

TROPOMI, the space air quality sensor, being tested

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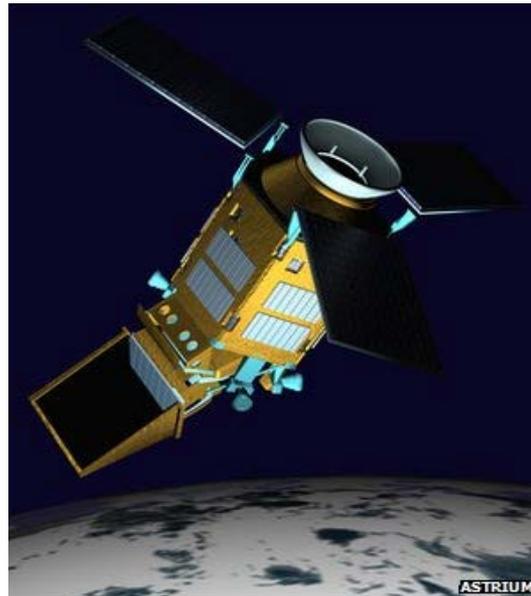
sentinel-5 precursor

COPERNICUS/GMES ATMOSPHERE MISSION IN POLAR ORBIT

- The ESA Sentinel-5 Precursor (S-5P) is a pre-operational mission focussing on global observations of the atmospheric composition for air quality and climate.
- The TROPospheric Monitoring Instrument (**TROPOMI**) is the payload of the S-5P mission and is jointly developed by The Netherlands and ESA.
- The planned launch date for S-5P is 2016 with a 7 year design lifetime.

TROPOMI

- ▶ UV-VIS-NIR-SWIR nadir view grating spectrometer.
- ▶ Spectral range: 270-500, 675-775, 2305-2385 nm
- ▶ Spectral Resolution: 0.25-1.1 nm
- ▶ Spatial Resolution: 7x7km²
- ▶ Global daily coverage at 13:30 local solar time.

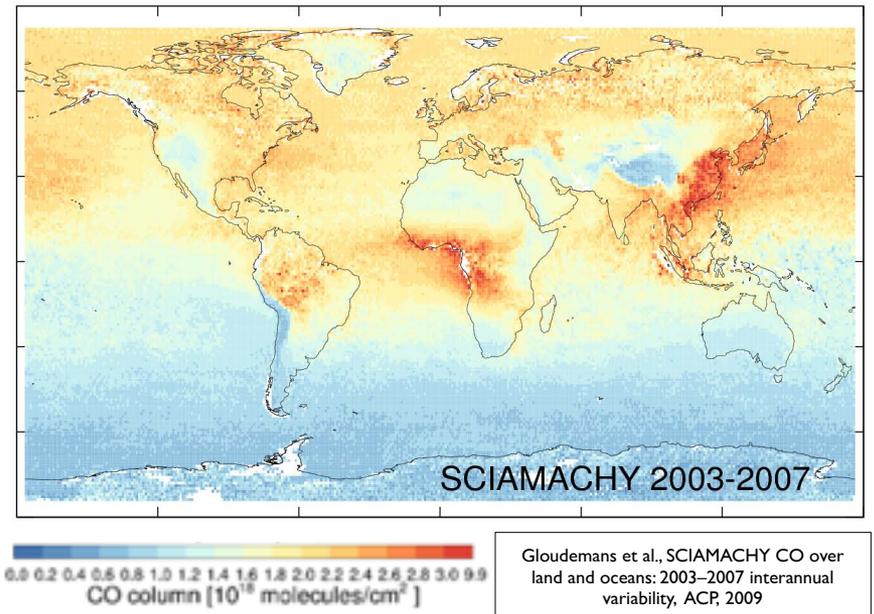
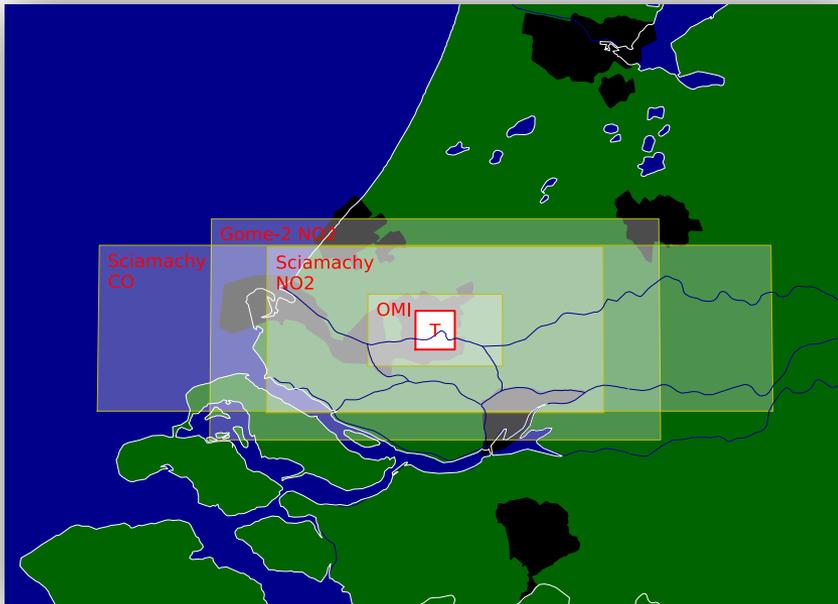


CONTRIBUTION TO GMES

- ▶ Total column
O₃, NO₂, CO, SO₂, CH₄,
CH₂O, H₂O, BrO
- ▶ Tropospheric column
O₃, NO₂
- ▶ O₃ profile
- ▶ Aerosol absorbing index, type,
optical depth

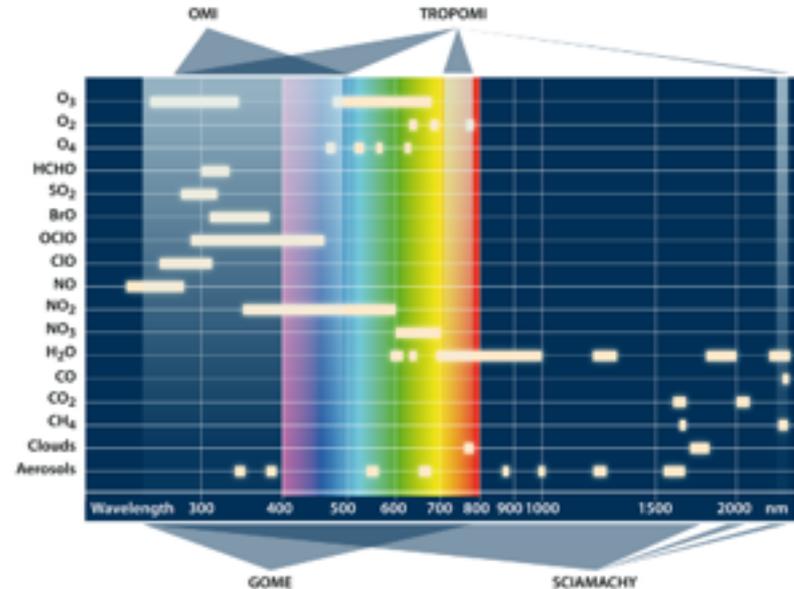
From OMI to TROPOMI

- **6x higher spatial resolution**
7x7 km² vs. 13x24 km²
- **1-5x higher signal-to-noise**
- **Variable binning scheme**
- **better cloud information**
from the oxygen A+B bands
- **CO and CH₄ observations**
from the SWIR band
- **Data rate ~20x OMI**

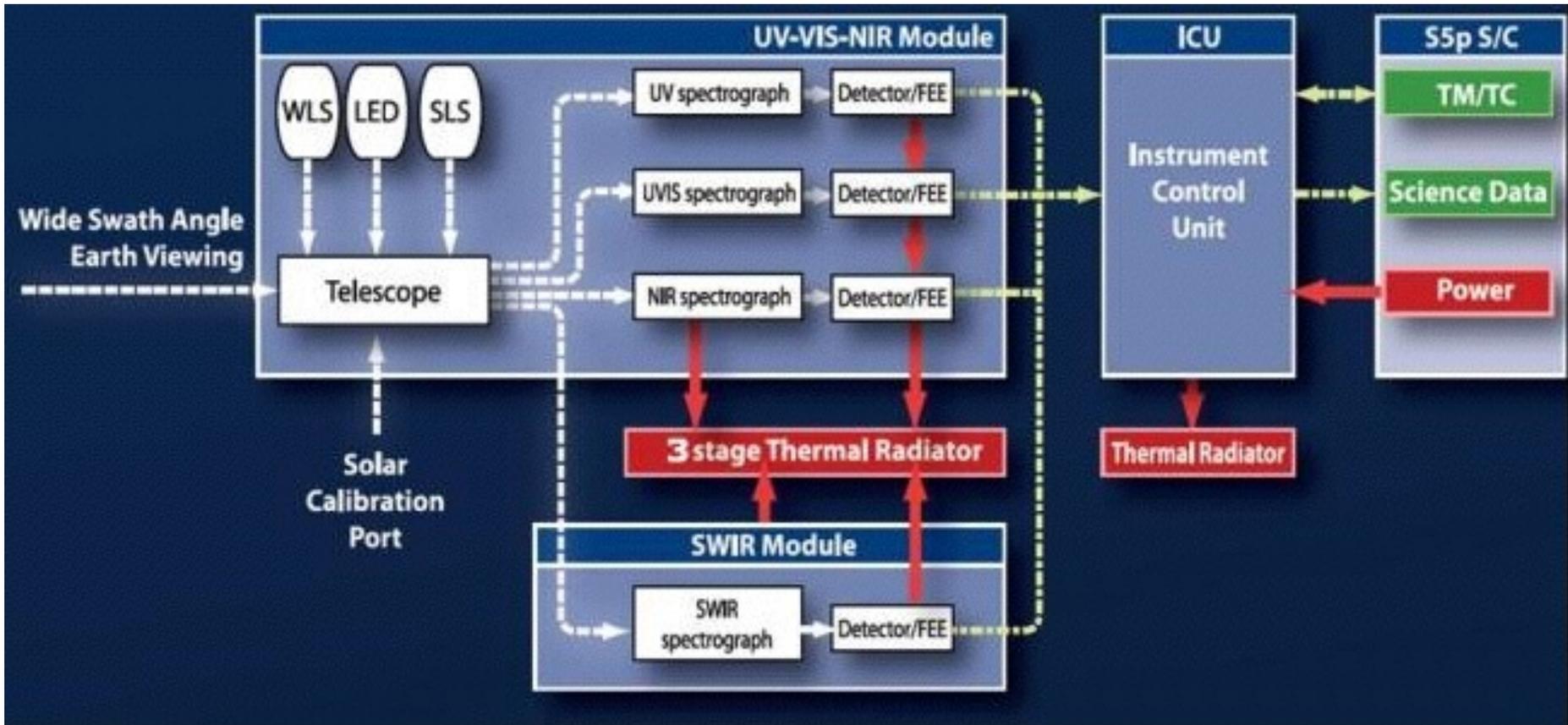


TROPOMI improves SCIAMACHY and OMI

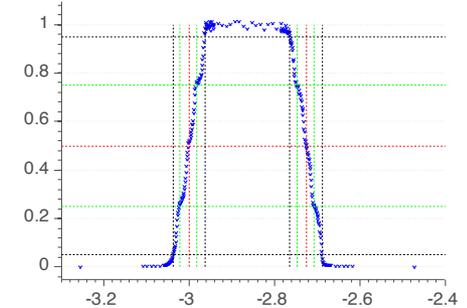
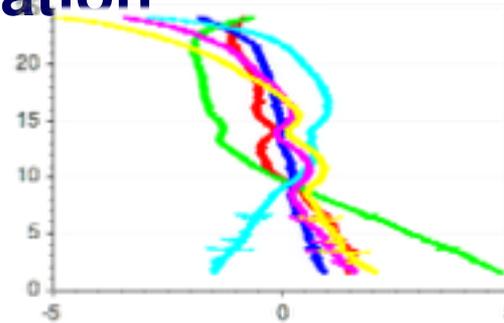
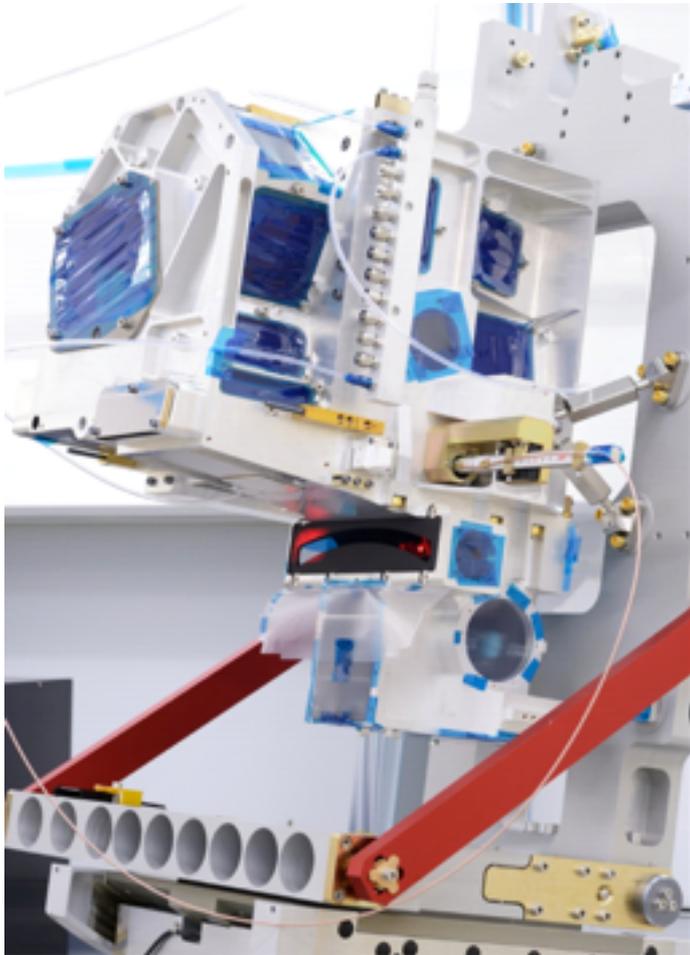
- Push broom configuration
 - Wide swath (2600 km), small pixel
- Polarization scrambler
- Optics well inside the instrument
 - Low degradation
- Wide wavelength range
 - UV (270 nm) to SWIR (2385 nm)
 - Adds CO, CH₄, O₂A (clouds), H₂O
- Instrument designed for 2 % albedo instead of 30 %
 - 10 x better sensitivity
- Ground pixel down to 7 x 7 km²
- Better overlap UV1 – UV2



Building blocks

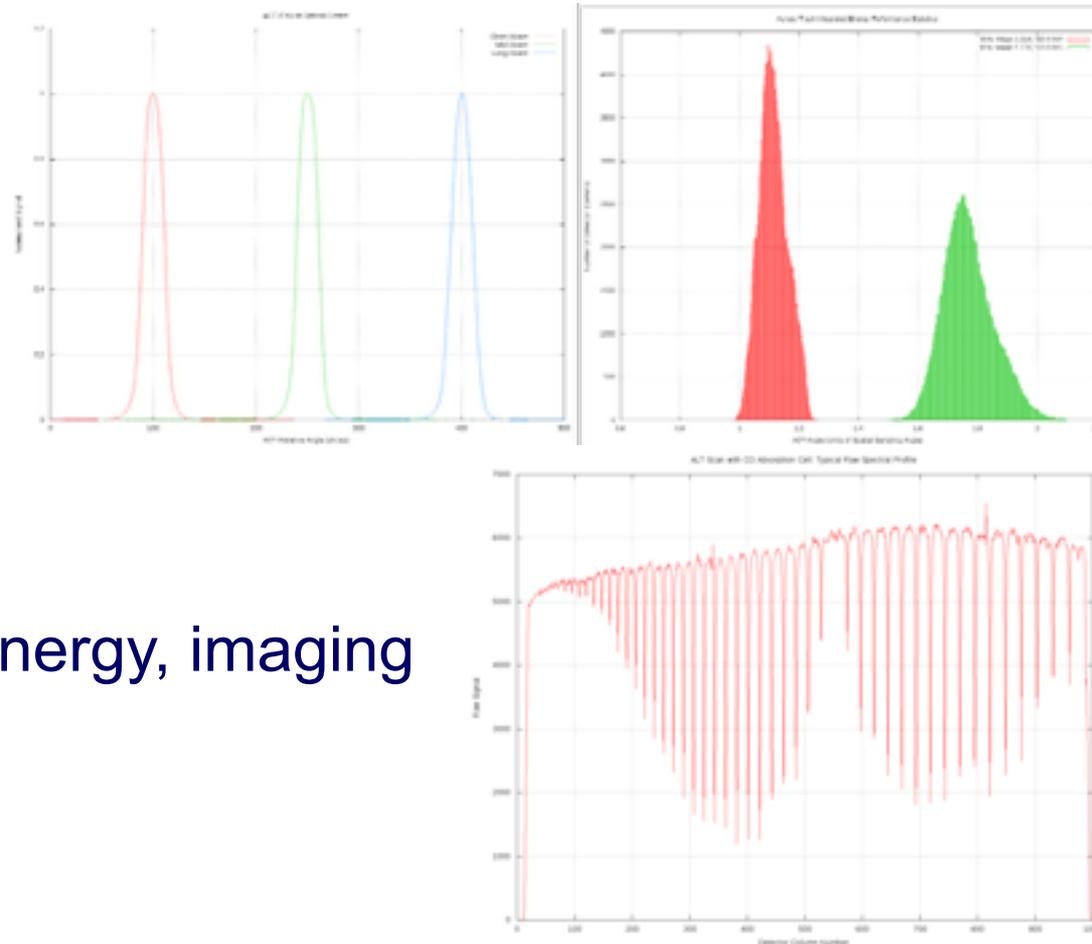
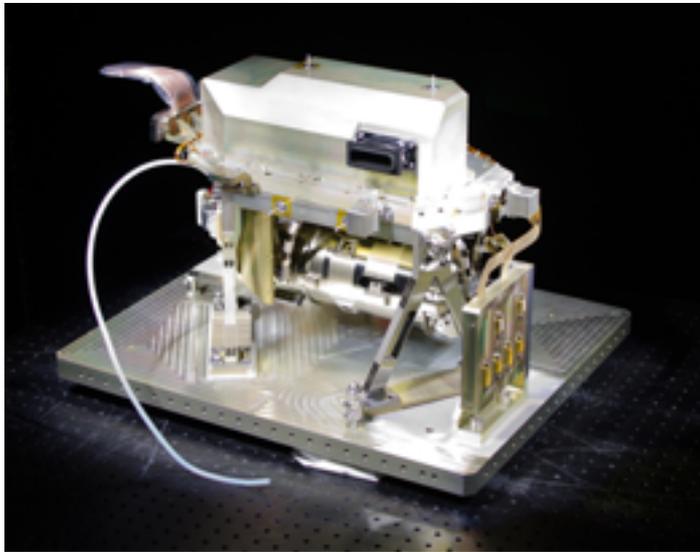


UVN Module after integration



- Excellent telescope
- All three spectrometers perfect imaging and co-registration
- Small features in sun calibration measurements

SWIR Module after integration



- Excellent integrated energy, imaging properties

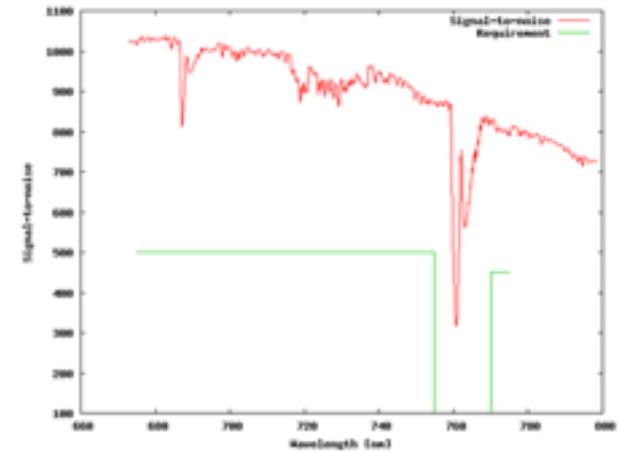
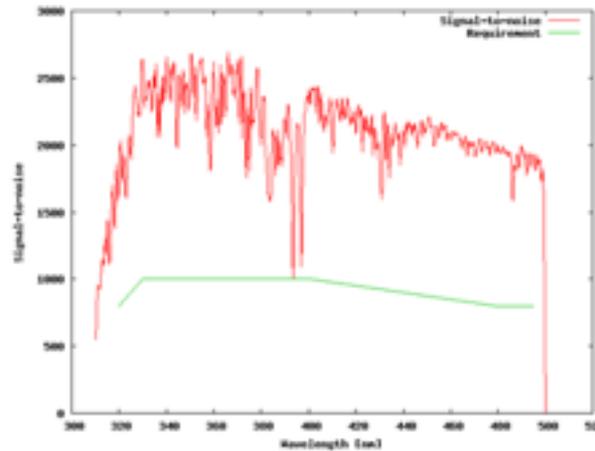
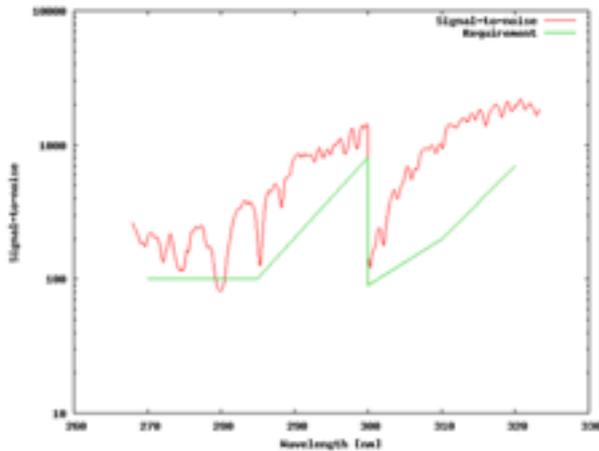
Current activities

- Pre-environmental tests finished
 - Spectral, spatial performance verified
 - Co-registration
 - Spectral stray light bands 1-4 first results as OMI
 - Internal WLS showed saturation, we switch to a different internal diffuser
- Vibration tests (about) finished
- Thermal balance is starting
- From November to March performance / calibration
- Launch early 2016



Very good overall (expected) performances

- UVN S/N estimate using measured throughput and electronics noise performances
 - Requirements for 2 % albedo
 - Exceeds requirements





sentinel-5 precursor

→ GMES LOW EARTH ORBIT ATMOSPHERE MISSION

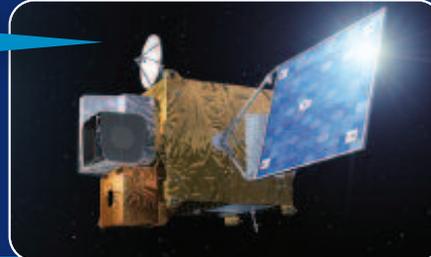
2015-2022
daily global
coverage

→ GMES LOW EARTH ORBIT ATMOSPHERE MISSION



EUMETSAT Polar System

2019 - ~2030
hourly over
Europe



sentinel-4

→ GMES GEOSTATIONARY ATMOSPHERIC MISSION

→ GMES GEOSTATIONARY ATMOSPHERIC MISSION

2017 - ...
hourly over SE
- ASIA

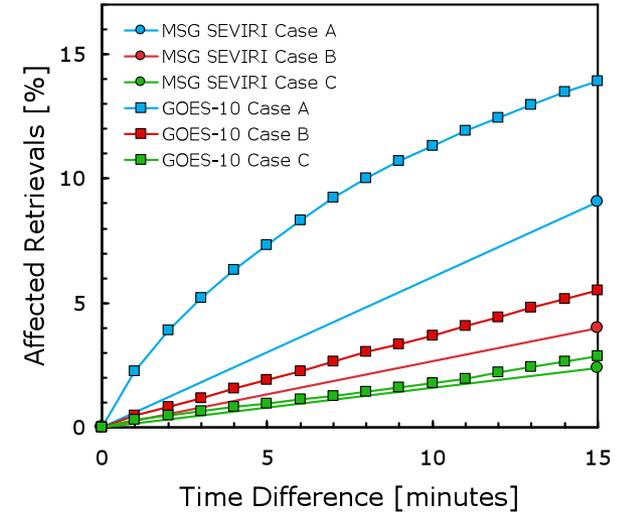
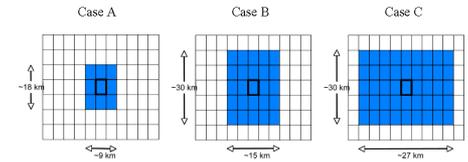
gems | tempo

KARI | NASA

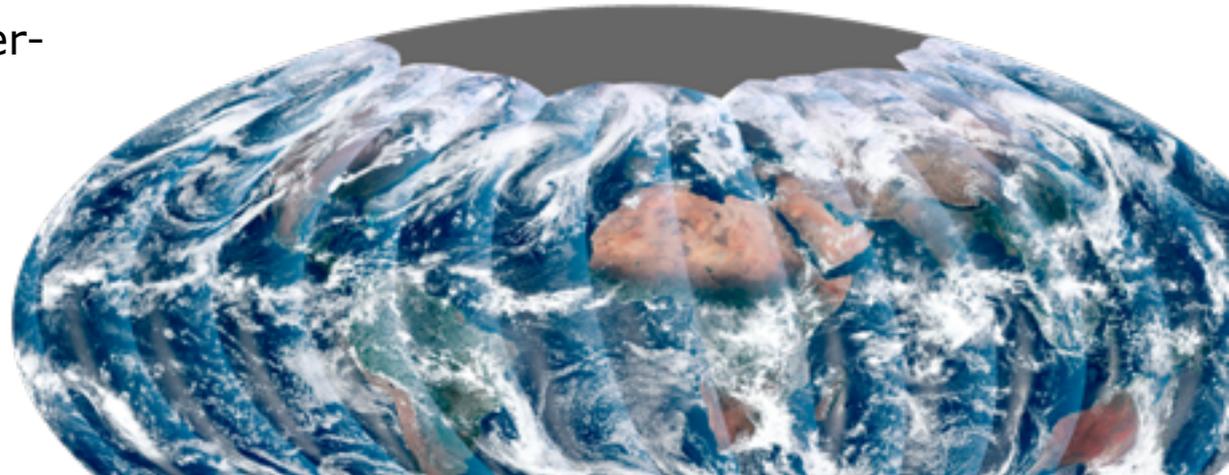
2019 - ...
hourly over N-
America

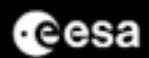
Suomi-NPP - S5P formation Flying

- S-5P is planned to observe within 5 min. of Suomi-NPP.
- Primary goal is to use VIIRS cloud mask for S-5P methane observations.
- Other opportunities:
 - ▶ TROPOMI-VIIRS cloud and aerosol combined products.
 - ▶ TROPOMI-OMPS-CRIS ozone profiles.
 - ▶ TROPOMI-OMPS inter-calibration.

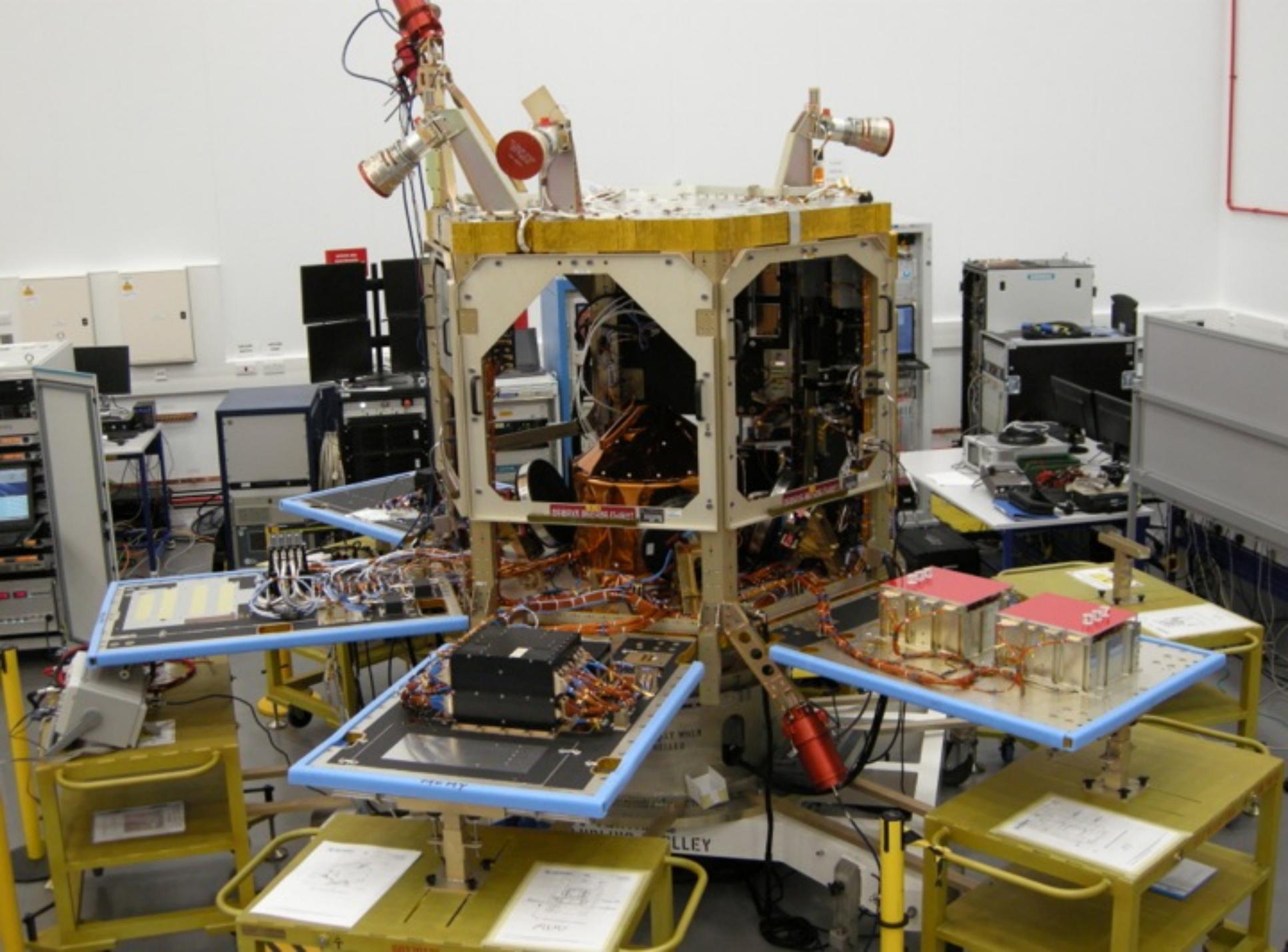


Genkova et al., AMT, 2012









ESA Announcement of Opportunity for Validation

<https://earth.esa.int/aos/S5PVT>

deadline 1-Oct