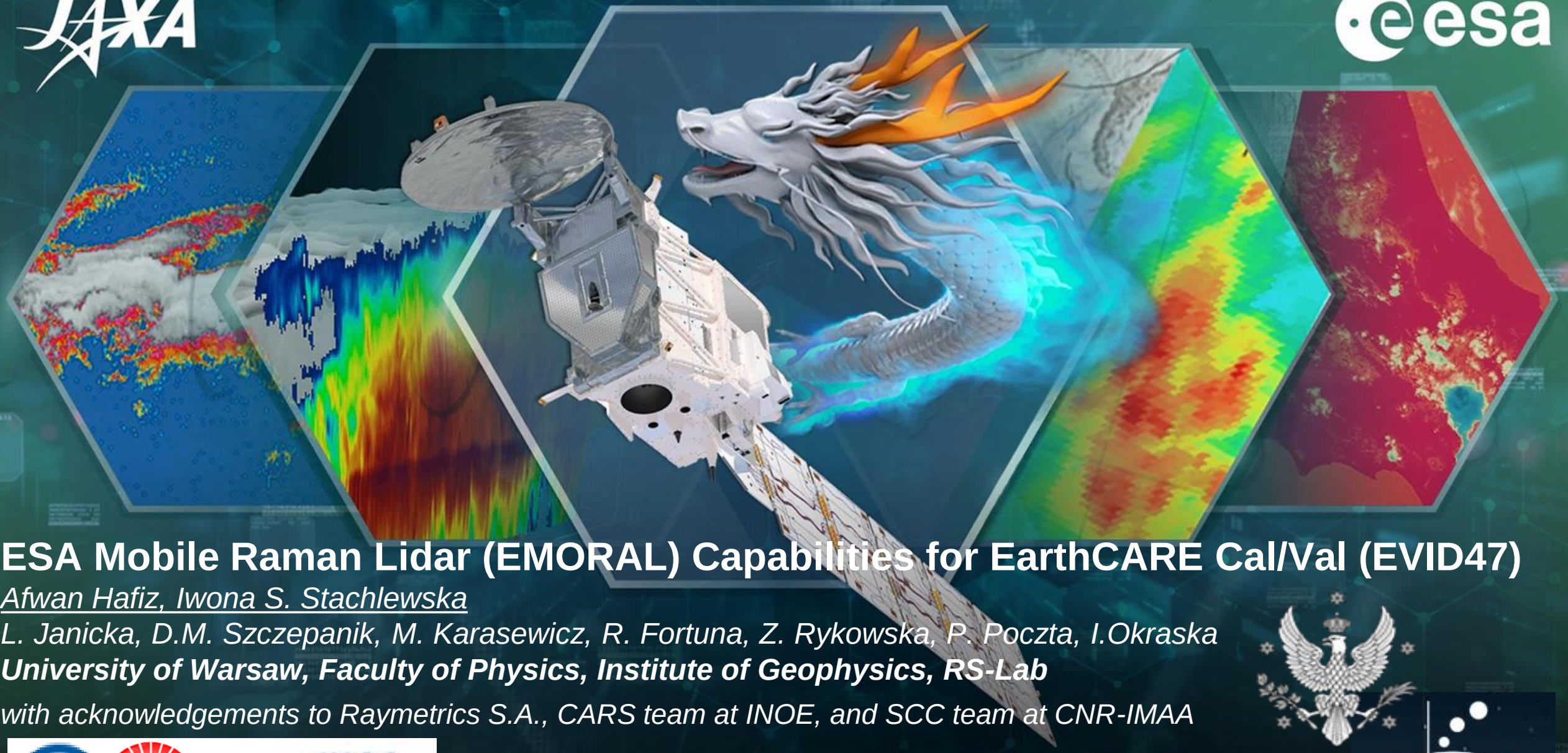

ESA Mobile Raman Lidar (EMORAL) Capabilities for EarthCARE Cal/Val (EVID47)

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1st ESA-JAXA EarthCARE In-Orbit Validation Workshop

14 – 17 January 2025 | VIRTUAL EVENT

Introduction

Objectives:

- EMORAL products for EarthCARE missions
- Overpass measurement can be collected:
  - as close as possible
  - in different environments

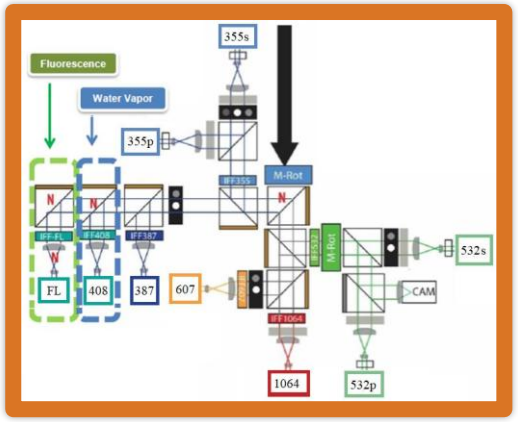
EarthCARE/EMORAL collocation measurements

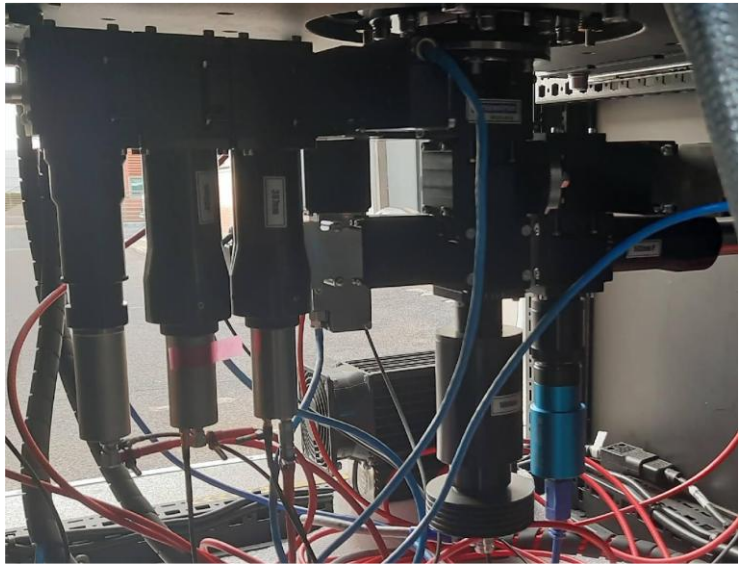
Introduction

355 532 1064 pulsed laser wavelengths

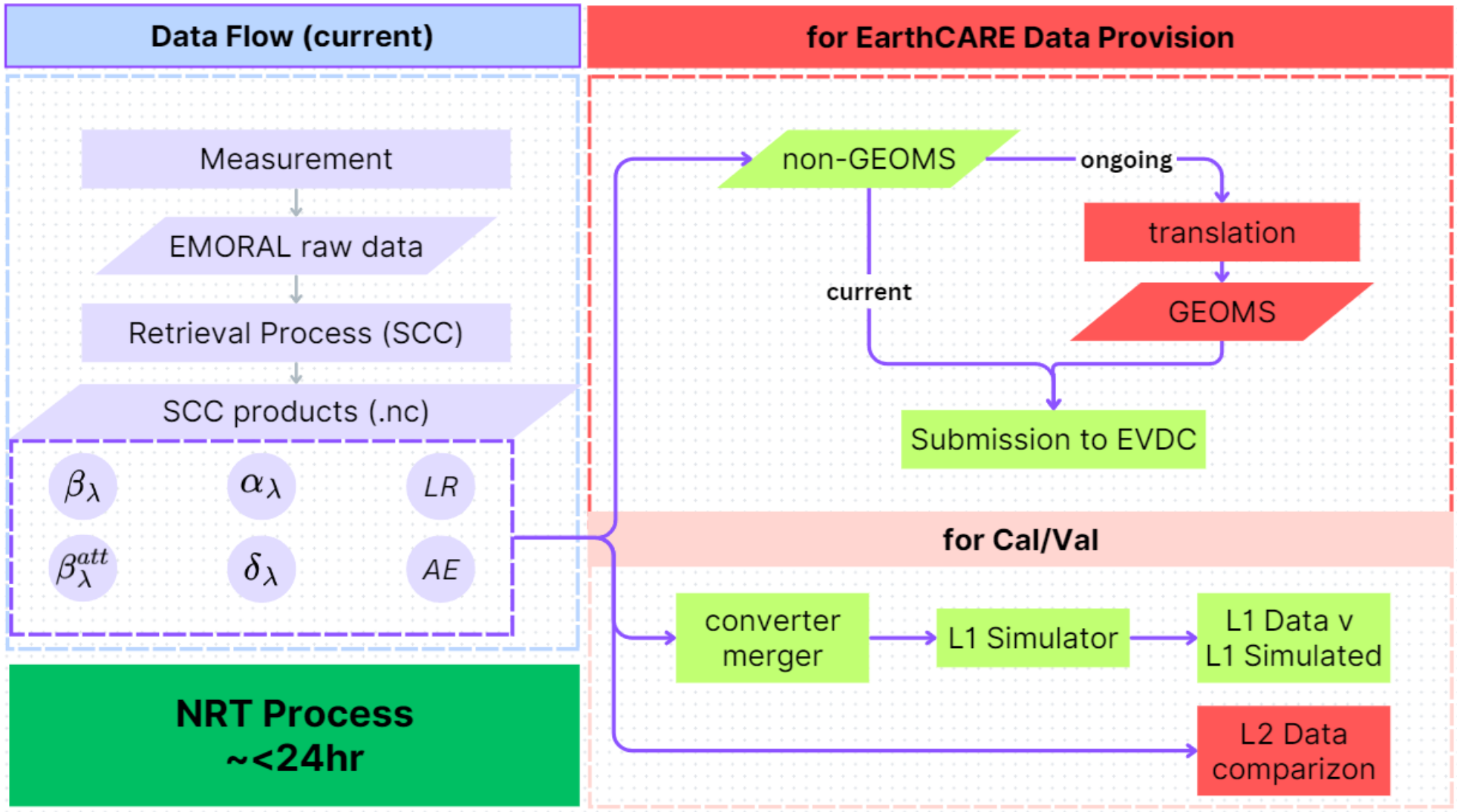
355 -p,-s	387	
532 -p,-s	408	470
1064	607	

Detection Configuration:
$(3\beta, 2\alpha, 2\delta$ + ***WV + Fluo.***$)$

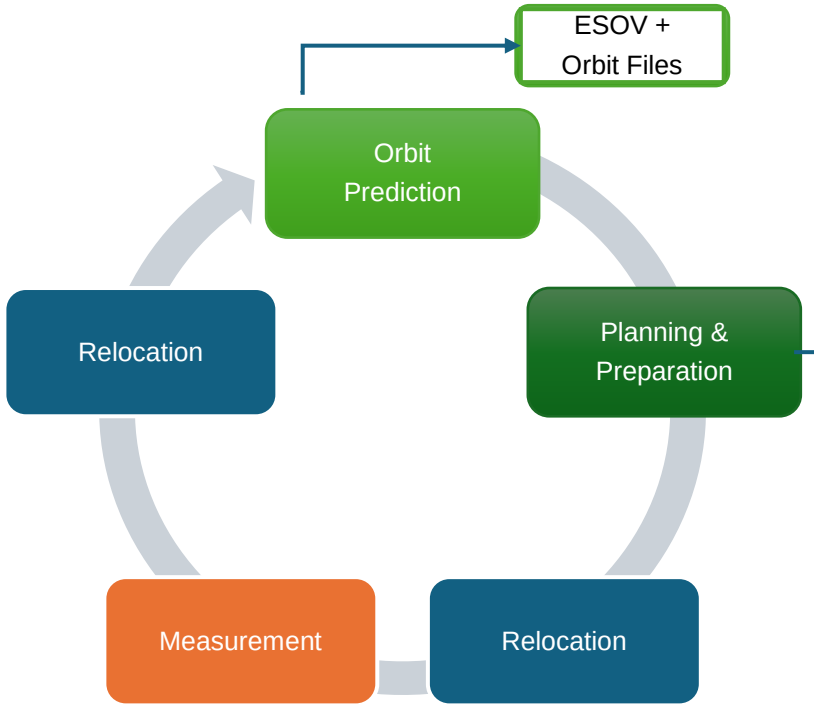




Introduction

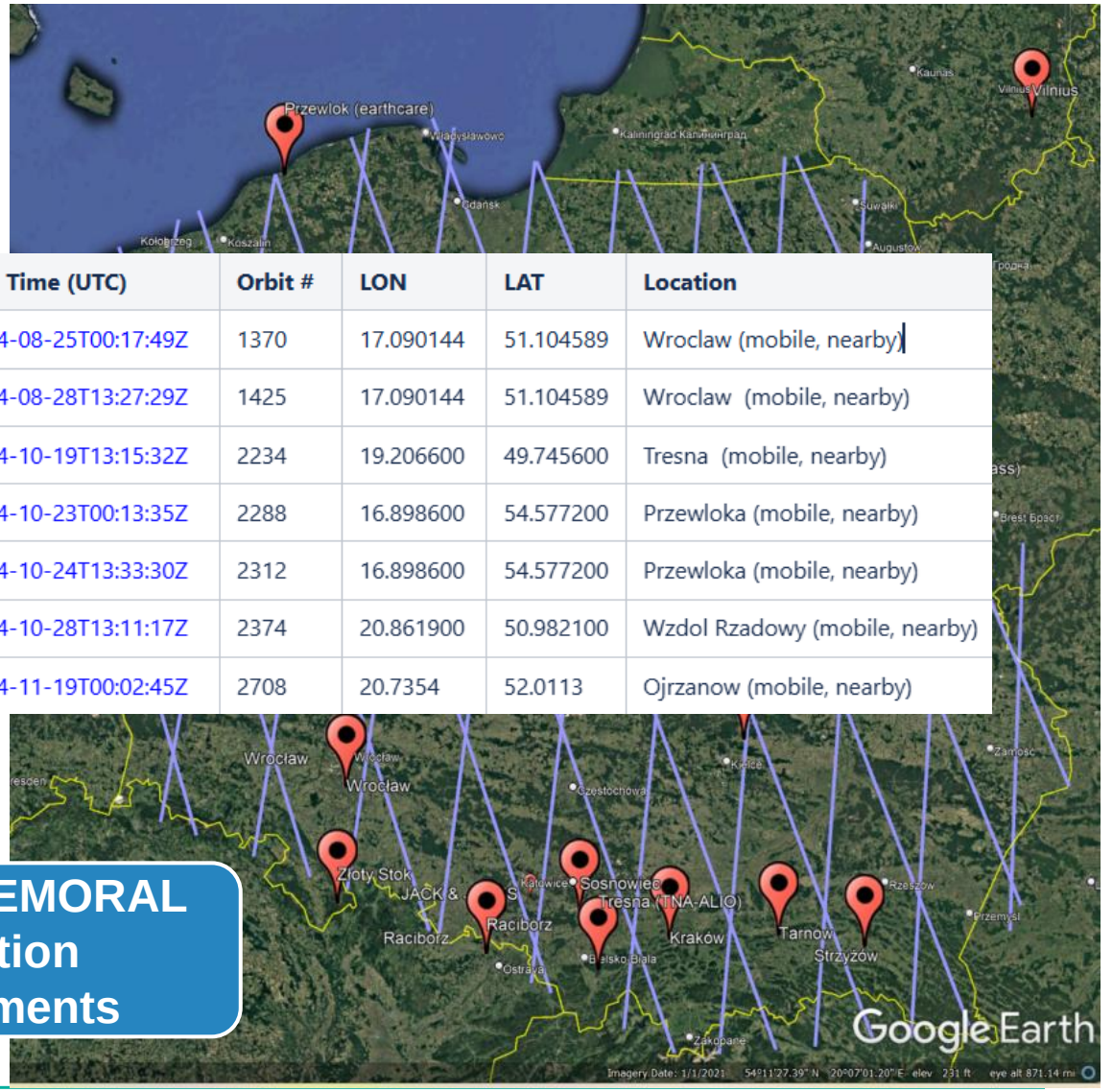


Overpass Campaigns



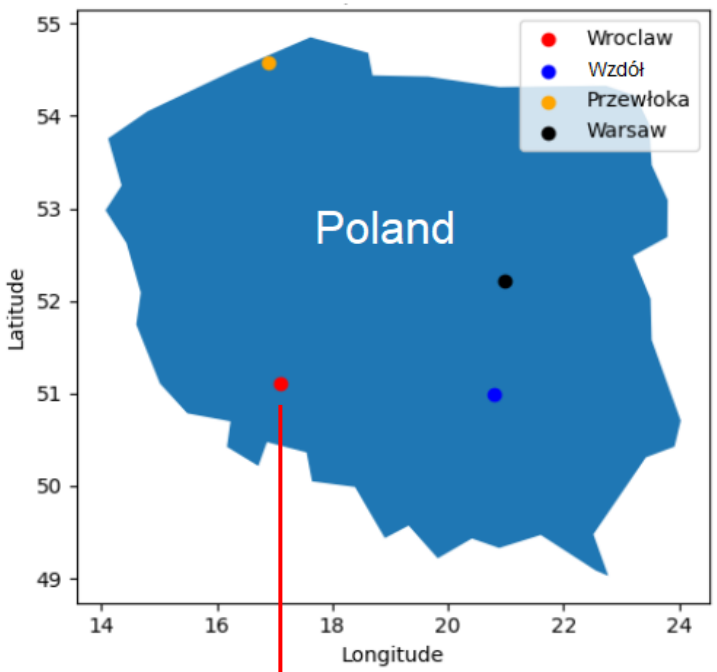
- Several overpass campaigns during commissioning phase
- Distance between sites to predicted orbits ranging from **<1km to 40km**

Start Time (UTC)	End Time (UTC)	Orbit #	LON	LAT	Location
2024-08-25T00:17:36Z	2024-08-25T00:17:49Z	1370	17.090144	51.104589	Wroclaw (mobile, nearby)
2024-08-28T13:27:16Z	2024-08-28T13:27:29Z	1425	17.090144	51.104589	Wroclaw (mobile, nearby)
2024-10-19T13:14:13Z	2024-10-19T13:15:32Z	2234	19.206600	49.745600	Tresna (mobile, nearby)
2024-10-23T00:12:17Z	2024-10-23T00:13:35Z	2288	16.898600	54.577200	Przewloka (mobile, nearby)
2024-10-24T13:32:29Z	2024-10-24T13:33:30Z	2312	16.898600	54.577200	Przewloka (mobile, nearby)
2024-10-28T13:09:54Z	2024-10-28T13:11:17Z	2374	20.861900	50.982100	Wzdol Rzadowy (mobile, nearby)
2024-11-19T00:00:37Z	2024-11-19T00:02:45Z	2708	20.7354	52.0113	Ojrzanow (mobile, nearby)

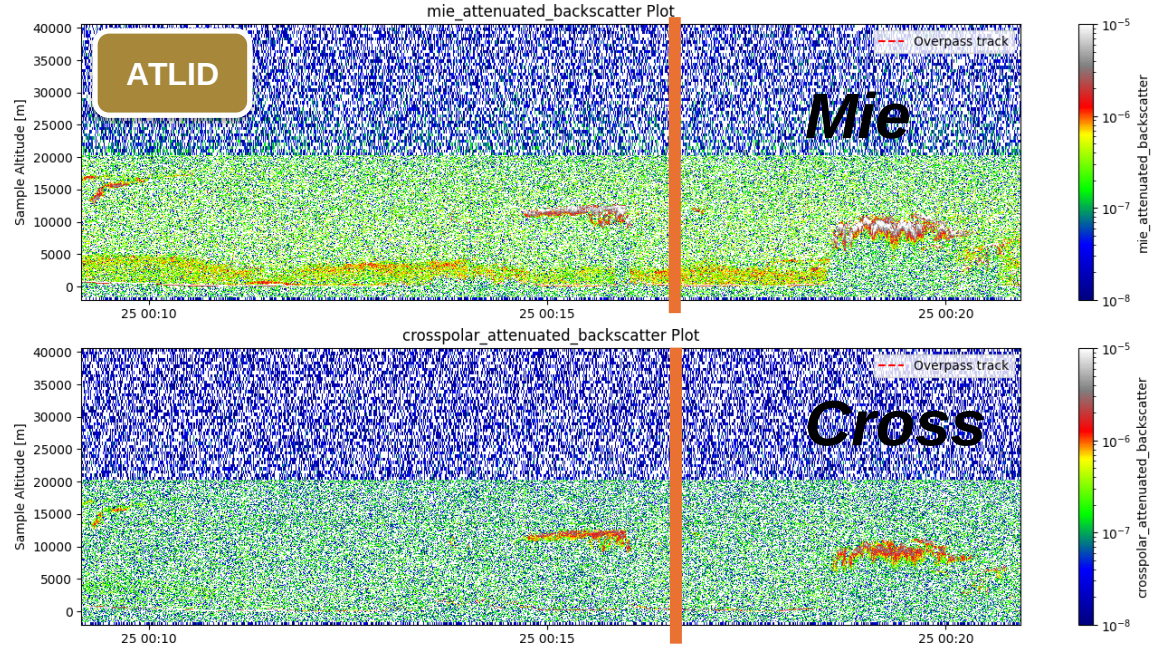


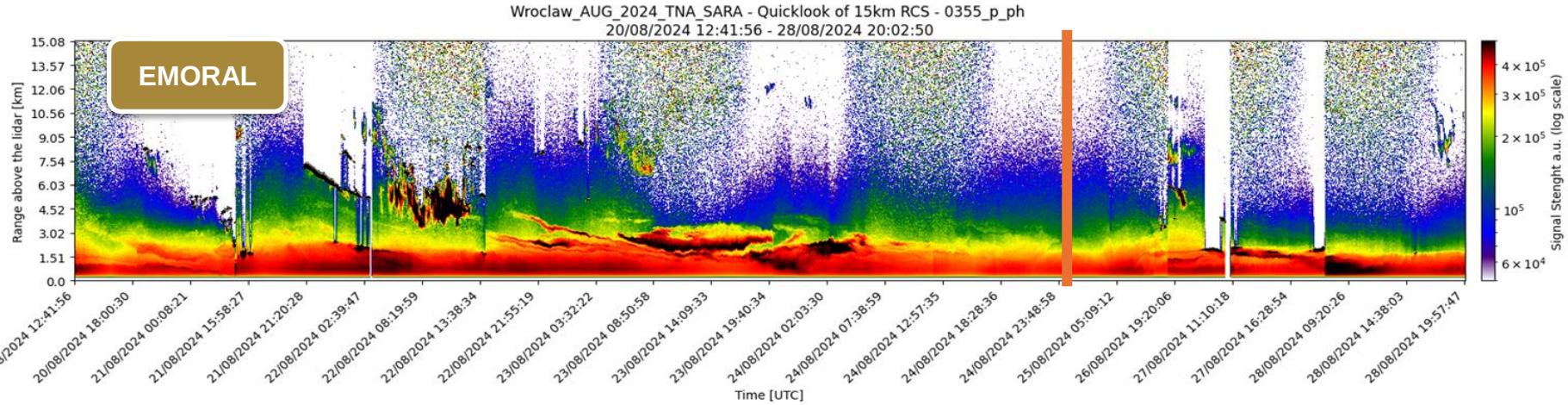
EarthCARE/EMORAL collocation measurements

Cal/Val Efforts: Case 1



- SARA Atmo-Access TNA with EarthCARE overpasses in Wroclaw, West-Southern Poland
- Several days of measurements
  - Rare 3 Overpasses: 19/8 bad weather, 25/8 nighttime, 28/8 daytime
  - ++ Information on the atm. conditions

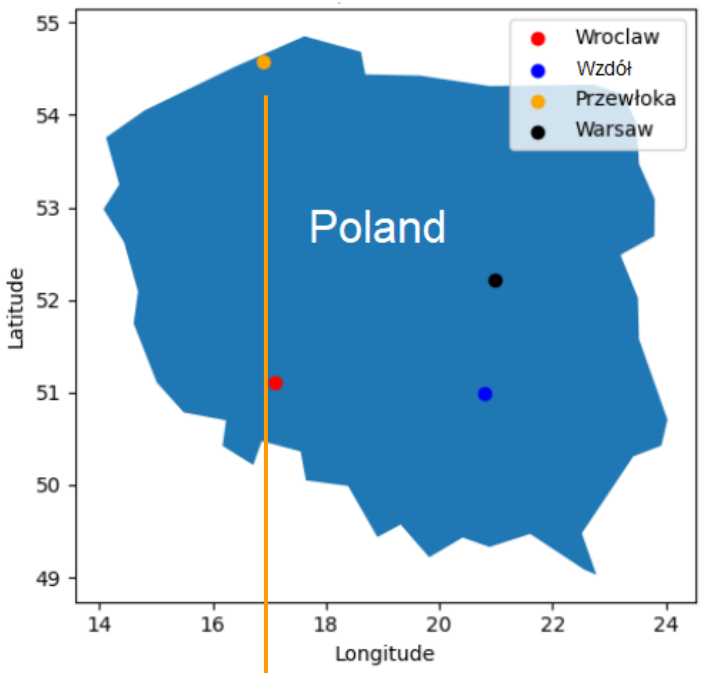




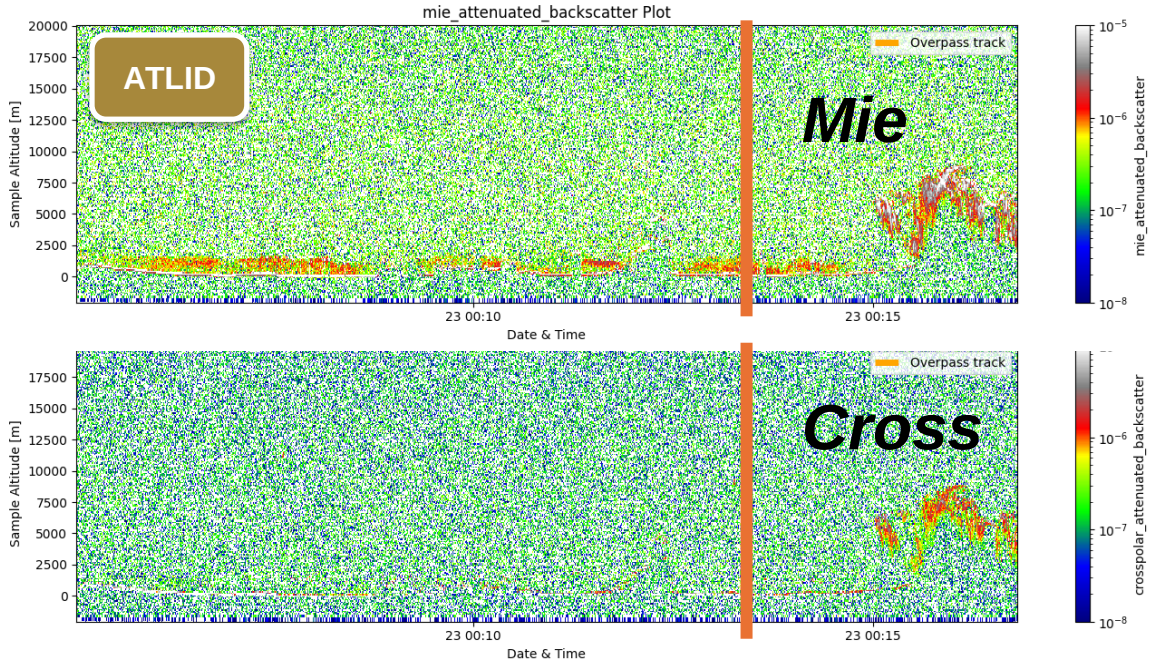
Case 1:

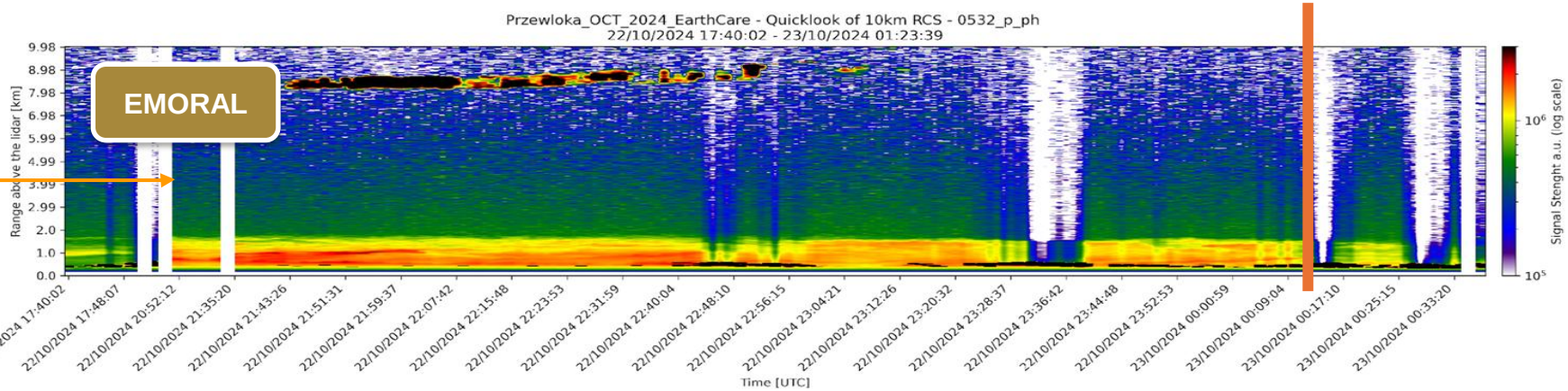
- Distance is bigger with real orbit **~20km → ~35km**

Cal/Val Efforts: Case 2



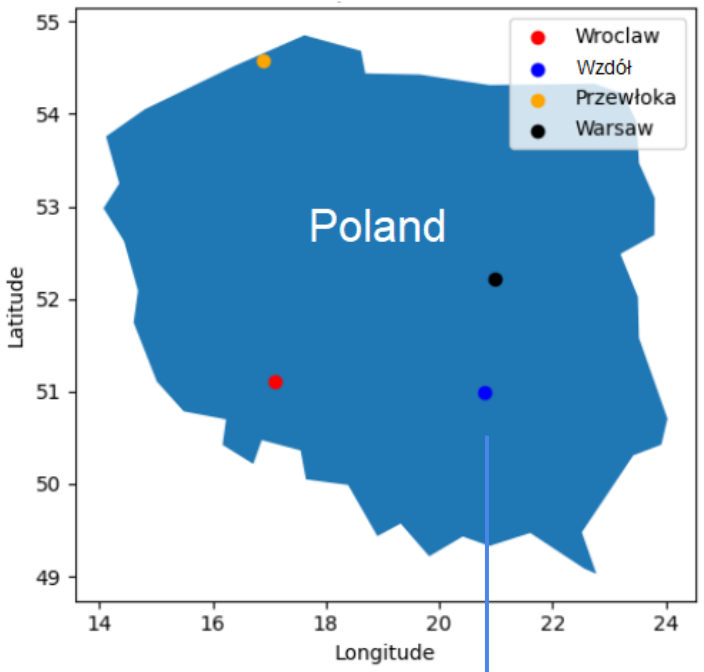
- Dedicated Overpass Campaign in Przewłoka, North Poland
- 2 Overpasses close in time:
  - 23/10 nighttime (fog very close to surface)
  - 24/10 daytime



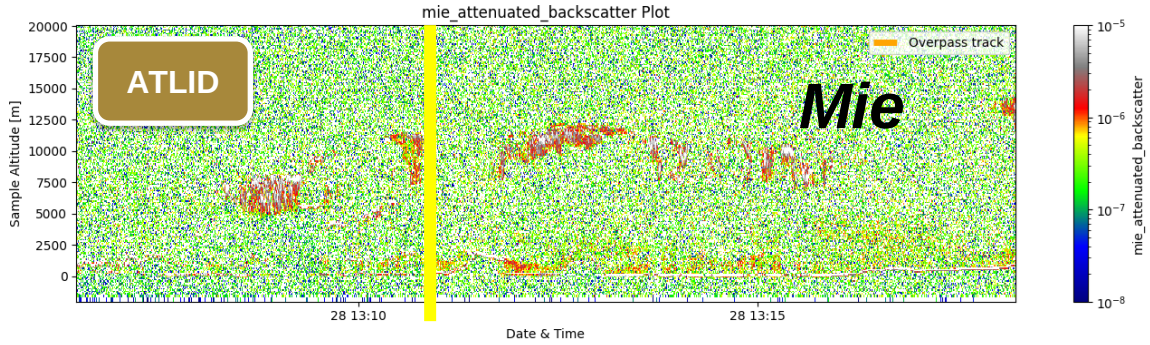


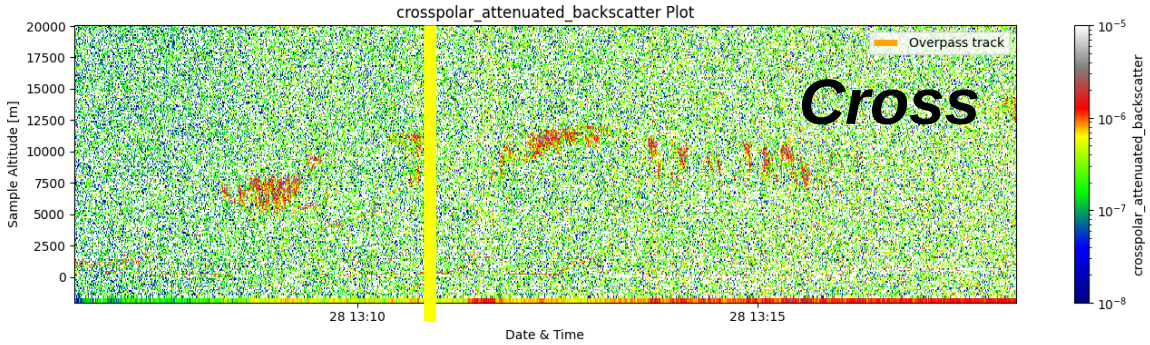
Case 1:
- Distance is closer with real orbit **~1km → ~0.3km**

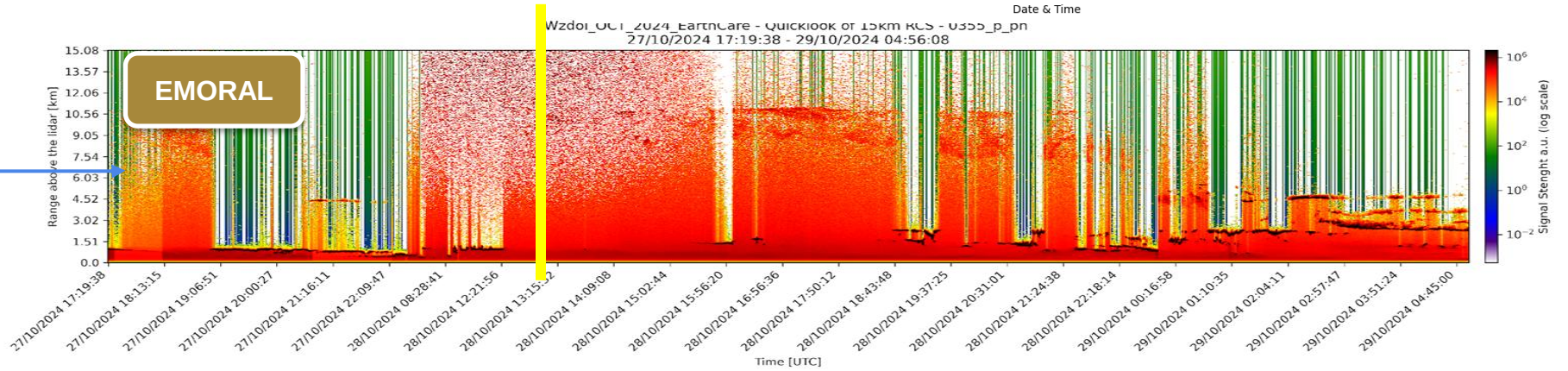
Cal/Val Efforts: Case 3



- Dedicated Overpass Campaign in Wzdół, Southern Poland
- 1 0verpass close in time:
  - 19/11 nighttime, strong aerosol load close to the surface



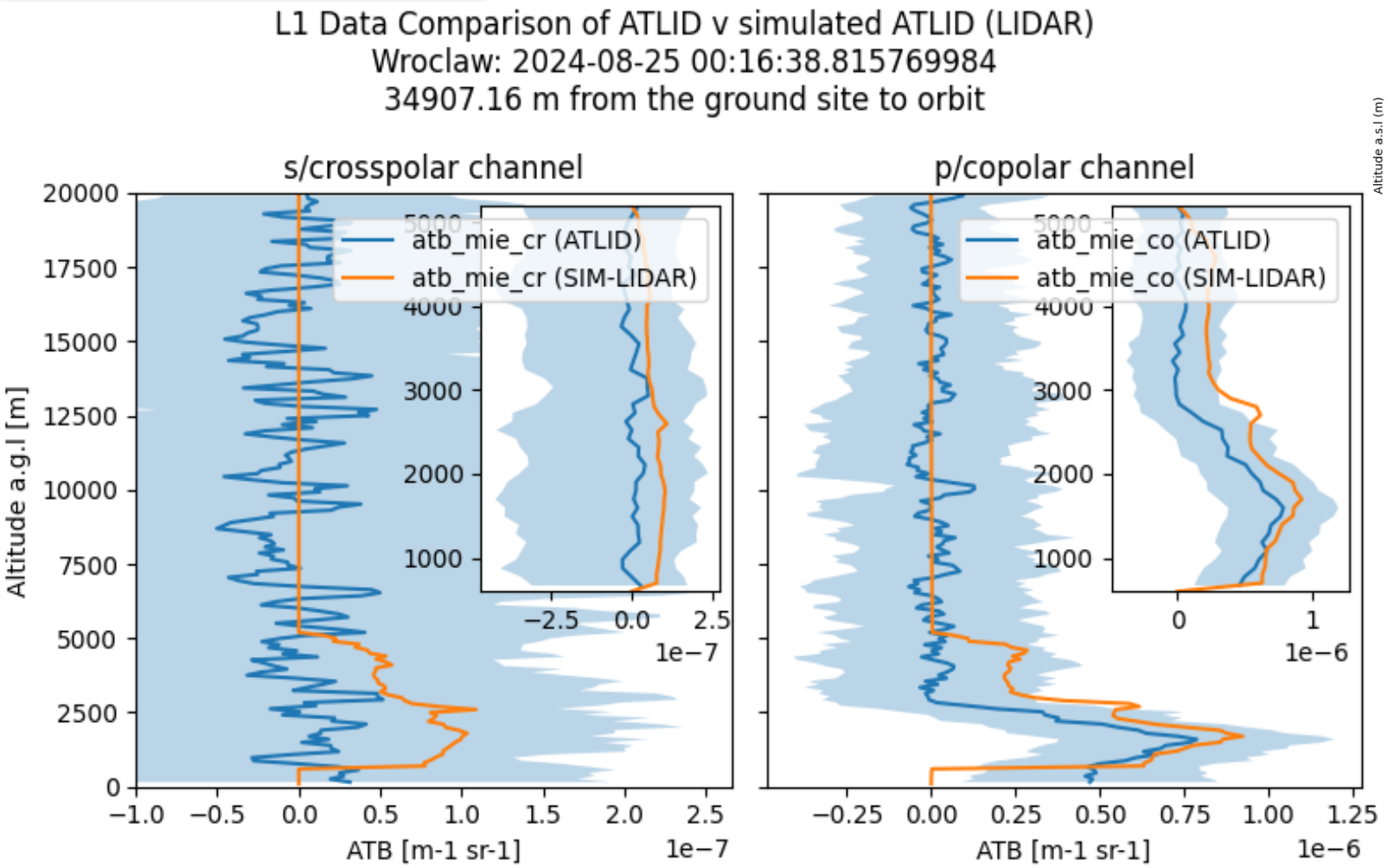


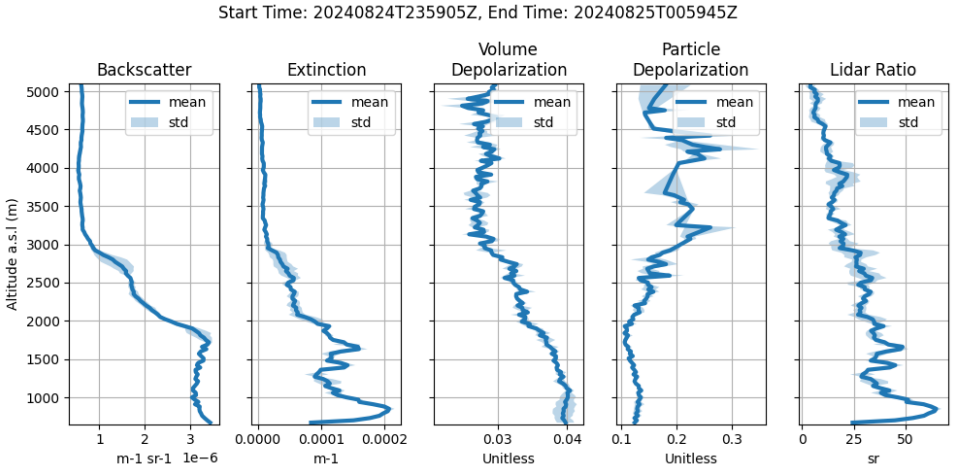


Case 3:
- Same distance (prediction v real)
  ~11km → ~11km

EMORAL v ATLID L1 Comparison

L1-tool: only nighttime tested





L1-tool Input:
- 1h profile (during overpass)
- Filtered to 5100 m
- More filters criteria for future comparison

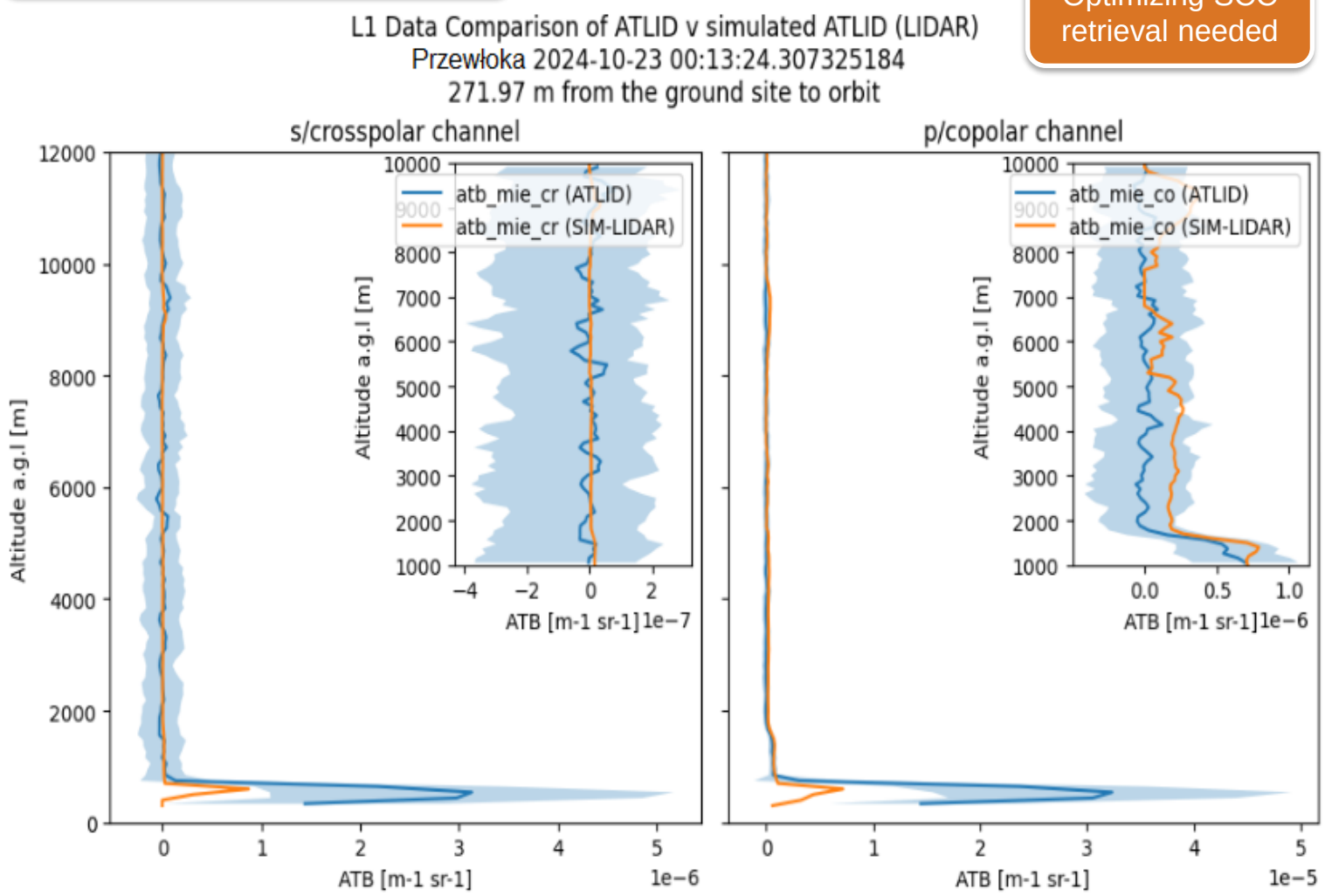
ATLID Data:
- Distance ~34.9km
- Average 18 profiles
- 35.1 km radius from ground-based site

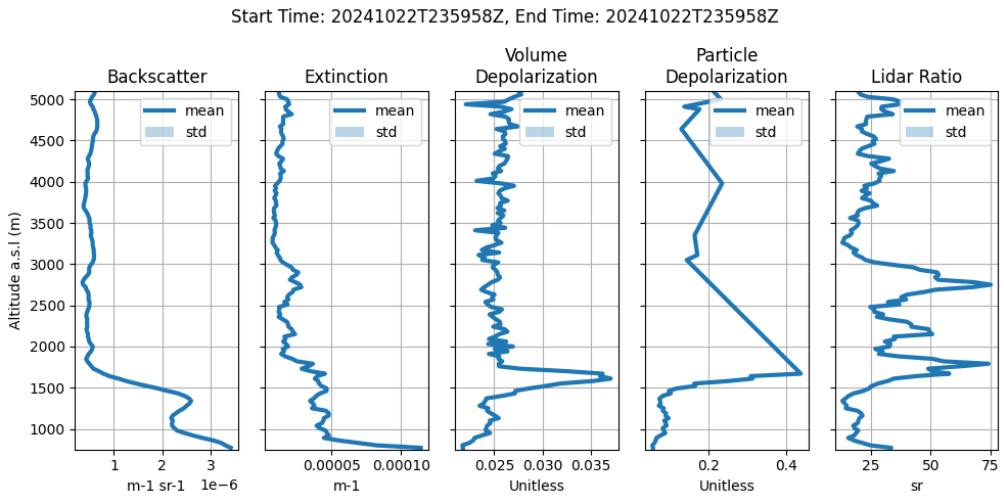
Comparison:
- Similar trend for co-polar
- Difficulties for cross-polar channel
- ATLID values lower for both channels

EMORAL v ATLID L1 Comparison

L1-tool: only nighttime tested

Optimizing SCC retrieval needed





L1-tool Input:
- 1h profile (during overpass)
- Layer (cloud/fog) close to surface

ATLID Data:
- Closest point ~271 m
- Average of 14 profiles
- 2 km radius from ground-bassed site

Comparison:
- Similar trend for co-polar at low altitude (spike), ATLID with lower values
- Difficulties for cross-polar channel

Future Works and Concluding Remarks

Challenges for Campaigns & Data provision

- Differences between predicted and real orbit
- Changing weather conditions
- SCC setup for different locations
- Delays in data provision due to lack of internet at highly remote locations

Challenges for L1 Data Comparison

- Optimizing inputs for L1-tool
  - Optimized retrieval
  - More filters criteria for inputs
- Manual download the data was prone to mistakes
- Only night-time measurement presented here
  - Daytime needs additional calculator

Lessons learned:

- Perfect collocation is difficult
- Changing orbit affected some observations (expected to be less in the future)
- (Almost) all measured data uploaded to EVDC within or close to 1 day from observations
- Extra time of measurement is needed for ensuring quality of data and their proper interpretation
- Workflow for serving cal/val is established

Future Work:

- Compare entire overpass dataset with ATLID
- Recalculate optical products based on the newest recommended settings (ATLAS assessment)
- Better select dataset (time-slots)
- Make more comparisons with updated/other L1 and L2 products
- Automize download of data