

Sentinel-5 Precursor

Air Quality

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1 General information

Launch: 13 October 2017 by ESA
Lifespan: 7 years
Coverage: daily
Orbit: high inclination orbit (approx 98.7°), 824 km altitude
Orbital cycle: 16 days (14 orbits per day, 227 orbits per cycle)
Sensor name: TROPOMI

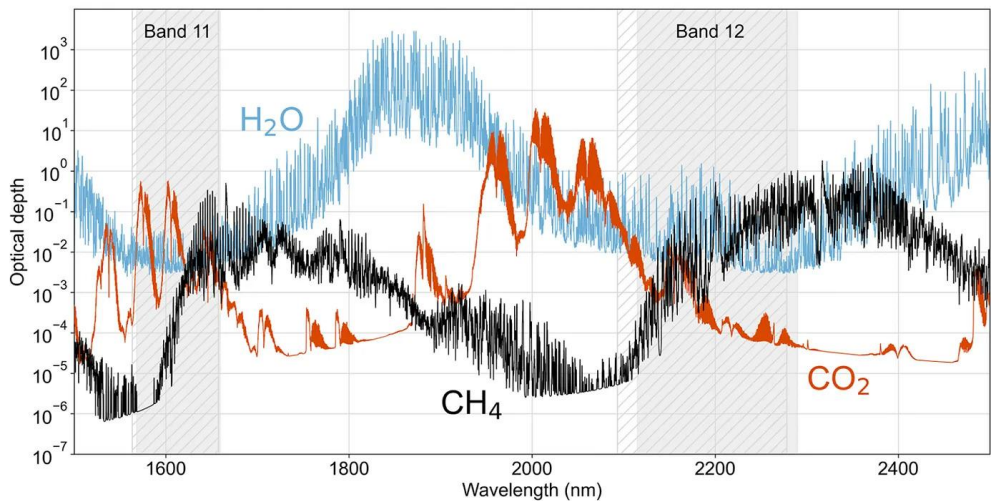
2 Sensor - TROPOMI

TROPOspheric Monitoring Instrument; capable of high-resolution monitoring of trace gases and aerosols in the atmosphere

- **Type:** passive grating imaging **spectrometer**
- **Spectral ranges:** 2 in ultraviolet (UV), 2 in visible (VIS), 2 in - near-infrared (NIR), and 2 in shortwave infrared (SWIR)
- **Radiometric accuracy** (absolute): 1.6% (SWIR) to 1.9% (UV) of the measured earth spectral reflectance
- **Swath width:** 2,600 km
- **Resolution:** 7x3.5 km² for most spectral bands

Spectrometer: measures reflectance over a continuous spectral band, instead of having an average value like a radiometer

Why using a spectrometer? Different molecules can't be differentiated without detailed information of the spectral reflectance. Being able to measure different molecules is necessary to monitor air quality.



3 Calculated quantities

Using Sentinel-5P the following can be calculated:

Overall data: aerosol index, cloud parameters

Concentrations of pollutants: nitrogen dioxide, carbon monoxide, methane, sulphur dioxide, ozone, formaldehyde

4 Challenges

Stray Light Control

Controlling unwanted "stray light" leaking from the diffraction gratings was a key challenge during instrument development. Too much stray light could make trace gas detection impossible

Spatial Resolution

While TROPOMI provides improved spatial resolution compared to previous instruments, its 7x3.5 km² resolution still limits the ability to detect very localized pollution sources or small-scale variations in trace gases.

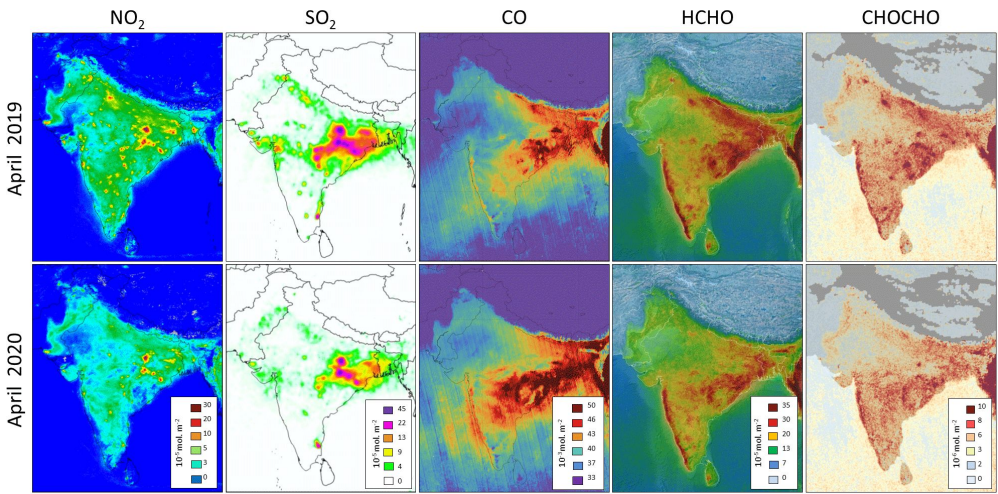
Cloud Cover

Clouds can obstruct measurements of trace gases in the lower atmosphere, reducing data availability in cloudy regions.

Vertical Resolution

TROPOMI has limited ability to resolve the vertical distribution of gases in the atmosphere.

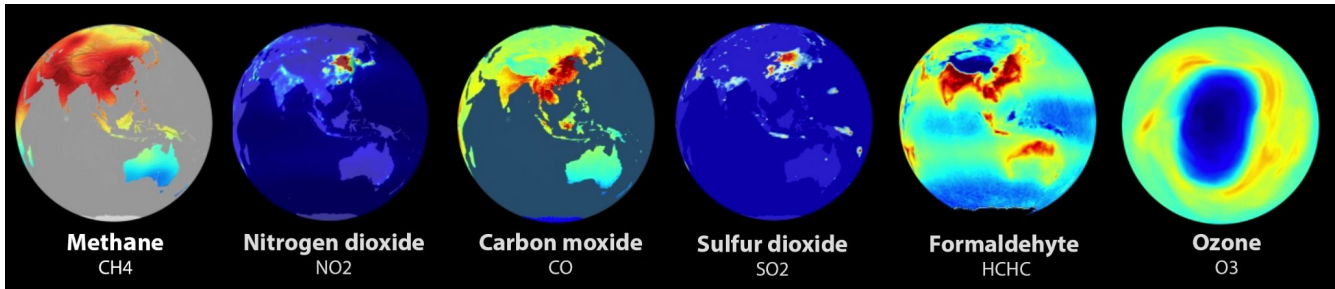
5 Air quality impacts of COVID-19 measures



Tropospheric and total columns maps for April 2019 (top row) and April 2020 (bottom row) for the various trace gas species measured by TROPOMI

A study^[2] used TROPOMI data, focusing on China and India, to measure the **positive impact** of **COVID-19 lockdown measures** on various air pollutants.

The study demonstrated Sentinel-5P's unique capability to **track rapid air quality changes** on global to city scales, showcasing its potential for monitoring **event-driven impacts** on atmospheric composition.



References

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