# REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR__2P) FOR JULY 2009

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## 1. Key points for July 2009

- The amount of observations measured by GOMOS in July 2009 was higher than in June, although not yet at the levels measured in 2008.
- The comparisons between the stratospheric temperature in the GOMOS BUFR files and the ECMWF temperature first-guess and analyses showed that the global mean first-guess and analysis residuals were almost zero in the lower stratosphere, and small negative departures up to -0.3% (about 0.5-0.6K) were found in the upper stratosphere. Larger departures up to -4% (about -8K) were seen in the mesosphere. In the tropics, these residuals were about -0.5% (-1 K) in all the stratosphere, and up to -2.5% (-5K) in the mesosphere. At mid and high latitudes in the SH, the first guess and analysis departures were within $\pm$1% ($\pm$2 K) in the stratosphere, and up to about -6% (-12K) in the mesosphere. The standard deviations of the departures were within 1 and 4% at all latitudes and levels.
- The ozone global mean first guess and analysis departures were within -5 and +20% at most vertical levels in the stratosphere (p$<$80hPa). Larger departures ($>$50% in places) were found in the lower stratosphere (p$>$80hPa) and in the mesosphere. First guess and analysis departures within -5 and +15% were found for p $<$ 50hPa in the tropical band. At mid and high latitudes in the SH, the ozone departures were typically within -15 and +25% in the stratosphere and lower mesosphere, but larger elsewhere. The standard deviations of the departures were larger than 15% at all levels.
- Based on the available data, 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, using the filter implemented in the PDS2BUFR converter. 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 available vertical levels and latitudes.
- The monitoring statistics for July were produced with the operational ECMWF model, CY35R2.

## 2. Quality and amount of received data

Data coverage and amount of received data during July 2009 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Since January 2009, instrumental problems have limited the amount of data measured by the GOMOS instrument, particularly at stratospheric levels. In July 2009, just over 1000 (good) observations were available for temperature, about 850 (good) observations were available for ozone, and about 350 for water vapour. The largest number of observations were available 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 cases of ozone and water vapour (see figure 3 in the attached ozone and water vapour reports). The low amount of observations currently available in some regions of the atmopshere might have made the corresponding results presented in this report not statistically significant. These results are nonetheless summarized below for completeness.

## 3. GOMOS temperature data

The profile plots (temperature report: Figures 3-6) show that in the global average the first-guess and analysis departures were almost zero in the stratosphere (for pressures larger than 20hPa), while small negative departures up to -0.3% (about 0.5-0.6K) can be found in the upper stratosphere. In the mesosphere, the mean temperature departures were up to -4% (about -8K). The global mean standard deviation of the first-guess and analysis departures were about 1% in the whole stratosphere and within 1 and 4% in the mesosphere. In the tropics, the first guess and analysis departures were negative and about -0.5% (-1 K) in all the stratosphere, and up to -2.5% (-5K) in the mesosphere. At mid and high latitudes in the SH, positive departures up to +1% (2 K) were found in the lower stratosphere (for pressures larger than 10hPa), and negative up to -1% (-2 K) in the rest of the stratosphere. Departures up to -6% (about -12K) were found in the mesosphere at these latitudinal bands. The standard deviations of the departures were within 0.5 and 2% at all latitudes and levels in the stratosphere and 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$4K at most vertical levels in the tropical 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 profile plots (ozone report: Figures 3-6) show that both the ozone first guess and analyses were within the observation one-standard deviation range. In the global average, the first-guess departures were within -5 and +20% at most vertical levels in the stratosphere (typically for pressures $<$80hPa). Larger departures ($>$50% in places) were found in the lower stratosphere for pressures larger than 80hPa and in the mesosphere. The standard deviations of the departures were larger than 15% at all levels.

When averaged over latitudinal bands, first guess and analysis departures within -5 and +15% were found in most of the stratosphere (p$<$50hPa) in the tropical band. At midlatitudes in the SH, the GOMOS ozone values and their model equivalent showed residuals typically within $-$10 and +25% in the stratosphere (p$<$40hPa). Larger departures were found elsewhere. At high latitudes in the SH, the first guess and analysis departures were within -15 and +20% in most of the stratosphere (p$<$40hPa) and lower mesosphere (p $>$0.4hPa), but larger elsewhere.

The standard deviations of the analysis and first guess departures were larger than 15% at all levels and latitudinal bands.

The scatter plots (ozone report: Figures 7-14), the timeseries of GOMOS ozone and departures (ozone report: Figure 15-18) and the Hovmoeller plots (ozone report: Figure 19-20) 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 was generally poor as already discussed in the last few months. 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, where the GOMOS observations exhibited on average values of four orders of magnitude larger than their model equivalent. However, the number of vater vapour data available at certain levels in July 2009 was sometimes too low to be statistically significant.

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 showed that very little signal if nothing at all was detected as a consequence of the combination of extremely low number of data and their poor quality.

## 6. Remarks

This monitoring report was produced with the operational ECMWF model (CY35R2). Ozone layers from SBUV/2 on NOAA-17 and NOAA-18, and OMI total column ozone were actively assimilated.

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 JULY 2009

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August 6, 2009

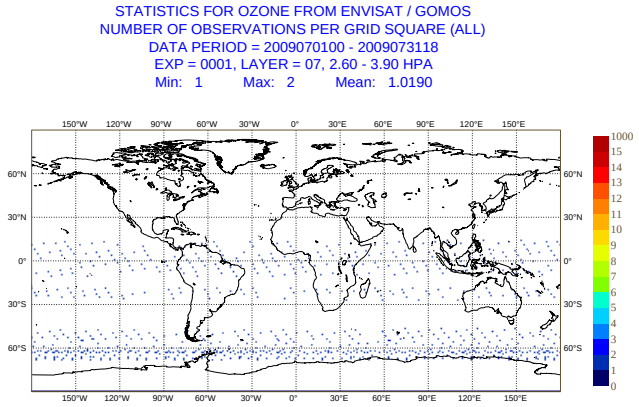



Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for July 2009.

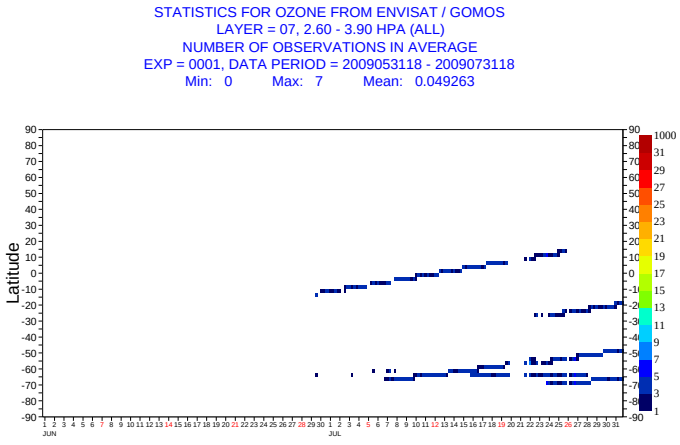



Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for June-July 2009.

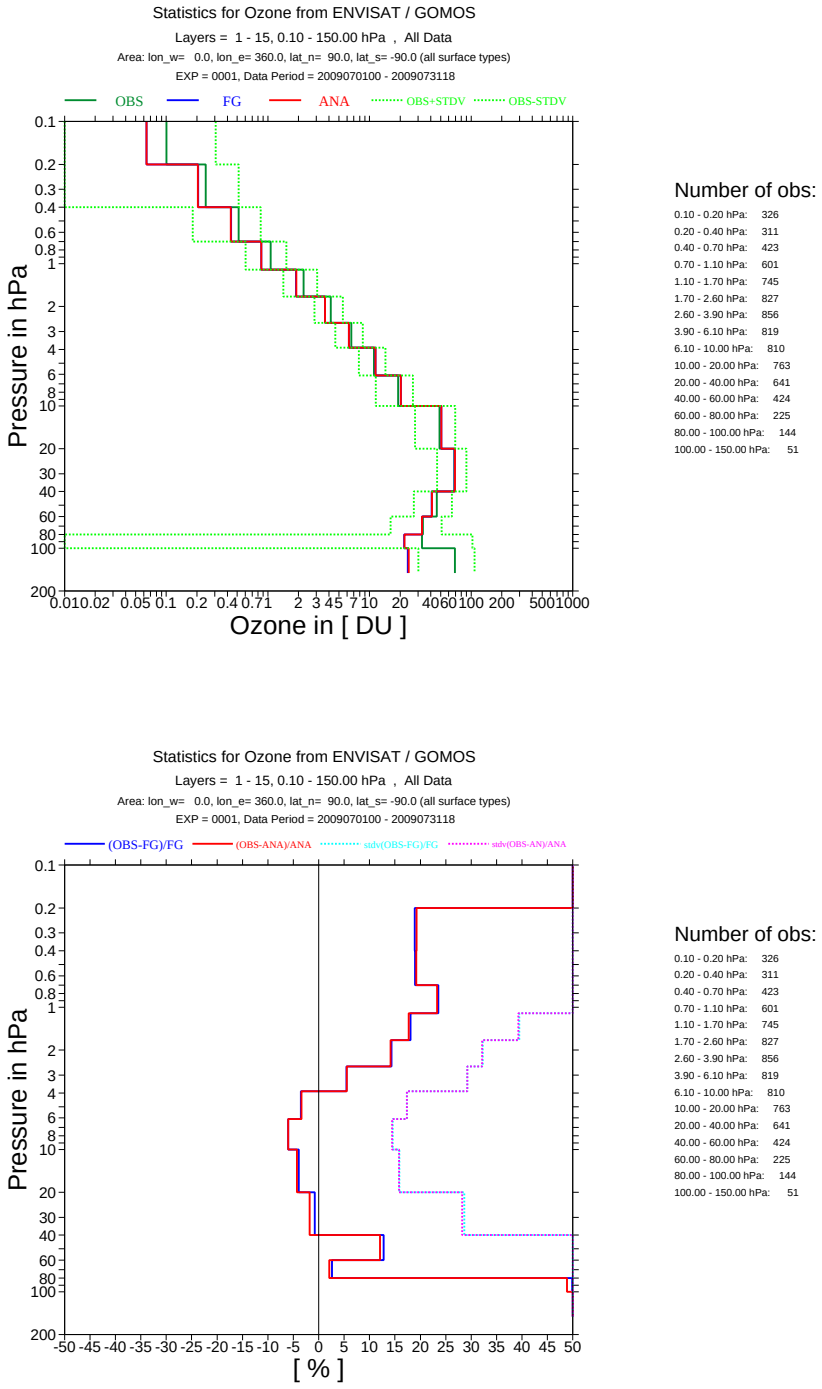
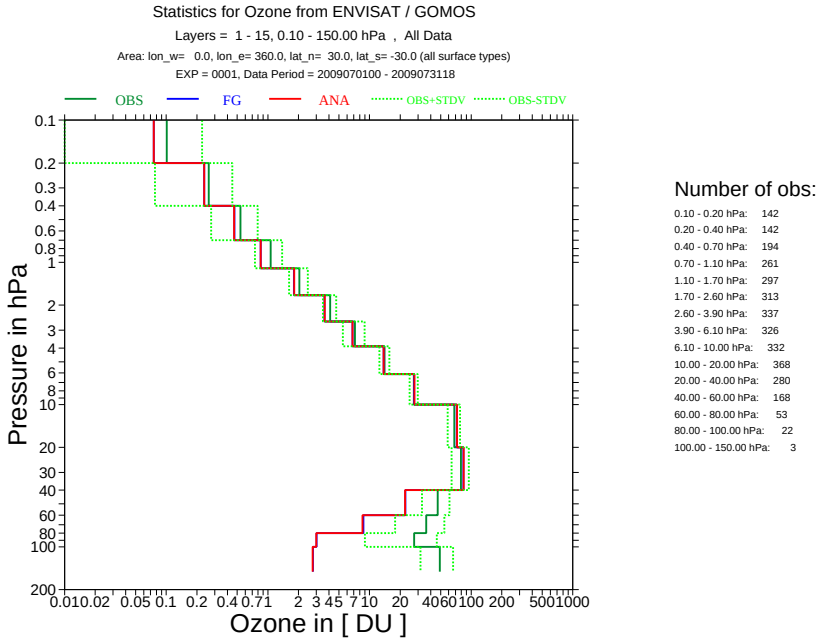



Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for July 2009 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) +/- 1 standard deviation (green dotted lines). The bottom 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.



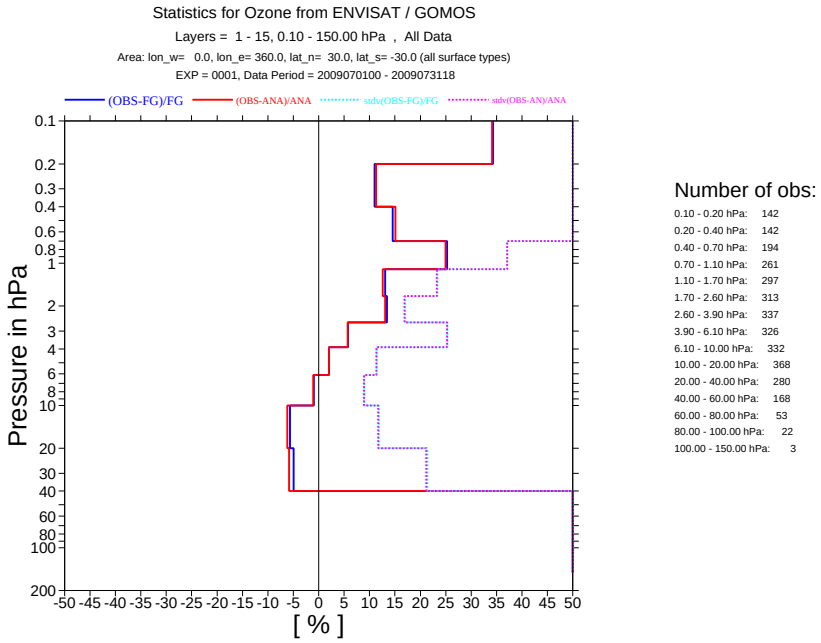




Fig. 4. As Fig. 3 but for 30N-30S.

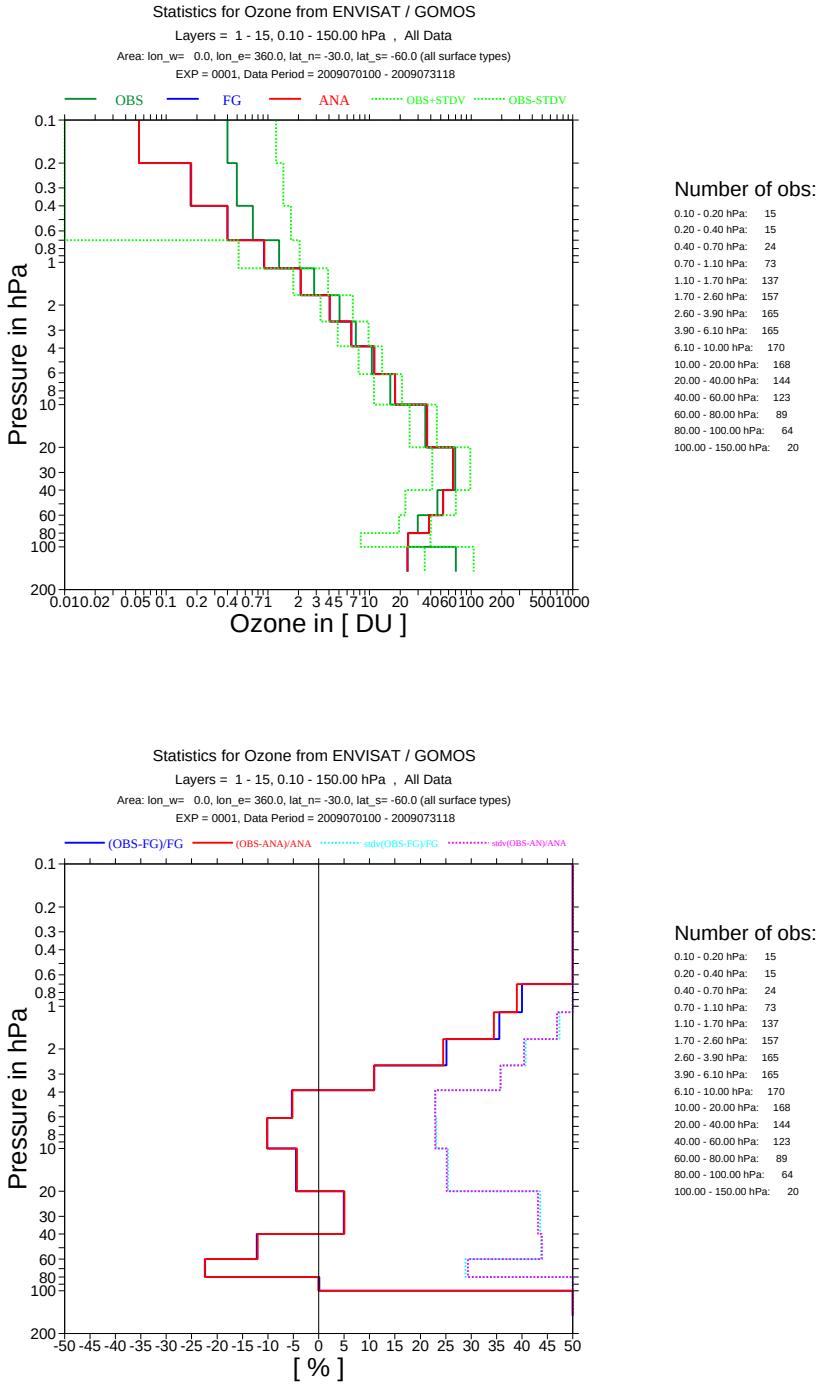
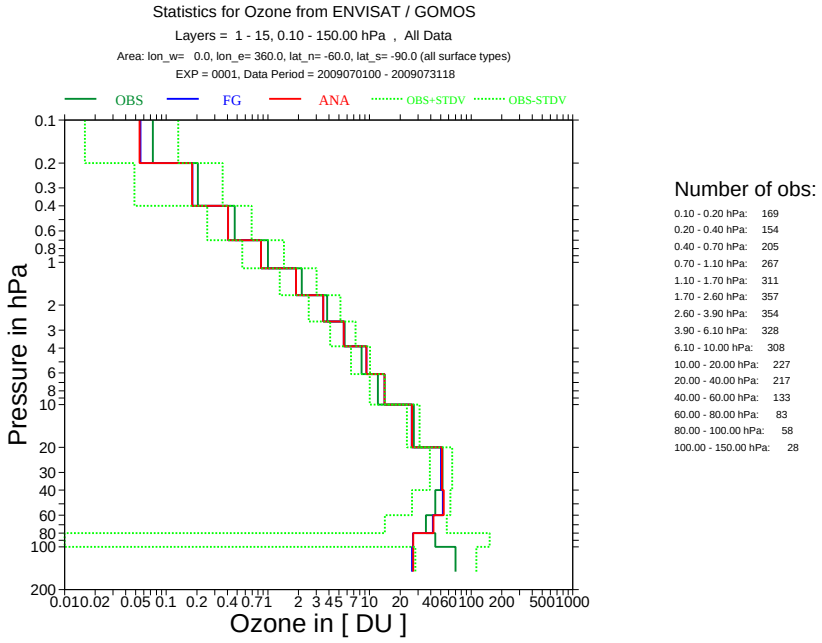






Fig. 5. As Fig. 3 but for 30S-60S.



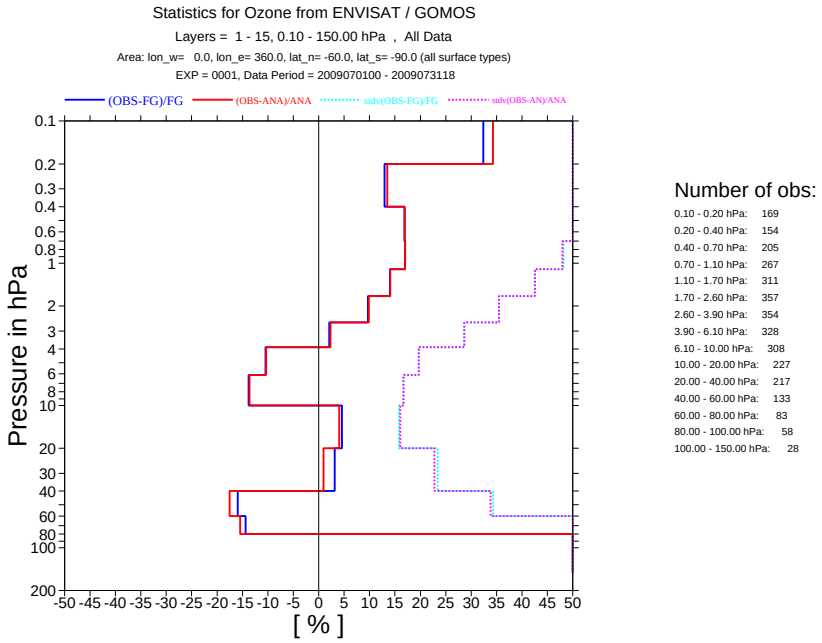




Fig. 6. As Fig. 3 but for 60-90S.

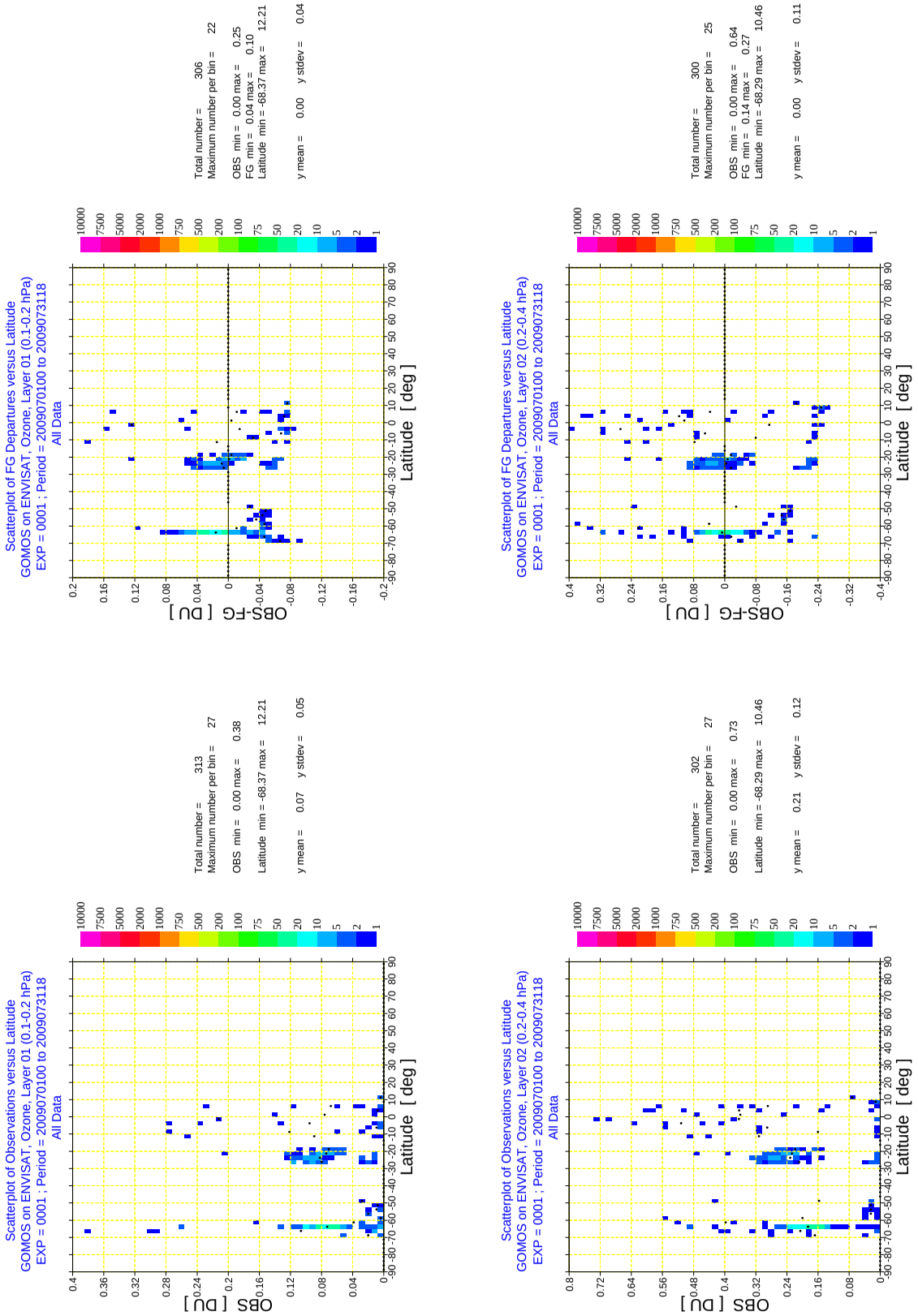



Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for July 2009 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black dots the mean value per bin.

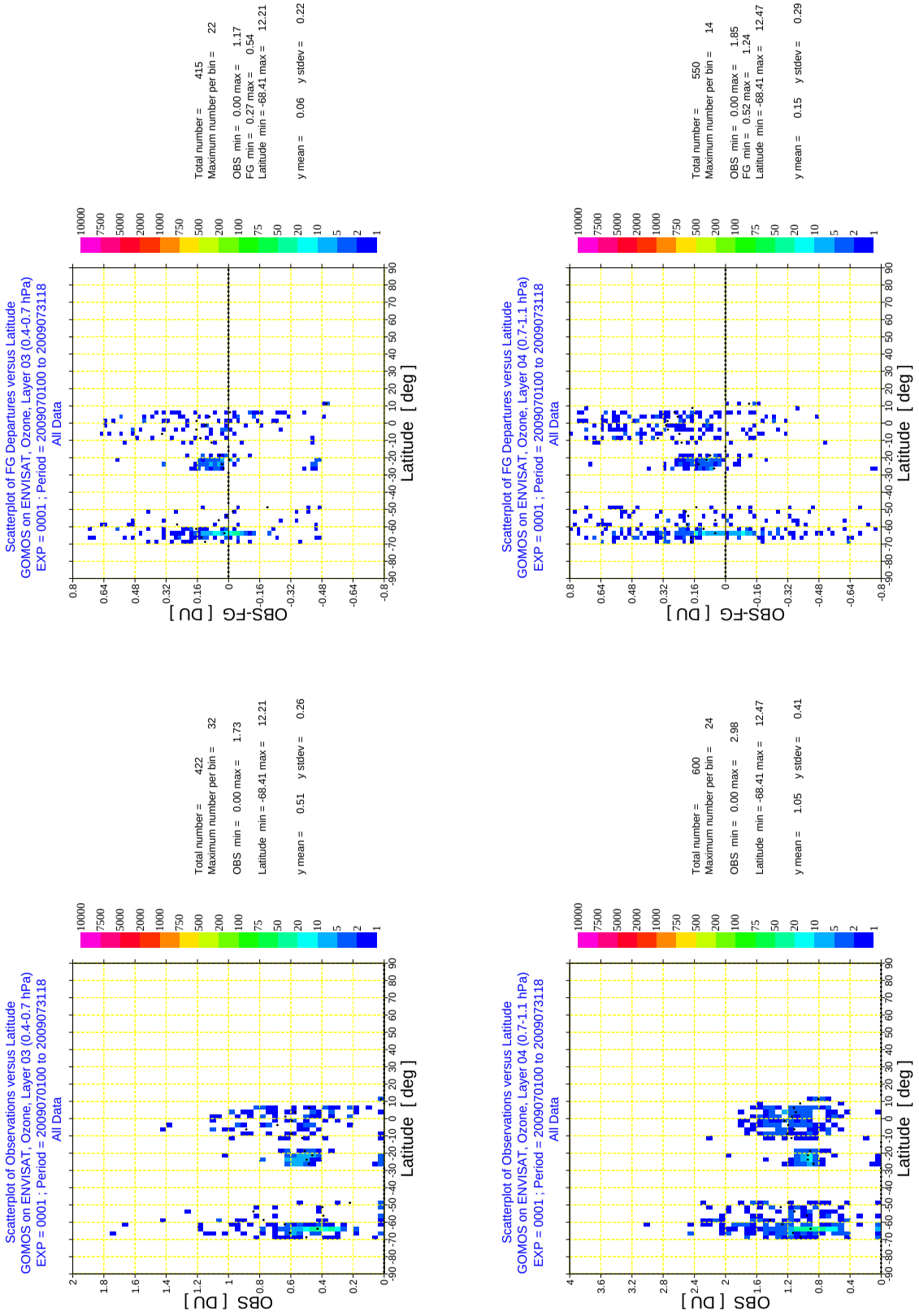



Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

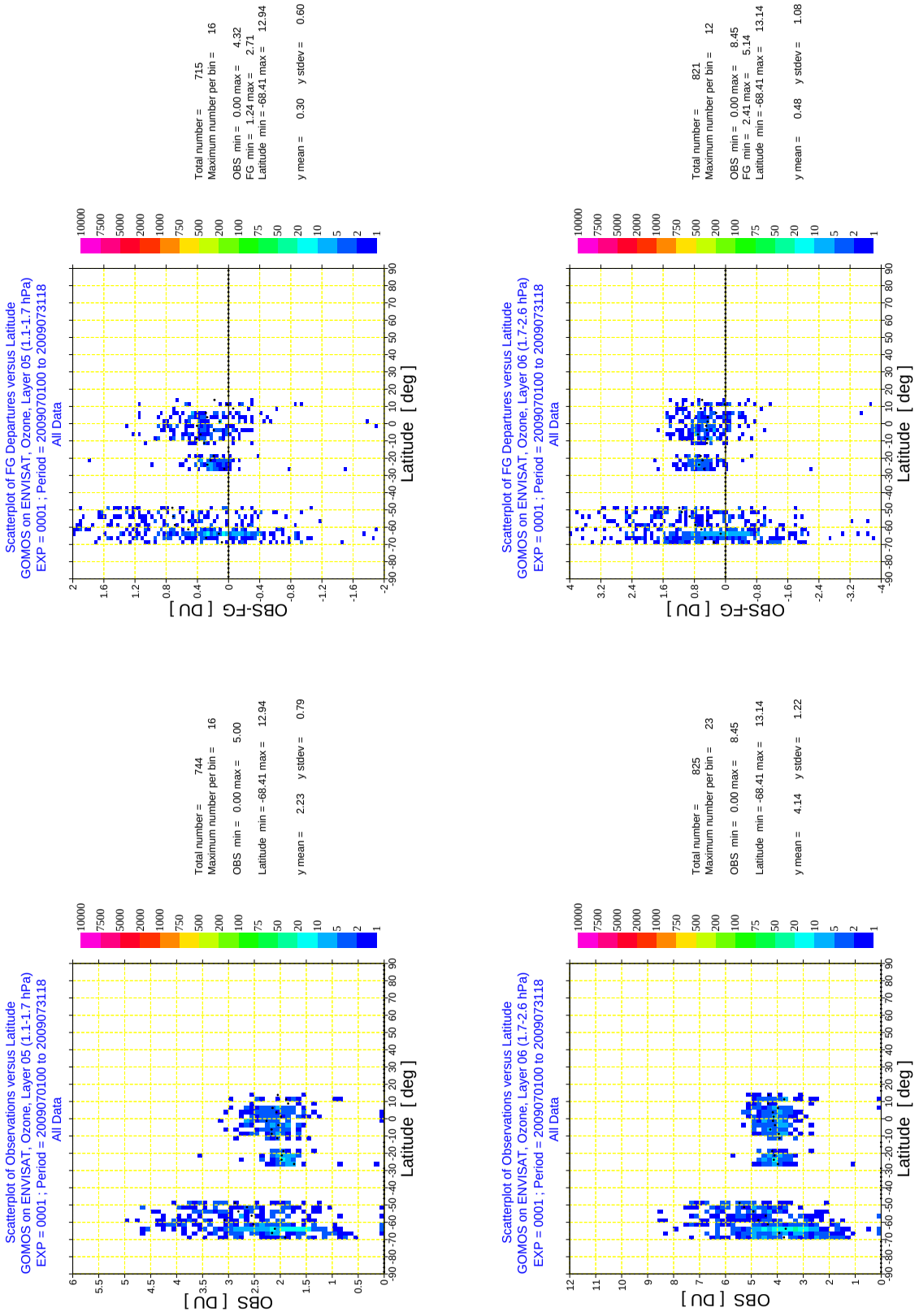



Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

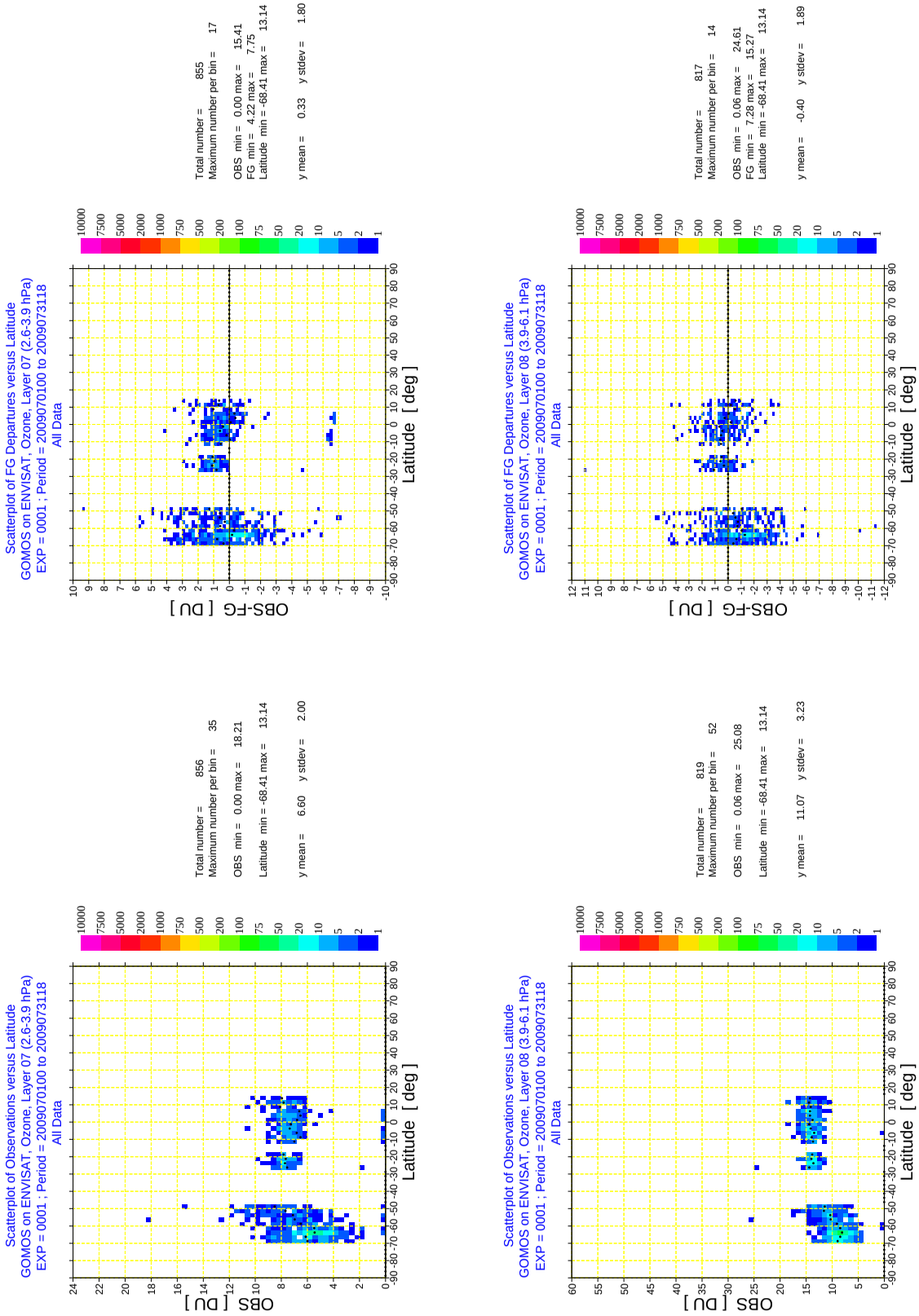



Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

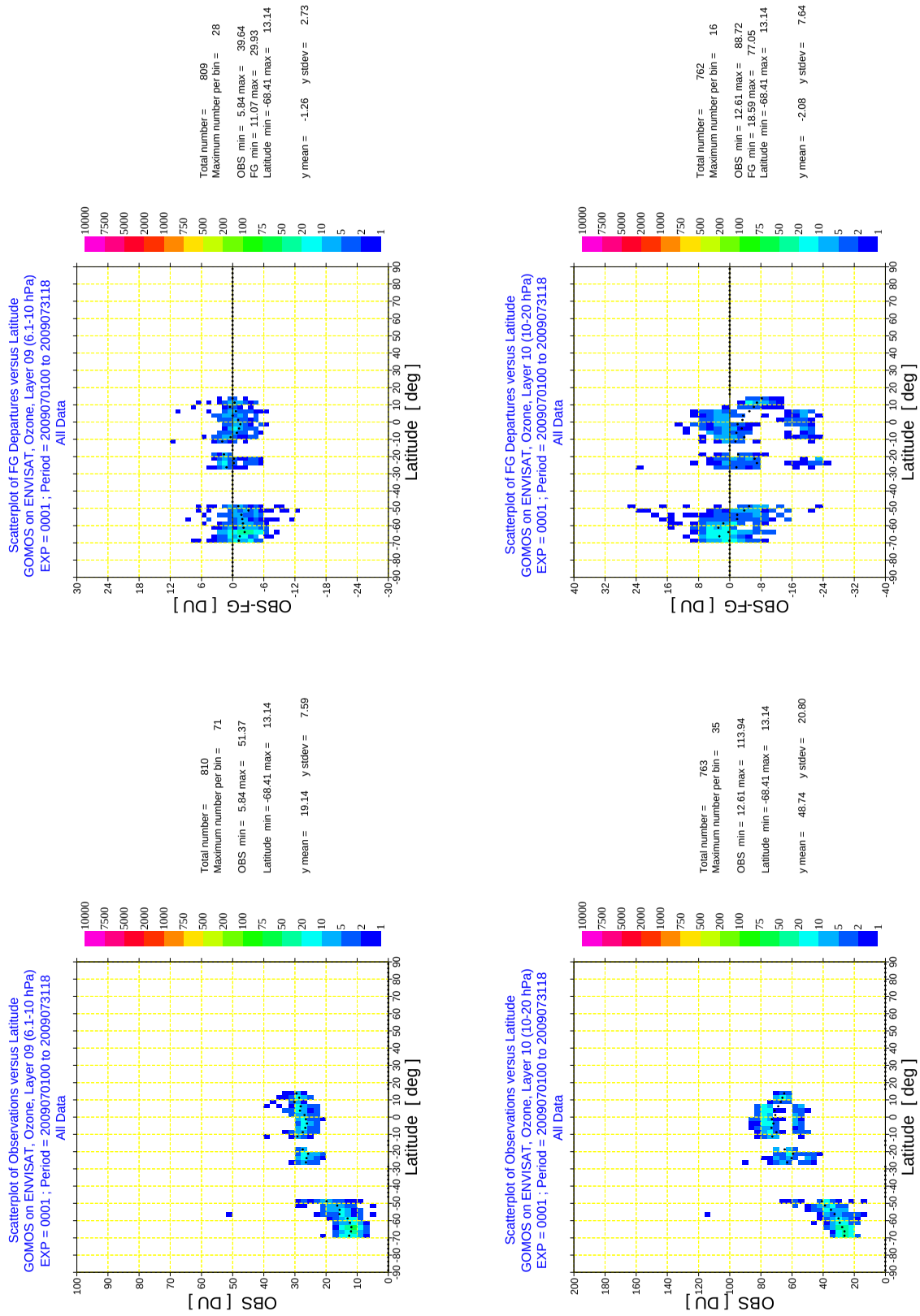



Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

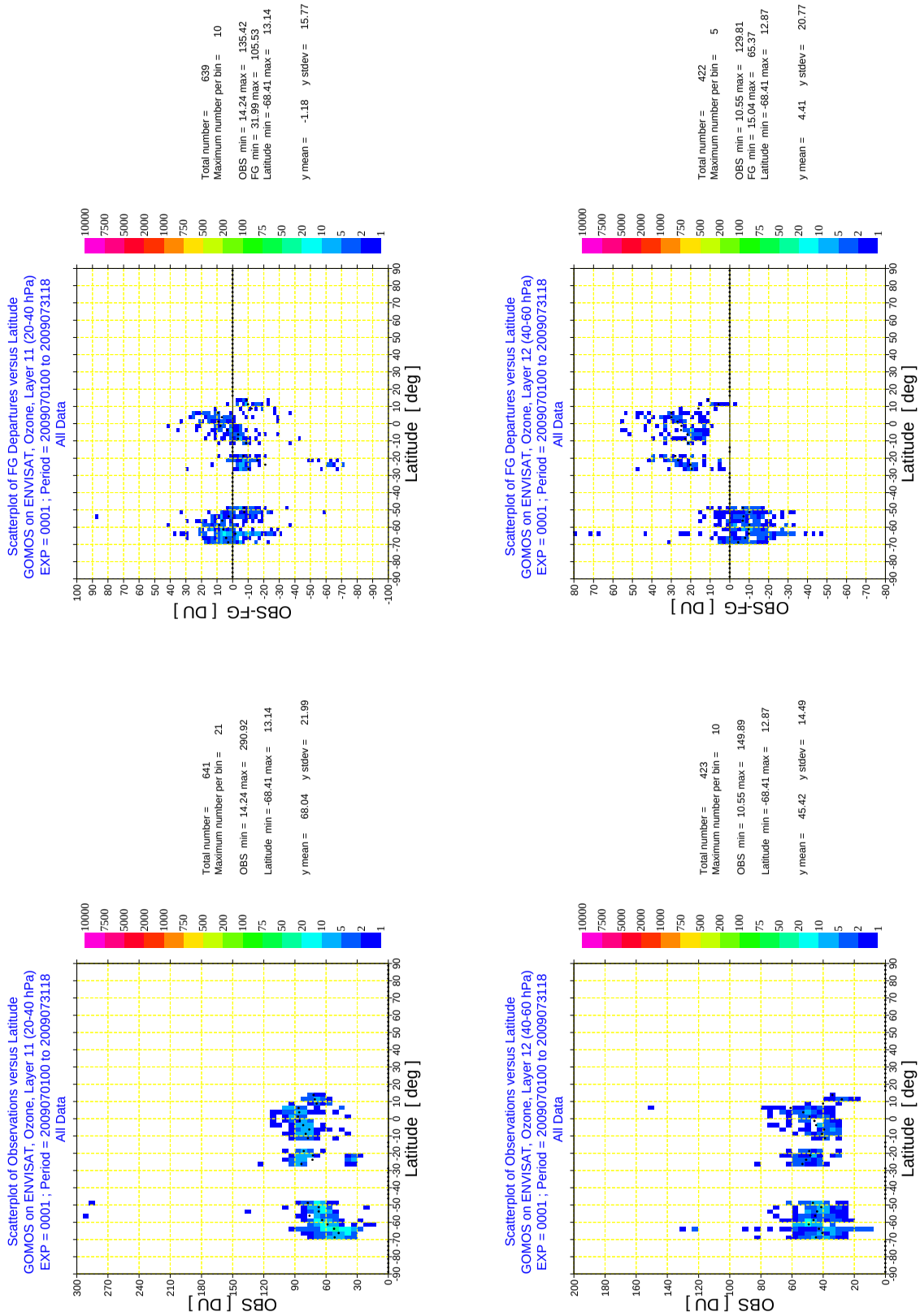



Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

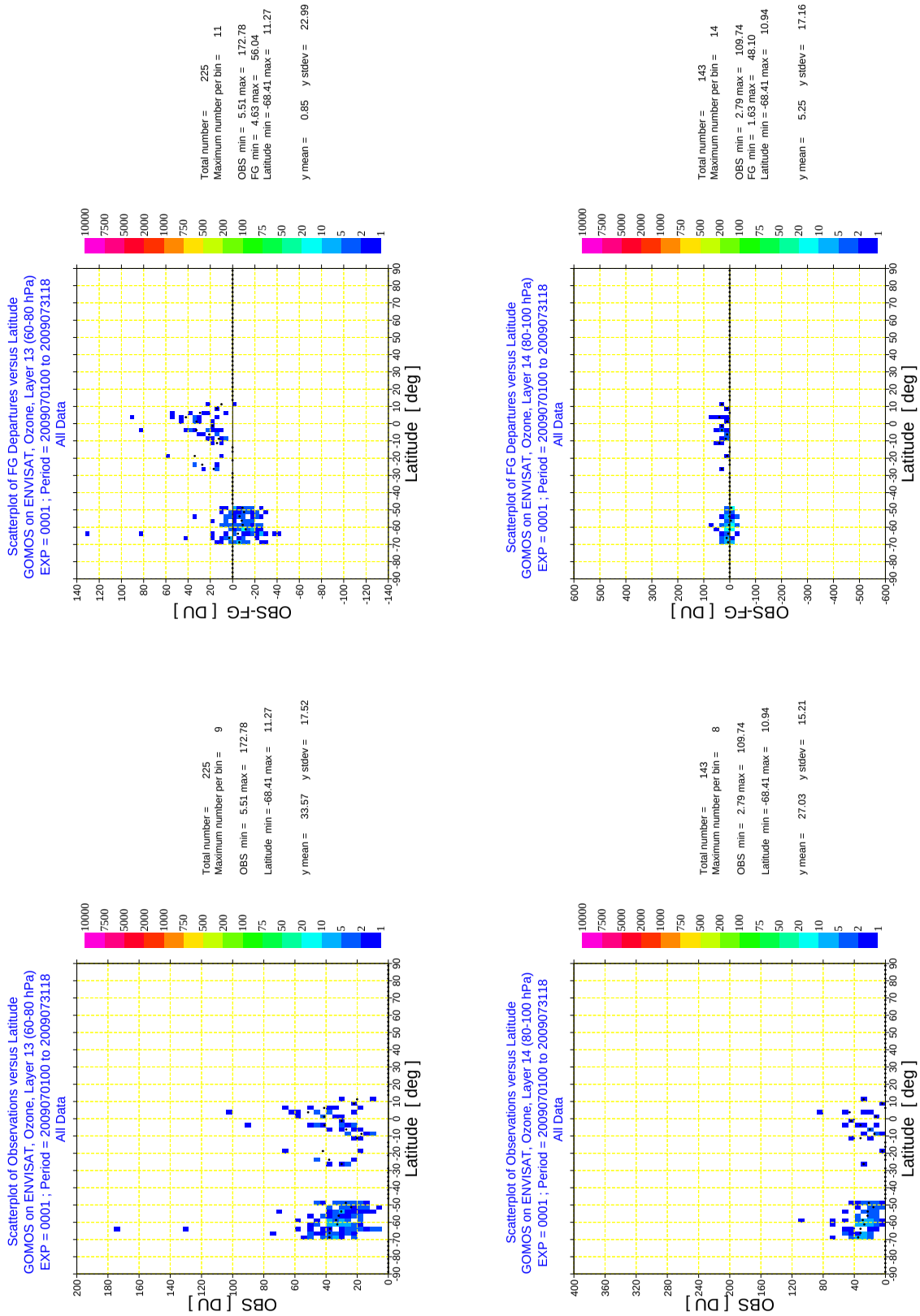



Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

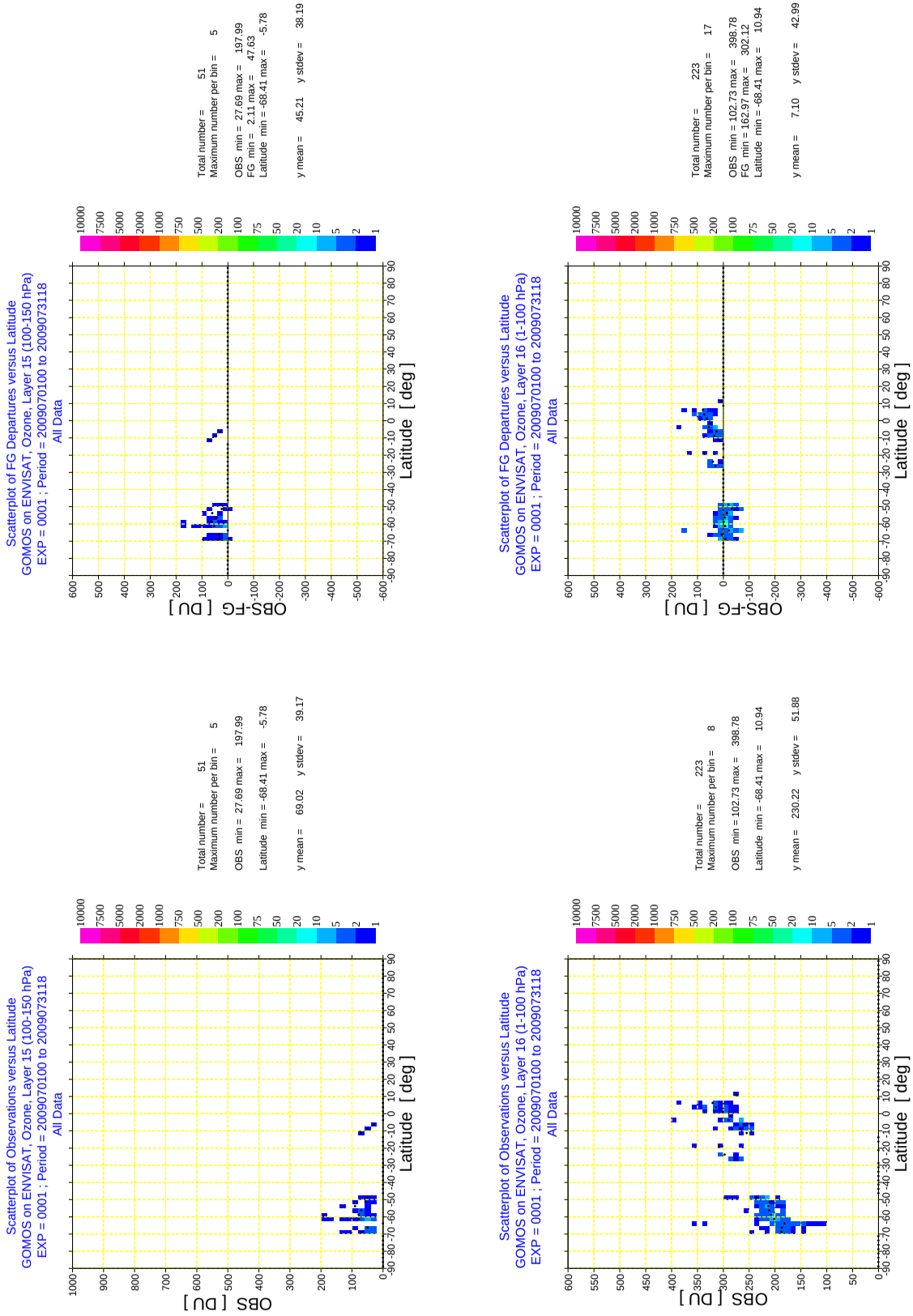



Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

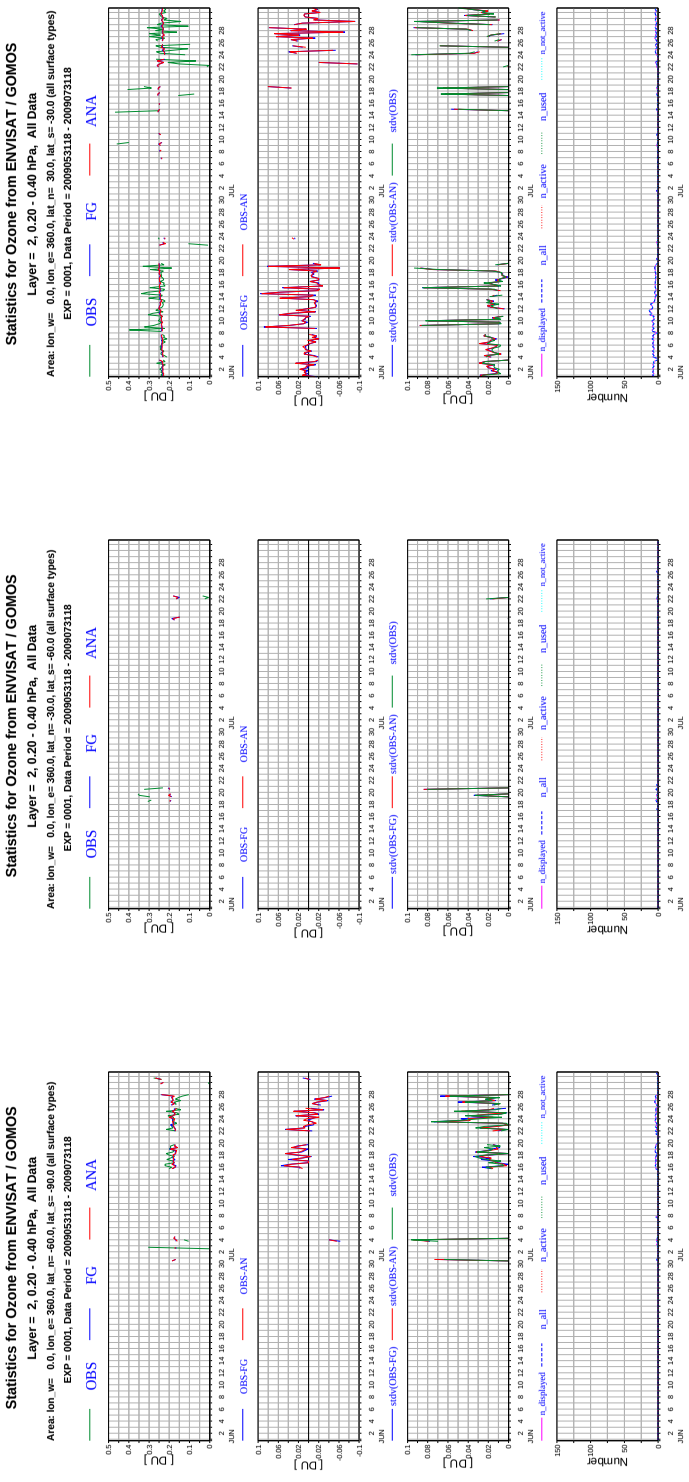



Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for the period June-July 2009.

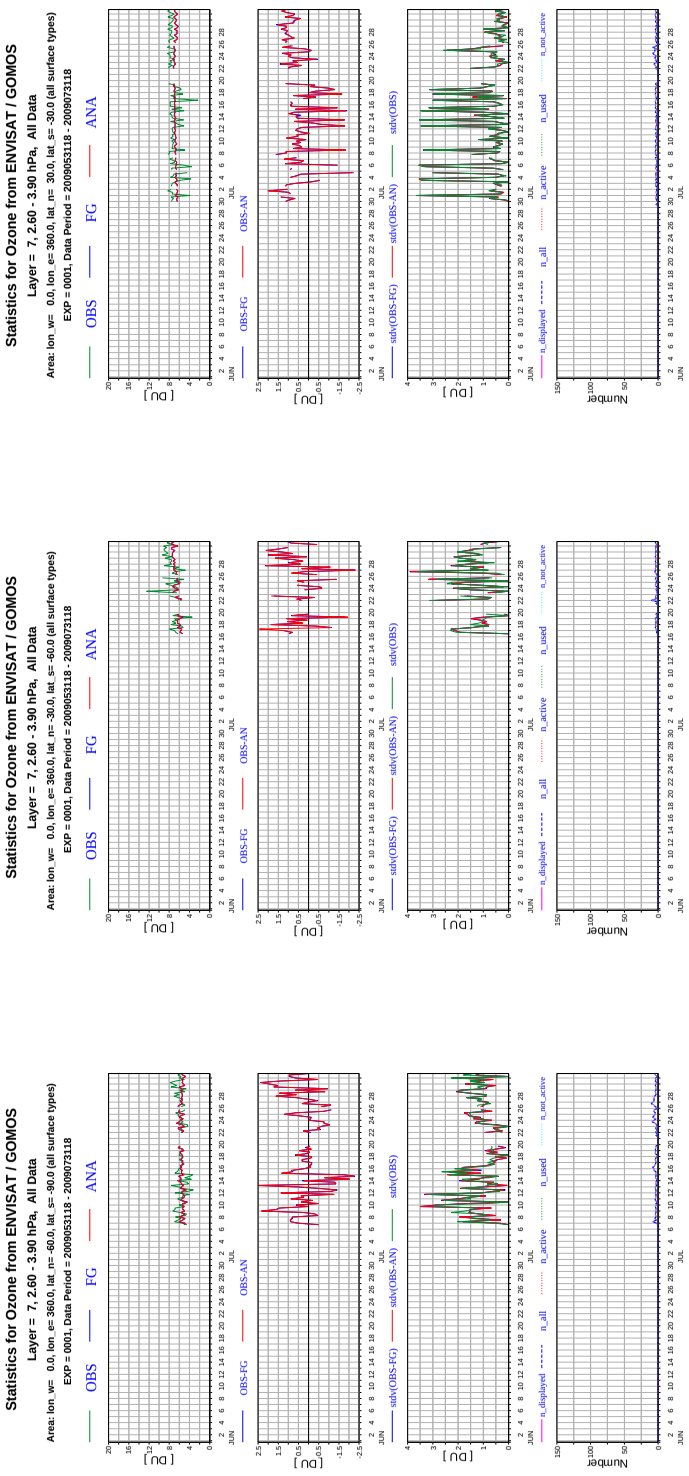



Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

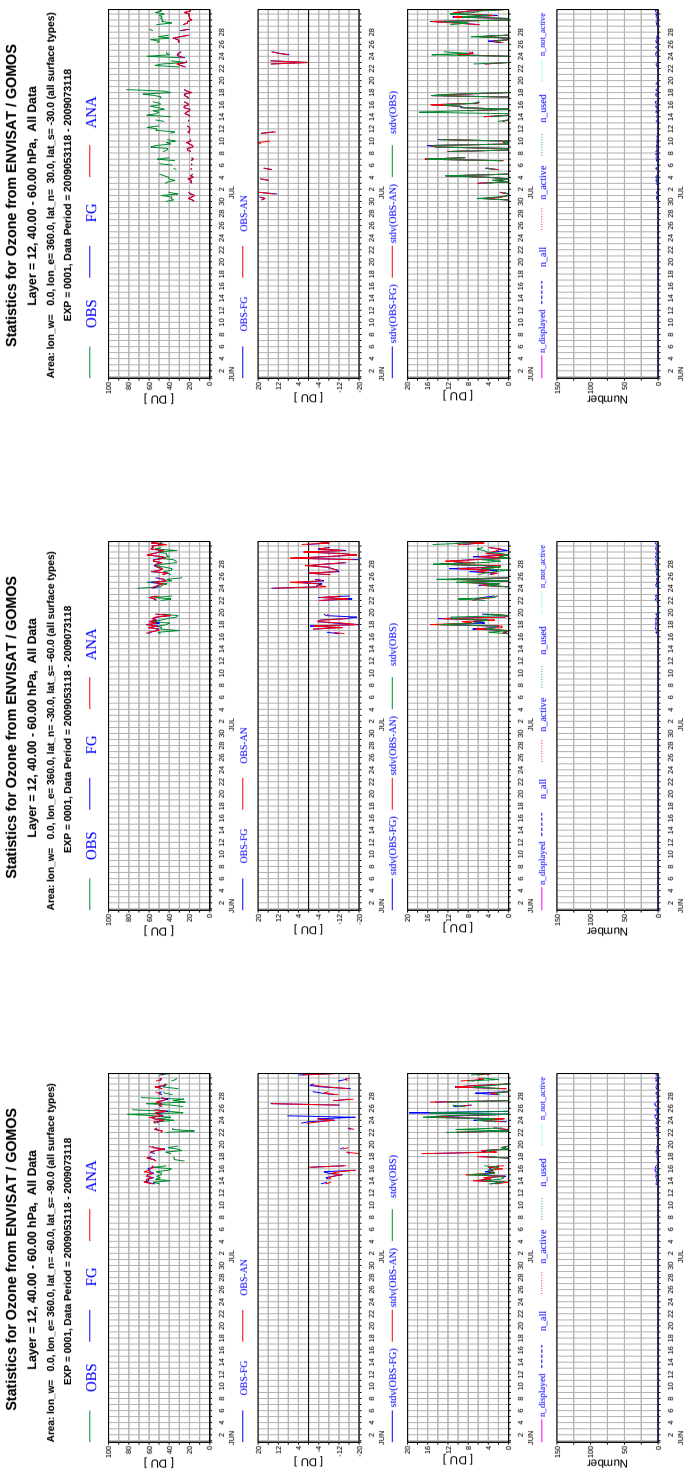



Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

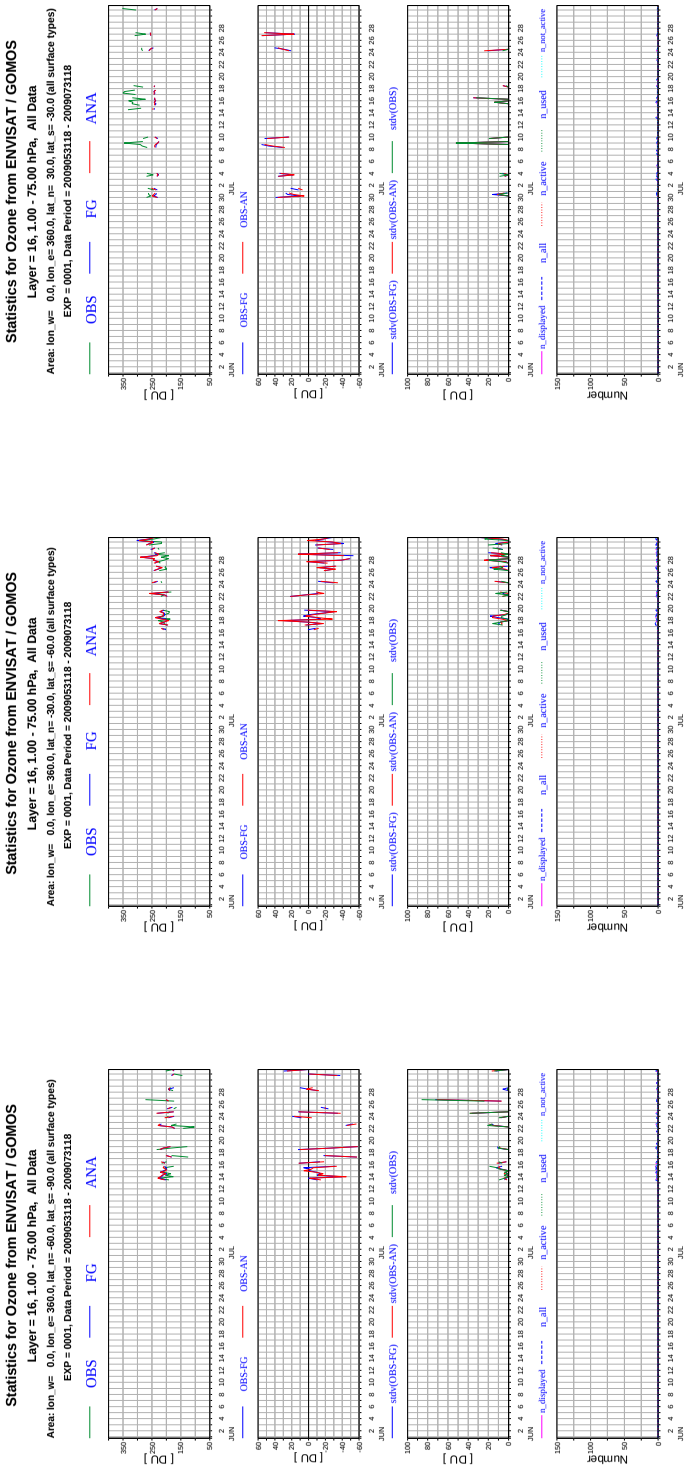



Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

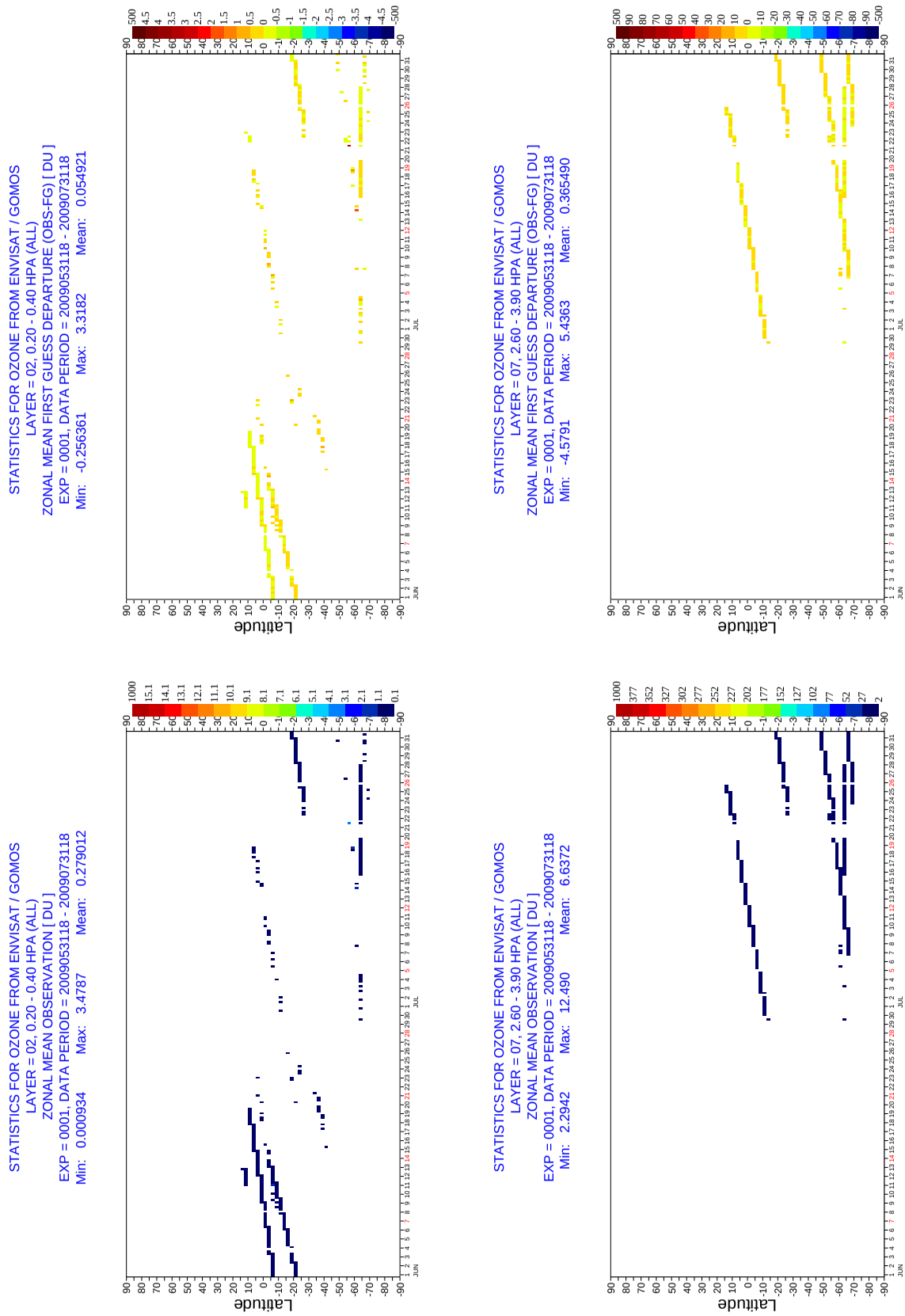



Fig. 19. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for June-July 2009 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

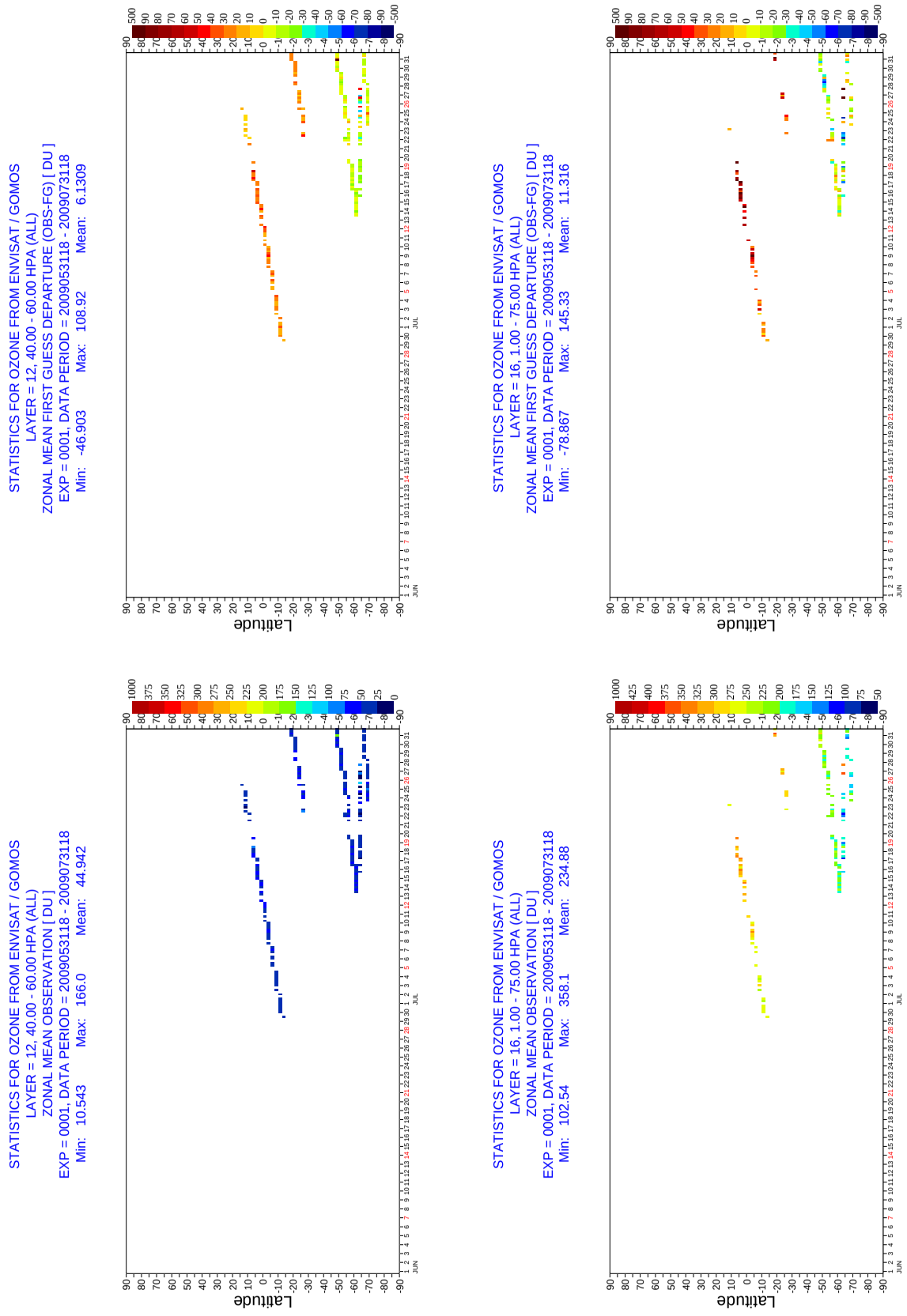



Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

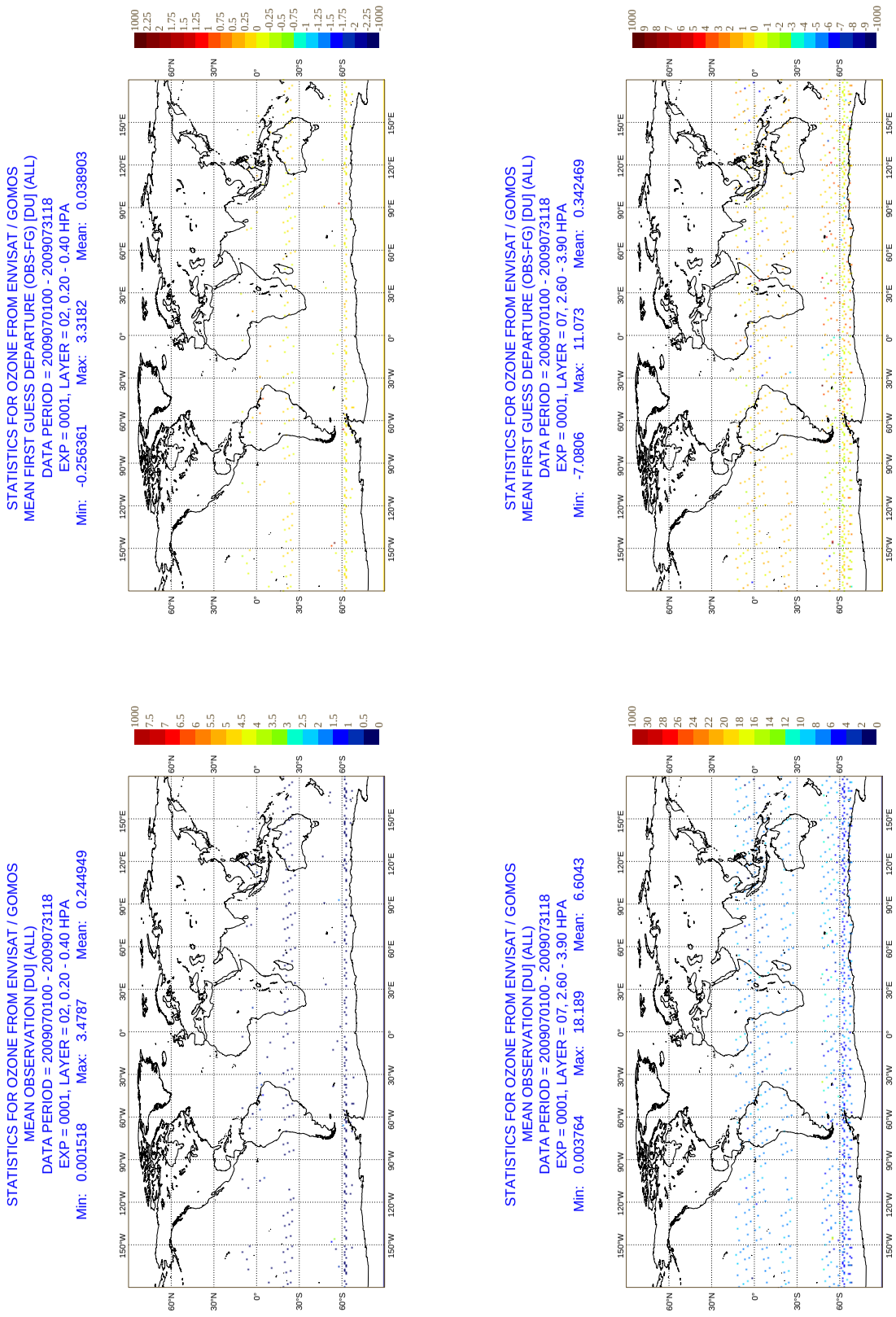



Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for July 2009 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

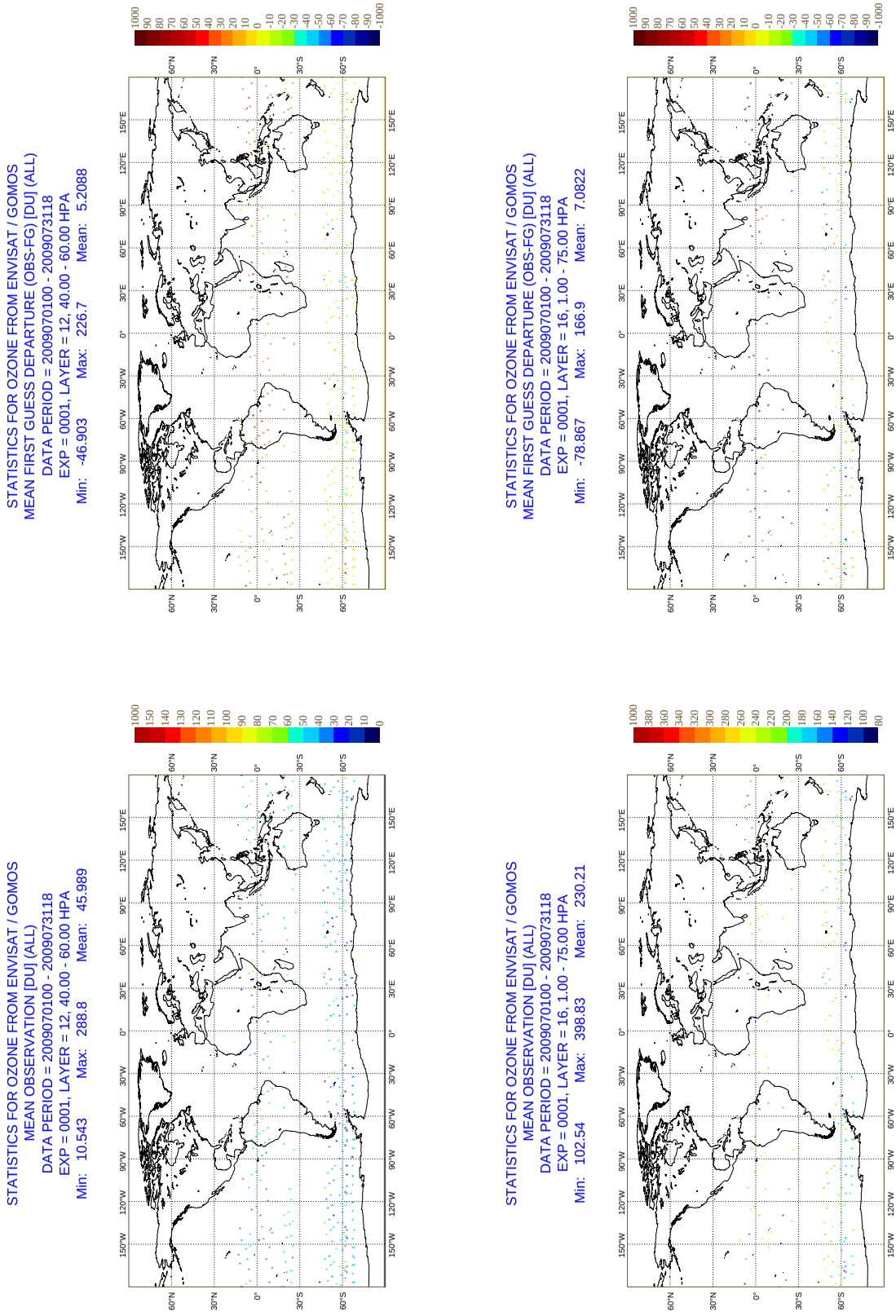



Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

# REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR_2P) FOR JULY 2009

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August 6, 2009

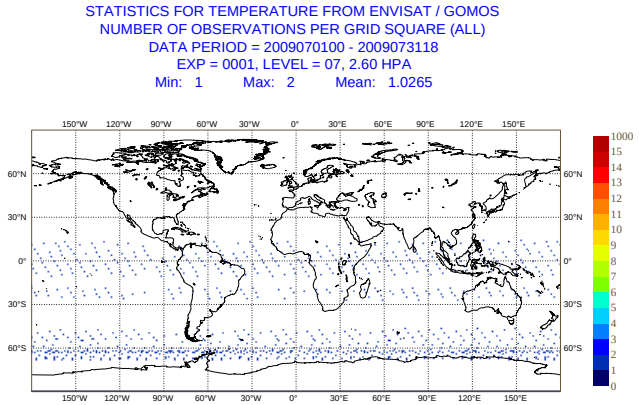



Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for July 2009.

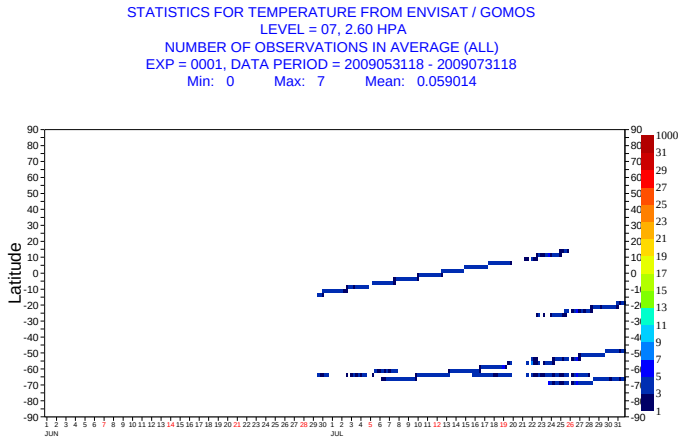



Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for June-July 2009.

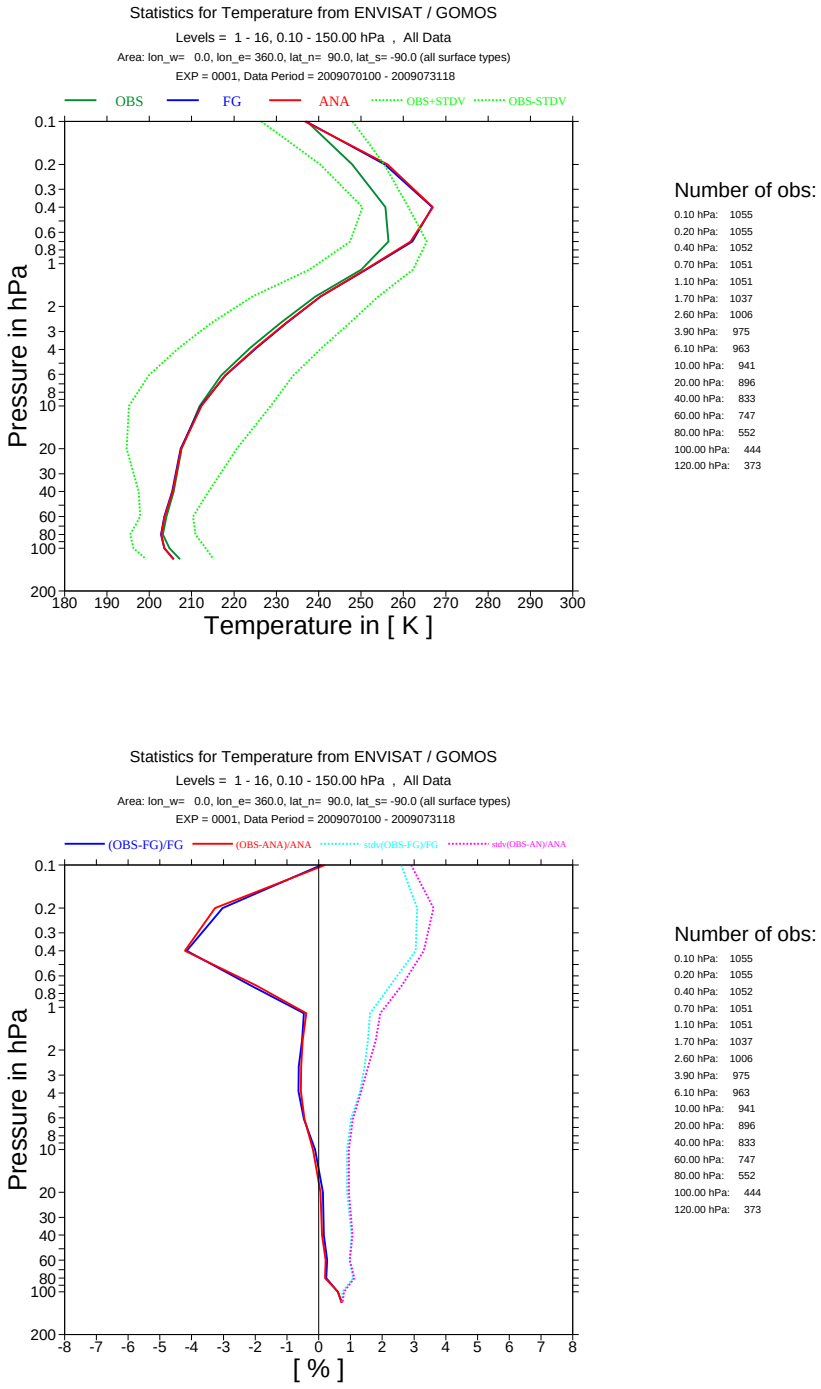
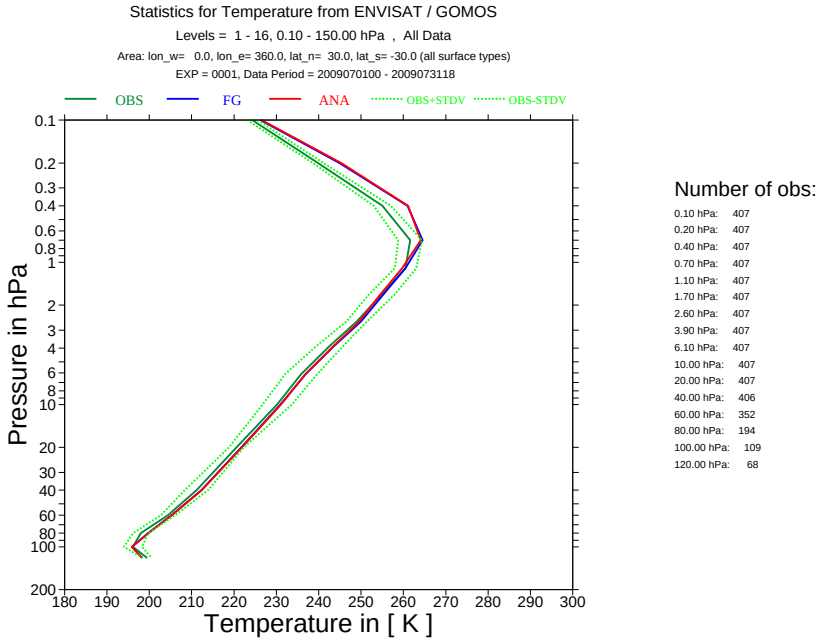



Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for July 2009 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation +/- 1 standard deviation (green dotted lines). The bottom 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.



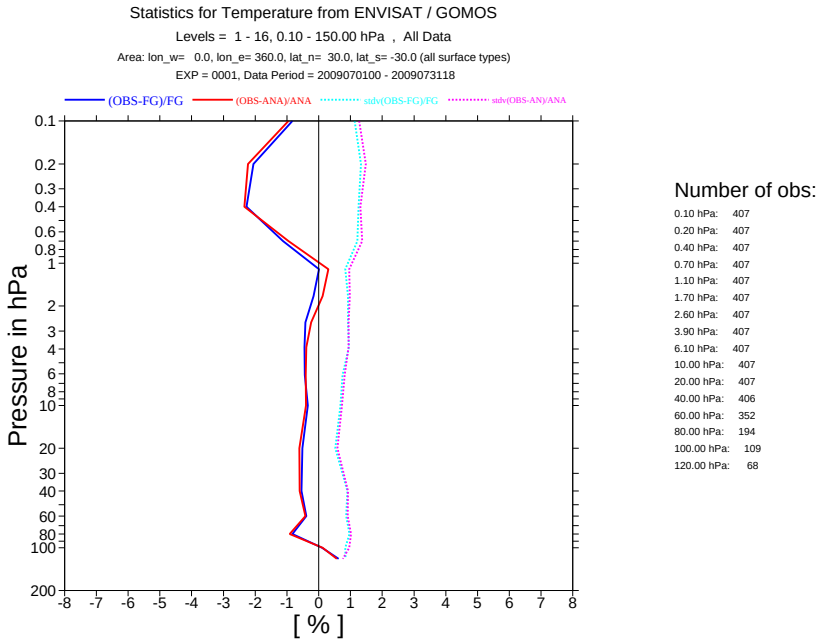
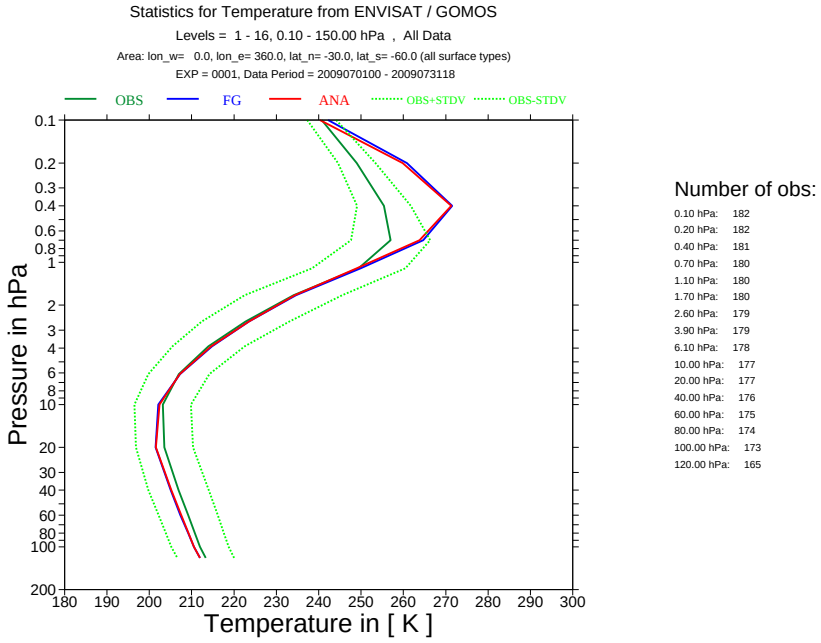




Fig. 4. As Fig. 3 but for 30N-30S.



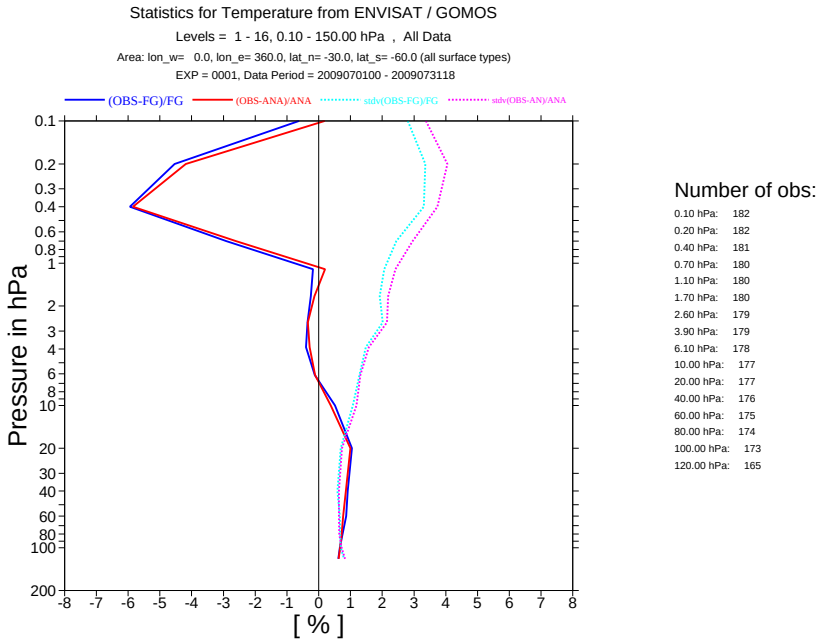
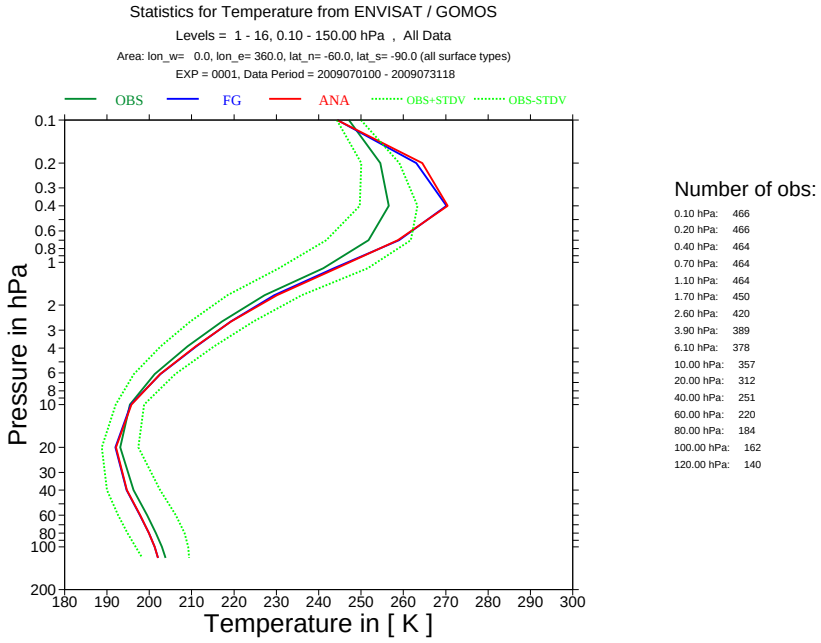




Fig. 5. As Fig. 3 but for 30-60S.



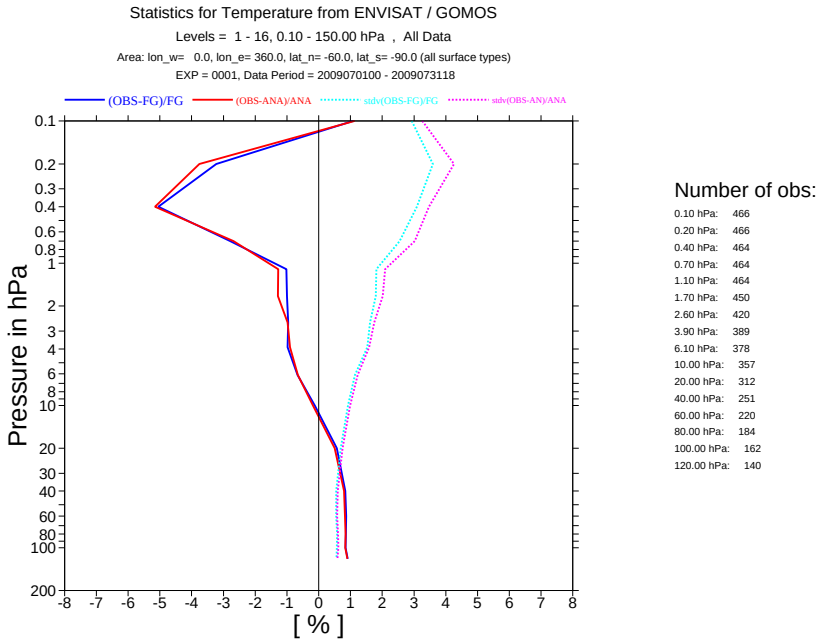




Fig. 6. As Fig. 3 but for 60-90S.

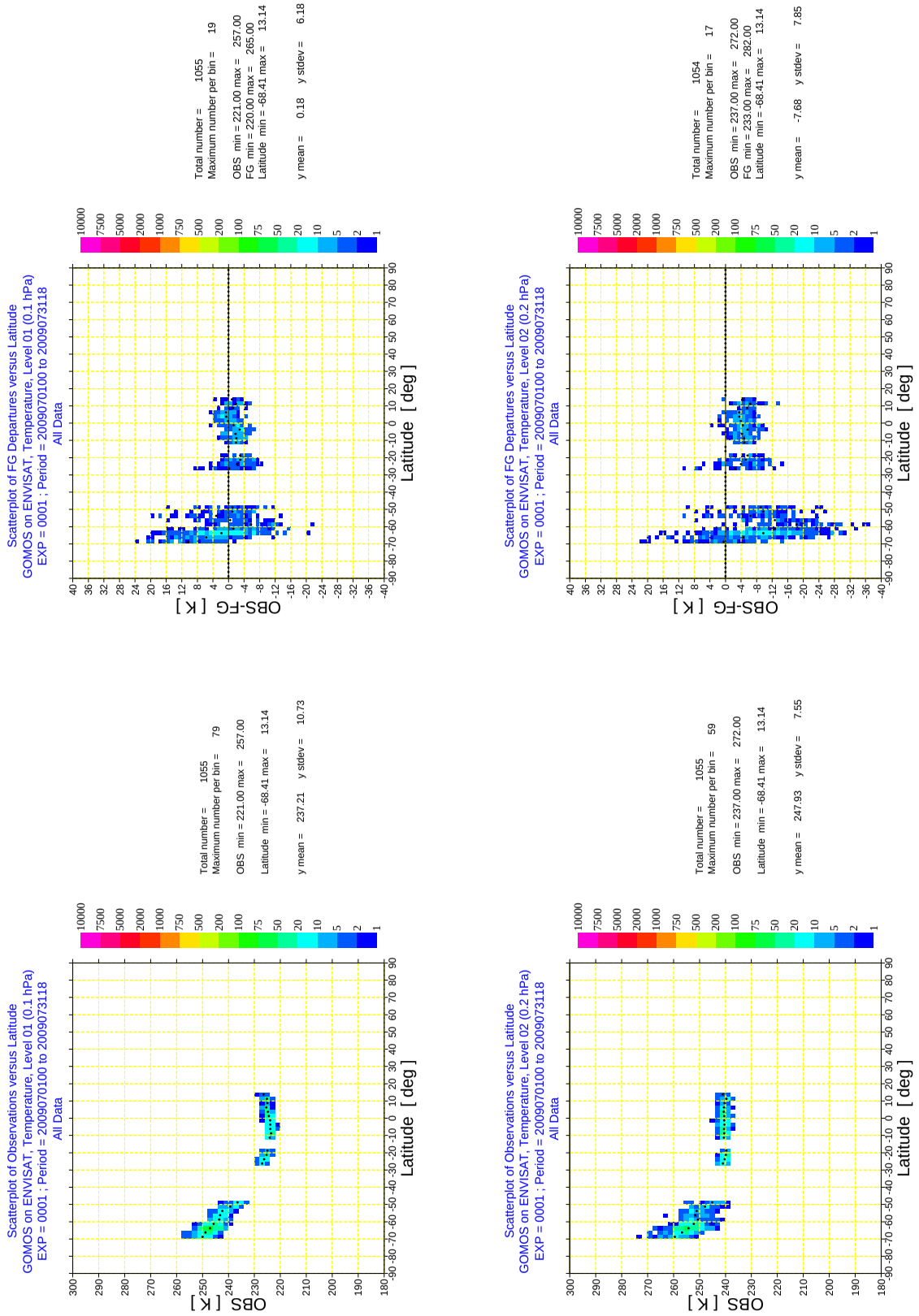



Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for July 2009 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

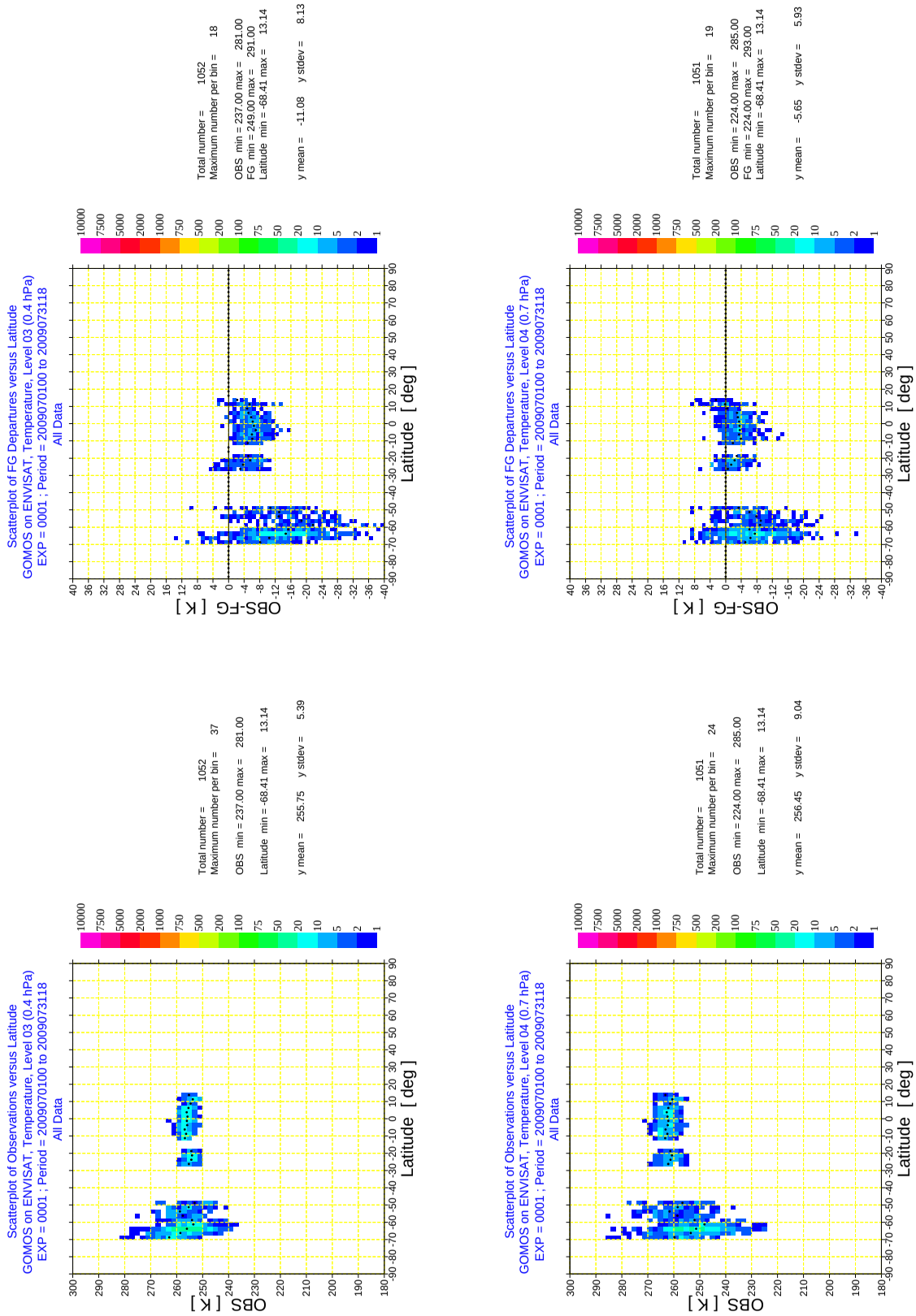



Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

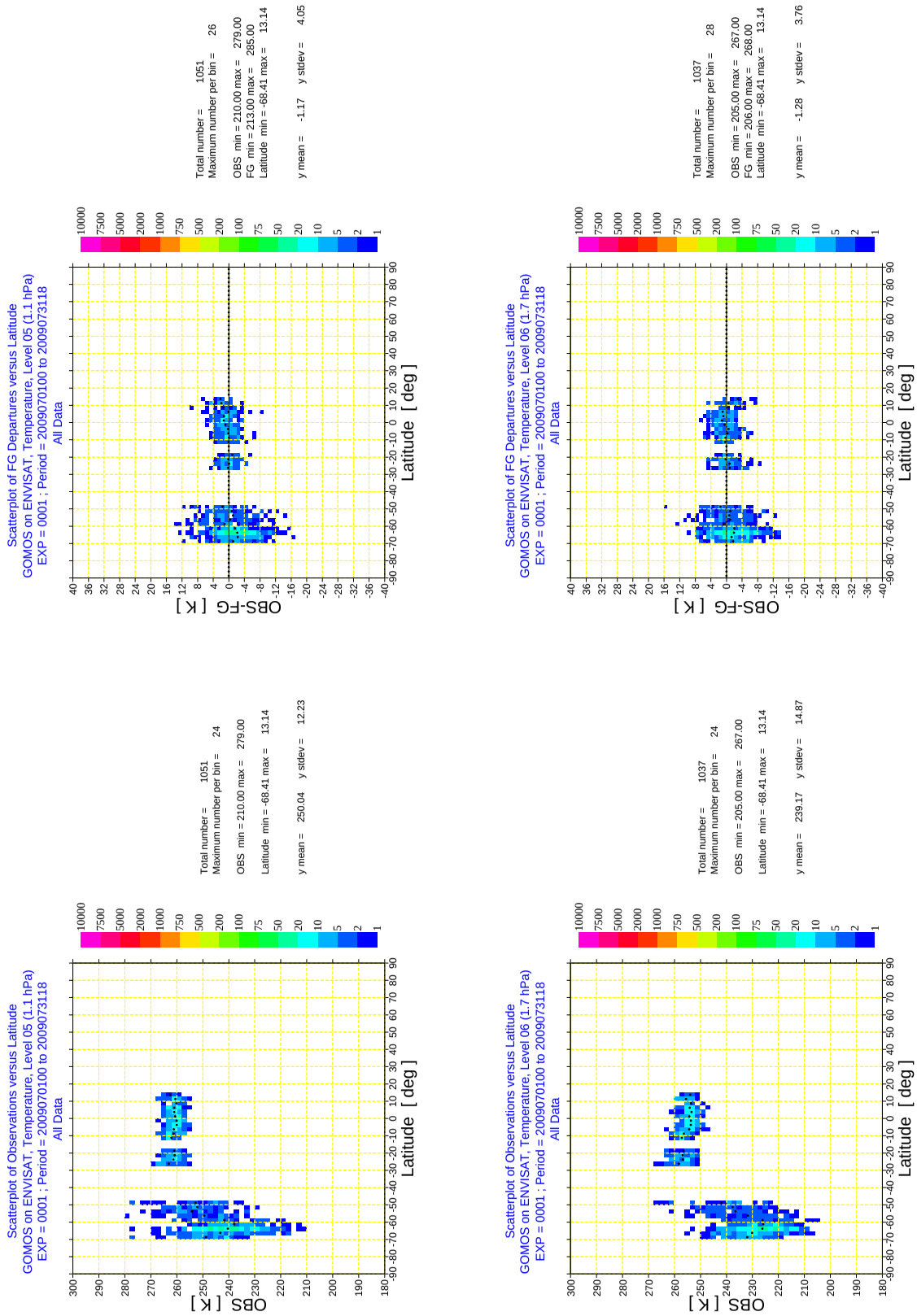



Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

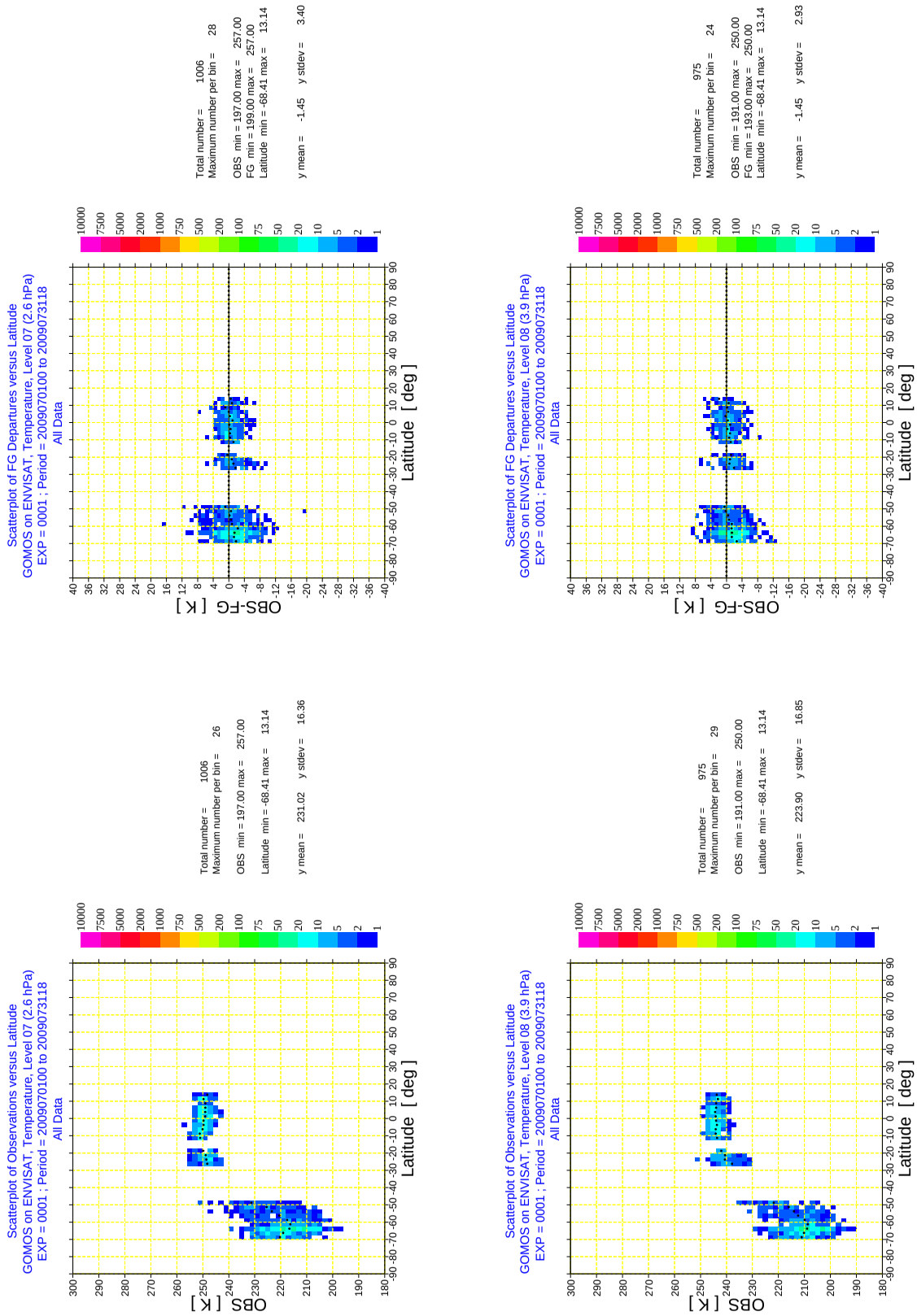



Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

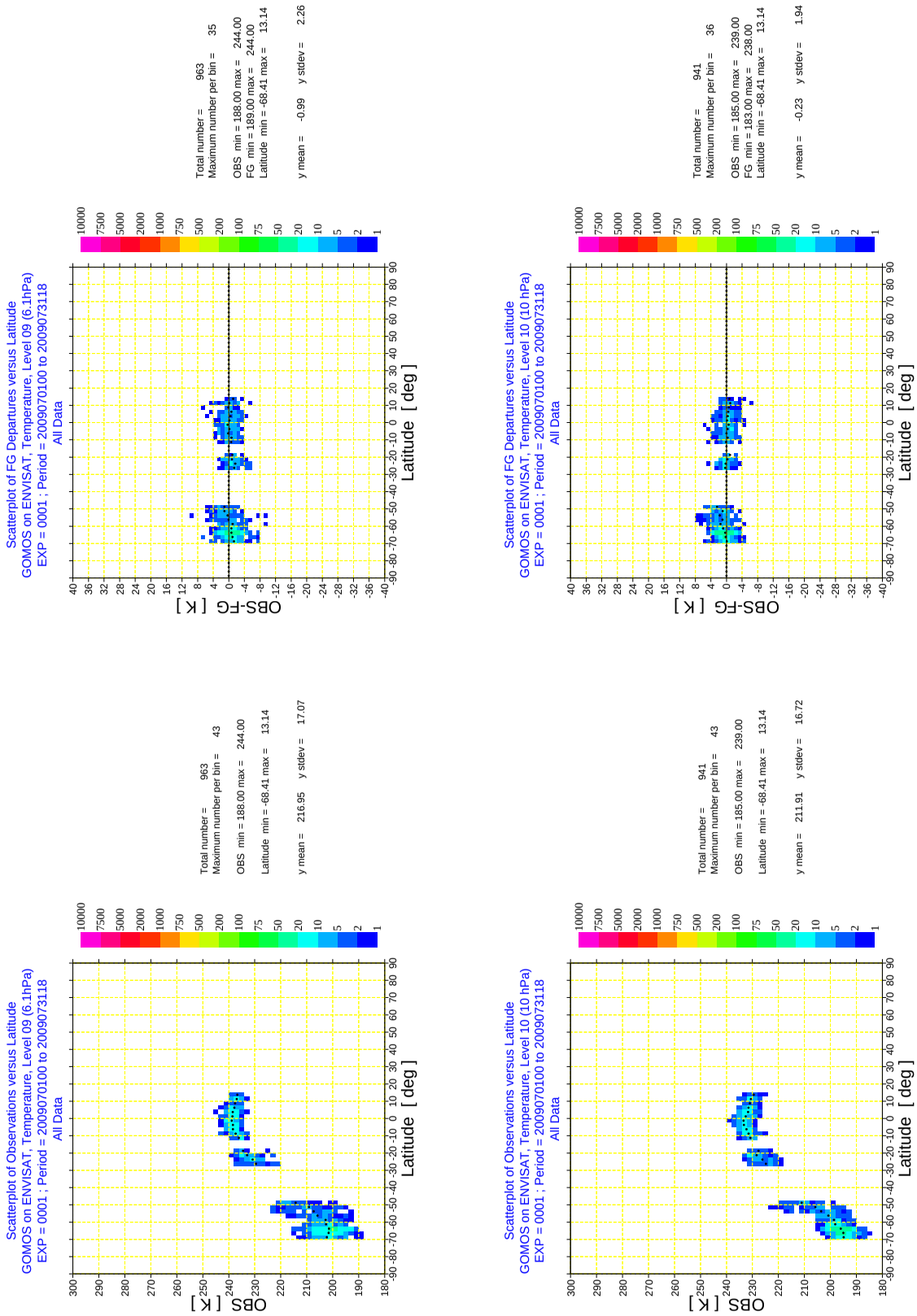



Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

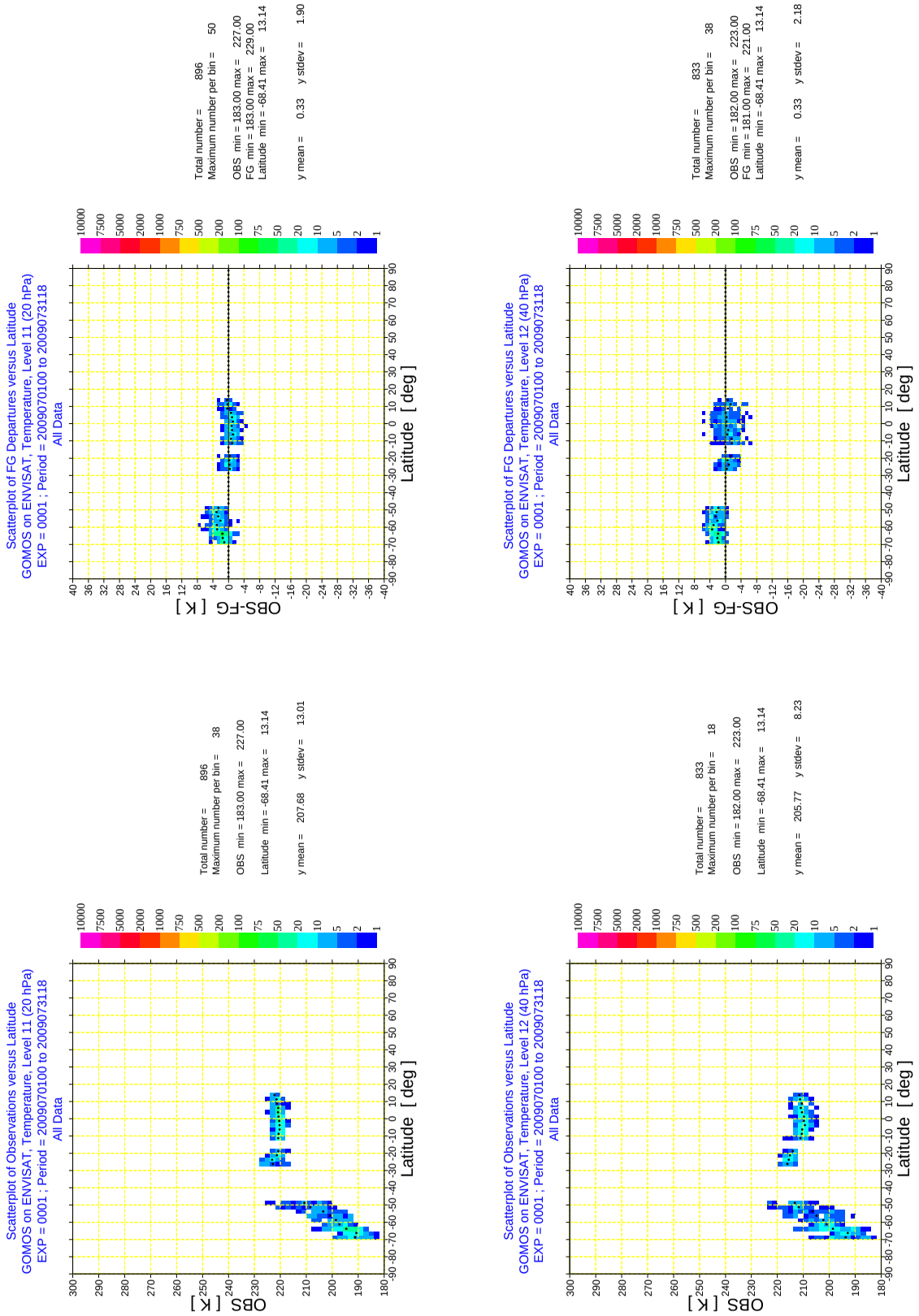



Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

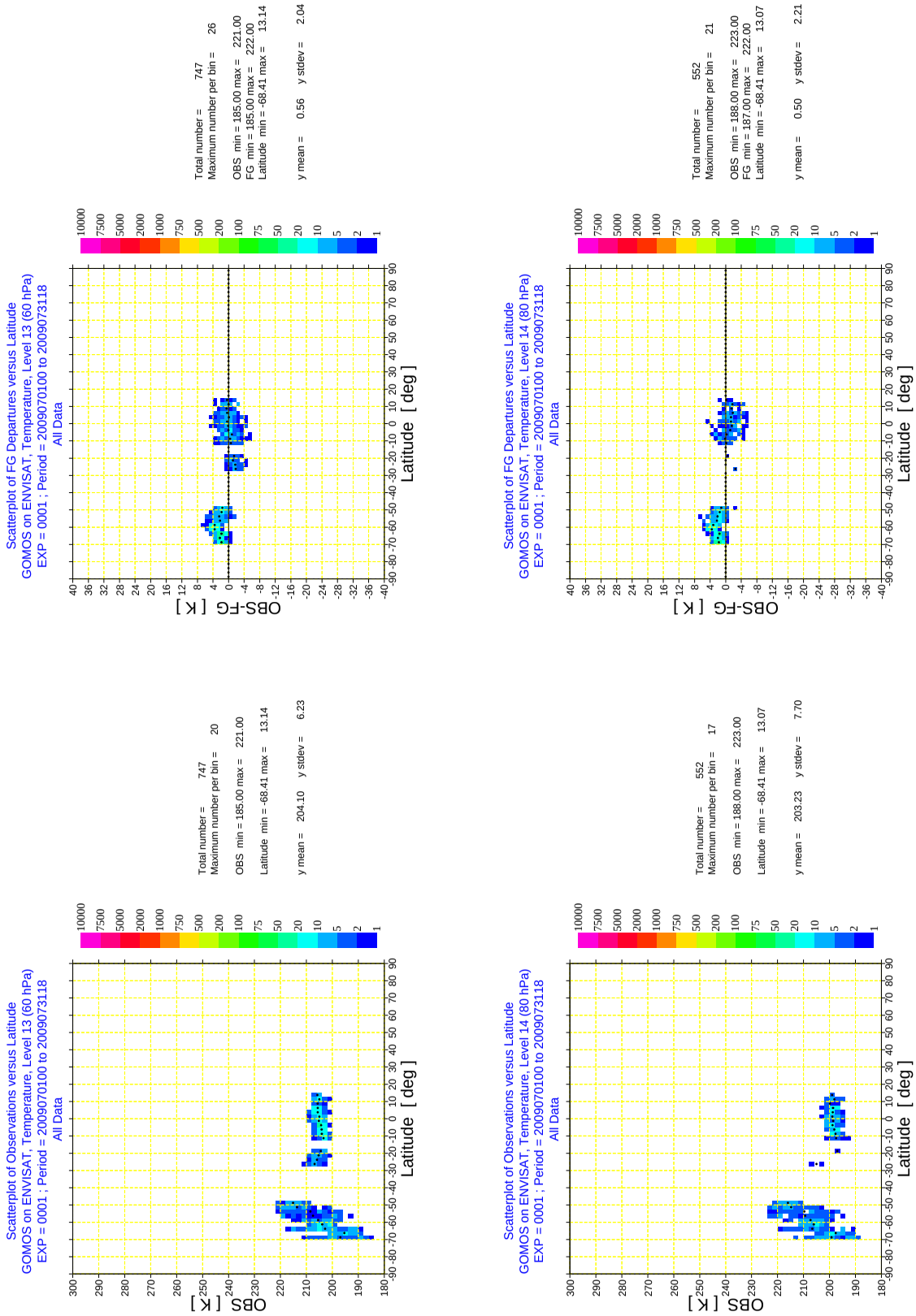



Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

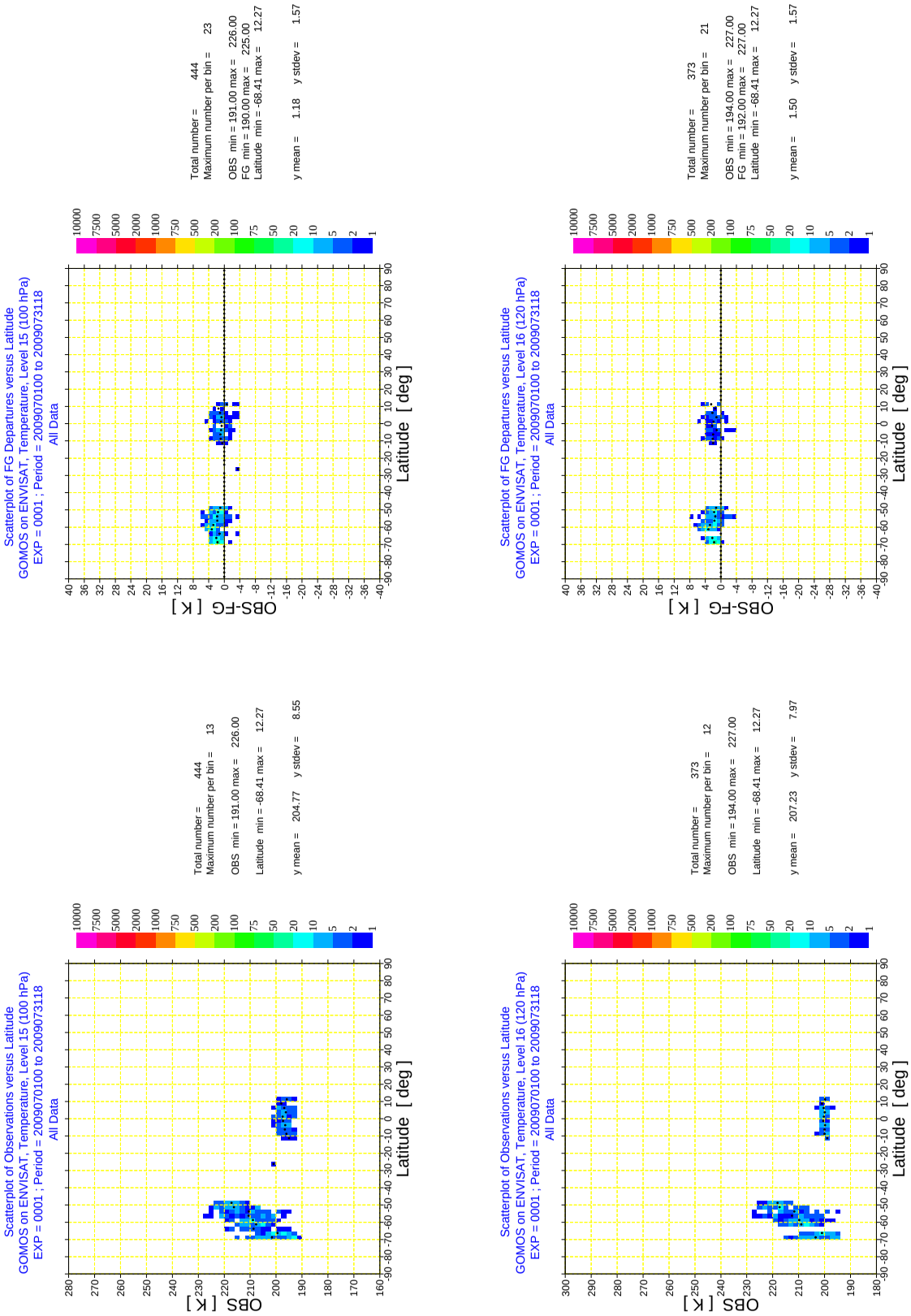



Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

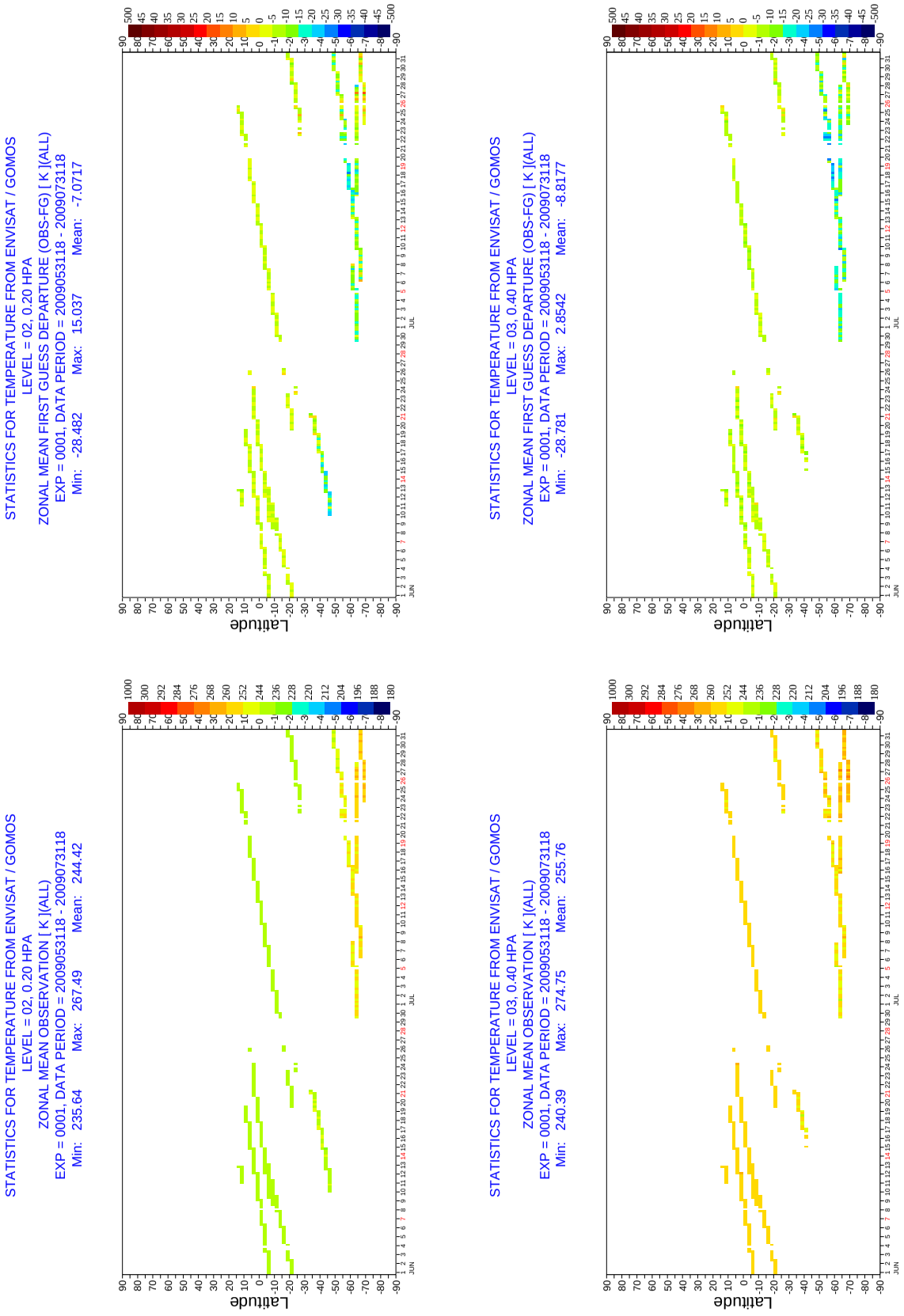



Fig. 15. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for June-July 2009.

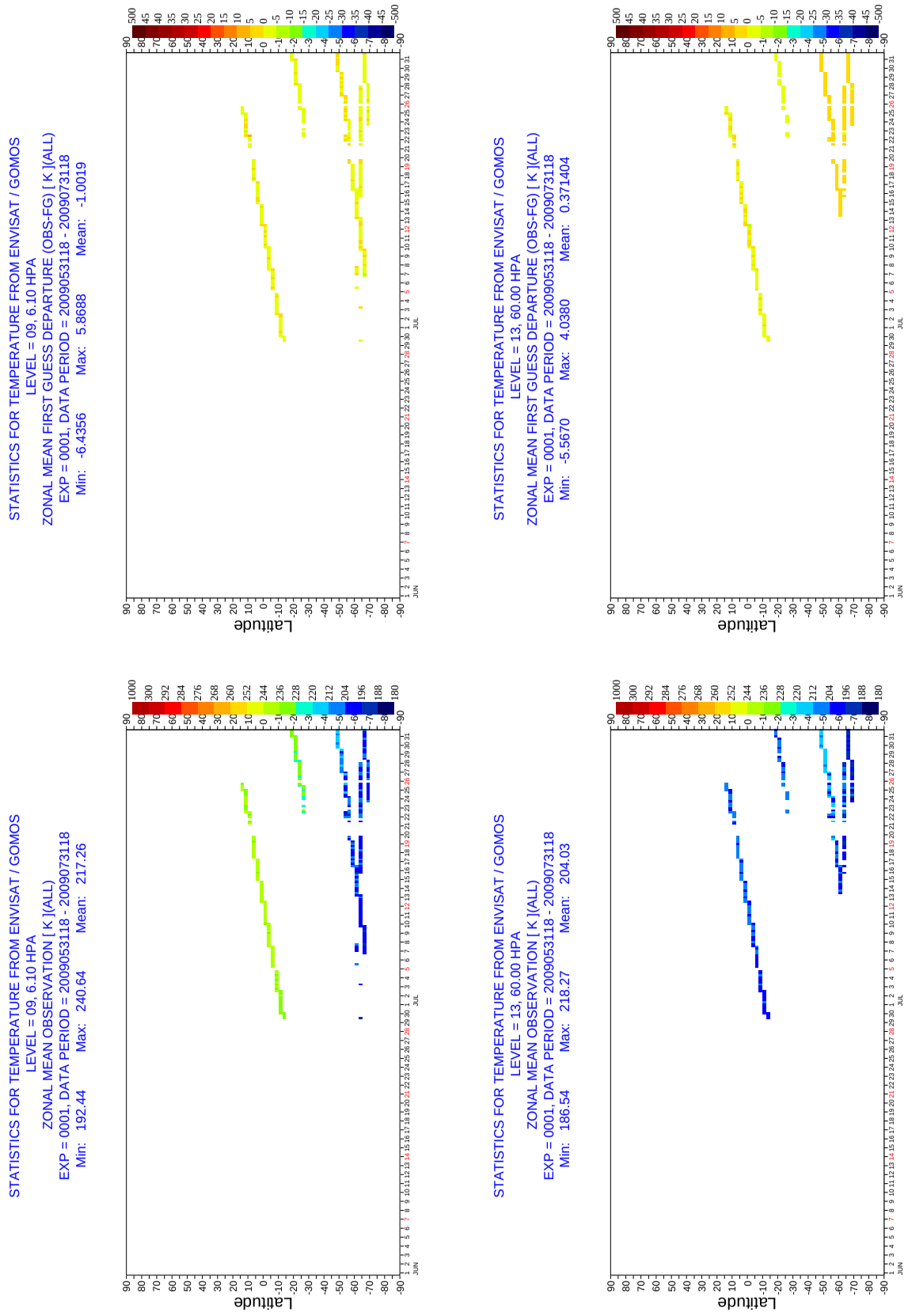



Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

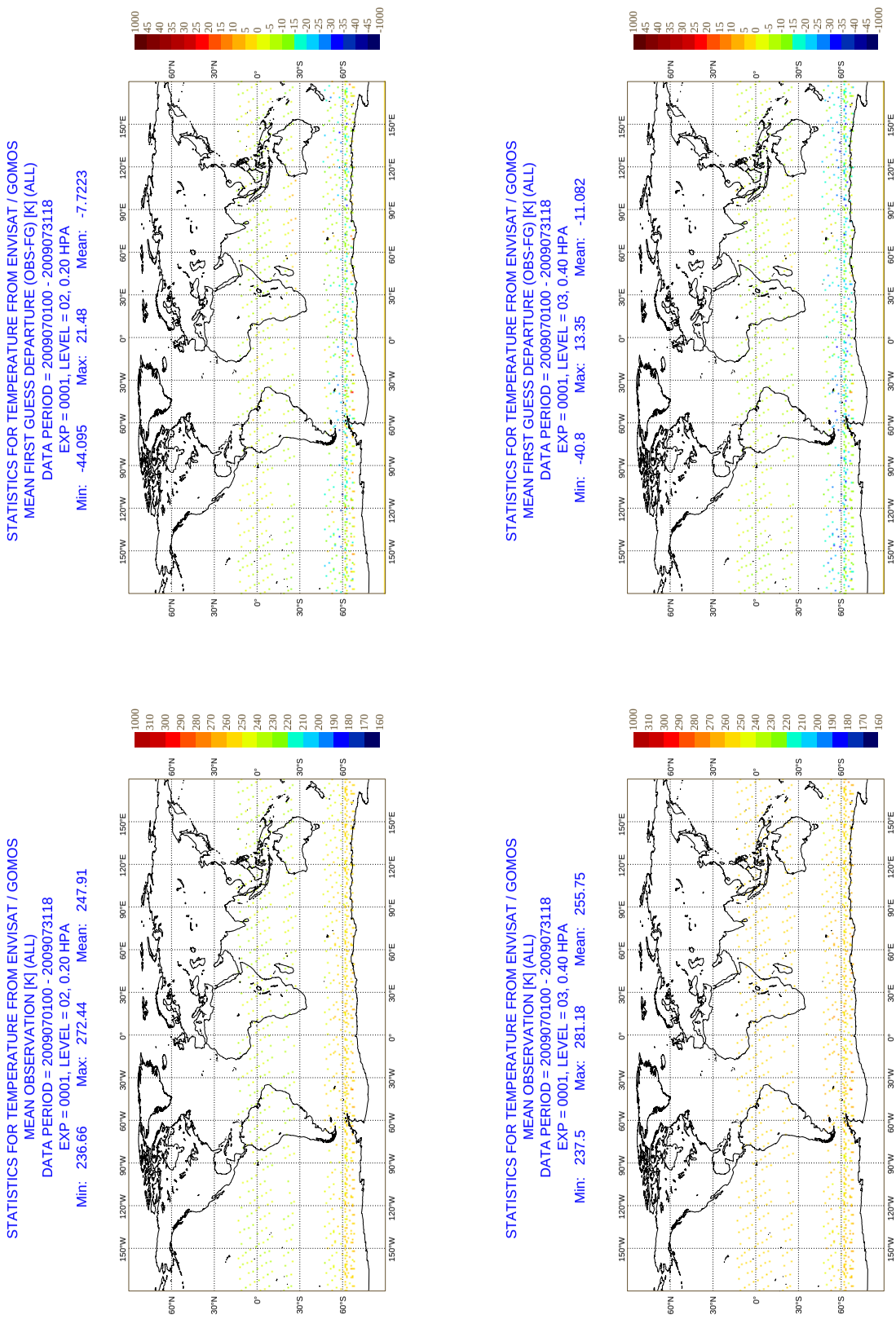



Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for July 2009.

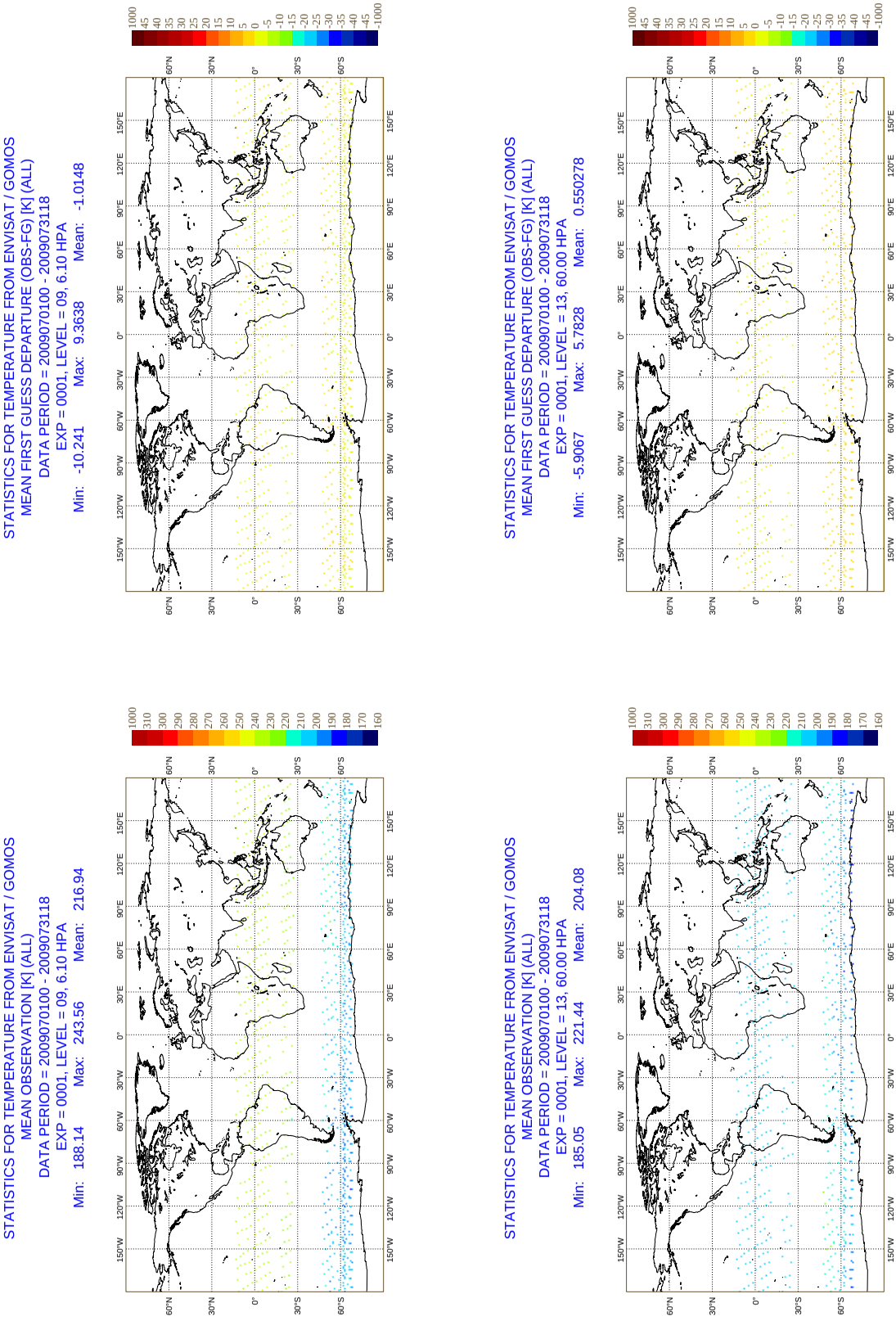



Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

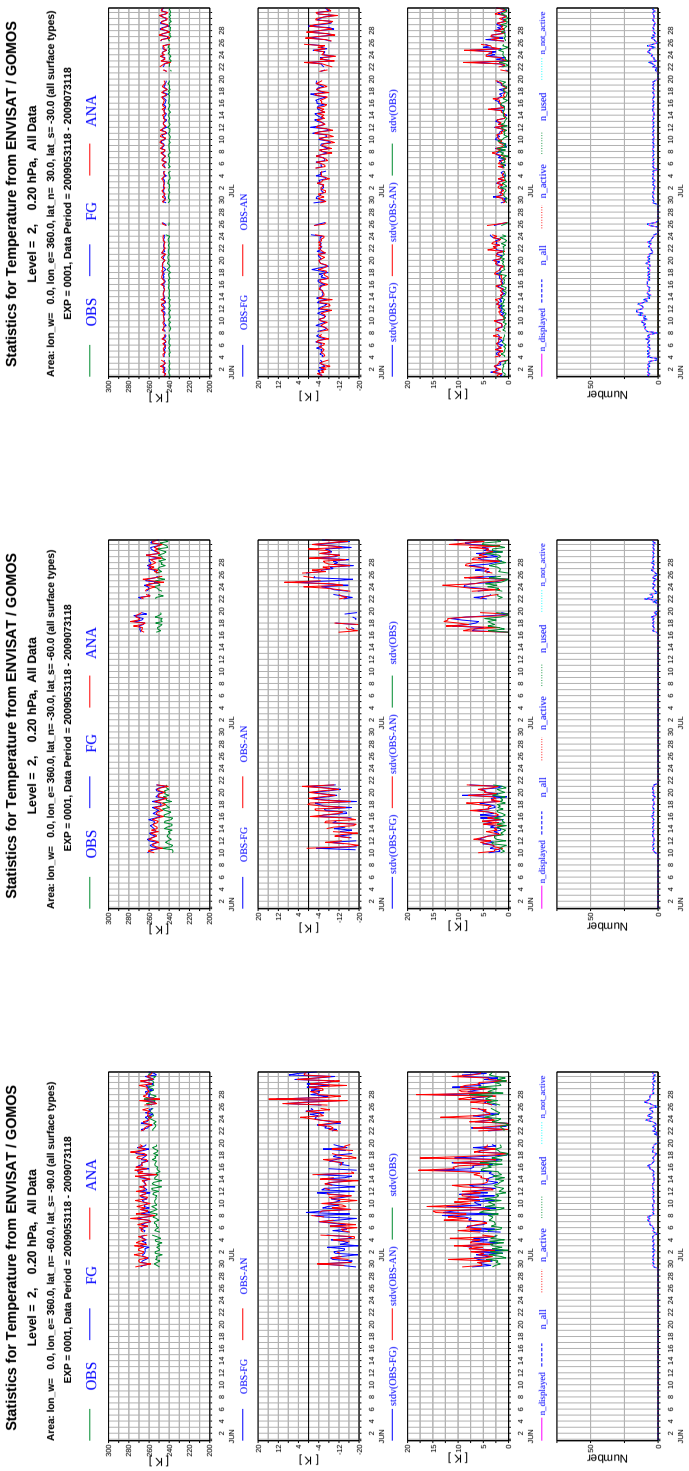



Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) 30N-30S, 30-60S, and 60-90S for the period June-July 2009.

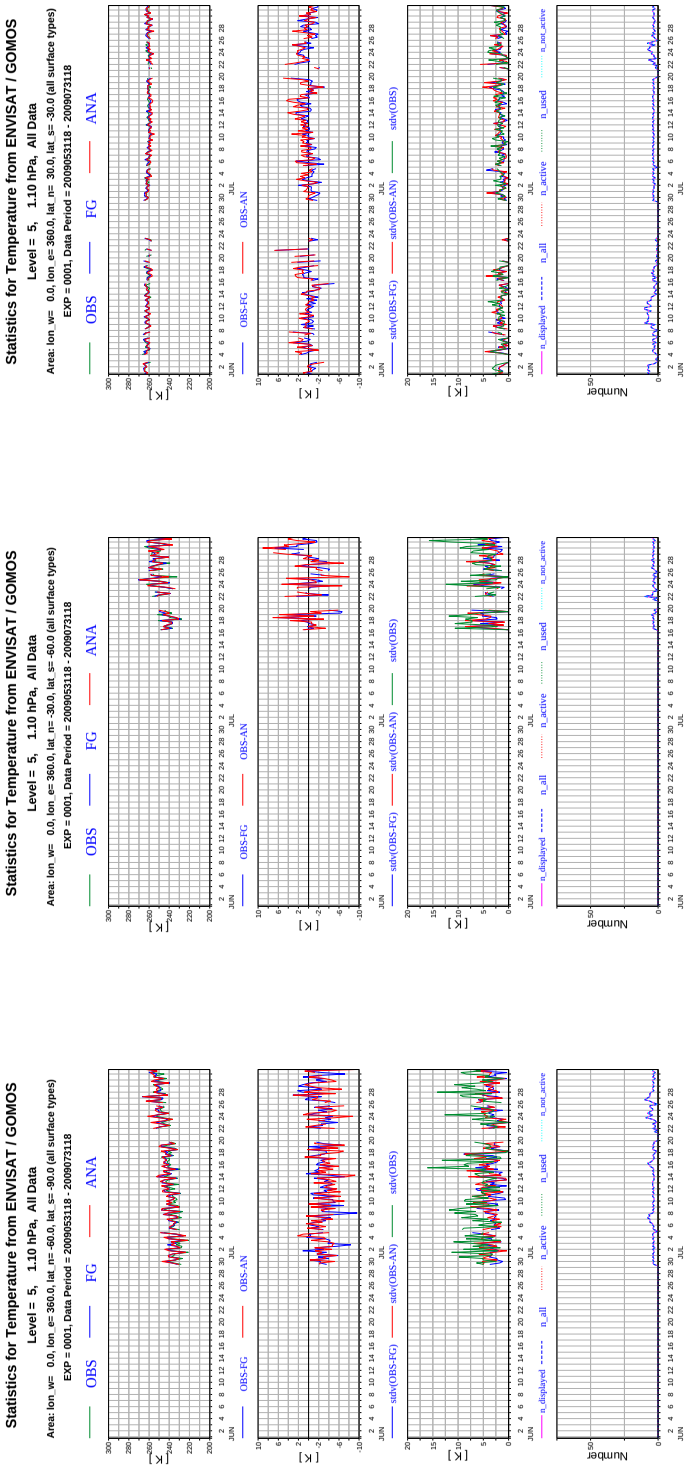









Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

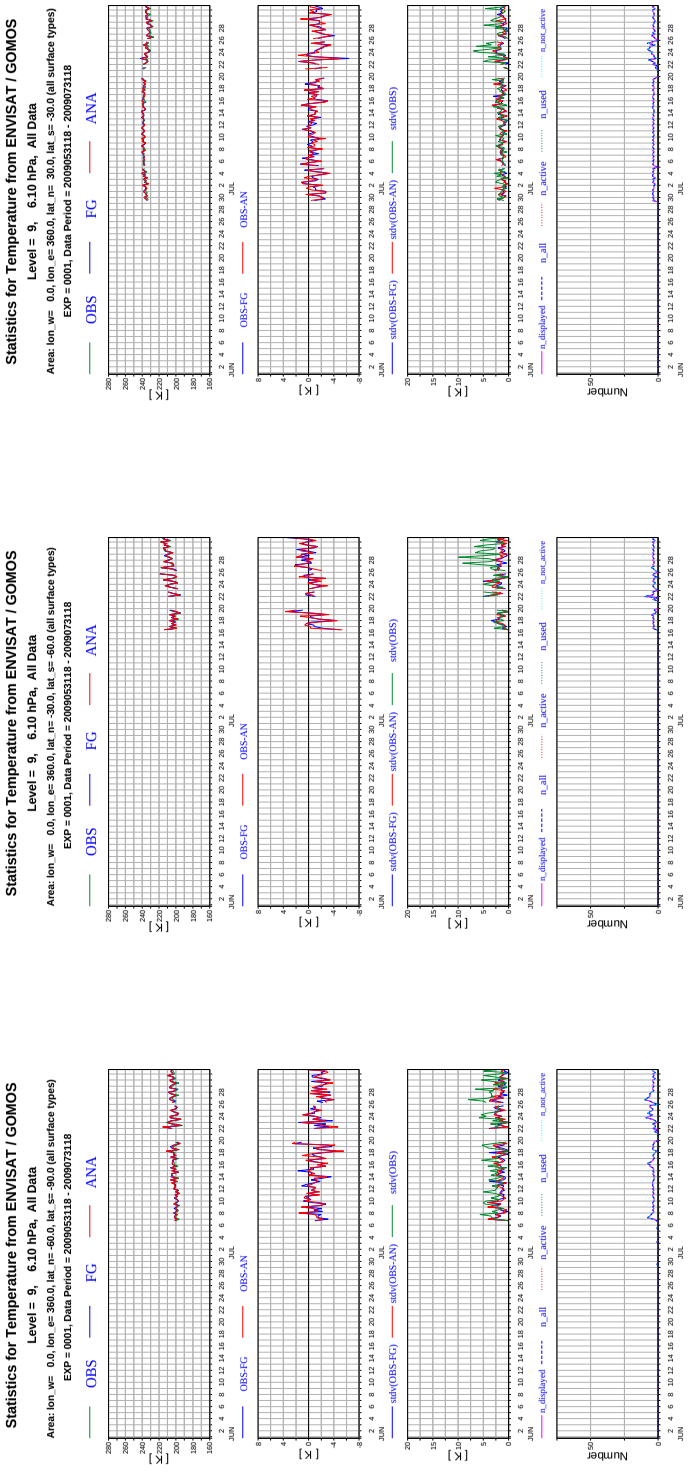









Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

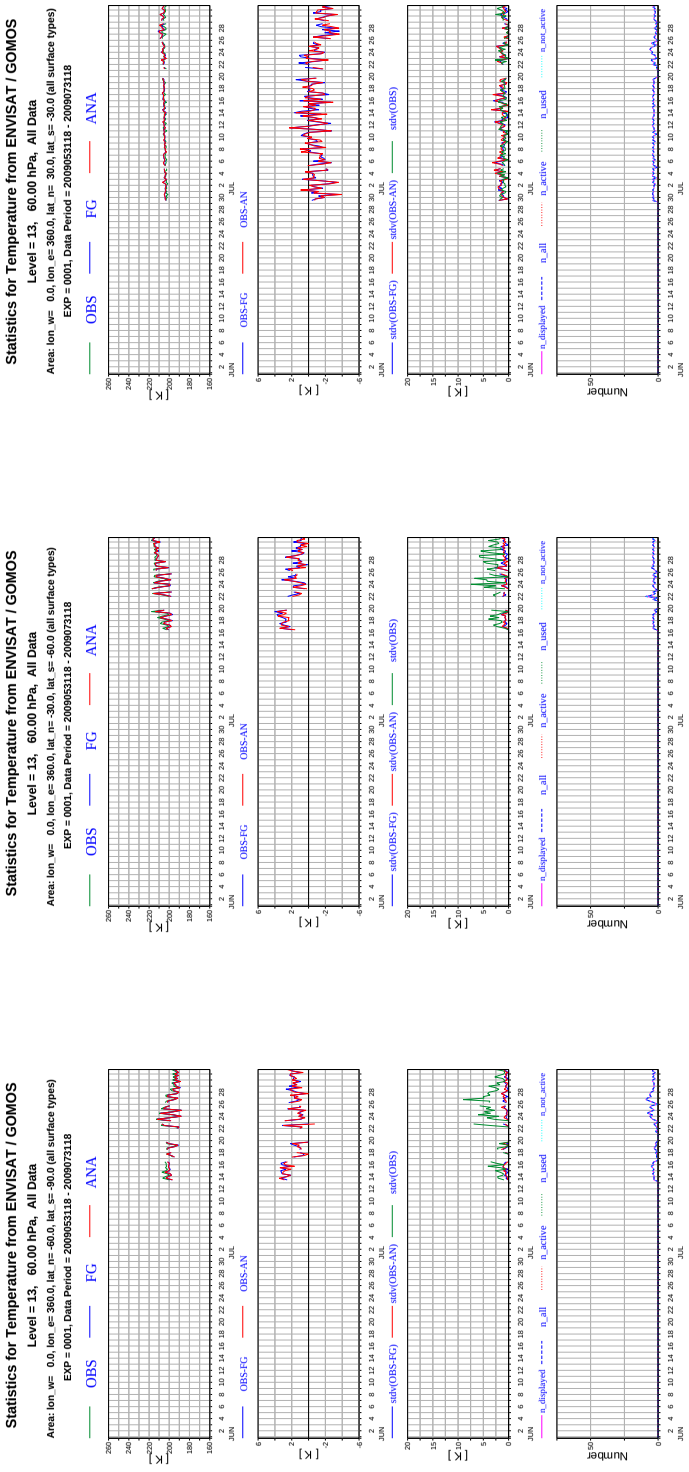









Fig. 22. As Figure 19, but for level 13 (60 hPa).

# REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR_2P) FOR JULY 2009

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*Emails: Rossana.Dragani@ecmwf.int, Tel: 0044 118 9499259*

August 6, 2009

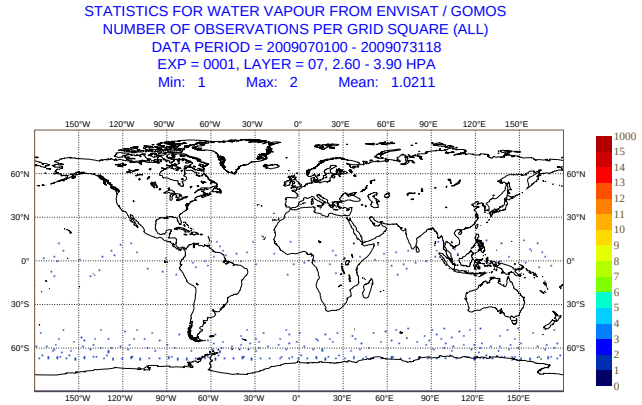


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for July 2009.

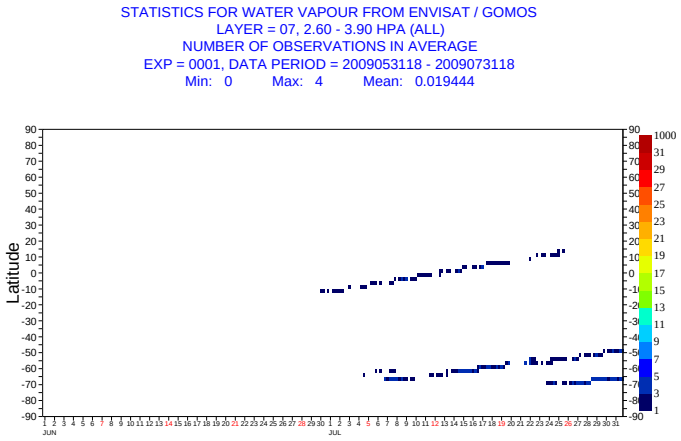


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for June-July 2009.

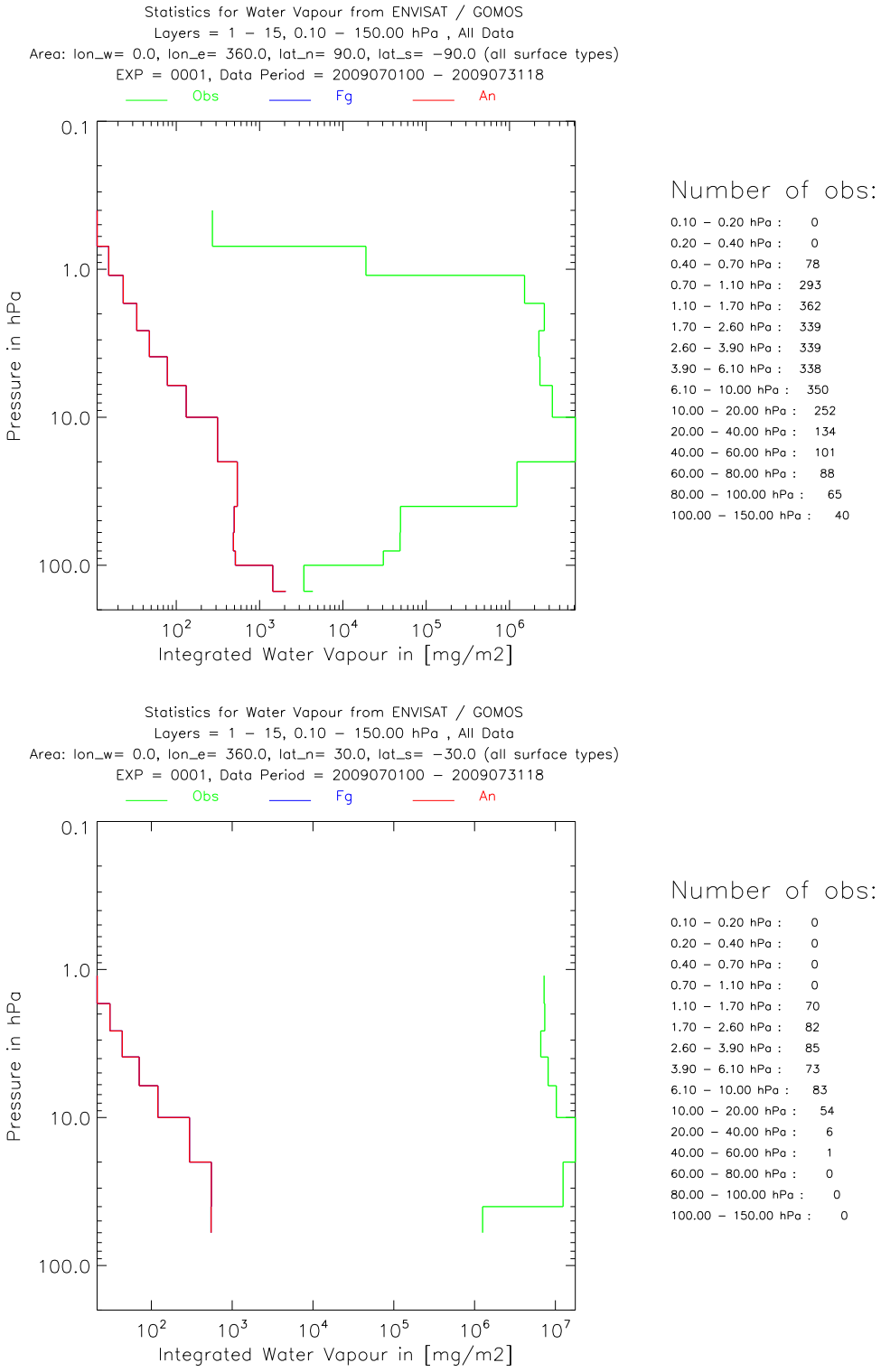


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m$^2$ for July 2009. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S). Plotted are the partial columns for the 16 levels listed to the right of the diagrams.

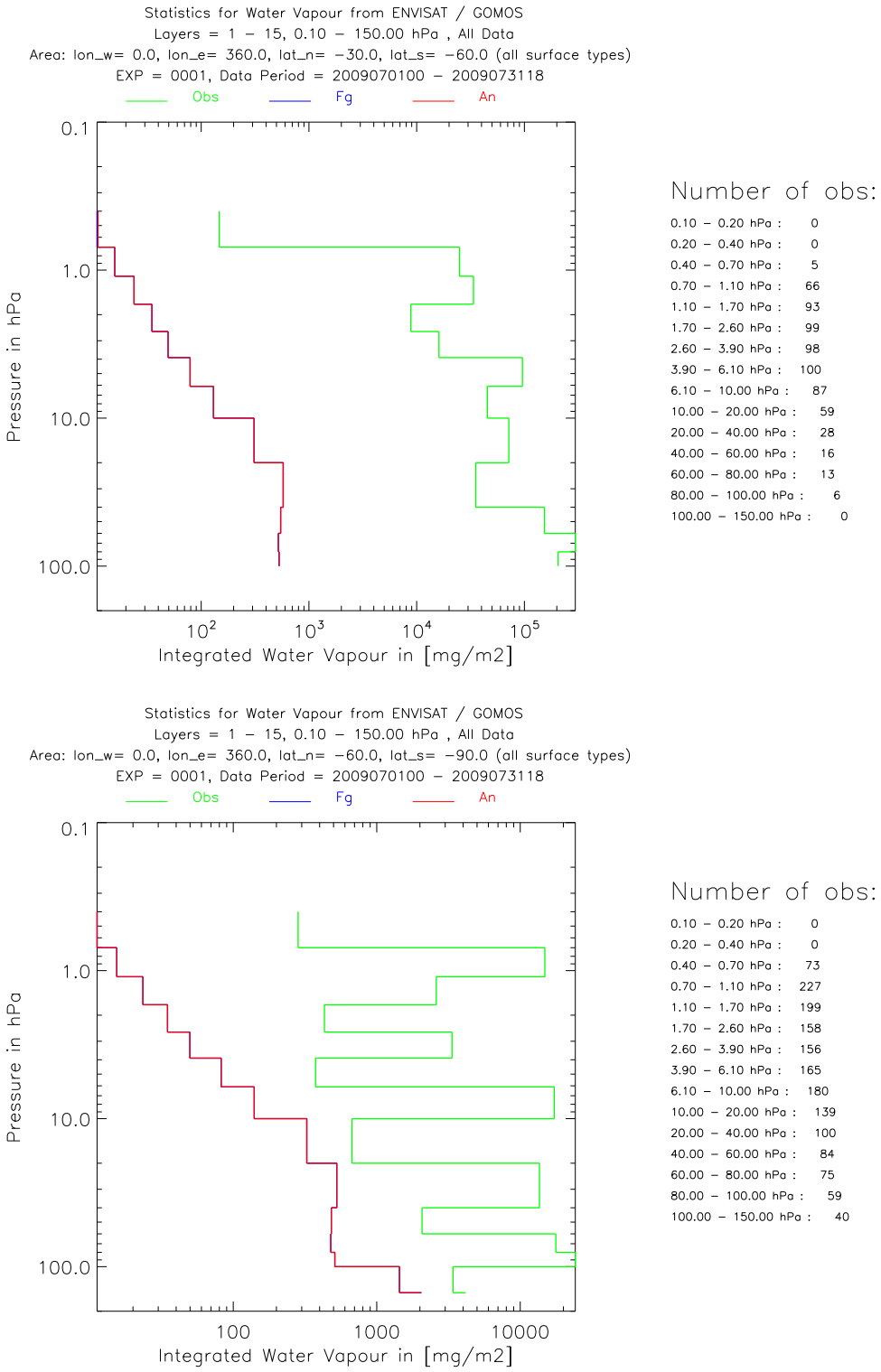


Fig. 4. As Fig. 3 but for 30-60S (top panel) and 60-90S (bottom panel).

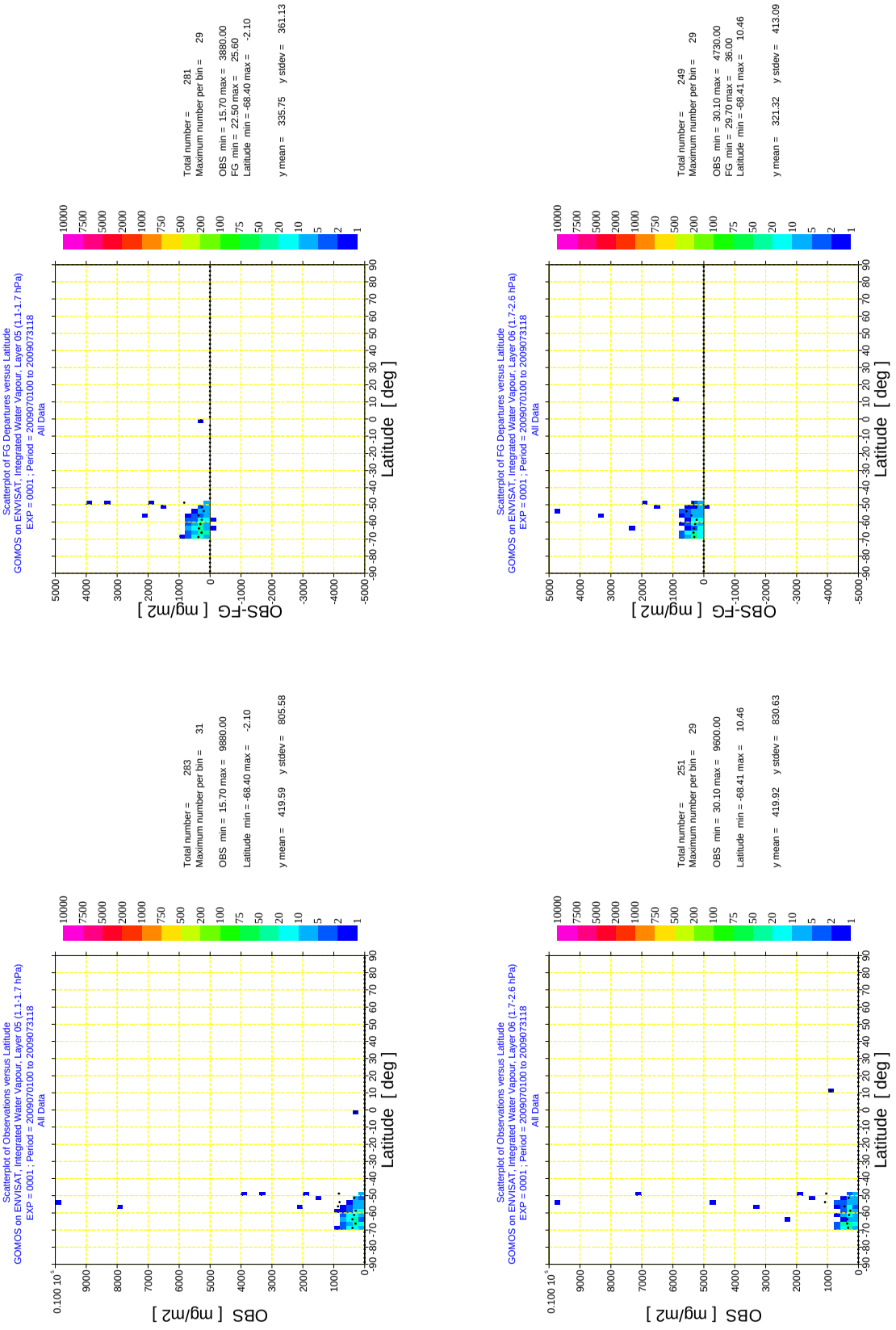


Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for July 2009 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

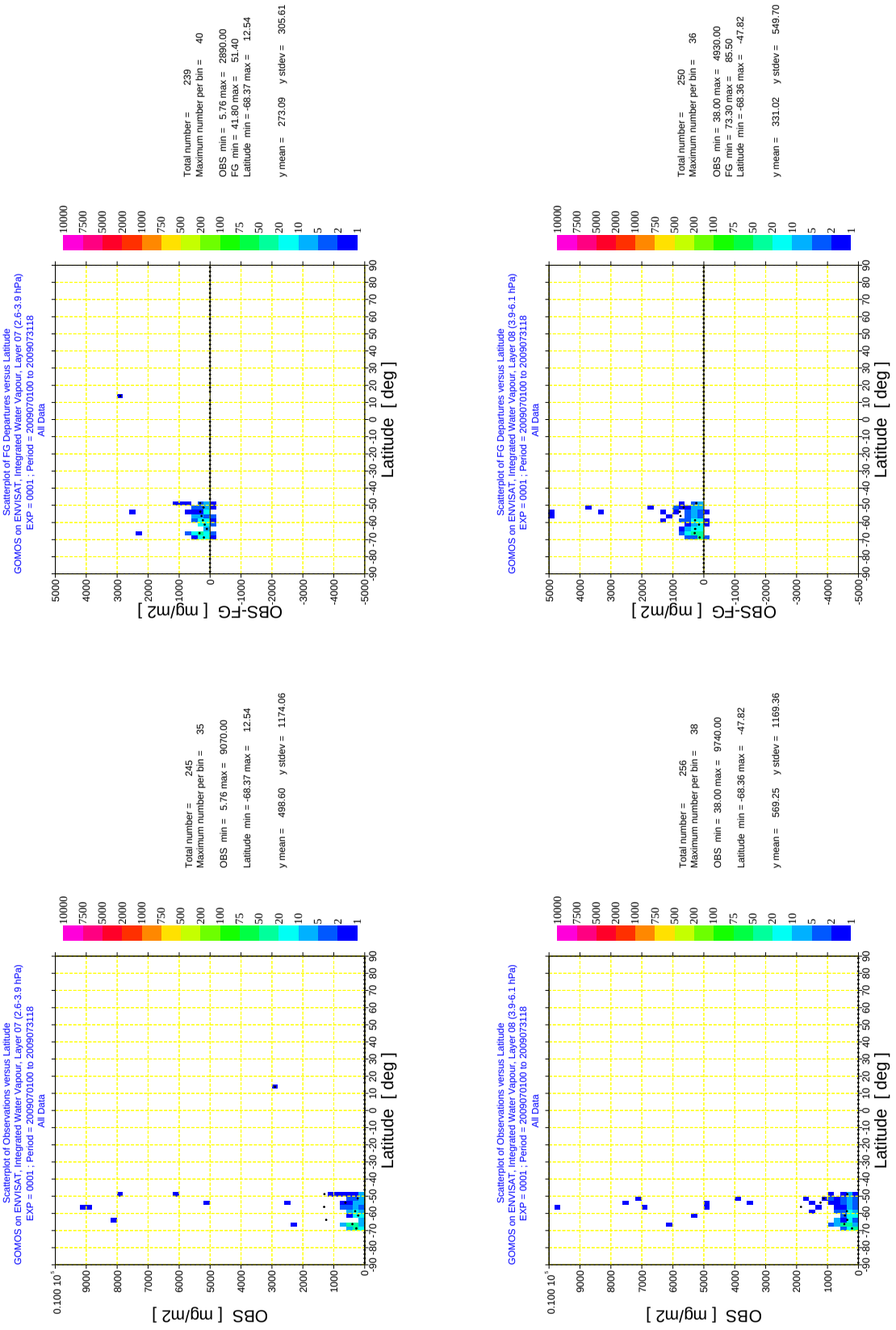


Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

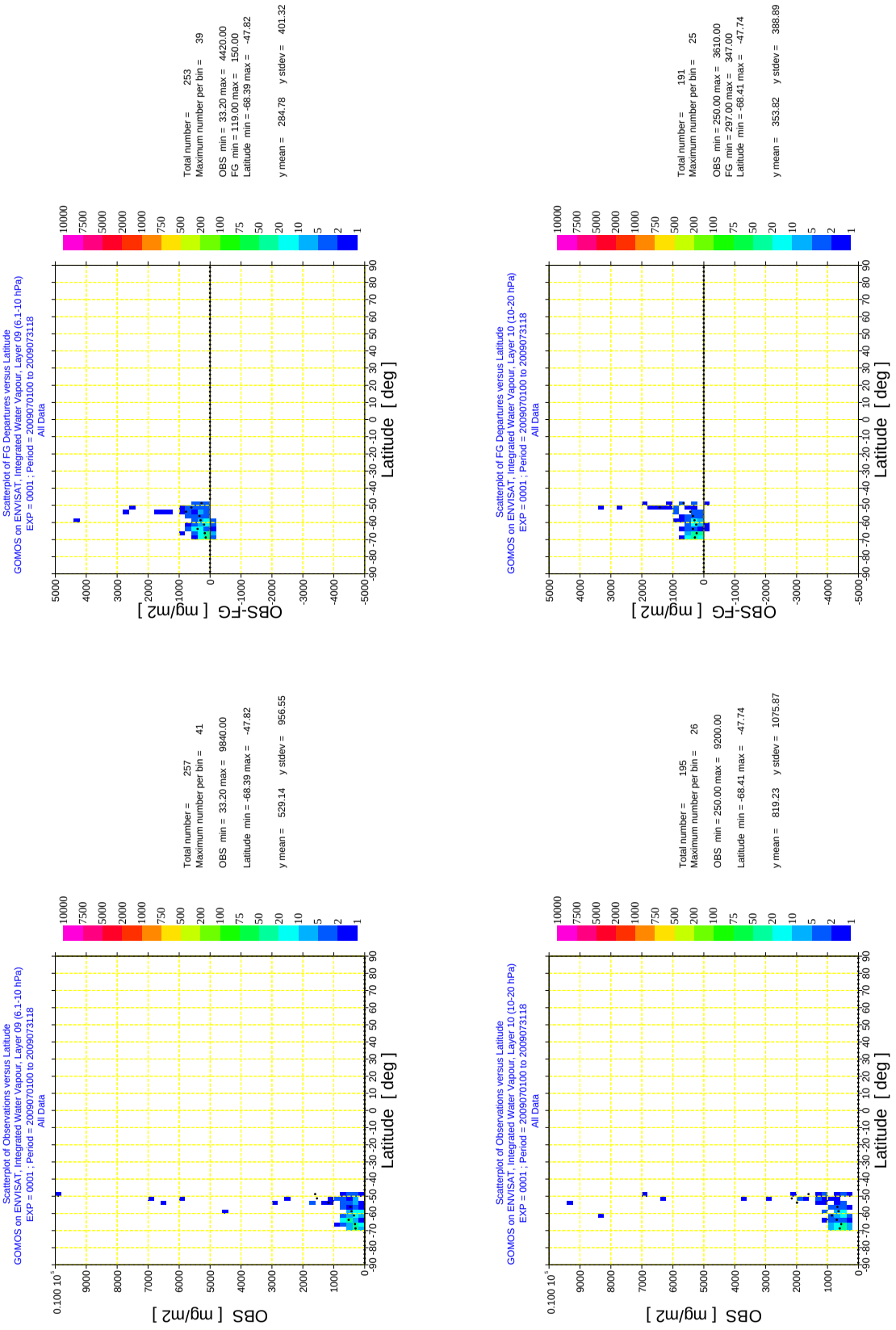


Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

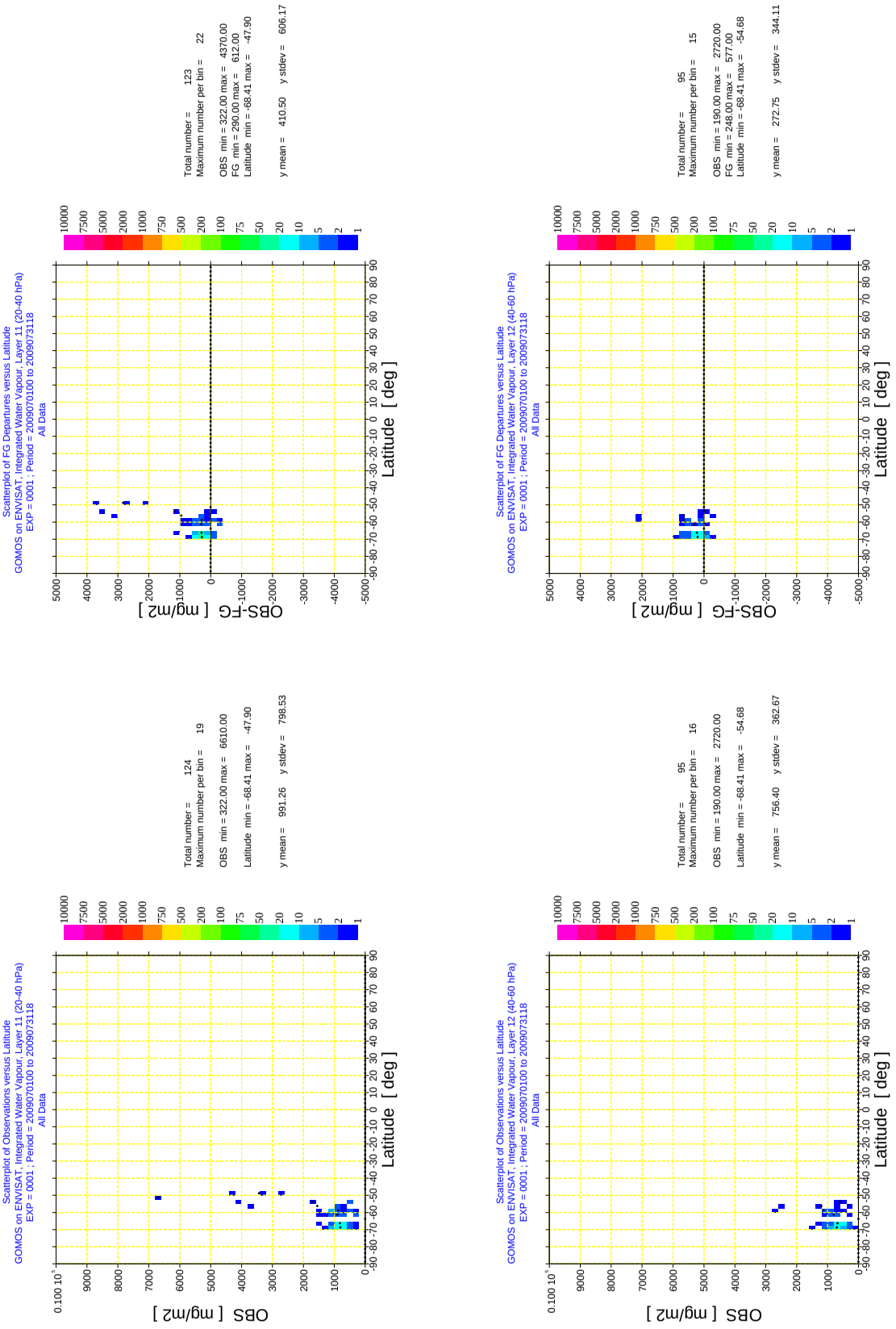


Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

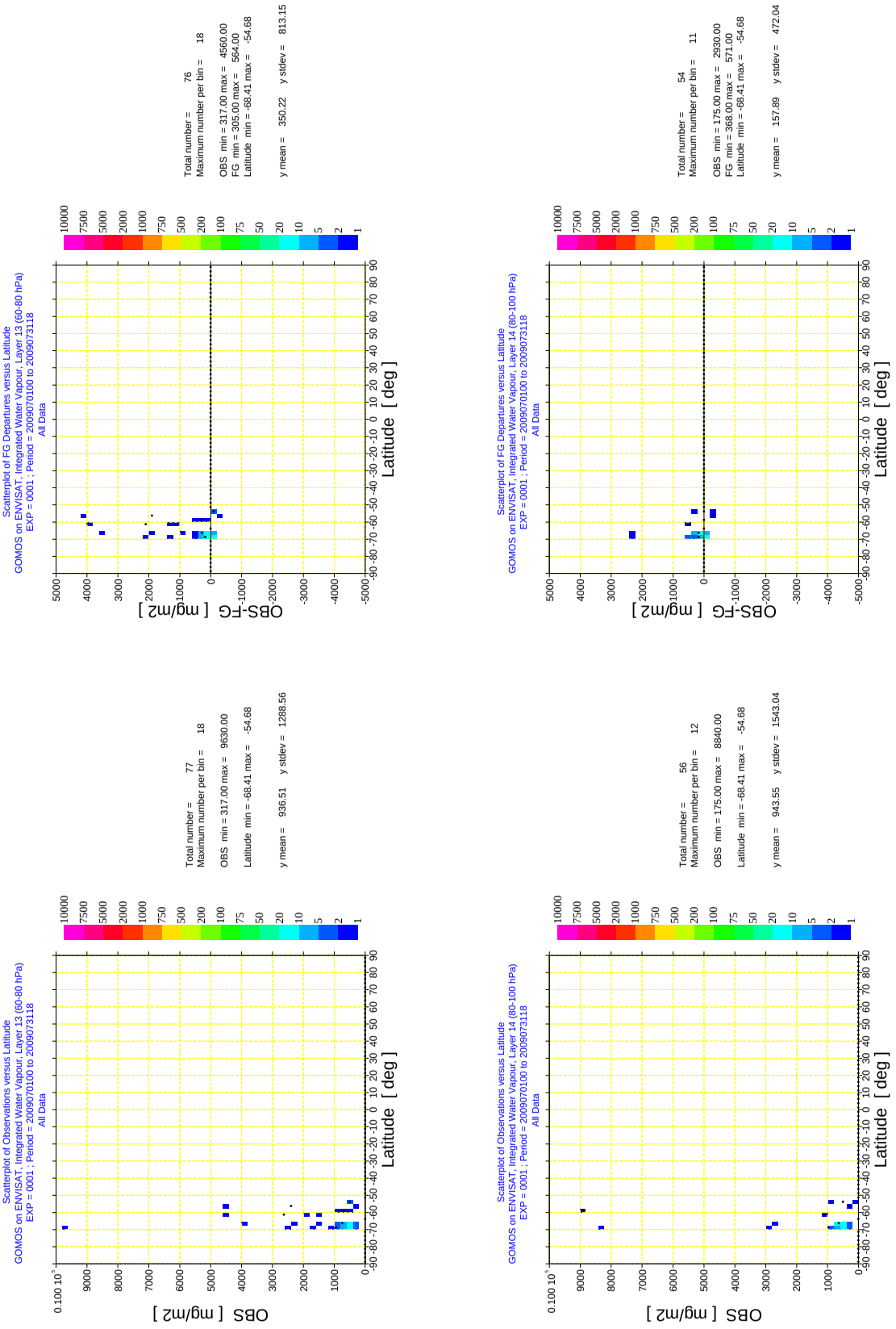


Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

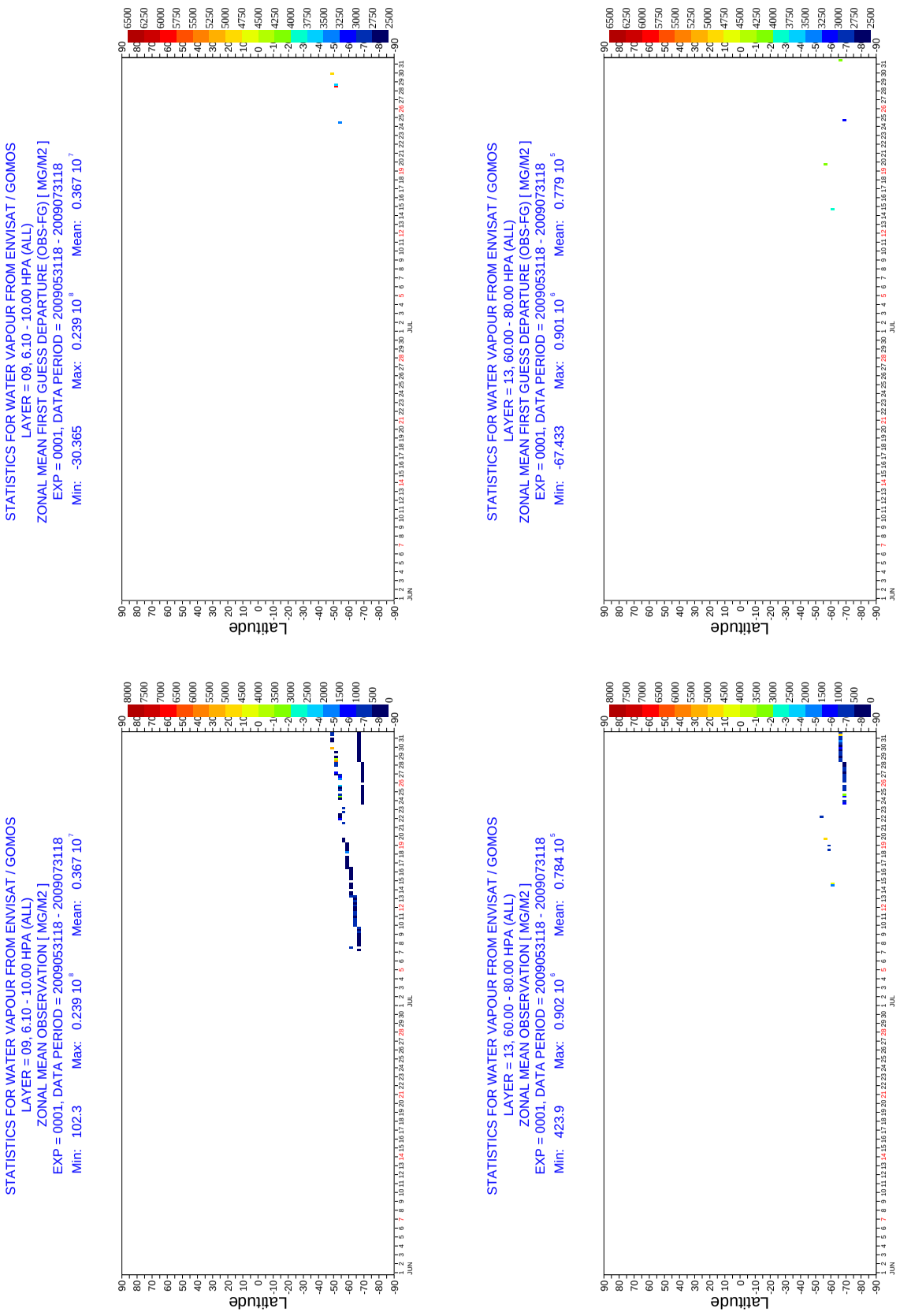


Fig. 10. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for June-July 2009.

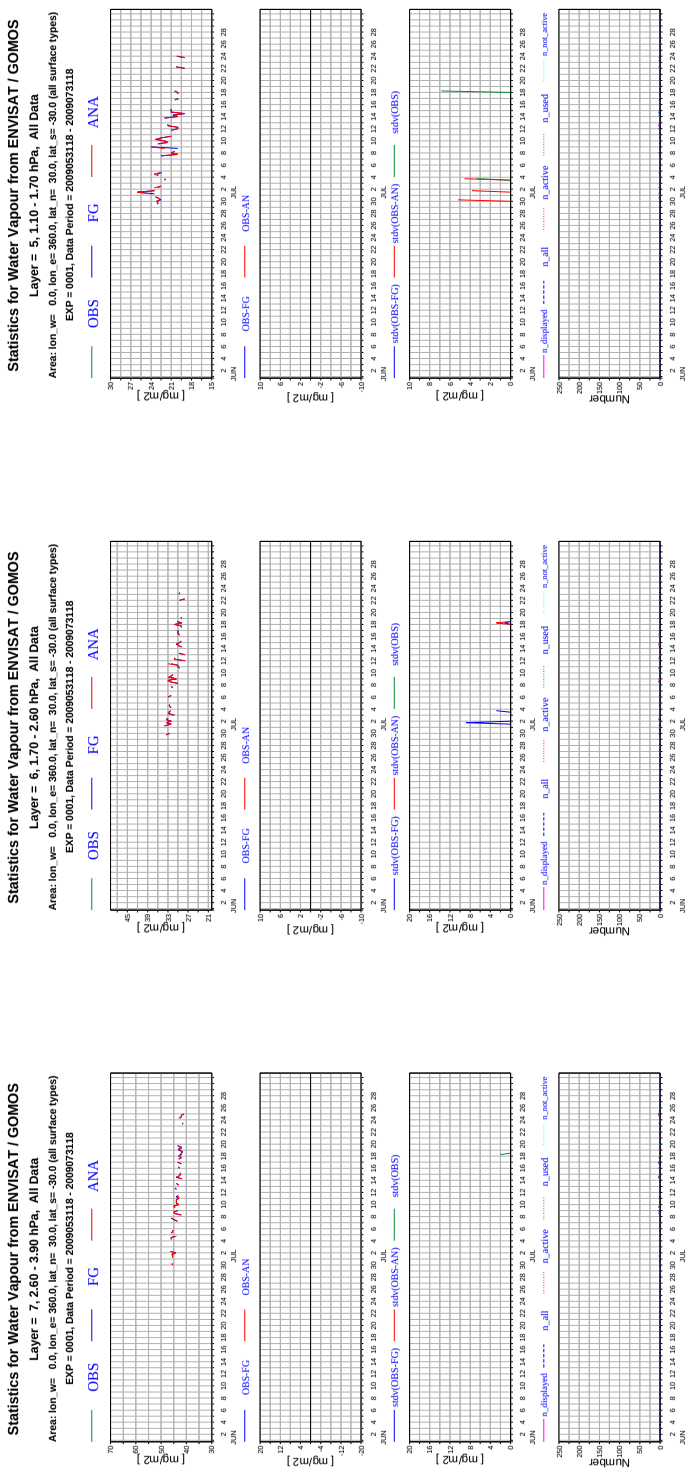


Fig. 11. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 11 (20-40 hPa), level 13 (60-80 hPa), and level 15 (100-150 hPa) in the latitudinal band 30N-30S for the period June-July 2009.