

REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR_2P) FOR AUGUST 2008

Rossana Dragani

*ECMWF, Shinfield Park, Reading, RG2 9AX, United Kingdom,
Emails: Rossana.Dragani@ecmwf.int, Tel: 0044 118 9499259*

September 8, 2008

1. Key points for August 2008

- There were no data in the BUFR files at mid and high latitudes in the NH.
- Overall the temperature in the GOMOS bufr files was found in good agreement with the ECMWF temperature. The global data monitoring shows that the first guess and analysis departures are typically negative at all levels in the global average with values of a few tenths of K in the lower stratosphere, and up to -4K in the upper stratosphere and mesosphere. When averaging over different latitudinal bands, biases within $\pm 1\%$ were generally found in stratosphere, and within -2 and -4% (-4 to -8K) in the mesosphere.
- The quality of the GOMOS ozone profiles was consistent with that reported in July. In the global mean, the departures between GOMOS and ECMWF ozone profiles were within -10 and +25% in the mid stratosphere at most vertical levels. The standard deviations of the first guess and analysis departures were larger than 20% at all levels. When averaging over latitudinal bands, the first guess and analysis departures between the GOMOS ozone values and their model equivalent were typically within -15 and +40% in the stratosphere, but larger than 50% at some mesospheric levels. The standard deviations of the analysis and first guess departures were larger than 20% at all latitudes, and levels.
- The quality of the water vapour retrievals was still quite poor despite the data used in the monitoring statistics were only those acquired in dark-limb conditions. The monitoring statistics showed that the GOMOS water vapour values were from one to four orders of magnitude larger than their model equivalent at all vertical levels and latitudes. The largest differences between GOMOS WV and ECMWF WV were still found in the Stratosphere. A slightly higher level of agreement between the GOMOS WV data and their model equivalent was found at midlatitudes in the SH, in particular in the upper stratosphere where the first-guess and analysis departures were typically about one order of magnitude.
- The monitoring statistics for August were produced with the operational ECMWF model, CY33R1.

2. Quality and amount of received data

Data coverage and amount of received data during August 2008 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Overall, just over 4500 (good) observations were available for temperature, about 4200 (good) observations were available for ozone, and just over 1000 for water vapour. The largest number of observations were available in the mesosphere and upper stratosphere in the cases of temperature and ozone (see figure 3 in the attached temperature, and ozone reports), and in the mid stratosphere in the case of water vapour (see figure 3 in the attached water vapour report). There were no temperature, water vapour and ozone data available at mid and high latitudes in the NH.

3. GOMOS temperature data

The quality of the temperature data in the GOMOS BUFR files was stable compared with that reported in the last few months. The profile plots (temperature report: Figures 3-6) show that both in the global average and in the average over latitudinal bands, temperature in the GOMOS BUFR files was generally colder than the operational ECMWF temperature at most vertical levels, with the only exception of the lower stratosphere. In the global average, the first-guess and analysis departures are slightly positive up to 20hPa, and about -2K (-1%) from 5 to 1 hPa with a smooth transition from 20 to 5 hPa. In the mesosphere the global departures are within -1 and -2% (within -2 and -4K). The standard deviations of the first-guess and analysis departures are typically 1% in the Stratosphere, and between 1 and 4% in the Mesosphere. The level of agreement found in the global average was also seen in the mean over latitudinal bands, the only exception being the tropics where the first guess and analysis departures were negative and about -1% (-2 K) in all the Stratosphere. The standard deviations of the departures were about 1% at all latitudes and levels in the Stratosphere, but larger (up to 4%) in the Mesosphere.

The scatter plots (temperature report: Figures 7-14) showed a similar level of agreement between the temperature in the GOMOS files and the operational ECMWF temperature, with a variability of the first-guess departures within $\pm 4\text{K}$ at most vertical levels in the Stratosphere. 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 confirmed the results discussed above.

4. GOMOS ozone data

The quality of the GOMOS ozone profiles was found consistent with that reported in the last few months. The profile plots (ozone report: Figures 3-6) showed that both the ozone first guess and analyses were within the observation one-standard deviation range at most levels and latitudinal bands, and that, with the exception of the lower stratosphere (typically between 5 and 20 hPa), the GOMOS ozone generally exhibits larger values than their model equivalent. In the global average, the first-guess departures were within -10 and +25% at most vertical levels in the stratosphere and mesosphere. Larger departures were found around 100hPa. The standard deviations of the departures were larger than 20% at all levels.

When averaged over latitudinal bands, first guess and analysis departures within -5 and 15% were found in most of the Stratosphere and lower Mesosphere in the tropical band. At midlatitudes in the SH, the departures between the GOMOS ozone values and their model equivalent were between -15 and +30% at most levels but larger departures were found near 100hPa and in the layer between 0.1 and 0.2 hPa. At high latitudes in the SH, the first-guess and analysis departures were larger than in the other latitudinal bands, with values within -15 and +40% in the stratosphere but larger than 50% at some levels in the mesosphere. The standard deviations of the analysis and first guess departures were larger than 20% at all levels and latitudinal bands.

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 most vertical levels that led to a large scatter in the first-guess departures.

The timeseries of GOMOS ozone and departures at several levels and the Hovmoeller plots are shown in figures 15-18, and 19-20 of the ozone report, respectively. Both the timeseries and the Hovmoeller plots confirm the level of agreement between NRT GOMOS ozone retrievals and the ECMWF ozone analyses discussed above.

5. Water vapour data

As found in the previous months also in September the level of agreement between the GOMOS water vapour and the ECMWF water vapour first guess and analyses was generally poor at all levels and available latitudinal bands. The level of agreement is slightly higher at high latitudes in the SH.

The profile plots (Water Vapour report: Figures 3-4) showed that the GOMOS water vapour values were from one to four orders of magnitude larger than those given by the model at all vertical levels and latitudinal bands. As discussed in the last months, the largest differences were still found in the Stratosphere, where not only did the GOMOS observations exhibit on average values of four orders of magnitude larger than their model equivalent, they also were larger than the mean GOMOS tropospheric observation. A higher level of agreement was found at high latitudes in the SH. Here the GOMOS WV observations still exhibited higher values than their model equivalent, but the departures were considerably smaller than those seen elsewhere. In addition, the WV content especially in the upper stratosphere decreases with height as expected. Yet, the first-guess and analysis departures were typically more than one order of magnitude at all levels.

The scatter plots (water vapour report: Figures 5-10) confirm the above analysis. They showed large scatter in the GOMOS water vapour data 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 at different levels are presented in figures 11, and 12 of the water vapour report, respectively. These plots show that with the exception of a few scattered data available in the tropics and at midlatitudes, most of the WV observations were sampled at high latitudes in the SH. In addition, because of the very large difference between the ECMWF WV and the GOMOS WV, very little signal was detected in the time series at most levels (figure 13).

6. Remarks

This monitoring report was produced with the operational ECMWF model (CY33R1). Ozone layers from SBUV/2 on NOAA-16, NOAA-17 and NOAA-18, SCIAMACHY total column ozone data produced by KNMI, as well as OMI total column ozone were actively assimilated.

The results presented in this reports made use of only the observations acquired in dark-limb conditions.

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 2008

Rossana Dragani

*ECMWF, Shinfield Park, Reading, RG2 9AX, United Kingdom,
Emails: Rossana.Dragani@ecmwf.int, Tel: 0044 118 9499259*

September 8, 2008

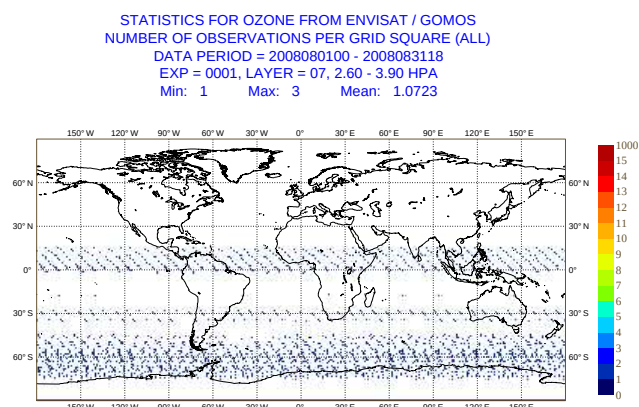


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for August 2008.

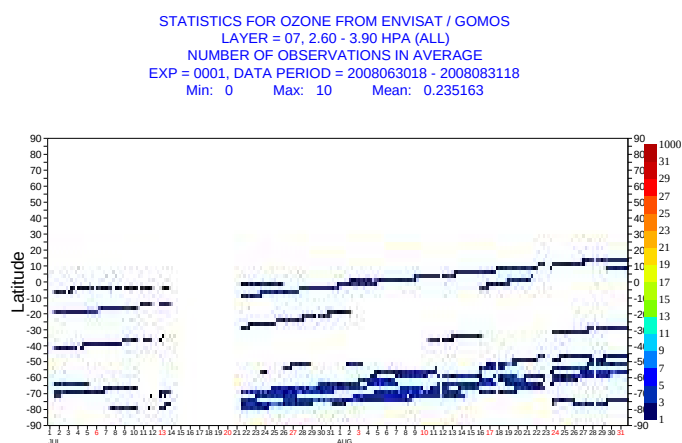


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for July-August 2008.

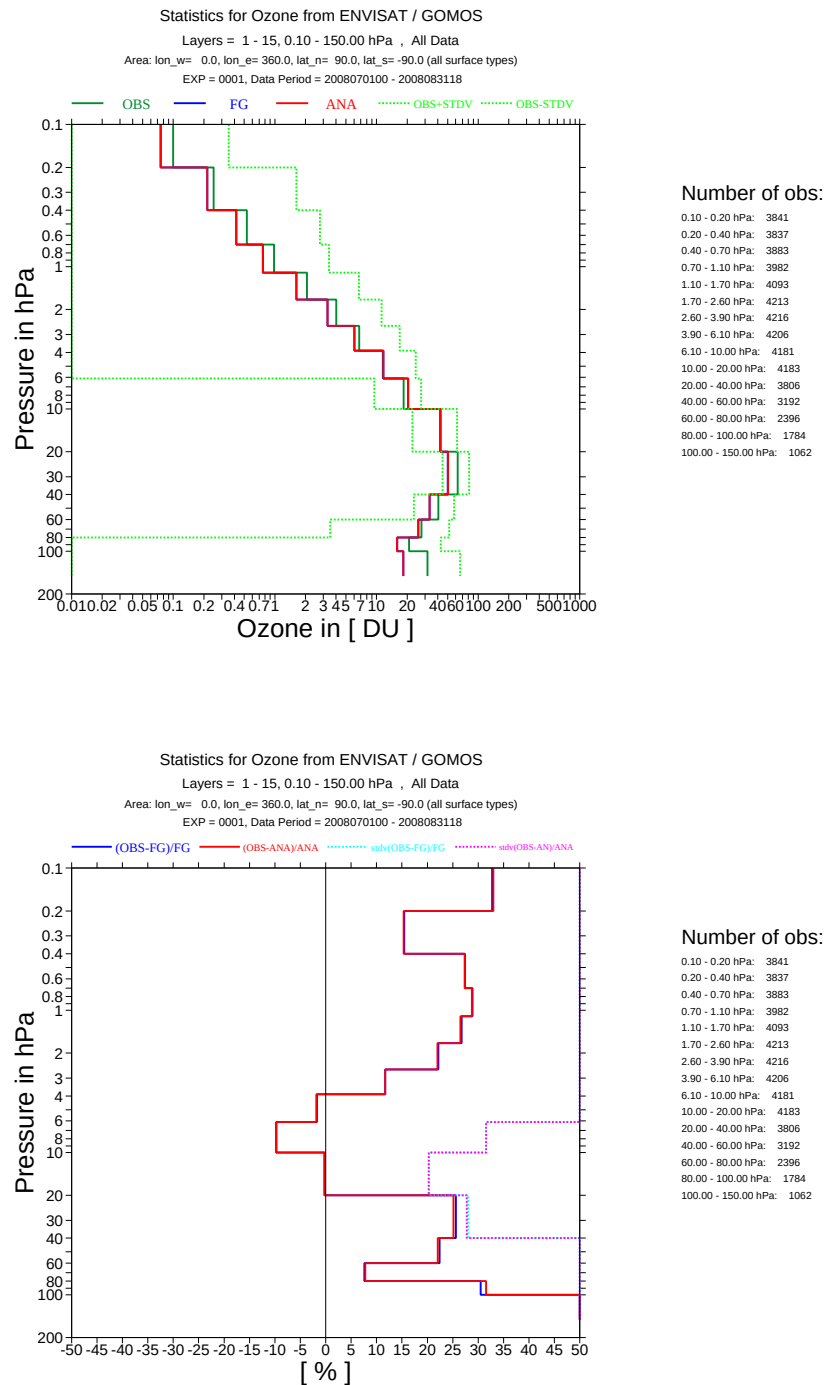


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for August 2008 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) $\pm$ 1 standard deviation (green dotted lines). The 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.

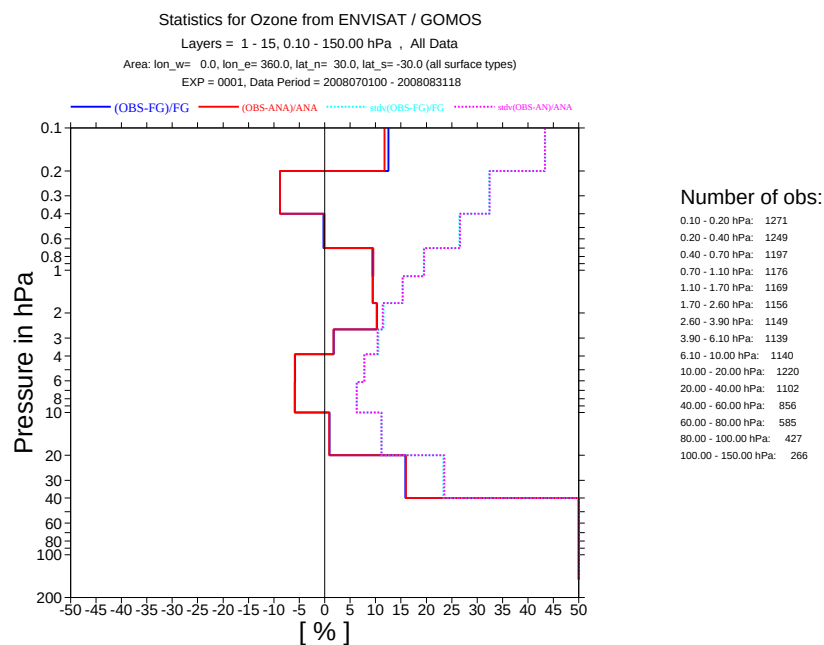
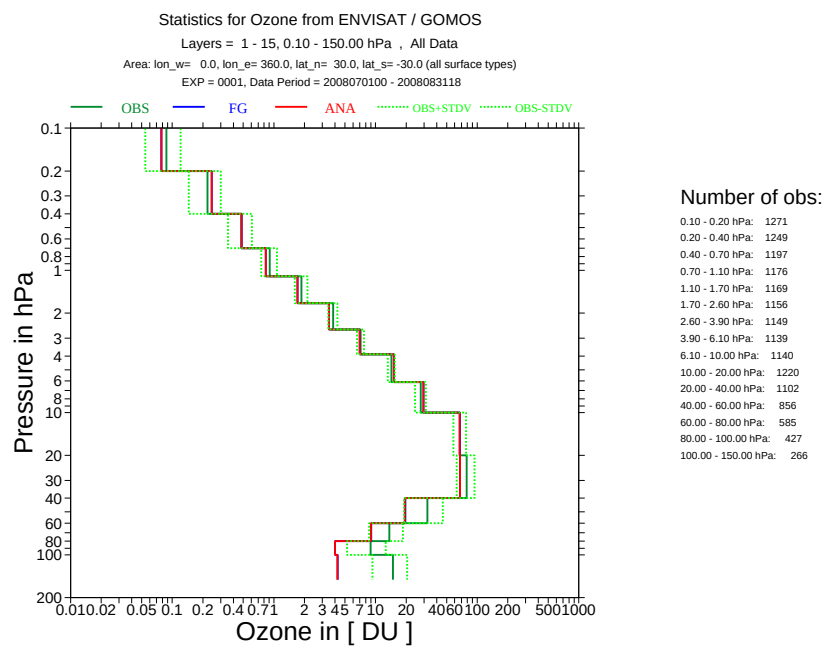


Fig. 4. As Fig. 3 but for 30N-30S.

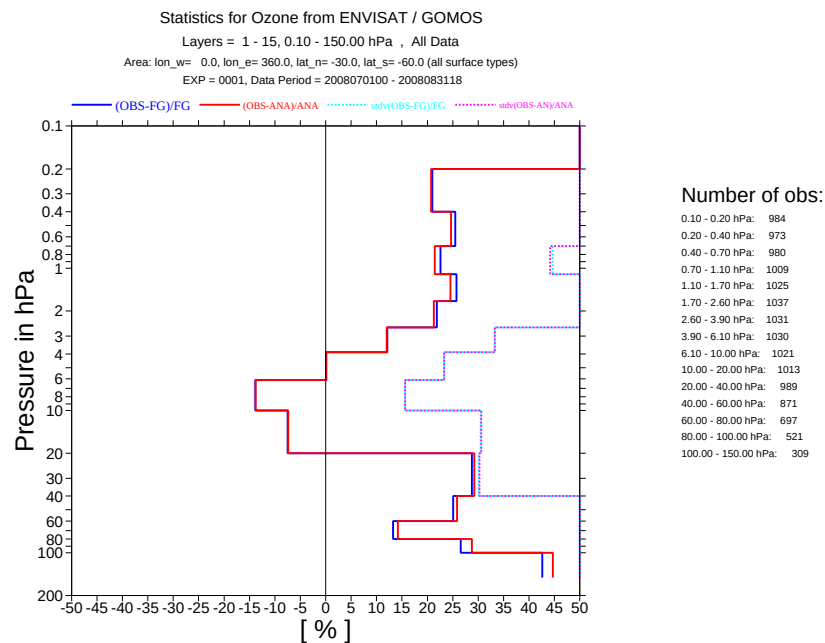
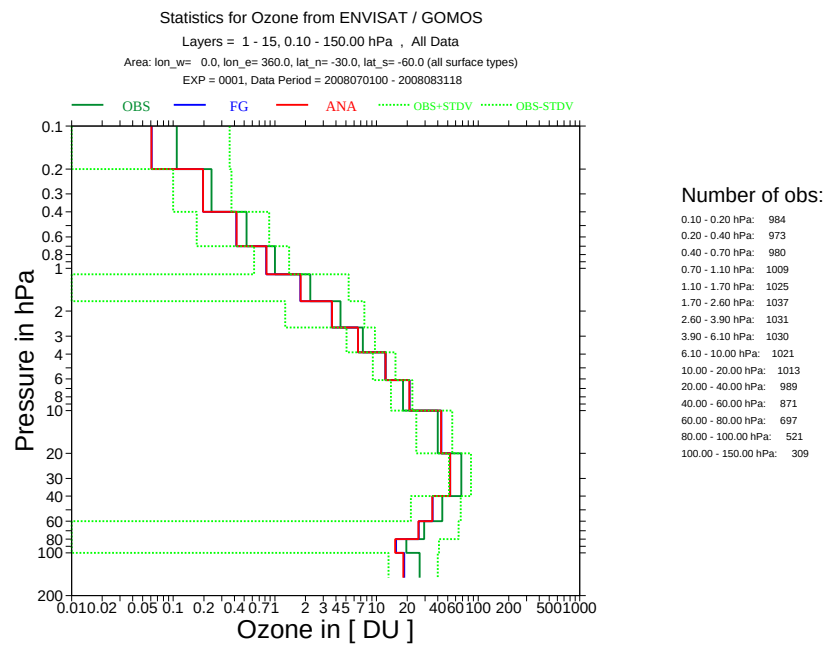


Fig. 5. As Fig. 3 but for 30S-60S.

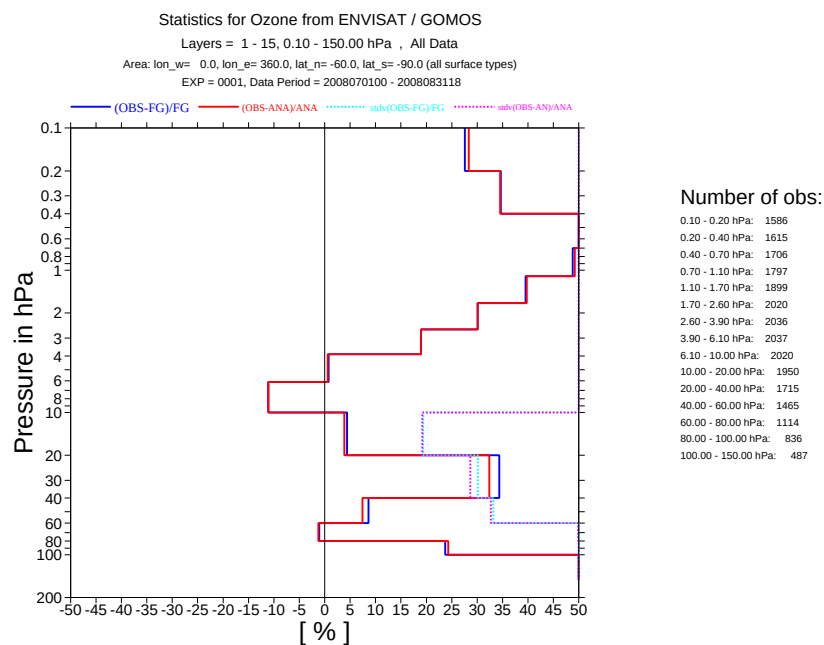
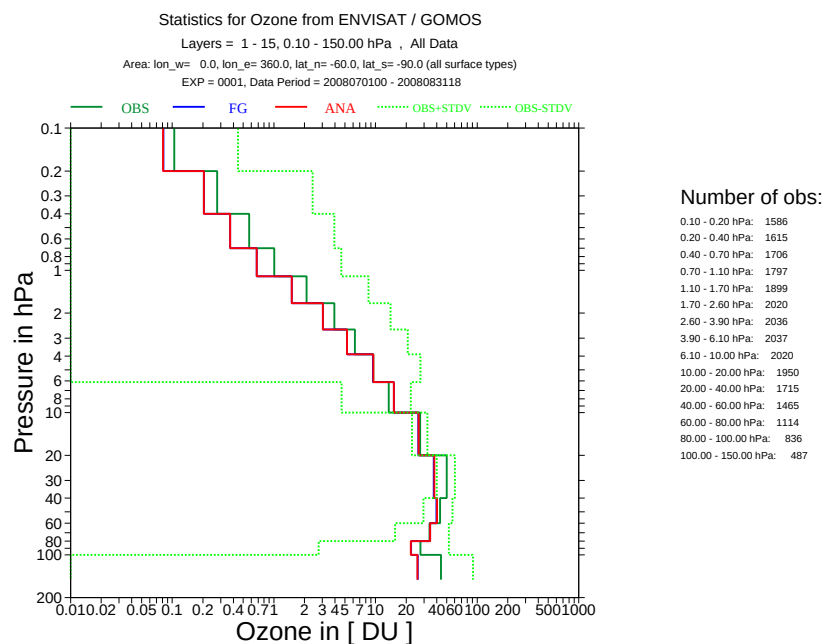


Fig. 6. As Fig. 3 but for 60-90S.

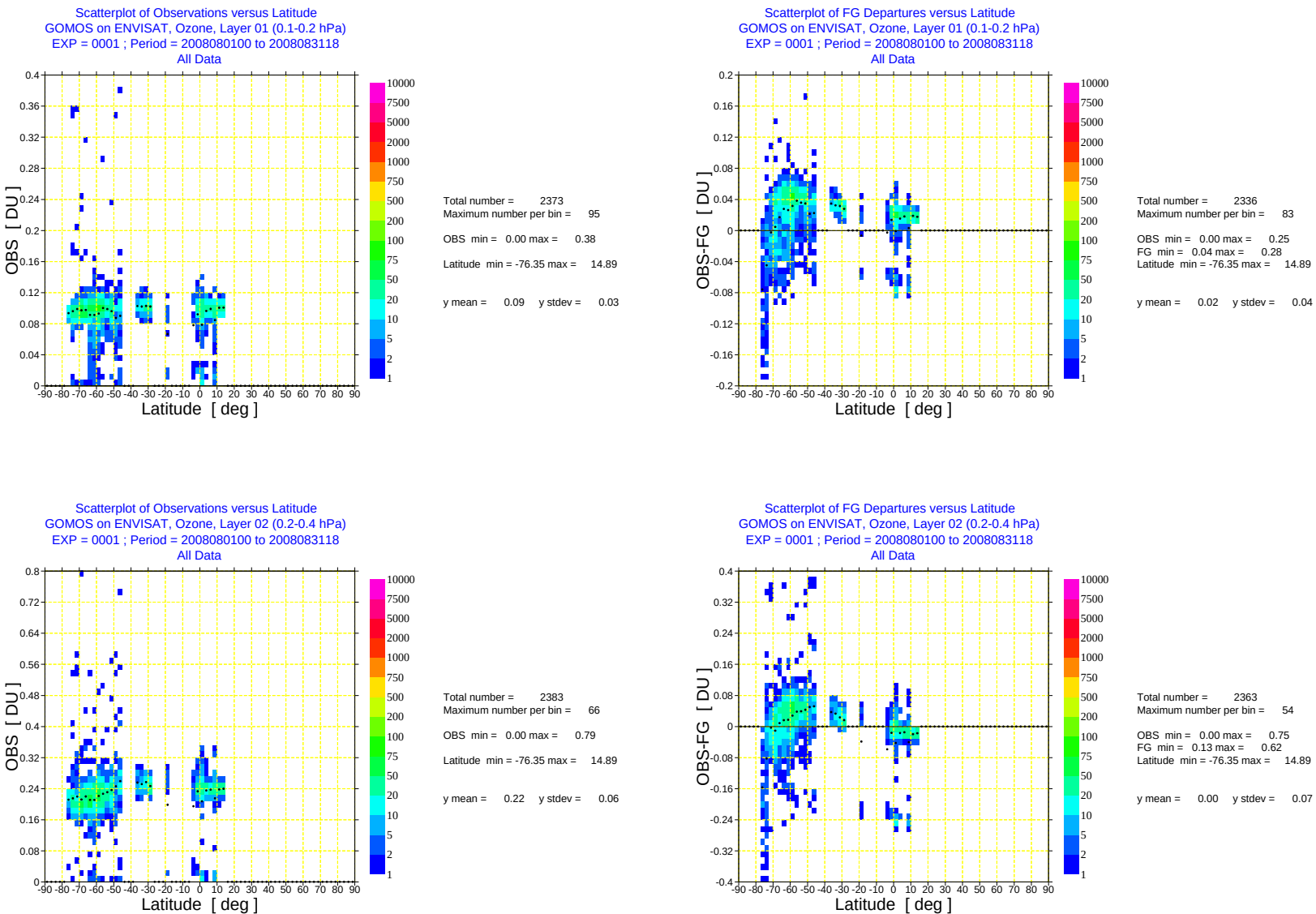


Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for August 2008 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black dots the mean value per bin.

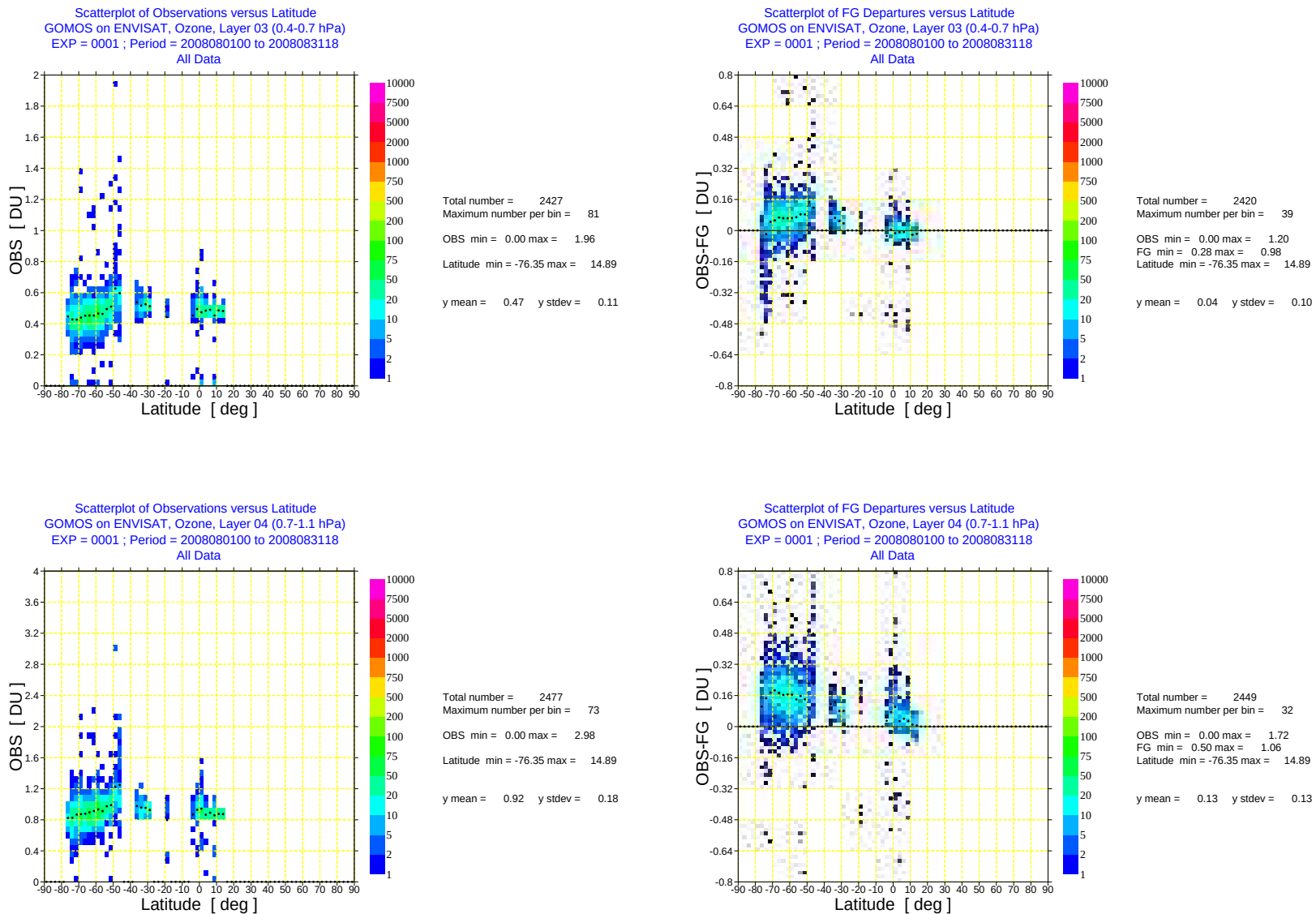


Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

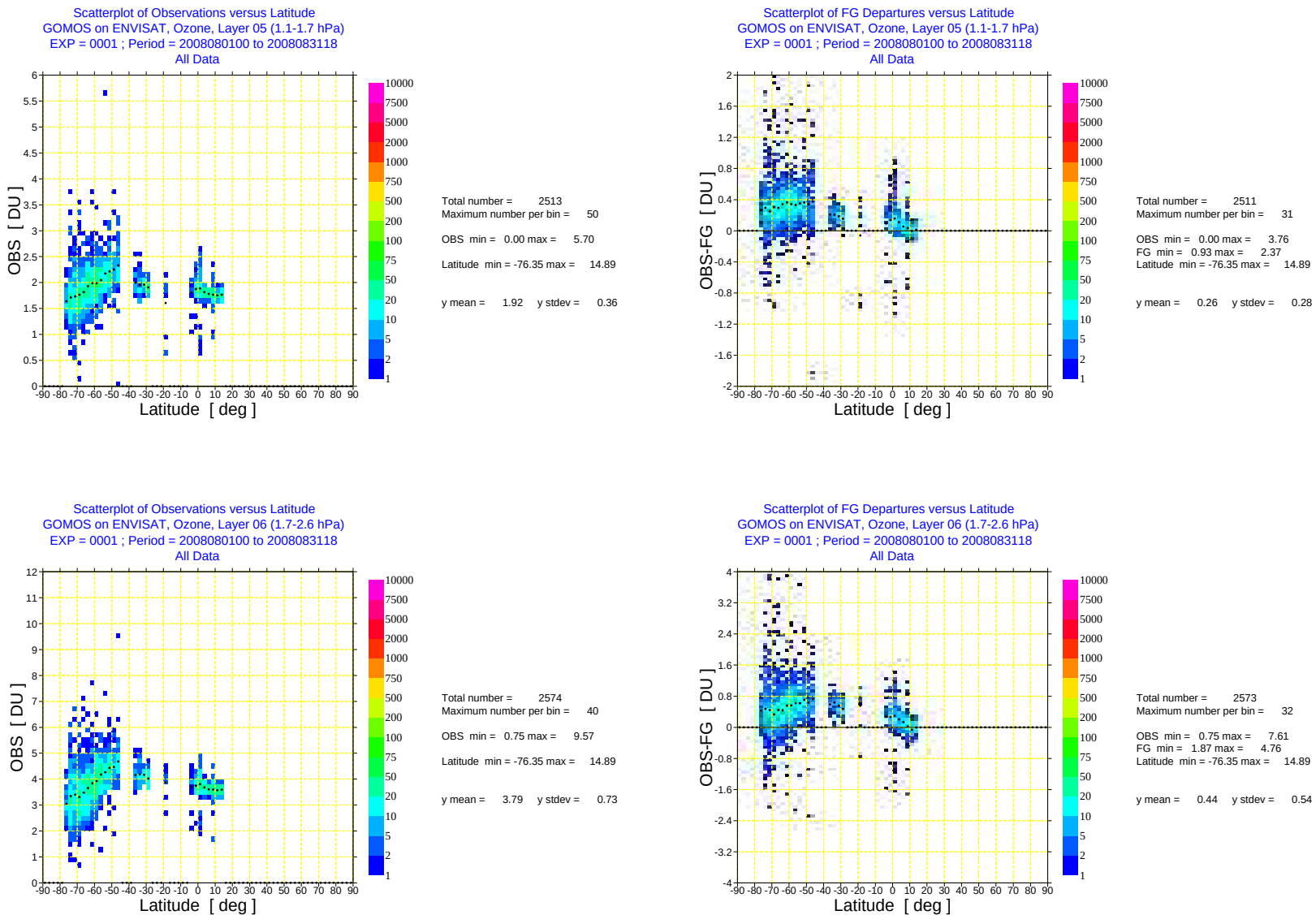


Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

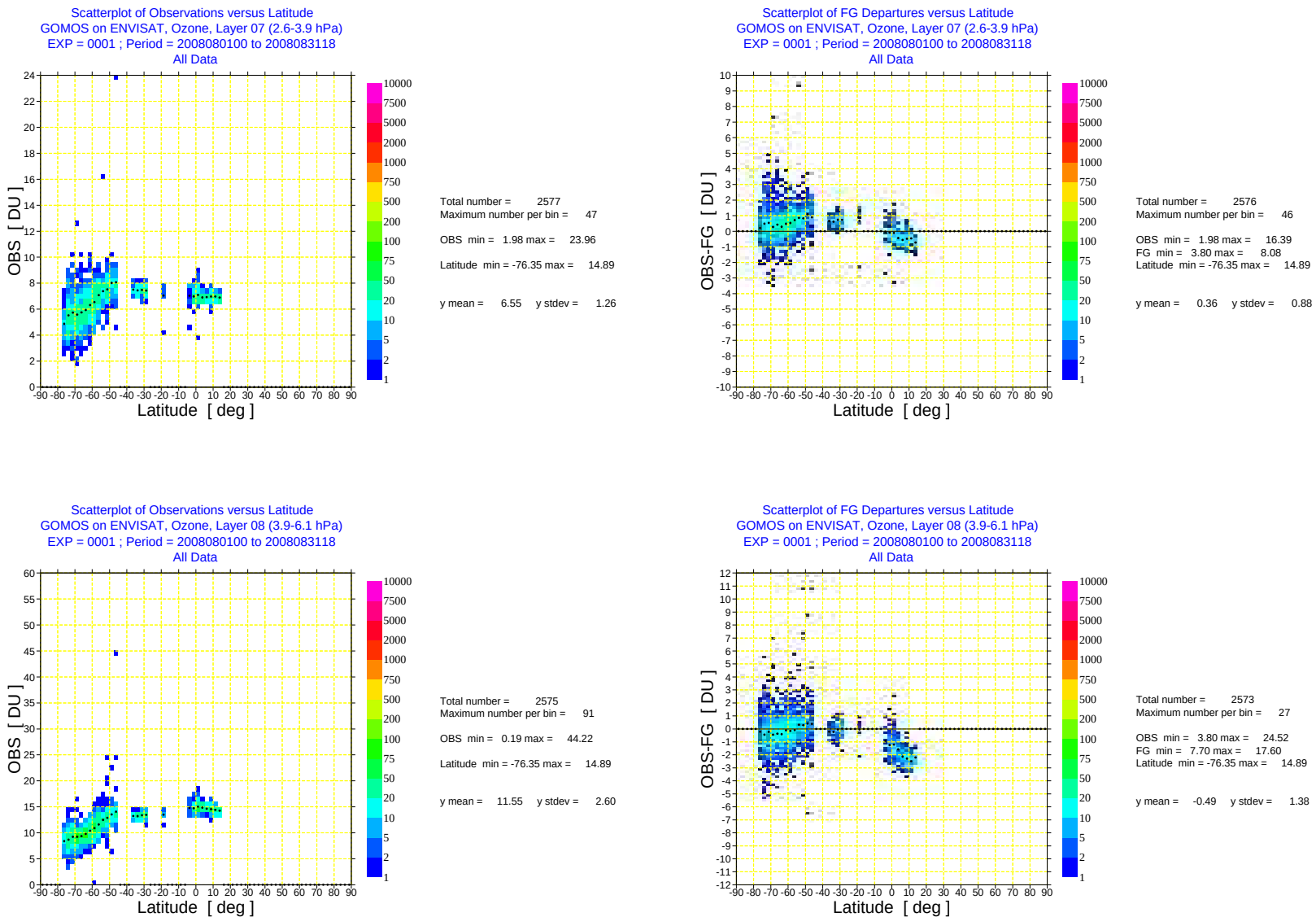


Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

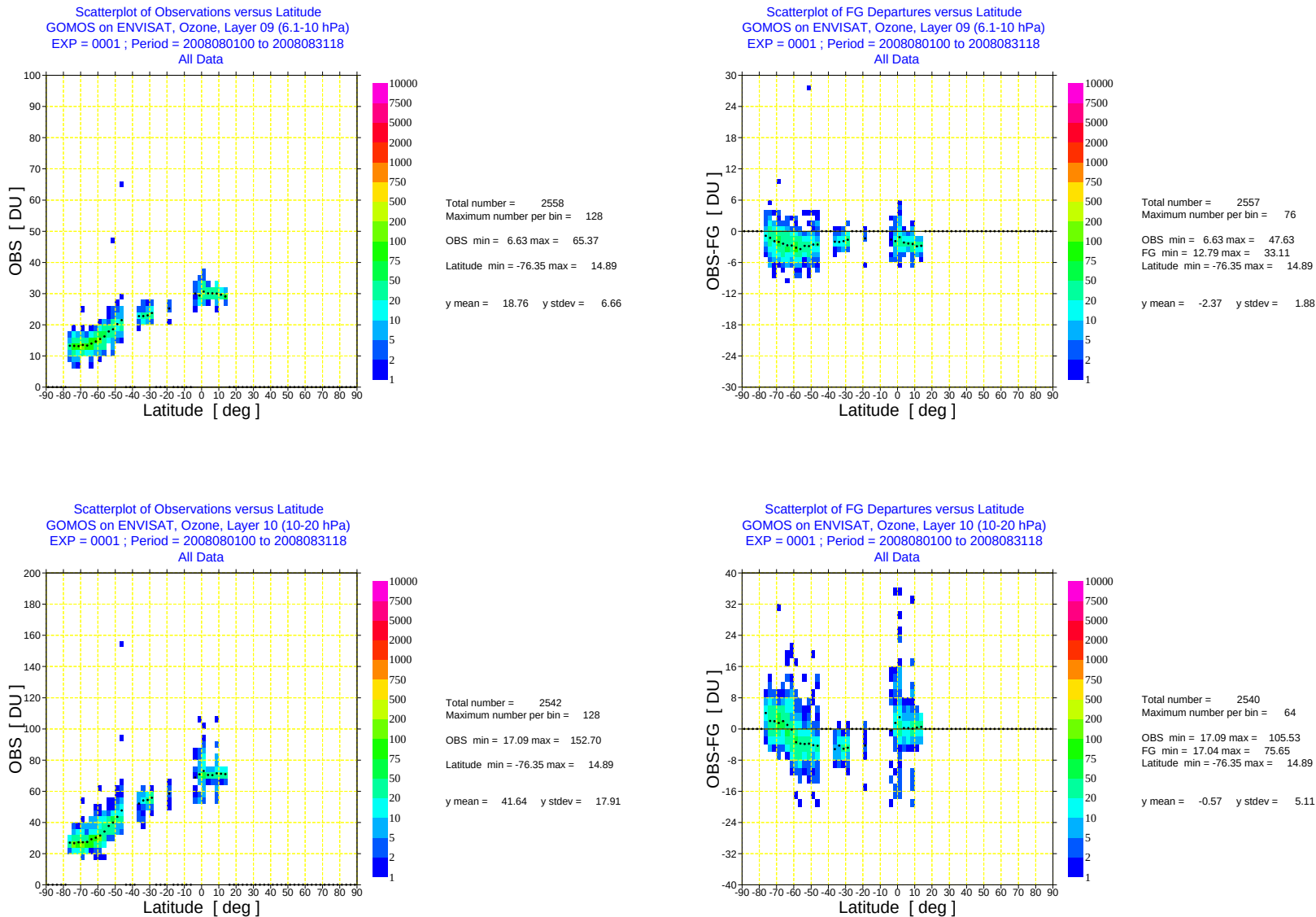


Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

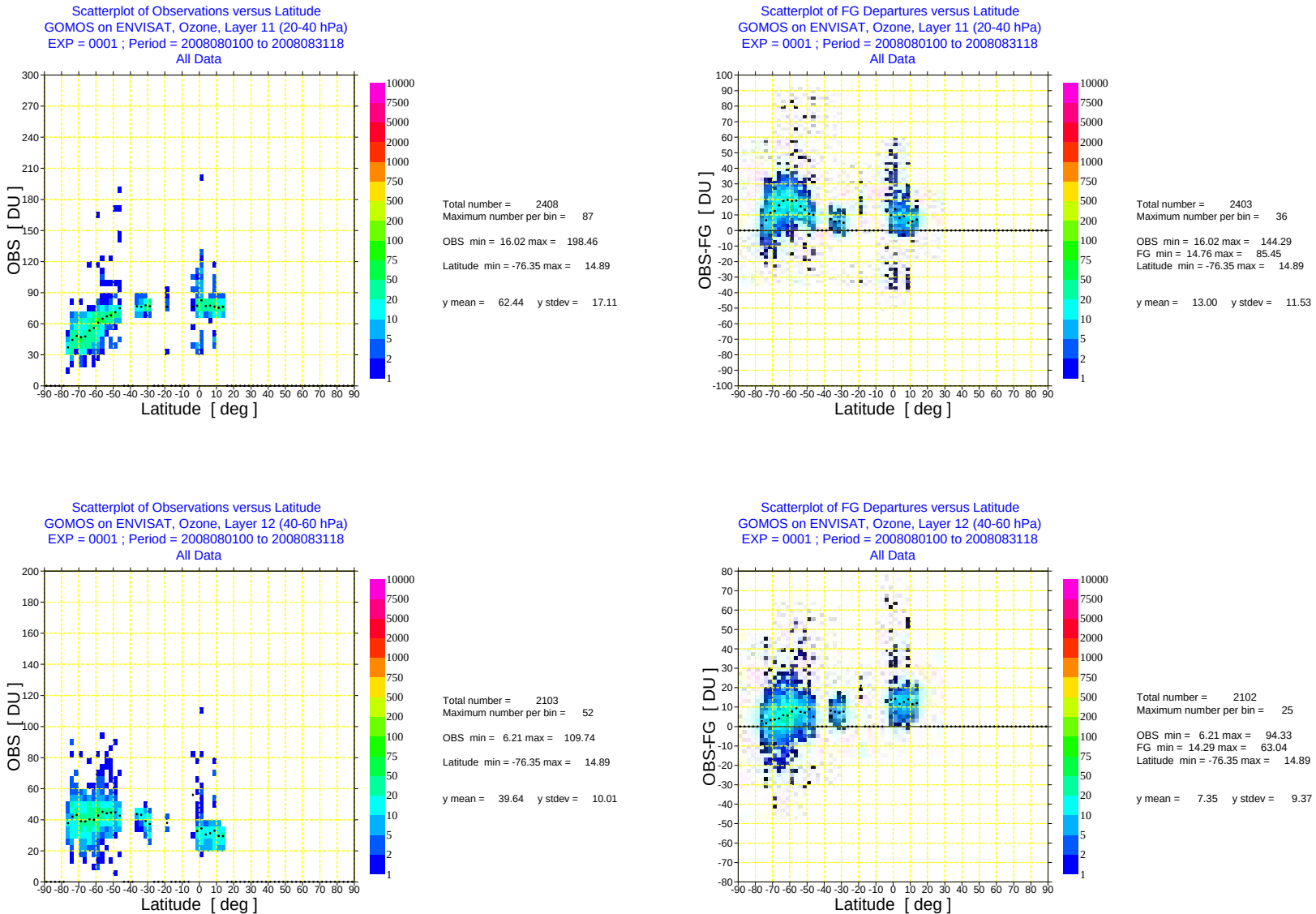


Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

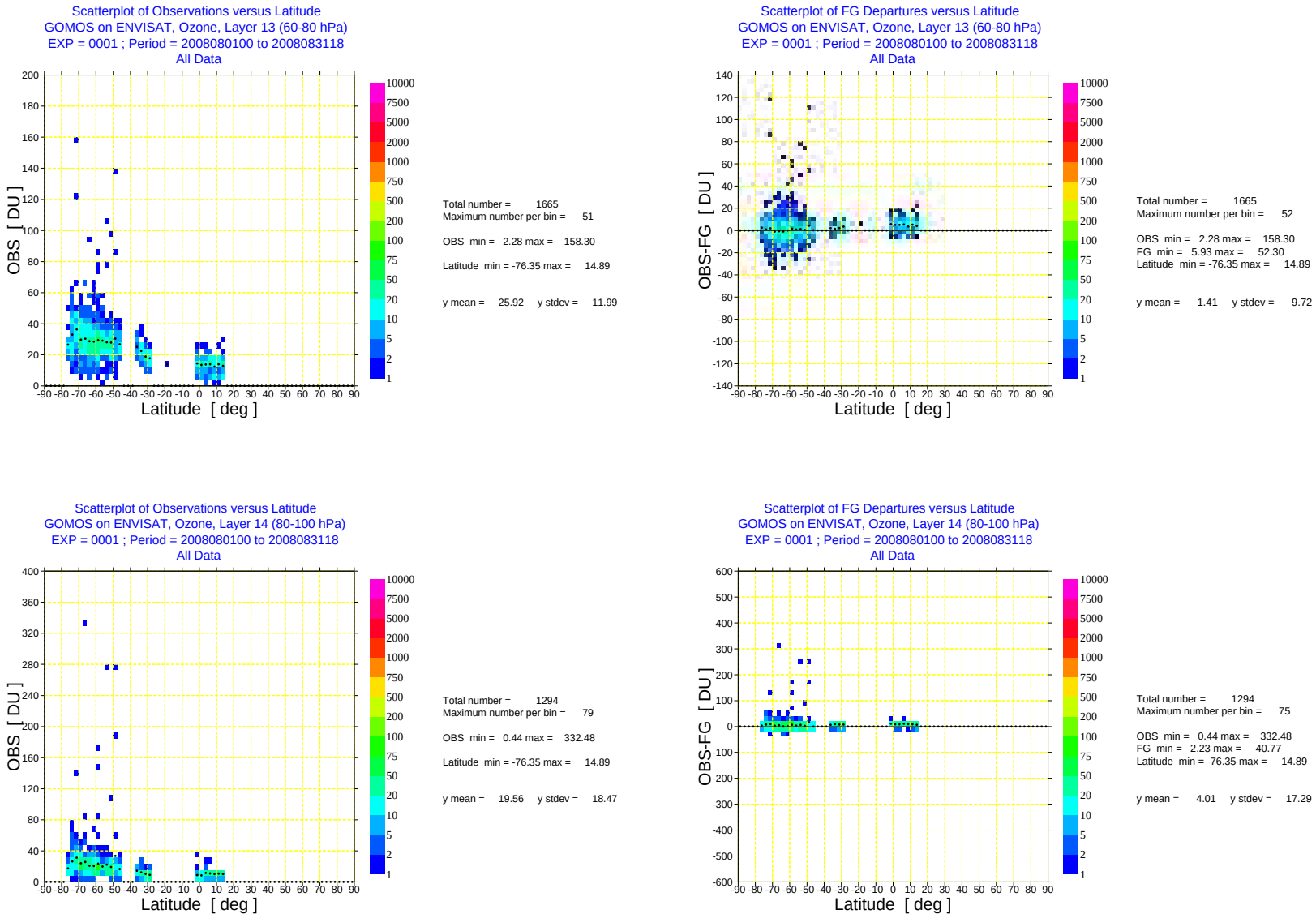


Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

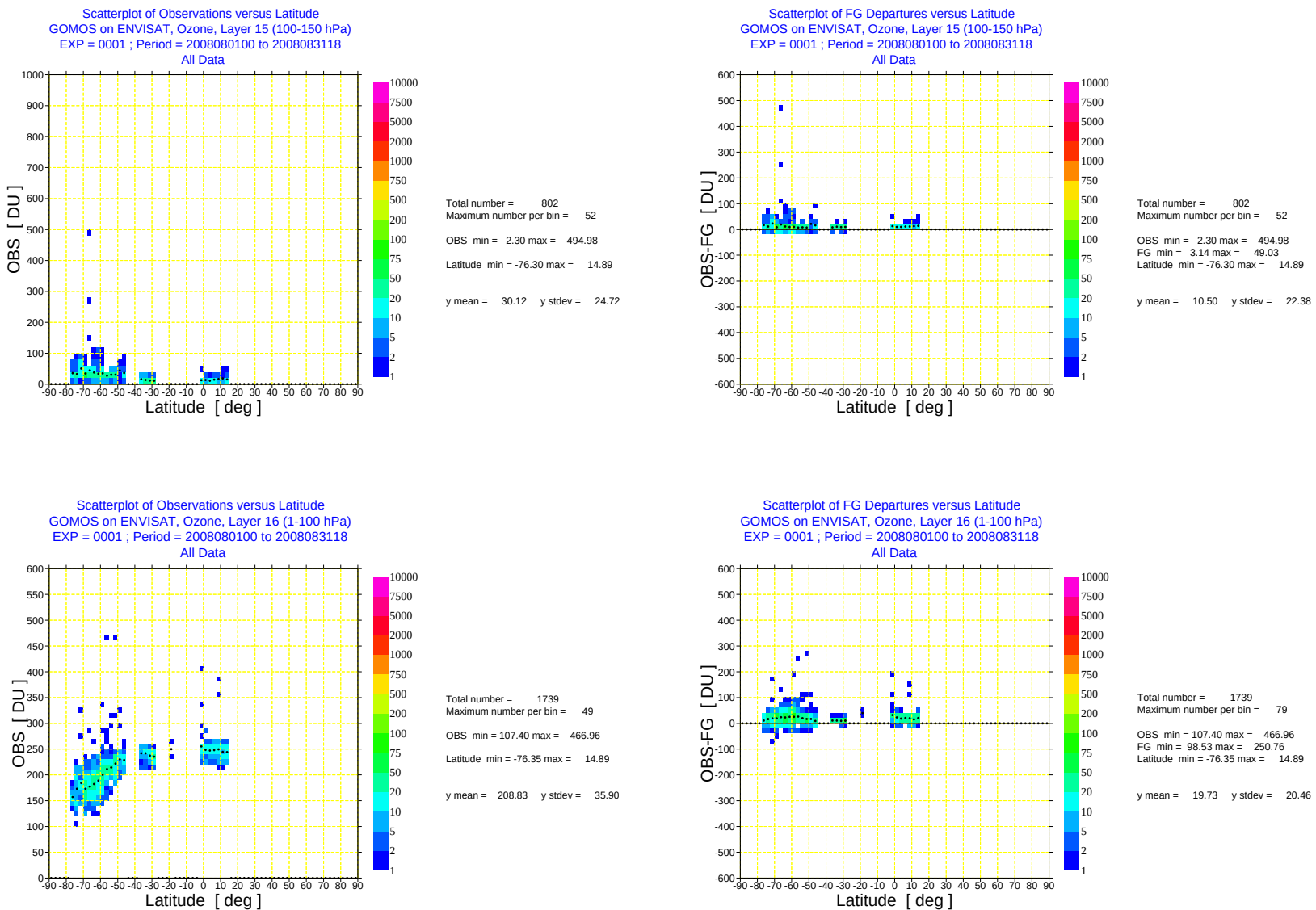


Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

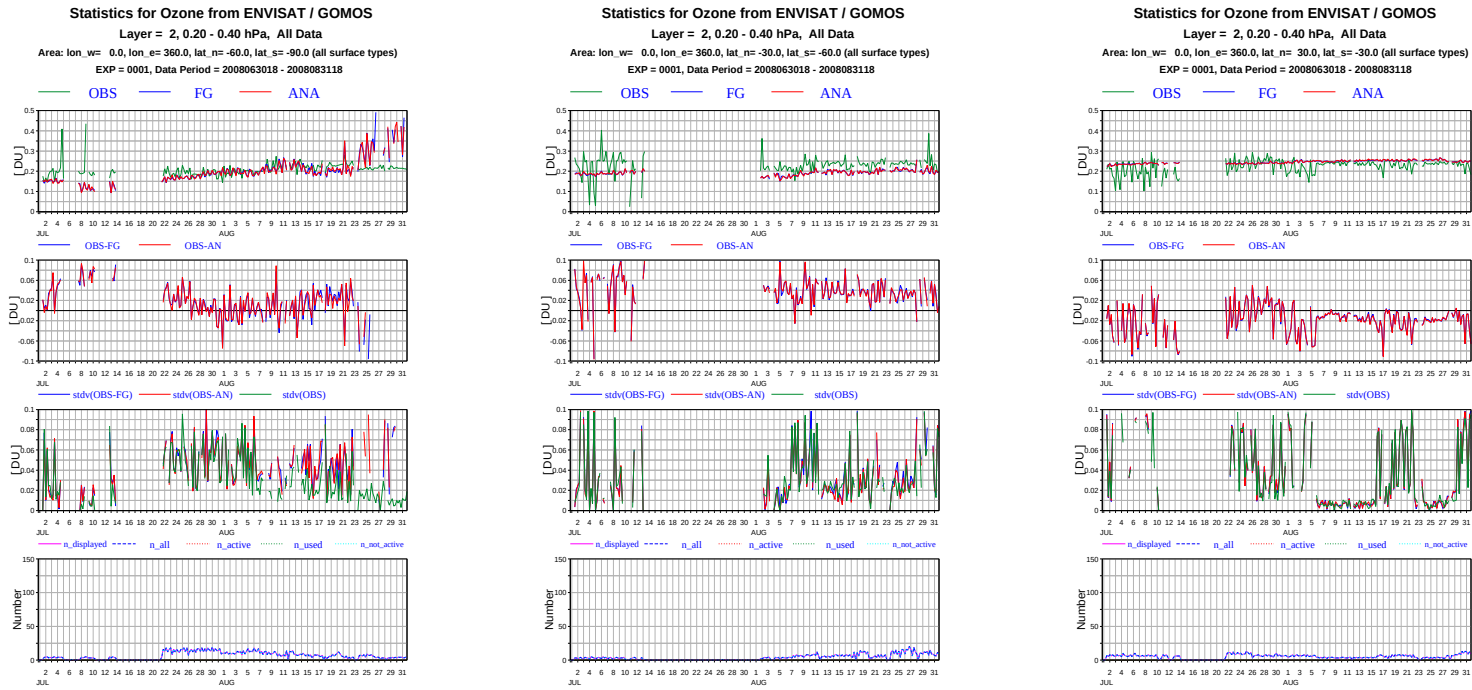


Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for the period July-August 2008.

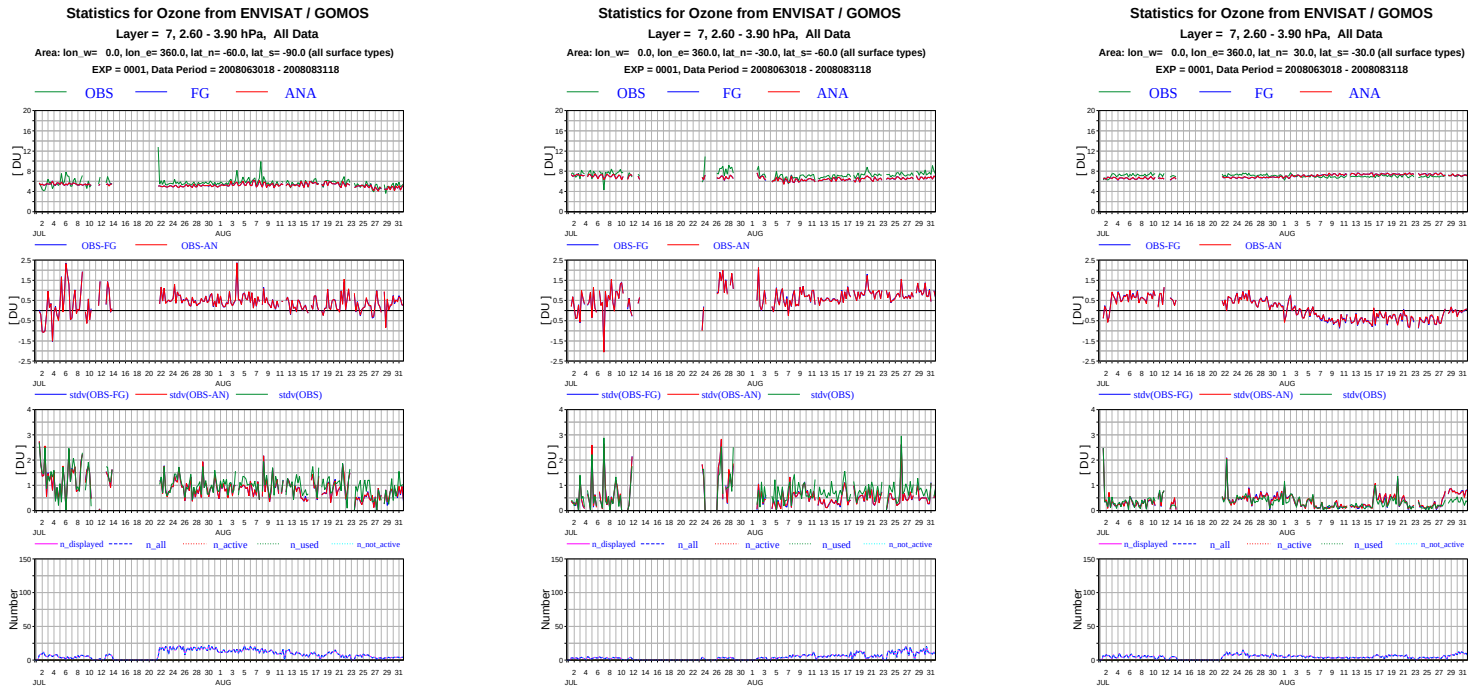


Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

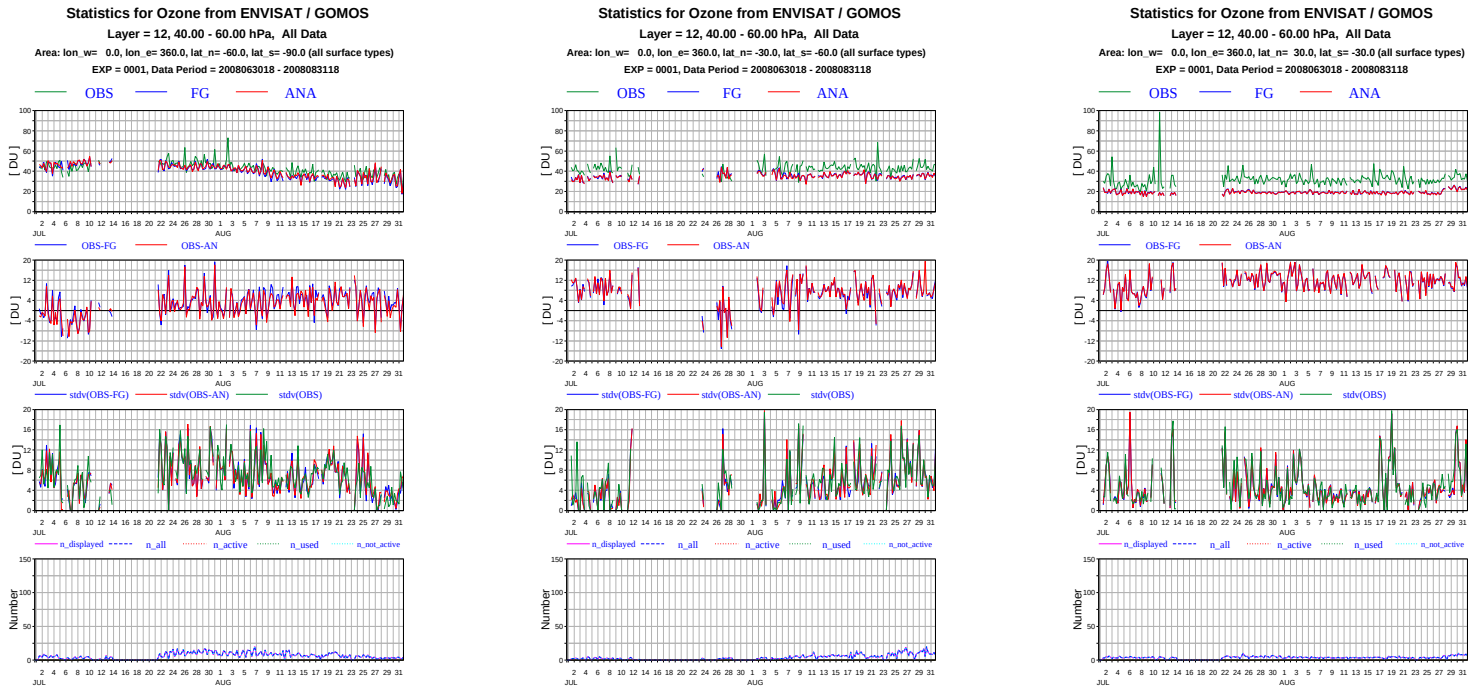


Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

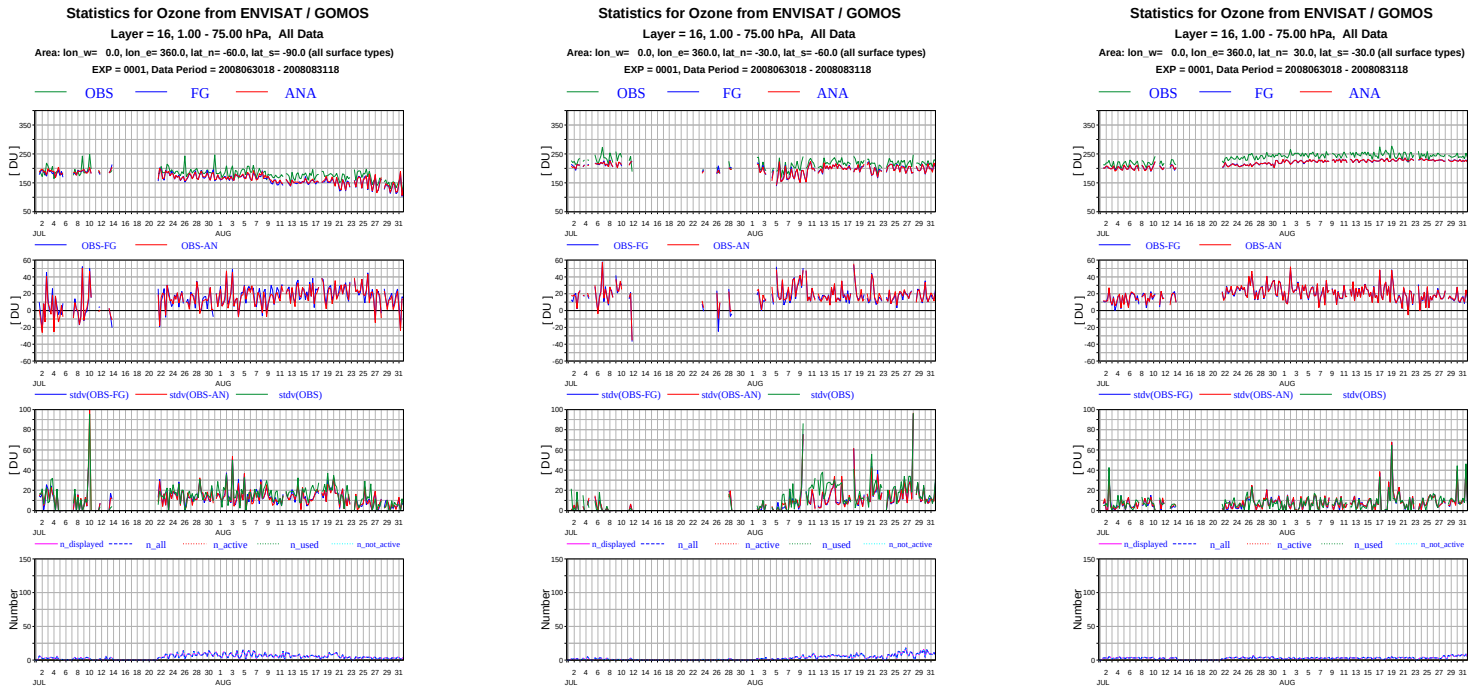


Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

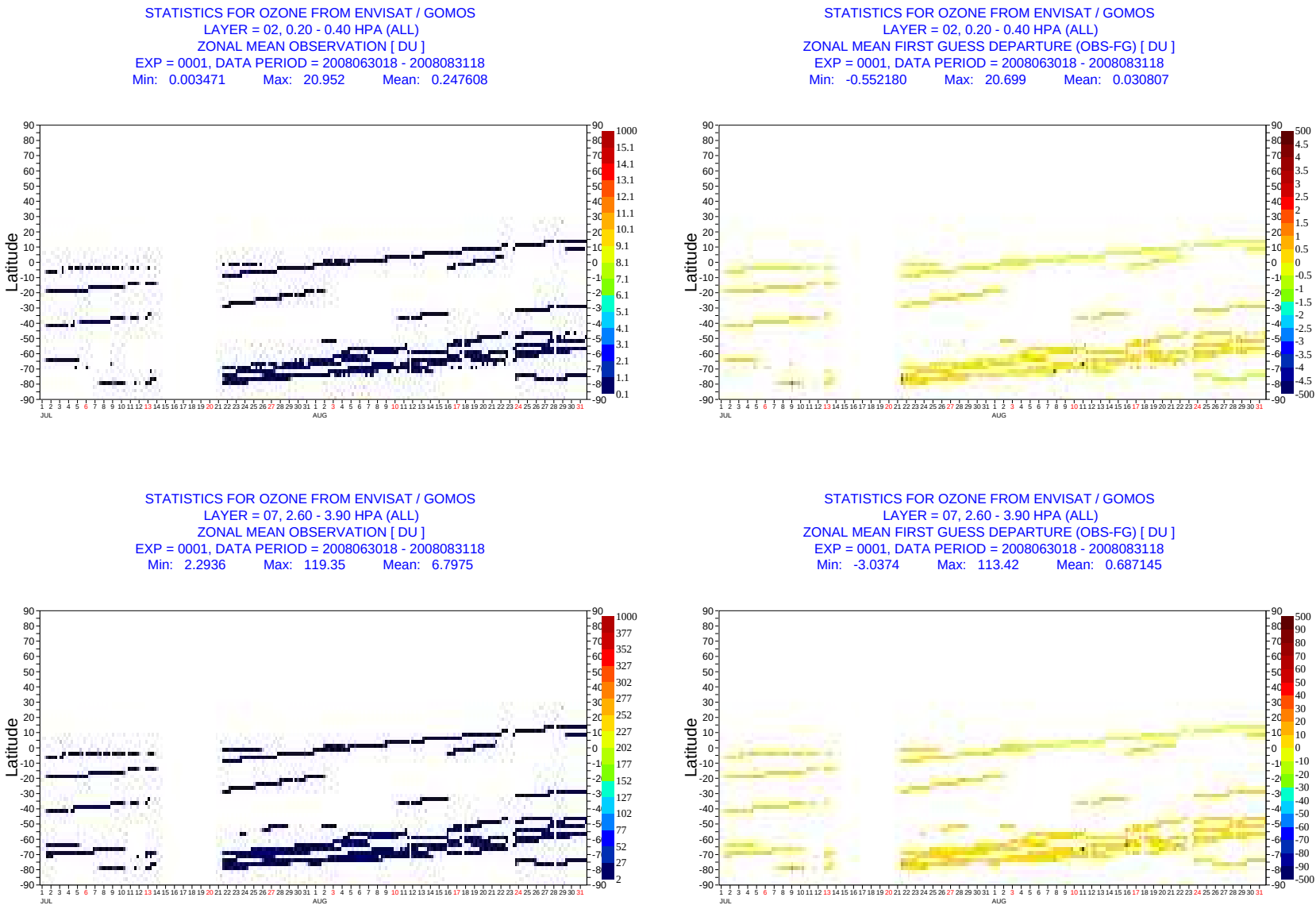


Fig. 19. Hornoeoller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for July-August 2008 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

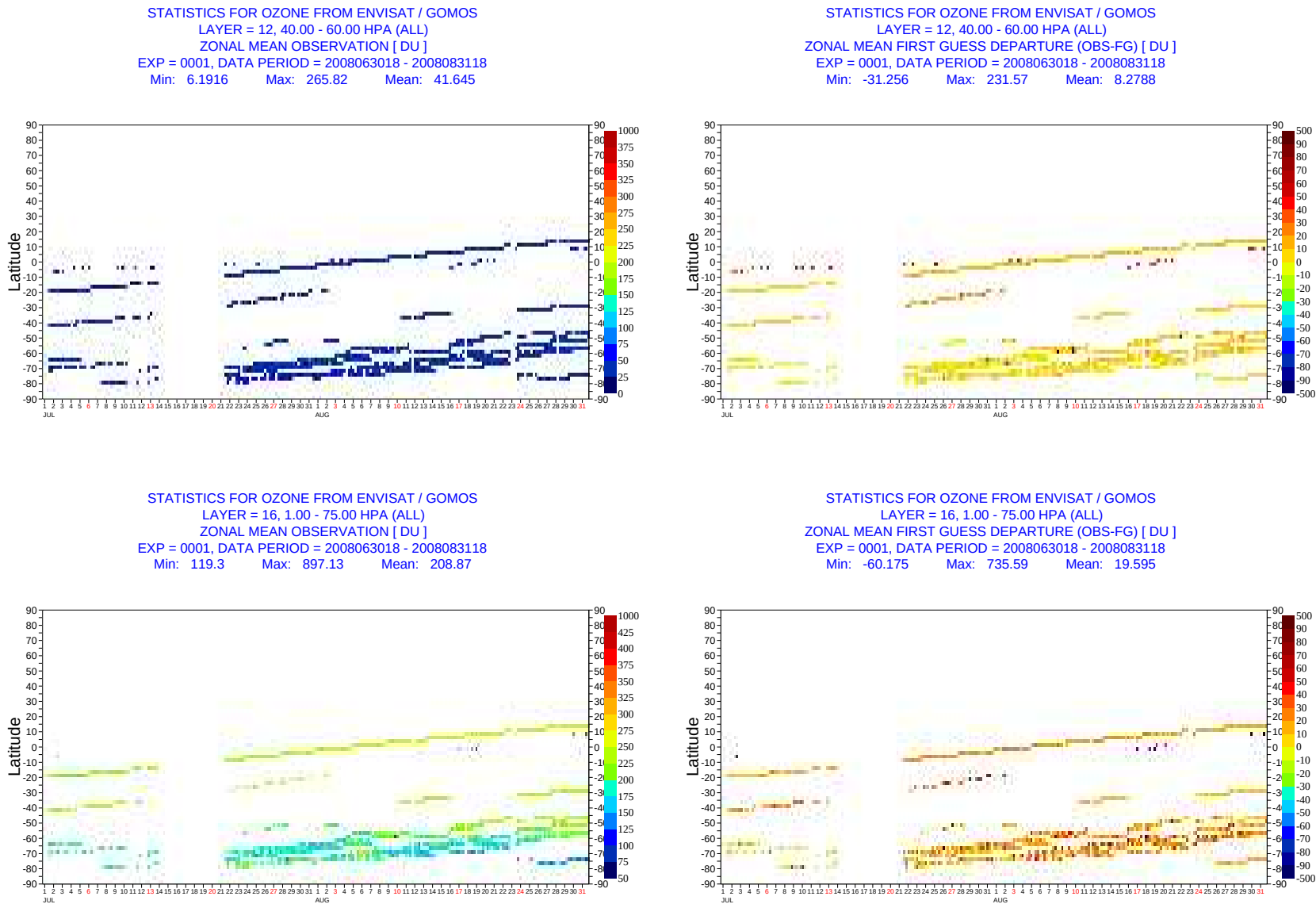


Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

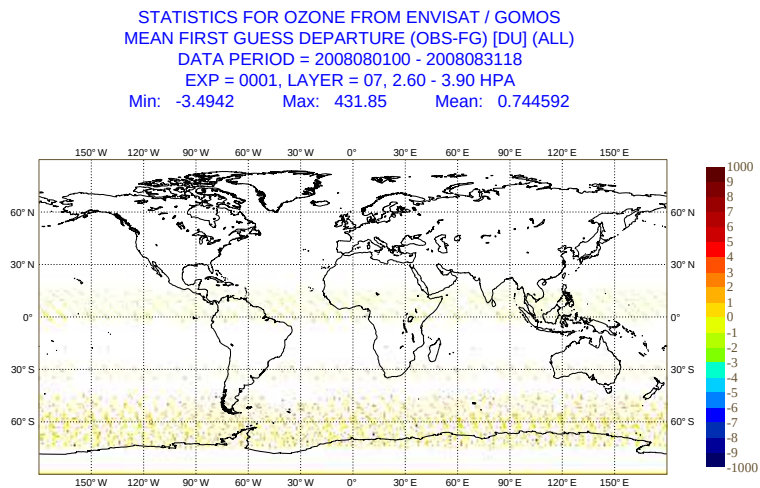
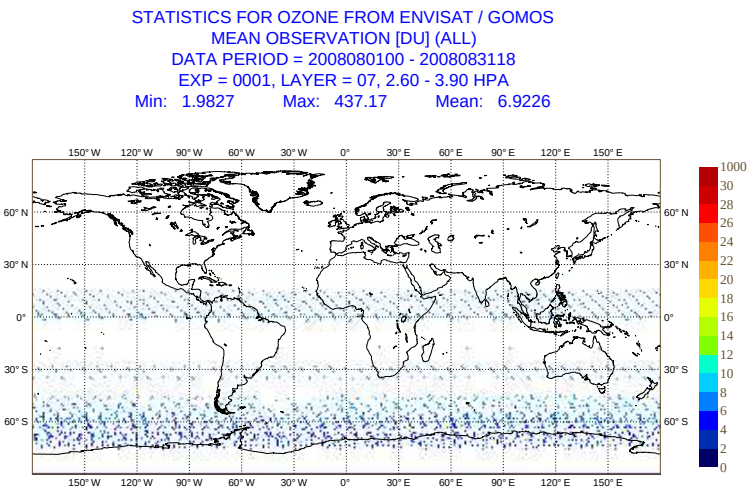
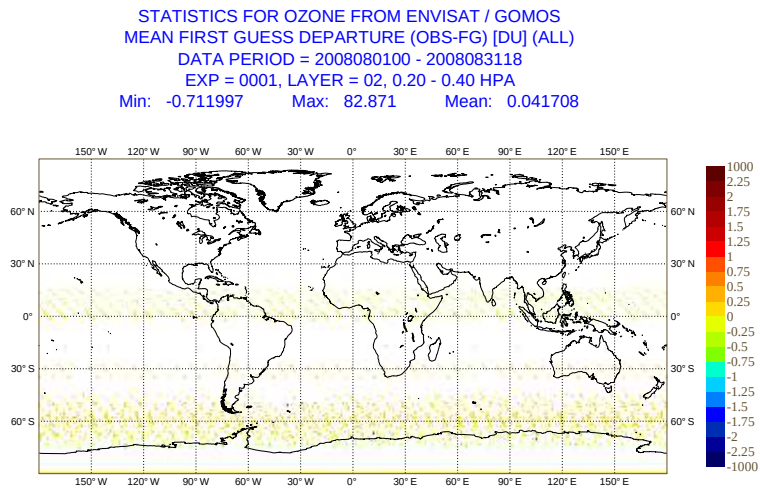
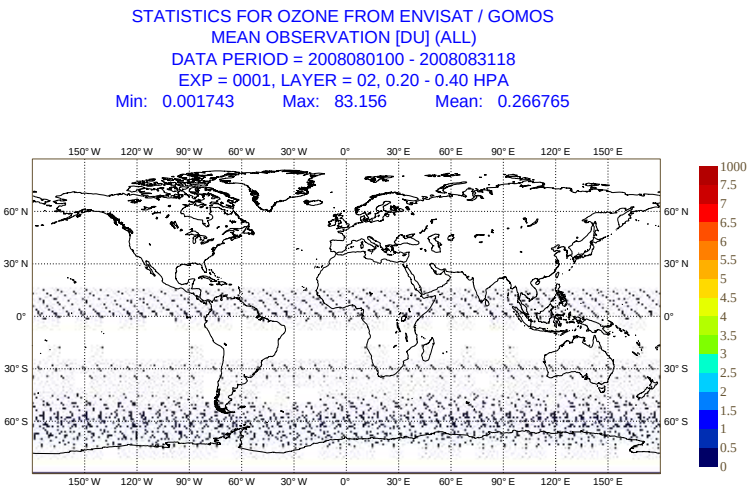


Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for August 2008 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

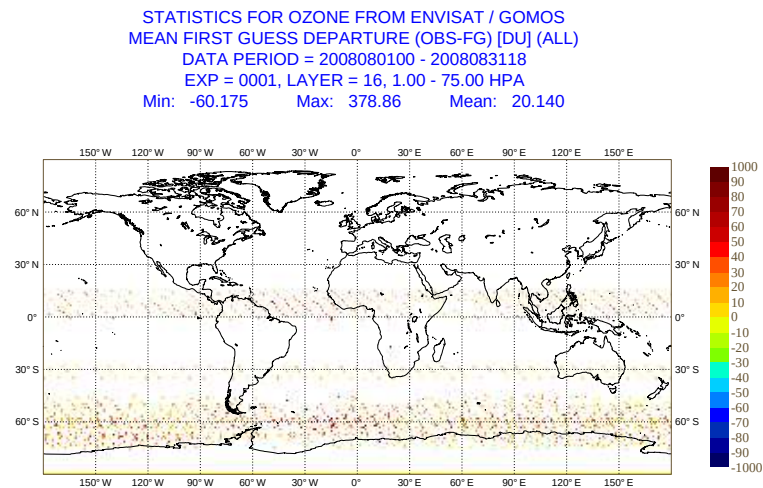
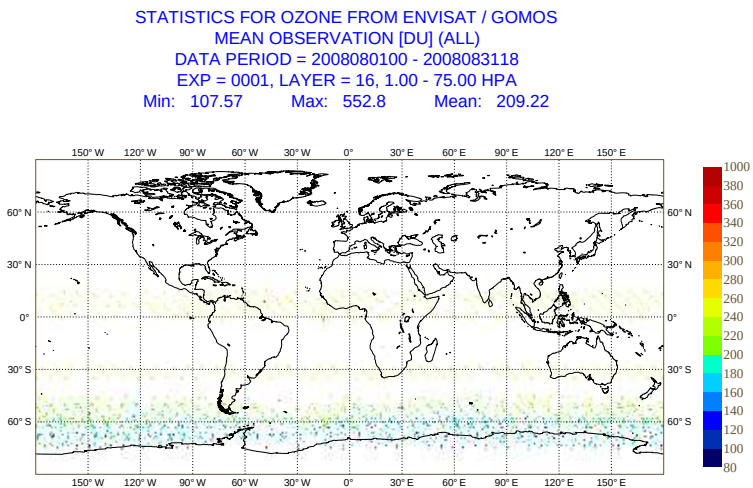
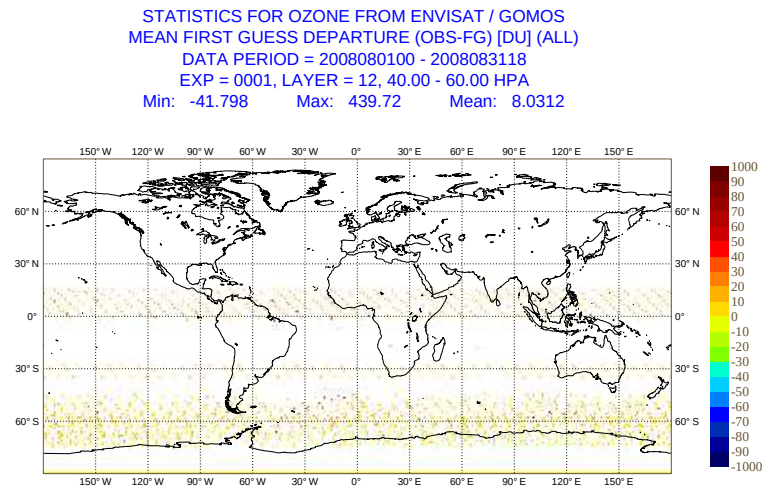
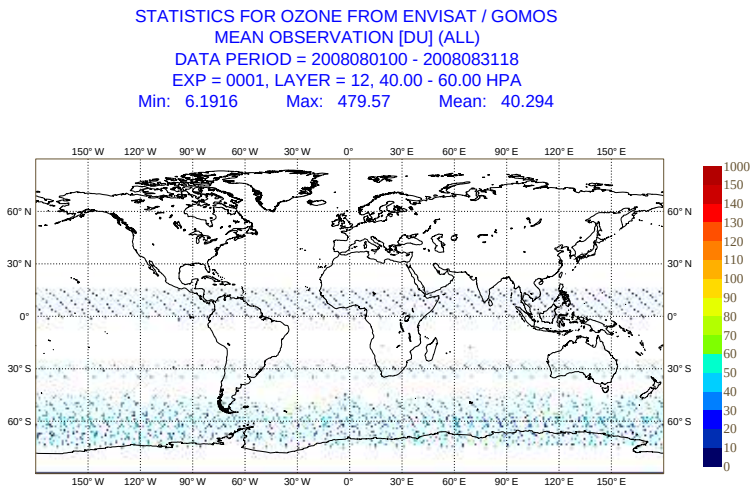


Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR_2P) FOR AUGUST 2008

Rossana Dragani

*ECMWF, Shinfield Park, Reading, RG2 9AX, United Kingdom,
Emails: Rossana.Dragani@ecmwf.int, Tel: 0044 118 9499259*

September 8, 2008

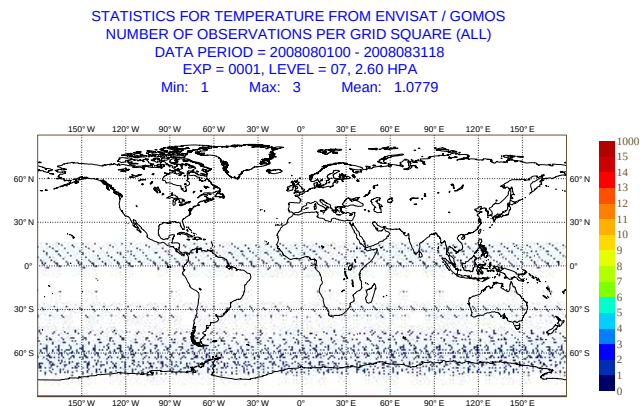


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for August 2008.

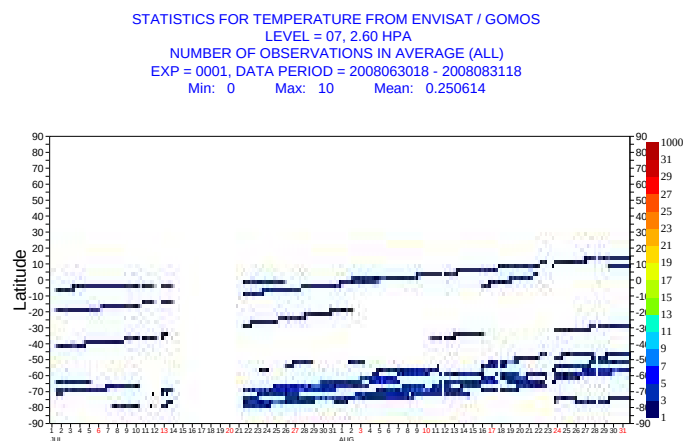


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for July-August 2008.

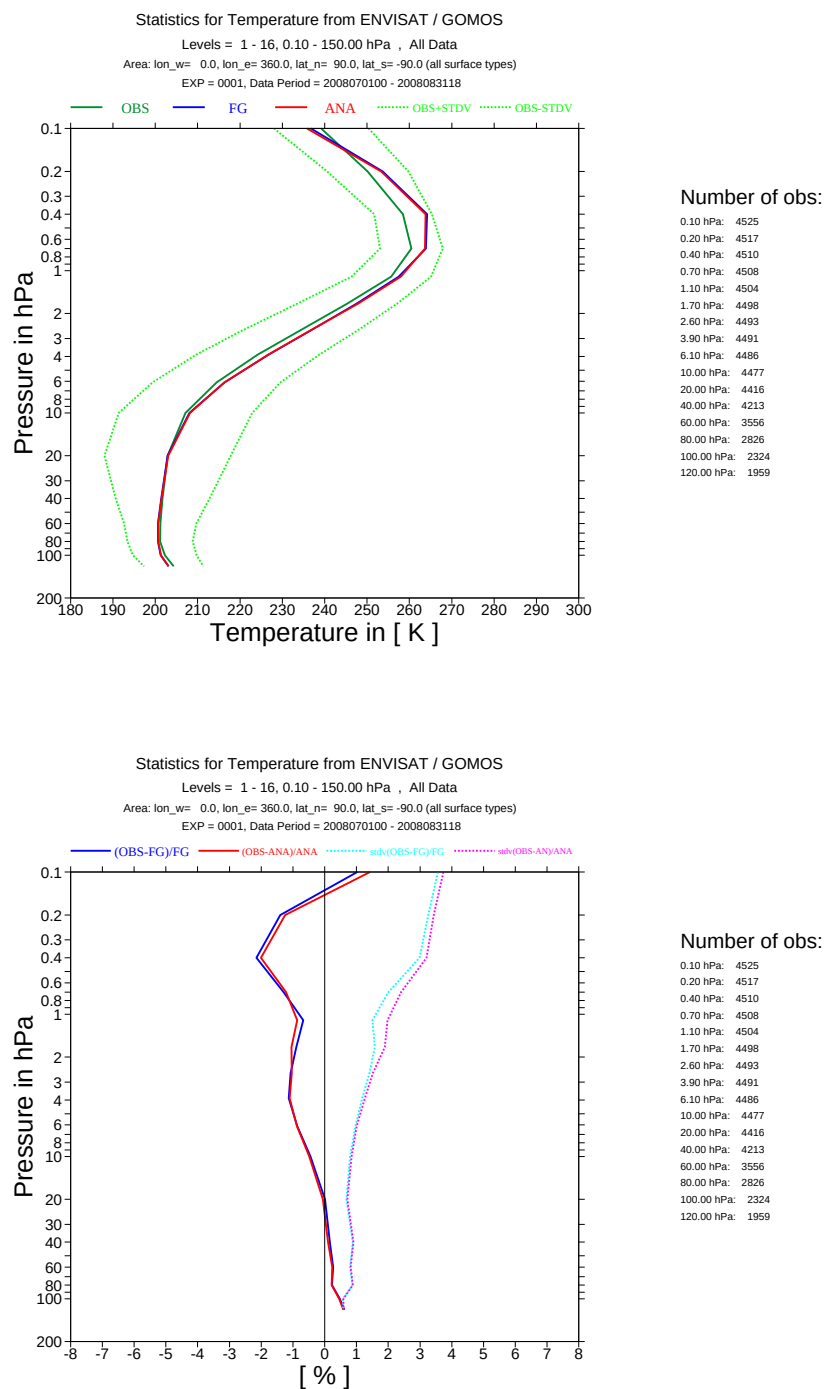


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for August 2008 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation +/- 1 standard deviation (green dotted lines). The bottom 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.

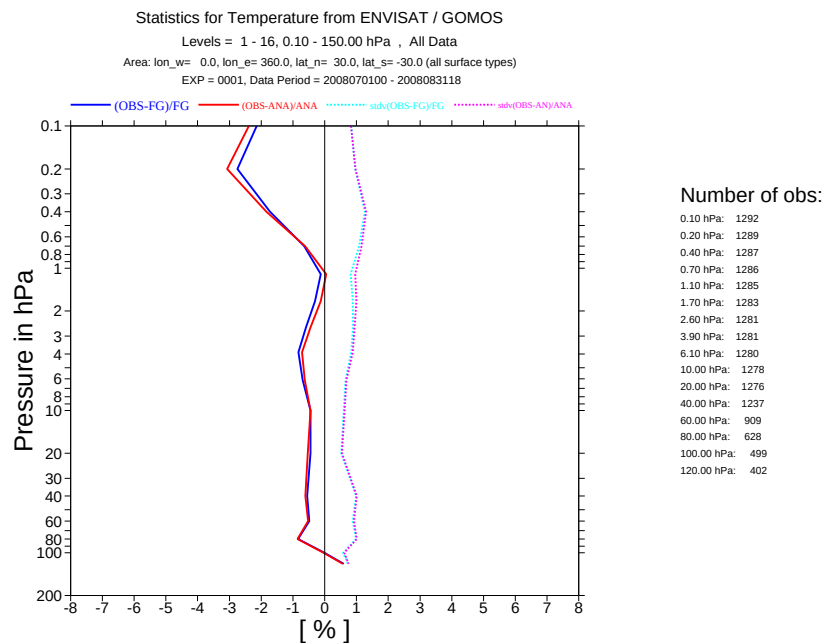
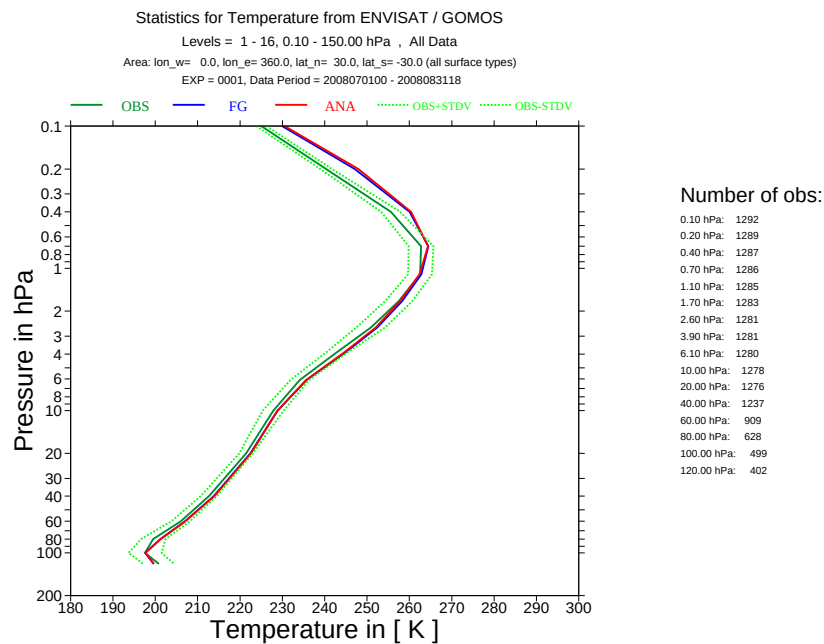


Fig. 4. As Fig. 3 but for 30N-30S.

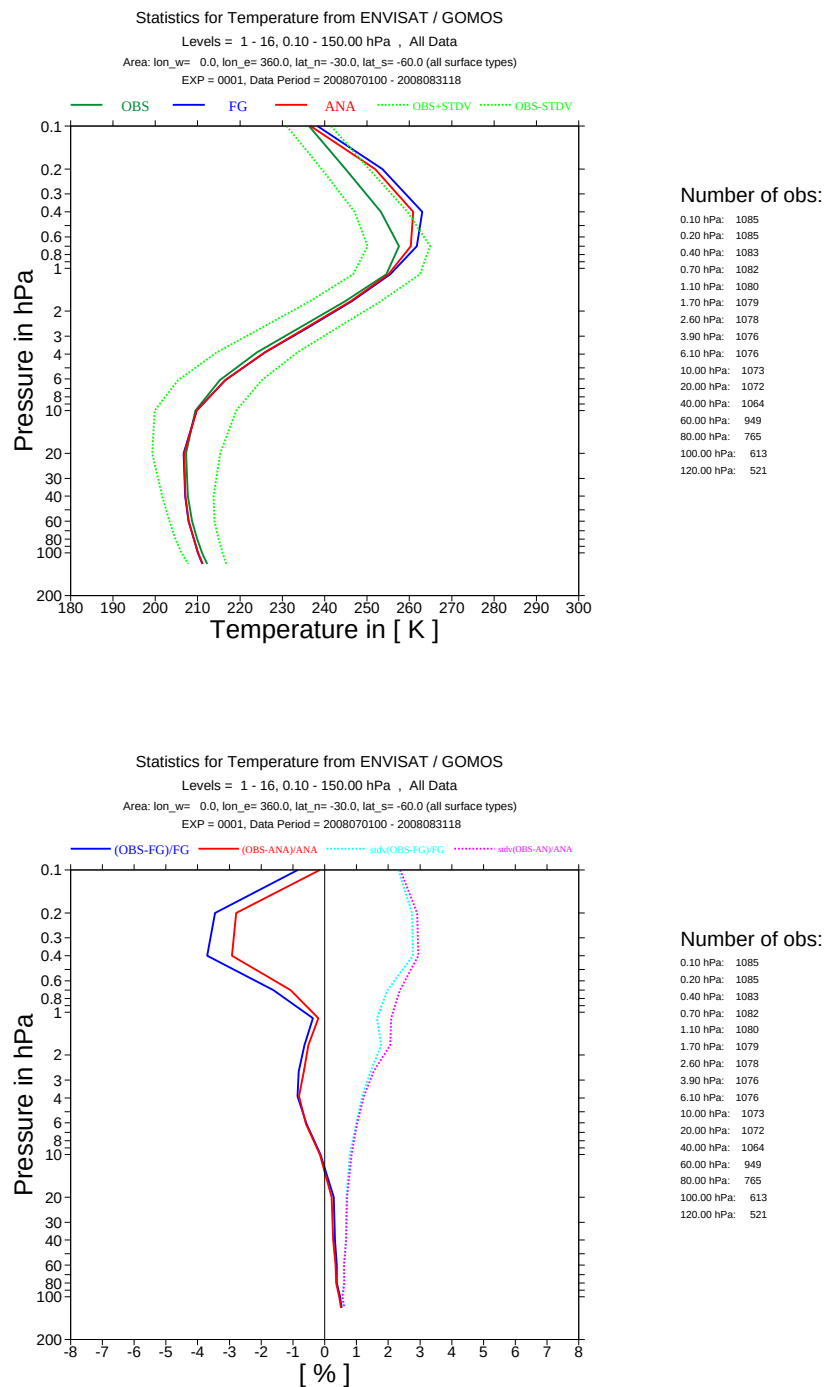


Fig. 5. As Fig. 3 but for 30-60S.

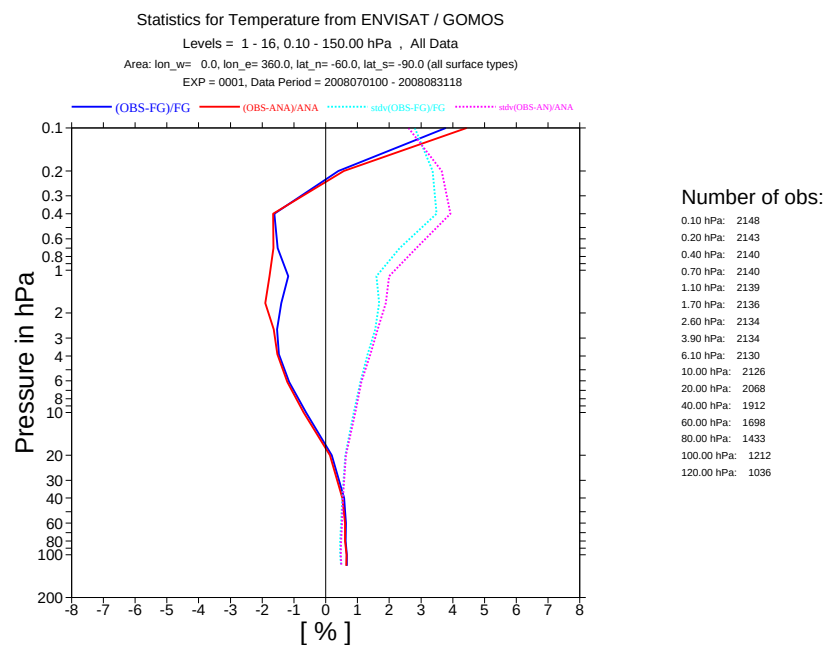
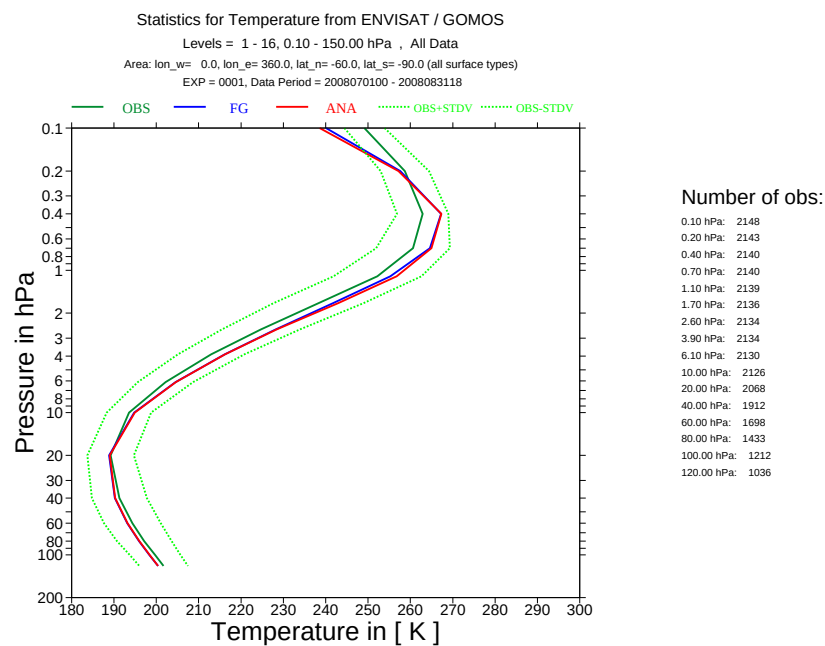


Fig. 6. As Fig. 3 but for 60-90S.

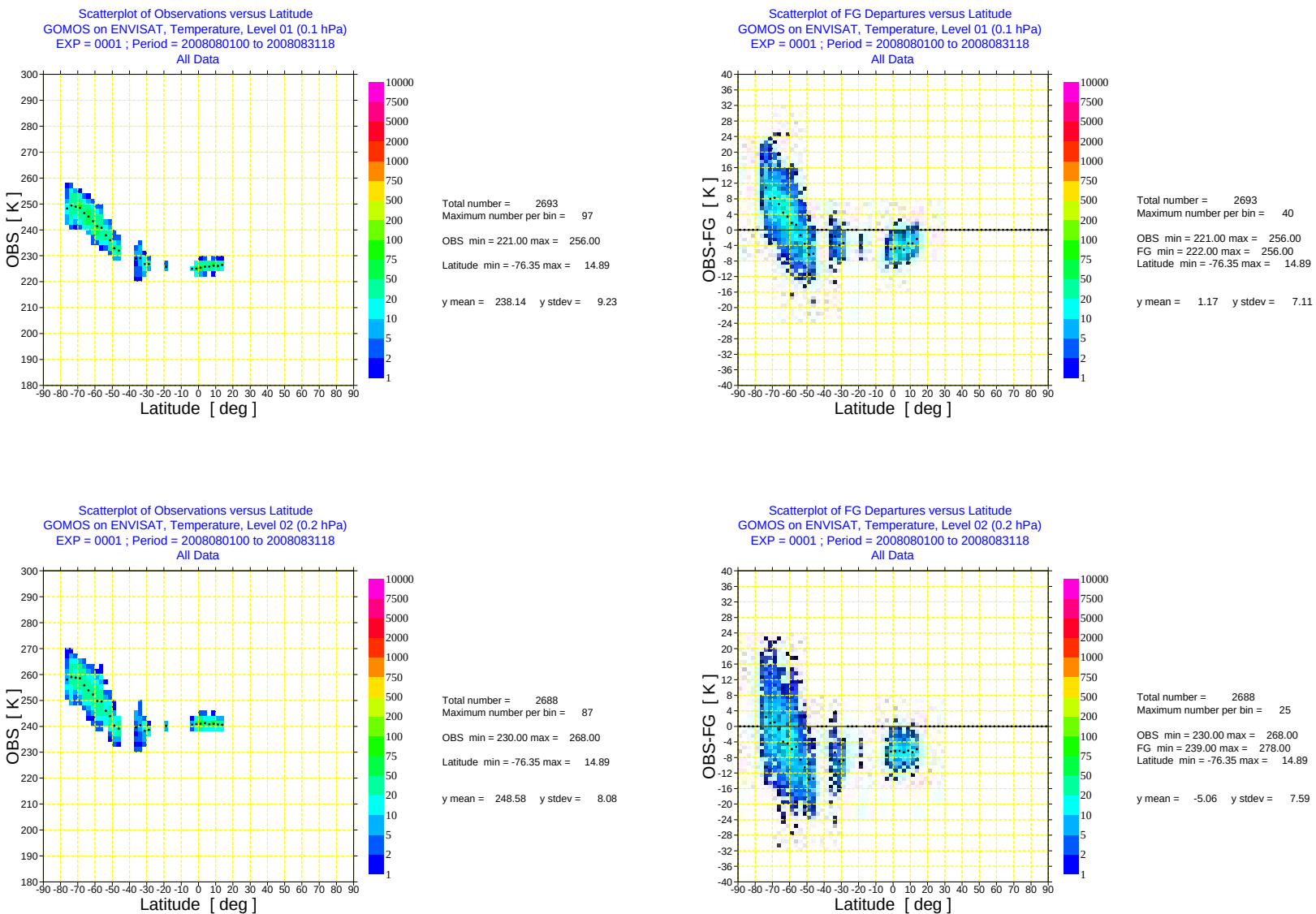


Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for August 2008 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

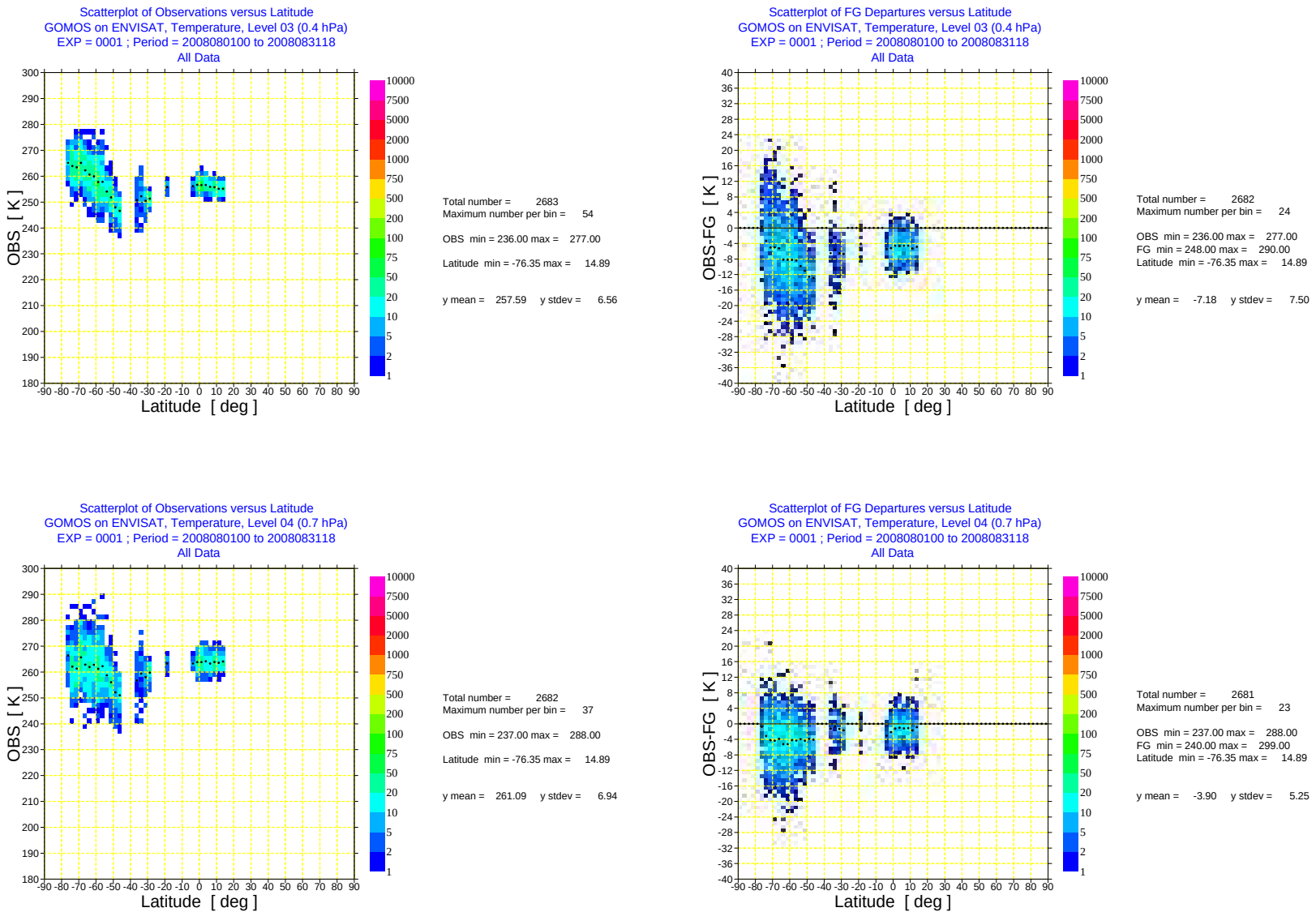


Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

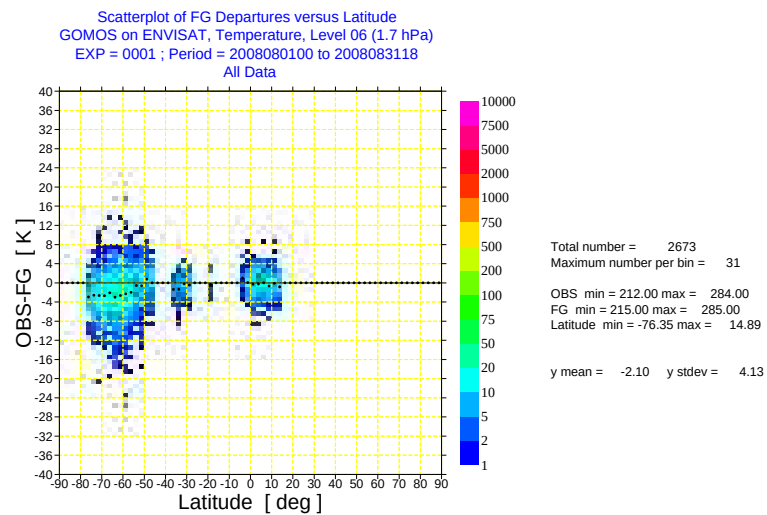
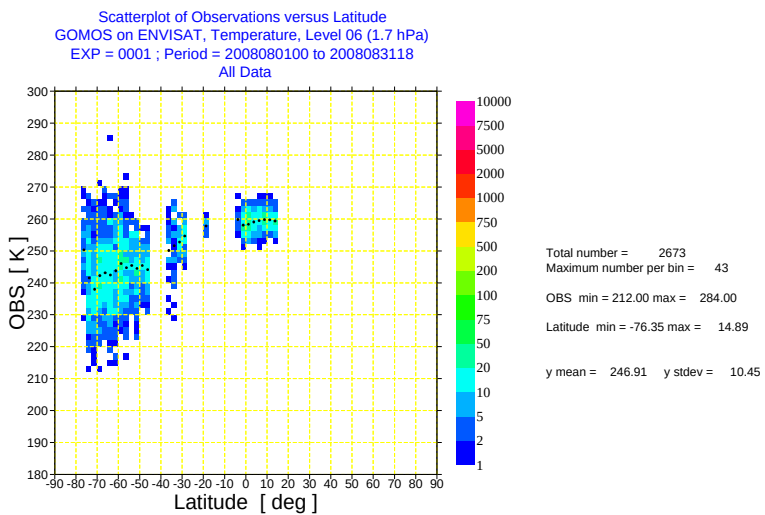
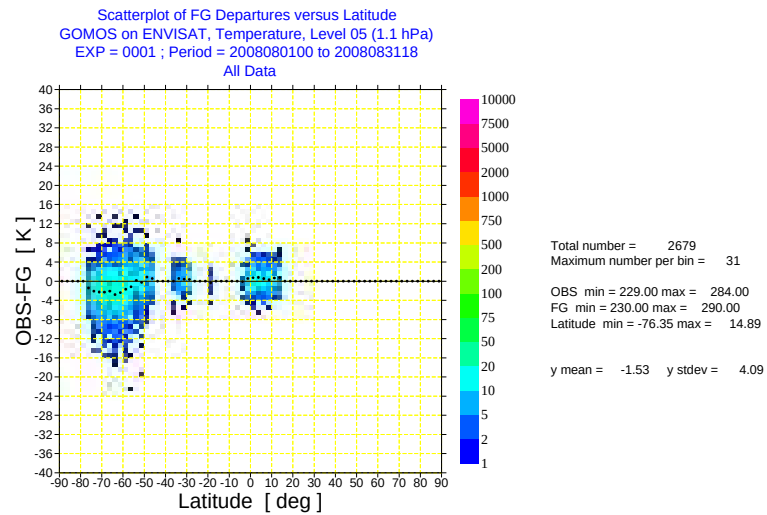
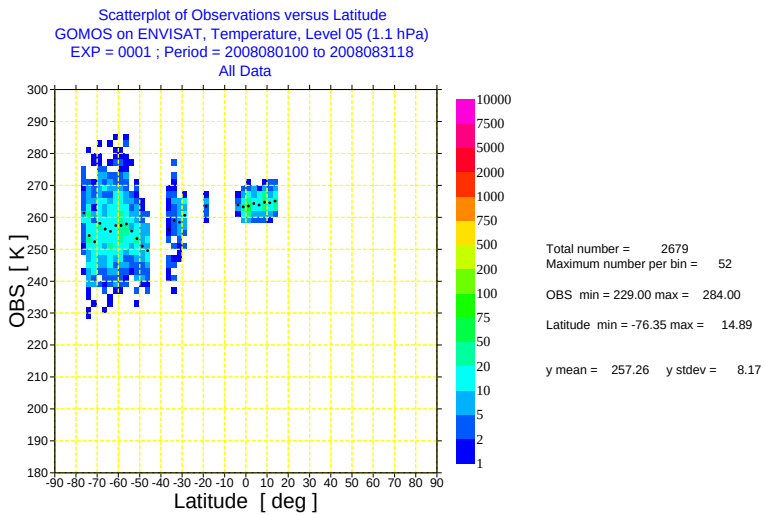


Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

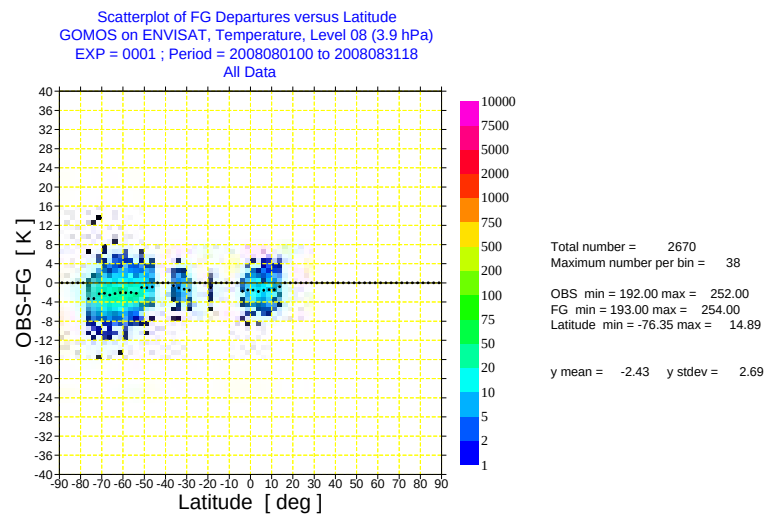
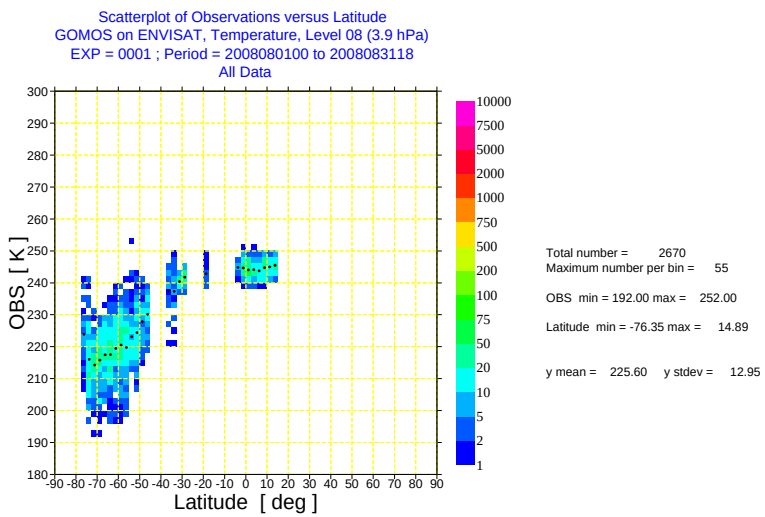
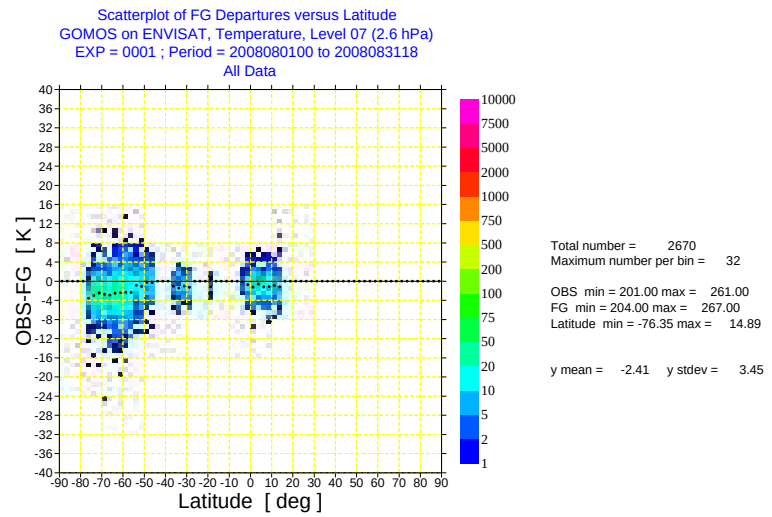
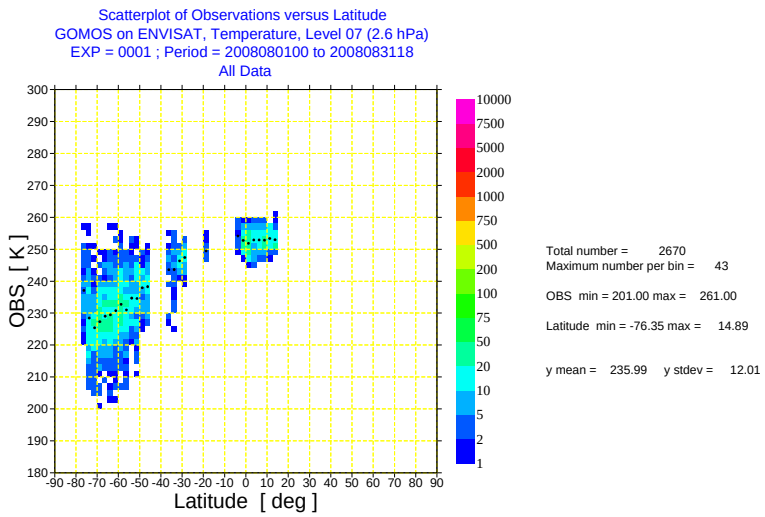


Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

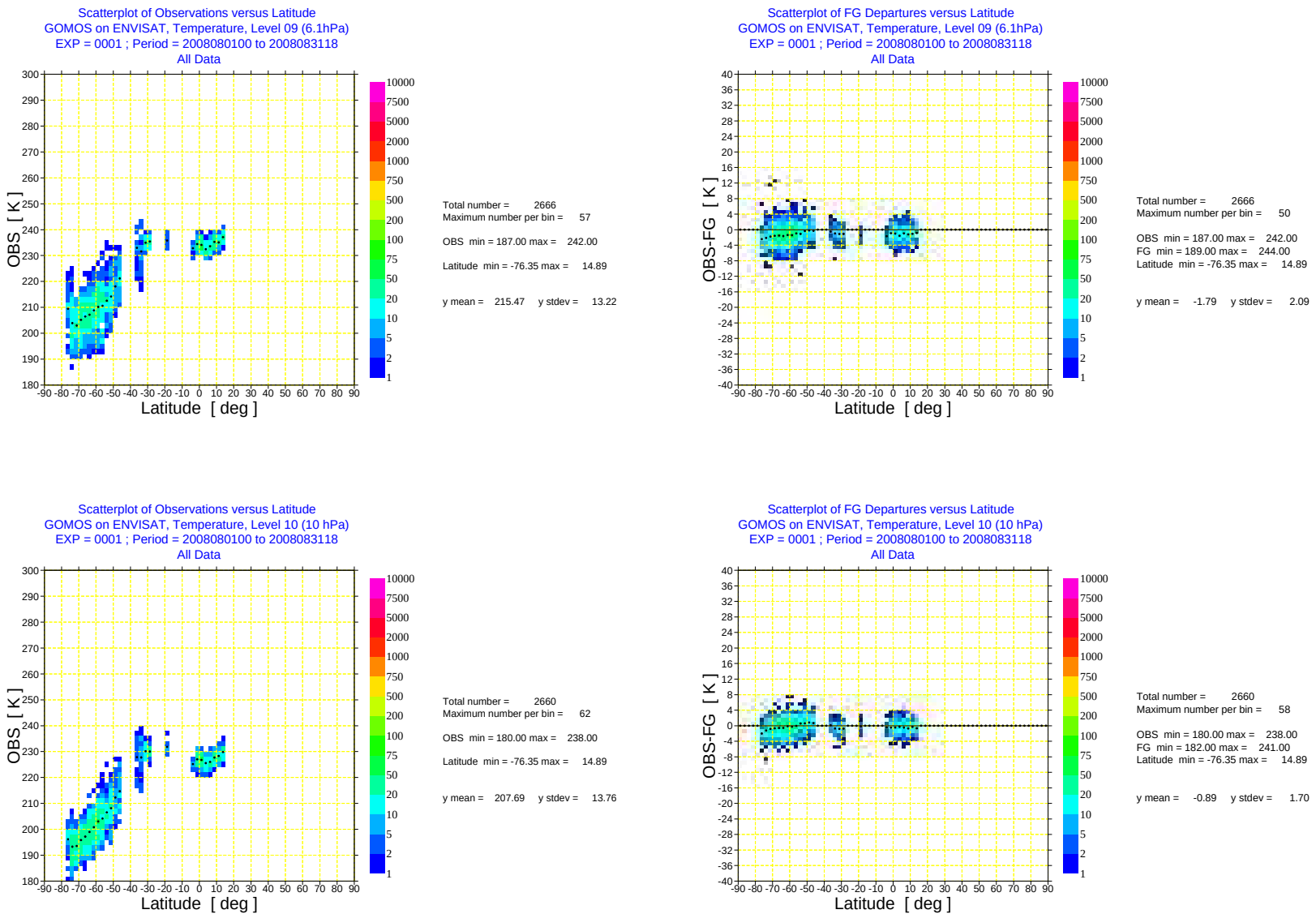


Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

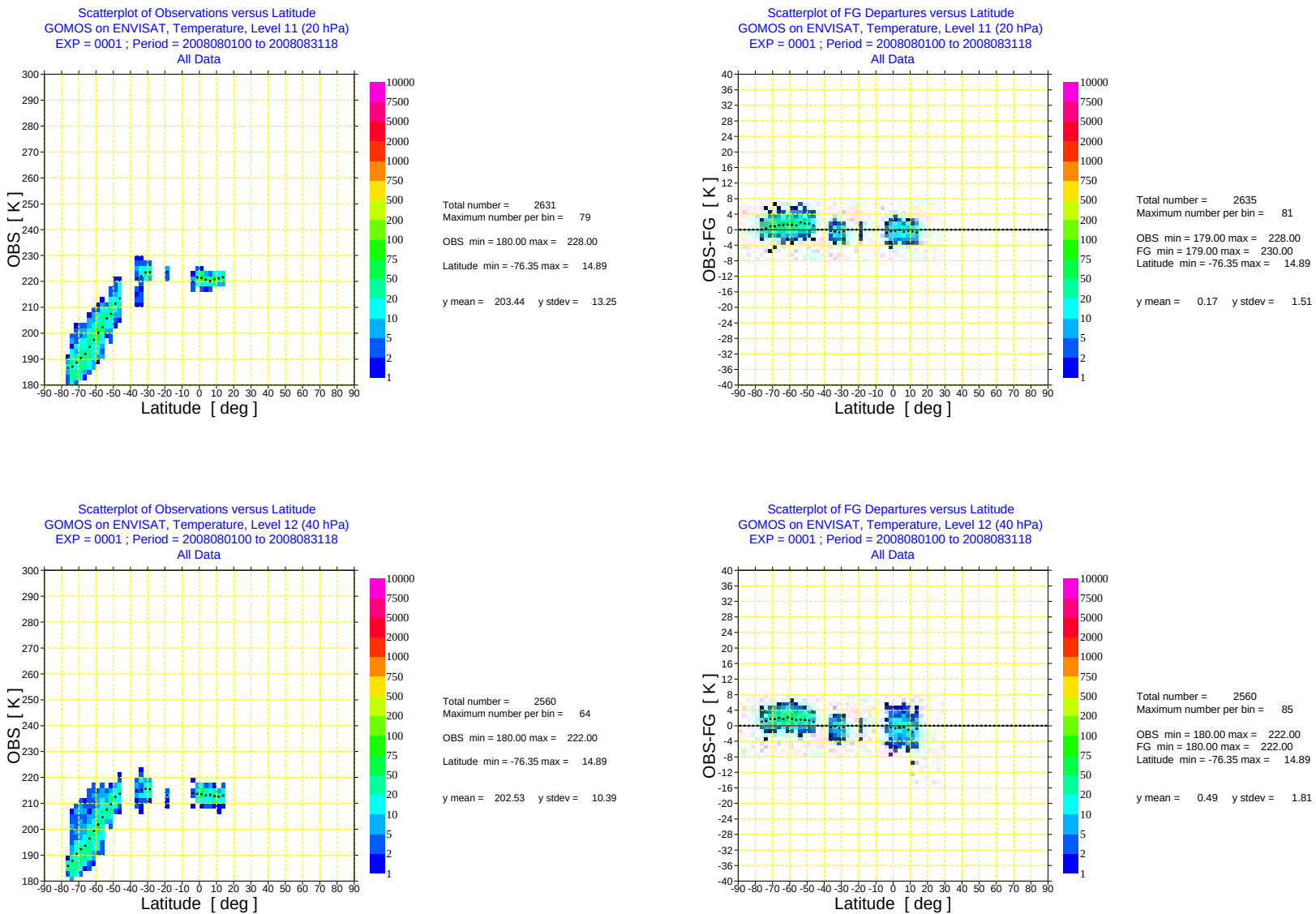


Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

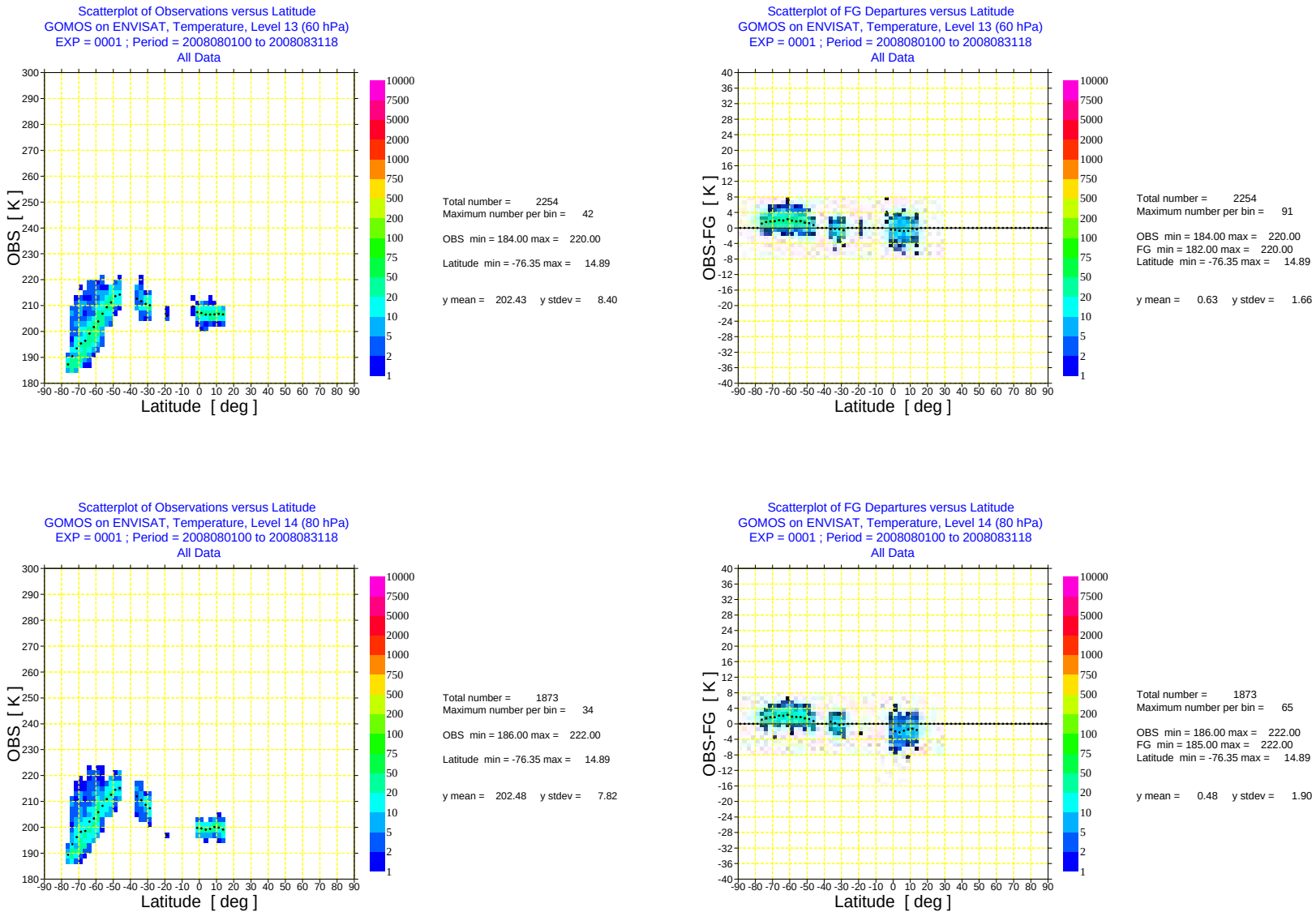


Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

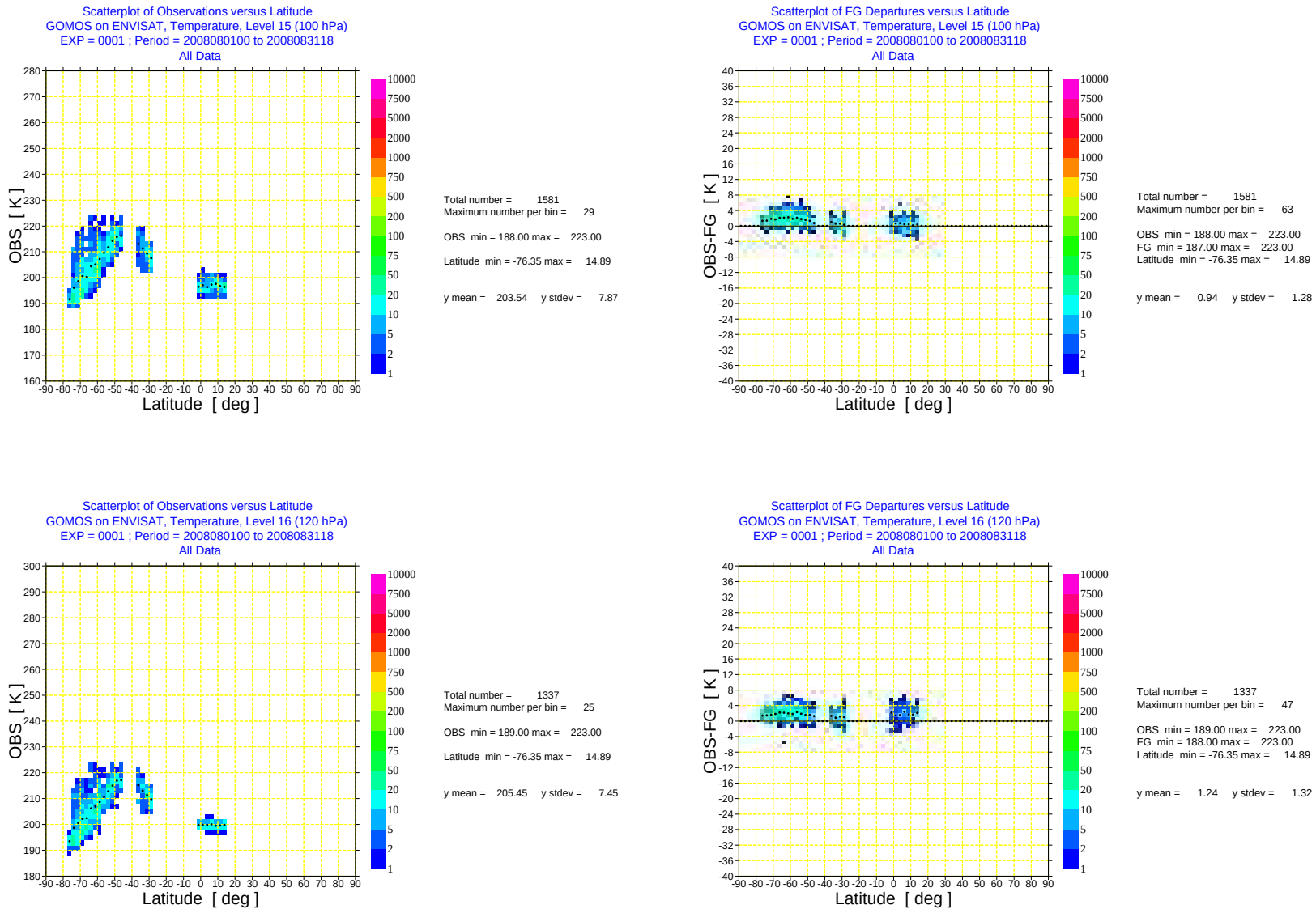


Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

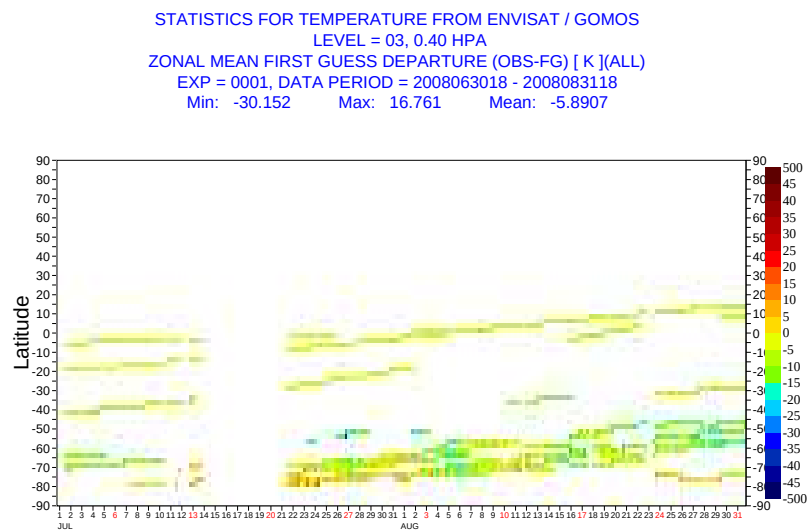
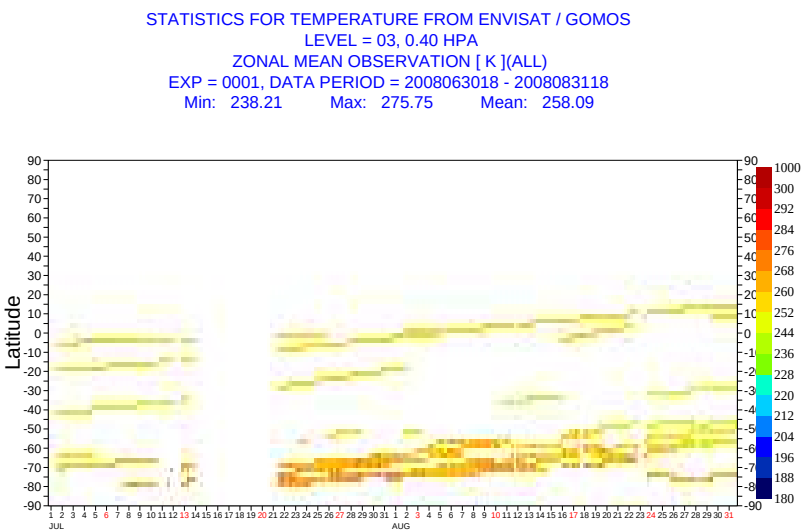
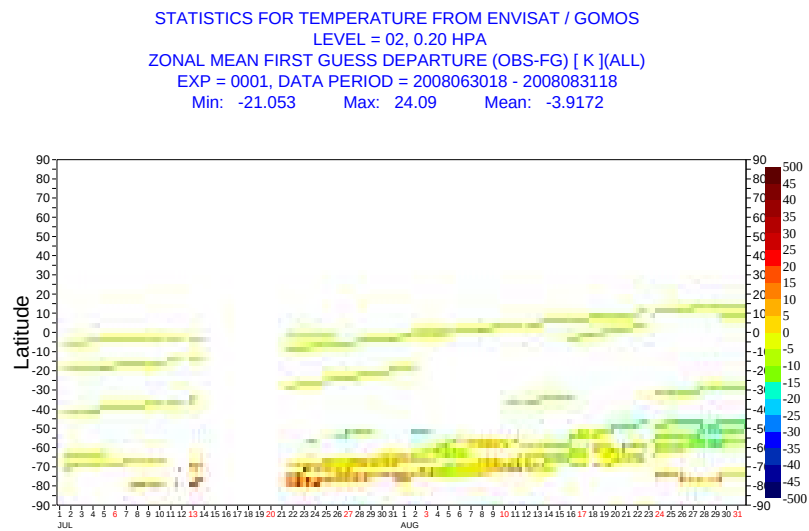
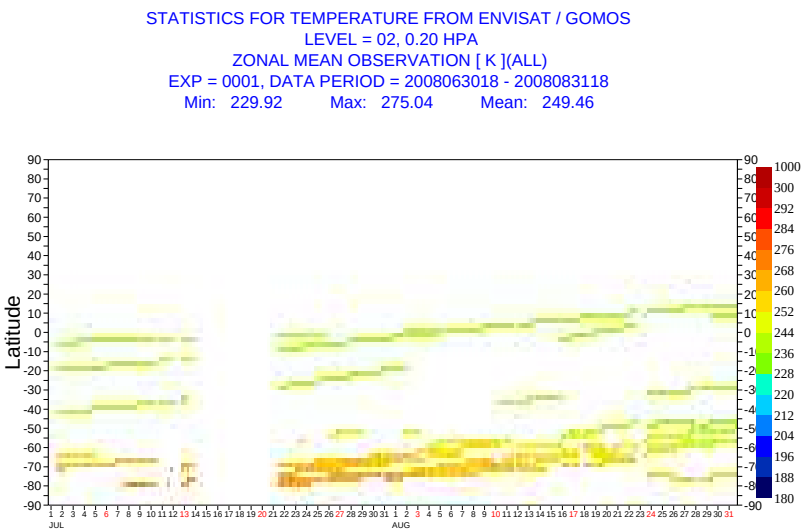


Fig. 15. Hovmöller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for July-August 2008.

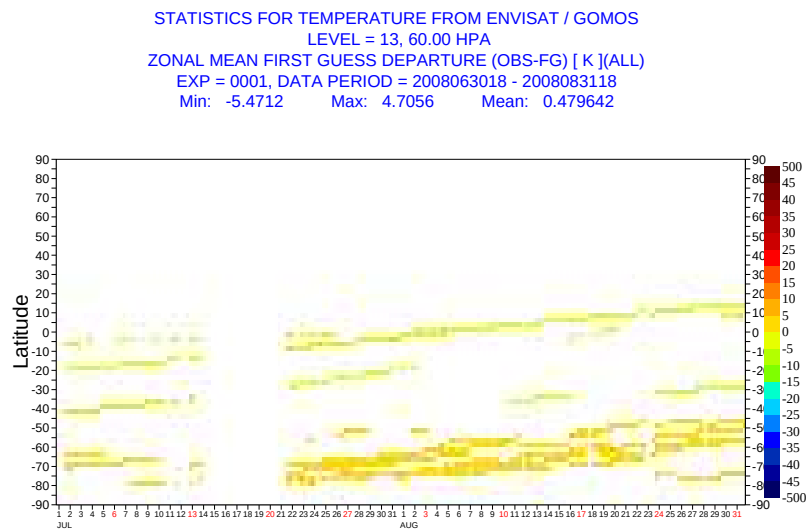
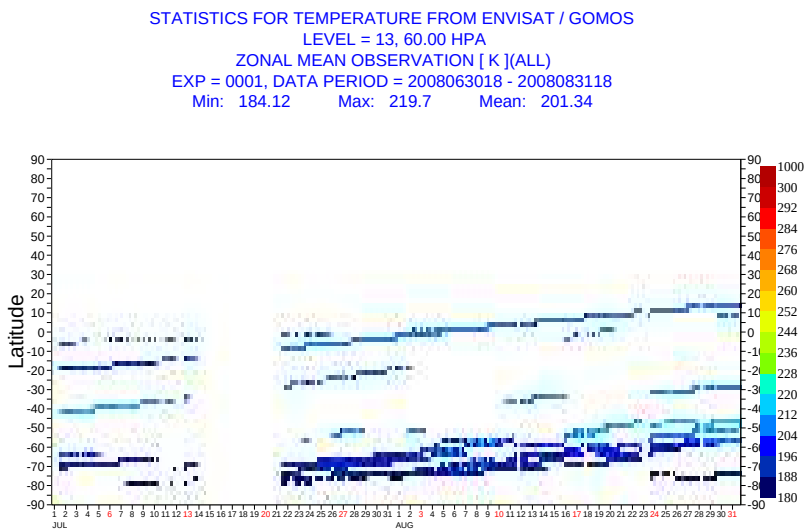
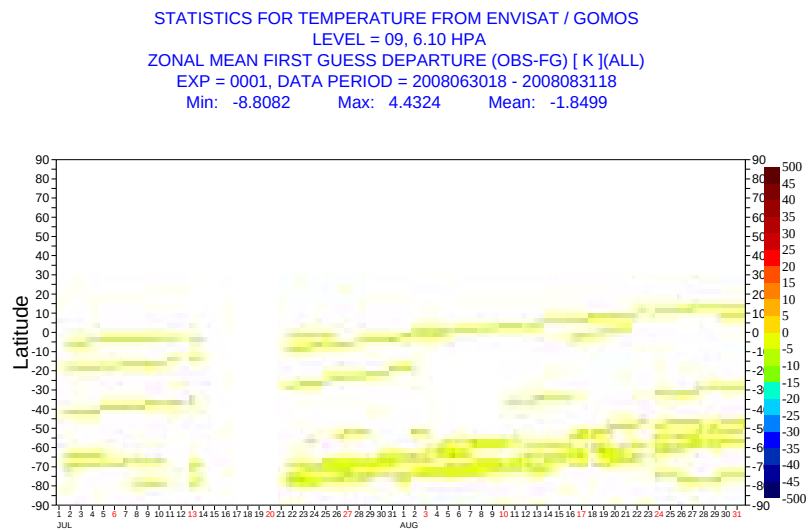
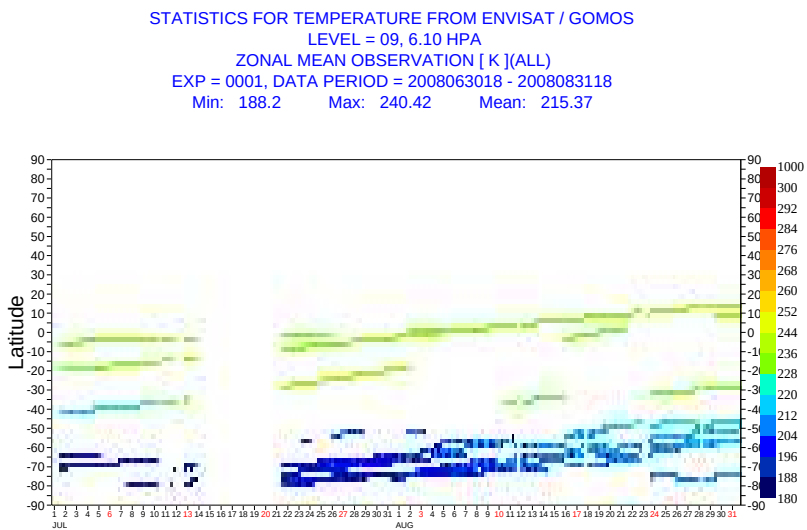


Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

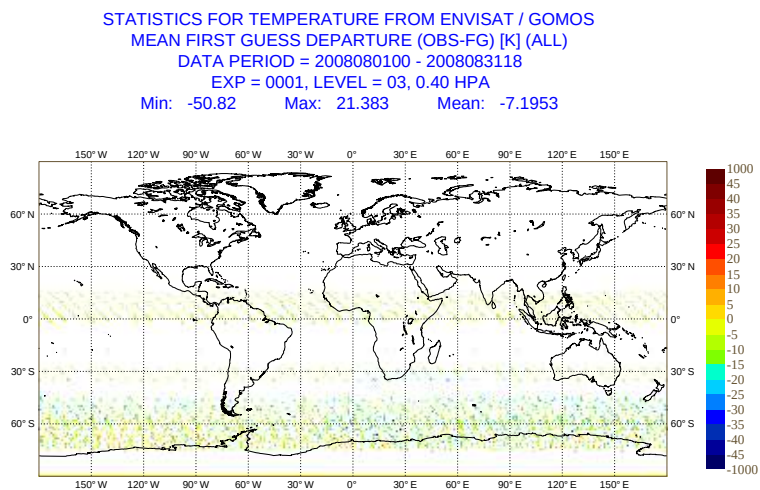
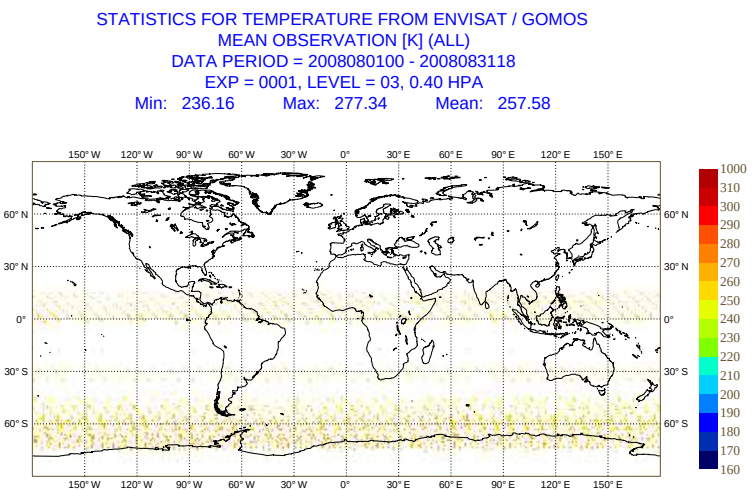
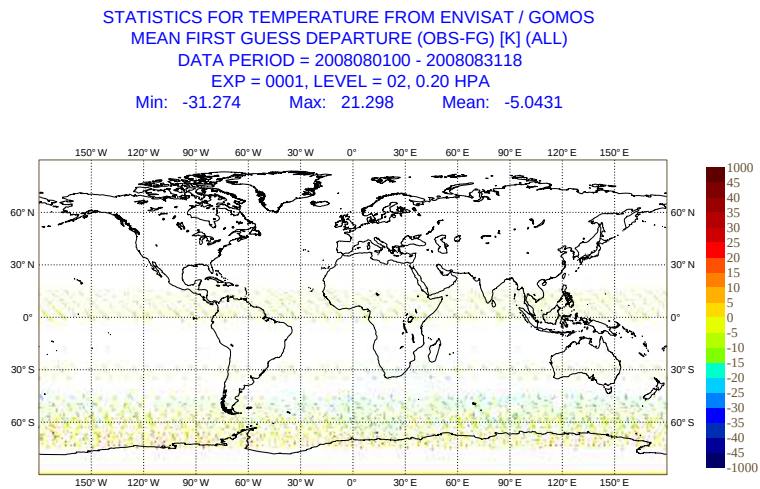
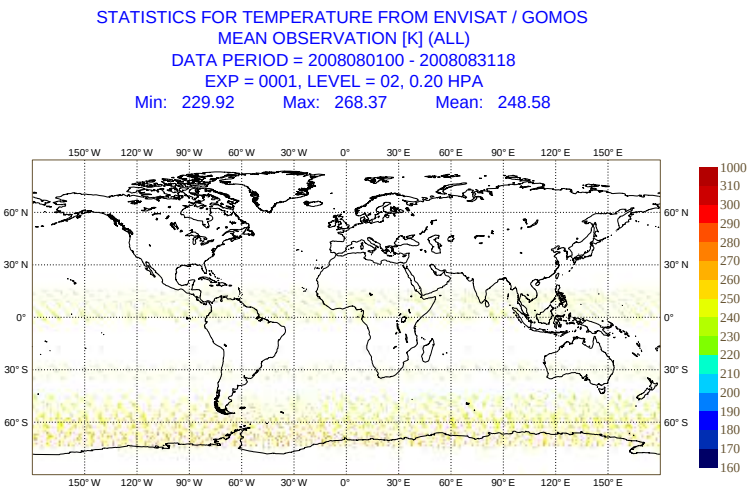
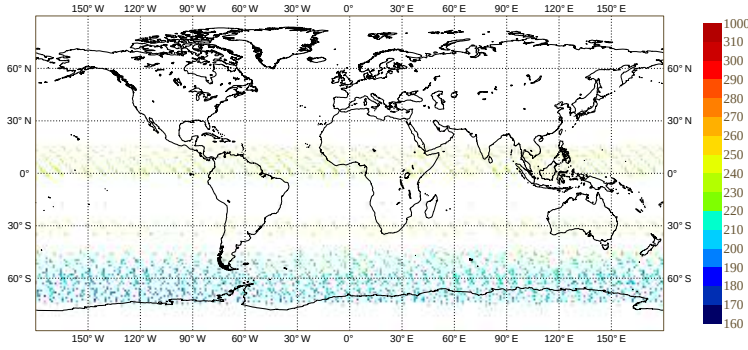
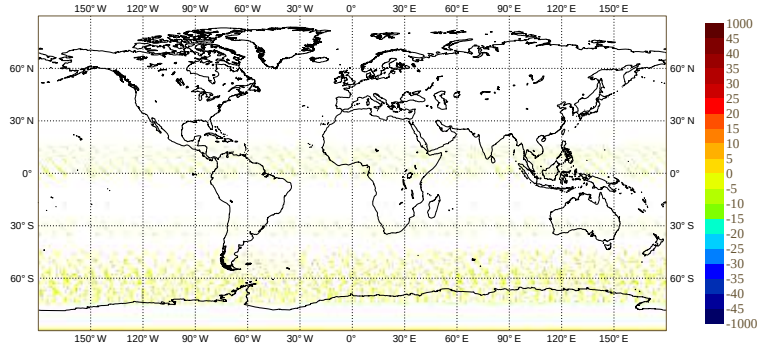


Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for August 2008.

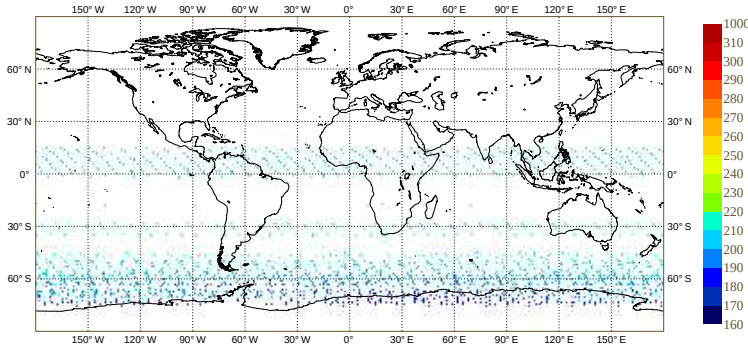
STATISTICS FOR TEMPERATURE FROM ENVISAT / GOMOS
MEAN OBSERVATION [K] (ALL)
DATA PERIOD = 2008080100 - 2008083118
EXP = 0001, LEVEL = 09, 6.10 HPA
Min: 187.05 Max: 242.4 Mean: 215.47



STATISTICS FOR TEMPERATURE FROM ENVISAT / GOMOS
MEAN FIRST GUESS DEPARTURE (OBS-FG) [K] (ALL)
DATA PERIOD = 2008080100 - 2008083118
EXP = 0001, LEVEL = 09, 6.10 HPA
Min: -12.102 Max: 12.138 Mean: -1.7958



STATISTICS FOR TEMPERATURE FROM ENVISAT / GOMOS
MEAN OBSERVATION [K] (ALL)
DATA PERIOD = 2008080100 - 2008083118
EXP = 0001, LEVEL = 13, 60.00 HPA
Min: 183.5 Max: 219.88 Mean: 202.44



STATISTICS FOR TEMPERATURE FROM ENVISAT / GOMOS
MEAN FIRST GUESS DEPARTURE (OBS-FG) [K] (ALL)
DATA PERIOD = 2008080100 - 2008083118
EXP = 0001, LEVEL = 13, 60.00 HPA
Min: -7.5569 Max: 6.6244 Mean: 0.638754

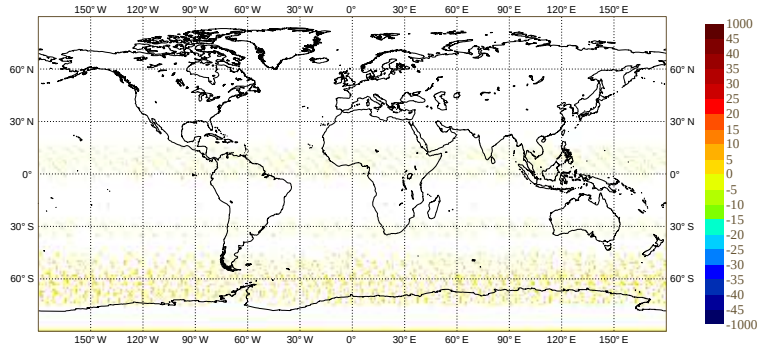


Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

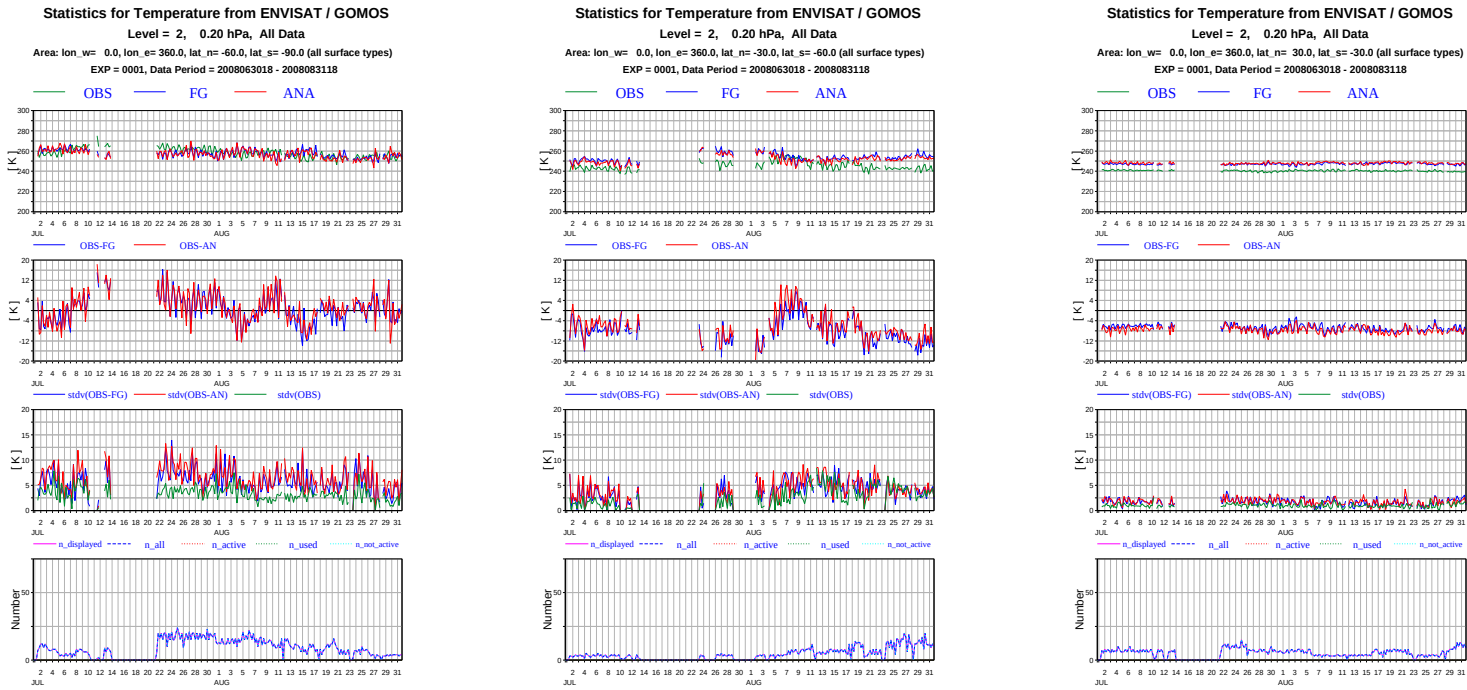


Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) 30N-30S, 30-60S, and 60-90S for the period July-August 2008.

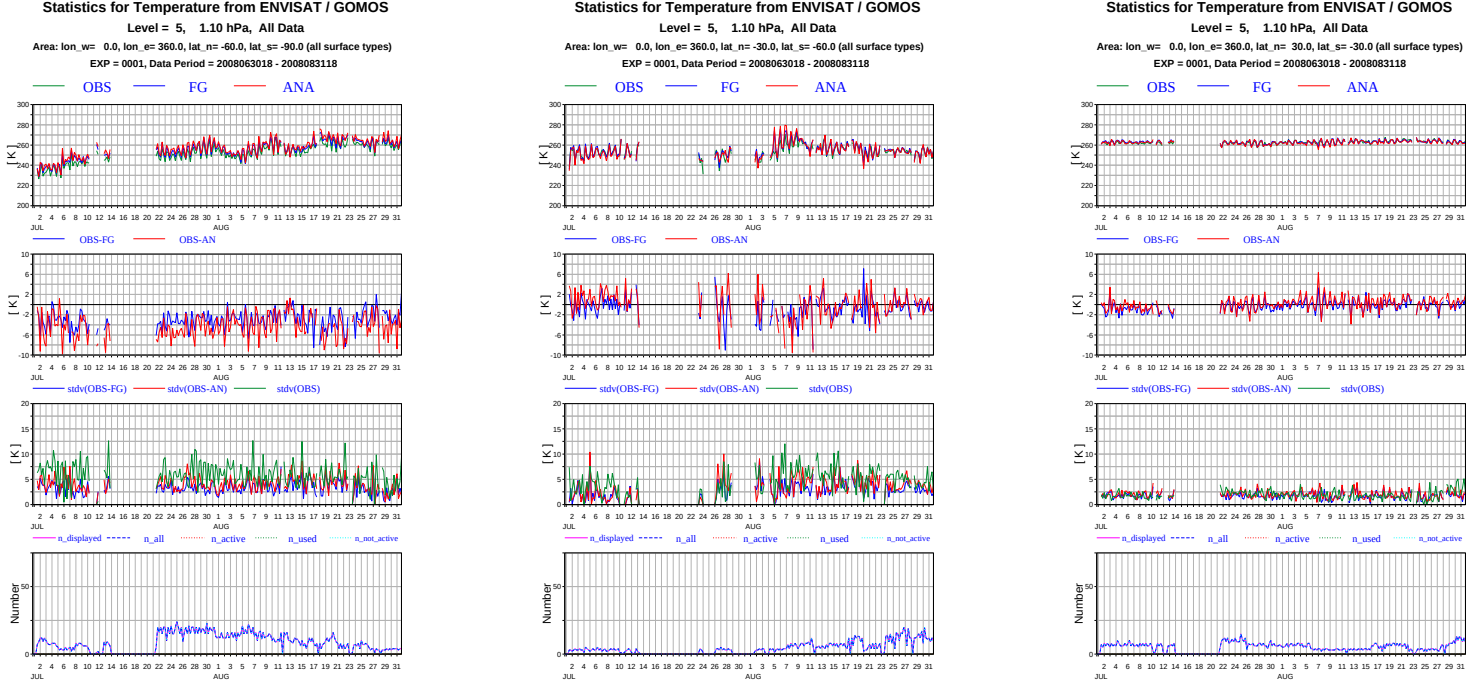


Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

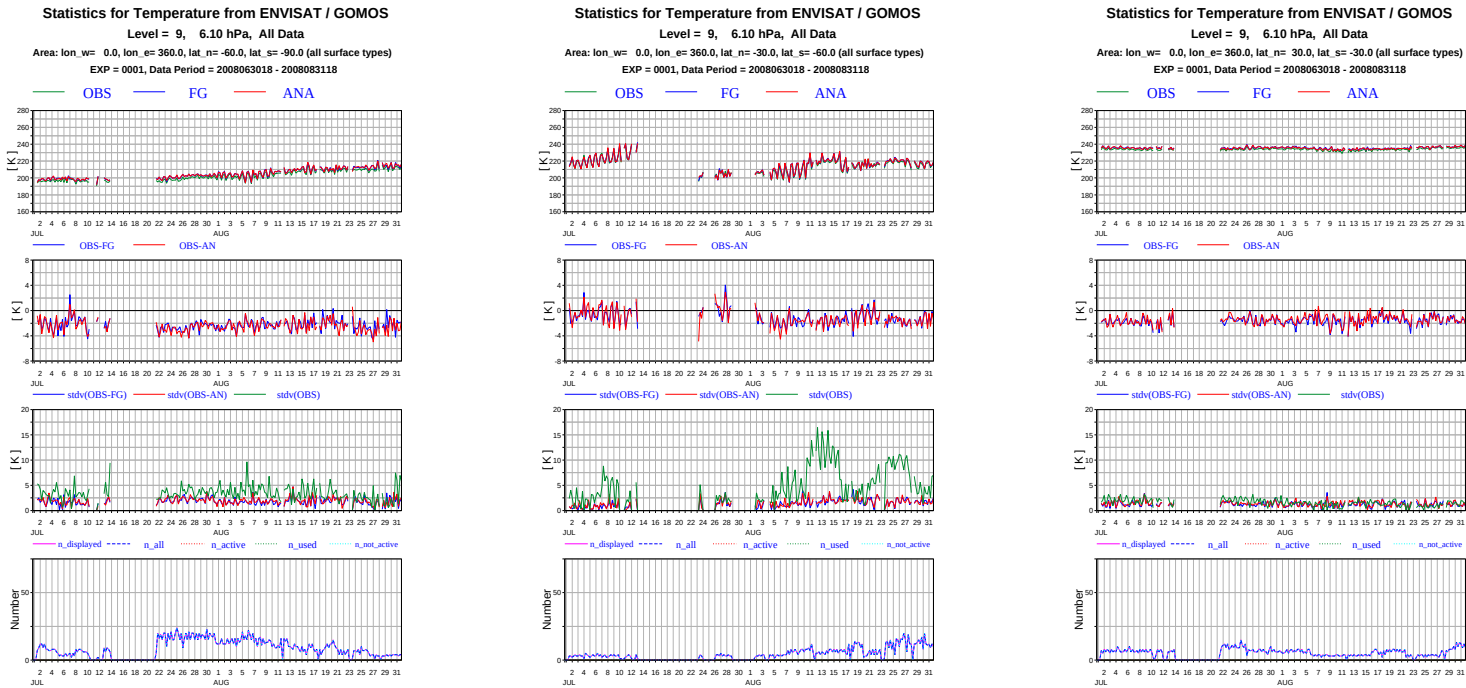


Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

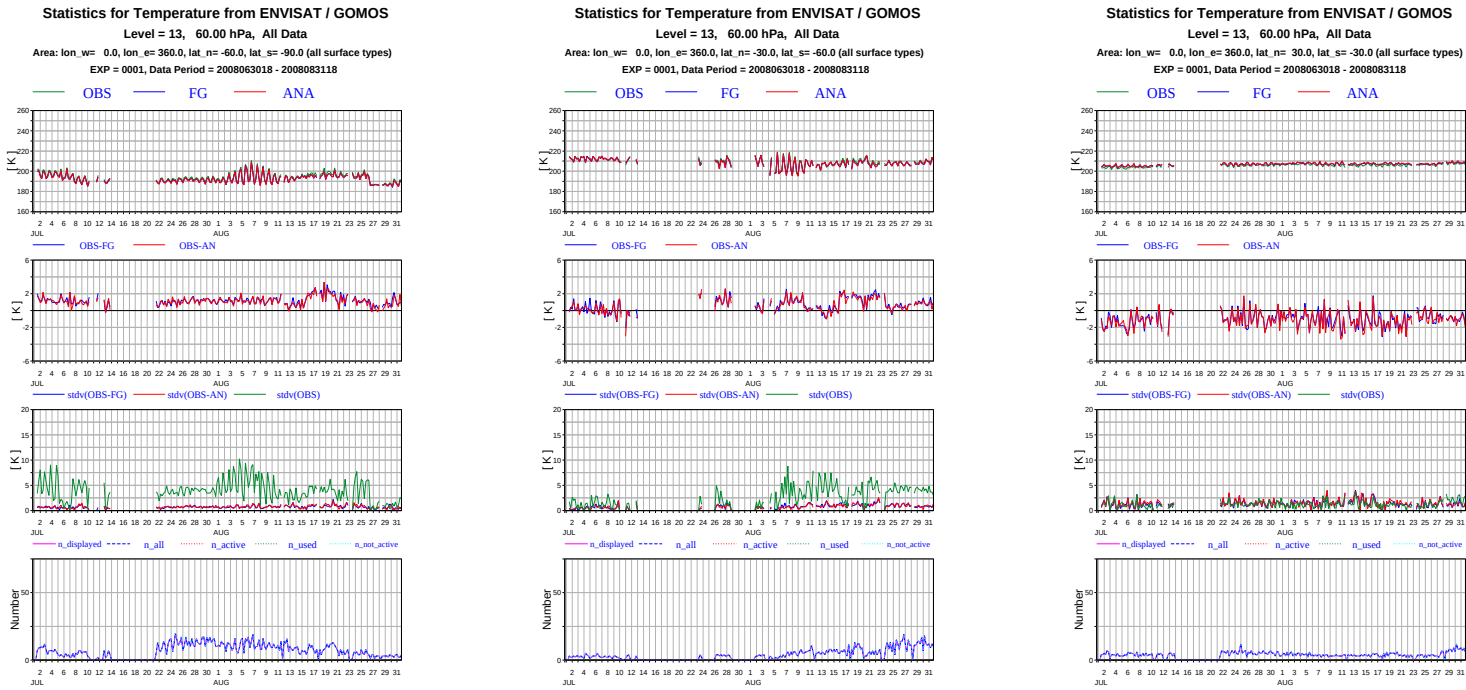


Fig. 22. As Figure 19, but for level 13 (60 hPa).

REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR_2P) FOR AUGUST 2008

Rossana Dragani

*ECMWF, Shinfield Park, Reading, RG2 9AX, United Kingdom,
Emails: Rossana.Dragani@ecmwf.int, Tel: 0044 118 9499259*

September 8, 2008

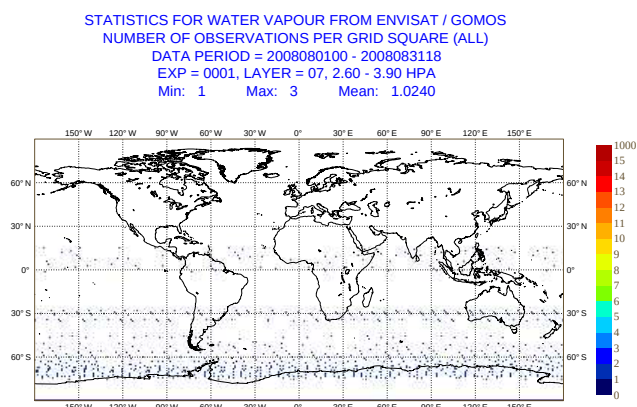


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for August 2008.

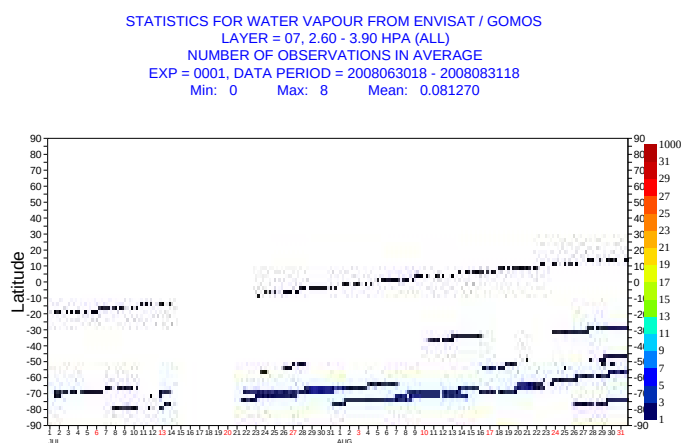


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for July-August 2008.

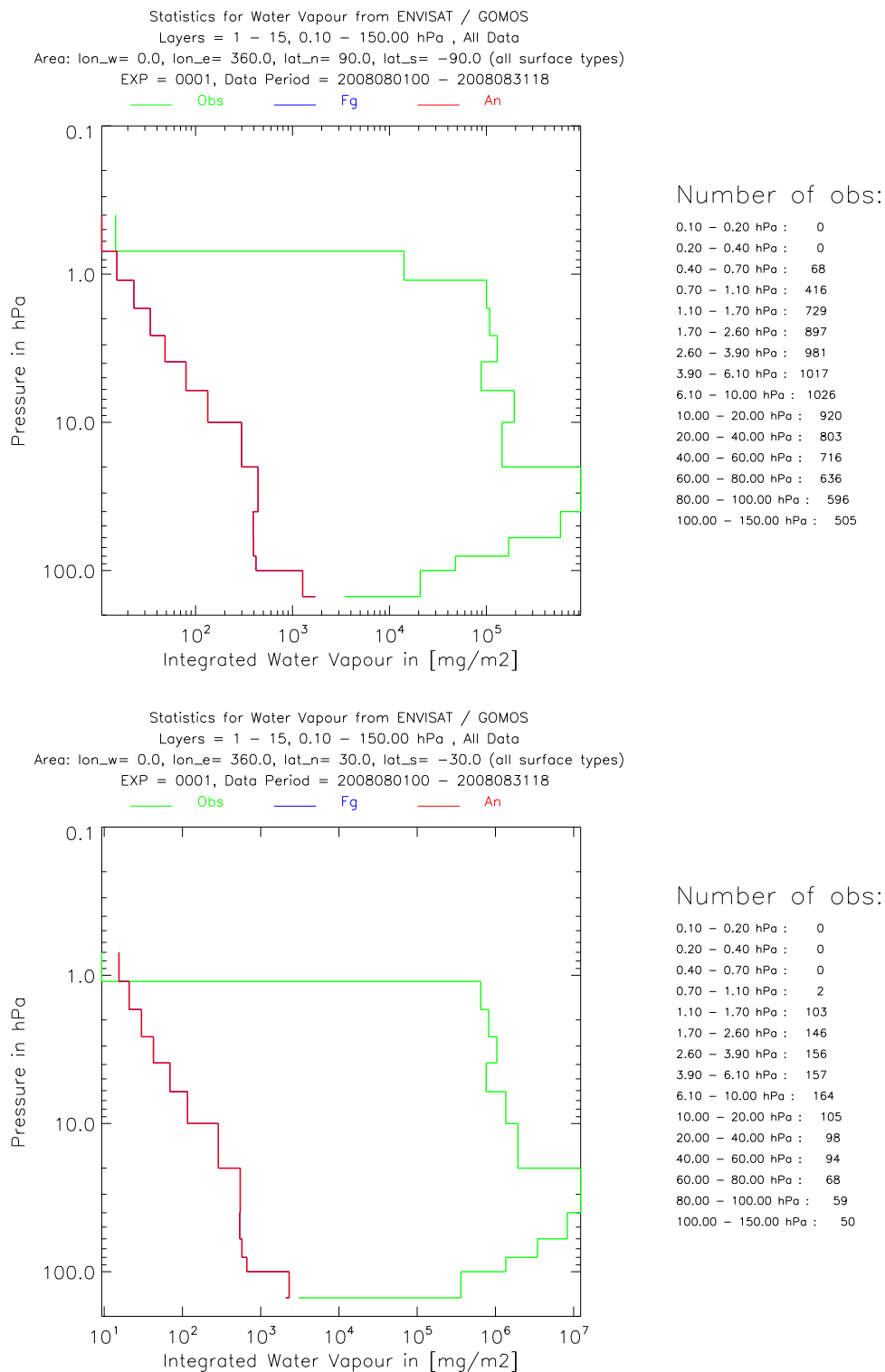


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m^2 for August 2008. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S). Plotted are the partial columns for the 16 levels listed to the right of the diagrams.

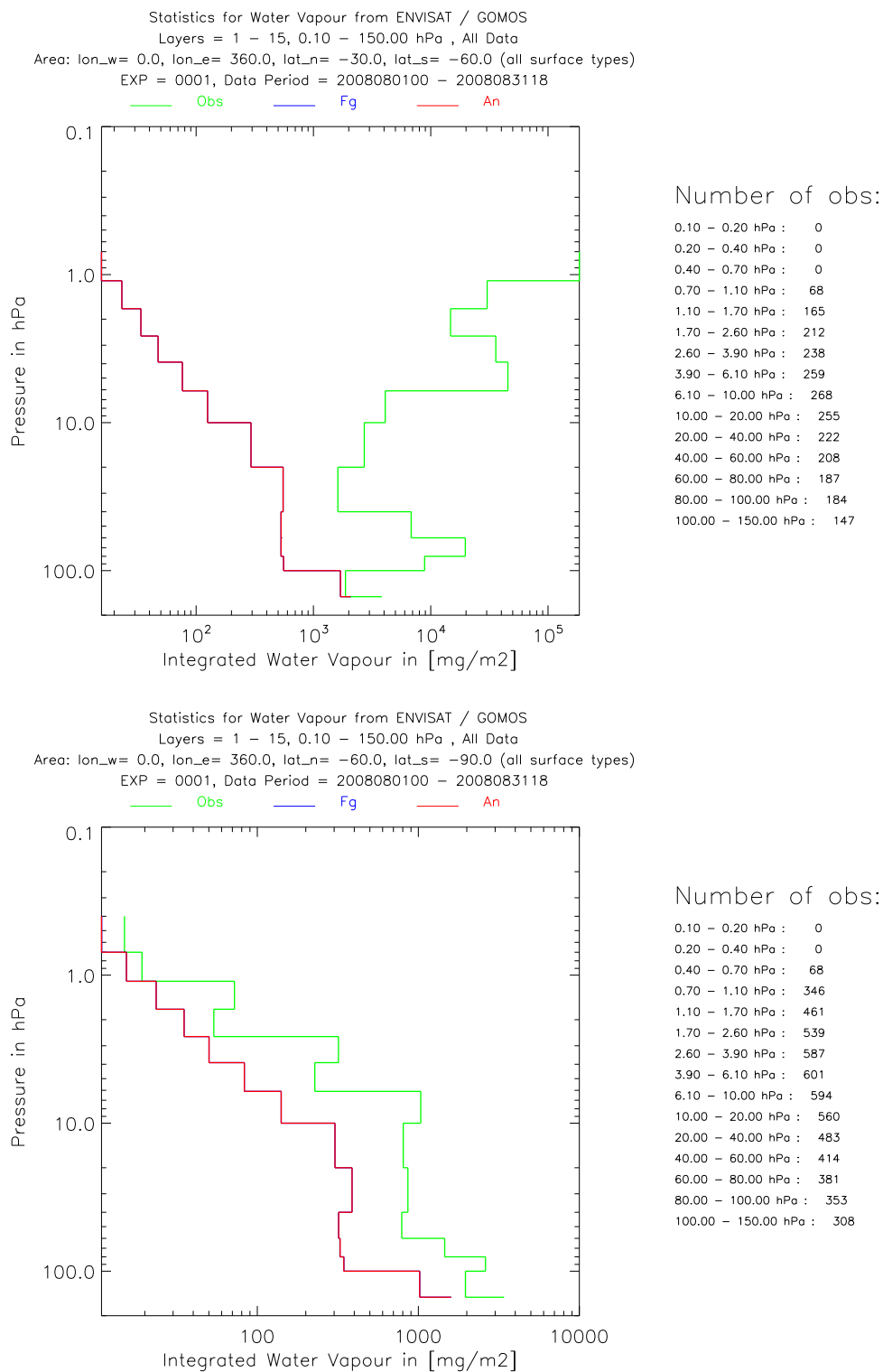


Fig. 4. As Fig. 3 but for 30-60S (top panel) and 60-90S (bottom panel).

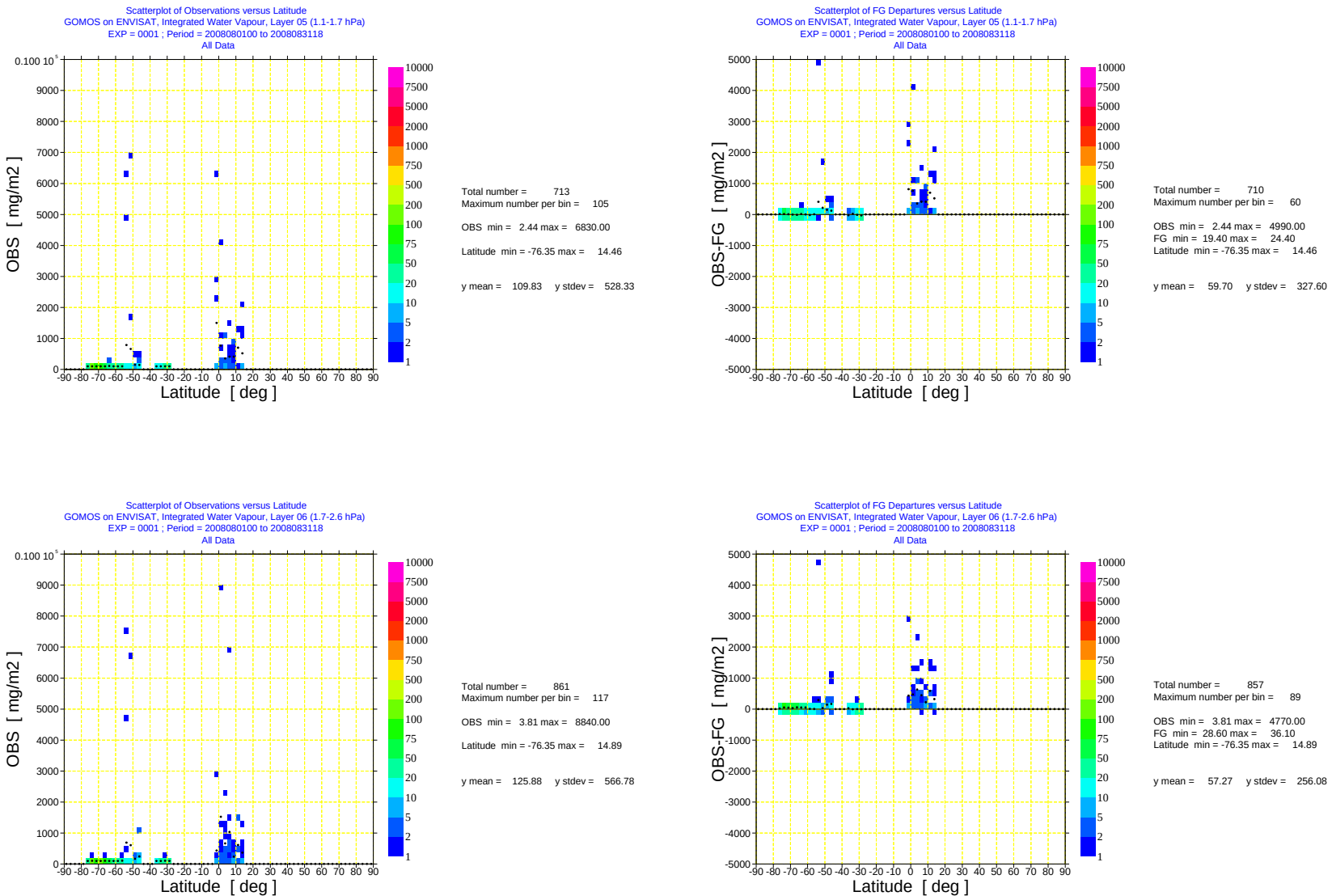


Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for August 2008 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

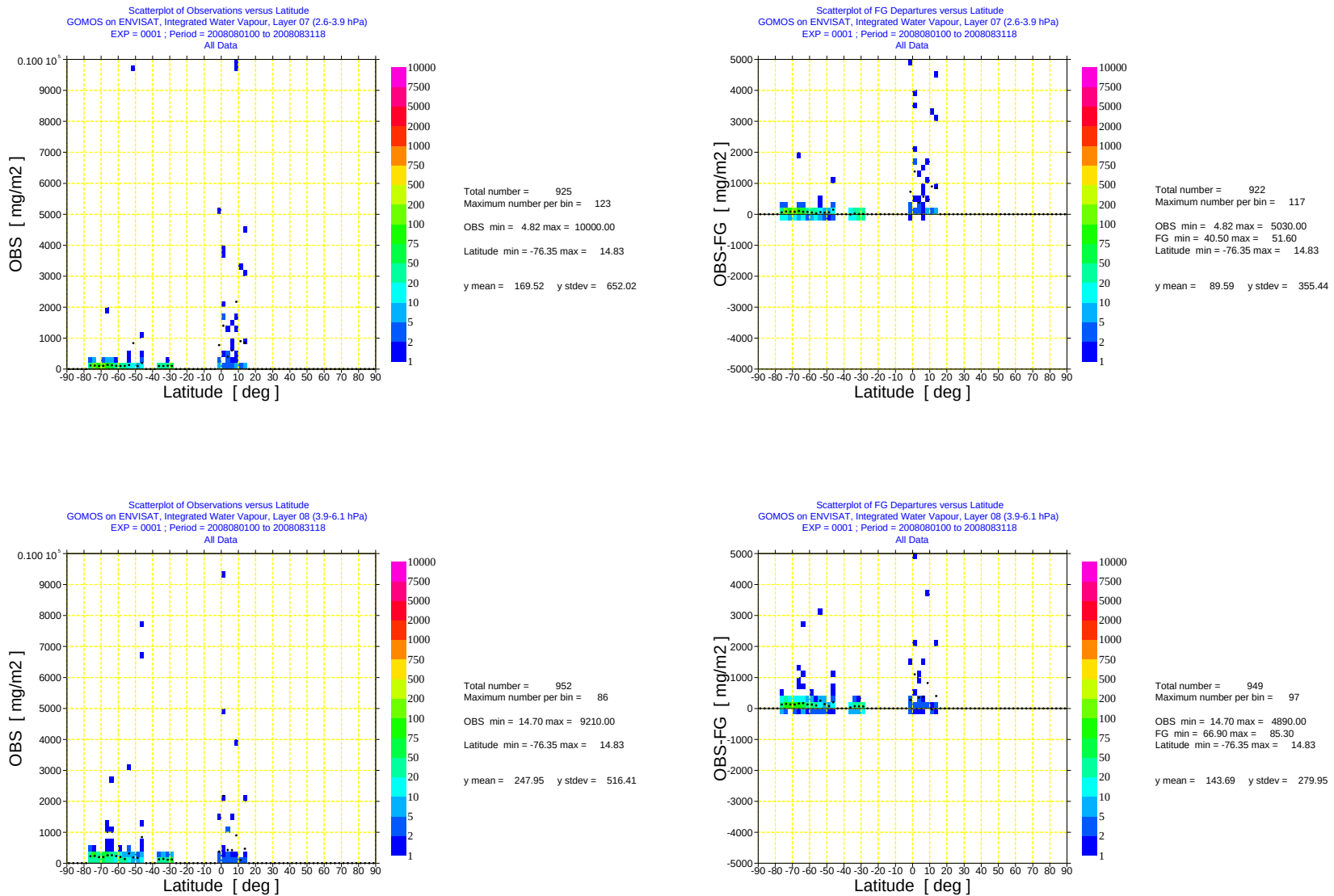


Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

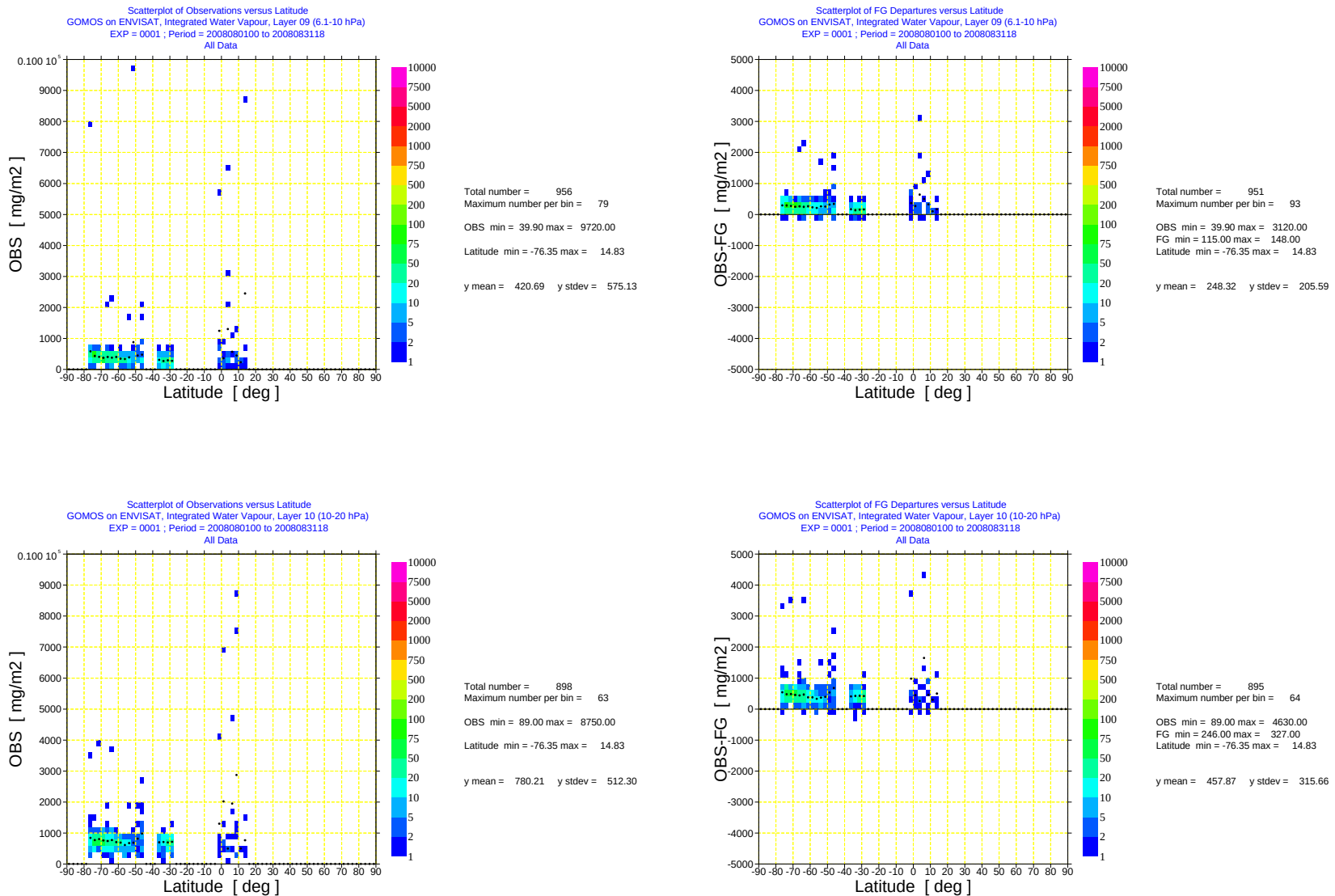


Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

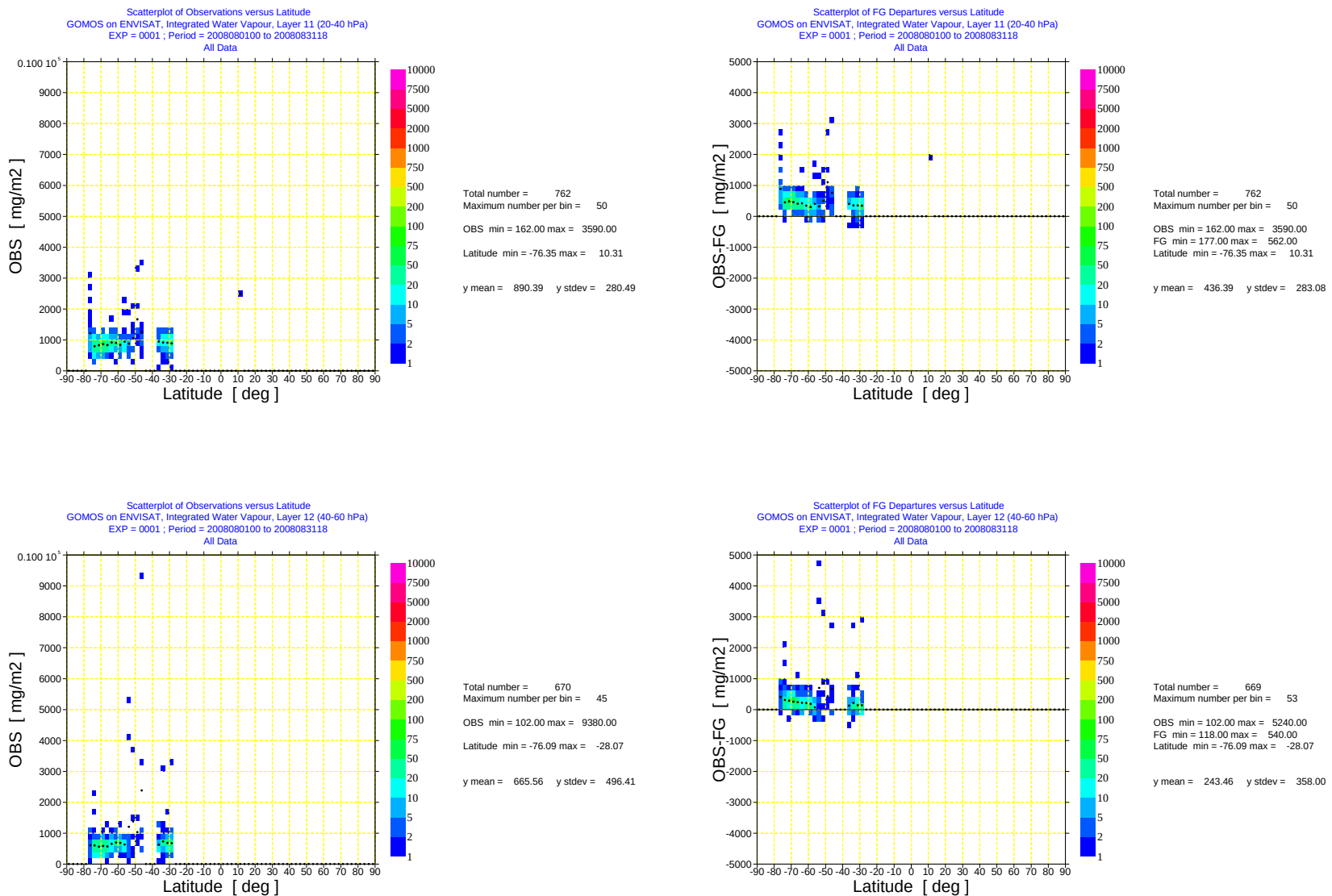


Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

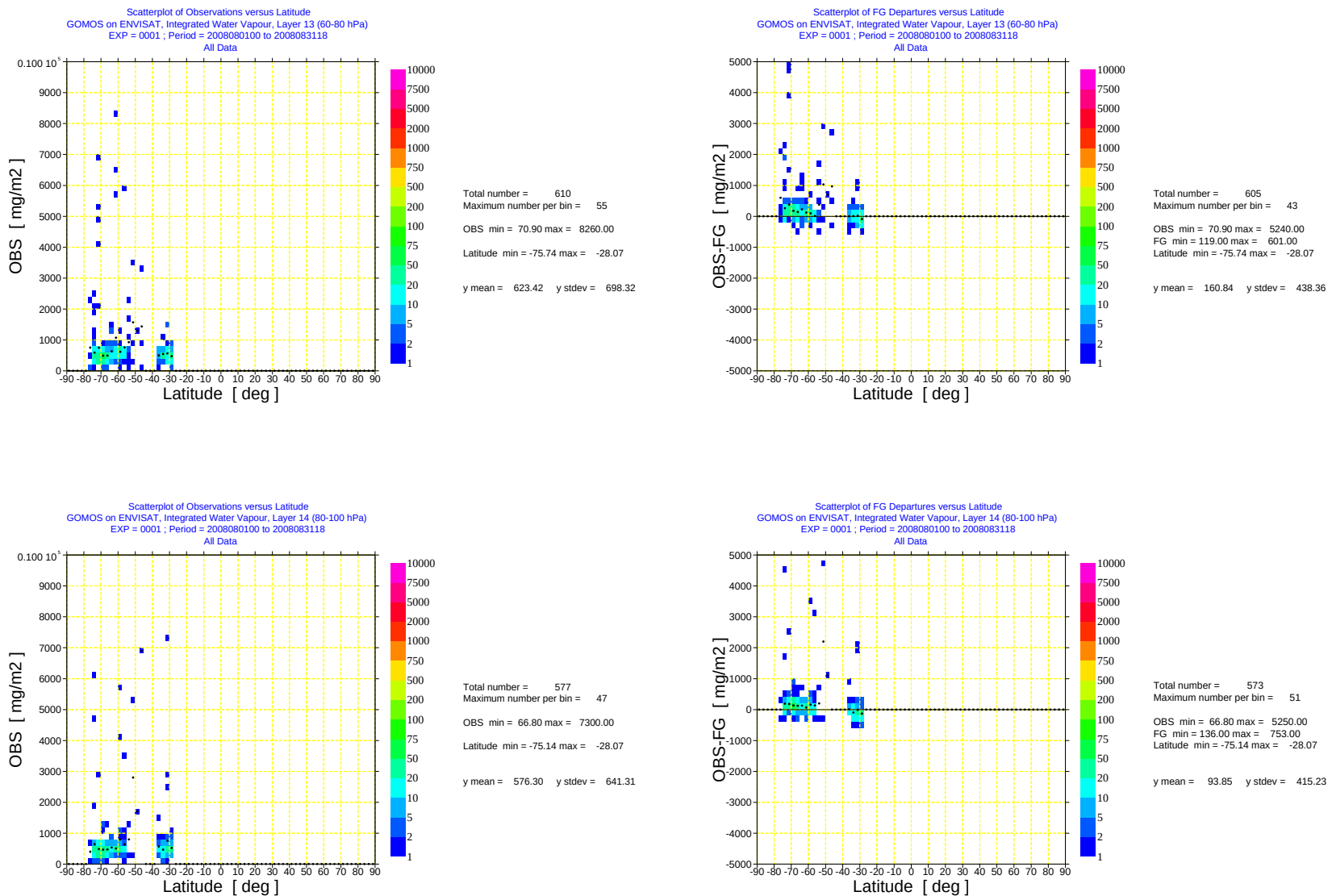


Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

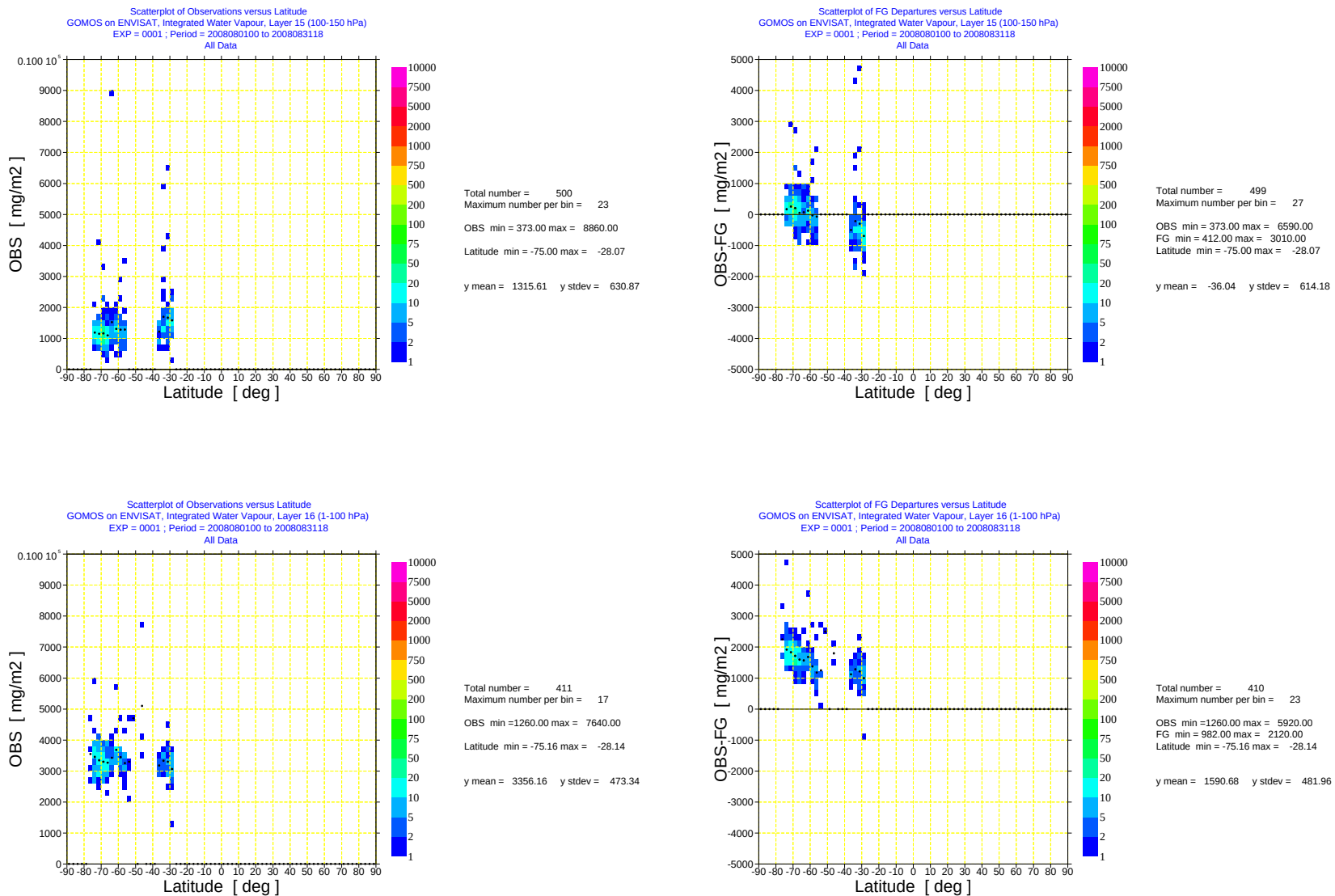


Fig. 10. As Fig. 5 but for level 15 (100-150 hPa) and level 16 (1-100 hPa).

Fig. 11. Howmoeller 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 2008.

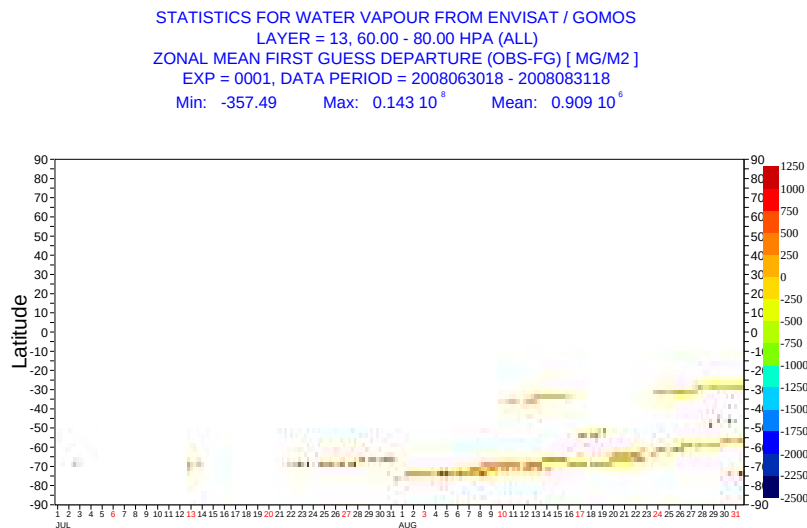
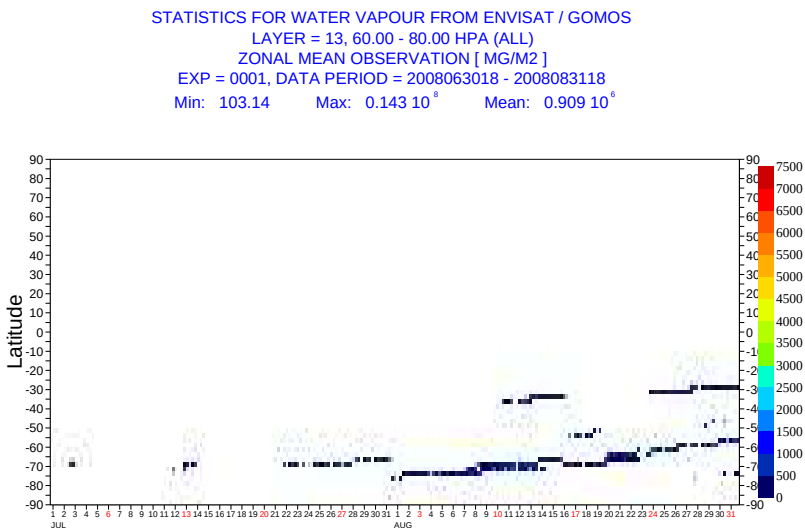
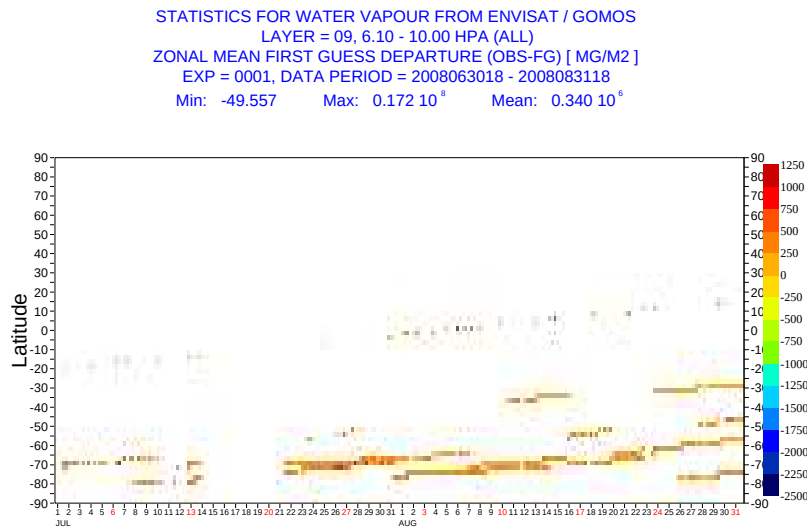
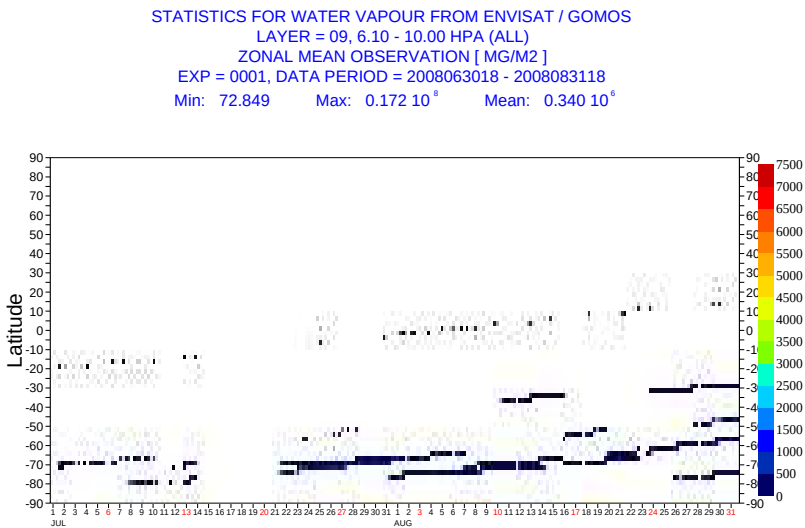
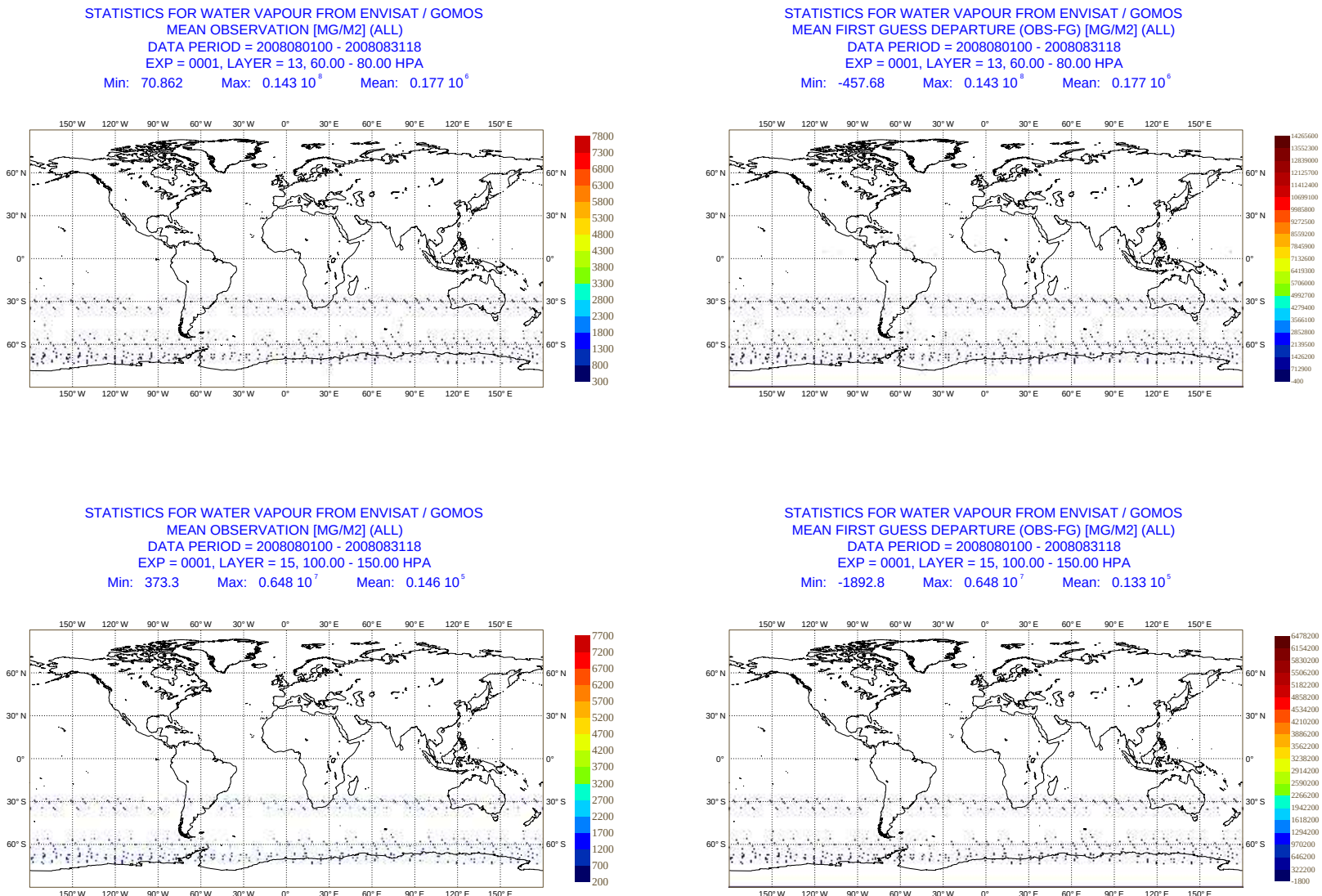


Fig. 12. Geographical distribution of mean ENVISAT GOMOS NRT water vapour data and mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for August 2008.



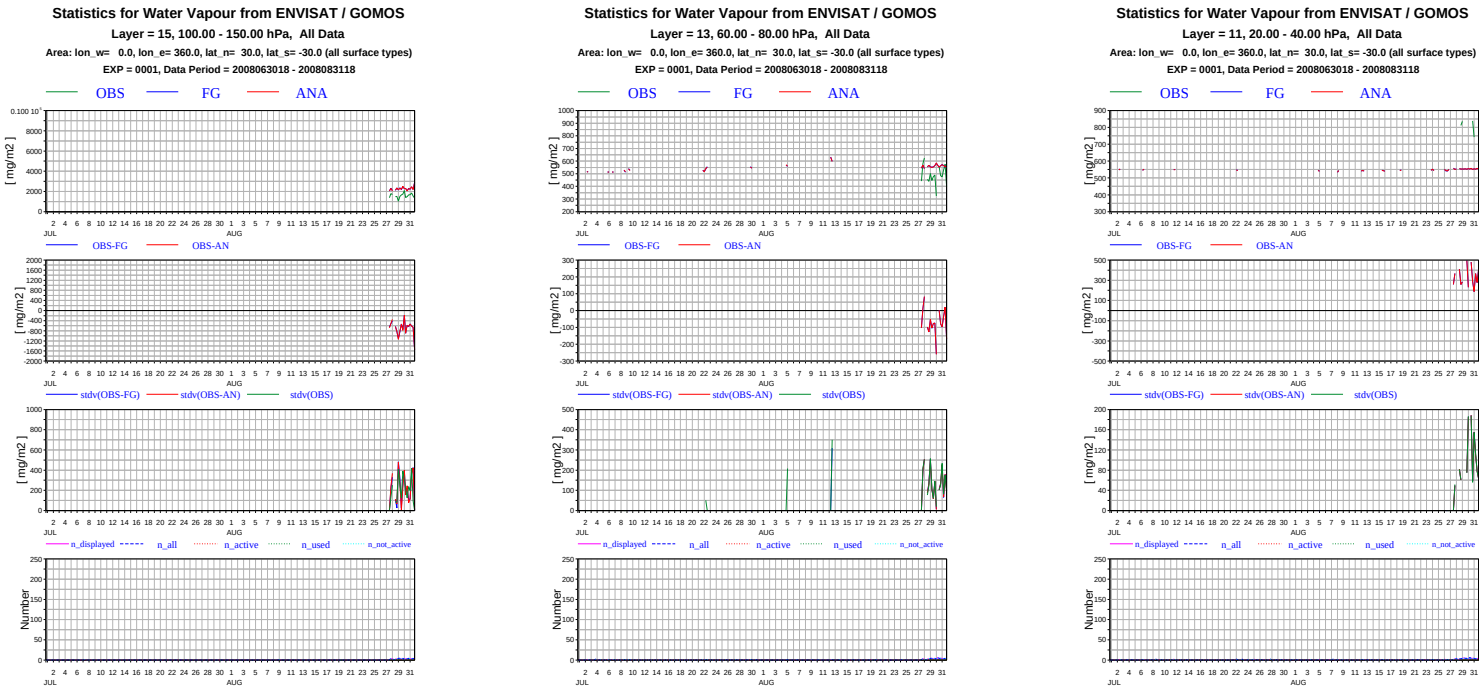


Fig. 13. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 11 (20-40 hPa), level 13 (60-80 hPa), and level 15 (100-150 hPa) in the latitudinal band 30N-30S for the period July-August 2008.