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EUROPEAN UNION



Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
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S5P-TROPOMI Aerosol Products

Development and results of the first global aerosol layer height product from S5p/TROPOMI

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M. Sneep, M. ter Linden, P. Veefkind

Complete TROPOMI aerosol product suite:

Absorbing Aerosol Index (S5P-AAI):

- Degradation corrected in V2 (D. Stein-Zweers)
- New definitions to account for cloud effects

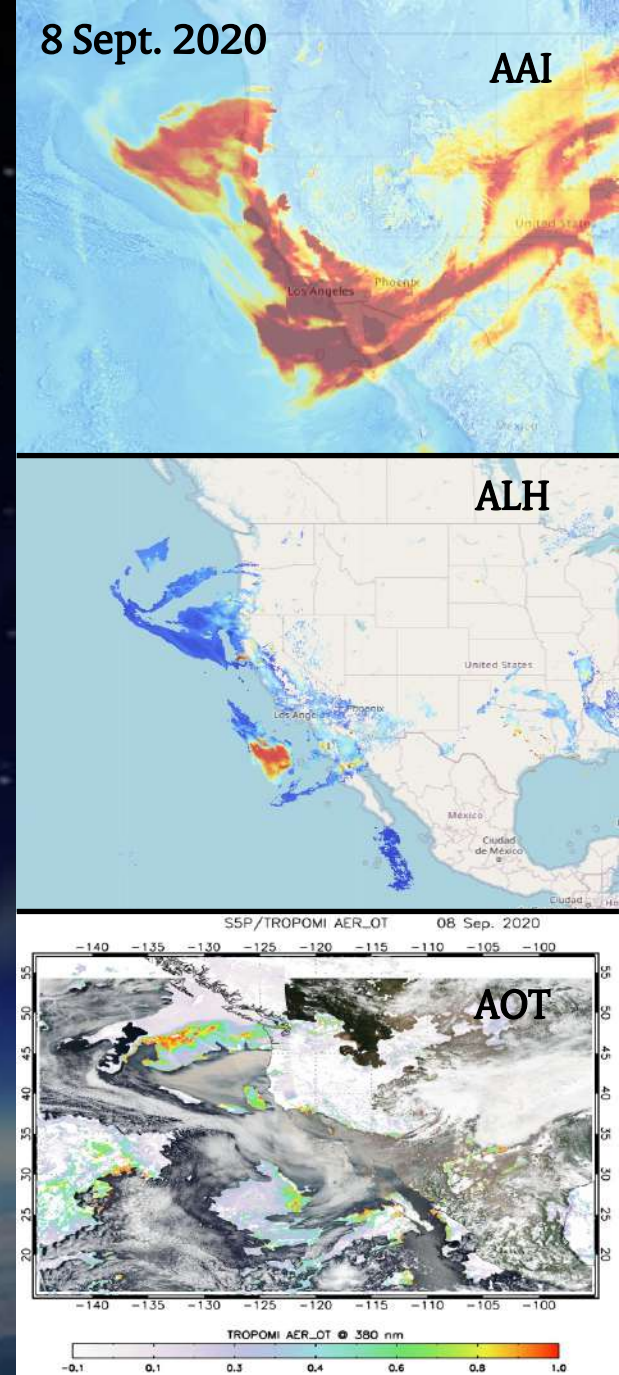
Aerosol Layer Height (S5p_ALH):

- New, fast, global operational product
- Global, based on VIIRS cloud mask
- Over land accuracy should be improved.

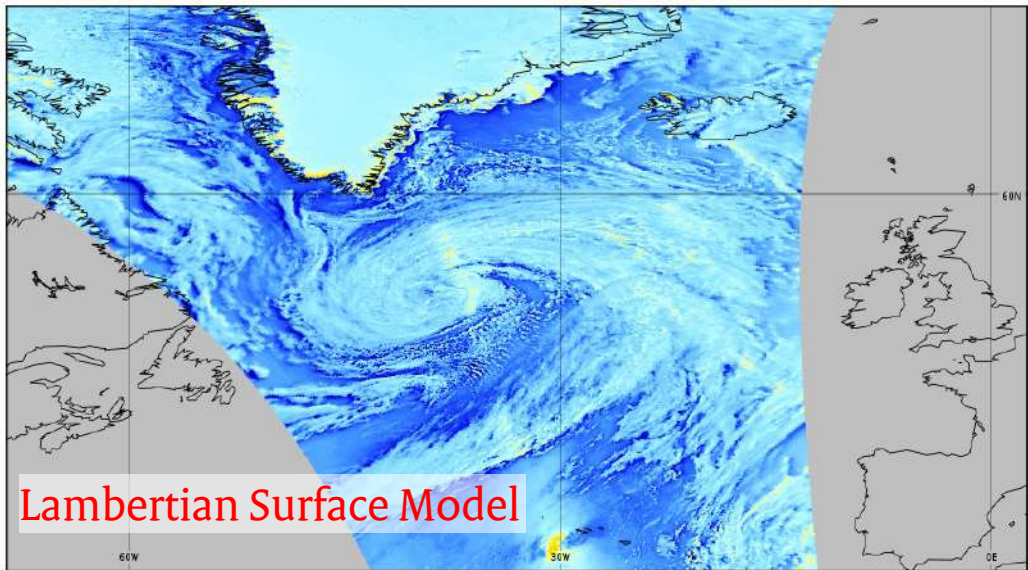
Aerosol Optical Thickness and Single Scattering Albedo in UV (S5p_AOT):

- Based on OMI OMAERO and OMAERUV algorithms in UV:
340, 380, 416, 440, 496 nm
- Uses S5P input (CO, AAI, LER), will be improved to include
S5P-ALH and S5P DLER
- Cloud fraction from VIIRS

All these aerosol products provide a consistent and complete view of the aerosol macrophysics and microphysics in the UV and SWIR

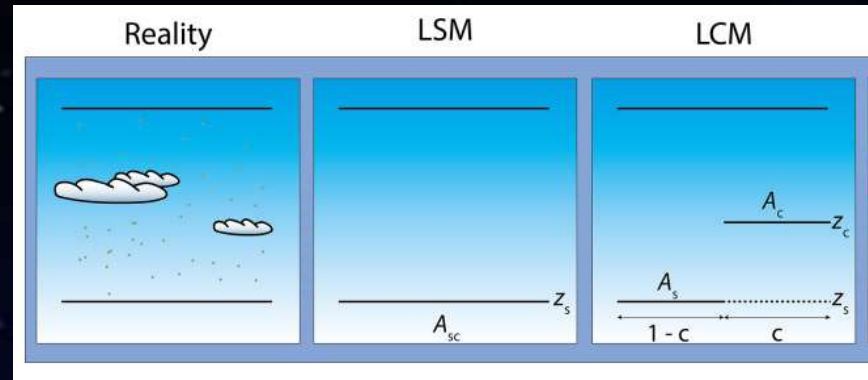


LSM: Aerosol index from 380 and 340 nm

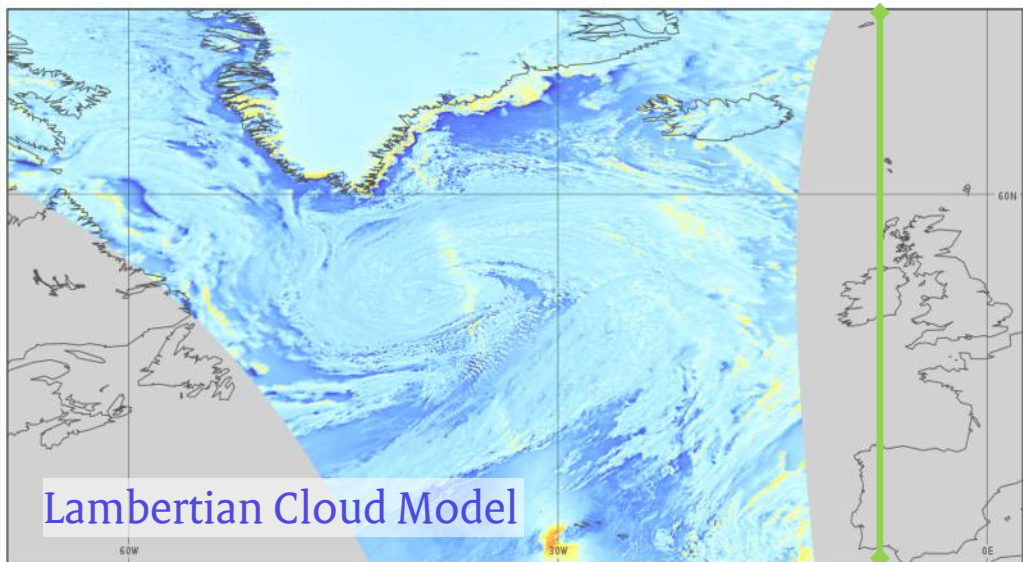


LSM: Aerosol index from 380 and 340 nm ()

AER_AI: Simple cloud models to reduce cloud effects.



LCM -- NO CLOUD HEIGHT: Aerosol index from 380 and 340 nm

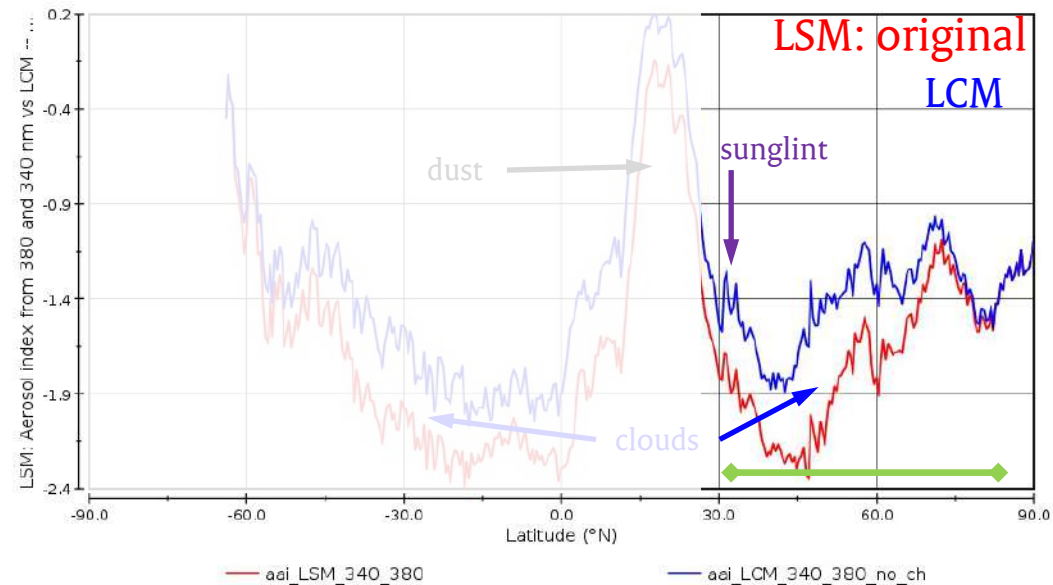


LCM -- NO CLOUD HEIGHT: Aerosol index from 380 and 340 nm ()



Data Min = -6.56, Max = 6.94

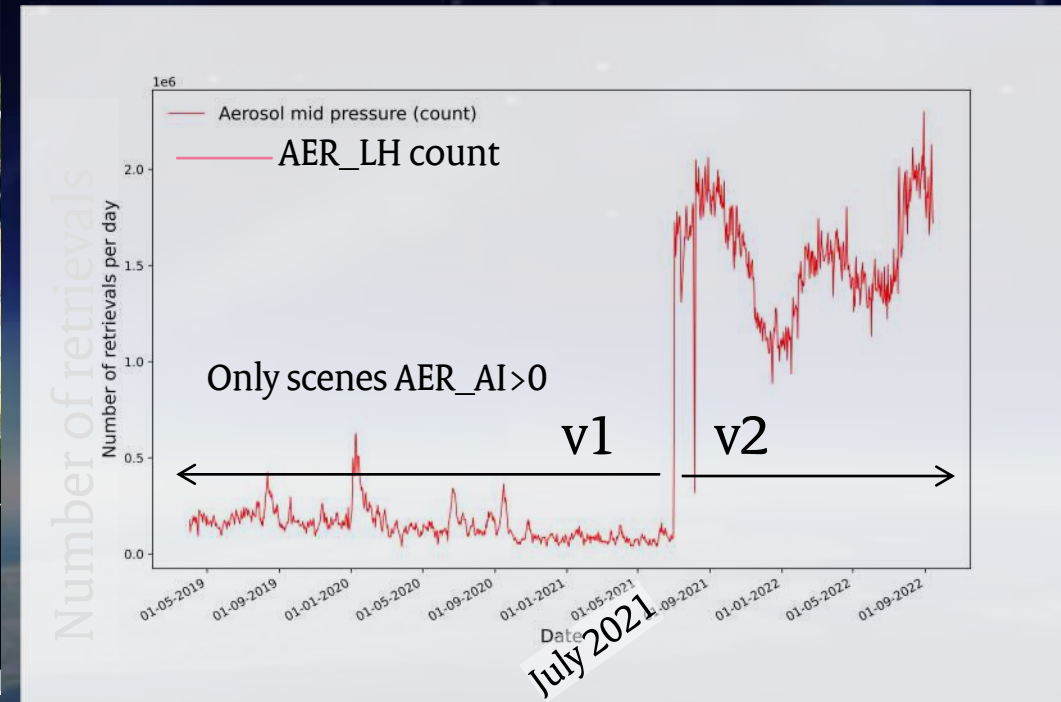
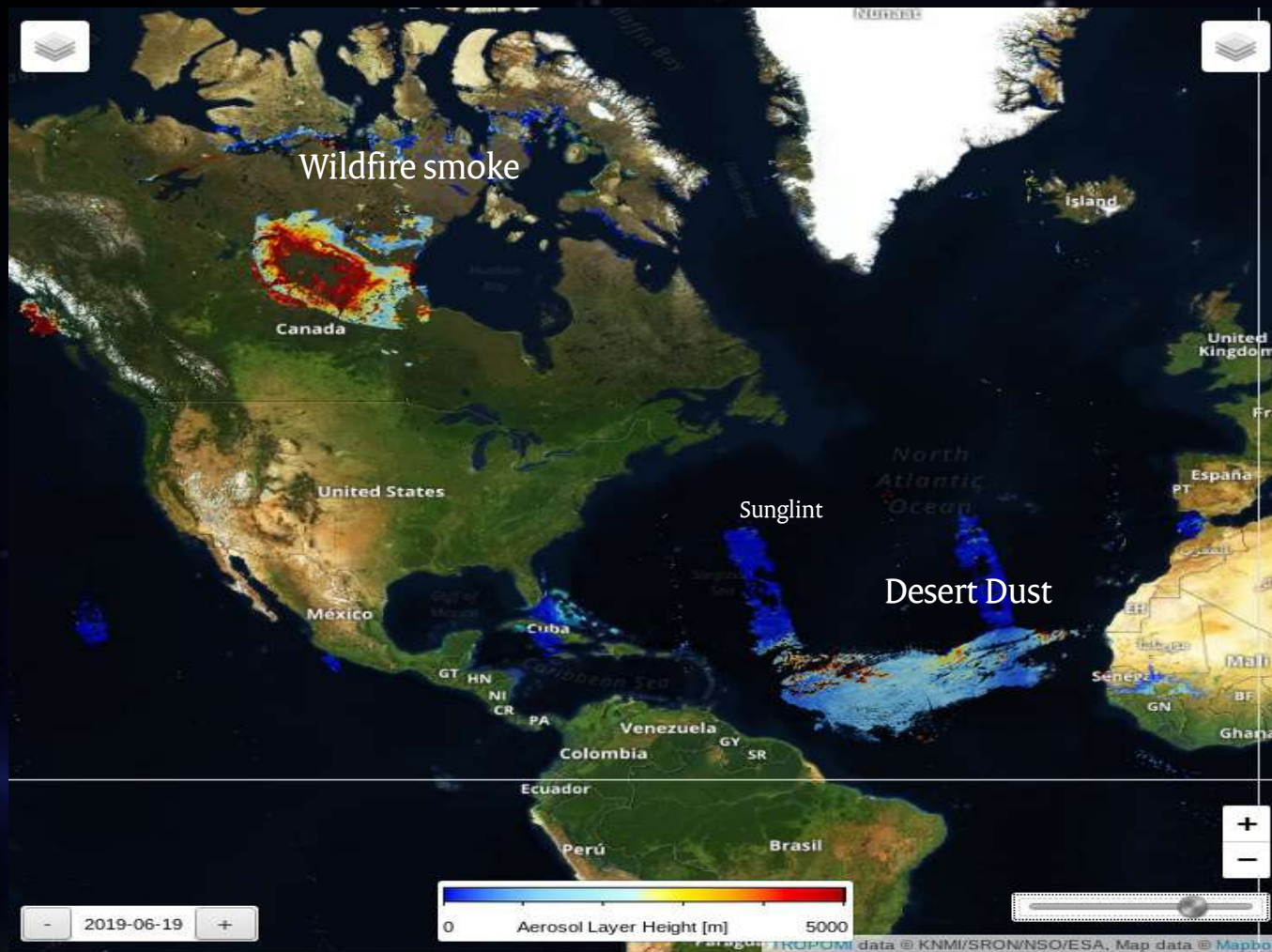
Zonally averaged AAI



TROPOMI AER_LH released Sept. 30, 2019

Aerosol Layer Height is available

- globally, over land and ocean, cloud screened
- within 3 hrs of sensing
- for all cloud-free scenes (v2)





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Version changes

Version 1.0	Initial release	20.03.2019	NN implementation, global product, AAI>0 as filter
Version 2.0	First major update	01.07.2021	Cloud mask as filter, including scattering aerosols
Version 2.4	Latest version	April 2022	TROPOMI (D)LER as surface albedo climatology (replacing GOME-2 LER)
Version 3	Planned updates	2023?	Surface albedo fit

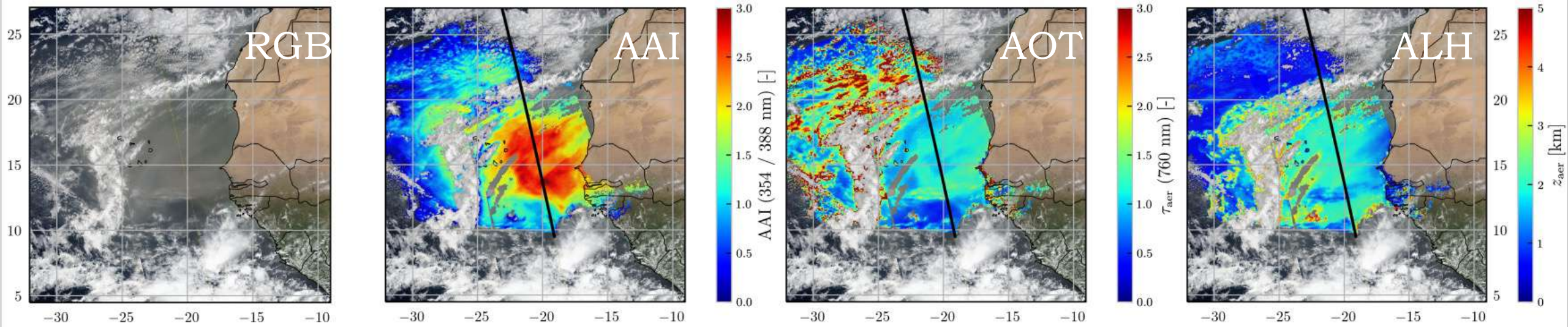
2018 - 06 - 08 Saharan dust



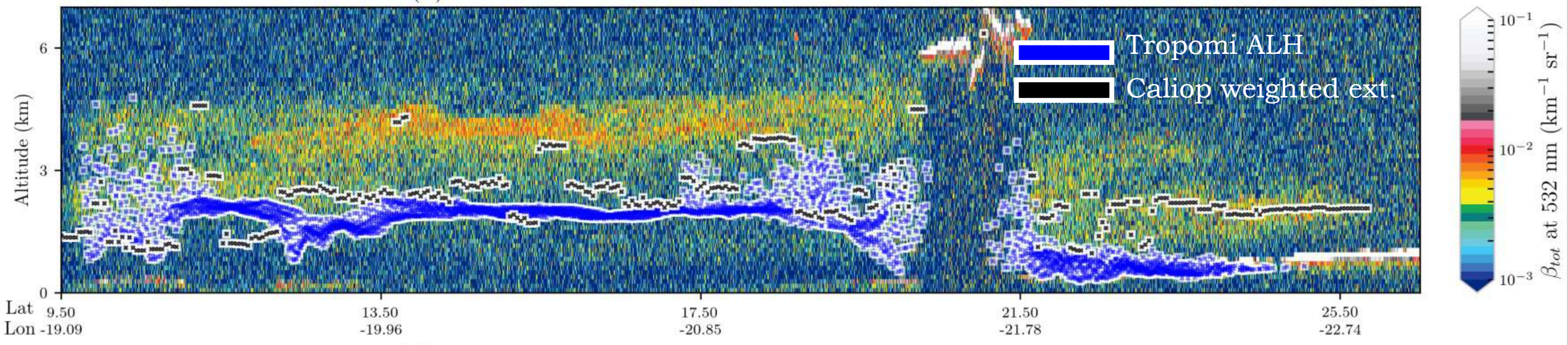
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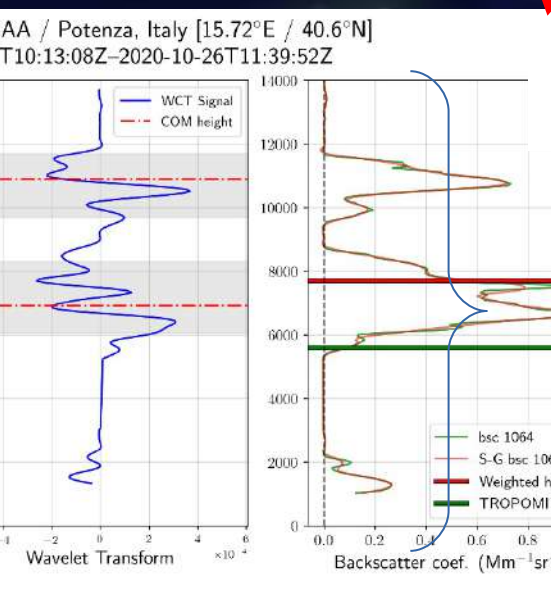
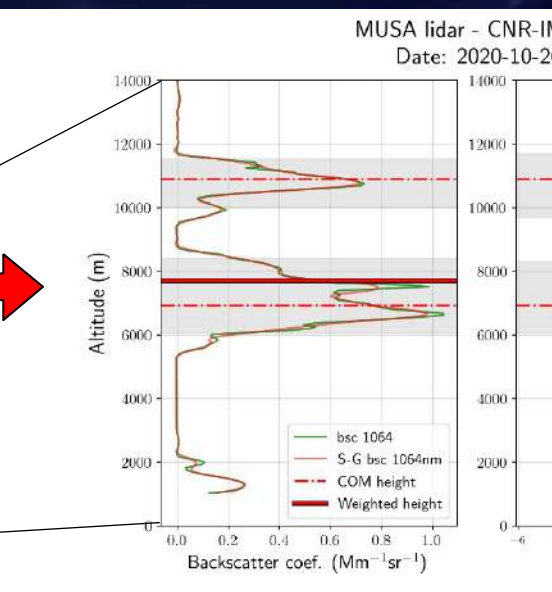
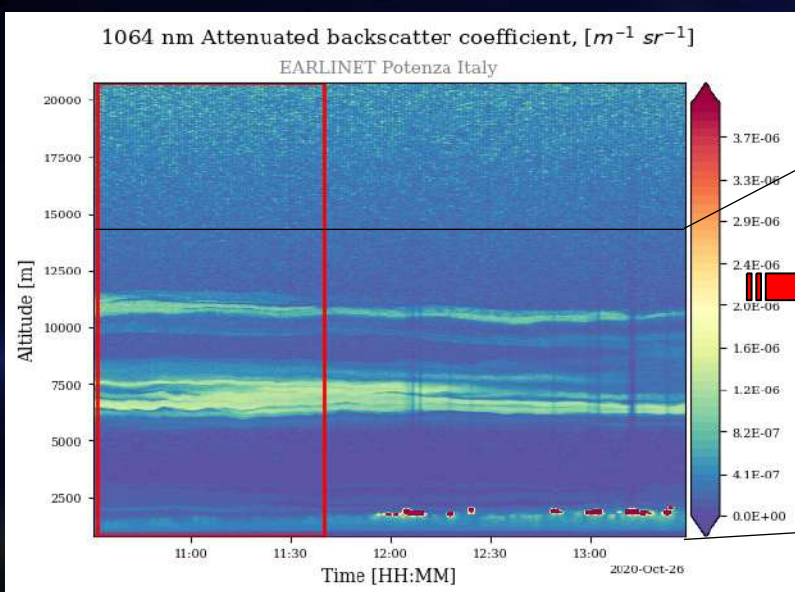
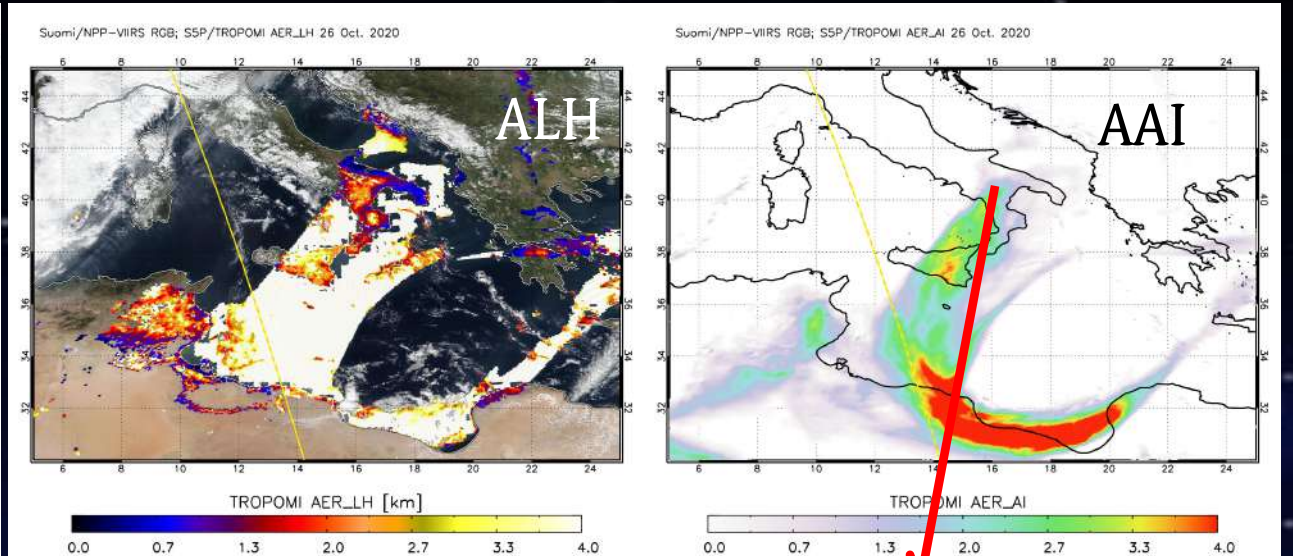
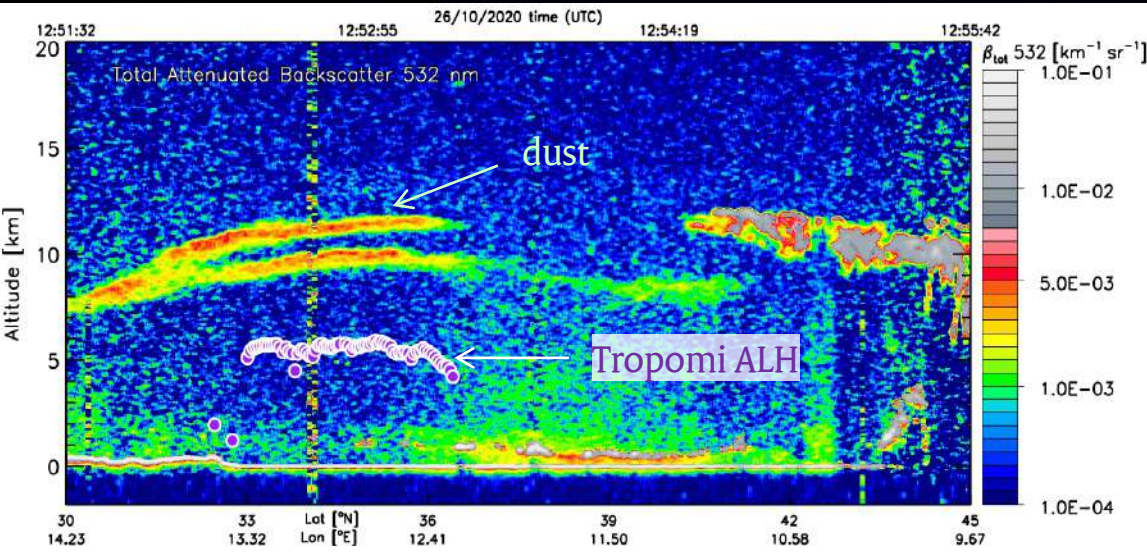
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(b) 8 Jun 2018 14:55:51 UTC - 8 Jun 2018 15:04:26 UTC



26 Oct. 2020 Dust over Sicily

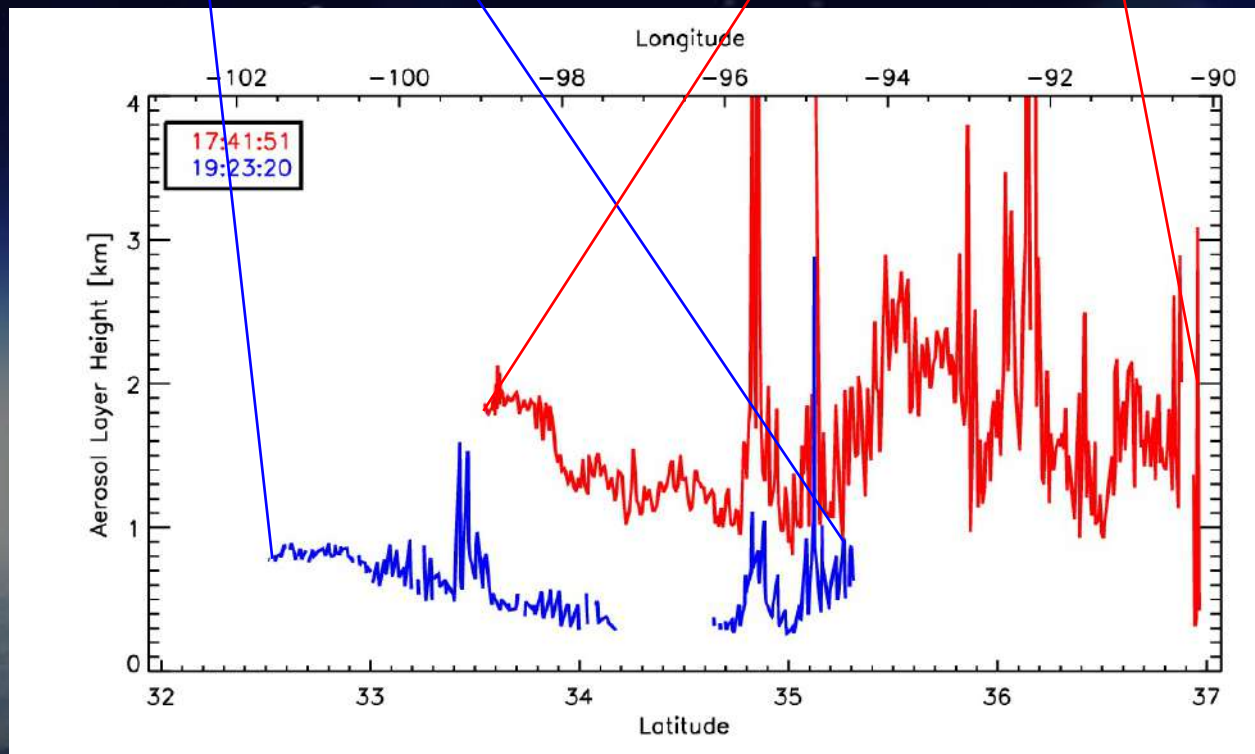
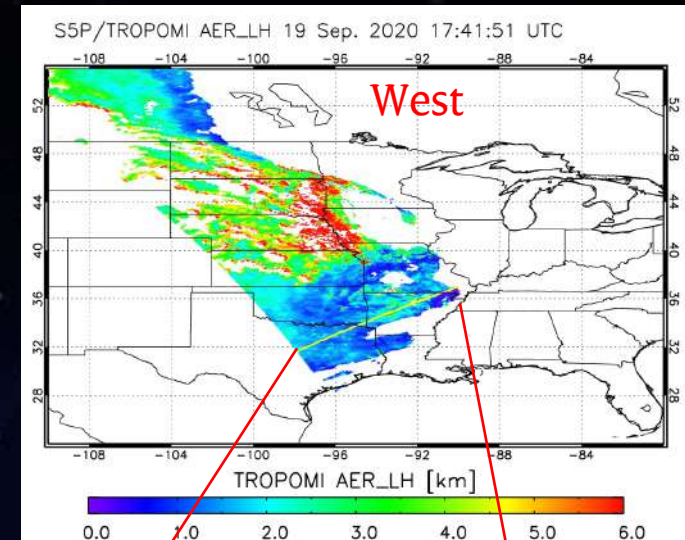
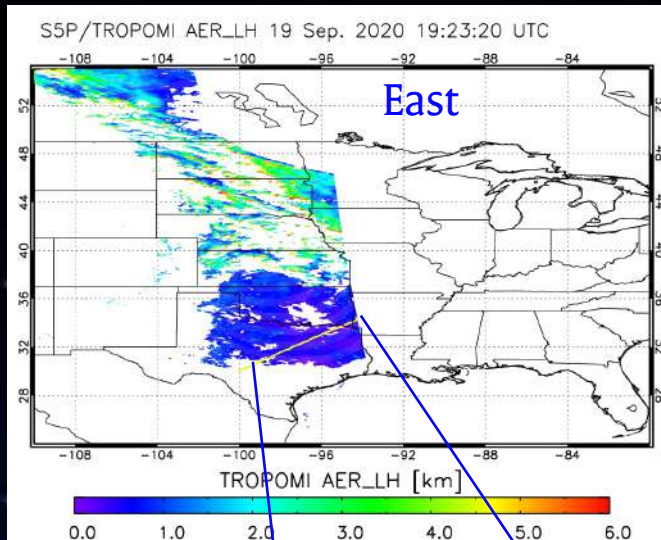
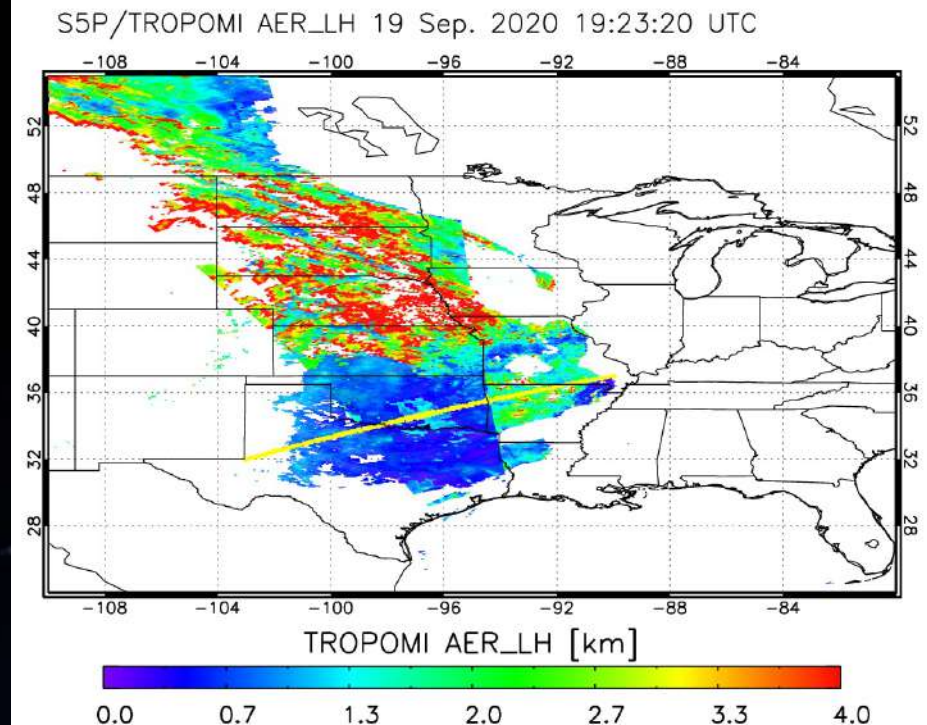


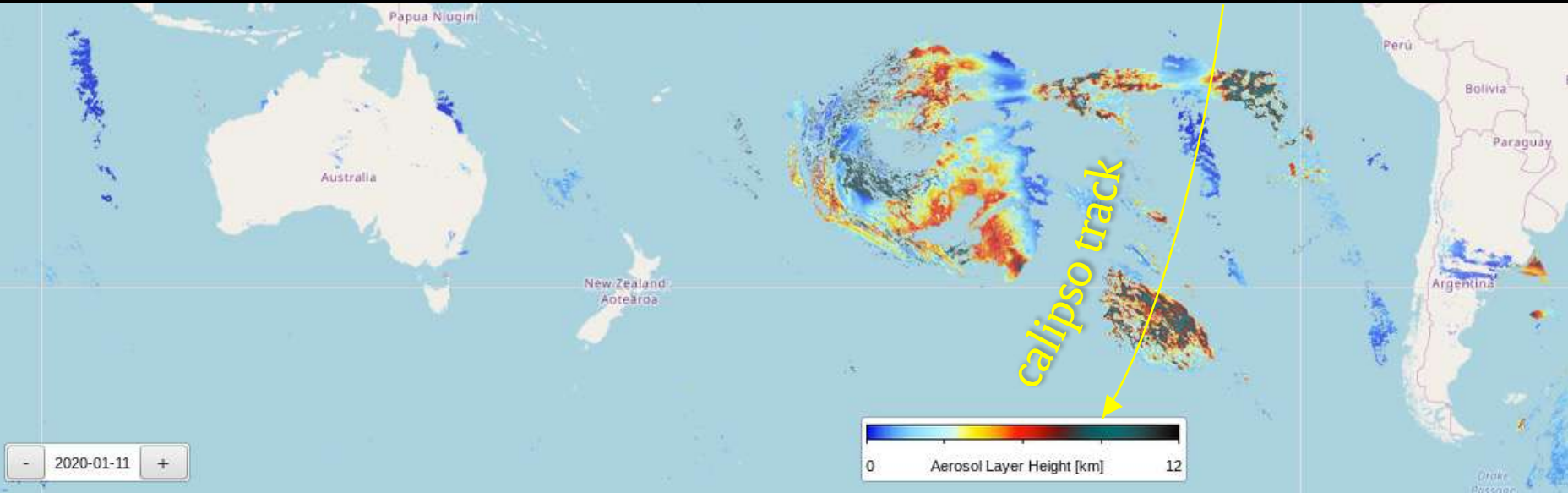
MUSA-Potenza lidar station:
Attenuated backscatter coefficient at 1064nm

weighted ext.
TROPOMI ALH

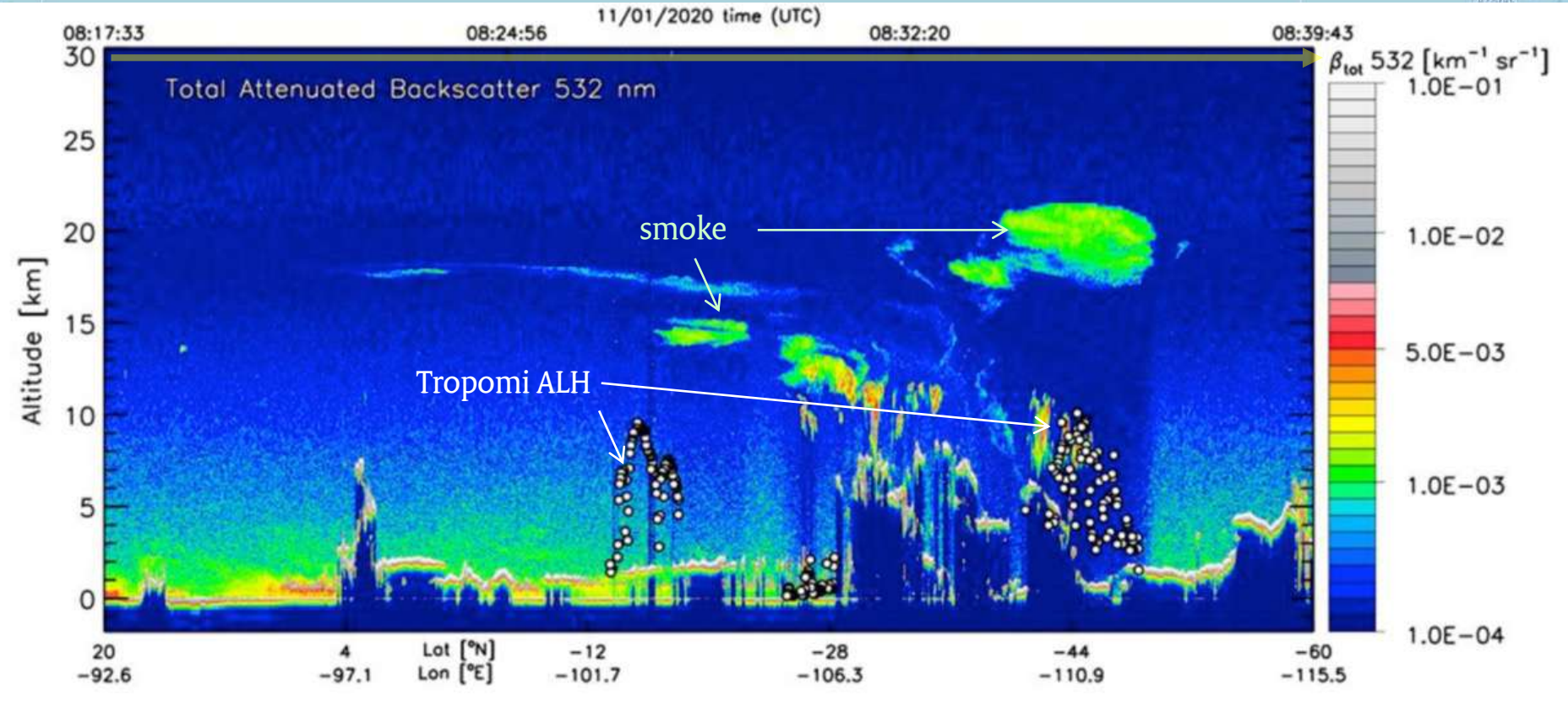


Angular dependence due to surface BRDF





upper altitude limit



ALH on 11 Jan 2020

Smoke from fires in New South Wales reached up to 25 km (S5P ALH ~ 12 km)

Ambient pressure are around 70 hPa - 15 hPa from 20-30 km altitude

ALH is constructed to have a fixed thickness of 50 hPa!

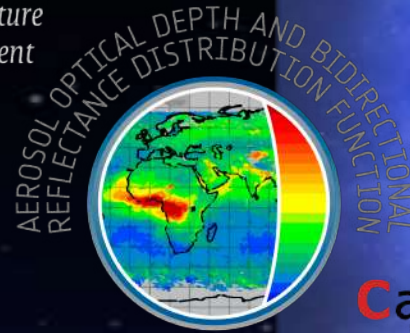


SENTINEL-5P+ INNOVATION

FSA EOP-SDR initiative (IT)

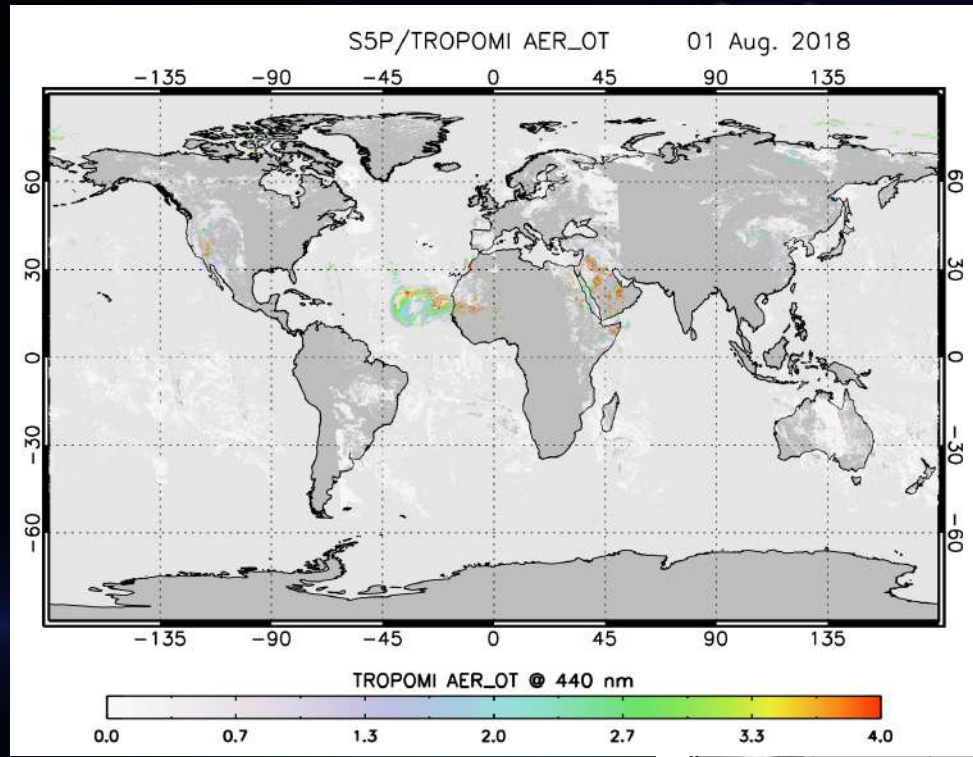


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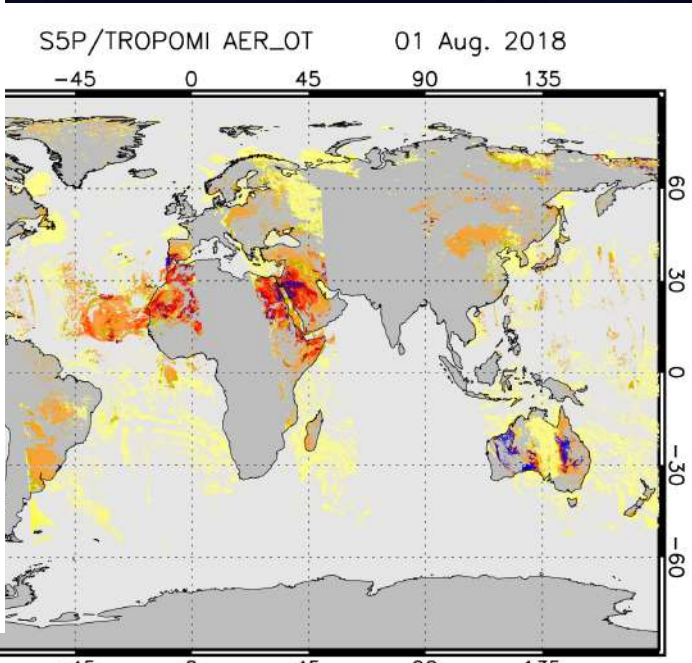


S5P-TROPOMI AER_OT PRODUCT

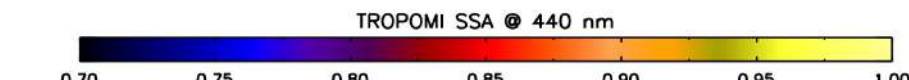
Global aerosol optical thickness and single scattering albedo



AOT



TROPOMI SSA

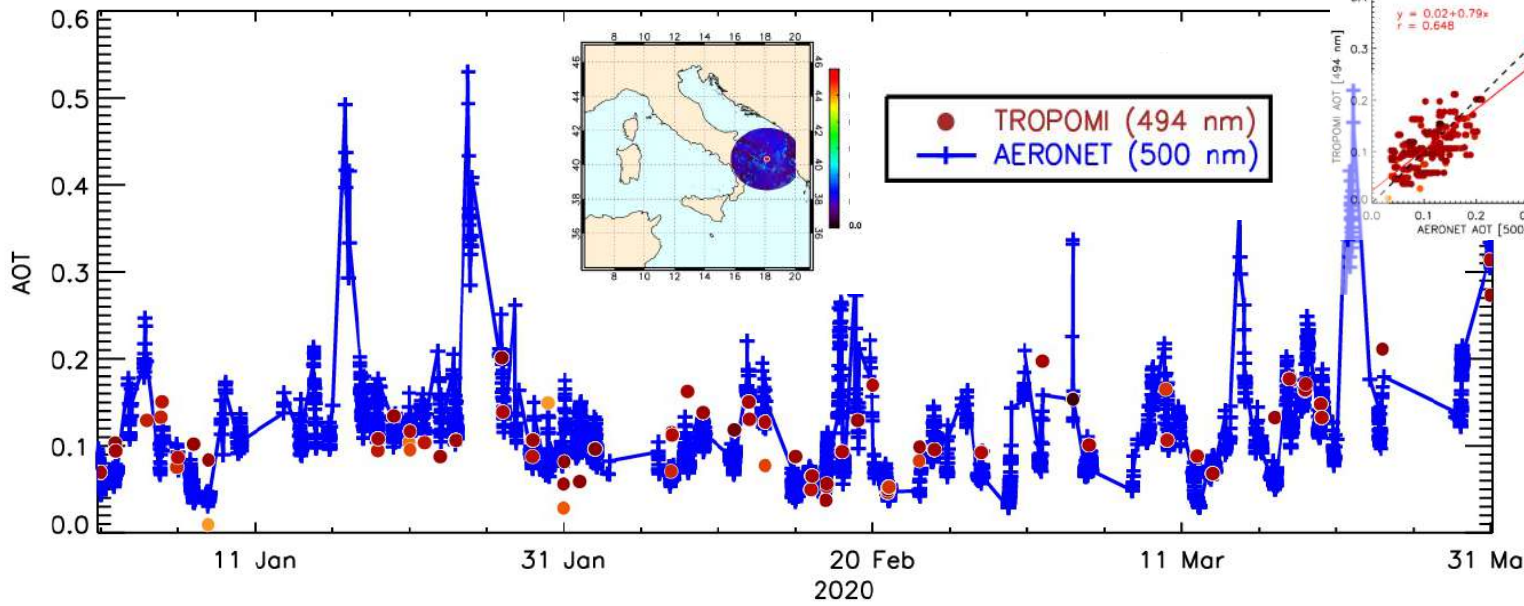
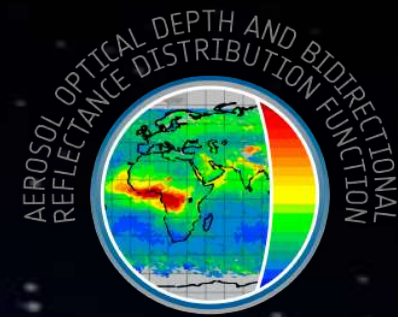


TROPOMI AER_OT

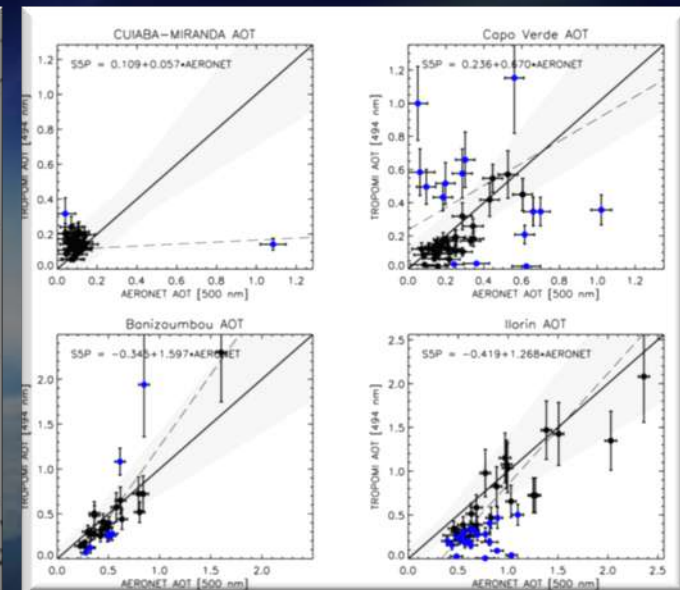
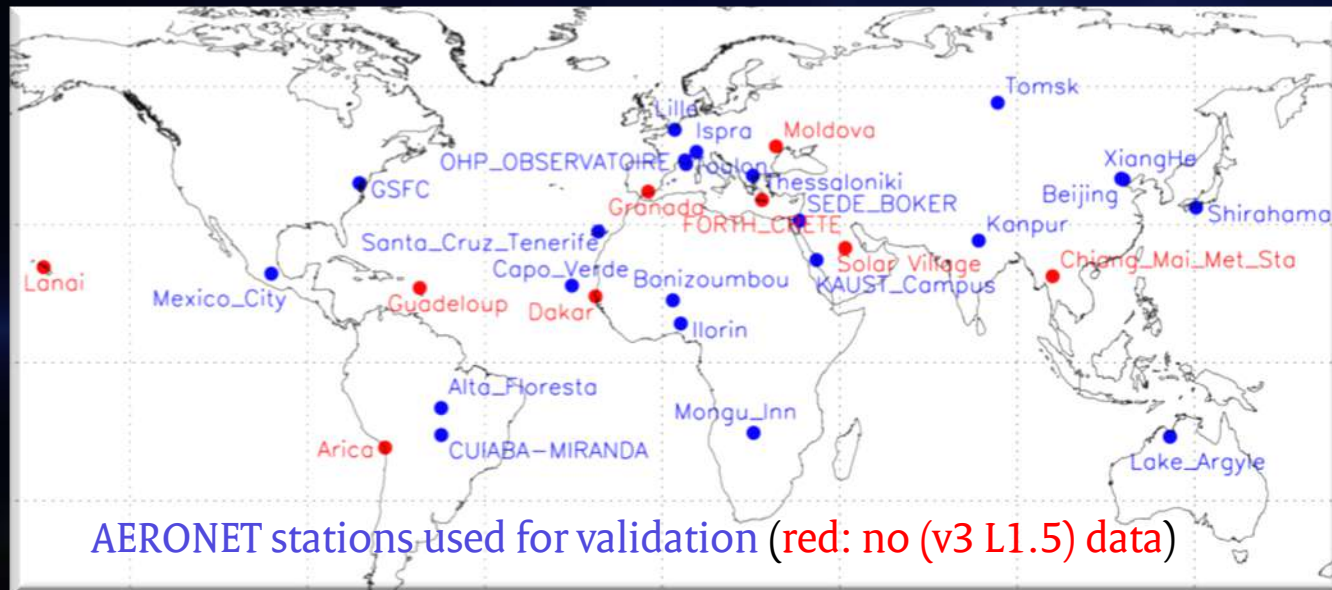


- Developed at KNMI
 - Produced and available on PAL
 - Retrieved in UV at 340, 380, 416, 440, 494 nm
 - Provides 3D view of aerosols globally
- Output:
- L2 files in standard S5P format (NetCDF)

AERONET vs TROPOMI



AOT near Lecce
 (40°20'N; 18°6'E)
 alt: 30 masl



S5P < 200 km, < 15 min
 processed on PAL.

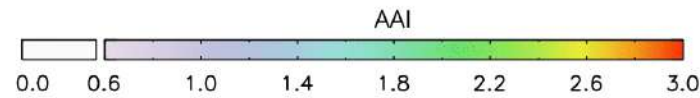
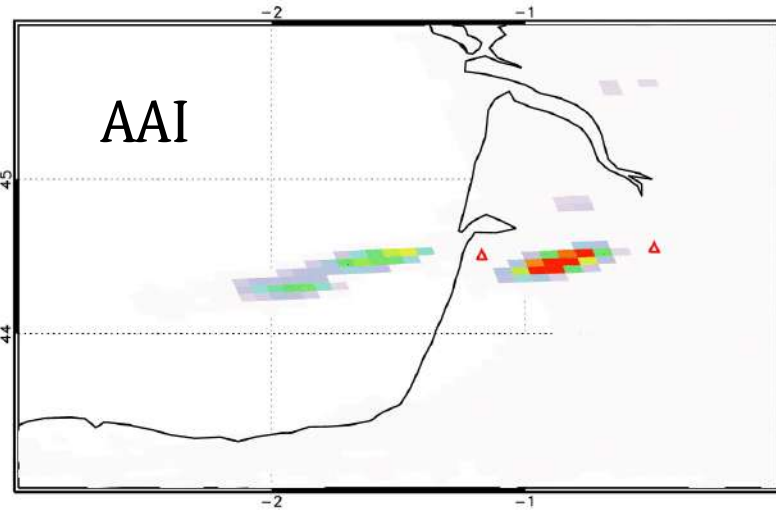
AERONET: Version 3,
 Level 1.5

3D-view of aerosols:

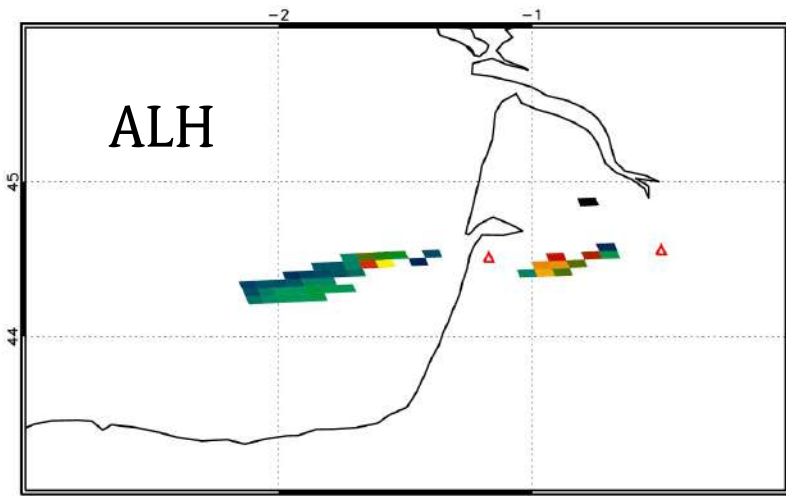
Aqua/MODIS RGB 13-07-2022



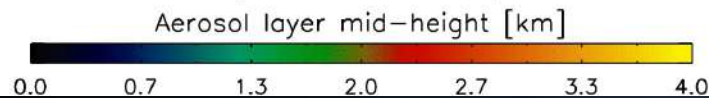
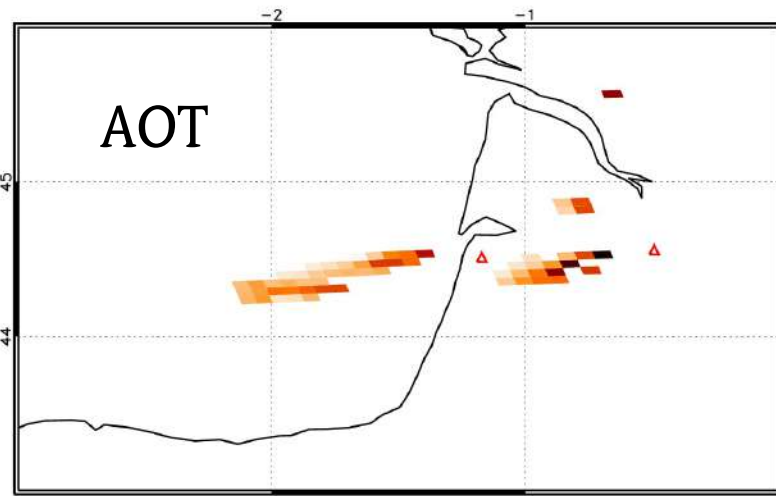
S5P/TROPOMI AAI_{354/388} 13-07-2022



S5P/TROPOMI AER_LH (AAI>0.6) 13-07-2022



S5P/TROPOMI AER_LOT (AAI>0.6) 13-07-2022



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Extreme weather

'Heat apocalypse' warning in western France as thousands flee wildfire

Nearly 25,000 escape blaze sparked by southern European heatwave that has already killed hundreds of people



Landiras and La Teste-de-Buch (France) fires – July 2022



Conclusions

- TROPOMI Aerosol product suite is state-of-the-art, providing unprecedented global, 3D views of aerosol events.
- Development of the aerosol products is necessary
- PAL has been instrumental in the fast development of a new L2 product (L2__AER_OT) and production and dissemination of data
- Knowledge from TROPOMI will benefit upcoming missions like EarthCare, 3MI, S4, S5 and aerosol/cloud products will be important in the changing climate

Video courtesy of the Earth Science and Remote Sensing Unit, NASA Johnson Space Center & ESA

5 years Sentinel-5p anniversary, 10-14 Oct. 2022 | M. de Graaf *et al.* – TROPOMI Aerosol Products