PyCAMA report generated by tropl2-proc

tropl2-proc

2025-10-06 (17:26)

1 Short Introduction

1.1 The list of parameters

You may want to keep the list given in table 1 at hand when viewing the results.

2 Definitions

The averages shown here are *unweighed* averages:

$$\bar{x} = \frac{1}{N}\sum_{i=1}^{N} x_i \tag{1}$$

with N the number of observations in the dataset.

The spread of the measurements is indicated with the variance $V(x)$, or rather the standard deviation $\sigma(x) = \sqrt{V(x)}$.

$$V(x) = \frac{1}{N-1}\sum_{i=1}^{N}(x_i - \bar{x})^2 \tag{2}$$

We also report the more robust statistics median, minimum, maximum, various percentiles and inter quartile range.

The median m is the value of parameter x for which half of the observations of x is smaller than m:

$$P(x \leq m) = P(x \geq m) = \int_{-\infty}^{m} f(x)\,\mathrm{d}x = \frac{1}{2} \tag{3}$$

with $f(x)$ the probability density function.

The median is a special case of a percentile. Instead of ½ in equation 3, other threshold values can be used. We report results for 1 %, 5 %, 10 %, 15.9 %, 25 %, 75 %, 84.1 %, 90 %, 95 % and 99 %. The inter quartile range is the difference between the 75 % and 25 % percentiles. Similarly the minimum and maximum values correspond to the 0 % and 100 % percentiles respectively.

For normally distributed parameters the mean and median are the same, while the $\mu \pm \sigma$ values and the 15.9 % and 84.1 % percentiles coincide.

To get a measure for the relation of one variable $x_{(k)}$ with another $x_{(l)}$, we calculate the covariance matrix C_{kl}.

$$C_{kl} = C(x_{(k)}, x_{(l)}) = \frac{1}{N-1}\sum_{i=1}^{N}(x_{(k),i} - \overline{x_{(k)}})(x_{(l),i} - \overline{x_{(l)}}) \tag{4}$$

Rather than a dimensionally dependent covariance, it is often easier to interpret a correlation matrix R_{kl}, a matrix of Pearson's r coefficients:

$$R_{kl} = R(x_{(k)}, x_{(l)}) = \frac{C_{kl}}{\sqrt{C_{kk}C_{ll}}} = \frac{C_{kl}}{\sqrt{V(x_k)V(x_l)}} \tag{5}$$

The diagonal elements of the covariance matrix are the variances of the elements, $V(x_{(k)}) = C_{kk}$ and obviously $R_{kk} = 1$.

Table 1: Parameterlist and basic statistics for the analysis

Variable	mean $\pm\sigma$	Count	Mode	IQR	Median	Minimum	Maximum
qa value [1]	0.827 ± 0.252	2242291	0.905	0.180	0.900	0.0	1.000
ozone total vertical column [mol m^{-2}]	0.137 ± 0.024	2242291	0.130	3.116×10^{-2}	0.133	6.328×10^{-2}	0.205
ozone total vertical column precision [mol m^{-2}]	$(3.422 \pm 3.128) \times 10^{-3}$	2242291	2.025×10^{-3}	1.252×10^{-3}	2.360×10^{-3}	9.387×10^{-4}	3.674×10^{-2}
ozone slant column density [mol m^{-2}]	0.512 ± 0.236	2242291	0.335	0.294	0.445	0.238	1.45
ozone slant column precision [mol m^{-2}]	$(3.597 \pm 3.398) \times 10^{-3}$	2242291	2.065×10^{-3}	1.359×10^{-3}	2.434×10^{-3}	9.446×10^{-4}	3.964×10^{-2}
number of iterations slant column [1]	3.02 ± 0.21	2242291	3.00	0.0	3.00	2.00	6.00
root mean square slant column fit [1]	$(1.389 \pm 1.311) \times 10^{-3}$	2242291	8.100×10^{-4}	5.262×10^{-4}	9.401×10^{-4}	3.615×10^{-4}	1.529×10^{-2}
fitted radiance shift [nm]	$(-1.361 \pm 3.019) \times 10^{-3}$	2242291	-1.500×10^{-3}	2.668×10^{-3}	-1.535×10^{-3}	-3.535×10^{-2}	3.284×10^{-2}
fitted radiance squeeze [1]	$(1.513 \pm 3.384) \times 10^{-4}$	2242291	1.000×10^{-4}	3.303×10^{-4}	1.463×10^{-4}	-5.984×10^{-3}	4.803×10^{-3}
ozone total air mass factor [1]	3.92 ± 1.87	2242291	2.25	1.93	3.23	2.10	13.4
ozone effective temperature [K]	233 ± 5	2242291	232	6.58	233	199	270
number of iterations vertical column [1]	2.07 ± 0.52	2242291	2.14	0.0	2.00	1.000	9.00

Table 2: Percentile ranges

Variable	1 %	5 %	10 %	15.9 %	25 %	75 %	84.1 %	90 %	95 %	99 %
qa value [1]	0.0	0.200	0.400	0.650	0.820	1.000	1.000	1.000	1.000	1.000
ozone total vertical column [mol m^{-2}]	7.240×10^{-2}	9.891×10^{-2}	0.117	0.119	0.122	0.154	0.160	0.168	0.179	0.191
ozone total vertical column precision [mol m^{-2}]	1.459×10^{-3}	1.651×10^{-3}	1.765×10^{-3}	1.860×10^{-3}	1.983×10^{-3}	3.235×10^{-3}	4.329×10^{-3}	6.032×10^{-3}	9.753×10^{-3}	1.852×10^{-2}
ozone slant column density [mol m^{-2}]	0.248	0.262	0.281	0.303	0.331	0.625	0.736	0.862	1.03	1.23
ozone slant column precision [mol m^{-2}]	1.478×10^{-3}	1.681×10^{-3}	1.802×10^{-3}	1.901×10^{-3}	2.030×10^{-3}	3.389×10^{-3}	4.587×10^{-3}	6.447×10^{-3}	1.051×10^{-2}	1.994×10^{-2}
number of iterations slant column [1]	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00
root mean square slant column fit [1]	5.699×10^{-4}	6.484×10^{-4}	6.951×10^{-4}	7.337×10^{-4}	7.838×10^{-4}	1.310×10^{-3}	1.772×10^{-3}	2.491×10^{-3}	4.058×10^{-3}	7.698×10^{-3}
fitted radiance shift [nm]	-9.350×10^{-3}	-5.575×10^{-3}	-4.368×10^{-3}	-3.609×10^{-3}	-2.828×10^{-3}	-1.597×10^{-4}	8.373×10^{-4}	1.937×10^{-3}	3.769×10^{-3}	8.204×10^{-3}
fitted radiance squeeze [1]	-8.938×10^{-4}	-2.944×10^{-4}	-1.689×10^{-4}	-9.252×10^{-5}	-1.277×10^{-5}	3.175×10^{-4}	4.116×10^{-4}	5.039×10^{-4}	6.454×10^{-4}	1.049×10^{-3}
ozone total air mass factor [1]	2.16	2.23	2.31	2.42	2.61	4.53	5.73	6.85	8.16	9.93
ozone effective temperature [K]	223	226	227	228	229	236	238	240	242	246
number of iterations vertical column [1]	1.000	1.000	2.00	2.00	2.00	2.00	2.00	3.00	3.00	4.00

Table 3: Parameterlist and basic statistics for the analysis for observations in the northern hemisphere

Variable	mean $\pm\sigma$	Count	IQR	Median	Minimum	Maximum	25 % percentile	75 % percentile
qa value [1]	0.814 ± 0.268	1436184	0.200	0.900	0.0	1.000	0.800	1.000
ozone total vertical column [mol m^{-2}]	0.137 ± 0.014	1436184	2.490×10^{-2}	0.133	0.112	0.186	0.125	0.150
ozone total vertical column precision [mol m^{-2}]	$(3.848 \pm 3.729) \times 10^{-3}$	1436184	1.707×10^{-3}	2.377×10^{-3}	9.646×10^{-4}	3.674×10^{-2}	1.994×10^{-3}	3.701×10^{-3}
ozone slant column density [mol m^{-2}]	0.538 ± 0.271	1436184	0.371	0.419	0.239	1.45	0.331	0.702
ozone slant column precision [mol m^{-2}]	$(4.056 \pm 4.049) \times 10^{-3}$	1436184	1.851×10^{-3}	2.450×10^{-3}	9.732×10^{-4}	3.964×10^{-2}	2.044×10^{-3}	3.895×10^{-3}
number of iterations slant column [1]	3.03 ± 0.25	1436184	0.0	3.00	2.00	6.00	3.00	3.00
root mean square slant column fit [1]	$(1.566 \pm 1.562) \times 10^{-3}$	1436184	7.151×10^{-4}	9.462×10^{-4}	3.686×10^{-4}	1.529×10^{-2}	7.894×10^{-4}	1.504×10^{-3}
fitted radiance shift [nm]	$(-7.624 \pm 30.146) \times 10^{-4}$	1436184	2.596×10^{-3}	-1.038×10^{-3}	-3.506×10^{-2}	3.284×10^{-2}	-2.166×10^{-3}	4.304×10^{-4}
fitted radiance squeeze [1]	$(1.309 \pm 3.665) \times 10^{-4}$	1436184	3.377×10^{-4}	1.349×10^{-4}	-5.984×10^{-3}	4.803×10^{-3}	-2.994×10^{-5}	3.078×10^{-4}
ozone total air mass factor [1]	3.99 ± 1.80	1436184	2.08	3.32	2.11	10.8	2.67	4.75
ozone effective temperature [K]	232 ± 5	1436184	5.47	232	206	270	229	235
number of iterations vertical column [1]	2.12 ± 0.57	1436184	0.0	2.00	1.000	9.00	2.00	2.00

Table 4: Parameterlist and basic statistics for the analysis for observations in the southern hemisphere

Variable	mean $\pm\sigma$	Count	IQR	Median	Minimum	Maximum	25 % percentile	75 % percentile
qa value [1]	0.851 ± 0.220	806107	0.1000	0.900	0.0	1.000	0.900	1.000
ozone total vertical column [mol m^{-2}]	0.138 ± 0.034	806107	5.357×10^{-2}	0.136	6.328×10^{-2}	0.205	0.117	0.170
ozone total vertical column precision [mol m^{-2}]	$(2.665 \pm 1.243) \times 10^{-3}$	806107	9.274×10^{-4}	2.335×10^{-3}	9.387×10^{-4}	1.860×10^{-2}	1.961×10^{-3}	2.889×10^{-3}
ozone slant column density [mol m^{-2}]	0.467 ± 0.148	806107	0.246	0.472	0.238	0.949	0.331	0.577
ozone slant column precision [mol m^{-2}]	$(2.781 \pm 1.369) \times 10^{-3}$	806107	1.033×10^{-3}	2.410×10^{-3}	9.446×10^{-4}	1.973×10^{-2}	2.003×10^{-3}	3.036×10^{-3}
number of iterations slant column [1]	3.00 ± 0.12	806107	0.0	3.00	2.00	5.00	3.00	3.00
root mean square slant column fit [1]	$(1.074 \pm 0.529) \times 10^{-3}$	806107	4.010×10^{-4}	9.307×10^{-4}	3.615×10^{-4}	7.512×10^{-3}	7.730×10^{-4}	1.174×10^{-3}
fitted radiance shift [nm]	$(-2.428 \pm 2.718) \times 10^{-3}$	806107	2.323×10^{-3}	-2.427×10^{-3}	-3.535×10^{-2}	2.923×10^{-2}	-3.663×10^{-3}	-1.341×10^{-3}
fitted radiance squeeze [1]	$(1.875 \pm 2.778) \times 10^{-4}$	806107	3.188×10^{-4}	1.656×10^{-4}	-3.080×10^{-3}	4.713×10^{-3}	1.482×10^{-5}	3.336×10^{-4}
ozone total air mass factor [1]	3.79 ± 1.97	806107	1.71	3.07	2.10	13.4	2.50	4.21
ozone effective temperature [K]	234 ± 6	806107	8.88	234	199	266	230	239
number of iterations vertical column [1]	1.98 ± 0.40	806107	0.0	2.00	1.000	5.00	2.00	2.00

Table 5: Parameterlist and basic statistics for the analysis for observations over water

Variable	mean $\pm\sigma$	Count	IQR	Median	Minimum	Maximum	25 % percentile	75 % percentile
qa value [1]	0.848 ± 0.235	1917268	0.1000	0.900	0.0	1.000	0.900	1.000
ozone total vertical column [mol m^{-2}]	0.139 ± 0.021	1917268	3.074×10^{-2}	0.132	6.841×10^{-2}	0.205	0.123	0.154
ozone total vertical column precision [mol m^{-2}]	$(3.289 \pm 3.152) \times 10^{-3}$	1917268	9.995×10^{-4}	2.245×10^{-3}	9.387×10^{-4}	3.674×10^{-2}	1.938×10^{-3}	2.938×10^{-3}
ozone slant column density [mol m^{-2}]	0.491 ± 0.239	1917268	0.272	0.398	0.238	1.45	0.321	0.593
ozone slant column precision [mol m^{-2}]	$(3.452 \pm 3.434) \times 10^{-3}$	1917268	1.076×10^{-3}	2.307×10^{-3}	9.446×10^{-4}	3.964×10^{-2}	1.983×10^{-3}	3.059×10^{-3}
number of iterations slant column [1]	3.02 ± 0.22	1917268	0.0	3.00	2.00	6.00	3.00	3.00
root mean square slant column fit [1]	$(1.332 \pm 1.323) \times 10^{-3}$	1917268	4.172×10^{-4}	8.914×10^{-4}	3.615×10^{-4}	1.529×10^{-2}	7.655×10^{-4}	1.183×10^{-3}
fitted radiance shift [nm]	$(-1.282 \pm 3.040) \times 10^{-3}$	1917268	2.535×10^{-3}	-1.488×10^{-3}	-3.535×10^{-2}	3.284×10^{-2}	-2.677×10^{-3}	-1.426×10^{-4}
fitted radiance squeeze [1]	$(1.332 \pm 3.277) \times 10^{-4}$	1917268	3.159×10^{-4}	1.311×10^{-4}	-5.984×10^{-3}	4.803×10^{-3}	-2.214×10^{-5}	2.938×10^{-4}
ozone total air mass factor [1]	3.63 ± 1.64	1917268	1.46	3.01	2.10	12.3	2.53	3.99
ozone effective temperature [K]	233 ± 5	1917268	6.42	232	199	270	229	236
number of iterations vertical column [1]	2.08 ± 0.53	1917268	0.0	2.00	1.000	9.00	2.00	2.00

Table 6: Parameterlist and basic statistics for the analysis for observations over land

Variable	mean $\pm\sigma$	Count	IQR	Median	Minimum	Maximum	25 % percentile	75 % percentile
qa value [1]	0.631 ± 0.325	206223	0.580	0.770	0.0	1.000	0.320	0.900
ozone total vertical column [mol m^{-2}]	0.117 ± 0.036	206223	7.401×10^{-2}	0.132	6.328×10^{-2}	0.183	7.712×10^{-2}	0.151
ozone total vertical column precision [mol m^{-2}]	$(4.259 \pm 2.774) \times 10^{-3}$	206223	1.921×10^{-3}	3.308×10^{-3}	1.365×10^{-3}	2.859×10^{-2}	2.727×10^{-3}	4.649×10^{-3}
ozone slant column density [mol m^{-2}]	0.617 ± 0.159	206223	0.156	0.587	0.268	1.41	0.513	0.669
ozone slant column precision [mol m^{-2}]	$(4.532 \pm 2.959) \times 10^{-3}$	206223	2.100×10^{-3}	3.504×10^{-3}	1.389×10^{-3}	2.963×10^{-2}	2.876×10^{-3}	4.976×10^{-3}
number of iterations slant column [1]	3.02 ± 0.18	206223	0.0	3.00	2.00	5.00	3.00	3.00
root mean square slant column fit [1]	$(1.755 \pm 1.151) \times 10^{-3}$	206223	8.144×10^{-4}	1.356×10^{-3}	5.320×10^{-4}	1.160×10^{-2}	1.112×10^{-3}	1.926×10^{-3}
fitted radiance shift [nm]	$(-2.353 \pm 2.752) \times 10^{-3}$	206223	3.329×10^{-3}	-2.787×10^{-3}	-3.021×10^{-2}	2.058×10^{-2}	-4.141×10^{-3}	-8.120×10^{-4}
fitted radiance squeeze [1]	$(2.931 \pm 3.964) \times 10^{-4}$	206223	3.971×10^{-4}	2.847×10^{-4}	-3.917×10^{-3}	3.510×10^{-3}	9.395×10^{-5}	4.911×10^{-4}
ozone total air mass factor [1]	6.16 ± 2.34	206223	3.52	5.44	2.26	13.4	4.18	7.70
ozone effective temperature [K]	236 ± 5	206223	6.56	236	209	266	233	240
number of iterations vertical column [1]	2.05 ± 0.44	206223	0.0	2.00	1.000	5.00	2.00	2.00

3 Granule outlines

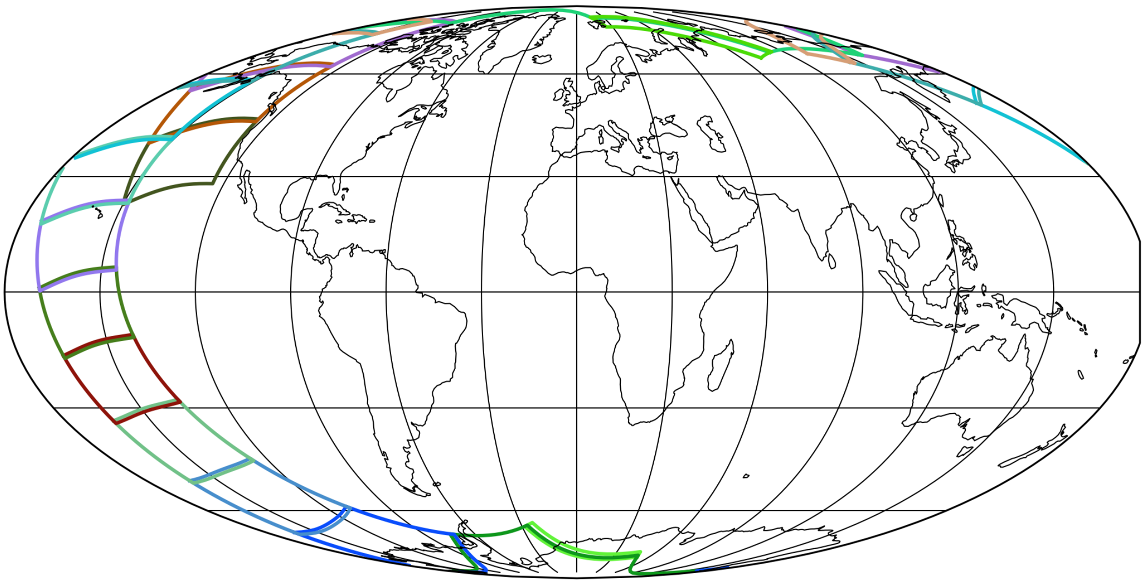

Figure 1: Outline of the granules.

4 Input data monitoring

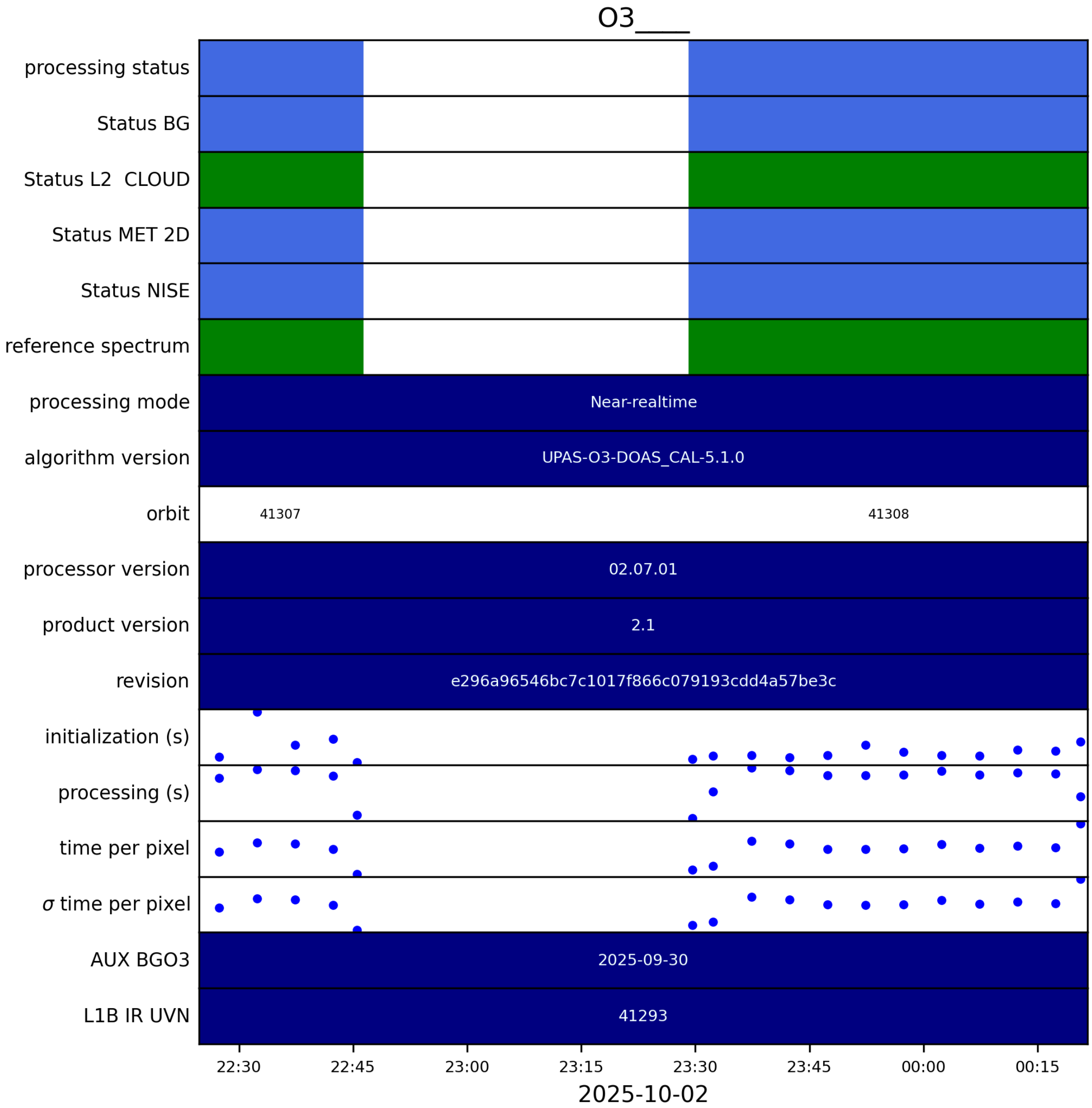

Figure 2: Input data per granule

5 Warnings and errors

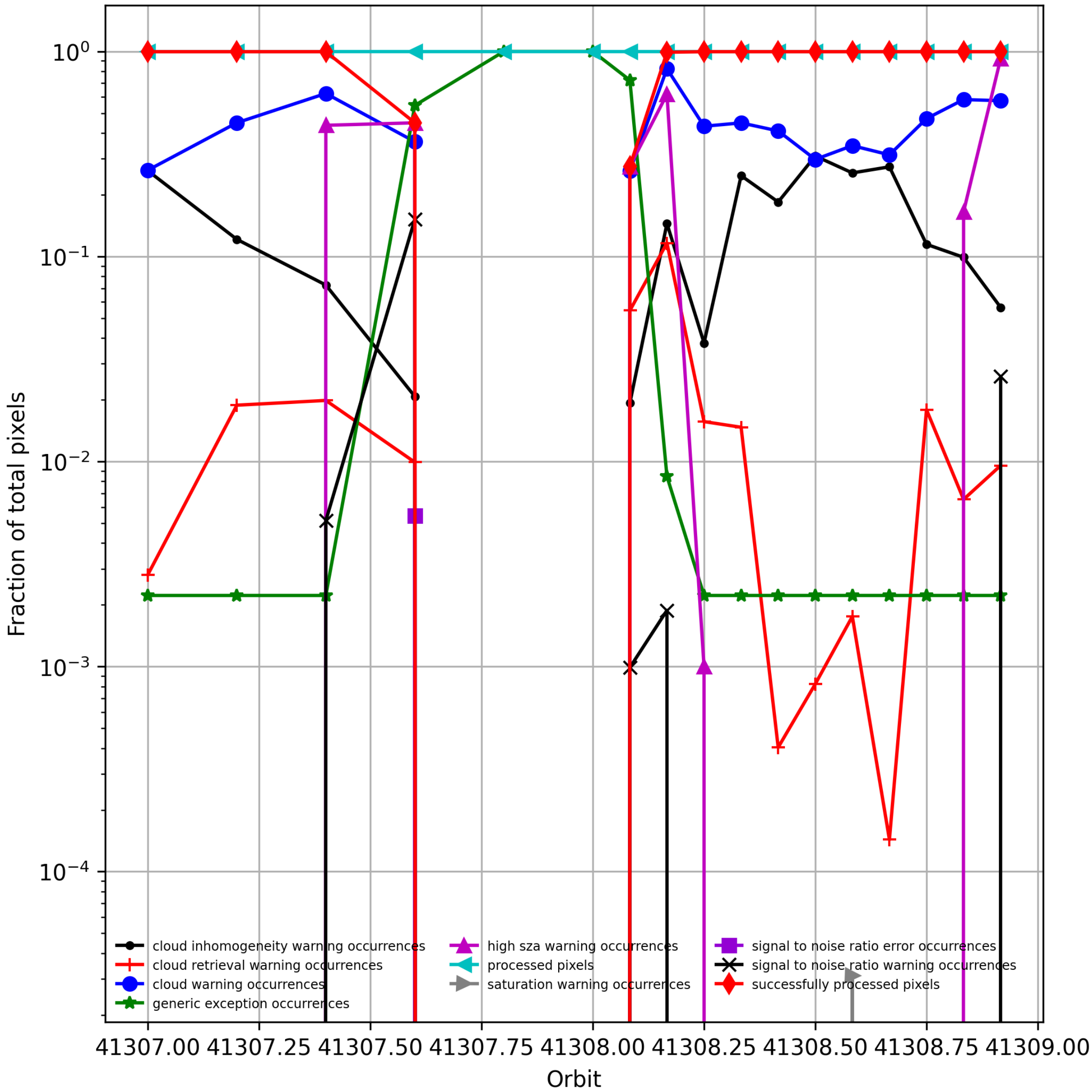

Figure 3: Fraction of pixels with specific warnings and errors during processing

6 World maps

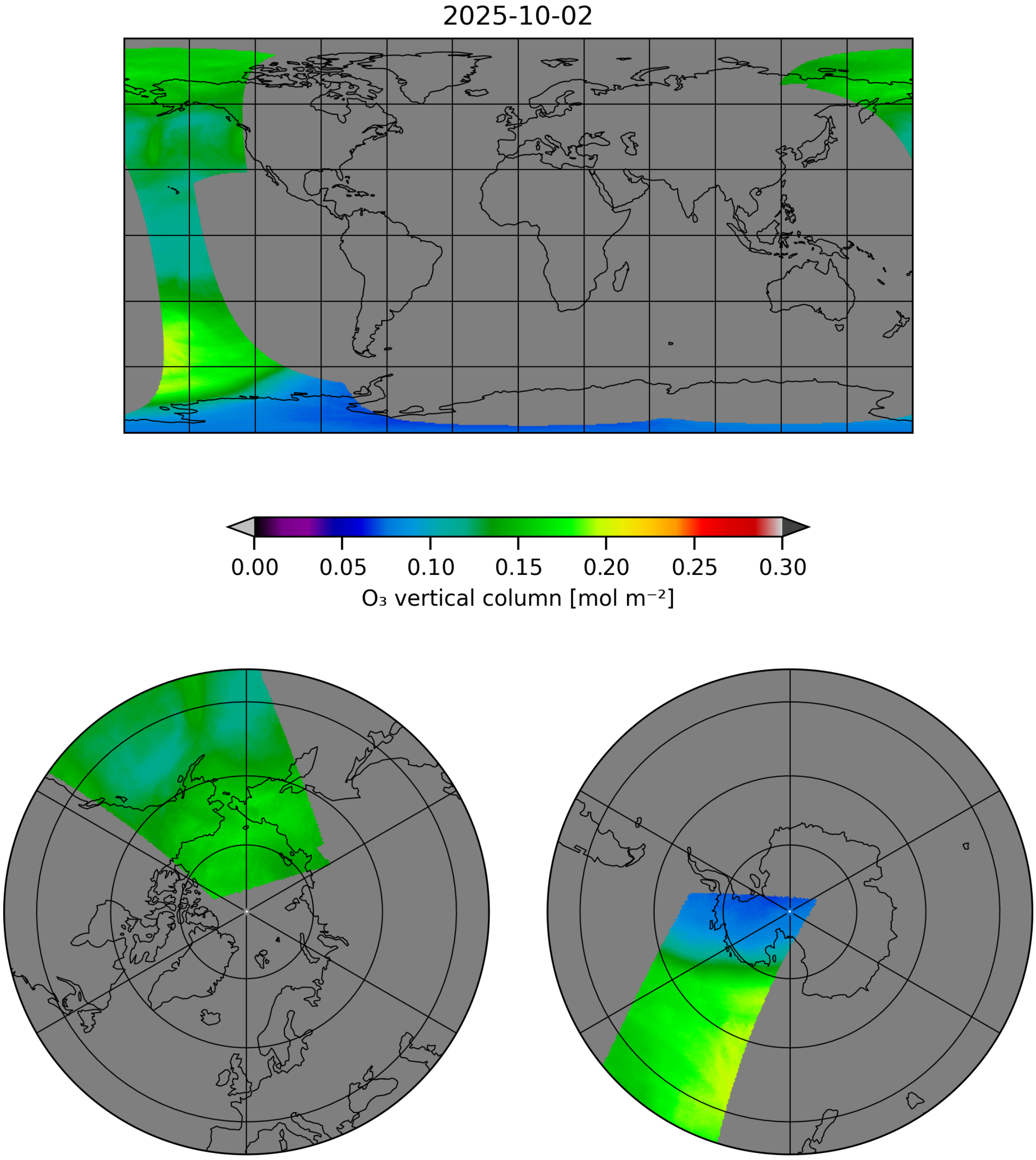

Figure 4: Map of "O_3 vertical column" for 2025-10-02 to 2025-10-03

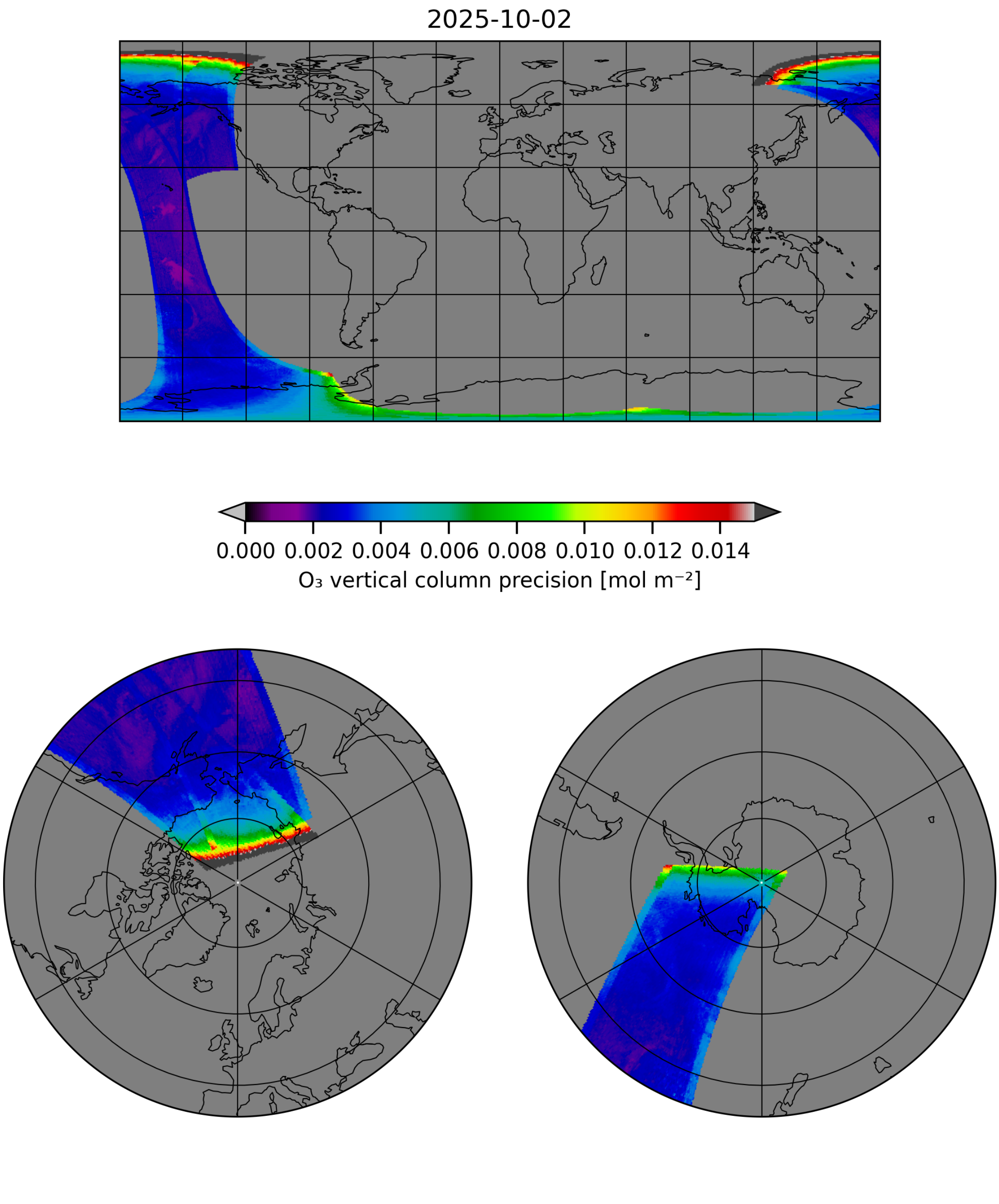

Figure 5: Map of “O_3 vertical column precision” for 2025-10-02 to 2025-10-03

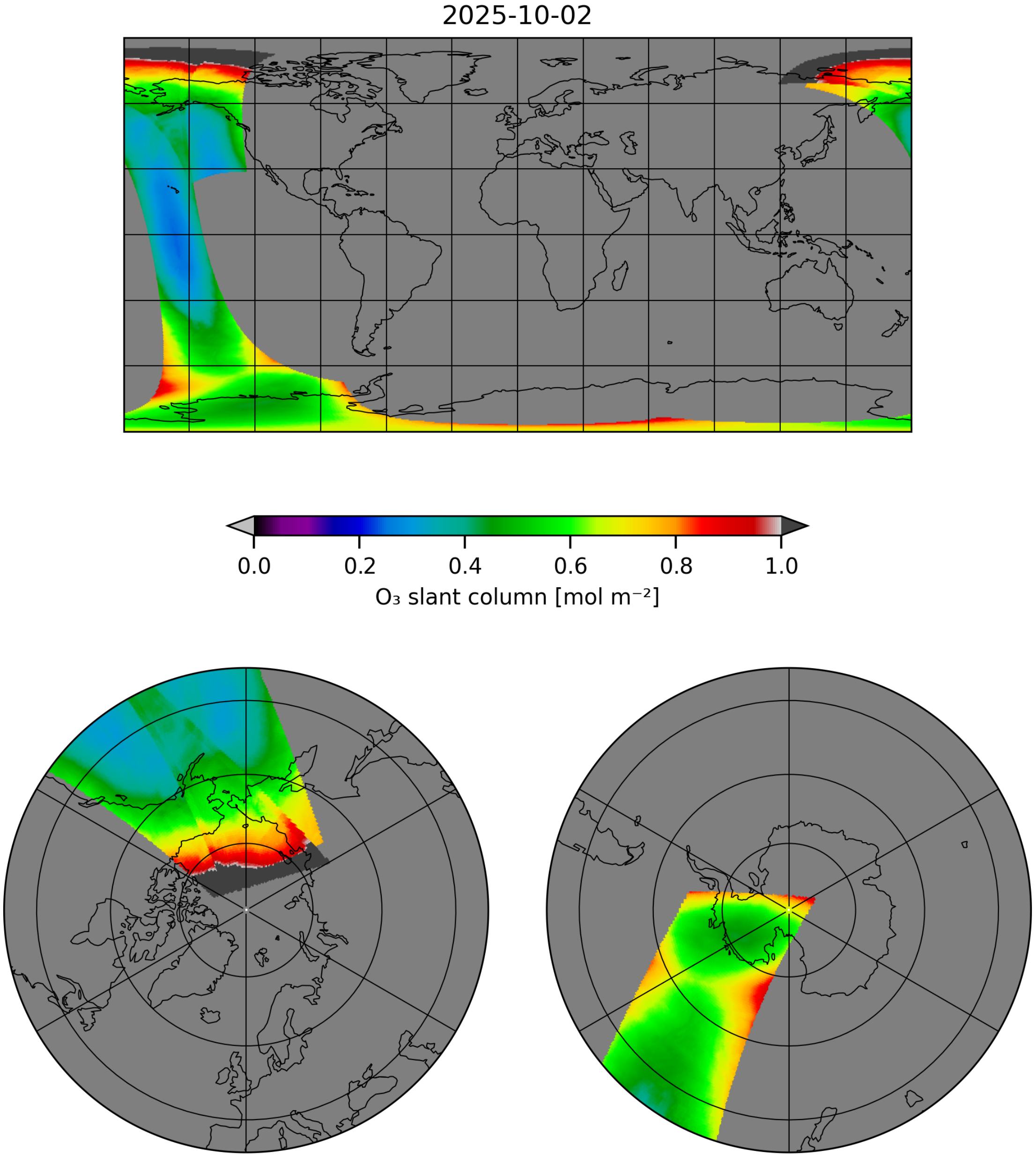

Figure 6: Map of “O_3 slant column” for 2025-10-02 to 2025-10-03

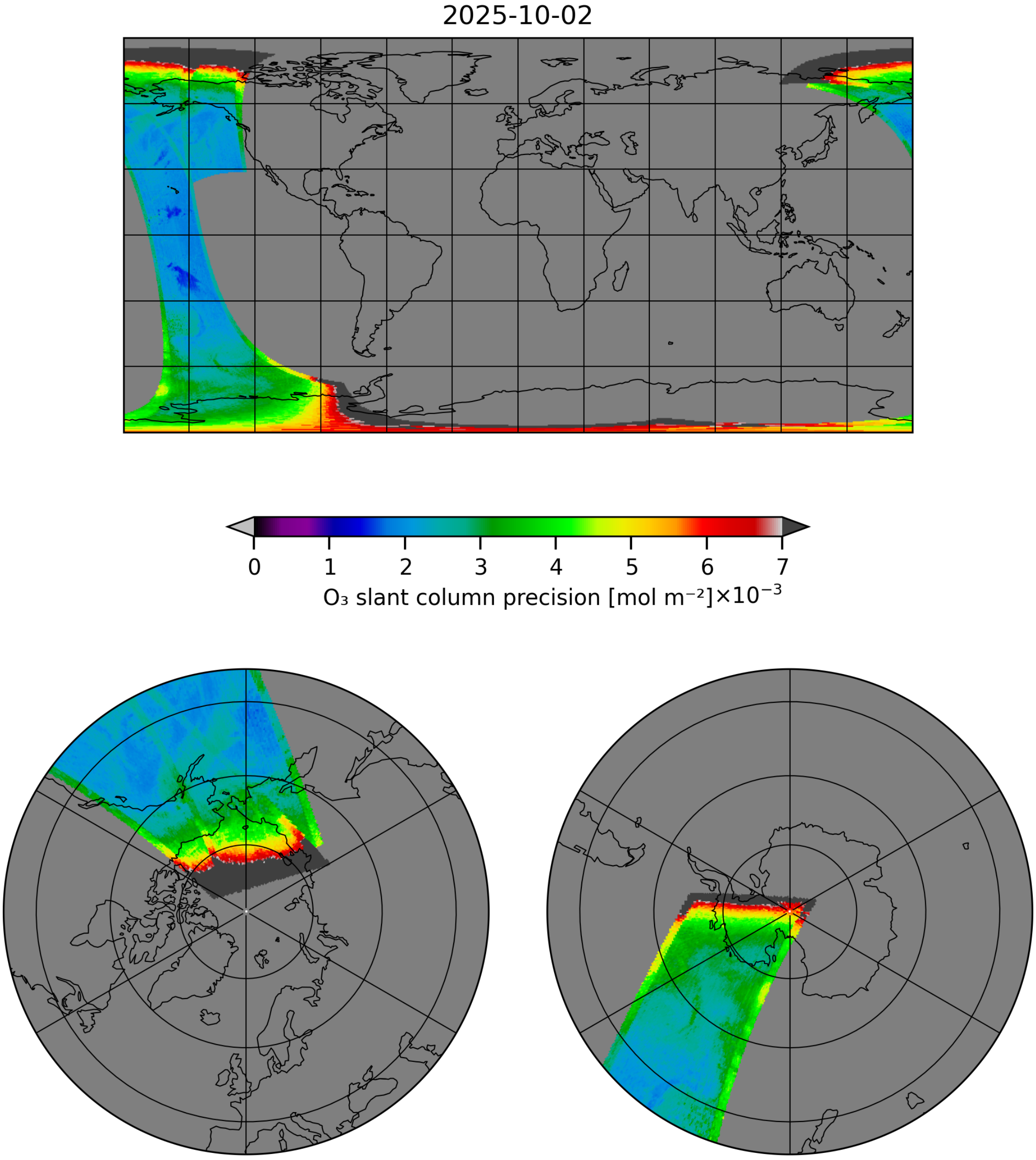

Figure 7: Map of “O_3 slant column precision” for 2025-10-02 to 2025-10-03

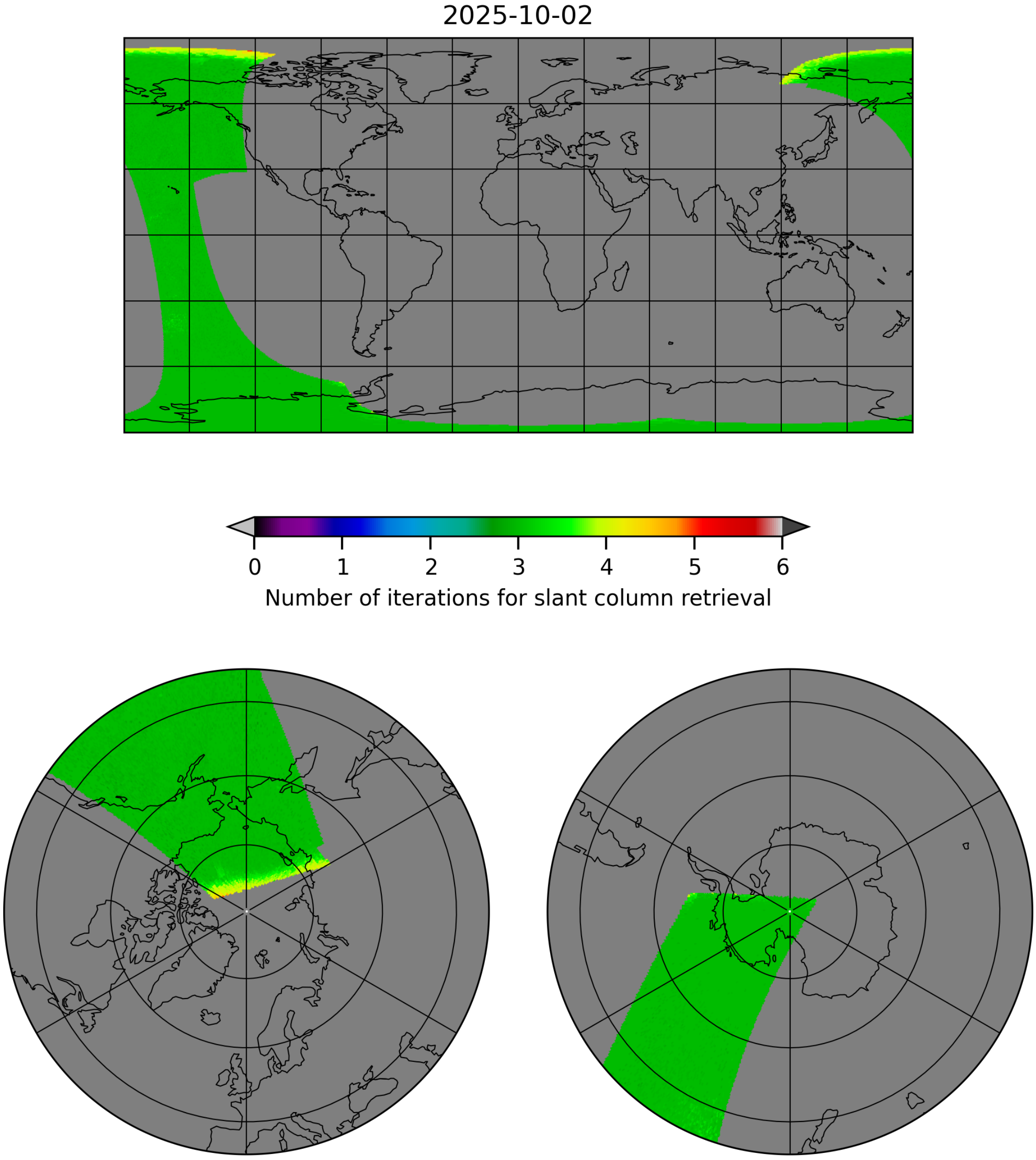

Figure 8: Map of “Number of iterations for slant column retrieval” for 2025-10-02 to 2025-10-03

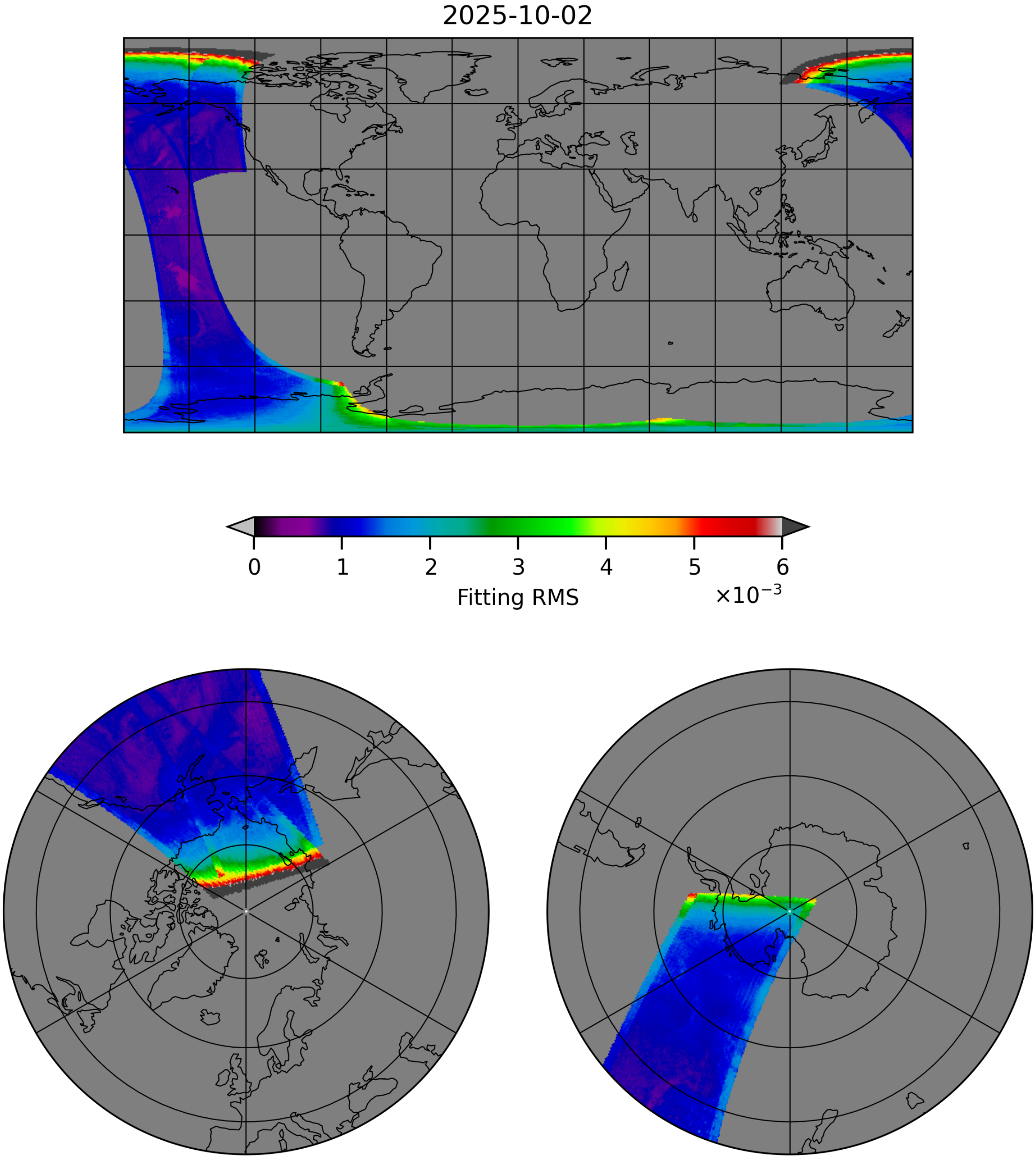

Figure 9: Map of “Fitting RMS” for 2025-10-02 to 2025-10-03

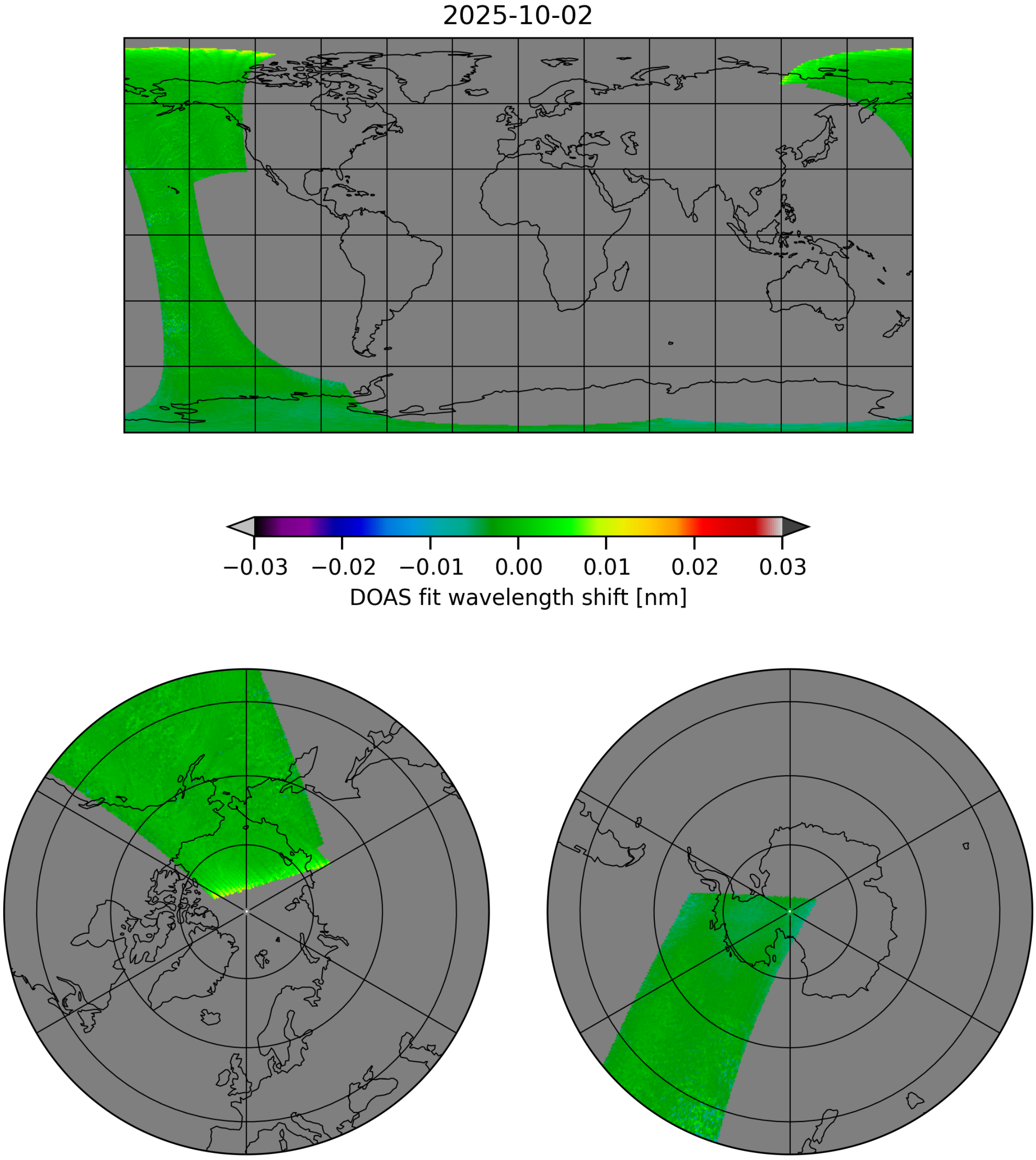

Figure 10: Map of “DOAS fit wavelength shift” for 2025-10-02 to 2025-10-03

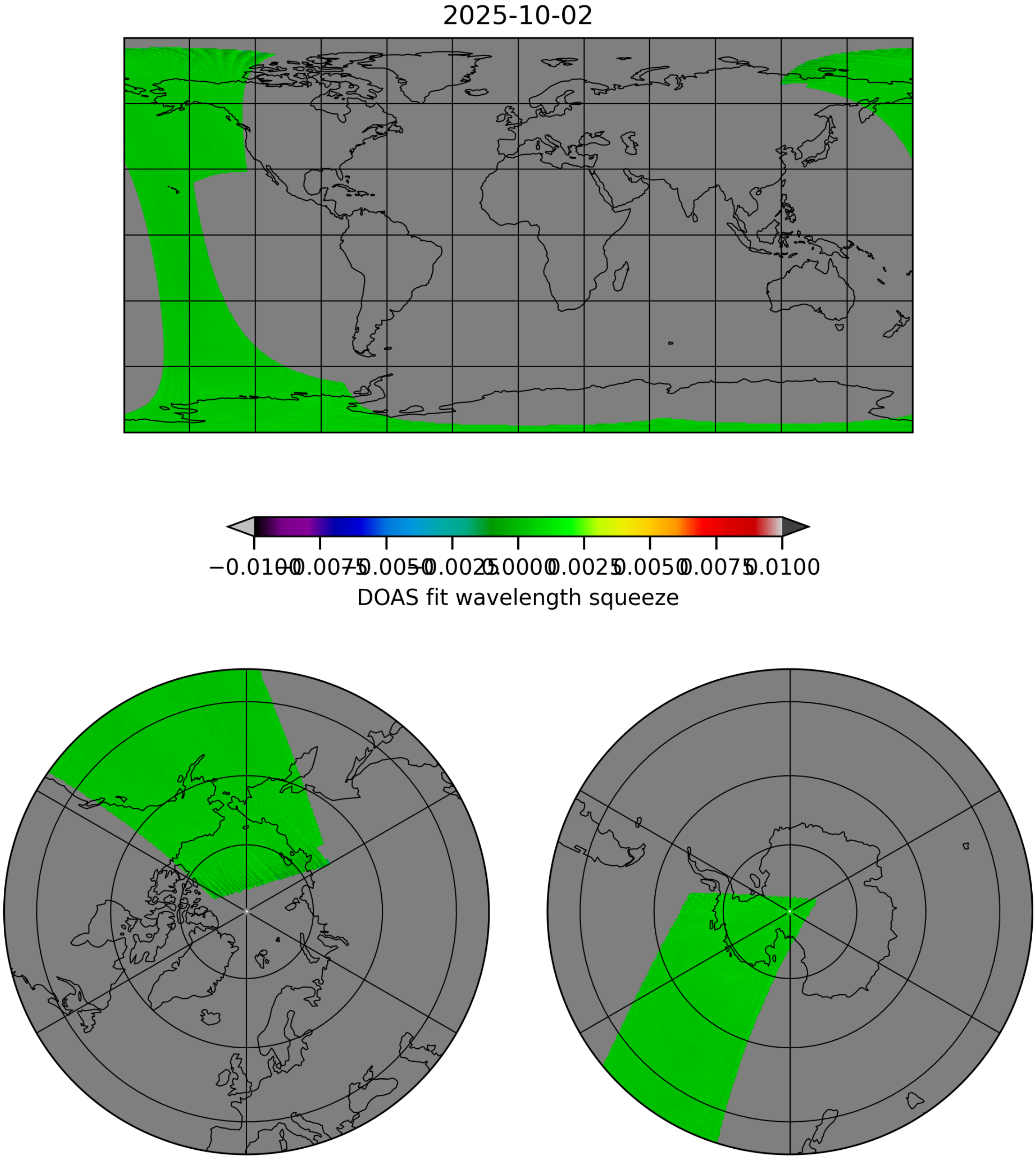

Figure 11: Map of “DOAS fit wavelength squeeze” for 2025-10-02 to 2025-10-03

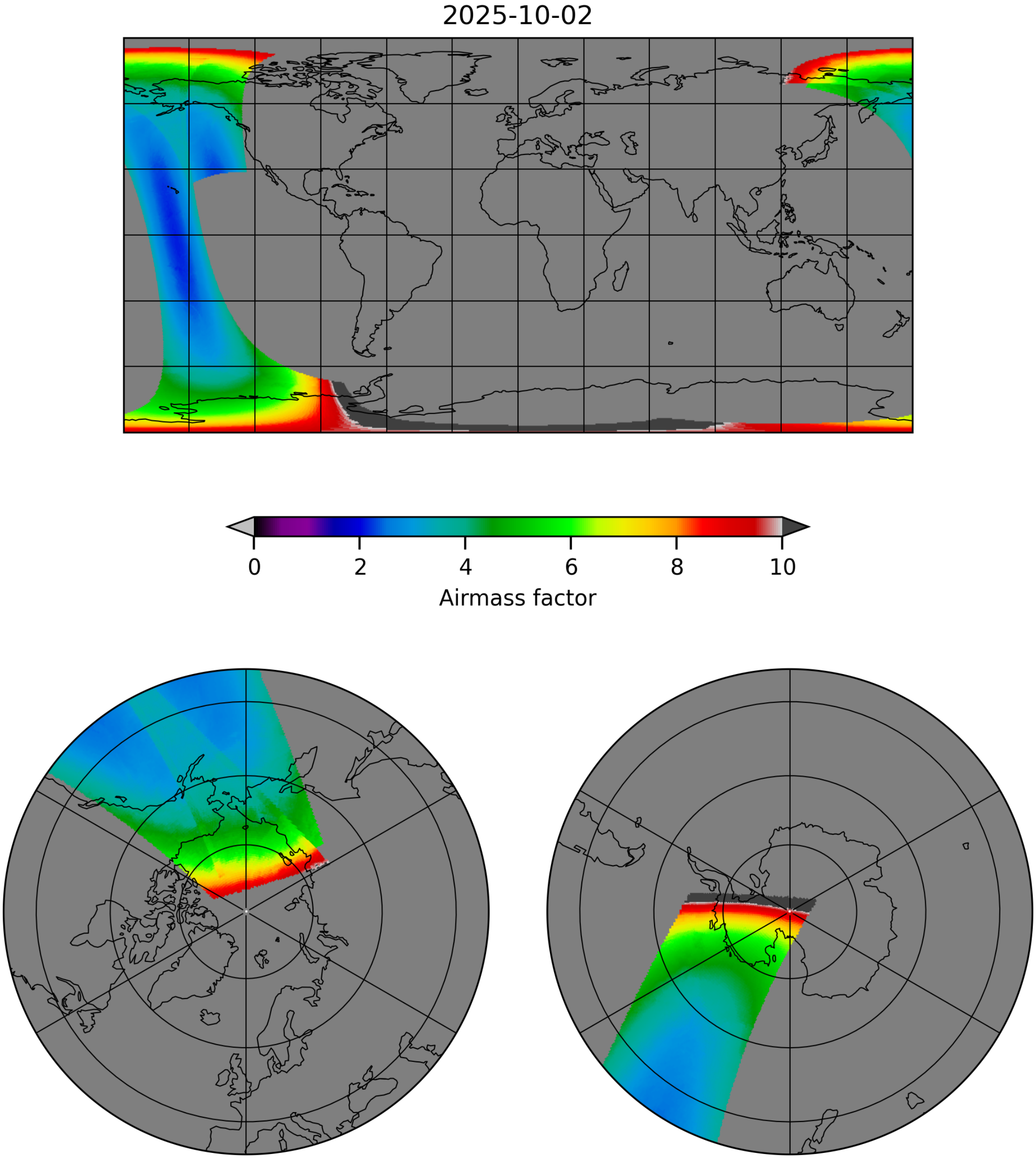

Figure 12: Map of “Airmass factor” for 2025-10-02 to 2025-10-03

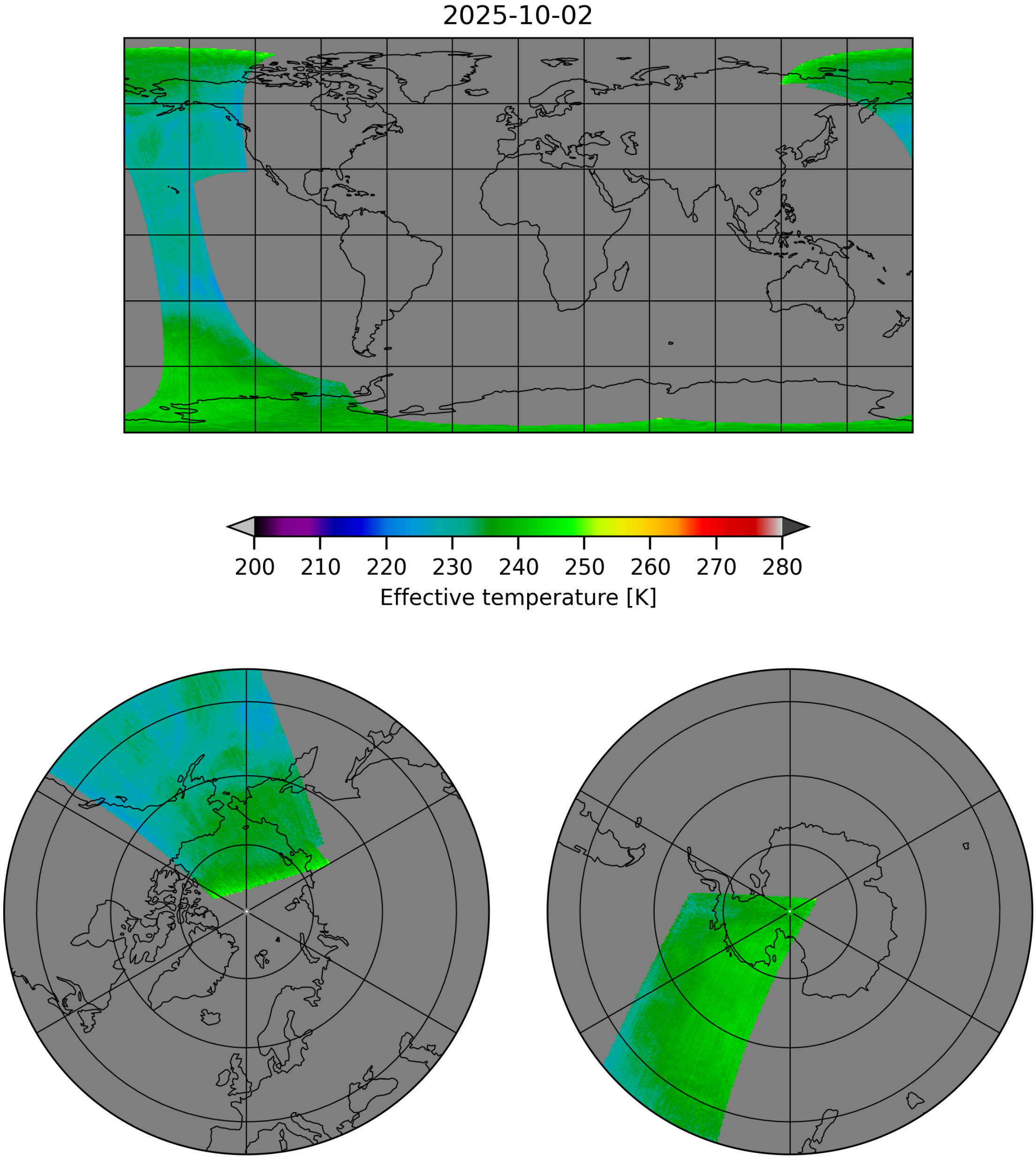

Figure 13: Map of “Effective temperature” for 2025-10-02 to 2025-10-03

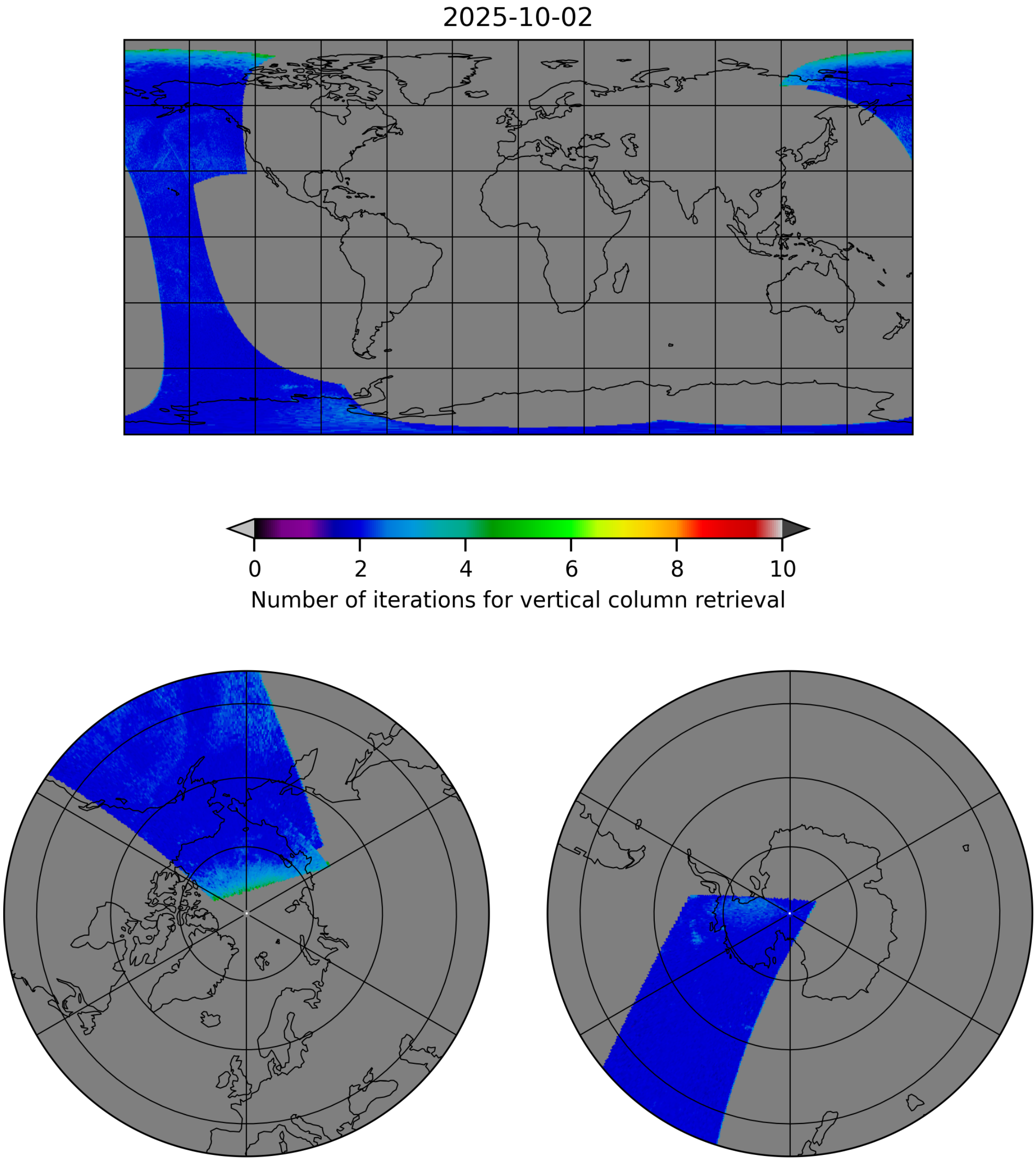

Figure 14: Map of “Number of iterations for vertical column retrieval” for 2025-10-02 to 2025-10-03

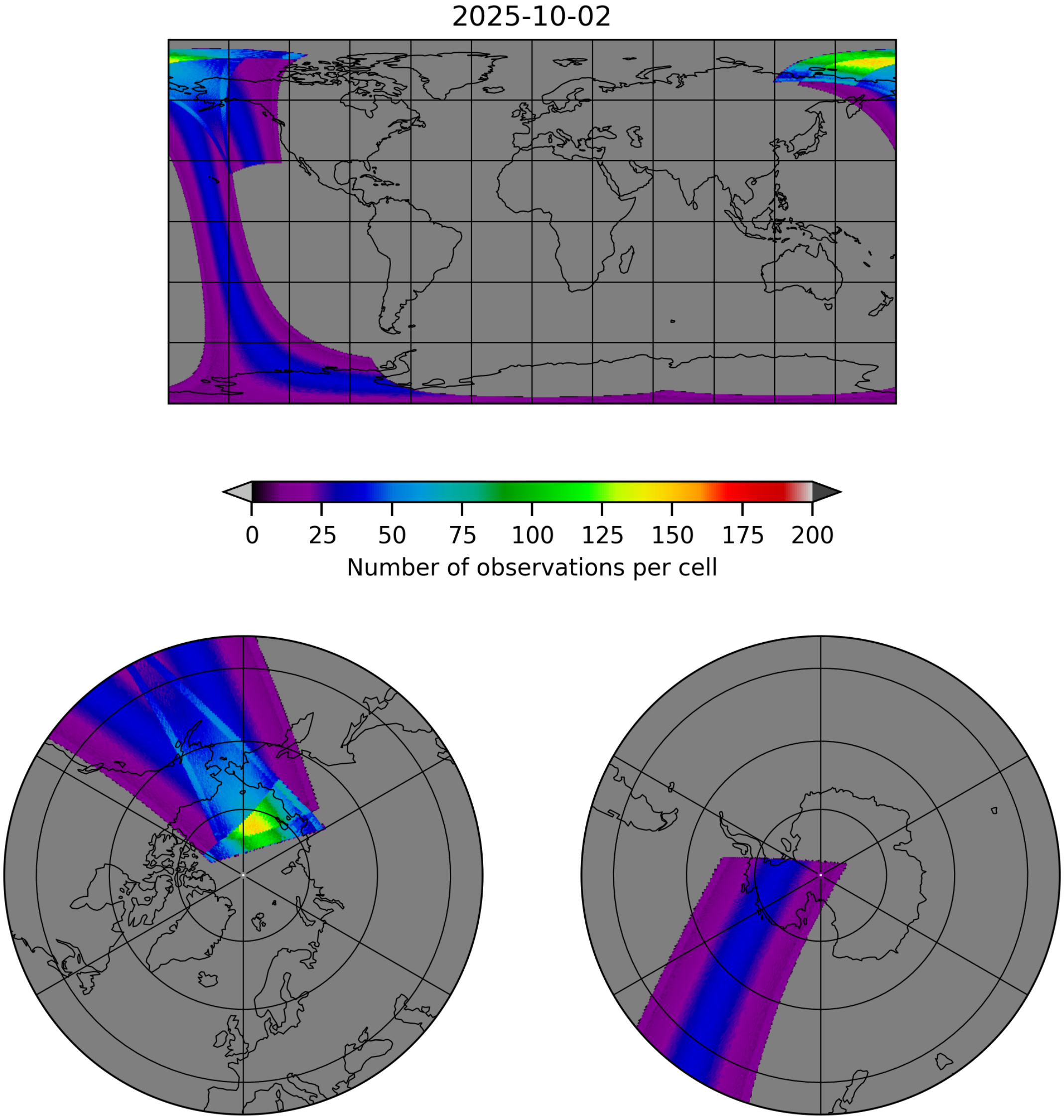

Figure 15: Map of the number of observations for 2025-10-02 to 2025-10-03

7 Zonal average

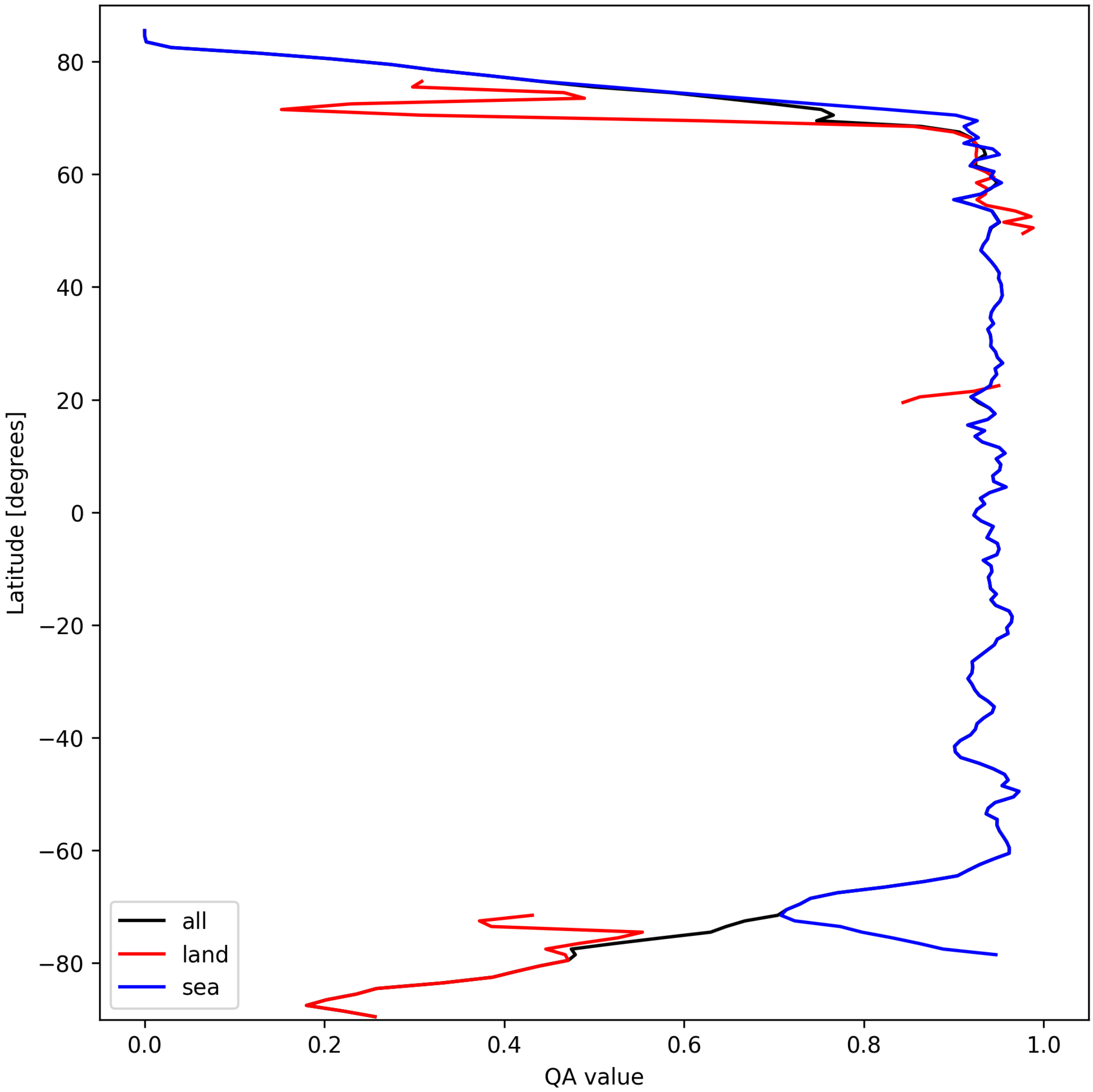

Figure 16: Zonal average of “QA value” for 2025-10-02 to 2025-10-03.

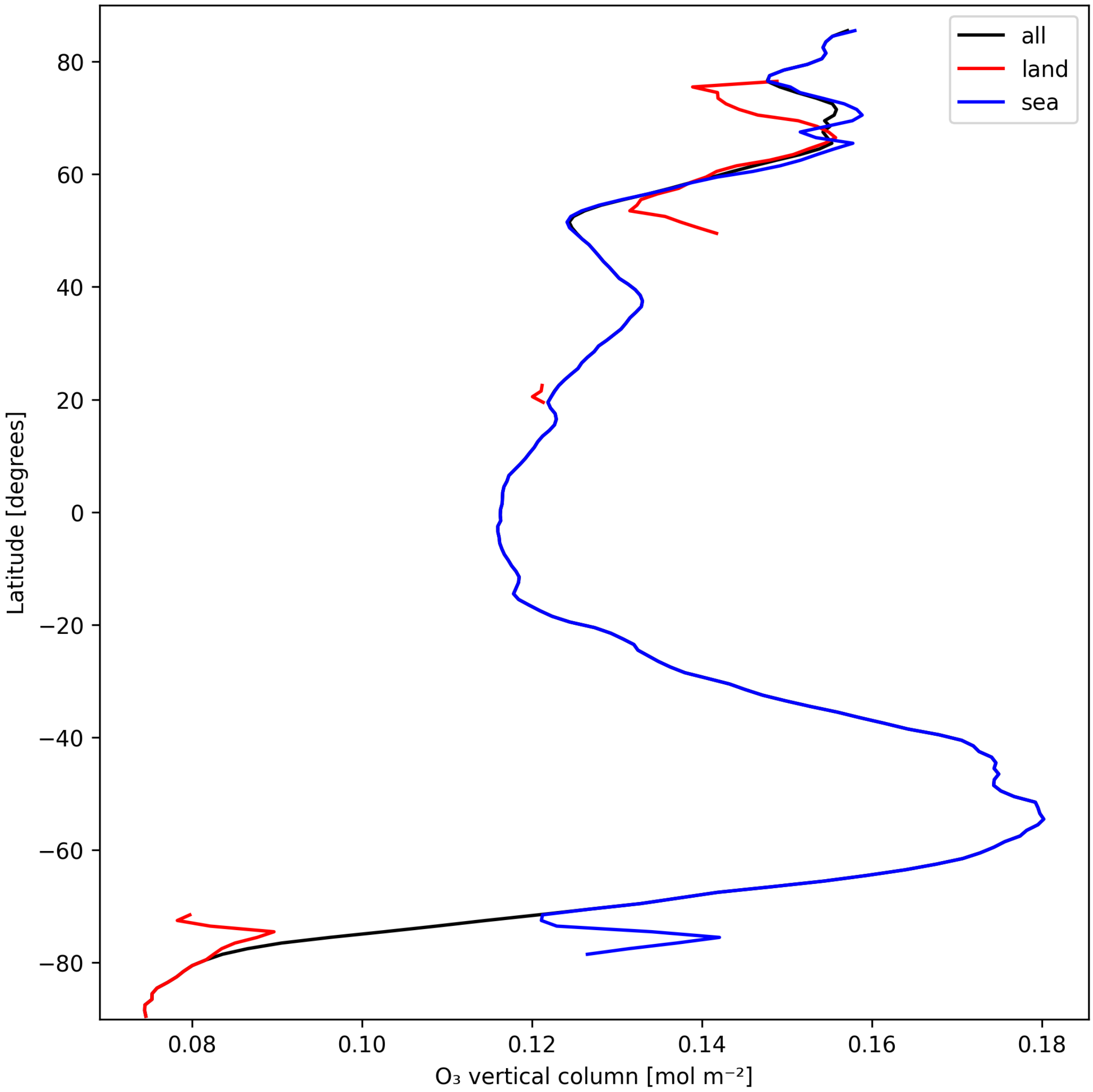

Figure 17: Zonal average of “O_3 vertical column” for 2025-10-02 to 2025-10-03.

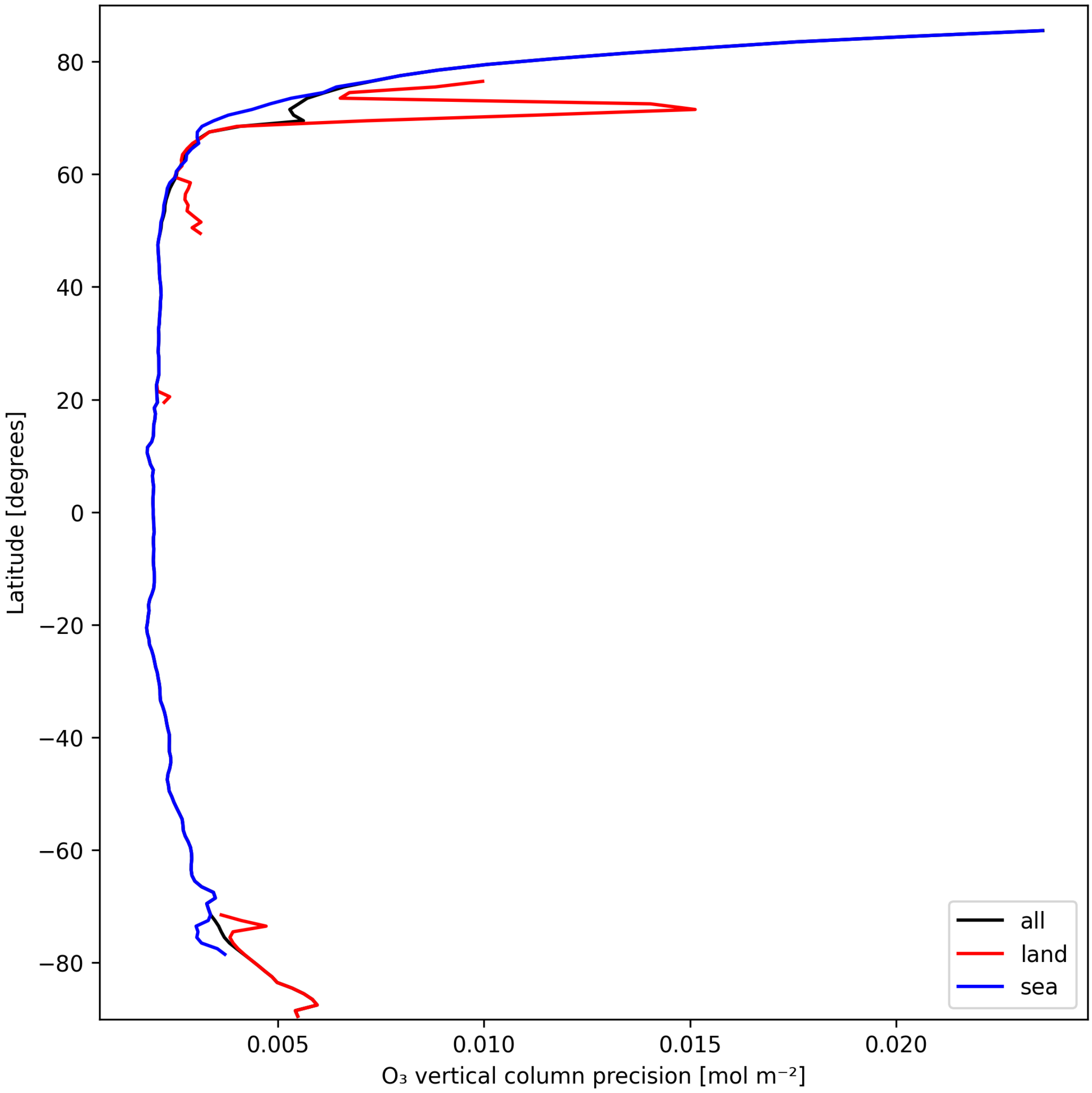

Figure 18: Zonal average of “O_3 vertical column precision” for 2025-10-02 to 2025-10-03.

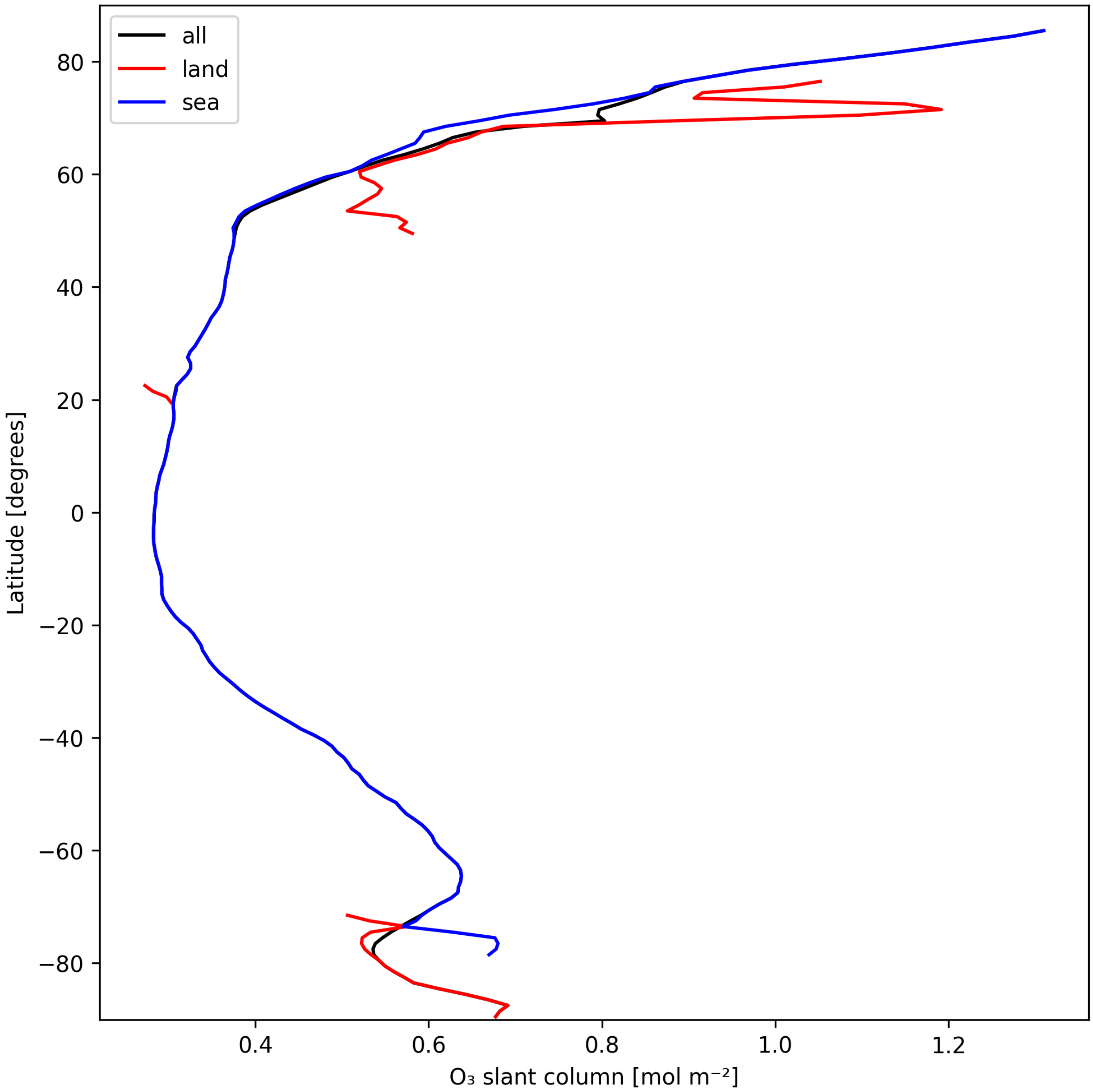

Figure 19: Zonal average of “O_3 slant column” for 2025-10-02 to 2025-10-03.

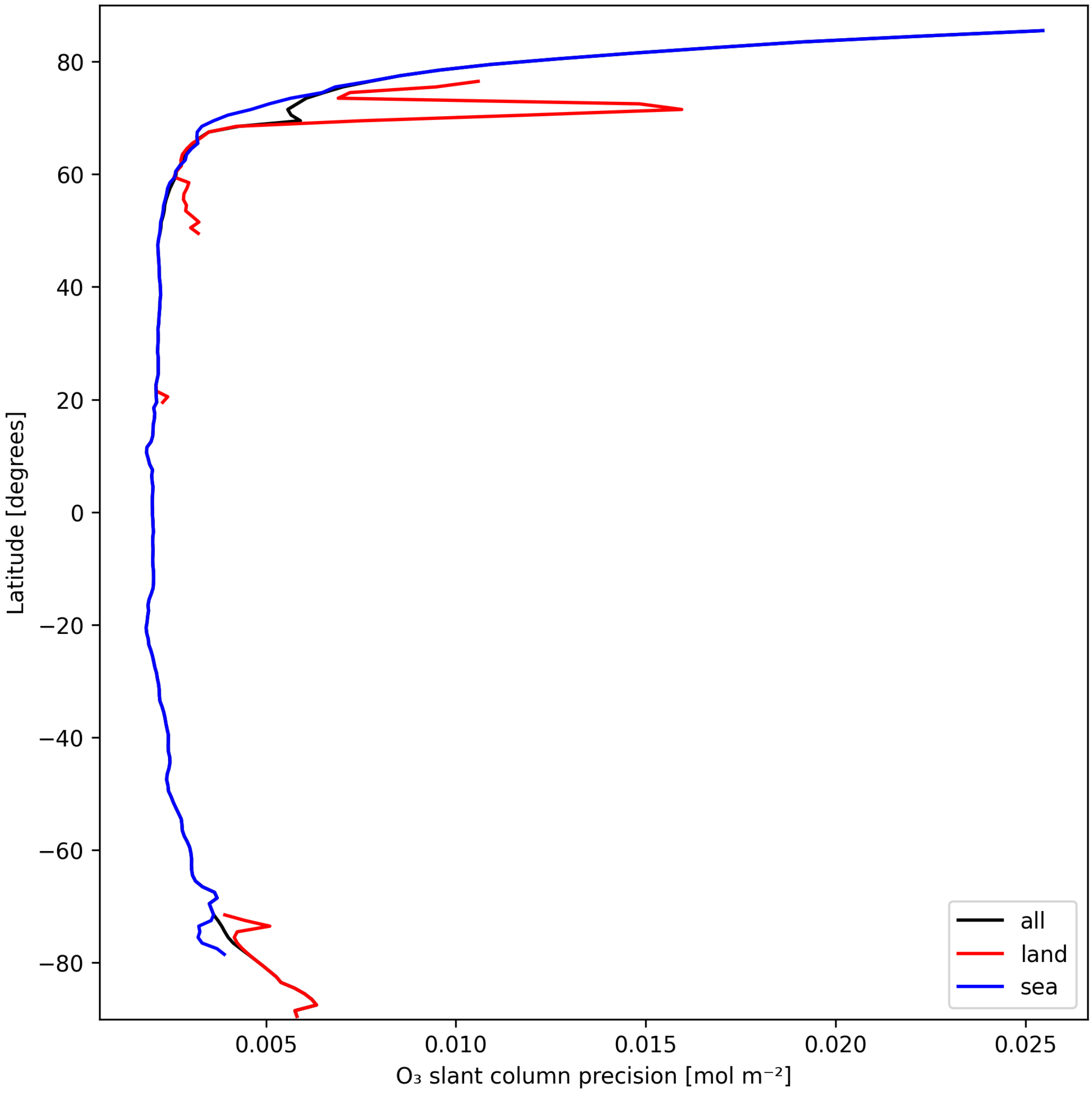

Figure 20: Zonal average of "O_3 slant column precision" for 2025-10-02 to 2025-10-03.

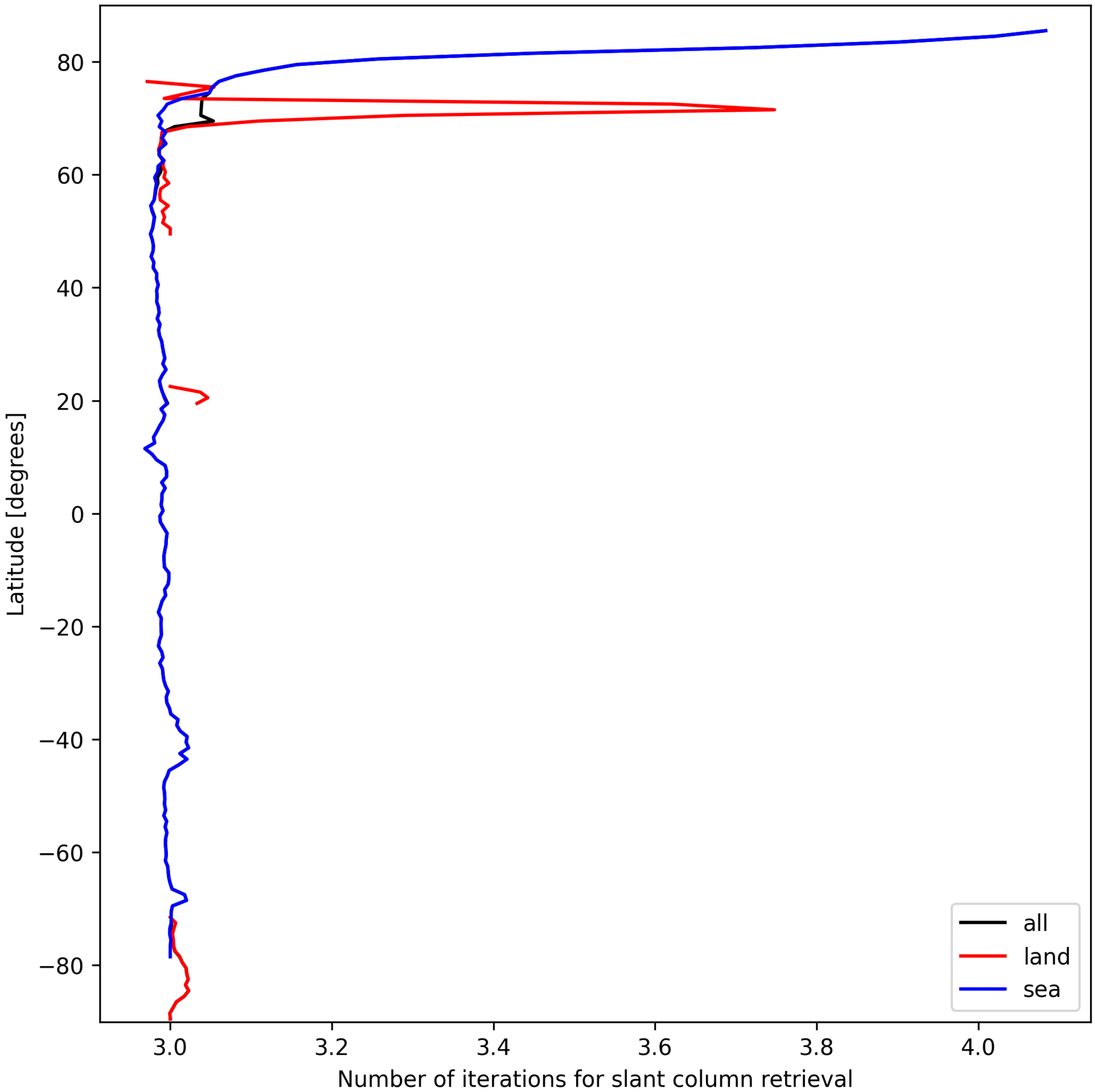

Figure 21: Zonal average of “Number of iterations for slant column retrieval” for 2025-10-02 to 2025-10-03.

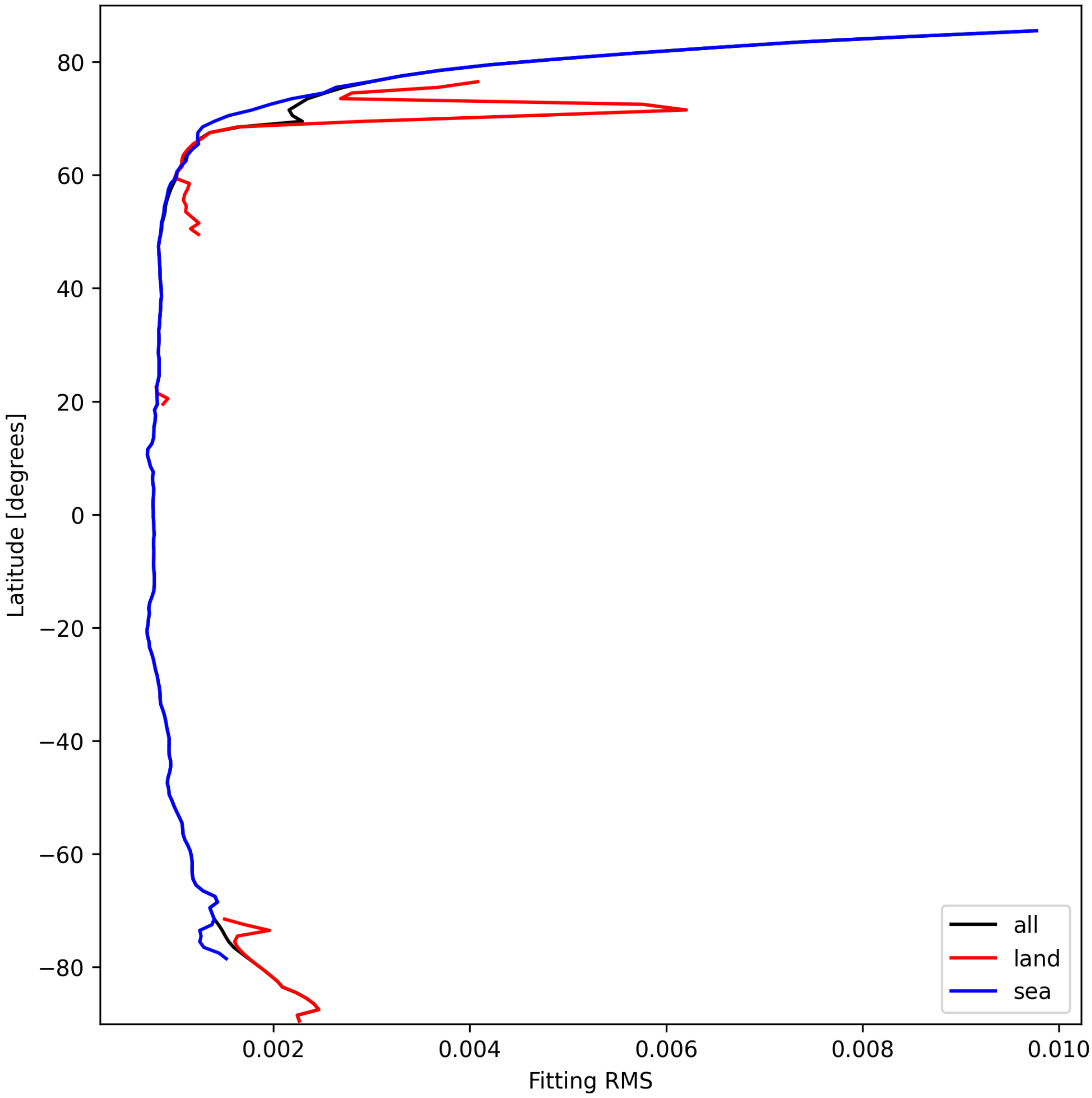

Figure 22: Zonal average of “Fitting RMS” for 2025-10-02 to 2025-10-03.

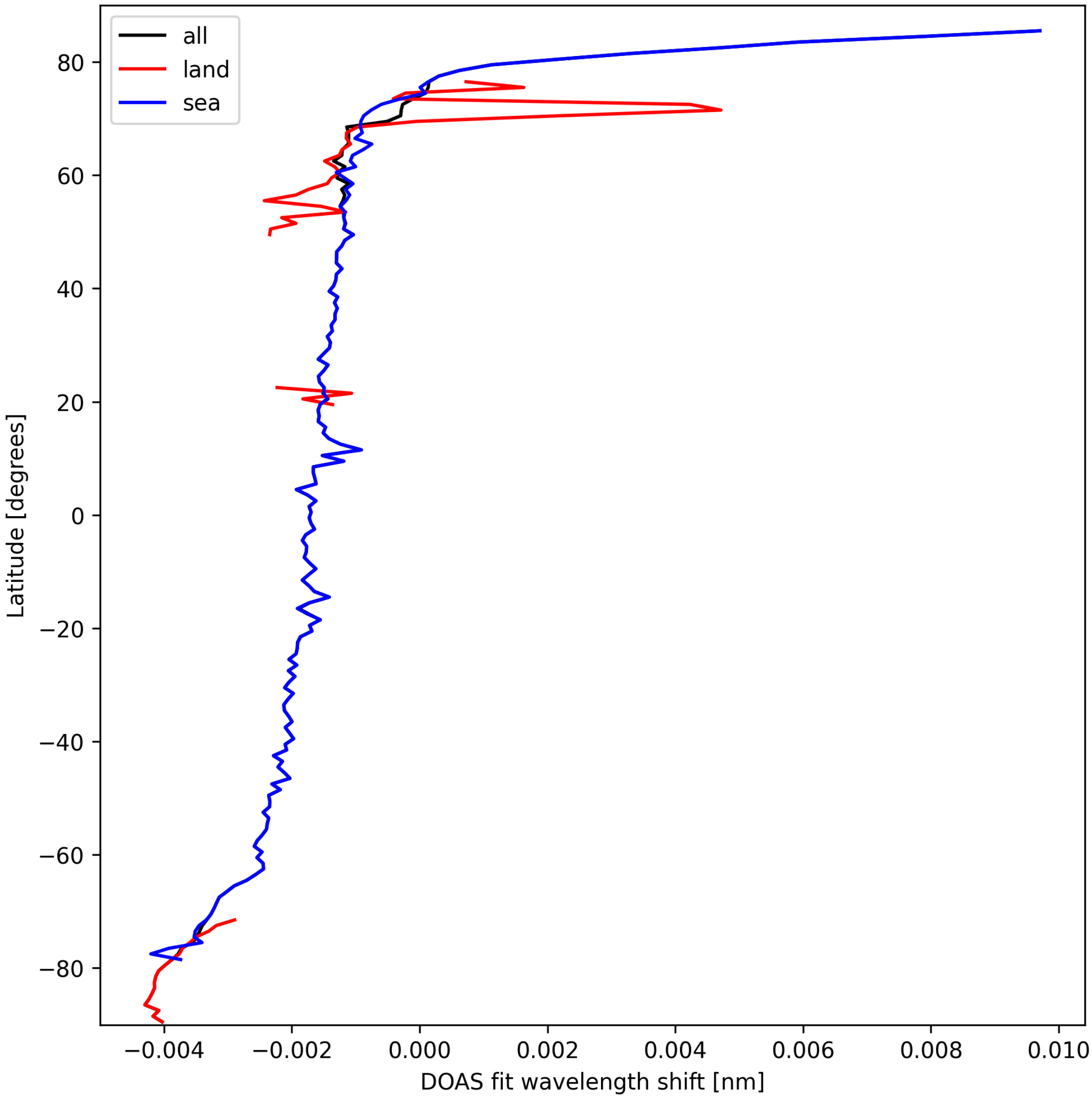

Figure 23: Zonal average of “DOAS fit wavelength shift” for 2025-10-02 to 2025-10-03.

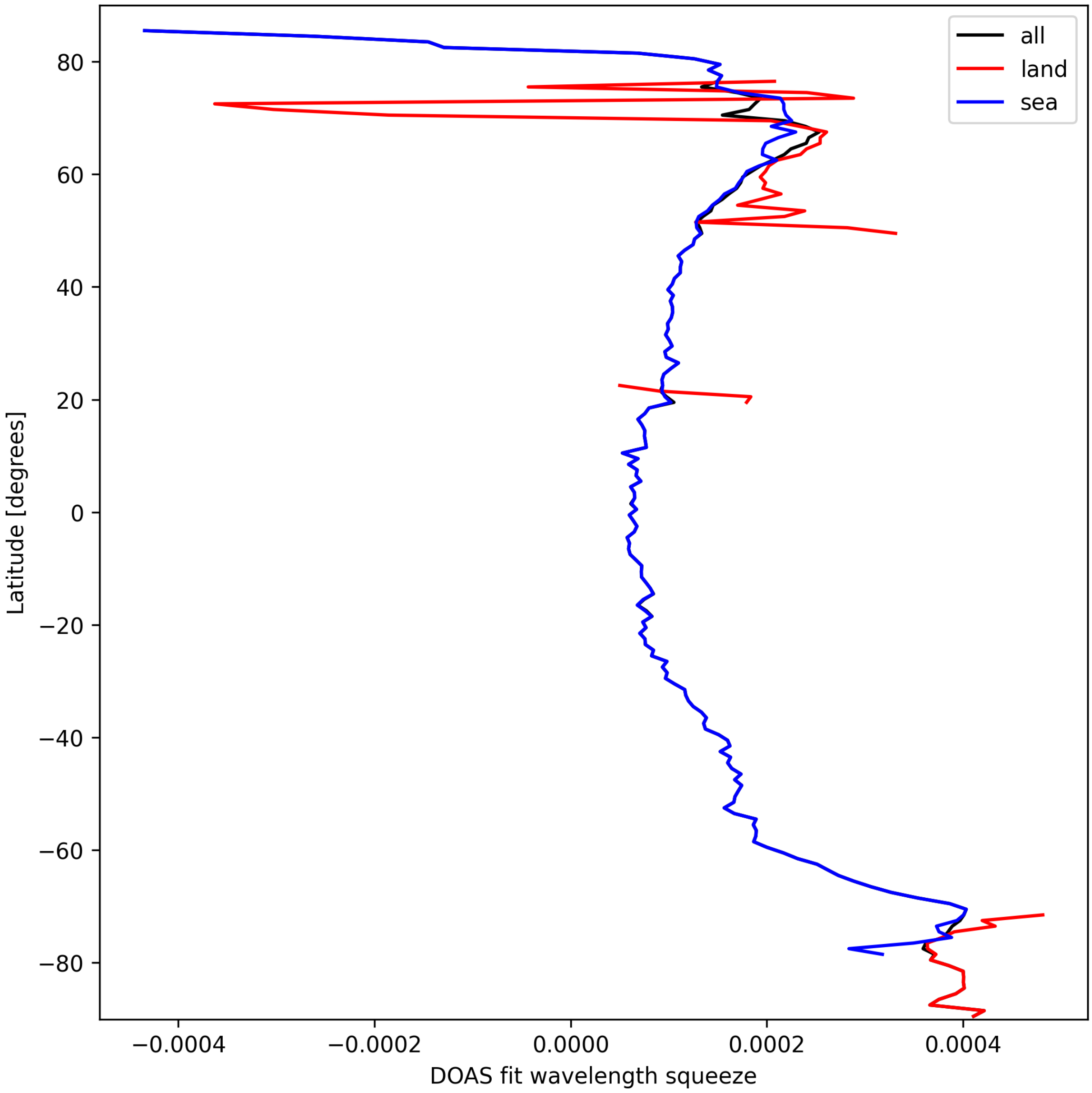

Figure 24: Zonal average of “DOAS fit wavelength squeeze” for 2025-10-02 to 2025-10-03.

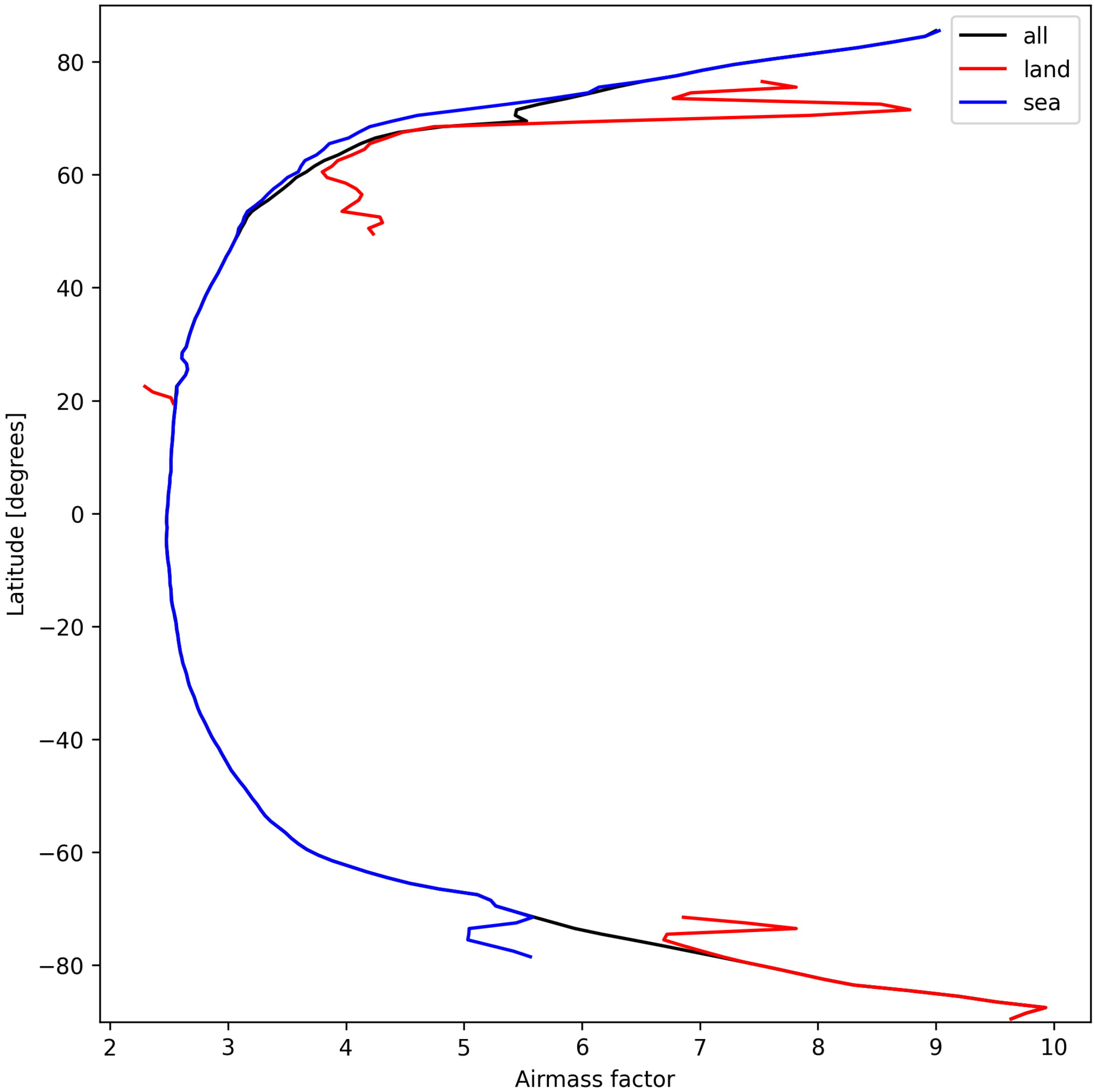

Figure 25: Zonal average of “Airmass factor” for 2025-10-02 to 2025-10-03.

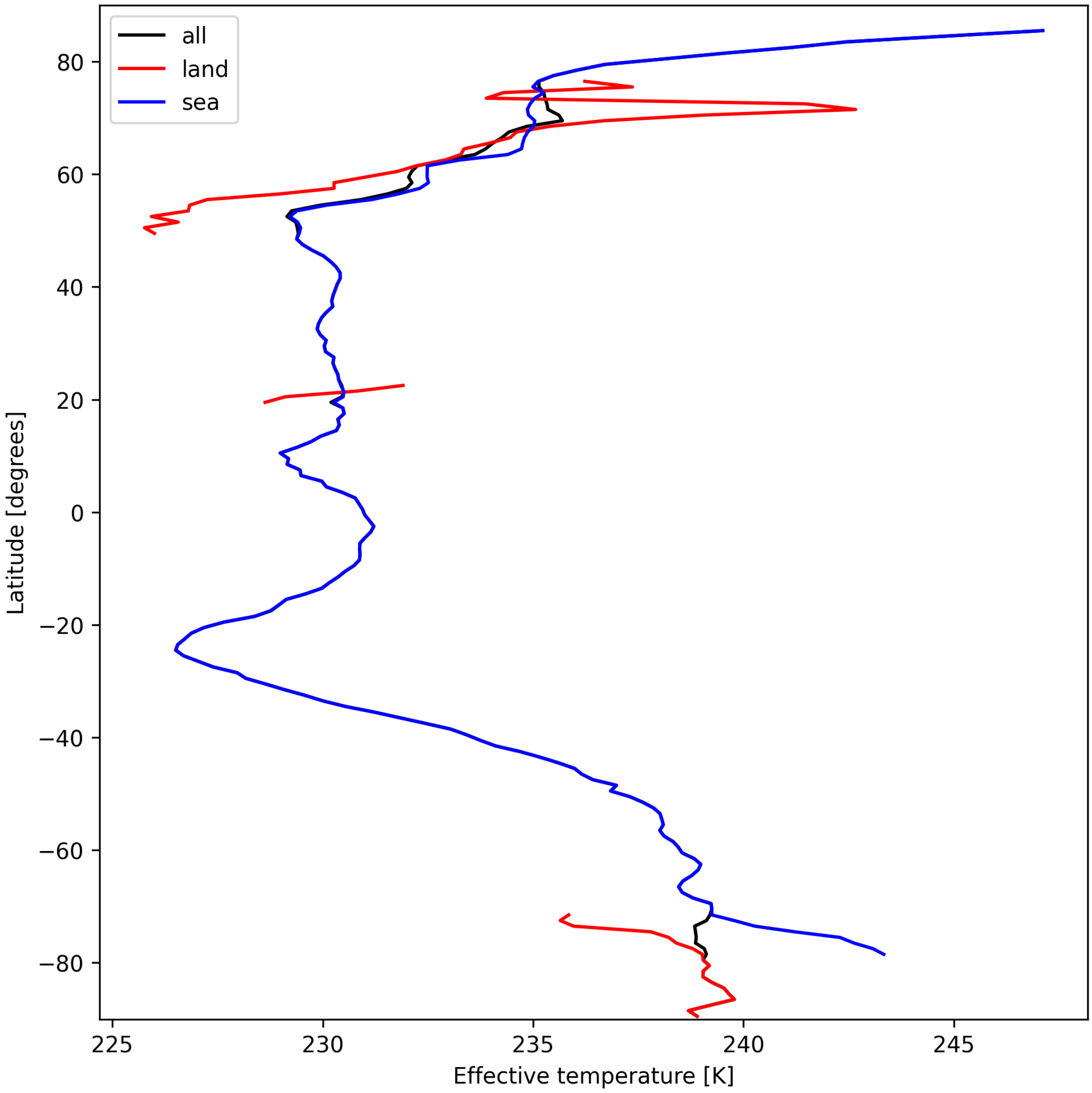

Figure 26: Zonal average of “Effective temperature” for 2025-10-02 to 2025-10-03.

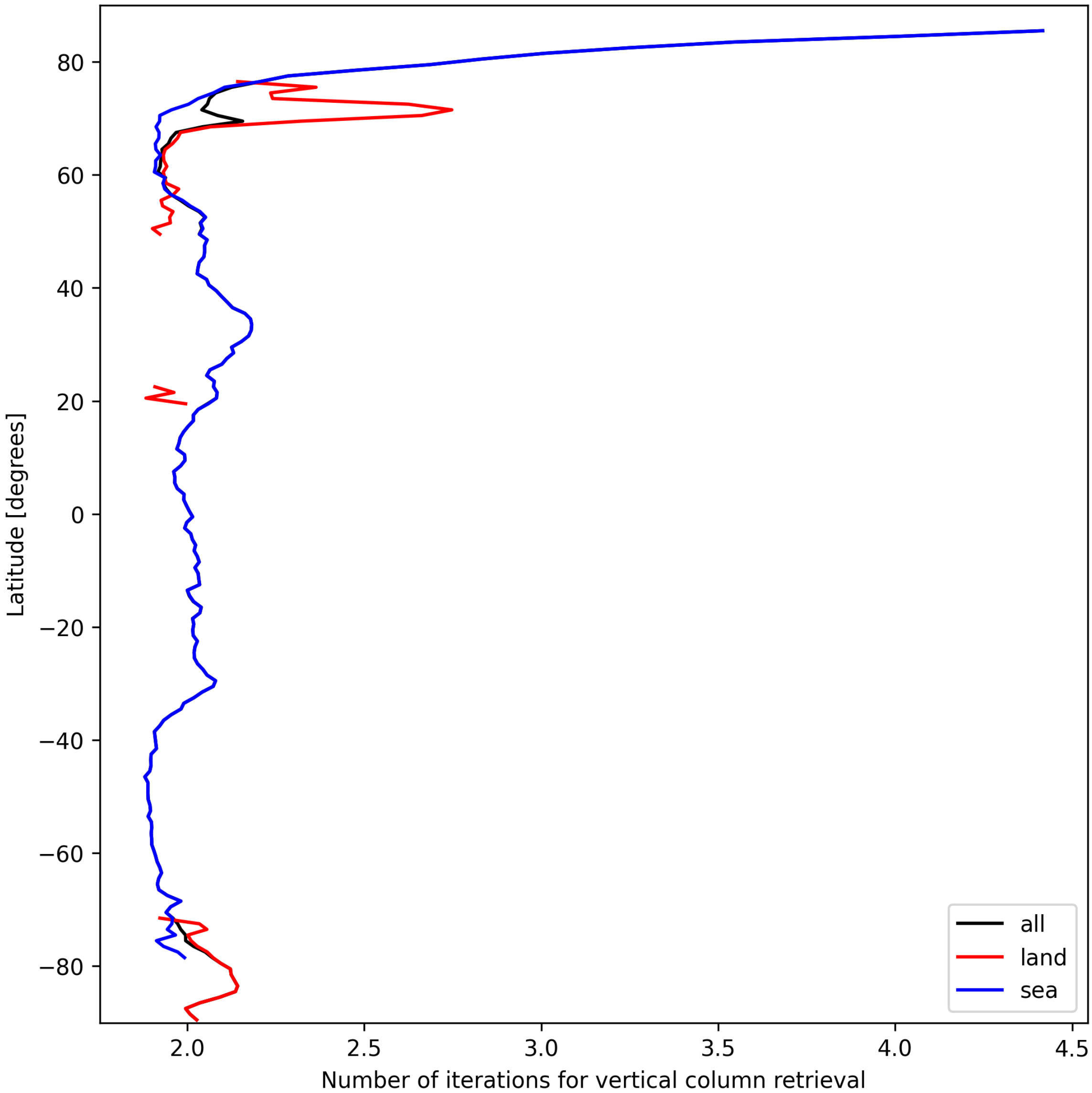

Figure 27: Zonal average of “Number of iterations for vertical column retrieval” for 2025-10-02 to 2025-10-03.

8 Histograms

The definitions of the parameters given in this section can be found in section 2.

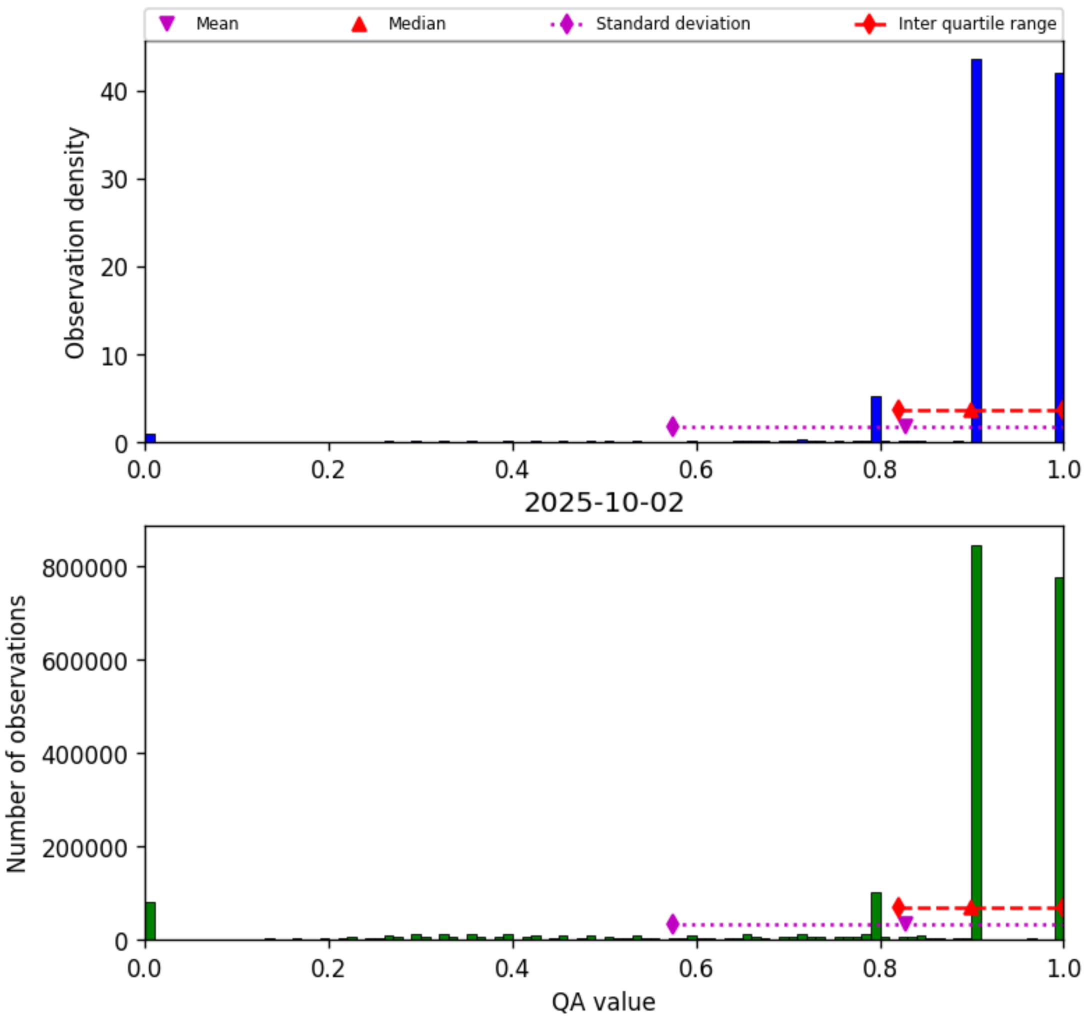

Figure 28: Histogram of “QA value” for 2025-10-02 to 2025-10-03

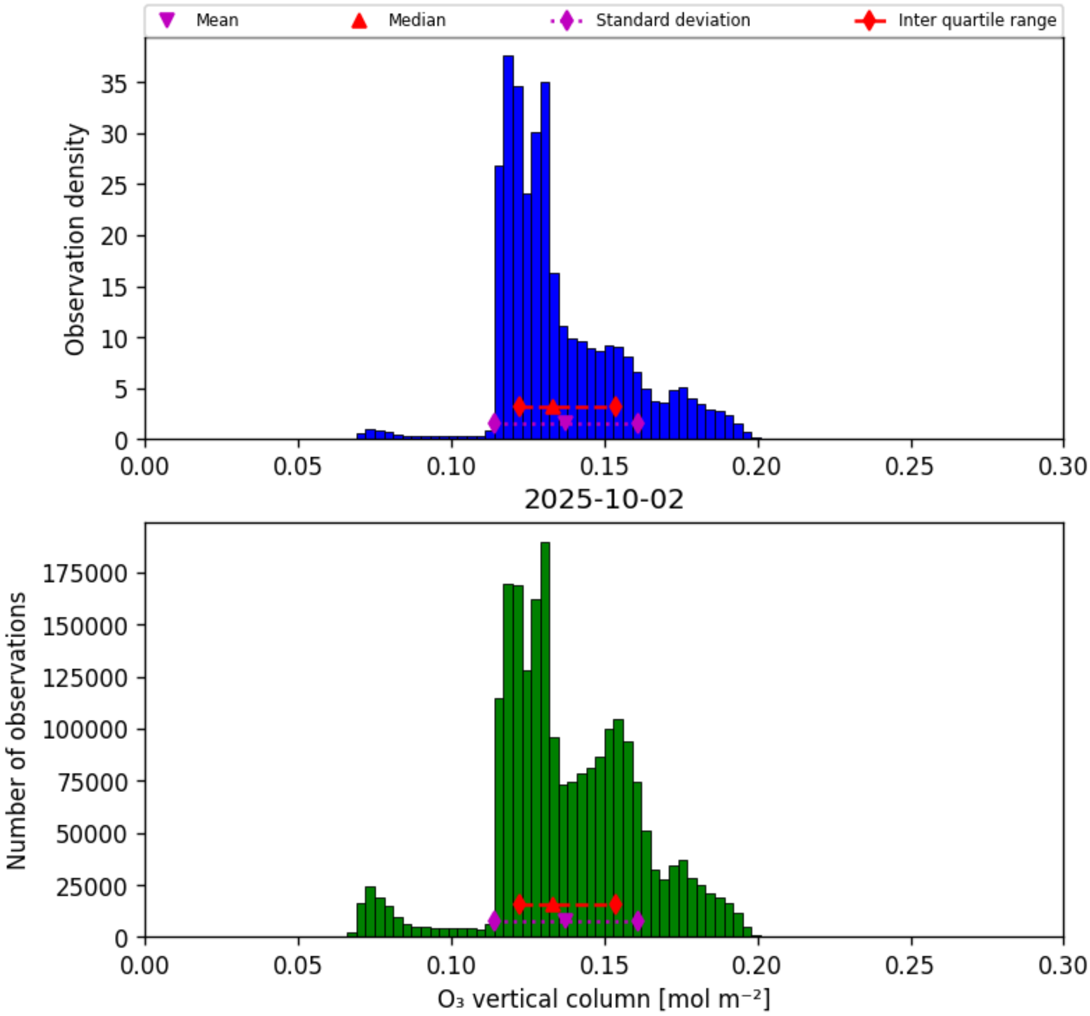

Figure 29: Histogram of "O_3 vertical column" for 2025-10-02 to 2025-10-03

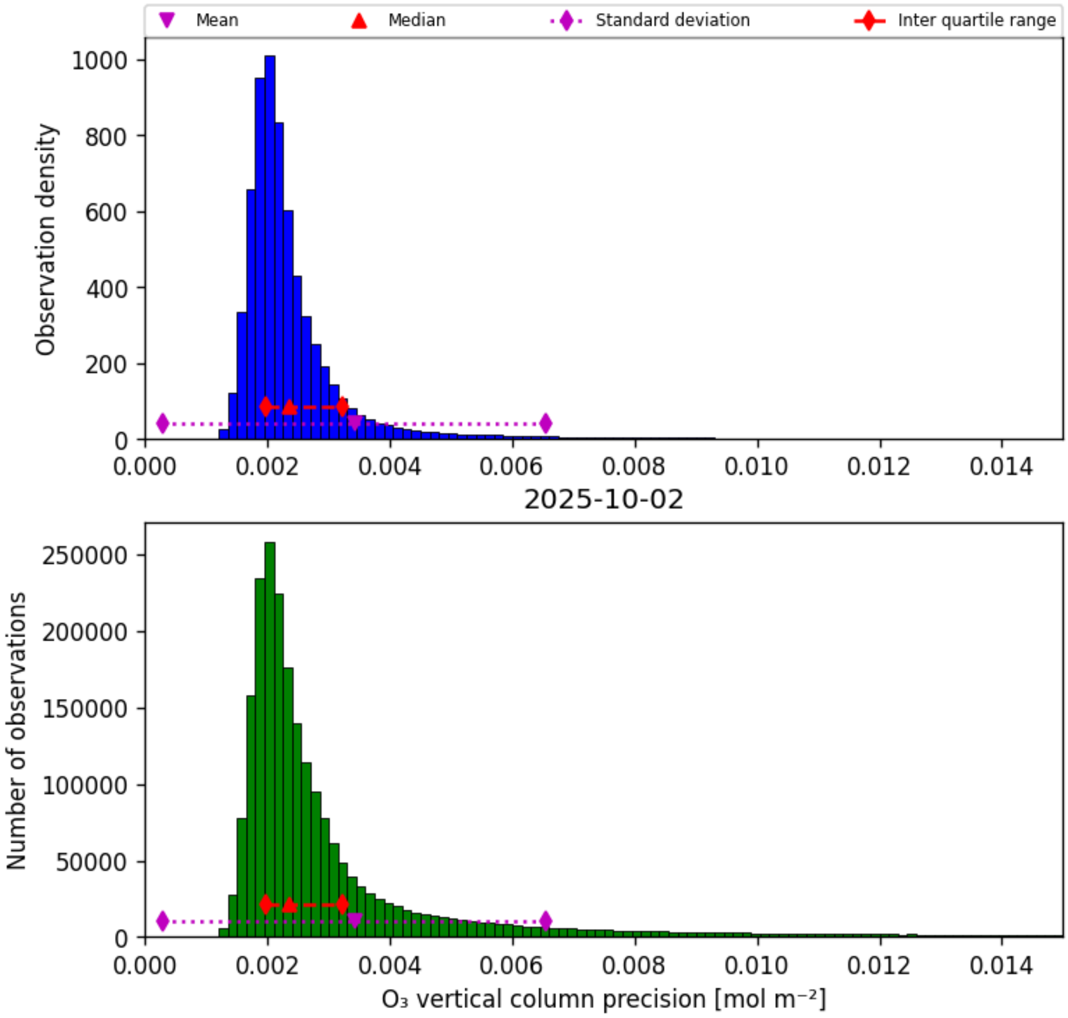

Figure 30: Histogram of "O_3 vertical column precision" for 2025-10-02 to 2025-10-03

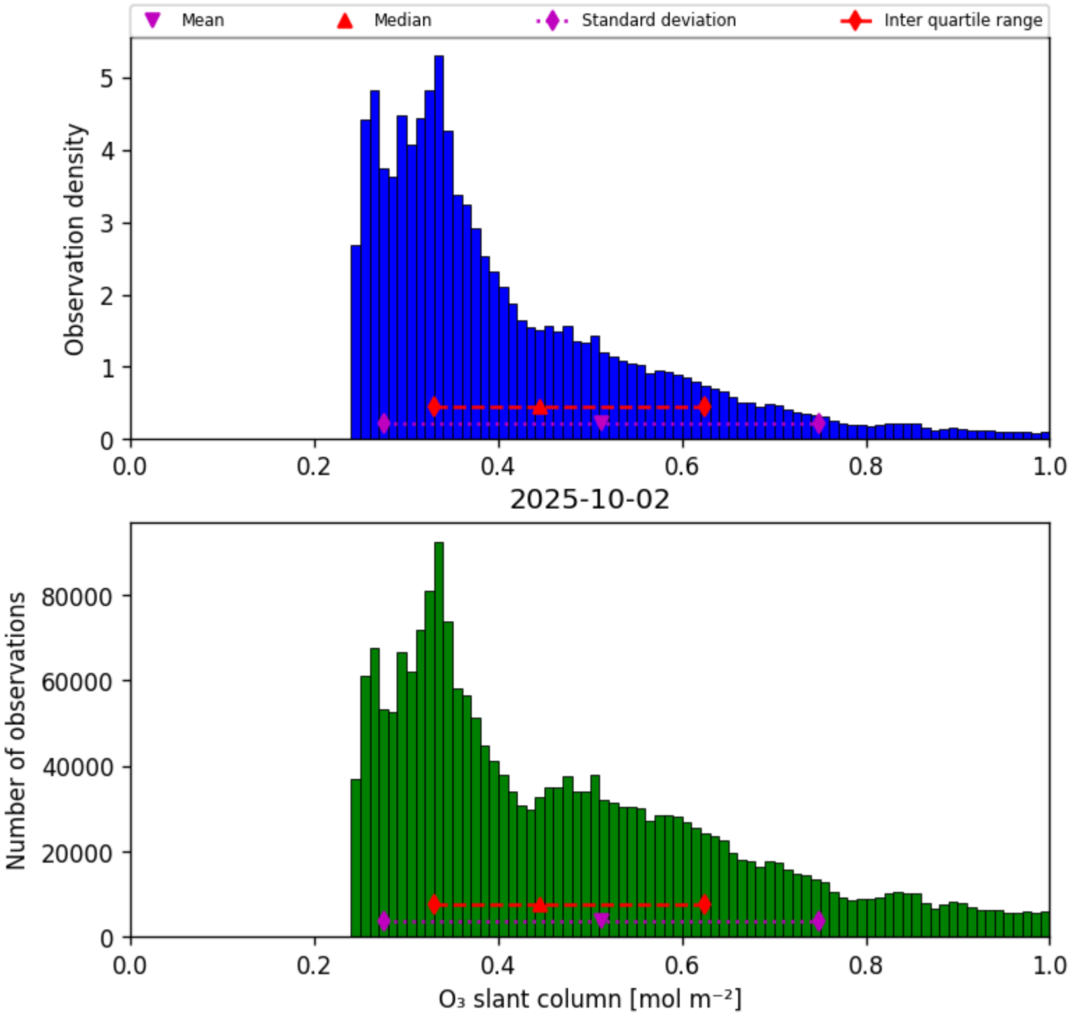

Figure 31: Histogram of “O_3 slant column” for 2025-10-02 to 2025-10-03

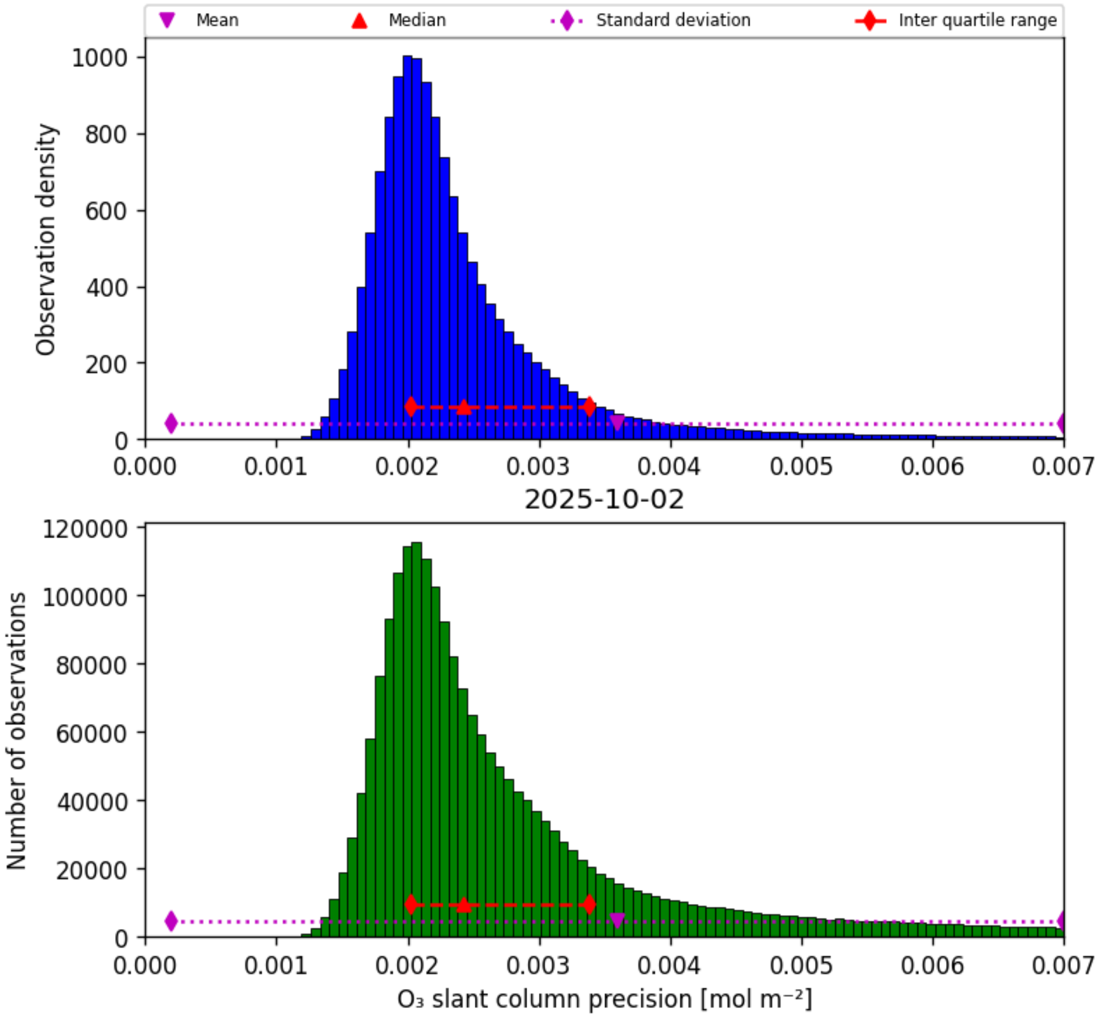

Figure 32: Histogram of “O_3 slant column precision” for 2025-10-02 to 2025-10-03

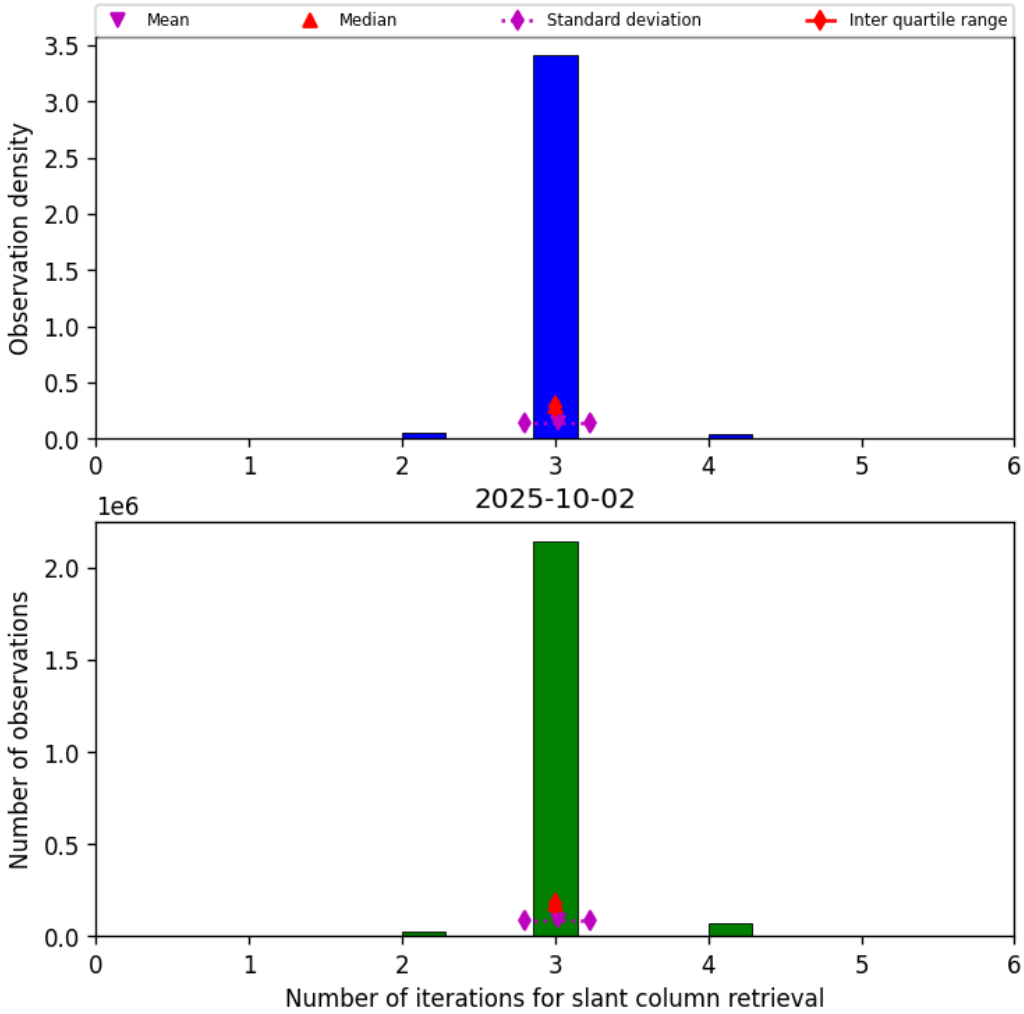

Figure 33: Histogram of “Number of iterations for slant column retrieval” for 2025-10-02 to 2025-10-03

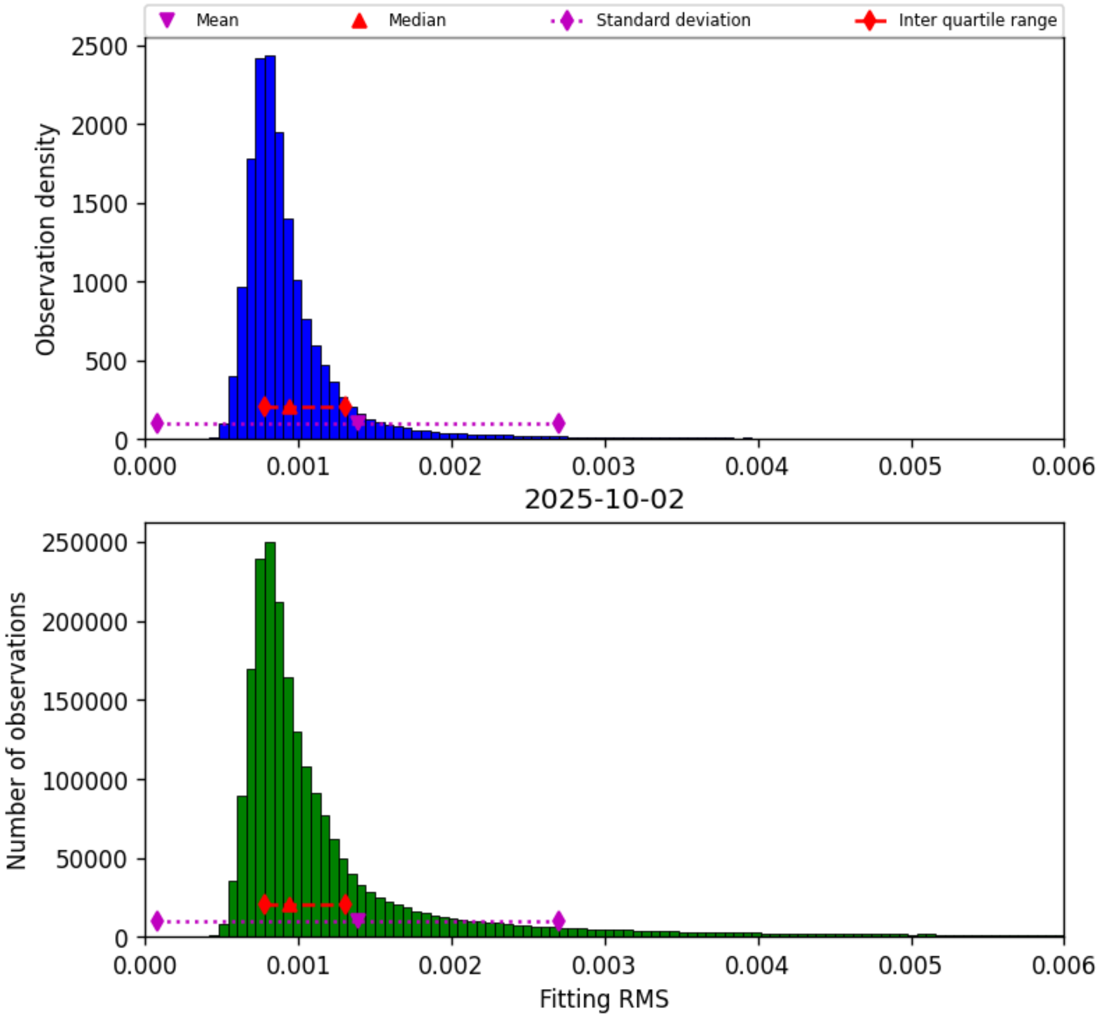

Figure 34: Histogram of “Fitting RMS” for 2025-10-02 to 2025-10-03

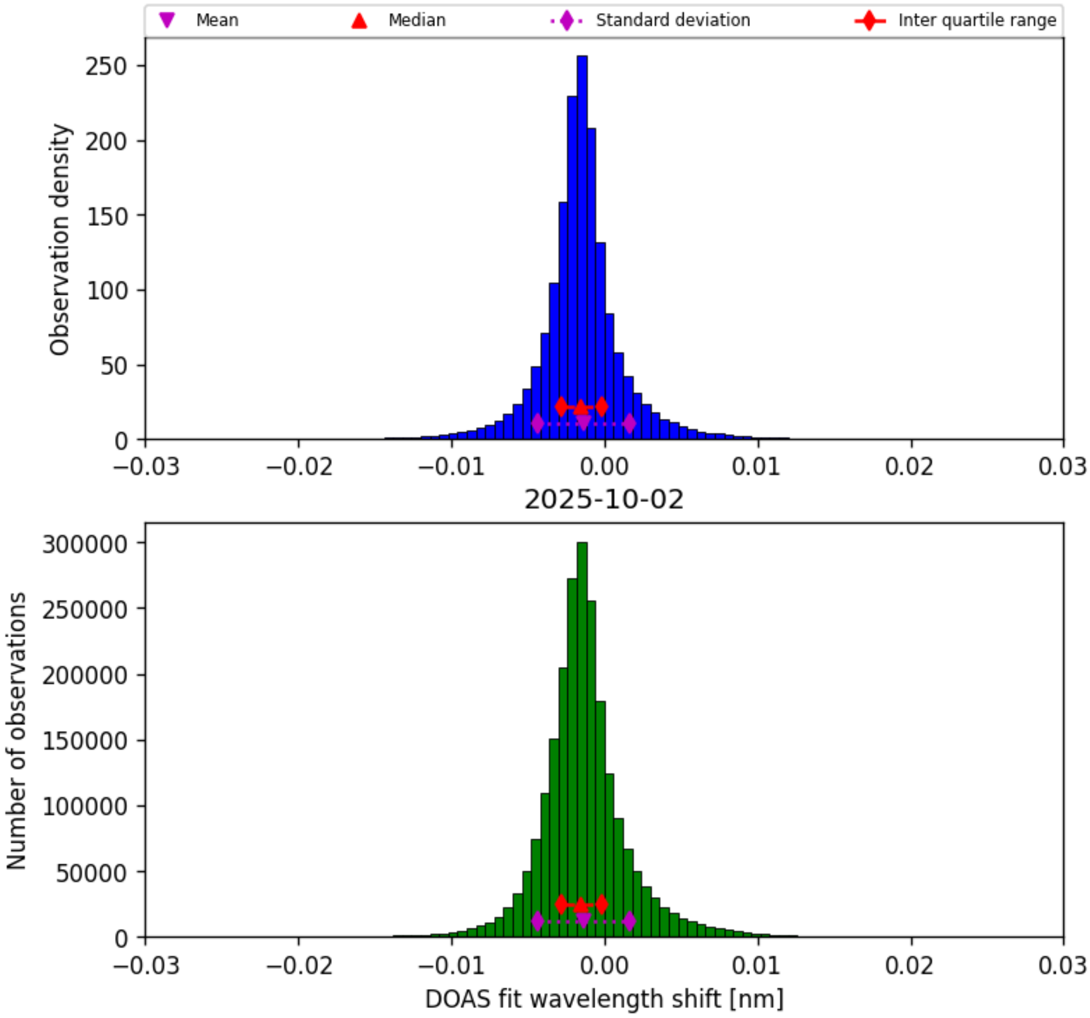

Figure 35: Histogram of “DOAS fit wavelength shift” for 2025-10-02 to 2025-10-03

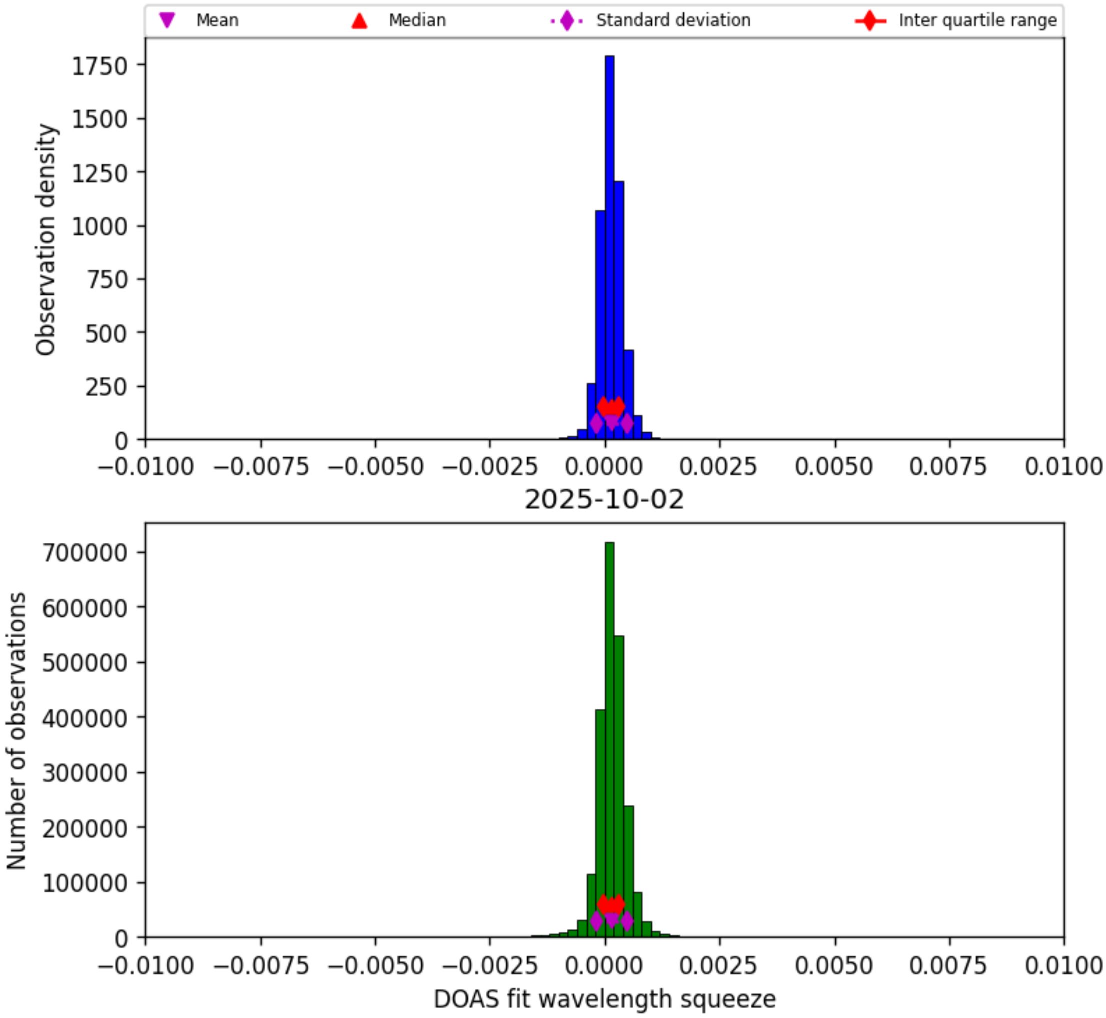

Figure 36: Histogram of “DOAS fit wavelength squeeze” for 2025-10-02 to 2025-10-03

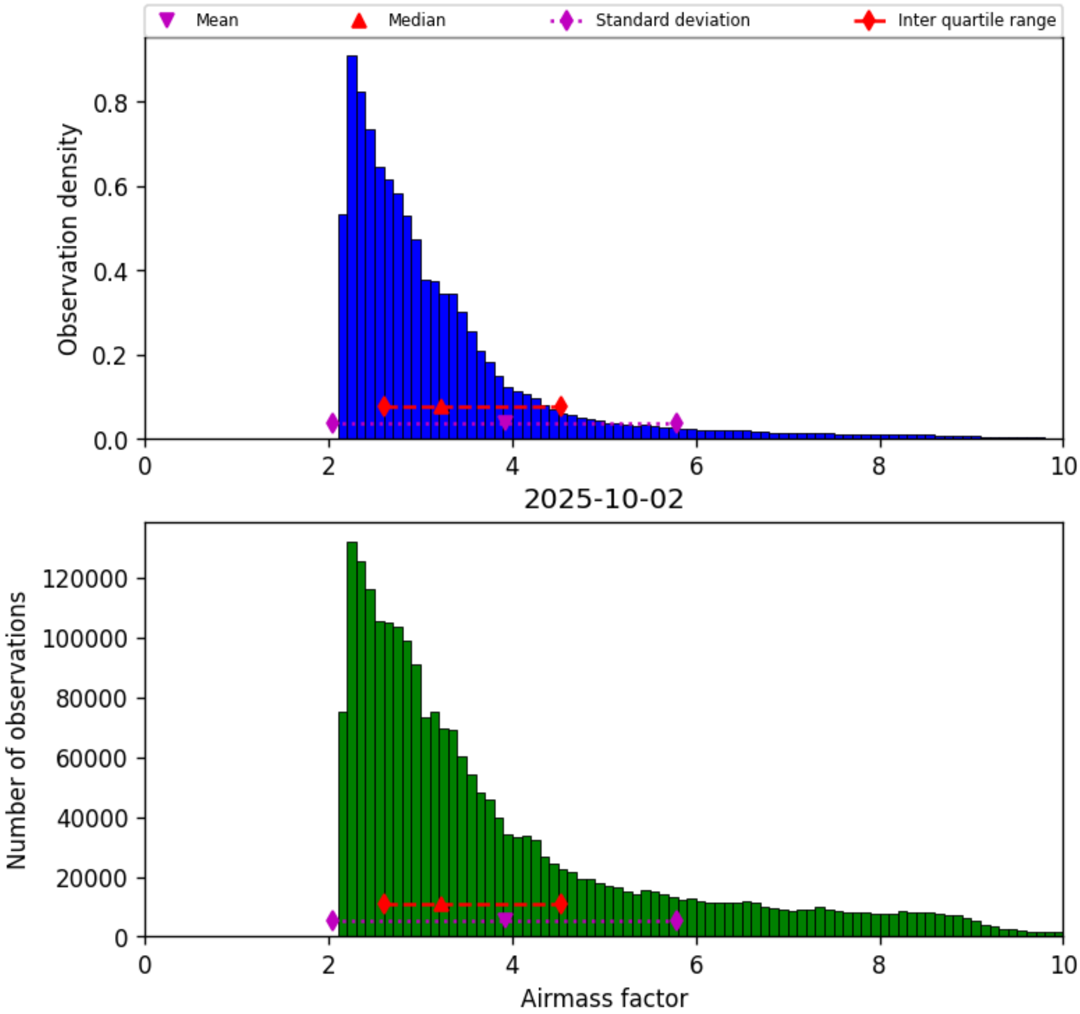

Figure 37: Histogram of “Airmass factor” for 2025-10-02 to 2025-10-03

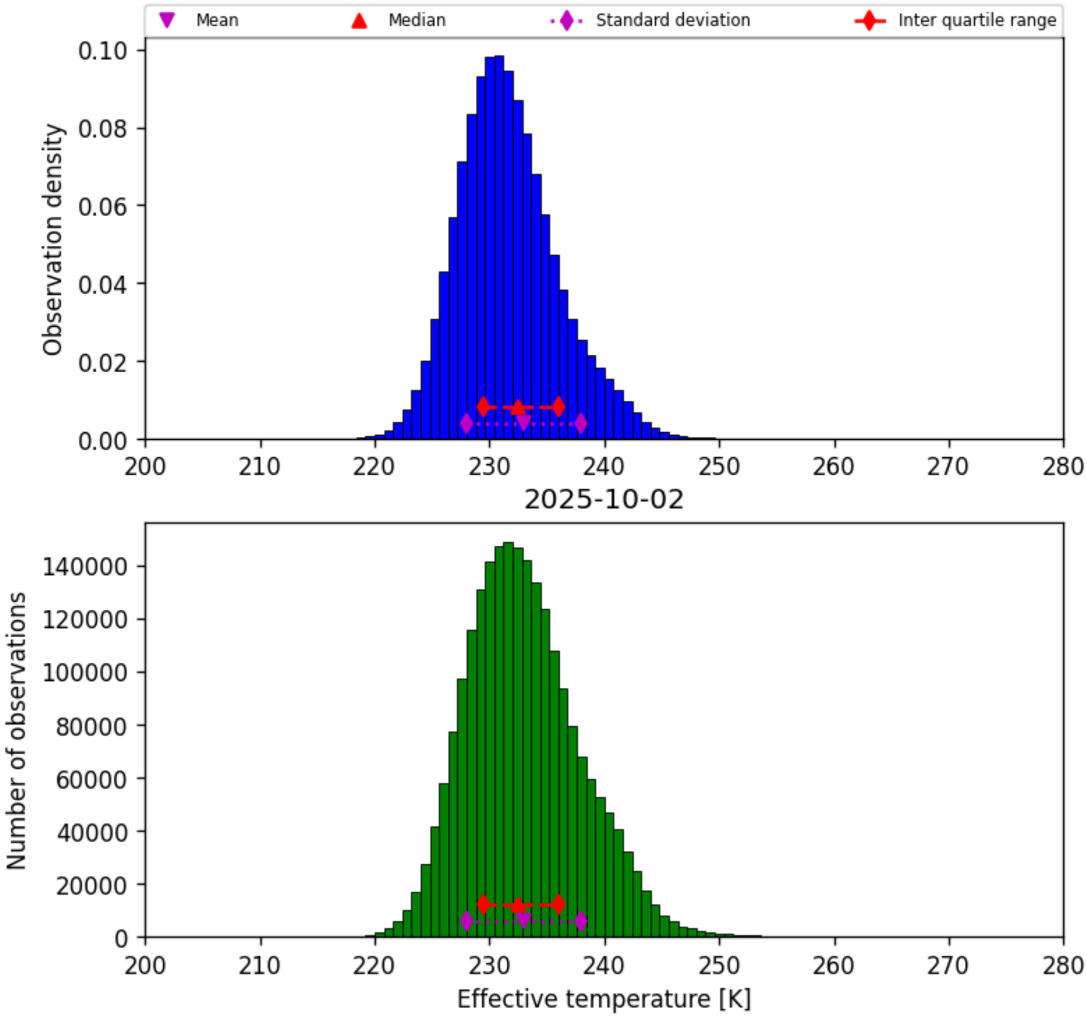

Figure 38: Histogram of “Effective temperature” for 2025-10-02 to 2025-10-03

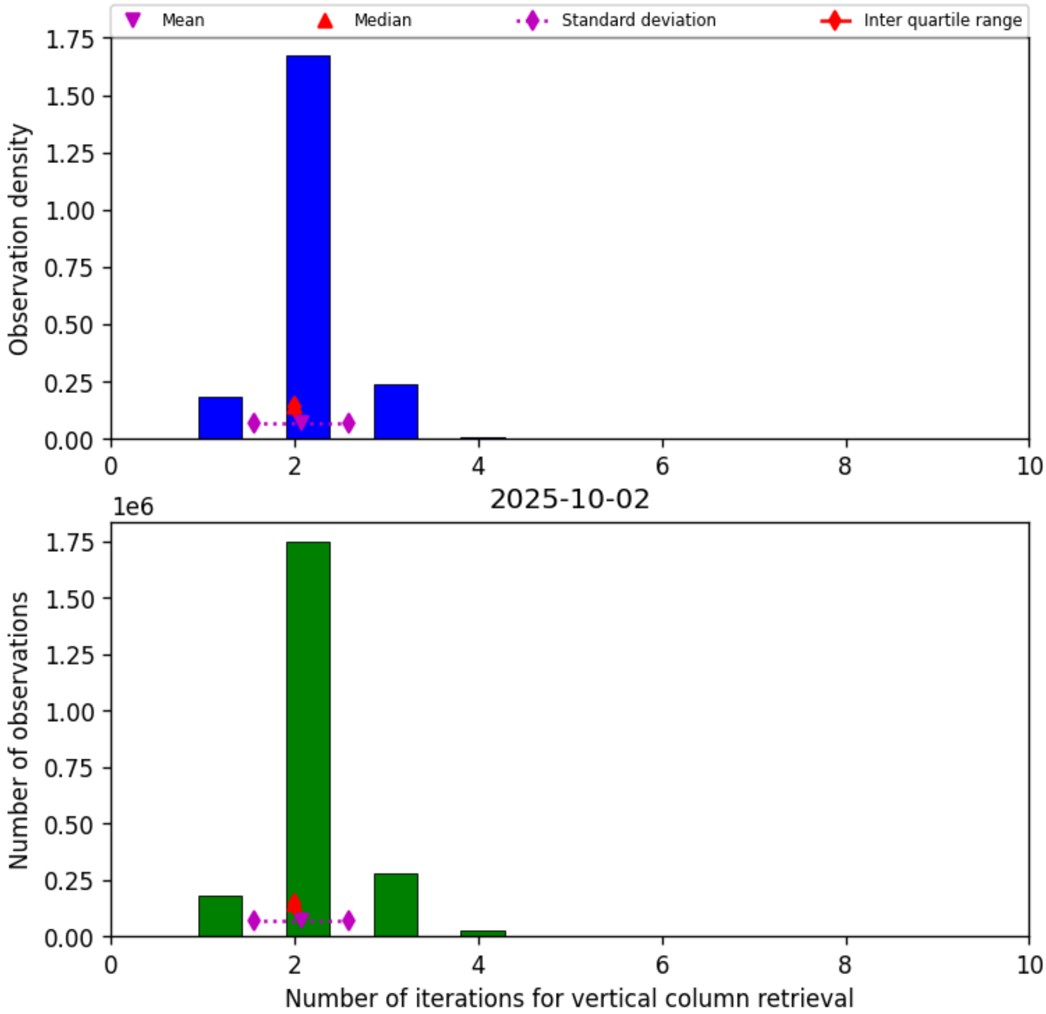

Figure 39: Histogram of “Number of iterations for vertical column retrieval” for 2025-10-02 to 2025-10-03

9 Along track statistics

The TROPOMI instrument uses different binned detector rows for different viewing directions. In this section statistics are presented for each of the binned rows in the instrument.

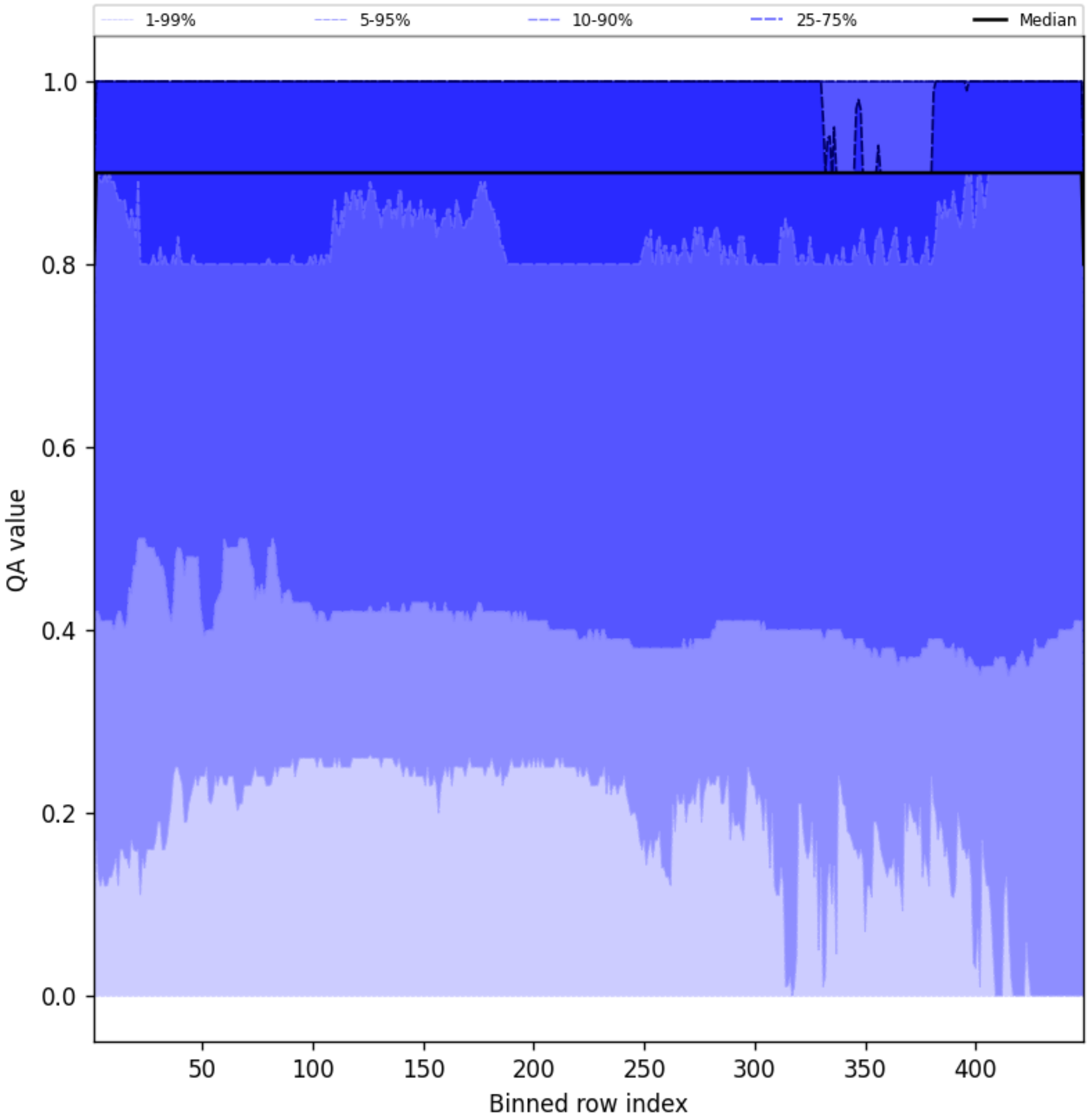

Figure 40: Along track statistics of “QA value” for 2025-10-02 to 2025-10-03

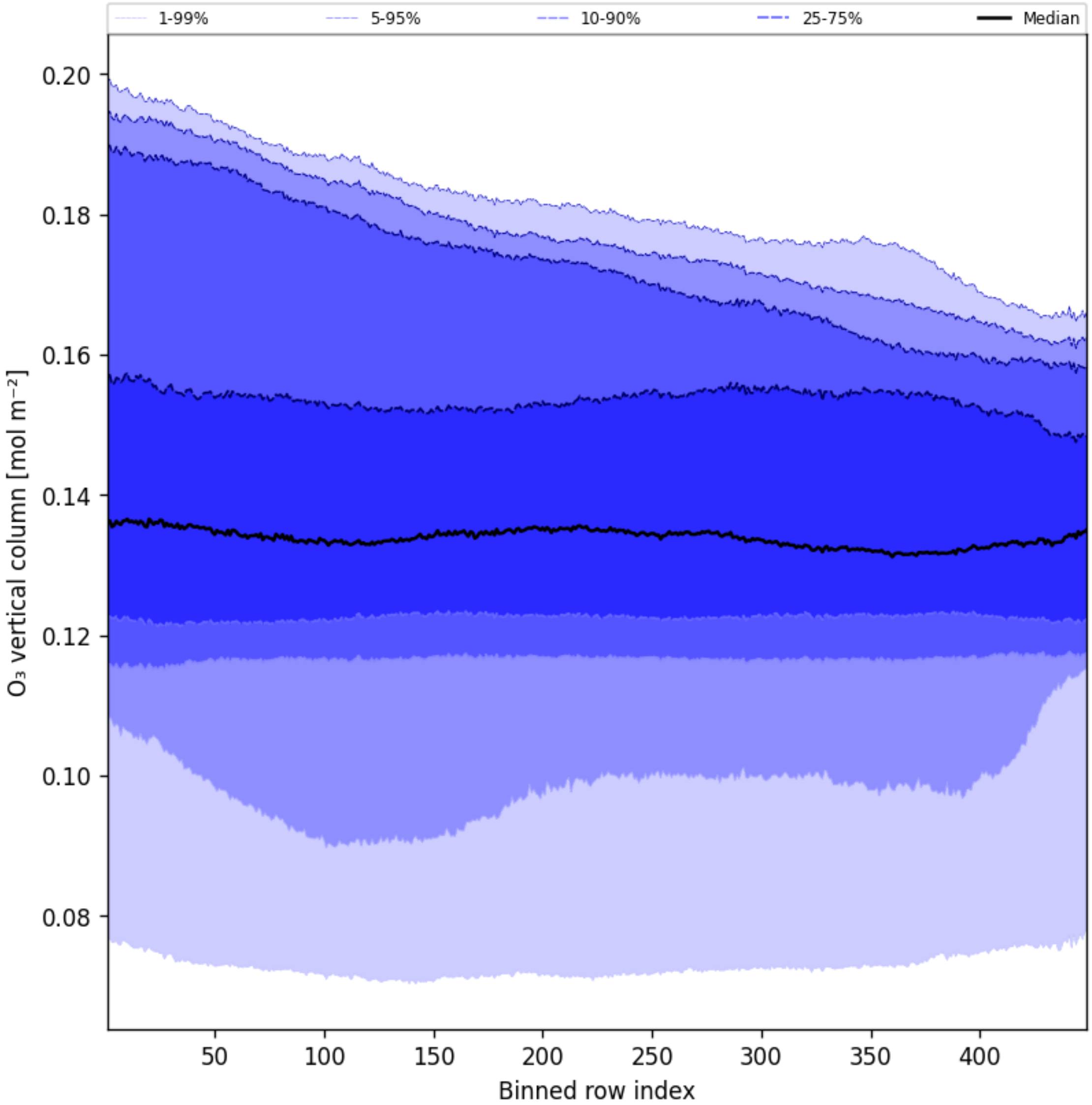

Figure 41: Along track statistics of “O_3 vertical column” for 2025-10-02 to 2025-10-03

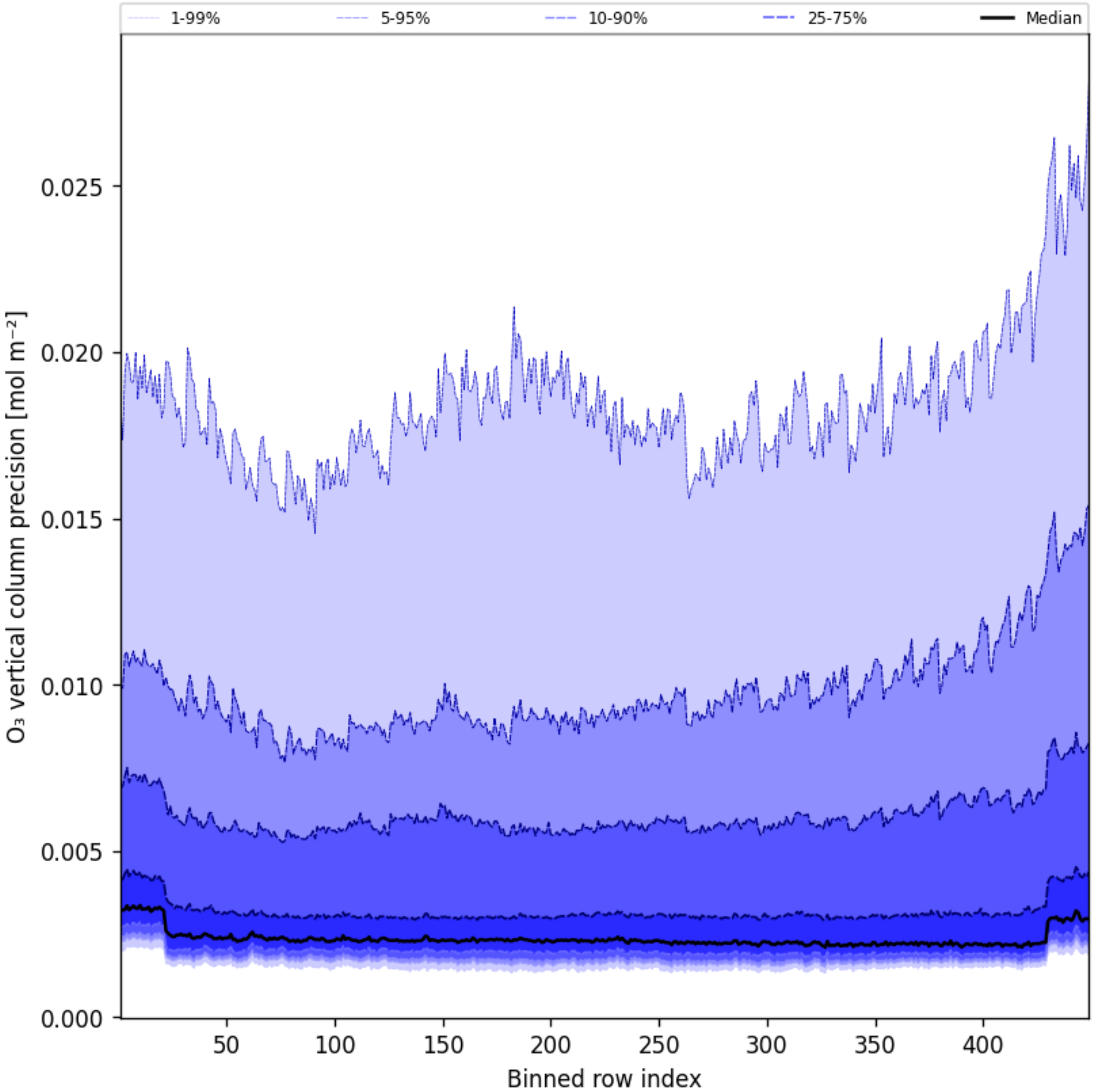

Figure 42: Along track statistics of "O_3 vertical column precision" for 2025-10-02 to 2025-10-03

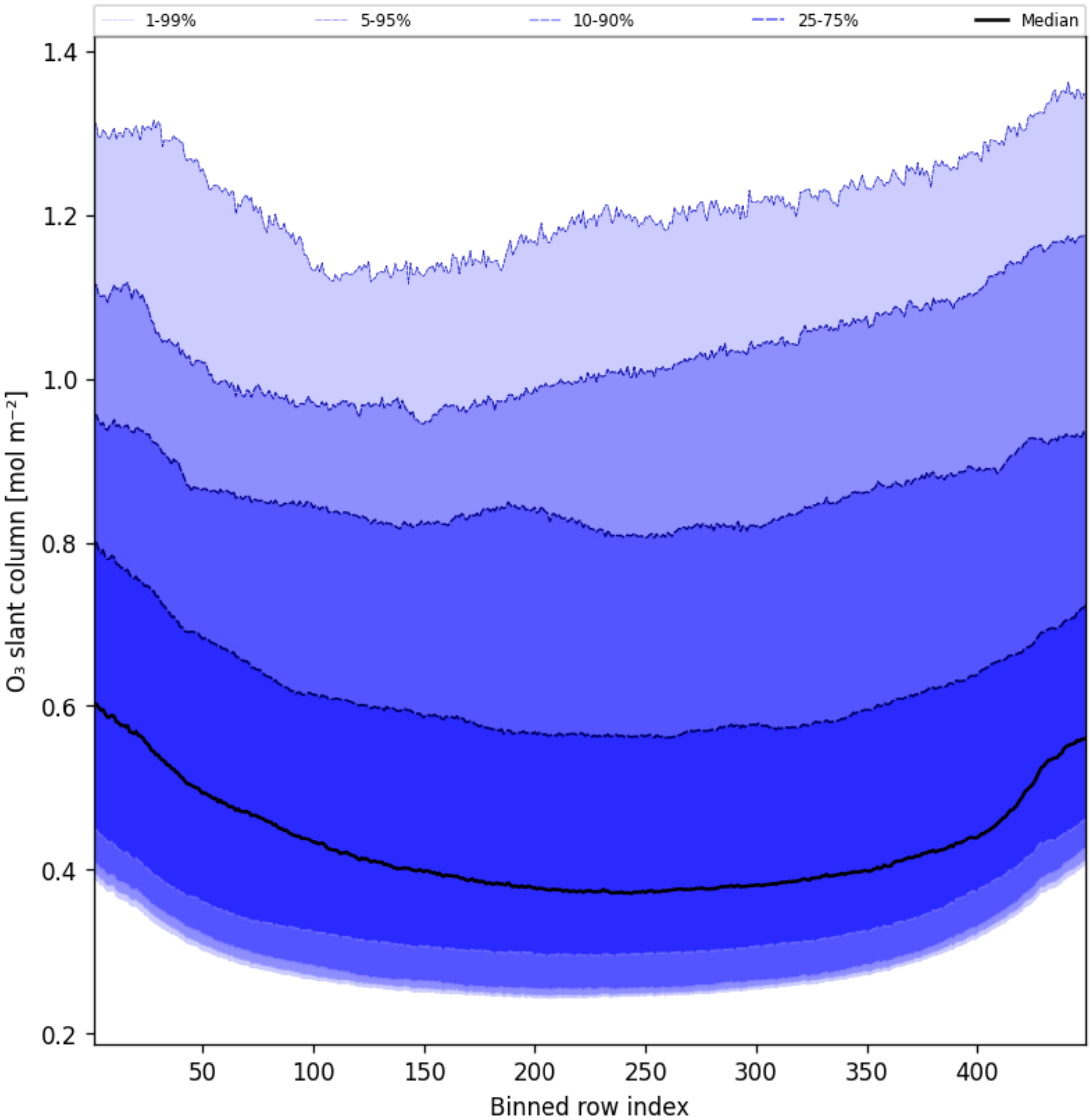

Figure 43: Along track statistics of “O_3 slant column” for 2025-10-02 to 2025-10-03

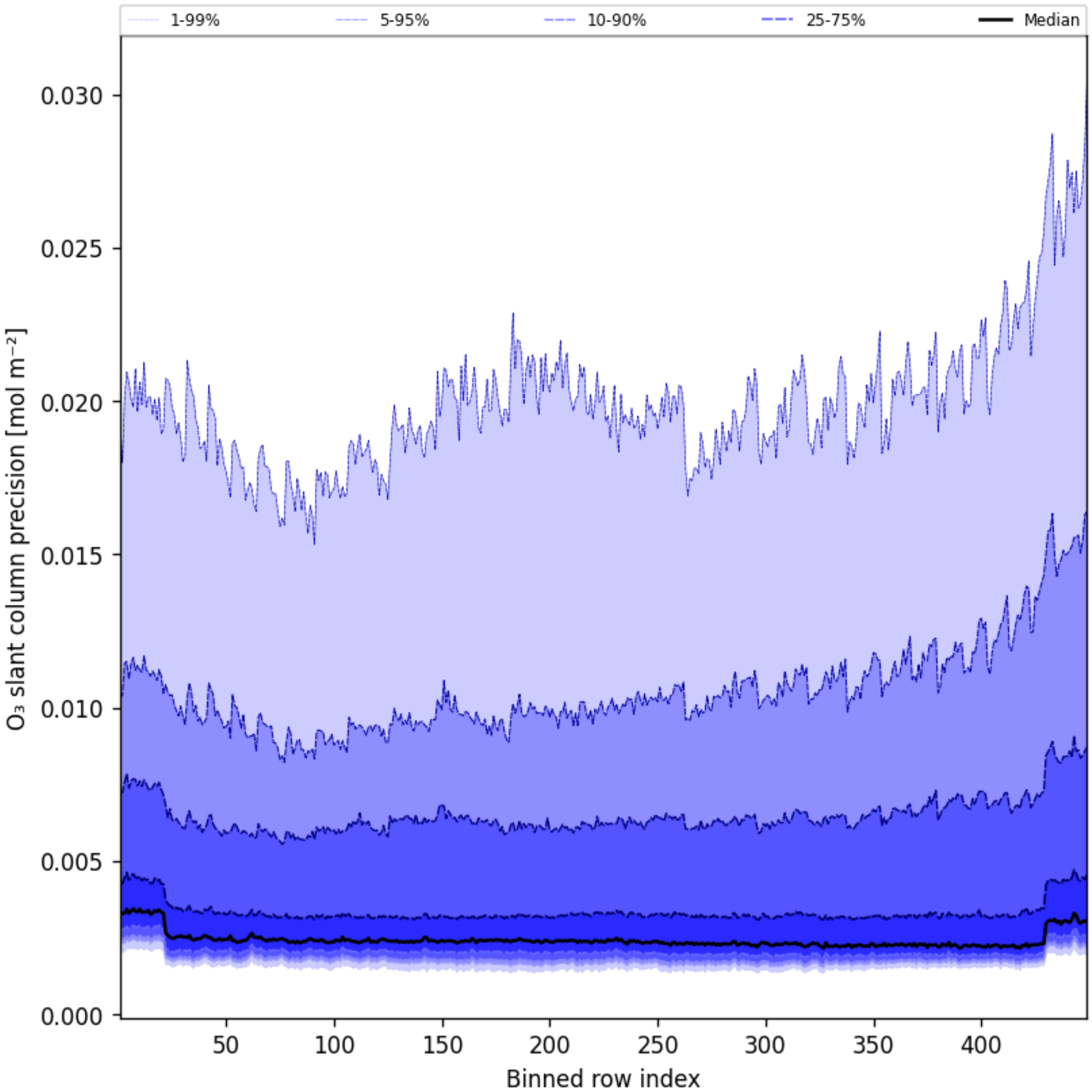

Figure 44: Along track statistics of “O_3 slant column precision” for 2025-10-02 to 2025-10-03

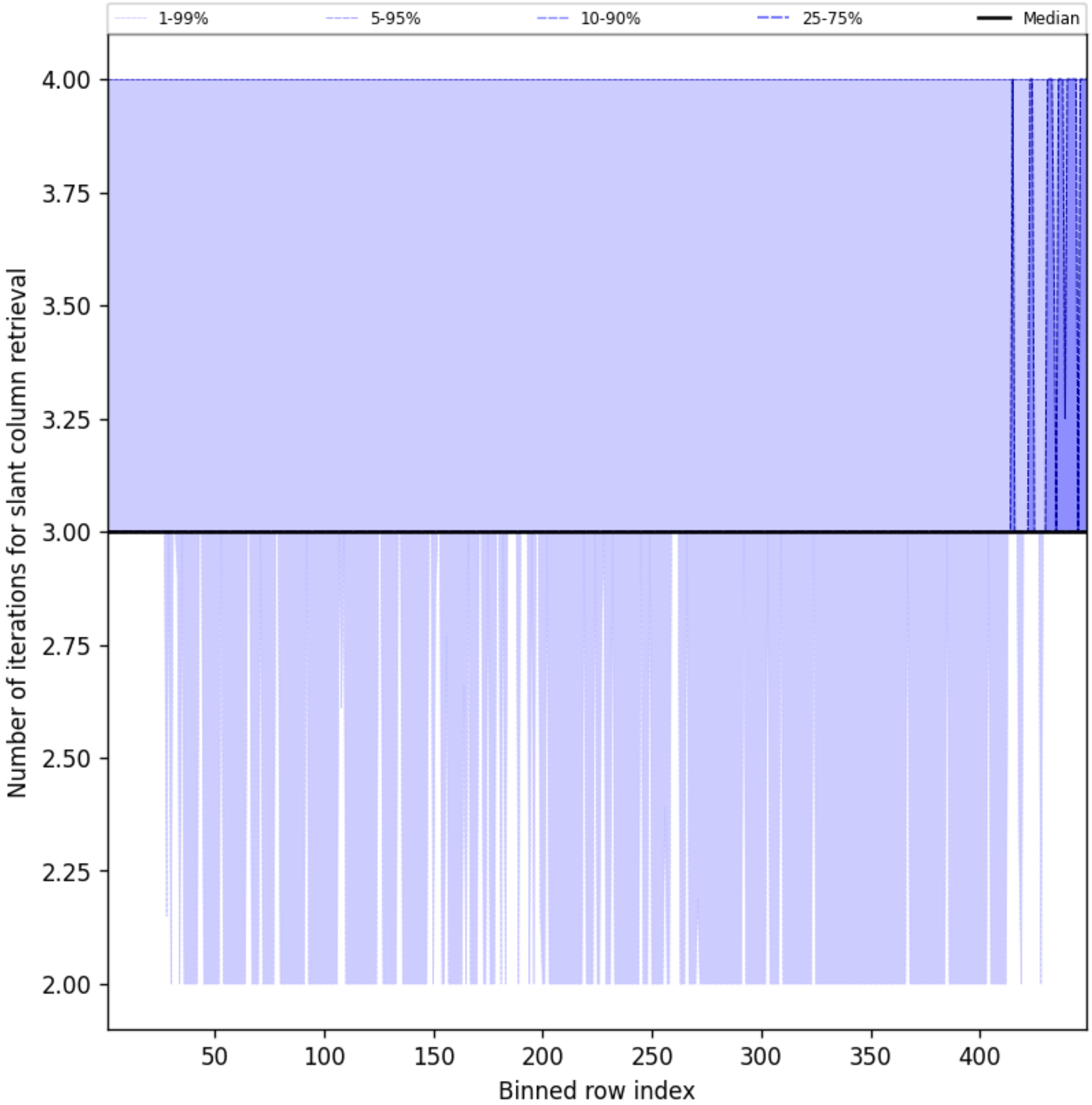

Figure 45: Along track statistics of “Number of iterations for slant column retrieval” for 2025-10-02 to 2025-10-03

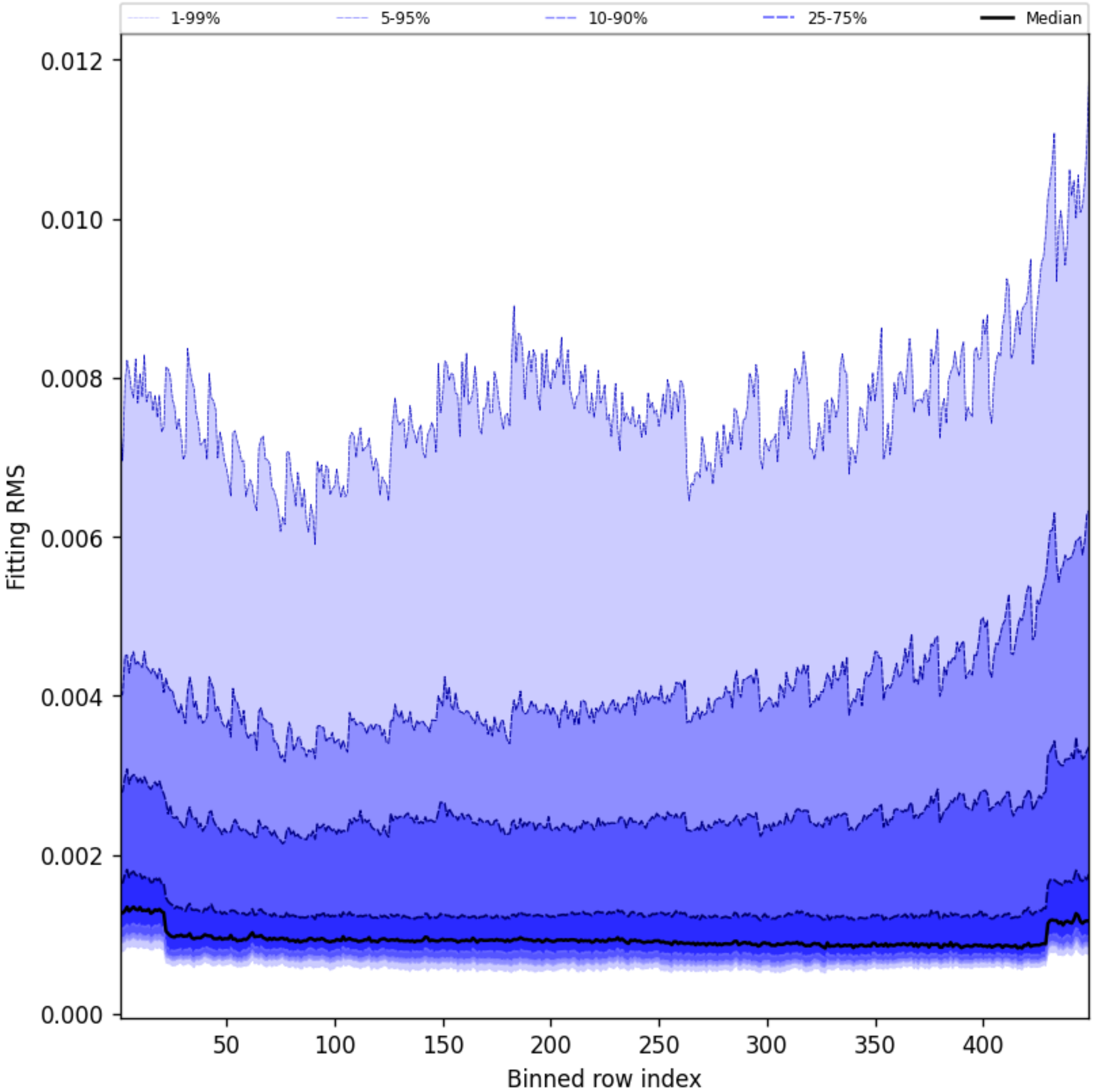

Figure 46: Along track statistics of “Fitting RMS” for 2025-10-02 to 2025-10-03

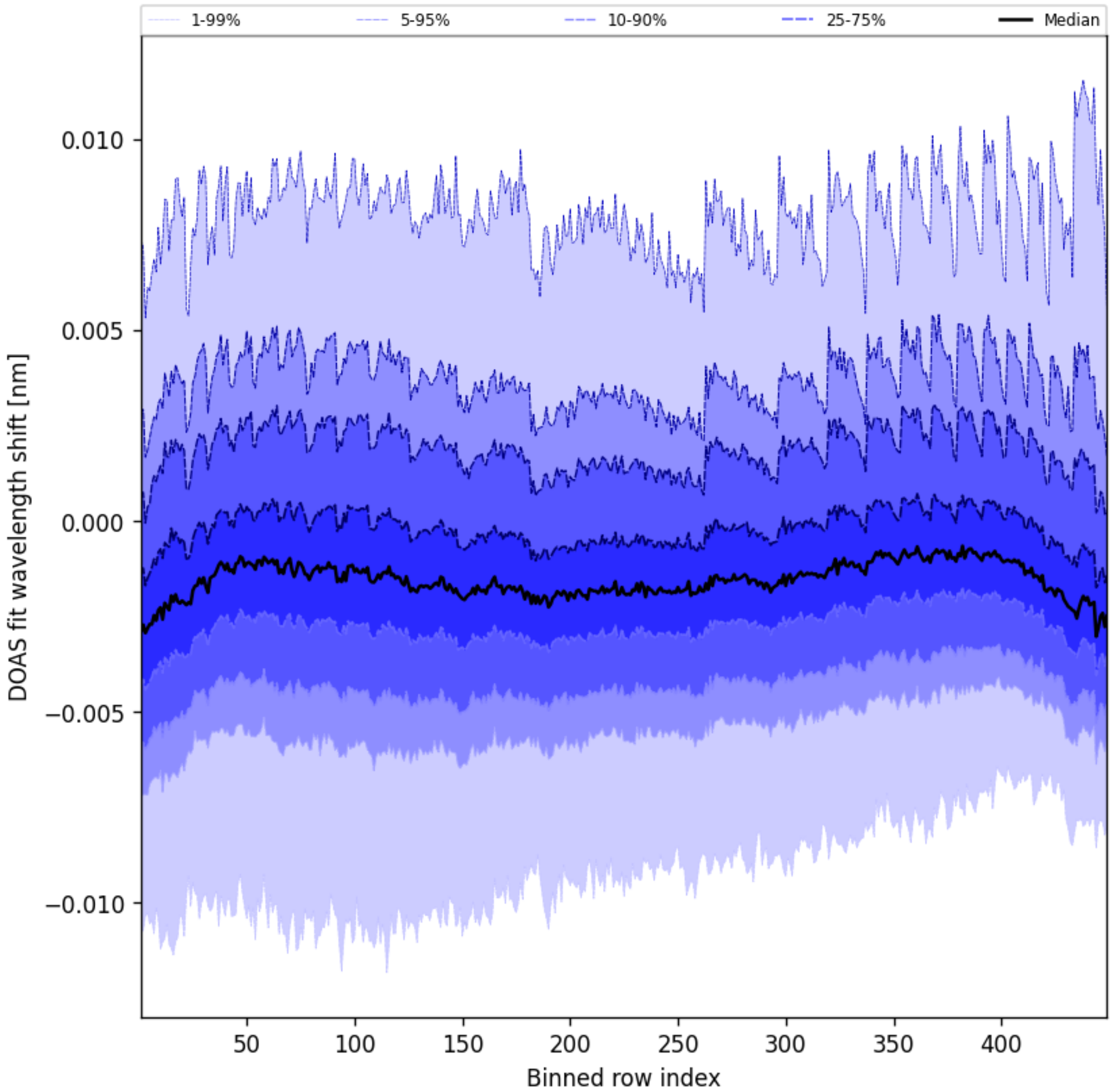

Figure 47: Along track statistics of “DOAS fit wavelength shift” for 2025-10-02 to 2025-10-03

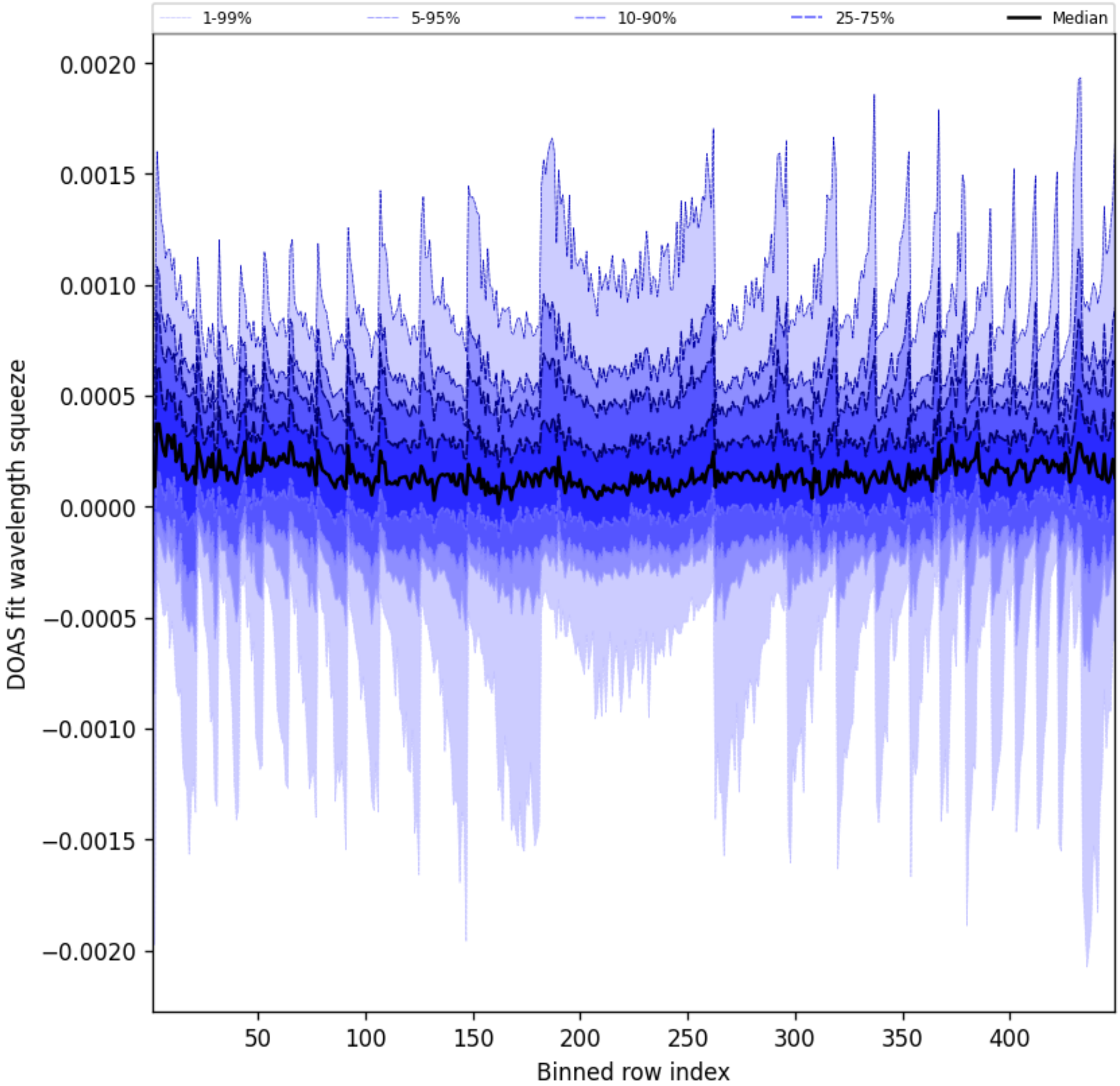

Figure 48: Along track statistics of “DOAS fit wavelength squeeze” for 2025-10-02 to 2025-10-03

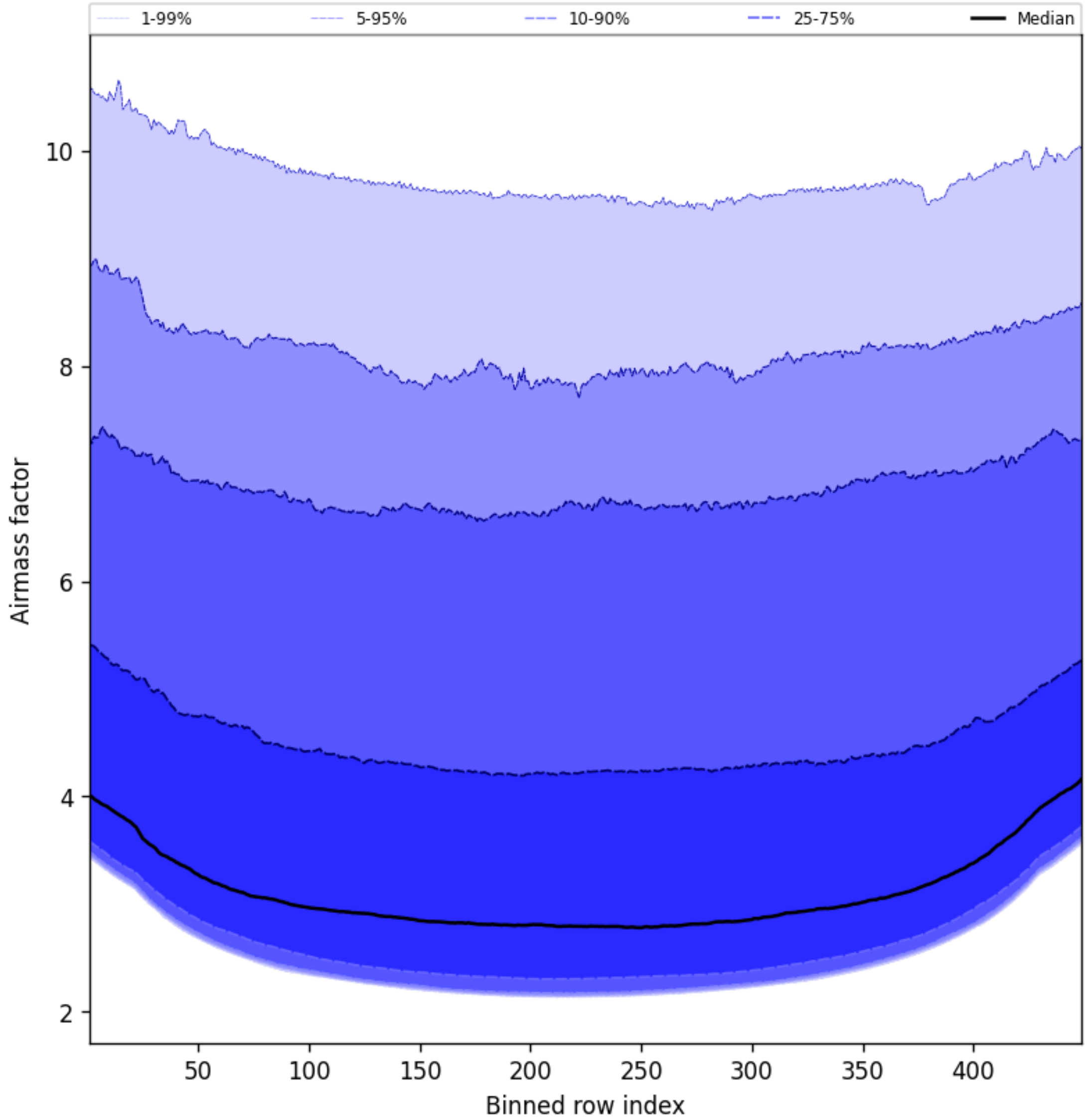

Figure 49: Along track statistics of “Airmass factor” for 2025-10-02 to 2025-10-03

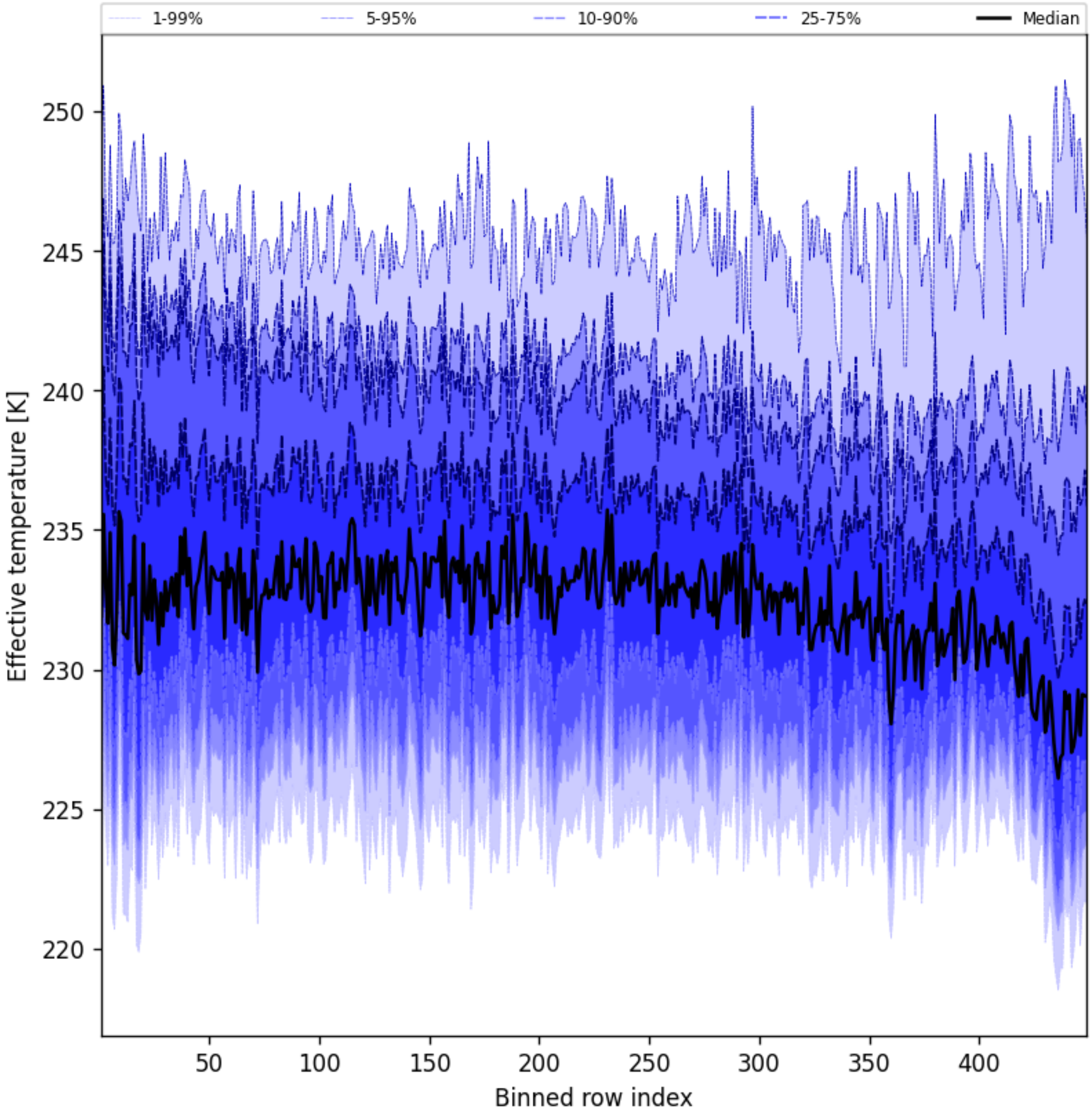

Figure 50: Along track statistics of “Effective temperature” for 2025-10-02 to 2025-10-03

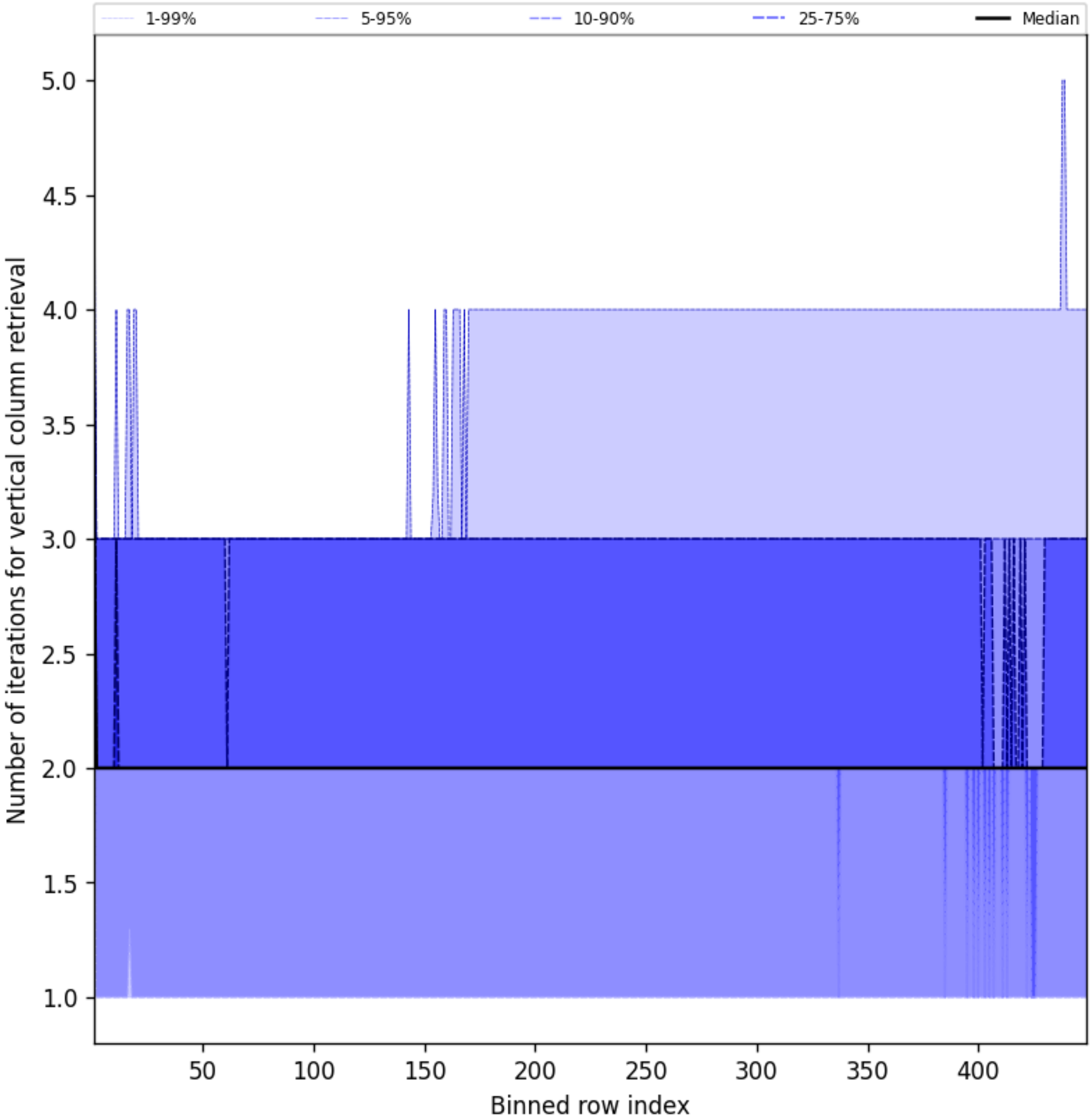

Figure 51: Along track statistics of “Number of iterations for vertical column retrieval” for 2025-10-02 to 2025-10-03

10 Coincidence density

To investigate the relation between parameters scatter density plots are produced. These include some 'hidden' parameters, latitude and the solar- and viewing geometries, in addition to all configured parameters. All combinations of pairs of parameters are included *once*, in one direction alone.

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