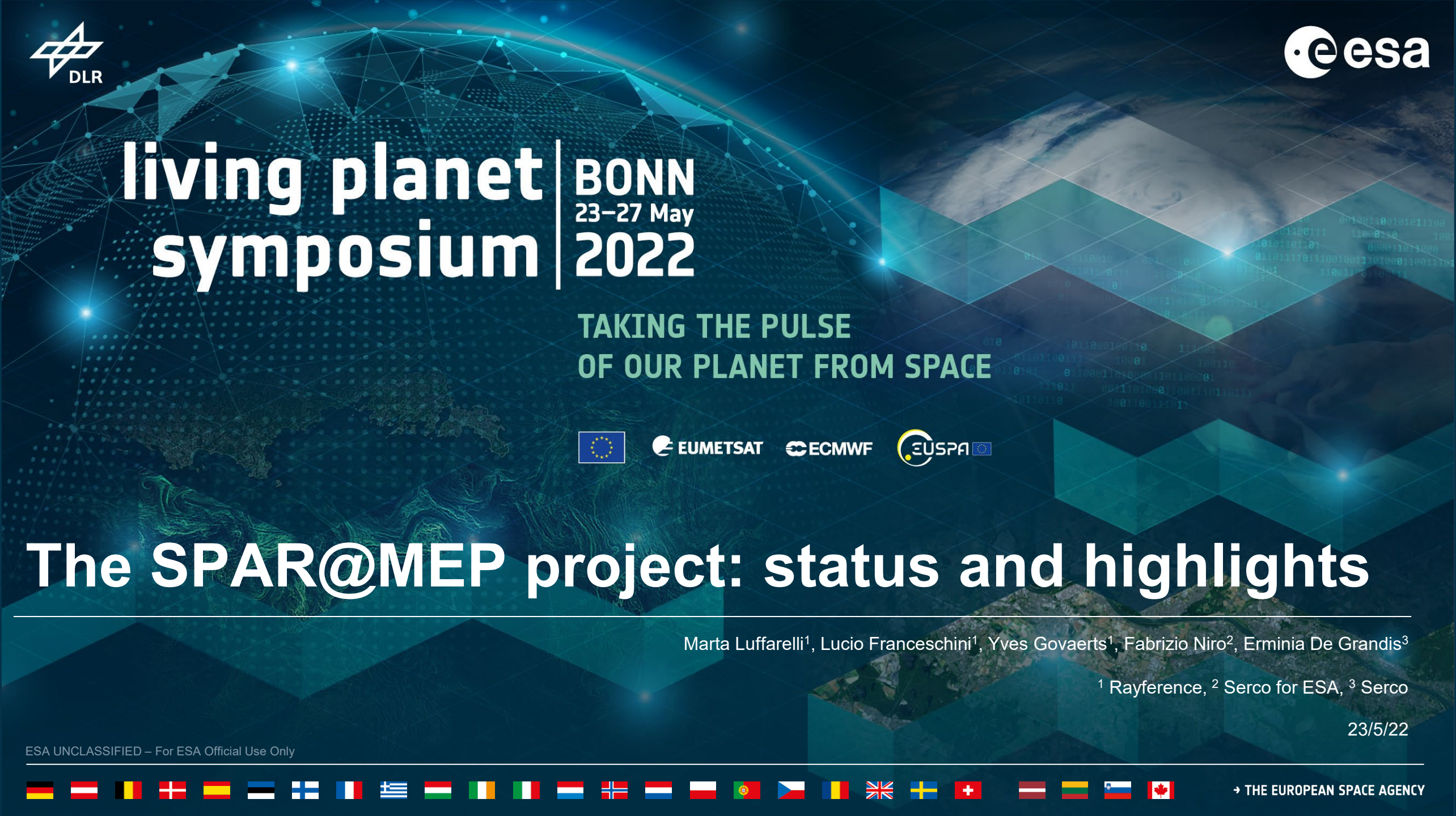



# The SPAR@MEP project: status and highlights

Marta Luffarelli[1], Lucio Franceschini[1], Yves Govaerts[1], Fabrizio Niro[2], Erminia De Grandis[3]

[1] Rayference, [2] Serco for ESA, [3] Serco

23/5/22

ESA UNCLASSIFIED – For ESA Official Use Only

# The SPAR@MEP Project: Overview

## OBJECTIVES

- Arvest the outcome of the PV-LAC demonstration study;
- To develop, test and validate an advanced algorithm for the generation of a Long-Term Data Record (LTDR) of AOT and surface BHR using the SPOT-VGT and PROBA-V archive of 1km data;
- Take advantage of the MEP facility;

## DELIVERABLES

- One year (2019) of AOT and surface BHR at 1 km resolution over Europe;
- a long-term (1998 – 2019) data record of AOT and BHR at 1km resolution over key macro-regions around selected AERONET stations;
- Global processing for one year at 5km resolution.

# The SPAR@MEP Project: Overview

## OBJECTIVES

- Arvest the outcome of the PV-LAC demonstration study;
- To develop, test and validate an advanced algorithm for the generation of a Long-Term Data Record (LTDR) of AOT and surface BHR using the SPOT-VGT and PROBA-V archive of 1km data;
- Take advantage of the MEP facility;

## DELIVERABLES

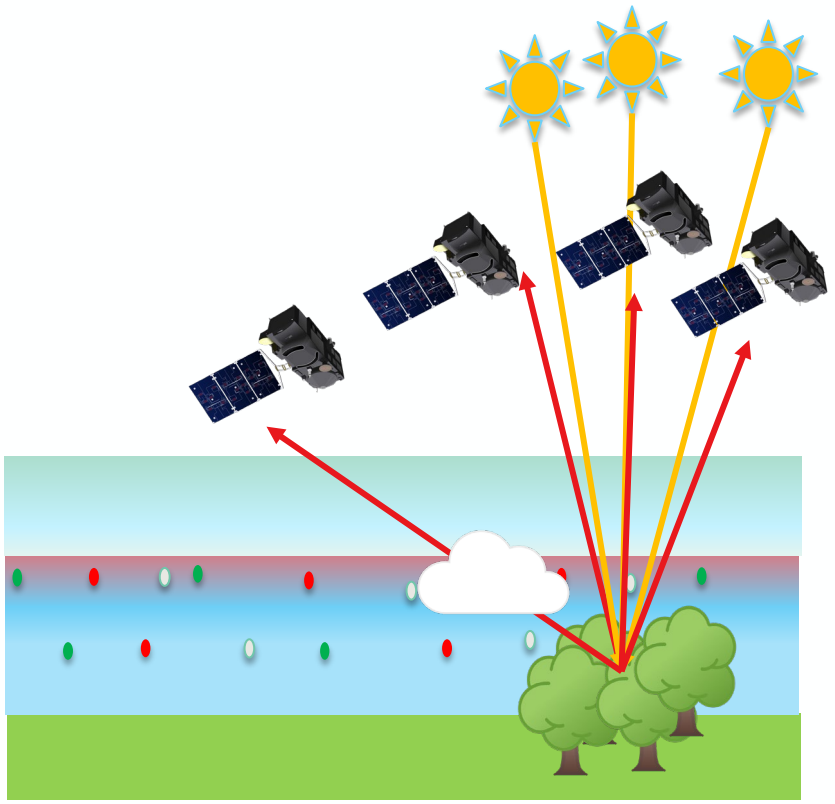
- One year (2019) of AOT and surface BHR at 1 km resolution over Europe; ✓
- a long-term (1998 – 2019) data record of AOT and BHR at 1km resolution over key macro-regions around selected AERONET stations; ✓
- Global processing for one year at 5km resolution. ✗

# The SPAR@MEP Project: Background

CISAR is a generic algorithm for the inversion of the couple surface-atmosphere system with continuous variation of the state variable in the solution space.

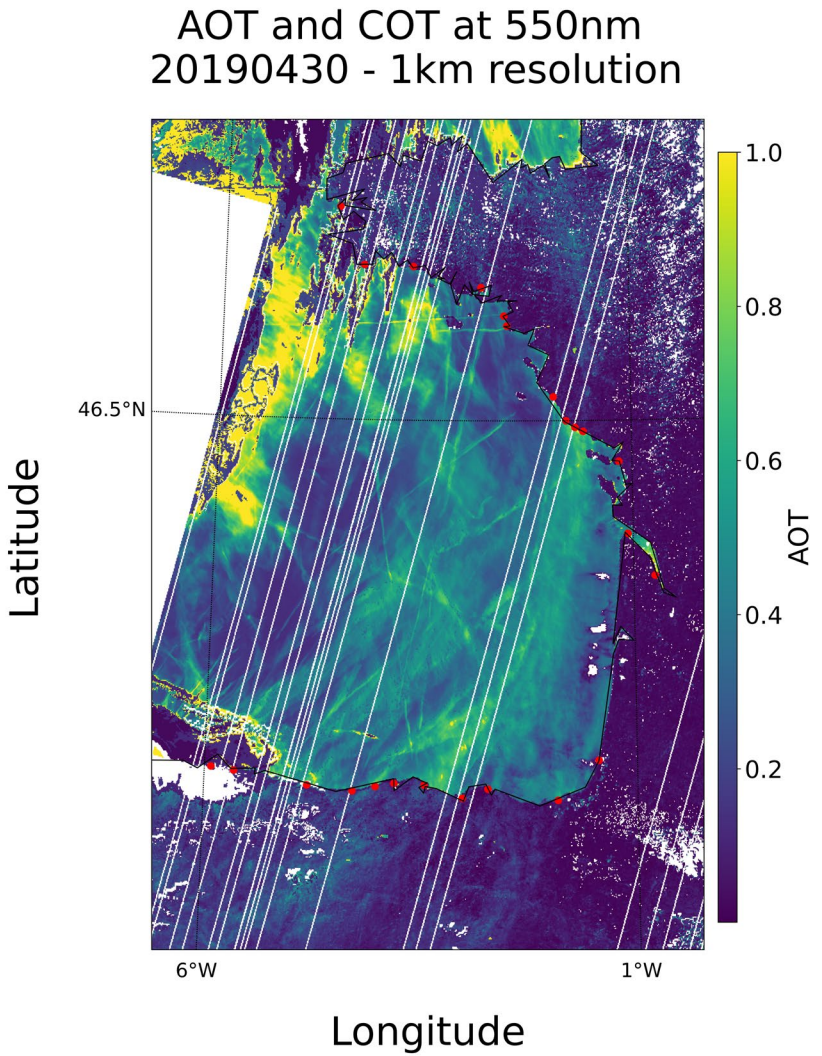
CISAR can process all-sky observations, relying on the cloud mask associated to the Level-1 product to build the prior information on the atmospheric state.

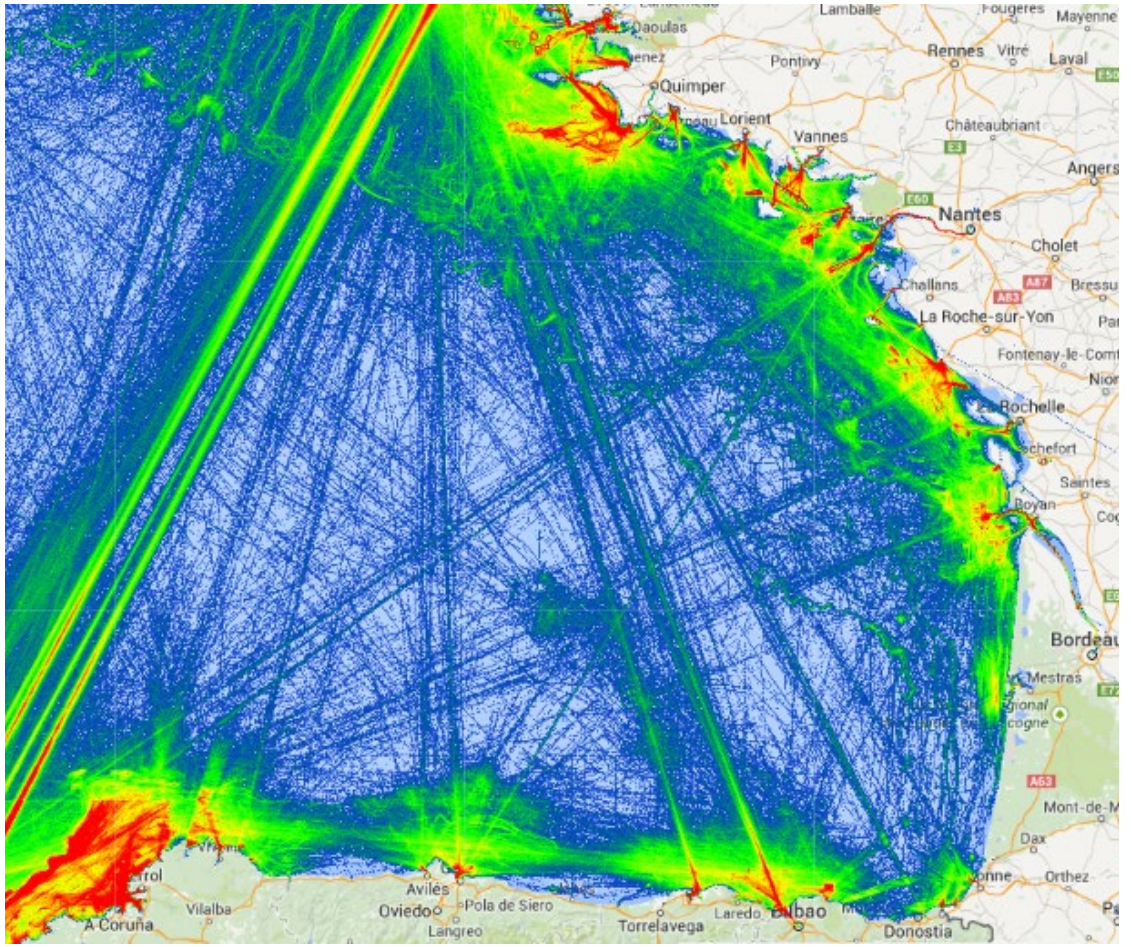
CISAR is deployed through the Generic Data Processing Chain (GEDAP) and installed on the MEP through Docker images.



# Product over Europe at 1 km

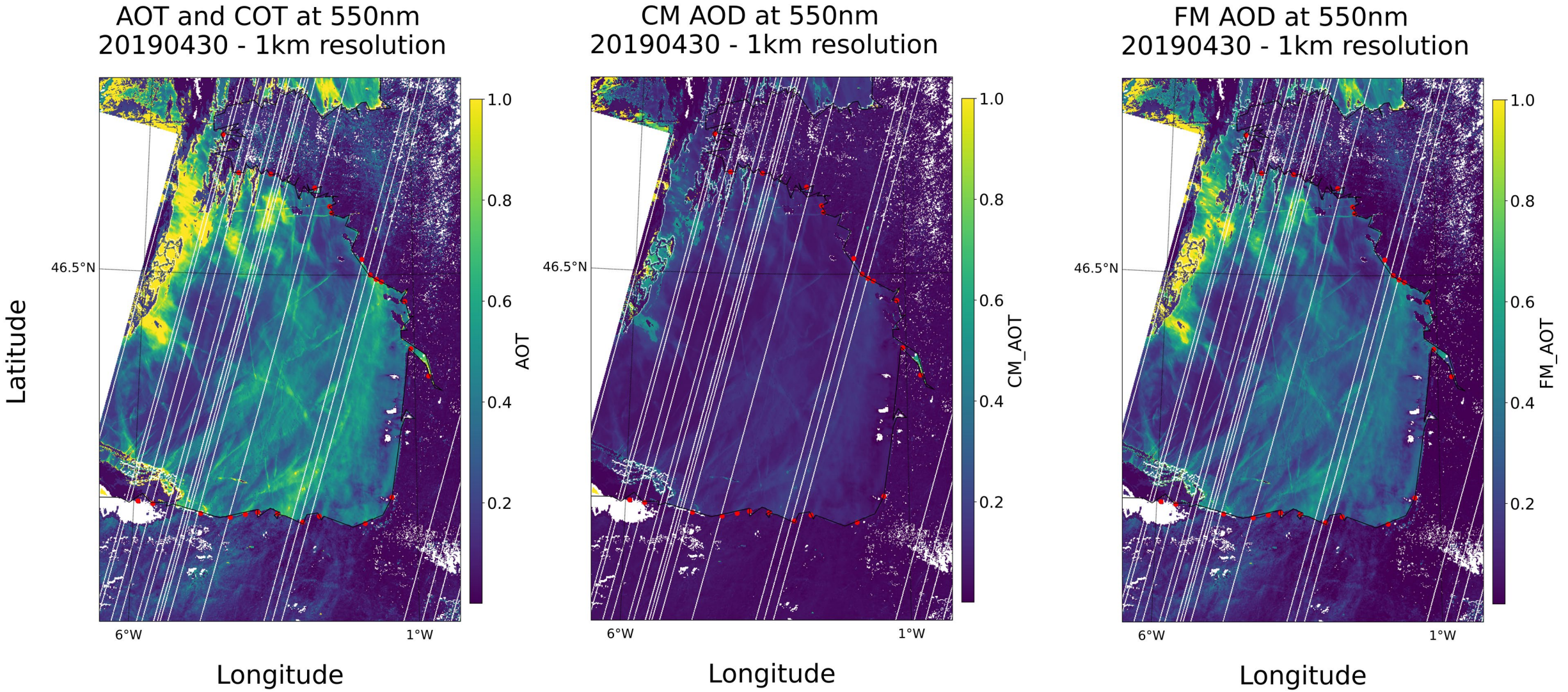
# Ship trails in the Biscay Bay



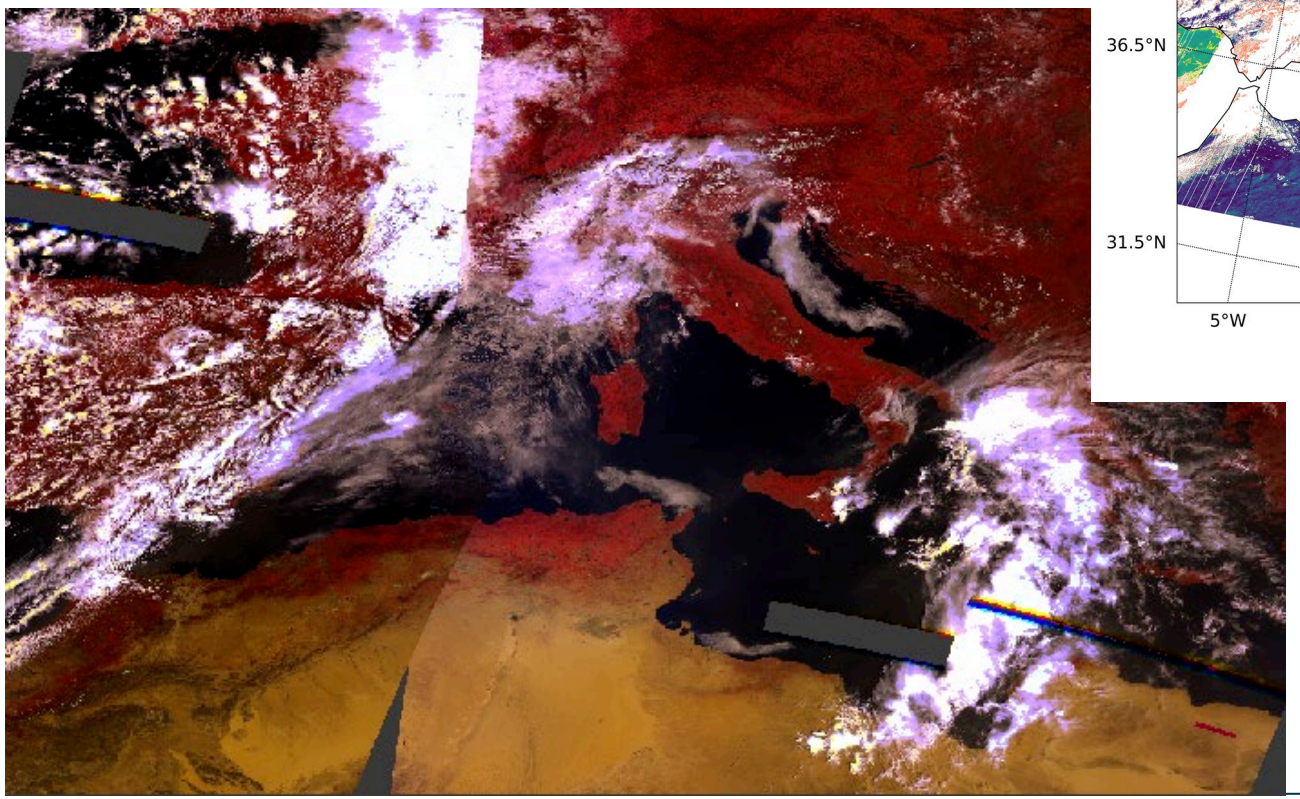



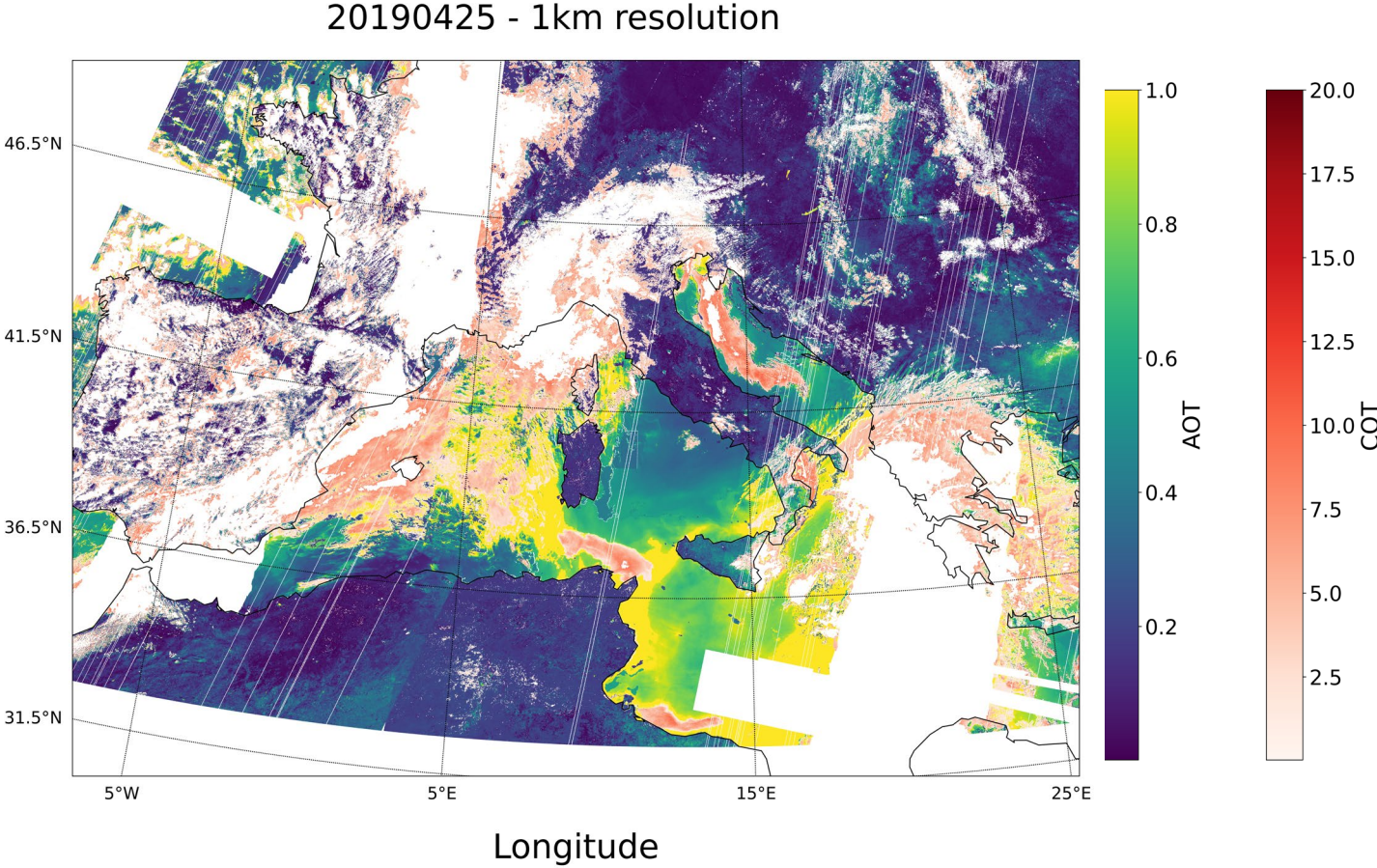

© Marine Vessel Traffic

# Ship trails in the Biscay Bay

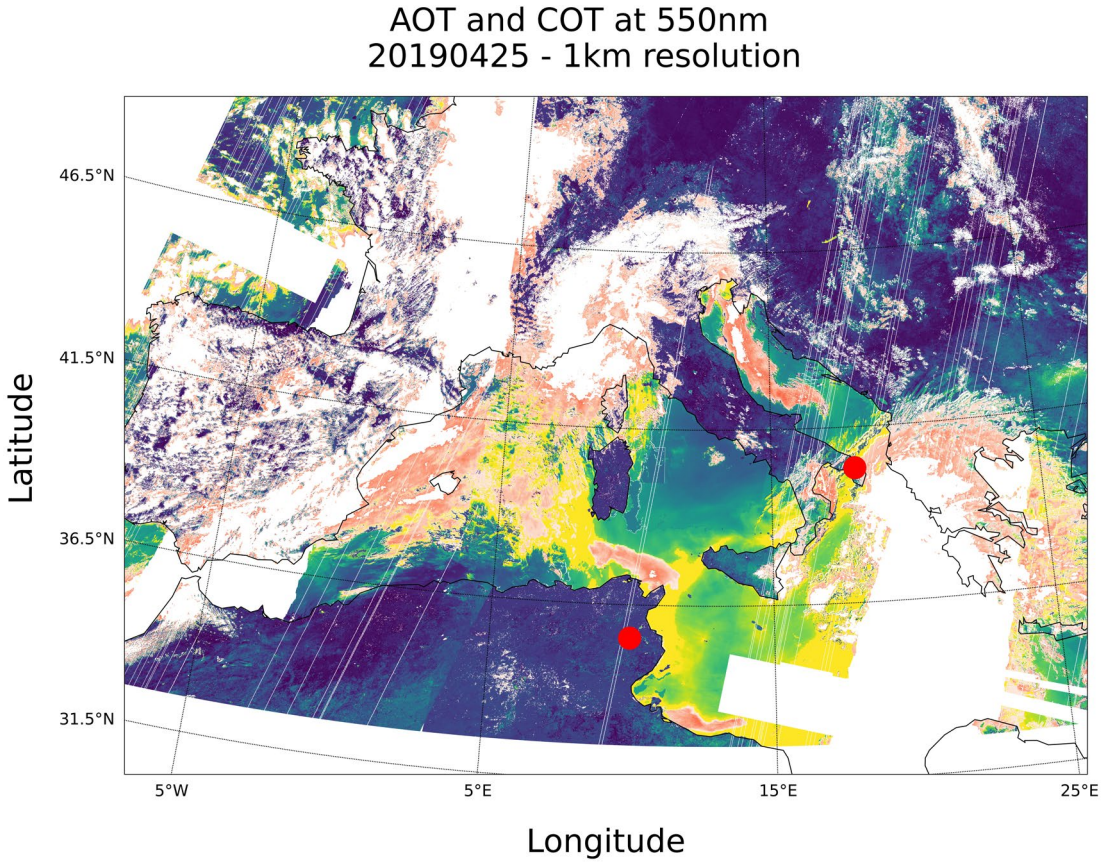


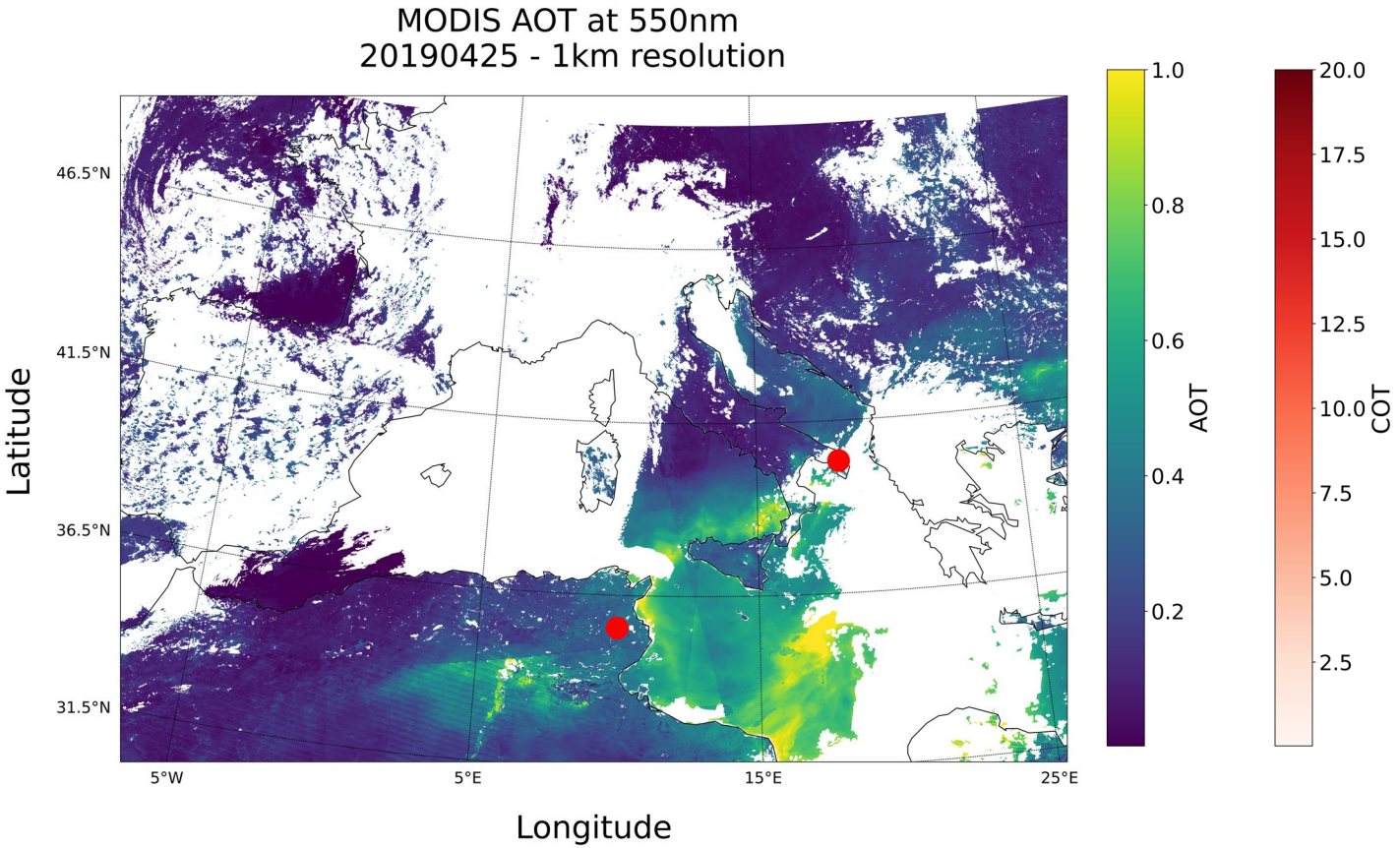
# Dust storm 25th April 2019



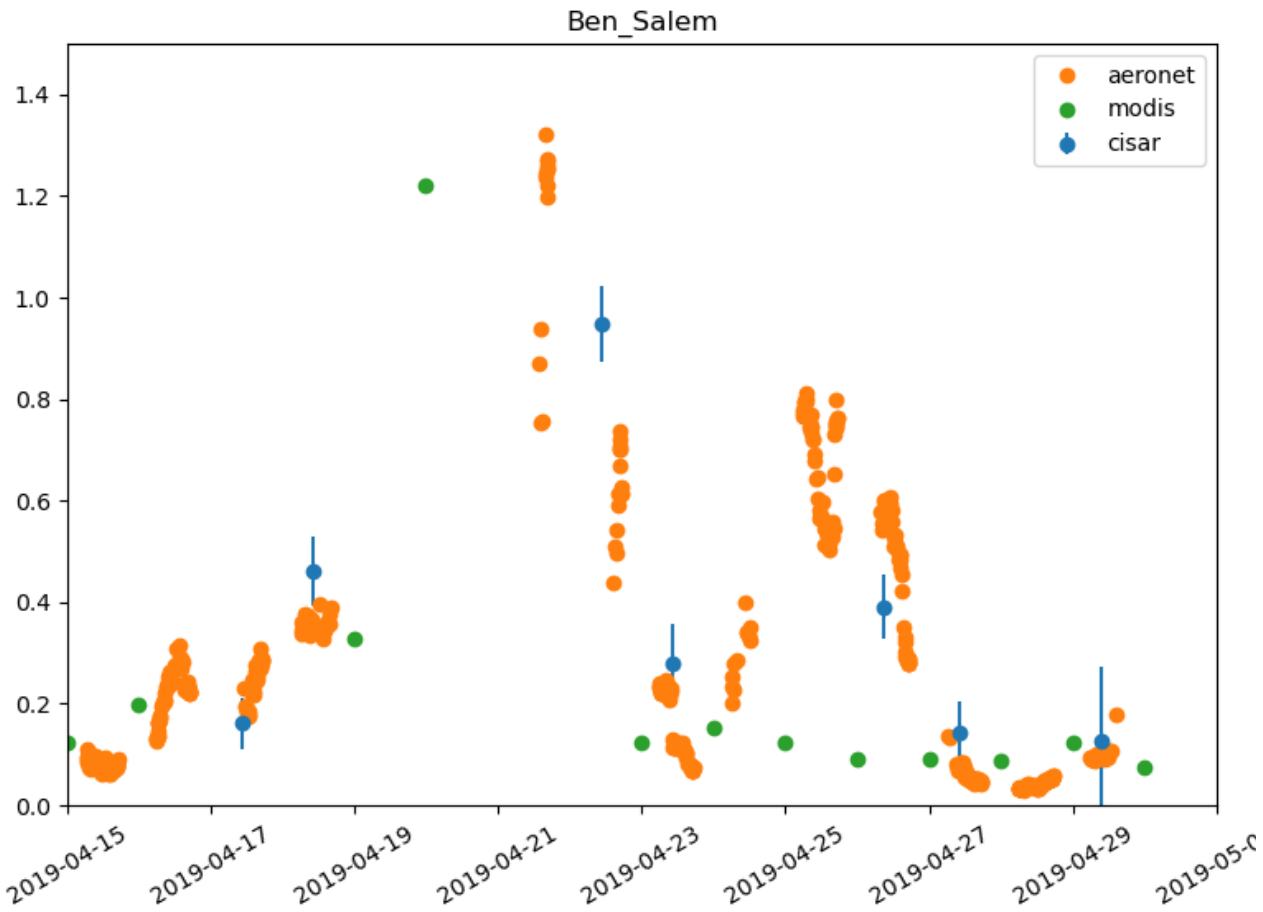


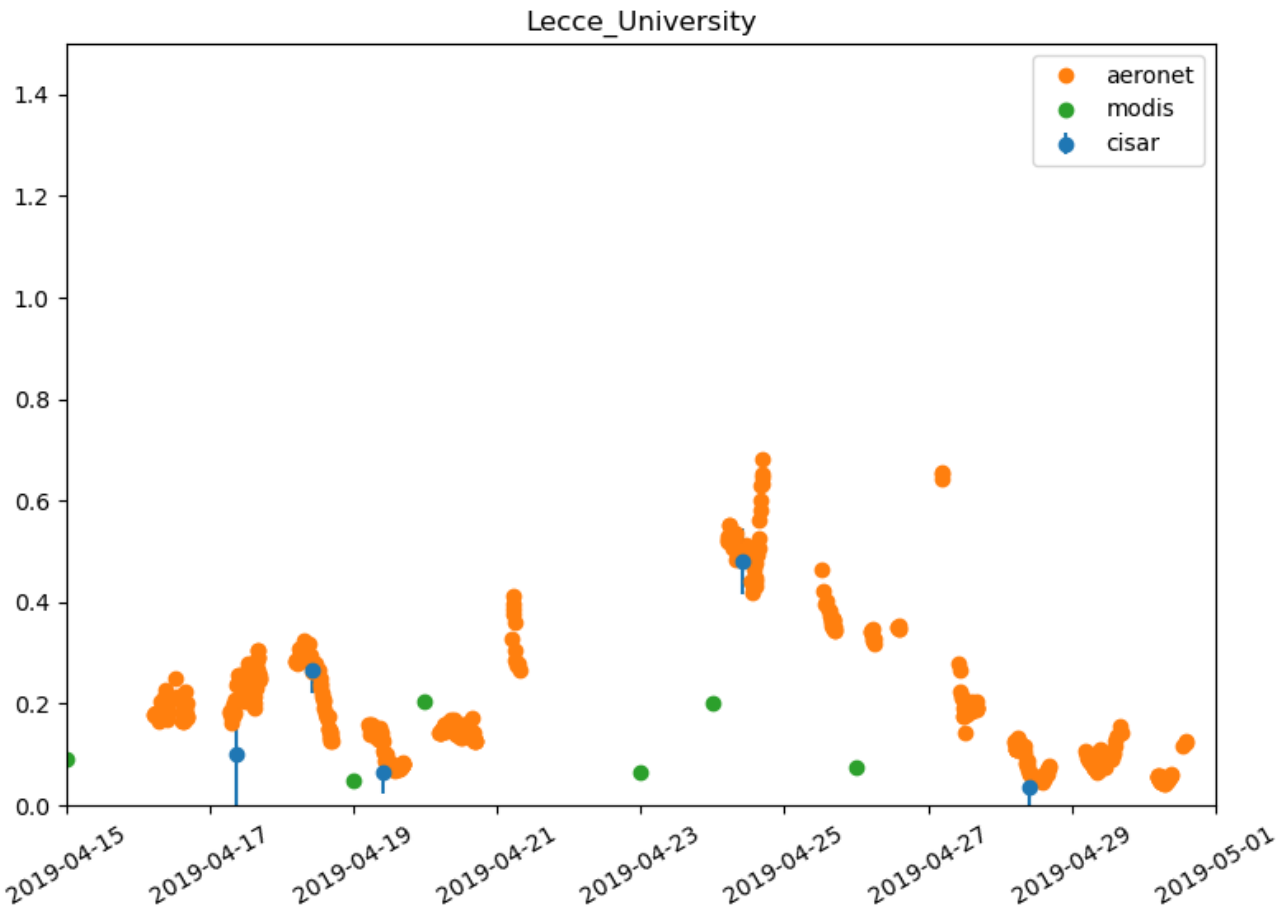
# Dust storm 25th April 2019



# Dust storm 25th April 2019



# Turkish Fires - August 2019

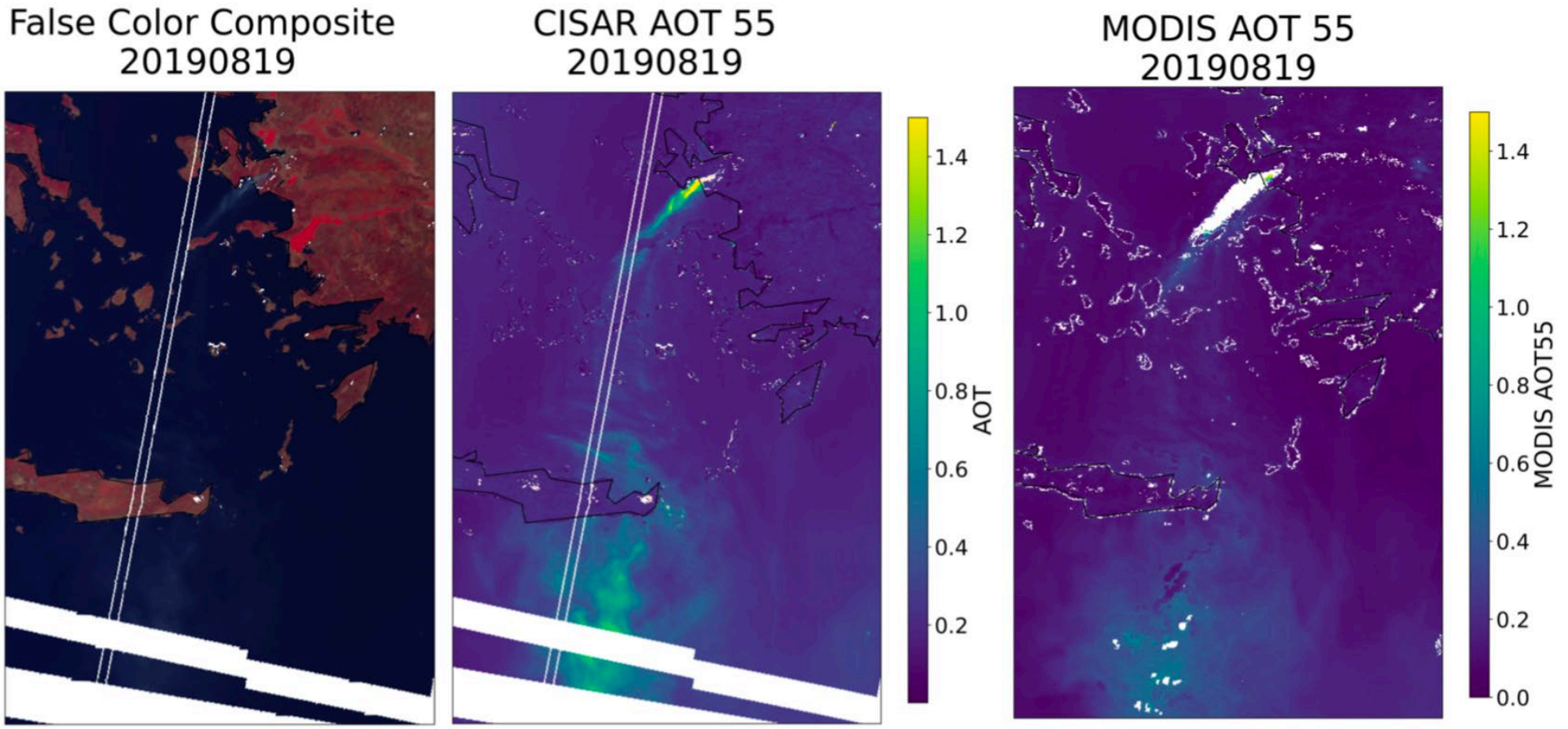



Figure 12: PROBA-V false color composite (left panel), CISAR (central panel) and MODIS (right panel) AOT retrieval at $0.55\mu m$ over the Mediterranean region during the 19th of August 2019.

# Turkish Fires - August 2019

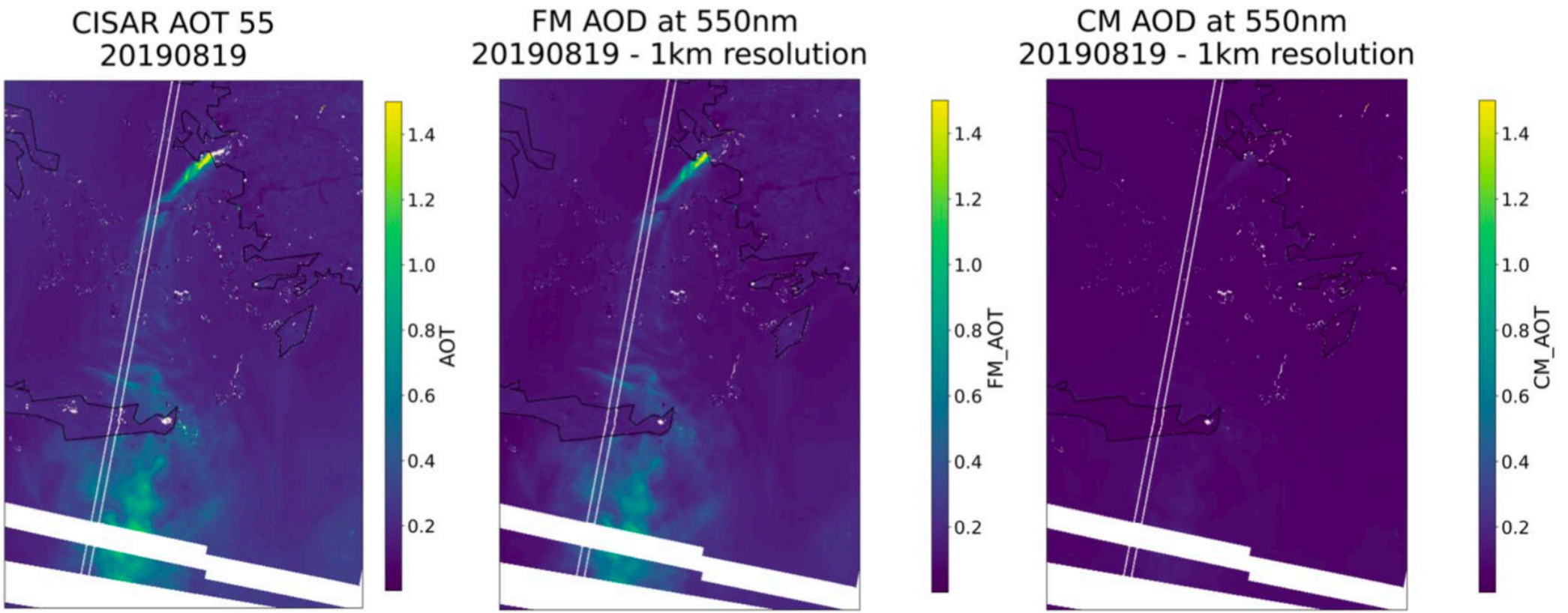
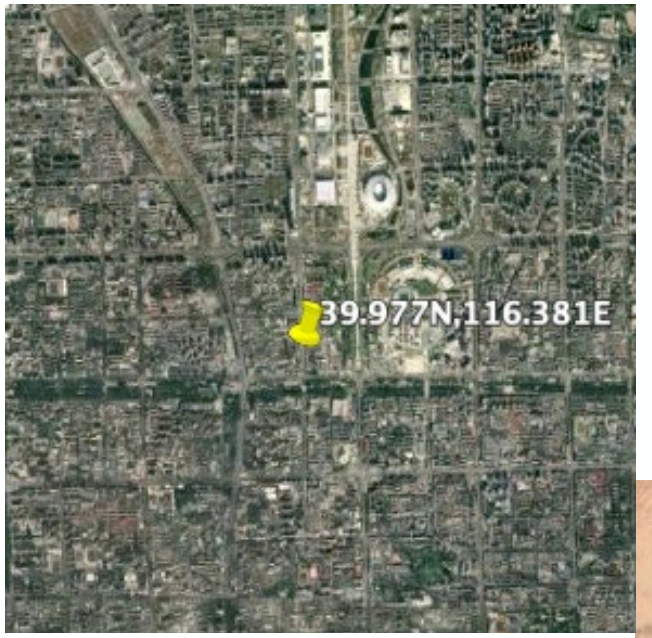



Figure 13: Same as Fig. 12 but for the Total AOT (left panel), the Fine Mode (FM) AOT (central panel) and the Coarse Mode (CM) AOT (right panel).

# LTDR over key areas at 5km

# LTDR over key areas at 5km

## Venice
- Water
- Northern Italy pollution

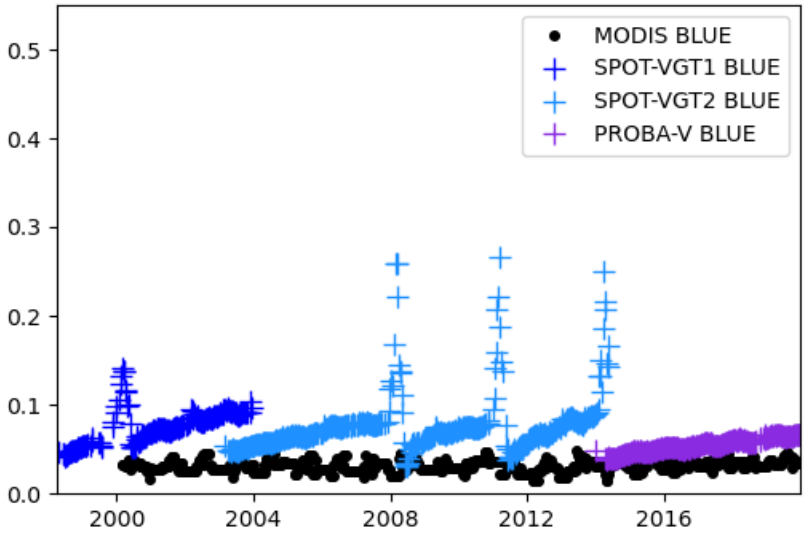


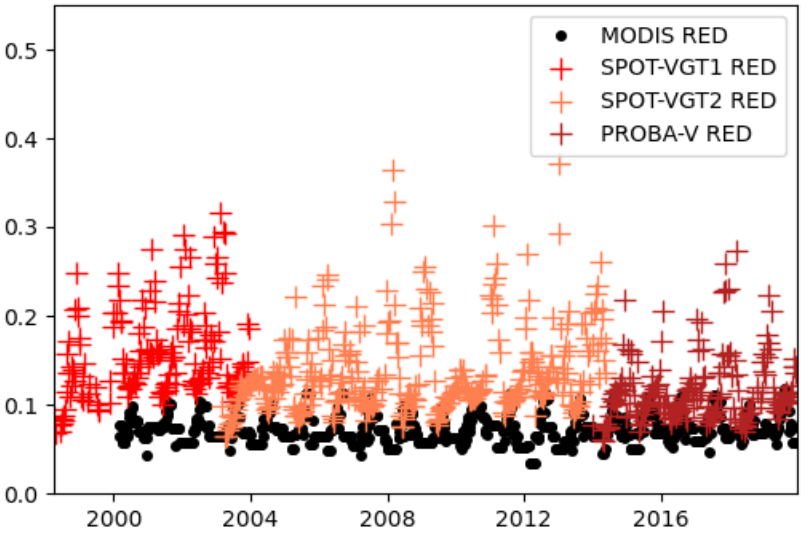

## Banizoumbou
- Arid
- Dust

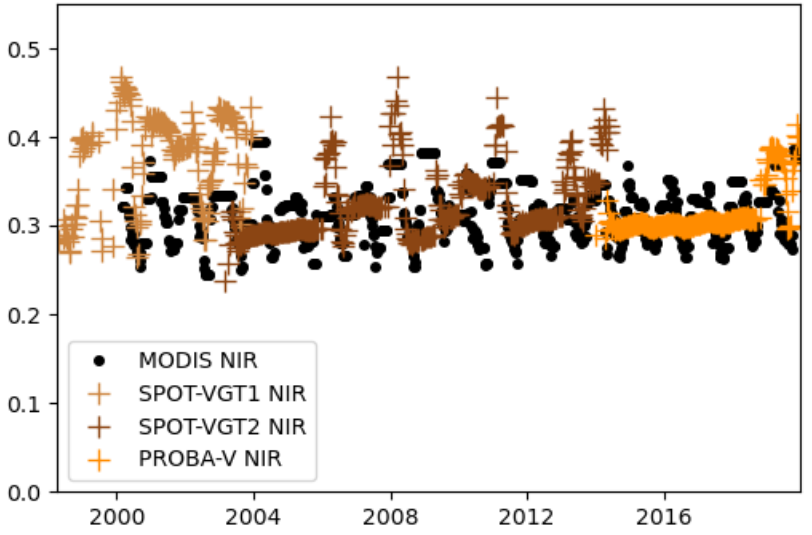
## Alta Floresta
- Forest
- Cropland
- Urban
- Biomass burning

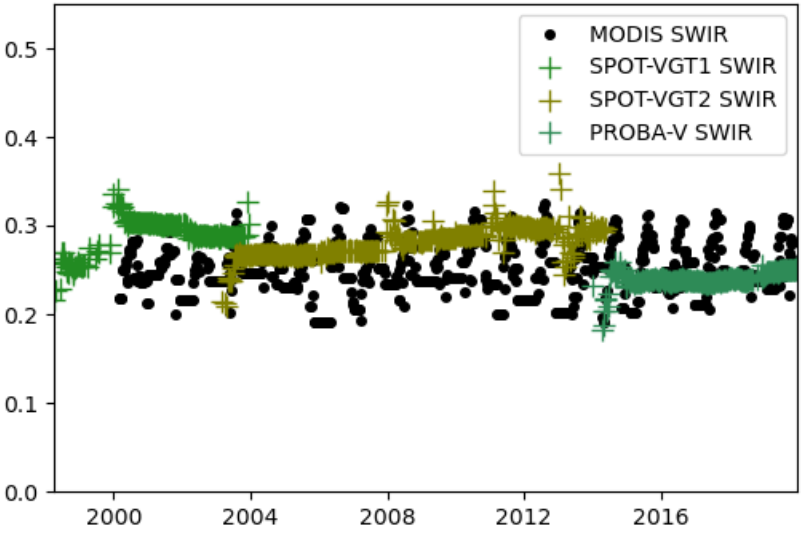
## Beijing
- Urban
- Extreme pollution

# LTDR over key areas at 5km – Alta Floresta

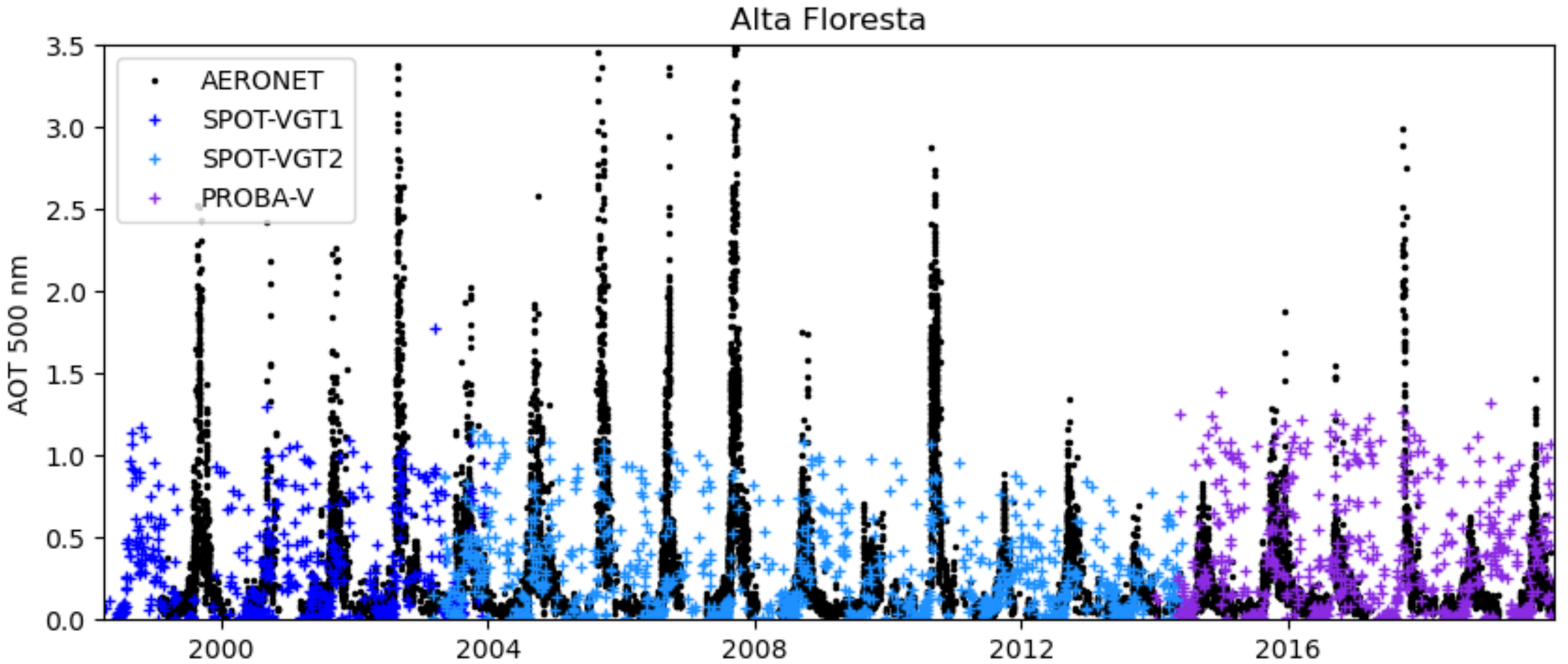


# LTDR over key areas at 5km – Alta Floresta



# Impact of PROBA-V Collection 2

# Impact of PROBA-V Collection 2

| | C1 | | | C2 | | |
|---|---|---|---|---|---|---|
| | A | P | U | A | P | U |
| Venice | 0.034 | 0.192 | 0.195 | -0.009 | 0.162 | 0.162 |
| Alta Floresta | 0.097 | 0.368 | 0.380 | 0.060 | 0.183 | 0.192 |
| Banizoumbou | 0.018 | 0.424 | 0.424 | -0.017 | 0.322 | 0.322 |
| Beijing | 0.097 | 0.484 | 0.493 | -0.049 | 0.313 | 0.316 |

# Conclusions

- The SPAR@MEP project exploits the MEP facilities to process observations acquired by VGT1, VGT2 and PROBA-V.
- The product at 1km obtained from PROBA-V over Europe during 2020 shows interesting cases over dust storms, fires, and ship trails, showing the advantages of processing all-sky observations and to invert data at such high resolution.
- The LTDR over the selected key areas shows CISAR's capabilities of delivering a consistent product among different sensors, given that the latter are properly characterised and harmonised.