PyCAMA report generated by tropl2-proc

tropl2-proc

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1 Short Introduction

1.1 The list of parameters

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

2 Definitions

The averages shown here are *unweighed* averages:

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

with N the number of observations in the dataset.

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 1: Parameterlist and basic statistics for the analysis

Variable	mean $\pm\sigma$	Count	Mode	IQR	Median	Minimum	Maximum
qa value [1]	0.985 ± 0.062	24817391	0.995	0.0	1.000	0.350	1.000
cloud pressure crb [hPa]	777 ± 211	24817391	1.015×10^{3}	318	848	130	1.053×10^{3}
cloud pressure crb precision [hPa]	1.75 ± 7.24	24817391	0.750	0.999	0.460	4.883×10^{-4}	1.585×10^{3}
cloud fraction crb [1]	0.396 ± 0.332	24817391	0.996	0.582	0.313	0.0	1.000
cloud fraction crb precision [1]	$(1.021 \pm 1.705) \times 10^{-4}$	24817391	2.500×10^{-4}	6.346×10^{-5}	6.543×10^{-5}	1.547×10^{-9}	0.126
scene albedo [1]	0.386 ± 0.272	24817391	1.500×10^{-2}	0.445	0.358	-5.553×10^{-3}	5.79
scene albedo precision [1]	$(6.462 \pm 7.165) \times 10^{-5}$	24817391	2.500×10^{-4}	4.251×10^{-5}	4.291×10^{-5}	9.547×10^{-6}	1.101×10^{-2}
apparent scene pressure [hPa]	808 ± 193	24817391	1.016×10^{3}	272	878	130	1.055×10^{3}
apparent scene pressure precision [hPa]	0.844 ± 1.610	24817391	0.500	0.522	0.323	4.098×10^{-2}	77.0
chi square [1]	$(0.750 \pm 49.904) \times 10^{5}$	24817391	0.150	4.484×10^{4}	2.398×10^{4}	52.4	1.577×10^{9}
number of iterations [1]	3.59 ± 1.43	24817391	3.23	1.000	3.00	1.000	14.0
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(7.373 \pm 62.808) \times 10^{-10}$	24817391	7.500×10^{-10}	4.498×10^{-9}	6.542×10^{-10}	-1.994×10^{-6}	2.243×10^{-6}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(1.791 \pm 0.759) \times 10^{-9}$	24817391	8.500×10^{-10}	1.143×10^{-9}	1.724×10^{-9}	4.508×10^{-10}	6.093×10^{-9}
chi square fluorescence [1]	$(0.734 \pm 1.160) \times 10^{5}$	24817391	750	7.871×10^{4}	3.355×10^{4}	101	5.508×10^{6}
degrees of freedom fluorescence [1]	6.00 ± 0.00	24817391	5.95	0.0	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0 ± 0.1	24817391	58.5	0.0	59.0	55.0	59.0
wavelength calibration offset [nm]	$(-6.885 \pm 11.217) \times 10^{-3}$	24817391	-4.400×10^{-3}	1.139×10^{-2}	-6.032×10^{-3}	-0.151	0.126

Table 2: Percentile ranges

Variable	1 %	5 %	10 %	15.9 %	25 %	75 %	84.1 %	90 %	95 %	99 %
qa value [1]	0.500	0.900	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
cloud pressure crb [hPa]	257	362	440	520	631	949	982	1.003×10^3	1.013×10^3	1.021×10^3
cloud pressure crb precision [hPa]	6.833×10^{-2}	9.631×10^{-2}	0.124	0.157	0.212	1.21	2.10	3.54	6.92	19.3
cloud fraction crb [1]	2.112×10^{-3}	1.284×10^{-2}	2.752×10^{-2}	4.770×10^{-2}	8.821×10^{-2}	0.671	0.821	0.945	1.000	1.000
cloud fraction crb precision [1]	1.703×10^{-5}	2.099×10^{-5}	2.420×10^{-5}	2.915×10^{-5}	4.010×10^{-5}	1.036×10^{-4}	1.512×10^{-4}	2.052×10^{-4}	2.989×10^{-4}	6.108×10^{-4}
scene albedo [1]	7.718×10^{-3}	1.975×10^{-2}	3.750×10^{-2}	6.804×10^{-2}	0.147	0.592	0.690	0.765	0.856	0.994
scene albedo precision [1]	1.275×10^{-5}	1.521×10^{-5}	1.851×10^{-5}	2.350×10^{-5}	2.949×10^{-5}	7.199×10^{-5}	9.487×10^{-5}	1.248×10^{-4}	1.849×10^{-4}	3.791×10^{-4}
apparent scene pressure [hPa]	309	407	493	578	689	961	988	1.004×10^3	1.014×10^3	1.021×10^3
apparent scene pressure precision [hPa]	6.818×10^{-2}	9.430×10^{-2}	0.119	0.147	0.188	0.710	1.18	1.92	3.60	8.38
chi square [1]	340	964	2.085×10^3	3.995×10^3	8.039×10^3	5.288×10^4	7.232×10^4	9.136×10^4	1.215×10^5	2.304×10^5
number of iterations [1]	2.00	2.00	2.00	3.00	3.00	4.00	4.00	5.00	6.00	10.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	-1.458×10^{-8}	-7.448×10^{-9}	-4.696×10^{-9}	-3.041×10^{-9}	-1.535×10^{-9}	2.963×10^{-9}	4.621×10^{-9}	6.417×10^{-9}	9.293×10^{-9}	1.614×10^{-8}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	6.826×10^{-10}	7.969×10^{-10}	8.759×10^{-10}	9.679×10^{-10}	1.137×10^{-9}	2.280×10^{-9}	2.581×10^{-9}	2.828×10^{-9}	3.205×10^{-9}	3.810×10^{-9}
chi square fluorescence [1]	436	1.108×10^3	2.295×10^3	4.224×10^3	8.764×10^3	8.747×10^4	1.297×10^5	1.825×10^5	2.870×10^5	5.795×10^5
degrees of freedom fluorescence [1]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0	59.0
wavelength calibration offset [nm]	-4.124×10^{-2}	-2.552×10^{-2}	-1.966×10^{-2}	-1.588×10^{-2}	-1.217×10^{-2}	-7.763×10^{-4}	1.771×10^{-3}	4.239×10^{-3}	8.811×10^{-3}	2.265×10^{-2}

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]	0.978 ± 0.075	16203722	0.0	1.000	0.350	1.000	1.000	1.000
cloud pressure crb [hPa]	785 ± 211	16203722	323	849	130	1.053×10^{3}	641	965
cloud pressure crb precision [hPa]	1.30 ± 5.36	16203722	0.755	0.376	4.883×10^{-4}	1.523×10^{3}	0.186	0.941
cloud fraction crb [1]	0.429 ± 0.340	16203722	0.620	0.360	0.0	1.000	0.107	0.727
cloud fraction crb precision [1]	$(1.050 \pm 1.934) \times 10^{-4}$	16203722	6.589×10^{-5}	6.640×10^{-5}	1.547×10^{-9}	0.126	4.117×10^{-5}	1.071×10^{-4}
scene albedo [1]	0.432 ± 0.270	16203722	0.423	0.425	-5.553×10^{-3}	4.90	0.217	0.640
scene albedo precision [1]	$(5.922 \pm 6.387) \times 10^{-5}$	16203722	3.822×10^{-5}	4.095×10^{-5}	9.547×10^{-6}	1.101×10^{-2}	2.885×10^{-5}	6.707×10^{-5}
apparent scene pressure [hPa]	819 ± 188	16203722	274	884	130	1.055×10^{3}	700	973
apparent scene pressure precision [hPa]	0.585 ± 1.152	16203722	0.317	0.264	4.098×10^{-2}	77.0	0.167	0.484
chi square [1]	$(0.863 \pm 54.050) \times 10^{5}$	16203722	5.100×10^{4}	3.500×10^{4}	52.4	1.577×10^{9}	1.498×10^{4}	6.598×10^{4}
number of iterations [1]	3.74 ± 1.47	16203722	1.000	3.00	1.000	14.0	3.00	4.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(9.613 \pm 71.954) \times 10^{-10}$	16203722	5.589×10^{-9}	7.586×10^{-10}	-1.994×10^{-6}	2.243×10^{-6}	-1.891×10^{-9}	3.698×10^{-9}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(1.993 \pm 0.760) \times 10^{-9}$	16203722	1.048×10^{-9}	1.953×10^{-9}	4.508×10^{-10}	6.093×10^{-9}	1.406×10^{-9}	2.454×10^{-9}
chi square fluorescence [1]	$(0.933 \pm 1.266) \times 10^{5}$	16203722	8.988×10^{4}	5.386×10^{4}	104	5.508×10^{6}	2.128×10^{4}	1.112×10^{5}
degrees of freedom fluorescence [1]	6.00 ± 0.00	16203722	0.0	6.00	6.00	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0 ± 0.1	16203722	0.0	59.0	55.0	59.0	59.0	59.0
wavelength calibration offset [nm]	$(-7.700 \pm 9.903) \times 10^{-3}$	16203722	1.037×10^{-2}	-6.727×10^{-3}	-0.146	8.344×10^{-2}	-1.240×10^{-2}	-2.034×10^{-3}

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]	0.998 ± 0.021	8613669	0.0	1.000	0.350	1.000	1.000	1.000
cloud pressure crb [hPa]	762 ± 211	8613669	320	846	130	1.039×10^{3}	604	924
cloud pressure crb precision [hPa]	2.61 ± 9.80	8613669	1.60	0.676	4.292×10^{-2}	1.585×10^{3}	0.299	1.90
cloud fraction crb [1]	0.335 ± 0.307	8613669	0.500	0.242	0.0	1.000	5.793×10^{-2}	0.558
cloud fraction crb precision [1]	$(9.658 \pm 11.570) \times 10^{-5}$	8613669	6.148×10^{-5}	6.393×10^{-5}	2.785×10^{-9}	5.331×10^{-2}	3.852×10^{-5}	1.000×10^{-4}
scene albedo [1]	0.300 ± 0.254	8613669	0.392	0.248	-2.998×10^{-3}	5.79	7.309×10^{-2}	0.465
scene albedo precision [1]	$(7.477 \pm 8.343) \times 10^{-5}$	8613669	5.184×10^{-5}	4.778×10^{-5}	1.005×10^{-5}	4.243×10^{-3}	3.110×10^{-5}	8.293×10^{-5}
apparent scene pressure [hPa]	787 ± 201	8613669	283	871	130	1.038×10^{3}	654	937
apparent scene pressure precision [hPa]	1.33 ± 2.15	8613669	1.04	0.539	4.292×10^{-2}	32.6	0.278	1.32
chi square [1]	$(0.537 \pm 40.980) \times 10^{5}$	8613669	2.122×10^{4}	1.046×10^{4}	66.8	1.141×10^{9}	3.122×10^{3}	2.435×10^{4}
number of iterations [1]	3.32 ± 1.30	8613669	1.000	3.00	1.000	14.0	3.00	4.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(3.159 \pm 39.988) \times 10^{-10}$	8613669	3.039×10^{-9}	5.461×10^{-10}	-9.262×10^{-7}	5.381×10^{-7}	-1.006×10^{-9}	2.033×10^{-9}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(1.411 \pm 0.596) \times 10^{-9}$	8613669	8.320×10^{-10}	1.271×10^{-9}	5.514×10^{-10}	5.811×10^{-9}	9.236×10^{-10}	1.756×10^{-9}
chi square fluorescence [1]	$(0.358 \pm 0.800) \times 10^{5}$	8613669	2.692×10^{4}	8.947×10^{3}	101	1.599×10^{6}	2.668×10^{3}	2.959×10^{4}
degrees of freedom fluorescence [1]	6.00 ± 0.00	8613669	0.0	6.00	6.00	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0 ± 0.1	8613669	0.0	59.0	57.0	59.0	59.0	59.0
wavelength calibration offset [nm]	$(-5.352 \pm 13.207) \times 10^{-3}$	8613669	1.330×10^{-2}	-4.260×10^{-3}	-0.151	0.126	-1.157×10^{-2}	1.727×10^{-3}

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]	0.988 ± 0.036	17376917	0.0	1.000	0.350	1.000	1.000	1.000
cloud pressure crb [hPa]	784 ± 215	17376917	326	864	130	1.039×10^{3}	631	957
cloud pressure crb precision [hPa]	1.86 ± 7.83	17376917	0.943	0.456	1.892×10^{-3}	1.585×10^{3}	0.222	1.16
cloud fraction crb [1]	0.398 ± 0.326	17376917	0.584	0.340	0.0	1.000	8.491×10^{-2}	0.669
cloud fraction crb precision [1]	$(9.280 \pm 11.182) \times 10^{-5}$	17376917	6.925×10^{-5}	5.488×10^{-5}	1.547×10^{-9}	5.331×10^{-2}	3.110×10^{-5}	1.003×10^{-4}
scene albedo [1]	0.351 ± 0.279	17376917	0.501	0.315	-5.553×10^{-3}	5.79	8.059×10^{-2}	0.582
scene albedo precision [1]	$(6.556 \pm 7.341) \times 10^{-5}$	17376917	5.019×10^{-5}	4.463×10^{-5}	9.547×10^{-6}	1.101×10^{-2}	2.578×10^{-5}	7.598×10^{-5}
apparent scene pressure [hPa]	806 ± 203	17376917	293	886	130	1.054×10^{3}	675	968
apparent scene pressure precision [hPa]	1.06 ± 1.86	17376917	0.767	0.403	4.118×10^{-2}	77.0	0.213	0.979
chi square [1]	$(0.846 \pm 59.385) \times 10^{5}$	17376917	4.065×10^{4}	1.769×10^{4}	66.8	1.577×10^{9}	5.182×10^{3}	4.583×10^{4}
number of iterations [1]	3.27 ± 1.09	17376917	1.000	3.00	1.000	14.0	3.00	4.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(3.271 \pm 50.611) \times 10^{-10}$	17376917	3.825×10^{-9}	4.155×10^{-10}	-1.987×10^{-6}	1.647×10^{-6}	-1.521×10^{-9}	2.304×10^{-9}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(1.650 \pm 0.732) \times 10^{-9}$	17376917	1.105×10^{-9}	1.510×10^{-9}	4.520×10^{-10}	5.619×10^{-9}	1.028×10^{-9}	2.132×10^{-9}
chi square fluorescence [1]	$(0.595 \pm 1.056) \times 10^{5}$	17376917	6.692×10^{4}	2.354×10^{4}	101	5.508×10^{6}	5.585×10^{3}	7.250×10^{4}
degrees of freedom fluorescence [1]	6.00 ± 0.00	17376917	0.0	6.00	6.00	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0 ± 0.1	17376917	0.0	59.0	57.0	59.0	59.0	59.0
wavelength calibration offset [nm]	$(-6.702 \pm 11.862) \times 10^{-3}$	17376917	1.163×10^{-2}	-5.934×10^{-3}	-0.151	0.126	-1.211×10^{-2}	-4.755×10^{-4}

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]	0.969 ± 0.120	4826032	0.0	1.000	0.350	1.000	1.000	1.000
cloud pressure crb [hPa]	758 ± 199	4826032	285	807	130	1.042×10^{3}	636	922
cloud pressure crb precision [hPa]	1.59 ± 5.51	4826032	1.23	0.490	4.883×10^{-4}	1.379×10^{3}	0.181	1.41
cloud fraction crb [1]	0.376 ± 0.353	4826032	0.582	0.217	0.0	1.000	8.066×10^{-2}	0.663
cloud fraction crb precision [1]	$(1.213 \pm 2.804) \times 10^{-4}$	4826032	4.073×10^{-5}	7.817×10^{-5}	1.618×10^{-8}	6.116×10^{-2}	5.927×10^{-5}	1.000×10^{-4}
scene albedo [1]	0.477 ± 0.235	4826032	0.332	0.406	2.694×10^{-2}	4.90	0.292	0.624
scene albedo precision [1]	$(5.537 \pm 5.621) \times 10^{-5}$	4826032	2.303×10^{-5}	3.825×10^{-5}	1.238×10^{-5}	1.530×10^{-3}	3.190×10^{-5}	5.493×10^{-5}
apparent scene pressure [hPa]	810 ± 163	4826032	226	860	130	1.042×10^{3}	715	941
apparent scene pressure precision [hPa]	0.278 ± 0.269	4826032	0.171	0.216	4.098×10^{-2}	13.4	0.149	0.320
chi square [1]	$(0.539 \pm 2.504) \times 10^{5}$	4826032	4.723×10^{4}	3.919×10^{4}	118	2.374×10^{8}	2.224×10^{4}	6.947×10^{4}
number of iterations [1]	4.47 ± 1.86	4826032	2.00	4.00	1.000	14.0	3.00	5.00
fluorescence [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(1.510 \pm 9.072) \times 10^{-9}$	4826032	7.549×10^{-9}	1.434×10^{-9}	-1.994×10^{-6}	2.243×10^{-6}	-2.318×10^{-9}	5.231×10^{-9}
fluorescence precision [mol s^{-1} m^{-2} nm^{-1} sr^{-1}]	$(2.217 \pm 0.682) \times 10^{-9}$	4826032	8.887×10^{-10}	2.165×10^{-9}	4.510×10^{-10}	6.093×10^{-9}	1.766×10^{-9}	2.654×10^{-9}
chi square fluorescence [1]	$(0.121 \pm 0.140) \times 10^{6}$	4826032	1.337×10^{5}	6.665×10^{4}	158	2.716×10^{6}	2.925×10^{4}	1.630×10^{5}
degrees of freedom fluorescence [1]	6.00 ± 0.00	4826032	0.0	6.00	6.00	6.00	6.00	6.00
number of spectral points in retrieval [1]	59.0 ± 0.1	4826032	0.0	59.0	56.0	59.0	59.0	59.0
wavelength calibration offset [nm]	$(-7.621 \pm 9.124) \times 10^{-3}$	4826032	1.093×10^{-2}	-6.585×10^{-3}	-9.719×10^{-2}	5.713×10^{-2}	-1.264×10^{-2}	-1.717×10^{-3}

Table 7: Correlation matrix

Viewing zenith angle	Solar zenith angle	Latitude	Cloud pressure	Cloud fraction	Scene albedo	Apparent scene pressure	χ^2	Number of iterations	Fluorescence	χ^2 of fluorescence retrieval	Number of points in the spectrum	Spectral offset (λ(true) − λ(nominal))
1.000	1.457×10^{-2}	-2.116×10^{-3}	−0.111	8.693×10^{-2}	8.838×10^{-2}	−0.108	4.384×10^{-3}	-2.017×10^{-2}	4.198×10^{-2}	-2.794×10^{-3}	1.719×10^{-2}	-9.902×10^{-2}
1.457×10^{-2}	1.000	−0.143	-9.704×10^{-2}	0.257	0.240	−0.120	-8.512×10^{-3}	-4.697×10^{-2}	0.115	−0.356	2.853×10^{-3}	0.173
-2.116×10^{-3}	−0.143	1.000	0.125	0.216	0.323	0.151	8.932×10^{-4}	0.174	0.100	0.147	1.465×10^{-3}	-5.216×10^{-2}
−0.111	-9.704×10^{-2}	0.125	1.000	−0.260	−0.256	0.927	8.873×10^{-3}	-3.909×10^{-2}	−0.161	0.192	-4.989×10^{-3}	−0.220
8.693×10^{-2}	0.257	0.216	−0.260	1.000	0.928	−0.404	1.594×10^{-2}	−0.210	0.253	0.140	2.648×10^{-3}	0.178
8.838×10^{-2}	0.240	0.323	−0.256	0.928	1.000	−0.356	-4.468×10^{-3}	-1.633×10^{-2}	0.262	0.224	4.468×10^{-3}	0.145
−0.108	−0.120	0.151	0.927	−0.404	−0.356	1.000	1.789×10^{-3}	5.600×10^{-2}	−0.183	0.215	-3.494×10^{-3}	−0.263
4.384×10^{-3}	-8.512×10^{-3}	8.932×10^{-4}	8.873×10^{-3}	1.594×10^{-2}	-4.468×10^{-3}	1.789×10^{-3}	1.000	2.285×10^{-2}	-1.239×10^{-3}	4.729×10^{-3}	3.071×10^{-4}	-4.328×10^{-3}
-2.017×10^{-2}	-4.697×10^{-2}	0.174	-3.909×10^{-2}	−0.210	-1.633×10^{-2}	5.600×10^{-2}	2.285×10^{-2}	1.000	3.982×10^{-2}	2.281×10^{-2}	2.576×10^{-3}	-1.982×10^{-2}
4.198×10^{-2}	0.115	0.100	−0.161	0.253	0.262	−0.183	-1.239×10^{-3}	3.982×10^{-2}	1.000	−0.139	-4.224×10^{-3}	0.193
-2.794×10^{-3}	−0.356	0.147	0.192	0.140	0.224	0.215	4.729×10^{-3}	2.281×10^{-2}	−0.139	1.000	-2.989×10^{-5}	−0.316
1.719×10^{-2}	2.853×10^{-3}	1.465×10^{-3}	-4.989×10^{-3}	2.648×10^{-3}	4.468×10^{-3}	-3.494×10^{-3}	3.071×10^{-4}	2.576×10^{-3}	-4.224×10^{-3}	-2.989×10^{-5}	1.000	-1.008×10^{-2}
-9.902×10^{-2}	0.173	-5.216×10^{-2}	−0.220	0.178	0.145	−0.263	-4.328×10^{-3}	-1.982×10^{-2}	0.193	−0.316	-1.008×10^{-2}	1.000

Table 8: Covariance matrix

Viewing zenith angle	Solar zenith angle	Latitude	Cloud pressure	Cloud fraction	Scene albedo	Apparent scene pressure	χ^2	Number of iterations	Fluorescence	χ^2 of fluorescence retrieval	Number of points in the spectrum	Spectral offset (λ(true) − λ(nominal))
382	6.32	−1.82	−457	0.564	0.470	−408	4.276×10^5	−0.564	5.154×10^{-9}	-6.333×10^3	3.183×10^{-2}	-2.171×10^{-2}
6.32	493	−140	−455	1.90	1.45	−516	-9.427×10^5	−1.49	1.607×10^{-8}	-9.159×10^5	5.995×10^{-3}	4.299×10^{-2}
−1.82	−140	1.944×10^3	1.165×10^3	3.15	3.87	1.284×10^3	1.965×10^5	11.0	2.781×10^{-8}	7.520×10^5	6.115×10^{-3}	-2.579×10^{-2}
−457	−455	1.165×10^3	4.462×10^4	−18.2	−14.7	3.784×10^4	9.353×10^6	−11.8	-2.132×10^{-7}	4.706×10^6	-9.979×10^{-2}	−0.521
0.564	1.90	3.15	−18.2	0.110	8.369×10^{-2}	−25.9	2.639×10^4	-9.965×10^{-2}	5.275×10^{-10}	5.388×10^3	8.321×10^{-5}	6.628×10^{-4}
0.470	1.45	3.87	−14.7	8.369×10^{-2}	7.387×10^{-2}	−18.7	-6.059×10^3	-6.351×10^{-3}	4.467×10^{-10}	7.043×10^3	1.150×10^{-4}	4.425×10^{-4}
−408	−516	1.284×10^3	3.784×10^4	−25.9	−18.7	3.738×10^4	1.726×10^6	15.5	-2.217×10^{-7}	4.824×10^6	-6.397×10^{-2}	−0.571
4.276×10^5	-9.427×10^5	1.965×10^5	9.353×10^6	2.639×10^4	-6.059×10^3	1.726×10^6	2.490×10^{13}	1.632×10^5	-3.883×10^{-5}	2.736×10^9	145	−242
−0.564	−1.49	11.0	−11.8	-9.965×10^{-2}	-6.351×10^{-3}	15.5	1.632×10^5	2.05	3.581×10^{-10}	3.787×10^3	3.492×10^{-4}	-3.182×10^{-4}
5.154×10^{-9}	1.607×10^{-8}	2.781×10^{-8}	-2.132×10^{-7}	5.275×10^{-10}	4.467×10^{-10}	-2.217×10^{-7}	-3.883×10^{-5}	3.581×10^{-10}	3.945×10^{-17}	-1.011×10^{-4}	-2.512×10^{-12}	1.362×10^{-11}
-6.333×10^3	-9.159×10^5	7.520×10^5	4.706×10^6	5.388×10^3	7.043×10^3	4.824×10^6	2.736×10^9	3.787×10^3	-1.011×10^{-4}	1.345×10^{10}	−0.328	−412
3.183×10^{-2}	5.995×10^{-3}	6.115×10^{-3}	-9.979×10^{-2}	8.321×10^{-5}	1.150×10^{-4}	-6.397×10^{-2}	145	3.492×10^{-4}	-2.512×10^{-12}	−0.328	8.969×10^{-3}	-1.071×10^{-5}
-2.171×10^{-2}	4.299×10^{-2}	-2.579×10^{-2}	−0.521	6.628×10^{-4}	4.425×10^{-4}	−0.571	−242	-3.182×10^{-4}	1.362×10^{-11}	−412	-1.071×10^{-5}	1.258×10^{-4}

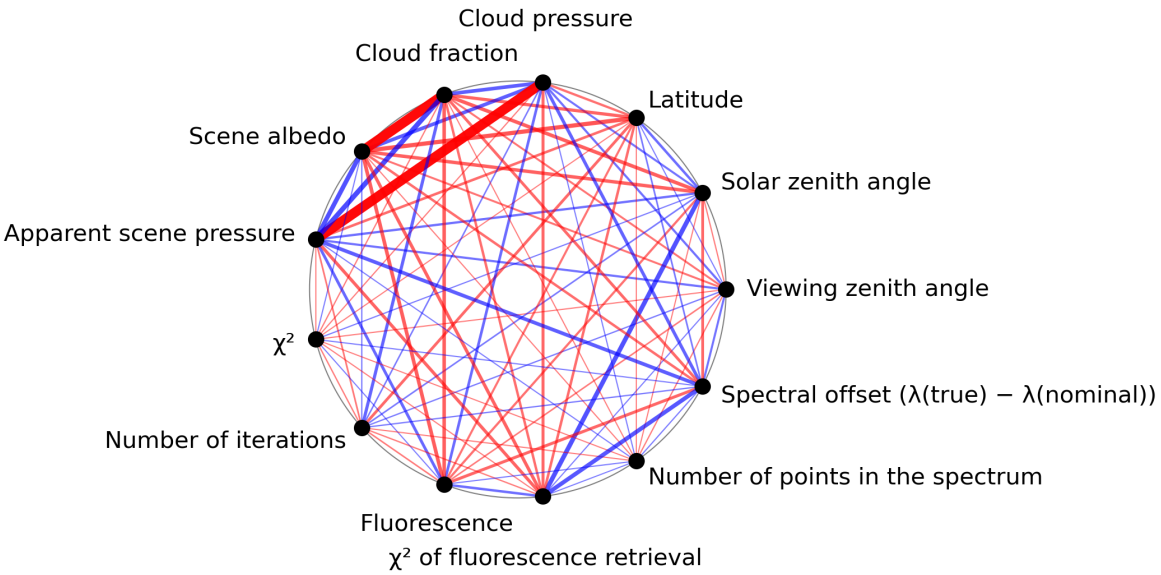


Figure 1: Map of correlation graph for 2024-06-24 to 2024-06-25.

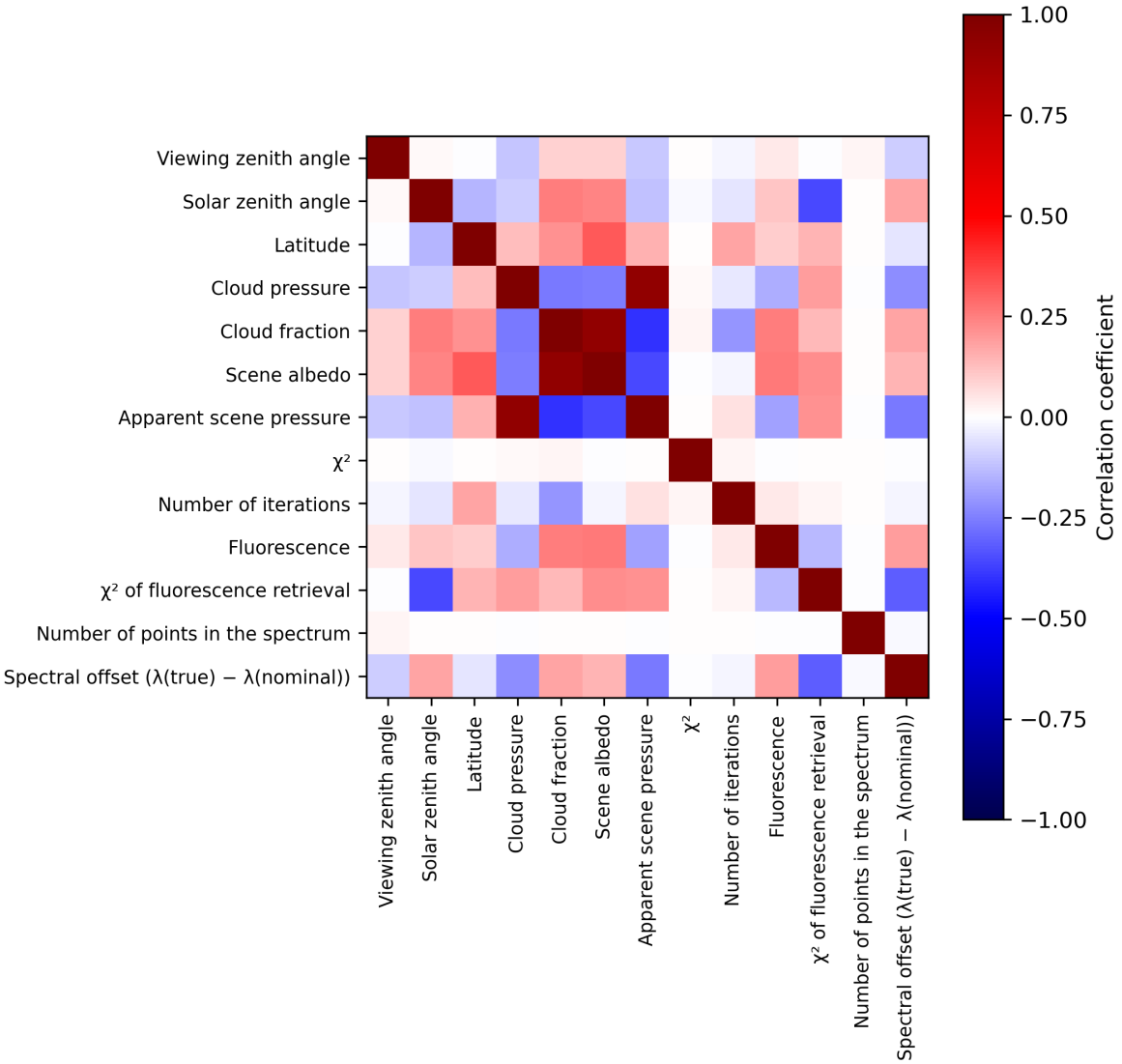


Figure 2: Map of correlation matrix for 2024-06-24 to 2024-06-25.

3 Granule outlines

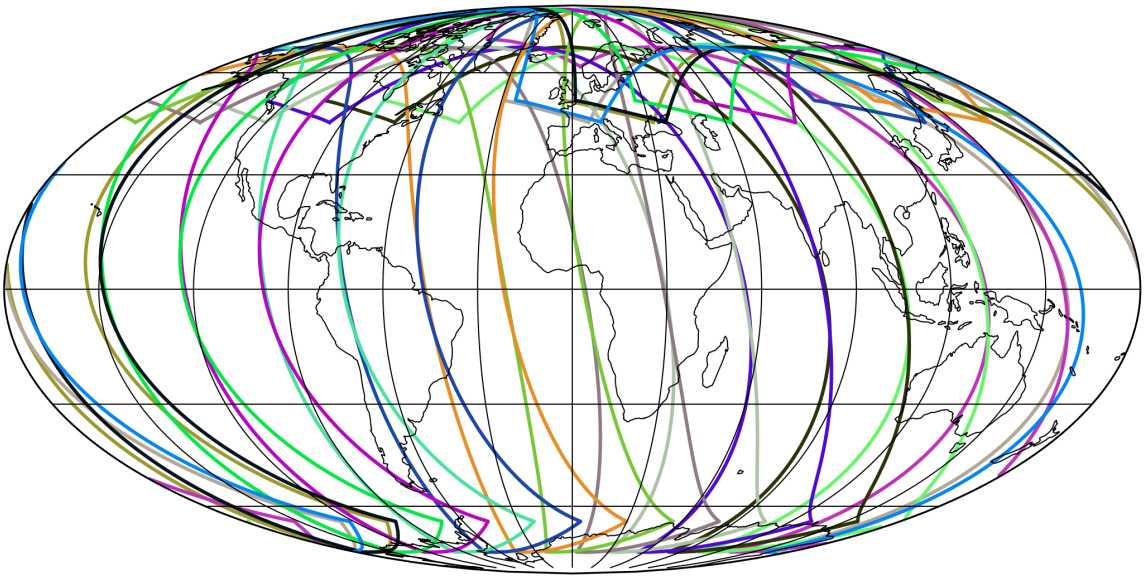


Figure 3: Outline of the granules.

4 Input data monitoring

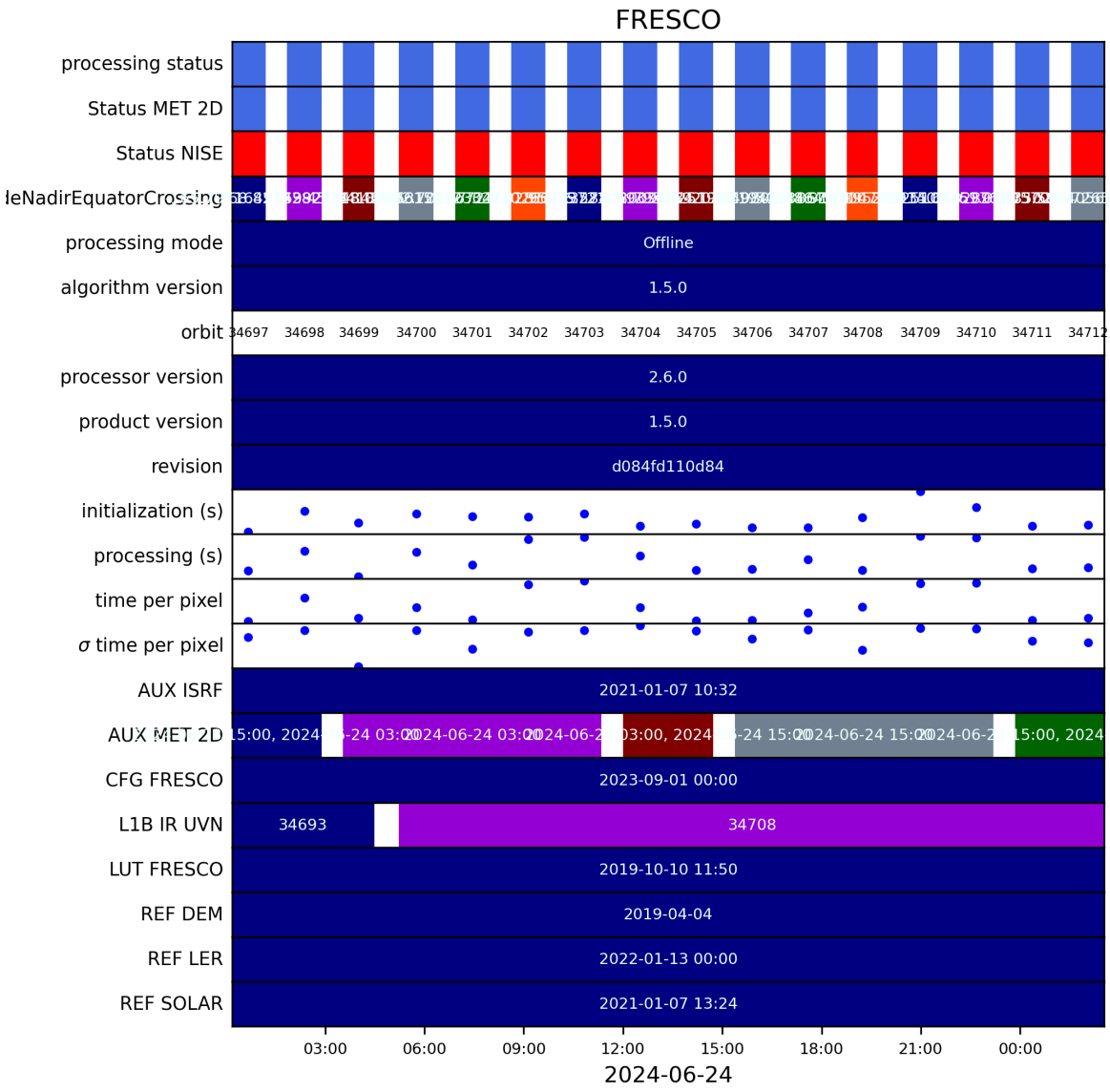


Figure 4: Input data per granule

5 Warnings and errors

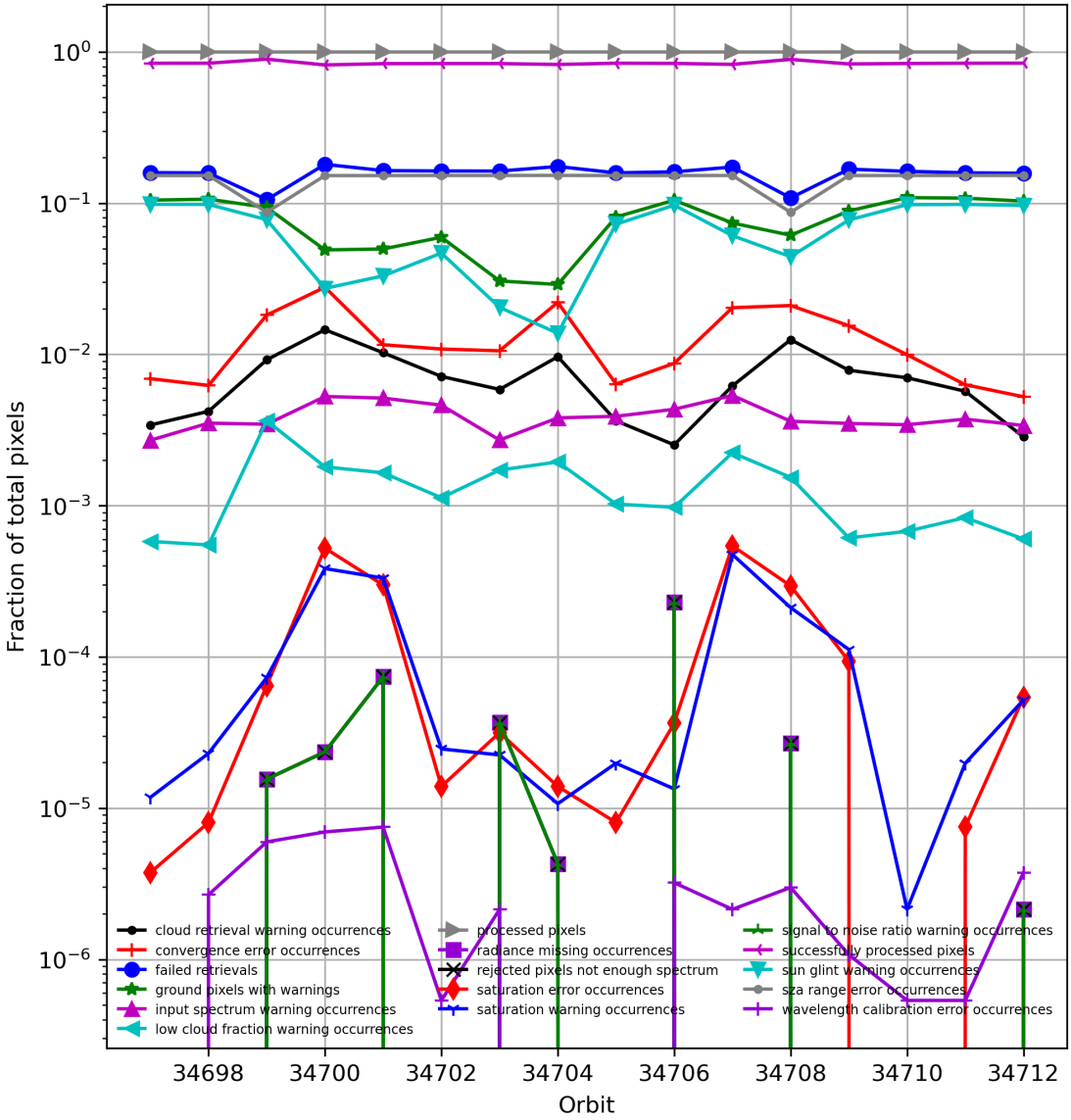


Figure 5: Fraction of pixels with specific warnings and errors during processing

6 World maps

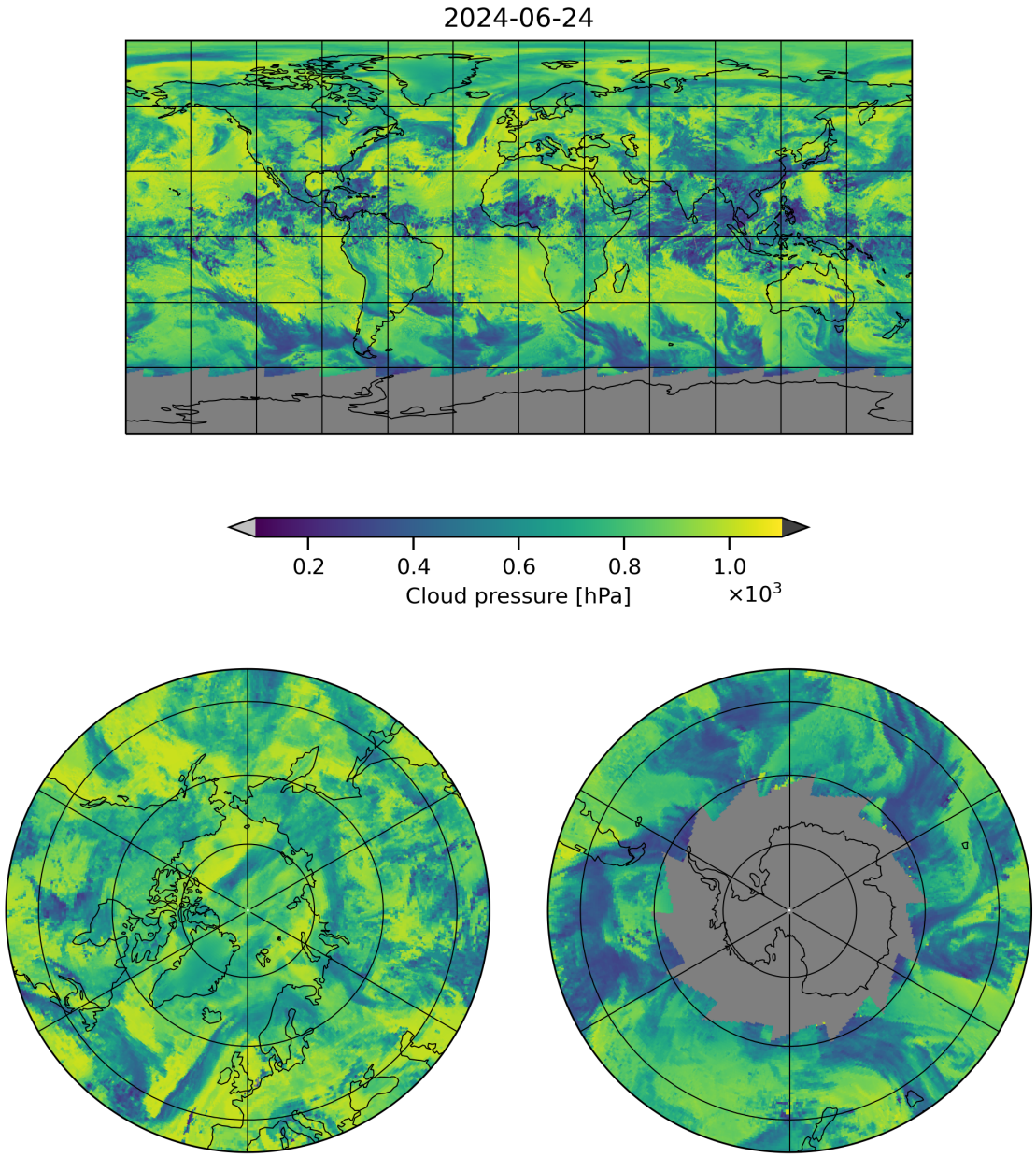


Figure 6: Map of “Cloud pressure” for 2024-06-24 to 2024-06-25

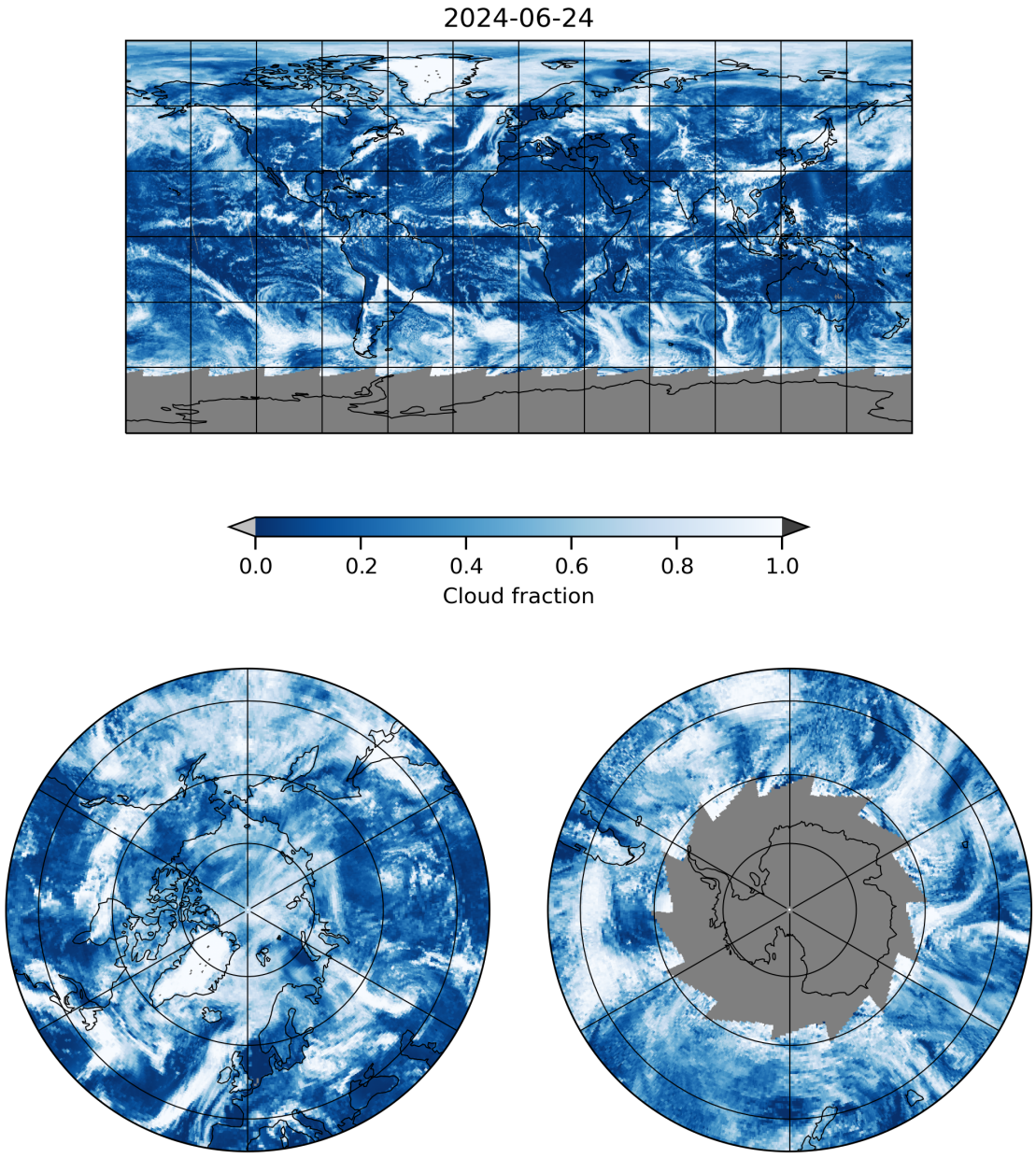


Figure 7: Map of “Cloud fraction” for 2024-06-24 to 2024-06-25

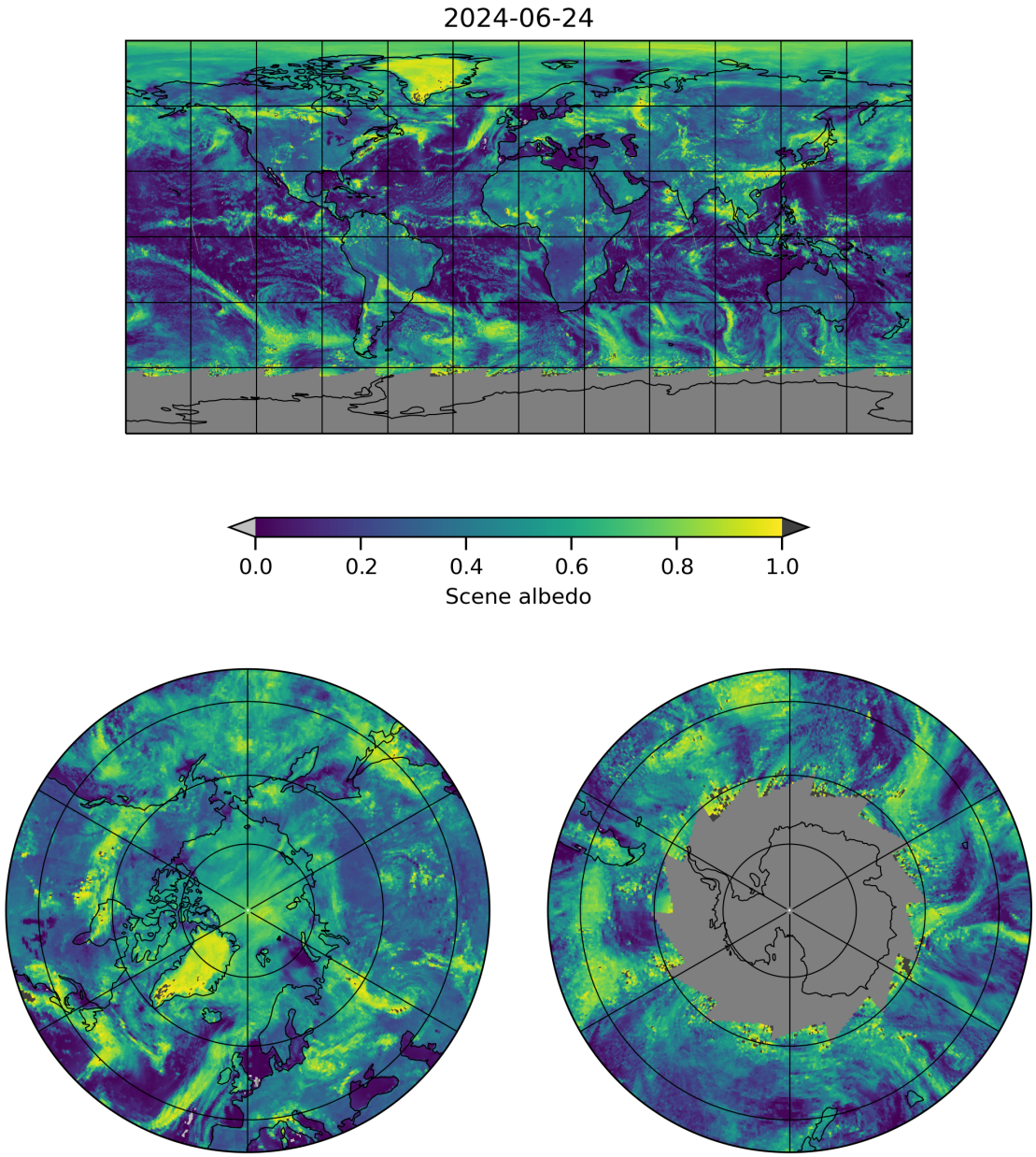


Figure 8: Map of “Scene albedo” for 2024-06-24 to 2024-06-25

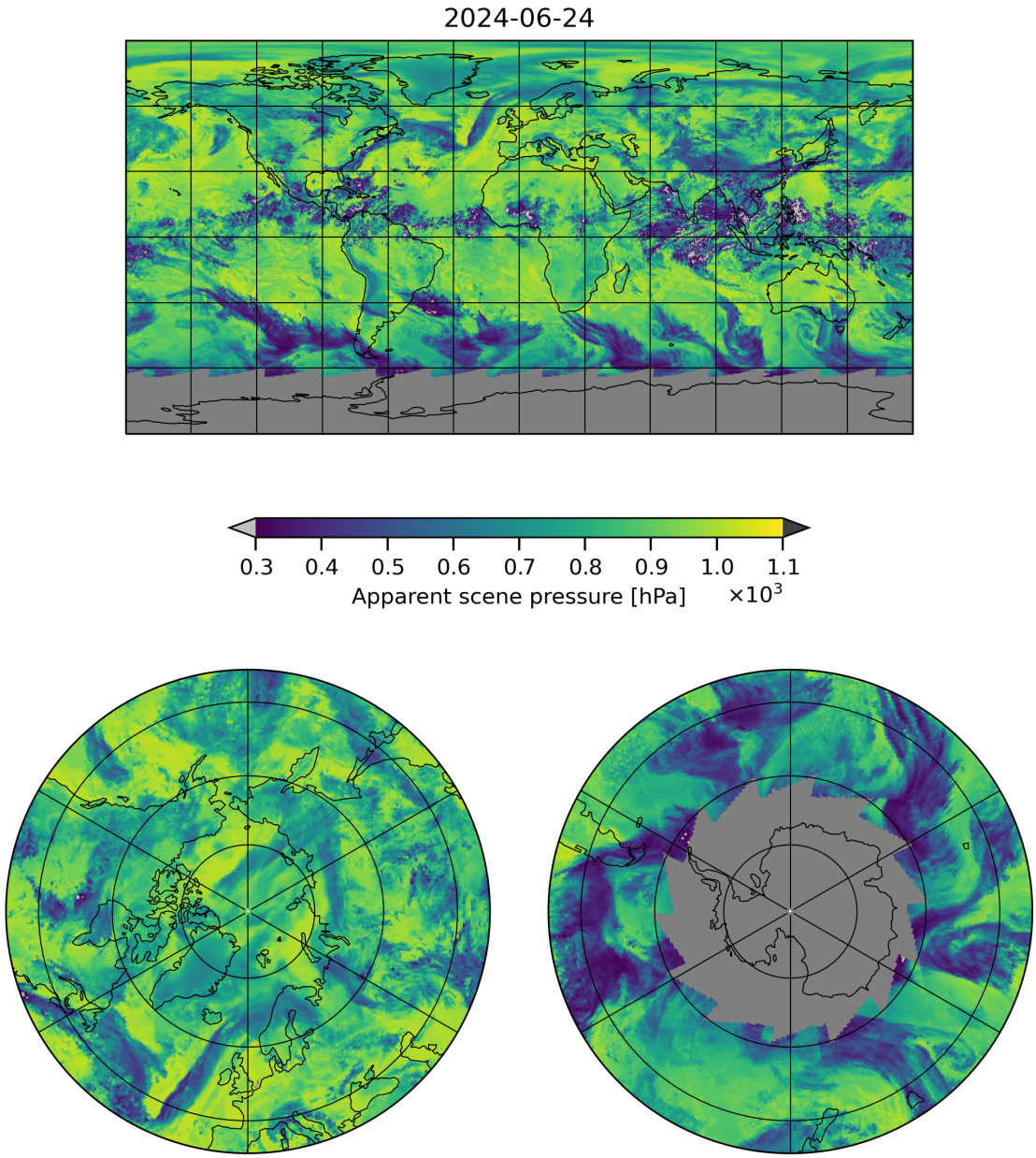


Figure 9: Map of “Apparent scene pressure” for 2024-06-24 to 2024-06-25

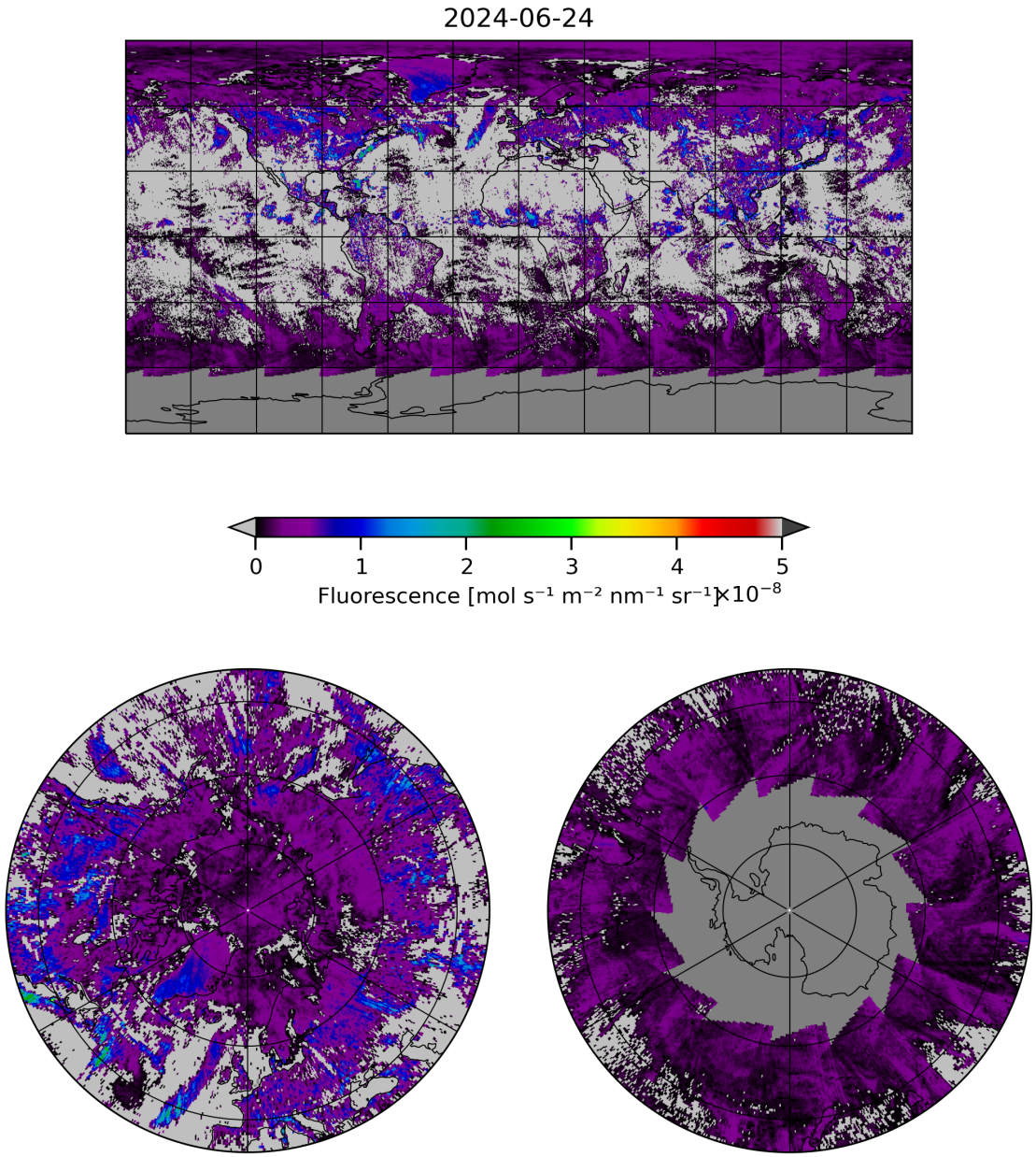


Figure 10: Map of “Fluorescence” for 2024-06-24 to 2024-06-25

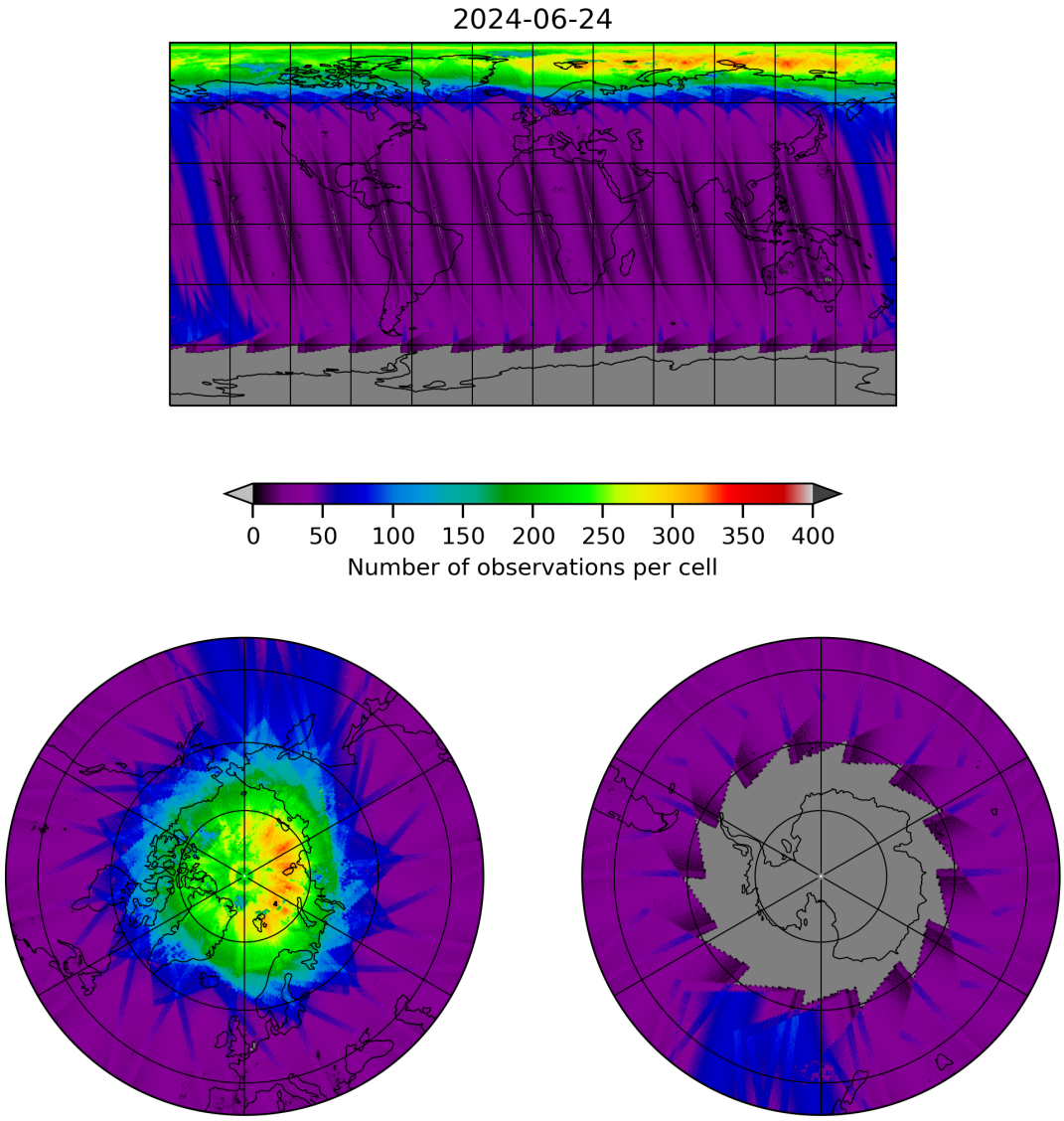


Figure 11: Map of the number of observations for 2024-06-24 to 2024-06-25

7 Zonal average

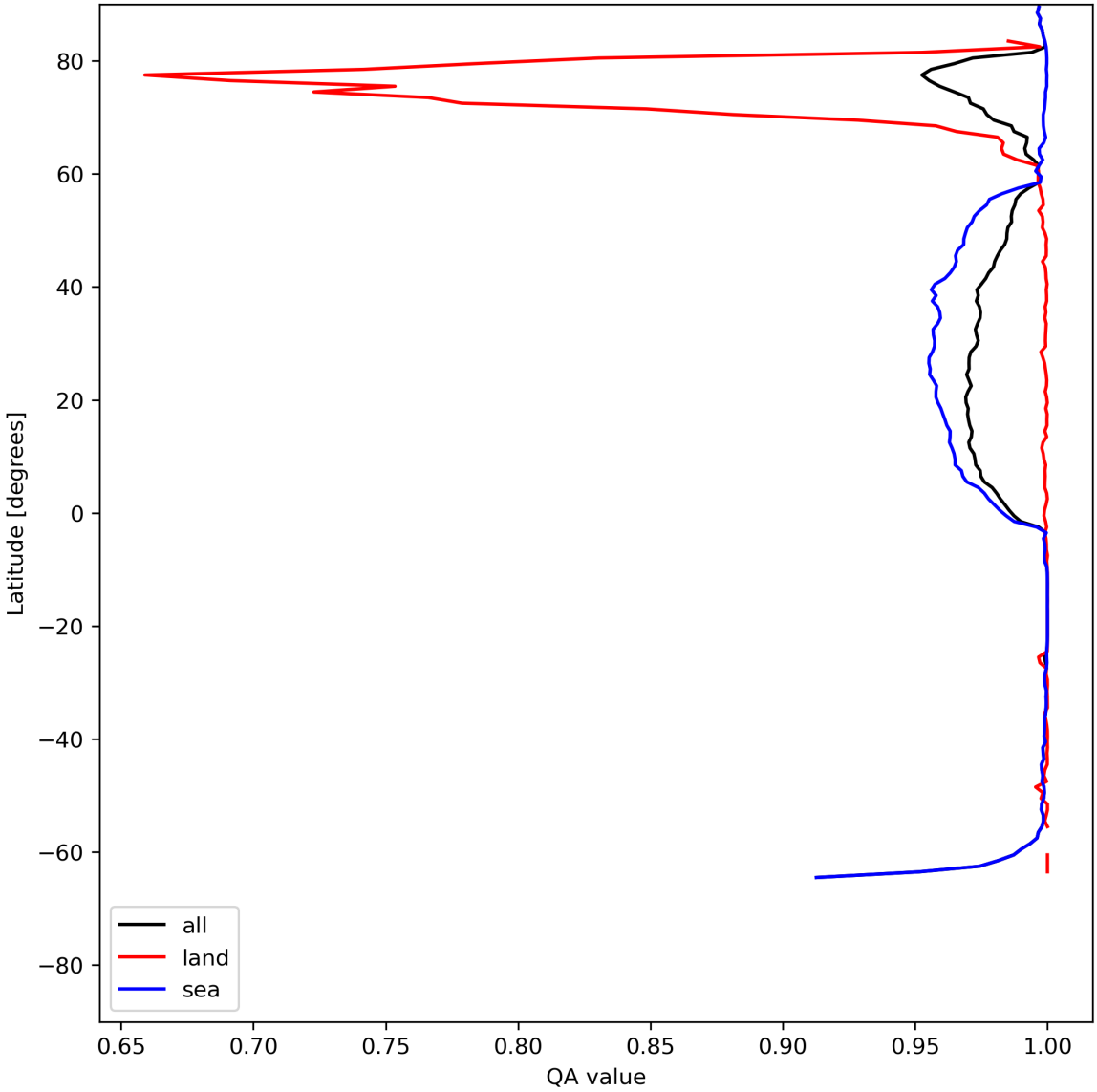


Figure 12: Zonal average of “QA value” for 2024-06-24 to 2024-06-25.

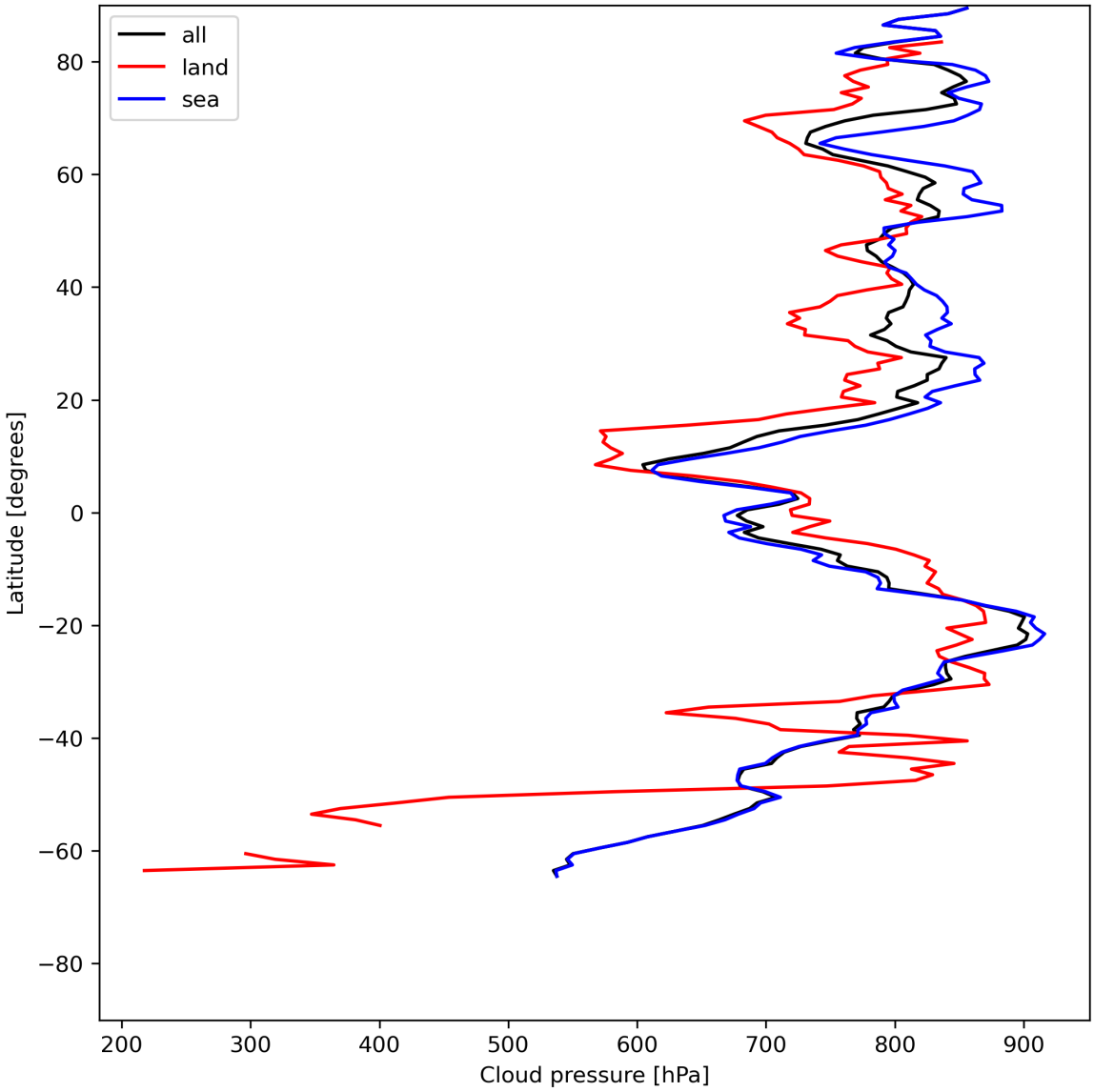


Figure 13: Zonal average of “Cloud pressure” for 2024-06-24 to 2024-06-25.

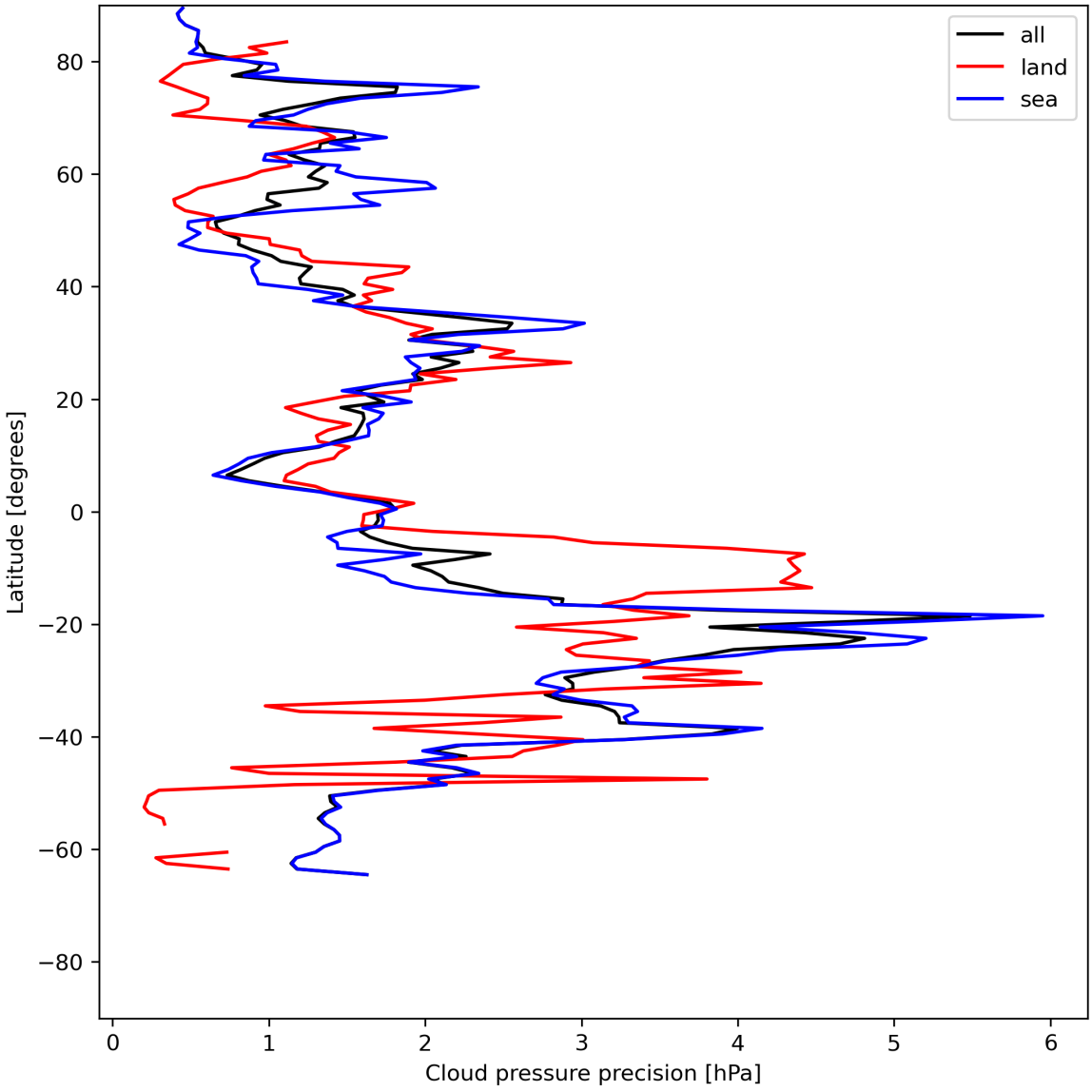


Figure 14: Zonal average of “Cloud pressure precision” for 2024-06-24 to 2024-06-25.

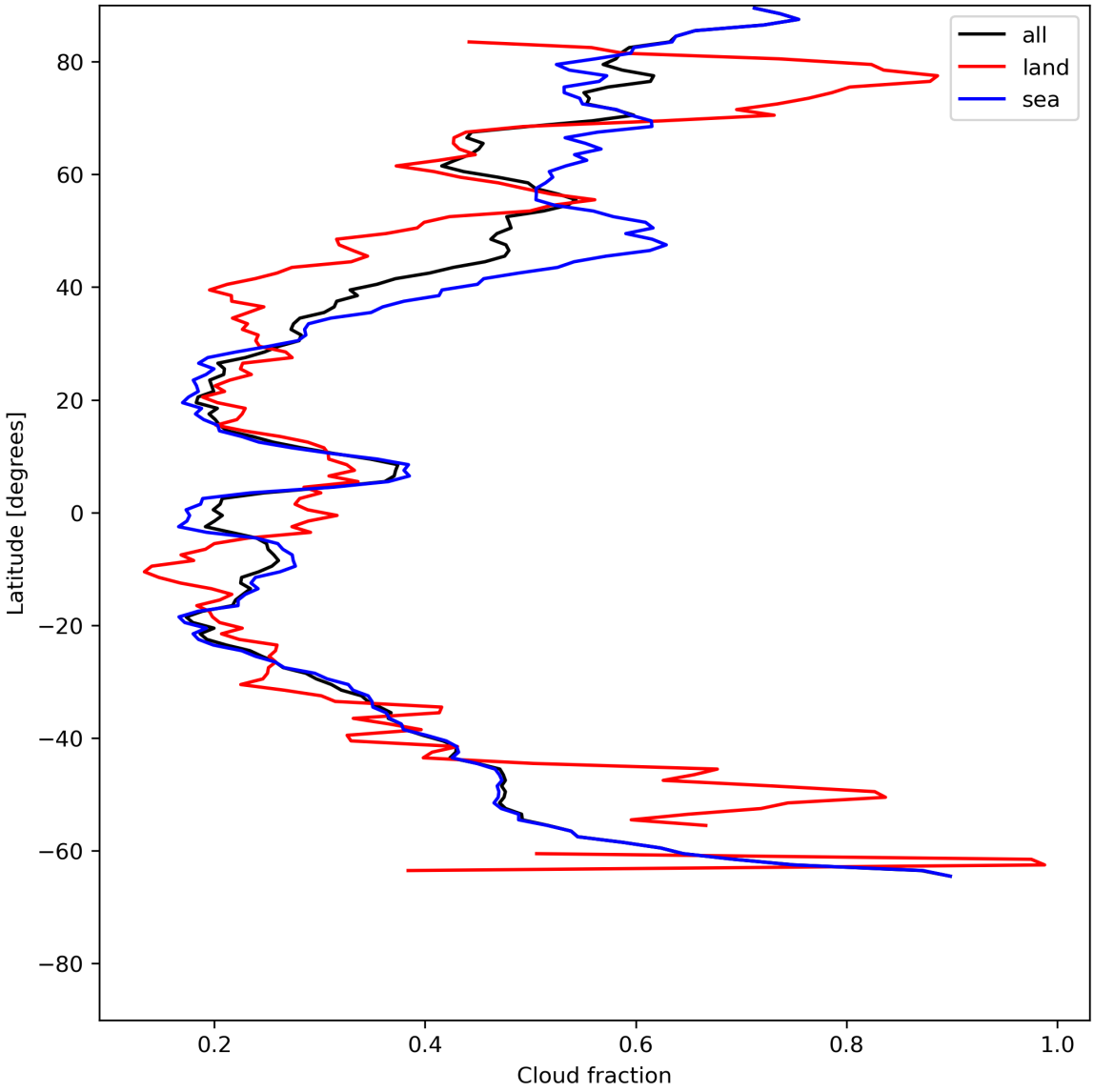


Figure 15: Zonal average of “Cloud fraction” for 2024-06-24 to 2024-06-25.

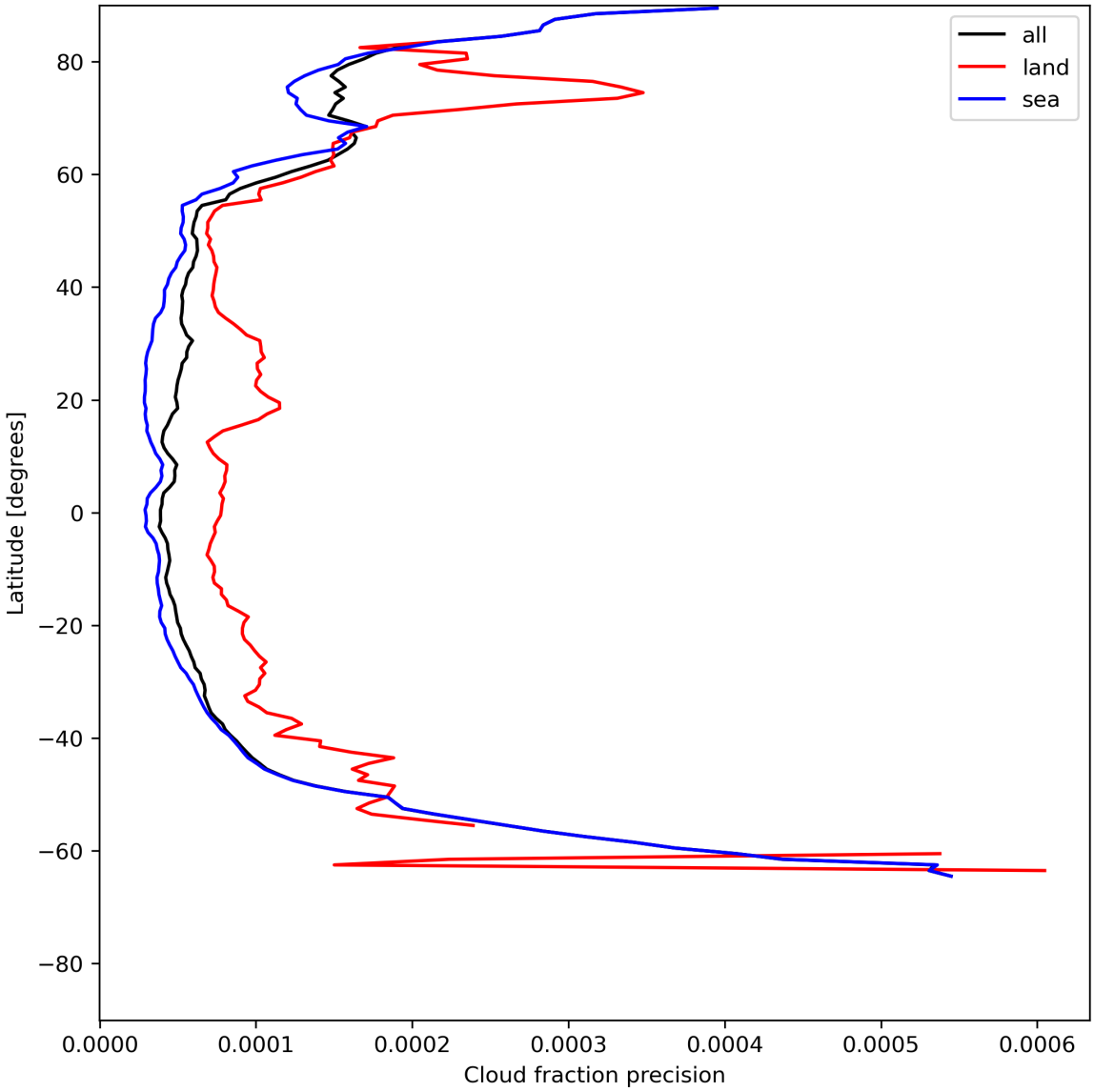


Figure 16: Zonal average of “Cloud fraction precision” for 2024-06-24 to 2024-06-25.

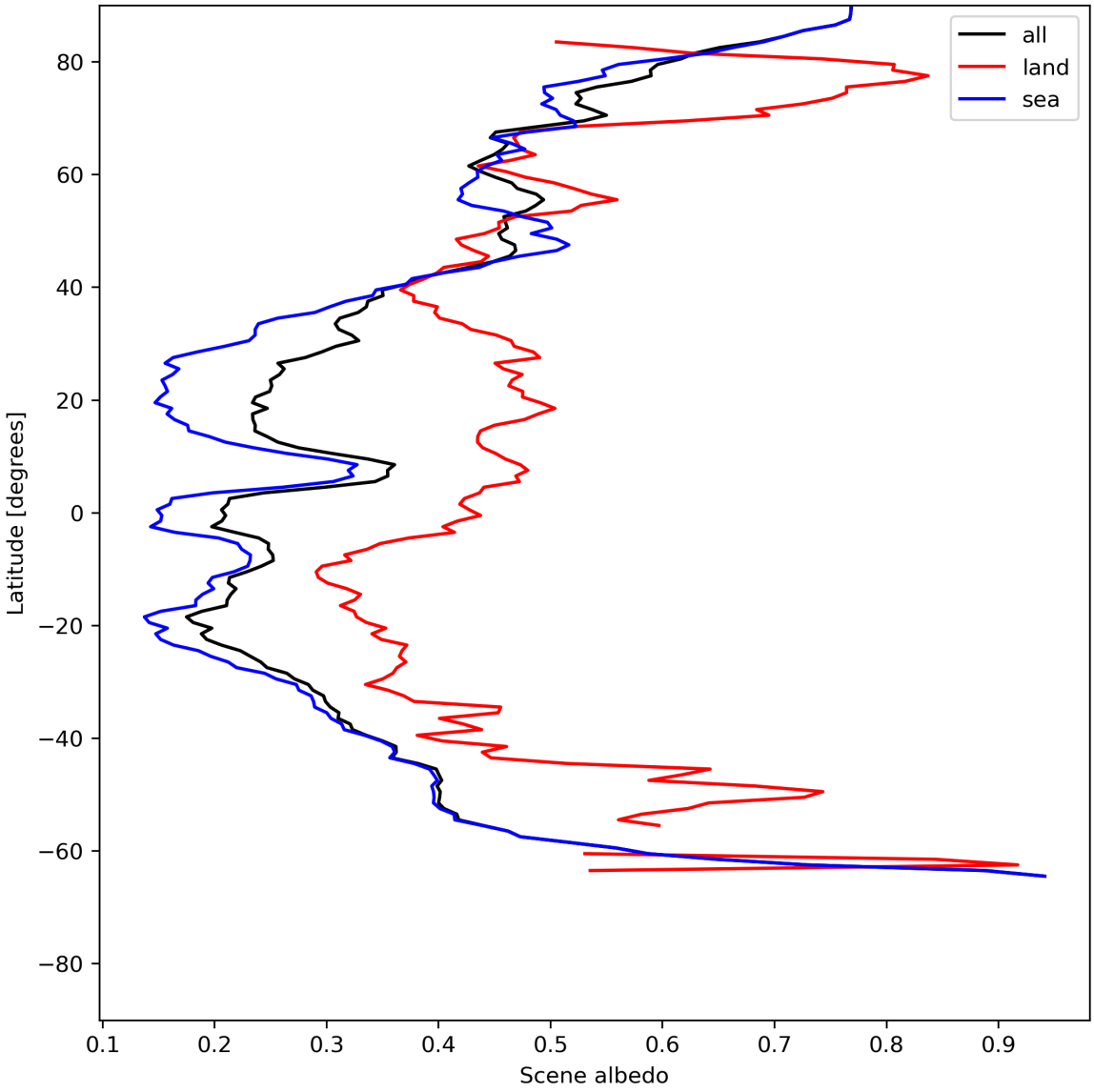


Figure 17: Zonal average of “Scene albedo” for 2024-06-24 to 2024-06-25.

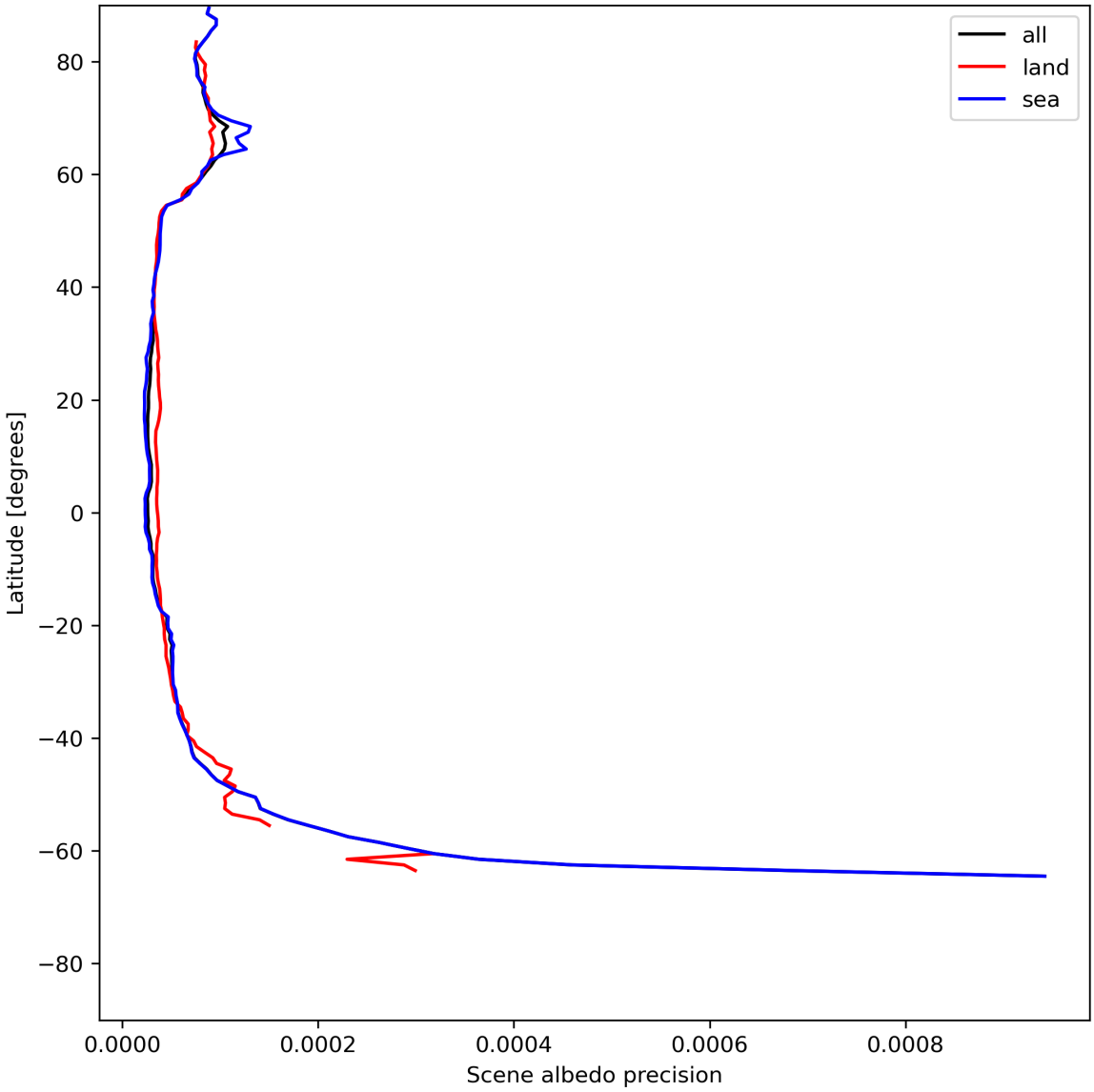


Figure 18: Zonal average of “Scene albedo precision” for 2024-06-24 to 2024-06-25.

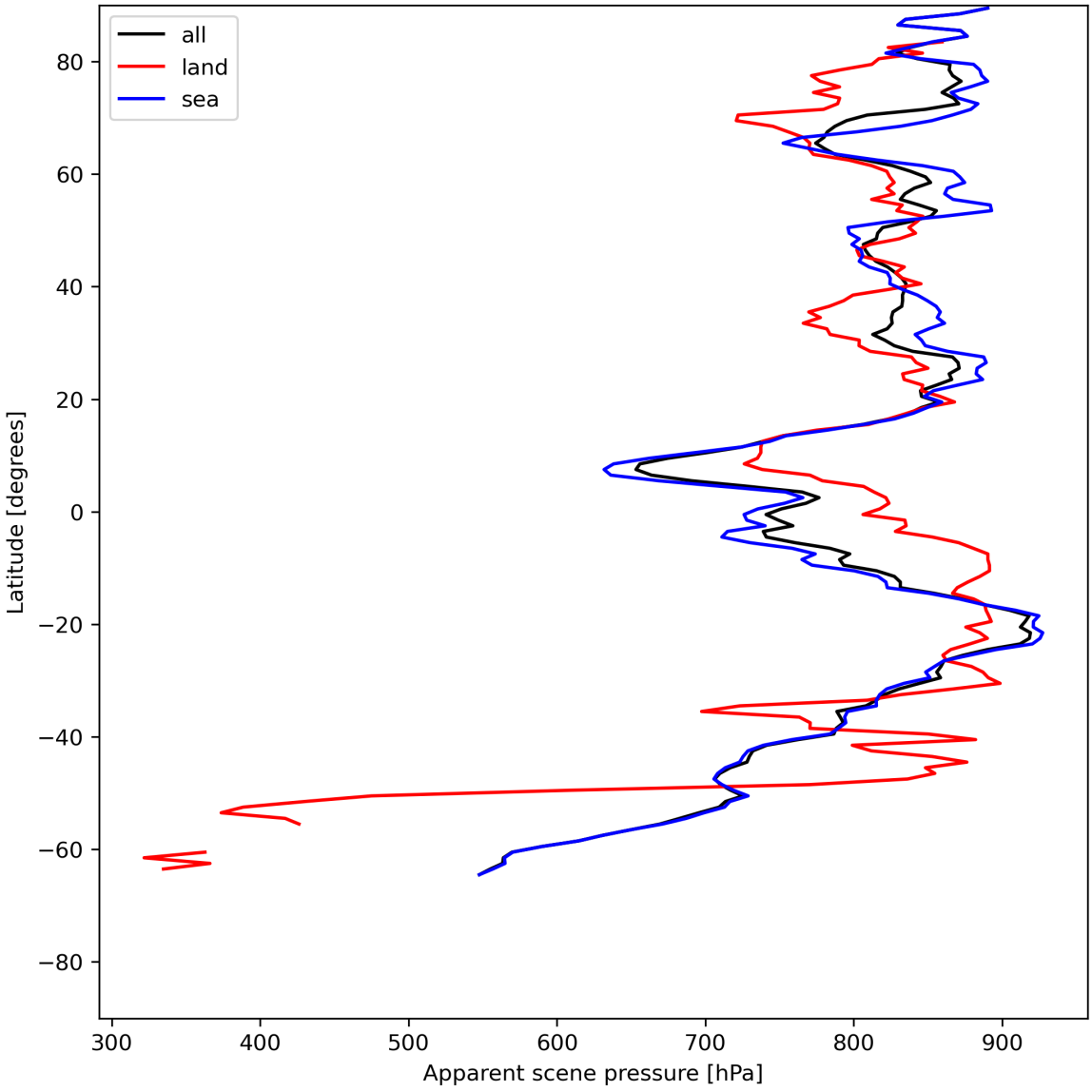


Figure 19: Zonal average of “Apparent scene pressure” for 2024-06-24 to 2024-06-25.

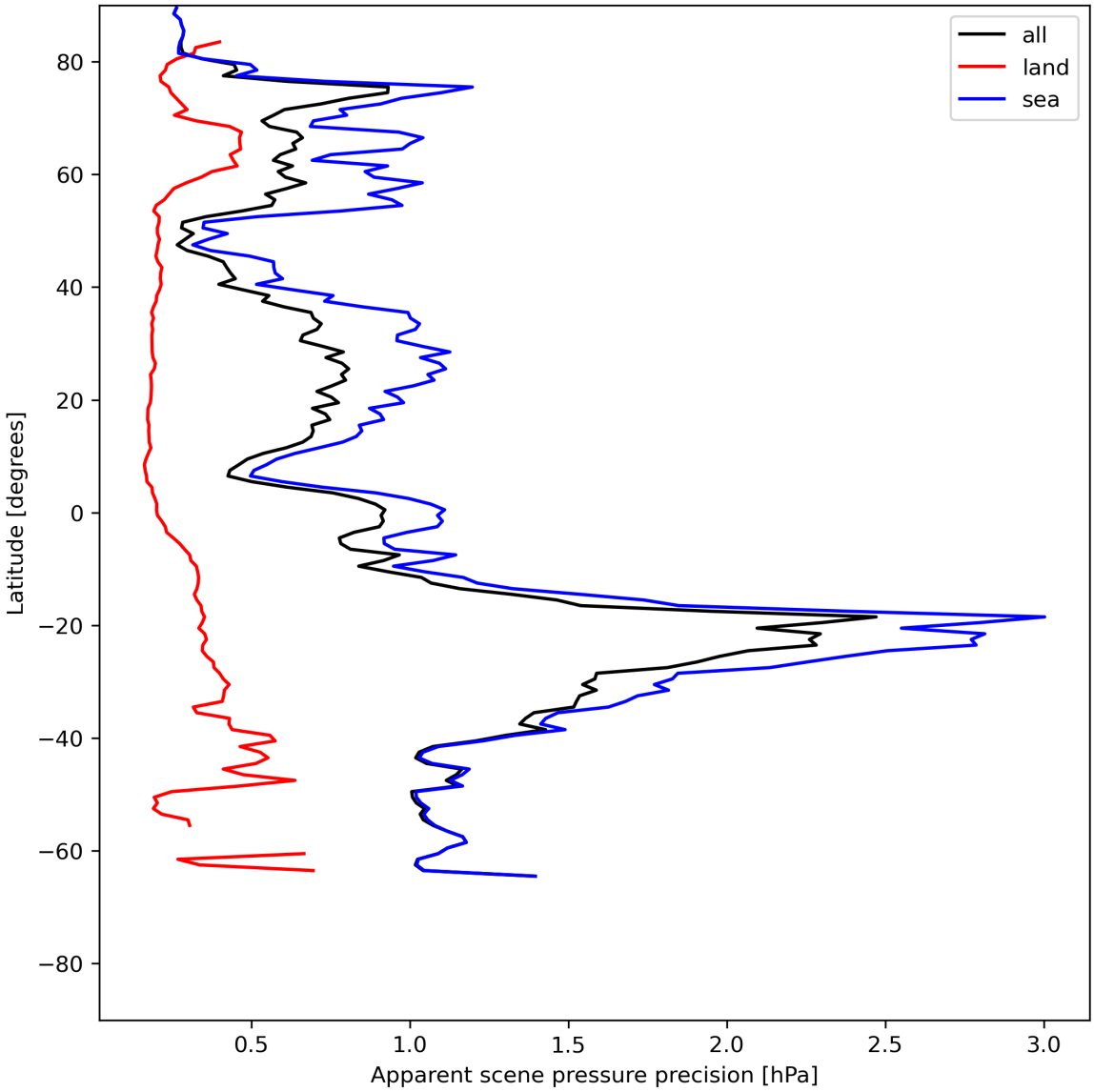


Figure 20: Zonal average of “Apparent scene pressure precision” for 2024-06-24 to 2024-06-25.

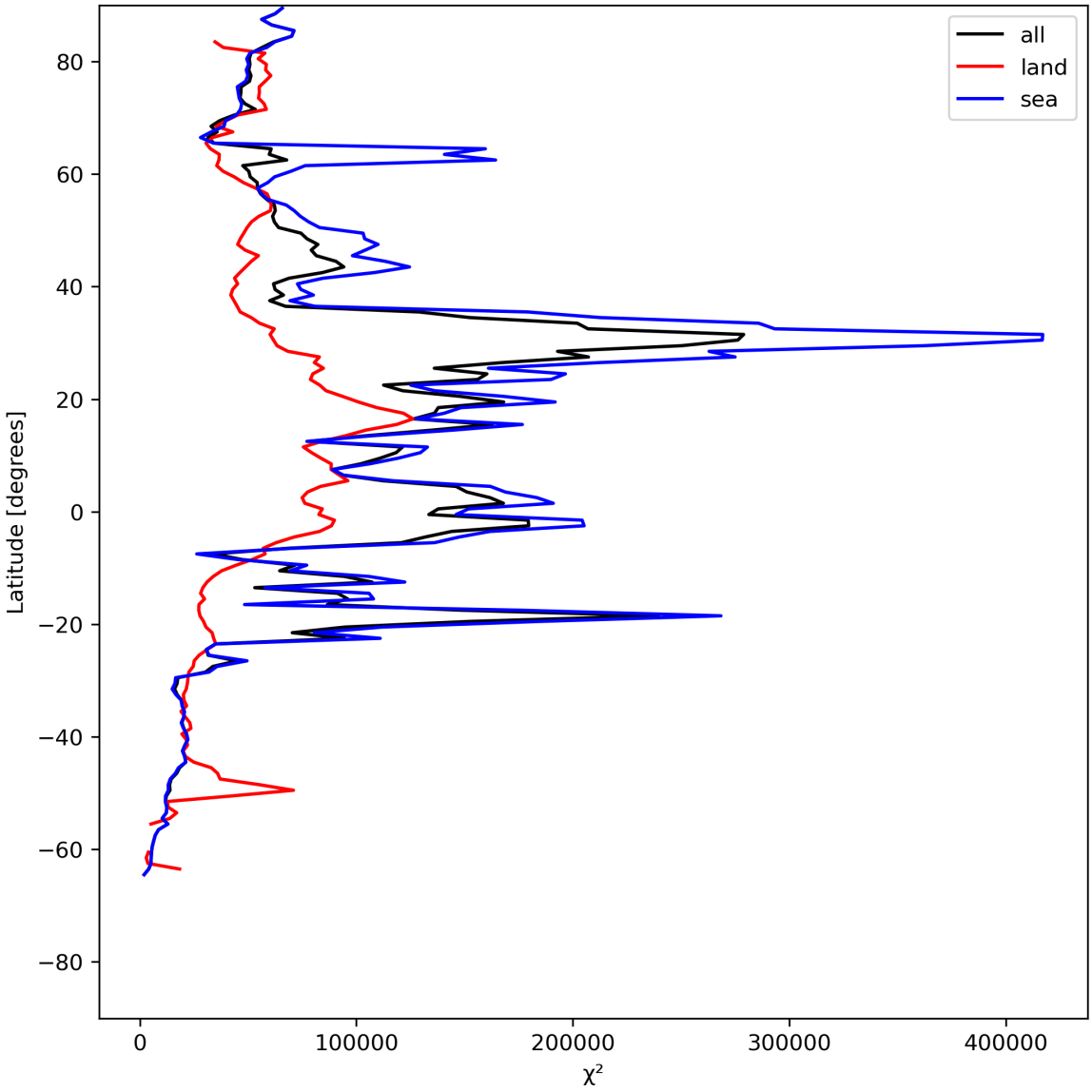


Figure 21: Zonal average of "χ^2" for 2024-06-24 to 2024-06-25.

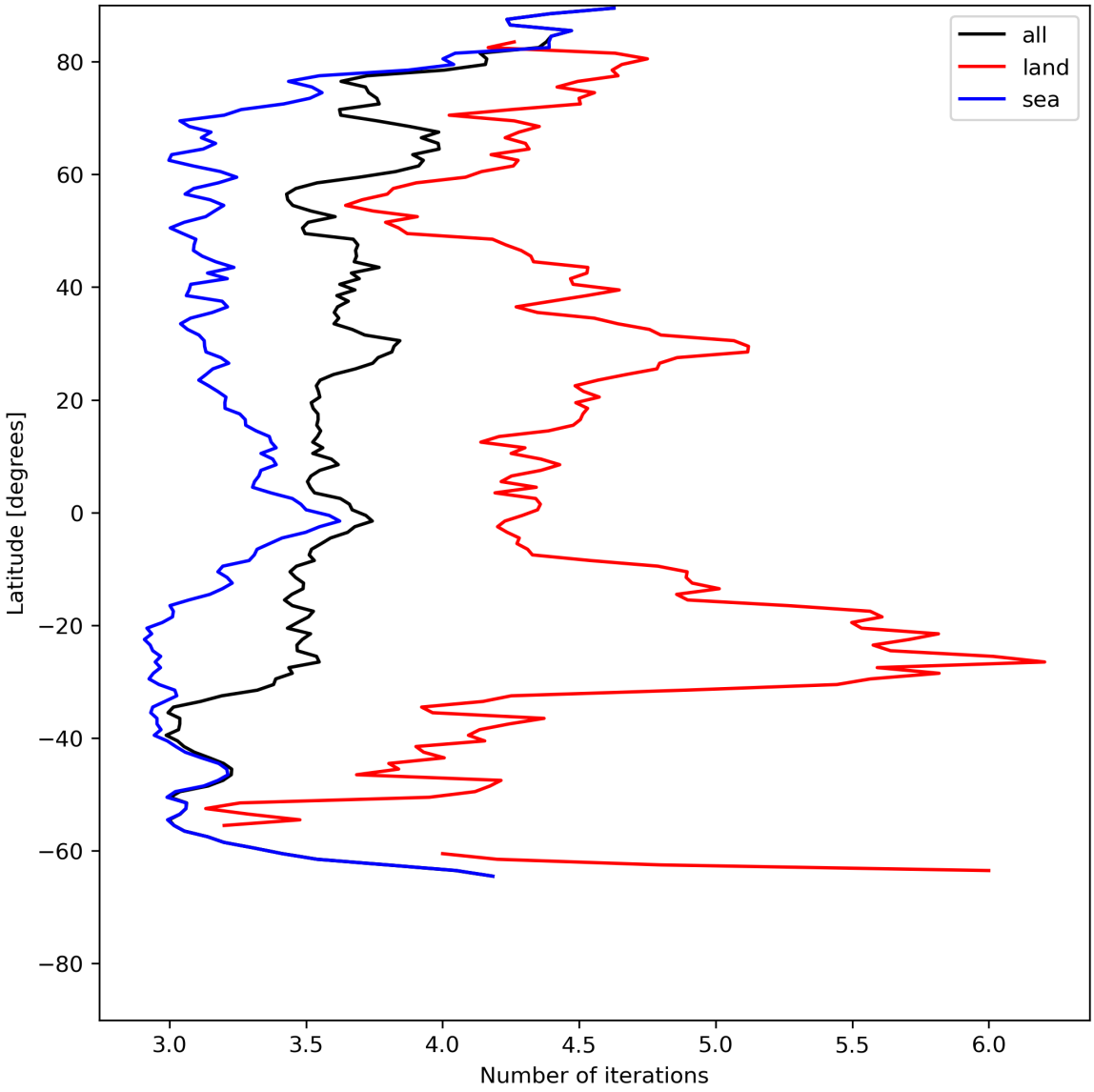


Figure 22: Zonal average of “Number of iterations” for 2024-06-24 to 2024-06-25.

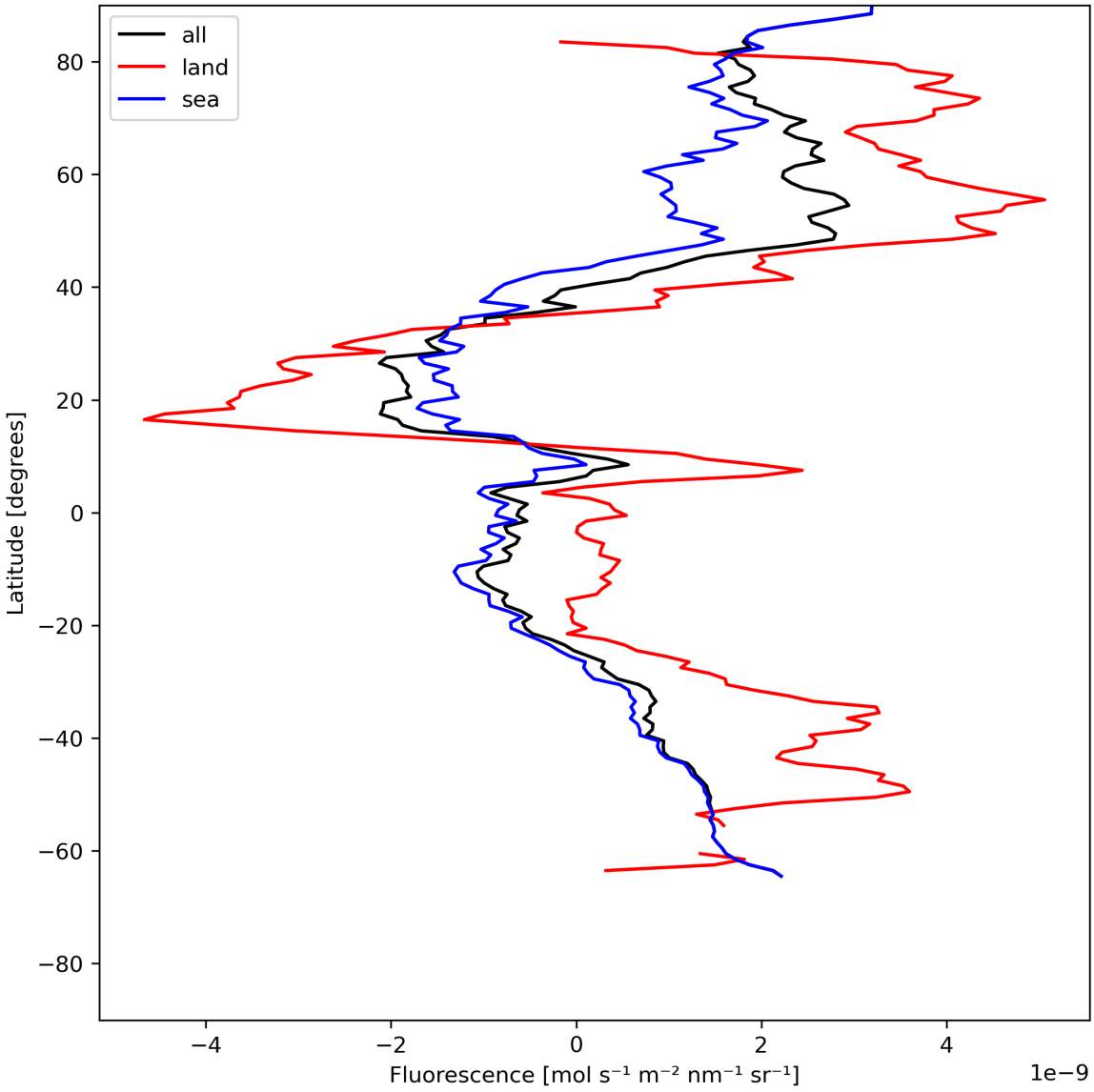


Figure 23: Zonal average of “Fluorescence” for 2024-06-24 to 2024-06-25.

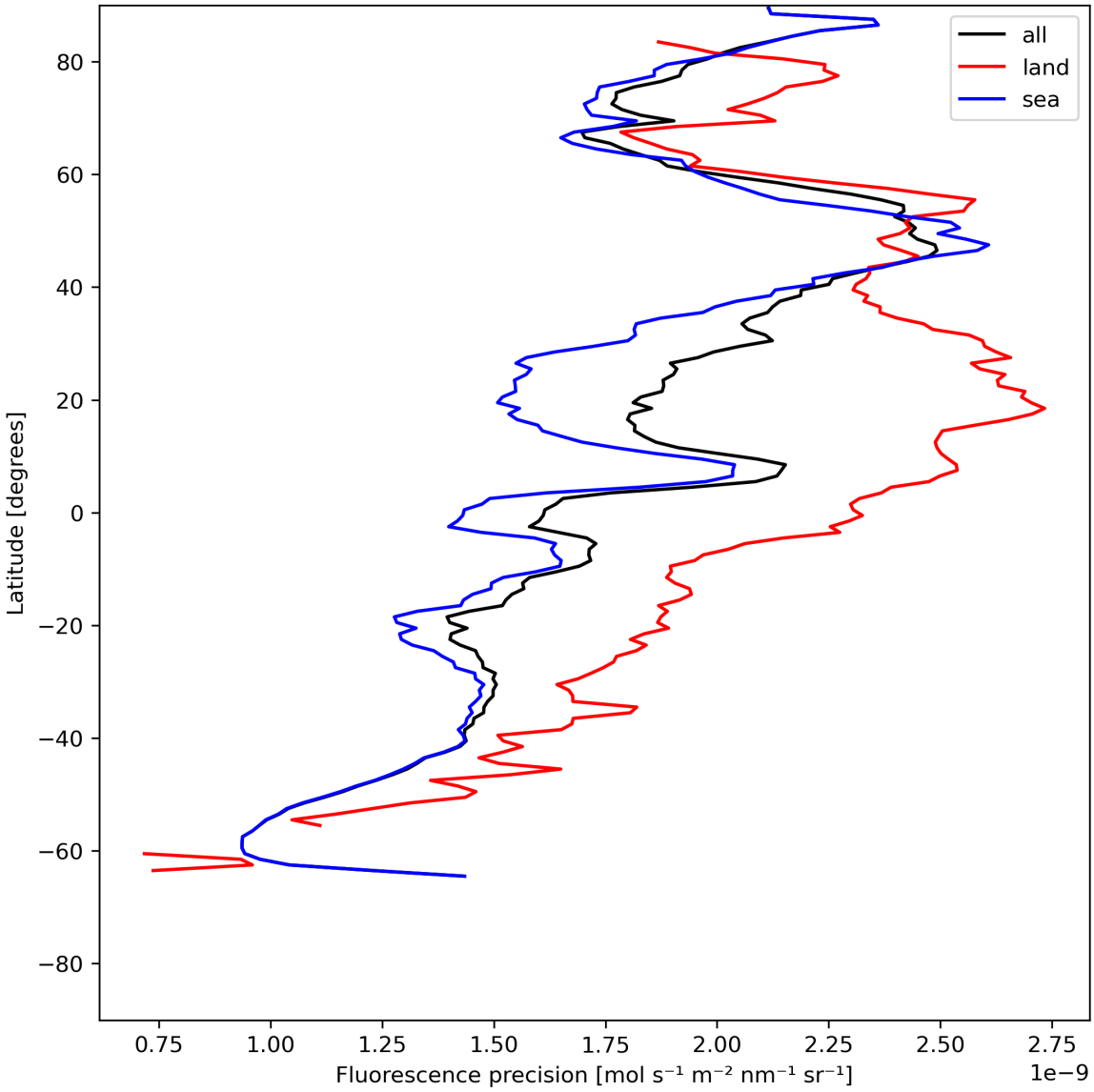


Figure 24: Zonal average of “Fluorescence precision” for 2024-06-24 to 2024-06-25.

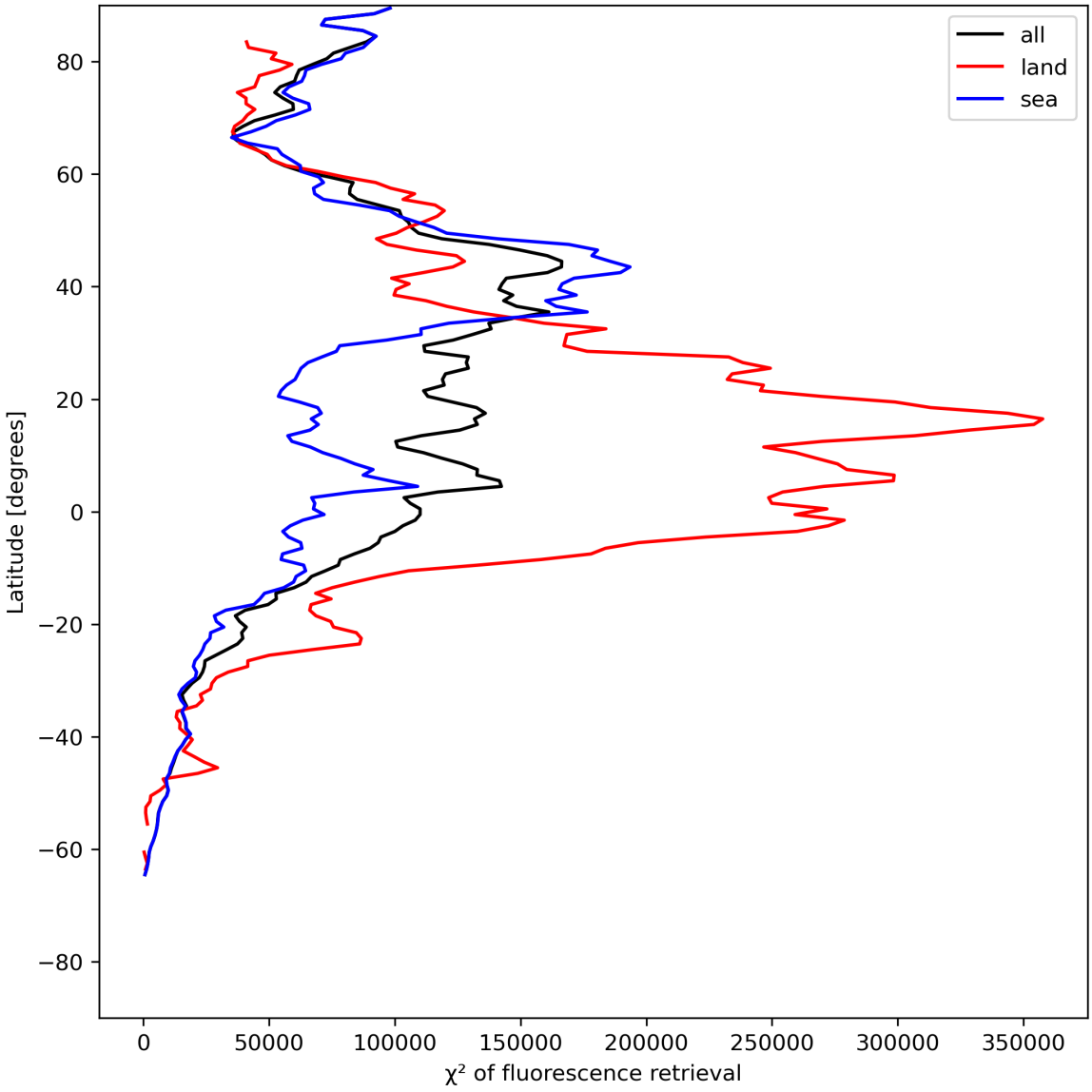


Figure 25: Zonal average of "χ^2 of fluorescence retrieval" for 2024-06-24 to 2024-06-25.

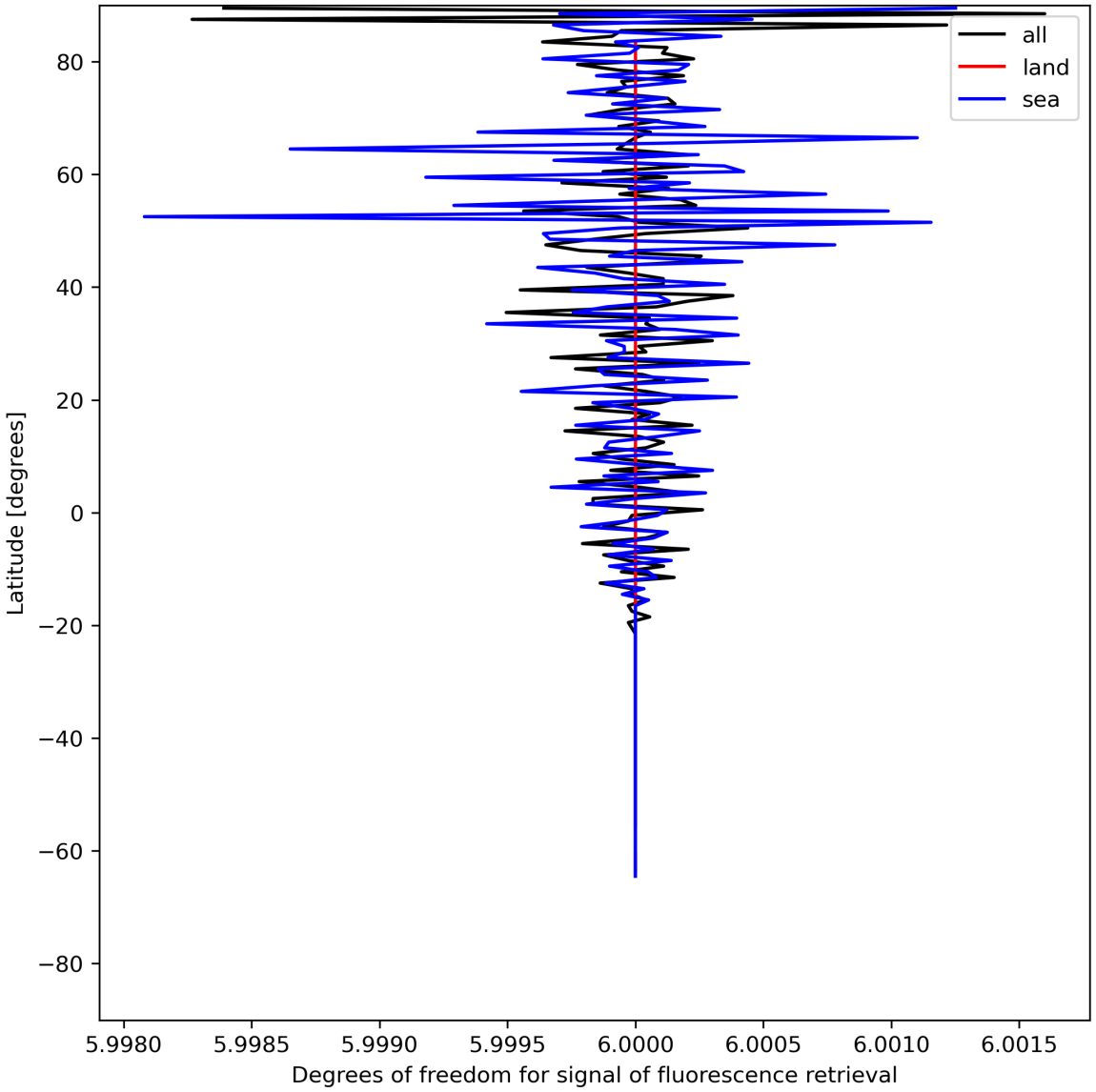


Figure 26: Zonal average of “Degrees of freedom for signal of fluorescence retrieval” for 2024-06-24 to 2024-06-25.

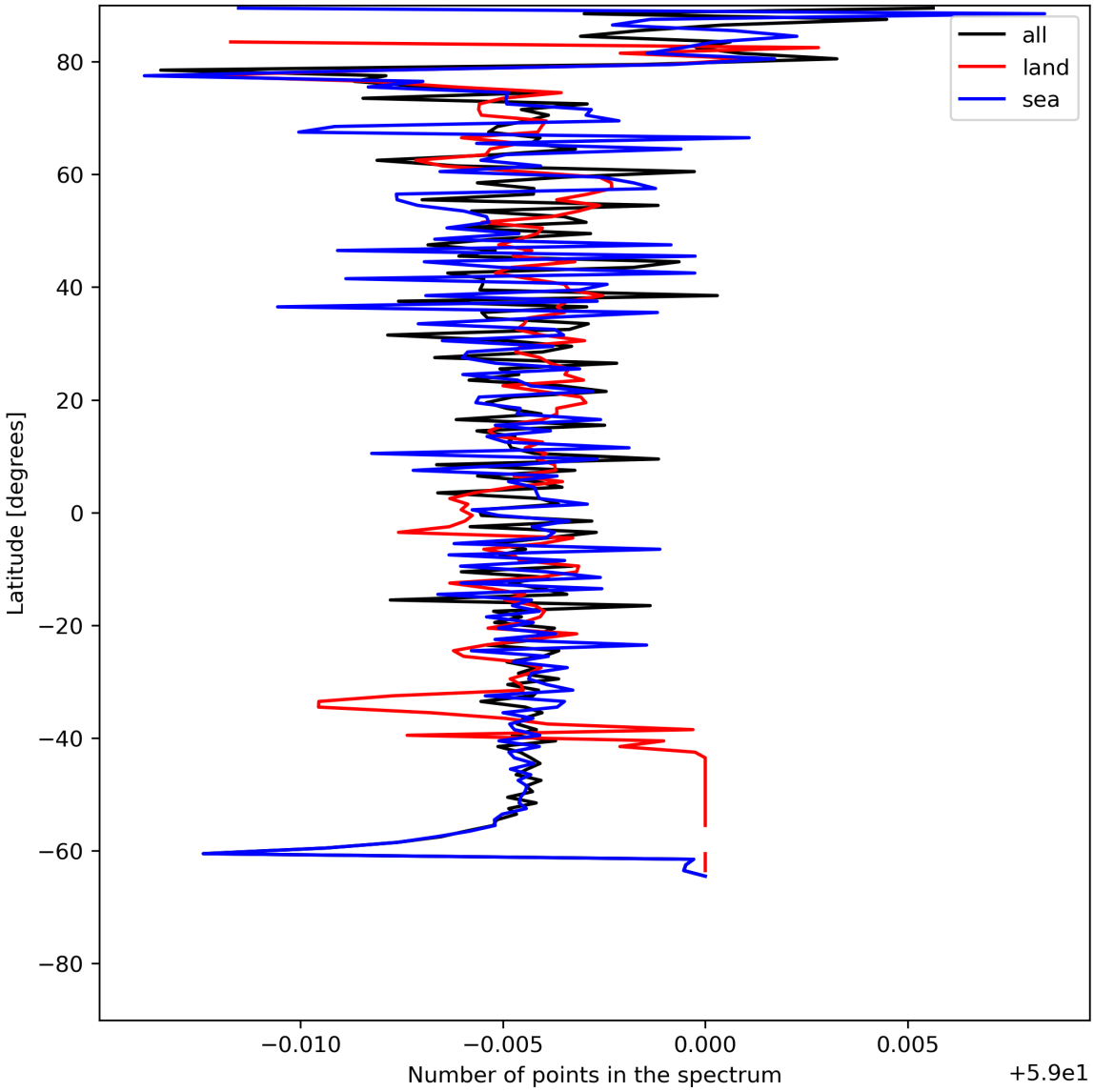


Figure 27: Zonal average of “Number of points in the spectrum” for 2024-06-24 to 2024-06-25.

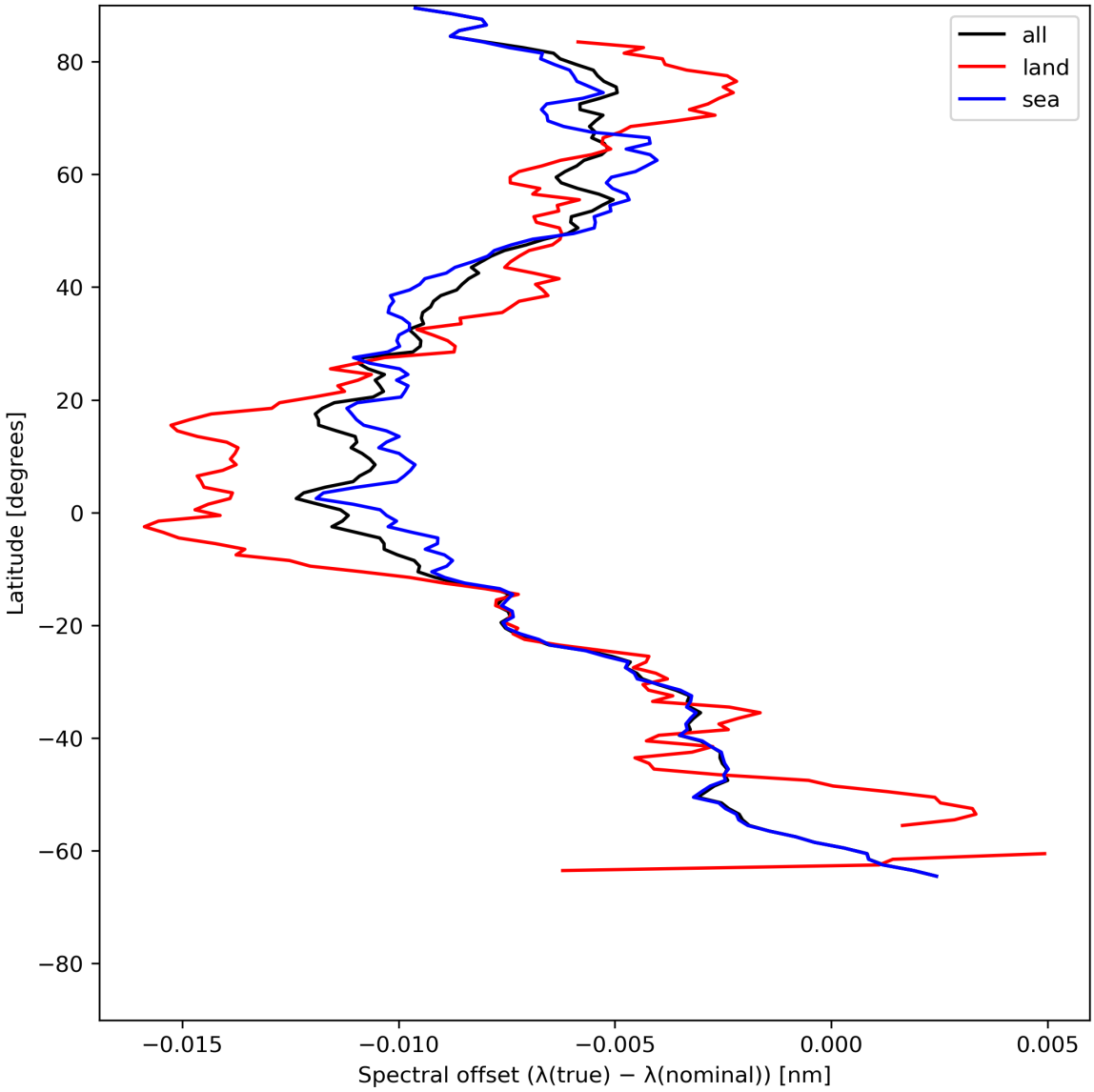


Figure 28: Zonal average of “Spectral offset (λ(true) − λ(nominal))” for 2024-06-24 to 2024-06-25.

8 Histograms

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

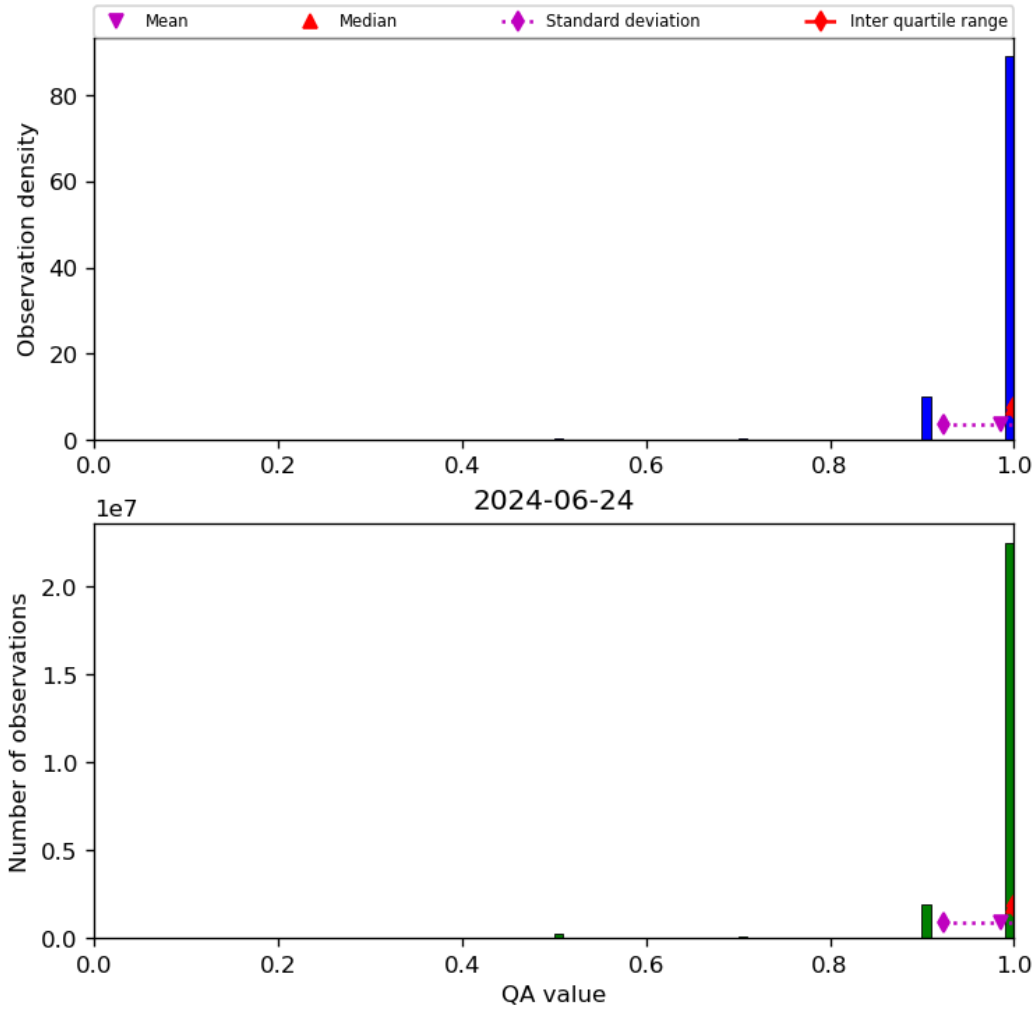


Figure 29: Histogram of “QA value” for 2024-06-24 to 2024-06-25

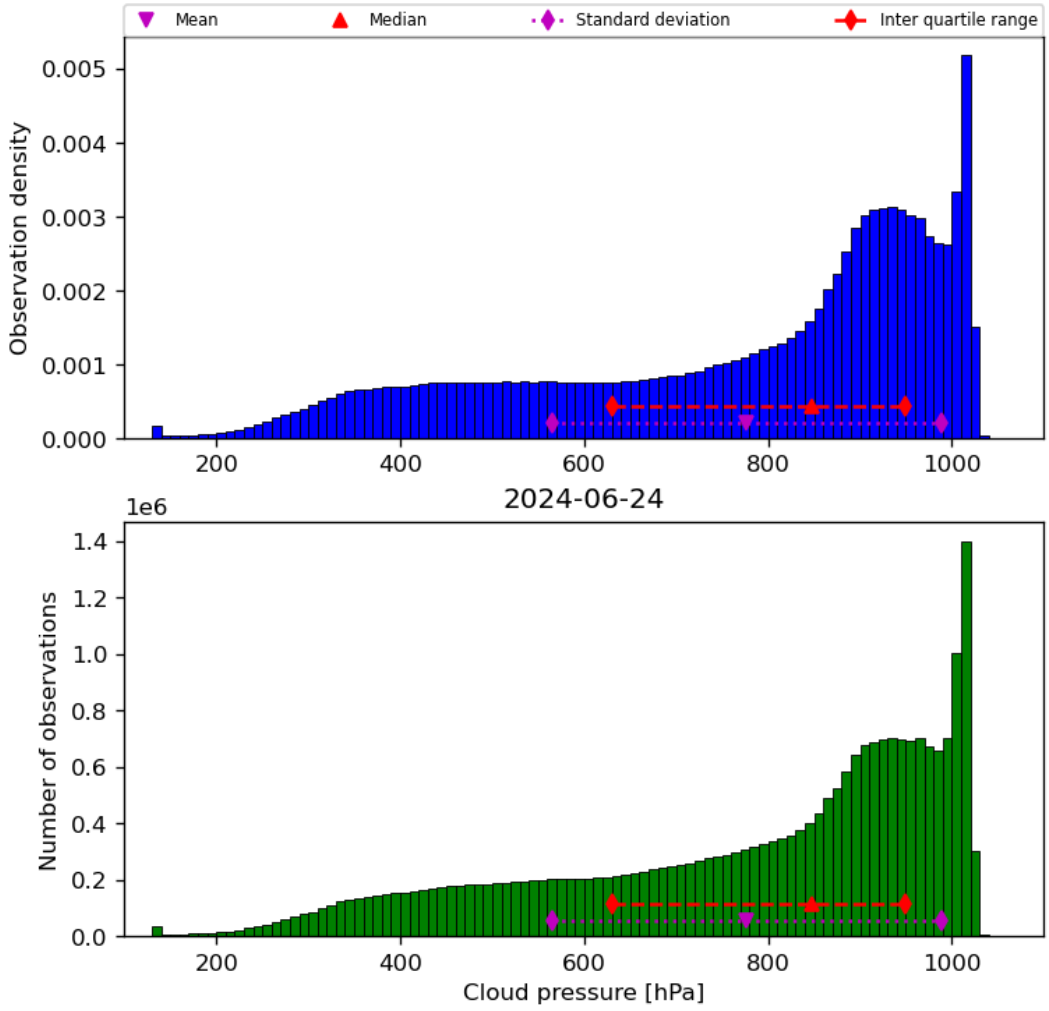


Figure 30: Histogram of “Cloud pressure” for 2024-06-24 to 2024-06-25

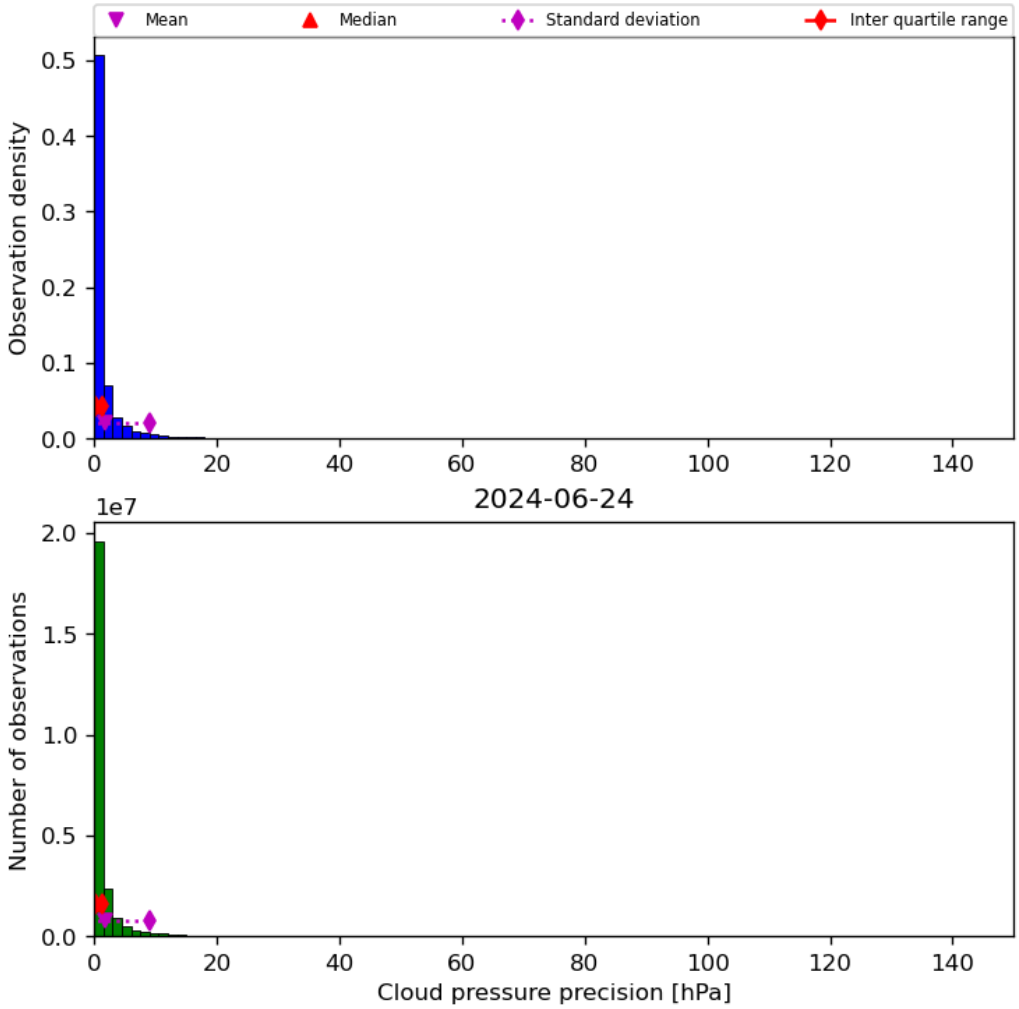


Figure 31: Histogram of “Cloud pressure precision” for 2024-06-24 to 2024-06-25

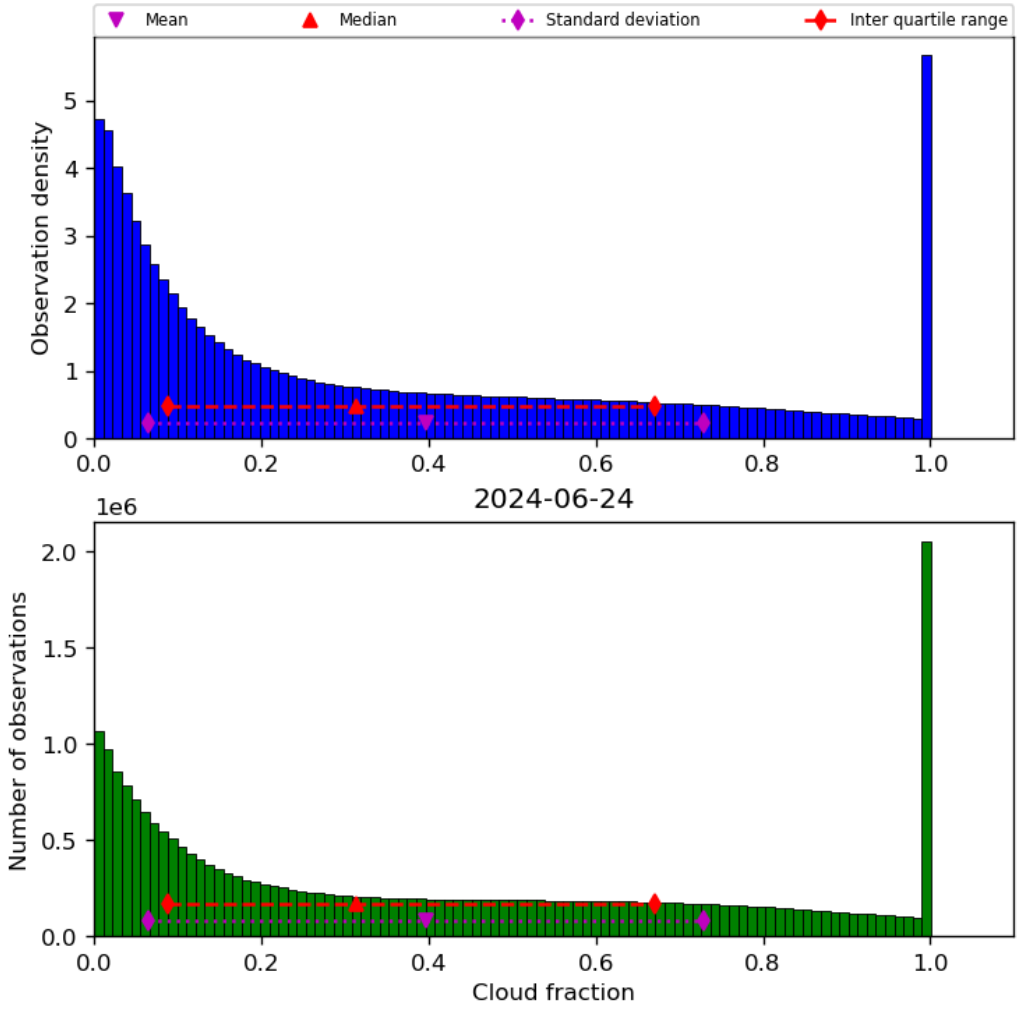


Figure 32: Histogram of “Cloud fraction” for 2024-06-24 to 2024-06-25

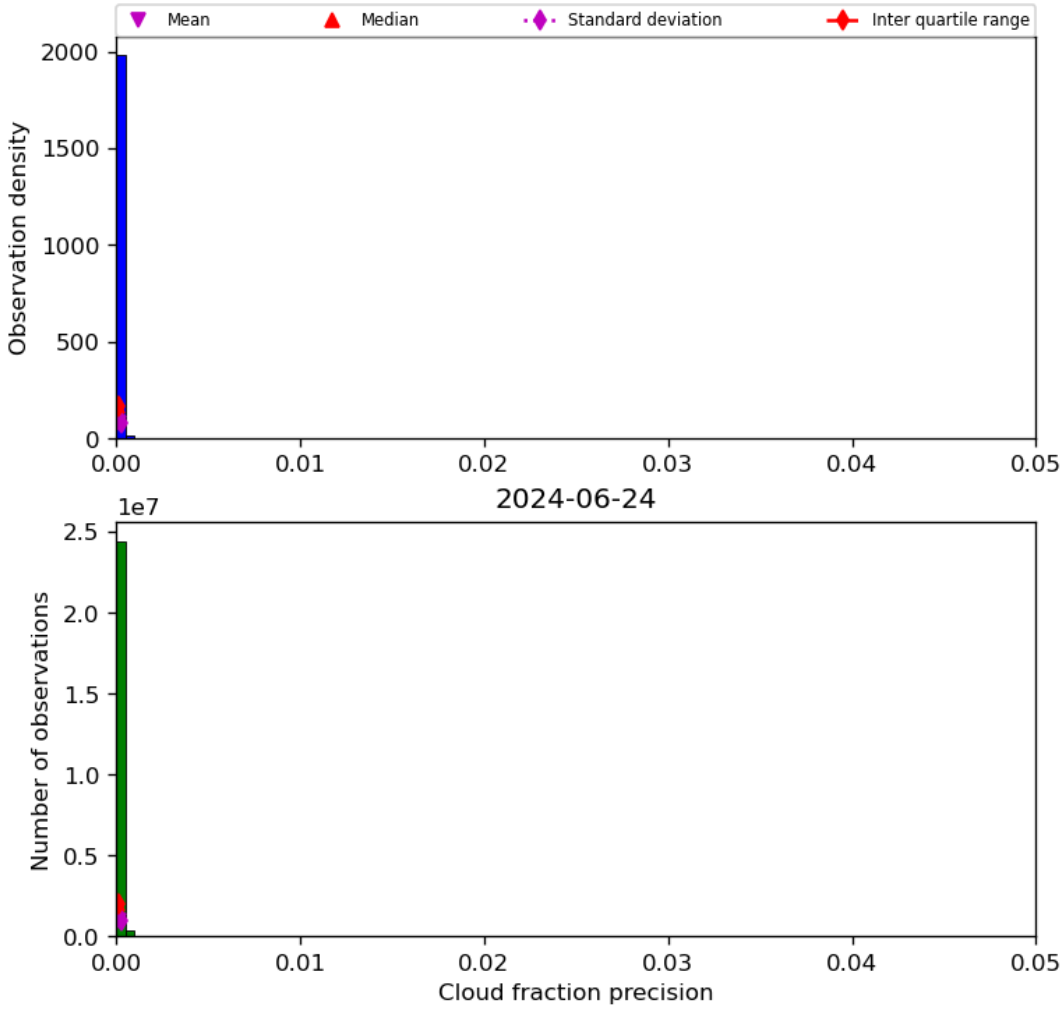


Figure 33: Histogram of “Cloud fraction precision” for 2024-06-24 to 2024-06-25

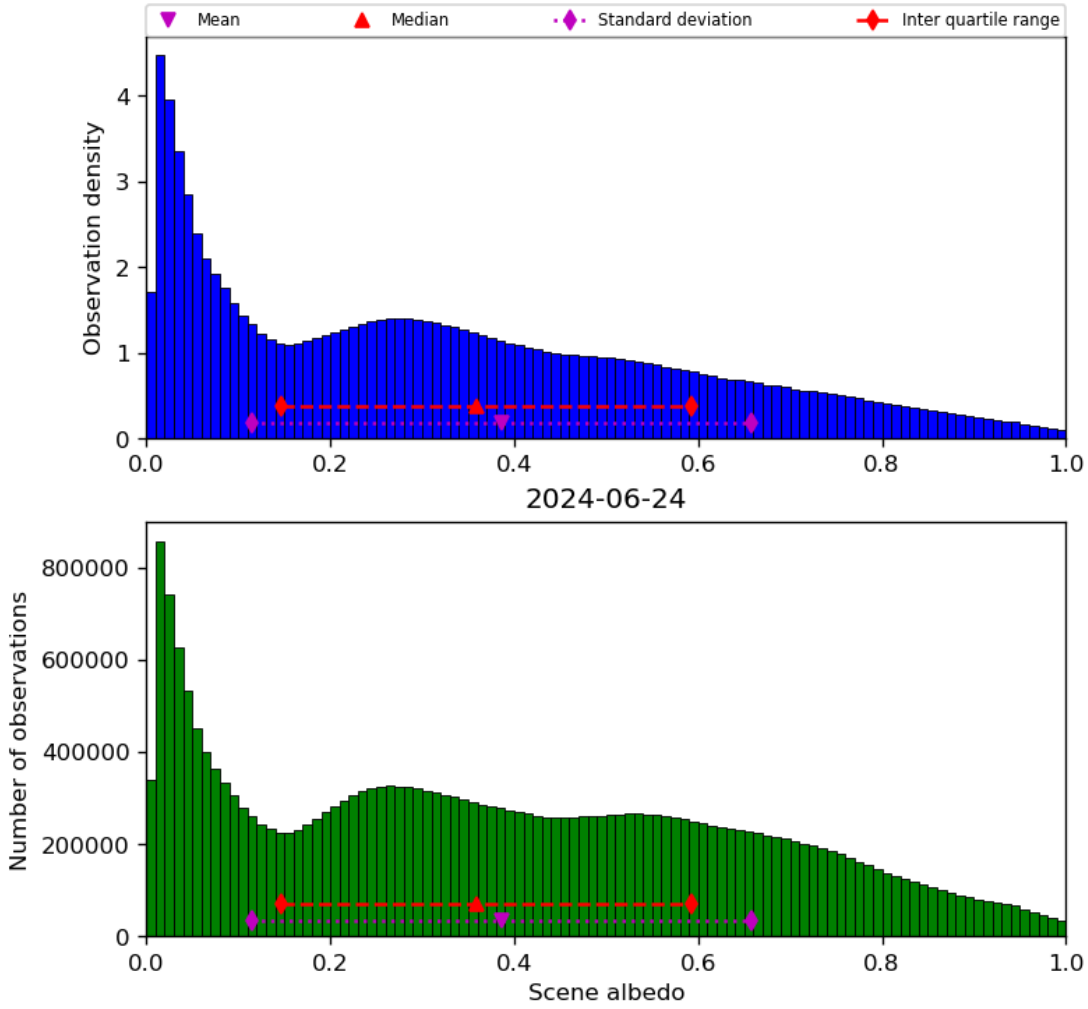


Figure 34: Histogram of “Scene albedo” for 2024-06-24 to 2024-06-25

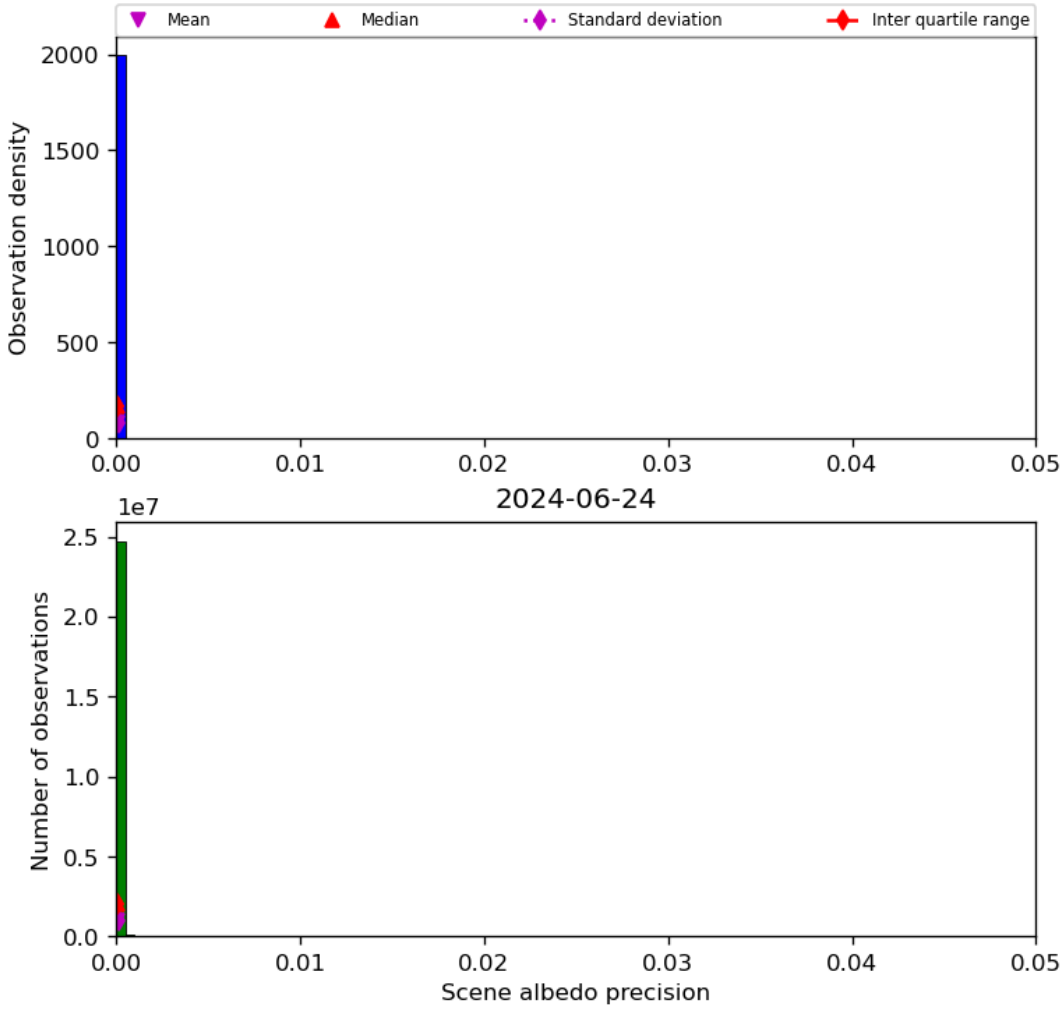


Figure 35: Histogram of “Scene albedo precision” for 2024-06-24 to 2024-06-25

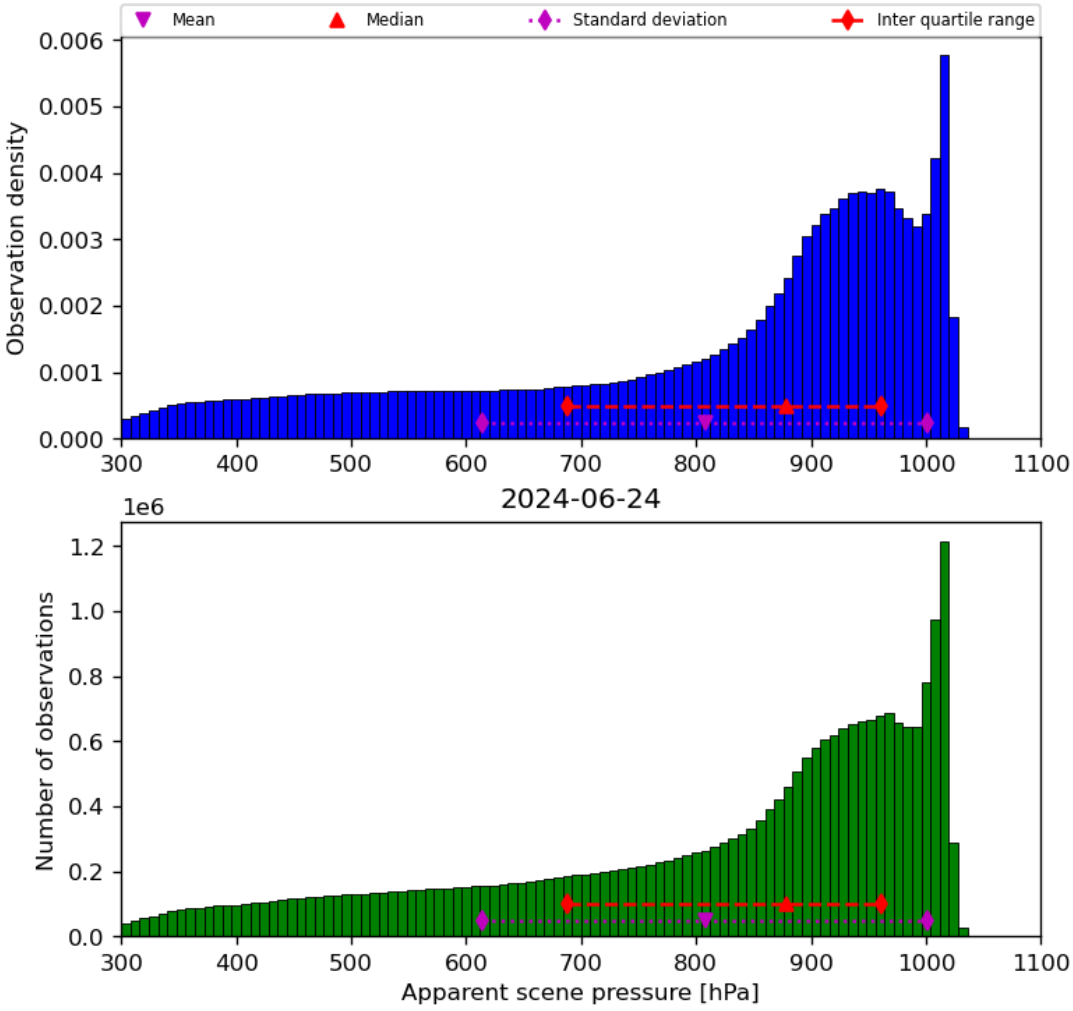


Figure 36: Histogram of “Apparent scene pressure” for 2024-06-24 to 2024-06-25

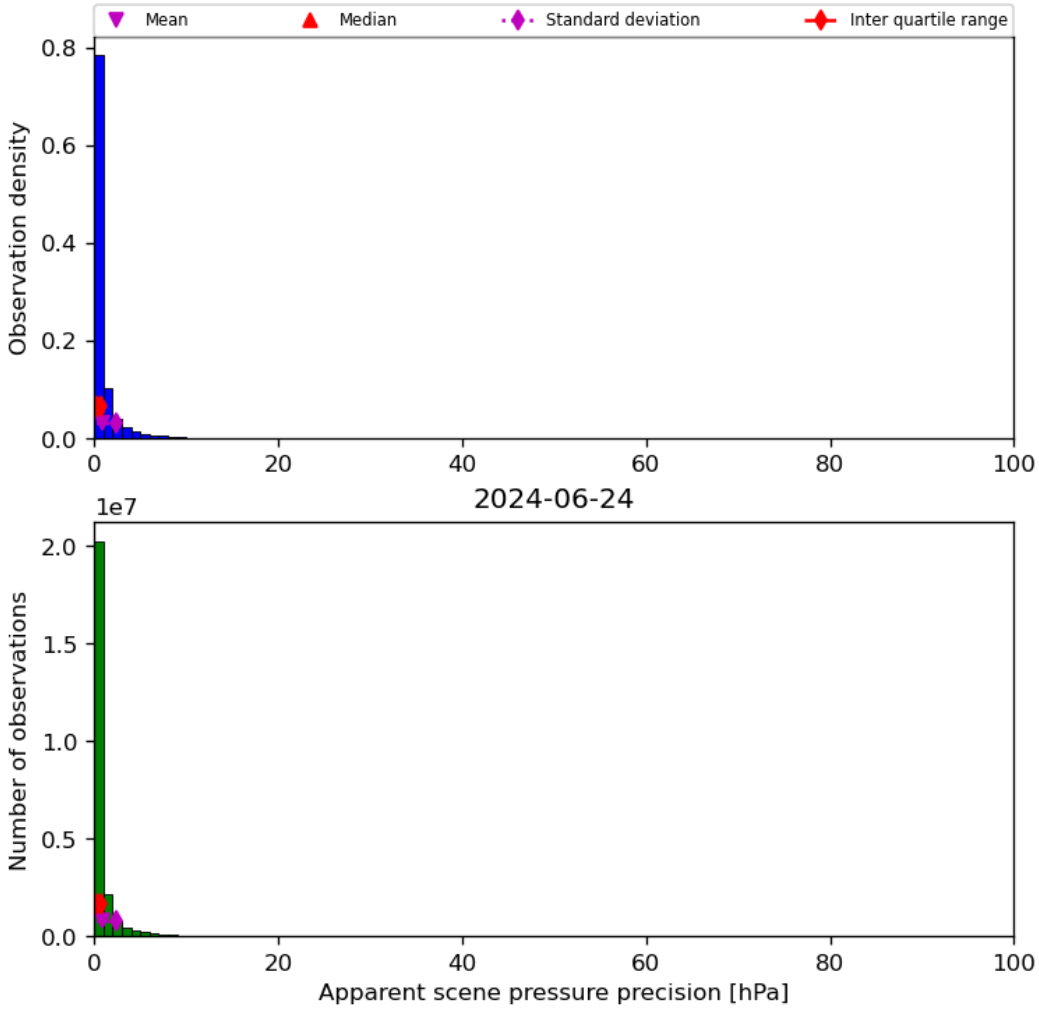


Figure 37: Histogram of “Apparent scene pressure precision” for 2024-06-24 to 2024-06-25

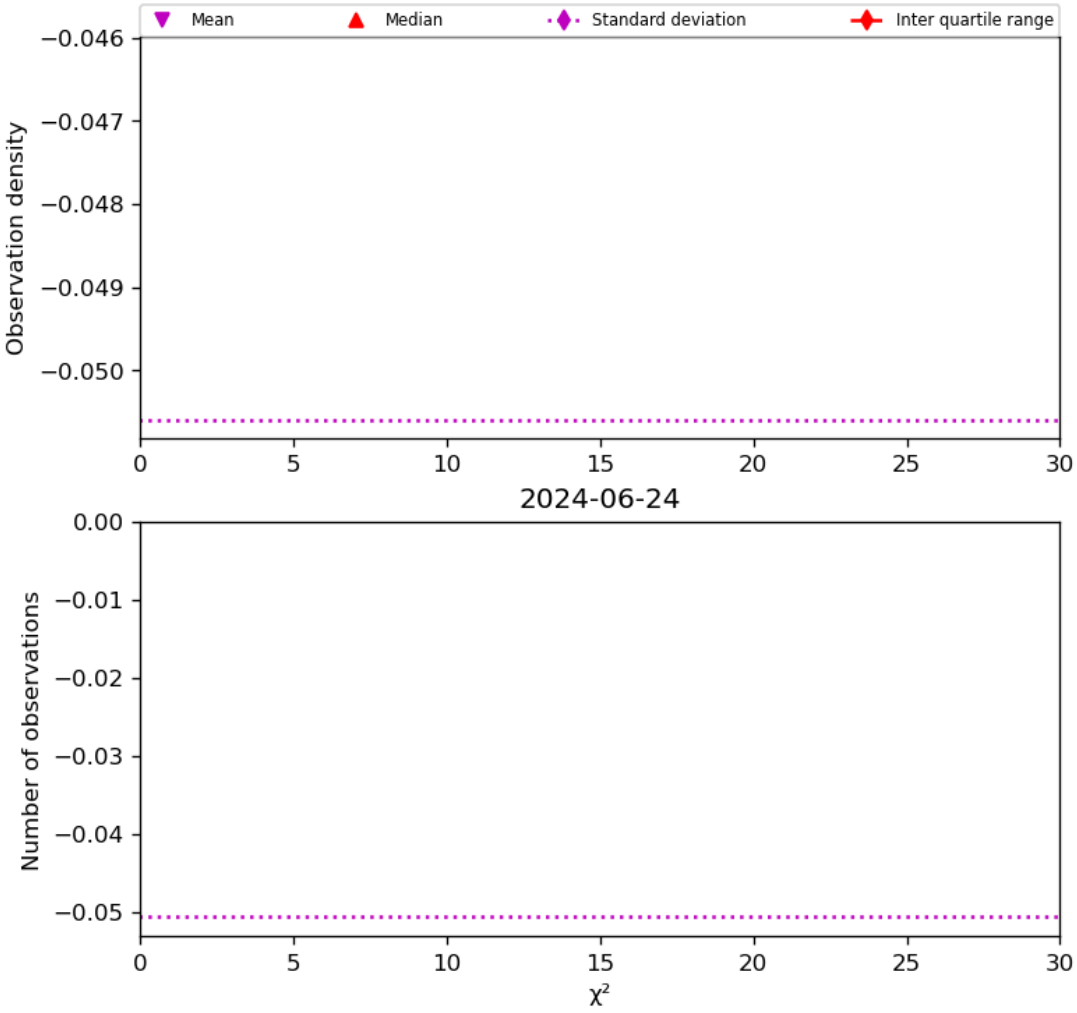


Figure 38: Histogram of "χ^2" for 2024-06-24 to 2024-06-25

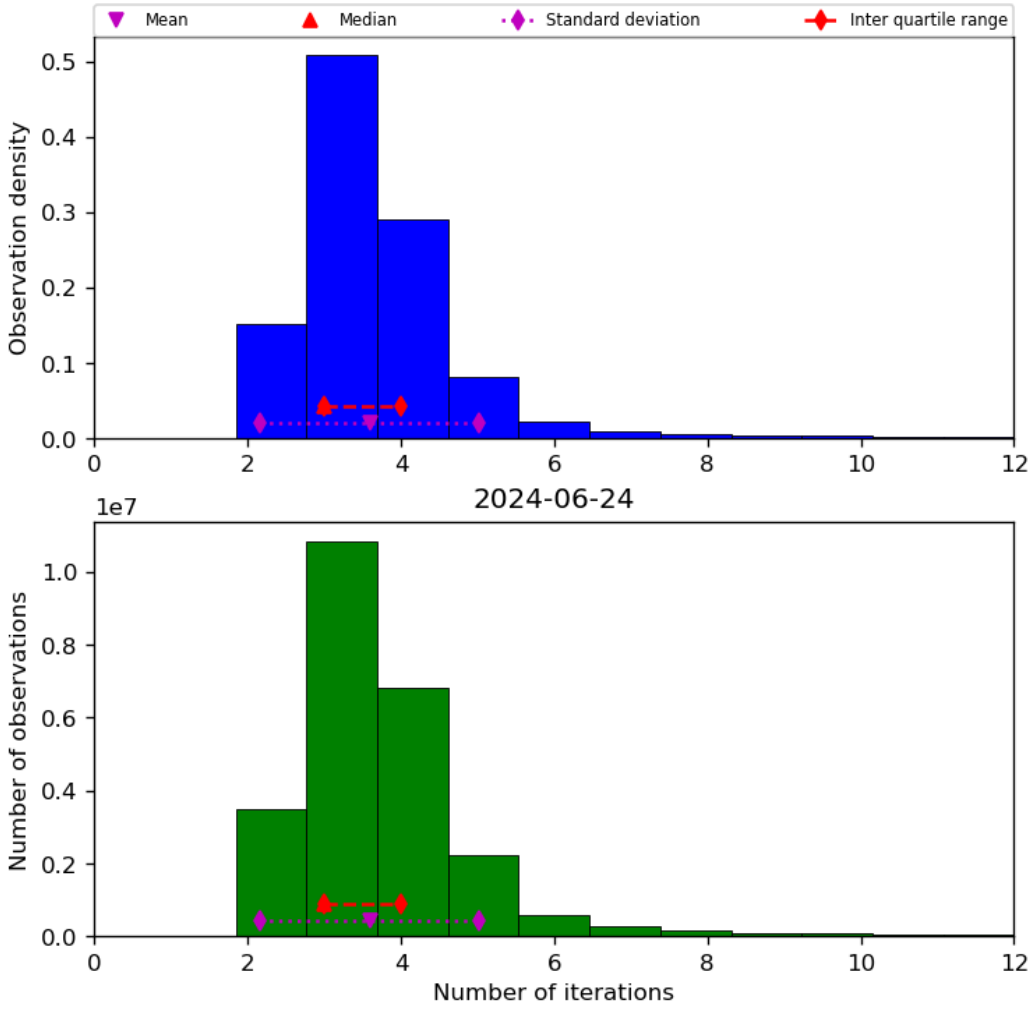


Figure 39: Histogram of “Number of iterations” for 2024-06-24 to 2024-06-25

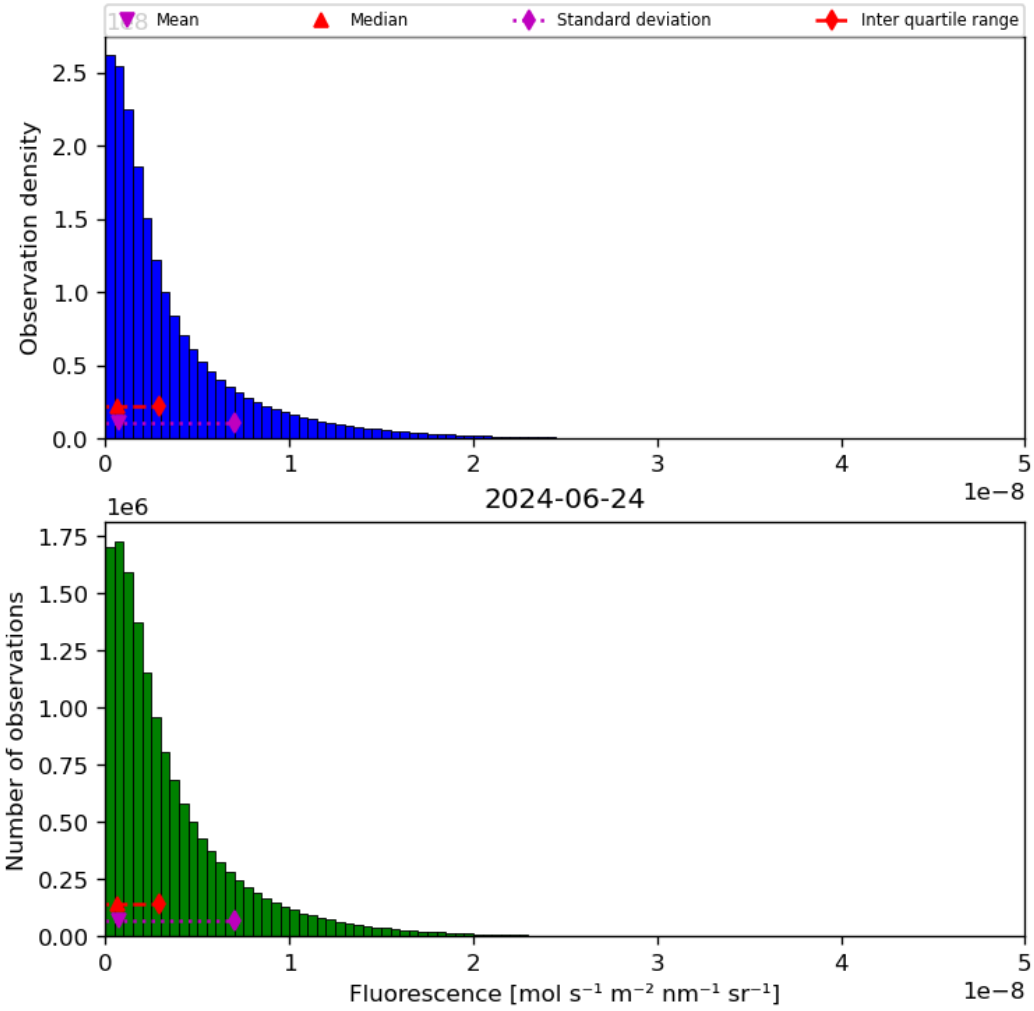


Figure 40: Histogram of “Fluorescence” for 2024-06-24 to 2024-06-25

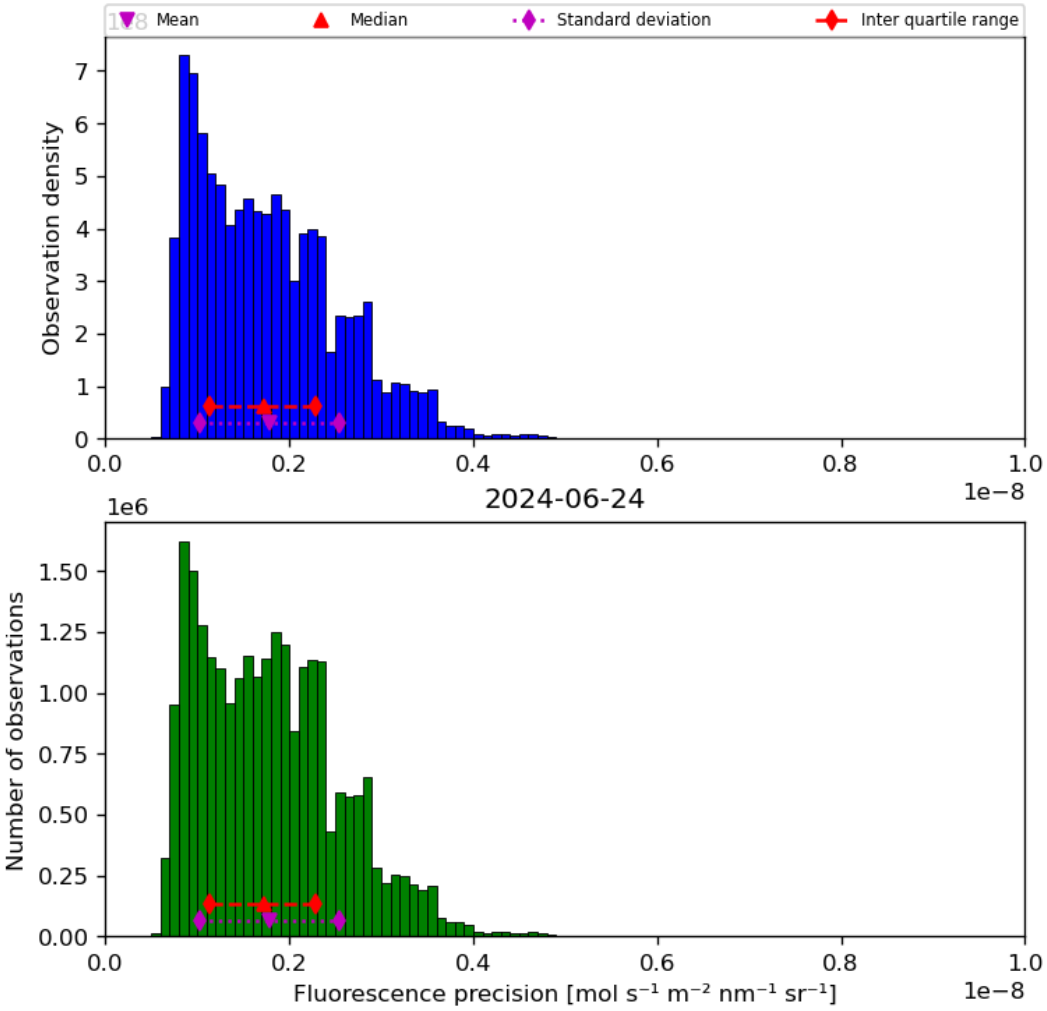


Figure 41: Histogram of “Fluorescence precision” for 2024-06-24 to 2024-06-25

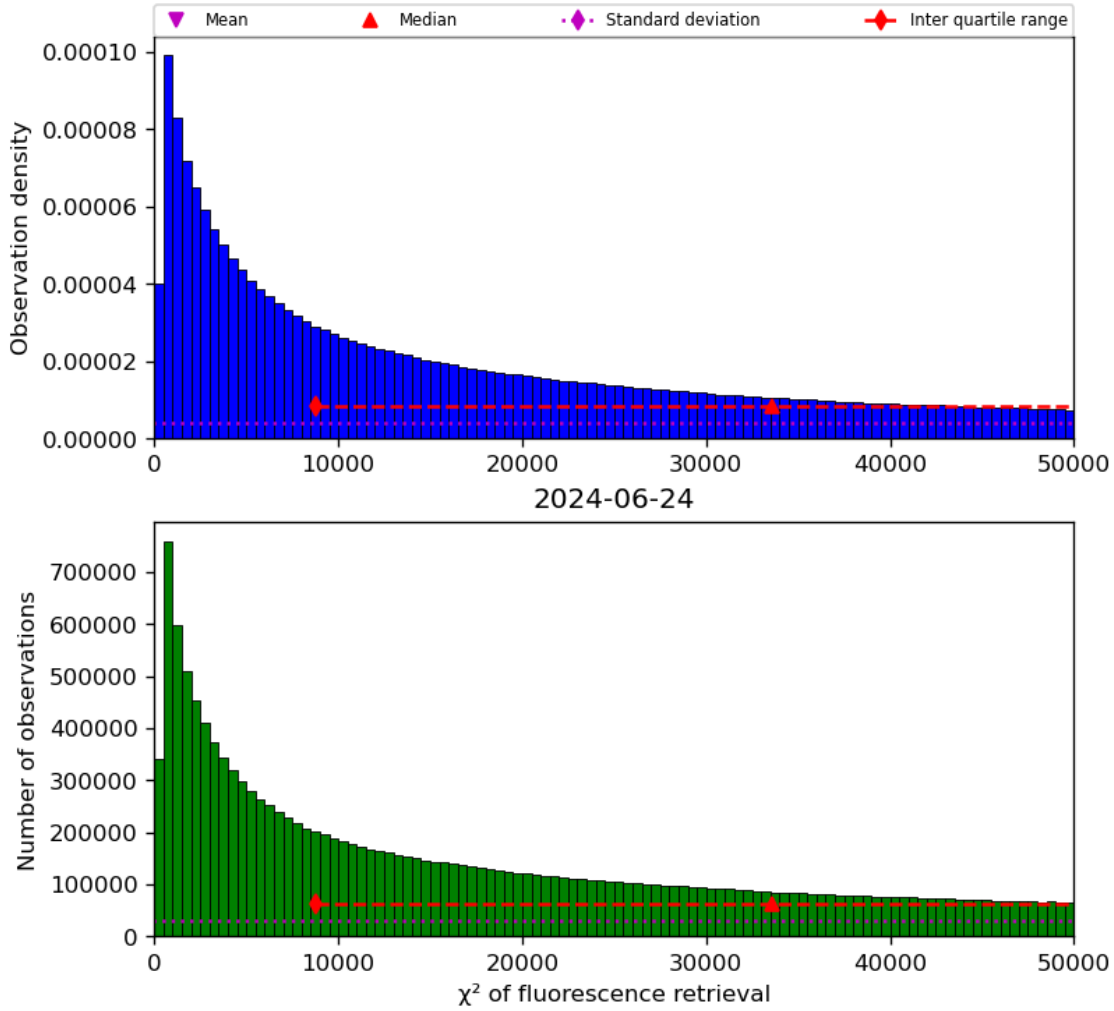


Figure 42: Histogram of "χ^2 of fluorescence retrieval" for 2024-06-24 to 2024-06-25

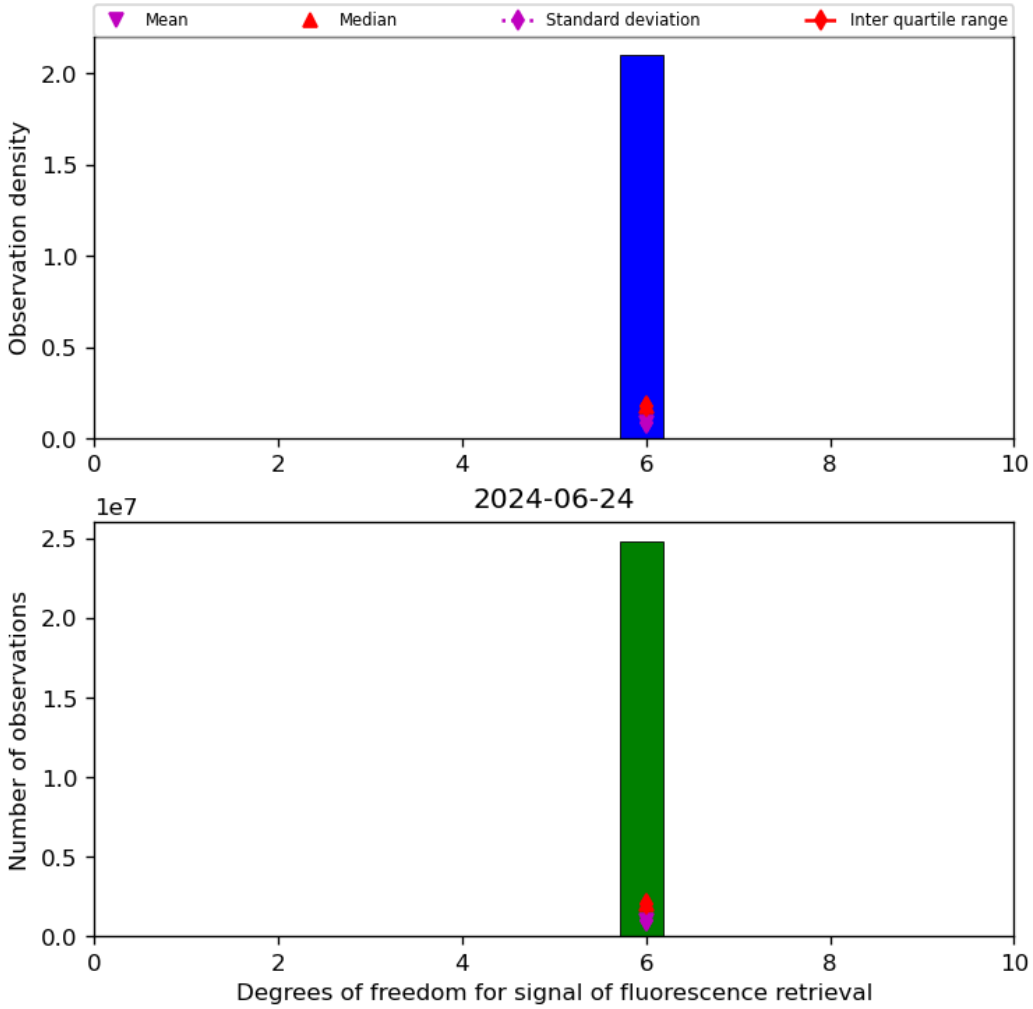


Figure 43: Histogram of “Degrees of freedom for signal of fluorescence retrieval” for 2024-06-24 to 2024-06-25

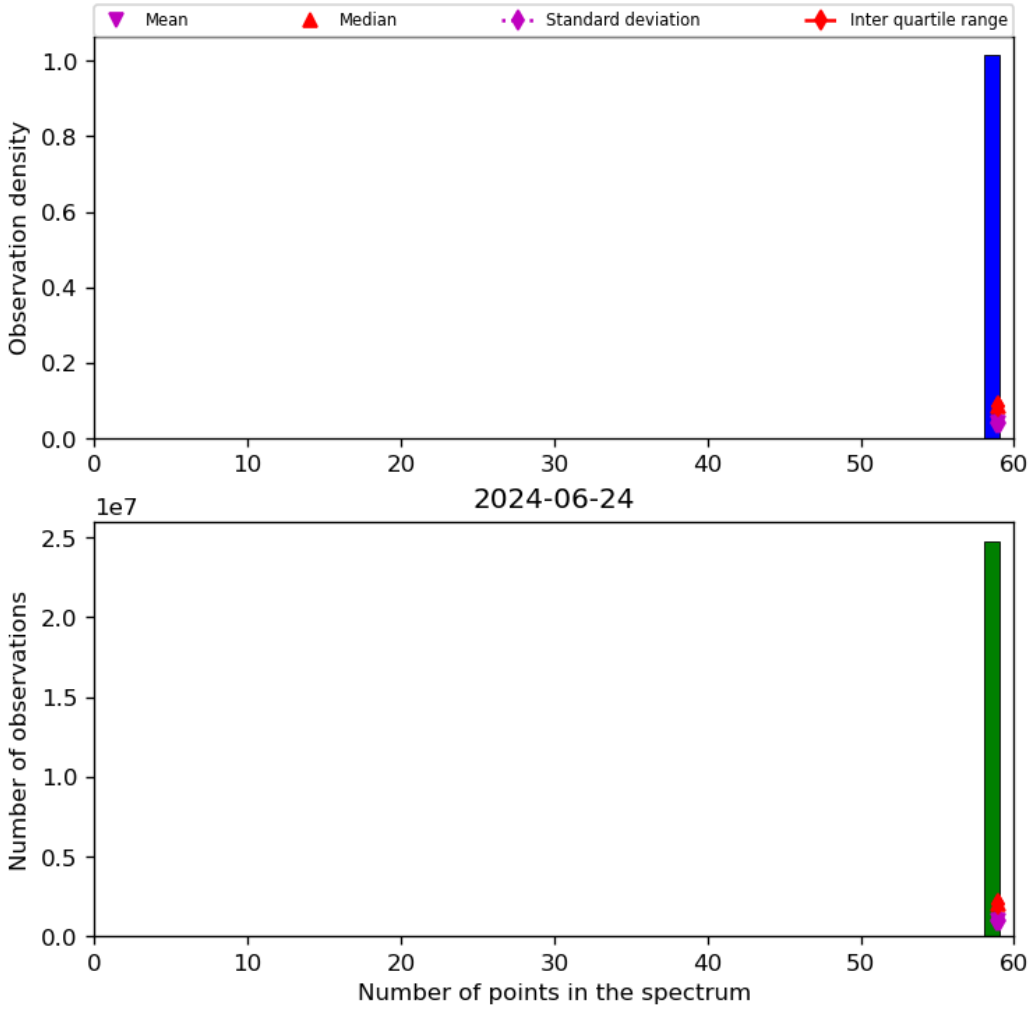


Figure 44: Histogram of “Number of points in the spectrum” for 2024-06-24 to 2024-06-25

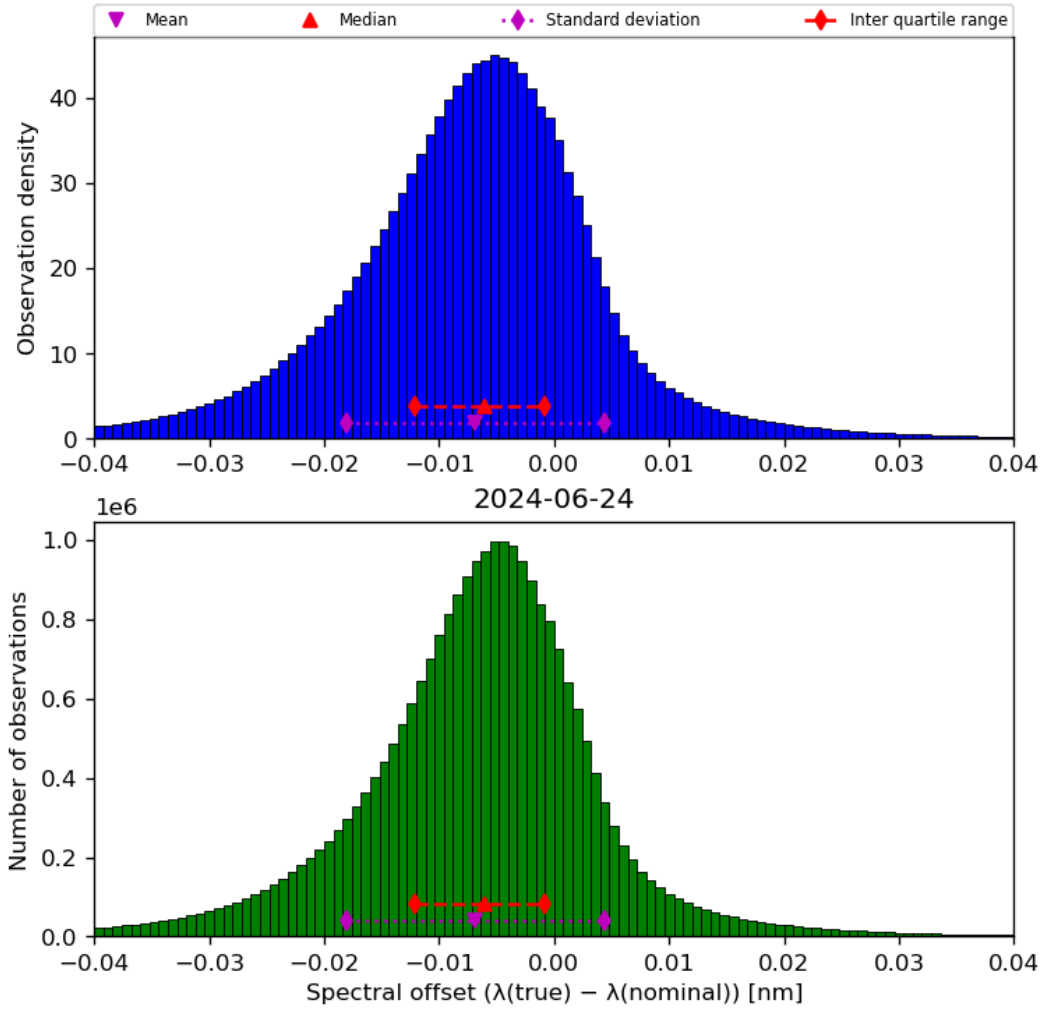


Figure 45: Histogram of "Spectral offset (λ(true) − λ(nominal))" for 2024-06-24 to 2024-06-25

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.

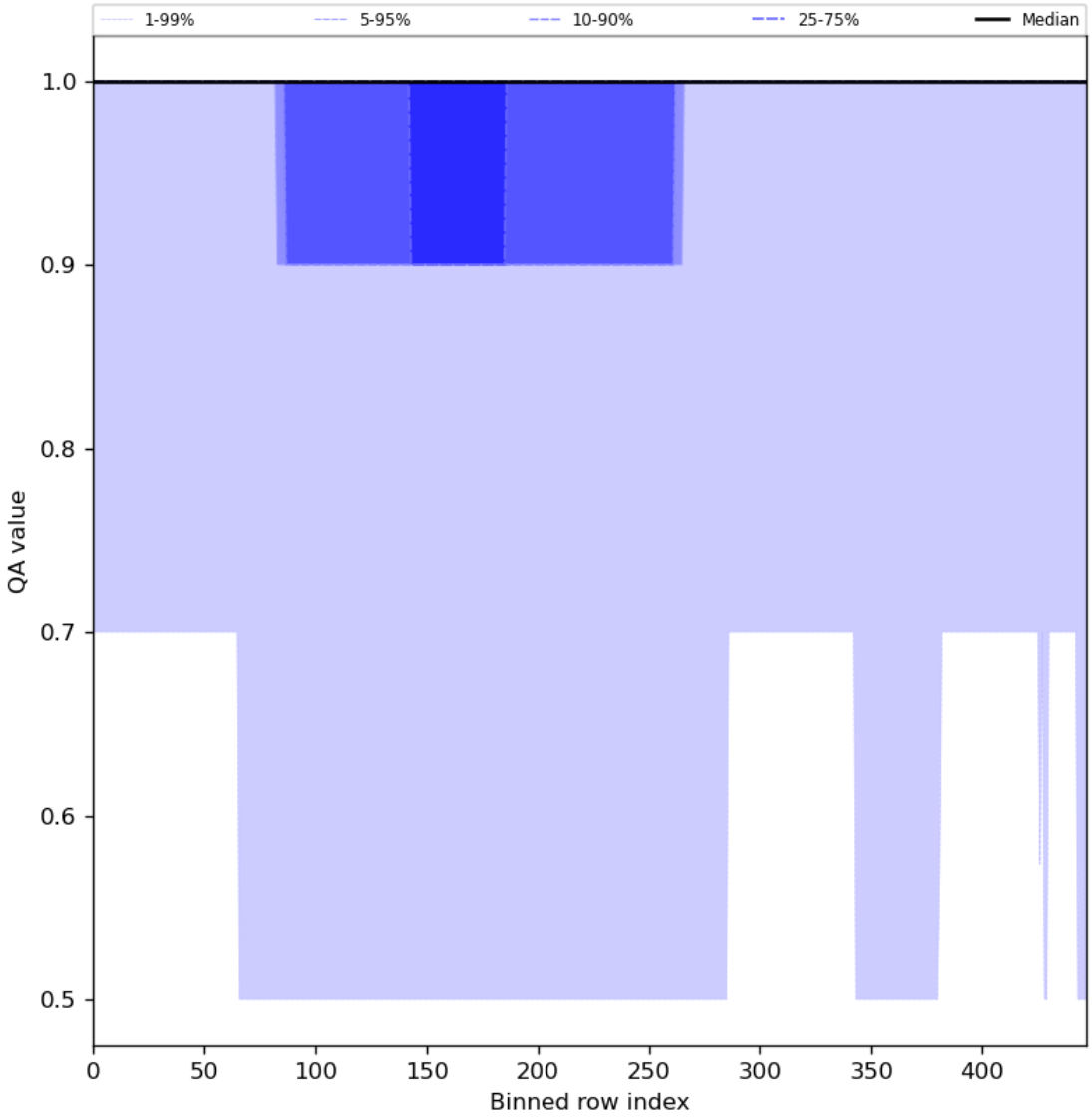


Figure 46: Along track statistics of “QA value” for 2024-06-24 to 2024-06-25

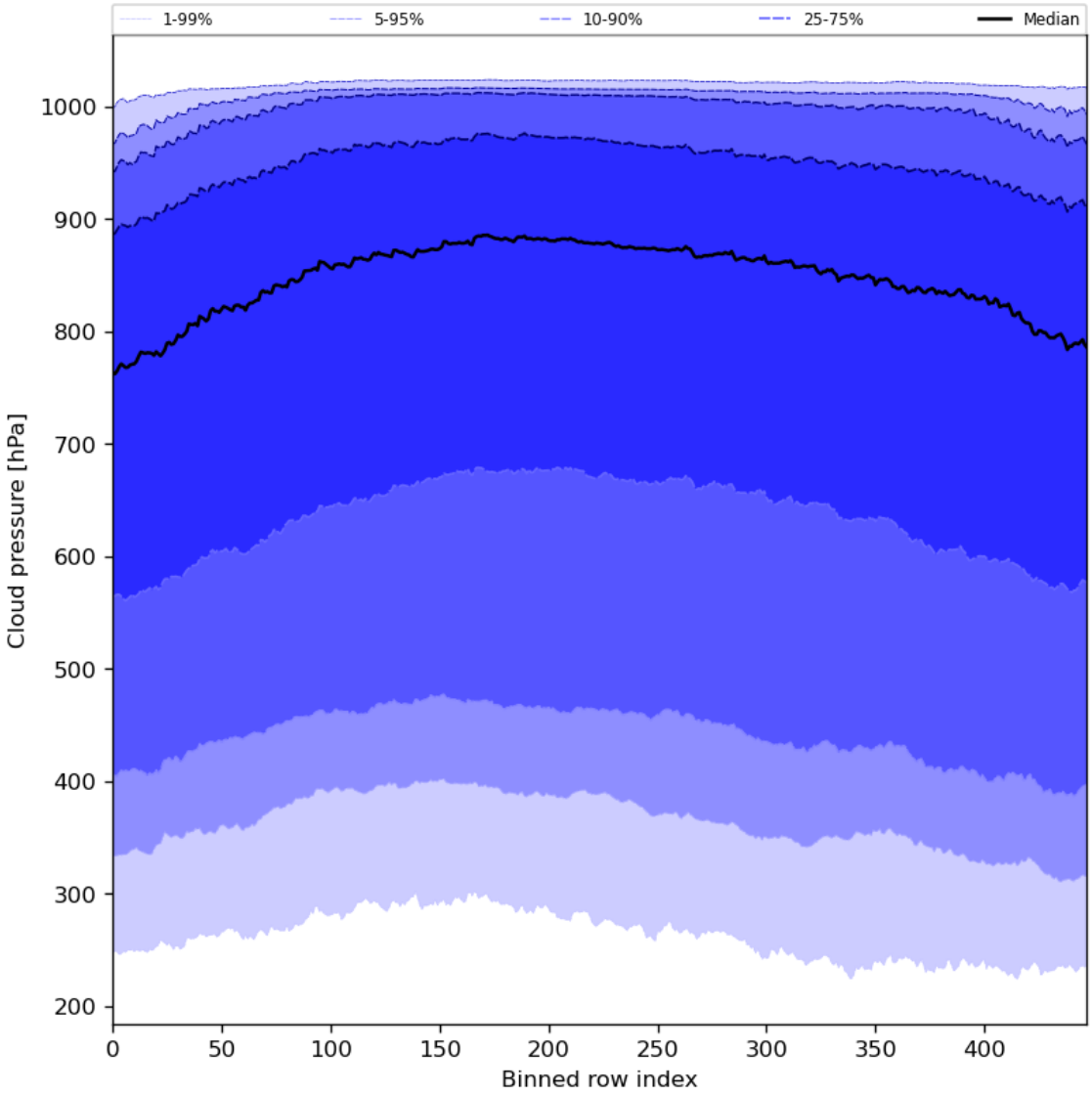


Figure 47: Along track statistics of “Cloud pressure” for 2024-06-24 to 2024-06-25

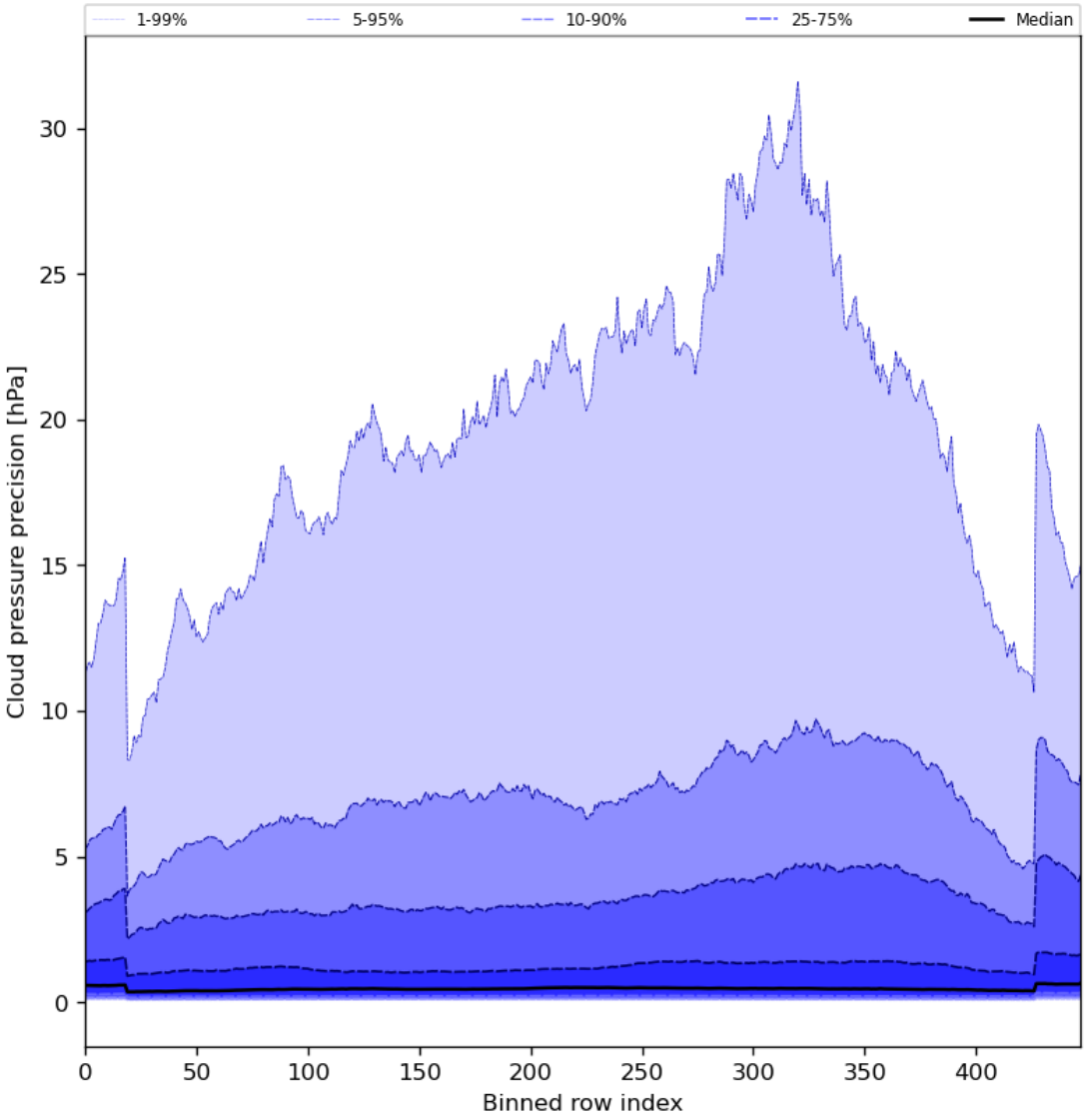


Figure 48: Along track statistics of “Cloud pressure precision” for 2024-06-24 to 2024-06-25

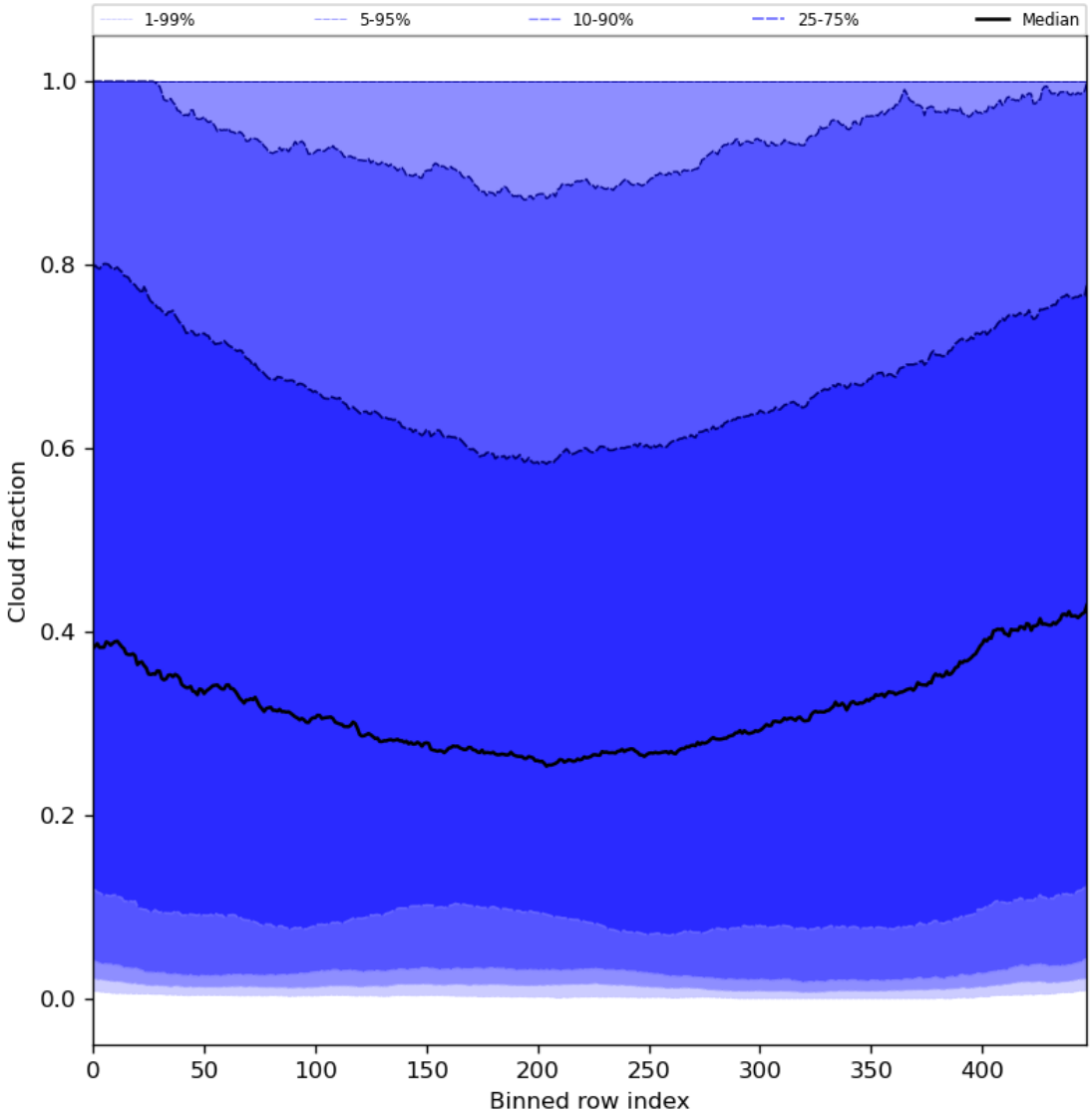


Figure 49: Along track statistics of “Cloud fraction” for 2024-06-24 to 2024-06-25

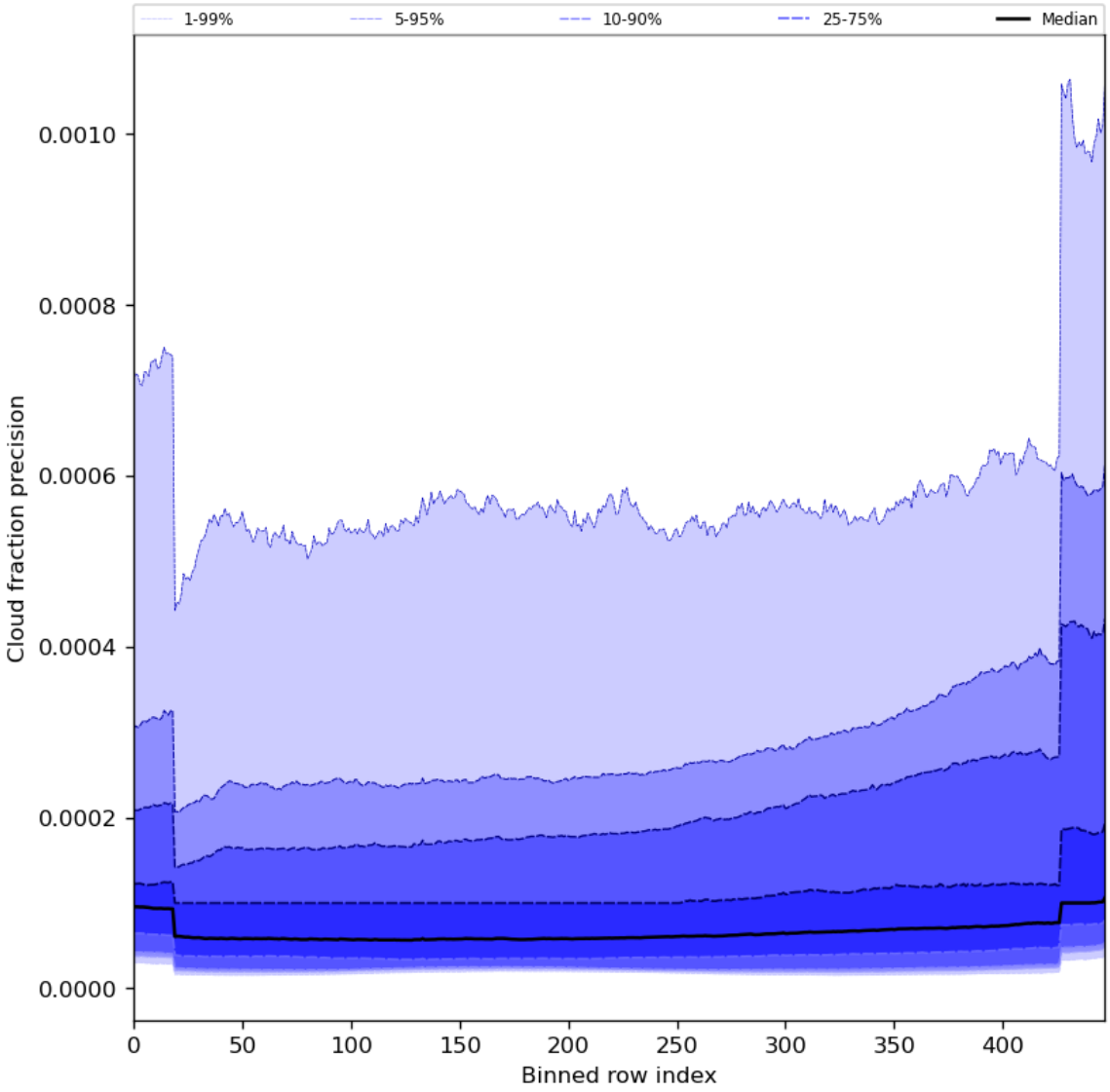


Figure 50: Along track statistics of “Cloud fraction precision” for 2024-06-24 to 2024-06-25

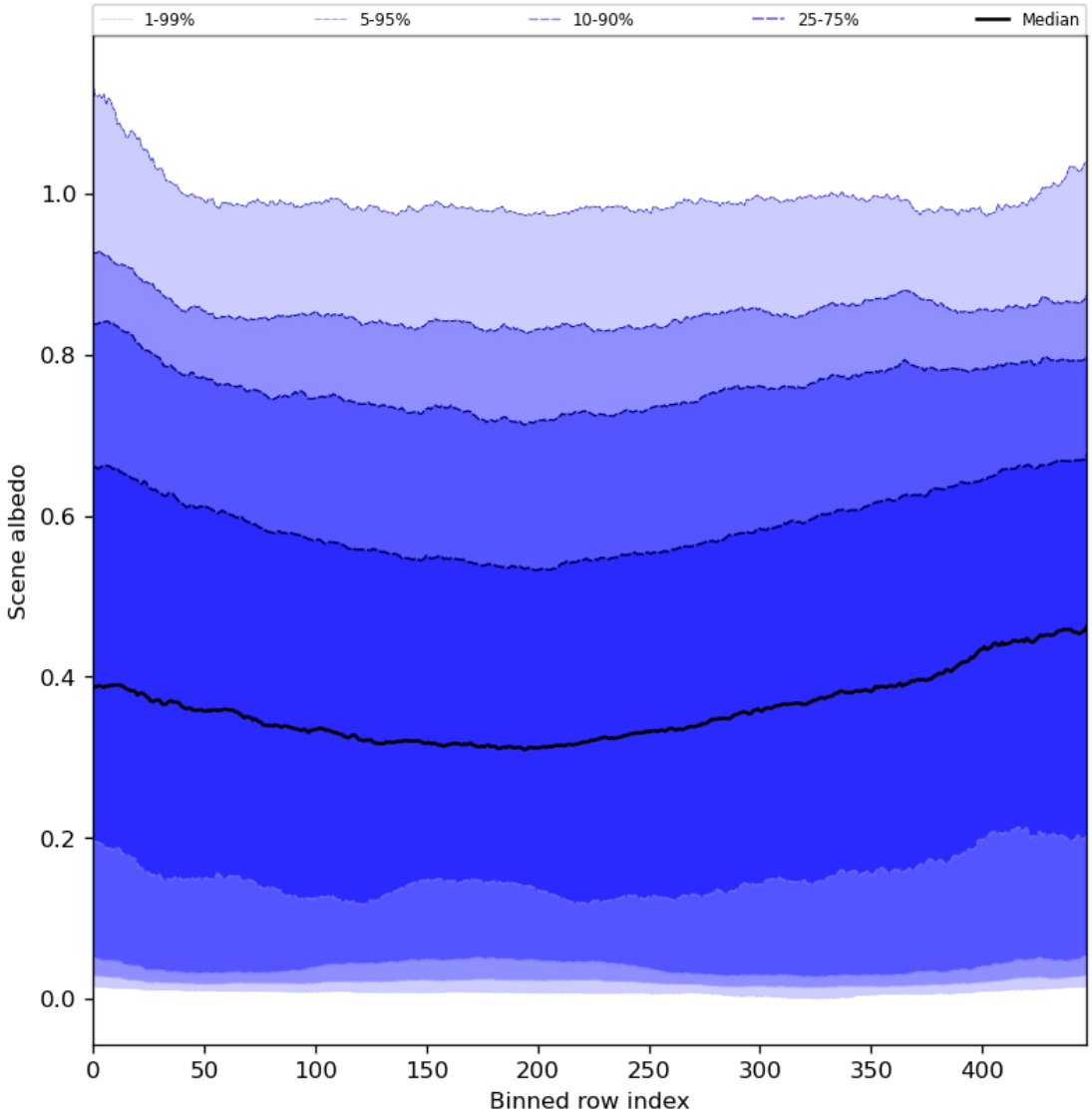


Figure 51: Along track statistics of “Scene albedo” for 2024-06-24 to 2024-06-25

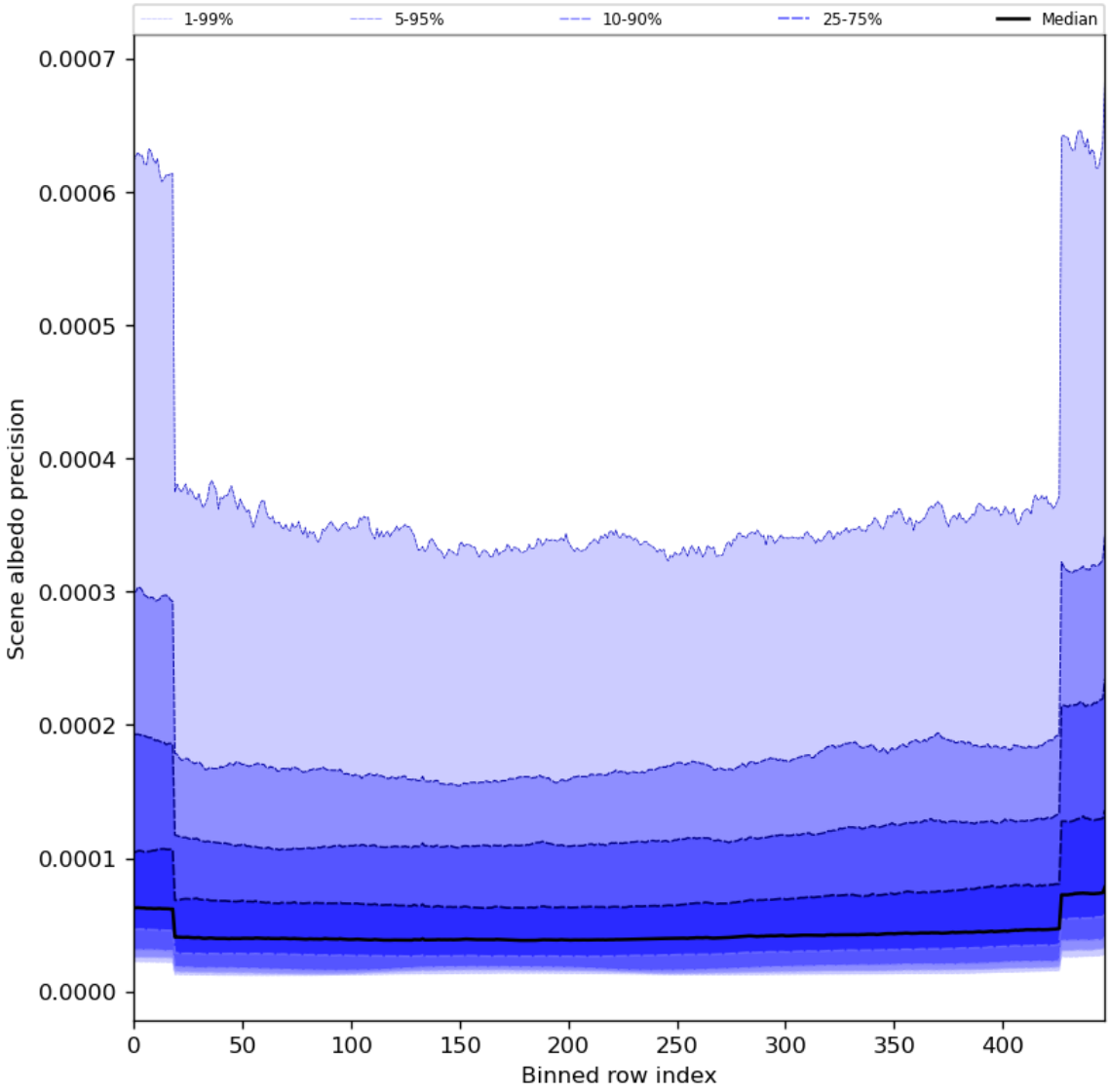


Figure 52: Along track statistics of “Scene albedo precision” for 2024-06-24 to 2024-06-25

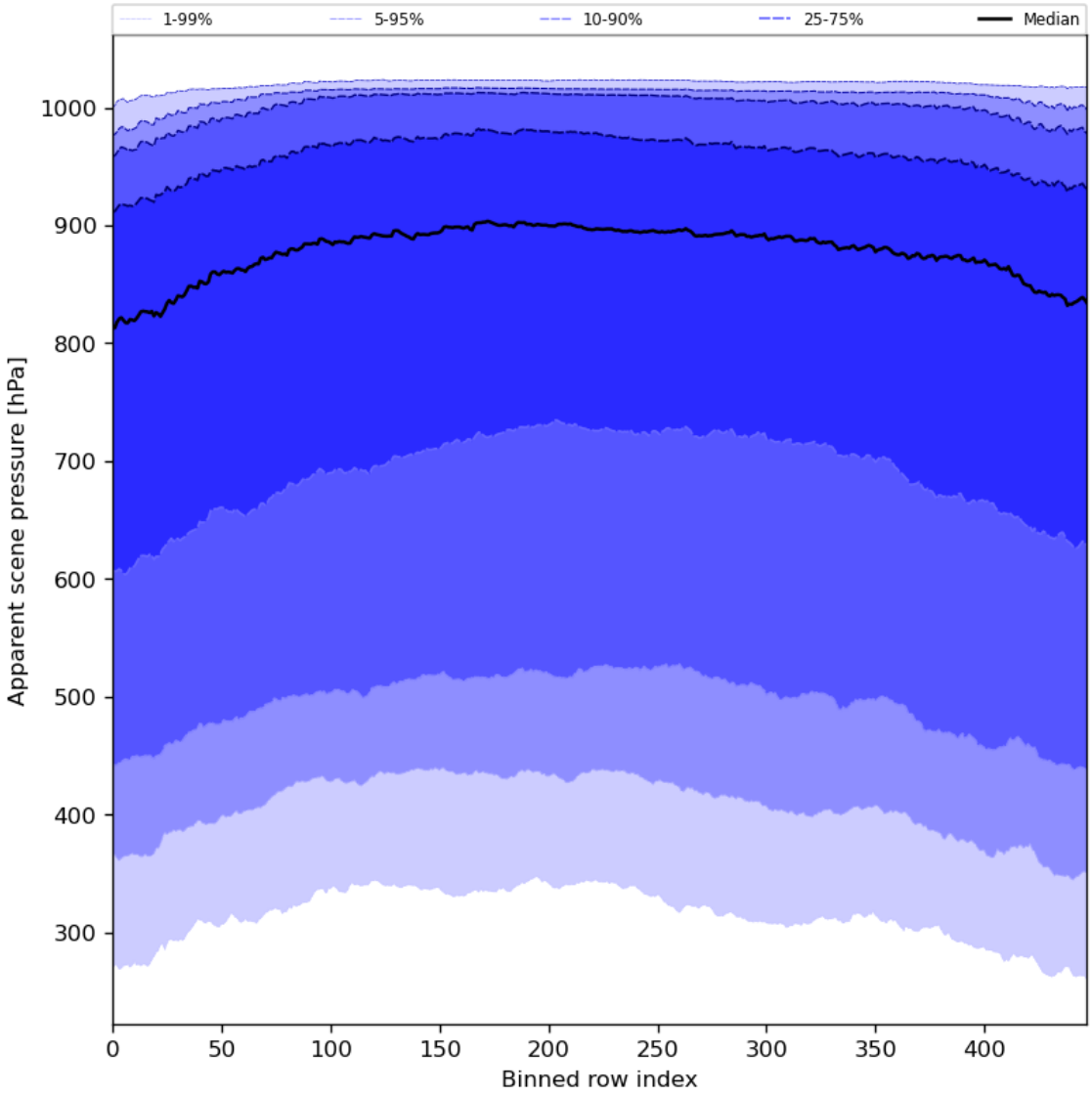


Figure 53: Along track statistics of “Apparent scene pressure” for 2024-06-24 to 2024-06-25

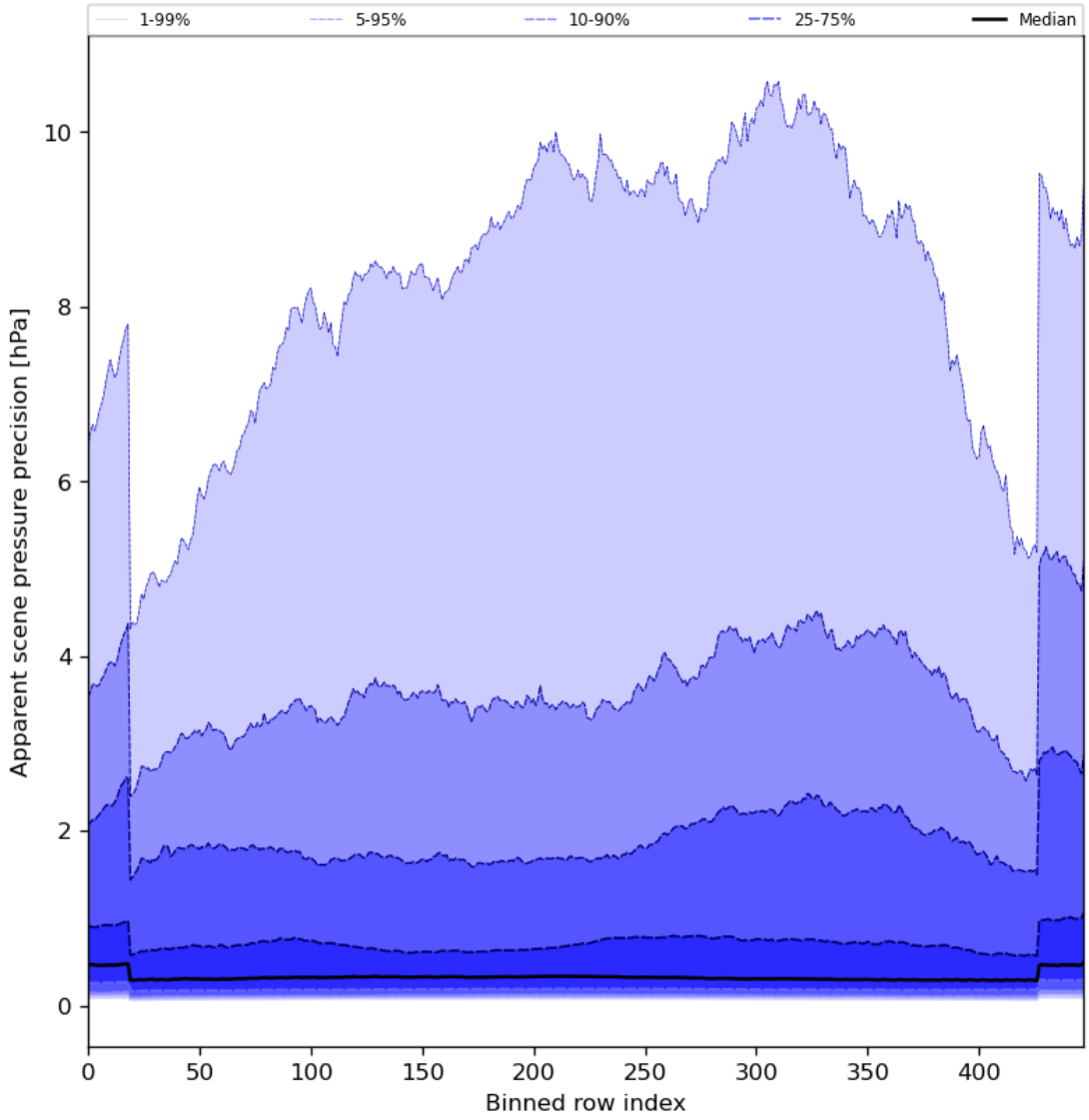


Figure 54: Along track statistics of “Apparent scene pressure precision” for 2024-06-24 to 2024-06-25

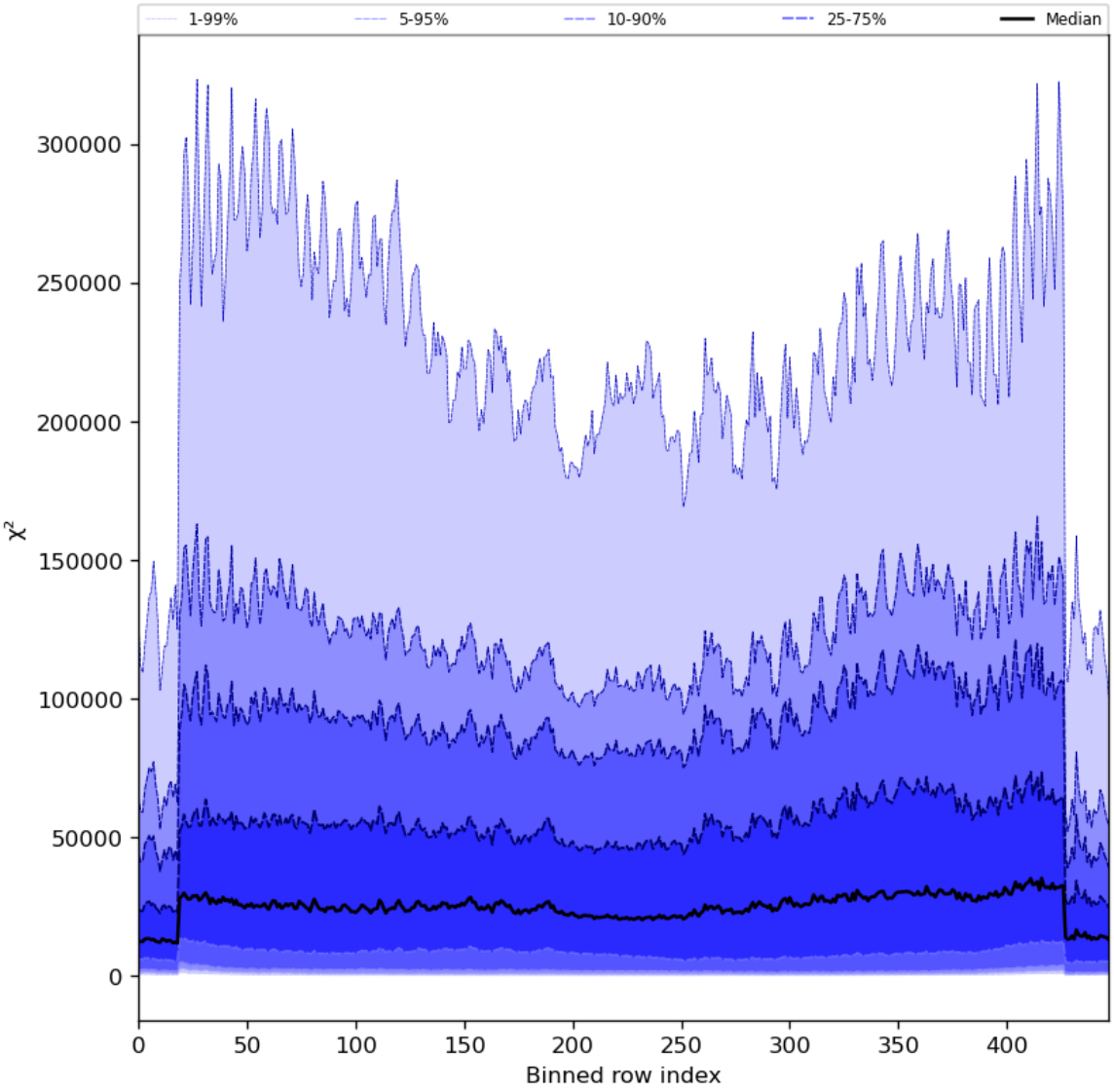


Figure 55: Along track statistics of "χ^2" for 2024-06-24 to 2024-06-25

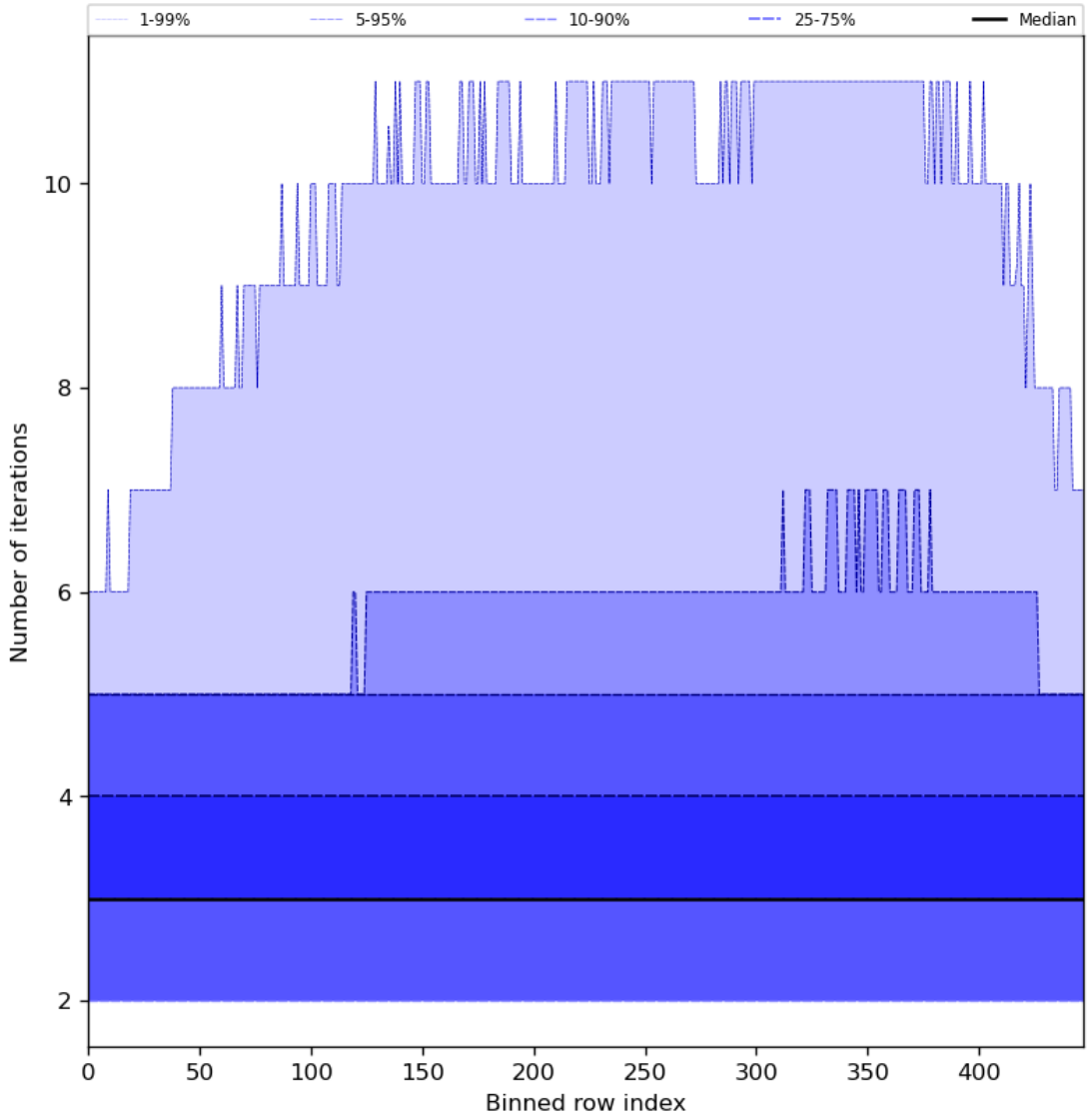


Figure 56: Along track statistics of “Number of iterations” for 2024-06-24 to 2024-06-25

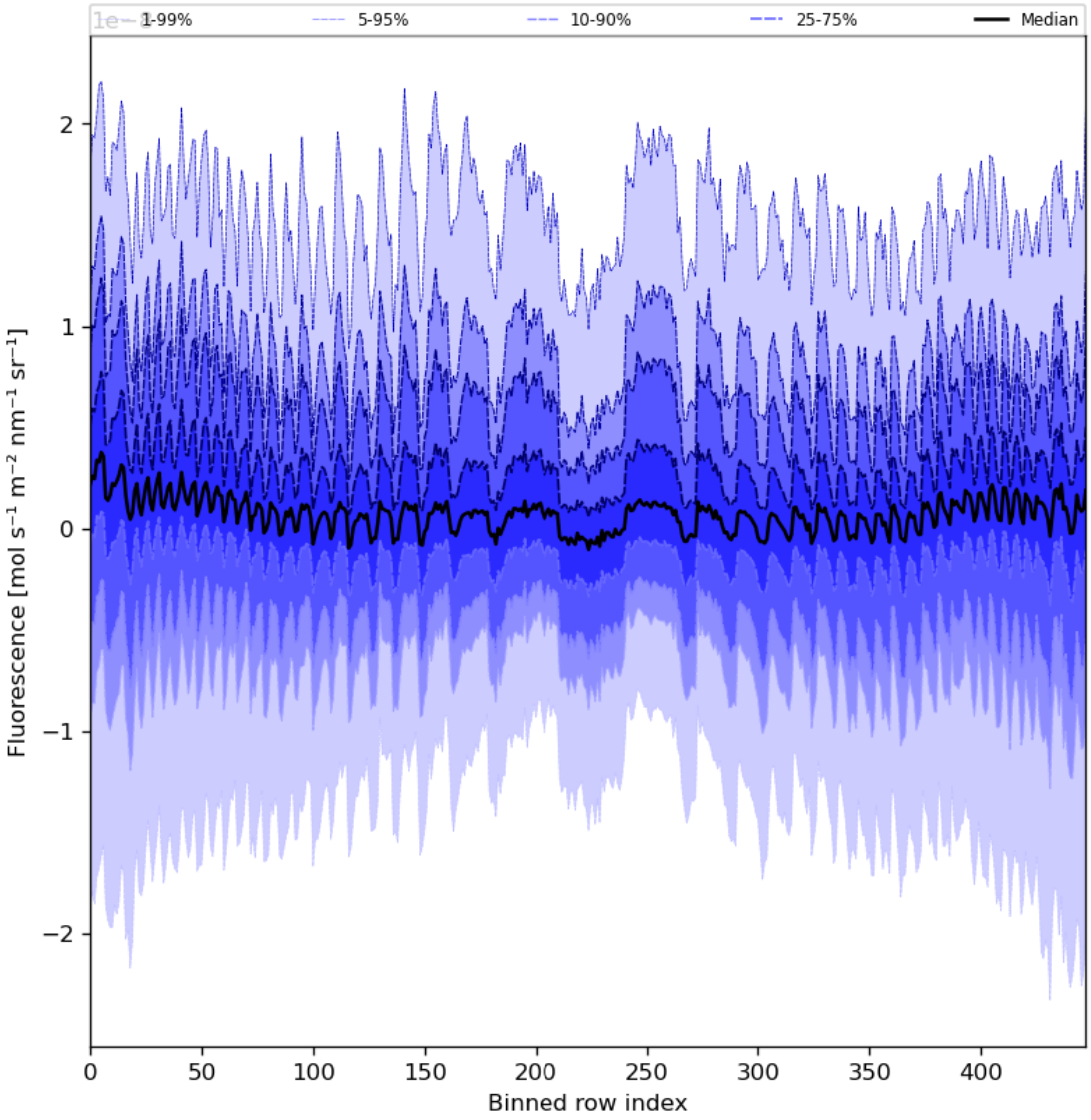


Figure 57: Along track statistics of “Fluorescence” for 2024-06-24 to 2024-06-25

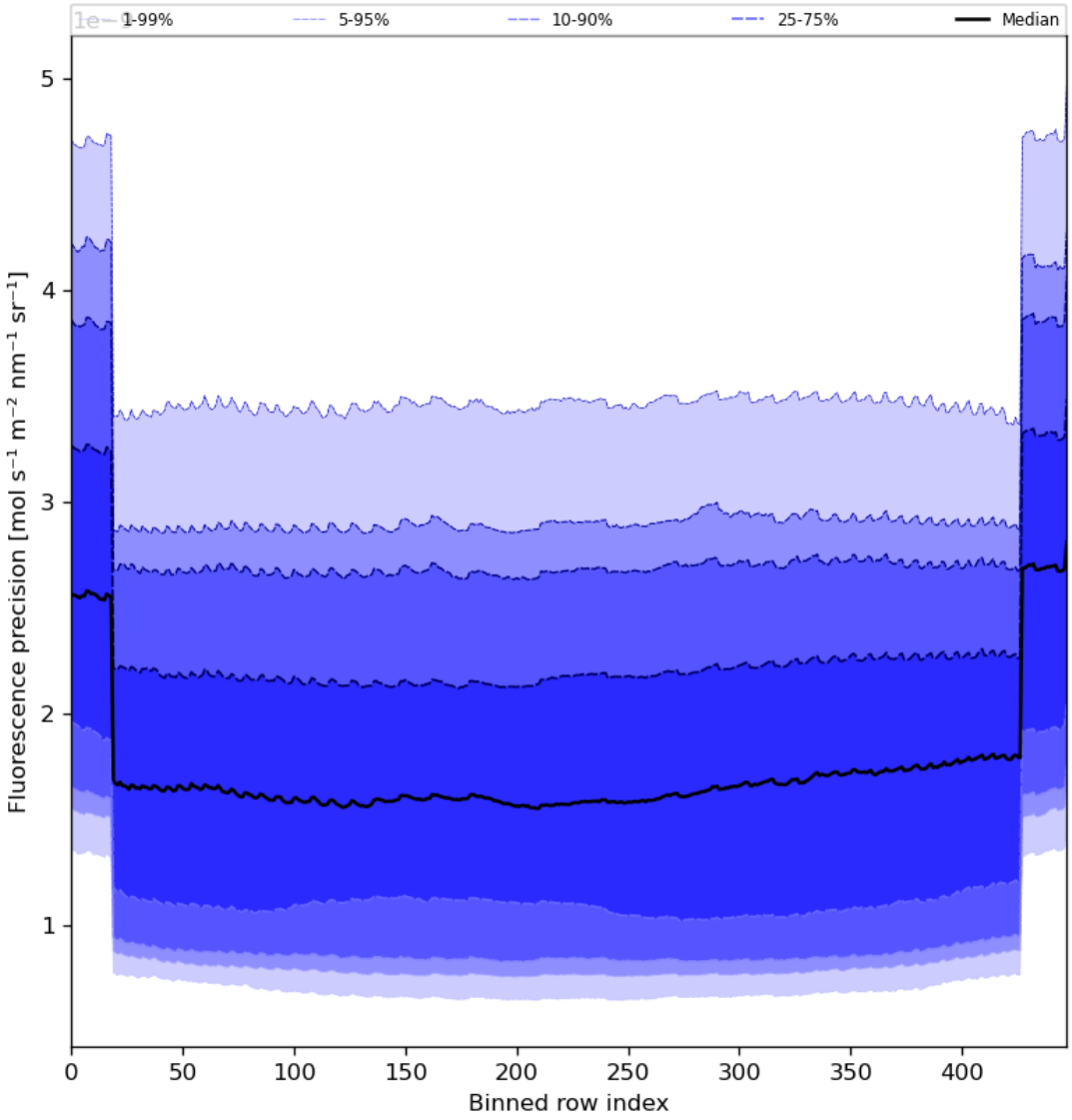


Figure 58: Along track statistics of “Fluorescence precision” for 2024-06-24 to 2024-06-25

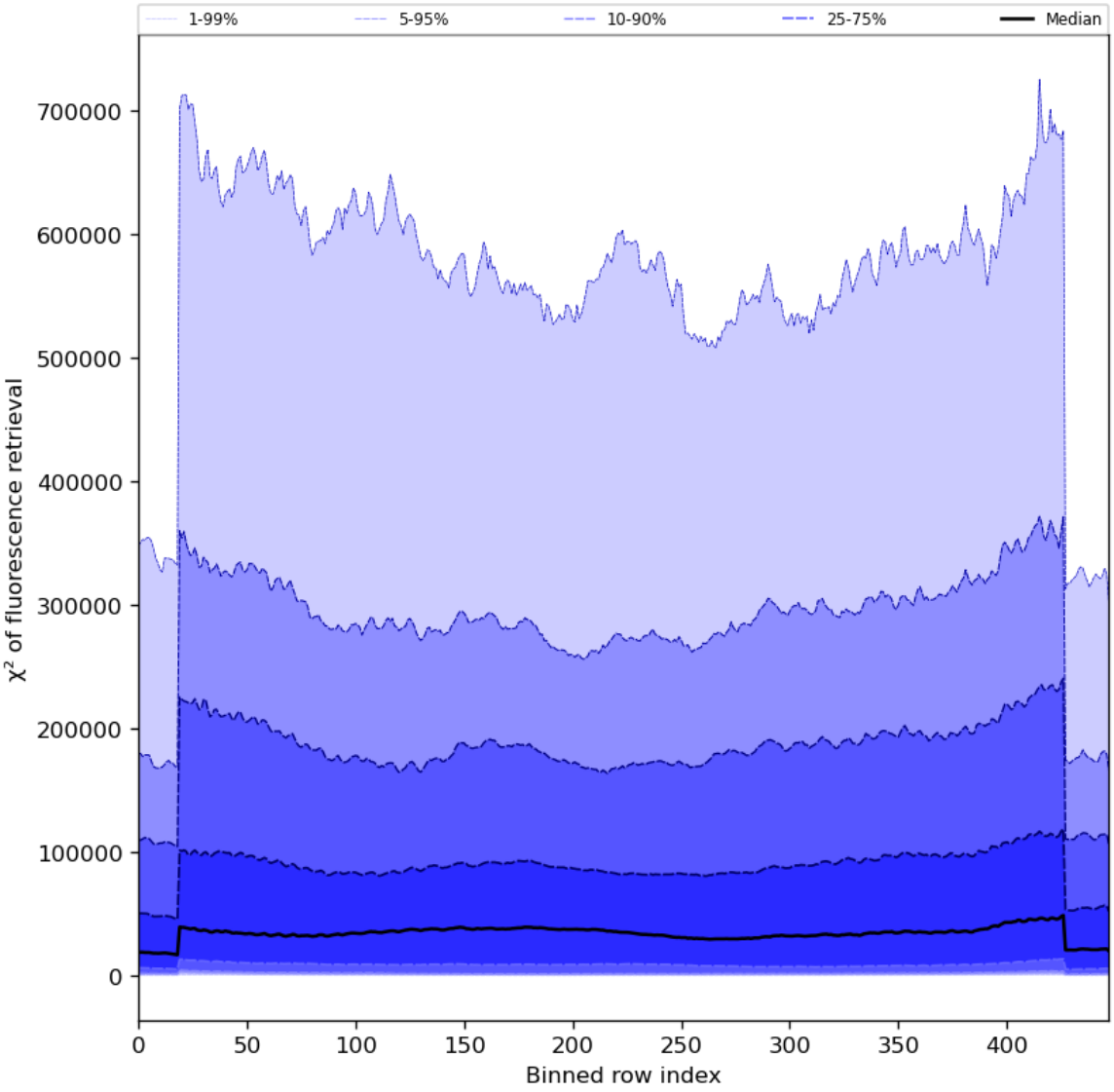


Figure 59: Along track statistics of "χ^2 of fluorescence retrieval" for 2024-06-24 to 2024-06-25

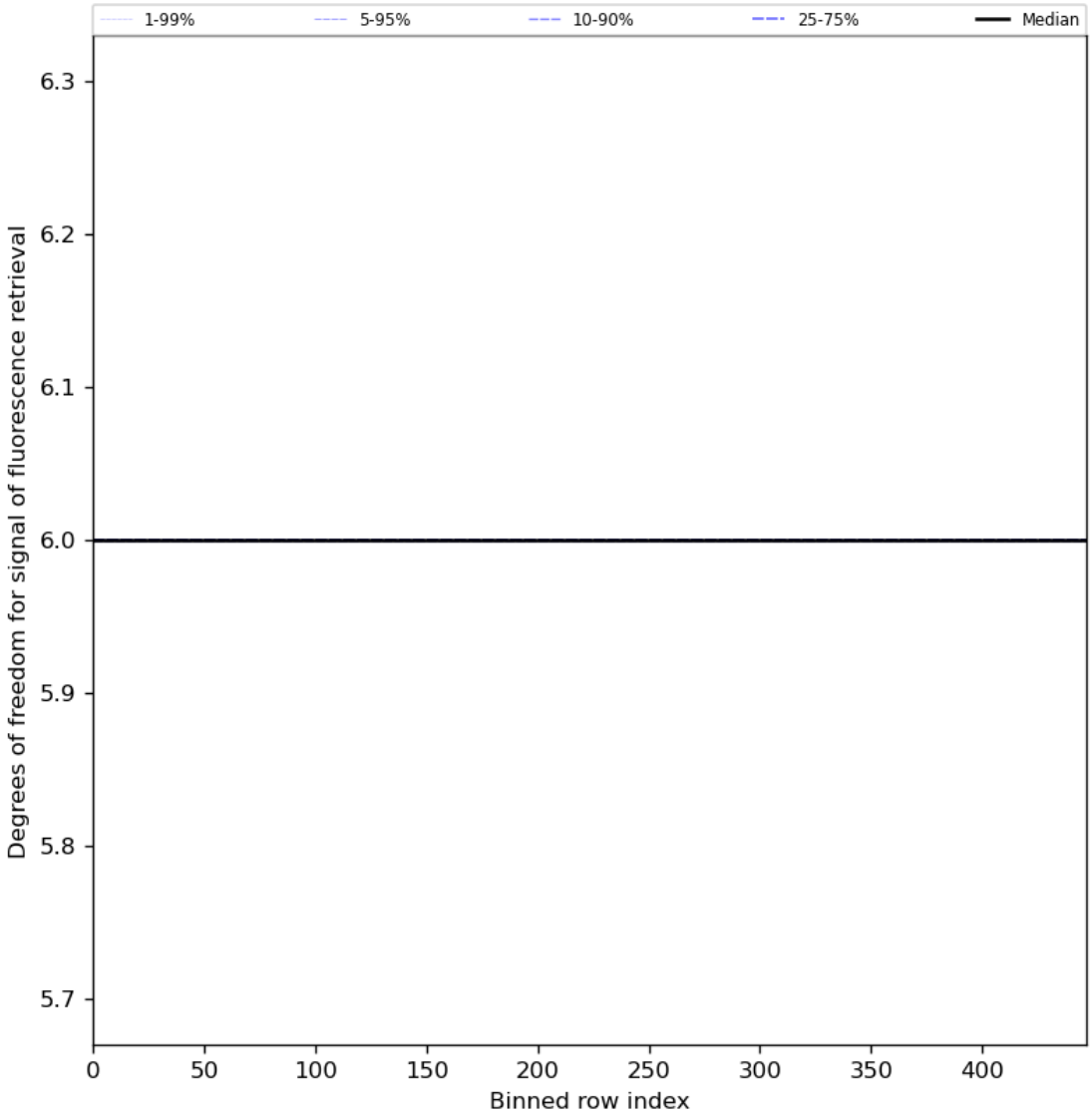


Figure 60: Along track statistics of “Degrees of freedom for signal of fluorescence retrieval” for 2024-06-24 to 2024-06-25

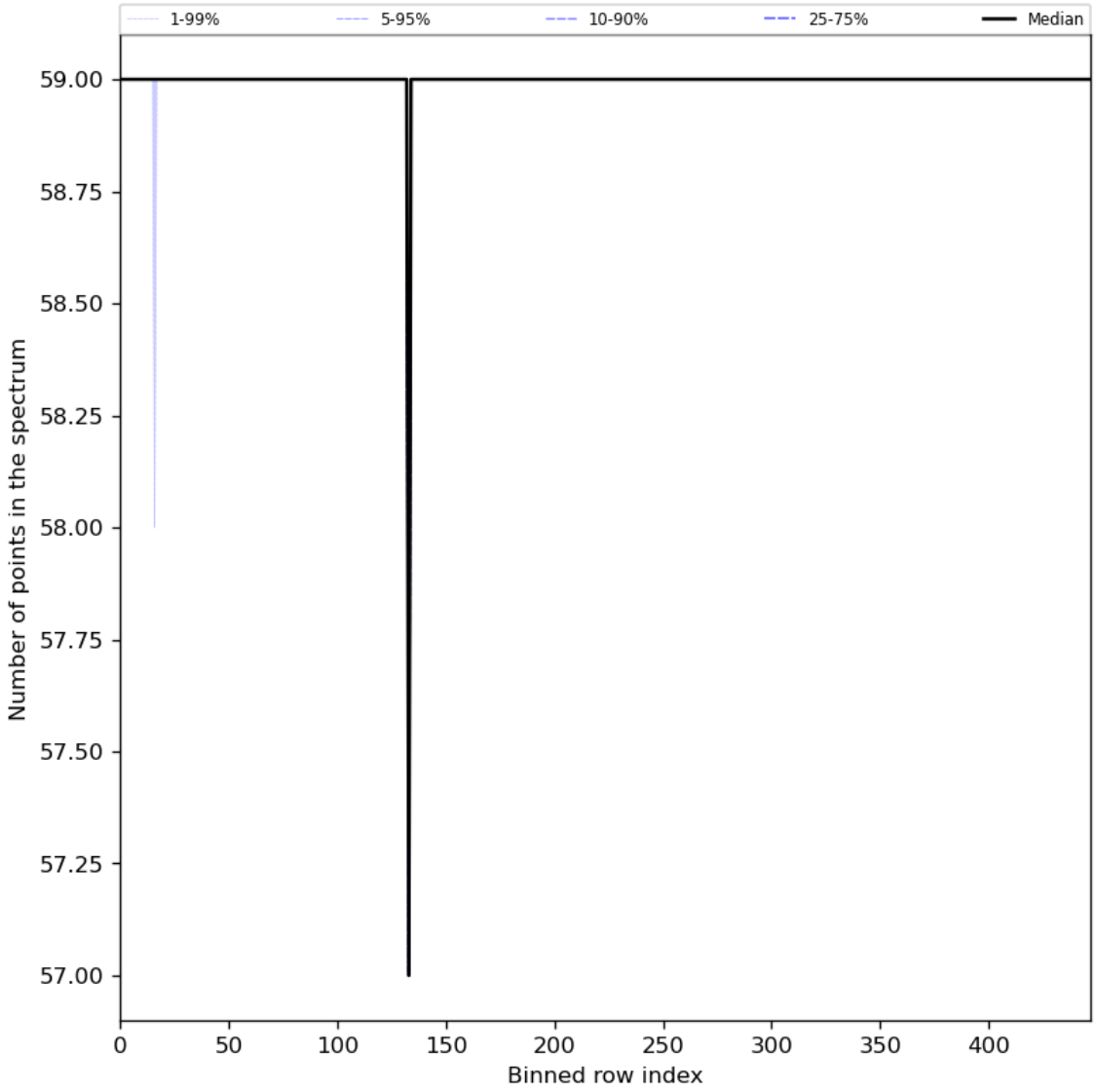


Figure 61: Along track statistics of “Number of points in the spectrum” for 2024-06-24 to 2024-06-25

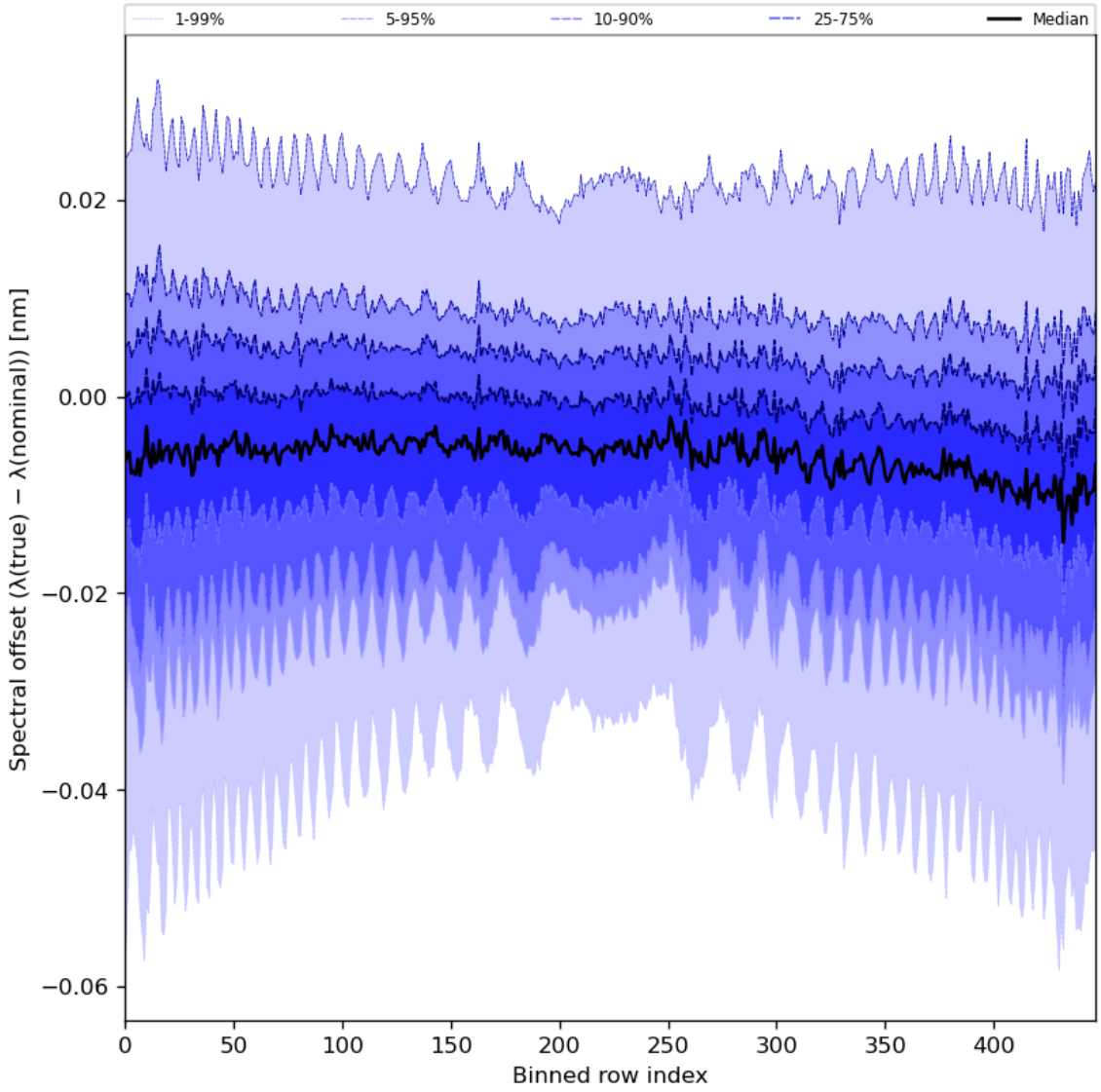


Figure 62: Along track statistics of “Spectral offset (λ(true) − λ(nominal))” for 2024-06-24 to 2024-06-25

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.

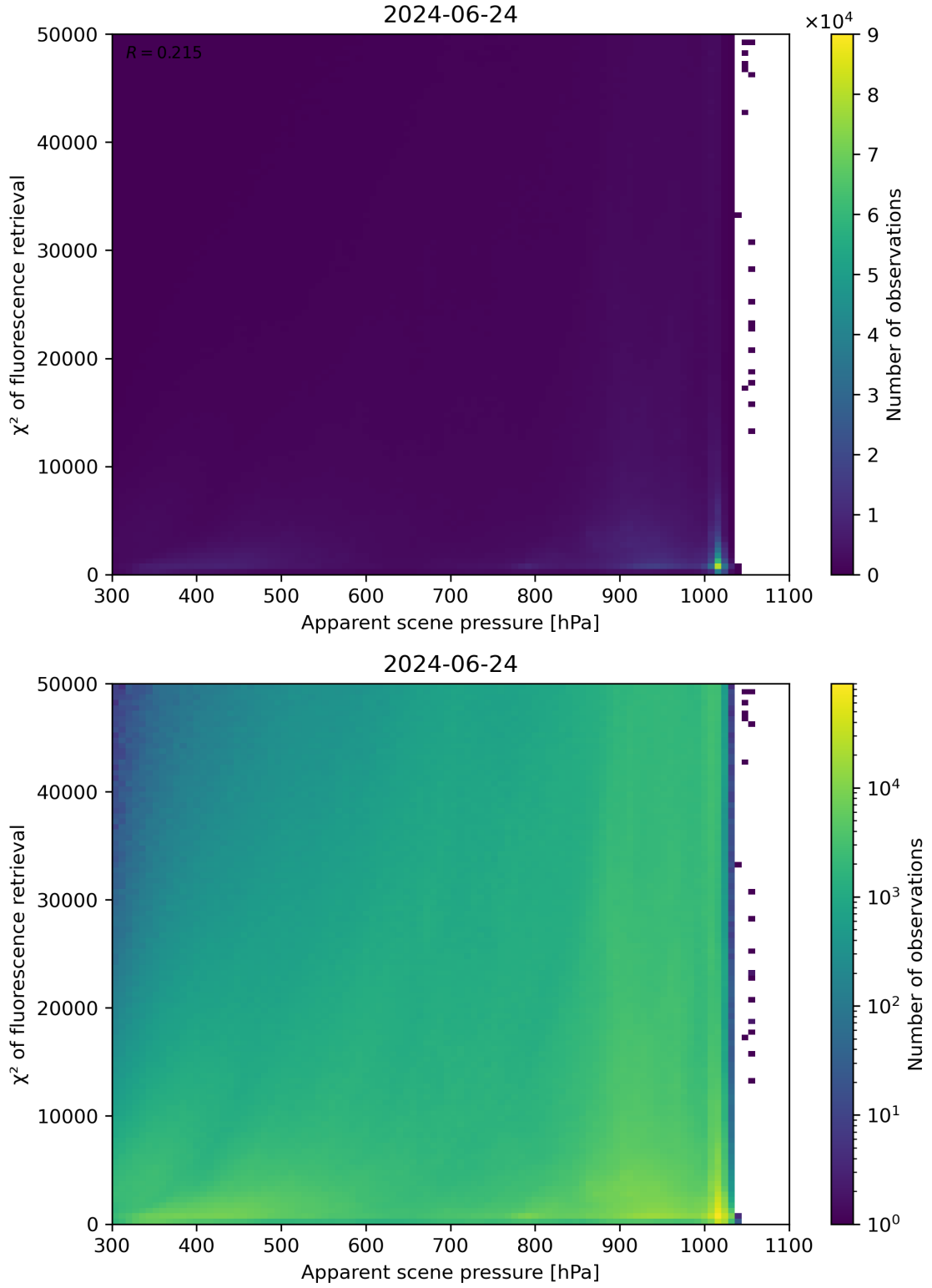


Figure 63: Scatter density plot of “Apparent scene pressure” against “χ^2 of fluorescence retrieval” for 2024-06-24 to 2024-06-25.

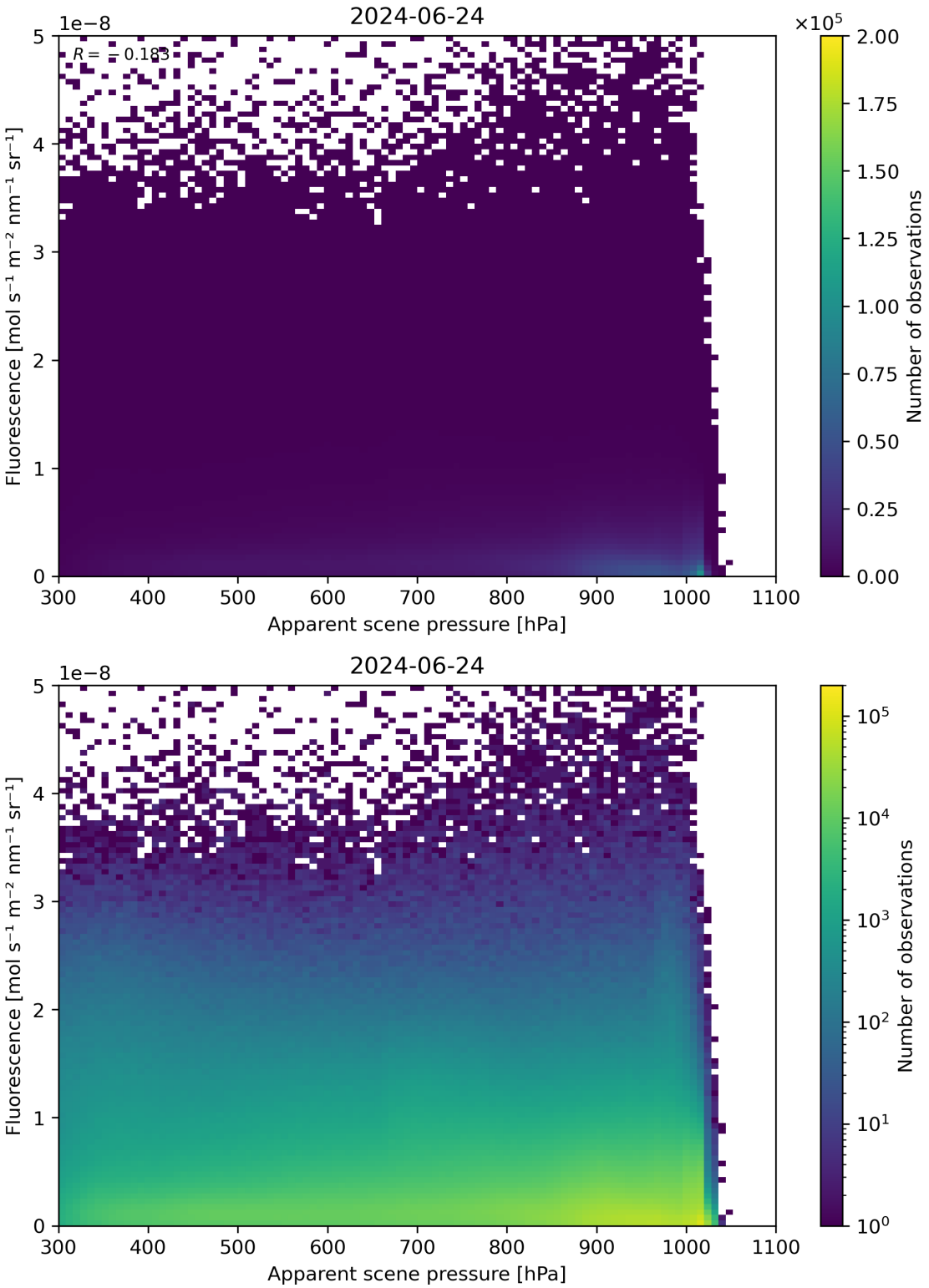


Figure 64: Scatter density plot of “Apparent scene pressure” against “Fluorescence” for 2024-06-24 to 2024-06-25.

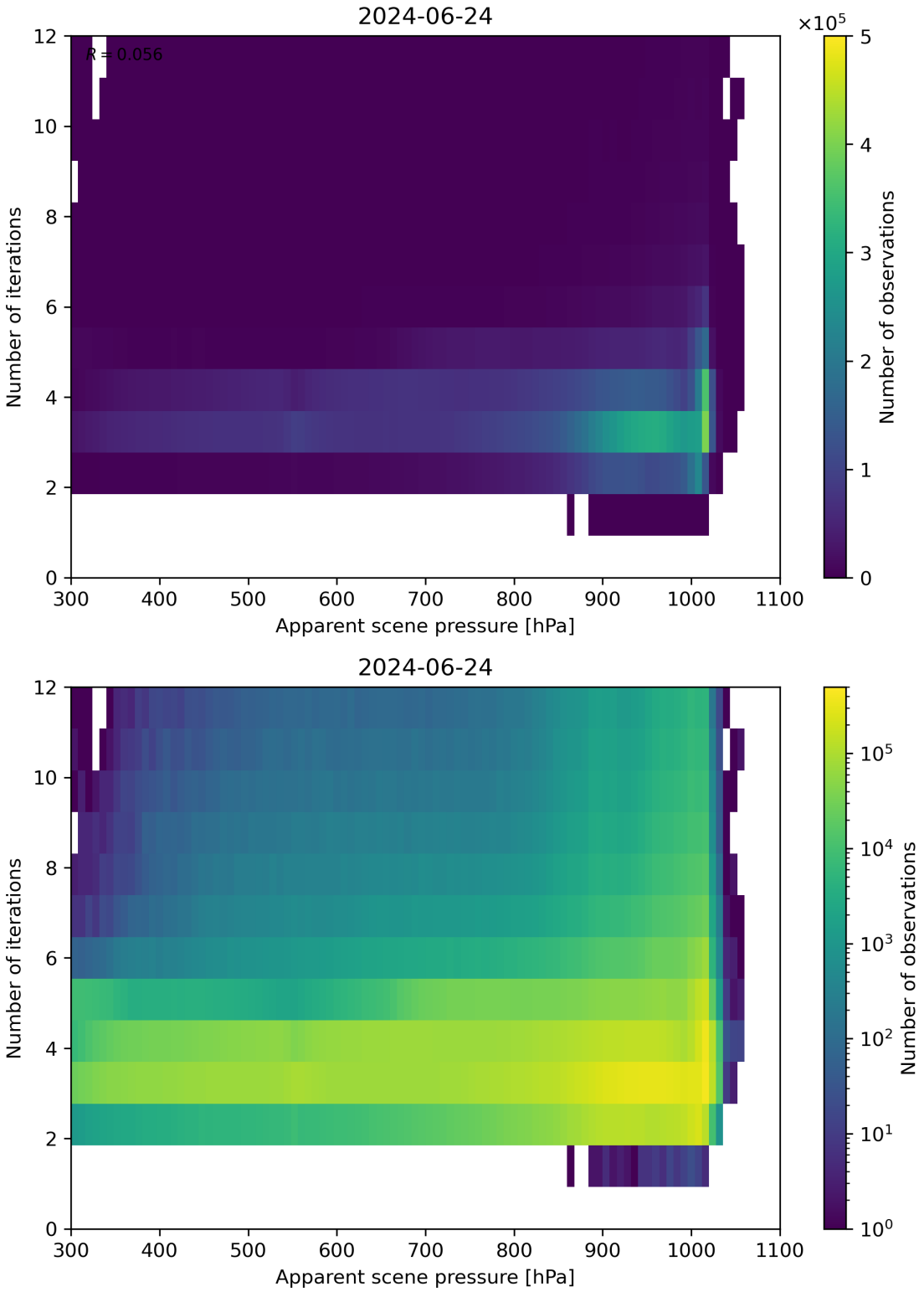


Figure 65: Scatter density plot of “Apparent scene pressure” against “Number of iterations” for 2024-06-24 to 2024-06-25.

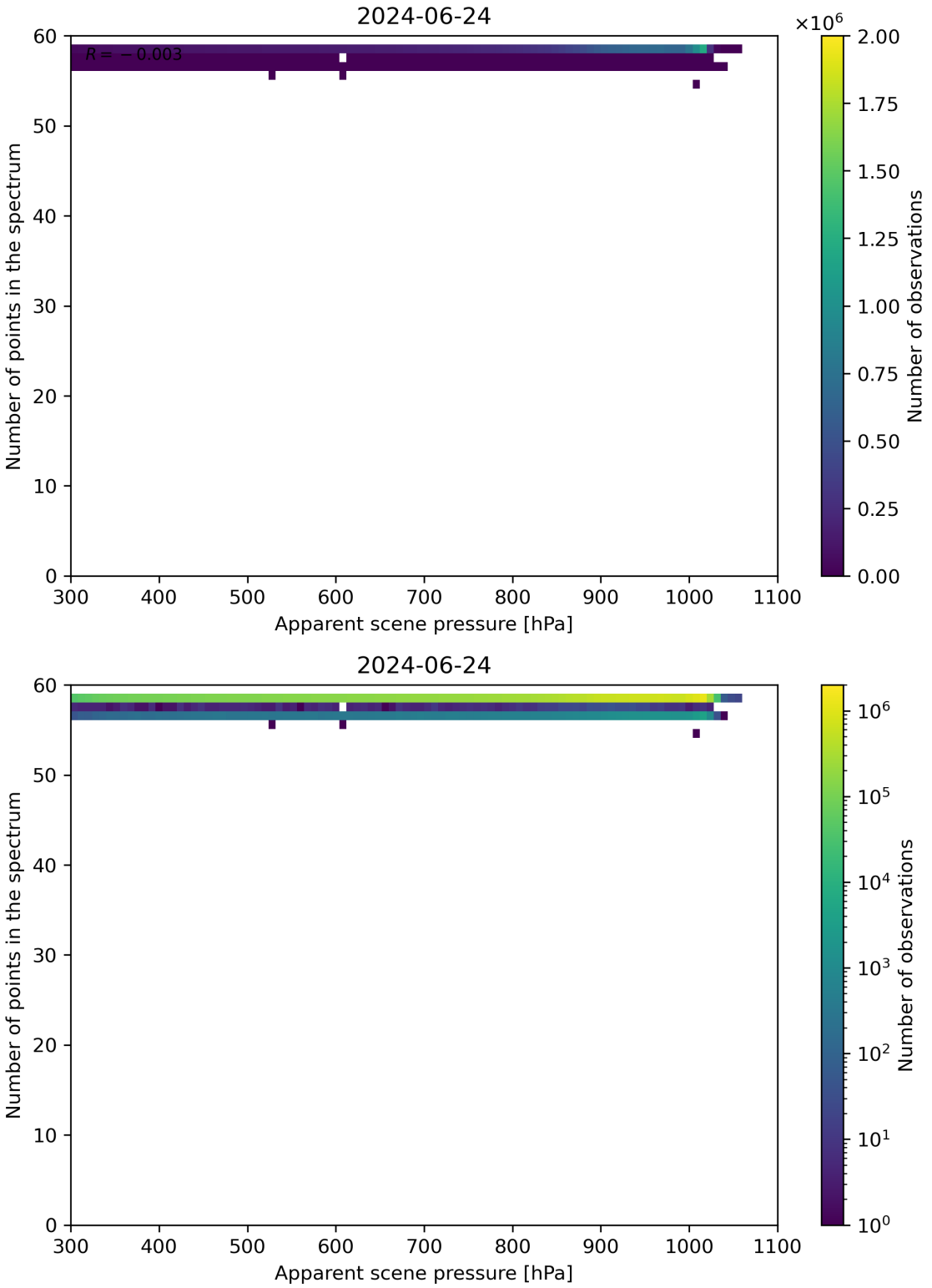


Figure 66: Scatter density plot of “Apparent scene pressure” against “Number of points in the spectrum” for 2024-06-24 to 2024-06-25.

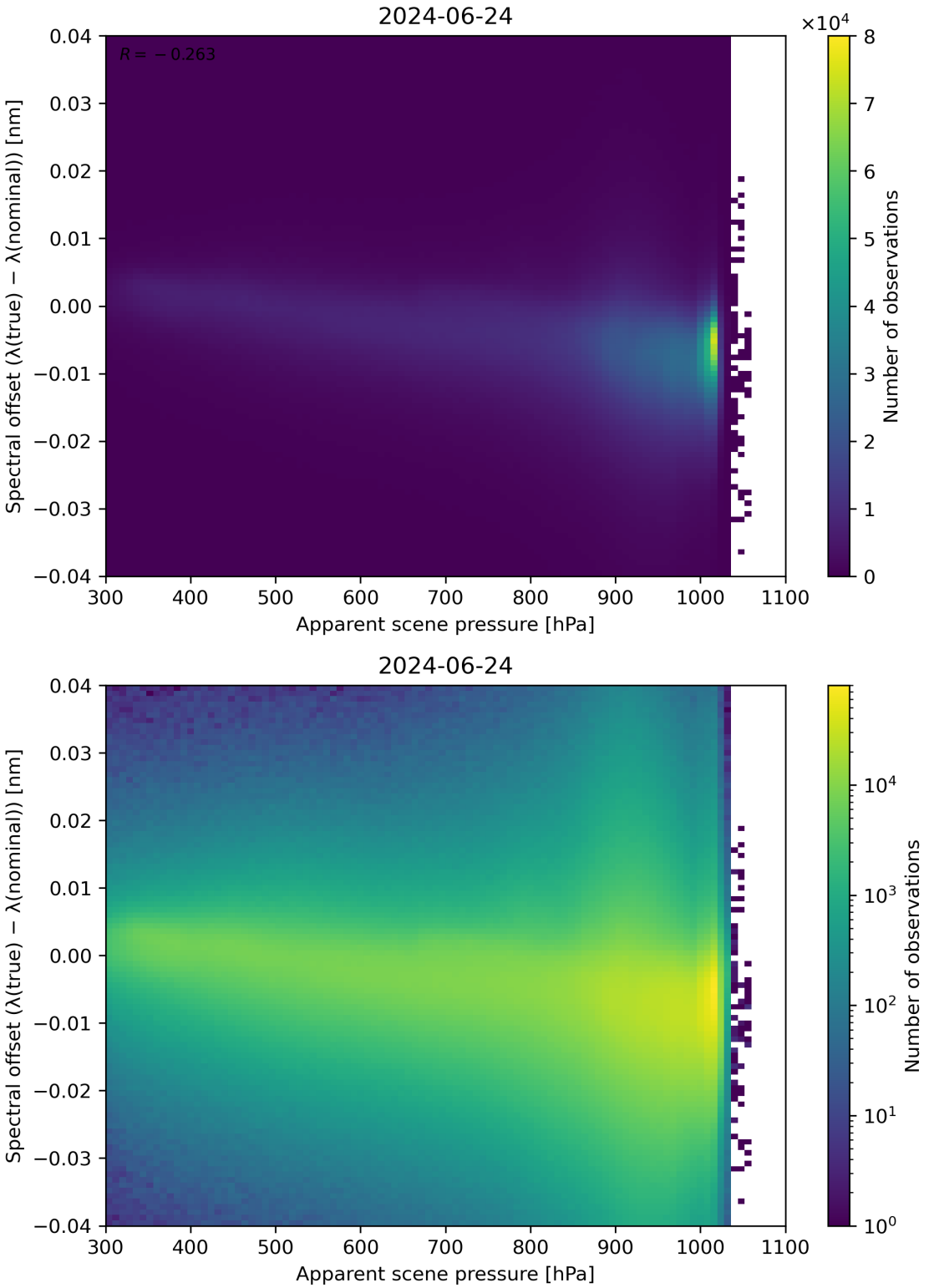


Figure 67: Scatter density plot of “Apparent scene pressure” against “Spectral offset (λ(true) − λ(nominal))” for 2024-06-24 to 2024-06-25.

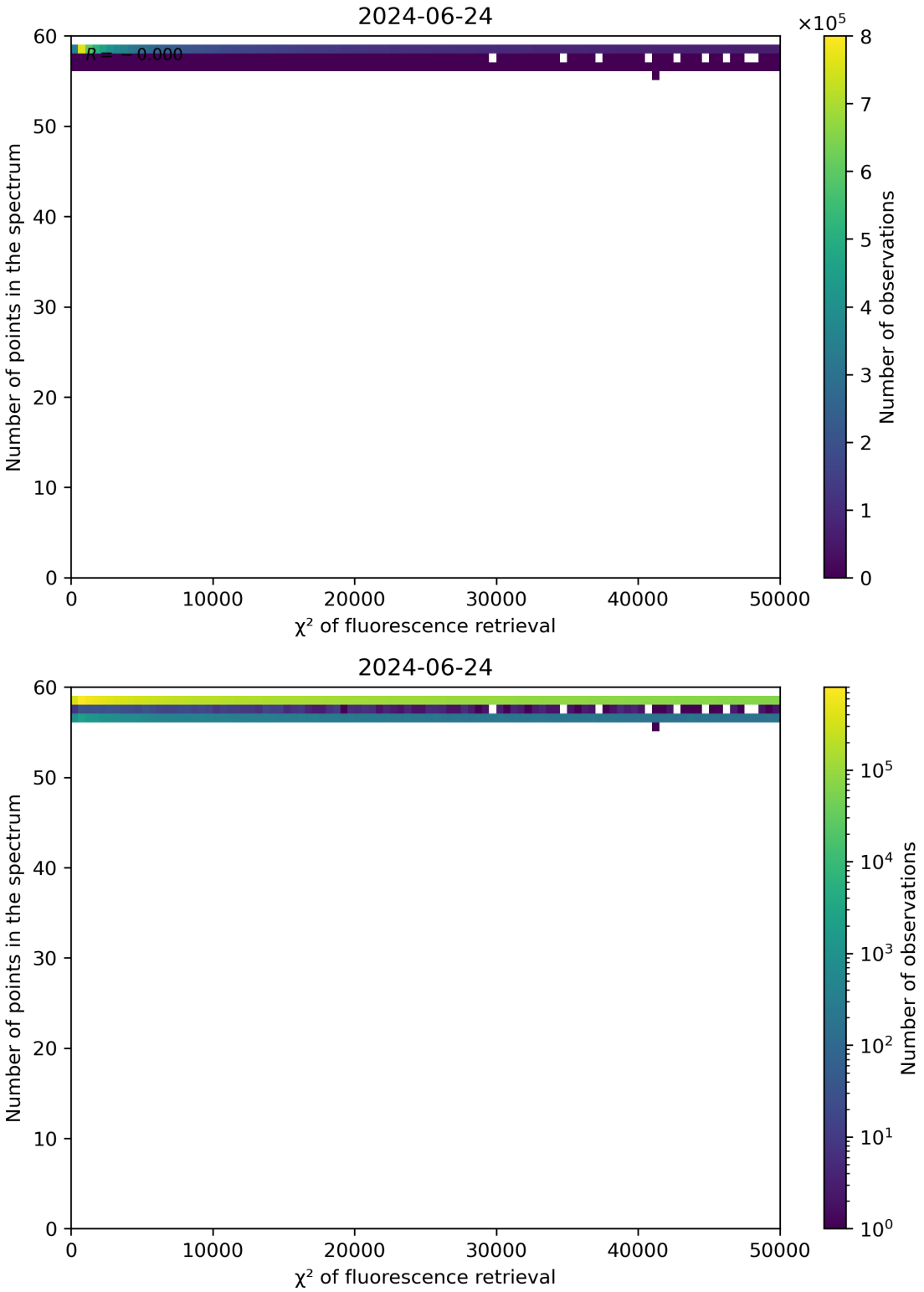


Figure 68: Scatter density plot of "χ^2 of fluorescence retrieval" against "Number of points in the spectrum" for 2024-06-24 to 2024-06-25.

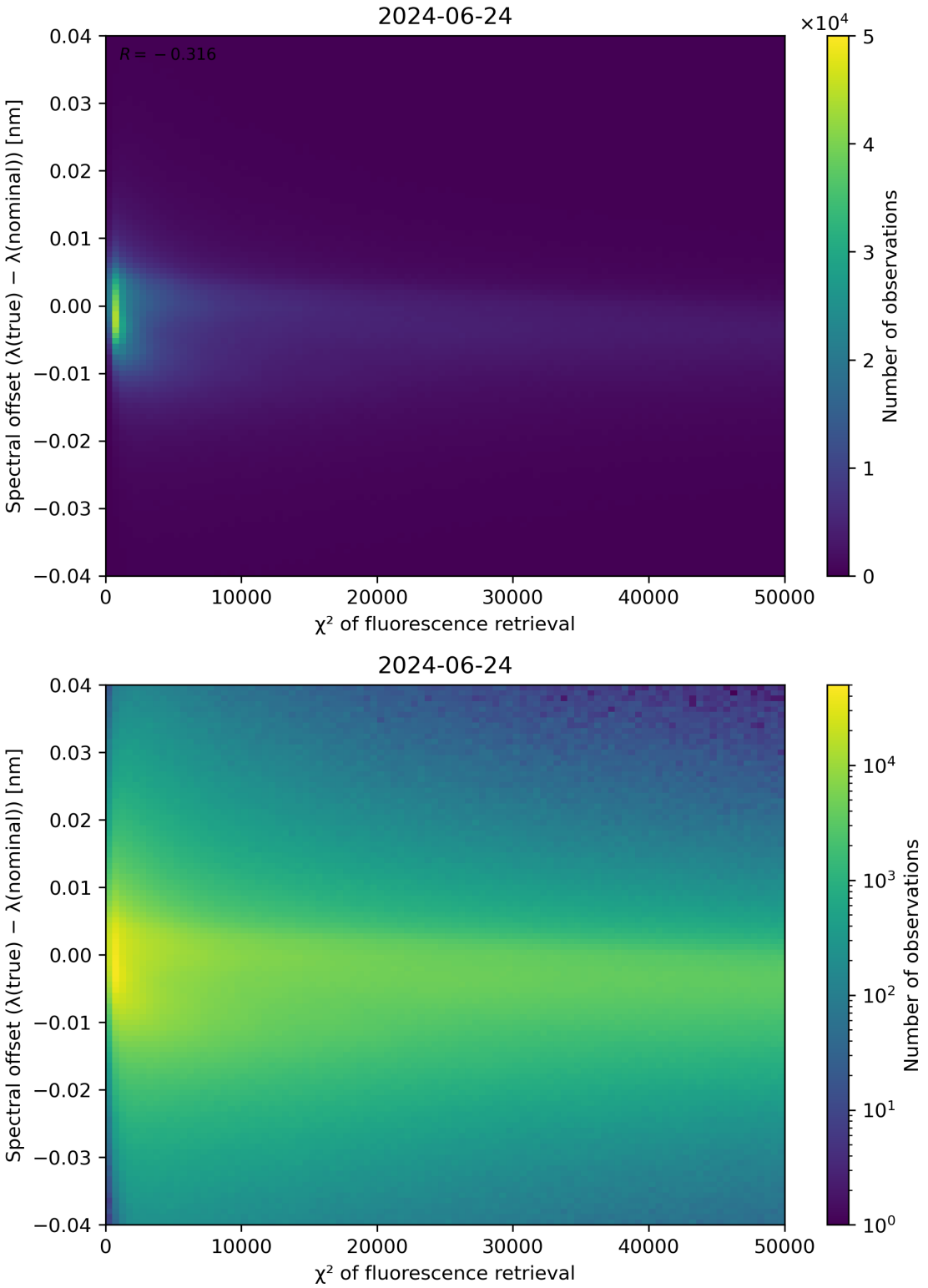


Figure 69: Scatter density plot of "χ^2 of fluorescence retrieval" against "Spectral offset (λ(true) − λ(nominal))" for 2024-06-24 to 2024-06-25.

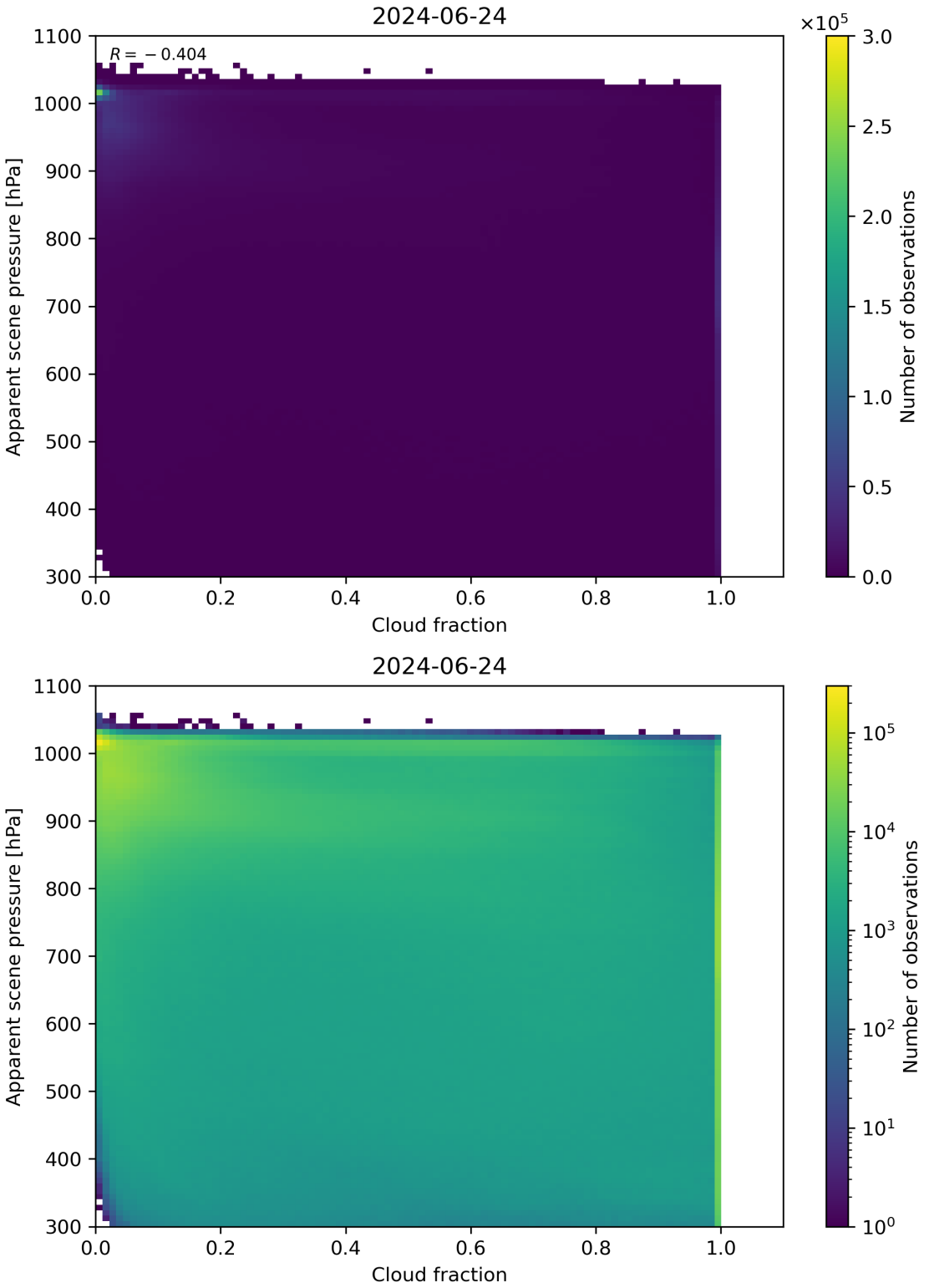


Figure 70: Scatter density plot of “Cloud fraction” against “Apparent scene pressure” for 2024-06-24 to 2024-06-25.

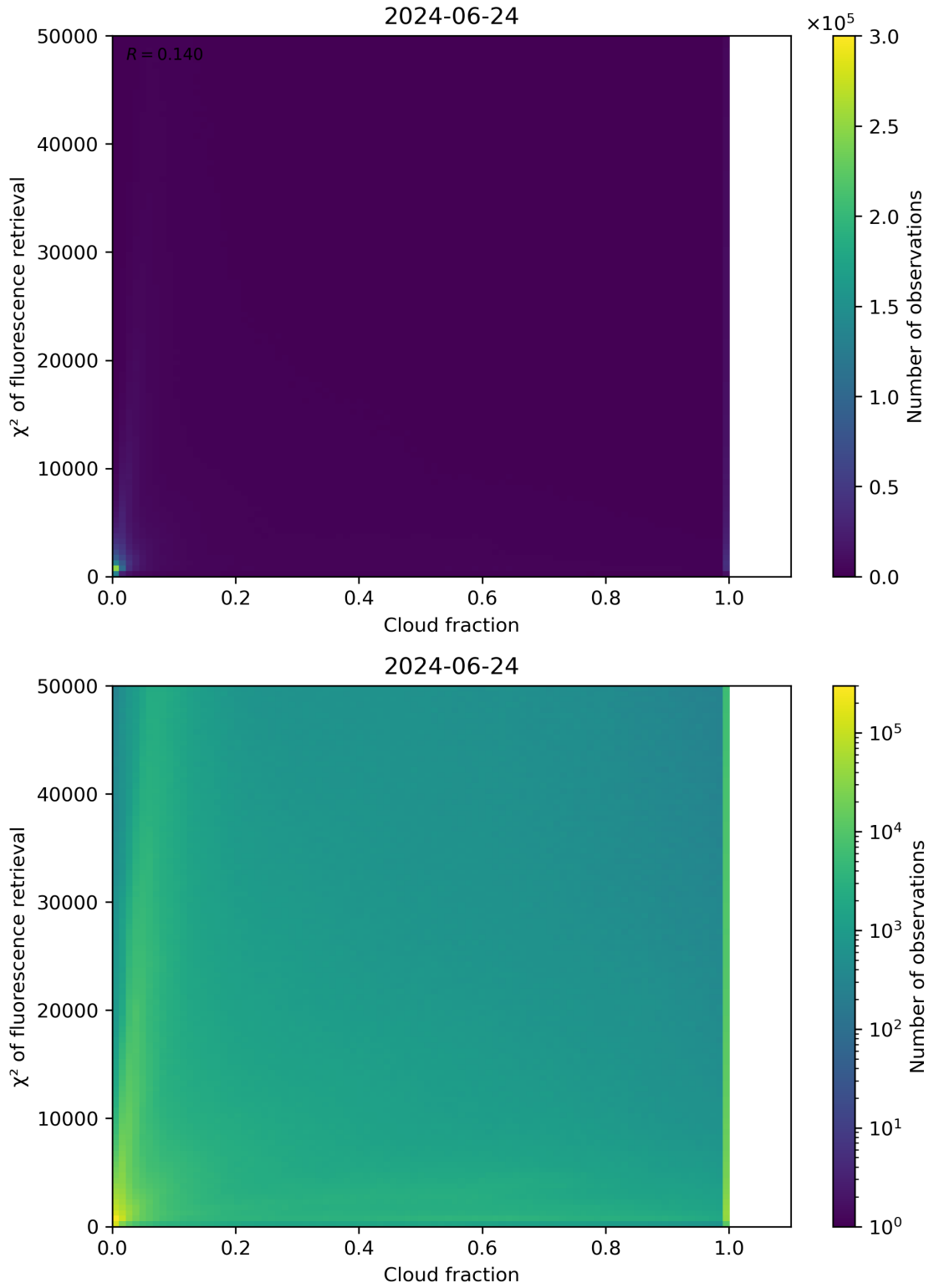


Figure 71: Scatter density plot of “Cloud fraction” against “χ^2 of fluorescence retrieval” for 2024-06-24 to 2024-06-25.

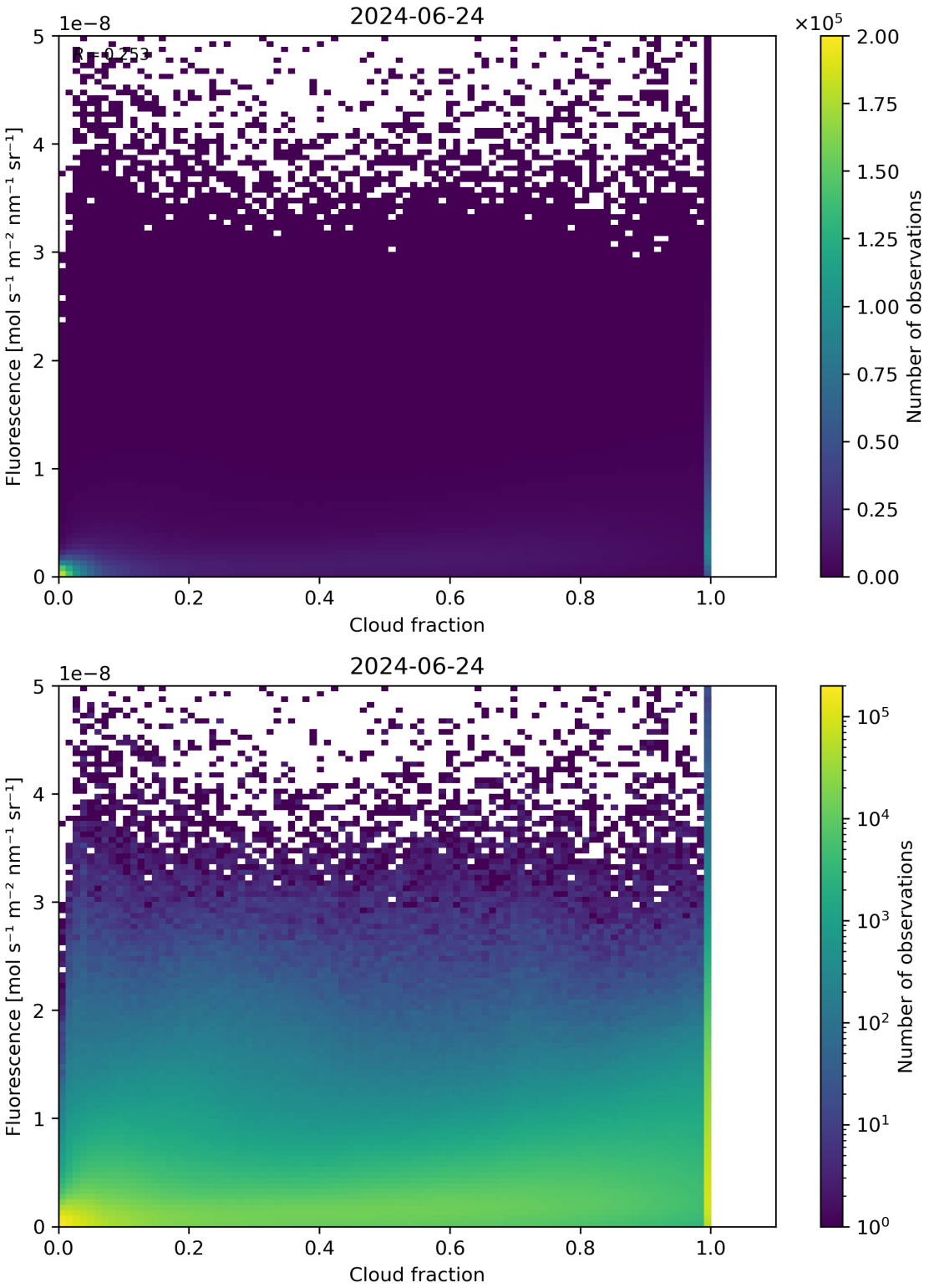


Figure 72: Scatter density plot of “Cloud fraction” against “Fluorescence” for 2024-06-24 to 2024-06-25.

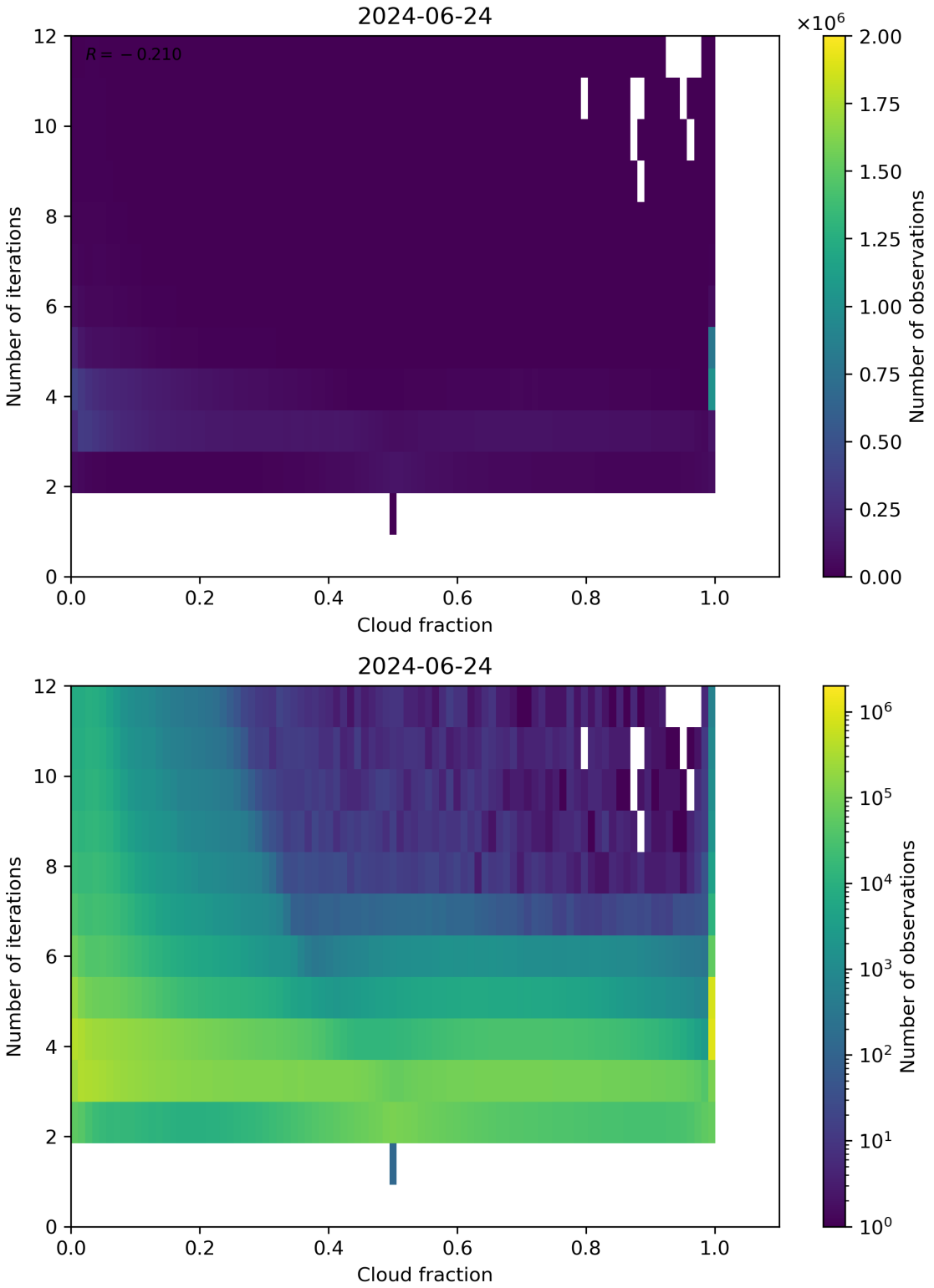


Figure 73: Scatter density plot of “Cloud fraction” against “Number of iterations” for 2024-06-24 to 2024-06-25.

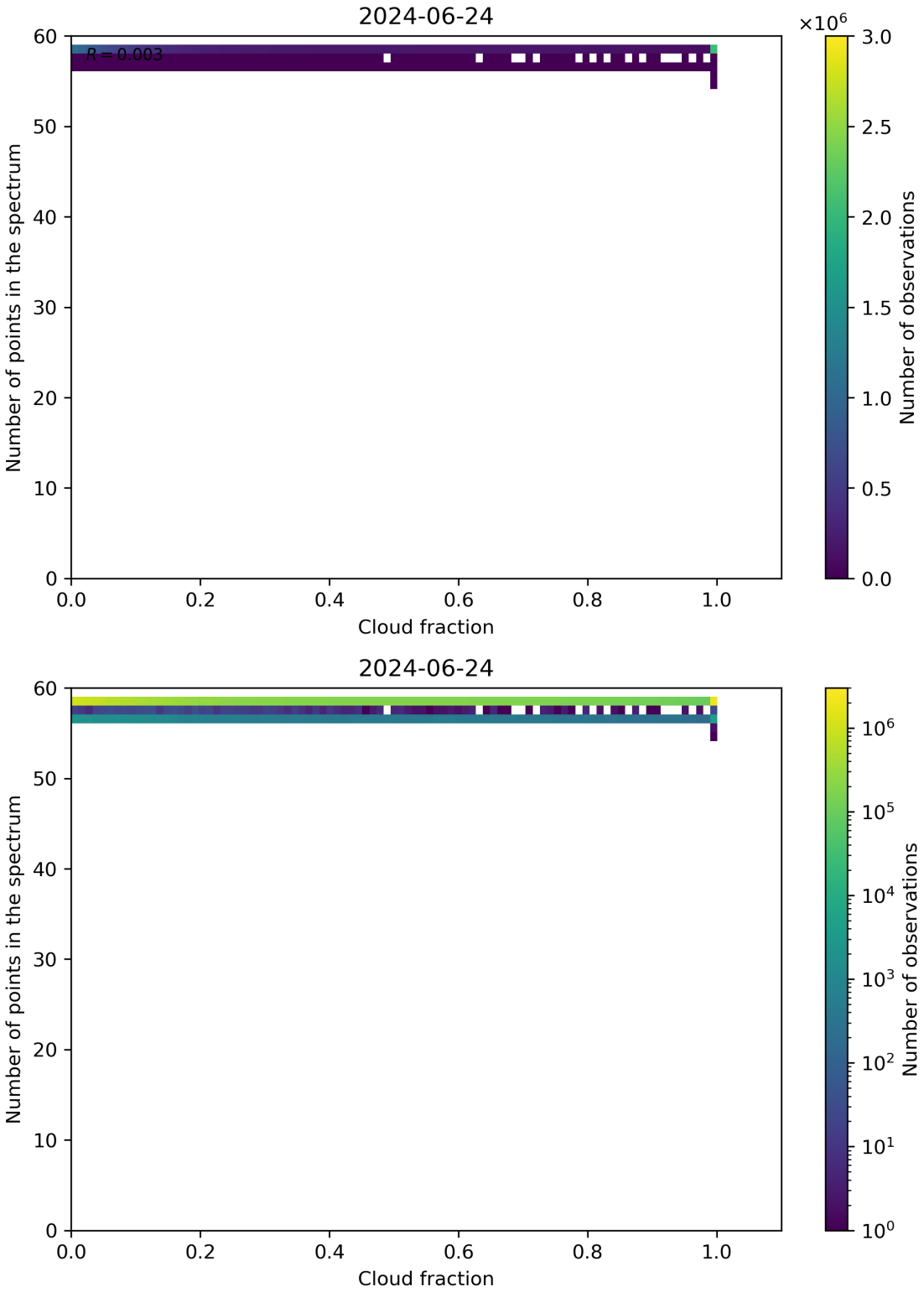


Figure 74: Scatter density plot of “Cloud fraction” against “Number of points in the spectrum” for 2024-06-24 to 2024-06-25.

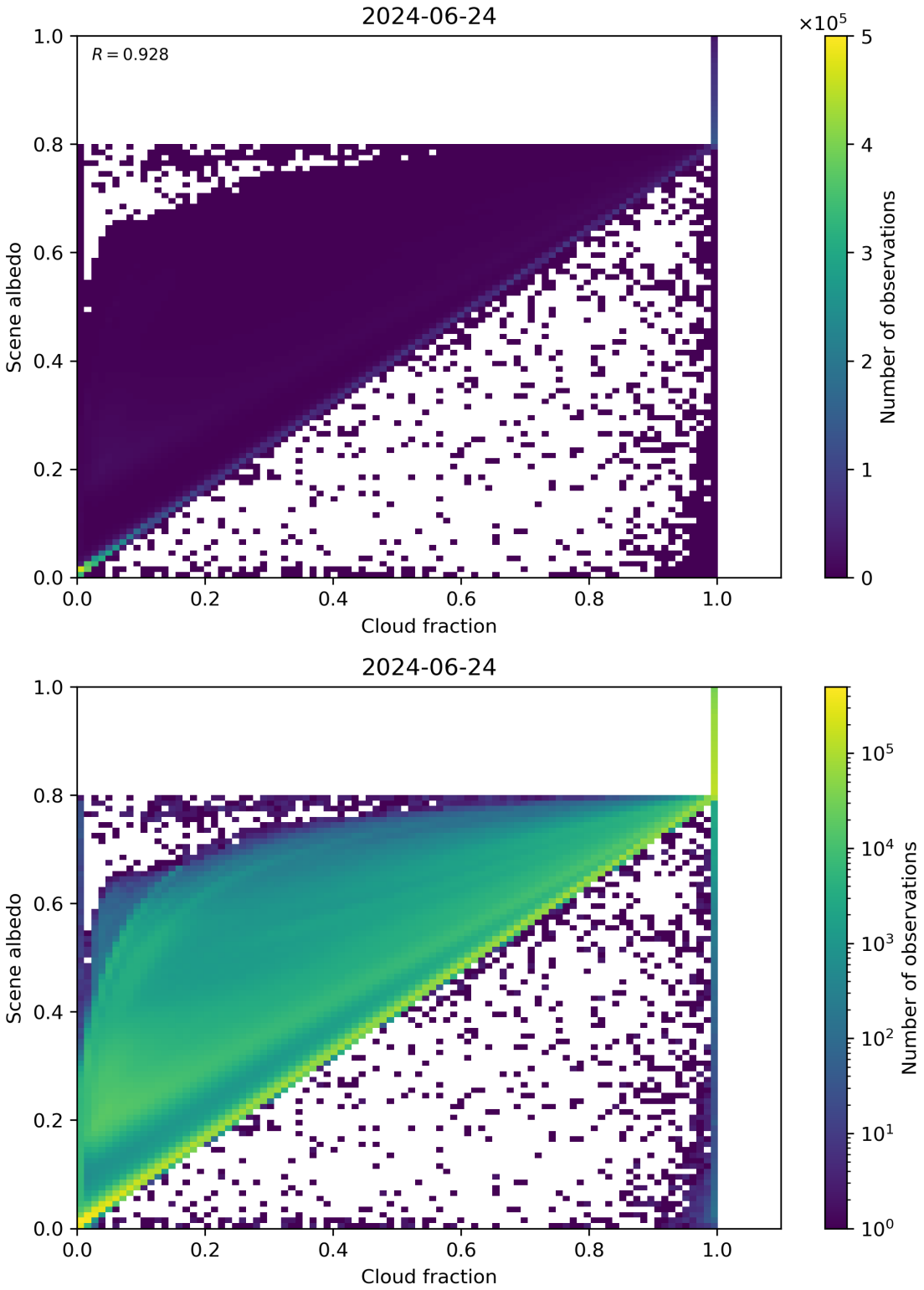


Figure 75: Scatter density plot of “Cloud fraction” against “Scene albedo” for 2024-06-24 to 2024-06-25.

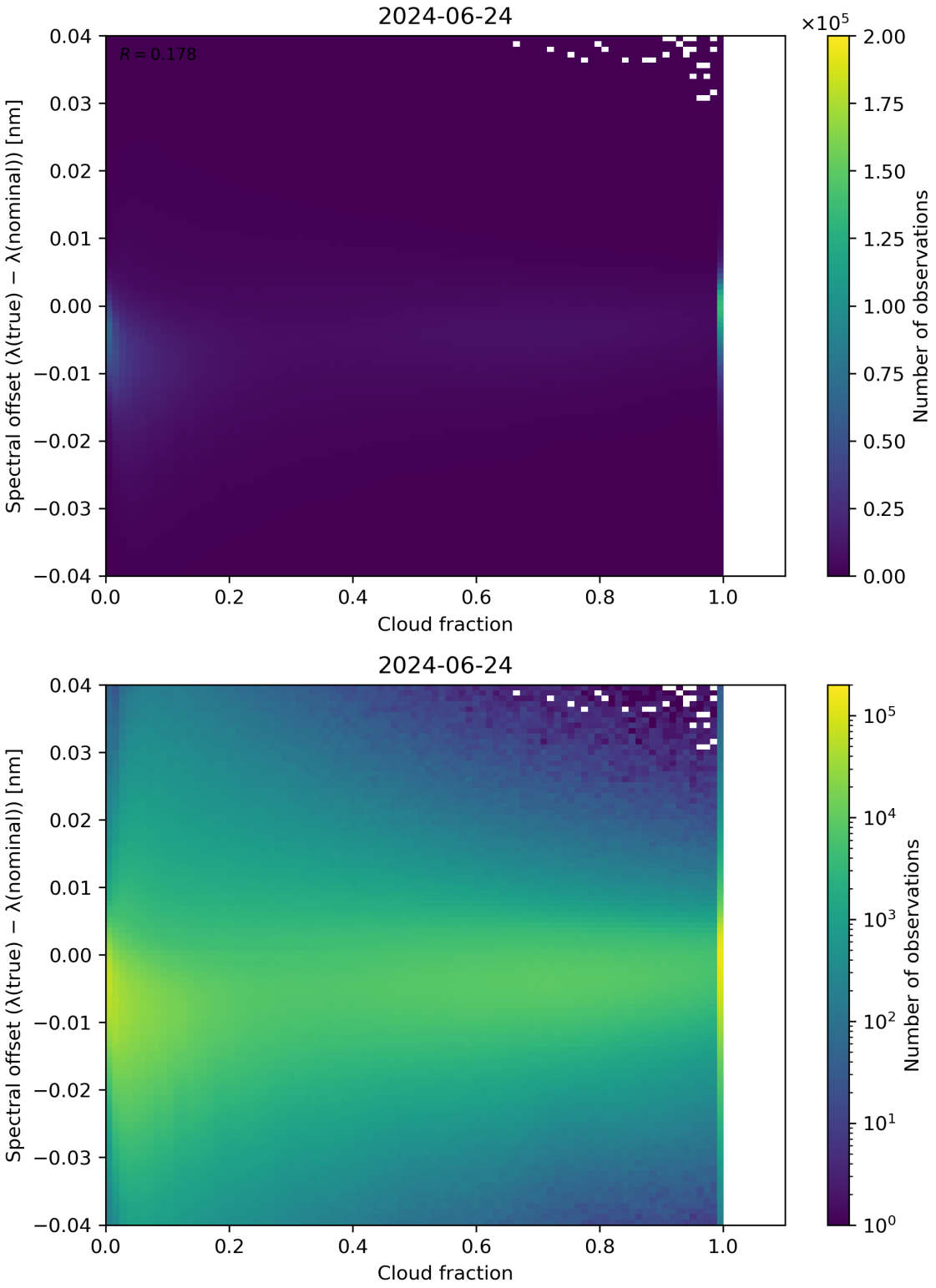


Figure 76: Scatter density plot of “Cloud fraction” against “Spectral offset (λ(true) − λ(nominal))” for 2024-06-24 to 2024-06-25.

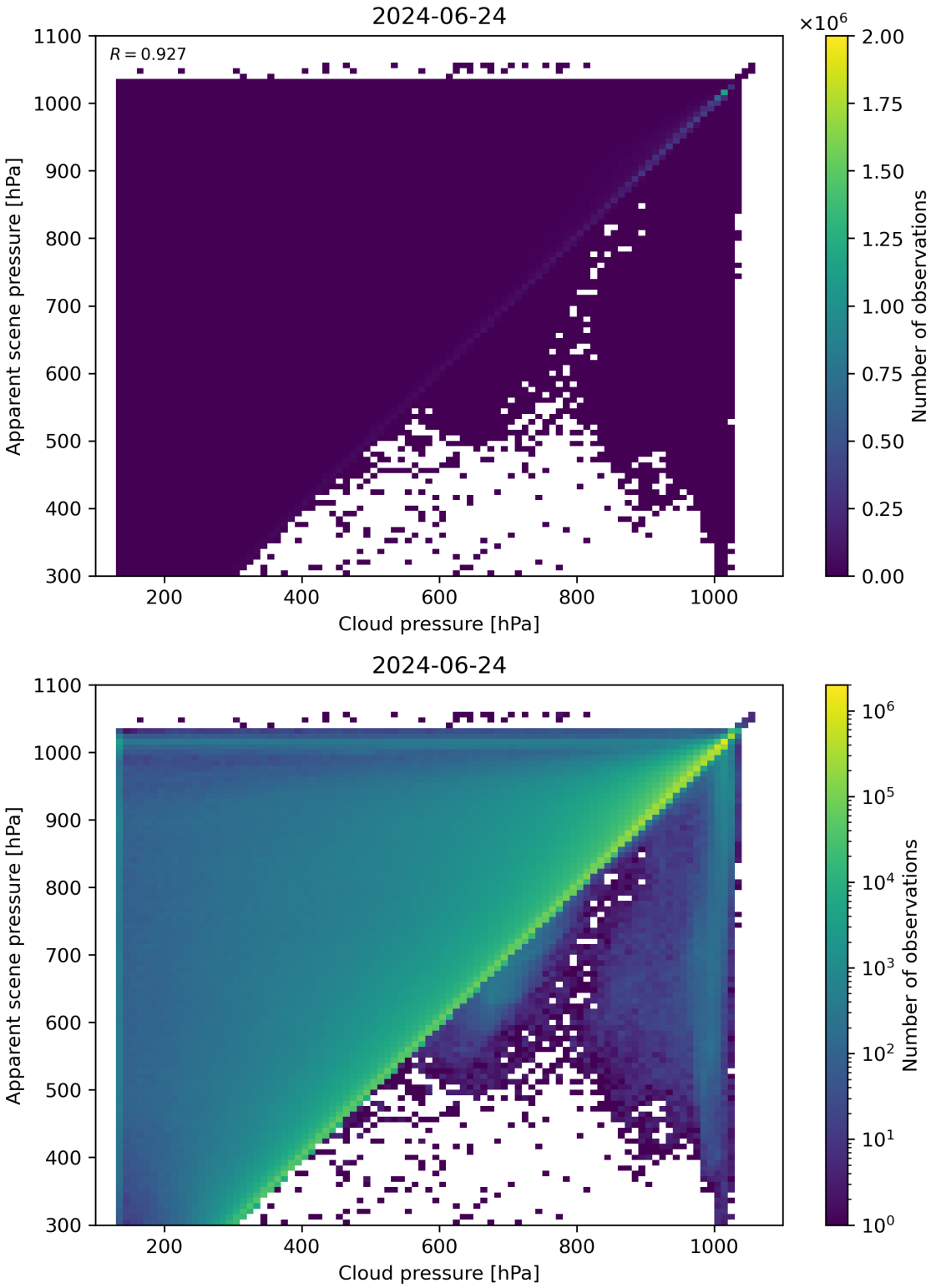


Figure 77: Scatter density plot of “Cloud pressure” against “Apparent scene pressure” for 2024-06-24 to 2024-06-25.

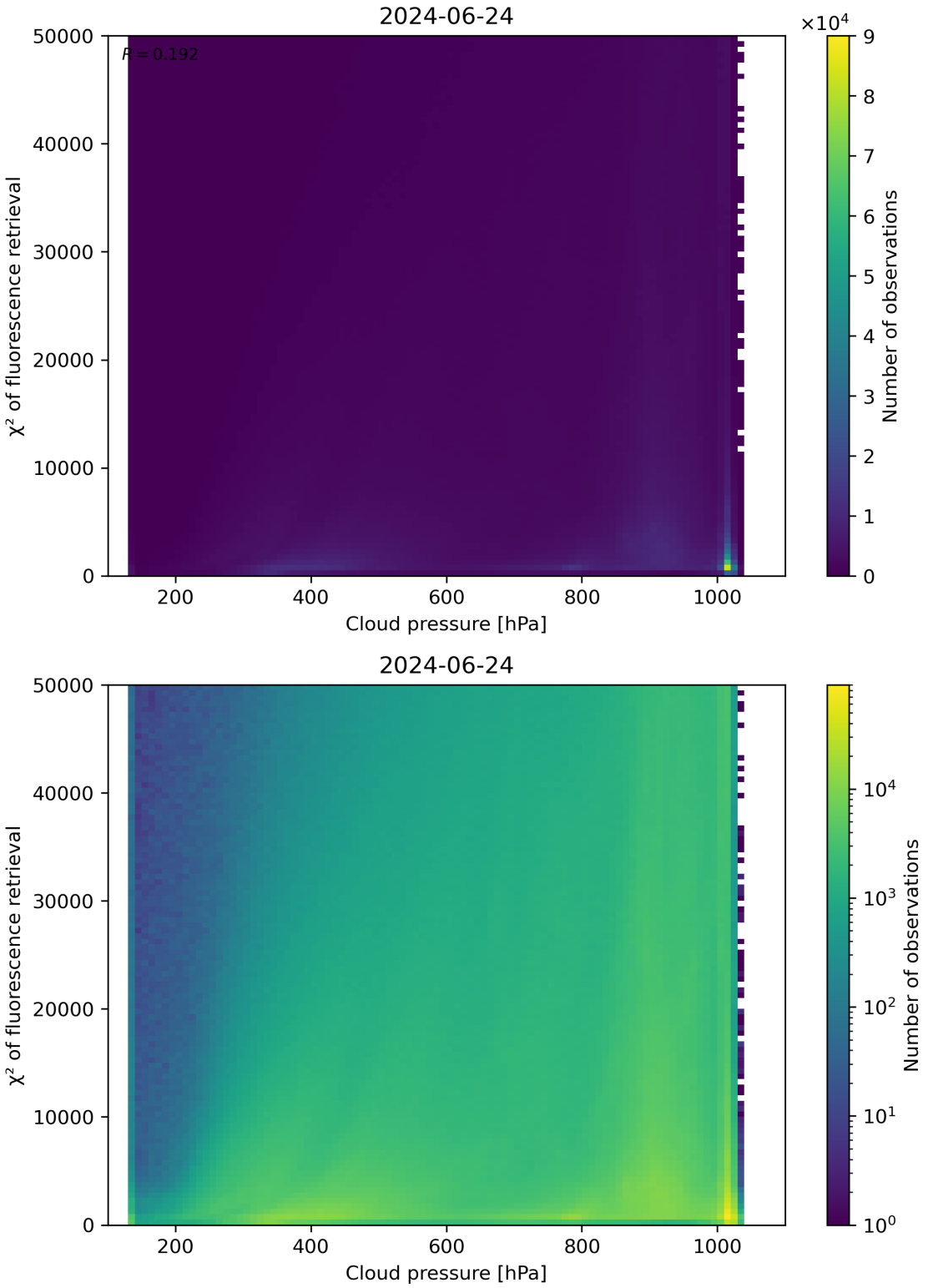


Figure 78: Scatter density plot of "Cloud pressure" against "χ^2 of fluorescence retrieval" for 2024-06-24 to 2024-06-25.

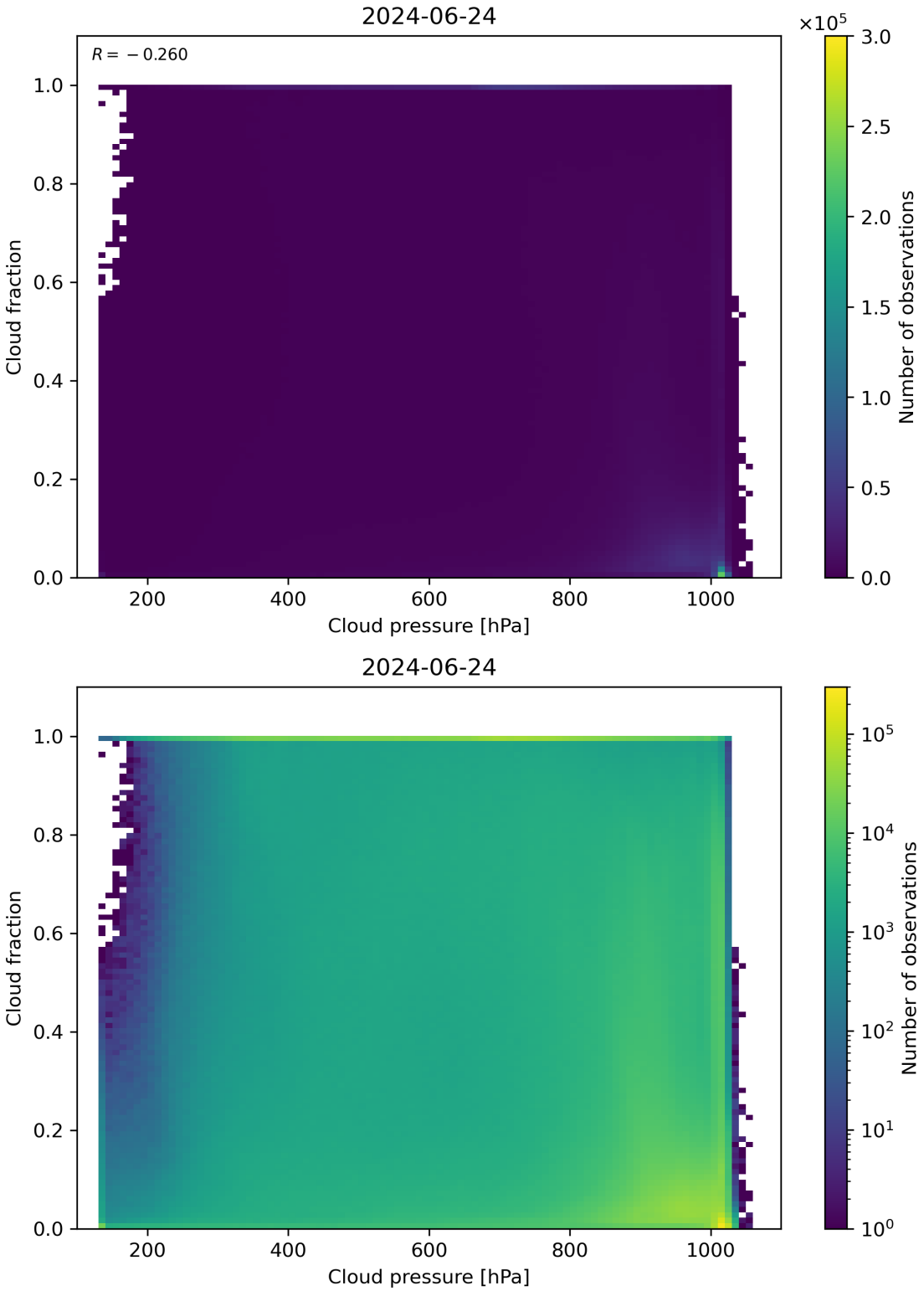


Figure 79: Scatter density plot of “Cloud pressure” against “Cloud fraction” for 2024-06-24 to 2024-06-25.

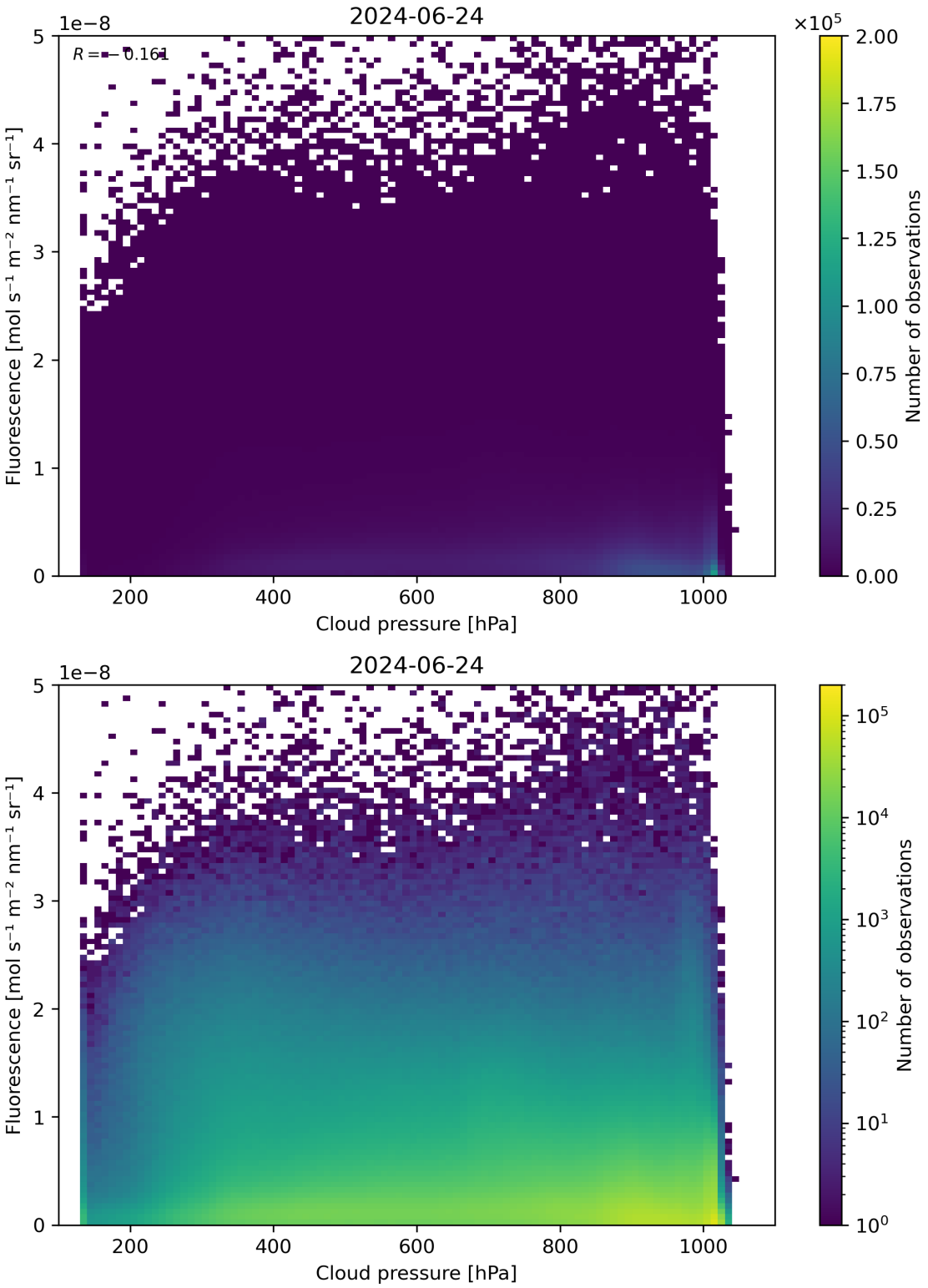


Figure 80: Scatter density plot of “Cloud pressure” against “Fluorescence” for 2024-06-24 to 2024-06-25.

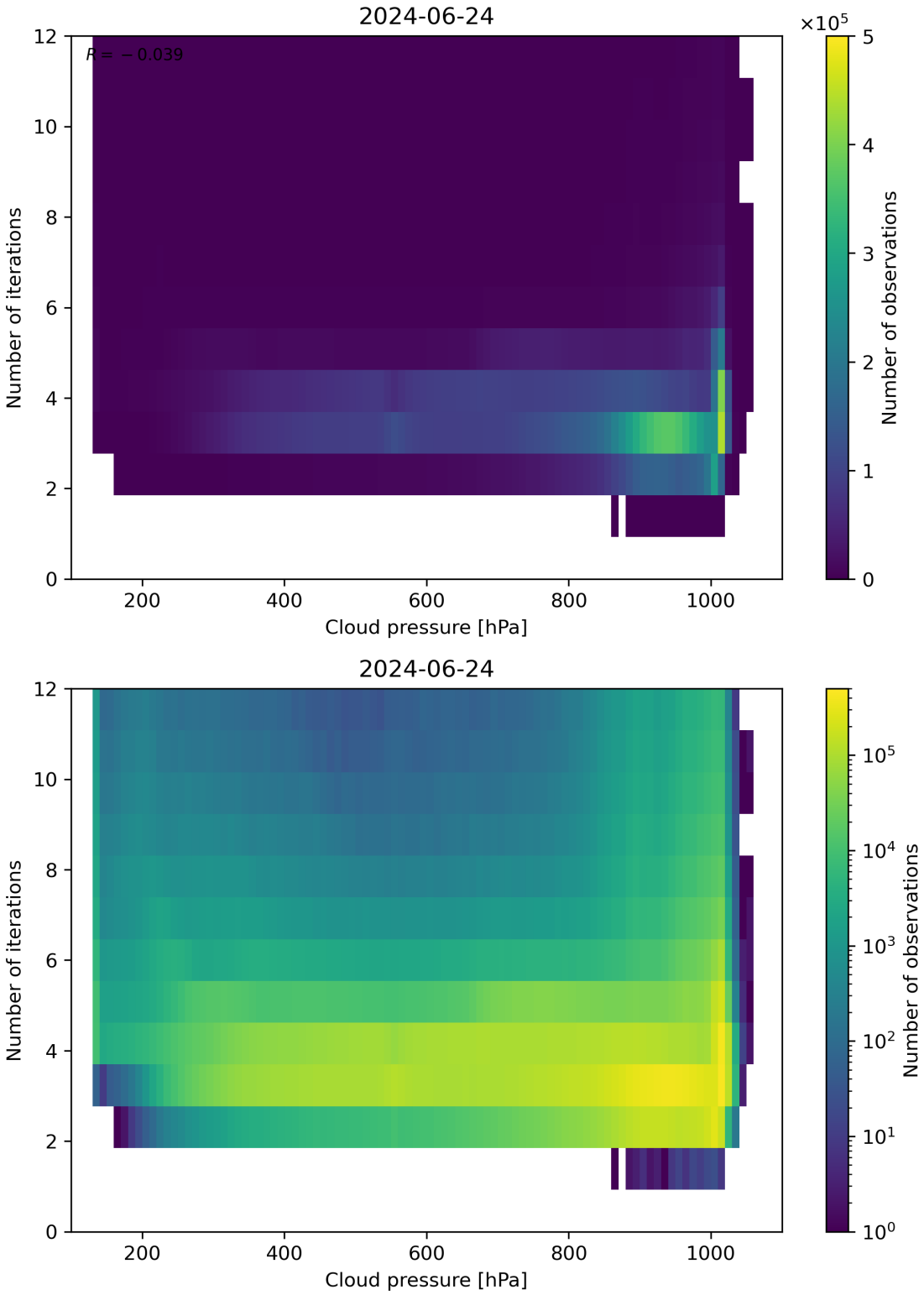


Figure 81: Scatter density plot of “Cloud pressure” against “Number of iterations” for 2024-06-24 to 2024-06-25.

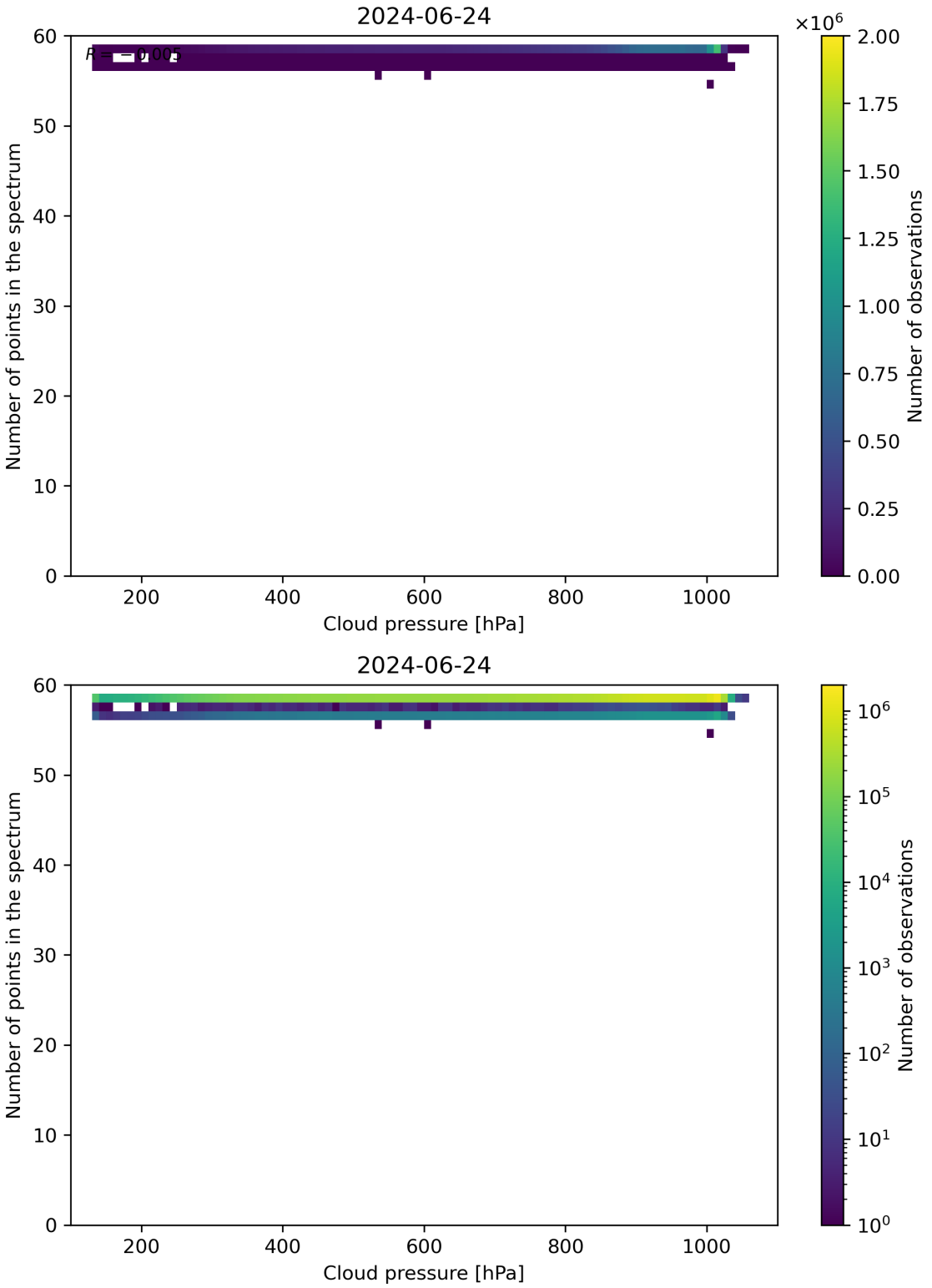


Figure 82: Scatter density plot of “Cloud pressure” against “Number of points in the spectrum” for 2024-06-24 to 2024-06-25.

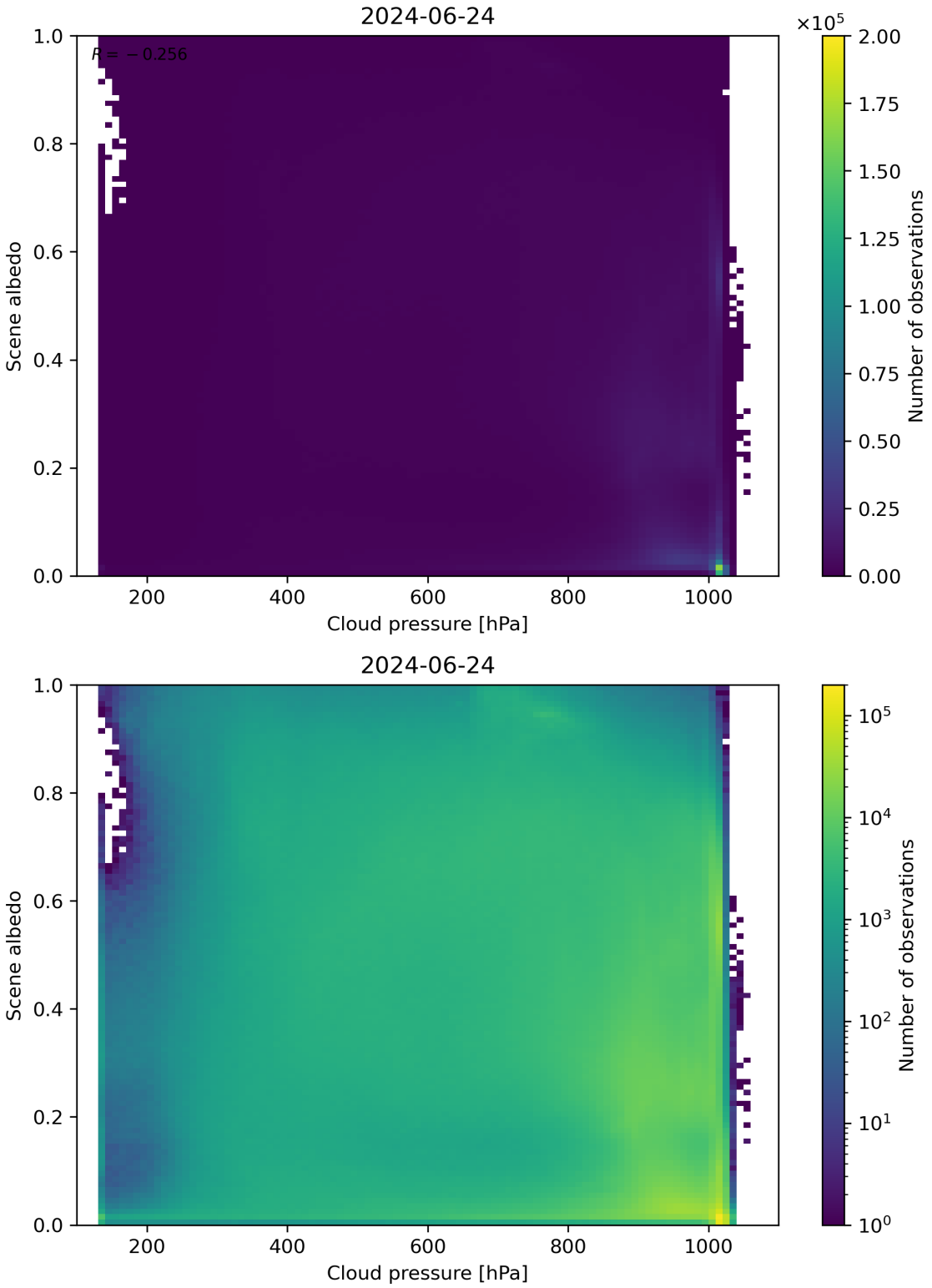


Figure 83: Scatter density plot of “Cloud pressure” against “Scene albedo” for 2024-06-24 to 2024-06-25.

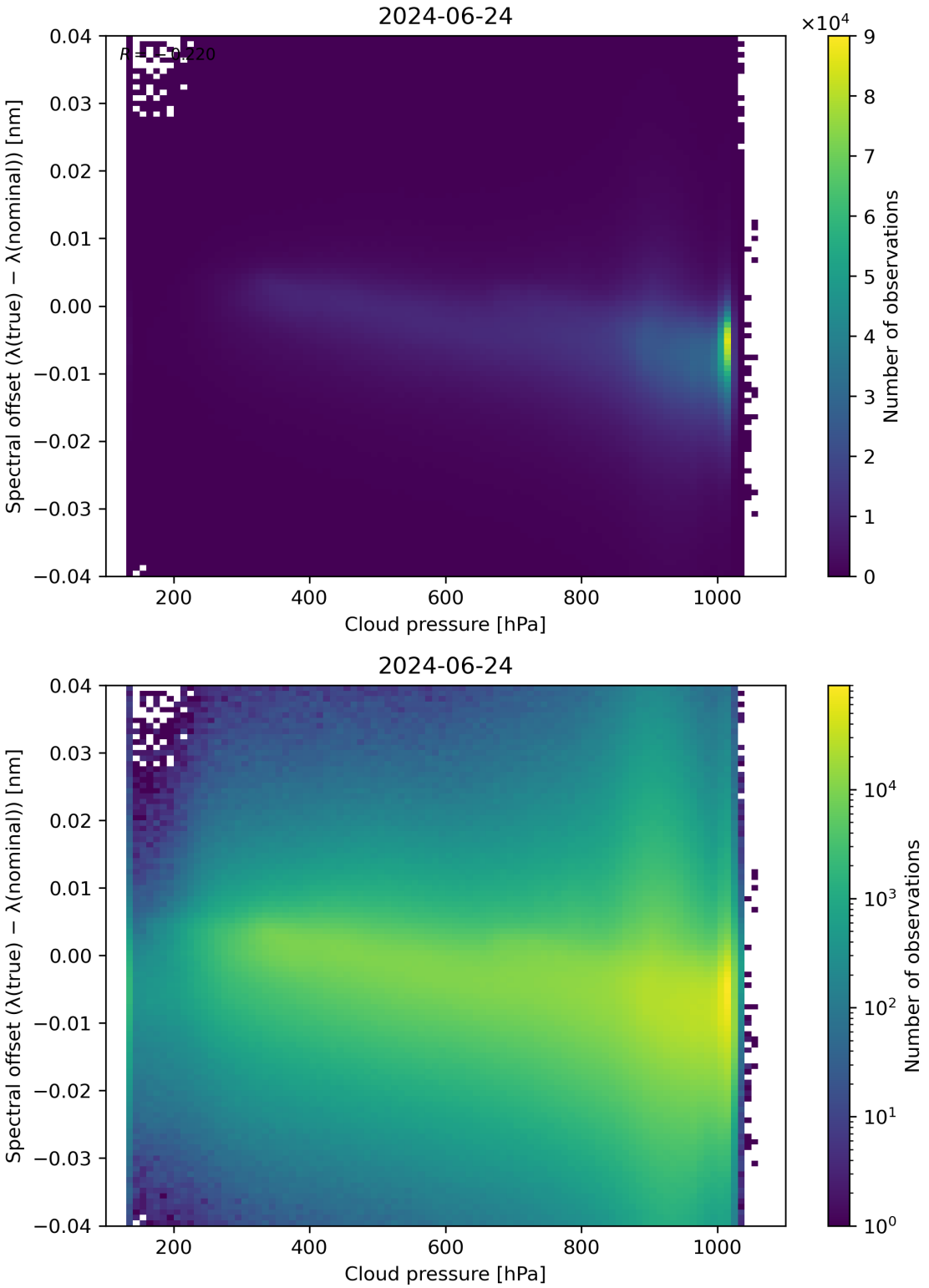


Figure 84: Scatter density plot of “Cloud pressure” against “Spectral offset (λ(true) − λ(nominal))” for 2024-06-24 to 2024-06-25.

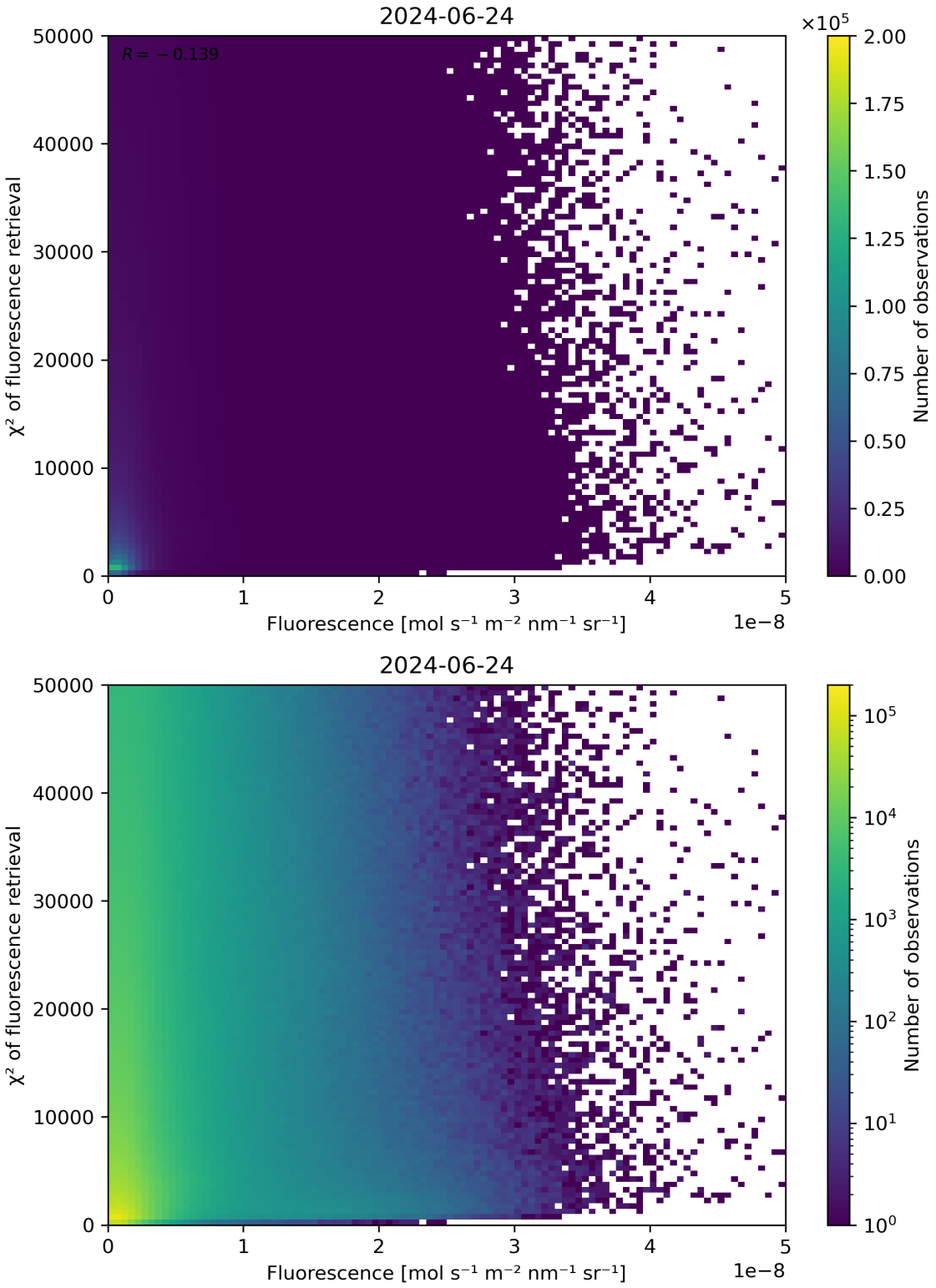
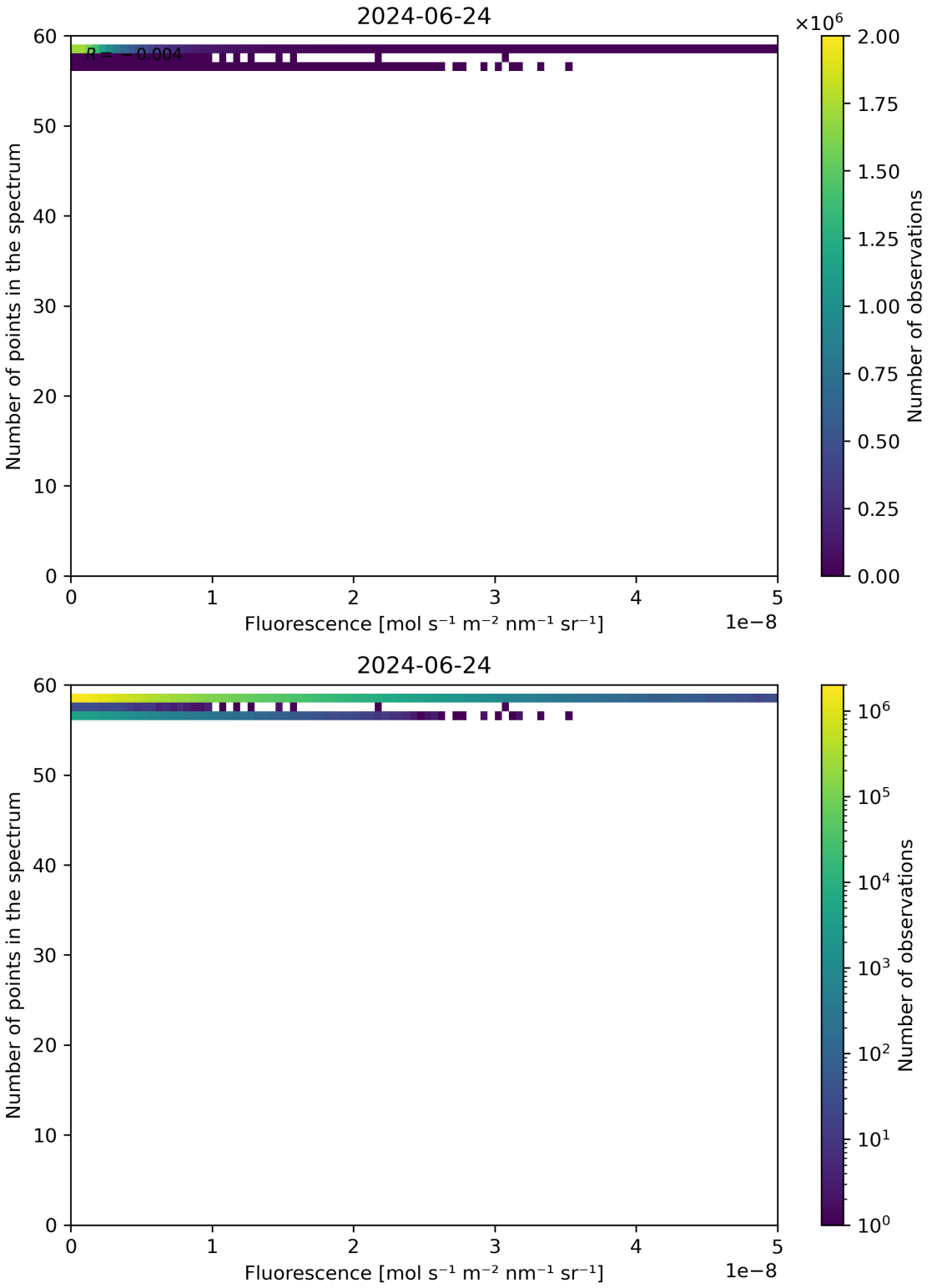


Figure 85: Scatter density plot of "Fluorescence" against "χ^2 of fluorescence retrieval" for 2024-06-24 to 2024-06-25.



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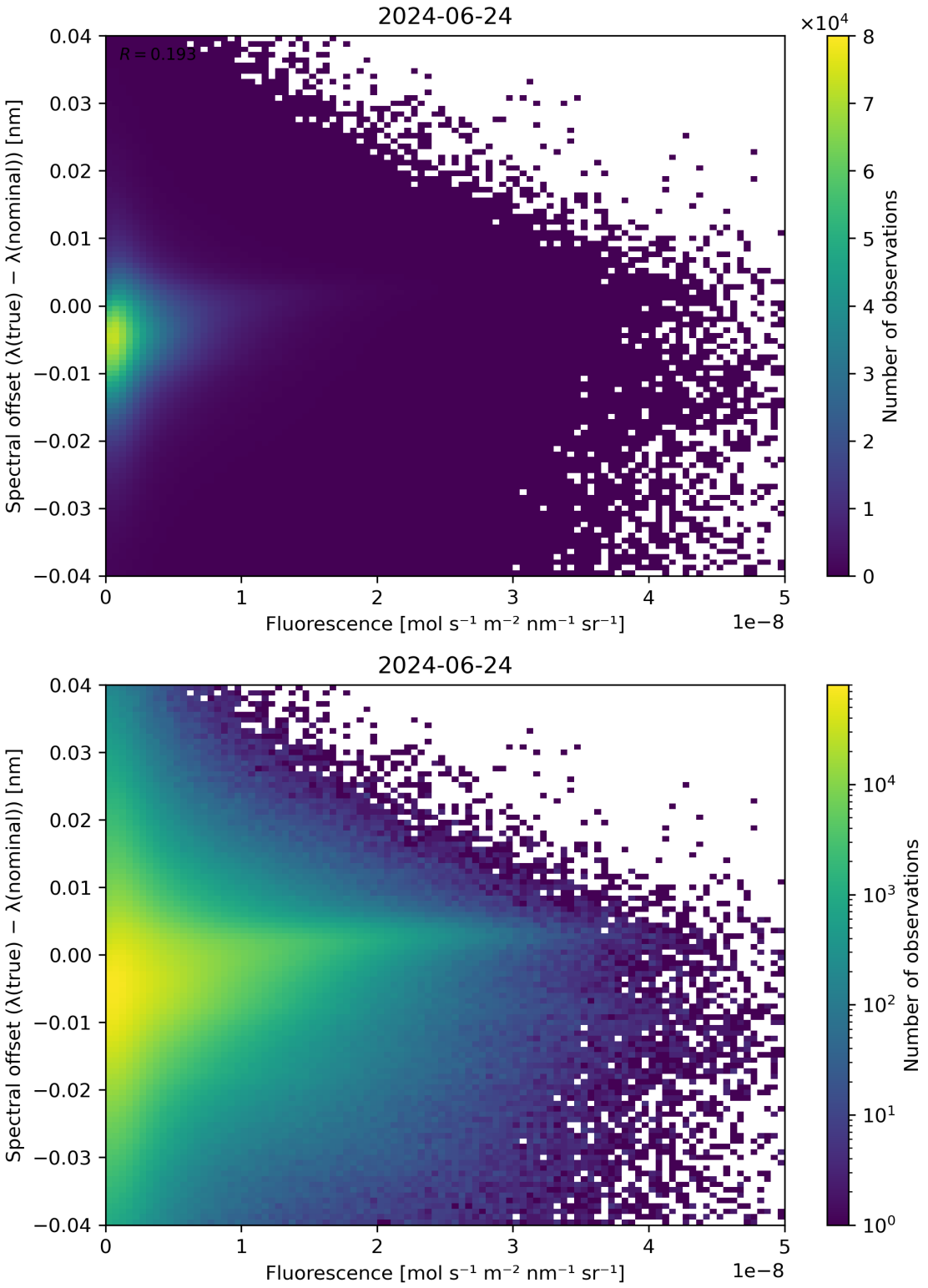

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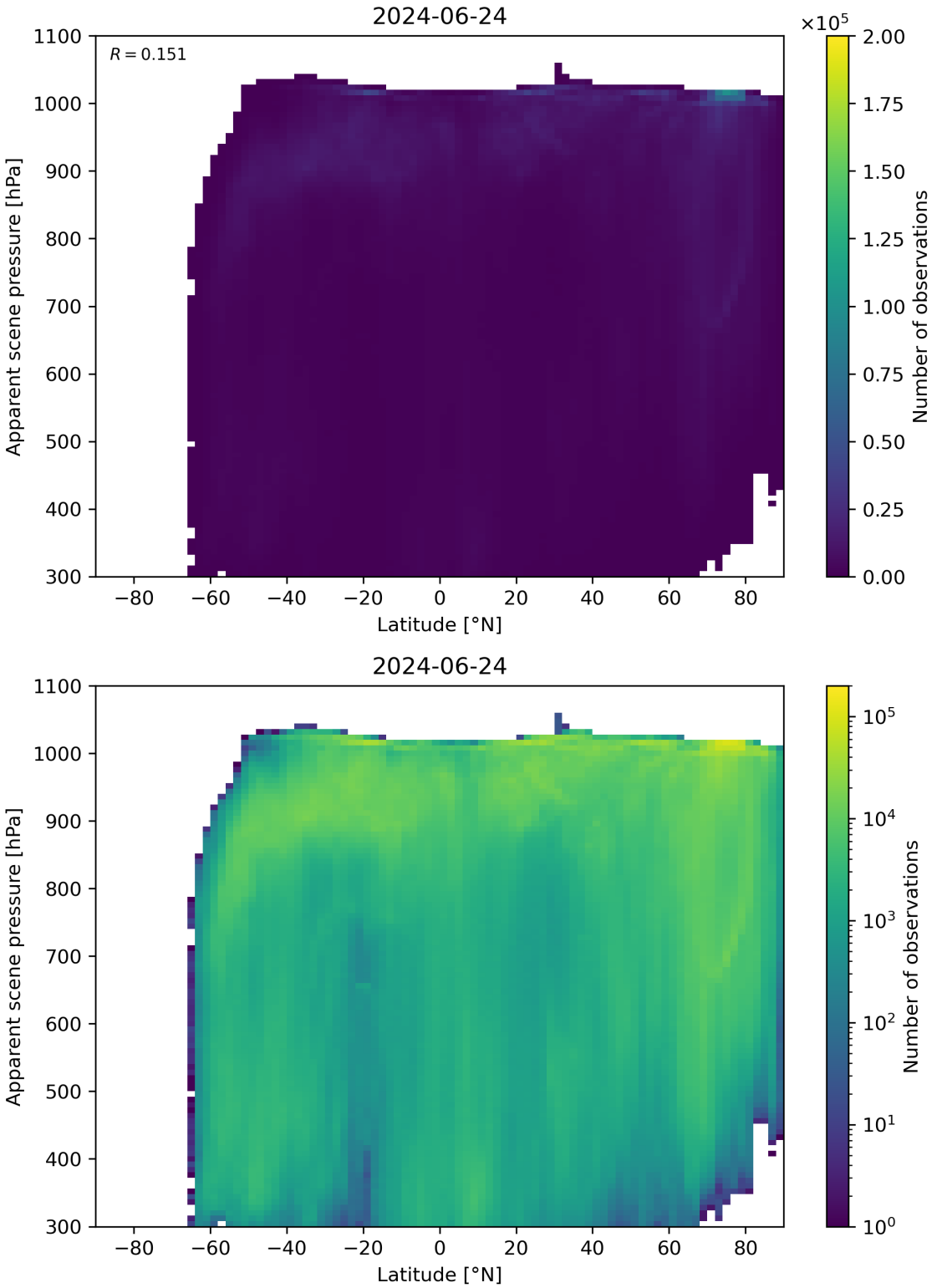

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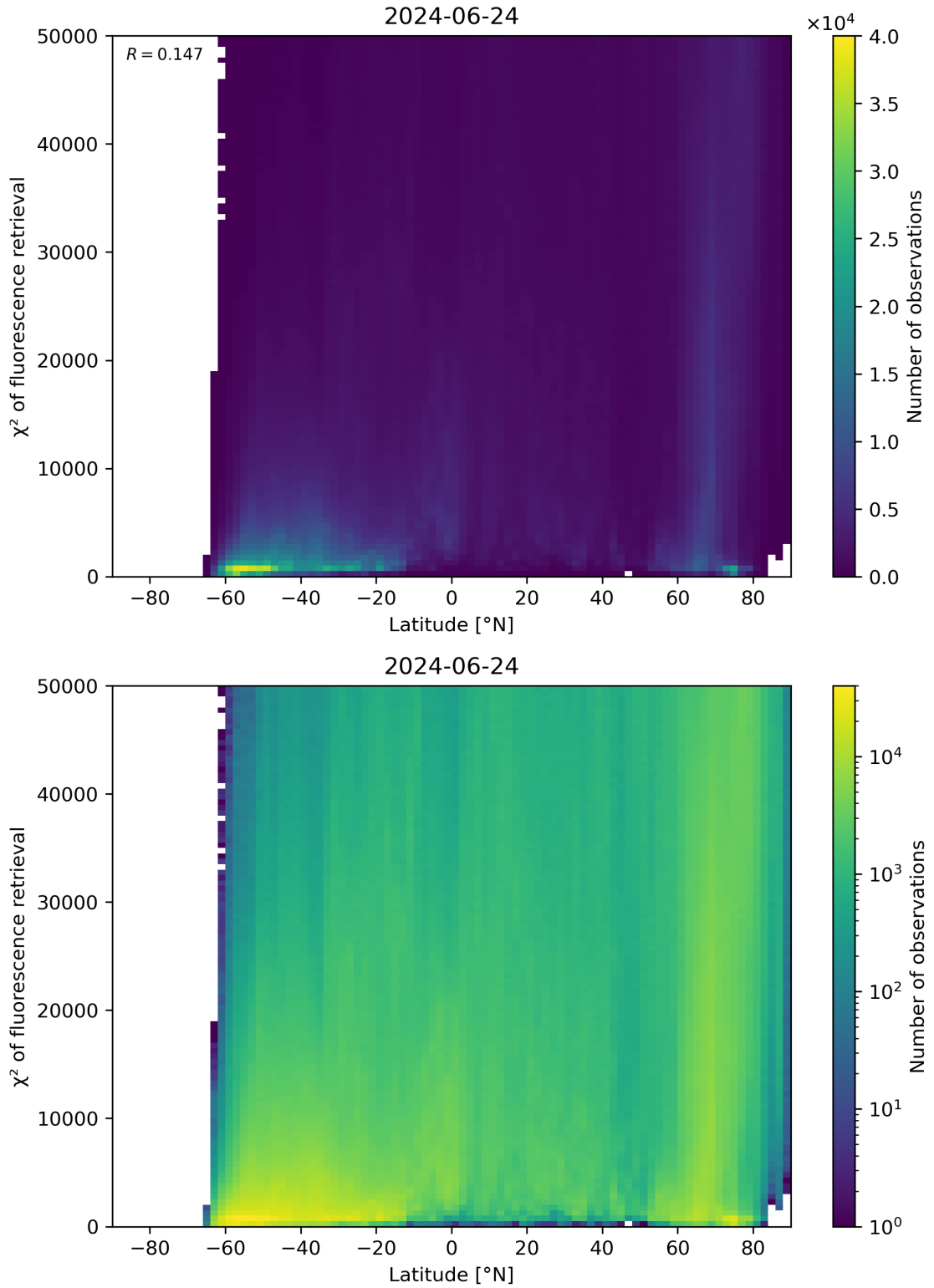

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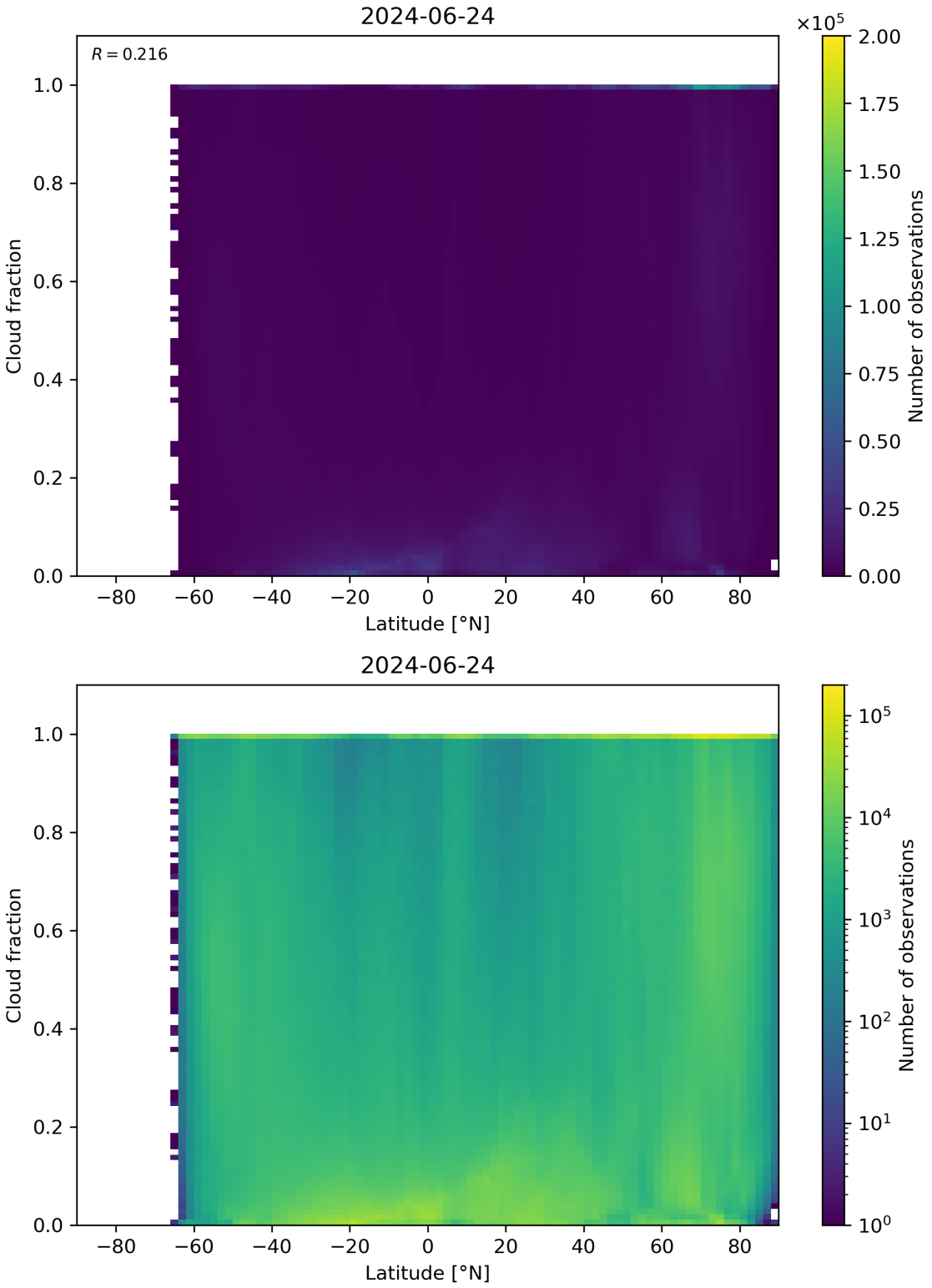

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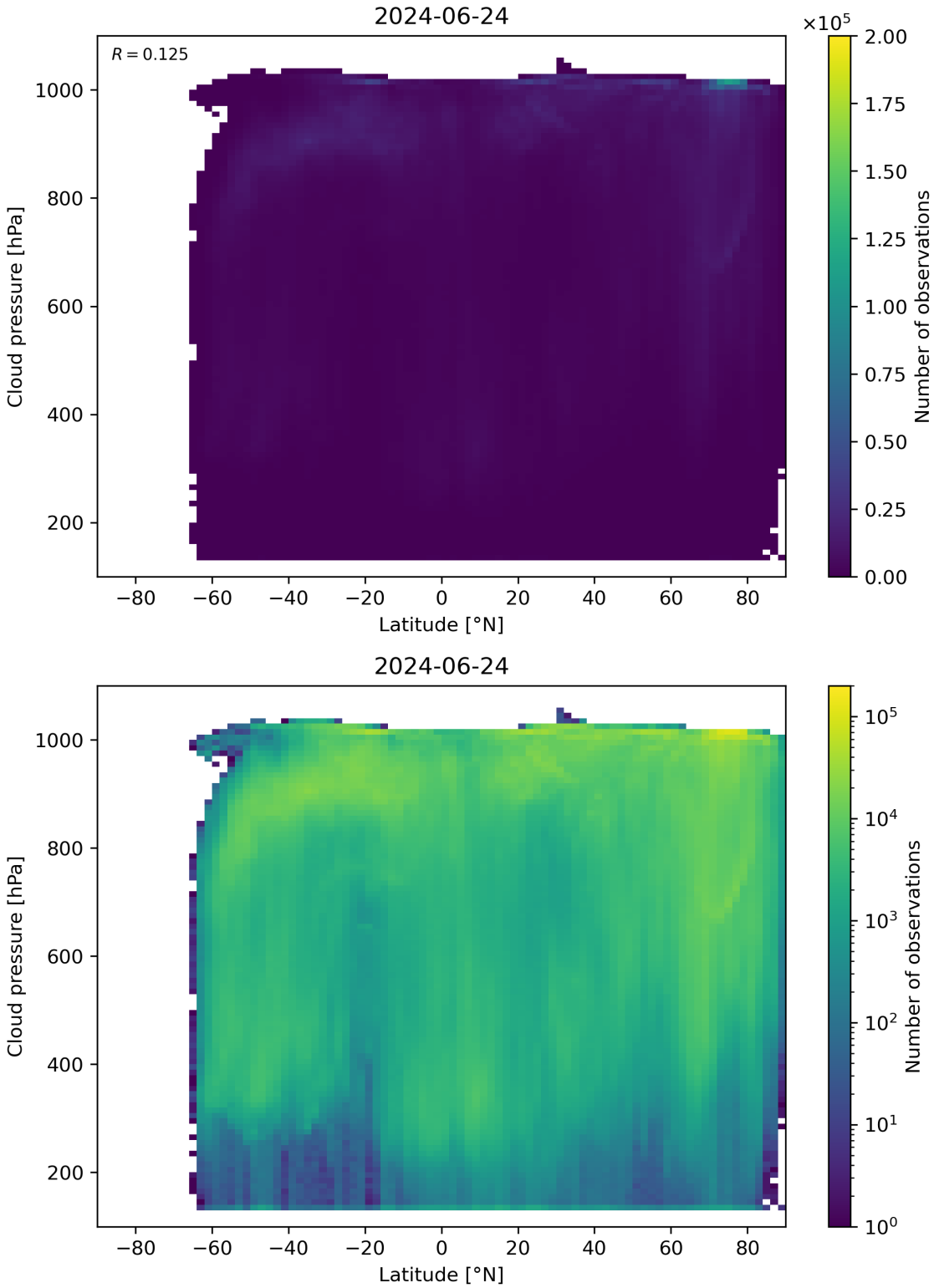

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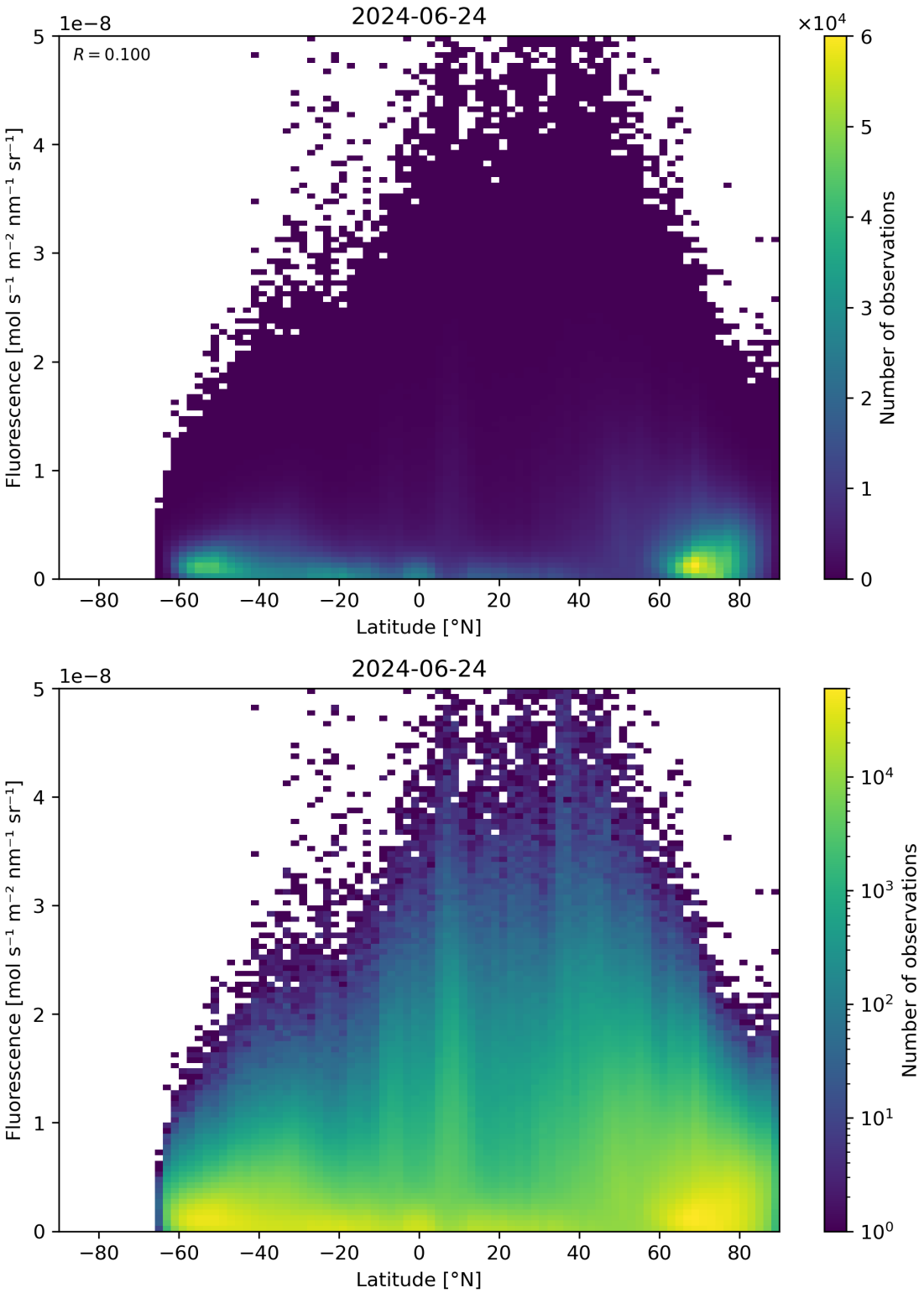

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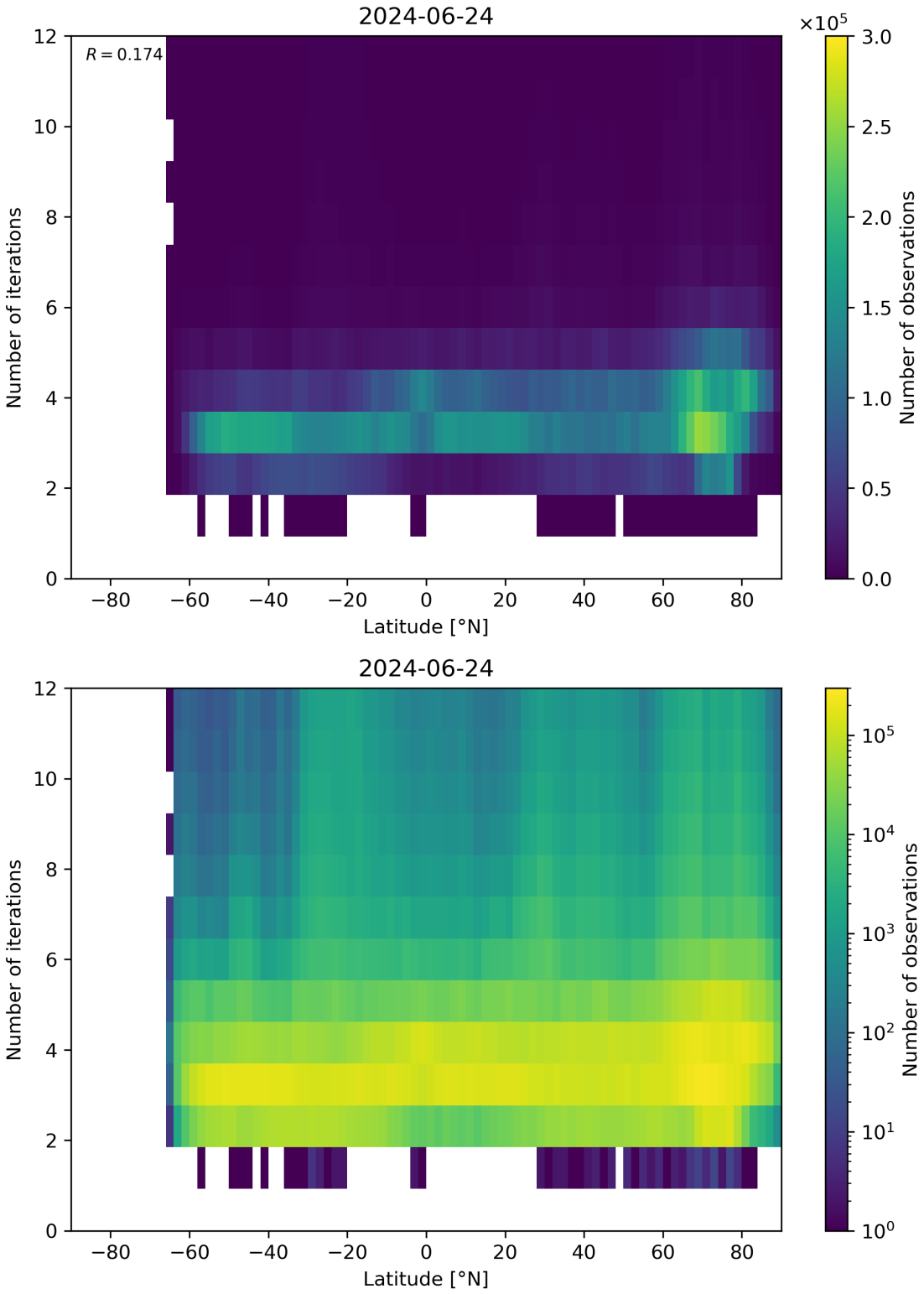

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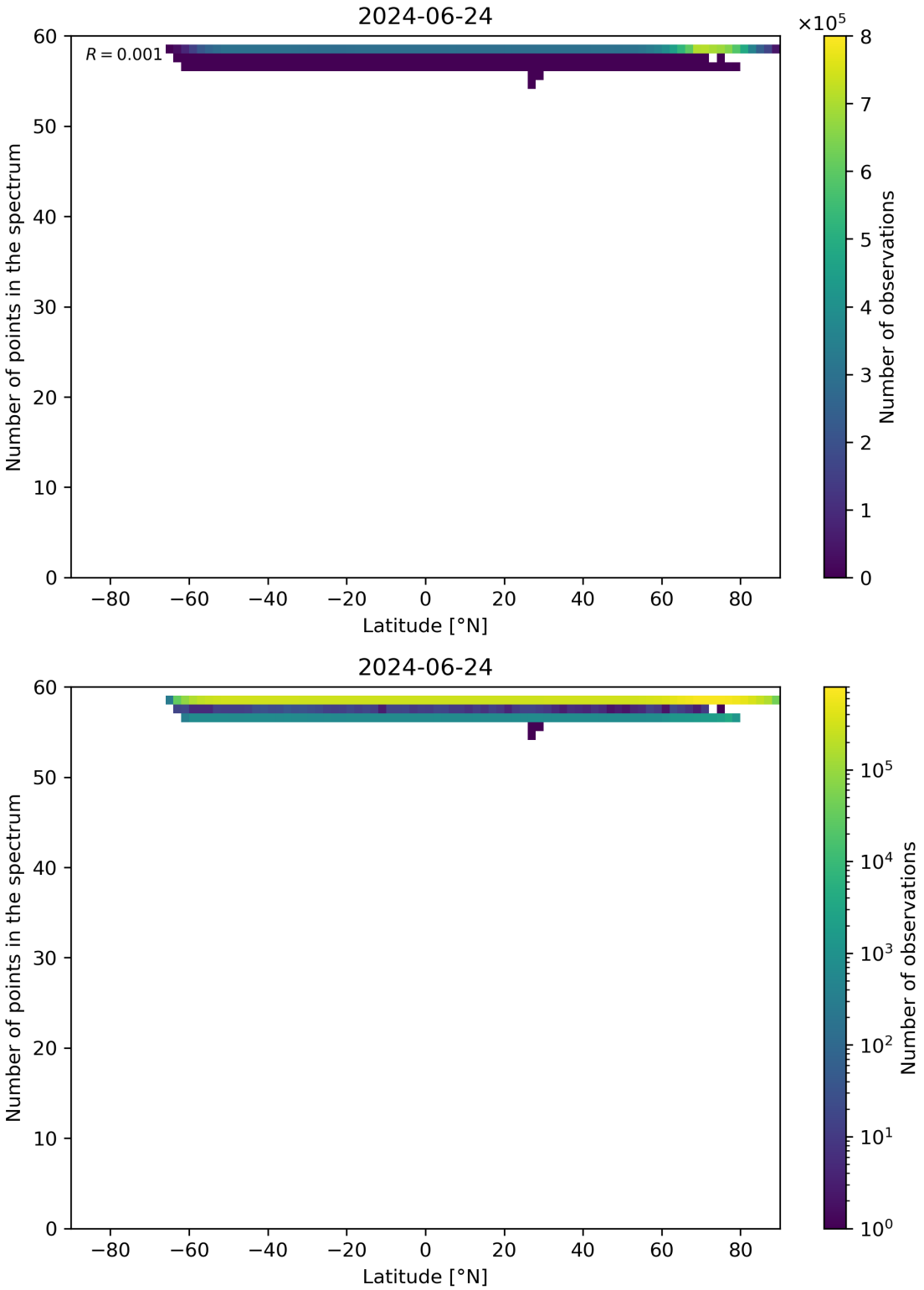

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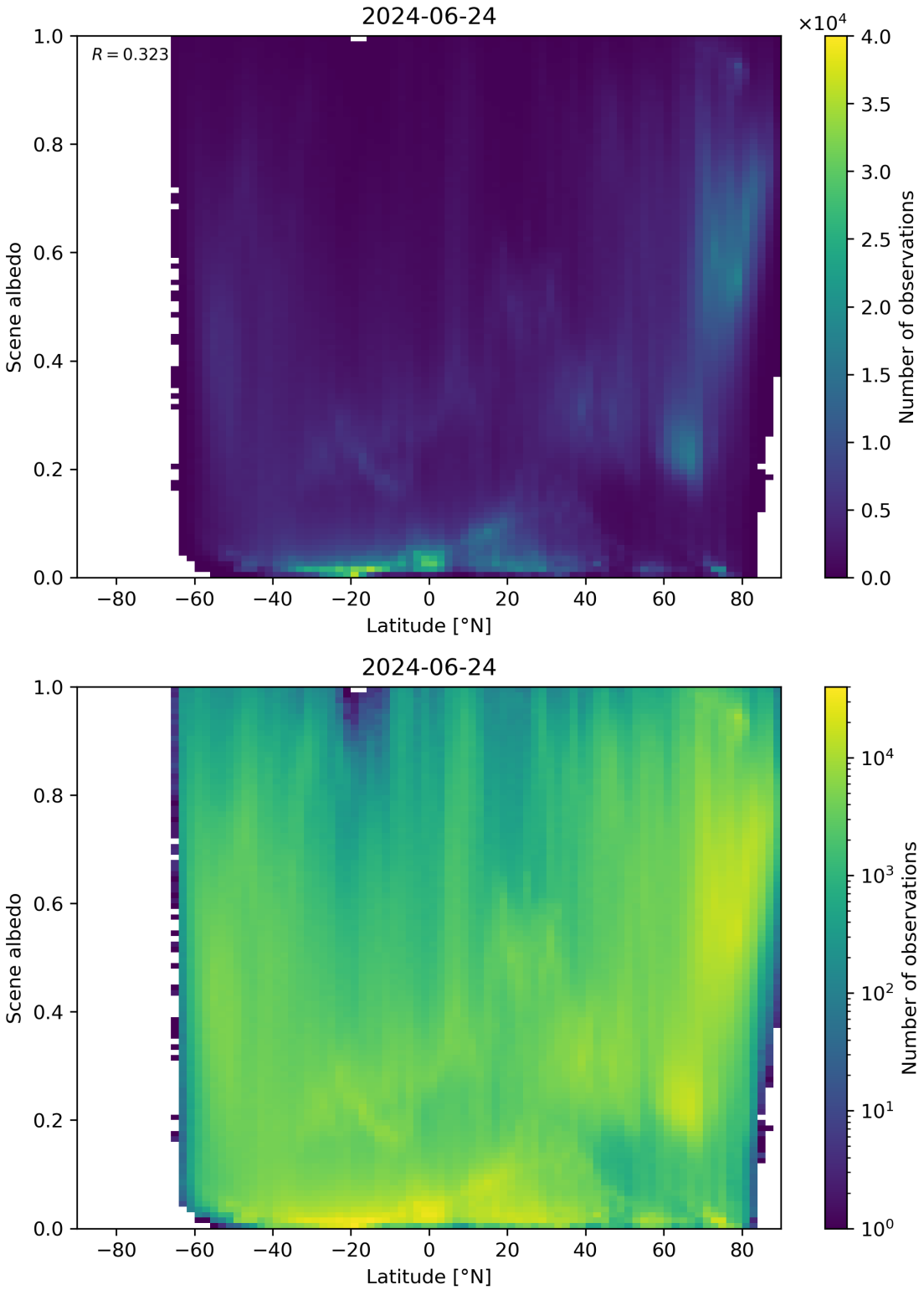

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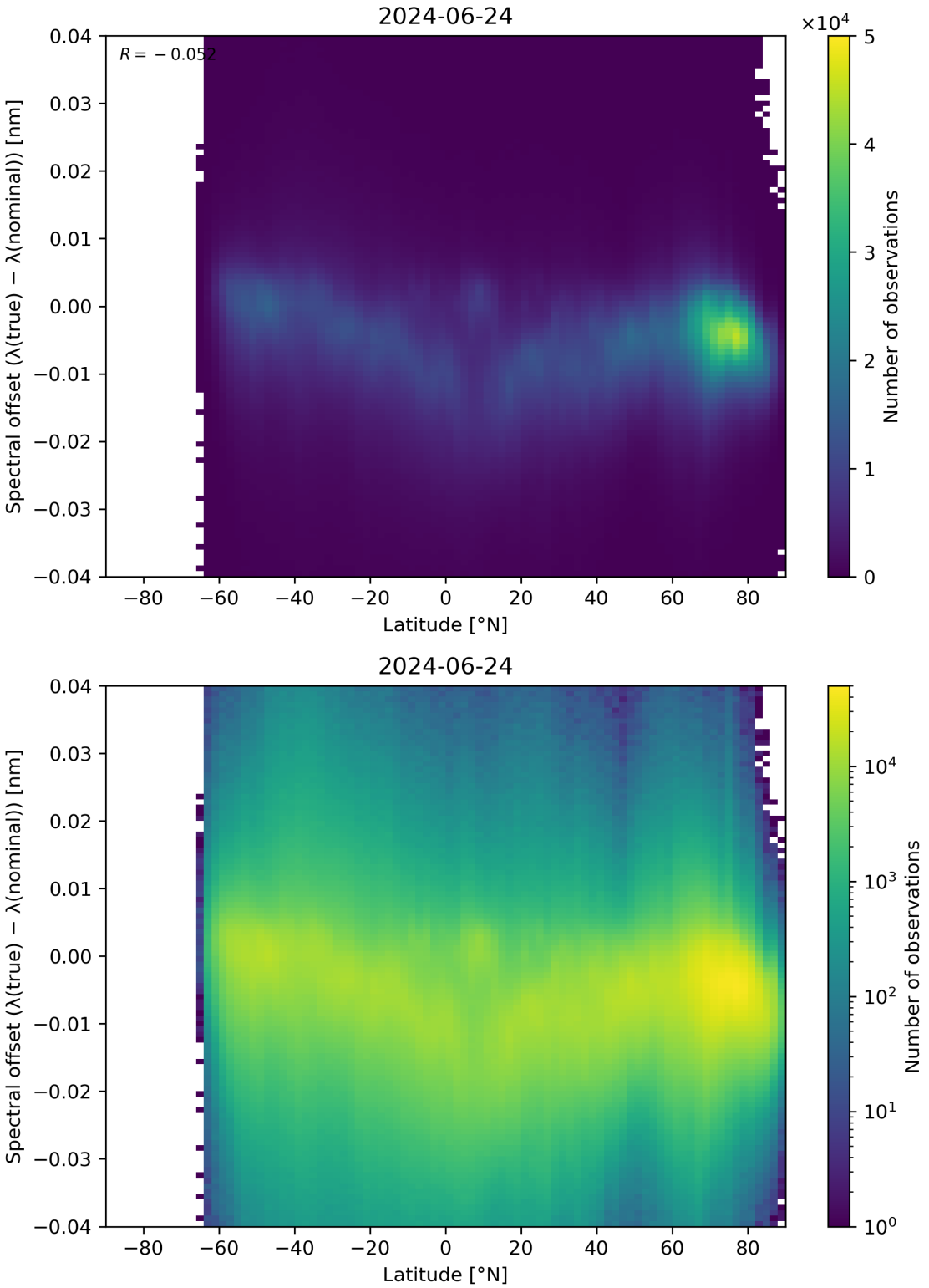

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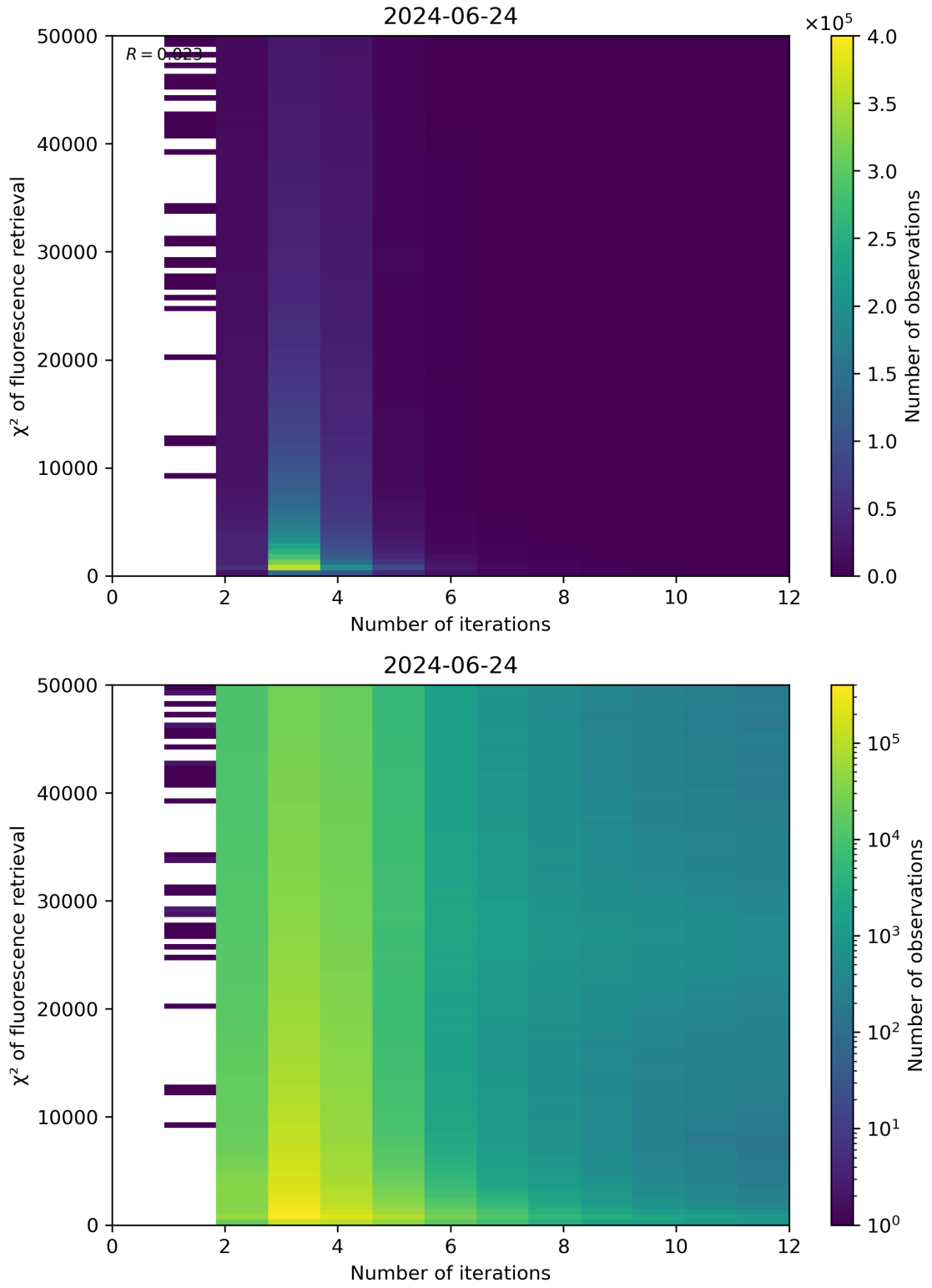

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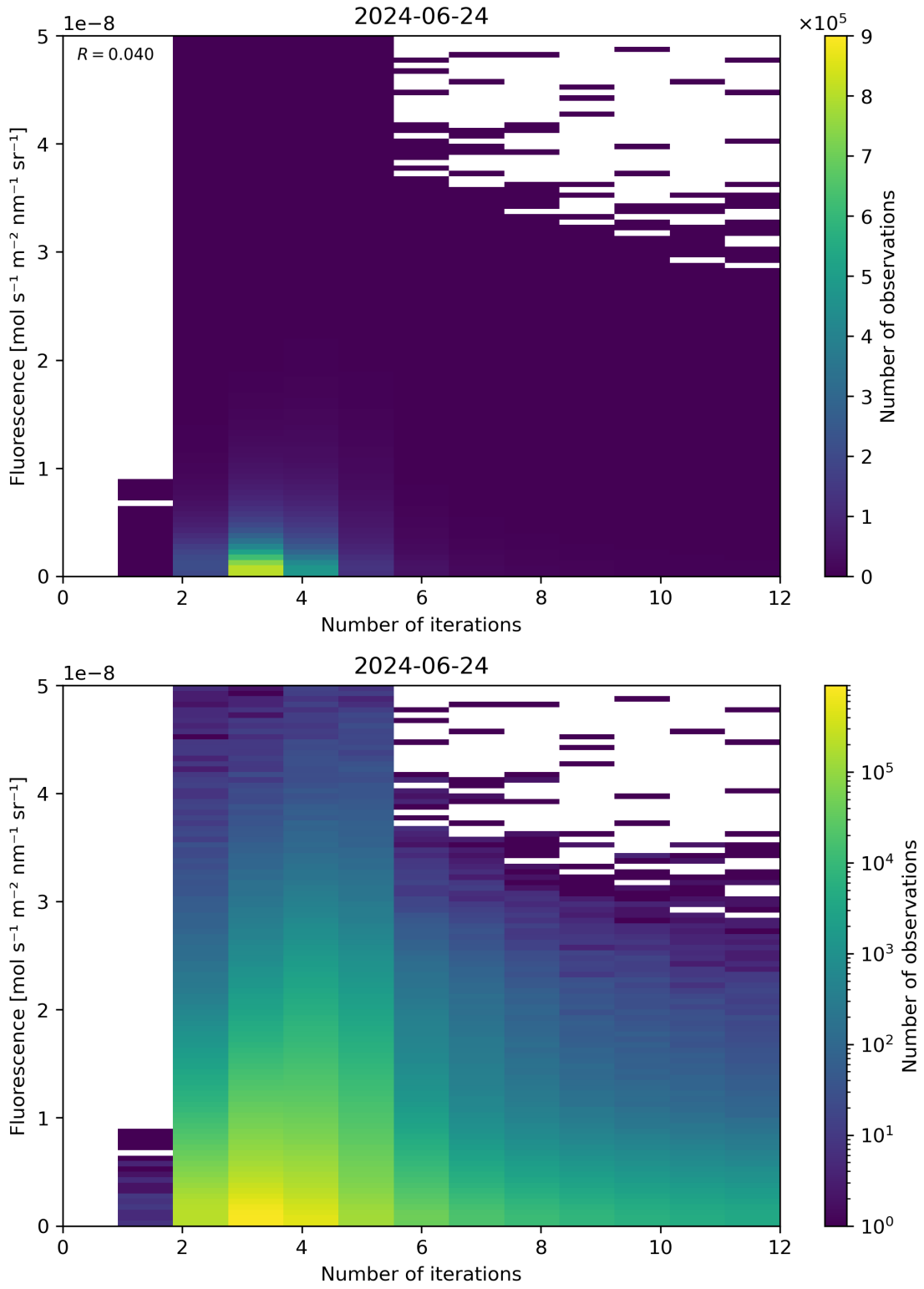

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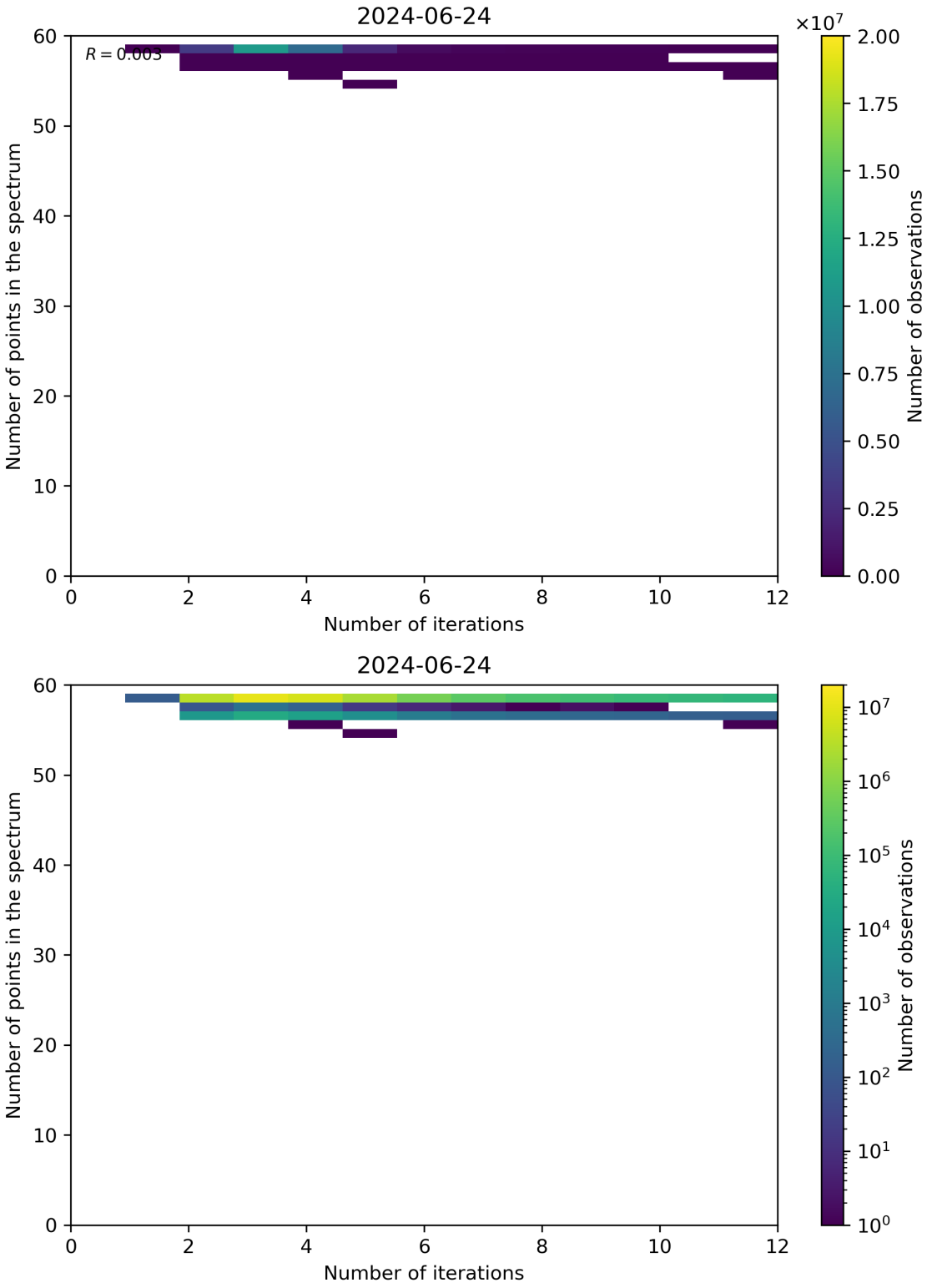

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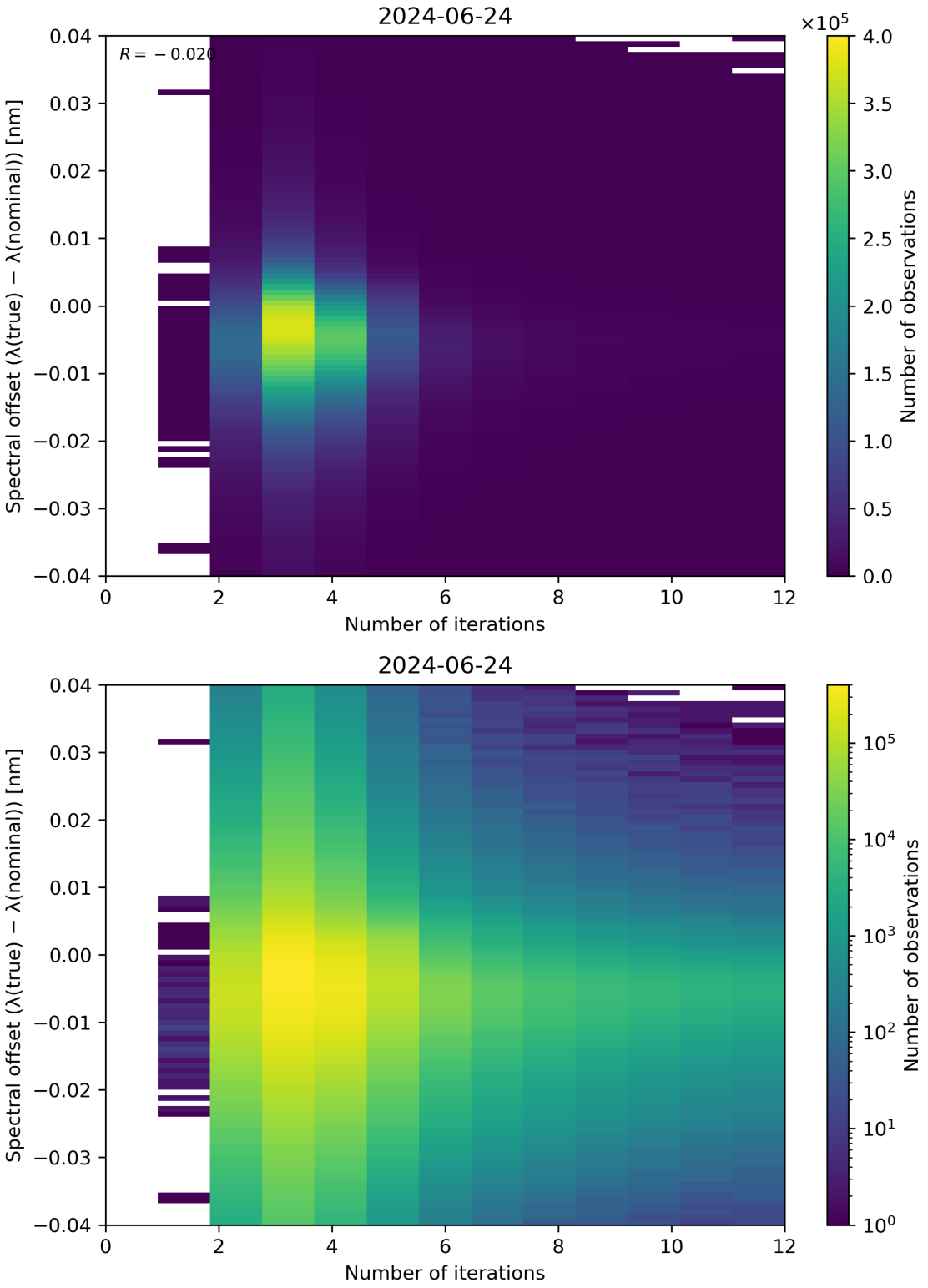

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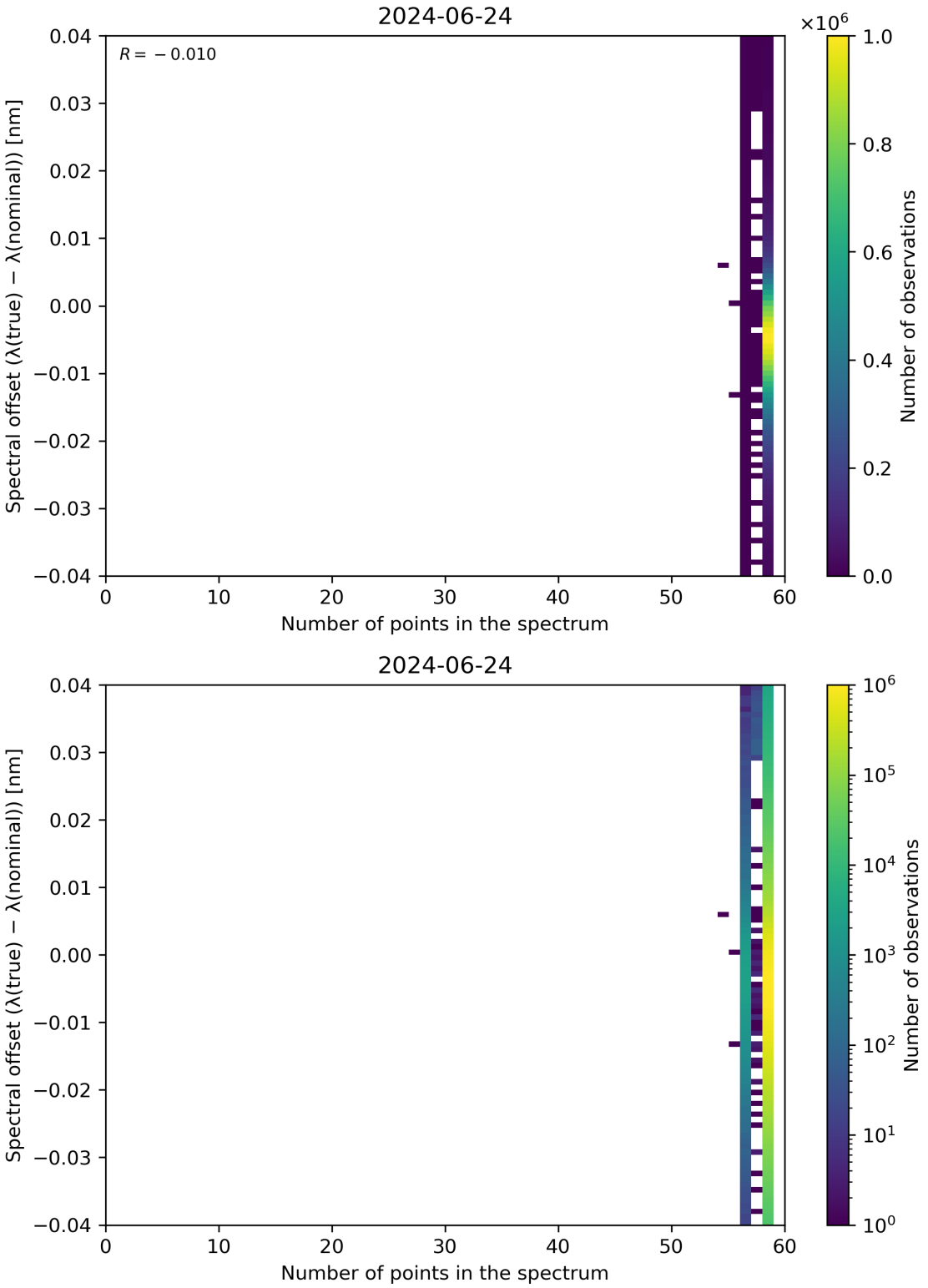

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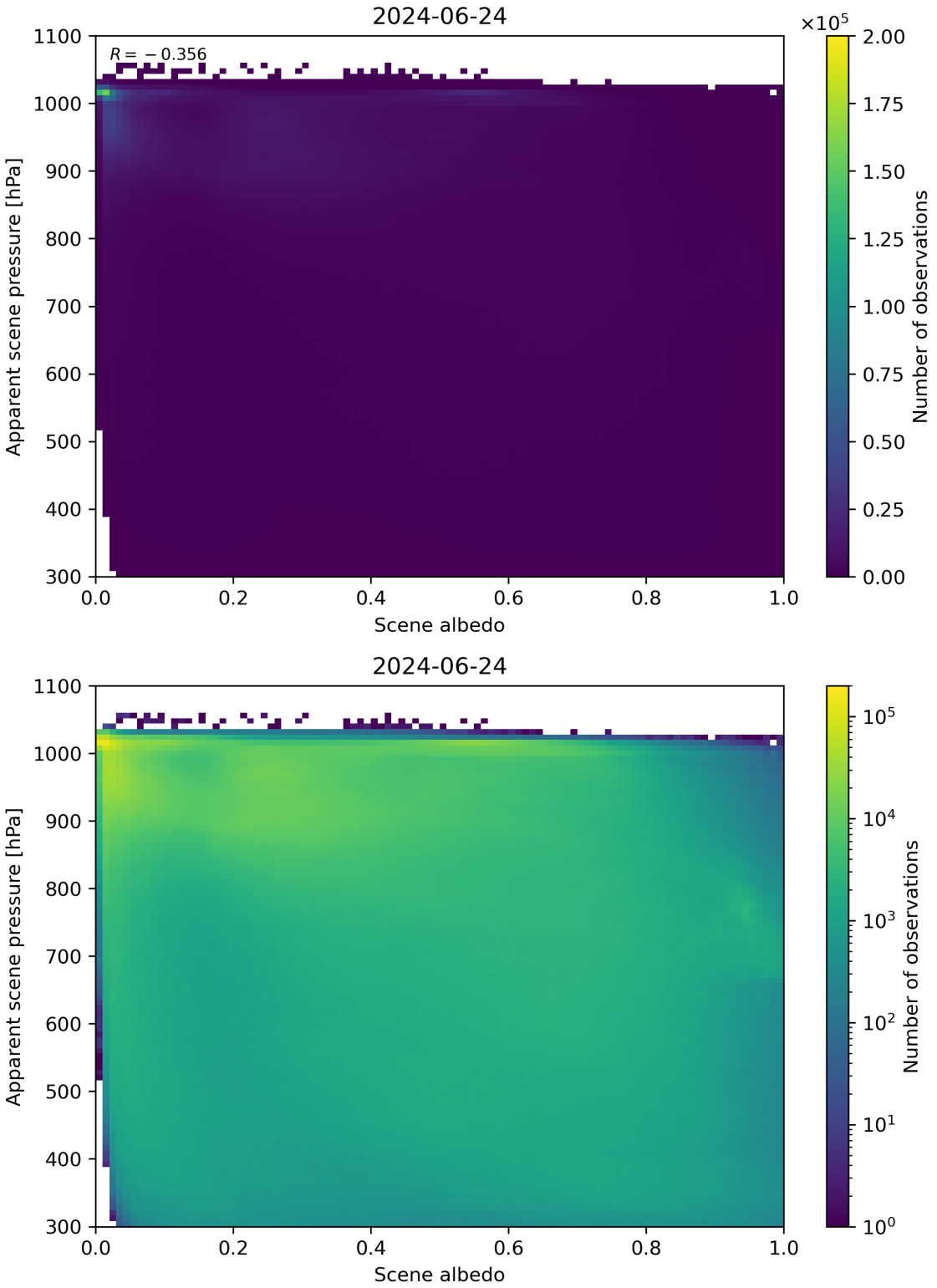

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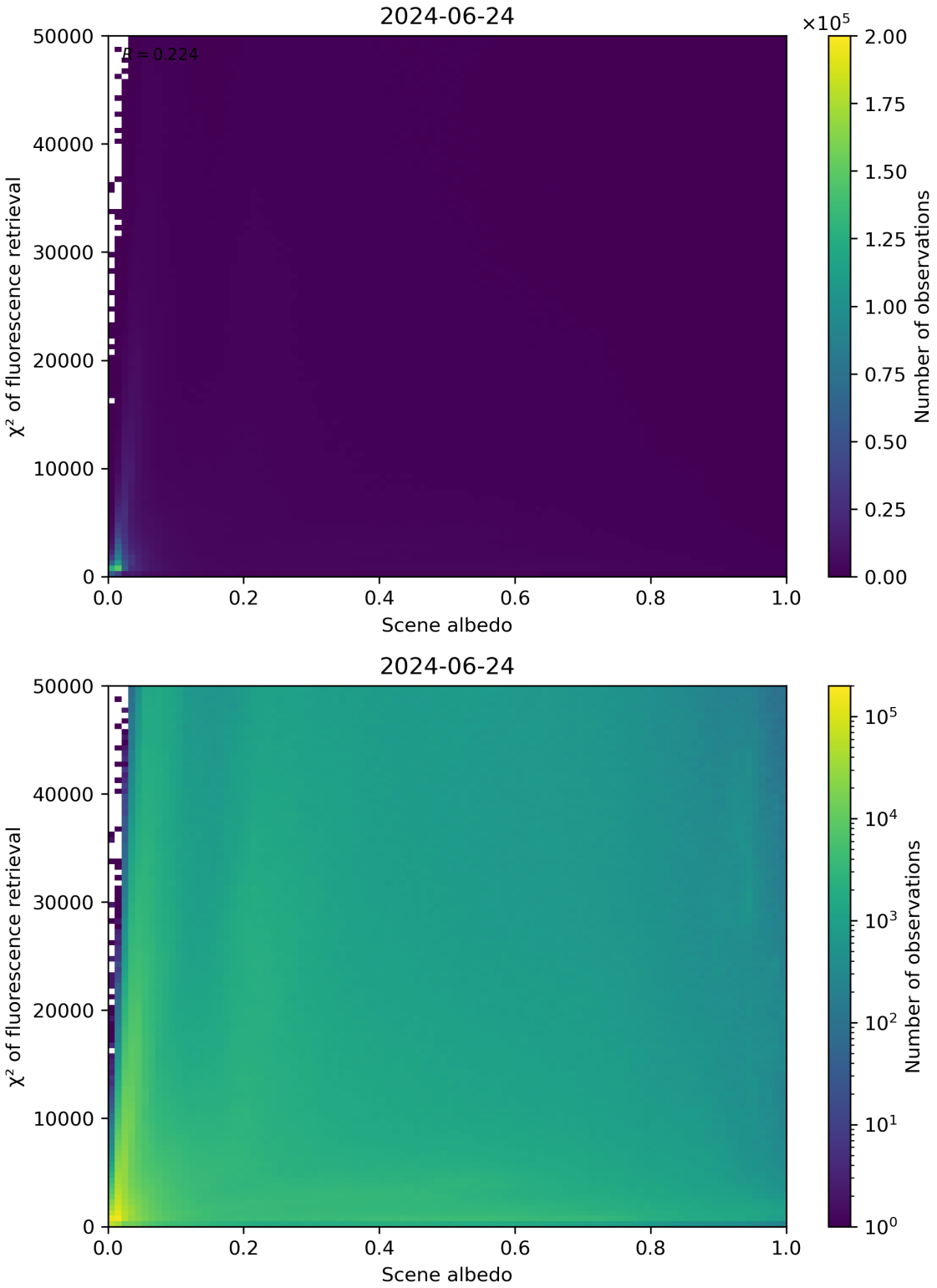

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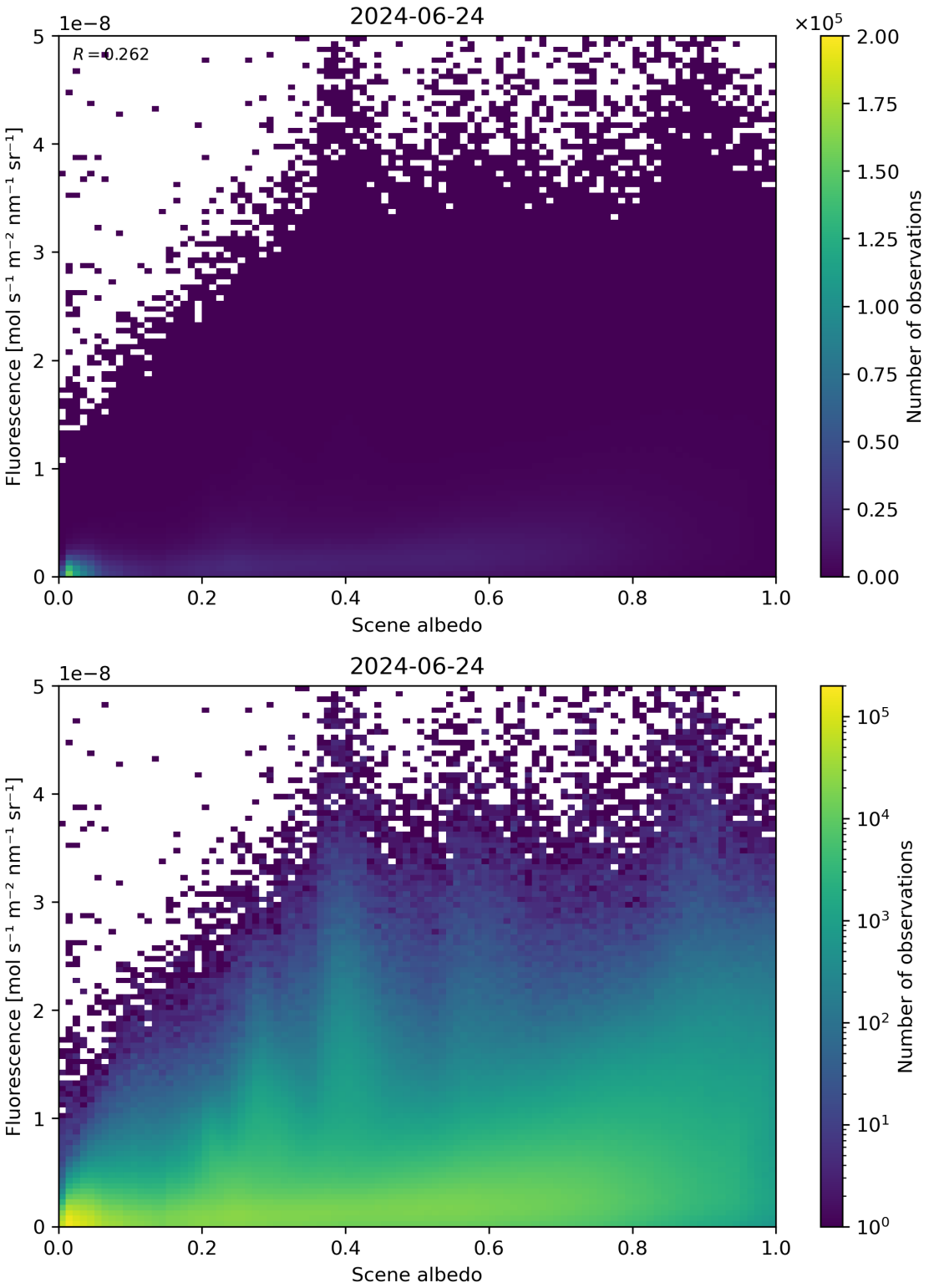

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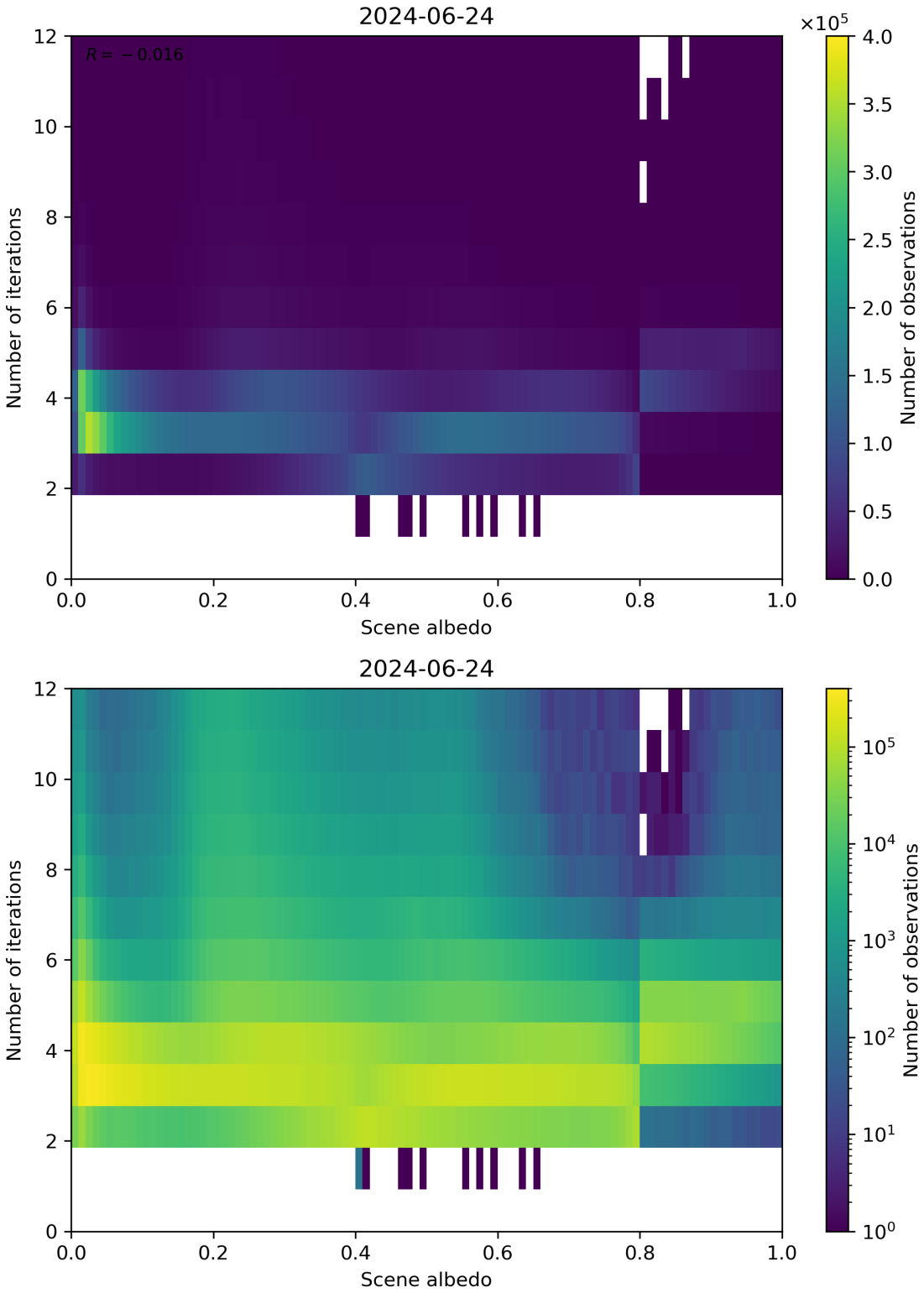

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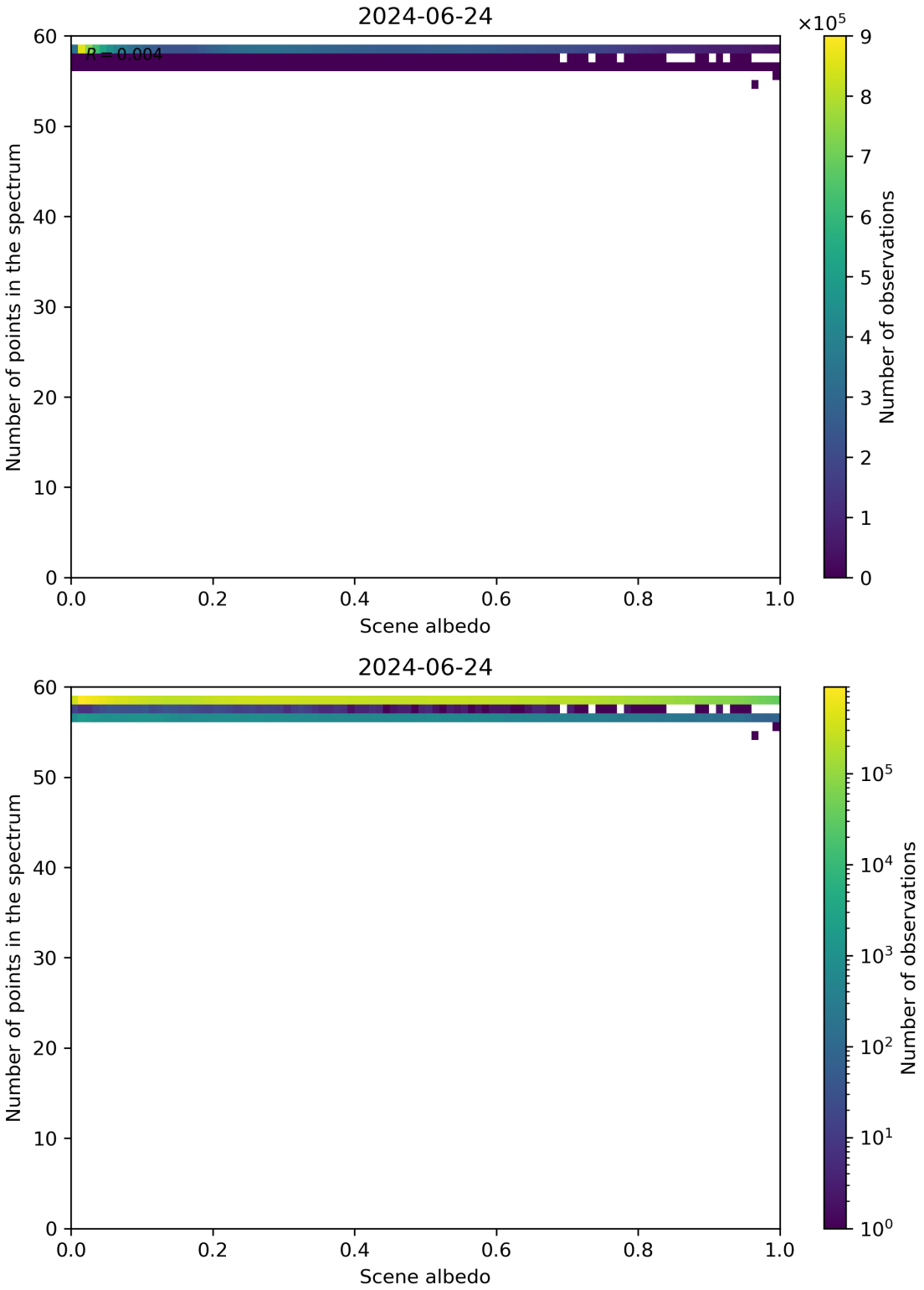

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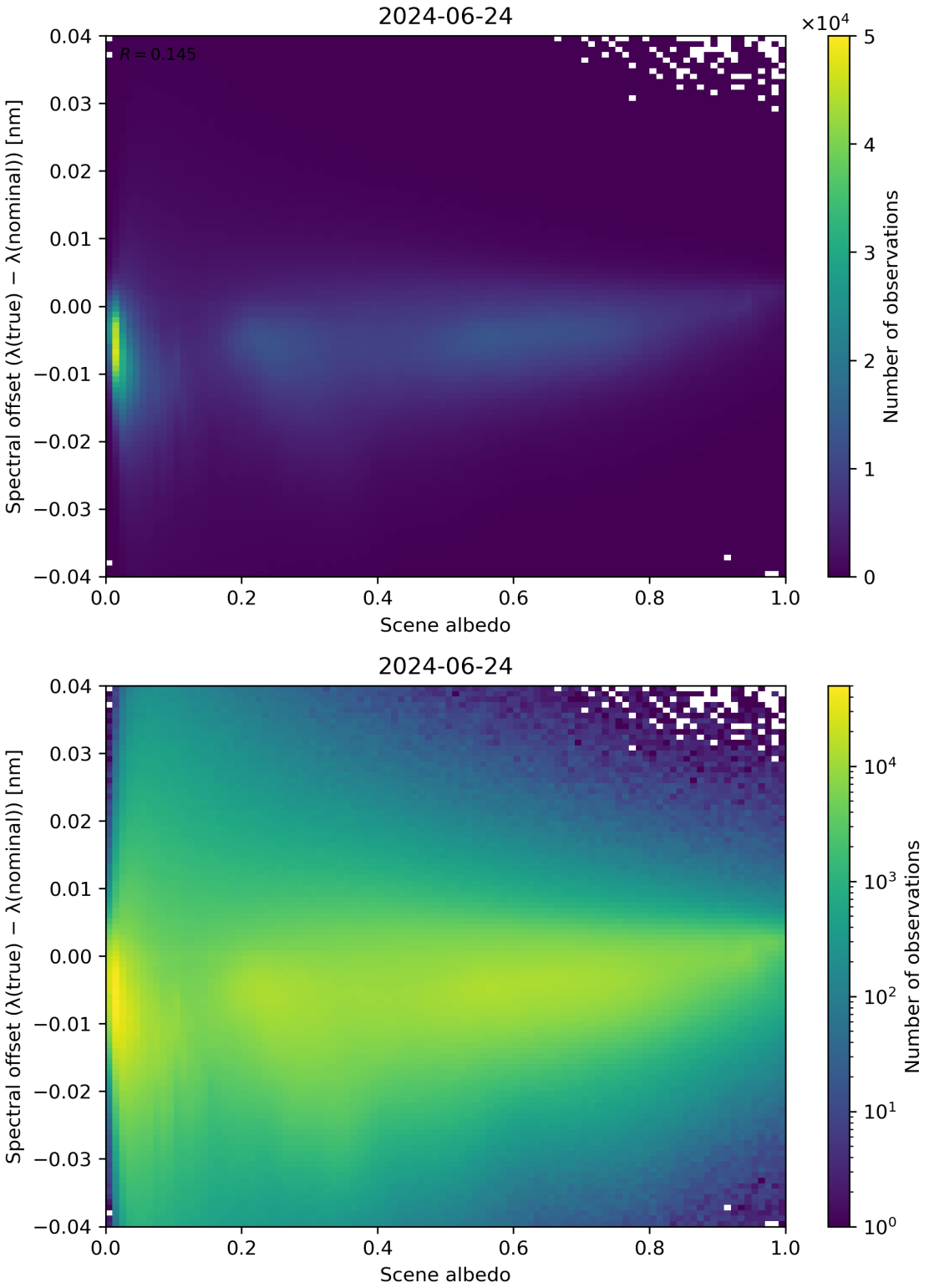

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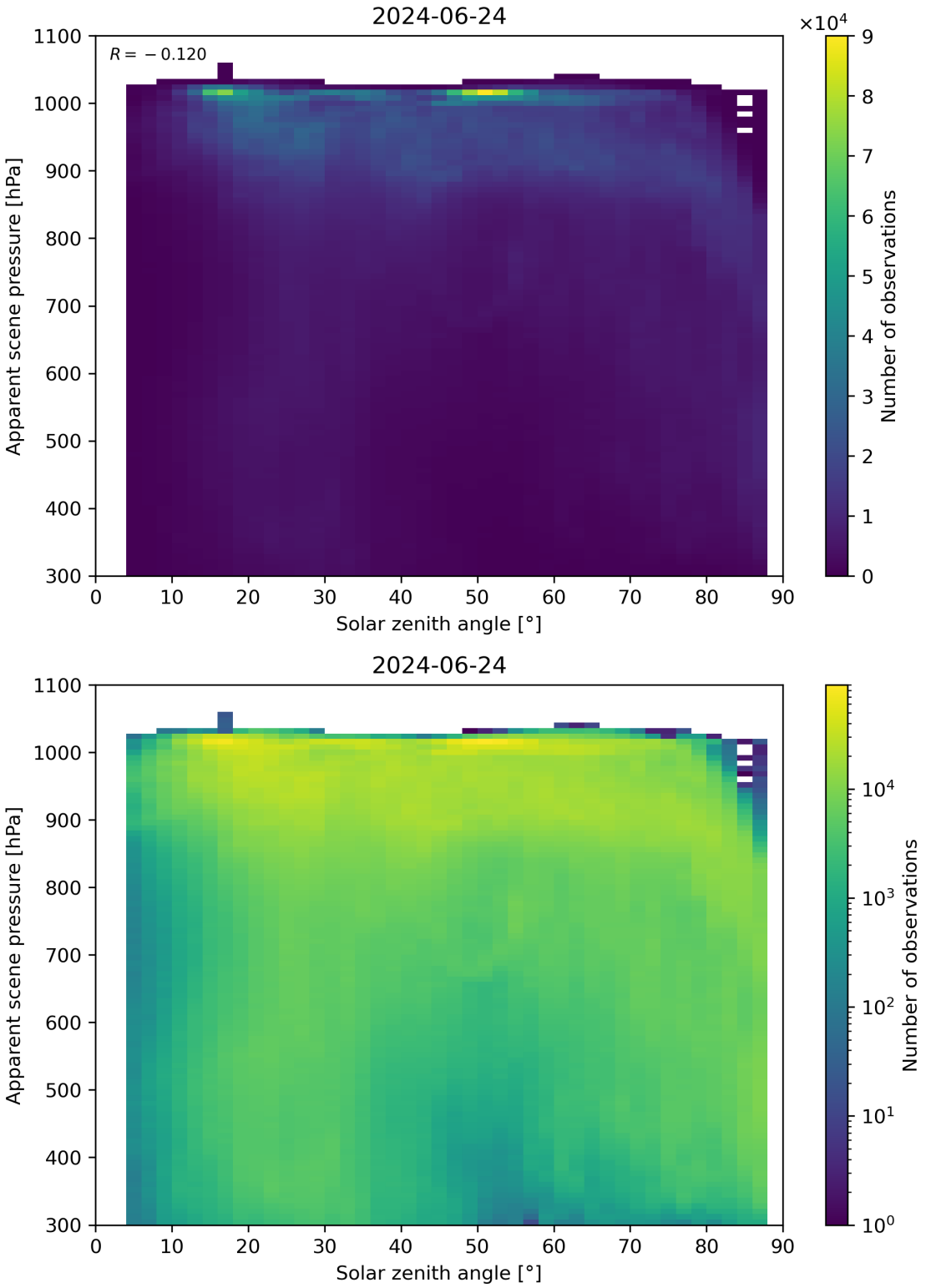

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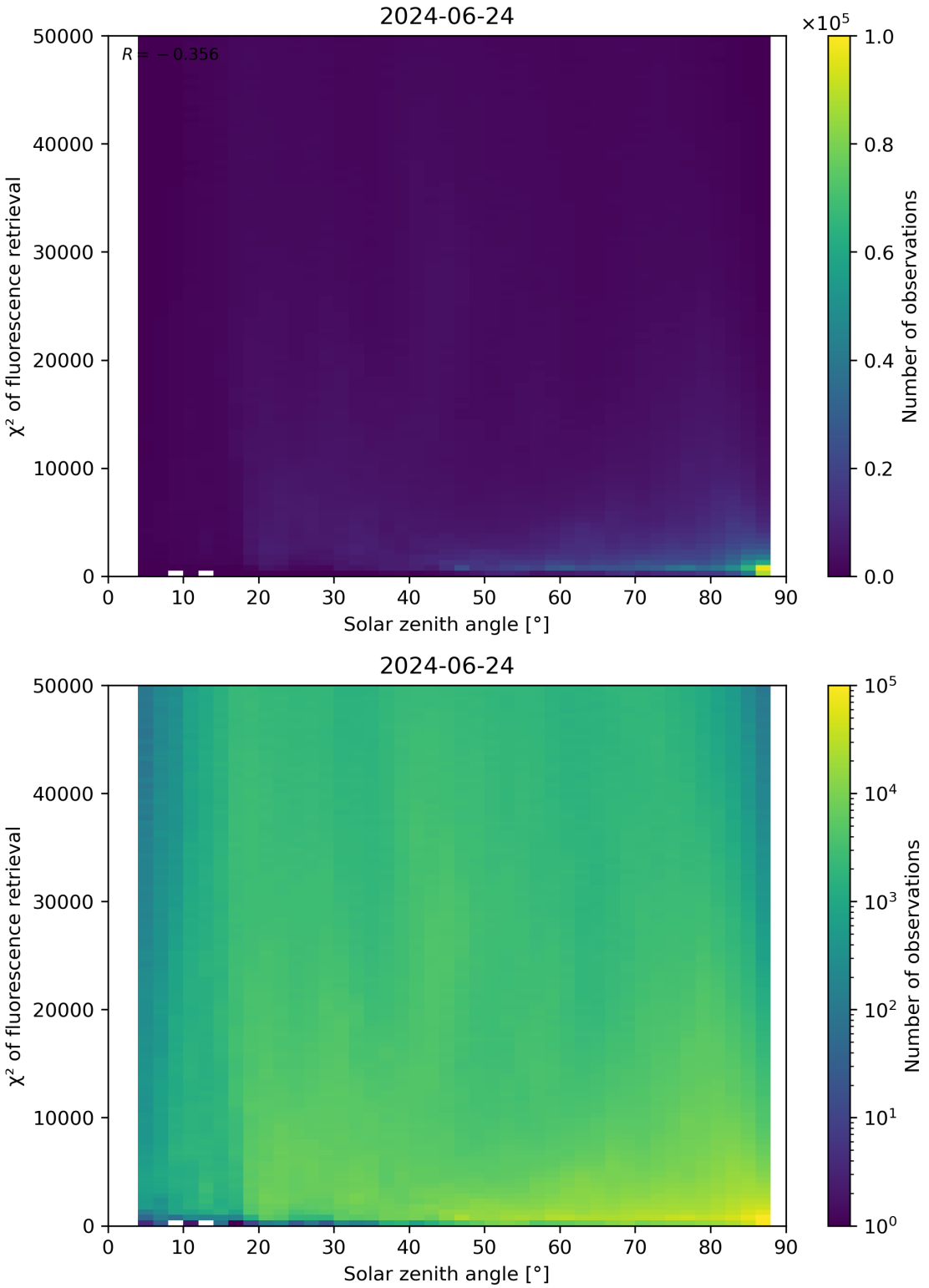

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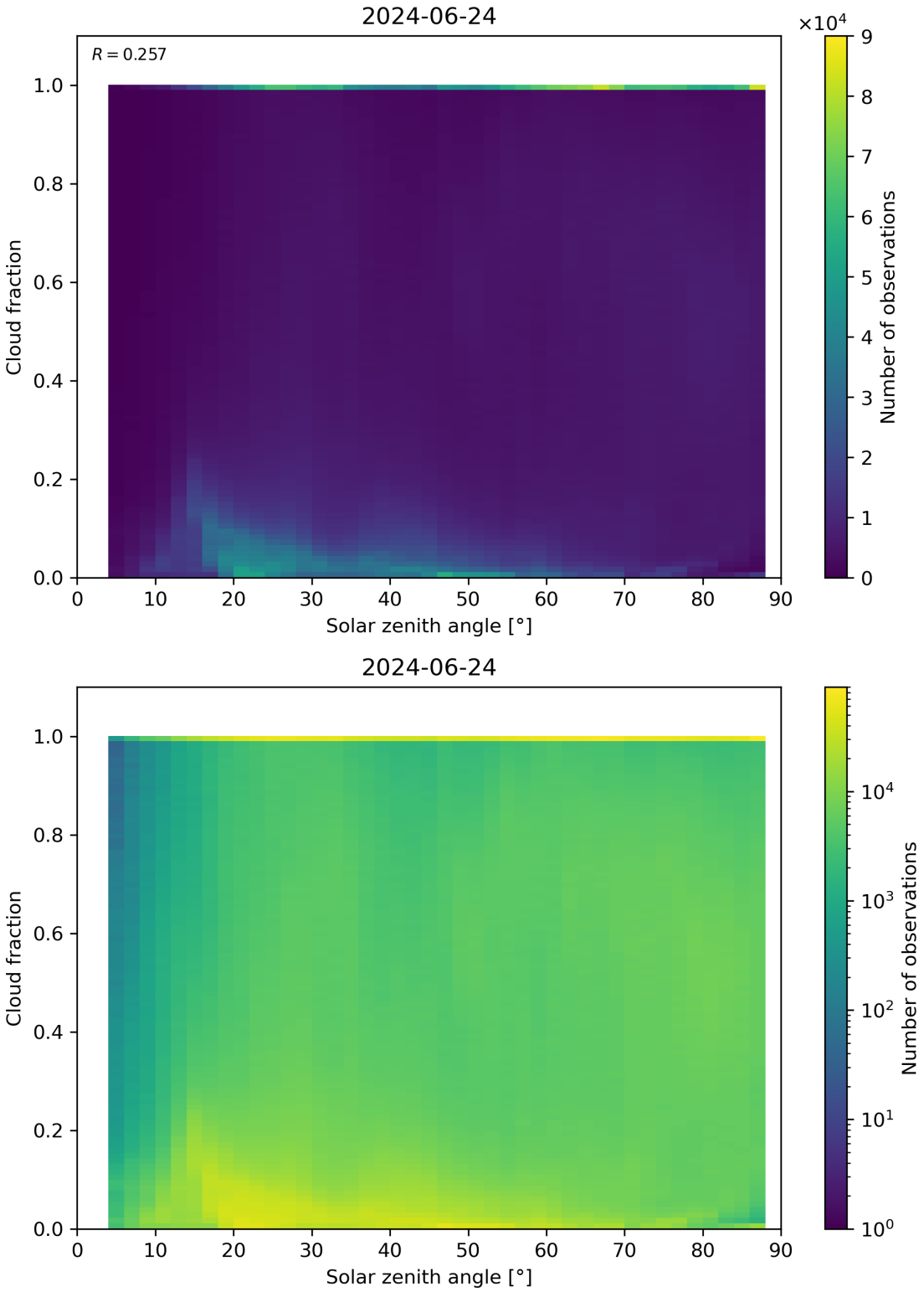

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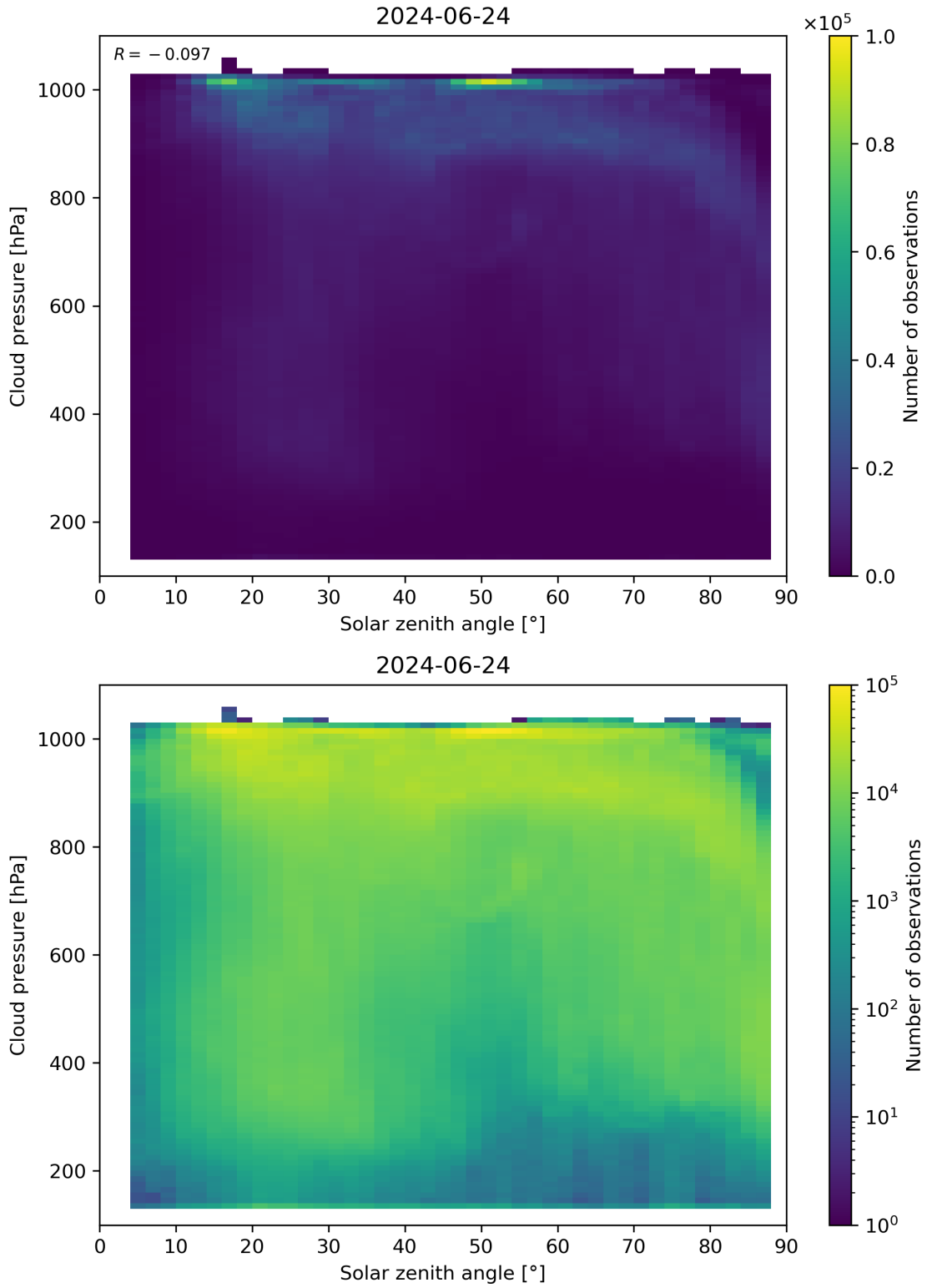

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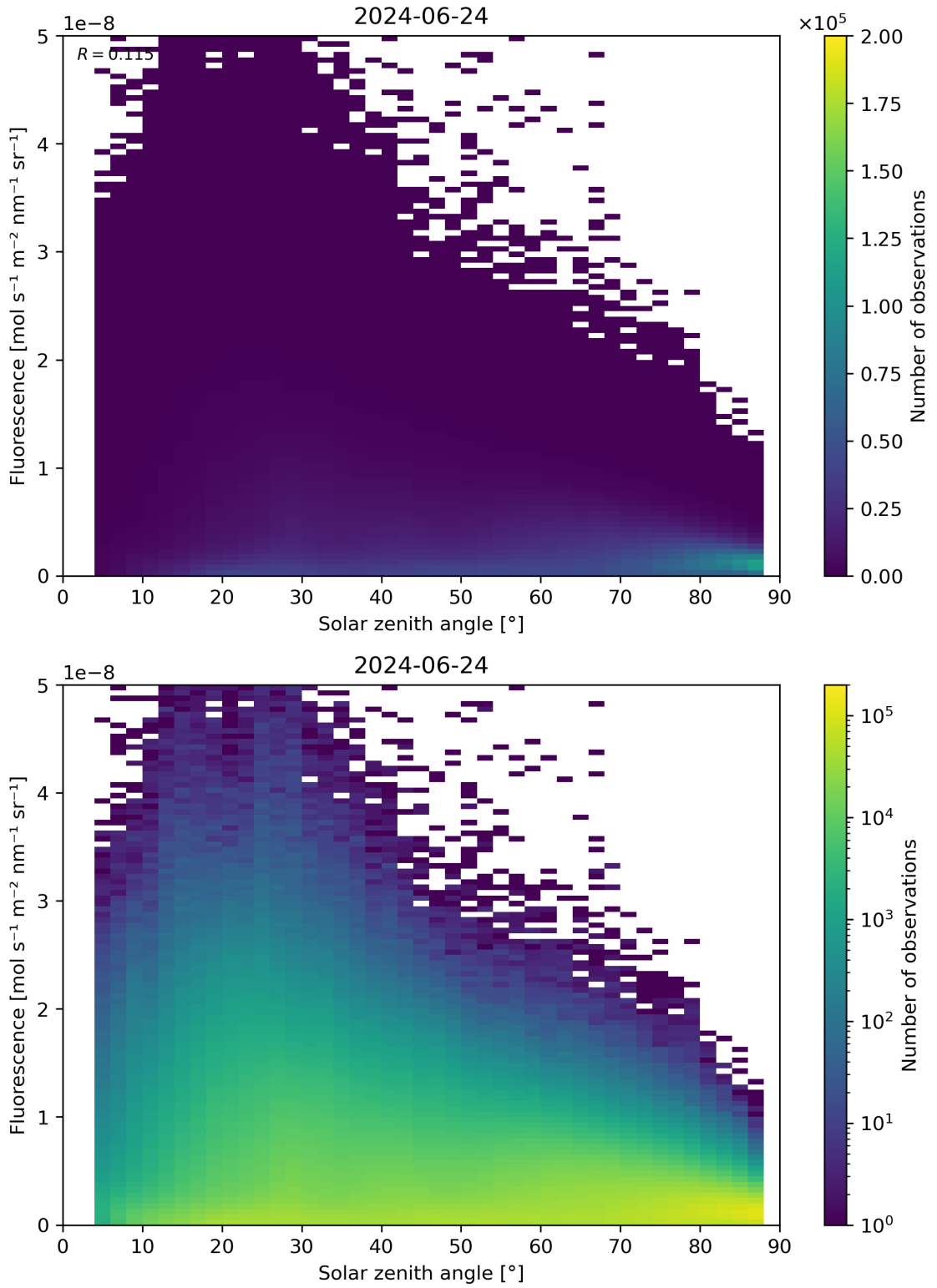

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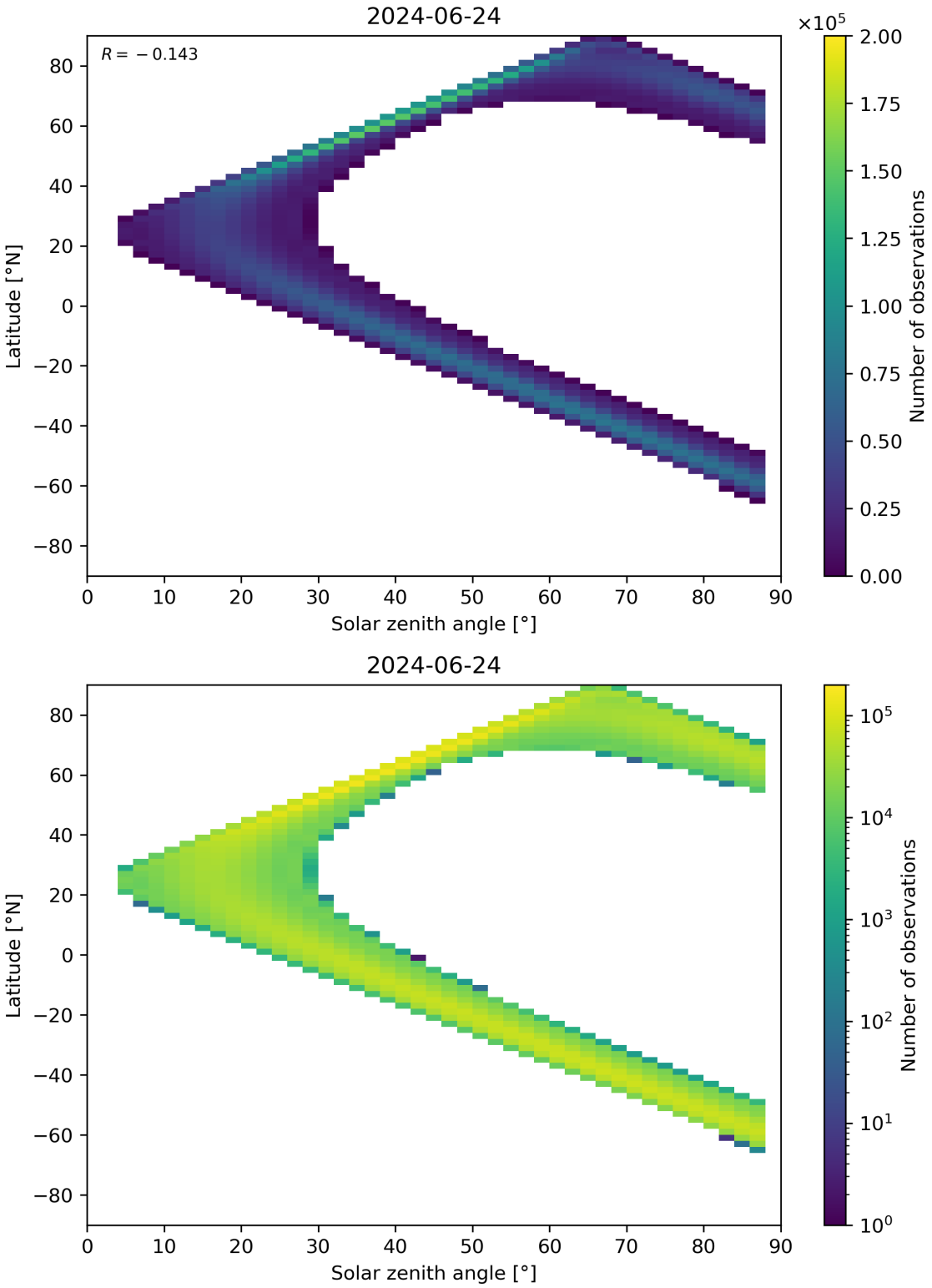

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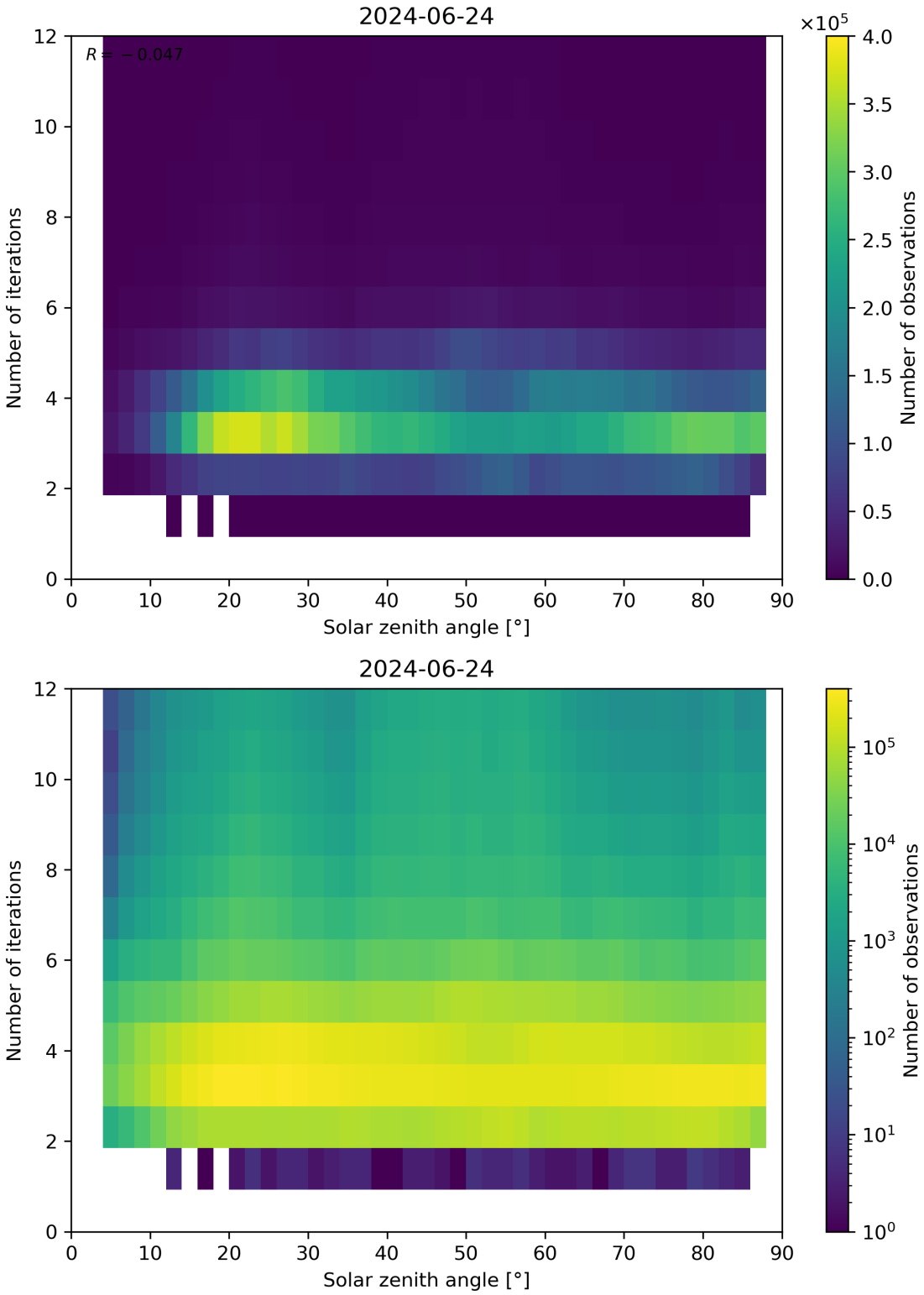

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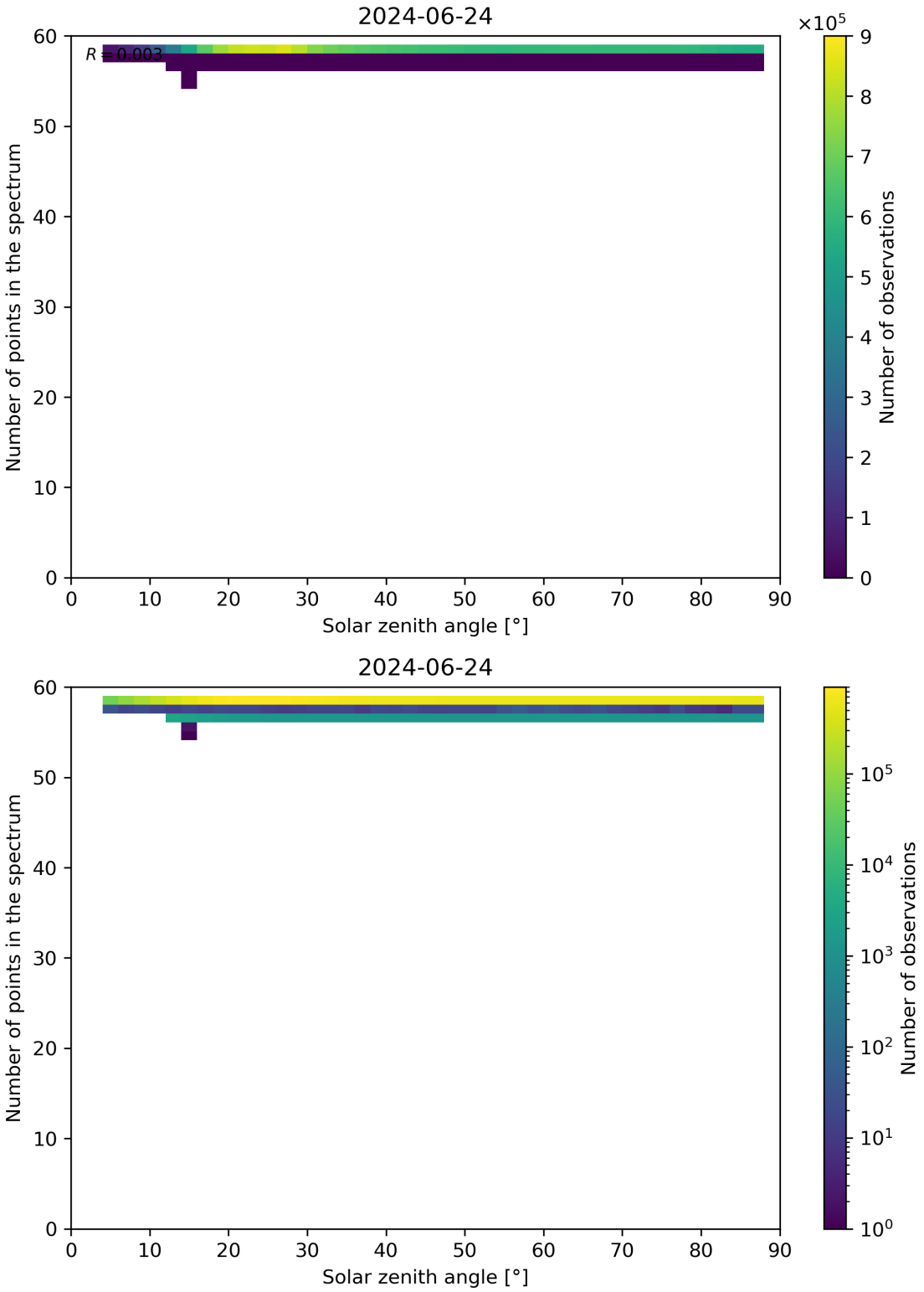

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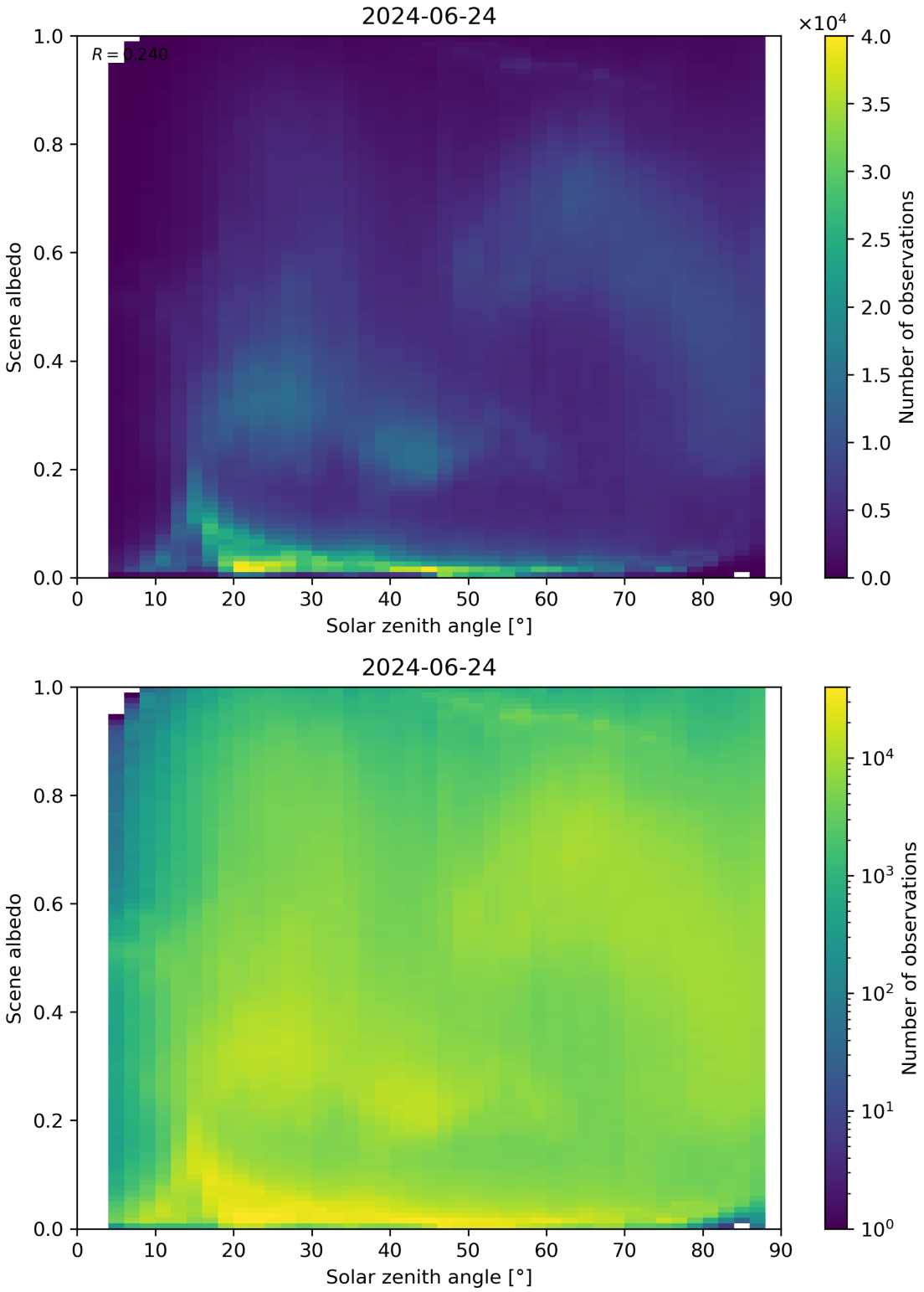

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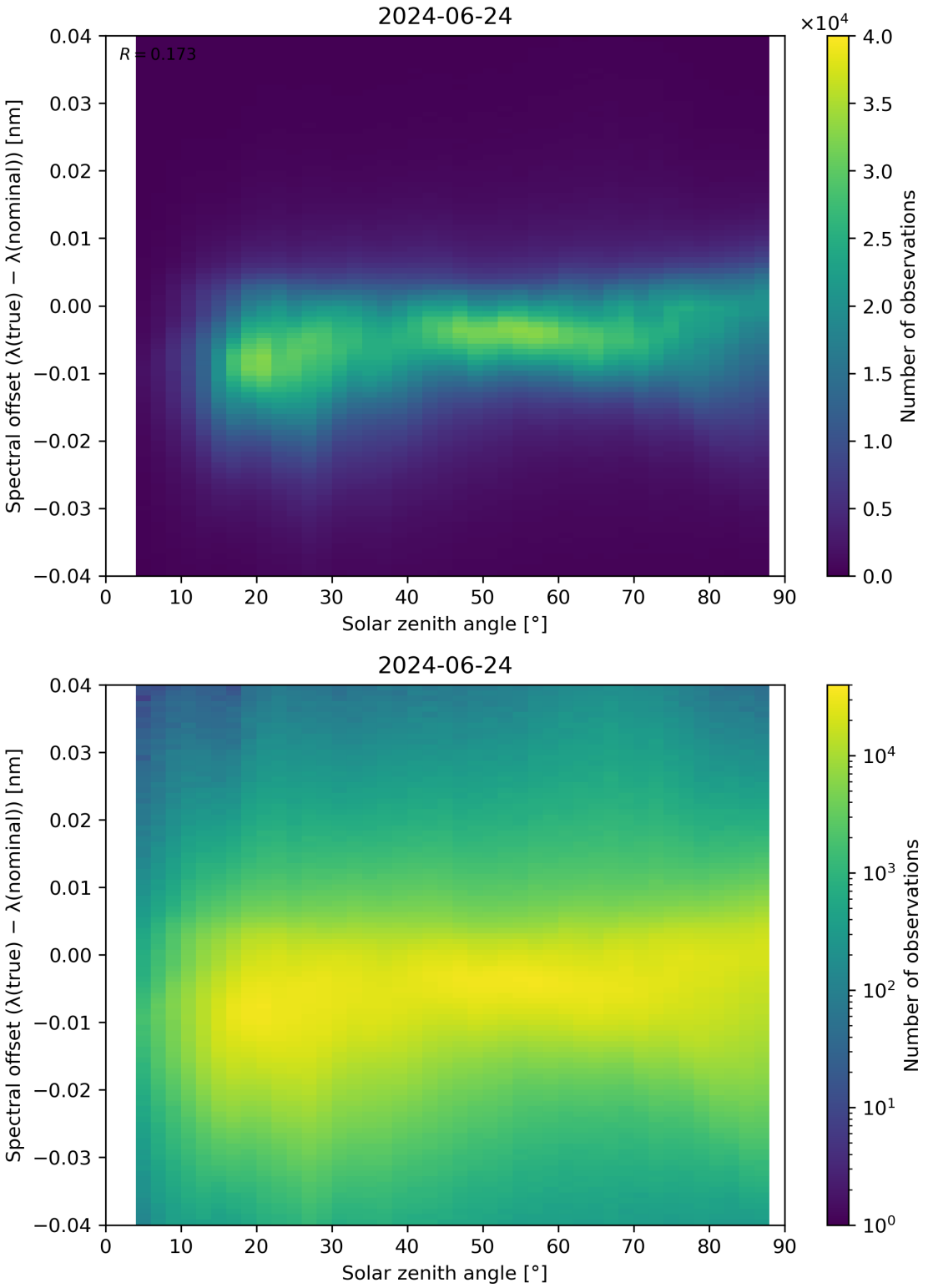

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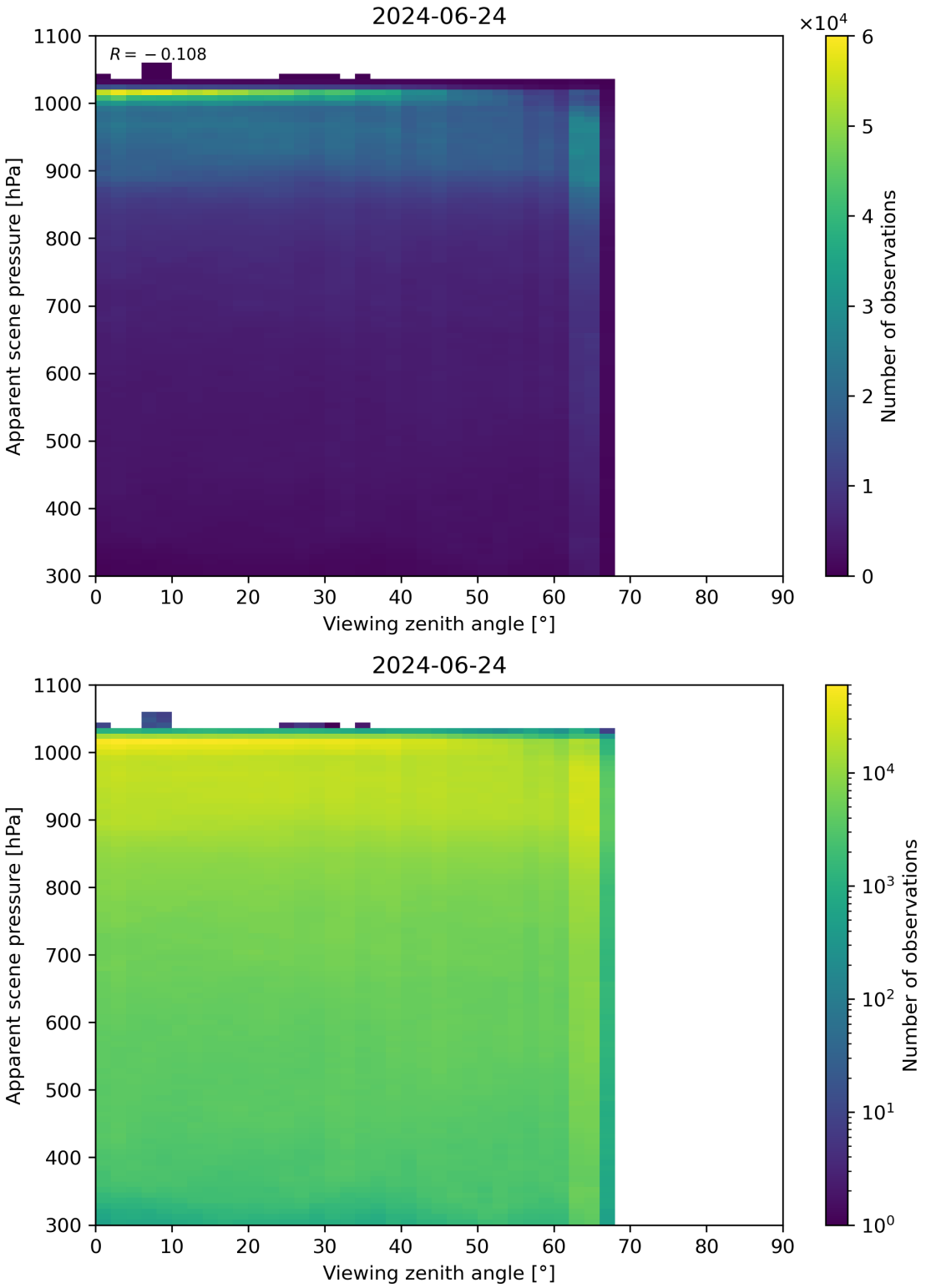

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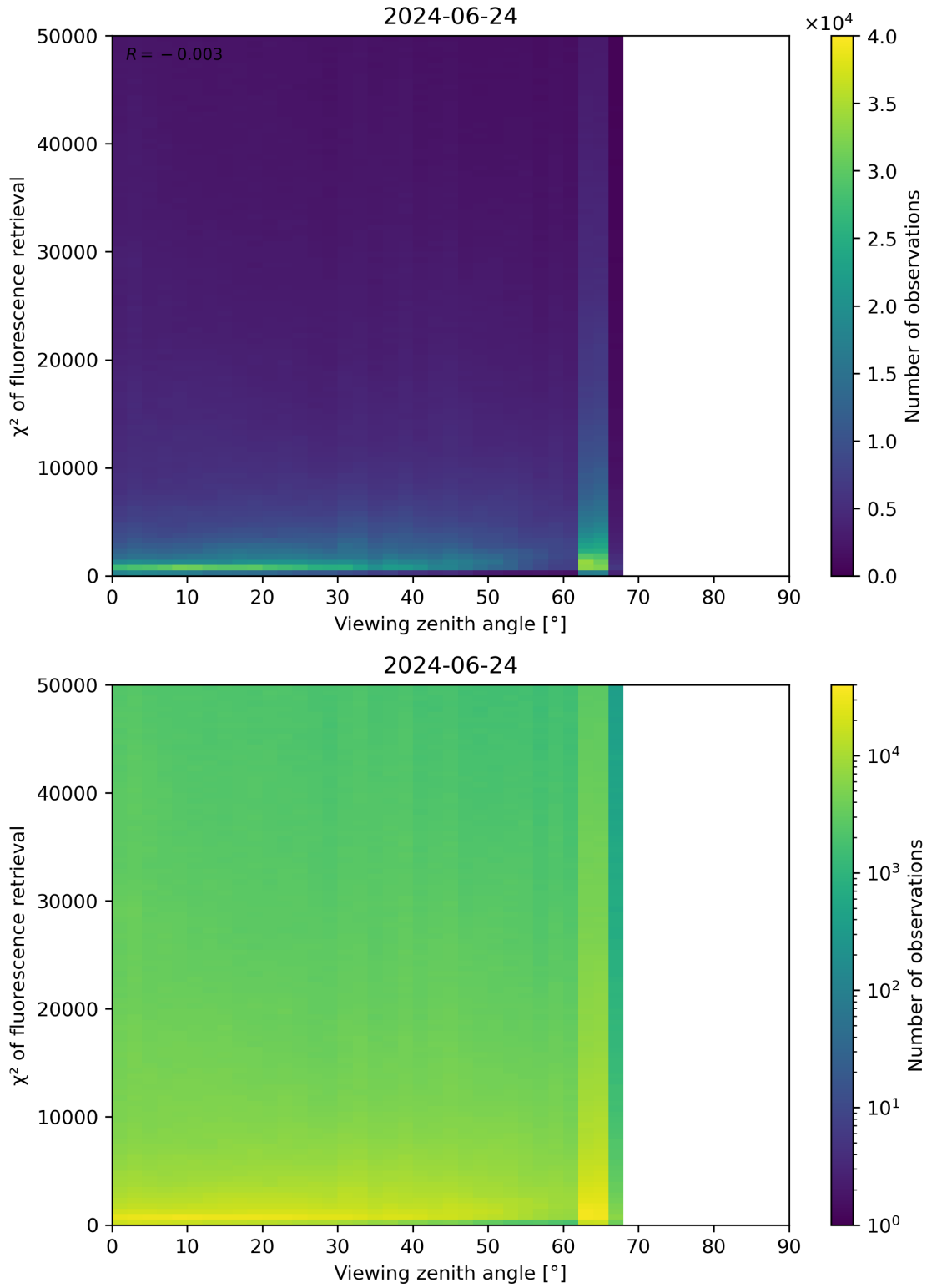

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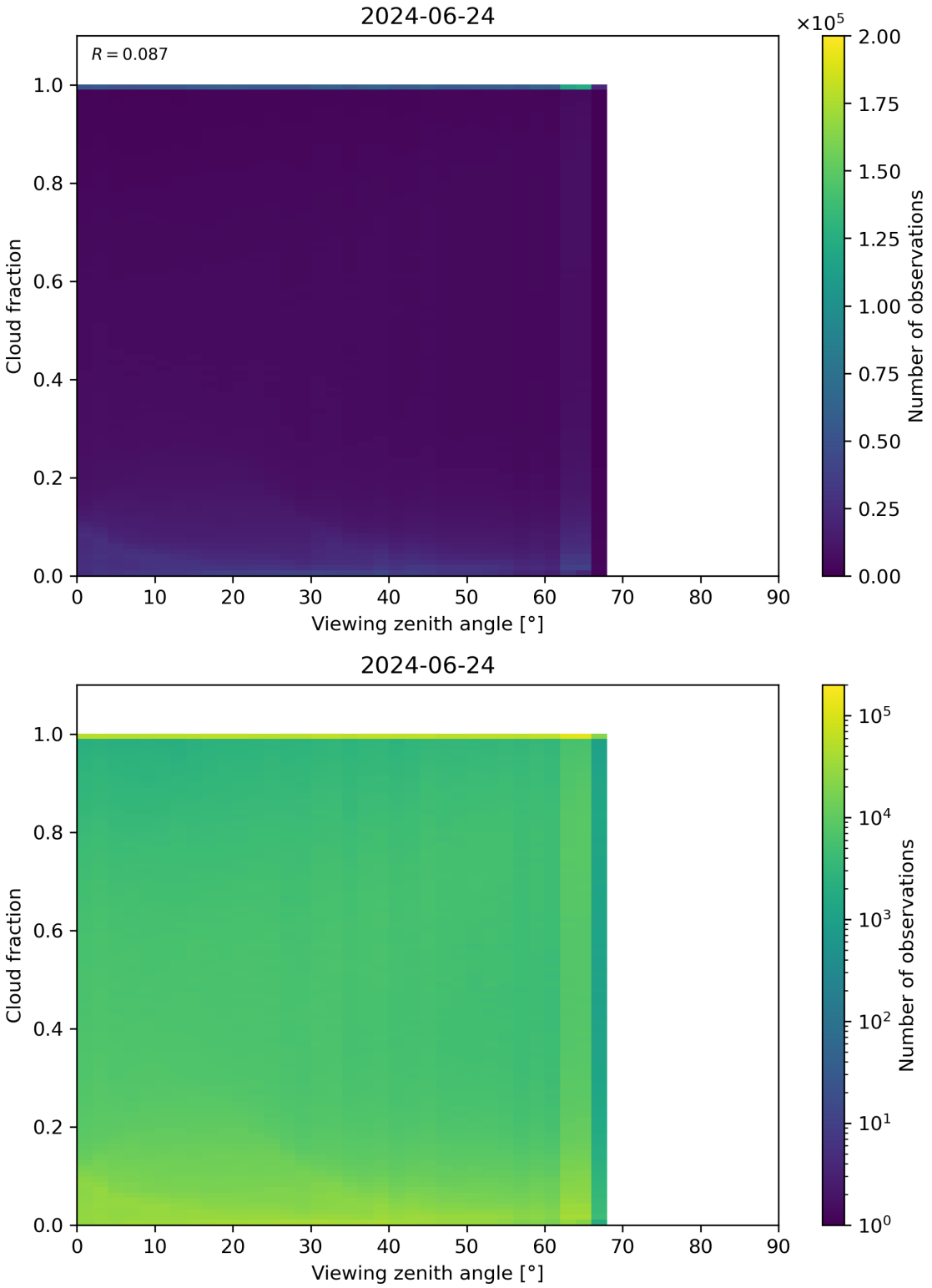

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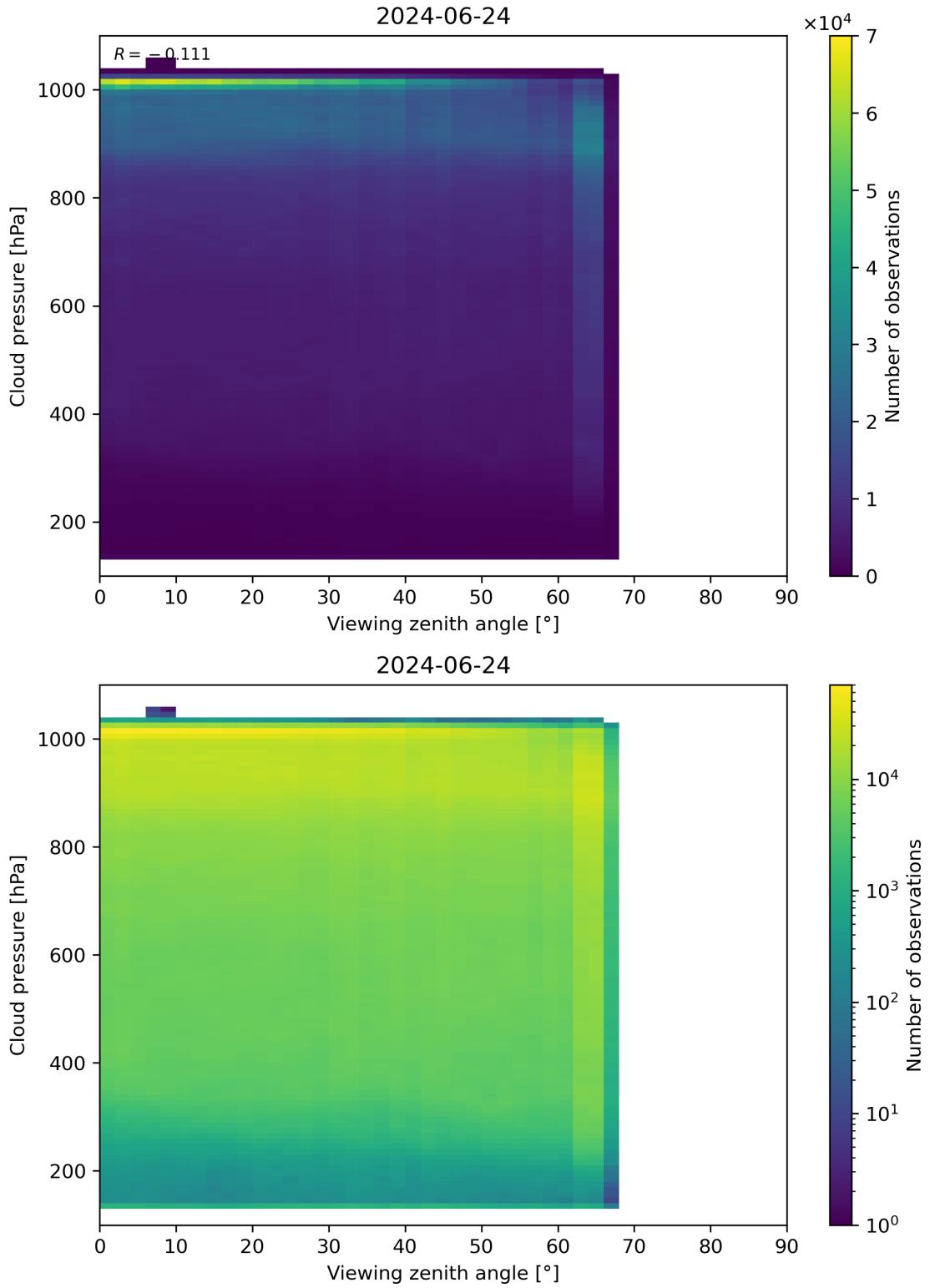

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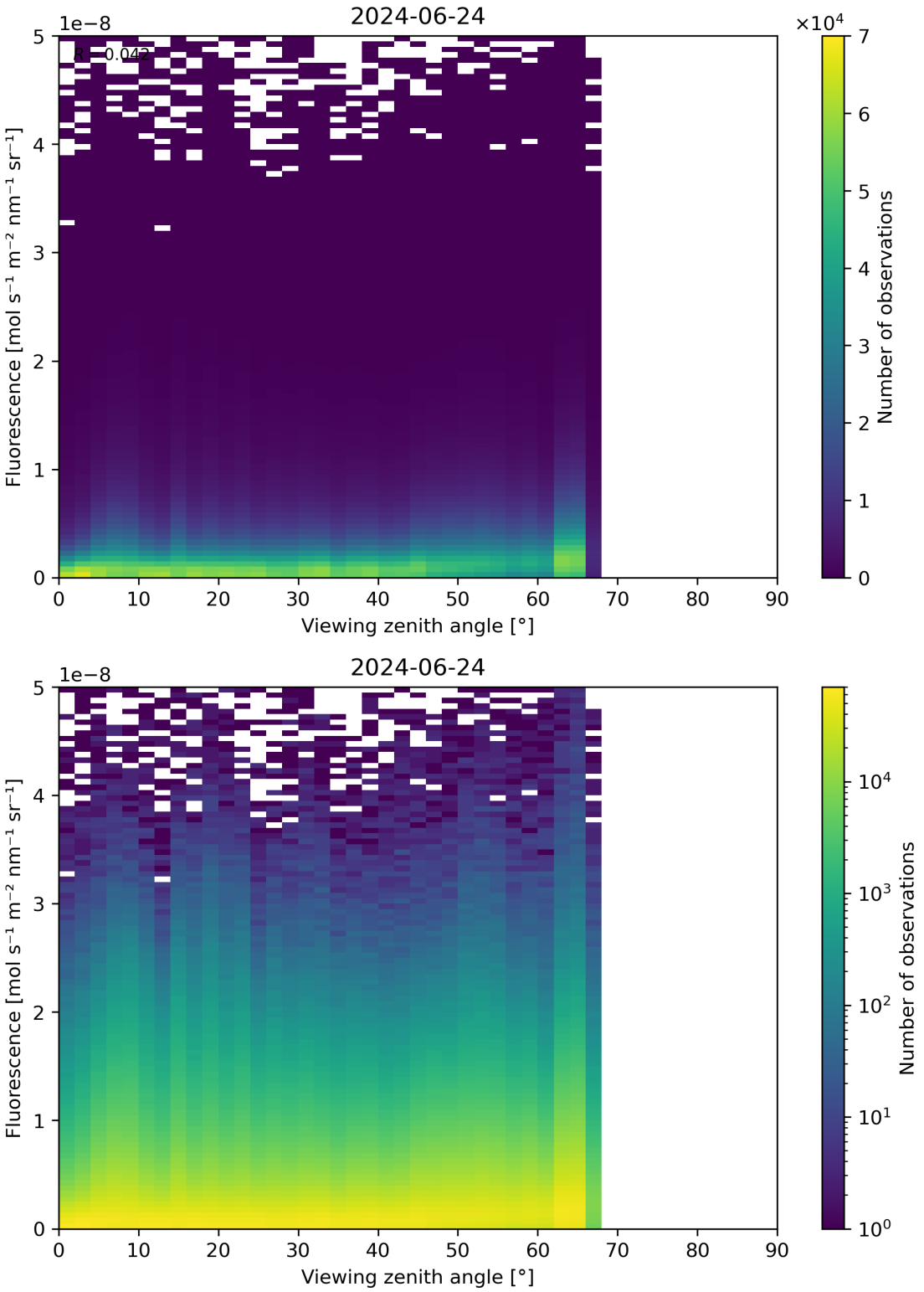

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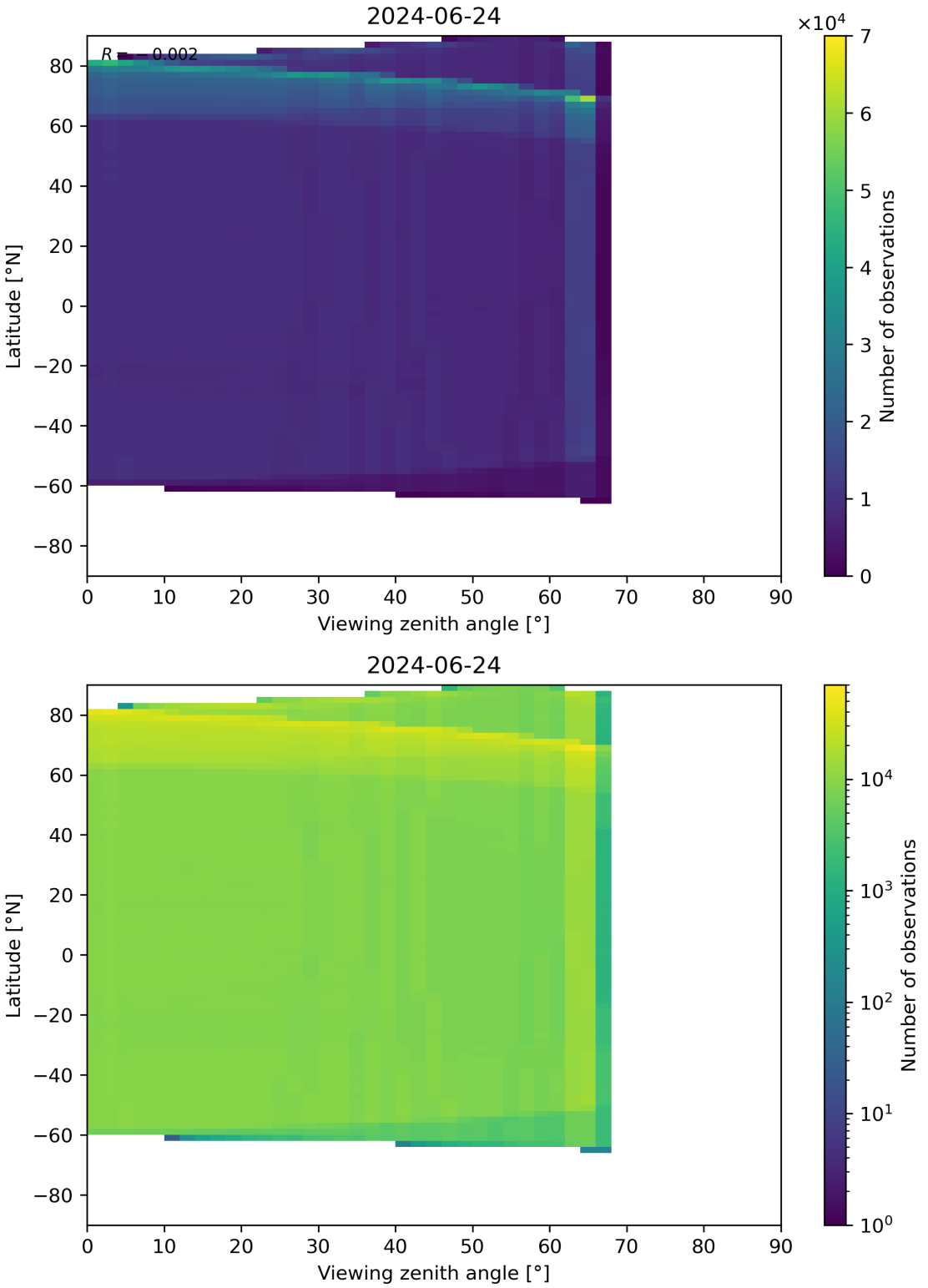

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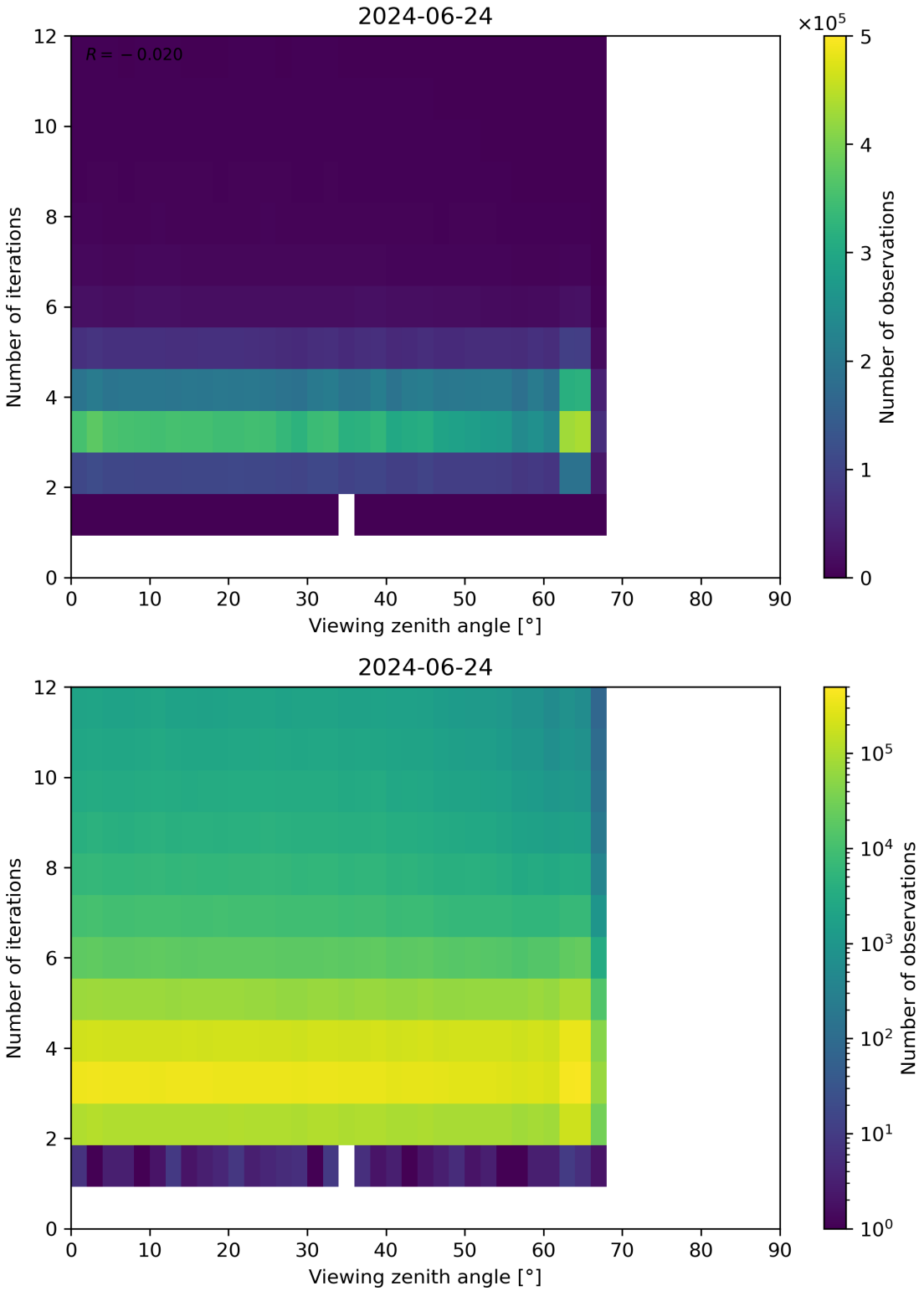

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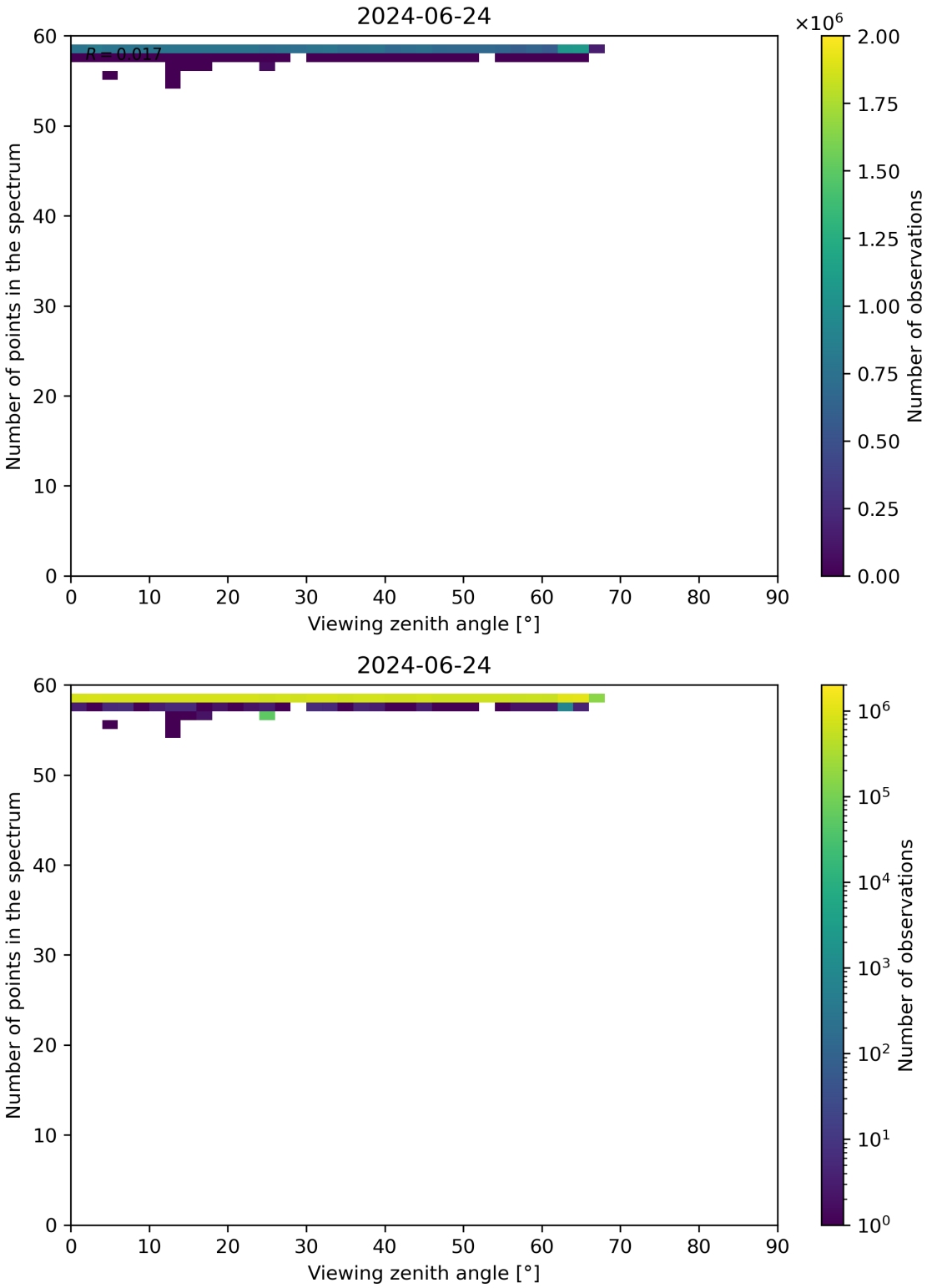

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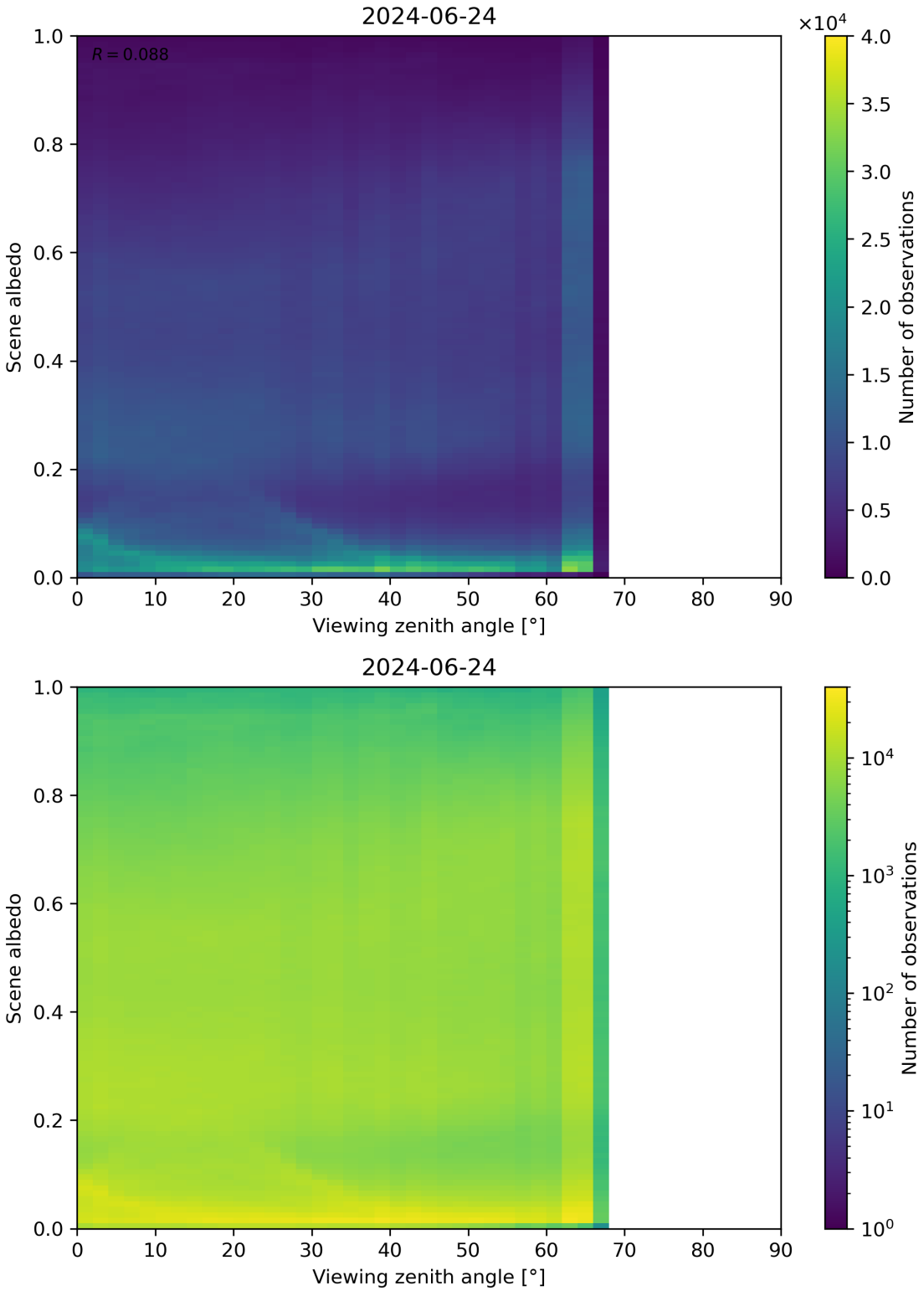

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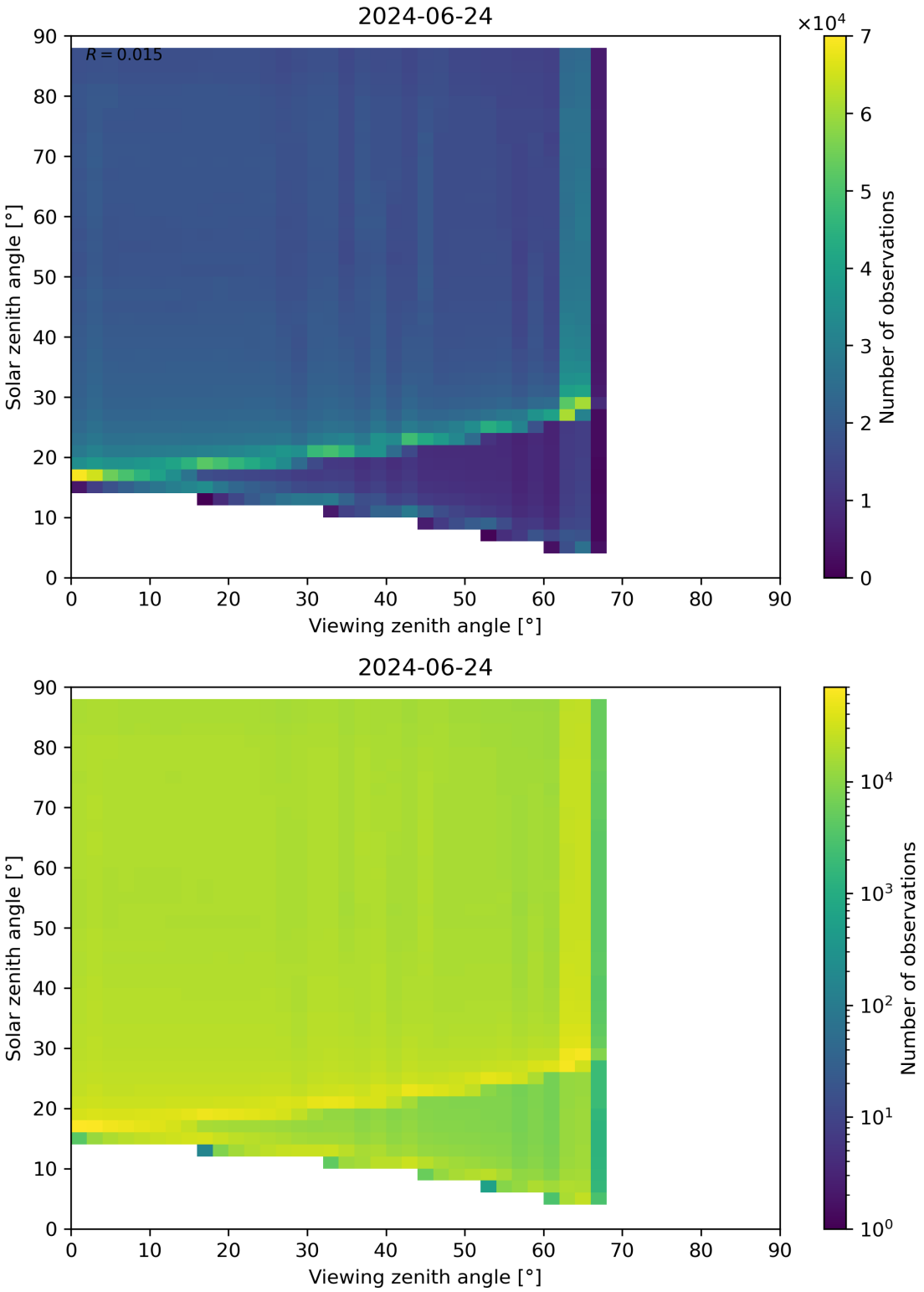

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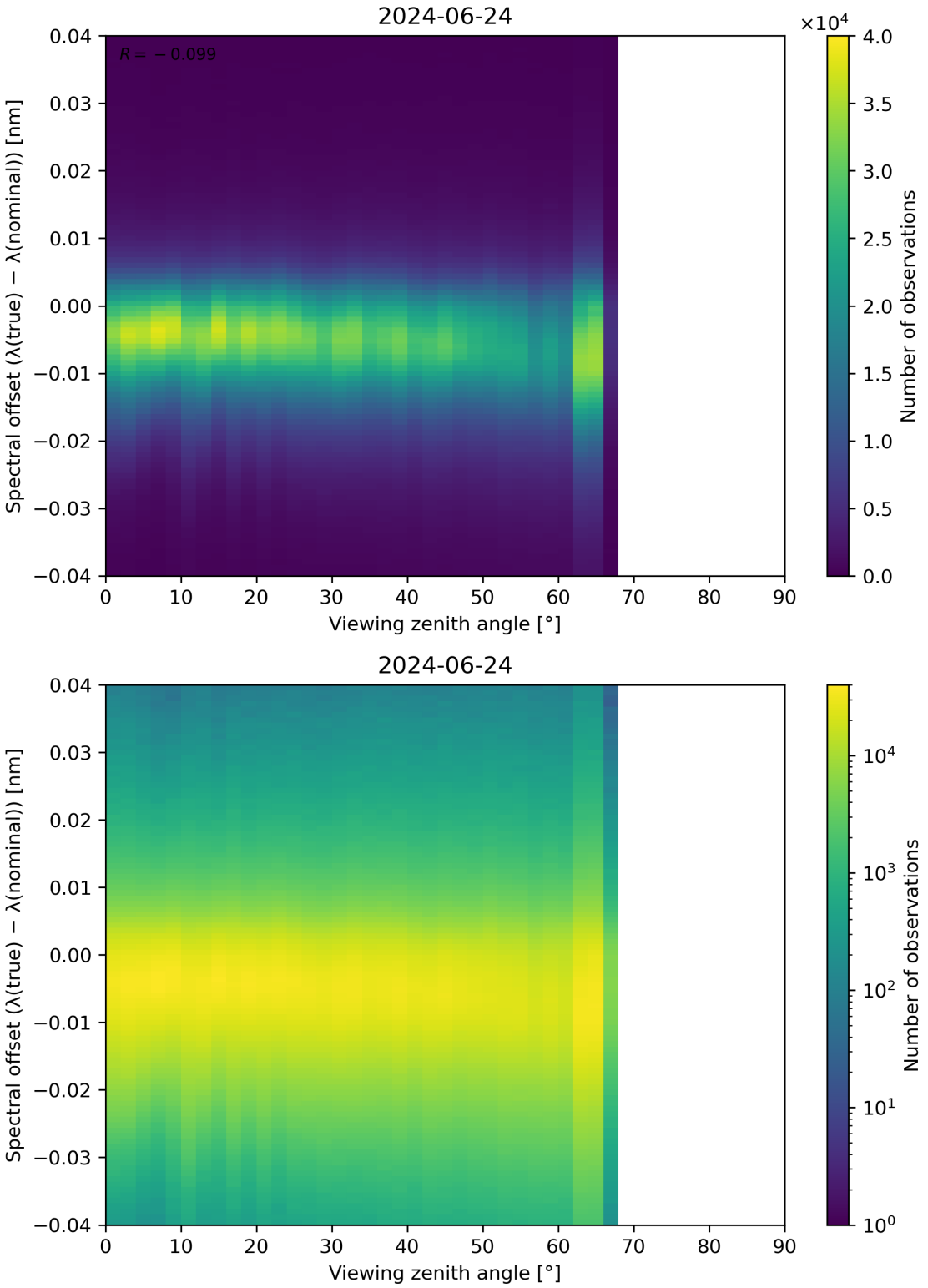

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Maarten Sneep (maarten.sneep@knmi.nl).