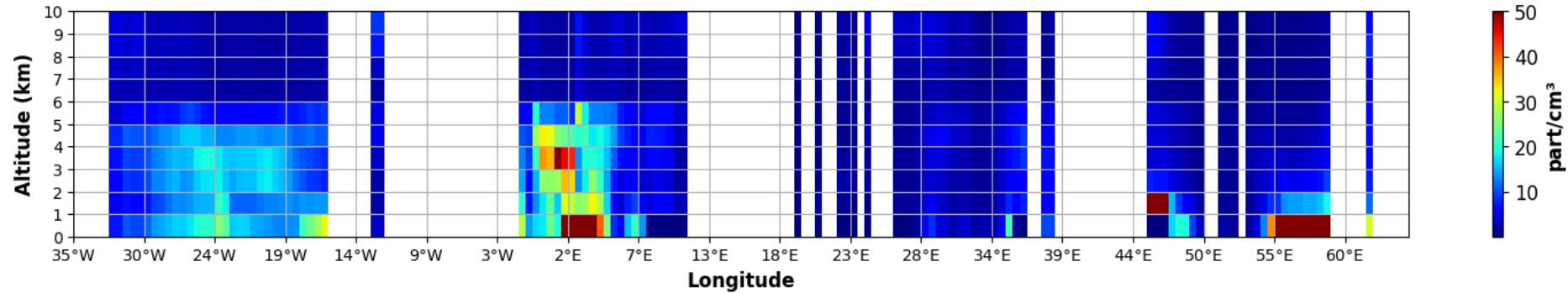
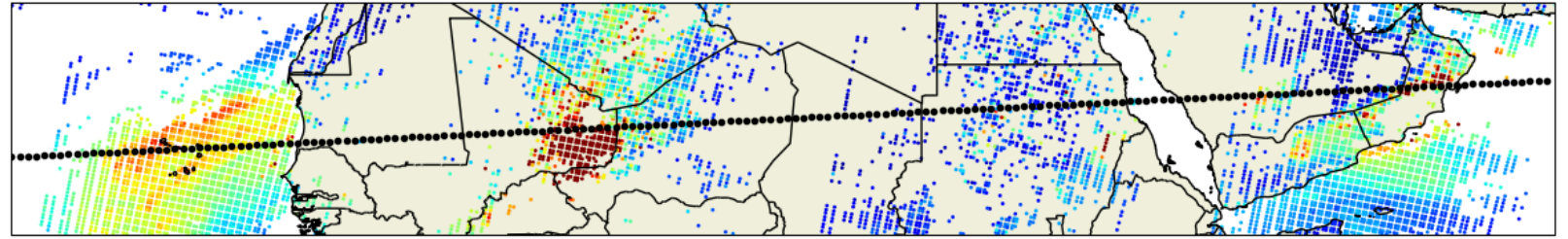




IASI MAPIR dust profiles

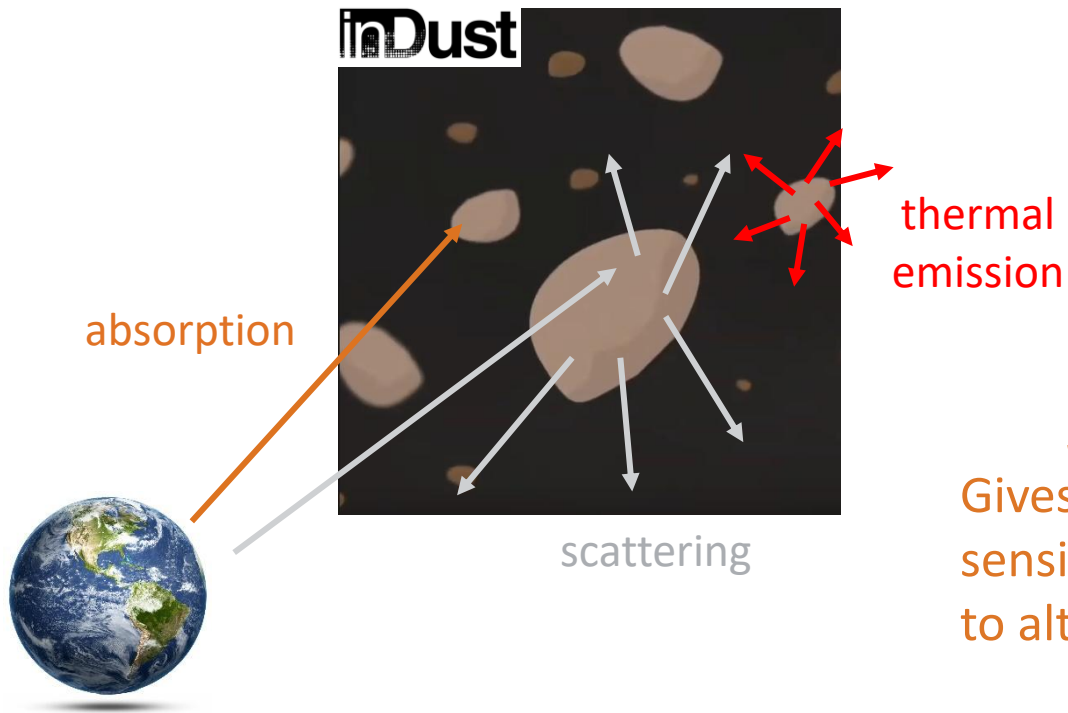
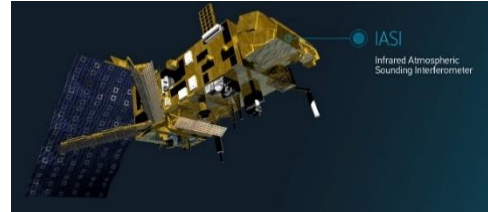


Current status, updates, thoughts ...

Sophie Vandebussche



Thermal IR specificities



Gives some sensitivity to altitude

Thermal Infrared radiative considerations

- Surface as **source**: temperature, emissivity
- Atmosphere as **source**: gases, aerosols, clouds (and their temperature)
- Atmosphere as **sink**: absorption and scattering by gases, aerosols, clouds
- No solar light needed -> day & night

Aerosol signature (in TIR)

- Absorption/emission → minerals
→ **dust and ash**
 - Scattering (little) → coarse mode (**large particles**)
- Drives the overall sensitivity
abs vs emiss -> T_{surf} vs T_{aer}



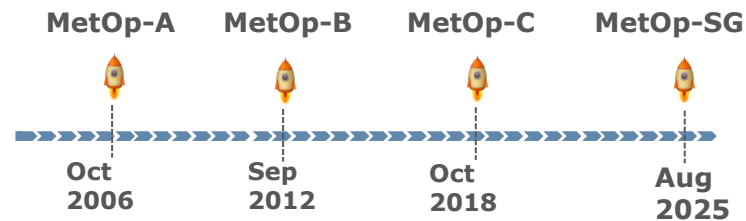
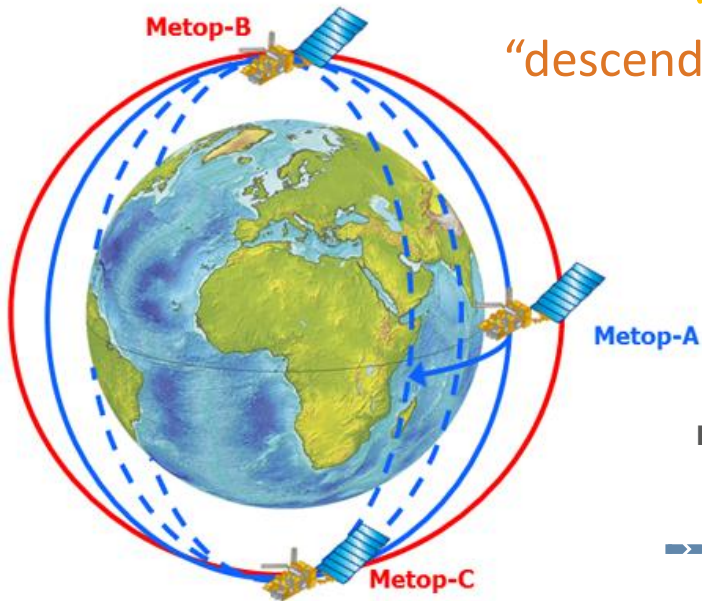
The IASI instrument

Orbital characteristics:

- Sun-synchronous (LEO)
- Overpass at local solar time:
~9h30 and 21h30

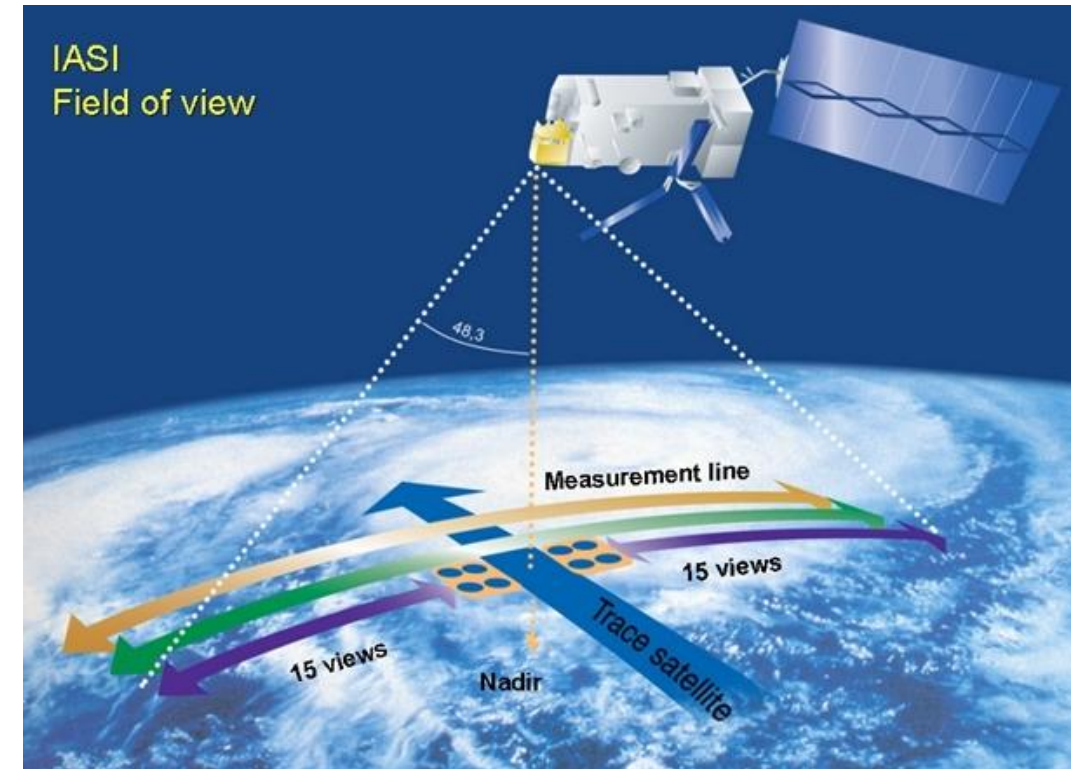


“descending” - “ascending”



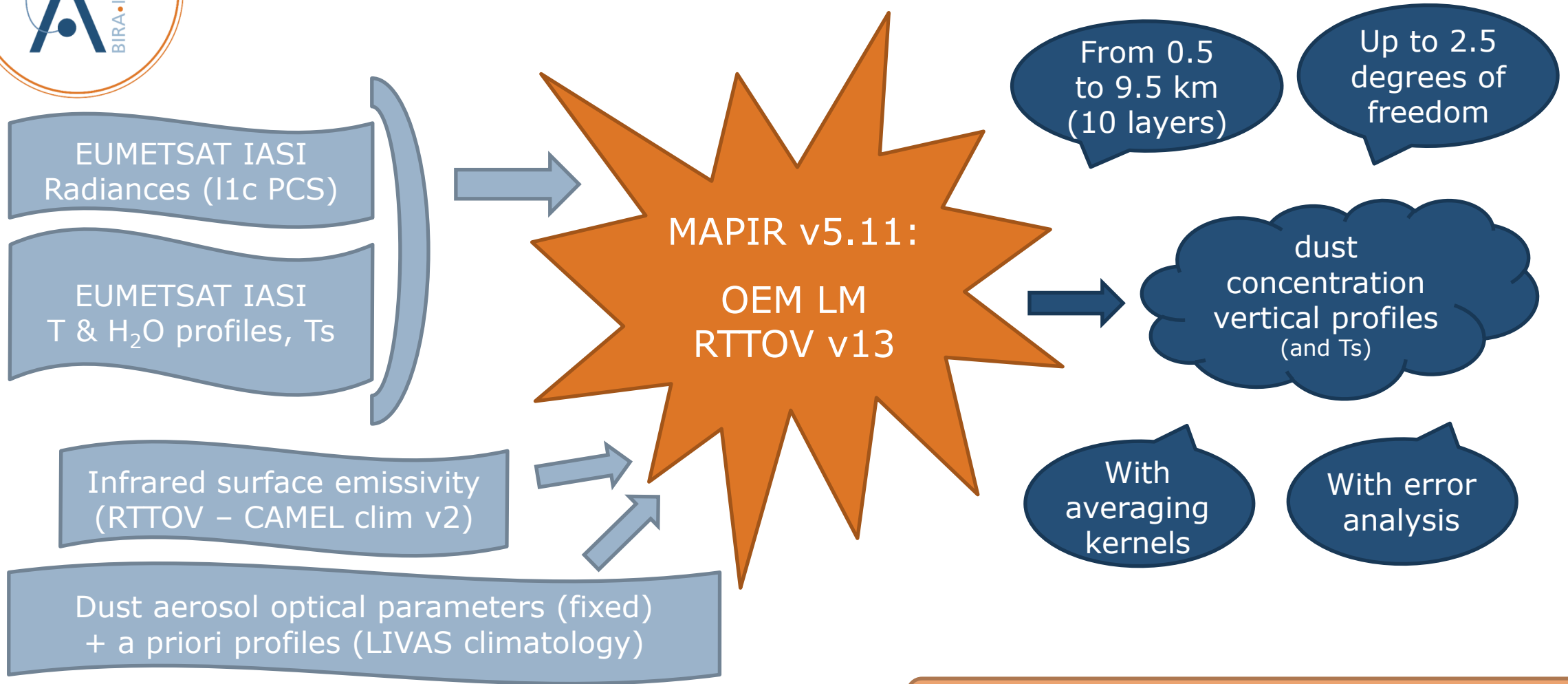
Observation technique:

- Nadir, across path scanning, FTIR
- 12km diameter pixels (at nadir)





The MAPIR algorithm (version 5.11)



Under review: Vandenbussche et al, AMT2026
doi: 10.5194/egusphere-2026-924



The MAPIR product (version 5.11)

Mineral Aerosol Profiling from Infrared Radiances

- Vertical profiles of dust concentration (particles /cm³)
- 10 layers, centred at 0.5 to 9.5km altitude
- Up to 2-3 degrees of freedom; not all 10 layers are independent
- Averaging kernels
- Error analysis
- Integrated dust AOD at 10μm, associated uncertainty
- Dust AOD at 550nm, from fixed conversion
- Dust mean altitude



Requires assumptions on particle optical properties

Increases the uncertainty

Converts only what is observable at 10μm
(= coarse dust particles)

Cloud filtering is
now part of the
« a posteriori »
quality control

Provided « cloud
flag » is not used,
is a copy of
EUMETSAT data



Dust AOD conversion to 550nm

... or why you should use the AOD 10 μ m

Visible (550 nm)

- All aerosol types, all sizes
- Scattering is very efficient (fine and coarse)
- Absorption from black / organic carbon, dust
- Absorption of dust depends on iron content
 - Large sensitivity to particle size

Thermal IR (10 μ m)

- Only dust / ash, mostly coarse
- Scattering is a small contribution (coarse)
- Absorption from minerals (silicates)
- Absorption depends on clays, quartz, calcite, kaolinite and feldspar
- Small sensitivity to particle size



Current conversion factor: **1.78** constant
Calculated using the PSD and RI from MAPIR retrievals
Strongly depends on those assumptions...



AOD evaluation



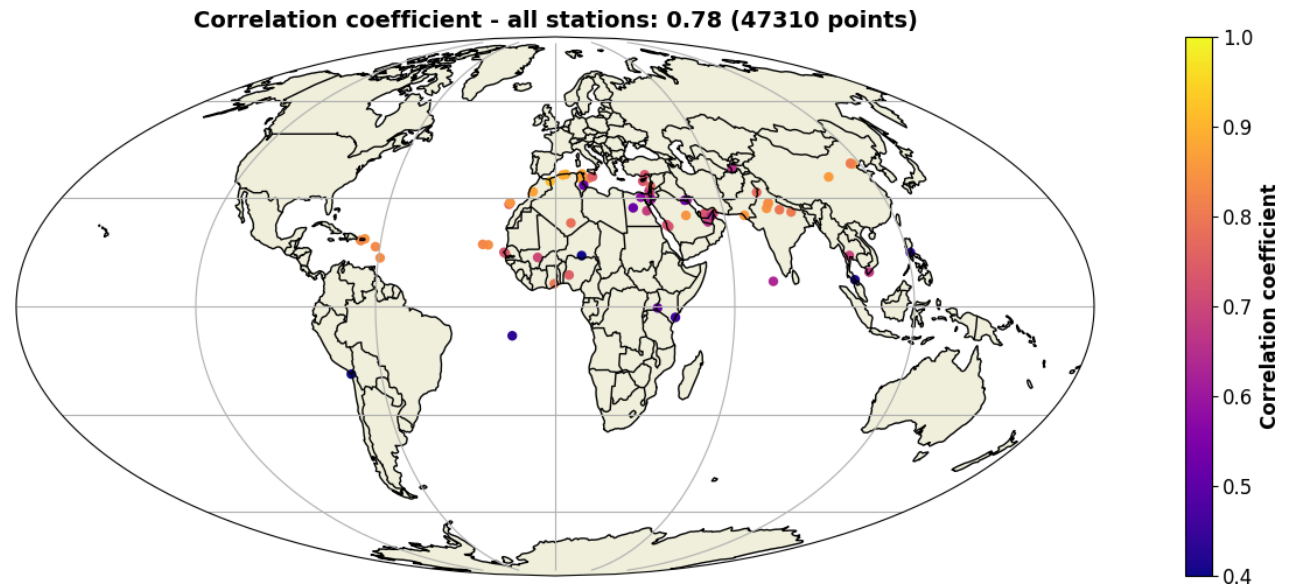
AERONET v3 I2 solar:

- Coarse mode SDA (v4.1) AOD 500nm (dust, sea salt, volcanic)
- Stations with med CAOD > 0.05
- QC: $RMSE < 0.05 + 0.15 * CAOD$
 - $FMF \leq 0.5$

Co-location / comparison:

1. All IASI max 25km from station
2. Each IASI compared with closest AERONET in time (max 15')
3. Removing 3% outliers

Parameter	IASI-A vs solar	IASI-A vs lunar	IASI-C vs solar	IASI-C vs lunar
N points	47 310	1 024	12 167	959
Correlation coeff. (all stations)	0.78	0.67	0.79	0.7
Mean absolute bias (std dev)	-0.002 (0.11)	-0.011 (0.18)	0.002 (0.09)	-0.001 (0.09)
Median absolute bias	0.012	-0.010	0.011	0.008
Median relative bias	9%	-5%	10%	6.2%
Comp. with bias lower than 0.1	76%	58%	81%	78%





AOD evaluation



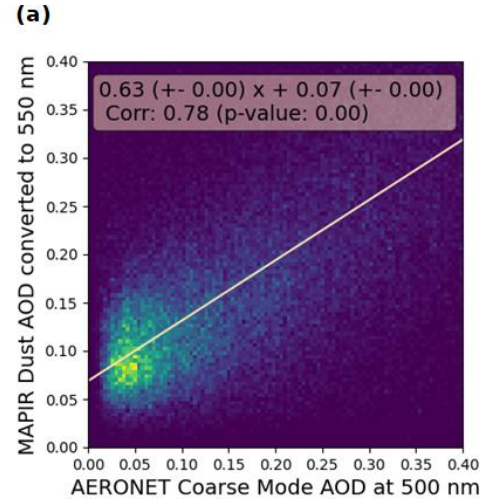
AERONET v3 I2 solar:

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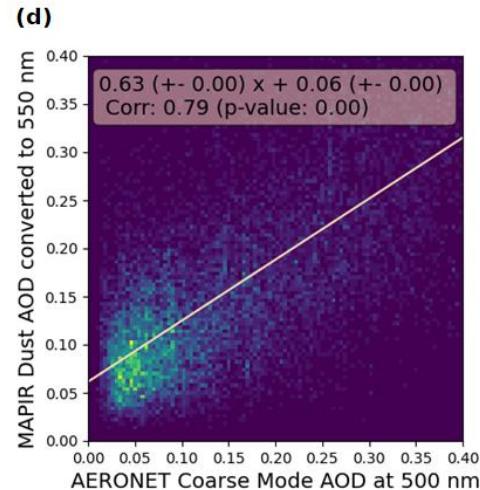
Co-location / comparison:

1. All IASI max 25km from station
2. Each IASI compared with closest AERONET in time (max 15')
3. Removing 3% outliers

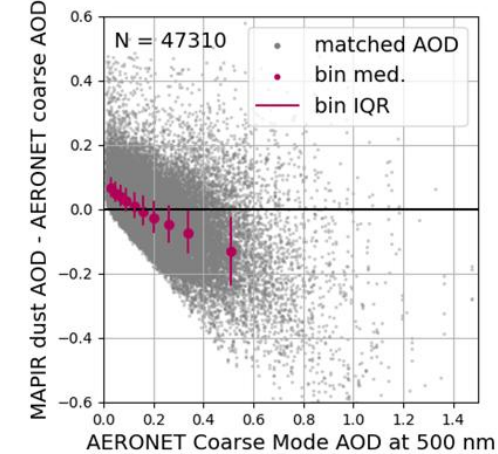
MAPIR IASI-A against AERONET solar



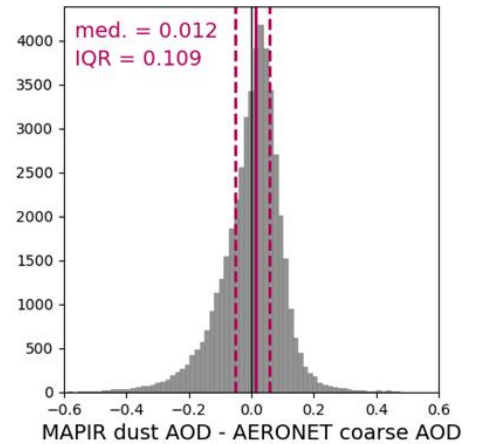
MAPIR IASI-C against AERONET solar



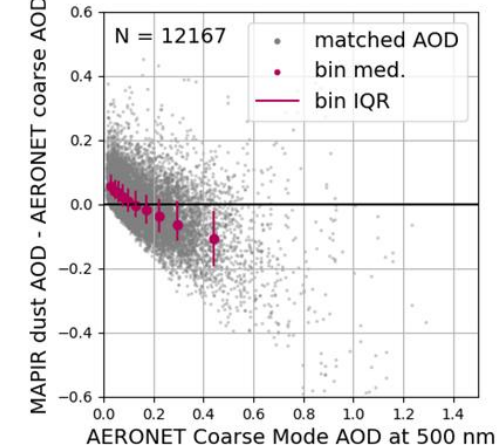
(b)



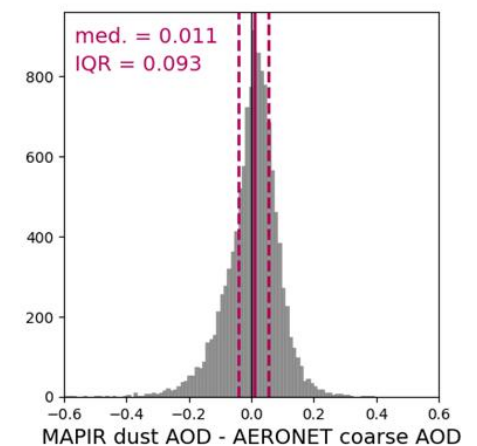
(c)



(e)



(f)



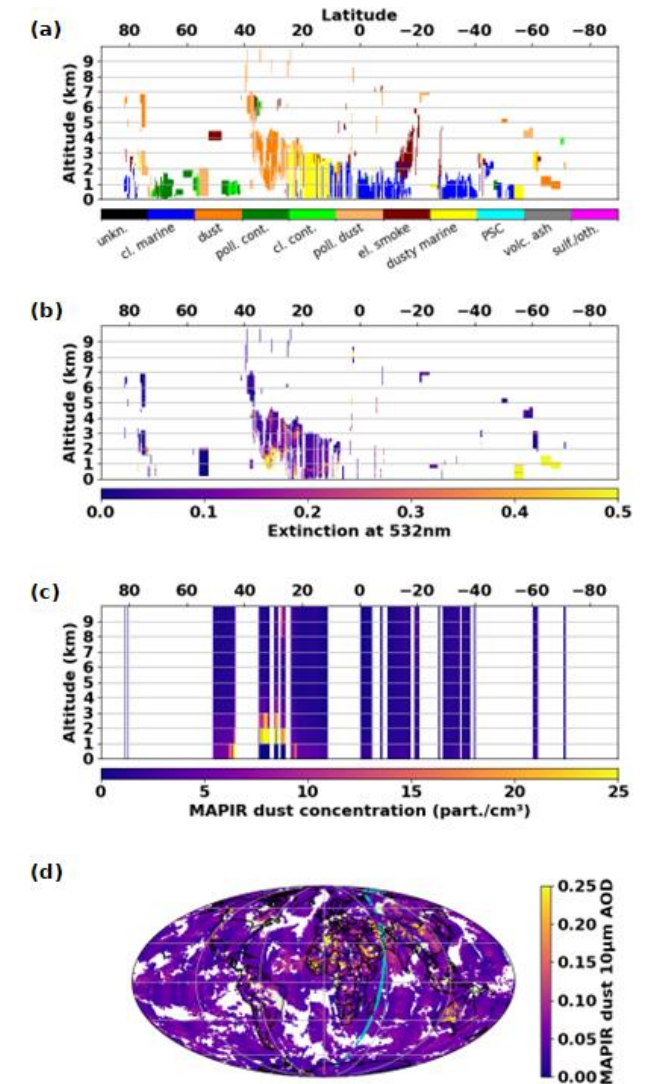
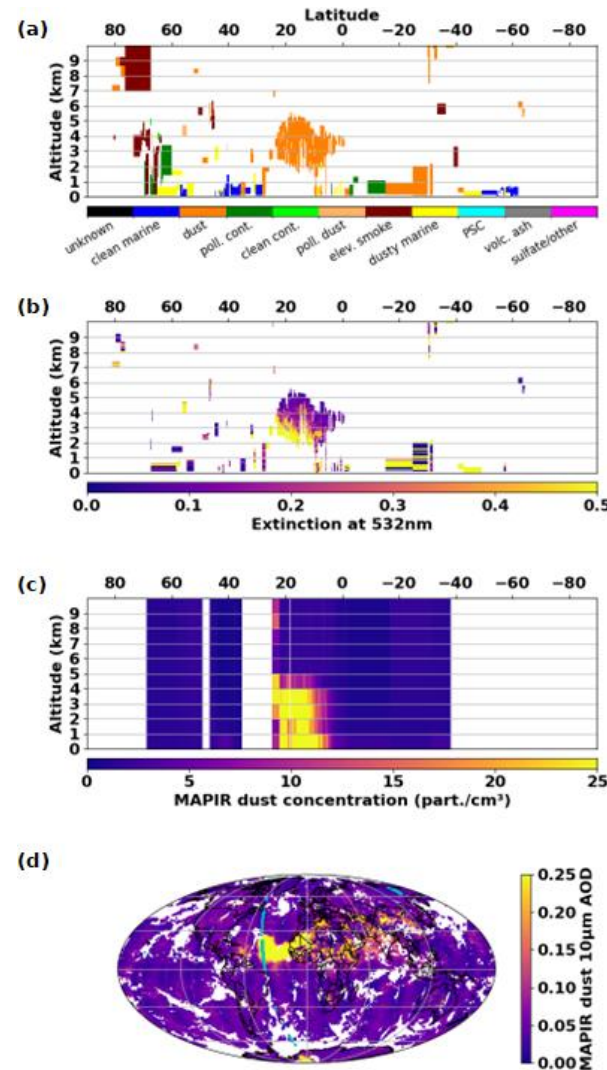


Vertical information

Comparisons with CALIOP

19/06/2020, day, IASI-C

28/10/2018, night, IASI-A

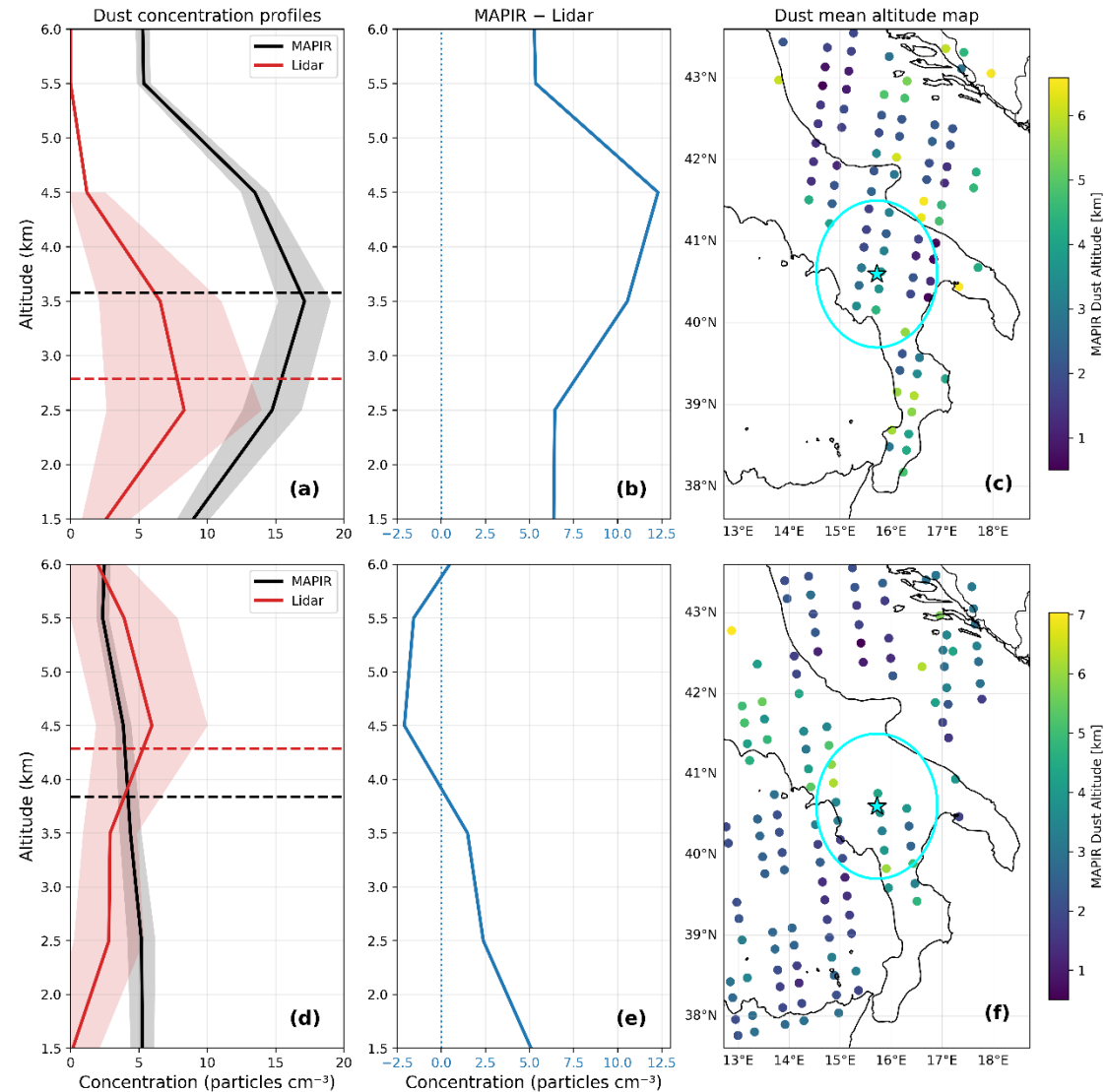




Vertical information

Comparisons with EARLINET
(ongoing ...)

Christos Biskas,
MariLiza Koulouki,
Dimitris Balis



19/06/2024
DOF 1.79
AOD 550nm 0.58

20/06/2023
DOF 1.38
AOD 550nm 0.21

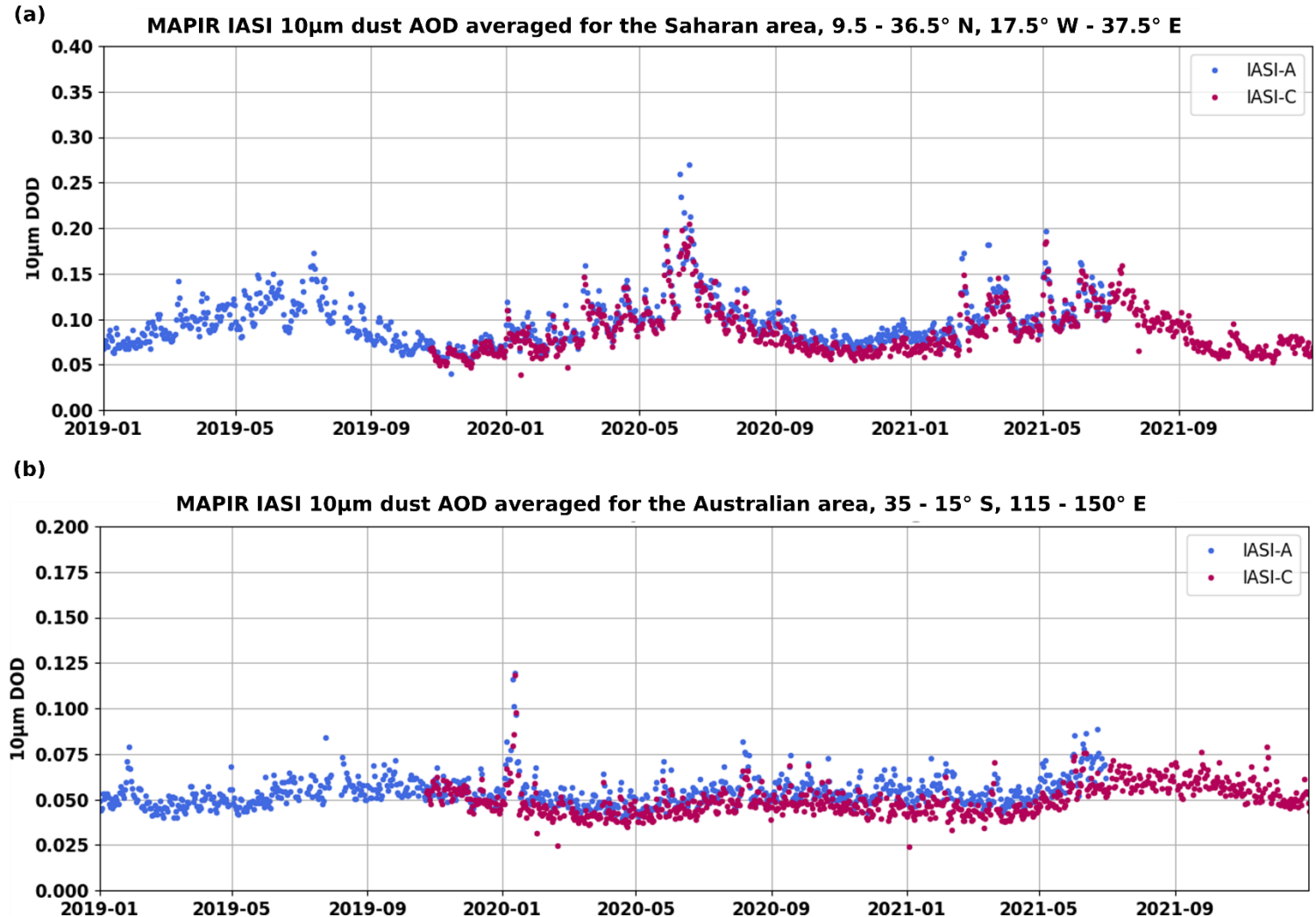


Long-term

No drift wrt AERONET

MAPIR results for IASI-A and IASI-C are consistent

In source area, differences due to the Metop-A orbit drift and different local solar time -> for long time series, switch from IASI-A to IASI-C end 2019!





Uncertainty calculation

Shown in detail last year, conclusions + thoughts:

1. Saved in the files: OEM propagated uncertainties, incl. T and H₂O profiles
 - Reported for profile and AOD 10μm
 - Median 0.005 to 0.01 for AOD 10μm (IP68 up to 0.03)
2. + AOD 10μm uncertainty due to 5% surface emissivity uncertainty:
 - 0.05 (low AOD) to 0.015 (high AOD)
 - NOT in the files
3. Uncertainty due to uncertain RI and PSD: ????

-> **Any AOD 10μm < 0.06 is “noise”**

And this matches the lowest threshold that the OEM seem to be able to reach



Known issues

Shown in detail last year, conclusions + thoughts:

1. Overestimation of low AOD, with ~ 0.06 lowest threshold for AOD $10\mu\text{m}$
2. Underestimation of high AOD 550 nm (from the conversion??)
3. Mean altitude provided if $\text{DOF} > 1.25$ ($\text{AOD} > 0.05$); but still some artefacts; leads sometimes to noise in monthly/yearly averages
4. For IASI-C, missing some pixels due to a technical issue in EUMETSAT data
5. Cloud filtering remains a huge challenge
6. From Jeff: Australia is “weird” ...



NRT and climate data series

NRT

Goal: best possible data
at processing time

- Input: NRT IASI I1 PCS and I2 OEM or PWLR3 (if OEM non convergence)



Under implementation as
EUMETSAT AC SAF IASI NRT product



climate

Goal: highest possible consistency
along time (since 2007)

- Input: RPRO IASI I1 PCS and I2 PWLR3 (OEM not available)



cds.climate.copernicus.eu

-> I3 AOD, mean alt

iasi.aeronomie.be

-> I2 profiles, AOD, mean alt



NRT status?

Currently:

- NRT is running effectively since April 2026
- Data downloaded and stored at BIRA-IASB, by granules then aggregated in daily files the night after
- Trying to setup the upload of data to EUMETSAT “test” server
- File name convention had to be changed for WMO convention, any problem?

e.g. W_XX-ACSAF-EWC,SOUNDING+SATELLITE,METOPC+IASI_C_
yyyymmddhhmmss_nnnnn_MAPIR_v51NRT.nc

Next steps:

- Test upload of data to operational server, solve any technical issues
- Trial dissemination (after 2 weeks notice) to EUMETSAT member states + selected users



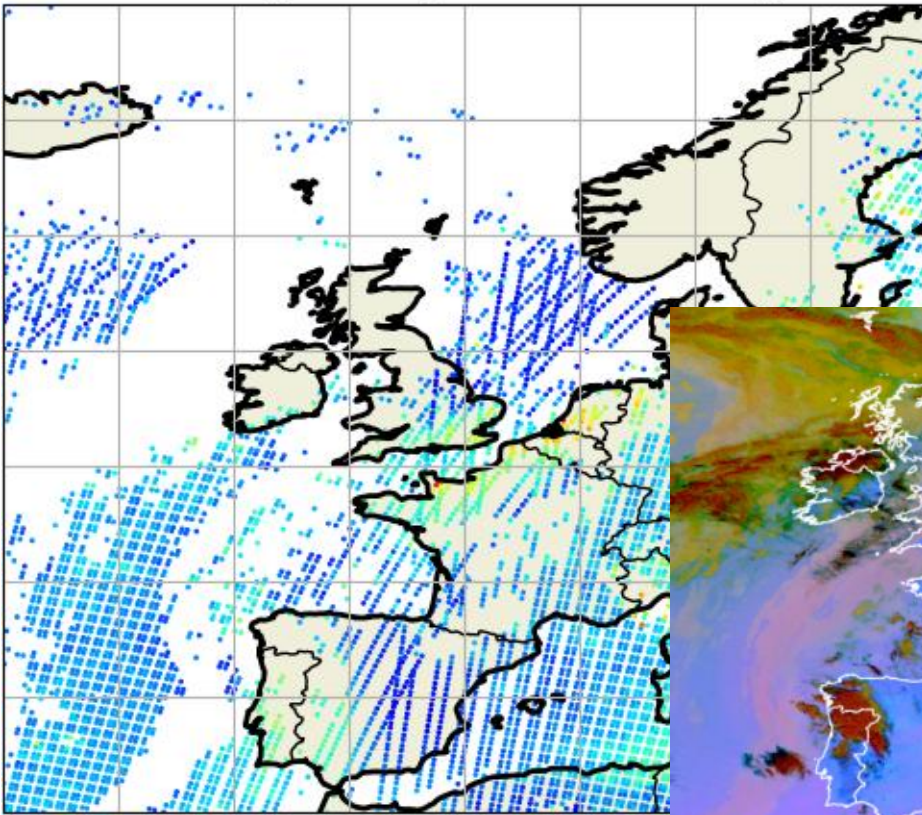
NRT and climate data - examples

NR
T

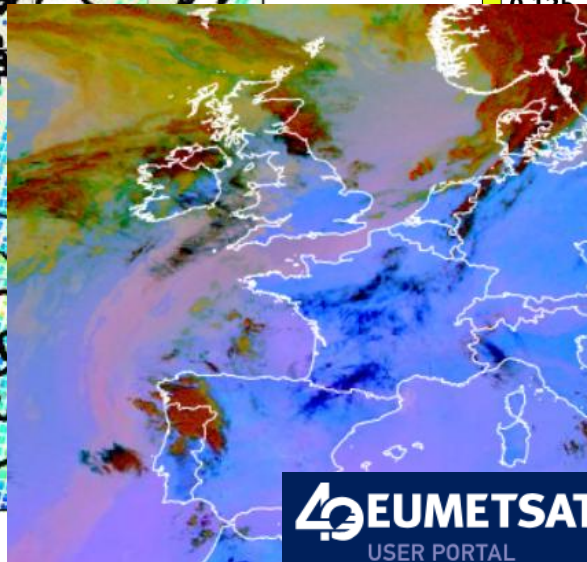
A “European event” on 23 May 2026
AOD 10 μ m

climate

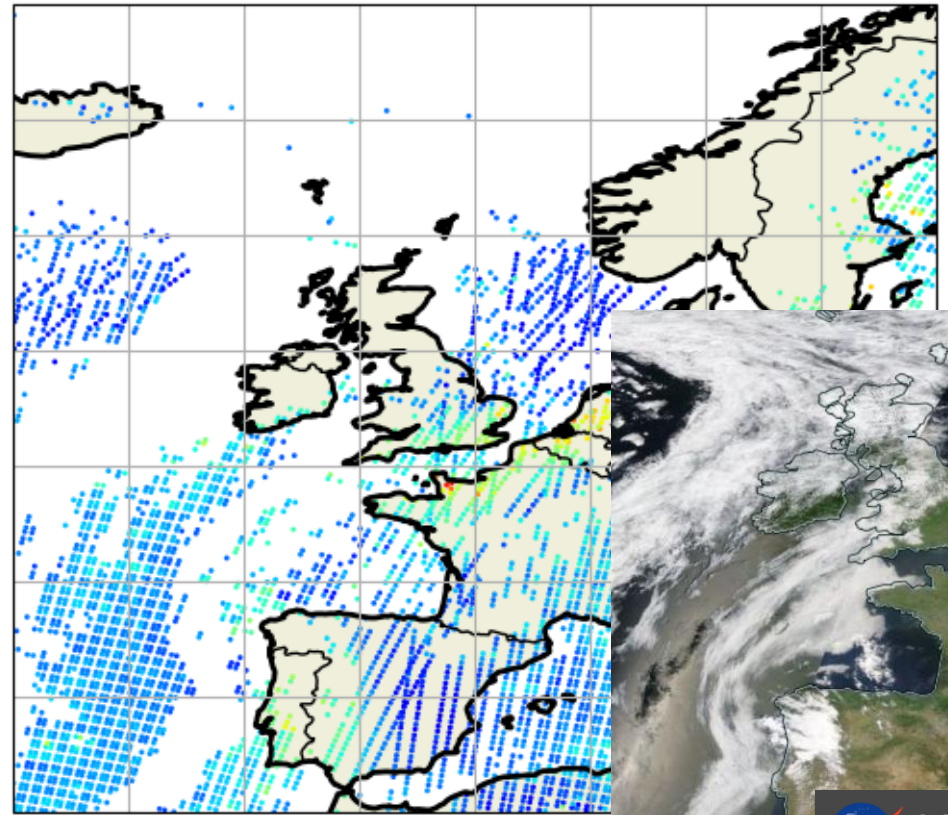
Descending orbit, local morning 9h30



SEVIRI dust RGB



Descending orbit, local morning 9h30



MODIS / Terra



Worldview



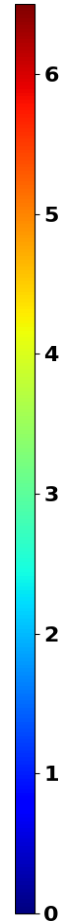
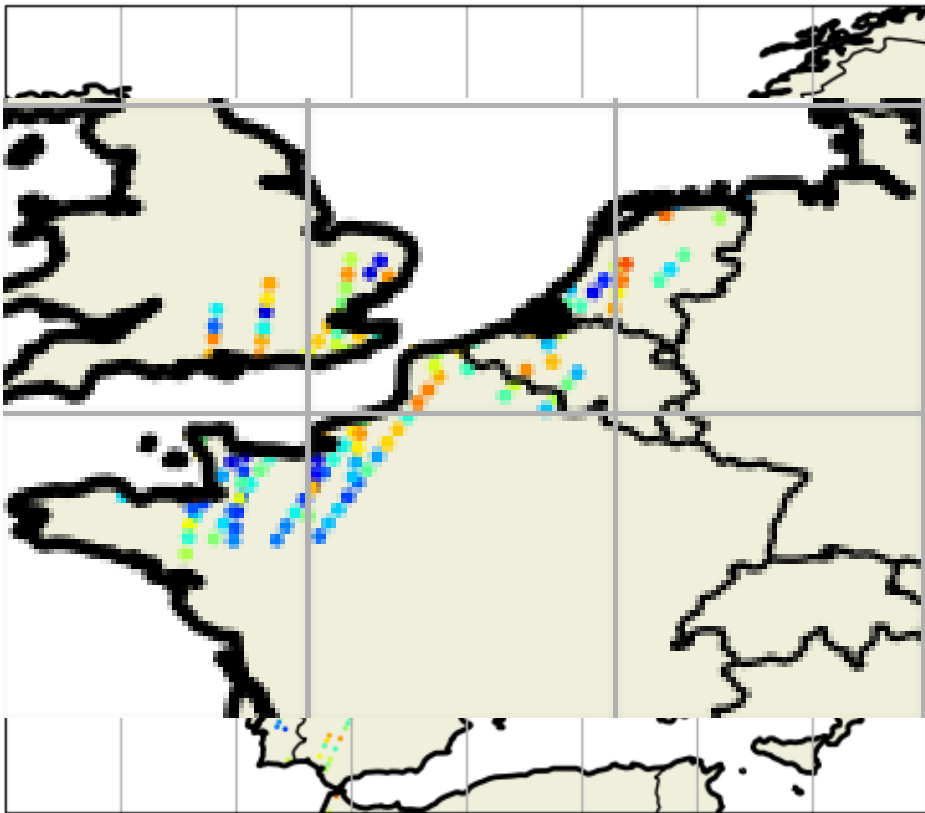
NRT and climate data - examples

NRT

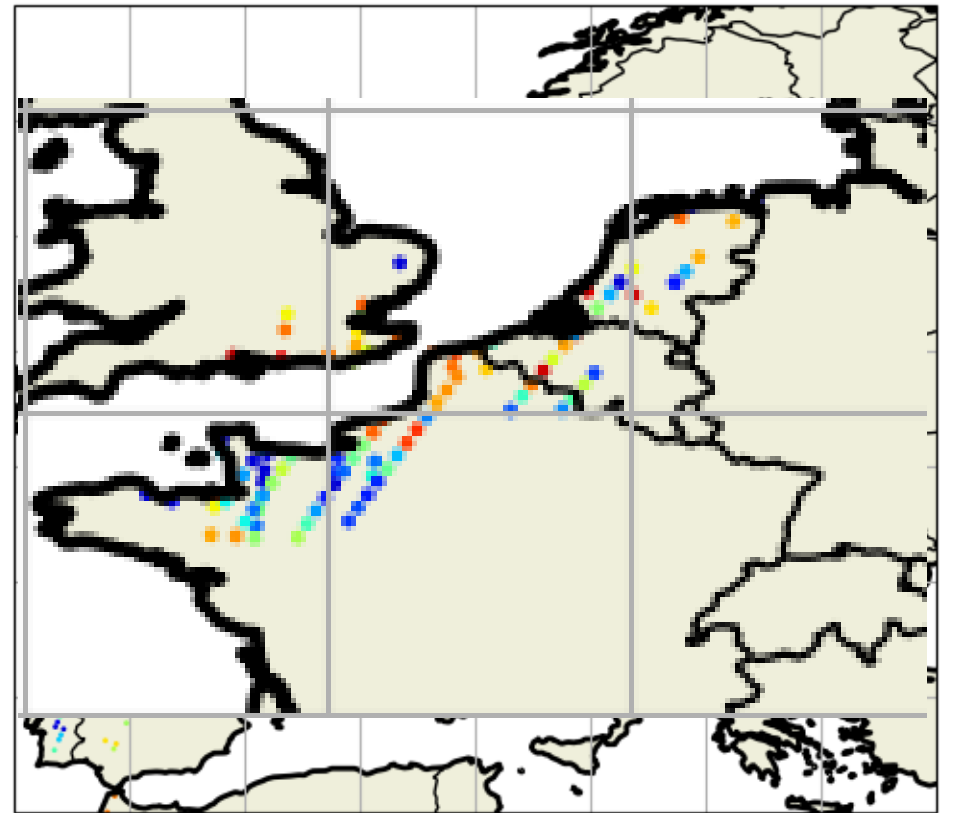
A “European event” on 23 May 2026
Mean altitude

climate

Descending orbit, local morning 9h30



Descending orbit, local morning 9h30





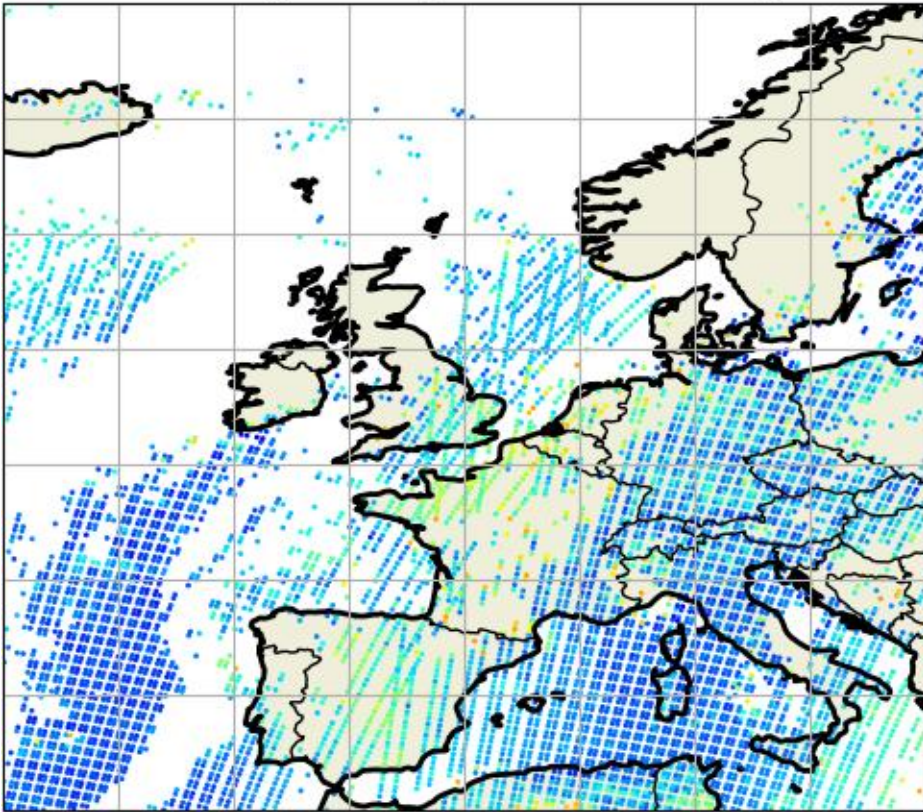
NRT and climate data - examples

NRT

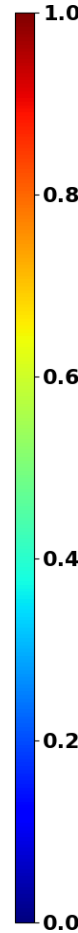
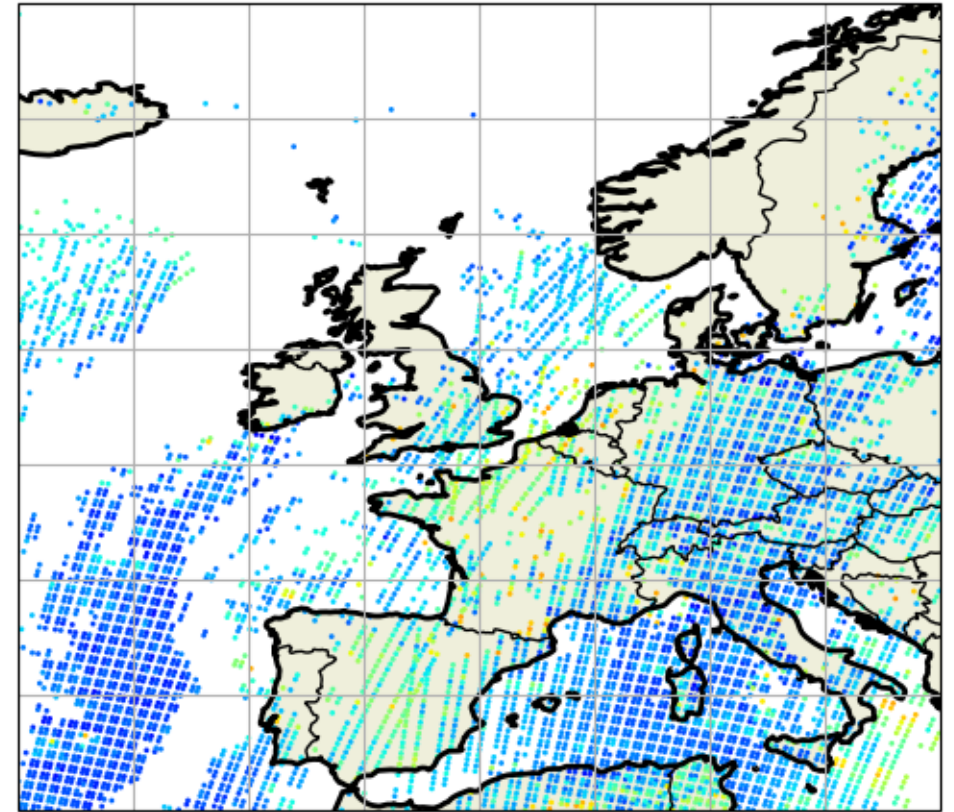
A “European event” on 23 May 2026
RMS of spectral residuals

climate

Descending orbit, local morning 9h30



Descending orbit, local morning 9h30





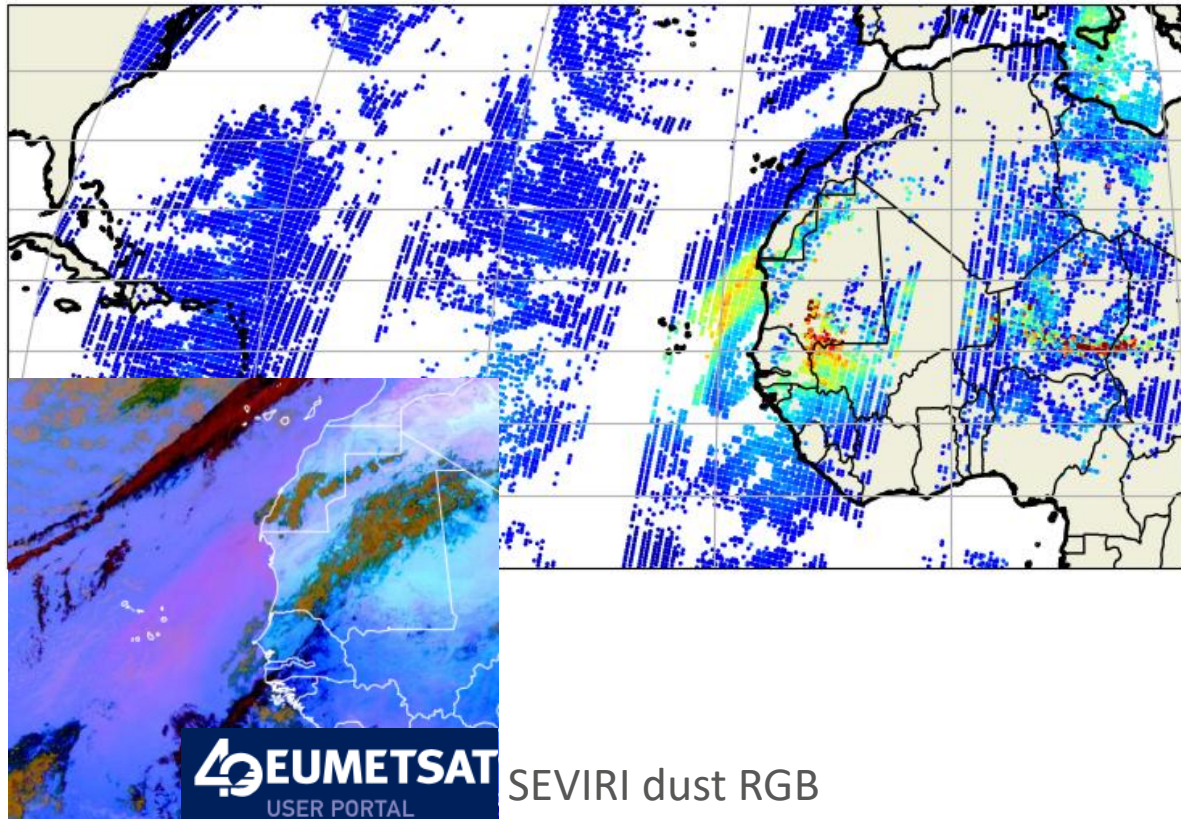
NRT and climate data - examples

NRT

A “typical Saharan outflow” on 10 May 2026
AOD 10 μ m

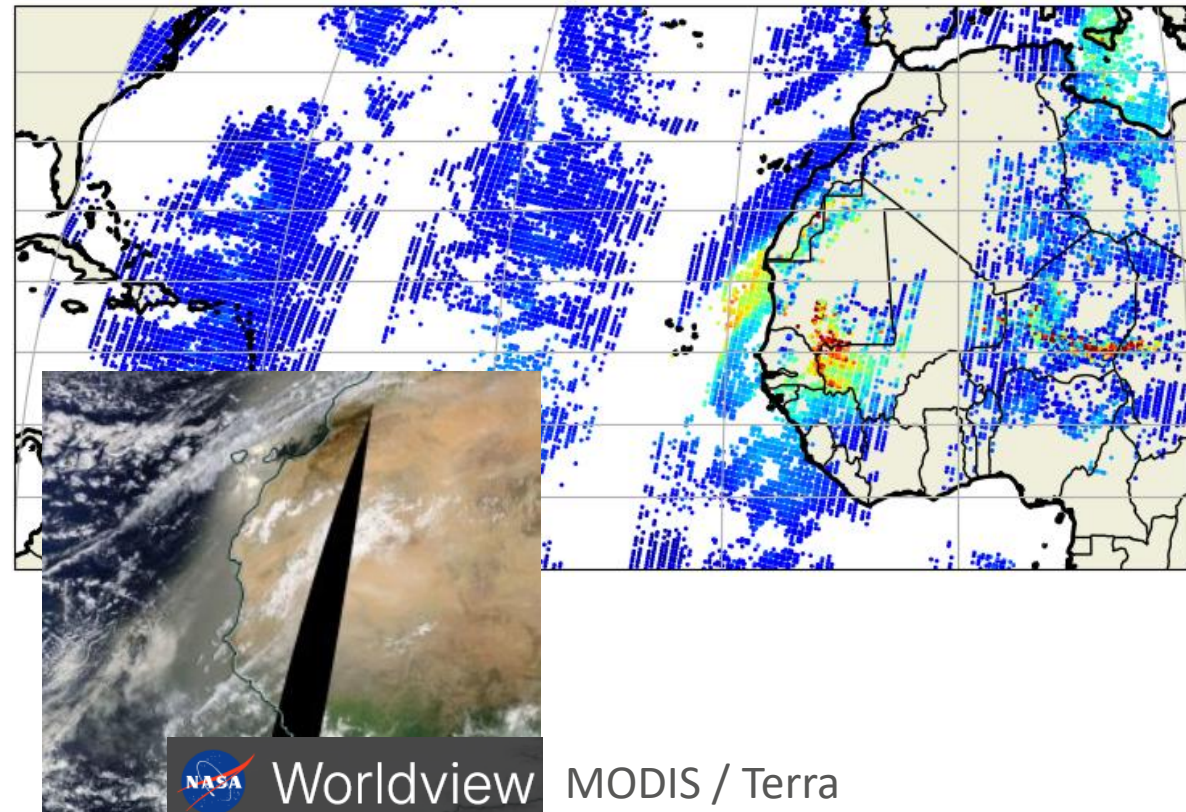
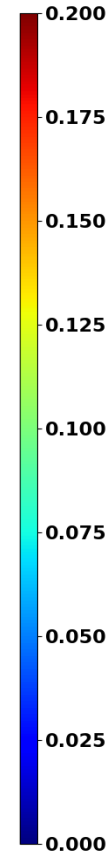
climate

Descending orbit, local morning 9h30



SEVIRI dust RGB

Descending orbit, local morning 9h30



MODIS / Terra



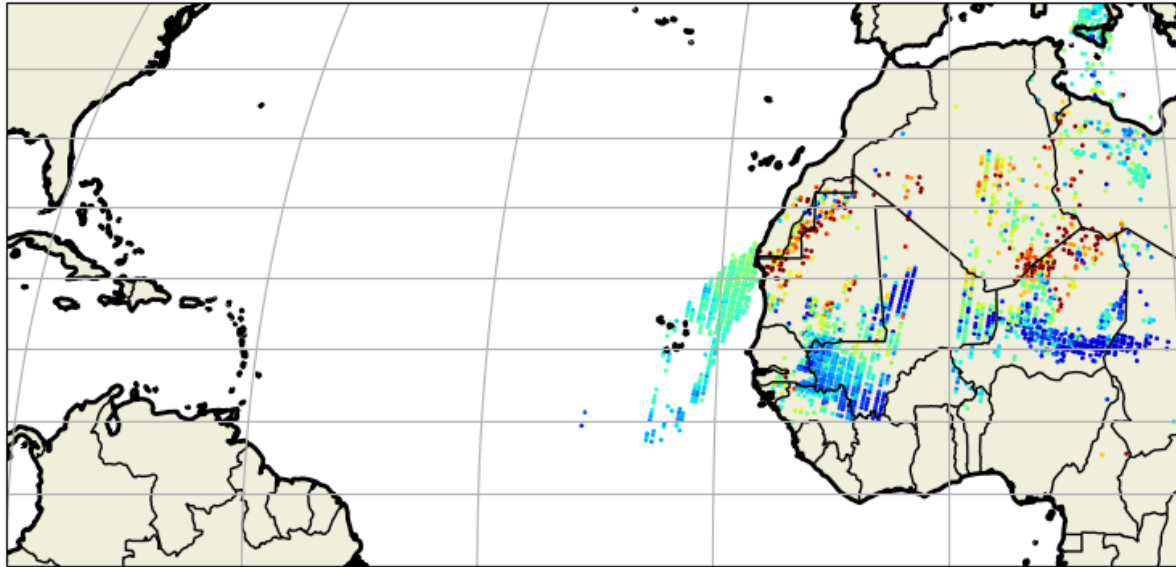
NRT and climate data - examples

NRT

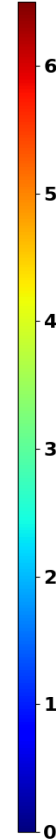
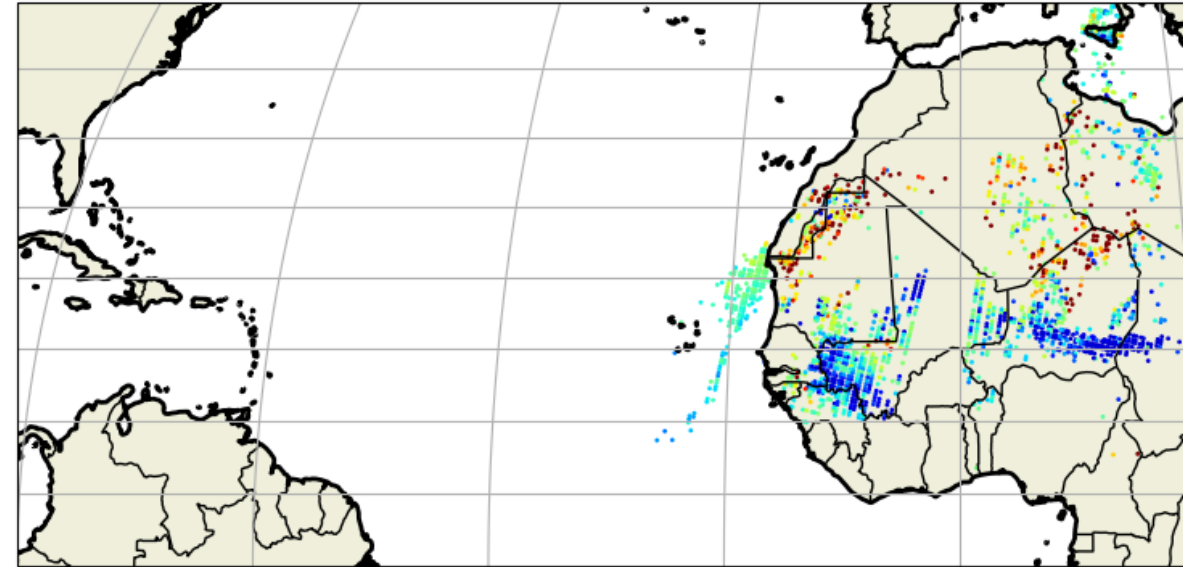
A “typical Saharan outflow” on 10 May 2026
Mean altitude

climate

Descending orbit, local morning 9h30



Descending orbit, local morning 9h30





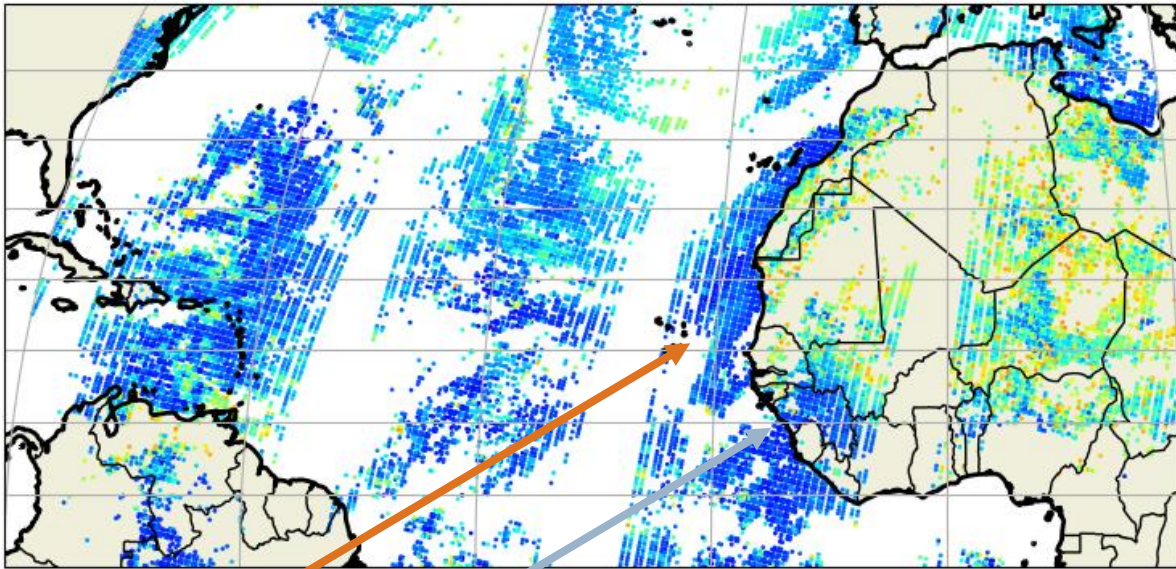
NRT and climate data - examples

NRT

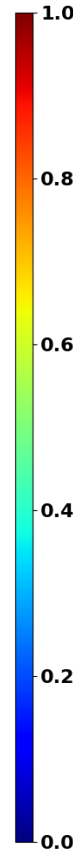
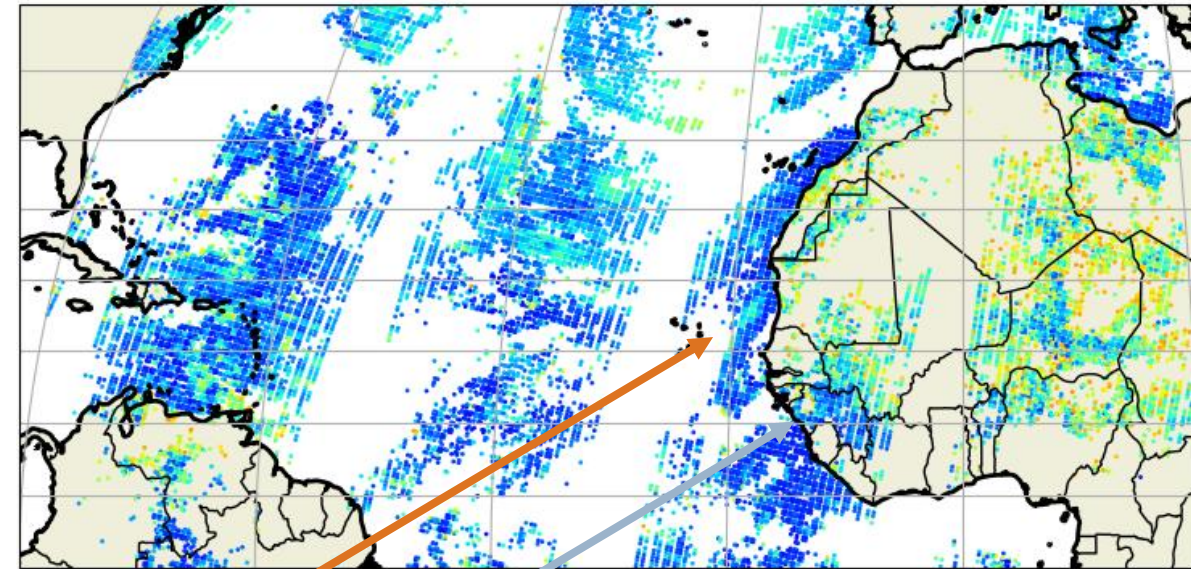
A “typical Saharan outflow” on 10 May 2026
RMS of spectral residuals

climate

Descending orbit, local morning 9h30



Descending orbit, local morning 9h30





Some key points to remember

- NRT product is not exactly the same as the climate product (different IASI input data)
- NRT seems of slightly better quality (preliminary) but will not be « time-consistent »
- NRT status: « hopefully » soon ??
- Lots of info on our website iasi.aeronomie.be (updated regularly)
- Climate product processed more regularly now (also being automatised, not yet there)
- AOD $10\mu\text{m} < 0.06$ is basically noise
- AOD 550nm has much larger uncertainty (not even quantified)
- Mean altitude can have some artefacts
- Cloud clearing remains challenging

Under review: Vandenbussche et al, AMT2026
doi: 10.5194/egusphere-2026-924



Some key points to remember

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- Climate



nie.be (update
early now (also k



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Under review: Vandenbussche et al, AMT2026
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THANK YOU!
MORE INFO?

iasi.aeronomie.be

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