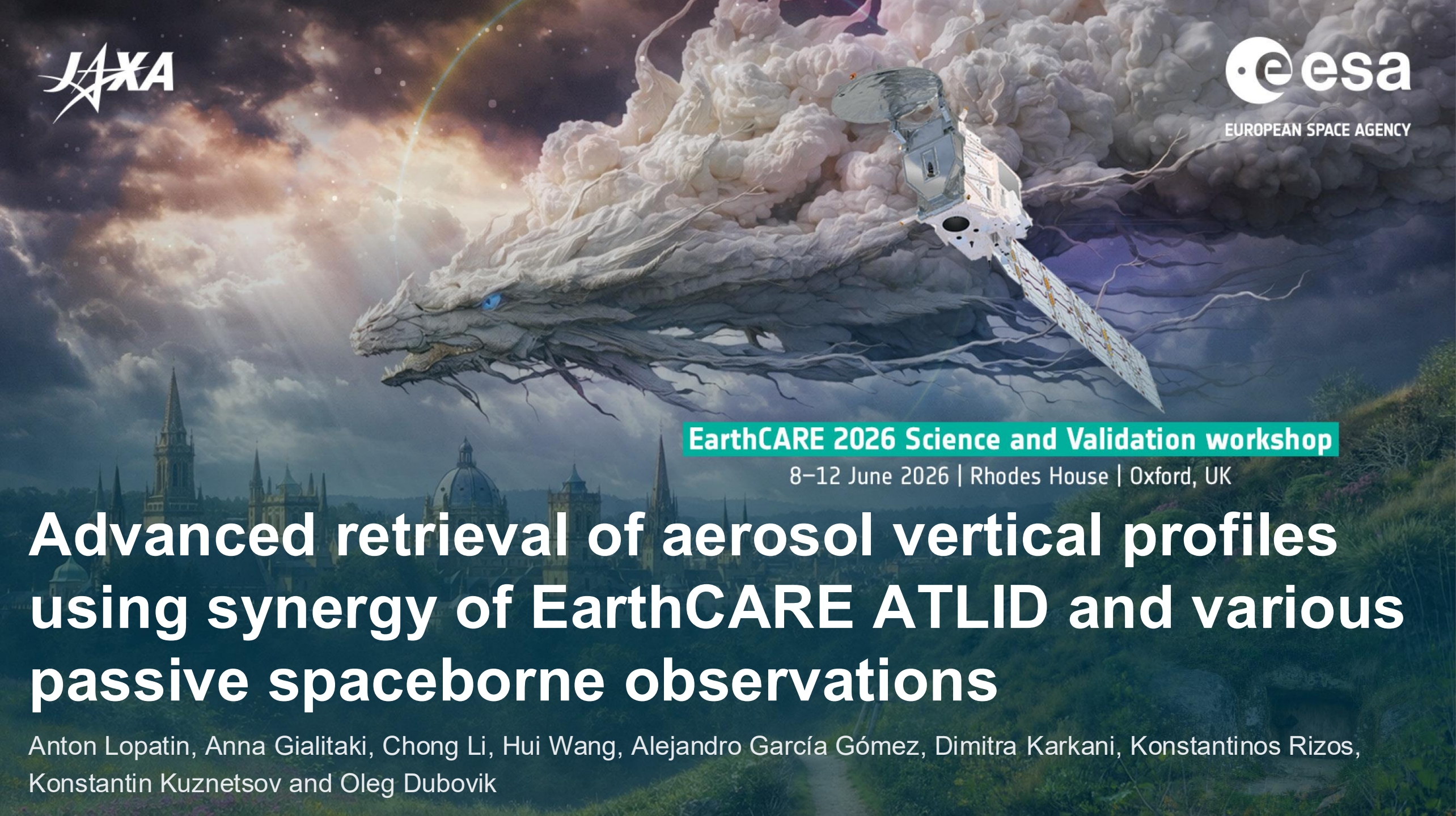
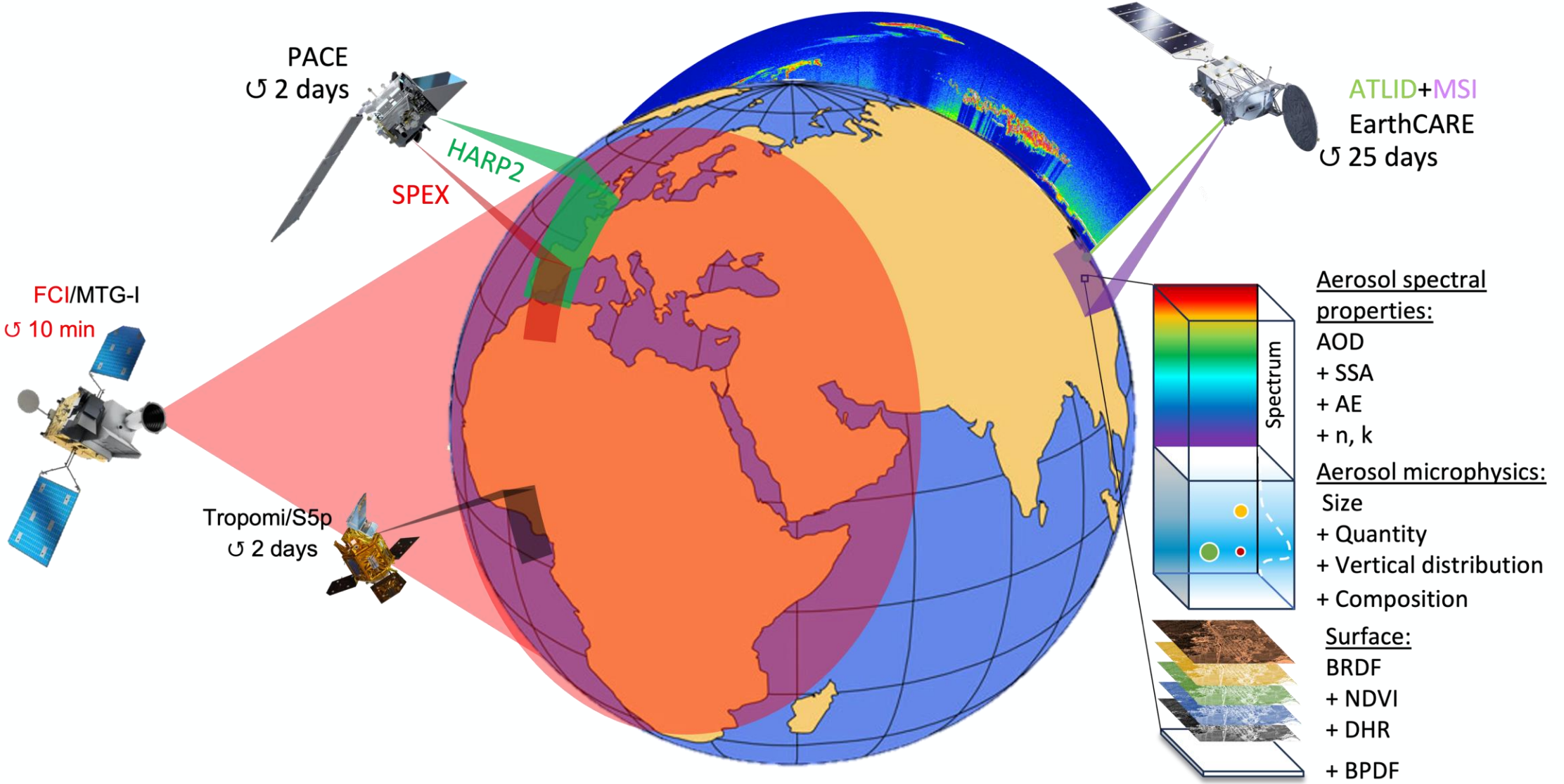


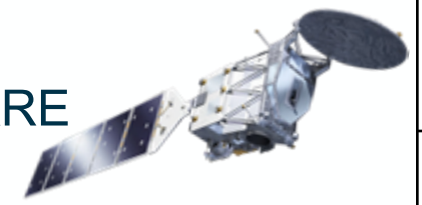
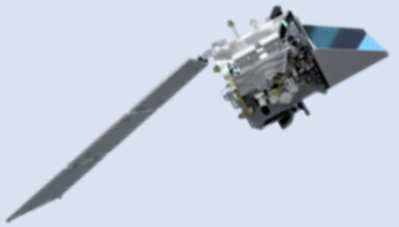
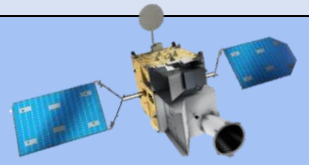
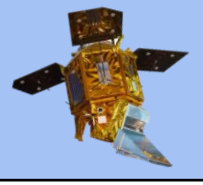
Advanced retrieval of aerosol vertical profiles using synergy of EarthCARE ATLID and various passive spaceborne observations

Anton Lopatin, Anna Gialitaki, Chong Li, Hui Wang, Alejandro García Gómez, Dimitra Karkani, Konstantinos Rizos, Konstantin Kuznetsov and Oleg Dubovik

ECAMS & GLADIS Overview

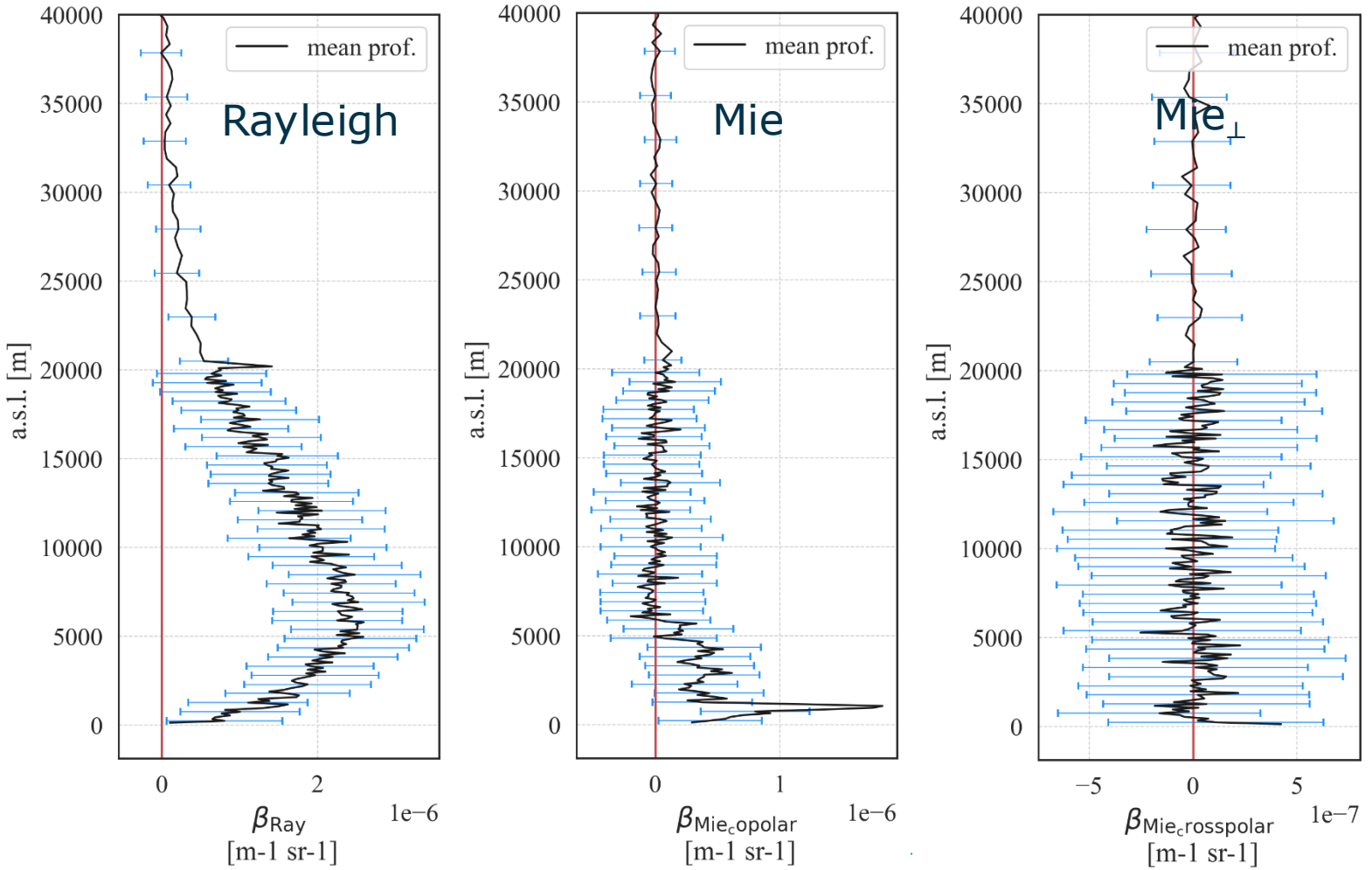


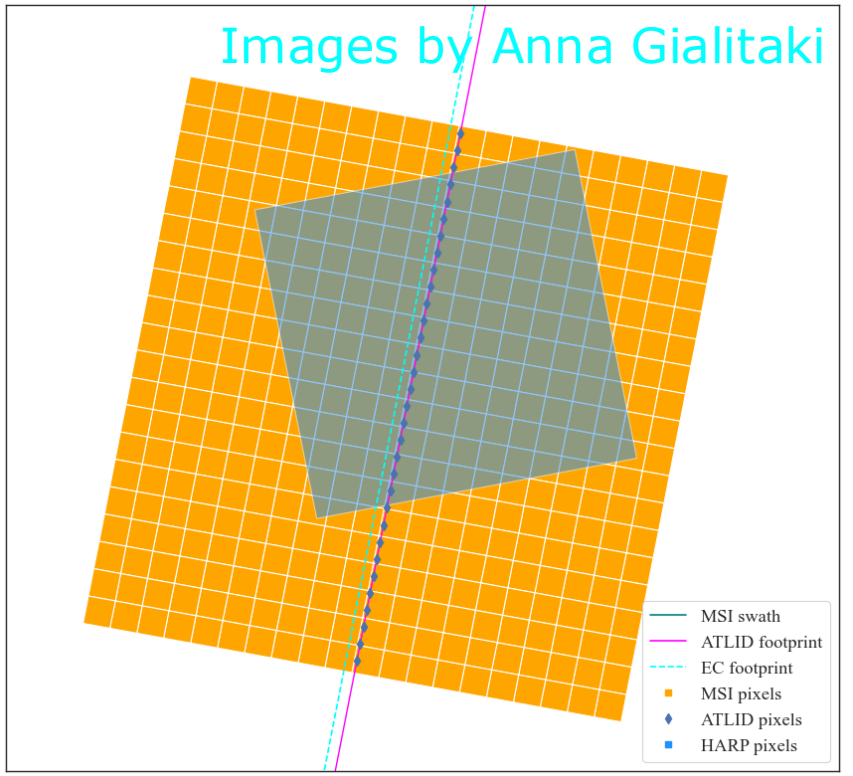
Instruments for L1 synergy

Project		Platform	Instrument	Band(s), µm	Resolution(s)	Measurement capabilities
GLADIS	ECAMS	EarthCARE 	ATLID	0.355	V: 100-300m H: ~1 Km T: 25 days	LEO, HSRL, Depolarisation
			MSI	0.670, 0.865, 1.670, 2.210	H: 0.5 Km T: 8 days	LEO, Imager
		PACE 	HARP-2	0.441, 0.549, 0.669, 0.873	H: 2.6Km T: 2 days	LEO, MAP
			SPEXone*	0.385 – 0.770	H: ~5 Km T: 1 month S: 2-5 nm	LEO, MAP, Spectrometer
		MTG-I 	FCI	0.444, 0.510, 0.640, 0.865, 1.610, 2.250	H: ~1Km T: 10 minutes	GEO
		Sentinel-5p 	TROPOMI	0.270 – 0.500 0.675 – 0.775 2.305 – 2.385	H: 7x3.5 Km T: 2days	LEO, Spectrometer

Spatial averaging and cloud filtering on L1 profiles

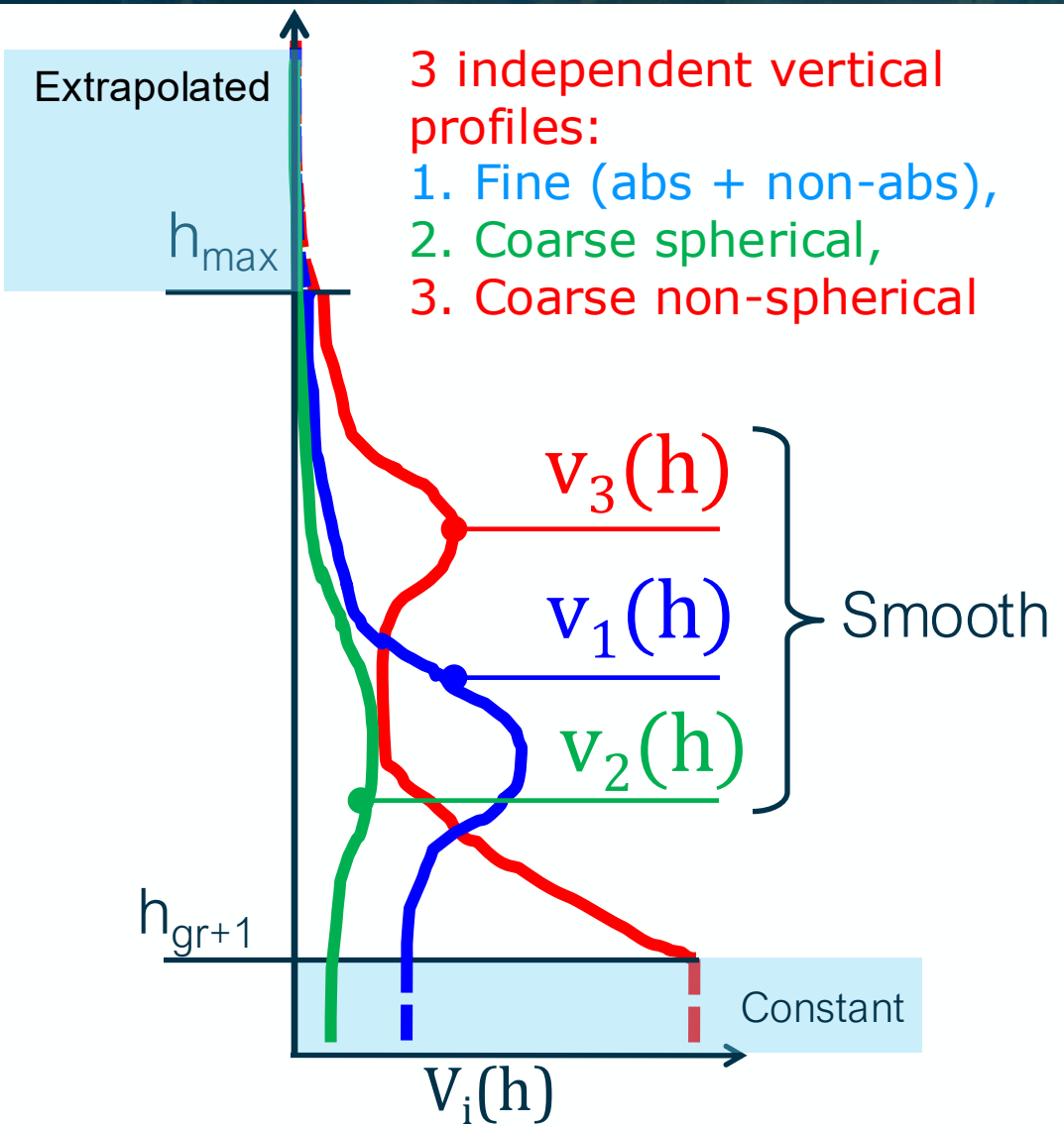
Spatial resolution: 10*10 km,
Vertical resolution: 100m (up to 10km), 200m (10 – 20km)
Temporal resolution: >2h





Cloud masking:
MSI cloud / ACOM HARP-2 (subpixel)
+
ATLID Feature masks
(MSI_CM_2A+ATL_FM_2A)

Vertical + Columnar = Unified aerosol model



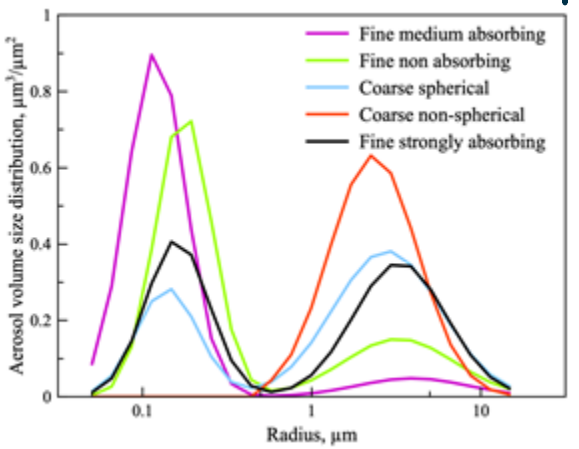
3 independent vertical profiles:

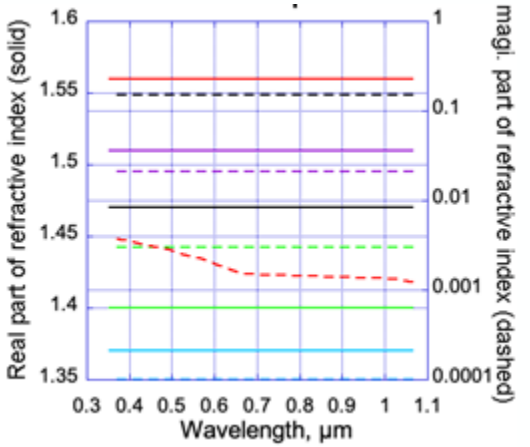
1. Fine (abs + non-abs),
2. Coarse spherical,
3. Coarse non-spherical

4 columnar constant types:

- $dV(r)/d\ln r$,
- $n(\lambda), k(\lambda)$
- $\omega_o(\lambda), P_{ij}(\lambda,\Theta)$

AERONET-based, Dubovik et al., 2006





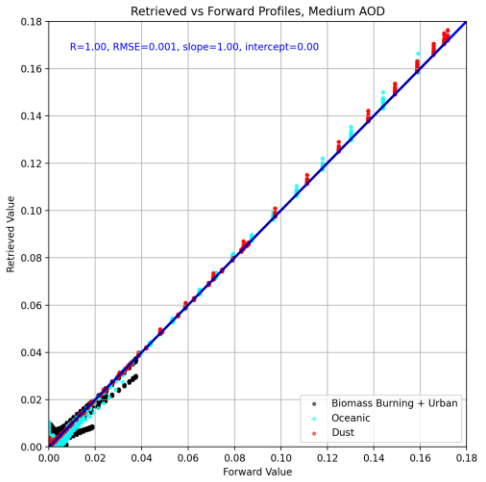
$$\sigma_a(h,\lambda) = \sum_i v_i(h)\tau_i^{ext}$$

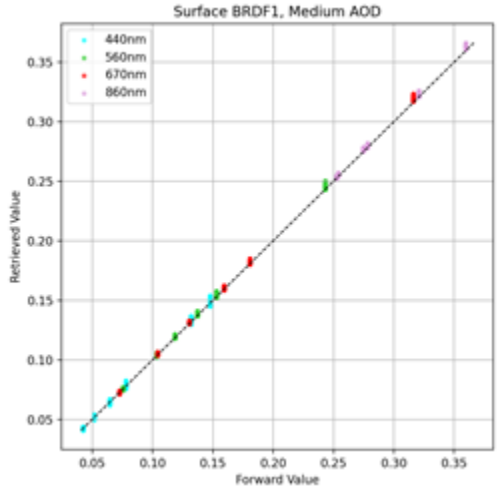
$$\beta_a(h,\lambda) = \sum_i v_i(h)\tau_i^{ext}/S_i$$

ECAMS synthetic tests: ATLID + HARP-2

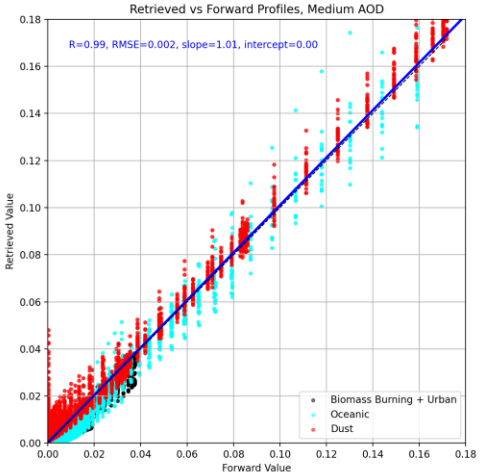
Land

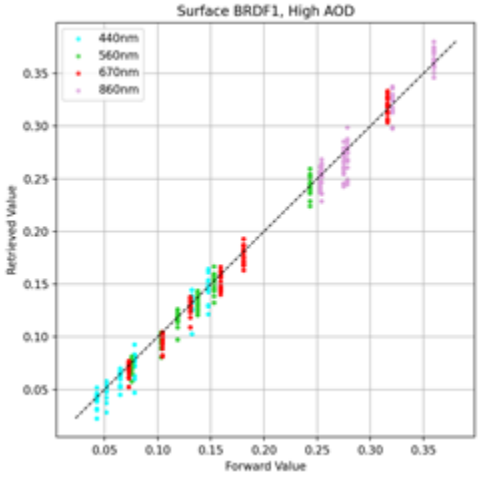
Noise free





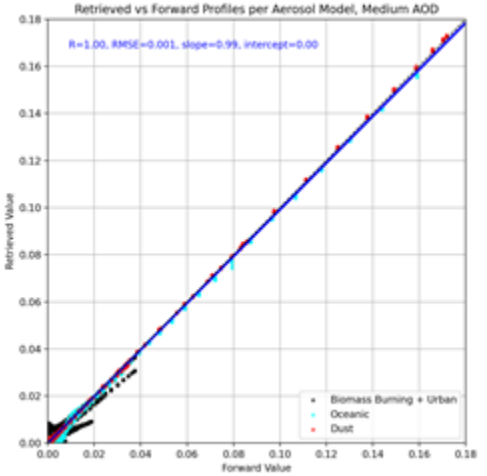
Noisy

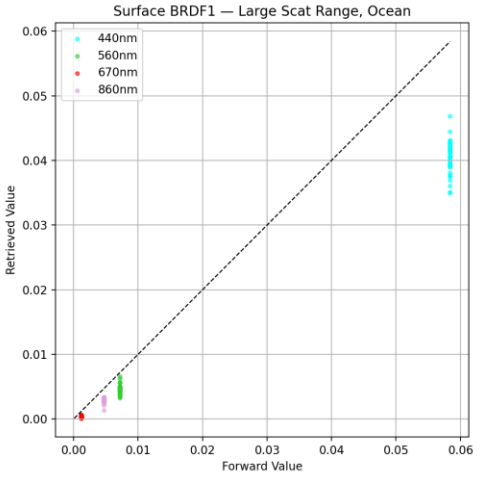




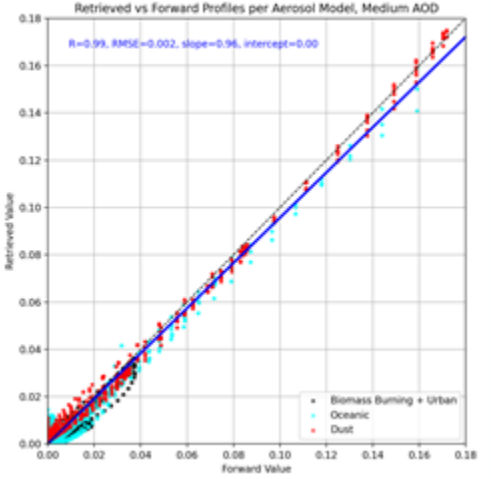
Ocean

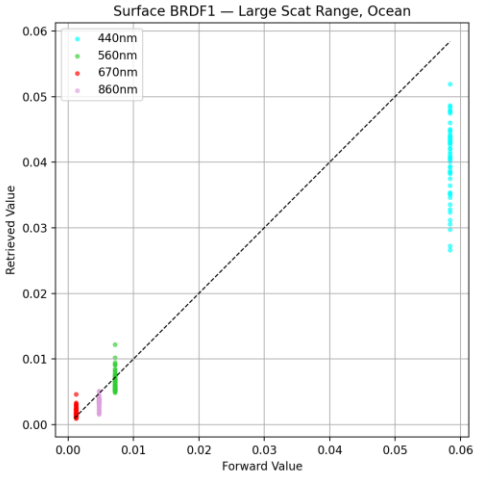
Noise free





Noisy



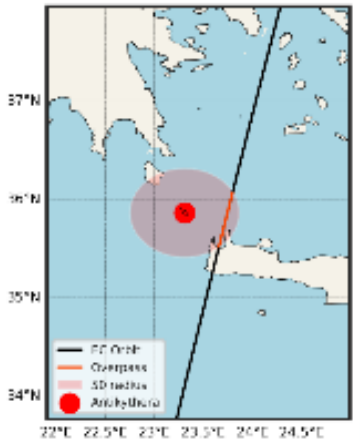


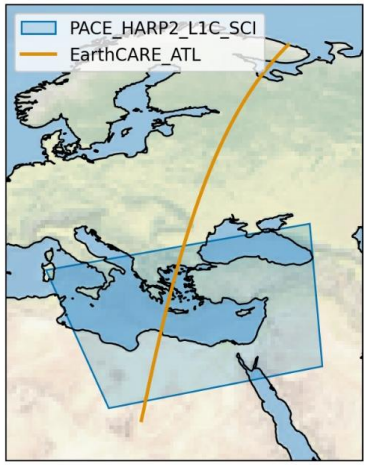
Aerosol

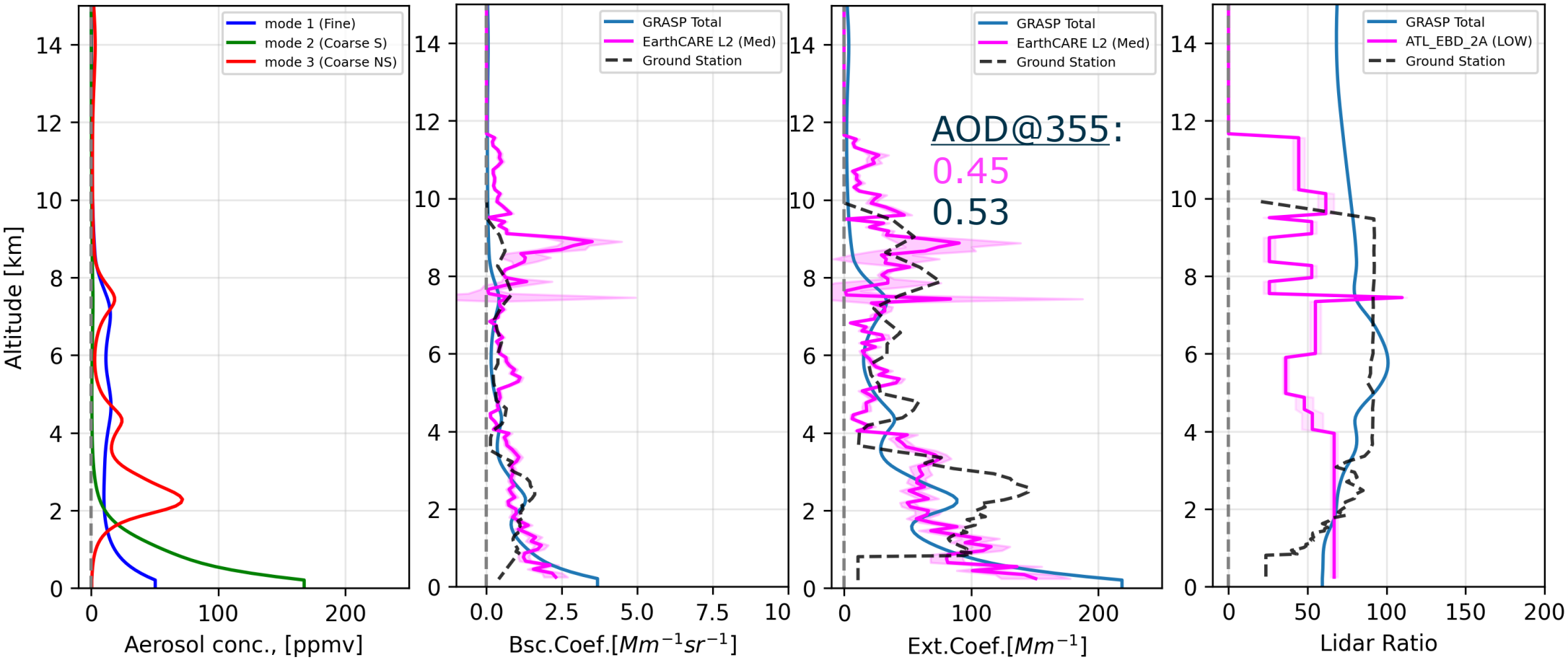
Surface

ECAMS preliminary results: Antikythera

EarthCARE @12:42 UTC, (BA baseline)
PACE @10:46 UTC (V3)
AERONET+POLLY @07:27, ~ 40km distance

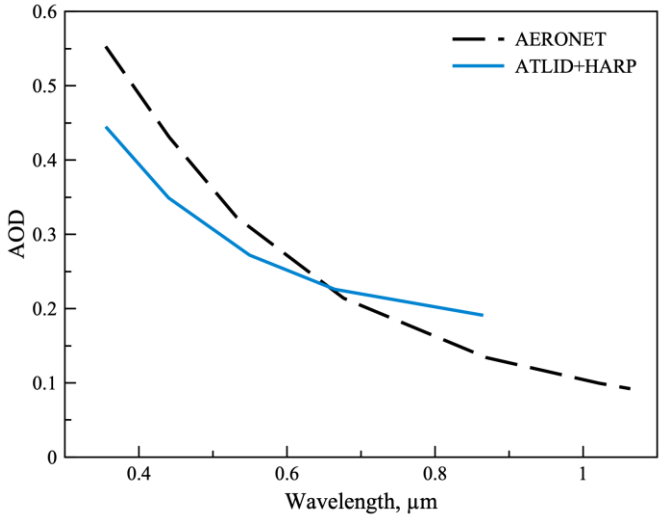


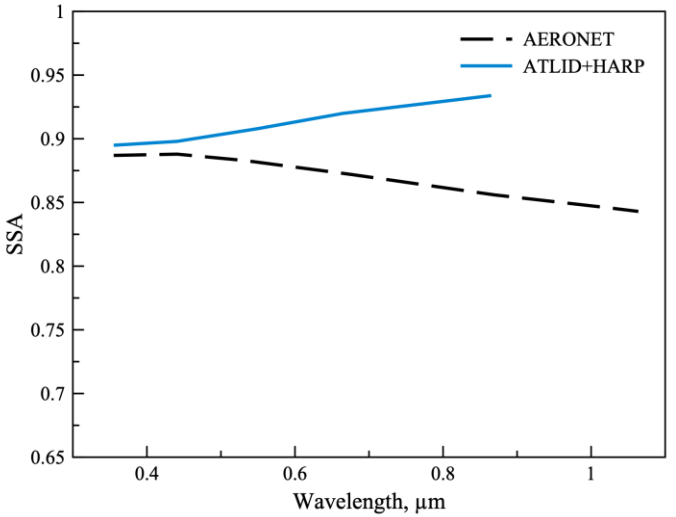


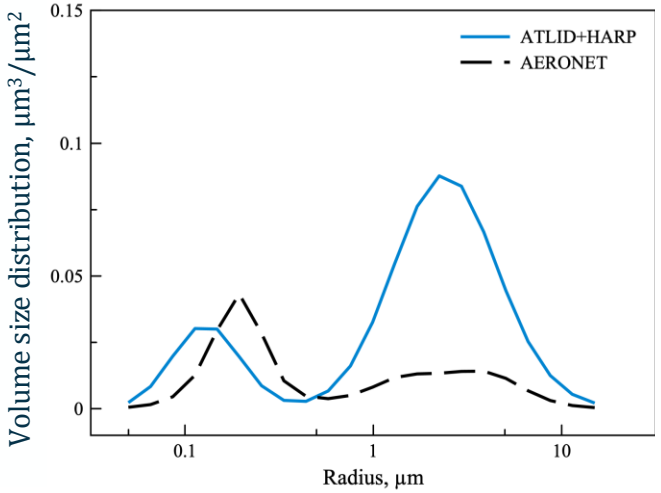


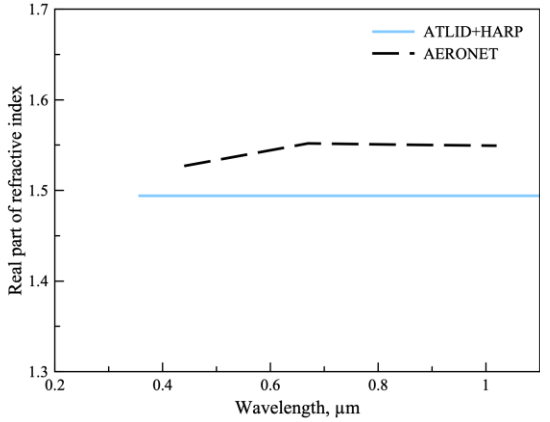
Plots by Hui Wang

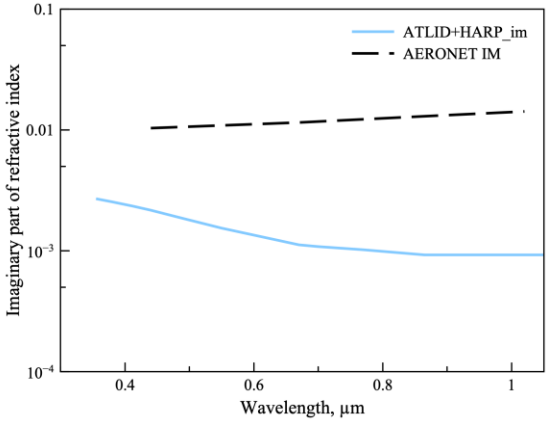
ECAMS preliminary results: Antikythera

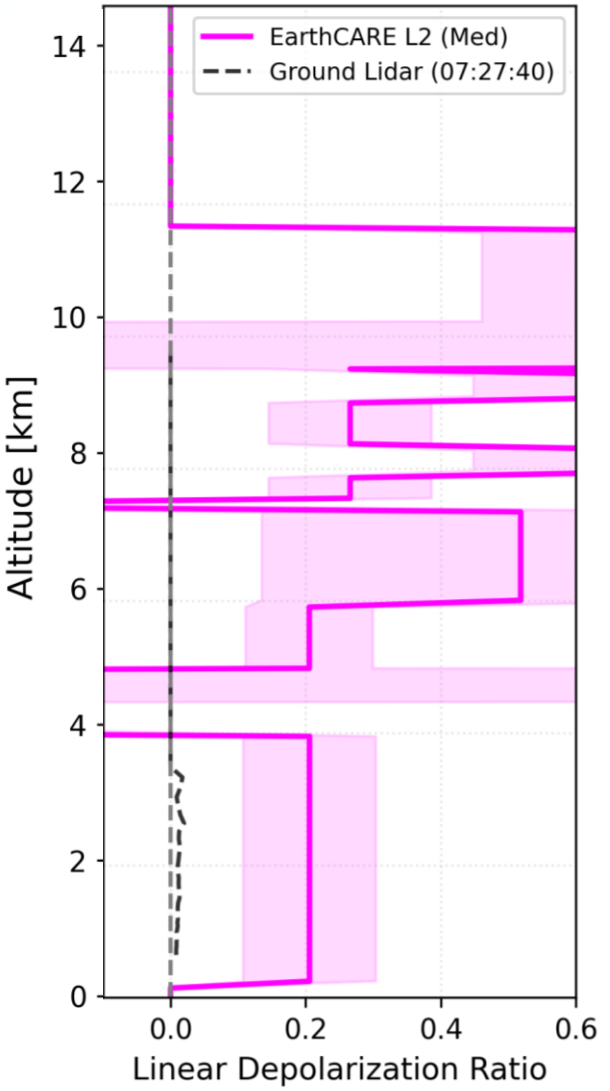






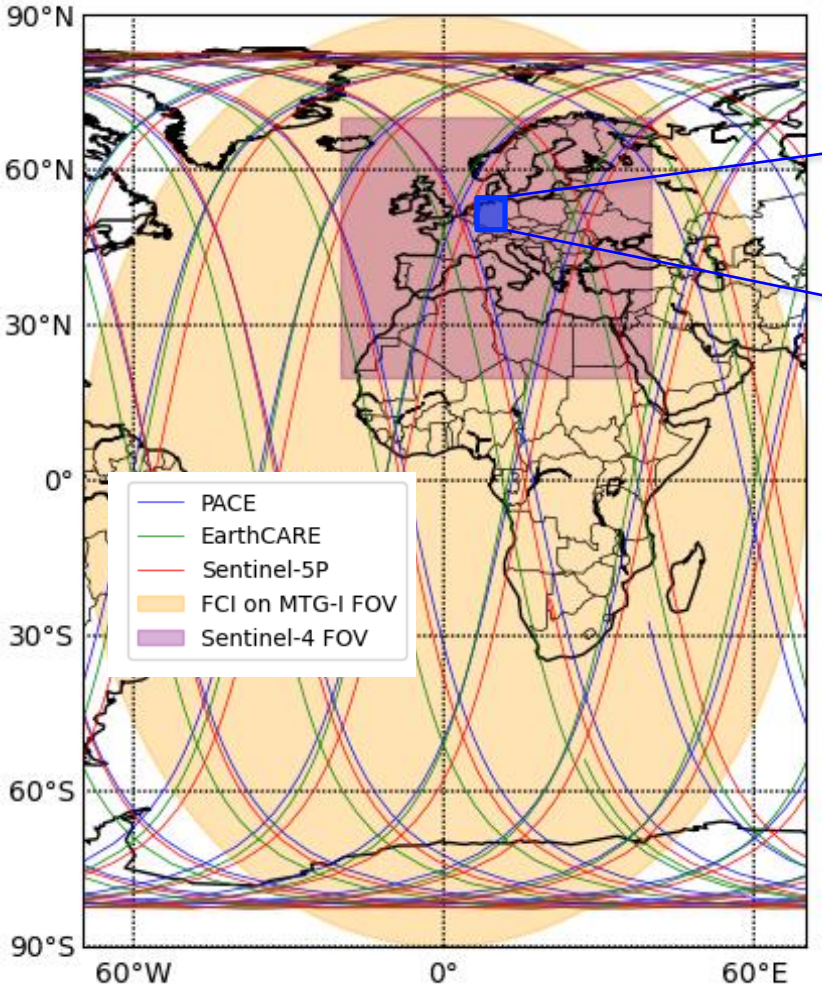


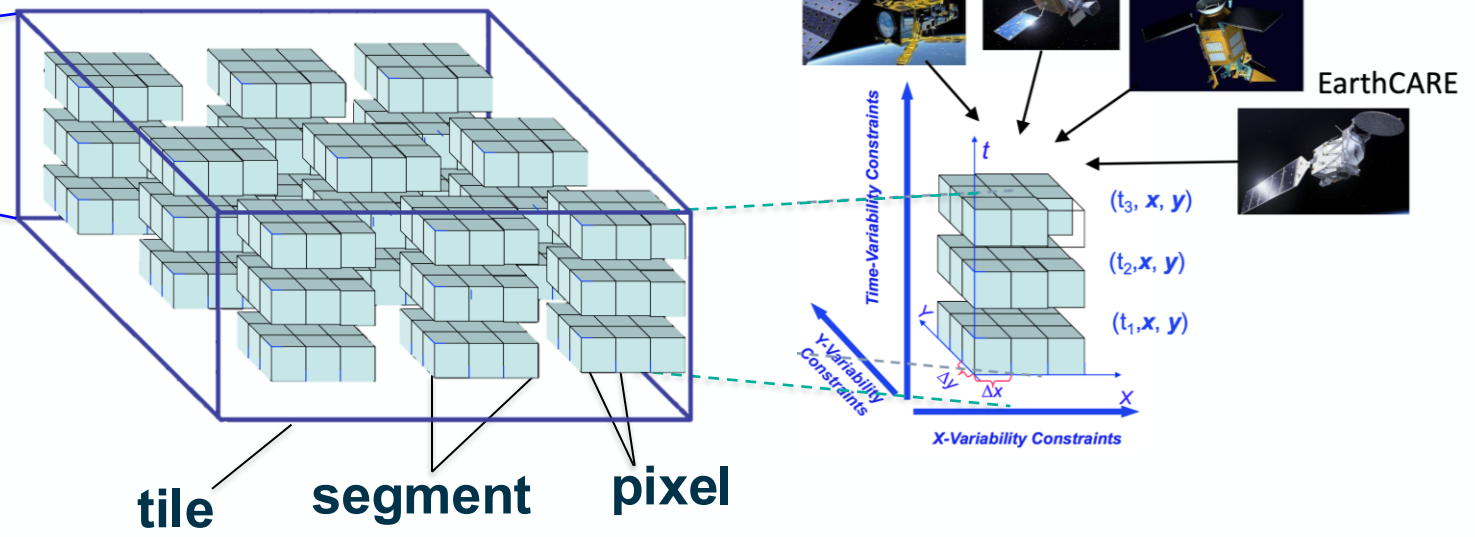




GLADIS non-coincident L1 synergy

Extend AIRSENSE approach to vertical profiling to maximise ATLID/EarthCARE and passive synergy (non-coincident)





GLADIS

Time constraints to be used:

- Surface changes very slowly
- Columnar aerosol type changes moderately in time
- Aerosol vertical distribution changes in time are limited

Conclusions

- New L1 ATLID synergy products are being developed
- Synergy of next-gen Lidars, MAP and GEO observations
- Temporally resolved retrieval of aerosol vertical structure is anticipated in the frame of nearest future
- Thorough validations and inter-comparison with existing EarthCARE products are ongoing
- Expected improvement from recent baselines (ATLID: BA->CA, HARP-2: V3->V4)
- New non-spherical models are tested
- Close interaction with ACI-oriented projects such as ESA AIRSENSE and EC CleanCloud and CERTAINTY