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

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The challenge?

The aerosol optical properties

1) Spectral

2) Directional

3) Polarised

The measurement

→ all signatures are mixed in the observed signal

At first order:

\[ R_{aerosol}(\lambda, \text{view}) \]

\[ \omega_o(\lambda) \cdot \tau(\lambda) \cdot P_{aerosol}(\lambda, \text{view}) \]

Challenge = disentangle the contributors to retrieve aerosol parameters

→ The larger information content, the better... but not only!
3MI on an nutshell

- The instrument relies on a very simple concept
  - 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)

(see Fougnie et al., 2018 in JQSRT APOLO’17)

Multi-view during the overpass

- 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)
EUMETSAT Polar System - Second Generation

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

- **METimage**: Visible-Infrared Imager
- **Sentinel-5**: UV-VIS-NIR-SWIR Sounder
- **RO**: Radio Occultation
- **IASI-NG**: Infrared Atmospheric Sounding Interferometer – New Generation
- **MWS**: Microwave Sounder
- **3MI**: Multi-viewing, -channel, -polarisation Imager
- **Metop-SG A**: Metop-like orbit 9:30
  - Launch Nov-2023
  - 25 years of operation
# Aerosol characterization from EPS-SG sensors

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

## Complementarity of EPS-SG sensors

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

### Characterisation

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

**Synergistic use for a better aerosol characterization**