

# Aeolus Level-2B HLOS (horizontal line-of-sight) wind product monthly quality report

**Period:** For the month up to 8 March 2021

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## Introduction

An introduction to the Aeolus Level-2B HLOS wind monitoring statistics is provided on the Aeolus CAL/VAL webpage (under L2B Data Quality Handbook); for those that have access. The ECWMF Technical Memorandum 864 (Section 2.3) provides information on how the Aeolus O-B departure statistics are calculated; it is available here:

<https://www.ecmwf.int/en/elibrary/19538-nwp-impact-aeolus-level-2b-winds-ecmwf>

Daily updated, automatically produced statistics of observation minus background (O-B) and observation minus analysis (O-A) are available from the following website (from which many of the plots used in this report have been taken):

<https://www.ecmwf.int/en/forecasts/charts/obstat/?facets=Data%20type,Aeolus%20HLOS%20Wind>

Quality Control is applied to produce the ECMWF automated statistics, which consists of:

- Rejecting observations with Level-2B processor estimated instrument error beyond a thresholds:  $\sigma_o > 12$  m/s for the Rayleigh and  $\sigma_o > 5$  m/s for the Mie.
- Rejecting observations when the Level-2B HLOS wind result overall confidence flag is invalid.
- A model based first-guess check i.e. reject if first-guess departure is deemed to be too large, indicating gross errors i.e.  $O - B > 5\sqrt{\sigma_o^2 + \sigma_B^2}$

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

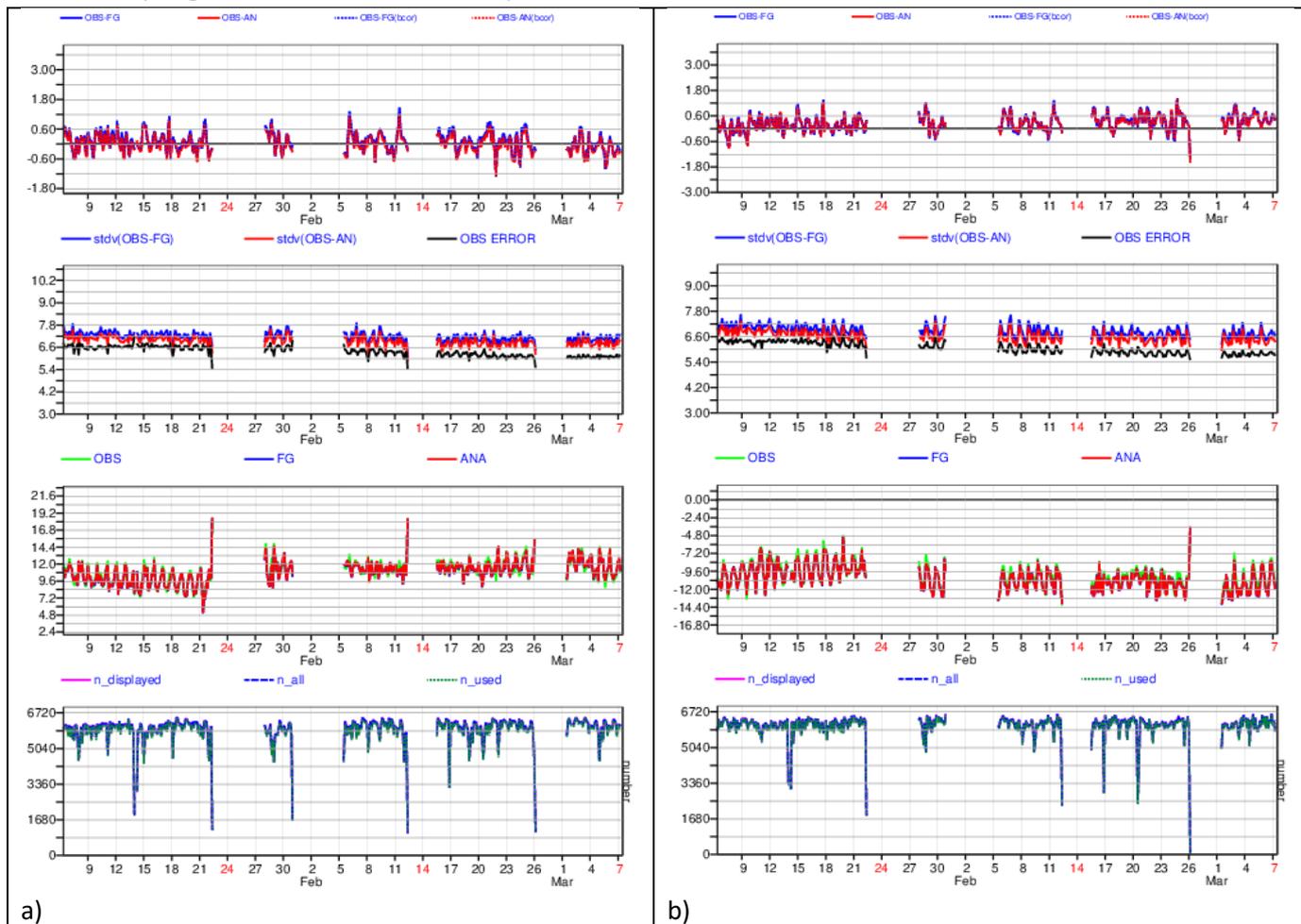


Figure 1. This figure shows changes with time in the O-B and O-A departure statistics of the L2B Rayleigh-clear winds with respect to the ECMWF model. The statistics are calculated every 3 hours for the 0-400 hPa pressure range. Panel a) is for ascending and panel b) is for descending orbit phase. The 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.

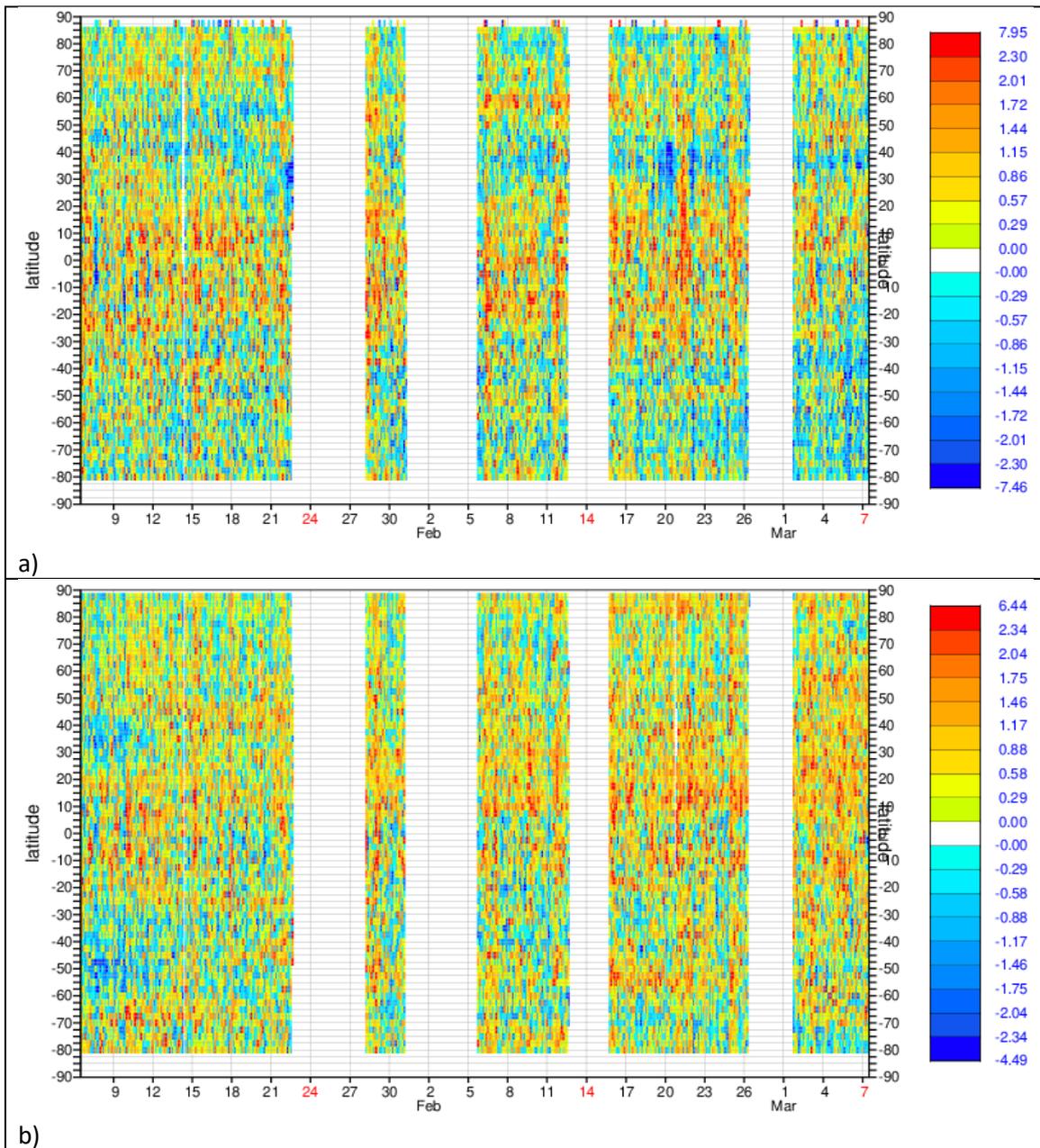


Figure 2. Latitude-time dependence of the mean(O-B) for L2B Rayleigh-clear HLOS winds for the 0-400 hPa pressure range for a) ascending and b) descending orbit phase. Unit: m/s.

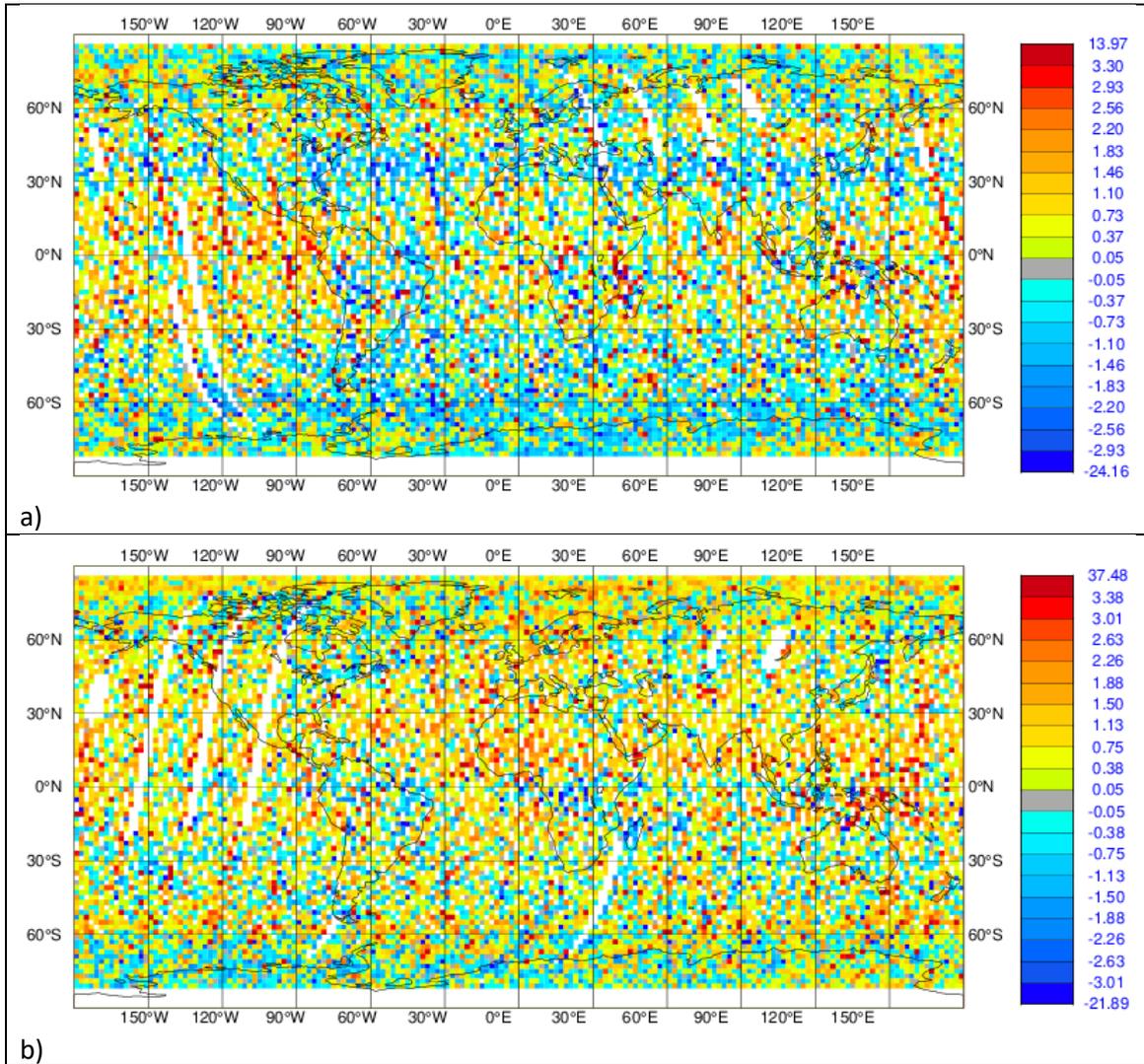
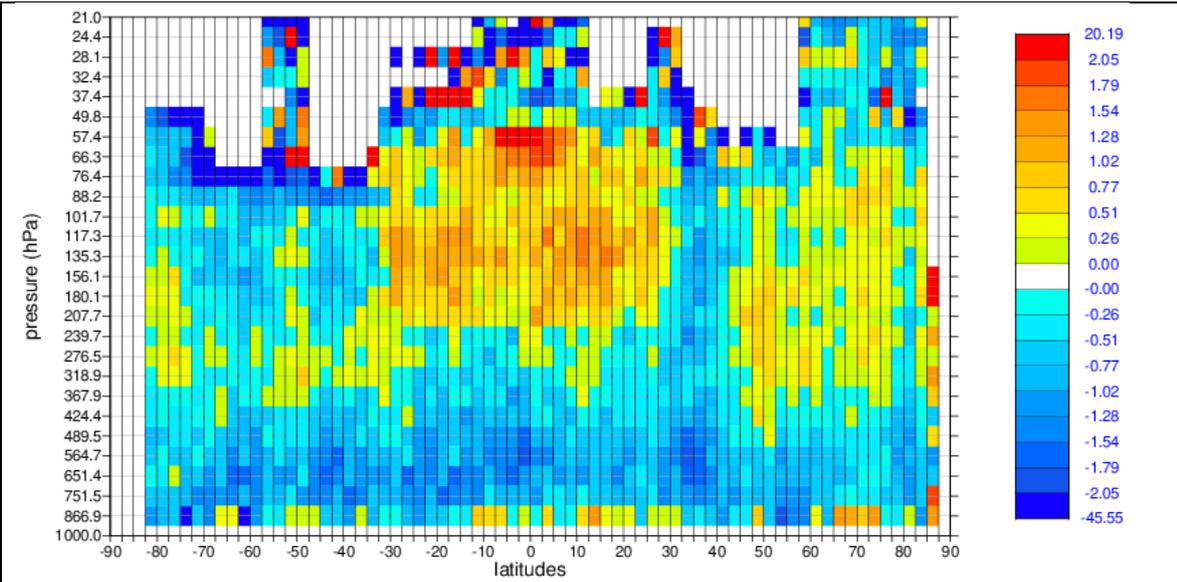
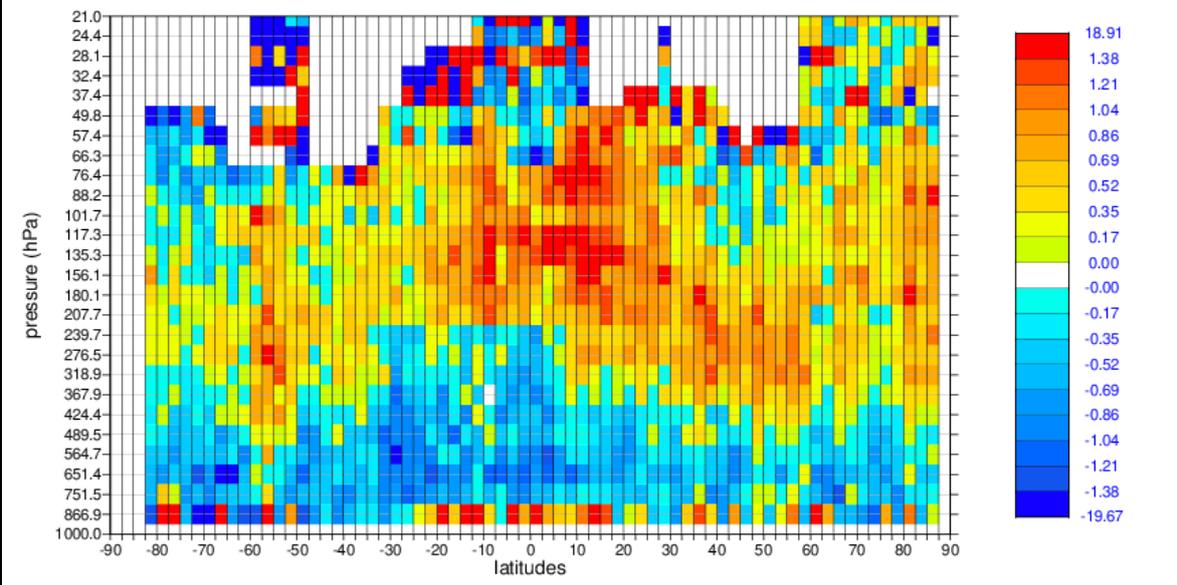


Figure 3. Maps of L2B Rayleigh-clear mean(O-B) for the 0-400 hPa pressure range for a) ascending and b) descending orbit phases. Unit: m/s. For the period: 15 February 2021 to 6 March 2021.



a)



b)

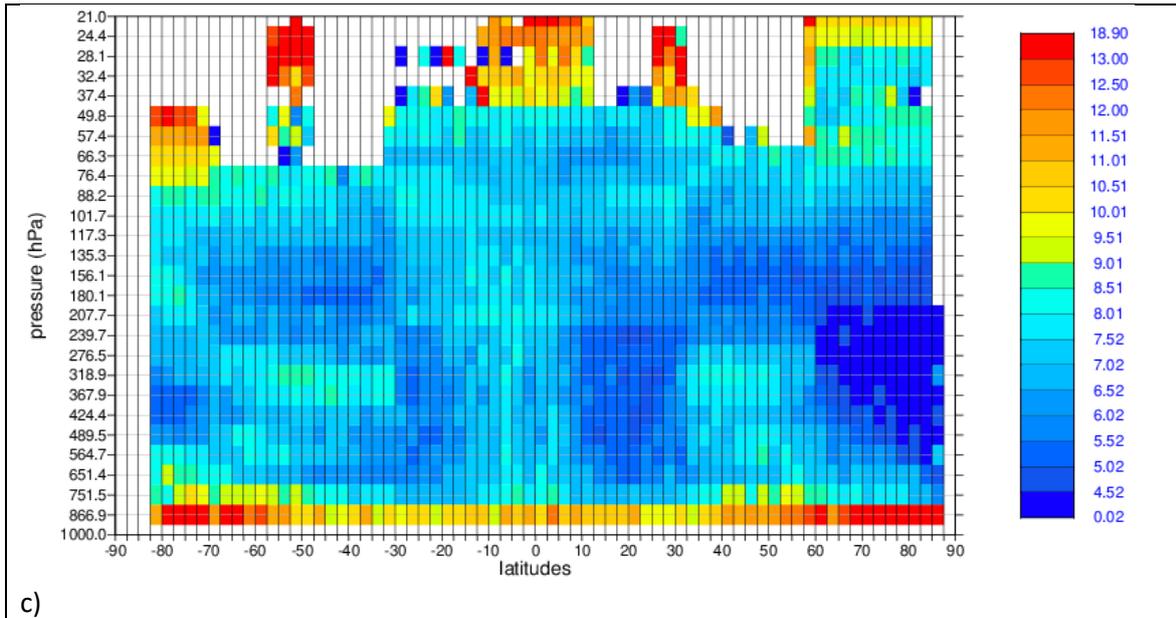


Figure 4. Pressure versus latitude dependence of the L2B Rayleigh-clear mean(O-B) for a) ascending and b) descending orbits. Panel c) is the standard deviation of (O-B) for ascending orbits. Unit: m/s. For the period: 15 February 2021 to 6 March 2021.

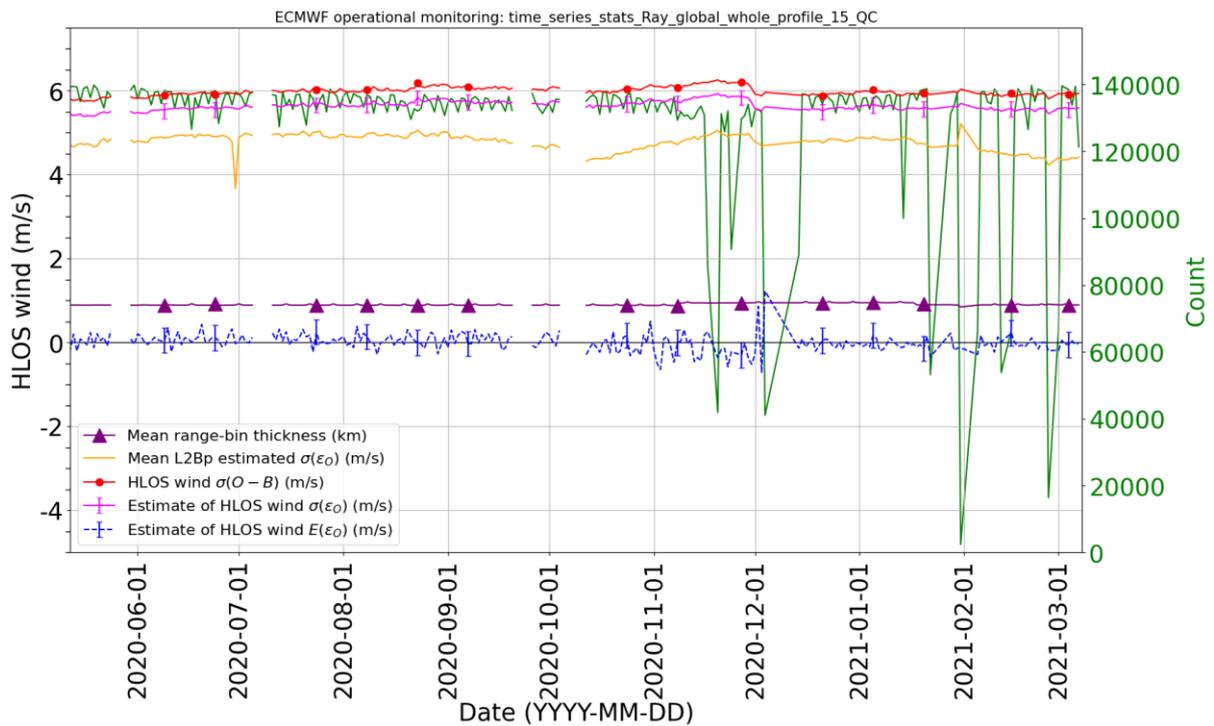


Figure 5. Times-series of daily global, whole profile L2B Rayleigh-clear HLOS wind related statistics since 12 May 2020. QC for this type of plot is to reject winds if  $abs(O-B) > 15$  m/s.

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

- There are three data gaps in this period, due to Special Operations Requests: 1. 31 January to ~6 February (M1 thermal test part 2); 2. 12-16 February (M1 thermal test part 3); 3. 26 February to 2 March (switch to new M1 set-point and then back to previous).
- Global average random errors appear to have decreased a bit due to reduced solar background noise (minimum in Spring and Autumn).

- The Hovmöller type bias plots show a bias feature around 20 February 2021 at latitude  $\sim 30\text{-}40^\circ\text{N}$  for ascending orbits. This was caused by the star-tracker switching off during a moon-blinding event and using the inertial measurement unit. This leads to temporary biases on certain parts of the orbit, affecting both Rayleigh and Mie winds (a pointing error). An updated IMU alignment matrix has not resolved this issue.
- Overall, the zonal average bias continues to show some similarities for ascending and descending orbits: with a generally negative bias at lower altitudes (higher pressures) and more positive bias at higher altitudes. There are indications in offline testing that this related to the Rayleigh response calibration curves as a function of atmospheric temperature (Rayleigh-Brillouin Correction) being not quite right - this will hopefully be improved soon.
- There is evidence of the moon-blinding negative bias at  $\sim 30\text{-}40^\circ\text{N}$  in the zonal average bias for ascending orbits. It stands out more than usual in a monthly average plot due to the increased number of data gaps recently.

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

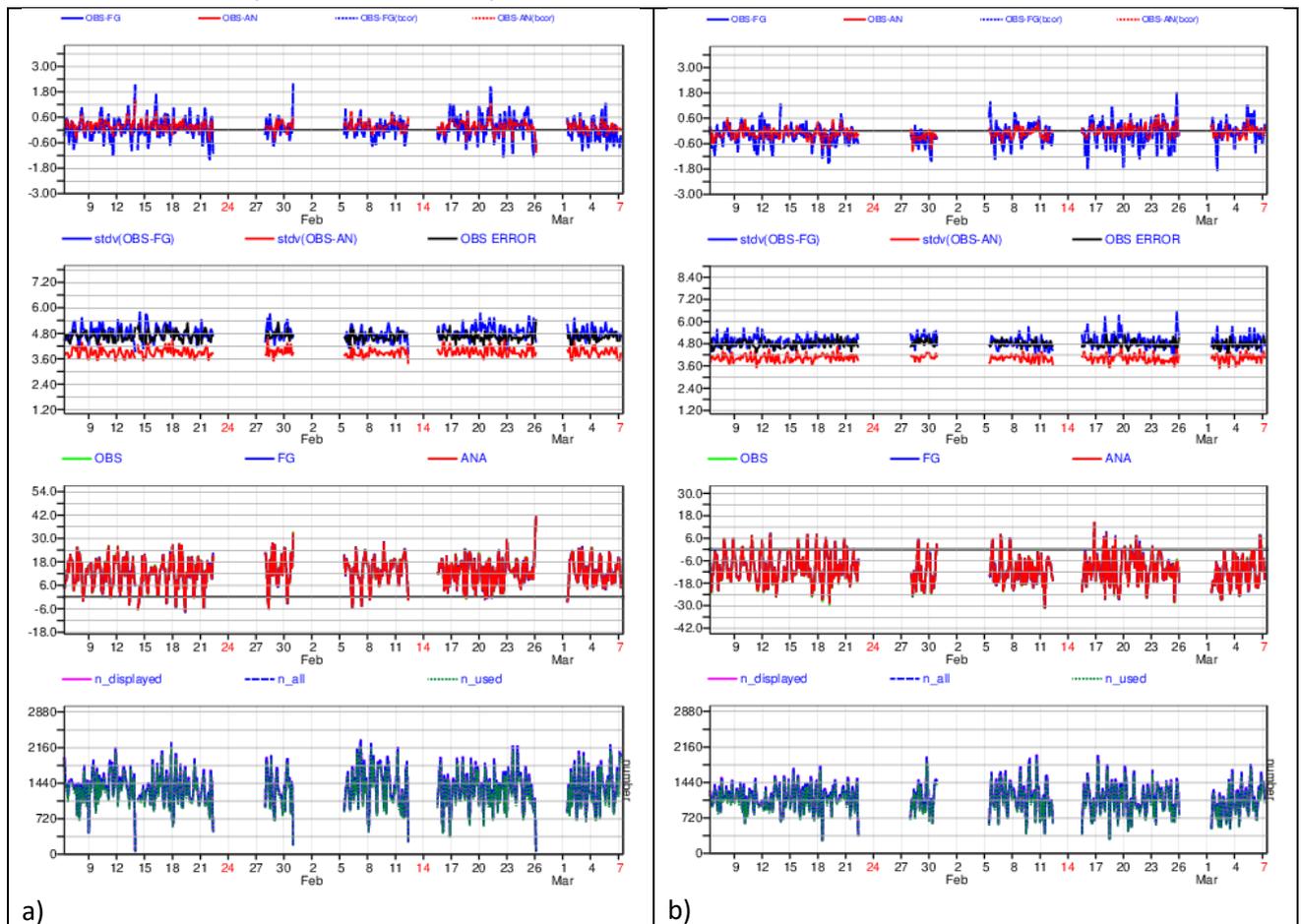


Figure 6. Same type of plots as in Figure 1, but for L2B Mie-cloudy HLOS winds.

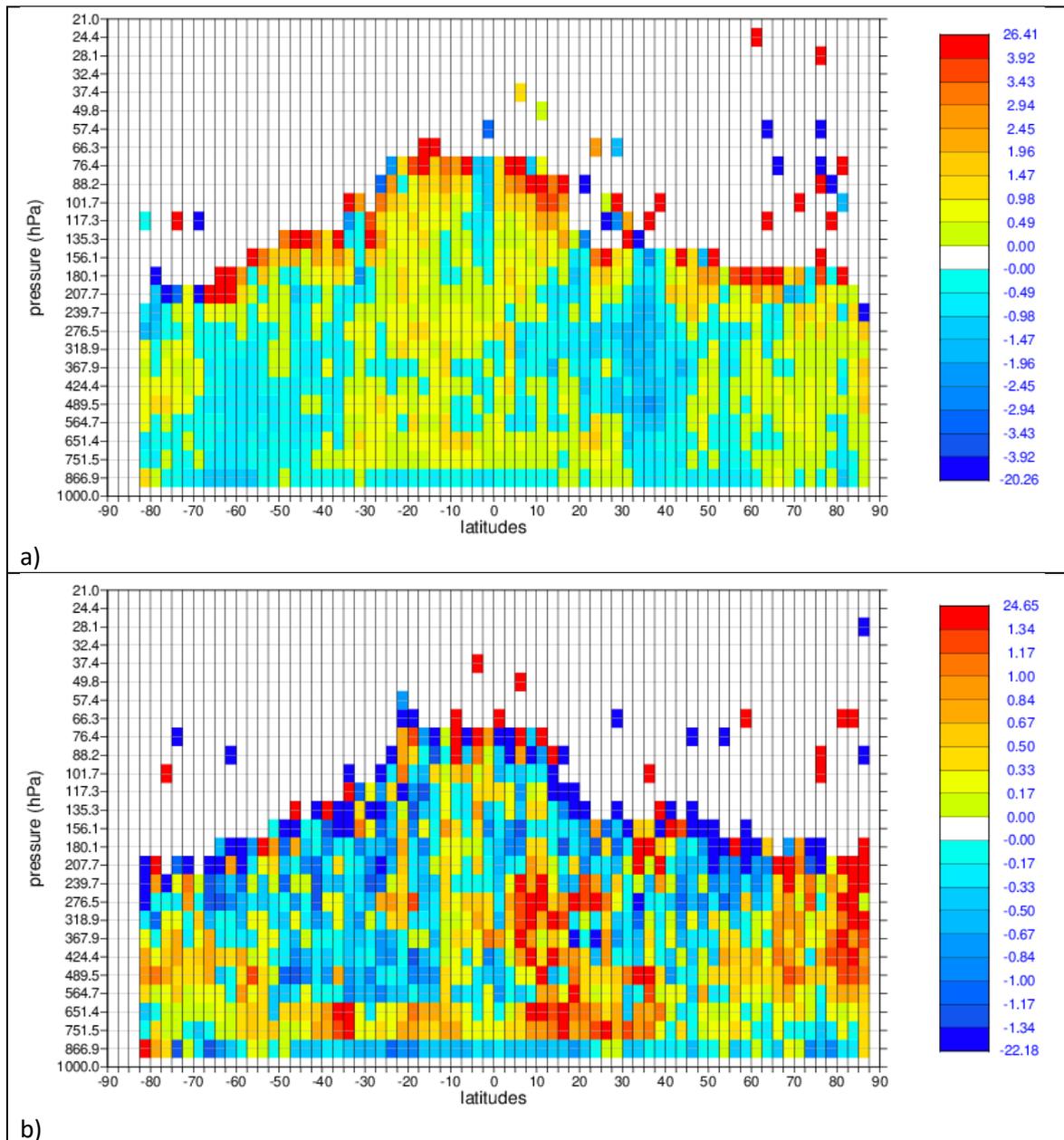


Figure 7. Pressure versus latitude dependence of the L2B Mie-cloudy mean(O-B) for a) ascending and b) descending orbits. Unit: m/s. For the period: 15 February 2021 to 6 March 2021.

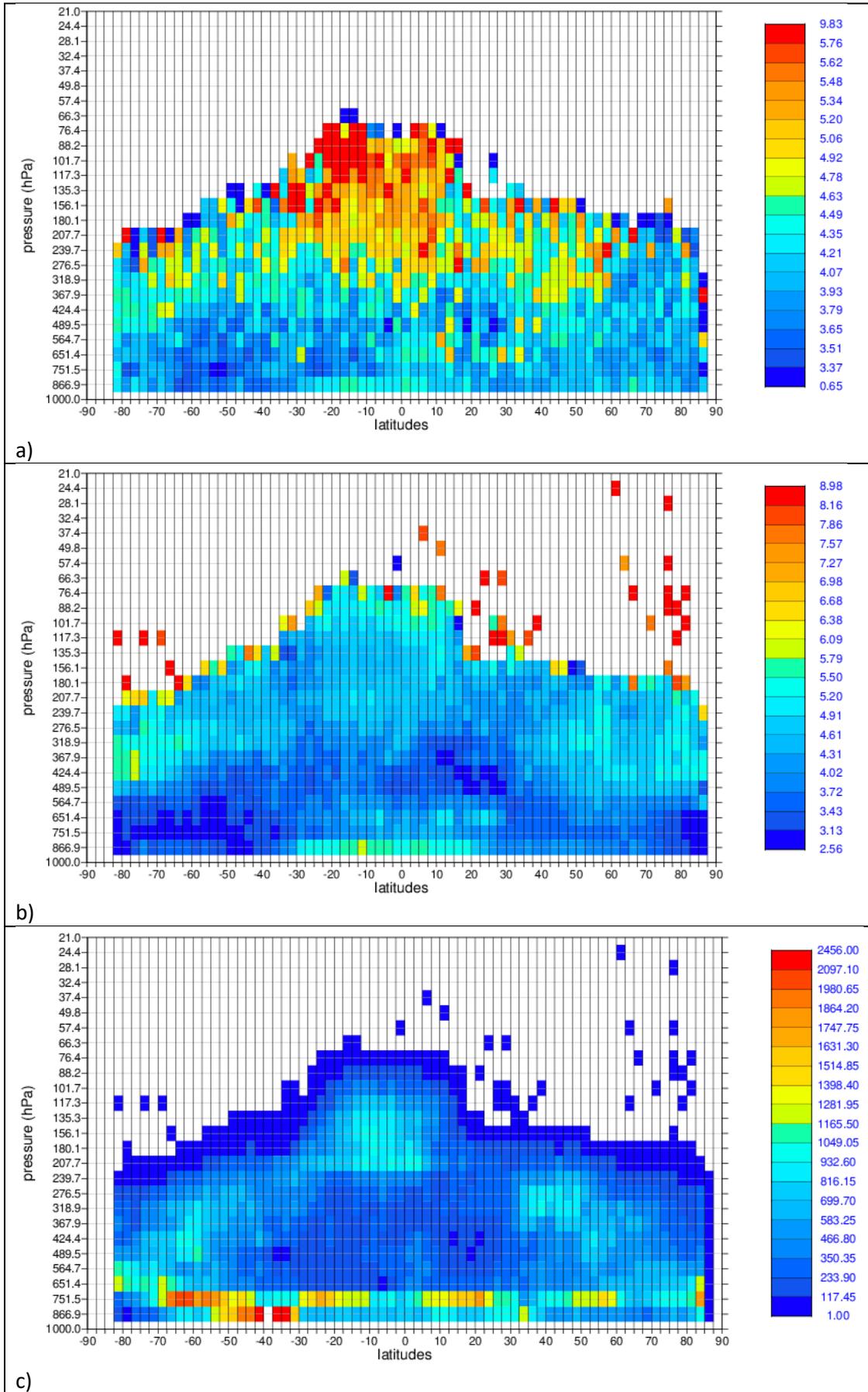


Figure 8. Pressure versus latitude dependence of the L2B Mie-cloudy a) ascending  $\text{stddev}(O-B)$  m/s, b) corresponding L2Bp estimated observation error m/s (scaled) and c) number of observations. For the period: 15 February 2021 to 6 March 2021.

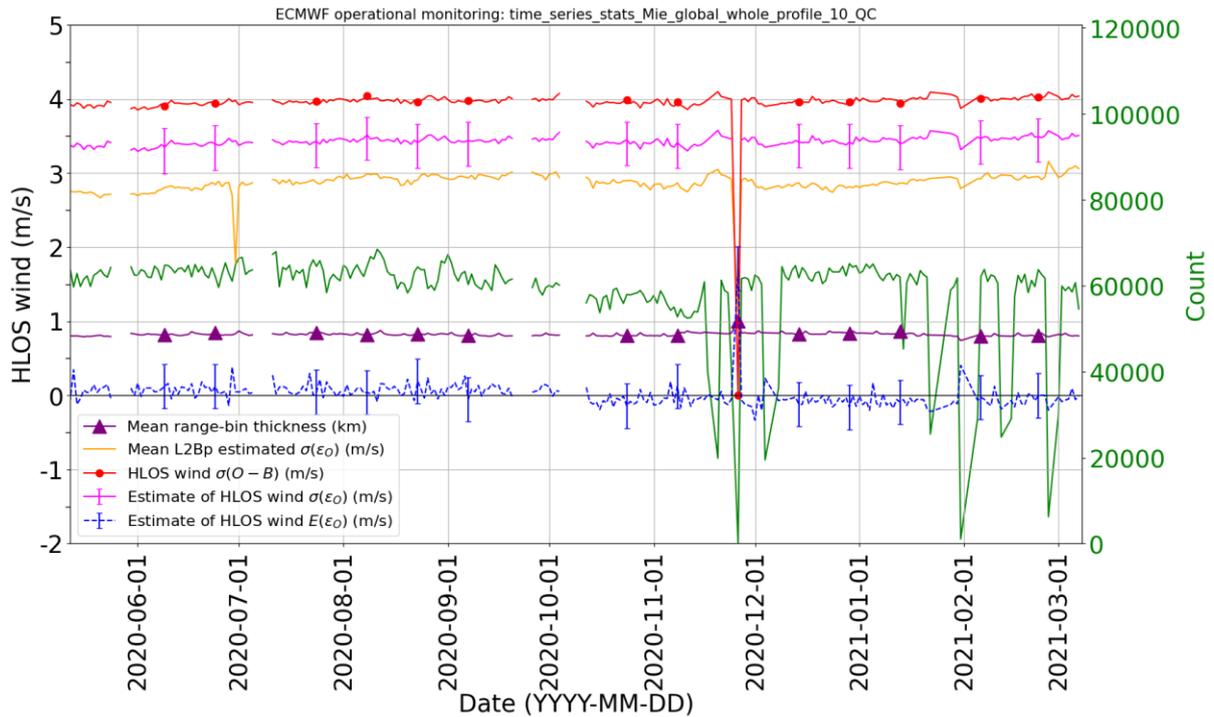


Figure 9. Times-series of daily, global, whole profile L2B Mie-cloudy HLOS wind related statistics since 12 May 2020. QC for this type of plot is to reject if  $\text{abs}(O-B) > 10 \text{ m/s}$ .

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

- There are three data gaps in this period, due to Special Operations Requests: 1. 31 January to ~6 February (M1 thermal test part 2); 2. 12-16 February (M1 thermal test part 3); 3. 26 February to 2 March (switch to new M1 set-point and then back to previous).
- Random errors have not changed much during the month. There were a few spikes in  $\text{stdev}(O-B)$  around 20 Feb, which must be associated with the moon-blinding related pointing bias.
- There is evidence of the moon-blinding negative bias at ~30-40 °N in the zonal average bias for ascending orbits. It stands out more than usual in a monthly average plot due to the increased number of data gaps recently.