TROPOMI on the Copernicus Sentinel 5 Precursor

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S5P/TROPOMI 5 yrs Anniversary 10-14
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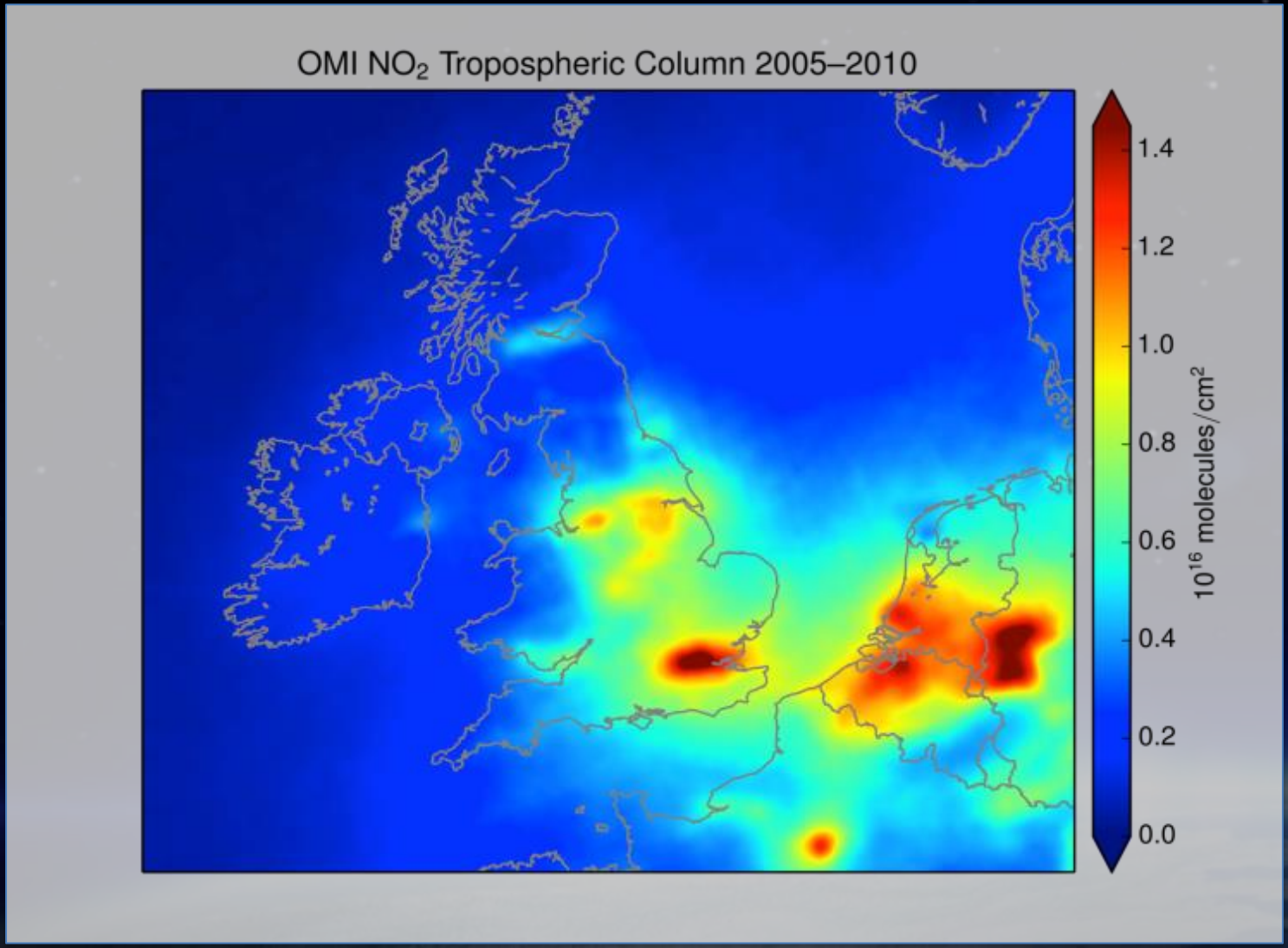
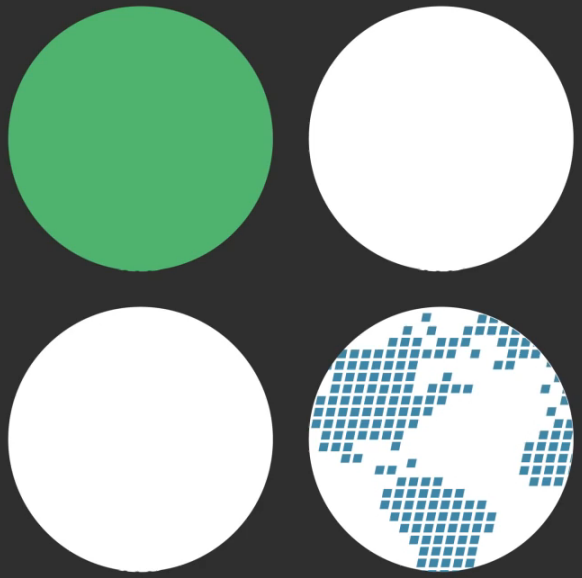
Democracy at work in NL

Professor F. Sherwood Rowland (left) shared the 1996 Nobel Prize for Chemistry with Professor Mario J. Molina (center) of the Massachusetts Institute of Technology, United States and Professor Paul J. Crutzen (right) of the Max Planck Institute, Germany, 'for their work in the atmospheric chemistry, particularly concerning the formation of the ozone.'

Air Quality in the NL



OMI a US instrument?



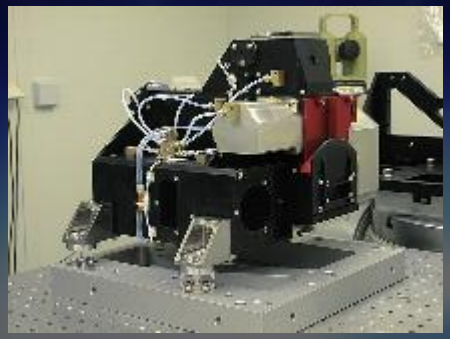
How it started

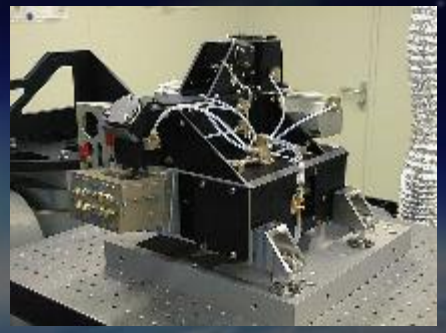
Concept presented to V. Liebig (D/EOP) in 2006:

Based on experience build up since mid 1980's:

GOME/SCIAMACHY technology

OMI technology





Formalisation of the Agreement

Sentinel 5 precursor

COPERNICUS ATMOSPHERE MISSION IN POLAR ORBIT

TROPOMI

- The ESA Sentinel-5 Precursor (S-5P) is an operational mission focusing 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.

Copernicus
The European Earth Observation Programme
esa
Netherlands Space Office

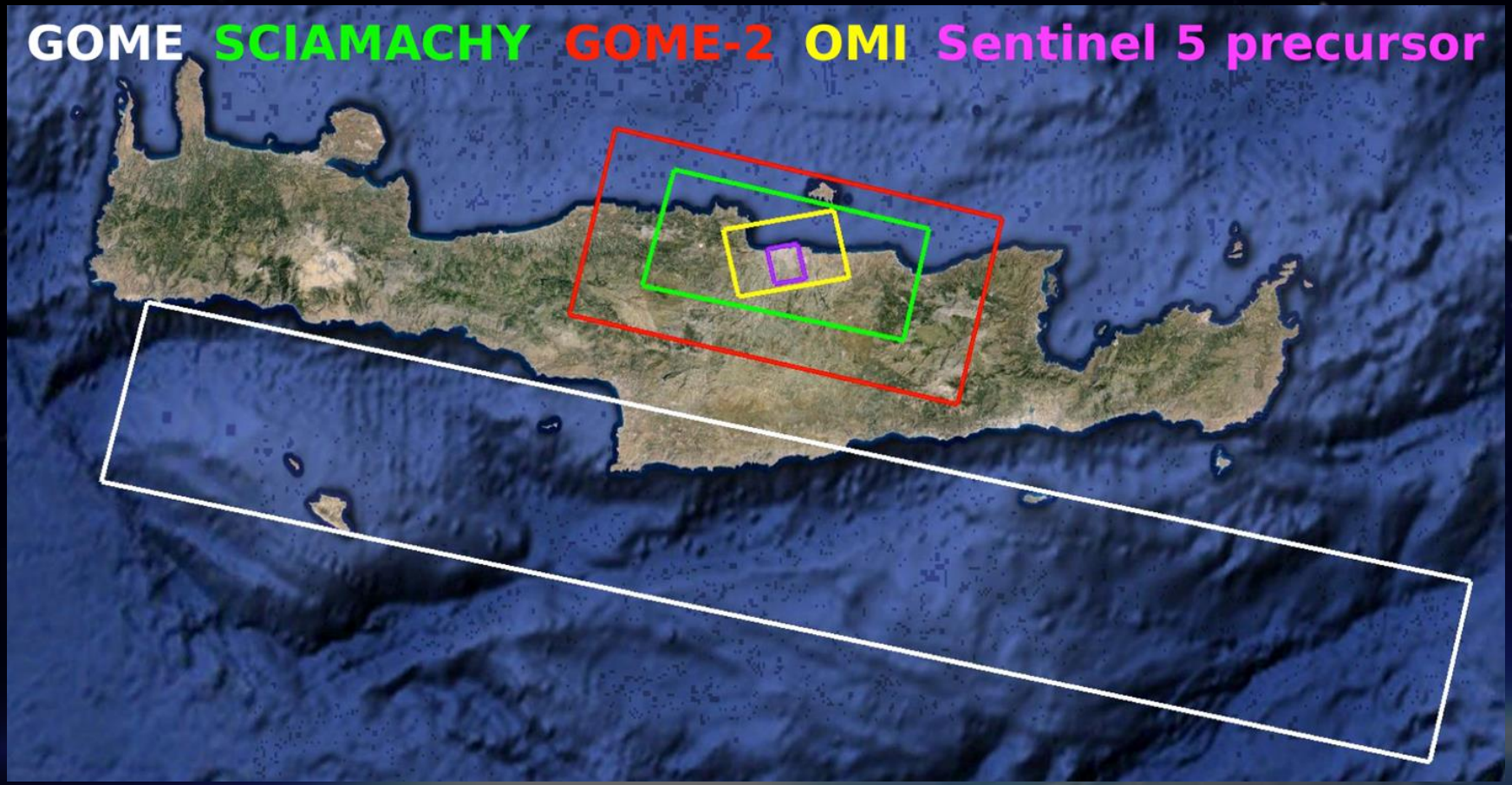
TROPOMI

- 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 Copernicus

- Total column O_3, NO_2, CO, SO_2,CH_4, CH_2O,H_2O,BrO
- Tropospheric column O_3, NO_2
- O_3 profile
- Aerosol absorbing index & layer height

Evolution



Specs at the start

TROPOMI Fact Sheet (TBC)

	UV1 (TBD)	UV2	VIS	NIR	SWIR
Range (nm)	270-320	300-400	380-490	710-775	2305-2385
Resolution (nm)	1.1	0.45	0.52	0.45	0.25
Sampling (nm)	~0.4	0.15	~0.18	0.15	0.125
Signal to Noise (minimum scenario)	100-1000	1000	1500	100-500	95
Groundpixel (km^2)	16 × 40	8 × 10			10 × 10
Swath (km)	2600				2600
Dimension (m^3)	0.56×0.45×0.38				0.45×0.3×0.2
Mass (OPB+Detect.)	35 kg				17 kg
Temp. OPB (K)	283				220
Temp. detector (K)	233				165
Data rate (Mb/s)	2 - 8				1 -3.5
Power (W)	90 (Nominal) – 150 (Peak)				15 (N) - 70 (P)

Performance as run

TROPOMI Fact Sheet (as run)

	UV	UVIS	NIR	SWIR
Groundpixel (km^2) ALTxACT @nadir	5.5 × 28	5.5 × 3.5		5.5 × 7
Swath (km)	2749	2713	2705	2709
Dimension (m^3)	0.579 x 0.486 x 0.735 Including solar baffle			0.515 x0.35x0.325 Excluding FEE
Mass (OPB+Detect.)	83.3			20.5
	The whole instrument (with ICU, Support structure, Radiator) is 199.6 kg			
Temp. OPB (K)	290			205
Temp. detector (K)	208			140
Data rate (Mb/s)	34.4 (all detectors for radiance with 5.5km ALT, 7.2km ALT was 27Mbit/s))			
Power (W)	In-orbit average 84.1 In-orbit maximum 113.6			

TROPOMI spectral bands – based on calibration data

Spectrometer	UV		UVIS		NIR		SWIR	
Band ID	1	2	3	4	5	6	7	8
Spectral range [nm]	267-300	300-332	305-400	400-499	661-725	725-786	2300-2343	2343-2389
Spectral resolution [nm]	0.45 - 0.5		0.45 - 0.65		0.34 - 0.35		0.227	0.225
Spectral sampling [nm]	0.065		0.195		0.126		0.094	
Spatial sampling [km^2]	5.5 x 28	5.5 x 3.5	5.5 x 3.5		5.5 x 3.5		5.5 x 7	
Detector binning factor	16	2	2	2	2	2	1	1
Minimum signal-to-noise ratio	50*	50-600*	100-1200*	1200*	500*	200-600*	100-120**	

*Based on simulations for low albedo mid-latitude radiance **Based on design values

TROPOMI: Observing our future

Acknowledgments

All NL instrument endeavours have been implemented in international cooperation, hence:

- We thank ESA for complementing TROPOMI with the SWIR channel and electronics the AS 250 platform and management of the operational phase
- We thank the EU for adopting the mission in the Copernicus programme and funding the operational phase
- We like to thank all industry involved in building the instrument to very high standards that remain unprecedented
- We like to thank all scientists involved in exploiting the data and their work on validation to guarantee reliable high quality data and generation of information for policy makers