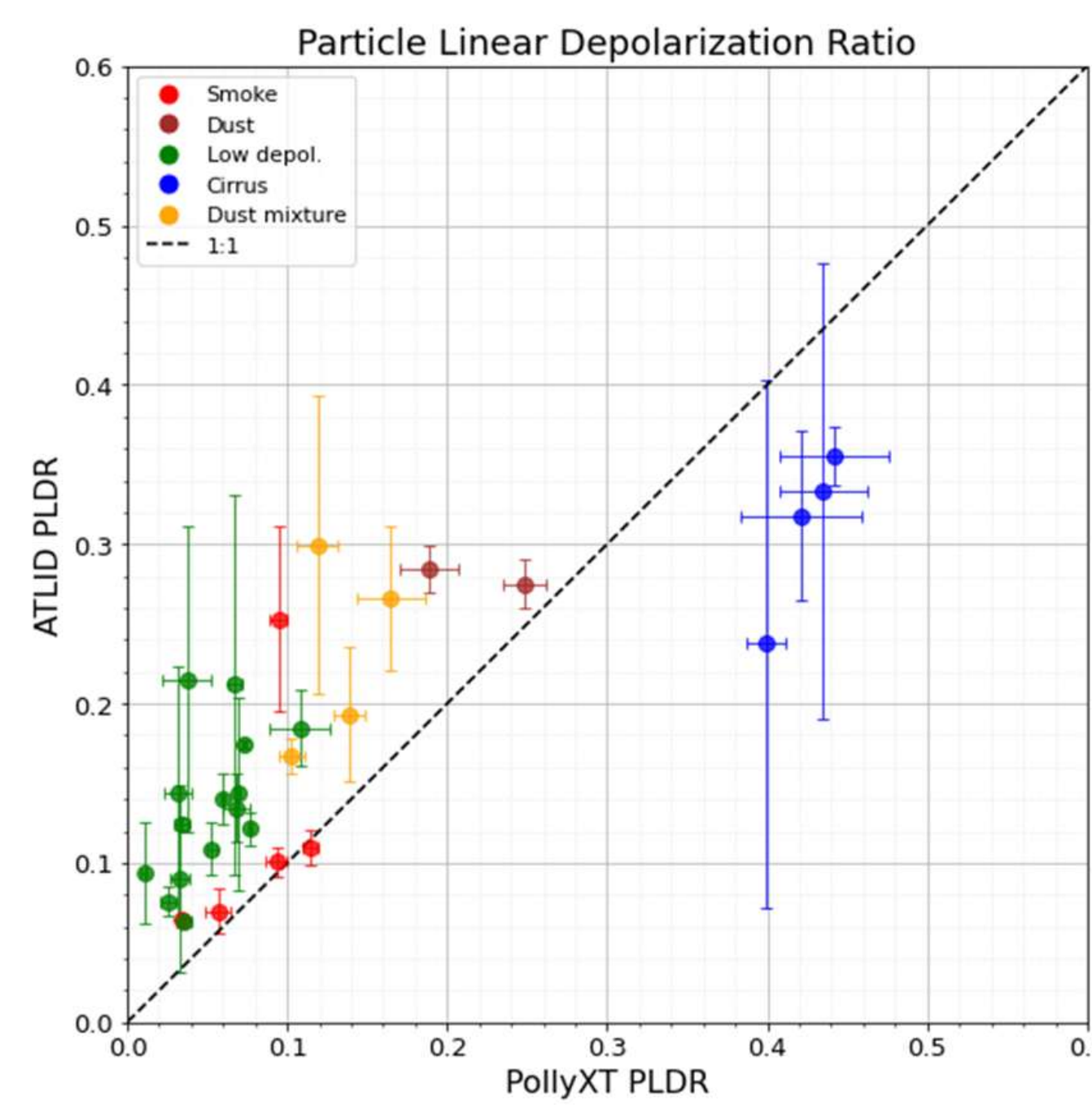
- Pyrgometer
- Pyranometer
- Sky camera
- Spectrophotometer

ACTRIS CLOUD Remote Sensing Observational Platform

- 35 GHz MiRA cloud radar
- Microwave radiometer
- Wind Doppler lidar
- Disdrometer
- Ceilometer

Statistical Analysis | Optical properties

Layer mean optical properties	
Analyzed period	Oct. 2024 - Oct. 2025
ATLID analysis	
Satellite overpass distance	<=100 km
Product, Baseline, Averaging	A-EBD, BA, ± 25 pixels around the closest point, low resolution
Total nighttime overpasses used (Polly profiles without clouds)	26
PollyXT analysis (355 nm)	
Profiles averaged around the overpass time (± 2 hrs)	Layering based on PLDR & BCK Coeff. (same layering for ATLID profiles)



RESULTS

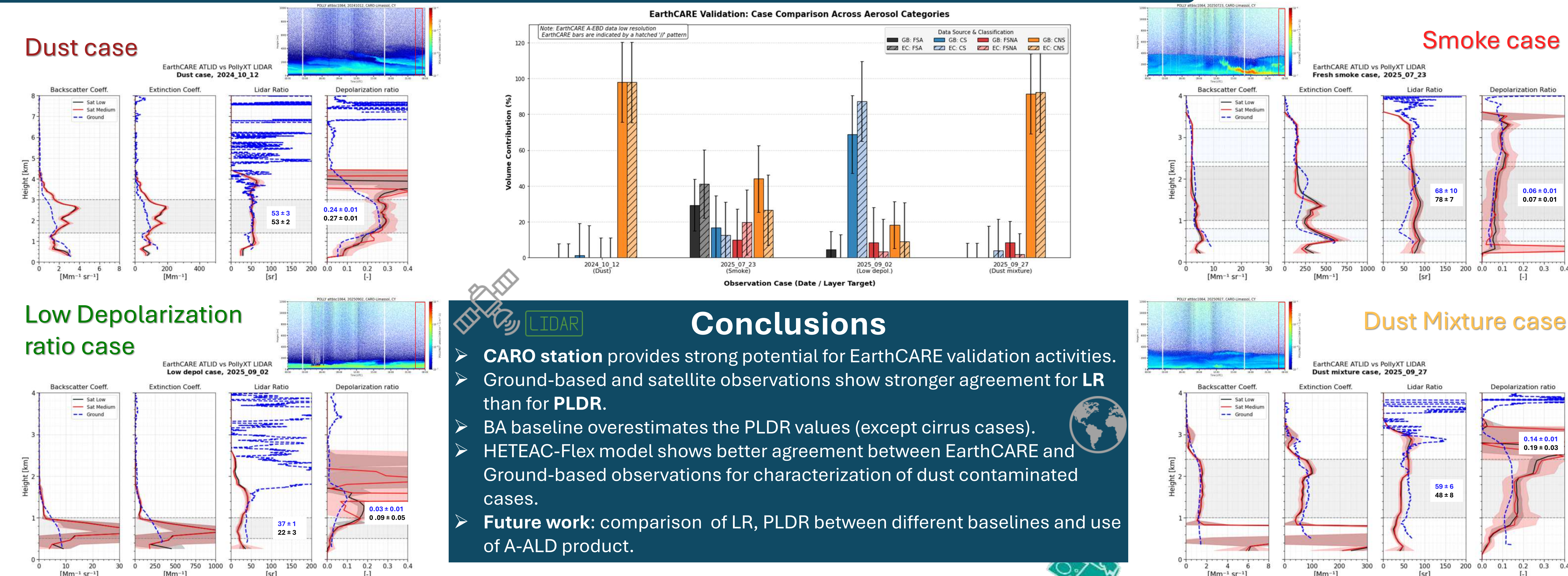
Statistical analysis

- PLDR:**
 - ATLID A-EBD overestimation for Low depol. cases, dust mixtures & dust
 - ATLID underestimation for cirrus cases
 - Good agreement for smoke cases
- LR:**
 - Overall good agreement for all aerosol categories

Aerosol characterization HETEAC-Flex:

- Dust & dust mixture cases good-agreement in characterization with EarthCARE and ground-based.
- Smoke case: Higher ATLID LR values → more FSA component compared to the GB.
- In Low depol. case: GB LR > ATLID LR → less CS & more CNS for GB characterization.

Aerosol characterization | HETEAC - FLEX



Conclusions

- CARO station provides strong potential for EarthCARE validation activities.
- Ground-based and satellite observations show stronger agreement for LR than for PLDR.
- BA baseline overestimates the PLDR values (except cirrus cases).
- HETEAC-Flex model shows better agreement between EarthCARE and Ground-based observations for characterization of dust contaminated cases.
- Future work:** comparison of LR, PLDR between different baselines and use of A-ALD product.

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