# A preliminary end-to-end ATLID validation chain using ACTRIS-EARLINET data

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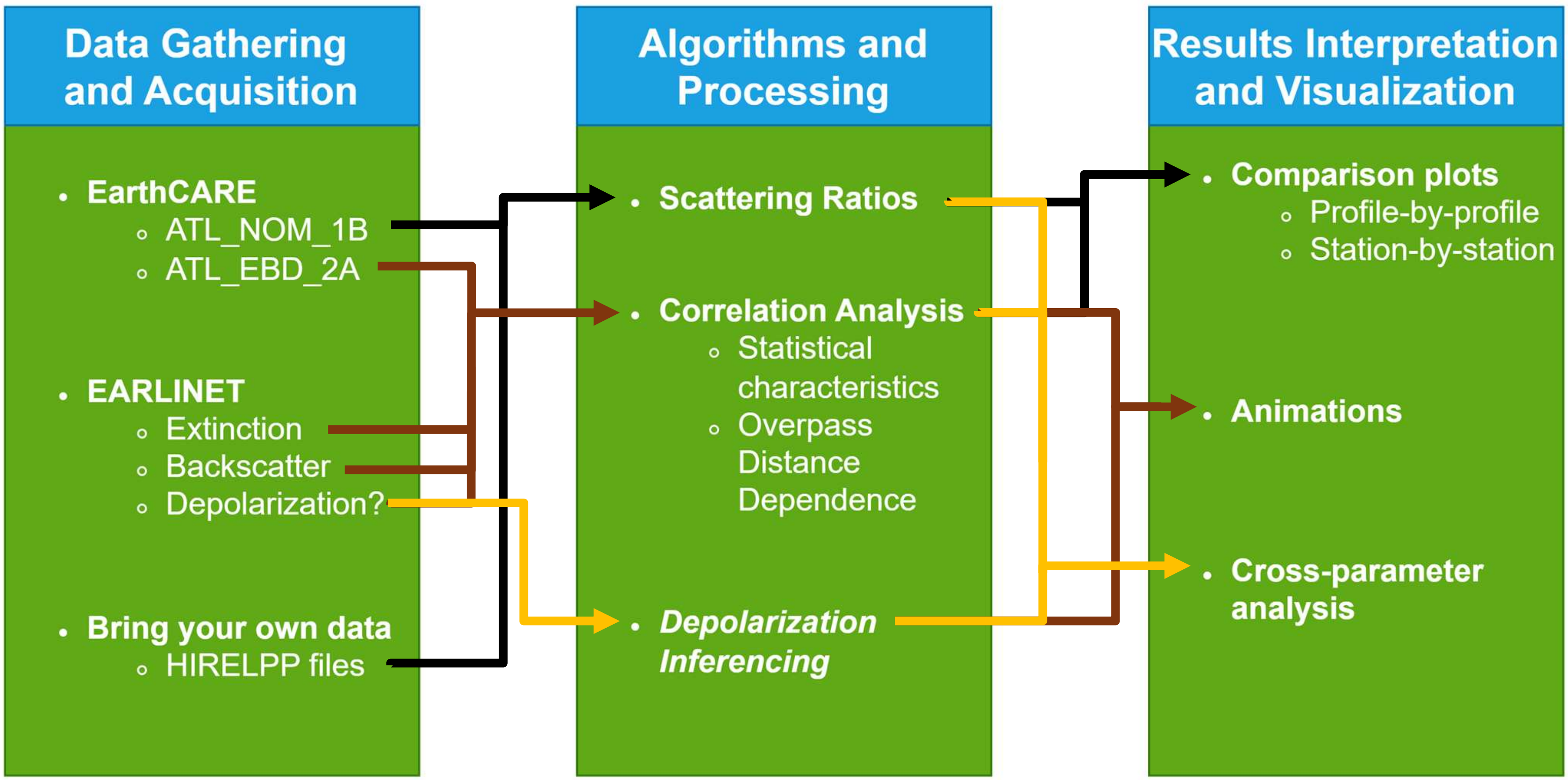
# Context

- Objective: Develop a ***complete*** validation chain for ATLID products
- Motivation: Lots of algorithms, lots of products, lots of data => hard to ensure cross-comparability between results and have a "complete picture"; ***Leverage EARLINET***
- Solution: Use an open collaborative platform (**DIVA**) to **centralize and publish algorithms** for the various data products

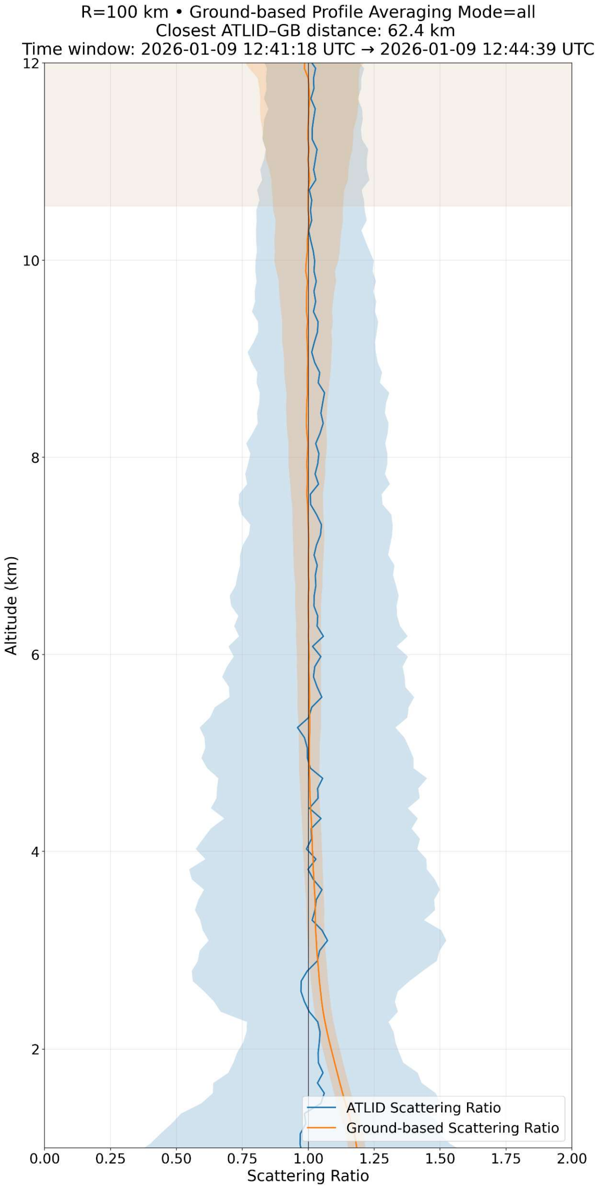
# Methodology



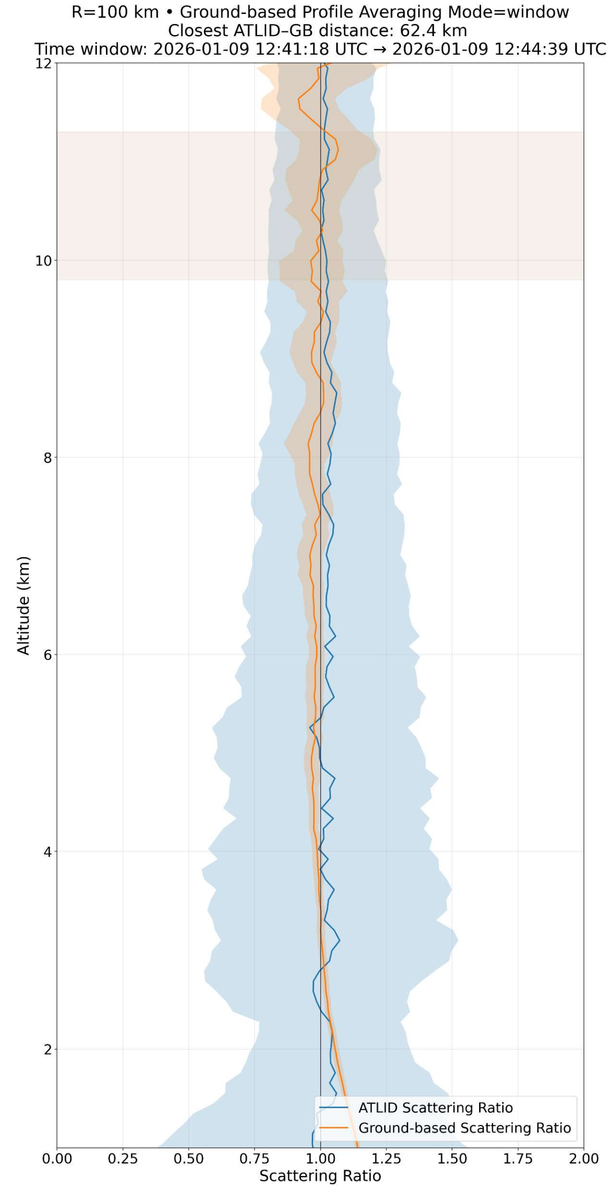
# Showcase

- Will use INO station EARLINET data from 2026
- In total, 6 overpasses found – only 5 have optical products in EARLINET
- No depolarization measurements present – will infer them with the ML module (experimental)

# ATLID_NOM_1B and RALI HIRELPP data

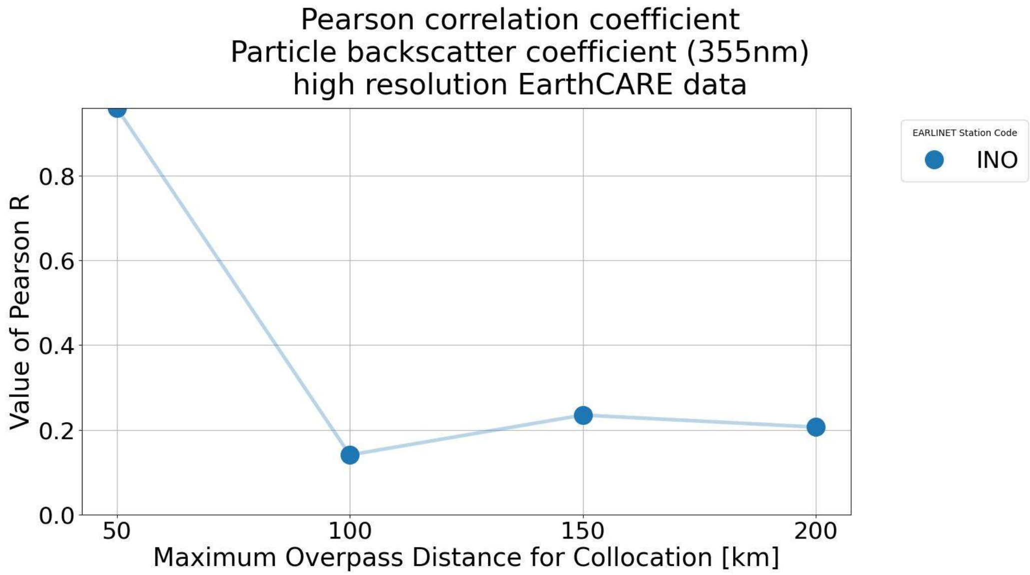


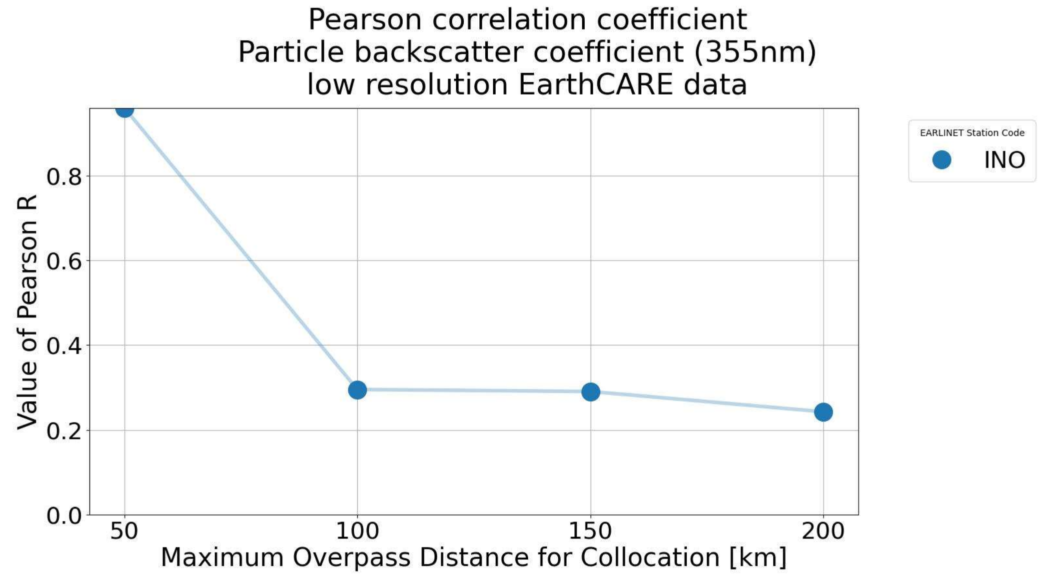

- Left pane: Scattering ratios of ATLID profiles averaged within overpass distance compared and entire 2-hour average measurement from ground-based lidar
- Right pane: Scattering ratios of ATLID profiles averaged within overpass distance and 5-min averaged lidar profile from ground-based instrument
- Obtained from calibrated ATLID and ground-based attenuated backscatters
- Shaded area between 10km and 12km altitude is the calibration window
- Configurable overpass distance and time filters



# Level 2 ATLID products

- Statistical analysis of the 5 overpasses with optical products
- 100km Pearson R value lower than for 150km – why is that?
- Why does the low resolution ATLID product agree better for higher overpass distances than the high resolution one?

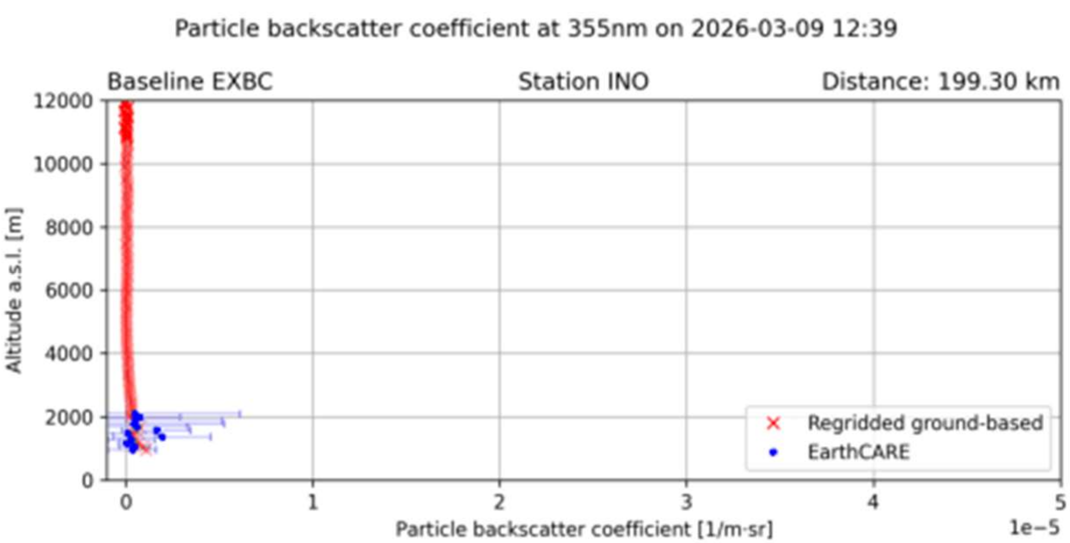


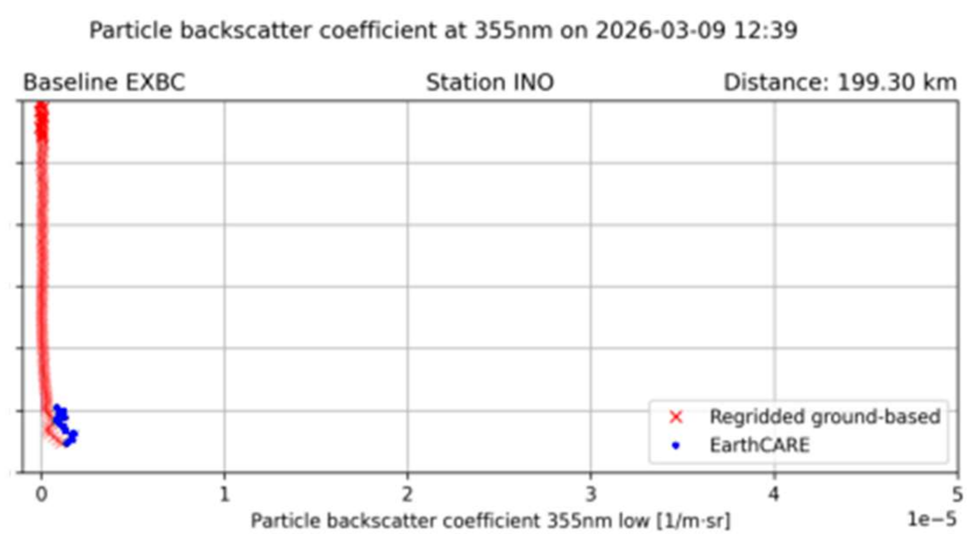
# Backscatter comparison

- Low layer at ~1.7km – better represented in the low resolution data
- Low resolution products have lower uncertainties and variability along track

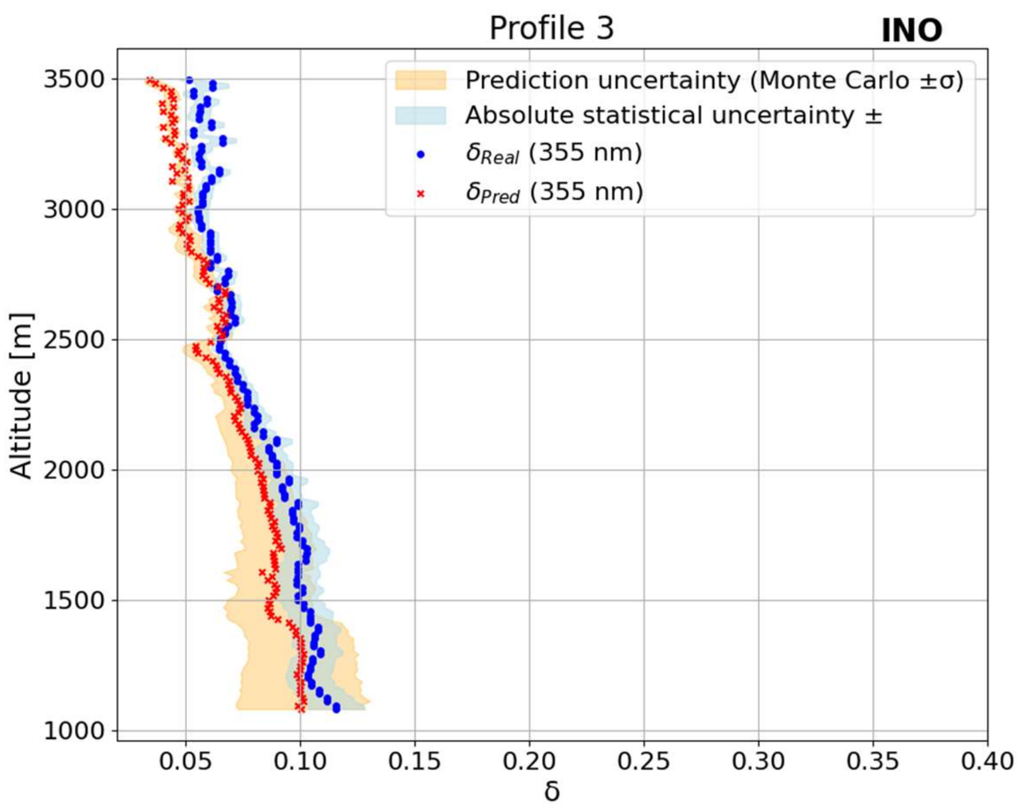
**High resolution ATLID_EBD_2A backscatter**




**Low resolution ATLID_EBD_2A backscatter**



# Depolarization inferencing (experimental)

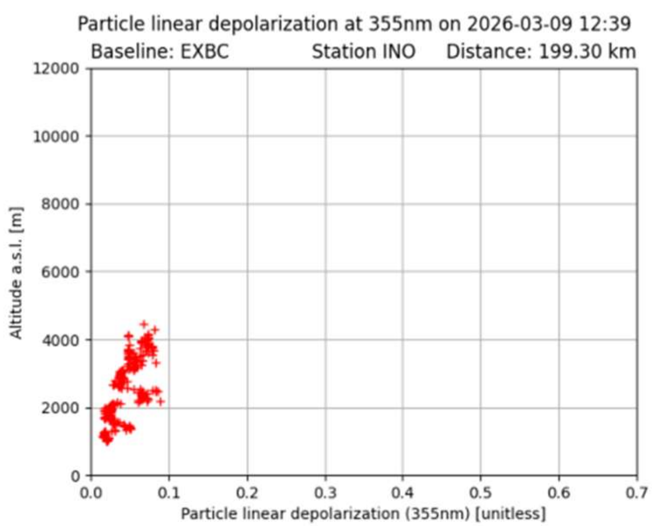



- Inferred from backscatter at 1064, 532 and 355nm and depolarization at 532nm
- Trained using known depolarization at 355nm from collocated system as ground truth
- XGBoost ML model

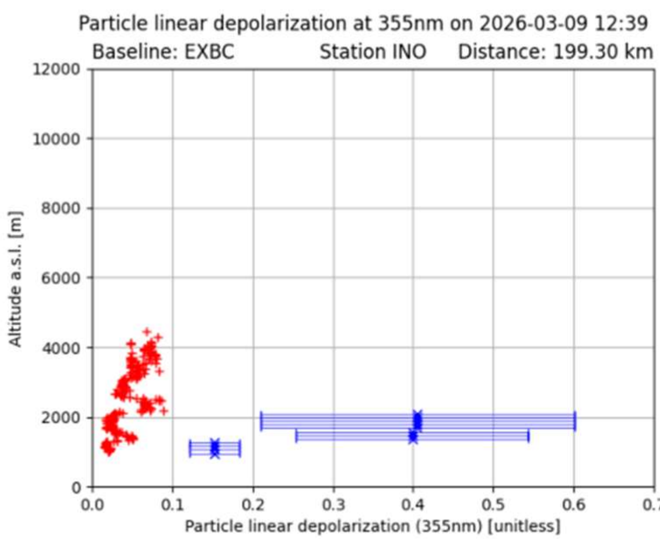
# Depolarization comparison

- Depolarizing layer at ~1.7km captured from satellite
- High resolution product is too noisy to characterize the depolarization values predicted from ground-based data

**High resolution ATLID_EBD_2A depolarization**




**Low resolution ATLID_EBD_2A depolarization**



# Conclusions and future work

**Key Takeaways**

- Complete processing chain for level 1 and 2 data for ATLID cal/val
- Good agreement for the showcased example
- Cross-parameter analysis helps with proper cal/val

**Next developments**

- Validate depolarization inferencing model
- Expand the algorithm and processing chain
- Fine-tune the attenuated backscatter calibration routine

# Thank you for your attention!

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