

Consiglio Nazionale -delle **Ricerche =**

Merging OMI and TROPOMI: towards a seamless 17-year-long tropospheric NO₂ (·eesa afternoon data record

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Background

Long-term NO₂ 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
Operational	2004-2021	2018-now
NO ₂ Retrieval Algorithm	Similar	
Spatial Resolution	13x24 km ²	3.5x7 km ²
Overpass Time	13.45 Local Time	13.30 Local Time
Level 2 Version	QA4ECV v1.1	v02.03.01

Spatial and Temporal Averaging and Uncertainty



Uncertainty Estimation:

- ✓ Measurement uncertainty
- ✓ Spatial representativity
- ✓ **Temporal** representativity

Step 2 average L3 cells over successive orbits/days



For method see:



Spatial Coverage

QA4ECV v1.1 O_2 A-Band O_2 - O_2 Absorption Same Limited after 2007 Complete

- ✓ Spatial and temporal correlations of the Poster 3.11 (Rijsdijk et al.) components
 - Poster 3.19 (Glissenaar et al.)

Level 3 Data Resolutions

OMI NO₂ Monthly L3 Data: October 2004 – March 2021 OMI NO₂ Monthly Mean Tropospheric VCD September 2005

(Row Anomaly)



OMI NO₂ Monthly Mean Tropospheric VCD September 2020











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OMI NO₂ Tropospheric VCD September 2020 - September 2005



OMI-TROPOMI Comparison

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

Monthly mean tropospheric NO₂ VCD and its total uncertainty for OMI and TROPOMI in January and June 2019 for 1°x1° resolution in 10¹⁵ molecules cm⁻² TROPOMI OMI Uncertainty NO₂ VCD NO₂ VCD Uncertainty 24.87 7.00 (28%) 26.32 2.30 (9%) Beijing 7.77 2.29 (30%) 0.85 (11%) New York 8.03 January

0.26 (44%)

1.61 (20%)

1.18 (29%)

0.11 (20%)

0.68 (10%)

0.41 (11%)

0.22 (15%)

0.56

6.99

3.85





 $molecules/cm^2$ 1510

 NO_2 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

Sub-Tropical 1.63 0.52 (32%) 1.51 Africa

0.58

8.04

4.09

Conclusions

Sub-Tropical

Africa

Beijing

New York

 \checkmark NO₂ Level 3 long-term data record available **OMI-TROPOMI** differences due to:

- Algorithm
- Sampling

2019

June

2019

Future Work

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

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