



Sentinel-5 Precursor Mission Status

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Sentinel-5P, Sentinel-4, Sentinel-5 Missions Manager

This presentation includes modified Copernicus data (2017-2019)

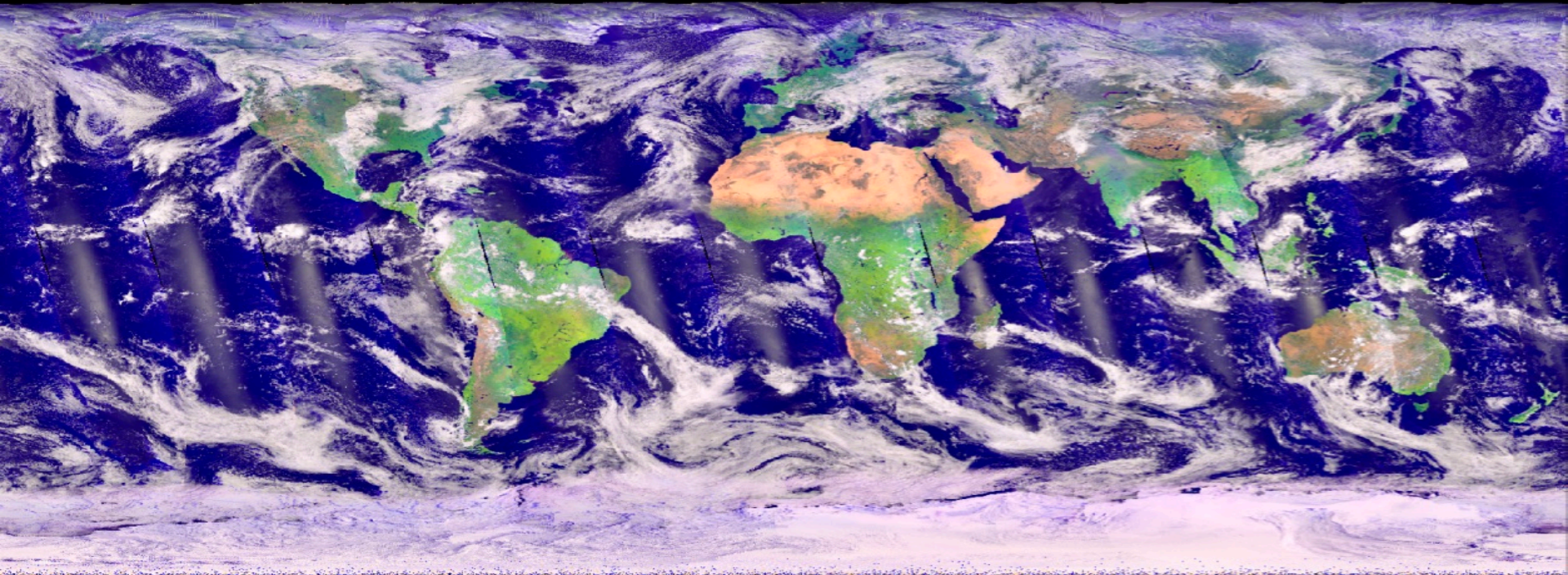
Sentinel-5 Precursor

COPERNICUS ATMOSPHERE MISSION IN POLAR ORBIT
 only currently flying European satellite mission with GHG
 measurement capability down to the Earth's surface

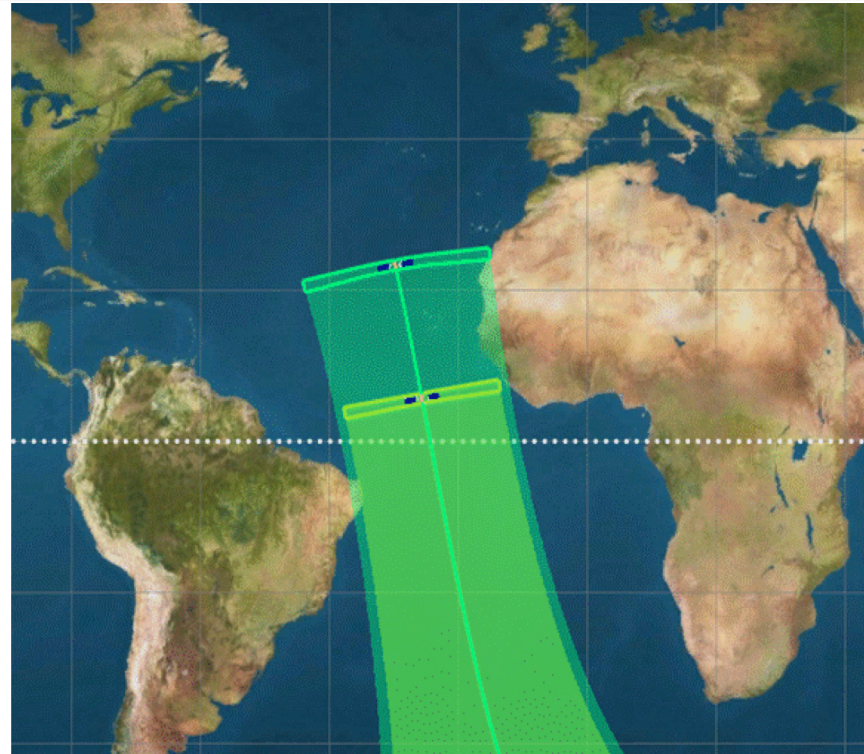
The Sentinel-5 Precursor (S5p) is the first **atmospheric Sentinel** mission focusing on global observations of the atmospheric composition for **air quality** and **climate monitoring**. Launched on **Oct. 13 2017** with a **7 years** design lifetime.



The TROPOspheric Monitoring Instrument (**TROPOMI**) is the payload of the S5P mission and was jointly developed by **The Netherlands and ESA**. Polar synchronous orbit at a height of about 820 km. Global coverage within 1 day (swath of 2600 km). Ground-pixel spatial resolution of 7 x 3.5 km. Open data access following the Copernicus Data Policy.



- improved S5p/TROPOMI Methane retrieval
- intercomparison/validation of the products from both satellites
- future synergistic data exploitation





European
Commission



S-1	S-2	S-3	S-4	S-5P	S-5	S-6
Radar	High Resolution Optical	Medium Resolution Optical & Altimetry	Atmospheric Chemistry (GEO)	Atmospheric Chemistry (LEO)	Atmospheric Chemistry (LEO)	Altimetry
A 3 Apr. 2014	A 23 Jun. 2015	A 16 Feb. 2016	A 2021	A 13 Oct. 2017	A 2021	A 2020
B 25 Apr. 2016	B 6 Mar. 2017	B 25 Apr. 2018	B 2027		B 2027	B 2025

- **EUROPEAN EO PROGRAMME**
- **the 7 Sentinels produce about 25 TByte of data per day**
- **OPEN DATA ACCESS (huge USER uptake – 230.000)**
- **250 TByte of Data are being distributed (multiple download) per day**

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since 2014

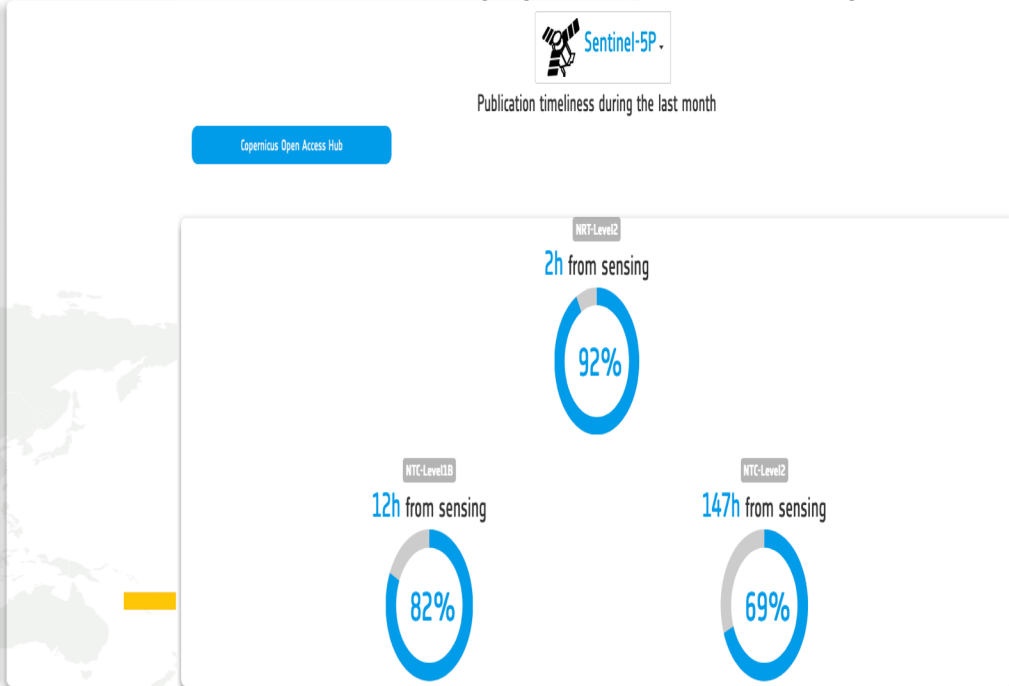
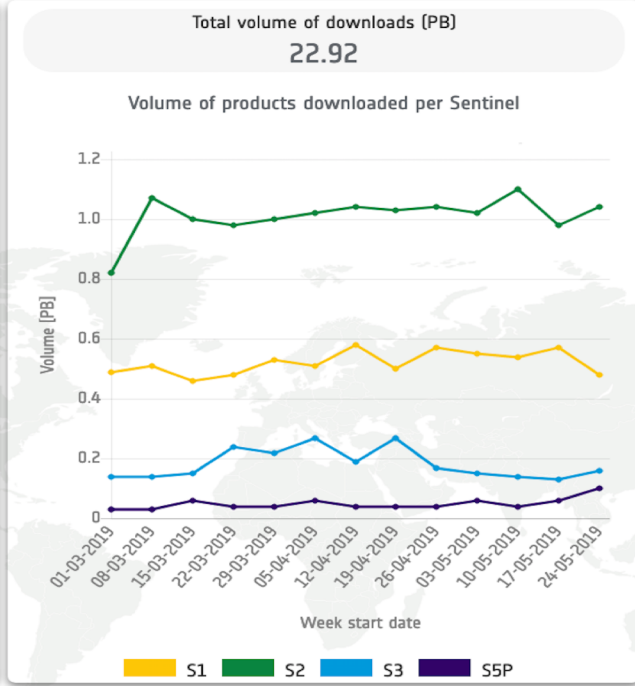
Publication and dissemination: Trends

last 3 months

S5p product delivery time

Registered Users
233,678

Open Access Hub Availability
in the past month
99.6%

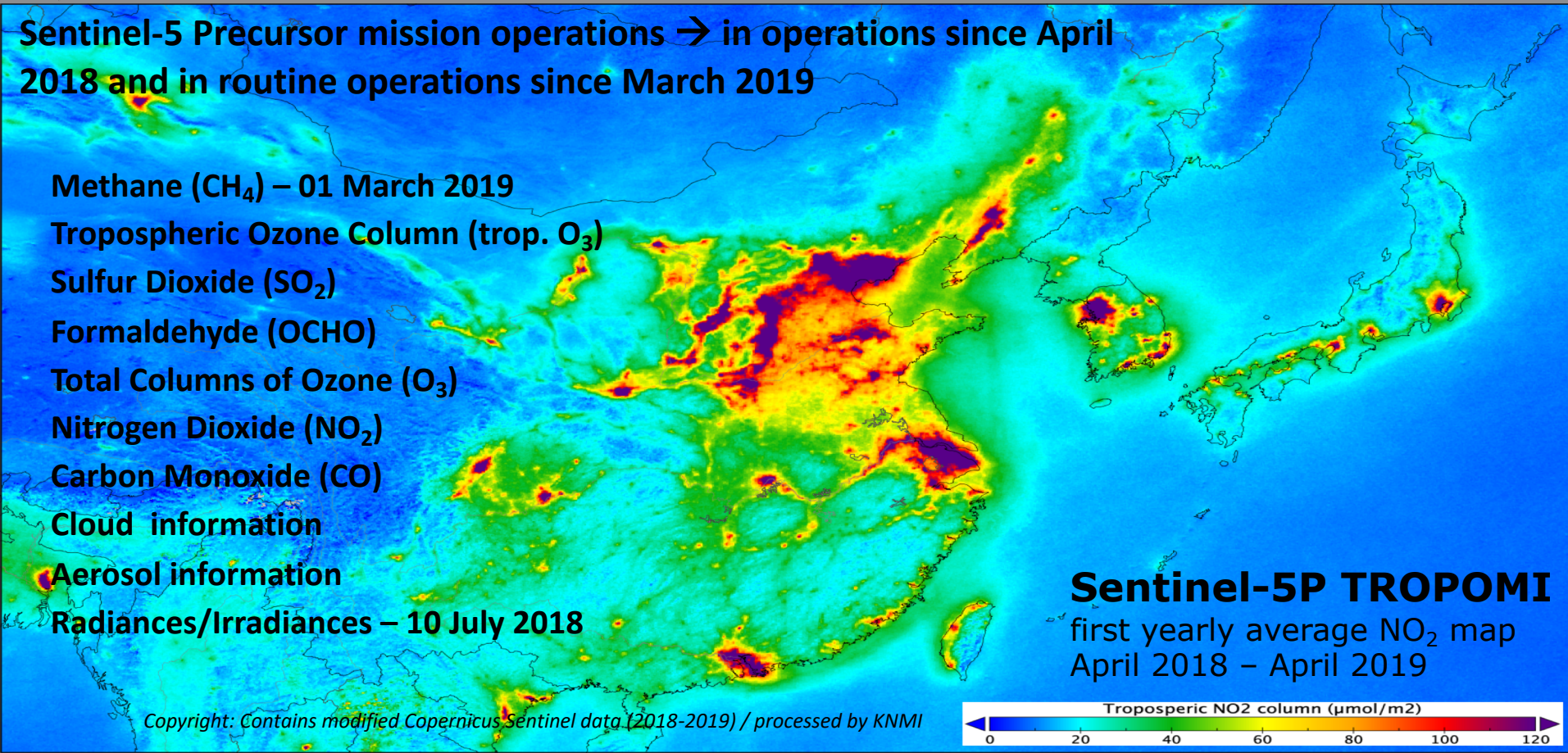


FOS/Data Acquisition

- **Mission Operations**: controlled by ESOC supported by the OSF at KNMI (defining TROPOMI operations)
- Post Launch Support Office (PLSO) ESTEC: in-orbit mission performance monitoring - **no major anomaly** reported so far
- Data Acquisition: **Inuvik and Svalbard** ground-stations
- Mission Commanding: **Kiruna and Svalbard** ground-station

PDGS

- Level 1 Prototype Development: at KNMI (supported by SRON)
- Level 2 Prototype: at KNMI (supported by SRON) & at DLR (supported by BIRA/IASB) & RAL
- **Operational Level 1 and Level 2 Product Processing** – Payload Data Ground Segment (PDGS): at **DLR**
- Cal/Val: MPC (operational) and **S5PVT** (science - AO projects) - **WS at ESRIN Nov. 11-14 2019**, Fiducial Reference Measurements (**FRM**) Projects (e.g. TCCON)



EO Browser Login

Search Results Visualization Pins

Dataset: SENTINEL-5P NO2

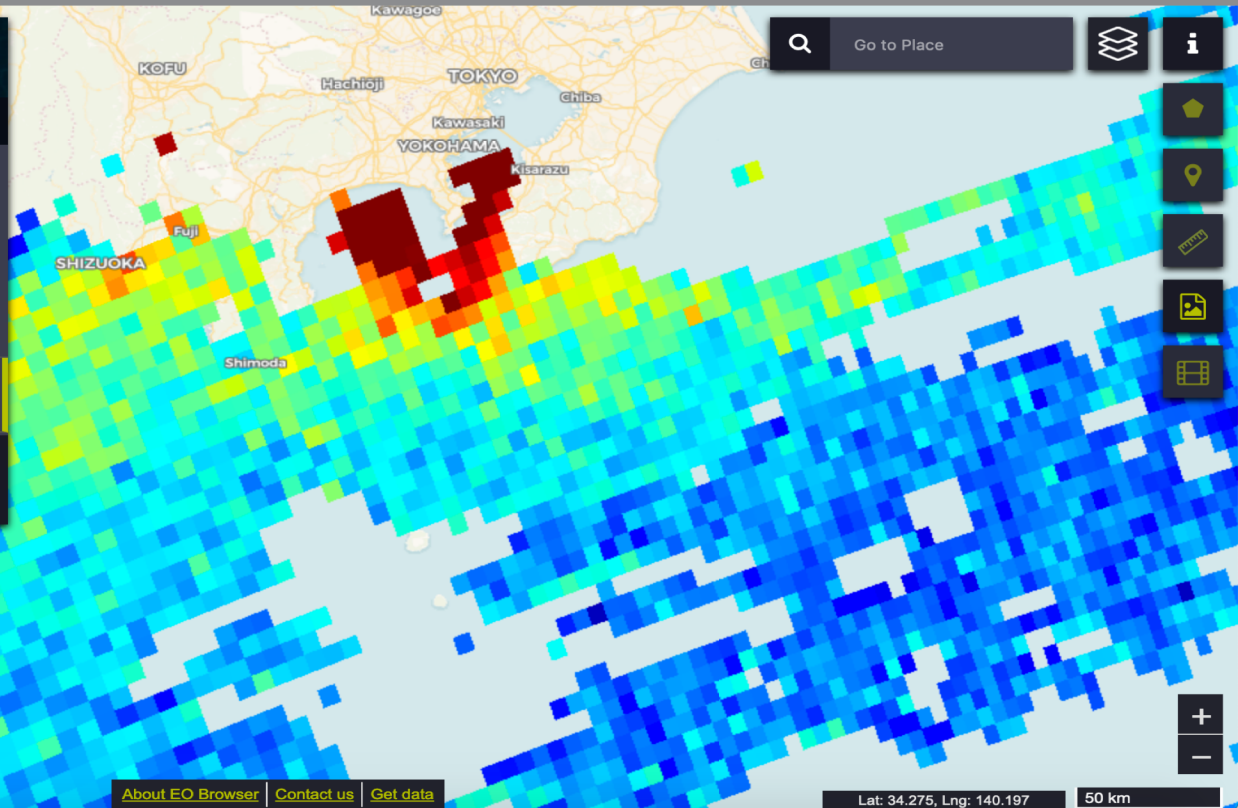
Date: 2019-06-08

Custom
Create custom rendering

Sentinel 5P L2 - Nitrogen Dioxide
Nitrogen Dioxide tropospheric column

[Free sign up](#) for all features

Powered by [Sinergise](#) with contributions from the European Space Agency v2.17.7

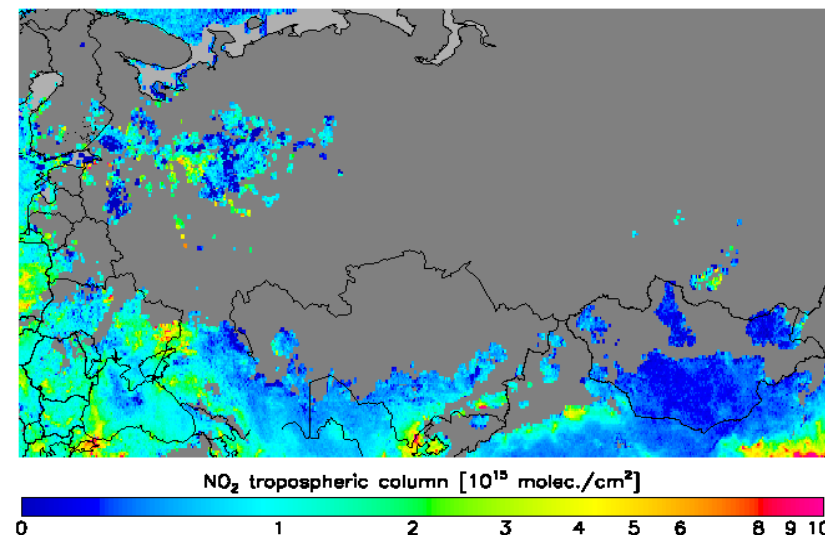


TROPOMI

TROPOMI with improved cloud/snow recognition

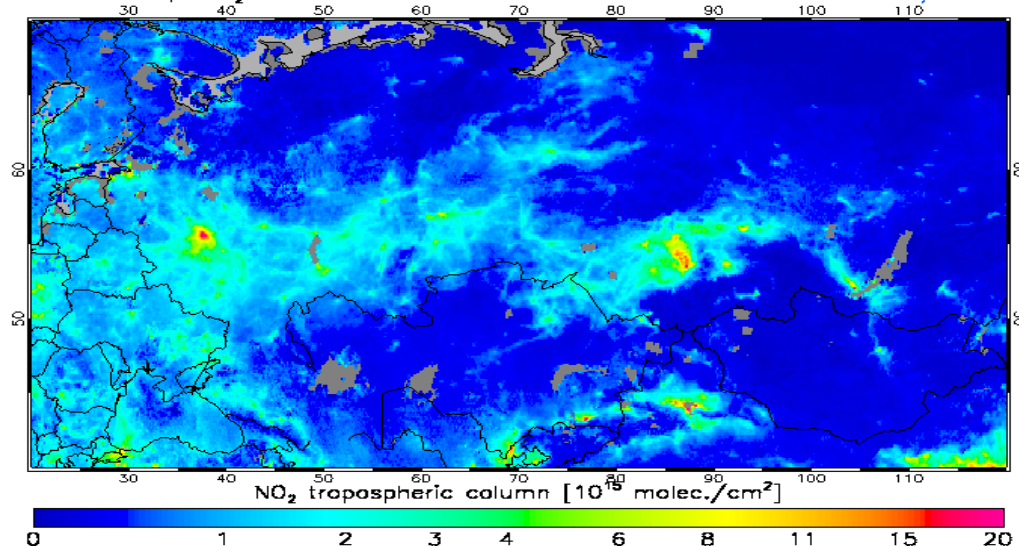
TROPOMI trop. NO₂ Feb. 2018

KNMI/ESA



TROPOMI trop. NO₂ Feb. 2018

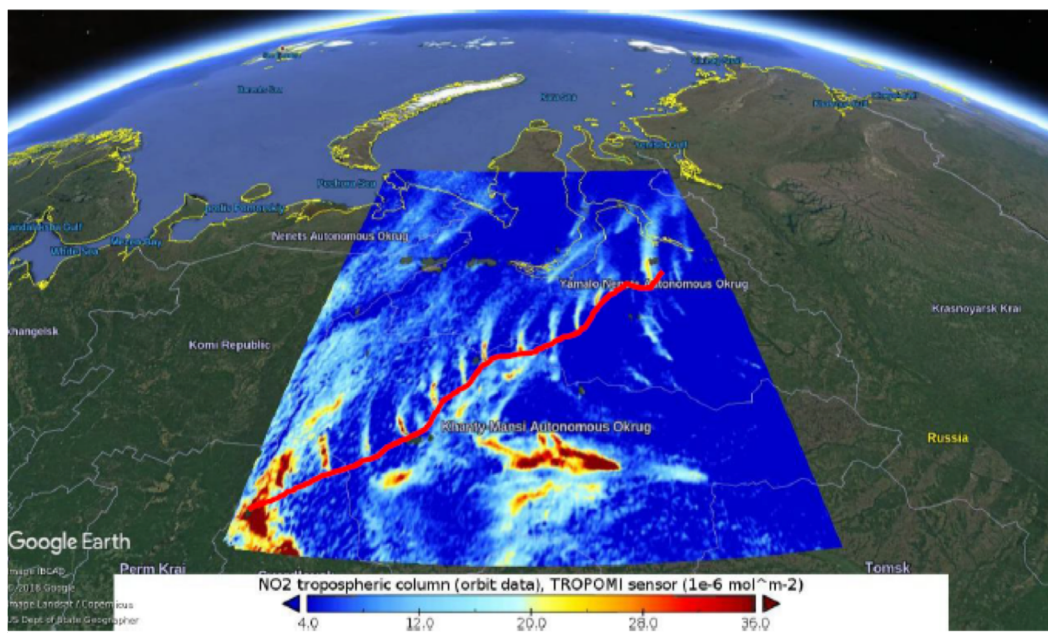
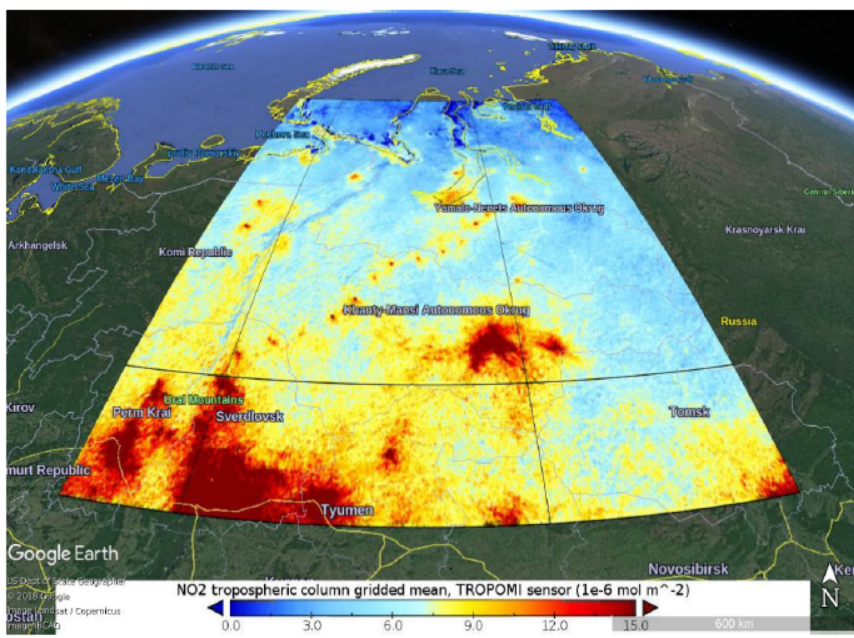
KNMI/ESA



Copyright: Contains modified Copernicus Sentinel data (2018) / processed by KNMI

April 2018: 'NO₂ Dots' over Siberia - KNMI

NO₂ Emissions of compressor stations along the Urengoj pipeline



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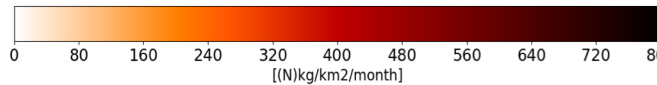
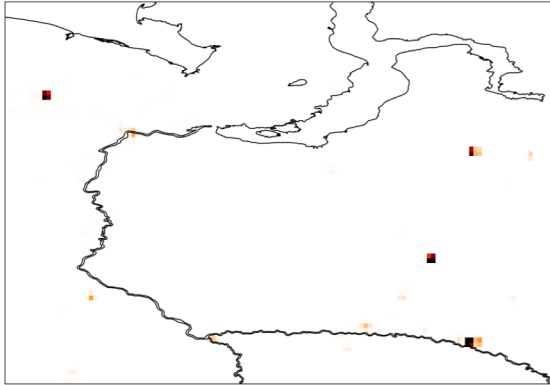
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West Siberia: gas compressor stations along pipeline to transport gas to Europe show up in map of NO_x emissions - KNMI

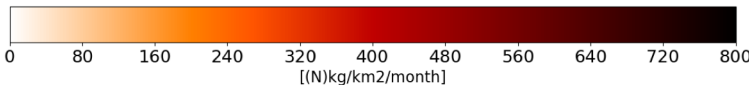
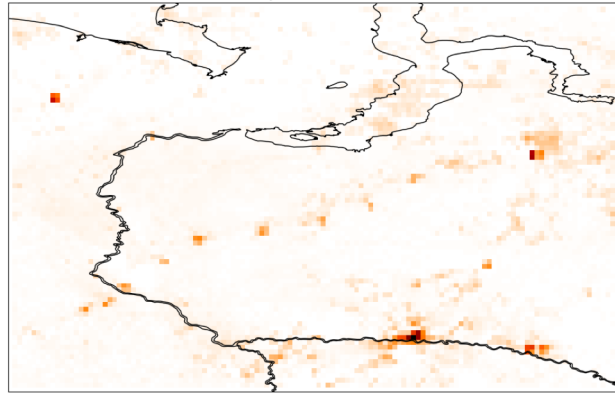
NO_x emissions January 2010 (HTAP)



NO_x emissions HTAP

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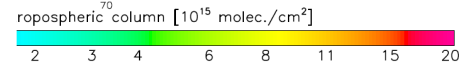
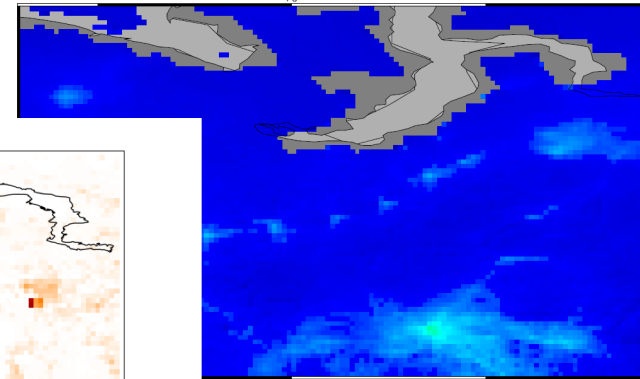
NO_x emissions June 2018 (DECSO-TROPOMI)



NO_x emissions DECSO-TROPOMI

TROPOMI trop. NO₂ Apr. 2018

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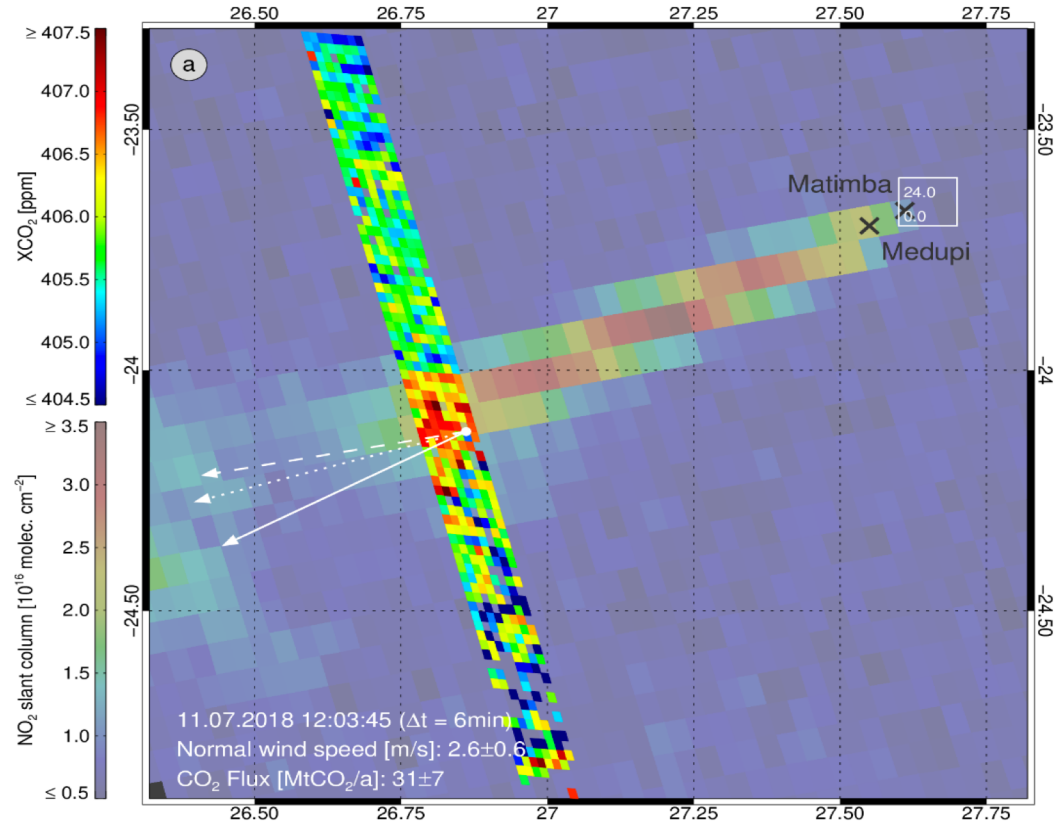
NO₂ observations
TROPOMI

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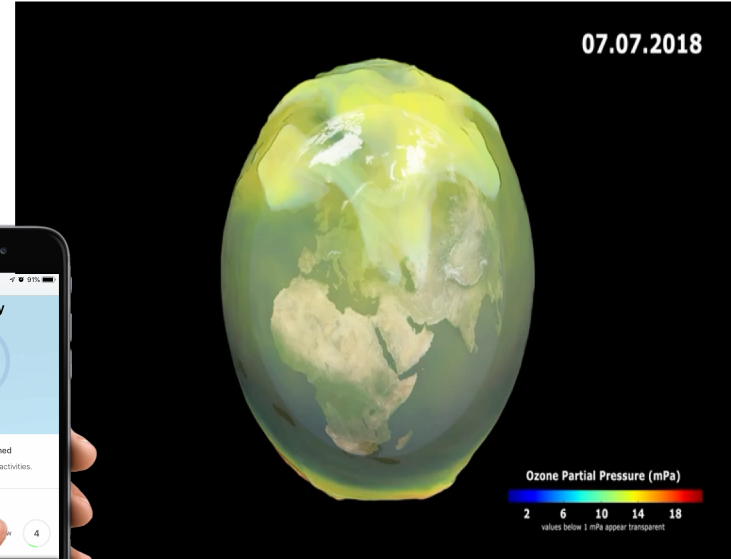
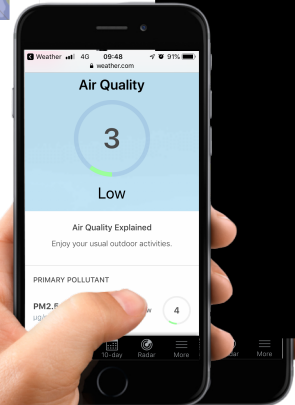
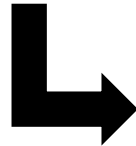
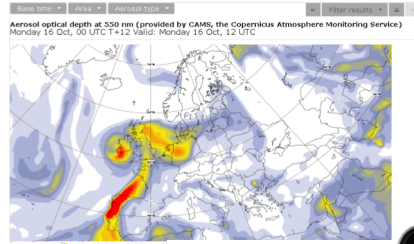
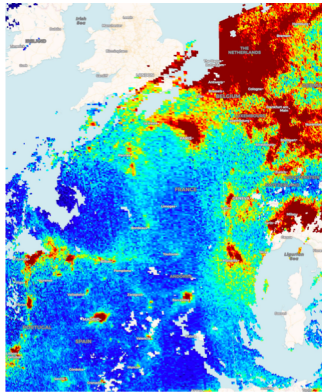
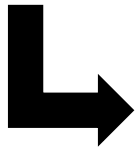
S5P NO₂ slant column (background)
 overlaid by OCO-2 XCO₂ (foreground)

University Bremen
 Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2019-15>

Medupi and Matimba power plants in
 South Africa on July 11, 2018.

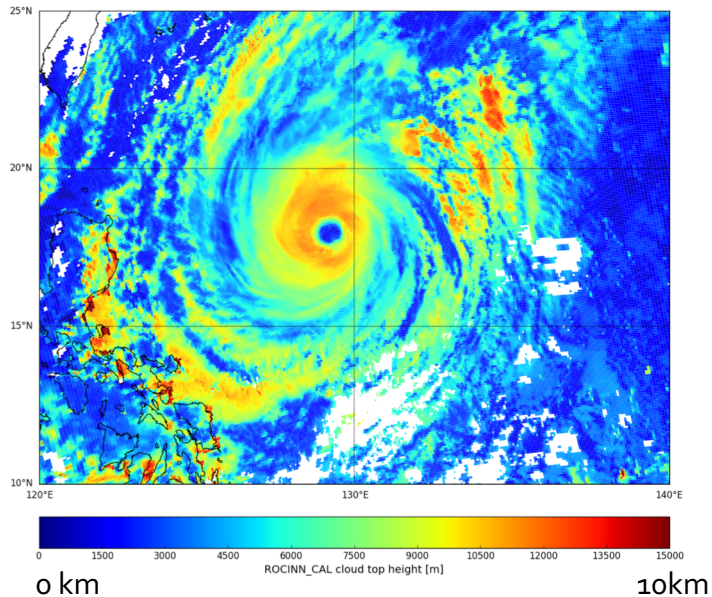


Copernicus Atmospheric Monitoring Service (CAMS) – operational uptake of S5p/TROPOMI Total Ozone columns on December 05 2018



Copyright: Contains modified Copernicus Sentinel data (2017-2018) / processed by DLR and KNMI

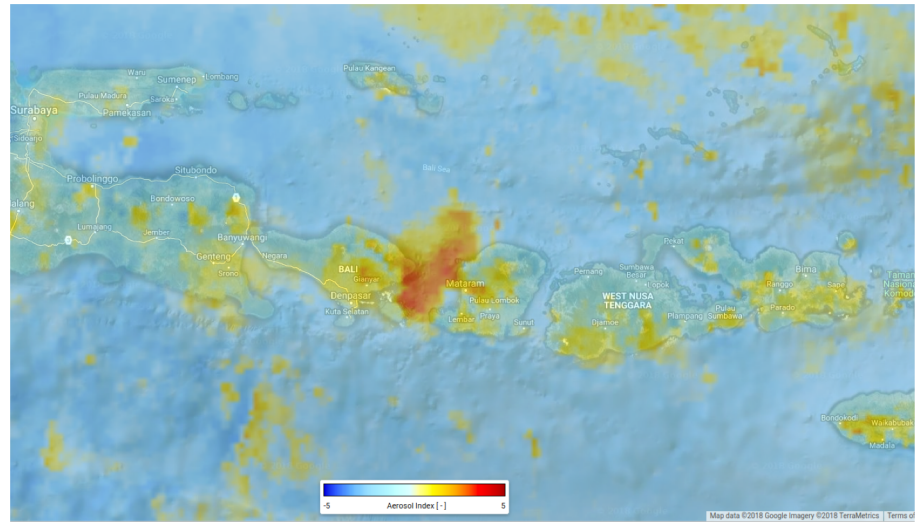
TROPOMI/S5P Cloud Height



S5p – Typhoon Yutu, Philippines, 28th October 2018

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S5p Aerosol Absorbing Index

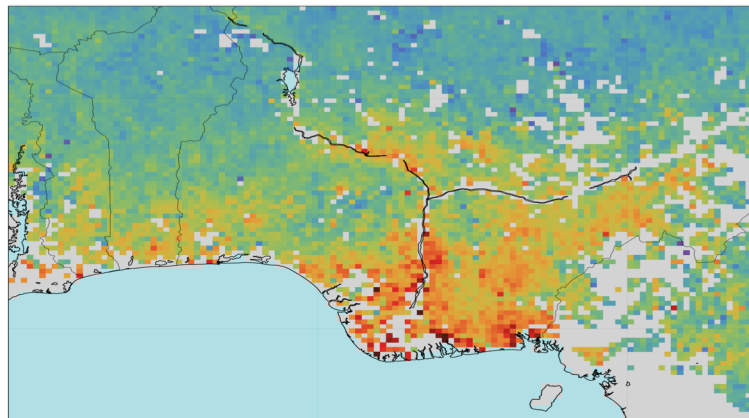


Agung Volcanic Eruption, 27 Nov 2017

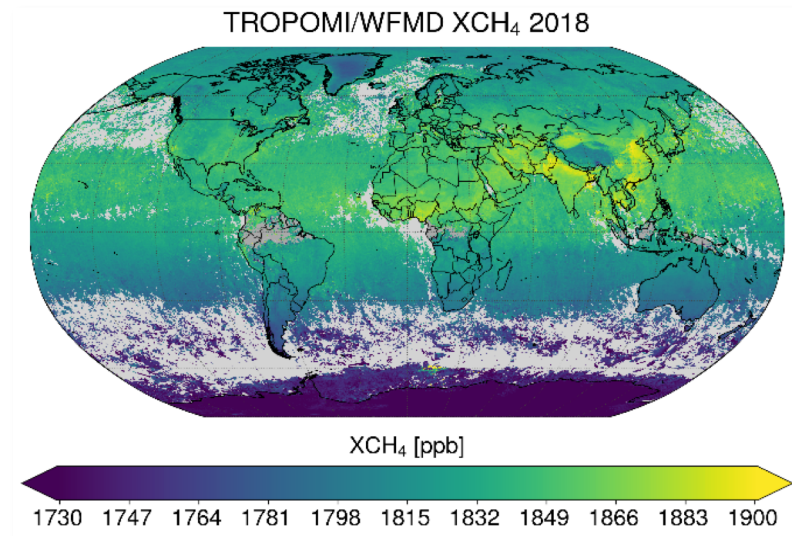
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http://www.esa.int/Our_Activities/Observing_the_Earth/Copernicus/Sentinel-5P/Methane_and_ozone_data_products_from_Copernicus_Sentinel-5P

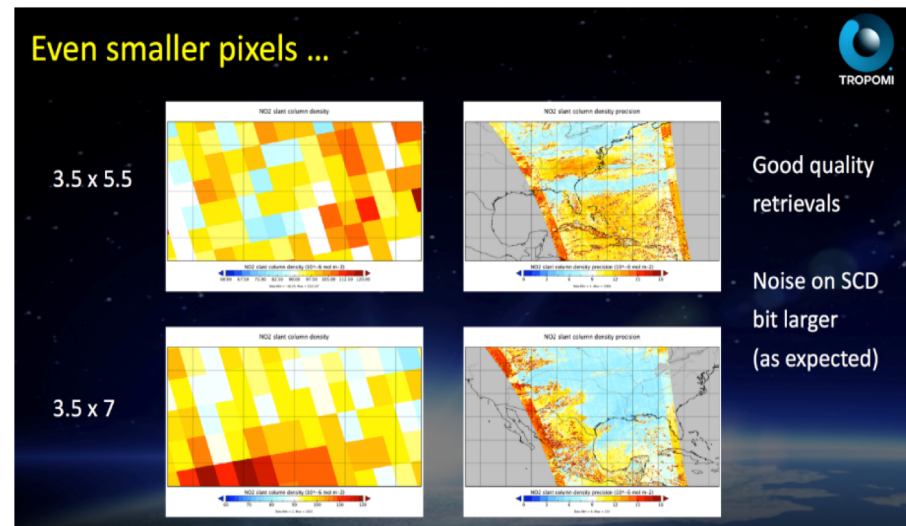


Systematic Uncertainty Requirement	Random Uncertainty Requirement
1.5%	1%



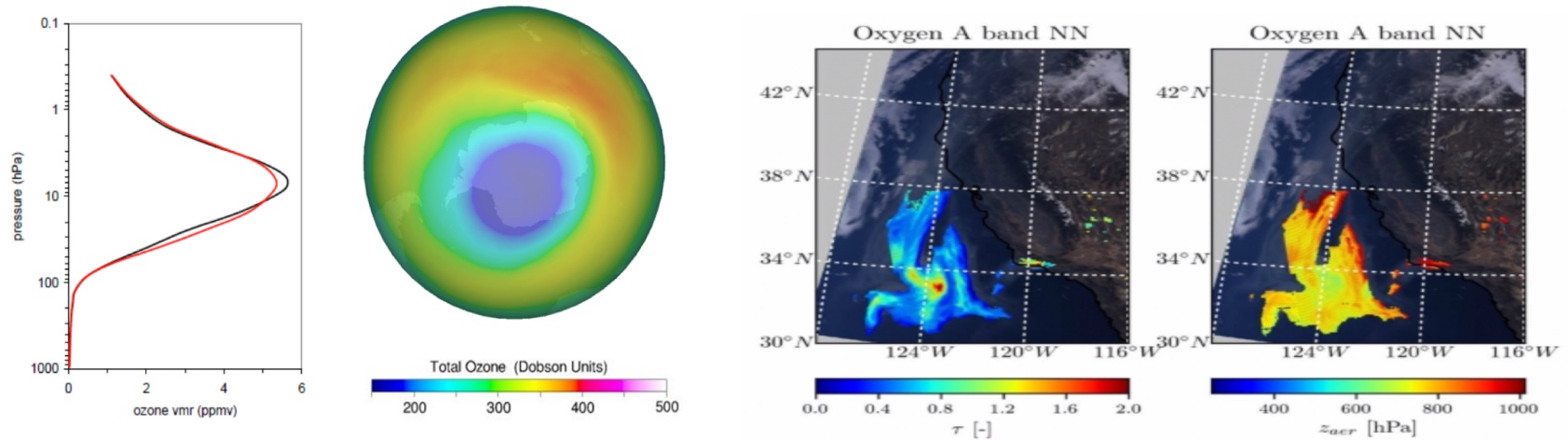
Methane during 2018 as retrieved by University Bremen

- **Towards an improved spatial sampling:**
 - ✓ change of TROPOMI operations for reduced along-track spatial sampling (5.5 km instead of 7 km) during mid 2019 to reduce occurrences of saturated pixels over the tropics for high clouds in the VIS and NIR wavelength range.
 - ✓ planned mid 06 August 2019
 - ✓ about 20% more science data



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Ozone Profiles (end 2019) and Aerosol Layer Height (mid 2019)



The Ozone Profiles release can only be done after a L1 product change

- Most products have been provided to the public (2 missing)
- The *Aerosol Layer Height* product to be released during this summer
- The *Ozone Profile* product to be released by the end of this year/early next year
- Overall product quality is already good but improvements are planned (e.g. use better surface reflectance (ozone NRT products), bias in SO₂ slant columns)
- First TROPOMI operations change is planned early August (improved spatial resolution – 20% more science data) – original Requirement: 7 x 7 km – 5.5 x 3.5 km
- Prototype development on 10 new possible products is starting (e.g. H₂O, BrO, SIF, AOD)