PyCAMA report generated by tropl2-proc

tropl2-proc

2025-12-13 (02:37)

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:

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

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 $\sigma(x) = \sqrt{V(x)}$.

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

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]	0.686 ± 0.264	1277992	0.905	0.540	0.900	0.360	0.900
methane mixing ratio [parts per 10^9]	$(0.181 \pm 0.010) \times 10^4$	1277992	1.732×10^3	189	1.763×10^3	1.340×10^3	2.307×10^3
methane mixing ratio precision [parts per 10^9]	2.99 ± 1.71	1277992	1.30	1.63	2.73	0.842	28.7
methane mixing ratio bias corrected [parts per 10^9]	$(0.182 \pm 0.009) \times 10^4$	1277992	1.752×10^3	168	1.783×10^3	1.332×10^3	2.358×10^3
number of spectral points in retrieval [1]	798 ± 3	1277992	798	4.00	798	725	805
wavelength calibration offset SWIR [nm]	$(-1.116 \pm 0.246) \times 10^{-2}$	1277992	-1.100×10^{-2}	2.146×10^{-3}	-1.102×10^{-2}	-6.935×10^{-2}	4.474×10^{-2}
chi square SWIR [1]	$(0.116 \pm 3.508) \times 10^5$	1277992	2.450×10^3	7.575×10^3	4.025×10^3	1.536×10^3	3.955×10^8
chi square NIR [1]	$(0.424 \pm 288.007) \times 10^6$	1277992	3.750×10^3	1.288×10^4	1.427×10^4	208	3.223×10^{11}
degrees of freedom [1]	17.8 ± 0.5	1277992	17.2	0.942	17.7	17.1	20.9
number of iterations [1]	10.1 ± 1.2	1277992	10.2	0.0	10.00	10.00	30.0
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(-2.316 \pm 3.393) \times 10^{-8}$	1277992	-8.700×10^{-9}	3.672×10^{-8}	-2.425×10^{-8}	-8.293×10^{-7}	1.304×10^{-6}
land fraction [1]	0.946 ± 0.216	1277992	0.995	0.0	1.000	0.0	1.000

Table 2: Percentile ranges

Variable	1 %	5 %	10 %	15.9 %	25 %	75 %	84.1 %	90 %	95 %	99 %
qa value [1]	0.360	0.360	0.360	0.360	0.360	0.900	0.900	0.900	0.900	0.900
methane mixing ratio [parts per 10^9]	1.651×10^3	1.693×10^3	1.706×10^3	1.716×10^3	1.728×10^3	1.917×10^3	1.935×10^3	1.944×10^3	1.953×10^3	1.972×10^3
methane mixing ratio precision [parts per 10^9]	1.10	1.25	1.37	1.51	1.90	3.53	4.05	4.60	5.71	9.97
methane mixing ratio bias corrected [parts per 10^9]	1.666×10^3	1.708×10^3	1.723×10^3	1.733×10^3	1.745×10^3	1.913×10^3	1.930×10^3	1.941×10^3	1.954×10^3	1.976×10^3
number of spectral points in retrieval [1]	792	793	794	795	796	800	801	802	803	804
wavelength calibration offset SWIR [nm]	-1.740×10^{-2}	-1.441×10^{-2}	-1.356×10^{-2}	-1.295×10^{-2}	-1.224×10^{-2}	-1.010×10^{-2}	-9.655×10^{-3}	-9.177×10^{-3}	-8.236×10^{-3}	-4.468×10^{-3}
chi square SWIR [1]	2.007×10^3	2.224×10^3	2.384×10^3	2.549×10^3	2.818×10^3	1.039×10^4	2.157×10^4	3.345×10^4	4.729×10^4	6.897×10^4
chi square NIR [1]	1.425×10^3	2.446×10^3	3.567×10^3	4.783×10^3	7.169×10^3	2.005×10^4	2.237×10^4	2.419×10^4	2.650×10^4	3.107×10^4
degrees of freedom [1]	17.1	17.2	17.2	17.2	17.3	18.2	18.4	18.6	18.8	18.9
number of iterations [1]	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	12.0
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	-1.032×10^{-7}	-7.220×10^{-8}	-5.956×10^{-8}	-5.108×10^{-8}	-4.240×10^{-8}	-5.684×10^{-9}	2.147×10^{-9}	1.156×10^{-8}	2.862×10^{-8}	7.551×10^{-8}
land fraction [1]	0.0	0.401	0.991	1.000	1.000	1.000	1.000	1.000	1.000	1.000

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]	0.657 ± 0.269	437171	0.540	0.900	0.360	0.900	0.360	0.900
methane mixing ratio [parts per 10^9]	$(0.193 \pm 0.003) \times 10^4$	437171	30.5	1.933×10^3	1.474×10^3	2.307×10^3	1.916×10^3	1.946×10^3
methane mixing ratio precision [parts per 10^9]	2.47 ± 1.75	437171	1.55	1.72	0.917	26.5	1.39	2.94
methane mixing ratio bias corrected [parts per 10^9]	$(0.193 \pm 0.003) \times 10^4$	437171	33.6	1.927×10^3	1.473×10^3	2.358×10^3	1.911×10^3	1.944×10^3
number of spectral points in retrieval [1]	798 ± 3	437171	4.00	798	780	805	796	800
wavelength calibration offset SWIR [nm]	$(-1.120 \pm 0.310) \times 10^{-2}$	437171	2.603×10^{-3}	-1.108×10^{-2}	-6.935×10^{-2}	4.474×10^{-2}	-1.254×10^{-2}	-9.943×10^{-3}
chi square SWIR [1]	$(0.230 \pm 0.256) \times 10^5$	437171	2.835×10^4	1.420×10^4	1.657×10^3	4.194×10^6	6.494×10^3	3.484×10^4
chi square NIR [1]	$(0.209 \pm 42.025) \times 10^6$	437171	6.413×10^3	6.280×10^3	208	2.706×10^{10}	3.878×10^3	1.029×10^4
degrees of freedom [1]	18.3 ± 0.4	437171	0.574	18.3	17.1	20.9	18.0	18.6
number of iterations [1]	10.2 ± 1.7	437171	0.0	10.00	10.00	30.0	10.00	10.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(-6.432 \pm 23.658) \times 10^{-9}$	437171	2.025×10^{-8}	-8.458×10^{-9}	-2.978×10^{-7}	8.645×10^{-7}	-1.893×10^{-8}	1.317×10^{-9}
land fraction [1]	0.979 ± 0.102	437171	6.949×10^{-4}	1.000	0.0	1.000	0.999	1.000

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]	0.701 ± 0.260	840821	0.540	0.900	0.360	0.900	0.360	0.900
methane mixing ratio [parts per 10^9]	$(0.175 \pm 0.005) \times 10^4$	840821	43.7	1.737×10^3	1.340×10^3	2.092×10^3	1.717×10^3	1.761×10^3
methane mixing ratio precision [parts per 10^9]	3.27 ± 1.63	840821	1.17	2.97	0.842	28.7	2.47	3.63
methane mixing ratio bias corrected [parts per 10^9]	$(0.176 \pm 0.005) \times 10^4$	840821	47.2	1.754×10^3	1.332×10^3	2.148×10^3	1.734×10^3	1.781×10^3
number of spectral points in retrieval [1]	798 ± 3	840821	4.00	798	725	805	796	800
wavelength calibration offset SWIR [nm]	$(-1.115 \pm 0.205) \times 10^{-2}$	840821	1.956×10^{-3}	-1.100×10^{-2}	-6.010×10^{-2}	3.708×10^{-2}	-1.211×10^{-2}	-1.016×10^{-2}
chi square SWIR [1]	$(0.569 \pm 43.194) \times 10^4$	840821	1.650×10^3	3.126×10^3	1.536×10^3	3.955×10^8	2.575×10^3	4.226×10^3
chi square NIR [1]	$(0.536 \pm 353.776) \times 10^6$	840821	8.469×10^3	1.806×10^4	467	3.223×10^{11}	1.369×10^4	2.216×10^4
degrees of freedom [1]	17.5 ± 0.4	840821	0.548	17.4	17.1	20.9	17.2	17.8
number of iterations [1]	10.1 ± 0.9	840821	0.0	10.00	10.00	30.0	10.00	10.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(-3.186 \pm 3.518) \times 10^{-8}$	840821	3.334×10^{-8}	-3.531×10^{-8}	-8.293×10^{-7}	1.304×10^{-6}	-4.998×10^{-8}	-1.663×10^{-8}
land fraction [1]	0.929 ± 0.255	840821	0.0	1.000	0.0	1.000	1.000	1.000

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]	0.497 ± 0.235	57598	0.540	0.360	0.360	0.900	0.360	0.900
methane mixing ratio [parts per 10^9]	$(0.185 \pm 0.004) \times 10^4$	57598	40.7	1.856×10^3	1.464×10^3	1.979×10^3	1.835×10^3	1.876×10^3
methane mixing ratio precision [parts per 10^9]	2.35 ± 0.65	57598	0.938	2.24	0.901	7.23	1.85	2.78
methane mixing ratio bias corrected [parts per 10^9]	$(0.186 \pm 0.004) \times 10^4$	57598	40.9	1.863×10^3	1.469×10^3	1.986×10^3	1.842×10^3	1.883×10^3
number of spectral points in retrieval [1]	798 ± 3	57598	4.00	798	788	803	796	800
wavelength calibration offset SWIR [nm]	$(-1.011 \pm 0.161) \times 10^{-2}$	57598	1.227×10^{-3}	-1.012×10^{-2}	-2.744×10^{-2}	1.307×10^{-2}	-1.079×10^{-2}	-9.560×10^{-3}
chi square SWIR [1]	$(0.156 \pm 16.481) \times 10^5$	57598	5.056×10^3	7.301×10^3	2.724×10^3	3.955×10^8	5.247×10^3	1.030×10^4
chi square NIR [1]	$(0.594 \pm 134.467) \times 10^7$	57598	2.572×10^3	3.130×10^3	589	3.223×10^{11}	2.092×10^3	4.665×10^3
degrees of freedom [1]	18.1 ± 0.2	57598	0.244	18.1	17.1	20.5	18.0	18.3
number of iterations [1]	10.0 ± 0.5	57598	0.0	10.00	10.00	29.0	10.00	10.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(8.616 \pm 45.277) \times 10^{-9}$	57598	2.173×10^{-8}	-3.094×10^{-9}	-9.612×10^{-8}	1.113×10^{-6}	-1.115×10^{-8}	1.058×10^{-8}
land fraction [1]	0.0 ± 0.00	57598	0.0	0.0	0.0	0.0	0.0	0.0

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]	0.707 ± 0.259	1067090	0.540	0.900	0.360	0.900	0.360	0.900
methane mixing ratio [parts per 10^9]	$(0.179 \pm 0.009) \times 10^4$	1067090	178	1.747×10^3	1.340×10^3	2.285×10^3	1.723×10^3	1.902×10^3
methane mixing ratio precision [parts per 10^9]	3.03 ± 1.73	1067090	1.62	2.81	0.842	28.7	1.96	3.58
methane mixing ratio bias corrected [parts per 10^9]	$(0.180 \pm 0.008) \times 10^4$	1067090	155	1.766×10^3	1.332×10^3	2.301×10^3	1.740×10^3	1.895×10^3
number of spectral points in retrieval [1]	798 ± 3	1067090	4.00	798	783	805	796	800
wavelength calibration offset SWIR [nm]	$(-1.119 \pm 0.198) \times 10^{-2}$	1067090	2.022×10^{-3}	-1.105×10^{-2}	-4.397×10^{-2}	3.558×10^{-2}	-1.220×10^{-2}	-1.018×10^{-2}
chi square SWIR [1]	$(0.116 \pm 0.266) \times 10^5$	1067090	6.819×10^3	3.537×10^3	1.536×10^3	7.622×10^6	2.701×10^3	9.521×10^3
chi square NIR [1]	$(0.184 \pm 41.757) \times 10^6$	1067090	9.966×10^3	1.603×10^4	357	3.199×10^{10}	1.102×10^4	2.098×10^4
degrees of freedom [1]	17.7 ± 0.6	1067090	0.894	17.5	17.1	20.9	17.3	18.2
number of iterations [1]	10.1 ± 1.2	1067090	0.0	10.00	10.00	30.0	10.00	10.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(-2.753 \pm 3.238) \times 10^{-8}$	1067090	3.596×10^{-8}	-2.999×10^{-8}	-3.182×10^{-7}	1.304×10^{-6}	-4.564×10^{-8}	-9.686×10^{-9}
land fraction [1]	1.000 ± 0.000	1067090	0.0	1.000	1.000	1.000	1.000	1.000

3 Granule outlines

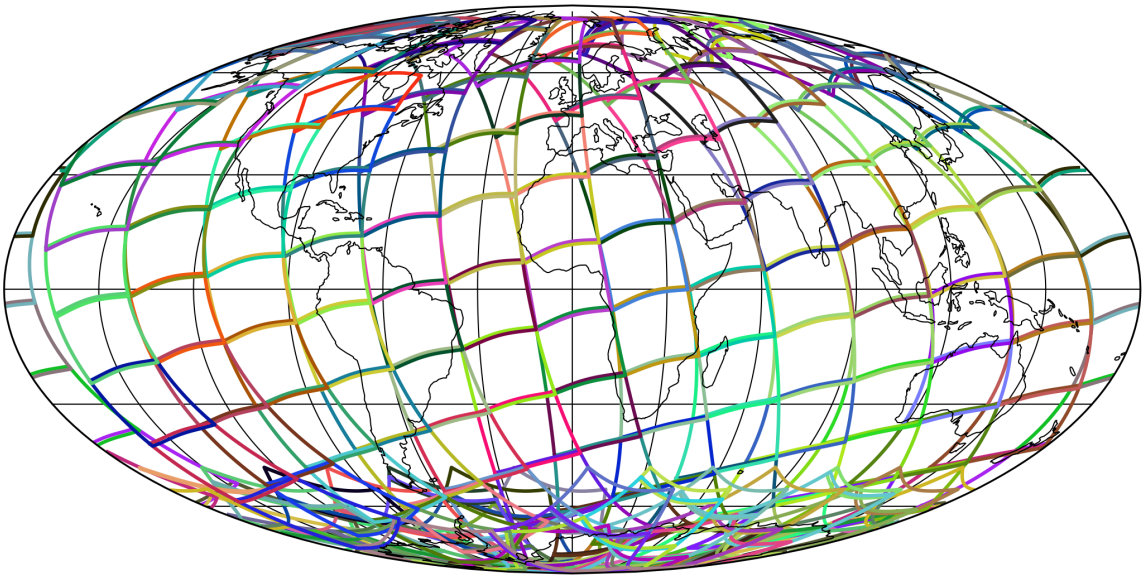

Figure 1: Outline of the granules.

4 Input data monitoring

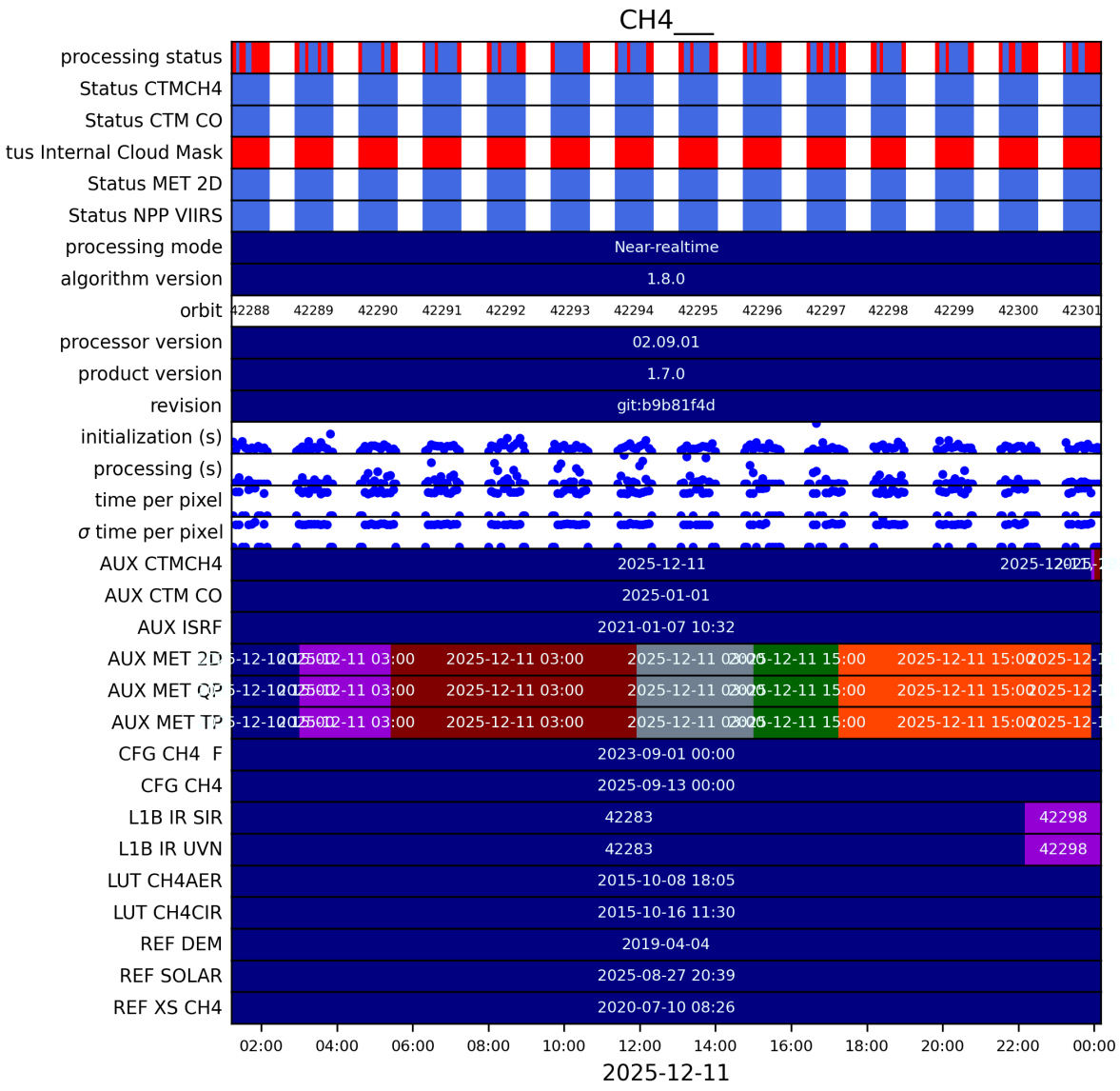

Figure 2: Input data per granule

5 Warnings and errors

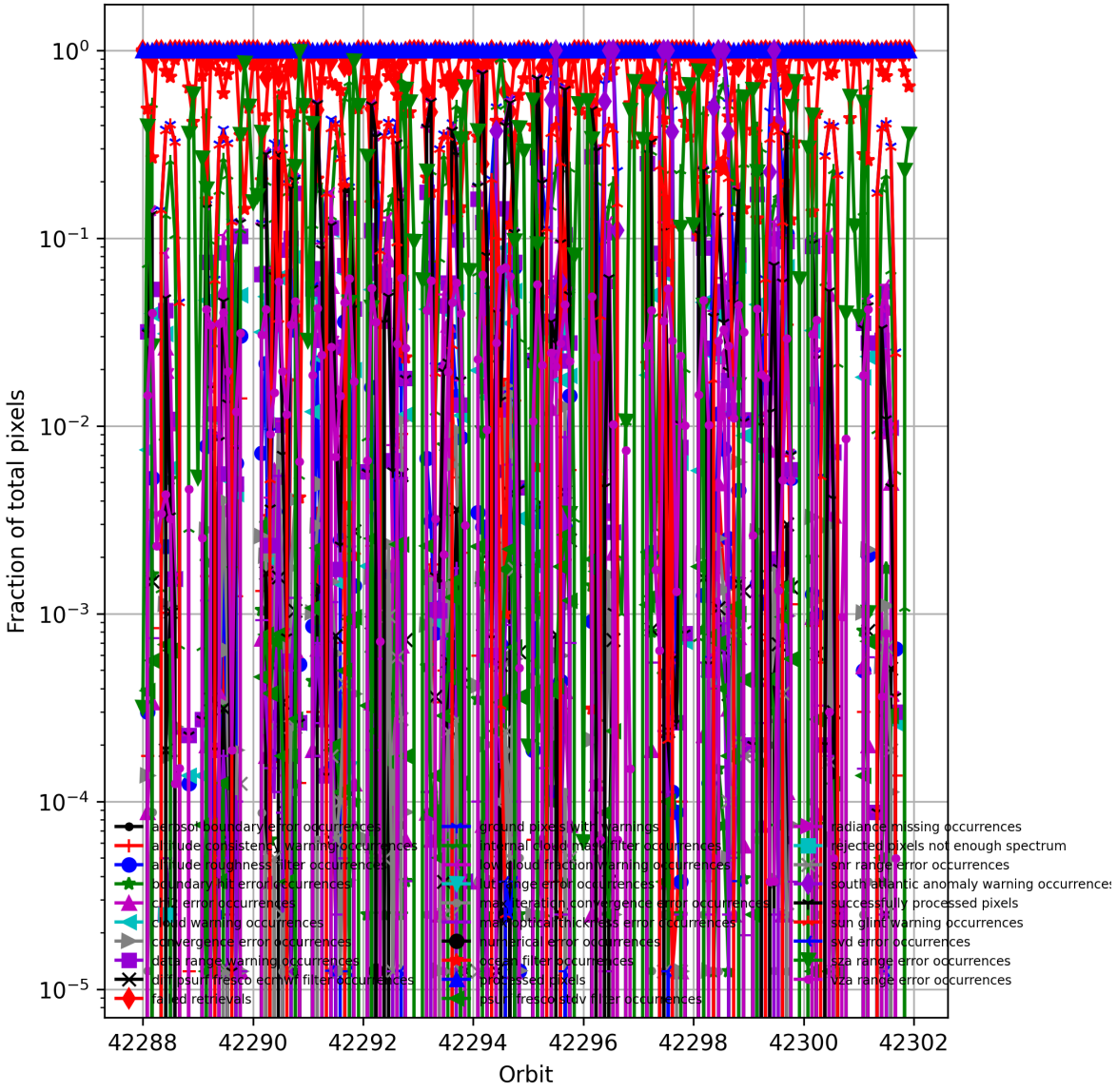

Figure 3: Fraction of pixels with specific warnings and errors during processing

6 World maps

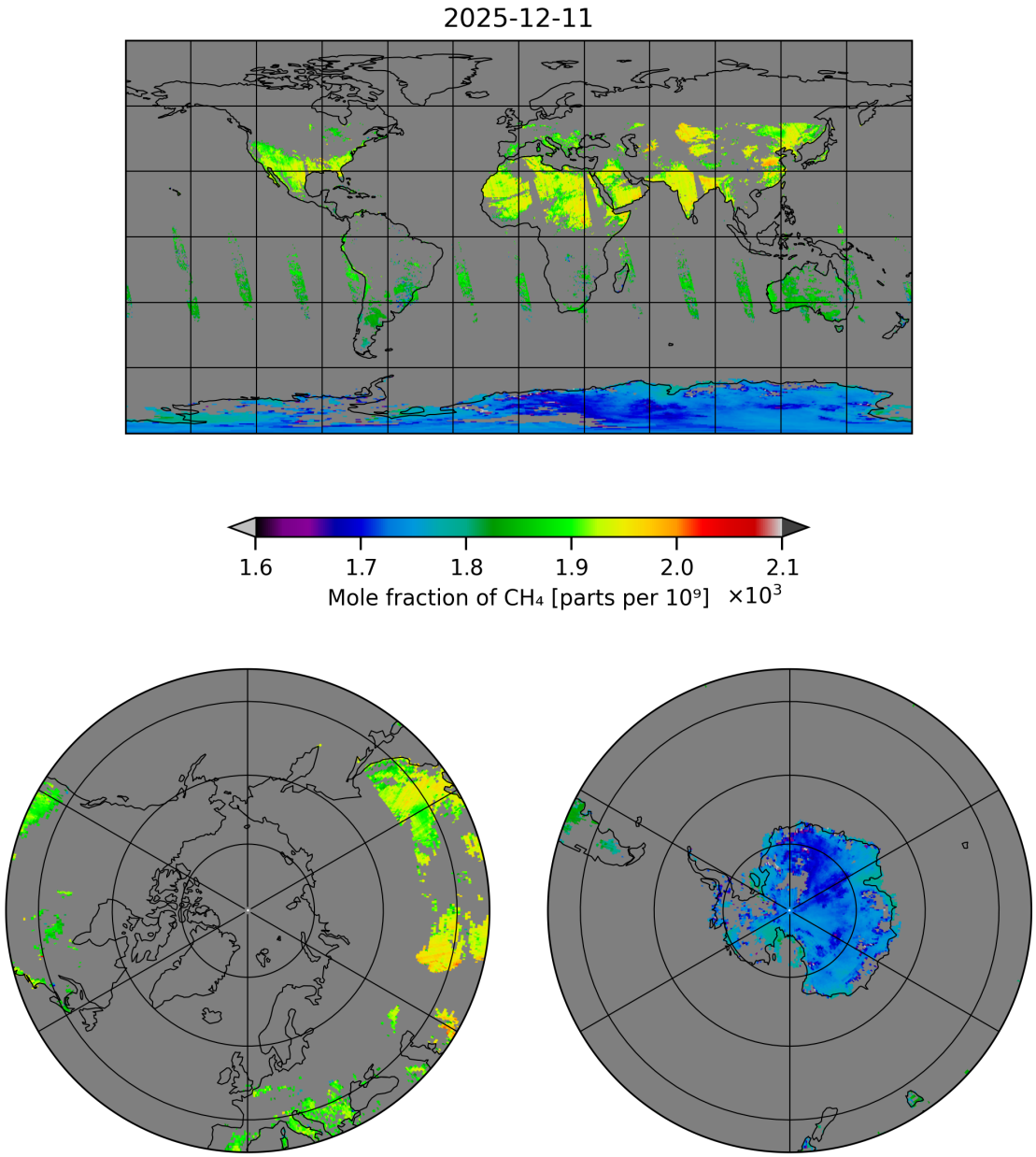

Figure 4: Map of “Mole fraction of CH_4” for 2025-12-11 to 2025-12-12

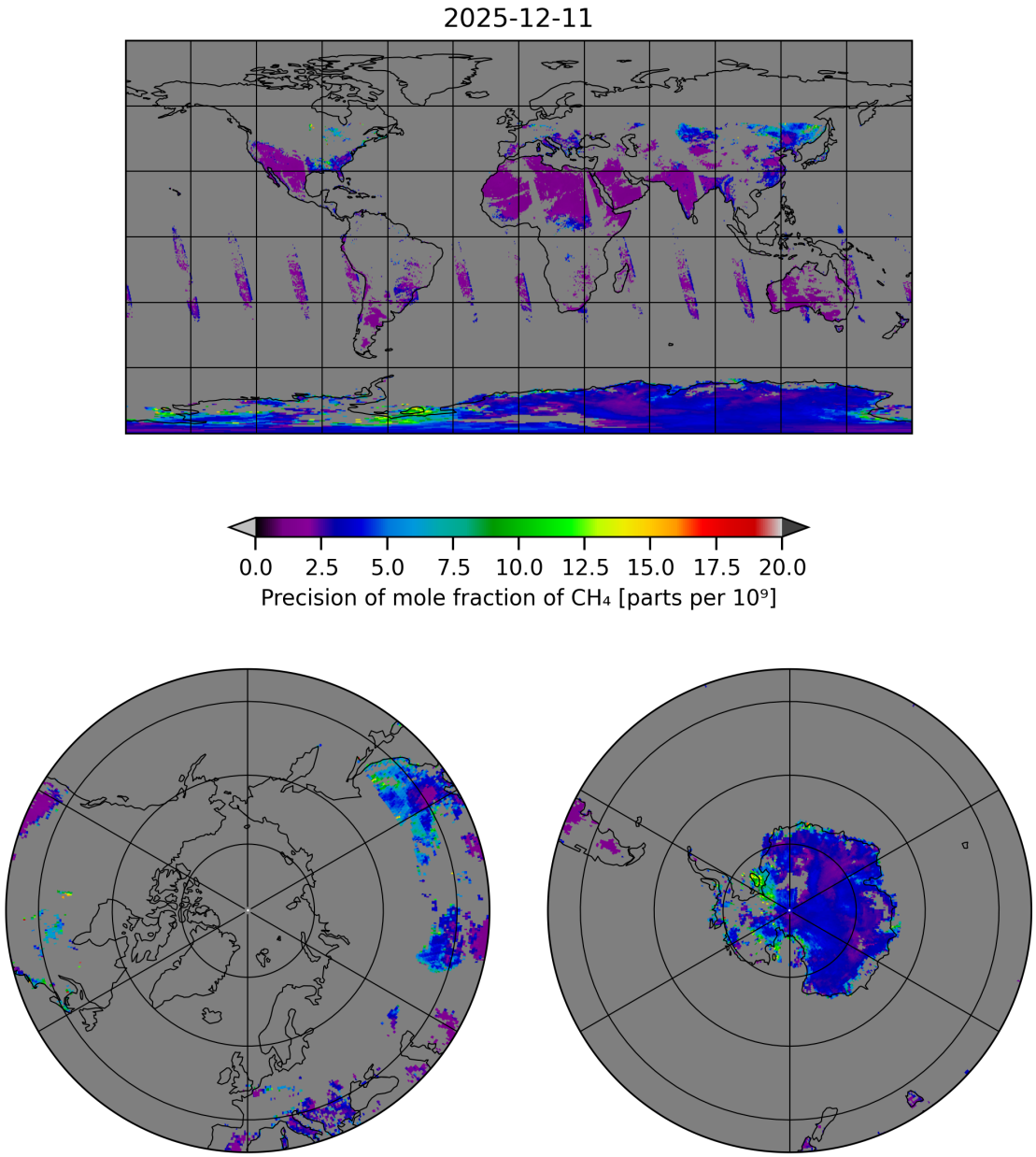

Figure 5: Map of "Precision of mole fraction of CH_4" for 2025-12-11 to 2025-12-12

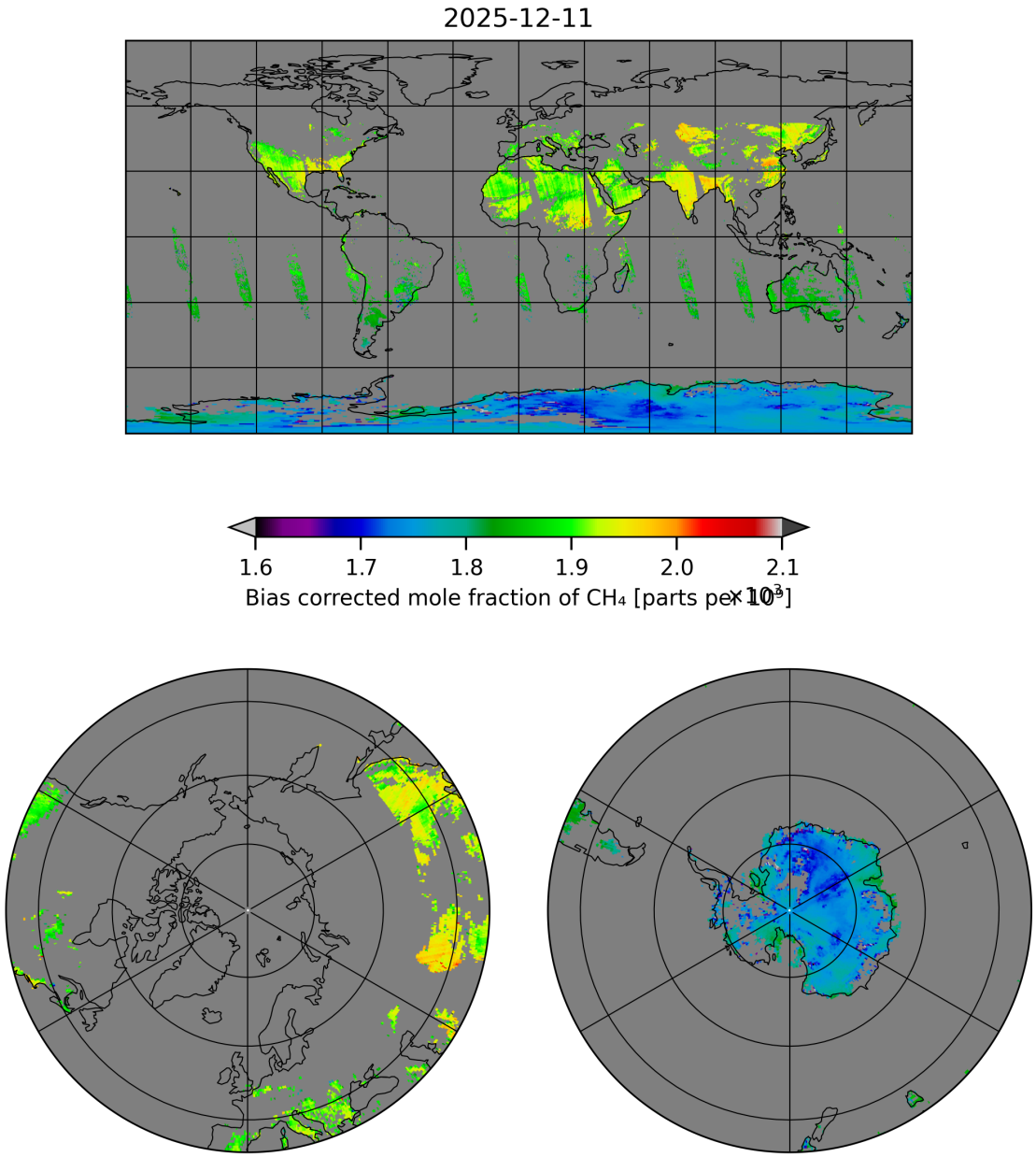

Figure 6: Map of “Bias corrected mole fraction of CH_4” for 2025-12-11 to 2025-12-12

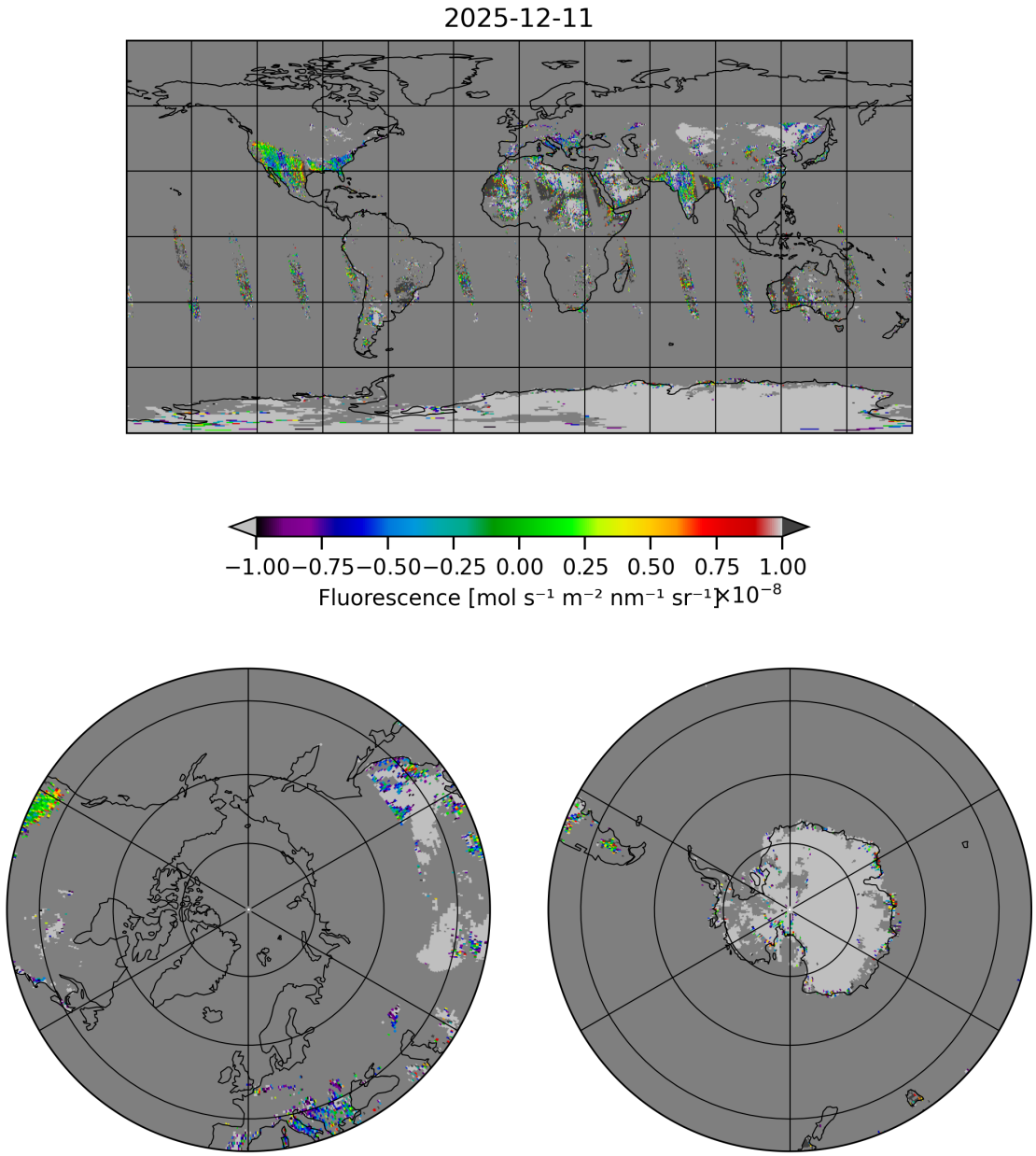

Figure 7: Map of “Fluorescence” for 2025-12-11 to 2025-12-12

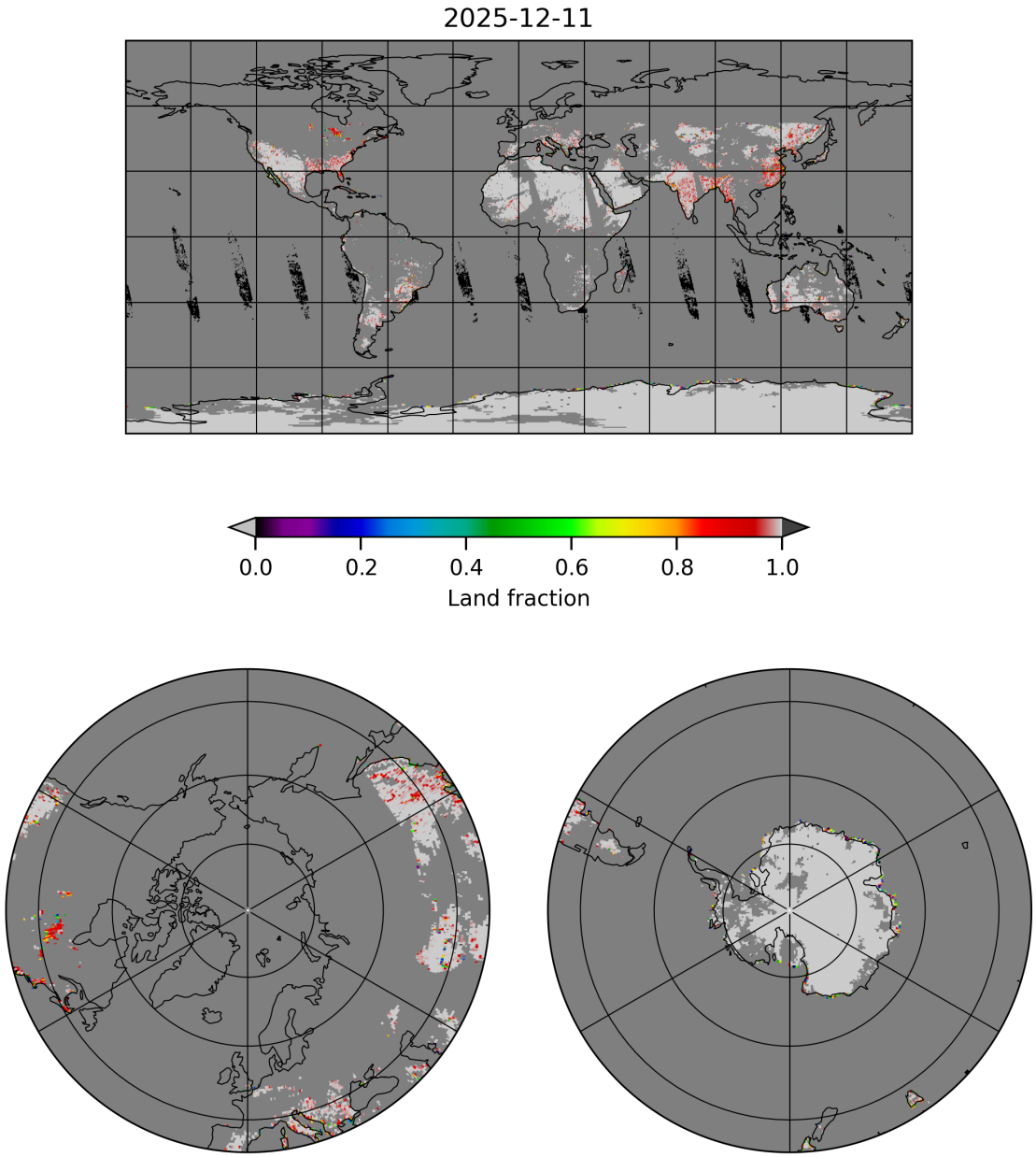

Figure 8: Map of “Land fraction” for 2025-12-11 to 2025-12-12

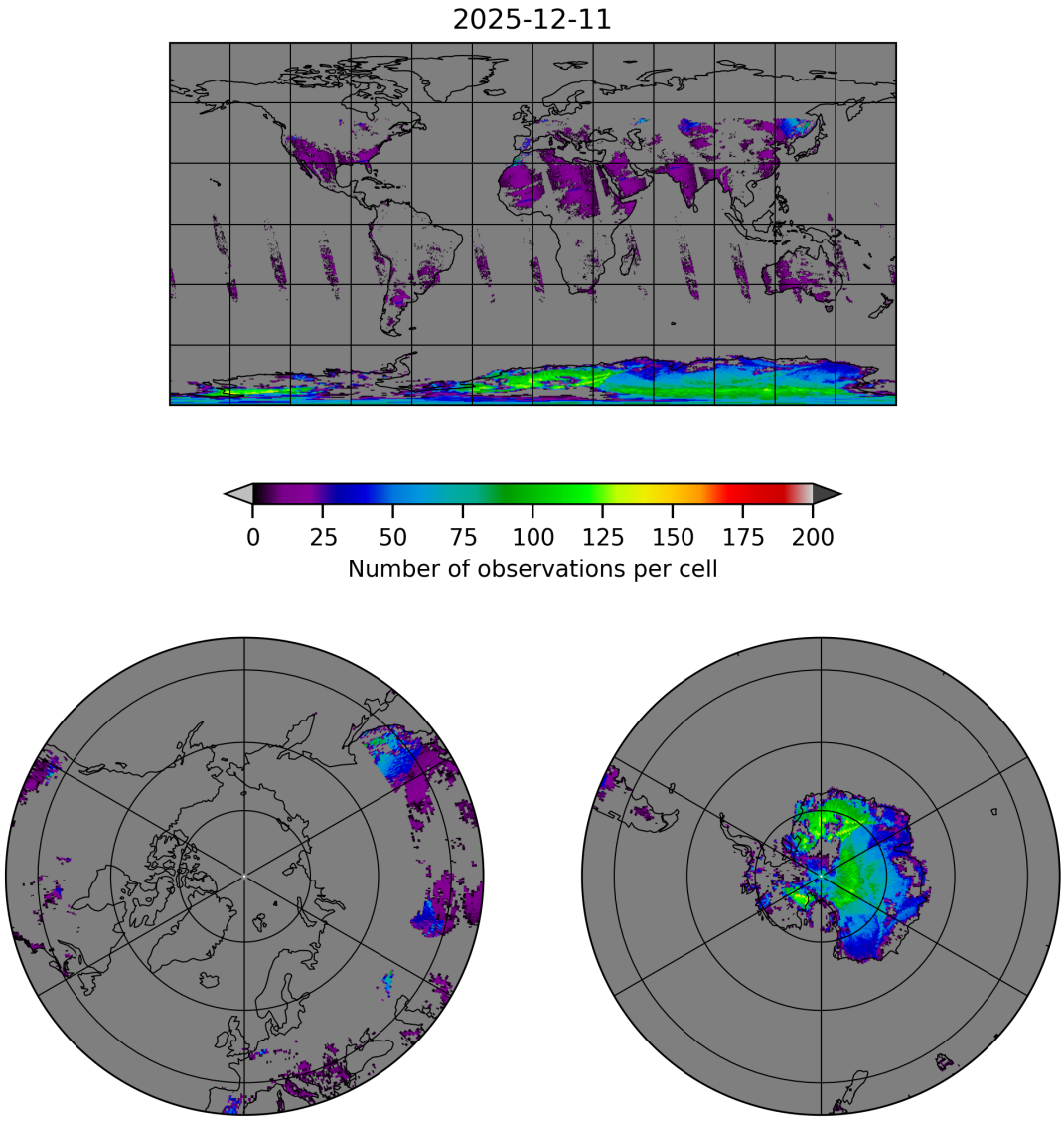

Figure 9: Map of the number of observations for 2025-12-11 to 2025-12-12

7 Zonal average

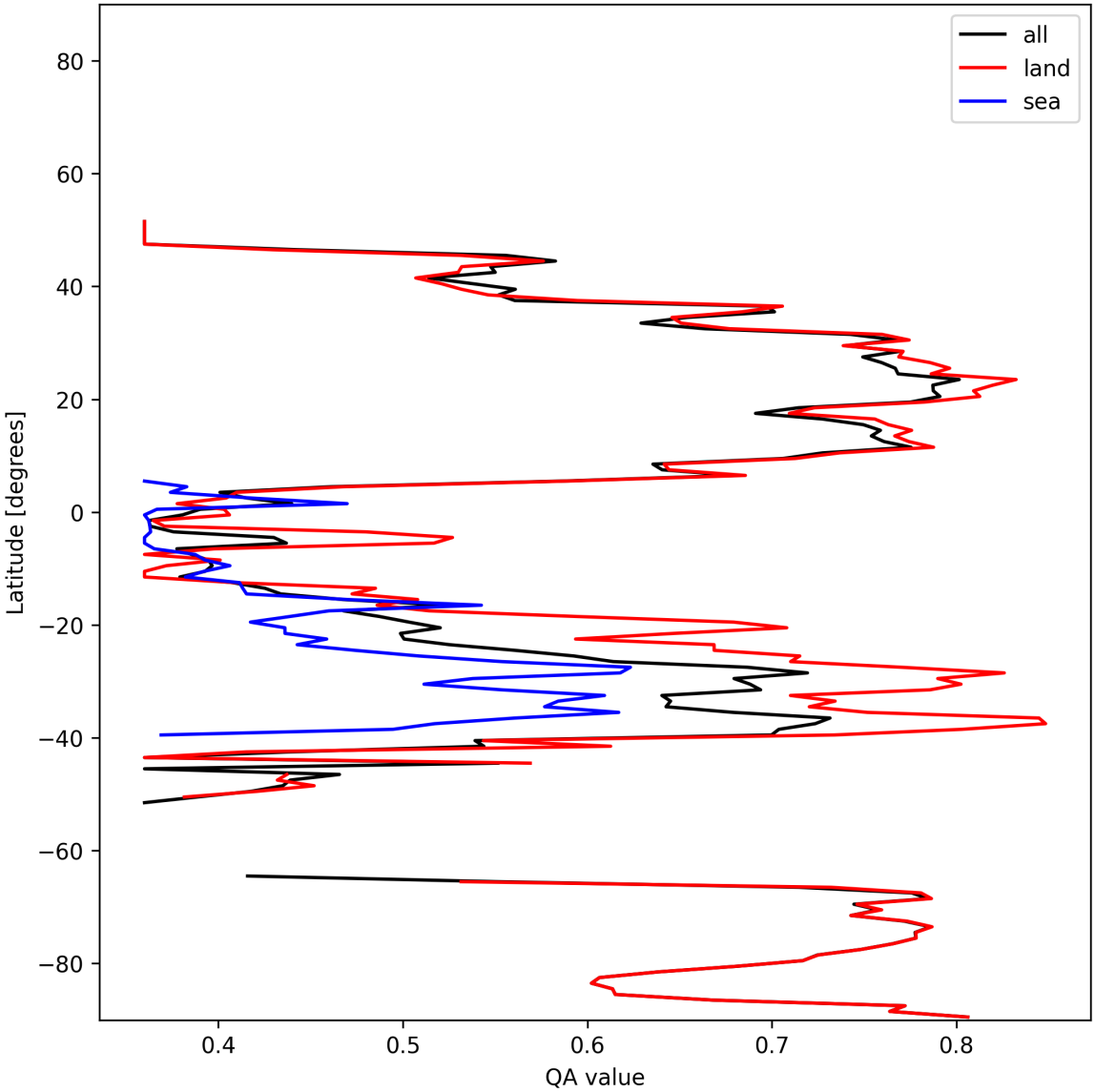

Figure 10: Zonal average of “QA value” for 2025-12-11 to 2025-12-12.

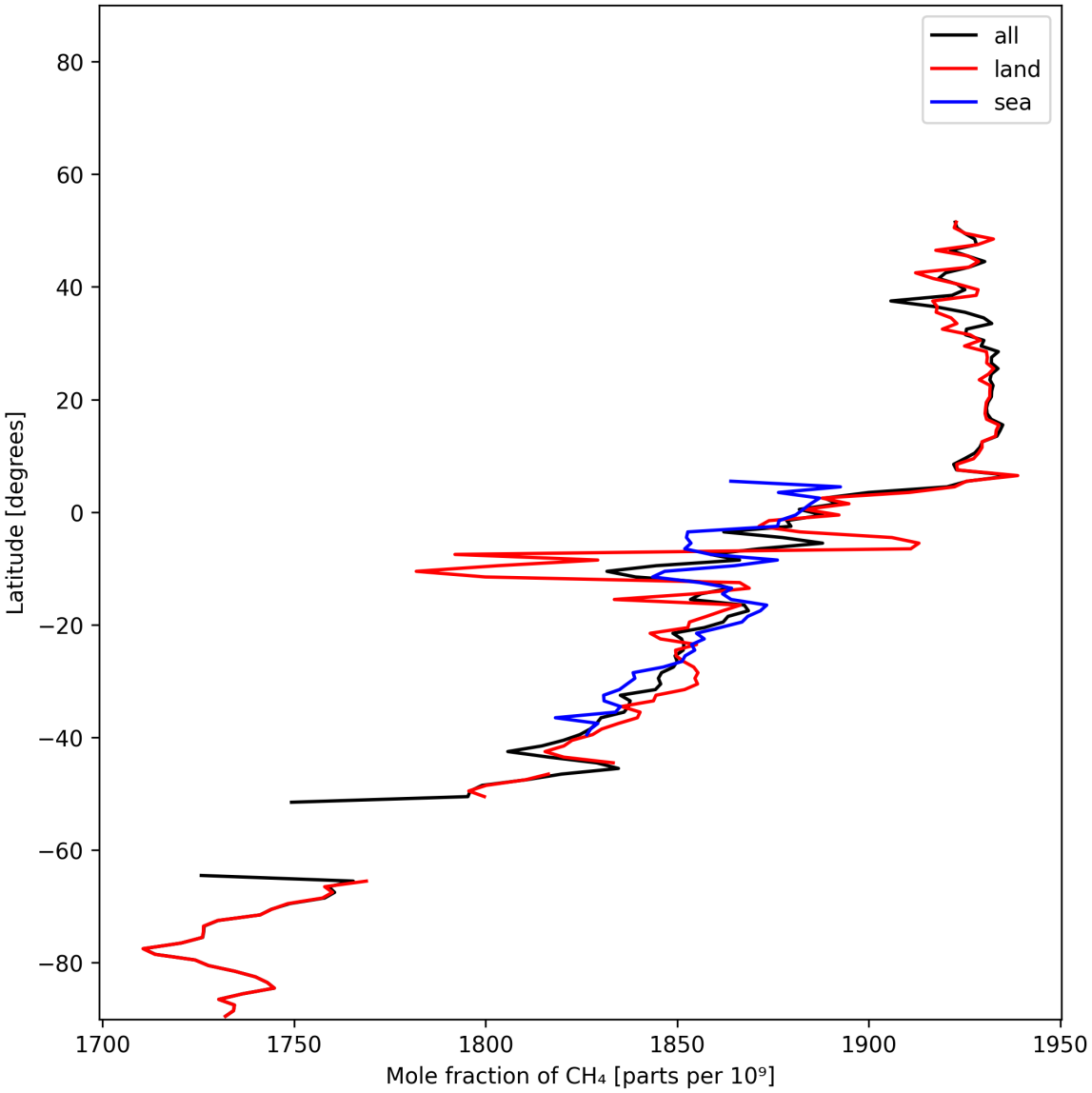

Figure 11: Zonal average of "Mole fraction of CH_4" for 2025-12-11 to 2025-12-12.

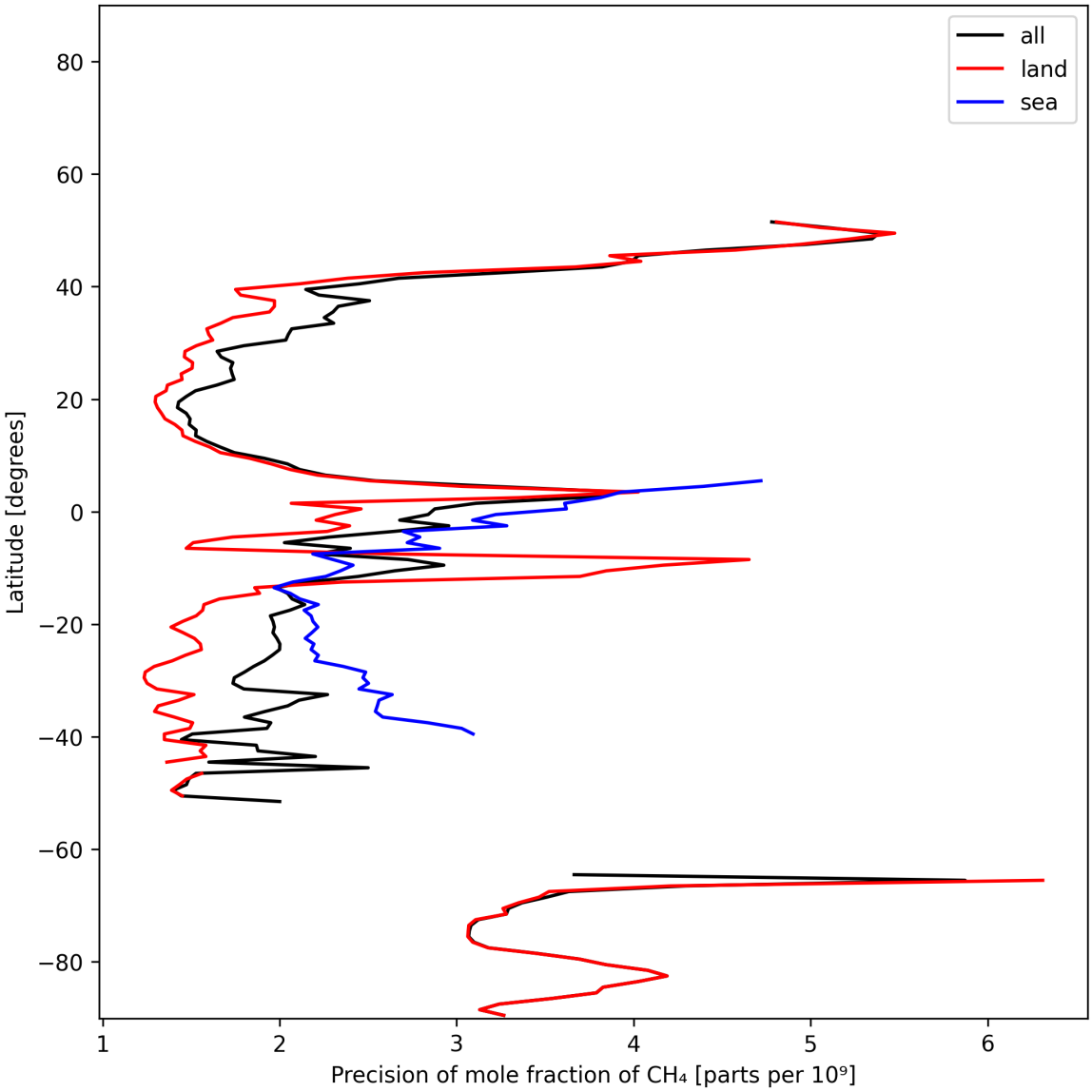

Figure 12: Zonal average of “Precision of mole fraction of CH_4” for 2025-12-11 to 2025-12-12.

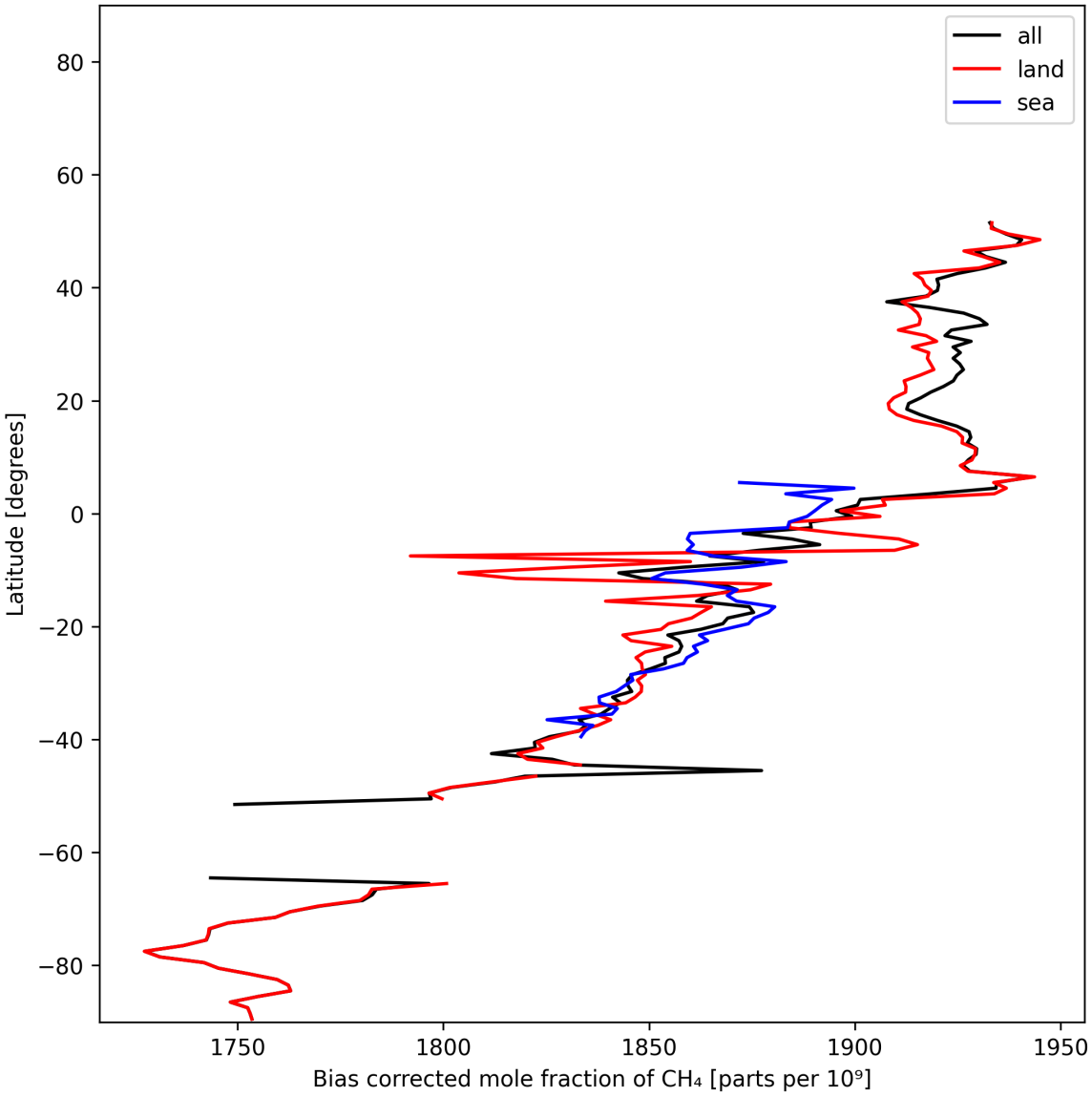

Figure 13: Zonal average of “Bias corrected mole fraction of CH_4” for 2025-12-11 to 2025-12-12.

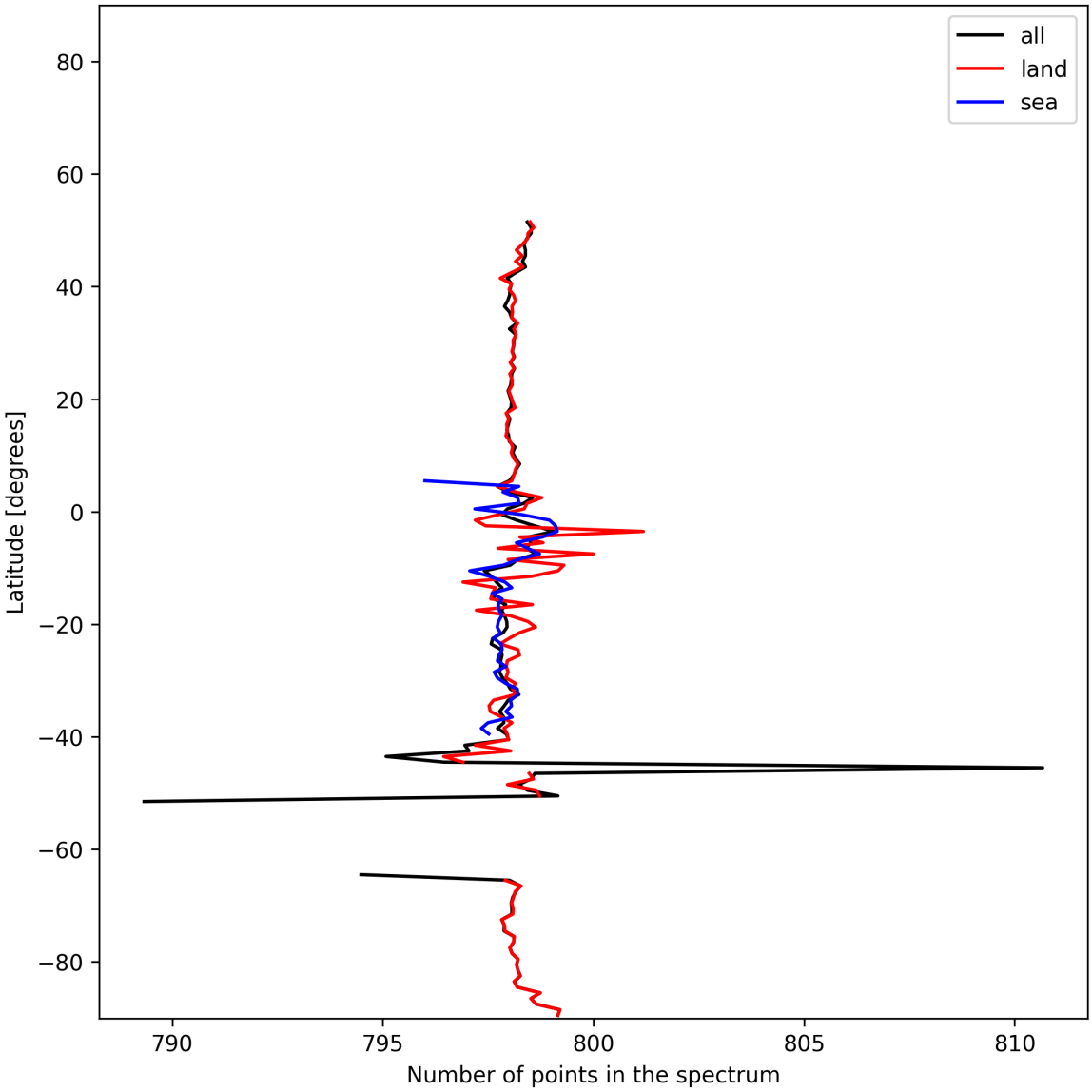

Figure 14: Zonal average of “Number of points in the spectrum” for 2025-12-11 to 2025-12-12.

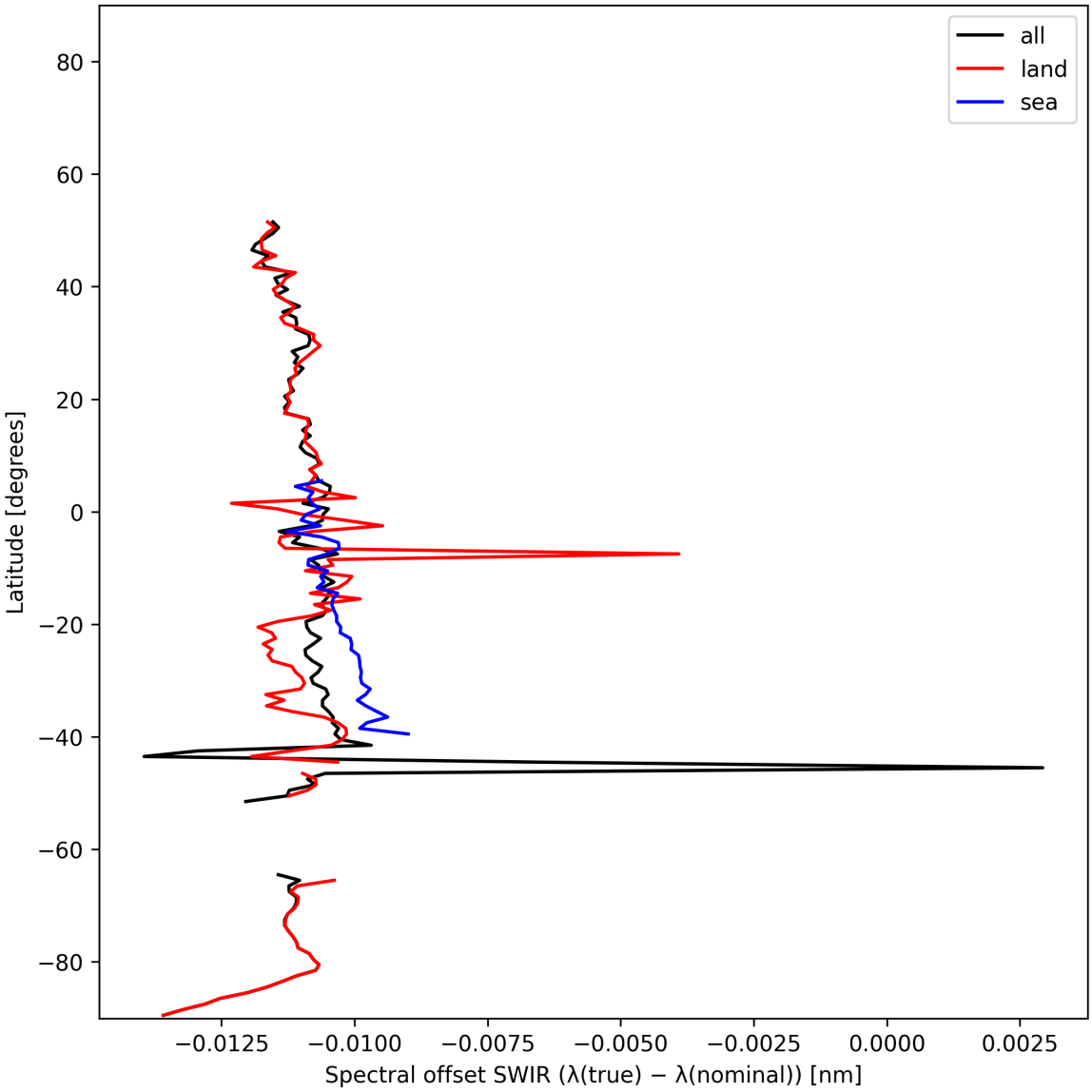

Figure 15: Zonal average of "Spectral offset SWIR ($\lambda_{\text{true}} - \lambda_{\text{nominal}}$)" for 2025-12-11 to 2025-12-12.

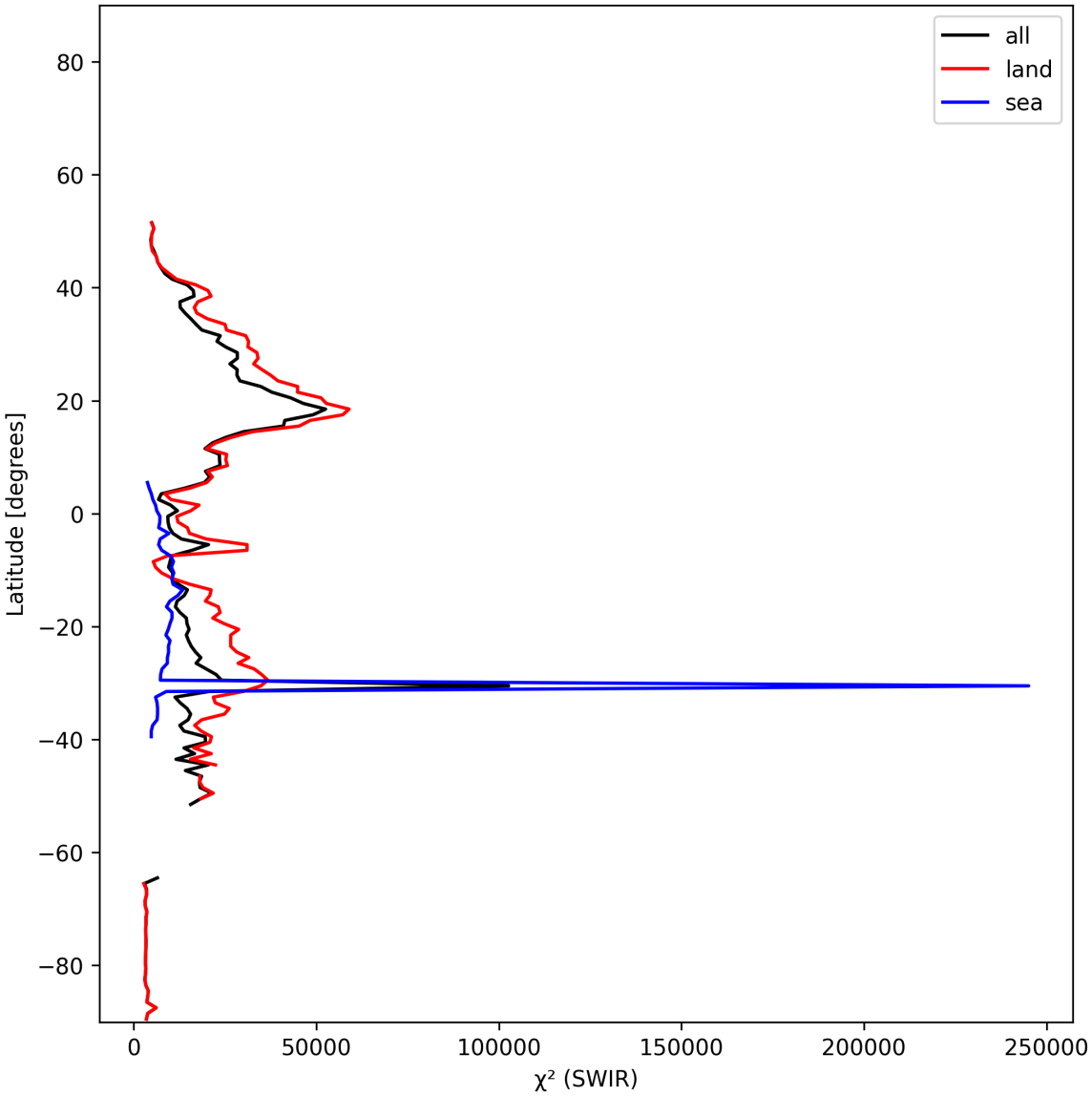

Figure 16: Zonal average of "χ^2 (SWIR)" for 2025-12-11 to 2025-12-12.

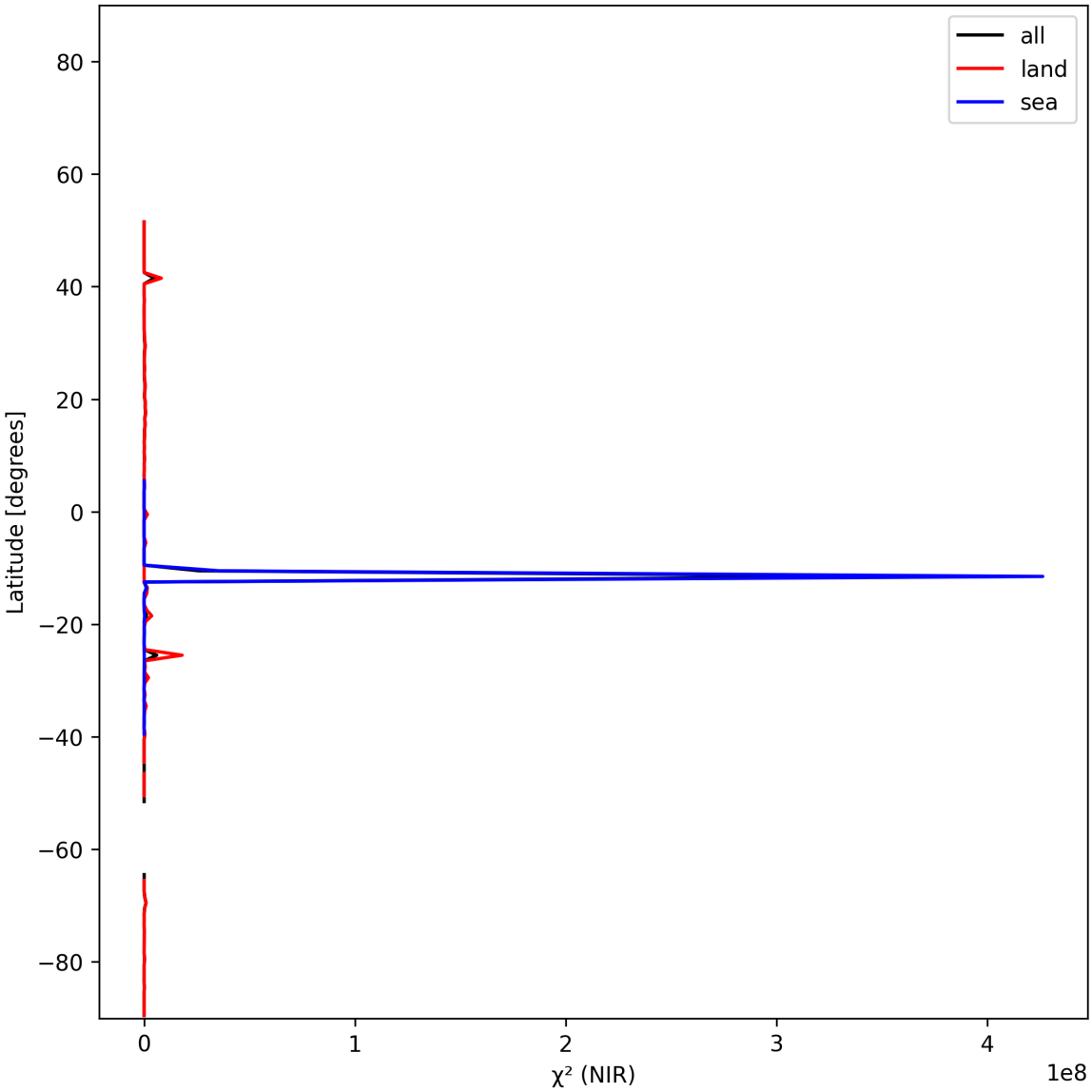

Figure 17: Zonal average of "χ^2 (NIR)" for 2025-12-11 to 2025-12-12.

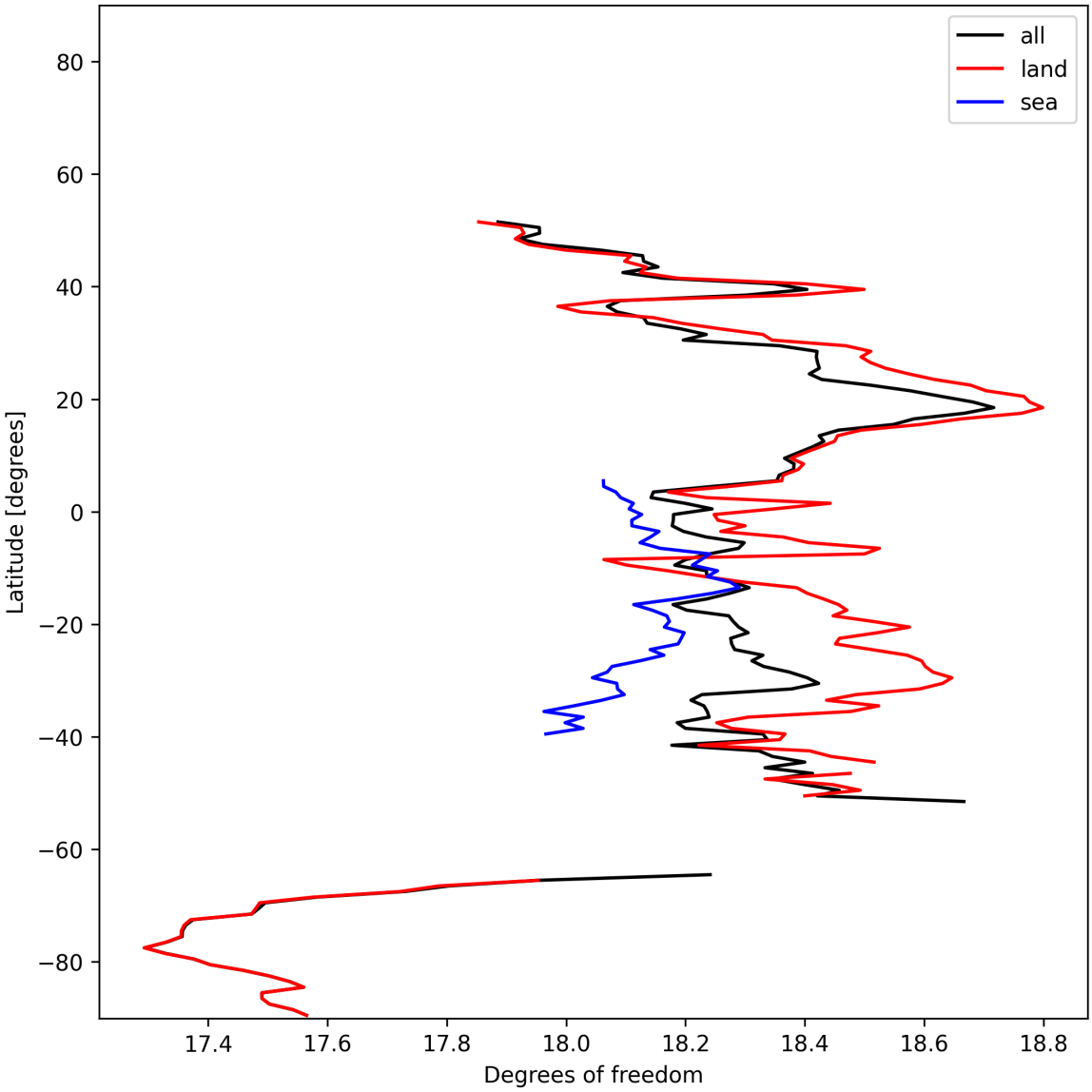

Figure 18: Zonal average of “Degrees of freedom” for 2025-12-11 to 2025-12-12.

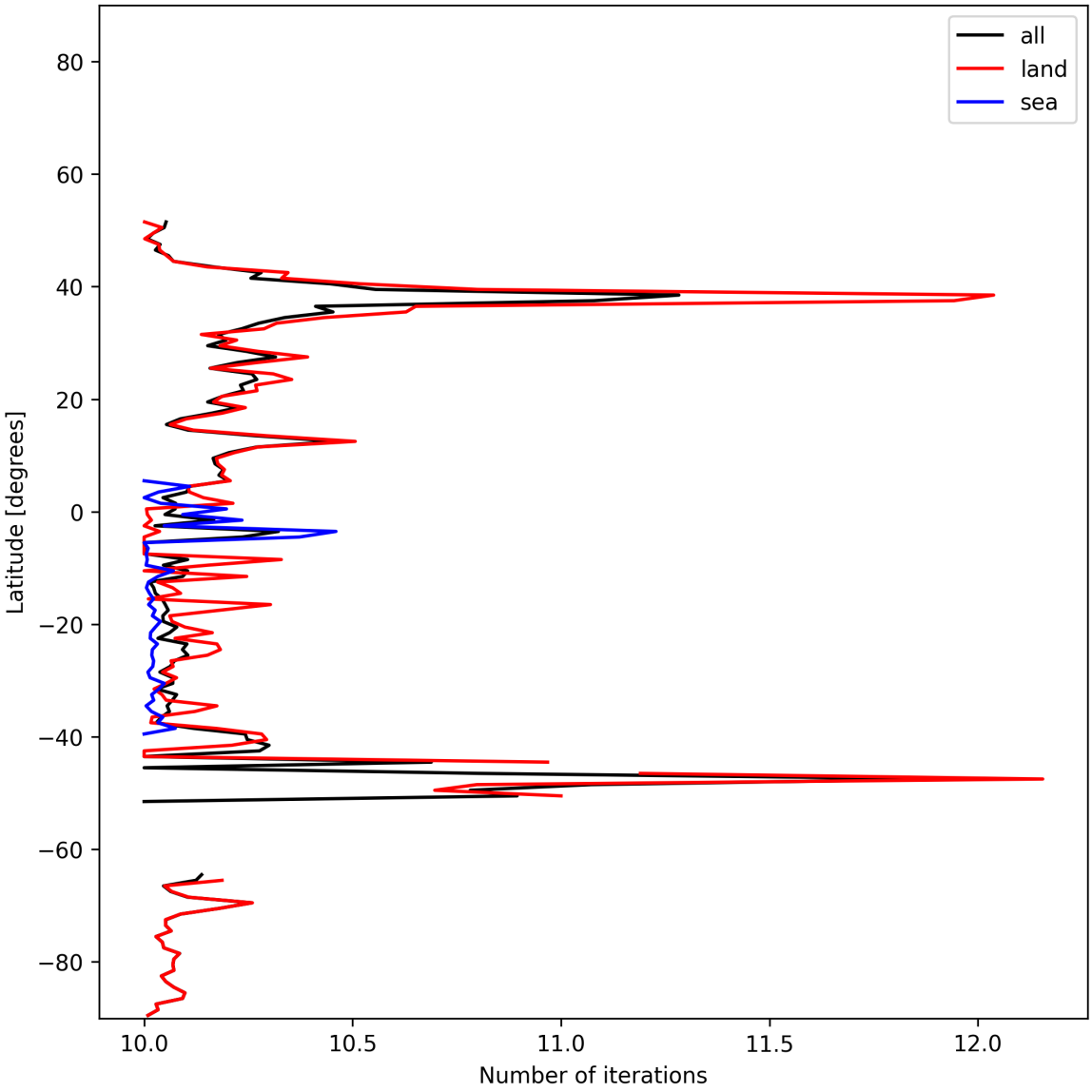

Figure 19: Zonal average of “Number of iterations” for 2025-12-11 to 2025-12-12.

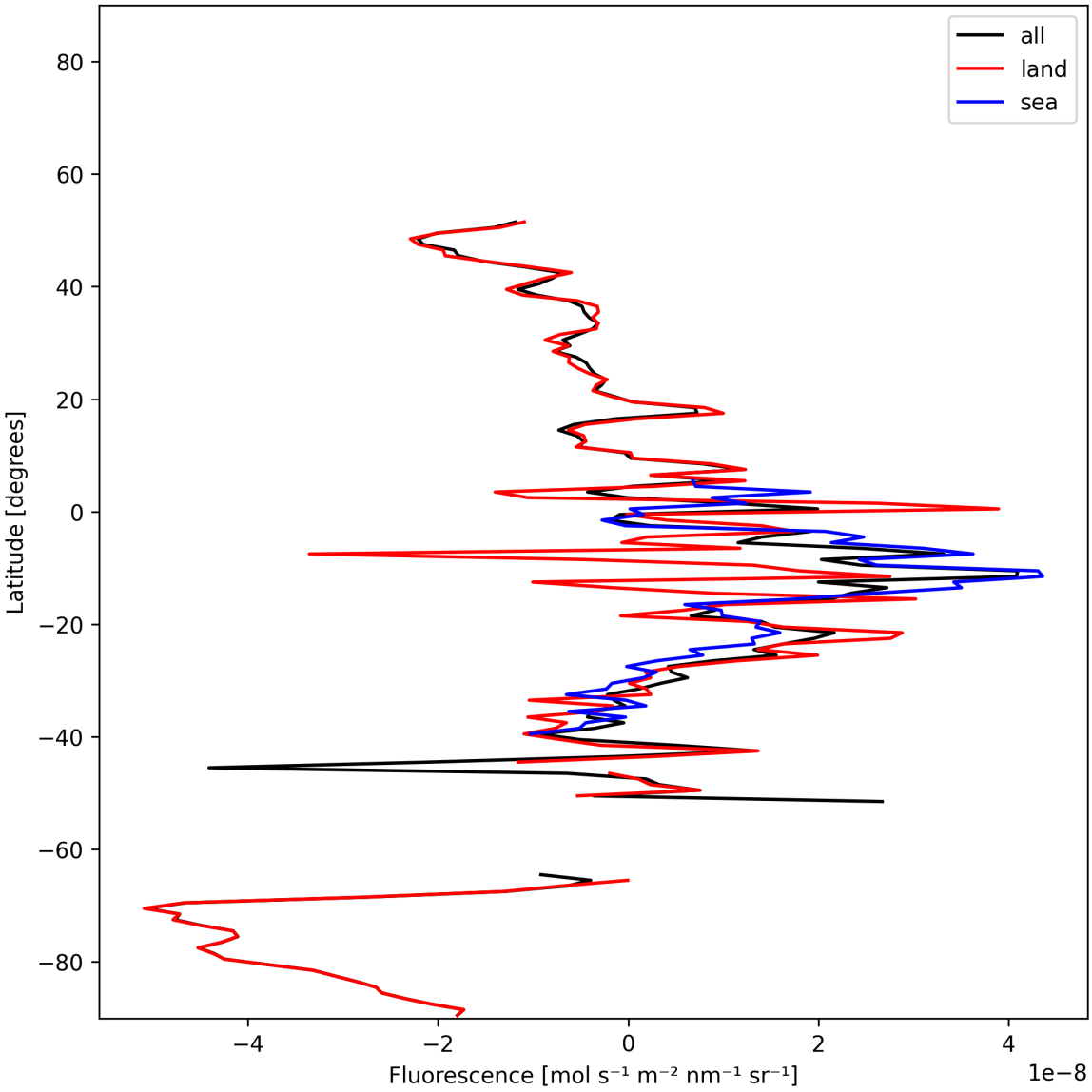

Figure 20: Zonal average of “Fluorescence” for 2025-12-11 to 2025-12-12.

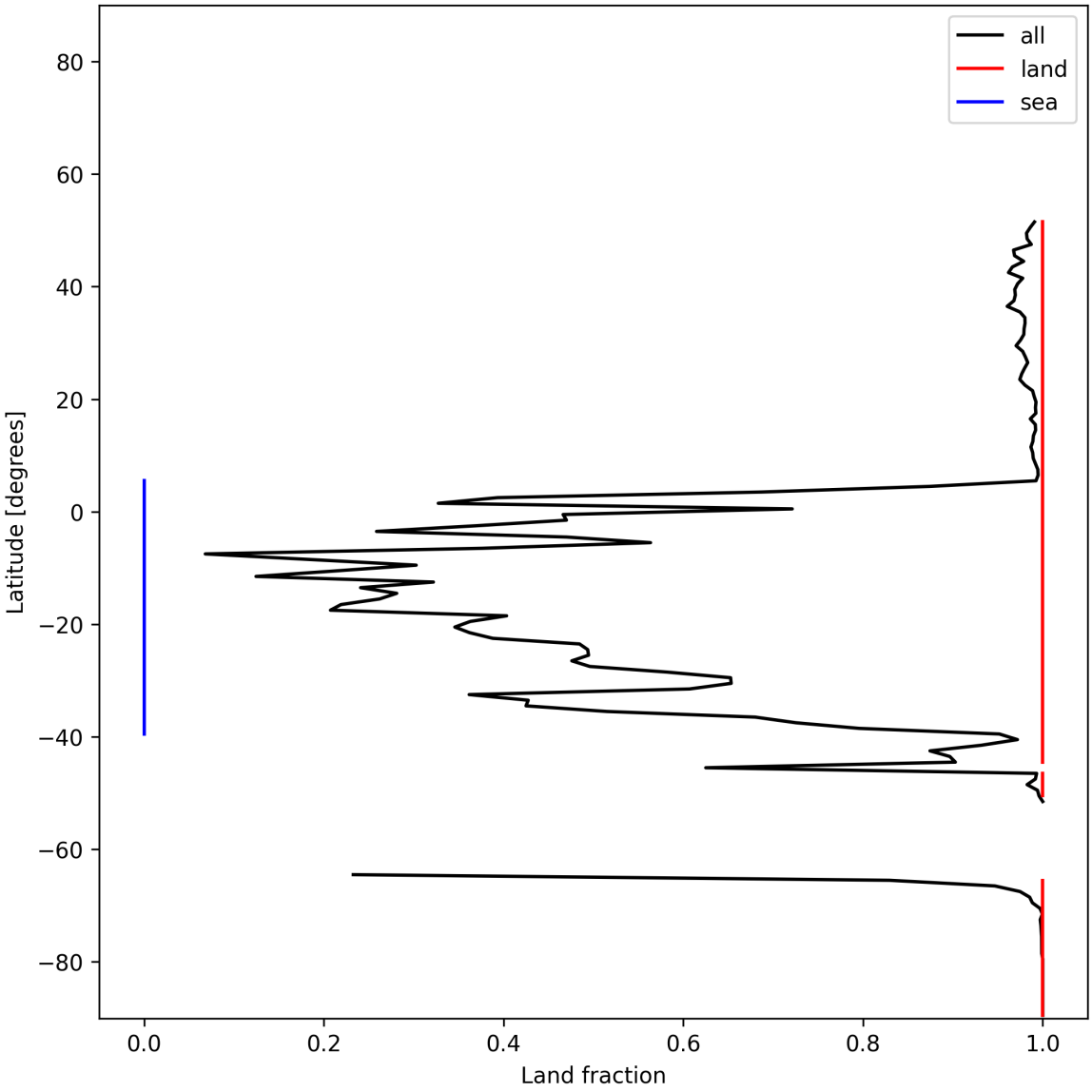

Figure 21: Zonal average of “Land fraction” for 2025-12-11 to 2025-12-12.

8 Histograms

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

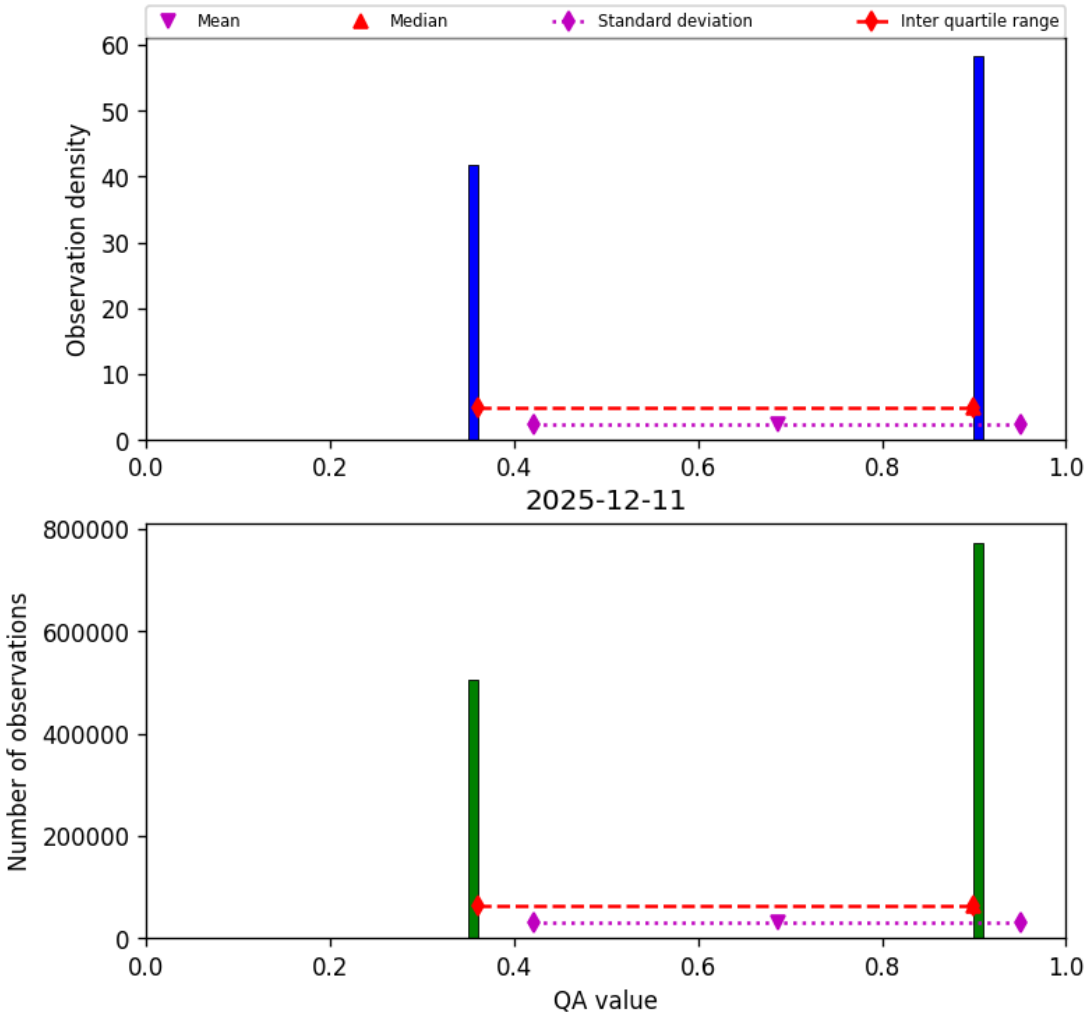

Figure 22: Histogram of “QA value” for 2025-12-11 to 2025-12-12

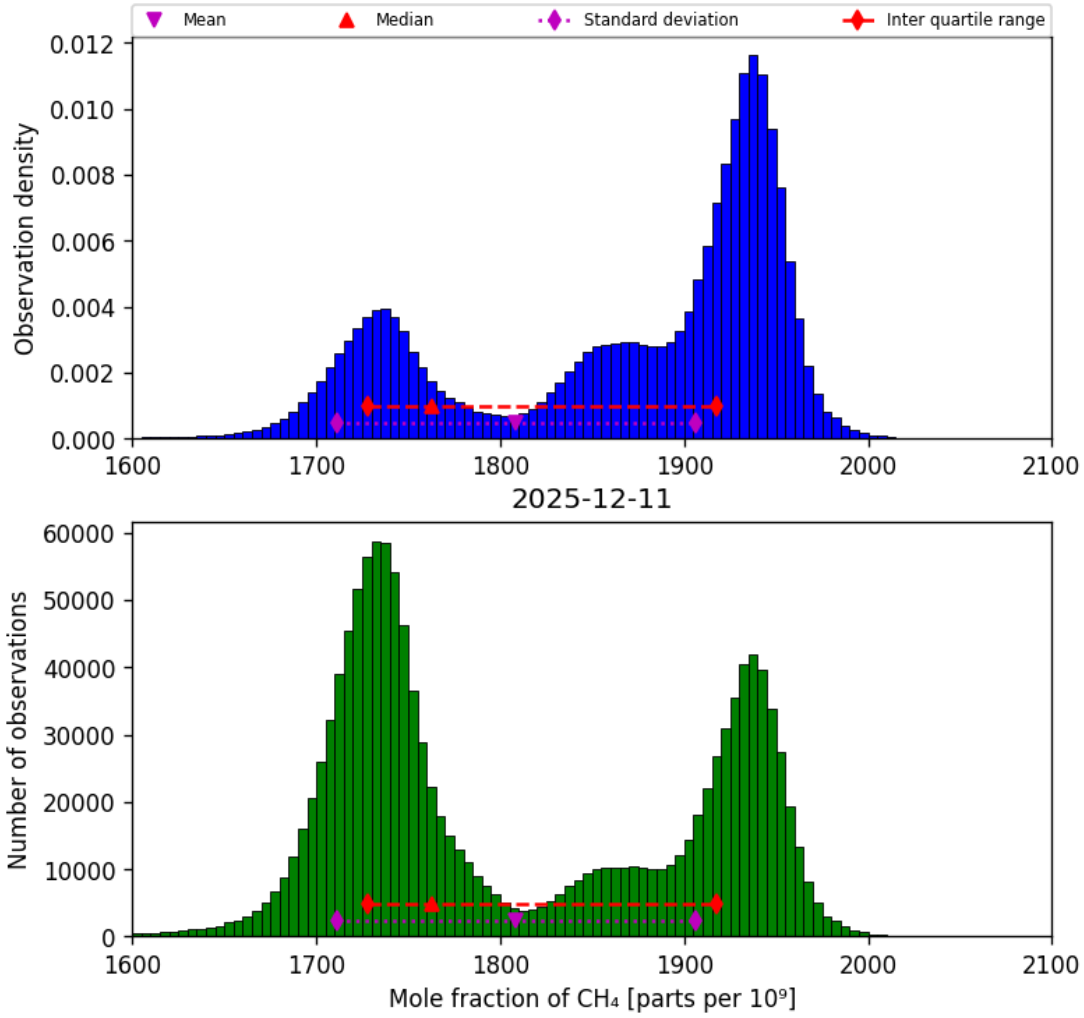

Figure 23: Histogram of "Mole fraction of CH_4" for 2025-12-11 to 2025-12-12

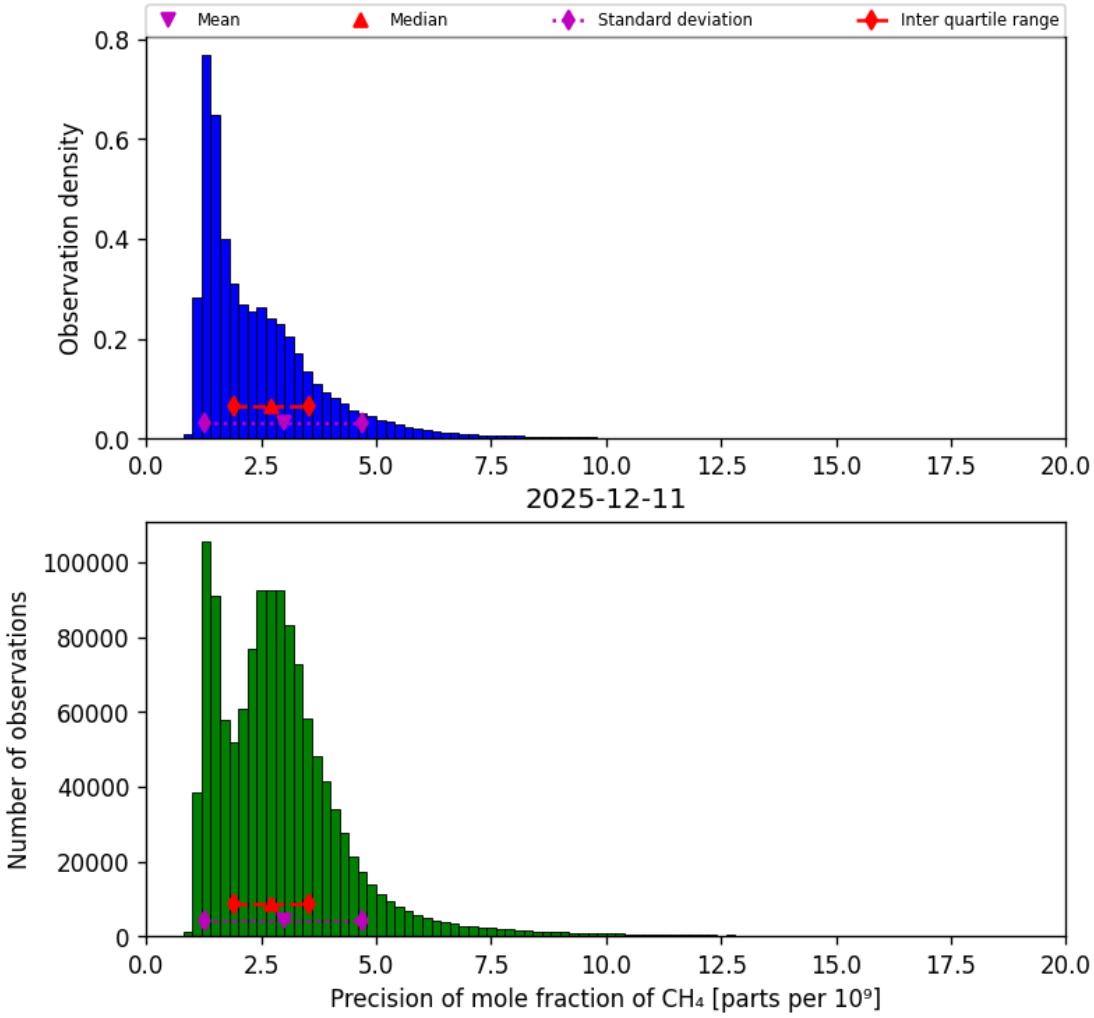

Figure 24: Histogram of "Precision of mole fraction of CH_4" for 2025-12-11 to 2025-12-12

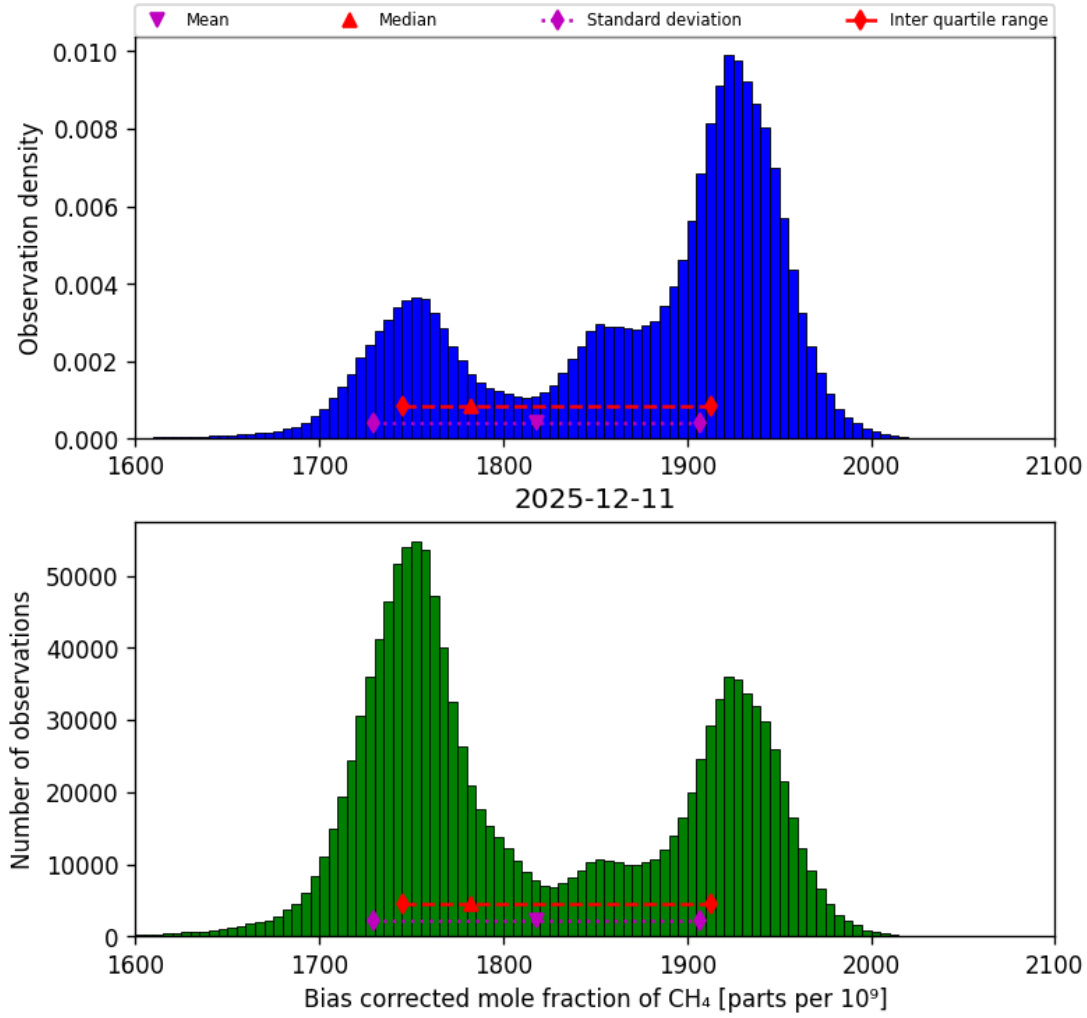

Figure 25: Histogram of "Bias corrected mole fraction of CH_4" for 2025-12-11 to 2025-12-12

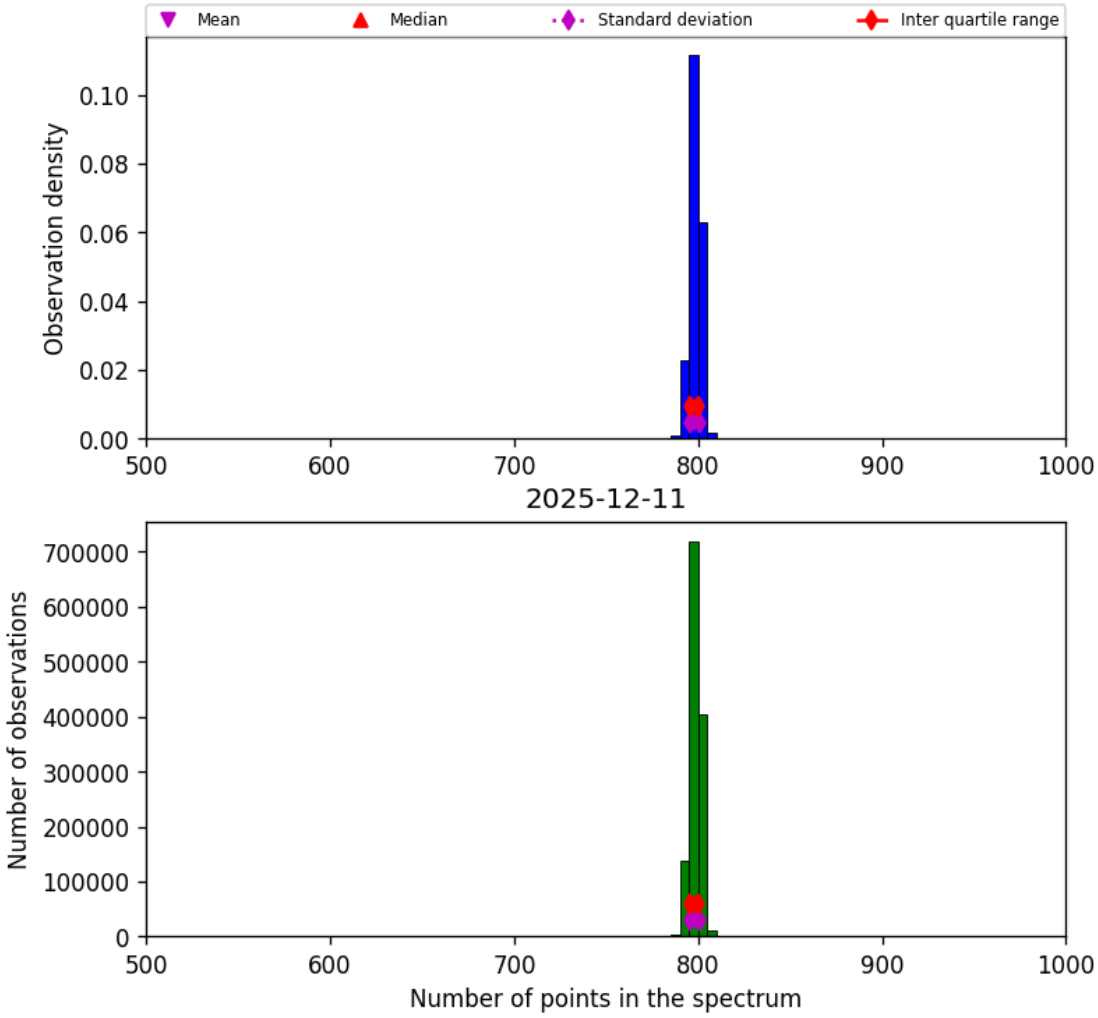

Figure 26: Histogram of “Number of points in the spectrum” for 2025-12-11 to 2025-12-12

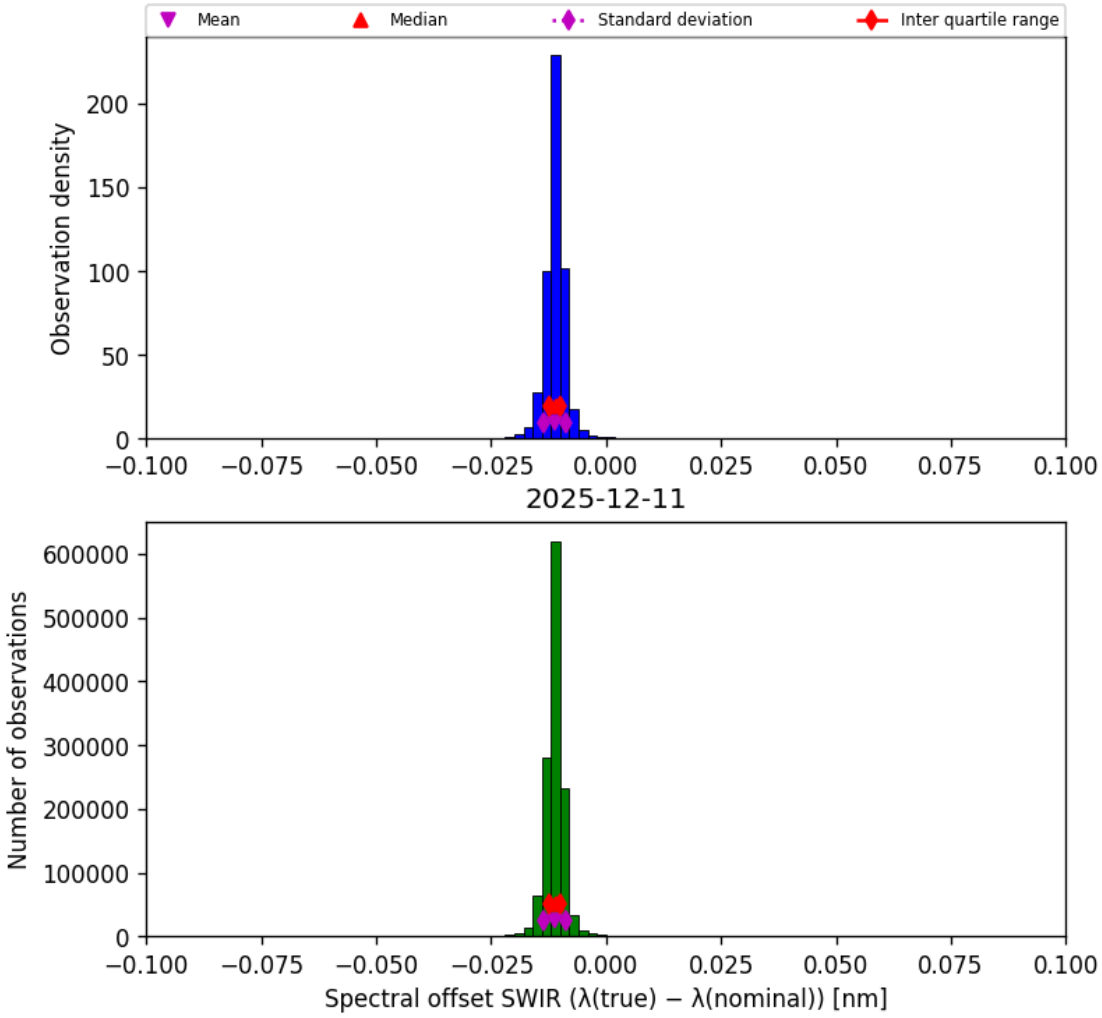

Figure 27: Histogram of "Spectral offset SWIR ($\lambda_{\text{true}} - \lambda_{\text{nominal}}$)" for 2025-12-11 to 2025-12-12

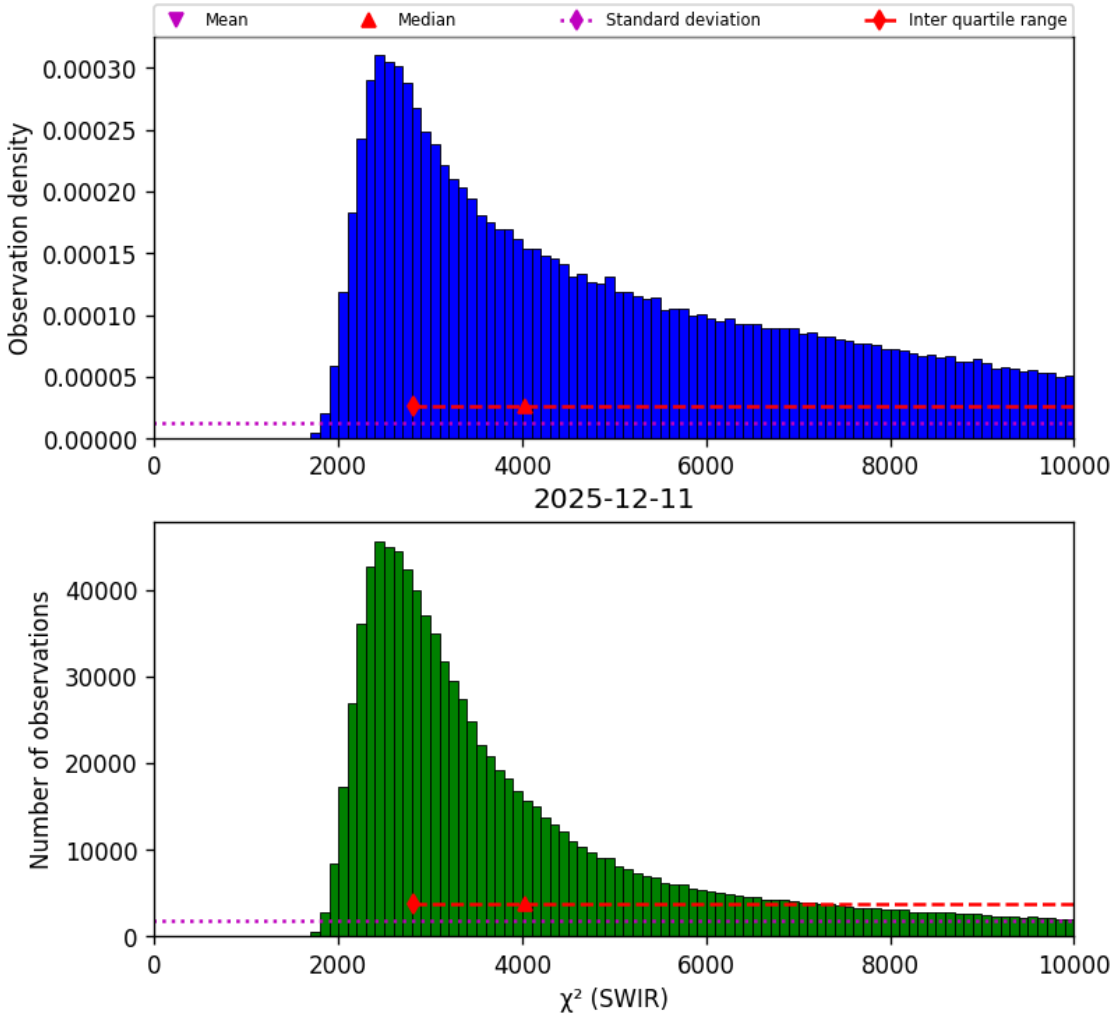

Figure 28: Histogram of "χ^2 (SWIR)" for 2025-12-11 to 2025-12-12

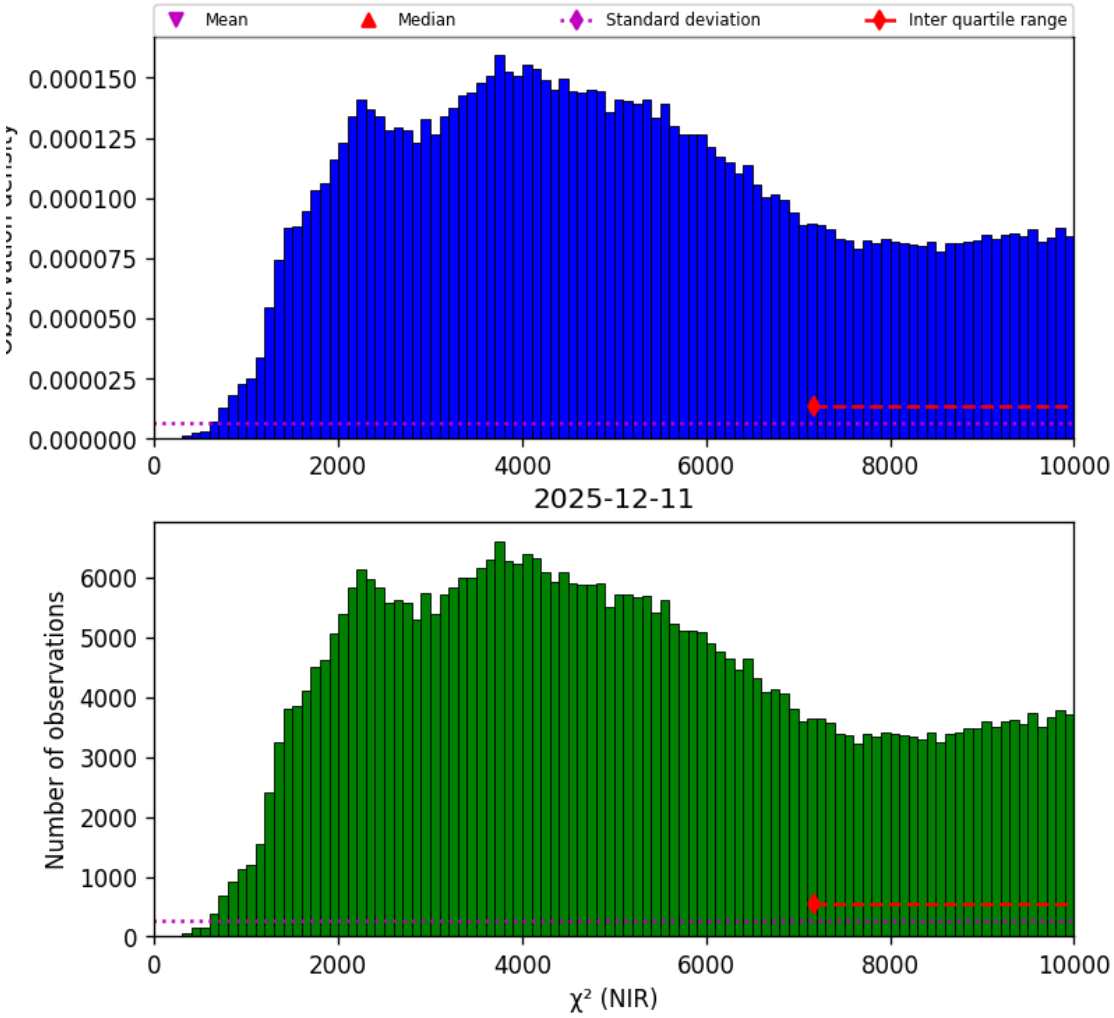

Figure 29: Histogram of "χ^2 (NIR)" for 2025-12-11 to 2025-12-12

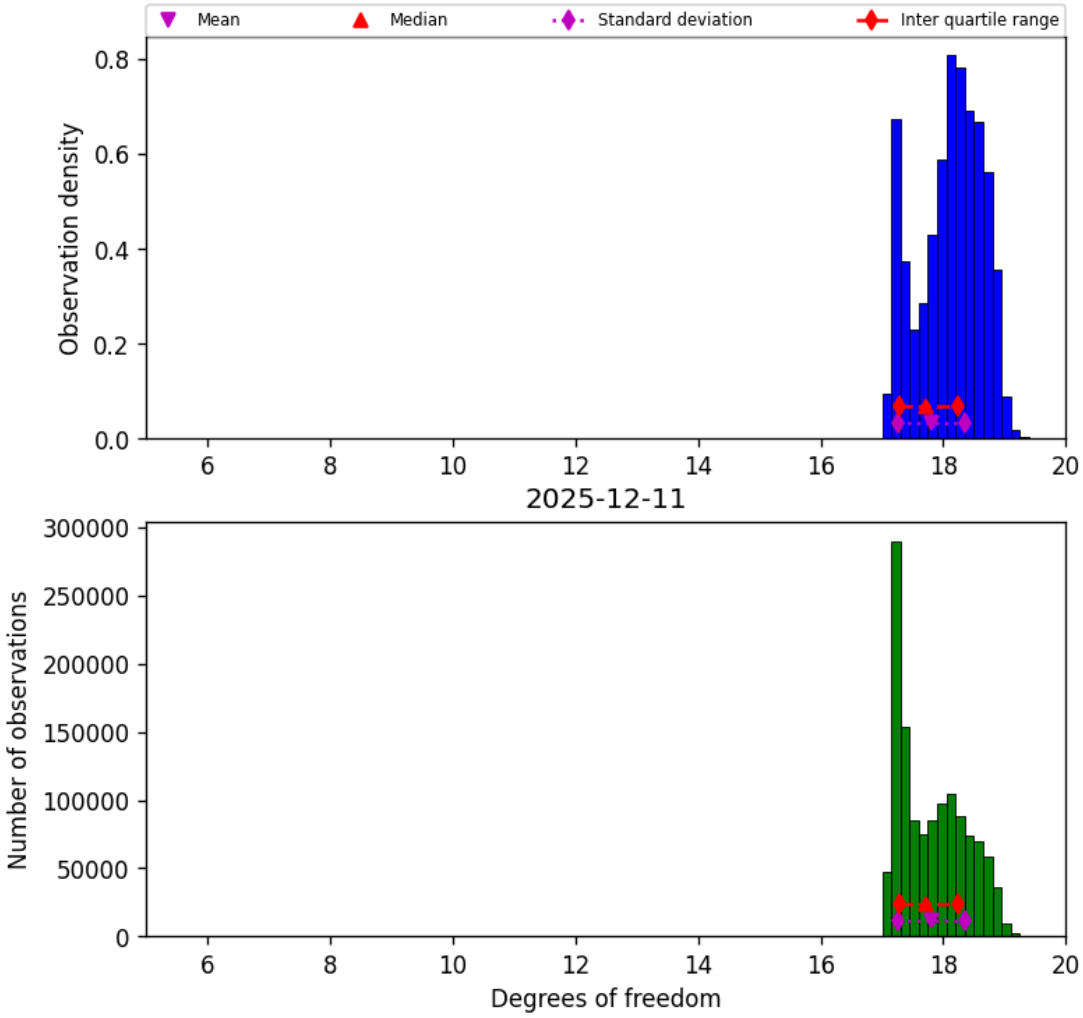

Figure 30: Histogram of “Degrees of freedom” for 2025-12-11 to 2025-12-12

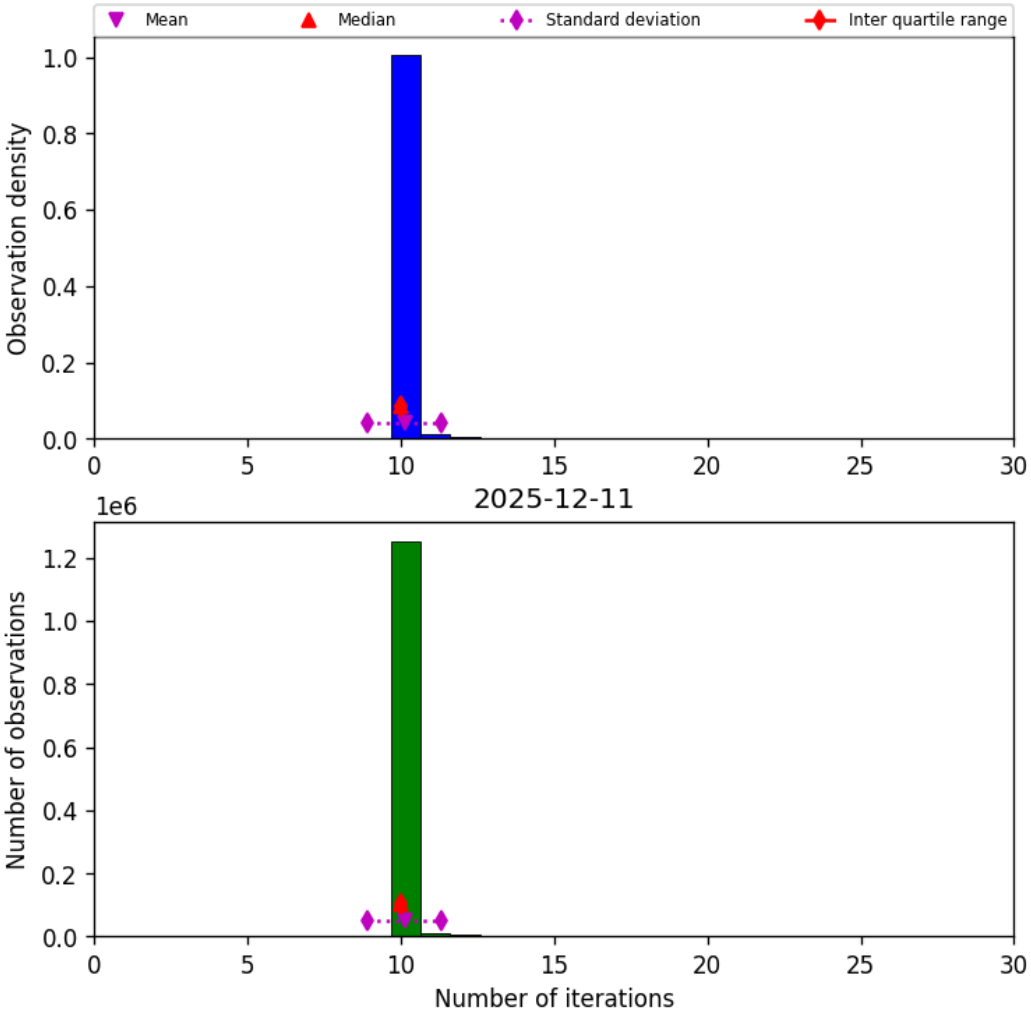

Figure 31: Histogram of “Number of iterations” for 2025-12-11 to 2025-12-12

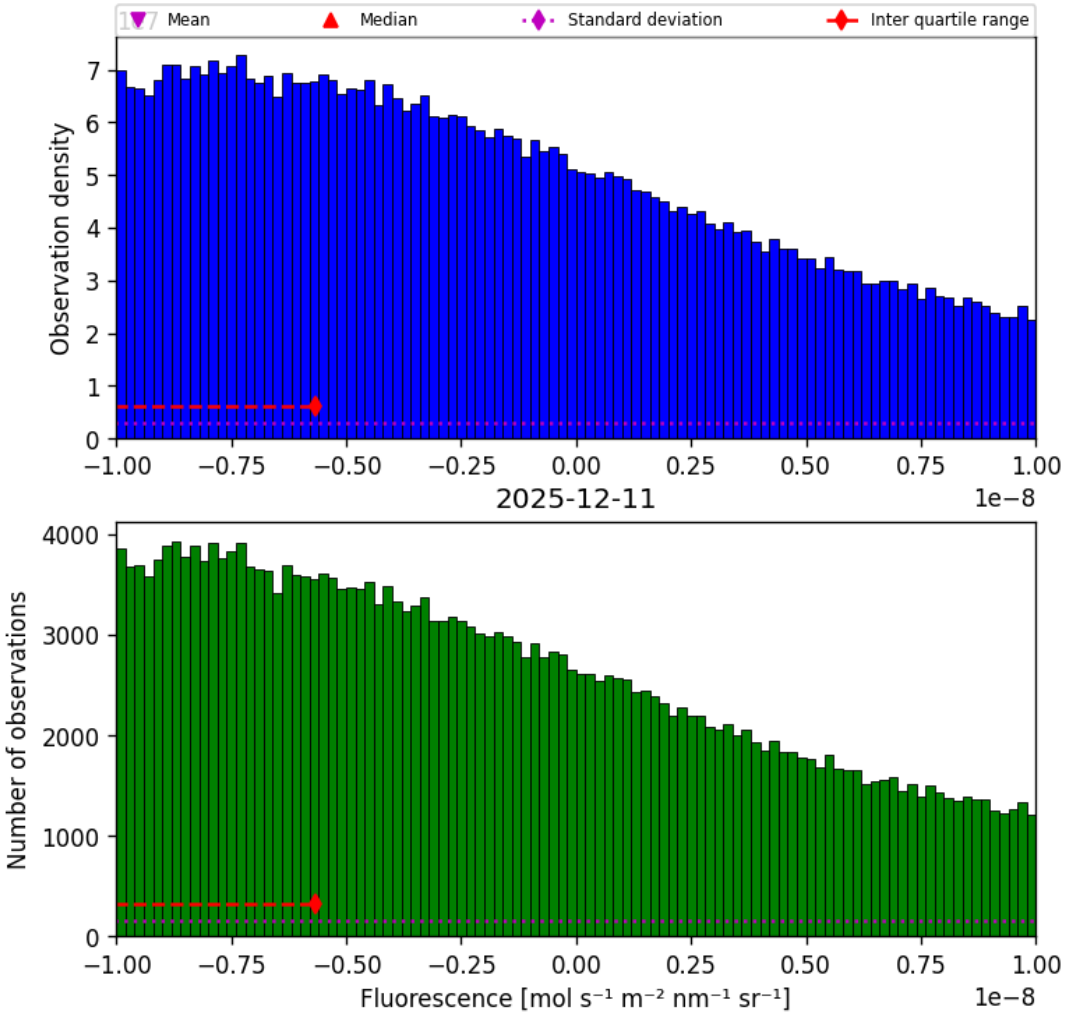

Figure 32: Histogram of “Fluorescence” for 2025-12-11 to 2025-12-12

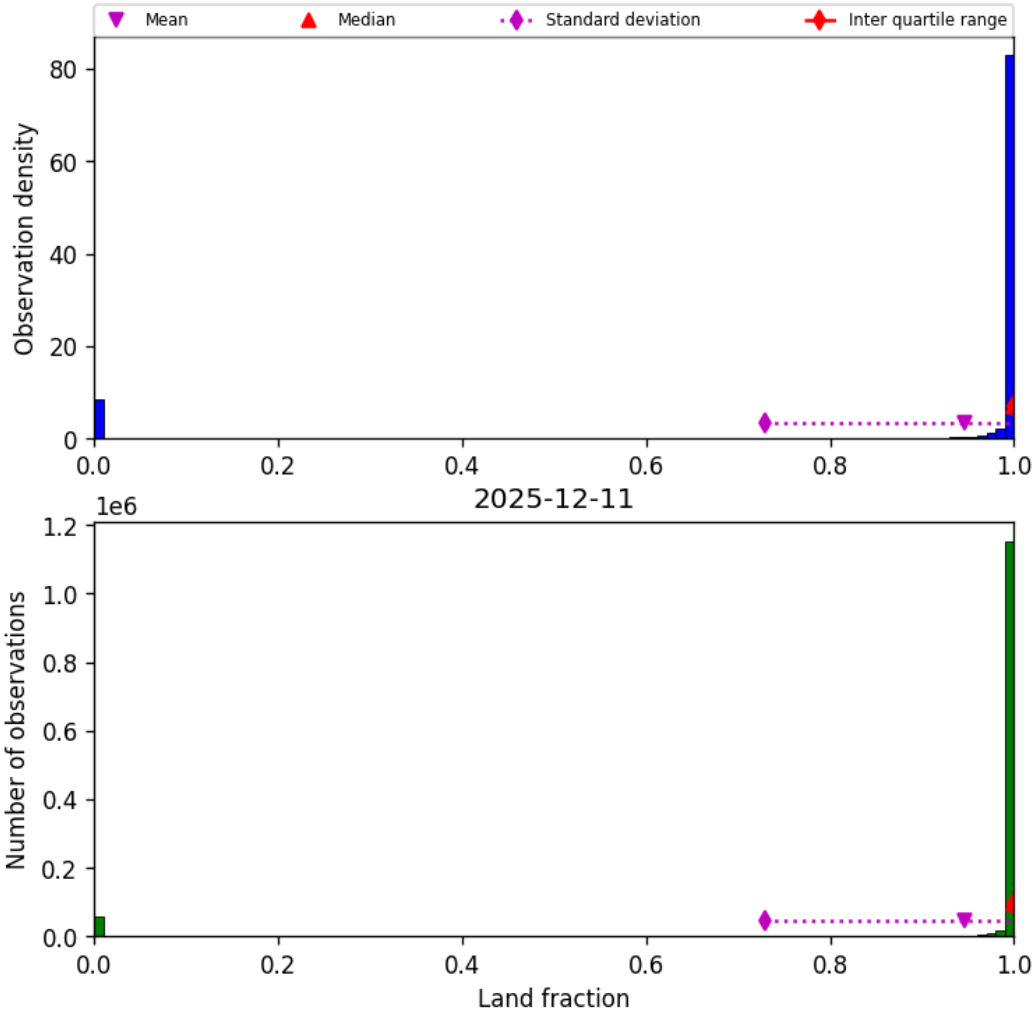

Figure 33: Histogram of “Land fraction” for 2025-12-11 to 2025-12-12

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.

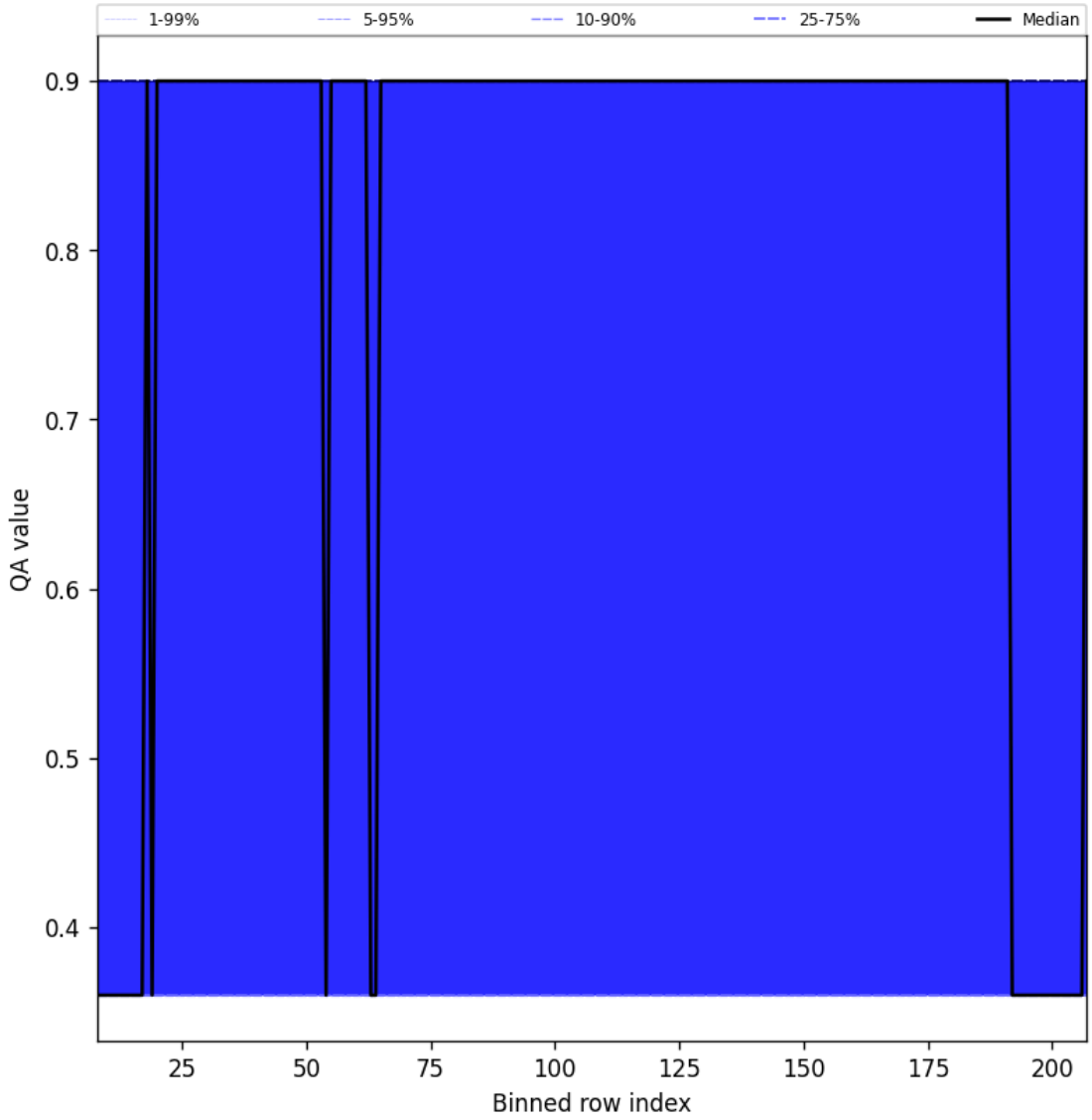

Figure 34: Along track statistics of “QA value” for 2025-12-11 to 2025-12-12

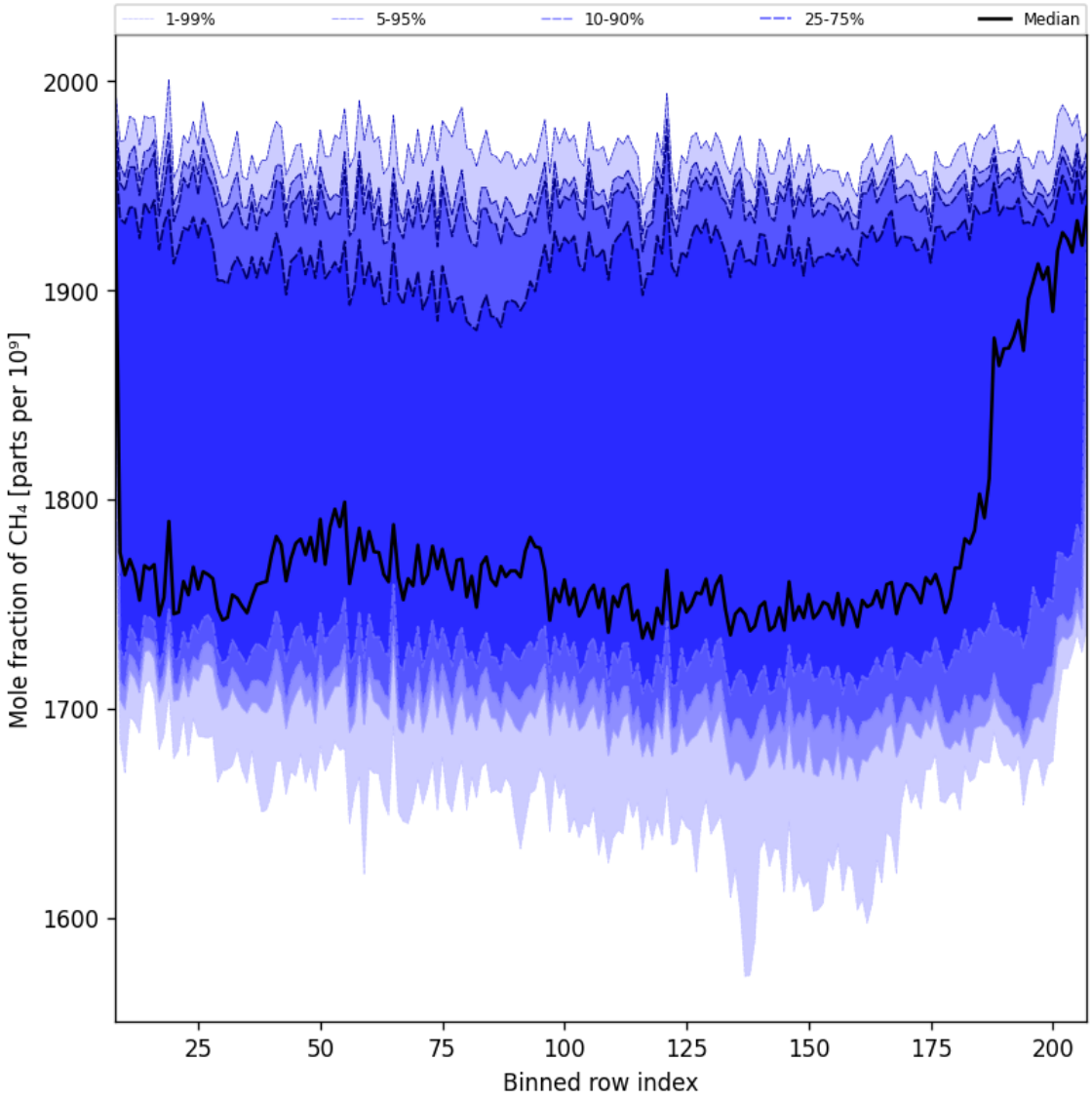

Figure 35: Along track statistics of “Mole fraction of CH_4” for 2025-12-11 to 2025-12-12

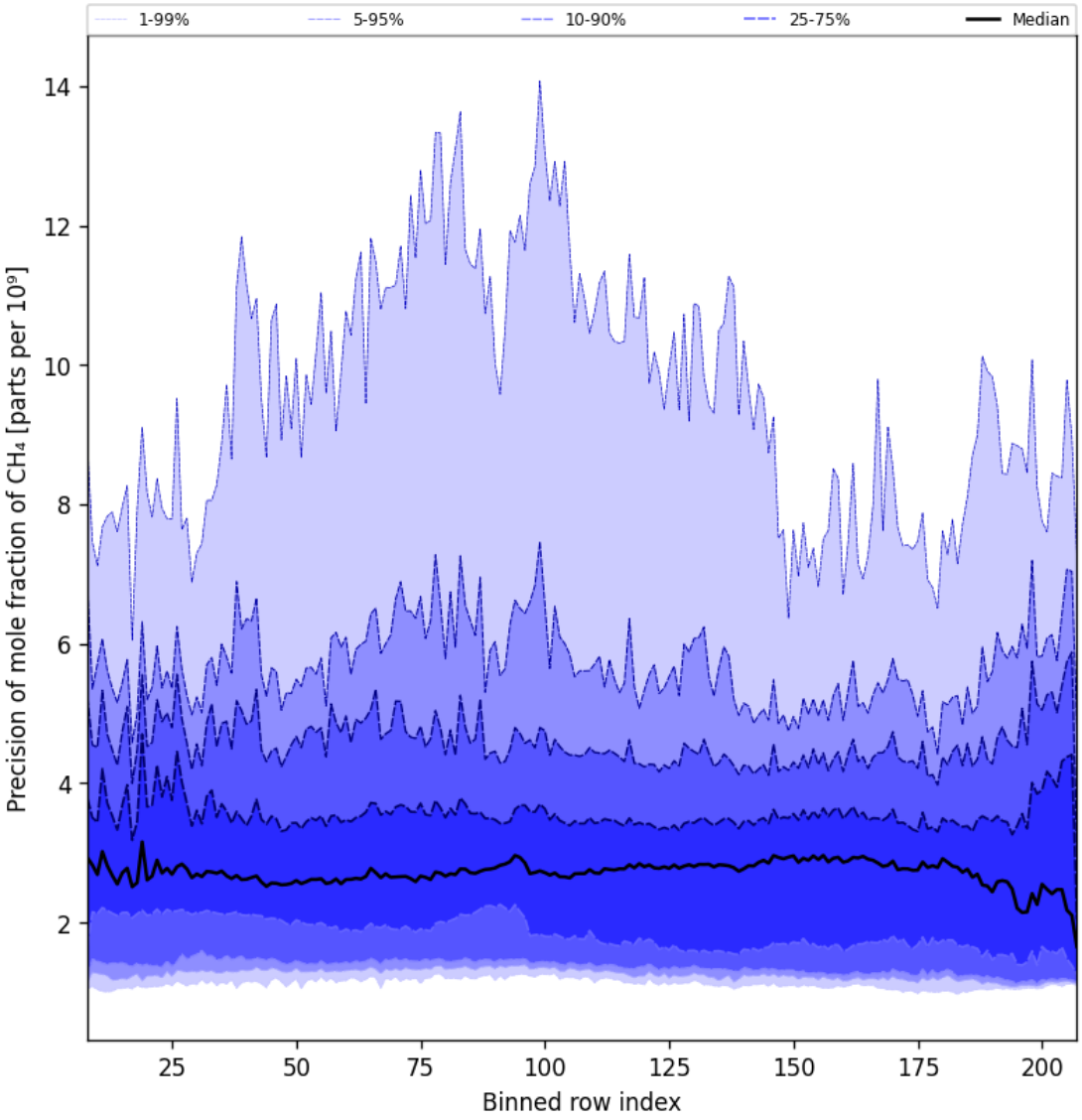

Figure 36: Along track statistics of “Precision of mole fraction of CH_4” for 2025-12-11 to 2025-12-12

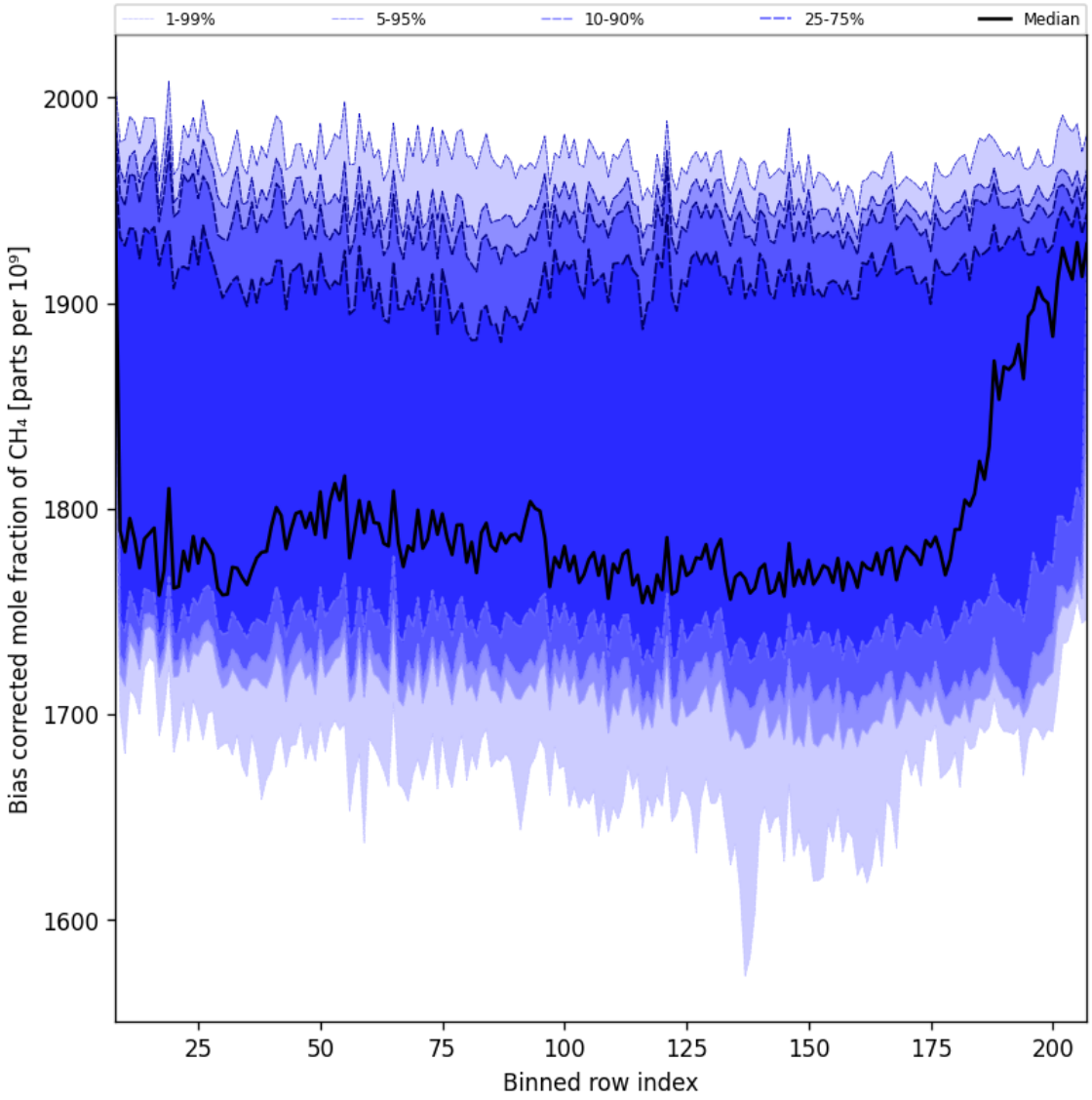

Figure 37: Along track statistics of “Bias corrected mole fraction of CH_4” for 2025-12-11 to 2025-12-12

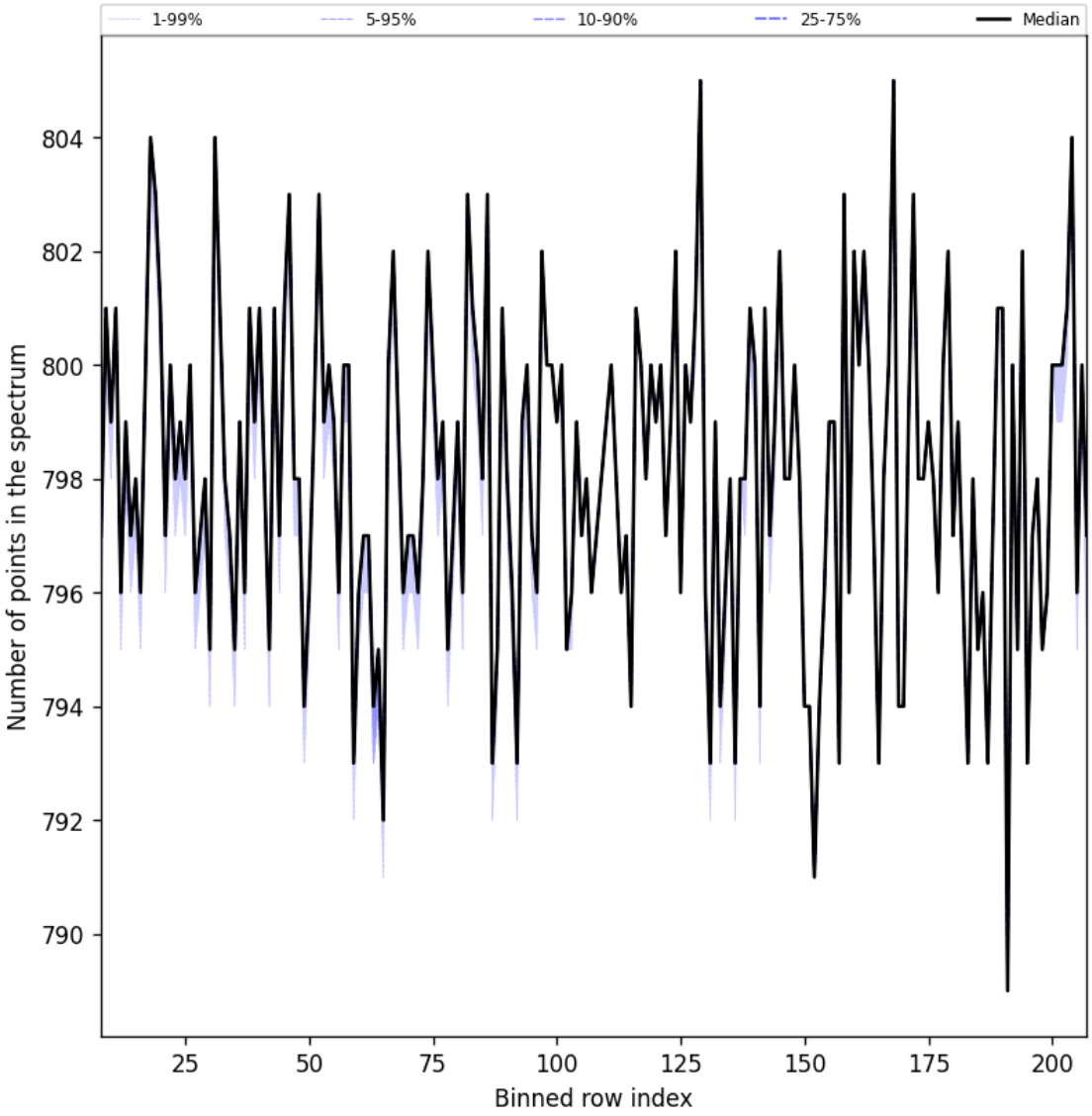

Figure 38: Along track statistics of “Number of points in the spectrum” for 2025-12-11 to 2025-12-12

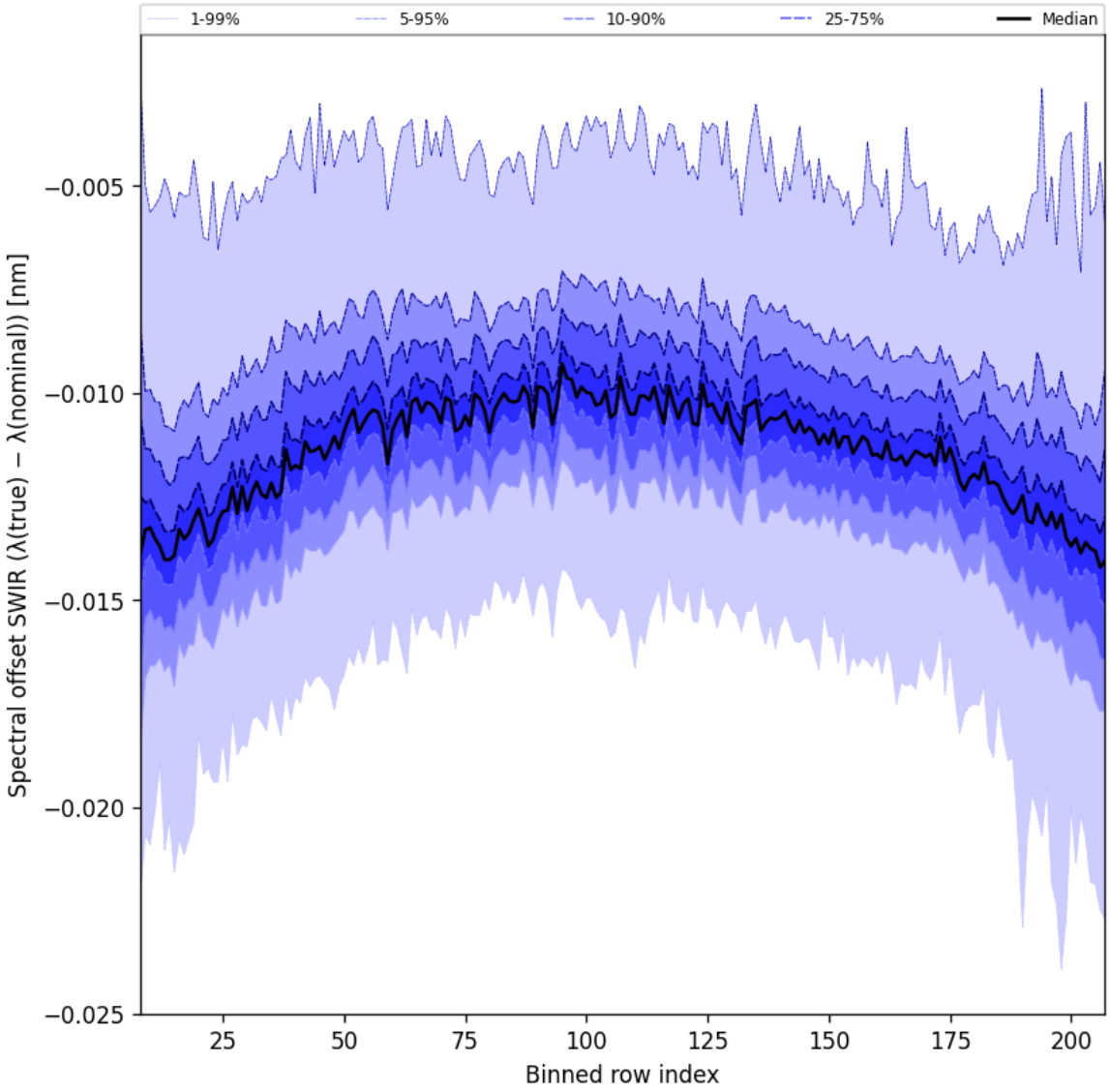

Figure 39: Along track statistics of "Spectral offset SWIR ($\lambda_{\text{true}} - \lambda_{\text{nominal}}$)" for 2025-12-11 to 2025-12-12

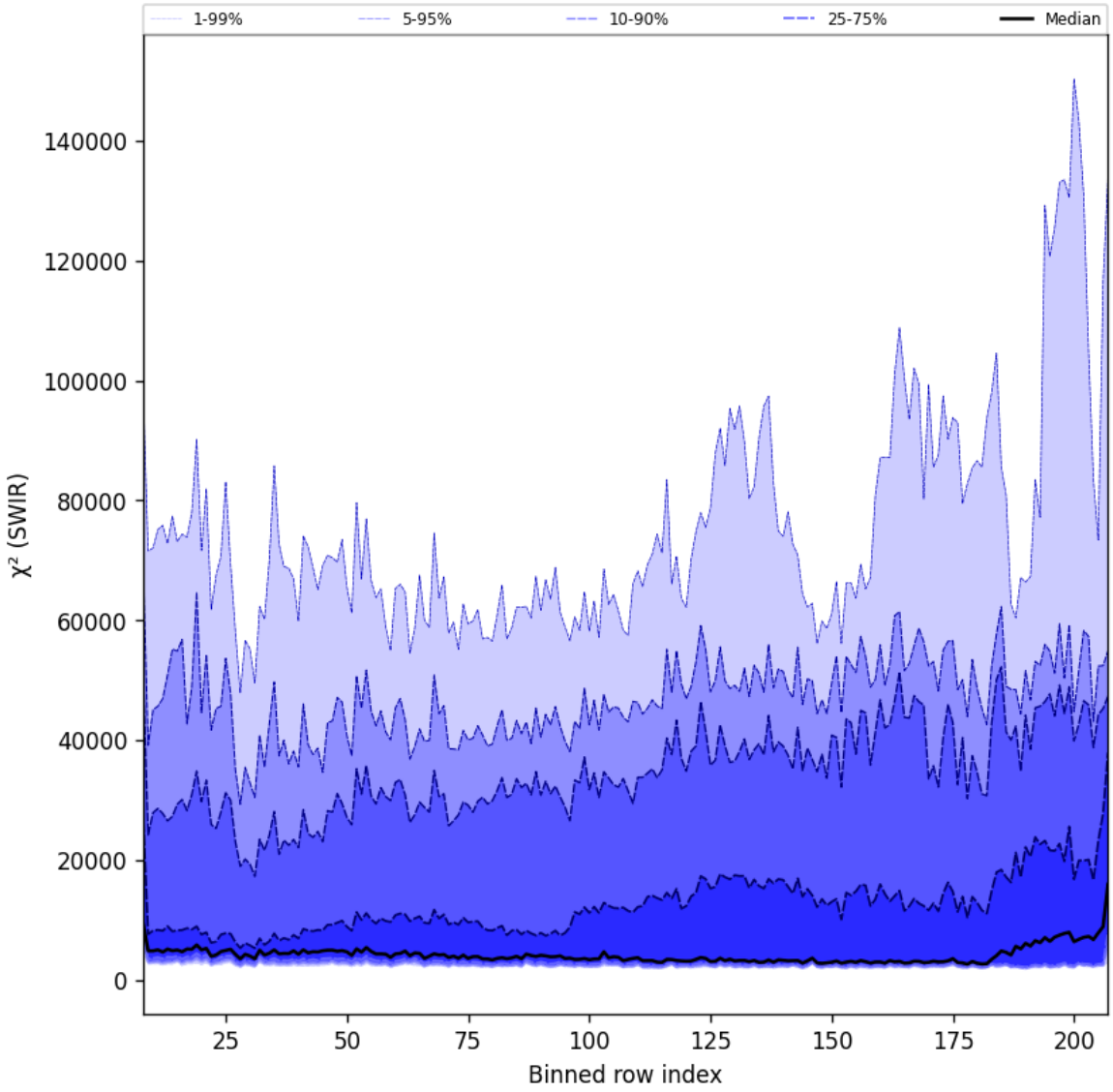

Figure 40: Along track statistics of "χ^2 (SWIR)" for 2025-12-11 to 2025-12-12

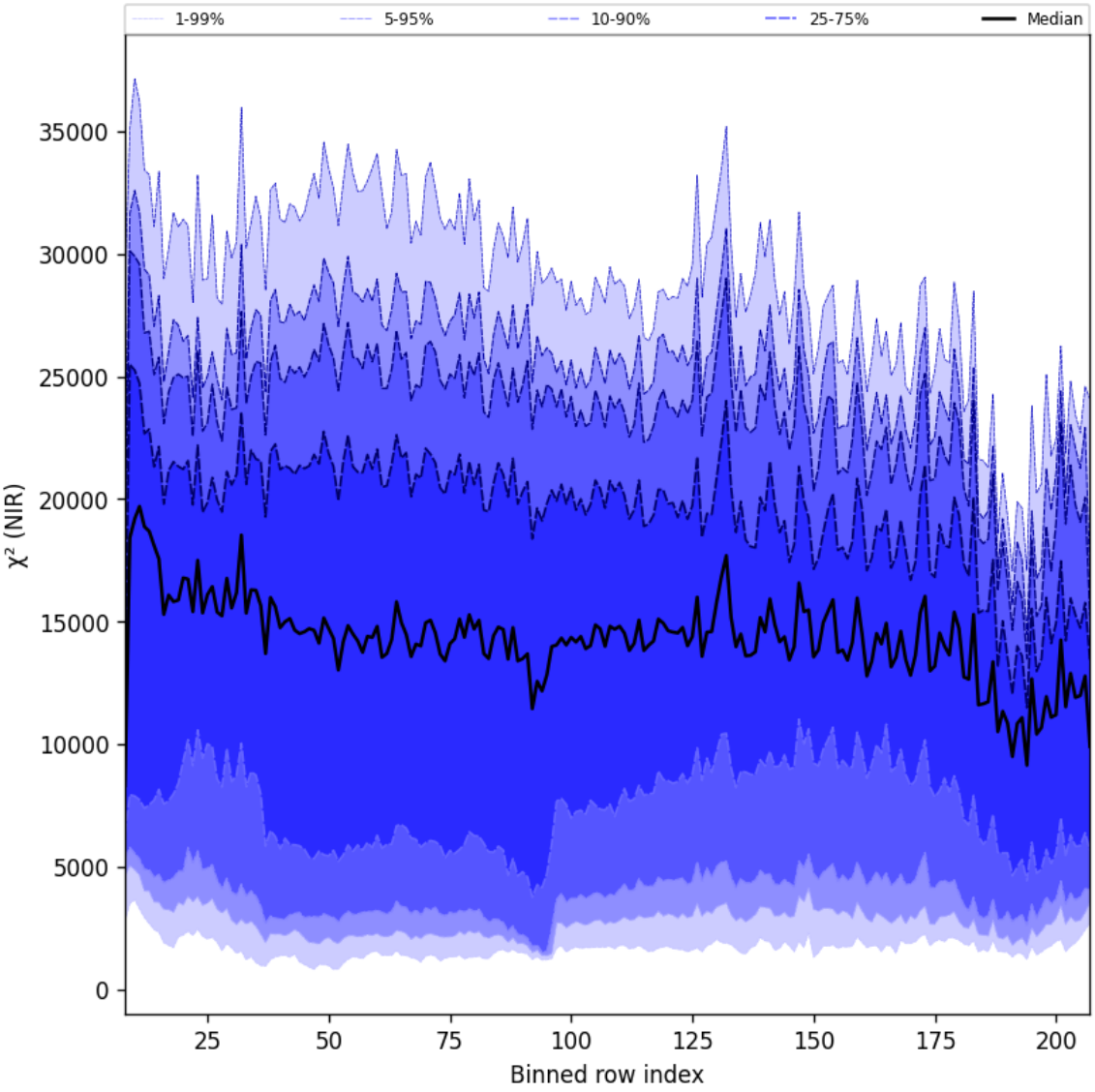

Figure 41: Along track statistics of "χ^2 (NIR)" for 2025-12-11 to 2025-12-12

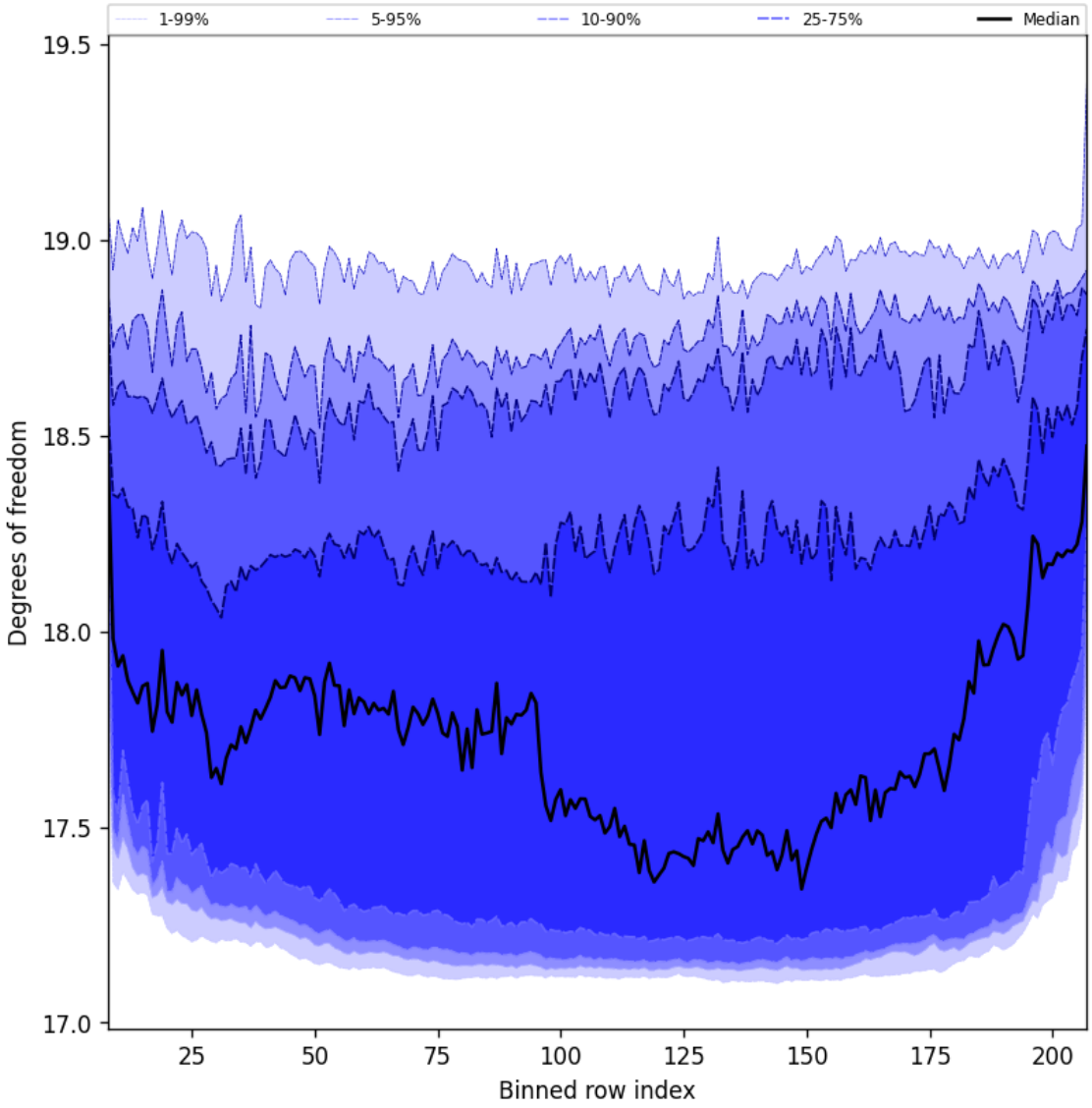

Figure 42: Along track statistics of “Degrees of freedom” for 2025-12-11 to 2025-12-12

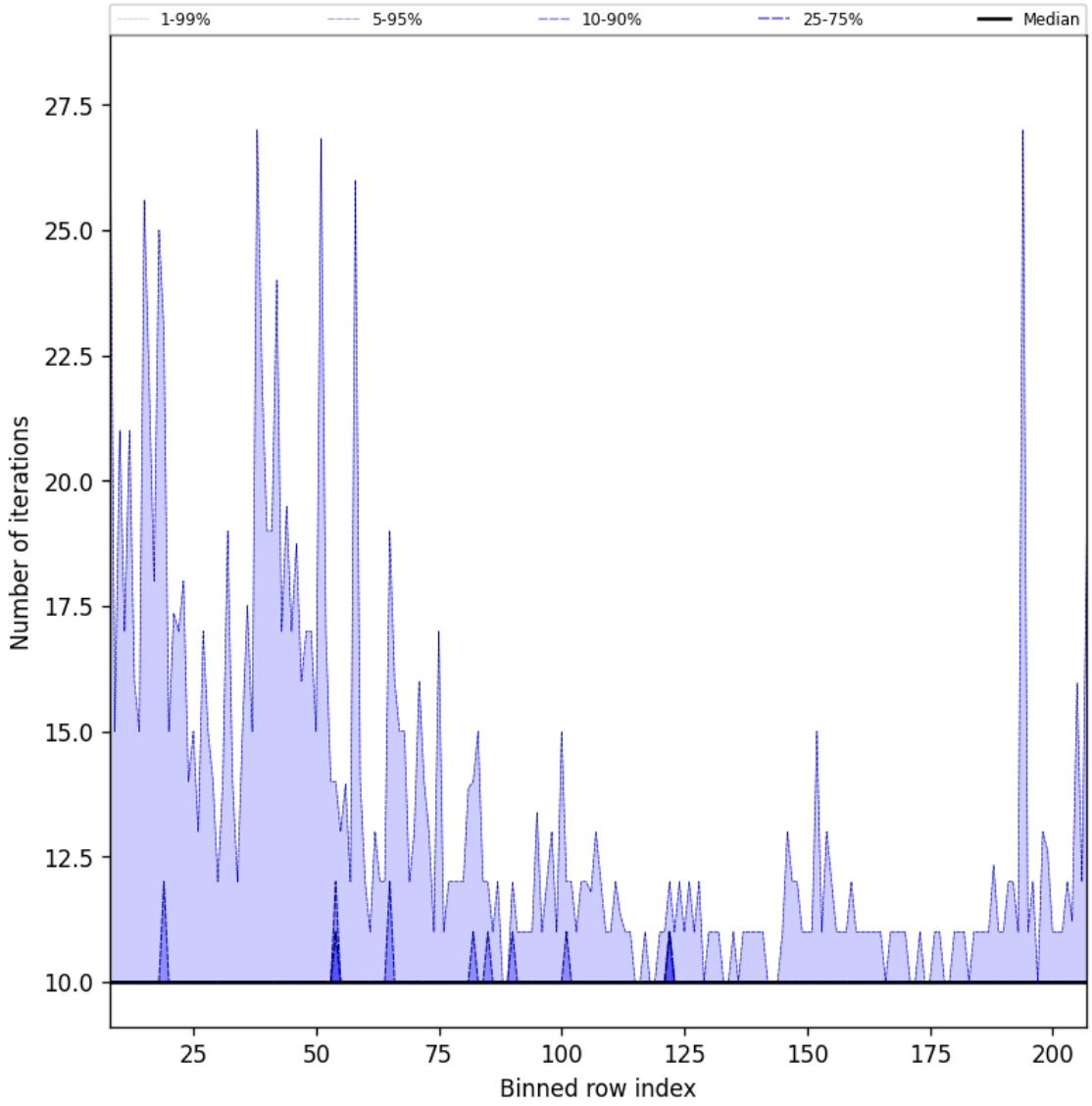

Figure 43: Along track statistics of “Number of iterations” for 2025-12-11 to 2025-12-12

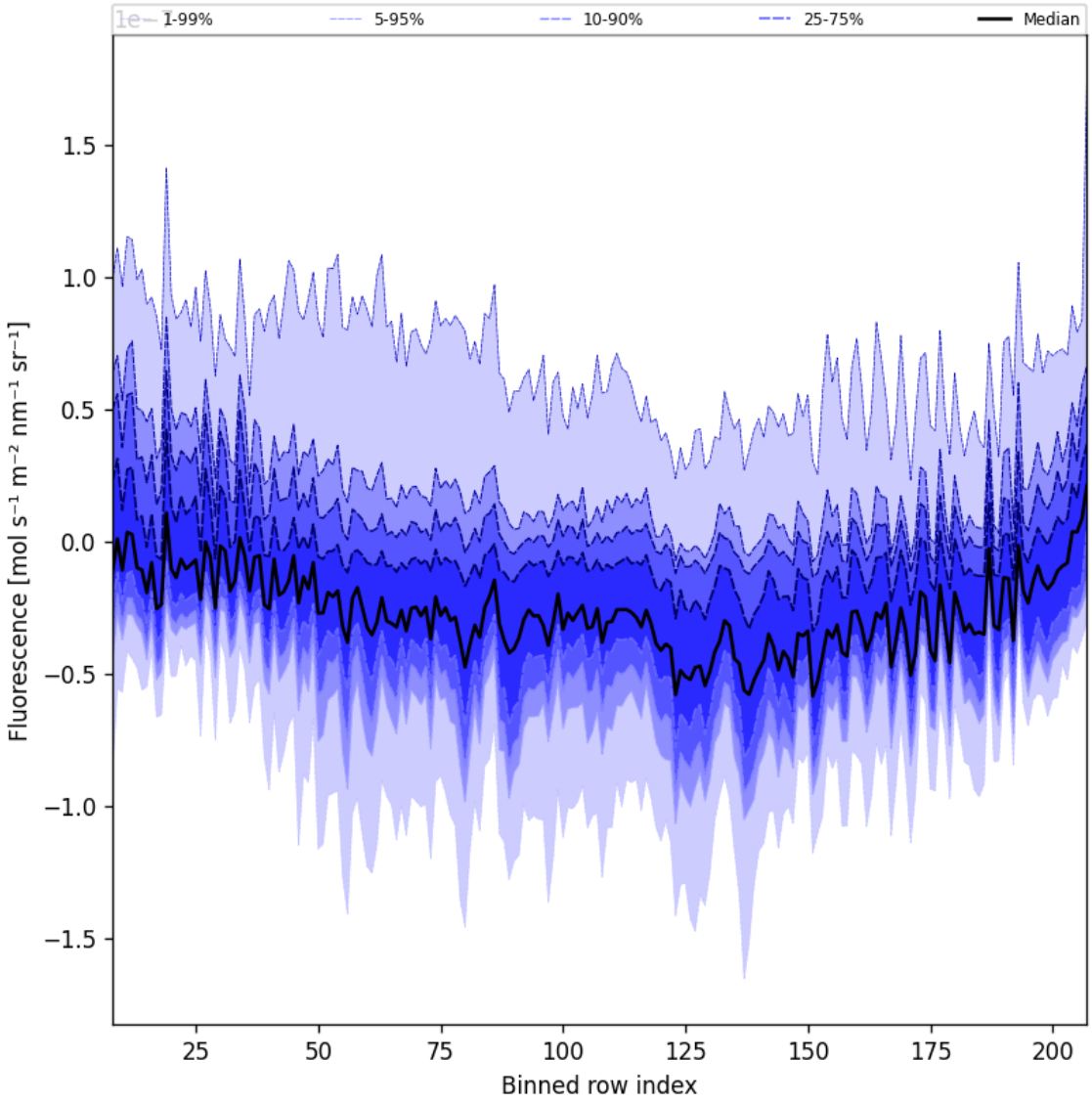

Figure 44: Along track statistics of “Fluorescence” for 2025-12-11 to 2025-12-12

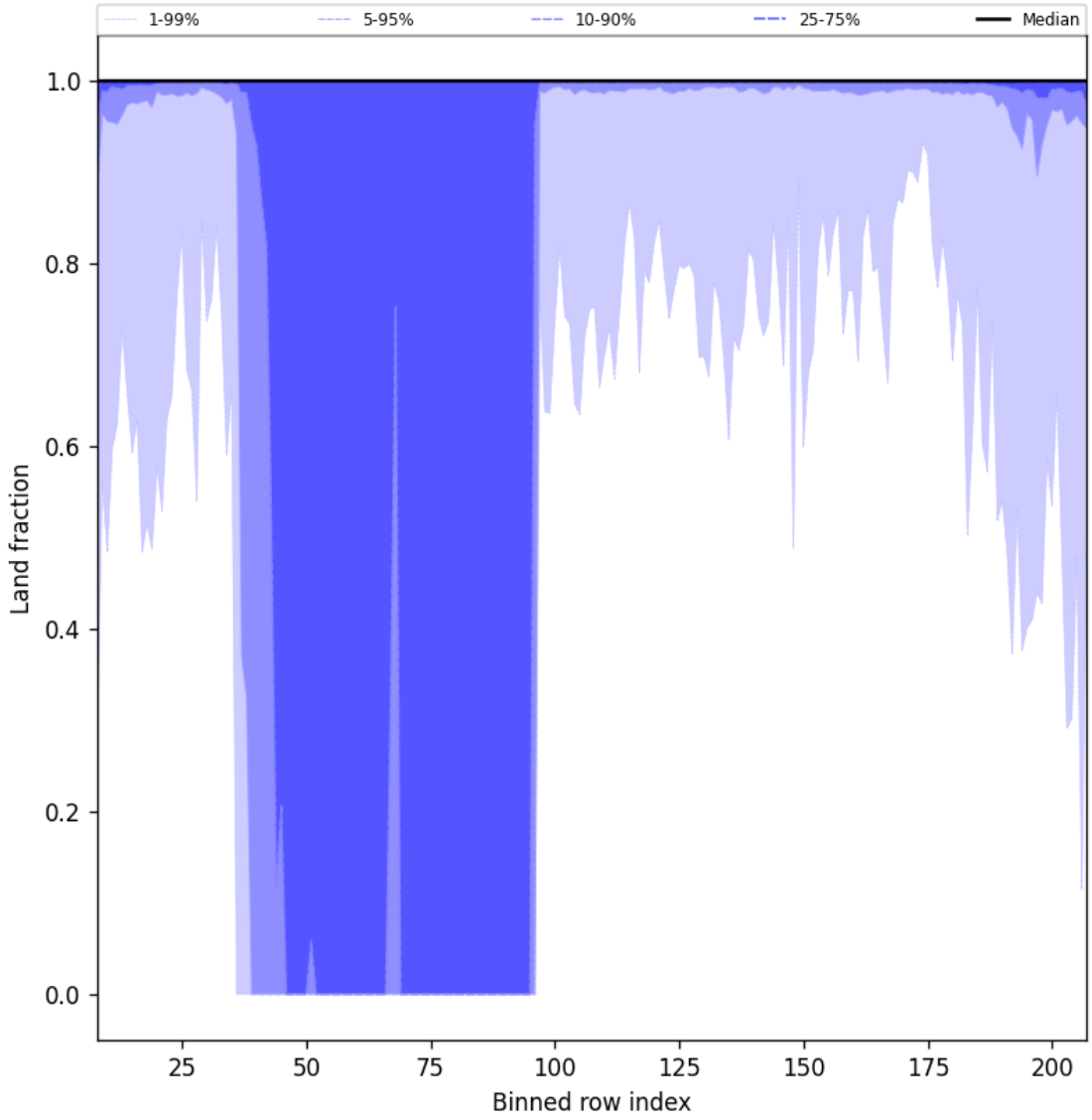

Figure 45: Along track statistics of “Land fraction” for 2025-12-11 to 2025-12-12

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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