The Copernicus Sentinel-3 Near Real Time (NRT) AOD Baseline Collection 1 product by EUMETSAT

Julien Chimot, Bertrand Fougnie, Bojan Bojkov

19th AEROCOM / AEROSAT

15th October 2020, On-Line

S3 NRT AOD – Release status

- Product maturity labels:
  - AOD Ocean 'Preliminary Operational':
    - Product close to user requirements. Validation to be completed.
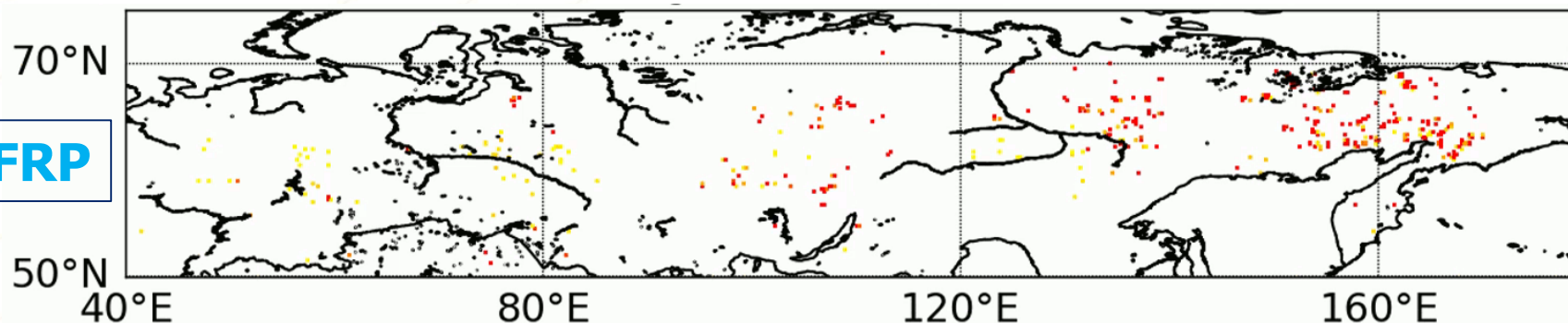 - AOD Land 'Demonstrational':
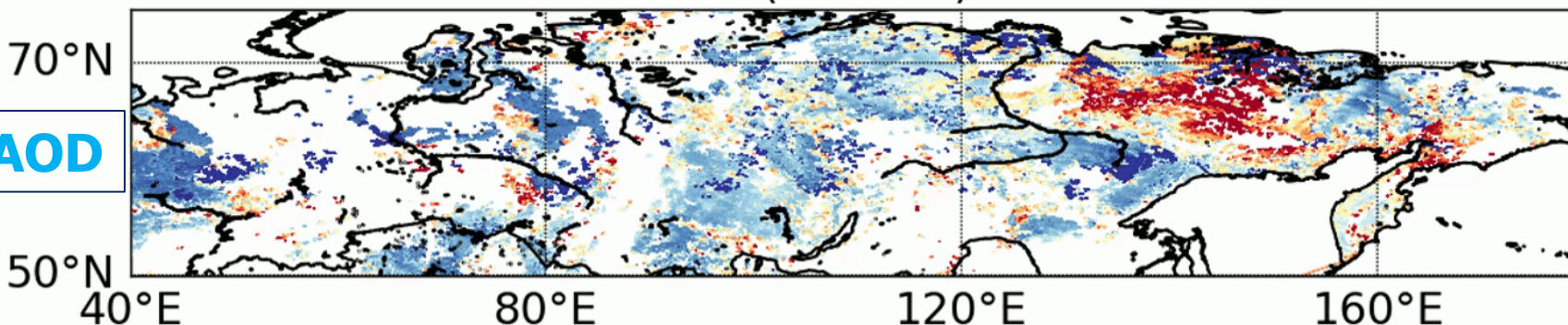   - Temporary label: product shall be used for mapping purposes.

- Toward a new algorithm redesigned and procured by EUMETSAT, entrusted by the European Commission:
  - Processor v2.0, Baseline Collection 1.0
  - Disseminated to public users on 27.08.2020

NRT FRP

NRT AOD

Siberia Wildfire : 24 June – 4 July 2020

From Copernicus Sentinel-3 A+B NRT Atmospheric L2 products deployed by EUMETSAT in 2020
NRT FRP Processor v2.0, Baseline Collection 1 (off-line)
NRT AOD Processor v2.0, Baseline Collection 1 (off-line)

Documentation & data access of Sentinel-3 NRT L2 Atmospheric products:
https://www.eumetsat.int/website/home/Satellites/CurrentSatellites/Sentinel3/AtmosphericComposition/index.html

S3 NRT AOD – The genesis of Processor v2.0

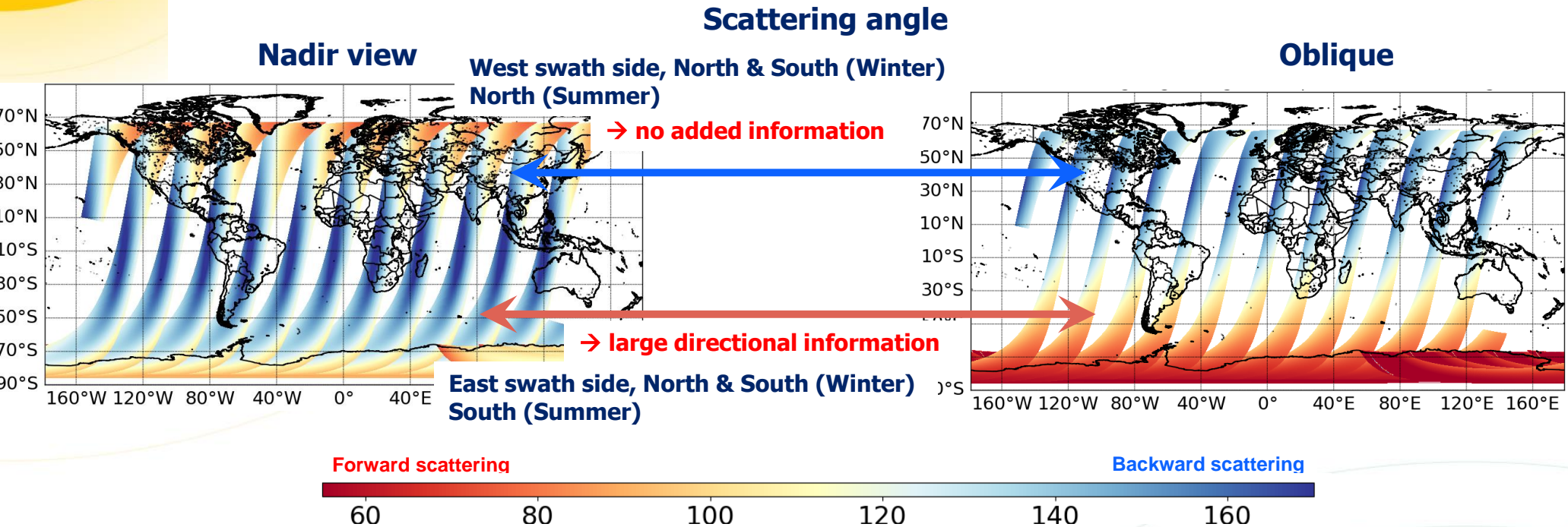*A proper understanding of the aerosol information content combined with radiometric improvements*

- **Land & Ocean:**
  - **Update of the absolute, inter-band & dual-view radiometric calibration**: based on vicarious calibration over desert sites and a consensus over 4 institutes (RAL, Rayference, CNES, Arizona University).

- **Land Geometry: joint aerosol-surface retrieval from the dual view for high information content**

  Land Model: North *et al.*, 1999, 2002

- **Land Spectral: AOD is retrieved. Surface reflectance is ~~retrieved~~ estimated. Lower information content.**
  - Taking advantage of the new SLSTR SWIR (2.25 μm) channel   Karnieli et al., 2000
  - Detection of land cover via the Aerosol Free Ratio Index (AFRI) → based on NIR and SWIR TOA radiometry
  - Development of a Red-SWIR spectral surface model, inspired by Suomi VIIRS.   Hsu *et al.*, Sayer *et al.*

- **Spectral channel weights:**
  - To focus on channels the most sensitive to aerosol signals, the less possible to land soils!

- **Additionally:**
  - Spatial resolution – 9.5 km – To mitigate potential dual mis-registration noise
  - Log(AOD) instead of AOD
  - AOD quality filtering criteria – To remove cloud residuals & sediments

https://www.eumetsat.int/website/home/Data/ScienceActivities/OperationalAlgorithms/CopernicusSentinel3 NRTAerosolOpticalDepth/index.html

SLSTR dual-view geometry information content

- Geometry: pros. and cons of **only** two views

Scattering angle

Nadir view   **Oblique**

West swath side, North & South (Winter)
North (Summer)

→ **no added information**

→ **large directional information**

East swath side, North & South (Winter)
South (Summer)

Forward scattering   **Backward scattering**

- References:
  - The EUMETSAT funded SARP project (final report to be online, Option 1 on-going)
  - Recently published peer-review paper "How the geometry of acquisition impacts the aerosol retrieval", Fougnie, Chimot, *et al.*, JQSRT, 2020, https://doi.org/10.1016/j.jqsrt.2020.107304
  - PMAP geometry analyses & preparation of 3MI & Geo (MTG FCI) AOD products by EUMETSAT
  - S3VT Talk in Dec 2020: Evaluation of recommendations to the S3VT for aerosol validation from satellite sensors – The importance of geometry & satellite inter-comparisons for NRT users

EUMETSAT   **FINNISH METEOROLOGICAL INSTITUTE**

https://www.eumetsat.int/website/home/Data/ScienceActivities/OperationalAlgorithms/CopernicusSentinel3NRTAerosolOpticalDepth/index.html
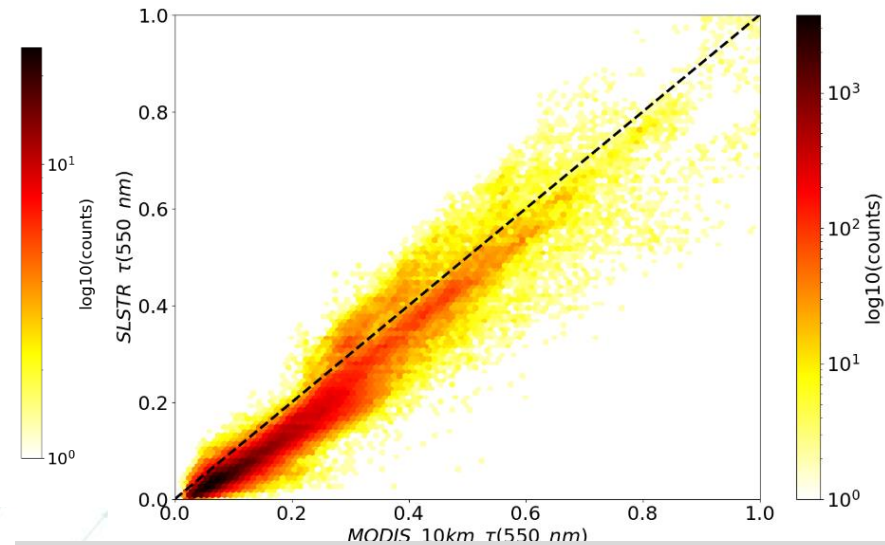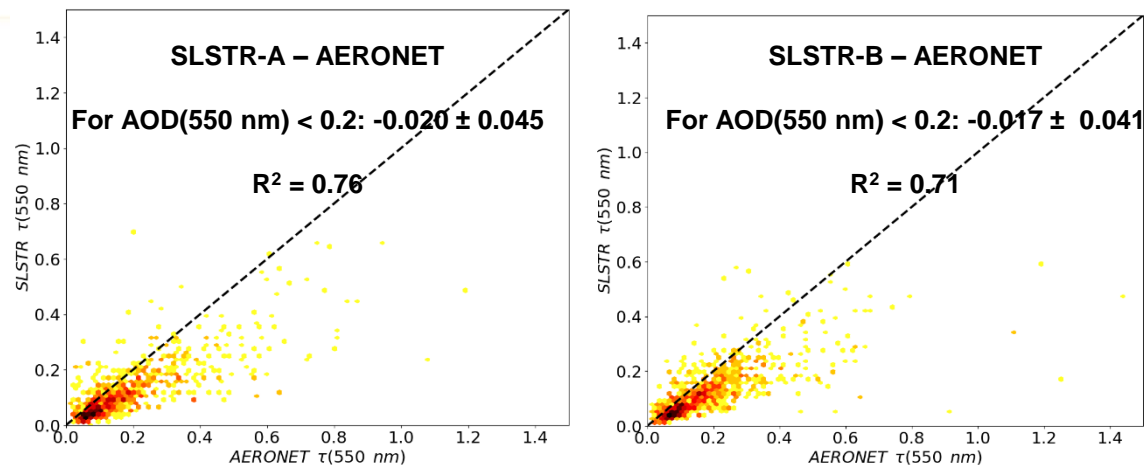
CUS   **EUMETSAT**

4

- Excellent correlation with MODIS-Terra Dark Target Ocean, Coll. 6.1

- Radiometric calibration correction allows a bias reduction for high dust AOD.

  - Benefits of the consistent spectral radiometry calibration correction

AOD Ocean – Entering into a new era with NRT SLSTR AOD, PMAP, VIIRS…
New interest under investigation with CAMS

- High correlation with AERONET

- Possible low negative bias (tbc)

- Dispersion at high AODs explained by Inland waters & coastal areas (Mediterranea)

- Lower values than MODIS Terra which is known to have a positive bias over ocean (~0.04).   **Levy et al., 2018**

SLSTR-A – AERONET

For AOD(550 nm) < 0.2: -0.020 ± 0.045

R² = 0.76

SLSTR-B – AERONET

For AOD(550 nm) < 0.2: -0.017 ± 0.041

R² = 0.71

August 2019 – February 2020 – All AODs Ocean – Sentinel-3 A & B SLSTR Near-Simultaneous spatially collocated match-up with AERONET Level1.5
Processor v2.0 (off-line)

December 2019 – January 2020 – Atlantic ocean – Sentinel-3 A SLSTR Near-Simultaneous spatially collocated match-up with MODIS Terra
Processor v2.0 (off-line)

S3 NRT AOD – Processor v2.0 performances - Land

Evaluation with MODIS Terra (Top) & AERONET (Bottom): Dec 2019 – Jan 2020