Introduction of stratospheric aerosol components in HETEAC

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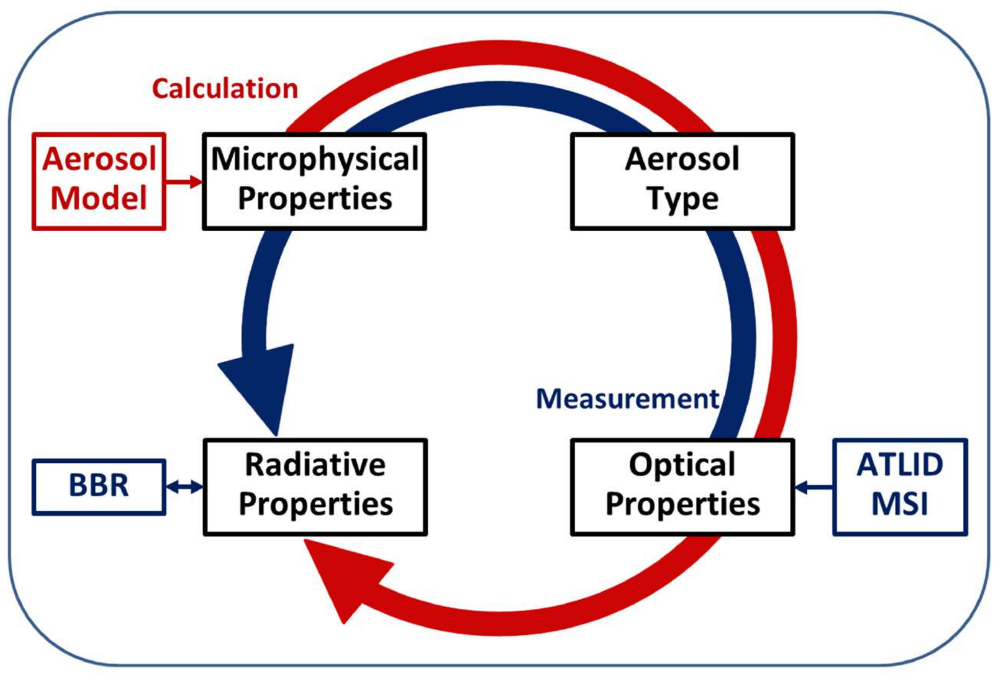
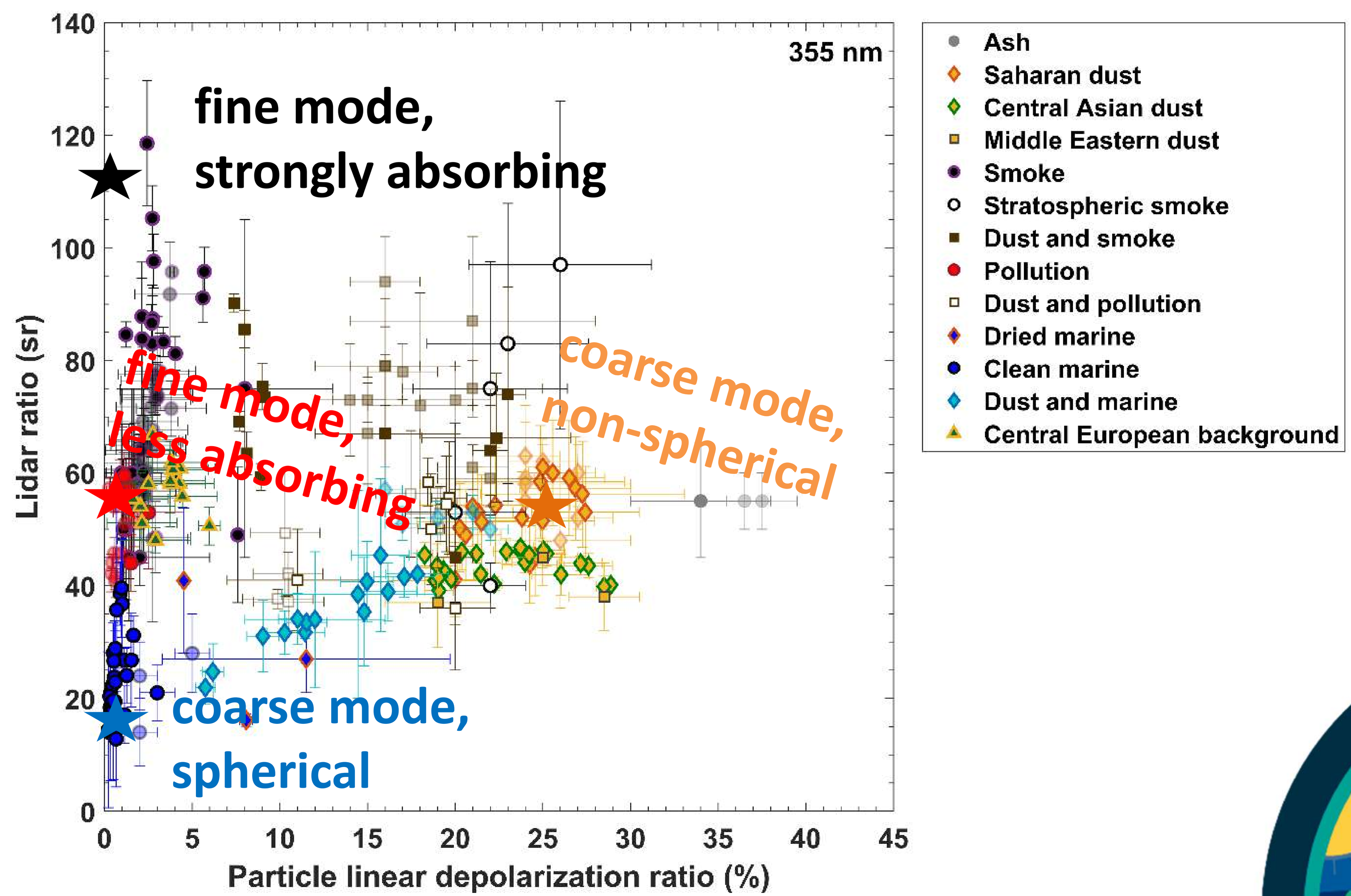
Hybrid-End-To-End Aerosol Classification model [1]



1. Proper aerosol classification based on the ATLID observations

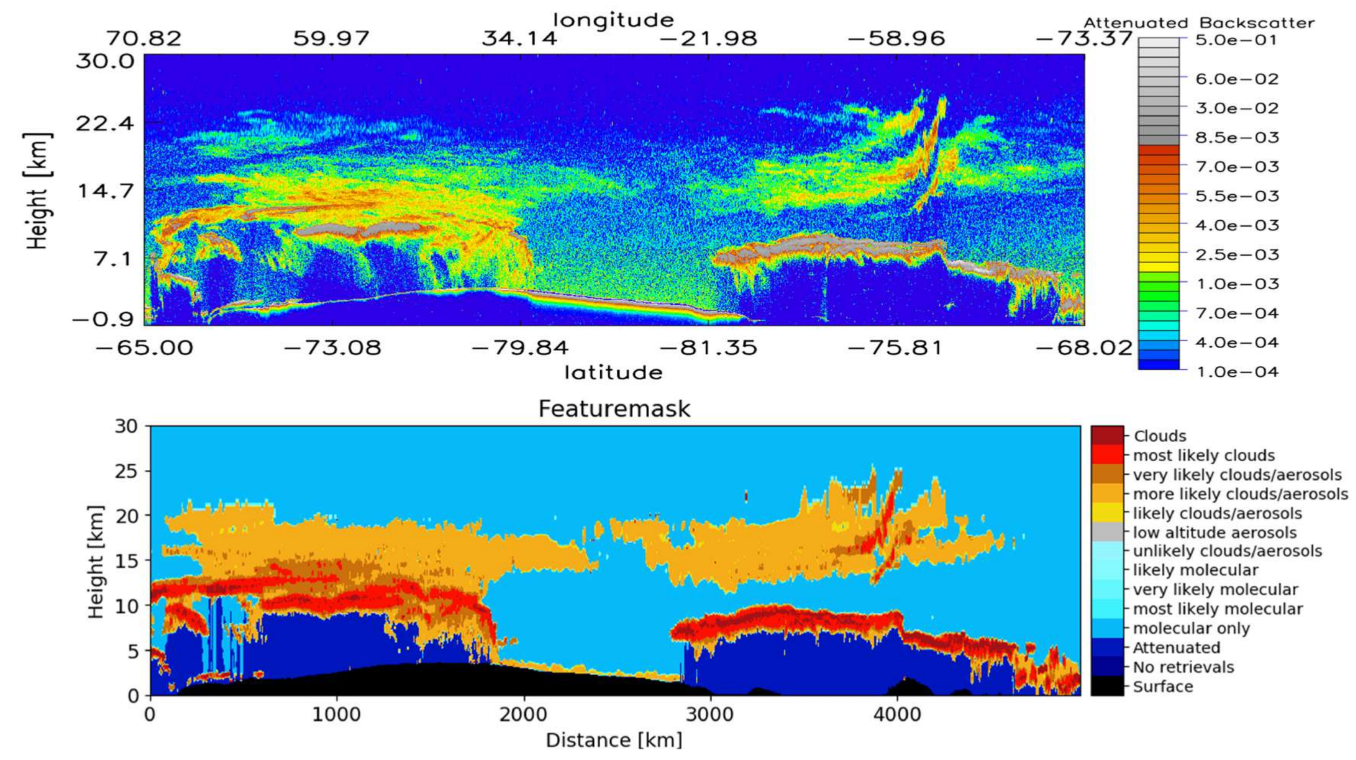
2. Connects microphysical, optical, and radiative properties of predefined aerosol types, to derive the input parameters for radiative transfer calculations

- Four aerosol components in agreement with DeLiAn [2]



HETEAC 2.0

ATLID L2a processing chain focussed on the troposphere with respect to targets and smoothing strategies
Improve the processing of stratospheric aerosol and clouds



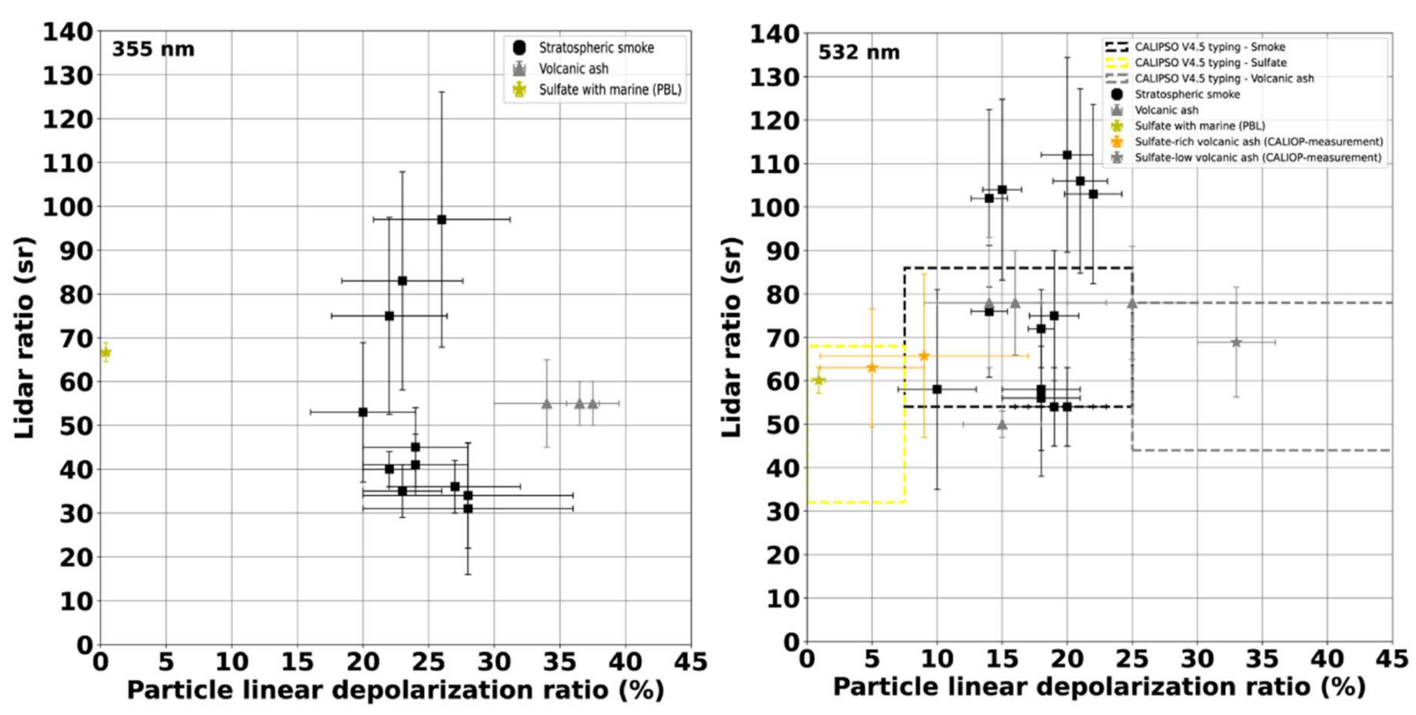
Requirements: Same as HETEAC (**baseline** for algorithm development/ **microphysical, optical, and radiative** properties **consistent** with observations/ **consistency** of ATLID, MSI and BBR L2a and L2b **aerosol products**) + consistent with the **CALIPSO** version 4.5 stratospheric aerosol subtyping algorithm [3]

4 features to be considered in HETEAC 2.0:

- Sulfates
- Volcanic ash
- Smoke
- Polar stratospheric clouds

→ consistent with A-TC product

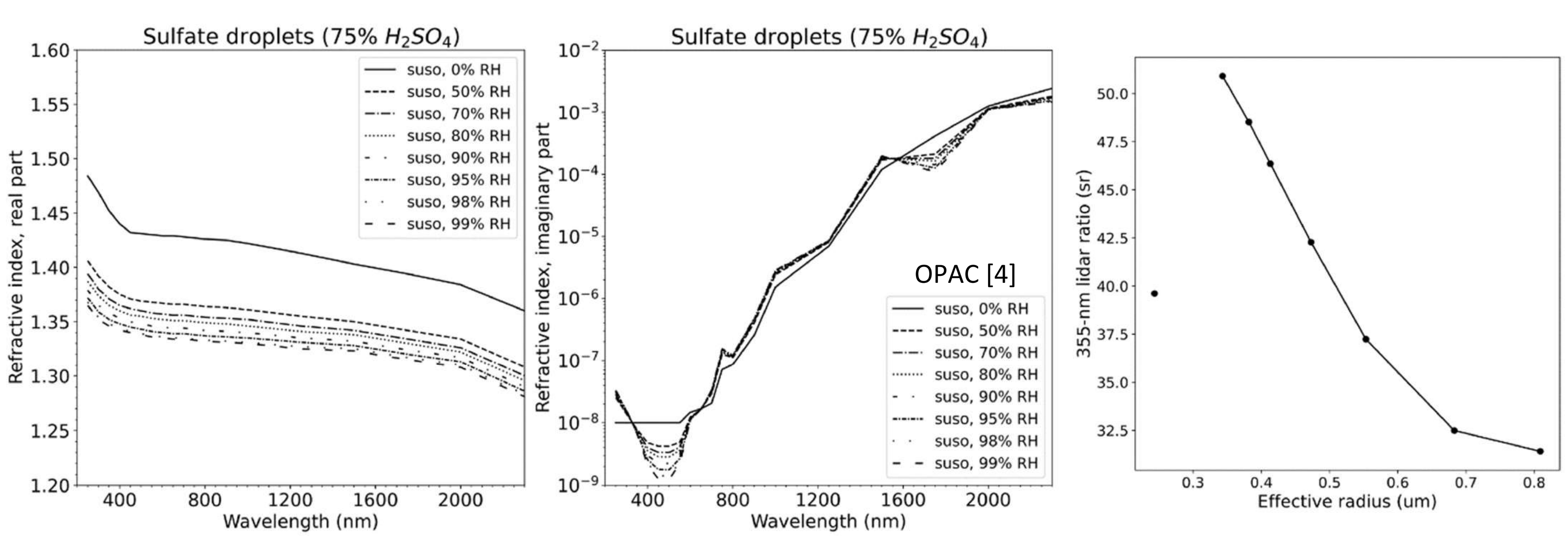
Stratospheric aerosol types

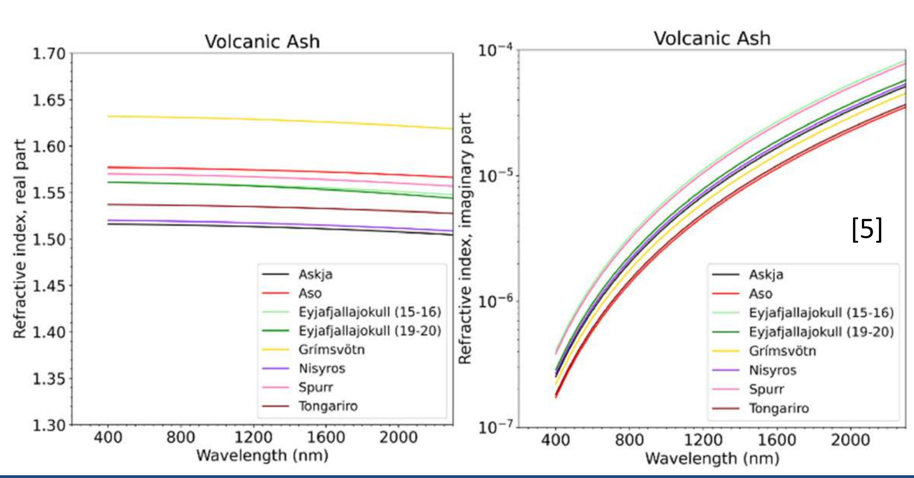


Limited information, especially at 355 nm

Sulfates

(75% H_2SO_4 and 25% H_2O)

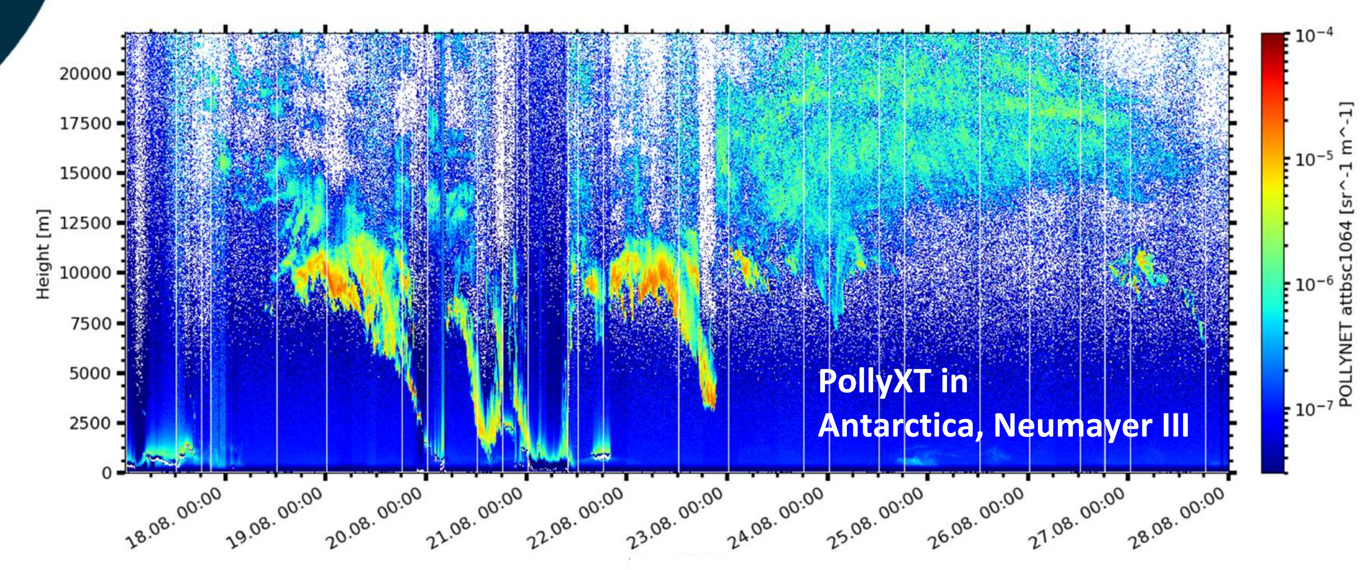


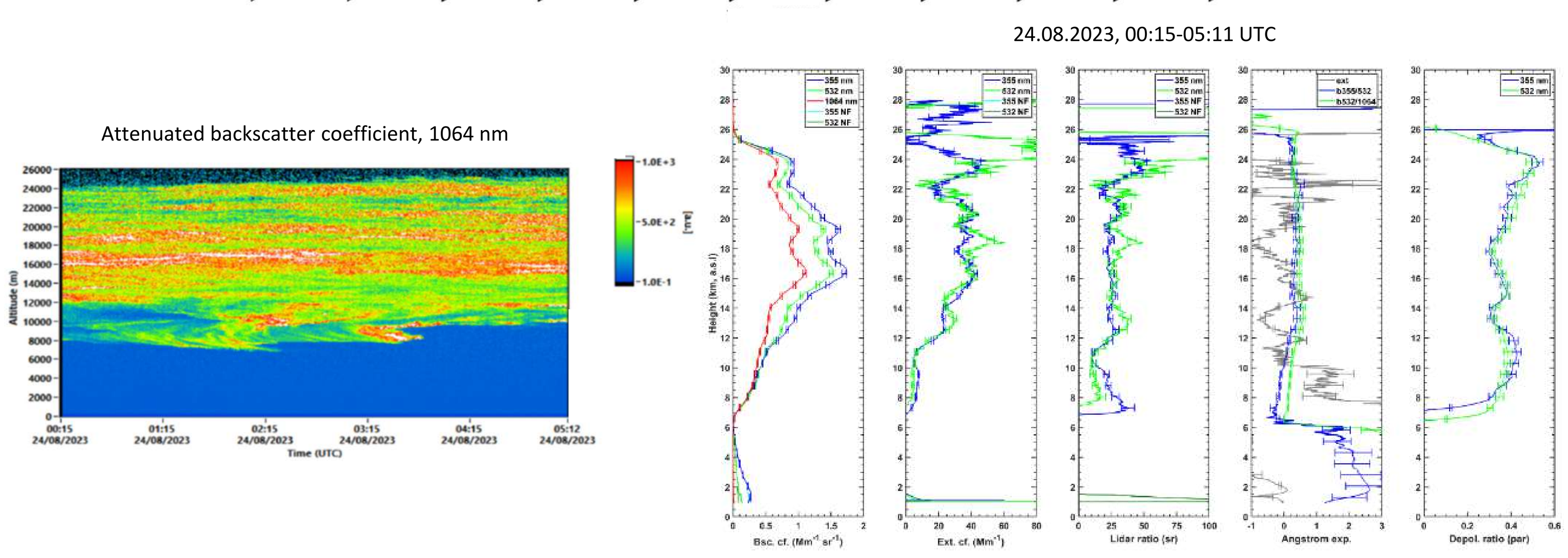


Volcanic Ash

- Challenging to model, due to the unique mineralogy in every eruption

Polar stratospheric clouds and aerosol





Differentiation between Ia, Ib and II PSCs [6]

Type	Composition	m_R	m_I	Shape
Ia	Nitric acid trihydrate (NAT)	1.50	0	Spheroidal (oblates, 1.2)
Ib	Supercooled ternary solution (STS)	1.43	0	Spherical
II	Ice crystals	1.308	0	Spheroidal (oblates, 1.2)

Smoke

- Sources: high-intensity wildfires via pyrocumulonimbus convection
- Significantly different than tropospheric smoke- high depolarization ratios
- Non-spherical soot particles, complex coating

References:
[1] Wandinger, U., et al., (2023), HETEAC – the Hybrid End-To-End Aerosol Classification model for EarthCARE, Atmos. Meas. Tech.
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[6] Pitts, M. C., et al., (2009), CALIPSO polar stratospheric cloud observations: second-generation detection algorithm and composition discrimination, Atmos. Chem. Phys.

ESA-JAXA Pre-Launch EarthCARE Science and Validation Workshop
13-17 November 2023 |ESA-ESRIN |Frascati (Rome), Italy