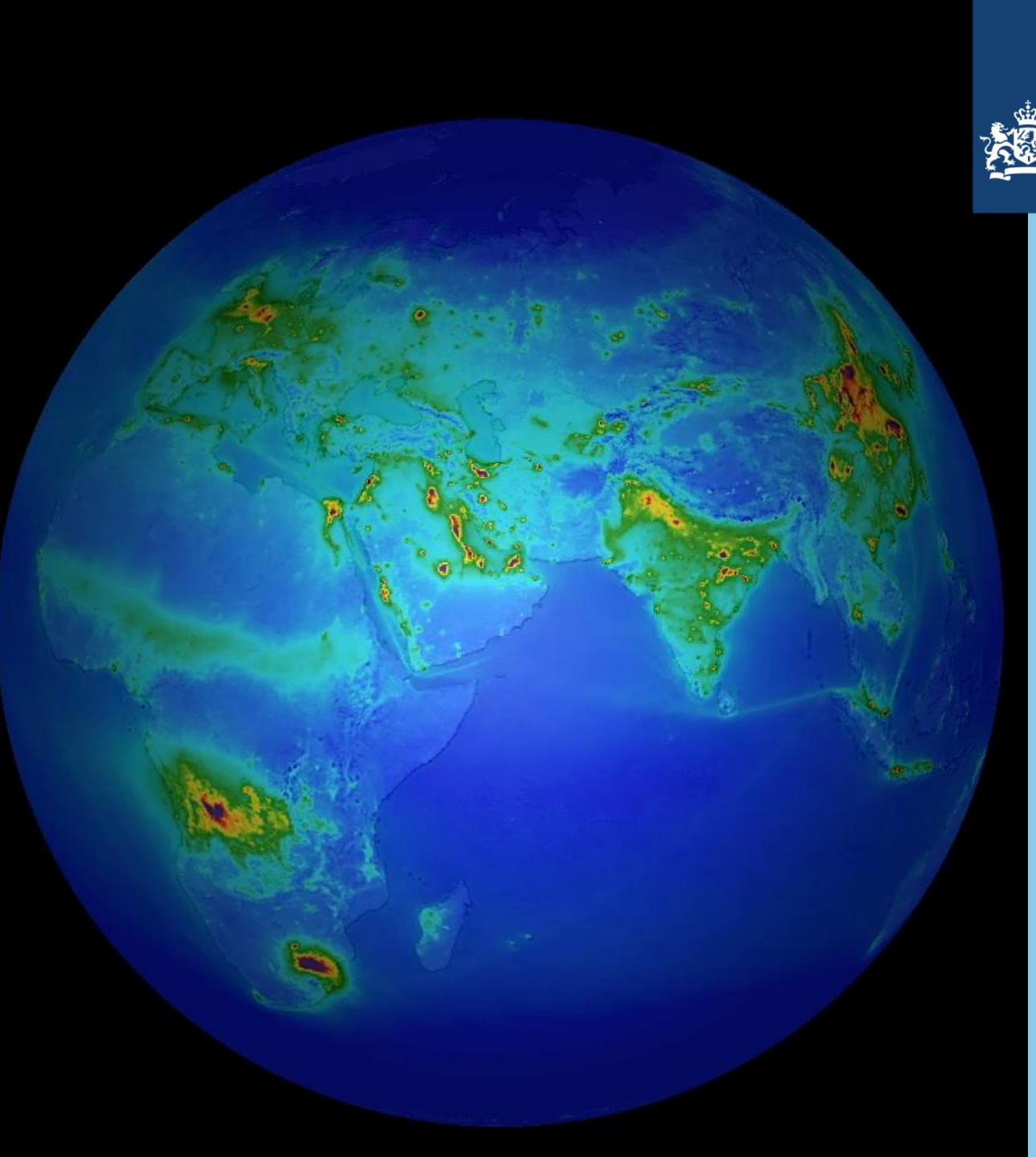


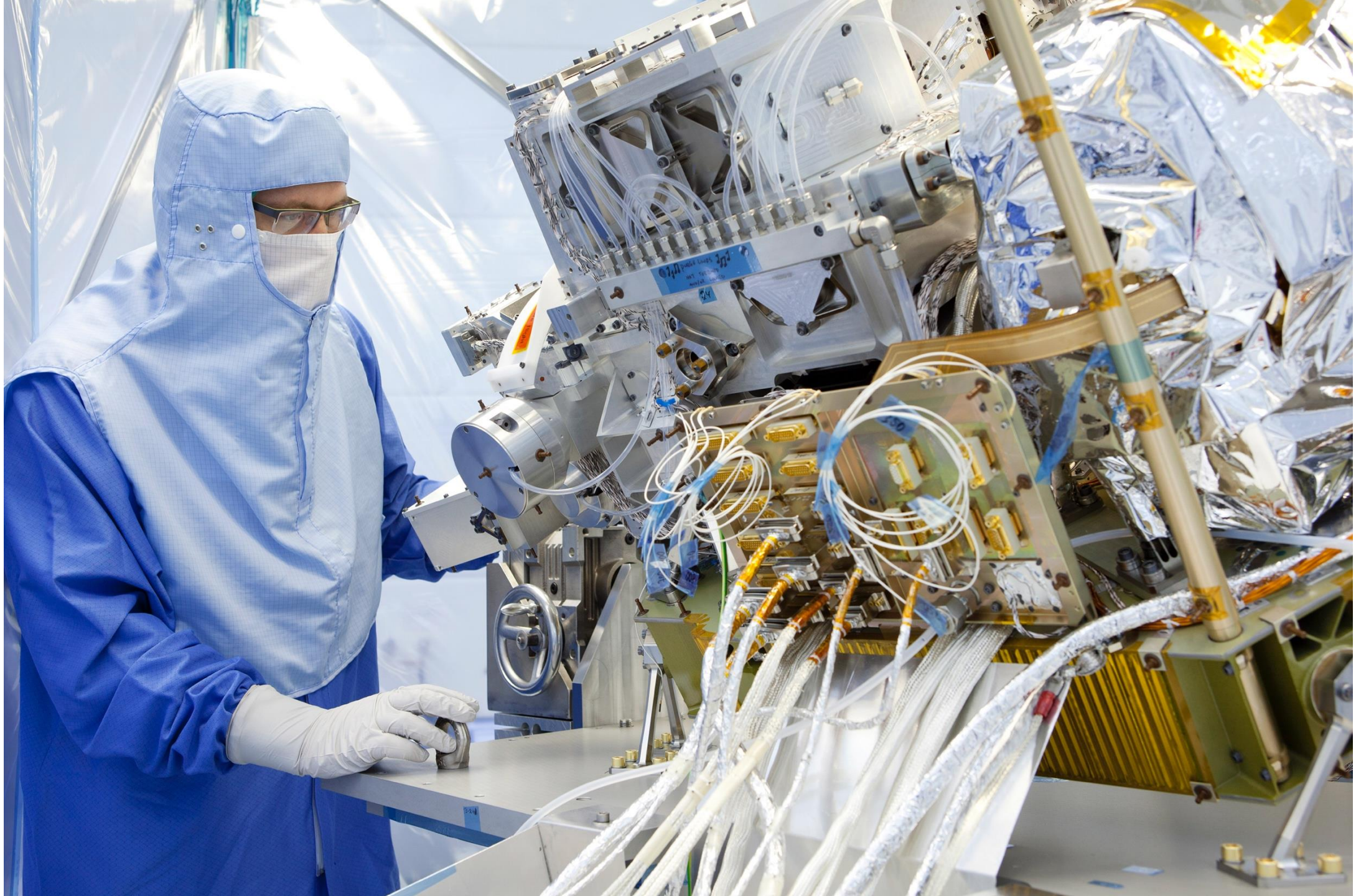
Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

5 Years TROPOMI

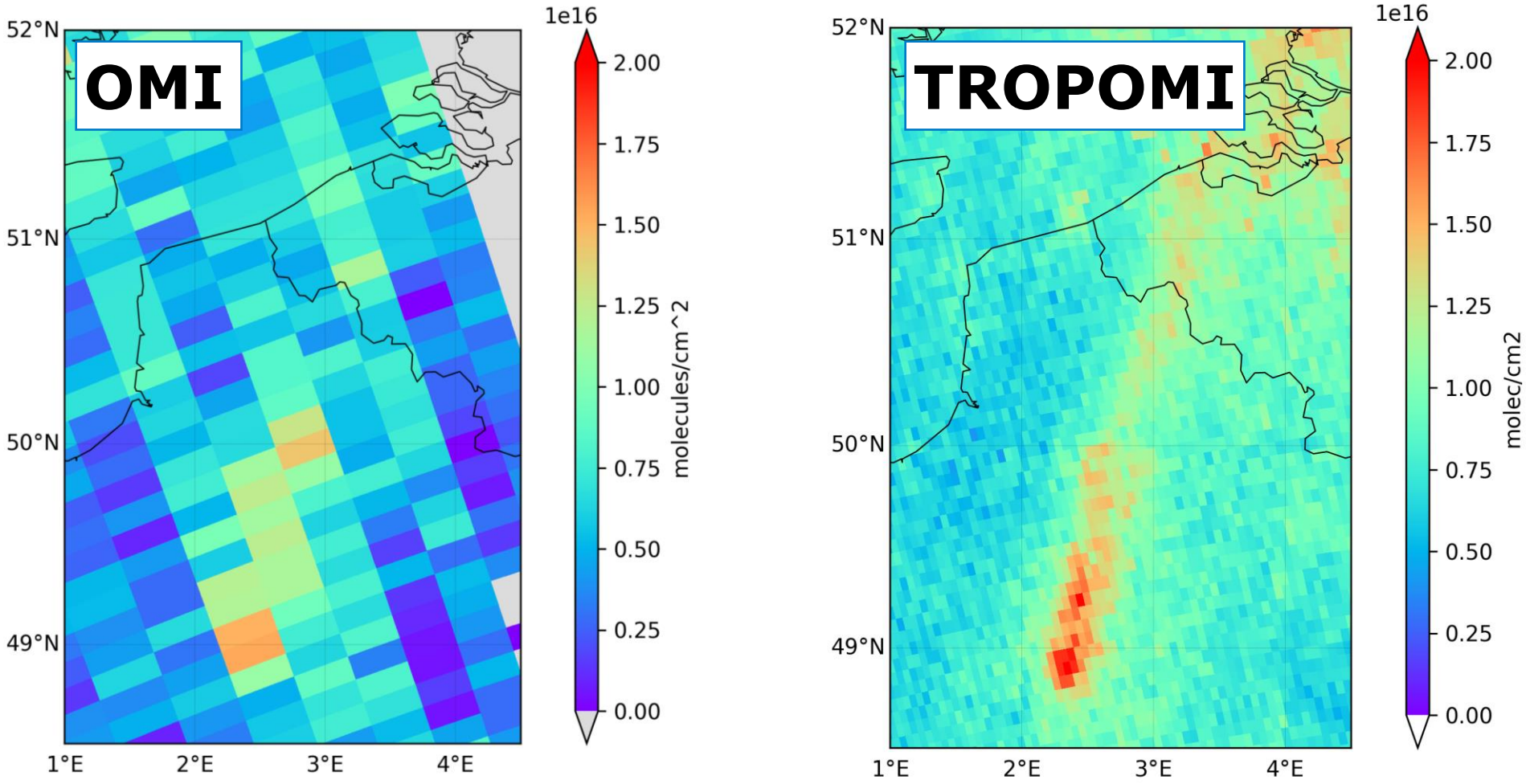
Achievements and Outlook

The S5P/TROPOMI Team
Pepijn Veefkind, KNMI & TU-Delft
veefkind@knmi.nl

SO_2 column density
2021
BIRA/DLR



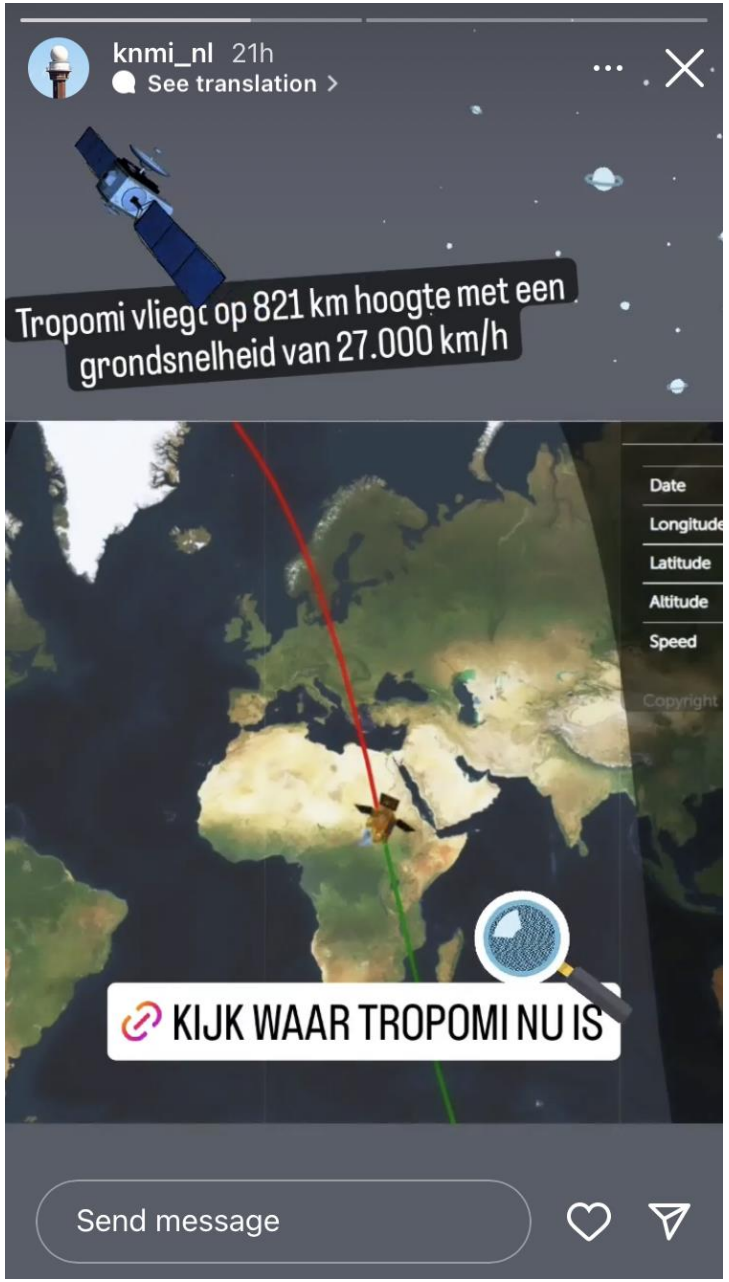
Comparing TROPOMI to OMI



22 Nov 2017

Tropomi Fun Facts

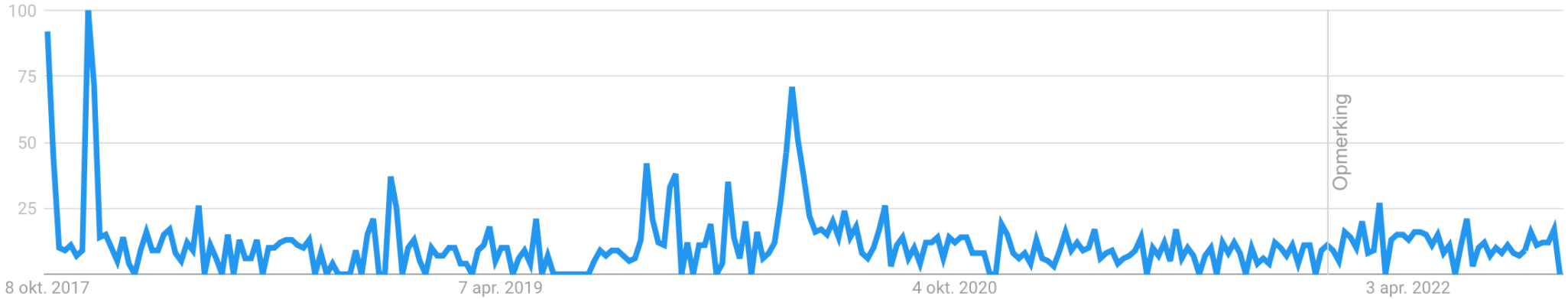
- More than 25,000 orbits.
- Tropomi data is used in air quality forecasts, UV forecast and volcanic plume warnings.
- Groundspeed 27,000 km/hr.
- More than 800 peer-reviewed papers ~3 per week.
- Issued warnings for volcanic plumes of 116 volcanoes.
- More than 500 Tbyte on the data hub.
- More than 1 petabyte downloaded in the last 3 months.



Google Search Interests

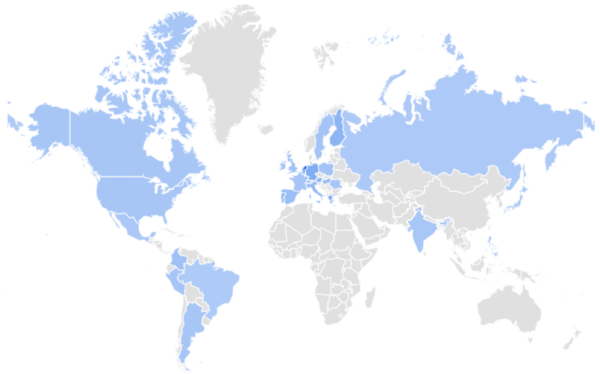
search term “Sentinel 5 Precursor”

Nov ‘17



Oct ‘17

March ‘20



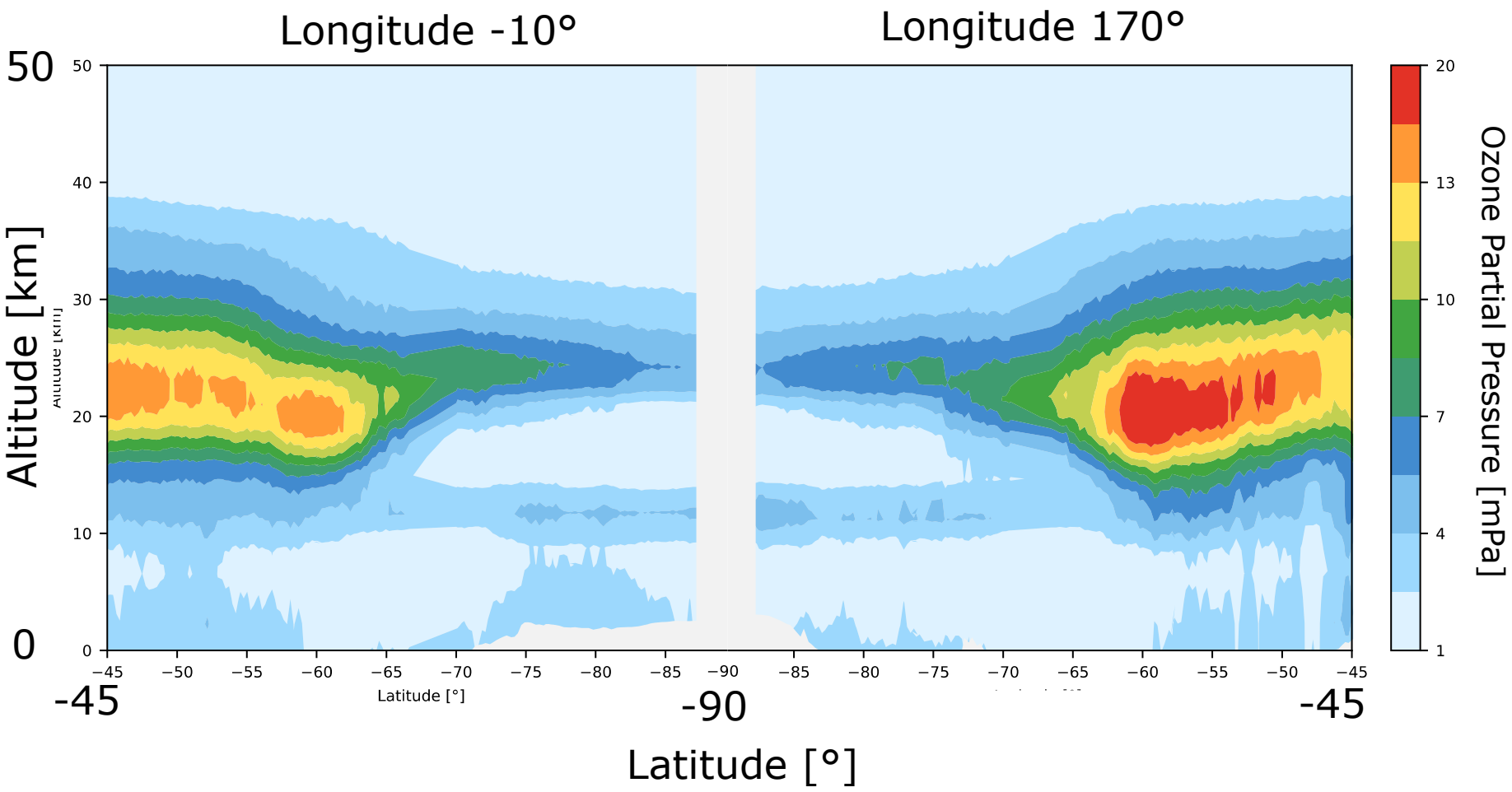
1	Nederland	100
2	Griekenland	32
3	Duitsland	27
4	België	25
5	Oostenrijk	22

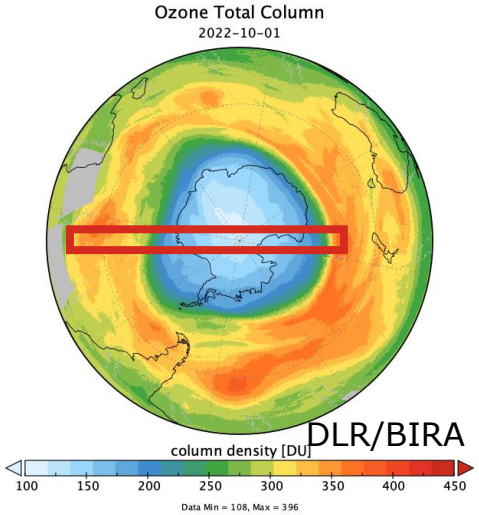
TROPOMI Operational Level 2 Data Products

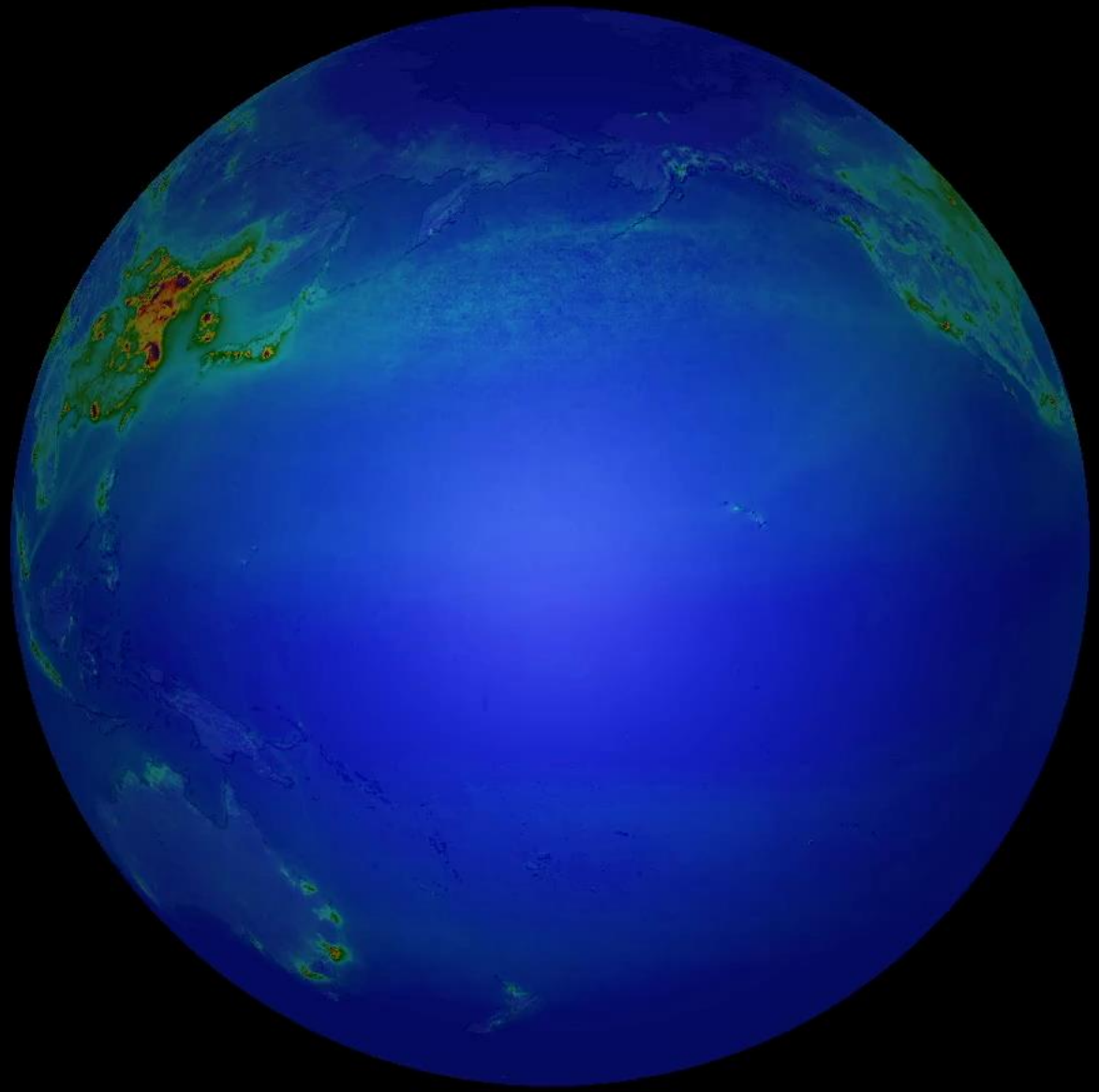
Product	Application
Ozone	Ozone layer monitoring, UV-index forecast, Climate monitoring
NO_2	Air quality forecast and monitoring
CO	Air quality forecast and monitoring
CH_2O	Air quality forecast and monitoring
CH_4	Climate monitoring
SO_2	Air quality forecast and monitoring, Climate monitoring, Volcanic plume detection
Aerosol	Air quality forecast and monitoring, Climate monitoring, Volcanic plume detection
Clouds	Climate monitoring
UV-Index	UV index forecast

KNMI | DLR | BIRA-IASB | SRON | RAL |IUP-Bremen | MPIC | FMI

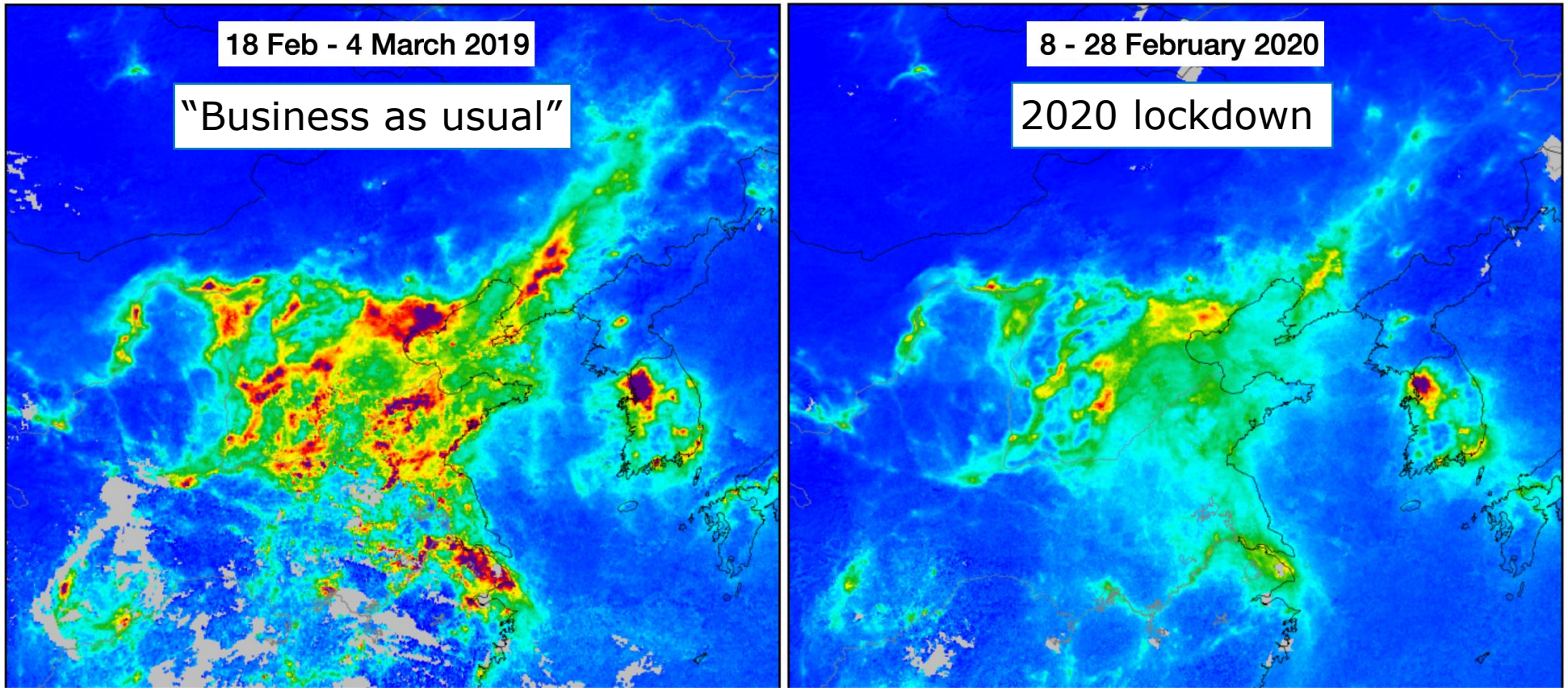
Ozone Profile 2022-10-01





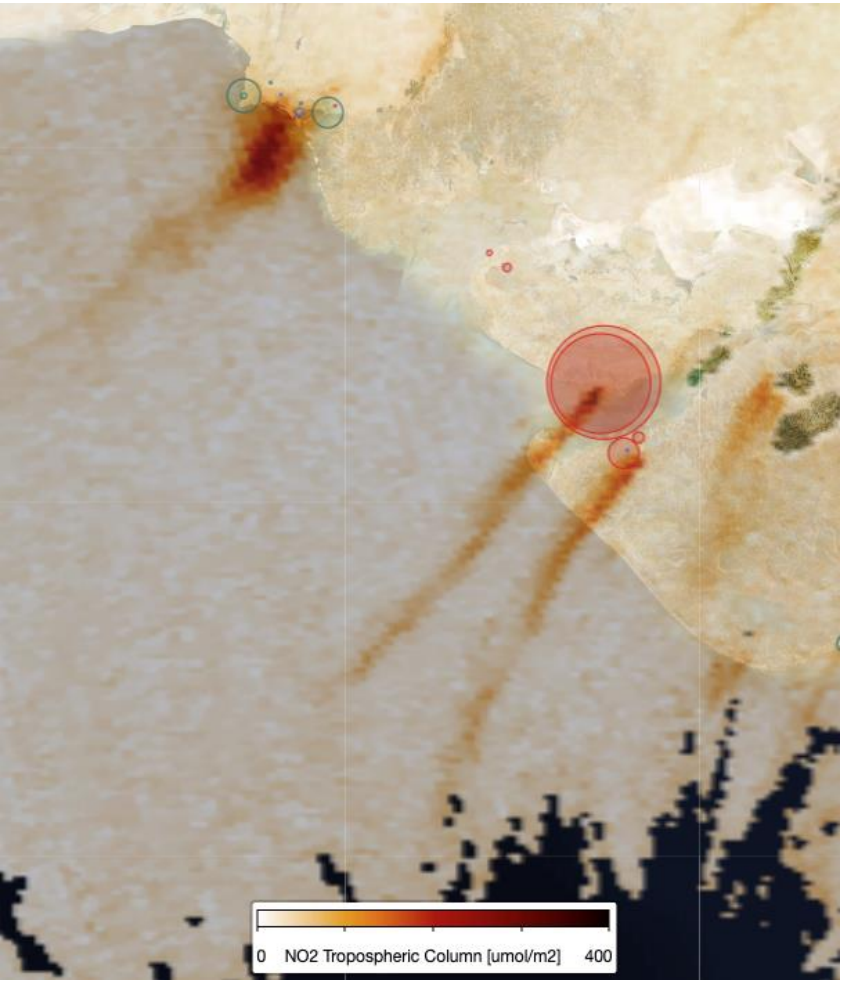


Highlight:
Unprecedented emission reductions during COVID-19 lockdowns

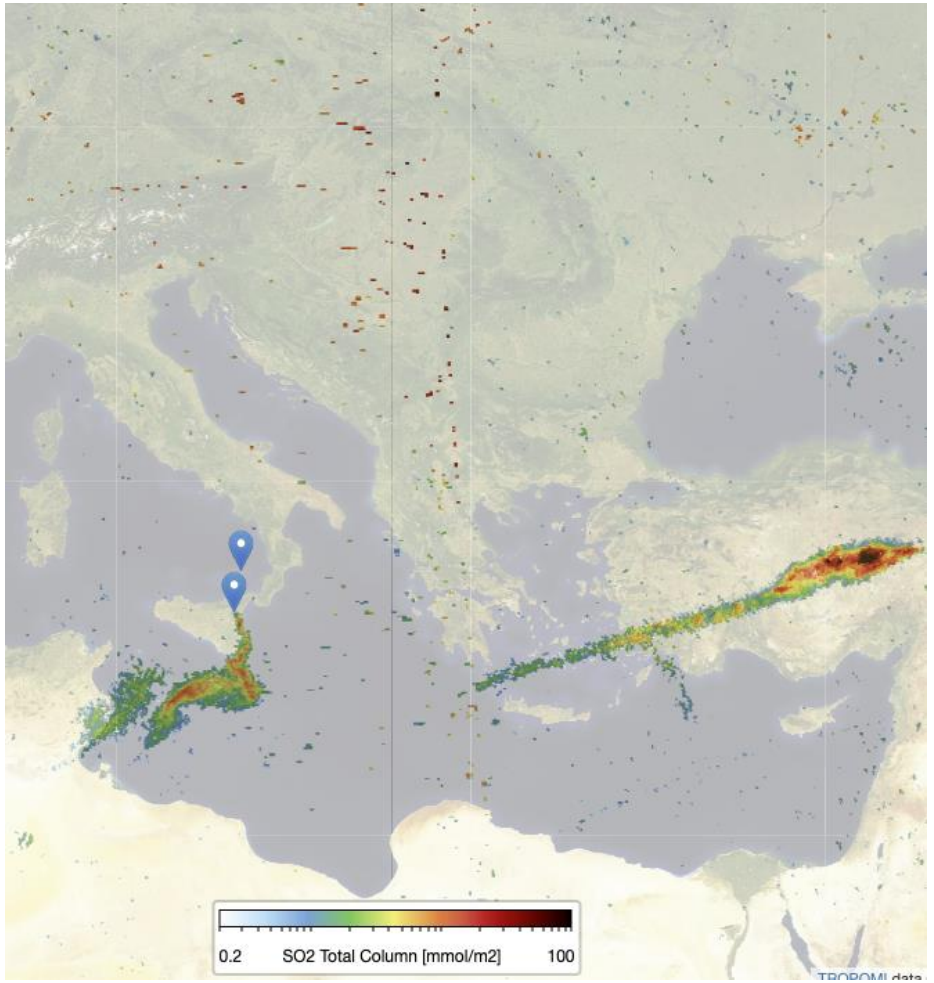


China nation-wide reductions in NO2 observed by TROPOMI during the China lockdown in February 2020

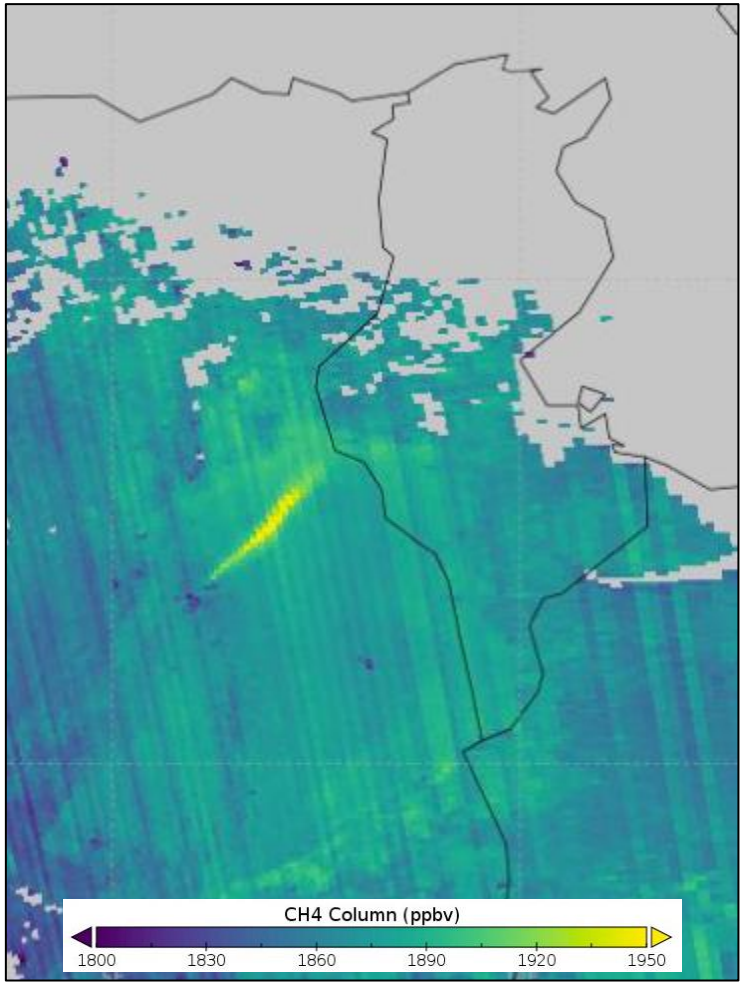
NO_2, India & Pakistan 2021-01-10

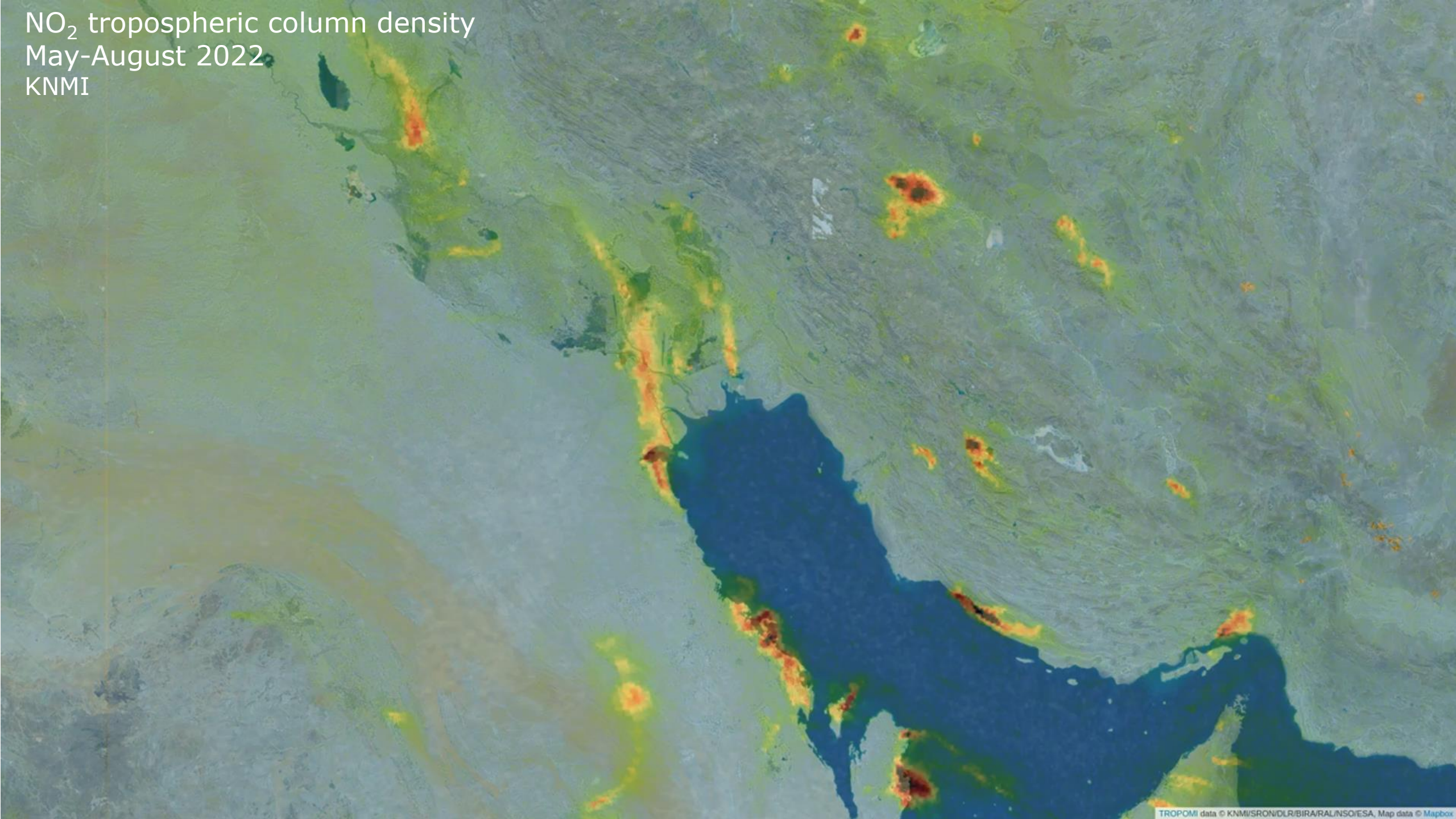


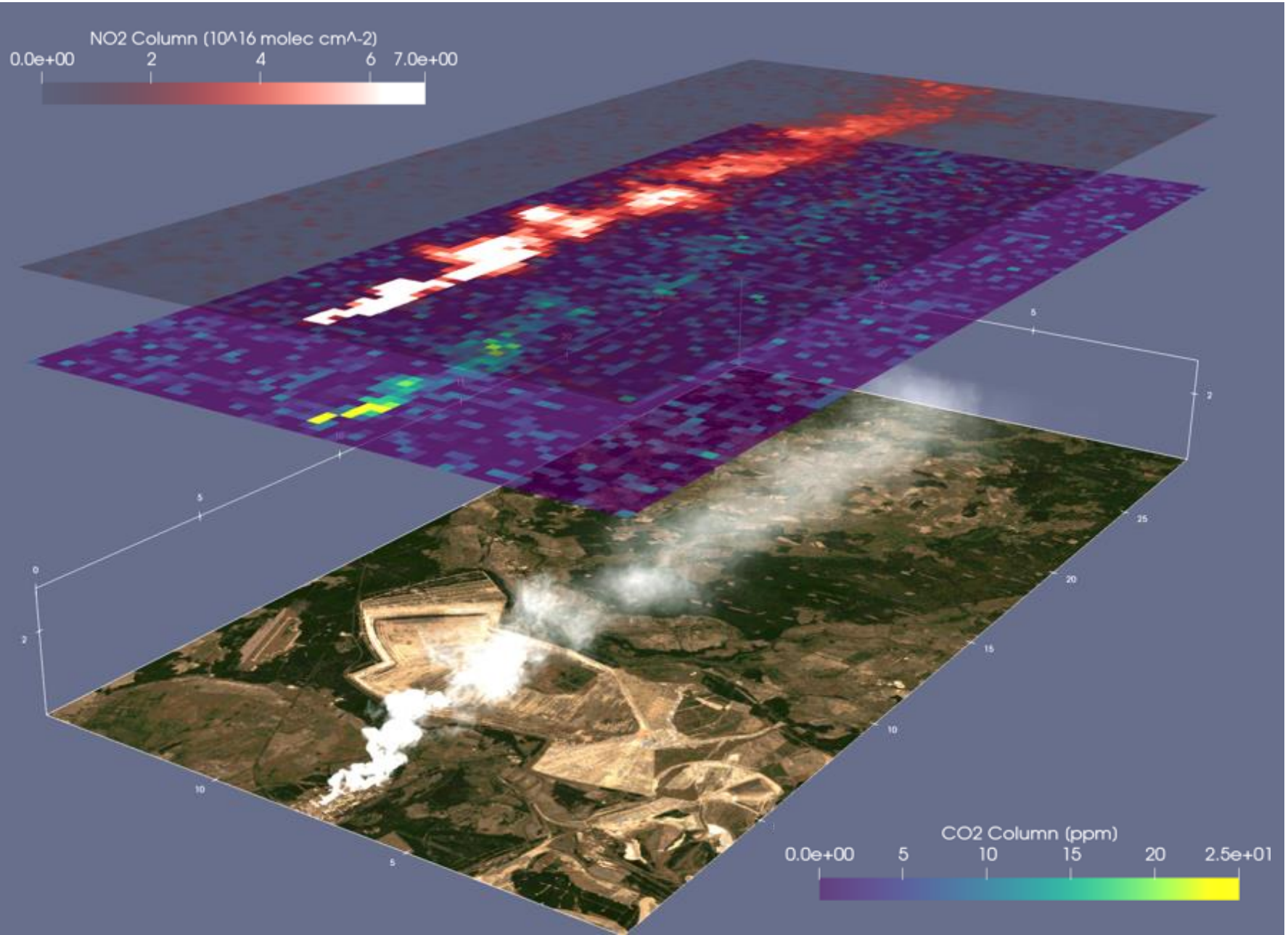
SO_2, Etna Volcano 2020-12-22



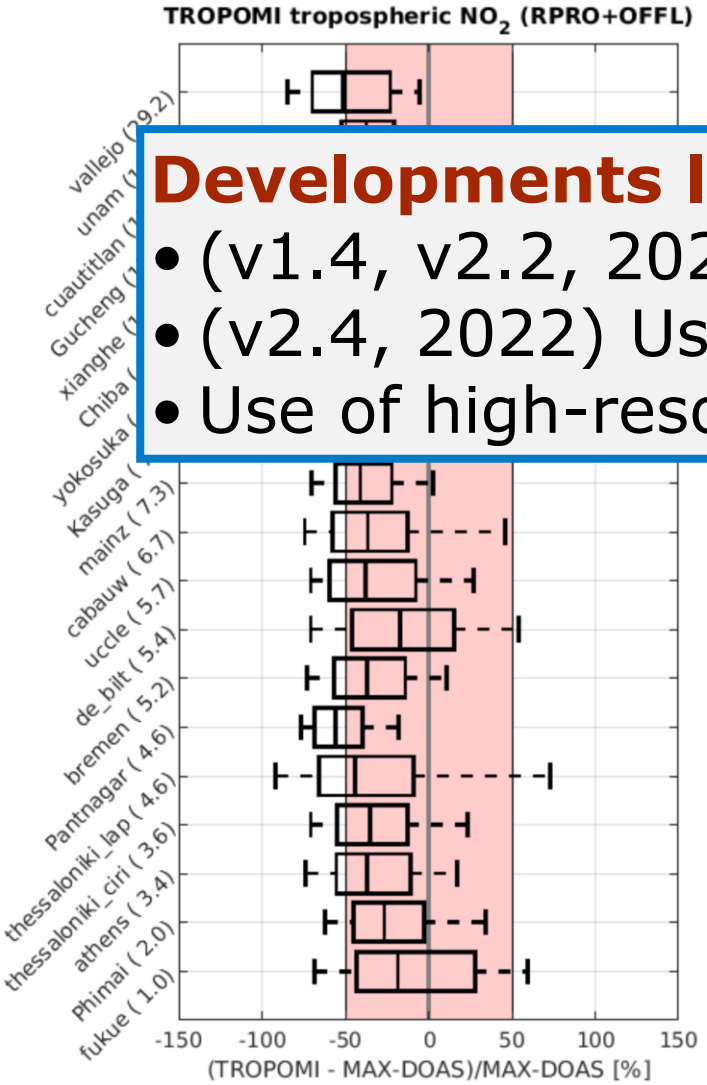
CH_4, Algeria, 2020-01-04

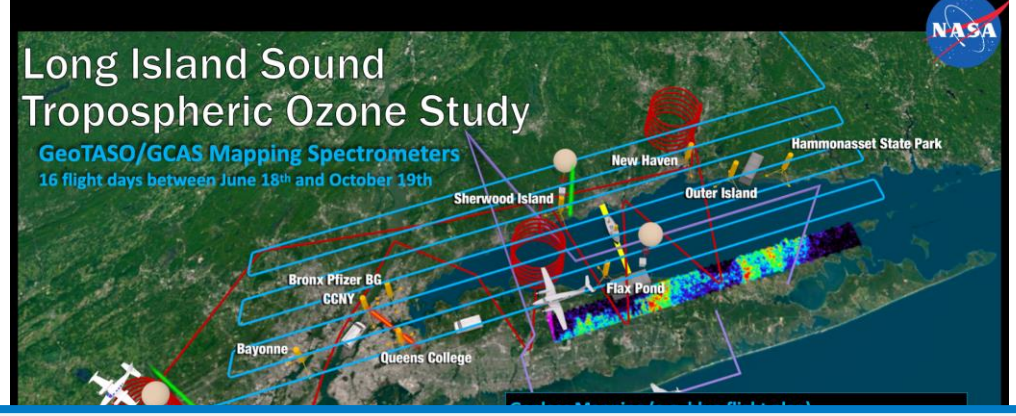



NO_2 tropospheric column density
May-August 2022
KNMI
TROPOMI data © KNMI/SRON/DLR/BIRA/RAL/NSO/ESA, Map data © Mapbox


NO2 Column (10^16 molec cm^-2)
0.0e+00
2
4
6
7.0e+00
CO2 Column (ppm)
0.0e+00
5
10
15
20
2.5e+01

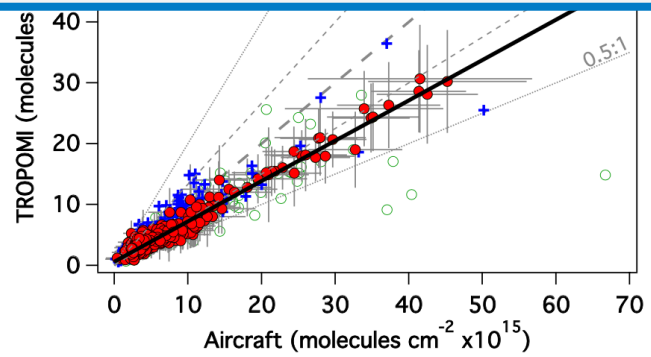
TROPOMI NO_2 v1.3: Validation summary





Developments led to much improved NO2 product:

- (v1.4, v2.2, 2021) Fresco cloud pressure improvements
- (v2.4, 2022) Use of TROPOMI DLER albedo (Gijs Tilstra)
- Use of high-resolution a-priori profile from CAMS-Europe (0.1 degree)



R^2 = 0.96

Judd et al., 2020
Tack et al., 2020

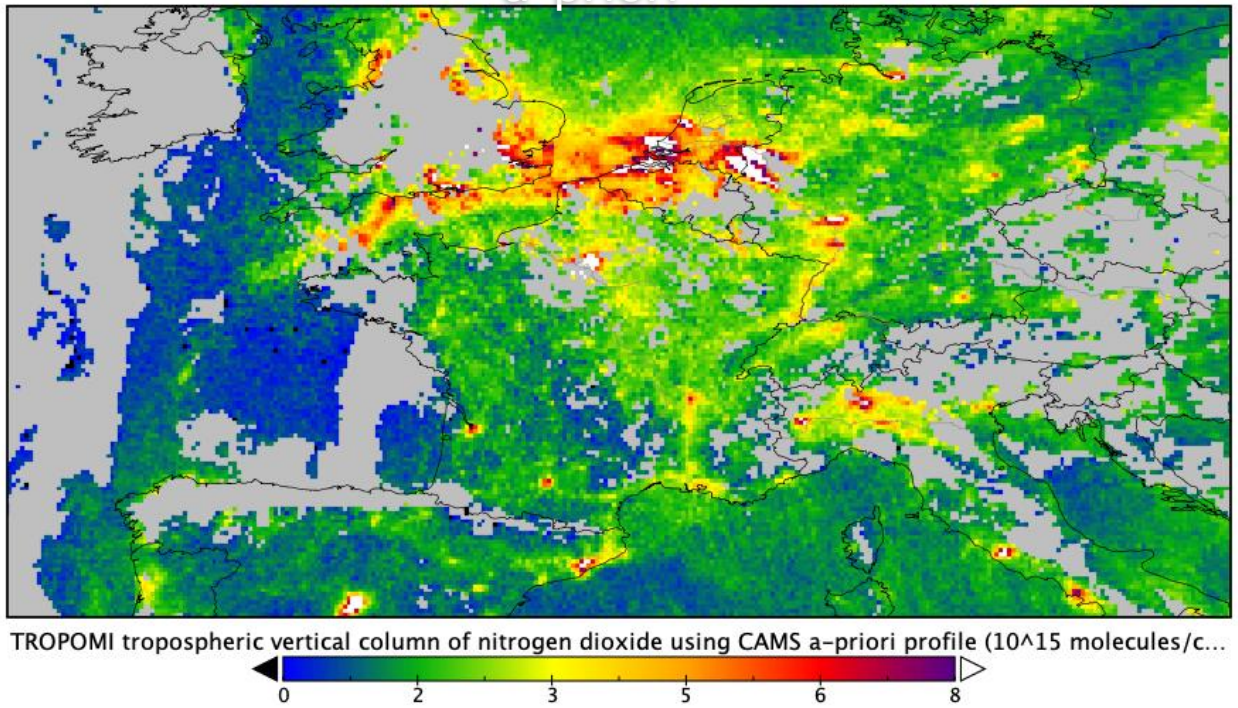
Verhoelst et al., 2020

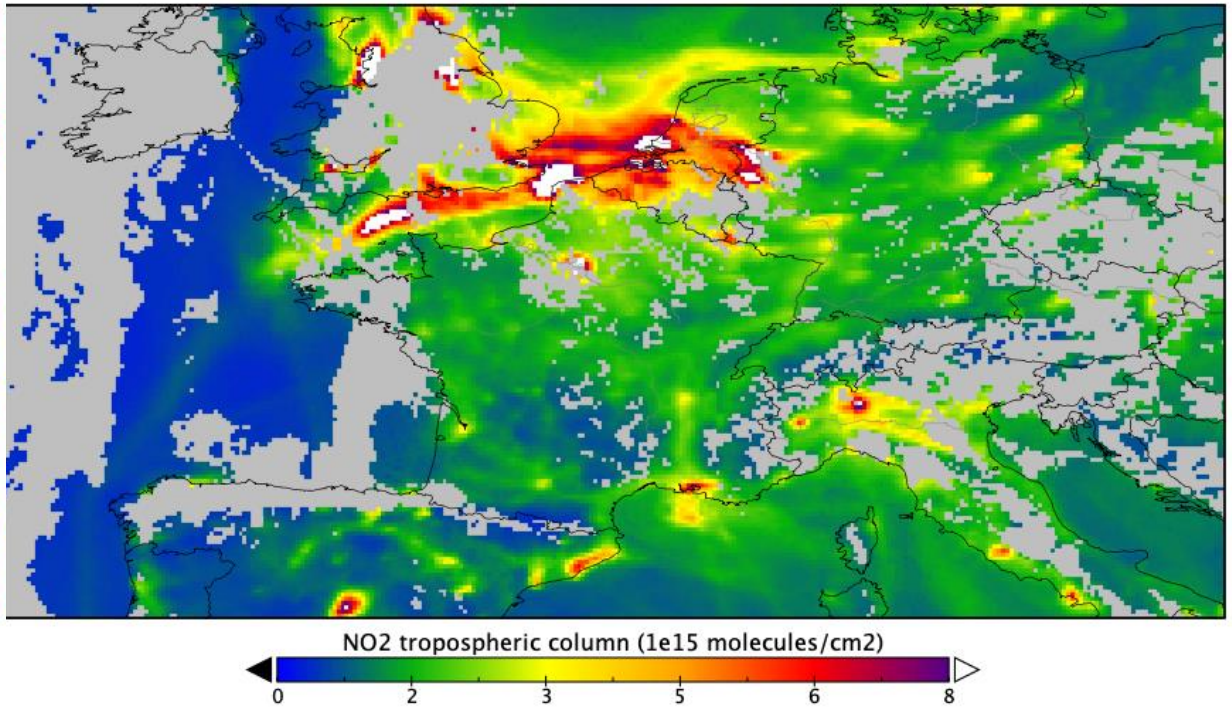
Conclusions:
- TROPOMI NO2 has low bias
- Partly due to (resolution of) the a-priori NO2 profile.
- High correlation vs aircraft

Model validation: comparisons with CAMS-regional AQ forecasts for Europe

TROPOMI NO2 based on CAMS-regional a-priori

CAMS-regional vertical column NO2



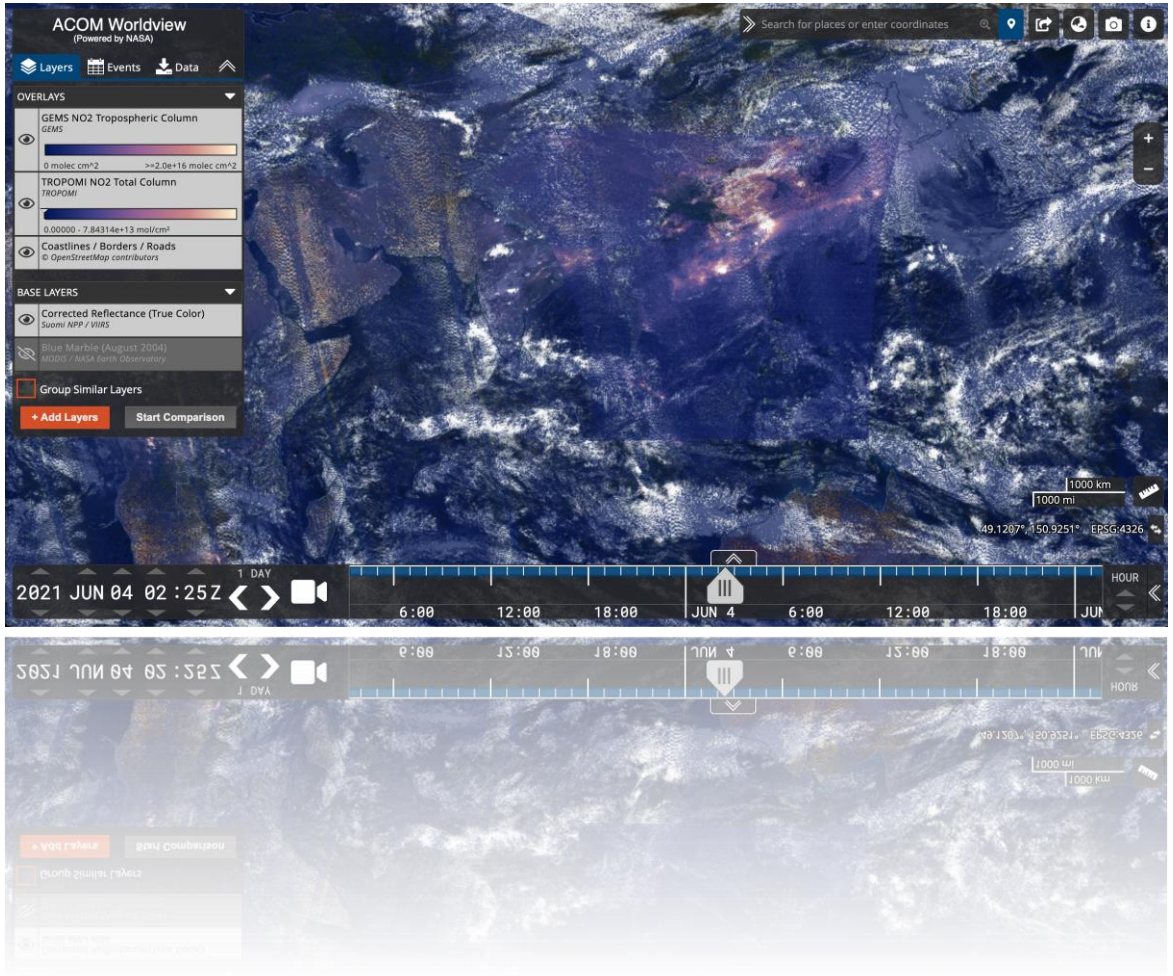


Single overpass, 26 July 2018

John Douros, KNMI

From Data to Information

- Data viewers
- Level 3 data
- One-stop shop
  - Operational products
  - Regional Products
  - Innovation products



Summary

- 5 years in orbit: an important milestone to celebrate.
  - Many years to come!
- Data quality:
  - Important reprocessing ongoing
  - Continuous evolution of algorithms and data processors.
- Recommendations to further promote the data uptake:
  - Development of user friendly data viewer, supporting.
  - Development of operational Level 3 daily and monthly product.
  - One-stop shop for operational, regional and innovation products
- Future missions:
  - TROPOMI demonstrates the importance of spatial resolution for emission quantification.
  - Prepare for combined use of S5P/TROPOMI, S4/UVN and S5/UVNS.