
# SENTINEL-3 MISSION AND OPTICAL PRODUCT STATUS

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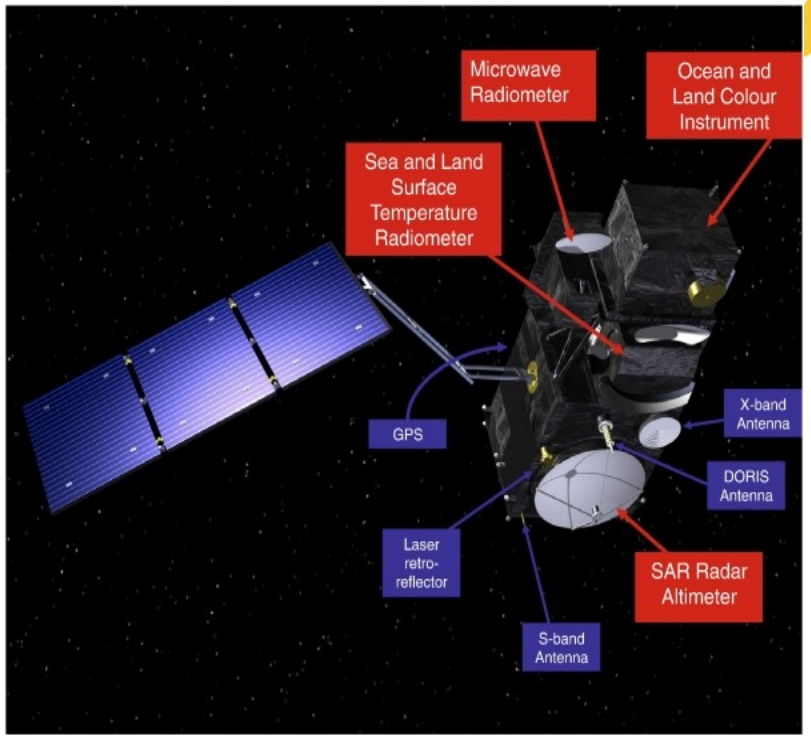
# SENTINEL-3 **MISSION OVERVIEW**

- **Operational Mission**: constellation of 2 satellites flying on same orbital plane separated by 140° - currently Sentinel-3A (launched 2016) and Sentinel-3B (2018) (B in advance of A)
- **Orbit**: polar, sun-synchronous at altitude of 815 km
- **Payload**
  - Optical: OLCI and SLSTR
  - Topography: SRAL, MWR, POD support




S3C

**Storage Tent**

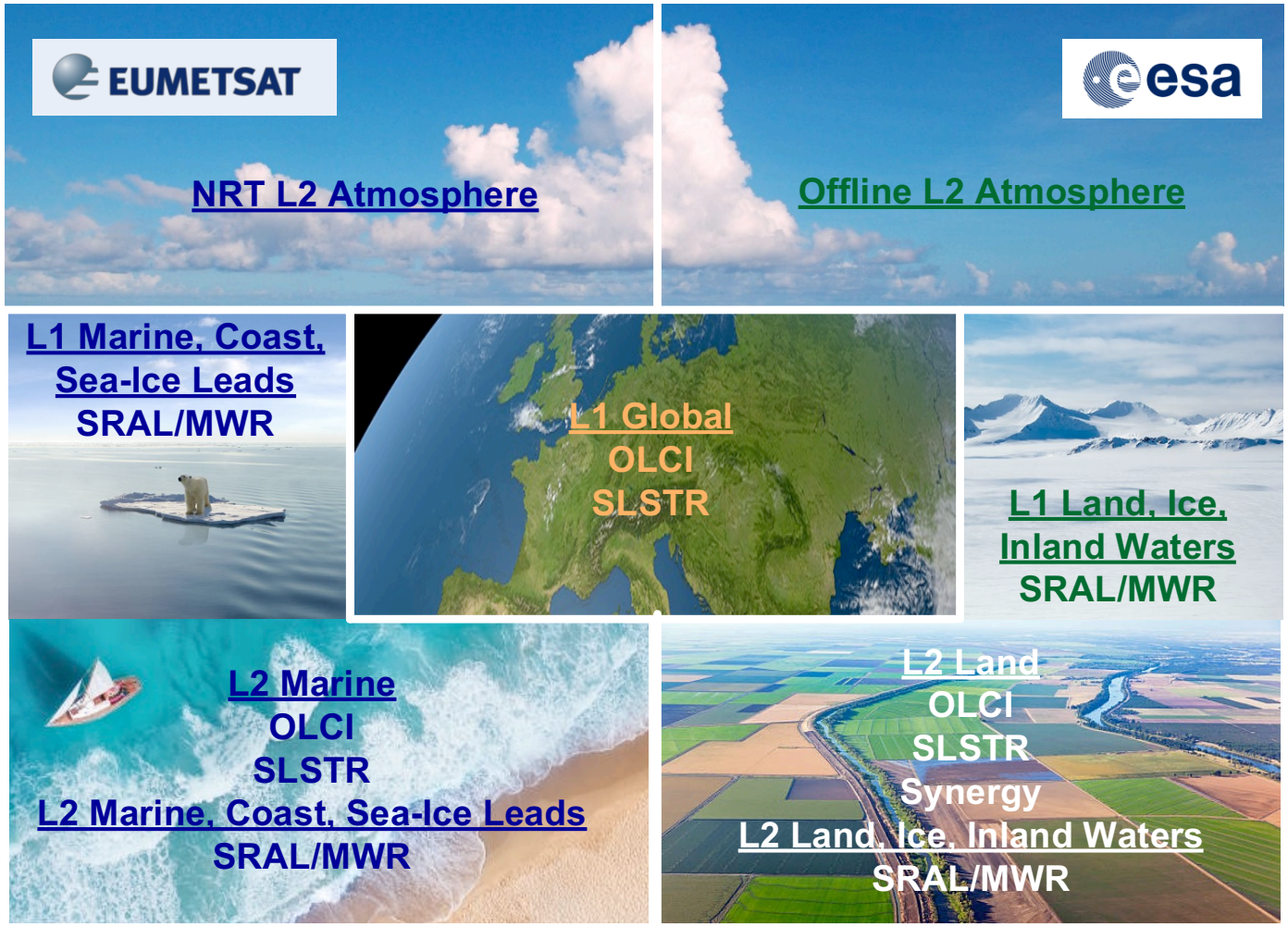
**Images courtesy of TAS-F**

- **Longer Term Mission Continuity**: ensured by Sentinel-3C (launch planned Q4/24 – Q1/25) and Sentinel-3D (2025-2028)

# SENTINEL-3 **OVERALL MISSION STATUS**

- The **Sentinel-3A** and **Sentinel-3B** missions are operating well with no significant issues to report
  - Satellite availability remains high with a lifetime beyond that expected by the design
  - Both ESA and EUMETSAT Ground Segments are operating well and delivering products to users within the expected targets (outside of planned maintenance activities or ground/space segment anomalies)
- The **3rd Mission Constellation Review** (covering operations during 2021) held on 12th January confirmed the mission continues to meet the applicable requirements within the known and documented limitations, noting that improvements/mitigations are planned in the future
- The 4th Mission Constellation Review (for 2022) is planned for 28 March 2023
- The **Sentinel-3C** and **Sentinel-3D** satellites have successfully completed their final reviews and are now being readied for on-ground storage
- More information on how you can access Sentinel-3 data can be found here:
  - ESA: https://sentinel.esa.int/web/sentinel/missions/sentinel-3
  - EUMETSAT: https://www.eumetsat.int/sentinel-3

# SENTINEL-3 **MISSION DATA PRODUCT** RESPONSIBILITIES



## SENTINEL-3 ESA OPTICAL DATA PRODUCTS

- OLCI L1B TOA radiances
- OLCI L2:
  - OLCI Terrestrial Chlorophyll Index OTCI
  - Green Instantaneous FAPAR GIFAPAR (formerly OGVI)
  - Integrated Water Vapour IVW
- SLSTR L1B TOA TIR Brightness Temperatures/VIS&SWIR Radiances
- SLSTR L2:
  - Landsurface Temperature LST
  - Fire Radiative Power FRP
- SYNergy L2:
  - Surface Directional Reflectance SDR
  - Proba-V continuity SYN-VGLike

OLCI & SLSTR monthly Data Quality Reports for L1 and L2 available on Sentinel Online

# SENTINEL-3 OLCI L2 OTCI STATUS (OPT-MPC SOUTHAMPTON UNIVERSITY)

## Indirect Validation: MERIS Climatology and Validation Sites

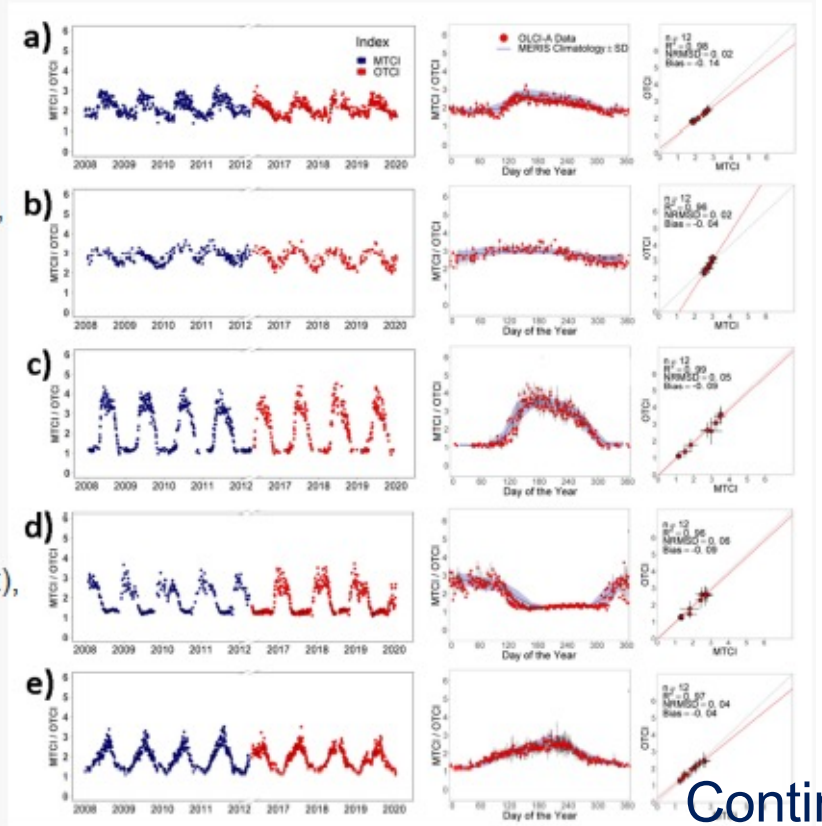
US-Talledaga (ENF),

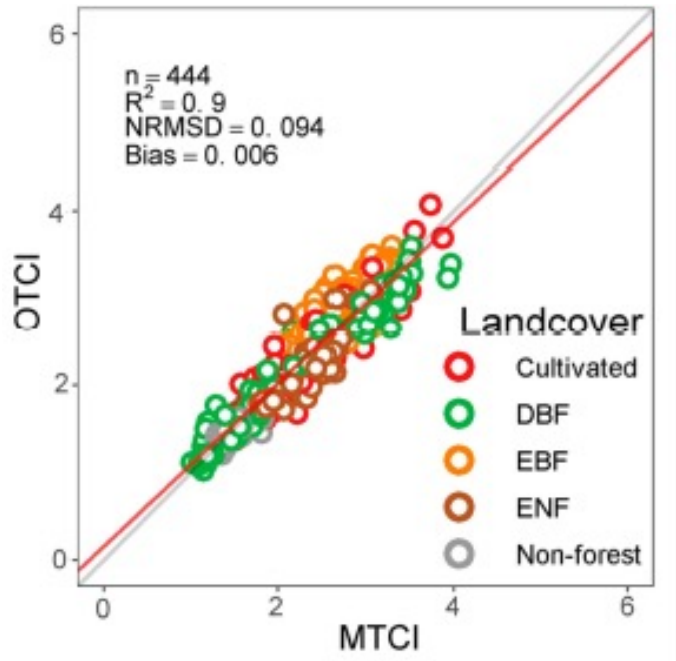
AU-Robson-Creek (EBF),

FR-Montiers (DBF),

BR-Mataseca (non-forest),

IT-Lison (cultivated).



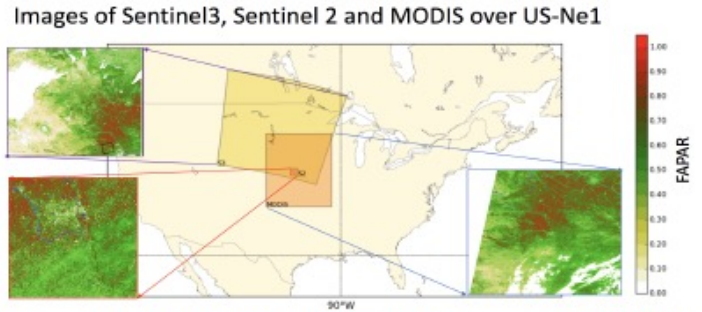

Comparison of monthly mean Sentinel-3 OTCI (2016 to 2019) and Envisat MTCI (2002 to 2012) values over the 37 validation sites

Continuity with MERIS

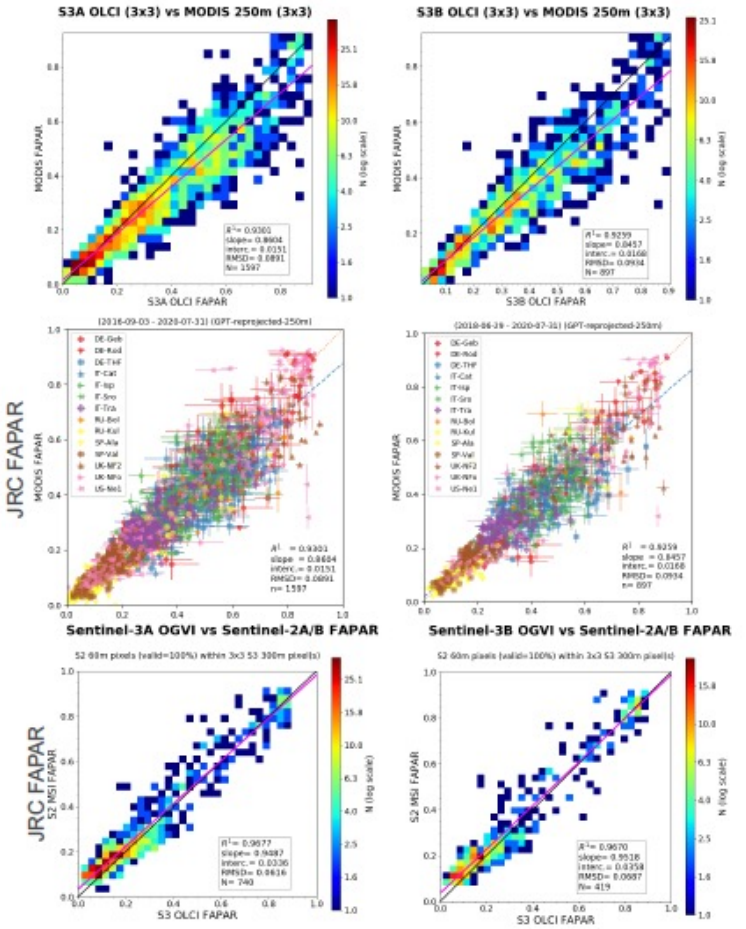
# SENTINEL-3 OLCI L2 GIFAPAR STATUS (JOINT RESEARCH CENTER)

Consistency with MODIS and Sentinel-2 FAPAR retrievals systematically done over a selection of sites.

OGVI to GIFAPAR name change end of 2021.

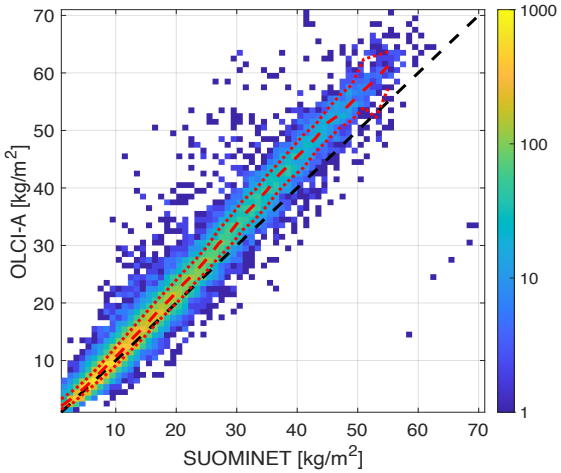


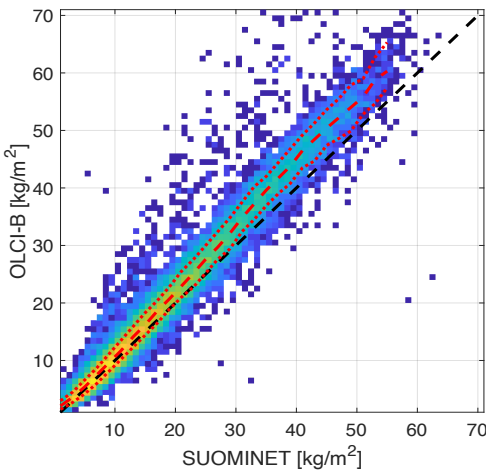

| Code | Latitude(°N+) | Longitude(°E+) | MGRS[a] | Land Cover Type |
|---|---|---|---|---|
| DE-Geb | 51.1001 | 10.9143 | 32UPB34036269 | Croplands |
| DE-Ros | 50.8300 | 11.7700 | 32UPB95063457 | Croplands,Evergreen Needleleaf Forest,Deciduous Needleleaf Forest |
| DE-Thf | 50.5730 | 10.8450 | 32UPB30640396 | Mixed Forest |
| IT-Cat | 37.278531 | 14.883261 | 33SVB89652577 | Croplands (Orange) |
| IT-Isp | 45.8128 | 8.6345 | 32TMR71537329 | Mixed Forest |
| IT-Sro | 43.7278 | 10.2844 | 32TPP03444244 | Pinus Pinea |
| IT-Tra | 37.645561 | 12.852736 | 33SUB10566865 | Croplands (Vineyards and olive trees) |
| RU-Bol | 57.05 | 93.37. | 46VEJ22442301 | Mixed Forest |
| RU-Kul | 52.561106 | 80.708522 | 44UMD80242348 | Cultivated Areas |
| SP-Ala | 38.451556 | -1.064556 | 30SXH68885769 | Semi-arid Mediterranean |
| SP-Val | 39.5207193 | -1.29259339 | 30SXJ46767595 | Semi-arid Mediterranean |
| UK-Nfo | 50.84984 | -1.57406 | 30UXB00378341 | Natural deciduous forest |
| US-Ne1 | 41.165 | -96.4766 | 14TQL11706015 | Croplands (Maize) |
| US-Ne2 | 41.1648 | -96.4701 | 14TQL12246014 | Croplands (Irrigated Maize Soybean rotation) |
| US-Ne3 | 41.1797 | -96.4396 | 14TQI14746186 | Croplands (Irrigated Maize Soybean rotation) |



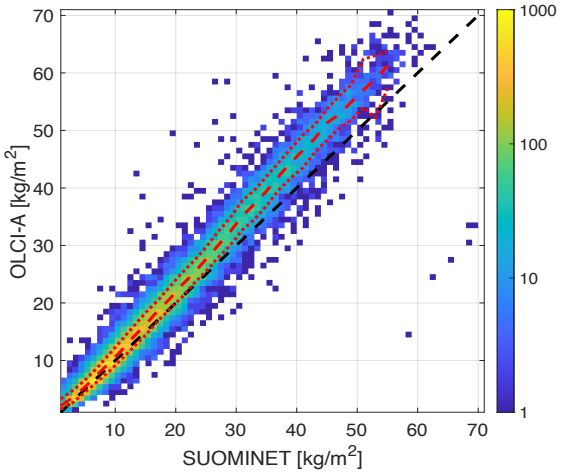
# SENTINEL-3 OLCI L2 INTEGRATED WATER VAPOUR (FMI)

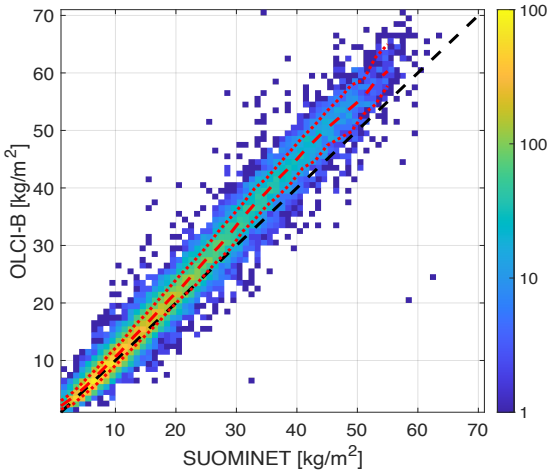
## IWV over Water & Land




## IWV over Land



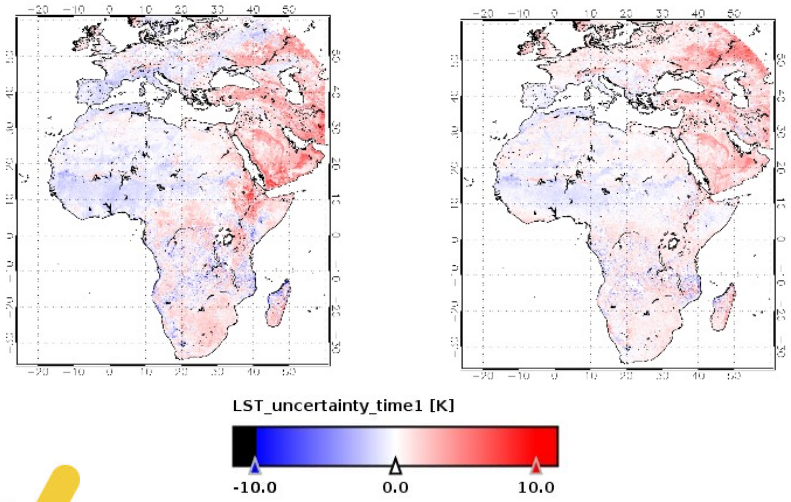

**OLCI-A (left) and -B (right) against SUOMINET Color field shows the number of matchups within 1 kg/m$^2$ x 1 kg/m$^2$ bin. Black dashed line shows the x = y line and the red lines median (dashed) and 16$^{th}$ and 84$^{th}$ percentiles (dotted) OLCI-A observation for each 2 kg/m$^2$ IGRA bin.**

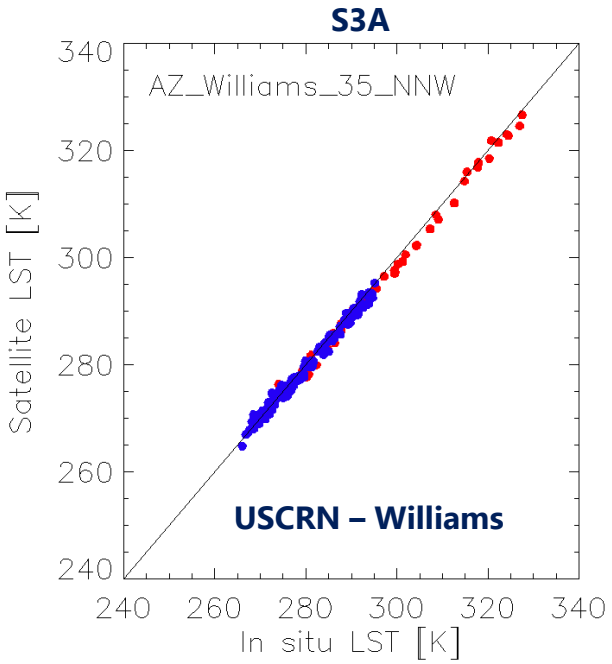
**Comparisons to IGRA and TCCON show similar results. Wet bias is stronger over water with also more wet outliers present. 11% over Water&Land and 9% over only land.**

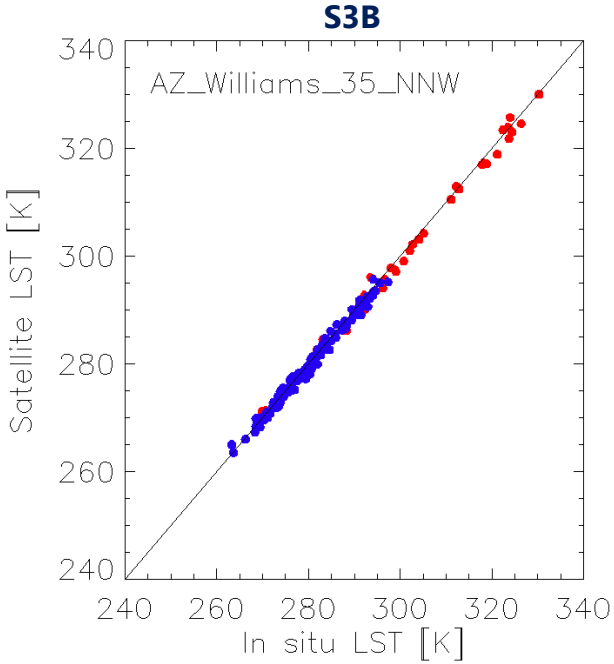
# SENTINEL-3 SLSTR L2 LST STATUS (OPT-MPC LEICESTER UNIVERSITY)

- Throughout the different validation sites LST is demonstrating to be within 1K accuracy requirement for both A – B
- Intercomparison with SEVIRI LST from LSA SAF shows that products are comparable within their uncertainty range

S3 A&B vs SEVIRI February 2020 Daytime



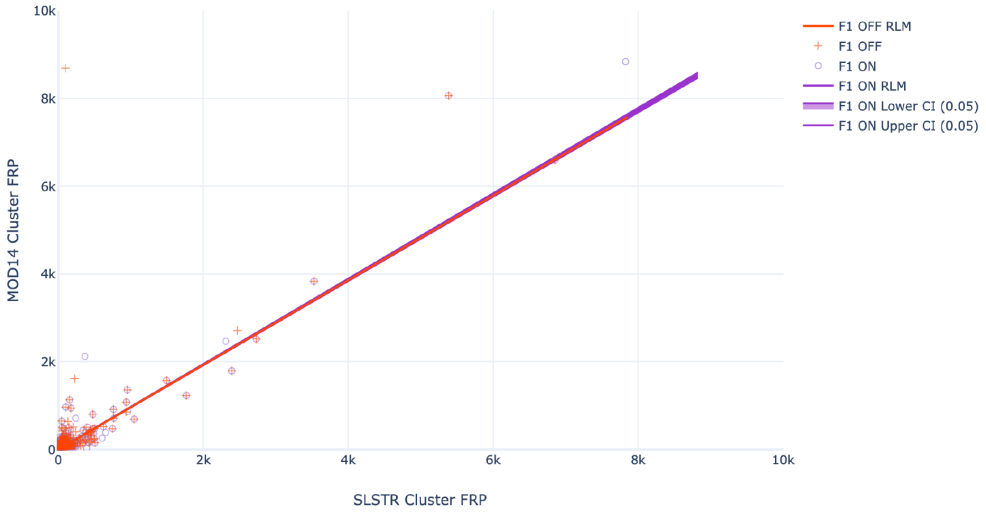



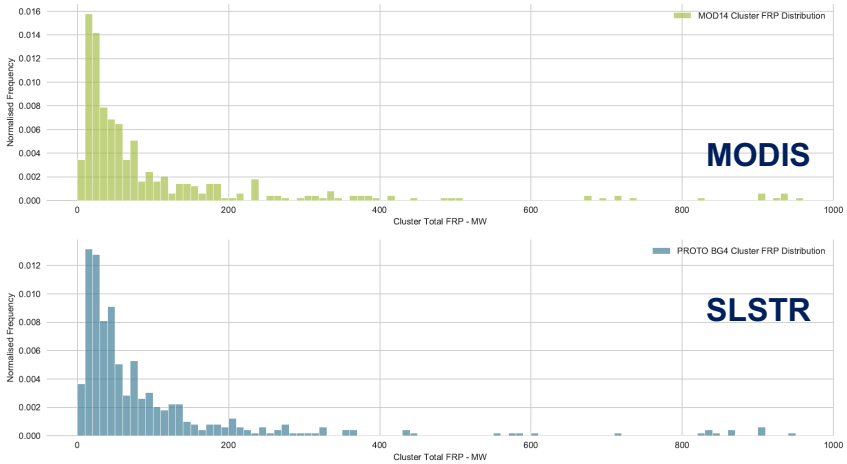

Latest product evolutions include:

- consolidated L2 uncertainties taking into account random, locally correlated atmospheric, locally correlated surface, locally correlated instrument and large-scale systematic contributions -> First Sentinel Dataset to do so.
- Transient snow masking based on NSIDC Snow mapping and VIS/SWIR-TIR channels to filter out pixels with a spectral signature corresponding to snow cover.

# SENTINEL-3 SLSTR L2 FRP STATUS (OPT-MPC PS & KCL)

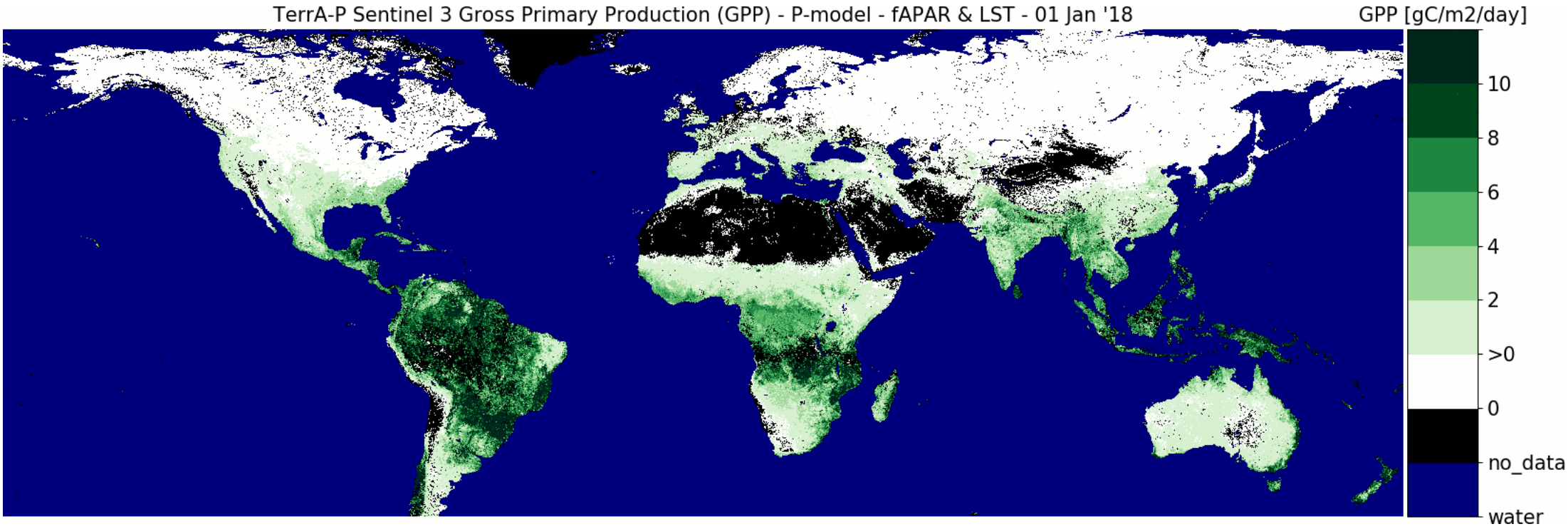



S3A & S3B NTC Fire Product vs MODIS



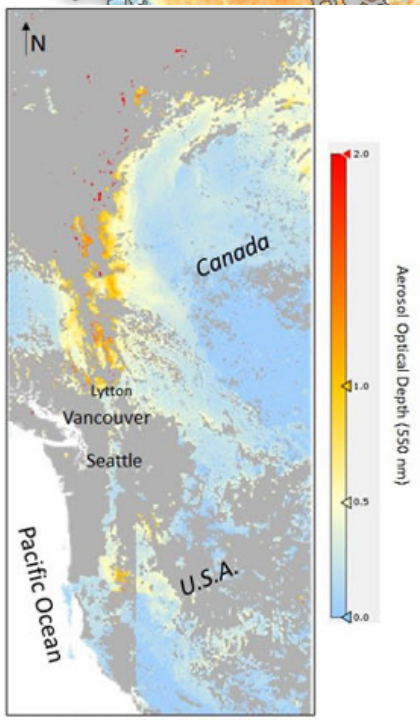

- At nighttime SLSTR detects 35% more AF pixels than MODIS with an omission of about 7%
- SLSTR has a negative bias of ~18.2 MW compared to MODIS
- Recently we improved significantly the daytime retrieval part of algorithm for which validation is ongoing
- Some issues with +ve F1 anomalies downscan of clouds causing false AF detections. Need to have improved cloud screening as well.

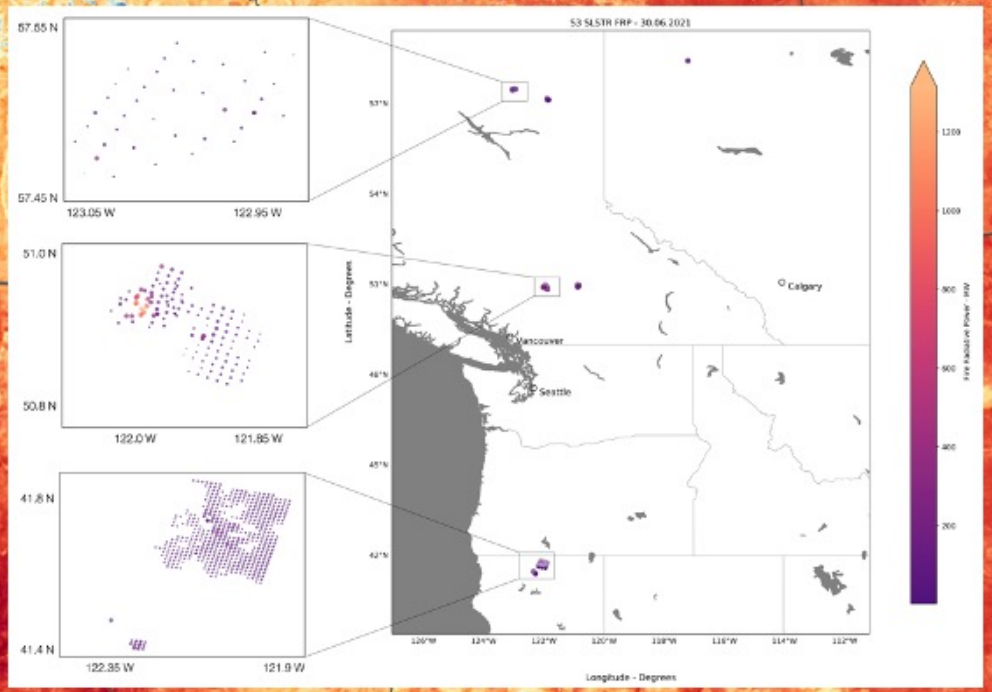
# GROSS PRIMARY PRODUCTION (GPP) FROM SENTINEL-3

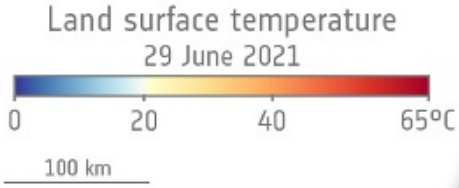



S3-derived GPP covering Jan-Dec 2018 in 10-days steps

# LST, FRP and AOD from heatwave and fires in Canada June 2021



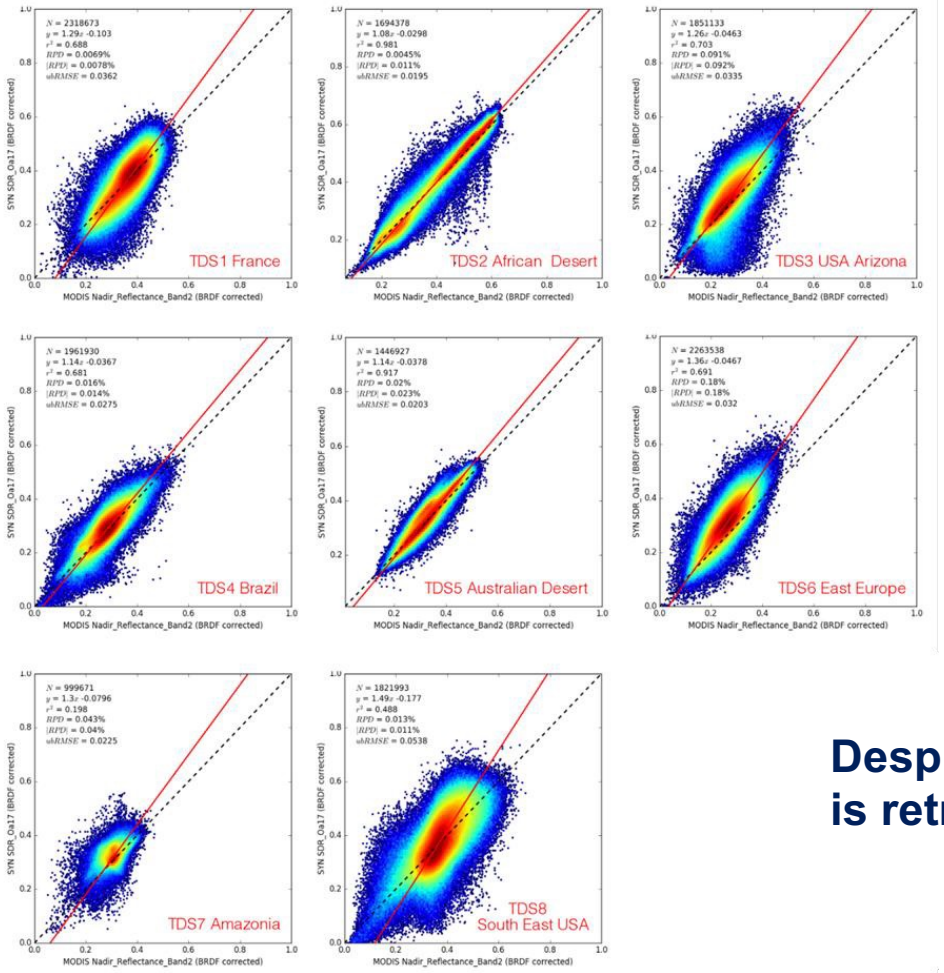






*Land surface temperature, Fire radiative power and Aerosol optical depth from the heatwave and fires in Canada in June 2021. Copyright: Contains modified Copernicus Sentinel data (2021)/processed by ESA*

# Sentinel-3 SYN Surface Reflectance vs MODIS (OPT-MPC ACRI-ST)

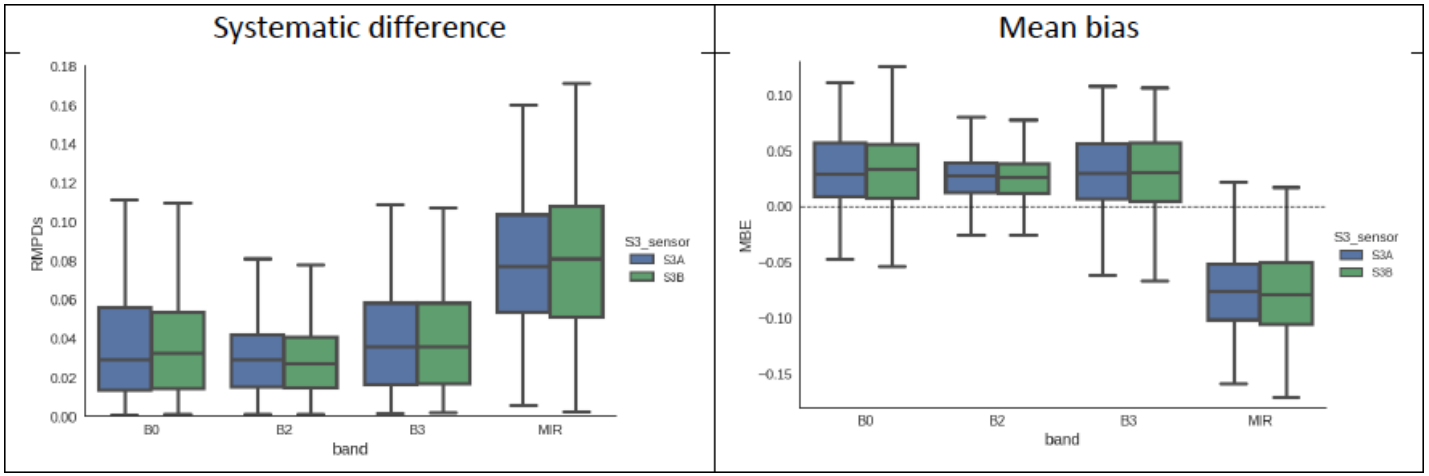



## Intercomparison with MODIS for different surface types

| REFERENCE SDR SYN (Oa17) vs. MODIS (b2) | | | |
|---|---|---|---|
| *Scene* | $r^2$ | $\|RPD\|$ | *ubRMSE* |
| TDS1 | 68.8% | 0.8% | 3.62% |
| TDS2 | 98.1% | 1.1% | 1.95% |
| TDS3 | 70.3% | 9.2% | 3.35% |
| TDS4 | 68.1% | 1.4% | 2.75% |
| TDS5 | 91.7% | 2.3% | 2.03% |
| TDS6 | 69.1% | 18.0% | 3.20% |
| TDS7 | 19.8% | 4.0% | 2.25% |
| TDS8 | 48.8% | 1.1% | 5.38% |

**Despite an overestimation of the AOD the reflectance is retrieved generally consistently with MODIS.**

# Sentinel-3 SYN-VGP ToA Reflectance vs Proba-V (OPT-MPC VITO)







**SY_VGP and PROBA-V L2A top-of-atmosphere (TOA) products with closest match in acquisition time over a 3 months period 01/07/2020 – 30/09/2020. The number of product match-ups is 608 for S3A, 610 for S3B.**

**For bands B0 (blue), B2 (red) and B3 (NIR), a mean bias of around 3% is observed, with SY_VGP being brighter than PROBA-V L2A**

**- differences in absolute calibration,**

**- SPOT4-VGT1 spectral response functions are used in the spectral band mapping procedure to generate SYN VGT products.**

**Both the systematic differences and the mean bias indicate large inconsistencies between SY_VGP and PROBA-V L2A for the MIR band, with biases of around 8%**

**- largely attributed to the calibration issues of SLSTR**

# Sentinel-3 News and Tools

- L1 radiometric uncertainty model for OLCI
  - Detailed model to estimate the instrument radiometric uncertainties at L1
  - First Sentinel L1 product to include this
  - Users can choose to download the per pixel uncertainty information or not
  - To be deployed end of August

- SYNergy L1c Tool
  - Developed by Brockmann-Consult as part of the S3-MPC activities.
  - TOA SYNergy radiances for OLCI and SLSTR VIS/SWIR channels on OLCI image grid
  - SNAP Plug-in to be installed via SNAP plug-in manager
  - Running operationally in CGLS Ground Segment as input into the L2 processing

- ICOR4S3 SNAP Plug-In to create OLCI-only Surface reflectances
  - Developed by VITO and available from VITO Website
  - Surface reflectances for OLCI channels based on ICOR atmospheric correction


Thank you!