TROPOMI and OMI NO_2: slant column uncertainties over time

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The poster presents the variation over time of the uncertainties of the DOAS NO_2 slant column density (SCD) retrieval and an independent estimate based on the spatial variability of the SCDs within a remote region over the Pacific Ocean, both for TROPOMI collection 03[5,6] and OMI collection 04 data[7].

Conclusion:

OMI NO_2 shows higher SCD uncertainties than TROPOMI NO_2, while the increase over time is for OMI two to three times larger than for TROPOMI, indicating that TROPOMI is quite a bit more stable than OMI.

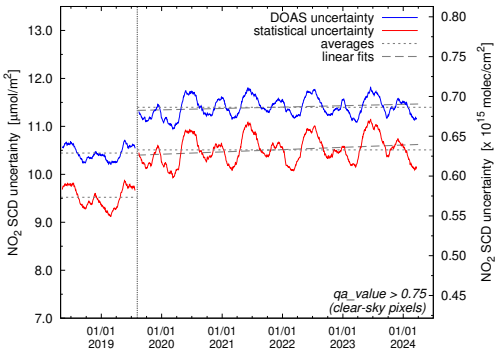
SCD uncertainty & DOAS error estimate

An independent statistical estimate using the spatial variability of the SCDs over a remote Pacific Ocean sector can be used to compare SCD uncertainties of different retrieval methods and different instruments. This statistical uncertainty is always a little lower than the SCD error estimate that follows from the DOAS fit.

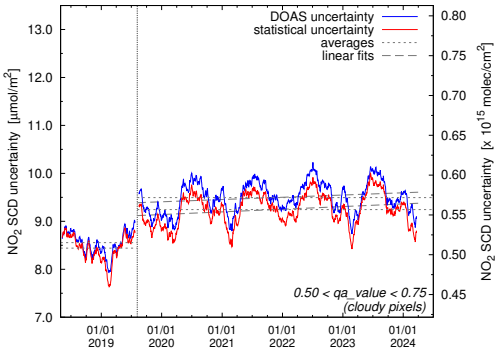
For **TROPOMI** the results are shown on the left, covering the collection 03 data versions v2.4.0 and following. The vertical line indicates a change in the along-track pixel size from 7.2 to 5.6 km on 6 Aug. 2019; only for the latter period a linear fit through the data is computed (dashed lines). Horizontal lines are period averages.

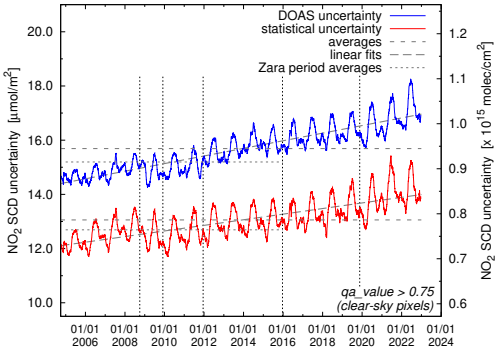
For **OMI** the results are shown on the right, covering the newly made collection 04 reprocessing. Vertical lines indicate changes in the instrument and/or the row anomaly. Horizontal lines are averages, both over the full period and over the collection 03 (QA4ECV v1.1) period analysed by Zara et al.[8]; in view of the large increase over time (dashed lines), the averages have little meaning.

Curves show 21-day running means for clarity. A distiction is made between clear-sky pixels (qa_value > 0.75; top panels) and cloudy pixels ($0.50 <$ qa_value < 0.75; bottom panels). Numbers are provided in the tables below, where the 'slope' is the absolute change per year.

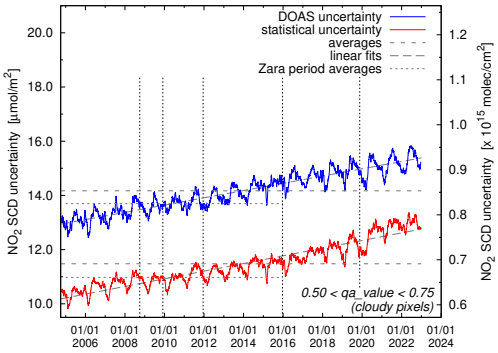


TROPOMI





OMI



Follow the QR-code for details on https://www.temis.nl/tropomi/no2scd/scdstats.php

Follow the QR-code for details on https://www.temis.nl/tropomi/no2scd/omi_scdstats.php

	TROPOMI collection 3	TROPOMI collection 3	
	2018/04/30 – 2019/08/05	2019/08/06 – 2024/03/31	
	average	*average*	*slope*
unit = μmol/m^2			
all pixels			
statistical	8.70 ± 0.34	9.53 ± 0.40	0.05
DOAS	9.16 ± 0.33	10.00 ± 0.39	0.02
clear-sky pixels			
statistical	9.52 ± 0.26	10.51 ± 0.32	0.05
DOAS	10.44 ± 0.19	11.40 ± 0.24	0.03
cloudy pixels			
statistical	8.44 ± 0.41	9.25 ± 0.46	0.06
DOAS	8.56 ± 0.40	9.50 ± 0.48	0.05

	OMI[8] collection 3	OMI collection 4		
	2005/01/01 – 2015/12/31	2005/01/01 – 2015/12/31	2004/10/01 – 2022/12/31	
	average	*average*	*average*	*slope*
unit = μmol/m^2				
all pixels				
statistical	11.45	11.69 ± 0.51	12.16 ± 0.83	0.13
DOAS	13.87	13.99 ± 0.58	14.48 ± 0.84	0.14
clear-sky pixels				
statistical	12.64	12.69 ± 0.57	13.06 ± 0.80	0.10
DOAS	15.11	15.20 ± 0.60	15.69 ± 0.88	0.14
cloudy pixels				
statistical	10.88	10.97 ± 0.46	11.48 ± 0.84	0.14
DOAS	13.91	13.70 ± 0.59	14.17 ± 0.82	0.13

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[5] van Geffen et al., TROPOMI NO_2 ATBD v2.7.1, 2024
[6] van Geffen et al., AMT *13*, 2020 & AMT *15*, 2022
[7] van Geffen et al., OMI NO_2 ATBD coll. 4, in prep., 2024
[8] Zara et al., AMT *11*, 2018

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