

REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR_2P) FOR DECEMBER 2010

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1. Key points for December 2010

- The monitoring activity performed during December 2010 showed that on average the quality of the GOMOS retrieval was mostly stable and consistent with that reported until October 2010. However, the ozone observations showed an increased scatter at most levels and available latitudes that could be a consequence the ENVISAT orbit change.
- The mean temperature first-guess and analysis departures were typically negative and up to -1% (-2K) in the stratosphere and up to -3% (-6K) at mesospheric levels. The mean standard deviation of the first-guess and analysis departures were within 1 and 3% at all levels and available latitudes.
- The global mean ozone first guess and analysis departures and those averaged over the tropics and the midlatitudes in the NH were typically between -10 and +20% at most levels. At midlatitudes in the SH, the first guess and analysis departures were within -5 and 10% for pressure levels between 3 and 40 hPa, but larger than 50% elsewhere. A larger than usual scatter was found in the data. The standard deviations of the departures were larger than 15% at all levels and latitudinal bands, values larger than 50% were found in places.
- The comparisons between the GOMOS water vapour retrievals and the ECMWF water vapour first guess and analyses showed a generally poor level of agreement as discussed in the last few months. GOMOS water vapour observations were from one to four orders of magnitude larger than their model equivalent at most vertical levels and latitudes.
- The monitoring statistics for December were produced with the operational ECMWF model, CY36R4.

2. Quality and amount of received data

Data coverage and amount of received data during December 2010 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Overall, up to 3678 (good) observations were available for temperature, 3186 data were available for ozone and up to almost 400 (good) observations were delivered for water vapour. The ozone and temperature data volumes are the largest received since March 2010. The largest number of observations were sampled in the mesosphere and upper stratosphere in the case of temperature (see figure 3 in the attached temperature report), and in the mid stratosphere in the case of water vapour and ozone (see figure 3 in the attached water vapour and ozone reports). There were no temperature, ozone and water vapour observations at high latitudes in the northern and southern hemispheres.

3. GOMOS temperature data

The quality of the temperature data in the GOMOS BUFR files was stable in December 2010 and generally consistent with that discussed in the last few months, before the ENVISAT orbit change.

The monitoring statistics showed that both in the global mean and in the area average over the tropics, and midlatitudes (temperature report: Figures 3 to 6) the stratospheric first-guess and analysis departures were mostly negative up to -1% (about -2K). In the mesosphere, the mean temperature departures were also negative and up to -3% (about -6K) in average. The mean standard deviation of the first-guess and analysis departures were within 1 and 3% at all levels and latitudes.

The scatter plots (temperature report: Figures 7-14) show a similar level of agreement between the temperature in the GOMOS files and the operational ECMWF temperature analyses, with a variability of the first-guess departures within $\pm 4K$ at most vertical levels in the stratosphere when available. Slightly larger departures were found in the mesosphere.

The Hovmoeller plots and the timeseries of the temperatures in the GOMOS files and their departures from the ECMWF temperature first-guess and analyses at several levels are shown in Figures 15-16, 19-22 of the temperature report, respectively. Both the Hovmoeller plots and the timeseries confirm the results discussed above.

4. GOMOS ozone data

Compared with the last few months before the orbit change, it seems that the quality of the GOMOS ozone observations is slightly degraded in December. This generally shows in an increased noise in the data and larger scatter in the first guess and analysis departures. The profile plots (ozone report: Figures 3-6) show that both the ozone first guess and analyses were within the observation one-standard deviation range at all levels and latitudinal bands.

In the global mean, the first-guess departures were within -5 and +20% at most vertical levels in the stratosphere ($p < 40$ hPa). Larger departures ($> 50\%$ in places) were found in the lower stratosphere and in the mesosphere. At midlatitudes in the NH and over the tropics, the first guess and analysis departures were typically within -10 and +20% at most levels in the stratosphere and mesosphere, although residuals larger than 50% were found in places, particularly in the lower stratosphere. At midlatitudes in the SH, the differences between the GOMOS ozone values and their model equivalent were typically within -5 and +10% between 3 and 40 hPa, but larger than 50% elsewhere. The standard deviations of the analysis and first guess departures were larger than 15% at all levels and latitudinal bands, and larger than 50% in the upper stratosphere and mesosphere.

The scatter plots (ozone report: Figures 7-14) confirm the above analysis. In particular, large scatter was still found in the GOMOS ozone observations at mesospheric levels that led to a large scatter in the first-guess departures.

The timeseries of GOMOS ozone and departures (ozone report: Figure 15-18) and the Hovmoeller plots (ozone report: Figure 19-20) also confirm the level of agreement between NRT GOMOS ozone retrievals and the ECMWF ozone analyses discussed above.

5. Water vapour data

The level of agreement between the GOMOS water vapour profiles and the corresponding ECMWF water vapour first guess and analyses is generally comparable with that discussed before the ENVISAT orbit change.

The profile plots (Water Vapour report: Figures 3-4) show that the GOMOS water vapour values were from one to four orders of magnitude larger than those given by the model at most vertical levels and all available latitudinal bands, with the model being drier than the GOMOS observations.

The scatter plots (water vapour report: Figure 5-9) confirm the above analysis. Where data were available, they showed large scatter at all vertical levels and available latitudes that led to large scatter in the first guess departures.

The Hovmoeller plots and the timeseries of GOMOS water vapour and departures show that very little signal if nothing at all was detected as a consequence of the combination of low number of data and their poor quality.

6. Remarks

This monitoring report was produced with the operational ECMWF model (CY36R4). Ozone layers from SBUV/2 on NOAA-17 and NOAA-18, SCIAMACHY total column ozone (produced by KNMI), and OMI total column ozone were actively assimilated. MERIS total column water vapour (TCWV) was also assimilated since September 2009.

A variational bias correction for retrieved products became operational in September 2009 in the ECMWF model CY35R3. All the assimilated ozone products (with the only exception of the SBUV/2 data) and the MERIS TCWV were bias corrected.

The results presented in this reports made use of only the observations acquired in dark-limb conditions as implemented in the PDS2BUFR converter in May 2007.

All ozone values are in Dobson Units (DU), temperatures are in K, and water vapour partial columns are in mg/m^2 .

REPORT ABOUT ENVISAT GOMOS NRT OZONE DATA (GOM_RR_2P) FOR DECEMBER 2010

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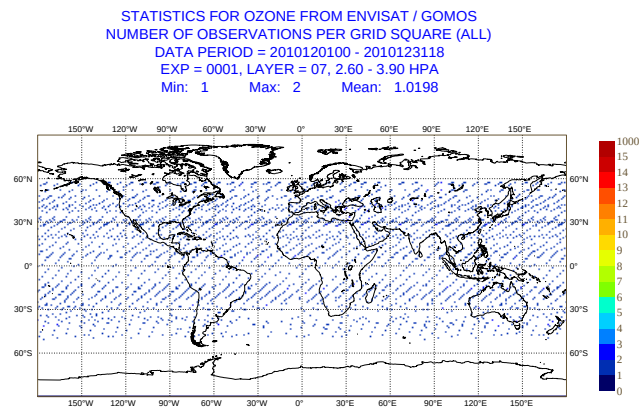


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for December 2010.

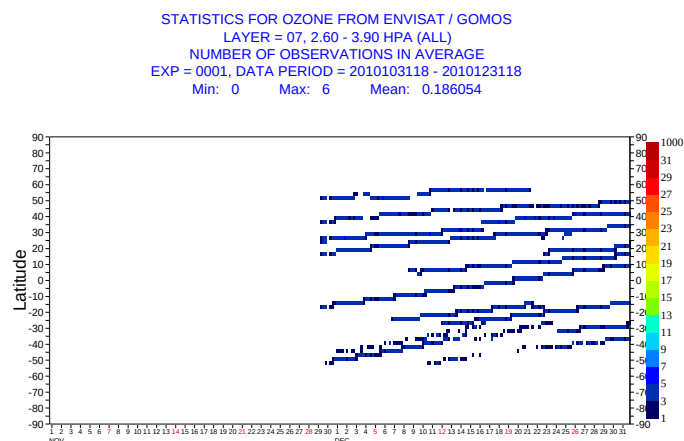


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for November-December 2010.

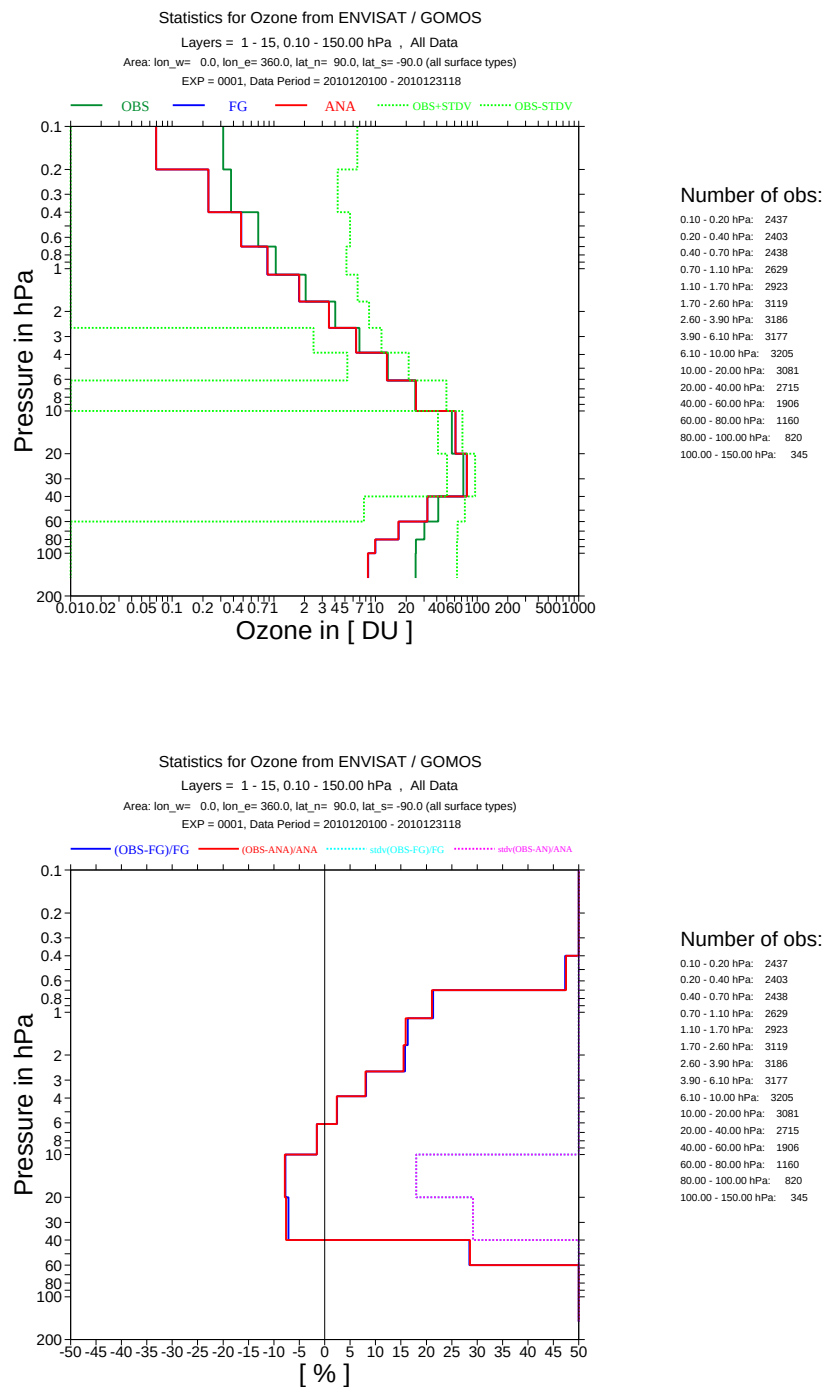


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for December 2010 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) $\pm$ 1 standard deviation (green dotted lines). The bottom plot shows the departures and the standard deviation of the departures in %. Plotted are the partial columns for the 15 layers listed to the right of the diagrams.

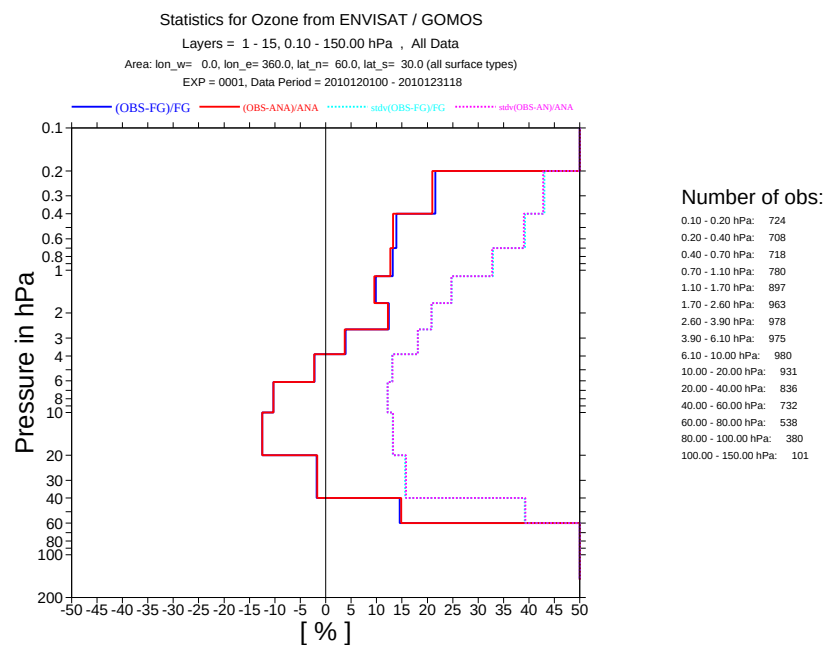
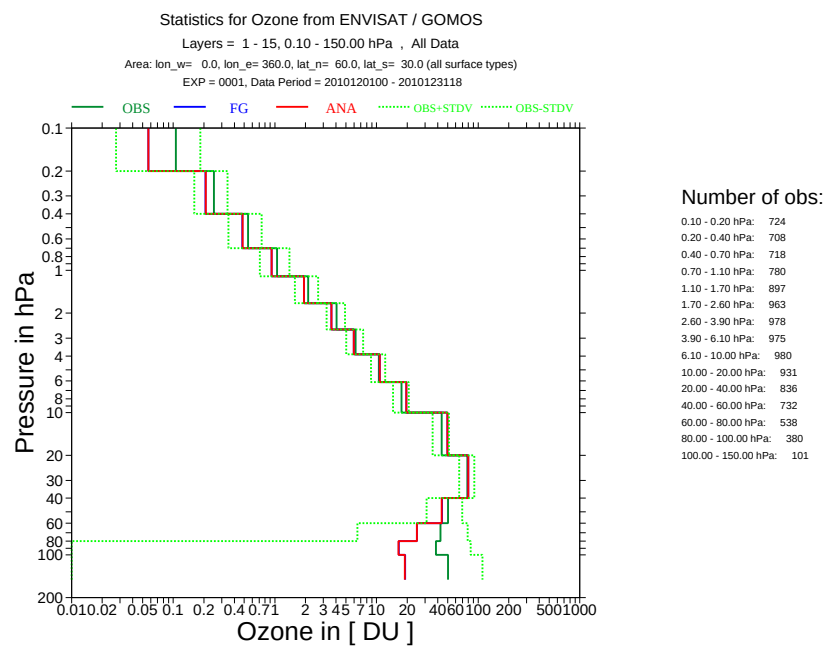


Fig. 4. As Fig. 3 but for 60-30N.

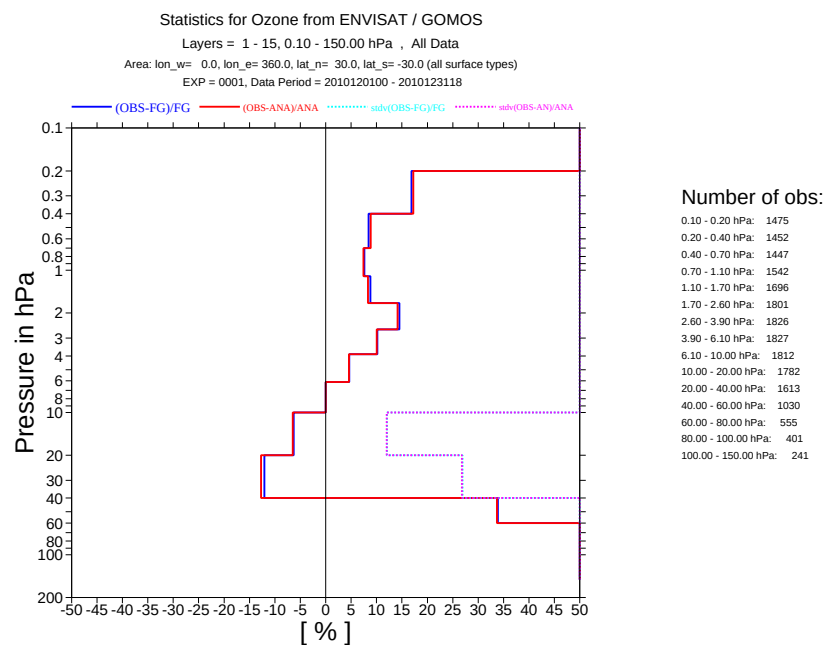
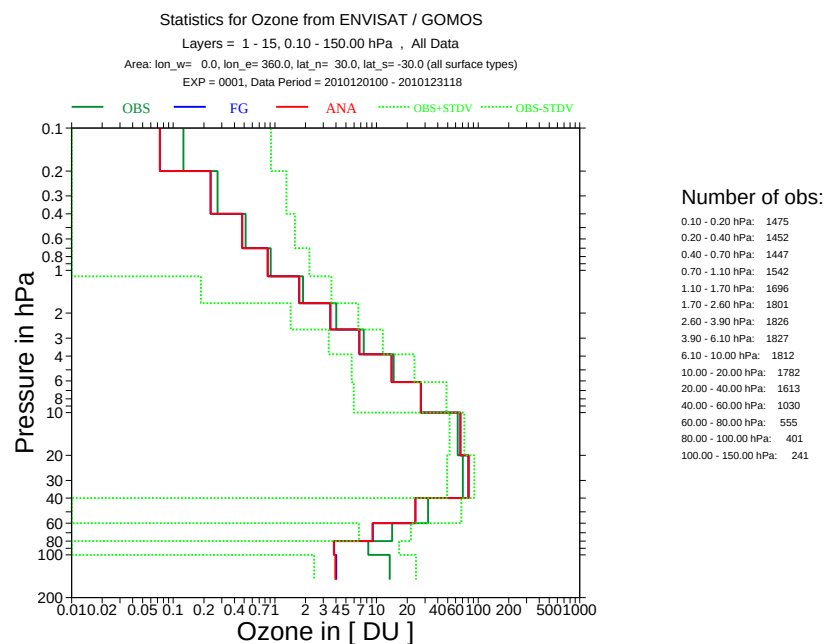


Fig. 5. As Fig. 3 but for 30N-30S.

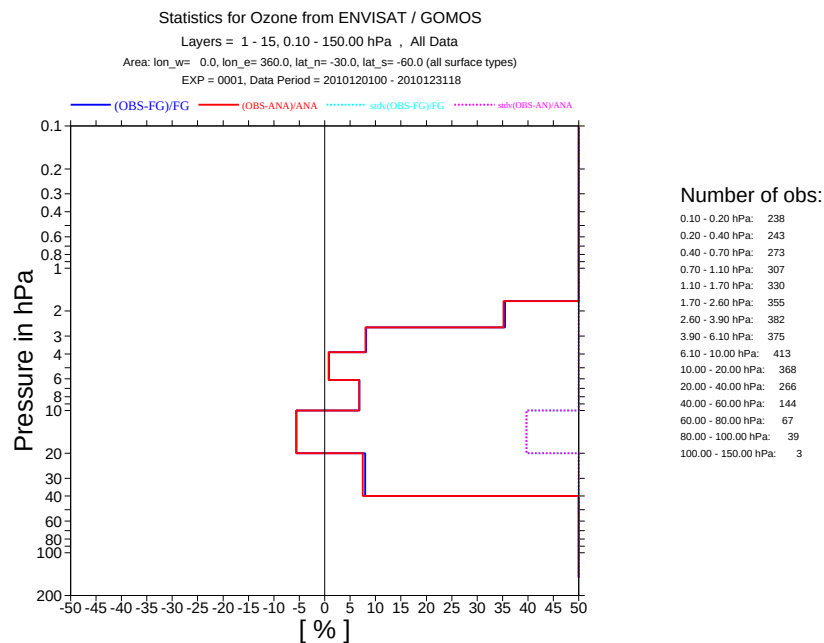
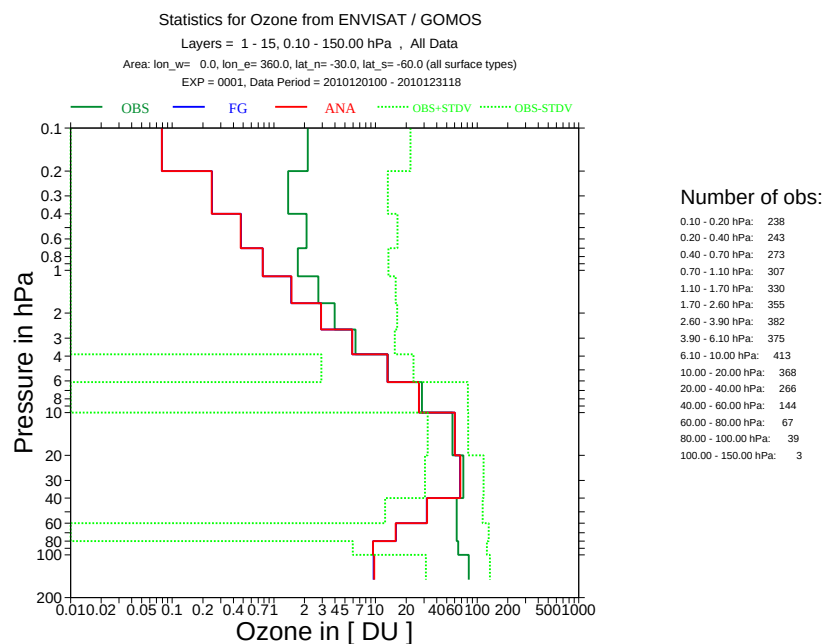


Fig. 6. As Fig. 3 but for 30S-60S.

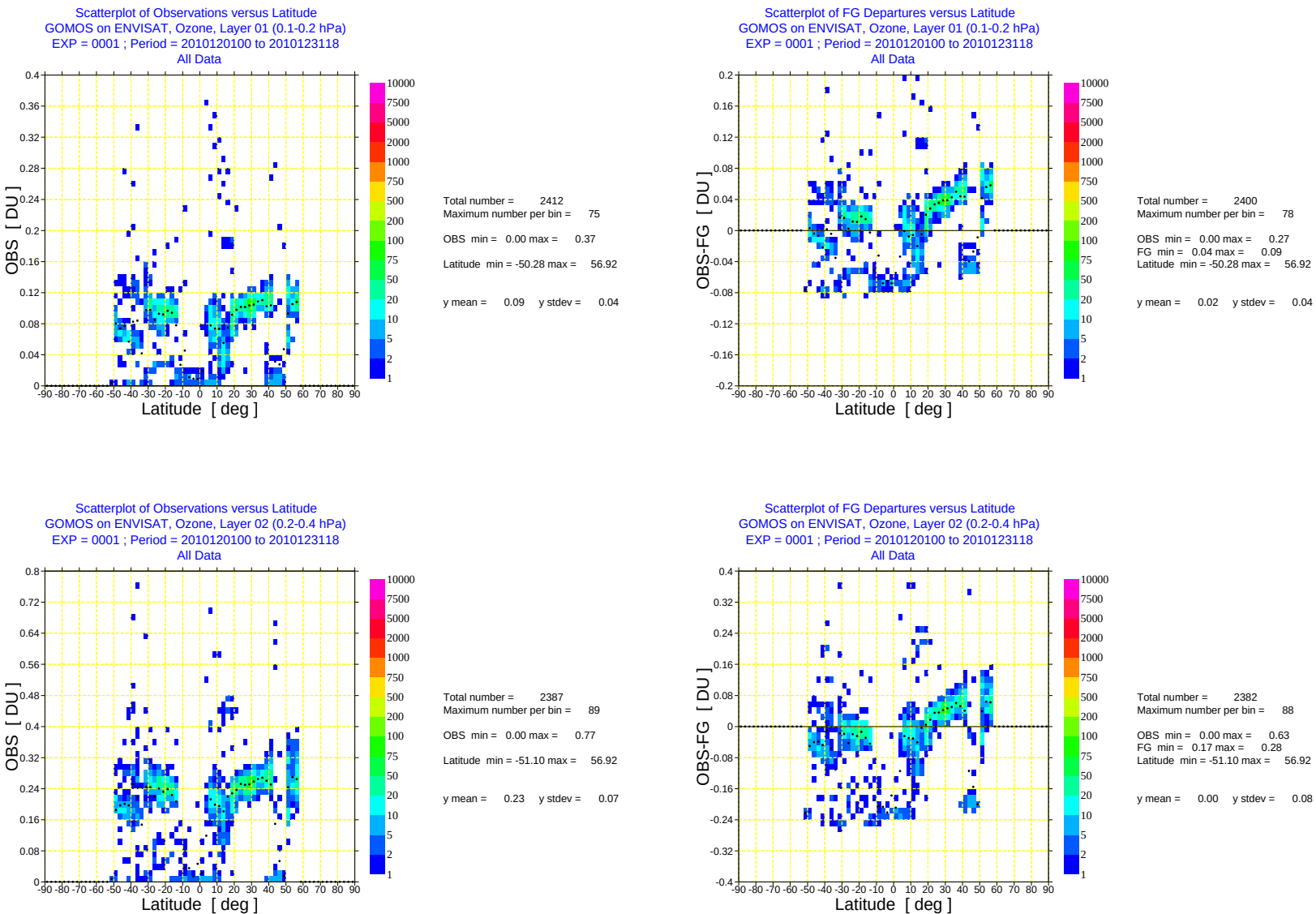


Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for December 2010 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black dots the mean value per bin.

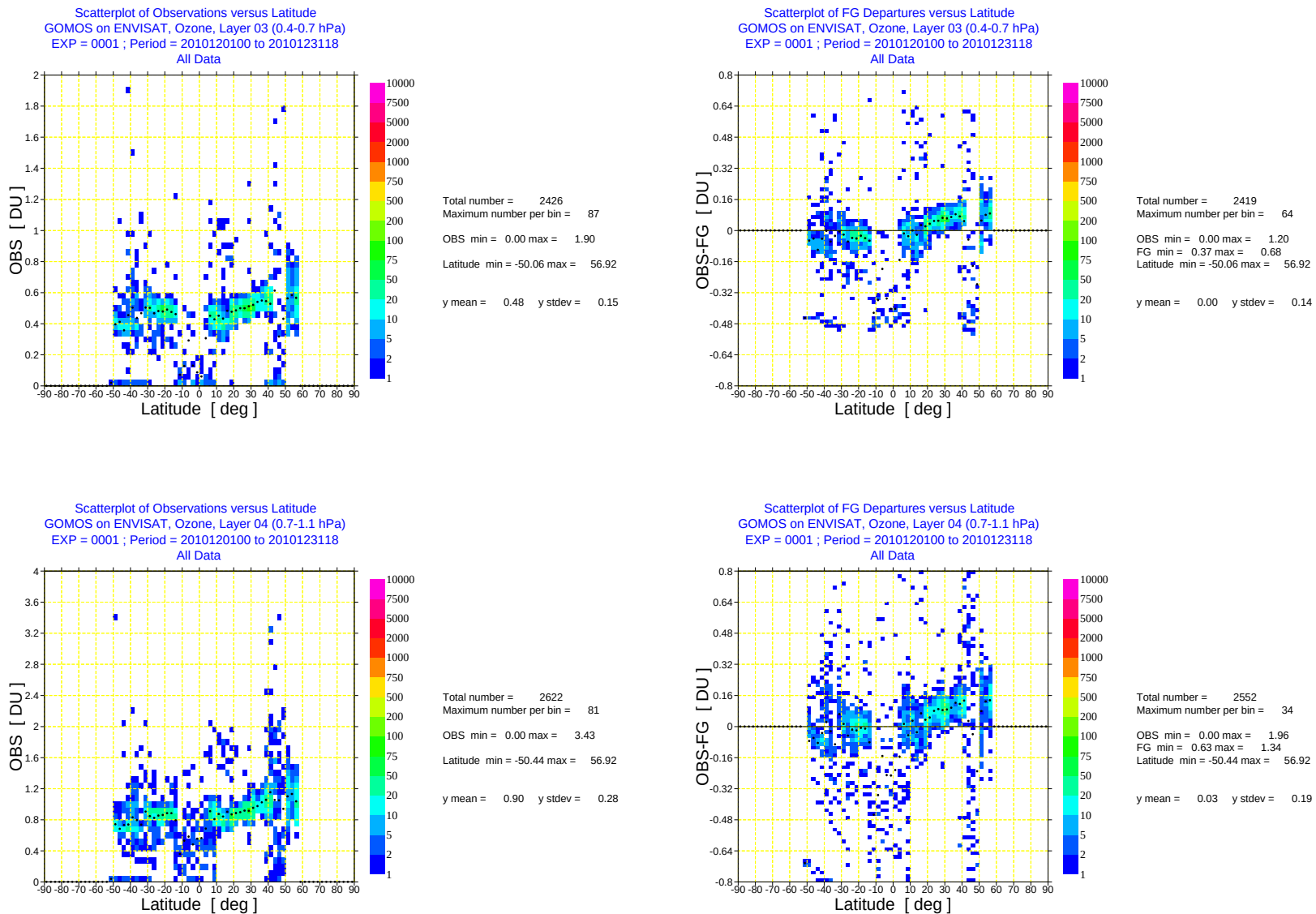


Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

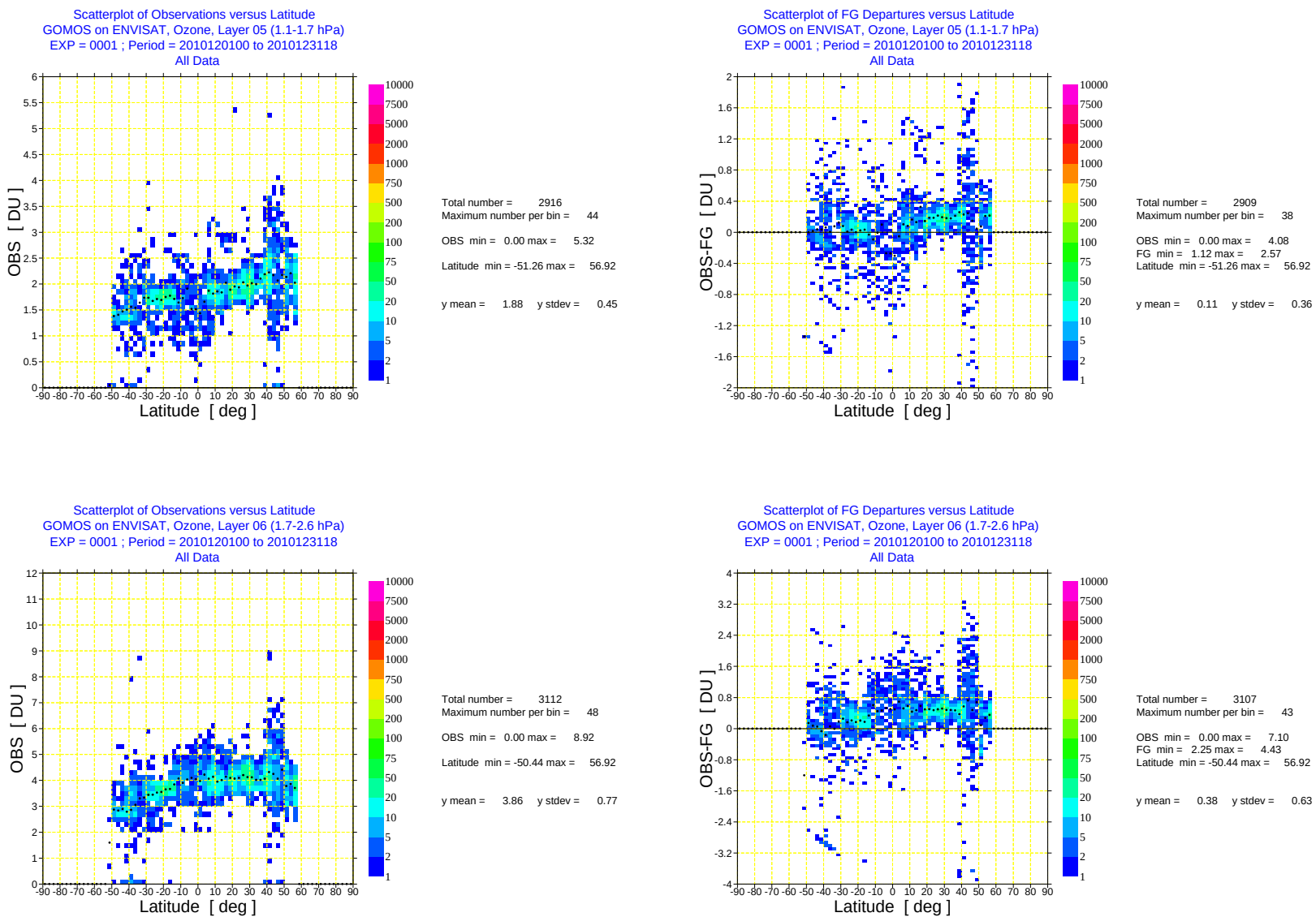


Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

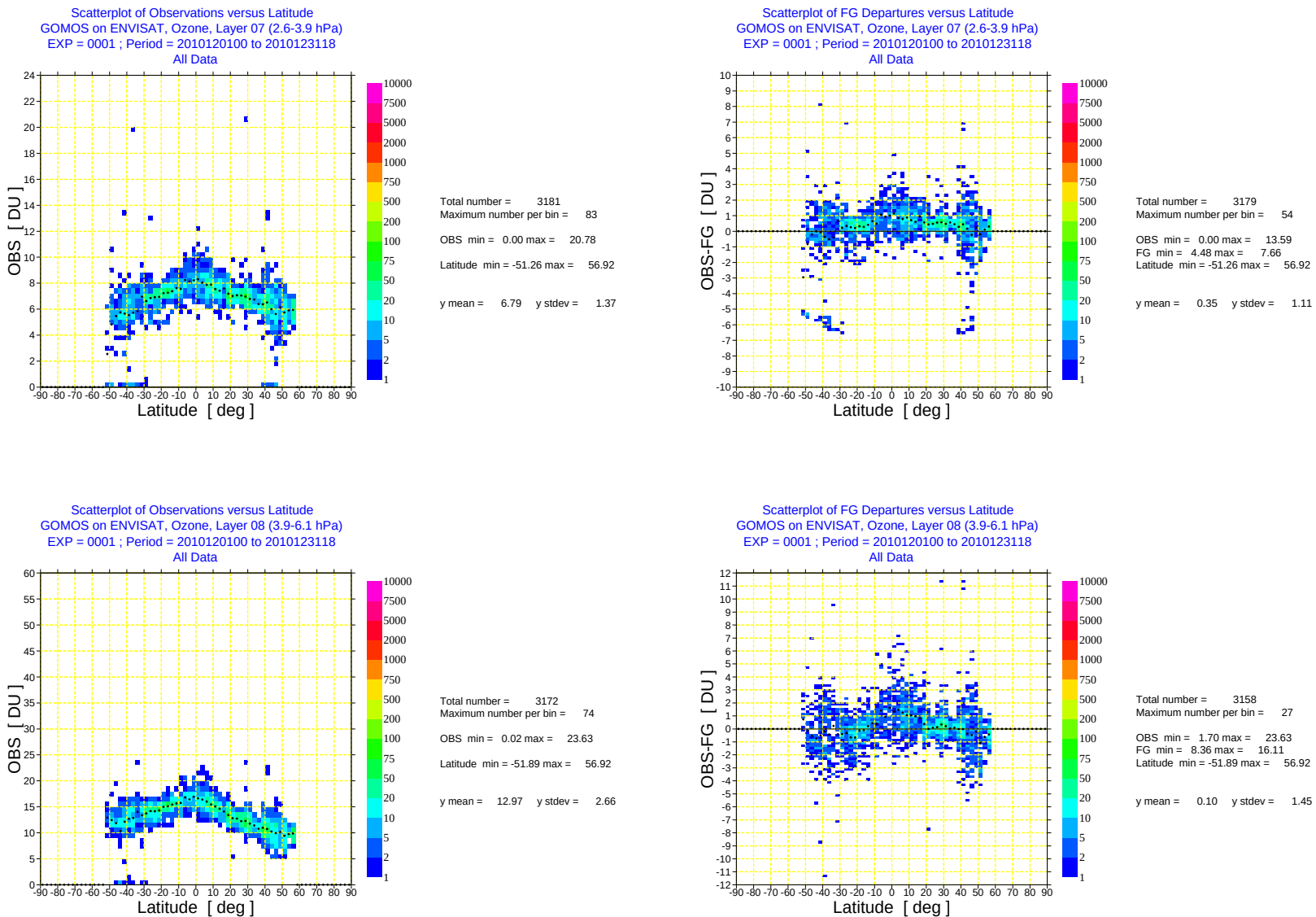


Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

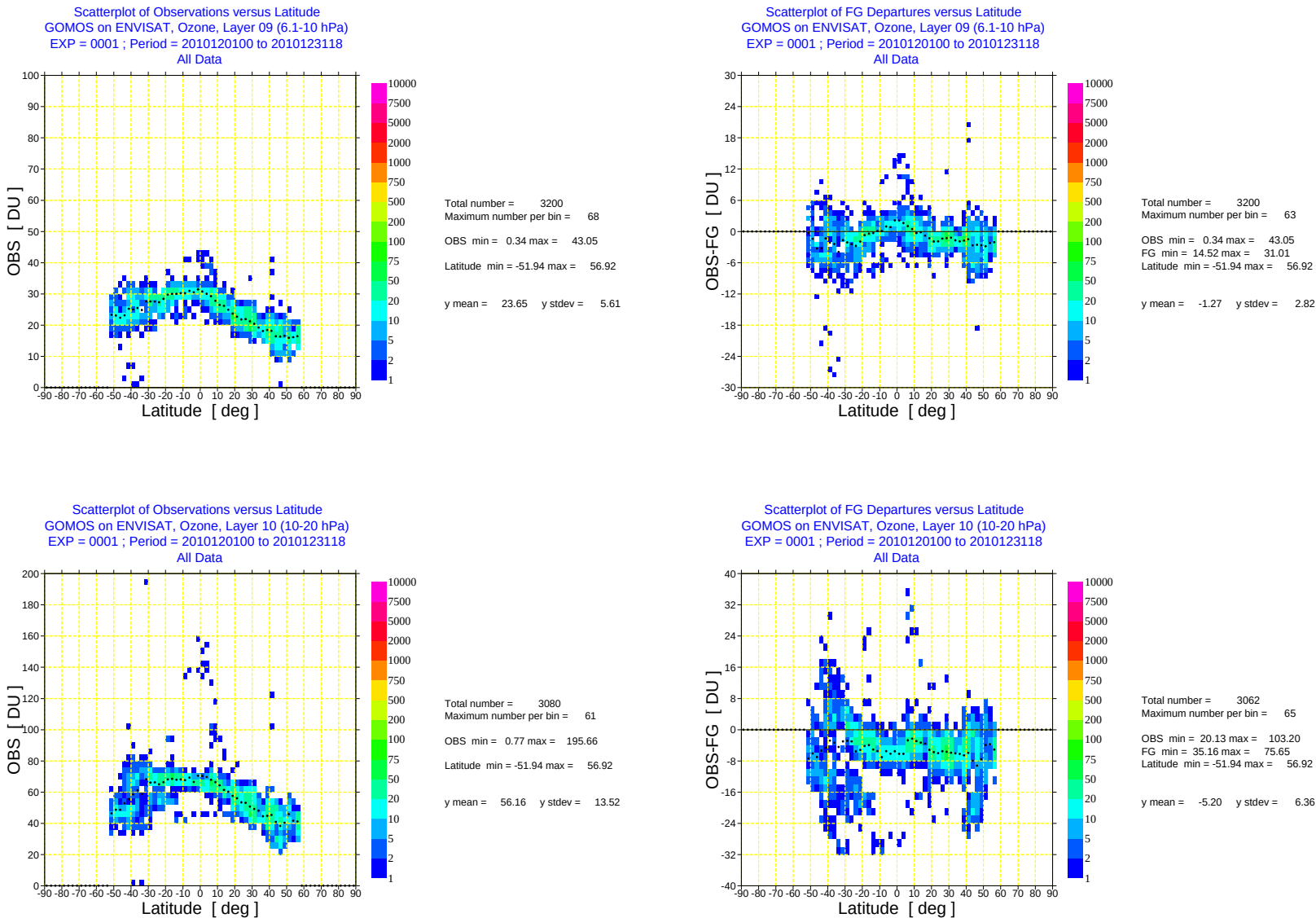


Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

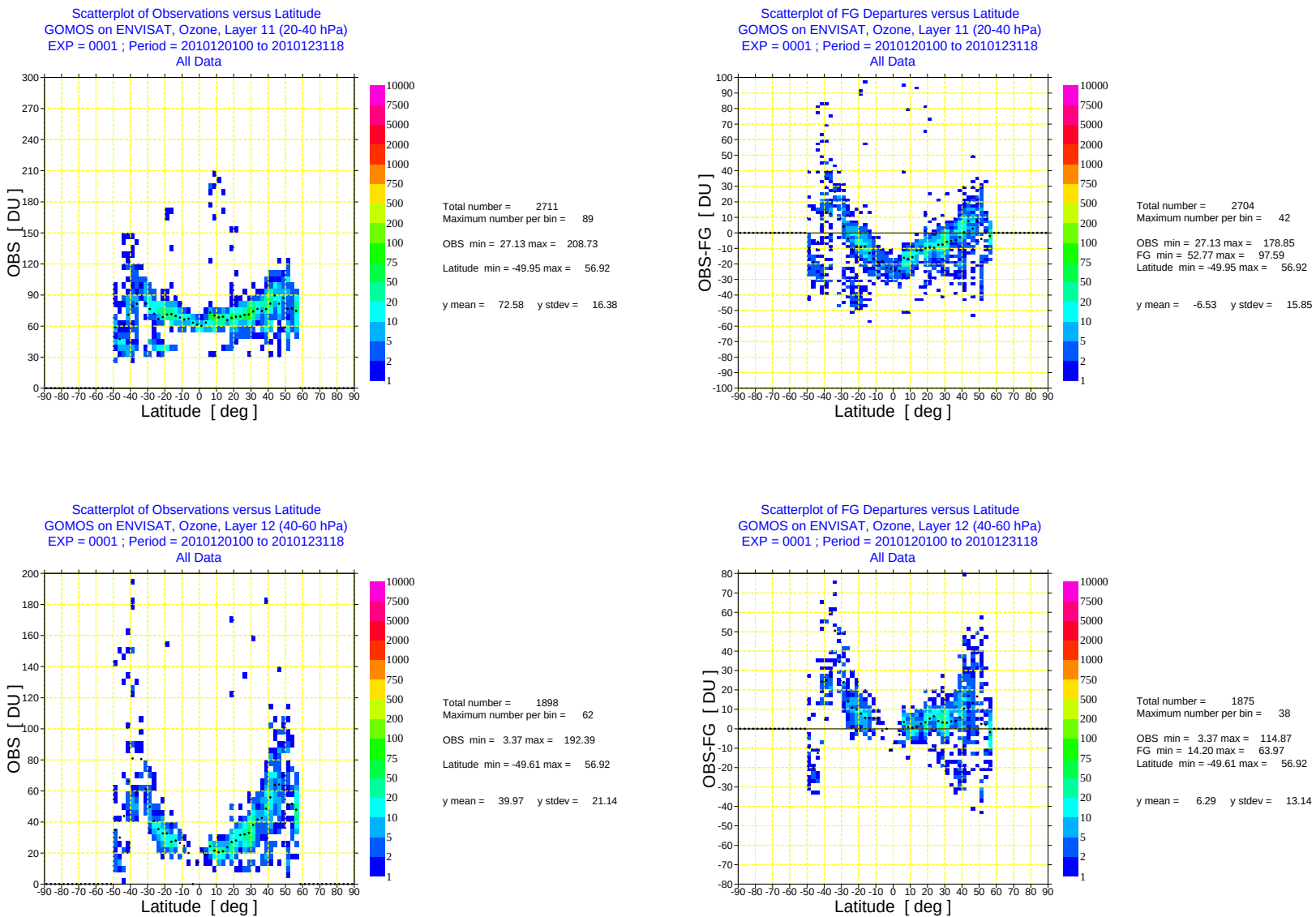


Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

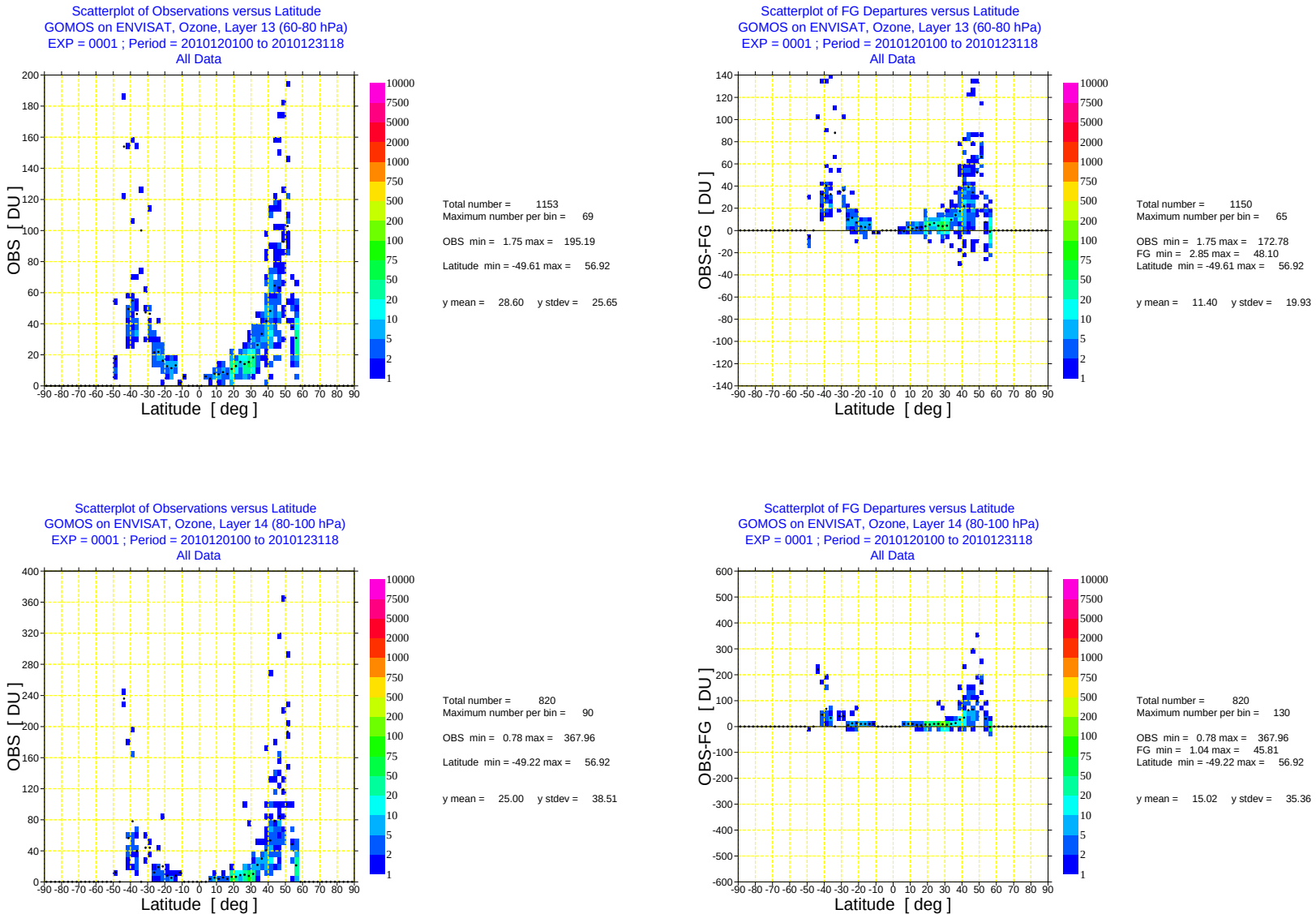


Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

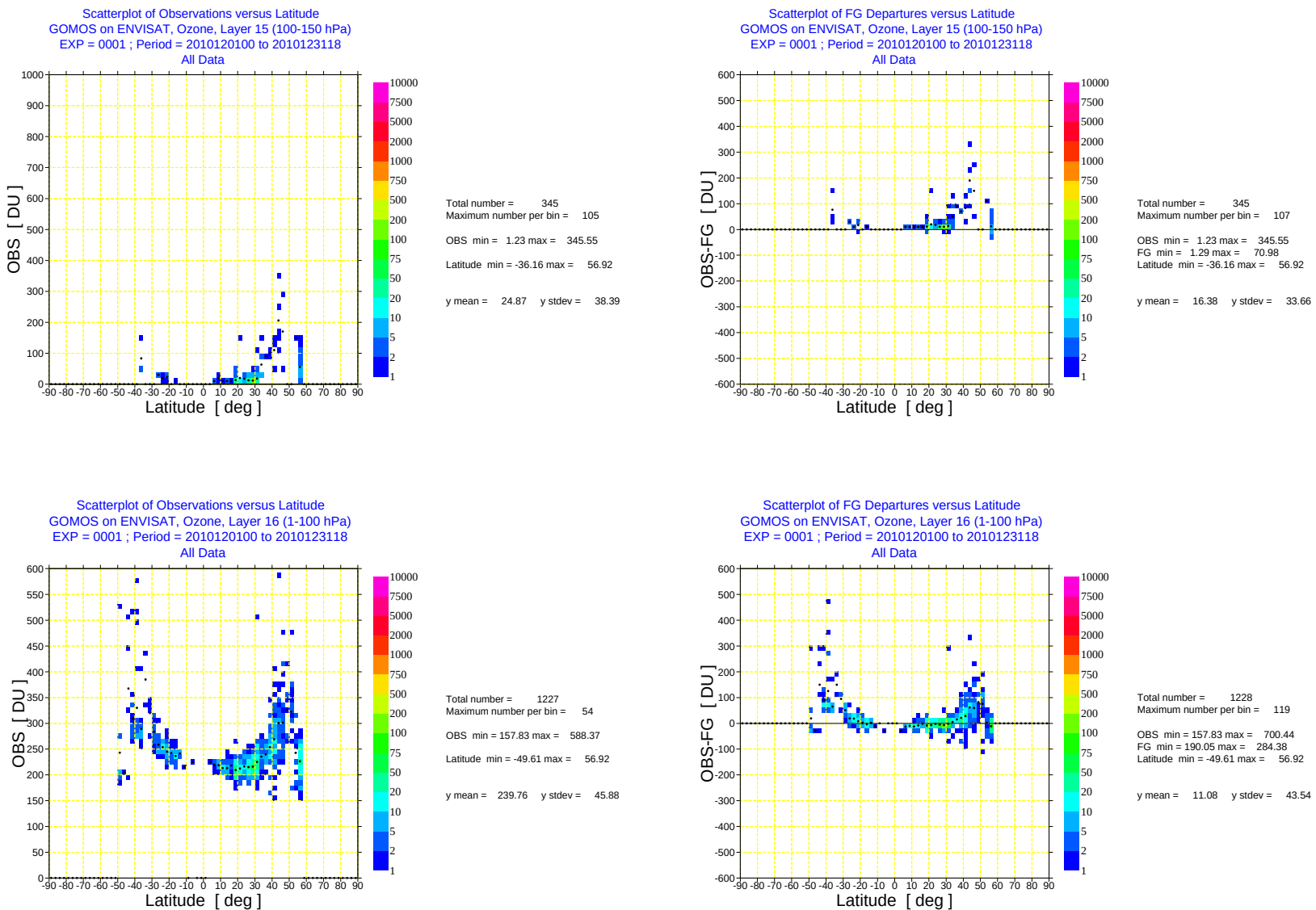


Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

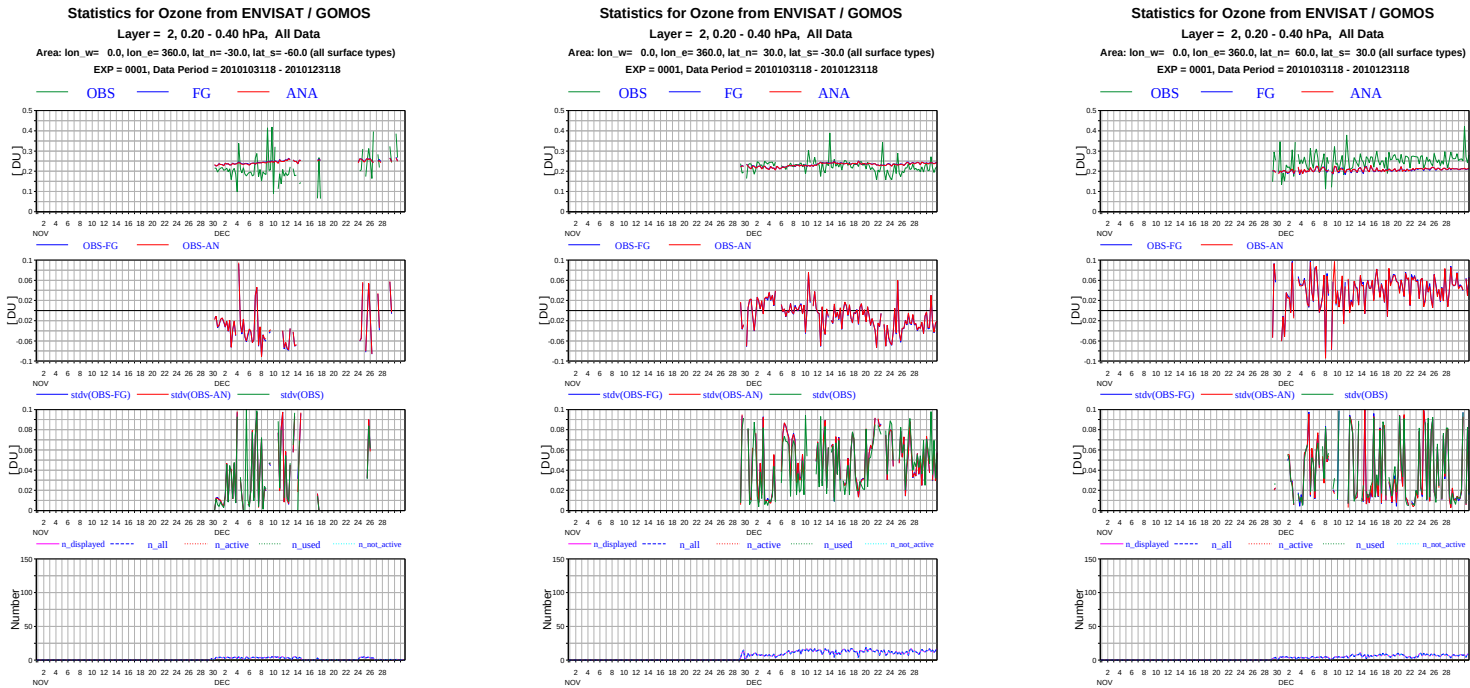


Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30-60N, 30N-30S, and 30-60S for the period November-December 2010.

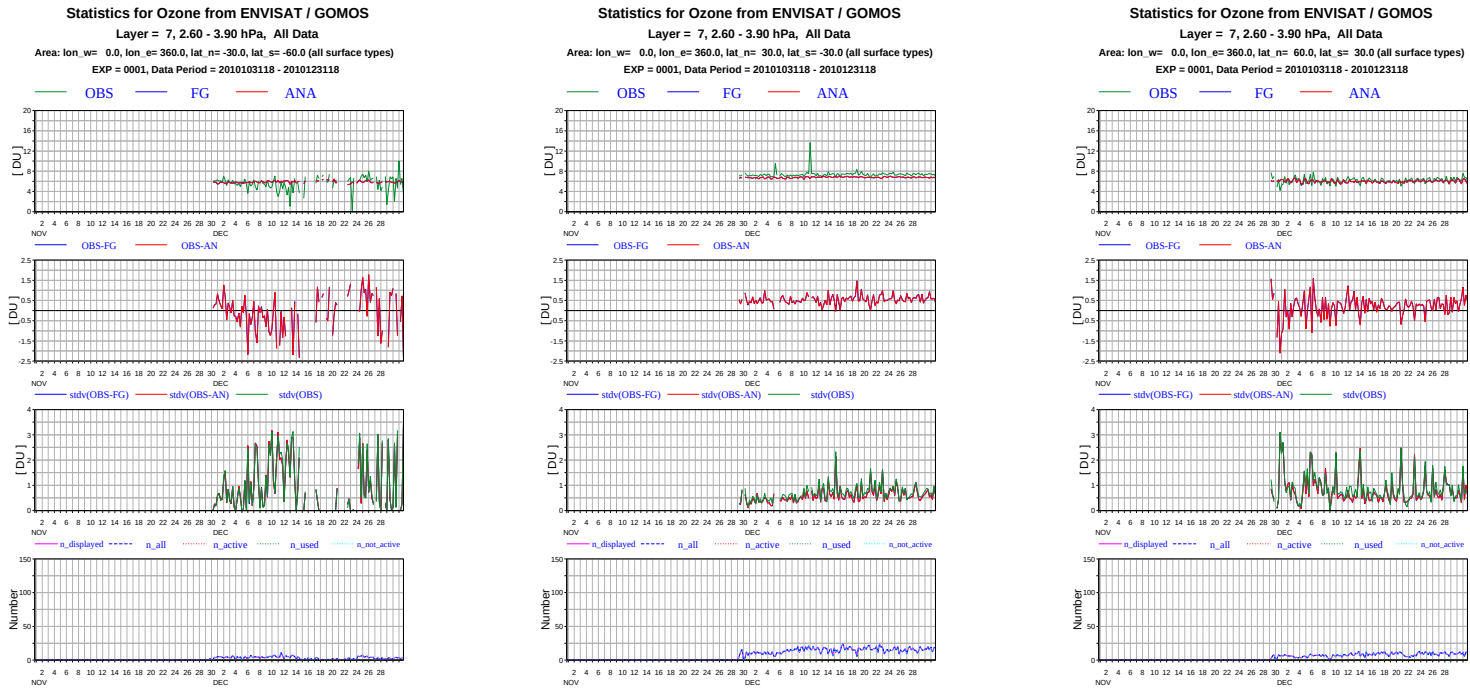


Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

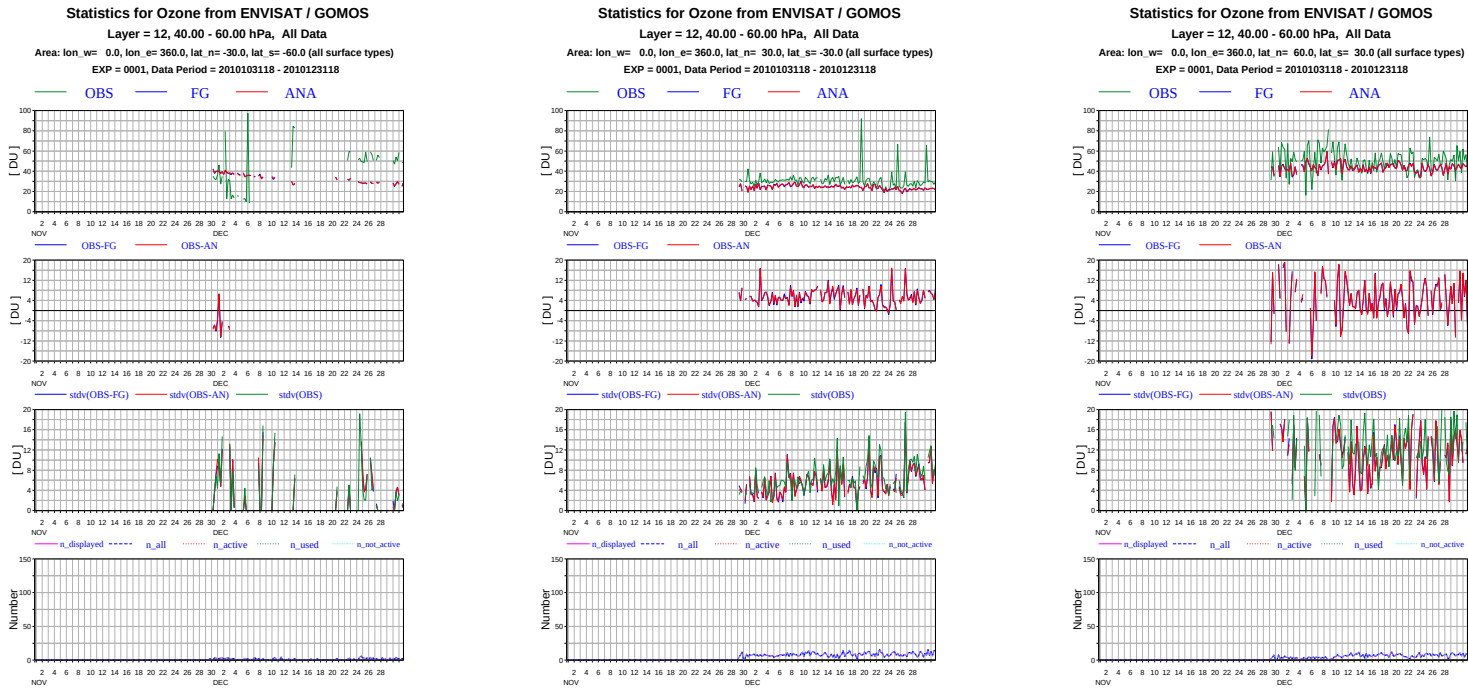


Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

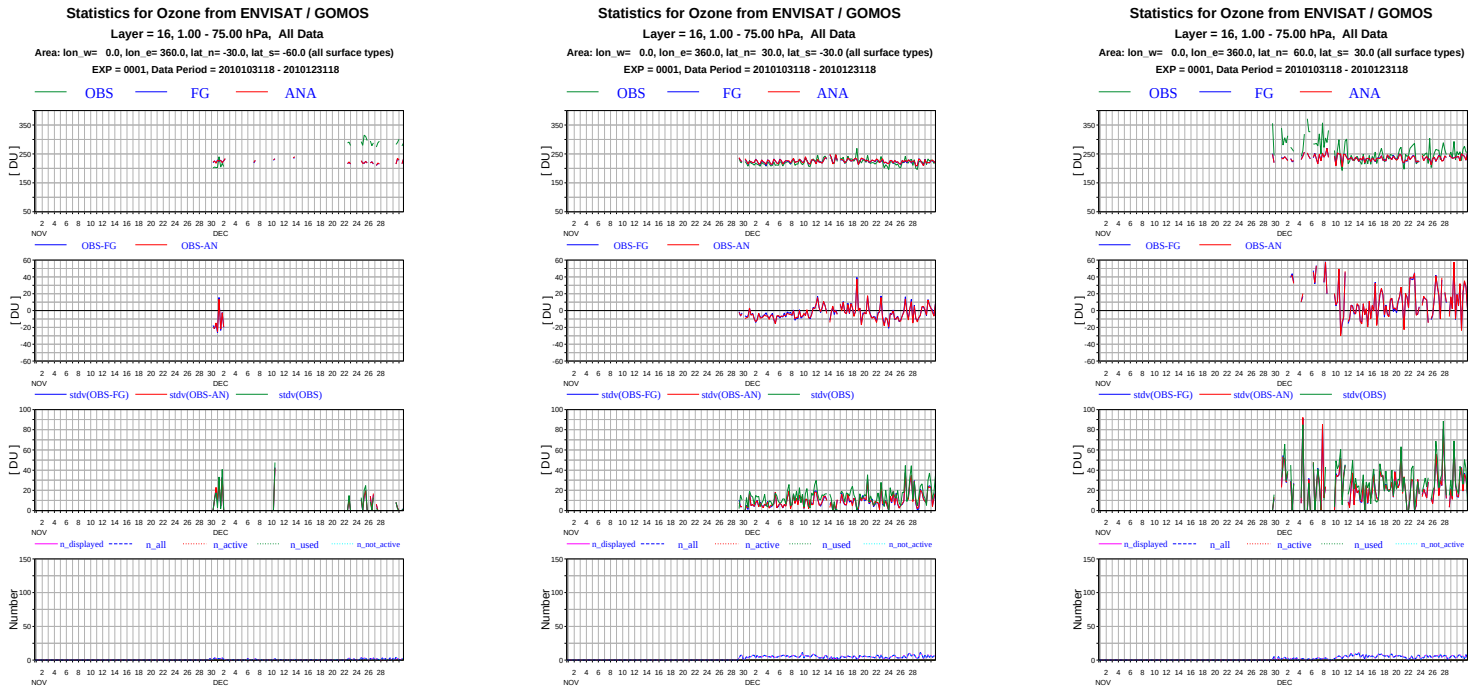


Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

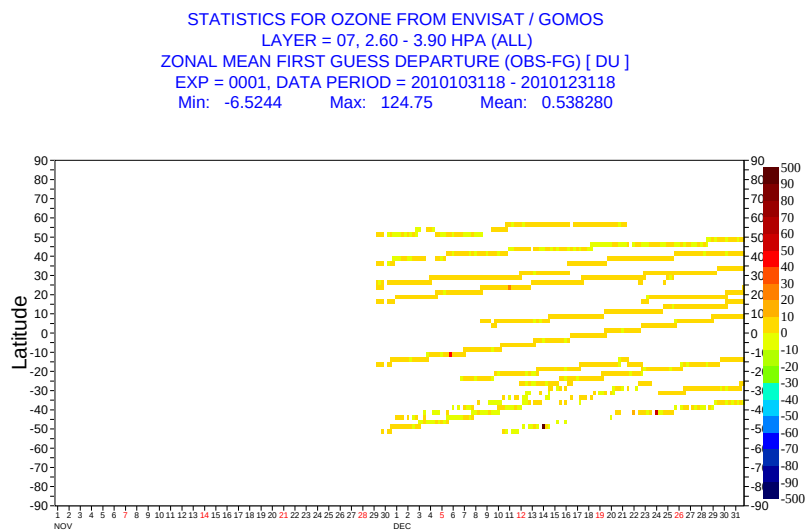
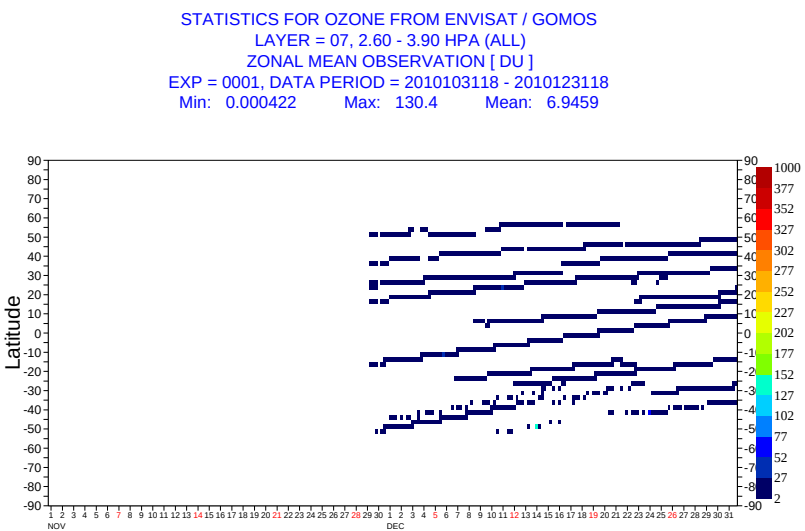
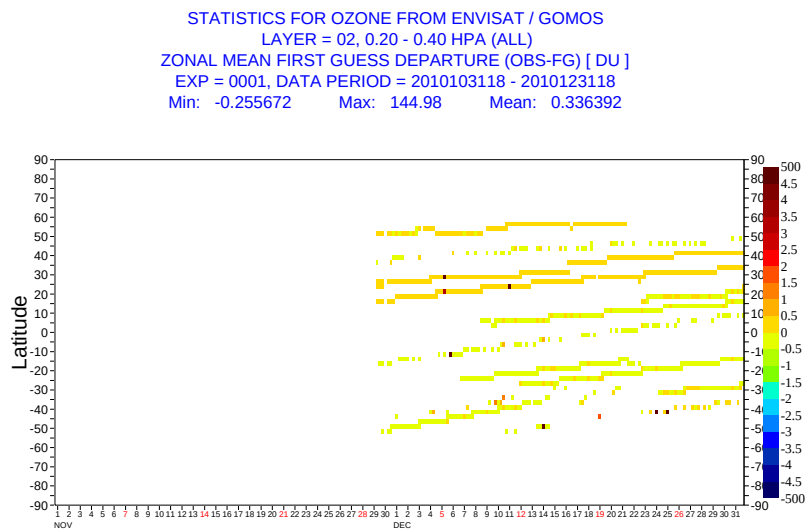
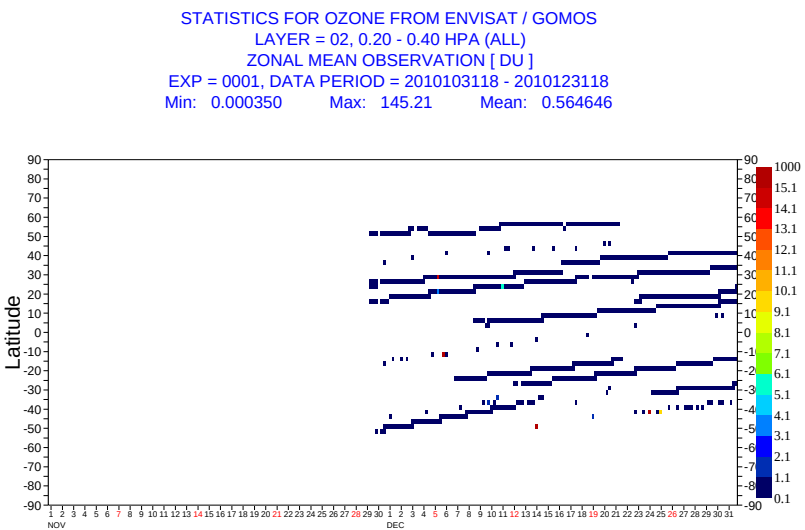


Fig. 19. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for November-December 2010 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

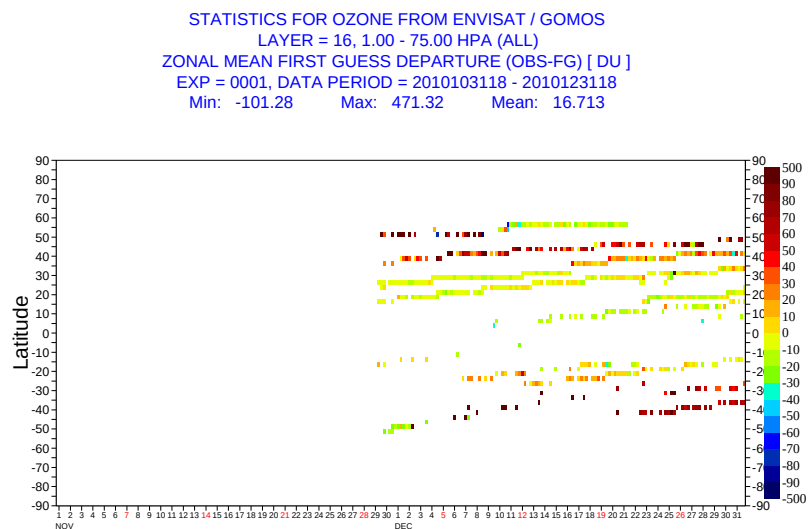
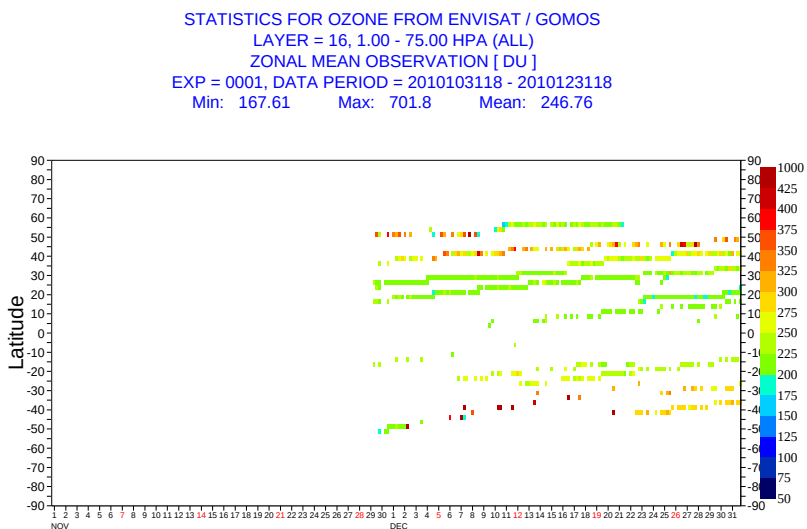
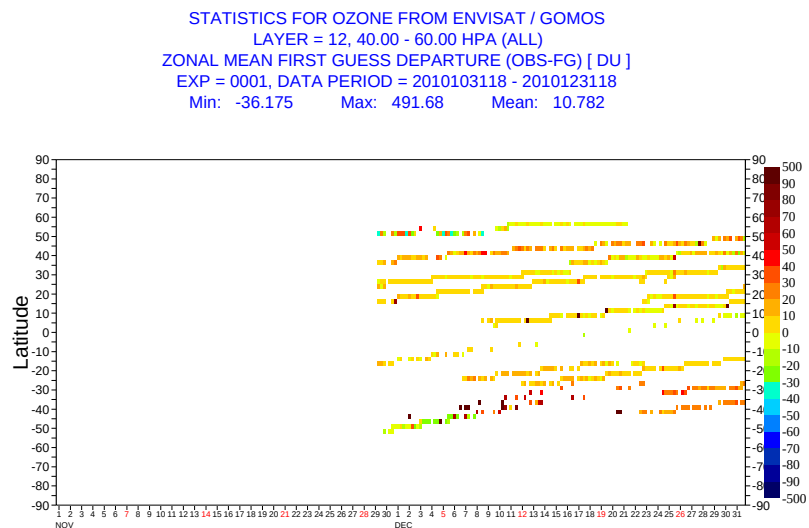
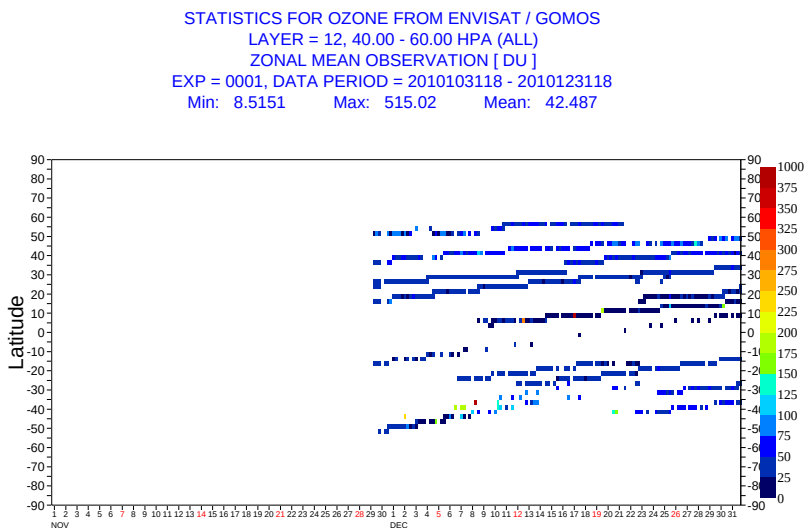


Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

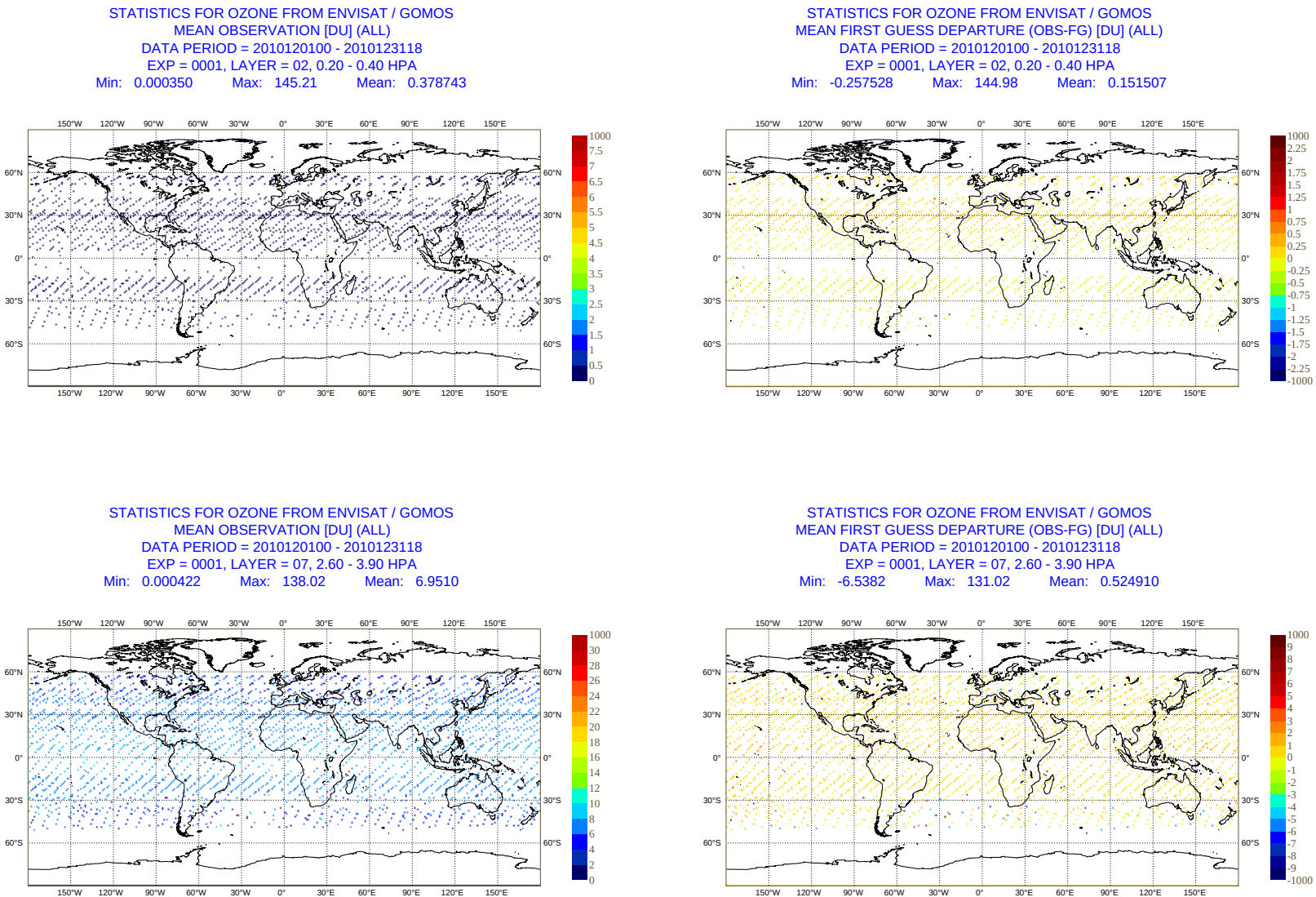


Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for December 2010 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

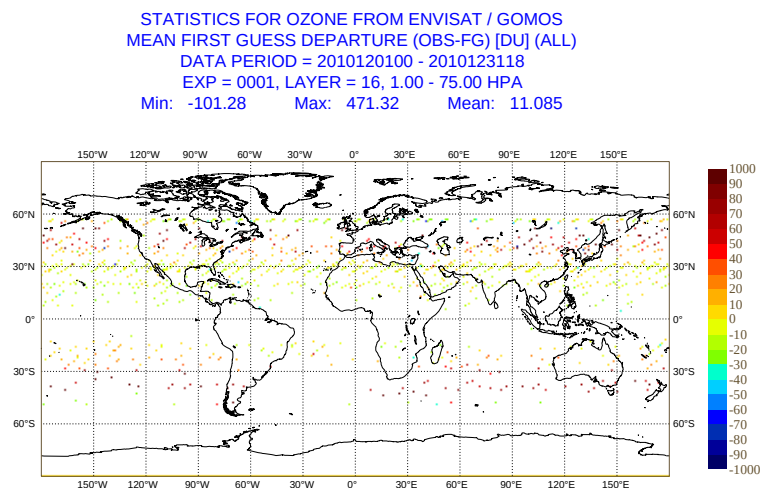
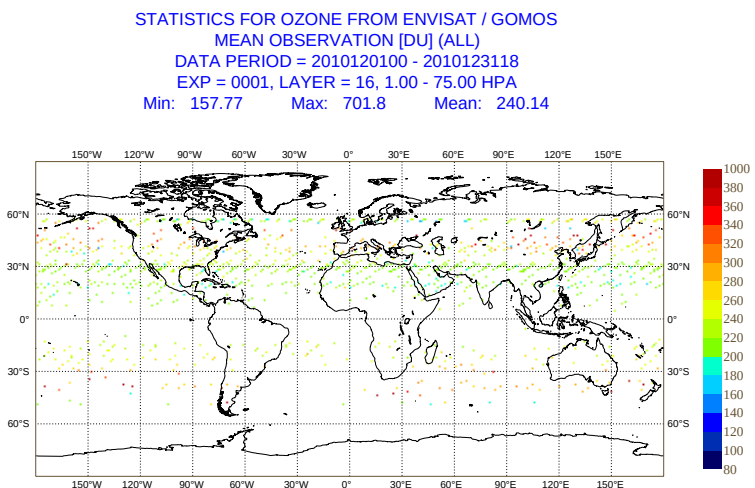
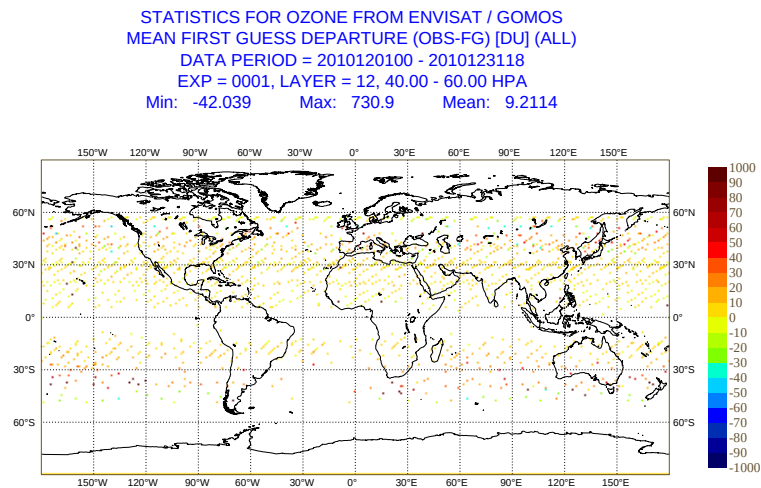
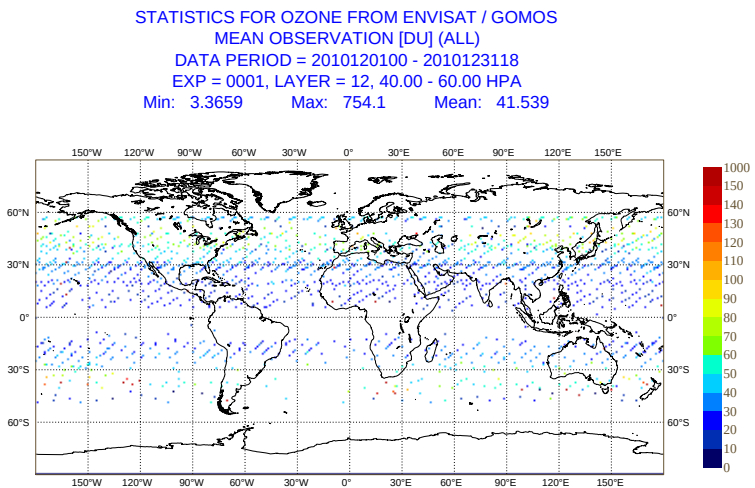


Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR_2P) FOR DECEMBER 2010

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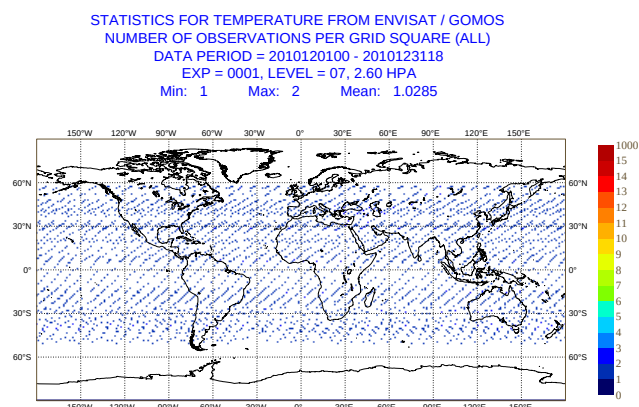


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for December 2010.

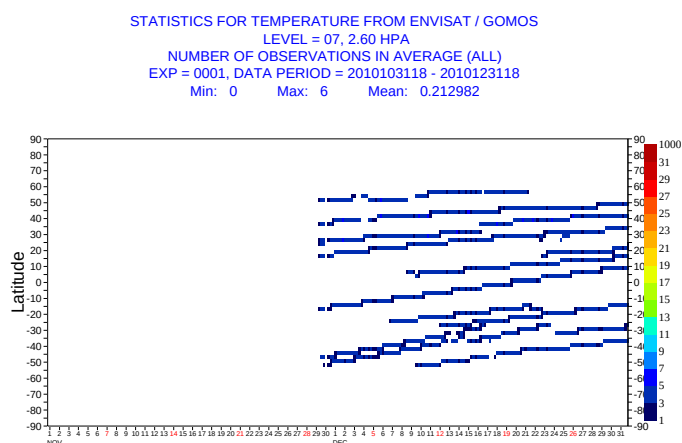


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for November-December 2010.

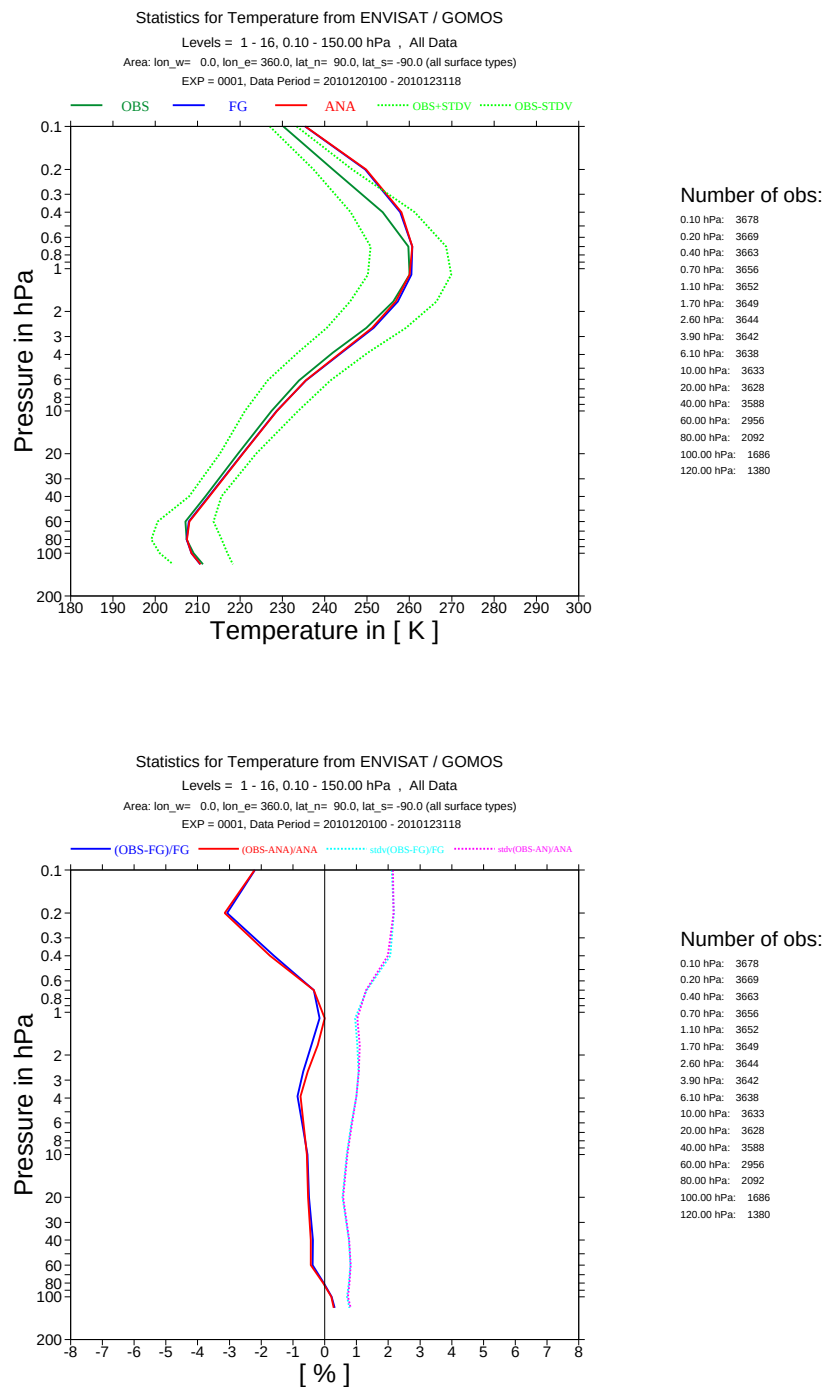


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for December 2010 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation ± 1 standard deviation (green dotted lines). The bottom plot shows the departures and the standard deviation of the departures in %. Plotted are the values for the 16 levels listed to the right of the diagrams.

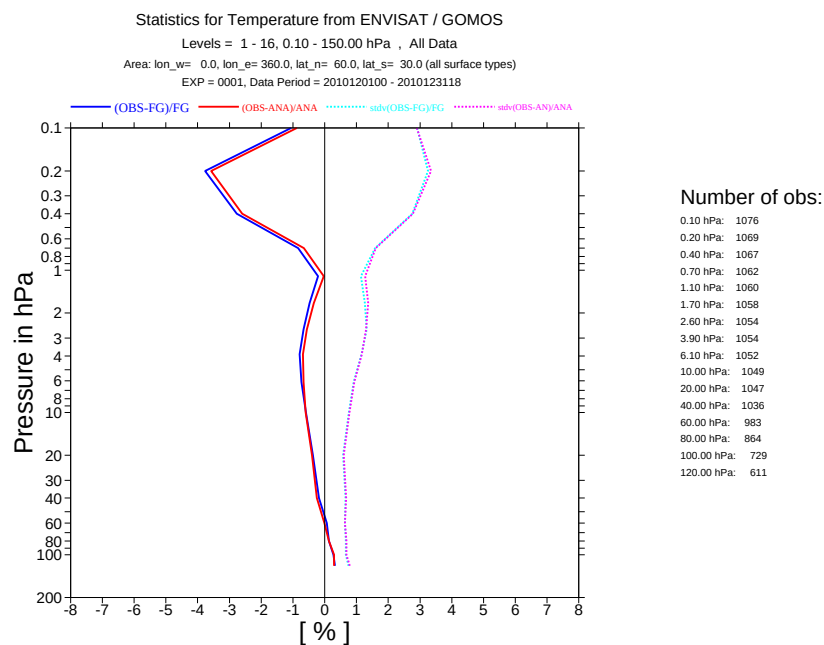
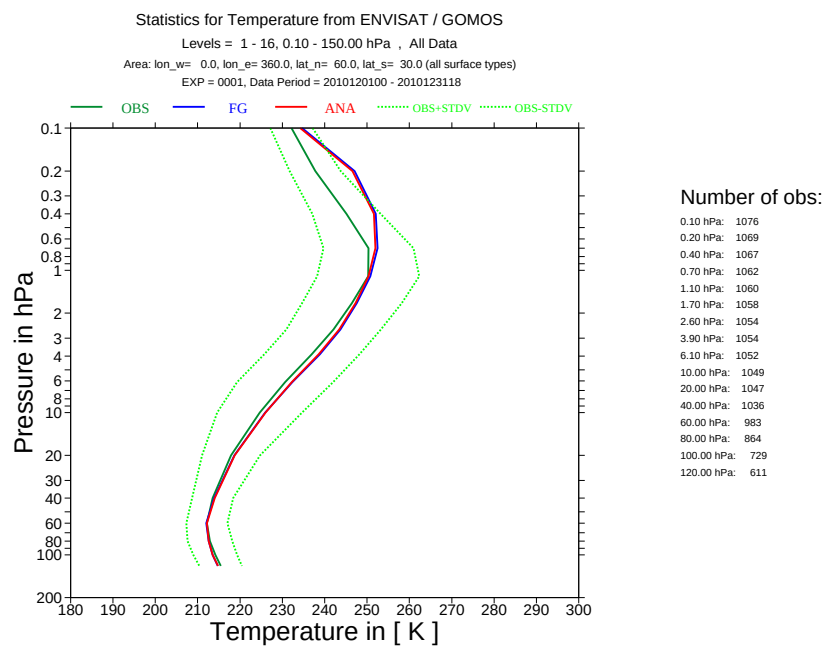


Fig. 4. As Fig. 3 but for 60-30N.

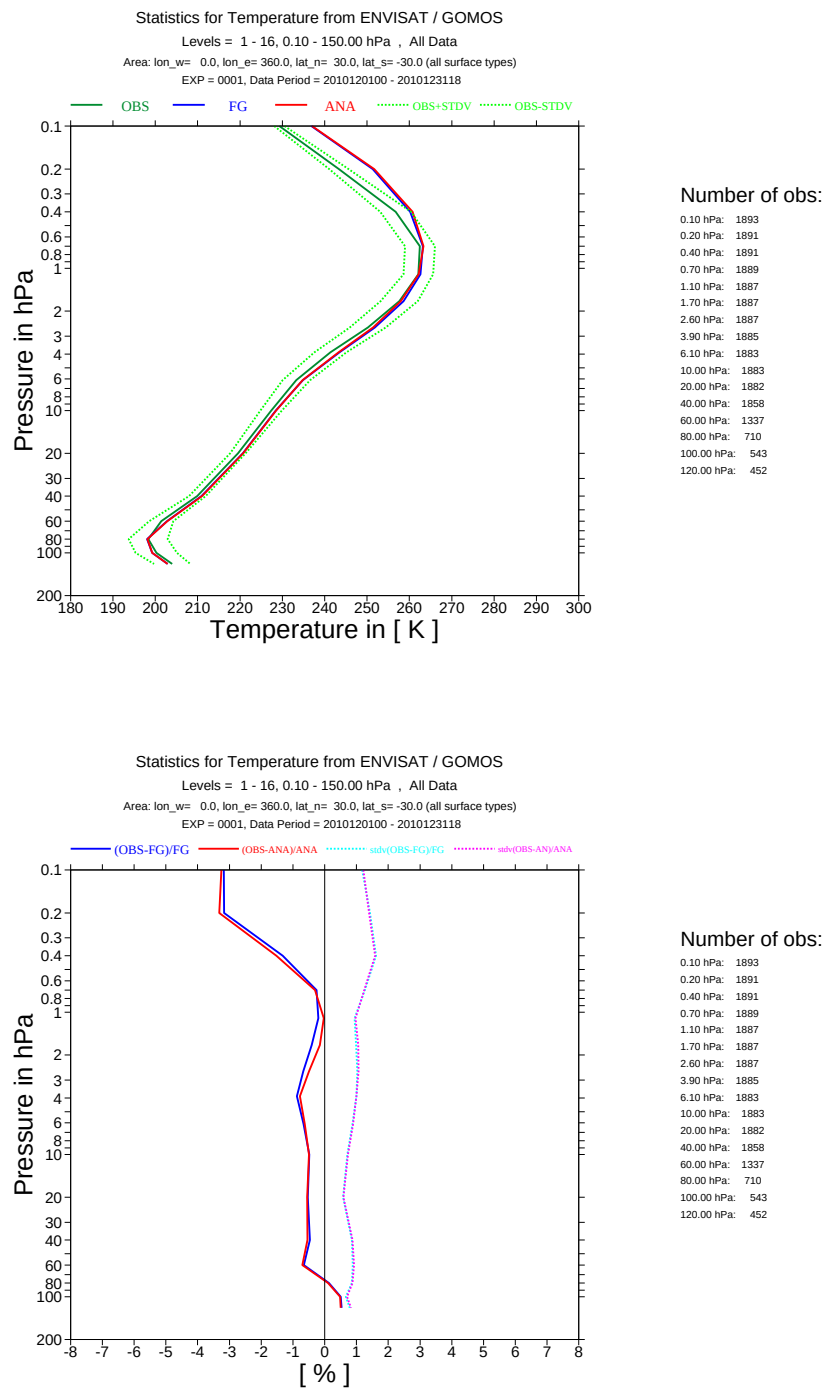


Fig. 5. As Fig. 3 but for 30N-30S.

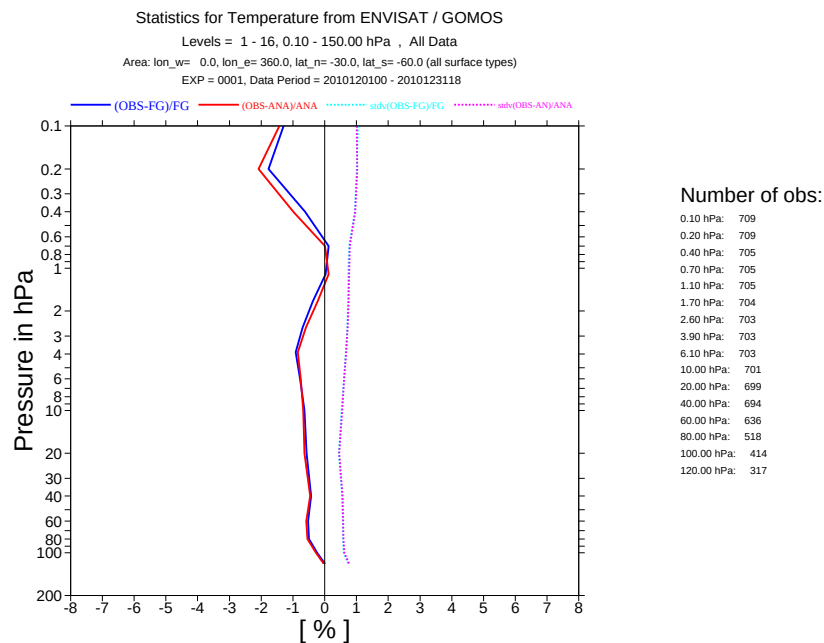
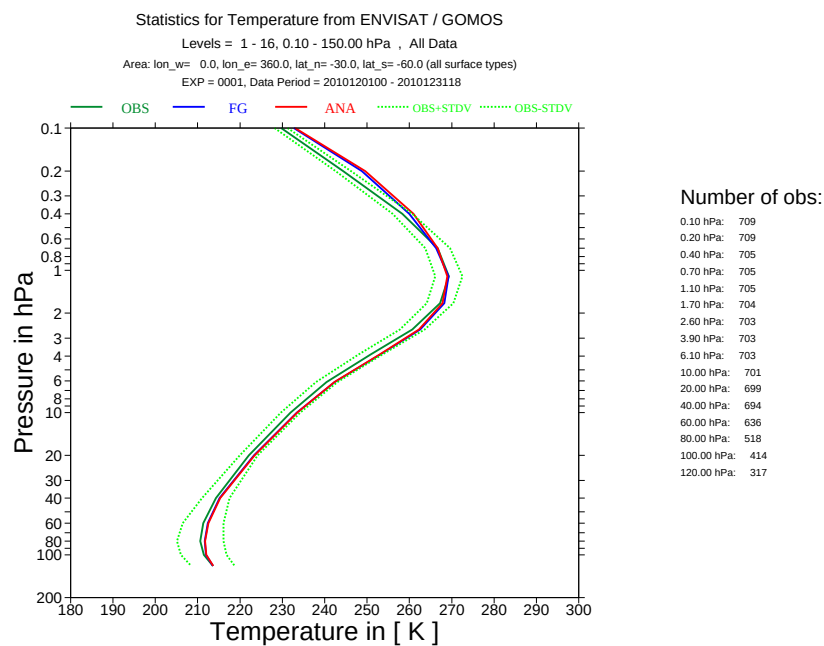


Fig. 6. As Fig. 3 but for 30-60S.

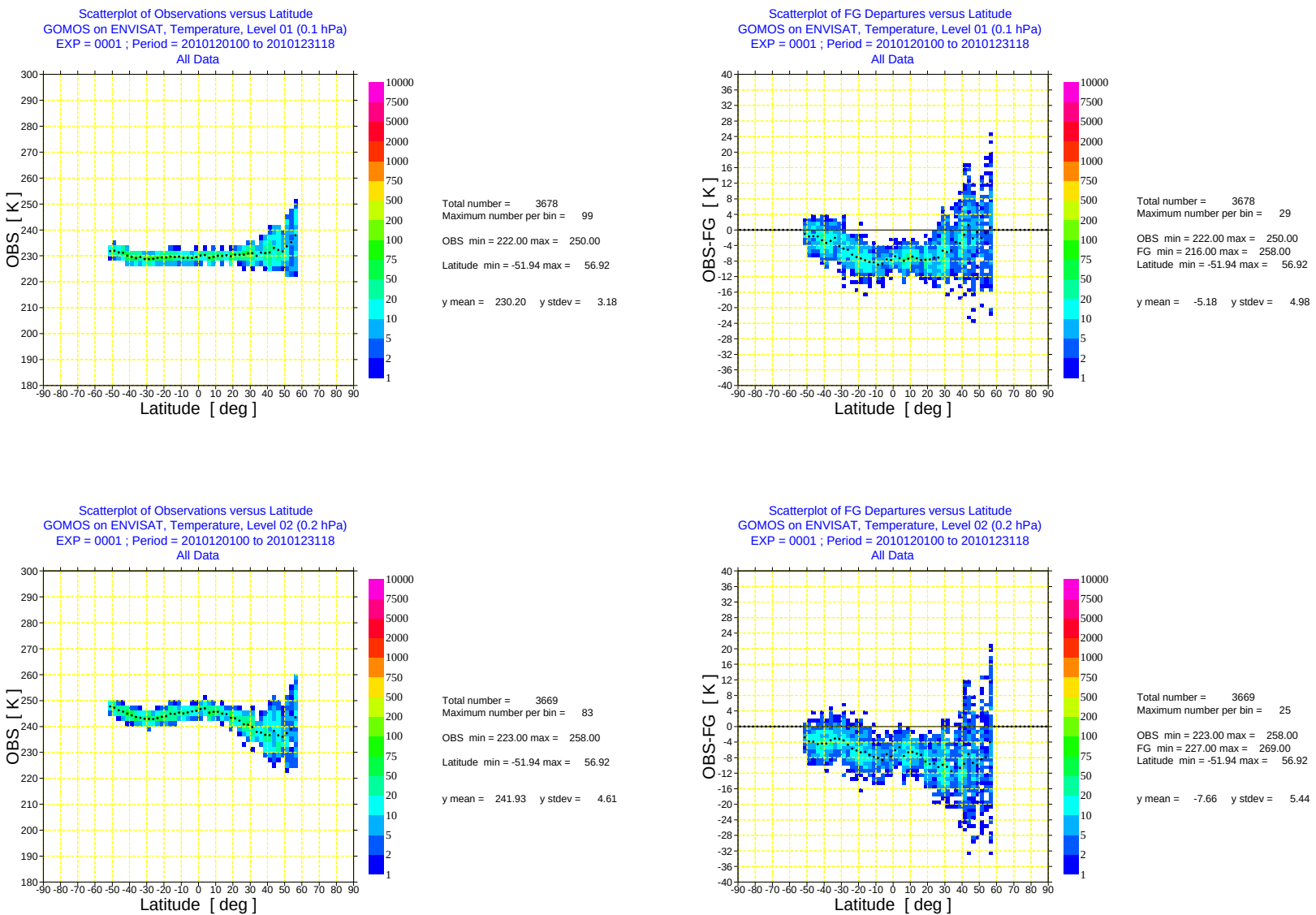


Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for December 2010 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

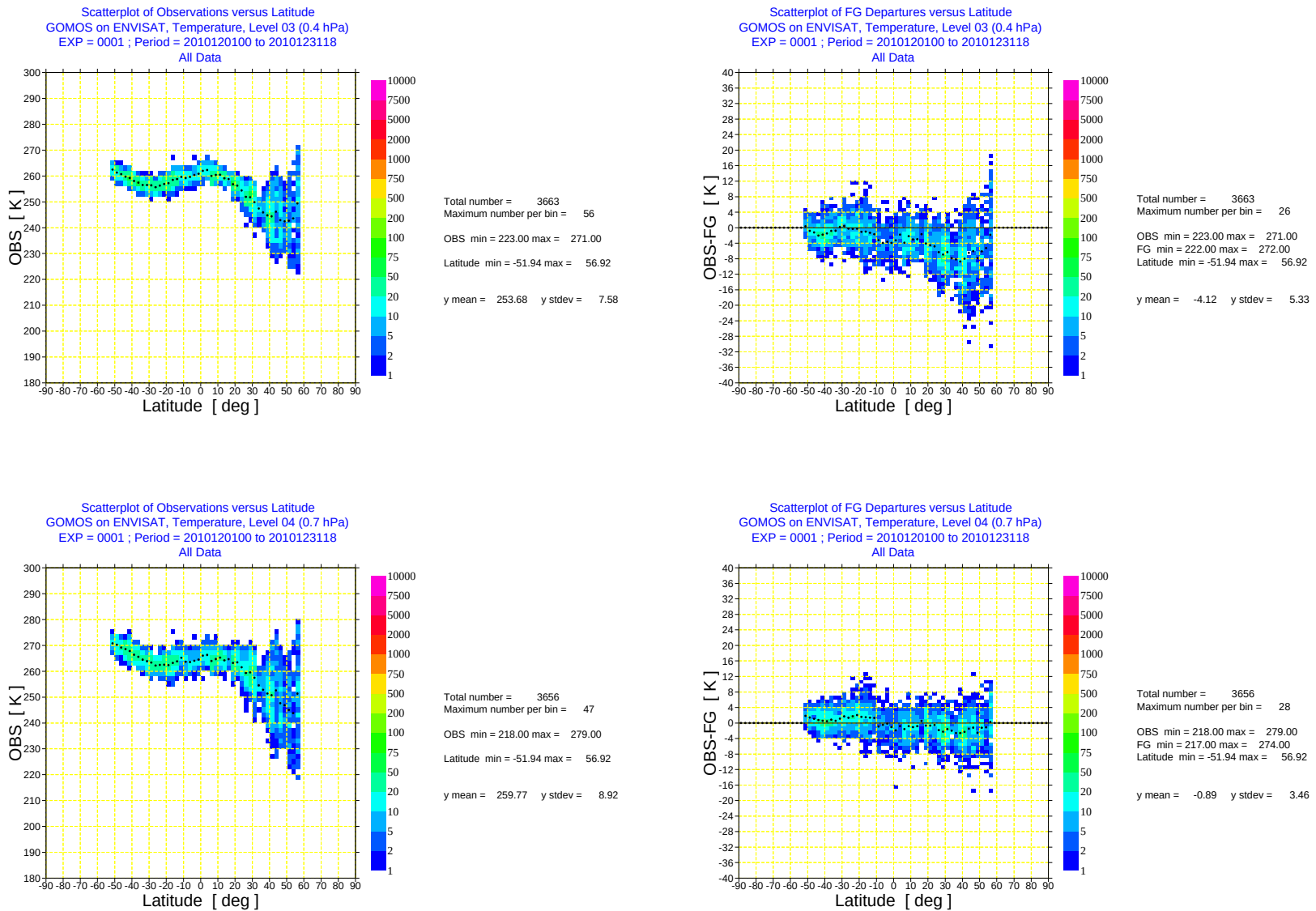


Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

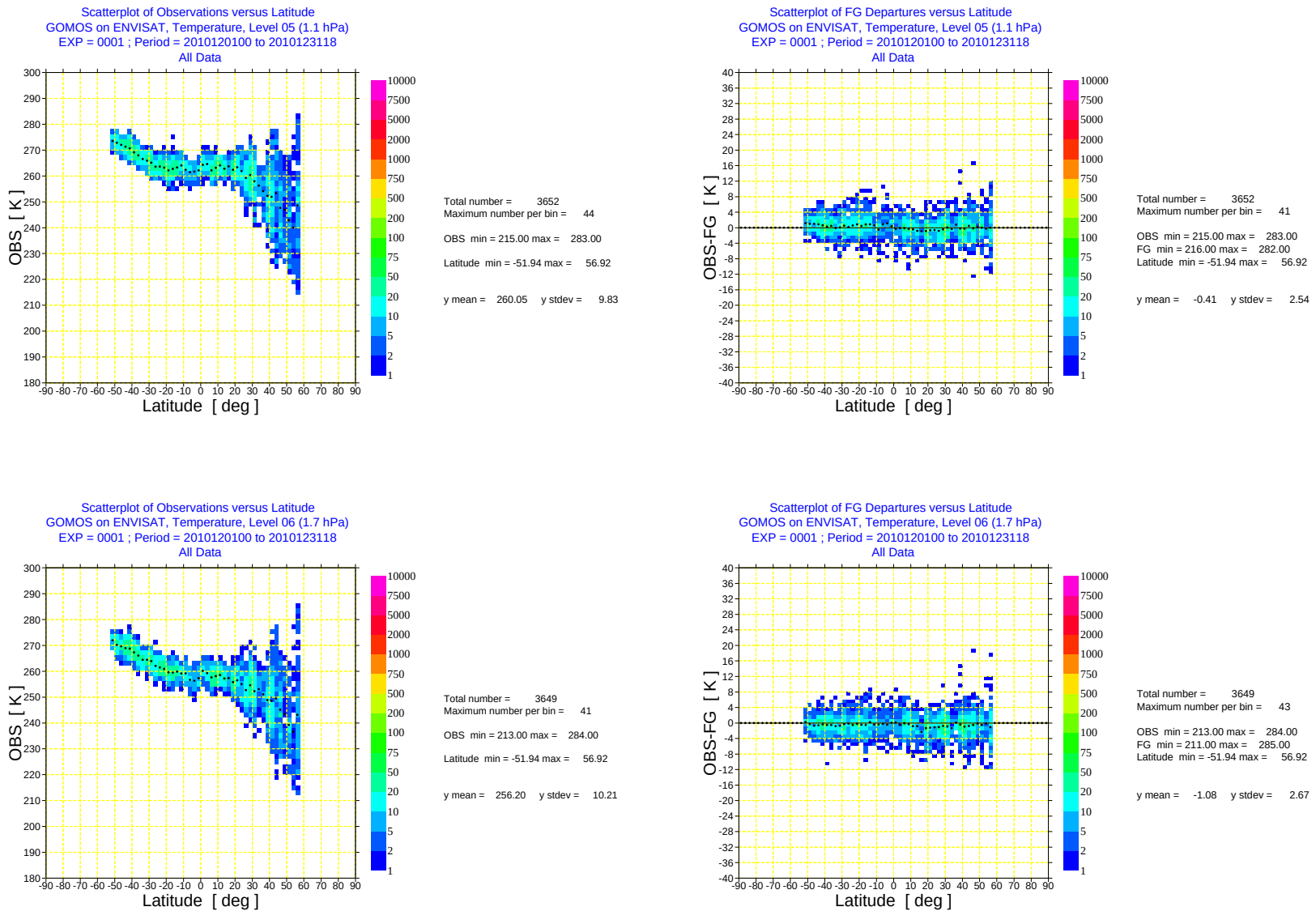


Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

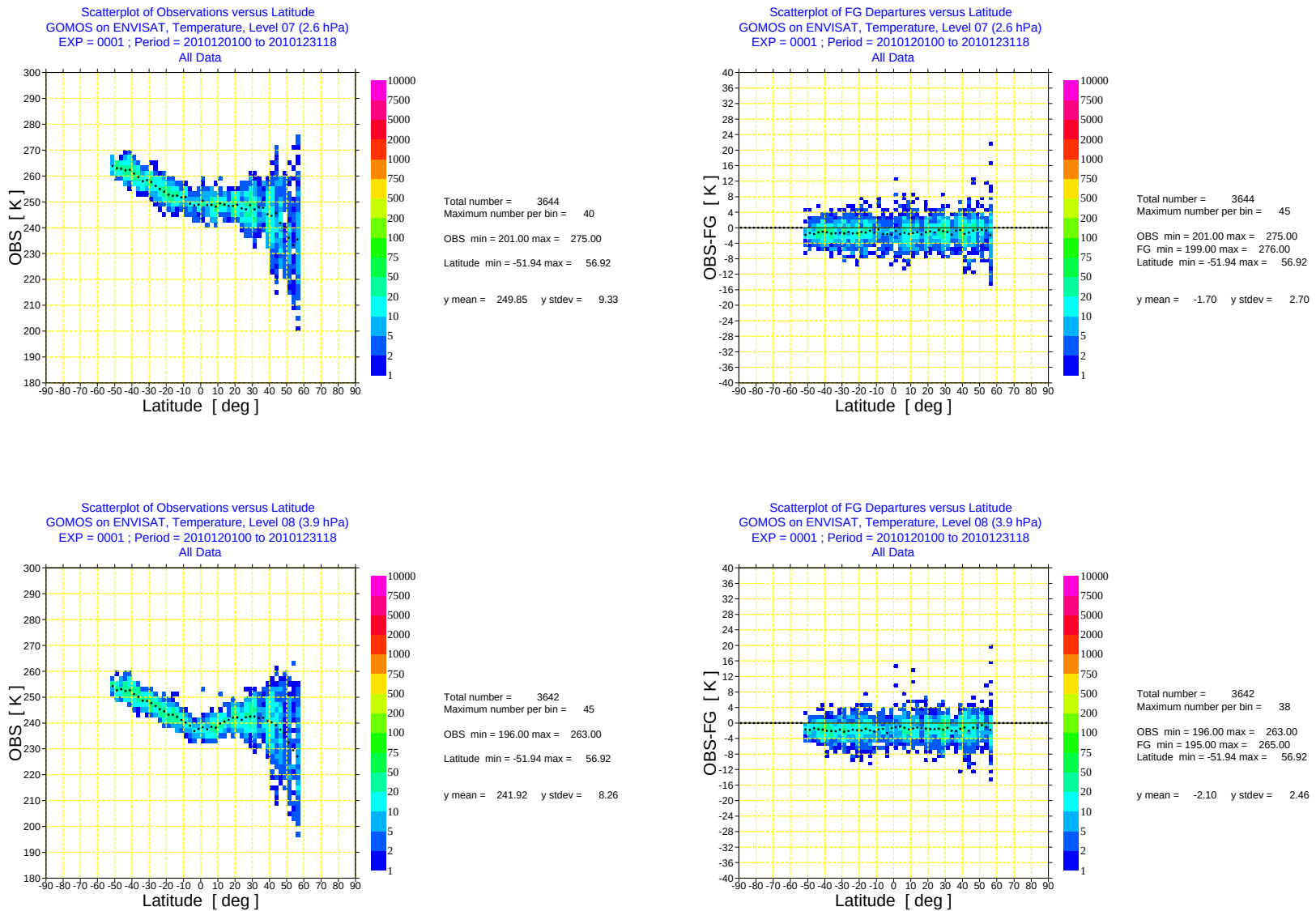


Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

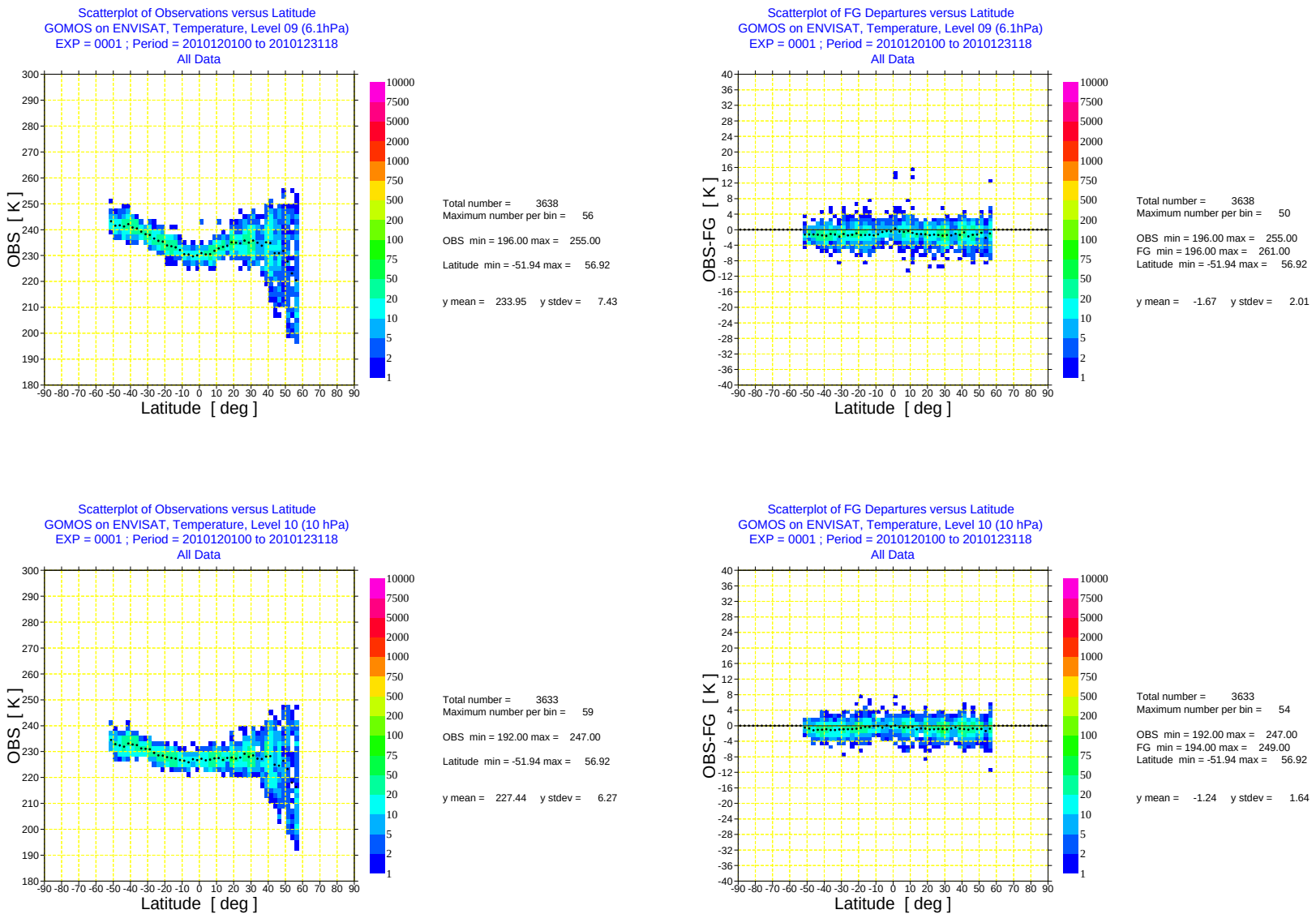


Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

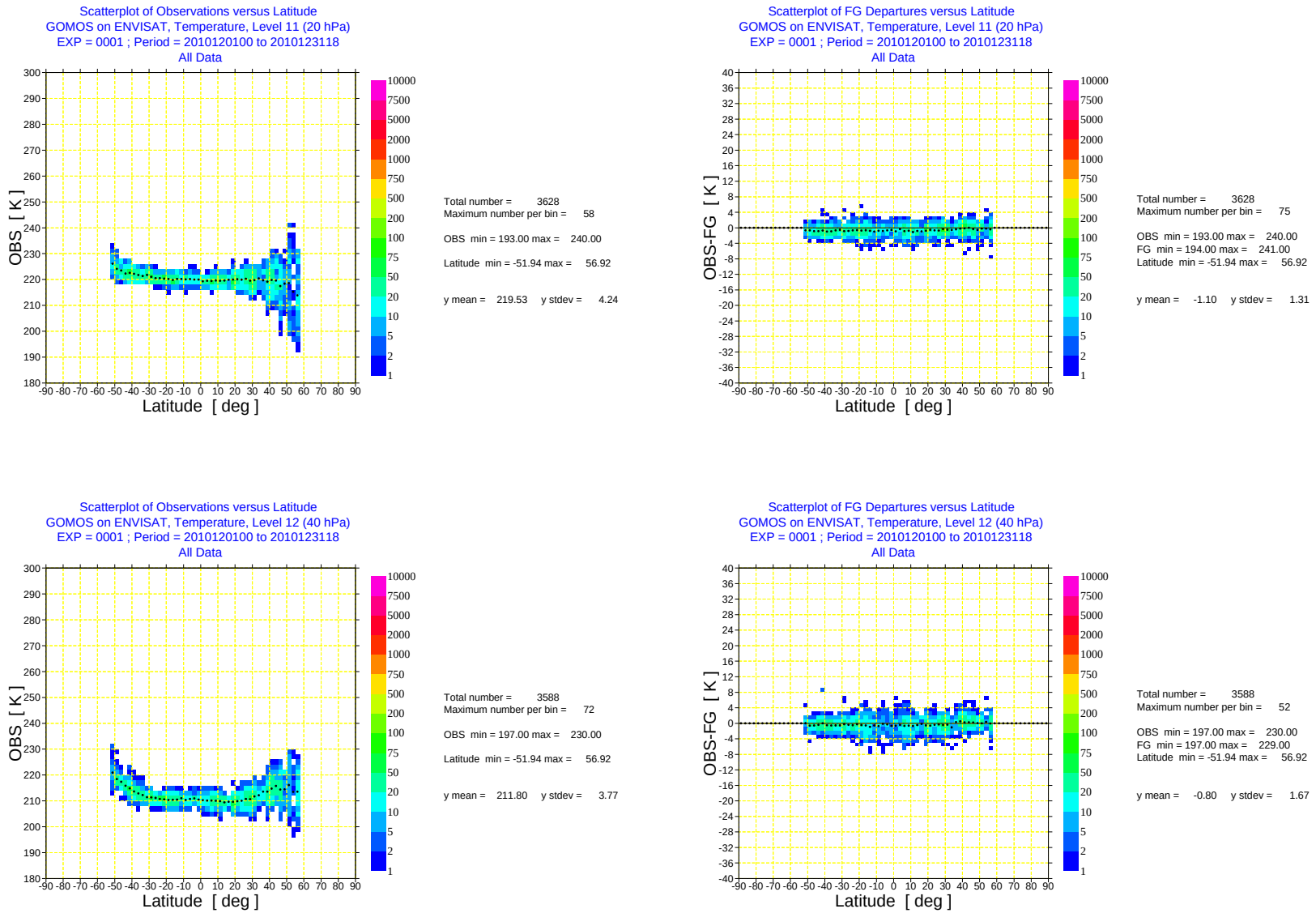


Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

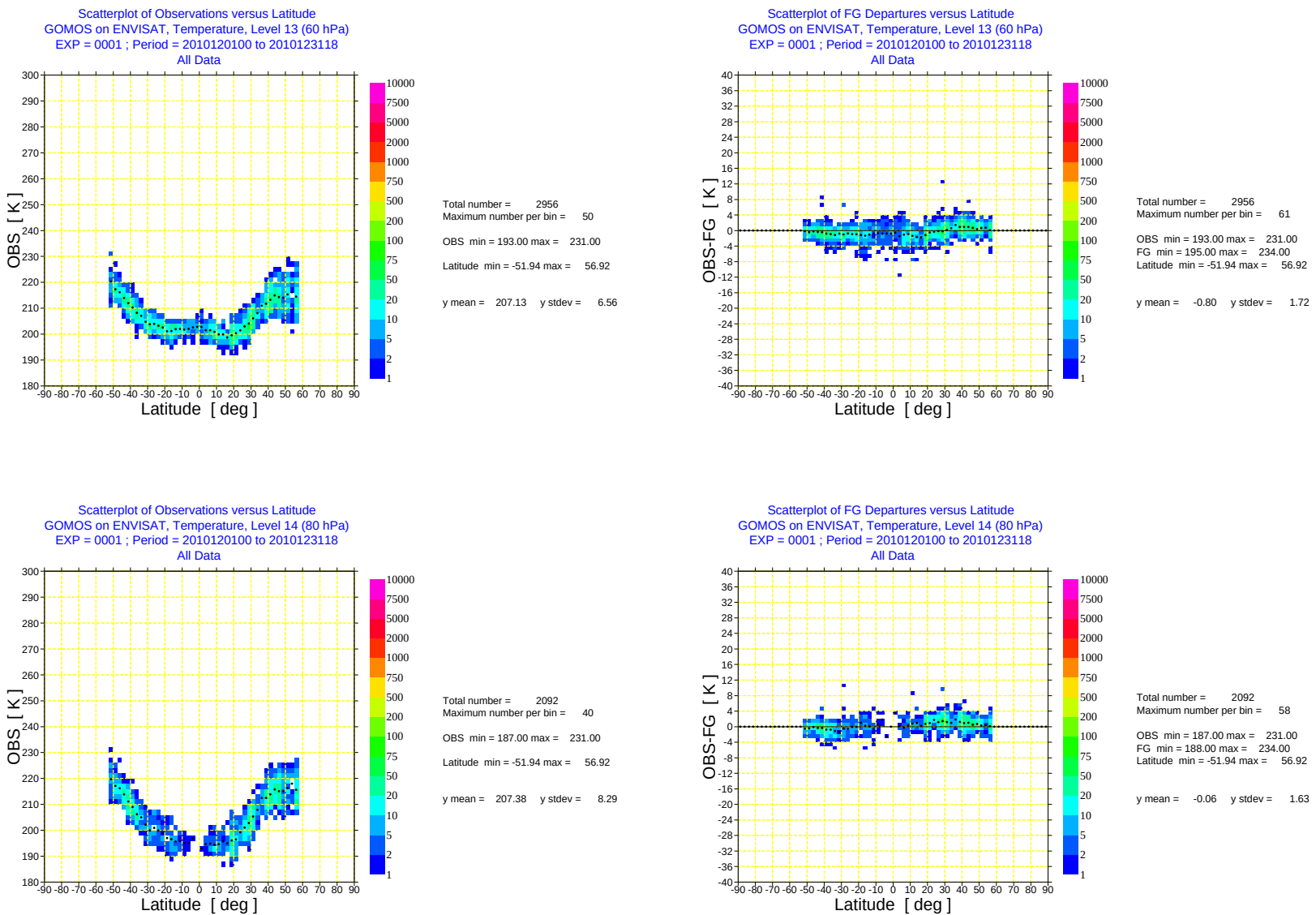


Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

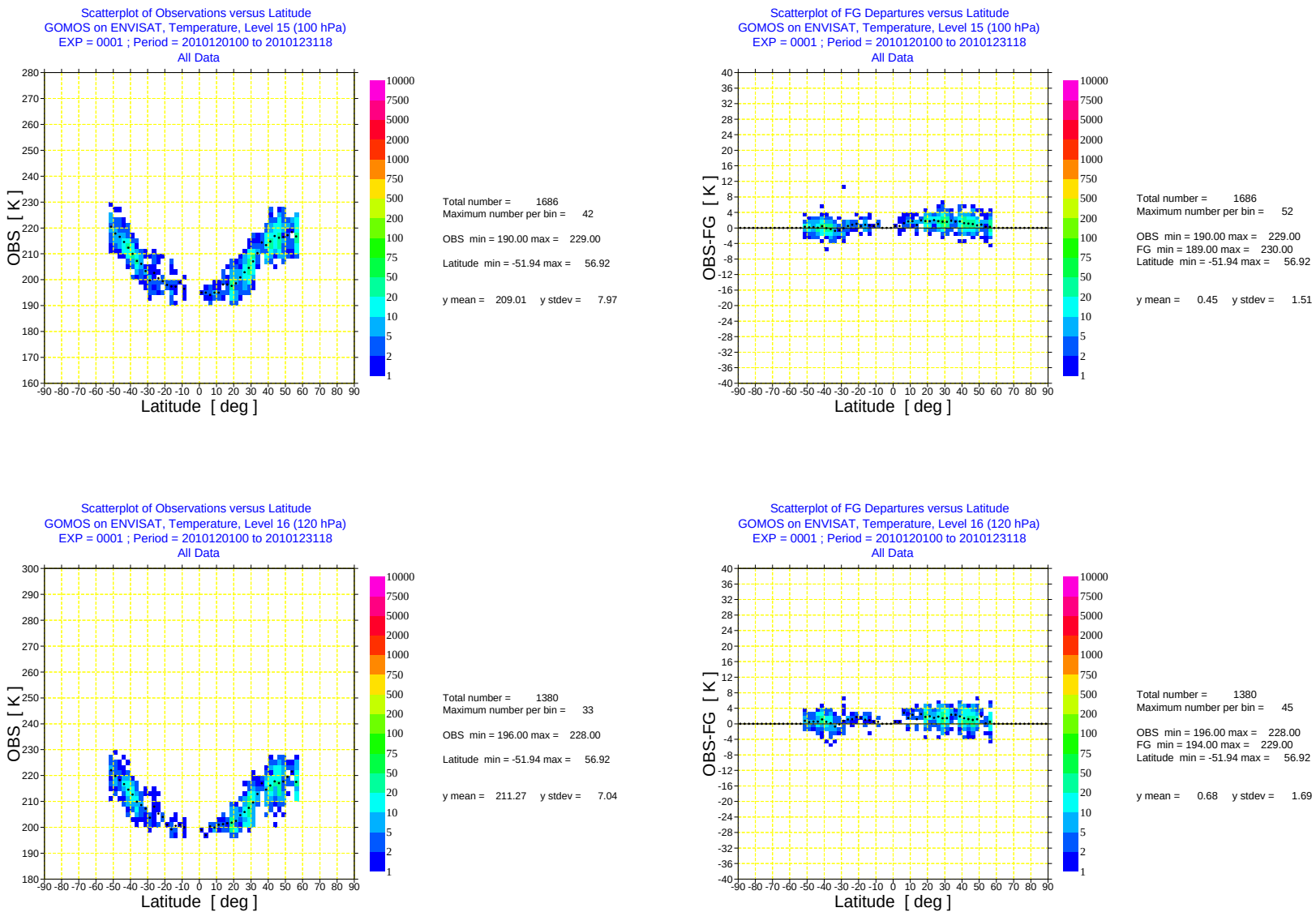


Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

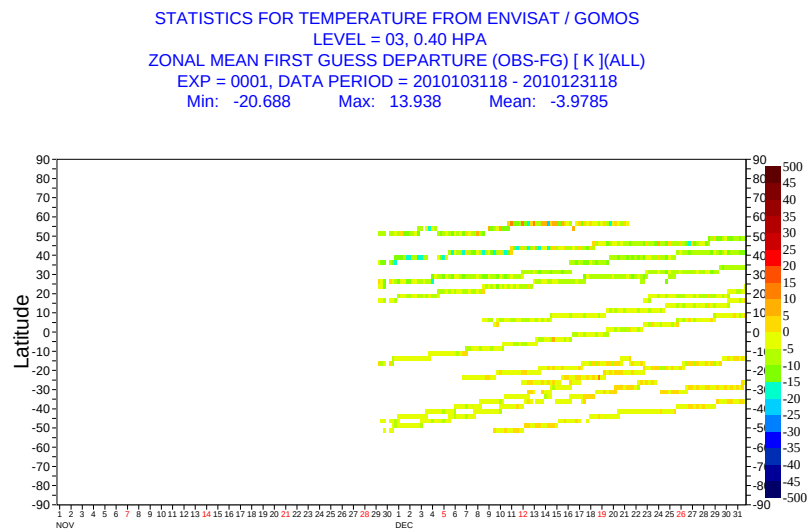
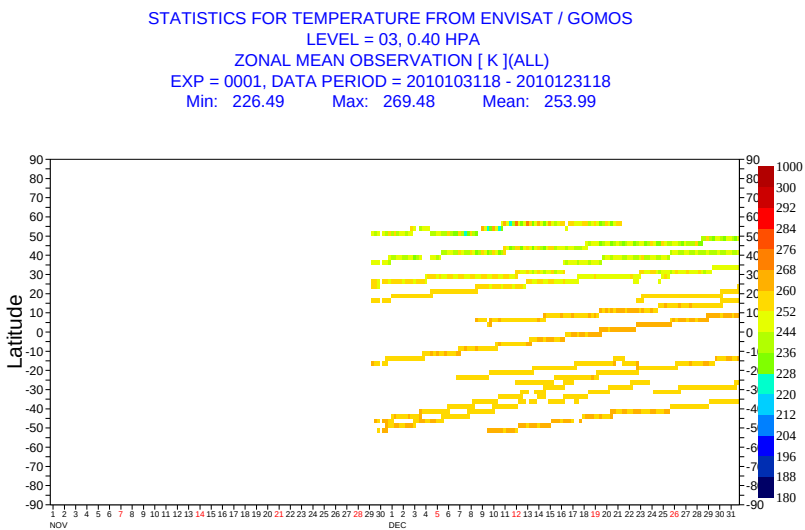
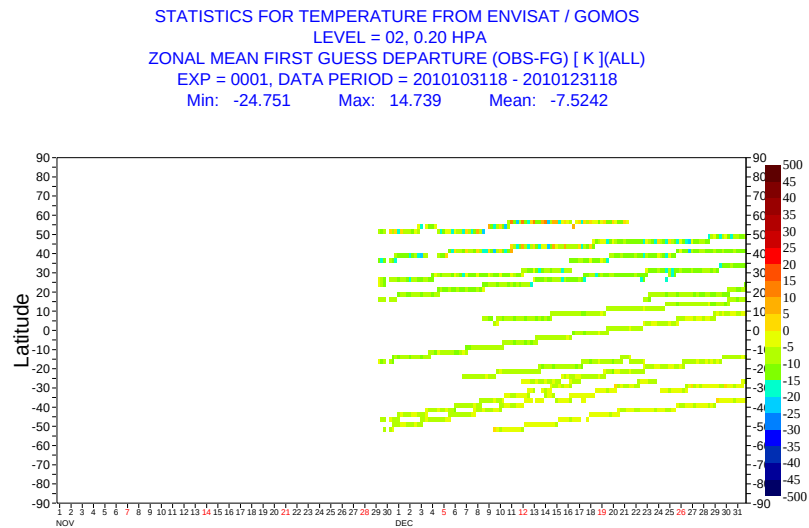
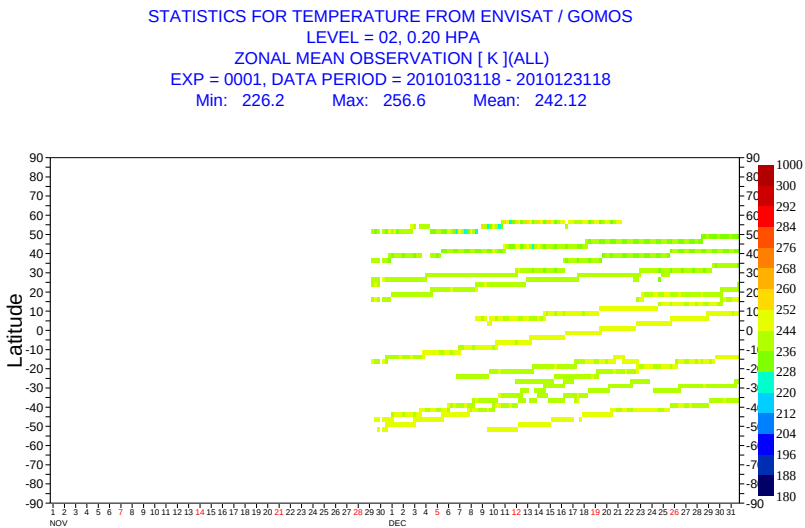


Fig. 15. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for November-December 2010.

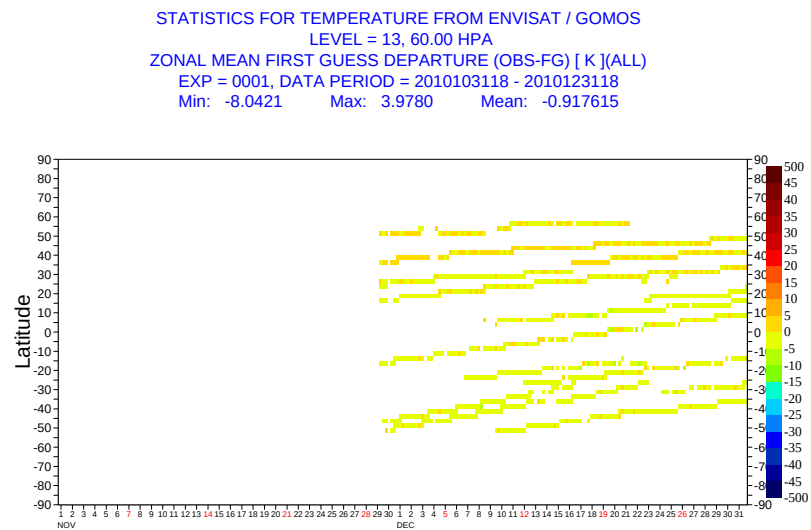
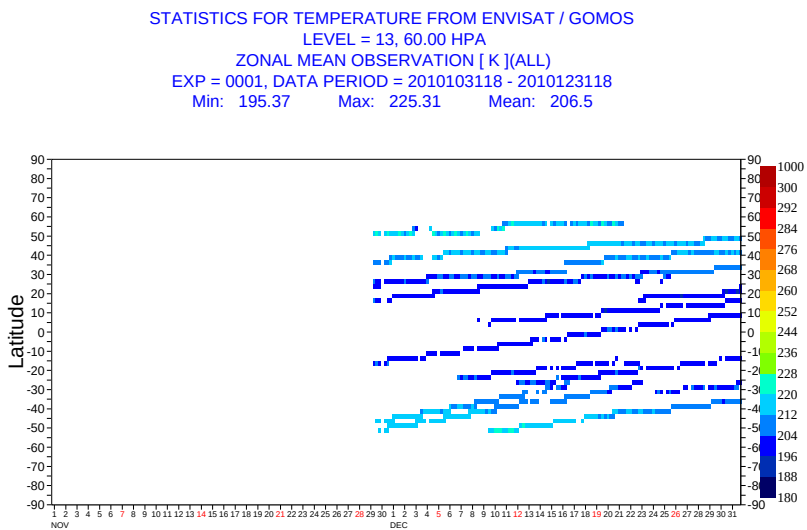
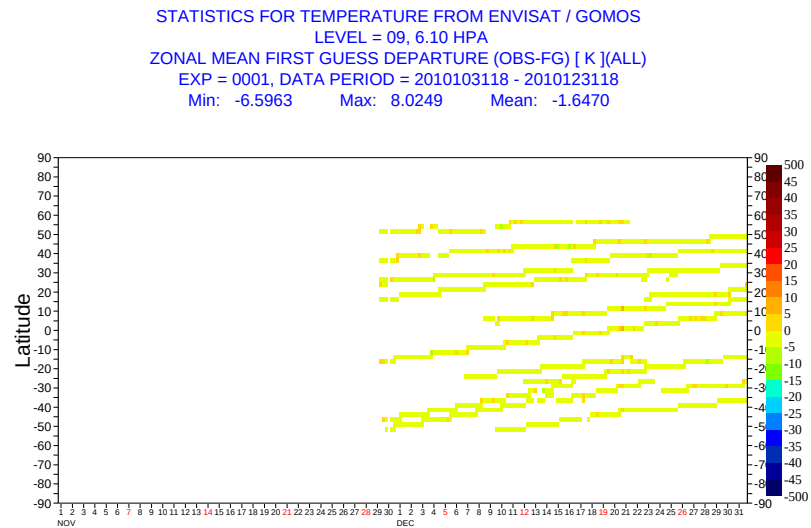
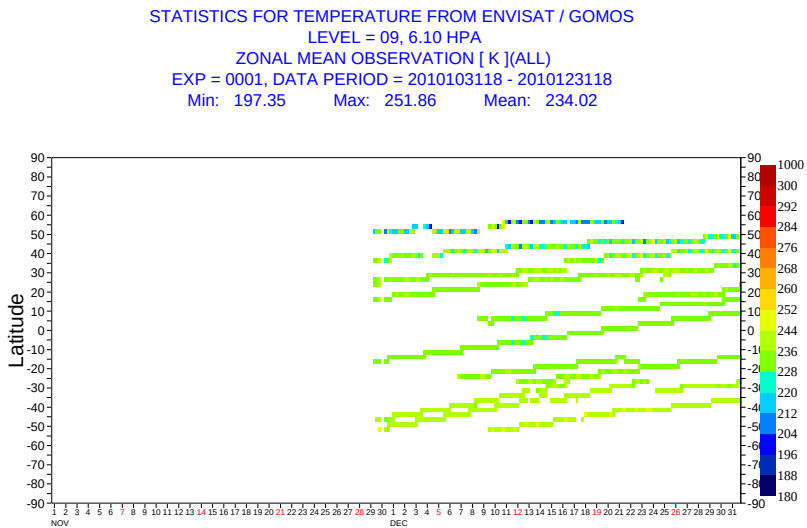


Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

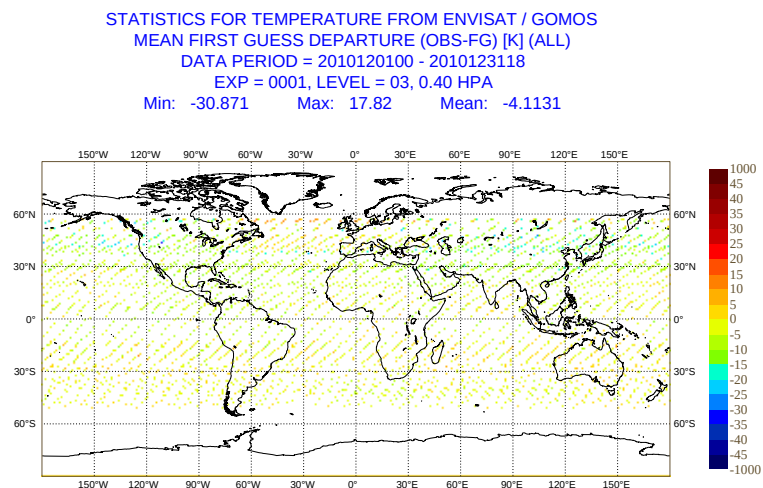
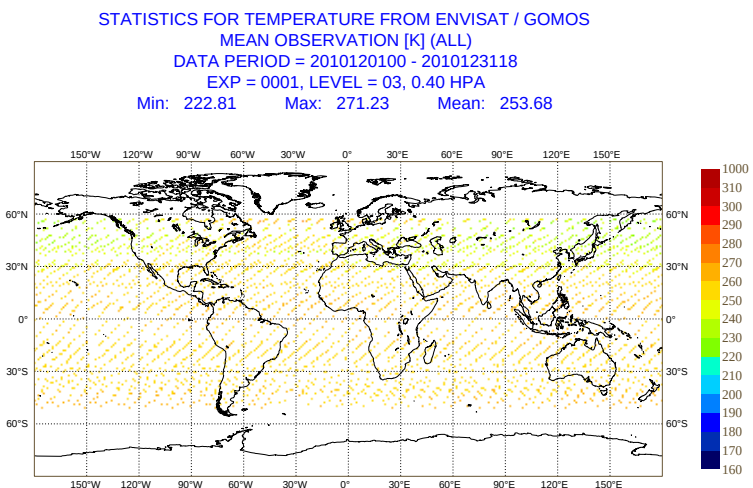
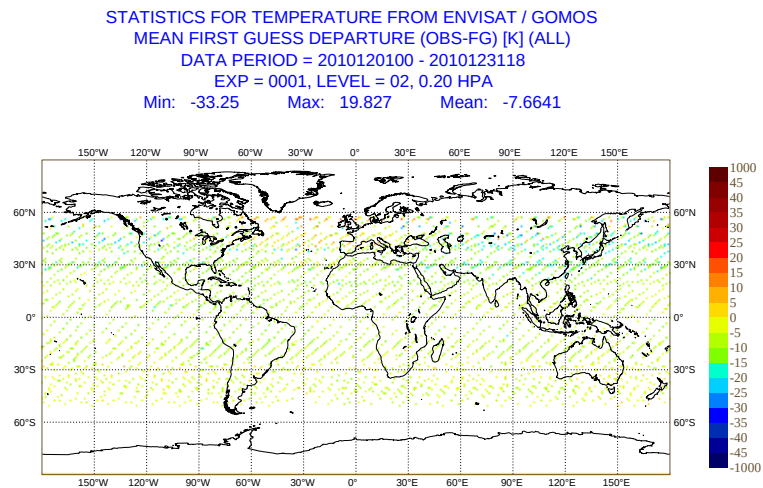
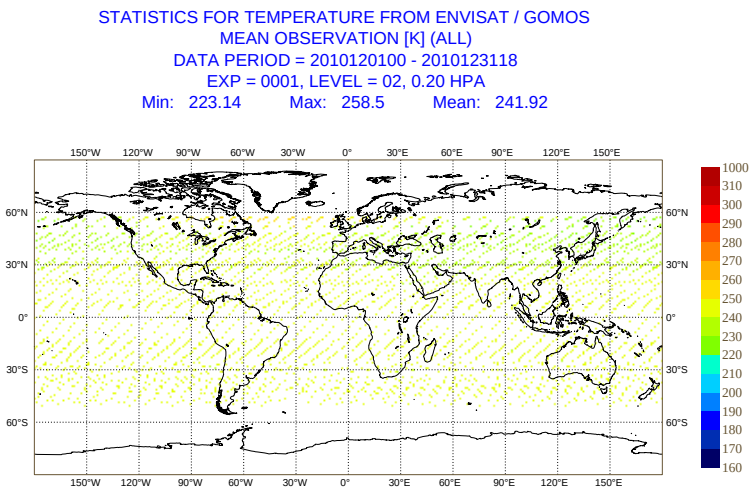


Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for December 2010.

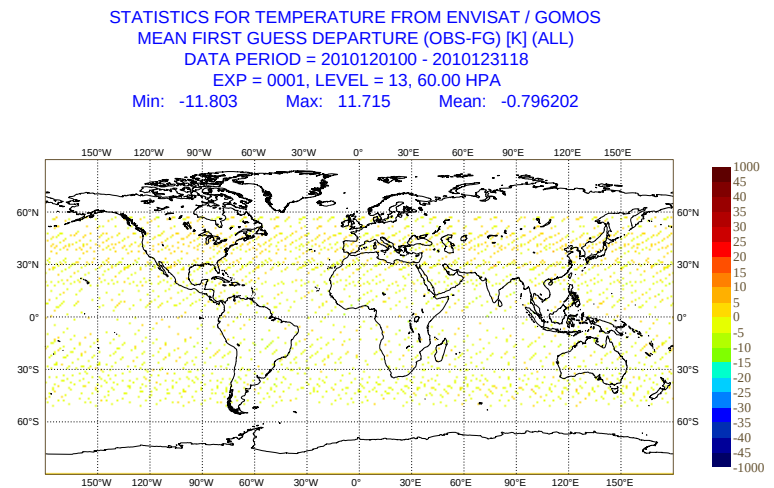
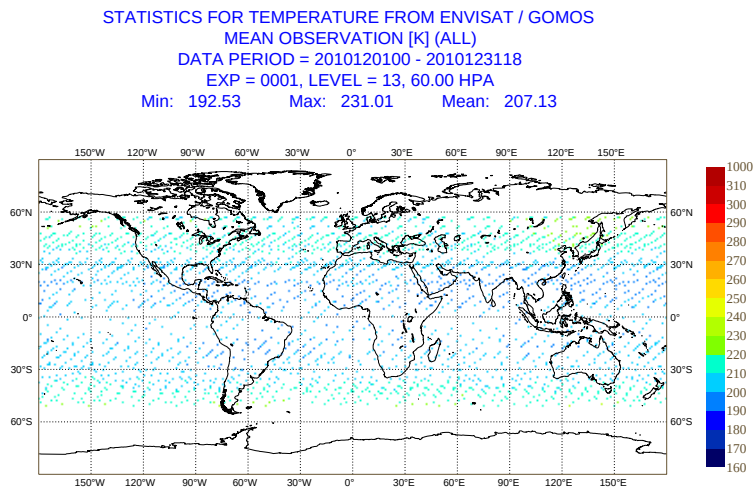
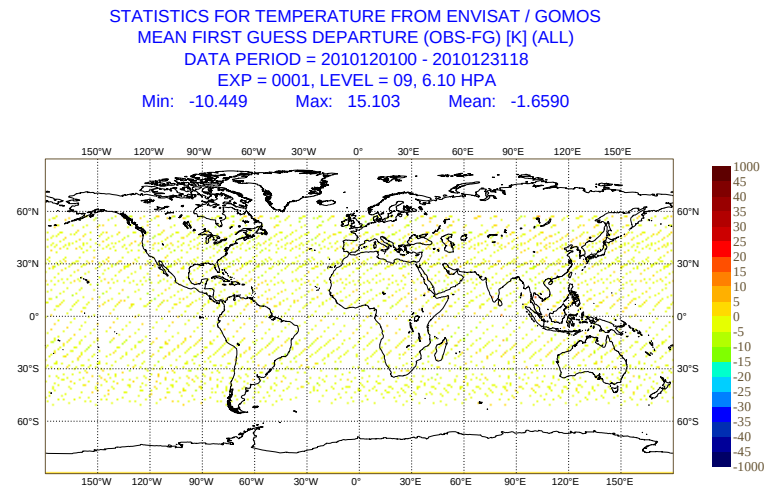
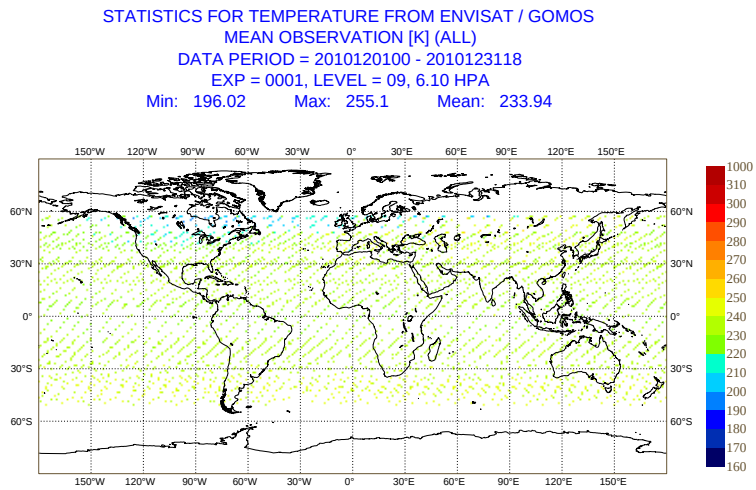


Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

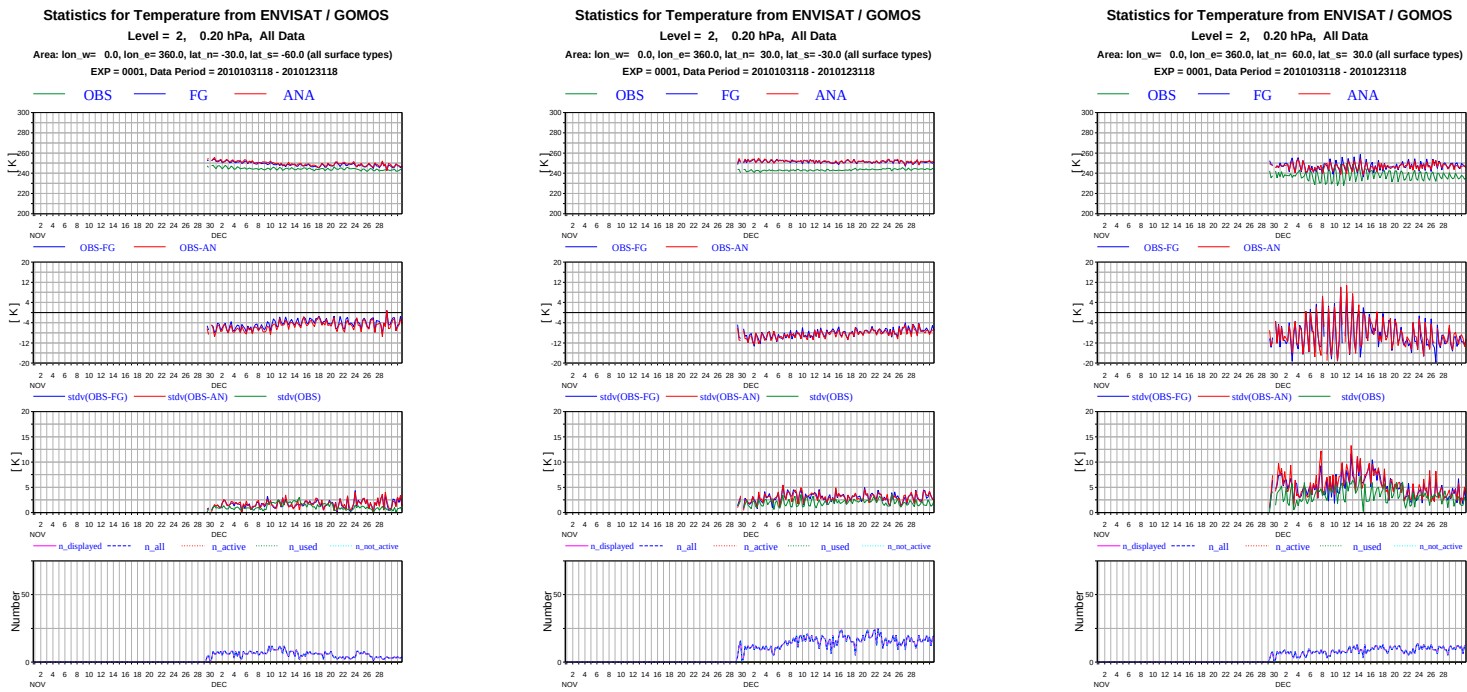


Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) at latitudinal bands 30-60N, 30N-30S, and 30-60S for the period November-December 2010.

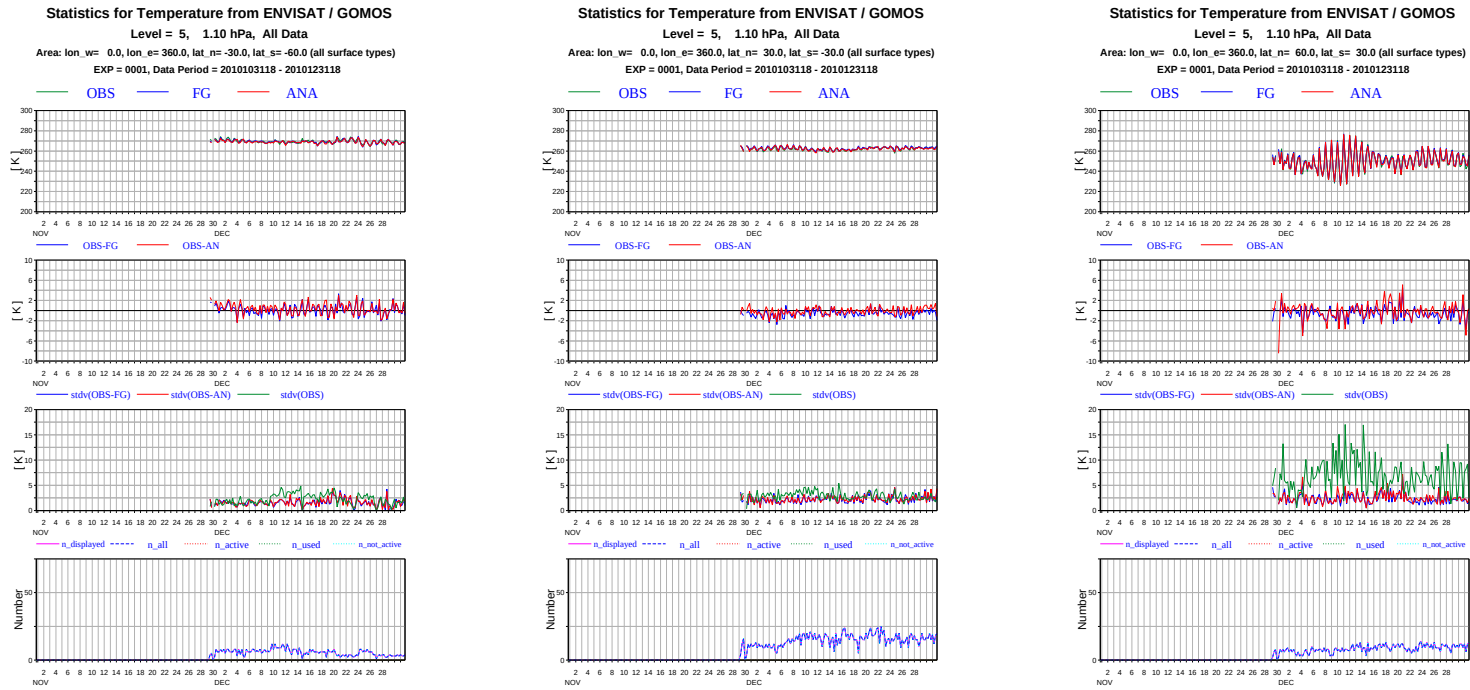


Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

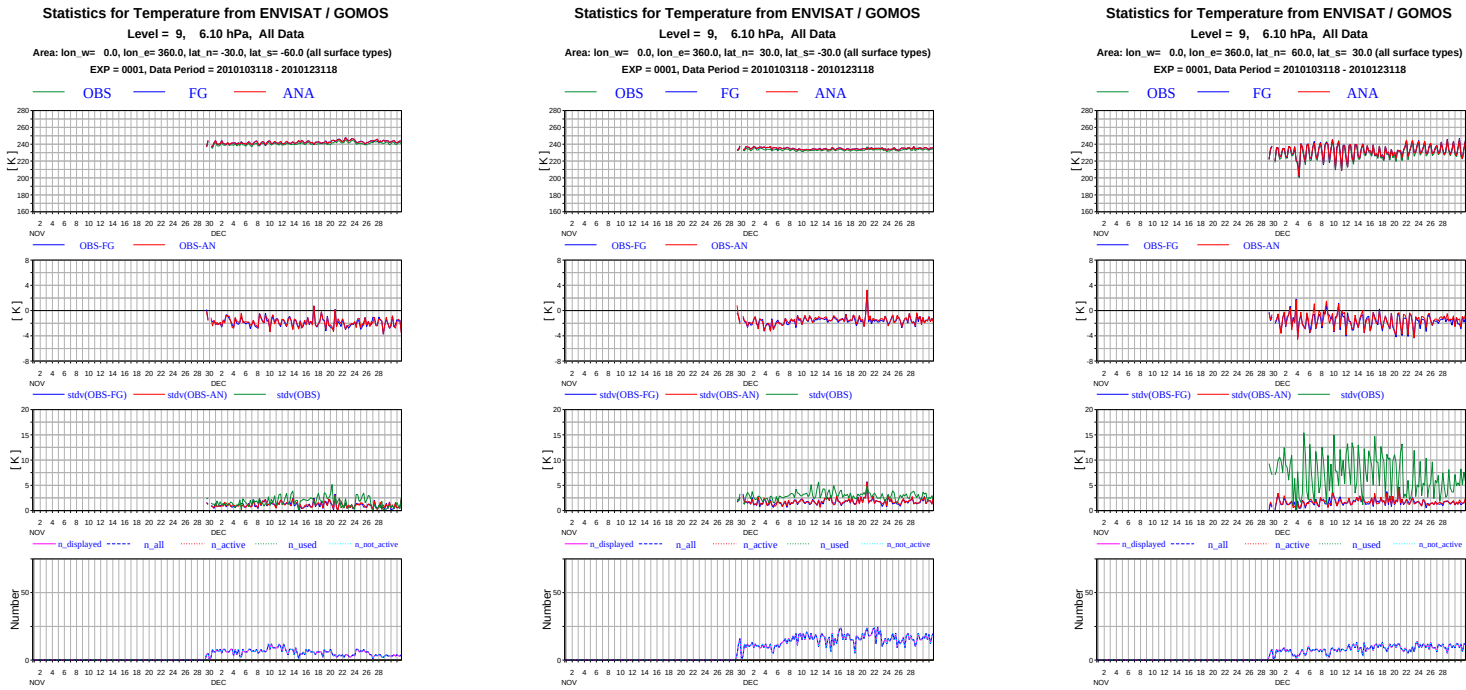


Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

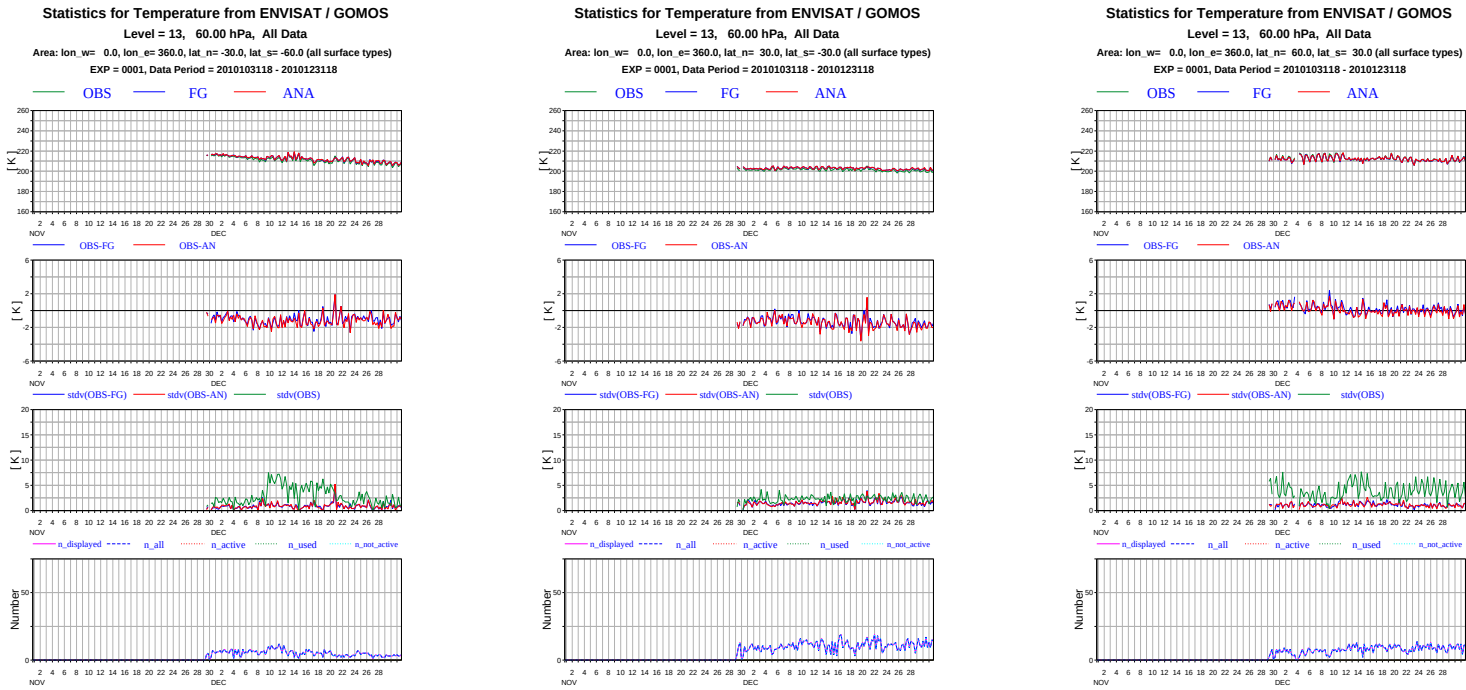


Fig. 22. As Figure 19, but for level 13 (60 hPa).

REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR_2P) FOR DECEMBER 2010

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January 7, 2011

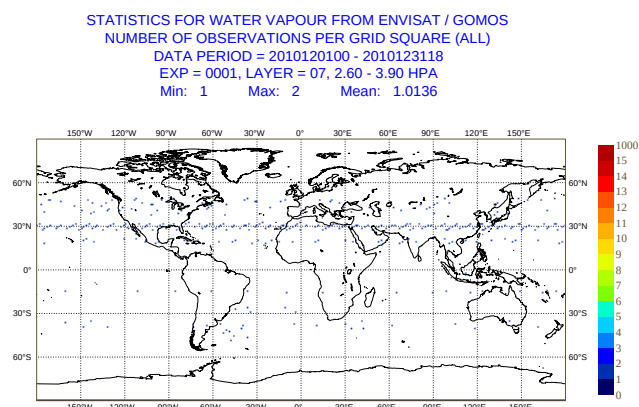


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for December 2010.

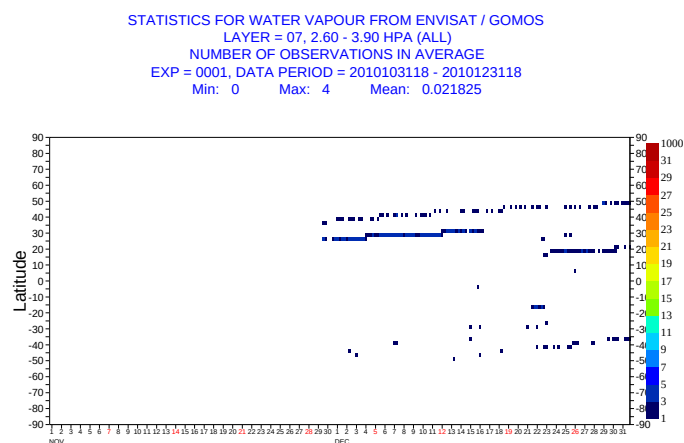


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for November-December 2010.

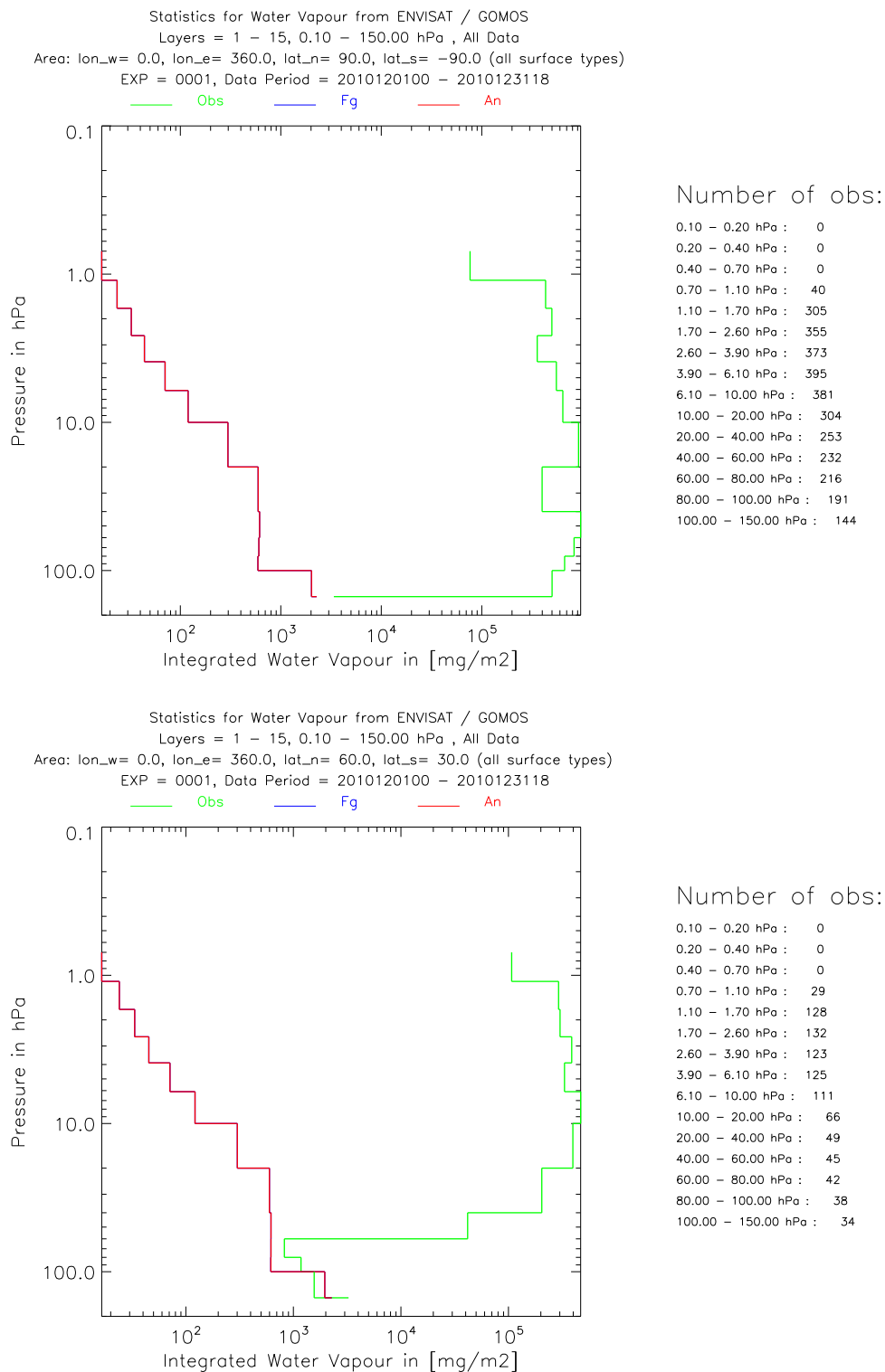


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m^2 for December 2010. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the midlatitudes in the NH (60-30N). Plotted are the partial columns for the 16 levels listed to the right of the diagrams.

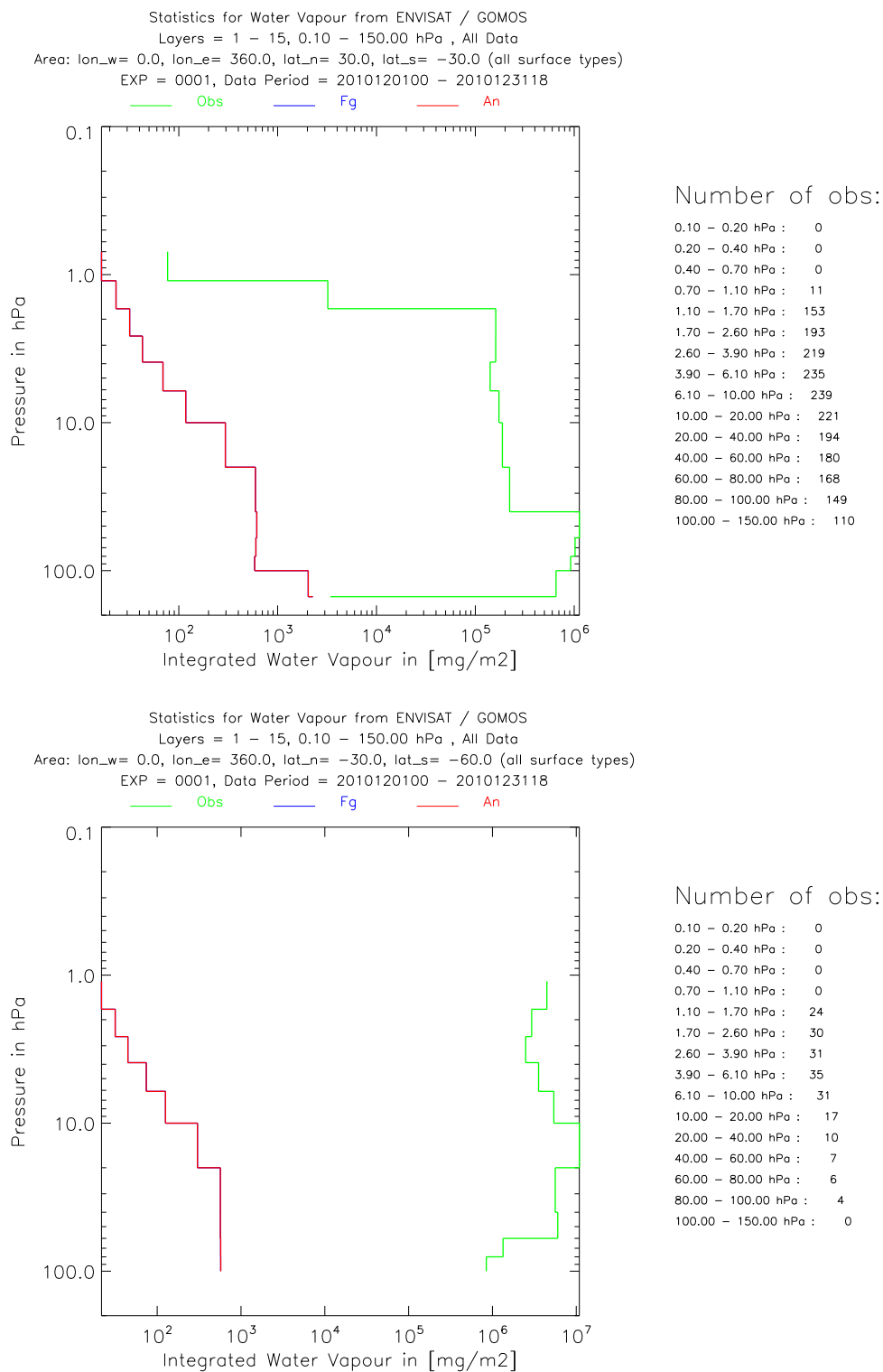


Fig. 4. As Fig. 3 but for the latitudinal band 30N-30S (top panel) and 30-60S (bottom panel).

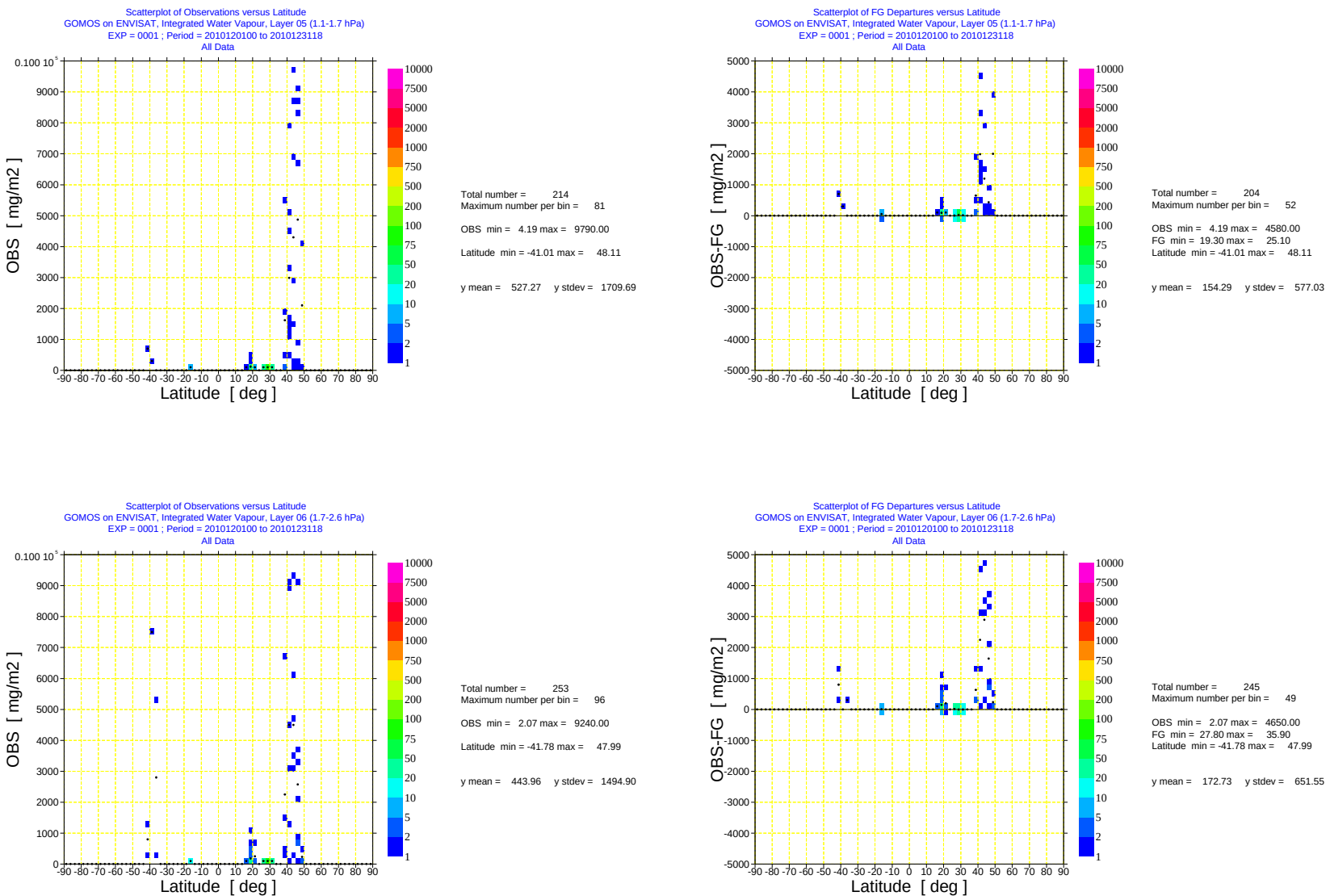


Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for December 2010 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

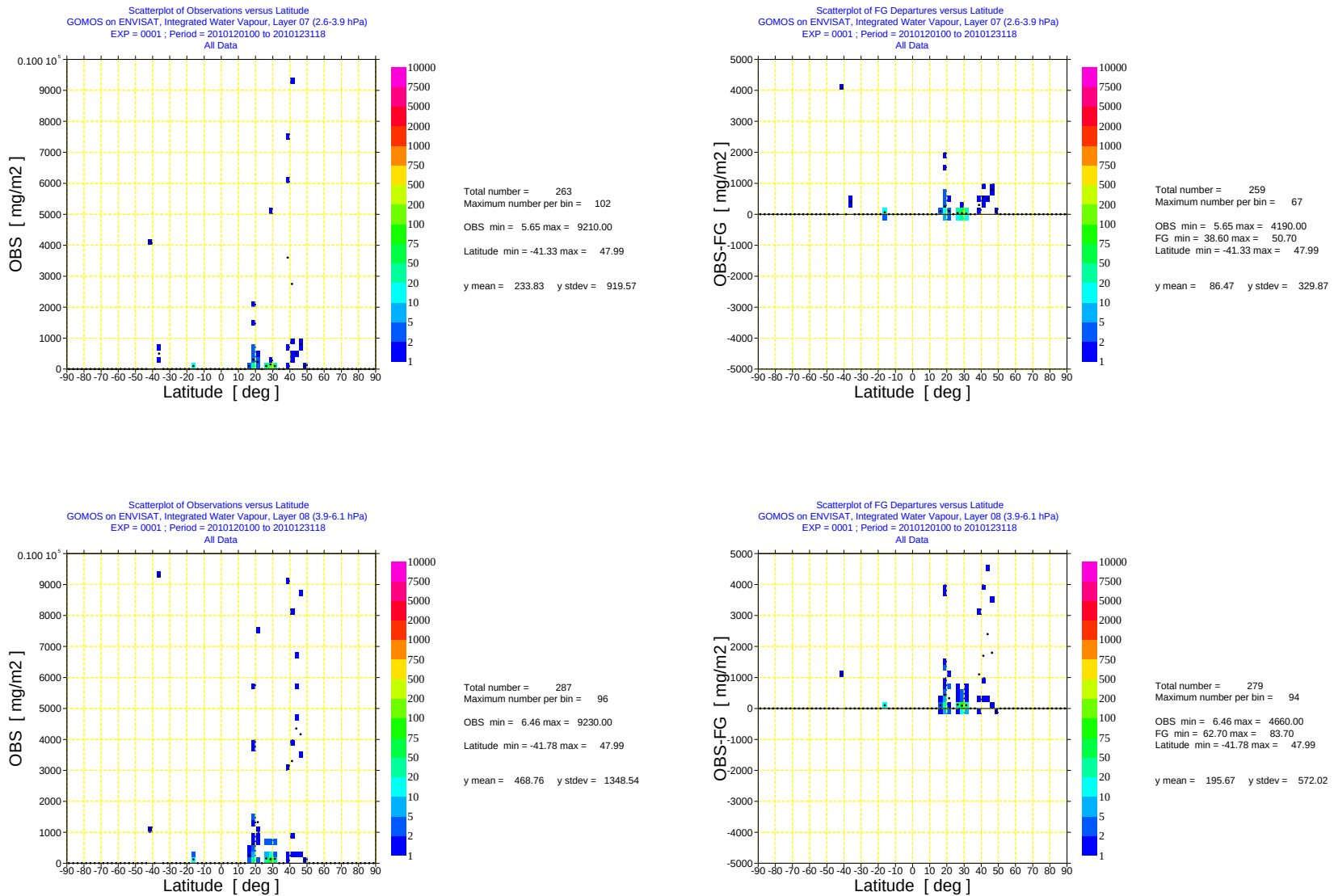


Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

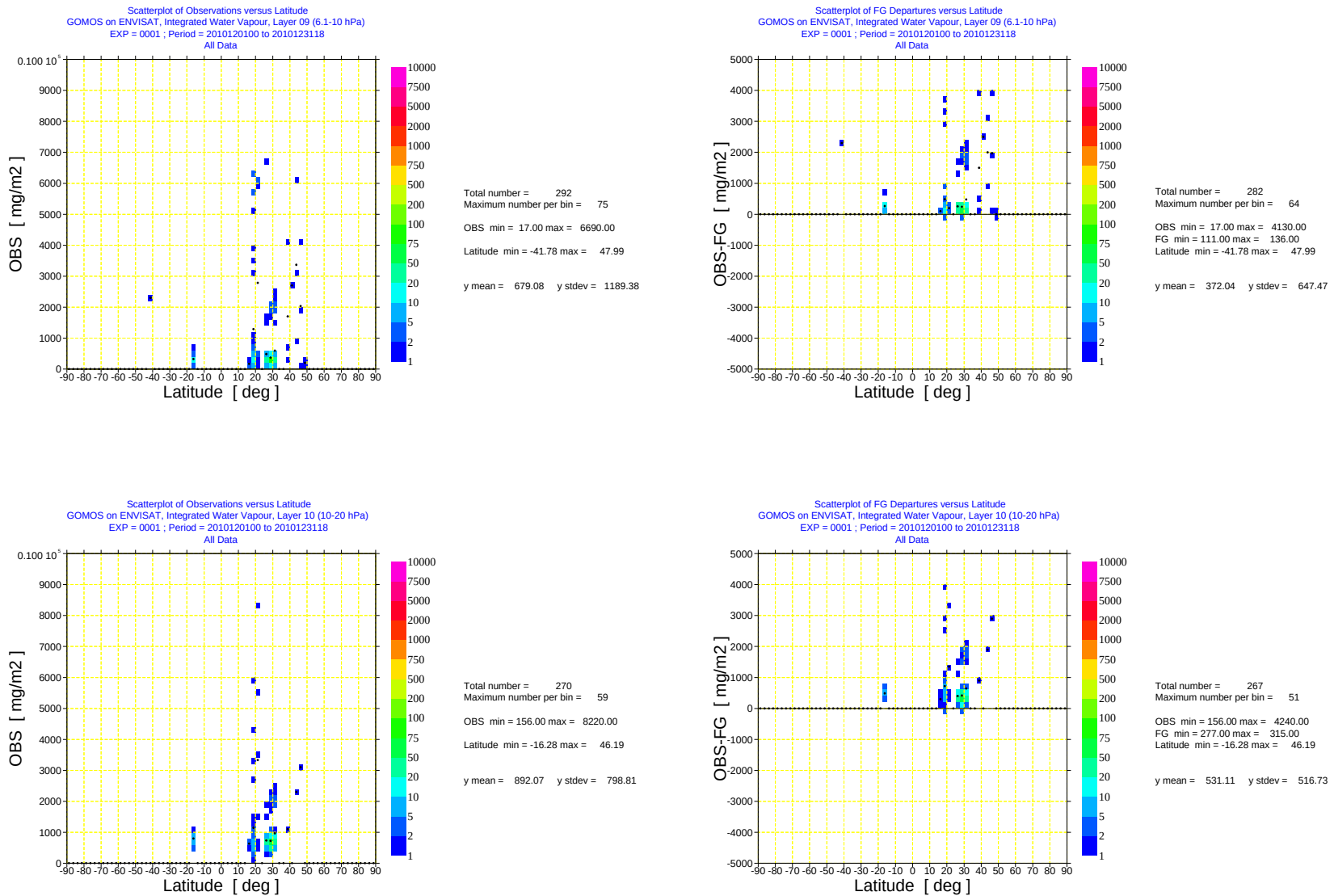


Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

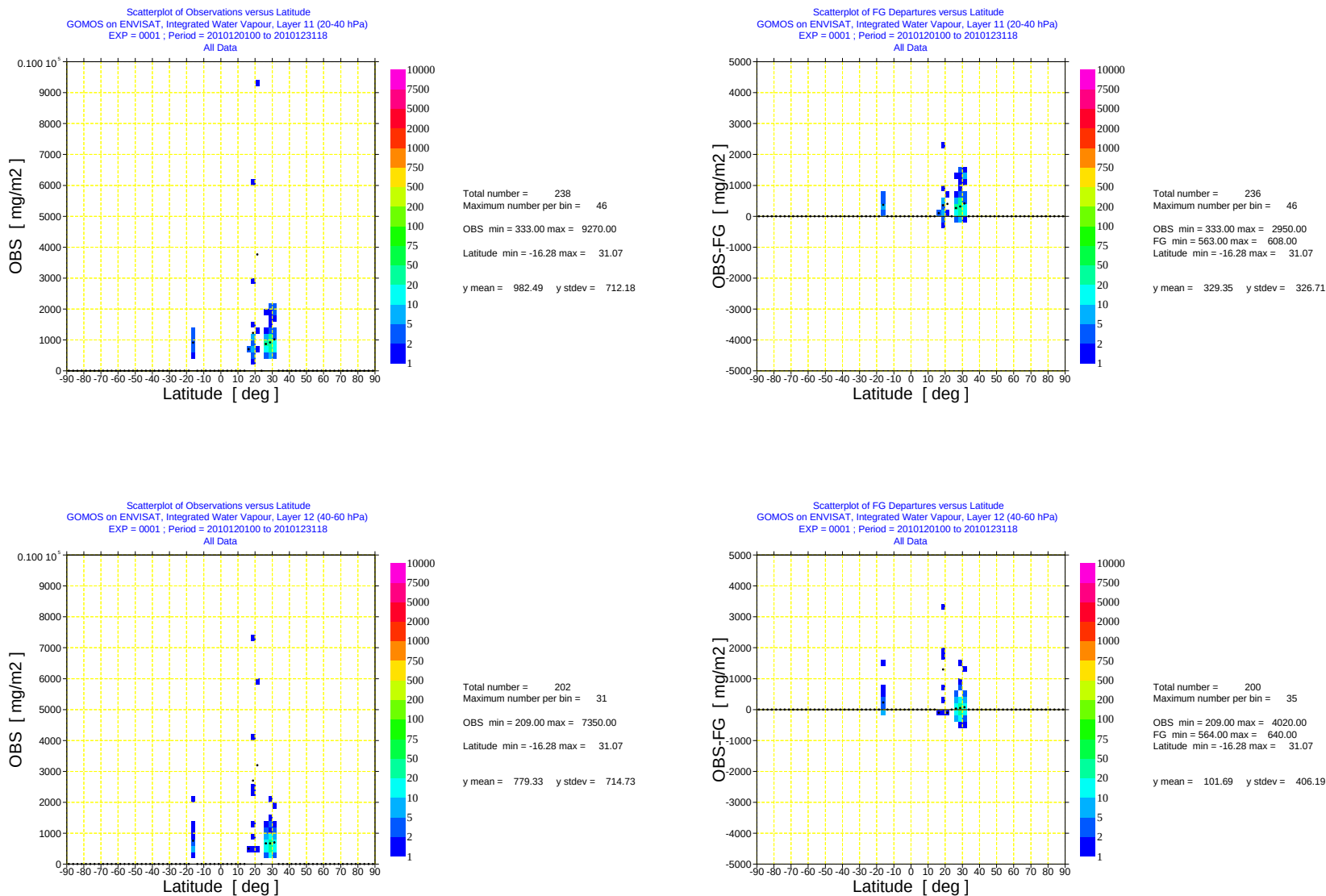


Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

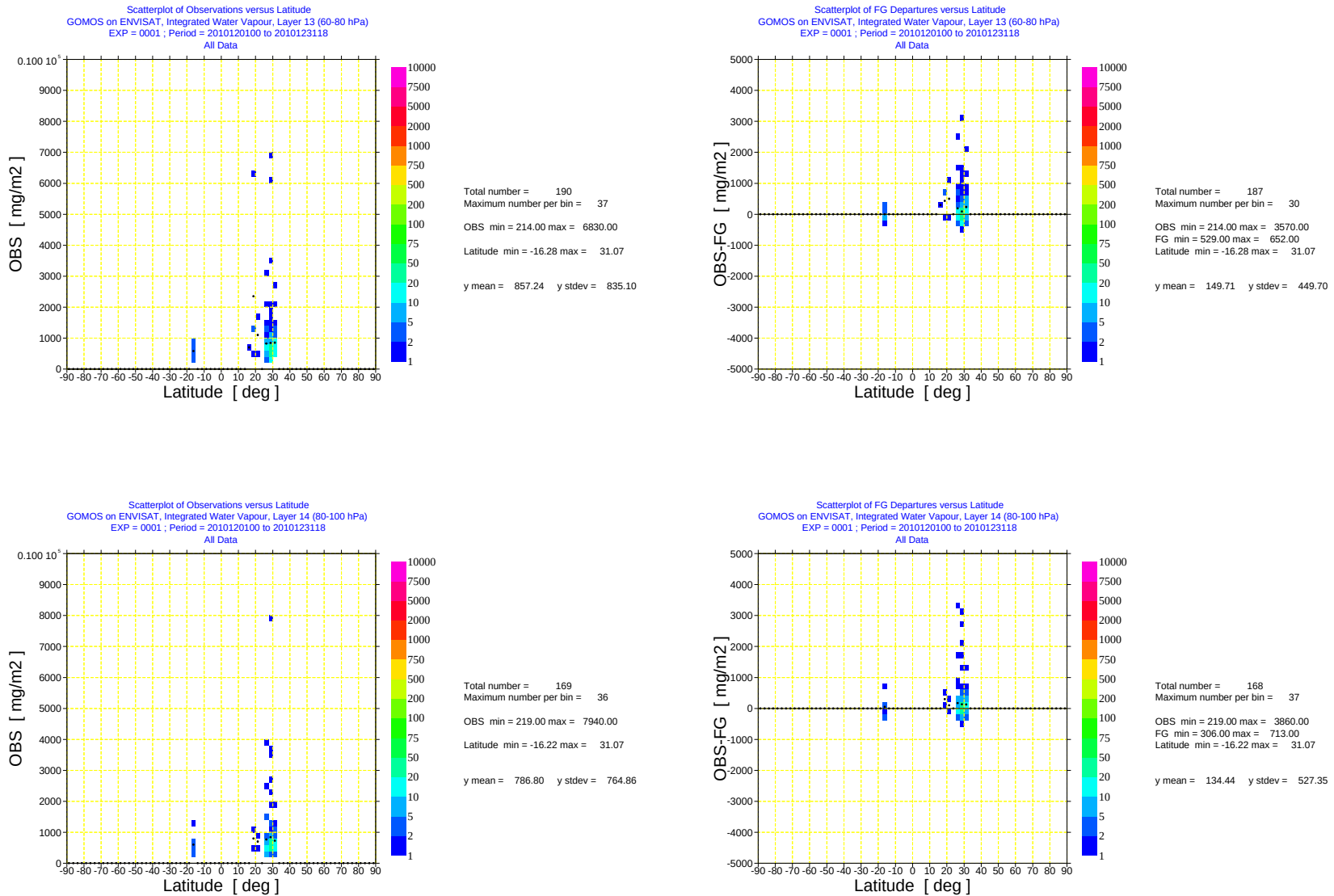


Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

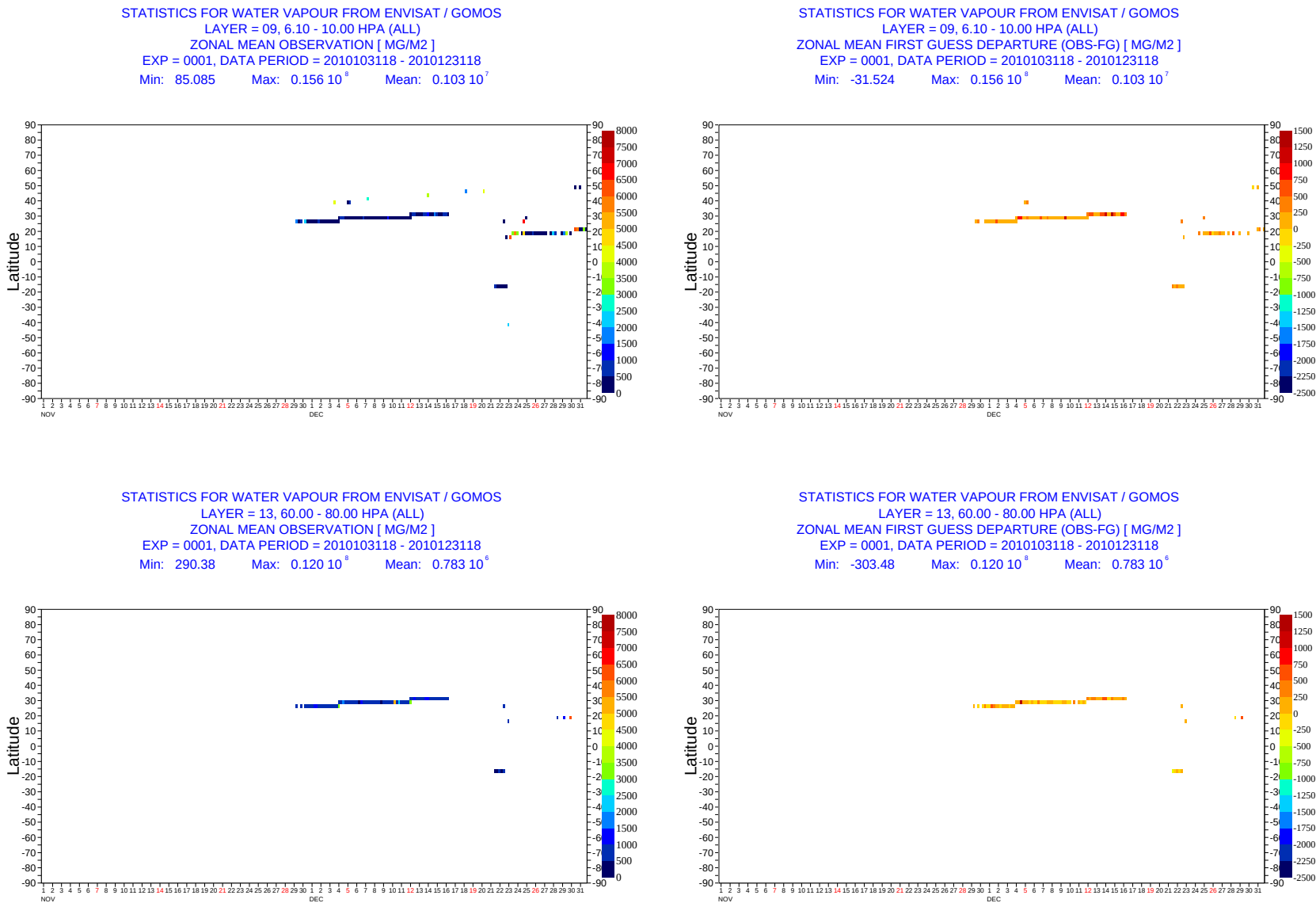


Fig. 10. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for November-December 2010.

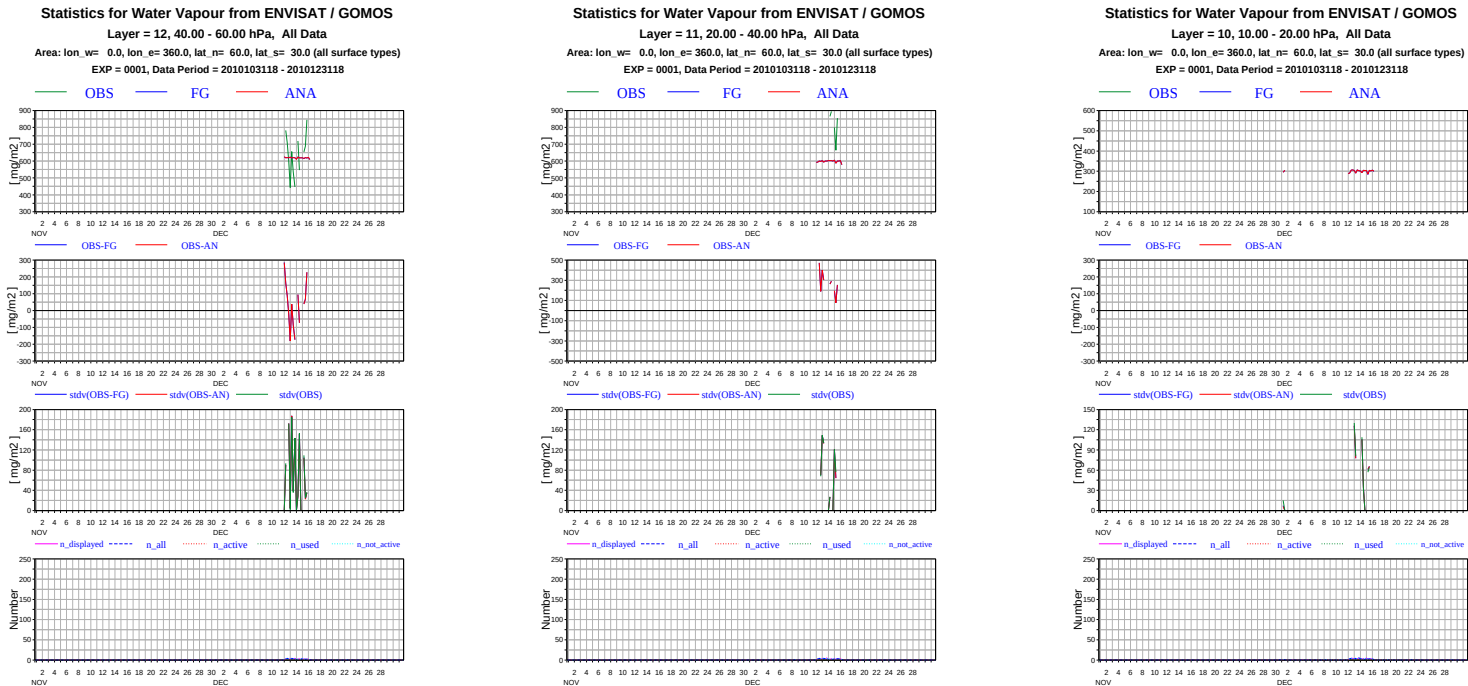


Fig. 11. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer level 10 (10-20 hPa), 11 (20-40 hPa), level 12 (40-60 hPa) in the latitudinal band 30-60N for the period November-December 2010.