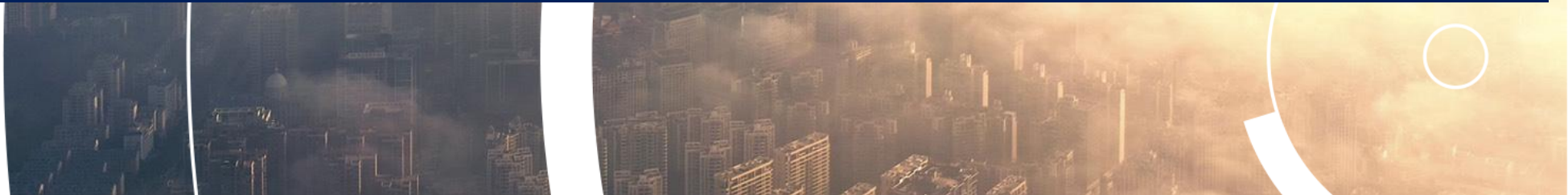


Fire and Smoke related Activities in EUMETSAT

Focus on the observation & characterisation of smoke

Bertrand Fougnie
for the *Cloud & Aerosol group (CLA)*
and the *Remote Sensing & Products division (RSP)*

EUMETSAT
3rd June 2026



- Operational products
 - Dissemination to operational users, Near Real Time delivery (<3:00h from sensing time), Robustness (availability), Documented performance (validation report), Stability of the performance, Monitoring of the performance, Continuous improvements, Product tailored to user needs
- Observation of Fires
 - **SLSTR NRT FRP** (S3-NGO under definition) [Sentinel-3]
 - **FCI FRP** [MTG]
 - VII FRP [EPS-SG]
- Observation of Smoke
 - **PMAp NRT AOD** (Synergy) [EPS]
 - **SLSTR NRT AOD** (Synergy & S3-NGO under development) [Sentinel-3]
 - **3MI Aerosol Characterisation** (Synergy under development) [EPS-SG]
 - FCI AOD [MTG]

- Detection and Power
 - Operational with Sentinel-3/SLSTR and MTG/FCI (EPS-SG coming)



1-km [SLSTR](#) FRP [MW]
RGB Composite from [OLCI](#)

FCI 0.5km True Color & Fire Temperature (3.8 & 2.2 μ m)
16.09.2024 00:00 – 18.09.2024 18:00
Note: simple fire mask applied – may miss smaller fire and contain artefacts.

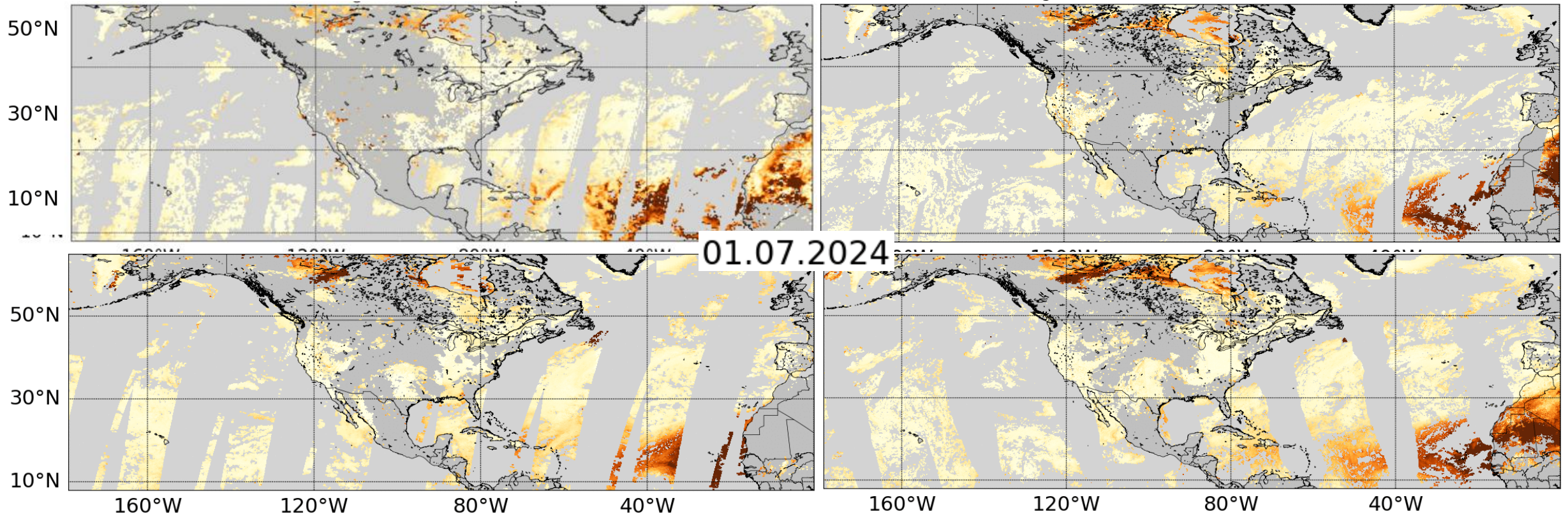
Demonstrating FCI's capabilities
Sept. 2024 Portugal Fires
[Preliminary results](#)

2024-09-16
00:00 UTC

North-America wildfires

Metop B+C
PMAP V2.2.6

Sentinel-3 A+B
Coll 3.1 – OSSAR-CS3



MODIS Terra
NASA Merged Dark Target / Deep Blue

VIIRS NOAA-20
NASA Deep Blue

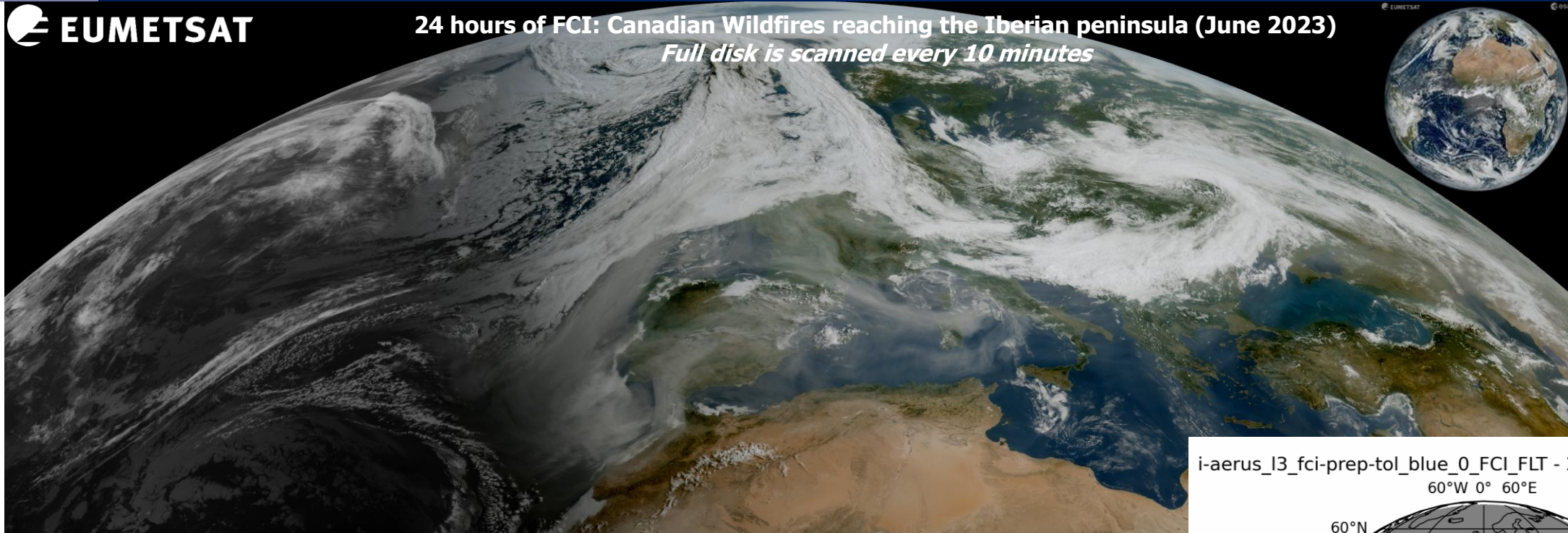
Aerosol Optical Depth (550 nm)



Monitoring of Smoke with MTG/FCI

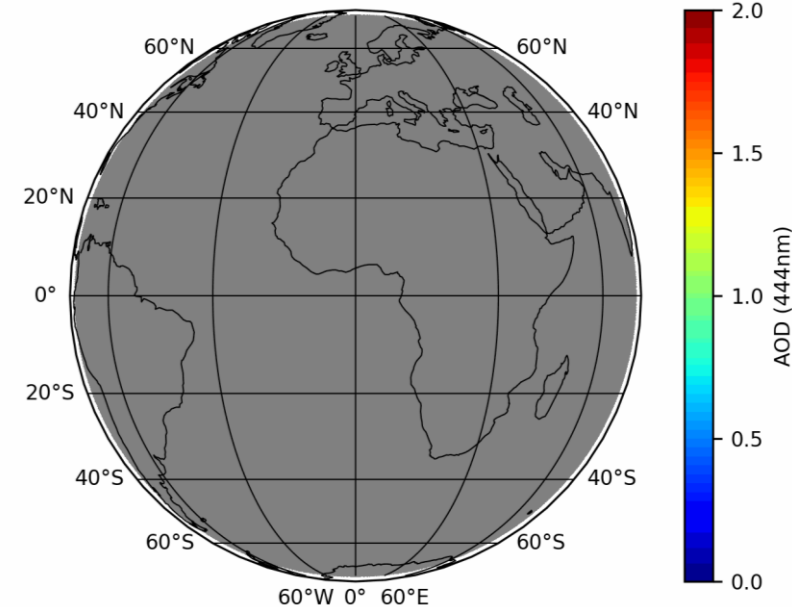
 EUMETSAT

24 hours of FCI: Canadian Wildfires reaching the Iberian peninsula (June 2023)
Full disk is scanned every 10 minutes

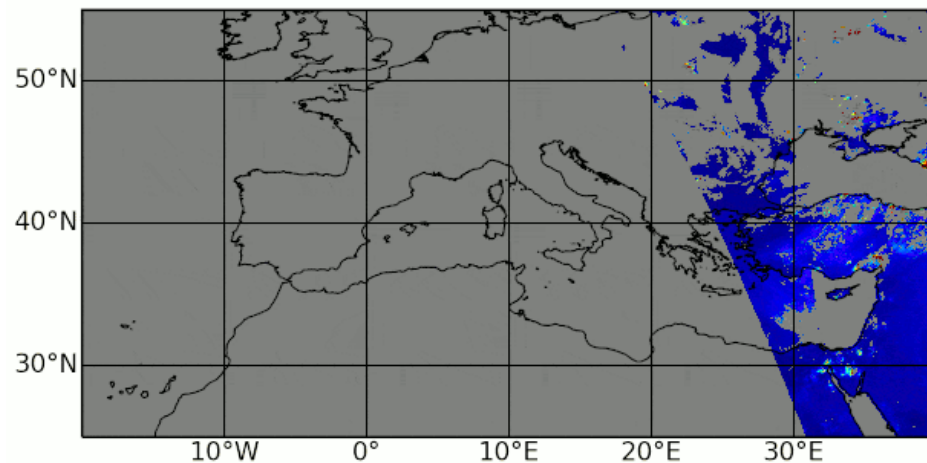


i-aerus_l3_fci-prep-tol_blue_0_FCI_FLT - 2025-04-25T03-00-00

60°W 0° 60°E



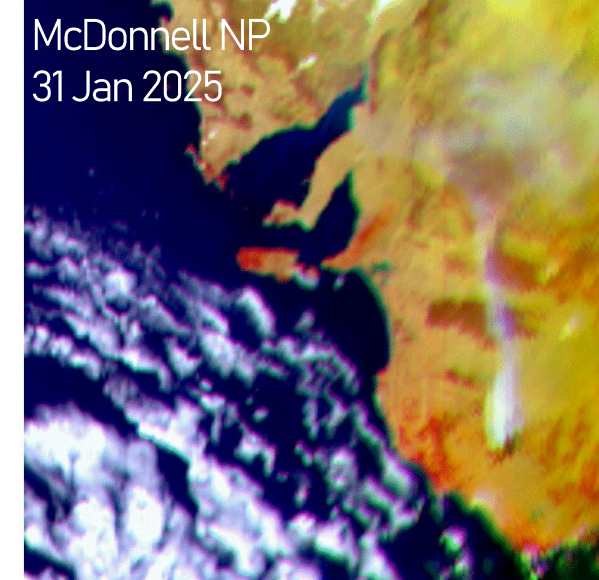
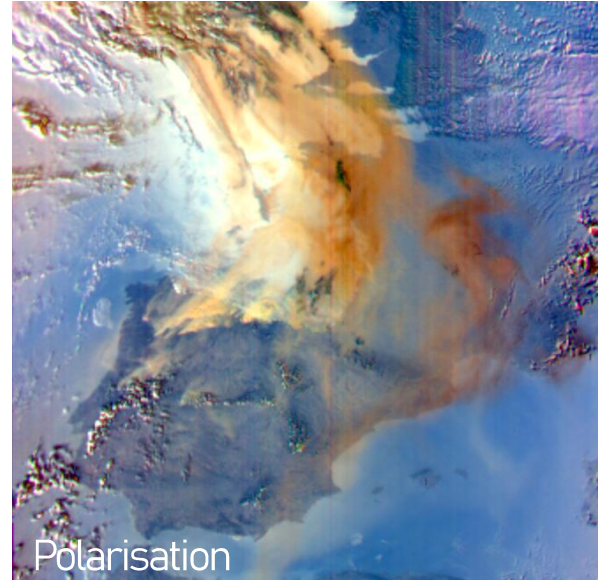
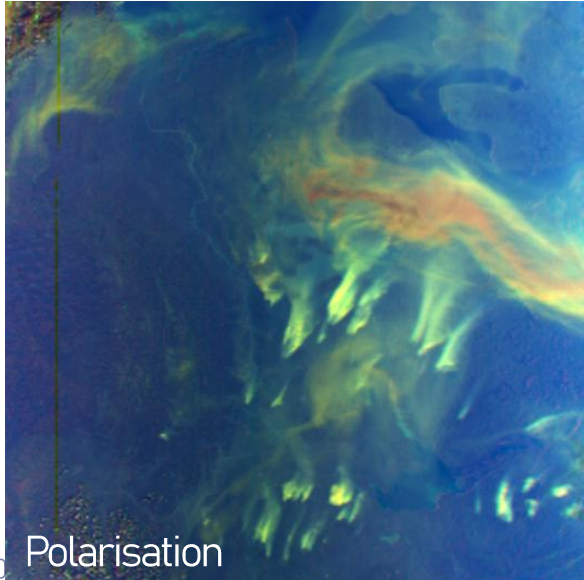
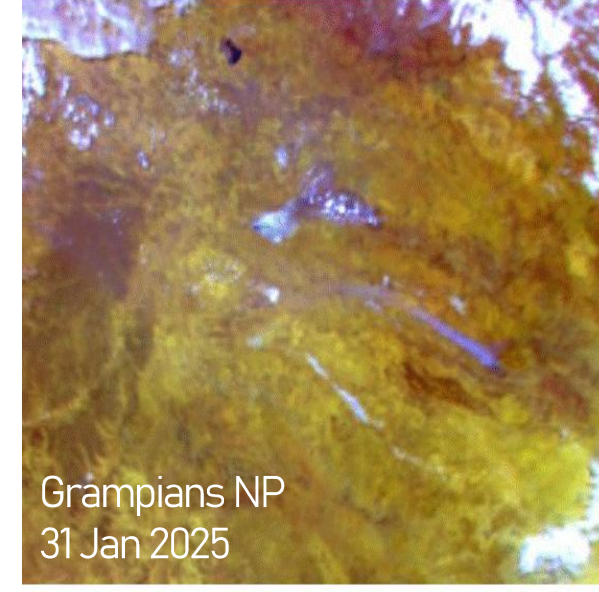
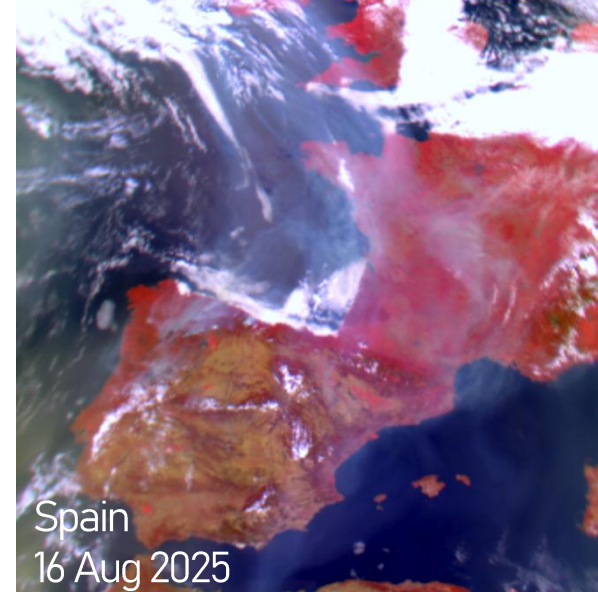
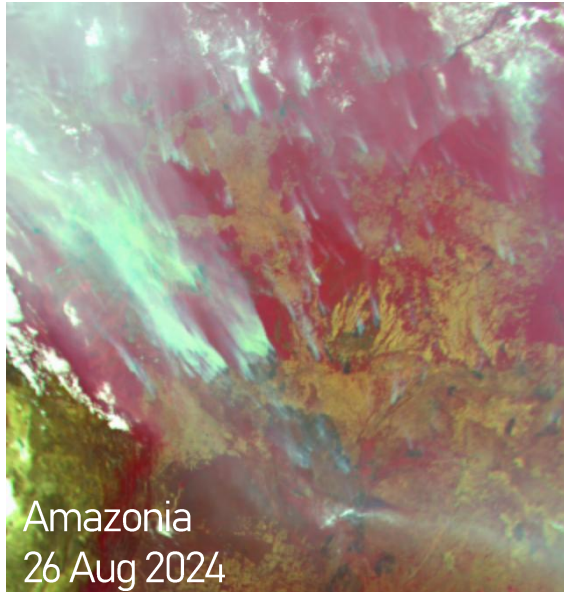
iAERUSGEO_v2.0.7.2 - 2016-07-19T04-00-00





New Generation of Enhanced Aerosol Products

- Importance of the multi-angle polarisation (& spectral) for aerosol monitoring



www.eumetsat.int

From PACE/HARP2



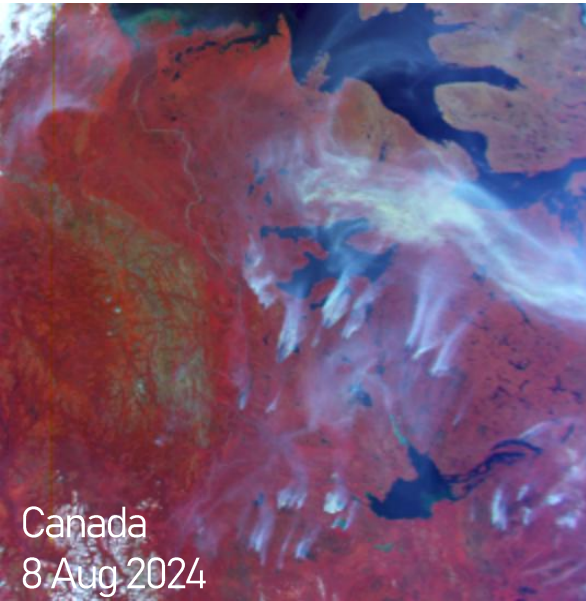
Observation & Characterisation of Smoke with Polarimetry

From PACE/HARP2

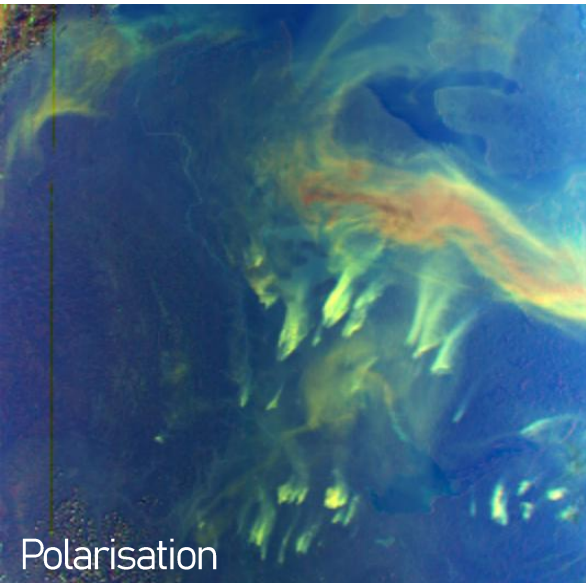
www.eumetsat.int

Multi-angular and spectral polarimetry

- Smoke → small particles → large polarisation
- Polarisation → reduced surface contribution
- Multi-view → sampling of the phase function → nature of particle



Canada
8 Aug 2024



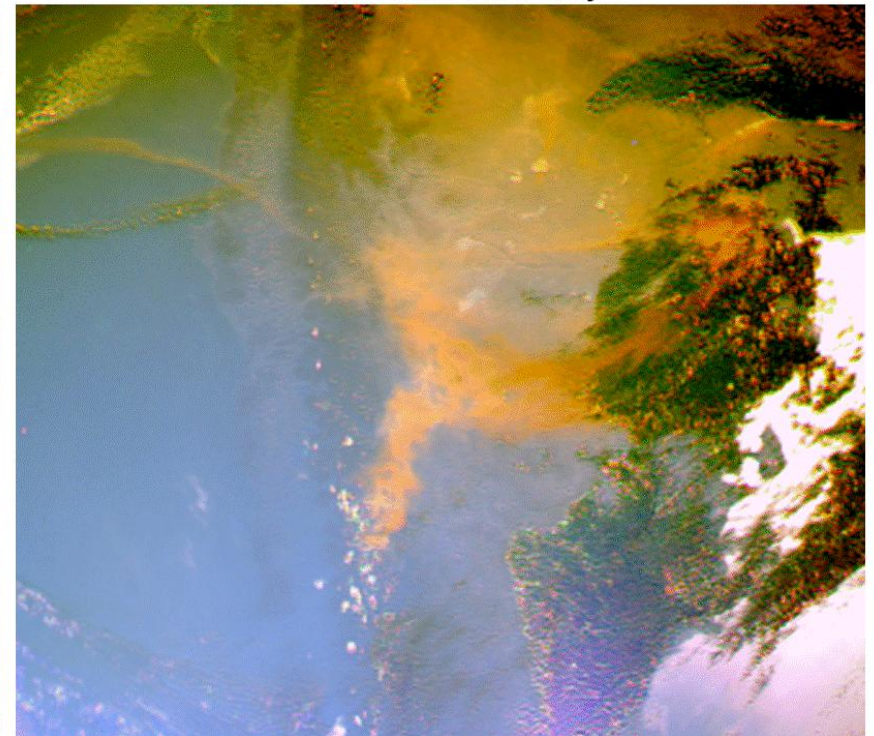
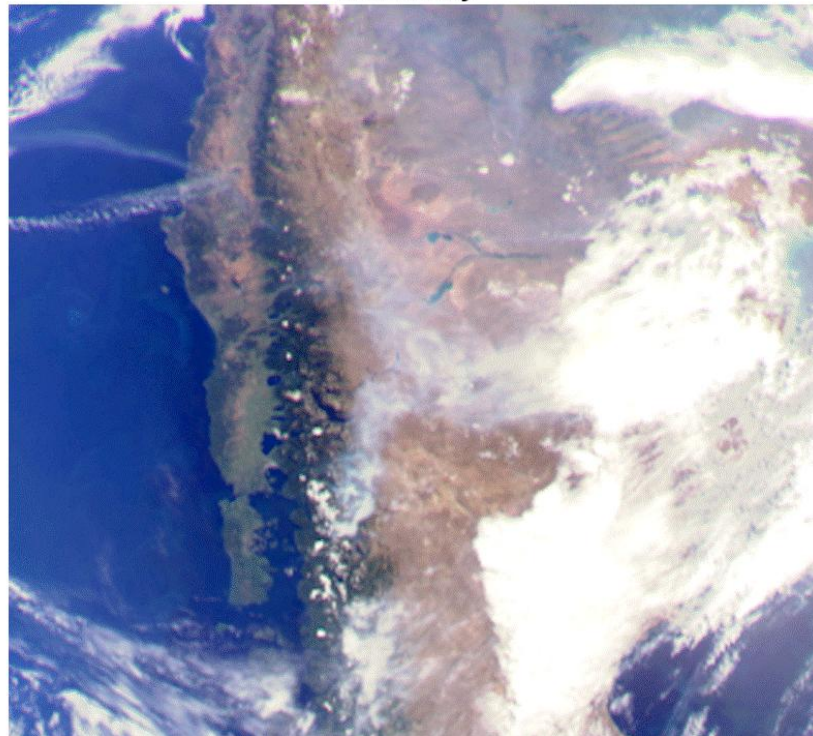
Polarisation



EPS-SG/3MI – 7th January 2026 – Wildfire El Hoyo, Patagonia, Chile

Intensity

Polarised Intensity



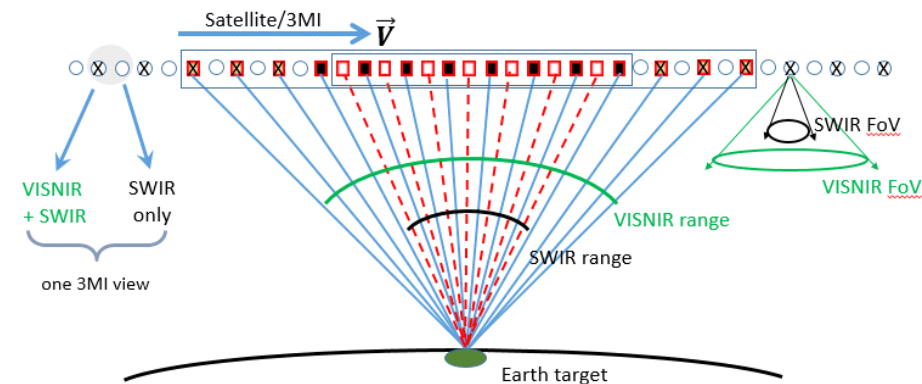
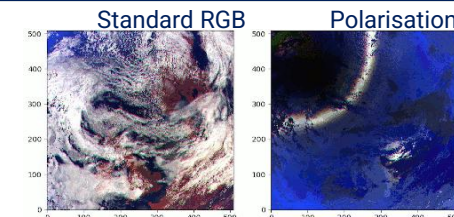


EPS-SG/3MI in a nutshell

- Multi-angle polarimeter
- Very extensive information content with spectral/directional/polarisation
 - 14 views [-50° backward / +50° forward]
 - 12 spectral bands [410 to 2130nm] for 3 polarisations [I, Q, U]
 - Potentially 420 information per pixel feeding the retrieval
 - Very large information content



Launched 12th August 2025
First image 28th August 2025

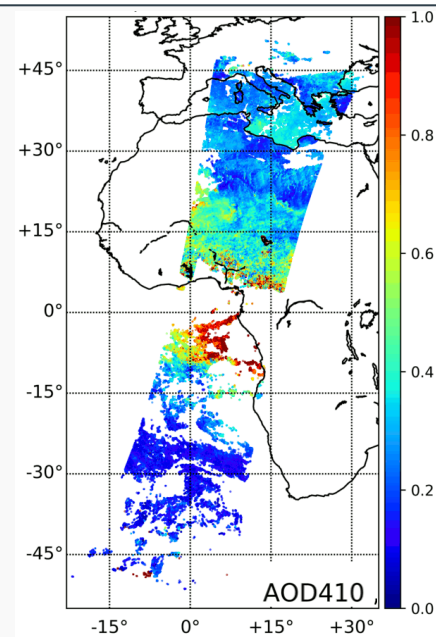


- Commissioning of Level-1 on-going
 - L1B mostly mature
 - L1C starting
 - Preoperational L1 – Sep'26
- Optimised 3MI NRT instantiation of GRASP
 - Enhanced aerosol characterisation
 - Performance tested on PARASOL 2005–2013

Retrieved
parameters
(linked to GRASP
optimisation)

&

Derived
parameters
(linked to
user needs)



AEROSOL

- Size distribution
- Fraction of chemical components
- Sphericity fraction
- Aerosol layer height
- **Spectral AOD** (fine and coarse)
- Spectral Absorbing AOD
- Angstrom Exponent
- Spectral SSA
- Spectral index of refraction

Error Estimation

Surface

- BRDF + BPDF (3 Spectral parameters)

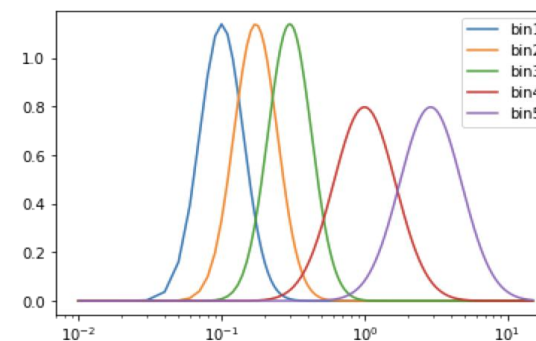


3MI L2 Aerosol Processor – New era of Product

www.eumetsat.int

- Aerosol components external mixture in **3 modes** (internal mixture by **Linear Volume Mixture**)
- **Refractive index** from **literature review** (publications 1979–2007)
- Vertical profiling is accounted with aerosol **concentration per mode** (exponential one).

	Size distribution	Volume Concentration	BC	BrC	Quartz	Iron Oxide	Water/ Sulphate	Sea salt
Fine mode	3 LN bins	✓	✓	✓	✓	✗	✓	✗
Coarse mode	2 LN bins	✓	✗	✗	✓	✓	✓	✗
Coarse mode	2 LN bins	✓	✗	✗	✗	✗	✓	✓



Size

Radius:

mode 1:

bins: 0.1, 0.1732, 0.3 μm

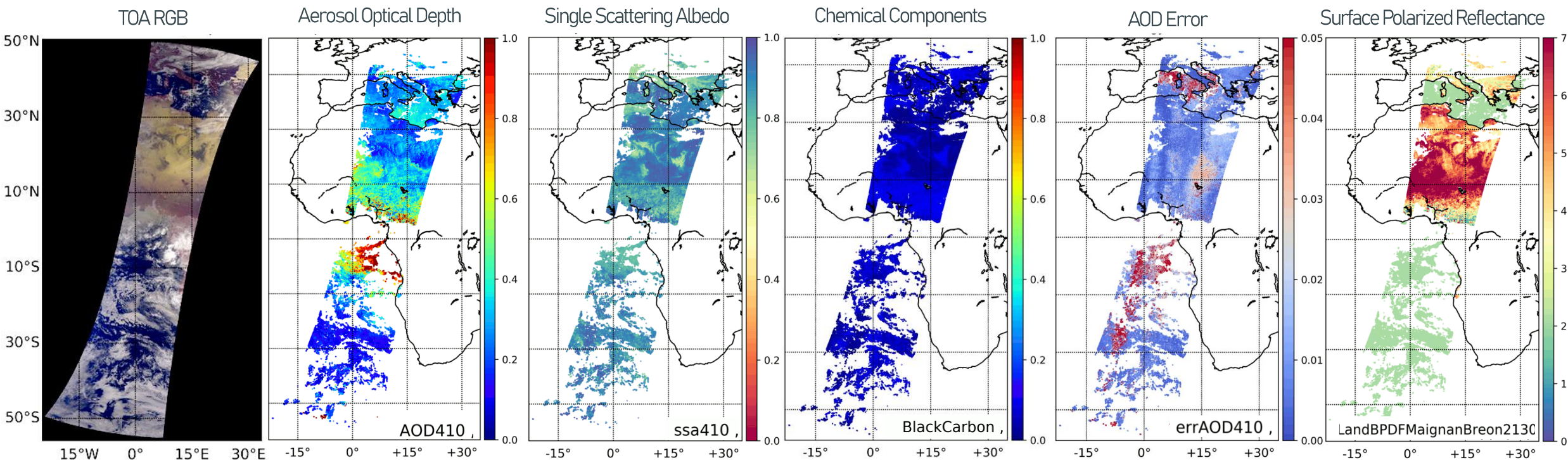
mode 2:

bins: 1, 2.9 μm

mode 3:

bins: 1, 2.9 μm

More parameters

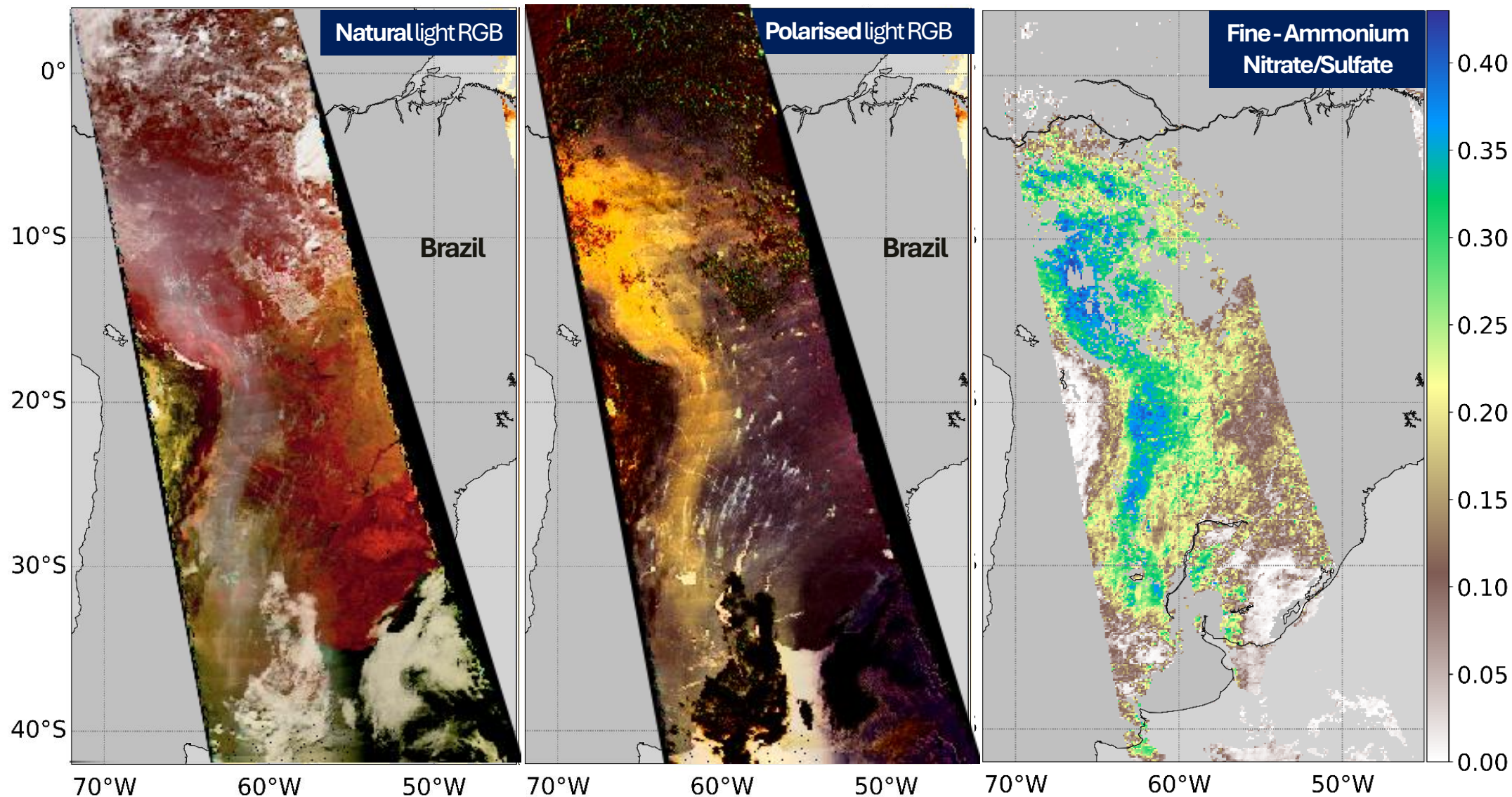




Case 1- Advanced Characterisation of a Smoke Plume

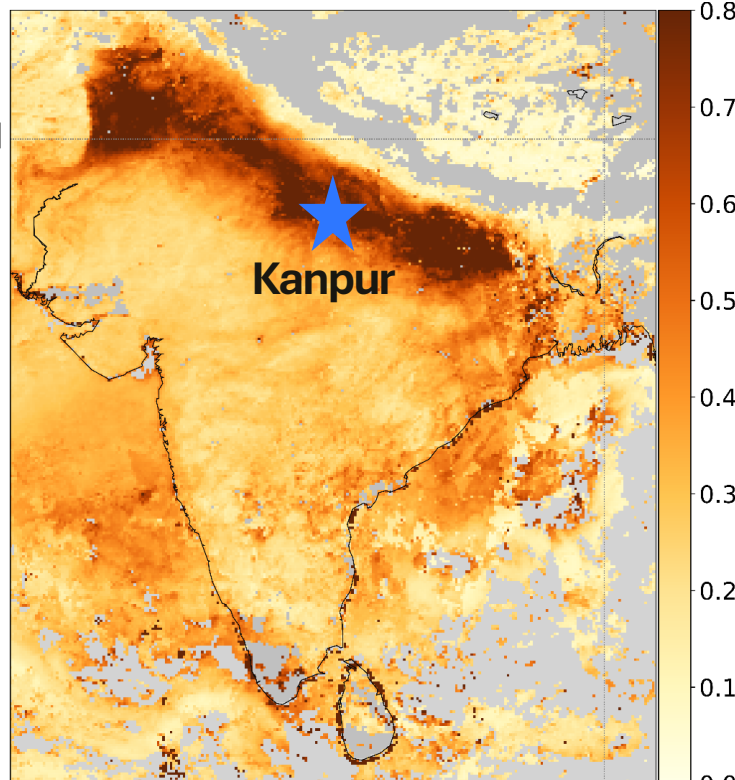
3MI processor – POLDER3 data
Argentina fires, 26 August 2008

www.eumetsat.int

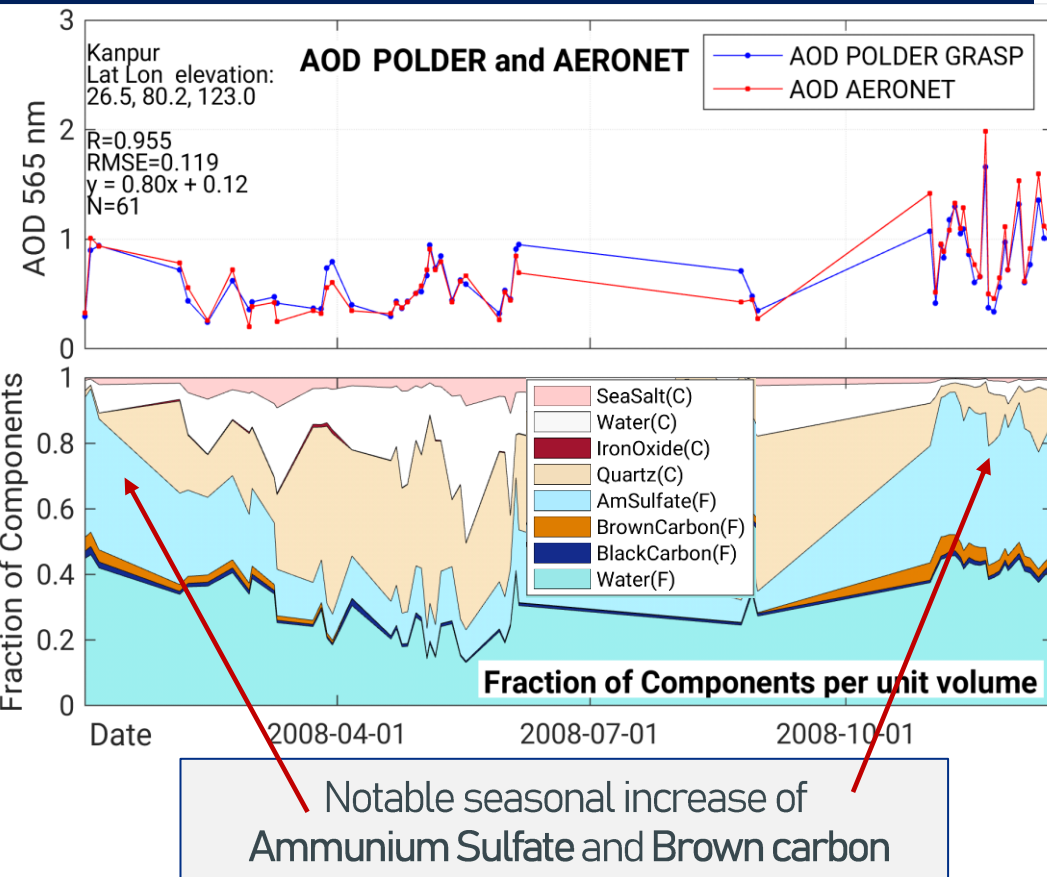
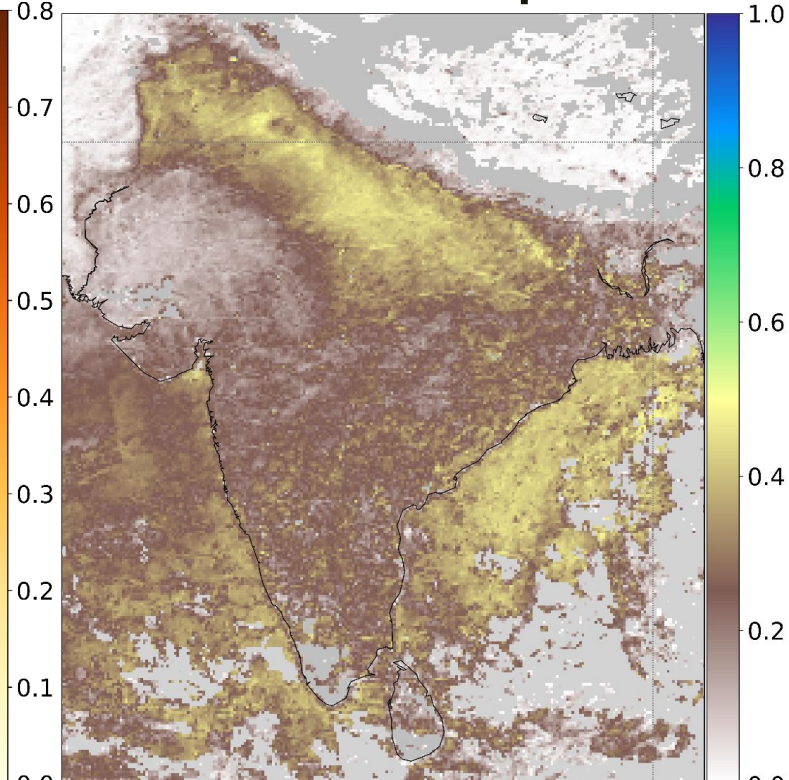


October 2008 POLDER-3

AOT 565nm



Fine Chemical Components

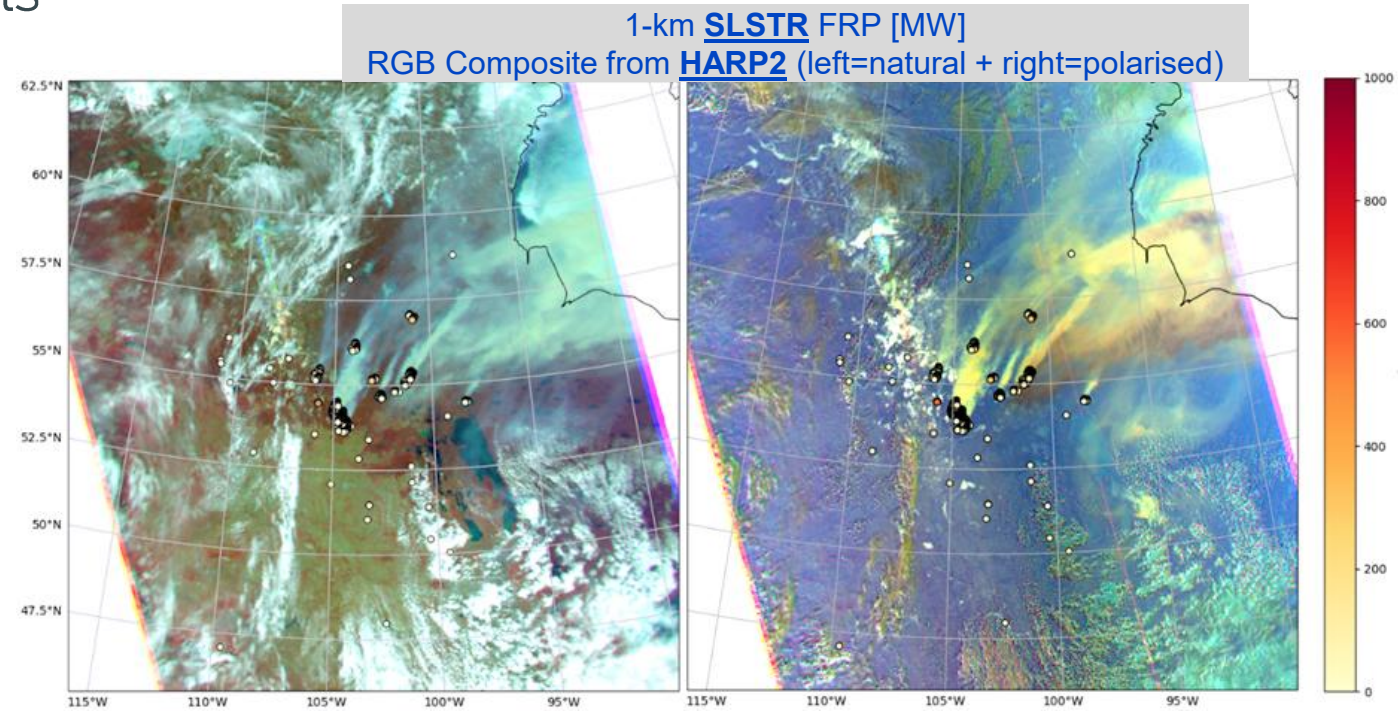


THE TIMES OF INDIA

One-third of Delhi's PM2.5 is ammonium sulfate

Right after the monsoon and through winter, ammonium sulfate makes up as much as 49% of PM2.5. In the winter, it's around 31%. So the haze isn't just dust or smoke you can see. It's also invisible chemistry where gases like sulfur dioxide (from burning coal and diesel) and ammonia (mostly from farms and fertilizers) mix in the air and turn into these tiny, harmful particles.

- Operational systems already in place for FRP and AOD
- Continuous improvement of the products, performances...
- New systems are coming
- For smoke – Major asset with multi-angle polarimetry (Game Changer)
 - Improved quantification of AOD and fine-AOD
 - Other parameters: absorption, size, altitude...
 - Characterisation of chemical components
- Complementarity of the operational systems and products





Thank you for your attention !