

# Merging OMI and TROPOMI: towards a seamless 17-year-long tropospheric NO<sub>2</sub> afternoon data record

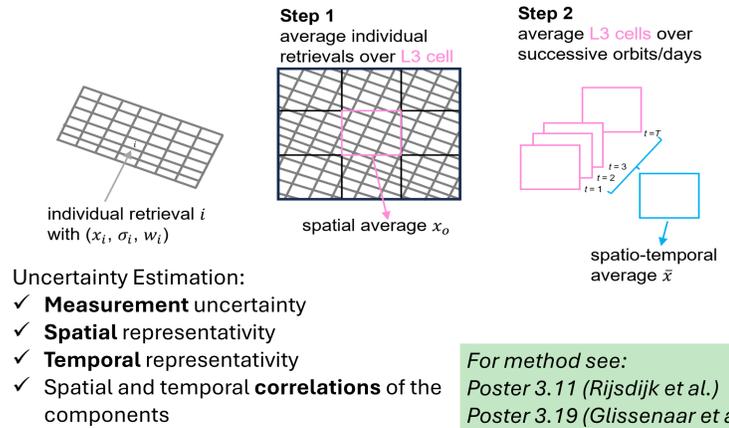
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## Background

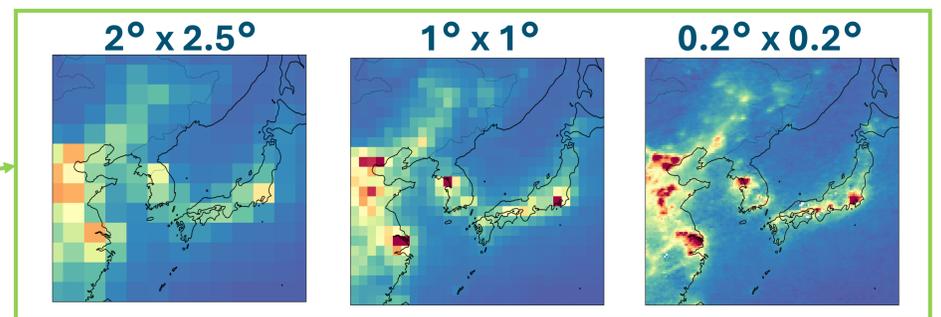
Long-term NO<sub>2</sub> monthly mean data records have been produced for the **ESA CCI+ project for the Precursors for Aerosols and Ozone** using satellite observations from two afternoon sensors: **OMI** and **TROPOMI**.

	OMI	TROPOMI
<b>Operational</b>	2004-2021	2018-now
<b>NO<sub>2</sub> Retrieval Algorithm</b>		Similar
<b>Spatial Resolution</b>	13x24 km <sup>2</sup>	3.5x7 km <sup>2</sup>
<b>Overpass Time</b>	13.45 Local Time	13.30 Local Time
<b>Level 2 Version</b>	QA4ECV v1.1	v02.03.01
<b>Cloud Retrieval</b>	O <sub>2</sub> -O <sub>2</sub> Absorption	O <sub>2</sub> A-Band
<b>Level 3 Method</b>		Same
<b>Spatial Coverage</b>	Limited after 2007 (Row Anomaly)	Complete

## Spatial and Temporal Averaging and Uncertainty

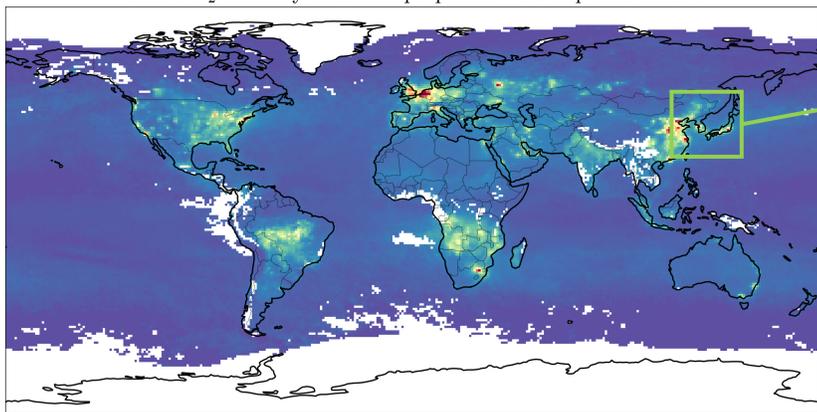


## Level 3 Data Resolutions

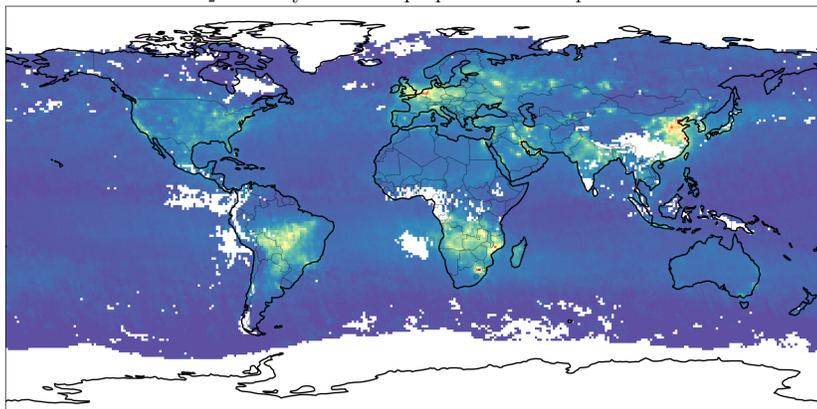


## OMI NO<sub>2</sub> Monthly L3 Data: October 2004 – March 2021

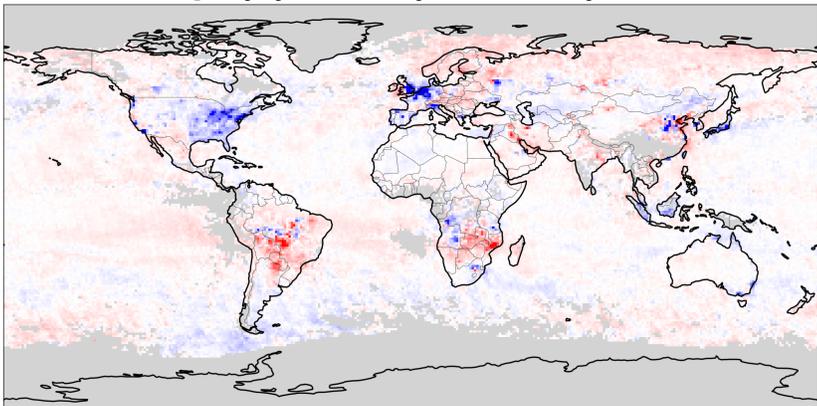
OMI NO<sub>2</sub> Monthly Mean Tropospheric VCD September 2005



OMI NO<sub>2</sub> Monthly Mean Tropospheric VCD September 2020



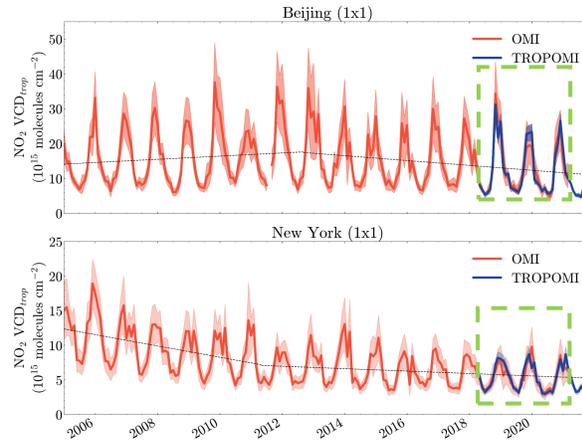
OMI NO<sub>2</sub> Tropospheric VCD September 2020 - September 2005



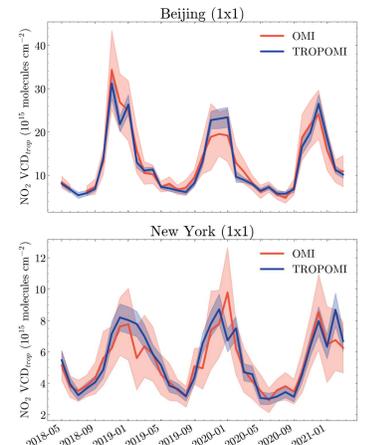
NO<sub>2</sub> Difference over 15 years:

- Decrease in Europe, USA, Japan
- Increase over Africa, India, Amazon
- Both increases and decreases over China
- Decrease in OMI coverage due to Row Anomaly

## Timeseries



## Overlapping period

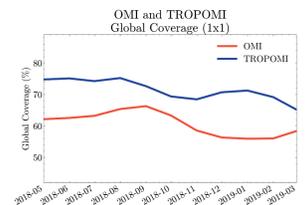
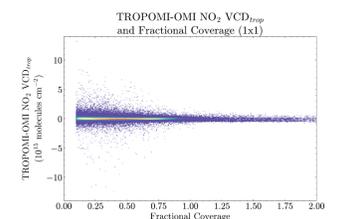


## OMI-TROPOMI Comparison

- Good agreement between OMI and TROPOMI
- OMI lower spatial coverage  
→ high uncertainty and largest discrepancies

Monthly mean tropospheric NO<sub>2</sub> VCD and its total uncertainty for OMI and TROPOMI in January and June 2019 for 1°x1° resolution in 10<sup>15</sup> molecules cm<sup>-2</sup>

		OMI		TROPOMI	
		NO <sub>2</sub> VCD	Uncertainty	NO <sub>2</sub> VCD	Uncertainty
<b>January 2019</b>	Beijing	24.87	7.00 (28%)	26.32	2.30 (9%)
	New York	7.77	2.29 (30%)	8.03	0.85 (11%)
	Sub-Tropical Africa	0.58	0.26 (44%)	0.56	0.11 (20%)
<b>June 2019</b>	Beijing	8.04	1.61 (20%)	6.99	0.68 (10%)
	New York	4.09	1.18 (29%)	3.85	0.41 (11%)
	Sub-Tropical Africa	1.63	0.52 (32%)	1.51	0.22 (15%)



## Conclusions

- ✓ NO<sub>2</sub> Level 3 long-term data record available
- OMI-TROPOMI differences due to:
  - Algorithm
  - Sampling

## Future Work

- Connect seamlessly OMI and TROPOMI
- Daily level 3 data records
- Make data available to public