

Aeolus Level-2B HLOS (horizontal line-of-sight) Wind Product Monthly Quality Report

Period: For the month up to 2 December 2021

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Introduction

Information on Aeolus Level-2B HLOS wind monitoring statistics is available on the CAL/VAL webpage (under L2B Data Quality Handbook); for those that have access. Section 2.3 of the ECMWF's [Technical Memorandum](#) explains how Aeolus observation minus background (O-B) departure statistics are calculated.

ECMWF's daily updated, automatically produced statistics of L2B HLOS wind observation minus background (O-B) and observation minus analysis (O-A) are available [here](#).

The statistics focus on Rayleigh-clear and Mie-cloudy (not Rayleigh-cloudy and Mie-clear). An expert interpretation of these statistics for the past month is provided in this report, including insights into relevant data events.

Quality Control (QC) is applied in the production of the ECMWF statistics:

- Rejecting observations with Level-2B processor estimated instrument error (1- σ) beyond a threshold: $\sigma_O > 12$ m/s for the Rayleigh-clear and $\sigma_O > 5$ m/s for the Mie-cloudy to remove outliers which spoil non-robust metrics.
- Rejecting observations if the Level-2B HLOS wind result overall confidence flag is set to invalid.
- Rejecting observations which fail the ECMWF model "first-guess check" i.e. reject if $O - B > 5\sqrt{\sigma_O^2 + \sigma_B^2}$ (a 5-sigma check)

Daily data coverage plots for Aeolus are also available [here](#).

Other Aeolus L2B wind monitoring websites

- [Météo-France](#)
- Met Office:
 - [O-B statistics](#)
 - [Data timeliness](#)

1. L2B Rayleigh-clear O-B and O-A departure statistics

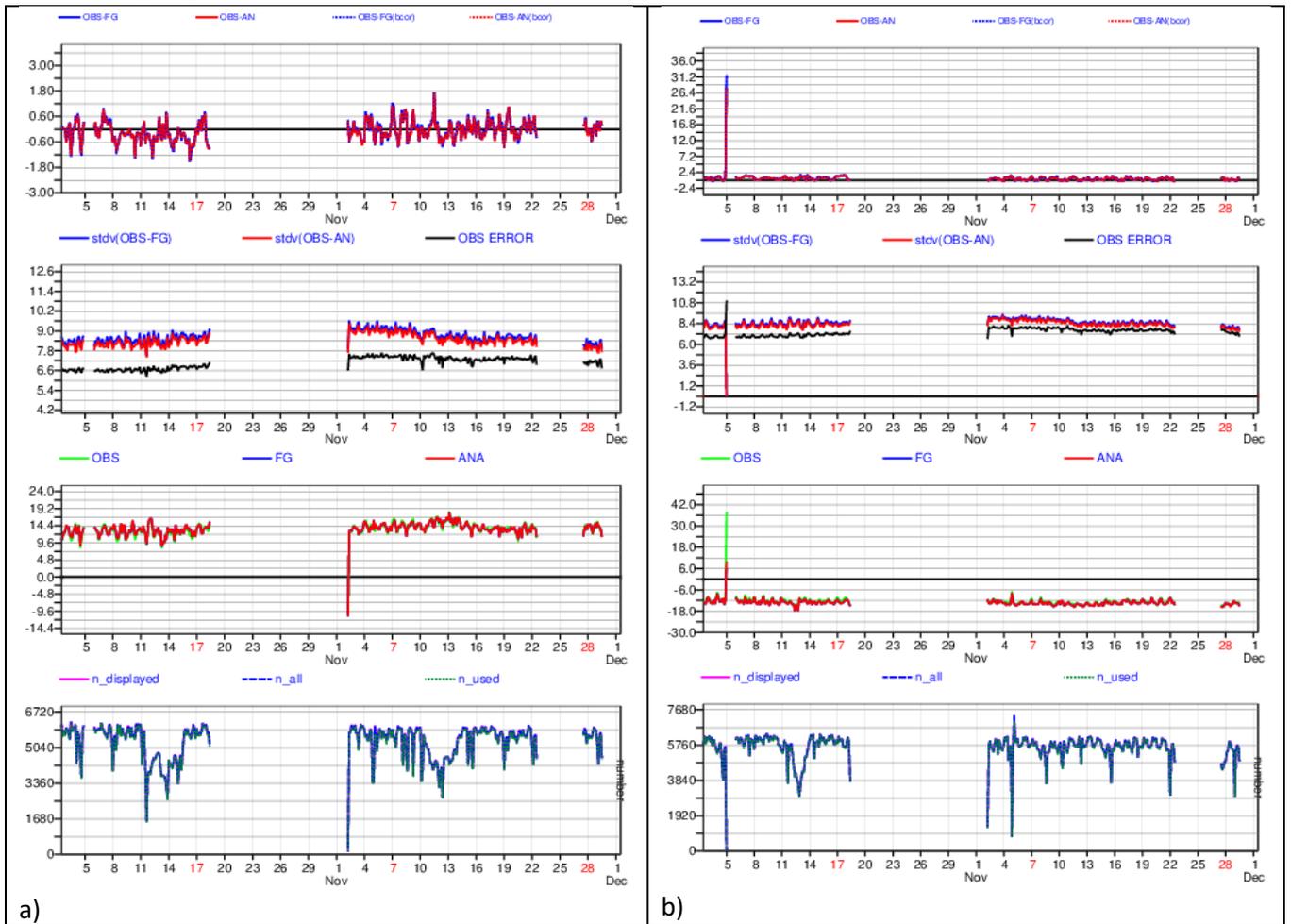


Figure 1. This figure shows changes with time in the O-B and O-A departure statistics of the L2B Rayleigh-clear winds with respect to the ECMWF model. The statistics are calculated every 3 hours for the 0-400 hPa pressure range. Panel a) is for ascending and panel b) is for descending orbit phase. The top plot is the mean of departures i.e. bias; the second plot down is the standard deviation of departures and the assigned observation error in data assimilation (OBS ERROR) i.e. information on random error; the third plot down is the mean observation value and mean model equivalent and the bottom plot is the number of observations per sample.

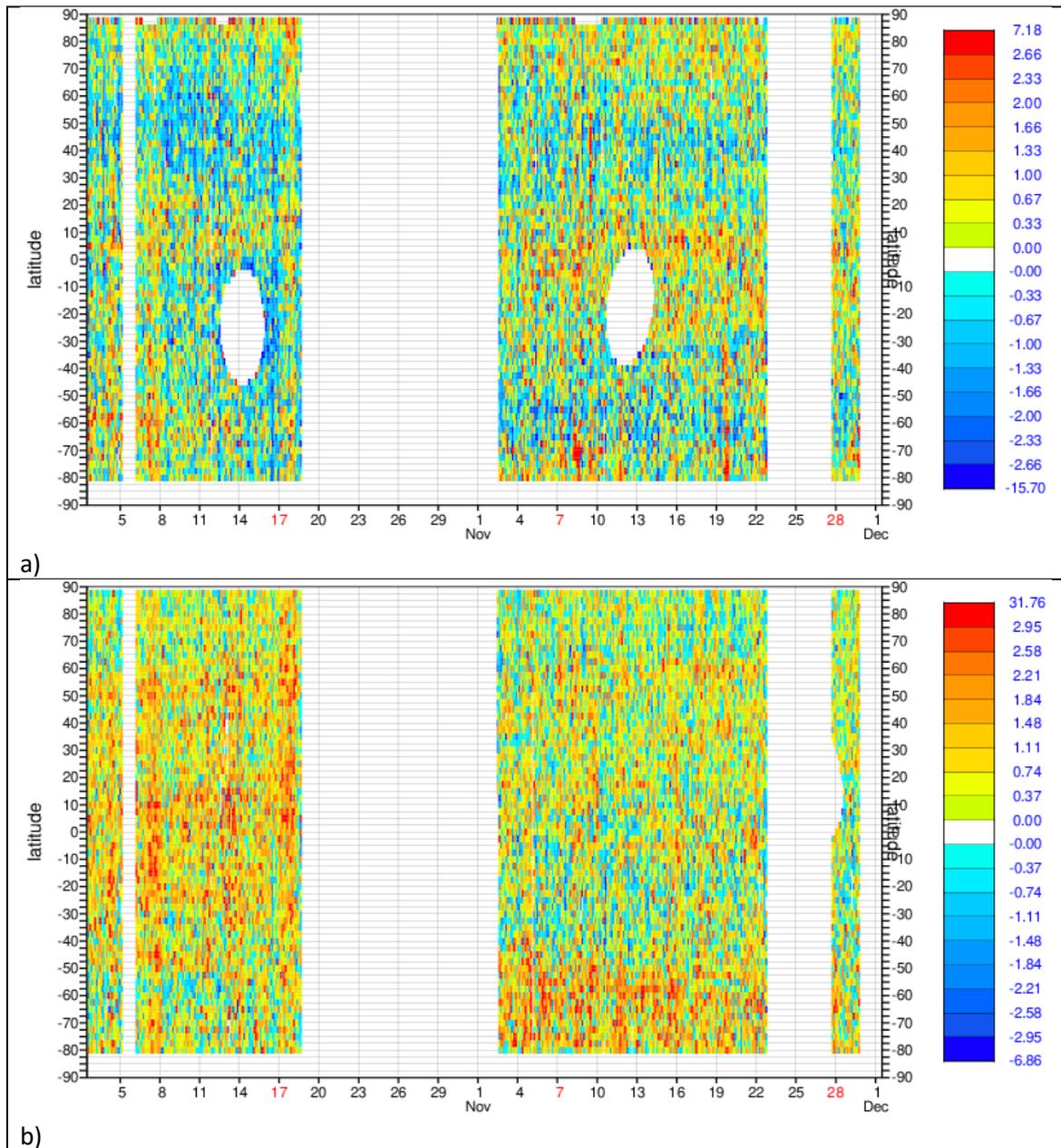


Figure 2. Latitude-time dependence of the mean(O-B) for L2B Rayleigh-clear HLOS winds for the 0-400 hPa pressure range for a) ascending and b) descending orbit phase. Unit: m/s.

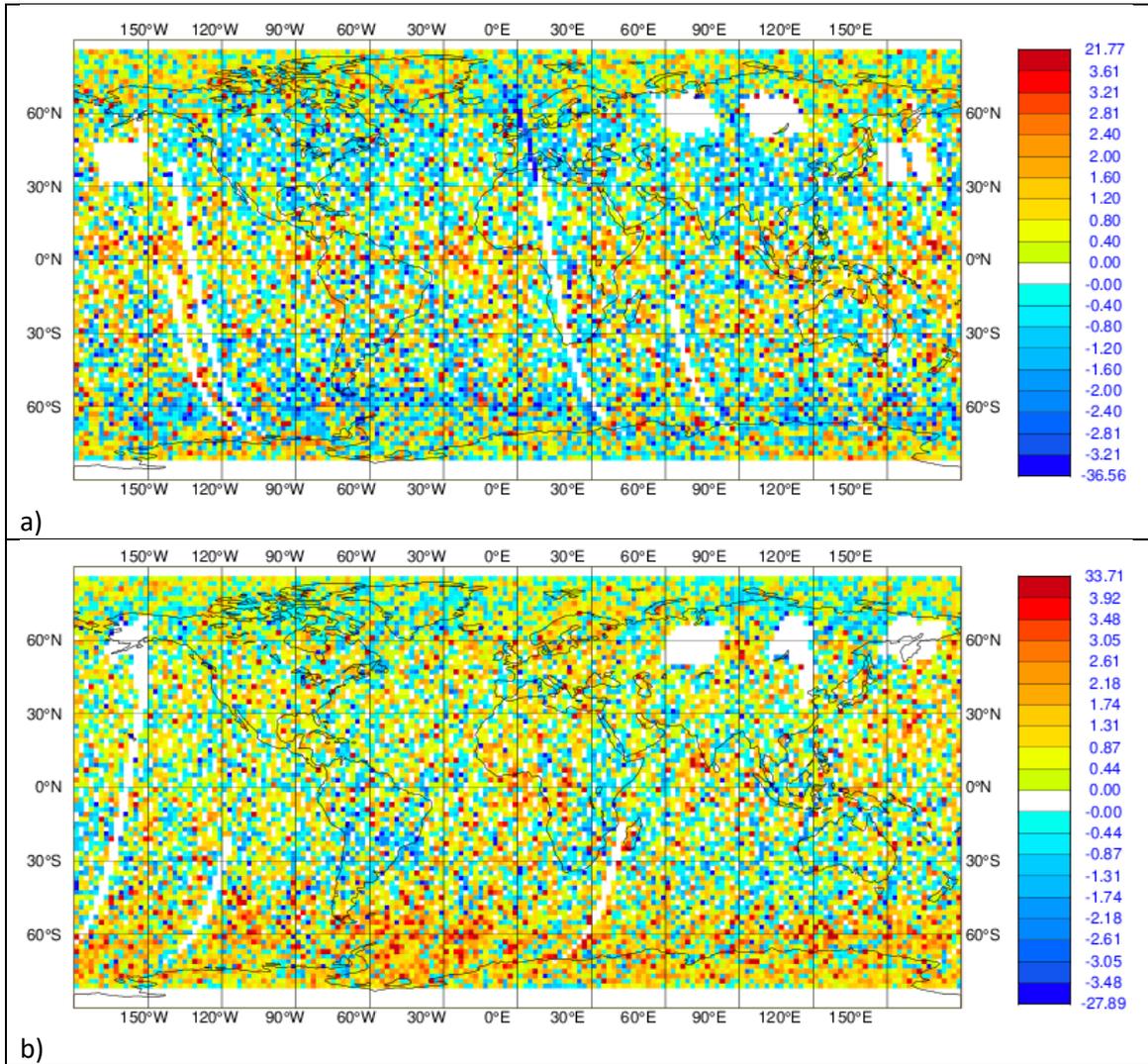
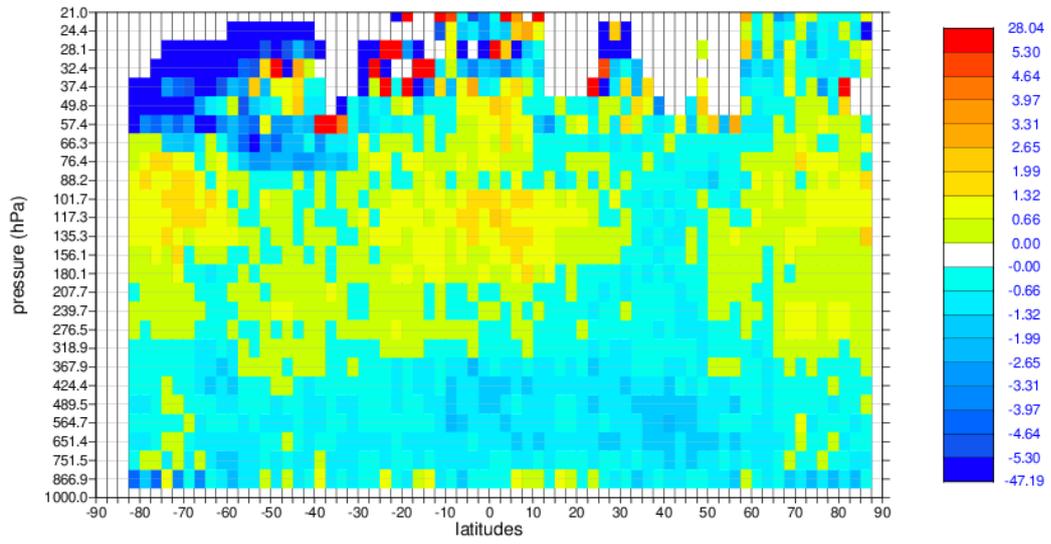
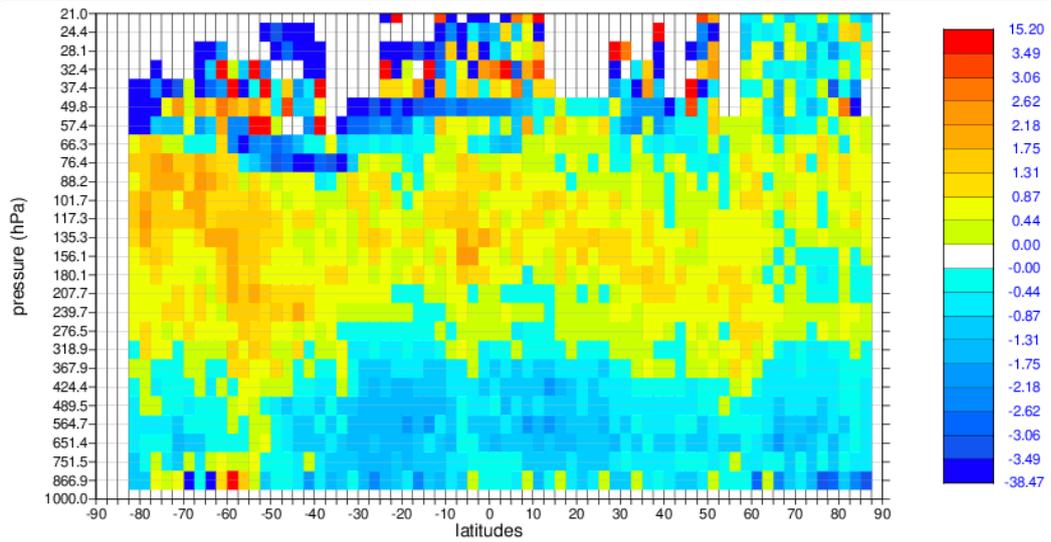


Figure 3. Maps of L2B Rayleigh-clear mean(O-B) for the 0-400 hPa pressure range for a) ascending and b) descending orbit phases. Unit: m/s. For the period: 1 November 2021 to 22 November 2021. These plots are only updated once per week.

STATISTICS FOR HLOS FROM AEOLUS/ (ASCENDING NODE)
LEVEL = 21.00 - 1000.00 HPA [TIME STEP = 3 HOURS]
MEAN FIRST GUESS DEPARTURE , ALL (QC FILTERED)
EXP =, DATA PERIOD = 2021110709 - 2021112215, AREA = 90S - 90N/ 00 - 360
Min: -47.188 Max: 28.042 Mean: -0.176



a)



b)

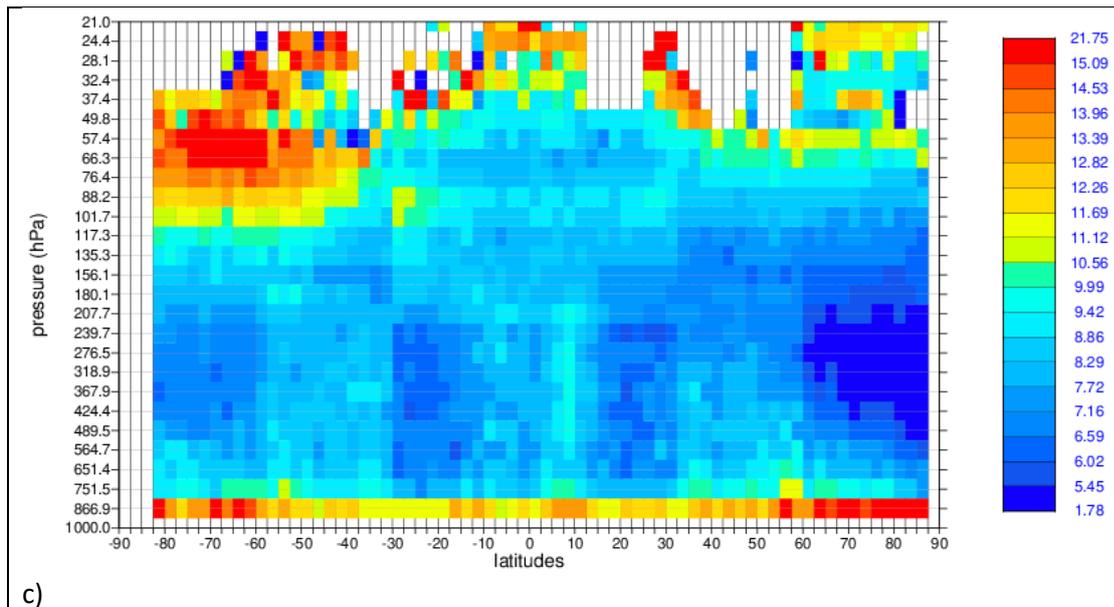


Figure 4. Pressure versus latitude dependence of the L2B Rayleigh-clear mean(O-B) for a) ascending and b) descending orbits. Panel c) is the standard deviation of (O-B) for ascending orbits. Unit: m/s. For the period: 7 November to 22 November 2021.

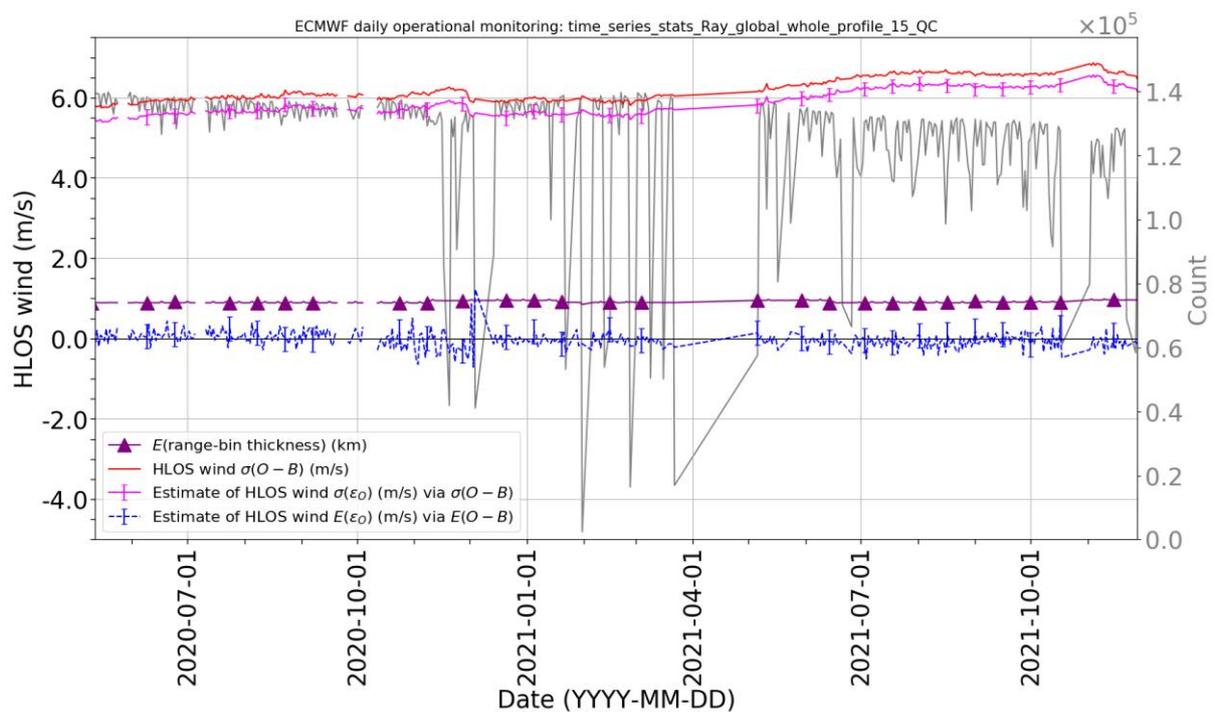


Figure 5. Times-series of daily, global, whole profile L2B Rayleigh-clear HLOS wind related statistics since 12 May 2020 (since L2B data was made public). QC for this type of plot is to reject winds if $abs(O-B) > 15$ m/s.

Comments and assessment of L2B Rayleigh-clear winds for this period:

- L2B data was blocklisted from 22-27 November and again from 29 November to 4 December 2021 (TBC) due to laser sensitivity testing with the aim of improving the atmospheric path signal, hence the gaps in data monitoring for operations.
- There has been some improvement in the Rayleigh-clear random error since the switching on of the FM-B laser again in late October. This is partially a settlement of the laser, partially some

tuning of the cold-plate temperatures to optimise laser energy and following the laser sensitivity testing in late November, some further improvements in laser energy with corresponding improvements in atmospheric path signal level.

- Looking at the long-term trend (since May 2020), these laser setpoint improvements result in similar random errors to those found in mid-2021 - avoiding reaching what would otherwise have been record high noise levels.
- The seasonal (October/March) ascending/descending bias differences improved a bit in November relative to October.
- Data is very noisy (not really usable for NWP) for <-40 degrees latitude and higher than 100 hPa due to the large solar background combined with low atmospheric path signal.

2. L2B Mie-cloudy O-B and O-A departure statistics

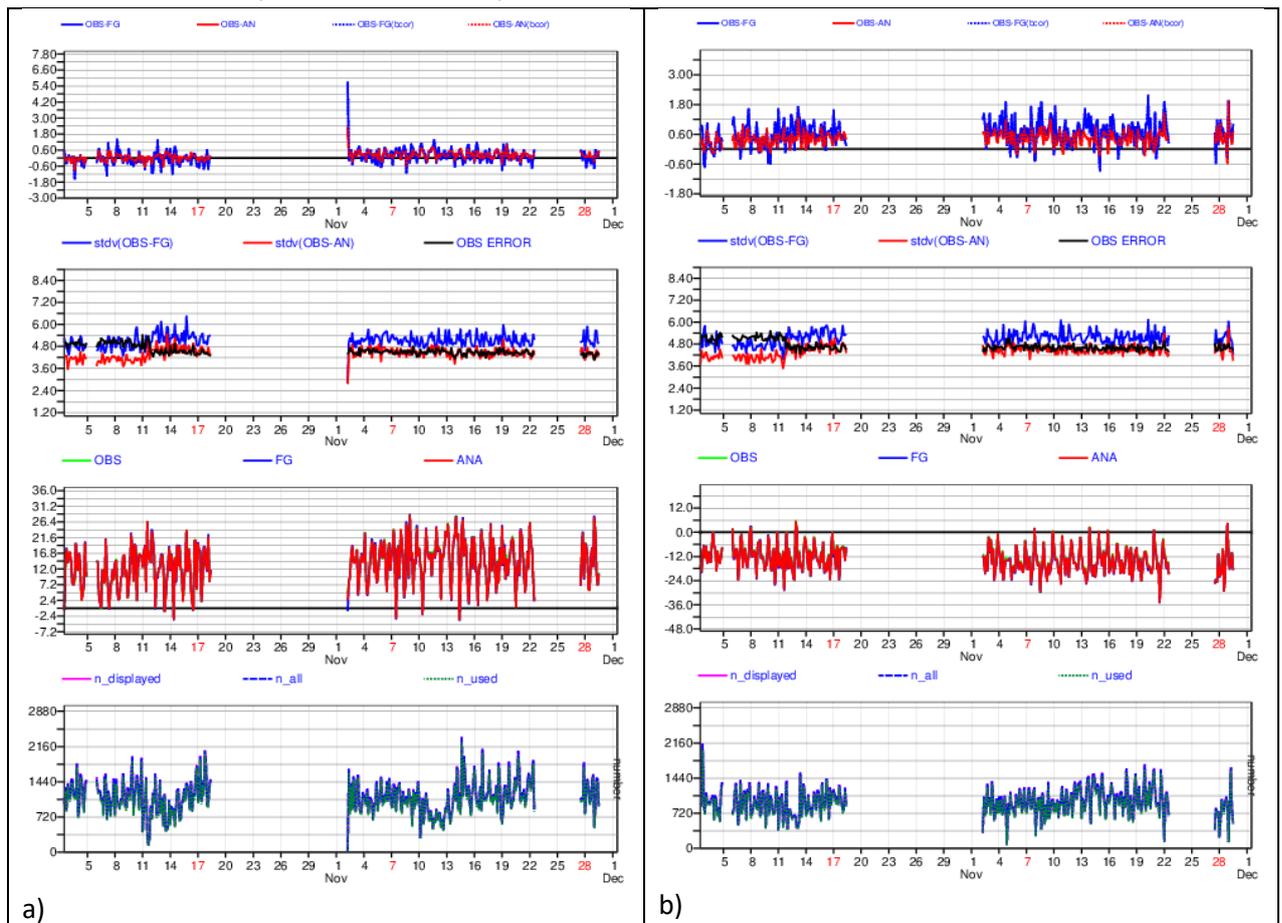


Figure 6. Same type of plots as in Figure 1, but for L2B Mie-cloudy HLOS winds.

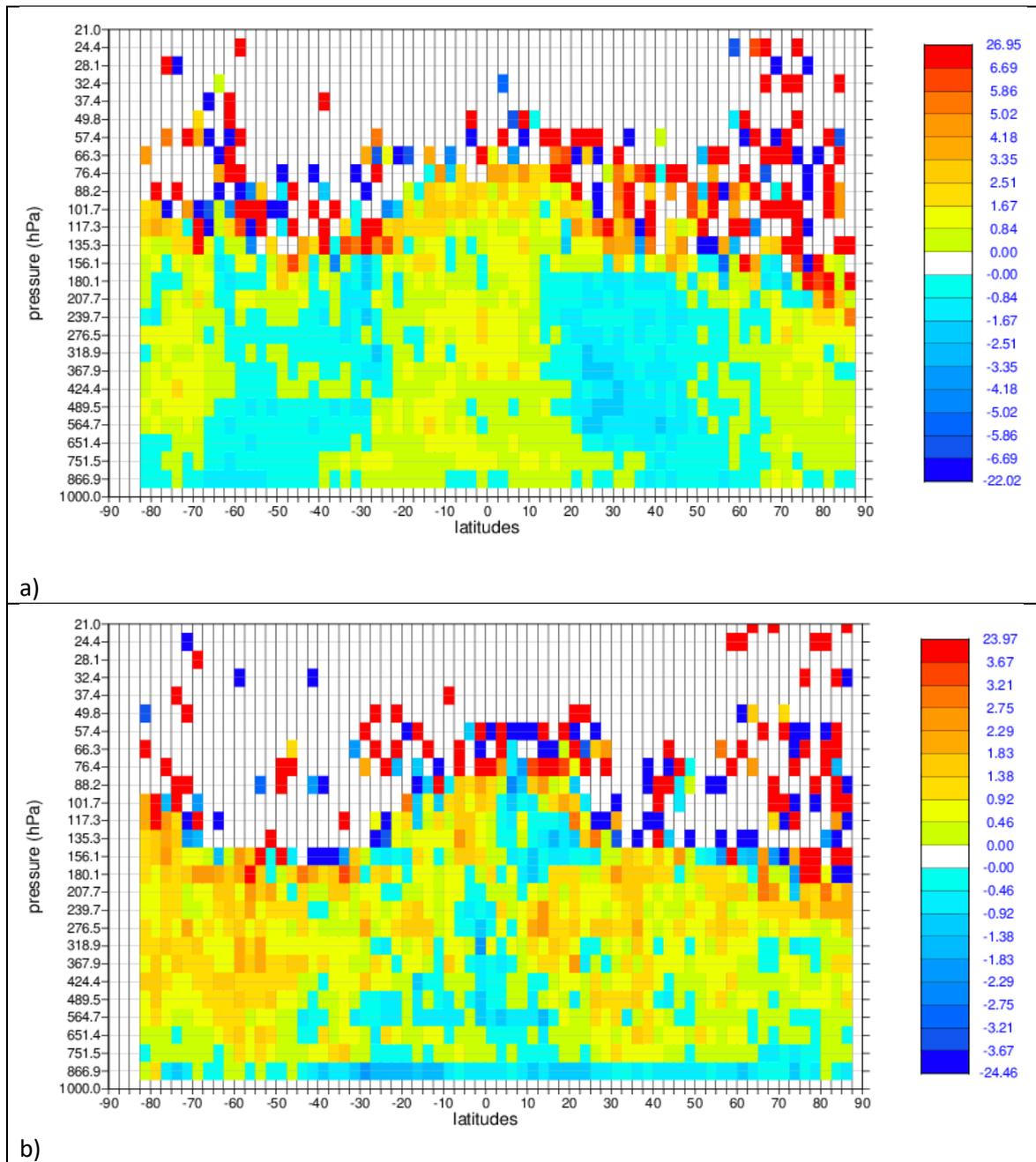


Figure 7. Pressure versus latitude dependence of the L2B Mie-cloudy mean(O-B) for a) ascending and b) descending orbits. Unit: m/s. For the period: 7 November to 22 November 2021.

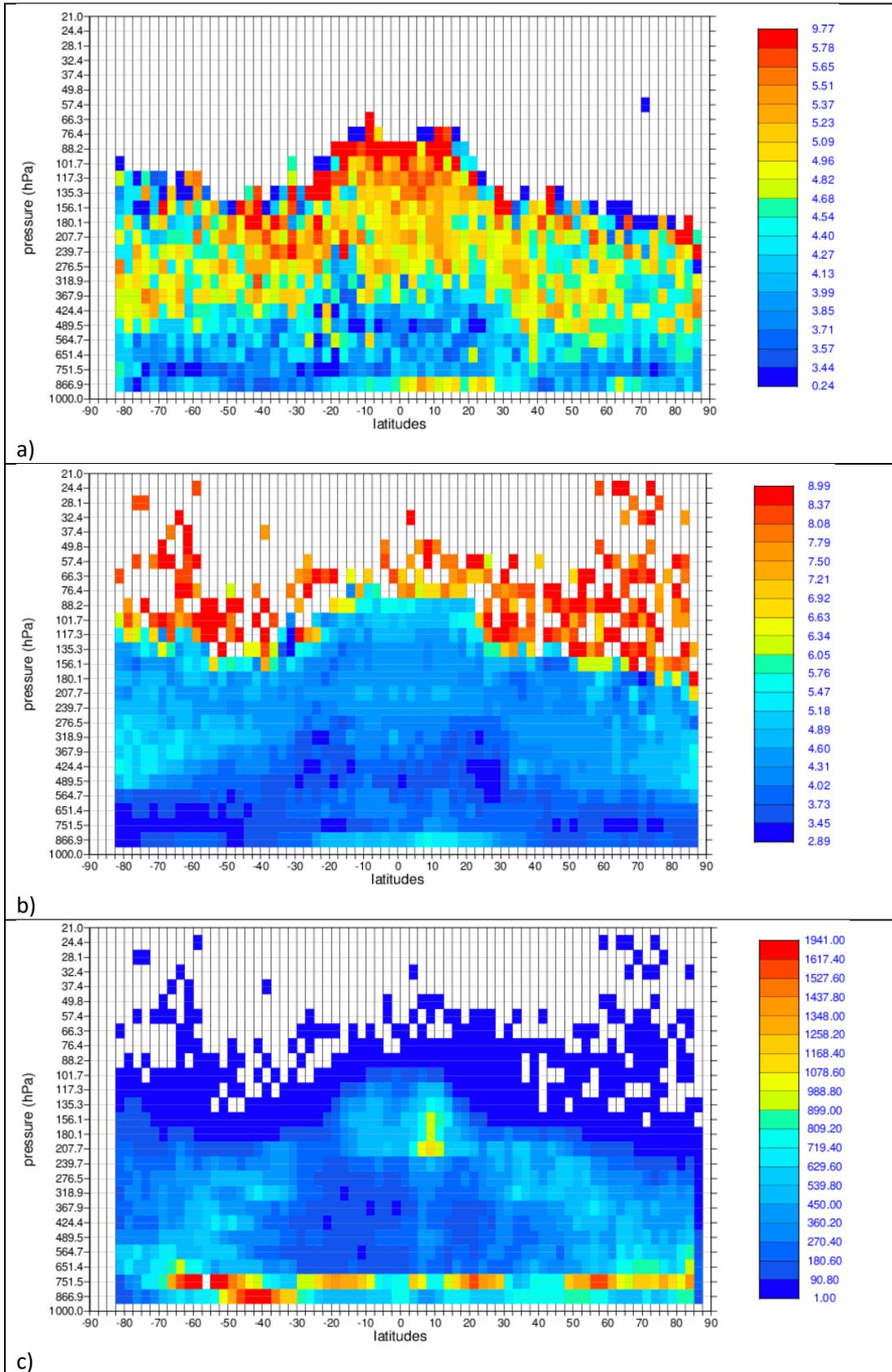


Figure 8. Pressure versus latitude dependence of the L2B Mie-cloudy a) ascending $std(O-B)$ m/s, b) assigned observation error in DA (via scaled L2Bp error estimates) and c) number of observations. For the period: 7 November to 22 November 2021.

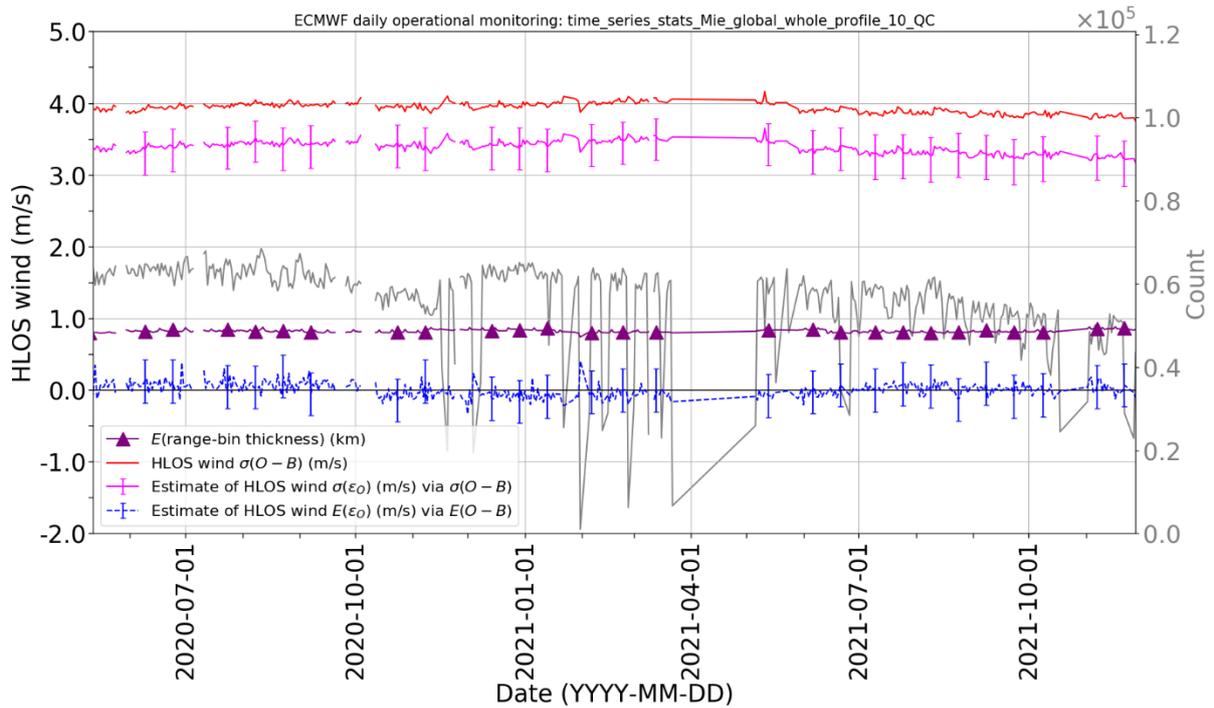


Figure 9. Times-series of daily, global, whole profile L2B Mie-cloudy HLOS wind related statistics since 12 May 2020 (when L2B data was made public). QC for this type of plot is to reject if $\text{abs}(O-B) > 10$ m/s.

Comments and assessment of on L2B Mie-cloudy winds for this period:

- See the comments on Rayleigh-clear as regards data gaps due to L2B blocklisting.
- Bias remained fairly stable.
- Random error showing perhaps a slight improvement recently.