

PyCAMA report generated by tropl2-proc

tropl2-proc

2023-12-06 (01:45)

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:

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i \quad (1)$$

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

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

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 :

$$P(x \leq m) = P(x \geq m) = \int_{-\infty}^m f(x) dx = \frac{1}{2} \quad (3)$$

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

The median is a special case of a percentile. Instead of 1/2 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} .

$$C_{kl} = C(x_{(k)}, x_{(l)}) = \frac{1}{N-1} \sum_{i=1}^N (x_{(k),i} - \bar{x}_{(k)})(x_{(l),i} - \bar{x}_{(l)}) \quad (4)$$

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

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

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]	0.769 ± 0.237	25171497	0.735	0.270	0.740	0.0	1.000
nitrogendioxide tropospheric column [mol m^{-2}]	$(8.261 \pm 32.813) \times 10^{-6}$	25171497	9.253×10^{-6}	1.058×10^{-5}	2.915×10^{-6}	-4.894×10^{-4}	3.696×10^{-3}
nitrogendioxide tropospheric column precision [mol m^{-2}]	$(1.064 \pm 2.008) \times 10^{-5}$	25171497	6.458×10^{-6}	4.950×10^{-6}	6.530×10^{-6}	2.965×10^{-6}	4.845×10^{-3}
air mass factor troposphere [1]	2.45 ± 1.42	25171497	1.86	1.52	2.07	2.138×10^{-2}	9.32
air mass factor total [1]	3.41 ± 1.88	25171497	2.22	1.30	2.77	0.393	14.4
number of spectral points in retrieval [1]	304 ± 1	25171497	304	1.000	304	234	305
number of iterations [1]	3.88 ± 1.19	25171497	4.22	1.000	4.00	2.00	9.00
wavelength calibration offset [nm]	$(-1.862 \pm 5.723) \times 10^{-3}$	25171497	-8.000×10^{-4}	4.647×10^{-3}	-1.640×10^{-3}	-6.591×10^{-2}	5.548×10^{-2}
nitrogendioxide stratospheric column [mol/m^2]	$(4.894 \pm 1.830) \times 10^{-5}$	25171497	3.450×10^{-5}	2.706×10^{-5}	4.518×10^{-5}	1.183×10^{-5}	1.372×10^{-4}
nitrogendioxide stratospheric column precision [mol/m^2]	$(3.321 \pm 0.000) \times 10^{-6}$	25171497	3.350×10^{-6}	0.0	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	$(5.628 \pm 2.135) \times 10^{-5}$	25171497	6.153×10^{-5}	2.259×10^{-5}	5.456×10^{-5}	4.588×10^{-6}	1.644×10^{-3}
nitrogendioxide total column precision [mol/m^2]	$(1.183 \pm 0.687) \times 10^{-5}$	25171497	1.289×10^{-5}	4.258×10^{-6}	1.134×10^{-5}	2.145×10^{-6}	1.308×10^{-3}
nitrogendioxide summed total column [mol/m^2]	$(5.720 \pm 3.397) \times 10^{-5}$	25171497	6.153×10^{-5}	2.371×10^{-5}	5.522×10^{-5}	-4.541×10^{-4}	3.729×10^{-3}
nitrogendioxide summed total column precision [mol/m^2]	$(1.144 \pm 1.992) \times 10^{-5}$	25171497	4.899×10^{-6}	4.436×10^{-6}	7.326×10^{-6}	4.452×10^{-6}	4.845×10^{-3}
chi square [1]	525 ± 569	25171497	312	192	397	148	3.347×10^4
root mean square error of fit [1]	$(3.960 \pm 2.545) \times 10^{-4}$	25171497	4.899×10^{-4}	3.082×10^{-4}	3.396×10^{-4}	8.742×10^{-5}	4.486×10^{-3}
air mass factor stratosphere [1]	3.74 ± 2.11	25171497	2.22	1.59	3.00	2.06	15.7

Table 2: Percentile ranges

Variable	1 %	5 %	10 %	15.9 %	25 %	75 %	84.1 %	90 %	95 %	99 %
qa value [1]	7.000×10^{-2}	0.220	0.330	0.730	0.730	1.000	1.000	1.000	1.000	1.000
nitrogendioxide tropospheric column [mol m^{-2}]	-1.962×10^{-5}	-7.040×10^{-6}	-3.990×10^{-6}	-2.358×10^{-6}	-8.320×10^{-7}	9.743×10^{-6}	1.440×10^{-5}	2.024×10^{-5}	3.300×10^{-5}	1.112×10^{-4}
nitrogendioxide tropospheric column precision [mol m^{-2}]	3.184×10^{-6}	3.400×10^{-6}	3.621×10^{-6}	3.935×10^{-6}	4.594×10^{-6}	9.543×10^{-6}	1.275×10^{-5}	1.765×10^{-5}	2.923×10^{-5}	8.315×10^{-5}
air mass factor troposphere [1]	0.259	0.647	0.991	1.25	1.56	3.08	3.87	4.56	5.41	6.84
air mass factor total [1]	1.59	2.02	2.10	2.18	2.31	3.62	4.50	5.74	7.63	11.1
number of spectral points in retrieval [1]	303	303	304	304	304	305	305	305	305	305
number of iterations [1]	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	8.00	8.00
wavelength calibration offset [nm]	-1.943×10^{-2}	-1.035×10^{-2}	-7.455×10^{-3}	-5.931×10^{-3}	-4.296×10^{-3}	3.510×10^{-4}	1.670×10^{-3}	3.458×10^{-3}	6.758×10^{-3}	1.596×10^{-2}
nitrogendioxide stratospheric column [mol/m^2]	1.627×10^{-5}	2.387×10^{-5}	3.009×10^{-5}	3.290×10^{-5}	3.468×10^{-5}	6.174×10^{-5}	6.764×10^{-5}	7.340×10^{-5}	8.201×10^{-5}	9.784×10^{-5}
nitrogendioxide stratospheric column precision [mol/m^2]	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	2.373×10^{-5}	3.217×10^{-5}	3.584×10^{-5}	3.874×10^{-5}	4.285×10^{-5}	6.545×10^{-5}	7.074×10^{-5}	7.675×10^{-5}	8.660×10^{-5}	1.138×10^{-4}
nitrogendioxide total column precision [mol/m^2]	5.095×10^{-6}	6.995×10^{-6}	7.791×10^{-6}	8.384×10^{-6}	9.174×10^{-6}	1.343×10^{-5}	1.448×10^{-5}	1.565×10^{-5}	1.761×10^{-5}	2.443×10^{-5}
nitrogendioxide summed total column [mol/m^2]	1.093×10^{-5}	2.885×10^{-5}	3.422×10^{-5}	3.783×10^{-5}	4.255×10^{-5}	6.626×10^{-5}	7.196×10^{-5}	7.812×10^{-5}	8.830×10^{-5}	1.430×10^{-4}
nitrogendioxide summed total column precision [mol/m^2]	4.601×10^{-6}	4.753×10^{-6}	4.914×10^{-6}	5.149×10^{-6}	5.668×10^{-6}	1.010×10^{-5}	1.317×10^{-5}	1.796×10^{-5}	2.942×10^{-5}	8.322×10^{-5}
chi square [1]	232	261	280	298	323	515	605	756	1.156×10^3	2.924×10^3
root mean square error of fit [1]	1.232×10^{-4}	1.399×10^{-4}	1.537×10^{-4}	1.700×10^{-4}	2.012×10^{-4}	5.094×10^{-4}	5.892×10^{-4}	6.841×10^{-4}	8.664×10^{-4}	1.340×10^{-3}
air mass factor stratosphere [1]	2.09	2.14	2.21	2.29	2.43	4.02	5.08	6.44	8.68	12.4

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]	0.763 ± 0.273	9909703	0.260	0.740	0.0	1.000	0.740	1.000
nitrogendioxide tropospheric column [mol m^{-2}]	$(1.799 \pm 4.988) \times 10^{-5}$	9909703	1.628×10^{-5}	9.239×10^{-6}	-4.536×10^{-4}	3.696×10^{-3}	2.595×10^{-6}	1.888×10^{-5}
nitrogendioxide tropospheric column precision [mol m^{-2}]	$(1.784 \pm 3.018) \times 10^{-5}$	9909703	9.605×10^{-6}	9.639×10^{-6}	3.269×10^{-6}	4.845×10^{-3}	7.155×10^{-6}	1.676×10^{-5}
air mass factor troposphere [1]	1.71 ± 0.91	9909703	0.979	1.69	2.138×10^{-2}	7.38	1.13	2.11
air mass factor total [1]	3.32 ± 1.75	9909703	1.24	2.72	0.393	13.3	2.31	3.55
number of spectral points in retrieval [1]	304 ± 1	9909703	1.000	304	234	305	304	305
number of iterations [1]	3.78 ± 1.10	9909703	1.000	4.00	2.00	8.00	3.00	4.00
wavelength calibration offset [nm]	$(-1.466 \pm 6.226) \times 10^{-3}$	9909703	5.120×10^{-3}	-1.205×10^{-3}	-6.508×10^{-2}	5.548×10^{-2}	-4.093×10^{-3}	1.027×10^{-3}
nitrogendioxide stratospheric column [mol/m^2]	$(3.327 \pm 0.727) \times 10^{-5}$	9909703	7.712×10^{-6}	3.427×10^{-5}	1.183×10^{-5}	5.725×10^{-5}	2.998×10^{-5}	3.769×10^{-5}
nitrogendioxide stratospheric column precision [mol/m^2]	$(3.321 \pm 0.000) \times 10^{-6}$	9909703	0.0	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	$(4.874 \pm 2.718) \times 10^{-5}$	9909703	1.433×10^{-5}	4.414×10^{-5}	4.588×10^{-6}	1.644×10^{-3}	3.743×10^{-5}	5.176×10^{-5}
nitrogendioxide total column precision [mol/m^2]	$(1.069 \pm 1.029) \times 10^{-5}$	9909703	2.880×10^{-6}	9.420×10^{-6}	2.145×10^{-6}	1.308×10^{-3}	8.089×10^{-6}	1.097×10^{-5}
nitrogendioxide summed total column [mol/m^2]	$(5.126 \pm 5.018) \times 10^{-5}$	9909703	1.765×10^{-5}	4.389×10^{-5}	-4.217×10^{-4}	3.729×10^{-3}	3.603×10^{-5}	5.368×10^{-5}
nitrogendioxide summed total column precision [mol/m^2]	$(1.837 \pm 3.004) \times 10^{-5}$	9909703	9.198×10^{-6}	1.020×10^{-5}	4.660×10^{-6}	4.845×10^{-3}	7.889×10^{-6}	1.709×10^{-5}
chi square [1]	487 ± 539	9909703	165	350	148	3.305×10^4	296	460
root mean square error of fit [1]	$(3.865 \pm 2.564) \times 10^{-4}$	9909703	2.793×10^{-4}	3.249×10^{-4}	9.558×10^{-5}	4.486×10^{-3}	1.983×10^{-4}	4.776×10^{-4}
air mass factor stratosphere [1]	4.11 ± 2.29	9909703	1.97	3.29	2.10	15.7	2.62	4.59

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]	0.772 ± 0.210	15261794	0.200	0.740	0.0	1.000	0.730	0.930
nitrogendioxide tropospheric column [mol m^{-2}]	$(1.941 \pm 7.664) \times 10^{-6}$	15261794	6.372×10^{-6}	9.045×10^{-7}	-4.894×10^{-4}	1.423×10^{-3}	-1.522×10^{-6}	4.850×10^{-6}
nitrogendioxide tropospheric column precision [mol m^{-2}]	$(5.967 \pm 4.281) \times 10^{-6}$	15261794	2.838×10^{-6}	5.165×10^{-6}	2.965×10^{-6}	1.118×10^{-3}	3.895×10^{-6}	6.733×10^{-6}
air mass factor troposphere [1]	2.94 ± 1.48	15261794	1.94	2.49	3.587×10^{-2}	9.32	1.87	3.81
air mass factor total [1]	3.47 ± 1.95	15261794	1.35	2.80	0.949	14.4	2.31	3.66
number of spectral points in retrieval [1]	304 ± 1	15261794	1.000	304	235	305	304	305
number of iterations [1]	3.95 ± 1.24	15261794	1.000	4.00	3.00	9.00	3.00	4.00
wavelength calibration offset [nm]	$(-2.119 \pm 5.356) \times 10^{-3}$	15261794	4.338×10^{-3}	-1.878×10^{-3}	-6.591×10^{-2}	5.340×10^{-2}	-4.409×10^{-3}	-7.094×10^{-5}
nitrogendioxide stratospheric column [mol/m^2]	$(5.911 \pm 1.596) \times 10^{-5}$	15261794	1.890×10^{-5}	5.866×10^{-5}	2.787×10^{-5}	1.372×10^{-4}	4.932×10^{-5}	6.822×10^{-5}
nitrogendioxide stratospheric column precision [mol/m^2]	$(3.321 \pm 0.000) \times 10^{-6}$	15261794	0.0	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	$(6.117 \pm 1.454) \times 10^{-5}$	15261794	1.691×10^{-5}	6.131×10^{-5}	1.349×10^{-5}	3.409×10^{-4}	5.203×10^{-5}	6.894×10^{-5}
nitrogendioxide total column precision [mol/m^2]	$(1.257 \pm 0.277) \times 10^{-5}$	15261794	3.360×10^{-6}	1.256×10^{-5}	4.795×10^{-6}	7.115×10^{-5}	1.071×10^{-5}	1.407×10^{-5}
nitrogendioxide summed total column [mol/m^2]	$(6.105 \pm 1.518) \times 10^{-5}$	15261794	1.754×10^{-5}	6.128×10^{-5}	-4.541×10^{-4}	1.474×10^{-3}	5.185×10^{-5}	6.940×10^{-5}
nitrogendioxide summed total column precision [mol/m^2]	$(6.942 \pm 4.096) \times 10^{-6}$	15261794	2.389×10^{-6}	6.140×10^{-6}	4.452×10^{-6}	1.118×10^{-3}	5.119×10^{-6}	7.508×10^{-6}
chi square [1]	549 ± 586	15261794	187	426	170	3.347×10^4	350	536
root mean square error of fit [1]	$(4.021 \pm 2.531) \times 10^{-4}$	15261794	3.202×10^{-4}	3.500×10^{-4}	8.742×10^{-5}	4.289×10^{-3}	2.041×10^{-4}	5.242×10^{-4}
air mass factor stratosphere [1]	3.51 ± 1.95	15261794	1.32	2.83	2.06	14.6	2.35	3.67

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]	0.810 ± 0.191	16098364	0.260	0.740	0.0	1.000	0.740	1.000
nitrogendioxide tropospheric column [mol m^{-2}]	$(5.303 \pm 13.634) \times 10^{-6}$	16098364	9.385×10^{-6}	3.496×10^{-6}	-4.894×10^{-4}	3.166×10^{-3}	-5.843×10^{-7}	8.800×10^{-6}
nitrogendioxide tropospheric column precision [mol m^{-2}]	$(8.507 \pm 10.081) \times 10^{-6}$	16098364	3.373×10^{-6}	6.416×10^{-6}	3.095×10^{-6}	4.107×10^{-3}	4.993×10^{-6}	8.366×10^{-6}
air mass factor troposphere [1]	2.15 ± 0.93	16098364	0.888	2.03	2.319×10^{-2}	9.26	1.65	2.53
air mass factor total [1]	2.98 ± 1.40	16098364	0.838	2.60	0.439	14.4	2.28	3.12
number of spectral points in retrieval [1]	304 ± 1	16098364	1.000	304	234	305	304	305
number of iterations [1]	4.05 ± 1.26	16098364	1.000	4.00	2.00	9.00	3.00	4.00
wavelength calibration offset [nm]	$(-1.756 \pm 6.018) \times 10^{-3}$	16098364	4.955×10^{-3}	-1.569×10^{-3}	-6.112×10^{-2}	5.548×10^{-2}	-4.314×10^{-3}	6.403×10^{-4}
nitrogendioxide stratospheric column [mol/m^2]	$(4.960 \pm 1.779) \times 10^{-5}$	16098364	2.754×10^{-5}	4.481×10^{-5}	1.183×10^{-5}	1.372×10^{-4}	3.483×10^{-5}	6.237×10^{-5}
nitrogendioxide stratospheric column precision [mol/m^2]	$(3.321 \pm 0.000) \times 10^{-6}$	16098364	0.0	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	$(5.484 \pm 1.623) \times 10^{-5}$	16098364	2.301×10^{-5}	5.437×10^{-5}	4.588×10^{-6}	5.018×10^{-4}	4.185×10^{-5}	6.486×10^{-5}
nitrogendioxide total column precision [mol/m^2]	$(1.146 \pm 0.324) \times 10^{-5}$	16098364	4.303×10^{-6}	1.136×10^{-5}	2.365×10^{-6}	2.245×10^{-4}	9.019×10^{-6}	1.332×10^{-5}
nitrogendioxide summed total column [mol/m^2]	$(5.490 \pm 1.872) \times 10^{-5}$	16098364	2.420×10^{-5}	5.522×10^{-5}	-4.541×10^{-4}	3.199×10^{-3}	4.144×10^{-5}	6.564×10^{-5}
nitrogendioxide summed total column precision [mol/m^2]	$(9.314 \pm 9.913) \times 10^{-6}$	16098364	3.005×10^{-6}	7.224×10^{-6}	4.540×10^{-6}	4.107×10^{-3}	5.997×10^{-6}	9.001×10^{-6}
chi square [1]	554 ± 571	16098364	208	419	148	3.305×10^4	339	547
root mean square error of fit [1]	$(3.317 \pm 2.111) \times 10^{-4}$	16098364	2.242×10^{-4}	2.850×10^{-4}	9.126×10^{-5}	4.486×10^{-3}	1.842×10^{-4}	4.083×10^{-4}
air mass factor stratosphere [1]	3.19 ± 1.60	16098364	0.986	2.70	2.06	15.7	2.34	3.33

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]	0.716 ± 0.271	7651894	0.150	0.740	0.0	1.000	0.730	0.880
nitrogendioxide tropospheric column [mol m^{-2}]	$(1.110 \pm 4.581) \times 10^{-5}$	7651894	1.198×10^{-5}	1.071×10^{-6}	-3.416×10^{-4}	2.297×10^{-3}	-1.209×10^{-6}	1.077×10^{-5}
nitrogendioxide tropospheric column precision [mol m^{-2}]	$(1.206 \pm 2.608) \times 10^{-5}$	7651894	7.534×10^{-6}	6.204×10^{-6}	2.965×10^{-6}	3.732×10^{-3}	3.623×10^{-6}	1.116×10^{-5}
air mass factor troposphere [1]	3.20 ± 1.90	7651894	3.20	3.43	2.138×10^{-2}	9.32	1.45	4.65
air mass factor total [1]	4.16 ± 2.26	7651894	2.51	3.49	0.393	14.2	2.52	5.03
number of spectral points in retrieval [1]	304 ± 1	7651894	1.000	304	235	305	304	305
number of iterations [1]	3.59 ± 1.01	7651894	1.000	3.00	3.00	9.00	3.00	4.00
wavelength calibration offset [nm]	$(-2.130 \pm 5.070) \times 10^{-3}$	7651894	4.104×10^{-3}	-1.795×10^{-3}	-6.591×10^{-2}	5.452×10^{-2}	-4.314×10^{-3}	-2.100×10^{-4}
nitrogendioxide stratospheric column [mol/m^2]	$(5.061 \pm 1.834) \times 10^{-5}$	7651894	2.604×10^{-5}	4.975×10^{-5}	1.204×10^{-5}	1.233×10^{-4}	3.633×10^{-5}	6.238×10^{-5}
nitrogendioxide stratospheric column precision [mol/m^2]	$(3.321 \pm 0.000) \times 10^{-6}$	7651894	0.0	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}	3.321×10^{-6}
nitrogendioxide total column [mol/m^2]	$(5.969 \pm 2.542) \times 10^{-5}$	7651894	2.022×10^{-5}	5.595×10^{-5}	6.924×10^{-6}	1.644×10^{-3}	4.712×10^{-5}	6.734×10^{-5}
nitrogendioxide total column precision [mol/m^2]	$(1.259 \pm 0.992) \times 10^{-5}$	7651894	3.949×10^{-6}	1.151×10^{-5}	2.160×10^{-6}	1.308×10^{-3}	9.832×10^{-6}	1.378×10^{-5}
nitrogendioxide summed total column [mol/m^2]	$(6.171 \pm 4.507) \times 10^{-5}$	7651894	2.090×10^{-5}	5.620×10^{-5}	-3.237×10^{-4}	2.338×10^{-3}	4.721×10^{-5}	6.810×10^{-5}
nitrogendioxide summed total column precision [mol/m^2]	$(1.291 \pm 2.589) \times 10^{-5}$	7651894	6.726×10^{-6}	7.037×10^{-6}	4.452×10^{-6}	3.732×10^{-3}	4.915×10^{-6}	1.164×10^{-5}
chi square [1]	478 ± 556	7651894	158	372	157	3.347×10^4	307	466
root mean square error of fit [1]	$(5.052 \pm 2.719) \times 10^{-4}$	7651894	3.201×10^{-4}	5.027×10^{-4}	8.742×10^{-5}	4.289×10^{-3}	2.983×10^{-4}	6.185×10^{-4}
air mass factor stratosphere [1]	4.56 ± 2.35	7651894	2.40	3.79	2.06	15.4	2.97	5.37

Table 7: Correlation matrix

Stratospheric airmass factor	RMS	χ^2	Summed vertical NO ₂ column precision	Summed vertical NO ₂ column	Total vertical NO ₂ column precision	Total vertical NO ₂ column	Stratospheric vertical NO ₂ column	Wavelength calibration offset	Total airmass factor	Tropospheric airmass factor	NO ₂ tropospheric vertical column precision	NO ₂ tropospheric vertical column	Latitude	Solar zenith angle	Viewing zenith angle
0.169	0.180	1.648×10^{-2}	1.469×10^{-2}	-7.444×10^{-3}	-9.746×10^{-3}	9.611×10^{-3}	4.580×10^{-3}	-0.291	0.168	8.242×10^{-2}	1.516×10^{-2}	-1.026×10^{-2}	-2.012×10^{-4}	4.790×10^{-3}	1.000
0.780	0.695	-0.204	0.168	0.112	8.352×10^{-2}	0.157	0.105	-1.792×10^{-2}	0.716	0.516	0.168	5.742×10^{-2}	5.497×10^{-2}	1.000	4.790×10^{-3}
9.437×10^{-2}	-0.129	-2.765×10^{-2}	0.321	-0.197	-0.186	-0.376	-0.830	7.416×10^{-2}	-0.127	-0.616	0.332	0.259	1.000	5.497×10^{-2}	-2.012×10^{-4}
8.738×10^{-4}	-3.484×10^{-2}	-1.921×10^{-2}	0.738	0.850	0.437	0.464	-0.215	8.791×10^{-2}	-0.133	-0.247	0.738	1.000	0.259	5.742×10^{-2}	-1.026×10^{-2}
0.181	0.129	-1.659×10^{-2}	1.000	0.574	0.444	0.324	-0.257	2.432×10^{-2}	-1.648×10^{-2}	-0.304	1.000	0.738	0.332	0.168	1.516×10^{-2}
0.518	0.573	-8.247×10^{-2}	-0.296	0.549	6.154×10^{-2}	0.176	0.545	-0.109	0.703	1.000	-0.304	-0.247	-0.616	0.516	8.242×10^{-2}
0.939	0.823	-0.162	-1.706×10^{-2}	-0.175	-2.778×10^{-2}	2.638×10^{-2}	0.223	-0.104	1.000	0.703	-1.648×10^{-2}	-0.133	-0.127	0.716	0.168
-8.833×10^{-2}	-6.391×10^{-2}	9.791×10^{-2}	2.343×10^{-2}	5.672×10^{-2}	3.107×10^{-2}	4.200×10^{-2}	-5.235×10^{-2}	1.000	-0.104	-0.109	2.432×10^{-2}	8.791×10^{-2}	7.416×10^{-2}	-1.792×10^{-2}	-0.291
2.812×10^{-2}	0.202	1.381×10^{-3}	-0.250	0.331	0.331	0.594	1.000	-5.235×10^{-2}	0.223	0.545	-0.257	-0.215	-0.830	0.105	4.580×10^{-3}
2.996×10^{-2}	0.120	-0.144	0.329	0.768	0.810	1.000	0.594	4.200×10^{-2}	2.638×10^{-2}	0.176	0.324	0.464	-0.376	0.157	9.611×10^{-3}
-3.596×10^{-3}	0.600	2.823×10^{-2}	0.448	1.000	1.000	0.810	0.331	3.107×10^{-2}	-0.104	-0.109	0.444	0.850	-0.186	8.352×10^{-2}	-9.746×10^{-3}
1.599×10^{-2}	0.579	-1.781×10^{-2}	0.579	1.000	0.600	0.768	0.331	5.672×10^{-2}	-1.648×10^{-2}	-0.304	1.000	0.738	0.332	0.112	-7.444×10^{-3}
0.178	0.129	-1.768×10^{-2}	1.000	0.579	0.448	0.329	-0.250	2.343×10^{-2}	-1.706×10^{-2}	-0.296	1.000	0.738	0.321	0.168	1.469×10^{-2}
-0.182	0.165	1.000	-1.768×10^{-2}	-0.178	-1.781×10^{-2}	-2.144×10^{-2}	1.381×10^{-3}	9.791×10^{-2}	-0.162	-0.127	-1.659×10^{-2}	-1.921×10^{-2}	-2.765×10^{-2}	-0.204	1.648×10^{-2}
0.833	1.000	0.165	0.129	0.600	0.579	0.768	0.202	-6.391×10^{-2}	0.823	0.573	0.129	-3.484×10^{-2}	-0.129	0.695	0.180
1.000	0.833	-0.182	0.178	1.599×10^{-2}	-3.596×10^{-3}	2.996×10^{-2}	2.812×10^{-2}	-8.833×10^{-2}	0.939	0.518	0.181	8.738×10^{-4}	9.437×10^{-2}	0.780	0.169

Table 8: Covariance matrix

Stratospheric airmass factor	RMS	χ^2	Summed vertical NO ₂ column precision	Summed vertical NO ₂ column	Total vertical NO ₂ column precision	Total vertical NO ₂ column	Stratospheric vertical NO ₂ column	Wavelength calibration offset	Total airmass factor	Tropospheric airmass factor	NO ₂ tropospheric vertical column precision	NO ₂ tropospheric vertical column	Latitude	Solar zenith angle	Viewing zenith angle
6.98	8.957×10^{-4}	183	5.723×10^{-6}	-4.947×10^{-6}	-1.310×10^{-6}	4.015×10^{-6}	1.639×10^{-6}	-3.257×10^{-2}	6.15	2.29	5.959×10^{-6}	-6.587×10^{-6}	-0.183	1.78	383
31.3	3.361×10^{-3}	-2.199×10^3	6.363×10^{-5}	7.234×10^{-5}	1.090×10^{-5}	6.373×10^{-5}	3.655×10^{-5}	-1.947×10^{-3}	25.5	13.9	6.402×10^{-5}	3.579×10^{-5}	48.5	361	1.78
9.25	-1.523×10^{-3}	-731	2.975×10^{-4}	-3.102×10^{-4}	-5.935×10^{-5}	-3.736×10^{-4}	-7.058×10^{-4}	1.972×10^{-2}	-11.1	-40.6	3.098×10^{-4}	3.956×10^{-4}	2.159×10^3	48.5	-0.183
6.051×10^{-8}	-2.909×10^{-10}	-3.585×10^{-4}	4.826×10^{-10}	9.479×10^{-10}	9.843×10^{-11}	3.250×10^{-10}	-1.288×10^{-10}	1.651×10^{-8}	-8.159×10^{-6}	-1.148×10^{-5}	4.864×10^{-10}	1.077×10^{-9}	3.956×10^{-4}	3.579×10^{-5}	-6.587×10^{-6}
7.674×10^{-6}	6.599×10^{-10}	-1.894×10^{-4}	3.999×10^{-10}	3.918×10^{-10}	6.126×10^{-11}	1.391×10^{-10}	-9.462×10^{-11}	2.795×10^{-9}	-6.208×10^{-7}	-8.648×10^{-6}	4.033×10^{-10}	4.864×10^{-10}	3.098×10^{-4}	6.402×10^{-5}	5.959×10^{-6}
1.55	2.065×10^{-4}	-66.5	-8.345×10^{-6}	2.643×10^{-6}	5.991×10^{-7}	5.316×10^{-6}	1.413×10^{-5}	-8.840×10^{-4}	1.87	2.01	-8.648×10^{-6}	-1.148×10^{-5}	-40.6	13.9	2.29
3.72	3.929×10^{-4}	-173	-6.370×10^{-7}	-5.207×10^{-7}	-3.579×10^{-7}	1.056×10^{-6}	7.638×10^{-6}	-1.119×10^{-3}	3.52	1.87	-6.208×10^{-7}	-8.159×10^{-6}	-11.1	25.5	6.15
-1.067×10^{-3}	-9.309×10^{-8}	0.319	2.671×10^{-9}	1.103×10^{-8}	1.222×10^{-9}	5.133×10^{-9}	-5.482×10^{-9}	3.276×10^{-5}	-1.119×10^{-3}	-8.840×10^{-4}	2.795×10^{-9}	1.651×10^{-8}	1.972×10^{-2}	-1.947×10^{-3}	-3.257×10^{-2}
1.086×10^{-6}	9.423×10^{-10}	1.437×10^{-5}	-9.101×10^{-11}	2.060×10^{-10}	4.159×10^{-11}	2.319×10^{-10}	3.348×10^{-10}	-5.482×10^{-9}	7.638×10^{-6}	1.413×10^{-5}	-9.462×10^{-11}	-1.288×10^{-10}	-7.058×10^{-4}	3.655×10^{-5}	1.639×10^{-6}
1.350×10^{-6}	6.528×10^{-10}	-2.604×10^{-4}	1.398×10^{-10}	5.569×10^{-10}	1.189×10^{-10}	4.559×10^{-10}	2.319×10^{-10}	5.133×10^{-9}	1.056×10^{-6}	5.316×10^{-6}	1.391×10^{-10}	3.250×10^{-10}	-3.736×10^{-4}	6.373×10^{-5}	4.015×10^{-6}
-5.214×10^{-8}	1.006×10^{-10}	-3.441×10^{-4}	6.124×10^{-11}	1.400×10^{-10}	4.720×10^{-11}	1.189×10^{-10}	4.159×10^{-11}	1.222×10^{-9}	-3.579×10^{-7}	-5.207×10^{-7}	6.126×10^{-11}	9.479×10^{-10}	-5.935×10^{-5}	1.090×10^{-5}	-1.310×10^{-6}
1.146×10^{-6}	6.514×10^{-10}	-3.441×10^{-4}	3.916×10^{-10}	1.154×10^{-9}	1.400×10^{-10}	5.569×10^{-10}	2.060×10^{-10}	1.103×10^{-8}	-6.370×10^{-7}	-8.345×10^{-6}	3.918×10^{-10}	4.826×10^{-10}	-3.102×10^{-4}	7.234×10^{-5}	-4.947×10^{-6}
7.500×10^{-6}	6.554×10^{-10}	-2.002×10^{-4}	3.967×10^{-10}	3.916×10^{-10}	6.124×10^{-11}	1.398×10^{-10}	-9.101×10^{-11}	2.671×10^{-9}	-6.370×10^{-7}	-8.345×10^{-6}	3.999×10^{-10}	4.826×10^{-10}	2.975×10^{-4}	6.363×10^{-5}	5.723×10^{-6}
-218	2.392×10^{-2}	3.233×10^5	-2.002×10^{-4}	-3.441×10^{-4}	1.103×10^{-4}	-2.604×10^{-4}	1.437×10^{-5}	0.319	-173	-66.5	-1.894×10^{-4}	-3.585×10^{-4}	-731	-2.199×10^3	183
4.474×10^{-4}	6.477×10^{-8}	2.392×10^{-2}	6.554×10^{-10}	6.514×10^{-10}	1.006×10^{-10}	6.528×10^{-10}	9.423×10^{-10}	-9.309×10^{-8}	3.929×10^{-4}	2.065×10^{-4}	6.599×10^{-10}	-2.909×10^{-10}	-1.523×10^{-3}	3.361×10^{-3}	-2.199×10^3
4.45	4.474×10^{-4}	-218	7.500×10^{-6}	1.146×10^{-6}	-5.214×10^{-8}	1.350×10^{-6}	1.086×10^{-6}	-1.067×10^{-3}	3.72	1.55	7.674×10^{-6}	6.051×10^{-8}	9.25	31.3	6.98

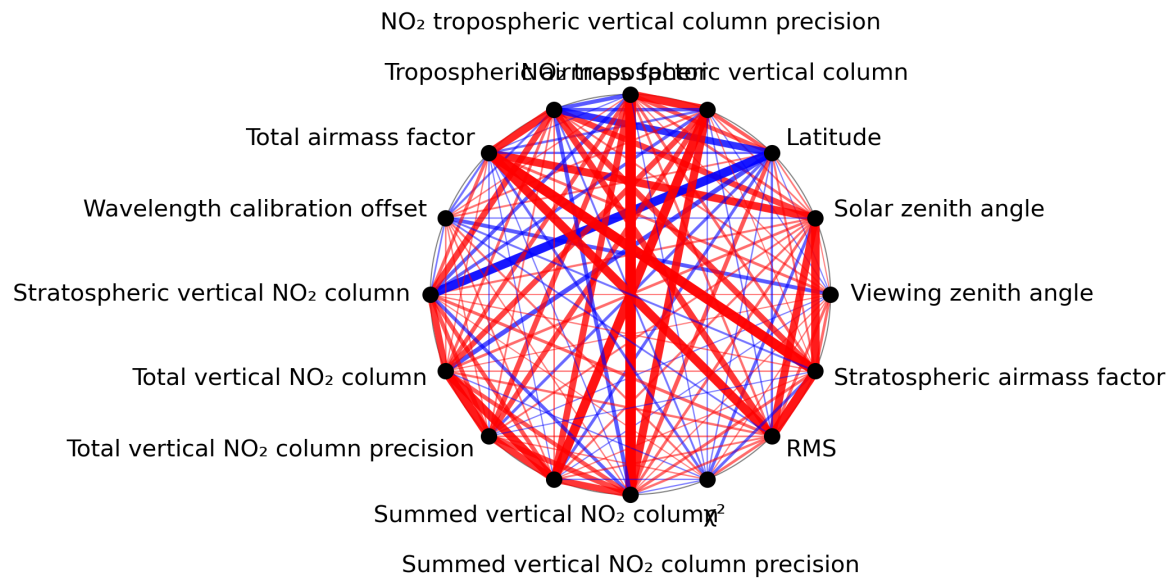


Figure 1: Map of correlation graph for 2023-11-20 to 2023-11-22.

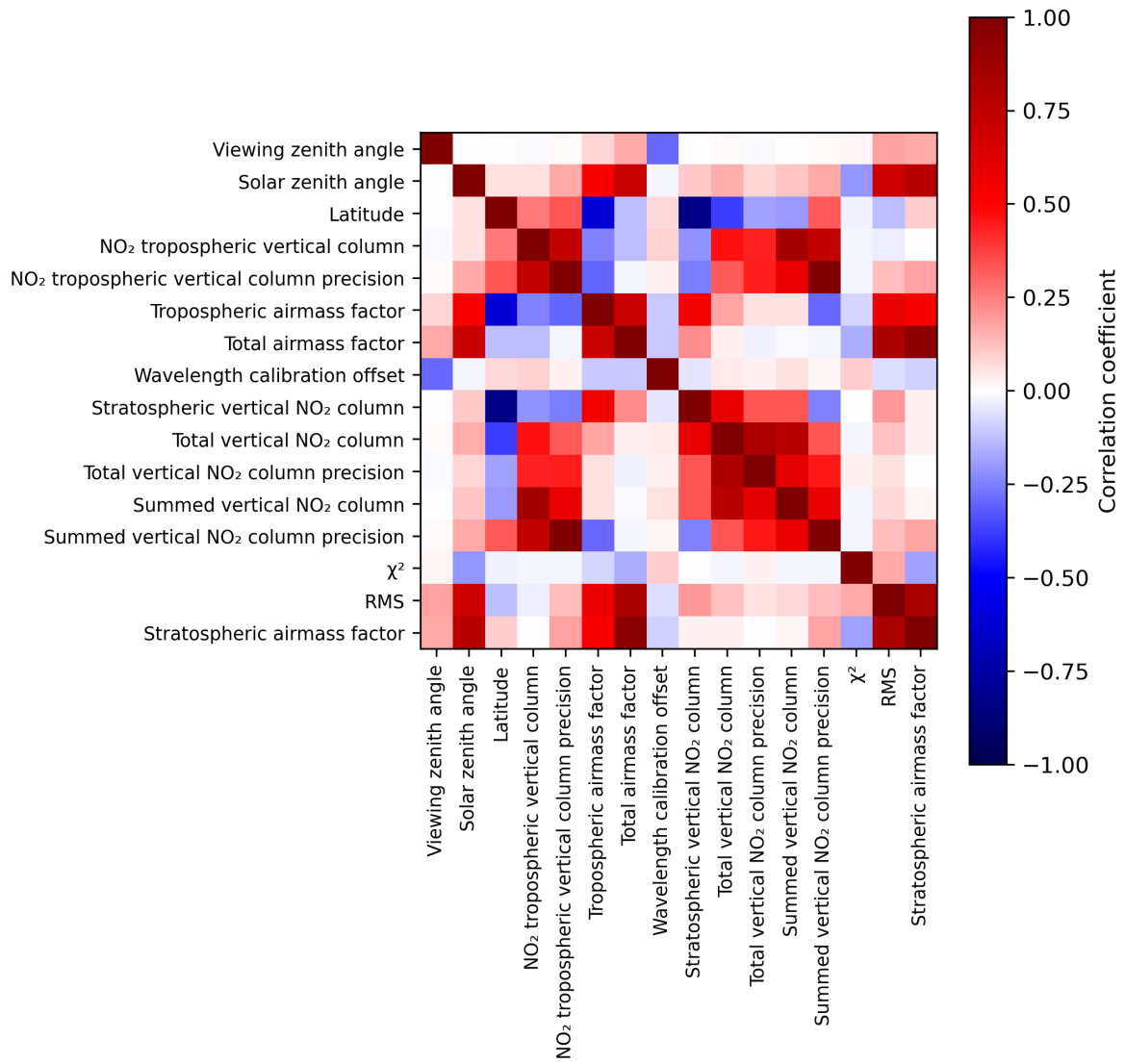


Figure 2: Map of correlation matrix for 2023-11-20 to 2023-11-22.

3 Granule outlines

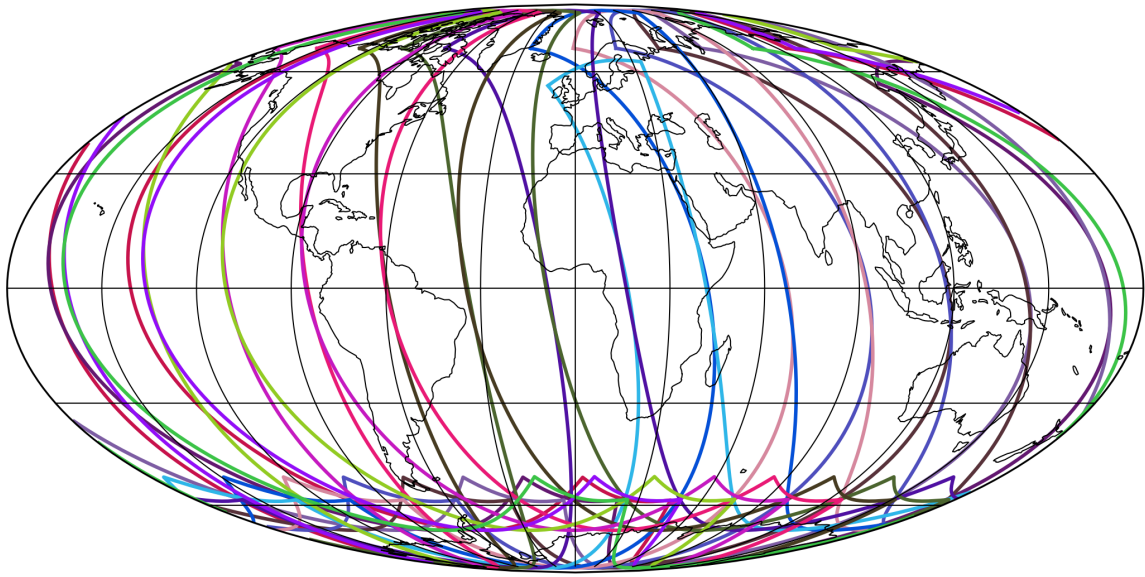


Figure 3: Outline of the granules.

4 Input data monitoring

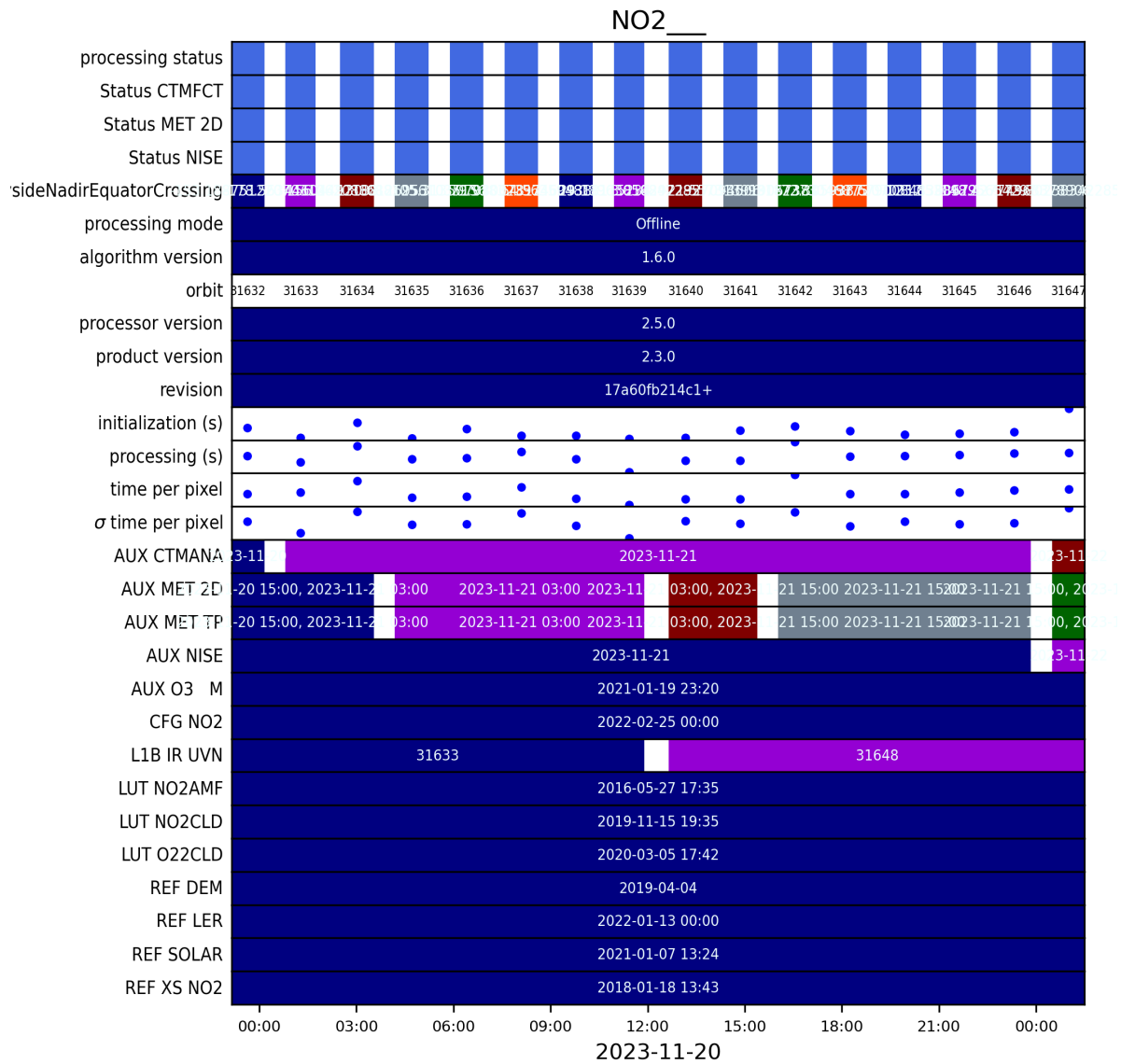


Figure 4: Input data per granule

5 Warnings and errors

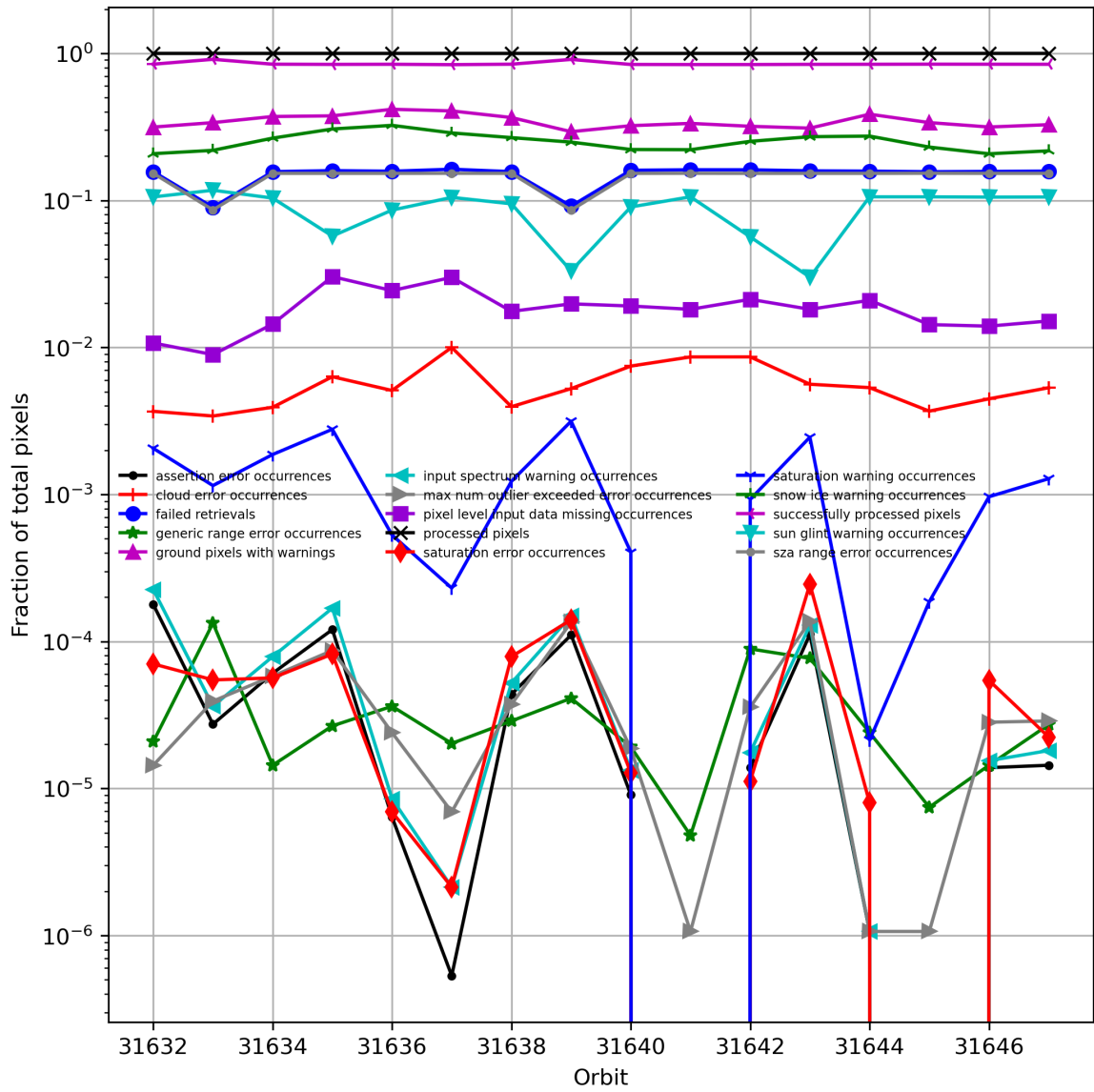


Figure 5: Fraction of pixels with specific warnings and errors during processing

6 World maps

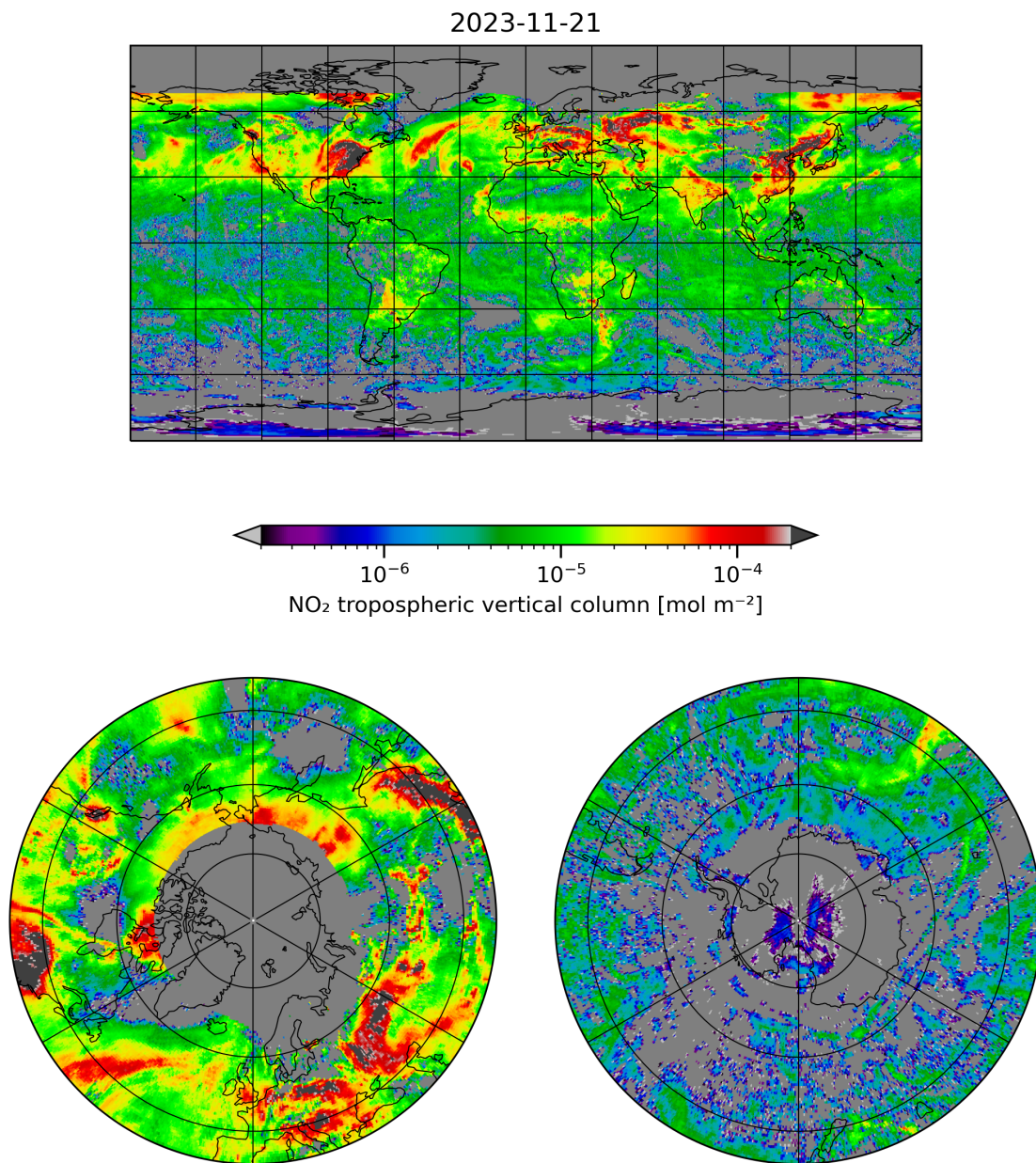


Figure 6: Map of “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22

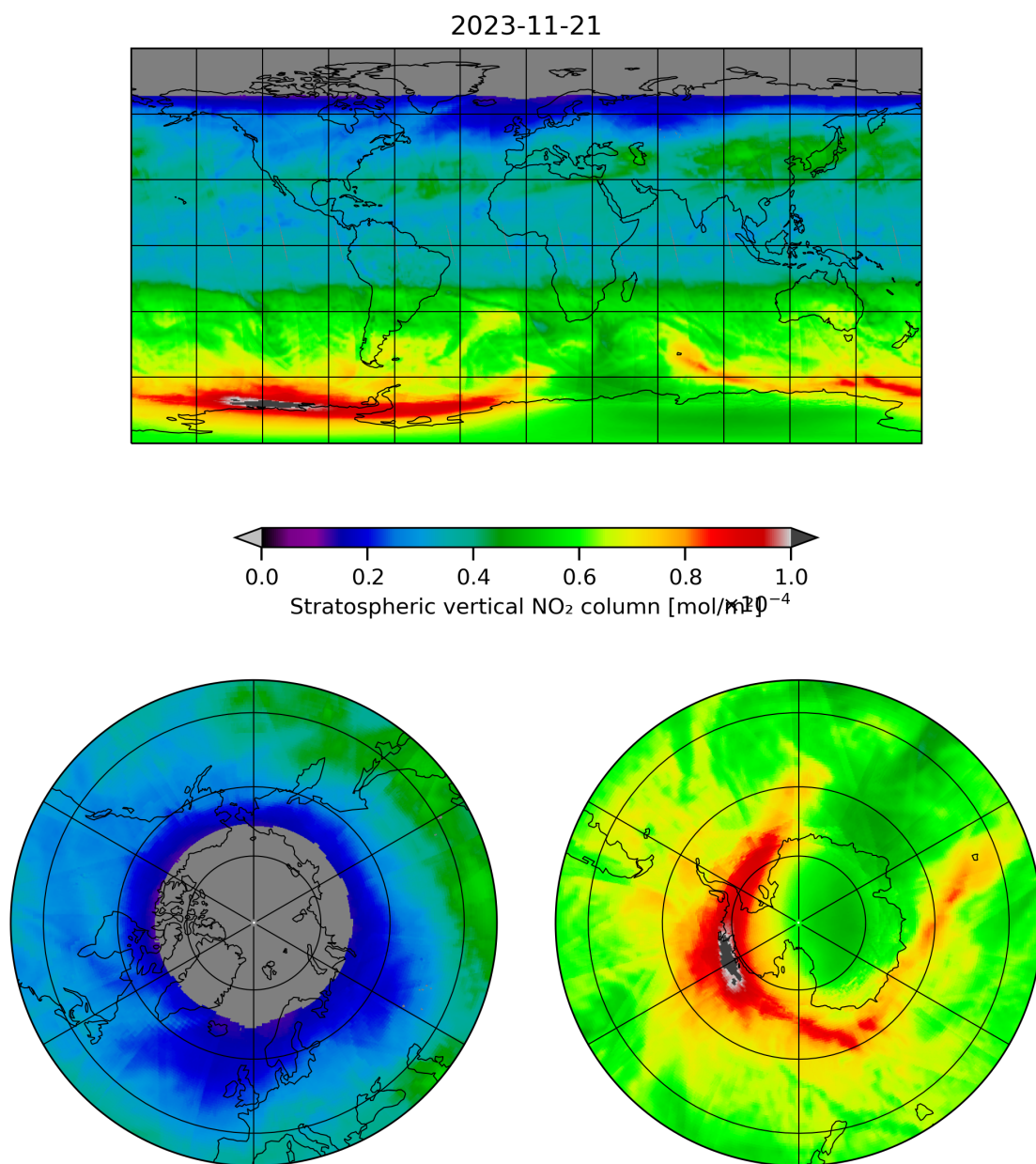


Figure 7: Map of “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22

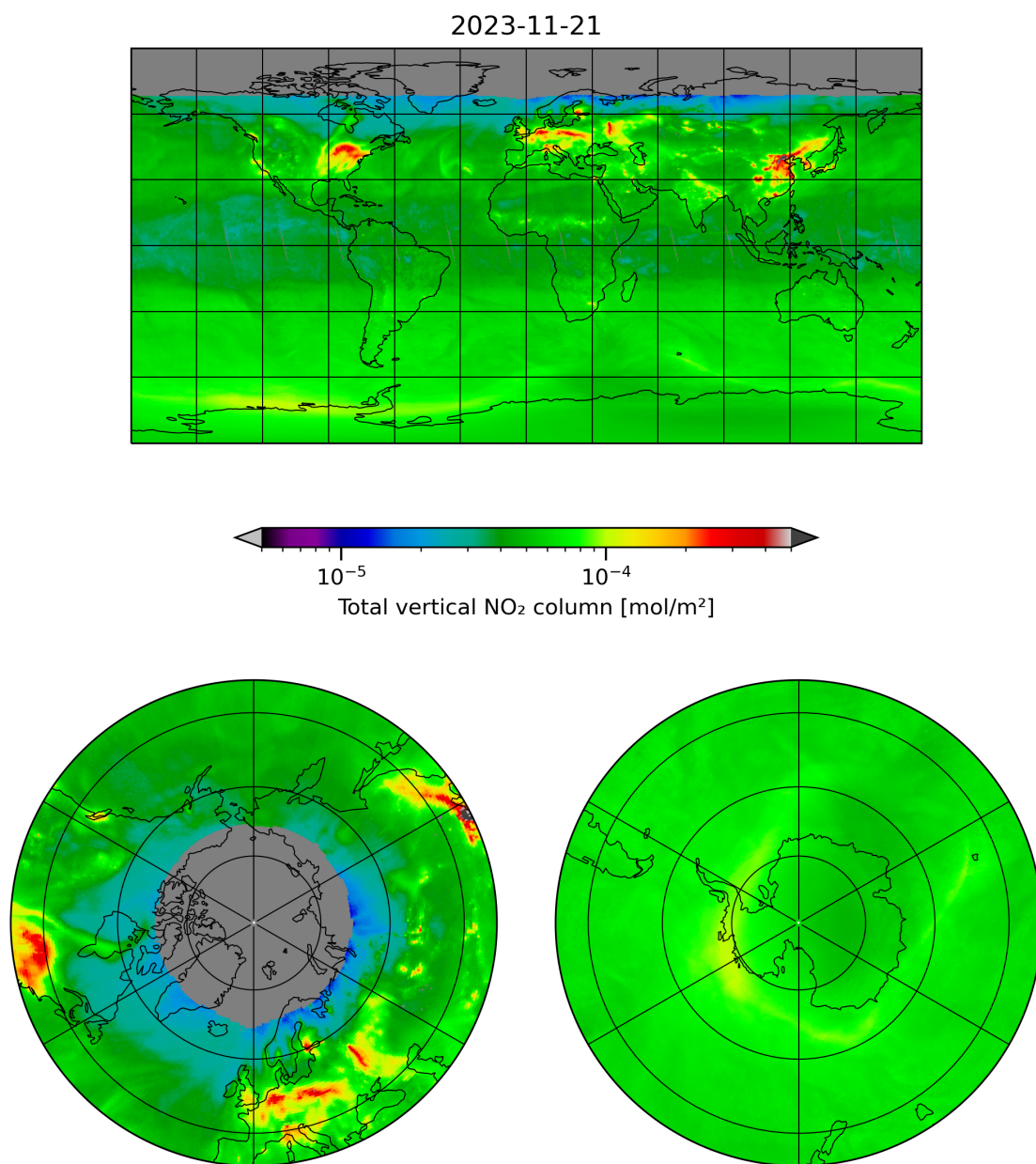


Figure 8: Map of “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22

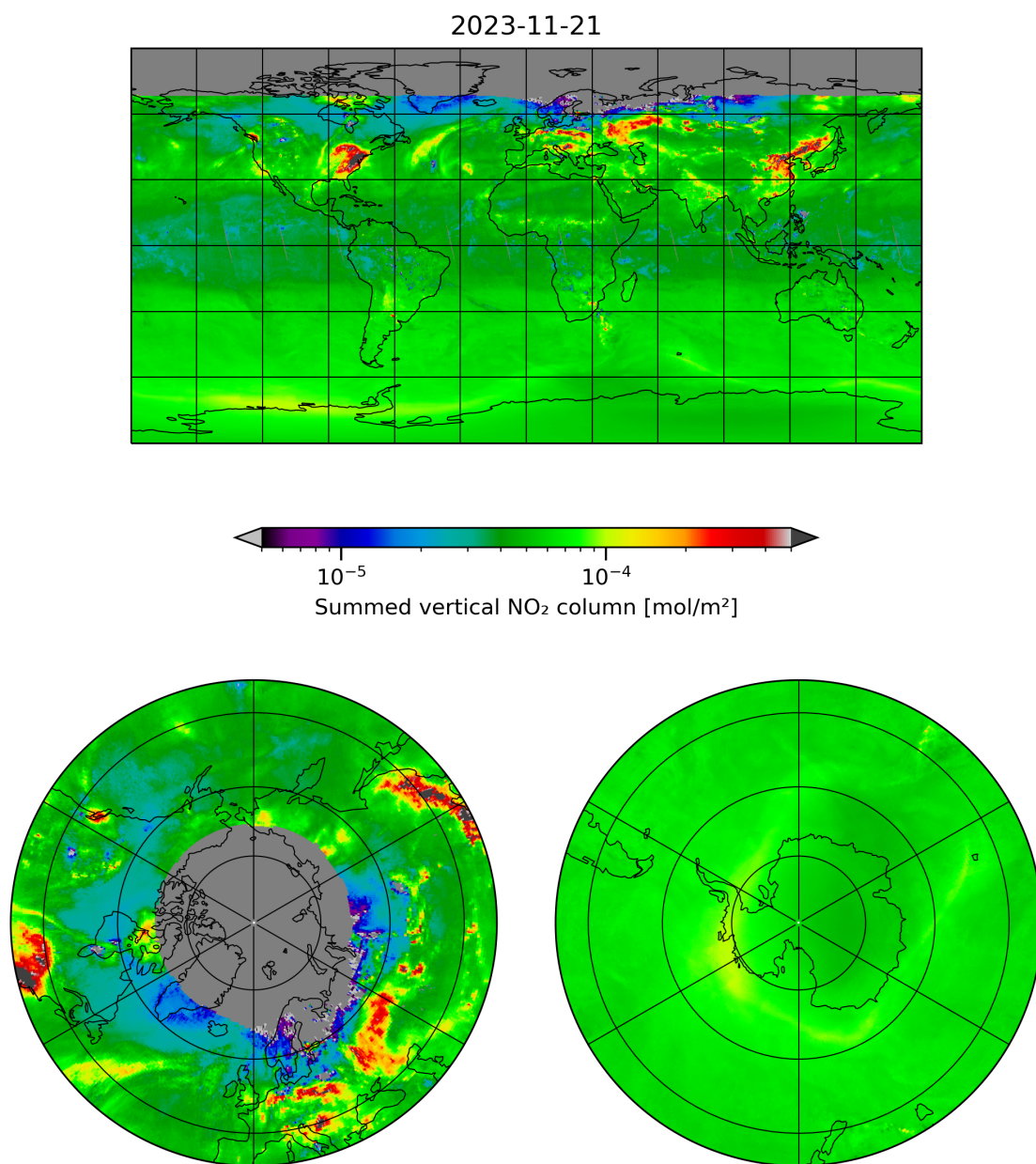


Figure 9: Map of “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22

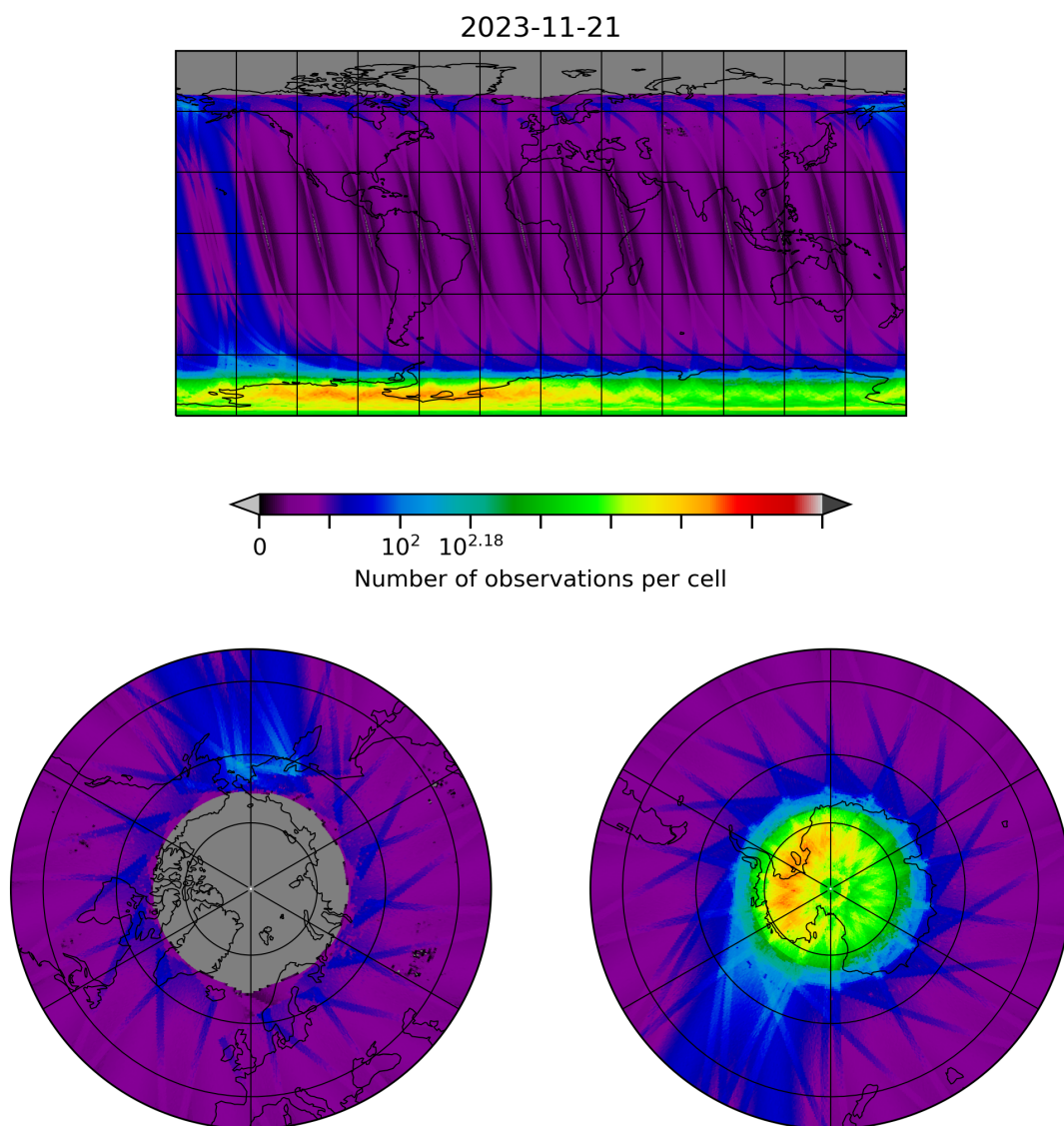


Figure 10: Map of the number of observations for 2023-11-20 to 2023-11-22

7 Zonal average

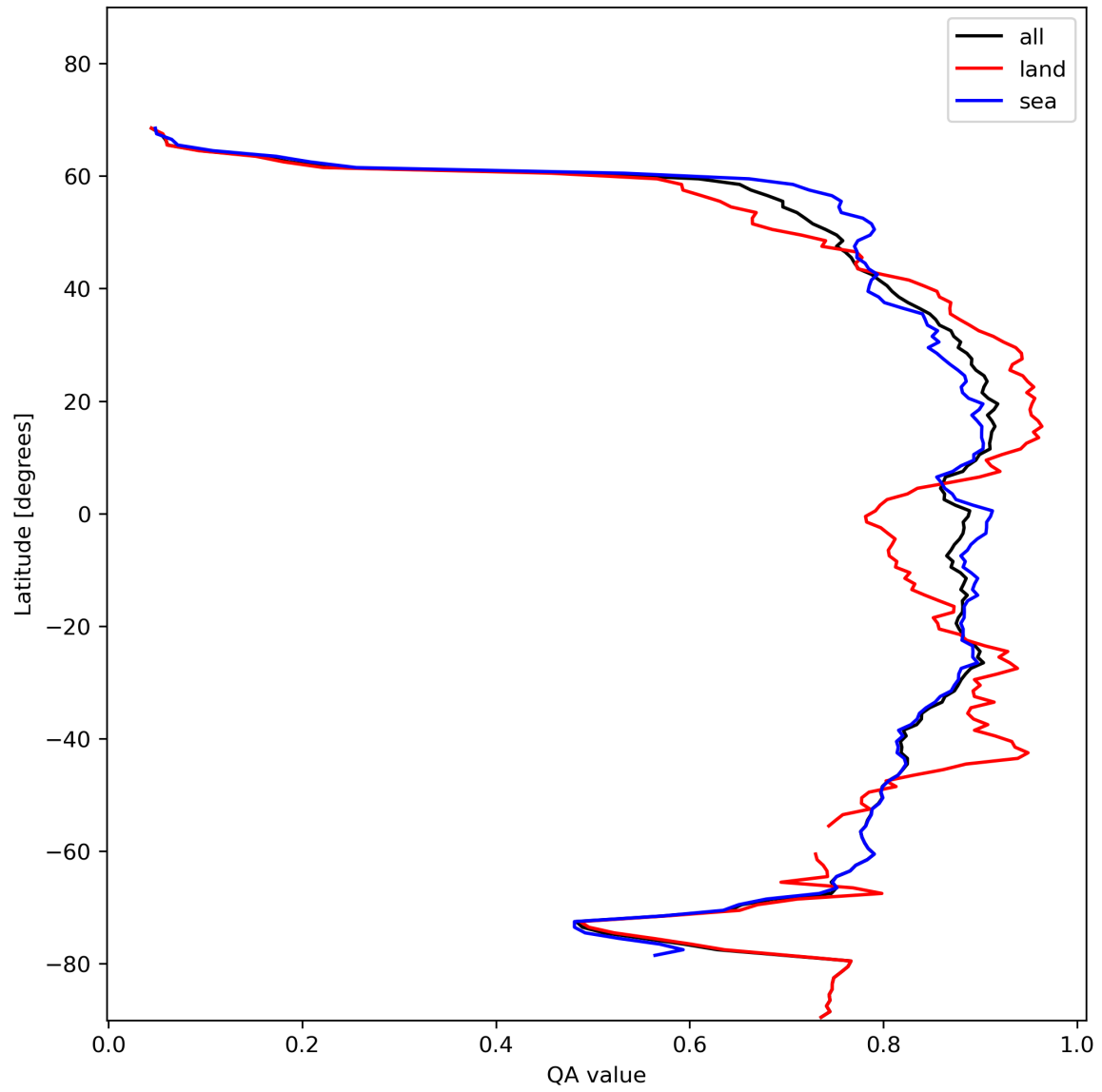


Figure 11: Zonal average of “QA value” for 2023-11-20 to 2023-11-22.

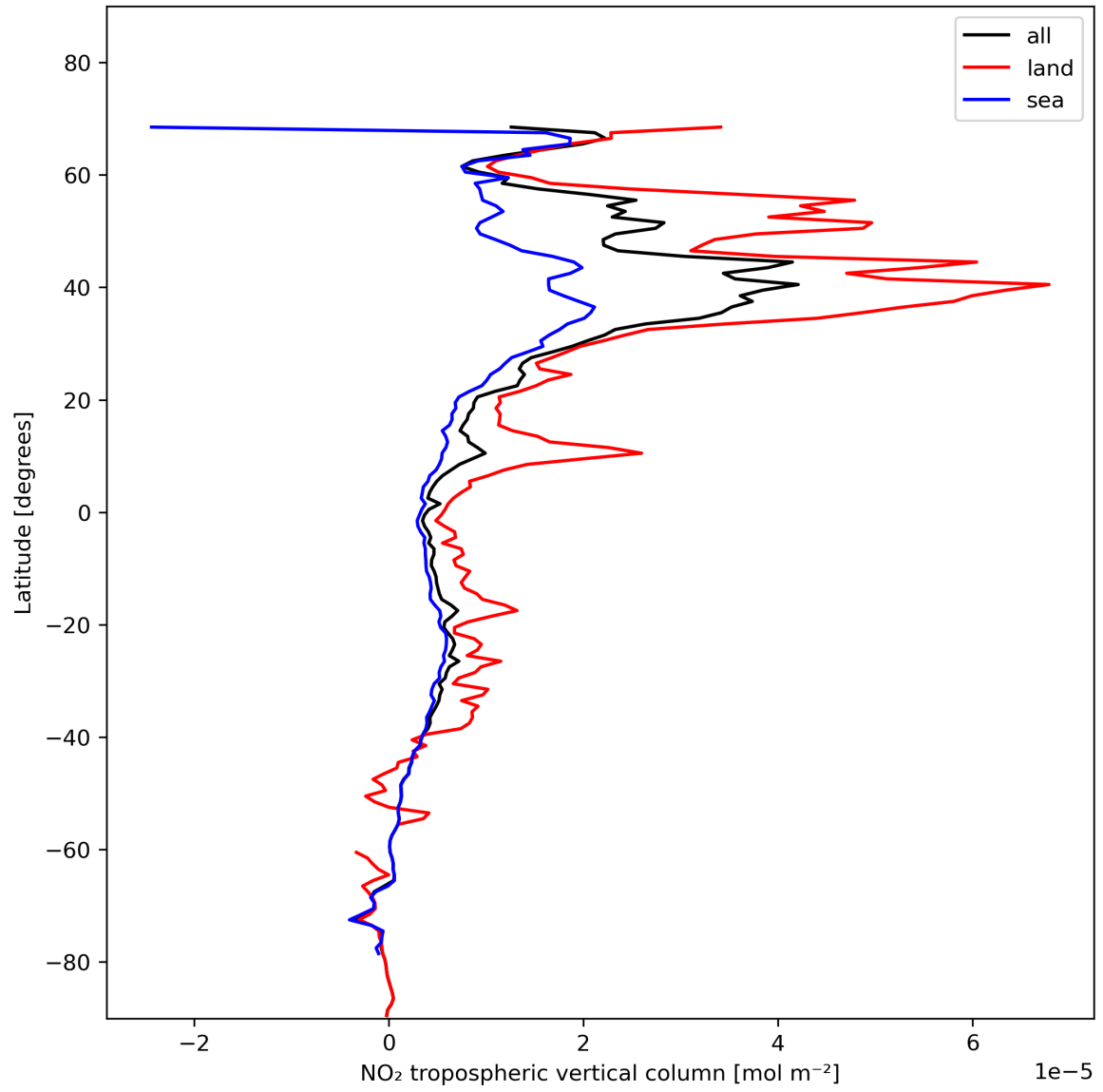


Figure 12: Zonal average of “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.

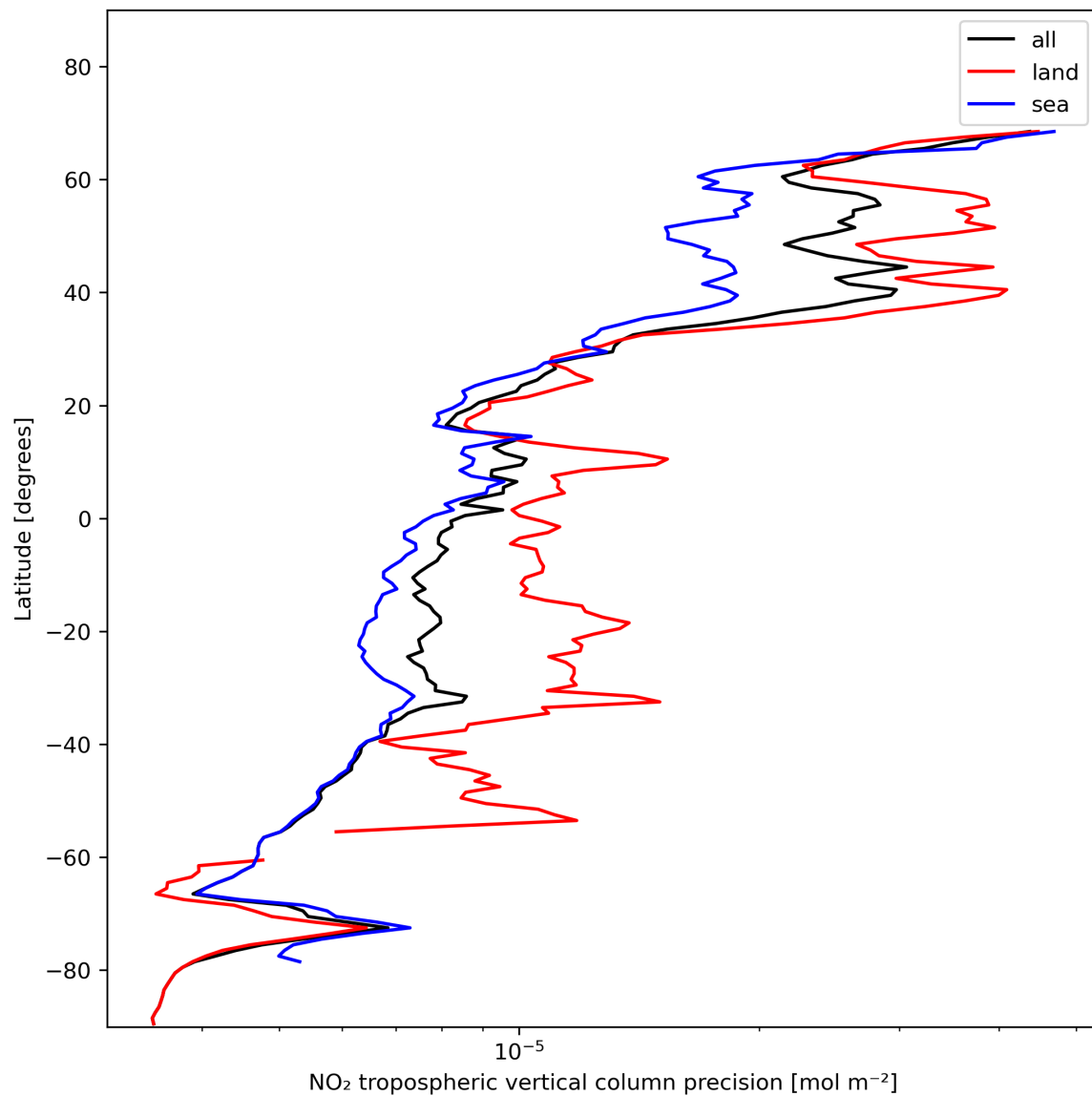


Figure 13: Zonal average of “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.

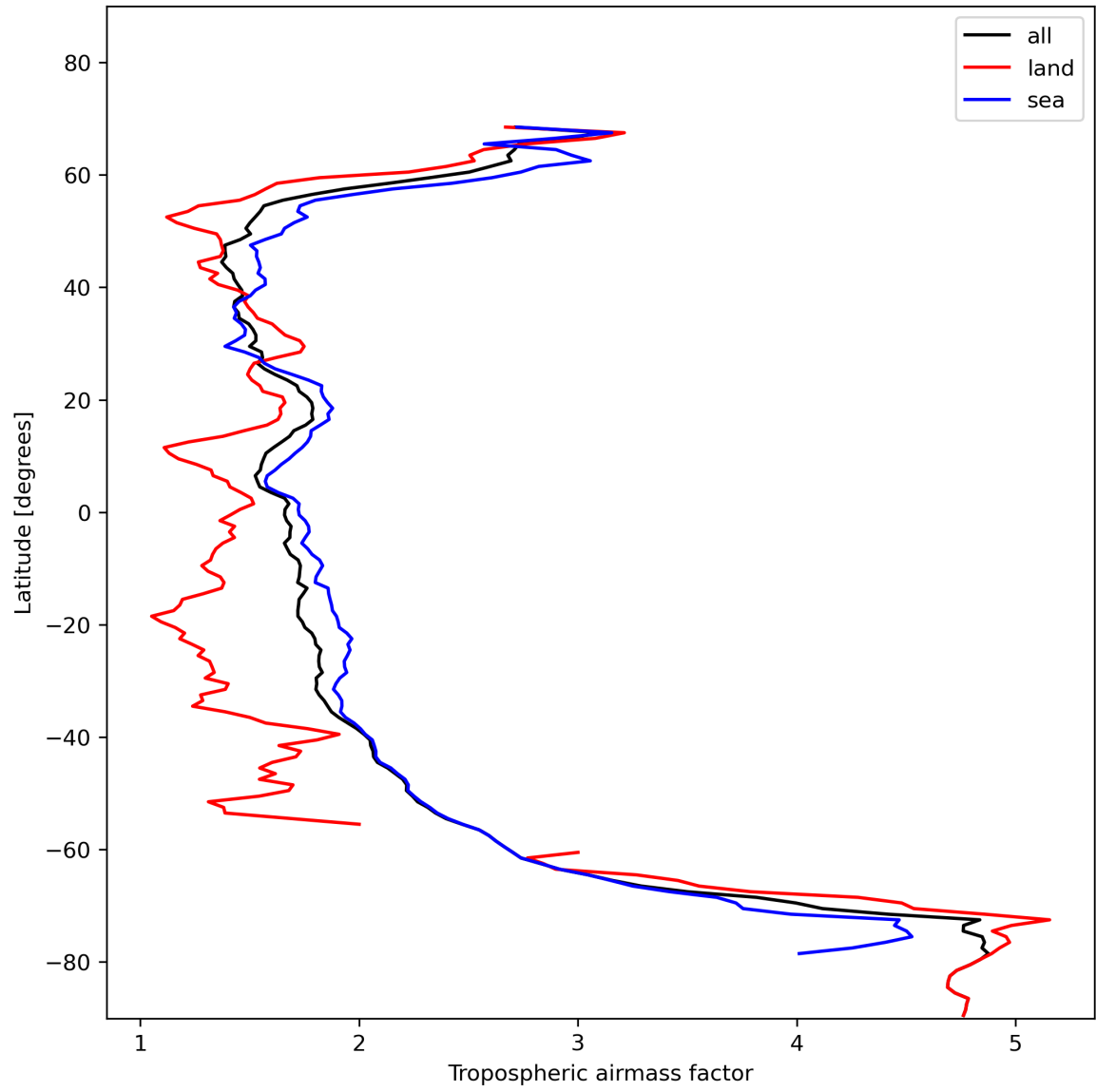


Figure 14: Zonal average of “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.

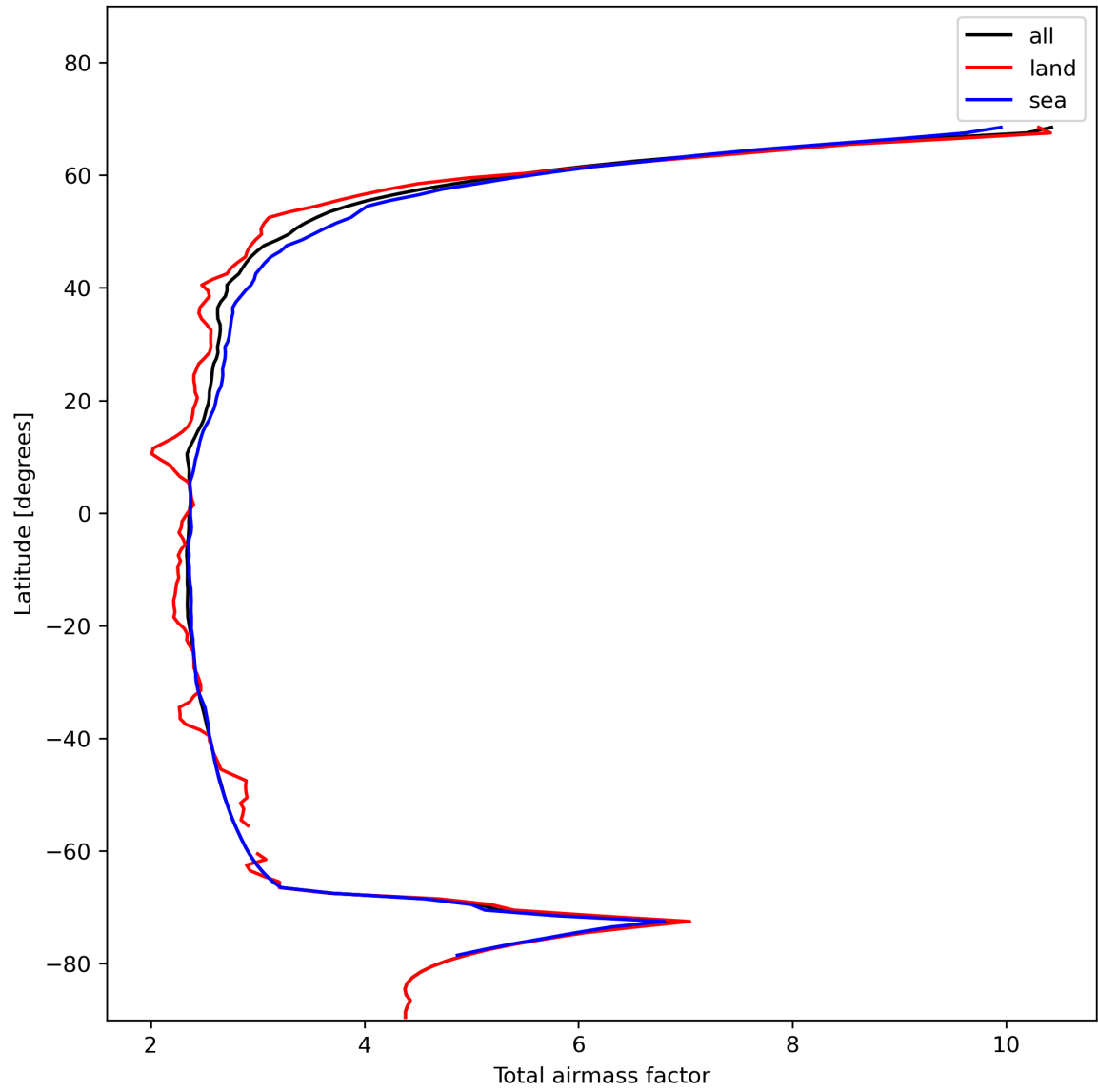


Figure 15: Zonal average of “Total airmass factor” for 2023-11-20 to 2023-11-22.

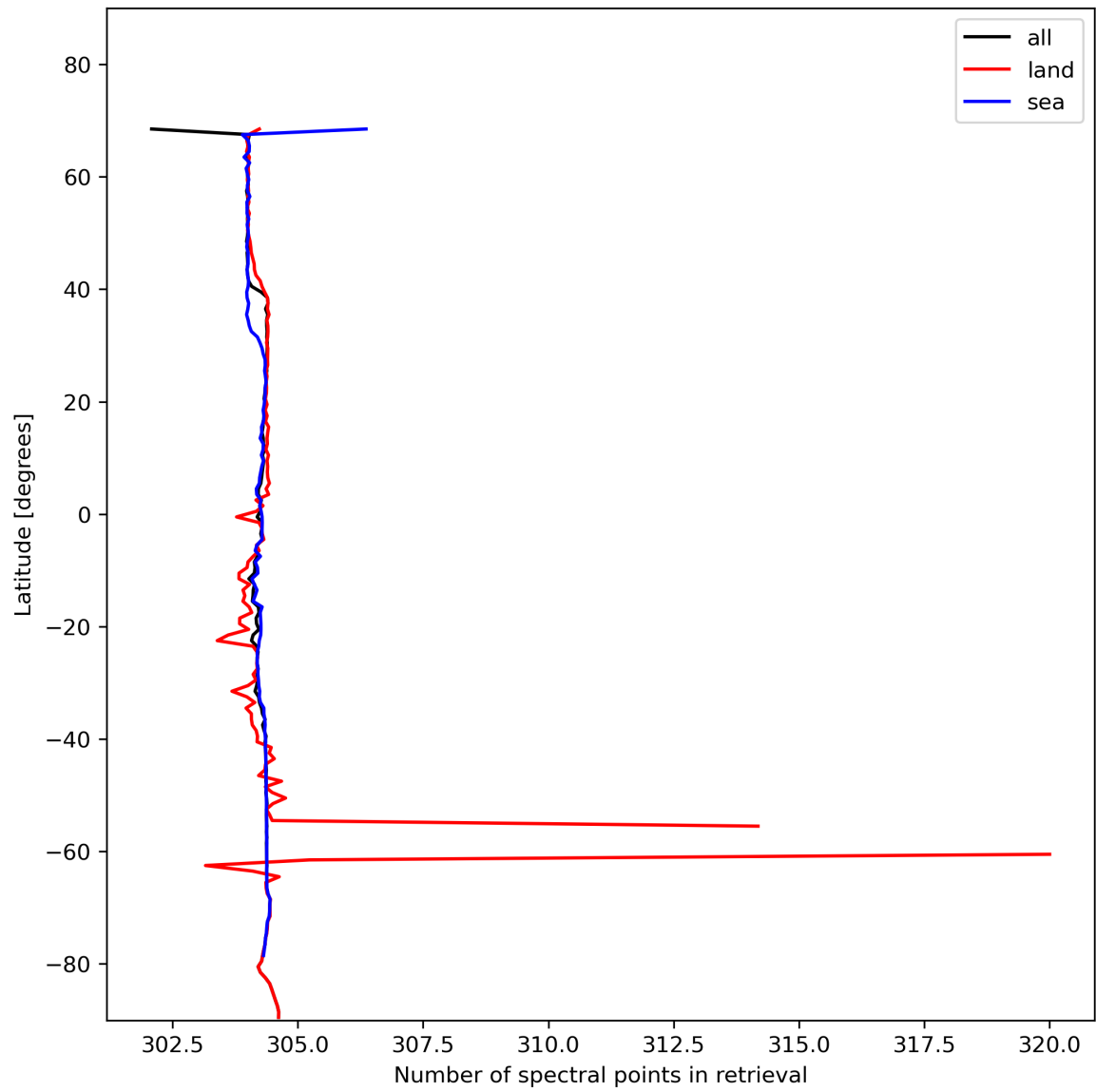


Figure 16: Zonal average of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22.

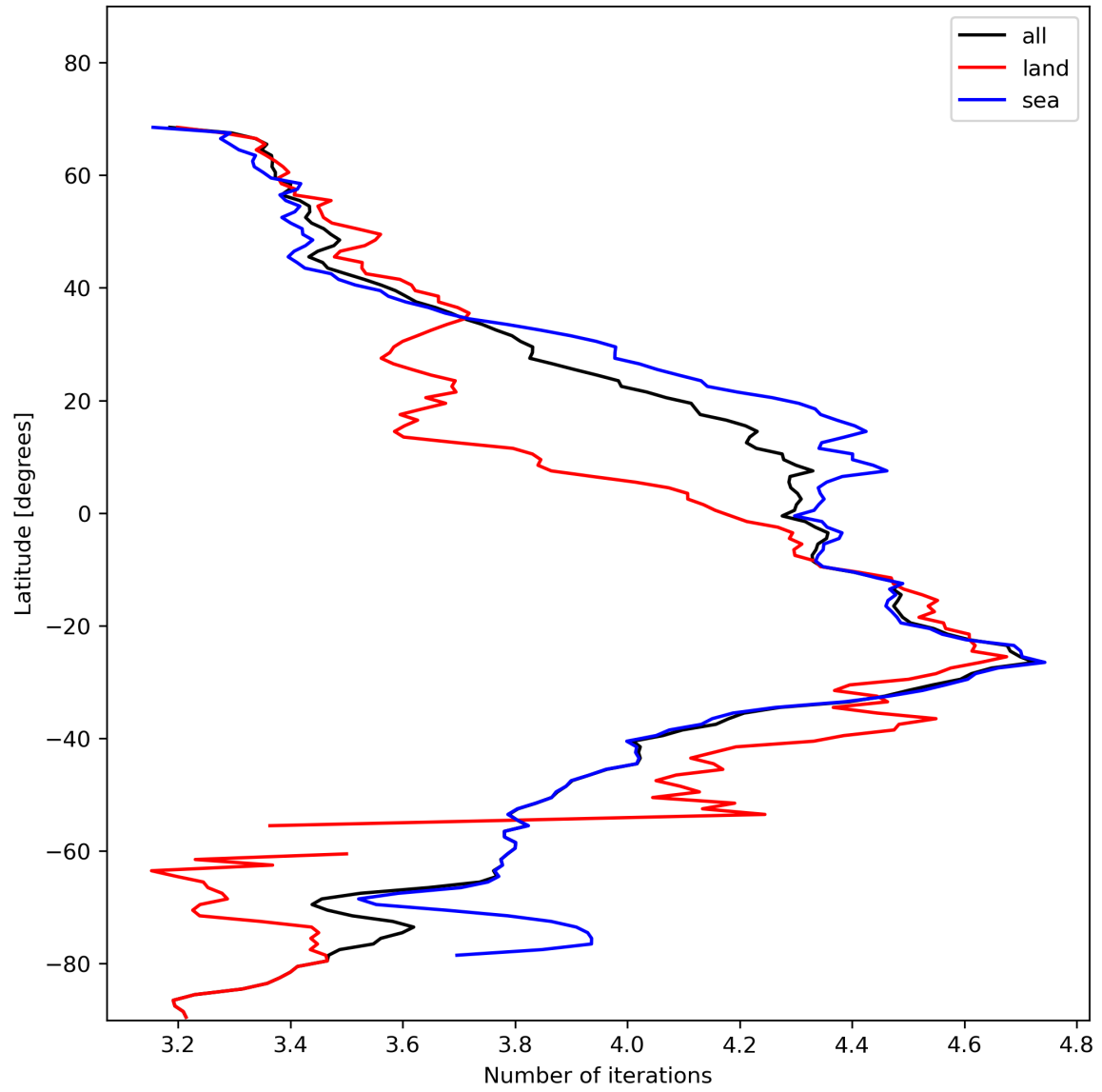


Figure 17: Zonal average of “Number of iterations” for 2023-11-20 to 2023-11-22.

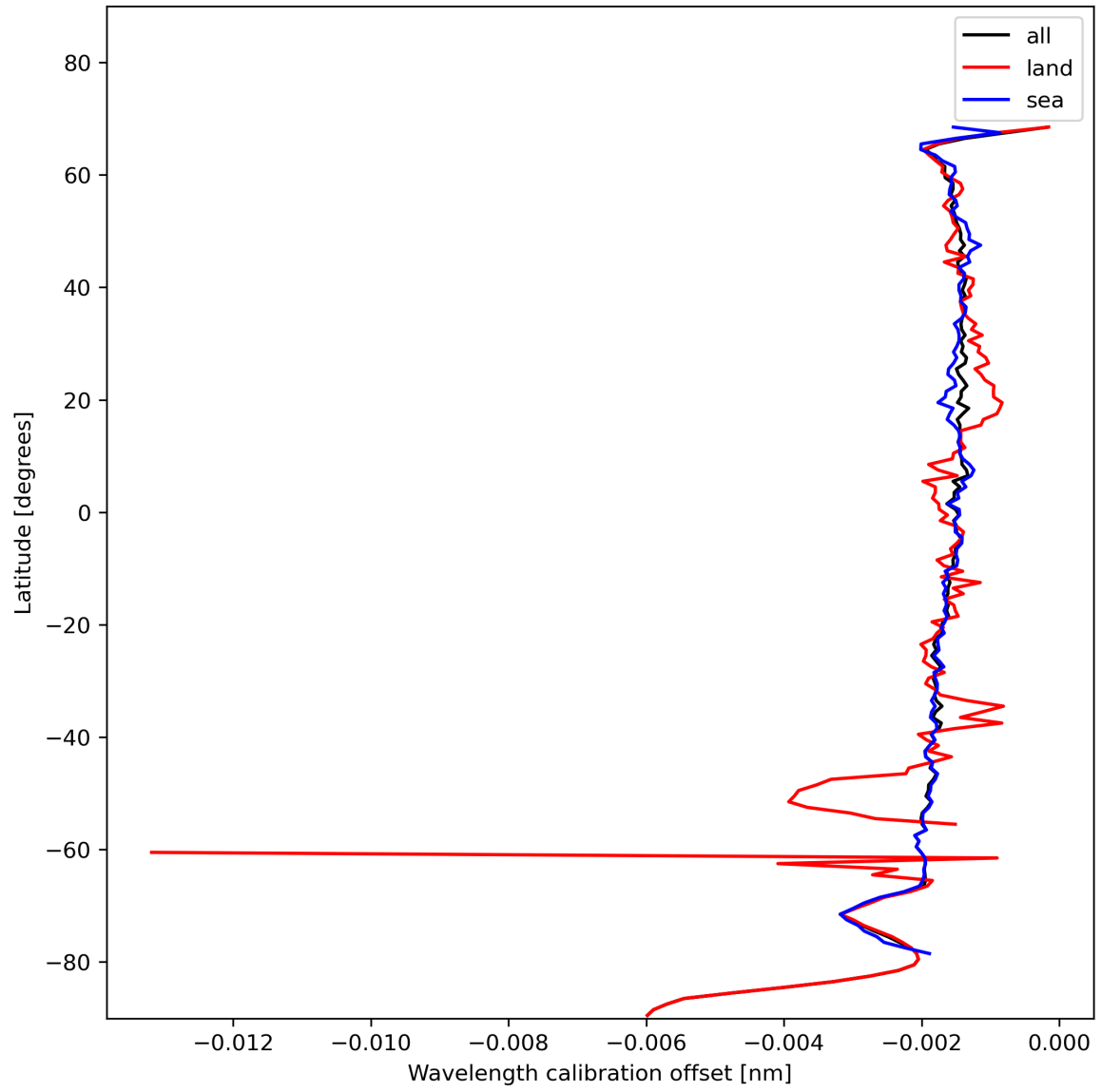


Figure 18: Zonal average of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

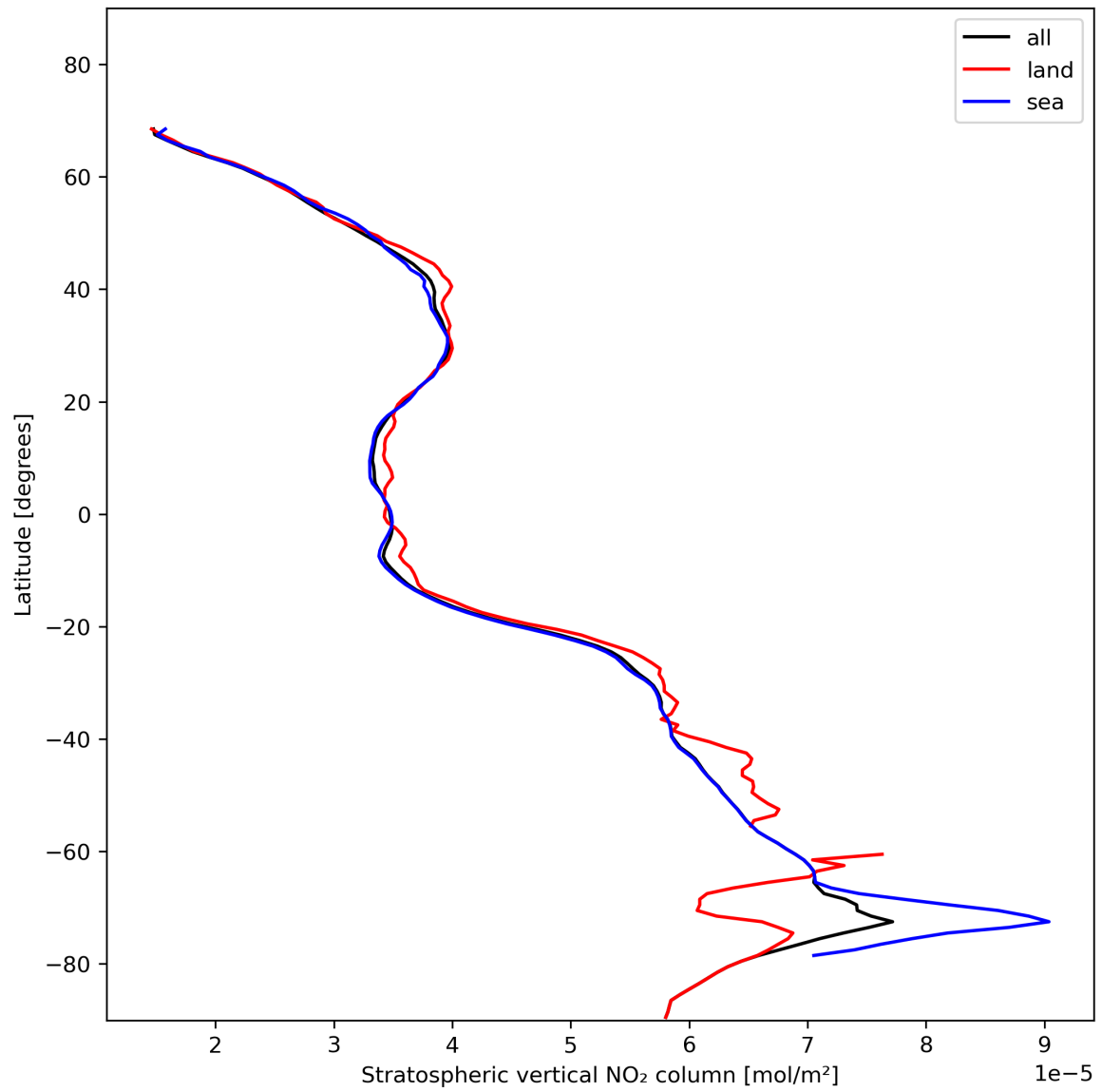


Figure 19: Zonal average of “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

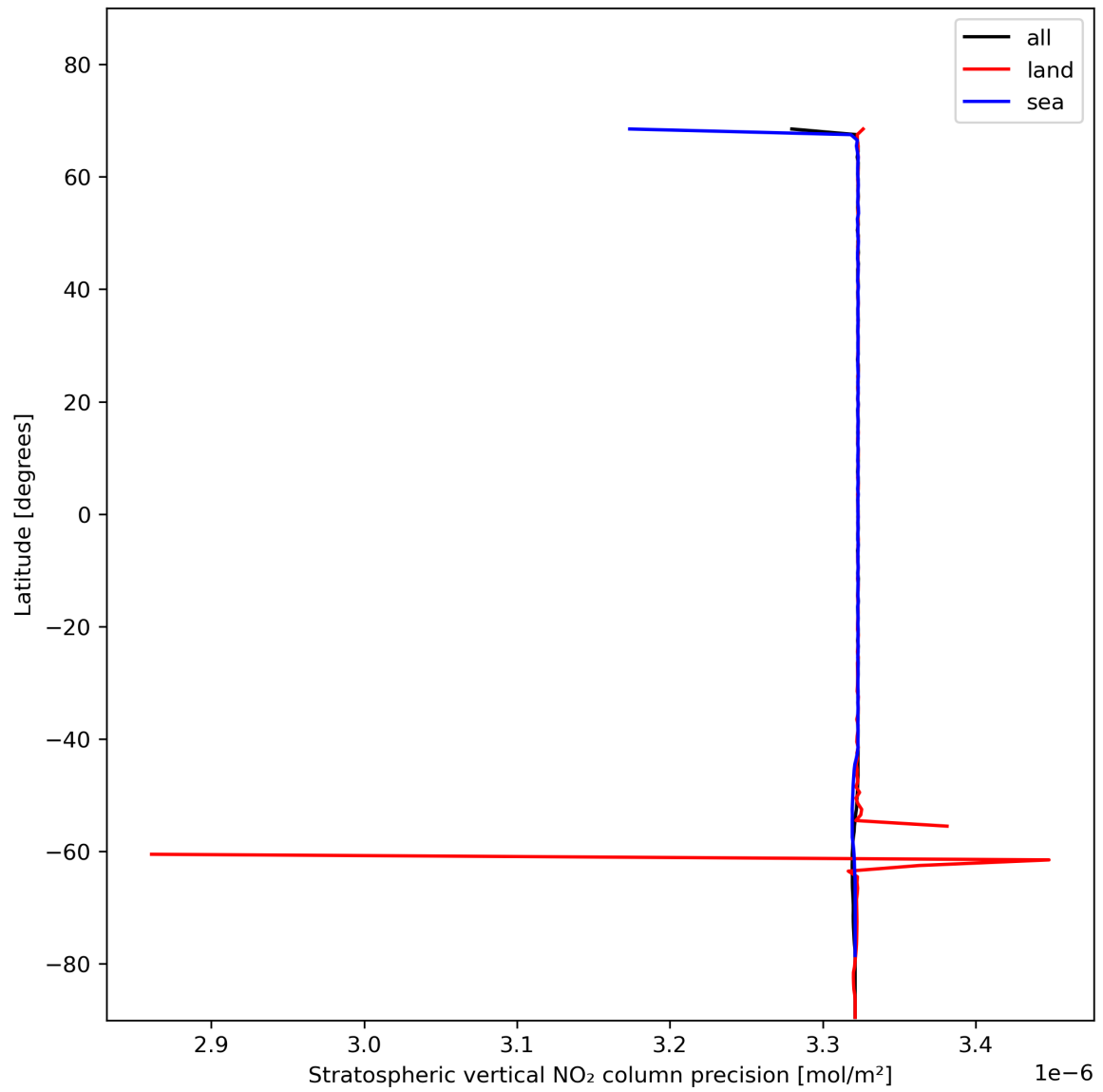


Figure 20: Zonal average of “Stratospheric vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

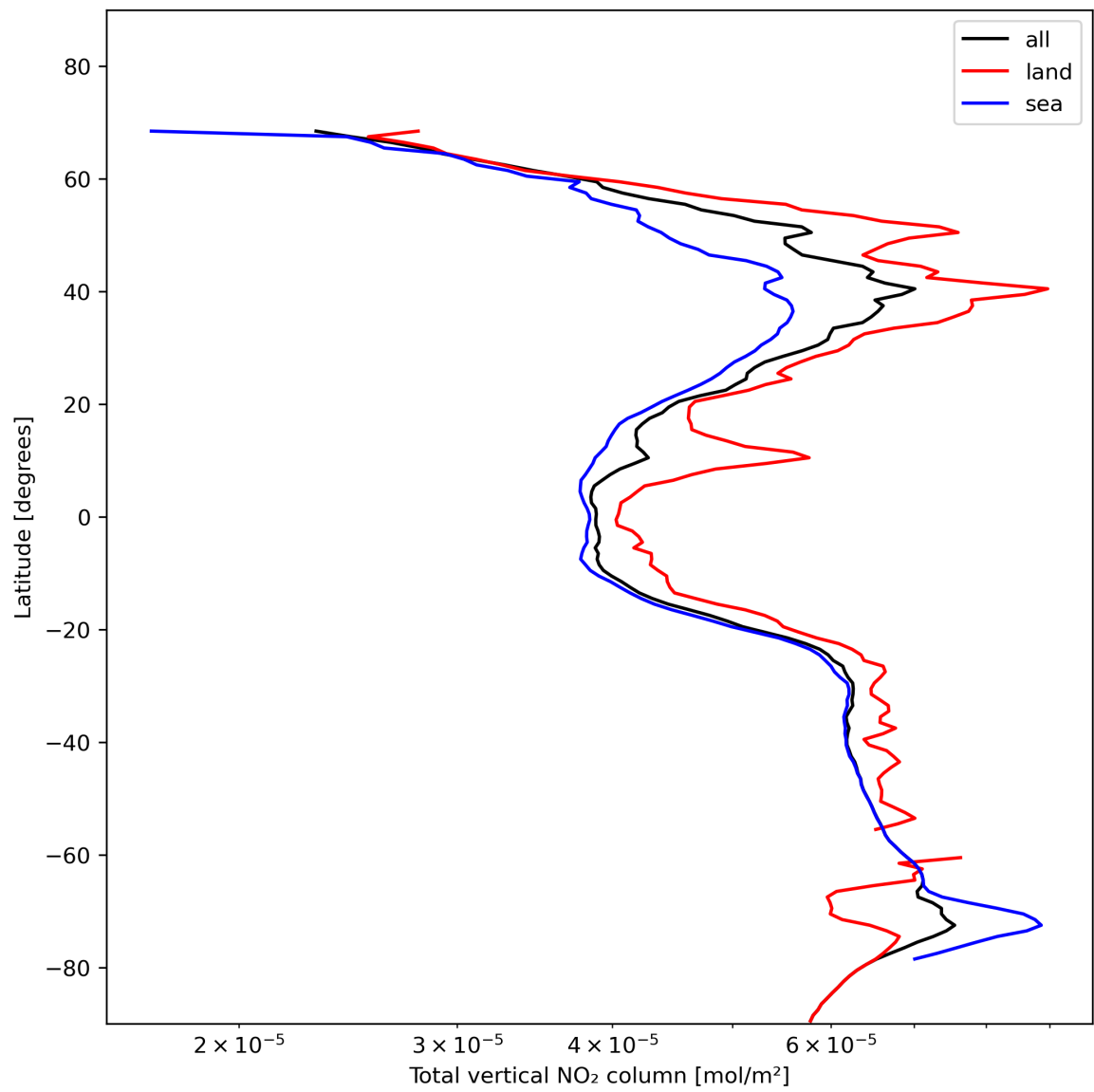


Figure 21: Zonal average of “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

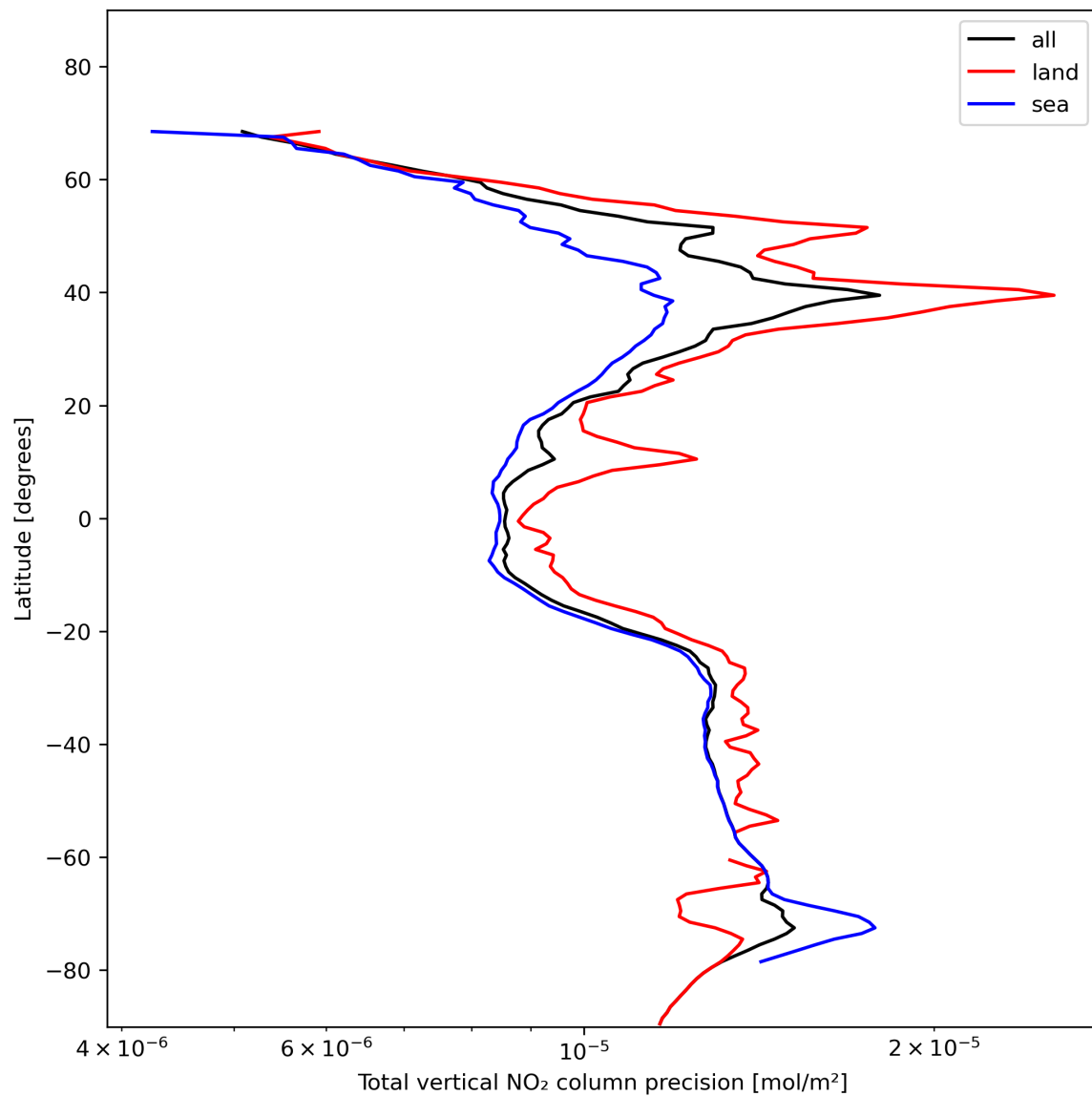


Figure 22: Zonal average of “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

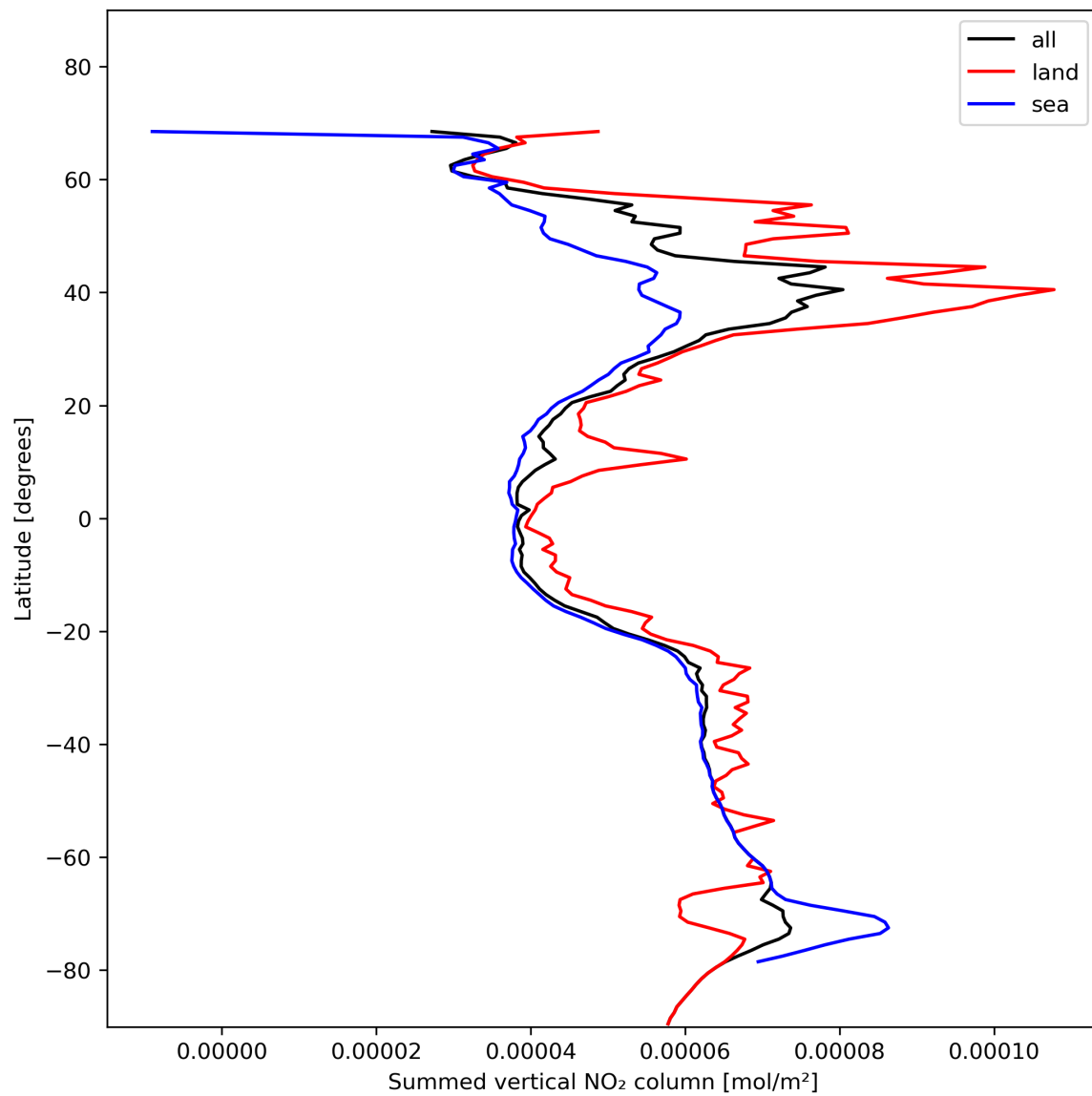


Figure 23: Zonal average of “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

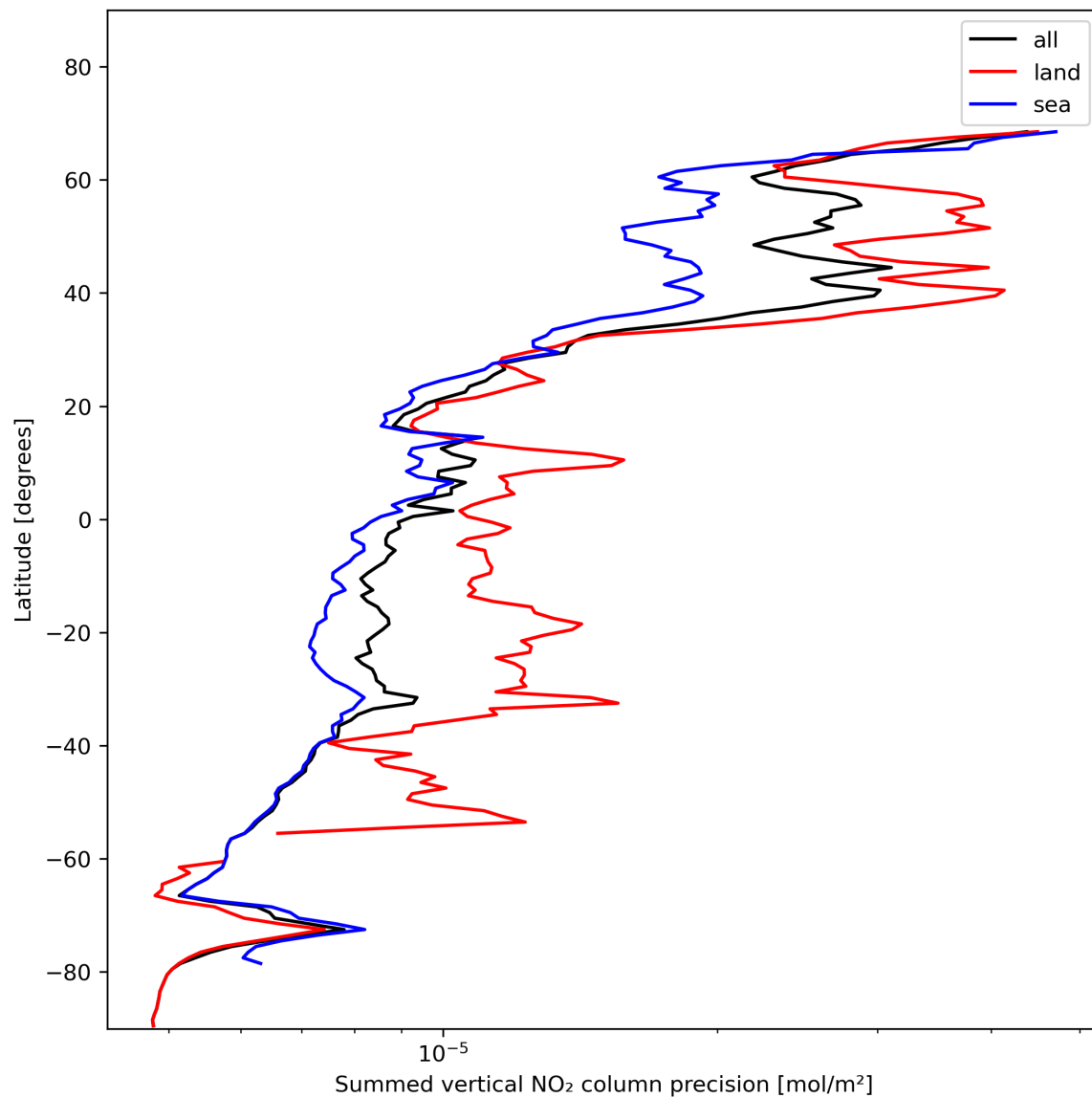


Figure 24: Zonal average of “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

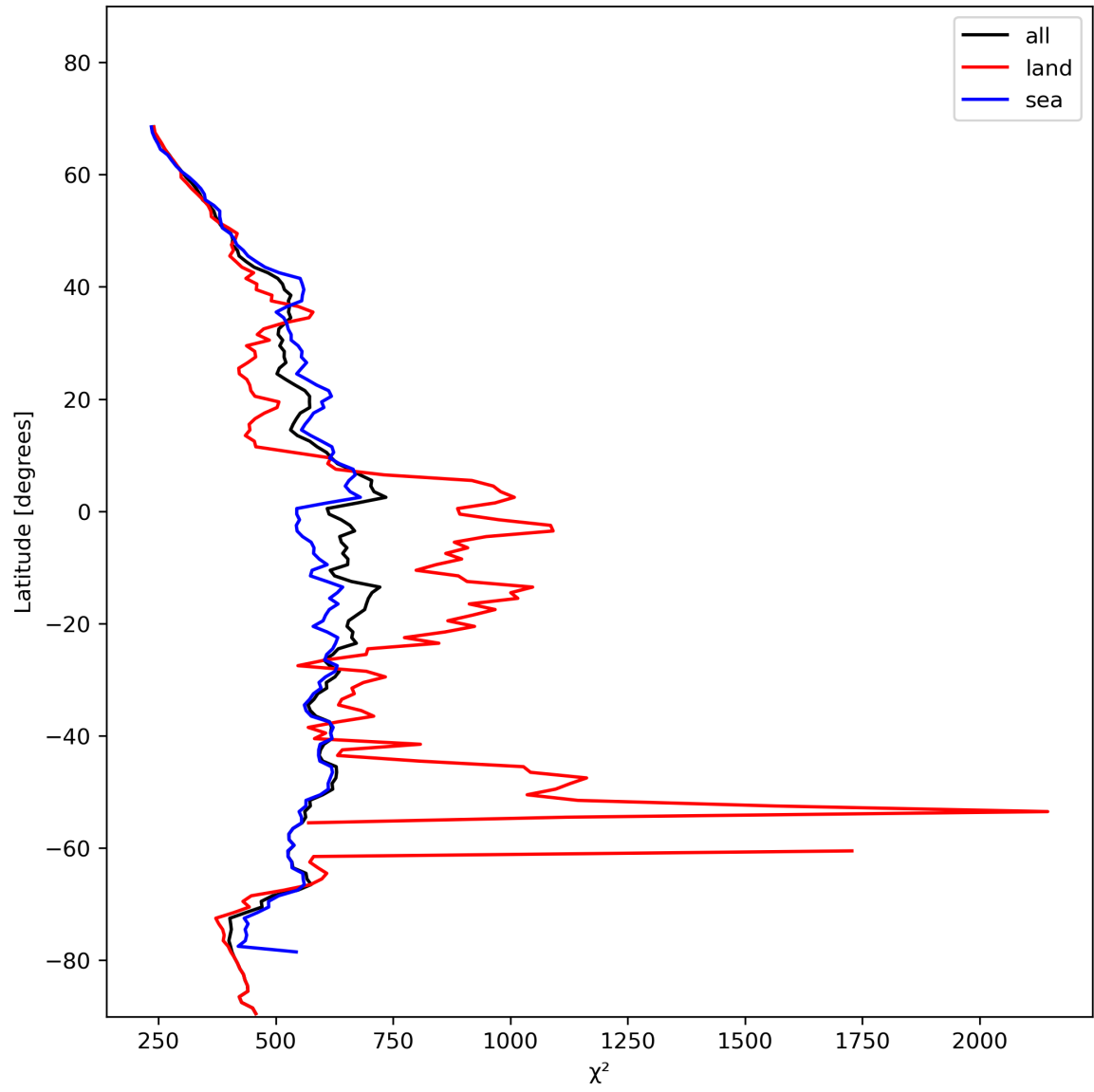


Figure 25: Zonal average of “ χ^2 ” for 2023-11-20 to 2023-11-22.

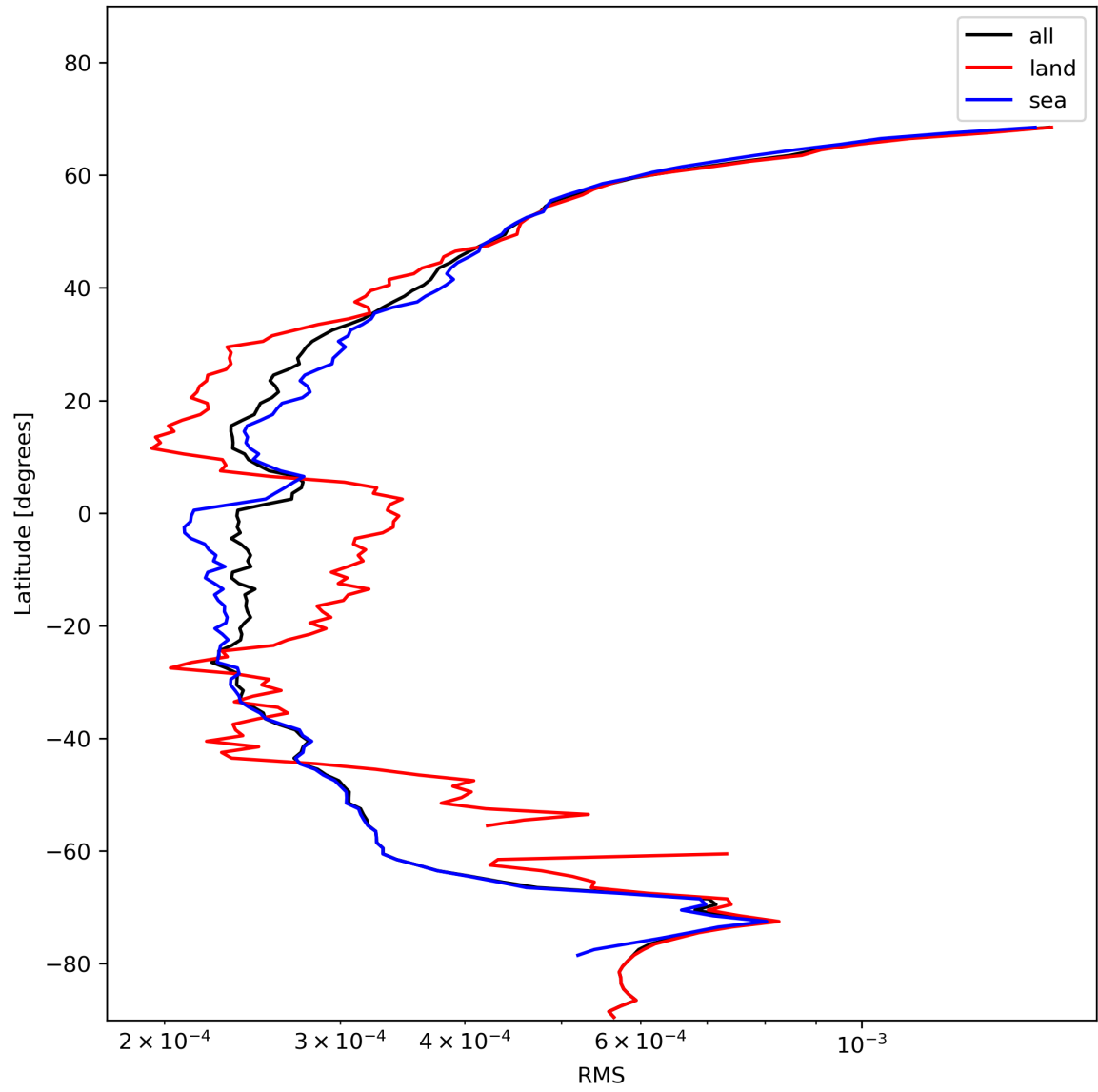


Figure 26: Zonal average of “RMS” for 2023-11-20 to 2023-11-22.

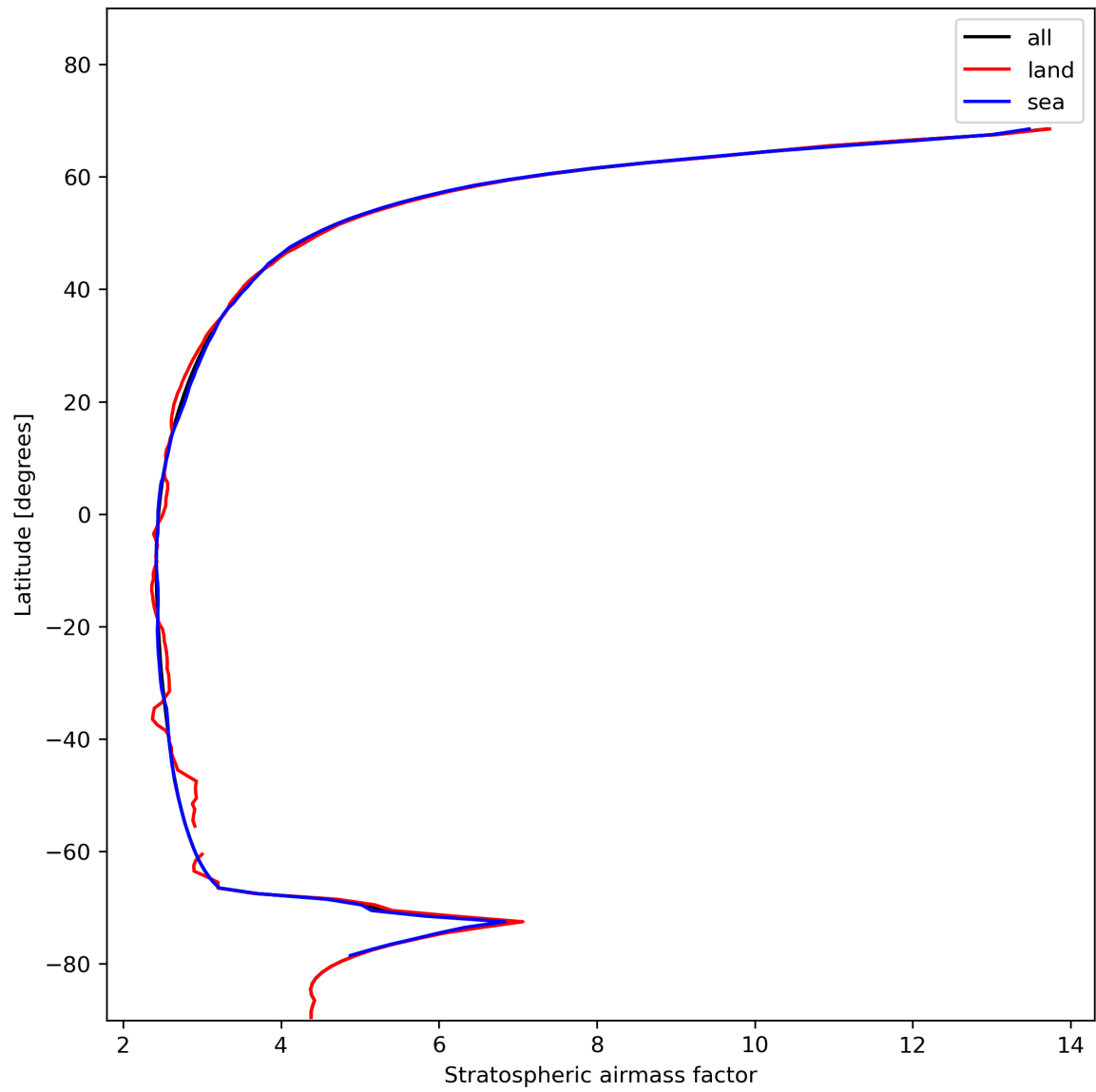


Figure 27: Zonal average of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

8 Histograms

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

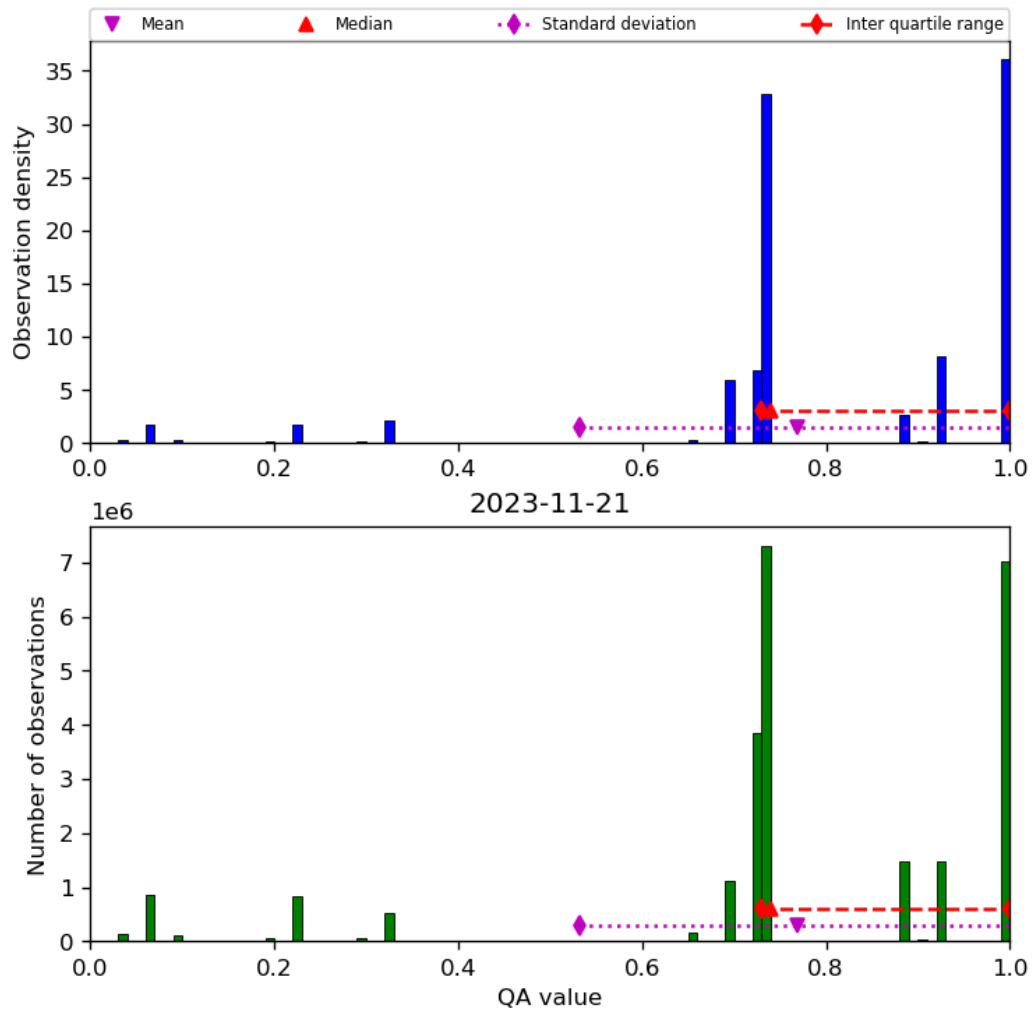


Figure 28: Histogram of “QA value” for 2023-11-20 to 2023-11-22

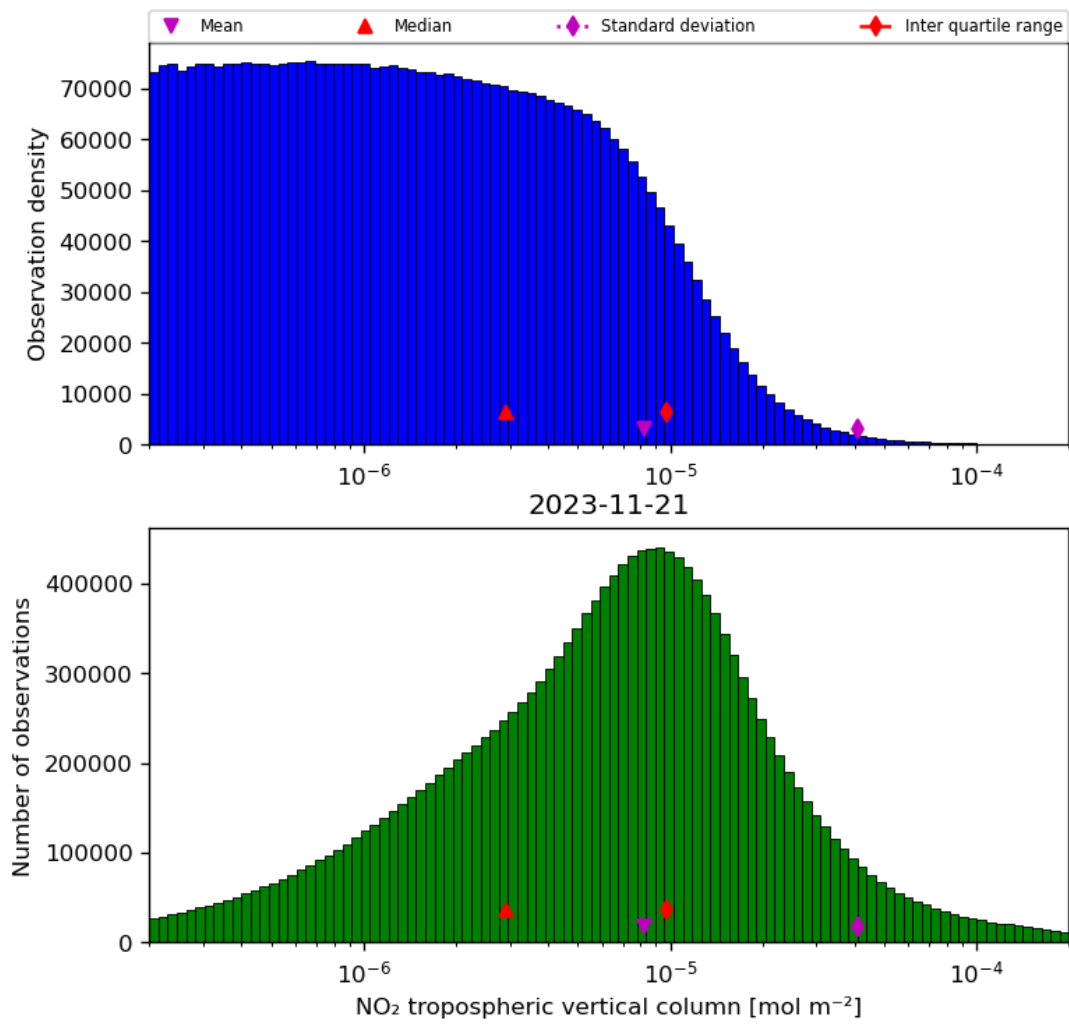


Figure 29: Histogram of “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22

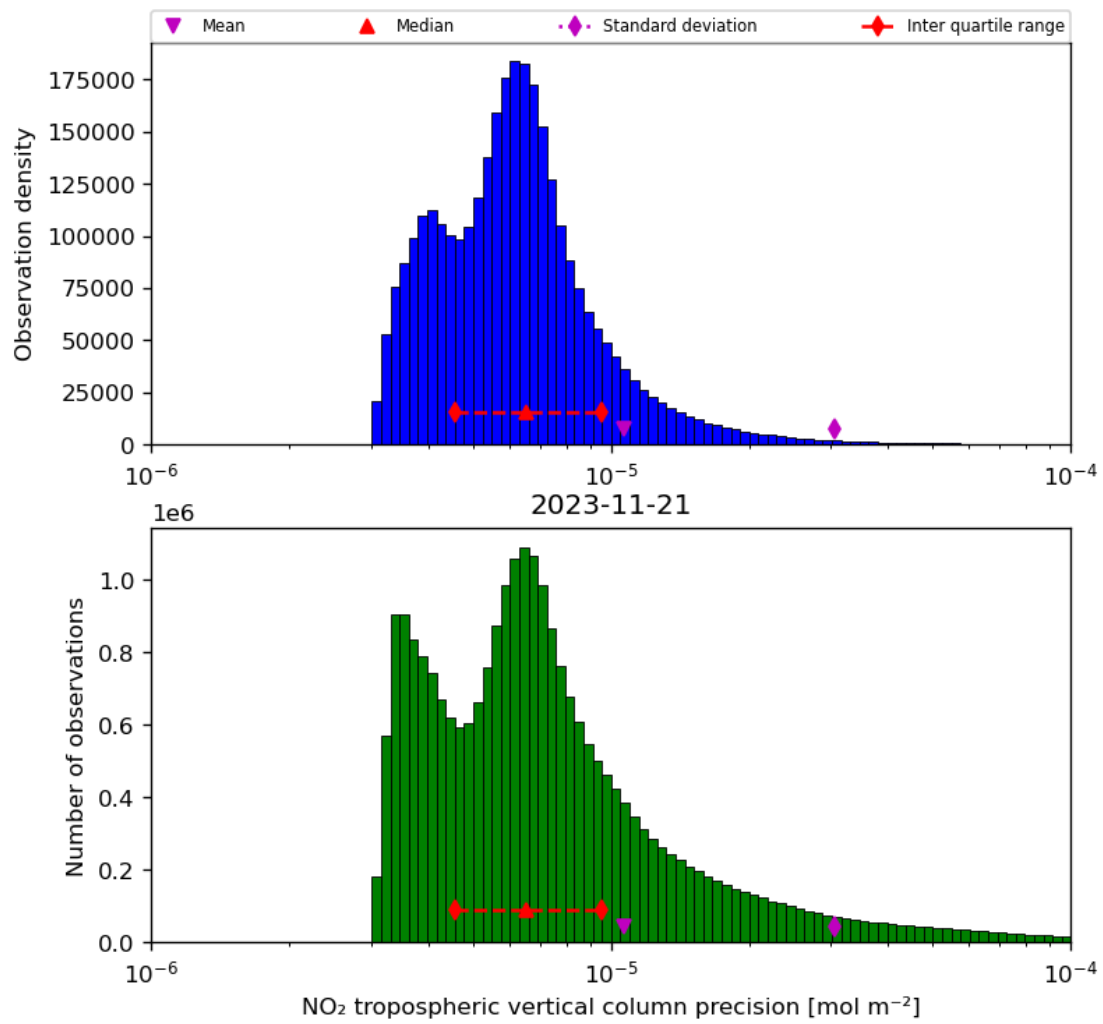


Figure 30: Histogram of “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22

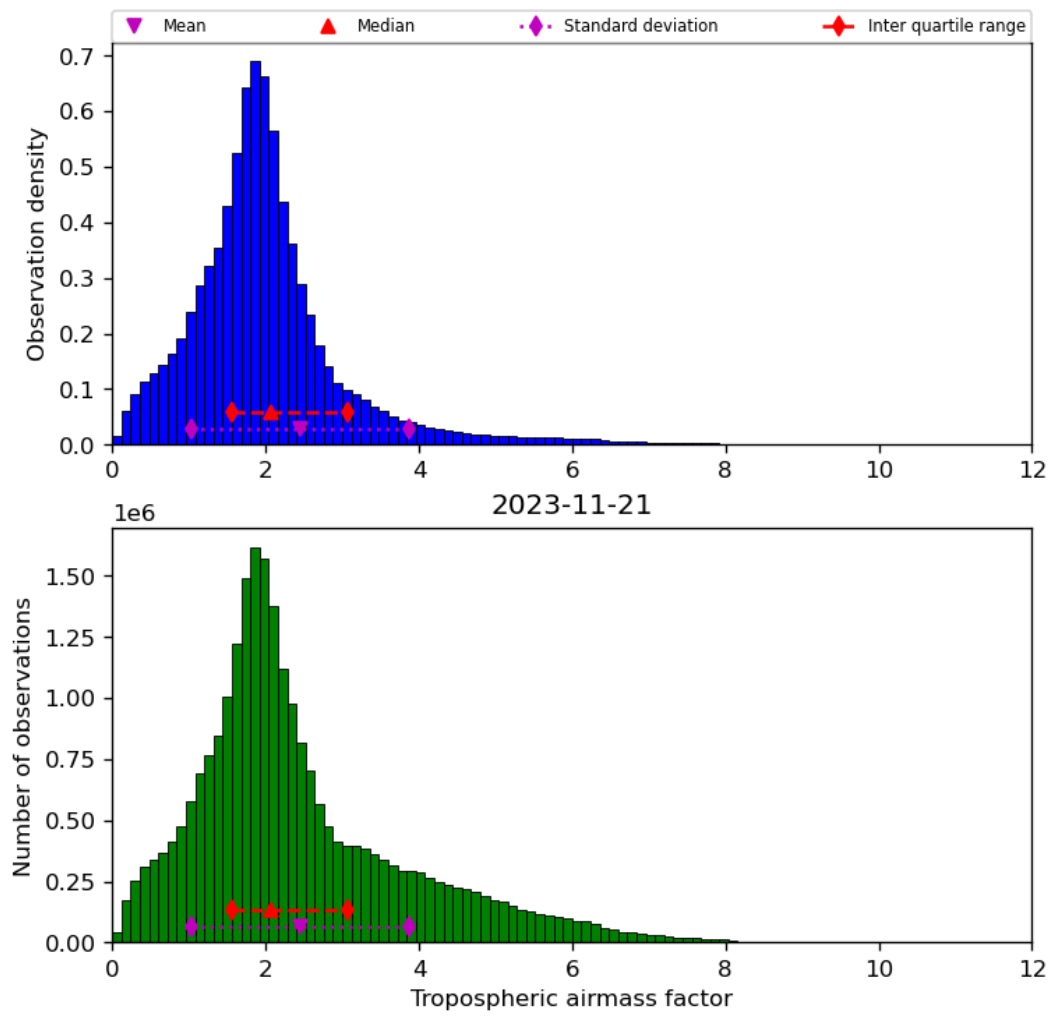


Figure 31: Histogram of “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22

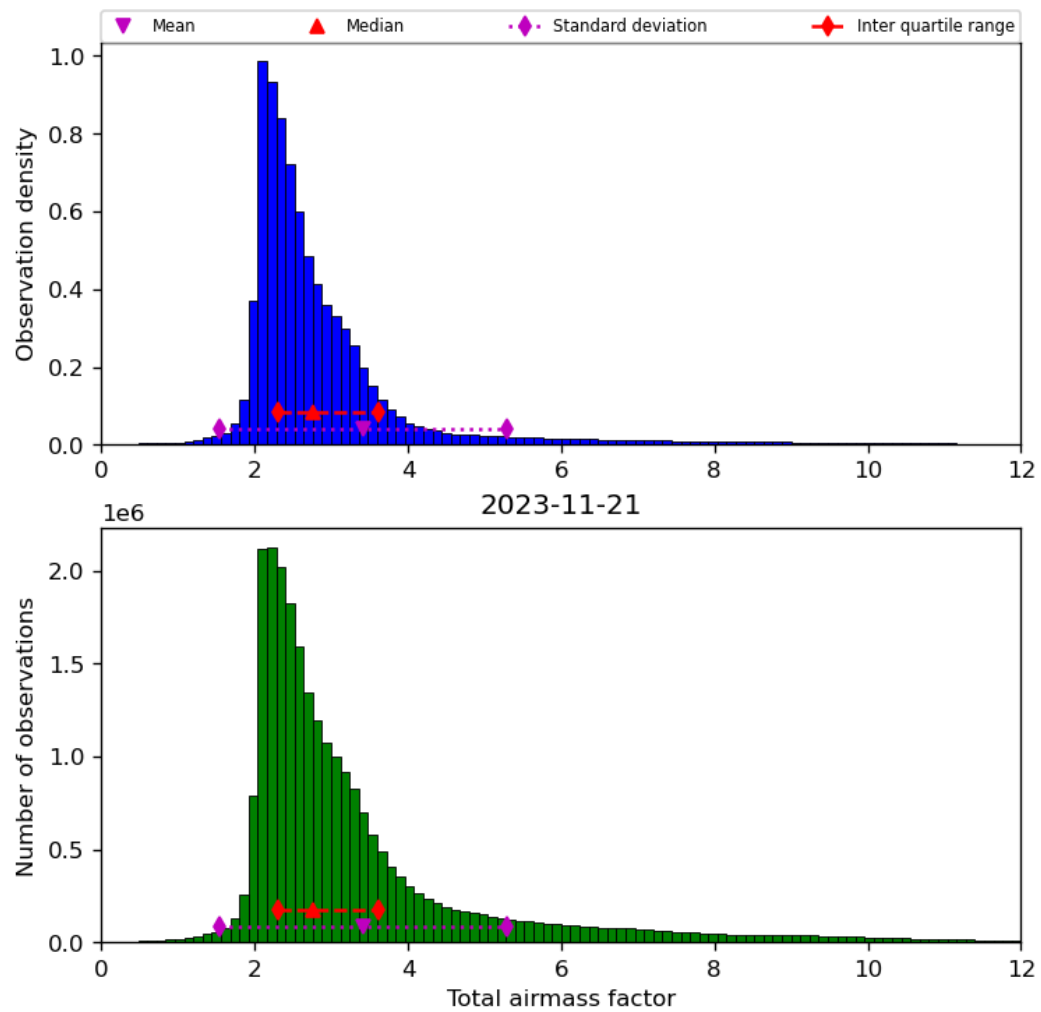


Figure 32: Histogram of “Total airmass factor” for 2023-11-20 to 2023-11-22

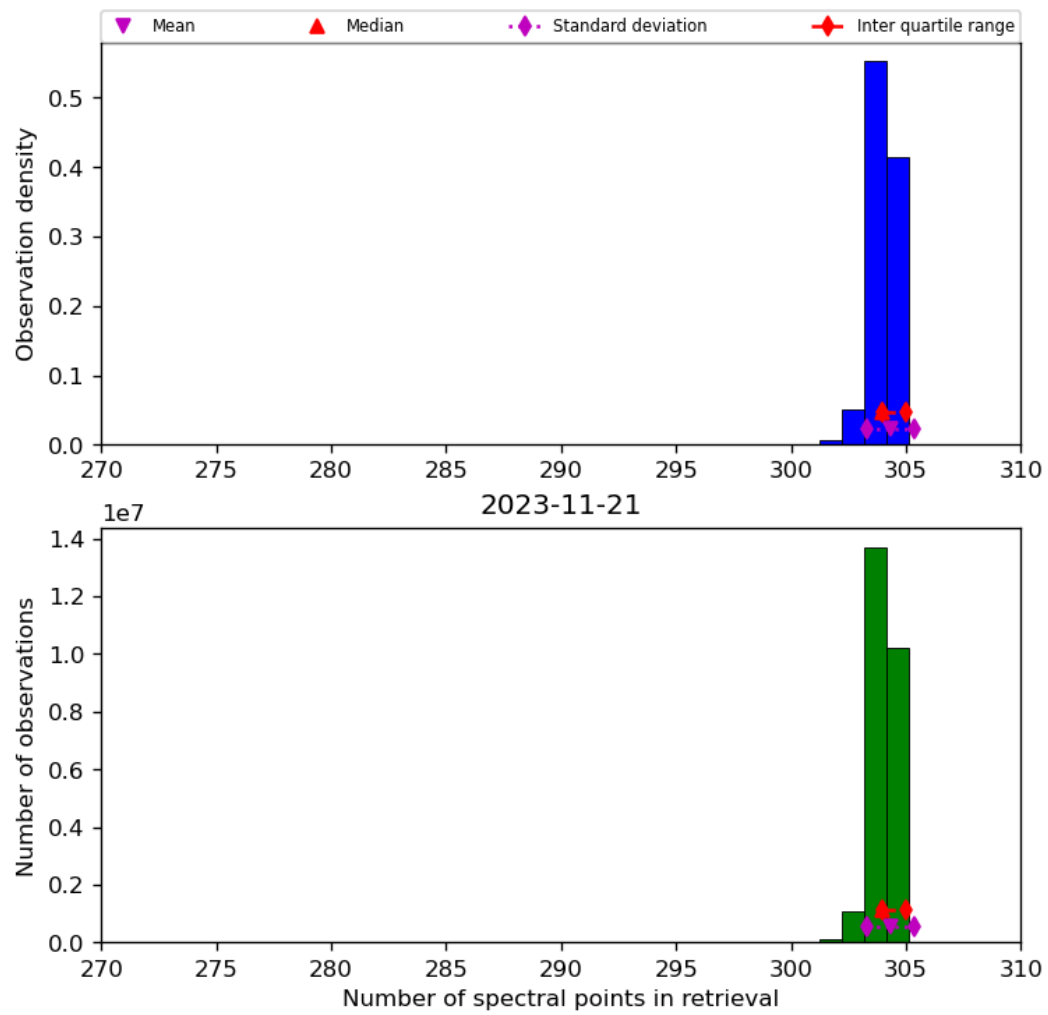


Figure 33: Histogram of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22

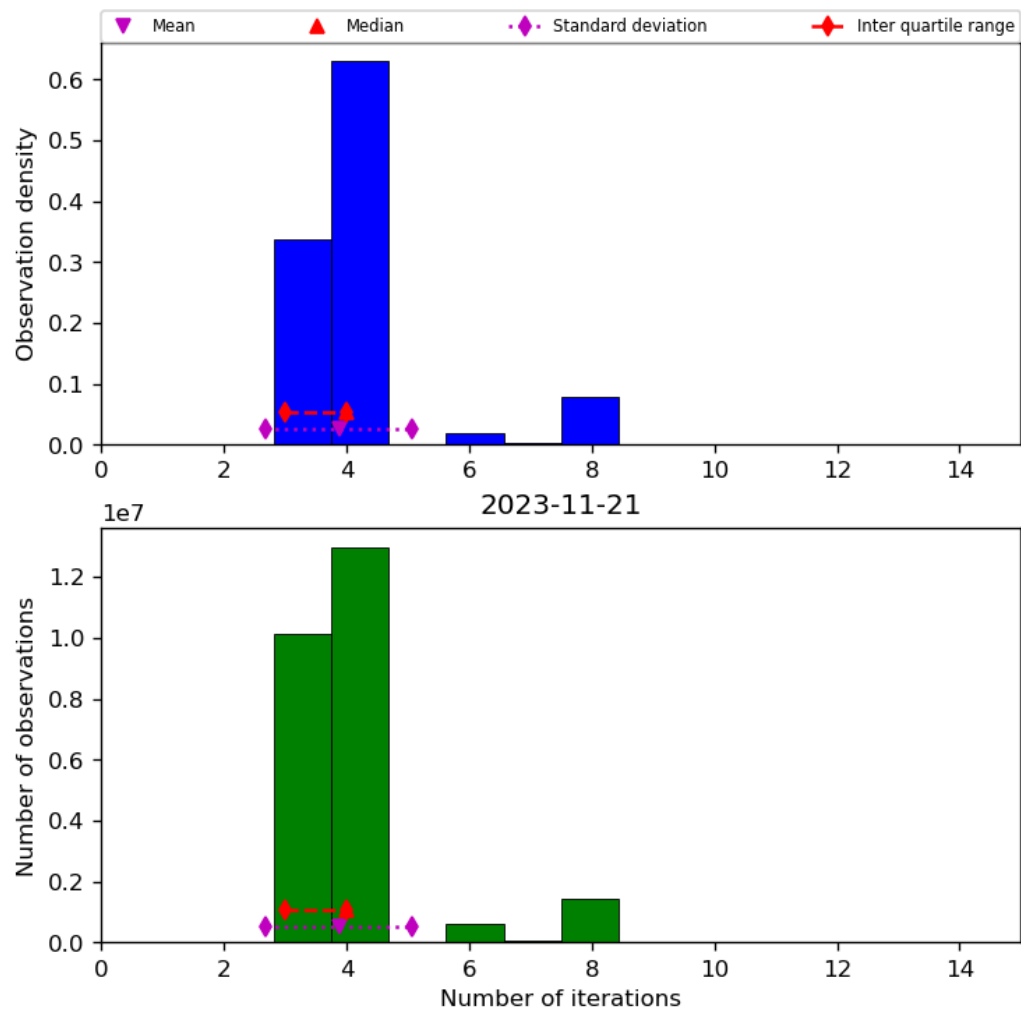


Figure 34: Histogram of “Number of iterations” for 2023-11-20 to 2023-11-22

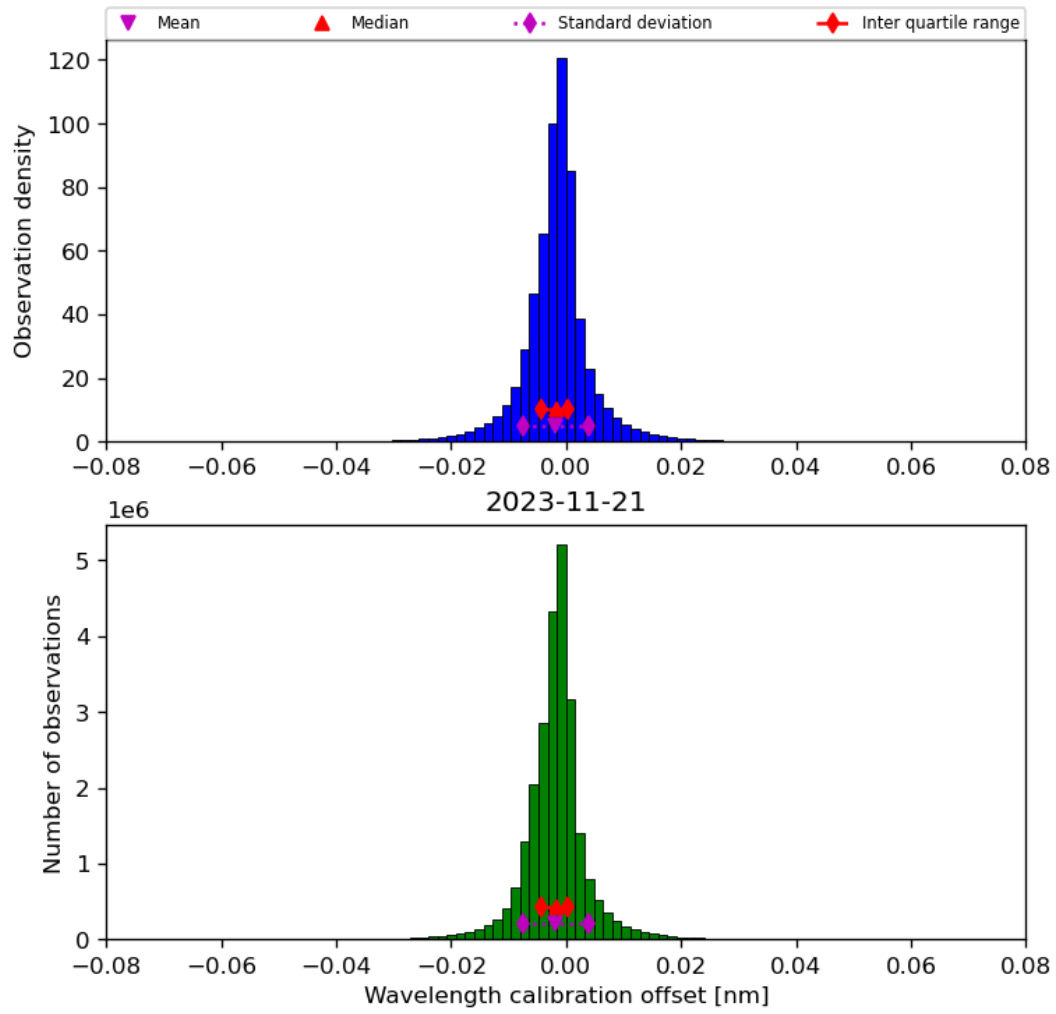


Figure 35: Histogram of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22

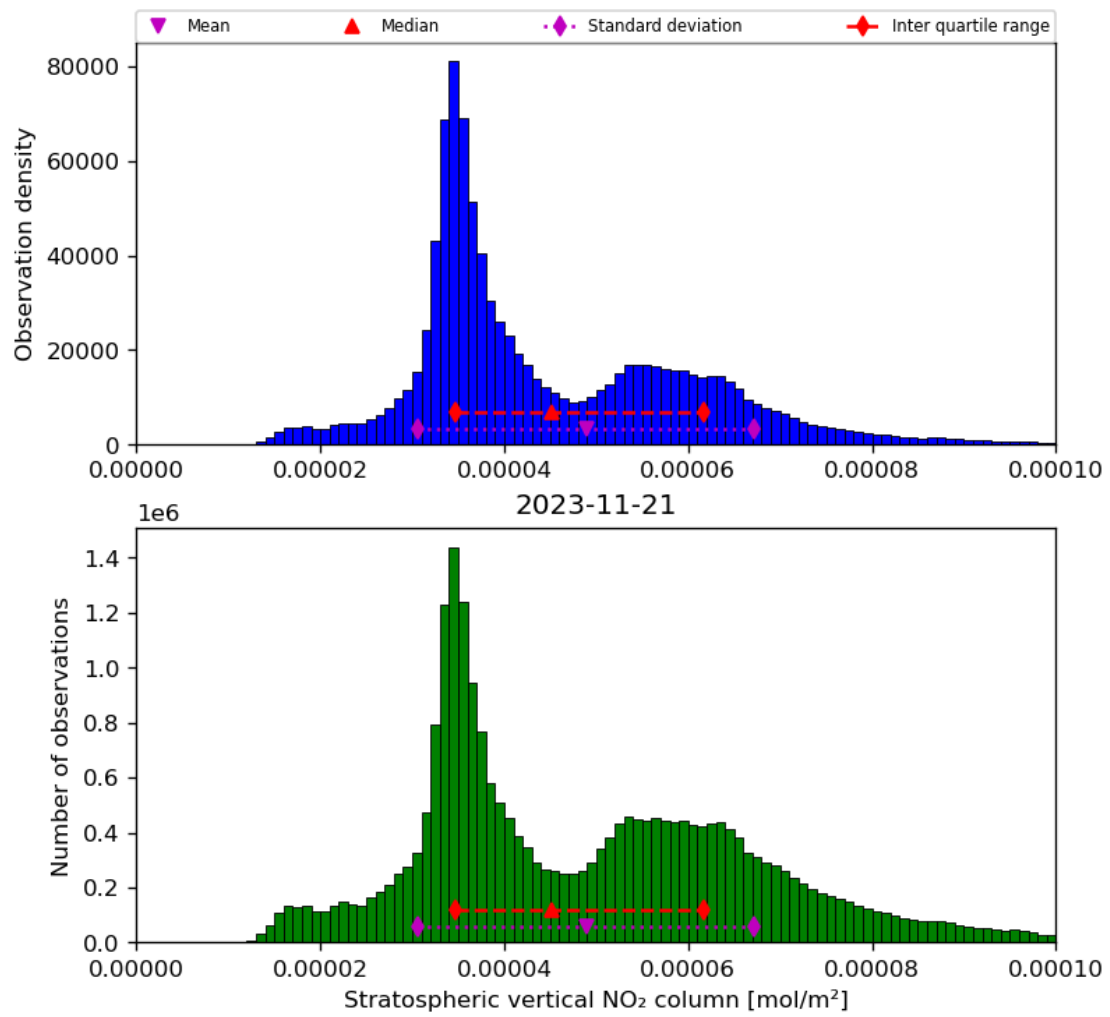


Figure 36: Histogram of “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22

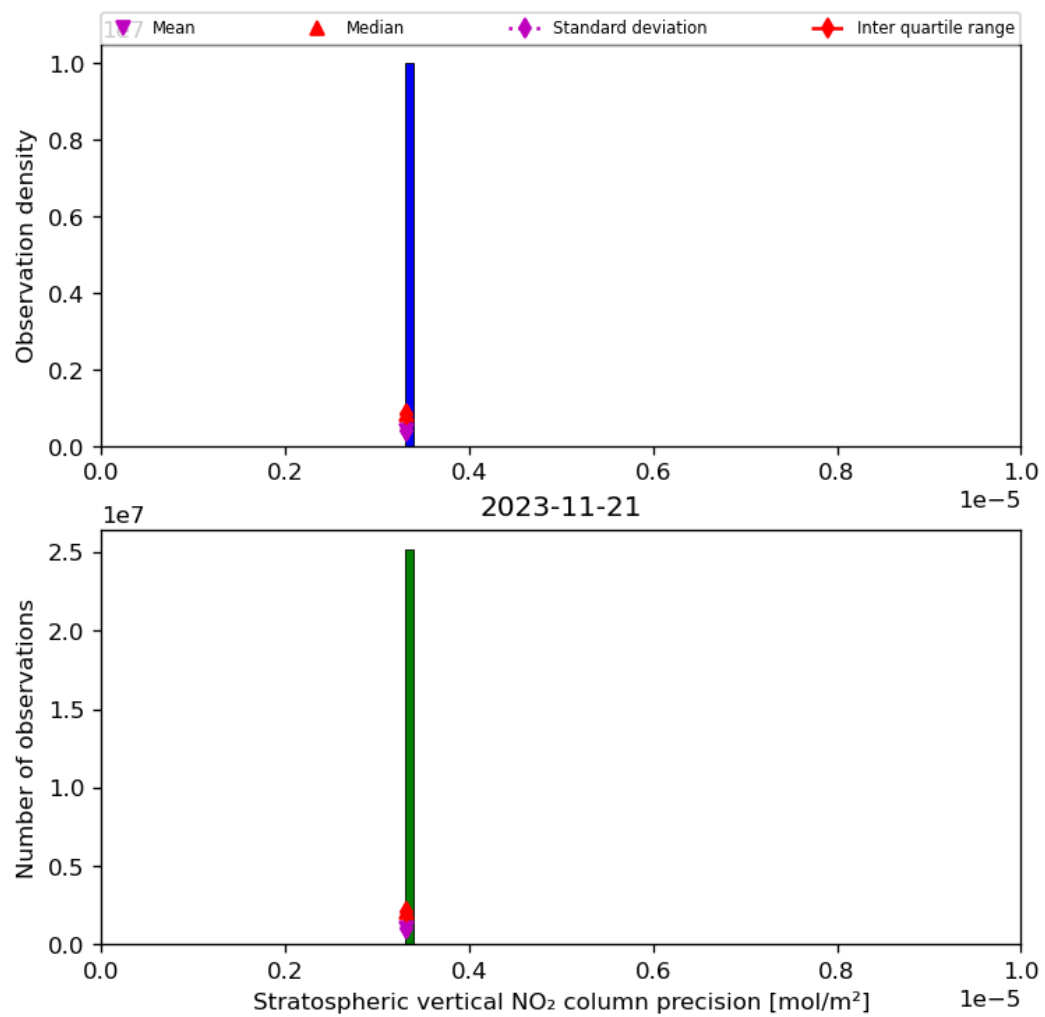


Figure 37: Histogram of “Stratospheric vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

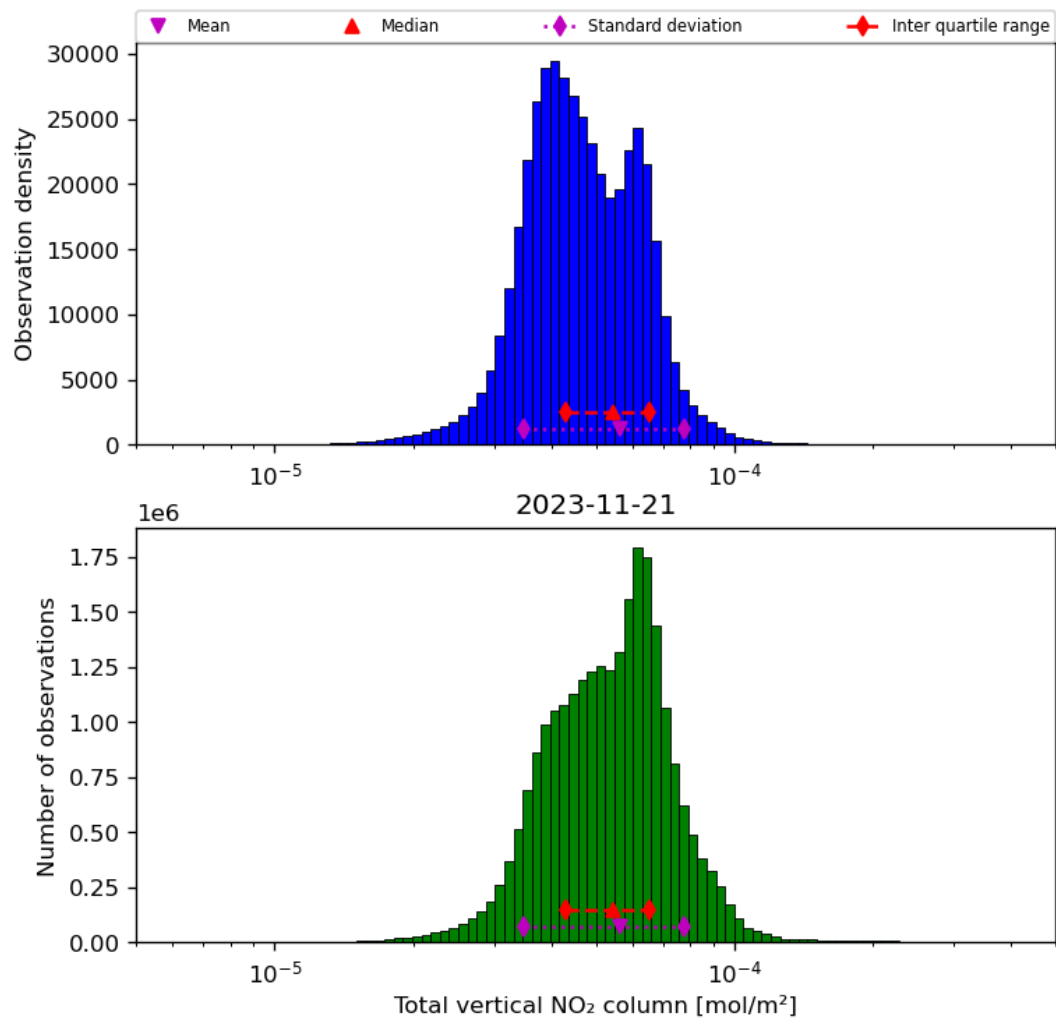


Figure 38: Histogram of “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22

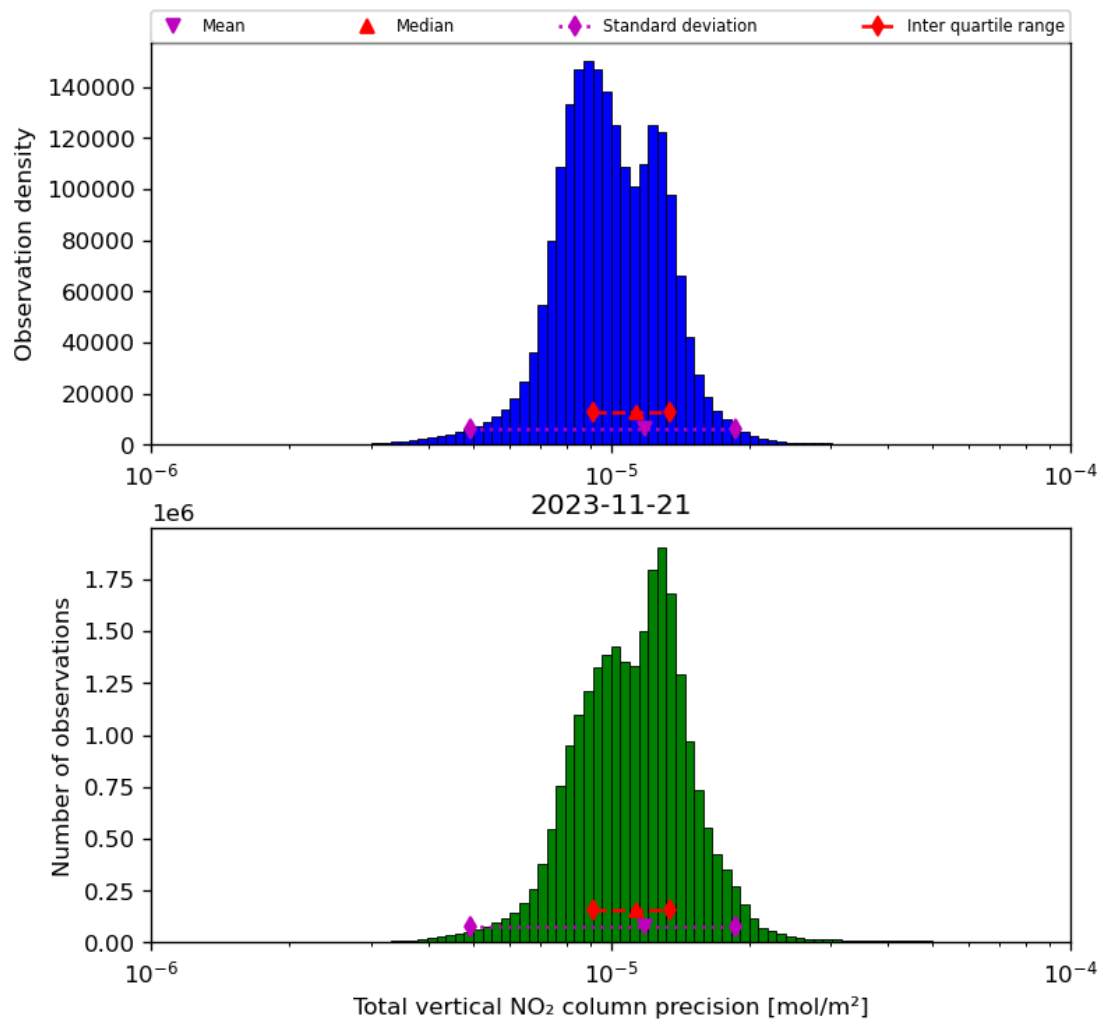


Figure 39: Histogram of “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

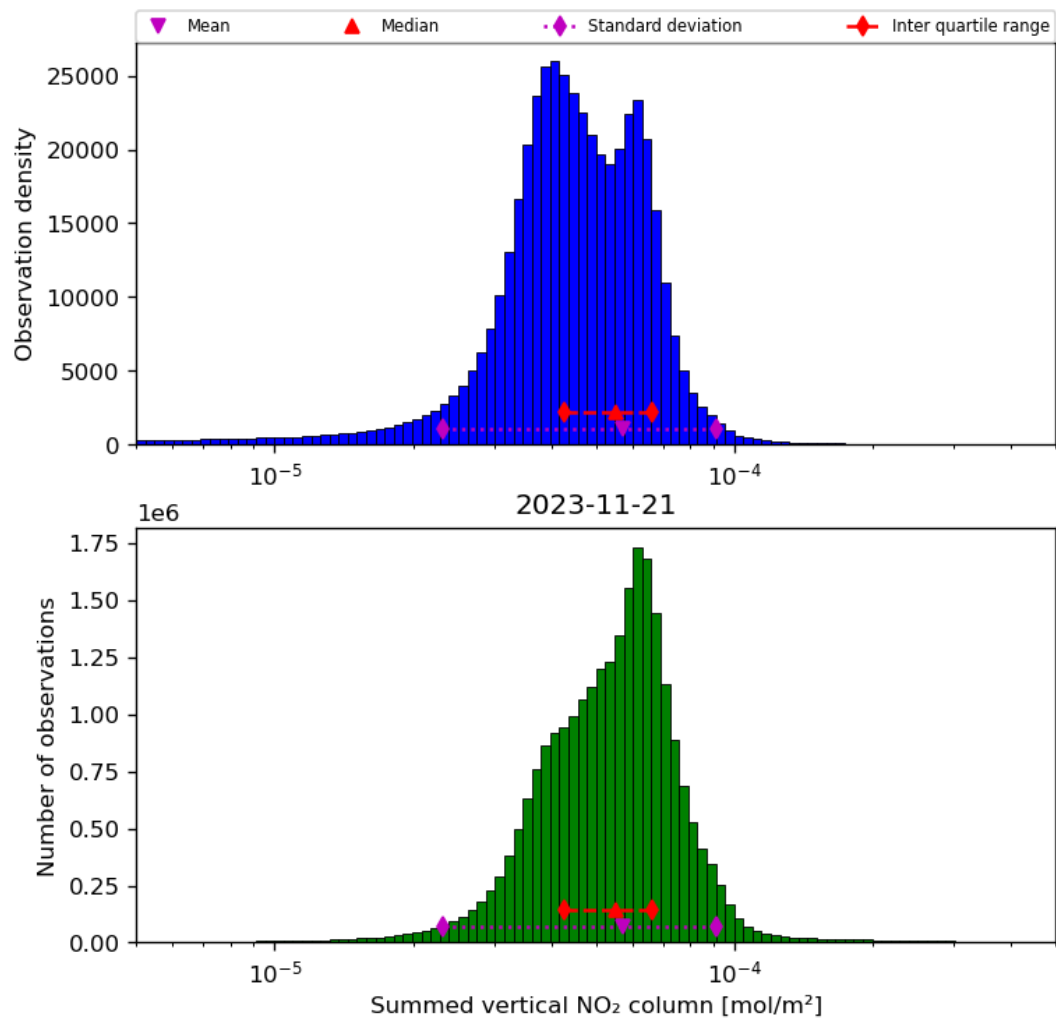


Figure 40: Histogram of “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22

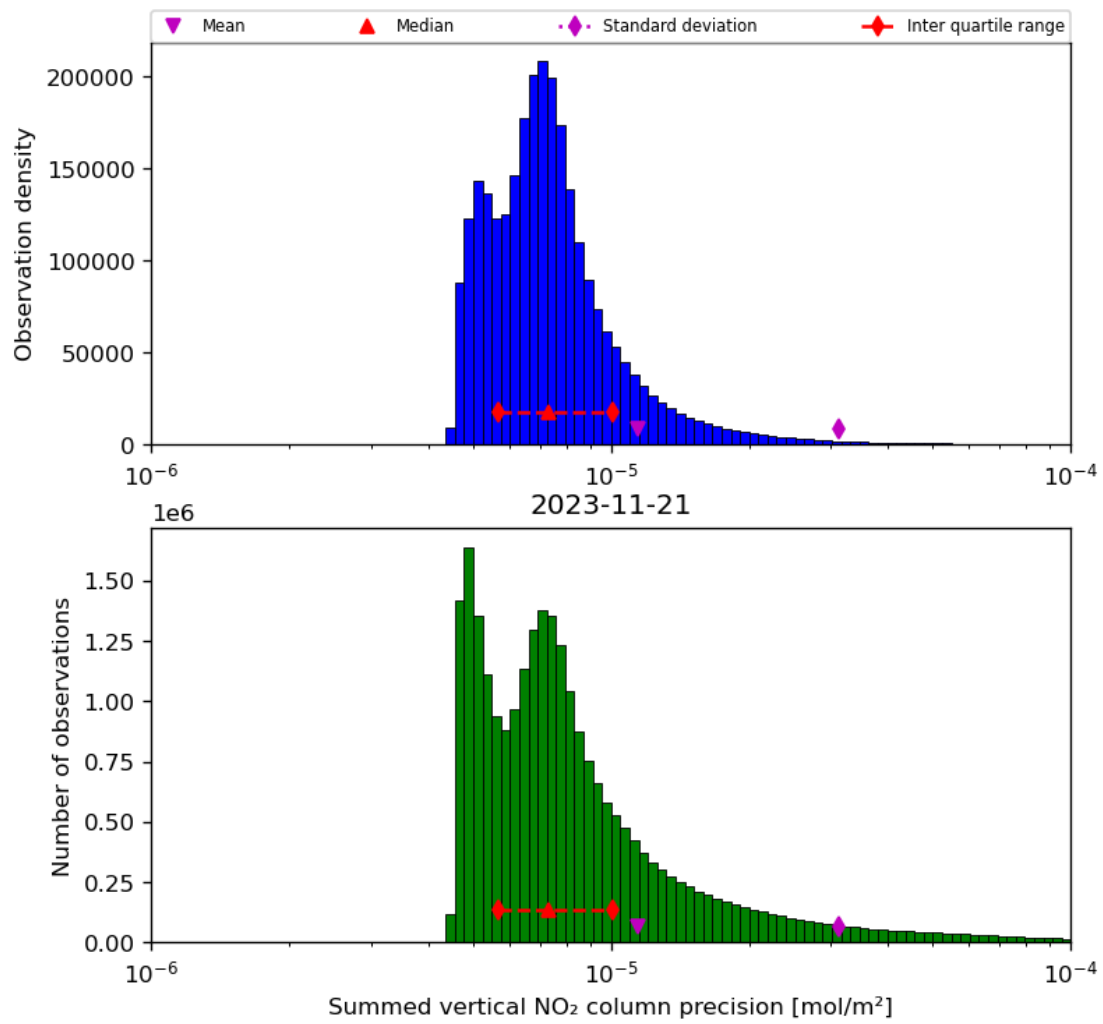


Figure 41: Histogram of “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

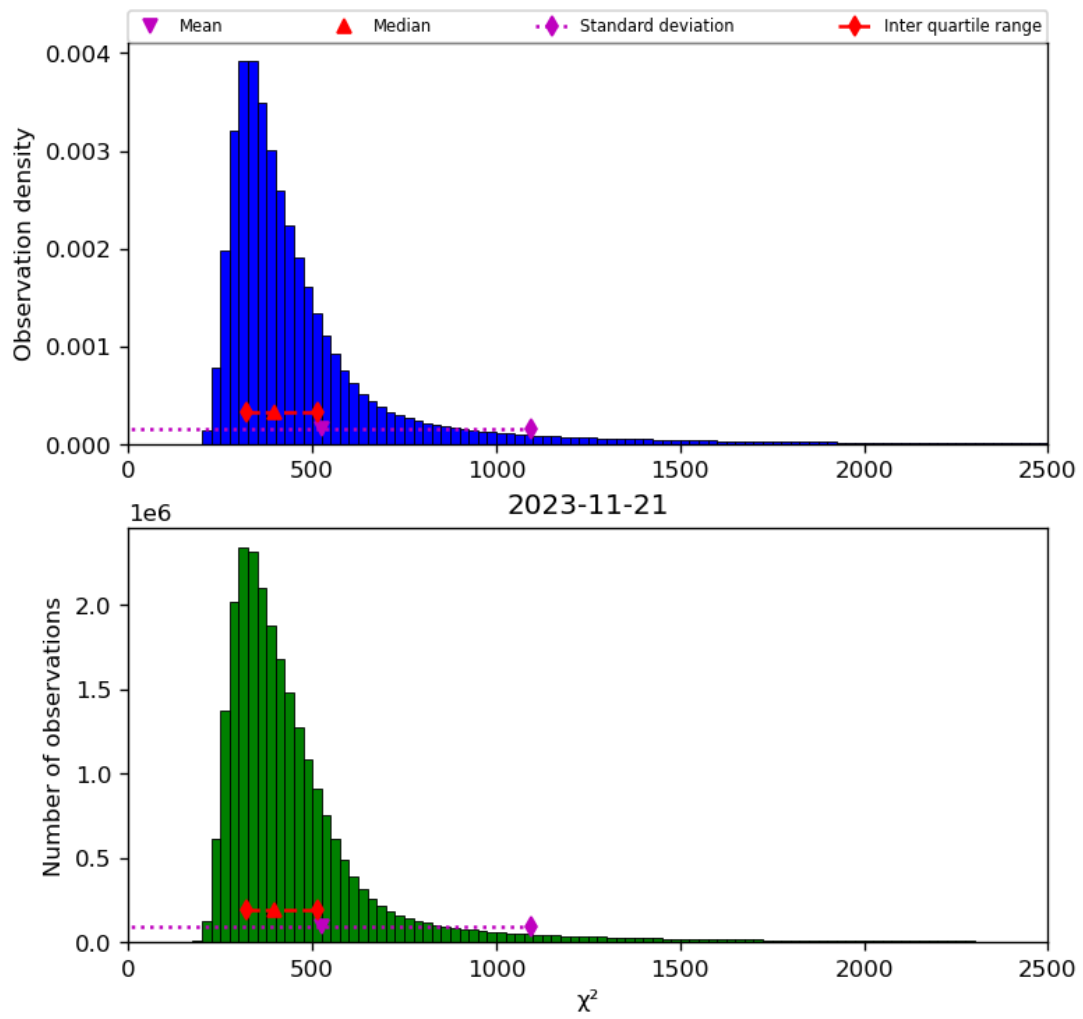


Figure 42: Histogram of “ χ^2 ” for 2023-11-20 to 2023-11-22

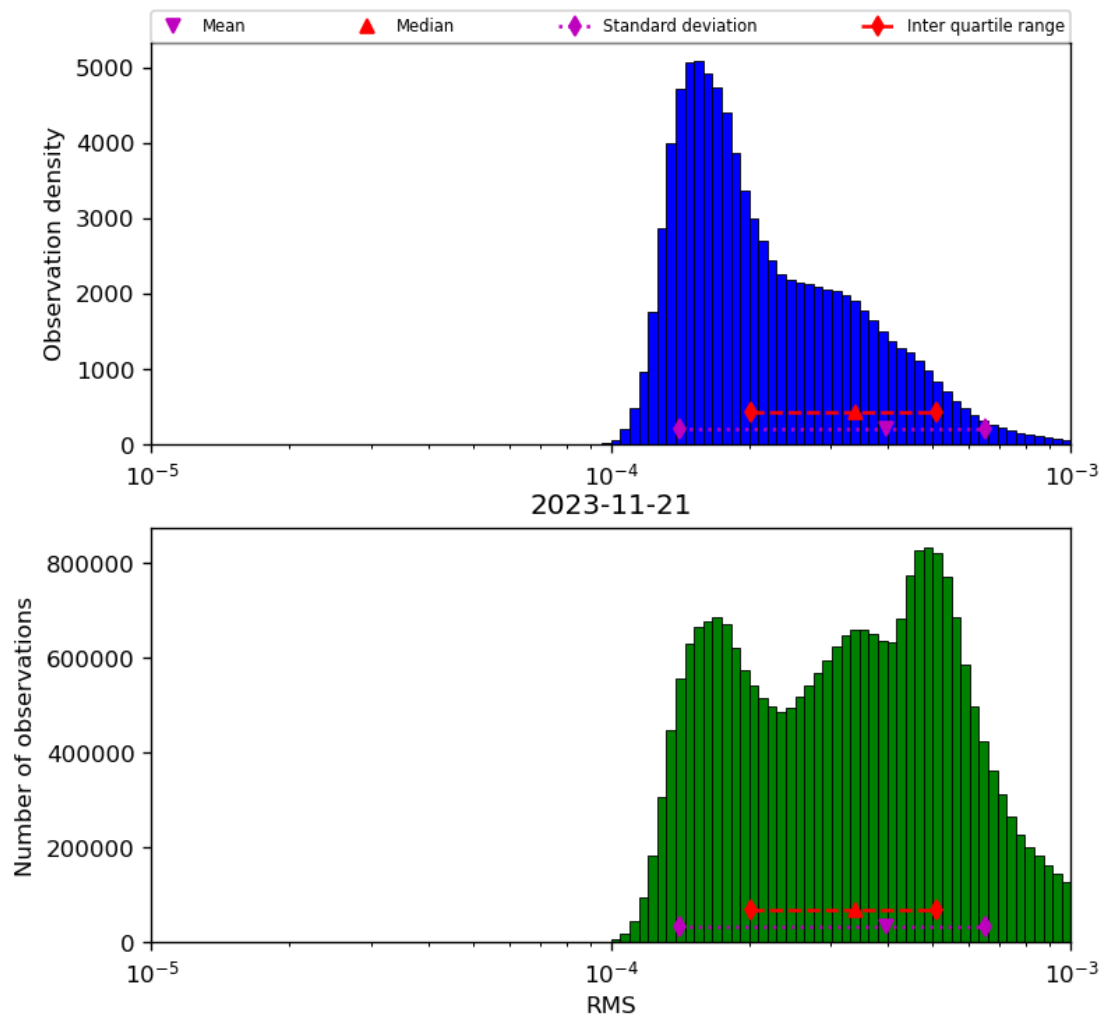


Figure 43: Histogram of “RMS” for 2023-11-20 to 2023-11-22

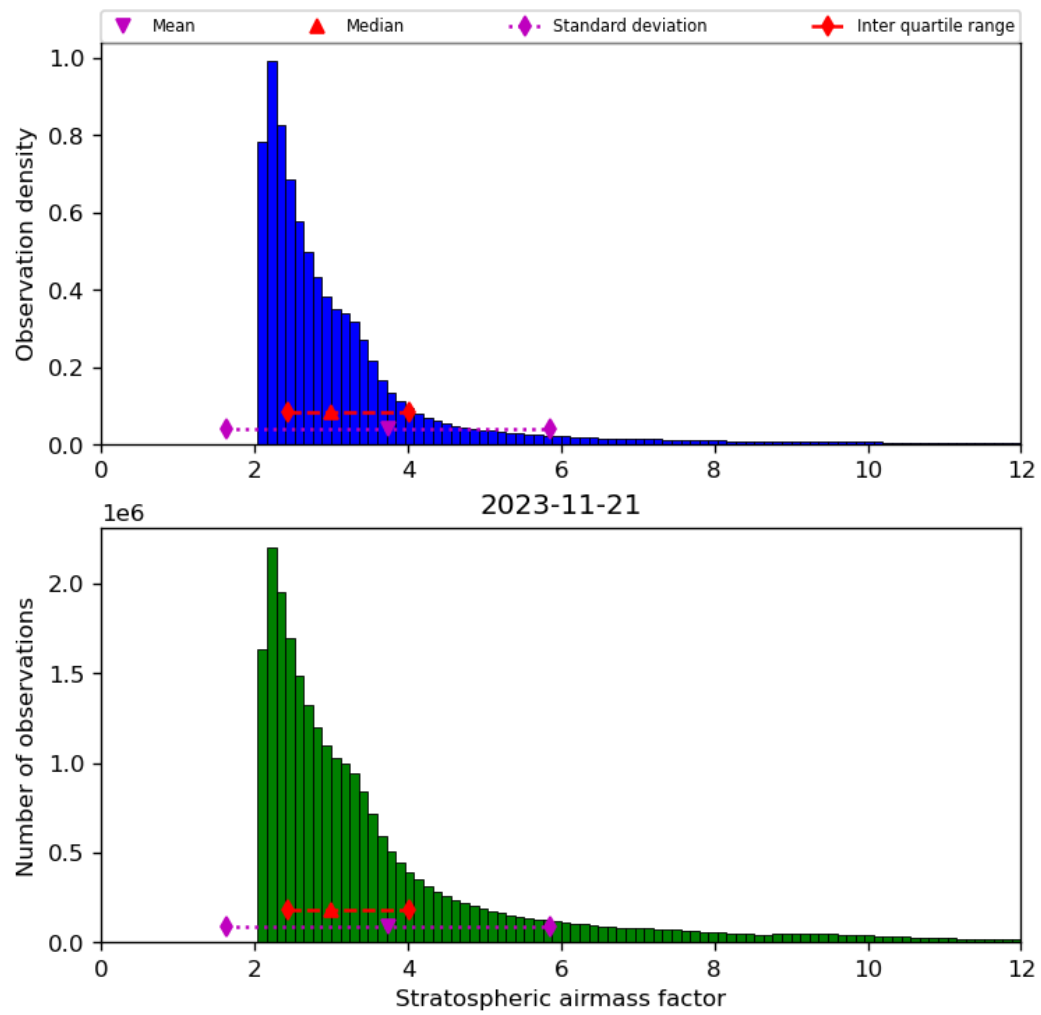


Figure 44: Histogram of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22

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.

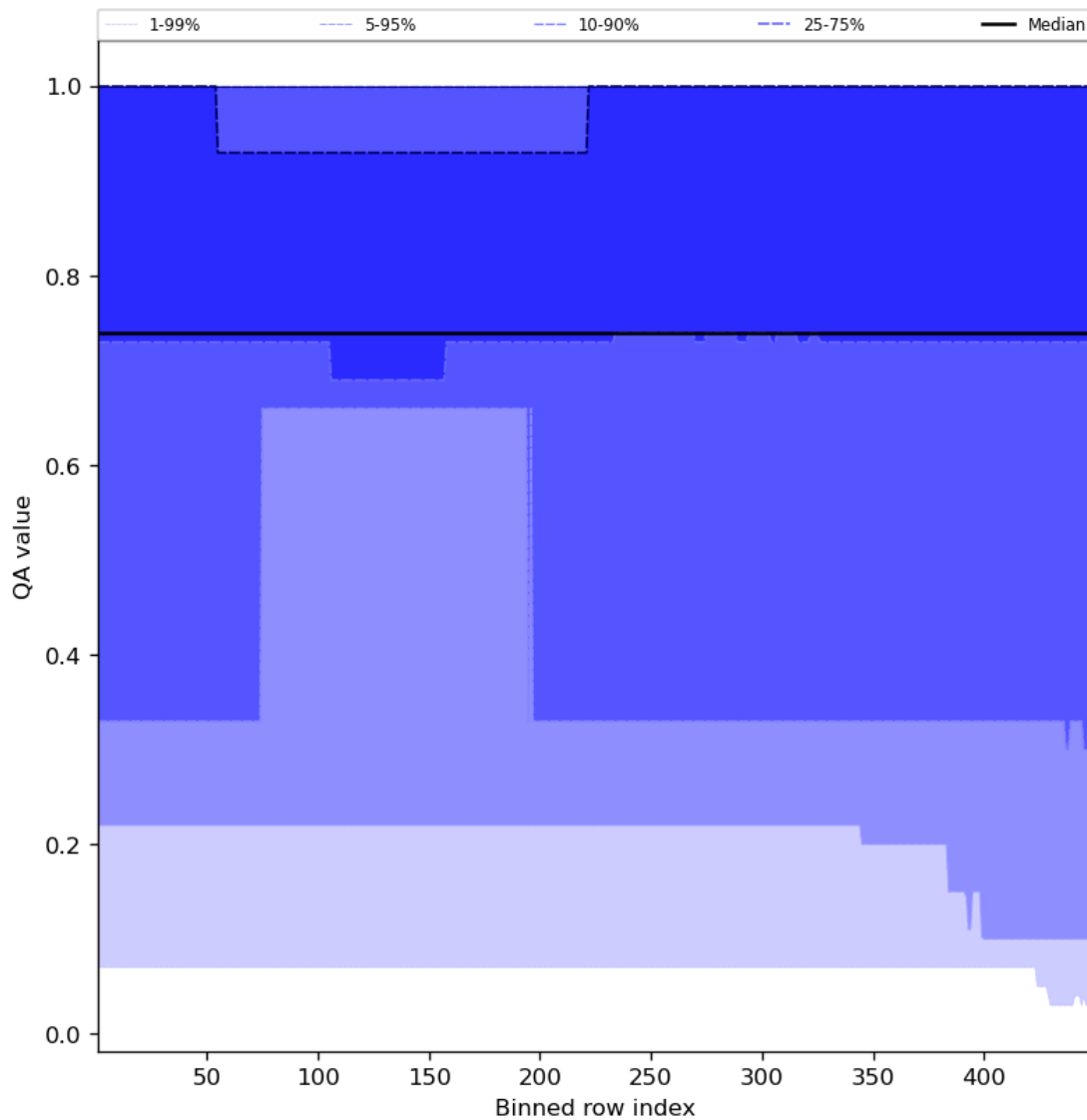


Figure 45: Along track statistics of “QA value” for 2023-11-20 to 2023-11-22

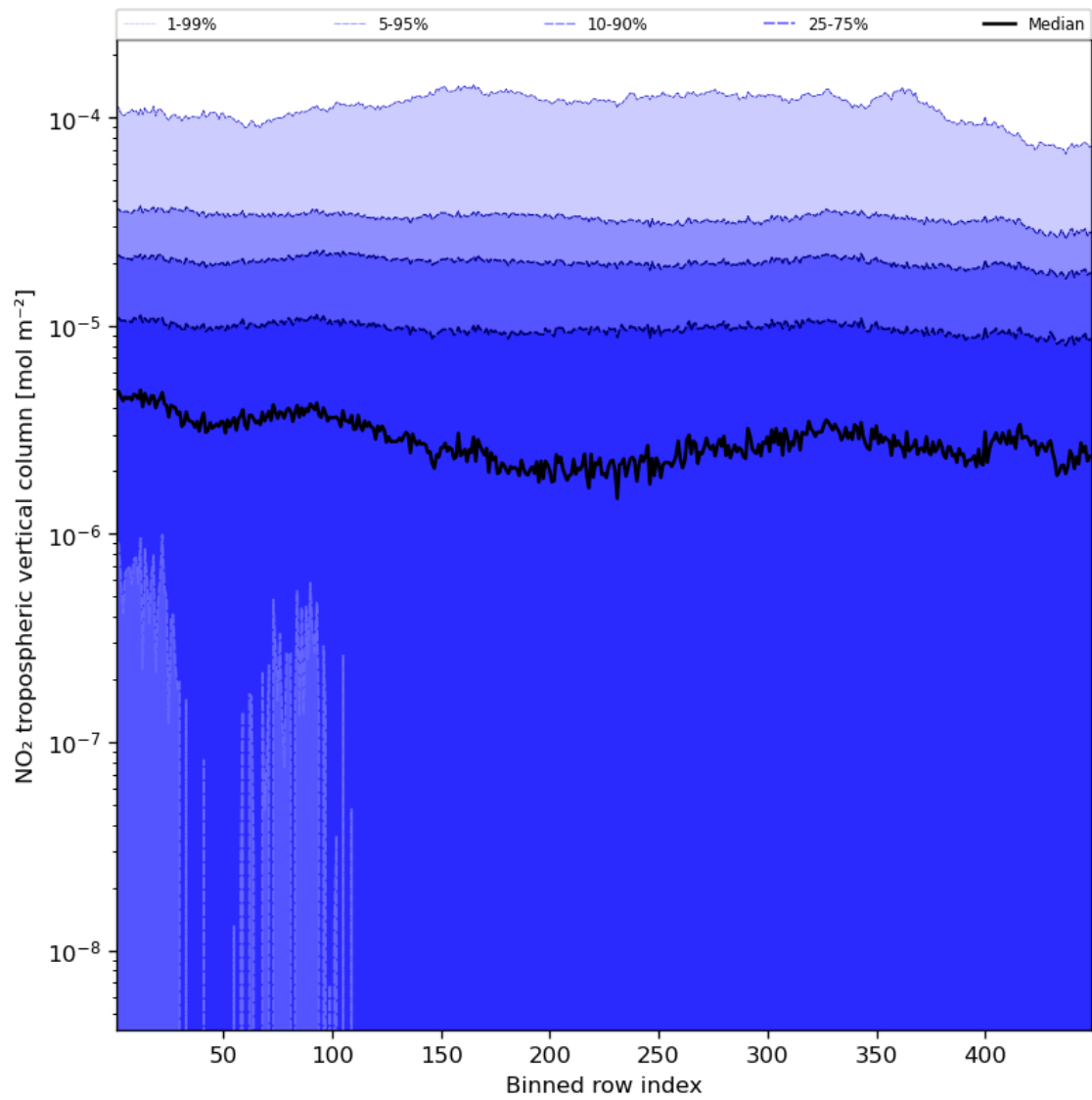


Figure 46: Along track statistics of “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22

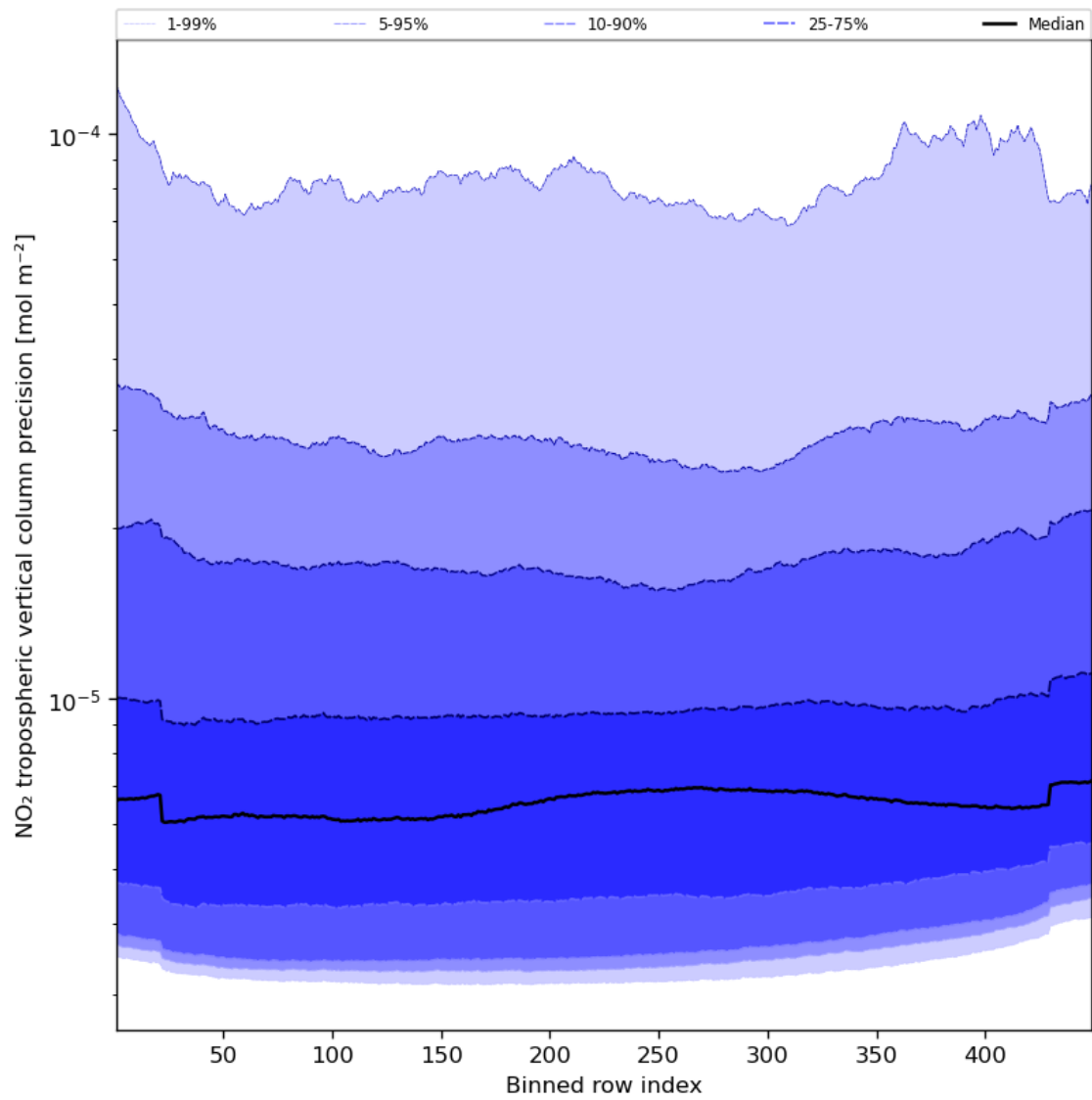


Figure 47: Along track statistics of “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22

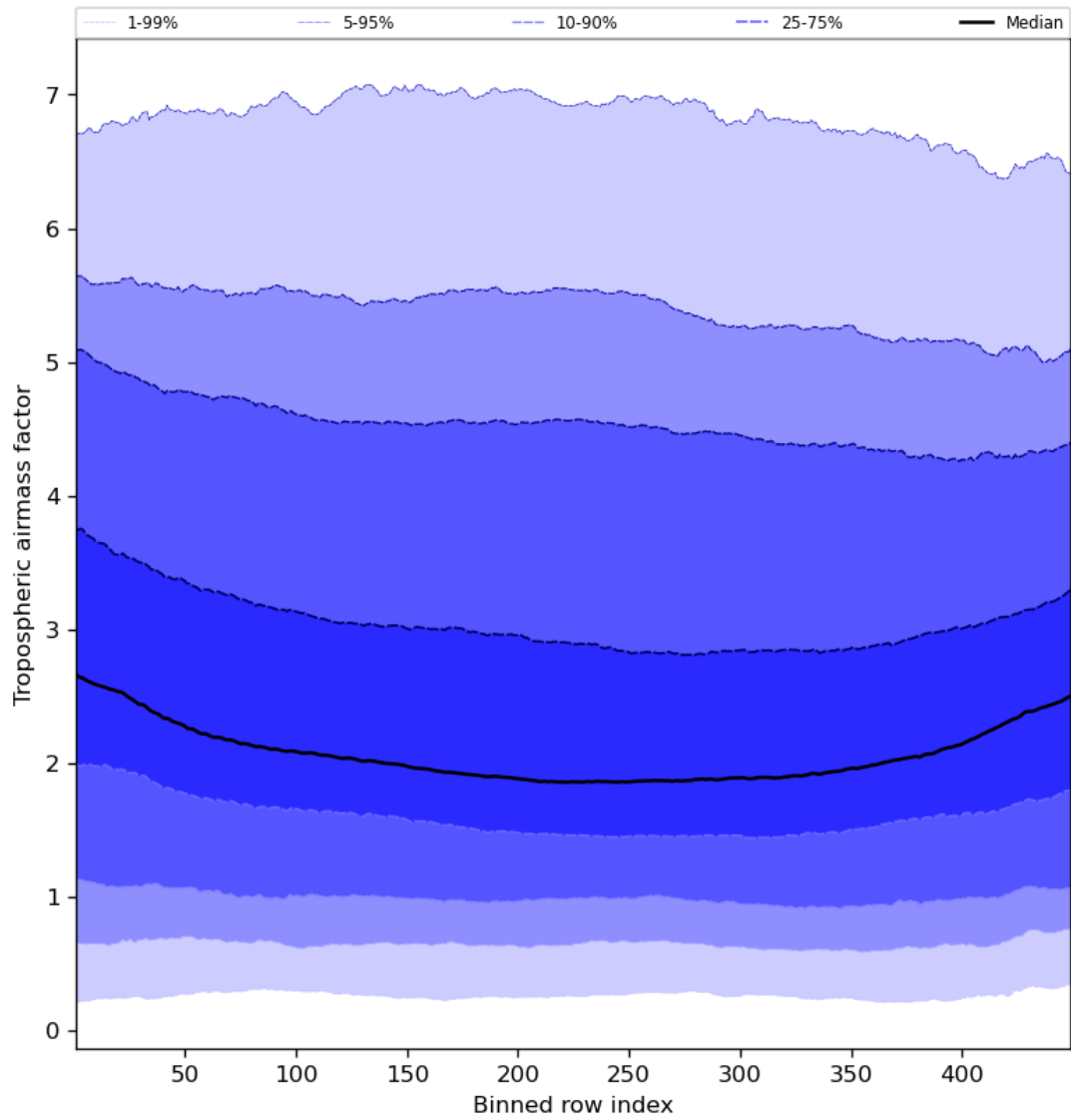


Figure 48: Along track statistics of “Tropospheric air mass factor” for 2023-11-20 to 2023-11-22

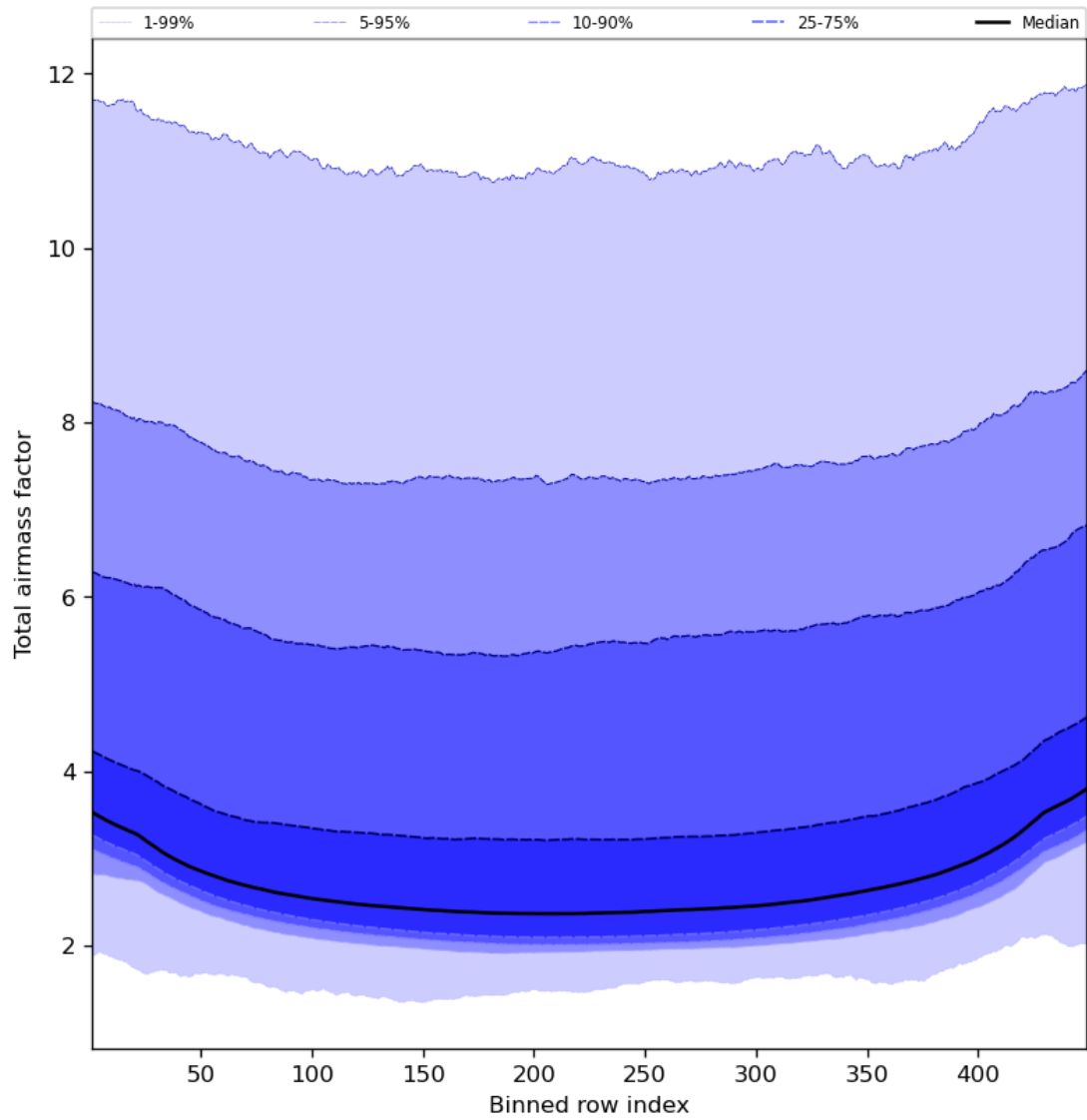


Figure 49: Along track statistics of “Total airmass factor” for 2023-11-20 to 2023-11-22

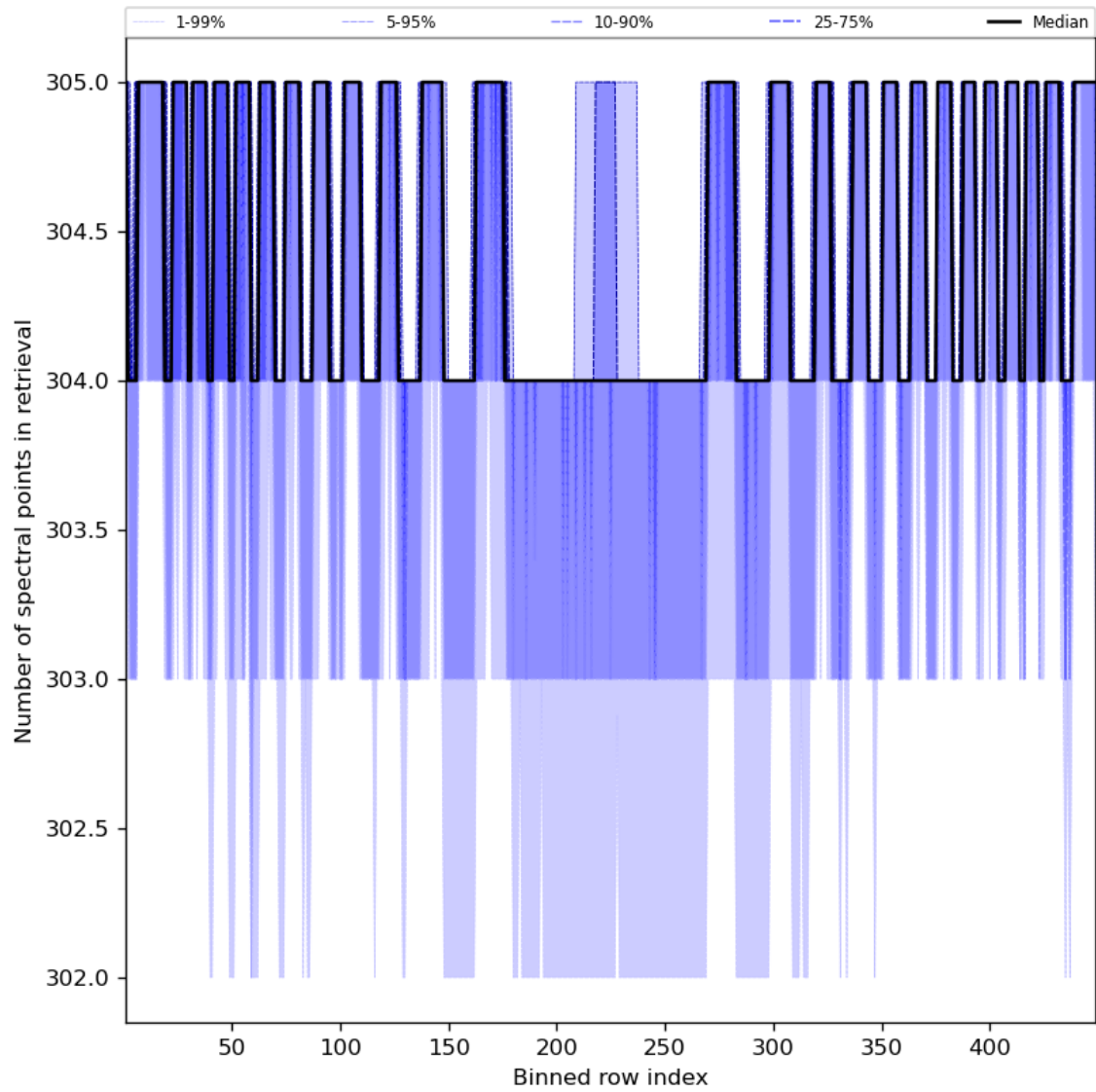


Figure 50: Along track statistics of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22

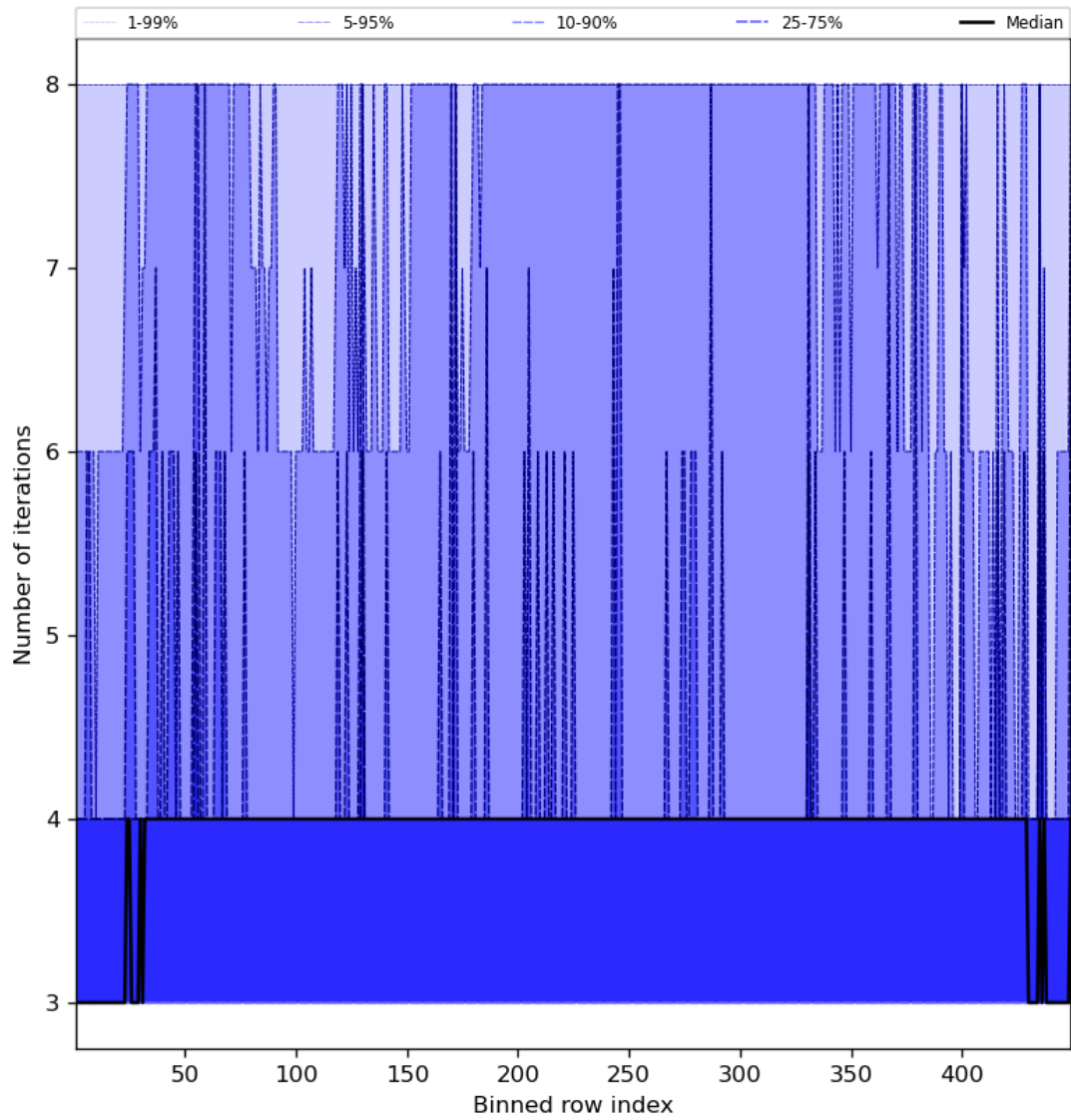


Figure 51: Along track statistics of “Number of iterations” for 2023-11-20 to 2023-11-22

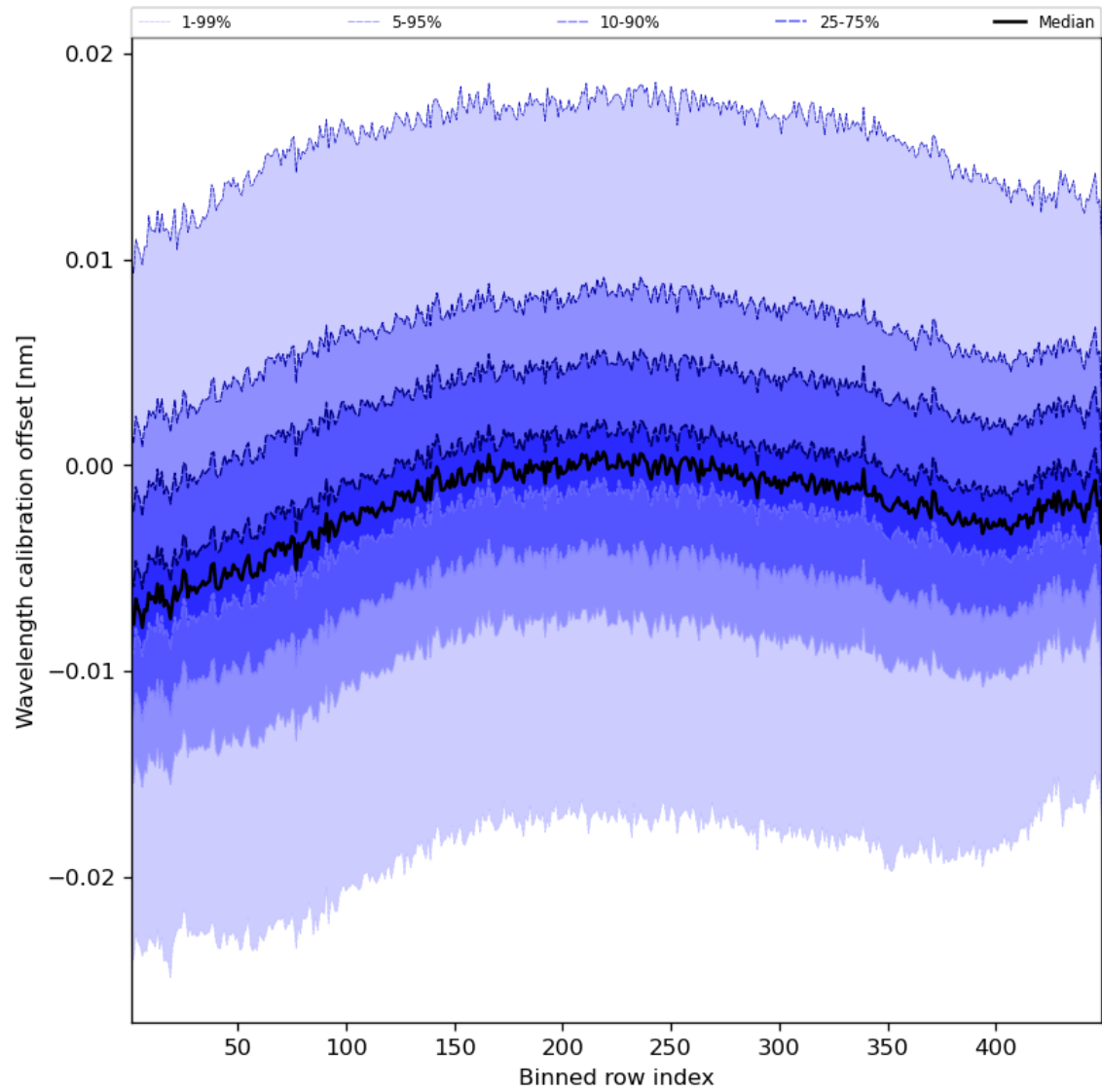


Figure 52: Along track statistics of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22

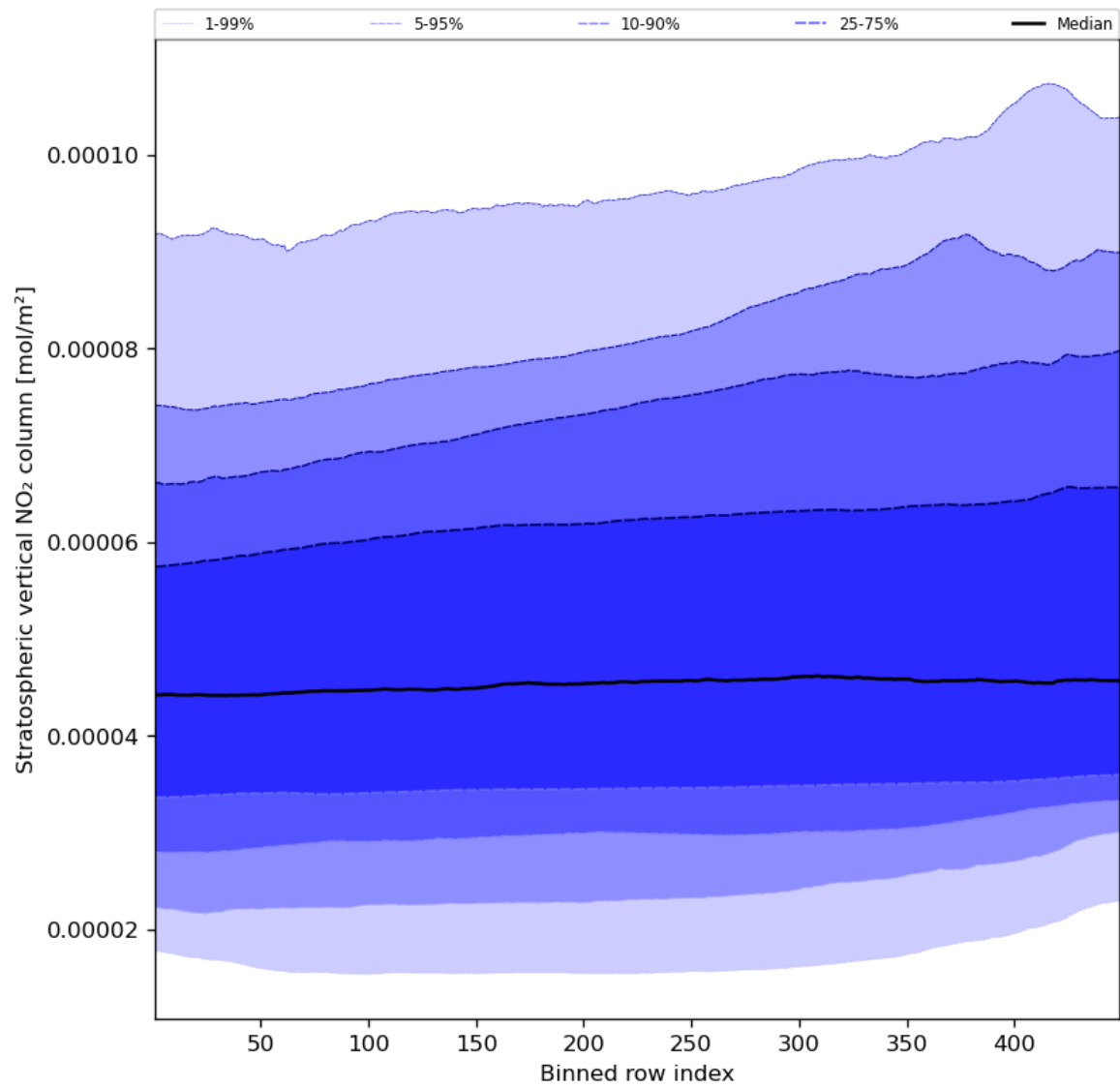


Figure 53: Along track statistics of “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22

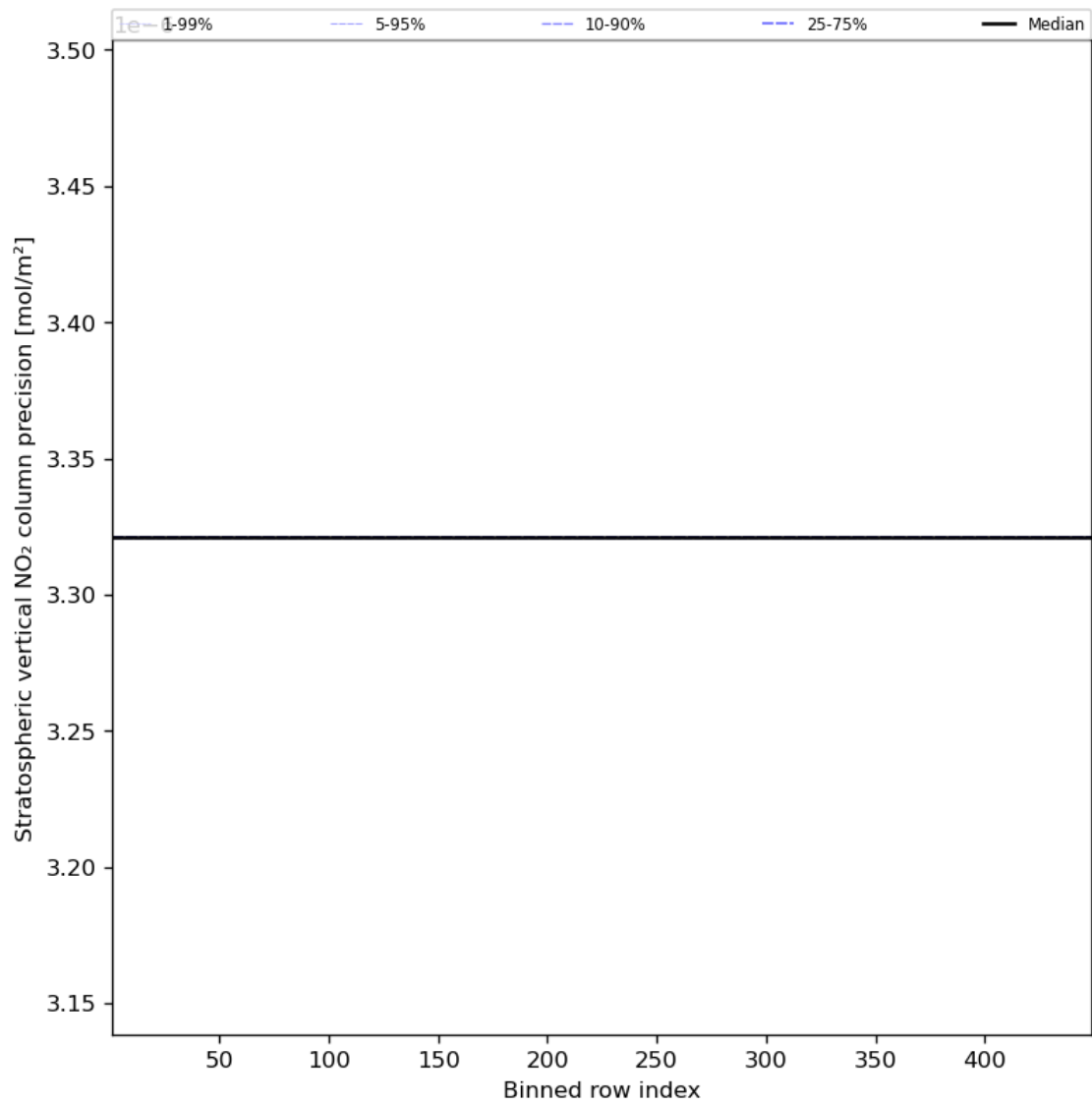


Figure 54: Along track statistics of “Stratospheric vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

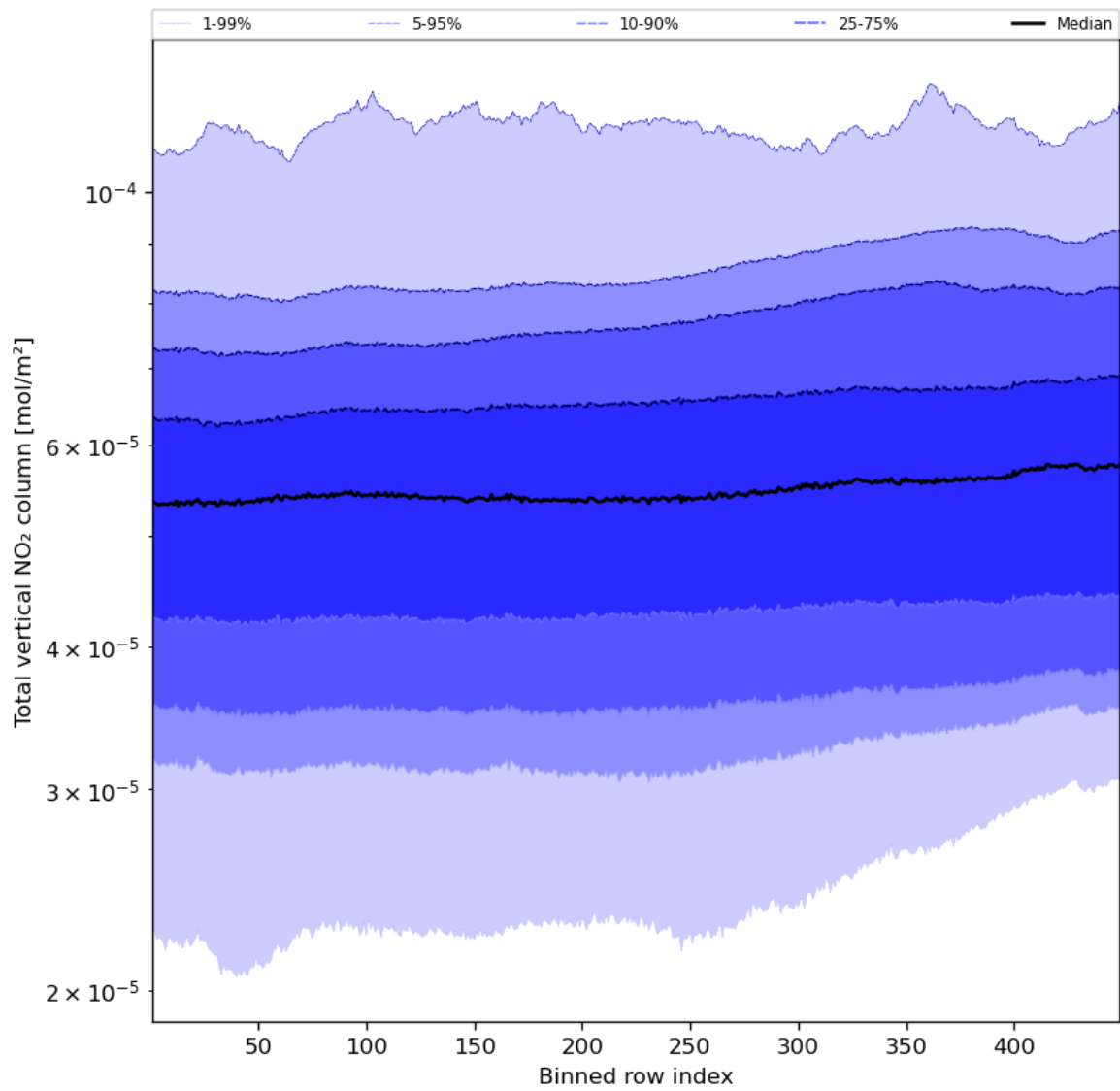


Figure 55: Along track statistics of “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22

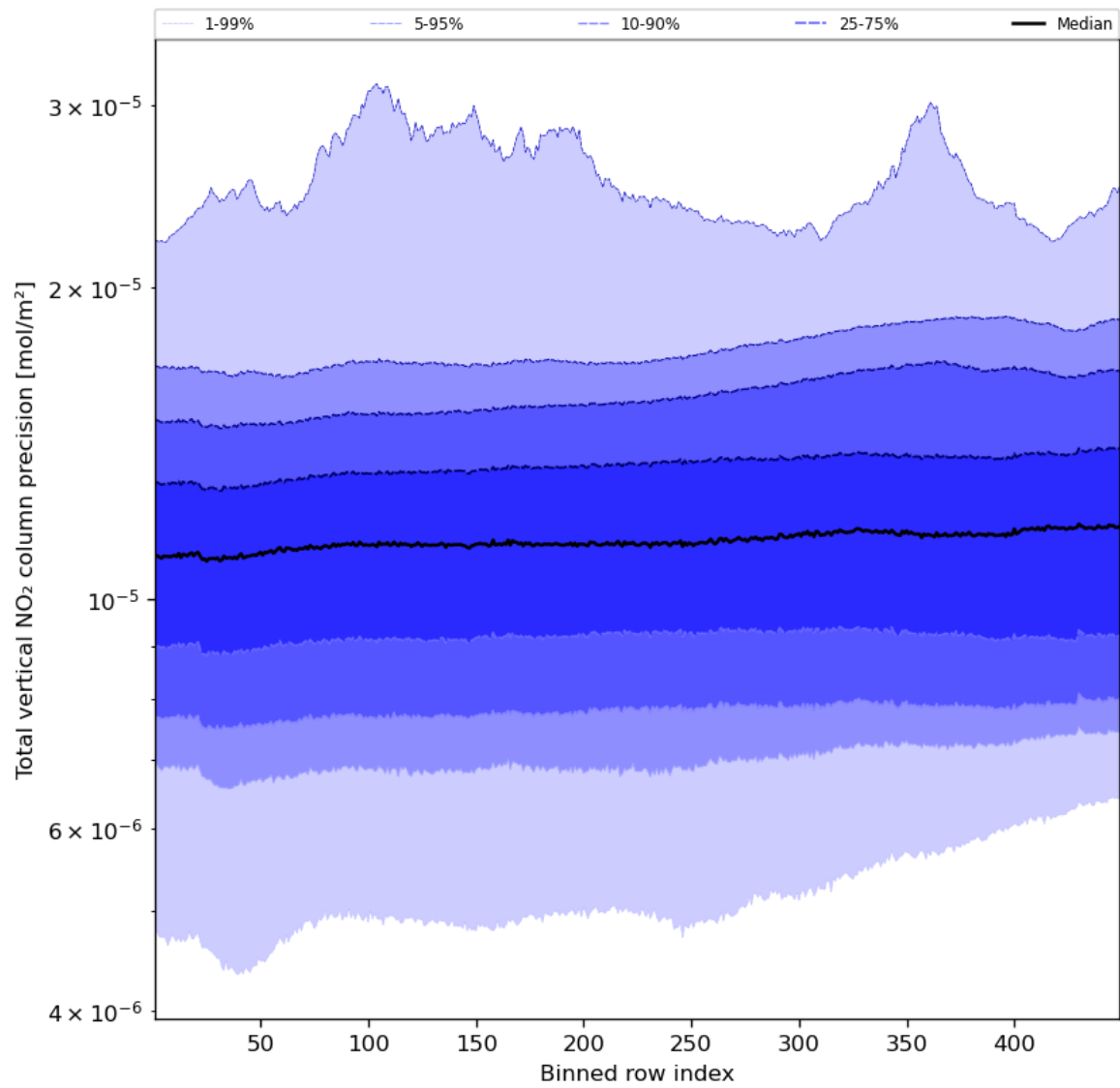


Figure 56: Along track statistics of “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

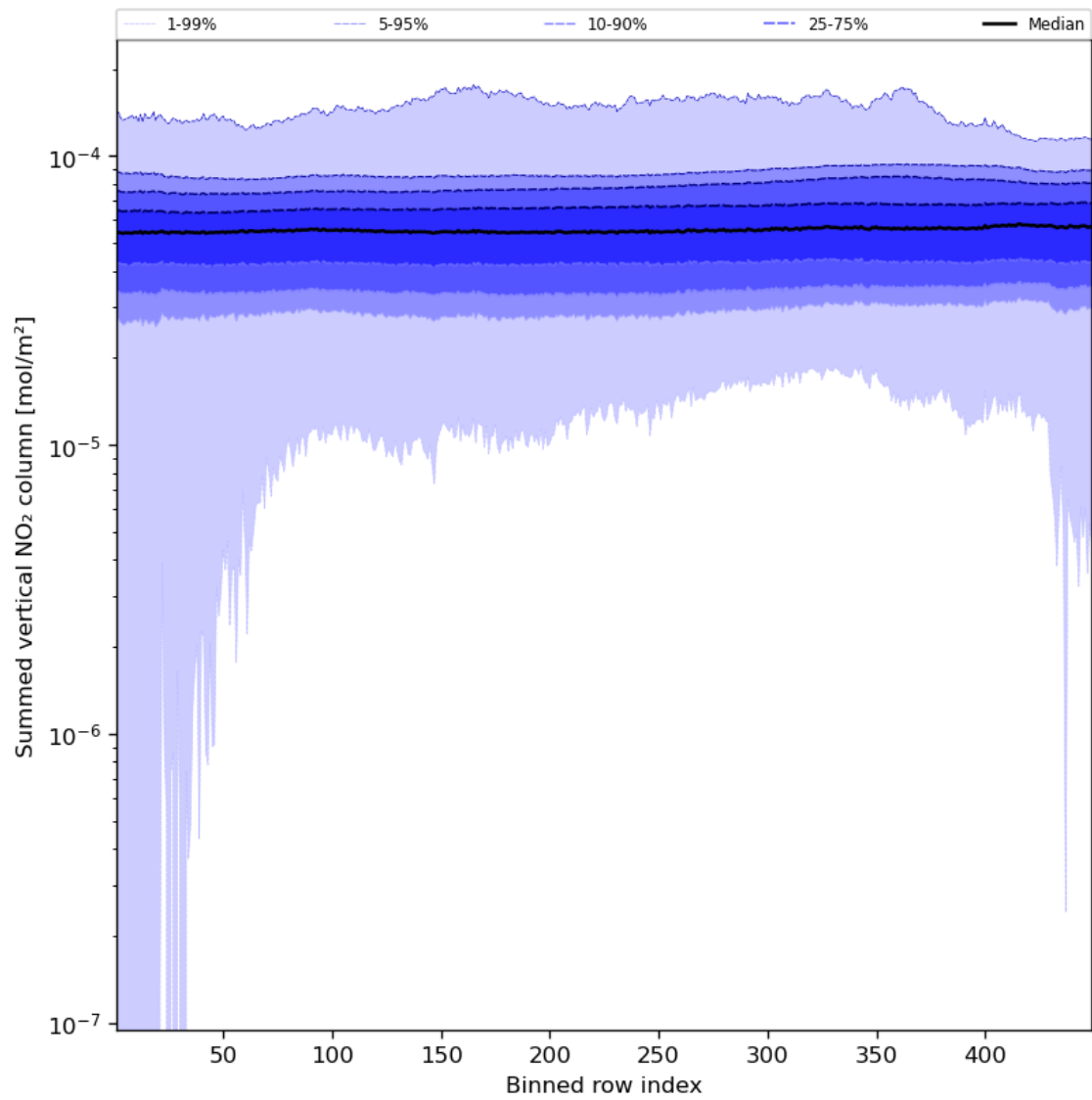


Figure 57: Along track statistics of “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22

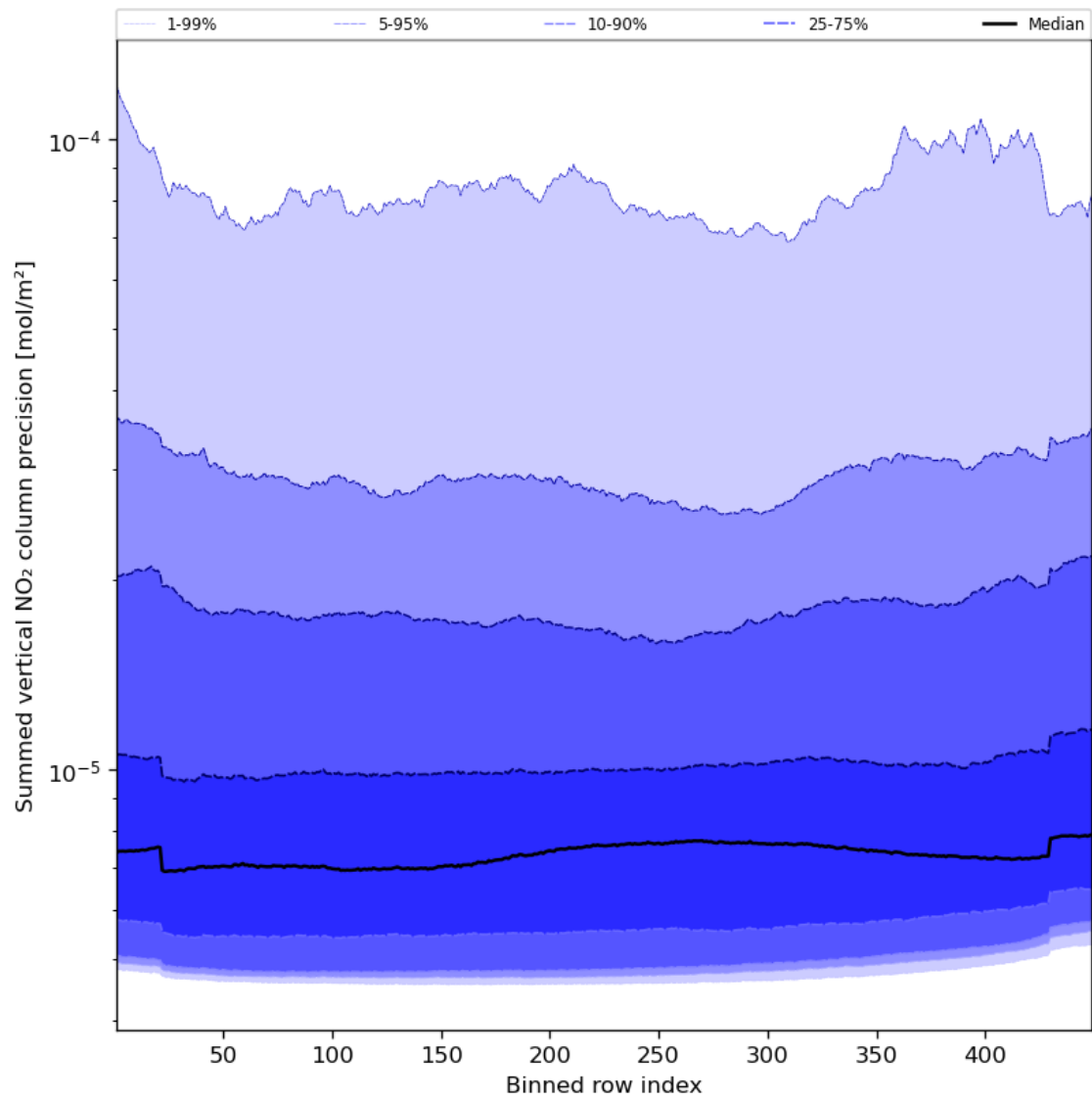


Figure 58: Along track statistics of “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22

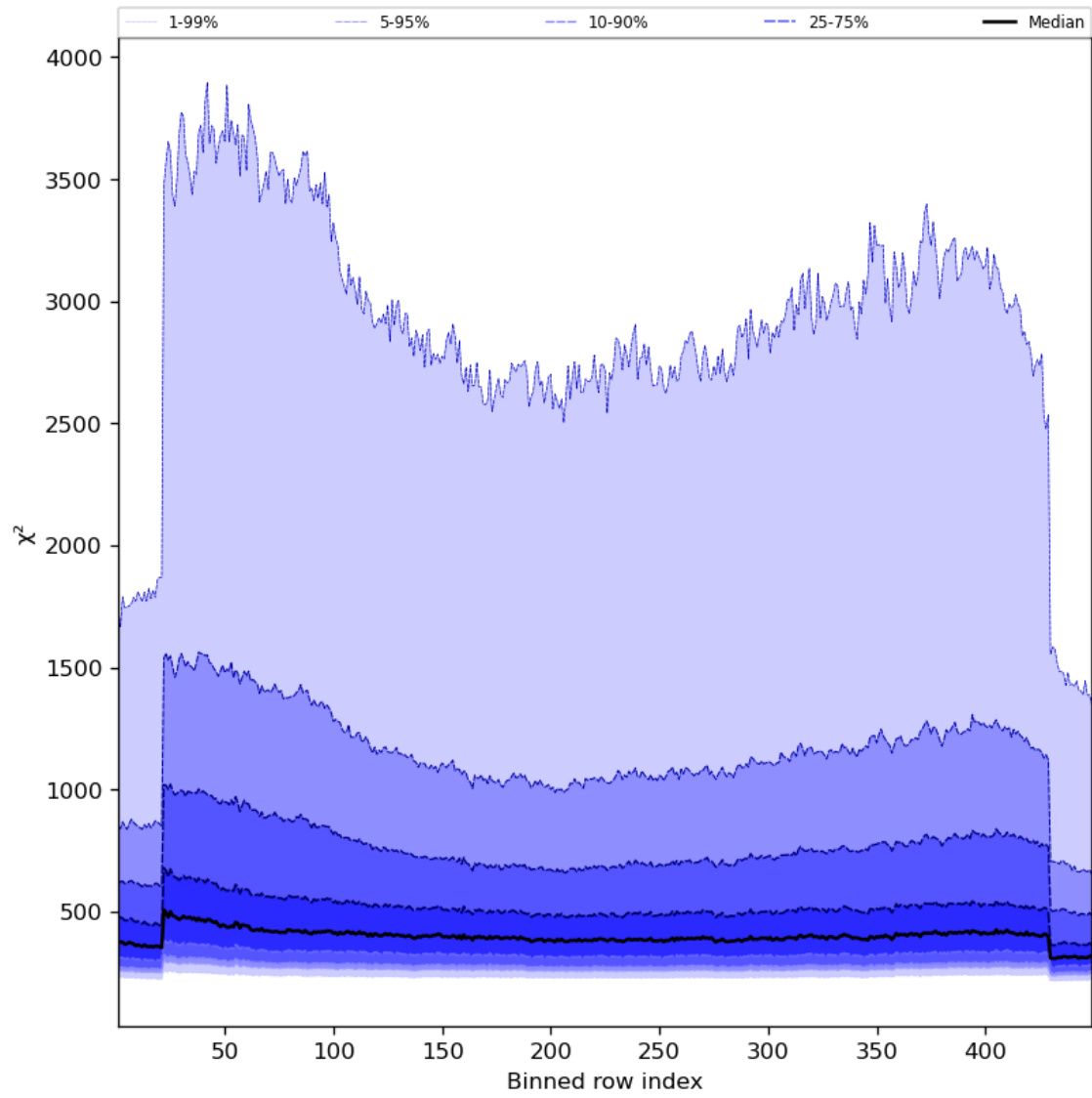


Figure 59: Along track statistics of “ χ^2 ” for 2023-11-20 to 2023-11-22

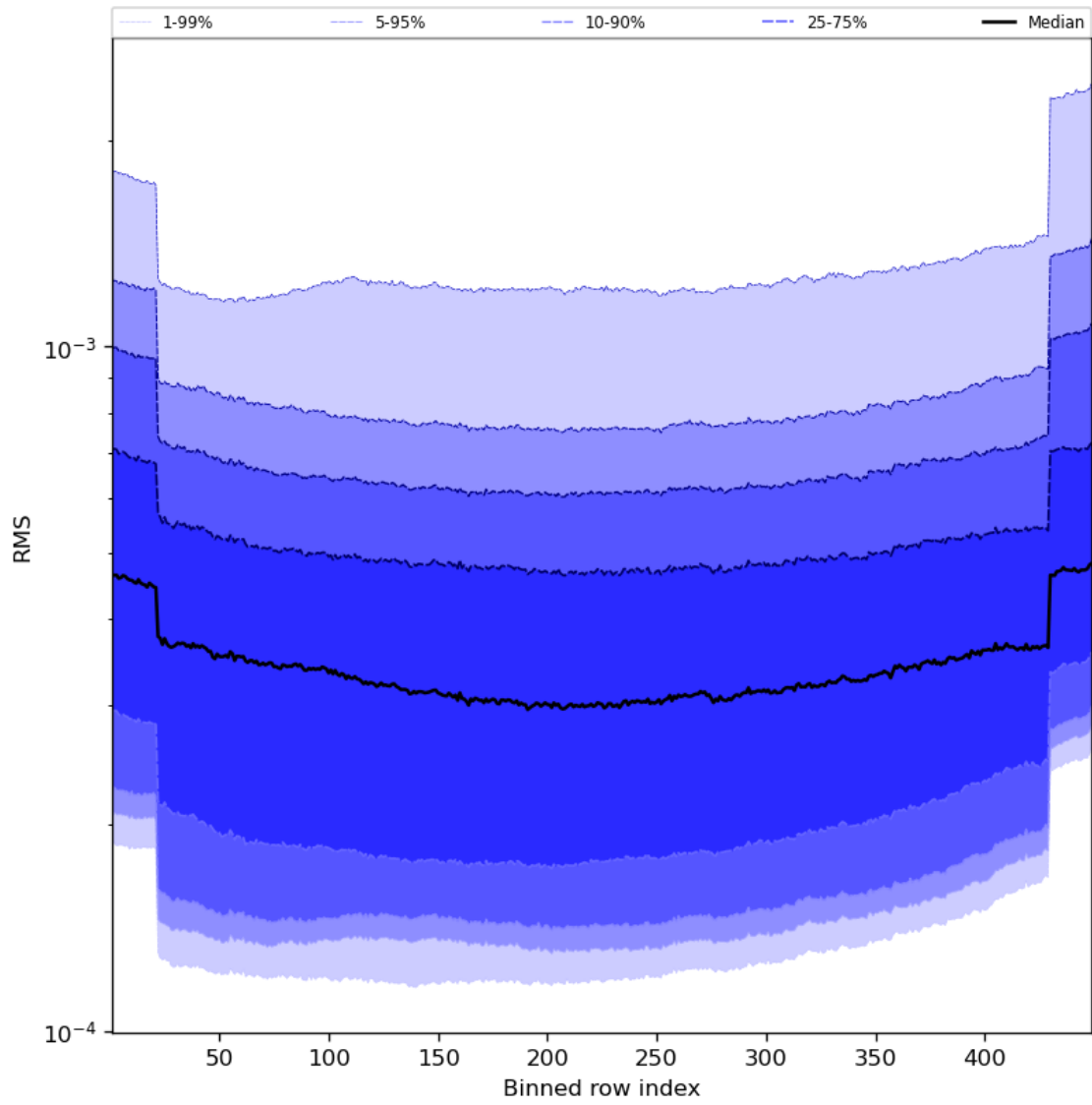


Figure 60: Along track statistics of “RMS” for 2023-11-20 to 2023-11-22

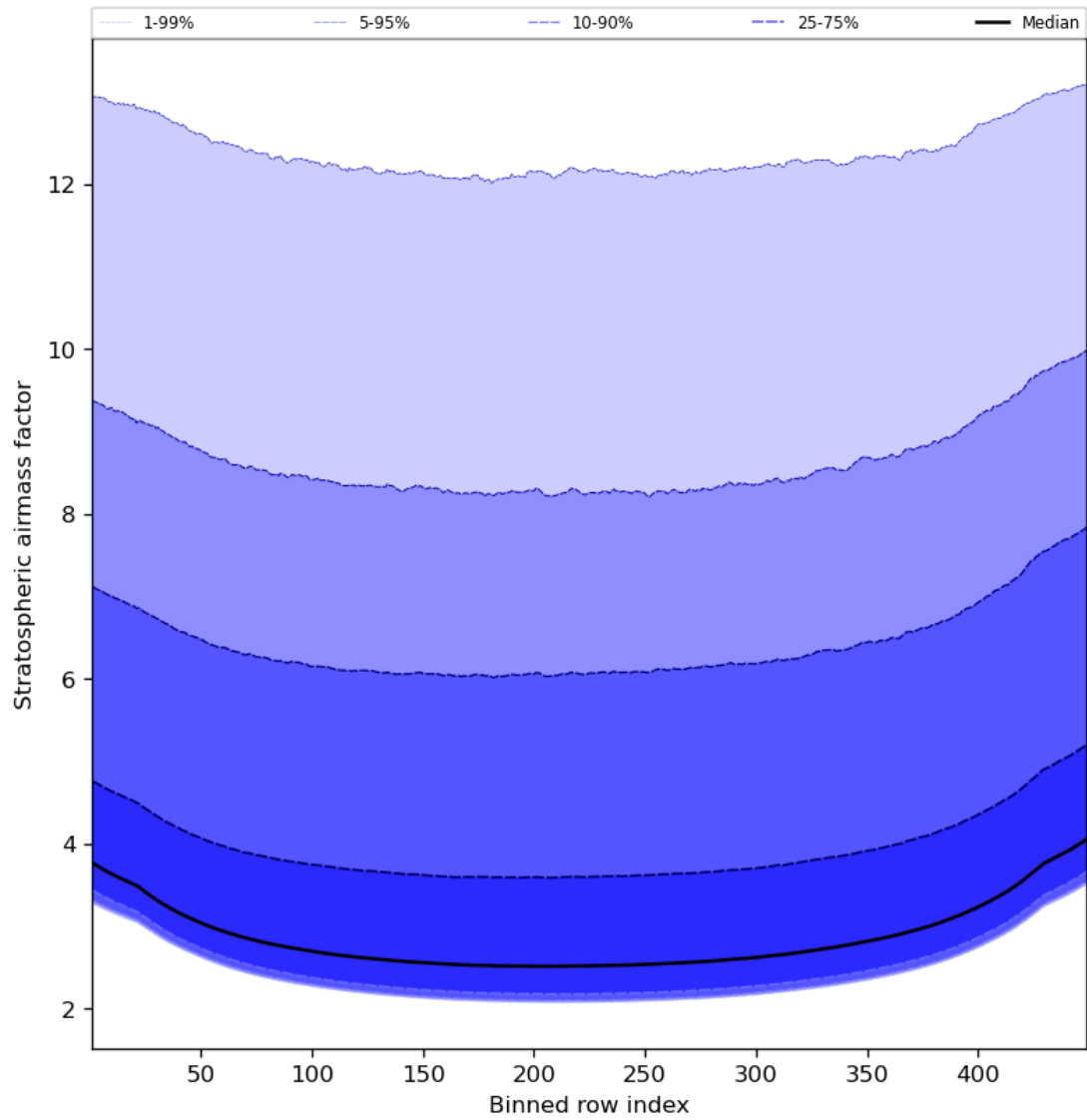


Figure 61: Along track statistics of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22

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.

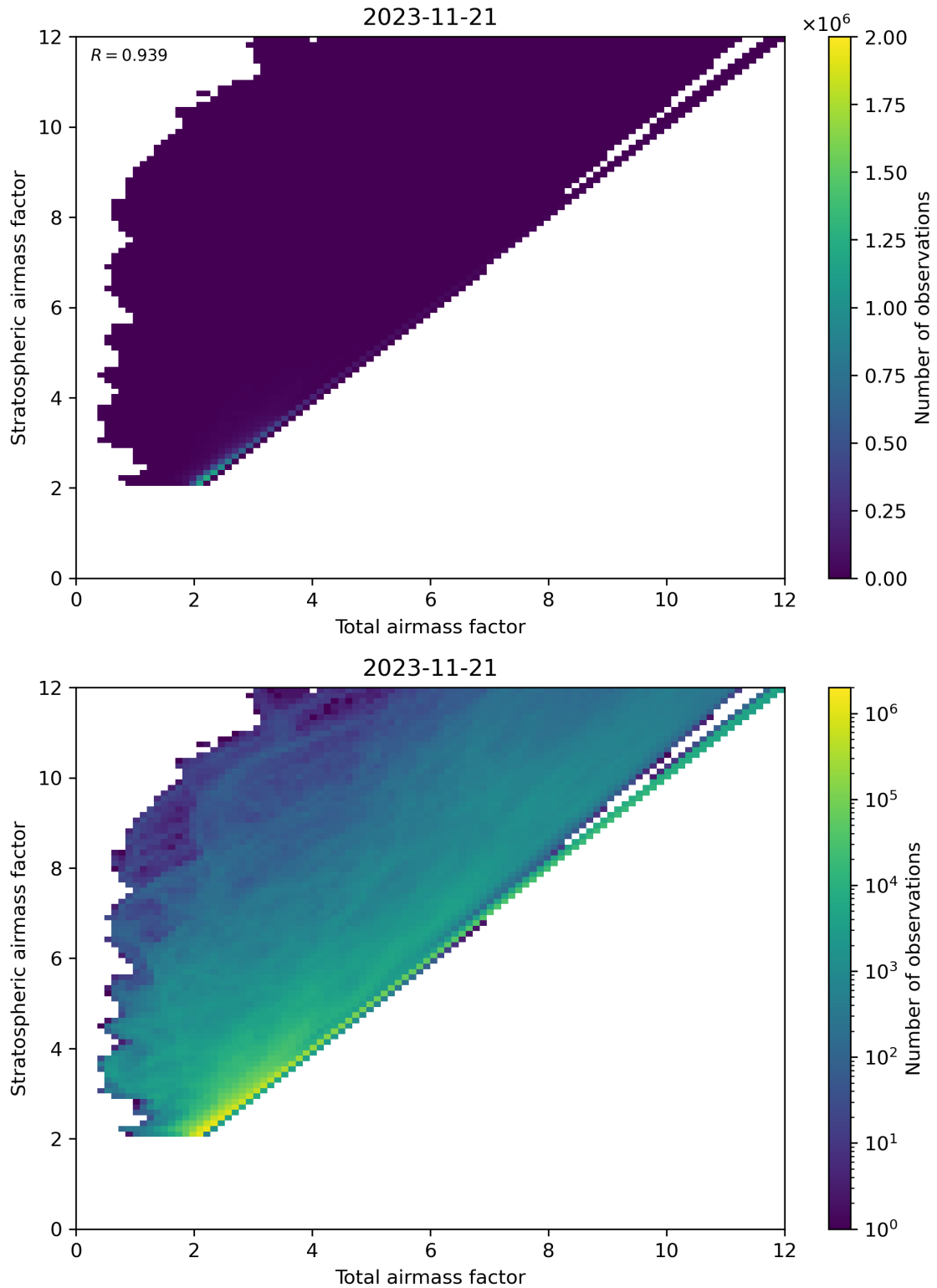


Figure 62: Scatter density plot of “Total airmass factor” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

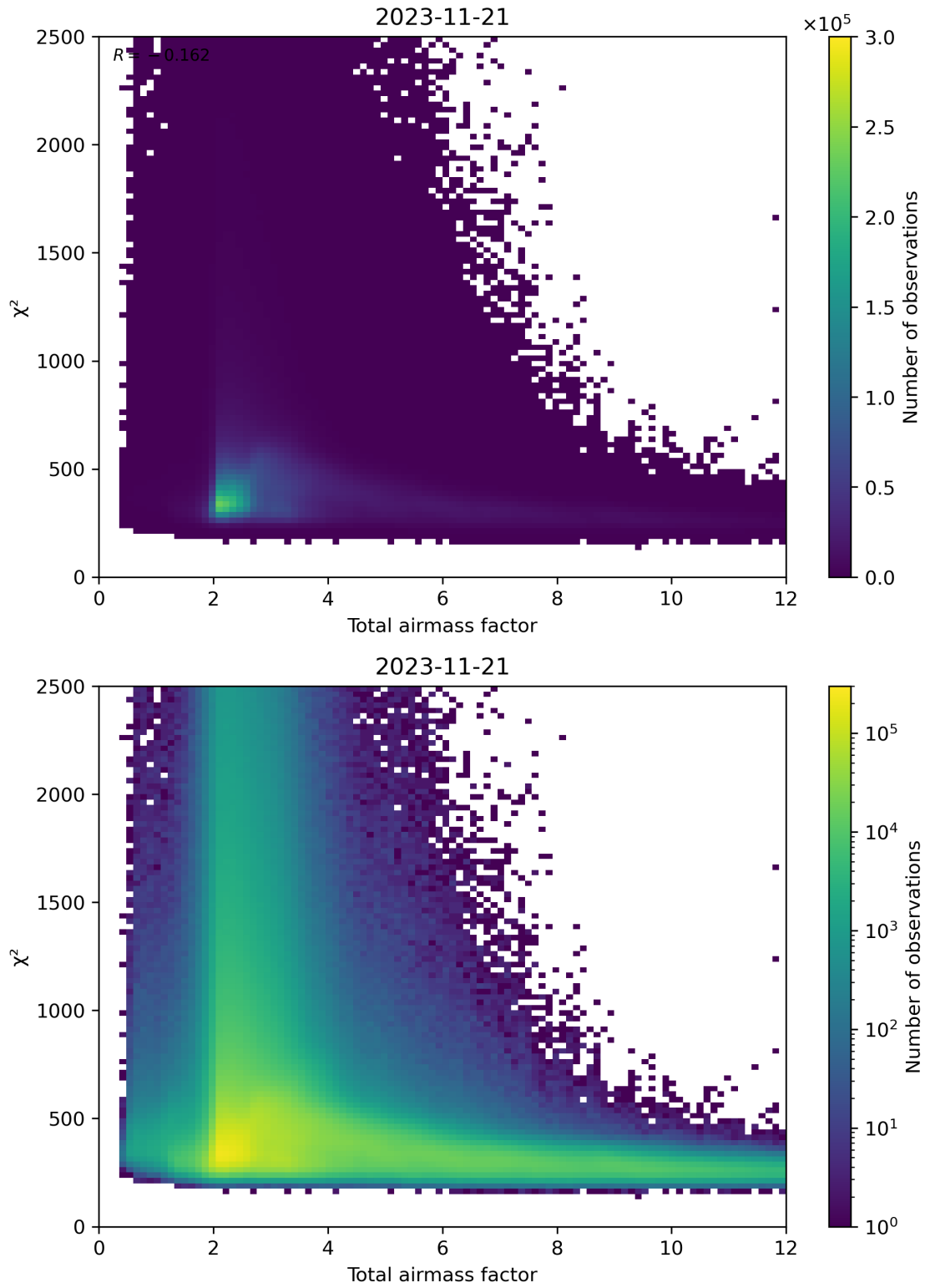


Figure 63: Scatter density plot of “Total airmass factor” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

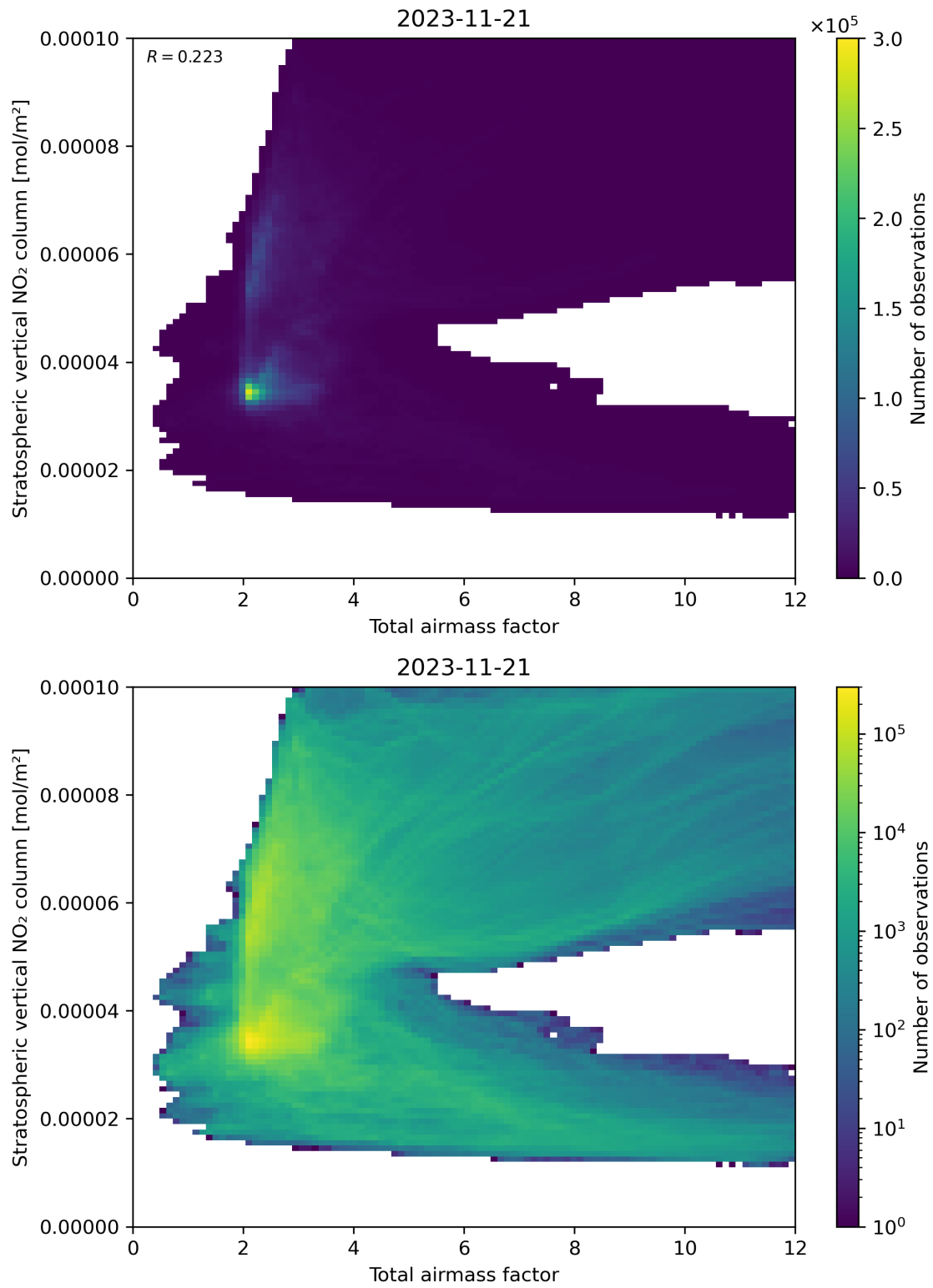


Figure 64: Scatter density plot of “Total airmass factor” against “Stratospheric vertical NO_2 column” for 2023-11-20 to 2023-11-22.

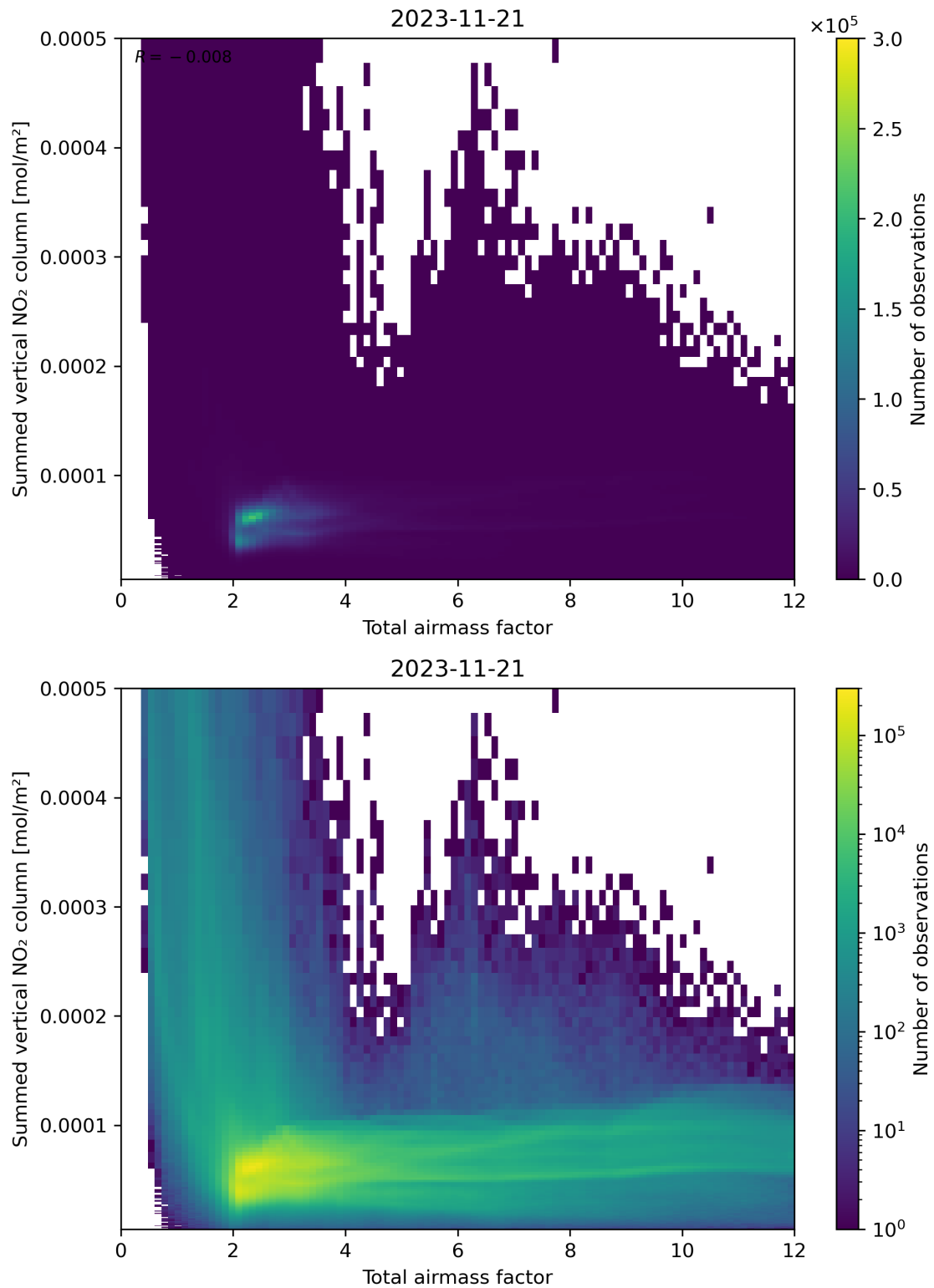


Figure 65: Scatter density plot of “Total airmass factor” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

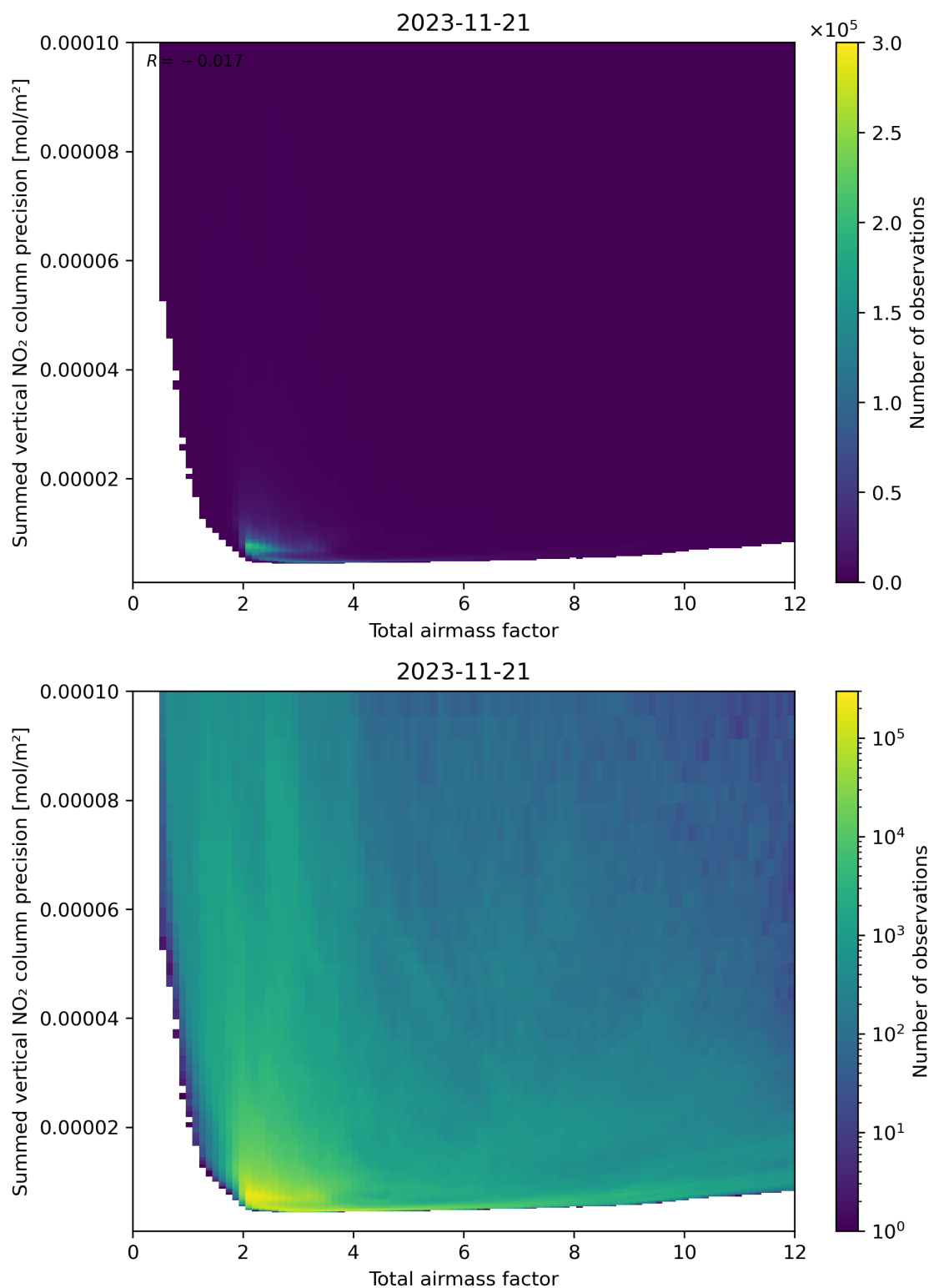


Figure 66: Scatter density plot of “Total airmass factor” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

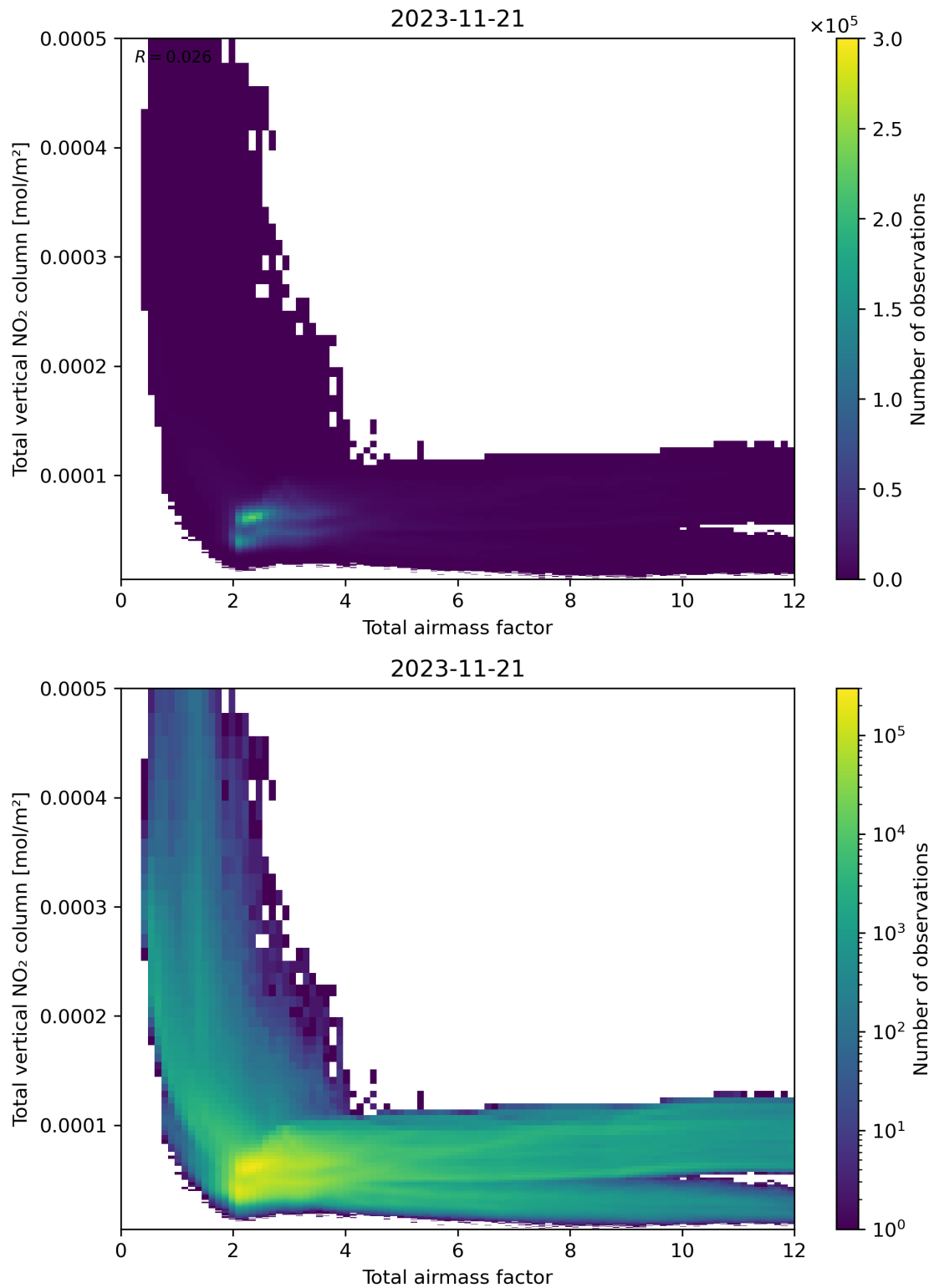


Figure 67: Scatter density plot of “Total airmass factor” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

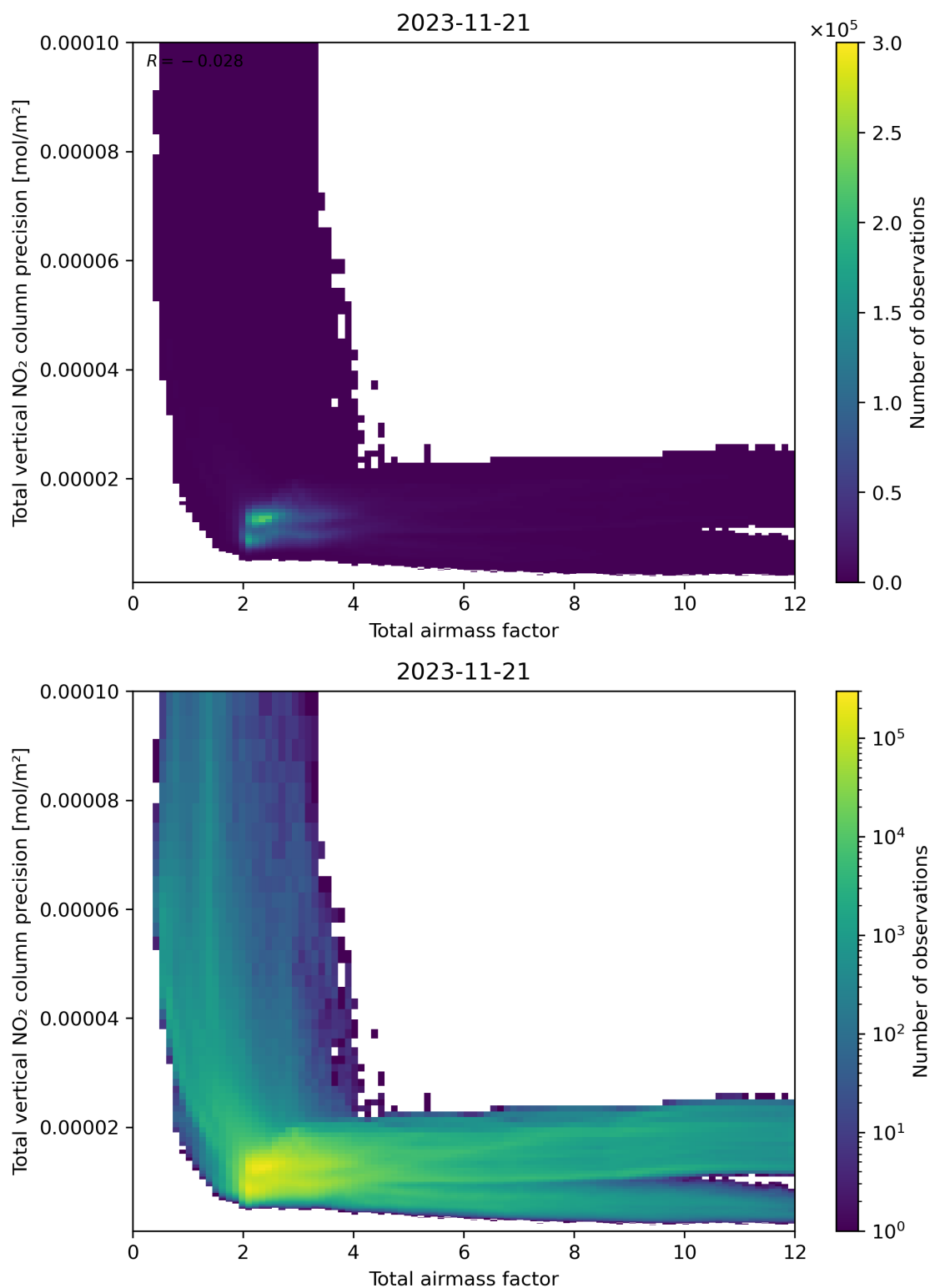


Figure 68: Scatter density plot of “Total airmass factor” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

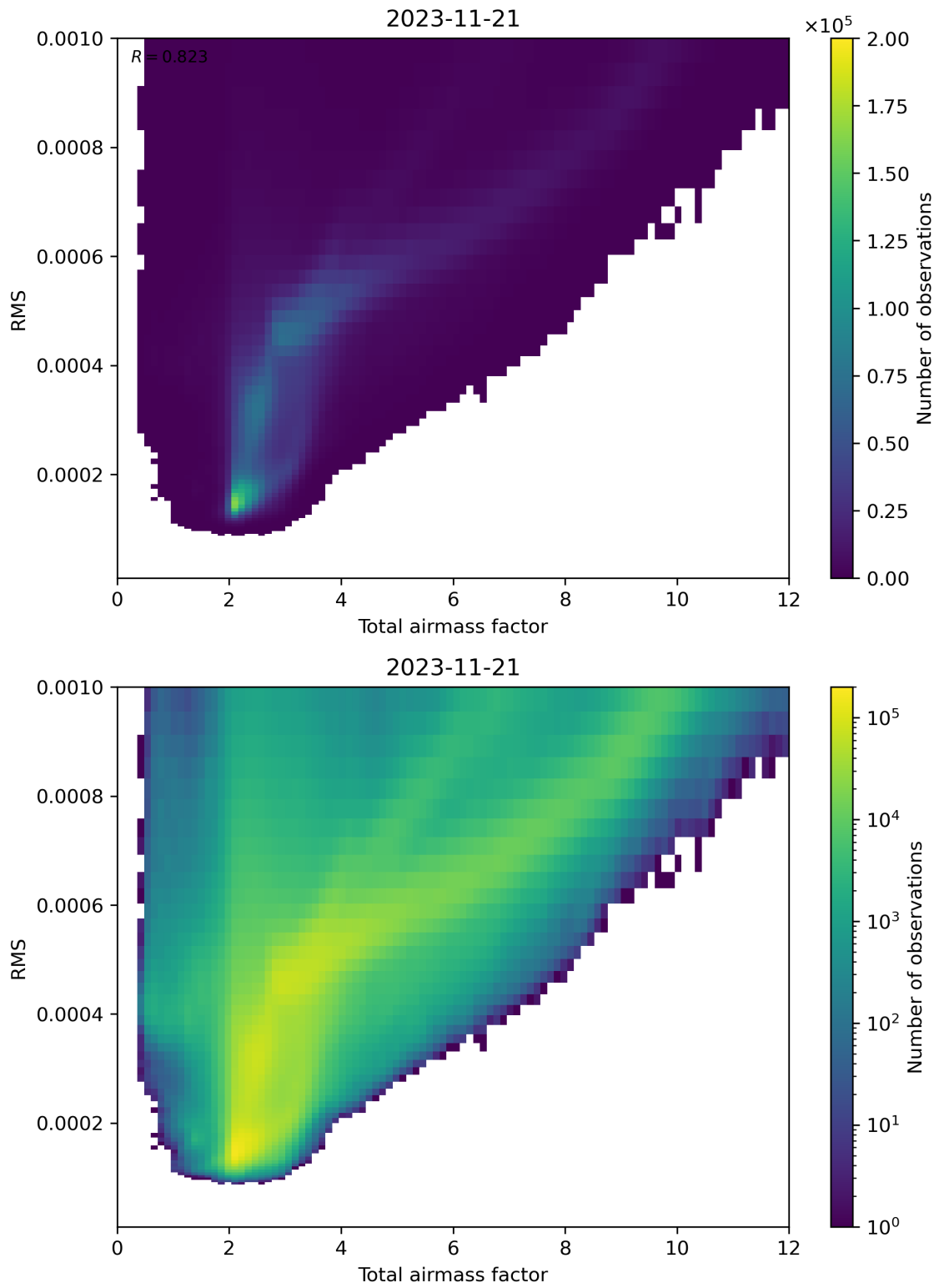


Figure 69: Scatter density plot of “Total airmass factor” against “RMS” for 2023-11-20 to 2023-11-22.

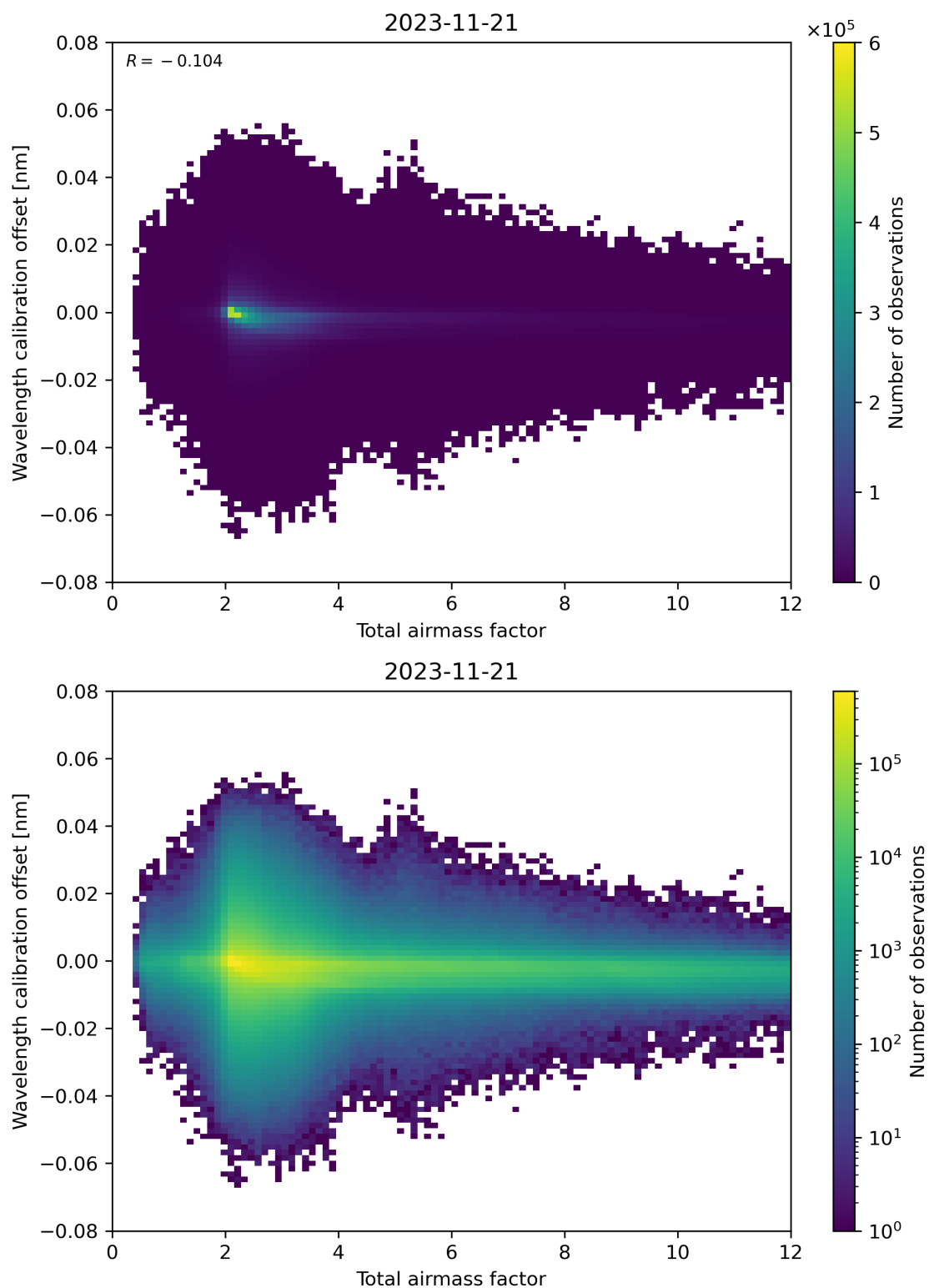


Figure 70: Scatter density plot of “Total airmass factor” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

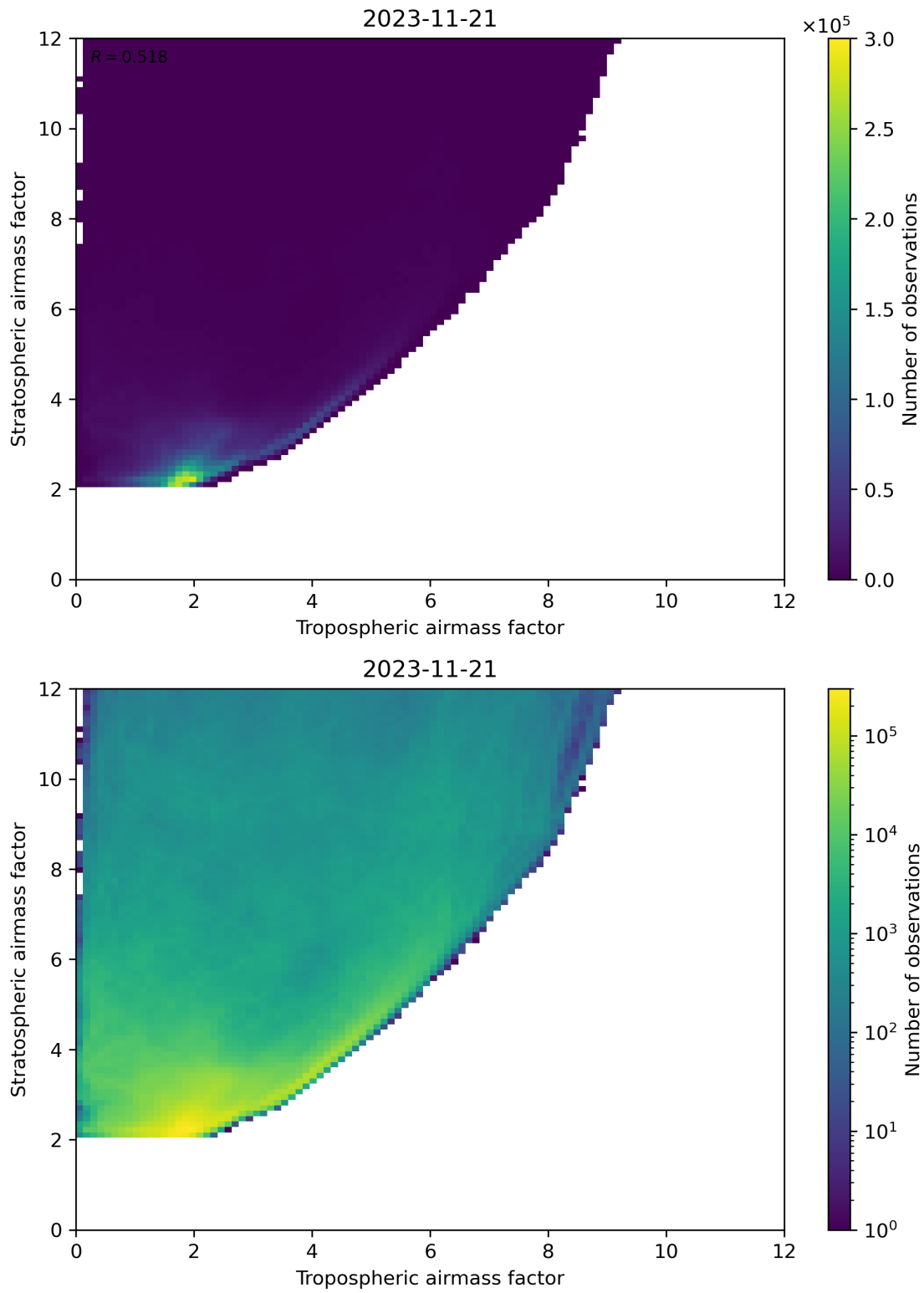


Figure 71: Scatter density plot of “Tropospheric airmass factor” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

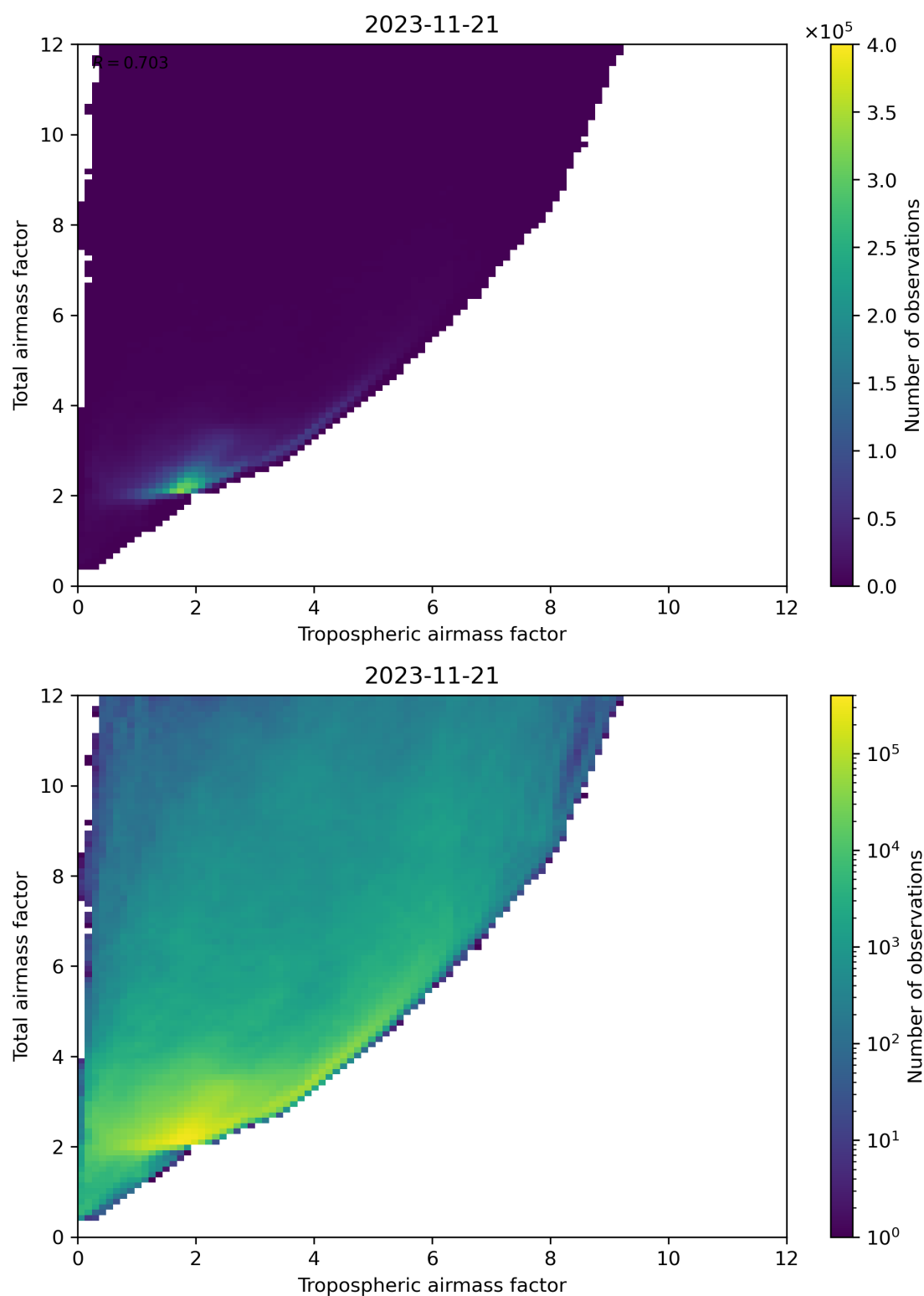


Figure 72: Scatter density plot of “Tropospheric airmass factor” against “Total airmass factor” for 2023-11-20 to 2023-11-22.

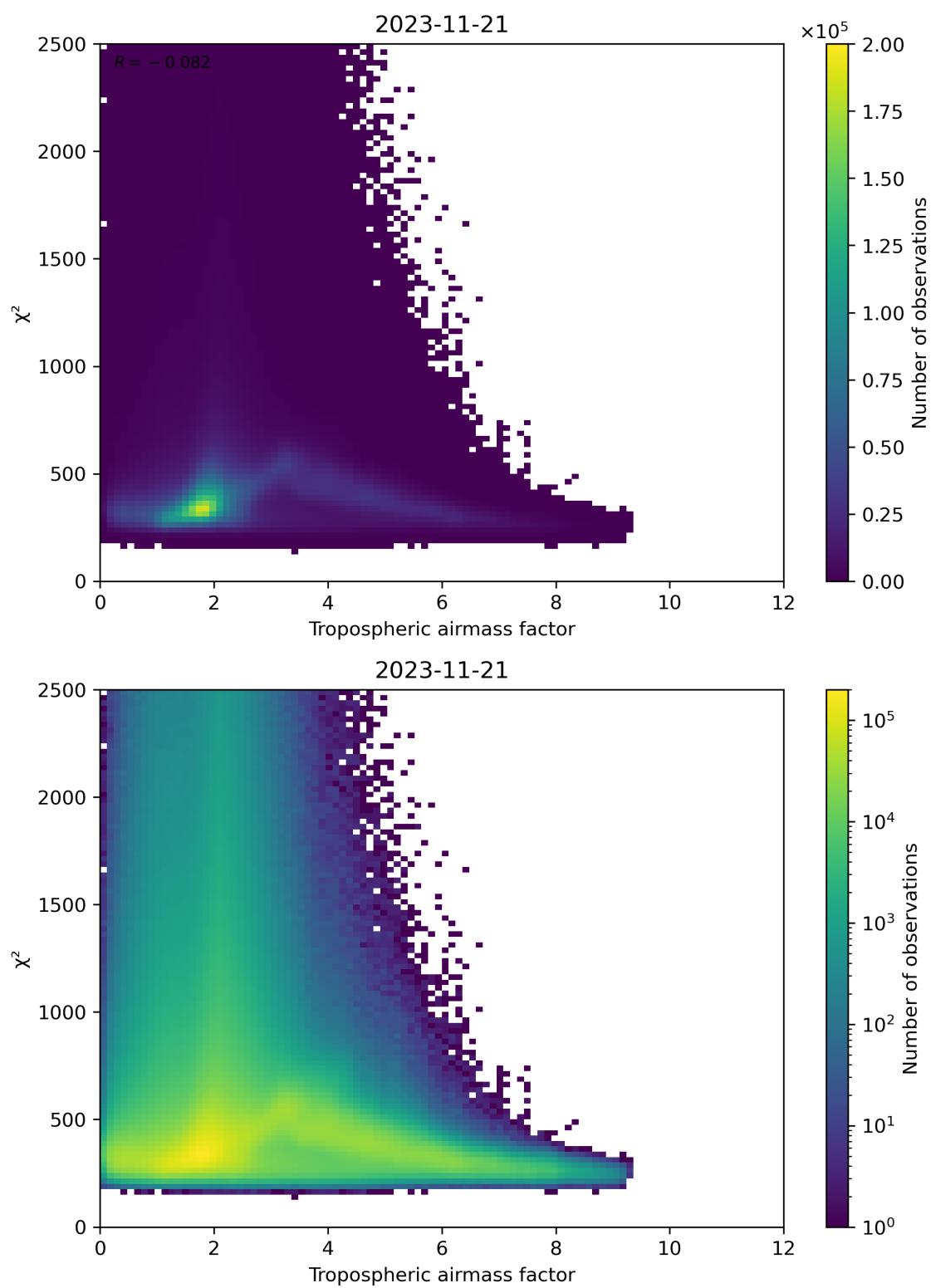


Figure 73: Scatter density plot of “Tropospheric airmass factor” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

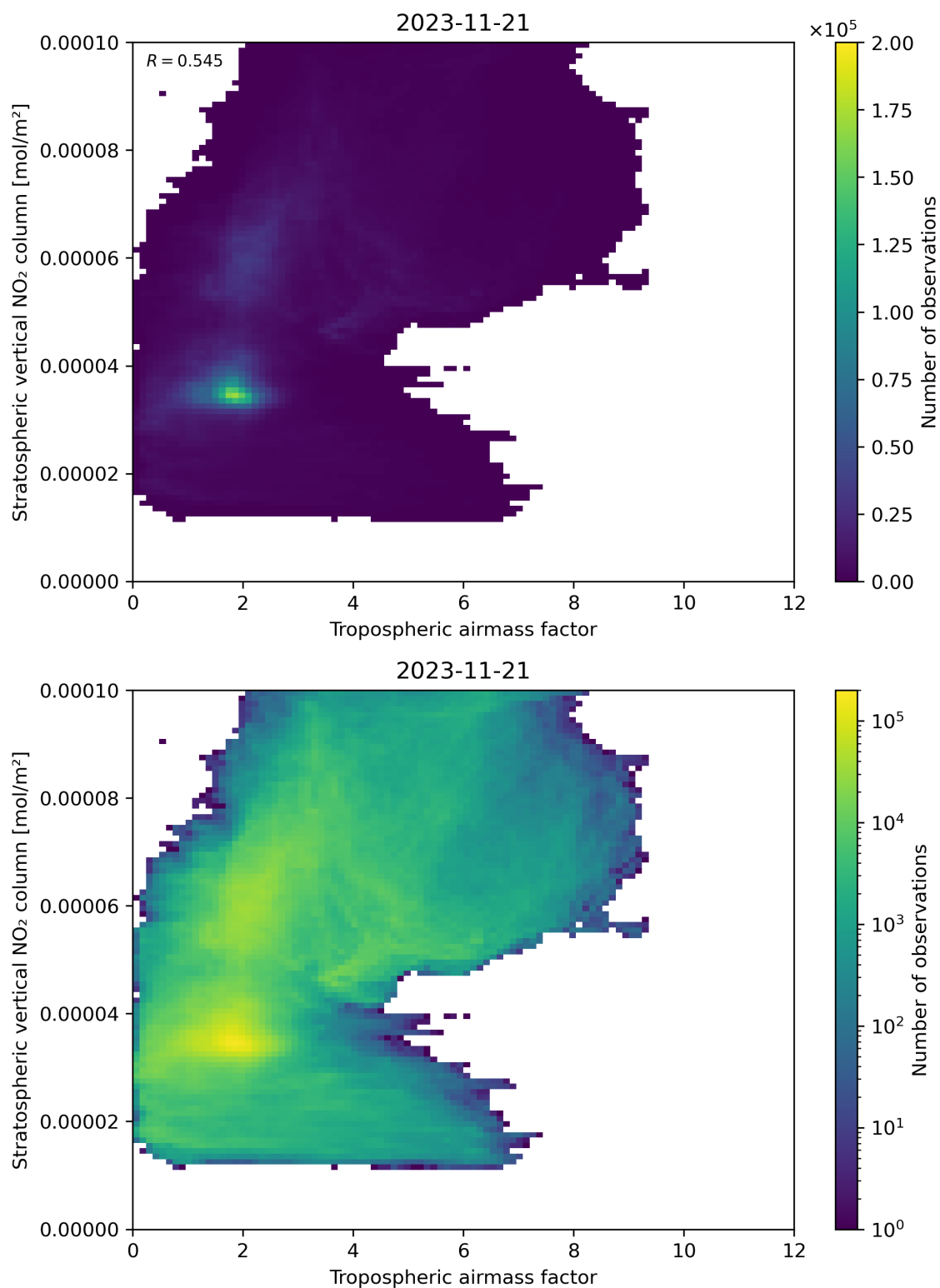


Figure 74: Scatter density plot of “Tropospheric air mass factor” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

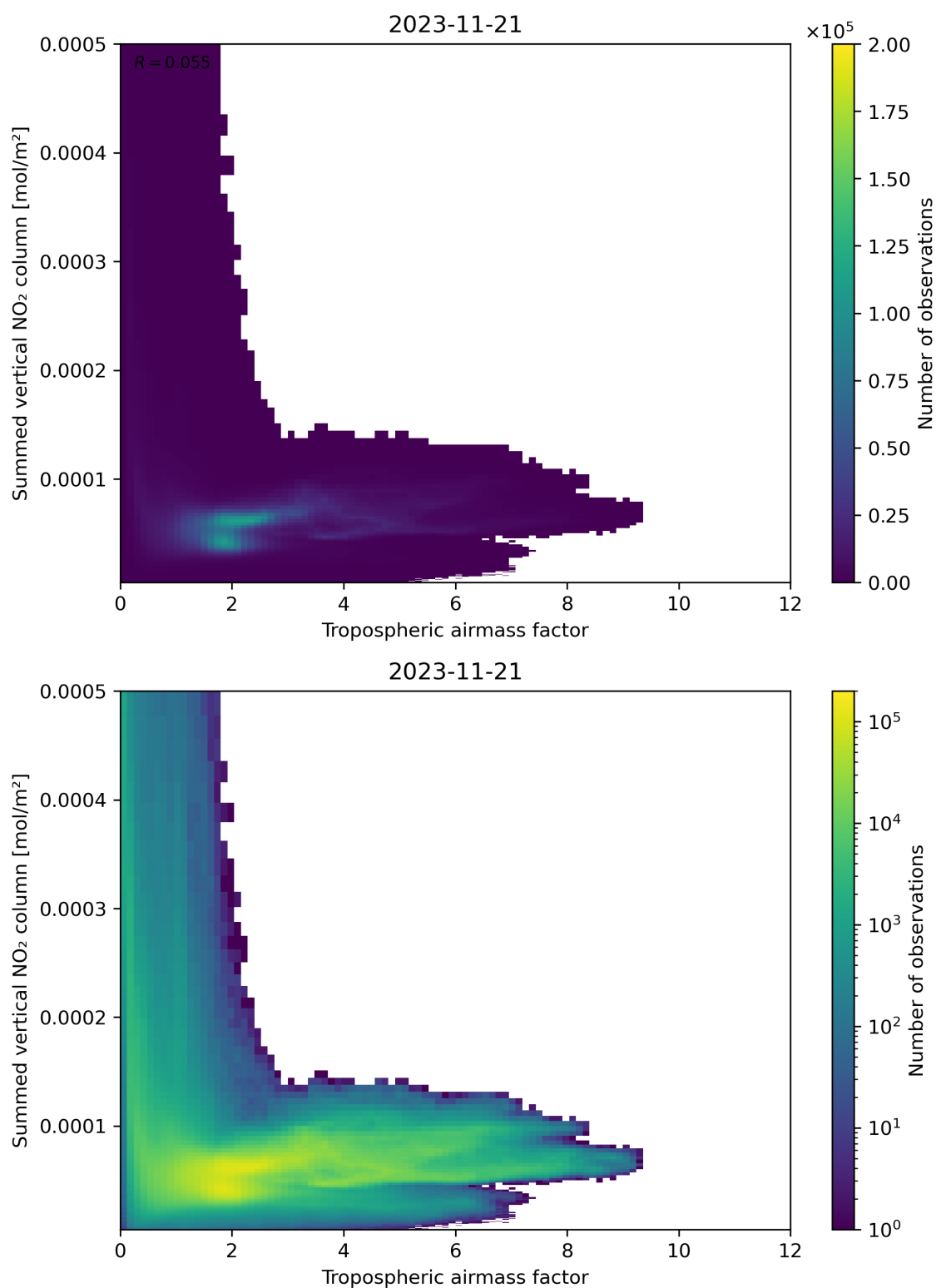


Figure 75: Scatter density plot of “Tropospheric airmass factor” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

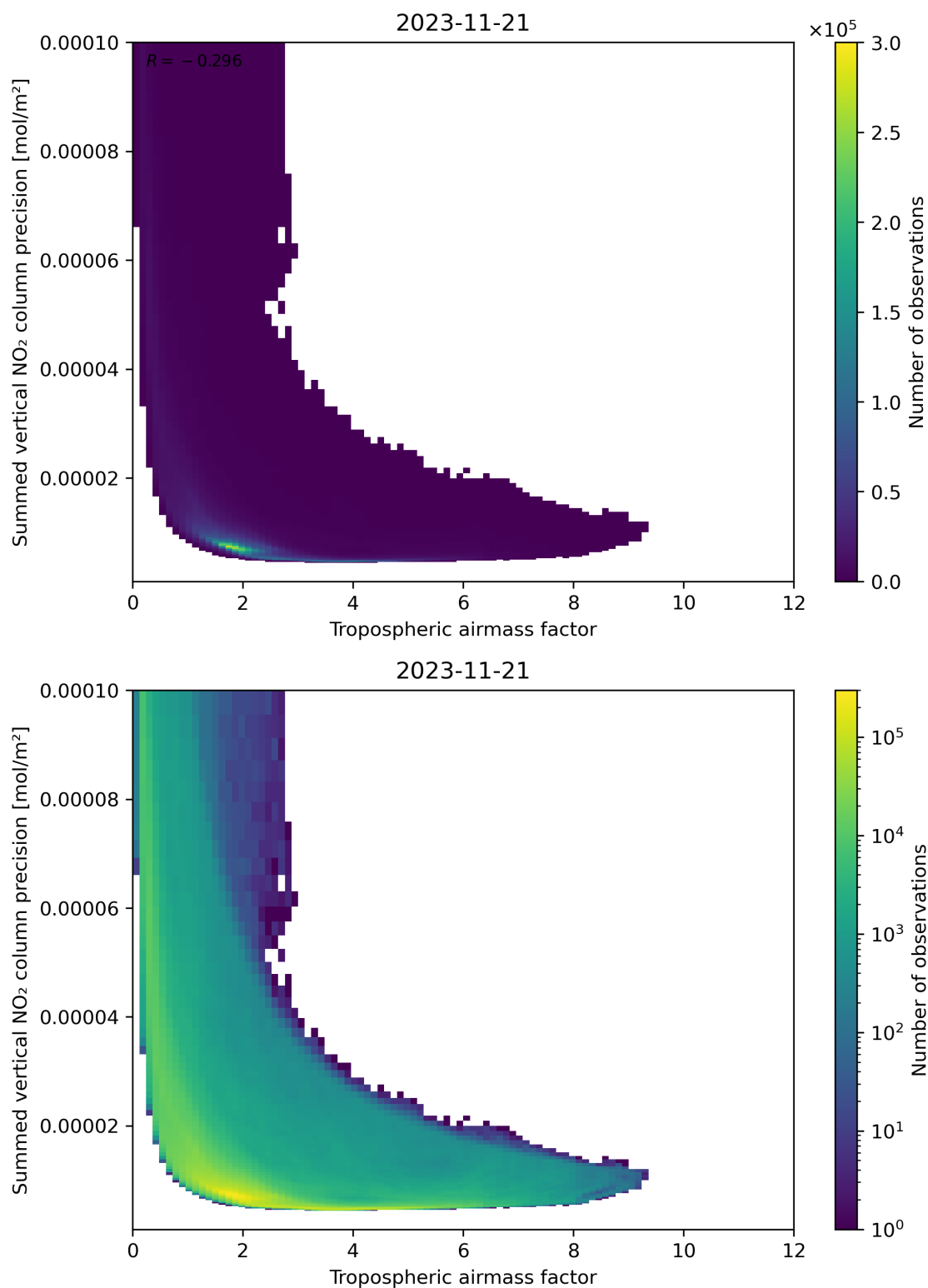


Figure 76: Scatter density plot of “Tropospheric air mass factor” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

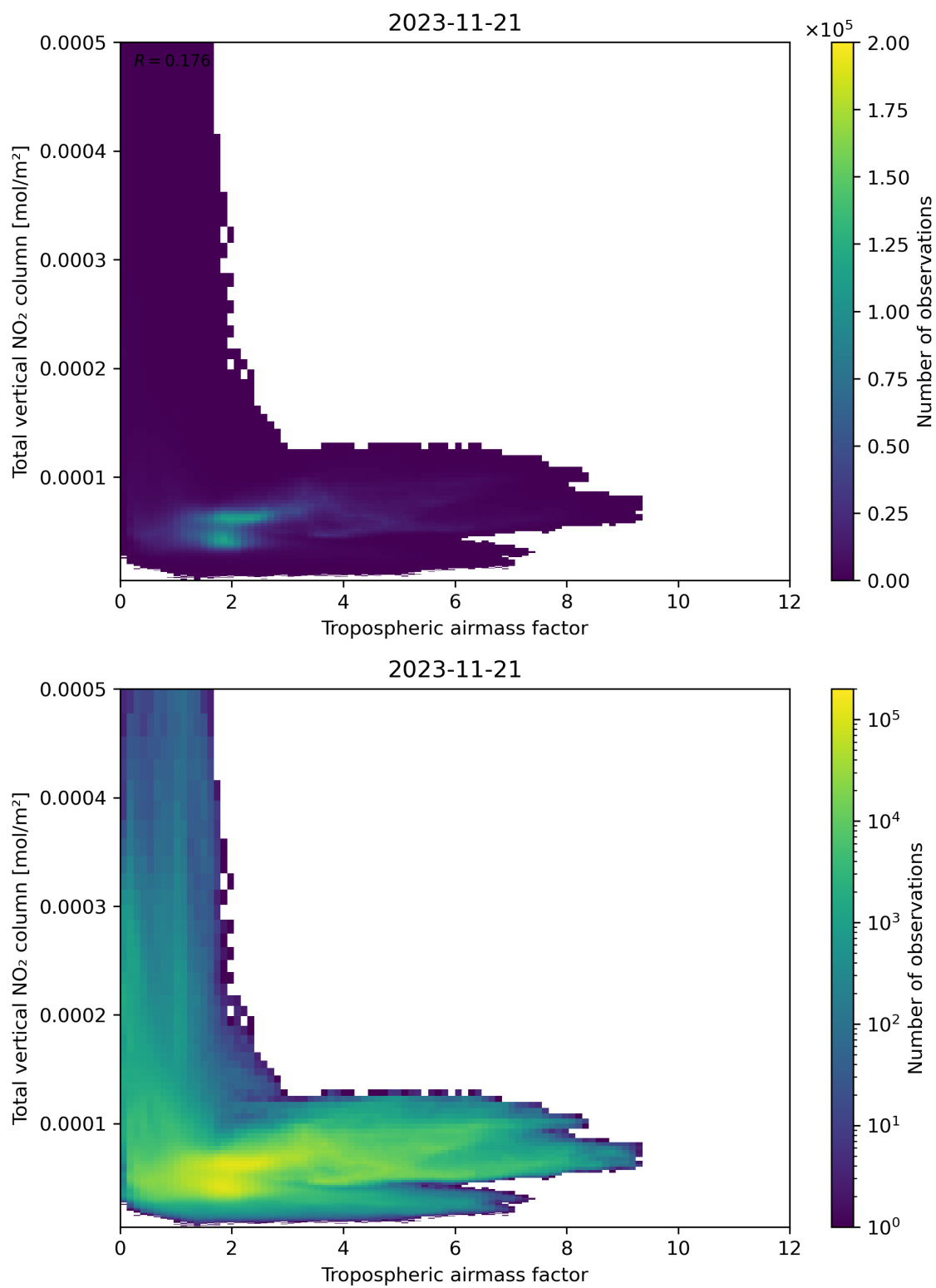


Figure 77: Scatter density plot of “Tropospheric airmass factor” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

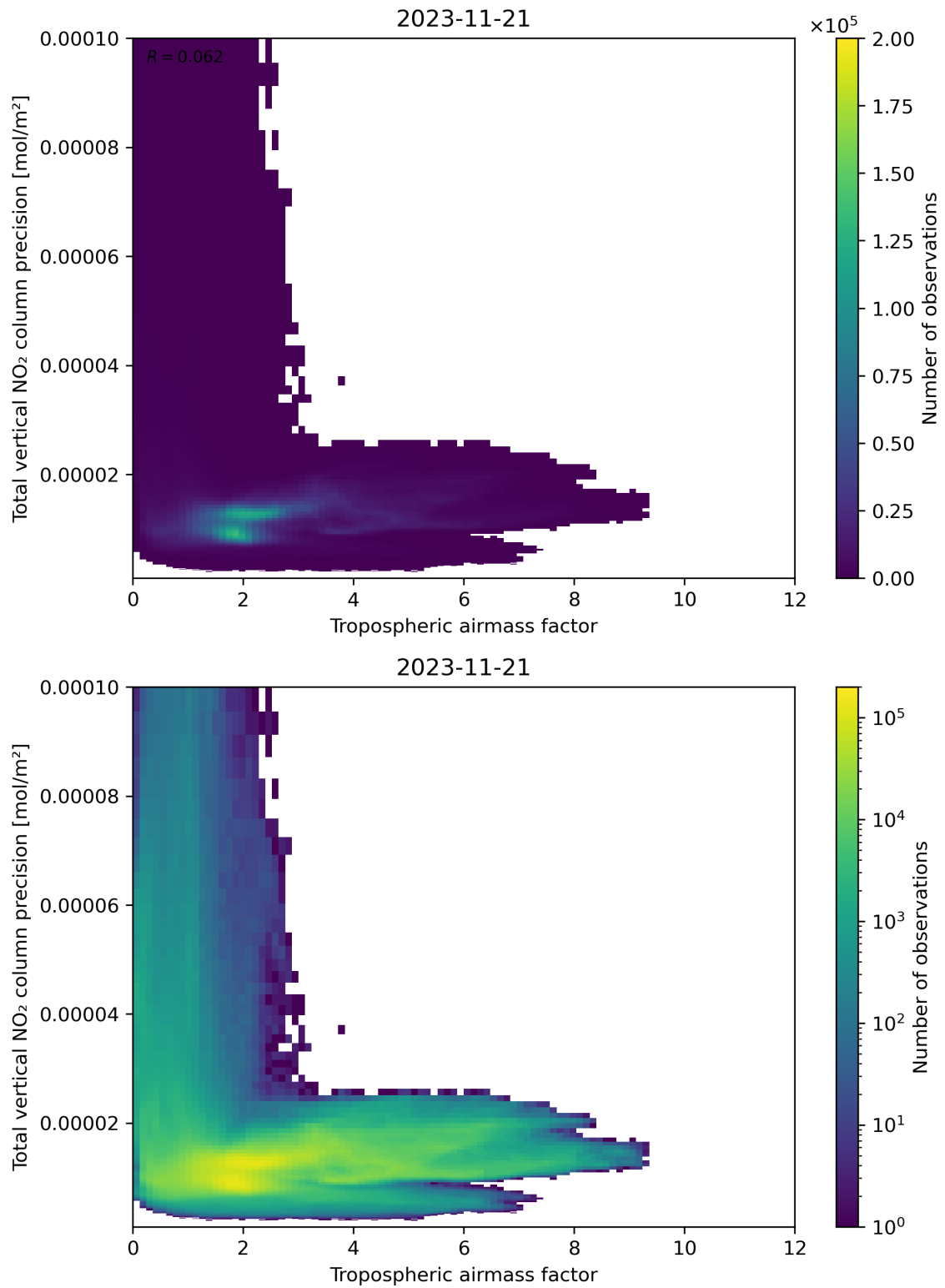


Figure 78: Scatter density plot of “Tropospheric air mass factor” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

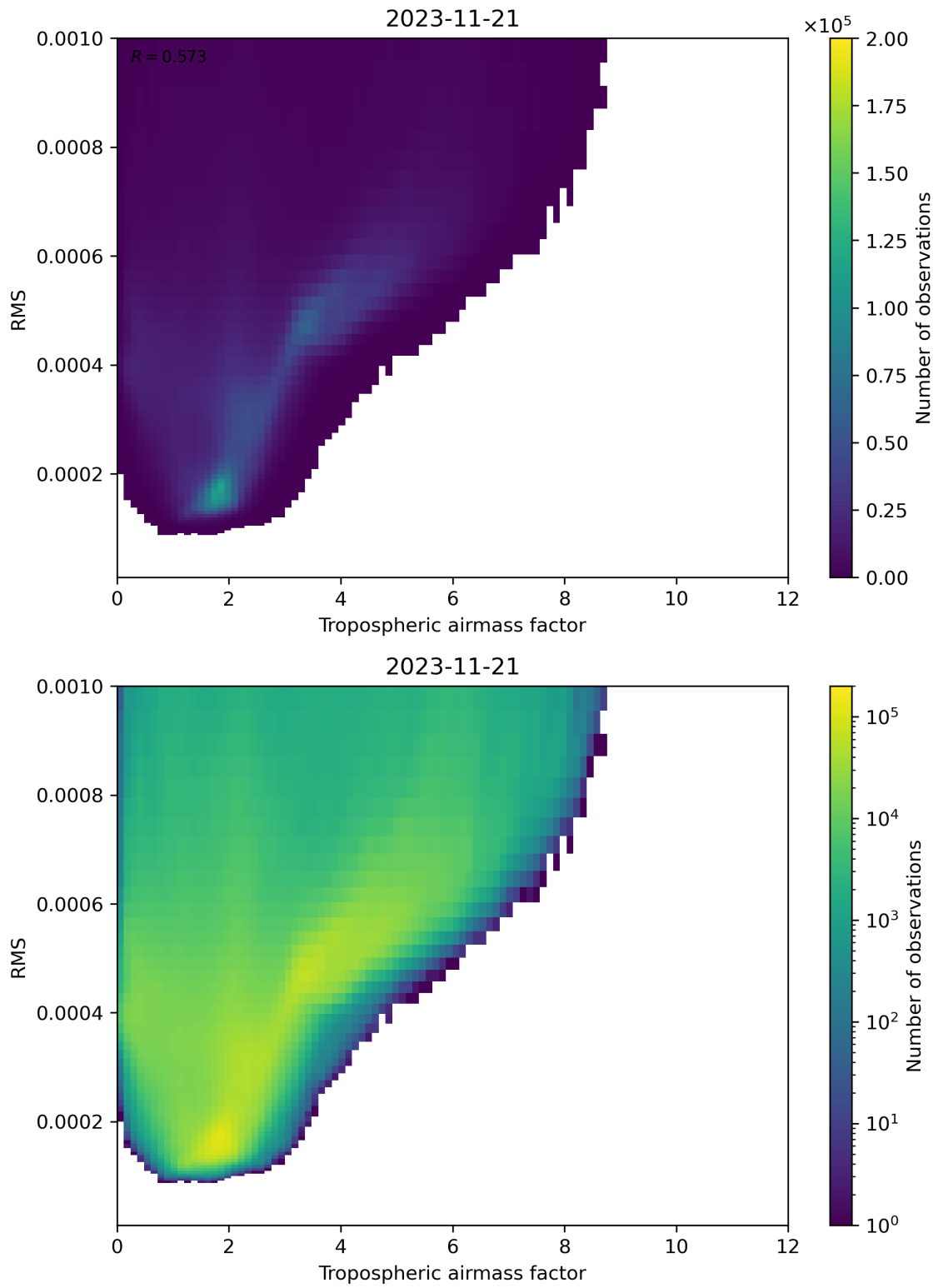


Figure 79: Scatter density plot of “Tropospheric airmass factor” against “RMS” for 2023-11-20 to 2023-11-22.

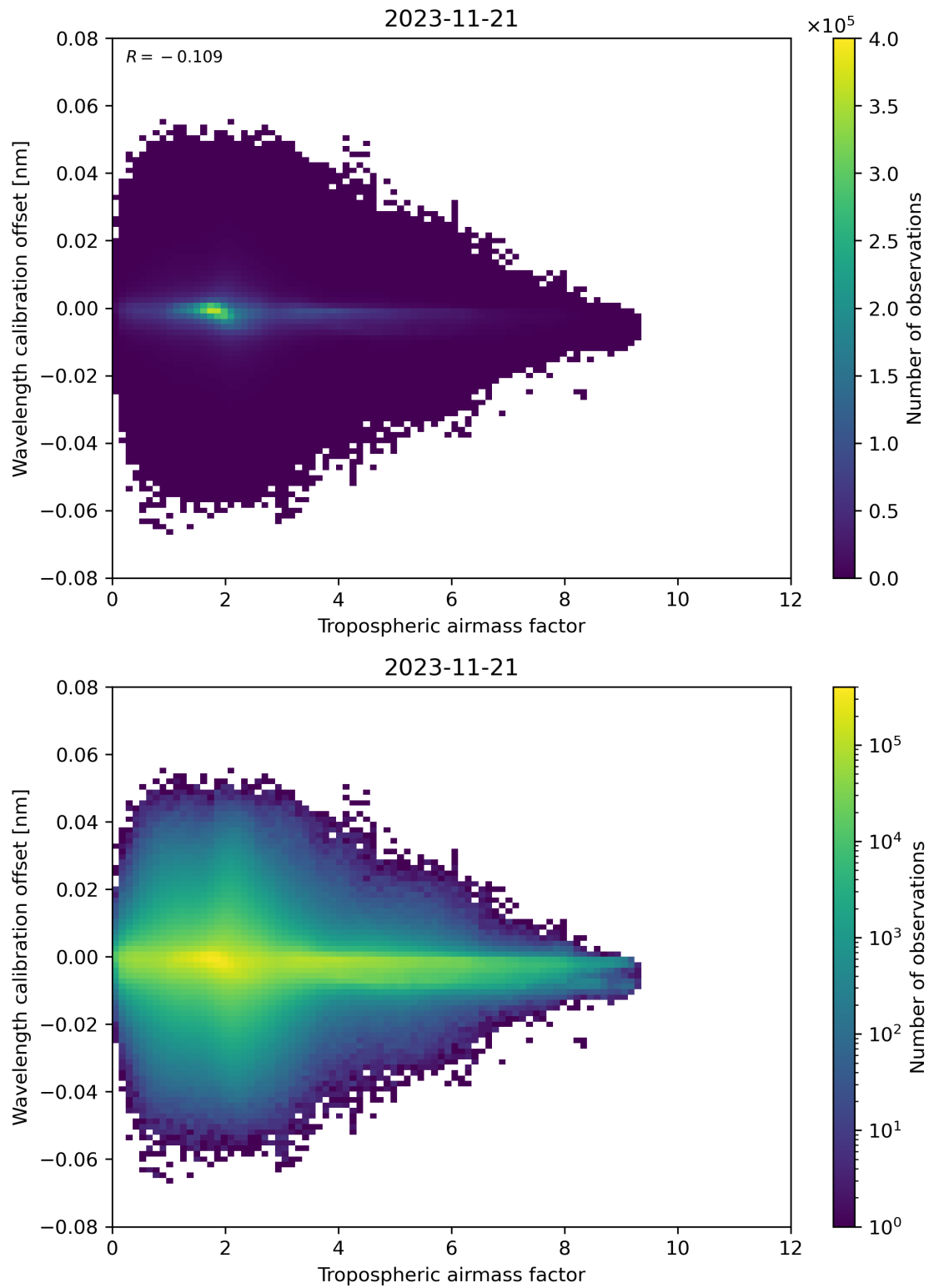


Figure 80: Scatter density plot of “Tropospheric airmass factor” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

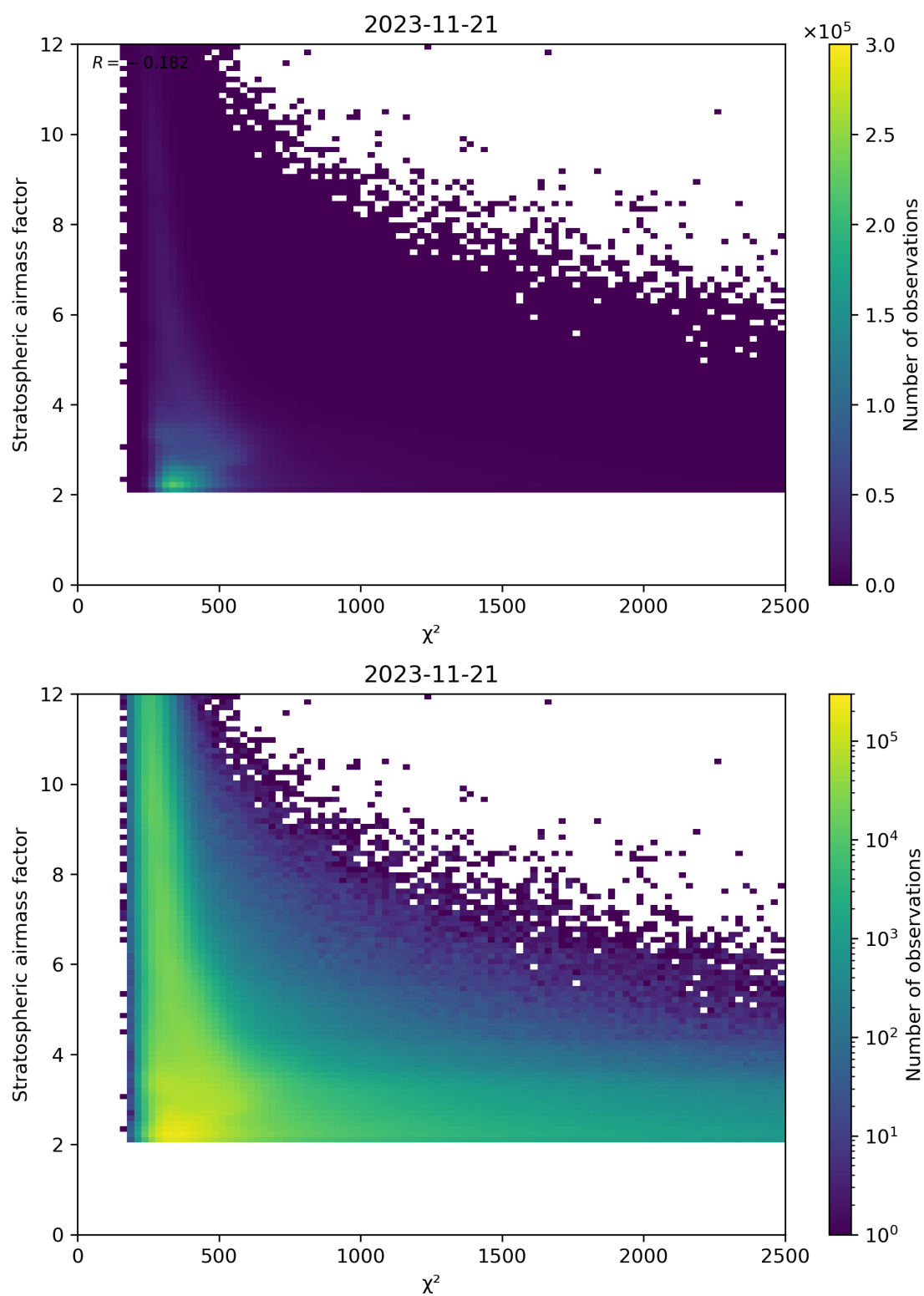


Figure 81: Scatter density plot of “ χ^2 ” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

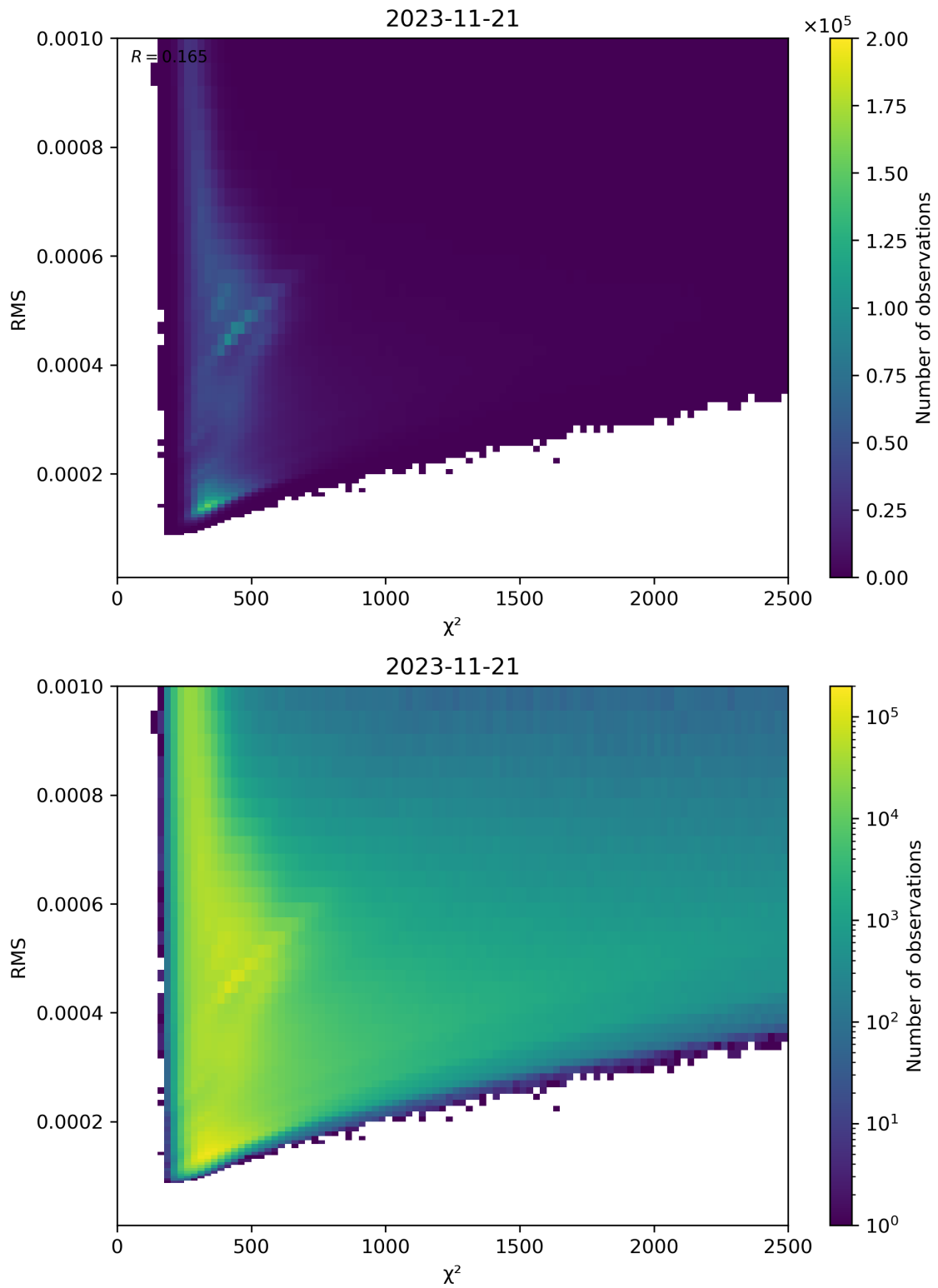


Figure 82: Scatter density plot of “ χ^2 ” against “RMS” for 2023-11-20 to 2023-11-22.

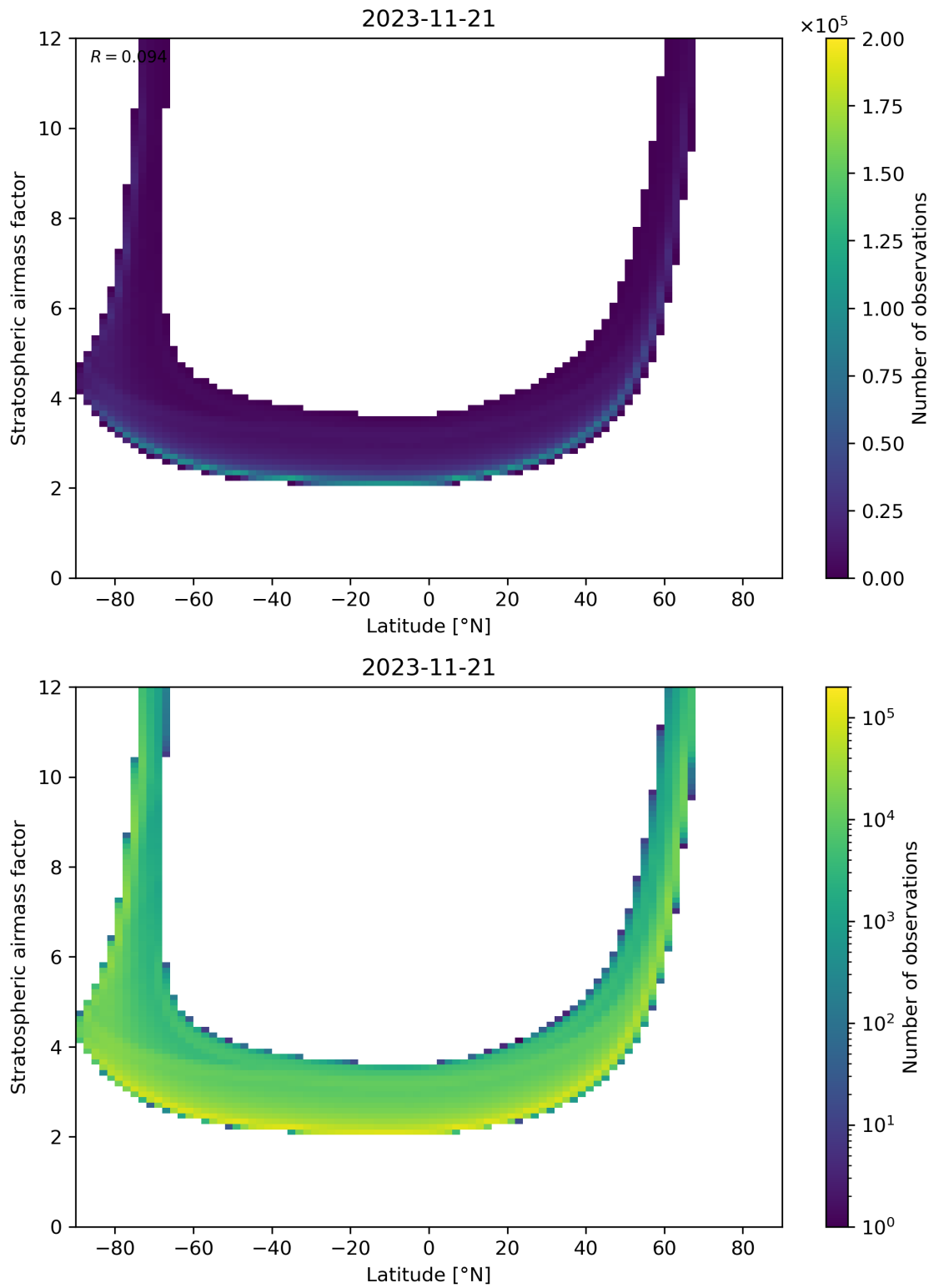


Figure 83: Scatter density plot of “Latitude” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

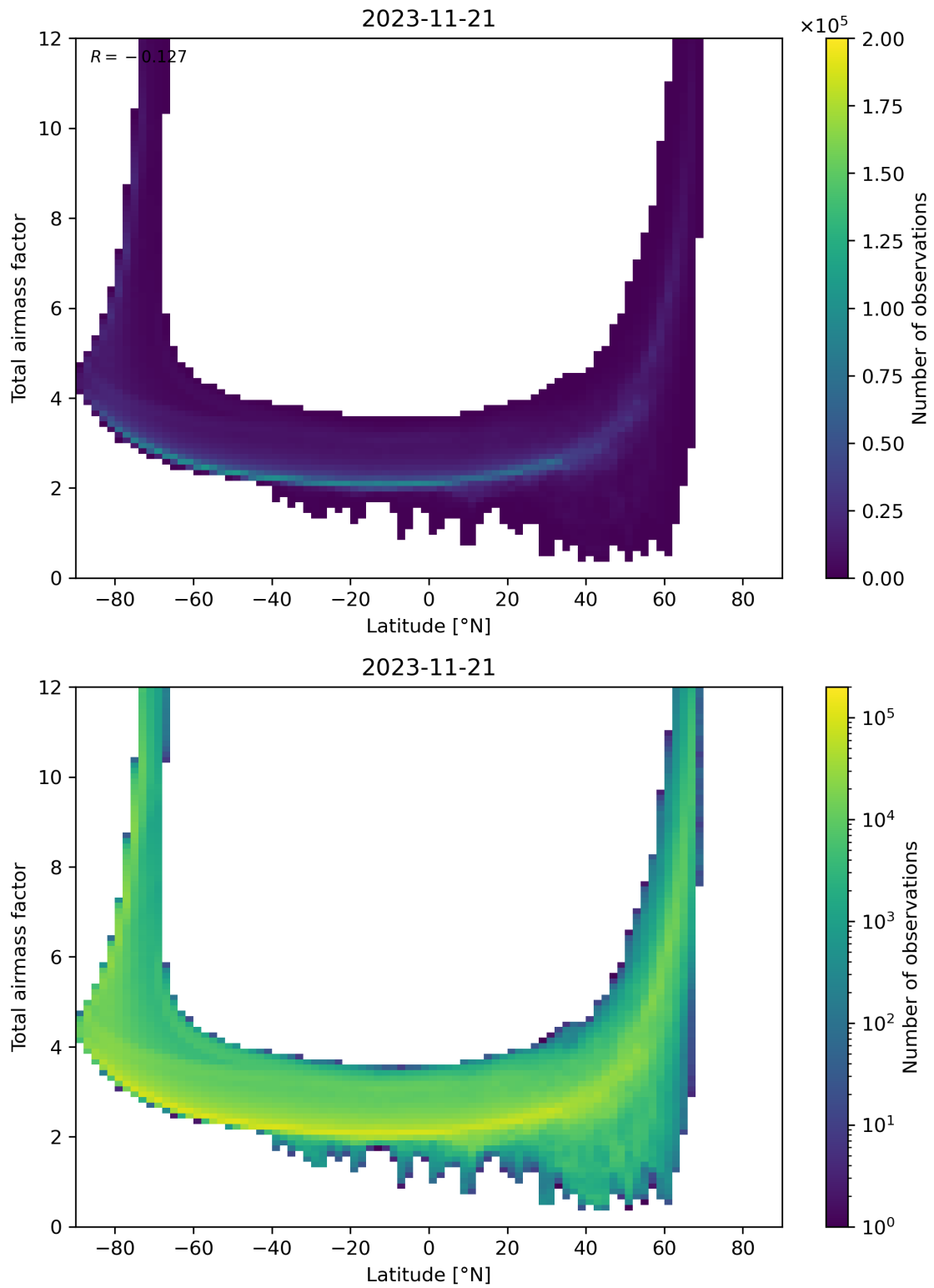


Figure 84: Scatter density plot of “Latitude” against “Total airmass factor” for 2023-11-20 to 2023-11-22.

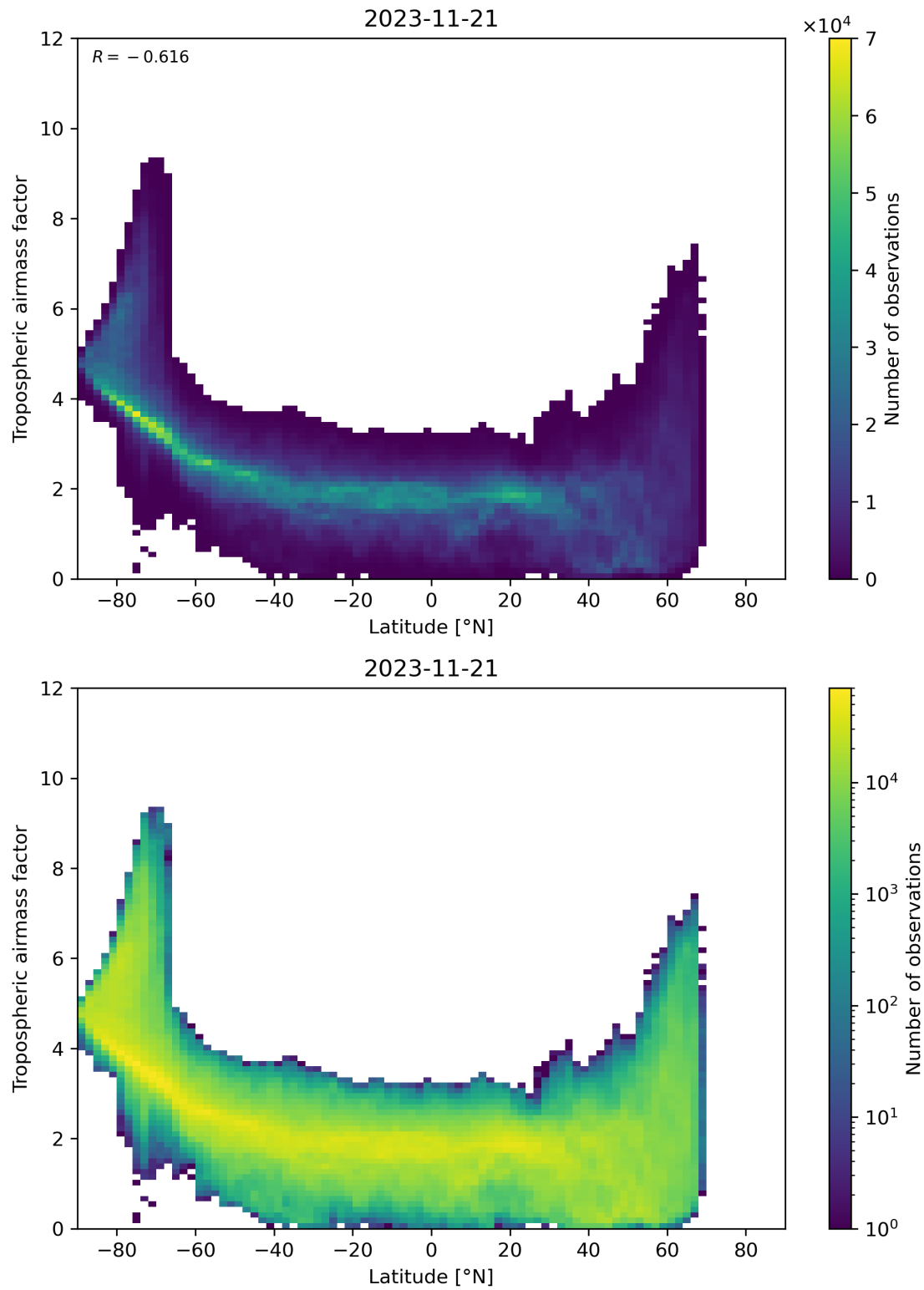


Figure 85: Scatter density plot of “Latitude” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.

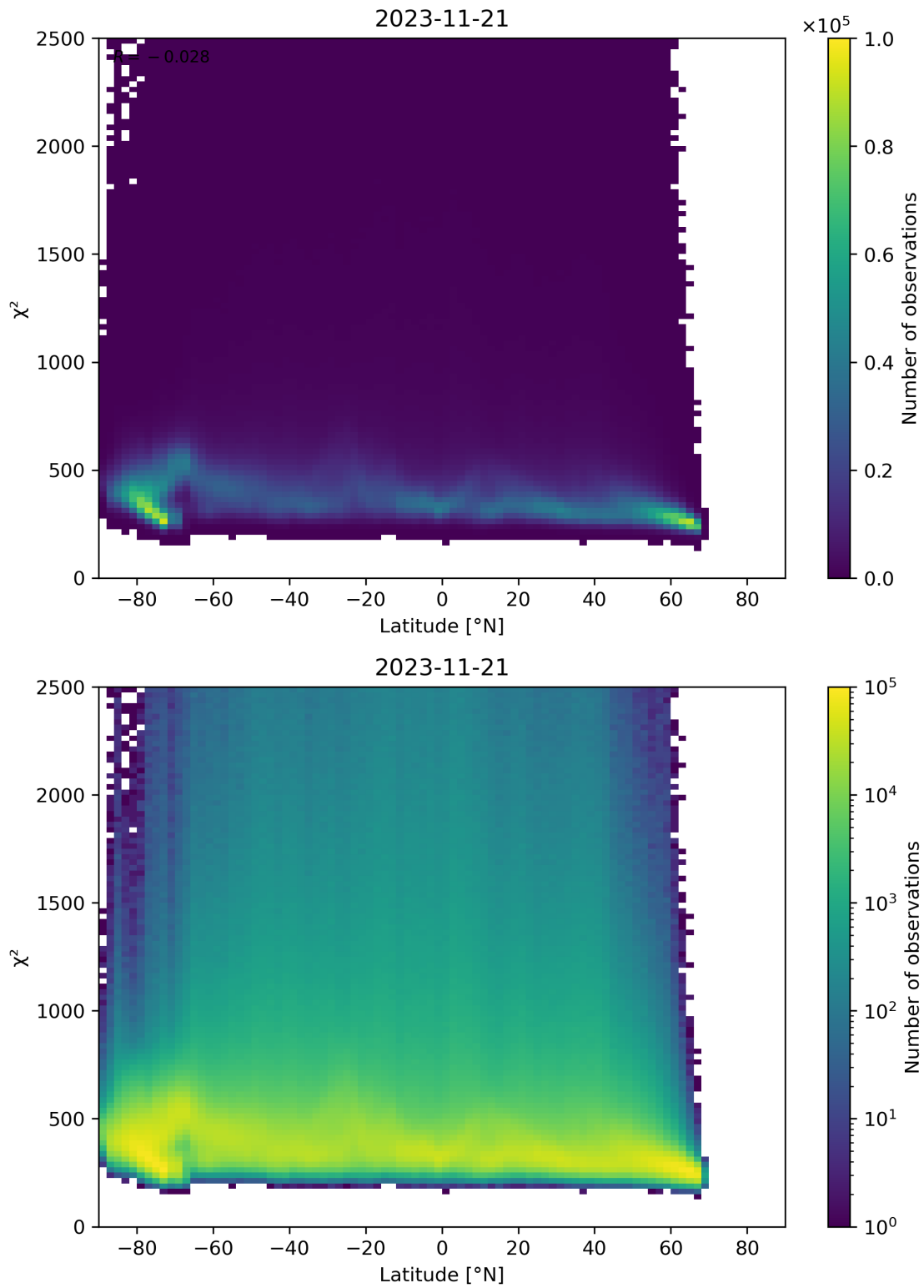


Figure 86: Scatter density plot of “Latitude” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

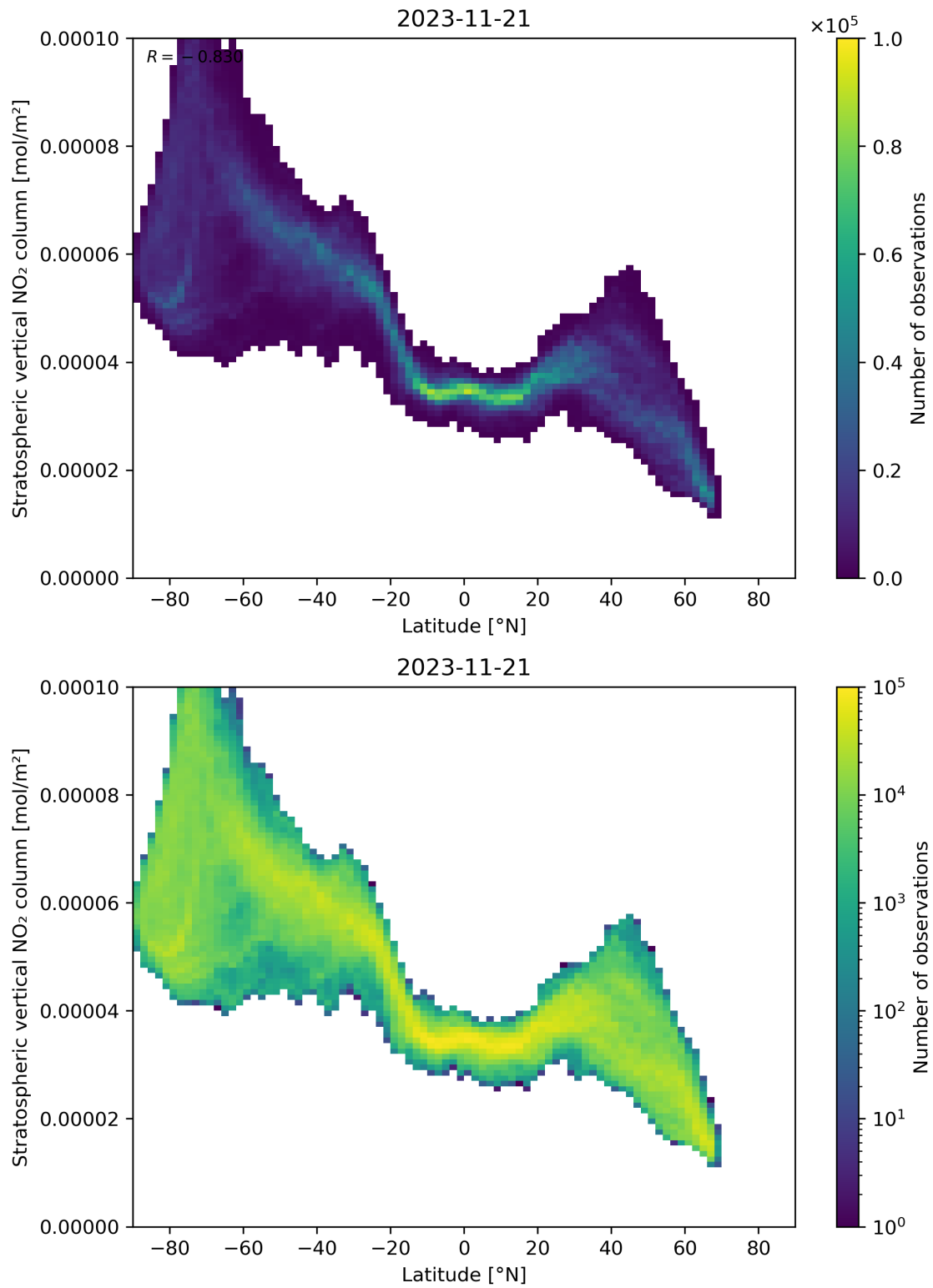


Figure 87: Scatter density plot of “Latitude” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

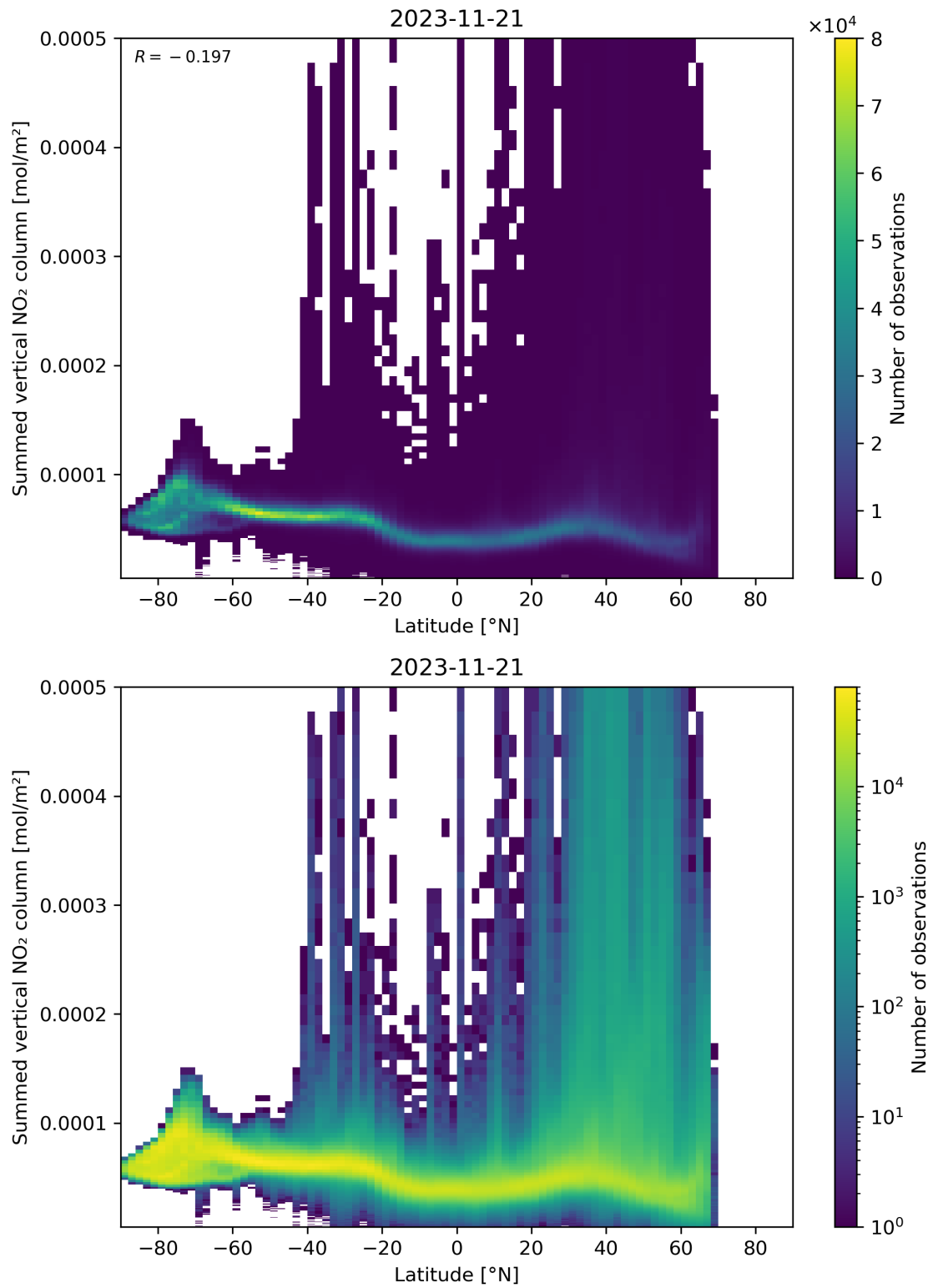


Figure 88: Scatter density plot of “Latitude” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

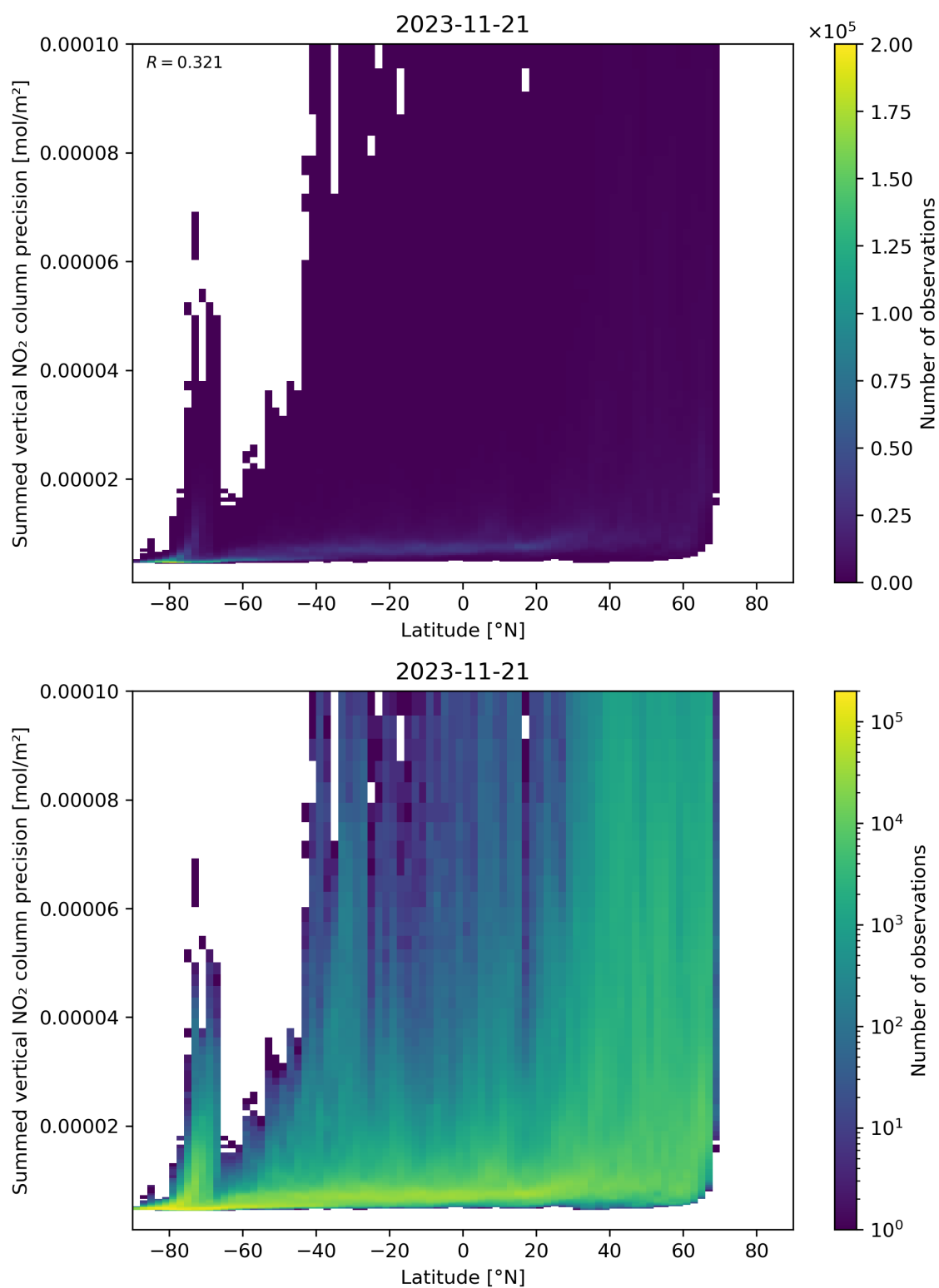


Figure 89: Scatter density plot of “Latitude” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

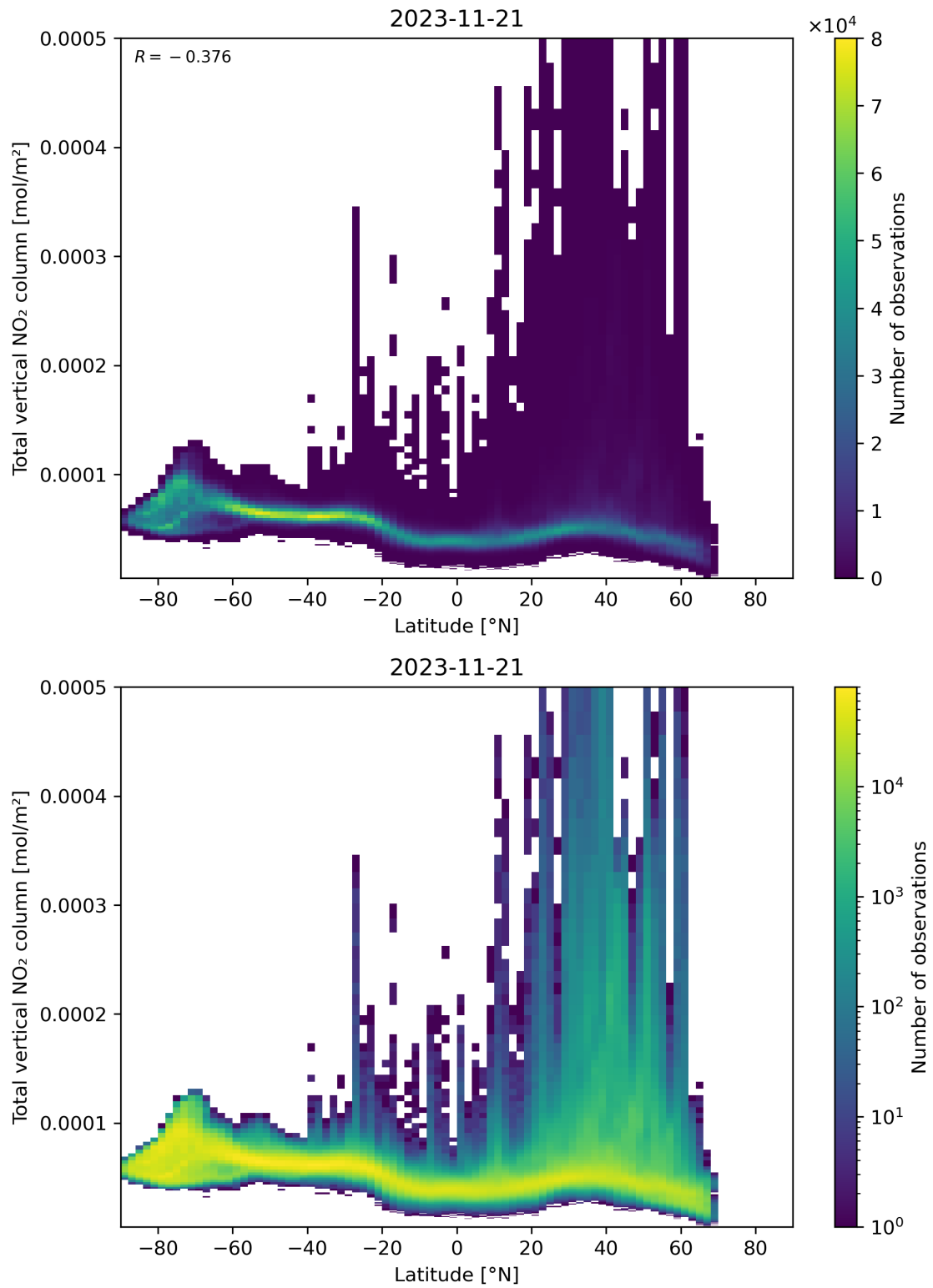


Figure 90: Scatter density plot of “Latitude” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

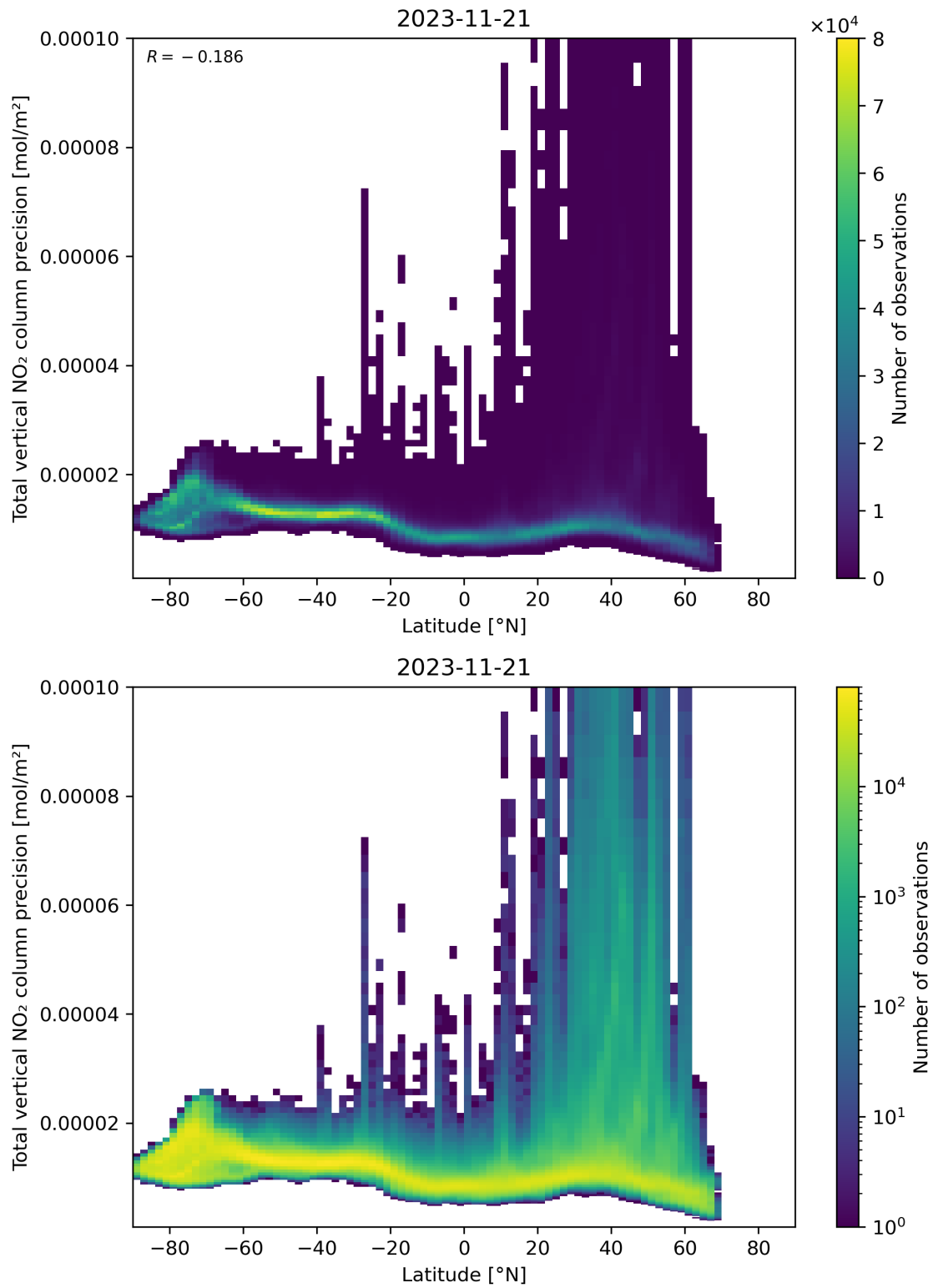


Figure 91: Scatter density plot of “Latitude” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

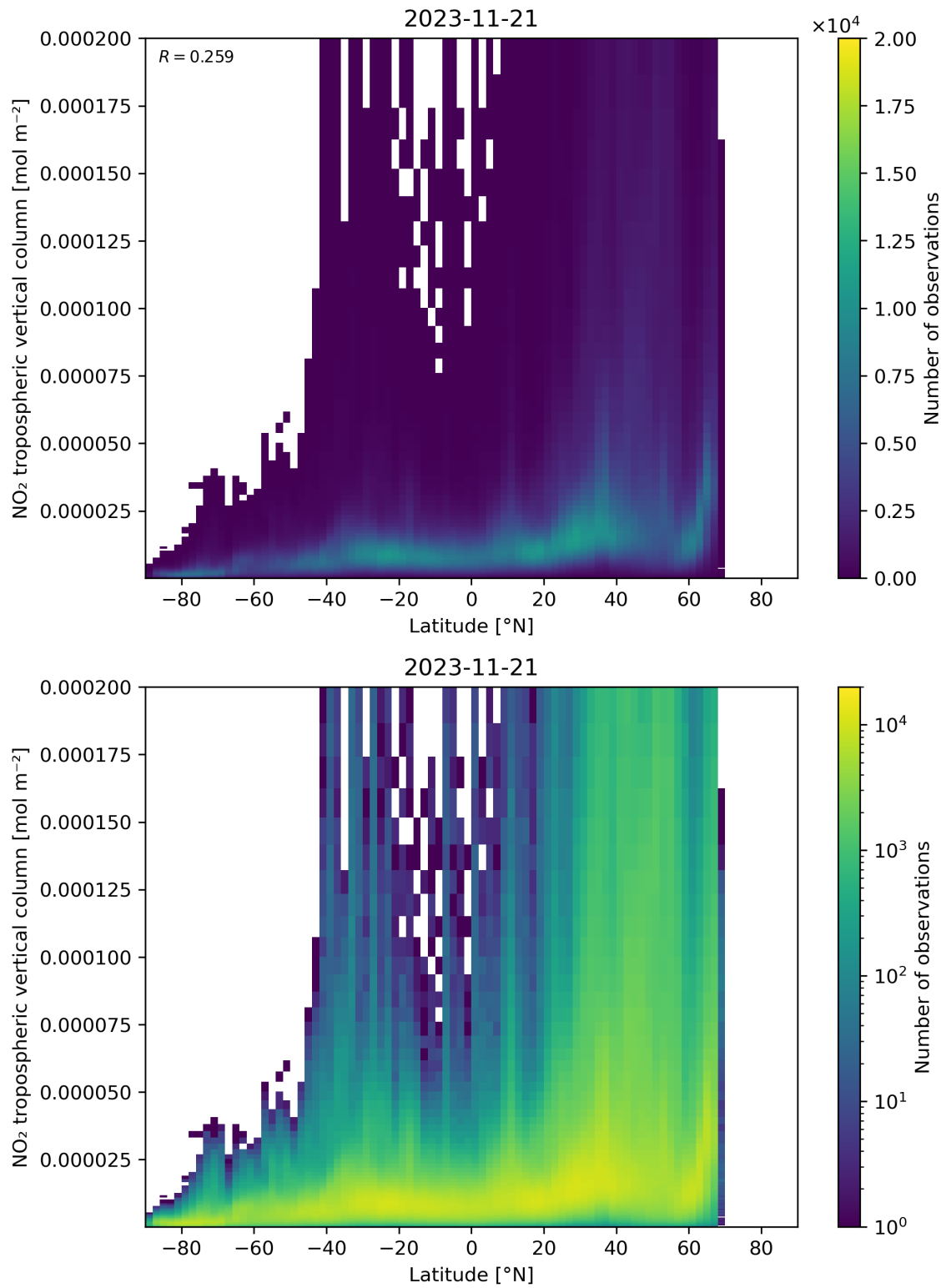


Figure 92: Scatter density plot of “Latitude” against “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.

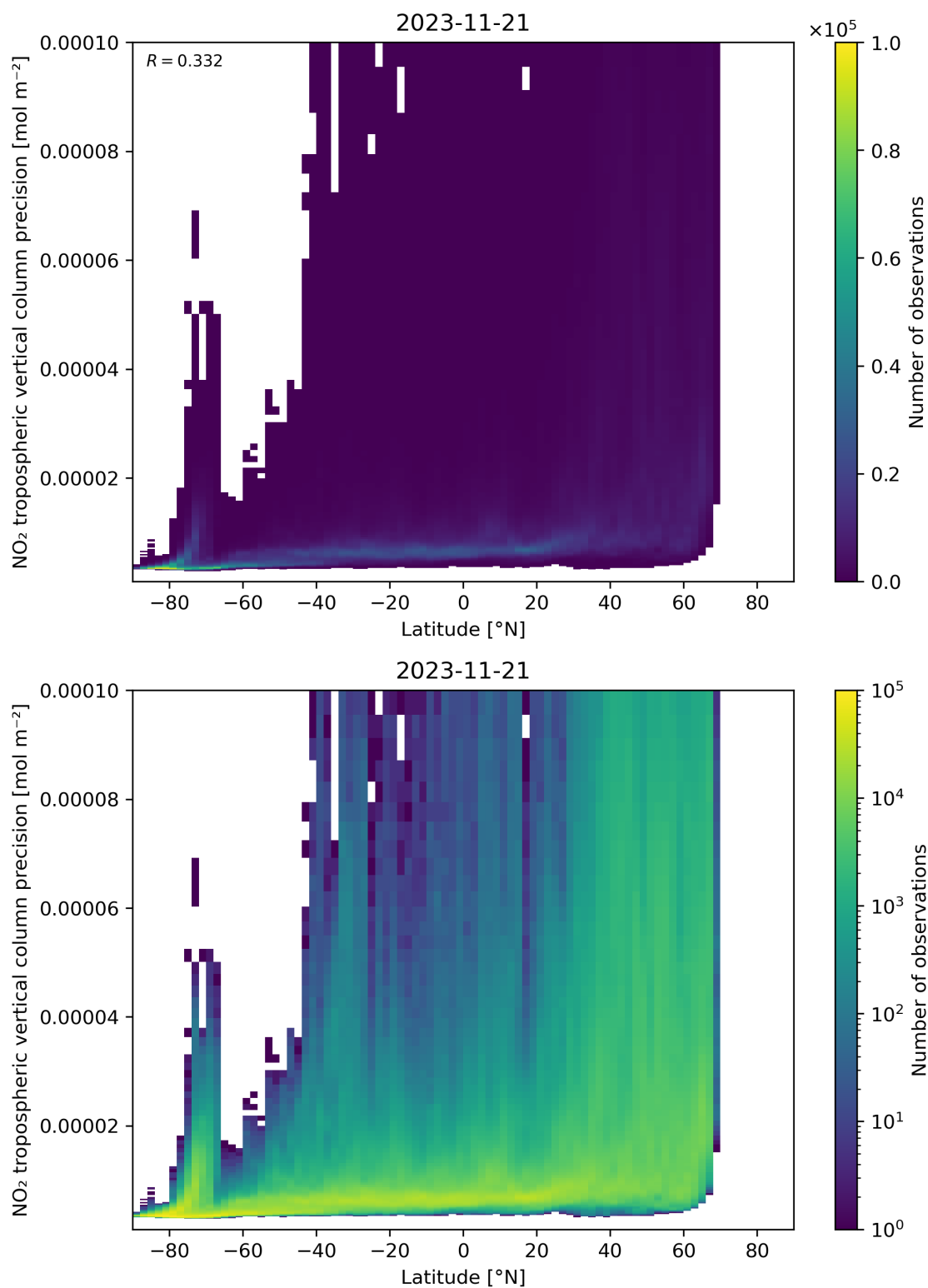


Figure 93: Scatter density plot of “Latitude” against “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.

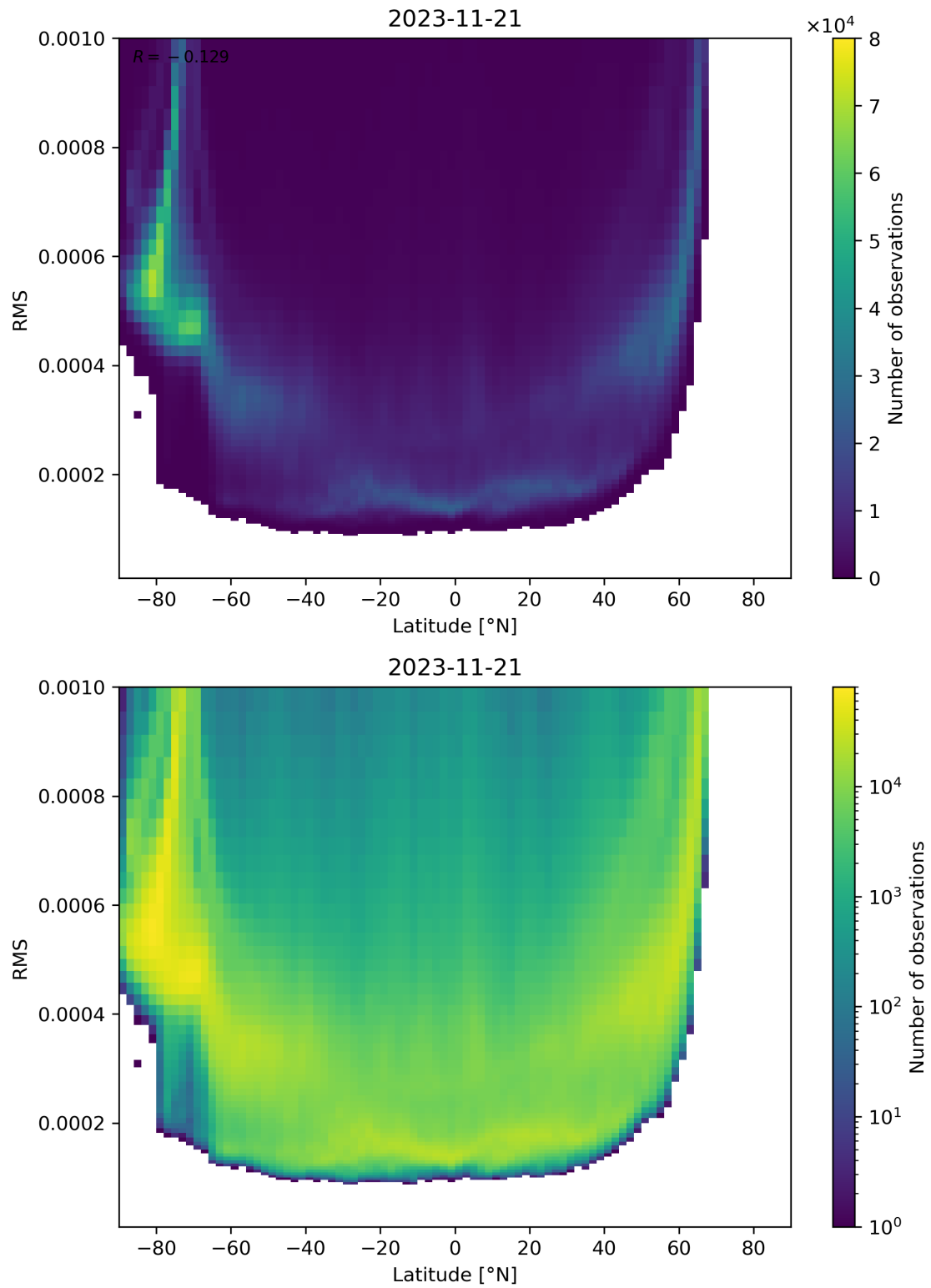


Figure 94: Scatter density plot of “Latitude” against “RMS” for 2023-11-20 to 2023-11-22.

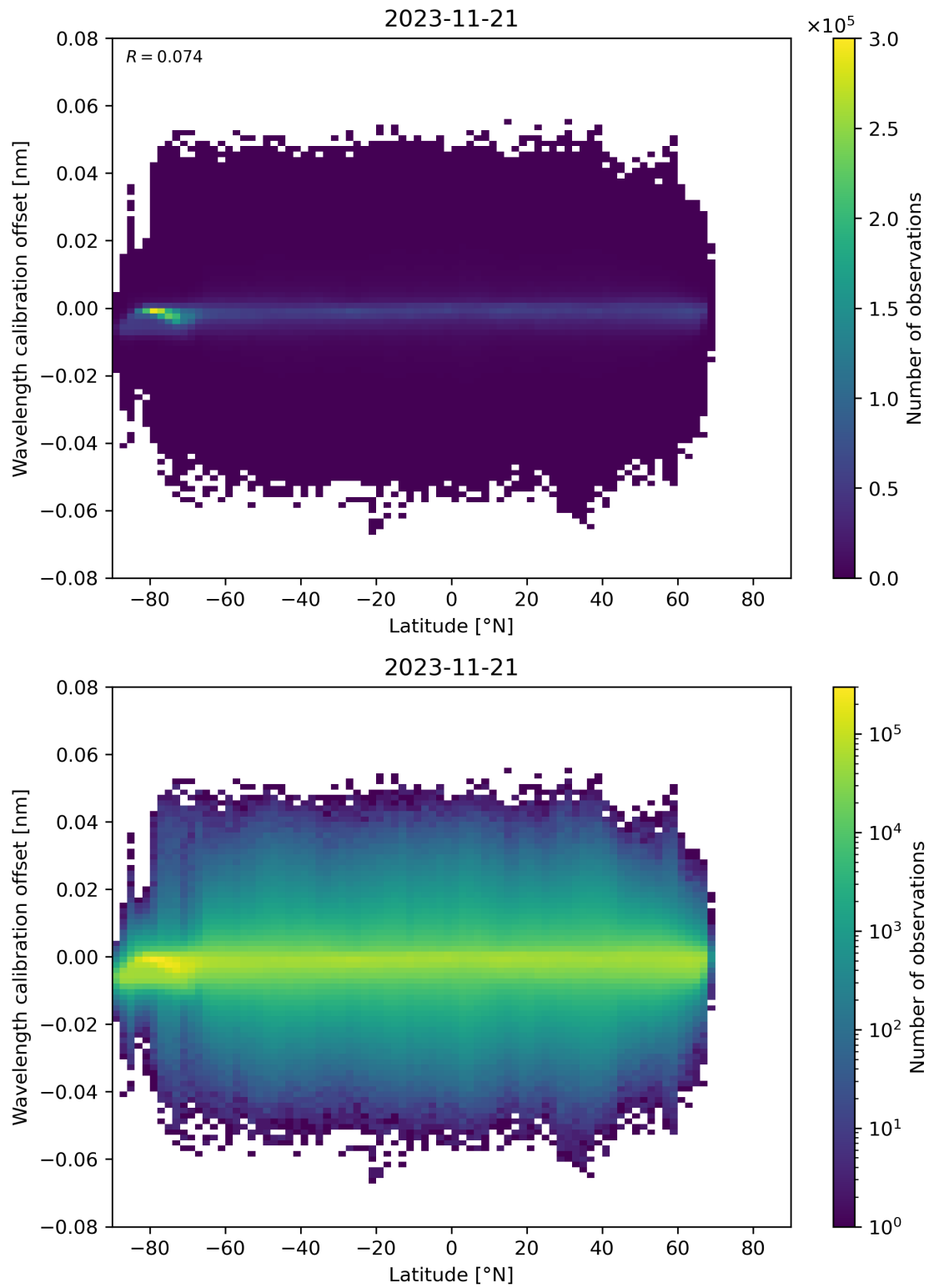


Figure 95: Scatter density plot of “Latitude” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

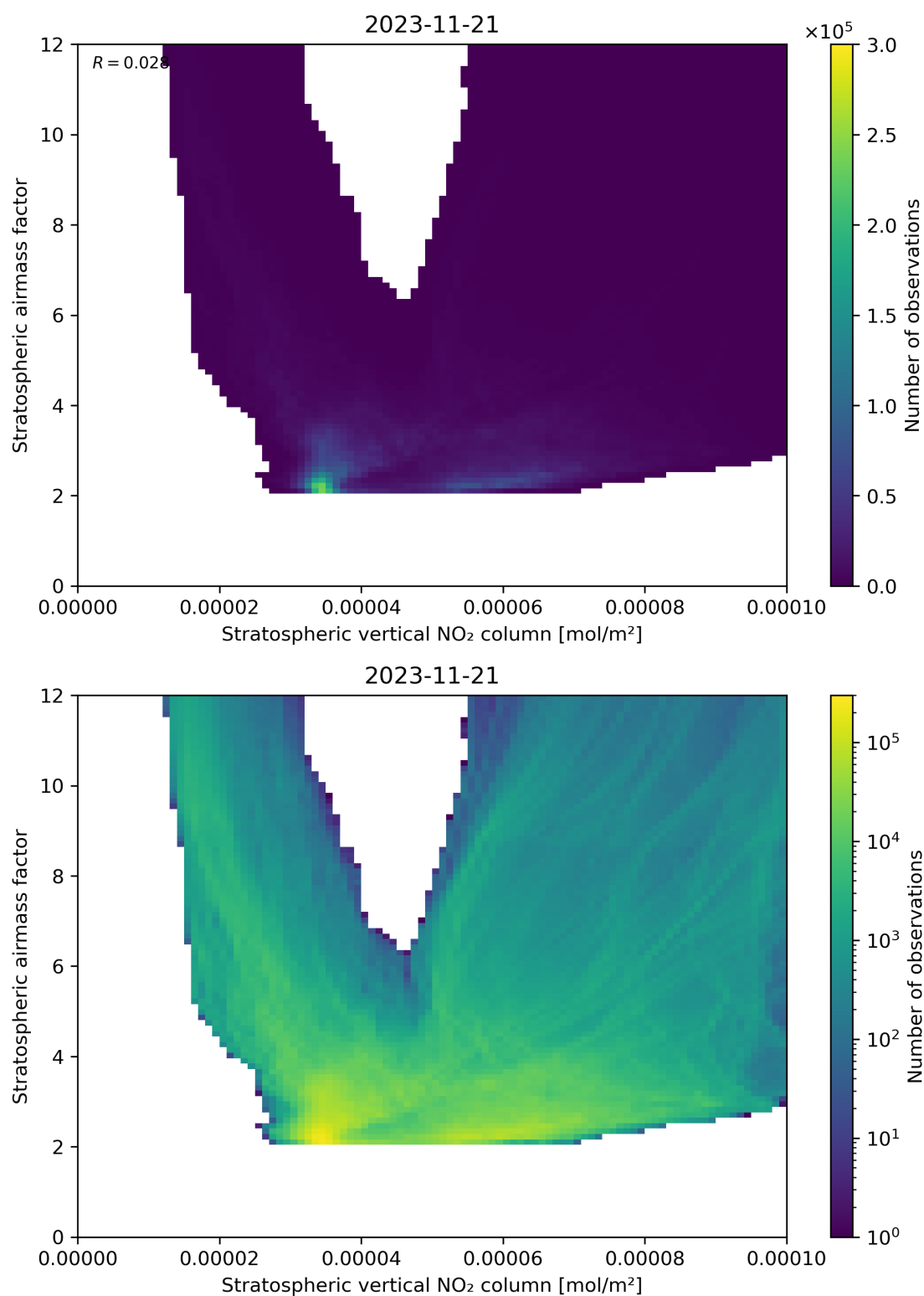


Figure 96: Scatter density plot of “Stratospheric vertical NO₂ column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

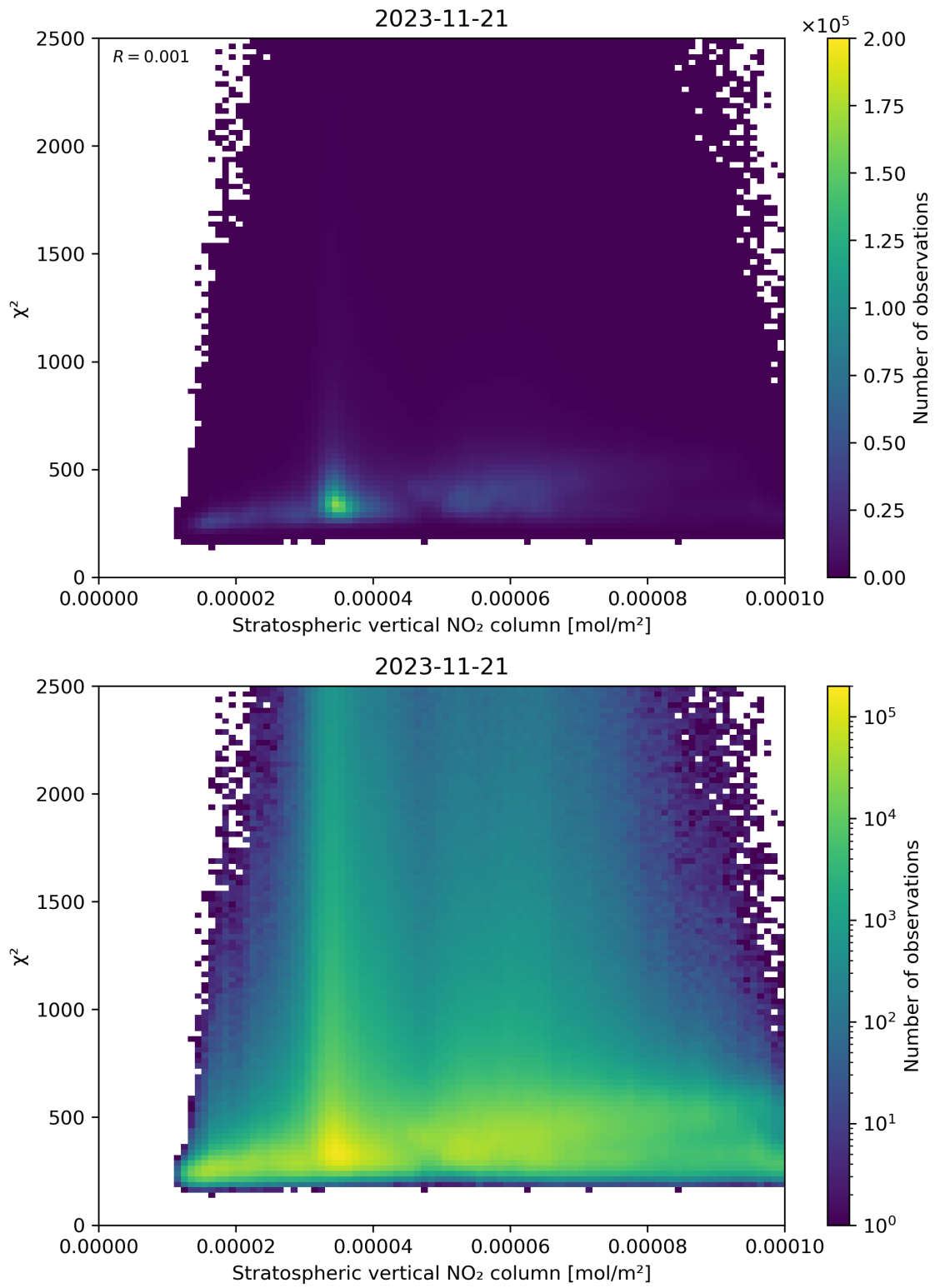


Figure 97: Scatter density plot of “Stratospheric vertical NO₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

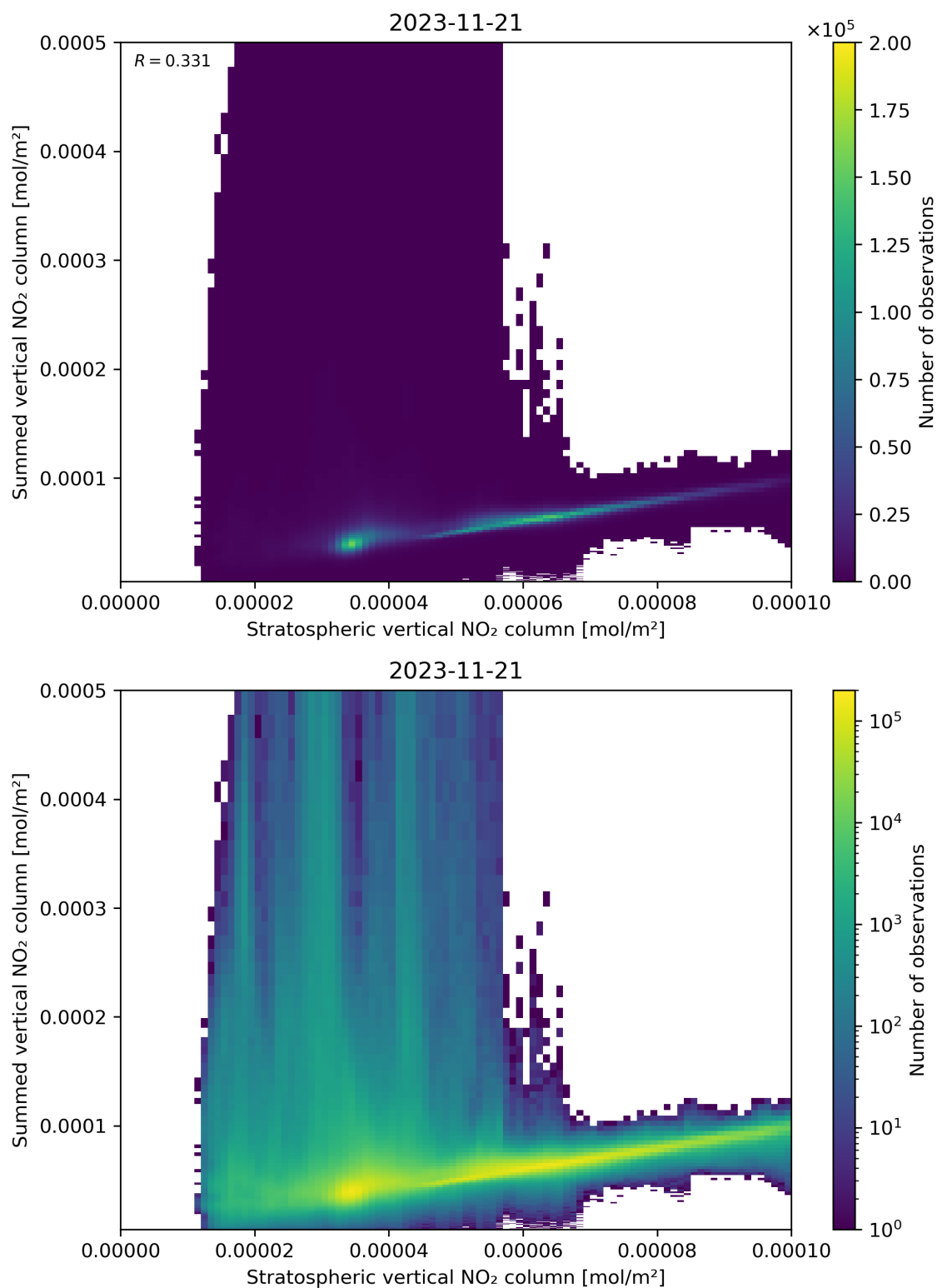


Figure 98: Scatter density plot of “Stratospheric vertical NO₂ column” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

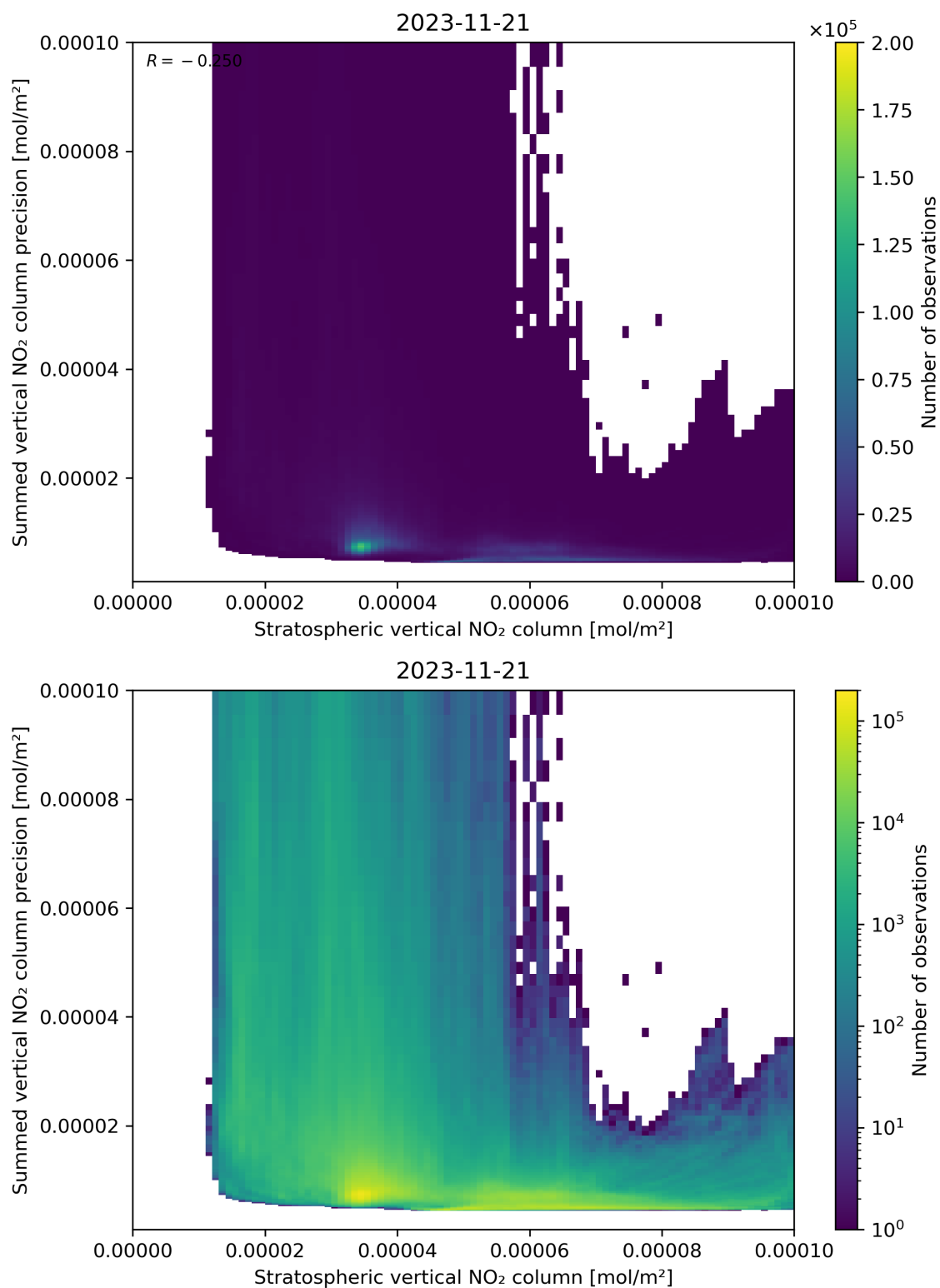


Figure 99: Scatter density plot of “Stratospheric vertical NO₂ column” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

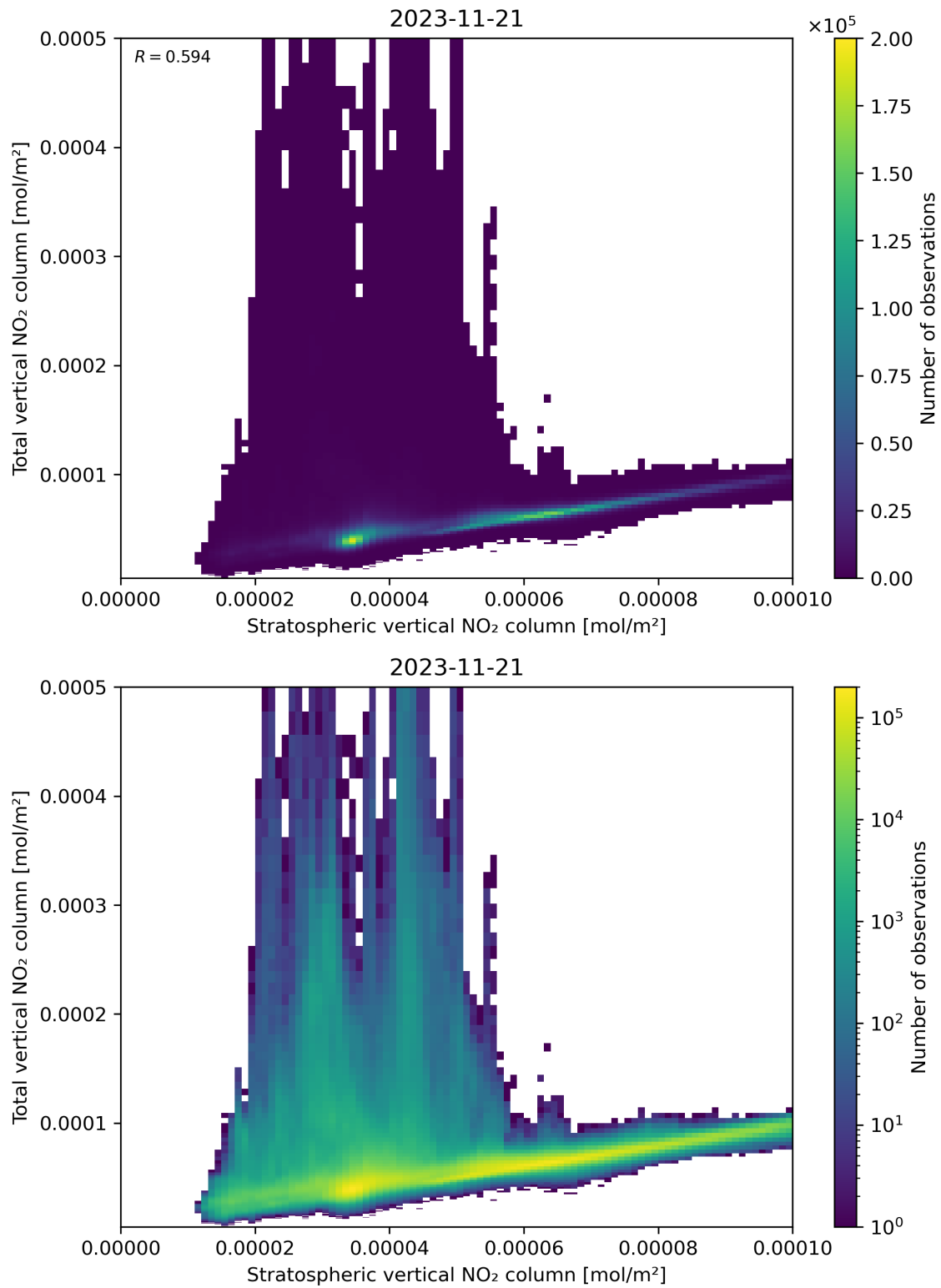


Figure 100: Scatter density plot of “Stratospheric vertical NO₂ column” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

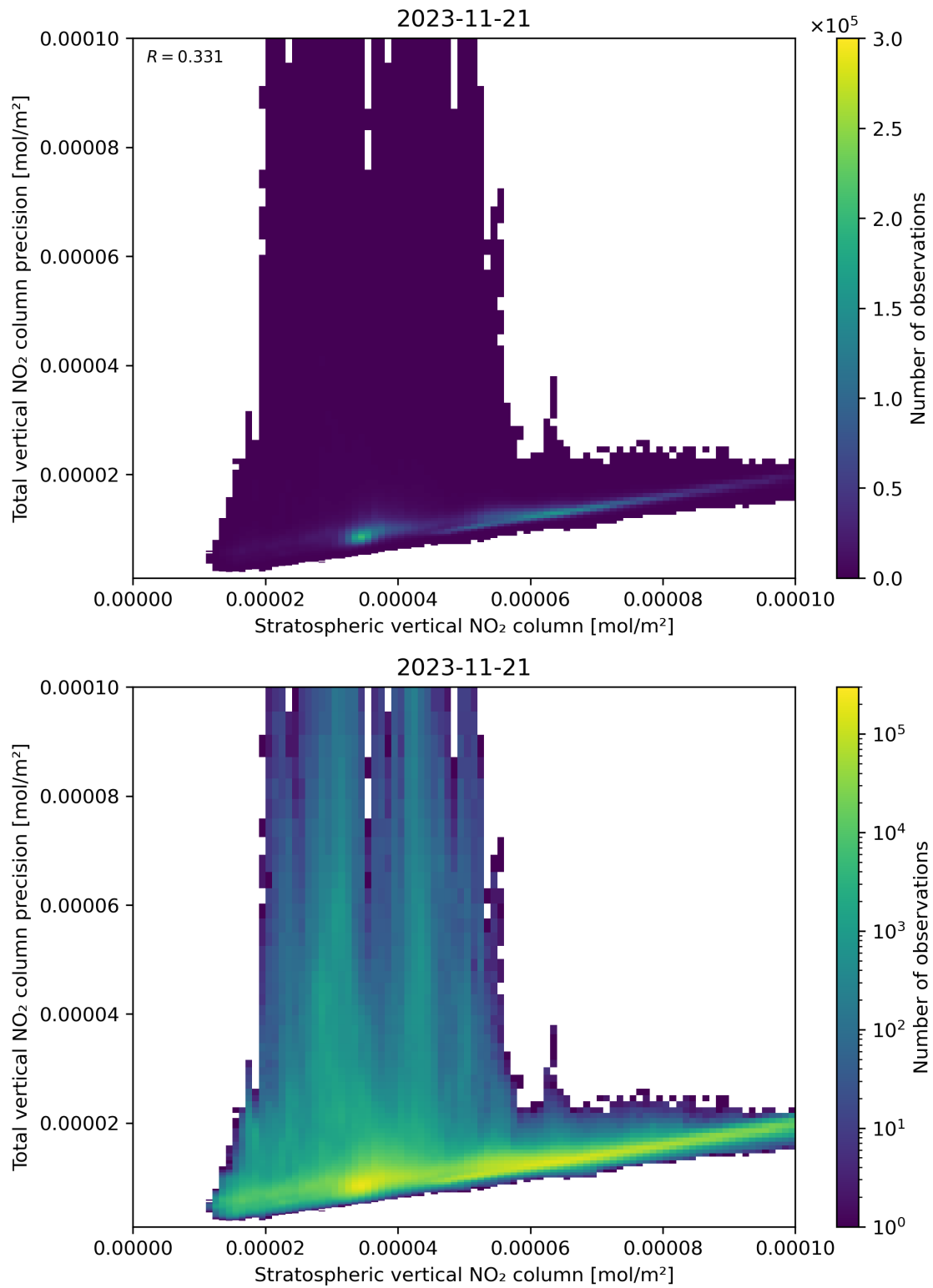


Figure 101: Scatter density plot of “Stratospheric vertical NO₂ column” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

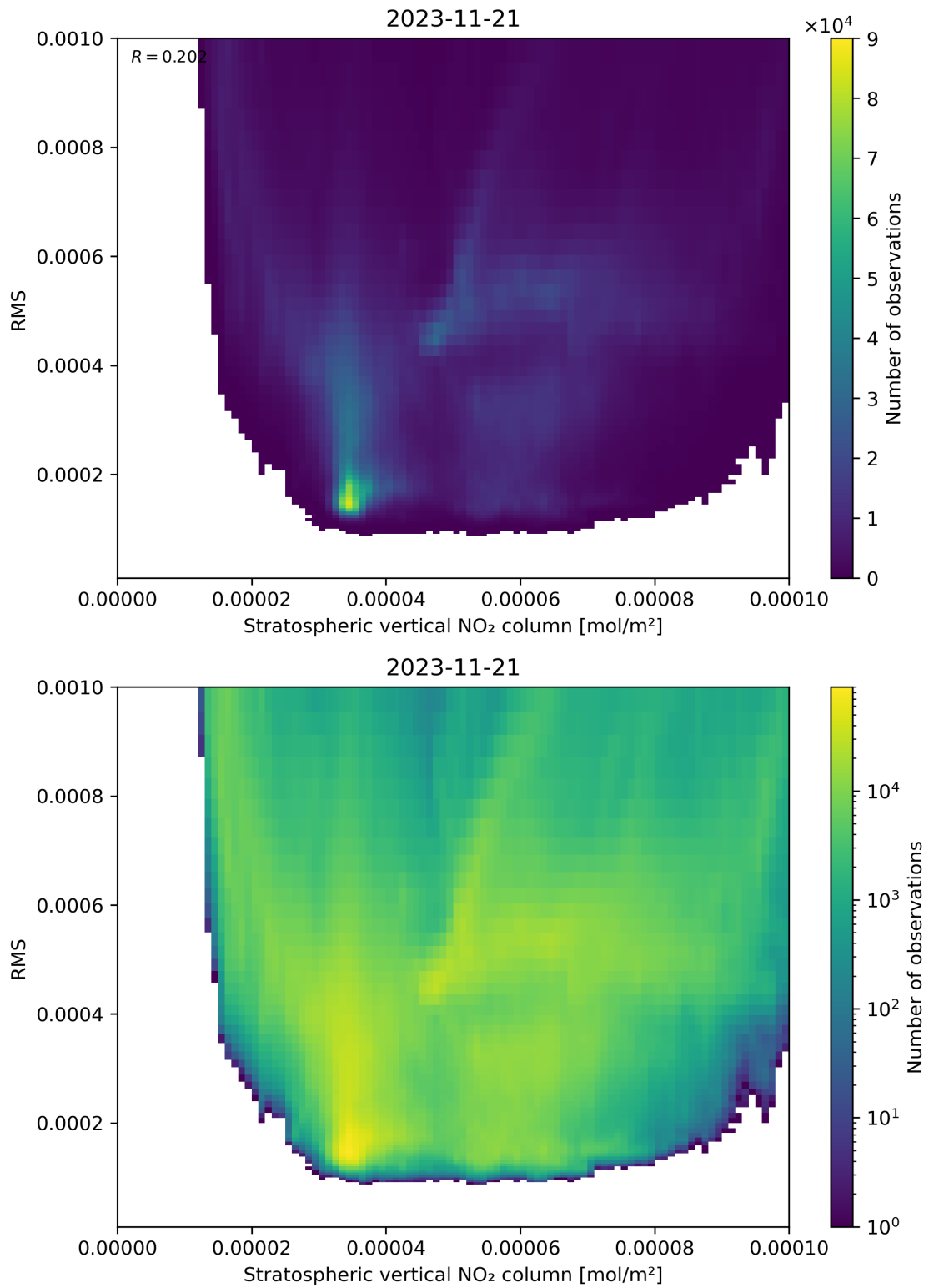


Figure 102: Scatter density plot of “Stratospheric vertical NO₂ column” against “RMS” for 2023-11-20 to 2023-11-22.

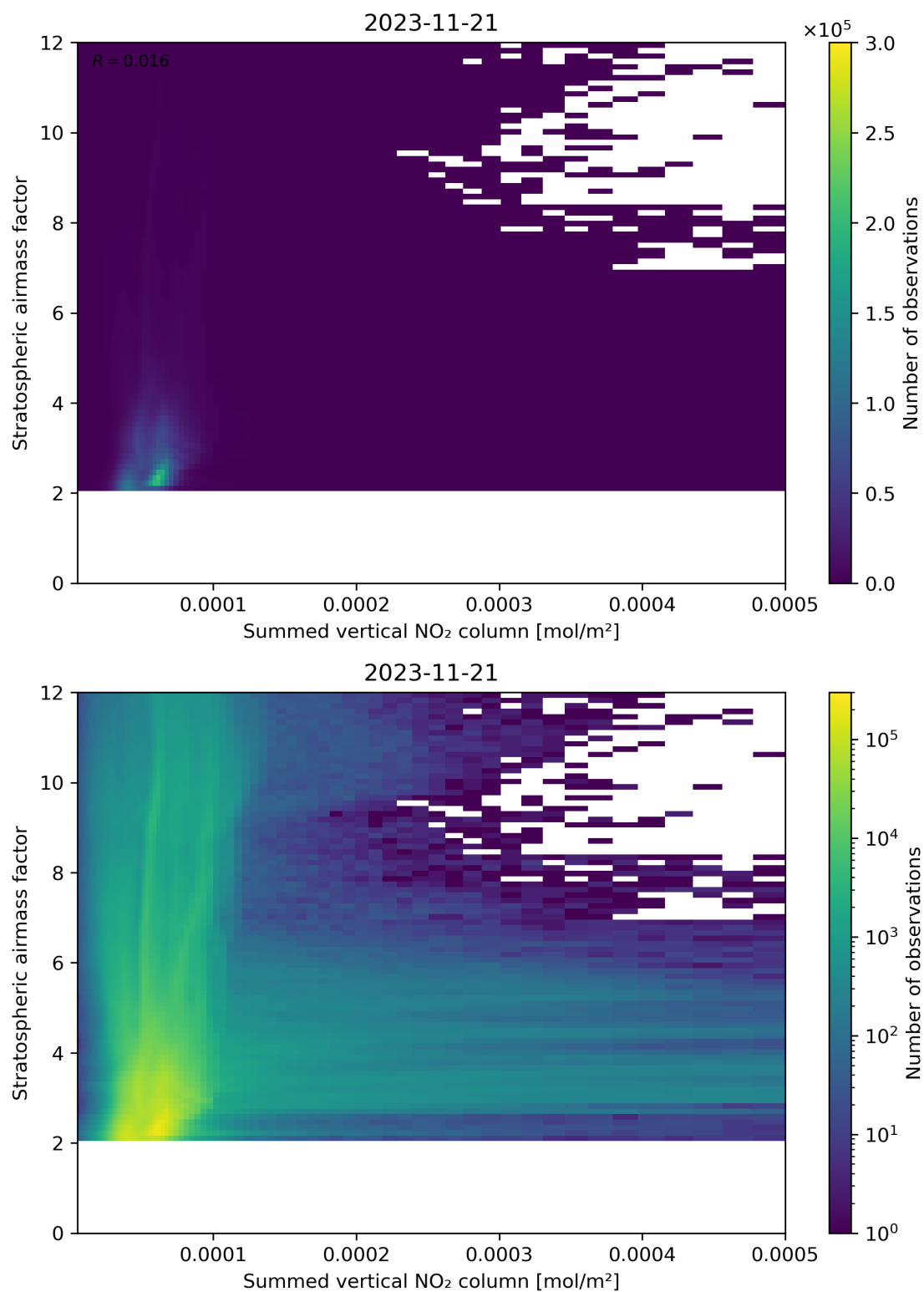


Figure 103: Scatter density plot of “Summed vertical NO₂ column” against “Stratospheric air mass factor” for 2023-11-20 to 2023-11-22.

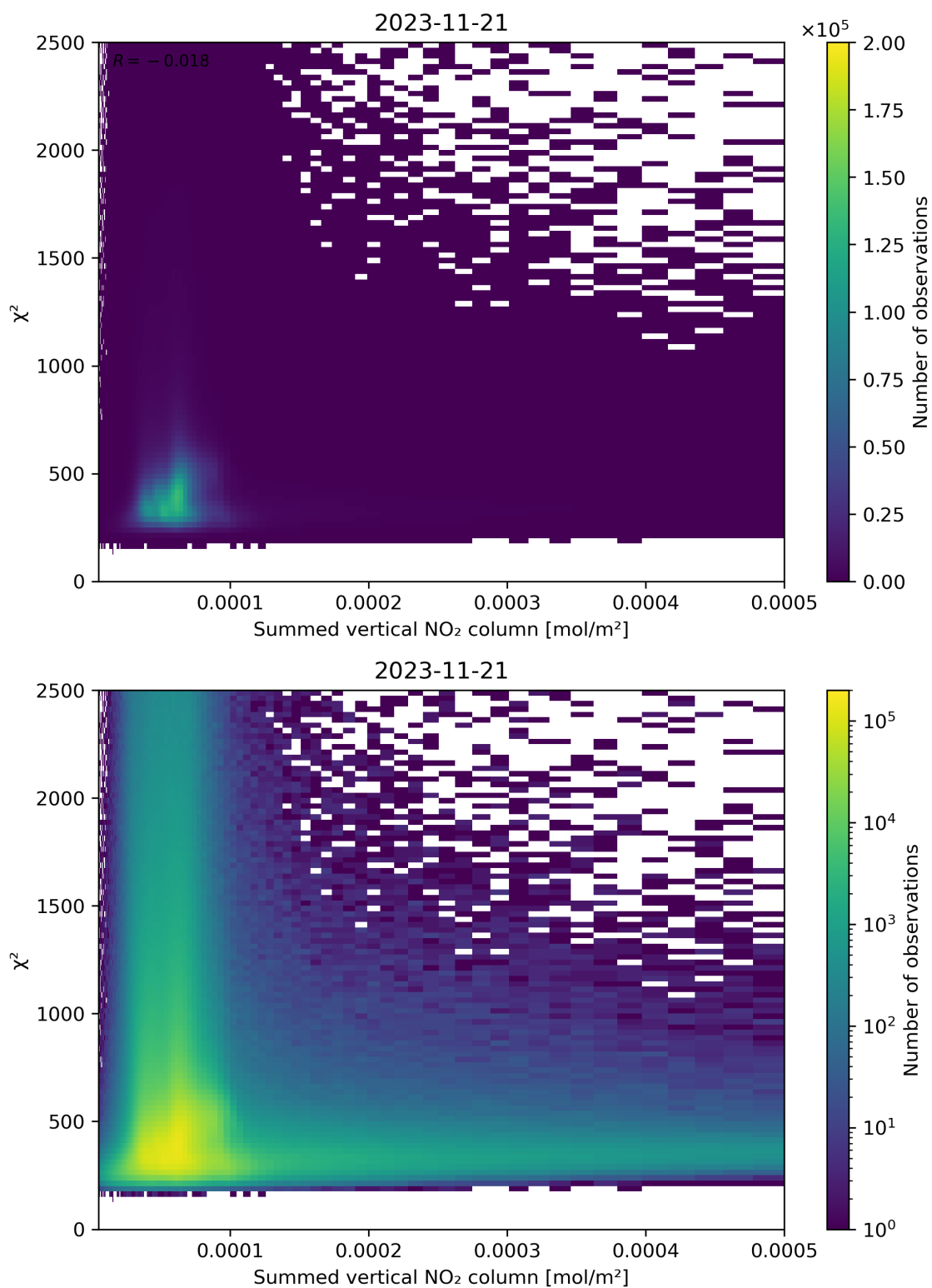


Figure 104: Scatter density plot of “Summed vertical NO₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

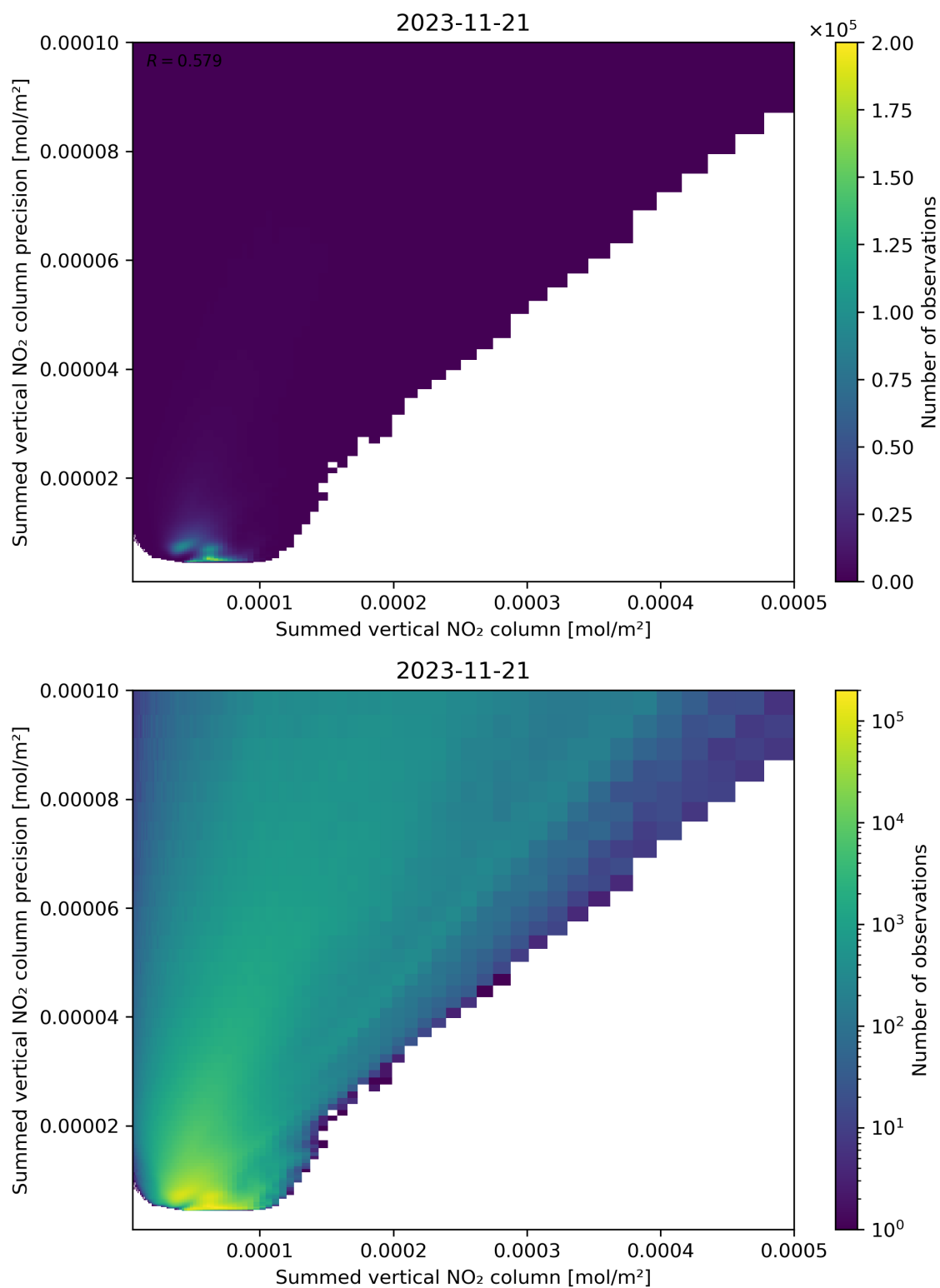


Figure 105: Scatter density plot of “Summed vertical NO₂ column” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

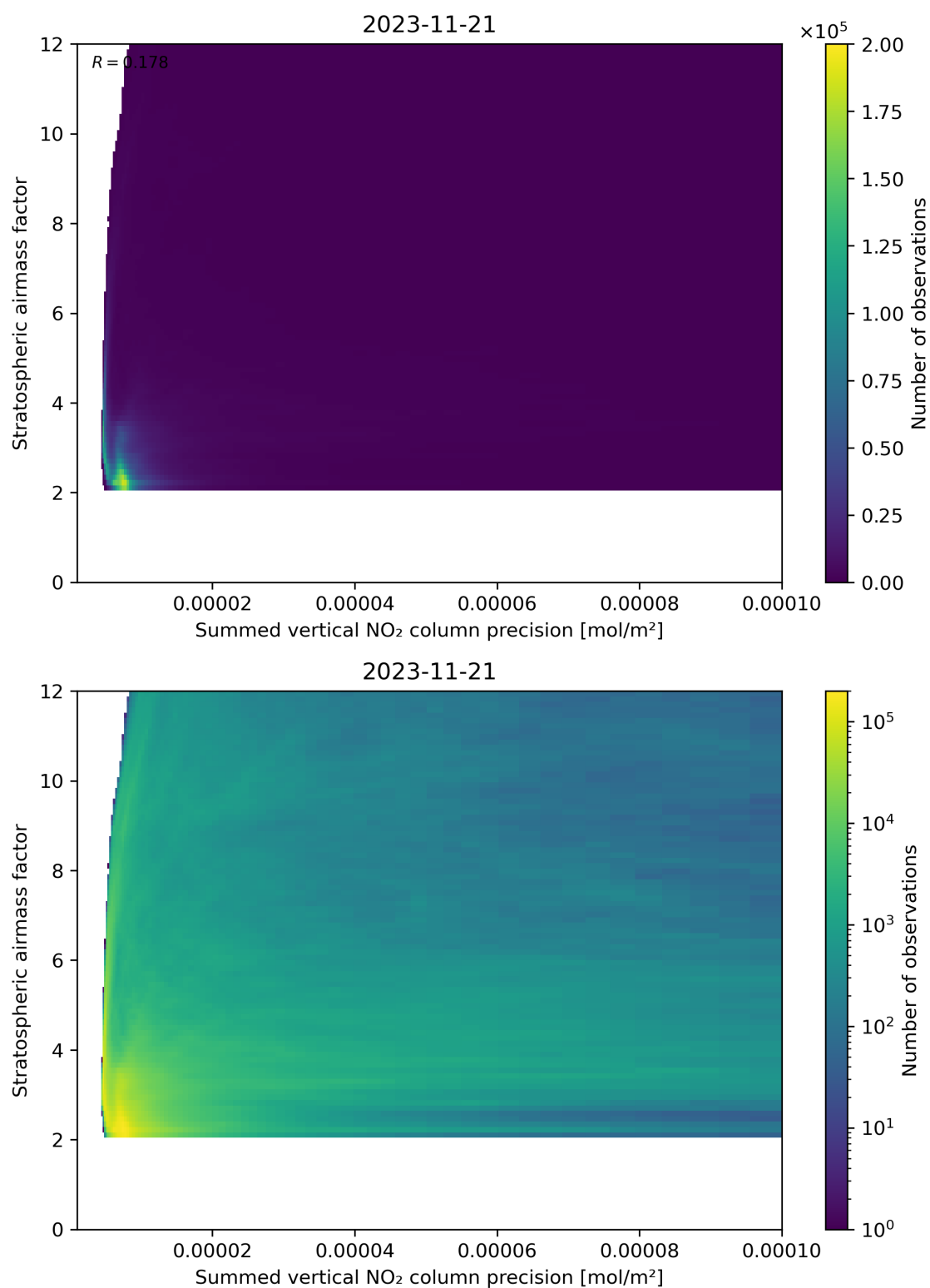


Figure 106: Scatter density plot of “Summed vertical NO₂ column precision” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

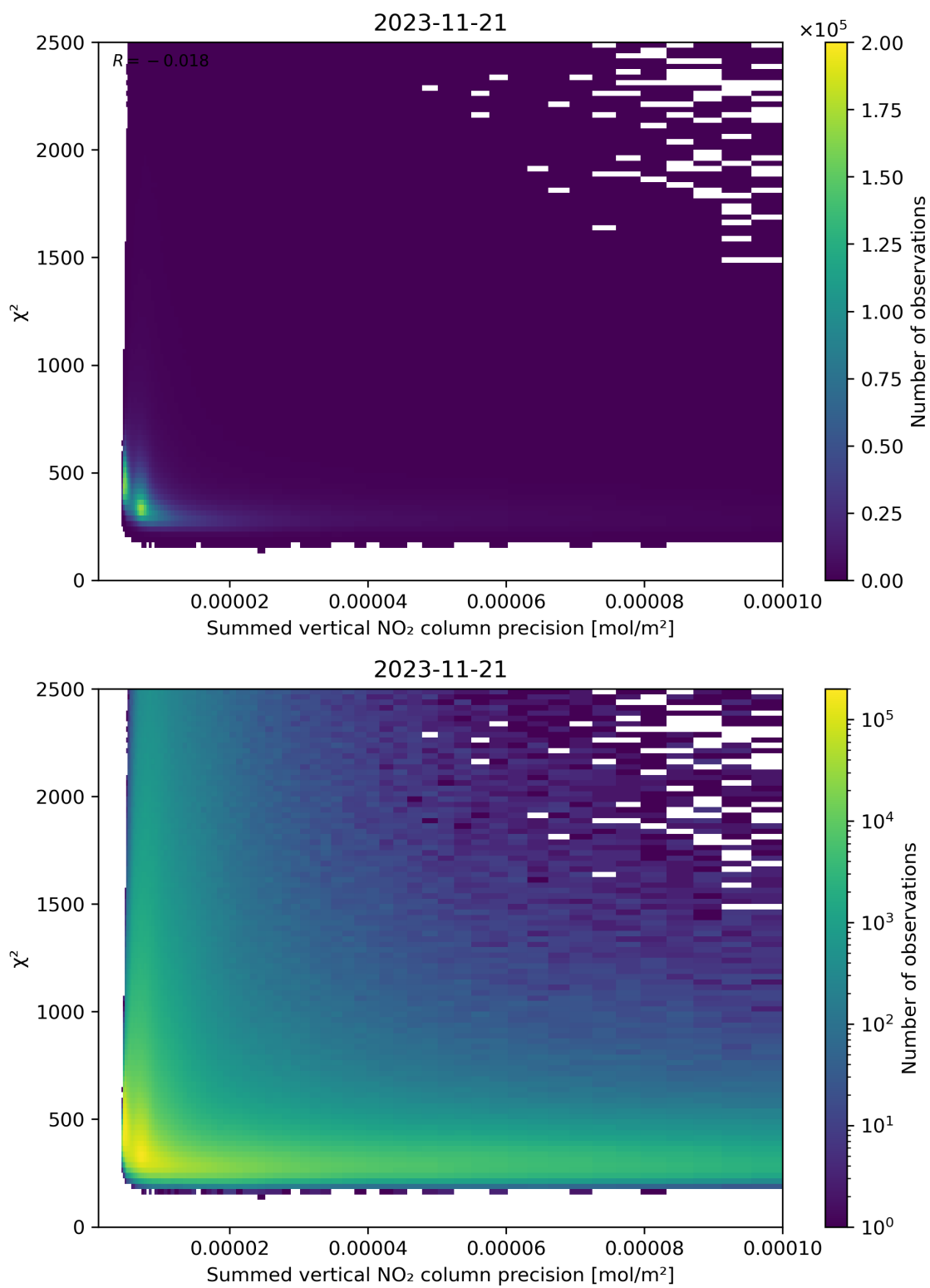


Figure 107: Scatter density plot of “Summed vertical NO₂ column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

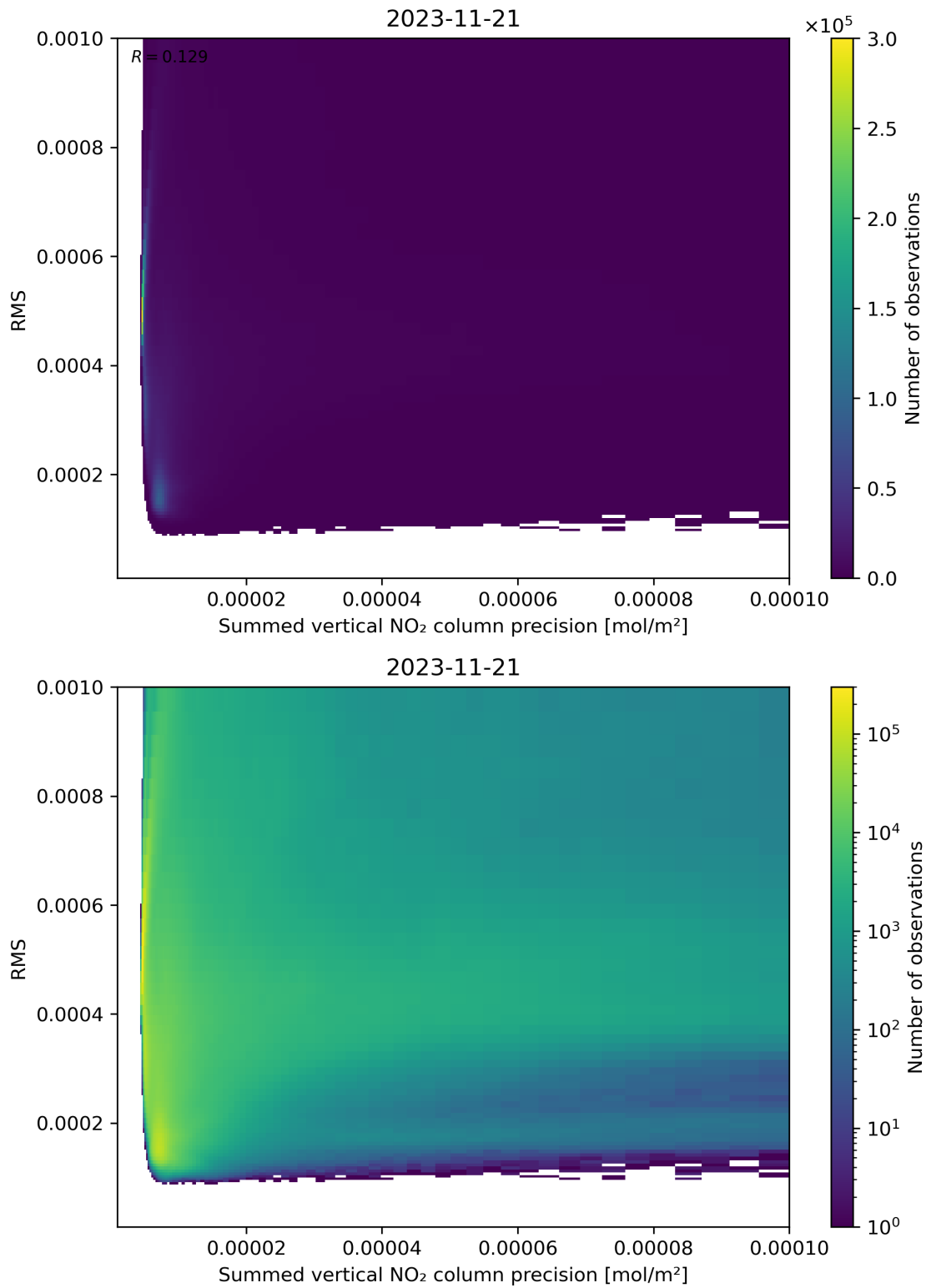


Figure 108: Scatter density plot of “Summed vertical NO₂ column precision” against “RMS” for 2023-11-20 to 2023-11-22.

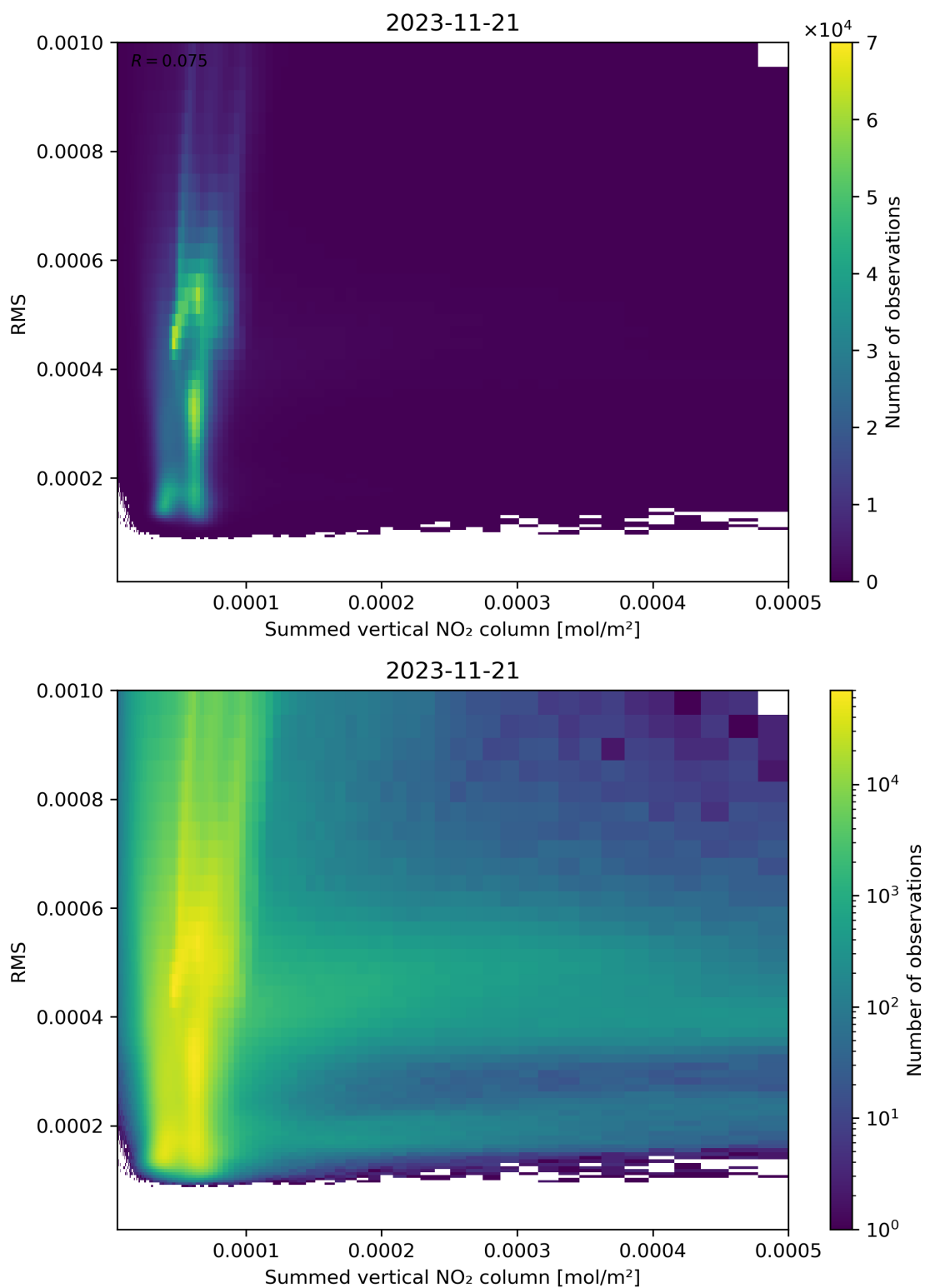


Figure 109: Scatter density plot of “Summed vertical NO₂ column” against “RMS” for 2023-11-20 to 2023-11-22.

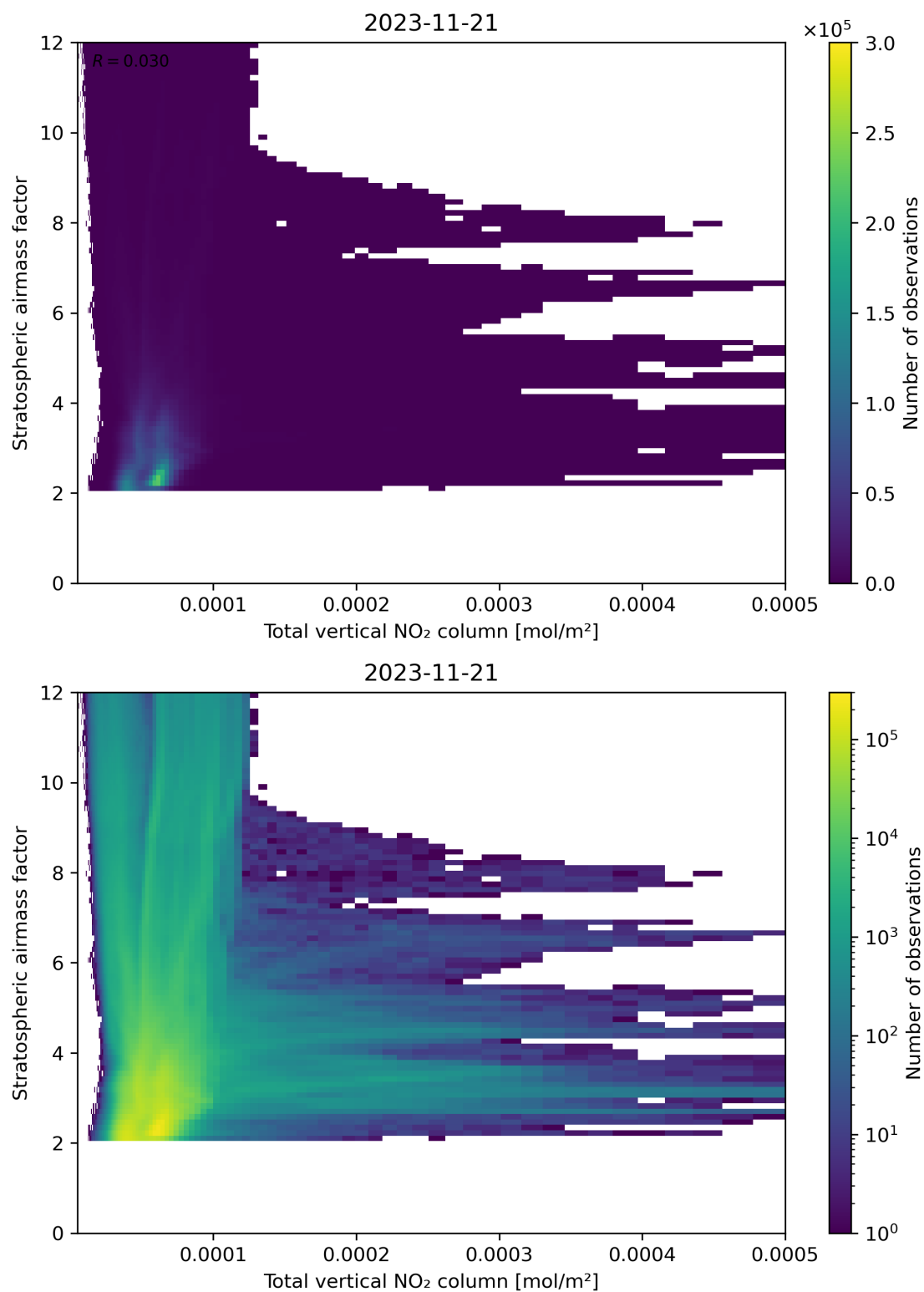


Figure 110: Scatter density plot of “Total vertical NO₂ column” against “Stratospheric air mass factor” for 2023-11-20 to 2023-11-22.

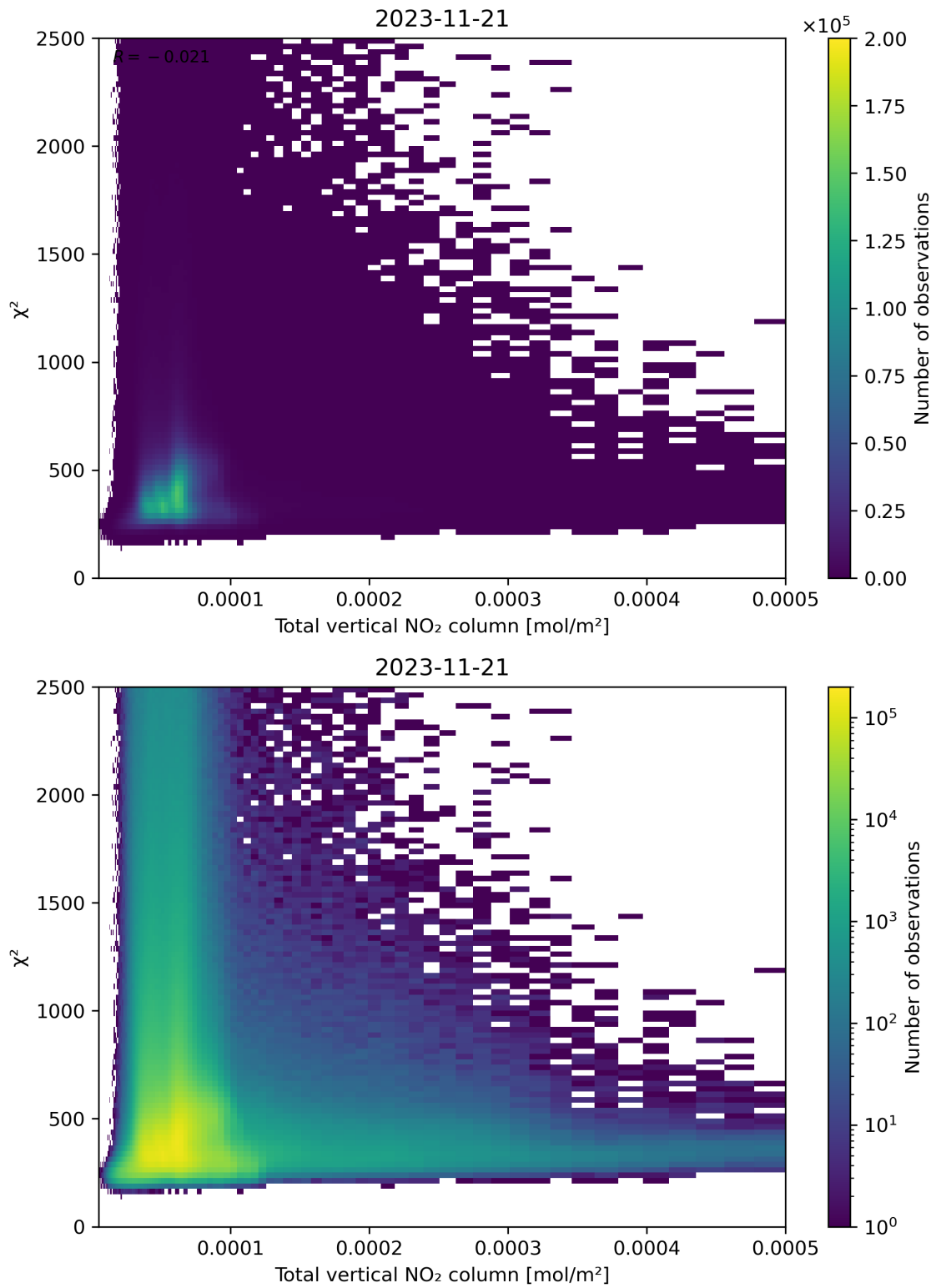


Figure 111: Scatter density plot of “Total vertical NO₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

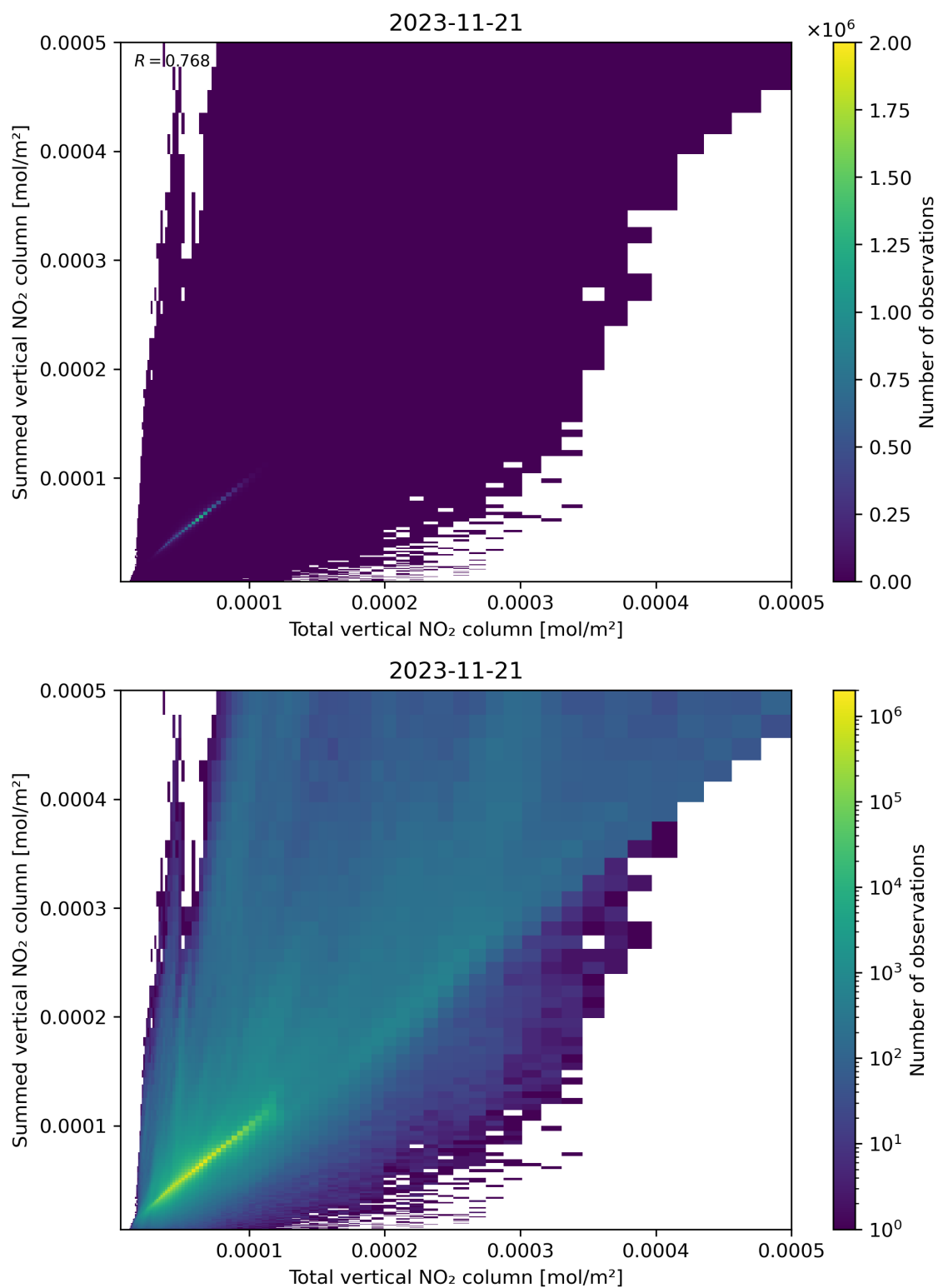


Figure 112: Scatter density plot of “Total vertical NO₂ column” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

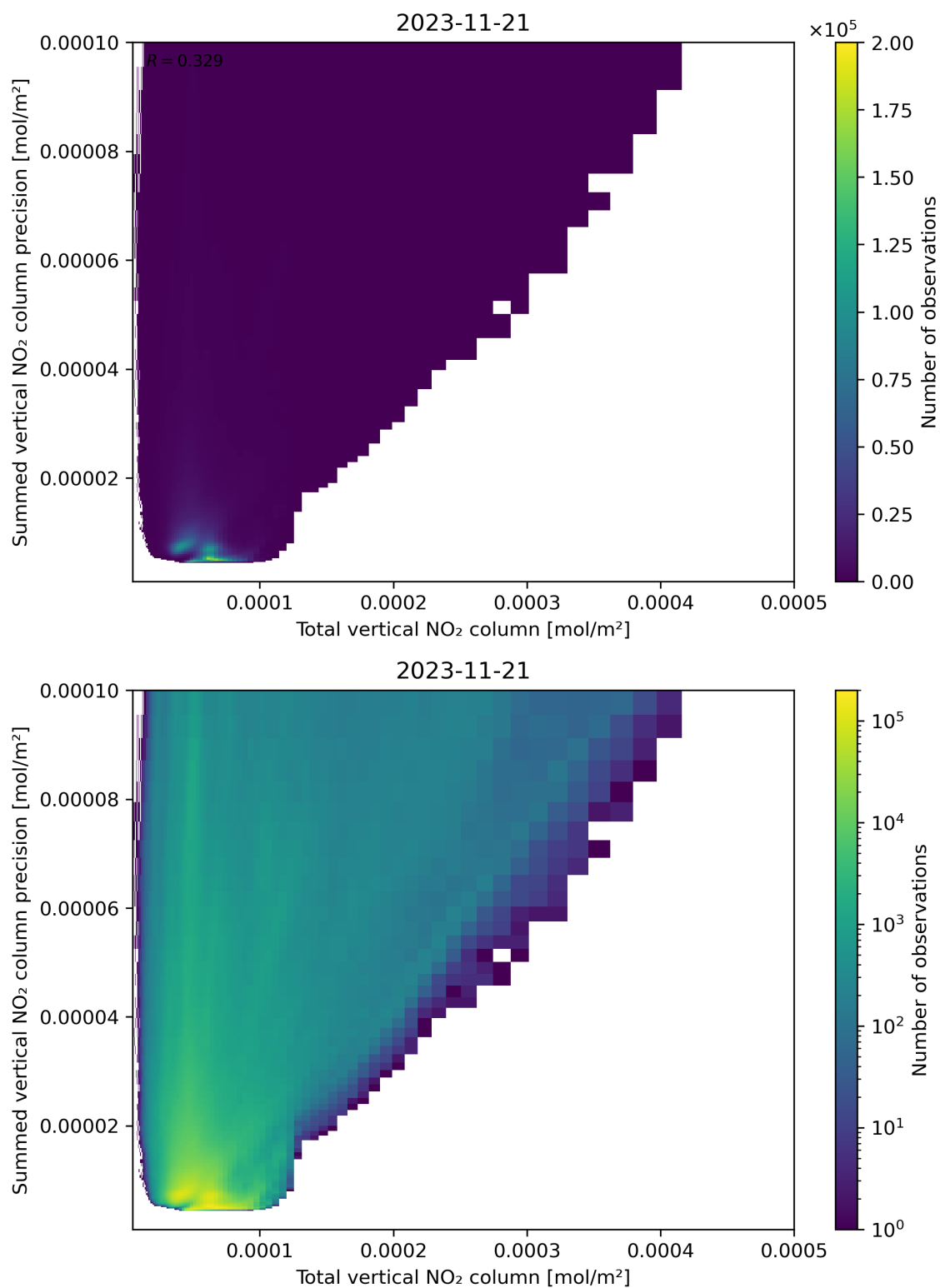


Figure 113: Scatter density plot of “Total vertical NO₂ column” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

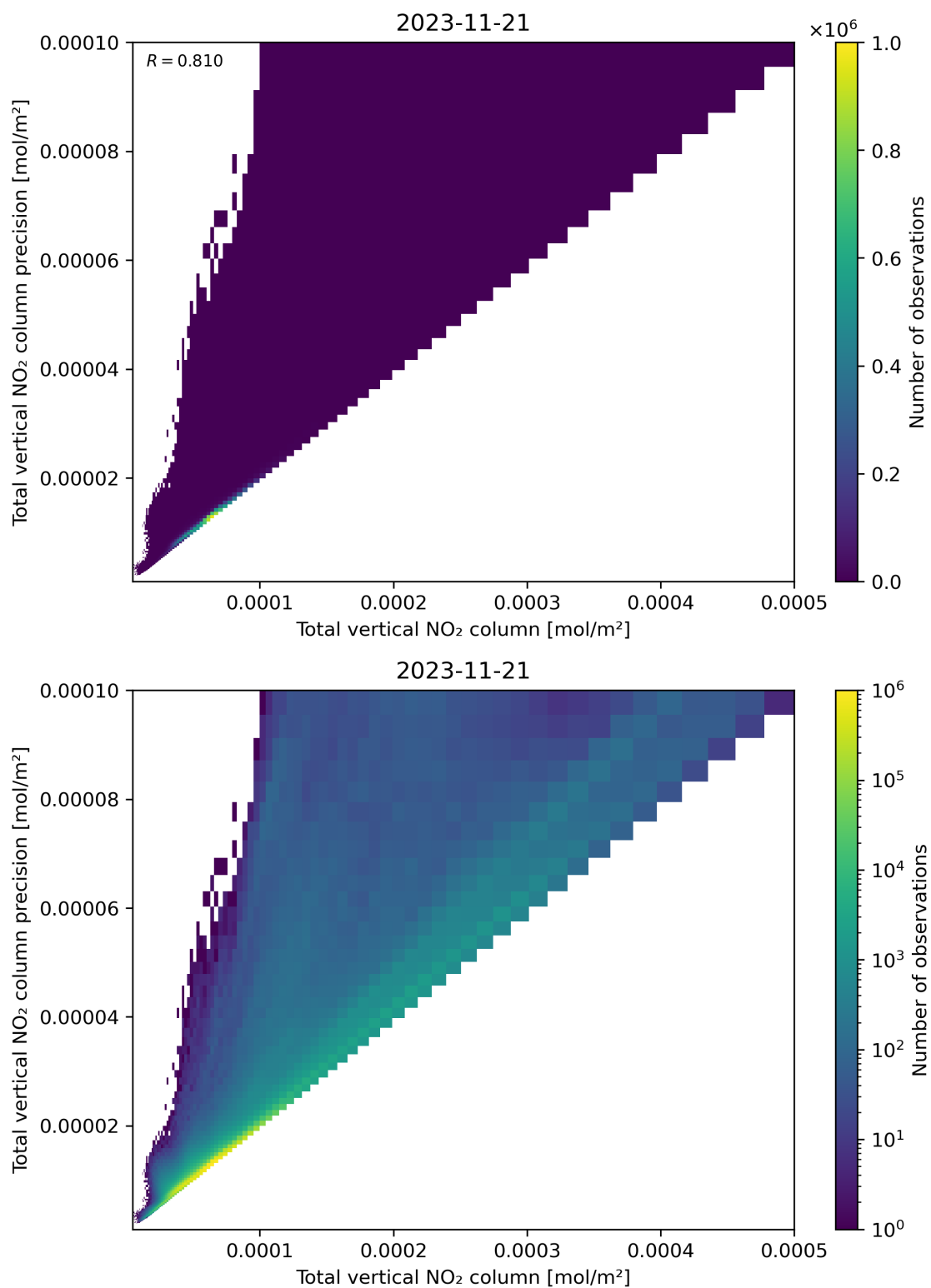


Figure 114: Scatter density plot of “Total vertical NO₂ column” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

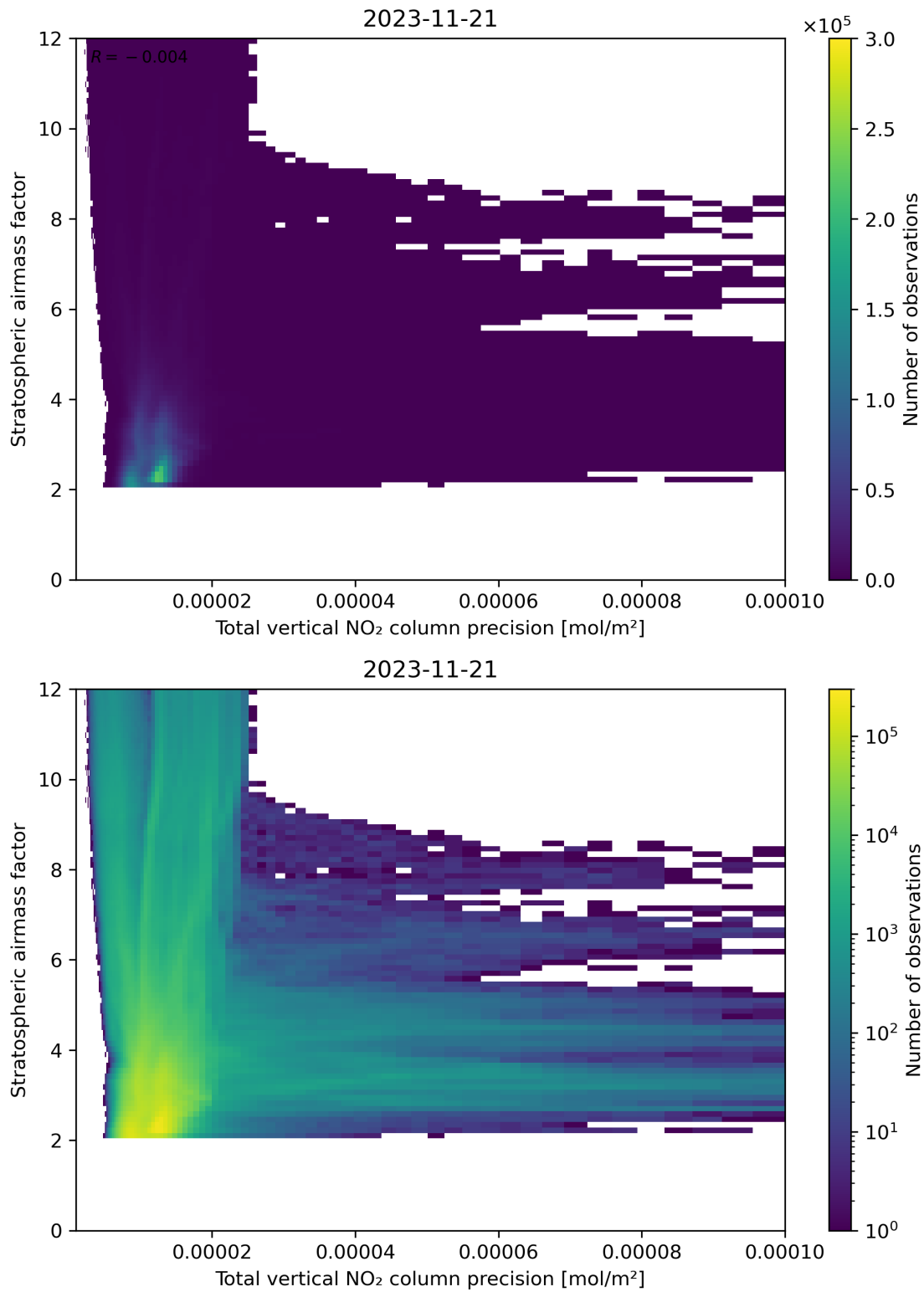


Figure 115: Scatter density plot of “Total vertical NO₂ column precision” against “Stratospheric air mass factor” for 2023-11-20 to 2023-11-22.

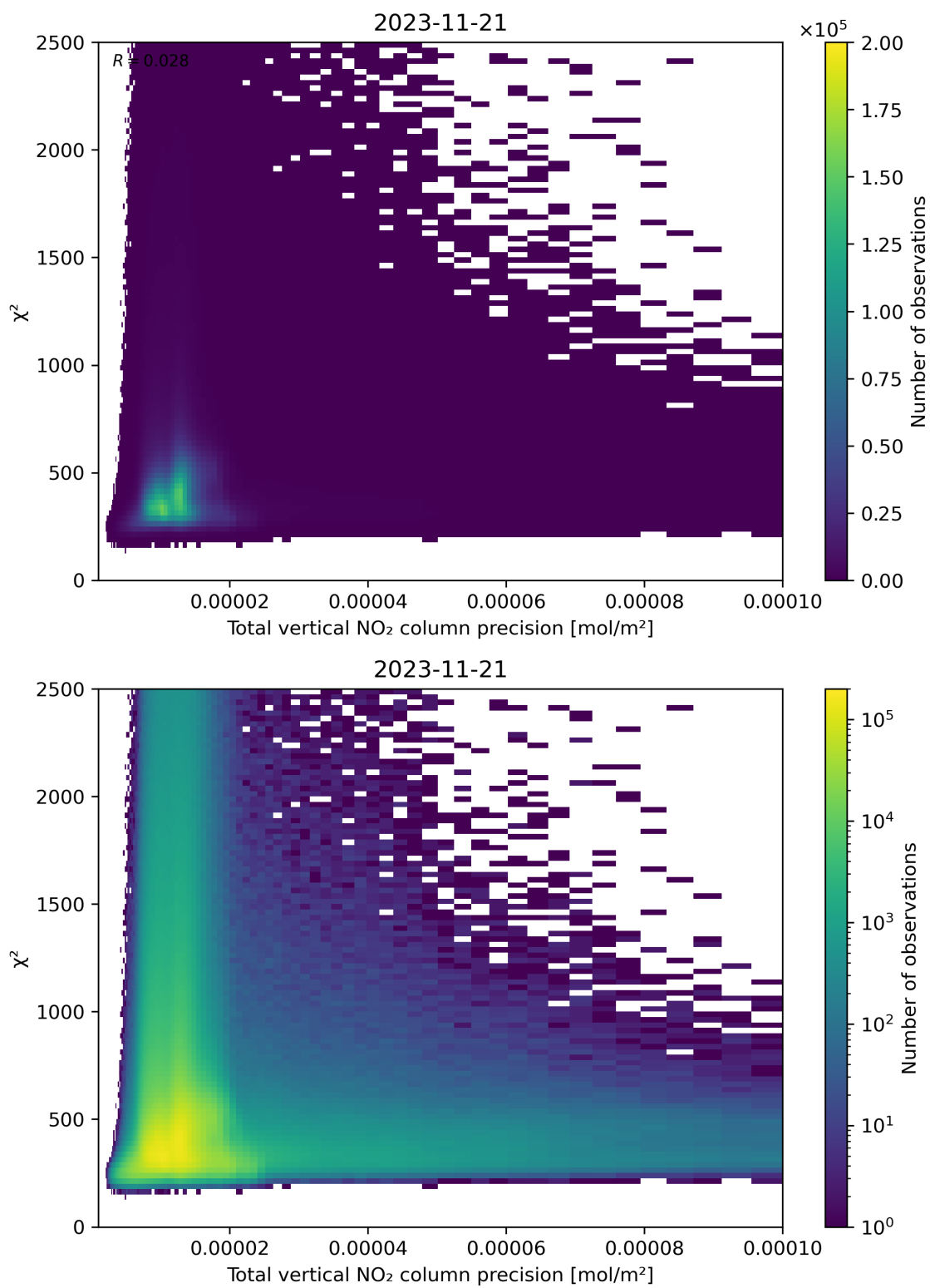


Figure 116: Scatter density plot of “Total vertical NO₂ column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

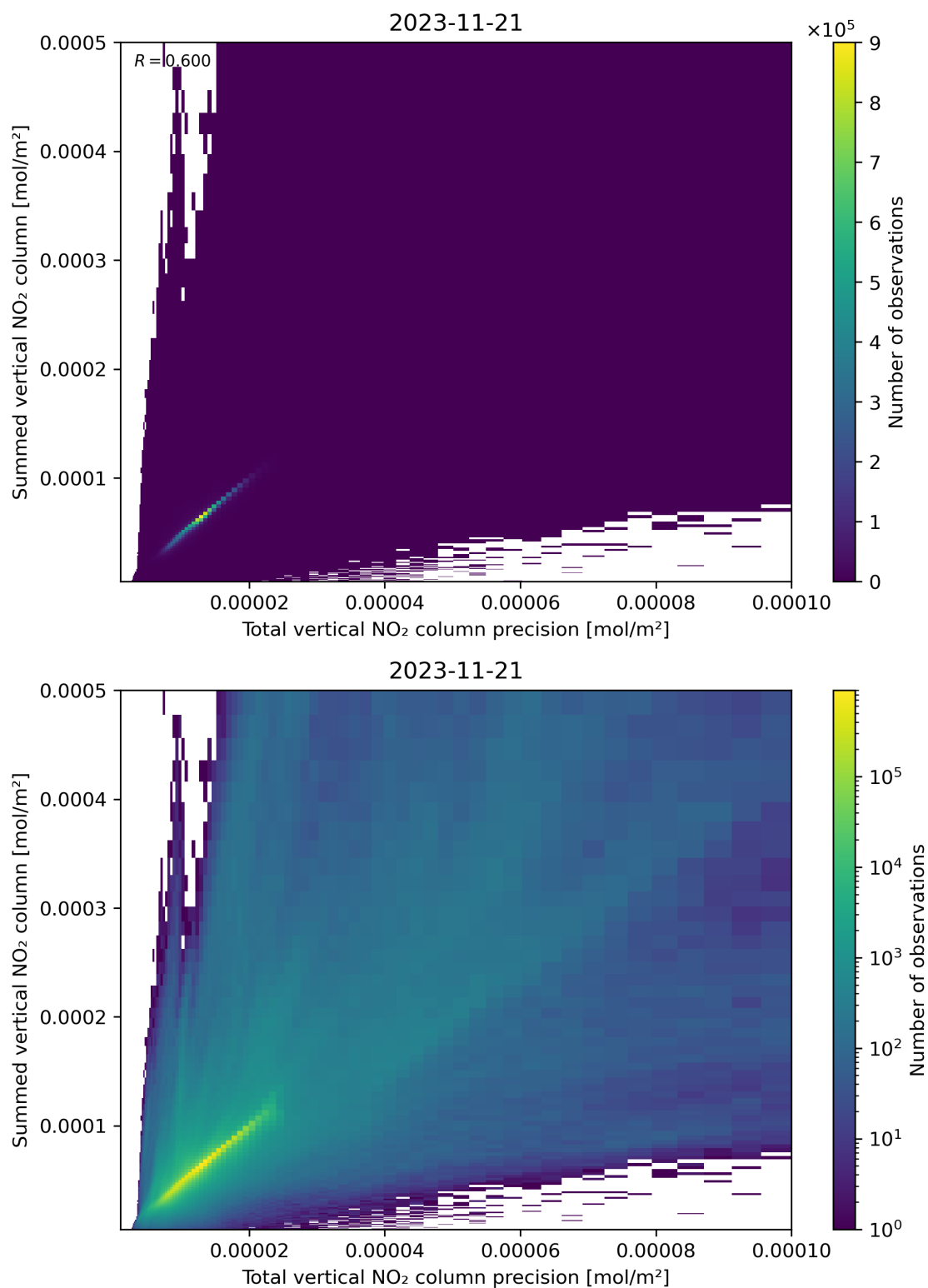


Figure 117: Scatter density plot of “Total vertical NO₂ column precision” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

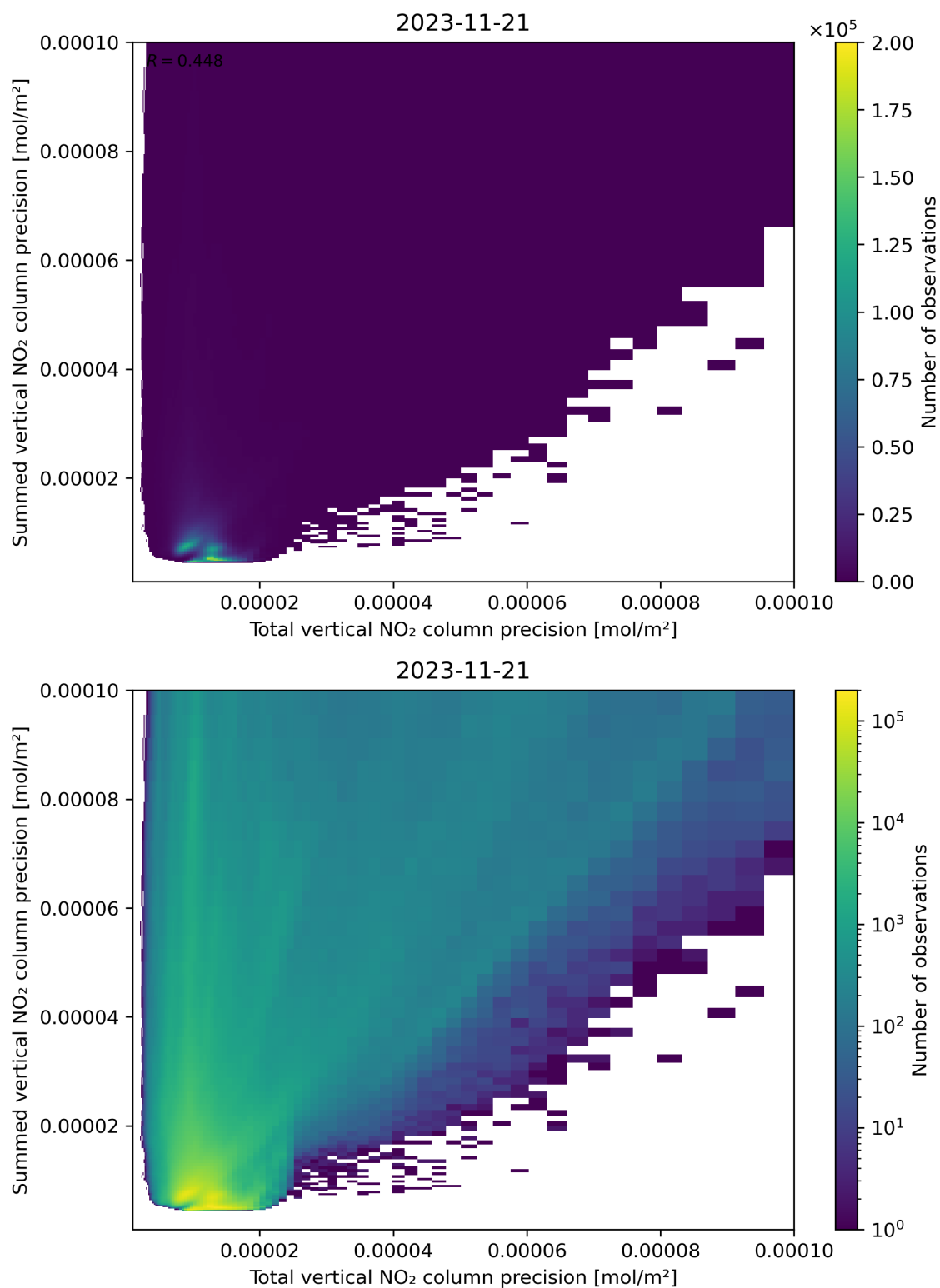


Figure 118: Scatter density plot of “Total vertical NO₂ column precision” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

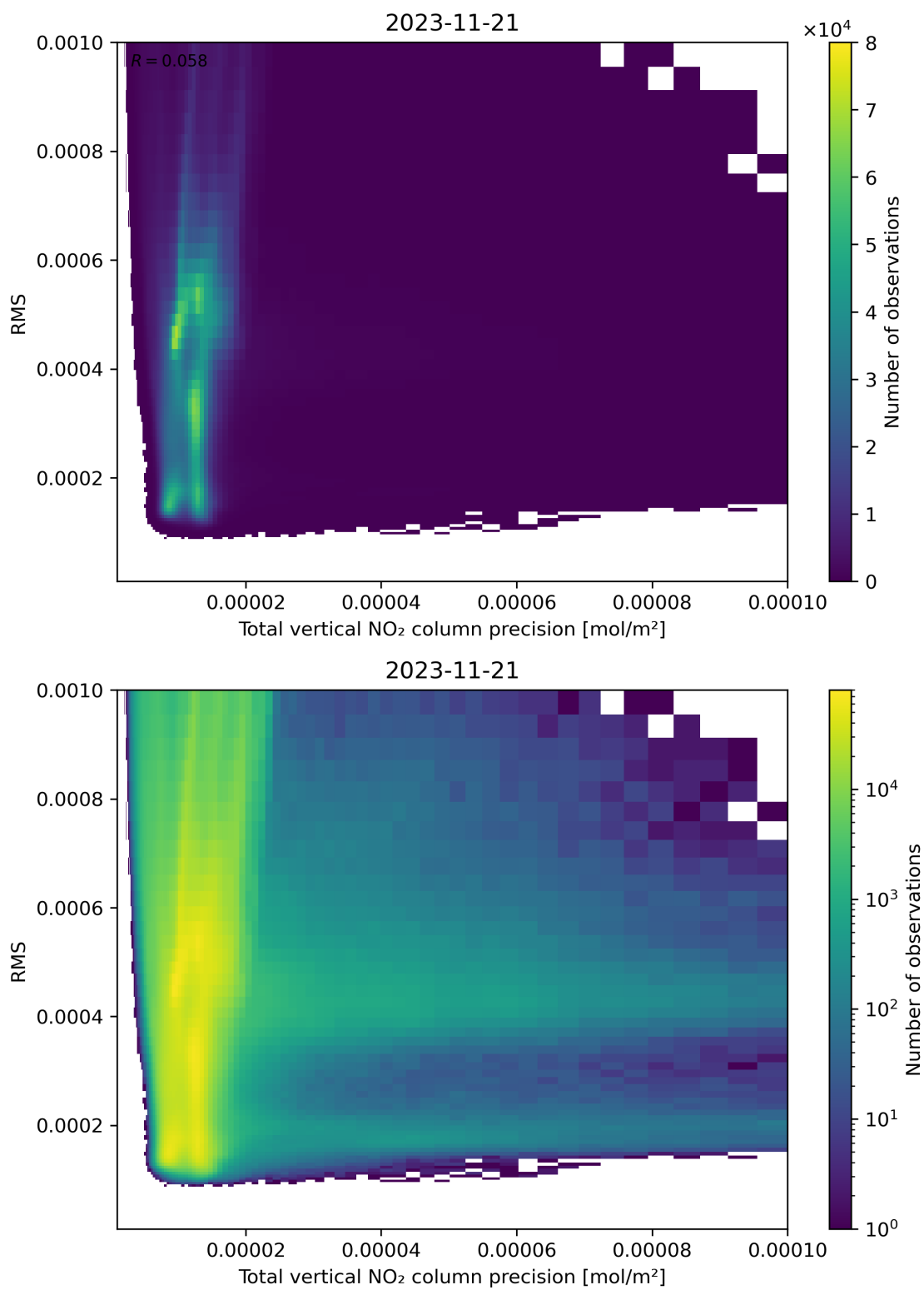


Figure 119: Scatter density plot of “Total vertical NO₂ column precision” against “RMS” for 2023-11-20 to 2023-11-22.

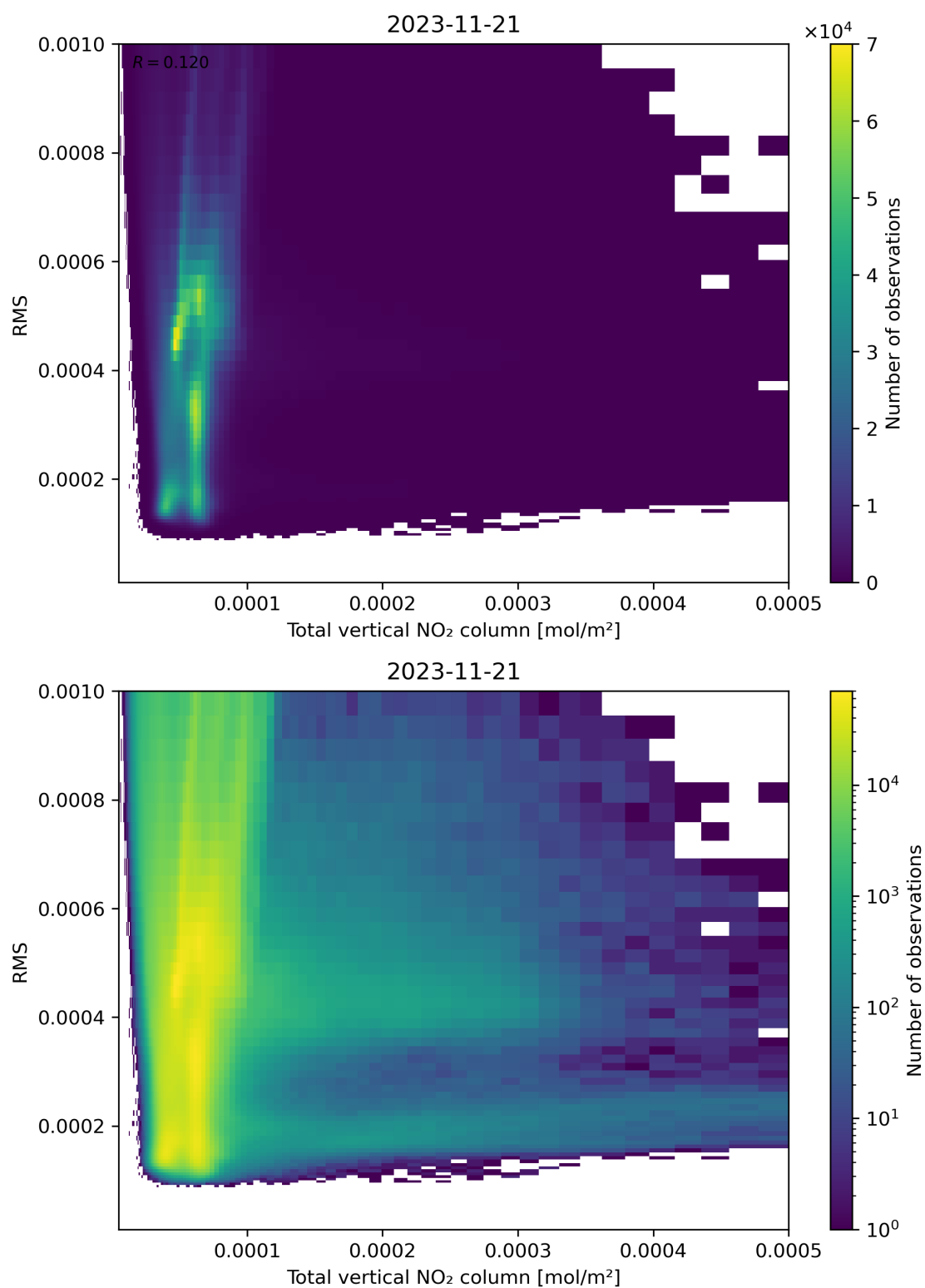


Figure 120: Scatter density plot of “Total vertical NO₂ column” against “RMS” for 2023-11-20 to 2023-11-22.

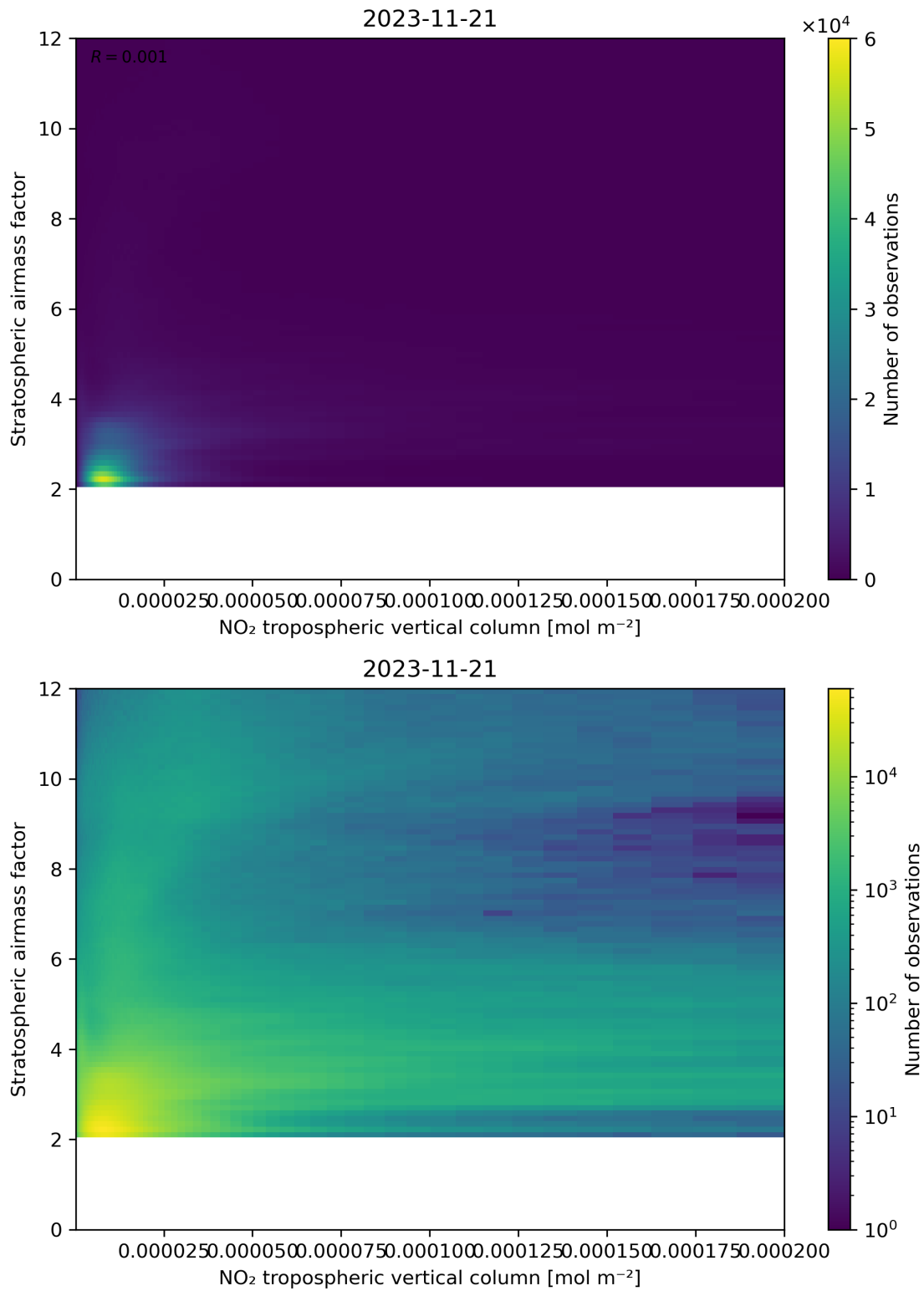


Figure 121: Scatter density plot of “NO₂ tropospheric vertical column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

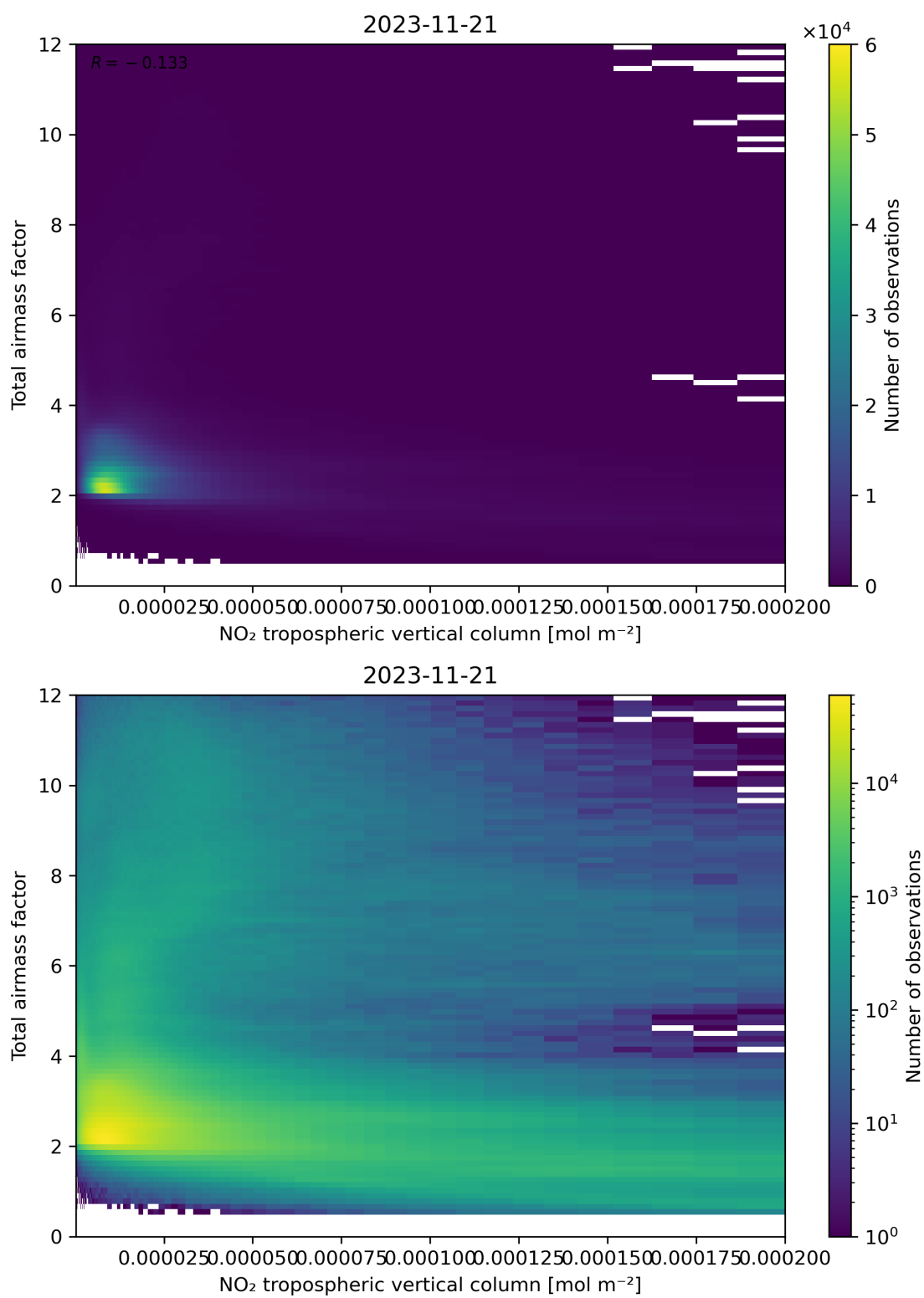


Figure 122: Scatter density plot of “NO₂ tropospheric vertical column” against “Total air mass factor” for 2023-11-20 to 2023-11-22.

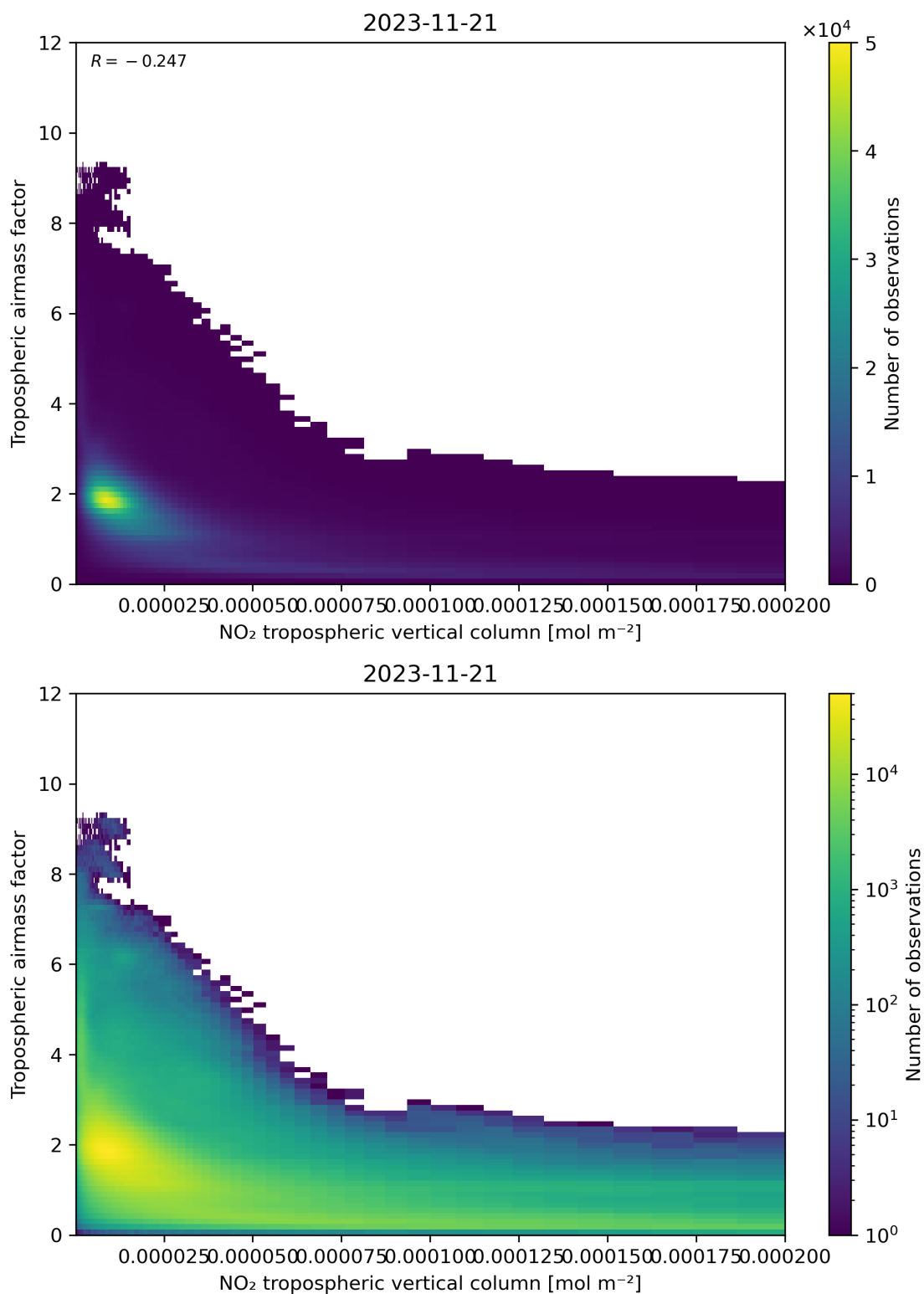


Figure 123: Scatter density plot of “NO₂ tropospheric vertical column” against “Tropospheric air mass factor” for 2023-11-20 to 2023-11-22.

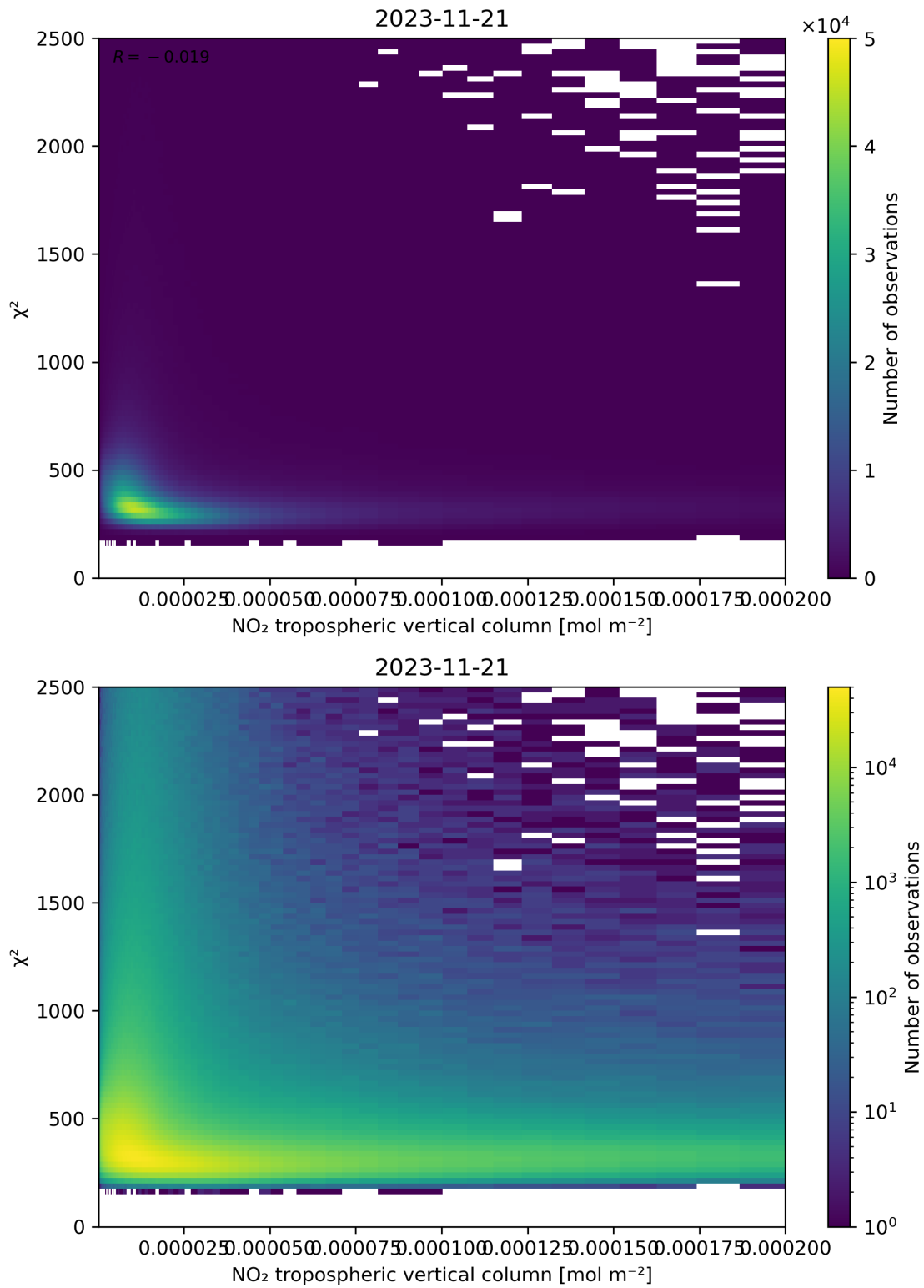


Figure 124: Scatter density plot of “NO₂ tropospheric vertical column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

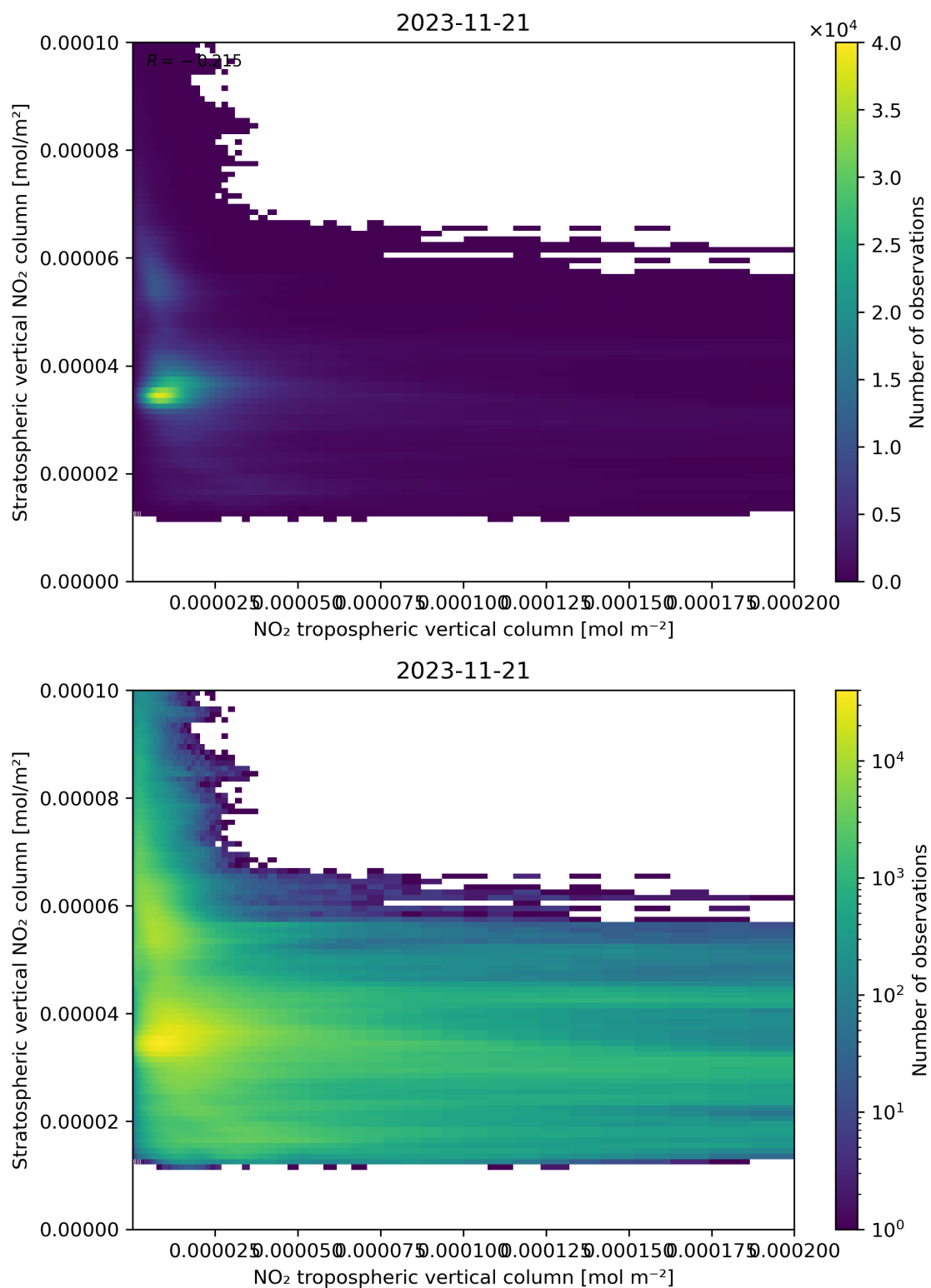


Figure 125: Scatter density plot of “NO₂ tropospheric vertical column” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

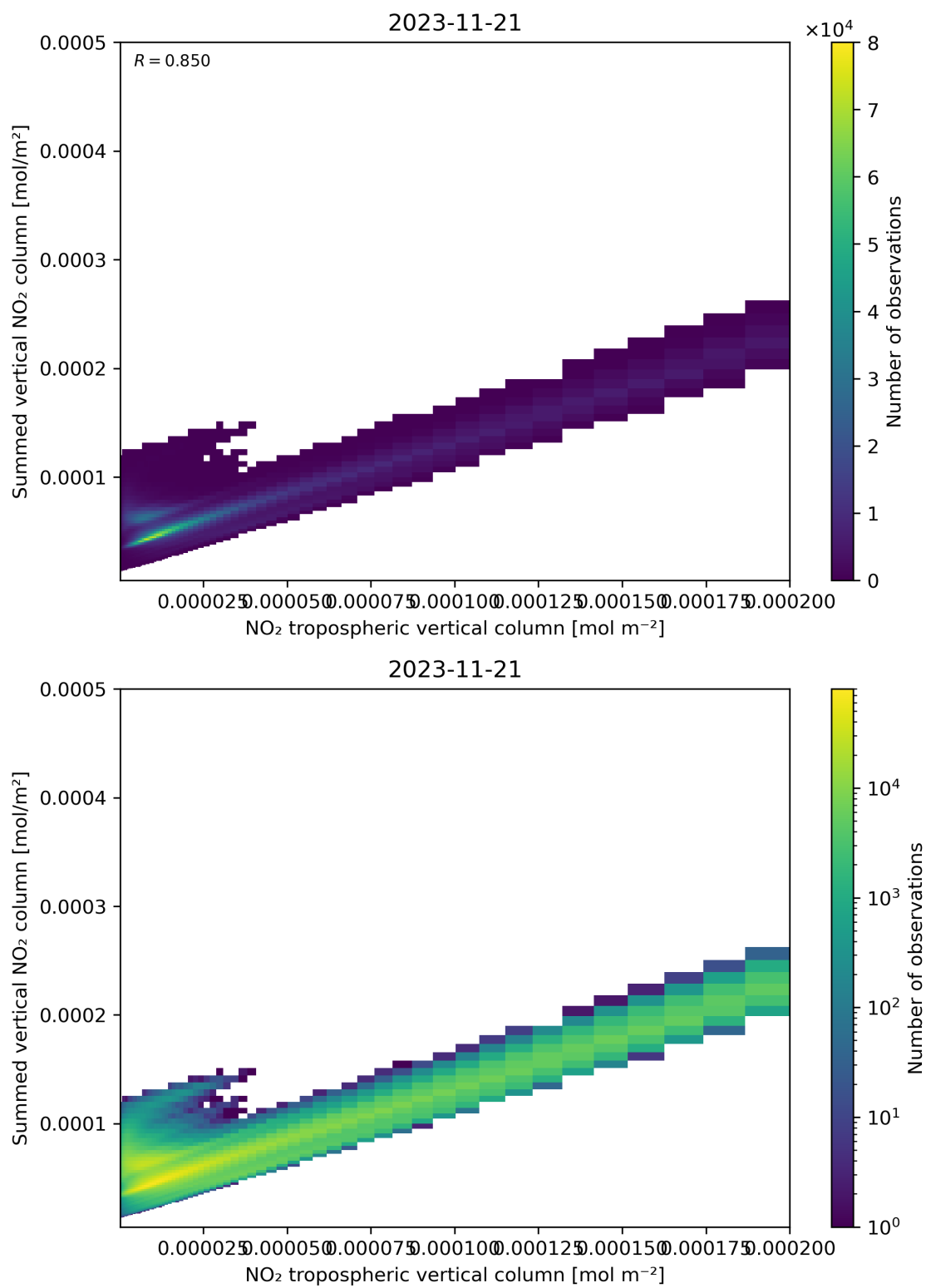


Figure 126: Scatter density plot of “NO₂ tropospheric vertical column” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

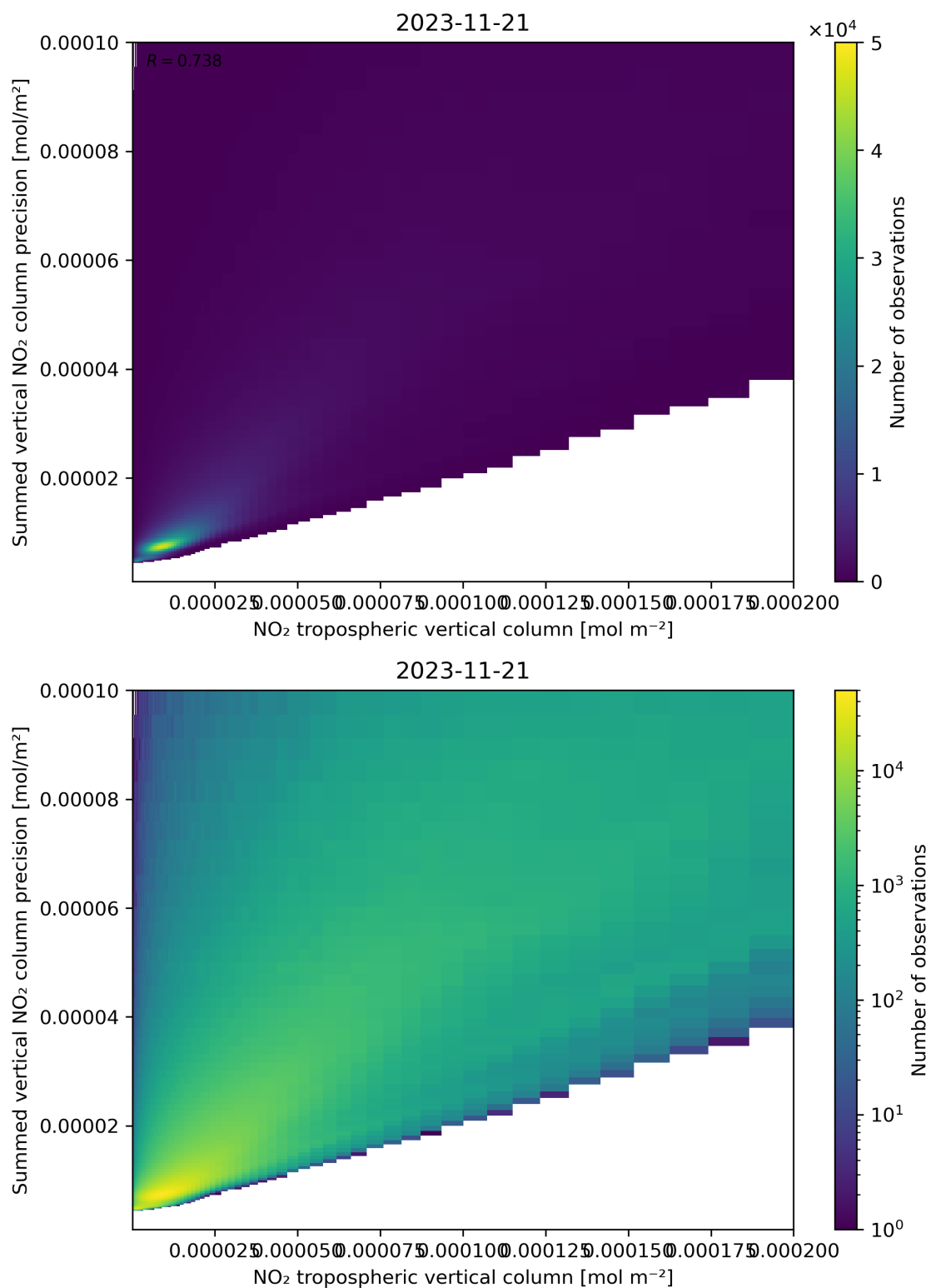


Figure 127: Scatter density plot of “NO₂ tropospheric vertical column” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

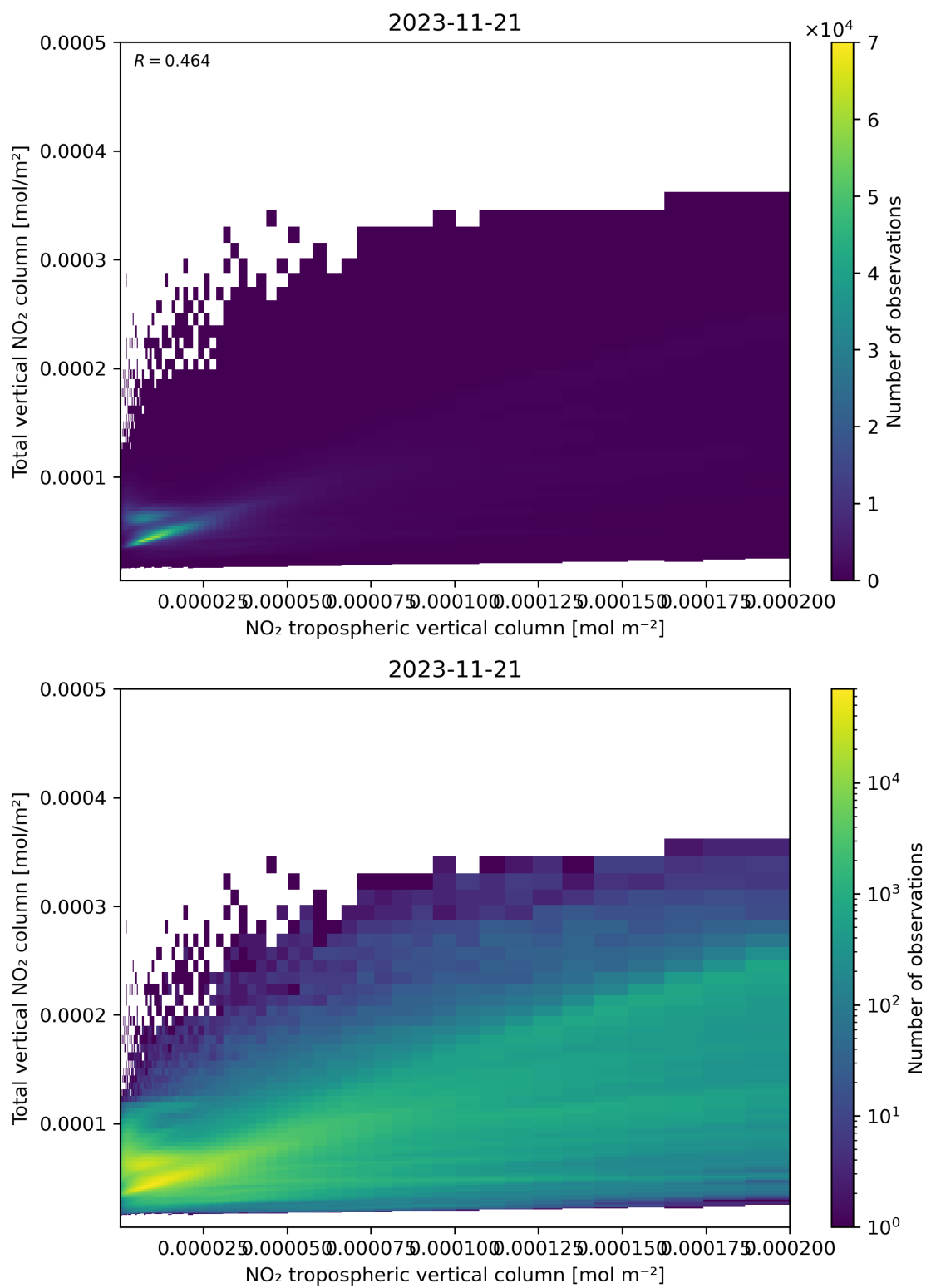


Figure 128: Scatter density plot of “NO₂ tropospheric vertical column” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

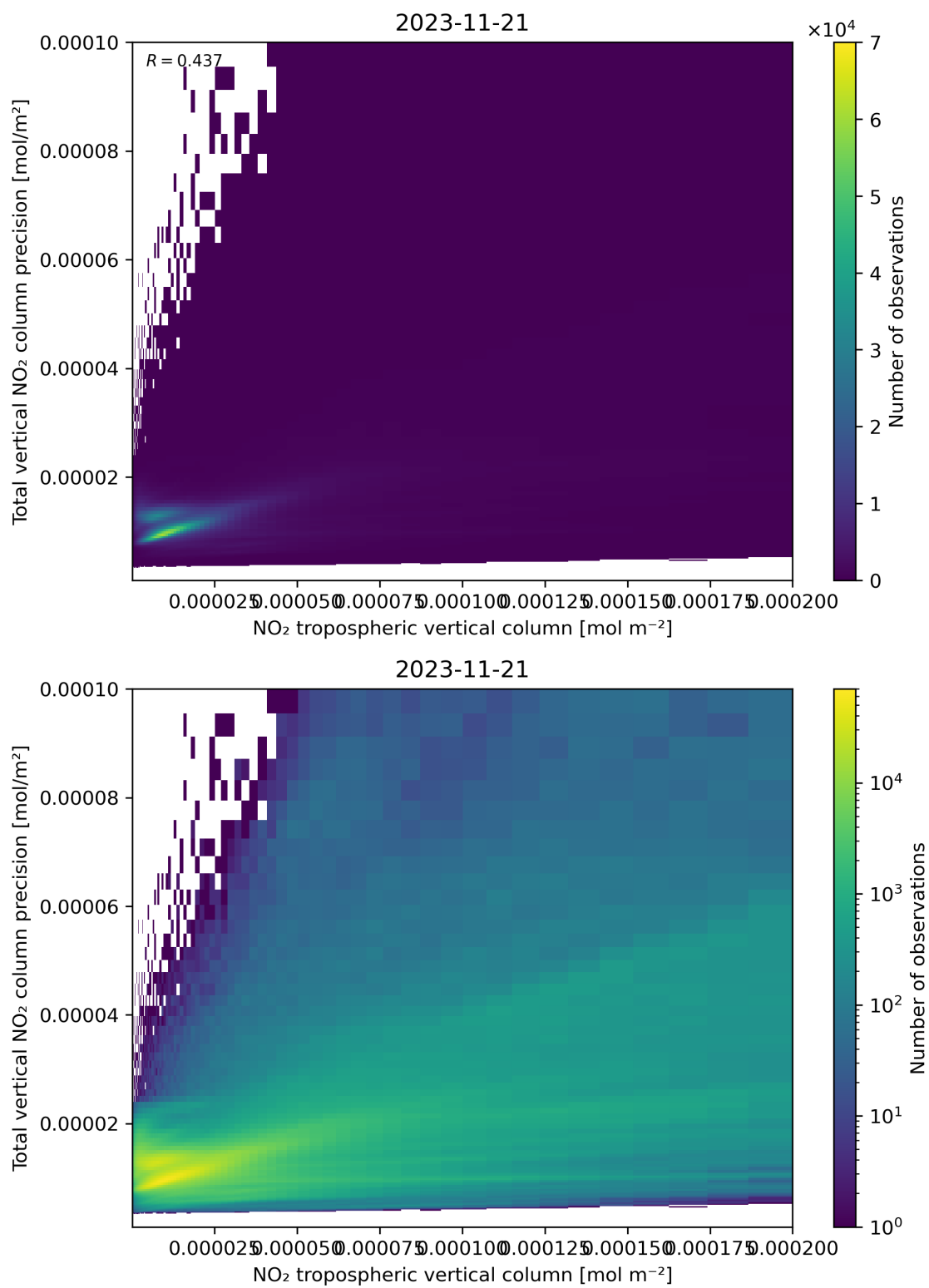


Figure 129: Scatter density plot of “NO₂ tropospheric vertical column” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

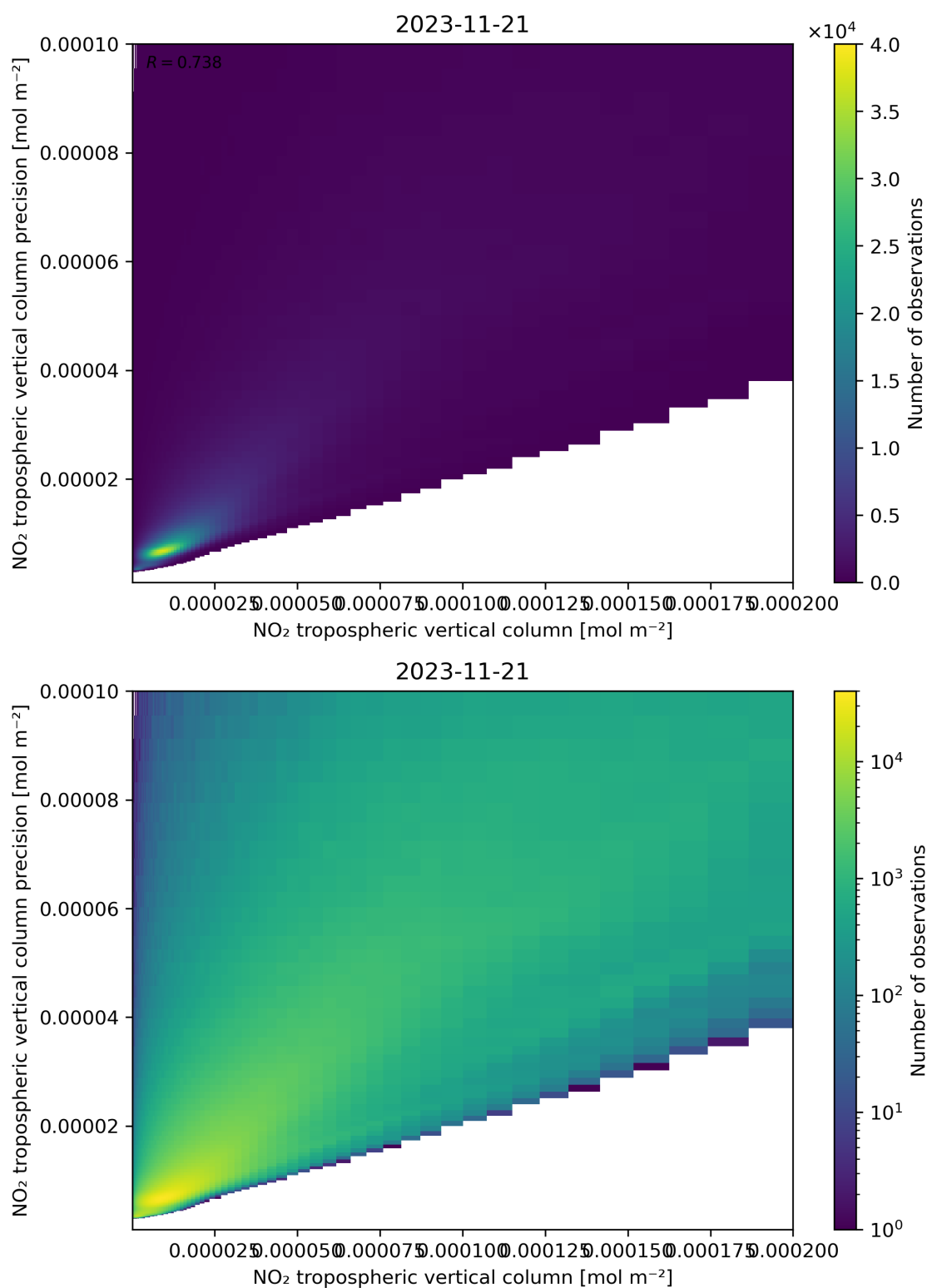


Figure 130: Scatter density plot of “NO₂ tropospheric vertical column” against “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.

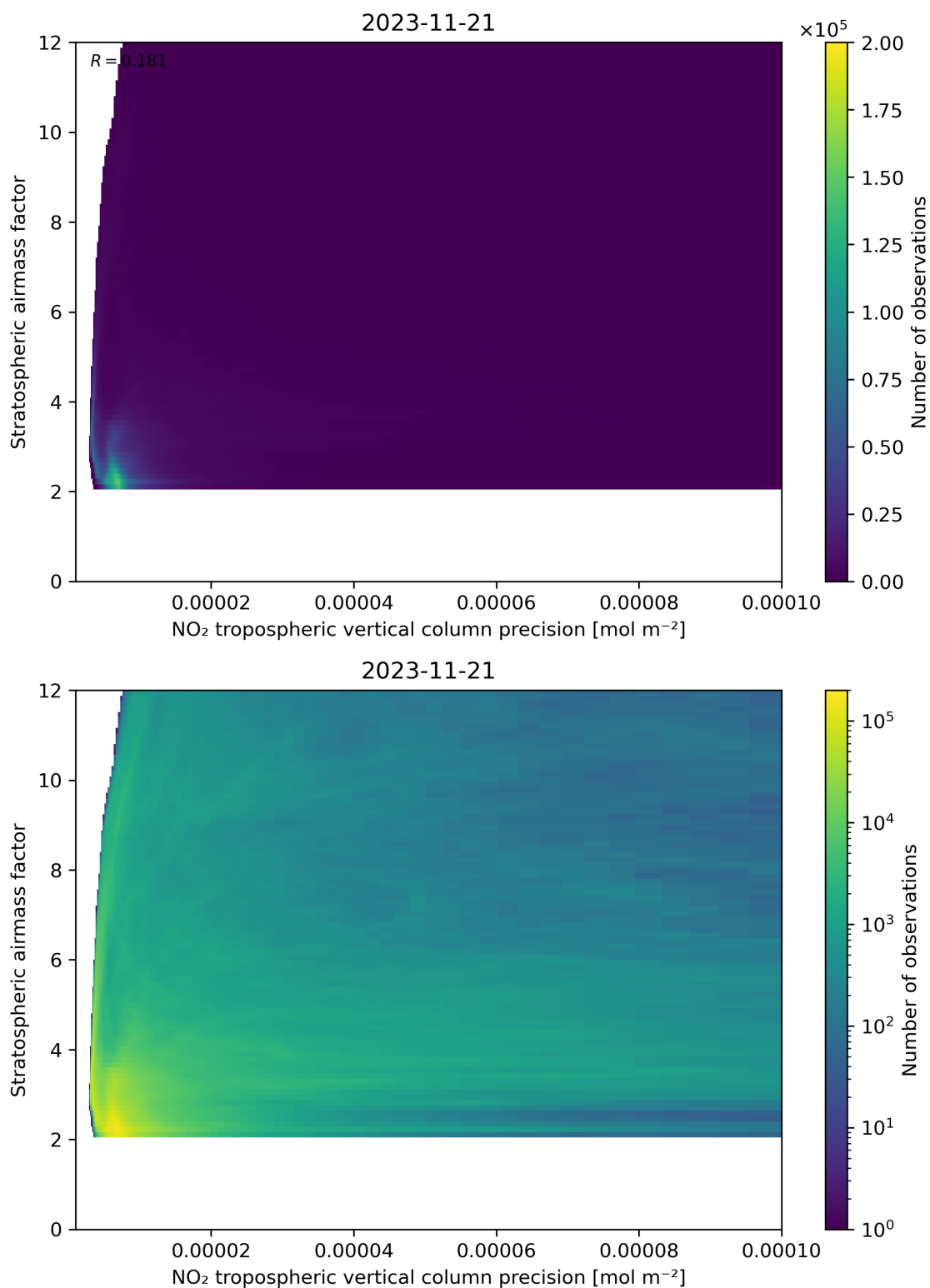


Figure 131: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

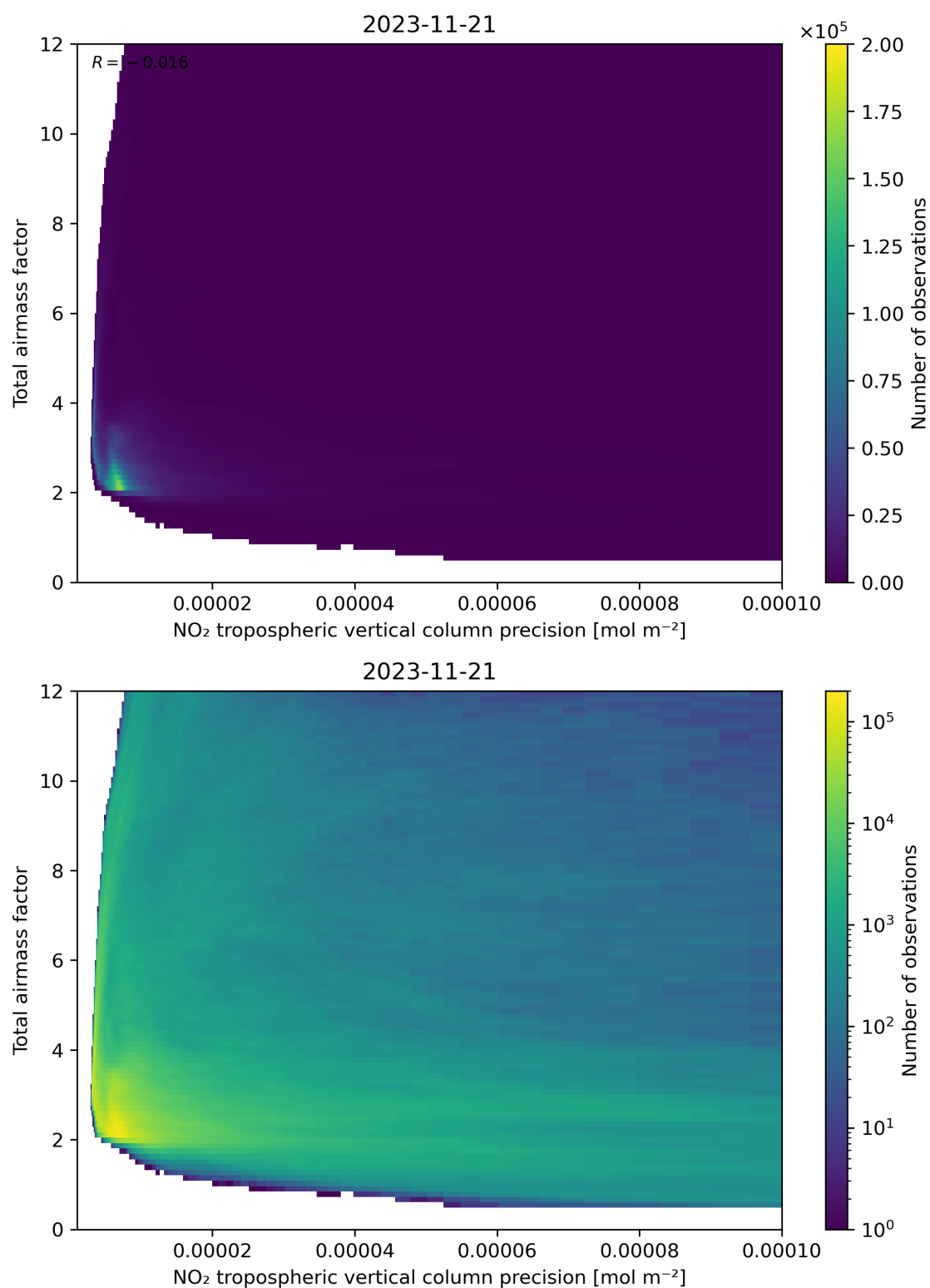


Figure 132: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Total air mass factor” for 2023-11-20 to 2023-11-22.

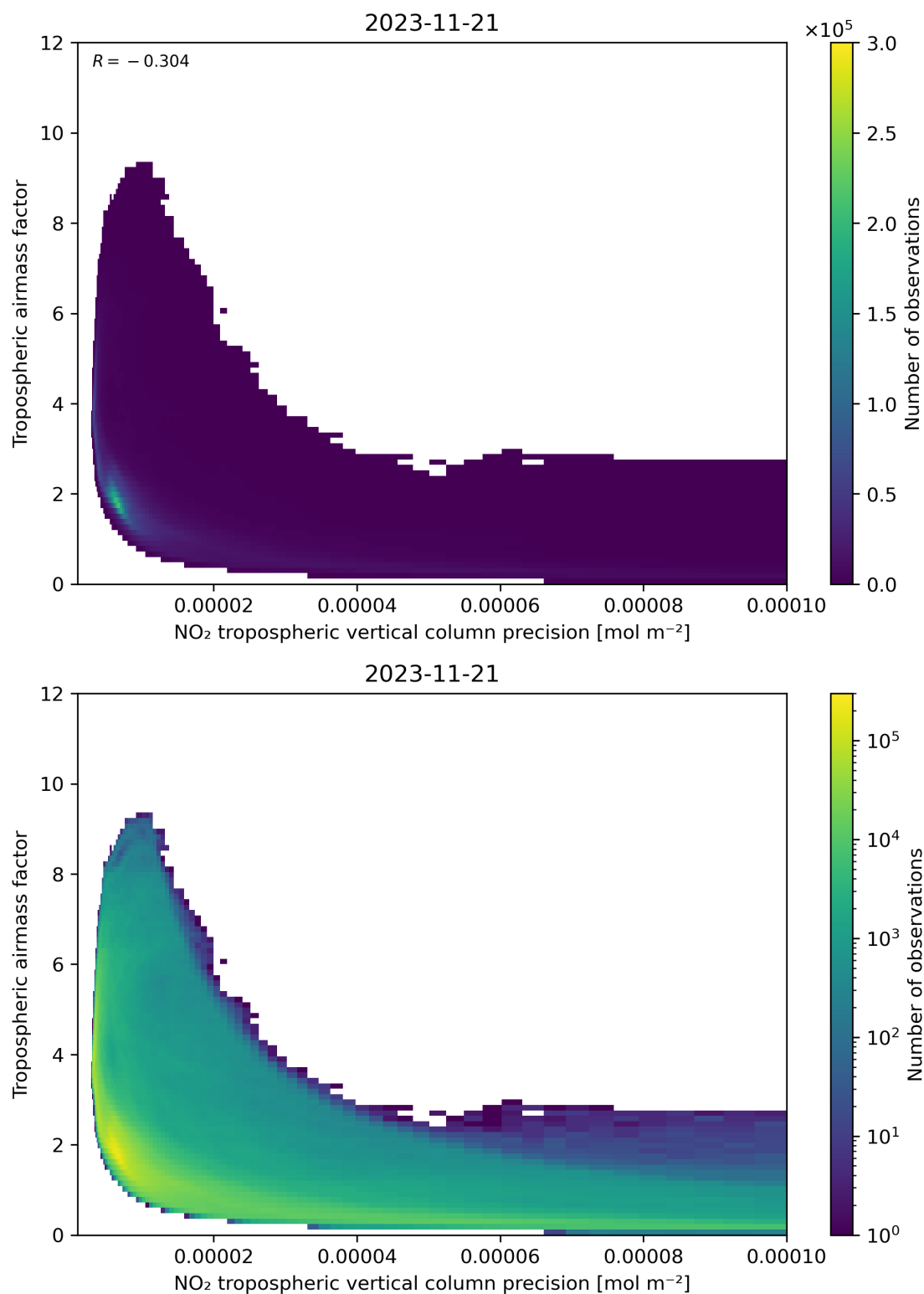


Figure 133: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.

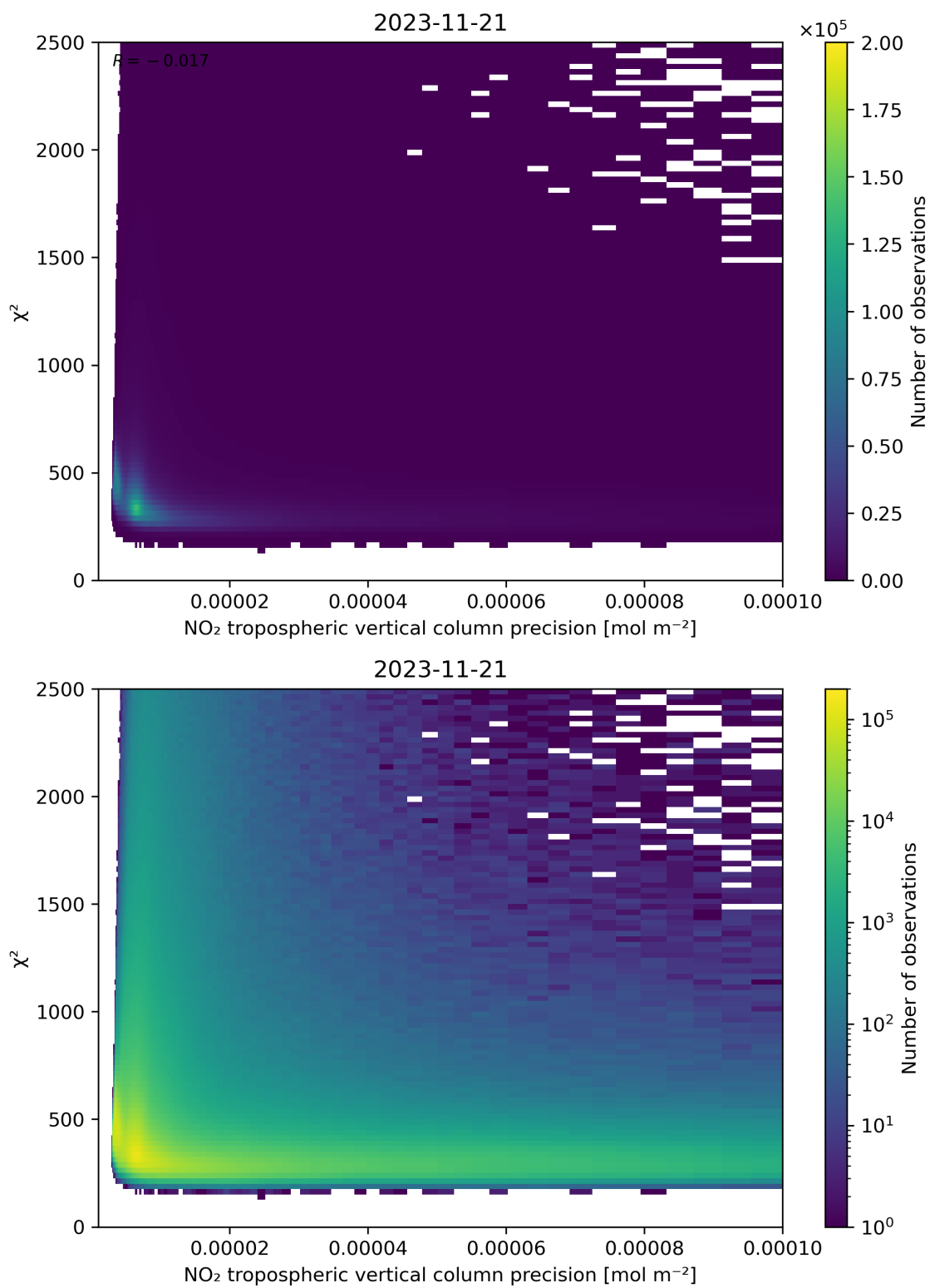


Figure 134: Scatter density plot of “NO₂ tropospheric vertical column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

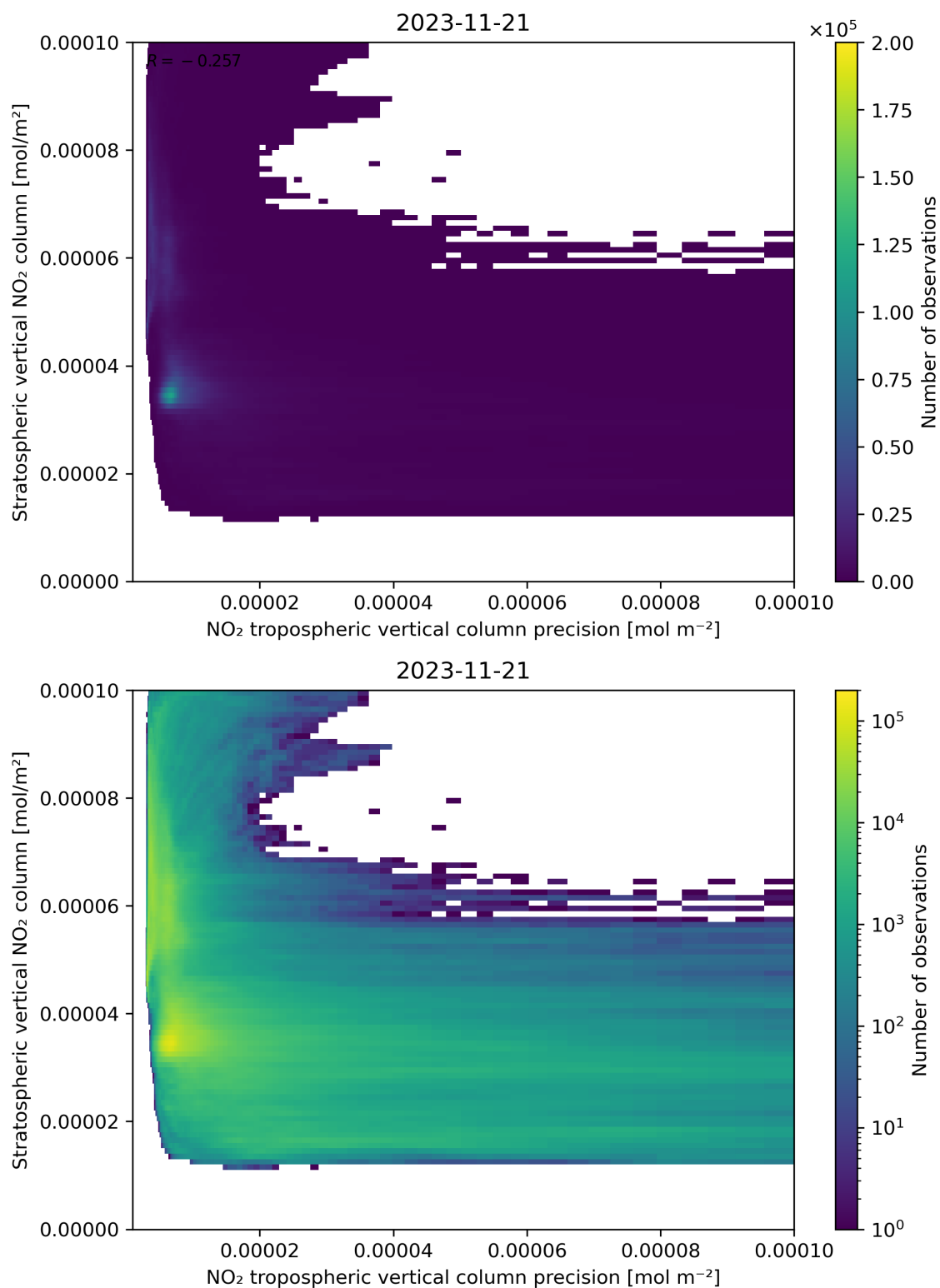


Figure 135: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

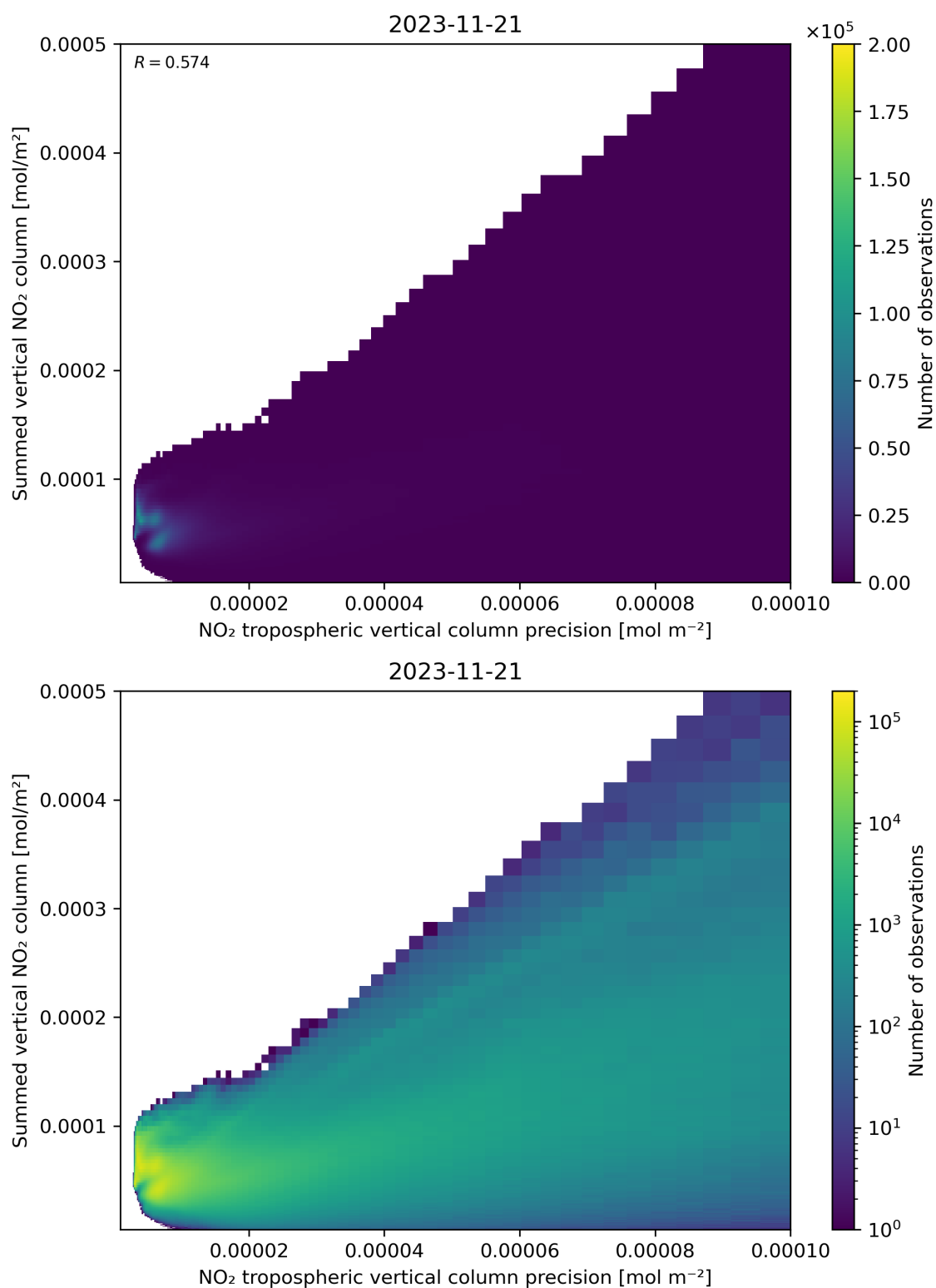


Figure 136: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

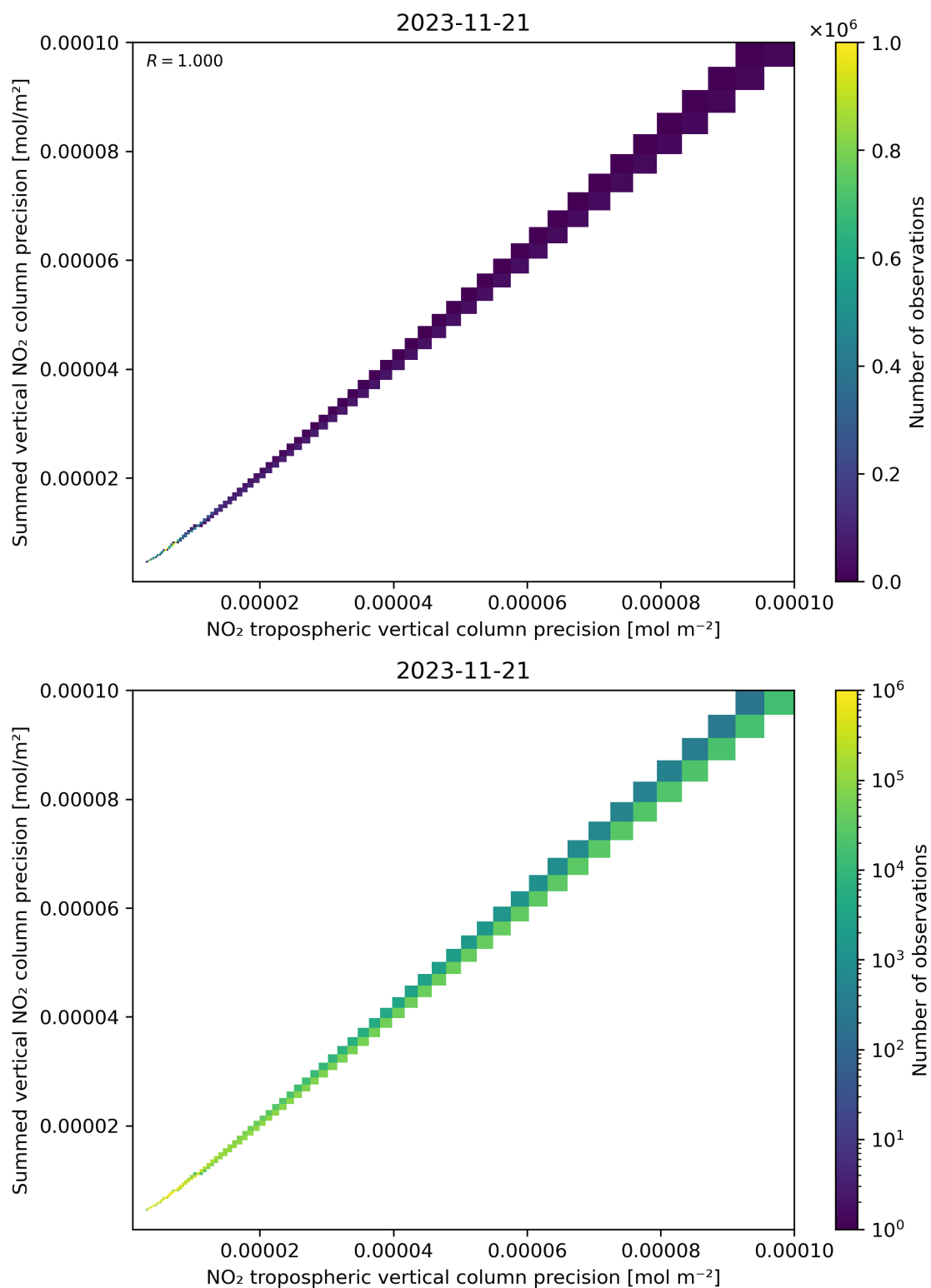


Figure 137: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

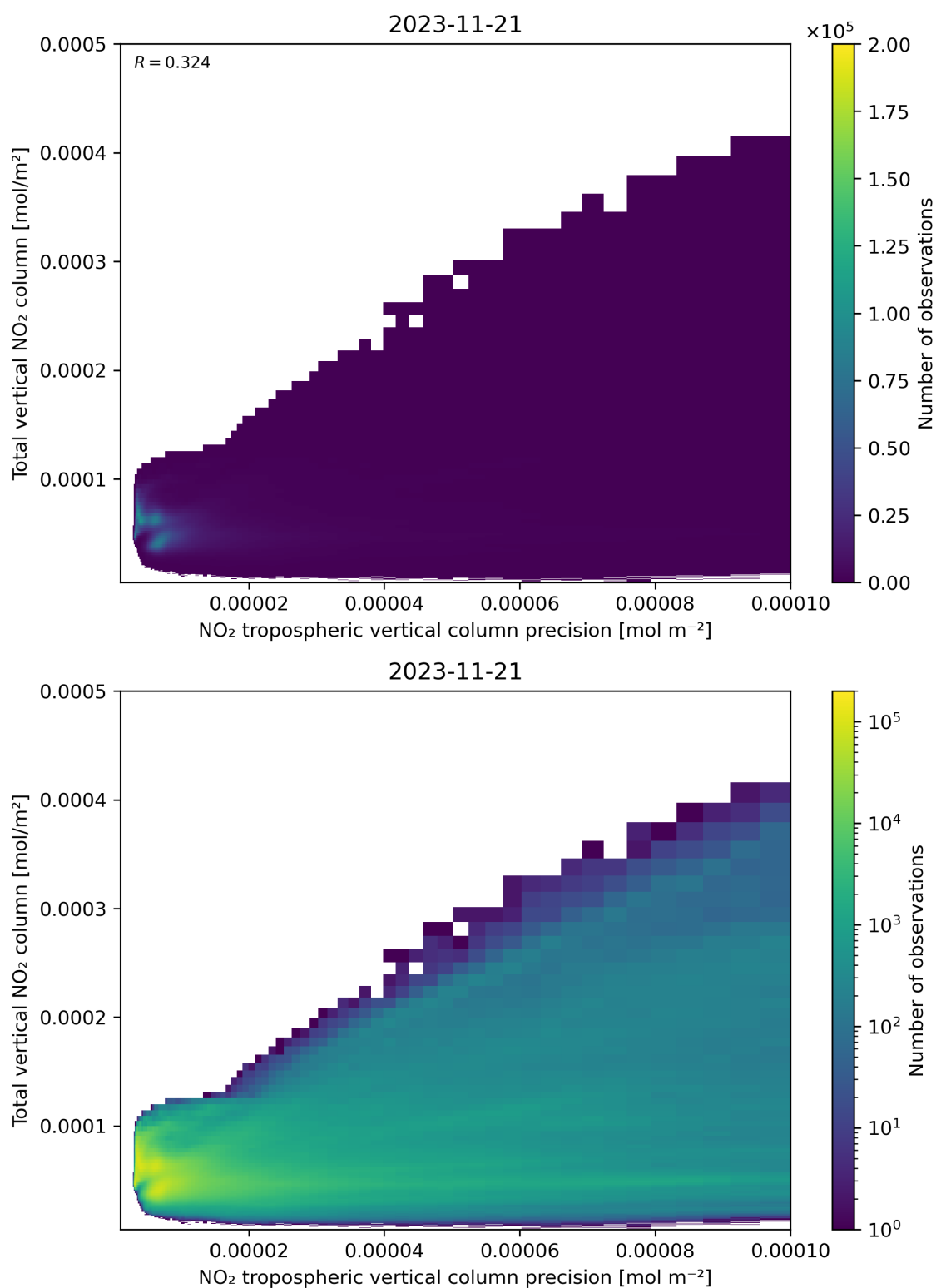


Figure 138: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

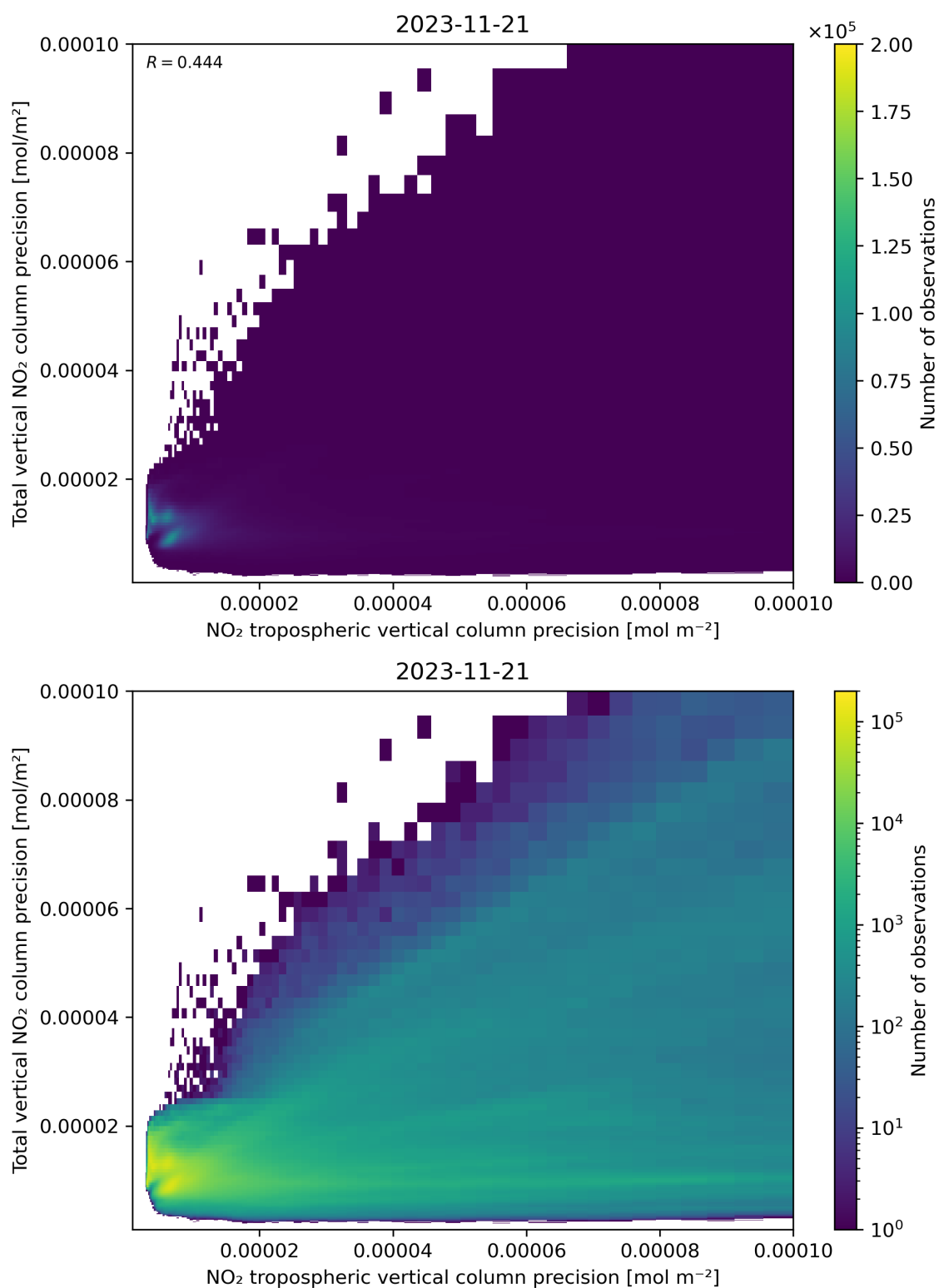


Figure 139: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

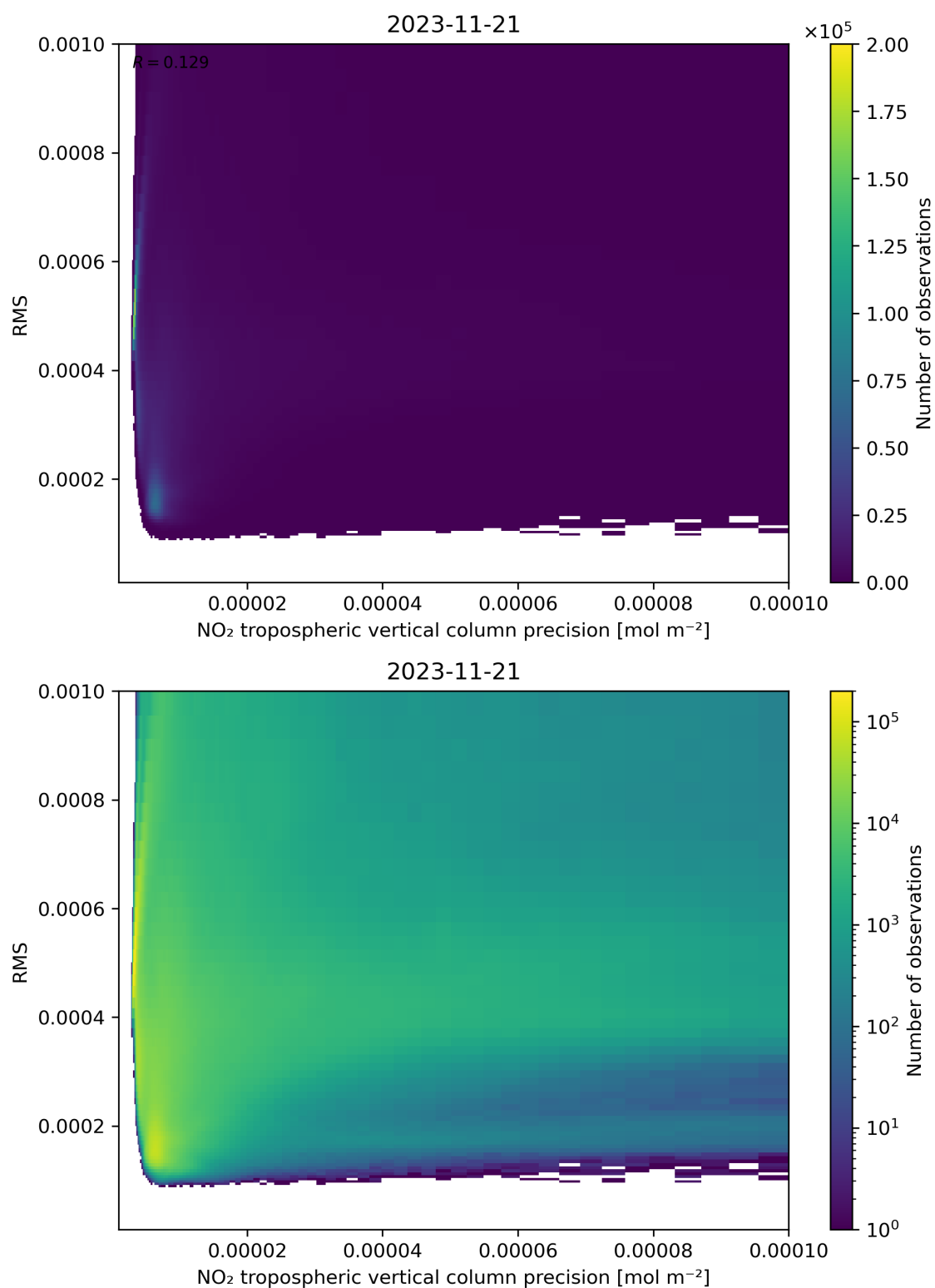


Figure 140: Scatter density plot of “NO₂ tropospheric vertical column precision” against “RMS” for 2023-11-20 to 2023-11-22.

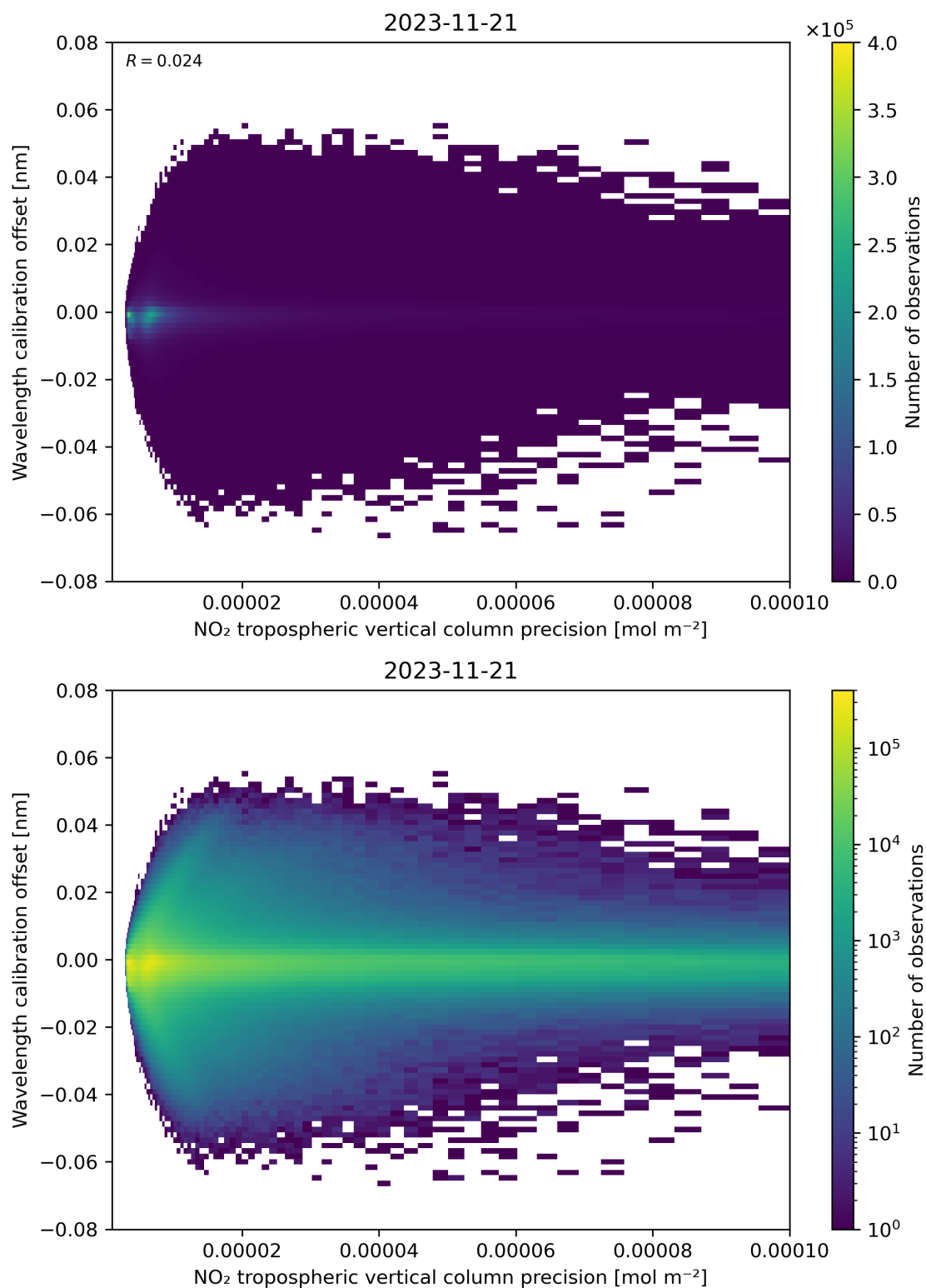


Figure 141: Scatter density plot of “NO₂ tropospheric vertical column precision” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

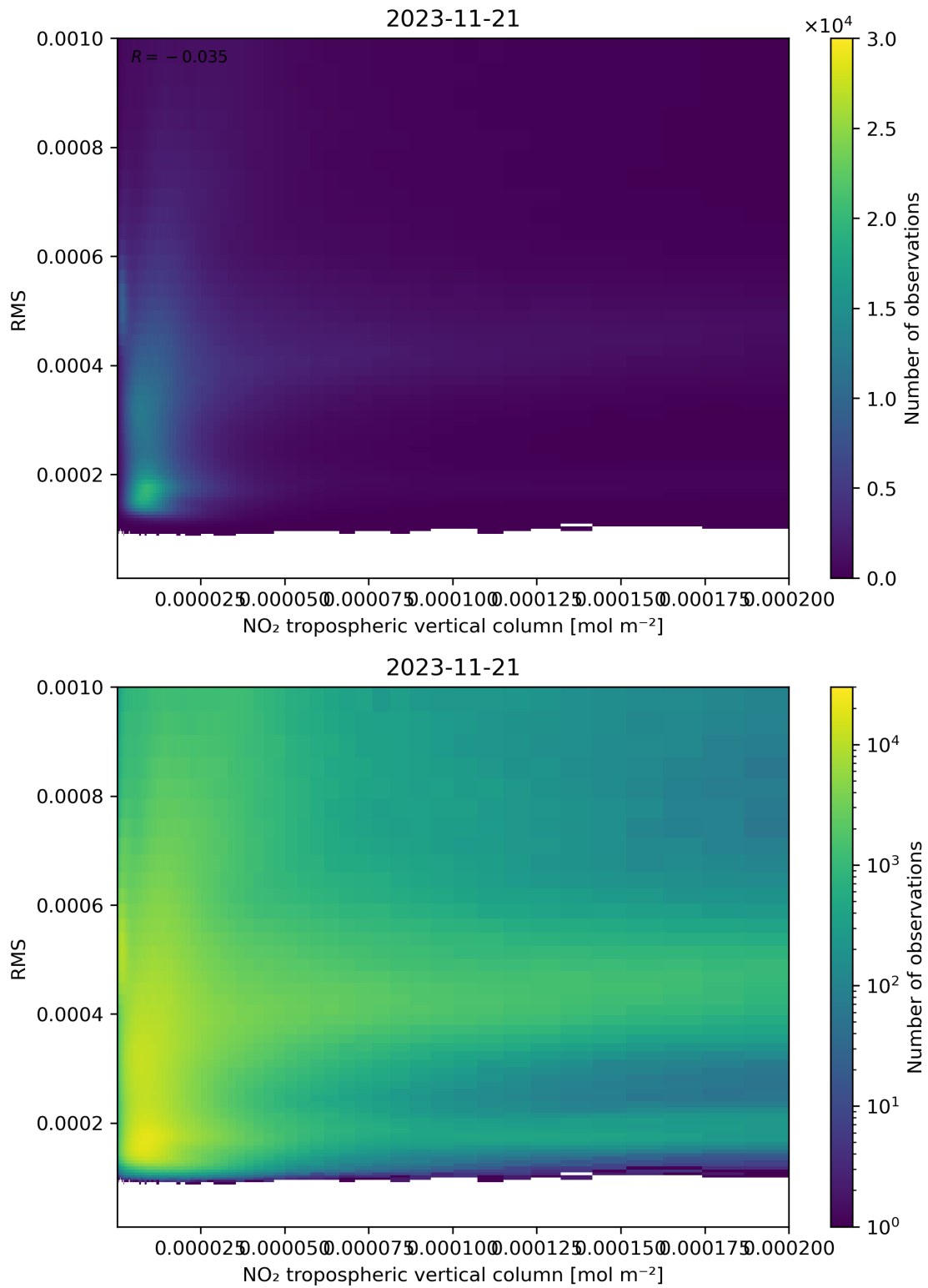


Figure 142: Scatter density plot of “NO₂ tropospheric vertical column” against “RMS” for 2023-11-20 to 2023-11-22.

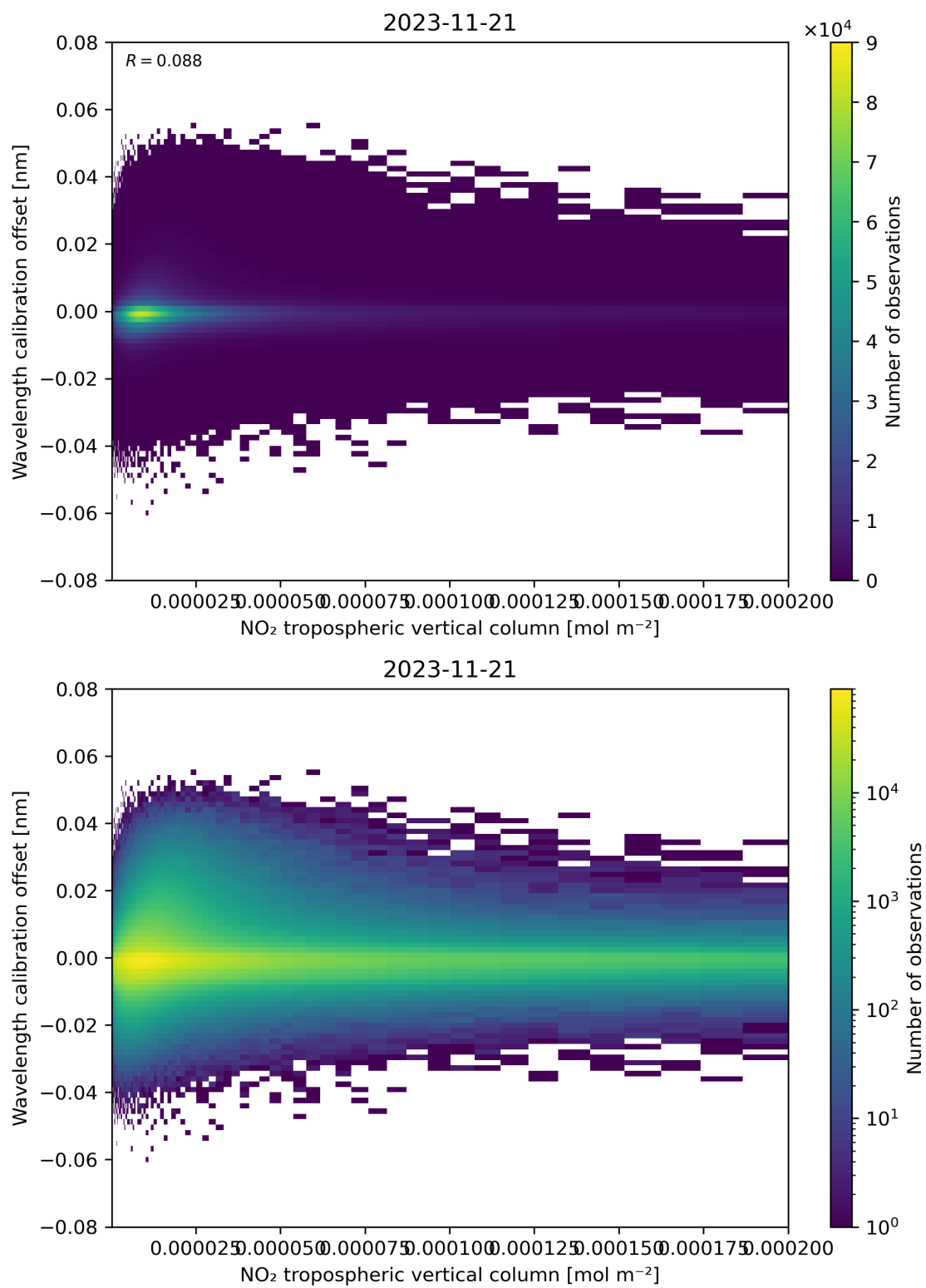


Figure 143: Scatter density plot of “NO₂ tropospheric vertical column” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

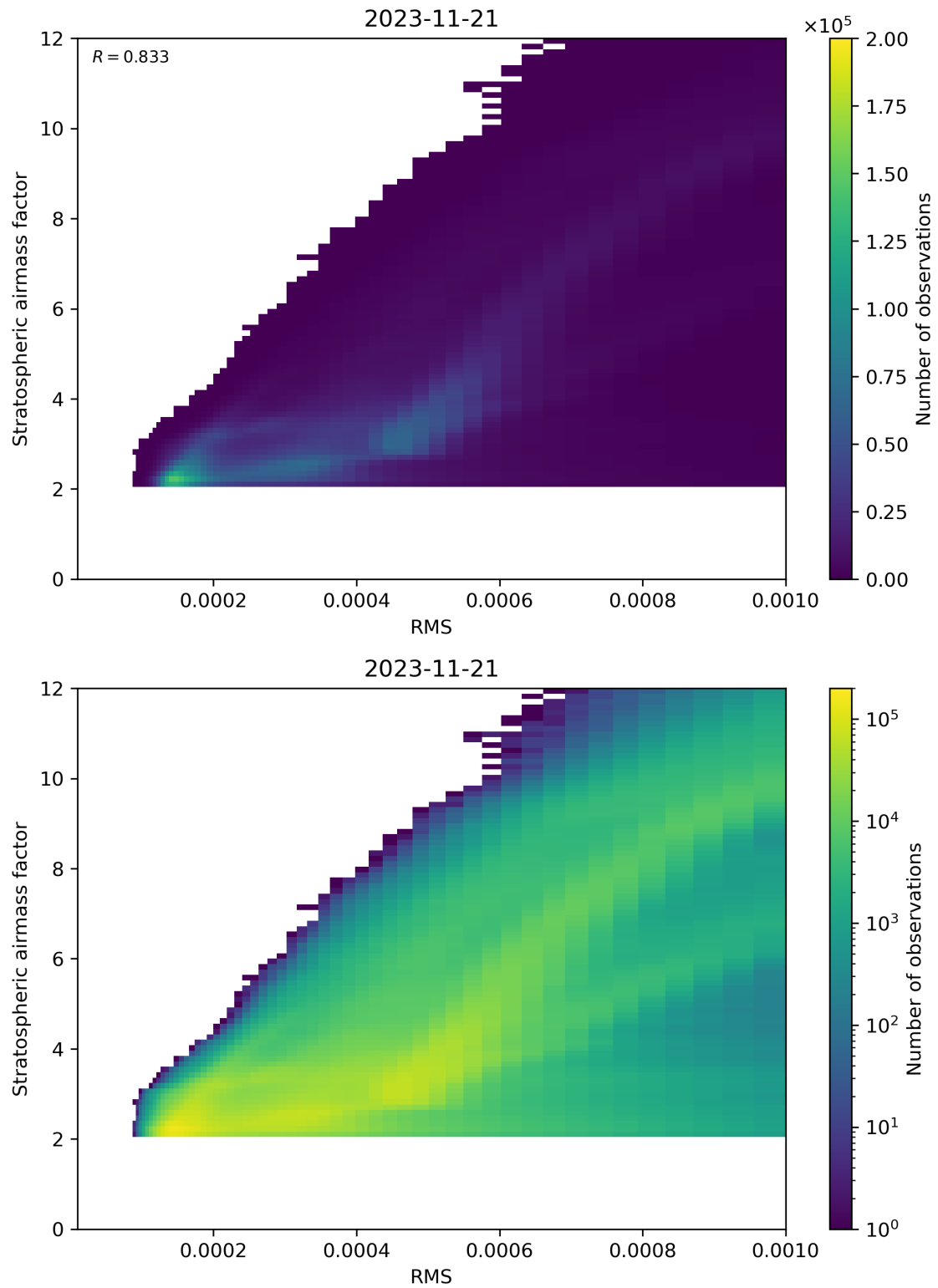


Figure 144: Scatter density plot of “RMS” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

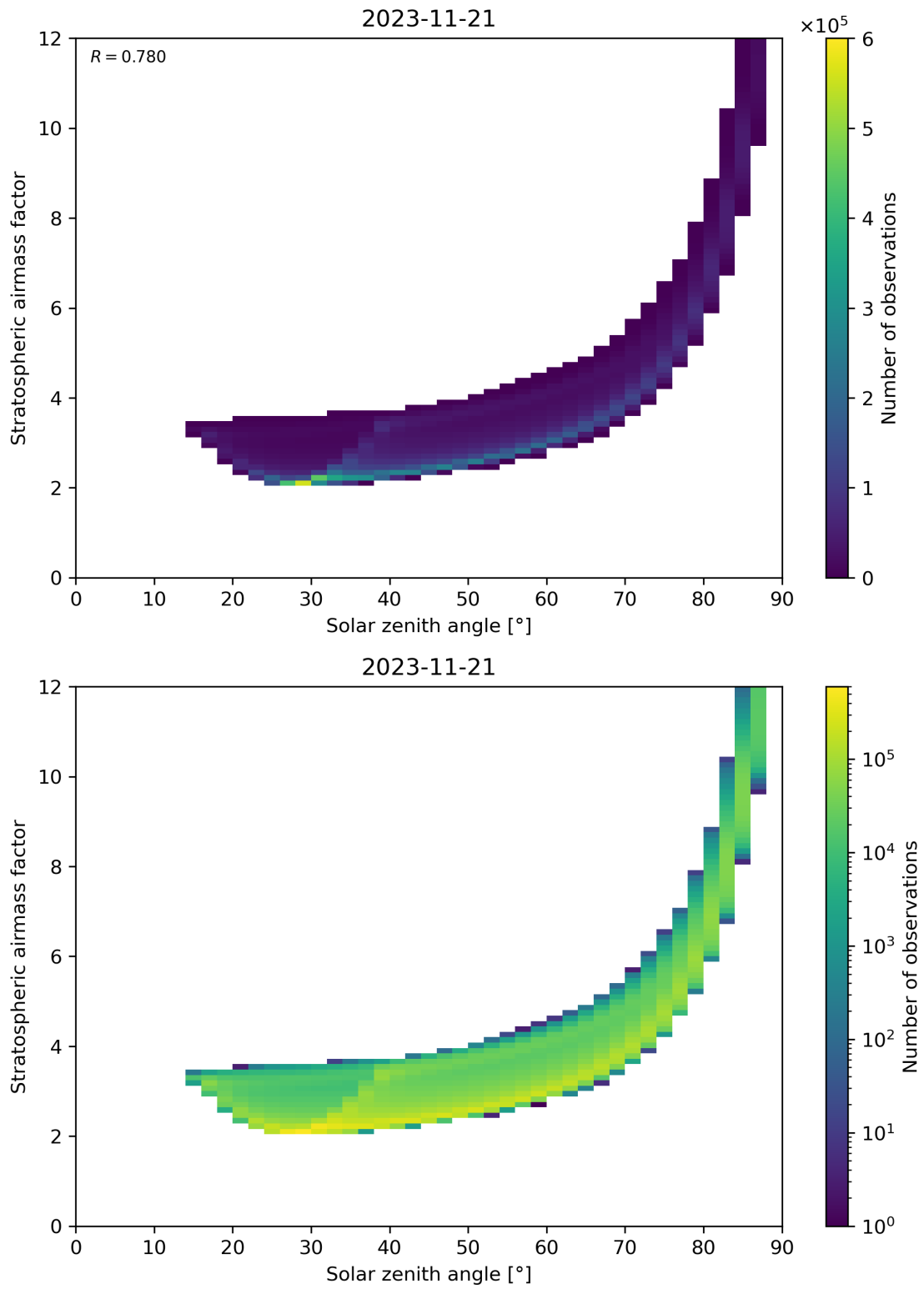


Figure 145: Scatter density plot of “Solar zenith angle” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

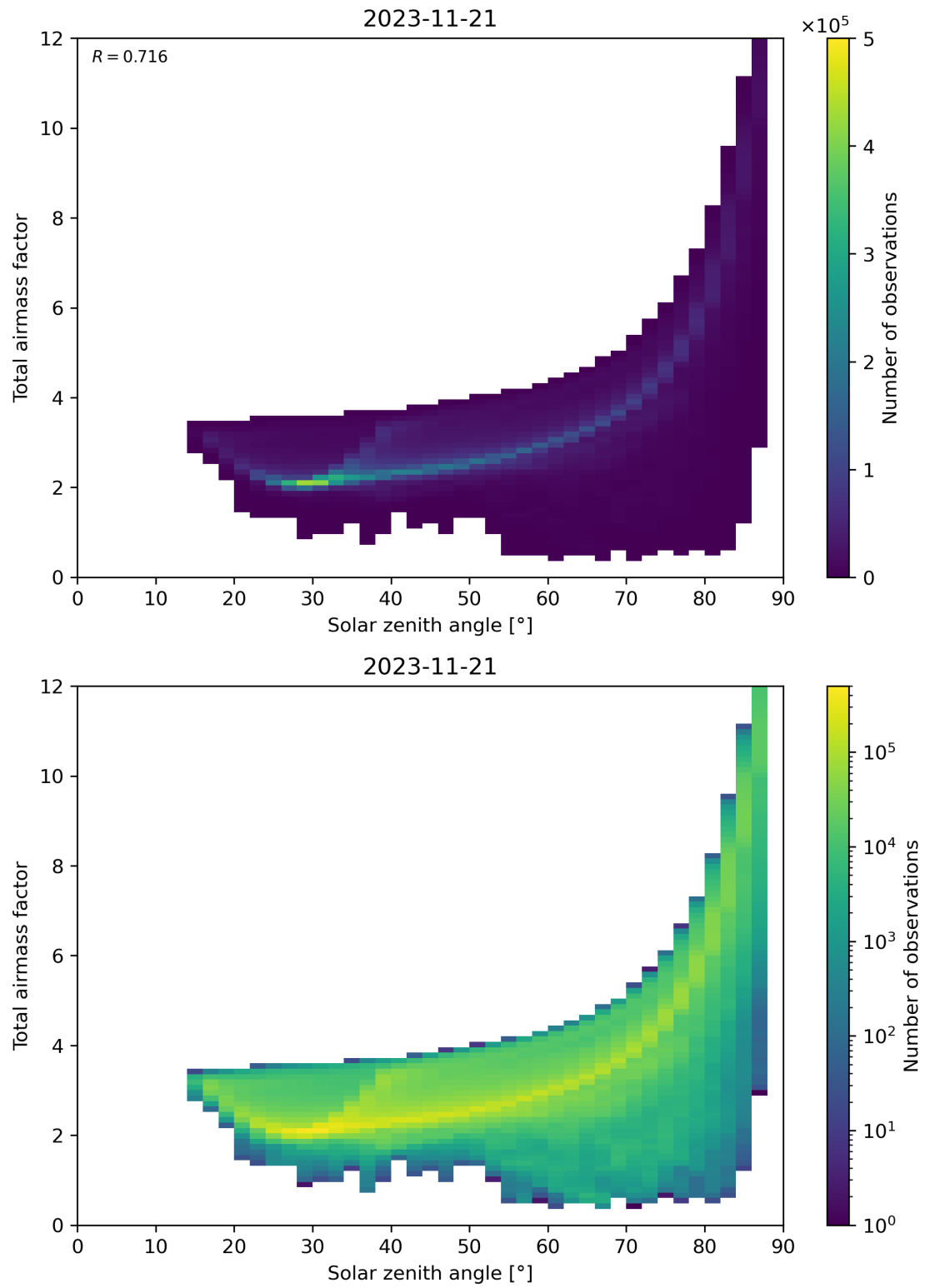


Figure 146: Scatter density plot of “Solar zenith angle” against “Total air mass factor” for 2023-11-20 to 2023-11-22.

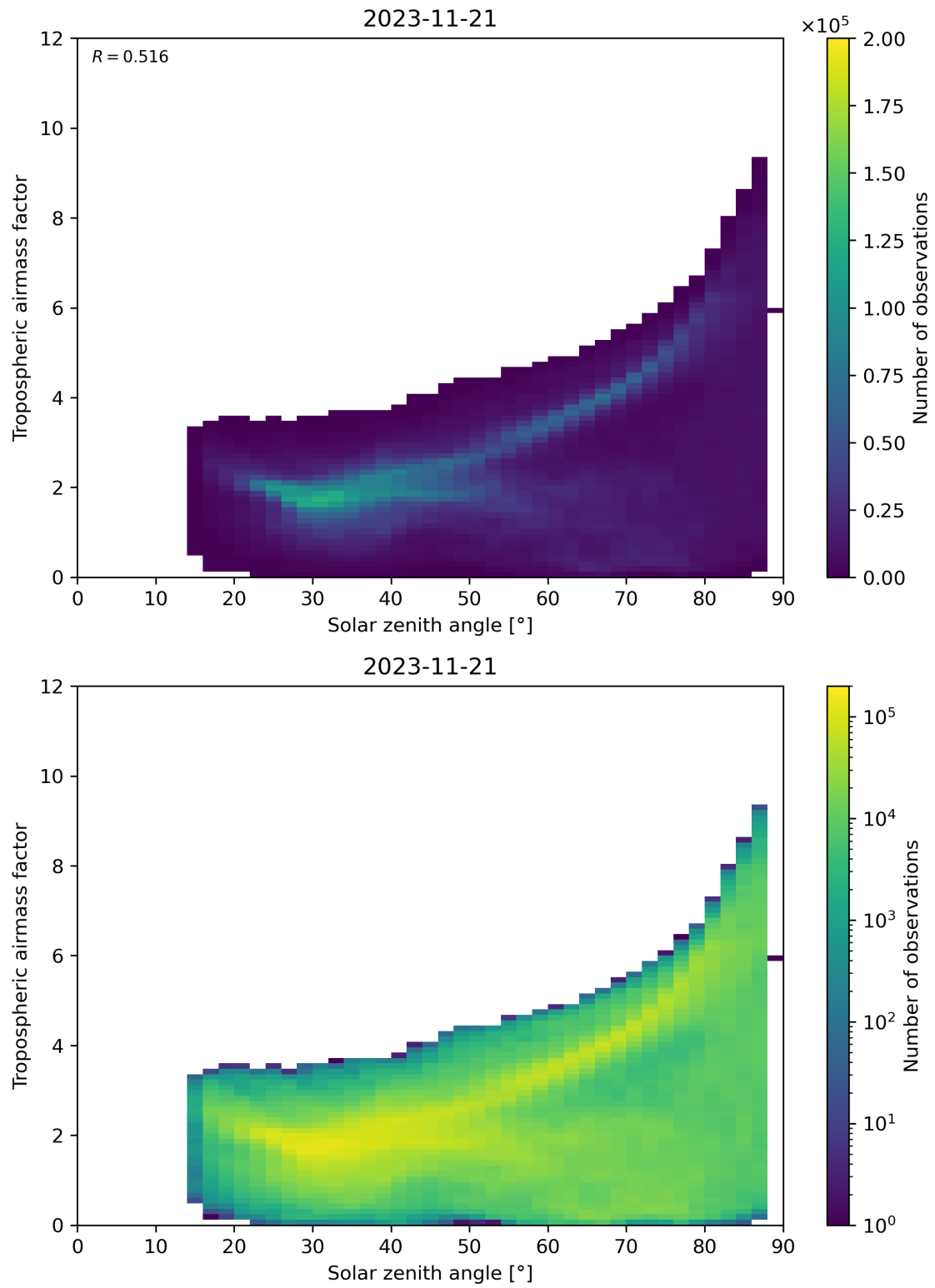


Figure 147: Scatter density plot of “Solar zenith angle” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.

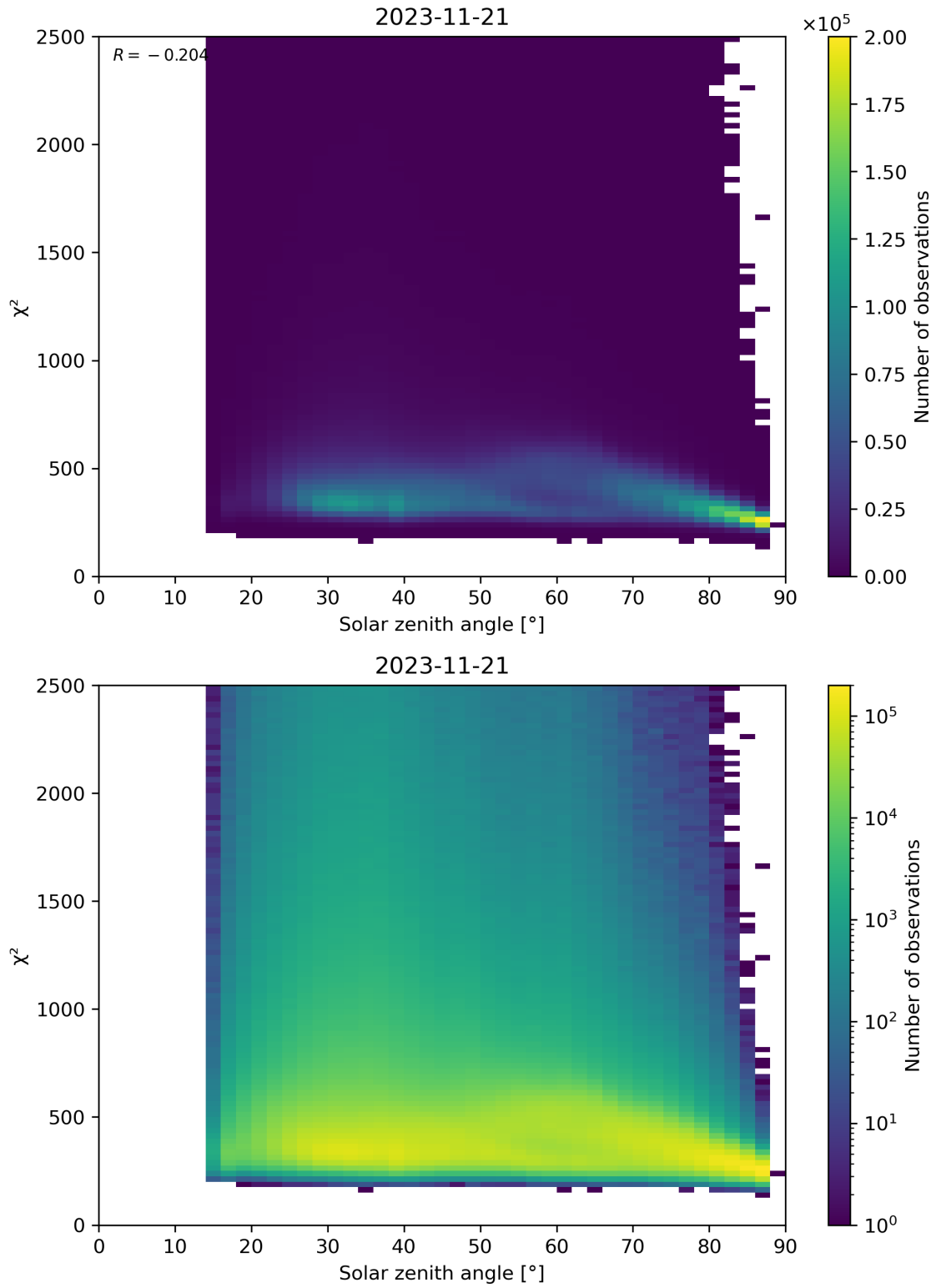


Figure 148: Scatter density plot of “Solar zenith angle” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

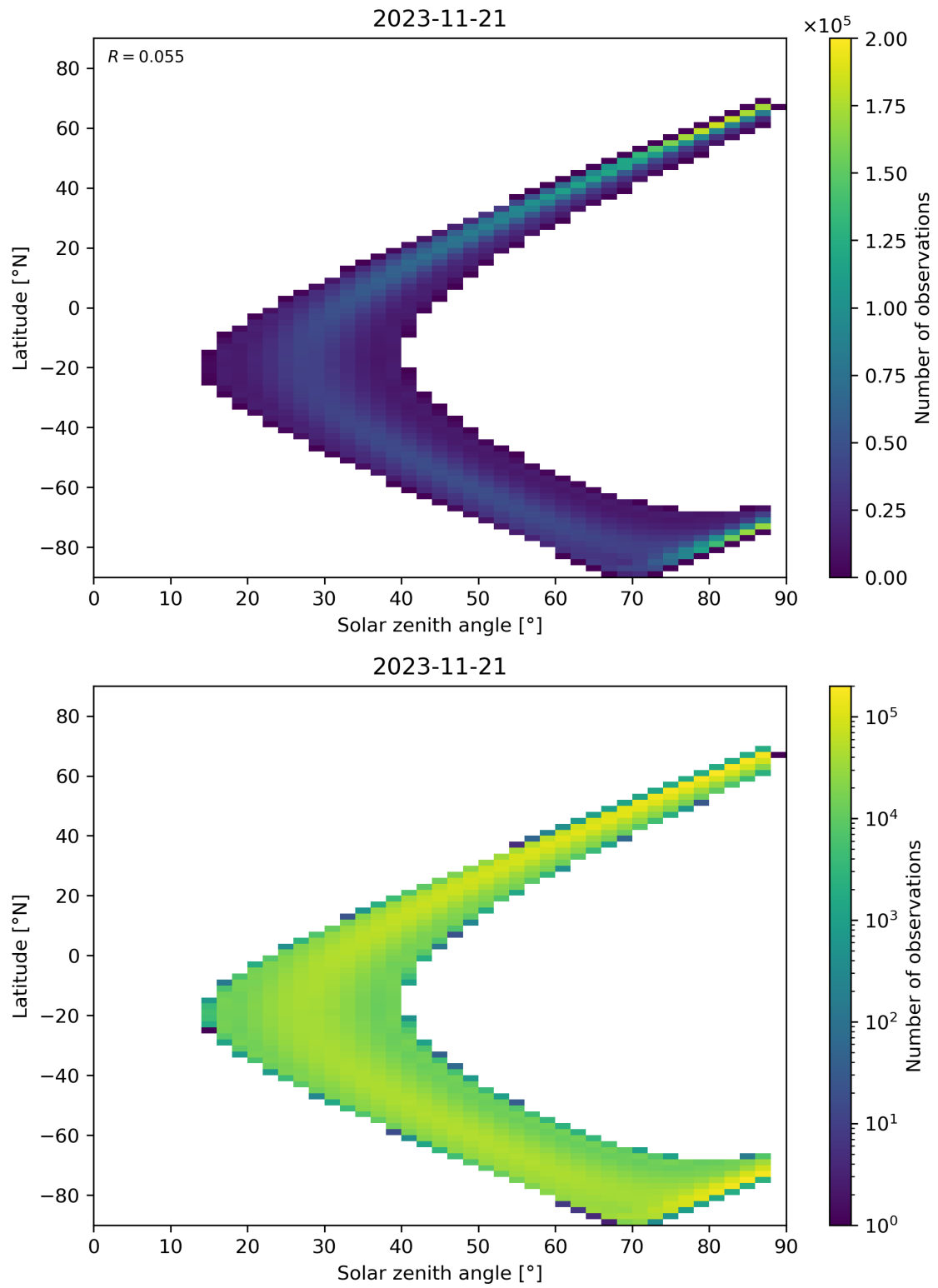


Figure 149: Scatter density plot of “Solar zenith angle” against “Latitude” for 2023-11-20 to 2023-11-22.

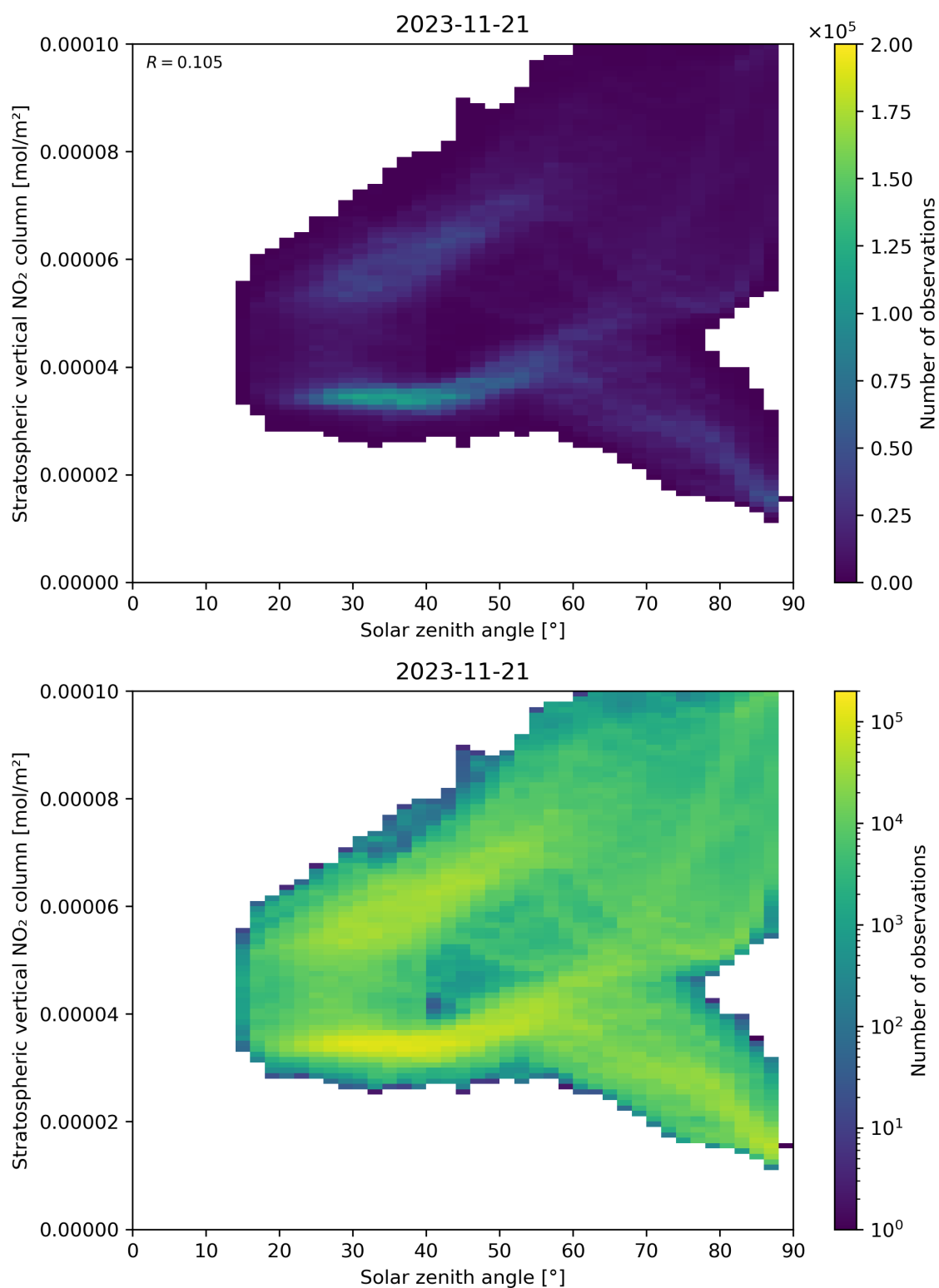


Figure 150: Scatter density plot of “Solar zenith angle” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

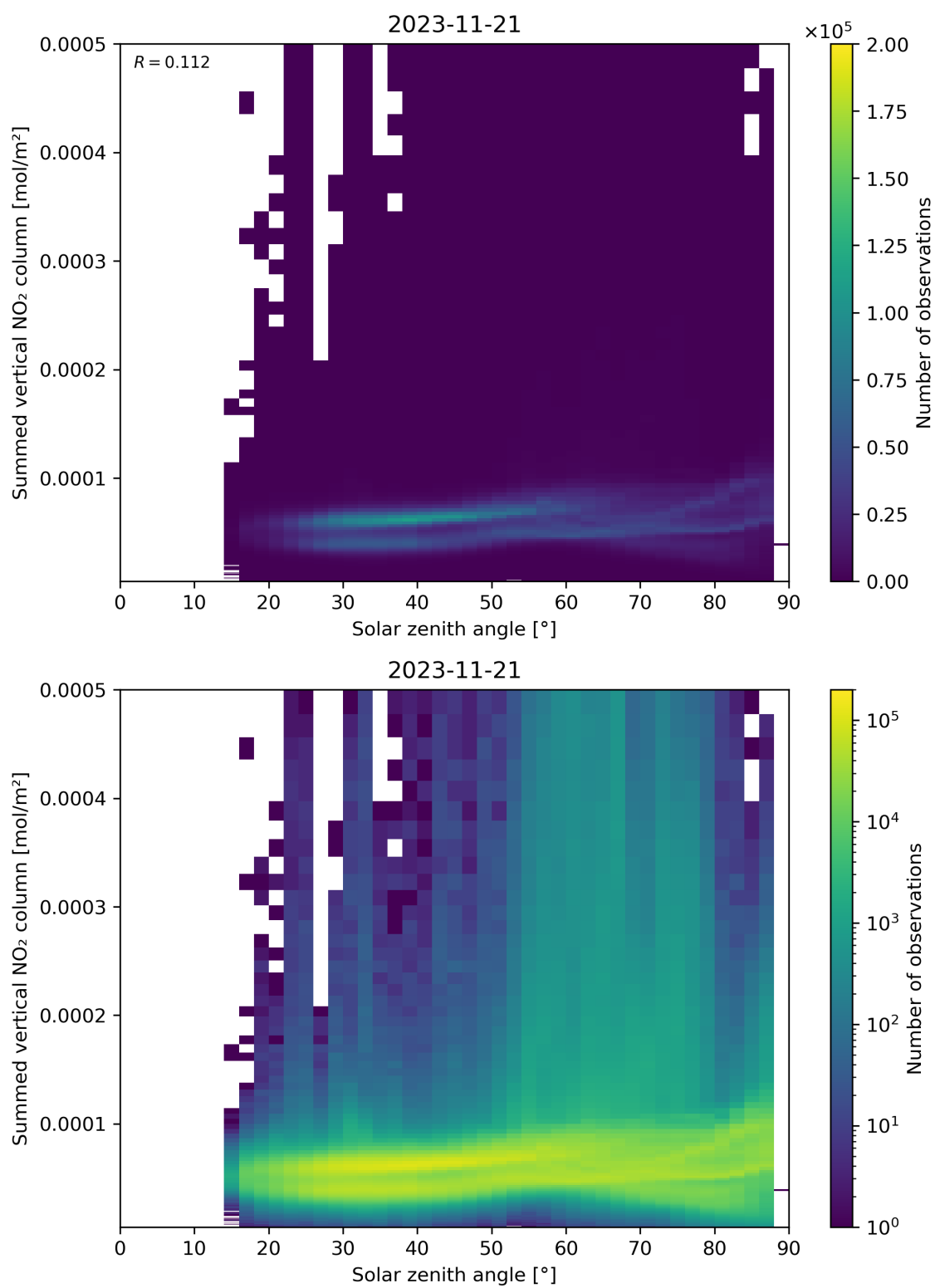


Figure 151: Scatter density plot of “Solar zenith angle” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

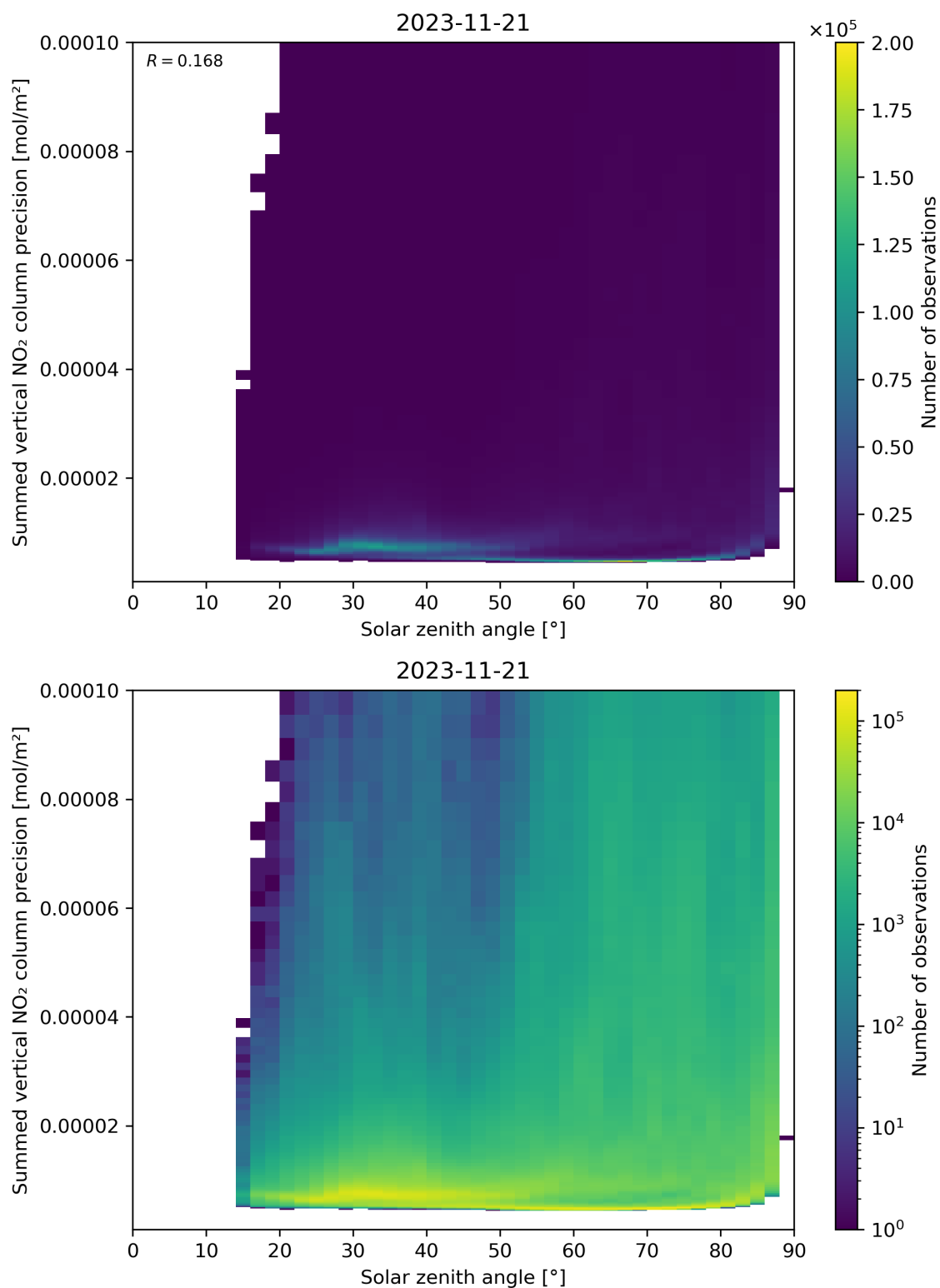


Figure 152: Scatter density plot of “Solar zenith angle” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

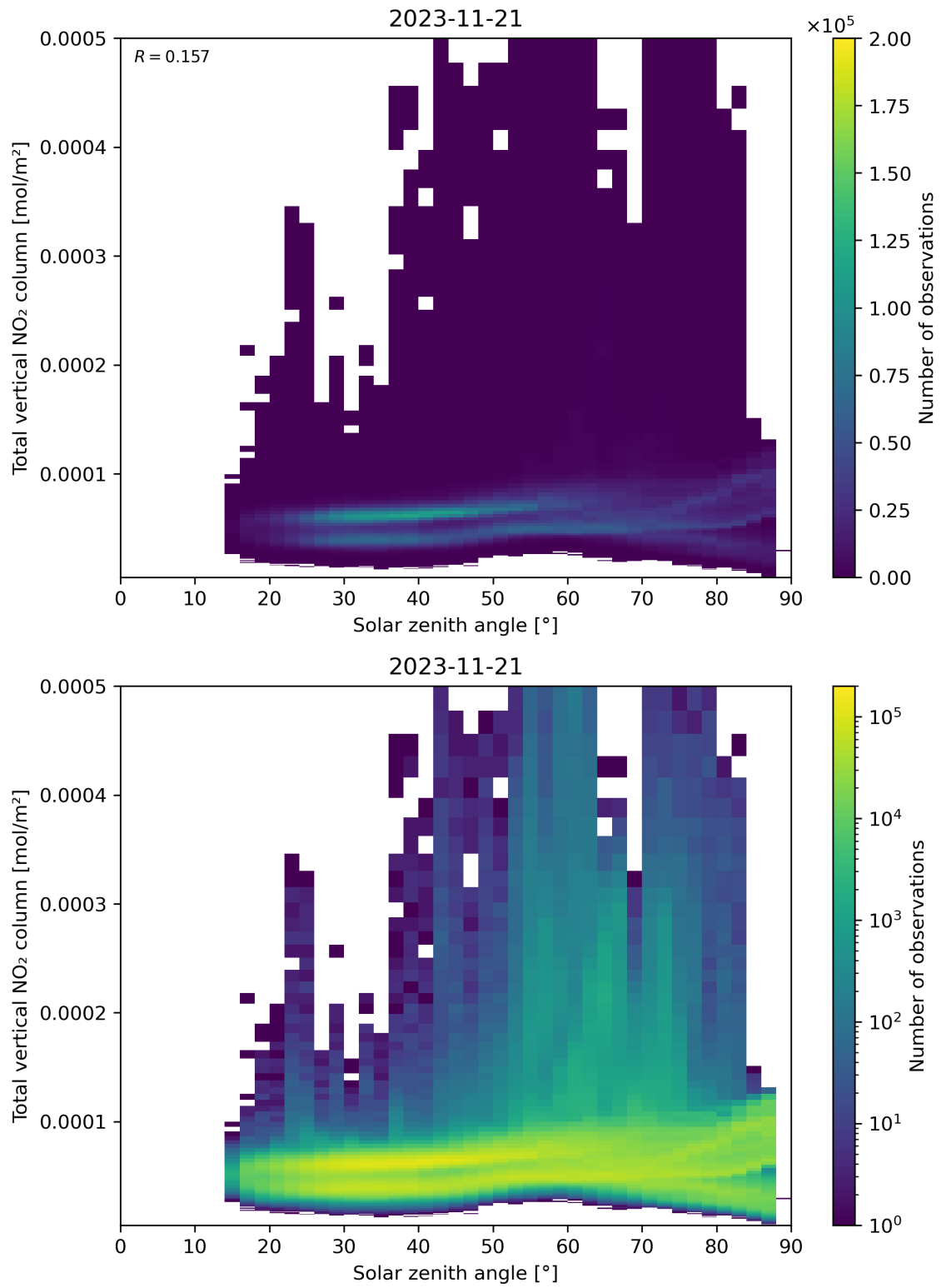


Figure 153: Scatter density plot of “Solar zenith angle” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

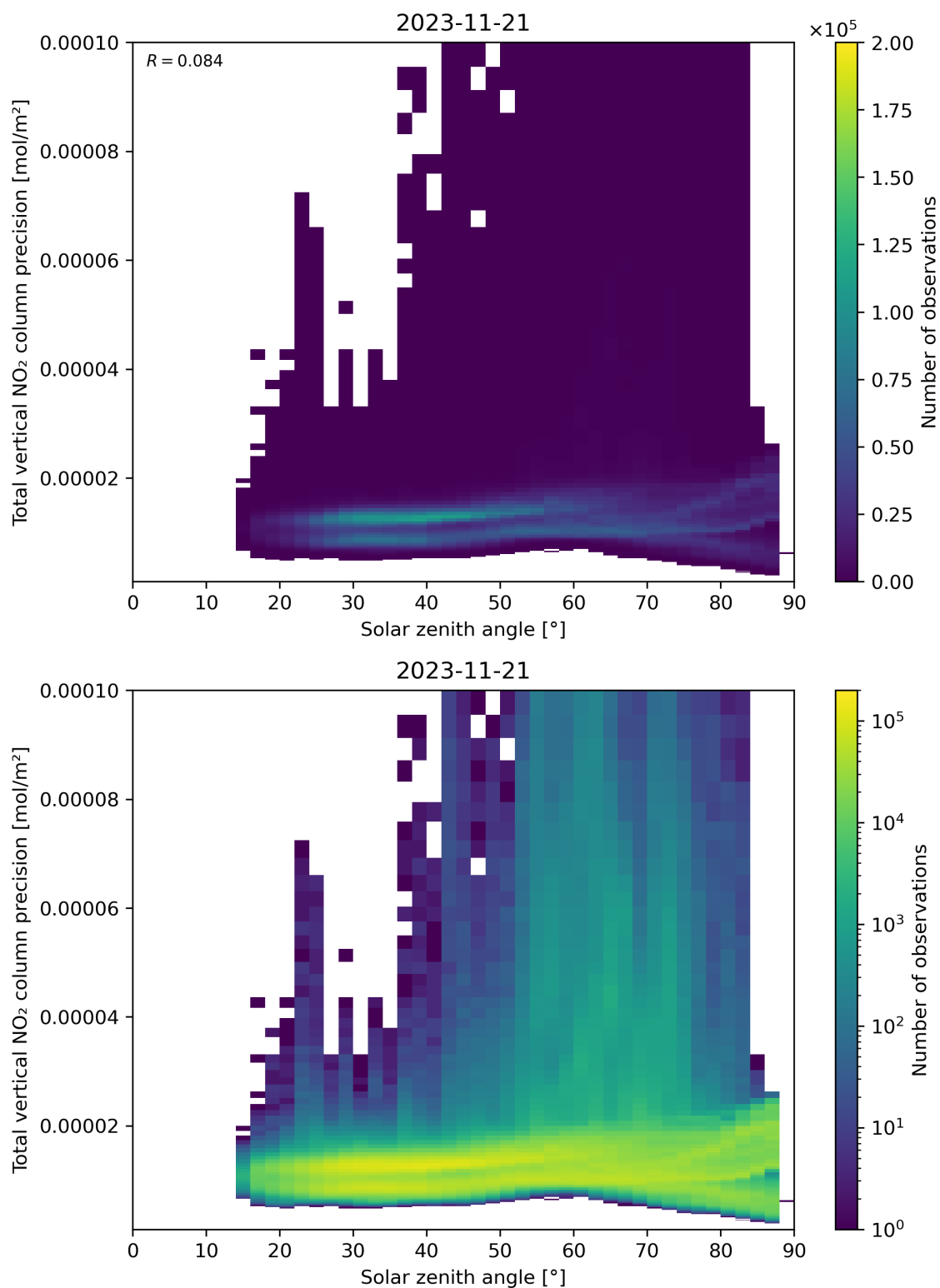


Figure 154: Scatter density plot of “Solar zenith angle” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

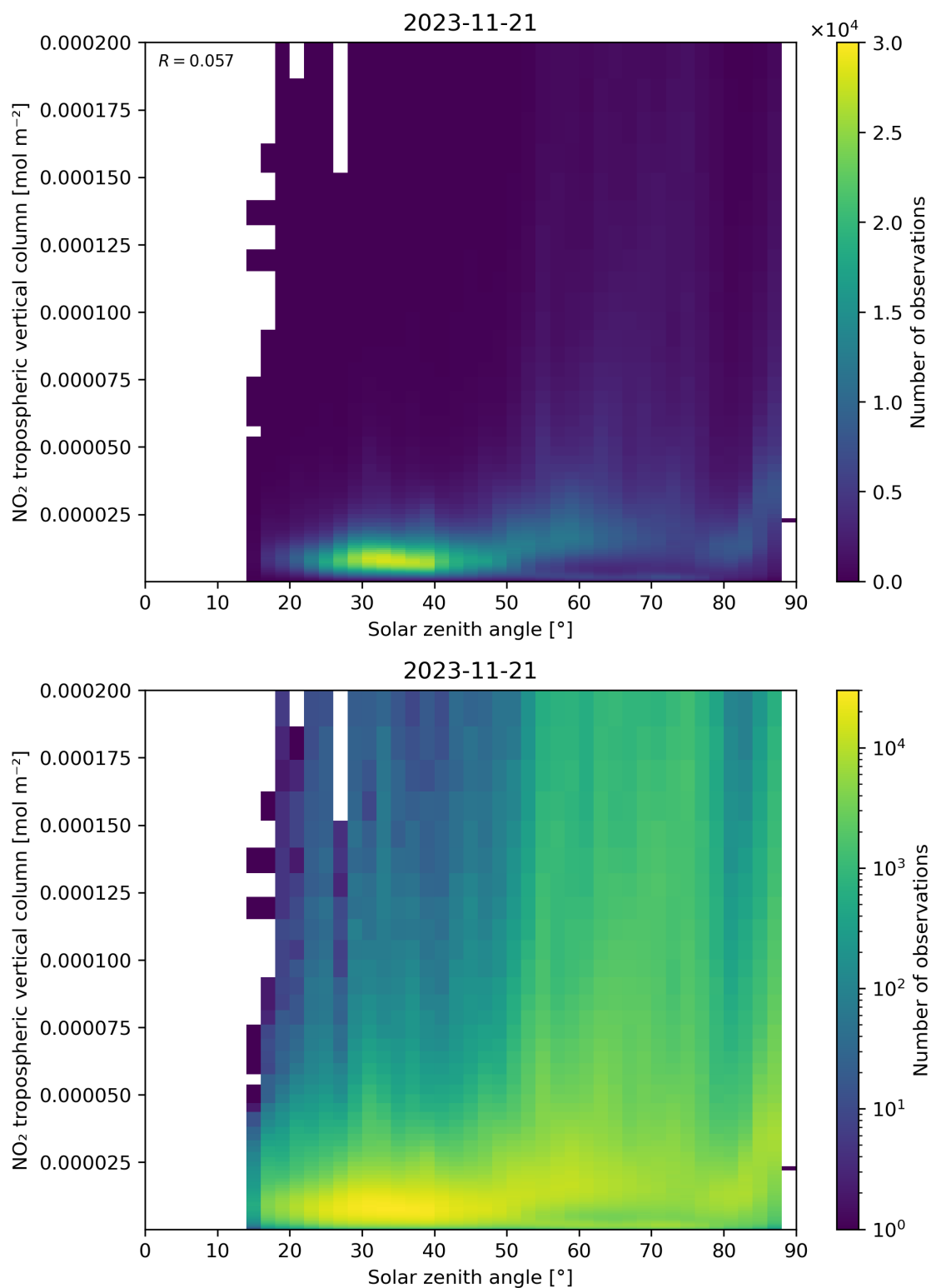


Figure 155: Scatter density plot of “Solar zenith angle” against “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.

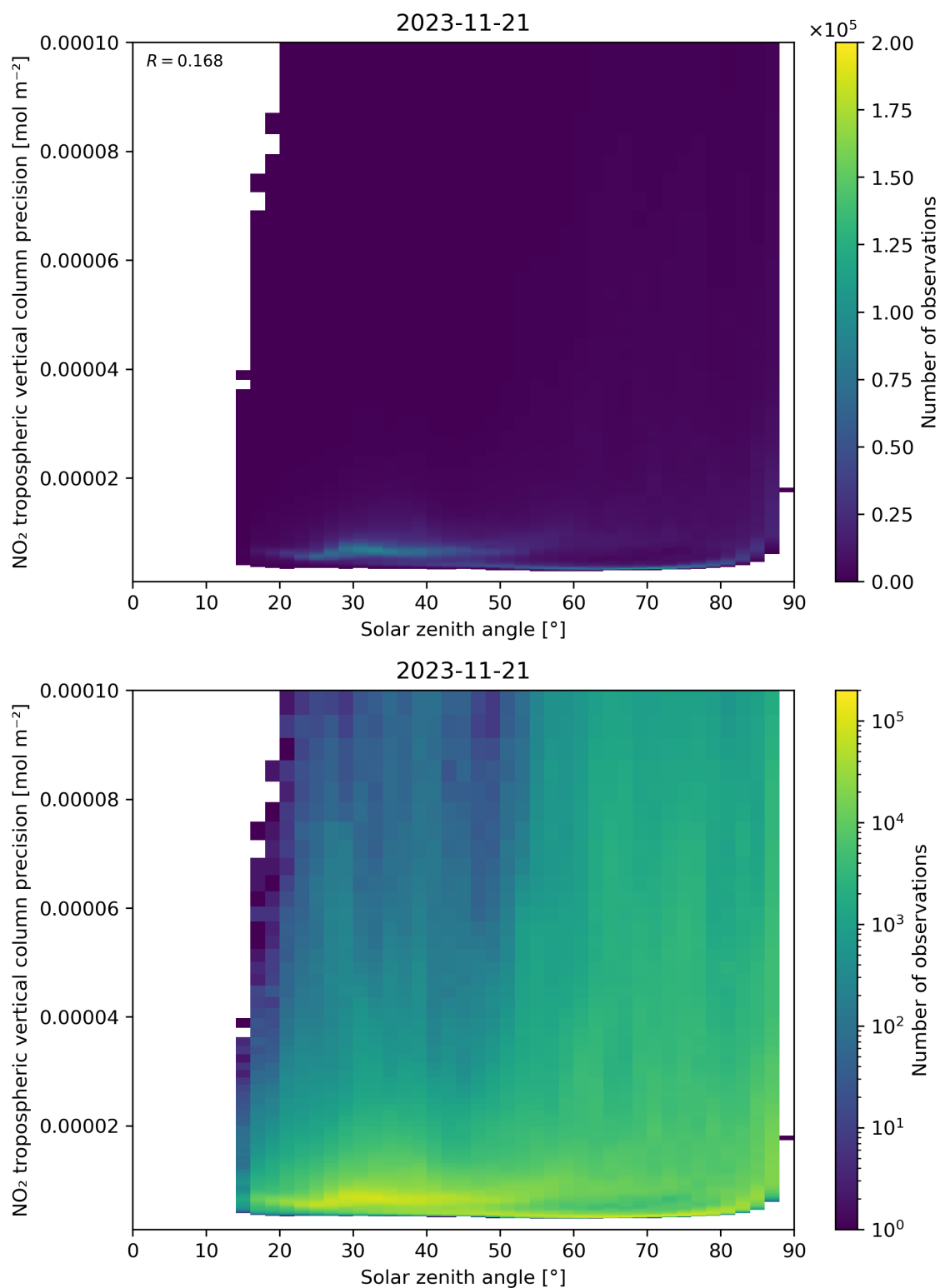


Figure 156: Scatter density plot of “Solar zenith angle” against “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.

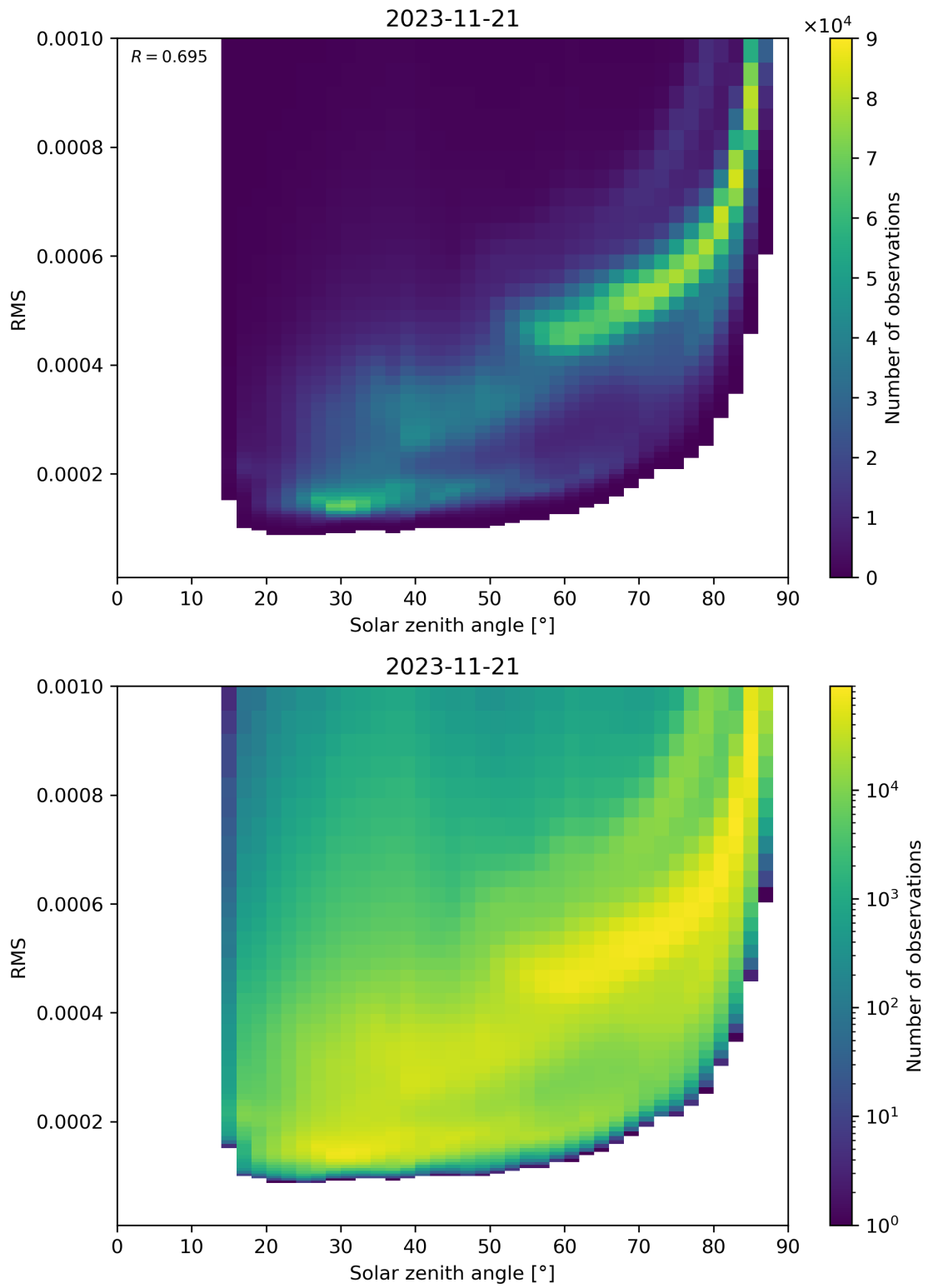


Figure 157: Scatter density plot of “Solar zenith angle” against “RMS” for 2023-11-20 to 2023-11-22.

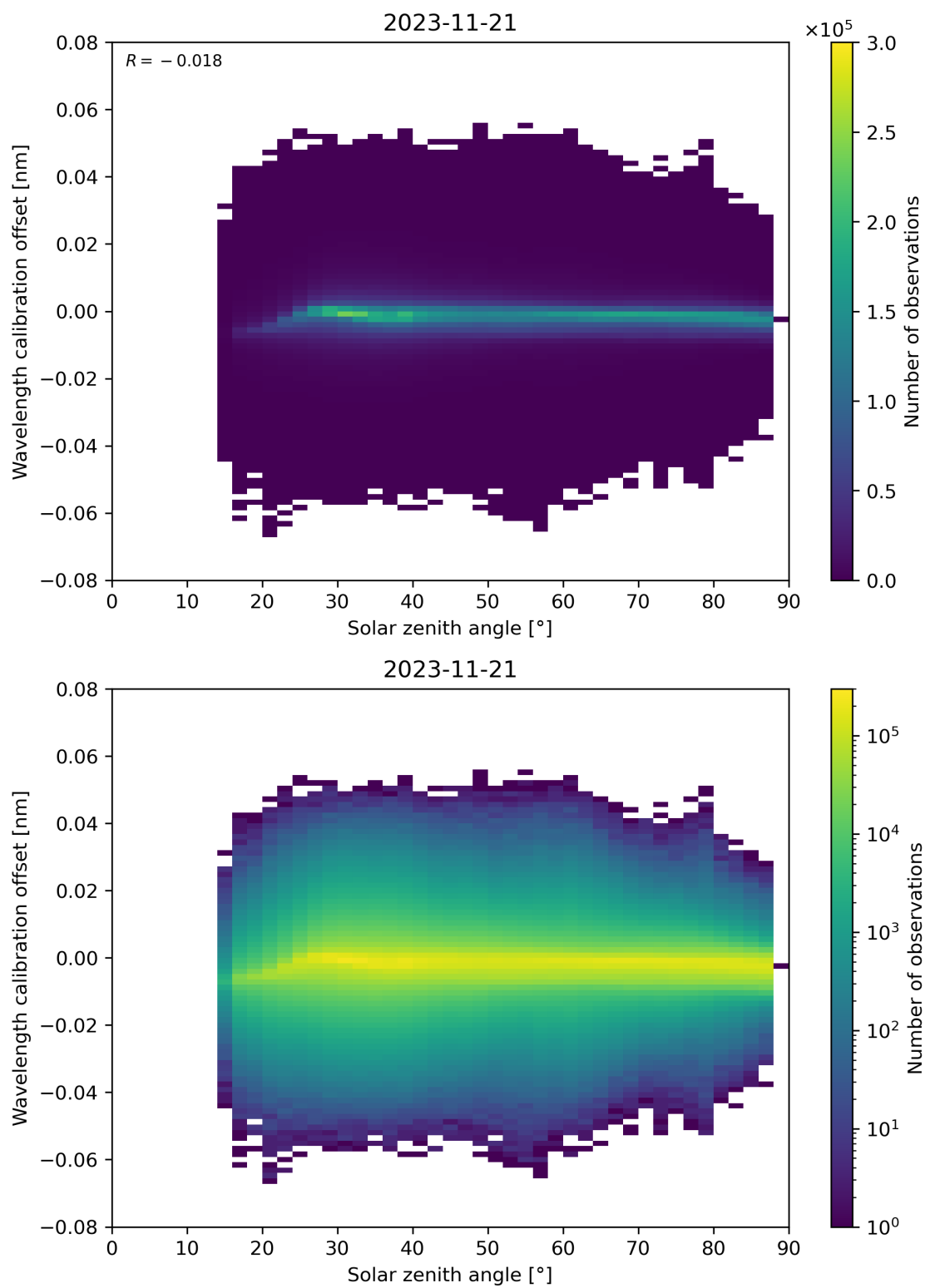


Figure 158: Scatter density plot of “Solar zenith angle” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

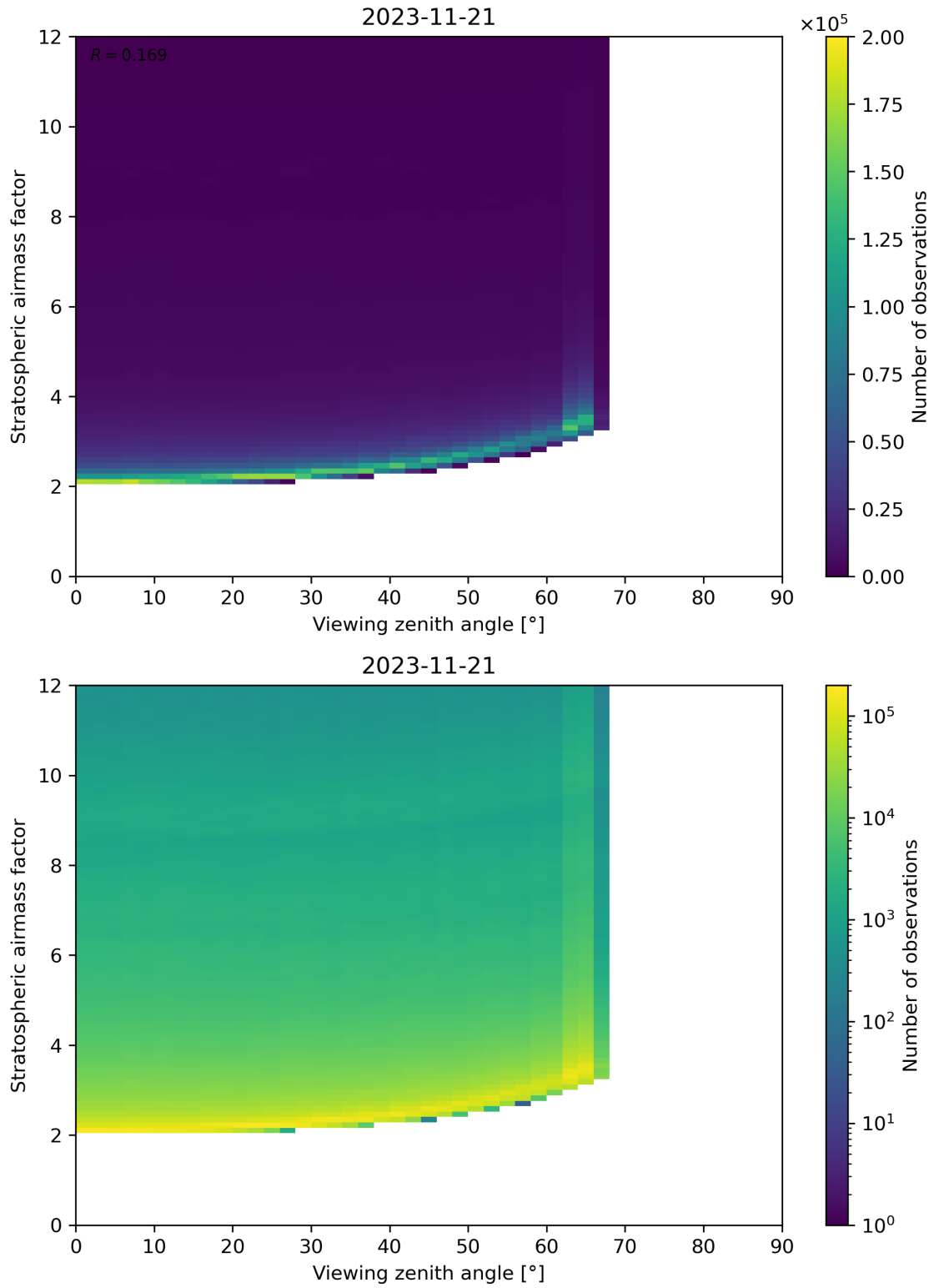


Figure 159: Scatter density plot of “Viewing zenith angle” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

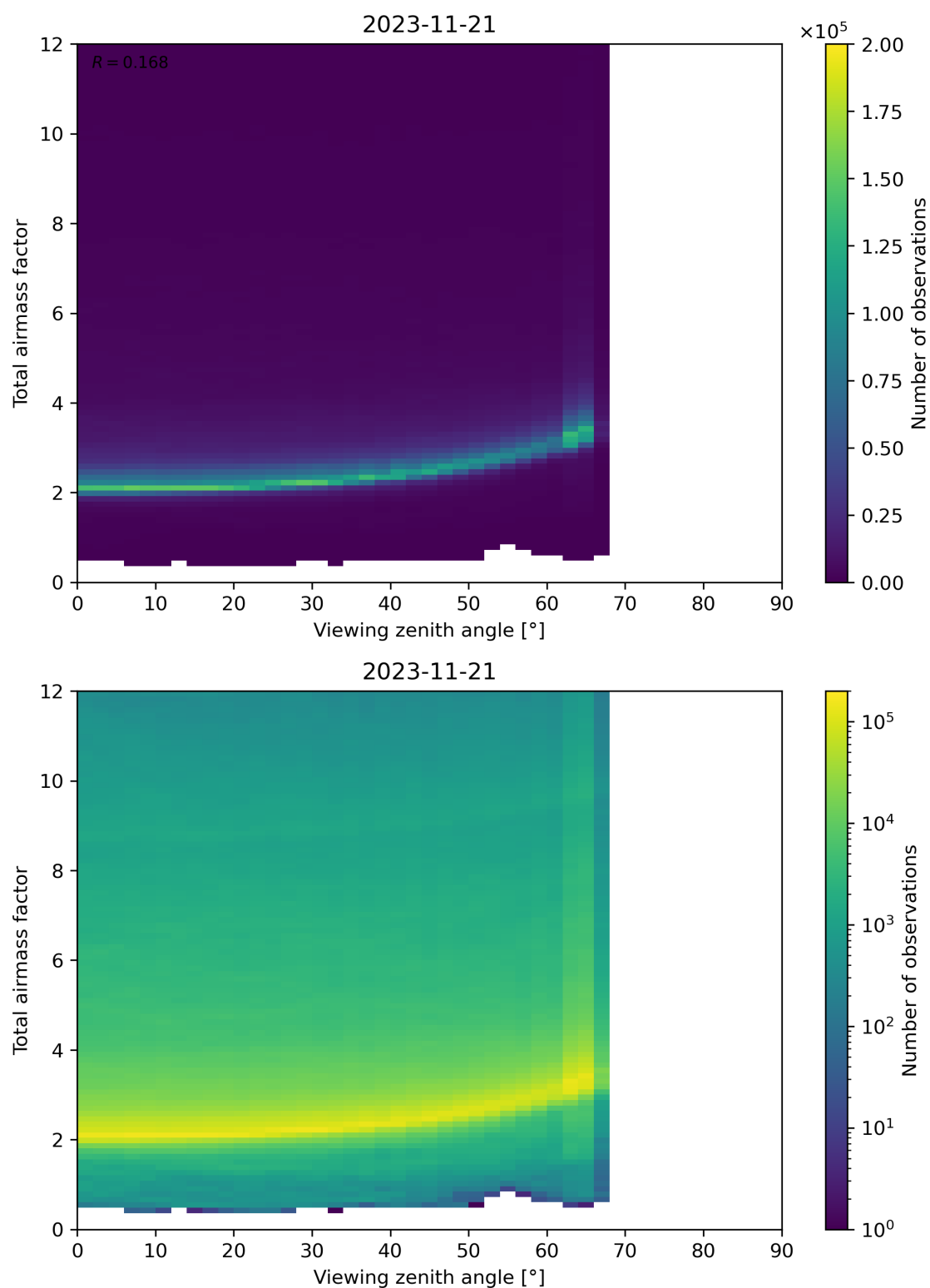


Figure 160: Scatter density plot of “Viewing zenith angle” against “Total airmass factor” for 2023-11-20 to 2023-11-22.

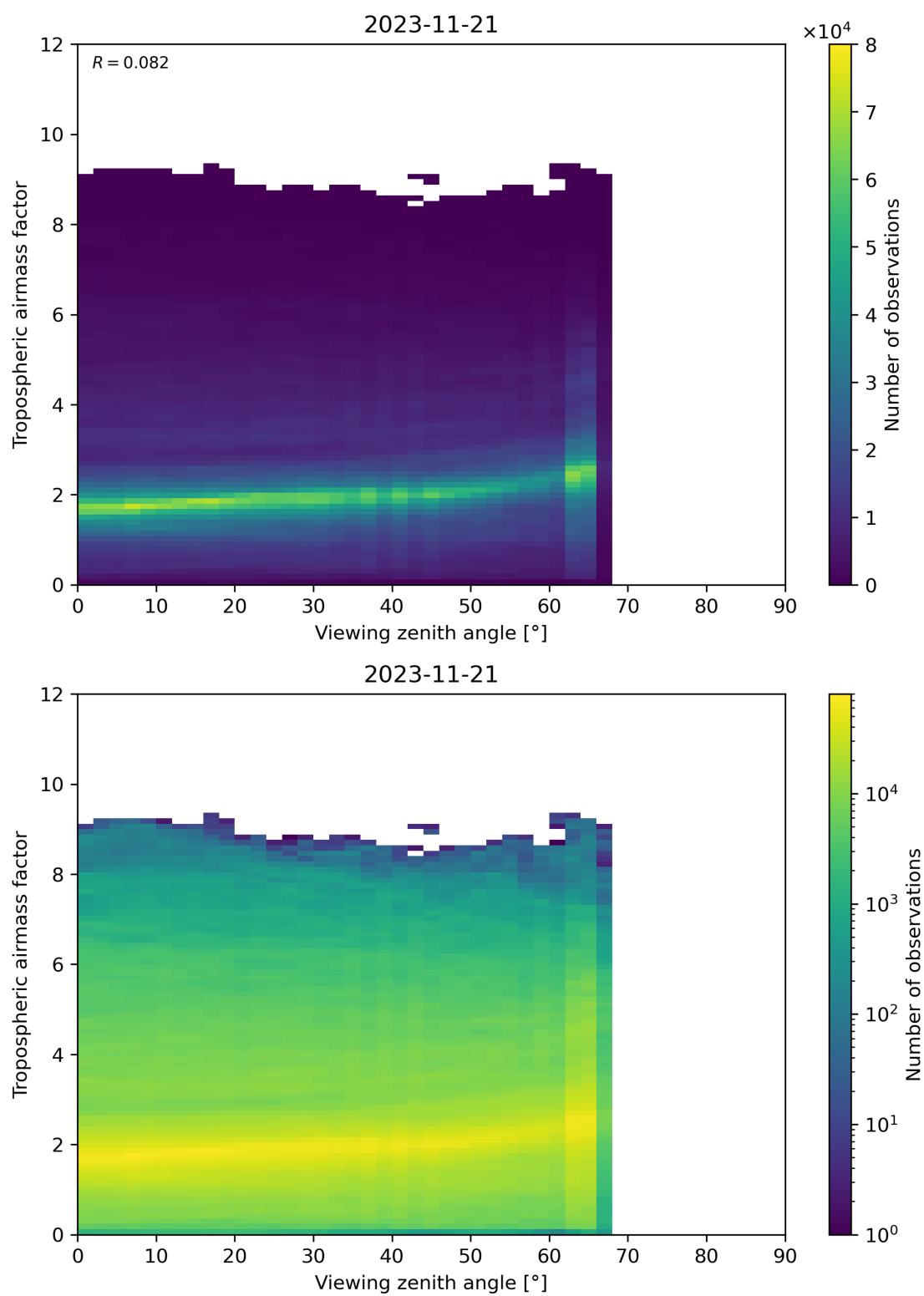


Figure 161: Scatter density plot of “Viewing zenith angle” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.

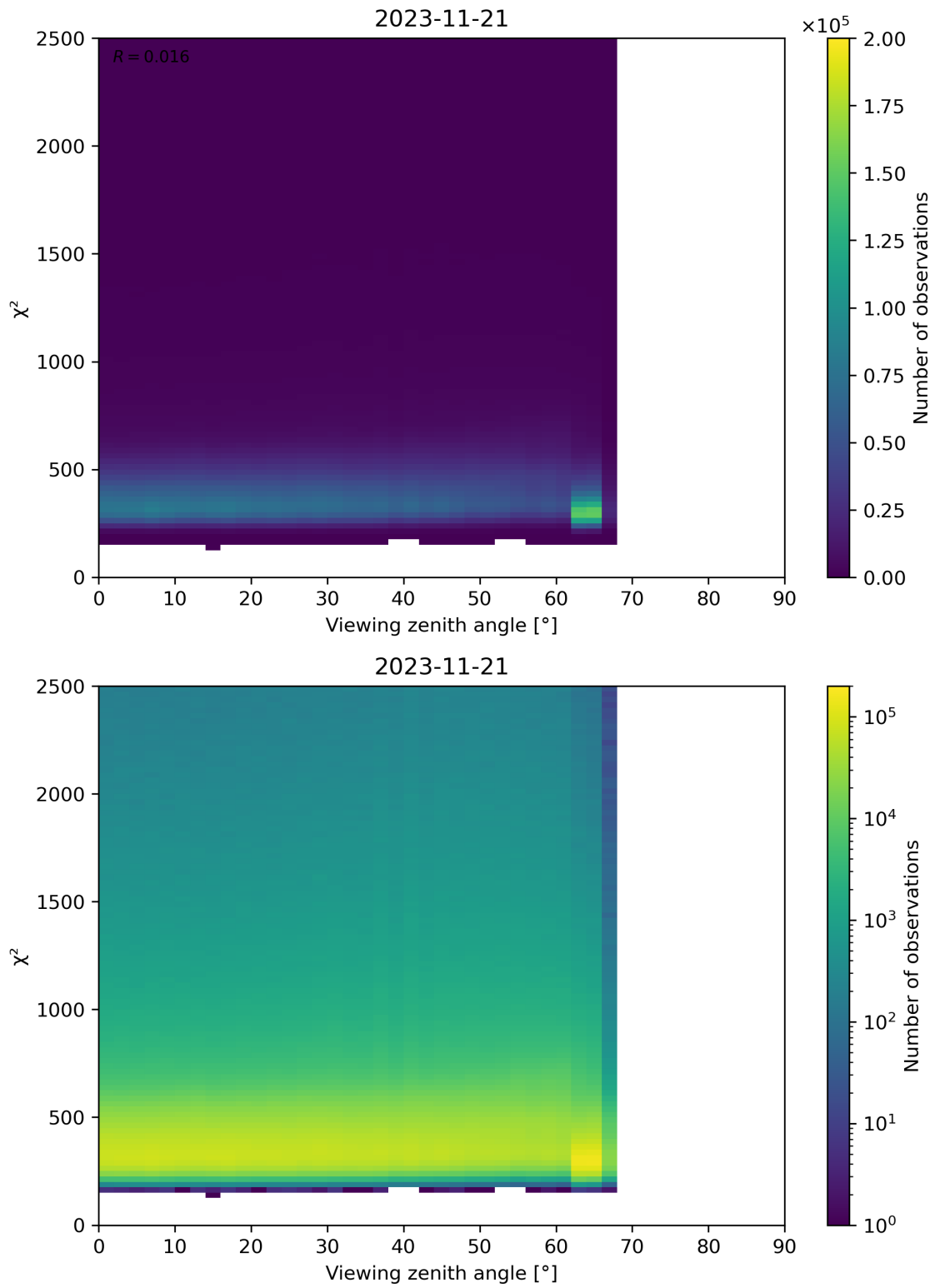


Figure 162: Scatter density plot of “Viewing zenith angle” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

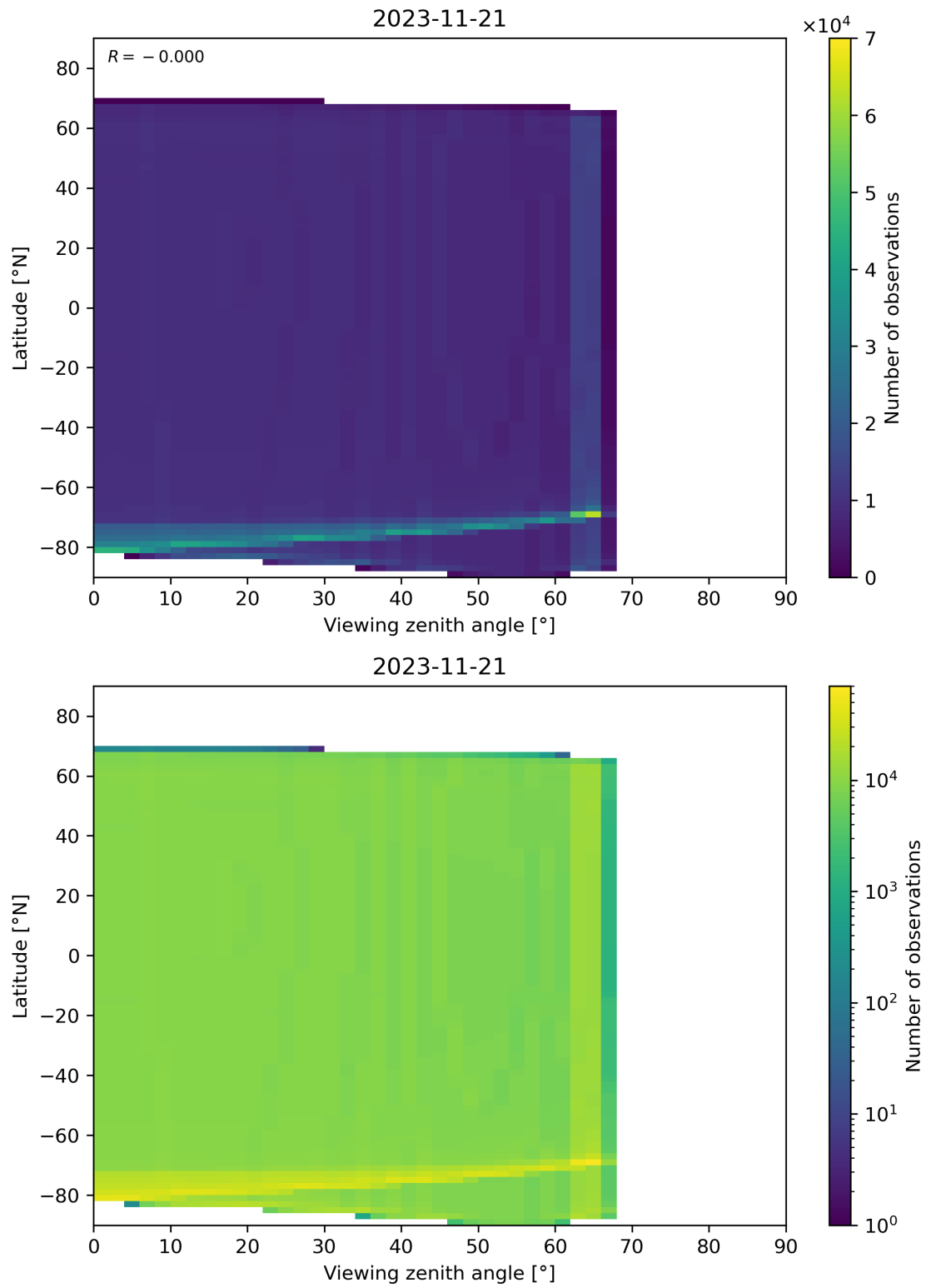


Figure 163: Scatter density plot of “Viewing zenith angle” against “Latitude” for 2023-11-20 to 2023-11-22.

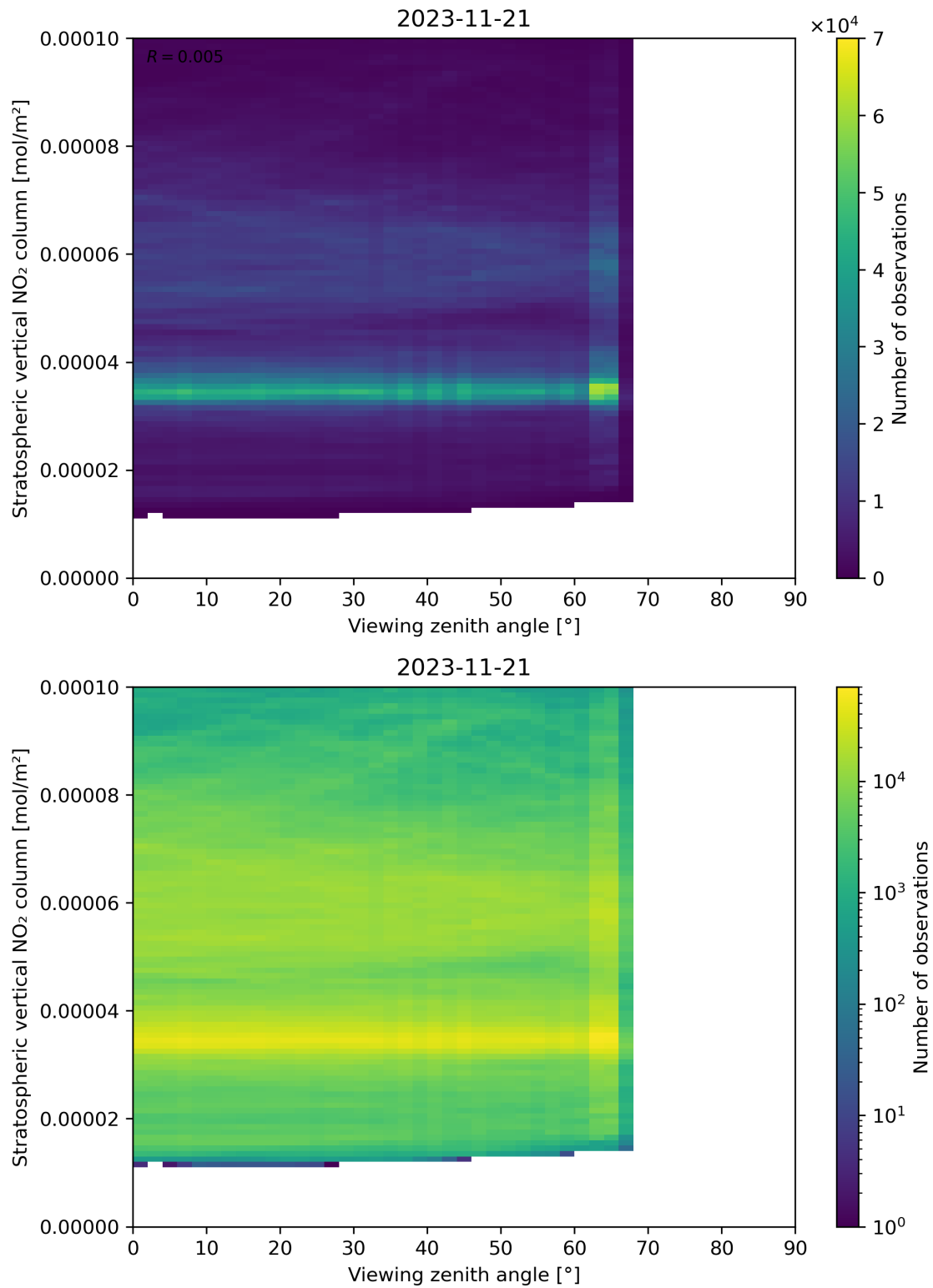


Figure 164: Scatter density plot of “Viewing zenith angle” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

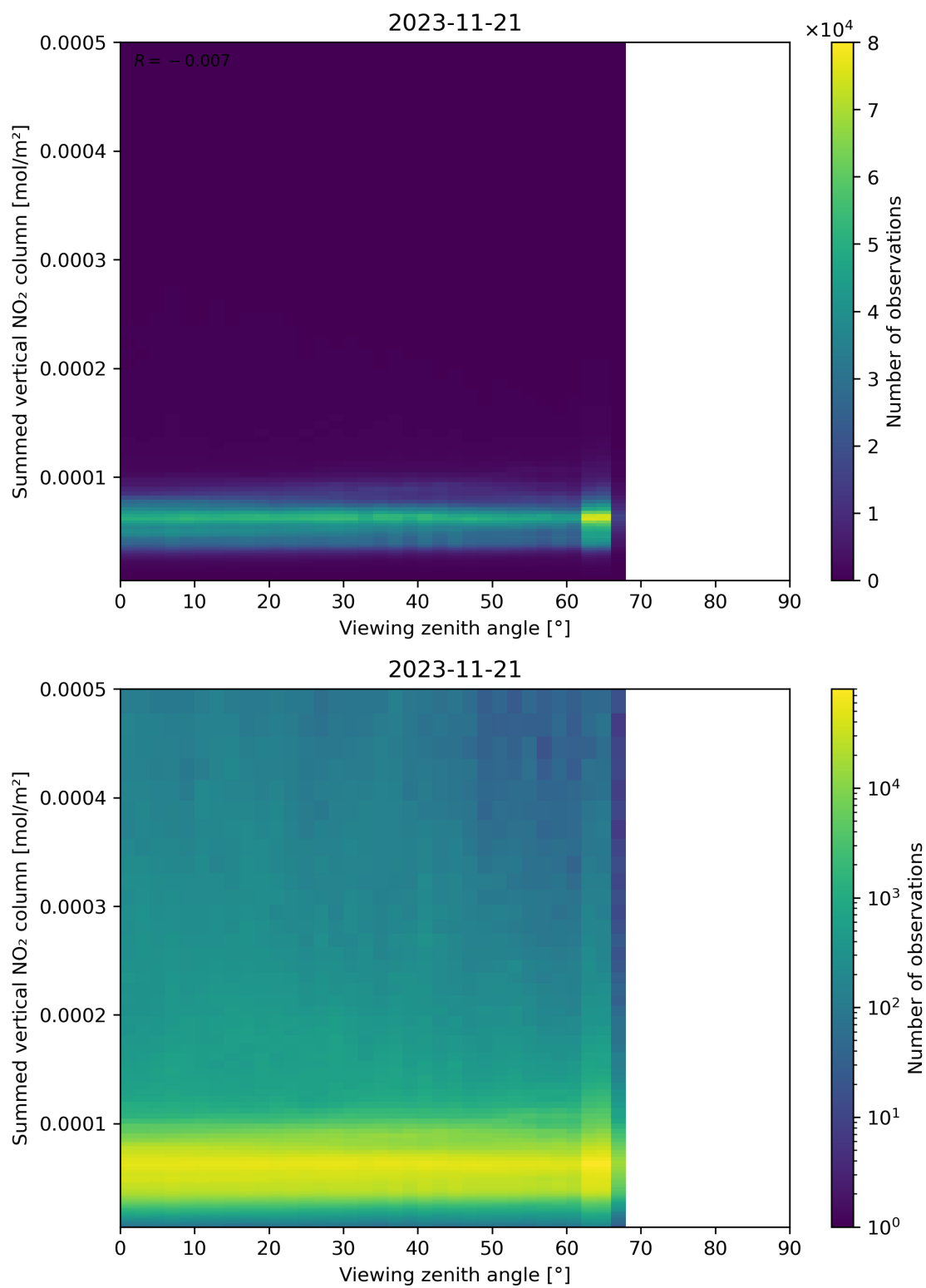


Figure 165: Scatter density plot of “Viewing zenith angle” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

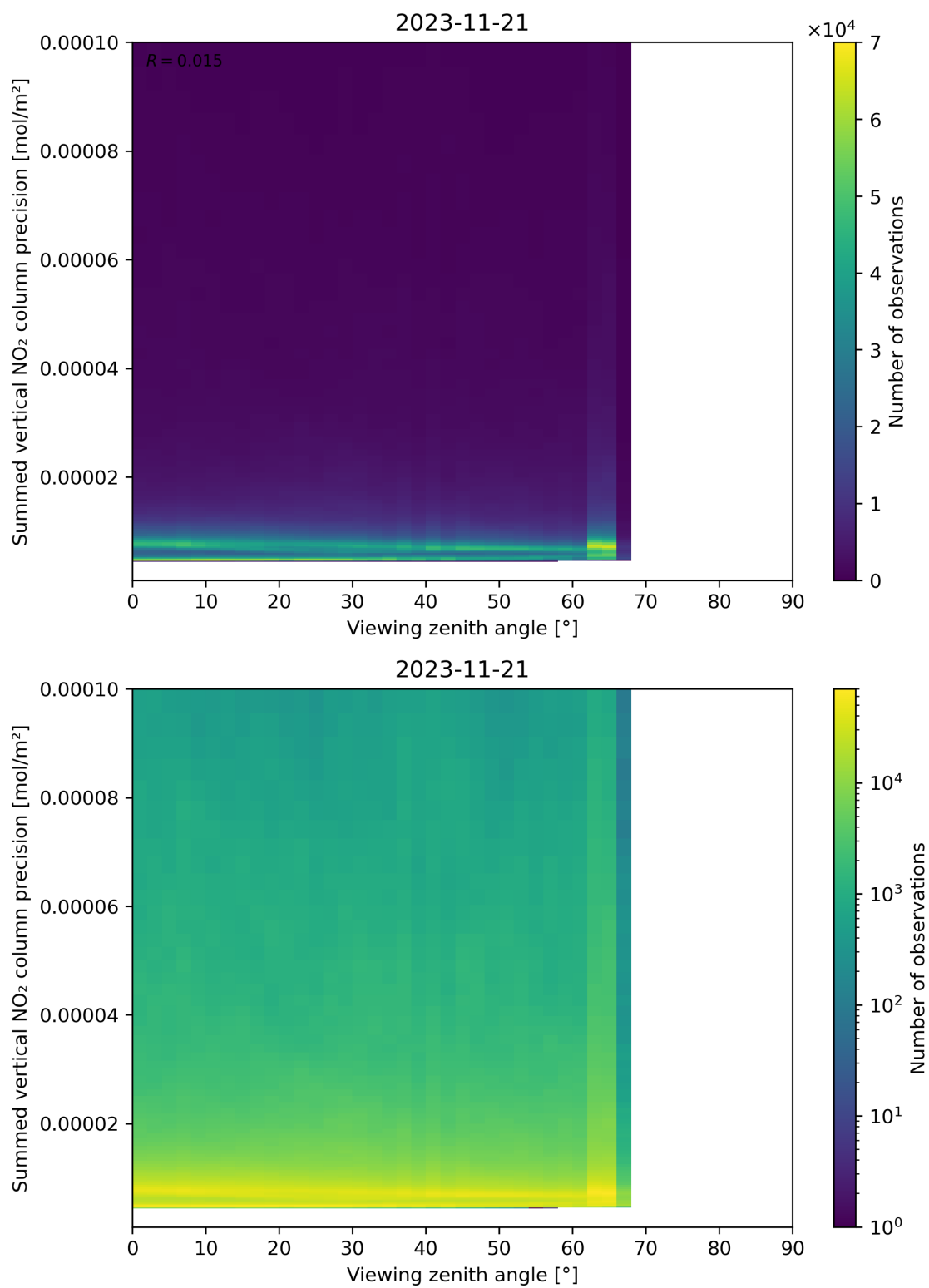


Figure 166: Scatter density plot of “Viewing zenith angle” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

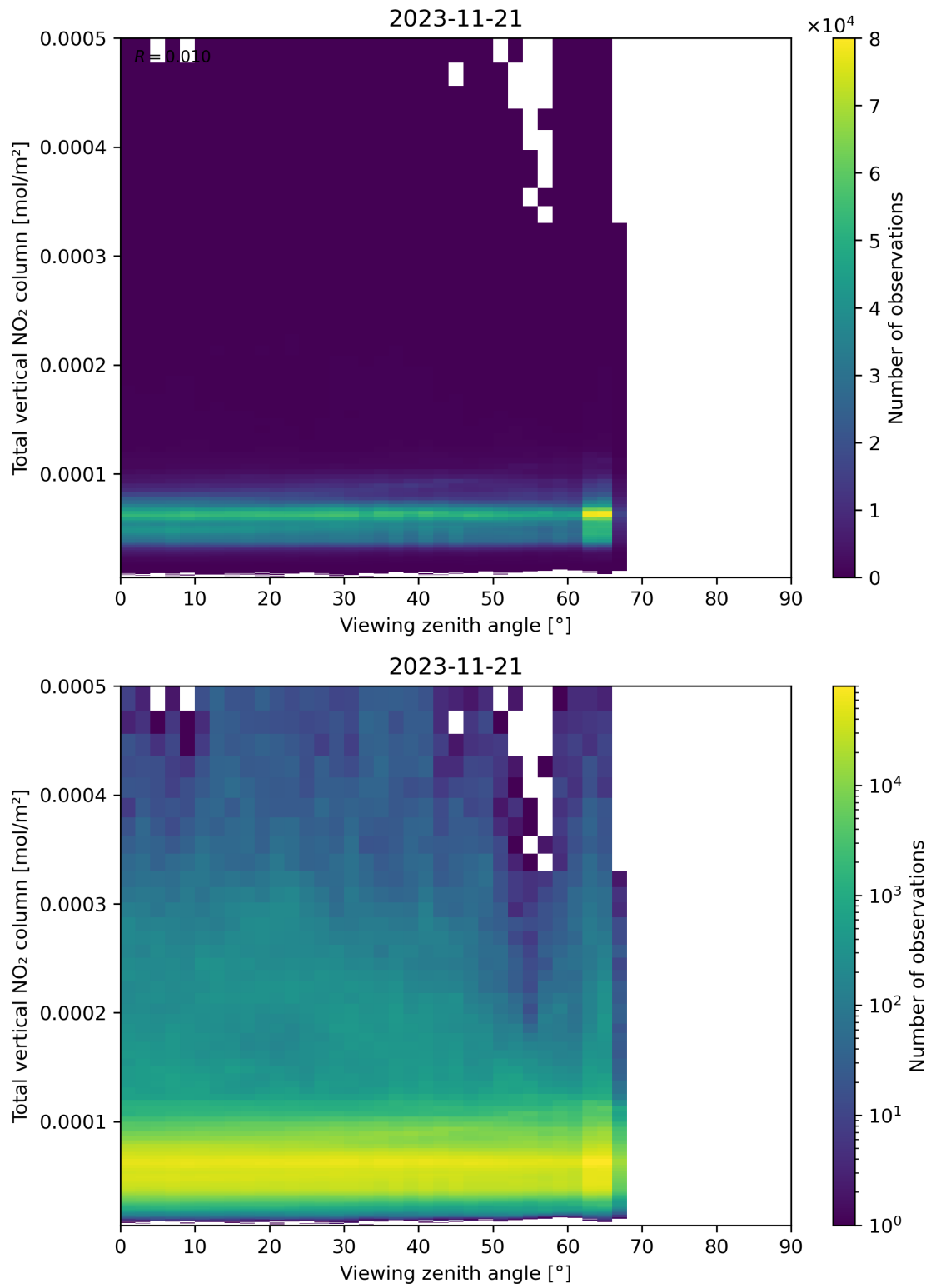


Figure 167: Scatter density plot of “Viewing zenith angle” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

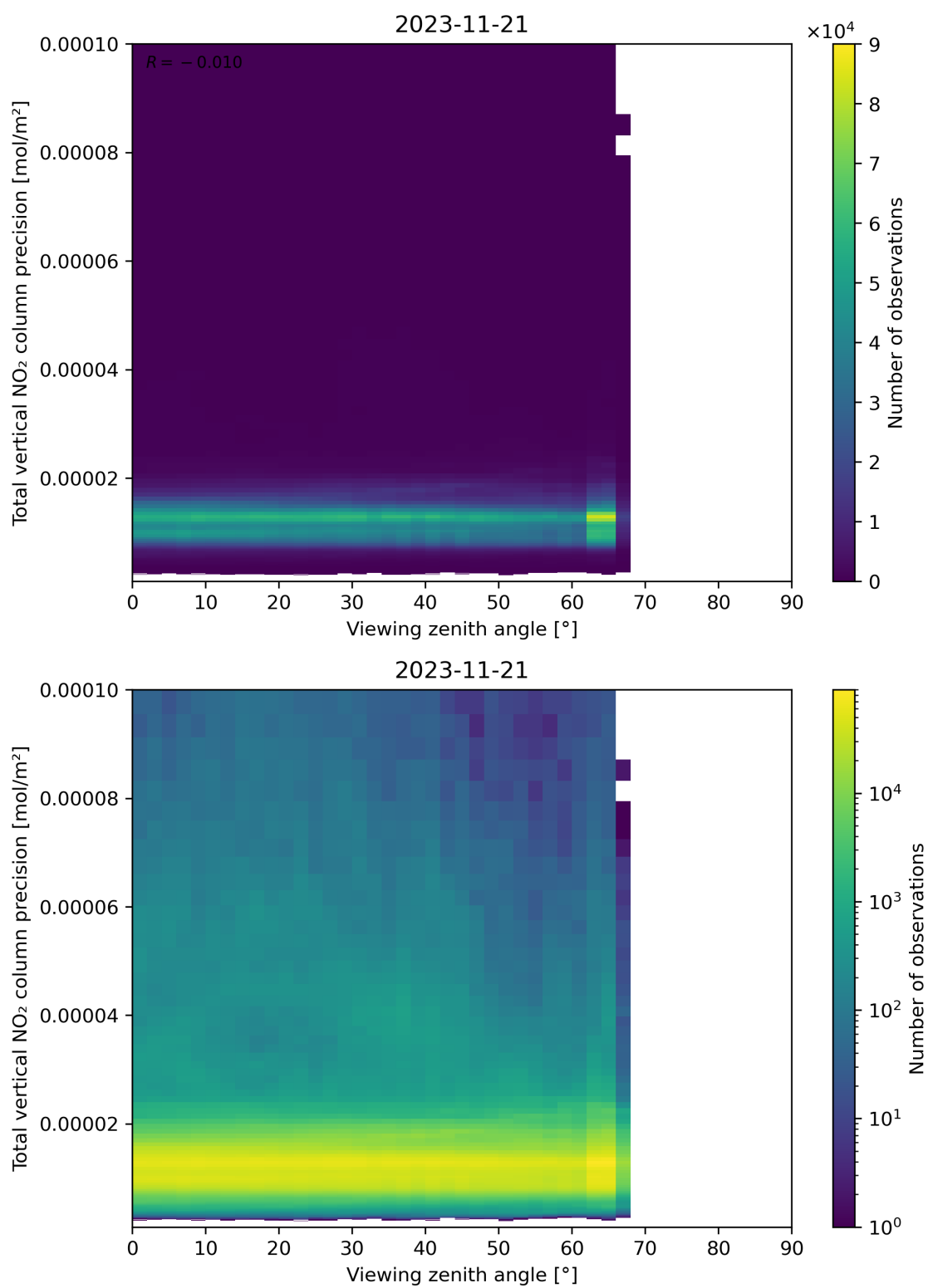


Figure 168: Scatter density plot of “Viewing zenith angle” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

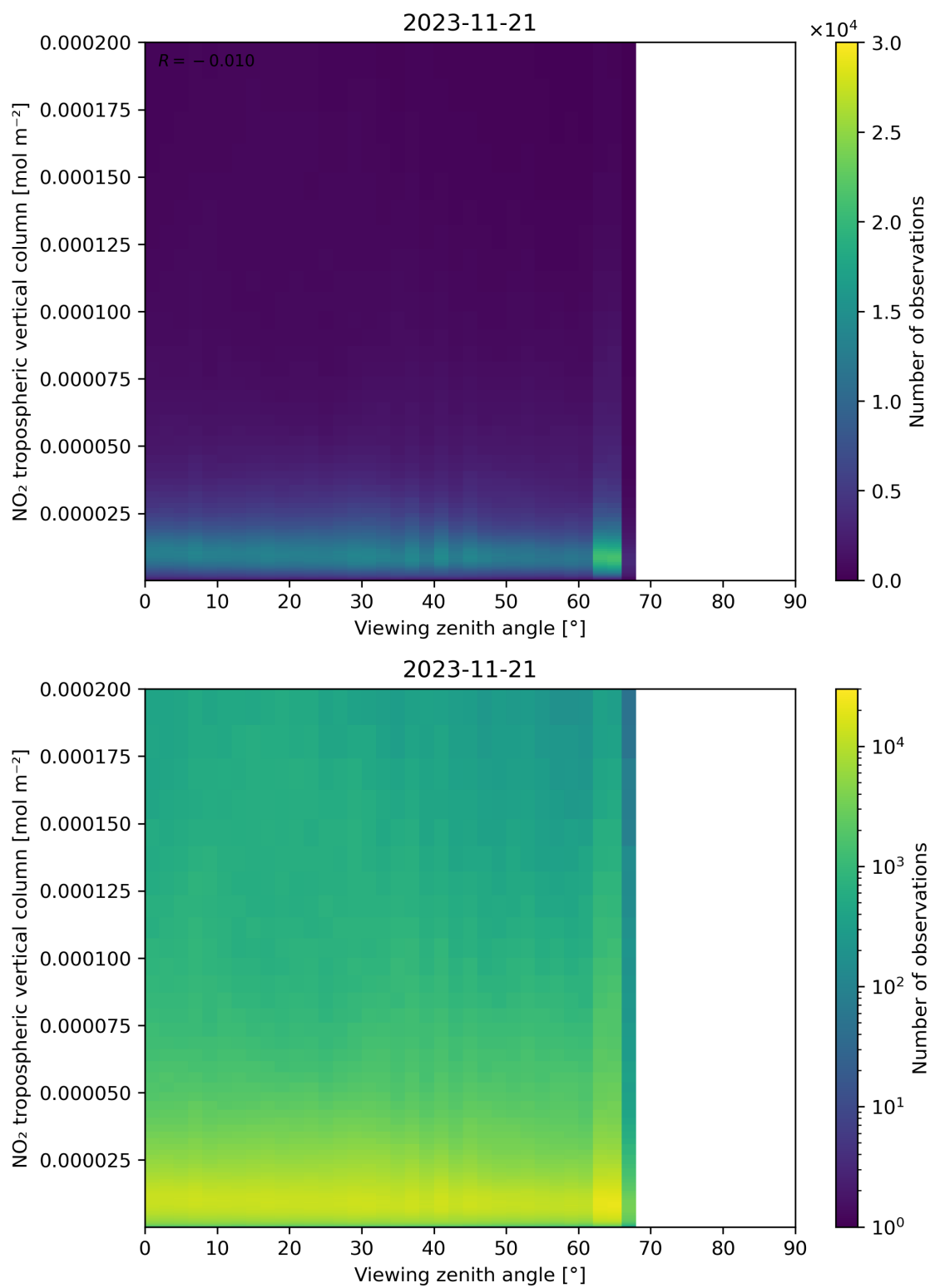


Figure 169: Scatter density plot of “Viewing zenith angle” against “NO₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.

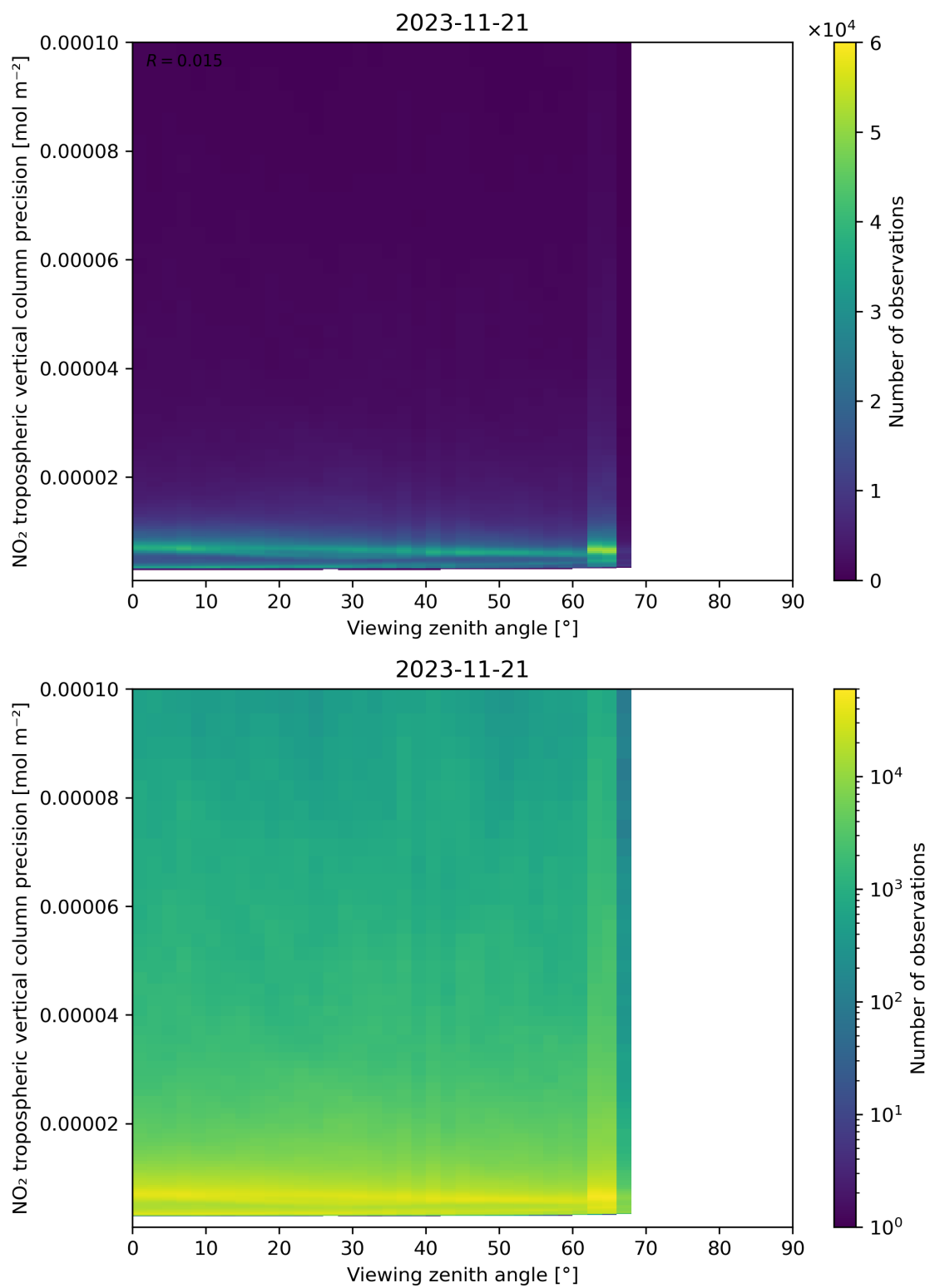


Figure 170: Scatter density plot of “Viewing zenith angle” against “NO₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.

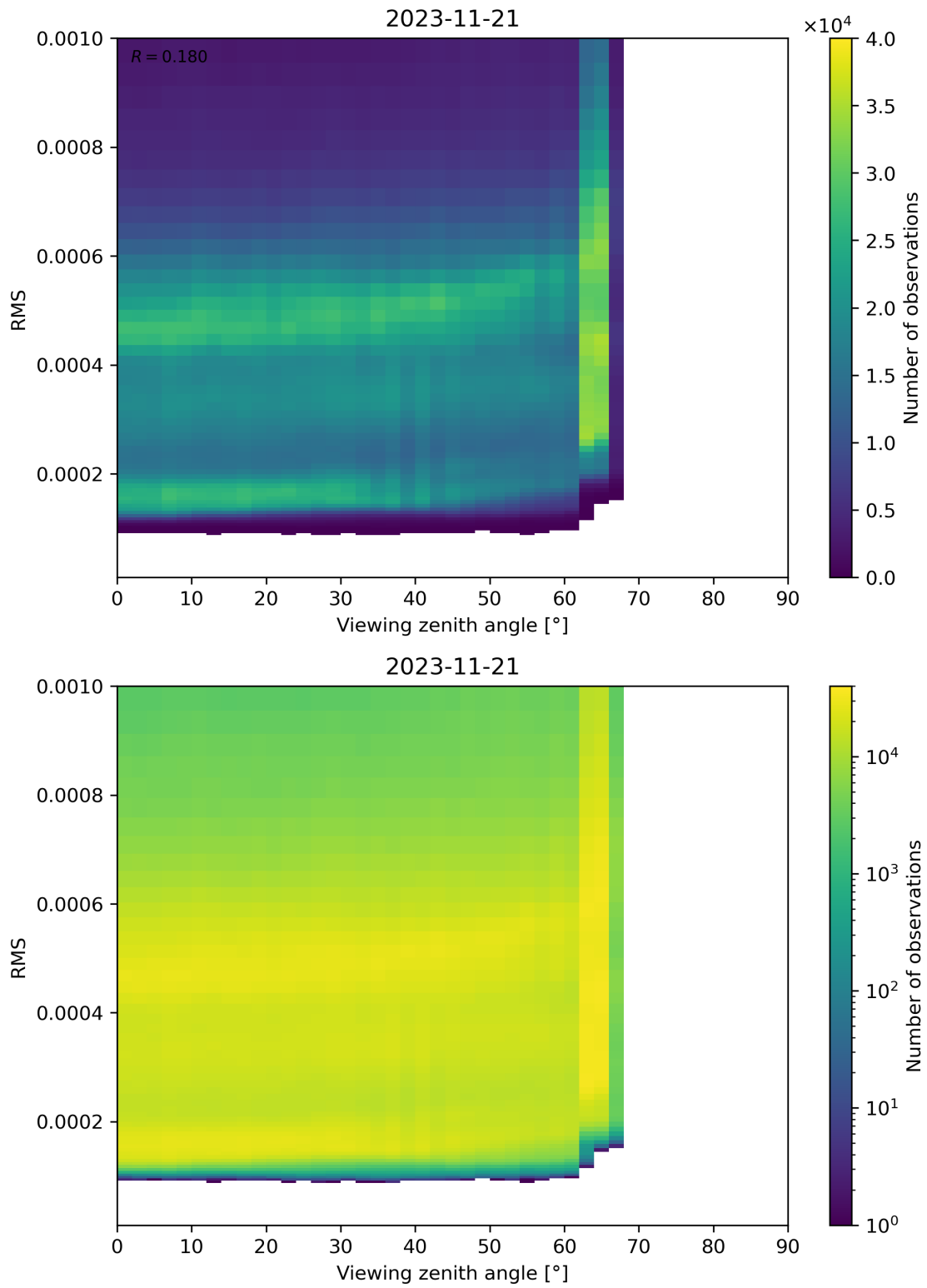


Figure 171: Scatter density plot of “Viewing zenith angle” against “RMS” for 2023-11-20 to 2023-11-22.

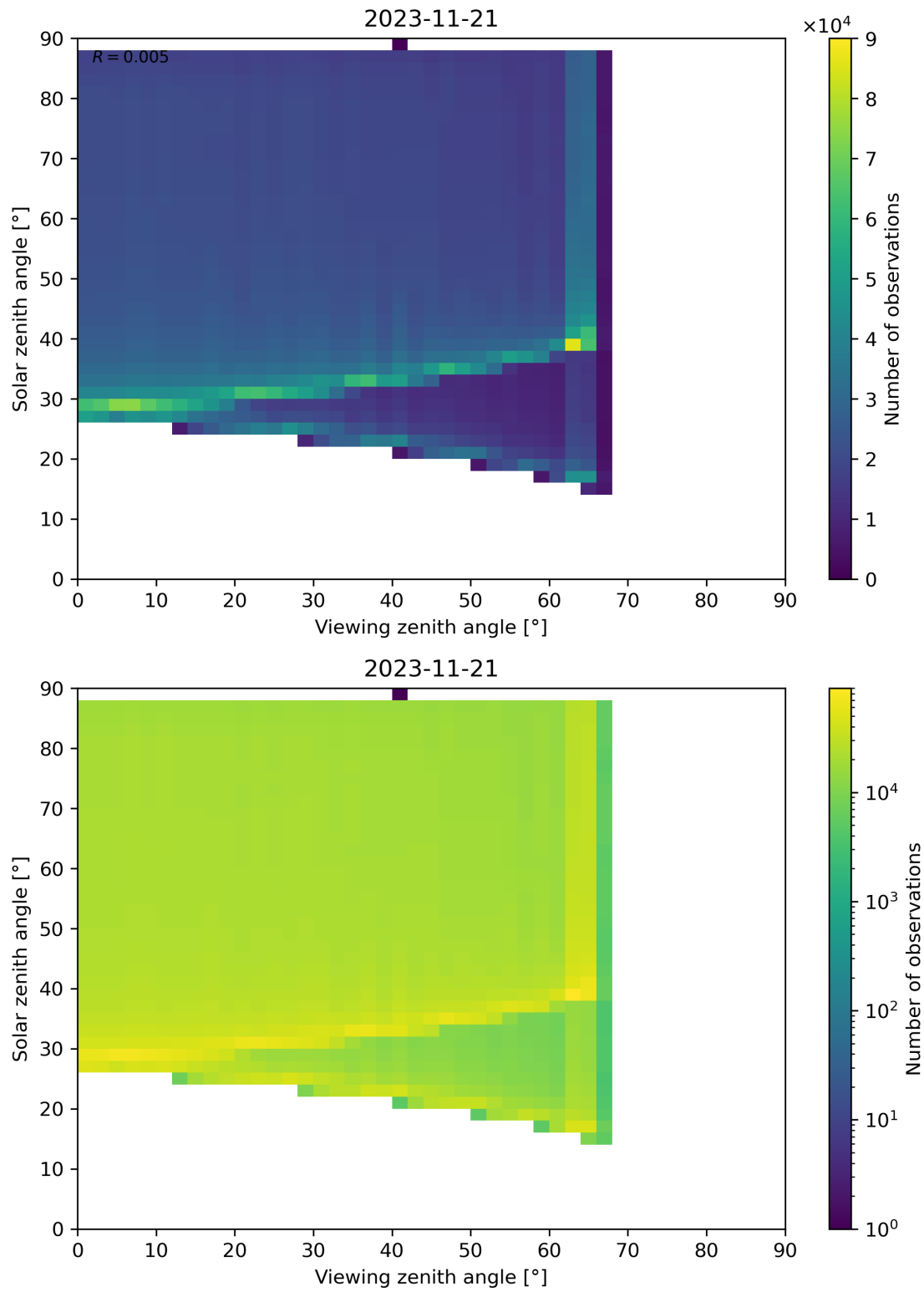


Figure 172: Scatter density plot of “Viewing zenith angle” against “Solar zenith angle” for 2023-11-20 to 2023-11-22.

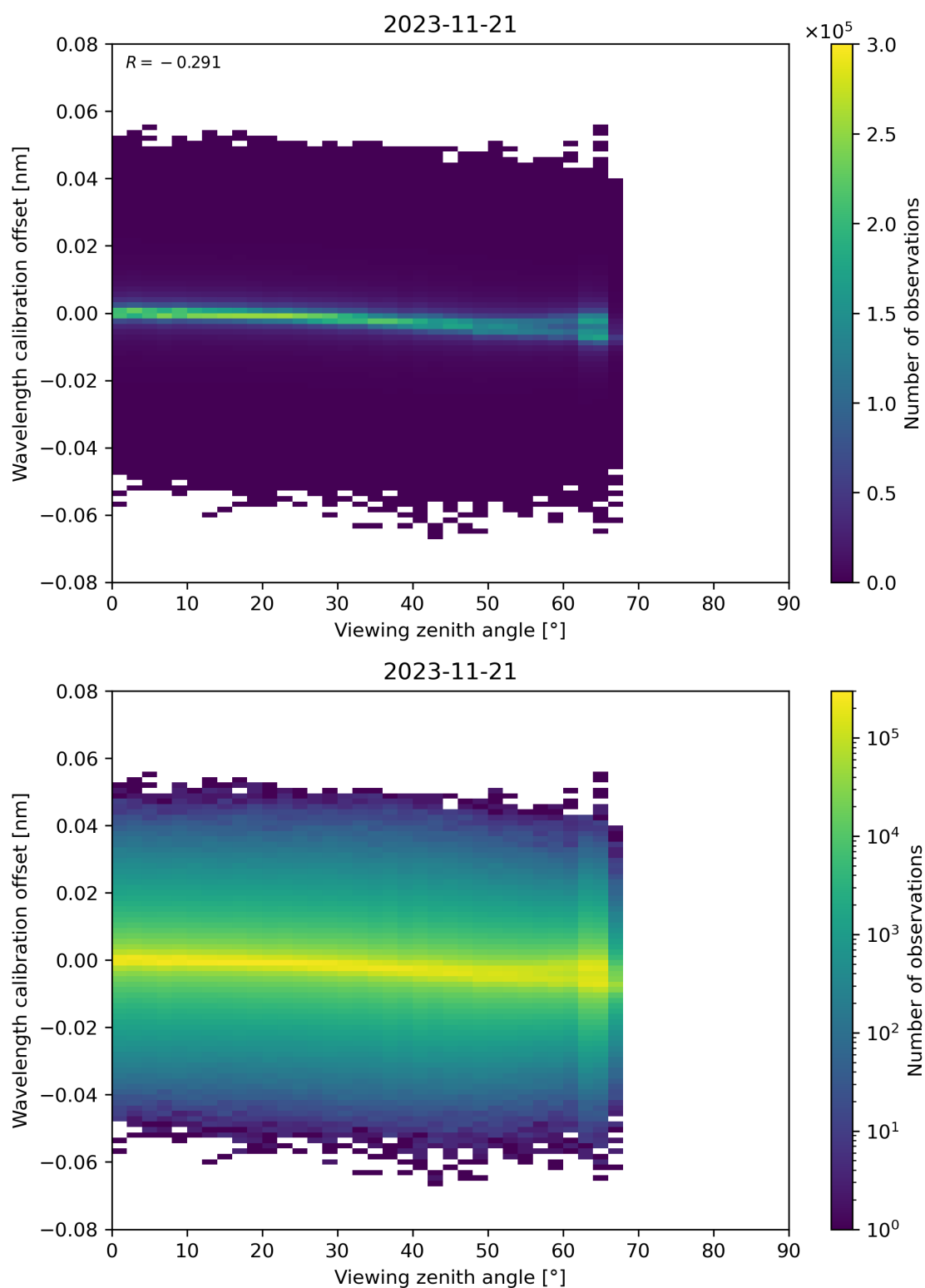


Figure 173: Scatter density plot of “Viewing zenith angle” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.

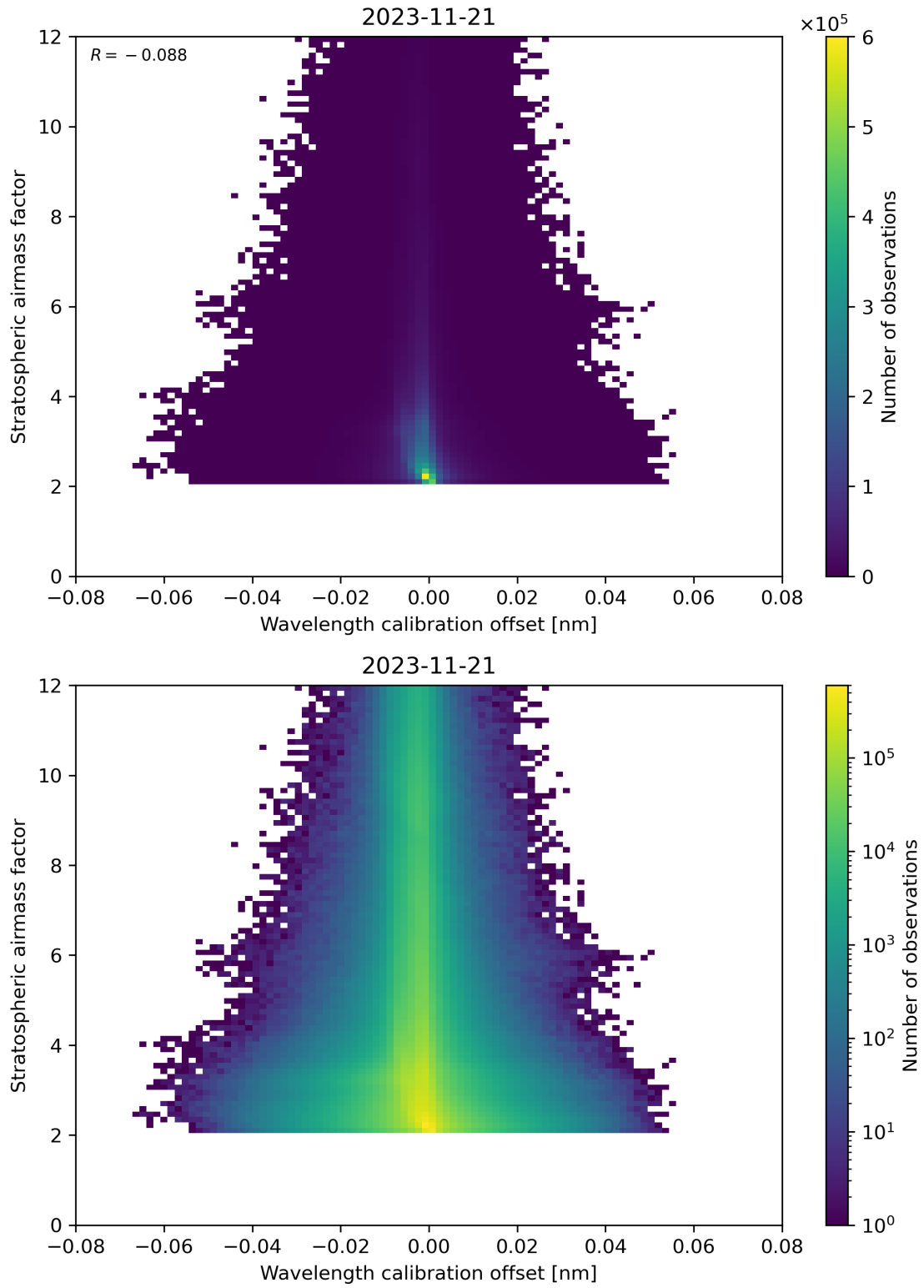


Figure 174: Scatter density plot of “Wavelength calibration offset” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.

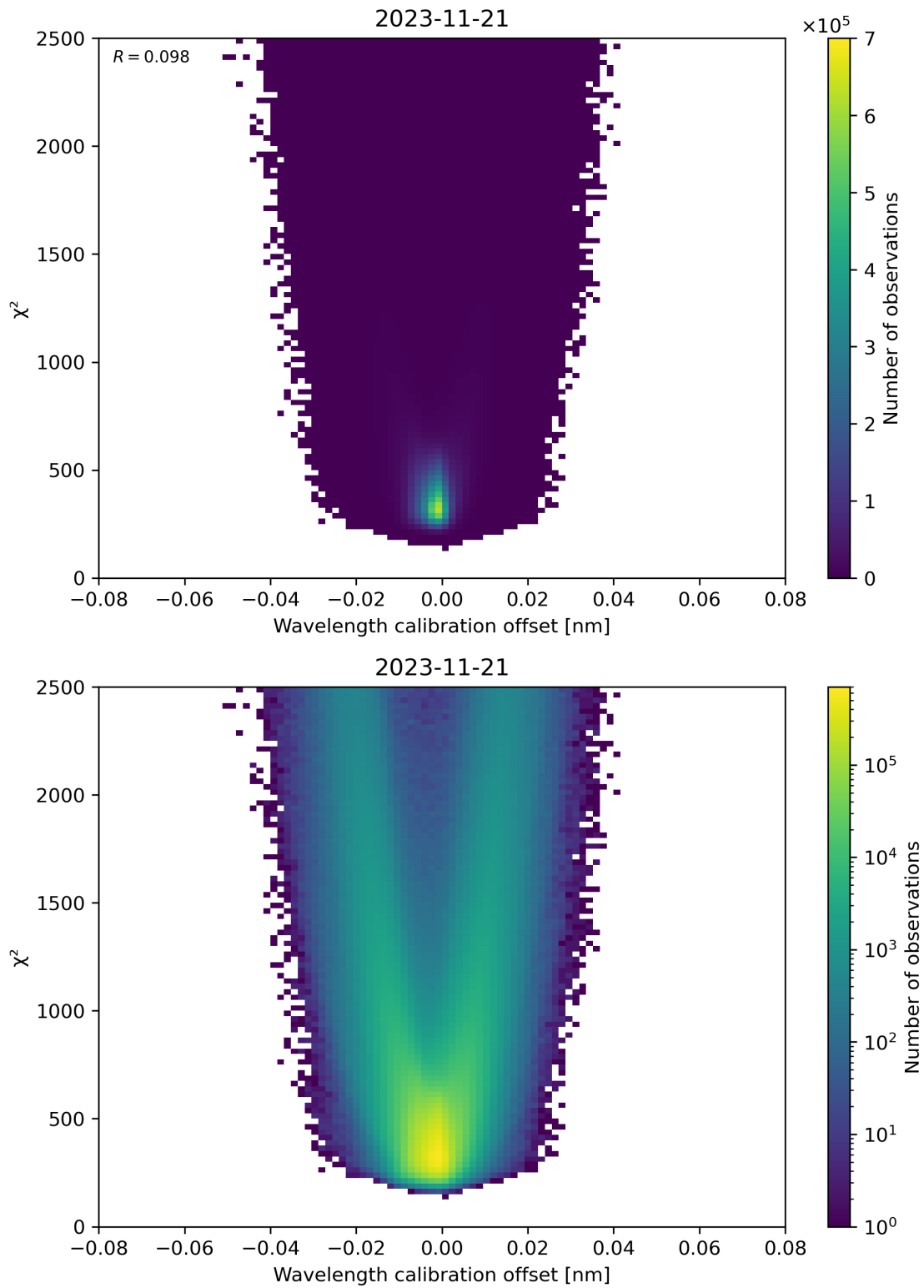


Figure 175: Scatter density plot of “Wavelength calibration offset” against “ χ^2 ” for 2023-11-20 to 2023-11-22.

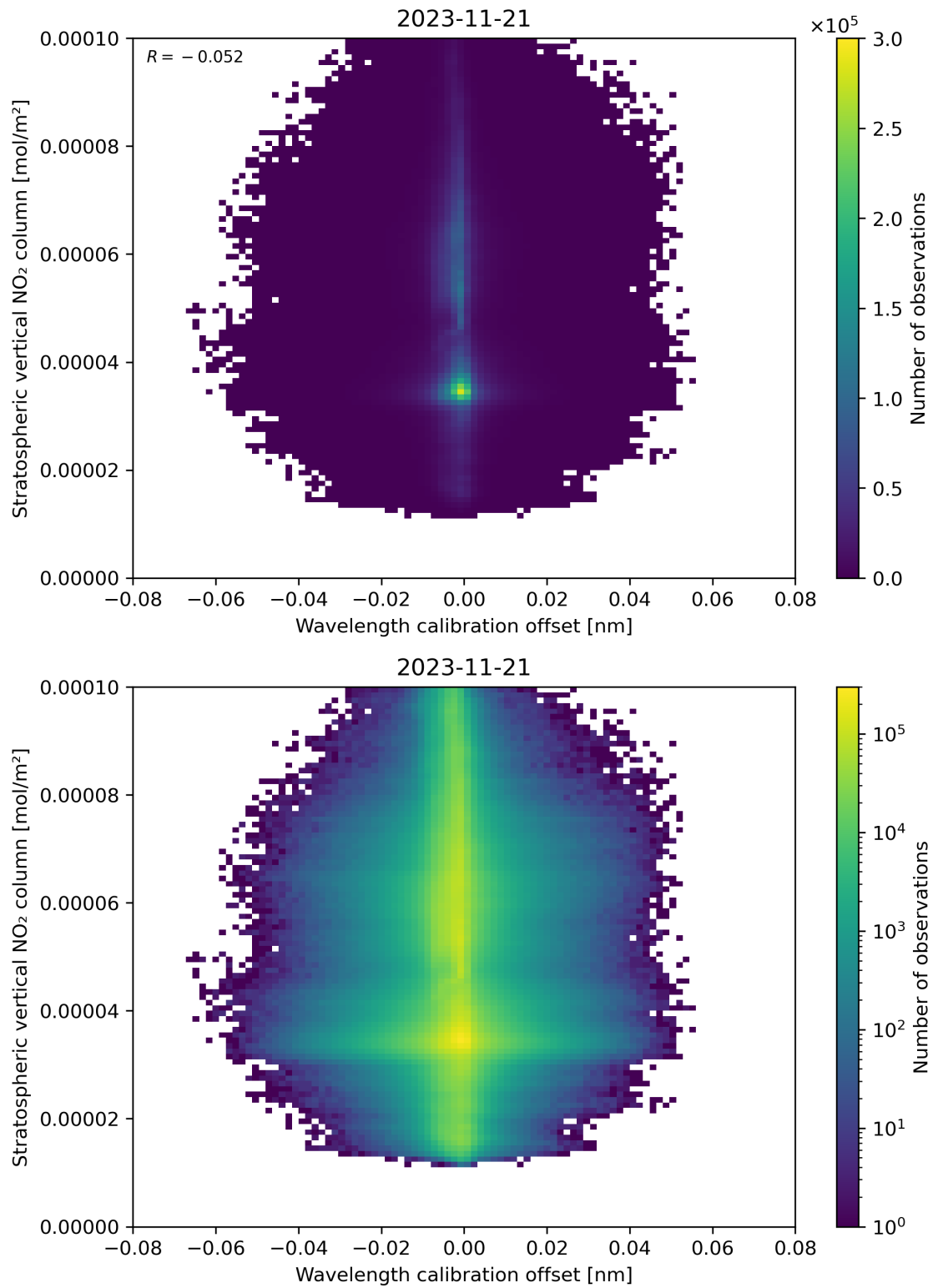


Figure 176: Scatter density plot of “Wavelength calibration offset” against “Stratospheric vertical NO₂ column” for 2023-11-20 to 2023-11-22.

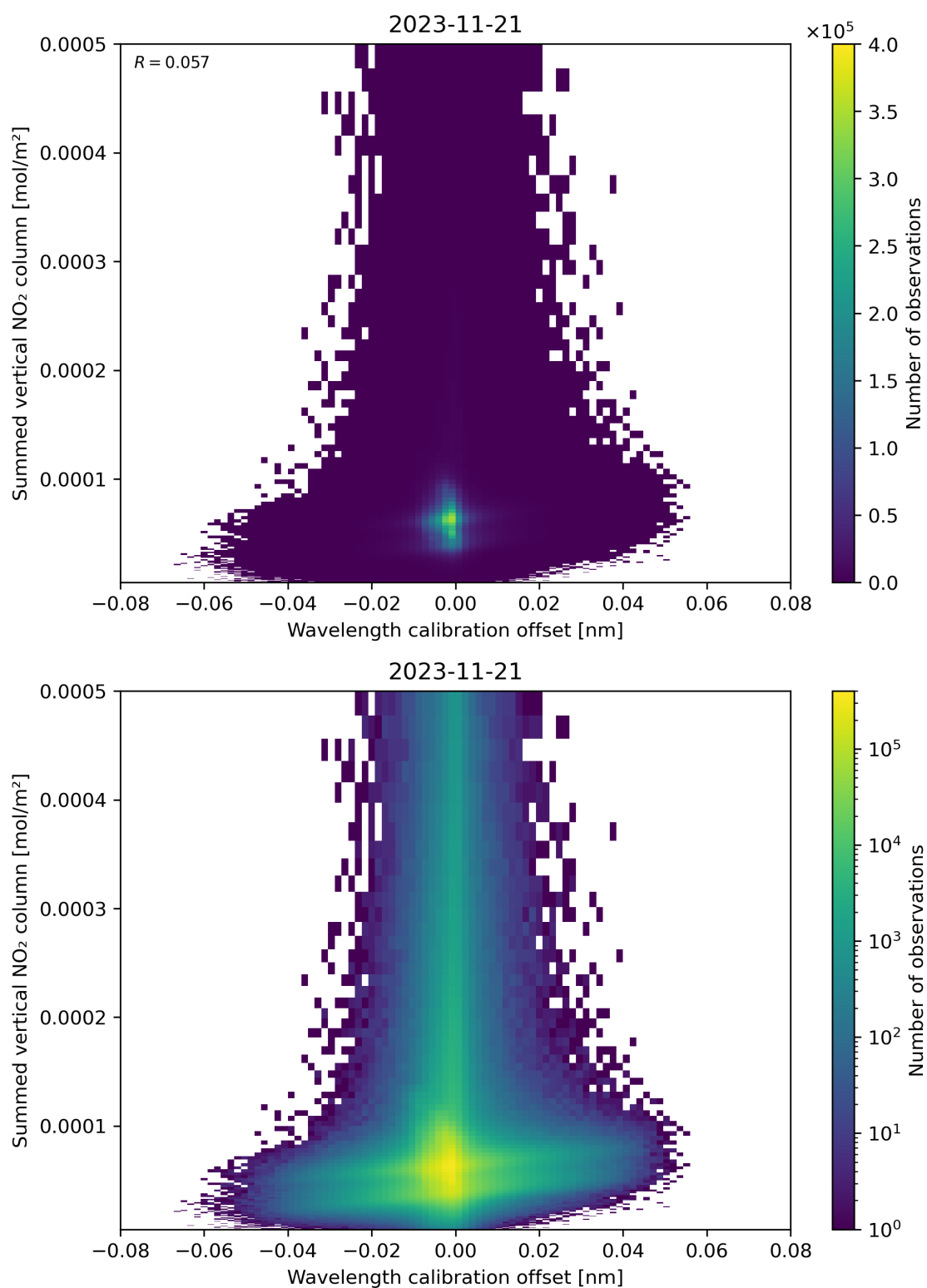


Figure 177: Scatter density plot of “Wavelength calibration offset” against “Summed vertical NO₂ column” for 2023-11-20 to 2023-11-22.

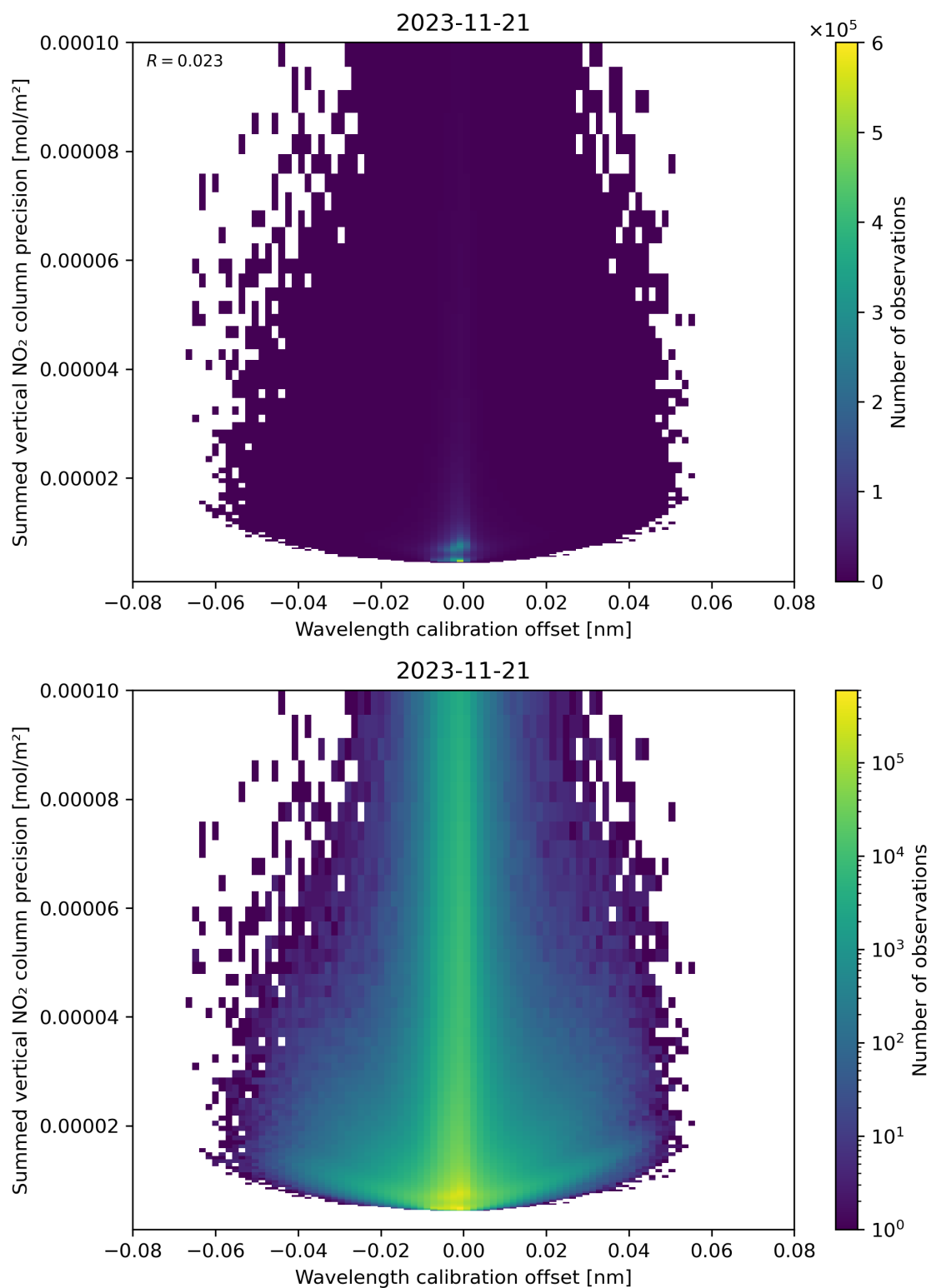


Figure 178: Scatter density plot of “Wavelength calibration offset” against “Summed vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

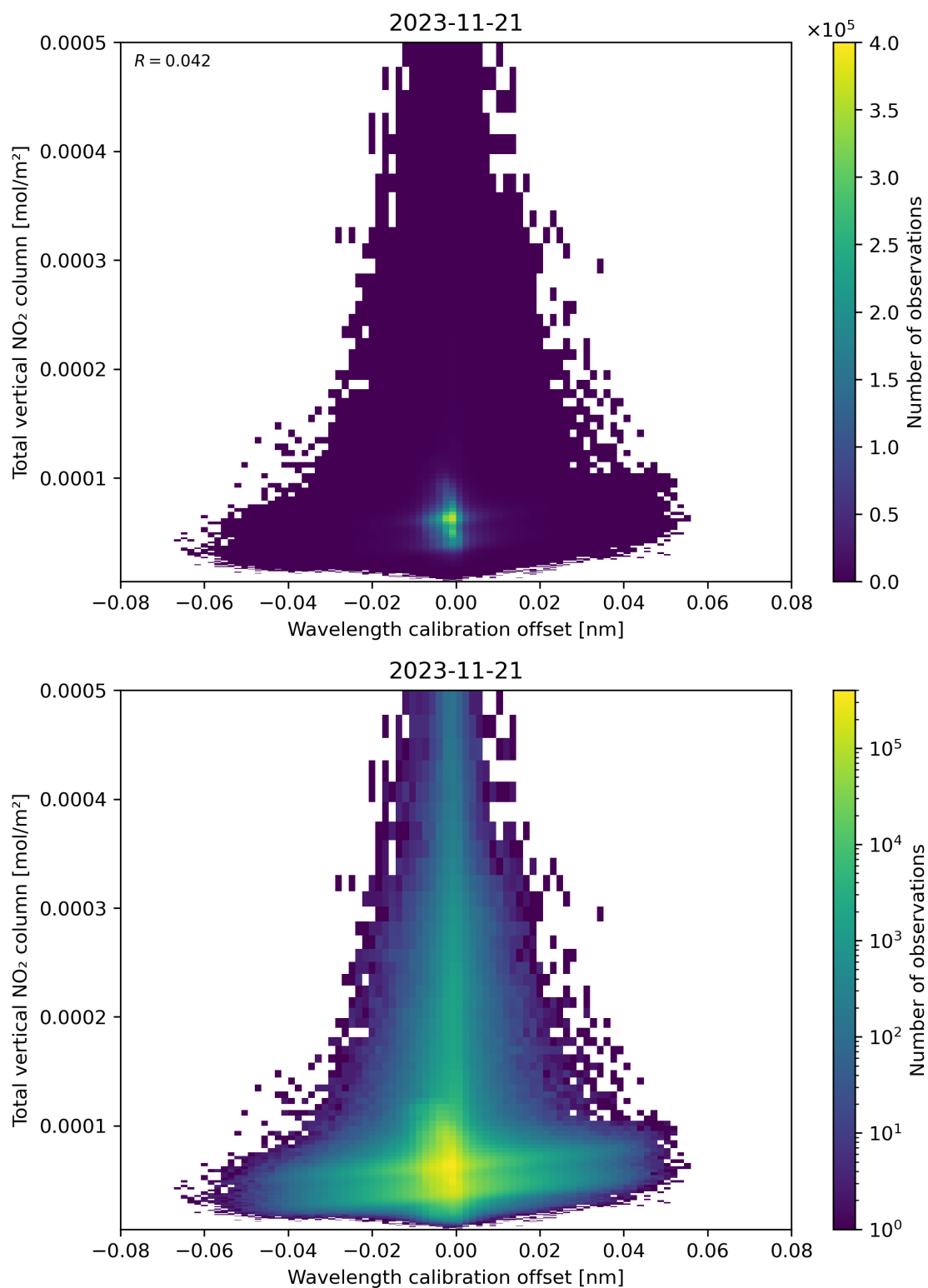


Figure 179: Scatter density plot of “Wavelength calibration offset” against “Total vertical NO₂ column” for 2023-11-20 to 2023-11-22.

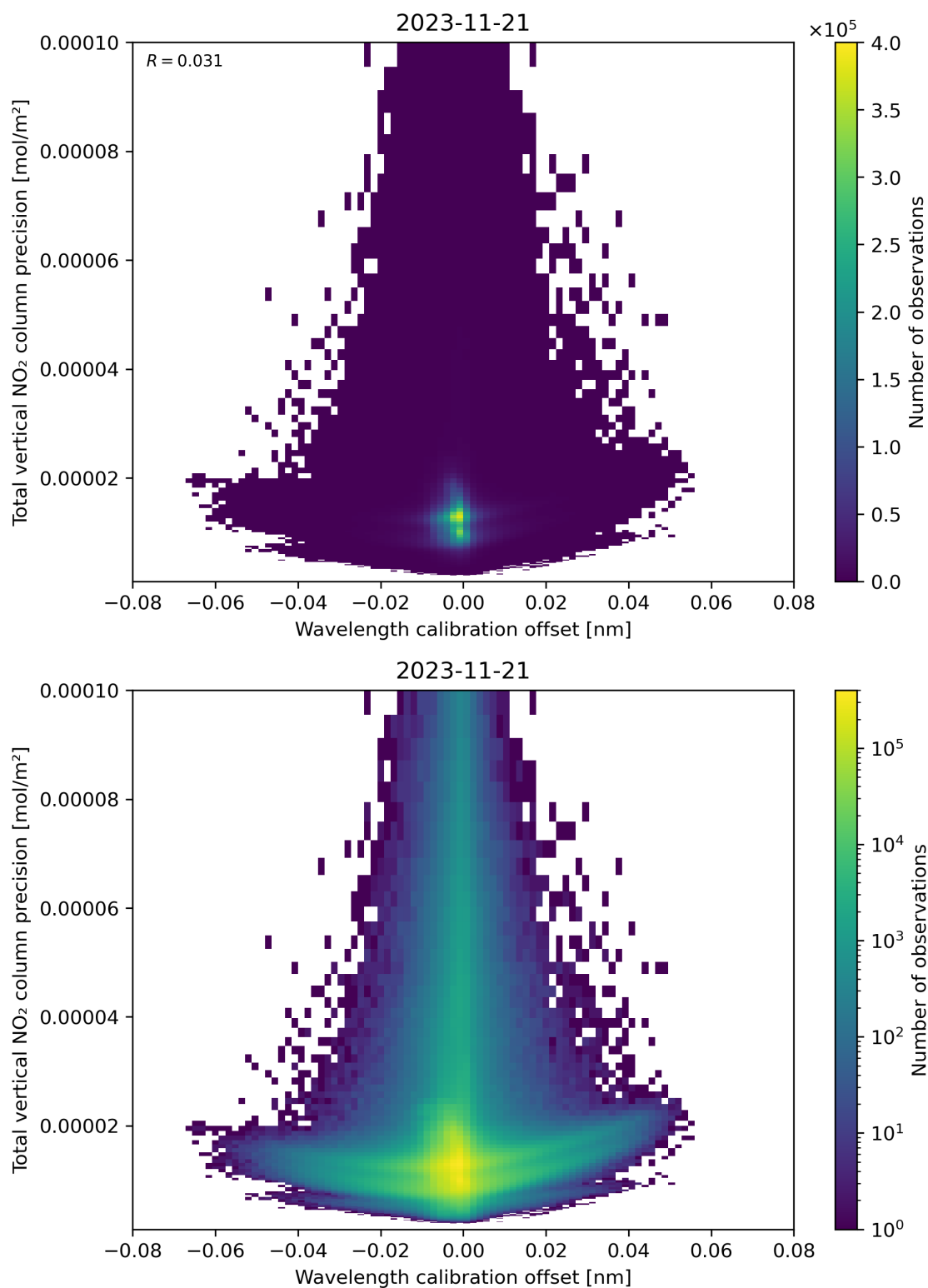


Figure 180: Scatter density plot of “Wavelength calibration offset” against “Total vertical NO₂ column precision” for 2023-11-20 to 2023-11-22.

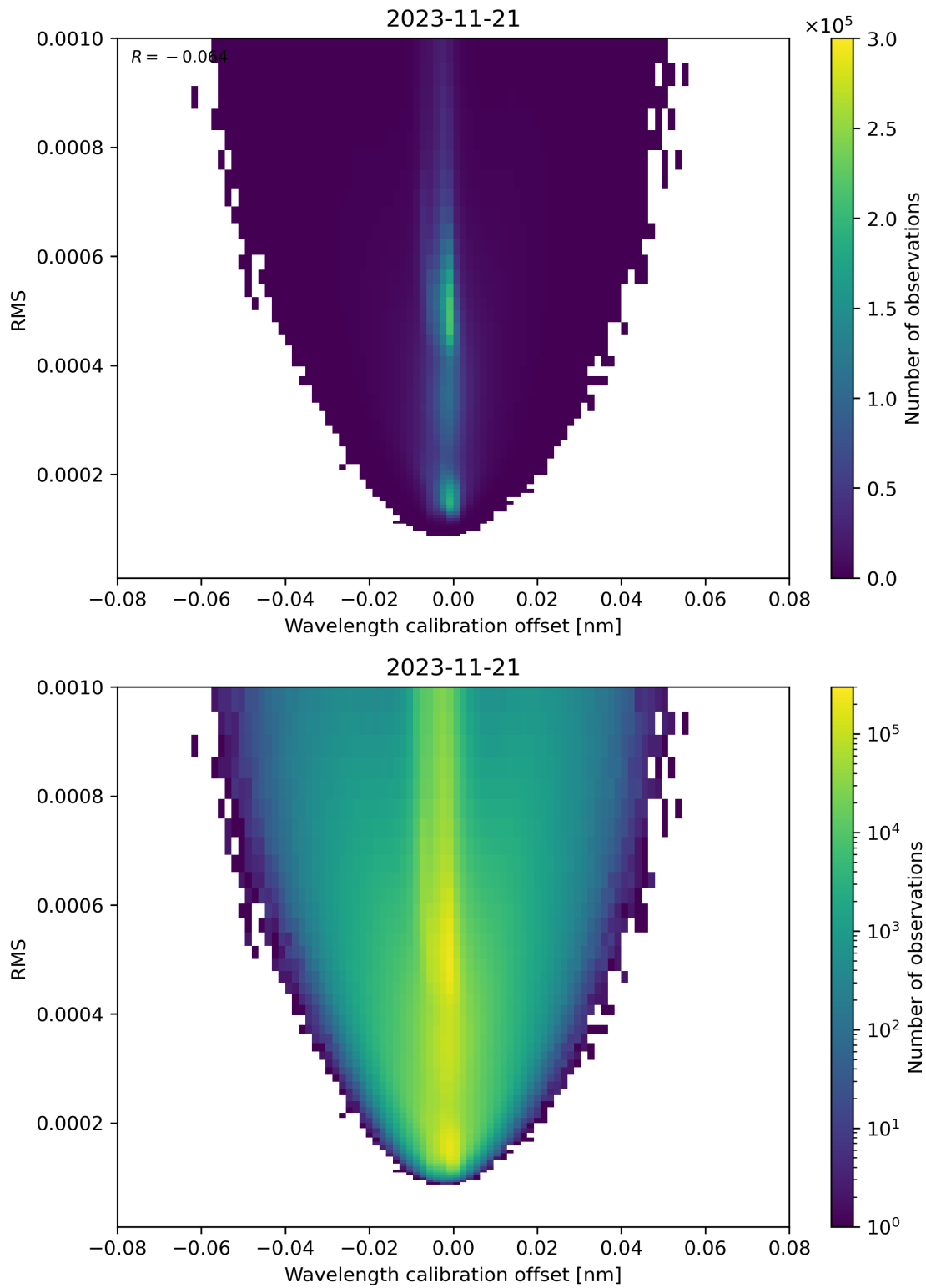


Figure 181: Scatter density plot of “Wavelength calibration offset” against “RMS” for 2023-11-20 to 2023-11-22.

Contents

1	Short Introduction	1
1.1	The list of parameters	1
2	Definitions	1
3	Granule outlines	12
4	Input data monitoring	13
5	Warnings and errors	14
6	World maps	15
7	Zonal average	20
8	Histograms	37
9	Along track statistics	54
10	Coincidence density	71
11	Copyright information of ‘PyCAMA’	191

List of Figures

1	Map of correlation graph for 2023-11-20 to 2023-11-22.	10
2	Map of correlation matrix for 2023-11-20 to 2023-11-22.	11
3	Outline of the granules.	12
4	Input data per granule	13
5	Fraction of pixels with specific warnings and errors during processing	14
6	Map of “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.	15
7	Map of “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22	16
8	Map of “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22	17
9	Map of “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22	18
10	Map of the number of observations for 2023-11-20 to 2023-11-22	19
11	Zonal average of “QA value” for 2023-11-20 to 2023-11-22.	20
12	Zonal average of “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.	21
13	Zonal average of “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.	22
14	Zonal average of “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.	23
15	Zonal average of “Total airmass factor” for 2023-11-20 to 2023-11-22.	24
16	Zonal average of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22.	25
17	Zonal average of “Number of iterations” for 2023-11-20 to 2023-11-22.	26
18	Zonal average of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	27
19	Zonal average of “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	28
20	Zonal average of “Stratospheric vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	29
21	Zonal average of “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	30
22	Zonal average of “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	31
23	Zonal average of “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	32
24	Zonal average of “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	33
25	Zonal average of “ χ^2 ” for 2023-11-20 to 2023-11-22.	34
26	Zonal average of “RMS” for 2023-11-20 to 2023-11-22.	35
27	Zonal average of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	36
28	Histogram of “QA value” for 2023-11-20 to 2023-11-22	37
29	Histogram of “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22	38
30	Histogram of “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22	39
31	Histogram of “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22	40
32	Histogram of “Total airmass factor” for 2023-11-20 to 2023-11-22	41
33	Histogram of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22	42
34	Histogram of “Number of iterations” for 2023-11-20 to 2023-11-22	43
35	Histogram of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22	44
36	Histogram of “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22	45

37	Histogram of “Stratospheric vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	46
38	Histogram of “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22	47
39	Histogram of “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	48
40	Histogram of “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22	49
41	Histogram of “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	50
42	Histogram of “ χ^2 ” for 2023-11-20 to 2023-11-22	51
43	Histogram of “RMS” for 2023-11-20 to 2023-11-22	52
44	Histogram of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22	53
45	Along track statistics of “QA value” for 2023-11-20 to 2023-11-22	54
46	Along track statistics of “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22	55
47	Along track statistics of “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22	56
48	Along track statistics of “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22	57
49	Along track statistics of “Total airmass factor” for 2023-11-20 to 2023-11-22	58
50	Along track statistics of “Number of spectral points in retrieval” for 2023-11-20 to 2023-11-22	59
51	Along track statistics of “Number of iterations” for 2023-11-20 to 2023-11-22	60
52	Along track statistics of “Wavelength calibration offset” for 2023-11-20 to 2023-11-22	61
53	Along track statistics of “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22	62
54	Along track statistics of “Stratospheric vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	63
55	Along track statistics of “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22	64
56	Along track statistics of “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	65
57	Along track statistics of “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22	66
58	Along track statistics of “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22	67
59	Along track statistics of “ χ^2 ” for 2023-11-20 to 2023-11-22	68
60	Along track statistics of “RMS” for 2023-11-20 to 2023-11-22	69
61	Along track statistics of “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22	70
62	Scatter density plot of “Total airmass factor” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	71
63	Scatter density plot of “Total airmass factor” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	72
64	Scatter density plot of “Total airmass factor” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	73
65	Scatter density plot of “Total airmass factor” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	74
66	Scatter density plot of “Total airmass factor” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	75
67	Scatter density plot of “Total airmass factor” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	76
68	Scatter density plot of “Total airmass factor” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	77
69	Scatter density plot of “Total airmass factor” against “RMS” for 2023-11-20 to 2023-11-22.	78
70	Scatter density plot of “Total airmass factor” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	79
71	Scatter density plot of “Tropospheric airmass factor” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	80
72	Scatter density plot of “Tropospheric airmass factor” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	81
73	Scatter density plot of “Tropospheric airmass factor” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	82
74	Scatter density plot of “Tropospheric airmass factor” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	83
75	Scatter density plot of “Tropospheric airmass factor” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	84
76	Scatter density plot of “Tropospheric airmass factor” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	85
77	Scatter density plot of “Tropospheric airmass factor” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	86
78	Scatter density plot of “Tropospheric airmass factor” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	87
79	Scatter density plot of “Tropospheric airmass factor” against “RMS” for 2023-11-20 to 2023-11-22.	88
80	Scatter density plot of “Tropospheric airmass factor” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	89
81	Scatter density plot of “ χ^2 ” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	90
82	Scatter density plot of “ χ^2 ” against “RMS” for 2023-11-20 to 2023-11-22.	91
83	Scatter density plot of “Latitude” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	92

84	Scatter density plot of “Latitude” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	93
85	Scatter density plot of “Latitude” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22. . . .	94
86	Scatter density plot of “Latitude” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	95
87	Scatter density plot of “Latitude” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	96
88	Scatter density plot of “Latitude” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22. .	97
89	Scatter density plot of “Latitude” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	98
90	Scatter density plot of “Latitude” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22. . . .	99
91	Scatter density plot of “Latitude” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	100
92	Scatter density plot of “Latitude” against “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.	101
93	Scatter density plot of “Latitude” against “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.	102
94	Scatter density plot of “Latitude” against “RMS” for 2023-11-20 to 2023-11-22.	103
95	Scatter density plot of “Latitude” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22. . .	104
96	Scatter density plot of “Stratospheric vertical NO ₂ column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	105
97	Scatter density plot of “Stratospheric vertical NO ₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22. . .	106
98	Scatter density plot of “Stratospheric vertical NO ₂ column” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	107
99	Scatter density plot of “Stratospheric vertical NO ₂ column” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	108
100	Scatter density plot of “Stratospheric vertical NO ₂ column” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	109
101	Scatter density plot of “Stratospheric vertical NO ₂ column” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	110
102	Scatter density plot of “Stratospheric vertical NO ₂ column” against “RMS” for 2023-11-20 to 2023-11-22. .	111
103	Scatter density plot of “Summed vertical NO ₂ column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	112
104	Scatter density plot of “Summed vertical NO ₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	113
105	Scatter density plot of “Summed vertical NO ₂ column” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	114
106	Scatter density plot of “Summed vertical NO ₂ column precision” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	115
107	Scatter density plot of “Summed vertical NO ₂ column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	116
108	Scatter density plot of “Summed vertical NO ₂ column precision” against “RMS” for 2023-11-20 to 2023-11-22.	117
109	Scatter density plot of “Summed vertical NO ₂ column” against “RMS” for 2023-11-20 to 2023-11-22. . . .	118
110	Scatter density plot of “Total vertical NO ₂ column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	119
111	Scatter density plot of “Total vertical NO ₂ column” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	120
112	Scatter density plot of “Total vertical NO ₂ column” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	121
113	Scatter density plot of “Total vertical NO ₂ column” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	122
114	Scatter density plot of “Total vertical NO ₂ column” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	123
115	Scatter density plot of “Total vertical NO ₂ column precision” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	124
116	Scatter density plot of “Total vertical NO ₂ column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22. .	125
117	Scatter density plot of “Total vertical NO ₂ column precision” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	126
118	Scatter density plot of “Total vertical NO ₂ column precision” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	127
119	Scatter density plot of “Total vertical NO ₂ column precision” against “RMS” for 2023-11-20 to 2023-11-22.	128
120	Scatter density plot of “Total vertical NO ₂ column” against “RMS” for 2023-11-20 to 2023-11-22.	129
121	Scatter density plot of “NO ₂ tropospheric vertical column” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	130
122	Scatter density plot of “NO ₂ tropospheric vertical column” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	131
123	Scatter density plot of “NO ₂ tropospheric vertical column” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.	132
124	Scatter density plot of “NO ₂ tropospheric vertical column” against “ χ^2 ” for 2023-11-20 to 2023-11-22. . .	133

125	Scatter density plot of “NO ₂ tropospheric vertical column” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	134
126	Scatter density plot of “NO ₂ tropospheric vertical column” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	135
127	Scatter density plot of “NO ₂ tropospheric vertical column” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	136
128	Scatter density plot of “NO ₂ tropospheric vertical column” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	137
129	Scatter density plot of “NO ₂ tropospheric vertical column” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	138
130	Scatter density plot of “NO ₂ tropospheric vertical column” against “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.	139
131	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	140
132	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	141
133	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.	142
134	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	143
135	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	144
136	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	145
137	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	146
138	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	147
139	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	148
140	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “RMS” for 2023-11-20 to 2023-11-22.	149
141	Scatter density plot of “NO ₂ tropospheric vertical column precision” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	150
142	Scatter density plot of “NO ₂ tropospheric vertical column” against “RMS” for 2023-11-20 to 2023-11-22.	151
143	Scatter density plot of “NO ₂ tropospheric vertical column” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	152
144	Scatter density plot of “RMS” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	153
145	Scatter density plot of “Solar zenith angle” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	154
146	Scatter density plot of “Solar zenith angle” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	155
147	Scatter density plot of “Solar zenith angle” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.	156
148	Scatter density plot of “Solar zenith angle” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	157
149	Scatter density plot of “Solar zenith angle” against “Latitude” for 2023-11-20 to 2023-11-22.	158
150	Scatter density plot of “Solar zenith angle” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	159
151	Scatter density plot of “Solar zenith angle” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	160
152	Scatter density plot of “Solar zenith angle” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	161
153	Scatter density plot of “Solar zenith angle” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	162
154	Scatter density plot of “Solar zenith angle” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	163
155	Scatter density plot of “Solar zenith angle” against “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.	164
156	Scatter density plot of “Solar zenith angle” against “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.	165
157	Scatter density plot of “Solar zenith angle” against “RMS” for 2023-11-20 to 2023-11-22.	166
158	Scatter density plot of “Solar zenith angle” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	167

159	Scatter density plot of “Viewing zenith angle” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	168
160	Scatter density plot of “Viewing zenith angle” against “Total airmass factor” for 2023-11-20 to 2023-11-22.	169
161	Scatter density plot of “Viewing zenith angle” against “Tropospheric airmass factor” for 2023-11-20 to 2023-11-22.	170
162	Scatter density plot of “Viewing zenith angle” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	171
163	Scatter density plot of “Viewing zenith angle” against “Latitude” for 2023-11-20 to 2023-11-22.	172
164	Scatter density plot of “Viewing zenith angle” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	173
165	Scatter density plot of “Viewing zenith angle” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	174
166	Scatter density plot of “Viewing zenith angle” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	175
167	Scatter density plot of “Viewing zenith angle” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	176
168	Scatter density plot of “Viewing zenith angle” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	177
169	Scatter density plot of “Viewing zenith angle” against “NO ₂ tropospheric vertical column” for 2023-11-20 to 2023-11-22.	178
170	Scatter density plot of “Viewing zenith angle” against “NO ₂ tropospheric vertical column precision” for 2023-11-20 to 2023-11-22.	179
171	Scatter density plot of “Viewing zenith angle” against “RMS” for 2023-11-20 to 2023-11-22.	180
172	Scatter density plot of “Viewing zenith angle” against “Solar zenith angle” for 2023-11-20 to 2023-11-22.	181
173	Scatter density plot of “Viewing zenith angle” against “Wavelength calibration offset” for 2023-11-20 to 2023-11-22.	182
174	Scatter density plot of “Wavelength calibration offset” against “Stratospheric airmass factor” for 2023-11-20 to 2023-11-22.	183
175	Scatter density plot of “Wavelength calibration offset” against “ χ^2 ” for 2023-11-20 to 2023-11-22.	184
176	Scatter density plot of “Wavelength calibration offset” against “Stratospheric vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	185
177	Scatter density plot of “Wavelength calibration offset” against “Summed vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	186
178	Scatter density plot of “Wavelength calibration offset” against “Summed vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	187
179	Scatter density plot of “Wavelength calibration offset” against “Total vertical NO ₂ column” for 2023-11-20 to 2023-11-22.	188
180	Scatter density plot of “Wavelength calibration offset” against “Total vertical NO ₂ column precision” for 2023-11-20 to 2023-11-22.	189
181	Scatter density plot of “Wavelength calibration offset” against “RMS” for 2023-11-20 to 2023-11-22.	190

List of Tables

1	Parameterlist and basic statistics for the analysis	2
2	Percentile ranges	3
3	Parameterlist and basic statistics for the analysis for observations in the northern hemisphere	4
4	Parameterlist and basic statistics for the analysis for observations in the southern hemisphere	5
5	Parameterlist and basic statistics for the analysis for observations over water	6
6	Parameterlist and basic statistics for the analysis for observations over land	7
7	Correlation matrix	8
8	Covariance matrix	9

11 Copyright information of ‘PyCAMA’

Copyright © 2005 – 2023, Maarten Sneep (KNMI).

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

This software is provided by the copyright holders and contributors "as is" and any express or implied warranties, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose are disclaimed. In no event shall the copyright holder or contributors be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of this software, even if advised of the possibility of such damage.

Maarten Sneep (maarten.sneep@knmi.nl).