Sentinel-5 Precursor Mission: Status and Results about the Methane, Nitrogen Dioxide, Cloud & Aerosol Information products

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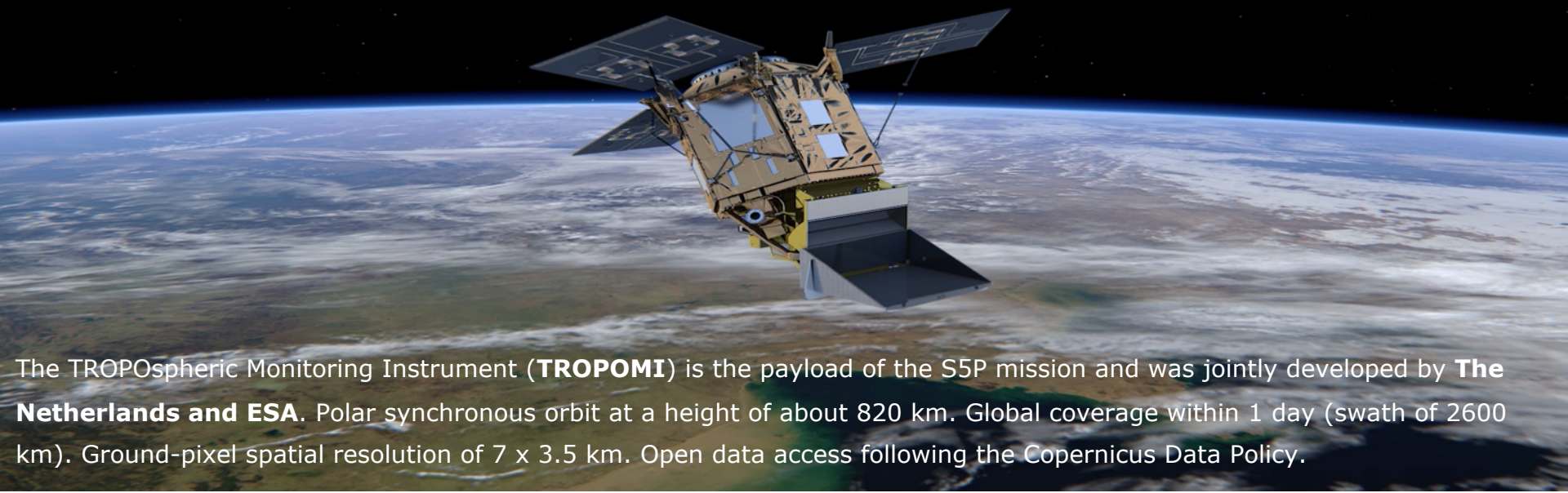
This presentation includes modified Copernicus data (2017-2019)

Sentinel-5 Precursor

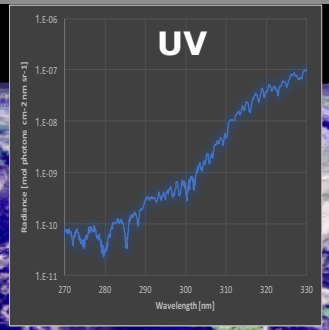
COPERNICUS ATMOSPHERE MISSION IN POLAR ORBIT
only currently flying European satellite mission with GHG measurement capability down to the Earth's surface

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.

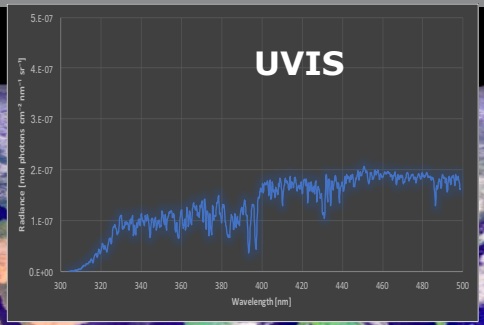


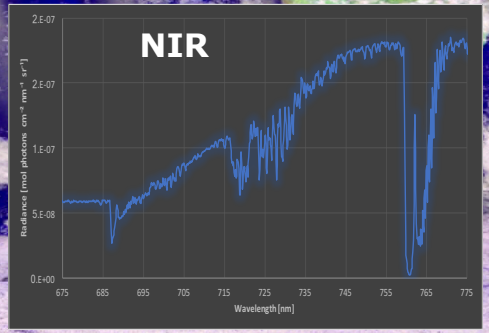
The TROPOspheric Monitoring Instrument (**TROPOMI**) is the payload of the S5P mission and was jointly developed by **The Netherlands and ESA**. Polar synchronous orbit at a height of about 820 km. Global coverage within 1 day (swath of 2600 km). Ground-pixel spatial resolution of 7 x 3.5 km. Open data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

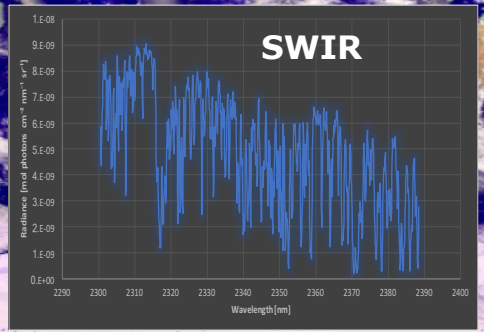
TROPOMI Wavelength Coverage



- 4000 wavelengths per spectrum
- 450 spectra per second
- 20 million spectra per day

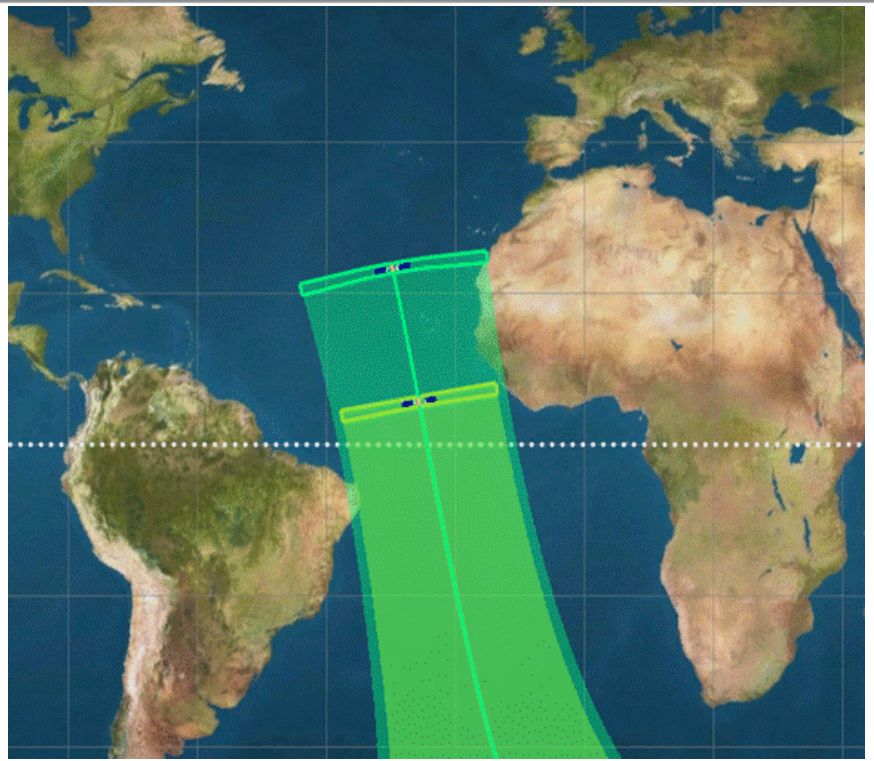






Loose Formation flying of Sentinel-5 Precursor with Suomi-NPP

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



Copernicus Sentinel Missions

European Commission

esa

S-1

Radar

A 3 Apr. 2014

B 25 Apr. 2016

S-2

High Resolution Optical

A 23 Jun. 2015

B 6 Mar. 2017

S-3

Medium Resolution Optical & Altimetry

A 16 Feb. 2016

B 25 Apr. 2018

S-4

Atmospheric Chemistry (GEO)

A 2021

B 2027

S-5P

Atmospheric Chemistry (LEO)

A 13 Oct. 2017

S-5

Atmospheric Chemistry (LEO)

A 2021

B 2027

S-6

Altimetry

A 2020

B 2025

COPERNICUS Programme – a EO game changer for Europe

- **EUROPEAN EO PROGRAMME**

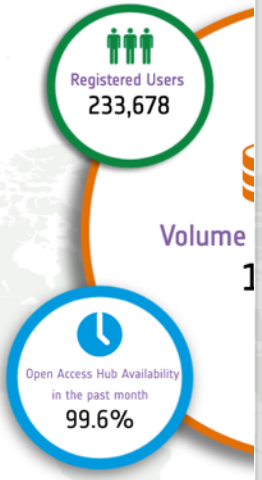
- **the 7 Sentinels produce about 25 TByte of data per day**

- **OPEN DATA ACCESS (huge USER uptake – 230.000)**

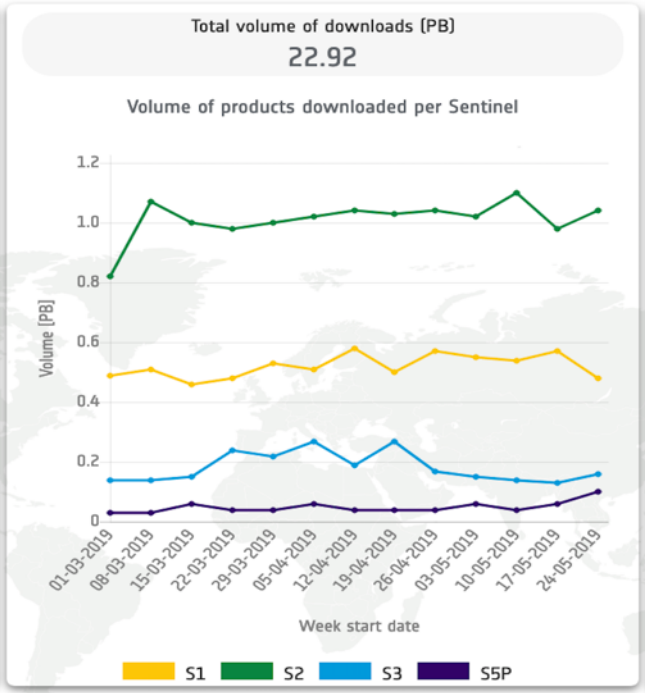
- **250 TByte of Data are being distributed (multiple download) per day**

COPERNICUS – Some Statistics

since 2014



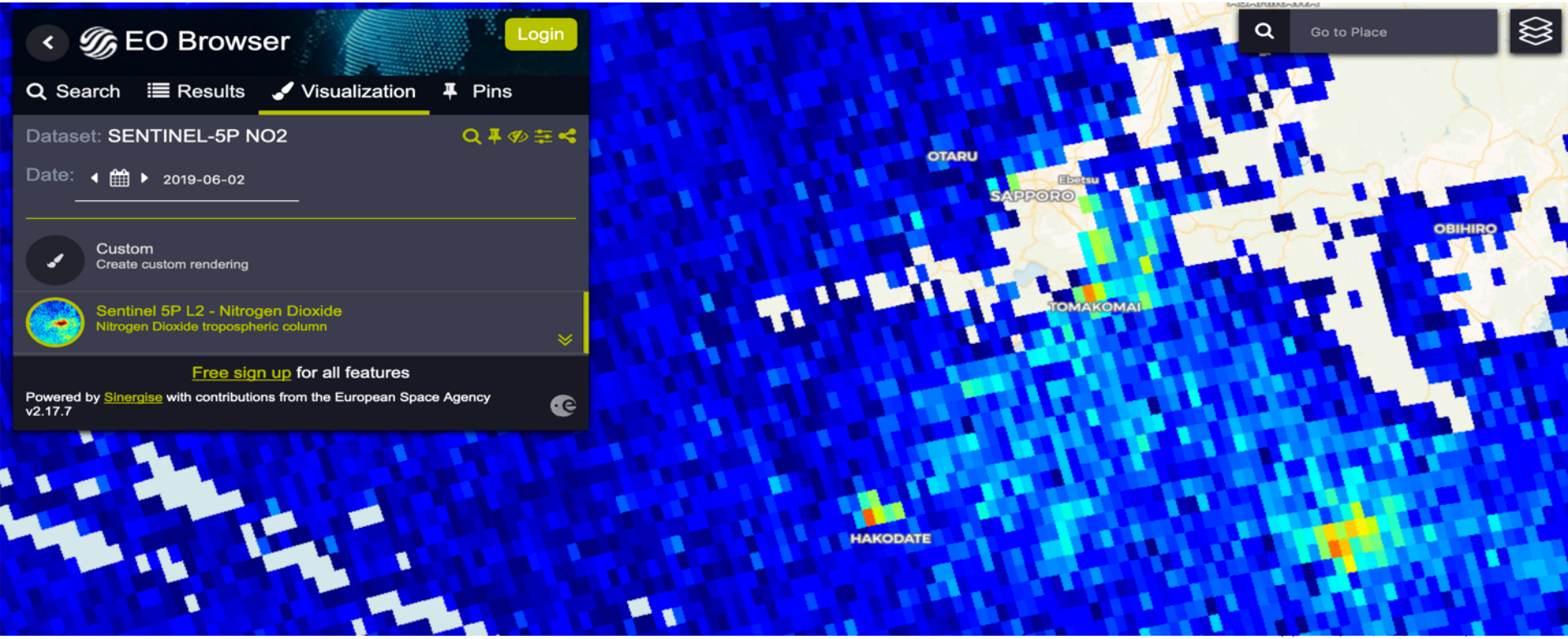
Publication and dissemination: Trends



last 3 months

S5p product delivery time

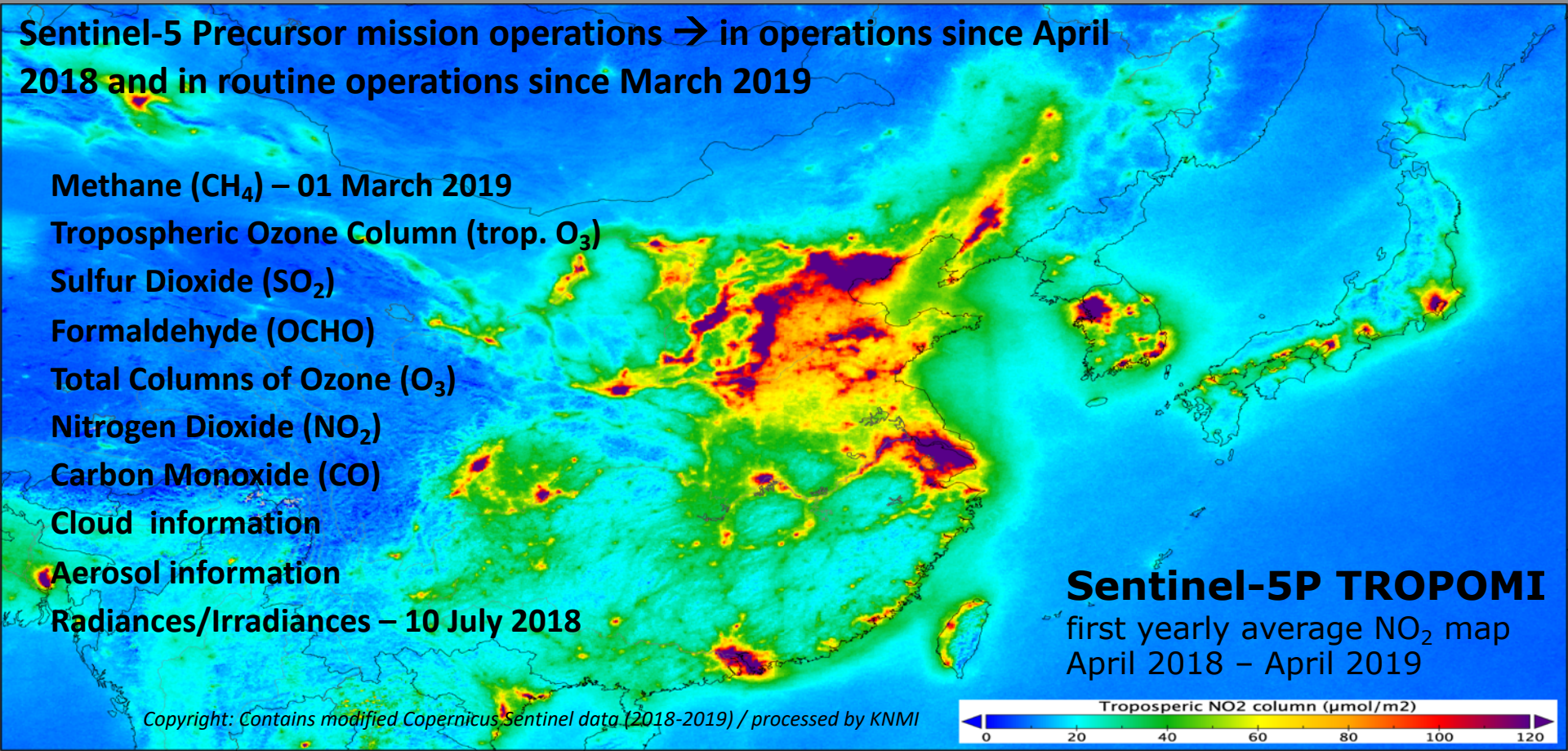
Open Data Access – Sentinel-5P



Sentinel-5 Precursor Products

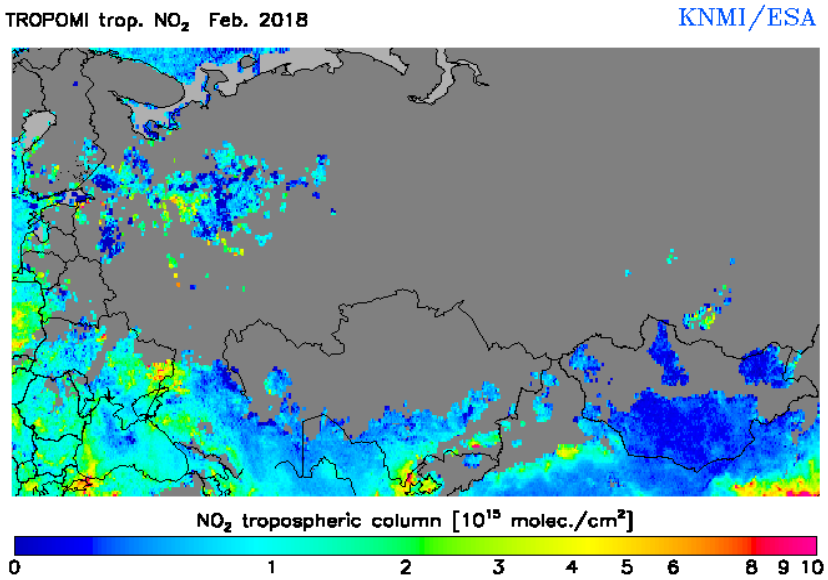
Sentinel-5 Precursor mission operations → in operations since April 2018 and in routine operations since March 2019

- Methane (CH_4) – 01 March 2019
- Tropospheric Ozone Column (trop. O_3)
- Sulfur Dioxide (SO_2)
- Formaldehyde (OCHO)
- Total Columns of Ozone (O_3)
- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Cloud information
- Aerosol information
- Radiances/Irradiances – 10 July 2018

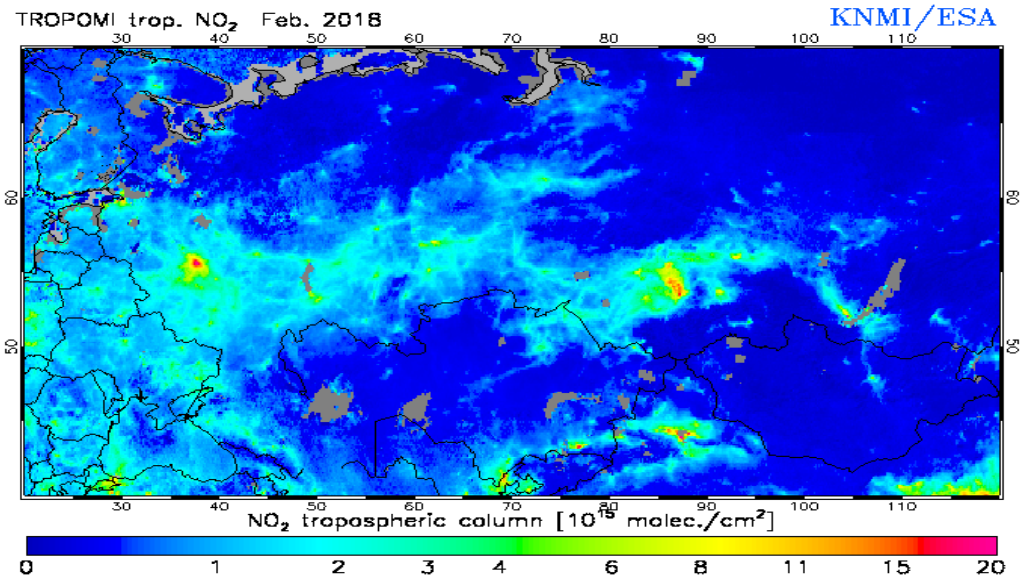


S5p/TROPOMI - Connecting the Dots

TROPOMI

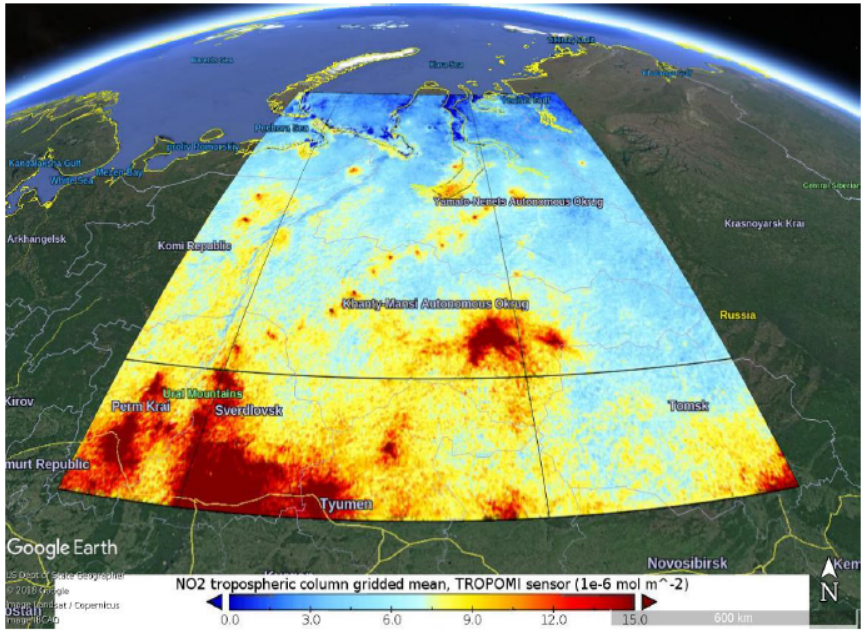


TROPOMI with improved cloud/snow recognition

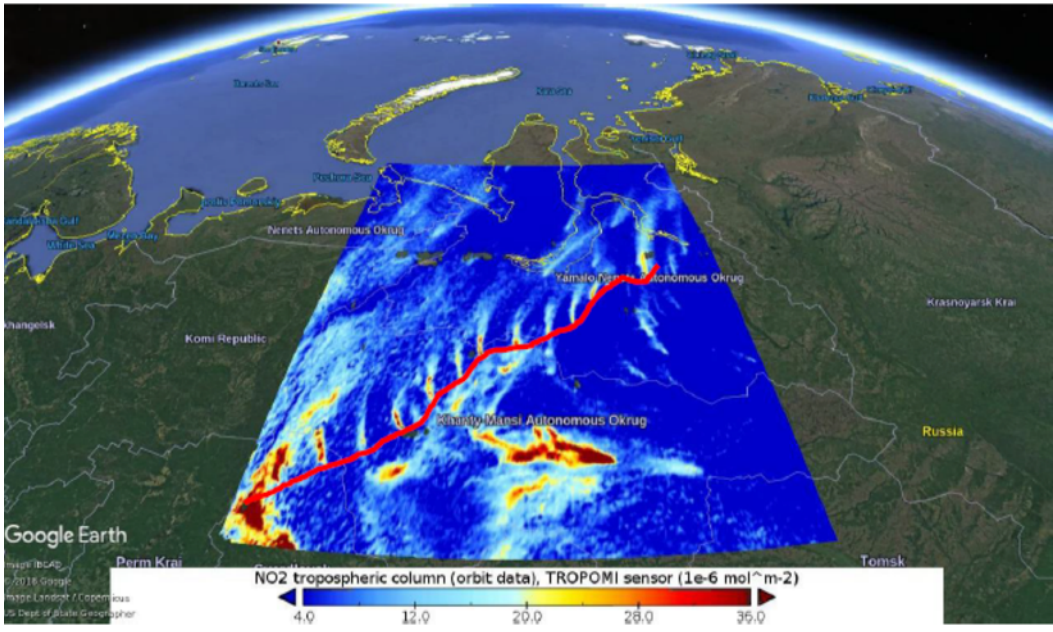


S5p/TROPOMI - Connecting the Dots

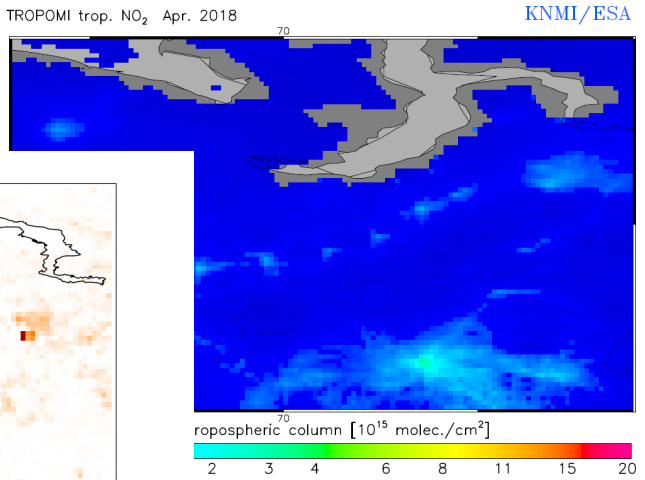
April 2018: 'NO_2 Dots' over Siberia - KNMI



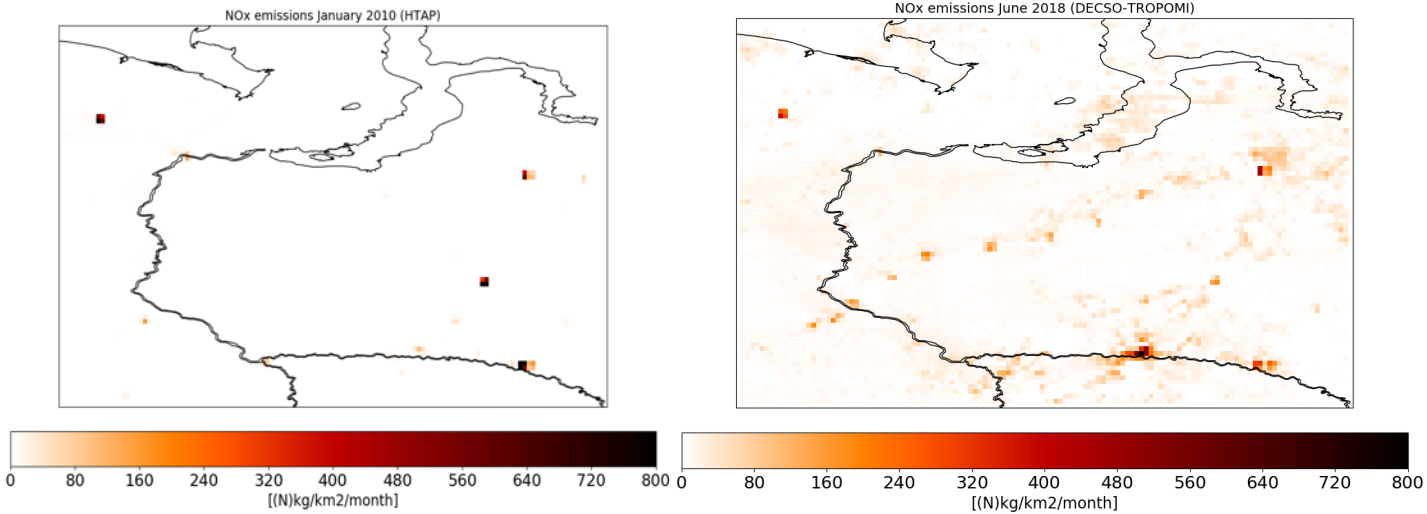
NO_2 Emissions of compressor stations along the Urengoj pipeline



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



NO2 observations TROPOMI



NOx emissions HTAP

NOx emissions DECSO-TROPOMI

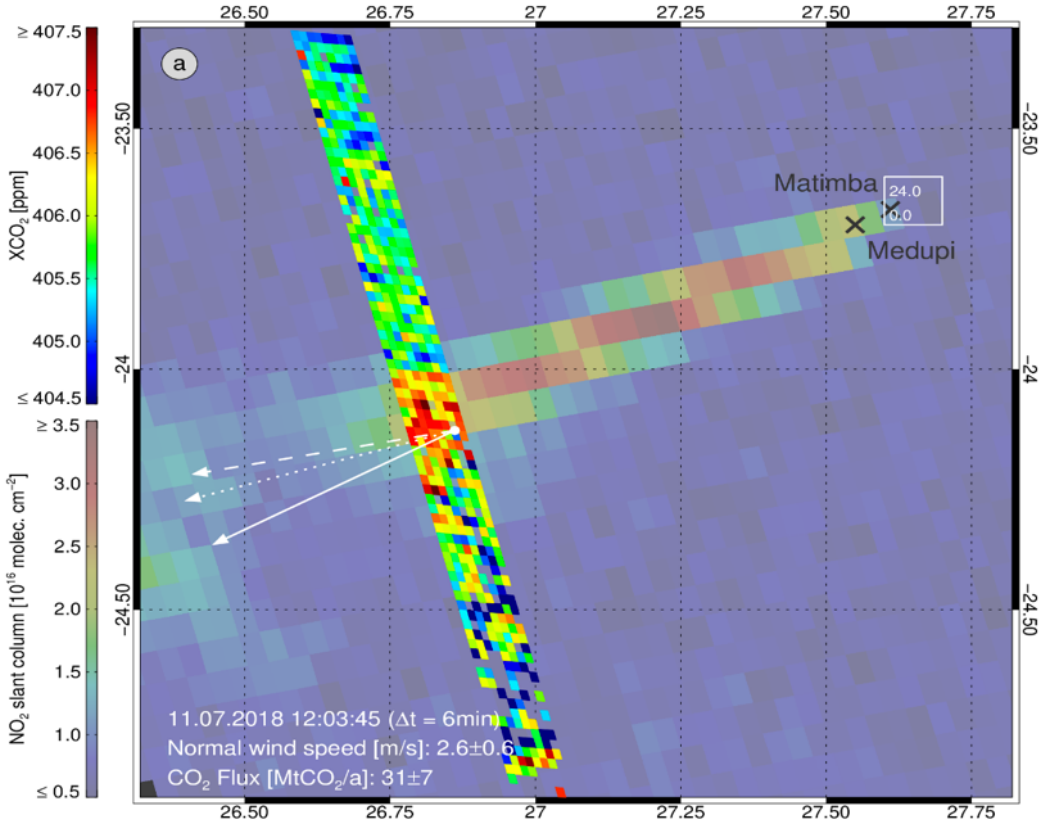
S5p-TROPOMI NO_2/OCO2 - CO_2

S5P NO_2 slant column (background) overlayed by OCO-2 XCO_2(foreground)

University Bremen

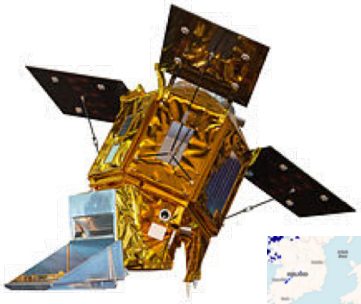
Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-15

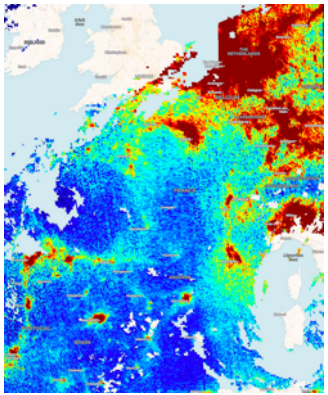
Medupi and Matimba power plants in South Africa on July 11, 2018.

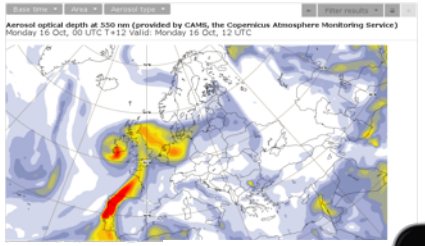


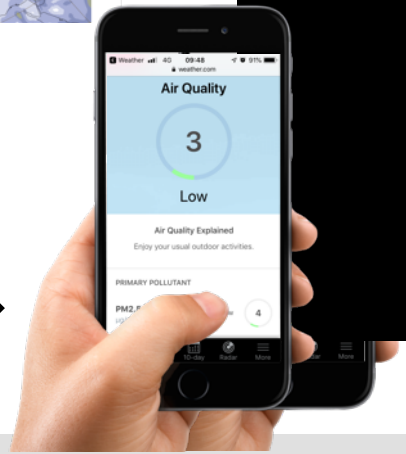
Sentinel-5 Precursor User Uptake
CAMS - ECMWF

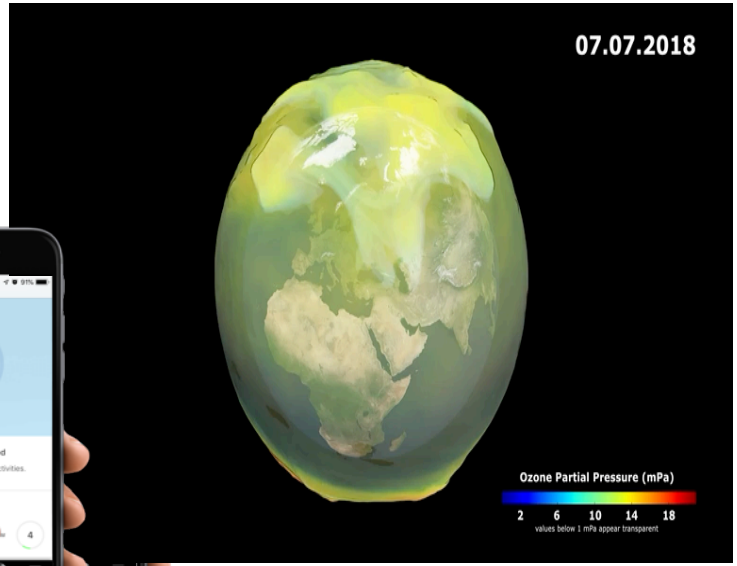
Copernicus Atmospheric Monitoring Service (CAMS) – operational uptake of S5p/TROPOMI Total Ozone columns on December 05 2018





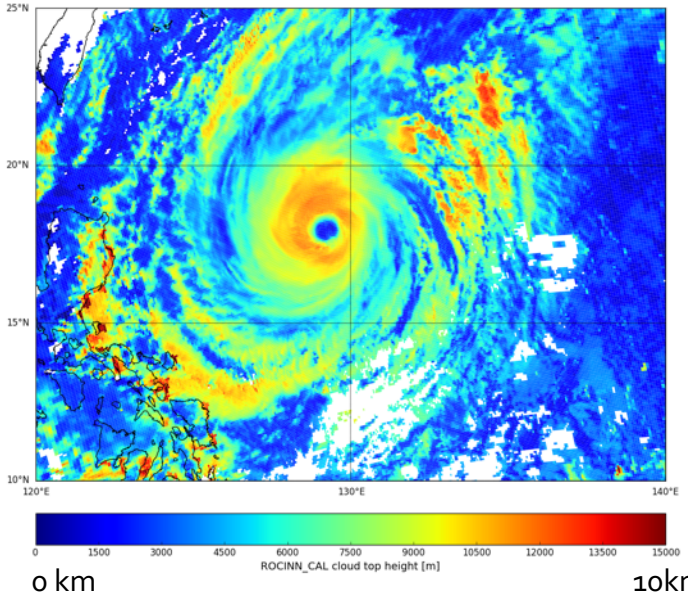






L1B Product (Radiances/Irradiances), Aerosol & Cloud information – released to the public during July 2018

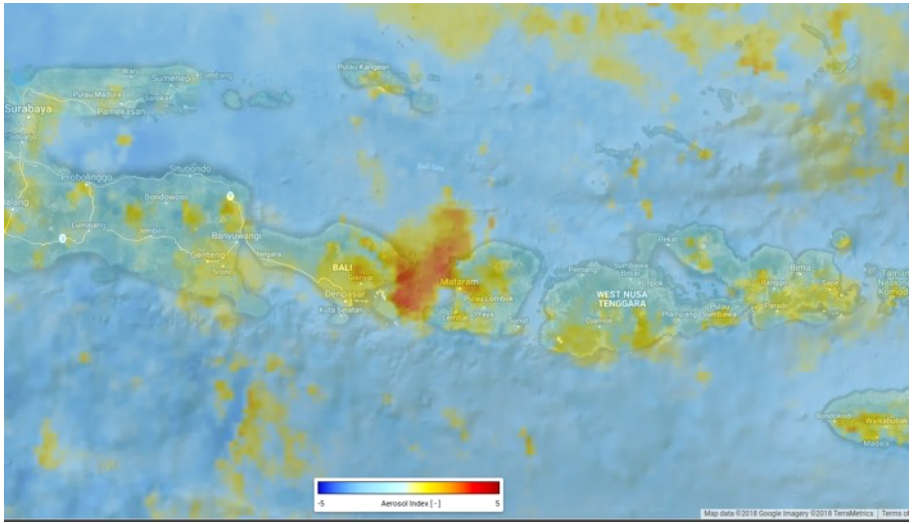
TROPOMI/S5P Cloud Height



0 km 10km

S5p – Typhoon Yutu, Phillipines, 28th October 2018

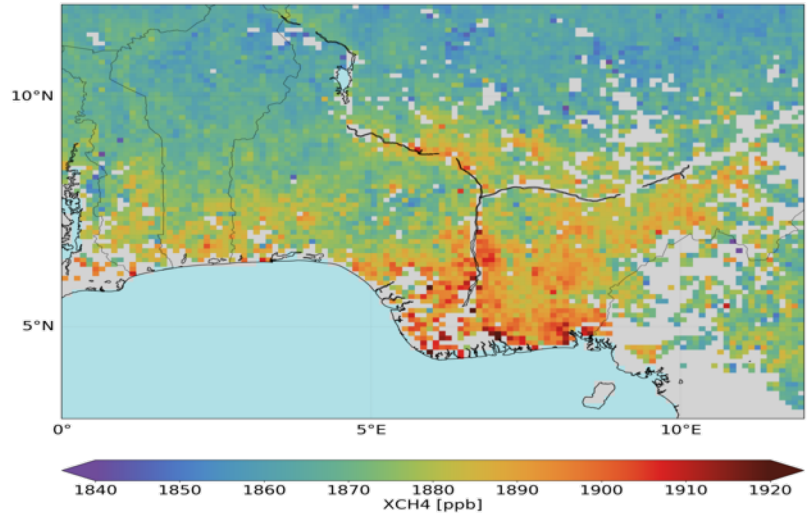
S5p Aerosol Absorbing Index



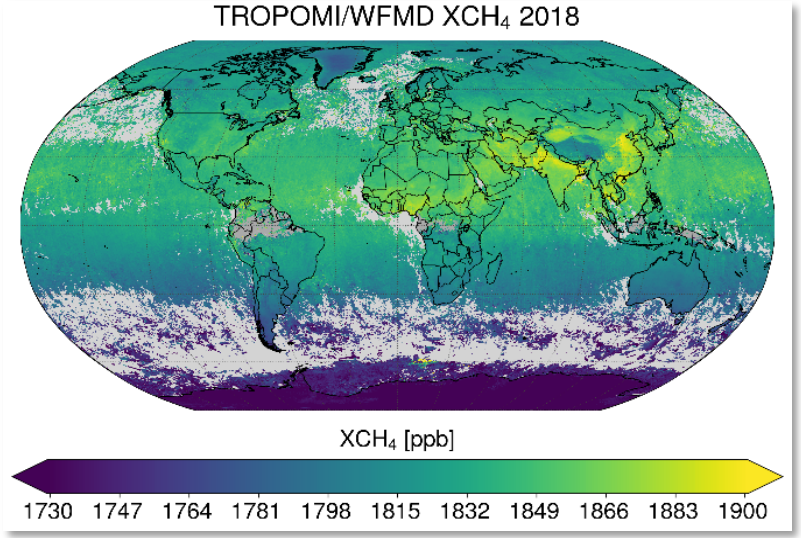
Agung Volcanic Eruption, 27 Nov 2017

Methane and tropospheric Ozone Column – released to the public during March 2019

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



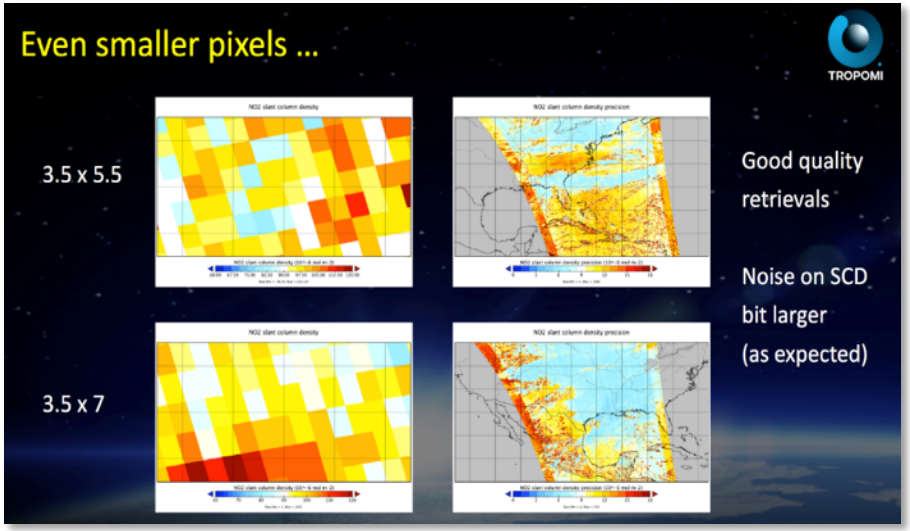
Methane over wetlands in Nigeria between November 2018 and February 2019 - SRON



Methane during 2018 as retrieved by University Bremen

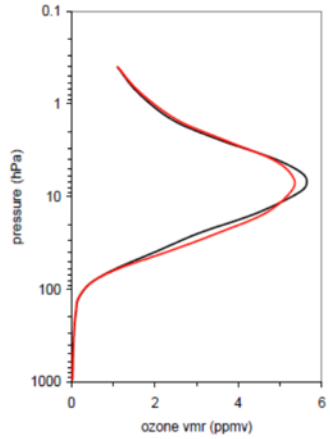
TROPOMI Operations Change

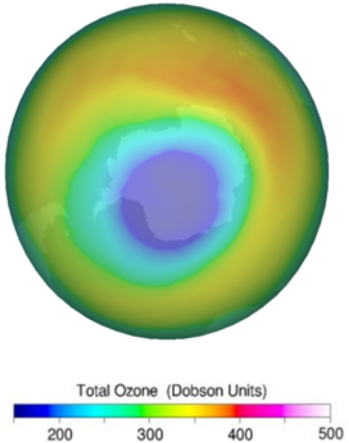
- **Towards an improved spatial sampling:**
  - ✓ change of TROPOMI operations for reduced along-track spatial sampling (5.5 km instead of 7 km) during mid 2019 to reduce occurrences of saturated pixels over the tropics for high clouds in the VIS and NIR wavelength range
  - ✓ planned mid July 2019
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

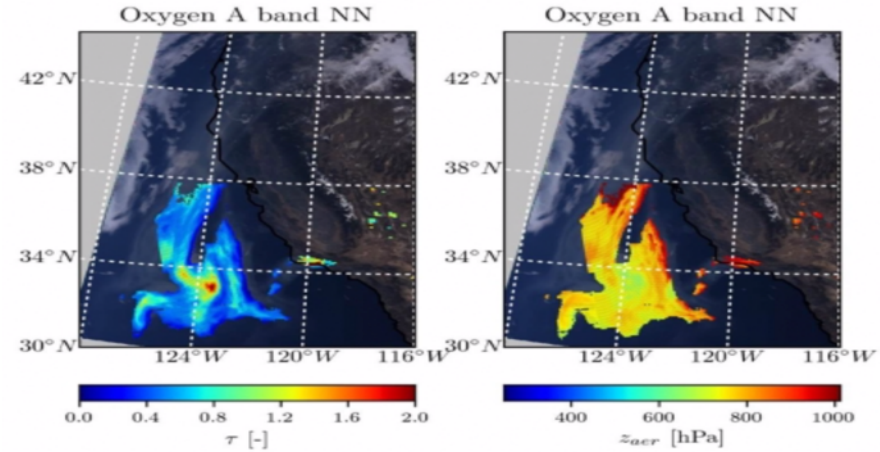


Copyright: Contains modified Copernicus Sentinel data (2018) / processed by KNMI

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







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