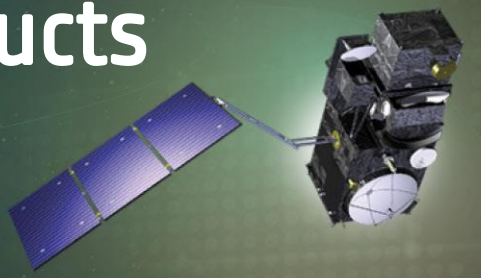
PROGRAMME OF THE EUROPEAN UNION

co-funded with

Sentinel-3 Atmospheric Products Status & Outlook



7th Sentinel-3 Validation Team Meeting 2022

18-20 October 2022 | ESA-ESRIN | Frascati (Rm), Italy

Christian Retscher[1], Steffen Dransfeld[1], Julien Chimot[2]

1 ESA/ESRIN

2 EUMETSAT

SLSTR L2 FRP NTC Operational Processing Baseline

Since 28-Feb-2022 PB FRP_NTC.004.07.00

- Improved fire detection and FRP retrieval for fire pixels surrounded by non-fire pixels with a temperature at S7/8 channel saturation level or above.

All info available on SentinelOnline.

SYNergy L2 SYN-AOD NTC Operational Processing Baseline

Since 27-Jan-2022 PB AOD_NTC.002.06.00

- Addition of the processing baseline number field into the product manifest

All info available on SentinelOnline.

OLCI L2 IWV Operational Processing Baseline

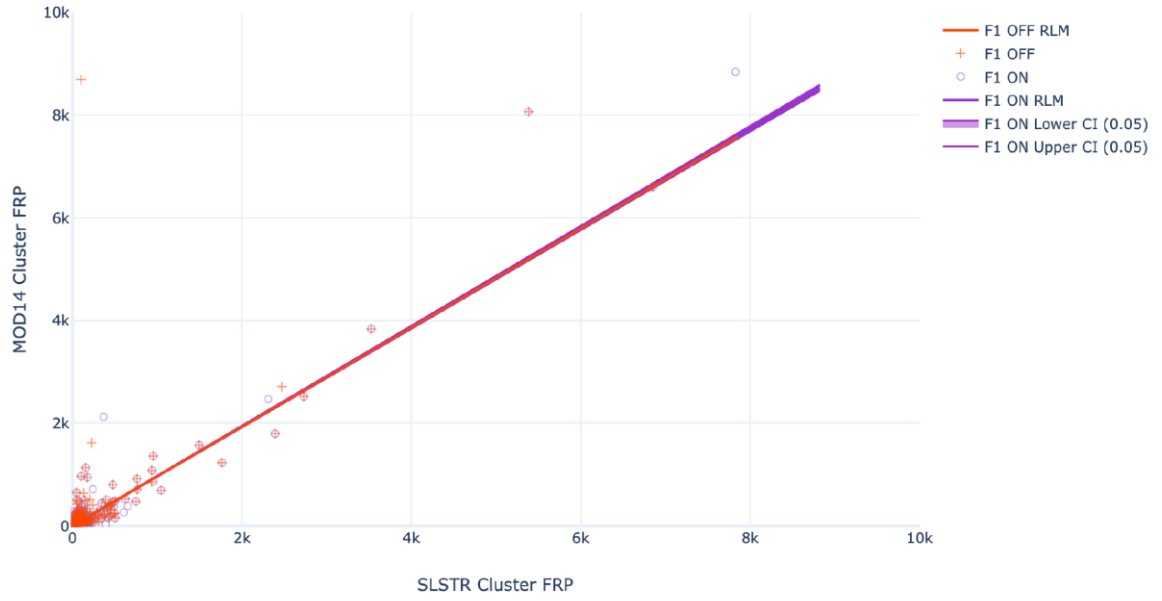
Since 30-Aug-2022 PB OL__L2L.002.10.01

- Addition of the processing baseline number field into the product manifest and adaptation to new L1 uncertainty product format.

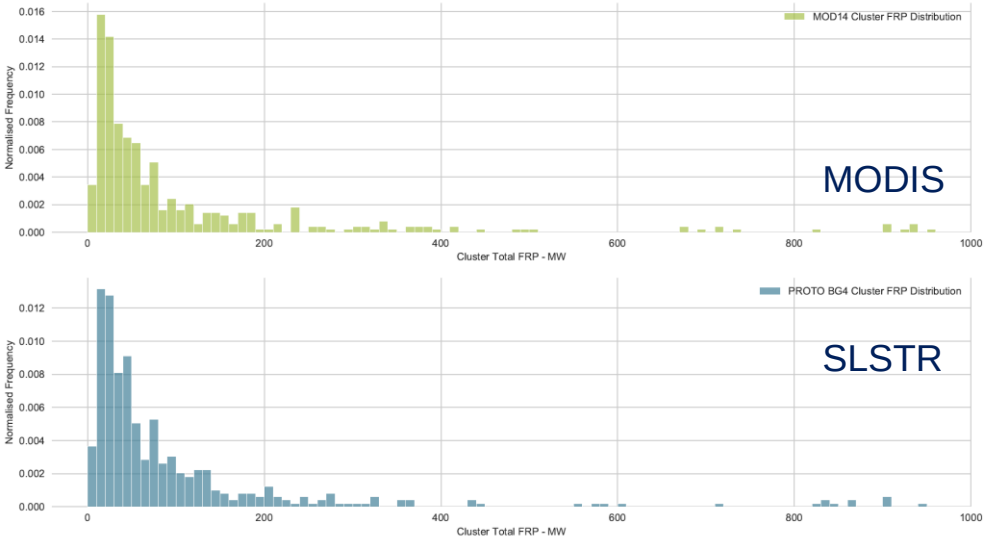
All info available on SentinelOnline.

SLSTR L2 FRP NTC Status

- **L2 FRP NTC PB -> FRP_NTC.004.08.00**
- At nighttime SLSTR detects 35% more AF pixels than MODIS with an omission of about 7%
- SLSTR has a negative bias of ~18.2 MW compared to MODIS
- Recently significant improvements to the daytime retrieval part of algorithm
- Some issues with +ve F1 anomalies downscan of clouds causing false AF detections. Need to have improved cloud screening as well. -> See Weidong Xu's oral presentation on the FRP NTC product.

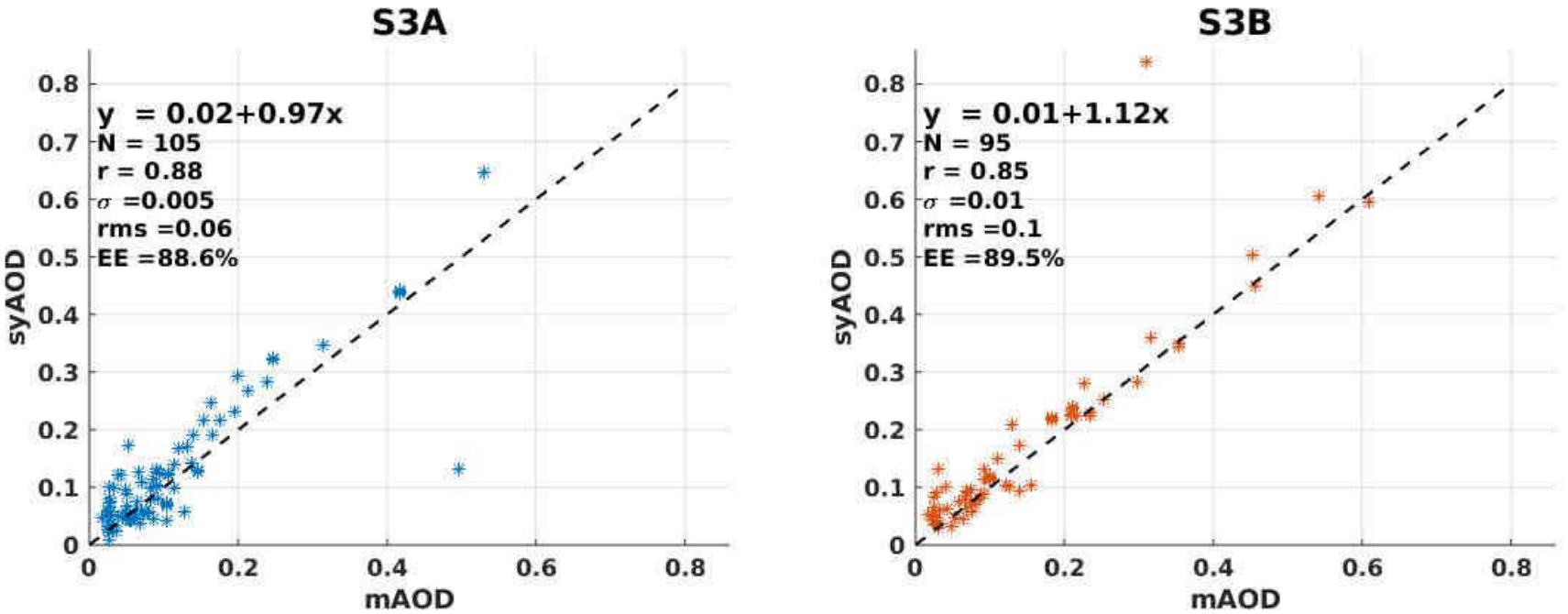


S3A & S3B NTC Fire Product vs MODIS



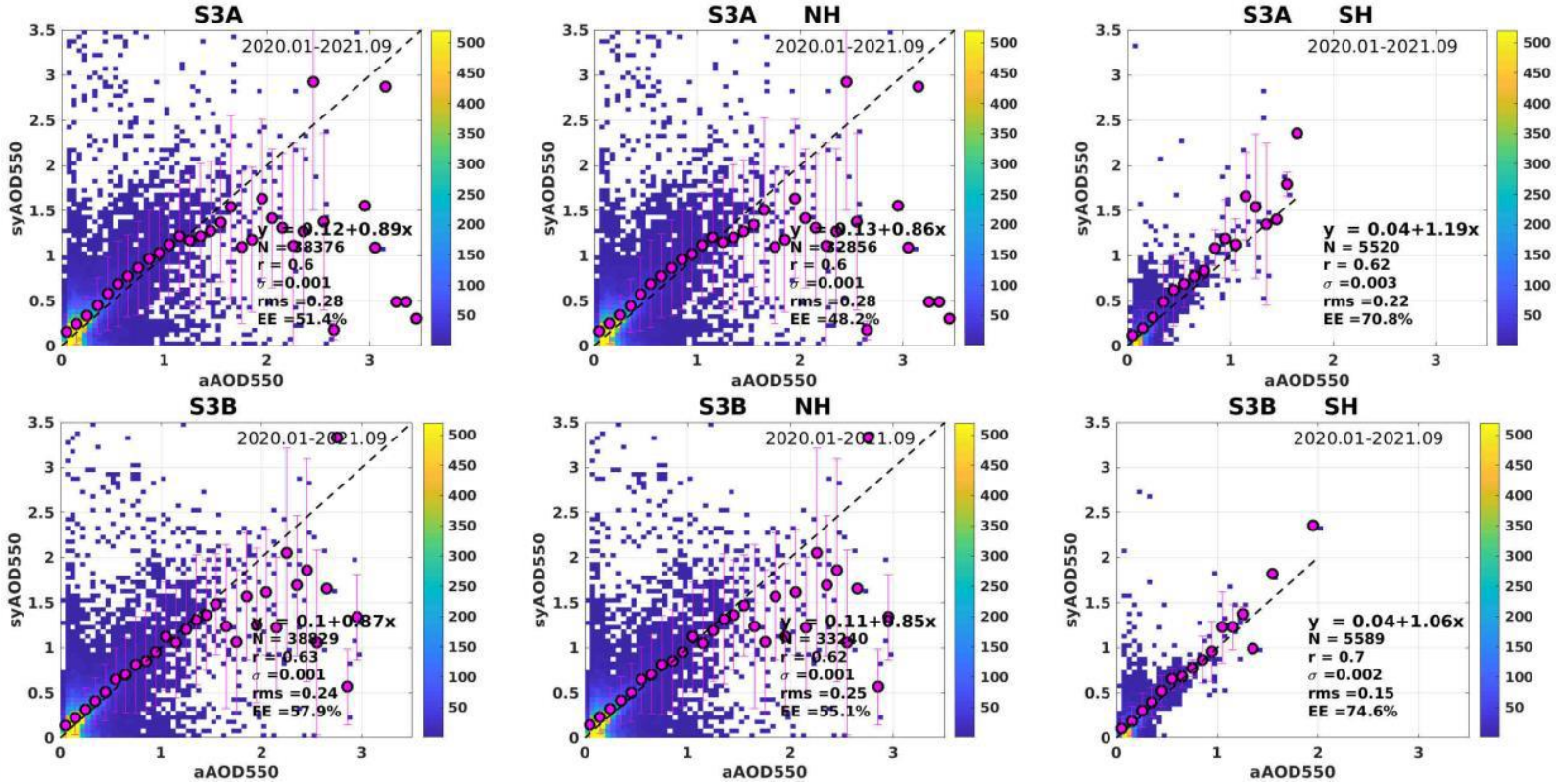
SYNergy L2 SYN-AOD NTC Status

- **L2 SYN-AOD NTC PB -> AOD_NTC.002.06.00**
- AOD validation using MAN measurements over ocean showing retrieval performance
- Generally a good accuracy over water is demonstrated also found in intercomparisons with MODIS



SYNergy L2 SYN-AOD NTC Status

- **L2 SYN-AOD NTC PB -> AOD_NTC.002.06.00**
- AOD validation using Aeronet site measurements
- Better retrieval found for the Southern Hemisphere but retrieval still subject to a significant scatter



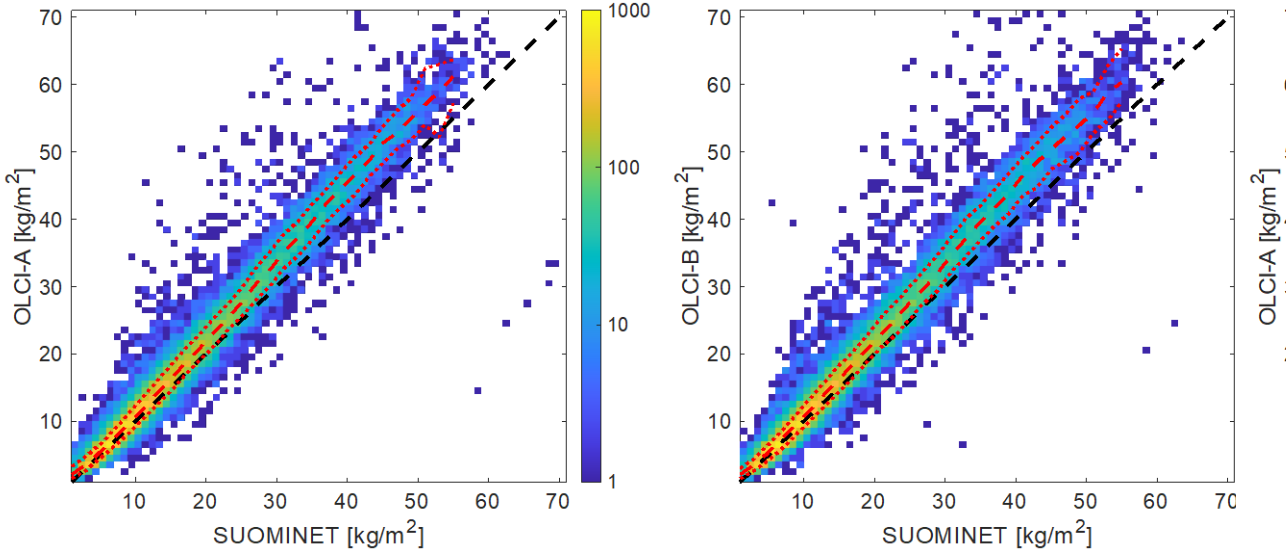
Product evolutions still to adress:

- Better screening snow & ice
- Better screening of cloud contamination
- Constraining to SZA below 70 degrees

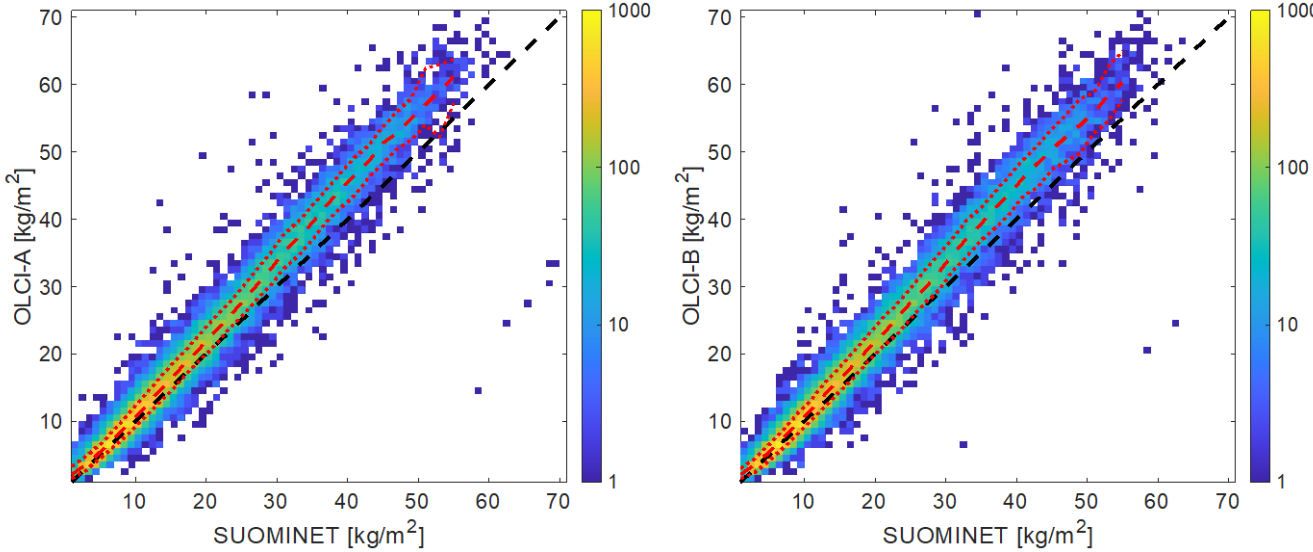
See Larisa Sogacheva's presentation on SYN-AOD validation

Status OLCI L2 IWV

IWV over Water & Land



IWV over Land



OLCI-A (left) and -B (right) against SUOMINET
Color field shows the number of matchups within 1 kg/m^2 x 1 kg/m^2 bin. Black dashed line shows the x = y line and the red lines median (dashed) and 16th and 84th percentiles (dotted) OLCI-A observation for each 2 kg/m^2 IGRA bin.

Comparisons to IGRA and TCCON show similar results. Wet bias is stronger over water with also more wet outliers present. 11% over Water&Land and 9% over only land. –> Oral presentation by Rene Preusker

EUMETSAT Sentinel-3 Atmosphere portfolio: Entrusted by Copernicus & Member States

Integrating the European operational Near real Time (NRT) constellation

Existing Operational: SLSTR: **NRT** Aerosols
NRT Fires

New on WekEo: OLCI TCWV (COWA)
SLSTR Wind (AMV)

Near Future:
Synergy Cloud mask
OLCI Cloud Top pressure (CTP)
SLSTR TCWV (AirWave)
OLCI Aerosol Layer Height (ALH)

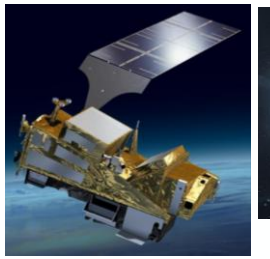
For all: NRT + Reprocessing (as per user requests)

MetOp

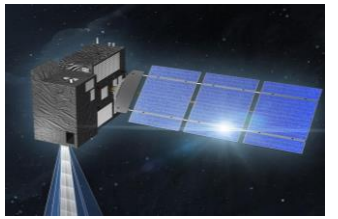
Sentinel-3

EUMETSAT

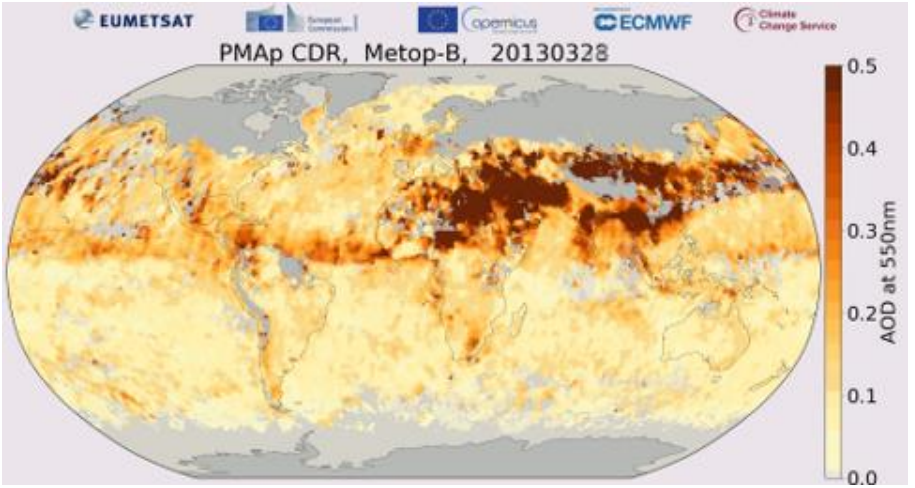
MTG
FCI, Sentinel-4



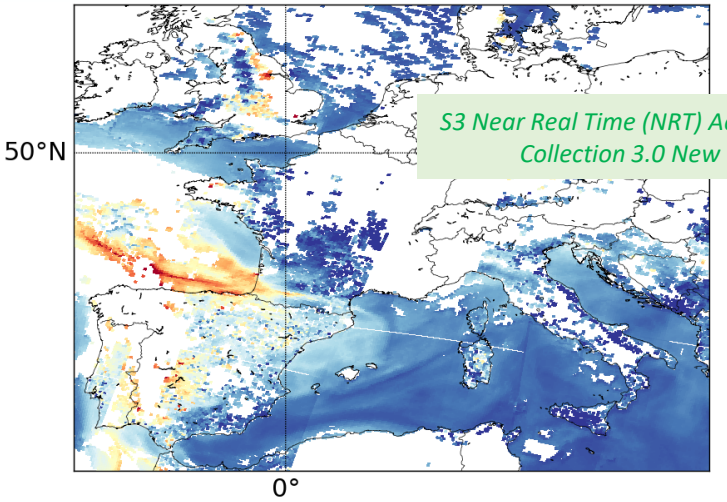
EPS-SG
Sentinel-5, 3MI



CO2M
MAP, CLIM



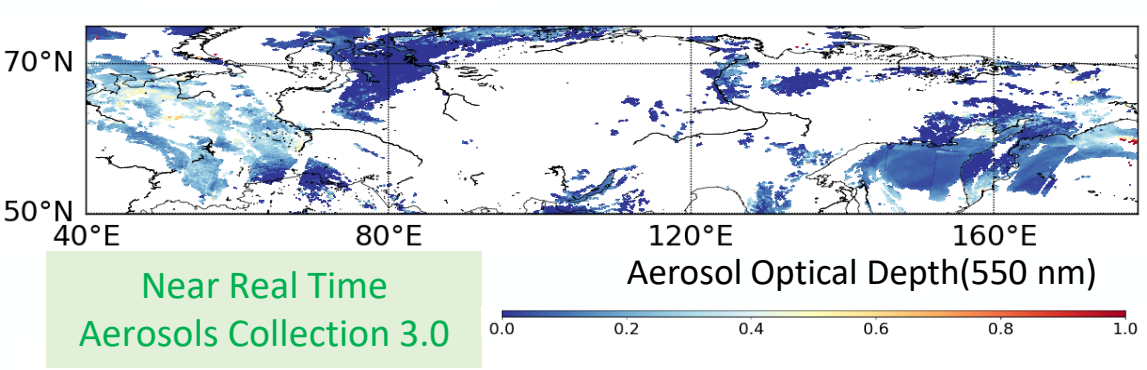
Courtesy: S. Jafariserajehlou + B. Fougnie (RSP)
+ all USC colleagues (M. Doutriaux)



NRT Aerosols (SLSTR): Collection 3.0 – October 2022:

- Reduced land AOD(550 nm) bias to ~0.05.
- Improved event detection over all water types
- Consistent time series with MODIS, VIIRS, and PMAP.
- Endorsed by SLSTR QWG (February 2022), CAMS.
- **Coll 3.1 (2023)**: under preparation (*e.g.* Ocean surface)
- See J. Chimot presentation (OSSAR-CS3) Wednesday am.

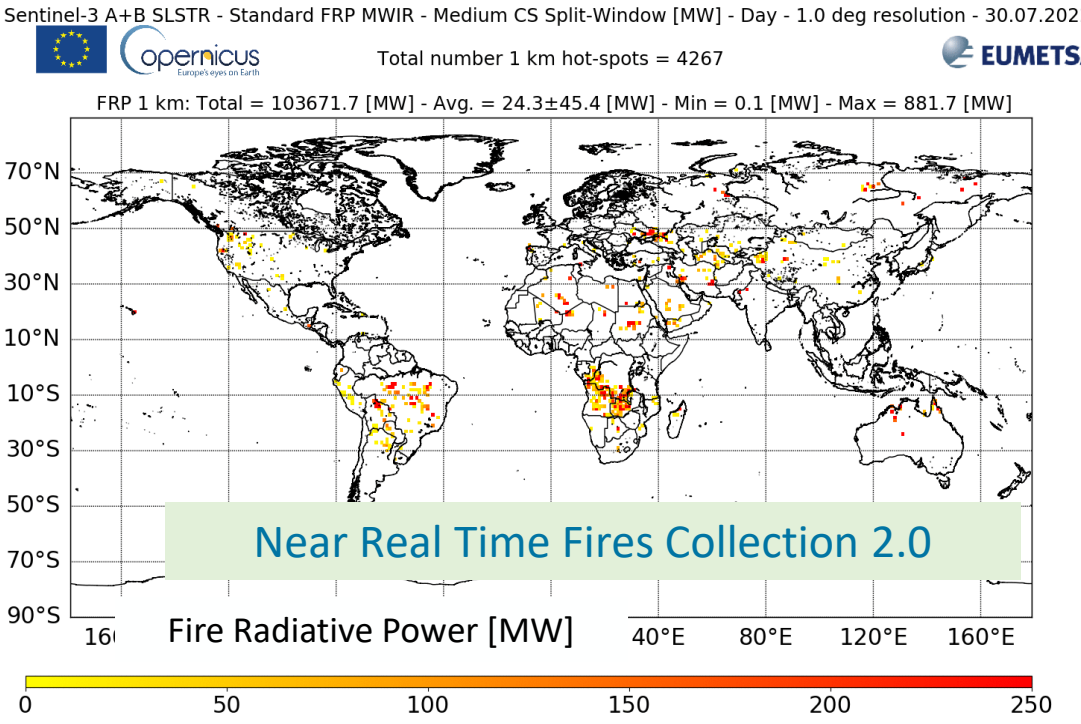
Biomass burning Siberia – Summer 2022



Near Real Time Aerosols Collection 3.0

NRT Fires (SLSTR): Collection 2.0 since 2021

- **Day+Night**, various fire types, F1 shooting mask, confidence classes
- High consistency with MODIS Terra & Geostationary (MSG).
- **Collection 2.1 - soon: Improved sun-glint screening & weak fires**
- See J. Chimot presentation (OFRaP-CS3) Wednesday pm.



Near Real Time Fires Collection 2.0

Excellent collaboration with S3VT Atmosphere, SLSTR QWG +

Atmosphere Monitoring Service atmosphere.copernicus.eu

Swansea University Prifysgol Abertawe

FINNISH METEOROLOGICAL INSTITUTE

KING'S College LONDON

NASA FIRMS Fire Information for Resource Management System

Companion developments in support to NRT Atmosphere

Cloud & Aerosol mask tailored to L2 aerosol applications:

- Naïve Probabilistic Cloud & Aerosol detection – Synergy Solar/Thermal
- Implemented in L2 NRT Aerosol Processor

  See E. Martins presentation (OSSAR-CS3) Wednesday am.

=> + new internal Snow/Ice, Glint & inland water masks

FRM Aerosols: See T. Marbach talk on Wednesday am.

Industrial gas flare monitoring – within NRT Fires

- See K. Stebel Poster talk Wednesday pm.

South Atlantic Anomaly (SAA) detection – within NRT Fires

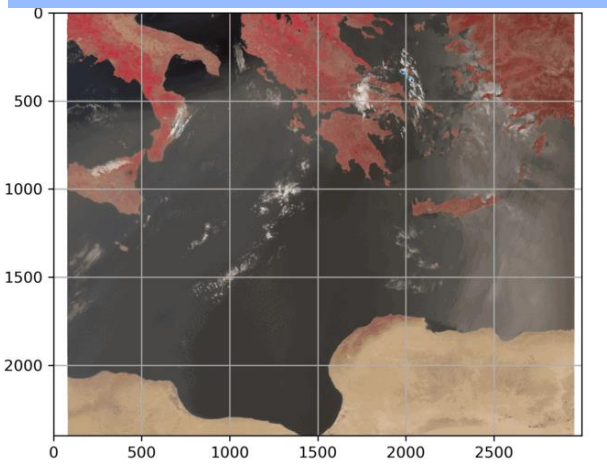
OLCI/GRASP L2 Aerosols (global): GRASP cloudflight

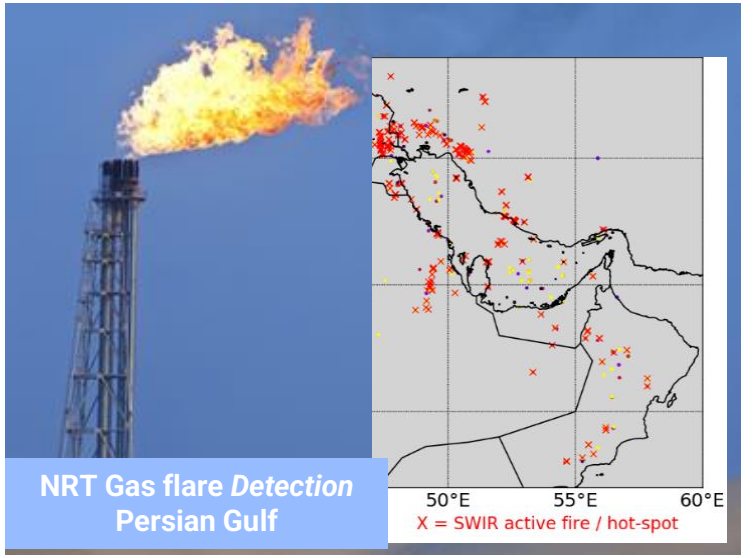
- Chen *et al.*, 2022 => See C. Chen presentation Wednesday am.

Pre-calculated Directional Land Surface Reflectivity (LSR): GRASP

- Future auxiliary for all operational NRT L2 Atmospheric chains

Naïve Probabilistic Clouds & Aerosols mask
EUMETSAT (E. Martins, J. Chimot)



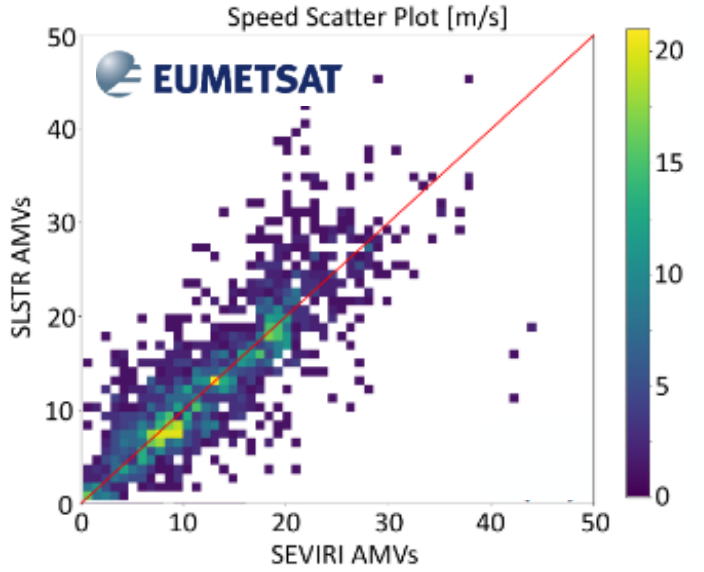


NRT Gas flare *Detection*
Persian Gulf

2 New Sentinel-3 Atmosphere products – Exclusively EUMETSAT

SLSTR Atmospheric Motion Vector (AMV) - Wind

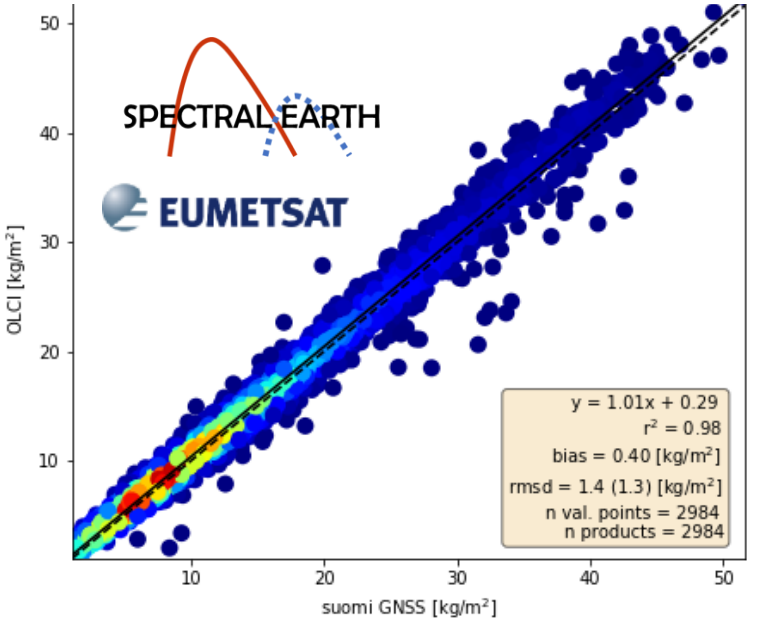
- Validated: Barbieux *et al.*, 2021
- NRT Demonstrator on WekEo under preparation - To support NWP.
- Operational implementation under discussion.



SLSTR vs. MSG AMV – Jan-Feb 2021
EUMETSAT (K. Barbieux, R. Borde)

OLCI Atmosphere H_2O – Dedicated to Meteorology:

- Optimized COWA – nearly zero bias & low dispersion
- NRT Demonstrator on WekEo - Disseminated to NWP centres.
- Operational processor nearly ready – Public in Q3 2023.
- Format aligned with EPS-SG/METimage.
  - See R. Preusker talk Wednesday pm.
- NB: Standard algorithm in L2 Ocean Colour will be decommissioned.



Additional H_2O developments: B. Picard (1D-Var MWR) – M. Valeri (SLSTR AIRWAVE) See Presentations Wednesday am.

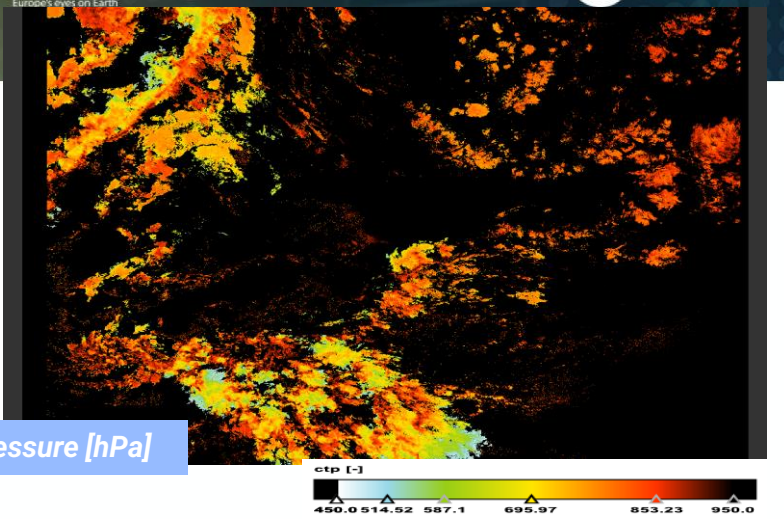
Future Sentinel-3 Atmosphere products - Exclusively EUMETSAT

OLCI O_2-A Cloud Top Pressure (CTP) – OCTPO2

- Prototype finalized & validated

https://www.eumetsat.int/S3-OLCI-CTP

SPECTRAL EARTH
EUMETSAT



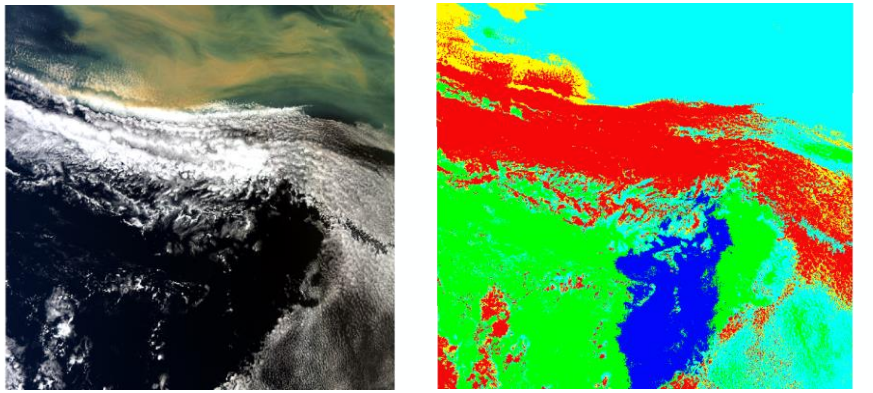
OLCI Cloud Top Pressure [hPa]

SYNergy Cloud-Mask (OLCI+SLSTR) – for manifold user requirements

- Prototype v1 finalized with successful expert review
- Demonstrational campaign – Expert users invited for test & feedbacks (H. Bauch, L. Spezzi, J. Chimot, R. Quast)
- See R. Quast presentation Tuesday pm

Brockmann Consult
Environmental Informatics • Geoinformation Services

EUMETSAT SPECTRAL EARTH GRASP



S3 SYNergy Cloud Mask

Colour	Value	Meaning
	1	Optically thick clouds
	2	Clouds with moderate optical thickness dominate here
	3	Aerosol and (or) clouds with moderate optical thickness
	4	Aerosol and (or) clouds with low optical thickness
	5	Clear sky, aerosol and (or) clouds with very low optical thickness
	other	No or invalid result

Aerosol Layer Height from OLCI O_2-A: ITT closed, offers under evaluation.