

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

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September 8, 2010

1. Key points for August 2010

- The volume of GOMOS observations available in August 2010 showed an increase of about 40% in temperature and water vapour, and an increase of 50% in ozone compared with the data volume disseminated in July 2010.
- The stratospheric mean temperature first-guess and analysis residuals were typically within -1 and +1% (-2 to +2K) depending on the latitudinal band. The mesospheric mean temperature departures were typically within -2 and -7% (within -4 and -14K). The mean standard deviation of the first-guess and analysis departures were within 1 and 5% at all levels and latitudes.
- The ozone first guess and analysis departures were typically between -10 and +20% at most levels and latitudinal bands. Larger first guess and analysis departures (>50% in places) were found in the lower stratosphere and in the upper mesosphere. The standard deviations of the departures were larger than 10% at all levels and latitudinal bands.
- 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. Improvements were found at high latitudes in the SH compared with July 2010, where the differences between the GOMOS observations and their model equivalent were about one order of magnitude.
- The monitoring statistics for August were produced with the operational ECMWF model, CY36R2.

2. Quality and amount of received data

Data coverage and amount of received data during August 2010 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Overall, up to 2713 (good) observations were available for temperature, 2563 data were available for ozone and up to 813 (good) observations were delivered for water vapour. This represents an increase of about 40% in the amount of temperature and water vapour data and an increase of 50% in the amount of ozone compared with July 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 mid and high latitudes in the northern hemisphere. Only a small amount of water vapour data was sampled at some levels particularly in the tropics, so that here the results might not be statistically significant. Nonetheless they are summarized below for completeness.

3. GOMOS temperature data

The quality of the temperature data in the GOMOS BUFR files was stable in August 2010 and consistent with that discussed in July 2010. The monitoring statistics showed that in the global mean and in the average over the mid and high latitudes in the SH (temperature report: Figures 3, 5 and 6) the stratospheric first-guess and analysis departures were positive up to +1% (about +2K) below 20 hPa and negative up to -1% (-2K) in the rest of the stratosphere. In the mesosphere, the temperature departures averaged over the mid and high latitudes were typically negative and within -2 and -7% (from -4 to -14K). In the tropics (temperature report: Figure 4), the stratospheric first-guess and analysis departures were generally negative and about -0.5% (-1K). Larger departures up to -4% (-8K) were found in the tropical mesosphere. The mean standard deviation of the first-guess and analysis departures were within 1 and 5% 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 ± 4 K 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

The quality of the GOMOS ozone profiles was found consistent with that reported in July 2010 in most of the stratosphere. 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 average, the first-guess departures were within -5 and +17% at most vertical levels in the stratosphere. In the tropics, the ozone residuals were within -3 and +10% for pressure levels smaller than 40hPa. Larger departures (>50% in places) were found in the lower tropical stratosphere. At mid and high latitudes in the SH, the first guess and analysis departures were within -10 and +20% at most levels in the stratosphere and mesosphere. The standard deviations of the analysis and first guess departures were larger than 10% at all levels and latitudinal bands, and larger than 50% in places.

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

GOMOS water vapour observations were mainly available at mid and high latitudes in the SH. At some levels in the tropics the data volume only was of a few units. Therefore the results at these levels, although summarised below, might not be statistically significant.

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 in the last few months. 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. Compared with the results reported in the past months, an higher level of agreement between the GOMOS water vapour retrievals and their model equivalent was found at most stratospheric levels at high latitudes in the SH, where the water vapour residuals were typically about one order of magnitude or less.

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 (CY36R2). 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 AUGUST 2010

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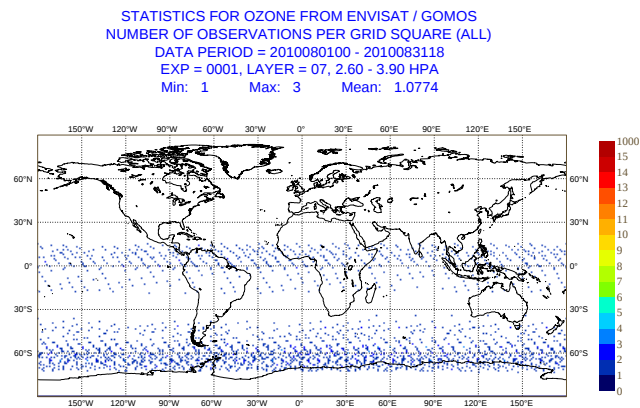


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for August 2010.

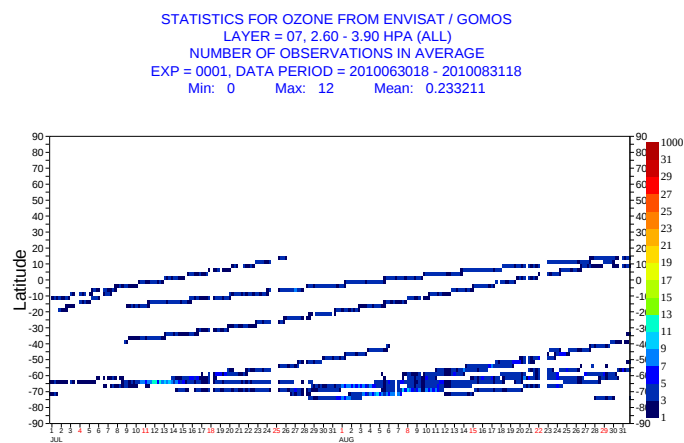


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for July-August 2010.

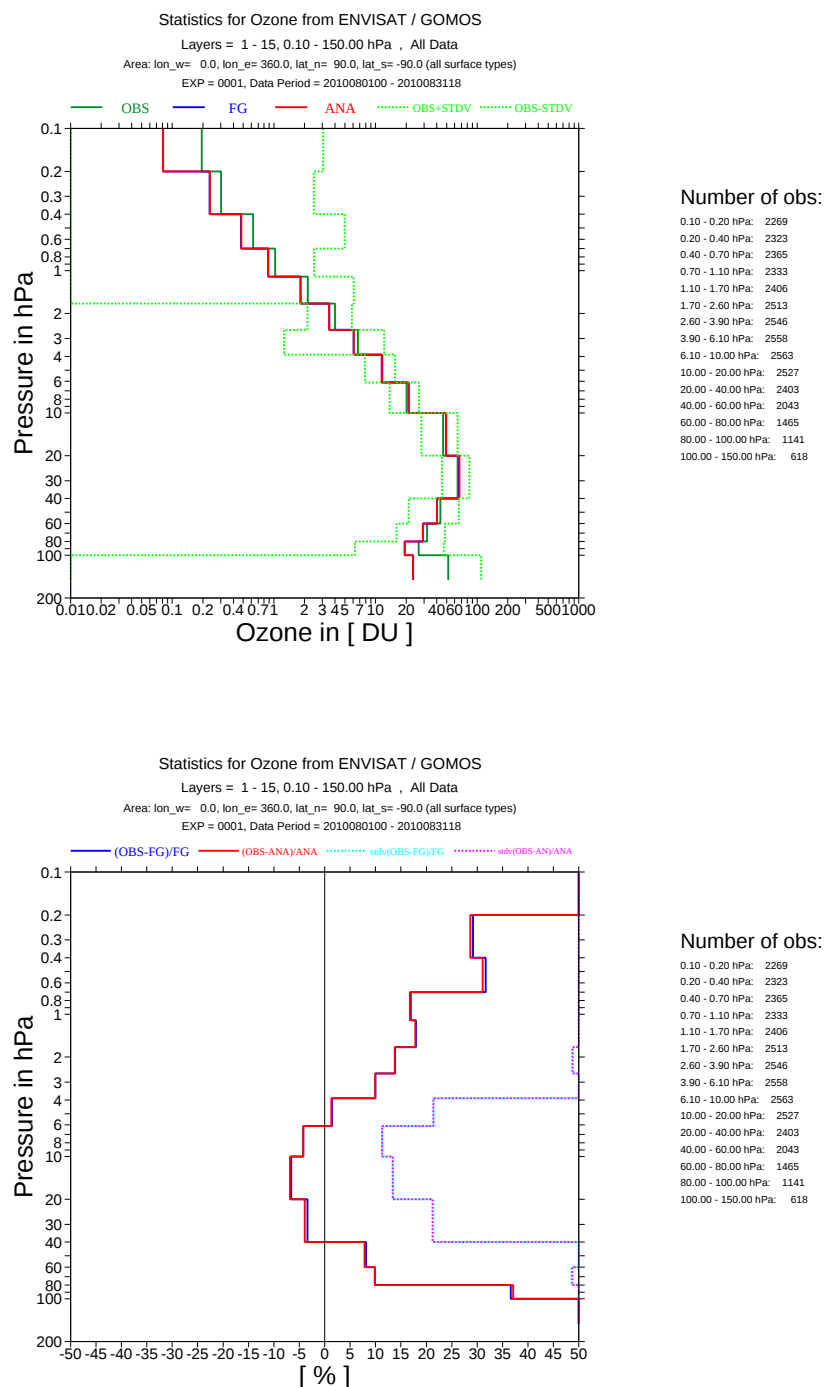


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for August 2010 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) $\pm$ 1 standard deviation (green dotted lines). The 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.

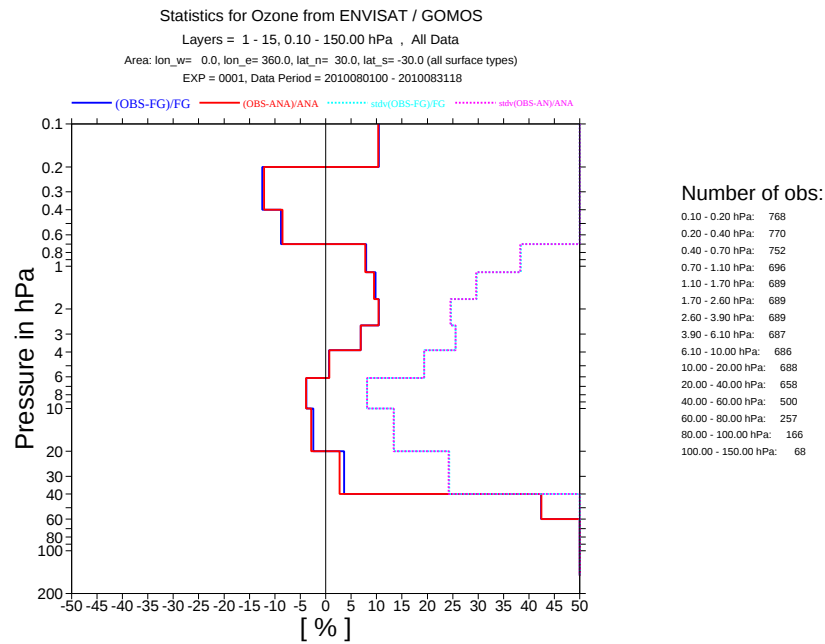
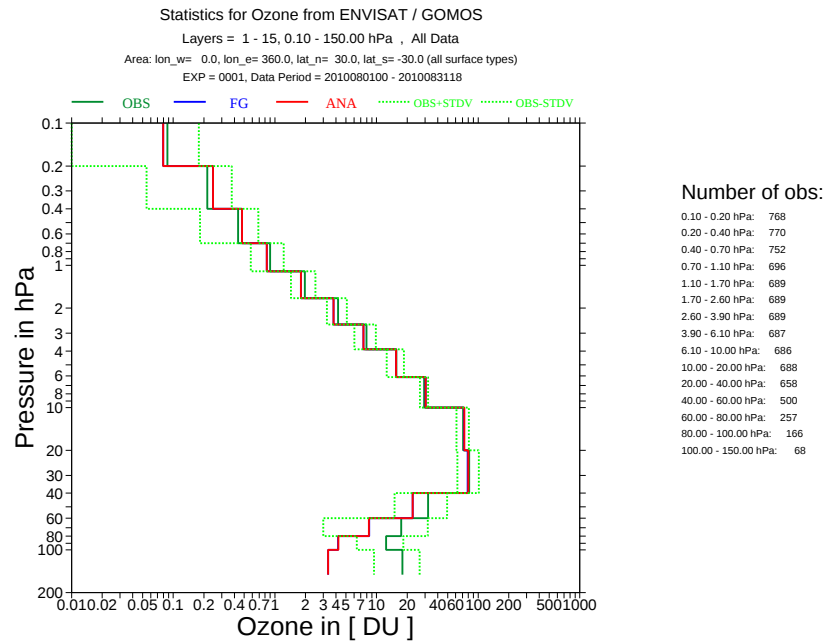


Fig. 4. As Fig. 3 but for 30N-30S.

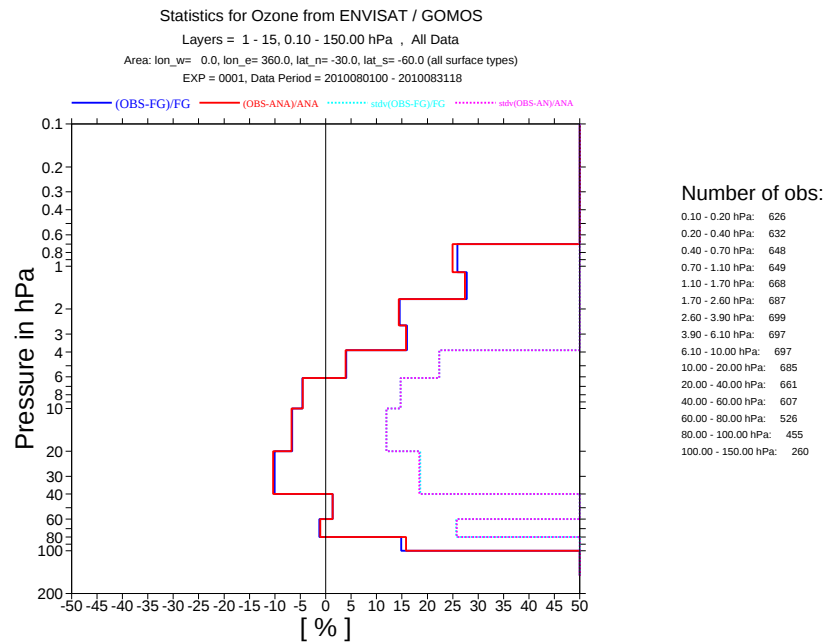
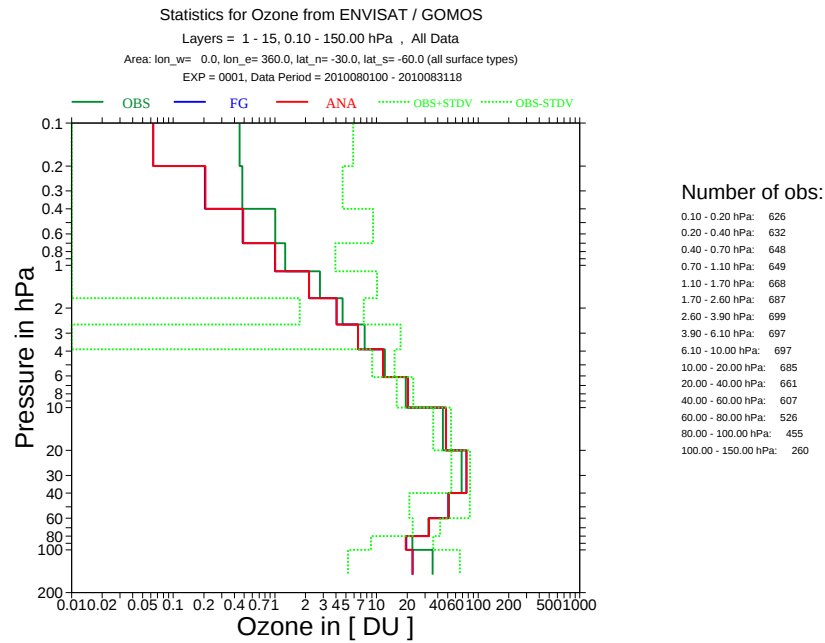


Fig. 5. As Fig. 3 but for 30S-60S.

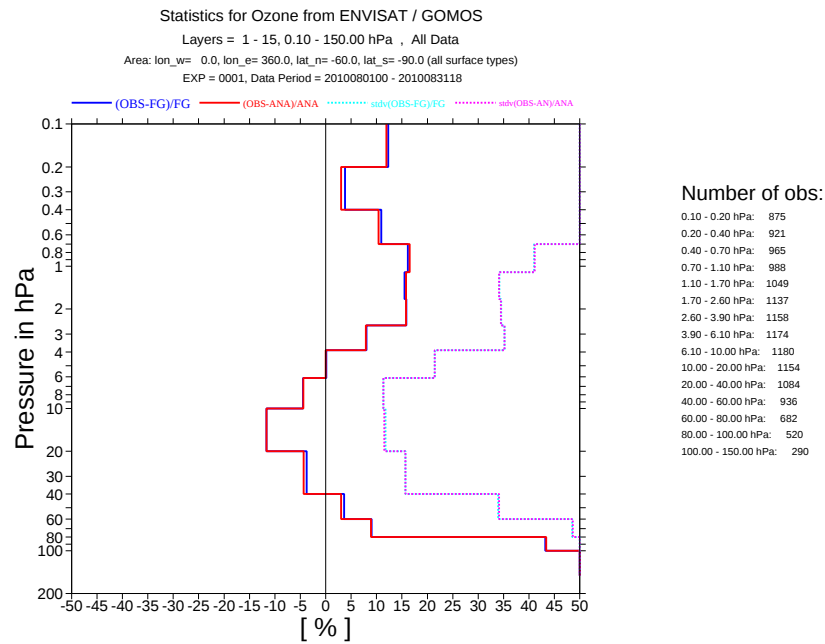
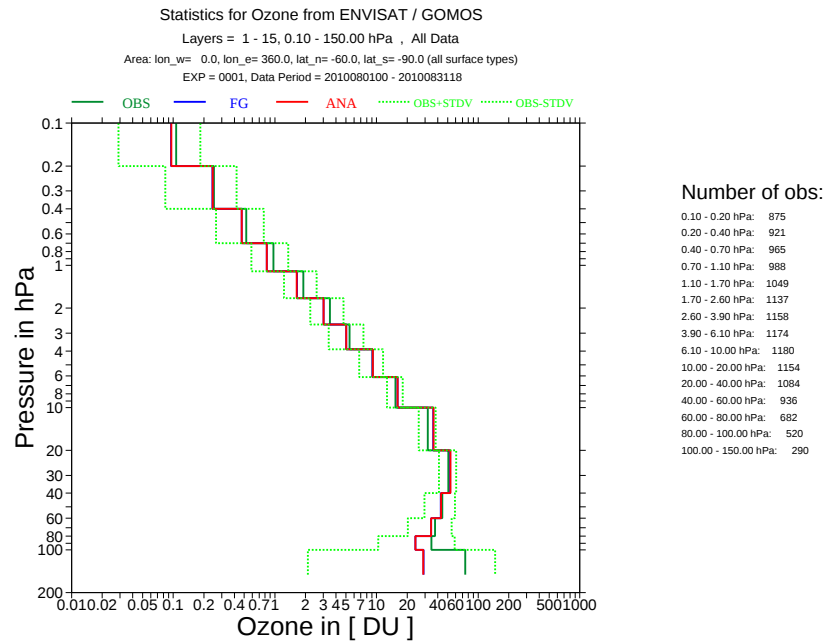


Fig. 6. As Fig. 3 but for 60-90S.

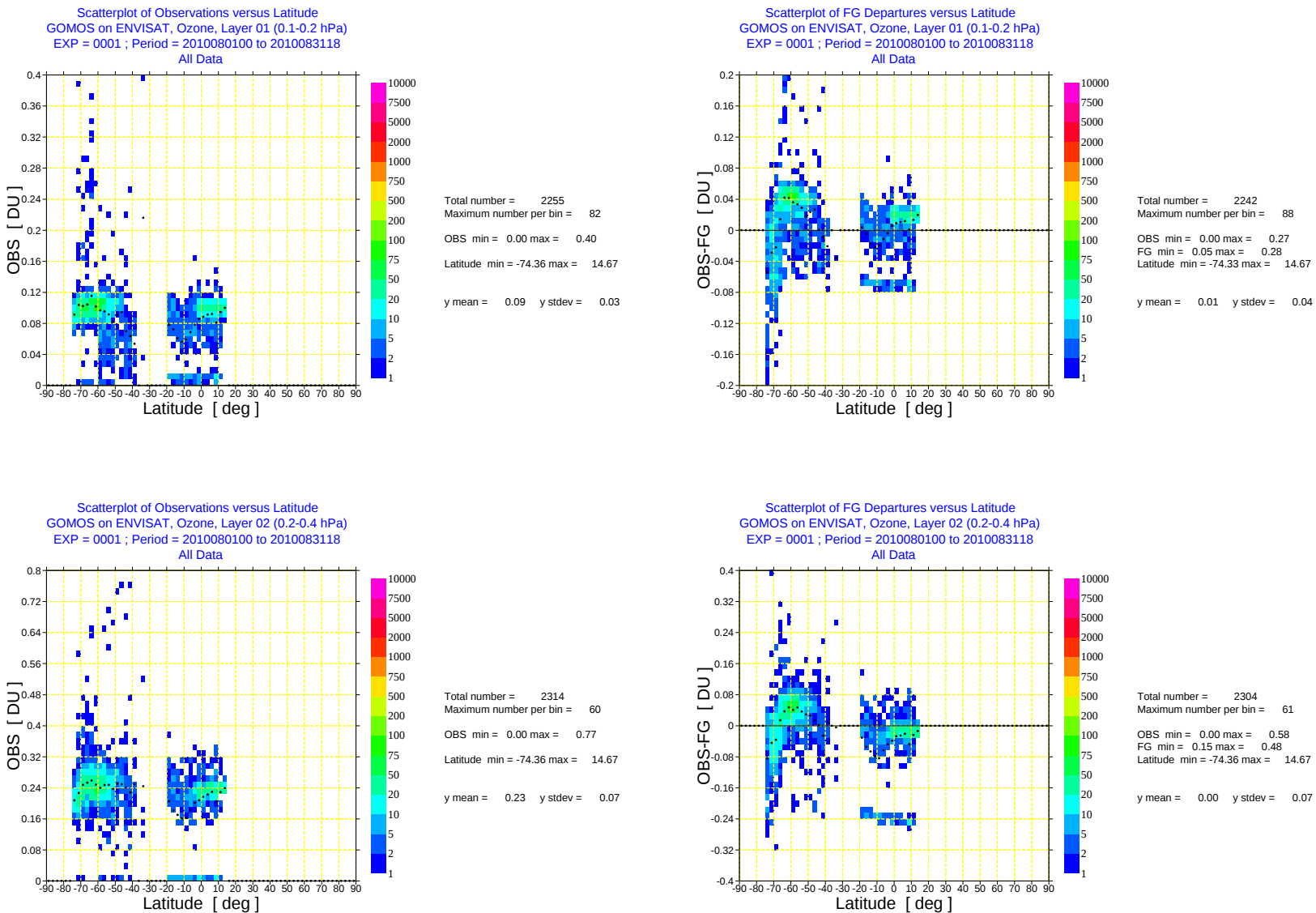


Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for August 2010 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black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

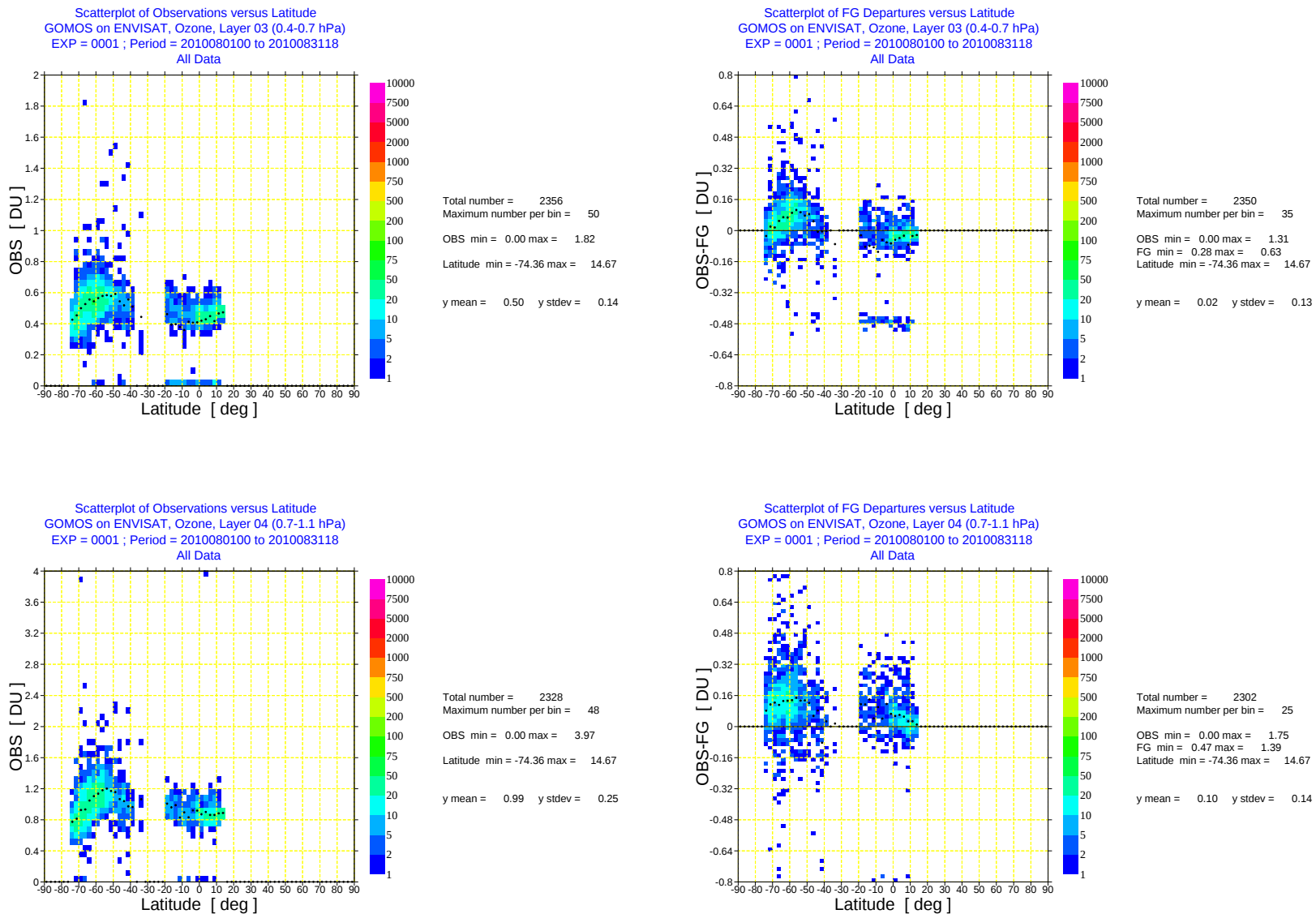


Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

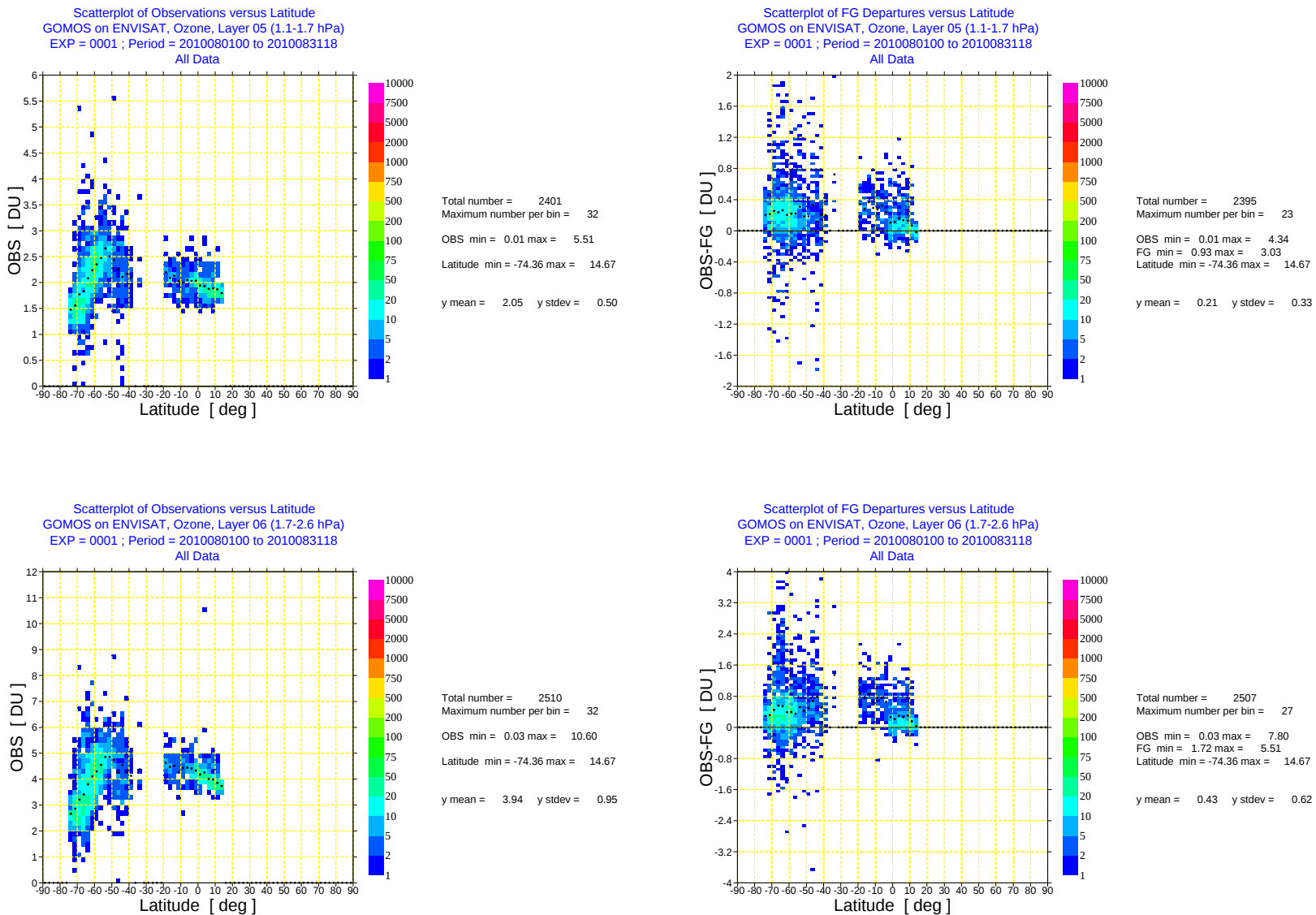


Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

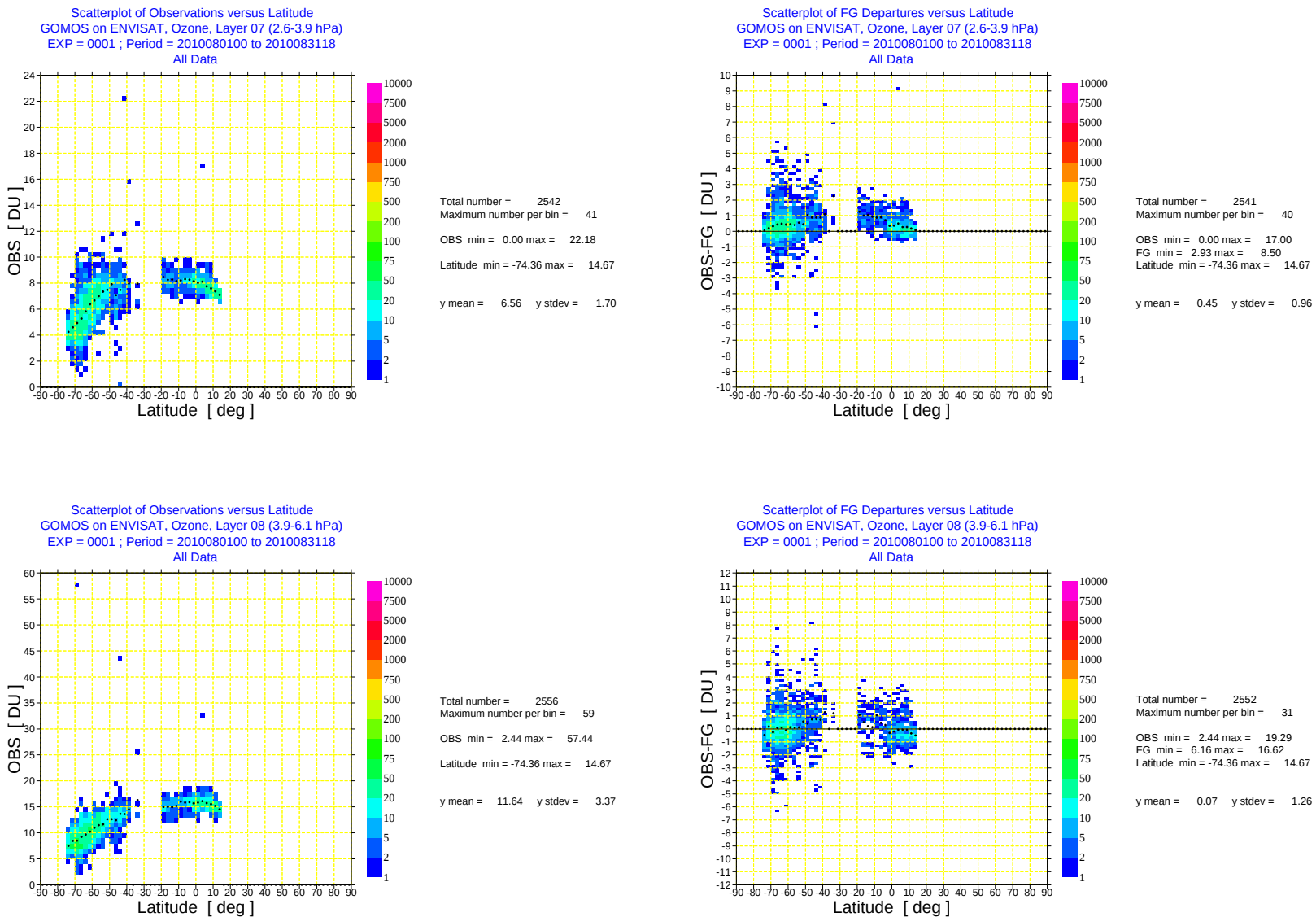


Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

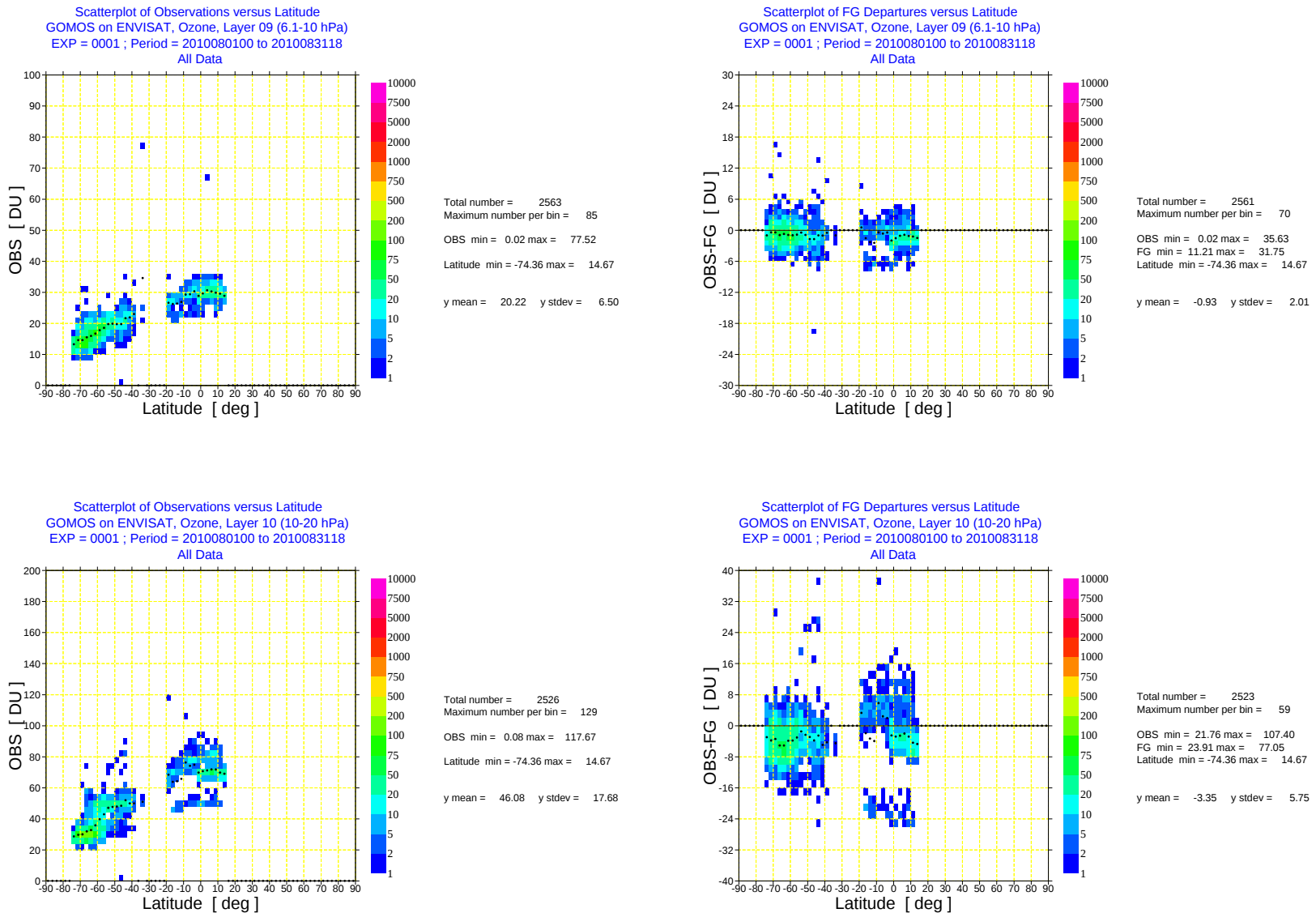


Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

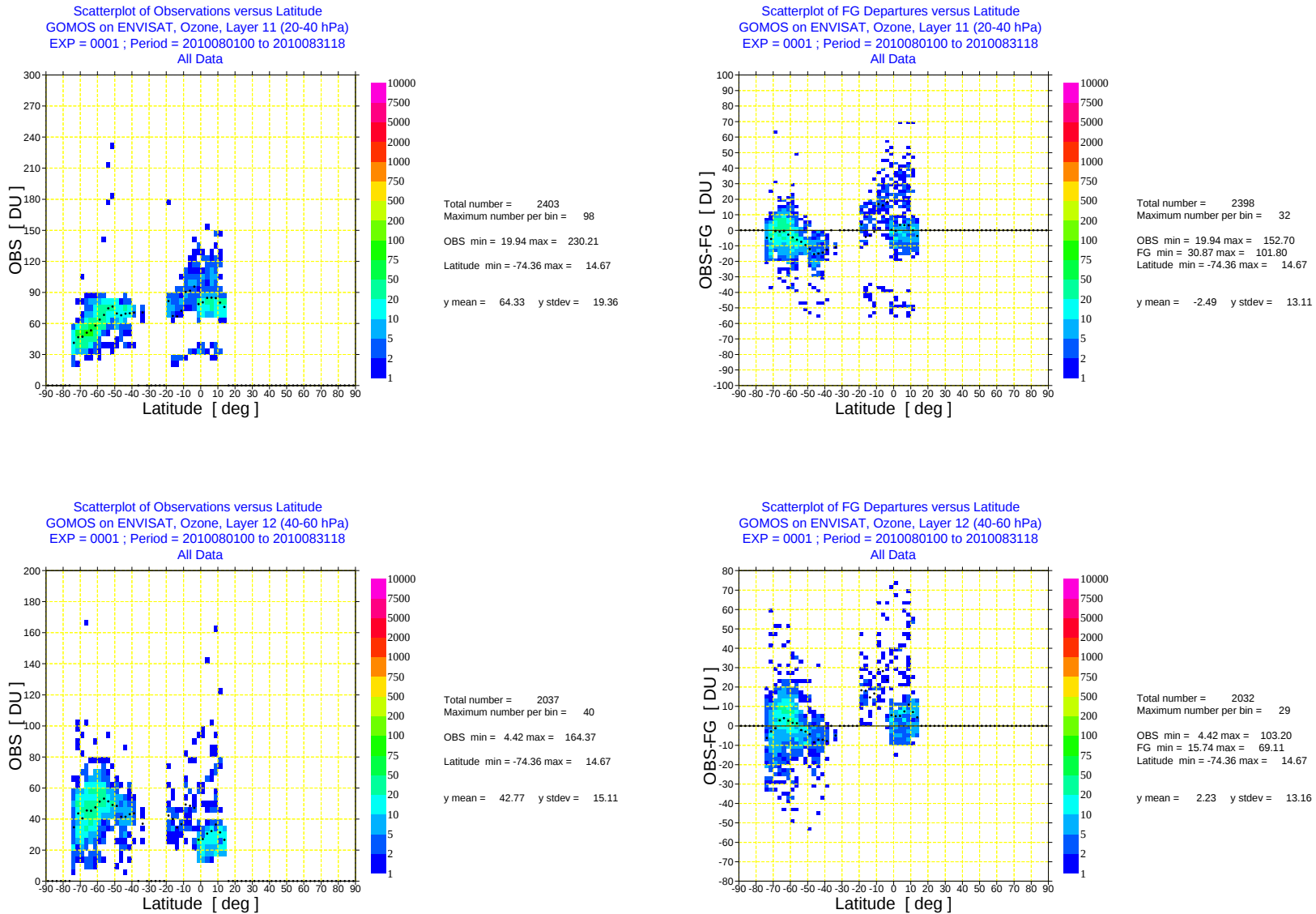


Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

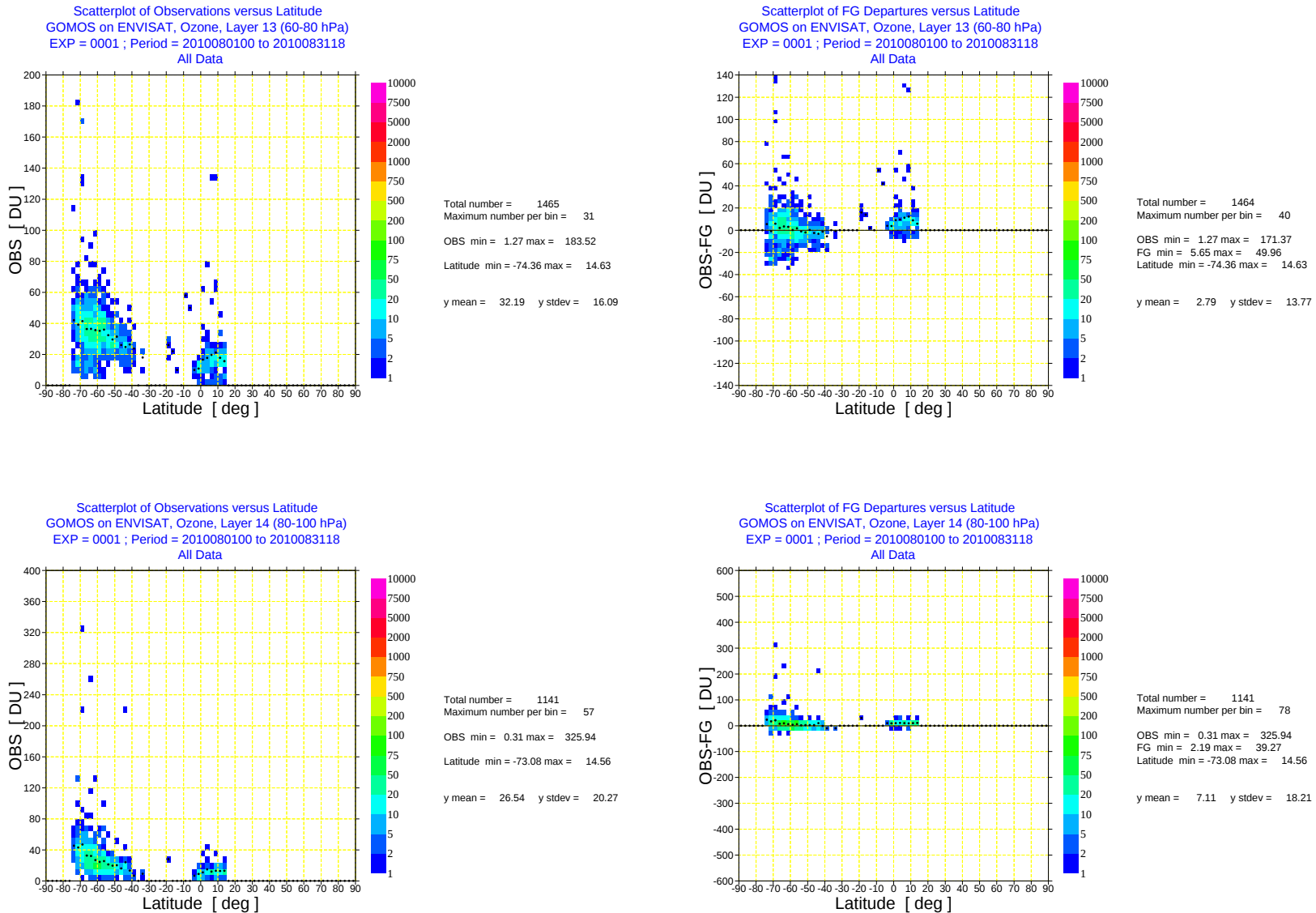


Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

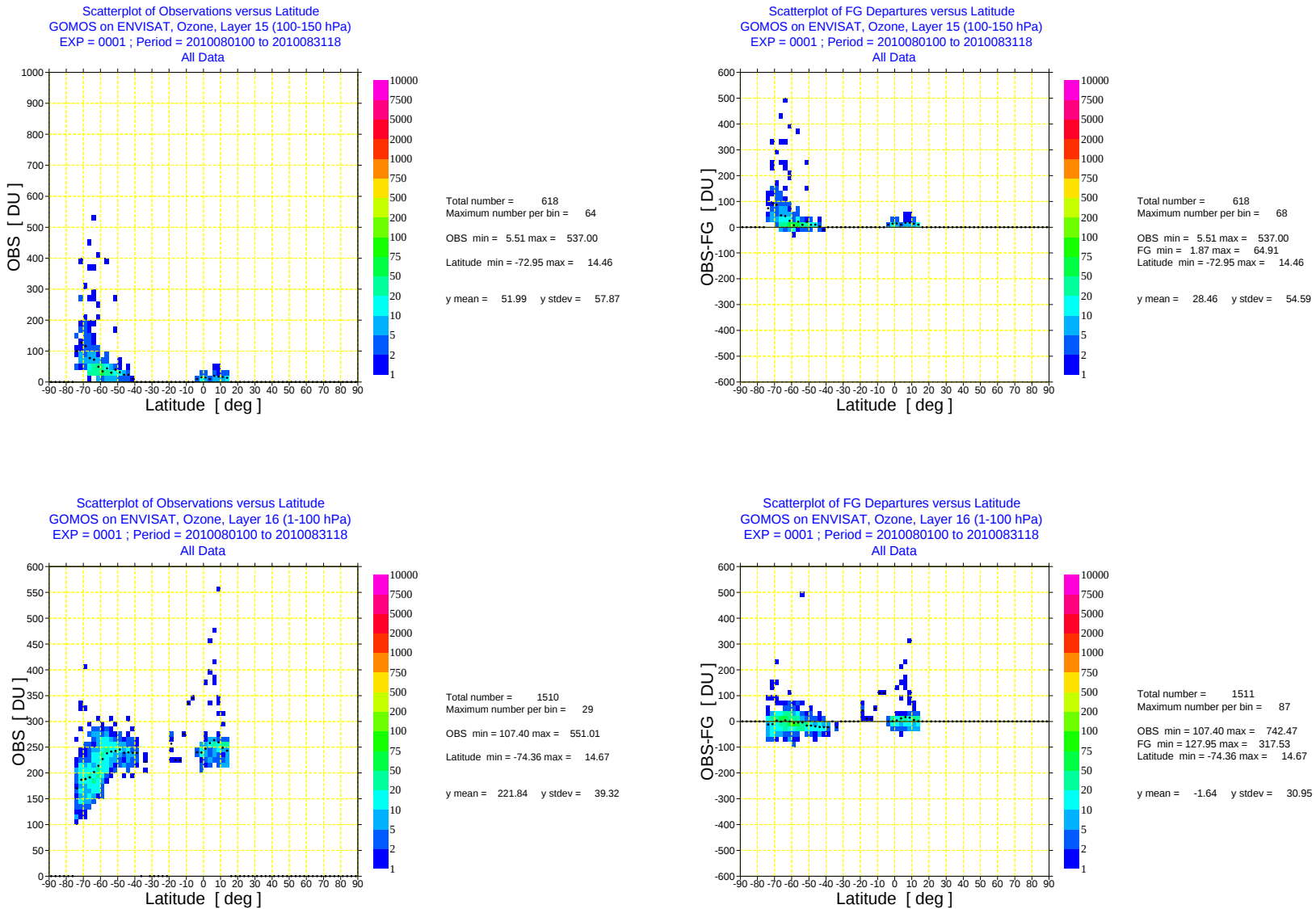


Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

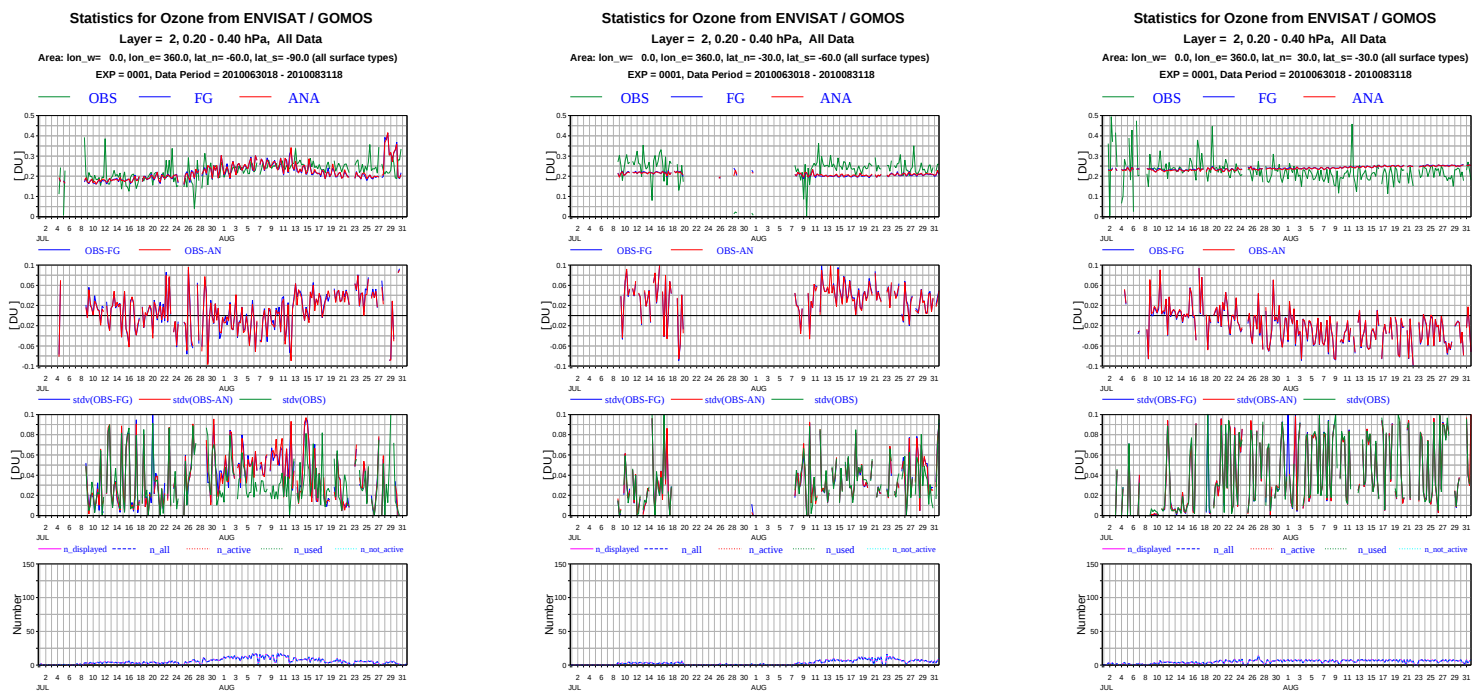


Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for the period July-August 2010.

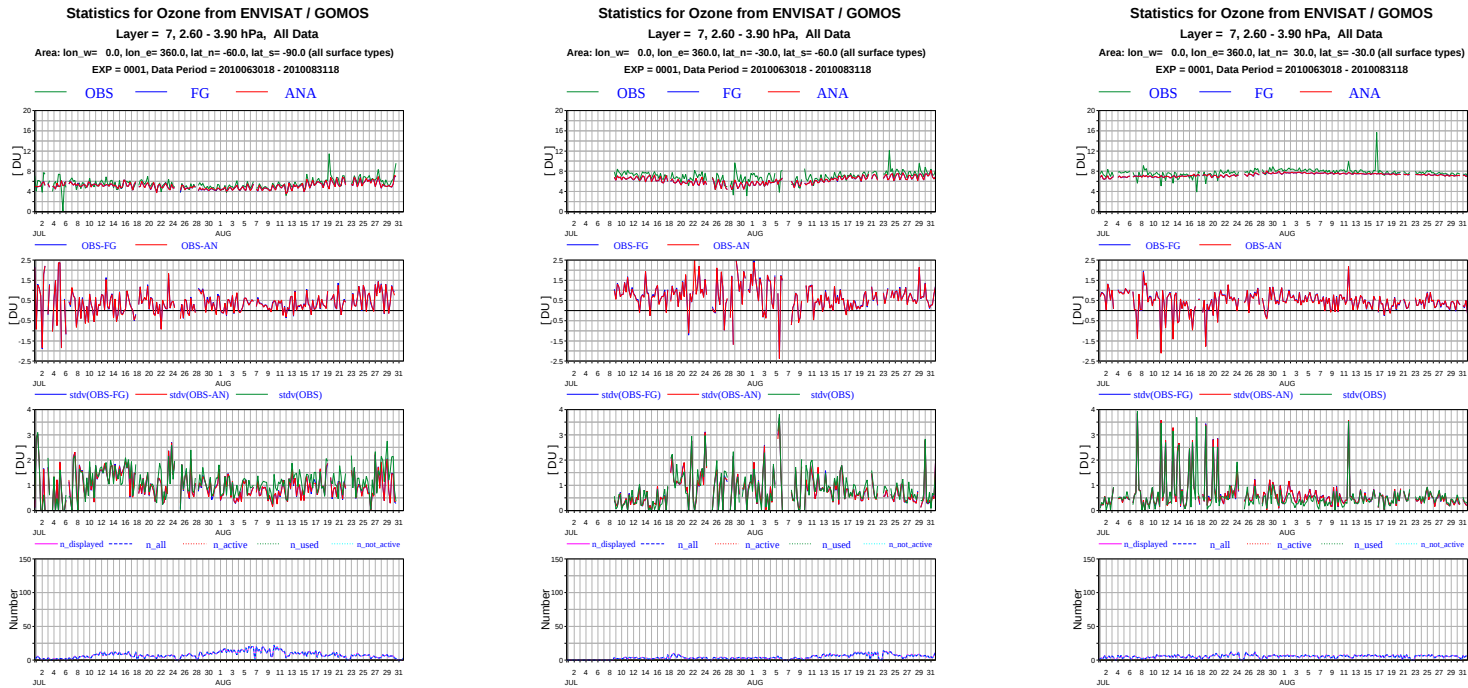


Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

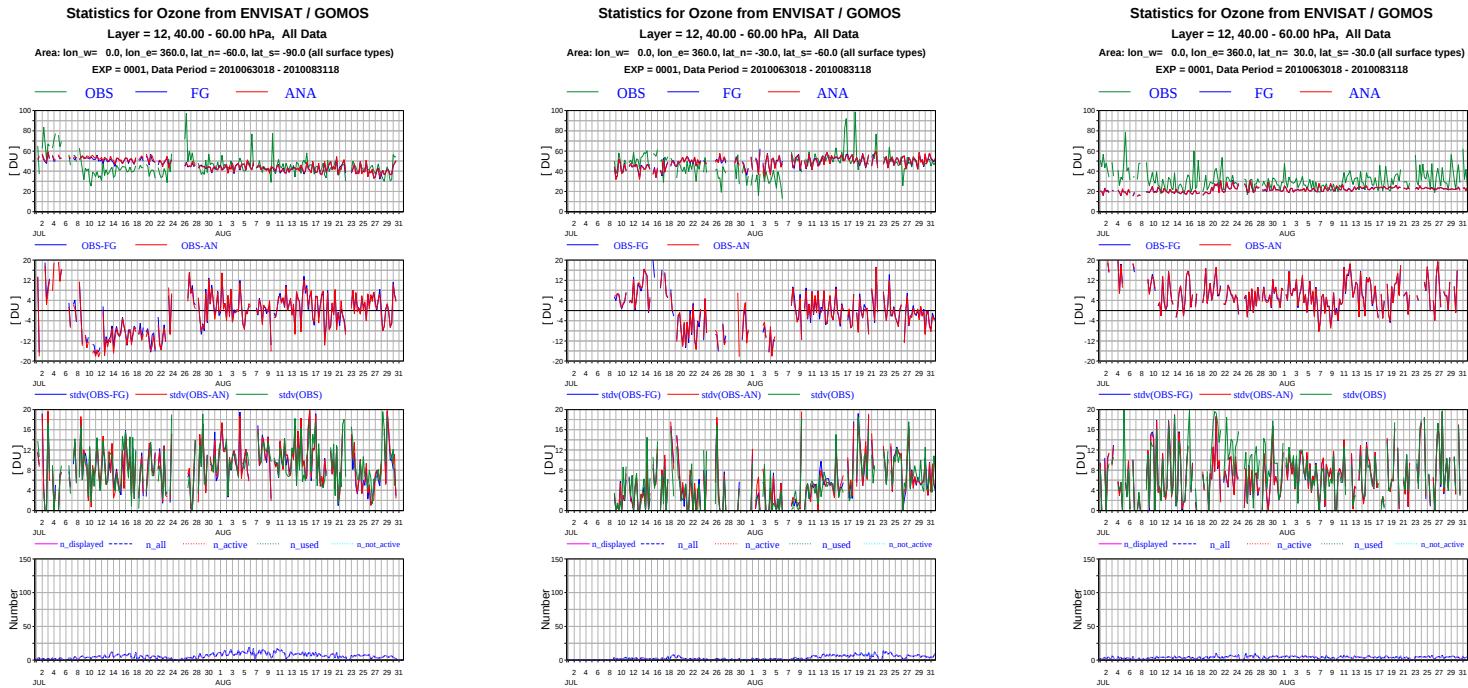


Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

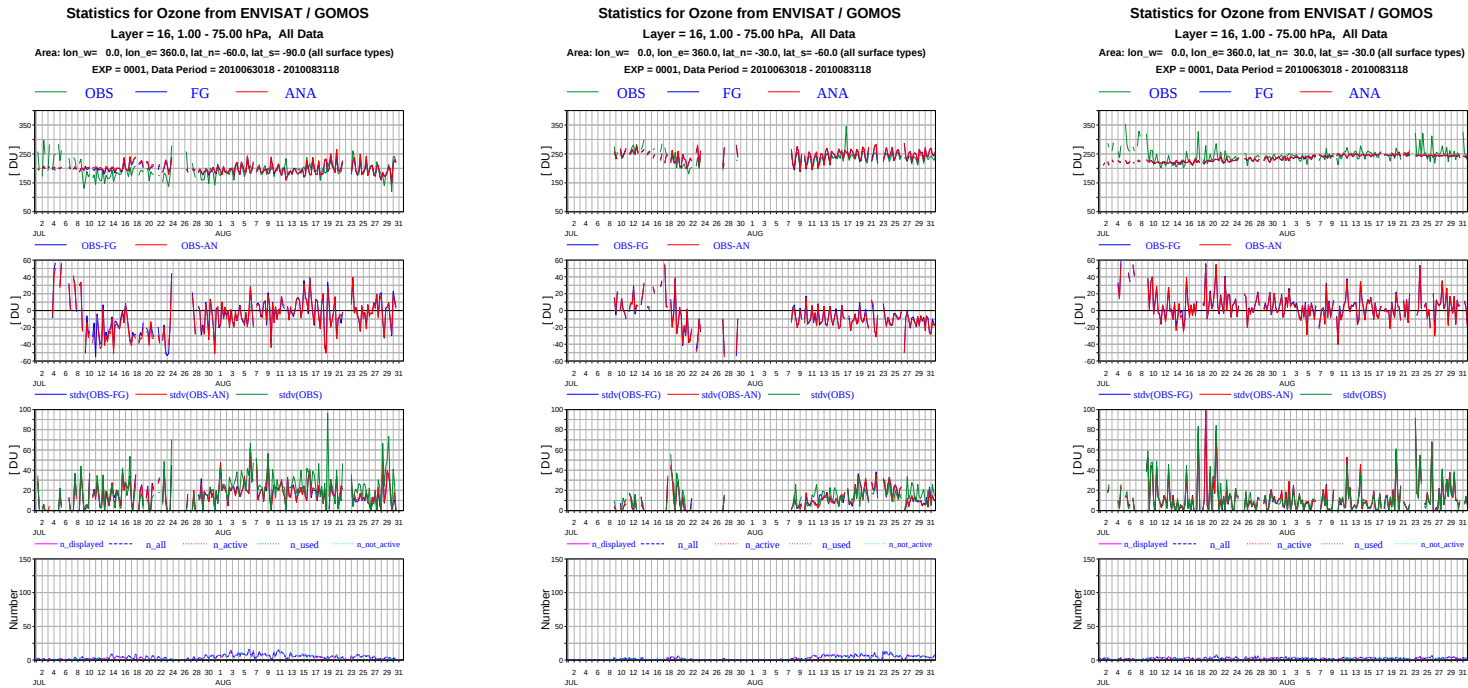


Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

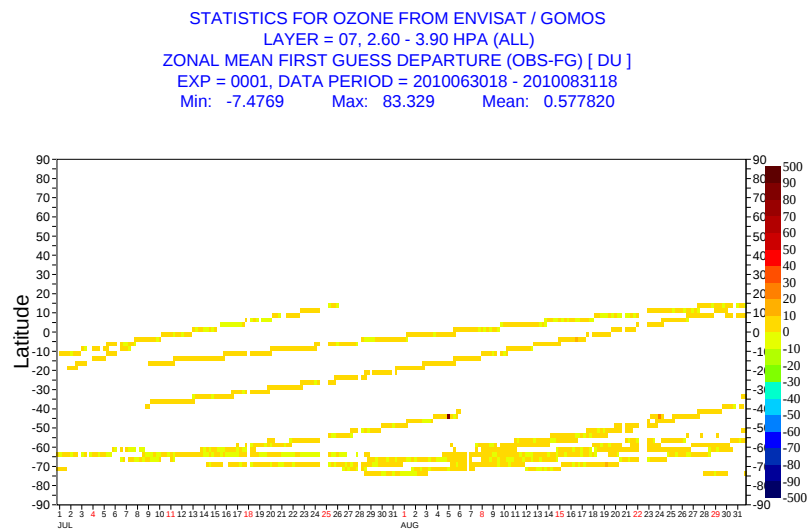
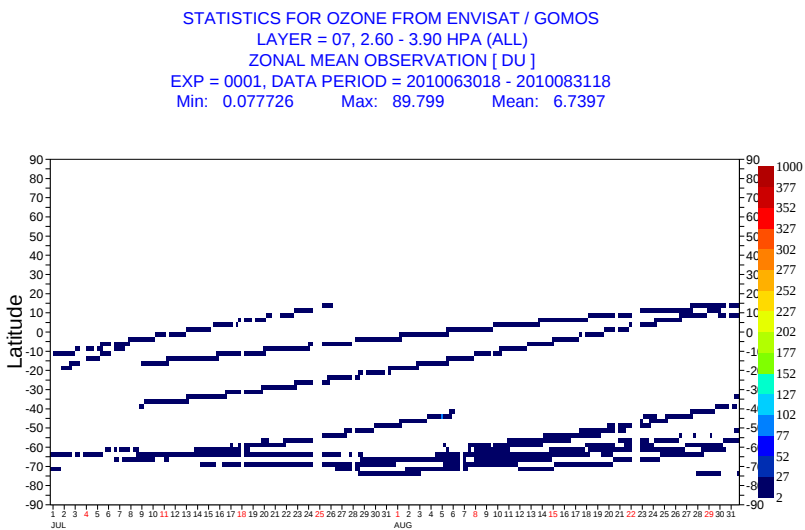
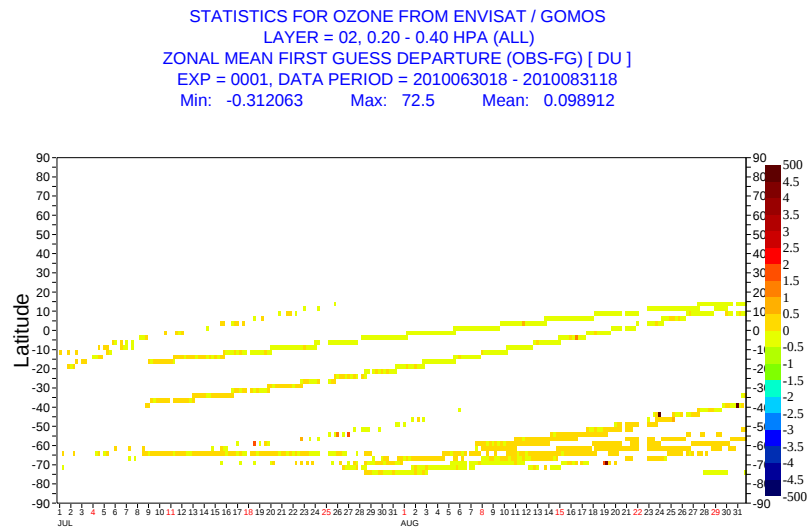
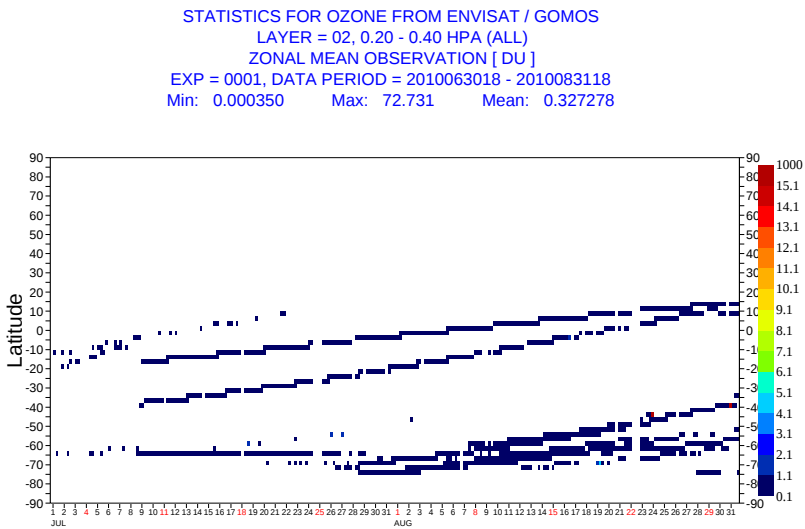


Fig. 19. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for July-August 2010 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

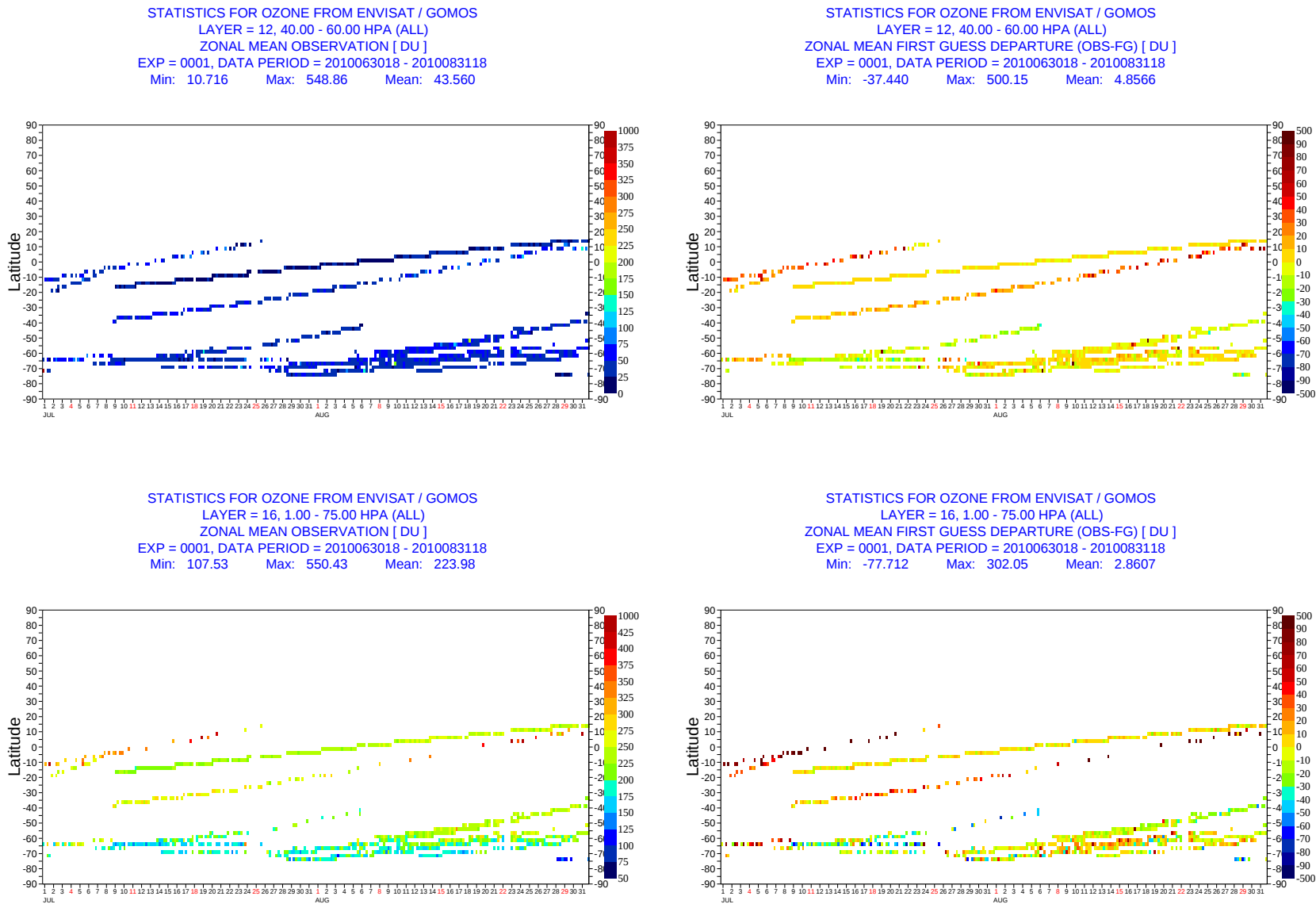


Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

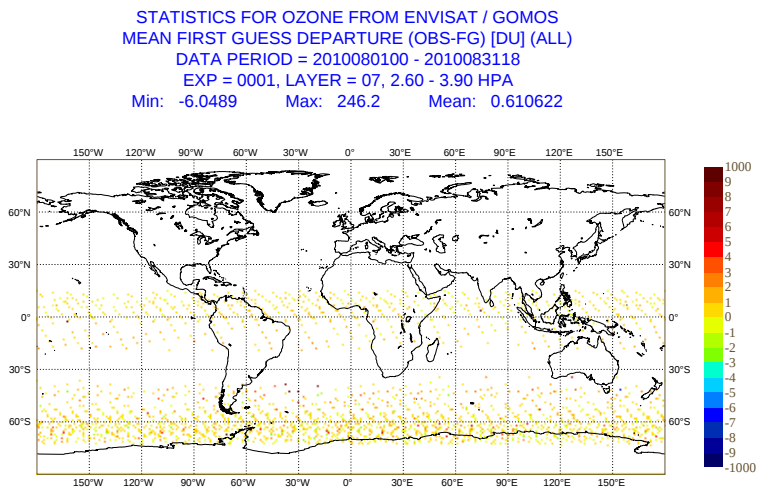
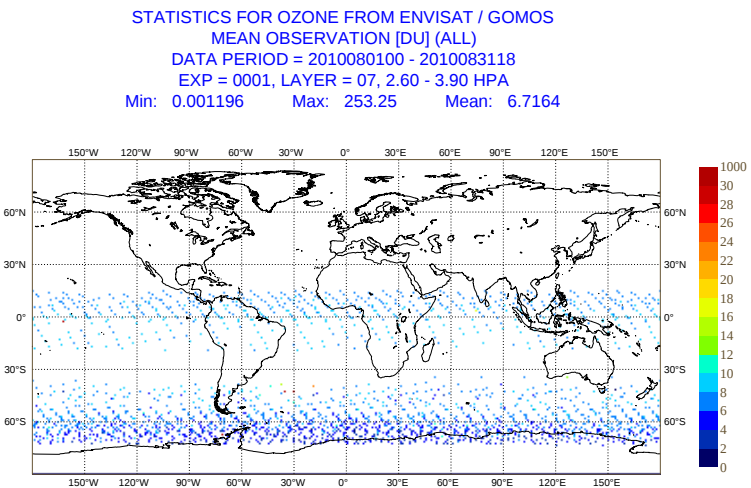
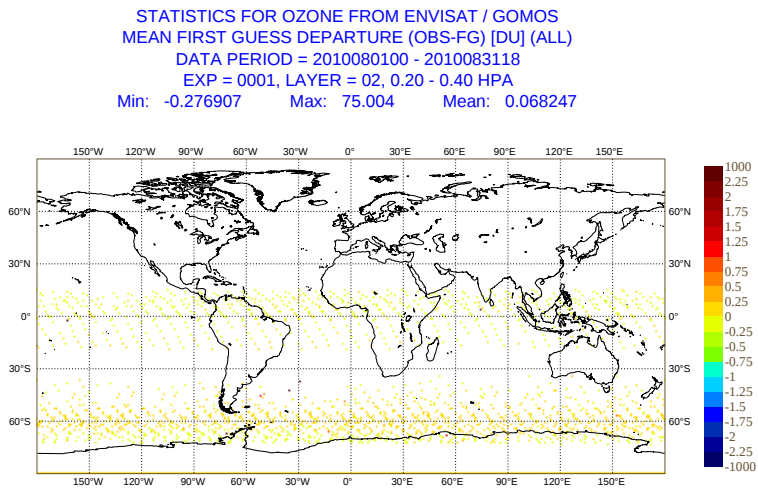
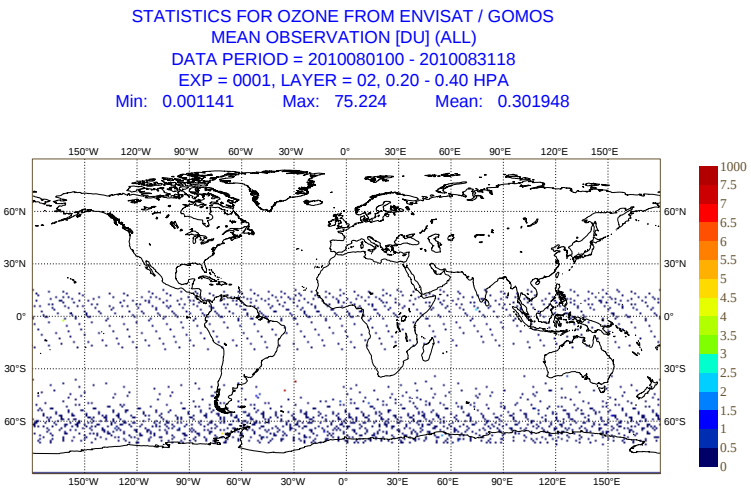


Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for August 2010 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

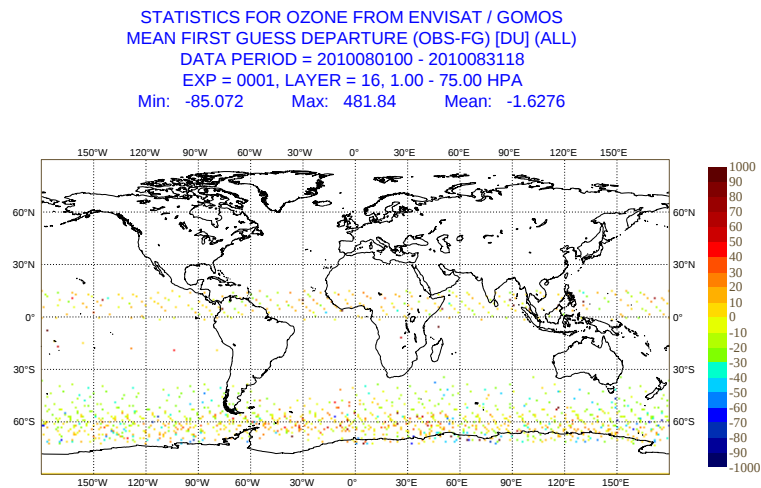
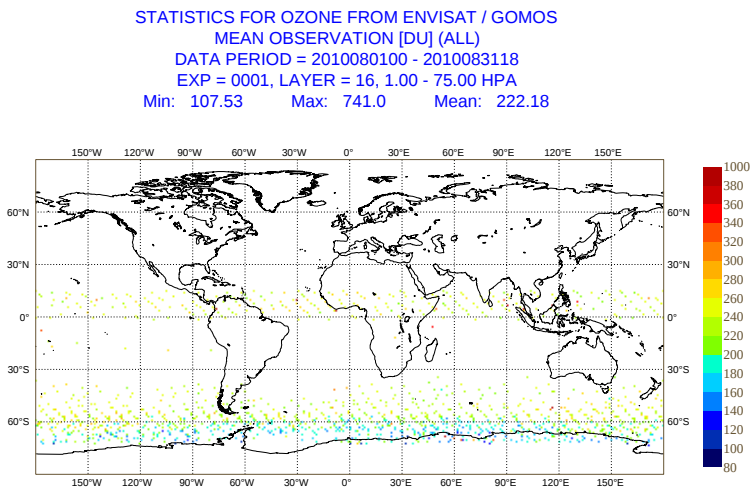
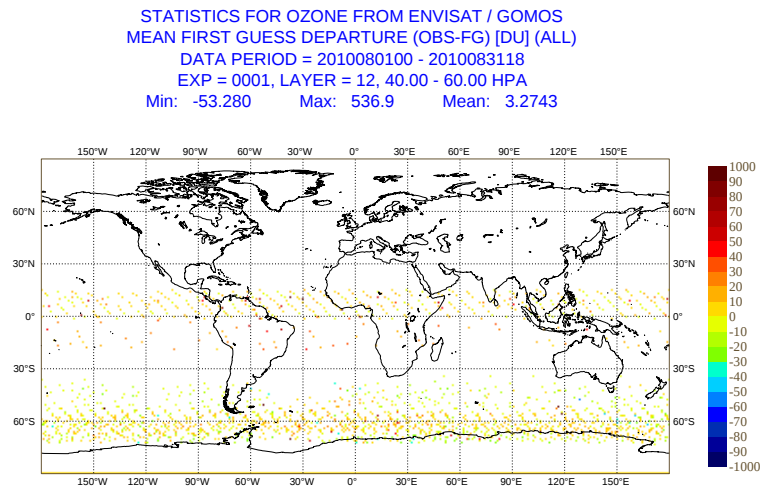
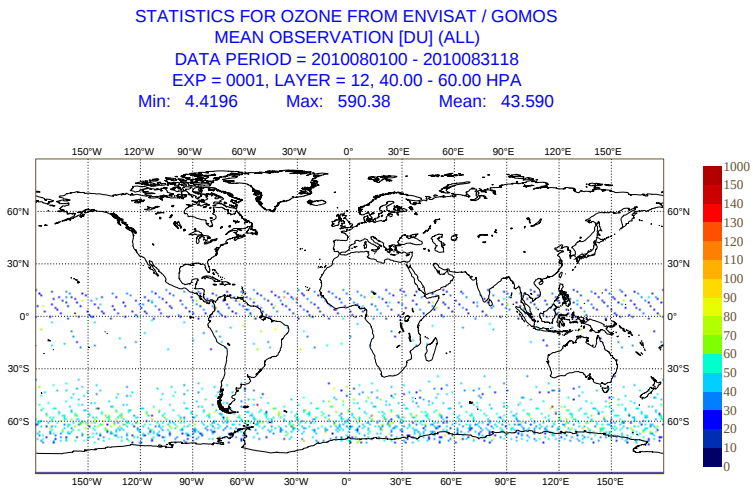


Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

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

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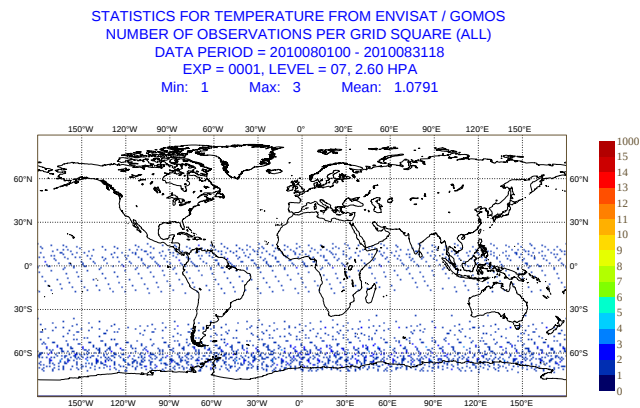


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for August 2010.

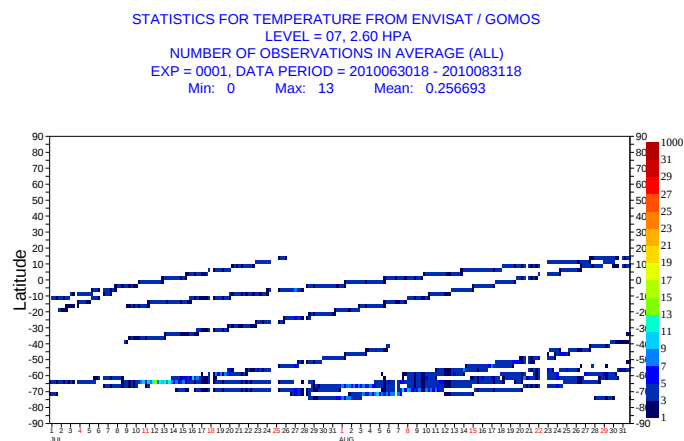


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for July-August 2010.

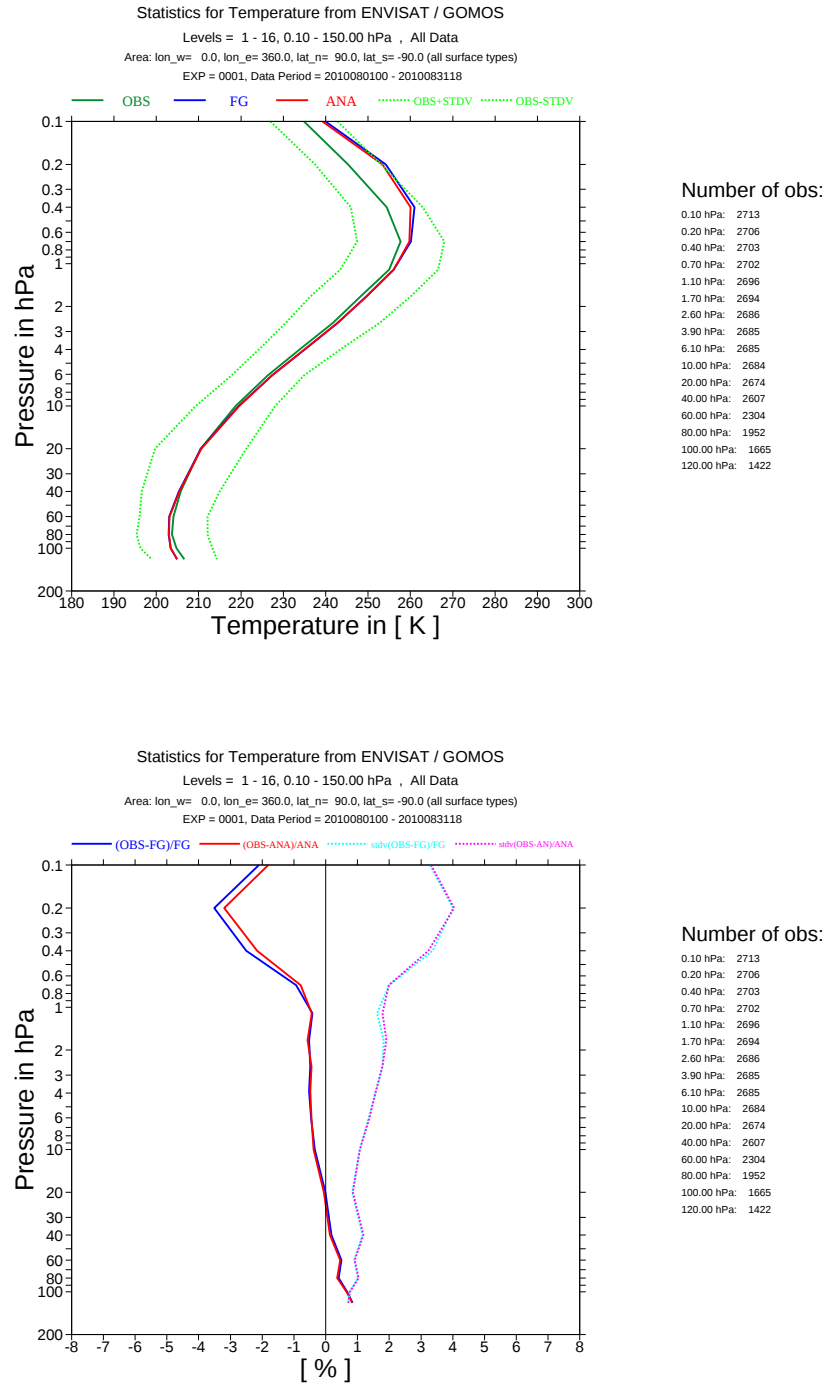


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for August 2010 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation $\pm$ 1 standard deviation (green dotted lines). The 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.

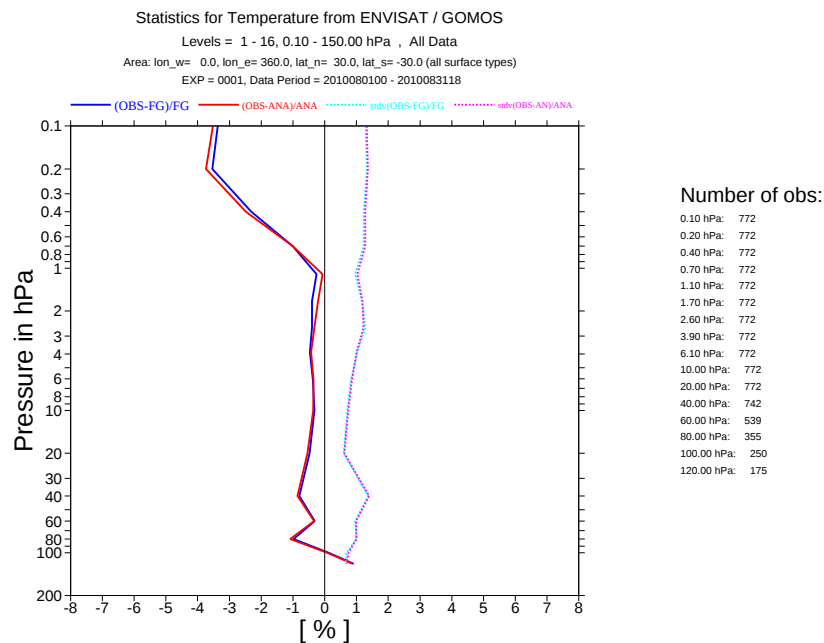
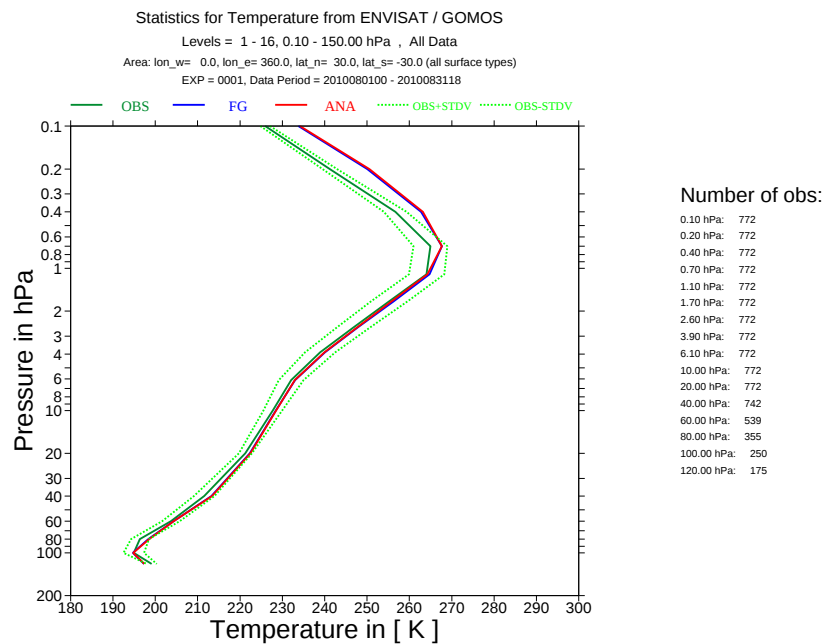


Fig. 4. As Fig. 3 but for 30N-30S.

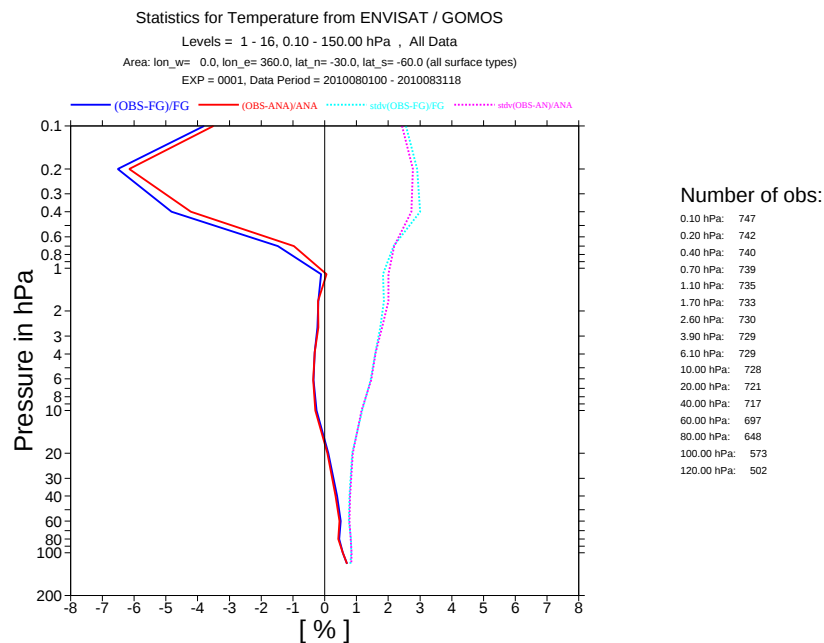
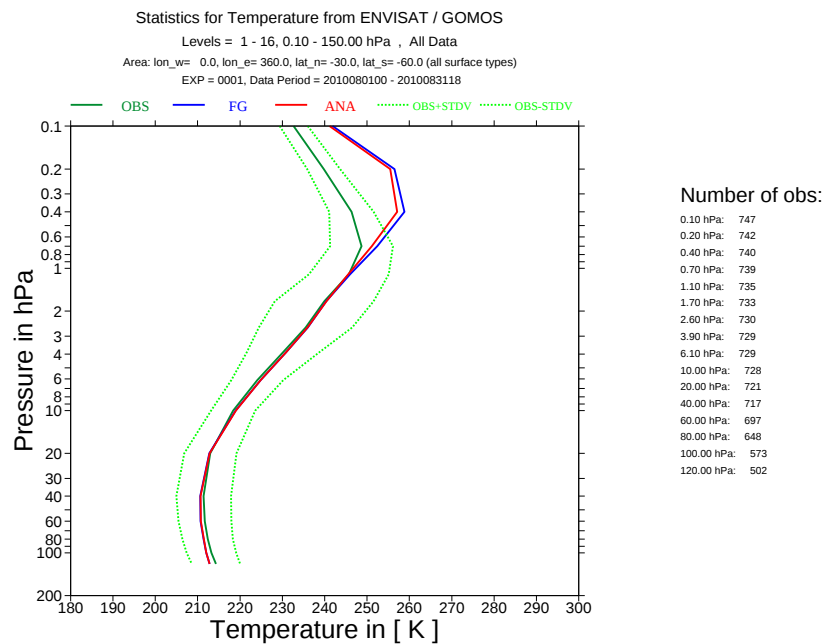


Fig. 5. As Fig. 3 but for 30-60S.

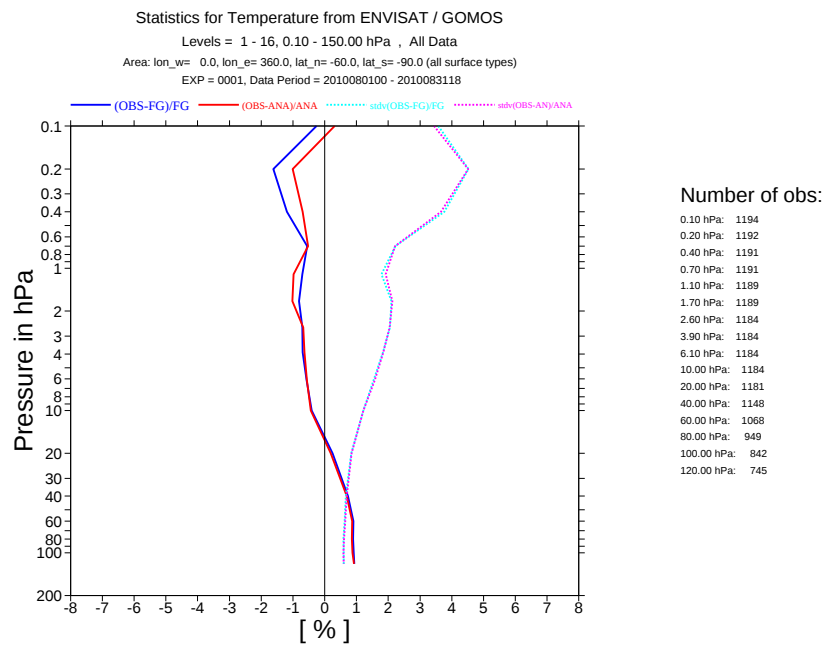
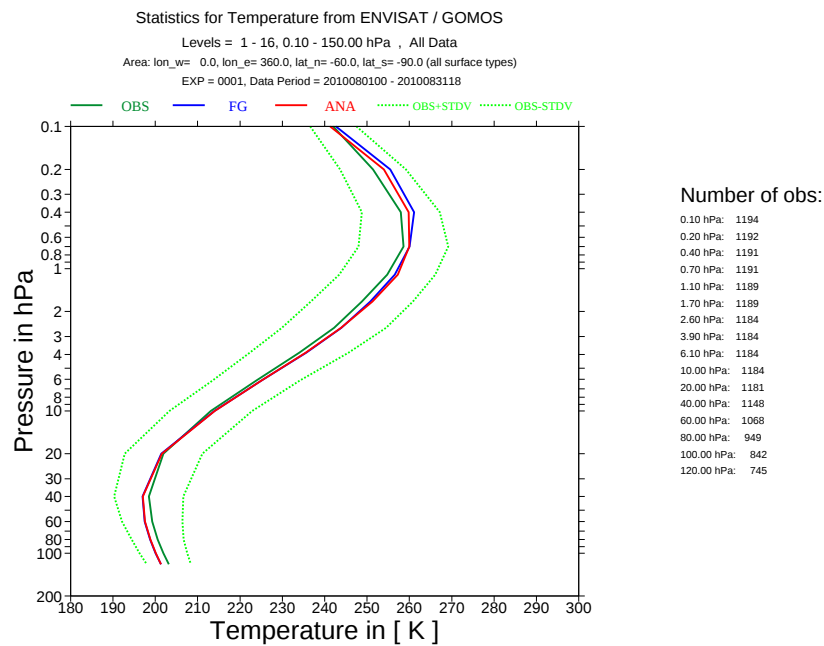


Fig. 6. As Fig. 3 but for 60-90S.

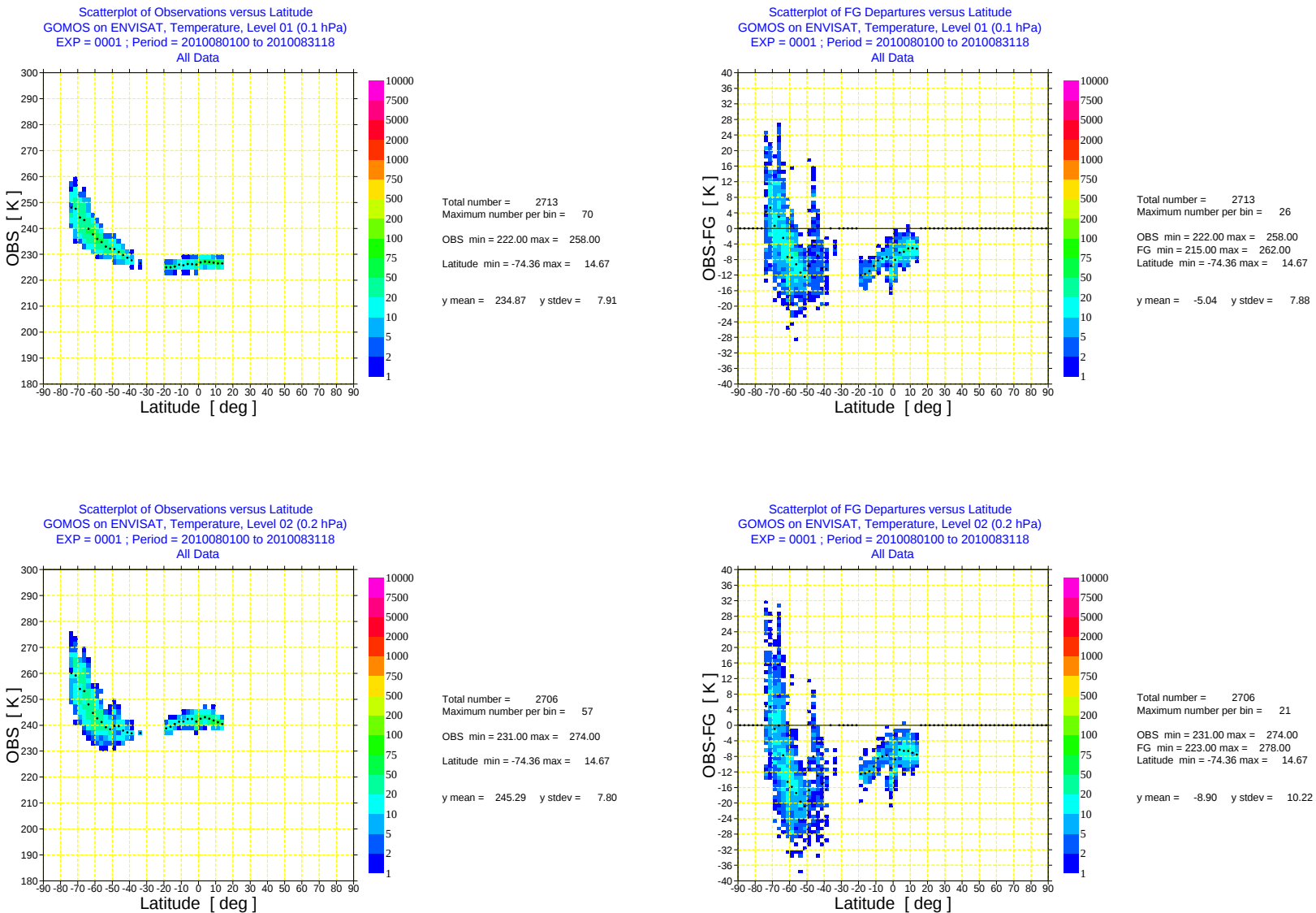


Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for August 2010 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the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

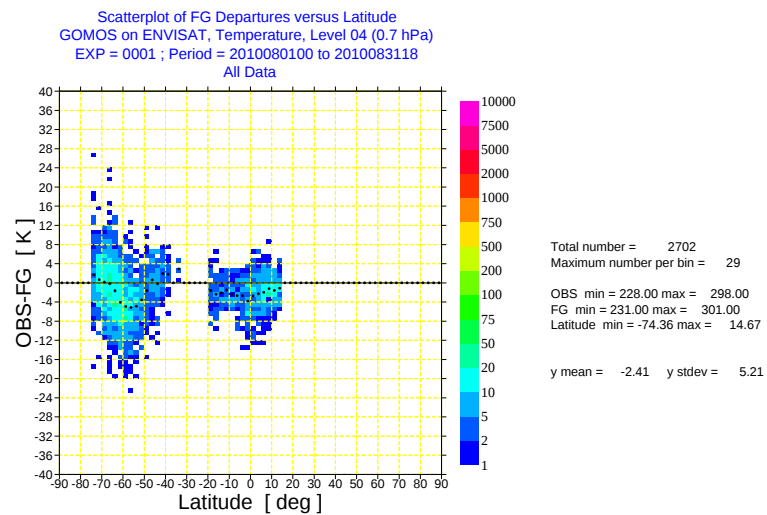
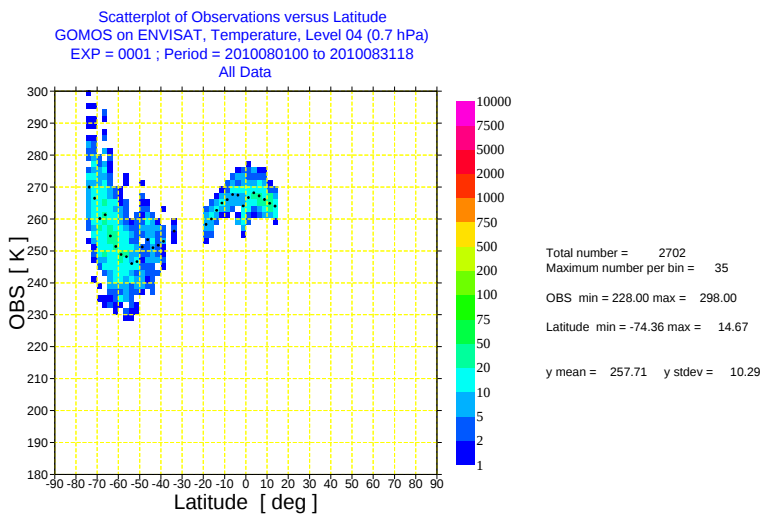
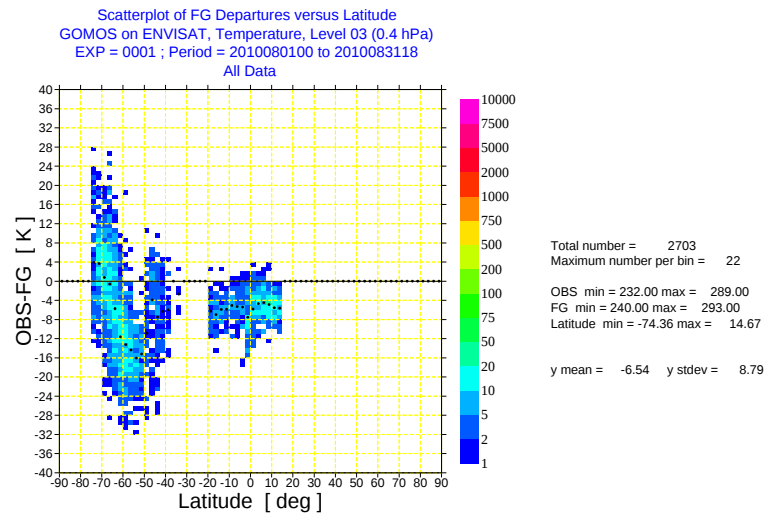
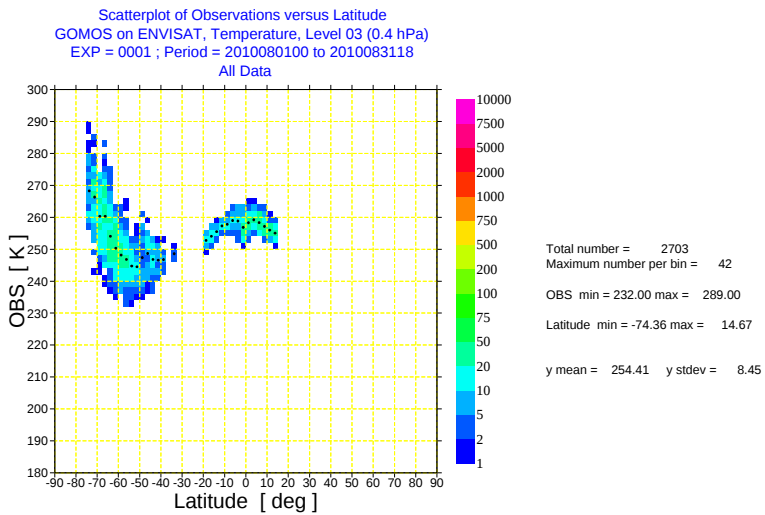


Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

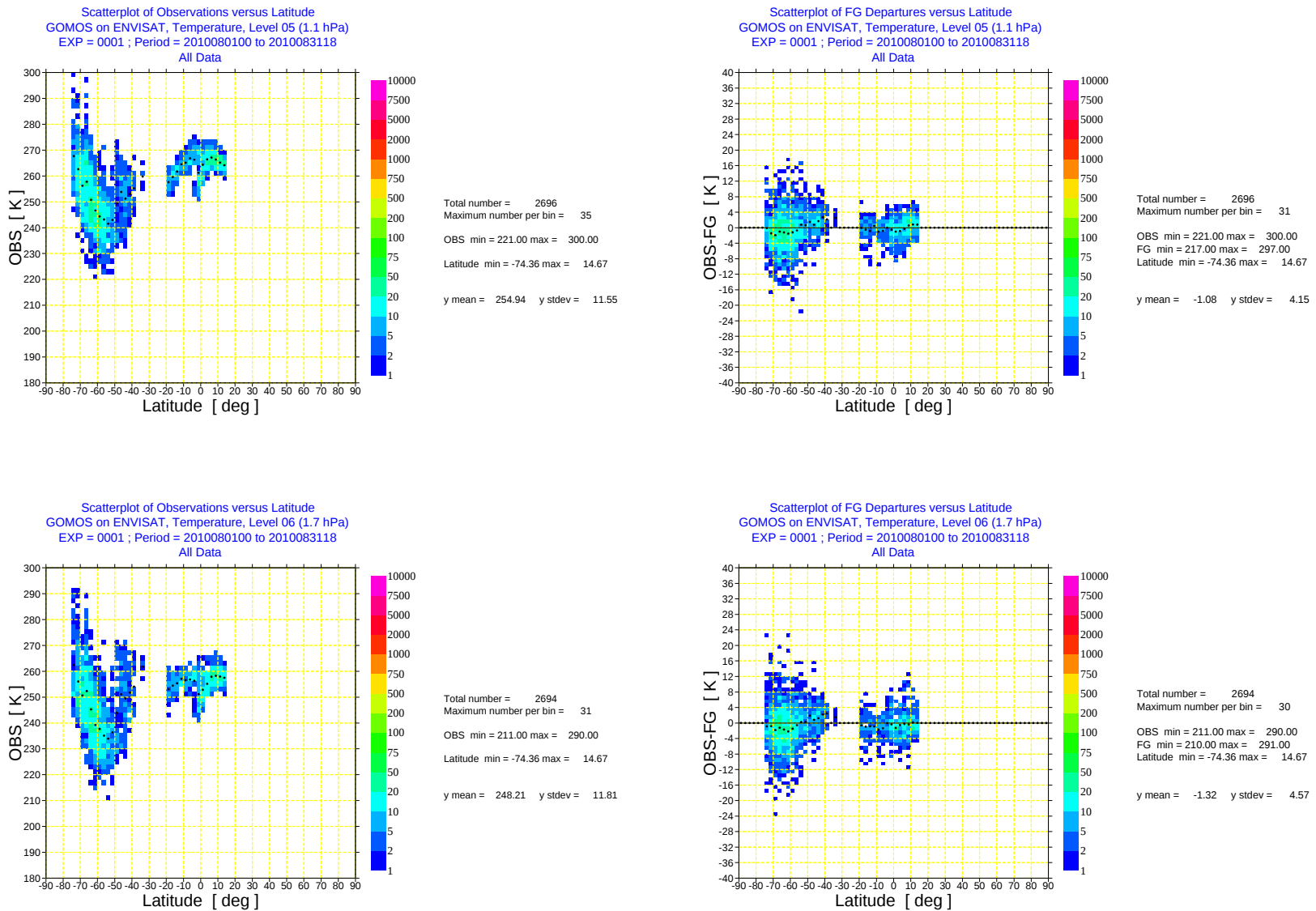


Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

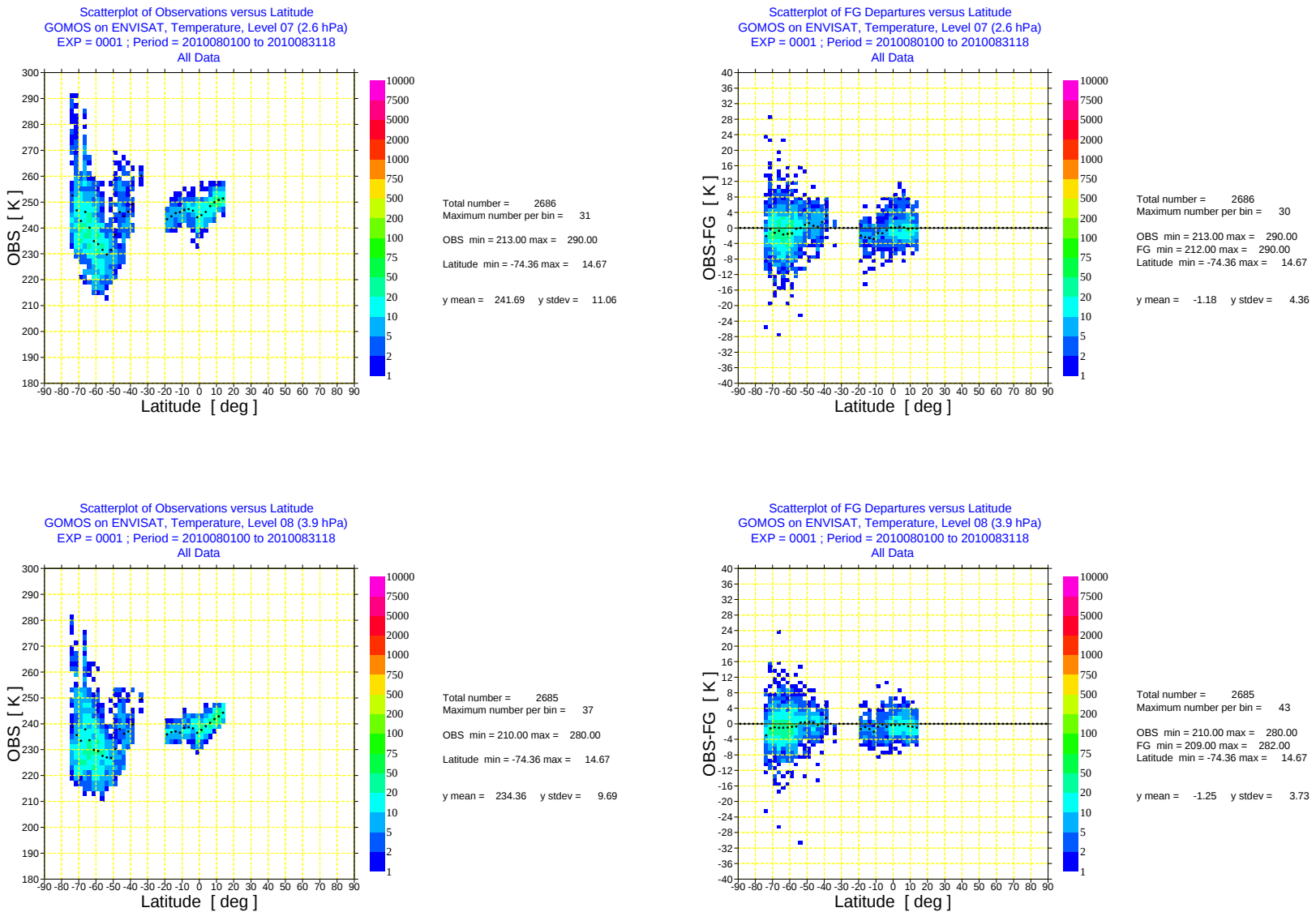


Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

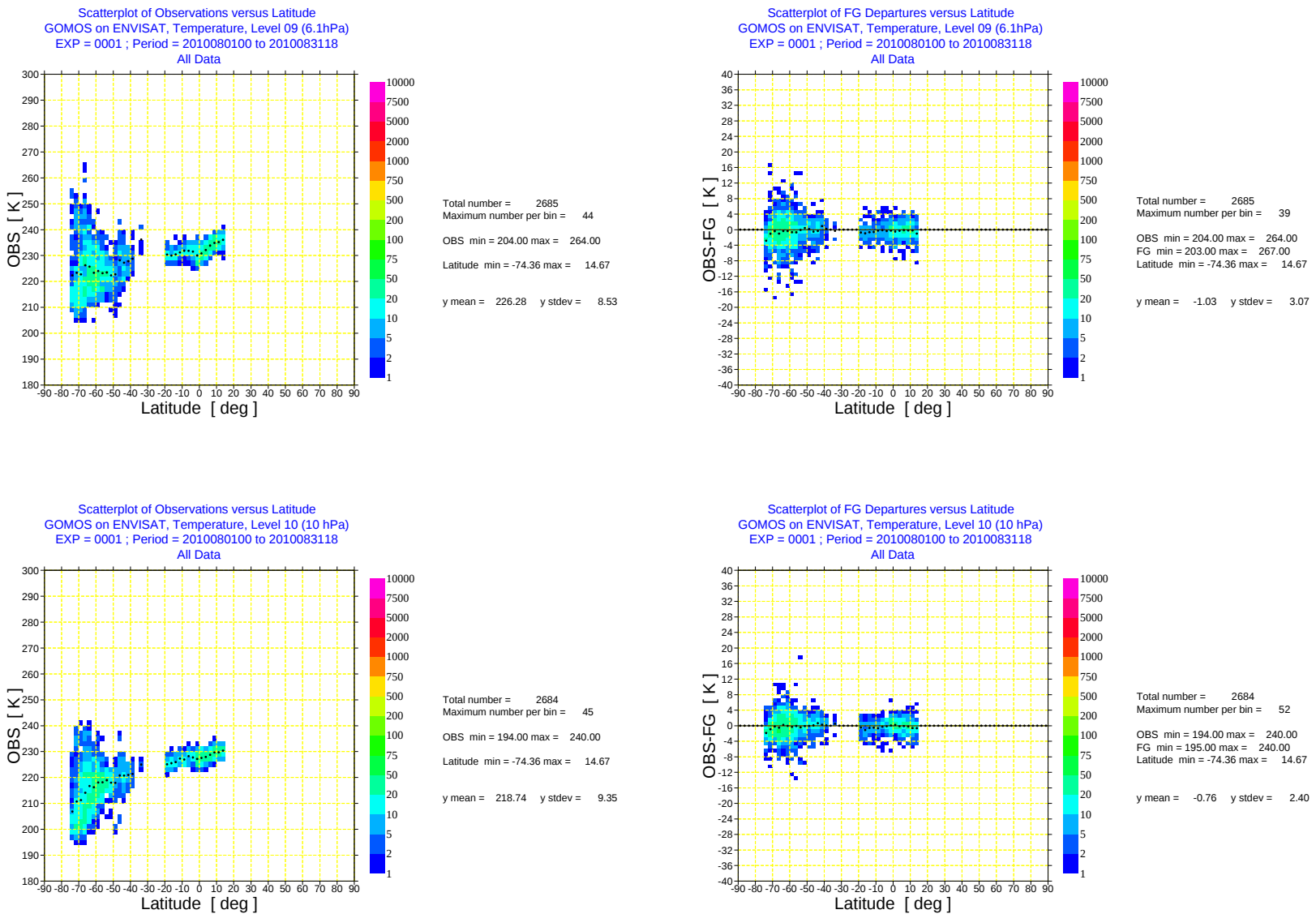


Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

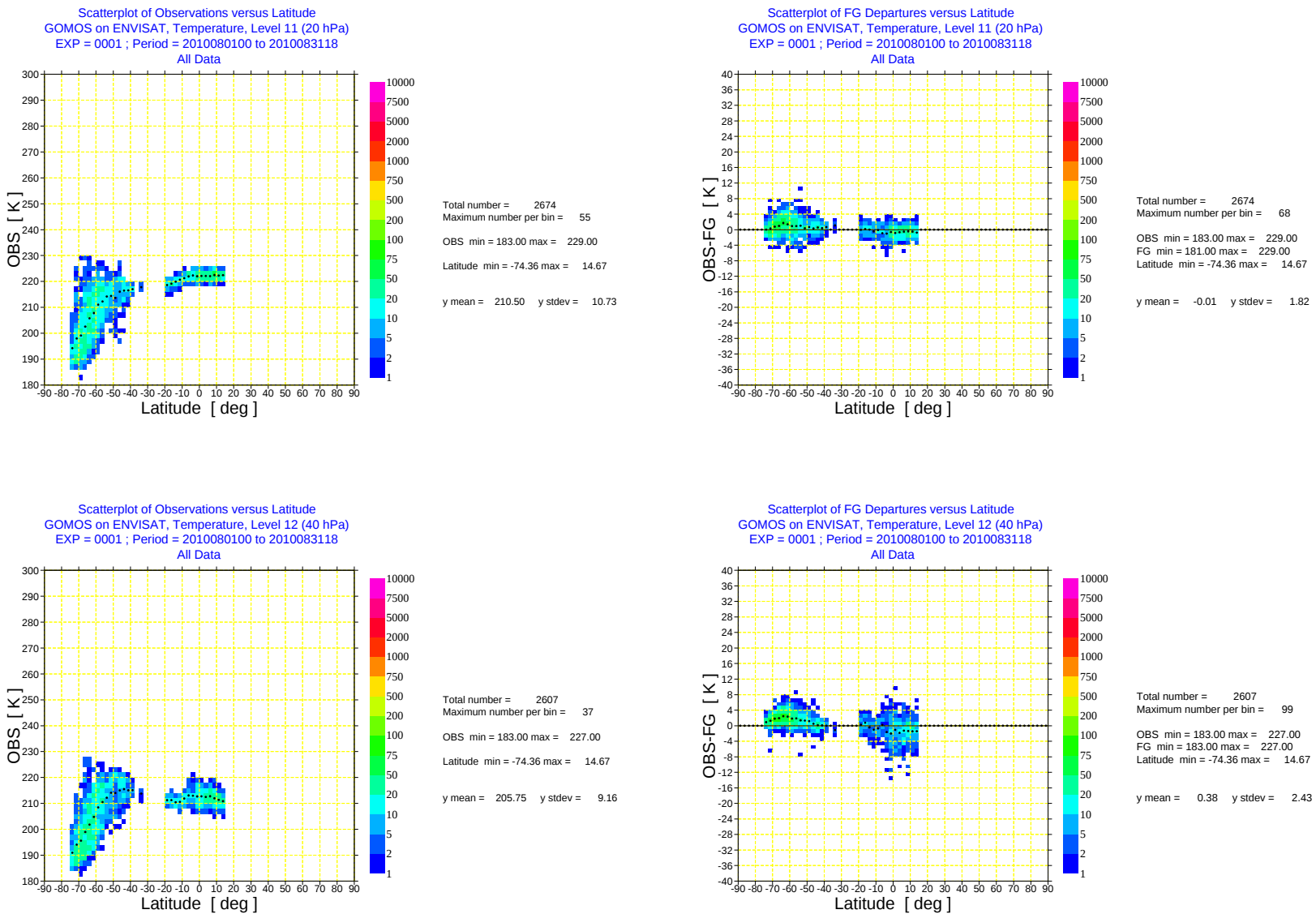


Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

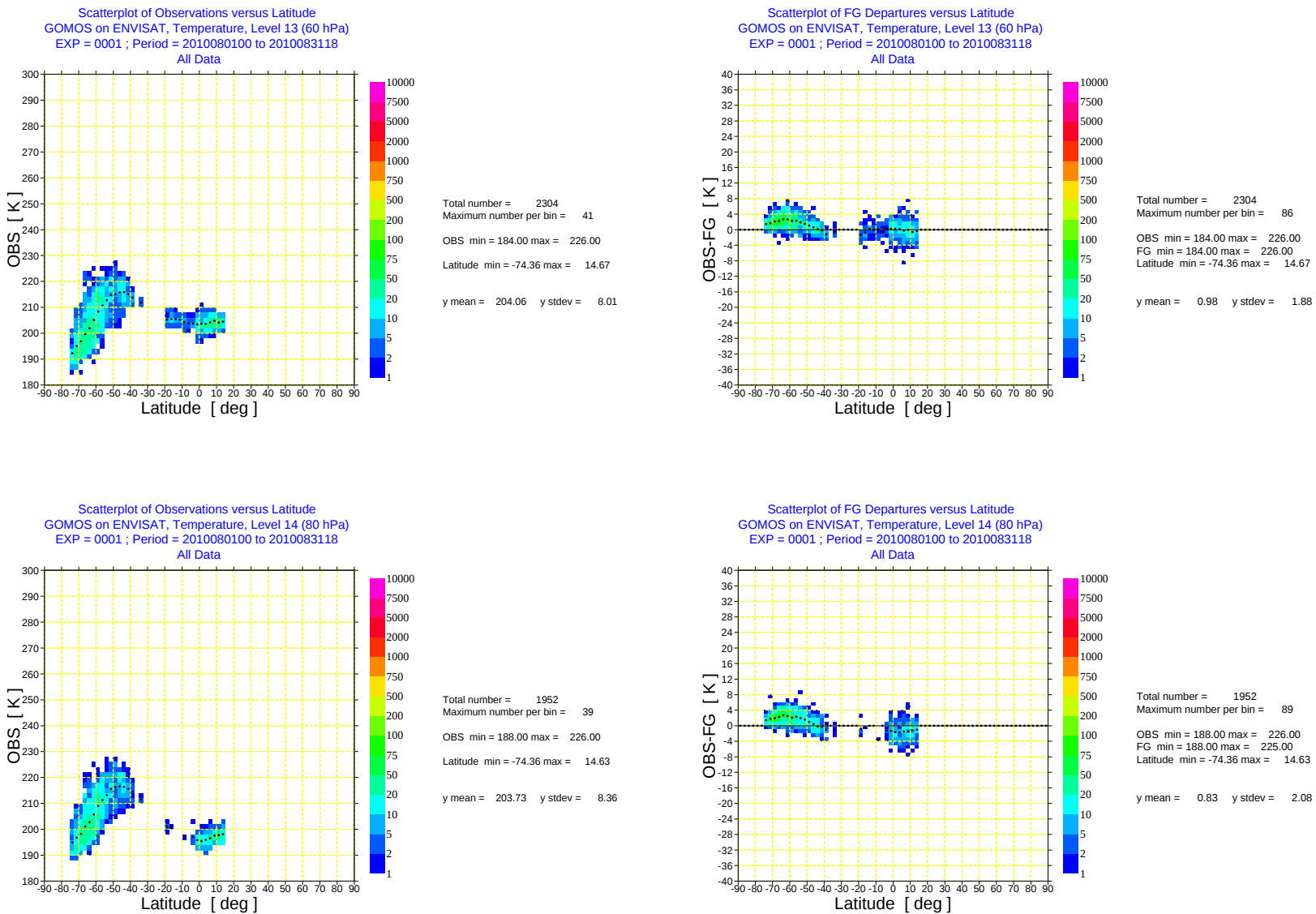


Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

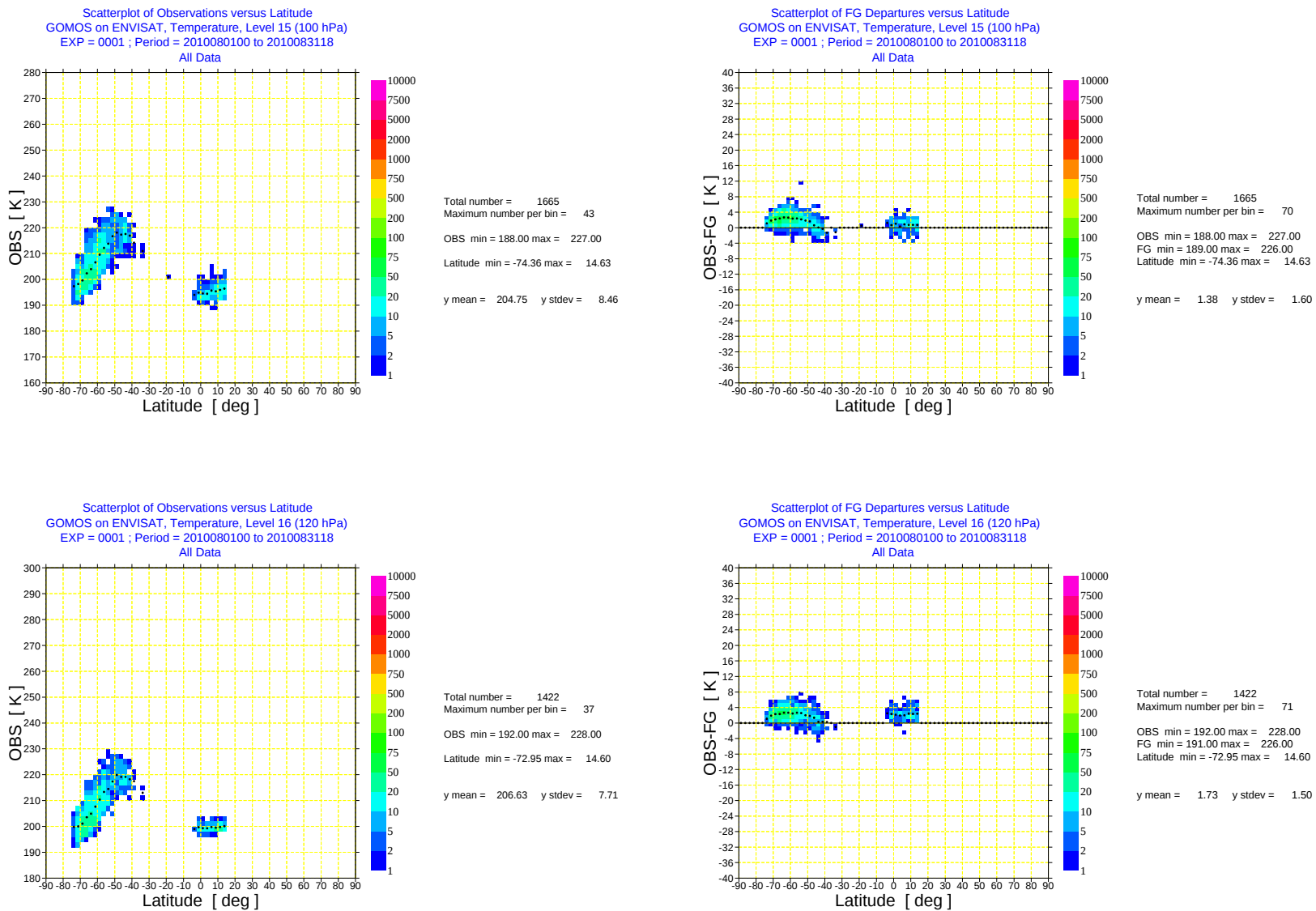


Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

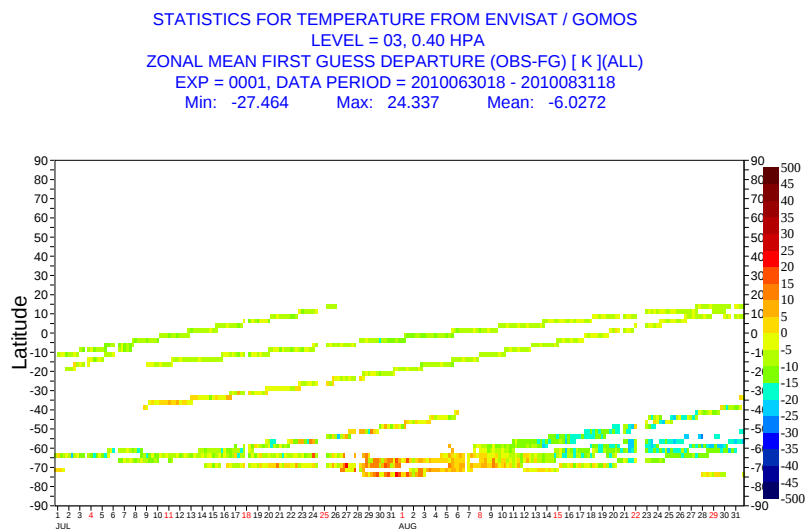
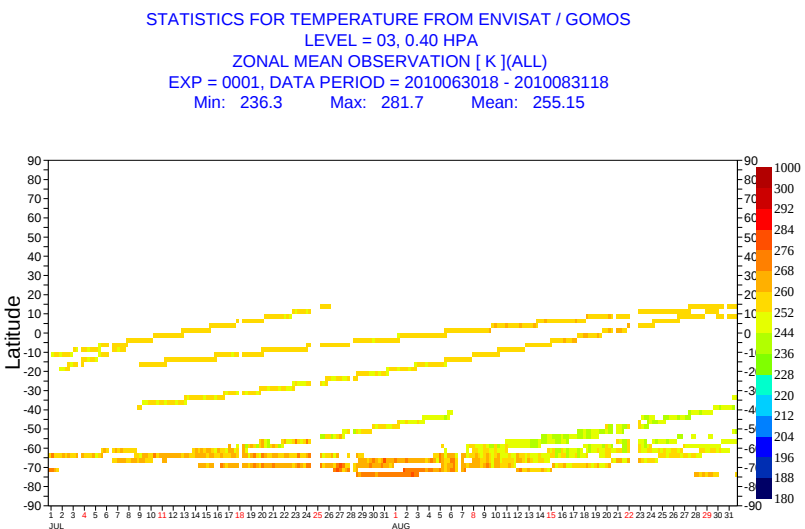
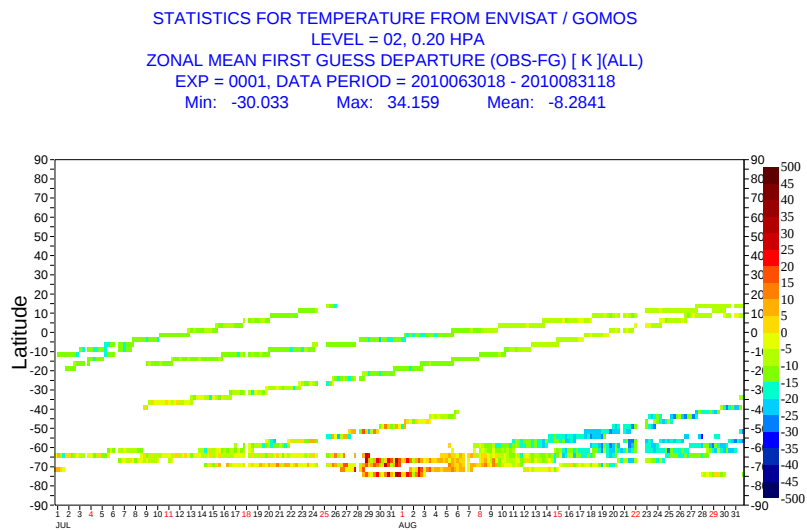
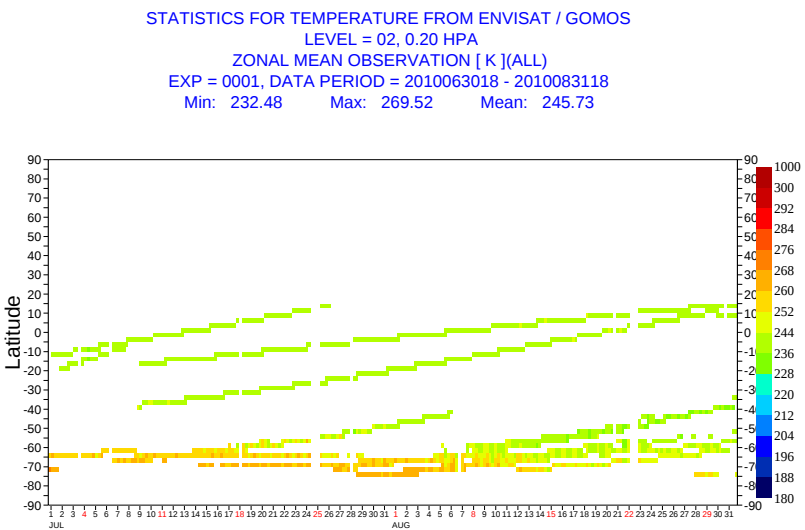


Fig. 15. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for July–August 2010.

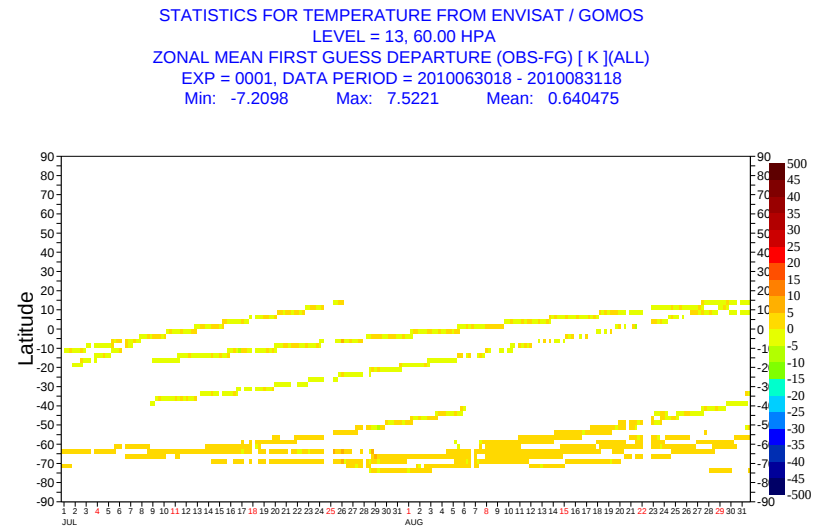
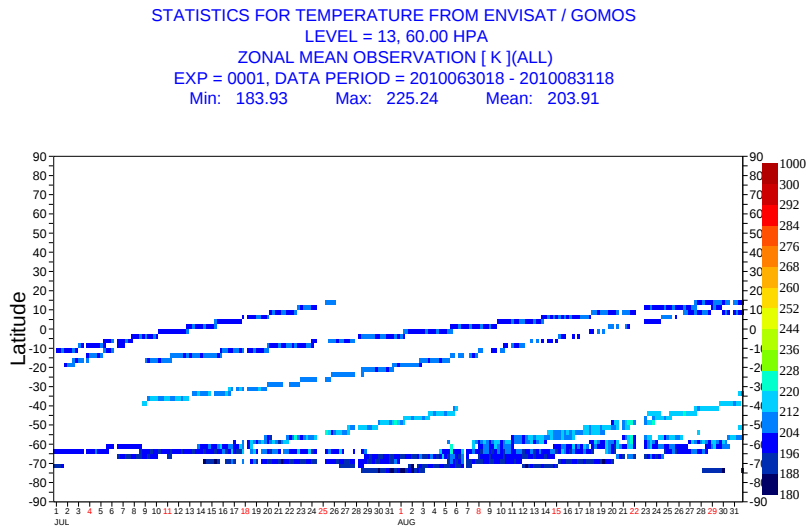
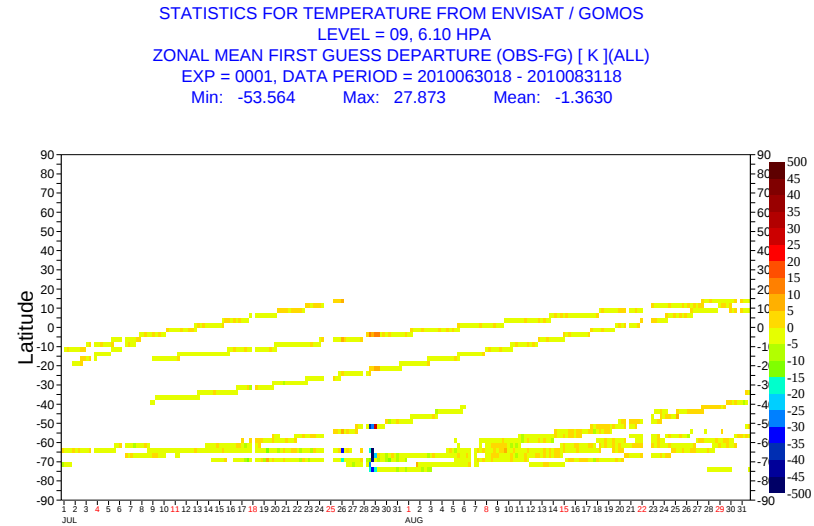
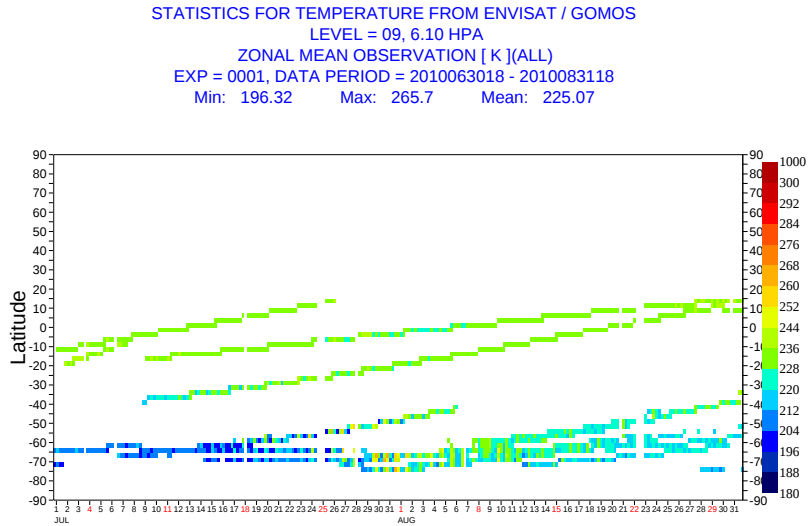


Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

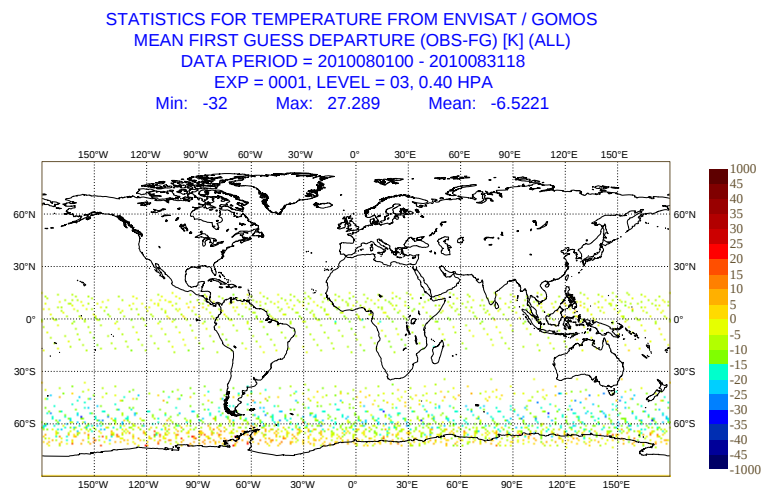
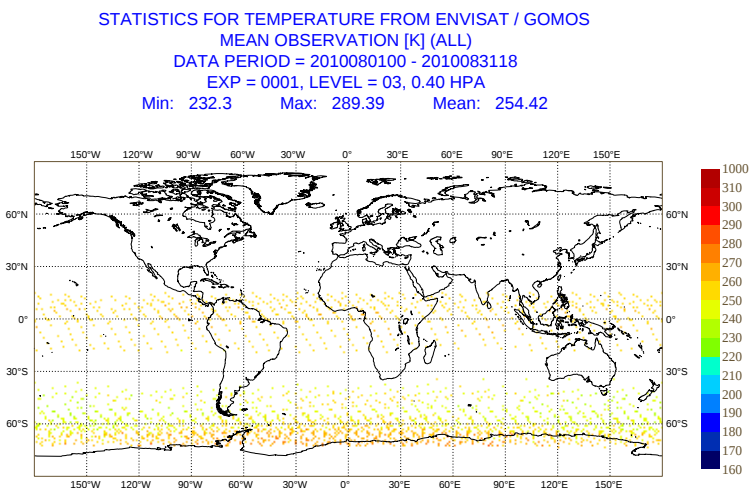
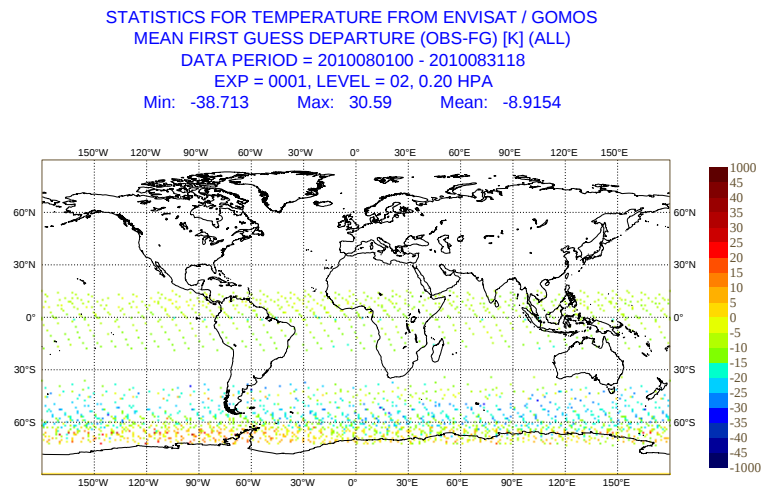
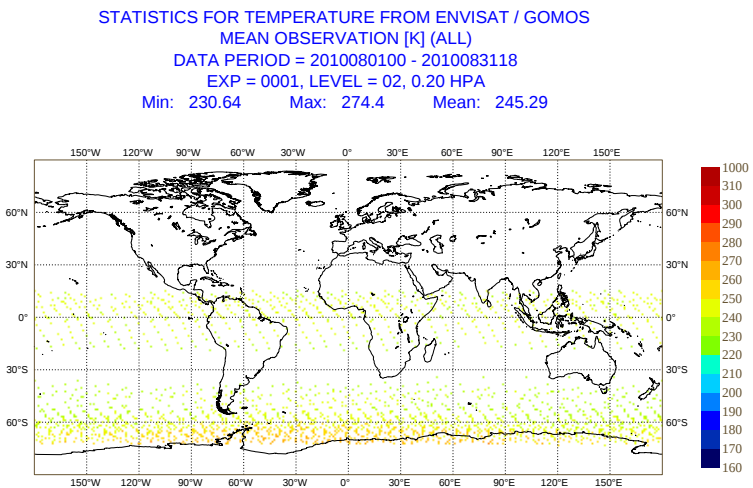


Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for August 2010.

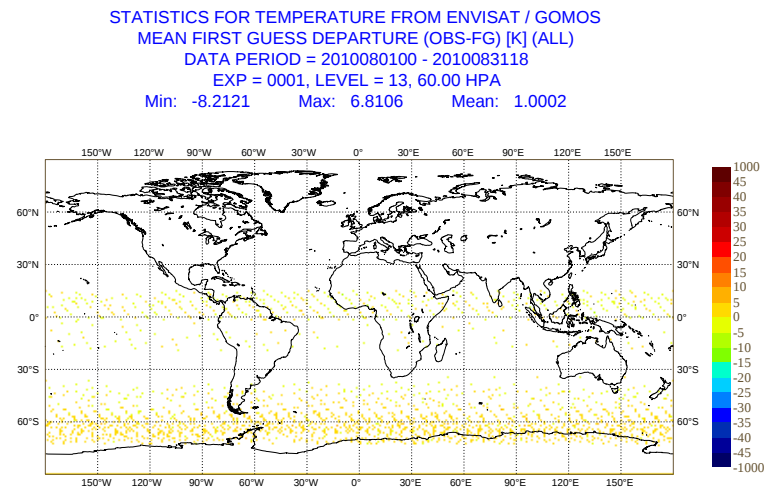
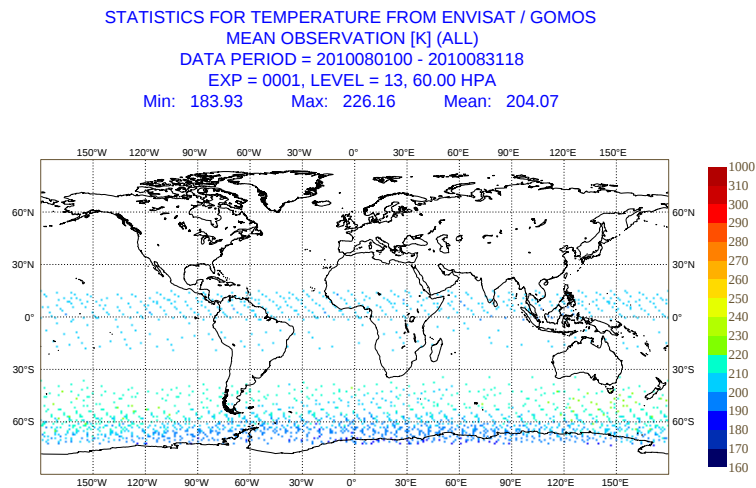
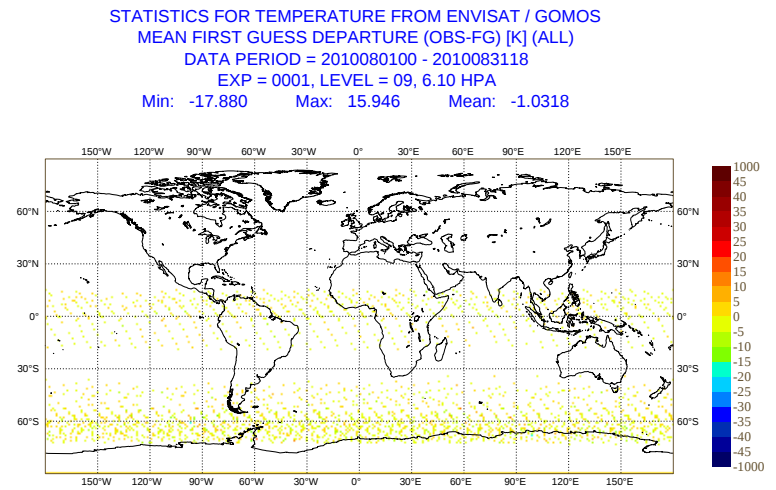
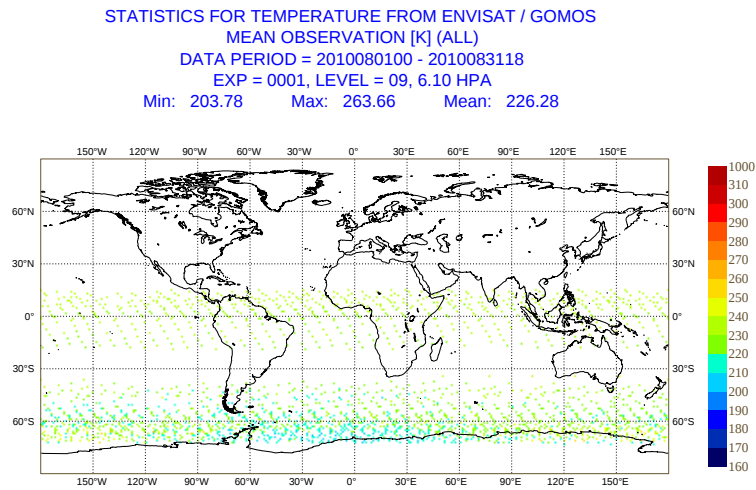


Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

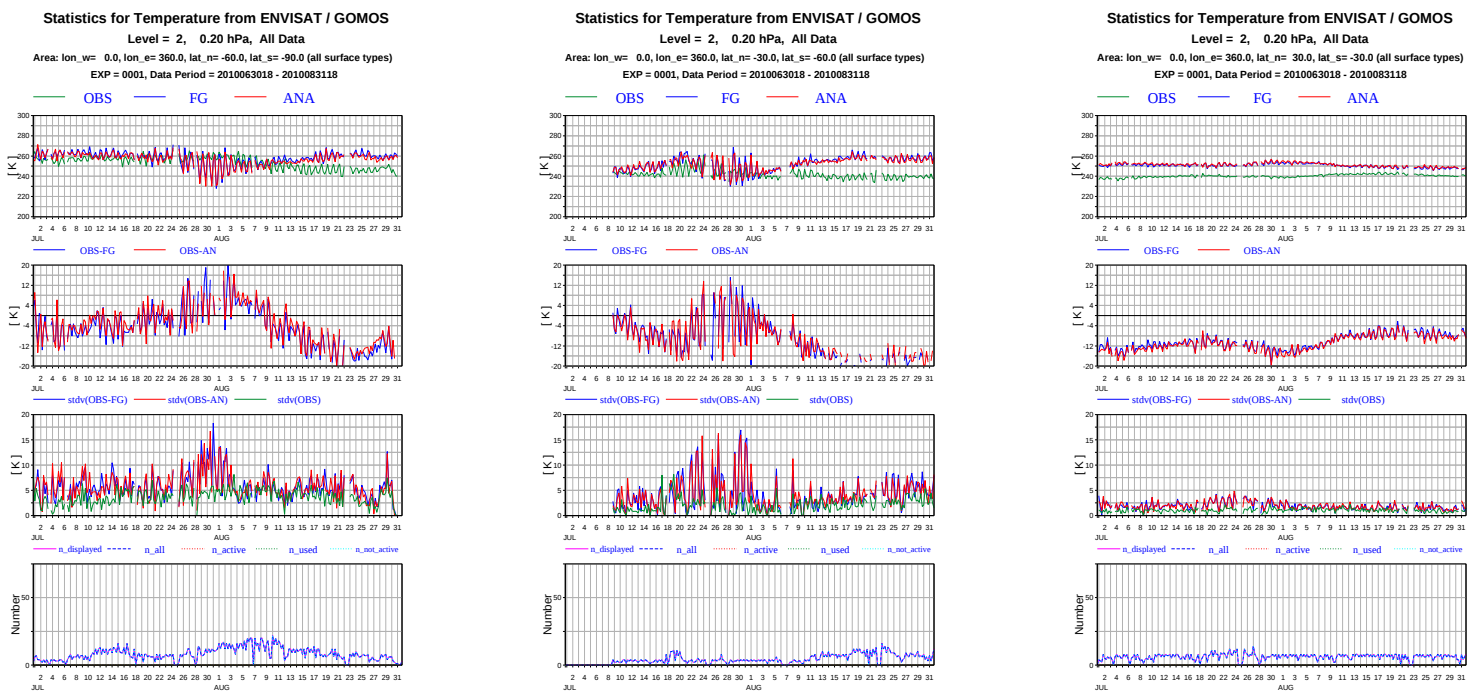


Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) at latitudinal bands 30N-30S, 30-60S, and 60-90S for the period July-August 2010.

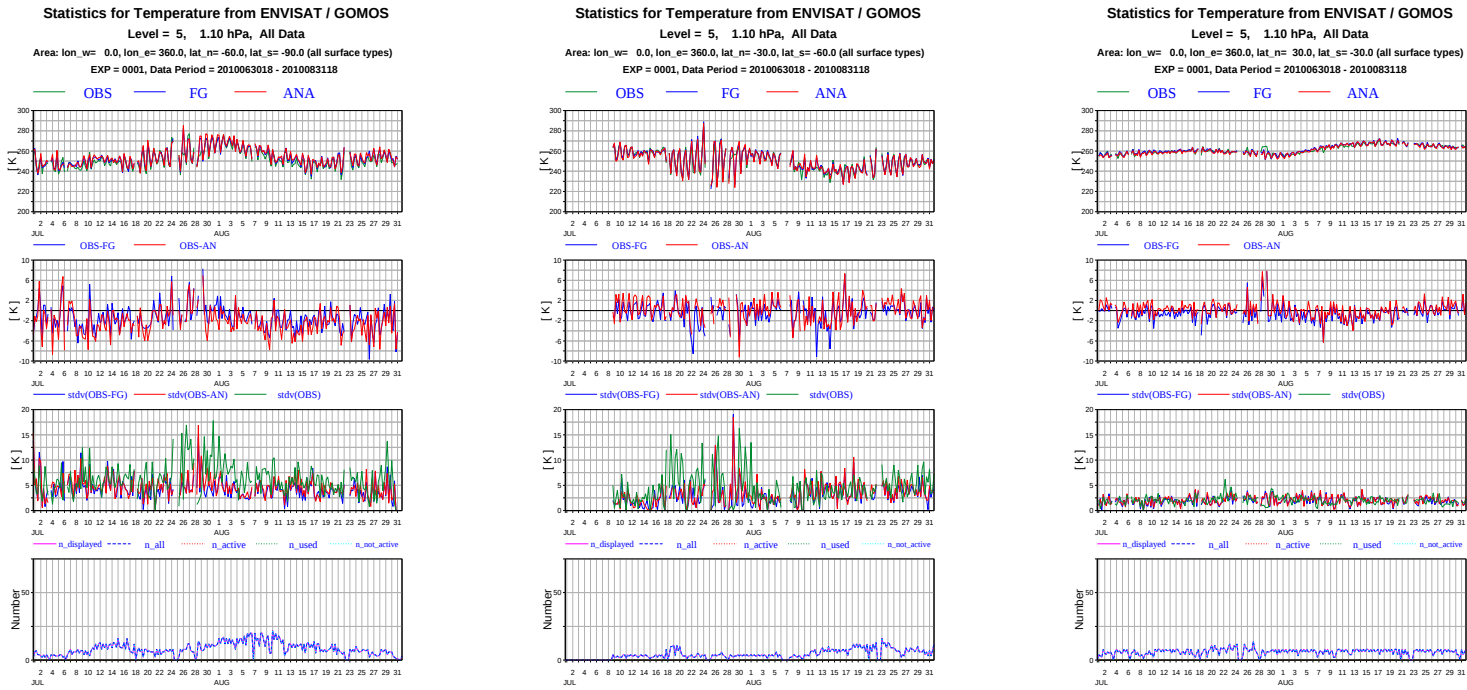


Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

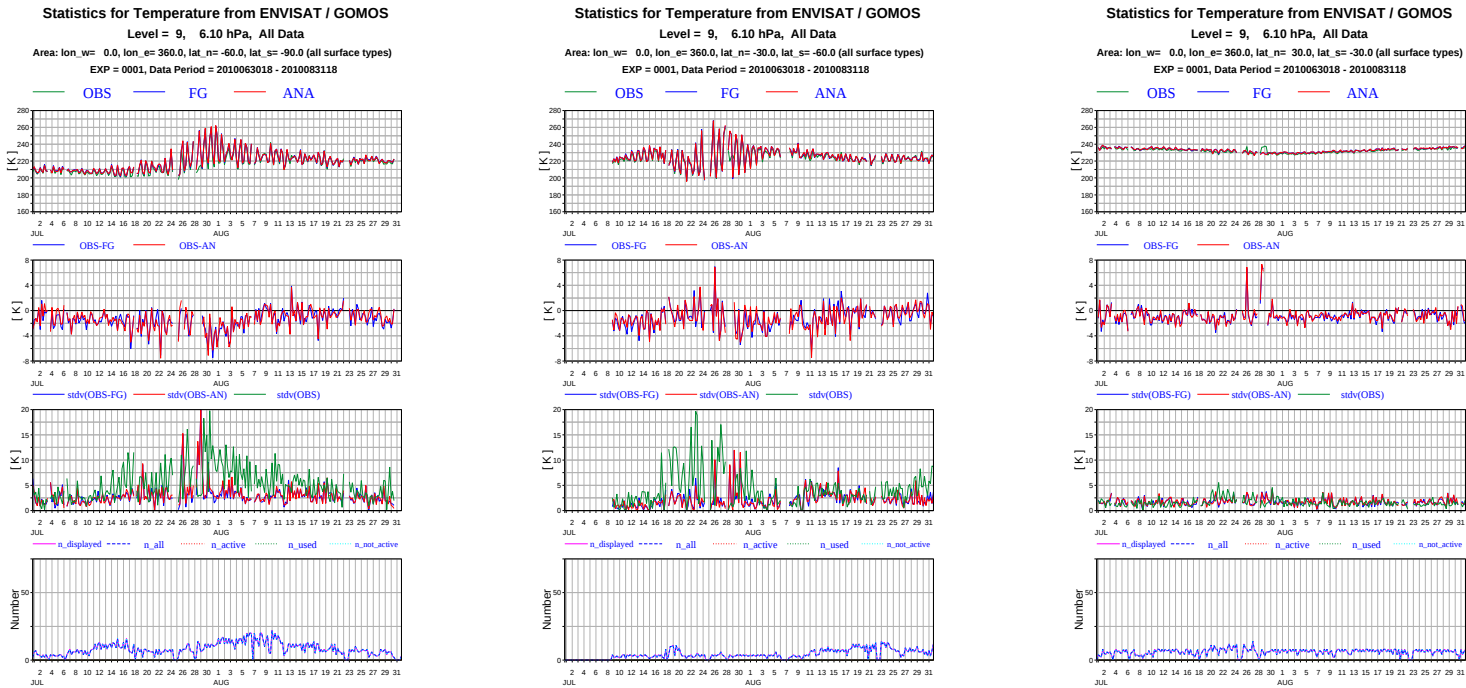


Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

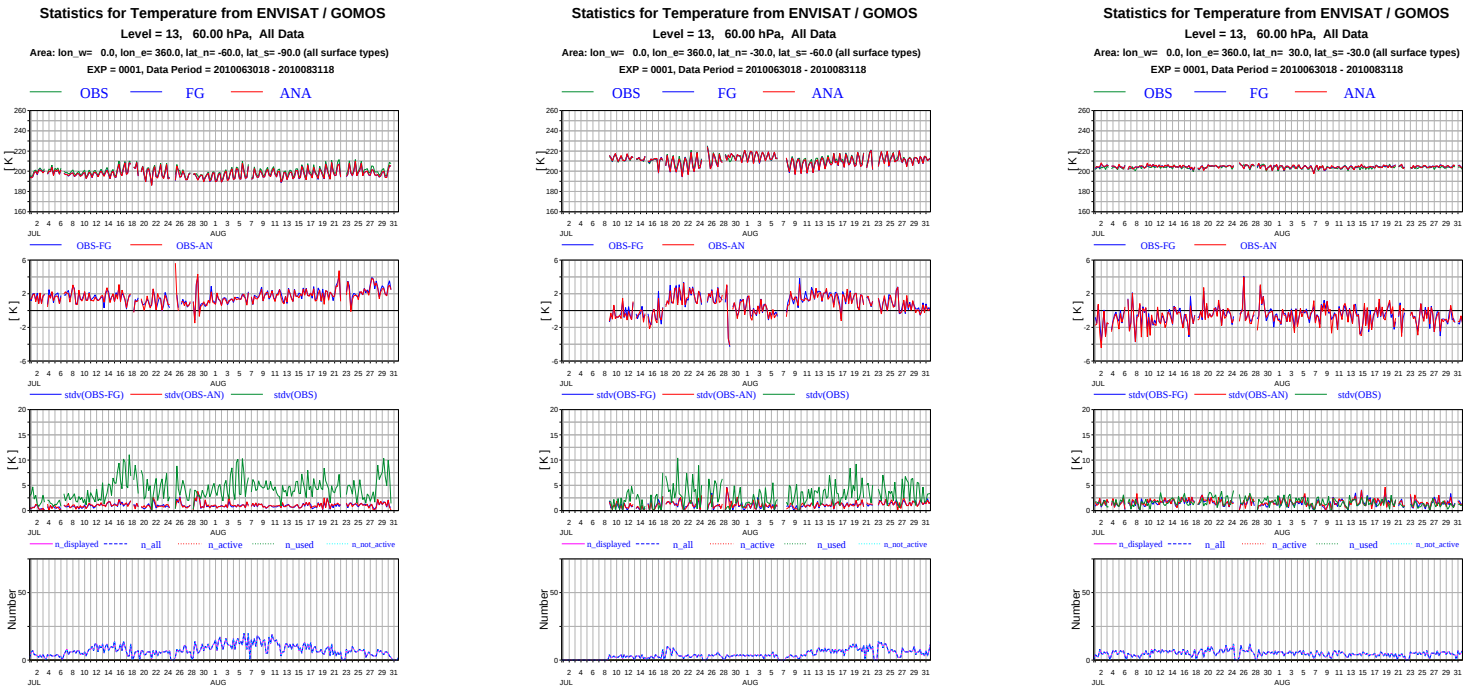


Fig. 22. As Figure 19, but for level 13 (60 hPa).

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

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September 8, 2010

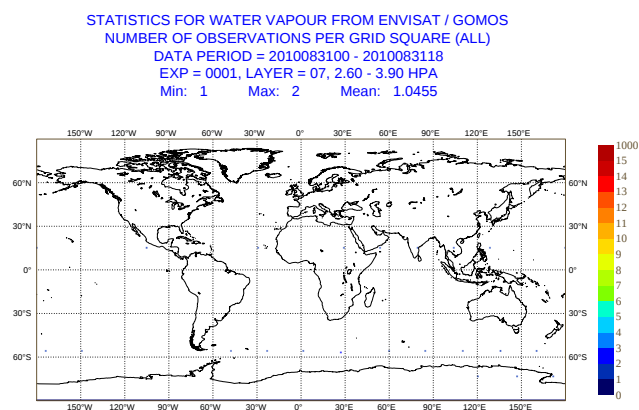


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for August 2010.

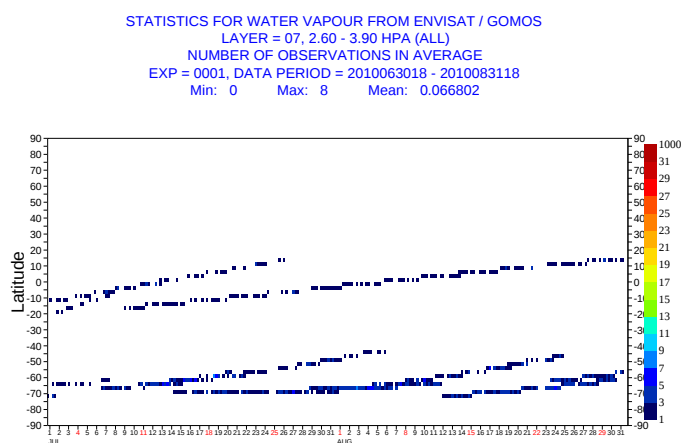


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for July-August 2010.

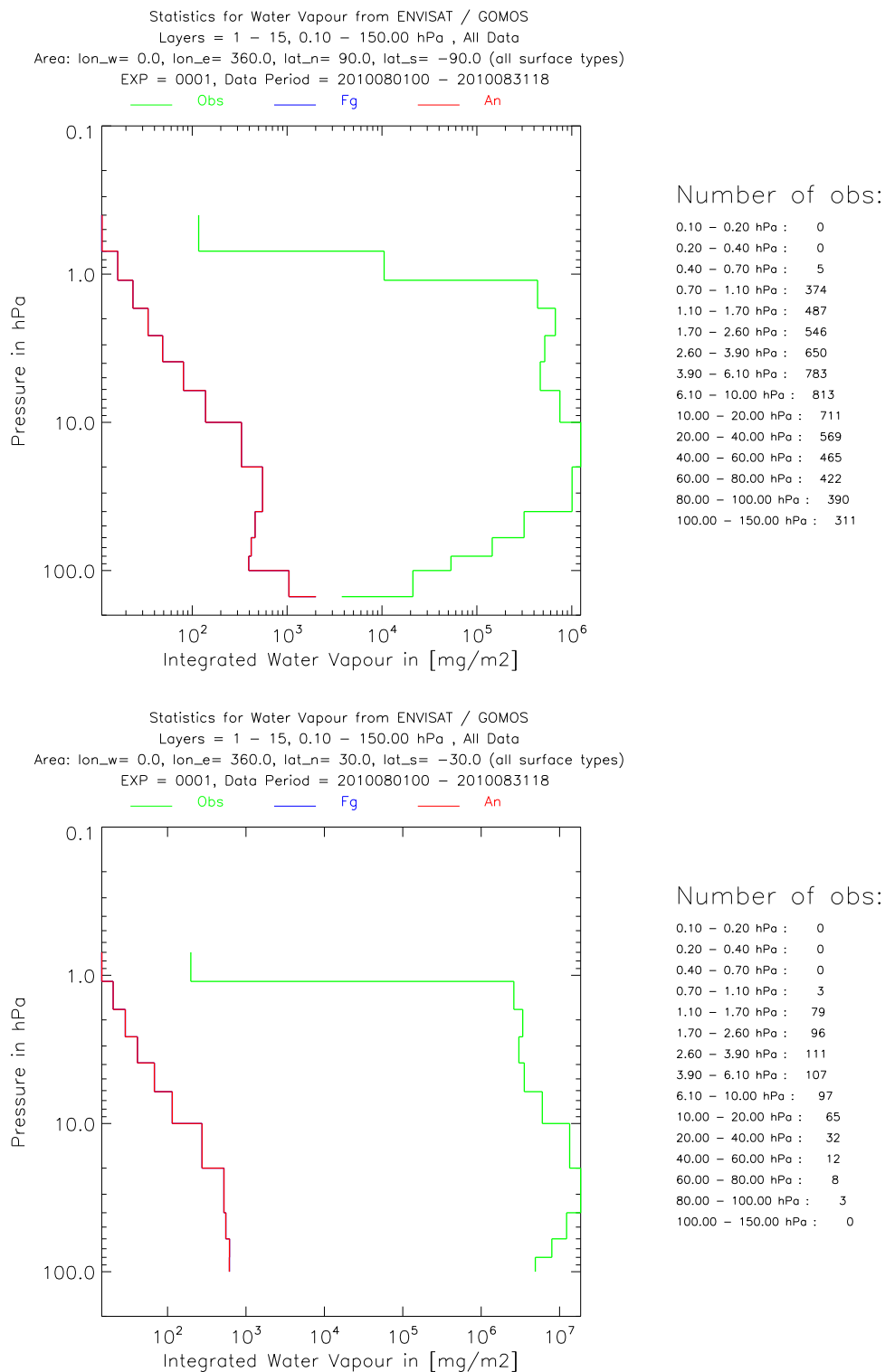


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m^2 for August 2010. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S).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

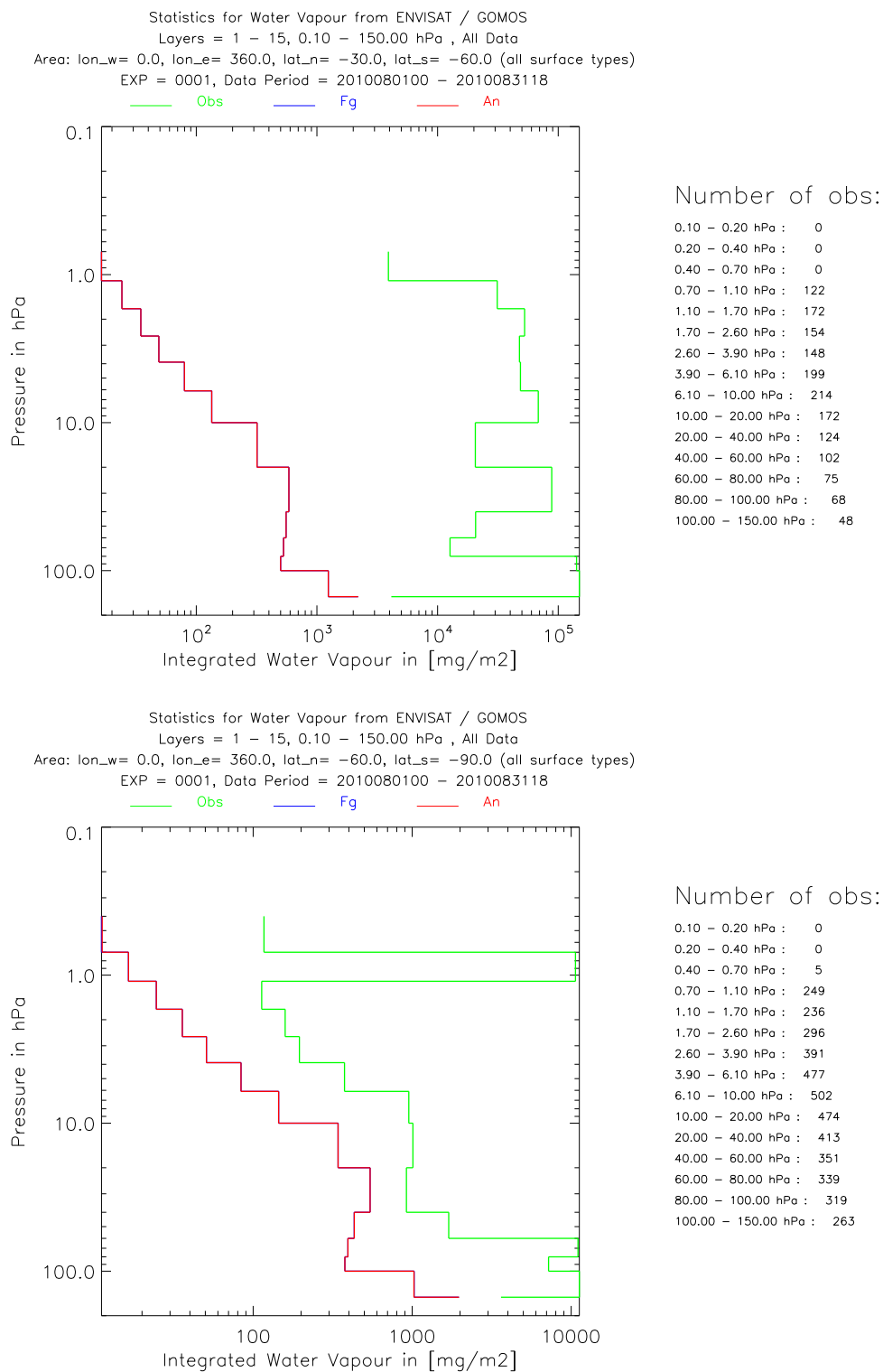


Fig. 4. As Fig. 3 but for the latitudinal band 30-60S (top panel) and 60-90S (bottom panel).

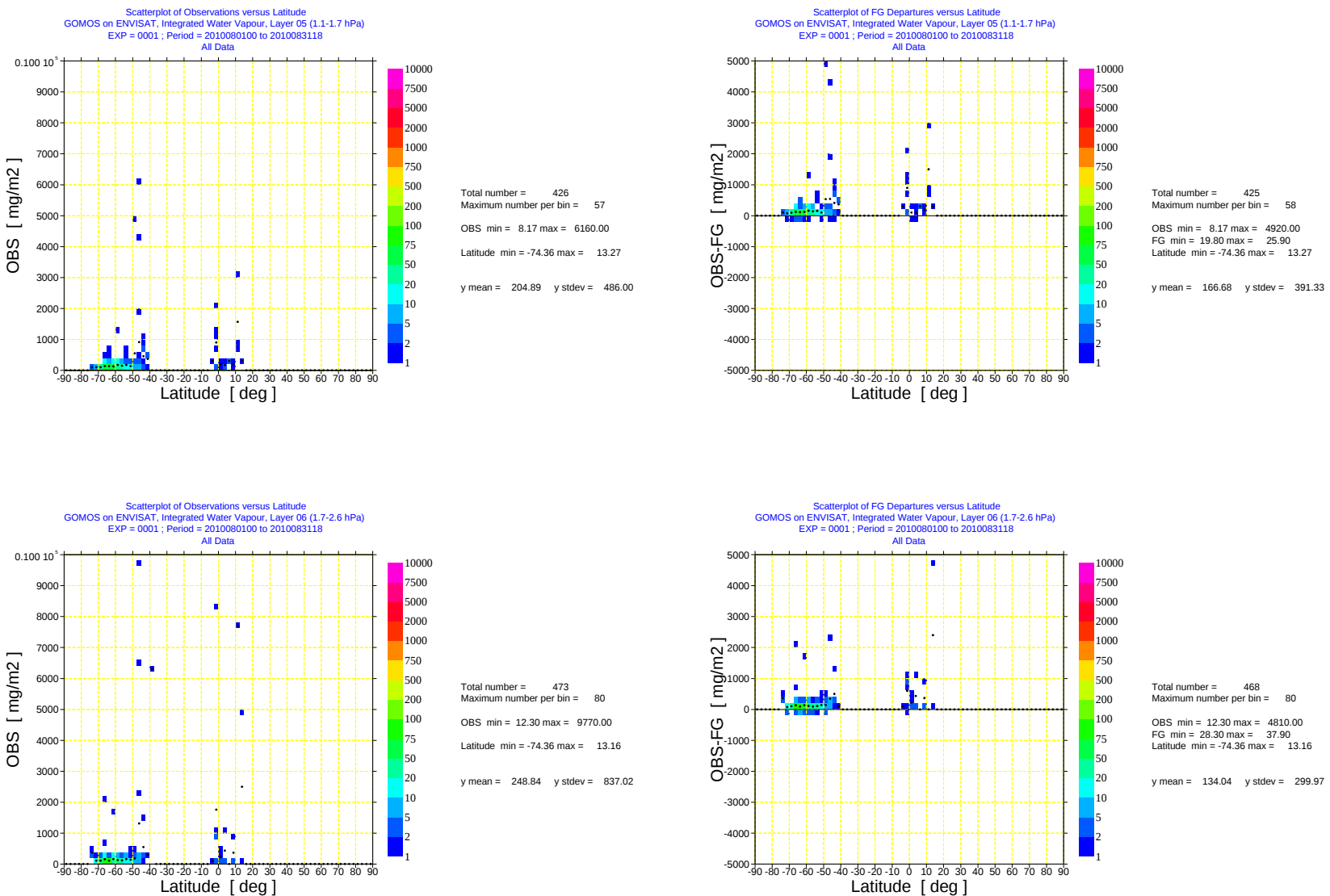


Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for August 2010 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and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

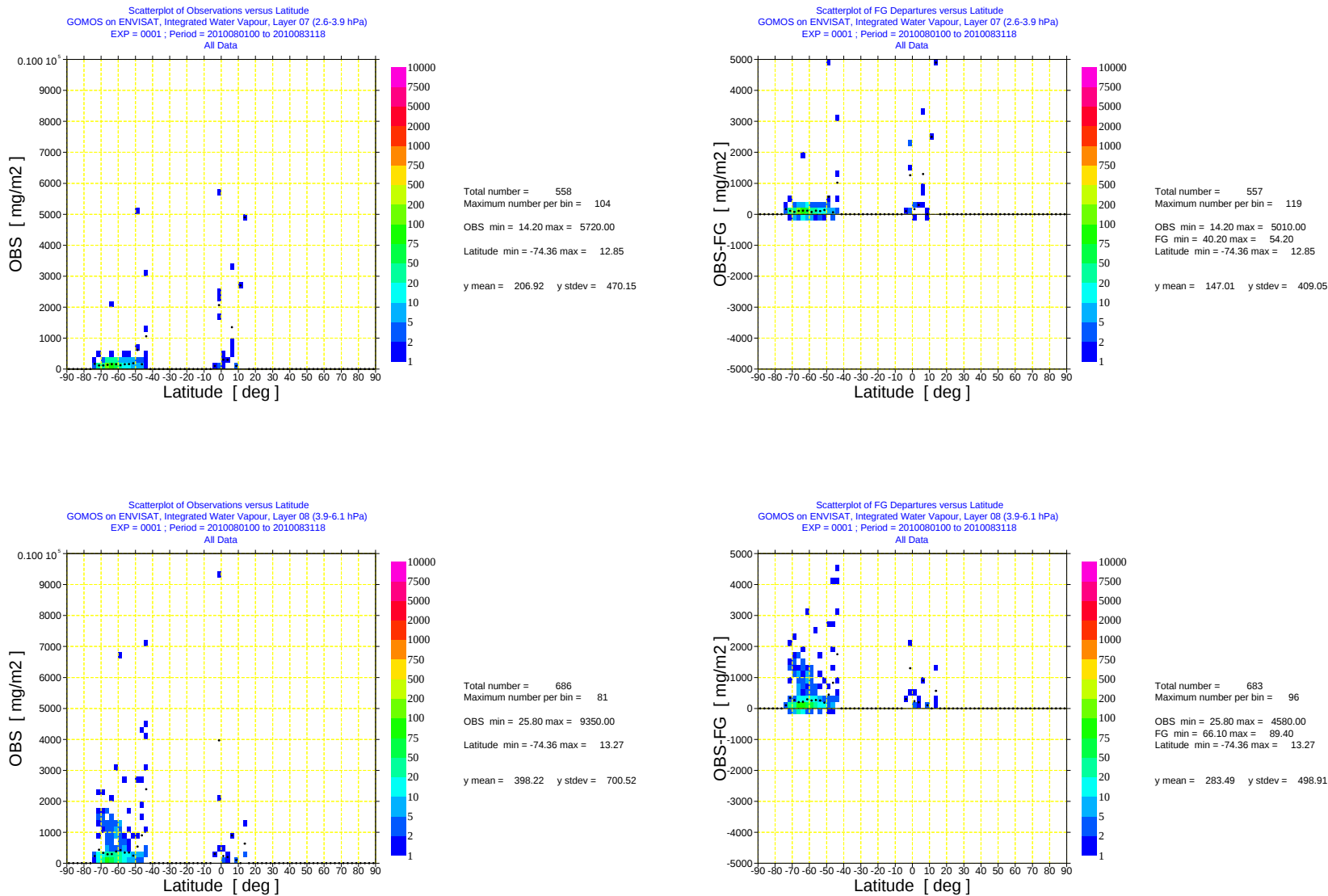


Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

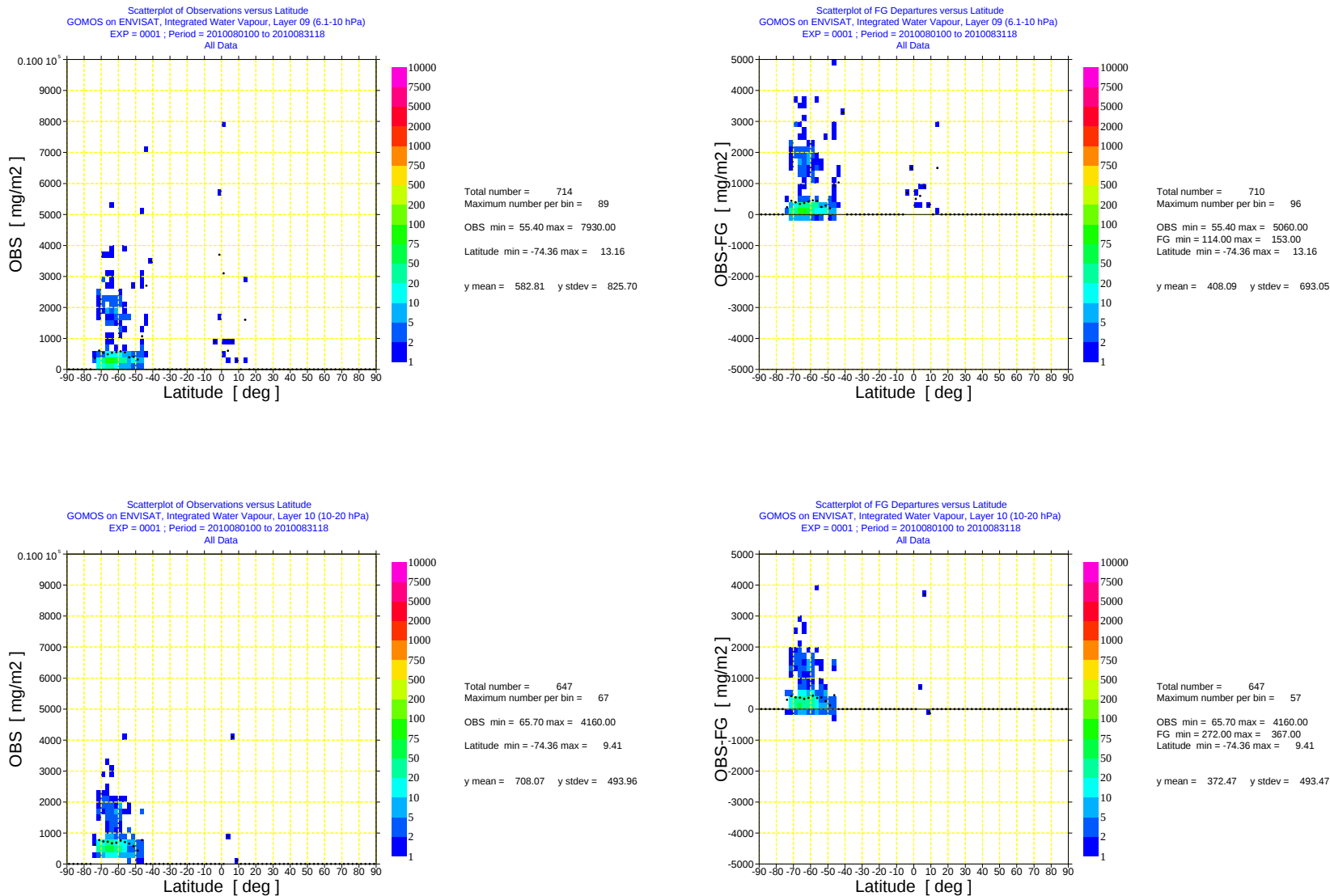


Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

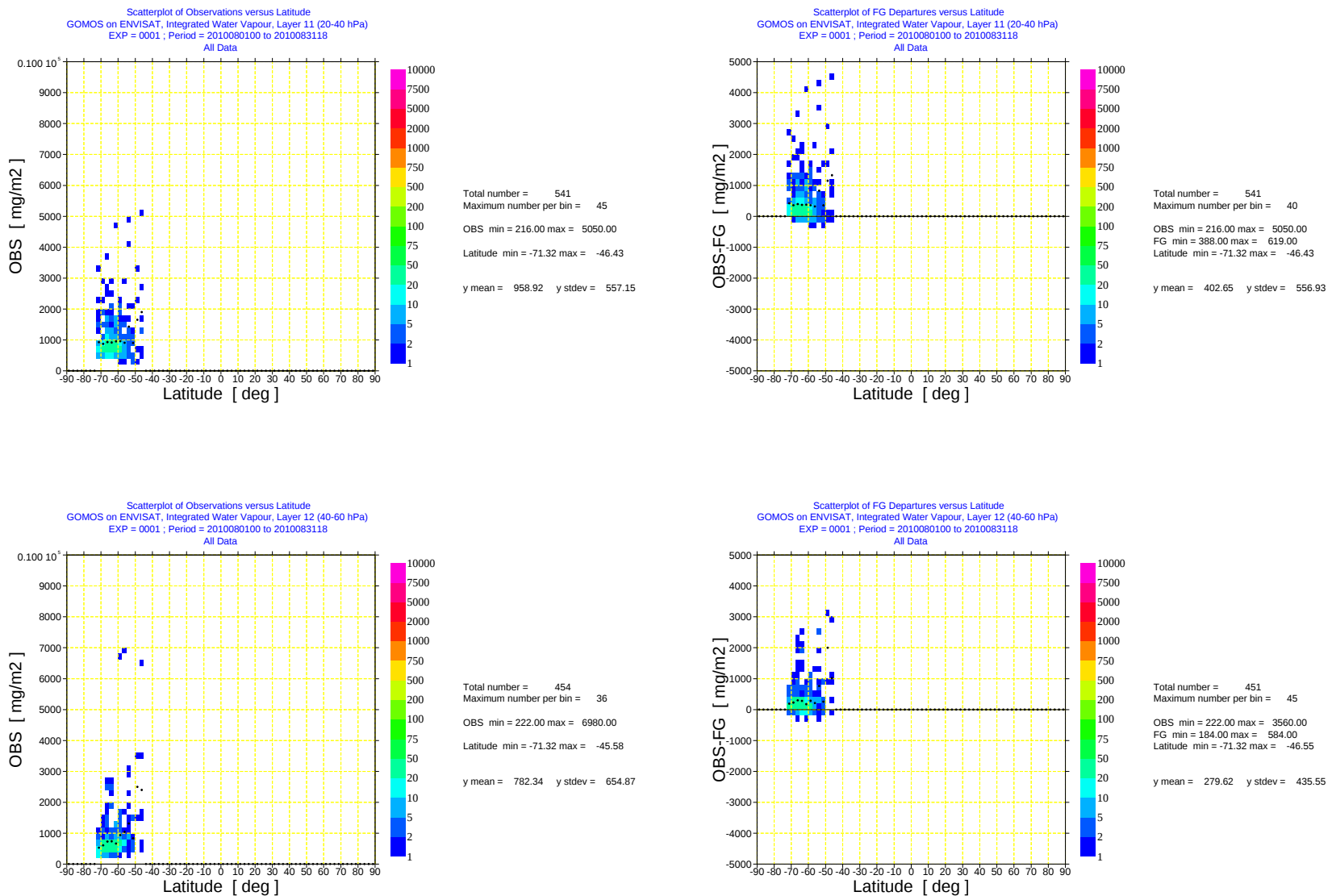


Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

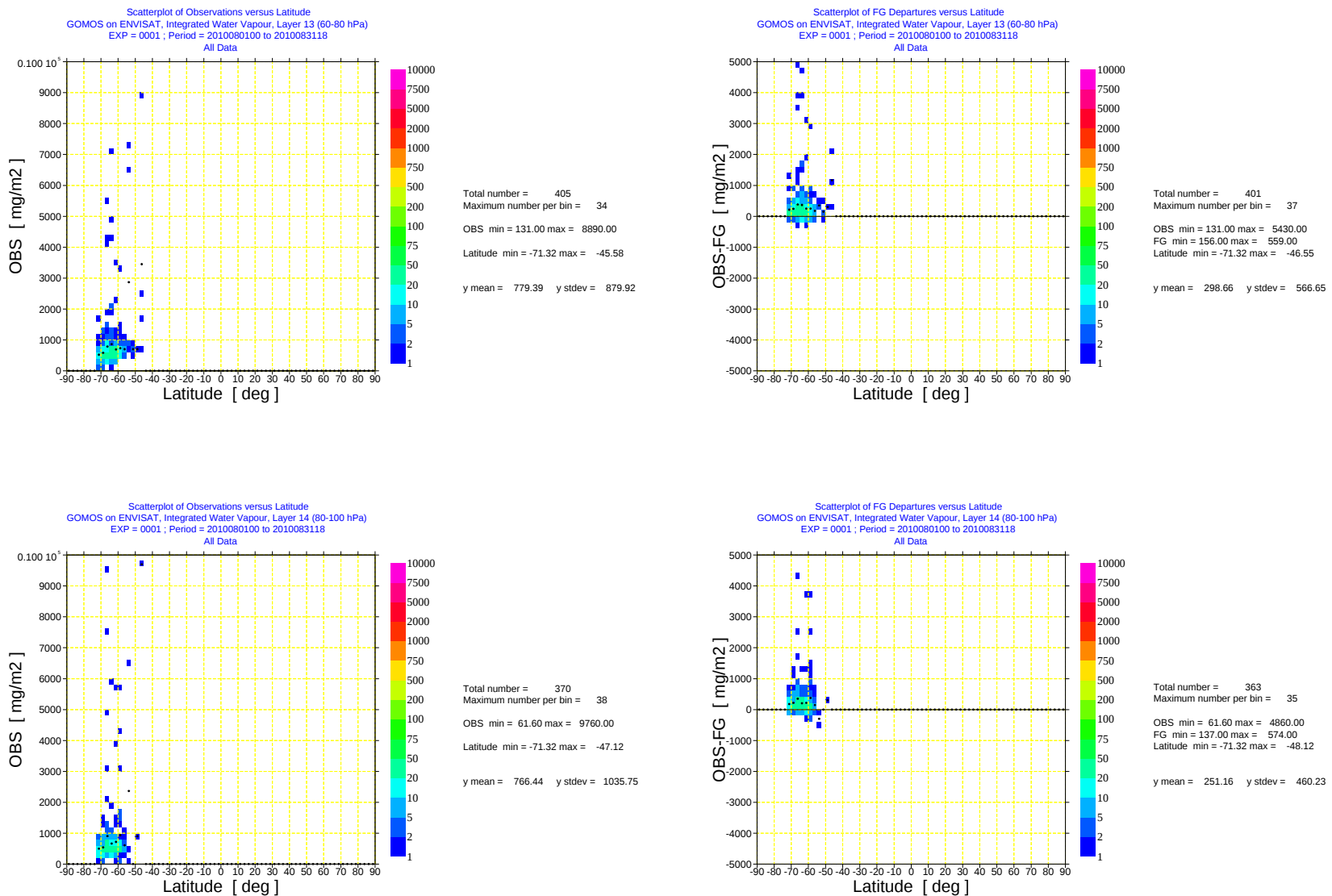


Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

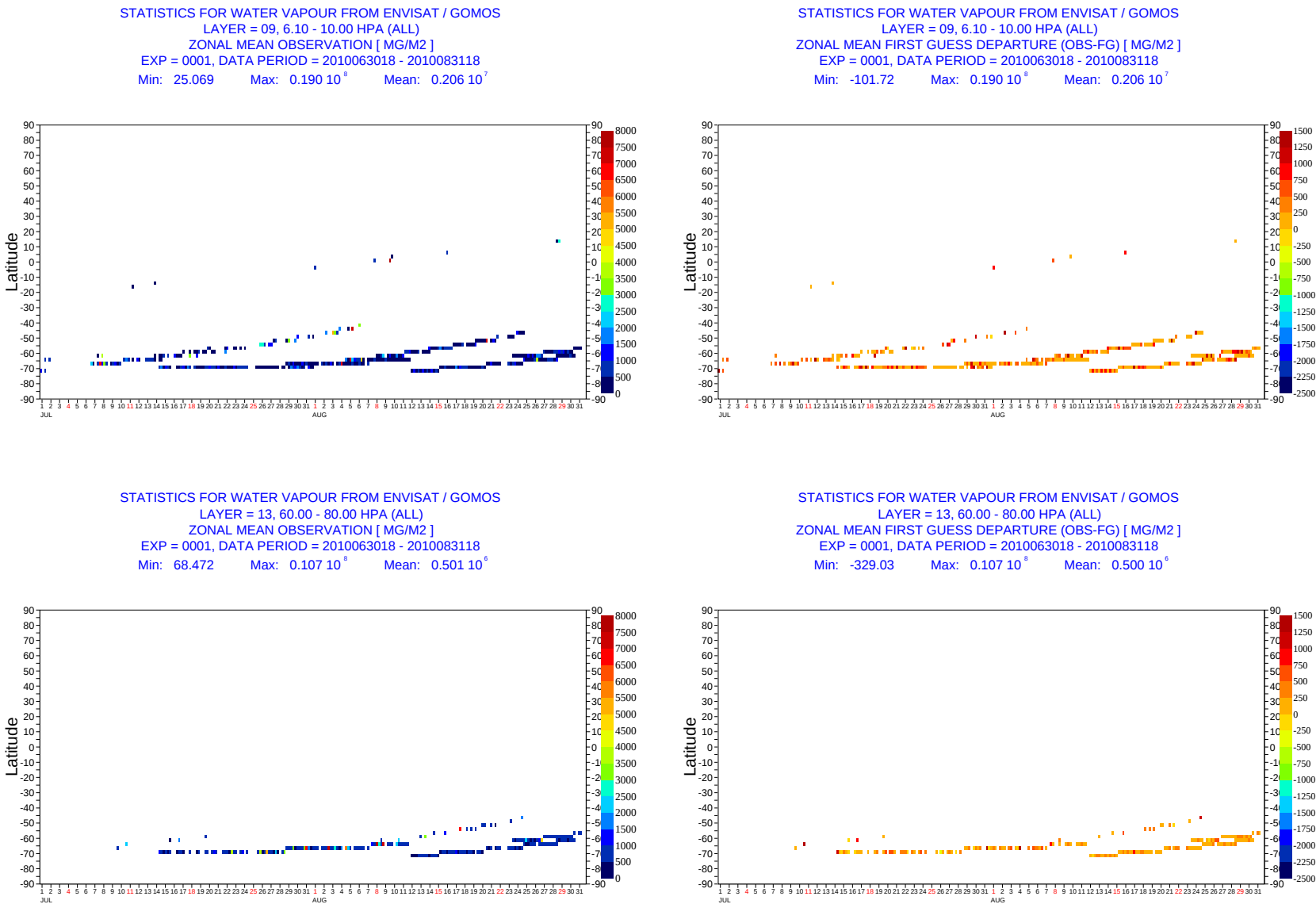


Fig. 10. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for July-August 2010.

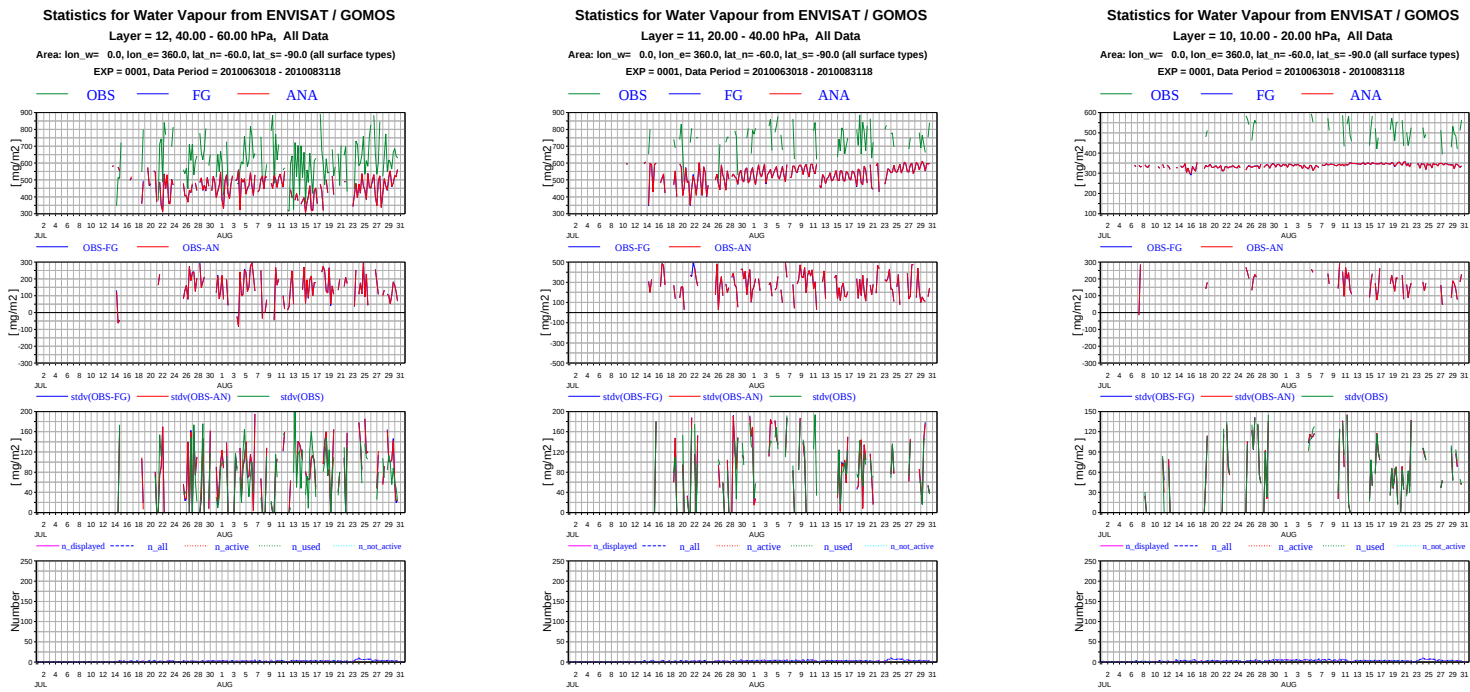


Fig. 11. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer level 10 (10-20 hPa), 11 (20-40 hPa), level 12 (40-60 hPa) in the latitudinal band 60-90S for the period July-August 2010.