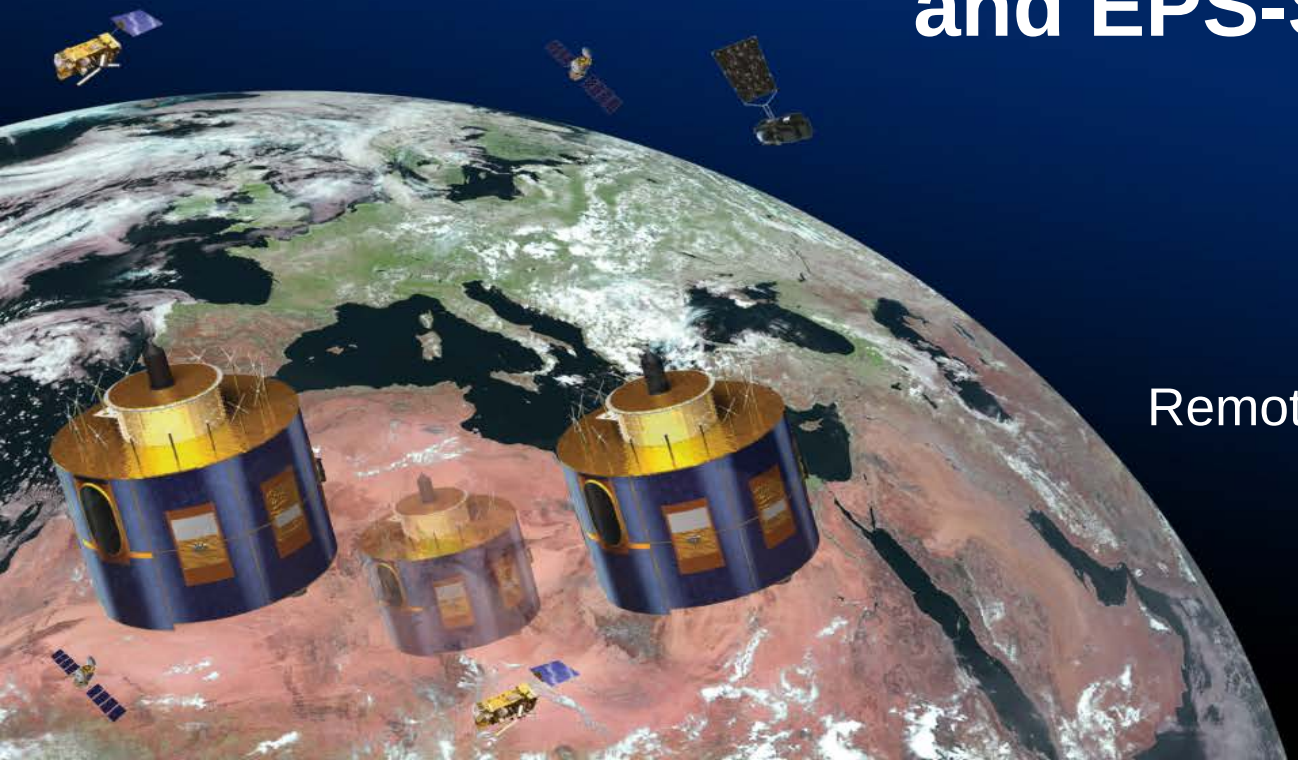
Aerosol Information from the 3MI polarimeter and EPS-SG sensors



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for the Cloud & Aerosol Team

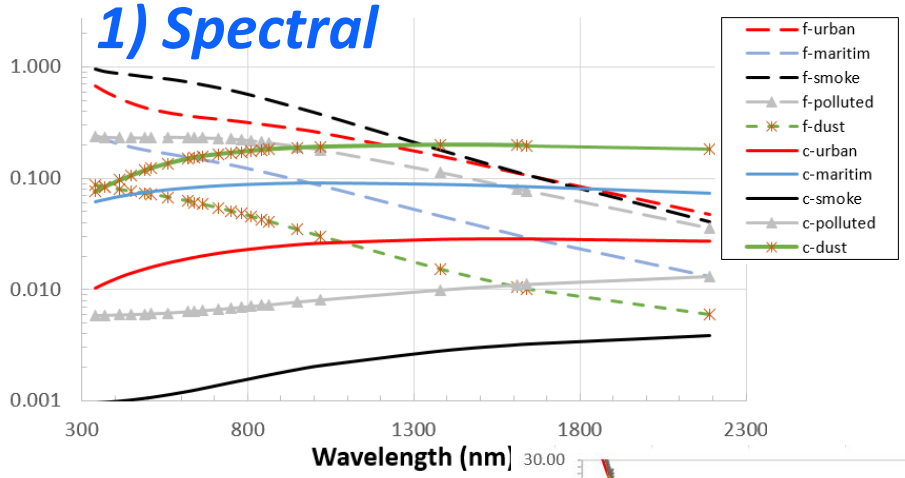
Remote Sensing & Products Division

EUM/RSP/VWG/19/1049991, v1 Draft, 15 January 2019

The challenge ?

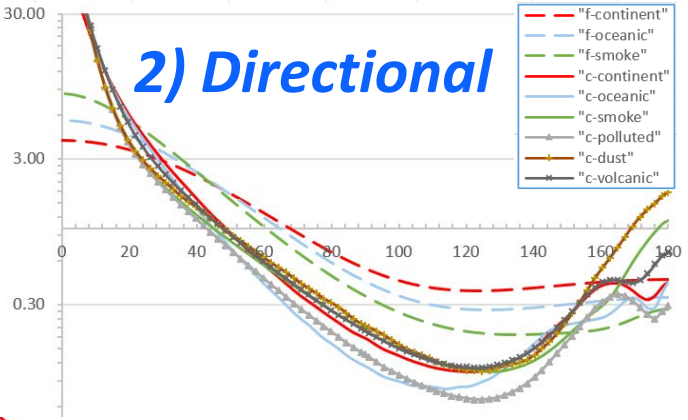
The aerosol optical properties

1) Spectral



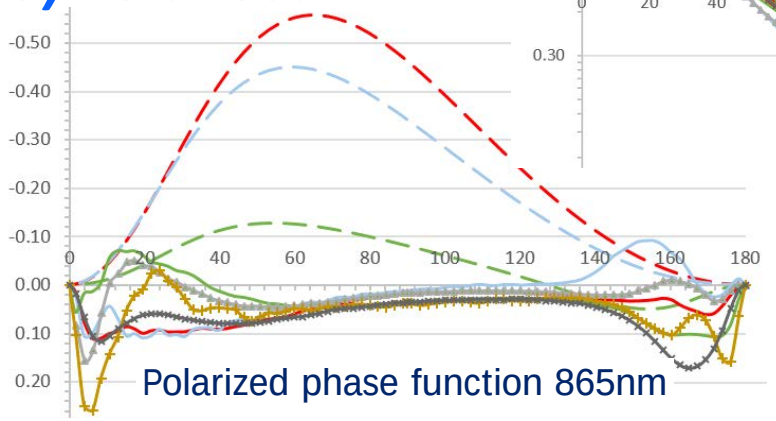
Spectral phase function at 140°

2) Directional



Phase function 865nm

3) Polarised



Polarized phase function 865nm

The measurement

→ **all signatures are mixed in the observed signal**

At first order :

$$R_{aerosol}(\lambda, view)$$

$$\omega_o(\lambda).\tau(\lambda)\,.P_{aerosol}(\lambda, view)$$

Challenge = disentangle the contributors to retrieve aerosol parameters

→ **The larger information content, the better… but not only !**

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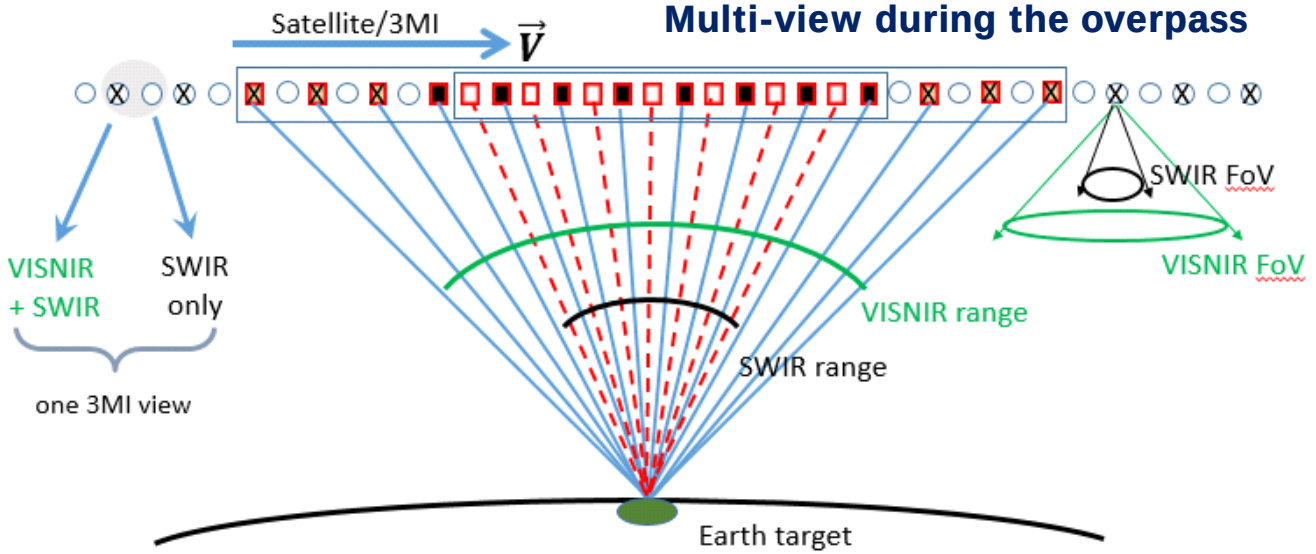
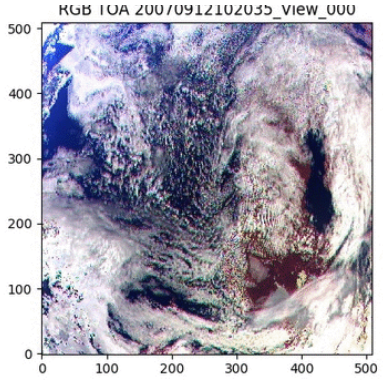
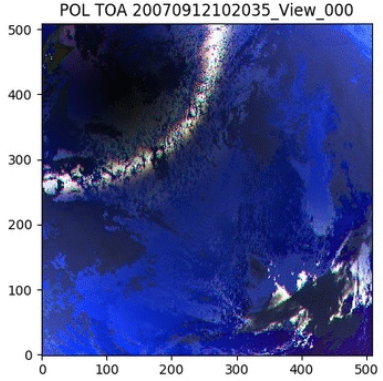
3MI on an nutshell

- The instrument relies on a very simple concept **(see Fougnie et al., 2018 in JQSRT APOLO'17)**
  - 2 wide field-of-view optics (VISNIR + SWIR)
  - 2D detectors at focal planes (CCD for VISNIR, and CMOS for SWIR)
  - 1 filter wheel inc. polarizer (12 bands from 410 to 2130nm with I/Q/U)



Natural light





Polarized light

- GRASP was adopted for an optimal simultaneous retrieval of the surface and aerosol (configuration for operational processing, and optimisation of the performance for the aerosol retrieval)

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EUMETSAT Polar System - Second Generation

Metop-like orbit 9:30
Launch Nov-2023
25 years of operation

AIRBUS DEFENCE & SPACE

Metop-SG A

3MI:
Multi-viewing,
-channel,
-polarisation Imager

RO:
Radio Occultation

MWS: Microwave Sounder

Sentinel-5: UV-VIS-NIR-SWIR Sounder

METimage: Visible-Infrared Imager

IASI-NG: Infrared Atmospheric Sounding Interferometer – New Generation

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Aerosol characterization from EPS-SG sensors

- Incredible information content provided by one single EPS-SG platform

Complementarity of EPS-SG sensors

Sensor	Spatial resolution	Swath	Spectral type	Spectral bands	Spectral range	Additional capabilities
3MI	4x4 km²	2200 x 2200 km²	VIS/NIR/SWIR	12 bands	410 to 2130nm	14 views Polarisation (I/Q/U)
METimage	0.5x0.5 km²	2670 km	VIS/NIR/SWIR TIR	11 bands 9 bands	443 to 2250nm 3.3 to 13.3µm	
S5-UVN	7.5x7.5 km² 50x50 km² (<300nm)	2670 km	UV/VIS/NIR/SWIR	1669 bands (0.25nm in SWIR to 1nm in UV)	270-300nm 300-370-500nm 685-710nm 755-773nm 1590-1675nm 2305-2385nm	
IASI-NG	12km spot	2000 km	TIR	16921 bands (0.25cm-1)	645 to 2760cm-1	

Characterisation		3MI	METimage	S5-UVN	IASI-NG
Cloud identification	CM	X	O		
Cloud decontamination			O		
Ash/Dust detection		X	O		O
Aerosol height	ALH	O	X	O	
Aerosol over clouds		O	X		O
Aerosol model		O	X	X	
Aerosol fine fraction	FMF	O			
Aerosol Optical Depth	AOD	O	X	X	
Aerosol absorption	AAI/SSA	O		O	

Synergistic use for a better aerosol characterization