

# PyCAMA report generated by tropl2-proc

tropl2-proc

2025-10-06 (20:05)

## 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]                    | $0.633 \pm 0.374$                  | 18764532 | 0.995                  | 0.610                  | 0.800                  | 0.0                     | 1.000                  |
| cloud fraction [1]              | $0.572 \pm 0.346$                  | 18764532 | 0.995                  | 0.735                  | 0.552                  | $5.506 \times 10^{-3}$  | 1.000                  |
| cloud top height [m]            | $(0.388 \pm 0.263) \times 10^4$    | 18764532 | $1.425 \times 10^3$    | $3.656 \times 10^3$    | $3.283 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    |
| cloud optical thickness [1]     | $23.4 \pm 43.2$                    | 18764532 | 9.77                   | 13.1                   | 10.1                   | 1.000                   | 250                    |
| cloud fraction crb [1]          | $0.571 \pm 0.346$                  | 18764532 | 0.995                  | 0.735                  | 0.550                  | $7.387 \times 10^{-3}$  | 1.000                  |
| cloud height crb [m]            | $(0.308 \pm 0.225) \times 10^4$    | 18764532 | 975                    | $3.164 \times 10^3$    | $2.639 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    |
| cloud albedo crb [1]            | $0.607 \pm 0.211$                  | 18764532 | 0.995                  | 0.273                  | 0.586                  | 0.0                     | 1.000                  |
| surface albedo fitted [1]       | $0.220 \pm 0.284$                  | 18764532 | $2.500 \times 10^{-2}$ | 0.261                  | $5.923 \times 10^{-2}$ | 0.0                     | 1.000                  |
| surface albedo fitted crb [1]   | $0.207 \pm 0.270$                  | 18764532 | $1.500 \times 10^{-2}$ | 0.262                  | $4.821 \times 10^{-2}$ | 0.0                     | 1.000                  |
| fitted root mean square [1]     | $(6.005 \pm 7.198) \times 10^{-4}$ | 18764532 | $5.000 \times 10^{-5}$ | $7.073 \times 10^{-4}$ | $3.709 \times 10^{-4}$ | $1.133 \times 10^{-6}$  | 0.130                  |
| fitted root mean square crb [1] | $(5.233 \pm 6.484) \times 10^{-4}$ | 18764532 | $5.000 \times 10^{-5}$ | $6.337 \times 10^{-4}$ | $2.764 \times 10^{-4}$ | $9.766 \times 10^{-7}$  | $5.590 \times 10^{-2}$ |
| wavelength shift [nm]           | $(8.669 \pm 7.215) \times 10^{-3}$ | 18764532 | $9.000 \times 10^{-4}$ | $1.057 \times 10^{-2}$ | $8.142 \times 10^{-3}$ | $-5.017 \times 10^{-2}$ | $6.483 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $0.576 \pm 0.351$                  | 18764532 | 0.995                  | 0.758                  | 0.561                  | 0.0                     | 1.000                  |
| reflectance blue ocra [1]       | $0.572 \pm 0.231$                  | 18764532 | 0.265                  | 0.392                  | 0.550                  | 0.129                   | 2.06                   |
| reflectance green ocra [1]      | $0.519 \pm 0.260$                  | 18764532 | 0.175                  | 0.463                  | 0.503                  | $7.768 \times 10^{-2}$  | 2.06                   |
| reflectance continuum aband [1] | $0.471 \pm 0.282$                  | 18764532 | $4.500 \times 10^{-2}$ | 0.467                  | 0.468                  | $1.159 \times 10^{-2}$  | 4.26                   |



Table 2: Percentile ranges

| Variable                        | 1 %                     | 5 %                     | 10 %                   | 15.9 %                 | 25 %                   | 75 %                   | 84.1 %                 | 90 %                   | 95 %                   | 99 %                   |
|---------------------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| qa value [1]                    | 0.0                     | 0.0                     | 0.0                    | 0.0                    | 0.340                  | 0.950                  | 1.000                  | 1.000                  | 1.000                  | 1.000                  |
| cloud fraction [1]              | $2.719 \times 10^{-2}$  | $7.015 \times 10^{-2}$  | 0.110                  | 0.158                  | 0.245                  | 0.980                  | 1.000                  | 1.000                  | 1.000                  | 1.000                  |
| cloud top height [m]            | 289                     | 786                     | $1.099 \times 10^3$    | $1.373 \times 10^3$    | $1.768 \times 10^3$    | $5.424 \times 10^3$    | $6.630 \times 10^3$    | $7.687 \times 10^3$    | $8.991 \times 10^3$    | $1.139 \times 10^4$    |
| cloud optical thickness [1]     | 1.000                   | 2.71                    | 3.84                   | 4.81                   | 6.10                   | 19.2                   | 30.2                   | 46.1                   | 90.0                   | 250                    |
| cloud fraction crb [1]          | $2.661 \times 10^{-2}$  | $6.931 \times 10^{-2}$  | 0.109                  | 0.158                  | 0.245                  | 0.979                  | 1.000                  | 1.000                  | 1.000                  | 1.000                  |
| cloud height crb [m]            | 0.0                     | 372                     | 656                    | 898                    | $1.237 \times 10^3$    | $4.401 \times 10^3$    | $5.417 \times 10^3$    | $6.374 \times 10^3$    | $7.504 \times 10^3$    | $9.383 \times 10^3$    |
| cloud albedo crb [1]            | $6.663 \times 10^{-2}$  | 0.255                   | 0.368                  | 0.428                  | 0.475                  | 0.748                  | 0.837                  | 0.922                  | 1.000                  | 1.000                  |
| surface albedo fitted [1]       | 0.0                     | $8.527 \times 10^{-3}$  | $1.464 \times 10^{-2}$ | $1.963 \times 10^{-2}$ | $2.690 \times 10^{-2}$ | 0.288                  | 0.630                  | 0.746                  | 0.846                  | 0.976                  |
| surface albedo fitted crb [1]   | 0.0                     | $7.485 \times 10^{-3}$  | $1.149 \times 10^{-2}$ | $1.524 \times 10^{-2}$ | $2.098 \times 10^{-2}$ | 0.283                  | 0.603                  | 0.701                  | 0.788                  | 0.918                  |
| fitted root mean square [1]     | $1.571 \times 10^{-5}$  | $2.991 \times 10^{-5}$  | $4.892 \times 10^{-5}$ | $7.792 \times 10^{-5}$ | $1.300 \times 10^{-4}$ | $8.373 \times 10^{-4}$ | $1.133 \times 10^{-3}$ | $1.439 \times 10^{-3}$ | $1.911 \times 10^{-3}$ | $3.102 \times 10^{-3}$ |
| fitted root mean square crb [1] | $8.160 \times 10^{-6}$  | $1.792 \times 10^{-5}$  | $3.032 \times 10^{-5}$ | $4.815 \times 10^{-5}$ | $8.506 \times 10^{-5}$ | $7.188 \times 10^{-4}$ | $1.035 \times 10^{-3}$ | $1.362 \times 10^{-3}$ | $1.860 \times 10^{-3}$ | $2.988 \times 10^{-3}$ |
| wavelength shift [nm]           | $-6.746 \times 10^{-3}$ | $-4.468 \times 10^{-4}$ | $3.456 \times 10^{-4}$ | $1.274 \times 10^{-3}$ | $3.017 \times 10^{-3}$ | $1.359 \times 10^{-2}$ | $1.604 \times 10^{-2}$ | $1.814 \times 10^{-2}$ | $2.089 \times 10^{-2}$ | $2.682 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $3.052 \times 10^{-2}$  | $6.650 \times 10^{-2}$  | 0.103                  | 0.152                  | 0.242                  | 1.000                  | 1.000                  | 1.000                  | 1.000                  | 1.000                  |
| reflectance blue ocra [1]       | 0.232                   | 0.257                   | 0.284                  | 0.315                  | 0.368                  | 0.761                  | 0.819                  | 0.868                  | 0.935                  | 1.15                   |
| reflectance green ocra [1]      | 0.152                   | 0.173                   | 0.193                  | 0.220                  | 0.275                  | 0.738                  | 0.809                  | 0.860                  | 0.927                  | 1.10                   |
| reflectance continuum aband [1] | $2.904 \times 10^{-2}$  | $5.266 \times 10^{-2}$  | $8.745 \times 10^{-2}$ | 0.137                  | 0.230                  | 0.697                  | 0.778                  | 0.835                  | 0.909                  | 1.07                   |

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]                    | $0.628 \pm 0.378$                  | 9574876 | 0.650                  | 0.800                  | 0.0                     | 1.000                  | 0.300                  | 0.950                  |
| cloud fraction [1]              | $0.601 \pm 0.354$                  | 9574876 | 0.751                  | 0.632                  | $5.506 \times 10^{-3}$  | 1.000                  | 0.249                  | 1.000                  |
| cloud top height [m]            | $(0.392 \pm 0.250) \times 10^4$    | 9574876 | $3.393 \times 10^3$    | $3.414 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $1.936 \times 10^3$    | $5.329 \times 10^3$    |
| cloud optical thickness [1]     | $24.4 \pm 40.6$                    | 9574876 | 16.4                   | 10.8                   | 1.000                   | 250                    | 6.50                   | 22.9                   |
| cloud fraction crb [1]          | $0.600 \pm 0.354$                  | 9574876 | 0.752                  | 0.630                  | $8.222 \times 10^{-3}$  | 1.000                  | 0.248                  | 0.999                  |
| cloud height crb [m]            | $(0.322 \pm 0.217) \times 10^4$    | 9574876 | $3.012 \times 10^3$    | $2.861 \times 10^3$    | 0.0                     | $1.766 \times 10^4$    | $1.443 \times 10^3$    | $4.455 \times 10^3$    |
| cloud albedo crb [1]            | $0.587 \pm 0.200$                  | 9574876 | 0.247                  | 0.579                  | 0.0                     | 1.000                  | 0.470                  | 0.717                  |
| surface albedo fitted [1]       | $0.164 \pm 0.204$                  | 9574876 | 0.188                  | $7.366 \times 10^{-2}$ | 0.0                     | 1.000                  | $2.867 \times 10^{-2}$ | 0.217                  |
| surface albedo fitted crb [1]   | $0.158 \pm 0.203$                  | 9574876 | 0.189                  | $5.926 \times 10^{-2}$ | 0.0                     | 1.000                  | $2.216 \times 10^{-2}$ | 0.211                  |
| fitted root mean square [1]     | $(5.167 \pm 6.972) \times 10^{-4}$ | 9574876 | $5.562 \times 10^{-4}$ | $2.728 \times 10^{-4}$ | $1.133 \times 10^{-6}$  | 0.130                  | $1.089 \times 10^{-4}$ | $6.651 \times 10^{-4}$ |
| fitted root mean square crb [1] | $(4.687 \pm 6.409) \times 10^{-4}$ | 9574876 | $5.533 \times 10^{-4}$ | $2.075 \times 10^{-4}$ | $9.766 \times 10^{-7}$  | $5.590 \times 10^{-2}$ | $6.129 \times 10^{-5}$ | $6.146 \times 10^{-4}$ |
| wavelength shift [nm]           | $(7.620 \pm 6.924) \times 10^{-3}$ | 9574876 | $9.941 \times 10^{-3}$ | $6.784 \times 10^{-3}$ | $-5.017 \times 10^{-2}$ | $6.483 \times 10^{-2}$ | $2.176 \times 10^{-3}$ | $1.212 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $0.604 \pm 0.359$                  | 9574876 | 0.757                  | 0.642                  | 0.0                     | 1.000                  | 0.243                  | 1.000                  |
| reflectance blue ocra [1]       | $0.548 \pm 0.223$                  | 9574876 | 0.356                  | 0.520                  | 0.129                   | 2.00                   | 0.356                  | 0.712                  |
| reflectance green ocra [1]      | $0.492 \pm 0.249$                  | 9574876 | 0.424                  | 0.469                  | $7.768 \times 10^{-2}$  | 2.06                   | 0.262                  | 0.686                  |
| reflectance continuum aband [1] | $0.448 \pm 0.273$                  | 9574876 | 0.418                  | 0.433                  | $1.159 \times 10^{-2}$  | 4.26                   | 0.228                  | 0.645                  |

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]                    | $0.637 \pm 0.371$                  | 9189656 | 0.560                  | 0.800                  | 0.0                     | 1.000                  | 0.390                  | 0.950                  |
| cloud fraction [1]              | $0.541 \pm 0.334$                  | 9189656 | 0.674                  | 0.488                  | $5.666 \times 10^{-3}$  | 1.000                  | 0.242                  | 0.916                  |
| cloud top height [m]            | $(0.384 \pm 0.277) \times 10^4$    | 9189656 | $3.923 \times 10^3$    | $3.118 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $1.614 \times 10^3$    | $5.537 \times 10^3$    |
| cloud optical thickness [1]     | $22.3 \pm 45.7$                    | 9189656 | 10.1                   | 9.57                   | 1.000                   | 250                    | 5.73                   | 15.8                   |
| cloud fraction crb [1]          | $0.541 \pm 0.334$                  | 9189656 | 0.672                  | 0.486                  | $7.387 \times 10^{-3}$  | 1.000                  | 0.243                  | 0.915                  |
| cloud height crb [m]            | $(0.294 \pm 0.231) \times 10^4$    | 9189656 | $3.275 \times 10^3$    | $2.371 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $1.061 \times 10^3$    | $4.336 \times 10^3$    |
| cloud albedo crb [1]            | $0.628 \pm 0.221$                  | 9189656 | 0.308                  | 0.595                  | 0.0                     | 1.000                  | 0.480                  | 0.788                  |
| surface albedo fitted [1]       | $0.277 \pm 0.338$                  | 9189656 | 0.629                  | $4.966 \times 10^{-2}$ | 0.0                     | 1.000                  | $2.554 \times 10^{-2}$ | 0.655                  |
| surface albedo fitted crb [1]   | $0.258 \pm 0.317$                  | 9189656 | 0.597                  | $4.142 \times 10^{-2}$ | 0.0                     | 1.000                  | $1.996 \times 10^{-2}$ | 0.617                  |
| fitted root mean square [1]     | $(6.879 \pm 7.325) \times 10^{-4}$ | 9189656 | $7.932 \times 10^{-4}$ | $5.018 \times 10^{-4}$ | $2.881 \times 10^{-6}$  | 0.116                  | $1.766 \times 10^{-4}$ | $9.698 \times 10^{-4}$ |
| fitted root mean square crb [1] | $(5.801 \pm 6.514) \times 10^{-4}$ | 9189656 | $6.866 \times 10^{-4}$ | $3.526 \times 10^{-4}$ | $2.449 \times 10^{-6}$  | $1.890 \times 10^{-2}$ | $1.232 \times 10^{-4}$ | $8.098 \times 10^{-4}$ |
| wavelength shift [nm]           | $(9.762 \pm 7.348) \times 10^{-3}$ | 9189656 | $1.067 \times 10^{-2}$ | $9.673 \times 10^{-3}$ | $-4.259 \times 10^{-2}$ | $6.440 \times 10^{-2}$ | $4.159 \times 10^{-3}$ | $1.483 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $0.547 \pm 0.339$                  | 9189656 | 0.707                  | 0.498                  | 0.0                     | 1.000                  | 0.241                  | 0.948                  |
| reflectance blue ocra [1]       | $0.597 \pm 0.236$                  | 9189656 | 0.412                  | 0.587                  | 0.148                   | 2.06                   | 0.383                  | 0.795                  |
| reflectance green ocra [1]      | $0.548 \pm 0.267$                  | 9189656 | 0.489                  | 0.548                  | $8.565 \times 10^{-2}$  | 2.02                   | 0.292                  | 0.782                  |
| reflectance continuum aband [1] | $0.495 \pm 0.289$                  | 9189656 | 0.507                  | 0.518                  | $1.291 \times 10^{-2}$  | 4.17                   | 0.233                  | 0.739                  |

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]                    | $0.670 \pm 0.354$                  | 12318328 | 0.560                  | 0.850                  | 0.0                     | 1.000                  | 0.400                  | 0.960                  |
| cloud fraction [1]              | $0.571 \pm 0.347$                  | 12318328 | 0.736                  | 0.567                  | $5.666 \times 10^{-3}$  | 1.000                  | 0.234                  | 0.970                  |
| cloud top height [m]            | $(0.348 \pm 0.244) \times 10^4$    | 12318328 | $3.103 \times 10^3$    | $2.861 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $1.611 \times 10^3$    | $4.714 \times 10^3$    |
| cloud optical thickness [1]     | $22.1 \pm 39.0$                    | 12318328 | 12.1                   | 10.5                   | 1.000                   | 250                    | 6.87                   | 19.0                   |
| cloud fraction crb [1]          | $0.570 \pm 0.347$                  | 12318328 | 0.737                  | 0.565                  | $7.387 \times 10^{-3}$  | 1.000                  | 0.232                  | 0.969                  |
| cloud height crb [m]            | $(0.279 \pm 0.217) \times 10^4$    | 12318328 | $2.891 \times 10^3$    | $2.267 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $1.081 \times 10^3$    | $3.972 \times 10^3$    |
| cloud albedo crb [1]            | $0.566 \pm 0.191$                  | 12318328 | 0.227                  | 0.550                  | 0.0                     | 1.000                  | 0.457                  | 0.684                  |
| surface albedo fitted [1]       | $0.119 \pm 0.224$                  | 12318328 | $3.887 \times 10^{-2}$ | $3.400 \times 10^{-2}$ | 0.0                     | 1.000                  | $2.019 \times 10^{-2}$ | $5.906 \times 10^{-2}$ |
| surface albedo fitted crb [1]   | $0.110 \pm 0.217$                  | 12318328 | $3.227 \times 10^{-2}$ | $2.684 \times 10^{-2}$ | 0.0                     | 1.000                  | $1.565 \times 10^{-2}$ | $4.792 \times 10^{-2}$ |
| fitted root mean square [1]     | $(5.295 \pm 6.685) \times 10^{-4}$ | 12318328 | $6.508 \times 10^{-4}$ | $2.699 \times 10^{-4}$ | $1.133 \times 10^{-6}$  | $4.675 \times 10^{-2}$ | $9.210 \times 10^{-5}$ | $7.429 \times 10^{-4}$ |
| fitted root mean square crb [1] | $(4.850 \pm 6.276) \times 10^{-4}$ | 12318328 | $6.152 \times 10^{-4}$ | $2.202 \times 10^{-4}$ | $9.766 \times 10^{-7}$  | $1.914 \times 10^{-2}$ | $6.380 \times 10^{-5}$ | $6.790 \times 10^{-4}$ |
| wavelength shift [nm]           | $(8.275 \pm 7.512) \times 10^{-3}$ | 12318328 | $1.109 \times 10^{-2}$ | $7.430 \times 10^{-3}$ | $-5.017 \times 10^{-2}$ | $6.483 \times 10^{-2}$ | $2.359 \times 10^{-3}$ | $1.345 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $0.574 \pm 0.352$                  | 12318328 | 0.772                  | 0.576                  | 0.0                     | 1.000                  | 0.228                  | 1.000                  |
| reflectance blue ocr [1]        | $0.535 \pm 0.214$                  | 12318328 | 0.345                  | 0.502                  | 0.151                   | 2.02                   | 0.351                  | 0.696                  |
| reflectance green ocr [1]       | $0.474 \pm 0.241$                  | 12318328 | 0.415                  | 0.443                  | $7.768 \times 10^{-2}$  | 2.01                   | 0.252                  | 0.667                  |
| reflectance continuum aband [1] | $0.403 \pm 0.273$                  | 12318328 | 0.475                  | 0.384                  | $1.159 \times 10^{-2}$  | 4.26                   | 0.147                  | 0.622                  |

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]                    | $0.516 \pm 0.410$                  | 4772493 | 0.900                  | 0.670                  | 0.0                     | 1.000                  | 0.0                    | 0.900                  |
| cloud fraction [1]              | $0.532 \pm 0.336$                  | 4772493 | 0.704                  | 0.440                  | $5.506 \times 10^{-3}$  | 1.000                  | 0.242                  | 0.946                  |
| cloud top height [m]            | $(0.504 \pm 0.287) \times 10^4$    | 4772493 | $4.155 \times 10^3$    | $4.857 \times 10^3$    | 0.0                     | $2.000 \times 10^4$    | $2.741 \times 10^3$    | $6.896 \times 10^3$    |
| cloud optical thickness [1]     | $24.1 \pm 50.4$                    | 4772493 | 11.4                   | 7.96                   | 1.000                   | 250                    | 4.94                   | 16.4                   |
| cloud fraction crb [1]          | $0.532 \pm 0.335$                  | 4772493 | 0.701                  | 0.439                  | $8.222 \times 10^{-3}$  | 1.000                  | 0.244                  | 0.945                  |
| cloud height crb [m]            | $(0.391 \pm 0.232) \times 10^4$    | 4772493 | $3.426 \times 10^3$    | $3.623 \times 10^3$    | 0.0                     | $1.889 \times 10^4$    | $2.047 \times 10^3$    | $5.473 \times 10^3$    |
| cloud albedo crb [1]            | $0.707 \pm 0.233$                  | 4772493 | 0.379                  | 0.712                  | 0.0                     | 1.000                  | 0.545                  | 0.924                  |
| surface albedo fitted [1]       | $0.479 \pm 0.288$                  | 4772493 | 0.538                  | 0.355                  | 0.0                     | 1.000                  | 0.214                  | 0.751                  |
| surface albedo fitted crb [1]   | $0.453 \pm 0.263$                  | 4772493 | 0.488                  | 0.356                  | $7.201 \times 10^{-3}$  | 1.000                  | 0.208                  | 0.696                  |
| fitted root mean square [1]     | $(8.082 \pm 8.221) \times 10^{-4}$ | 4772493 | $7.290 \times 10^{-4}$ | $6.123 \times 10^{-4}$ | $4.244 \times 10^{-6}$  | 0.130                  | $3.244 \times 10^{-4}$ | $1.053 \times 10^{-3}$ |
| fitted root mean square crb [1] | $(6.369 \pm 7.116) \times 10^{-4}$ | 4772493 | $6.762 \times 10^{-4}$ | $3.990 \times 10^{-4}$ | $2.931 \times 10^{-6}$  | $5.590 \times 10^{-2}$ | $1.652 \times 10^{-4}$ | $8.414 \times 10^{-4}$ |
| wavelength shift [nm]           | $(9.465 \pm 6.502) \times 10^{-3}$ | 4772493 | $9.316 \times 10^{-3}$ | $9.210 \times 10^{-3}$ | $-4.297 \times 10^{-2}$ | $5.563 \times 10^{-2}$ | $4.563 \times 10^{-3}$ | $1.388 \times 10^{-2}$ |
| cloud fraction apriori [1]      | $0.540 \pm 0.341$                  | 4772493 | 0.756                  | 0.449                  | 0.0                     | 1.000                  | 0.244                  | 1.000                  |
| reflectance blue ocra [1]       | $0.664 \pm 0.254$                  | 4772493 | 0.421                  | 0.744                  | 0.131                   | 2.06                   | 0.425                  | 0.845                  |
| reflectance green ocra [1]      | $0.632 \pm 0.279$                  | 4772493 | 0.487                  | 0.716                  | $8.331 \times 10^{-2}$  | 2.06                   | 0.356                  | 0.843                  |
| reflectance continuum aband [1] | $0.628 \pm 0.247$                  | 4772493 | 0.403                  | 0.663                  | $1.660 \times 10^{-2}$  | 3.97                   | 0.411                  | 0.814                  |

### 3 Granule outlines

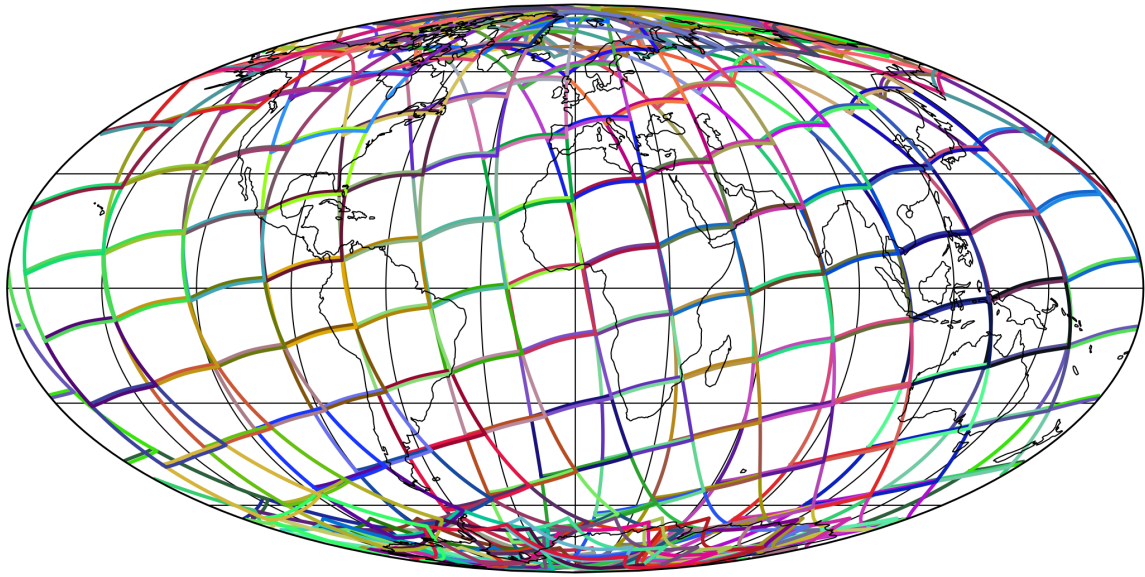


Figure 1: Outline of the granules.

## 4 Input data monitoring

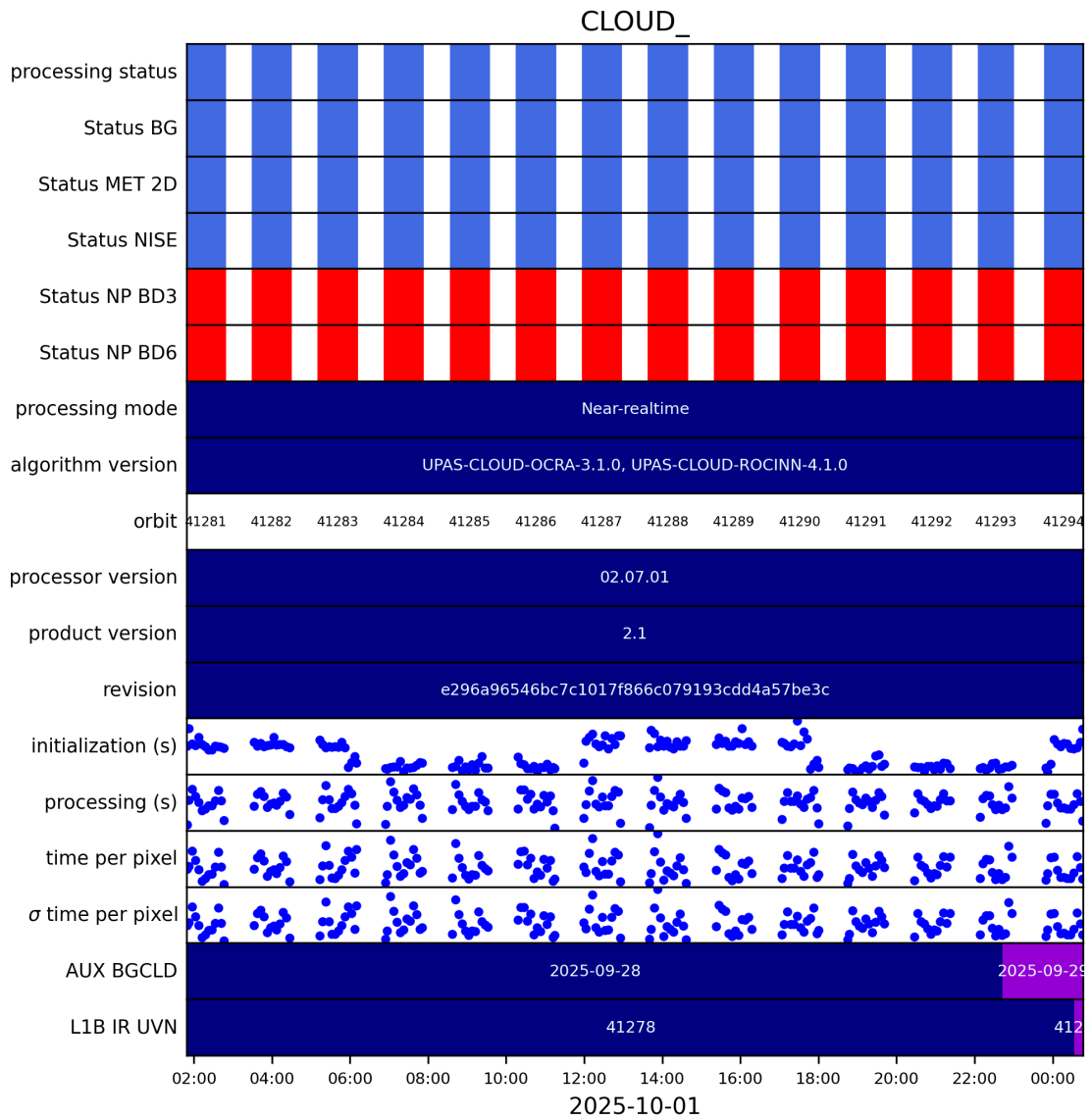


Figure 2: Input data per granule

## 5 Warnings and errors

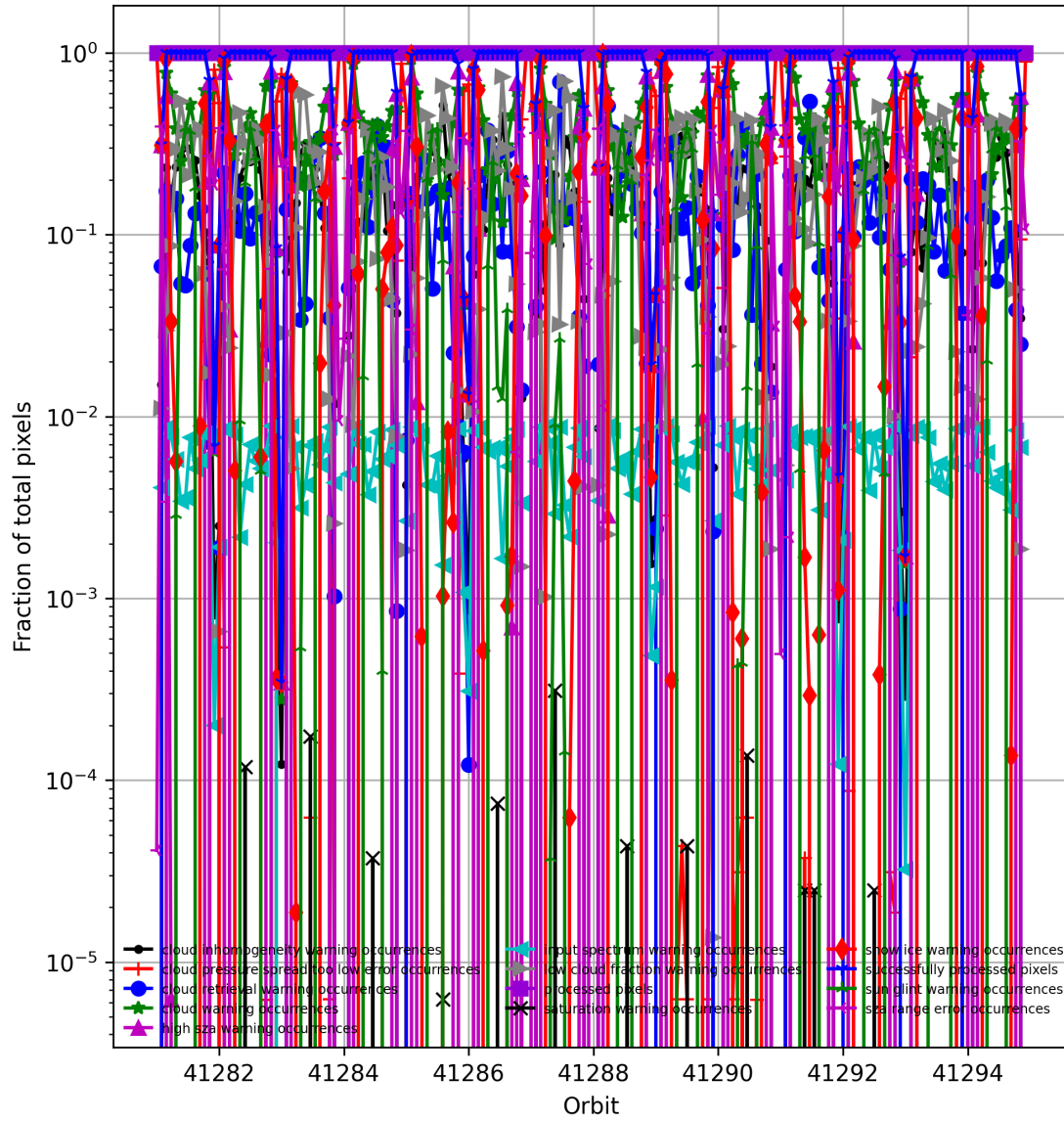


Figure 3: Fraction of pixels with specific warnings and errors during processing



## 6 World maps

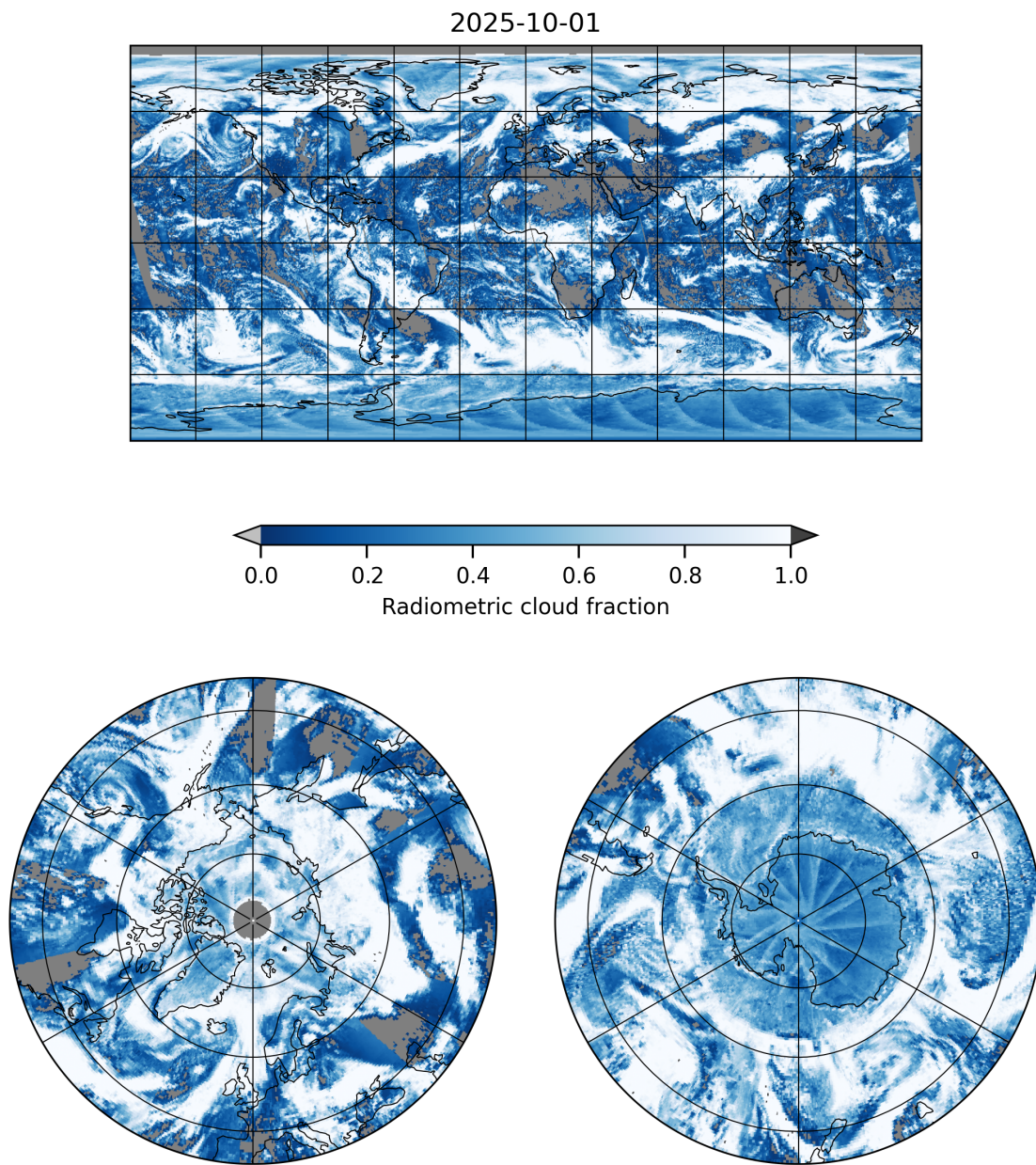


Figure 4: Map of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02

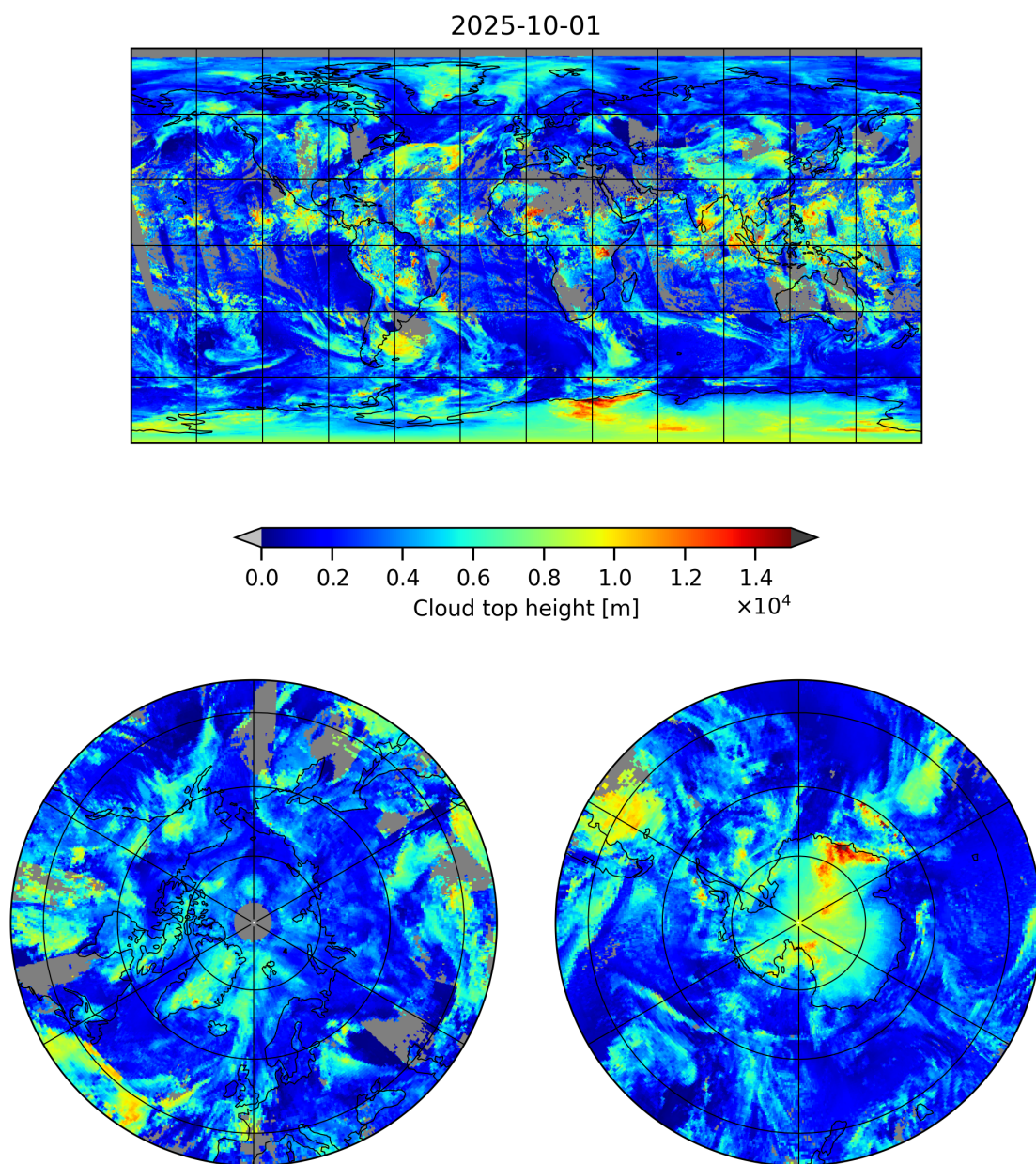


Figure 5: Map of “Cloud top height” for 2025-10-01 to 2025-10-02



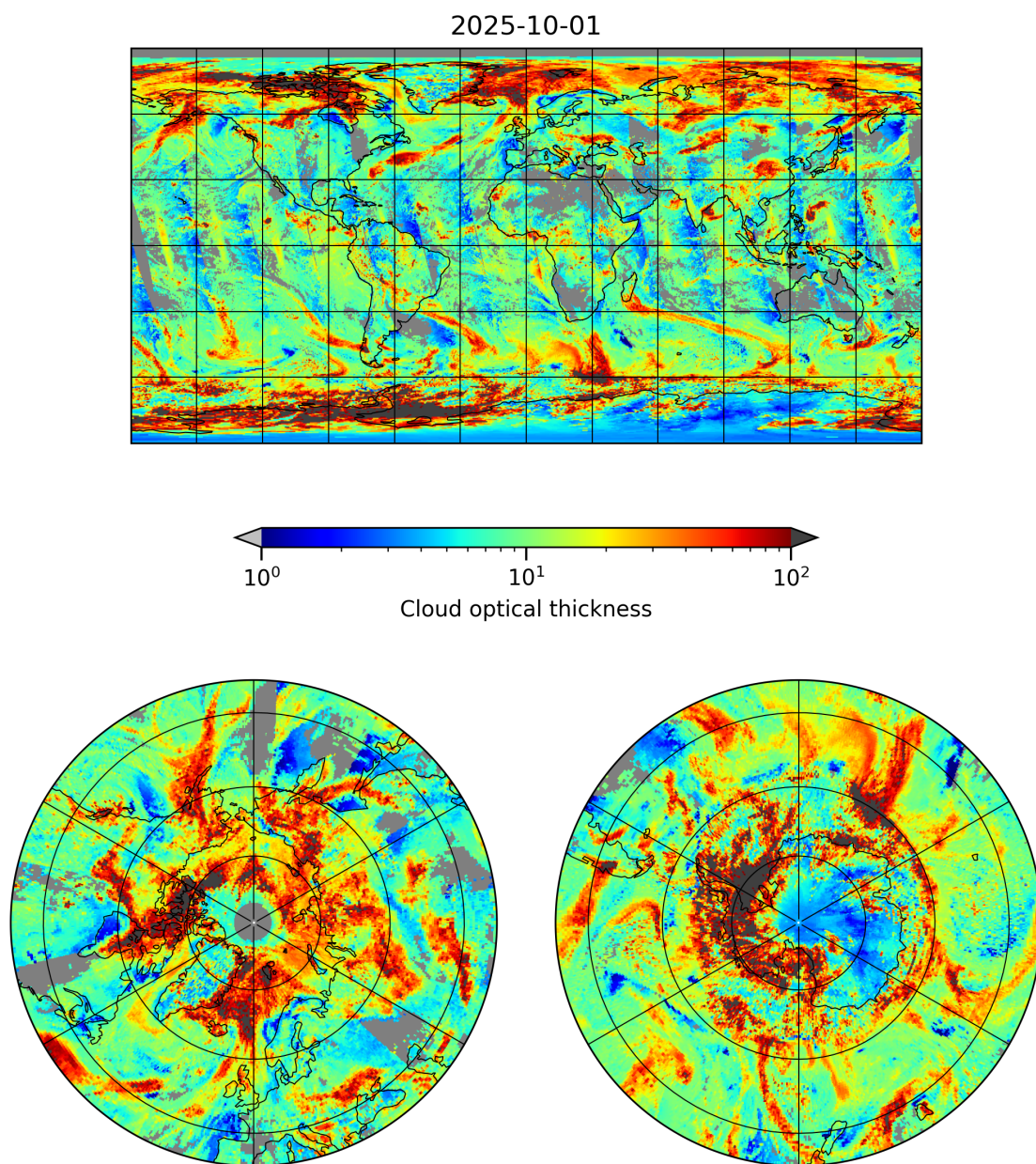


Figure 6: Map of “Cloud optical thickness” for 2025-10-01 to 2025-10-02

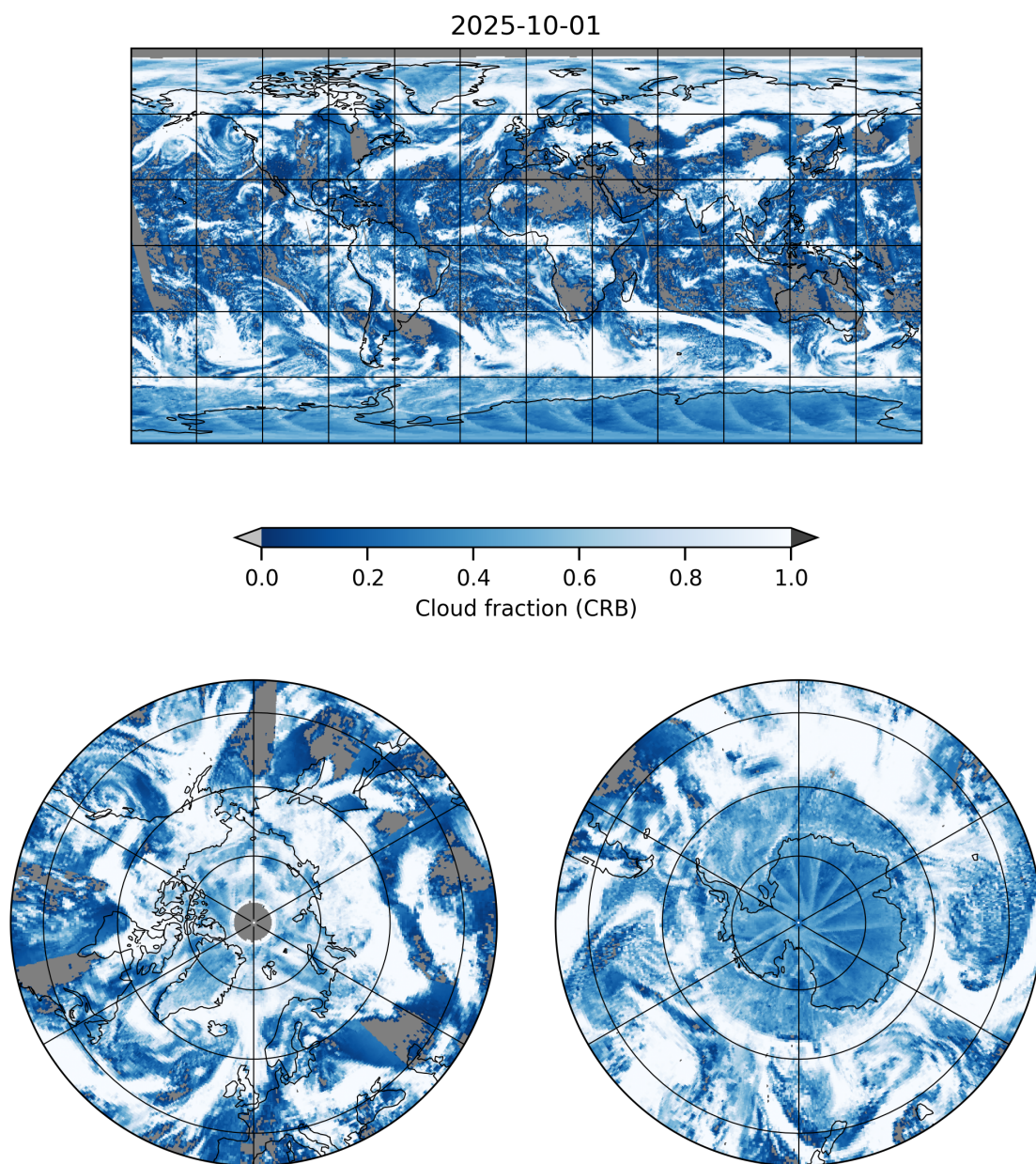


Figure 7: Map of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02



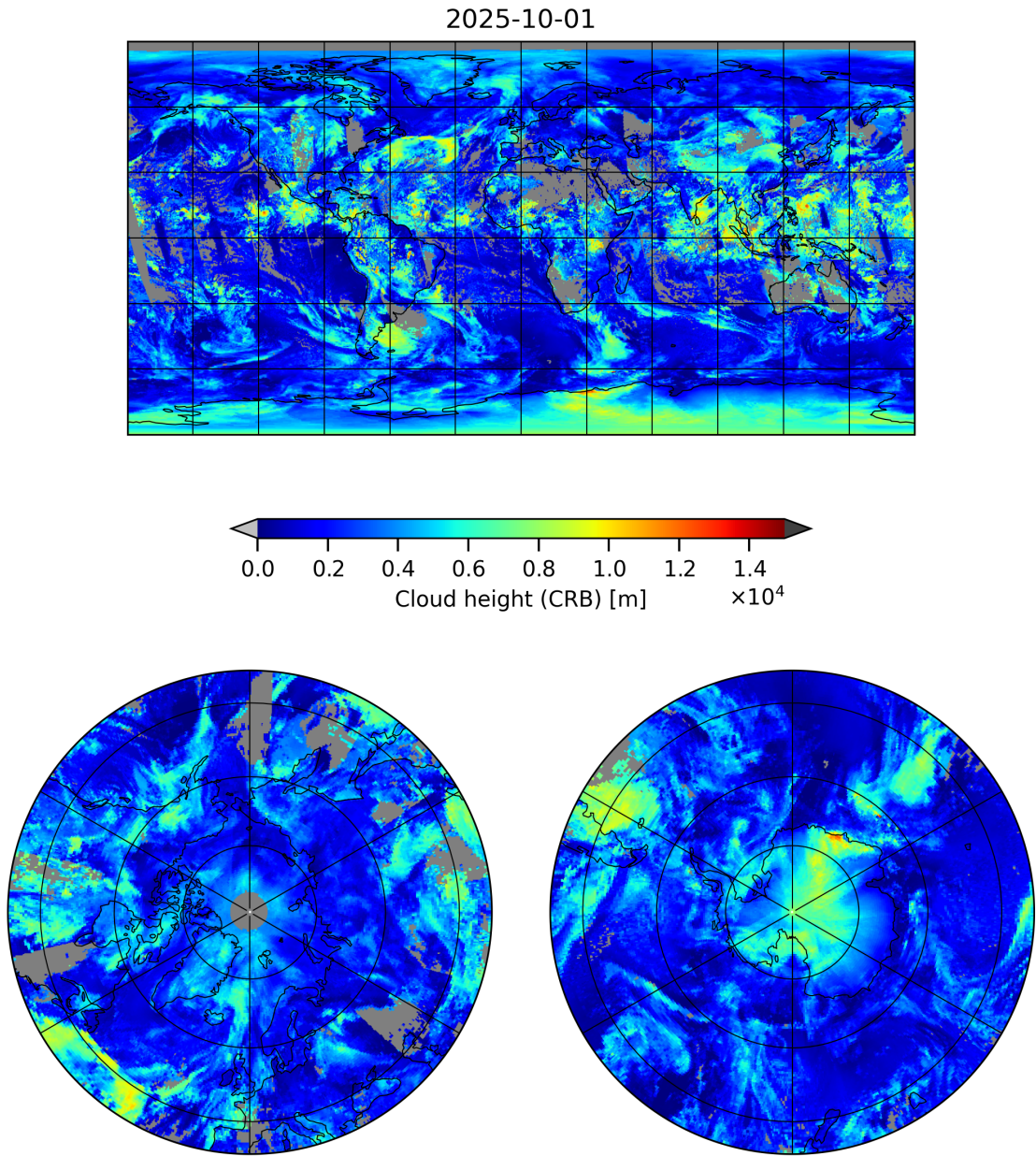


Figure 8: Map of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02

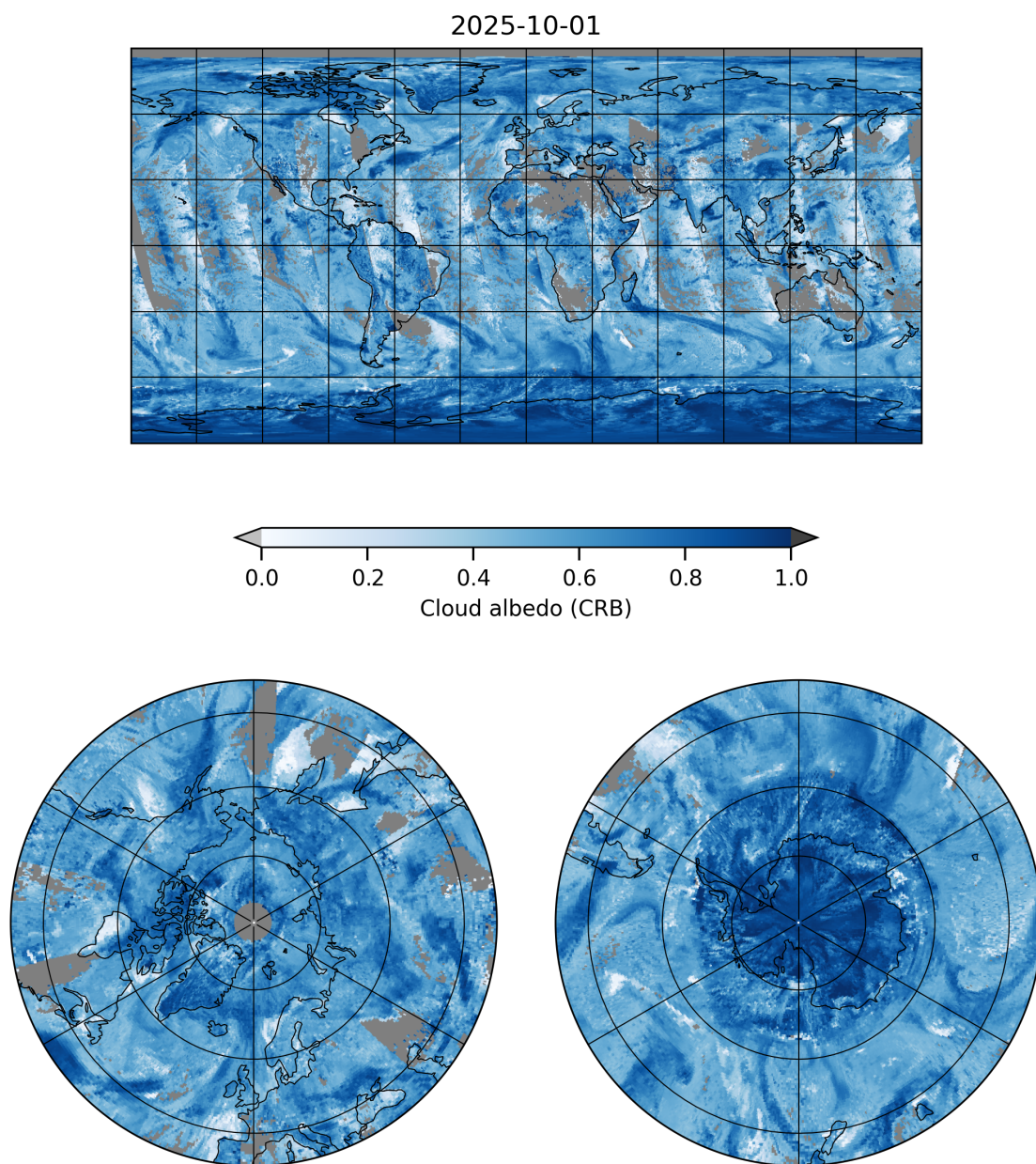


Figure 9: Map of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02



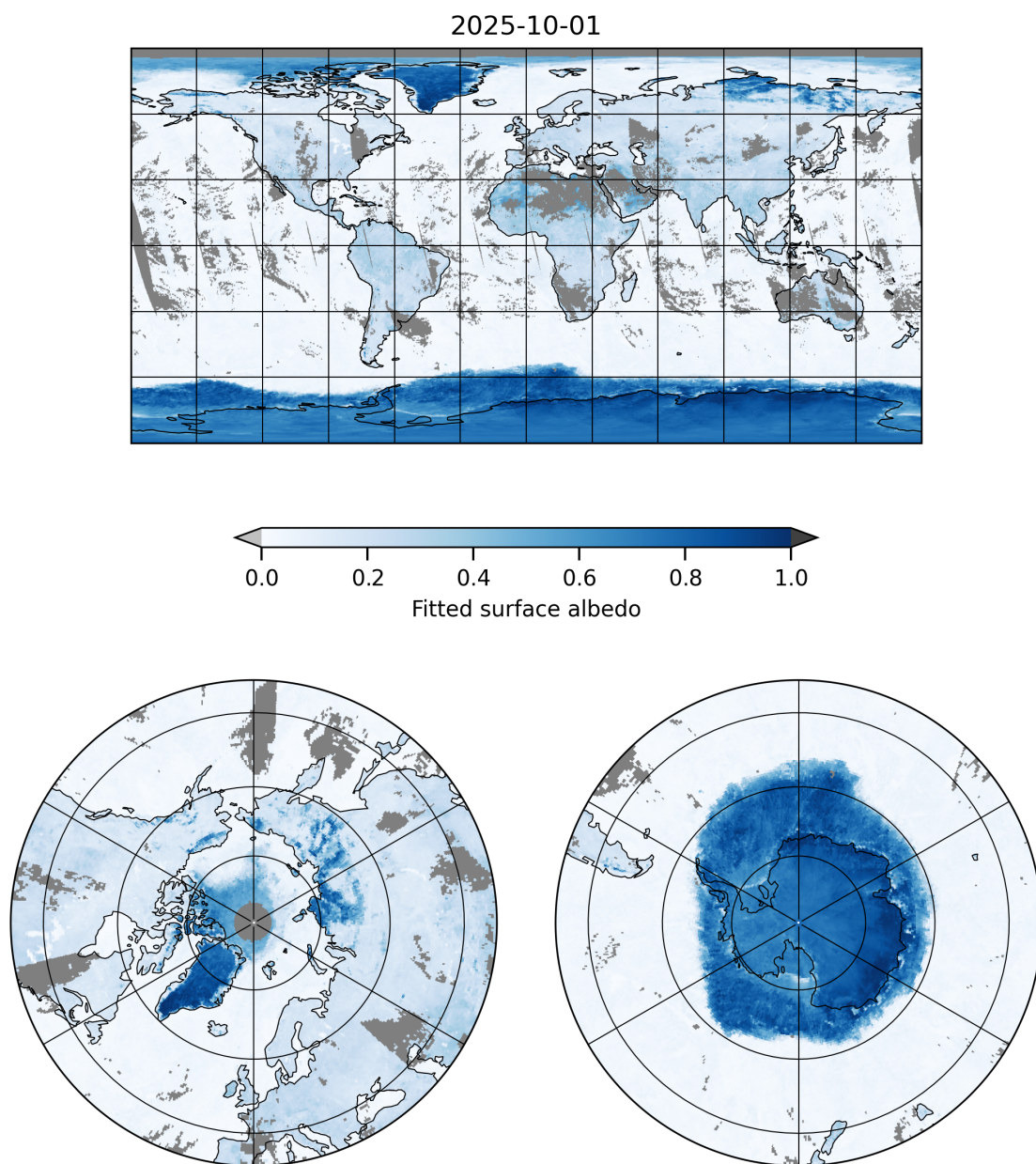


Figure 10: Map of “Fitted surface albedo” for 2025-10-01 to 2025-10-02

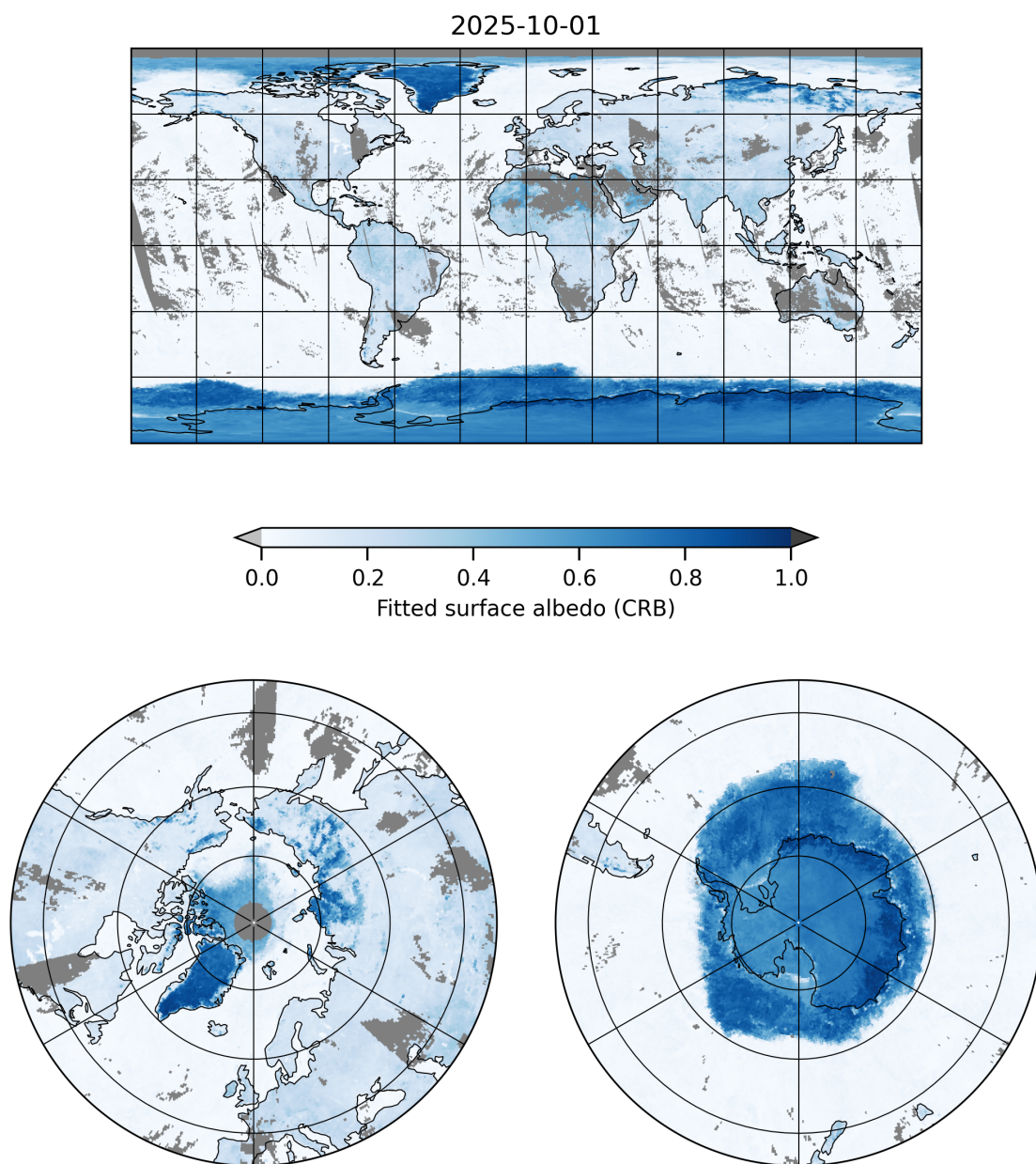


Figure 11: Map of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02



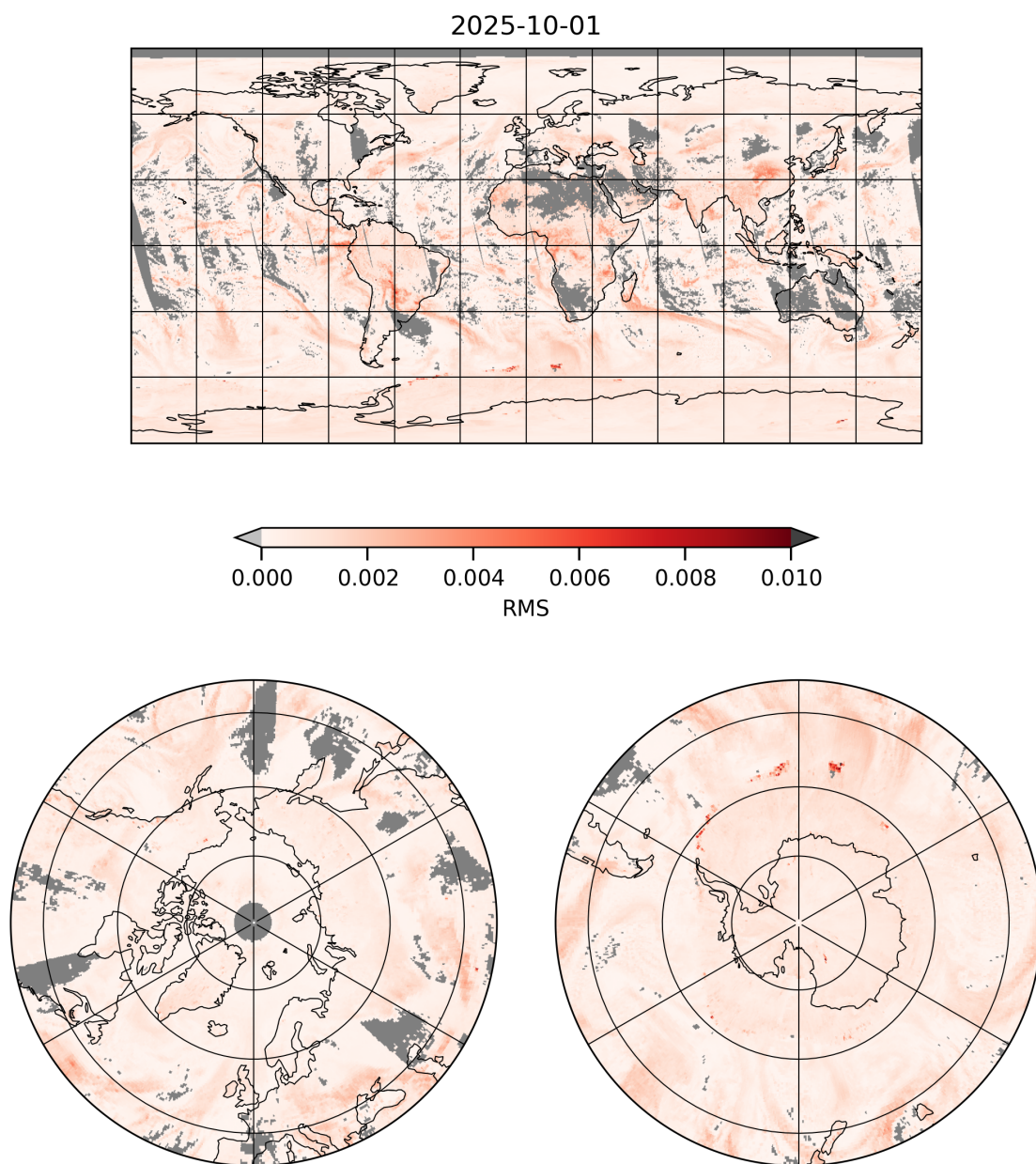


Figure 12: Map of “RMS” for 2025-10-01 to 2025-10-02

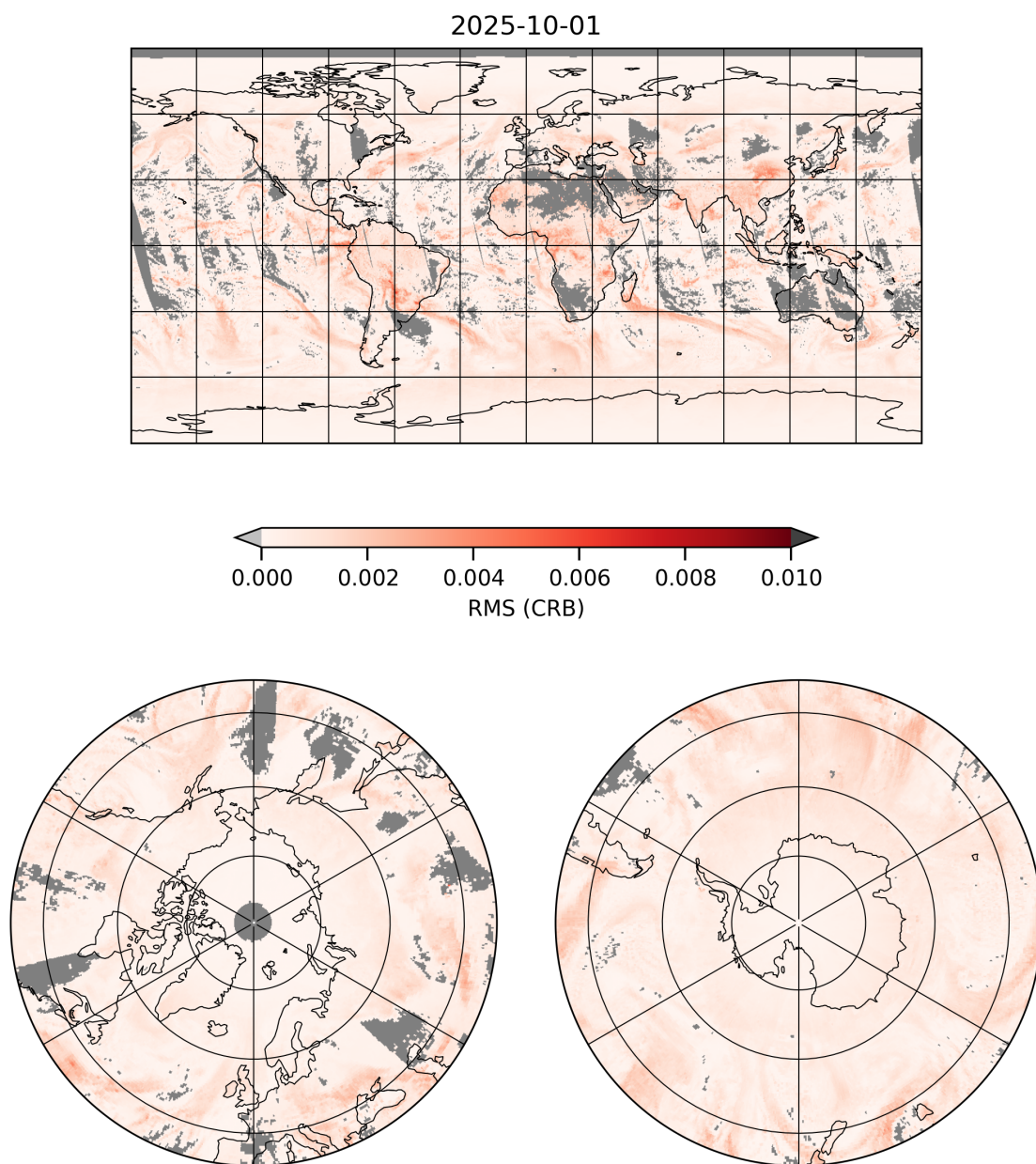


Figure 13: Map of “RMS (CRB)” for 2025-10-01 to 2025-10-02

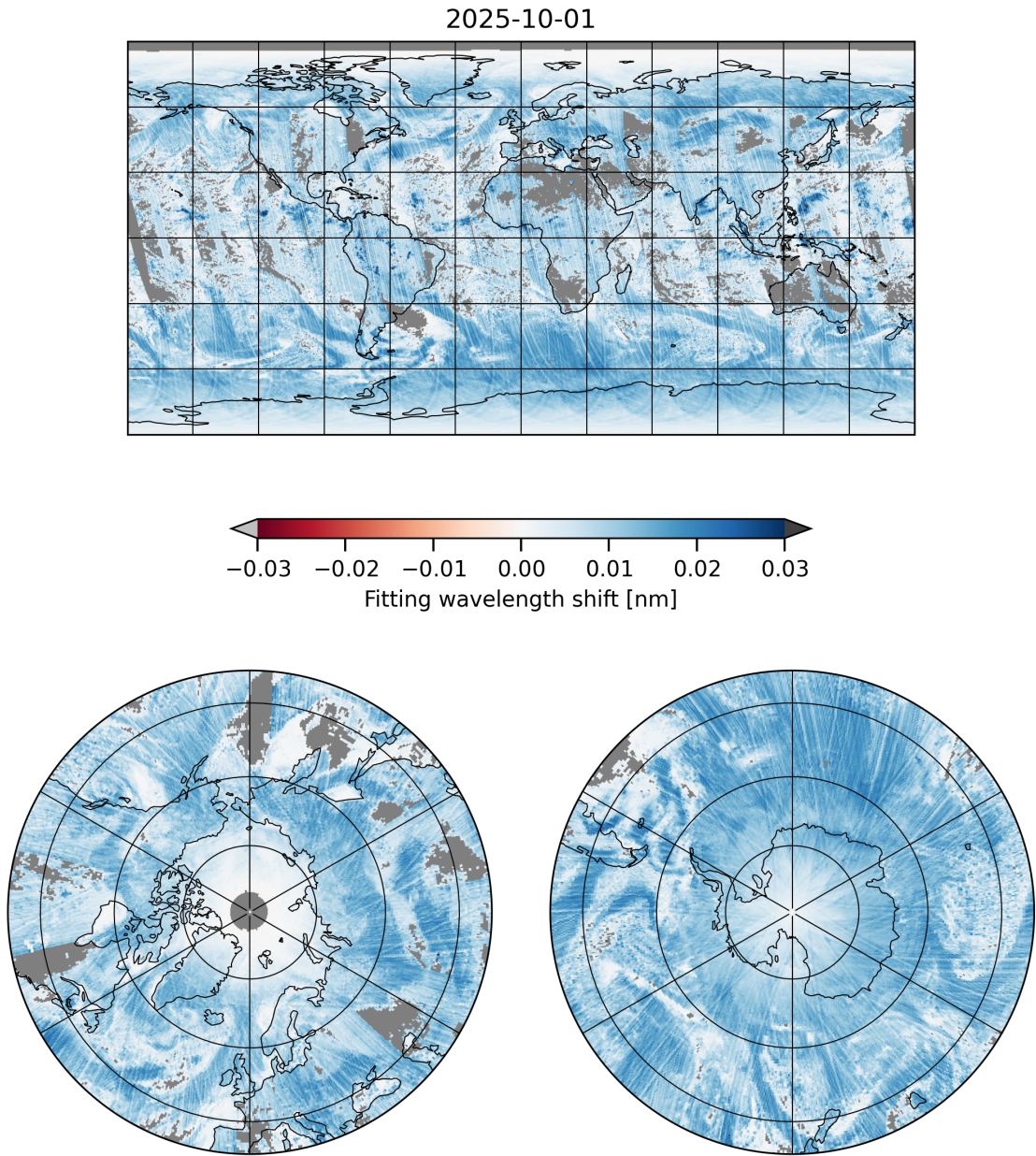


Figure 14: Map of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02



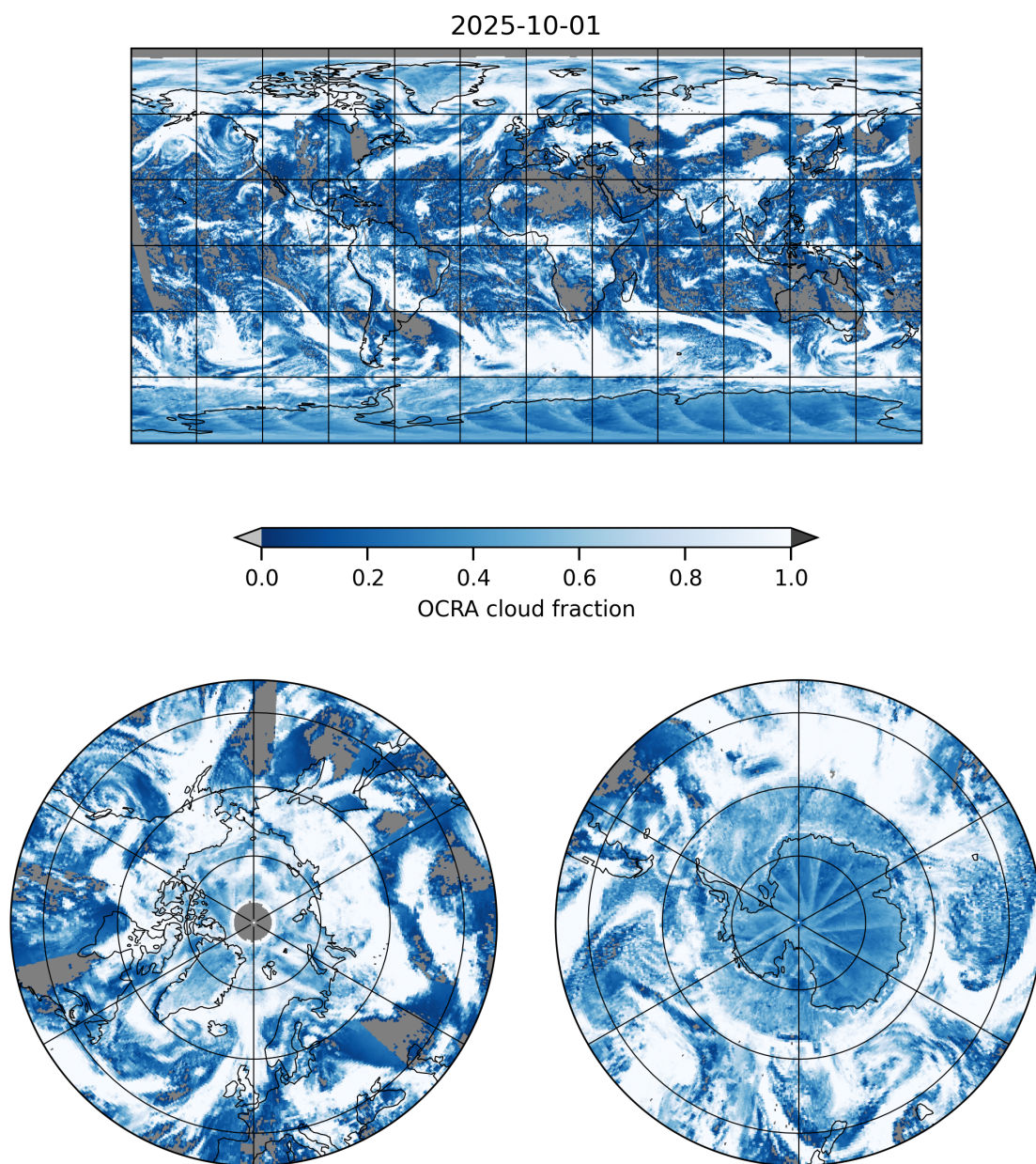


Figure 15: Map of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02

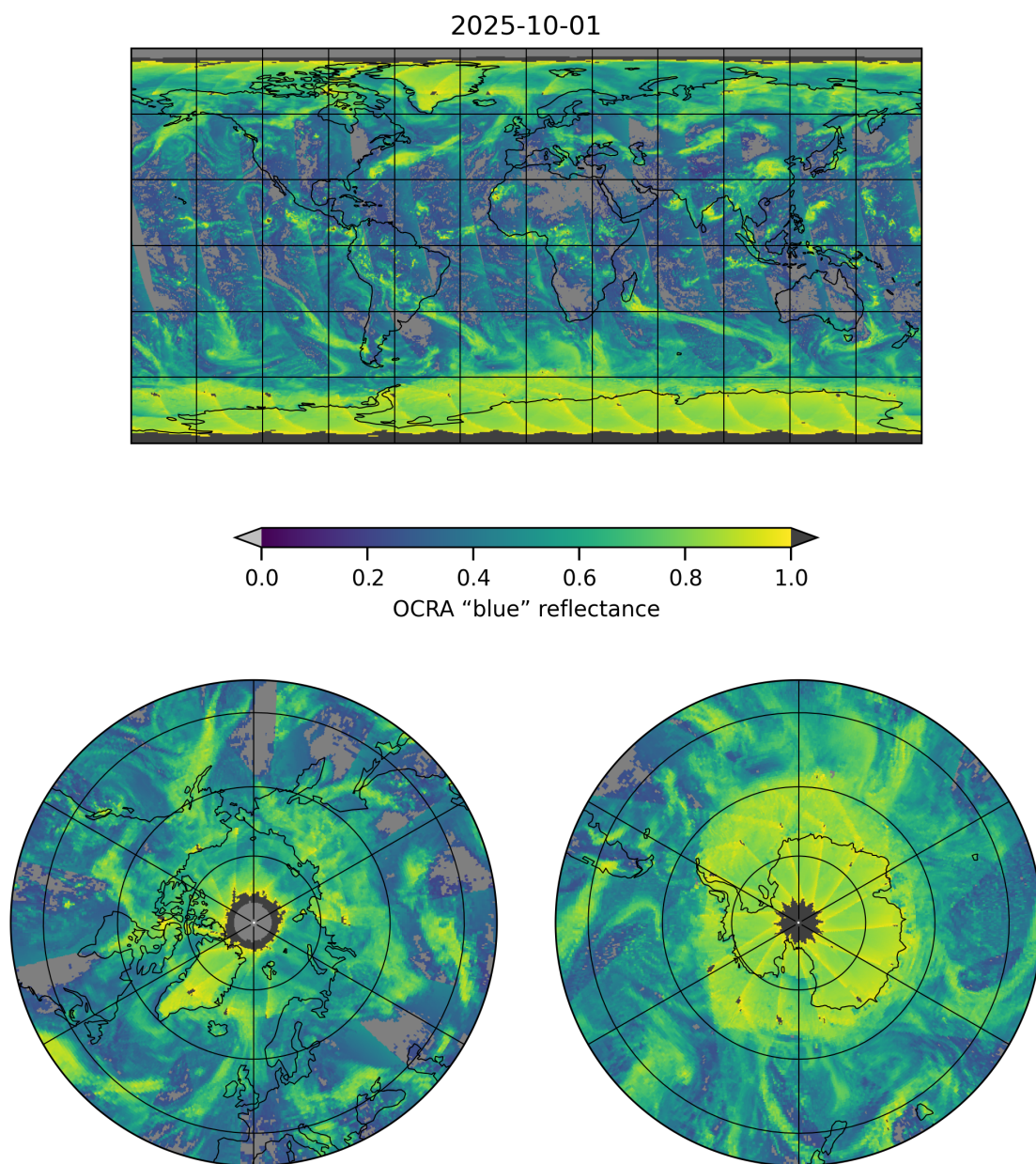


Figure 16: Map of "OCRA "blue" reflectance" for 2025-10-01 to 2025-10-02



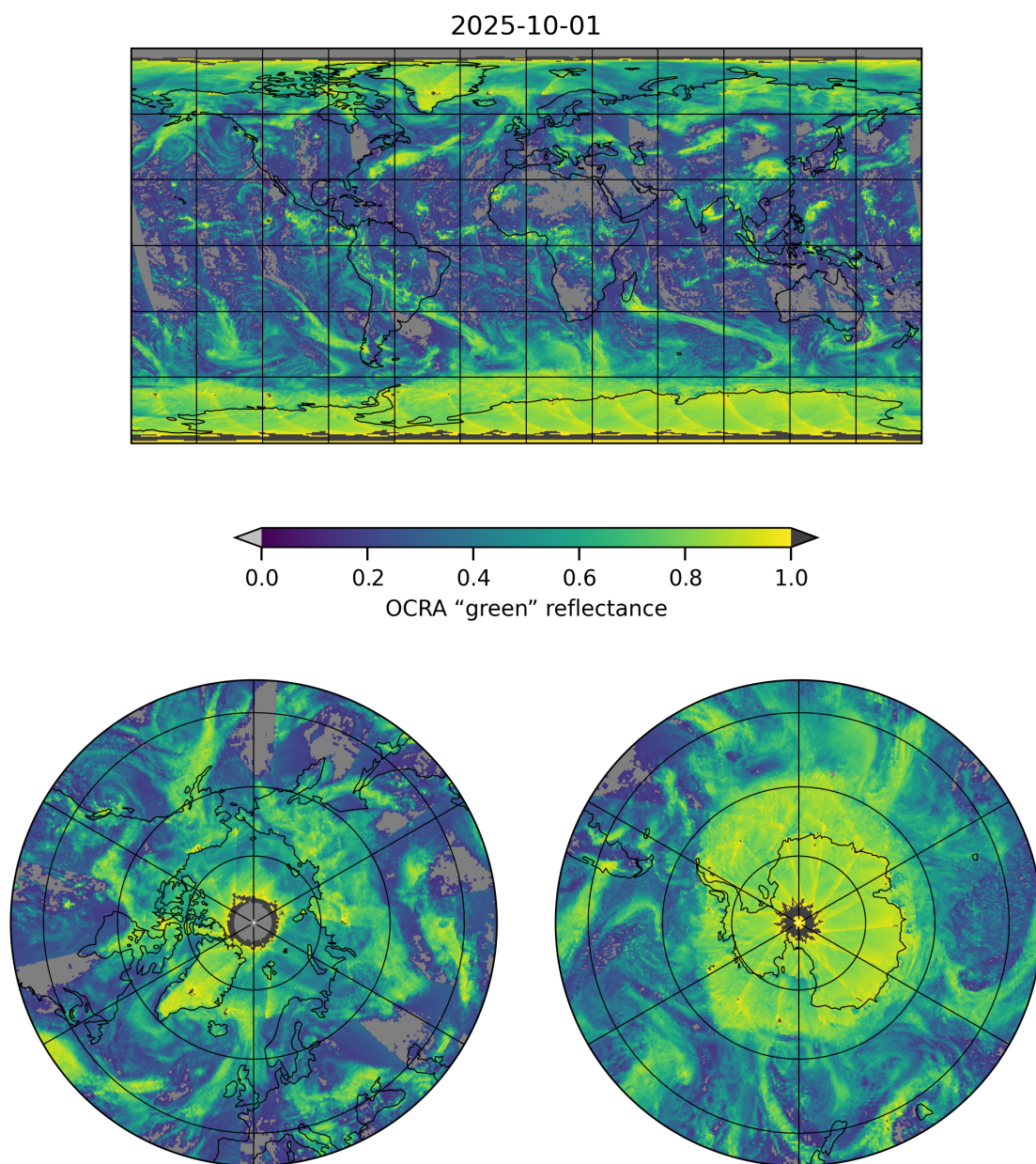


Figure 17: Map of "OCRA "green" reflectance" for 2025-10-01 to 2025-10-02

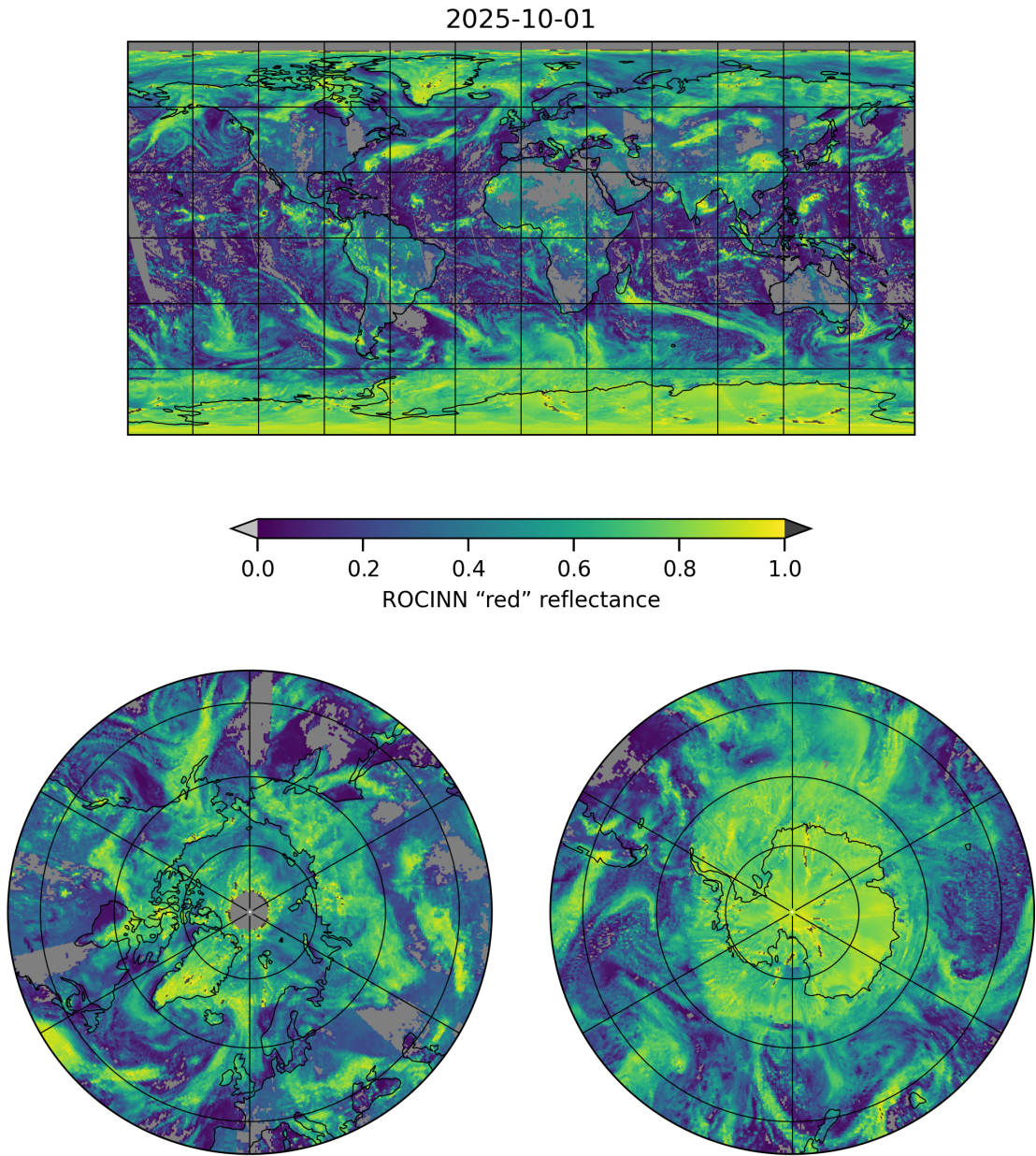


Figure 18: Map of "ROCINN "red" reflectance" for 2025-10-01 to 2025-10-02

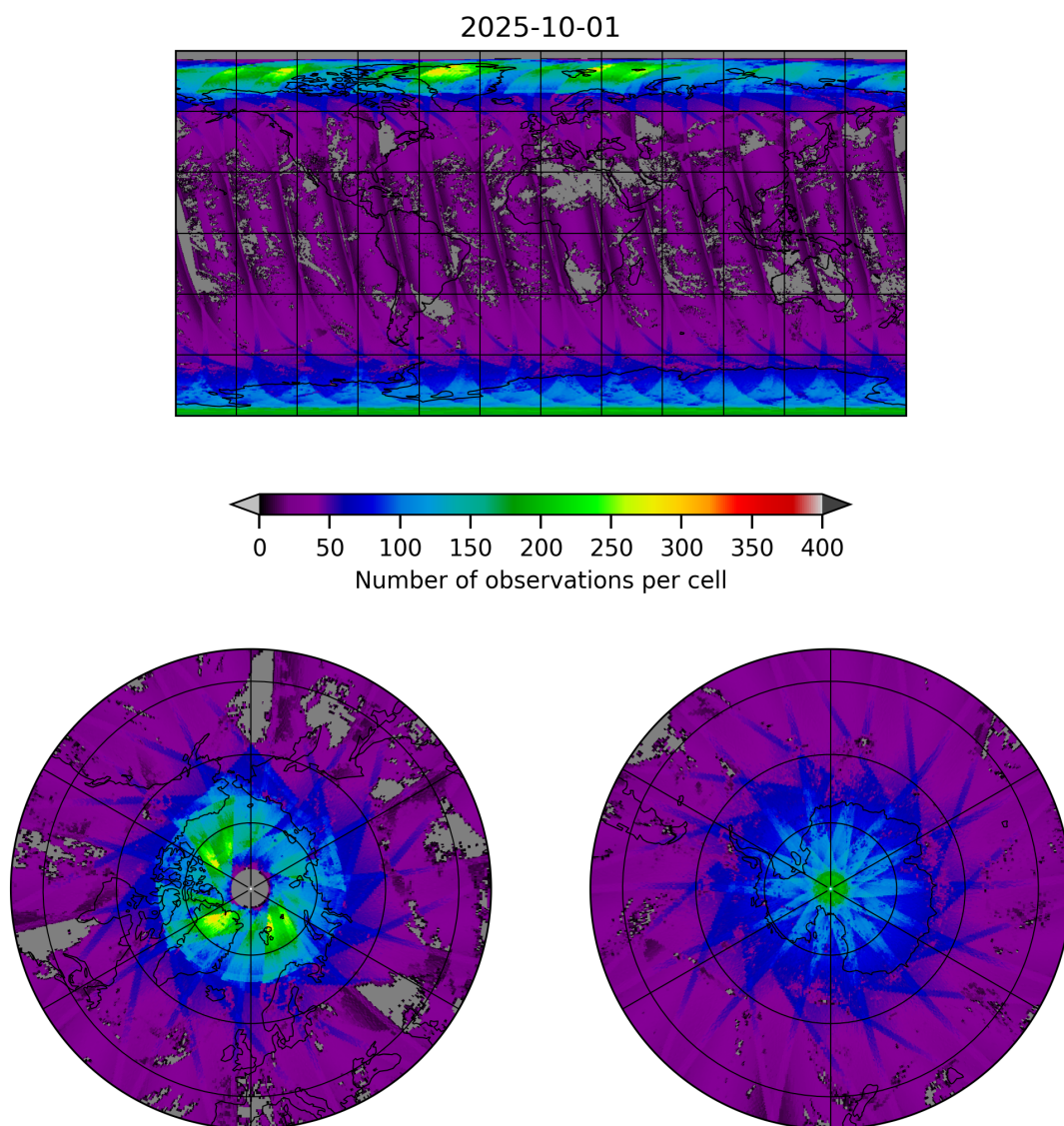


Figure 19: Map of the number of observations for 2025-10-01 to 2025-10-02



## 7 Zonal average

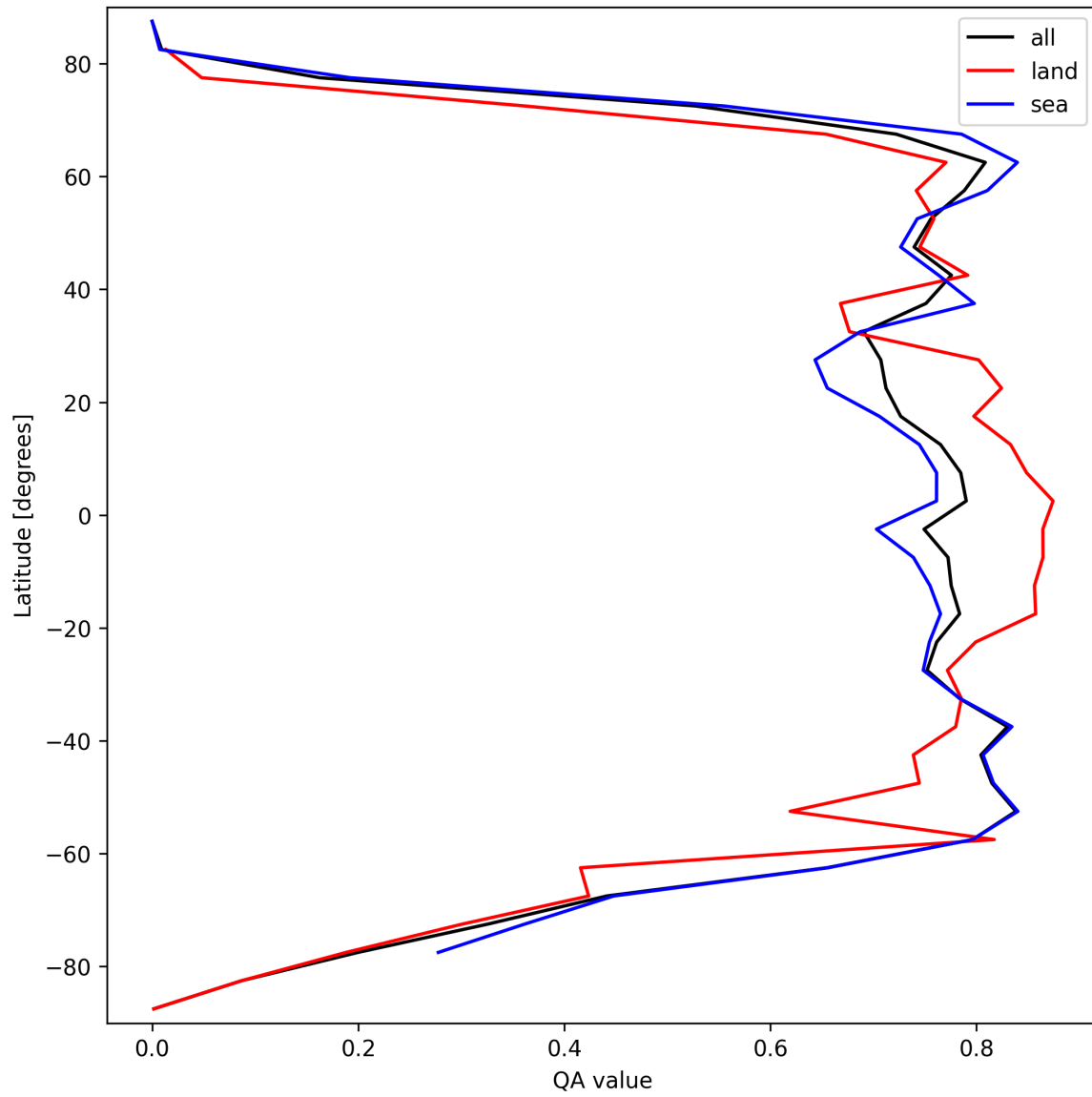


Figure 20: Zonal average of “QA value” for 2025-10-01 to 2025-10-02.



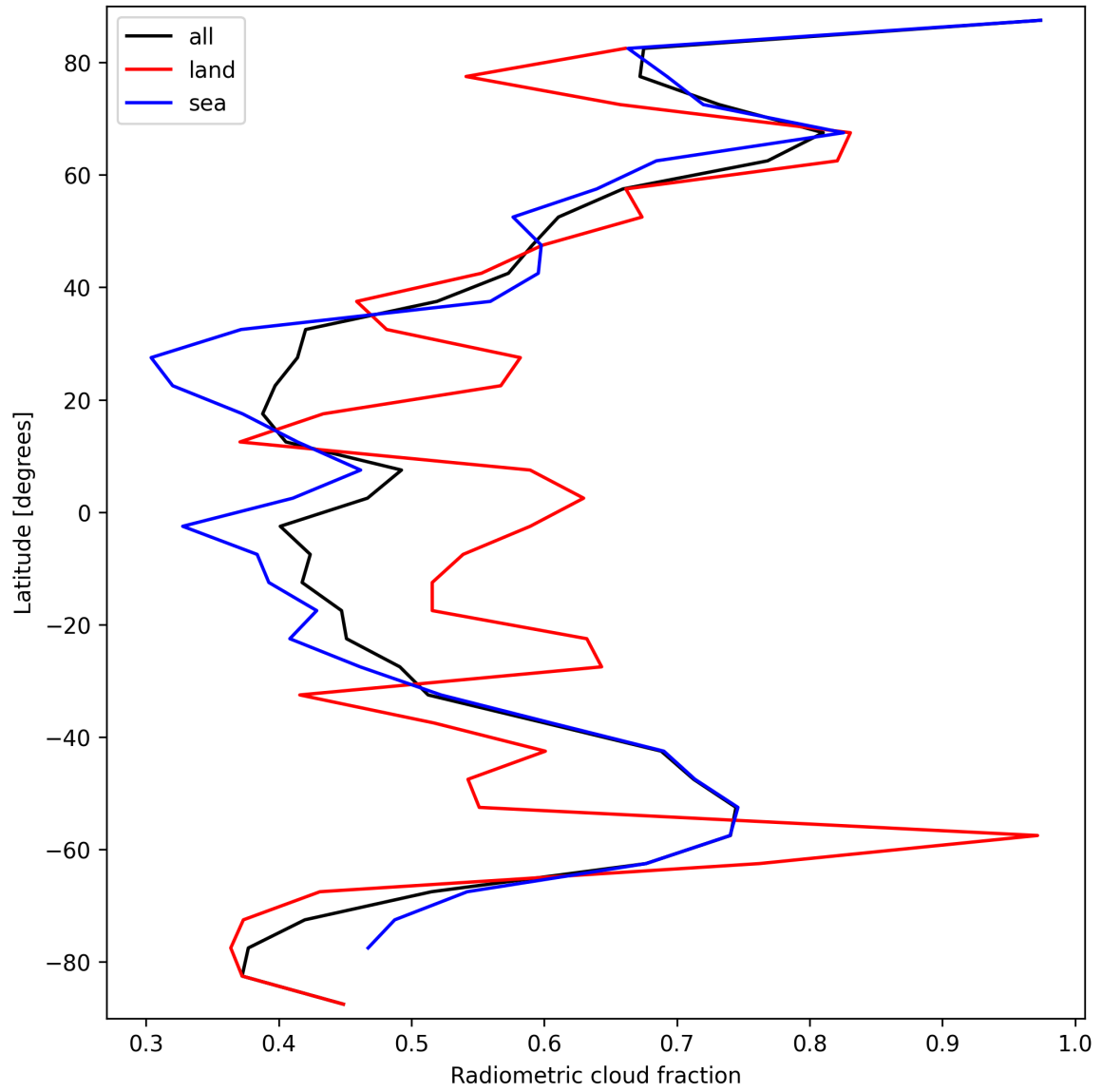


Figure 21: Zonal average of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02.

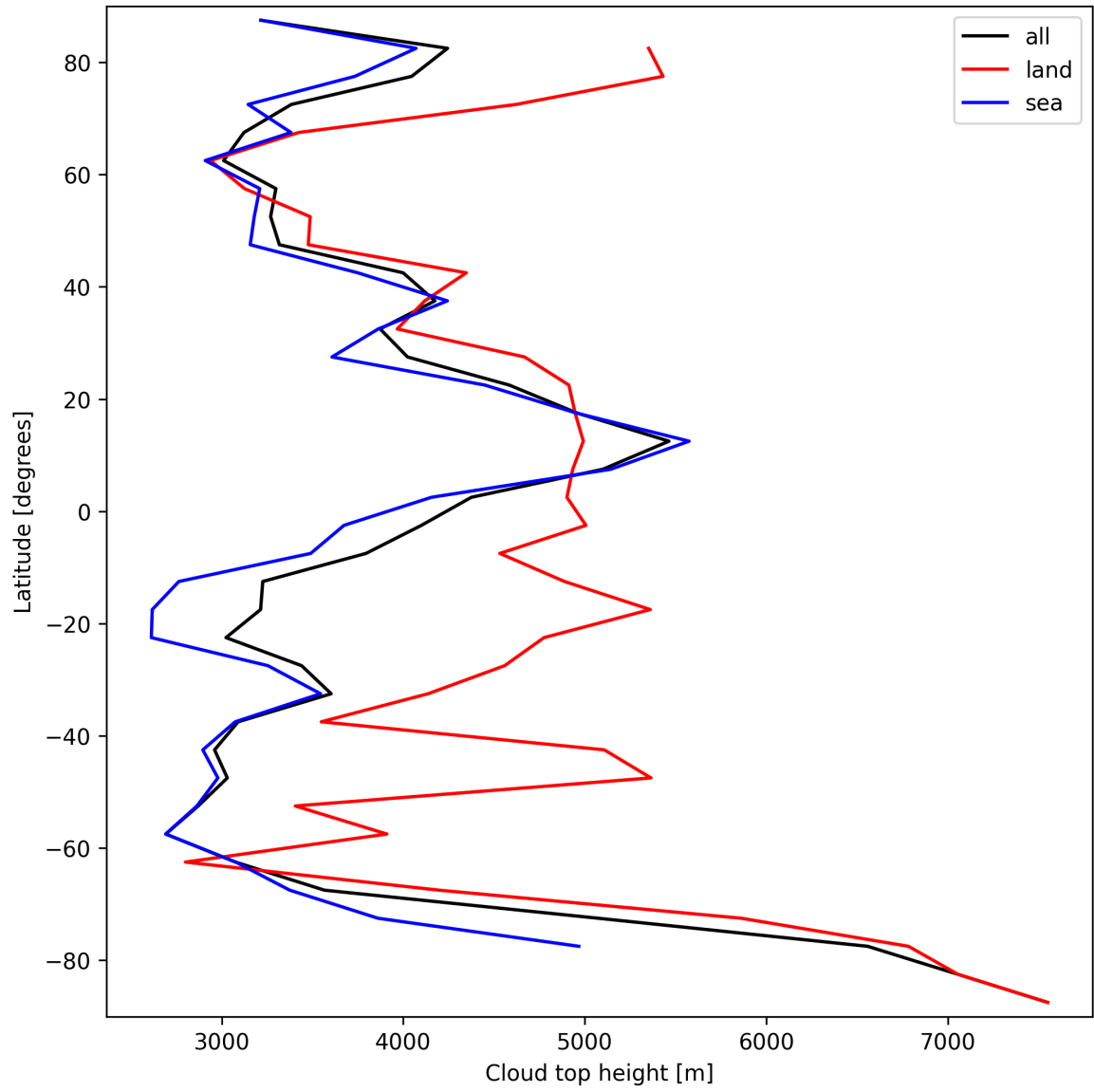


Figure 22: Zonal average of “Cloud top height” for 2025-10-01 to 2025-10-02.

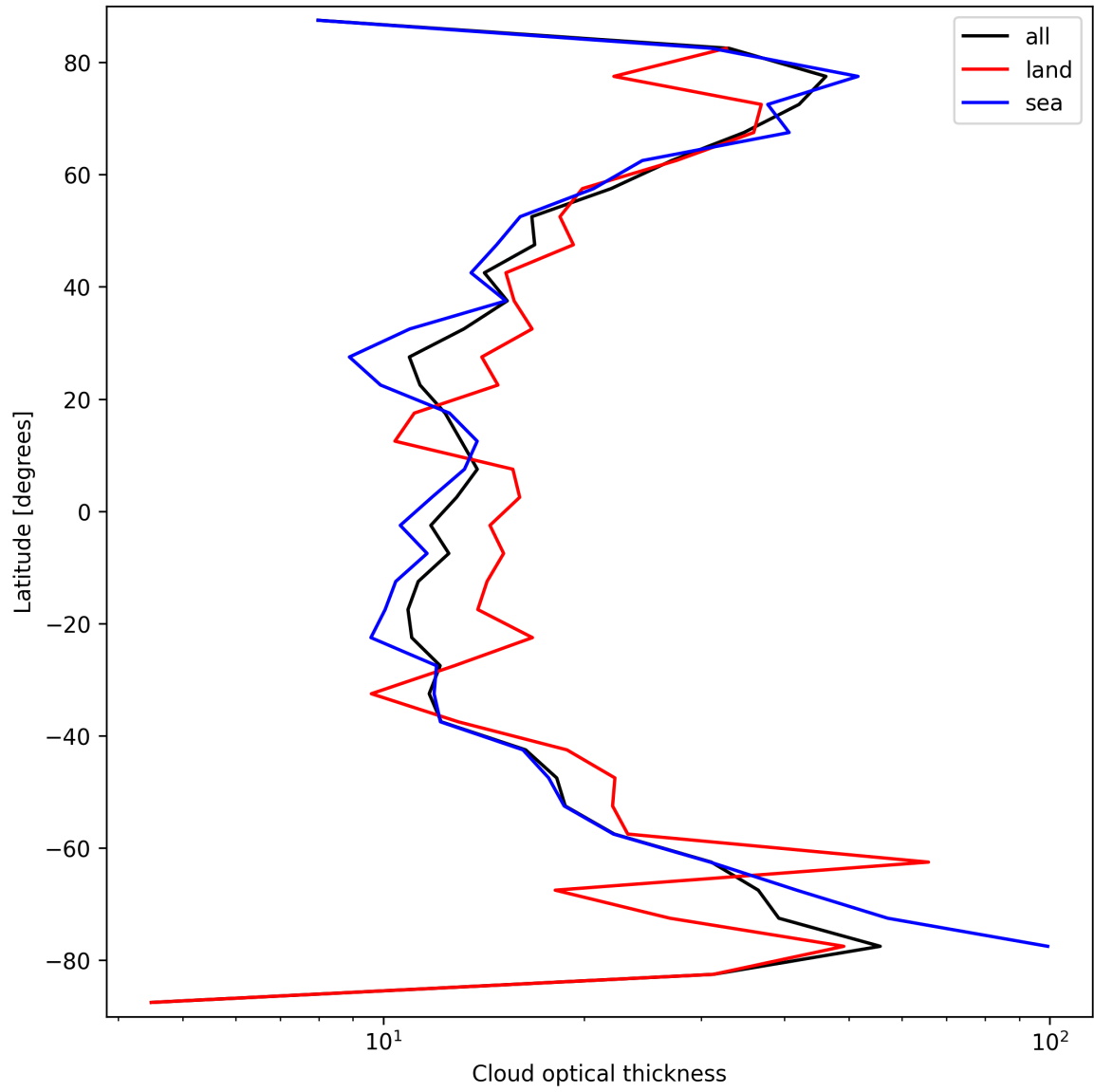


Figure 23: Zonal average of “Cloud optical thickness” for 2025-10-01 to 2025-10-02.

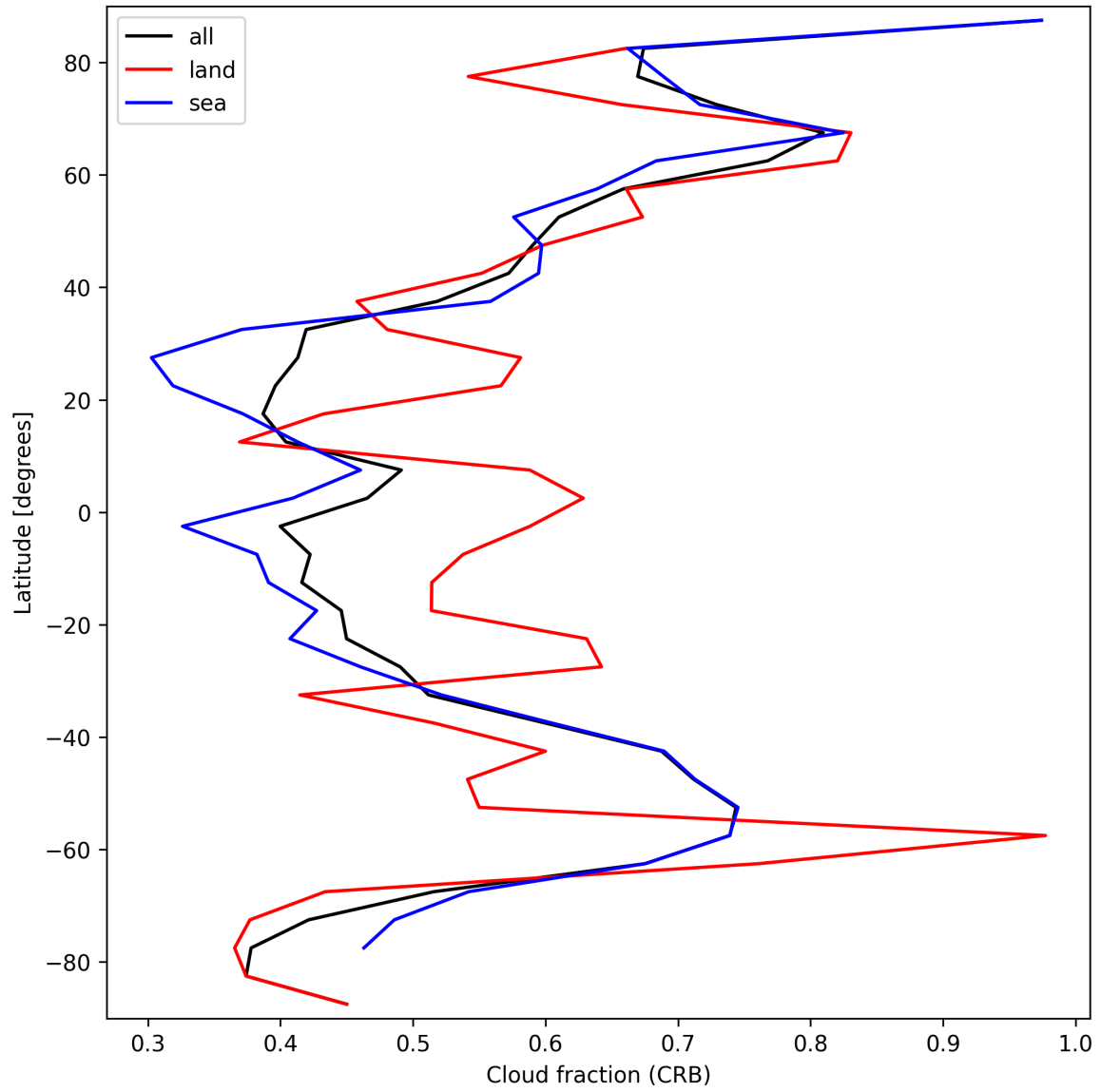


Figure 24: Zonal average of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02.



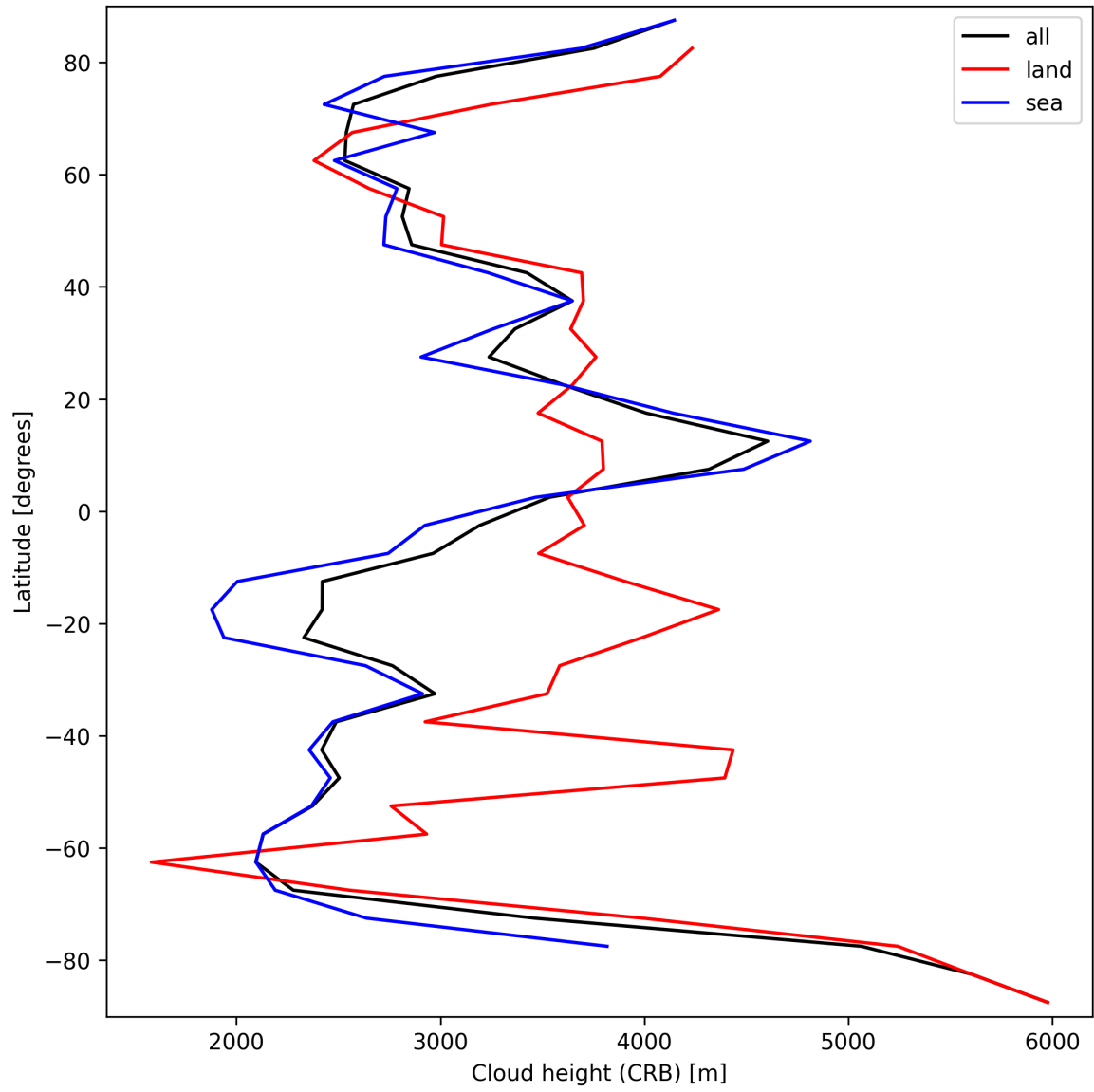


Figure 25: Zonal average of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02.

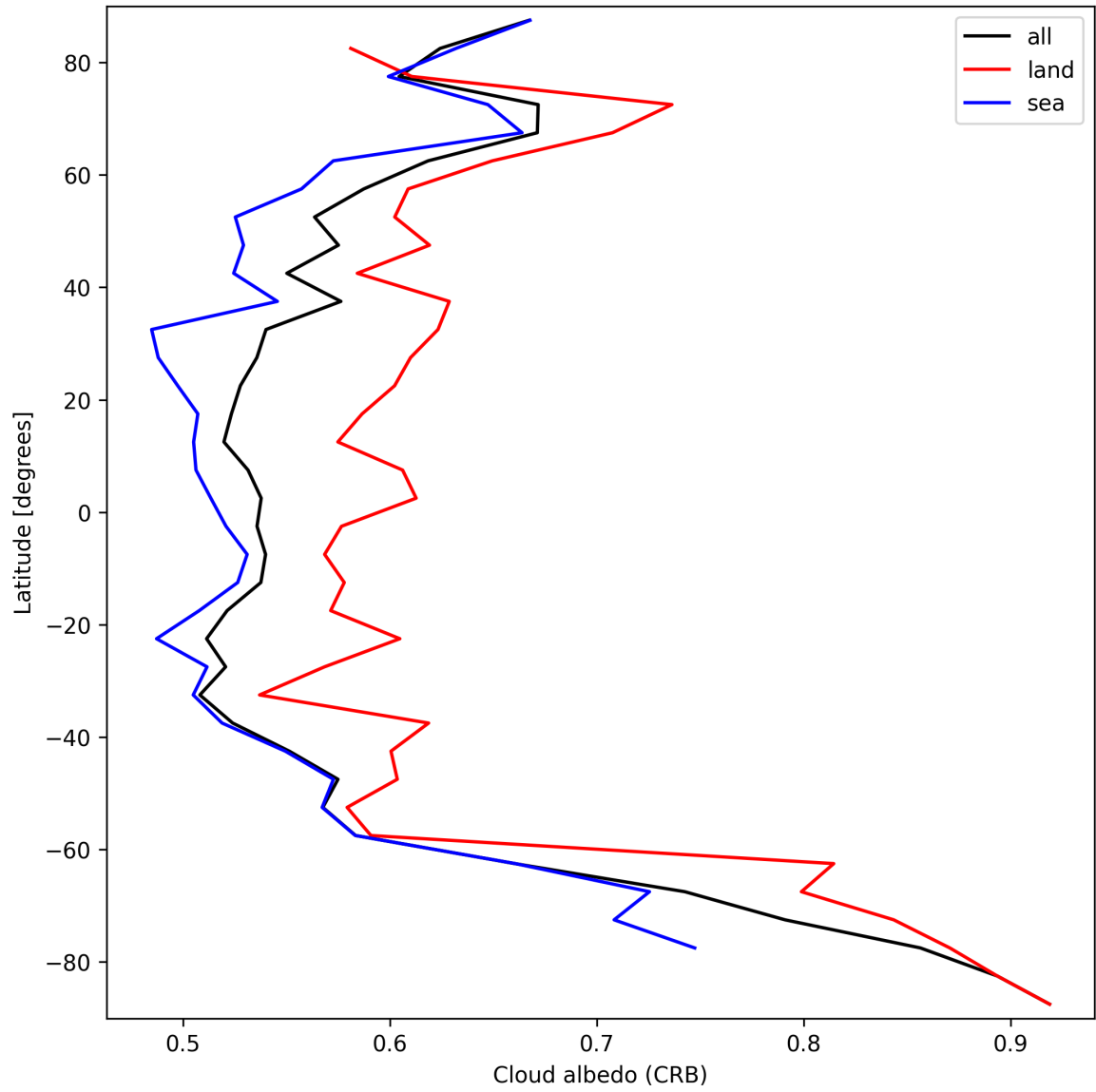


Figure 26: Zonal average of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02.

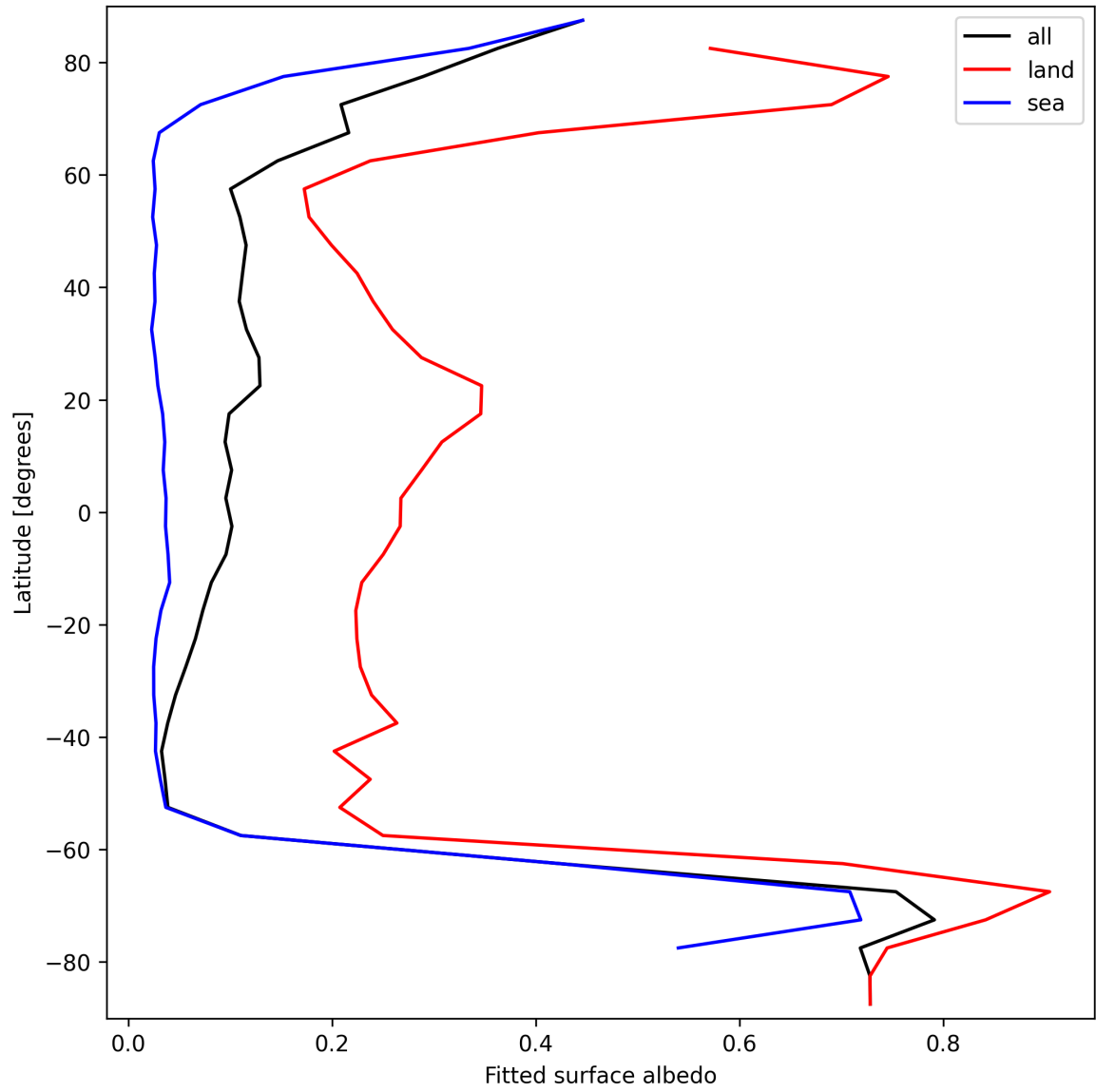


Figure 27: Zonal average of “Fitted surface albedo” for 2025-10-01 to 2025-10-02.

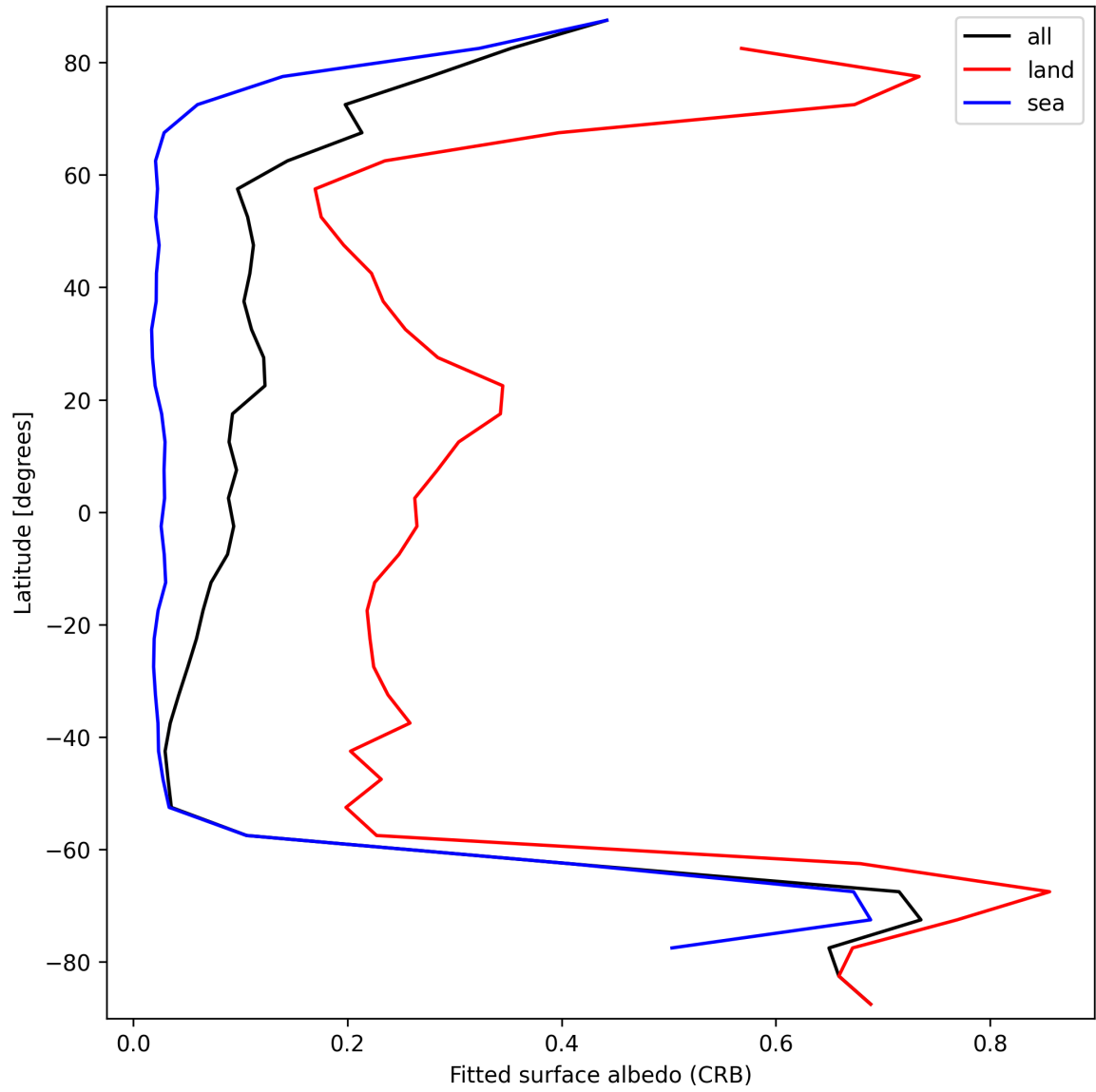


Figure 28: Zonal average of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02.



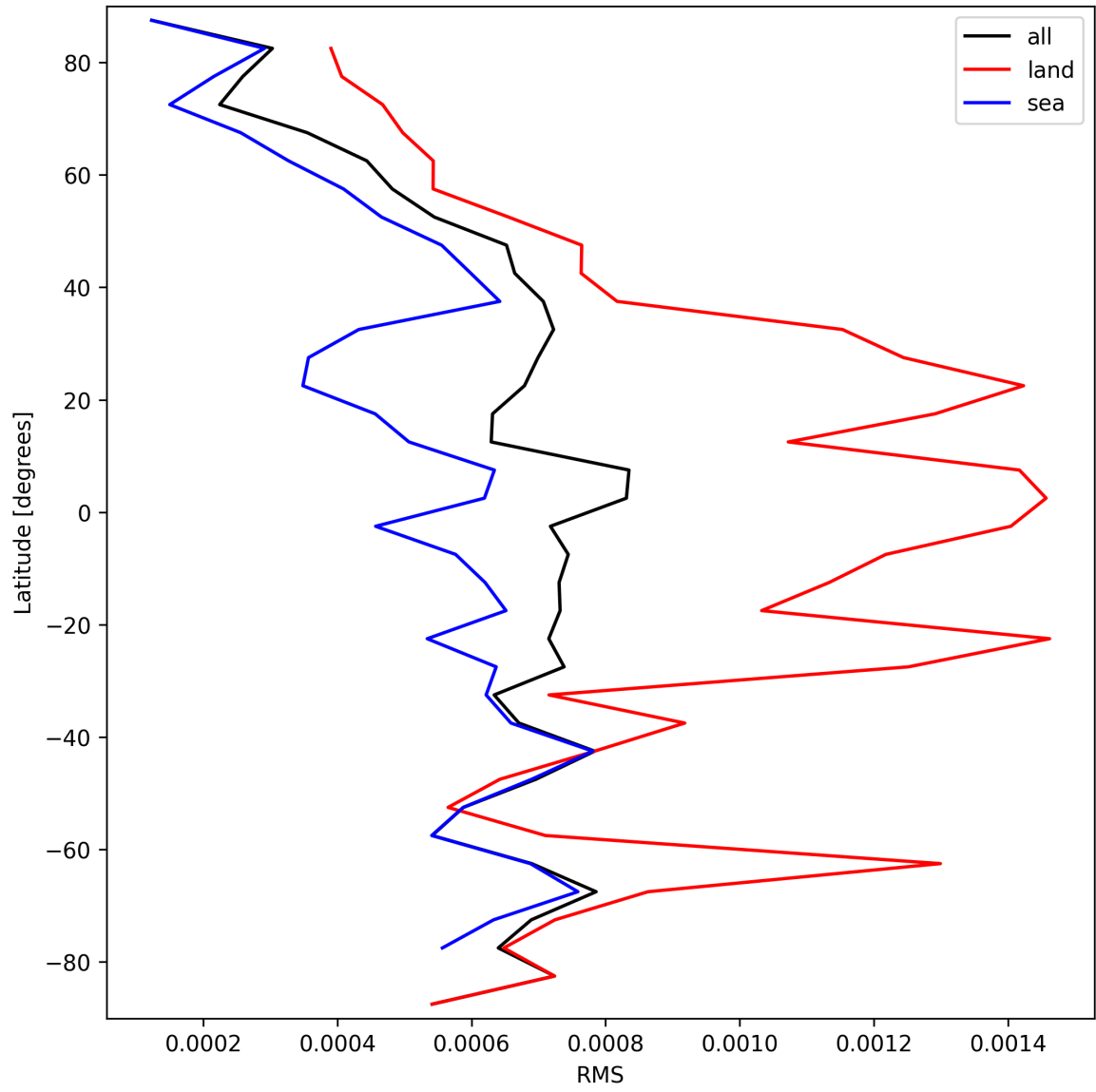


Figure 29: Zonal average of “RMS” for 2025-10-01 to 2025-10-02.

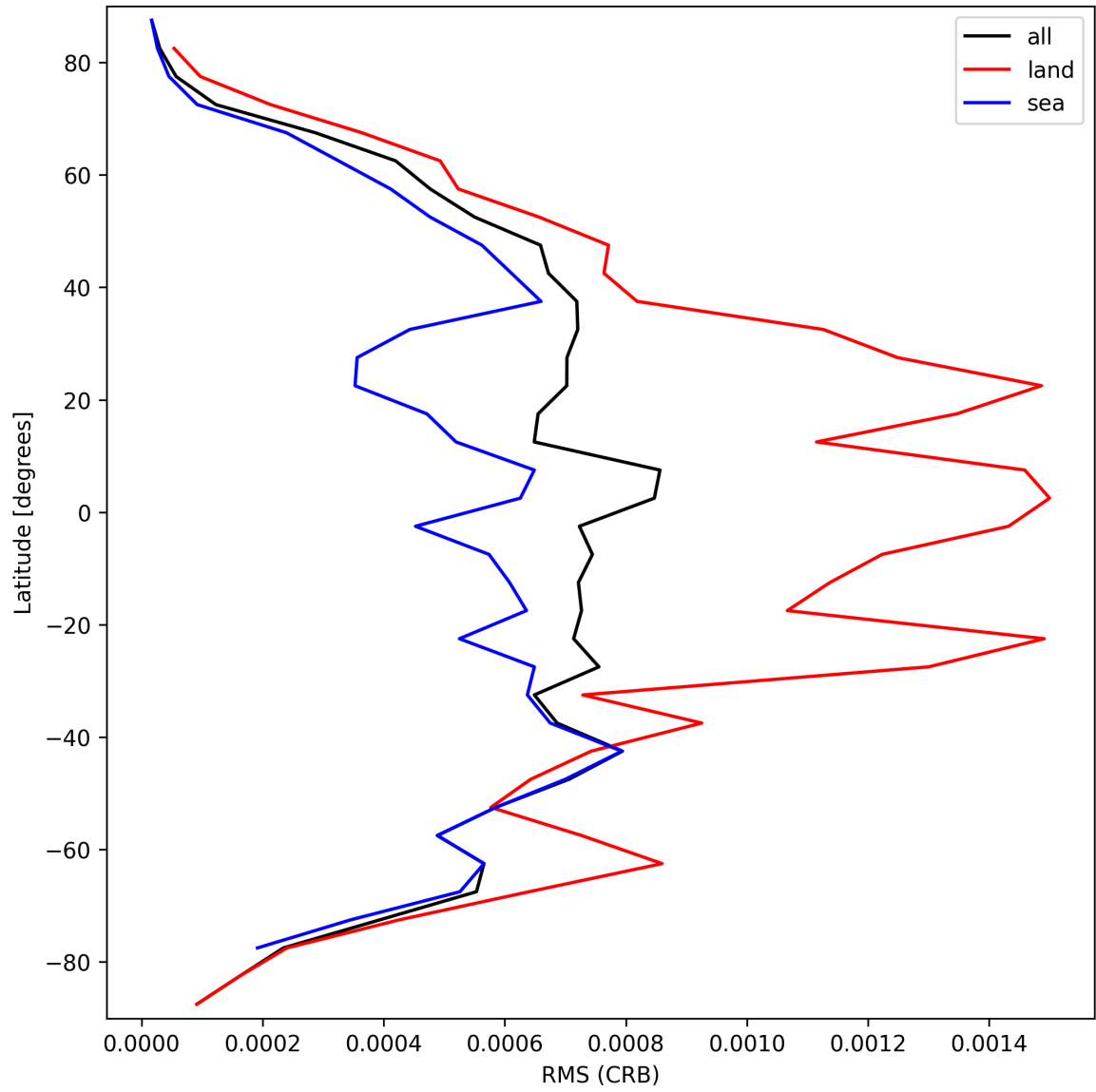


Figure 30: Zonal average of "RMS (CRB)" for 2025-10-01 to 2025-10-02.

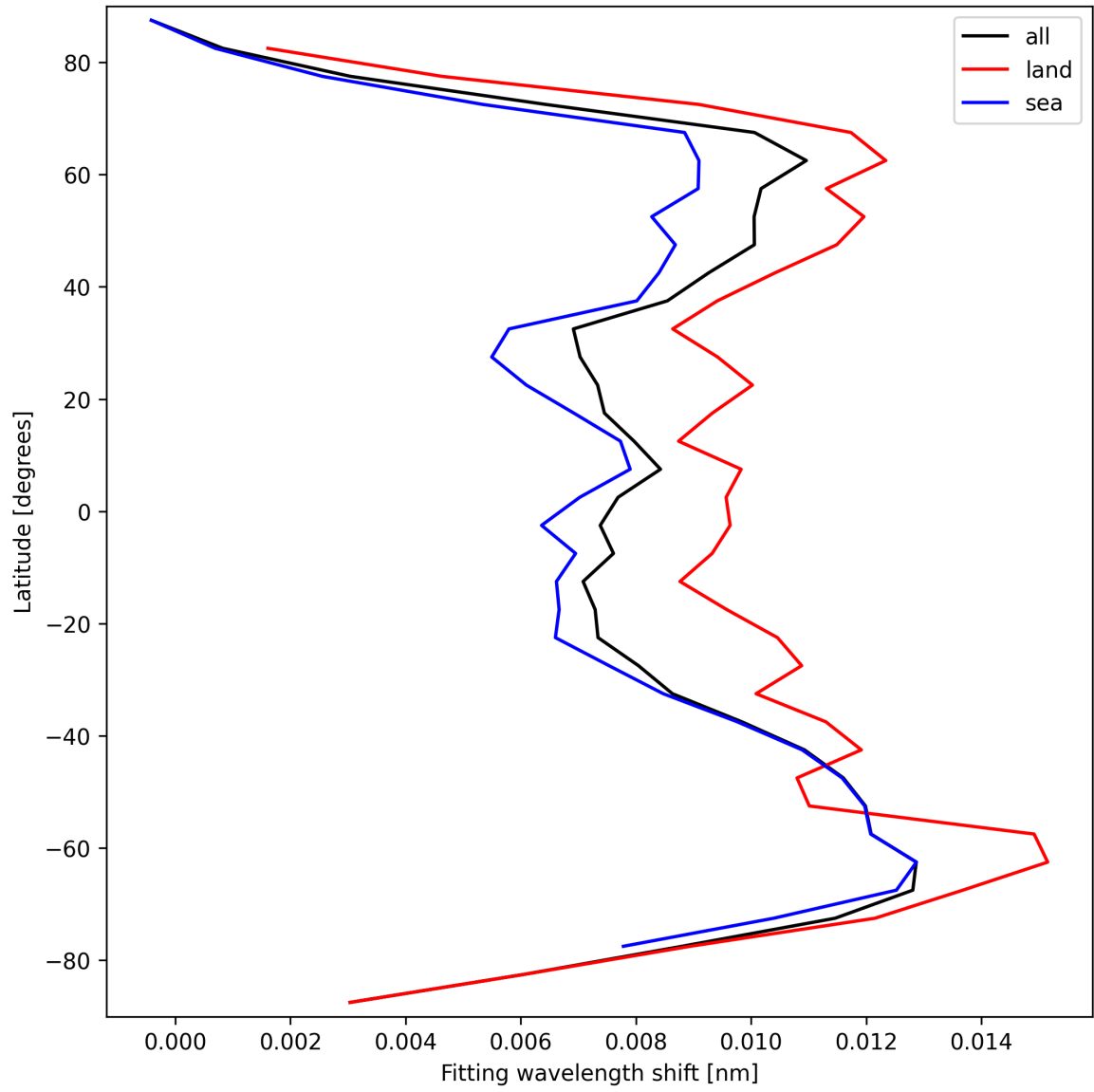


Figure 31: Zonal average of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02.

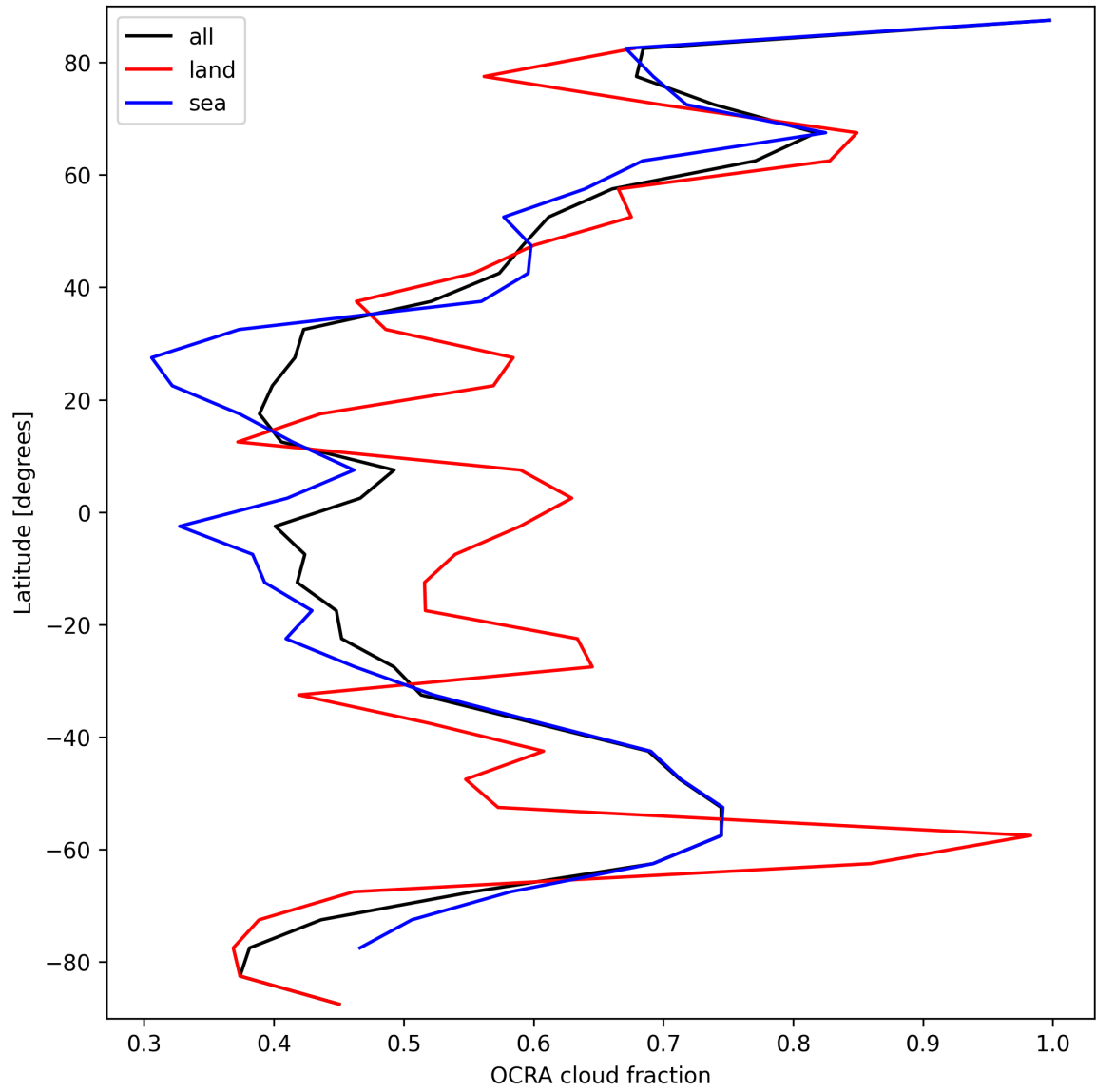


Figure 32: Zonal average of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02.

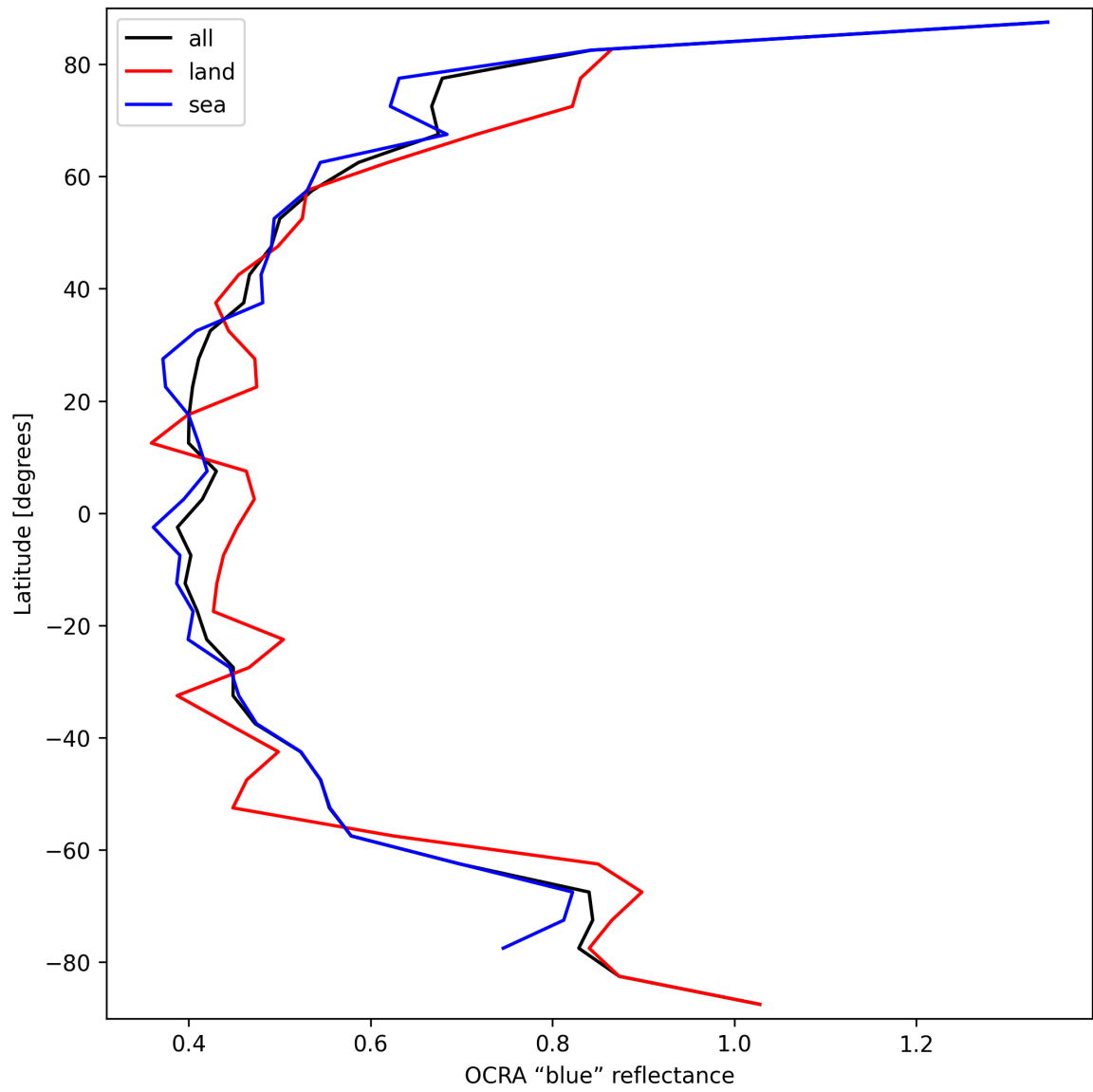


Figure 33: Zonal average of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02.



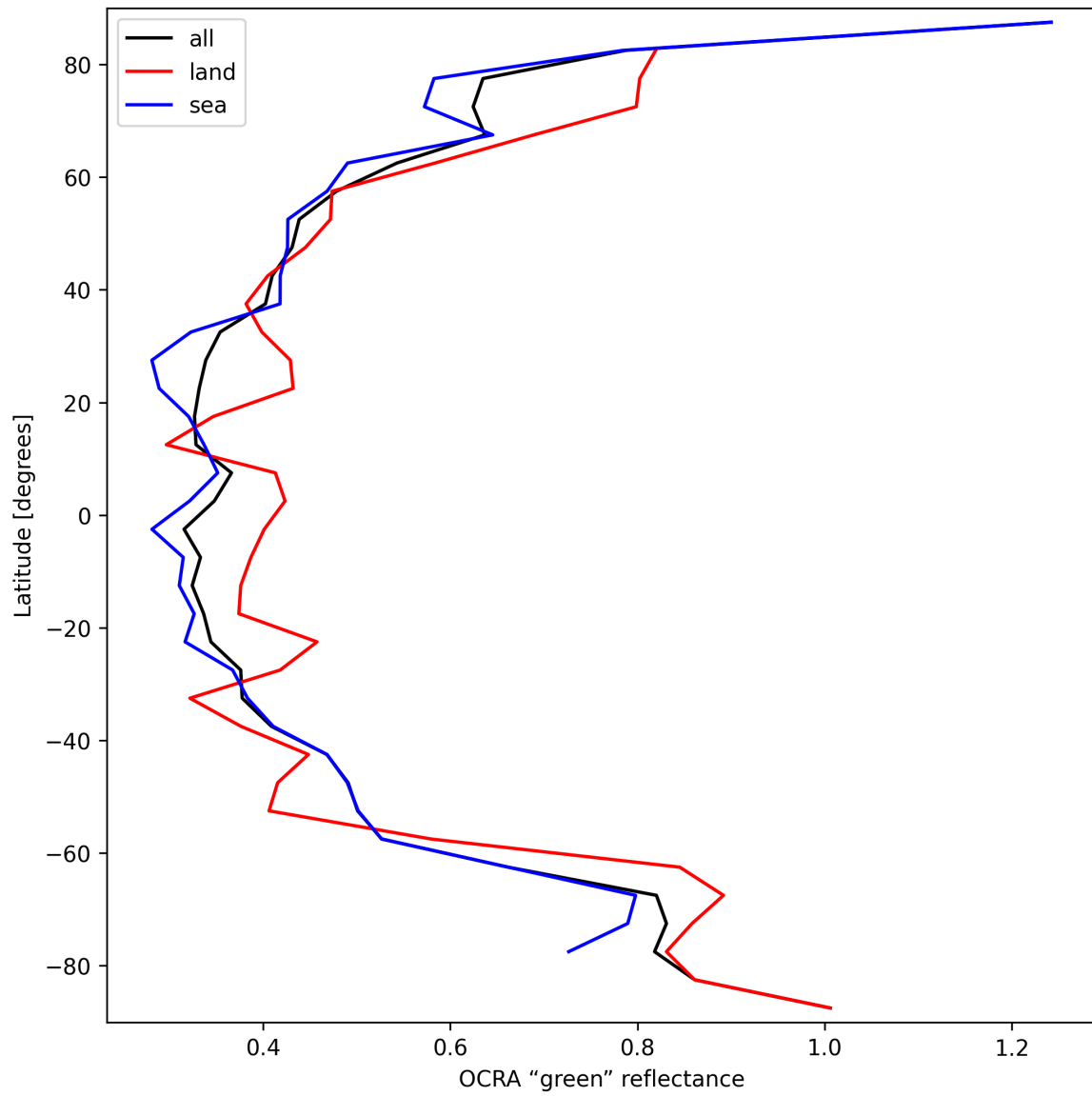


Figure 34: Zonal average of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02.

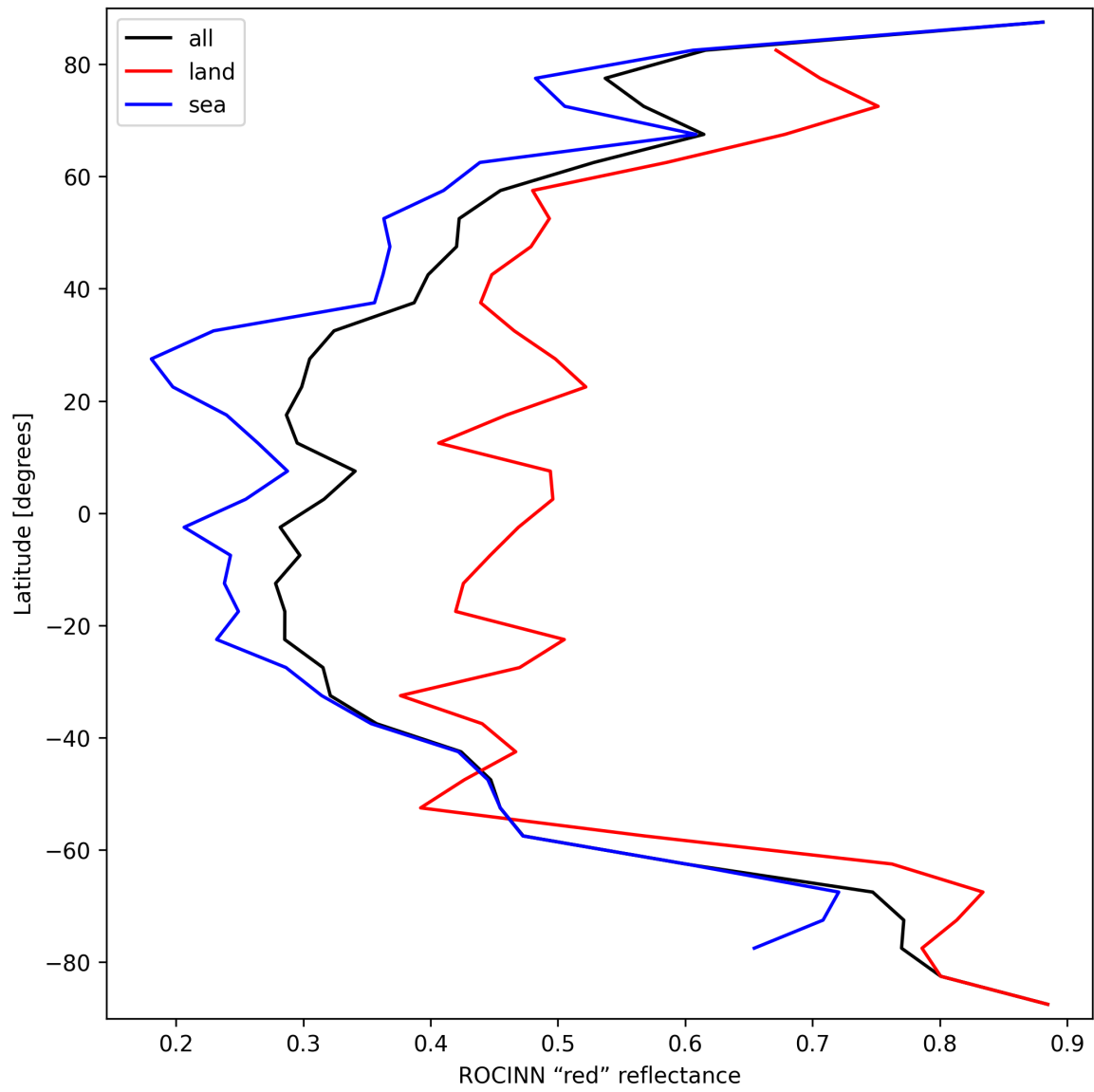


Figure 35: Zonal average of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02.

## 8 Histograms

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

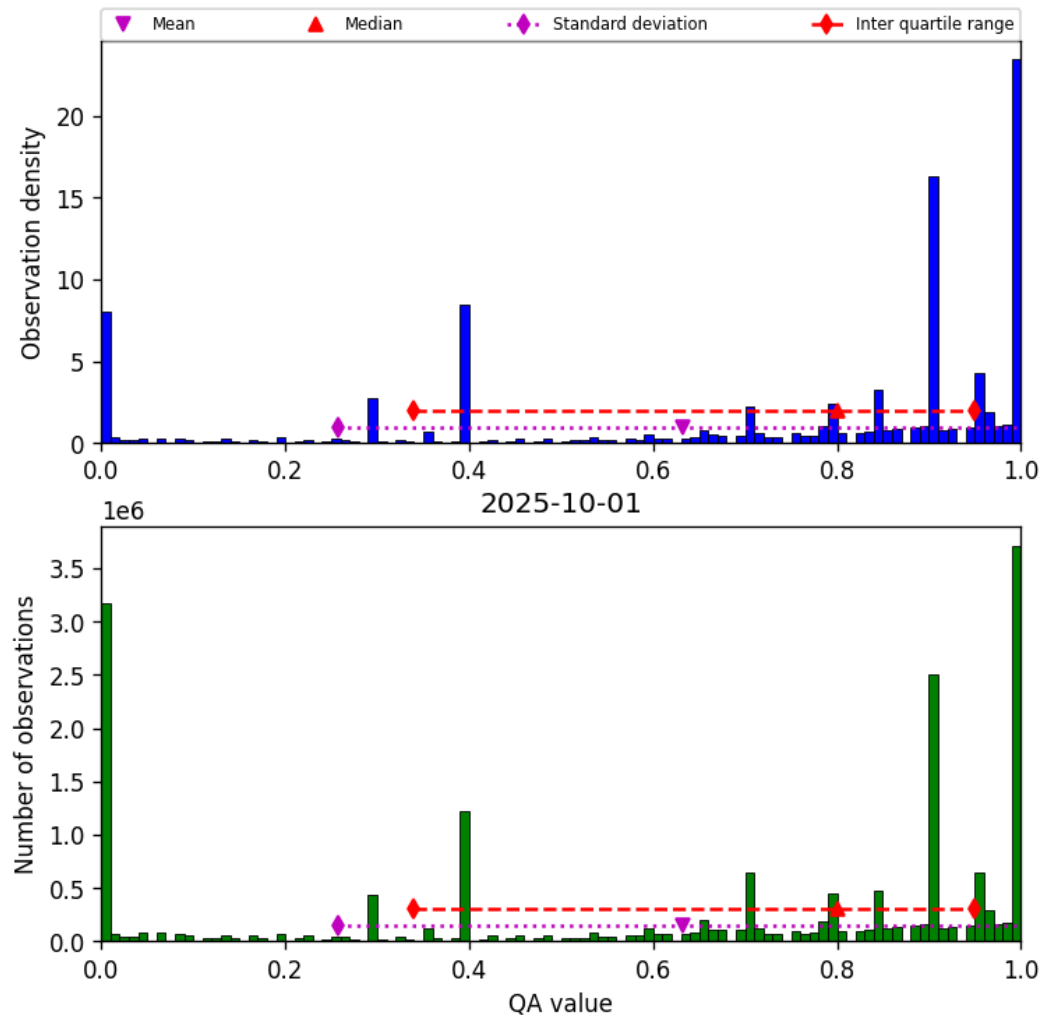


Figure 36: Histogram of “QA value” for 2025-10-01 to 2025-10-02

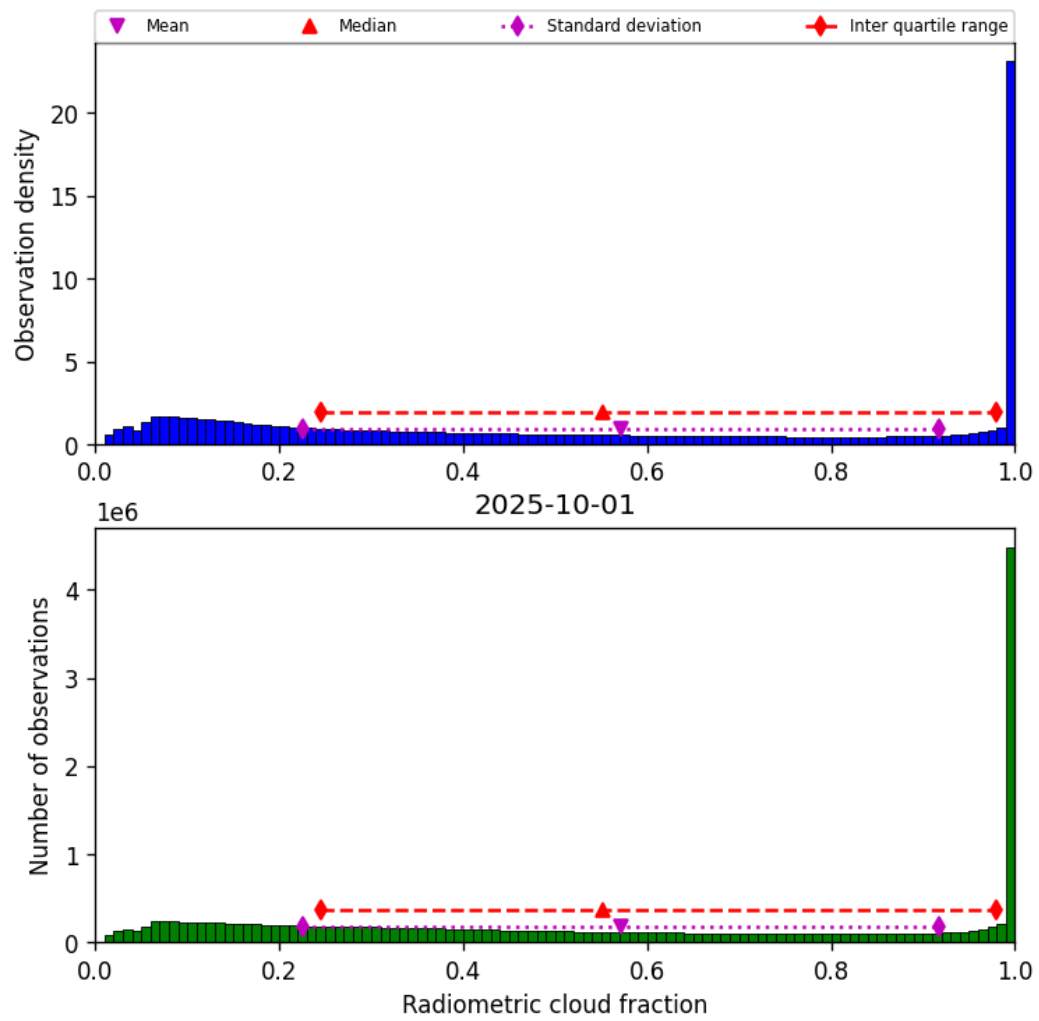


Figure 37: Histogram of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02

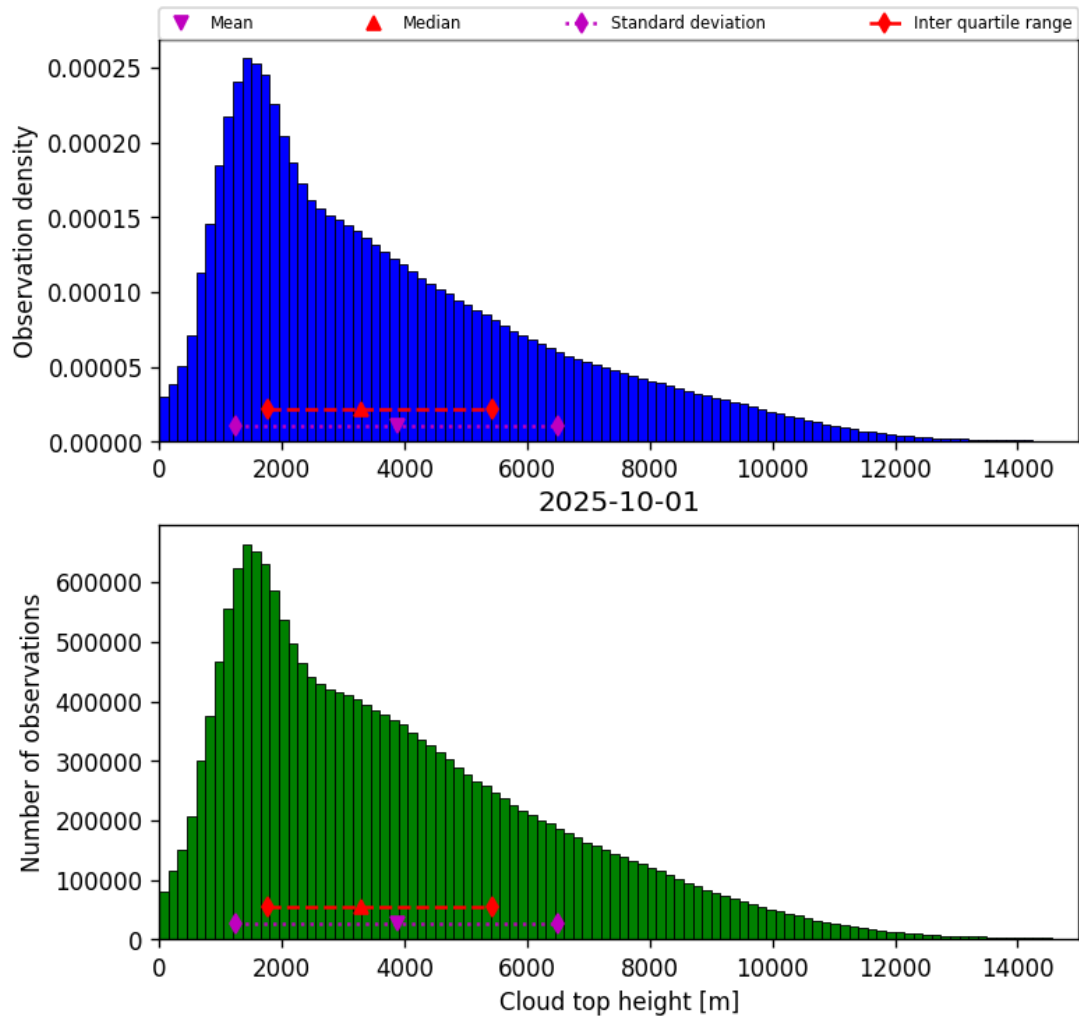


Figure 38: Histogram of “Cloud top height” for 2025-10-01 to 2025-10-02



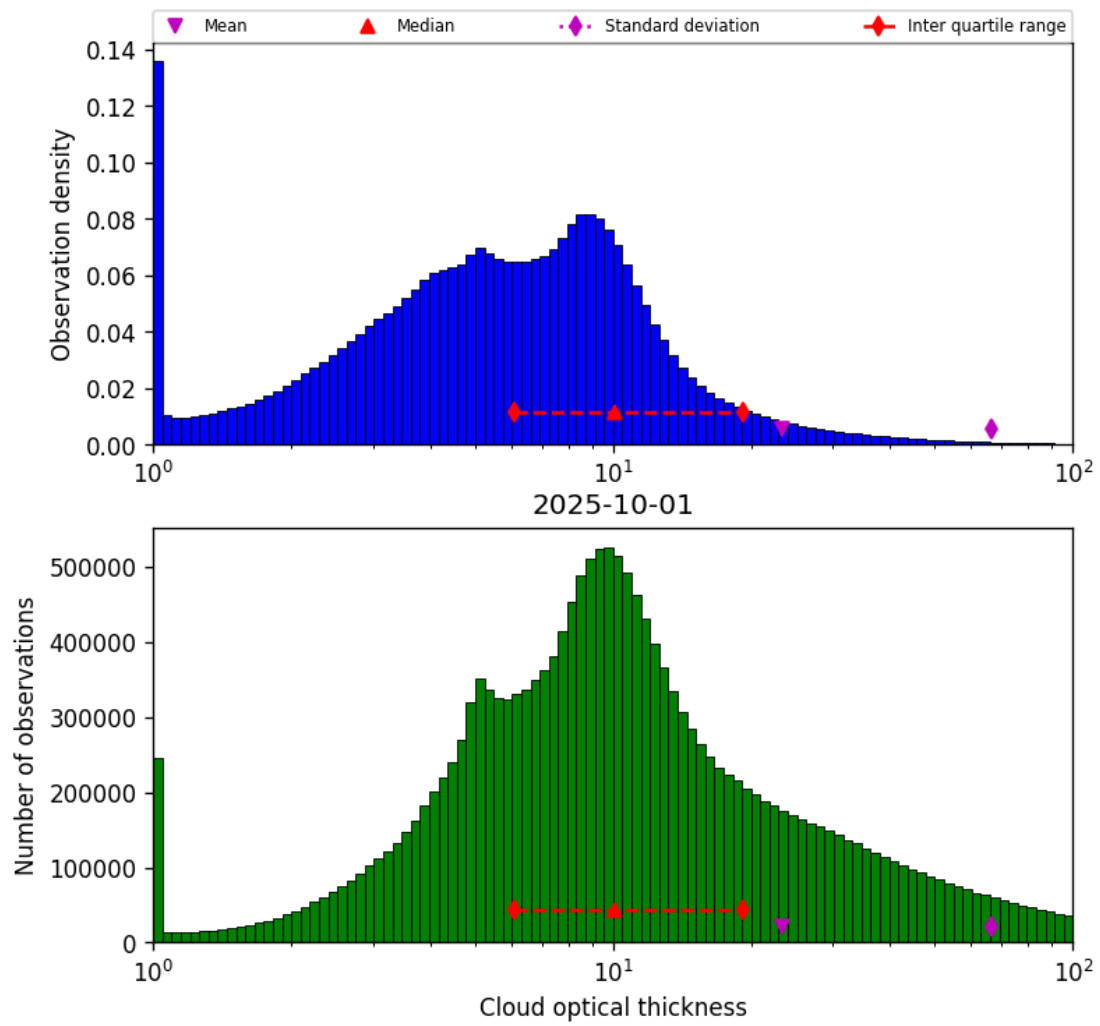


Figure 39: Histogram of “Cloud optical thickness” for 2025-10-01 to 2025-10-02

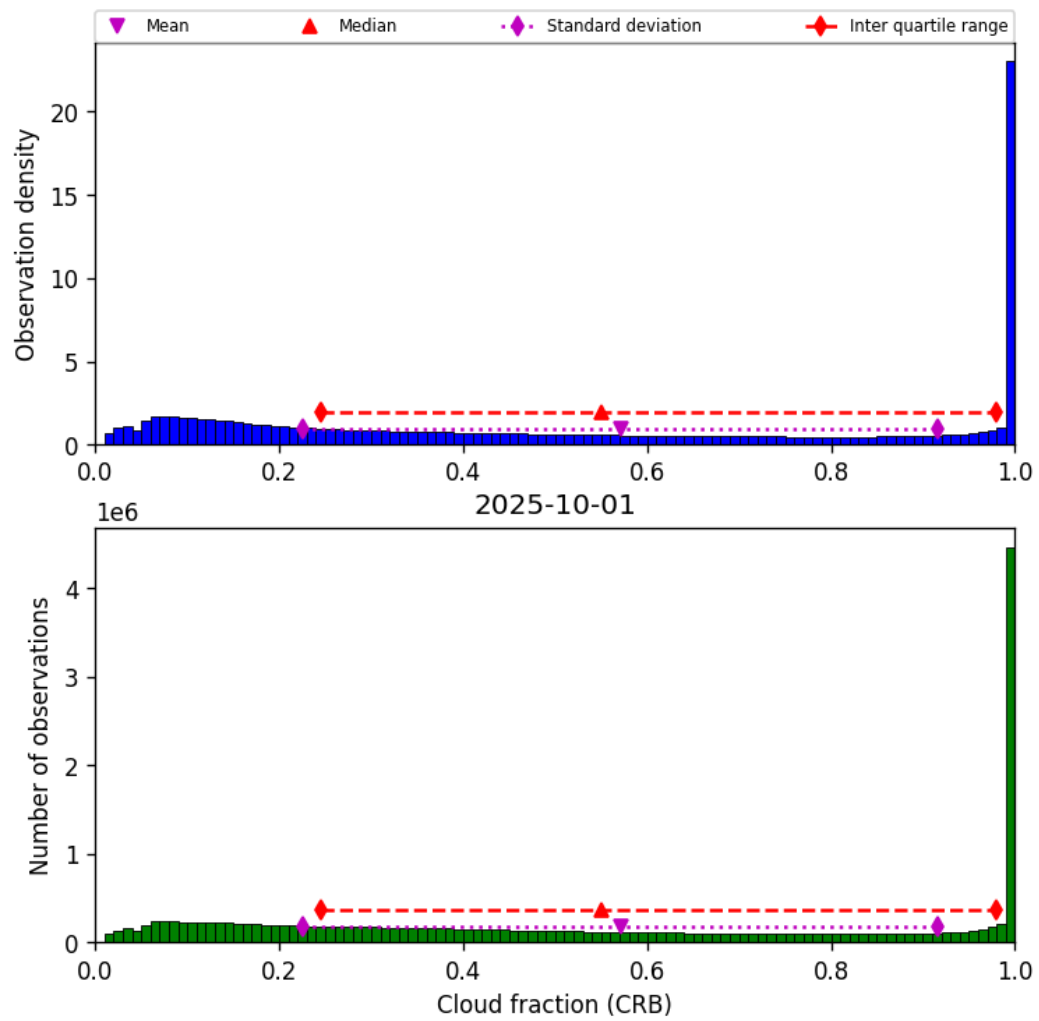


Figure 40: Histogram of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02

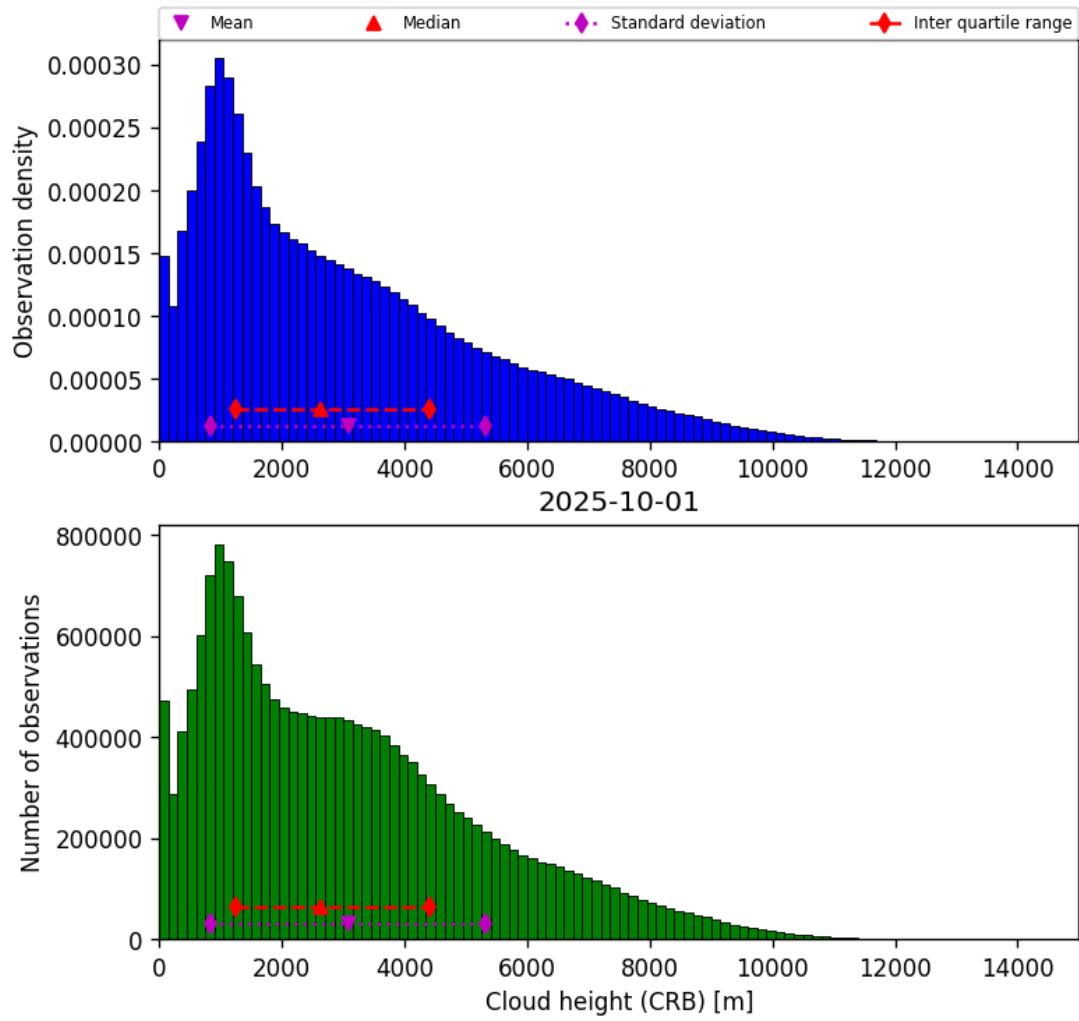


Figure 41: Histogram of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02

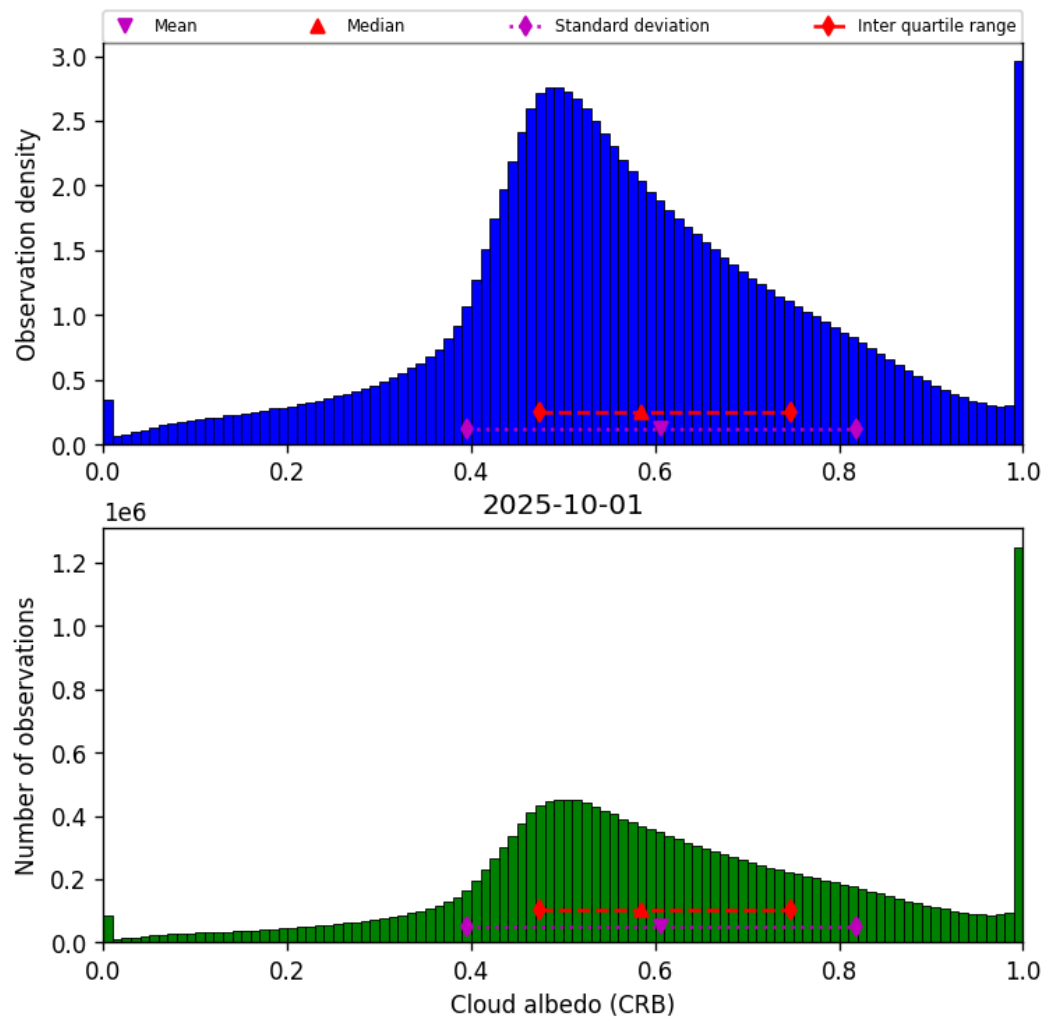


Figure 42: Histogram of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02

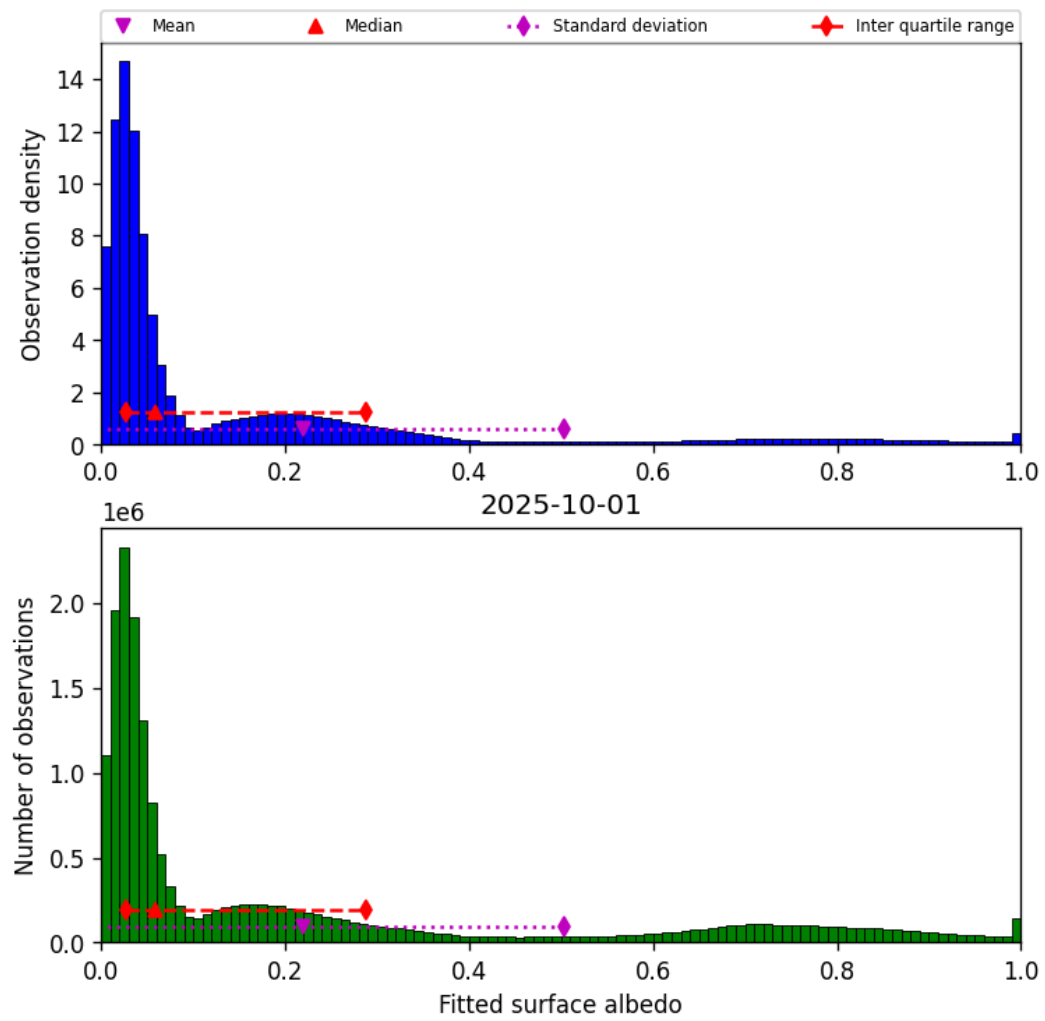


Figure 43: Histogram of “Fitted surface albedo” for 2025-10-01 to 2025-10-02

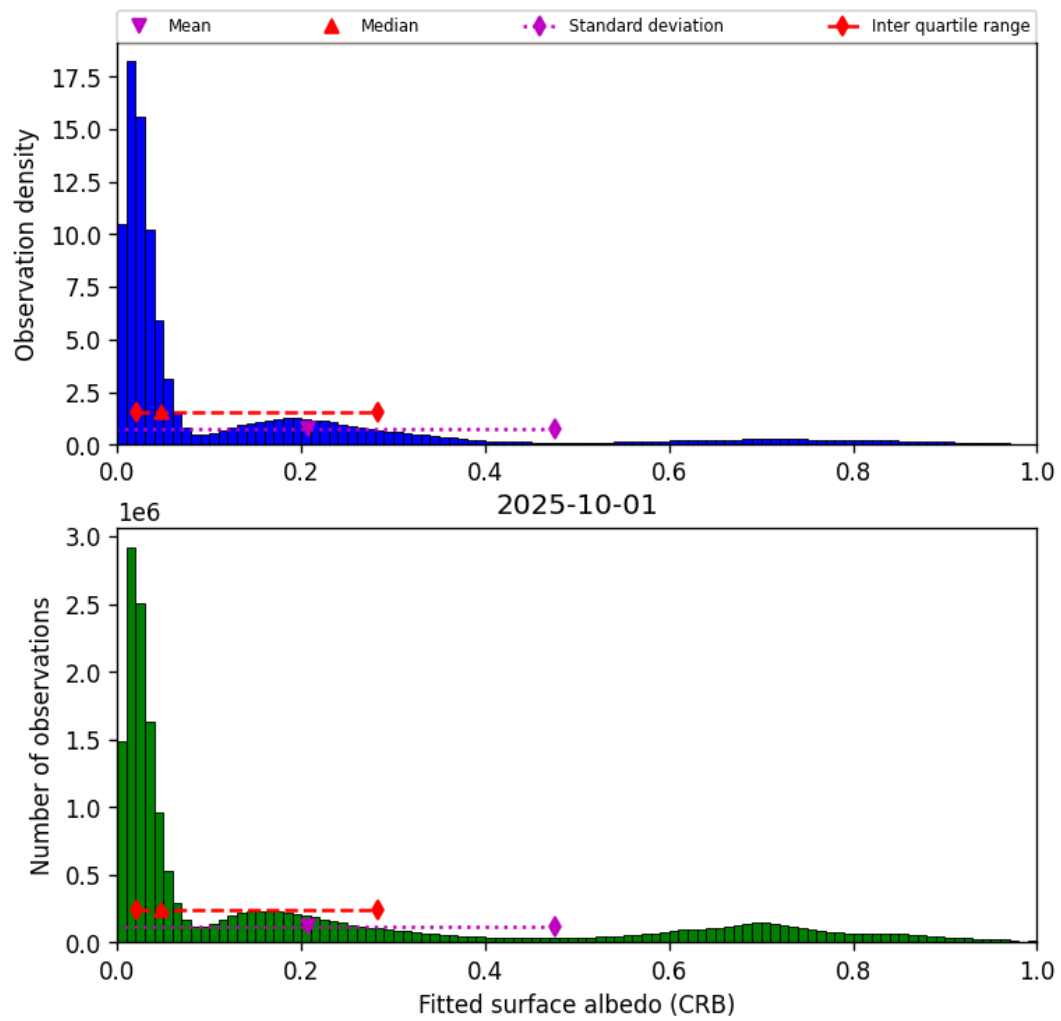


Figure 44: Histogram of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02



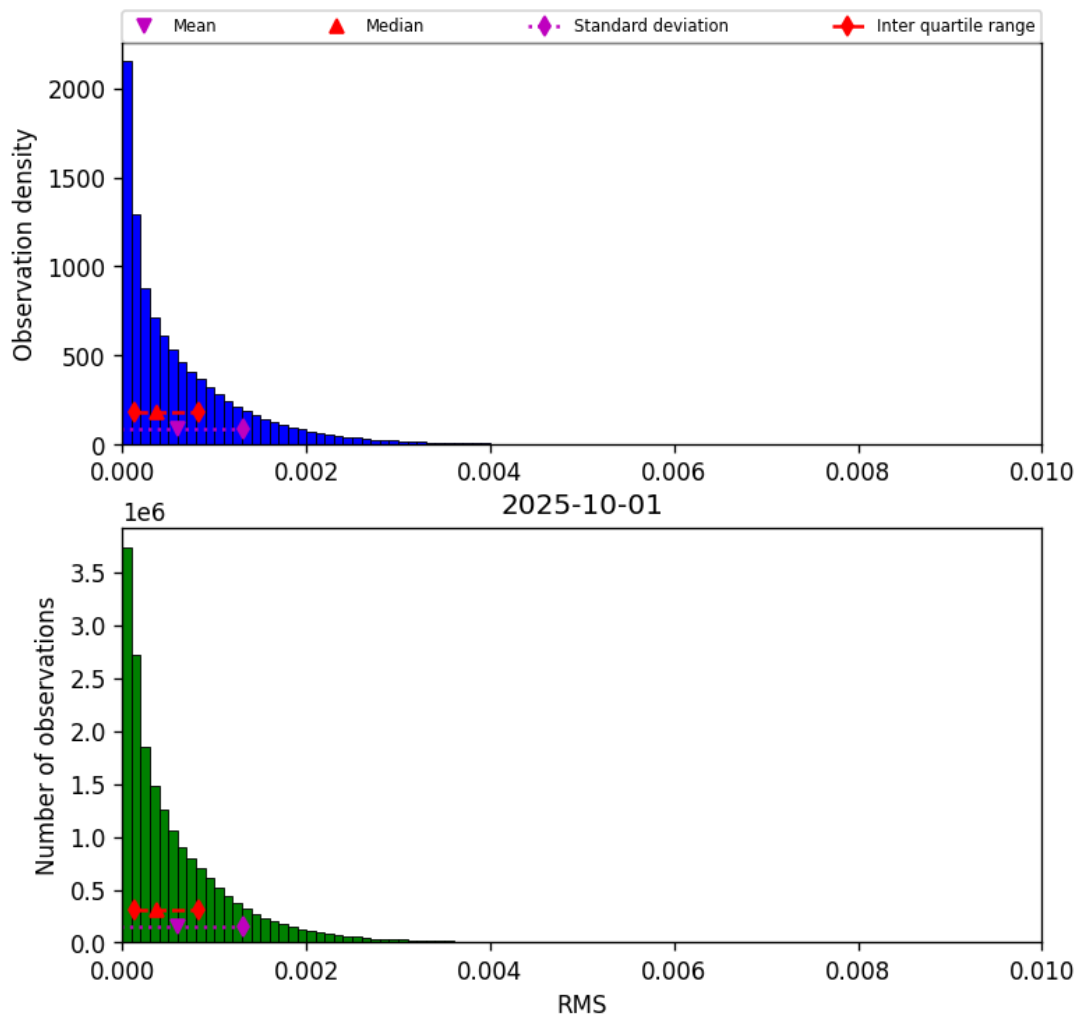


Figure 45: Histogram of “RMS” for 2025-10-01 to 2025-10-02

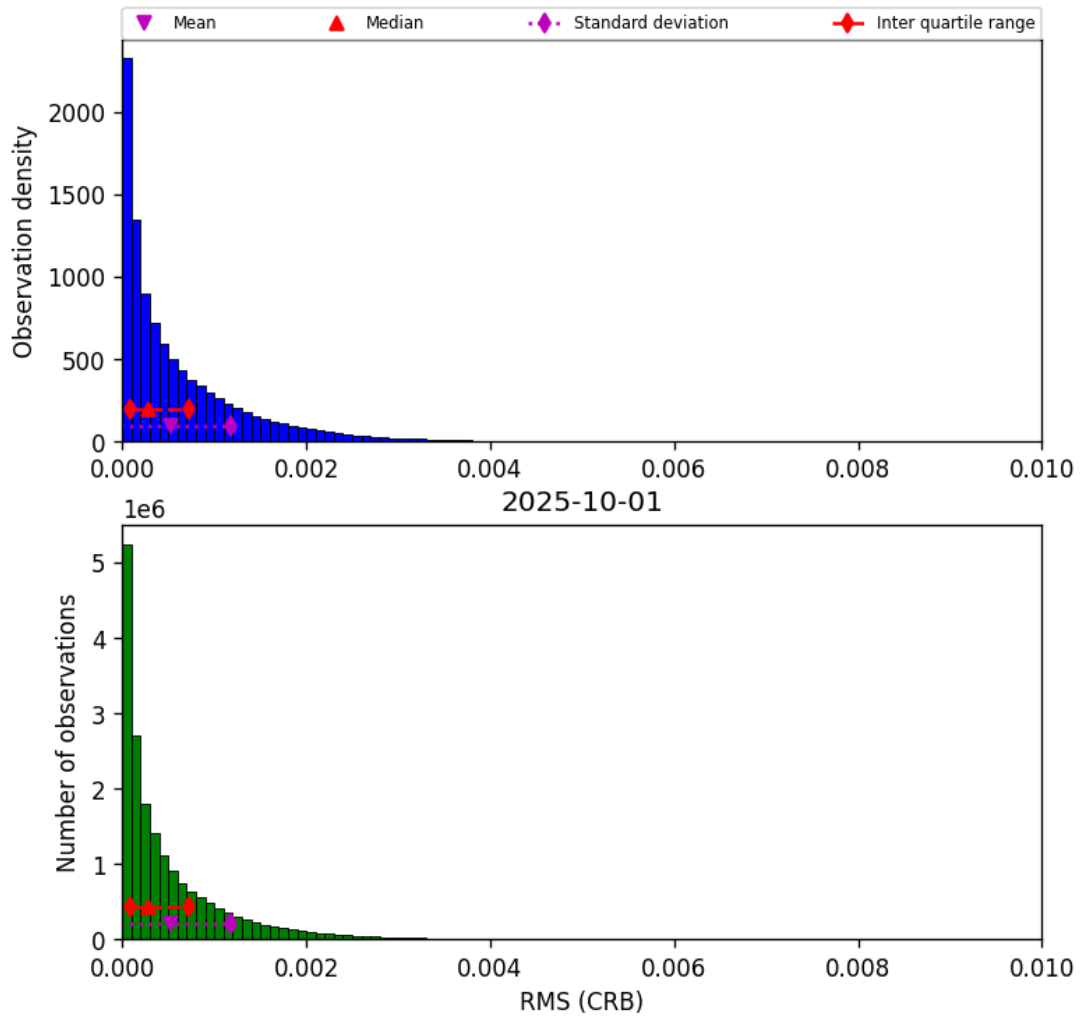


Figure 46: Histogram of “RMS (CRB)” for 2025-10-01 to 2025-10-02

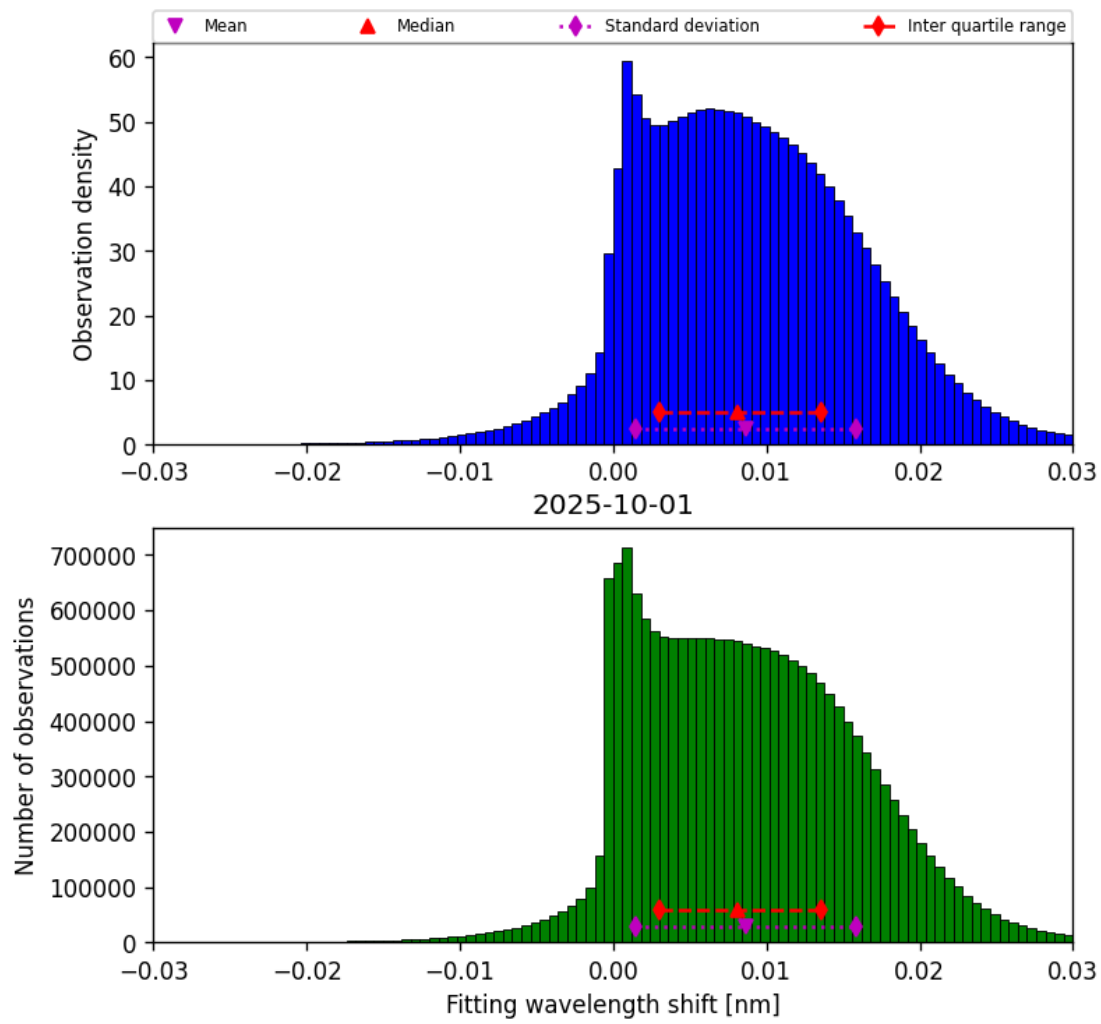


Figure 47: Histogram of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02

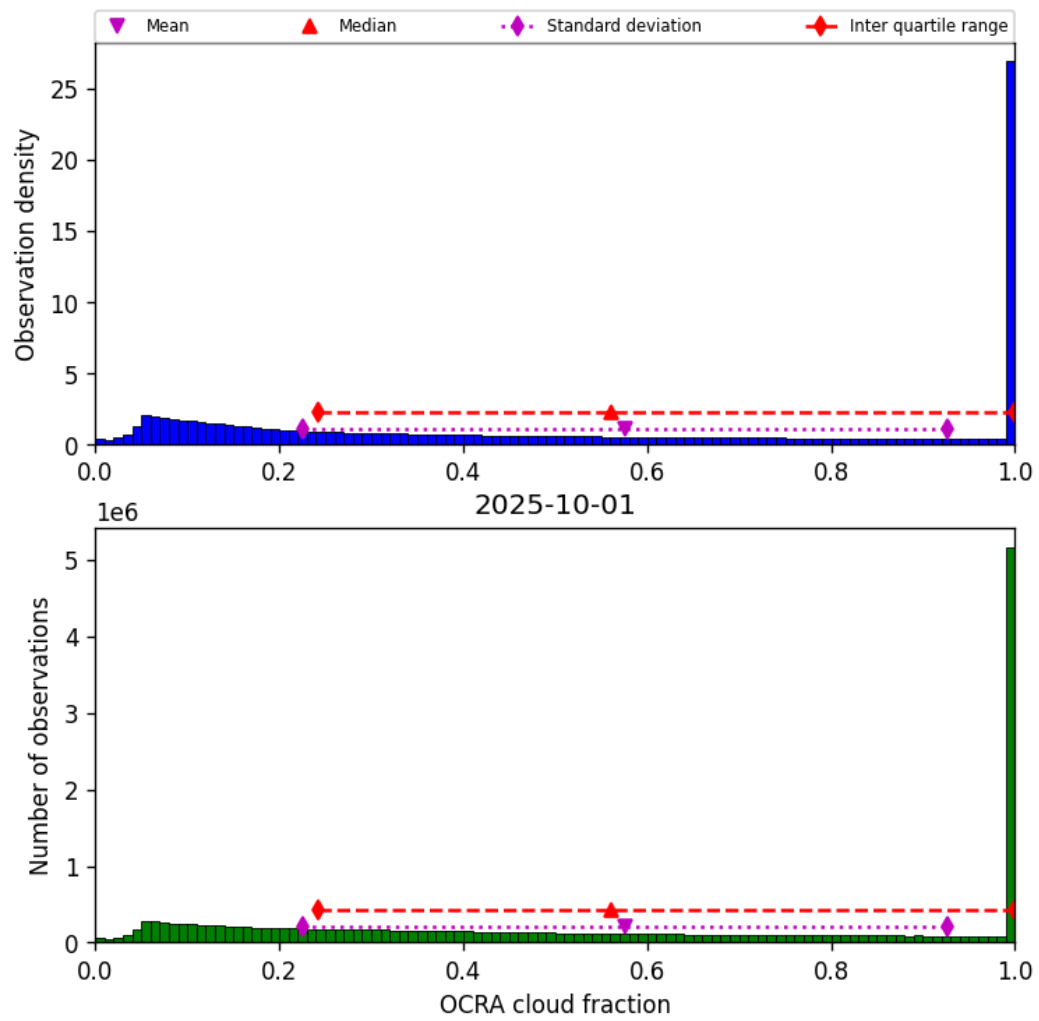


Figure 48: Histogram of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02

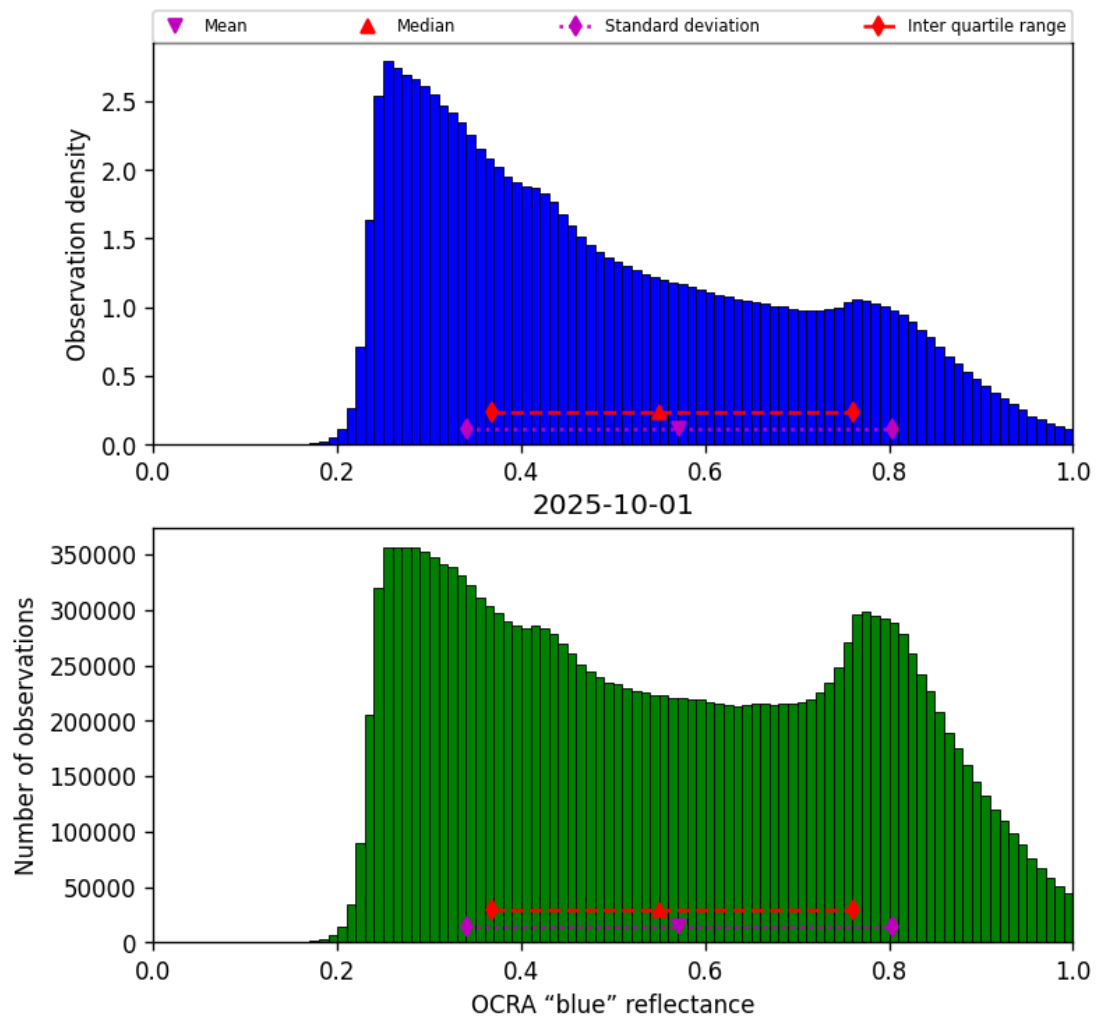


Figure 49: Histogram of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02

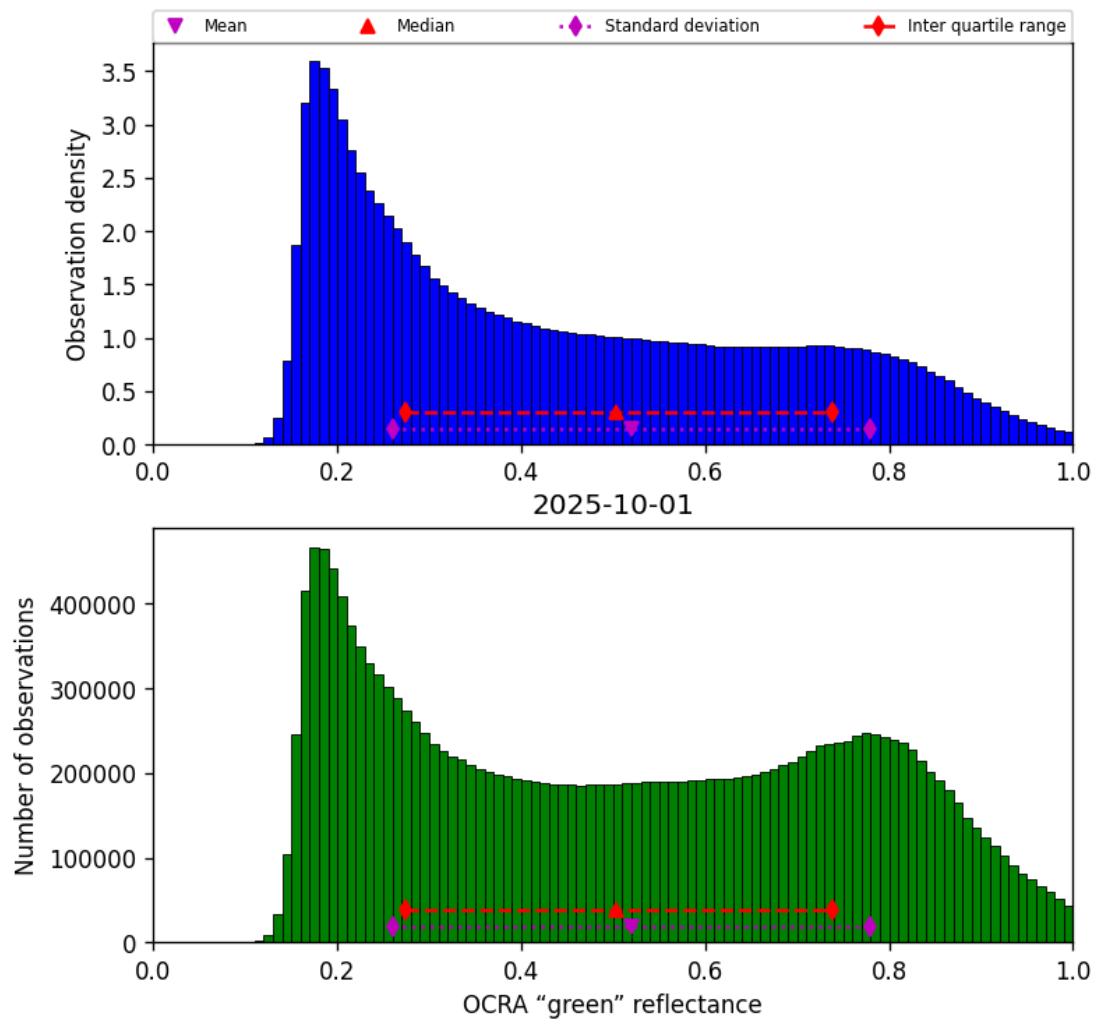


Figure 50: Histogram of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02

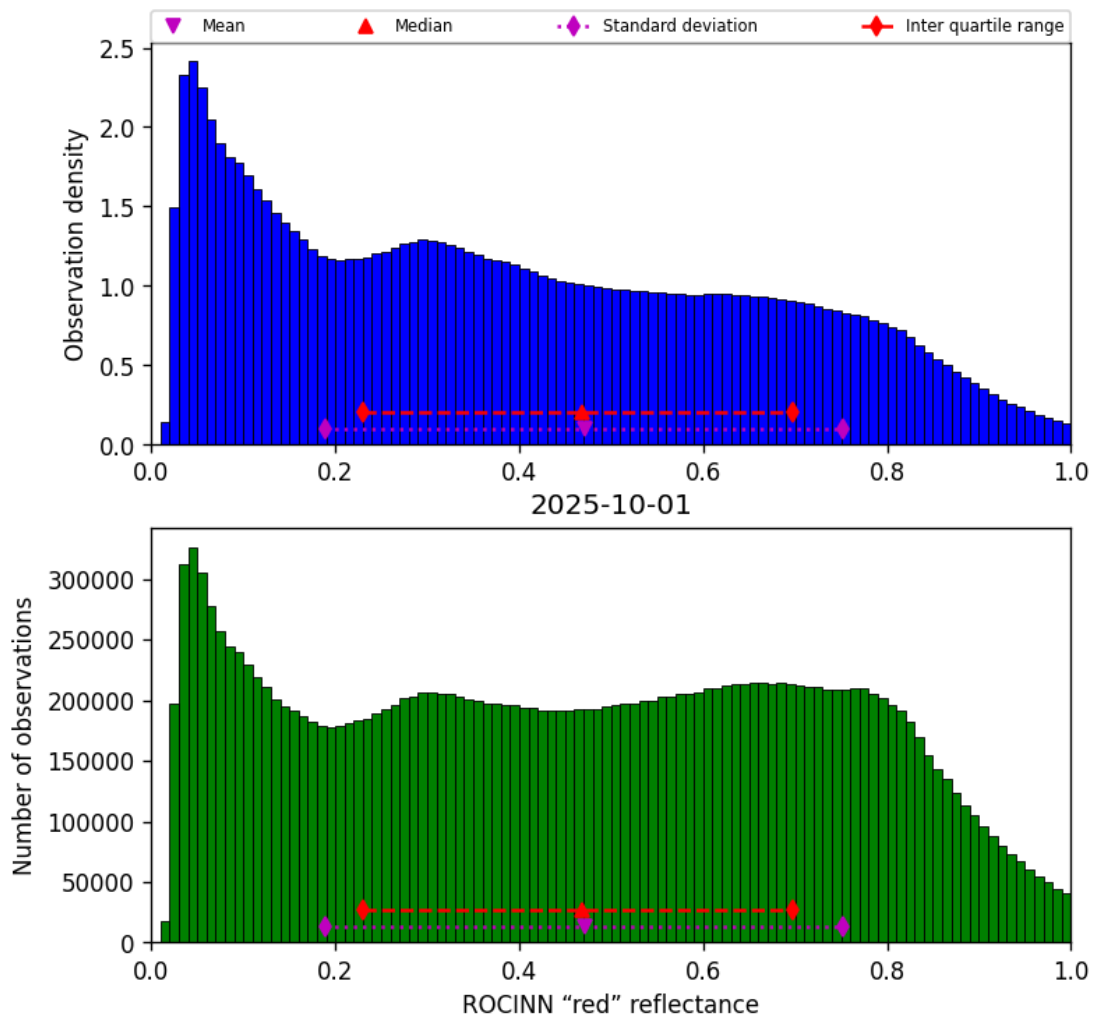


Figure 51: Histogram of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02



## 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.

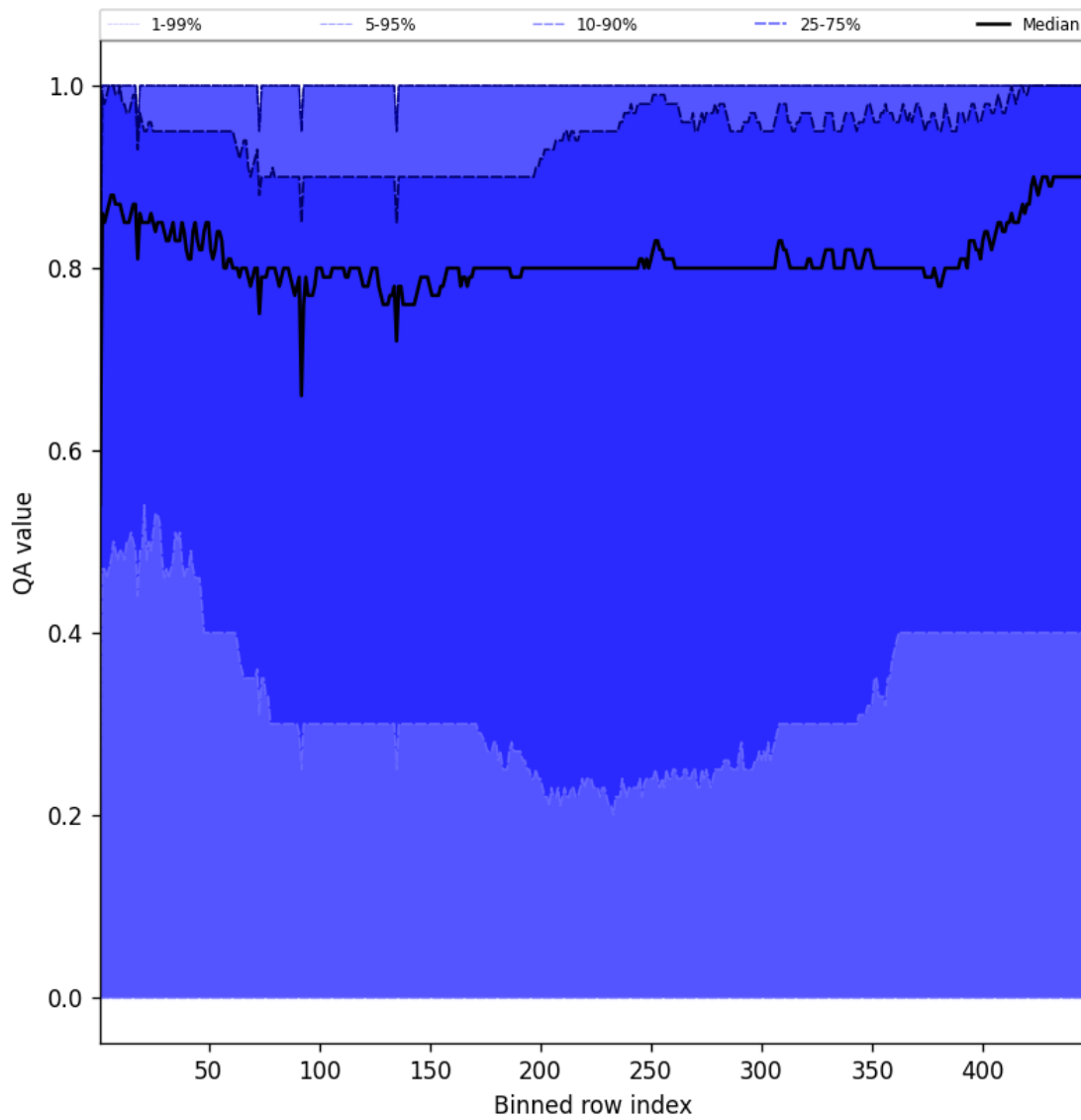


Figure 52: Along track statistics of “QA value” for 2025-10-01 to 2025-10-02

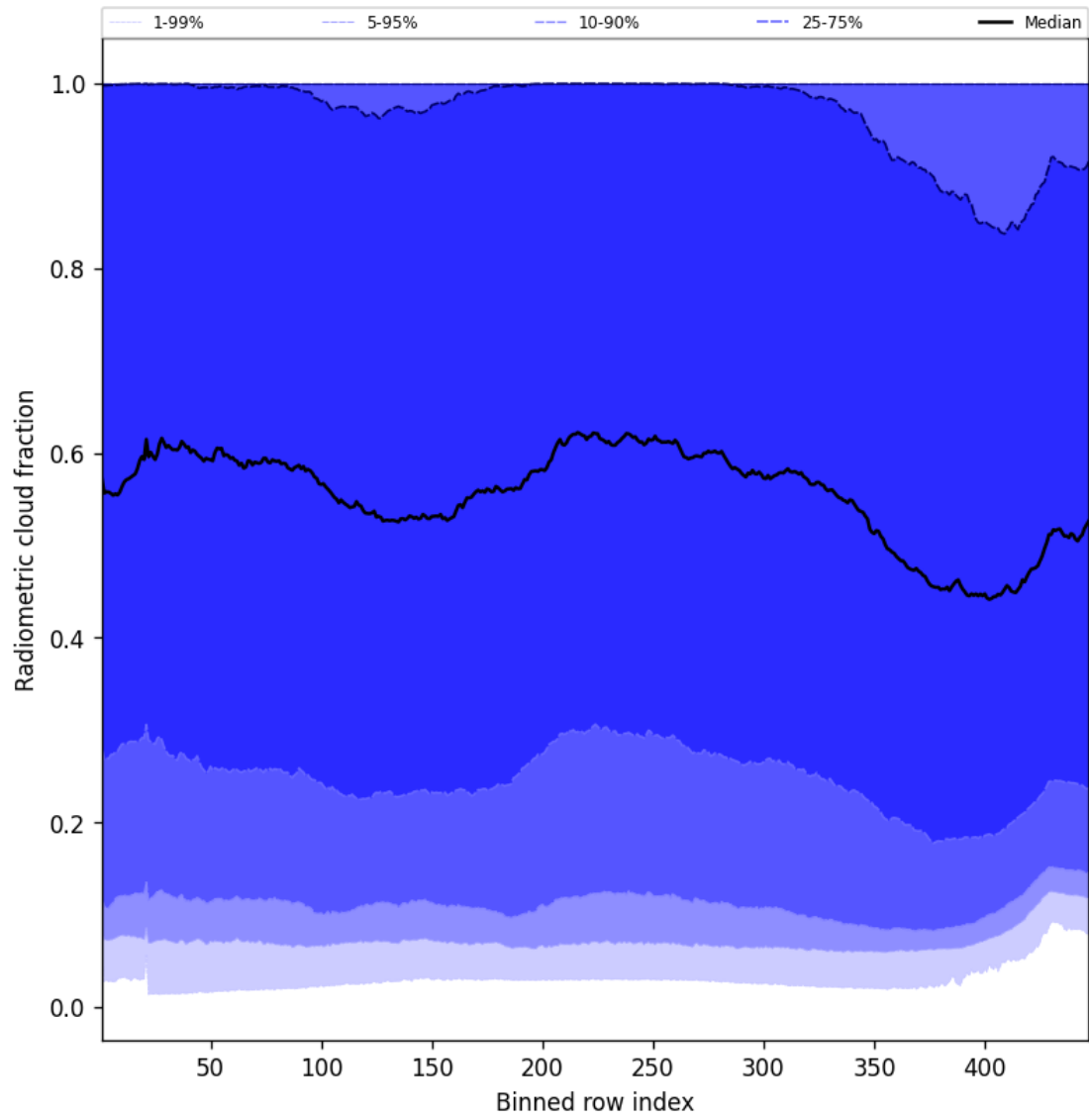


Figure 53: Along track statistics of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02

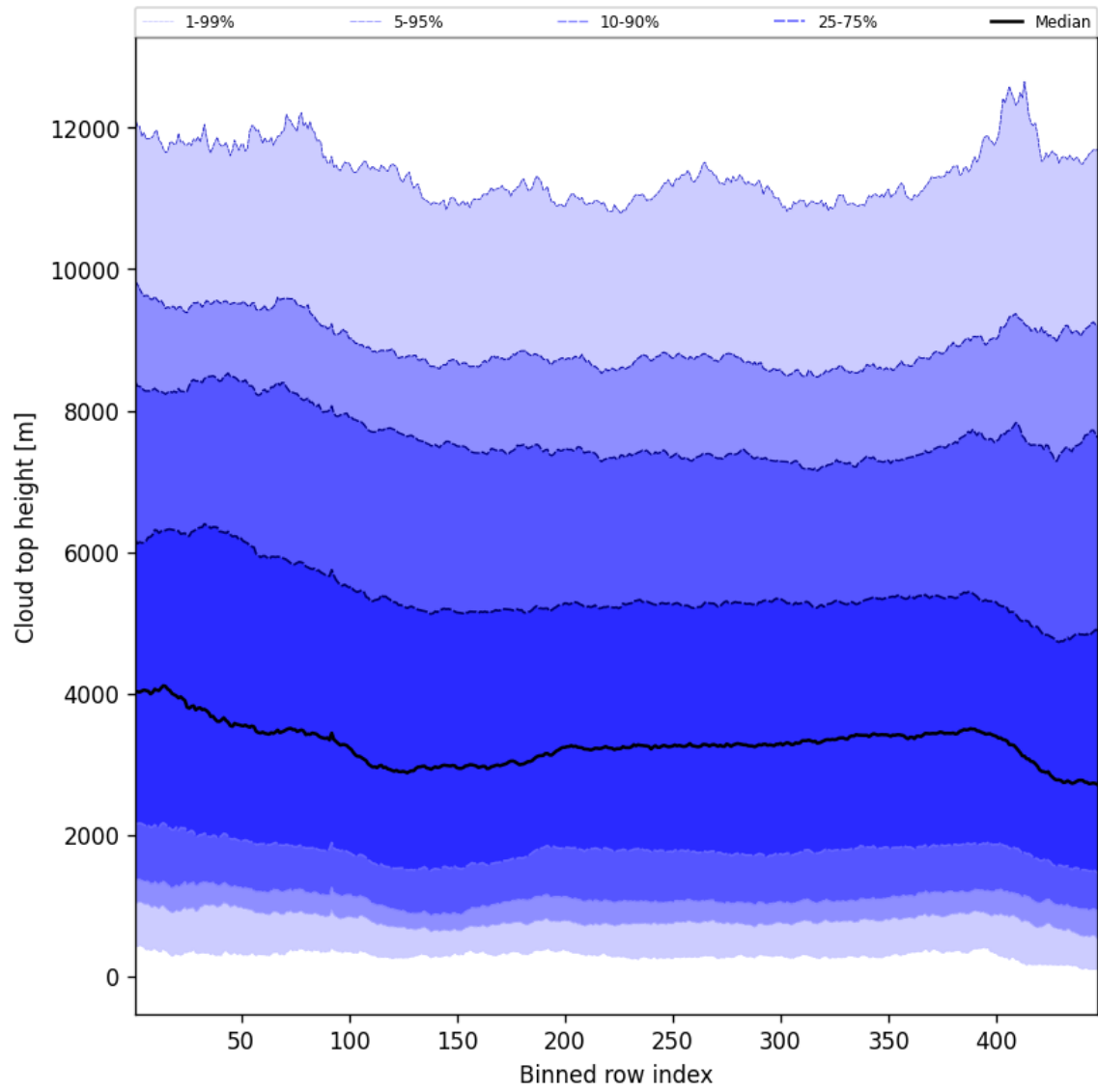


Figure 54: Along track statistics of “Cloud top height” for 2025-10-01 to 2025-10-02

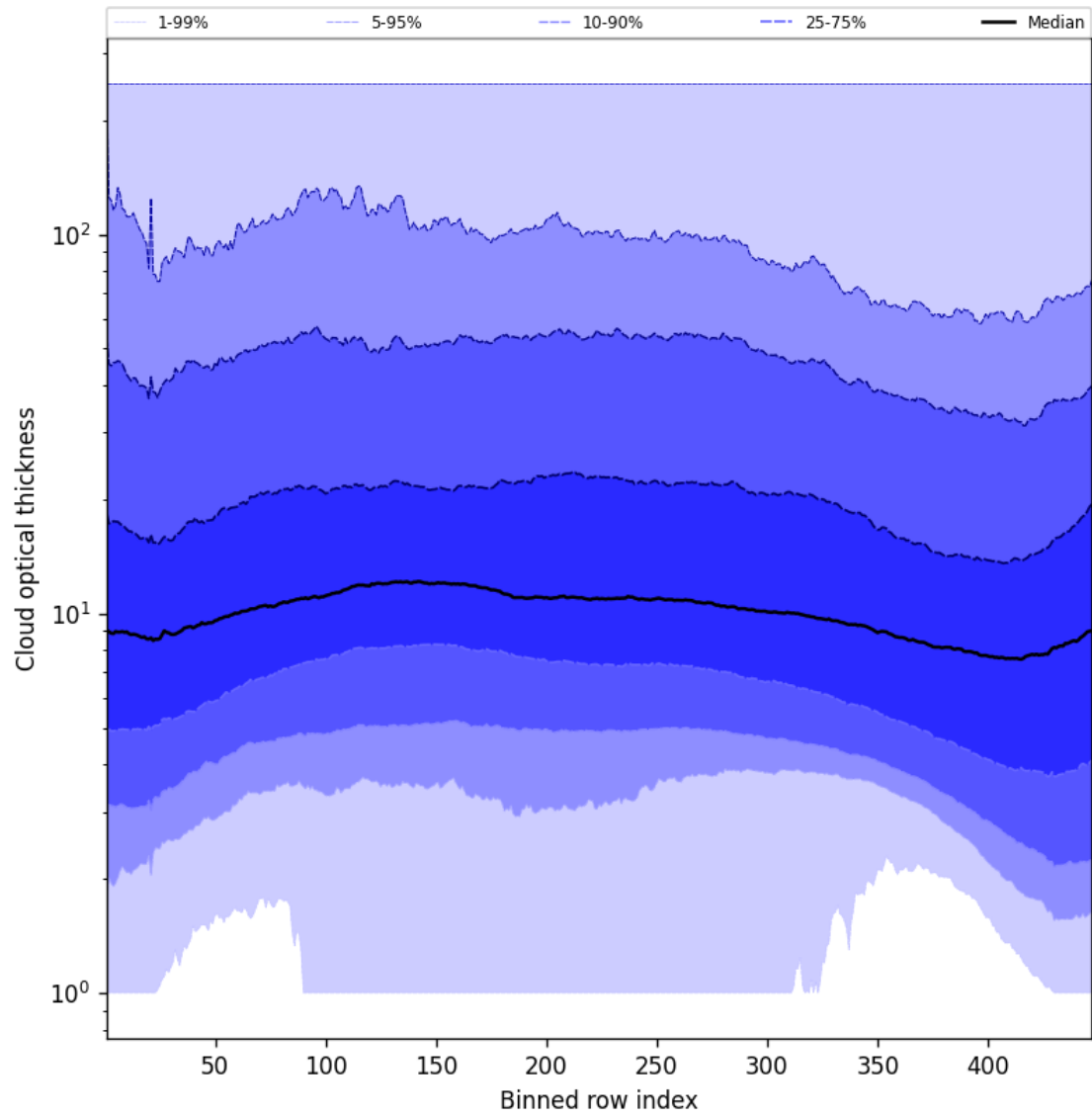


Figure 55: Along track statistics of “Cloud optical thickness” for 2025-10-01 to 2025-10-02

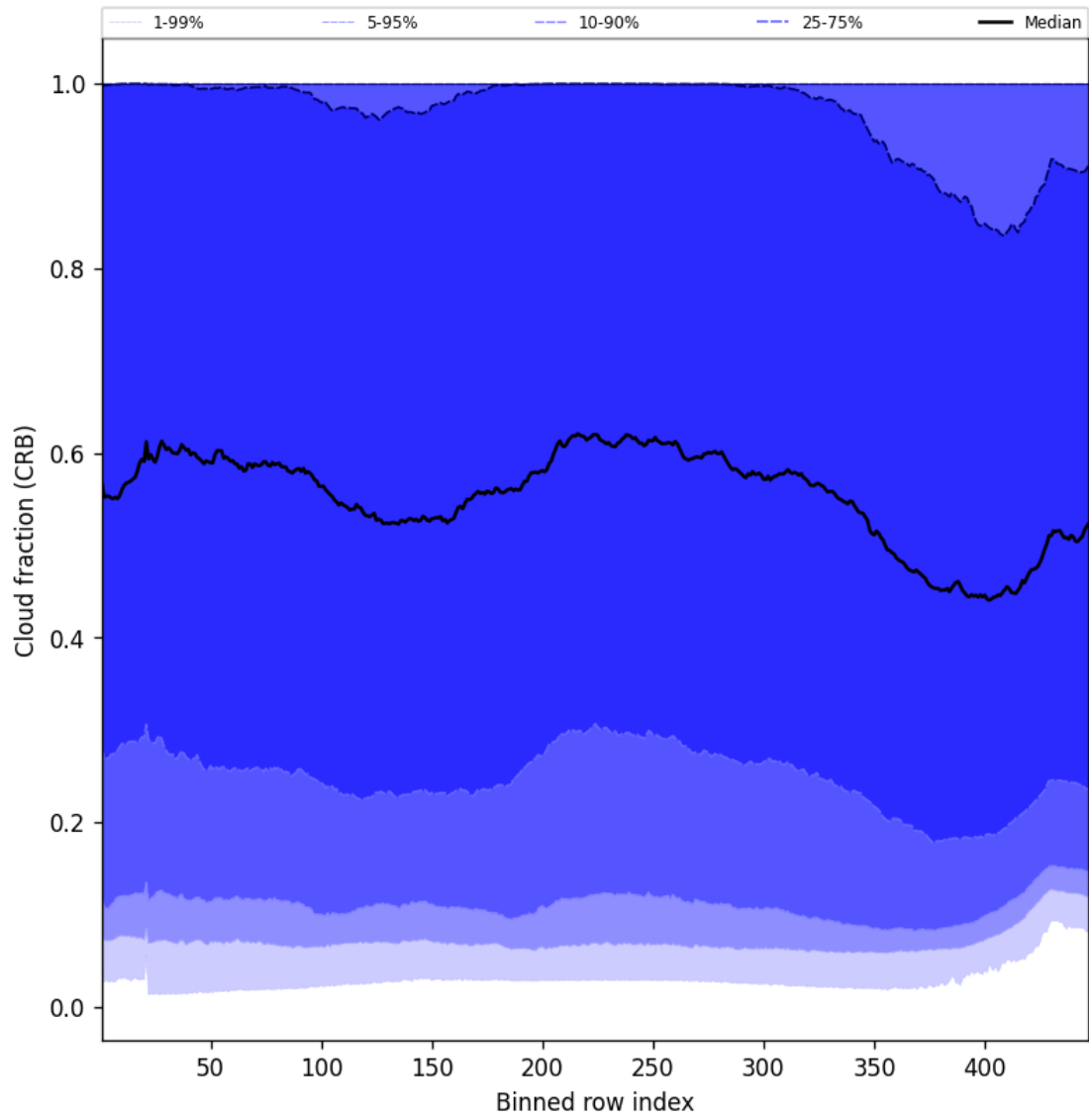


Figure 56: Along track statistics of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02

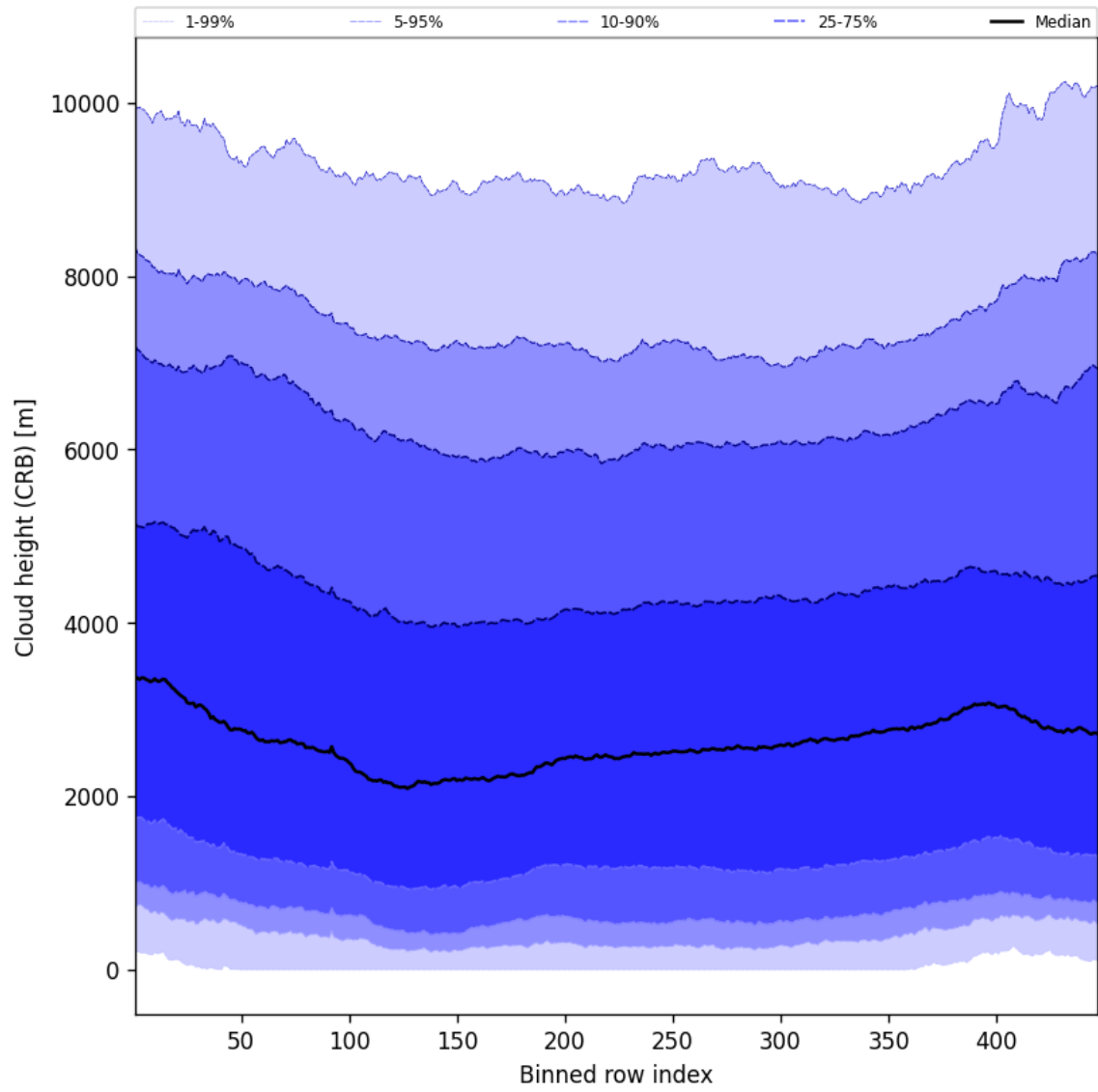


Figure 57: Along track statistics of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02

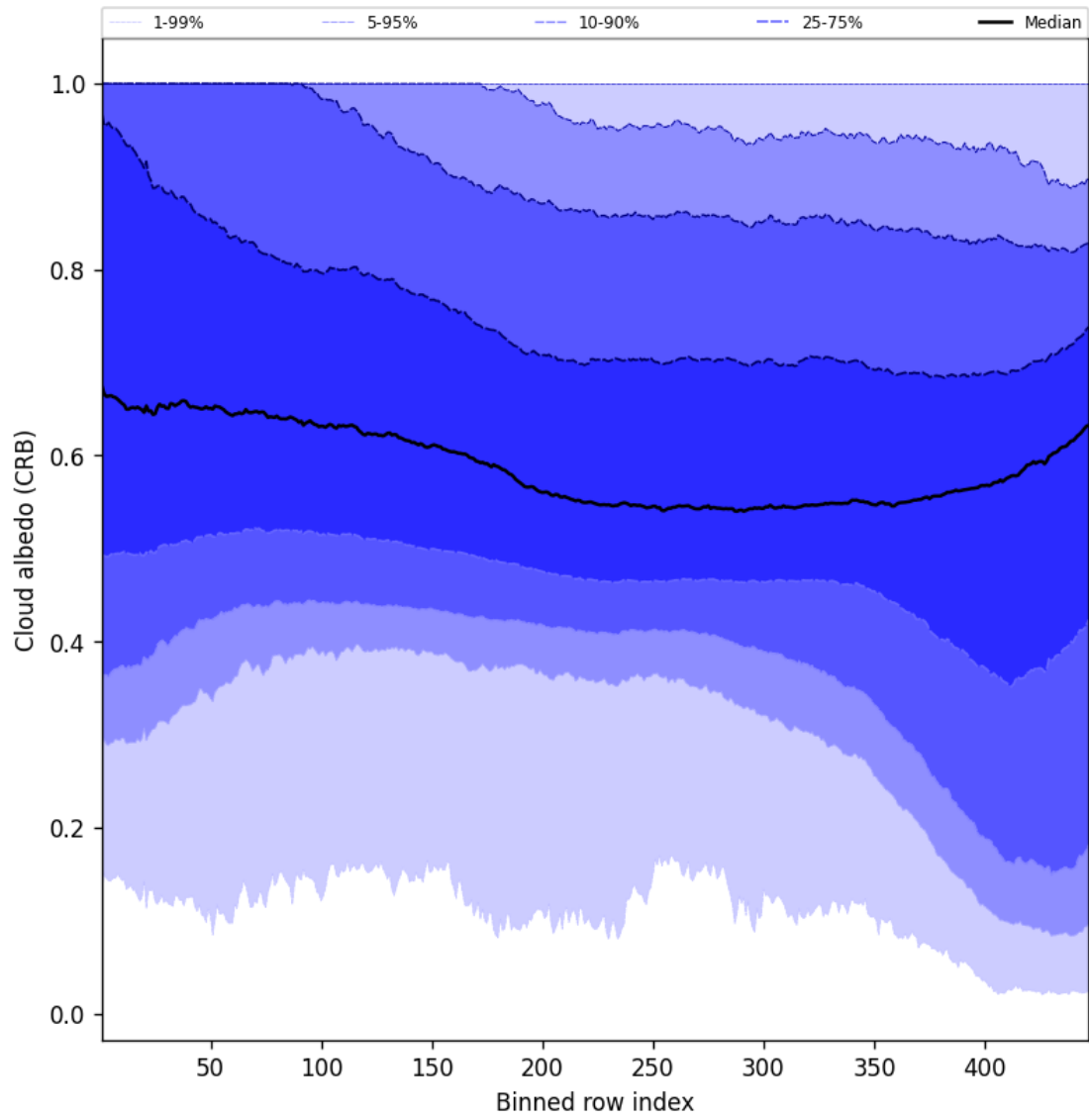


Figure 58: Along track statistics of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02



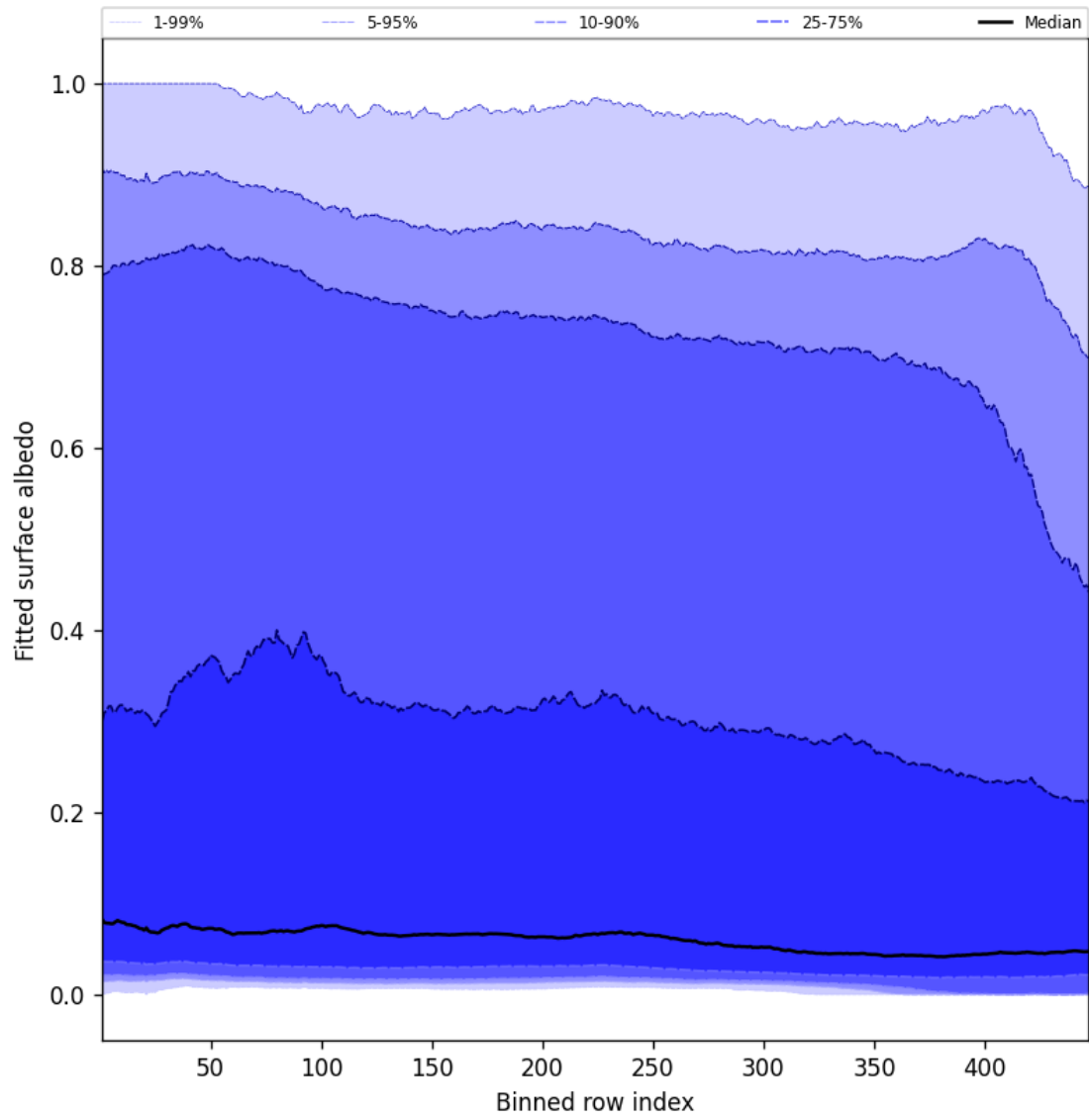


Figure 59: Along track statistics of “Fitted surface albedo” for 2025-10-01 to 2025-10-02

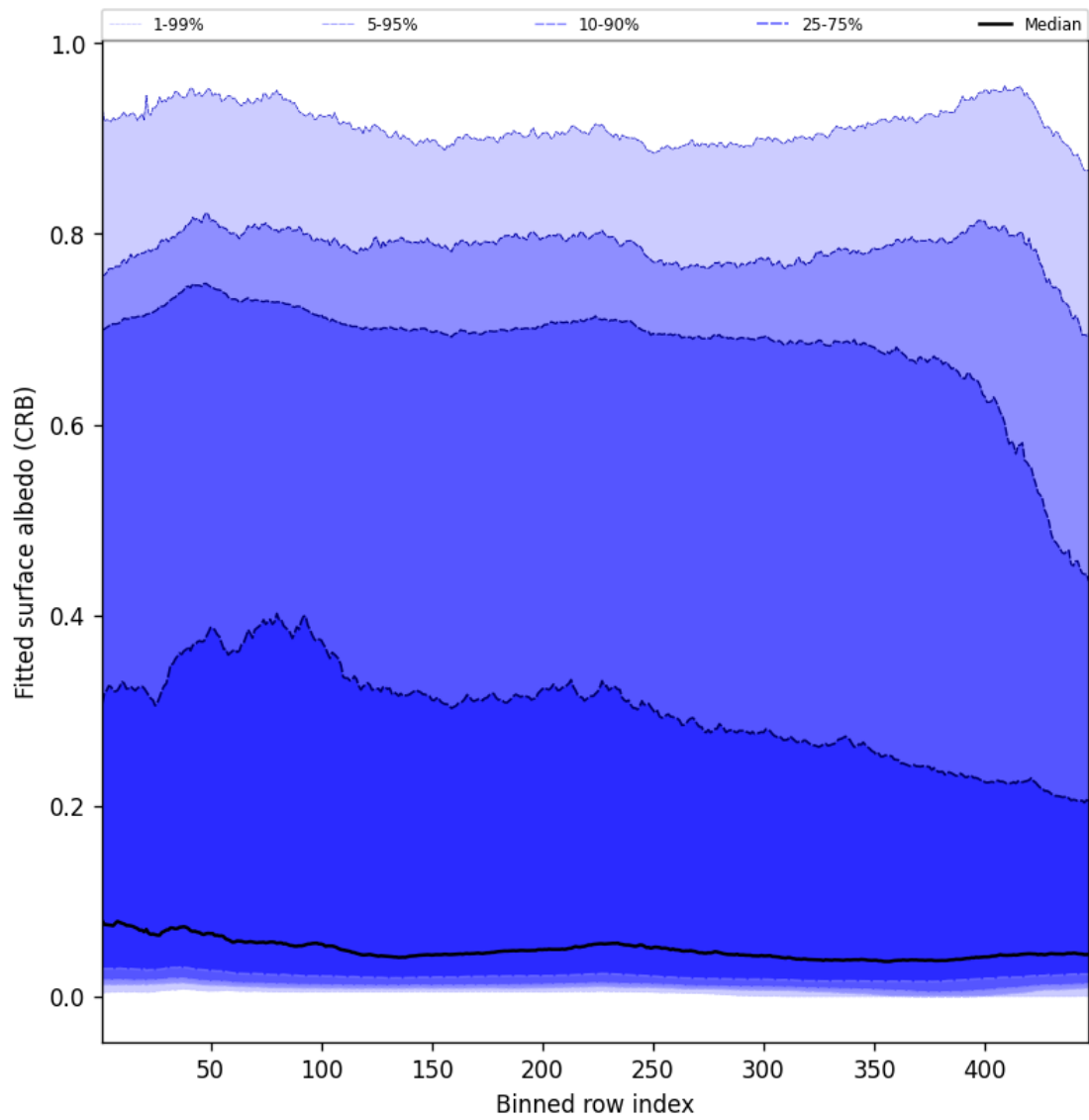


Figure 60: Along track statistics of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02

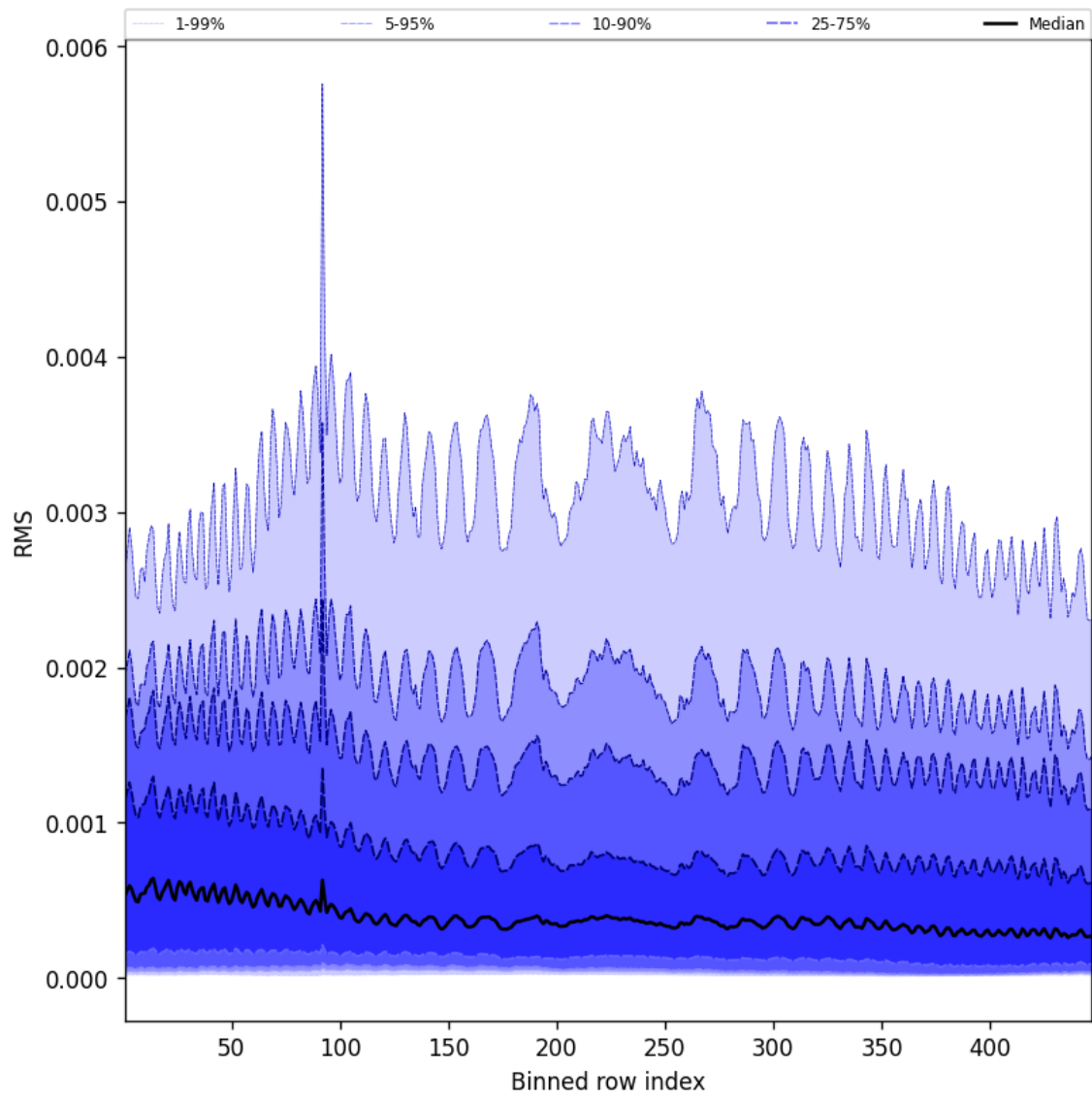


Figure 61: Along track statistics of “RMS” for 2025-10-01 to 2025-10-02

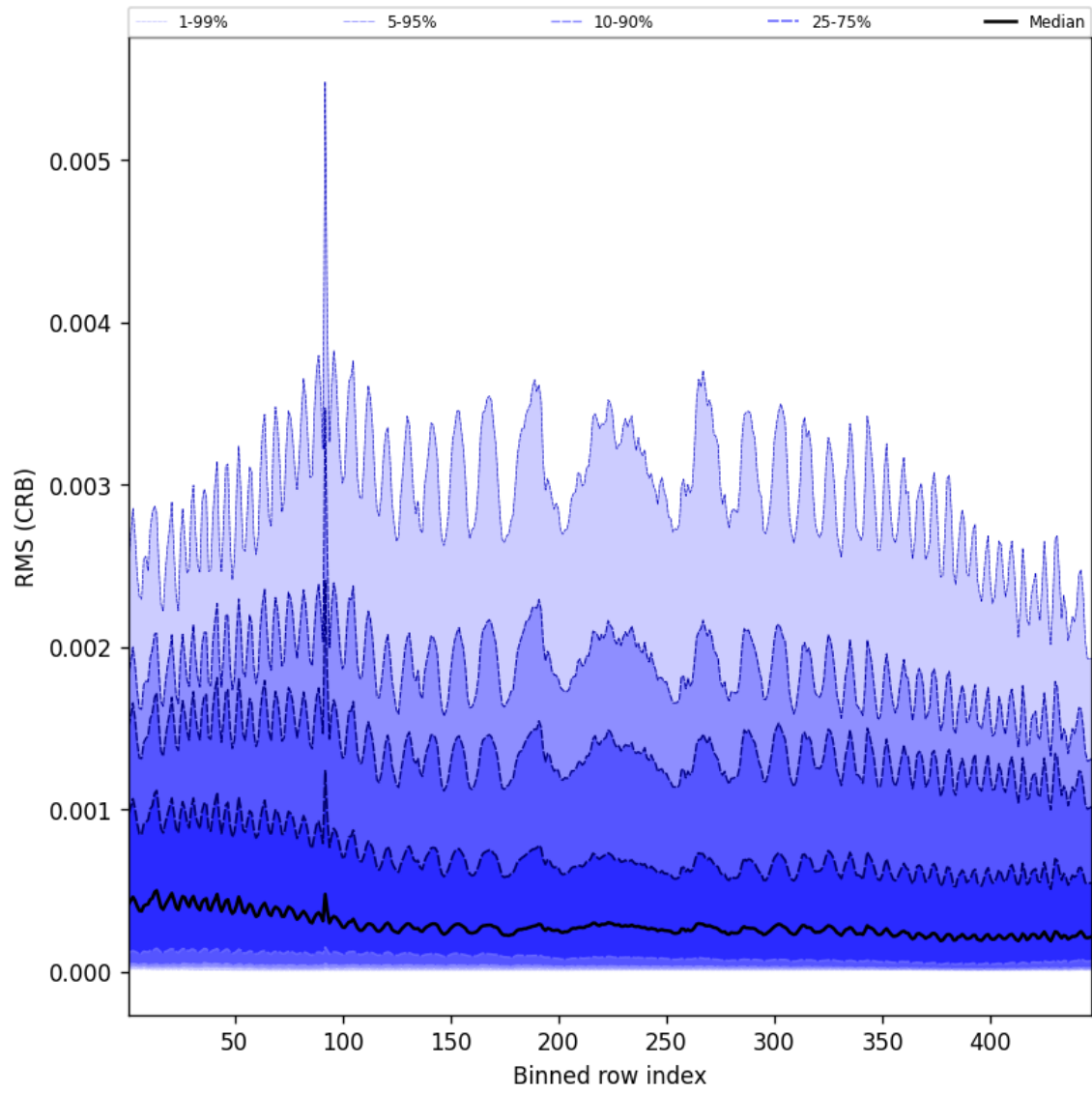


Figure 62: Along track statistics of “RMS (CRB)” for 2025-10-01 to 2025-10-02

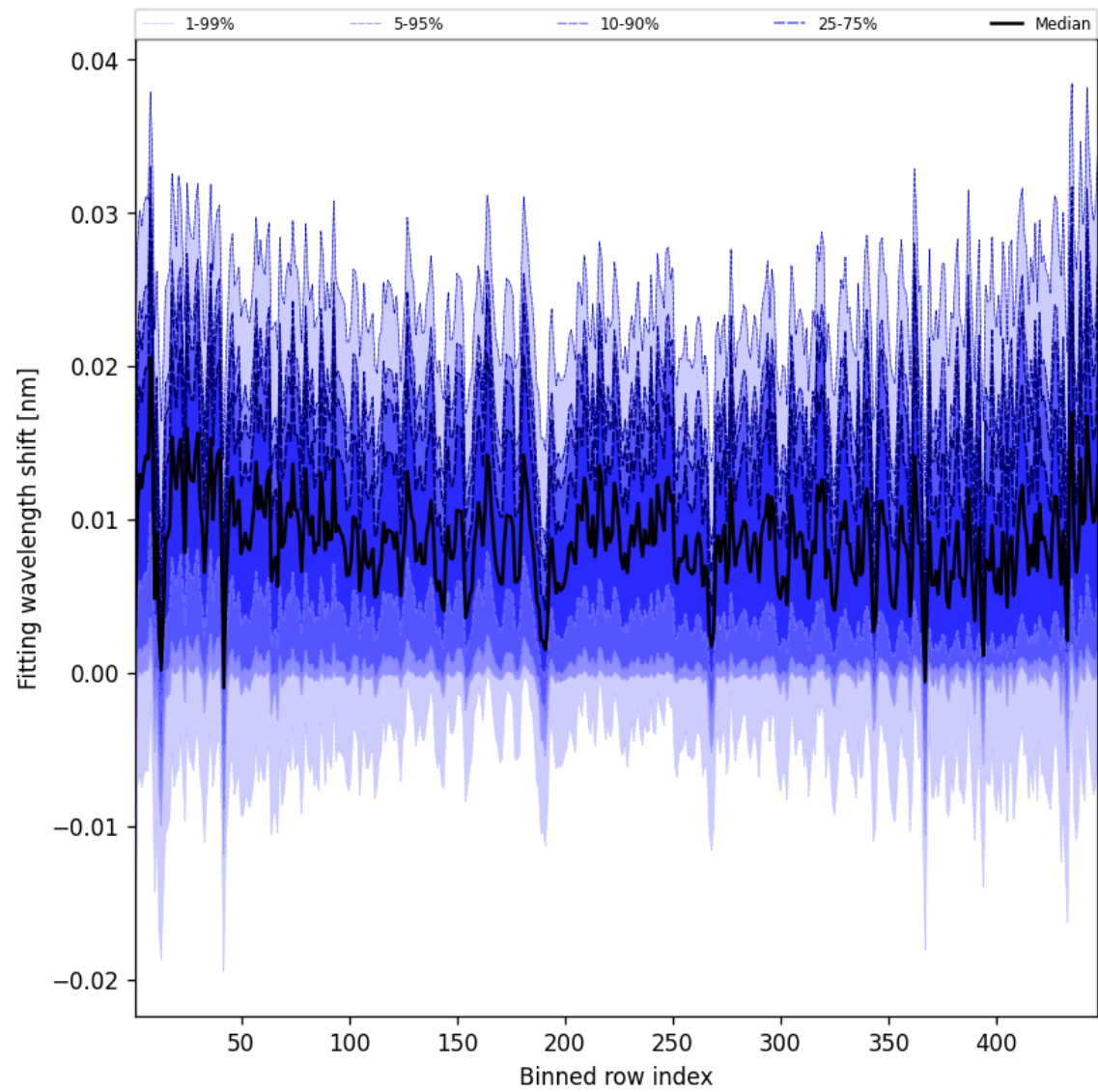


Figure 63: Along track statistics of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02

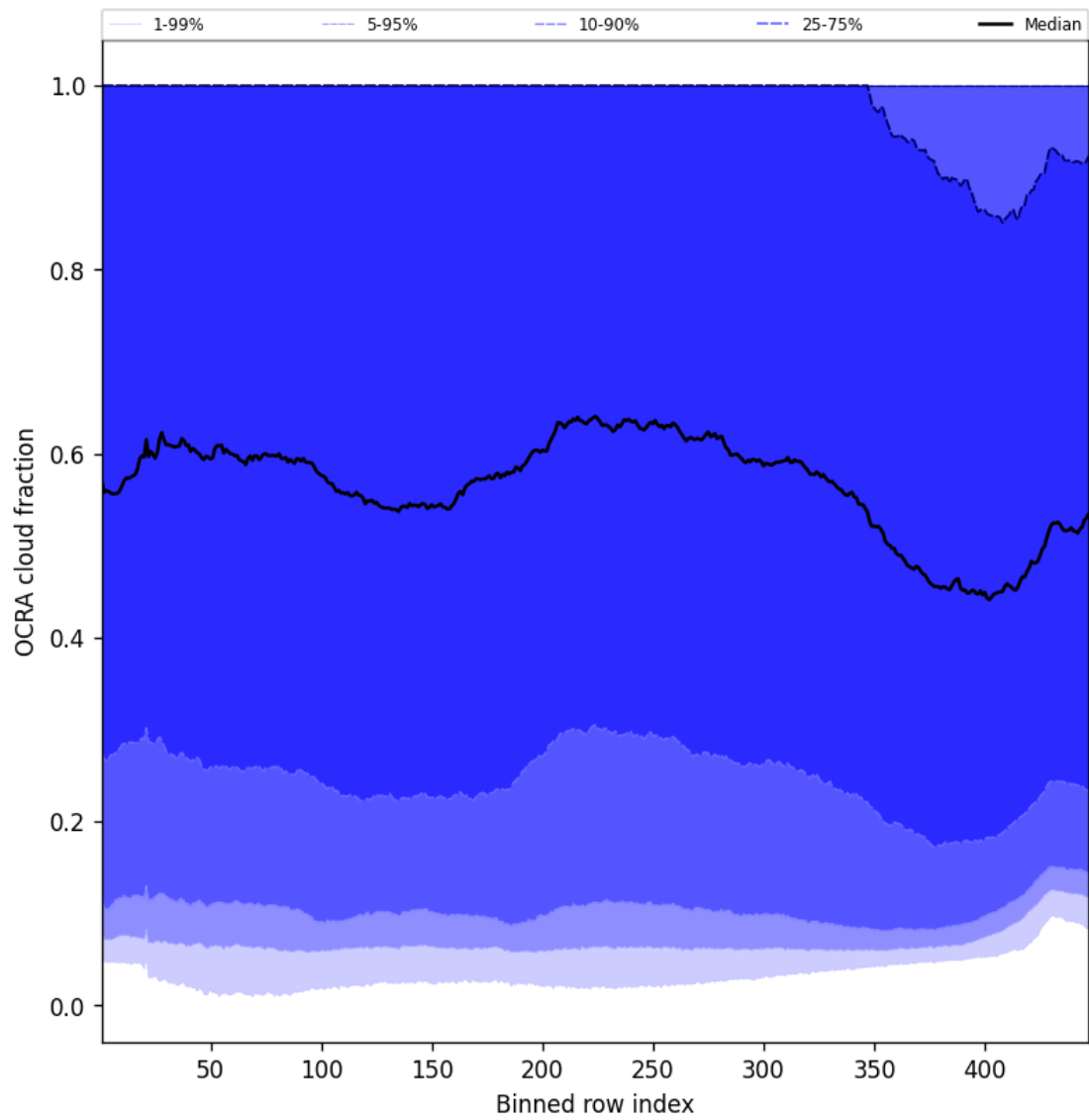


Figure 64: Along track statistics of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02

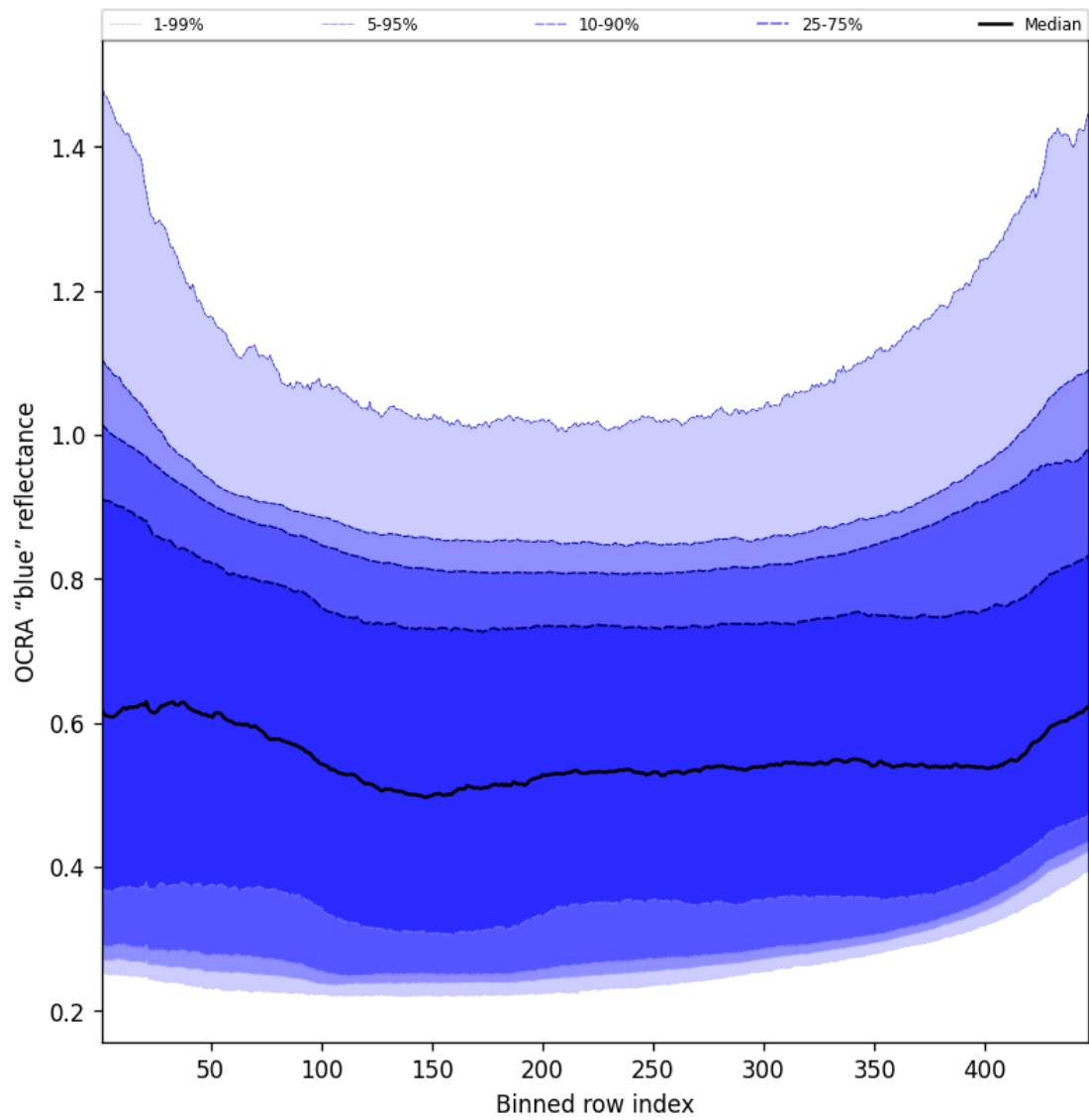


Figure 65: Along track statistics of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02

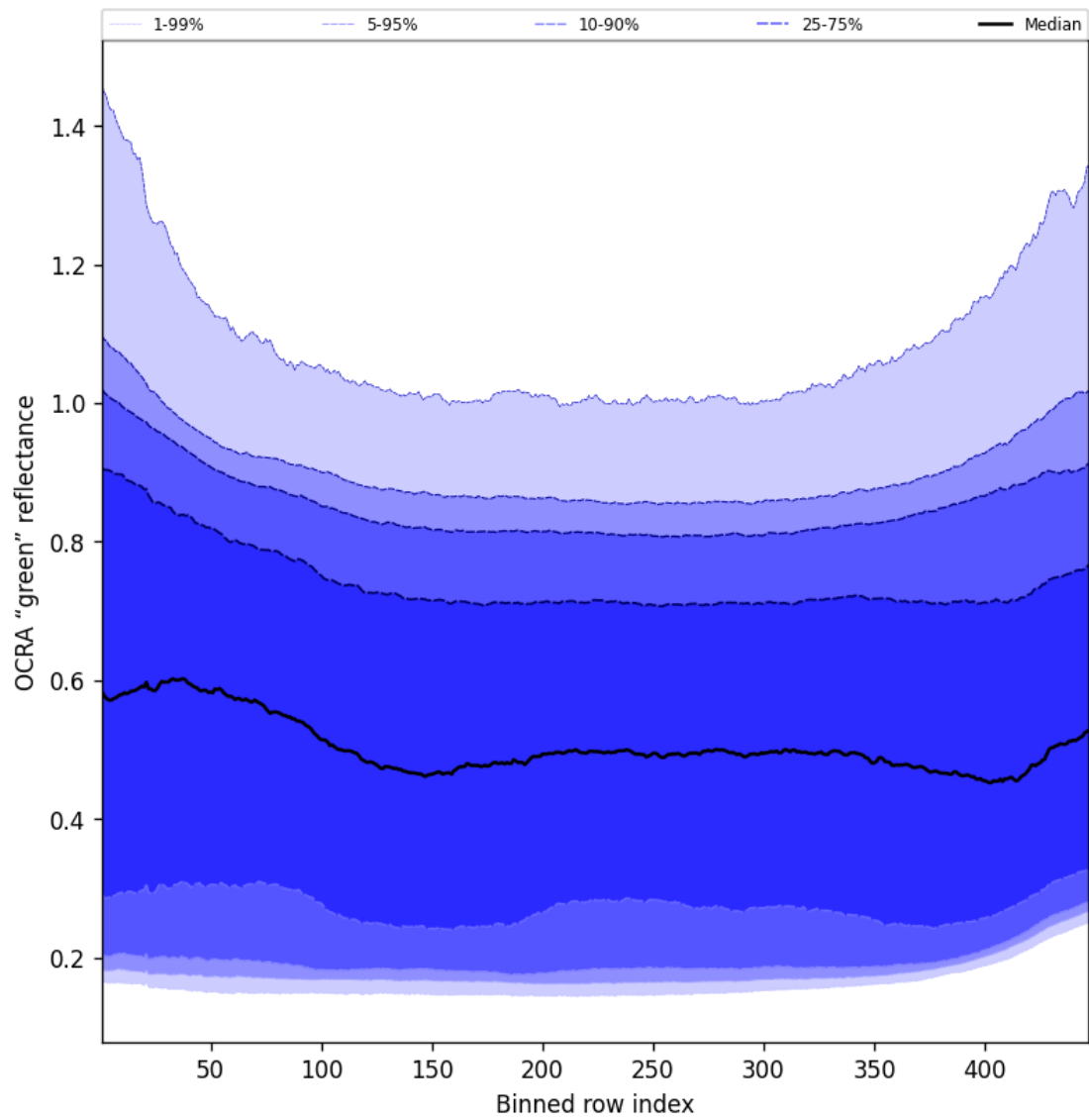


Figure 66: Along track statistics of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02



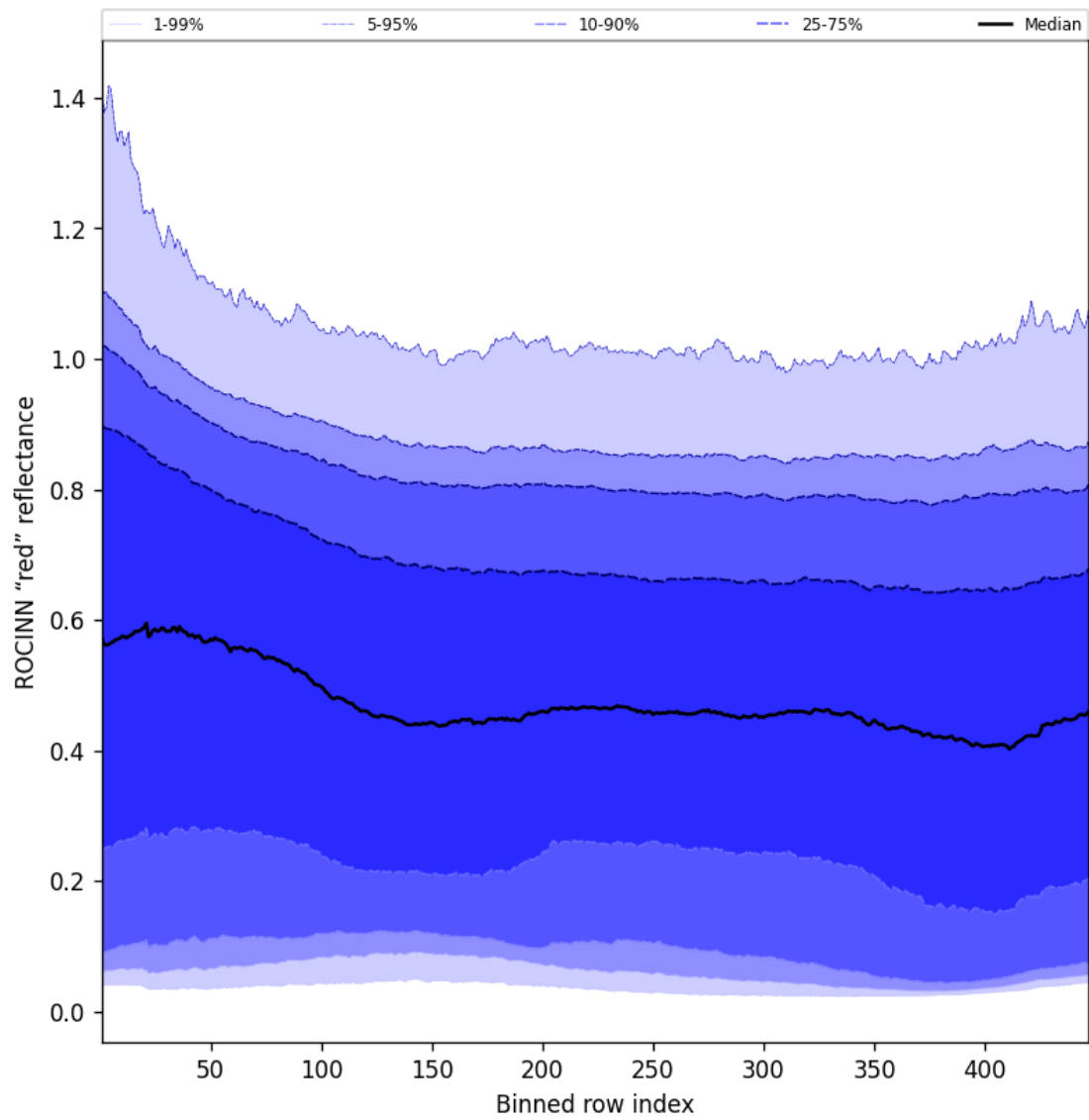


Figure 67: Along track statistics of "ROCINN "red" reflectance" for 2025-10-01 to 2025-10-02

## 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.

### Contents

|           |                                          |           |
|-----------|------------------------------------------|-----------|
| <b>1</b>  | <b>Short Introduction</b>                | <b>1</b>  |
| 1.1       | The list of parameters . . . . .         | 1         |
| <b>2</b>  | <b>Definitions</b>                       | <b>1</b>  |
| <b>3</b>  | <b>Granule outlines</b>                  | <b>8</b>  |
| <b>4</b>  | <b>Input data monitoring</b>             | <b>9</b>  |
| <b>5</b>  | <b>Warnings and errors</b>               | <b>10</b> |
| <b>6</b>  | <b>World maps</b>                        | <b>11</b> |
| <b>7</b>  | <b>Zonal average</b>                     | <b>27</b> |
| <b>8</b>  | <b>Histograms</b>                        | <b>43</b> |
| <b>9</b>  | <b>Along track statistics</b>            | <b>59</b> |
| <b>10</b> | <b>Coincidence density</b>               | <b>75</b> |
| <b>11</b> | <b>Copyright information of ‘PyCAMA’</b> | <b>75</b> |

### List of Figures

|    |                                                                                      |    |
|----|--------------------------------------------------------------------------------------|----|
| 1  | Outline of the granules. . . . .                                                     | 8  |
| 2  | Input data per granule . . . . .                                                     | 9  |
| 3  | Fraction of pixels with specific warnings and errors during processing . . . . .     | 10 |
| 4  | Map of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .           | 11 |
| 5  | Map of “Cloud top height” for 2025-10-01 to 2025-10-02 . . . . .                     | 12 |
| 6  | Map of “Cloud optical thickness” for 2025-10-01 to 2025-10-02 . . . . .              | 13 |
| 7  | Map of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                 | 14 |
| 8  | Map of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                   | 15 |
| 9  | Map of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                   | 16 |
| 10 | Map of “Fitted surface albedo” for 2025-10-01 to 2025-10-02 . . . . .                | 17 |
| 11 | Map of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . .          | 18 |
| 12 | Map of “RMS” for 2025-10-01 to 2025-10-02 . . . . .                                  | 19 |
| 13 | Map of “RMS (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                            | 20 |
| 14 | Map of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02 . . . . .             | 21 |
| 15 | Map of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .                  | 22 |
| 16 | Map of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02 . . . . .              | 23 |
| 17 | Map of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02 . . . . .             | 24 |
| 18 | Map of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02 . . . . .             | 25 |
| 19 | Map of the number of observations for 2025-10-01 to 2025-10-02 . . . . .             | 26 |
| 20 | Zonal average of “QA value” for 2025-10-01 to 2025-10-02. . . . .                    | 27 |
| 21 | Zonal average of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02. . . . .  | 28 |
| 22 | Zonal average of “Cloud top height” for 2025-10-01 to 2025-10-02. . . . .            | 29 |
| 23 | Zonal average of “Cloud optical thickness” for 2025-10-01 to 2025-10-02. . . . .     | 30 |
| 24 | Zonal average of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02. . . . .        | 31 |
| 25 | Zonal average of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02. . . . .          | 32 |
| 26 | Zonal average of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02. . . . .          | 33 |
| 27 | Zonal average of “Fitted surface albedo” for 2025-10-01 to 2025-10-02. . . . .       | 34 |
| 28 | Zonal average of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02. . . . . | 35 |
| 29 | Zonal average of “RMS” for 2025-10-01 to 2025-10-02. . . . .                         | 36 |

|    |                                                                                                |    |
|----|------------------------------------------------------------------------------------------------|----|
| 30 | Zonal average of “RMS (CRB)” for 2025-10-01 to 2025-10-02. . . . .                             | 37 |
| 31 | Zonal average of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02. . . . .              | 38 |
| 32 | Zonal average of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02. . . . .                   | 39 |
| 33 | Zonal average of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02. . . . .               | 40 |
| 34 | Zonal average of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02. . . . .              | 41 |
| 35 | Zonal average of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02. . . . .              | 42 |
| 36 | Histogram of “QA value” for 2025-10-01 to 2025-10-02 . . . . .                                 | 43 |
| 37 | Histogram of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .               | 44 |
| 38 | Histogram of “Cloud top height” for 2025-10-01 to 2025-10-02 . . . . .                         | 45 |
| 39 | Histogram of “Cloud optical thickness” for 2025-10-01 to 2025-10-02 . . . . .                  | 46 |
| 40 | Histogram of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                     | 47 |
| 41 | Histogram of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                       | 48 |
| 42 | Histogram of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                       | 49 |
| 43 | Histogram of “Fitted surface albedo” for 2025-10-01 to 2025-10-02 . . . . .                    | 50 |
| 44 | Histogram of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . .              | 51 |
| 45 | Histogram of “RMS” for 2025-10-01 to 2025-10-02 . . . . .                                      | 52 |
| 46 | Histogram of “RMS (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                                | 53 |
| 47 | Histogram of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02 . . . . .                 | 54 |
| 48 | Histogram of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .                      | 55 |
| 49 | Histogram of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02 . . . . .                  | 56 |
| 50 | Histogram of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02 . . . . .                 | 57 |
| 51 | Histogram of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02 . . . . .                 | 58 |
| 52 | Along track statistics of “QA value” for 2025-10-01 to 2025-10-02 . . . . .                    | 59 |
| 53 | Along track statistics of “Radiometric cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .  | 60 |
| 54 | Along track statistics of “Cloud top height” for 2025-10-01 to 2025-10-02 . . . . .            | 61 |
| 55 | Along track statistics of “Cloud optical thickness” for 2025-10-01 to 2025-10-02 . . . . .     | 62 |
| 56 | Along track statistics of “Cloud fraction (CRB)” for 2025-10-01 to 2025-10-02 . . . . .        | 63 |
| 57 | Along track statistics of “Cloud height (CRB)” for 2025-10-01 to 2025-10-02 . . . . .          | 64 |
| 58 | Along track statistics of “Cloud albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . .          | 65 |
| 59 | Along track statistics of “Fitted surface albedo” for 2025-10-01 to 2025-10-02 . . . . .       | 66 |
| 60 | Along track statistics of “Fitted surface albedo (CRB)” for 2025-10-01 to 2025-10-02 . . . . . | 67 |
| 61 | Along track statistics of “RMS” for 2025-10-01 to 2025-10-02 . . . . .                         | 68 |
| 62 | Along track statistics of “RMS (CRB)” for 2025-10-01 to 2025-10-02 . . . . .                   | 69 |
| 63 | Along track statistics of “Fitting wavelength shift” for 2025-10-01 to 2025-10-02 . . . . .    | 70 |
| 64 | Along track statistics of “OCRA cloud fraction” for 2025-10-01 to 2025-10-02 . . . . .         | 71 |
| 65 | Along track statistics of “OCRA “blue” reflectance” for 2025-10-01 to 2025-10-02 . . . . .     | 72 |
| 66 | Along track statistics of “OCRA “green” reflectance” for 2025-10-01 to 2025-10-02 . . . . .    | 73 |
| 67 | Along track statistics of “ROCINN “red” reflectance” for 2025-10-01 to 2025-10-02 . . . . .    | 74 |

## 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 |

## 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).