# REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR__2P) FOR JUNE 2008

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July 7, 2008

## 1. Key points for June 2008

- There were no data in the BUFR files at mid and high latitudes in the NH, and only a few observations were available at latitudes southern of 60S.
- Overall the temperature in the GOMOS bufr files wsa found in good agreemen 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 tenth 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 May. In the global mean, the departures between GOMOS and ECMWF ozone profiles were within -10 and +20% in the mid stratosphere (between 2 and 40hPa), but larger values were found elsewhere. The standard deviations of the first guess and analysis departures were larger than 10% 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 -20 and +35% in the stratosphere, but larger than 50% in the mesosphere. The standard deviations of the analysis and first guess departures were larger than 10% 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.
- At some levels and latitudinal bands, the number of GOMOS water vapour observations was sometimes too low to be statistically significant.
- The monitoring statistics for June 2008 were produced with the operational ECMWF model, CY33R1.

## 2. Quality and amount of received data

Data coverage and amount of received data during June 2008 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. During the period from 4 to 23 June, the monitoring of the GOMOS temperature could not be performed because of technical problems that arose after the cycle CY33R1 was switched on. As a consequence of these technical problems, less than 400 (good) observations were available for

temperature. Just under 1500 and up to 750 (good) observations were available for ozone and water vapour, respectively. 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 latitudes northern than 10N, and only a few observations were available at latitudes southern than 60S for the period under consideration.

## 3. GOMOS temperature data

As anticipated above, owing to technical problems arose when the new operational cycle (CY33R1) was turned on the monitoring of the temperature was not possible during the period between 4 and 23 June 2008. 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 all vertical levels, with the only exception of the lower stratosphere at high latitudes in the SH. As a consequence of different behaviour at various latitudinal bands, the global mean profile plot (temperature report: Figure 3) showed a very small negative bias between the temperature in the GOMOS BUFR files and the operational ECMWF temperature in the lower stratosphere. Larger negative bias was found in the upper stratosphere and mesosphere. In the tropics, the first guess and analysis departures were about -1% (-2 K) in all the Stratosphere. Small positive biases (a few tenth of K) were found in the lower stratosphere (up to about 10hPa) at midlatitudes in the SH; about -1K biases were seen in the upper stratosphere. At high latitudes in the SH, the first guess and analysis departures were about +1% (2 K) in the lower stratosphere up to 20 hPa, and larger than -1% (-2 K) in the upper stratosphere from about 5 hPa, with a smooth transition in the region of the atmosphere between 20 and 5 hPa. Larger first guess and analysis departures were found in the Mesosphere with the largest difference between -2 and -4% (-4 to -8K) between 0.2 and 0.4 hPa. 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$4K 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 May. 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 +20% in the mid stratosphere (between 2 and 40hPa). Larger departures were found elsewhere. The standard deviations of the departures were larger than 10% at all levels.

When averaged over latitudinal bands, first guess and analysis departures within -5 and 20% were found in most of the Stratosphere and lower Mesosphere (for 0.2 hPa $<$p$<$ 40 hPa) in the tropical band. At midlatitudes in the SH, the departures between the GOMOS ozone values and their model equivalent were between -15 and +35% at most levels in the stratosphere but larger than 50% in the mesosphere. At high latituds in the SH,

the first-guess and analysis departures were larger than in the other latitudinal bands, with values within -20 and +25% in the stratosphere and larger than 50% in the mesosphere. The standard deviations of the analysis and first guess departures were larger than 10% at most 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 June the level of agreement between the GOMOS water vapour and the ECMWF water vapour first guess and analyses was poor at all levels and available latitudinal bands.

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. However, it should be noted that the number of observations available at some latitudinal bands and vertical layers was sometimes too small to be statistically significant.

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 at mid latitudes, most of the WV observations were sampled in the tropics. 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, and NOAA-17, SCIAMACHY total column ozone data produced by KNMI, as well as OMI total column ozone were actively assimilated. Owing to instrumental problem, the NOAA-18 SBUV/2 ozone data were unavailable after 22 May 2008.

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 JUNE 2008

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July 7, 2008

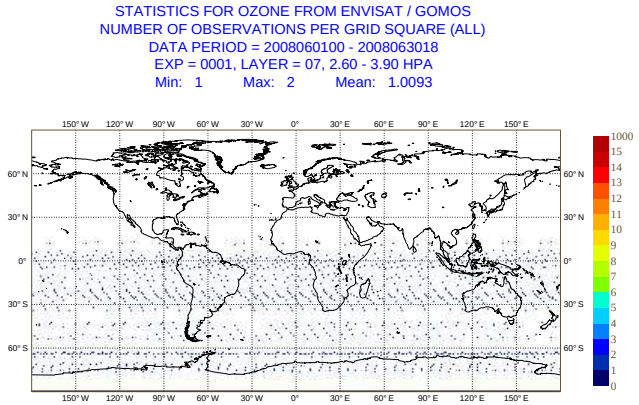



Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for June 2008.

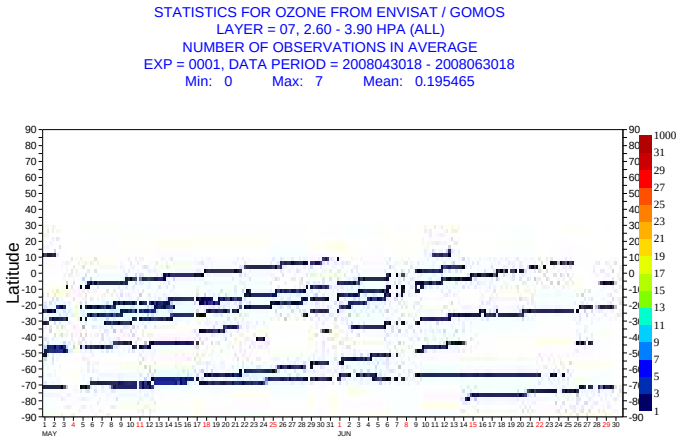



Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for May-June 2008.

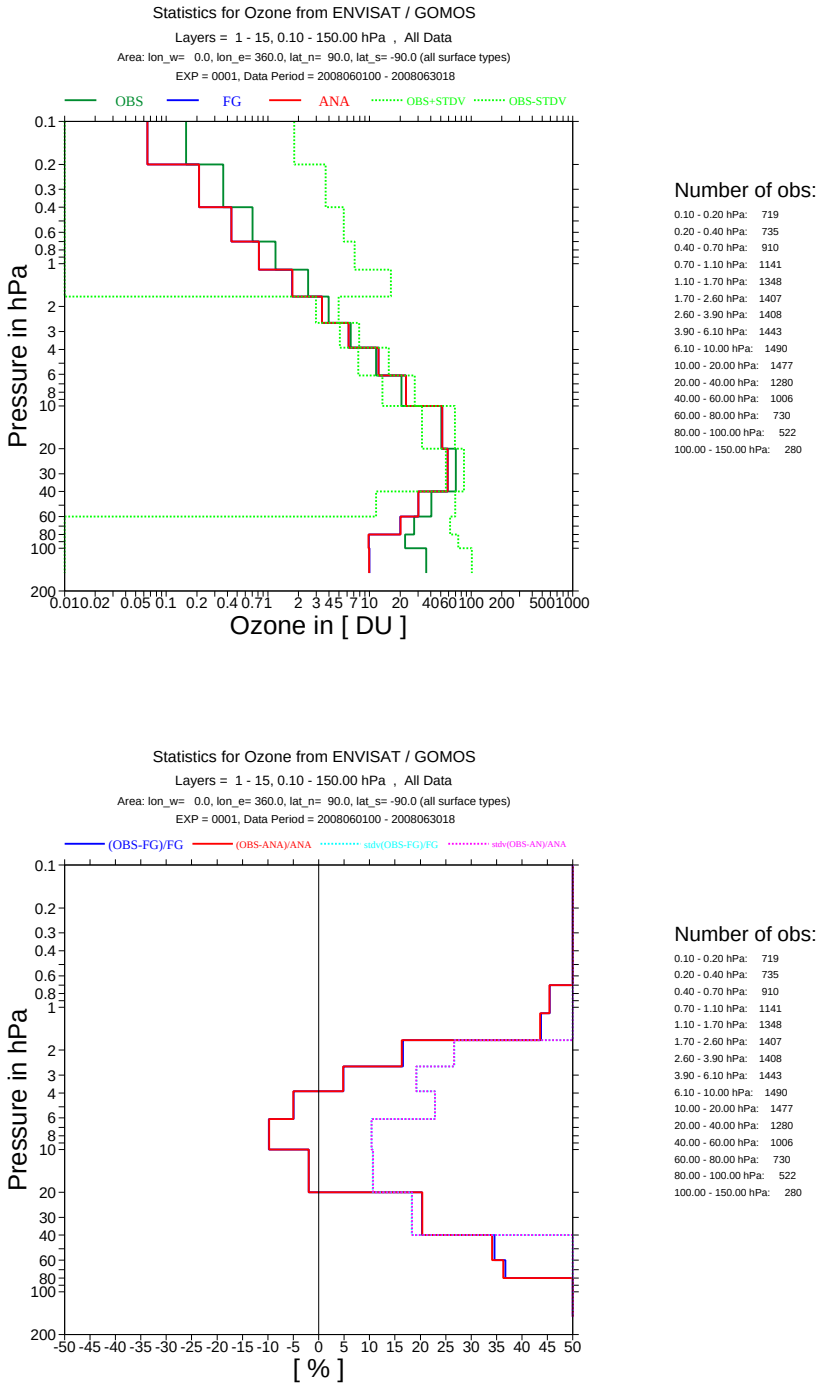
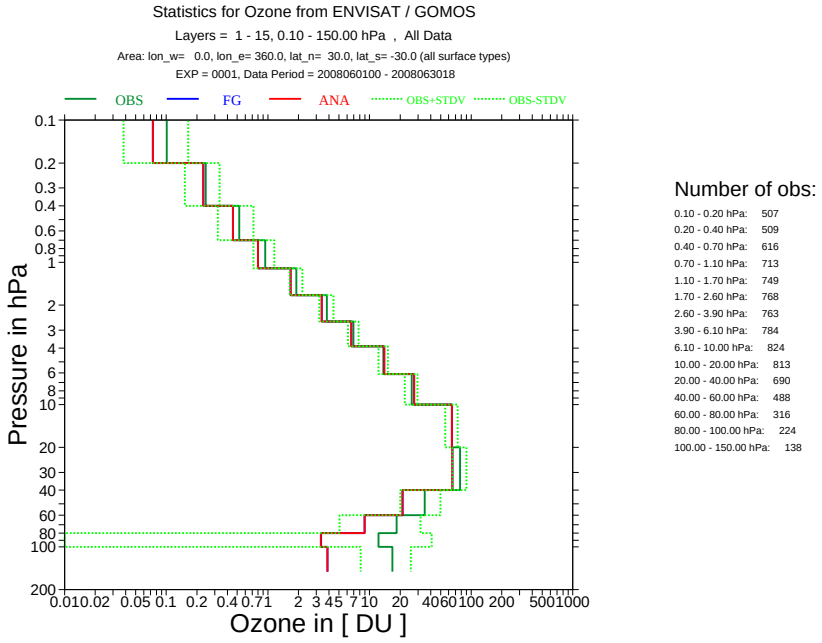



Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for June 2008 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) +/- 1 standard deviation (green dotted lines). The bottom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



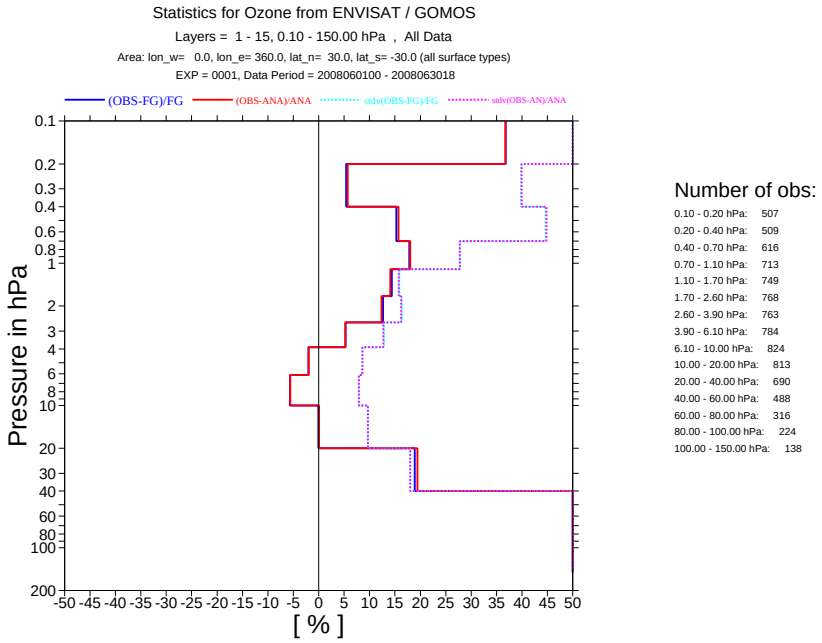
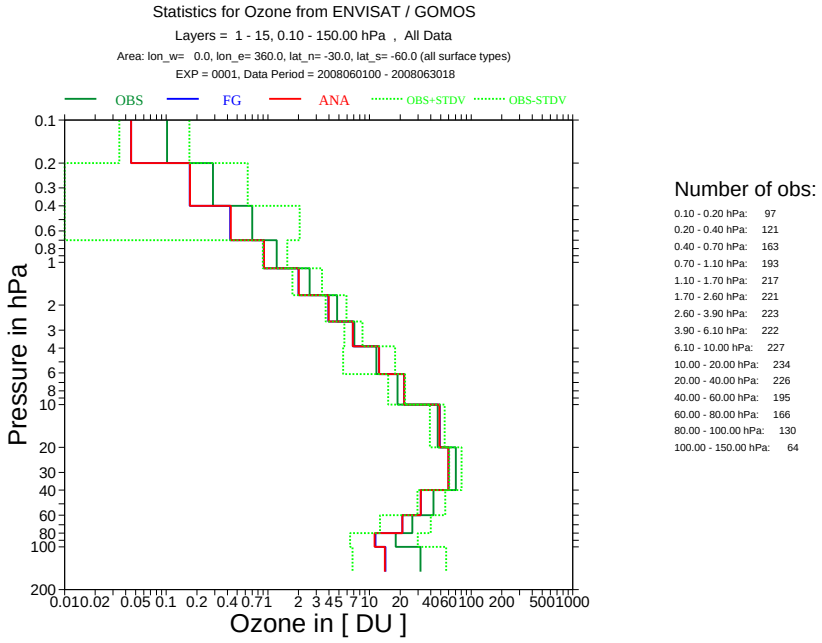




Fig. 4. As Fig. 3 but for 30N-30S.



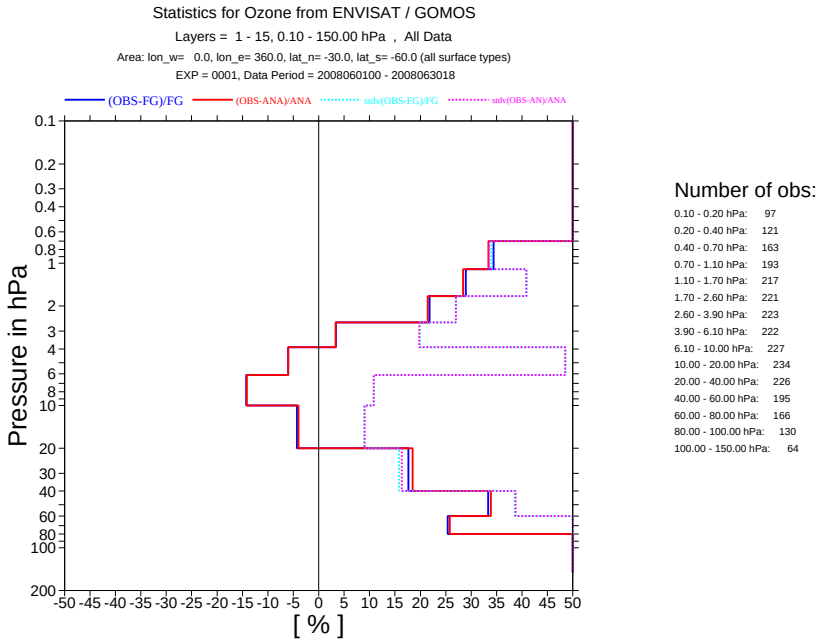
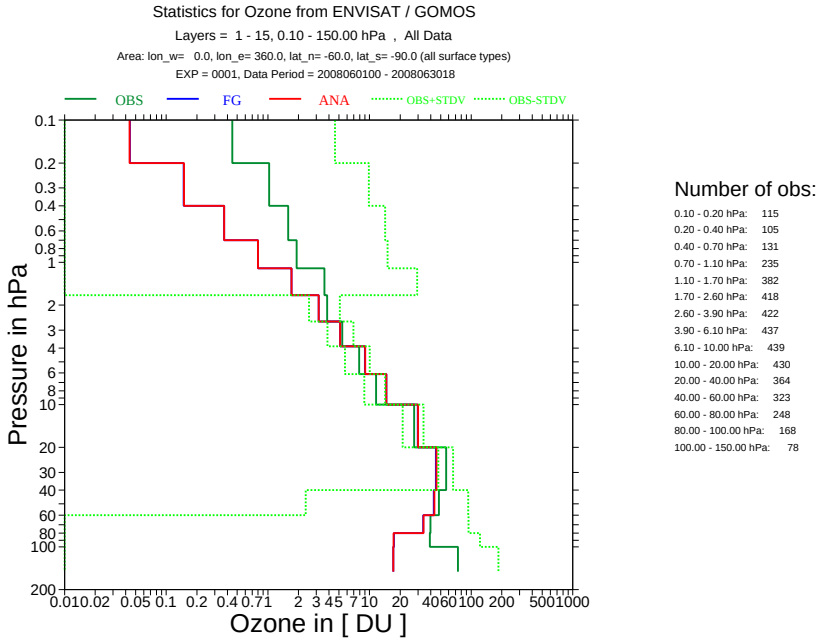




Fig. 5. As Fig. 3 but for 30S-60S.



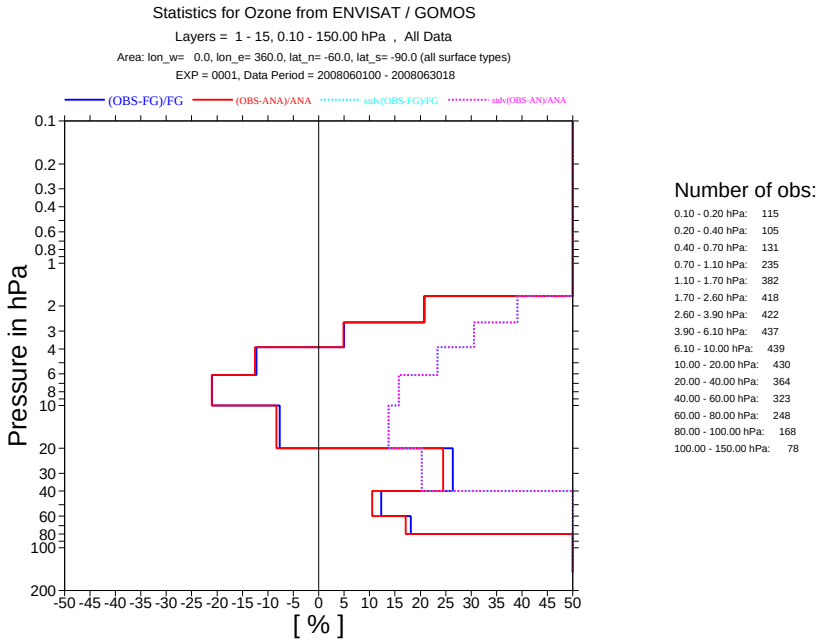




Fig. 6. As Fig. 3 but for 60-90S.

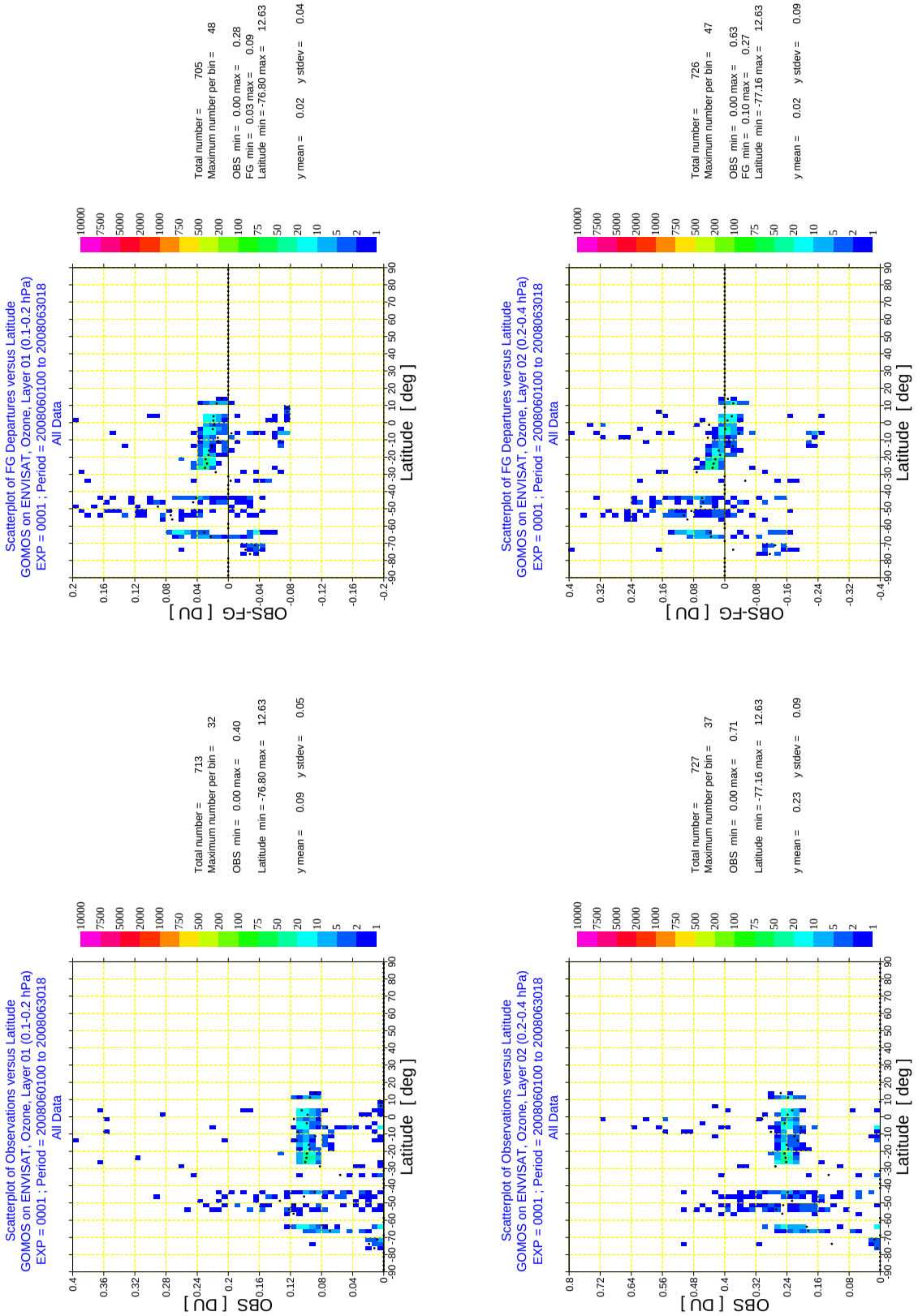



Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-uess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for June 2008 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black dots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

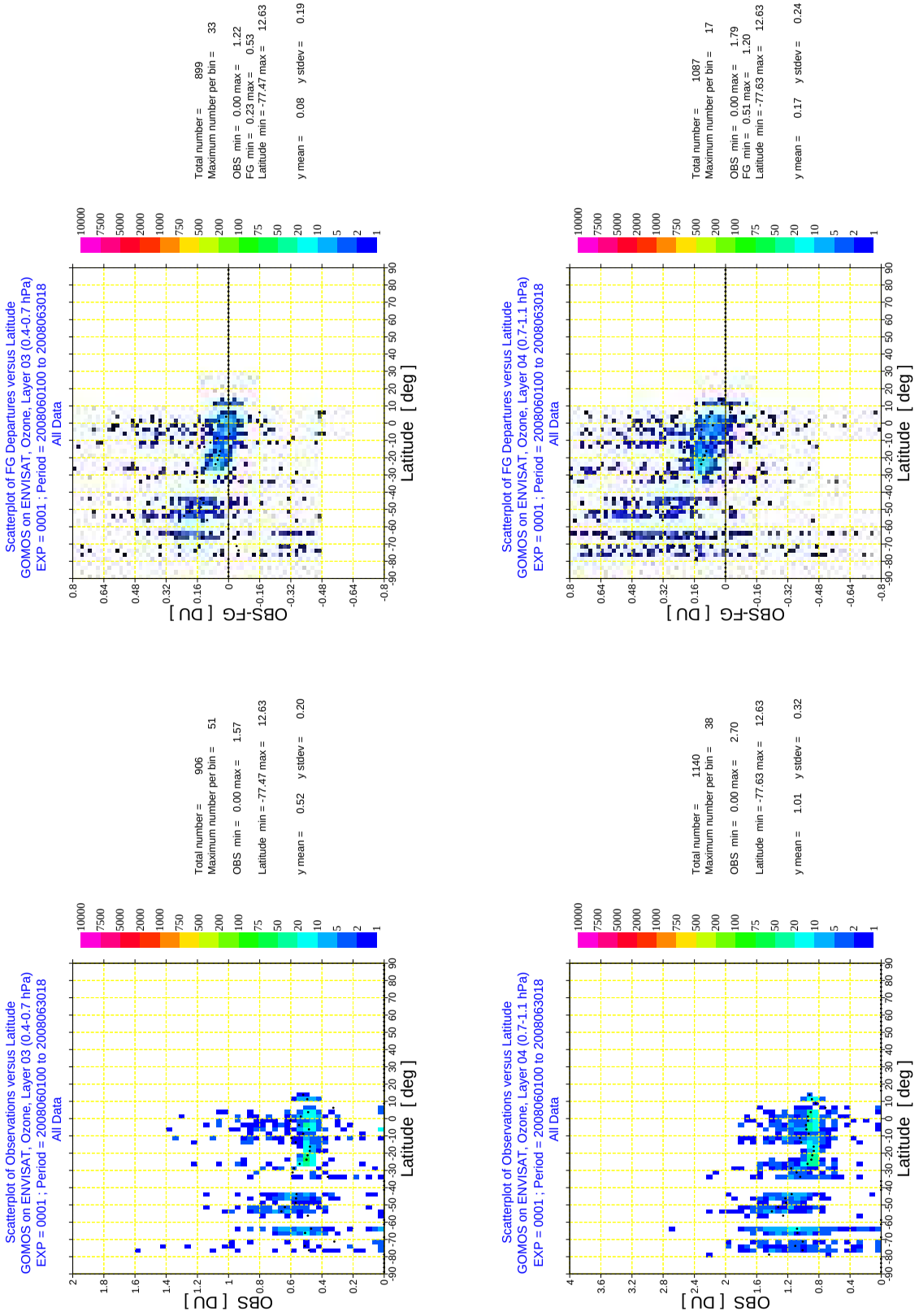



Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

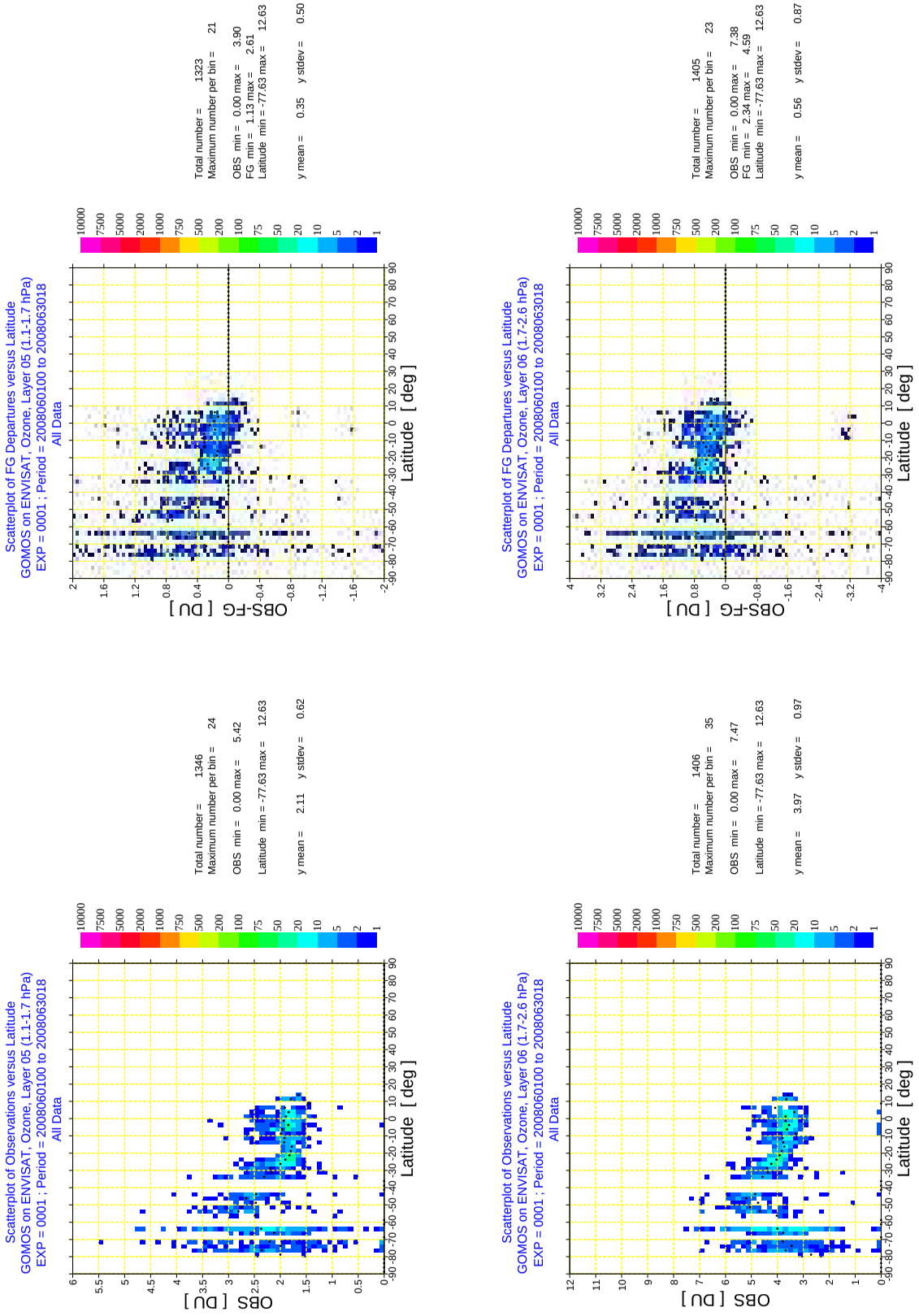



Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

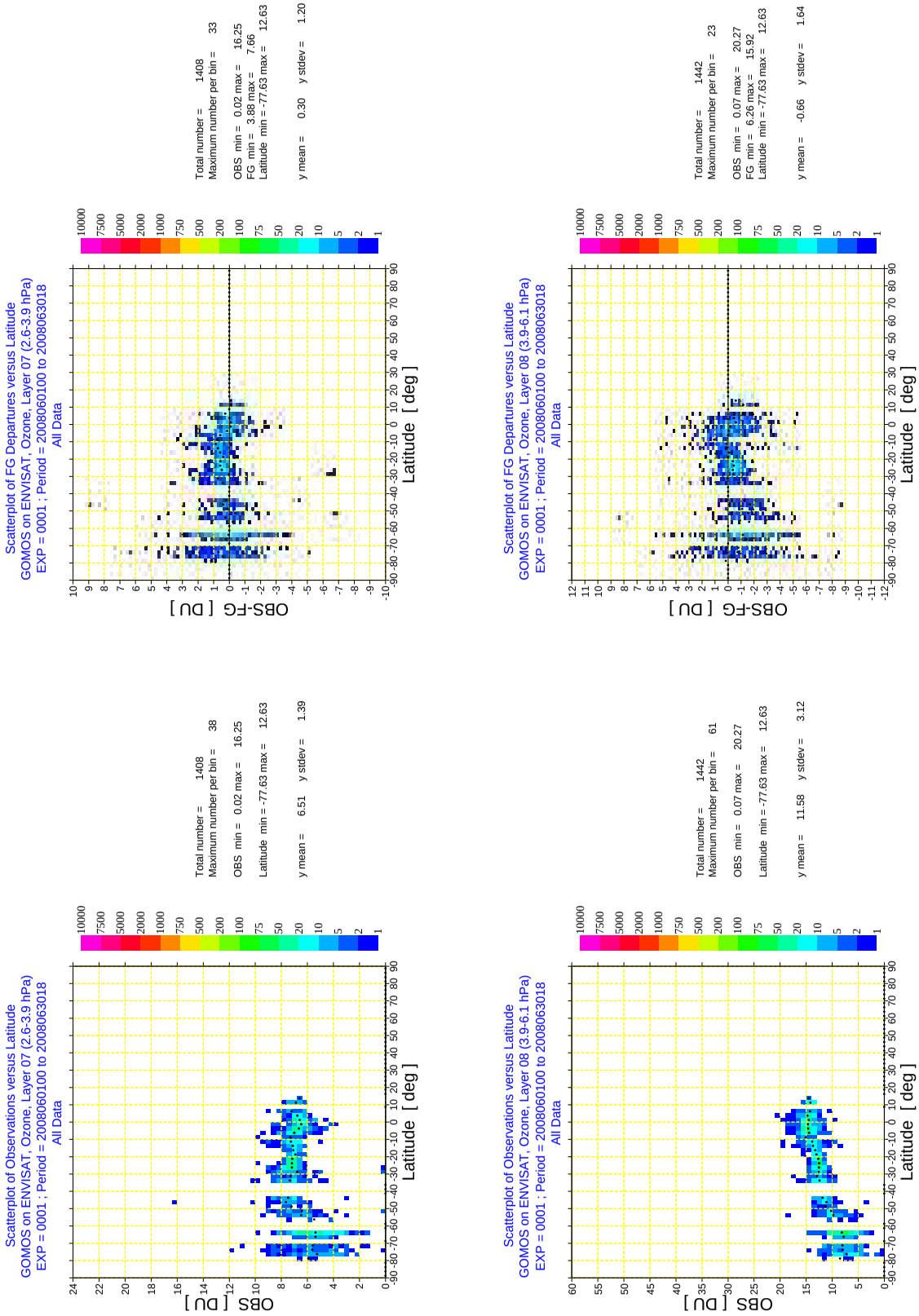



Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

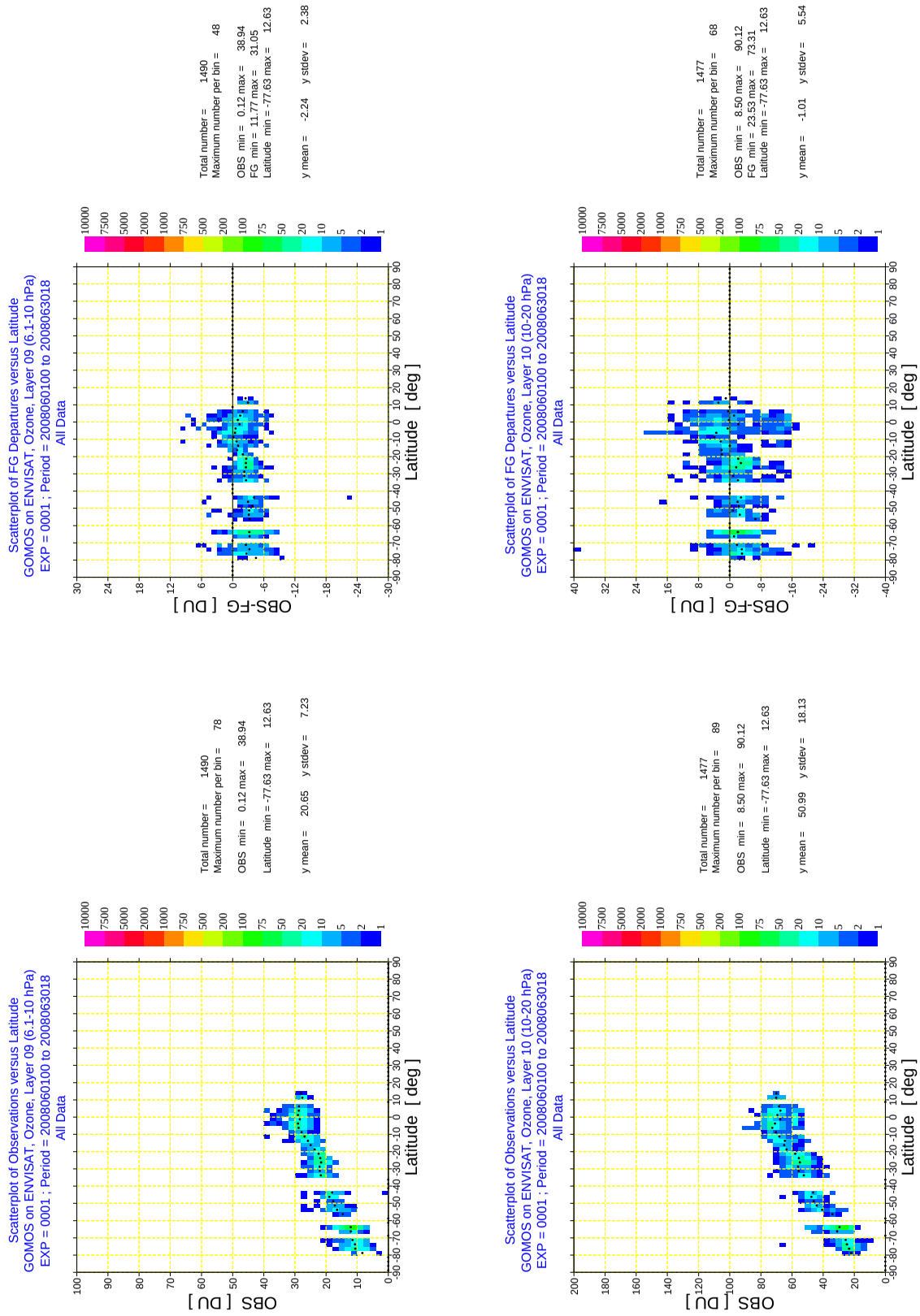



Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

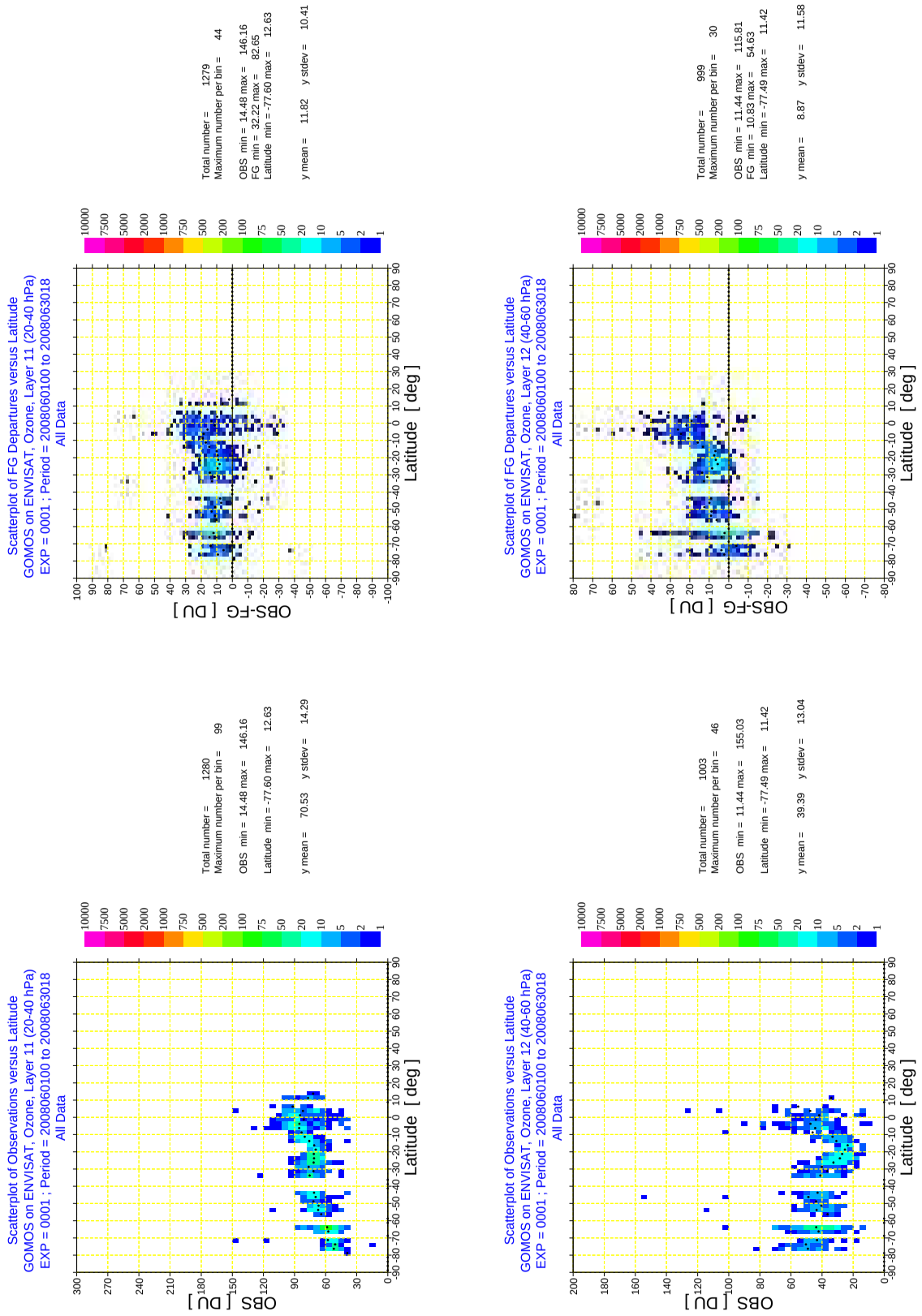



Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

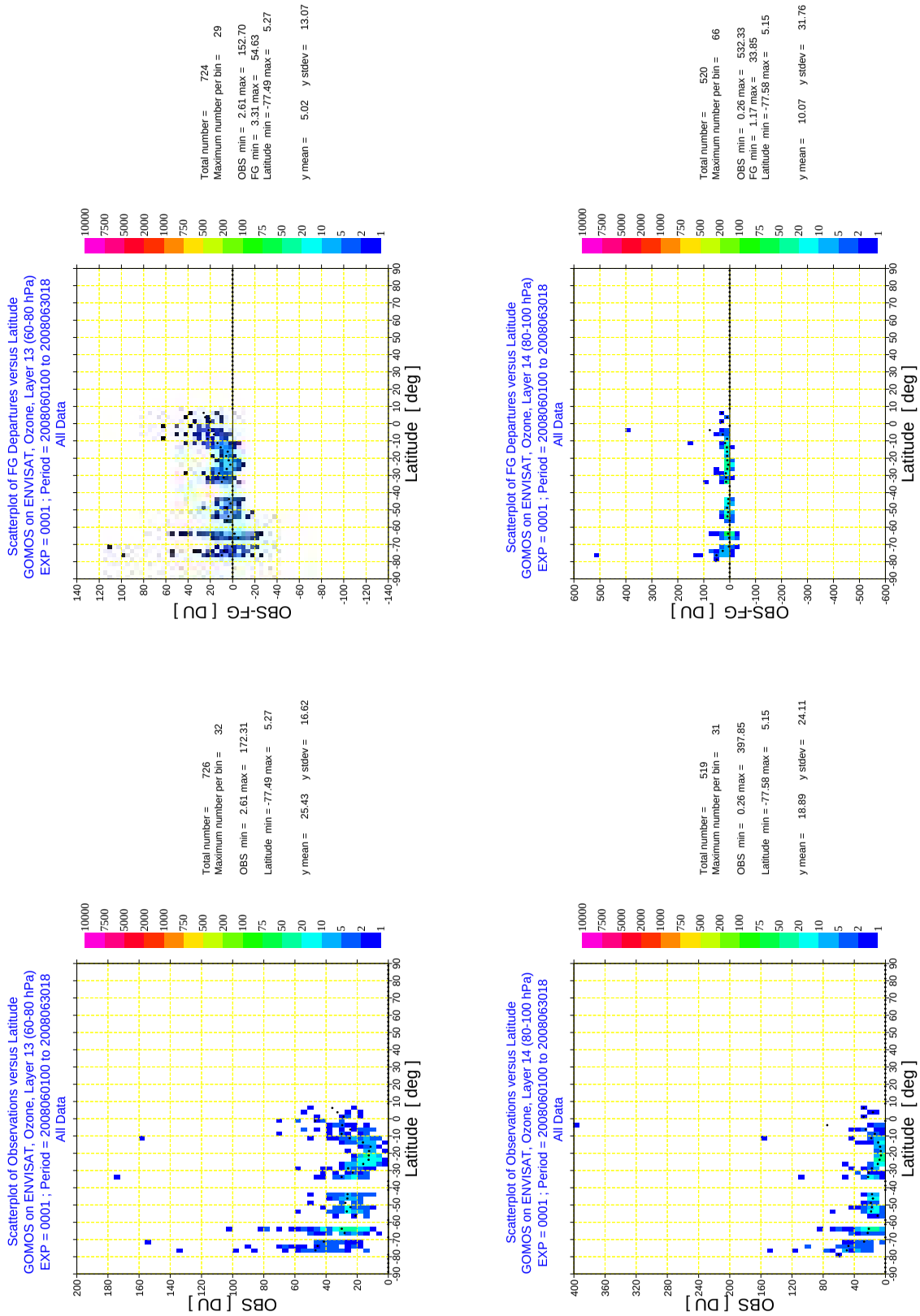



Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

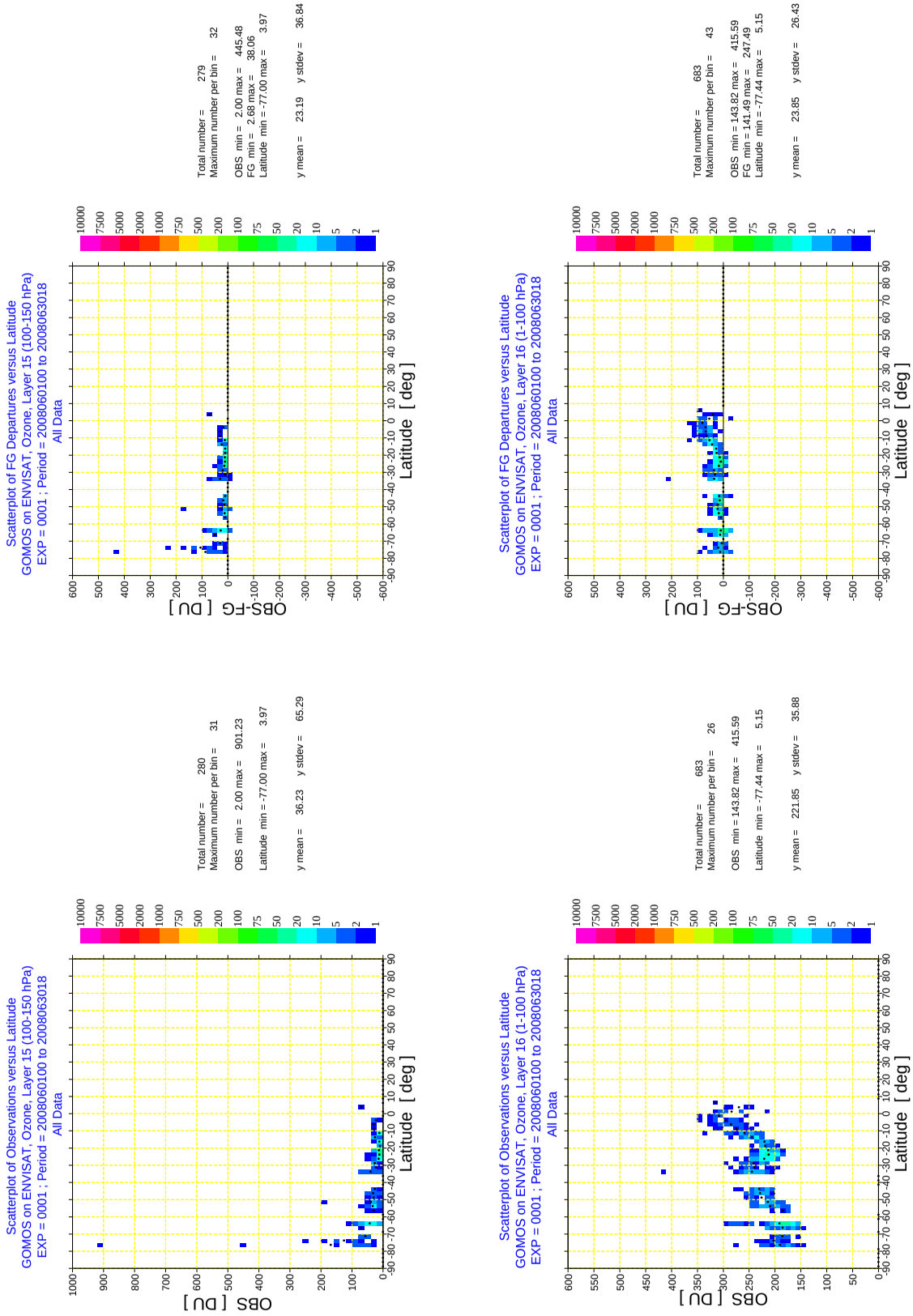



Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

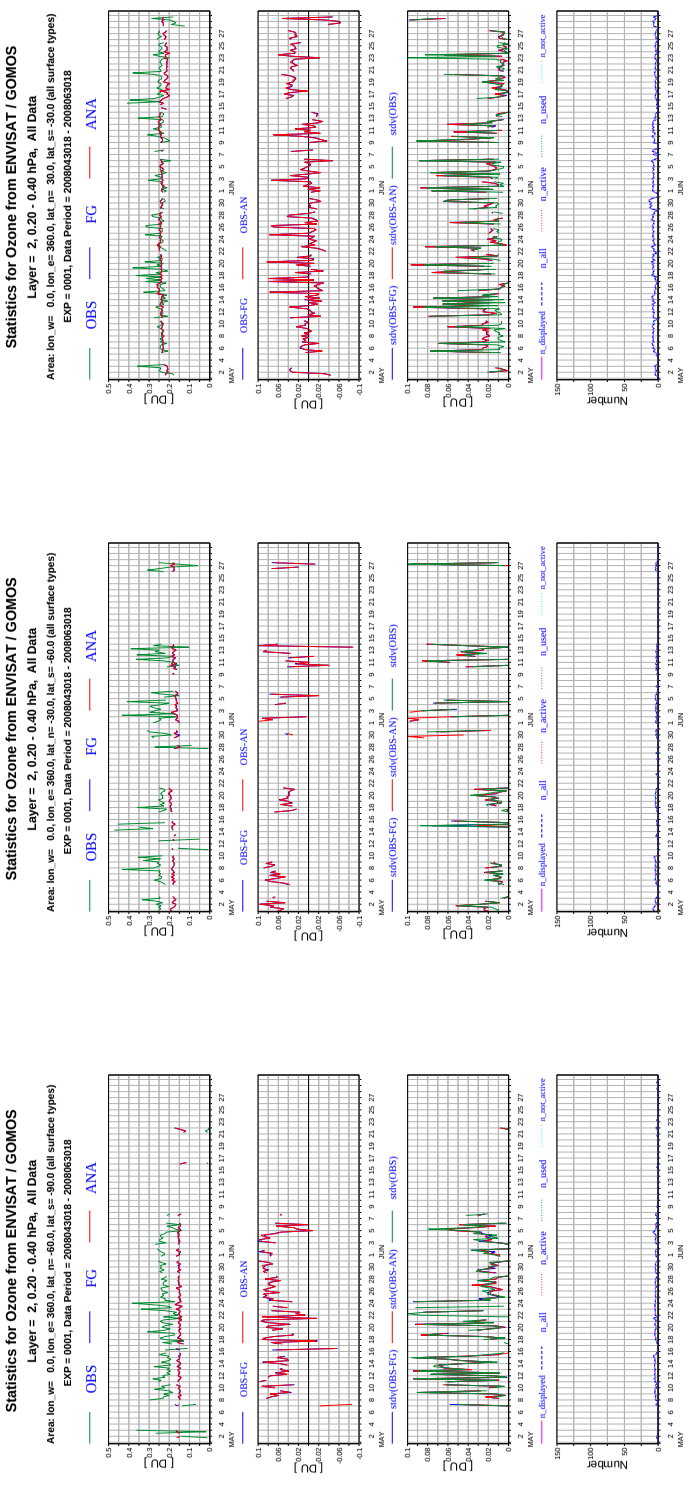



Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for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

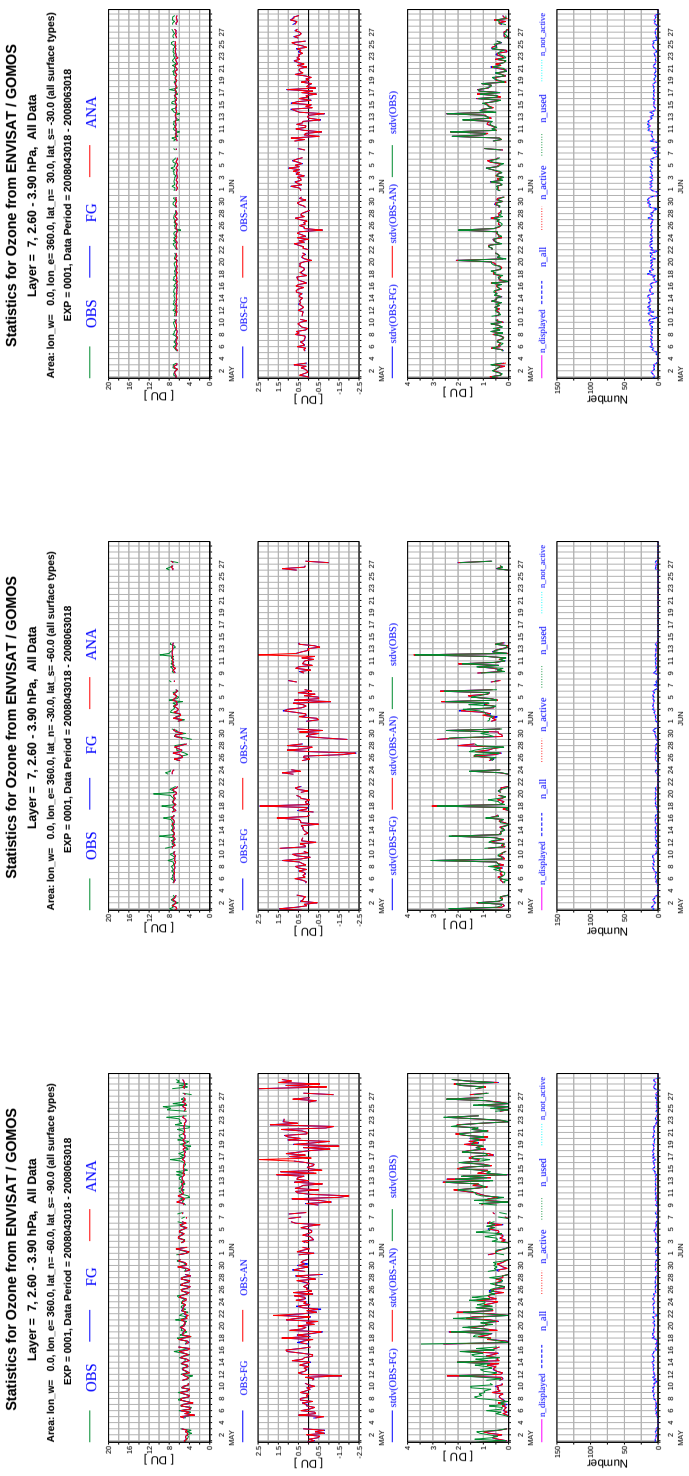



Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

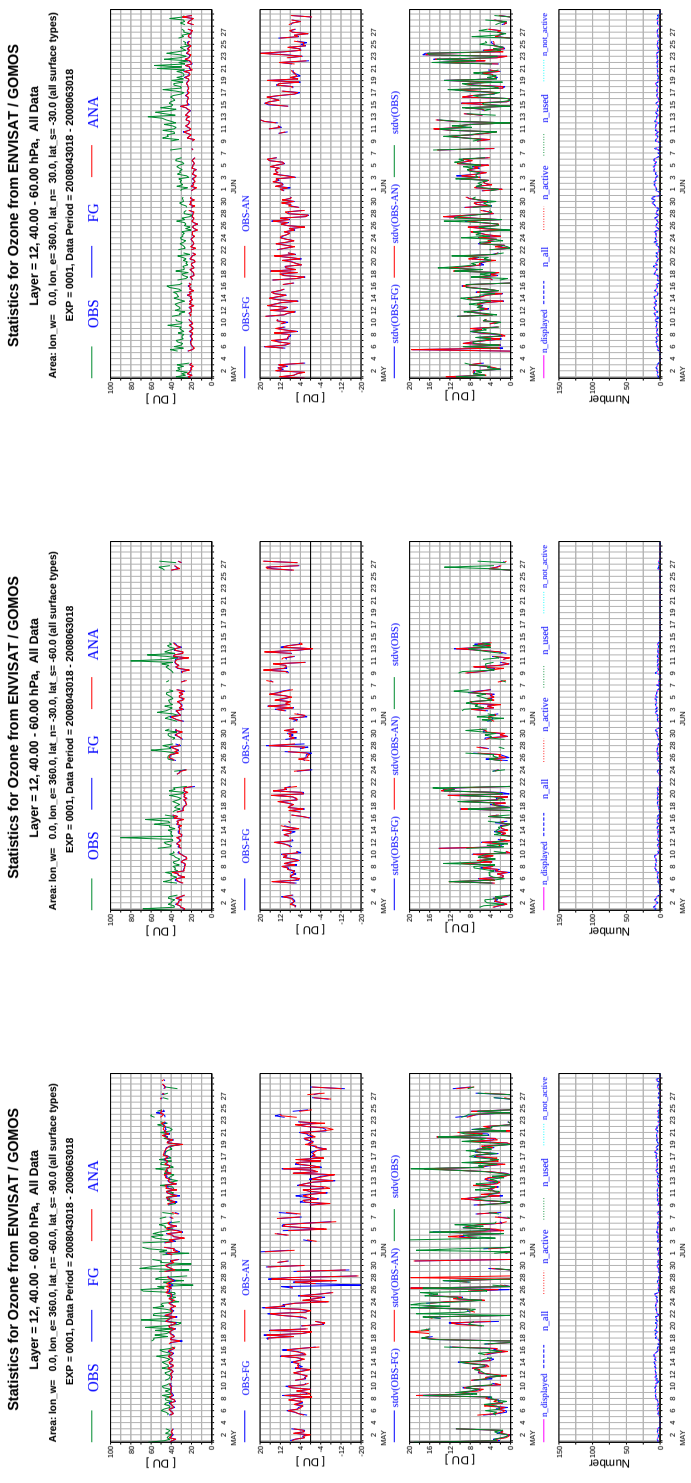



Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

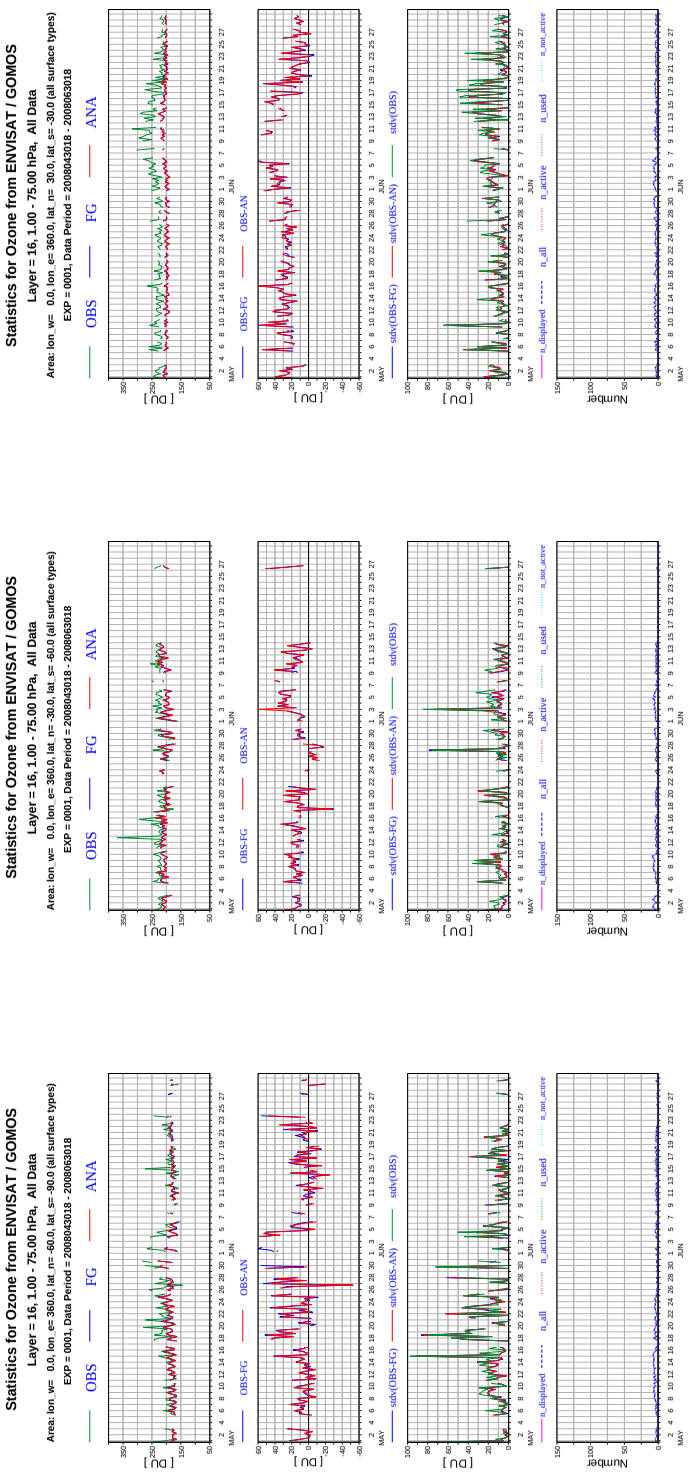



Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

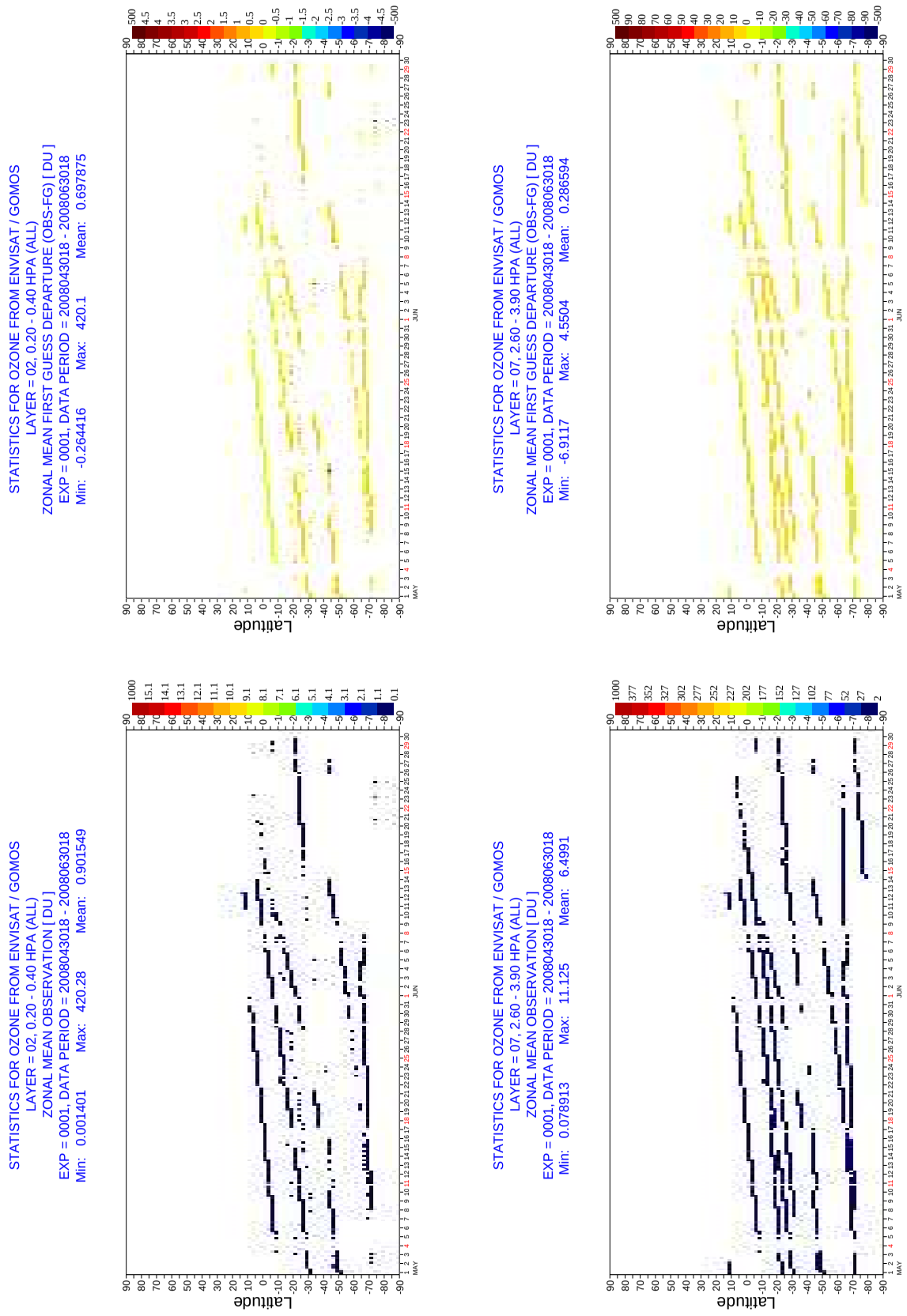



Fig. 19. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for May-June 2008 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

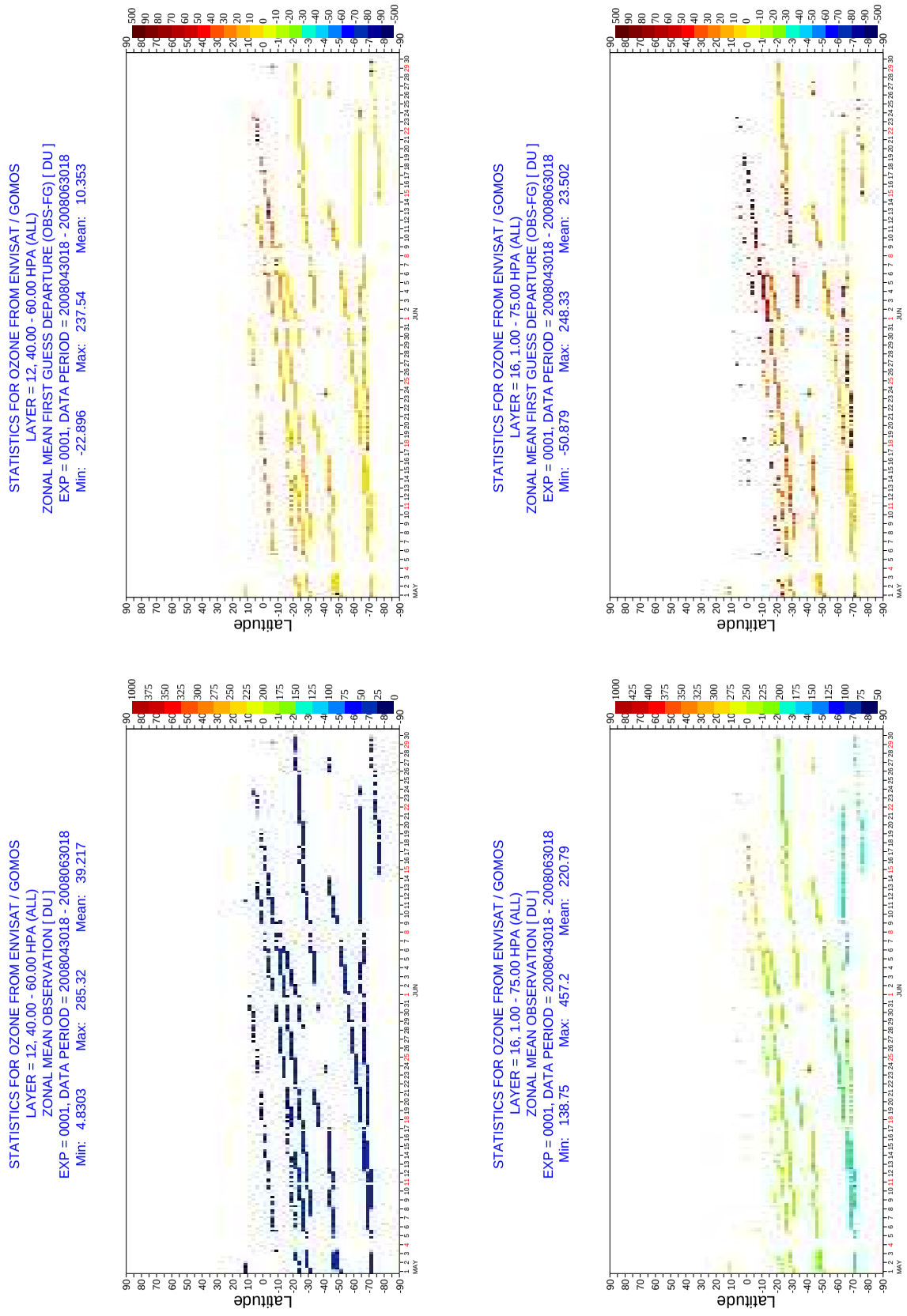



Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

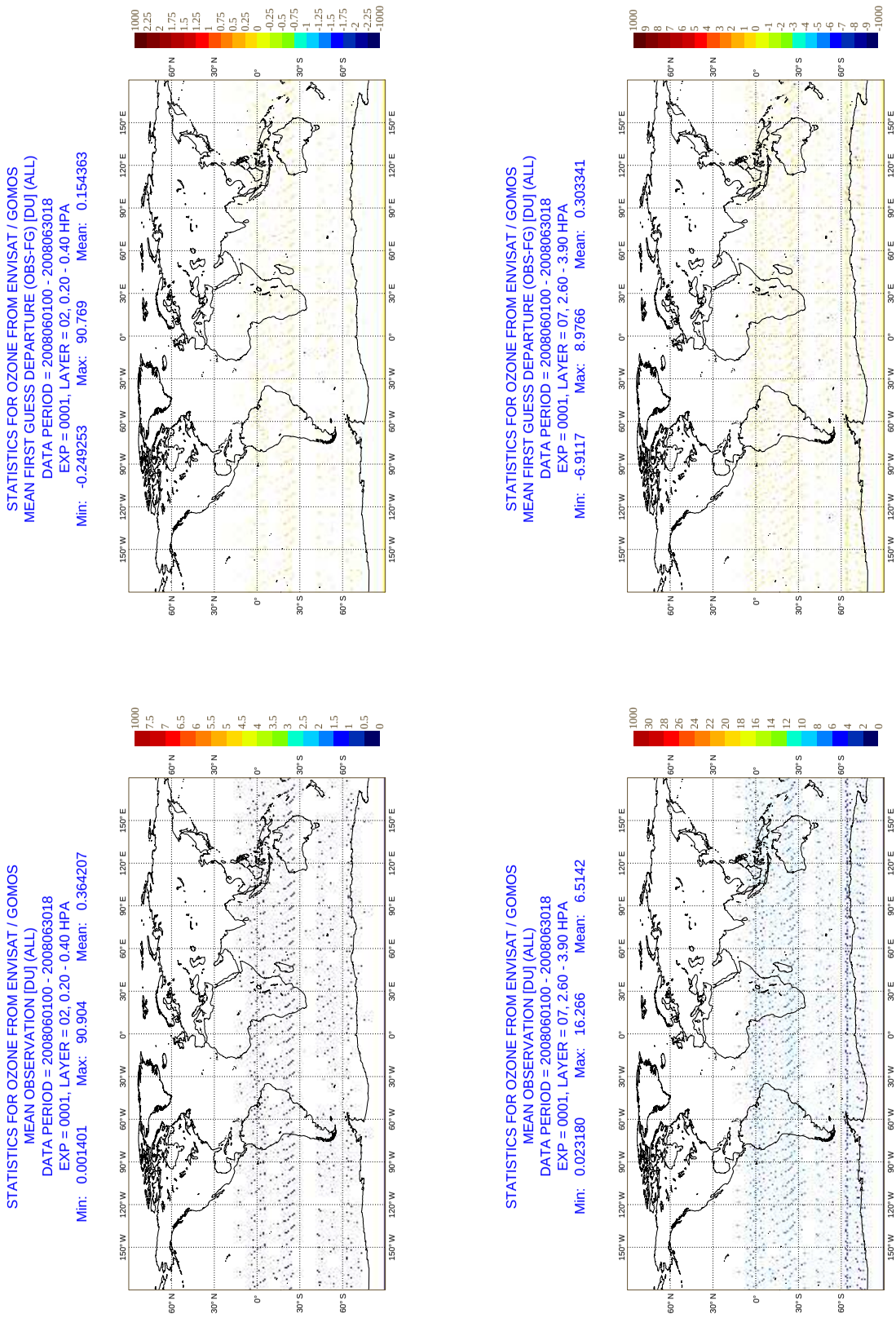



Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for June 2008 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

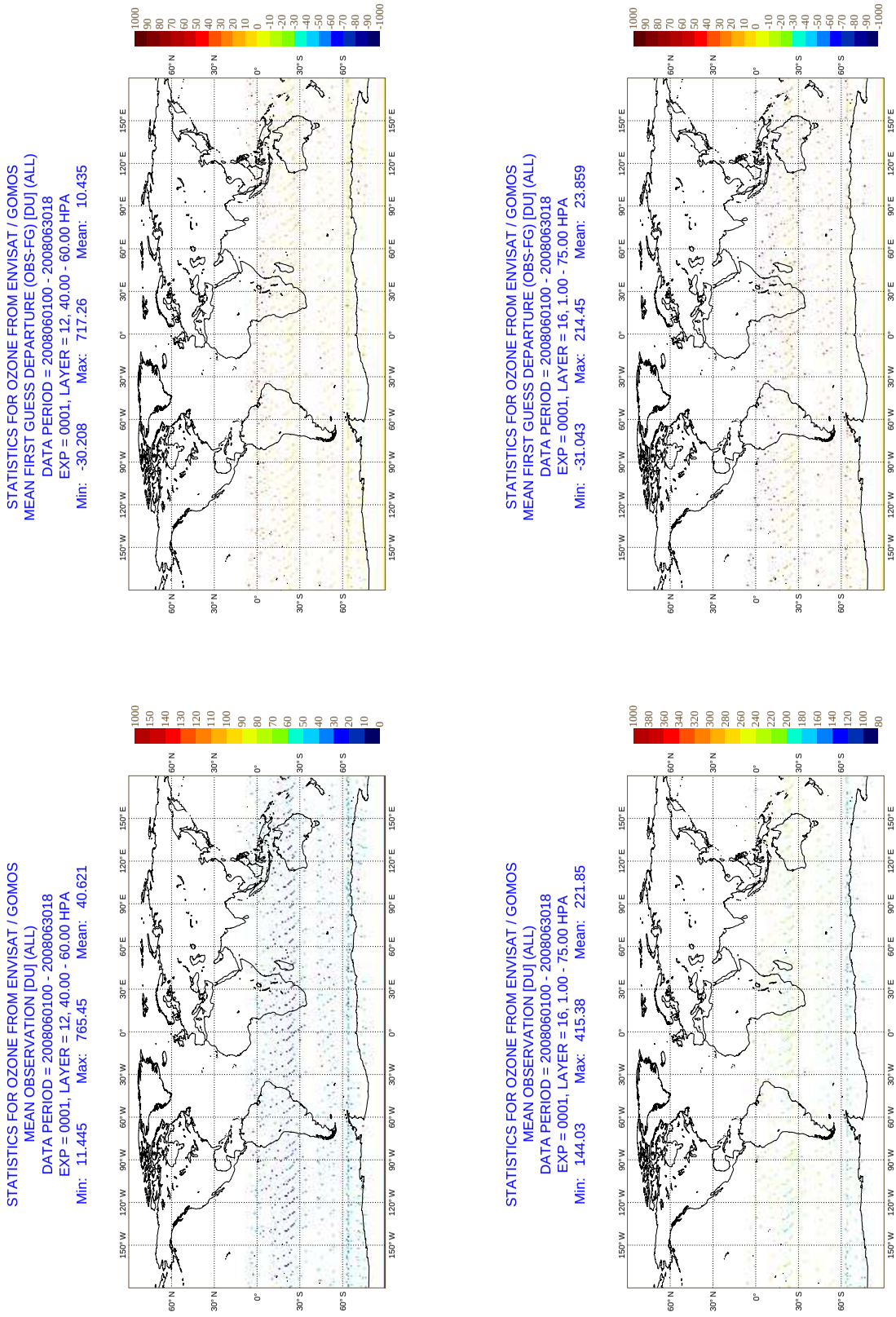



Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

# REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR__2P) FOR JUNE 2008

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July 7, 2008

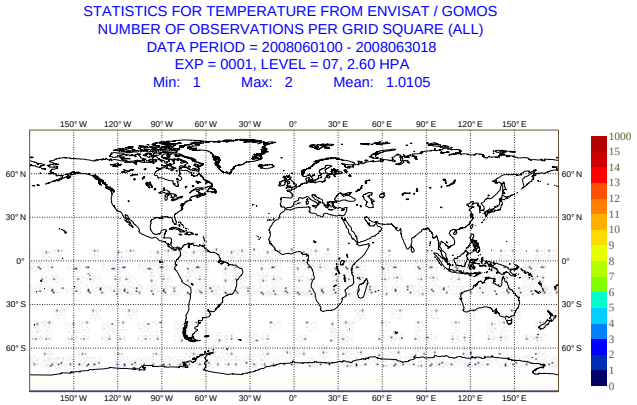



Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for June 2008.

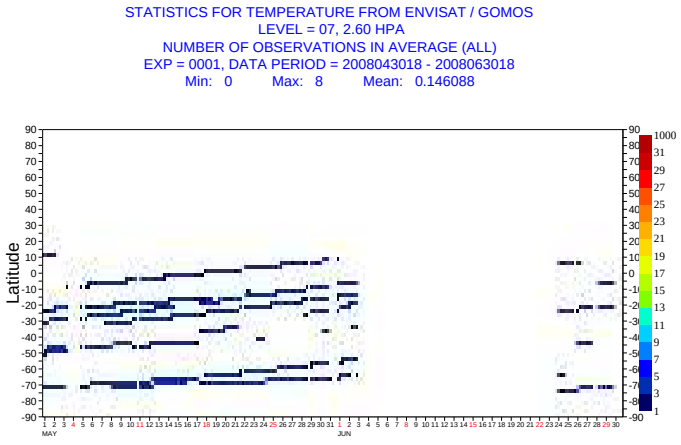



Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for May-June 2008.

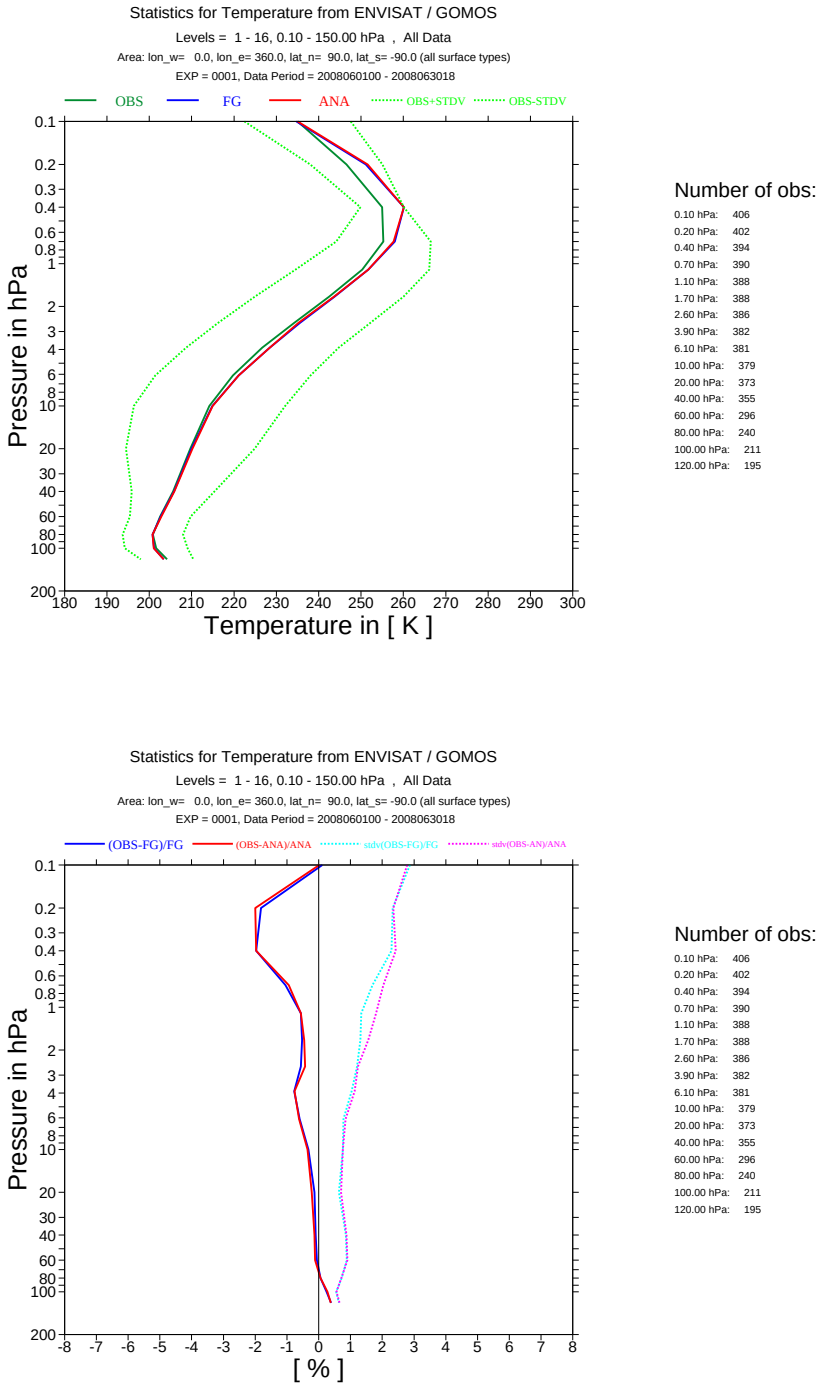
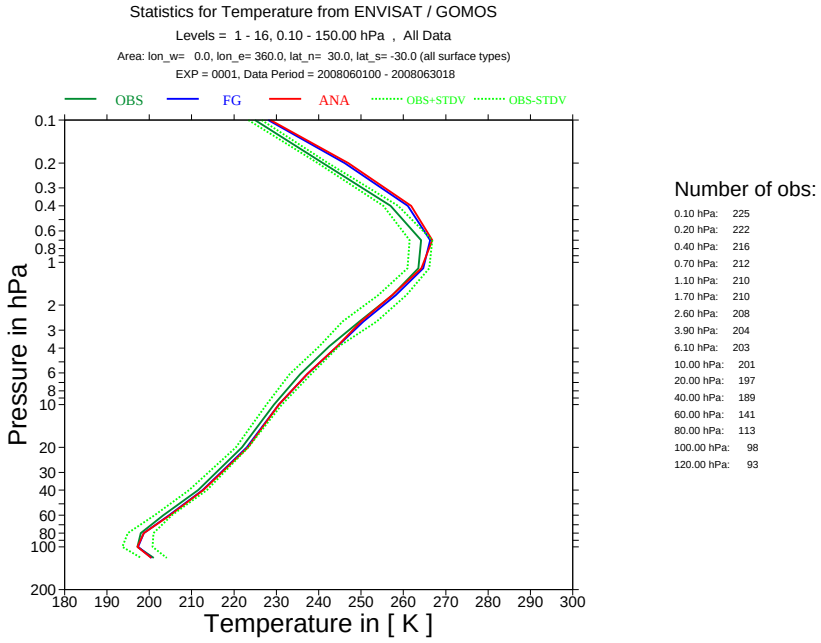



Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for June 2008 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation +/- 1 standard deviation (green dotted lines). The bottom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



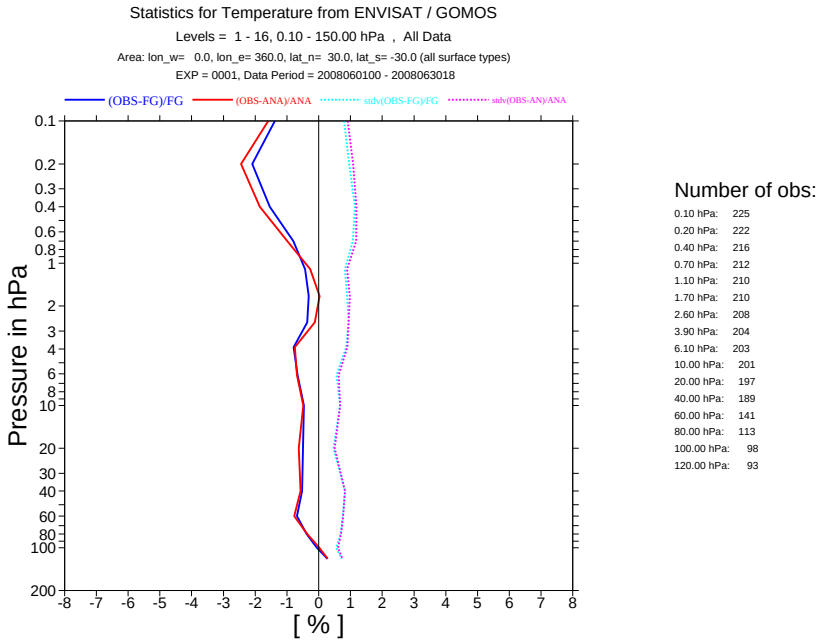
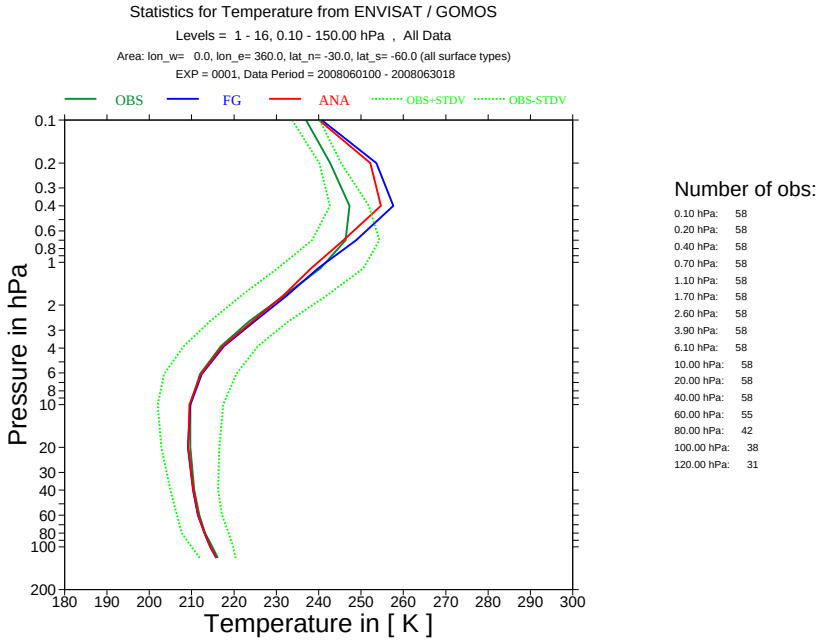




Fig. 4. As Fig. 3 but for 30N-30S.



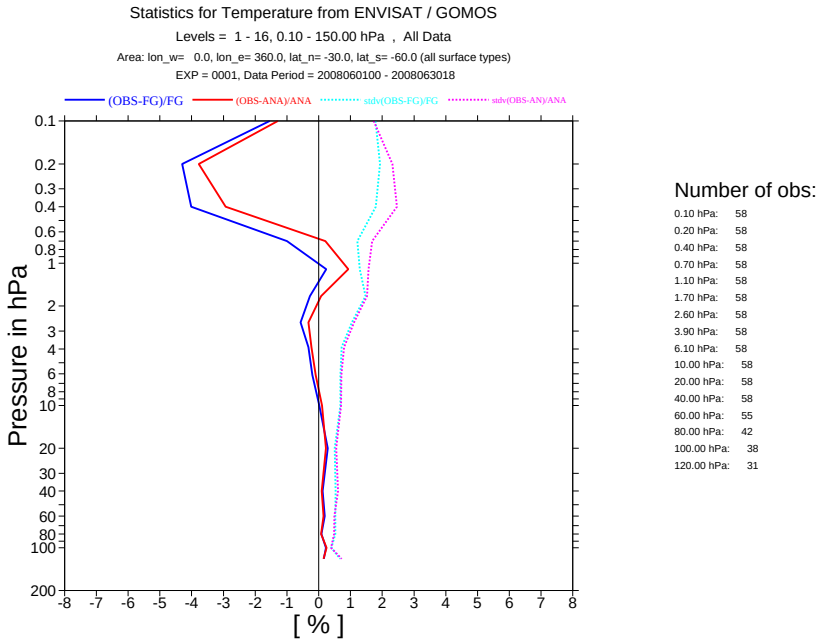
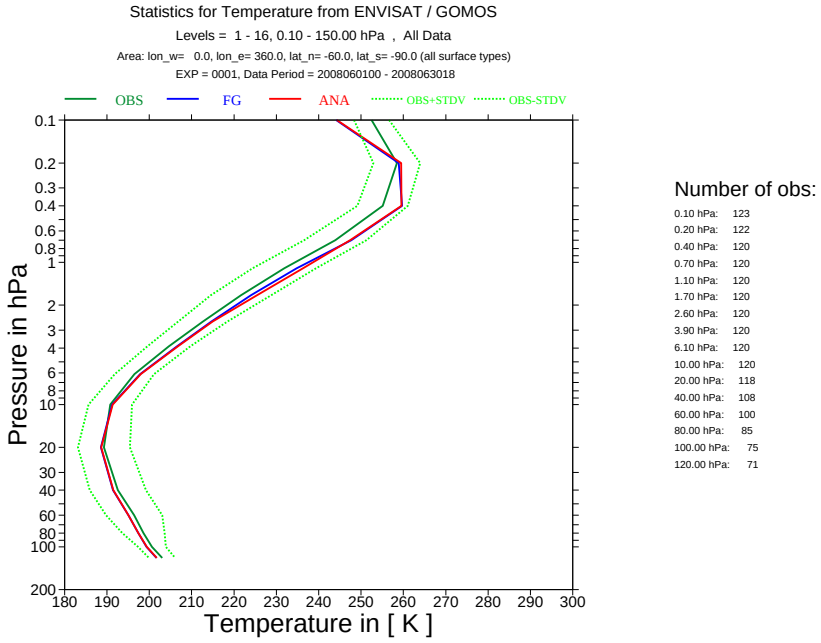




Fig. 5. As Fig. 3 but for 30-60S.



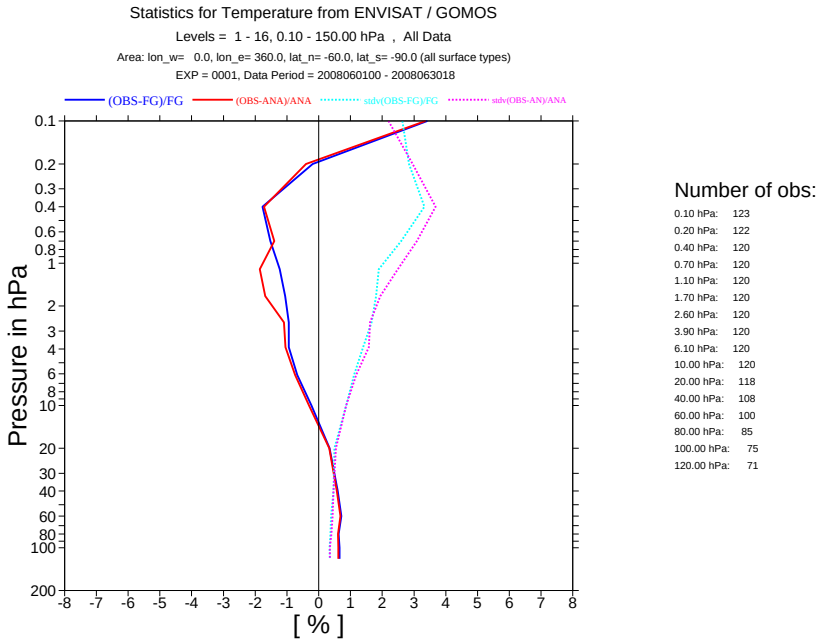




Fig. 6. As Fig. 3 but for 60-90S.

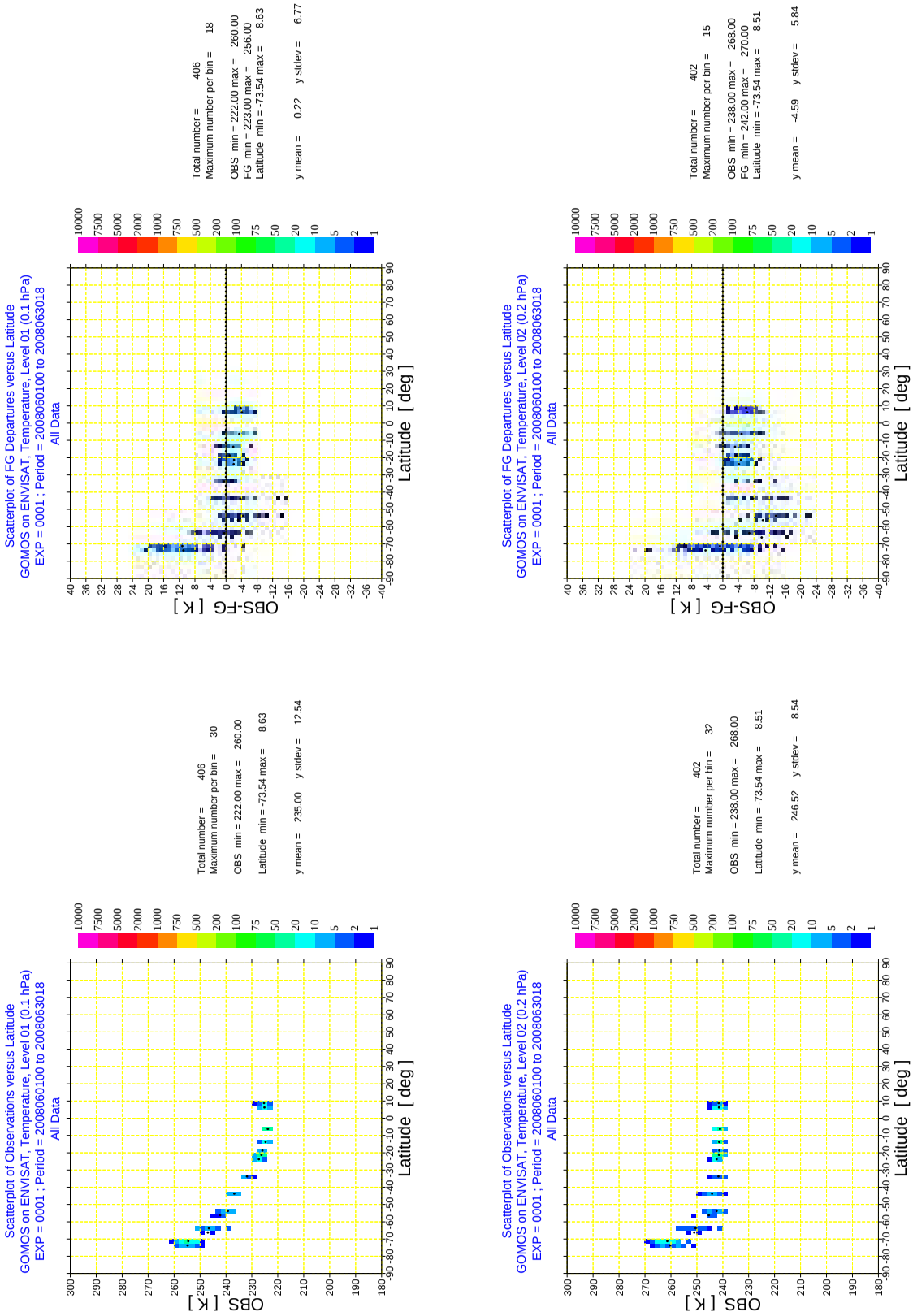



Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for June 2008 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the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

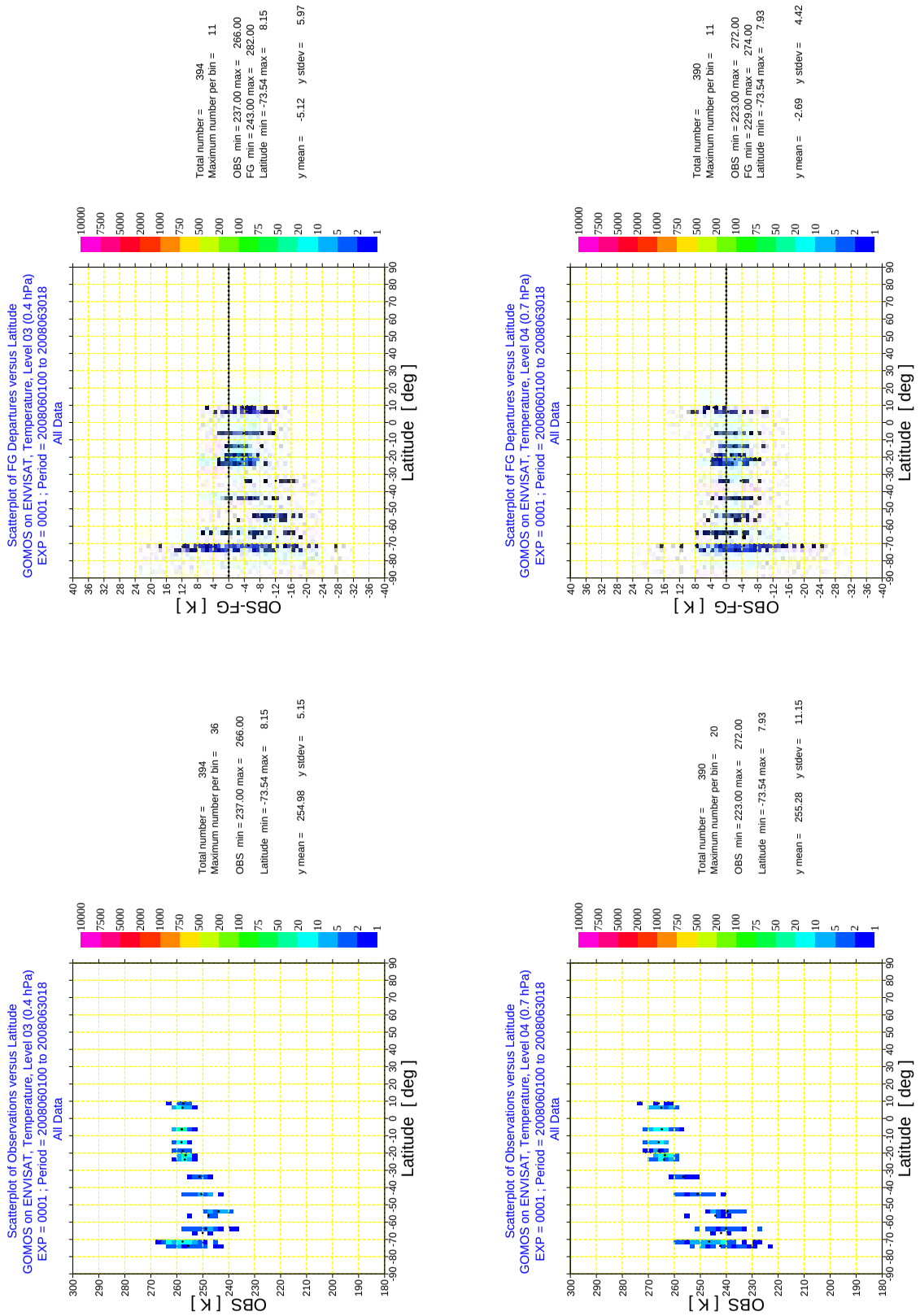



Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

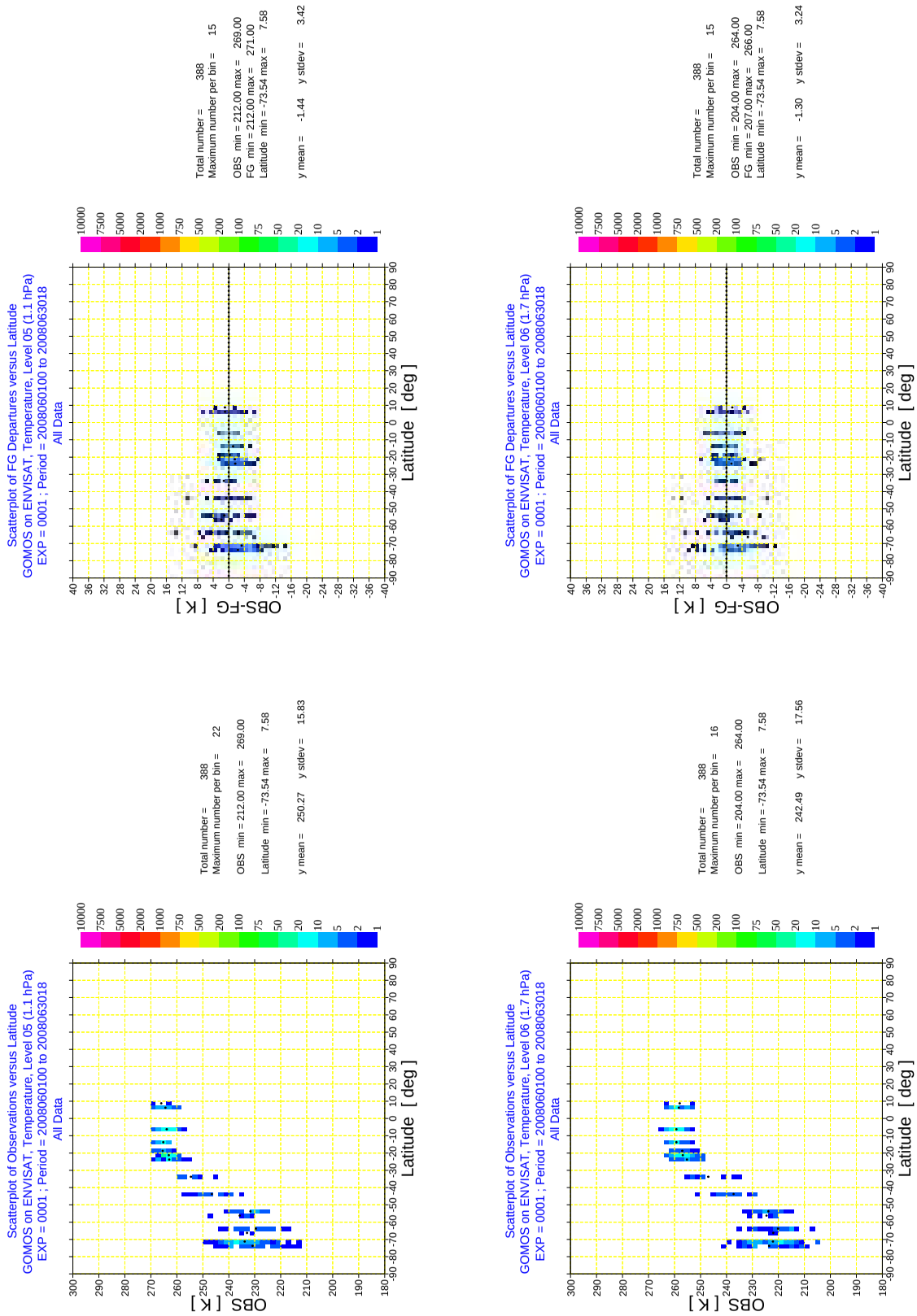



Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

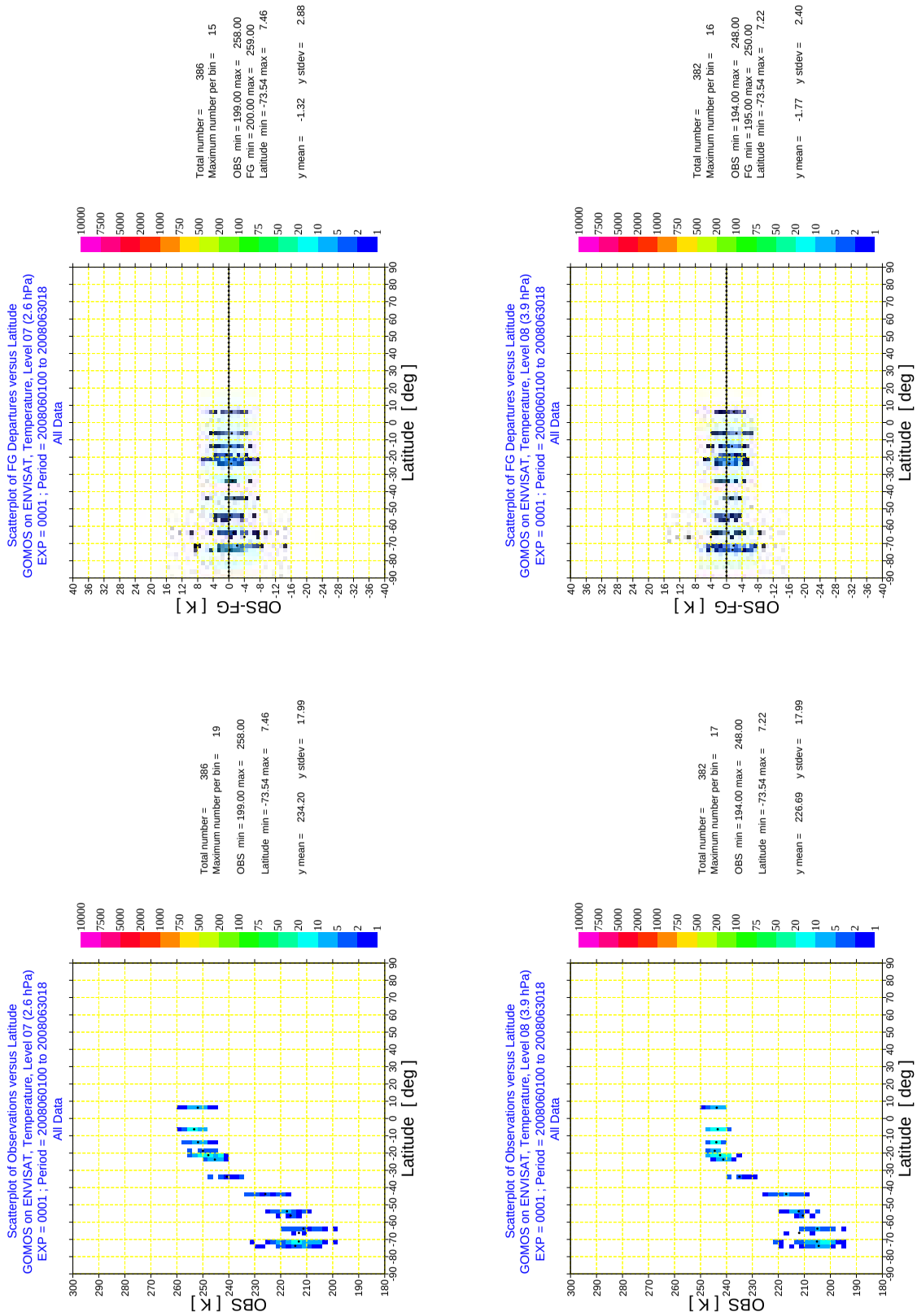



Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

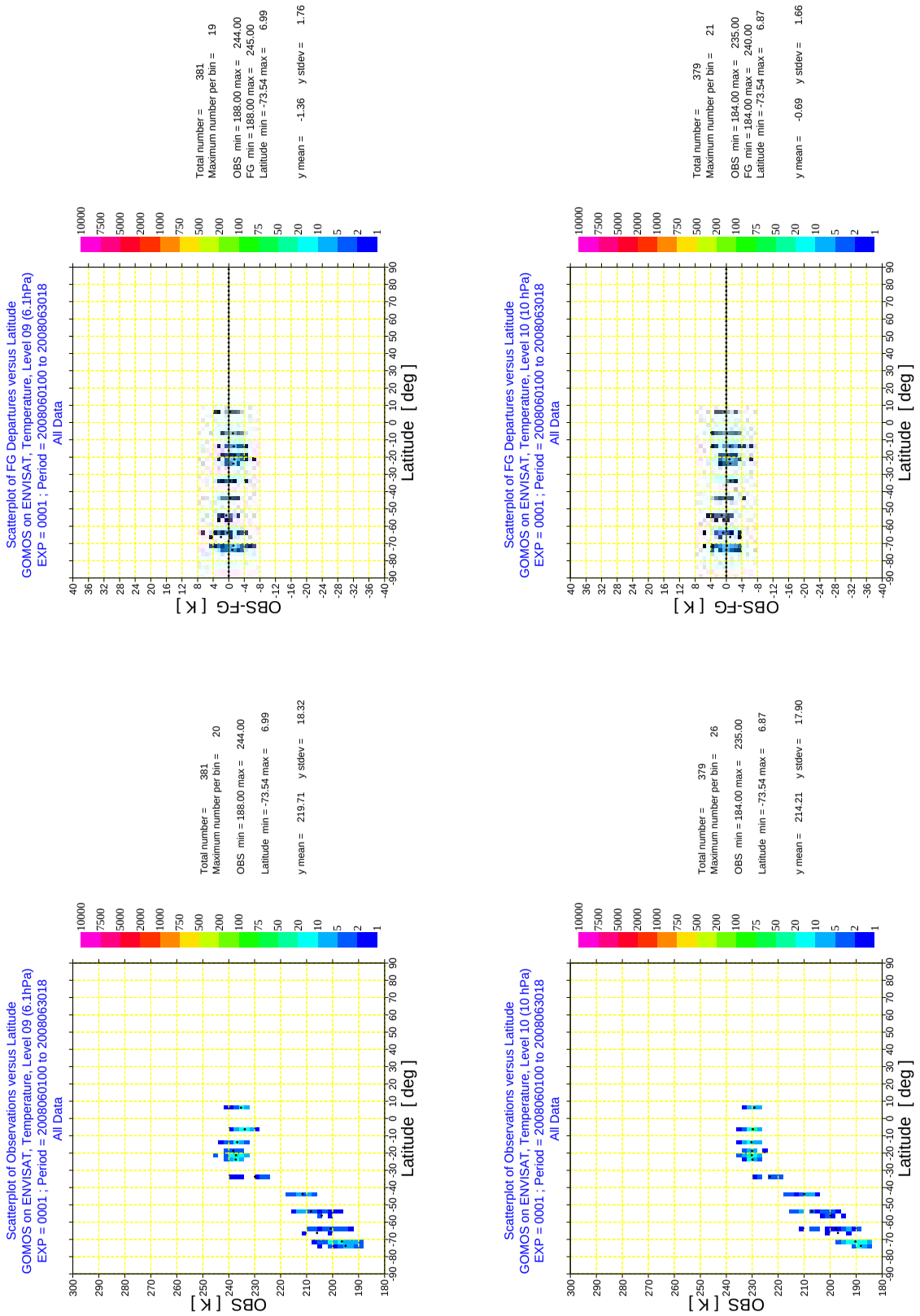



Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

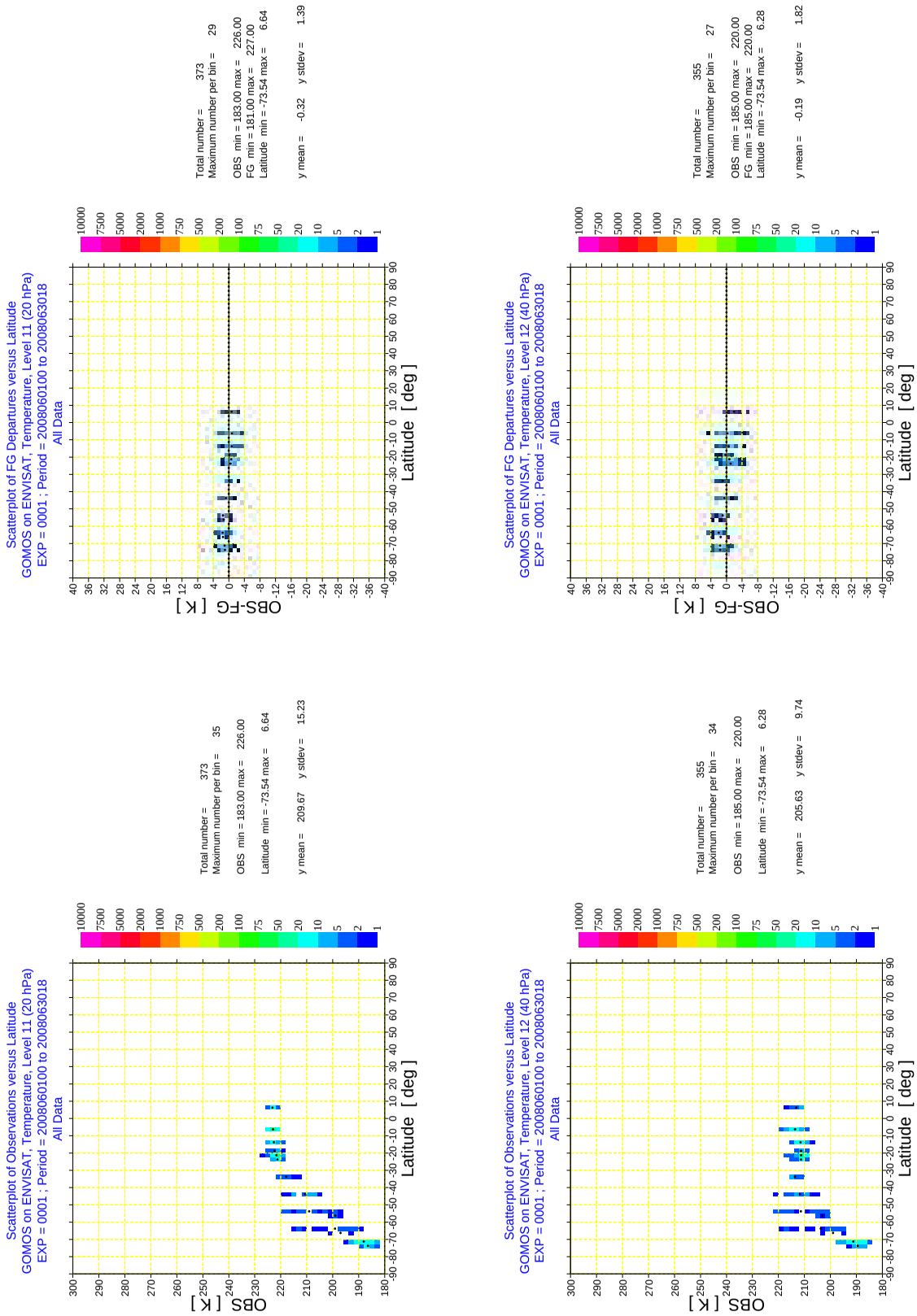



Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

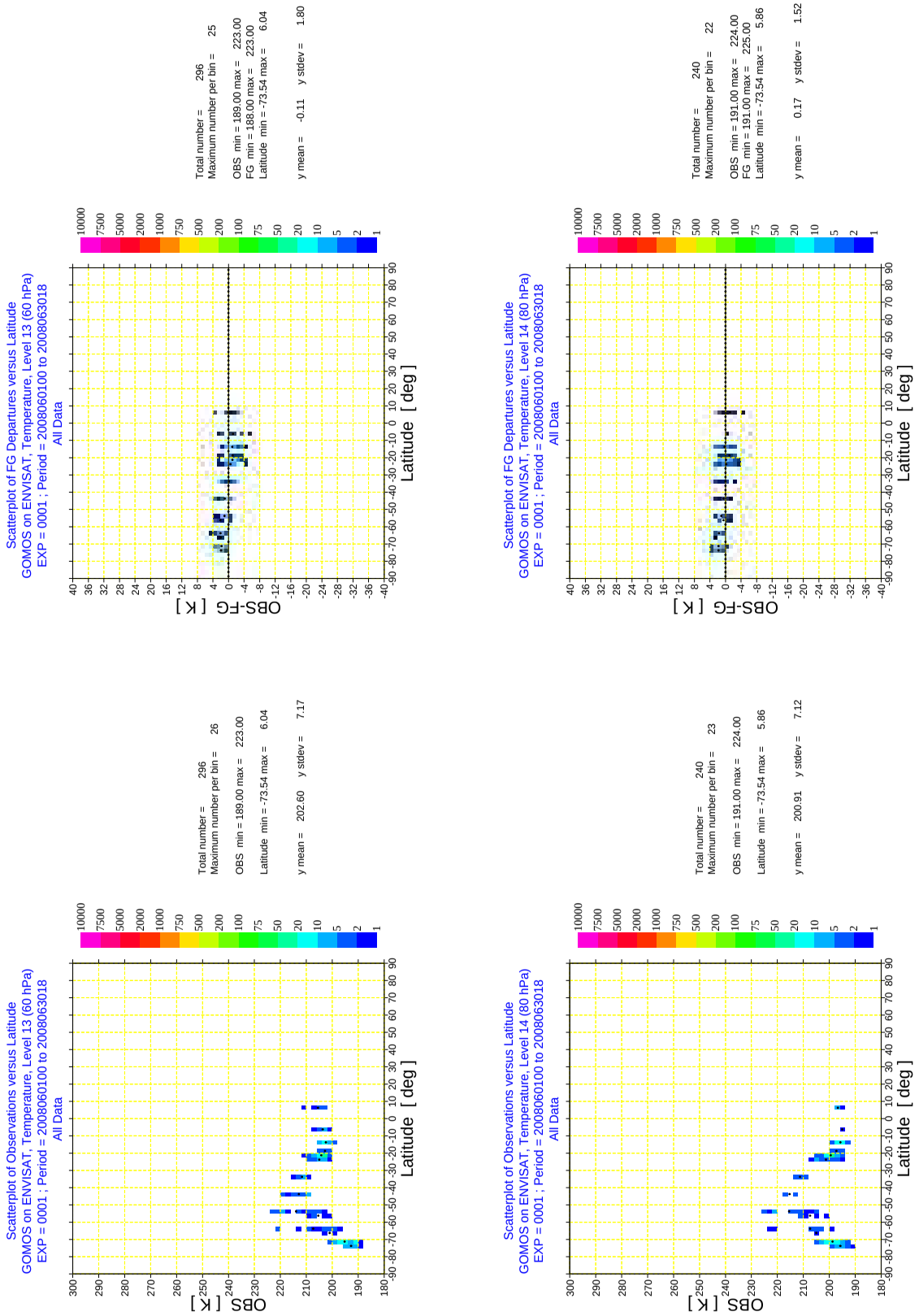



Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

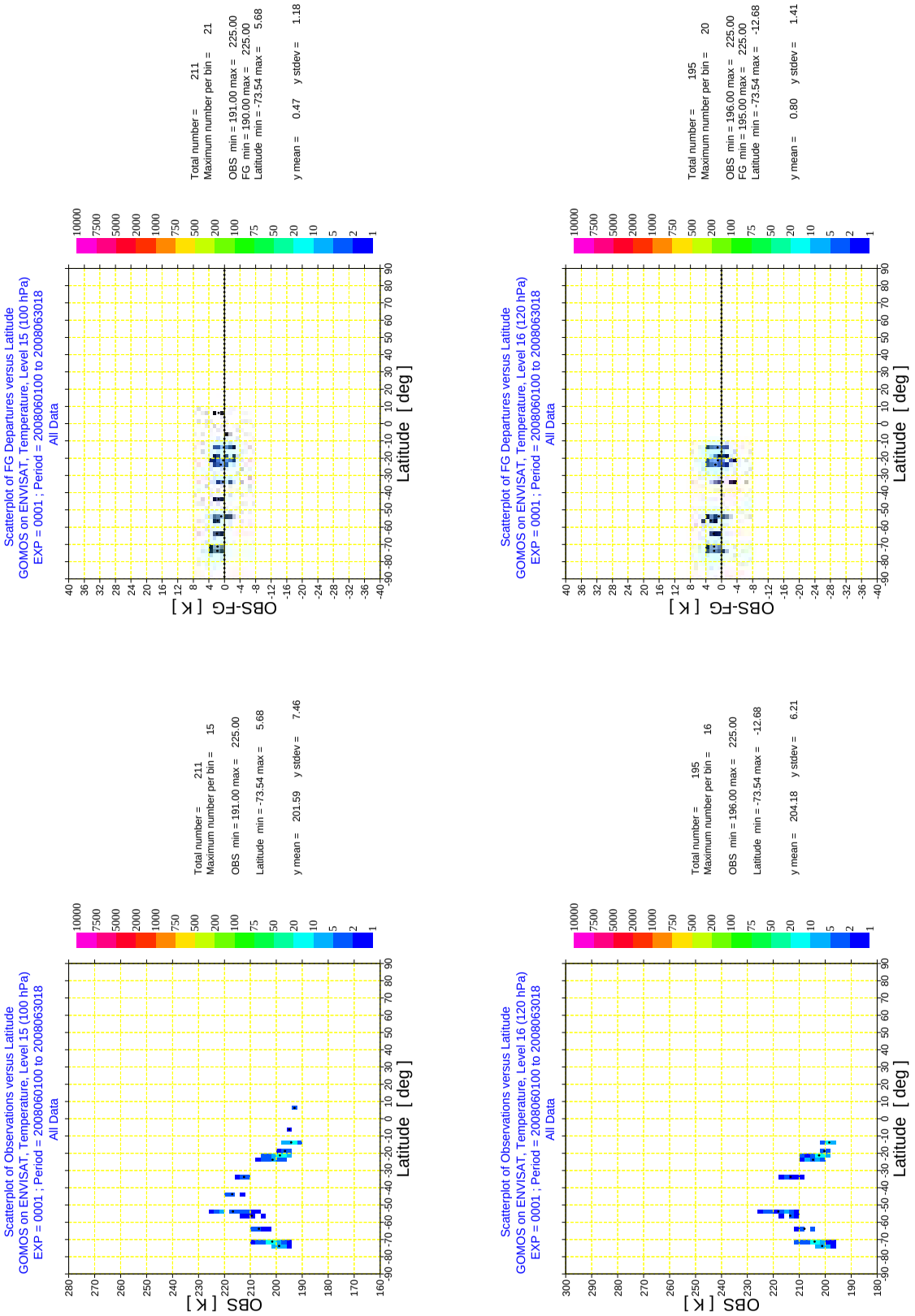



Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

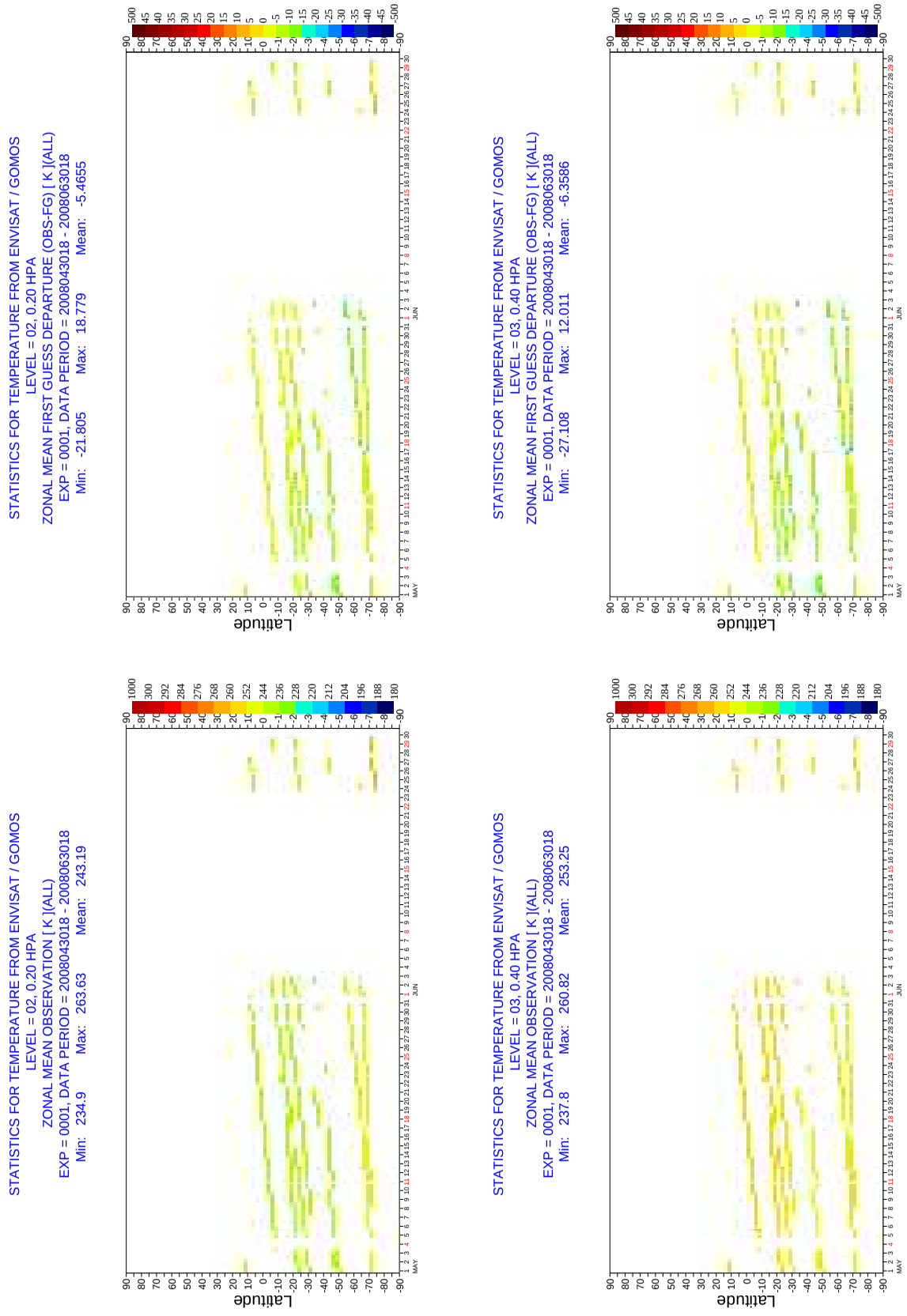



Fig. 15. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for May-June 2008.

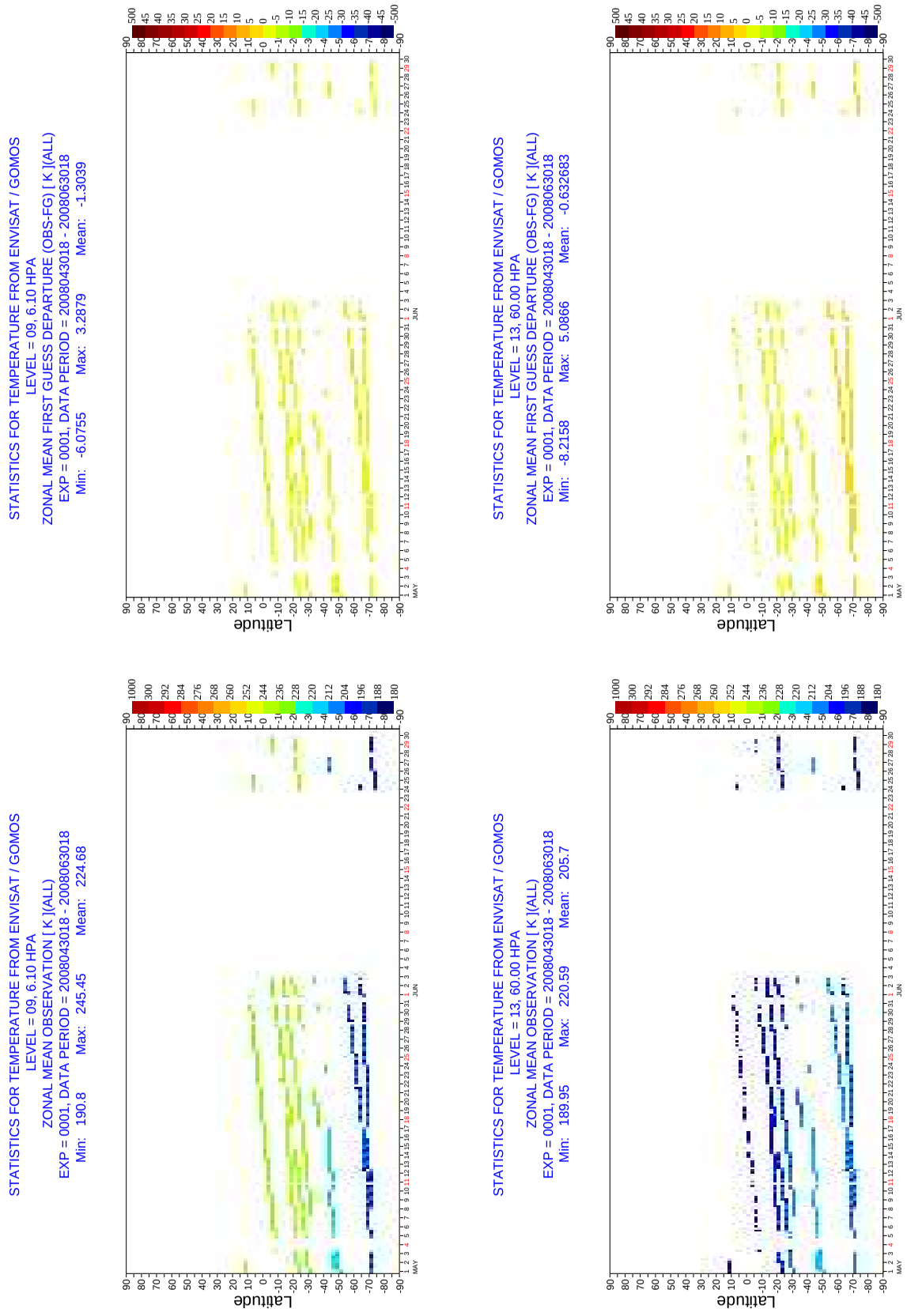



Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

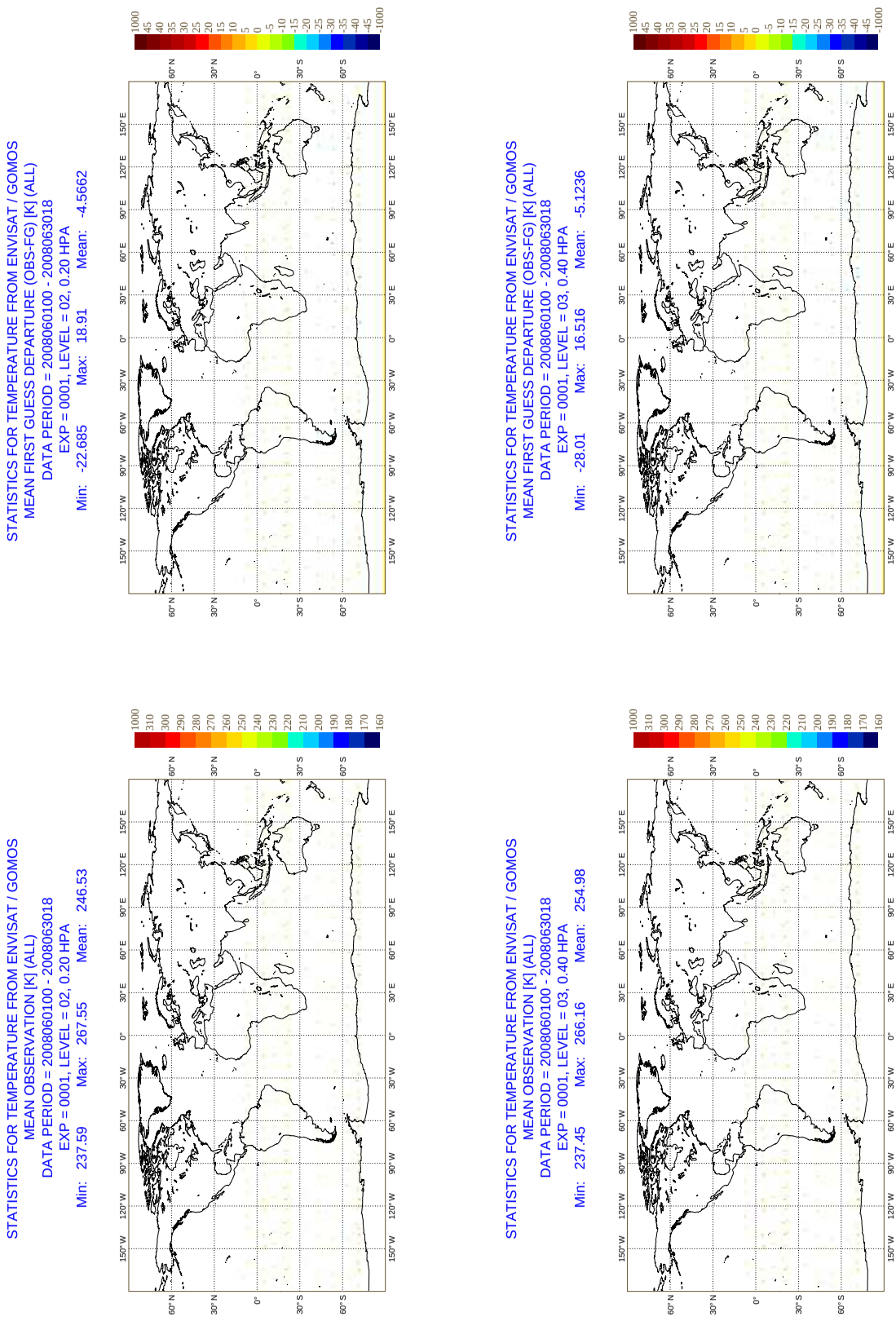



Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for June 2008.

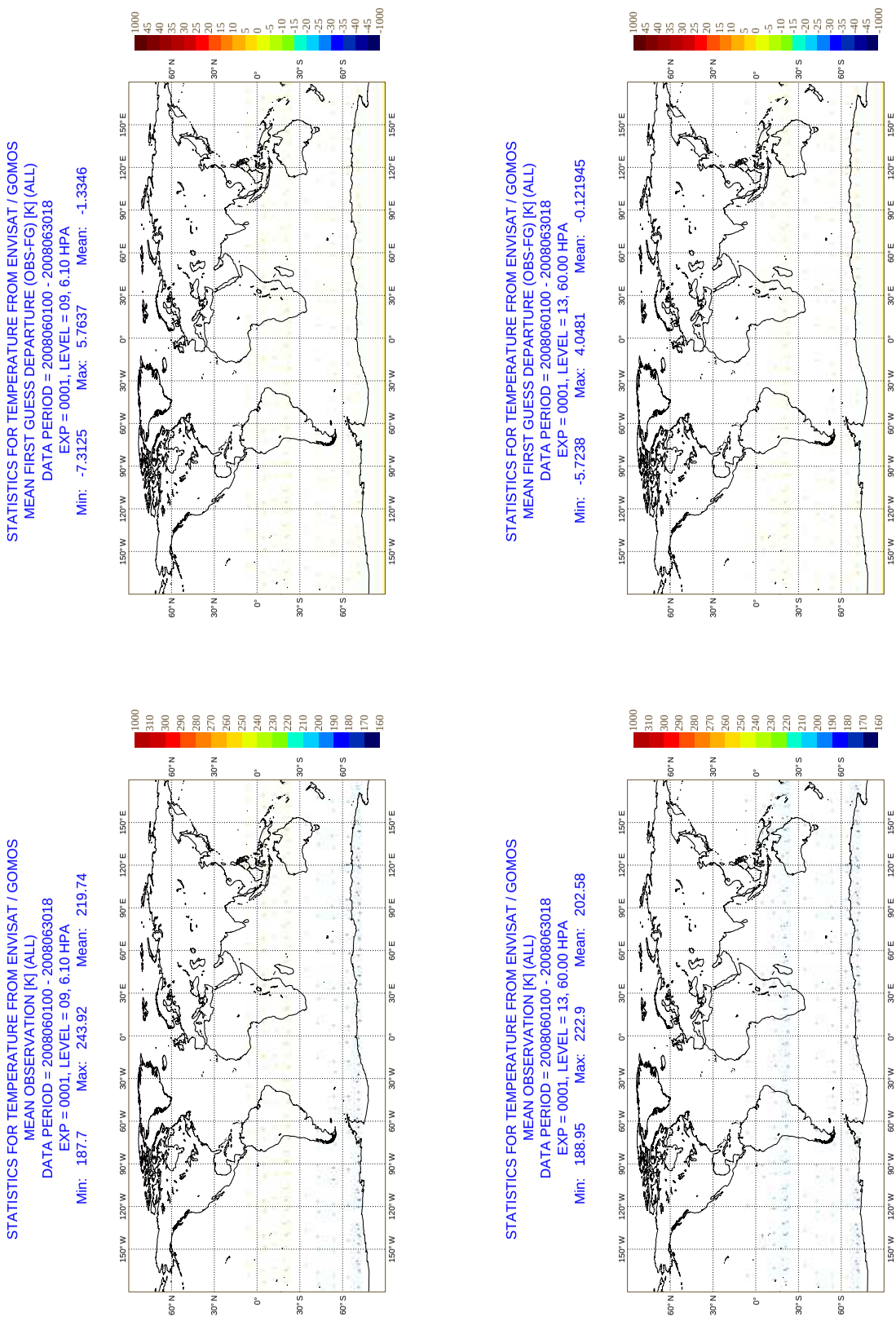



Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

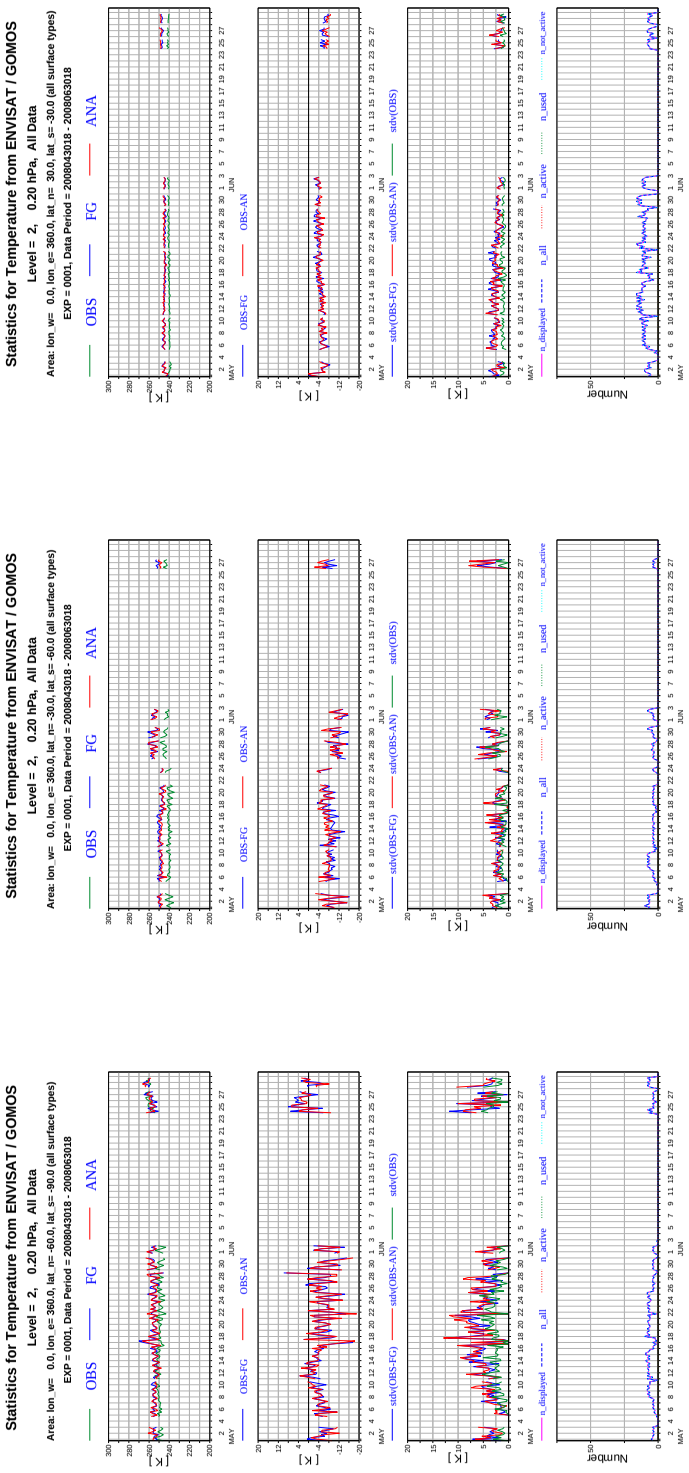



Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) 30N-30S, 30-60S, and 60-90S for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

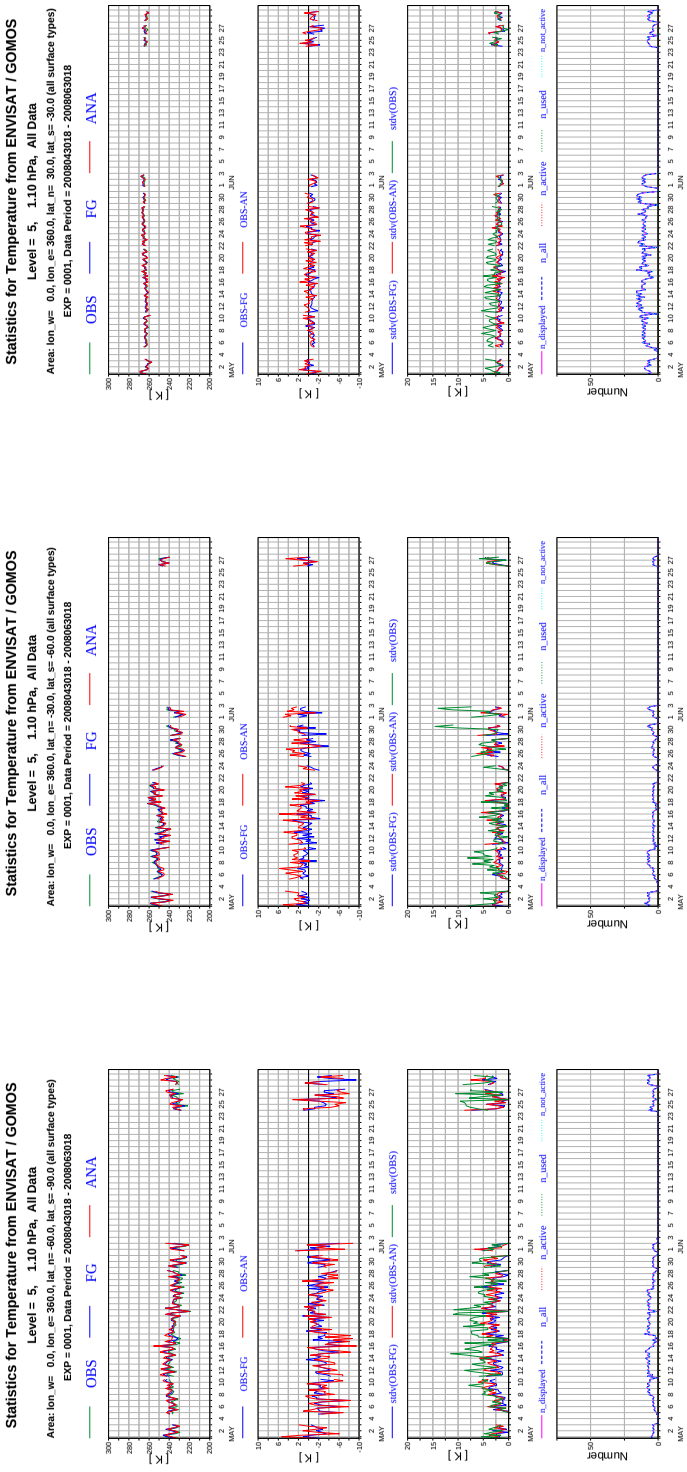



Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

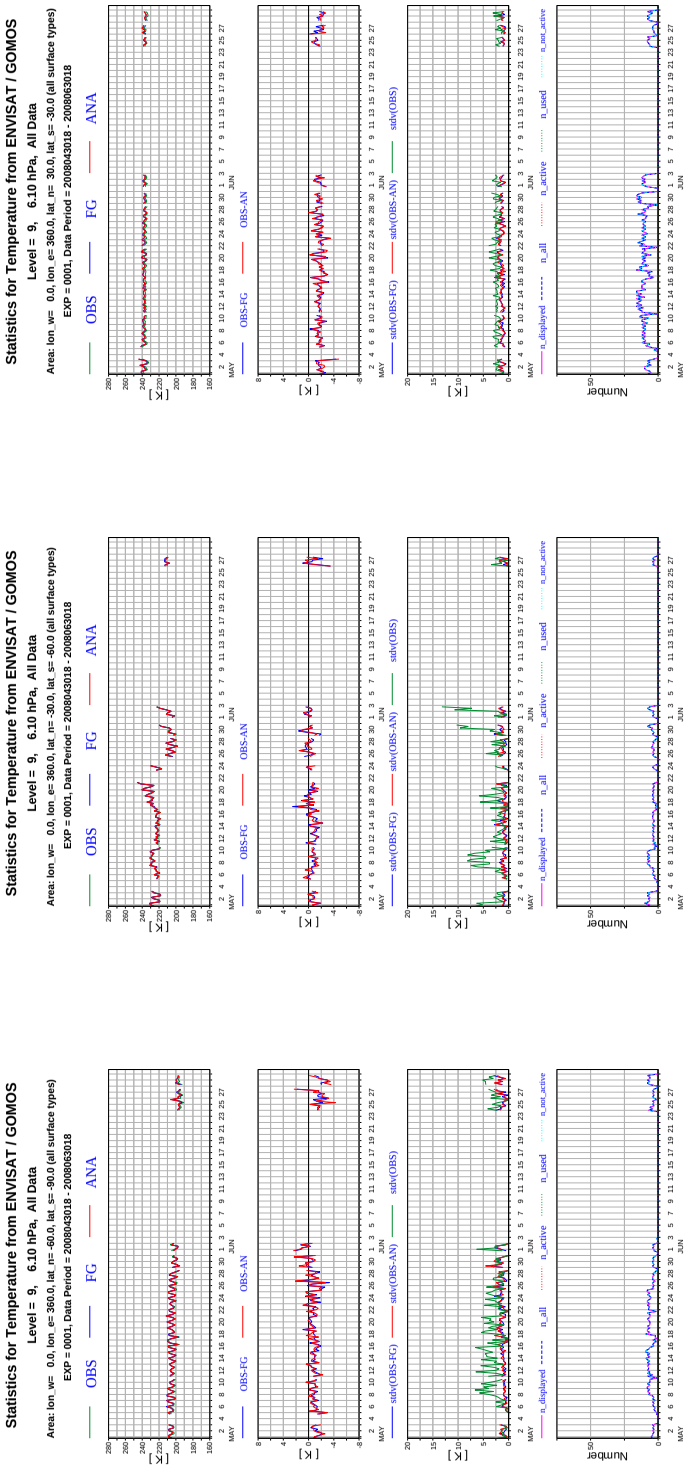



Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

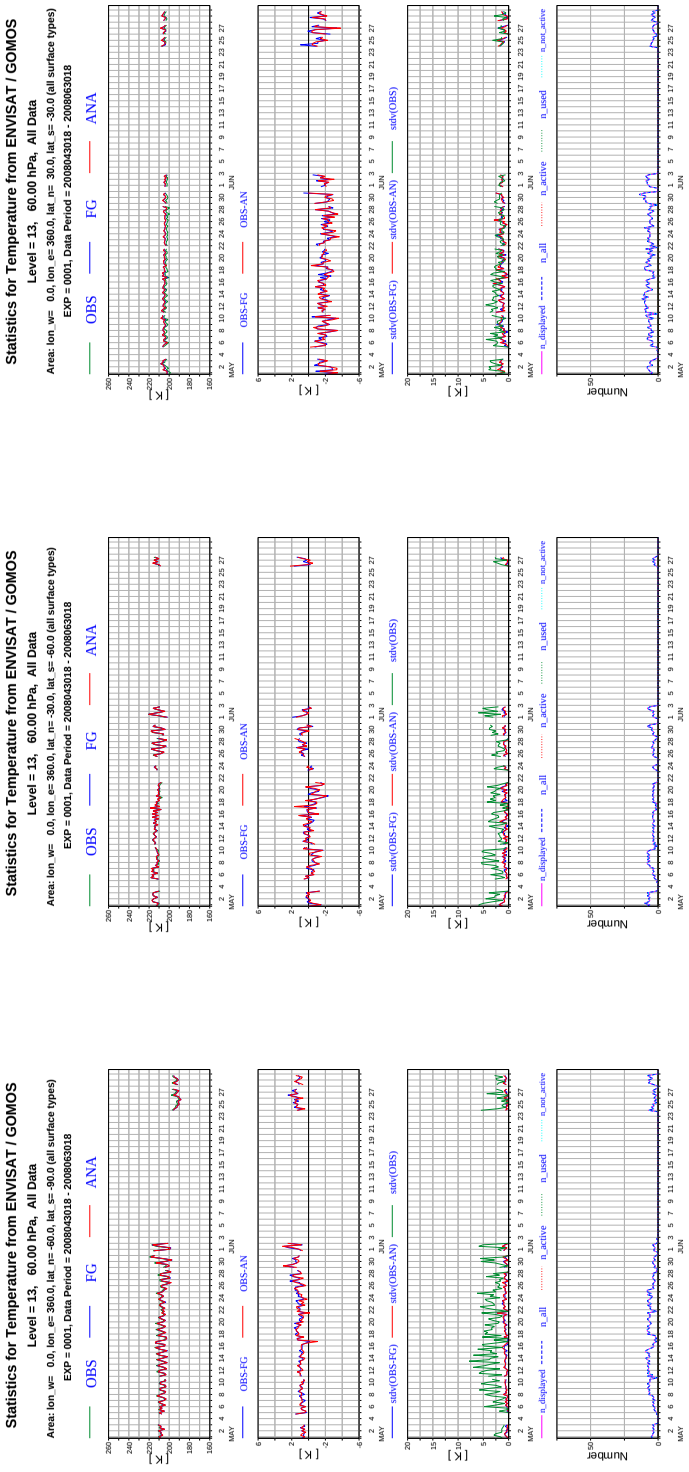



Fig. 22. As Figure 19, but for level 13 (60 hPa).

# REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR__2P) FOR JUNE 2008

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July 7, 2008

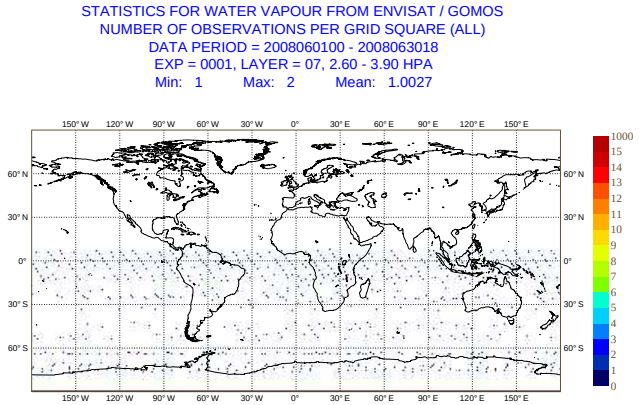


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for June 2008.

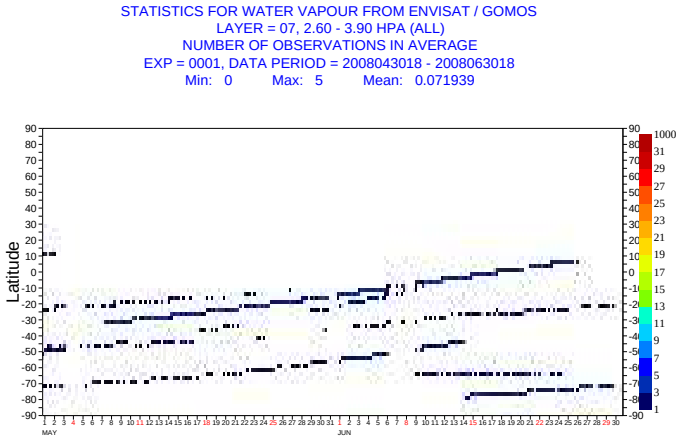


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for May-June 2008.

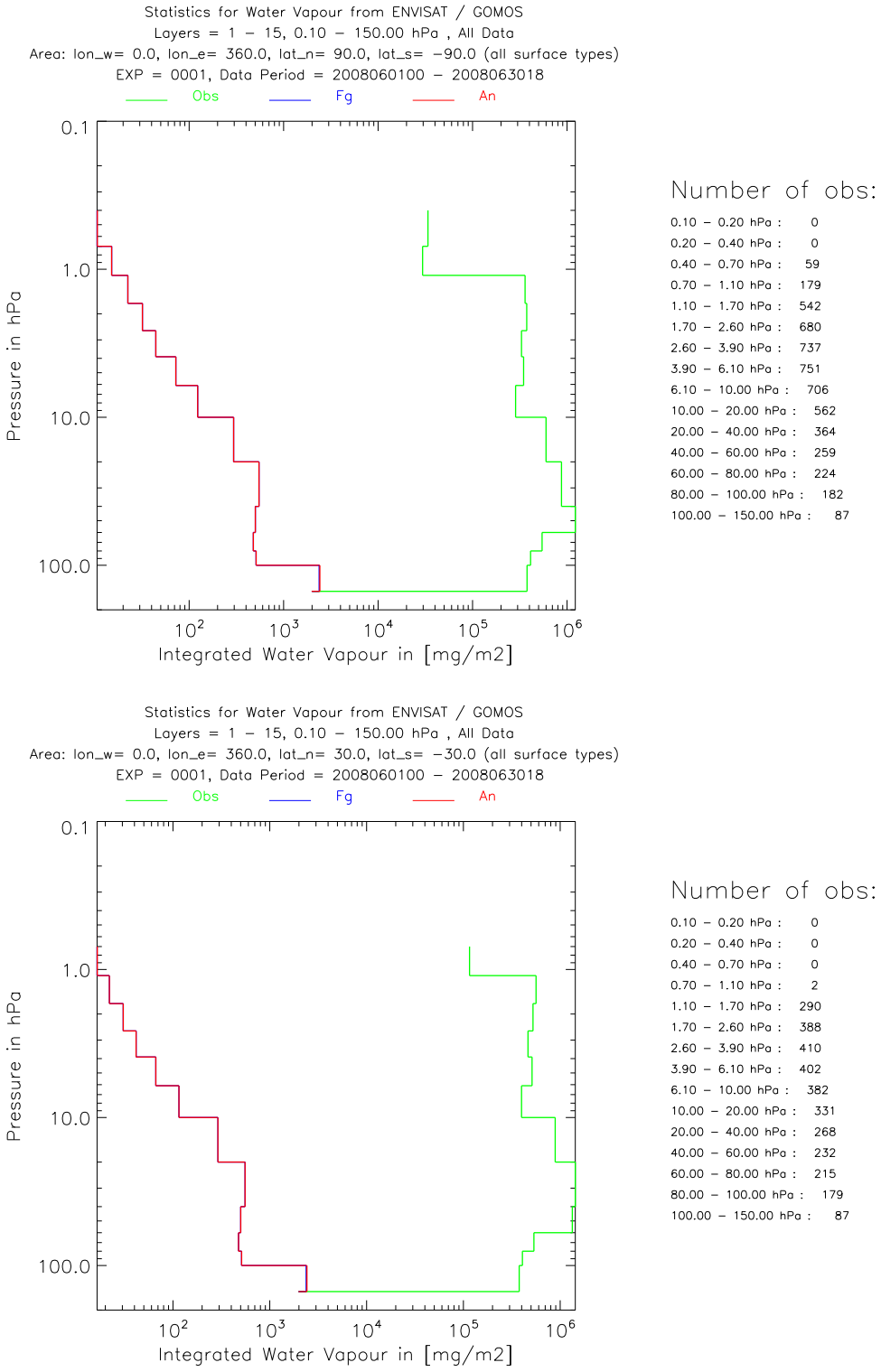


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m$^2$ for June 2008. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S)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

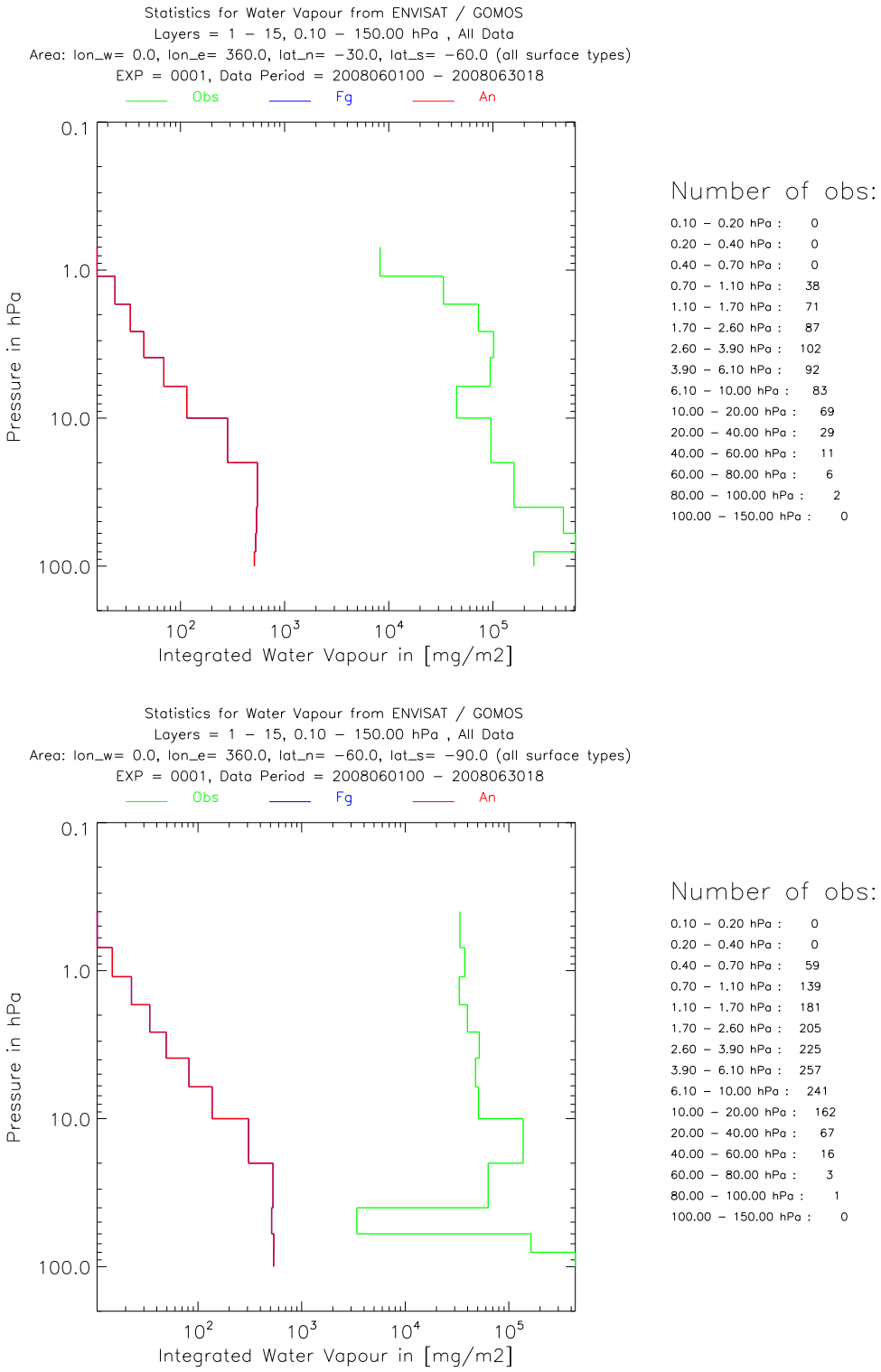


Fig. 4. As Fig. 3 but for 30-60S (top panel) and 60-90S (bottom panel).

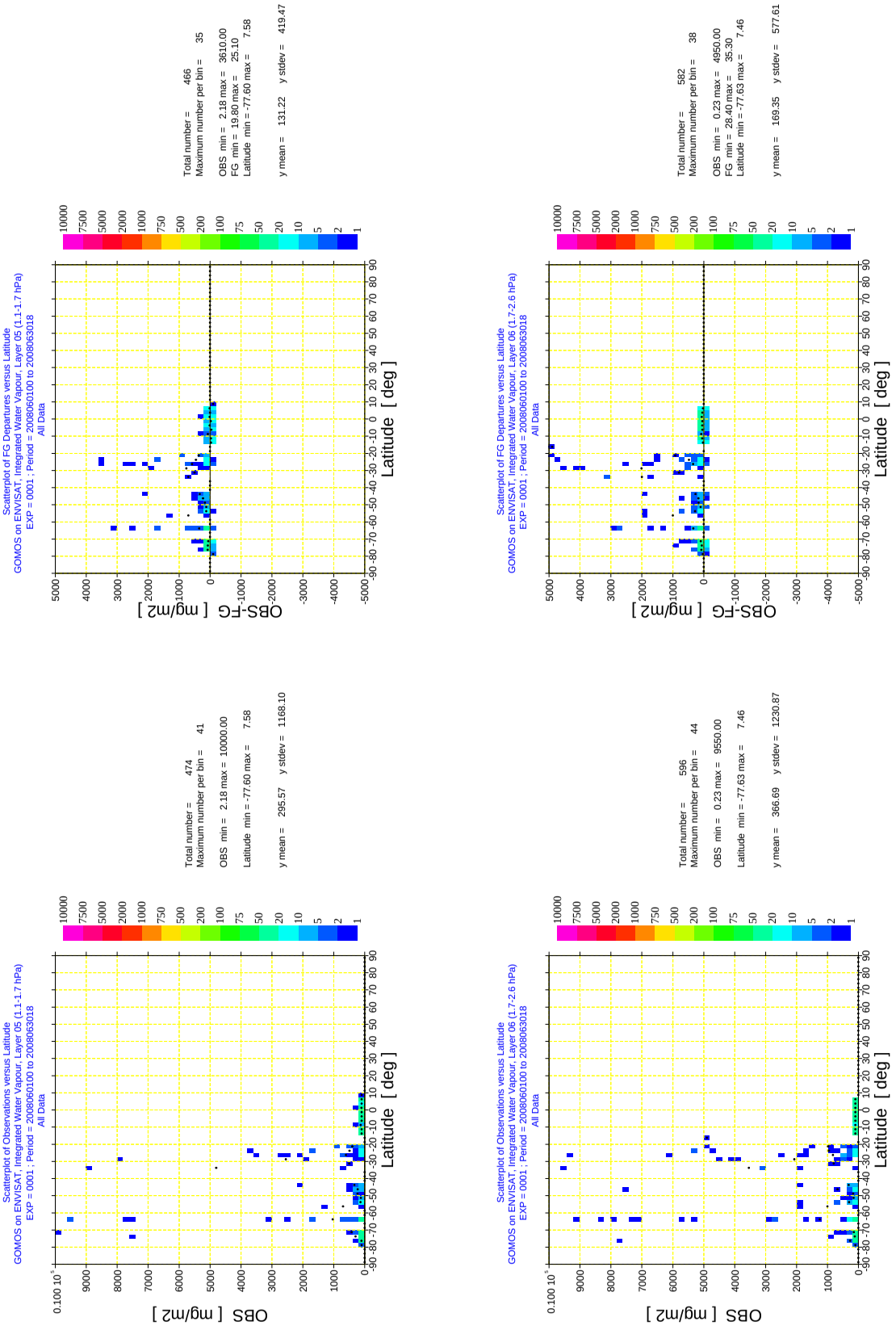


Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for June 2008 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and the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

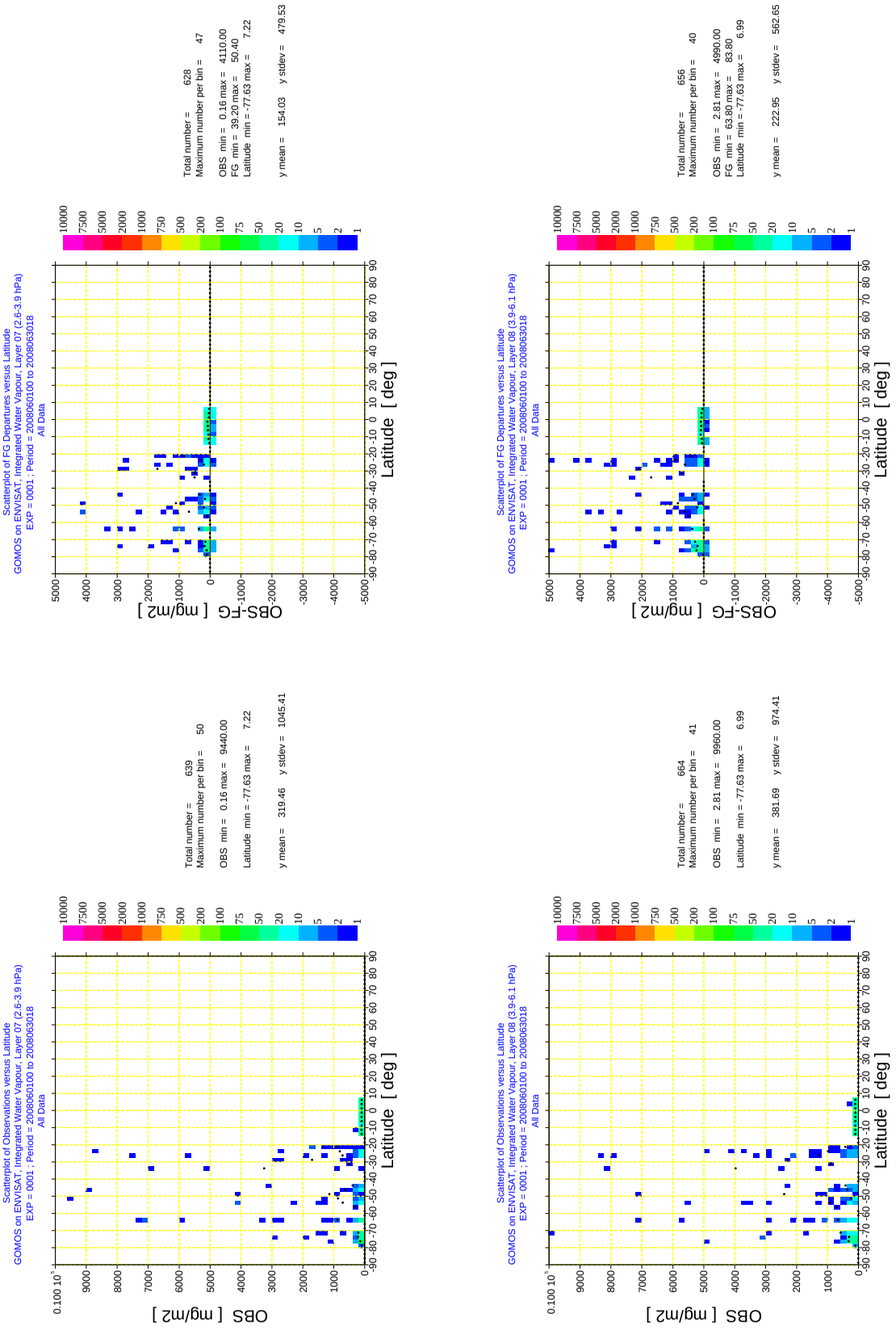


Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

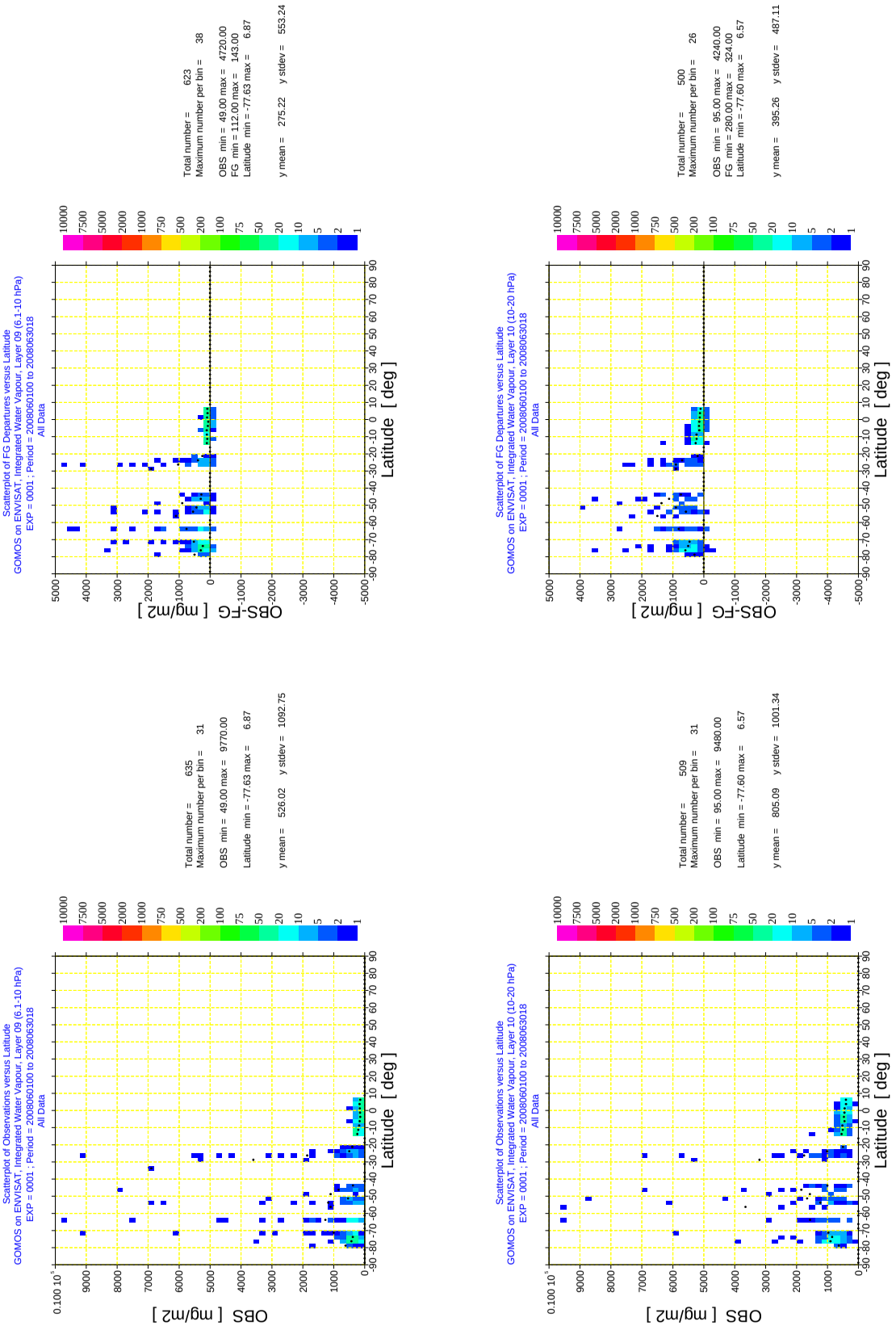


Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

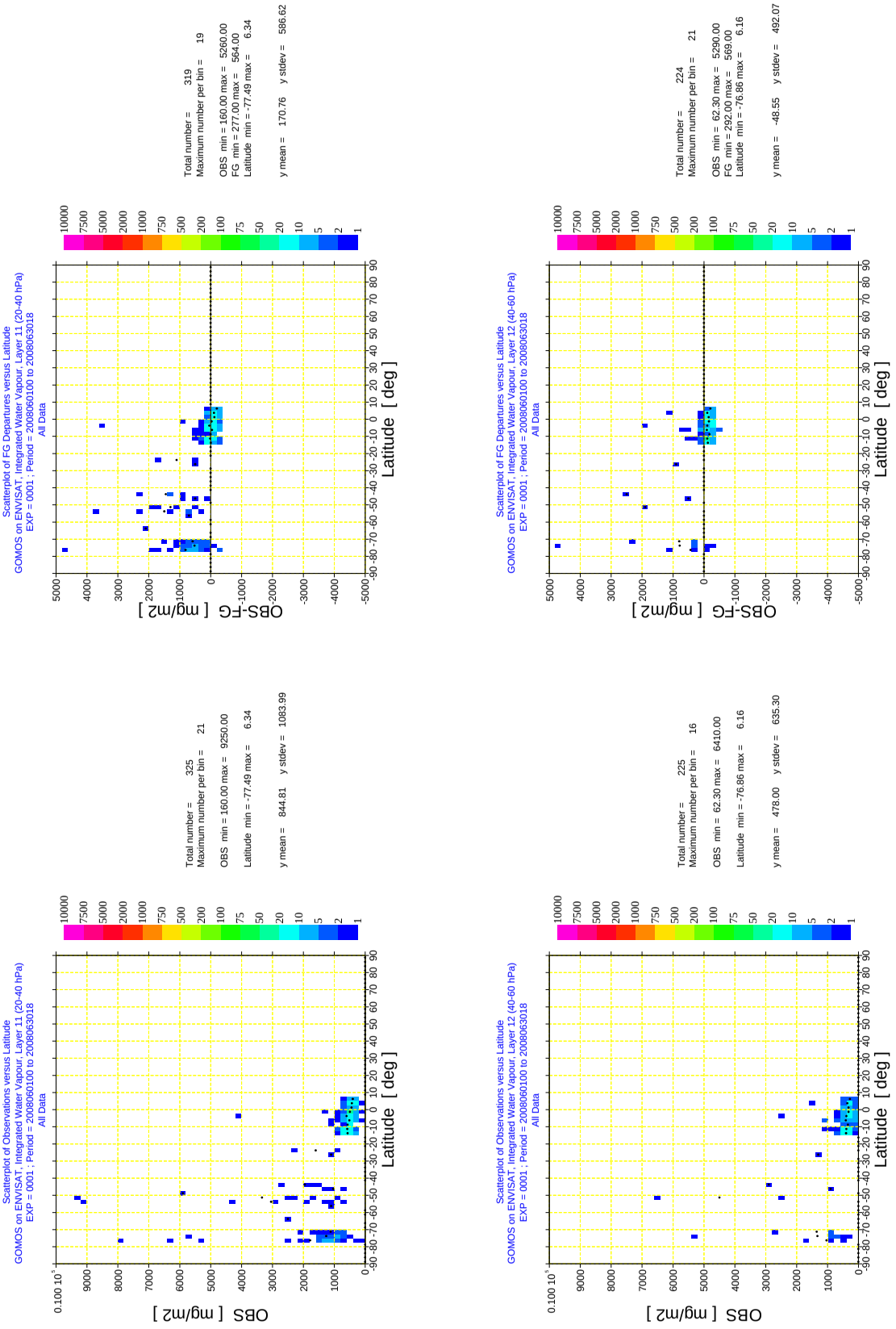


Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

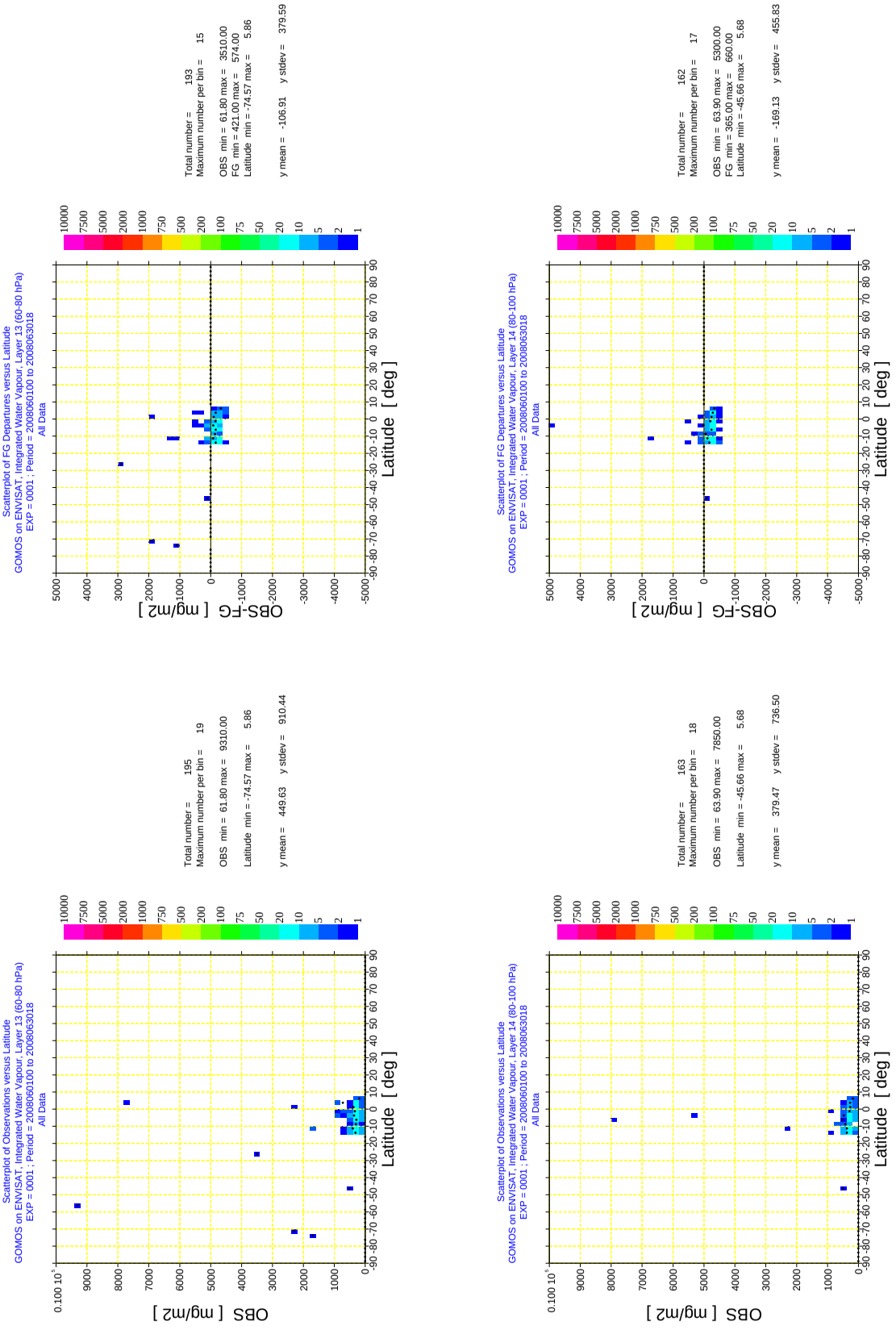


Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

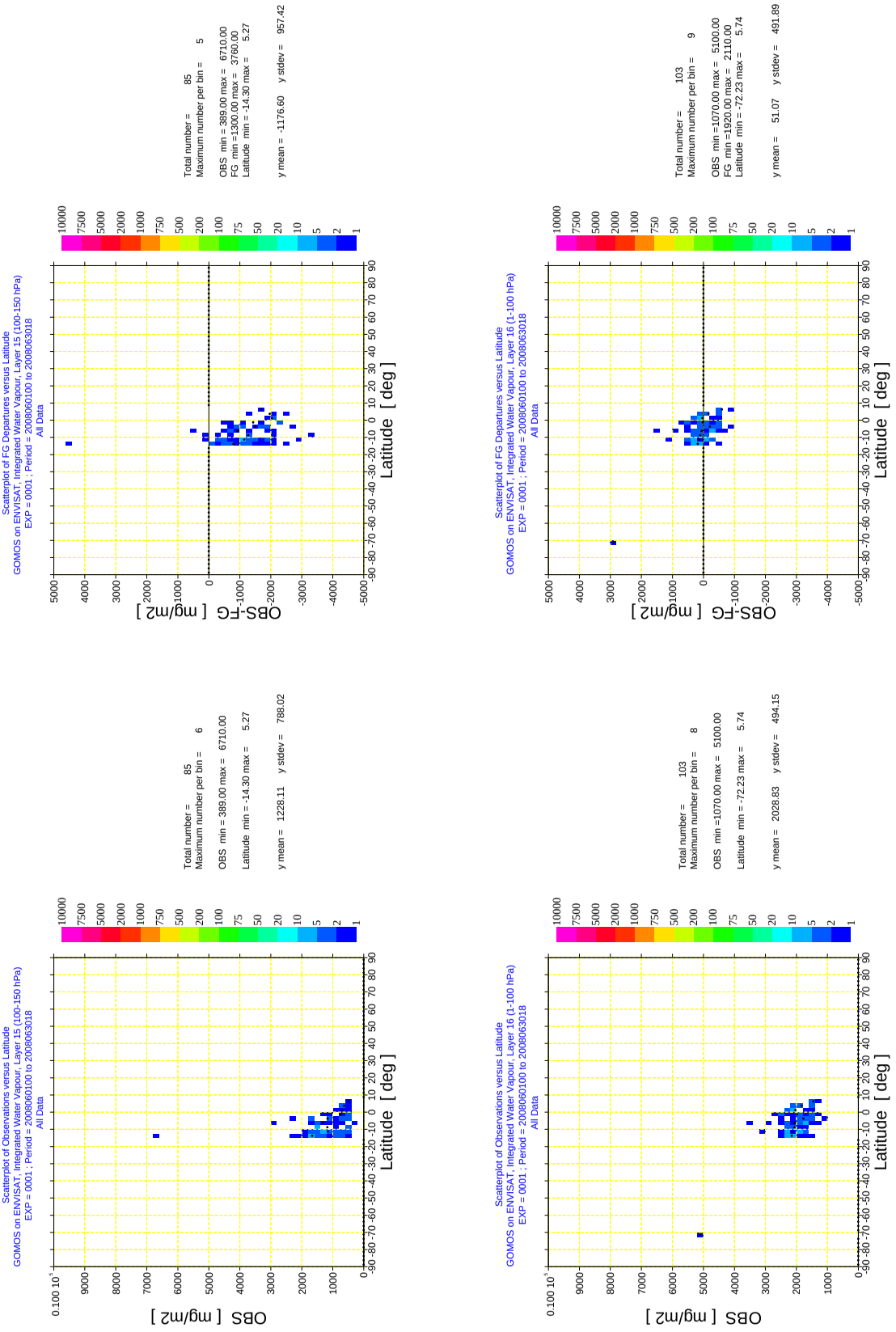


Fig. 10. As Fig. 5 but for level 15 (100-150 hPa) and level 16 (1-100 hPa).

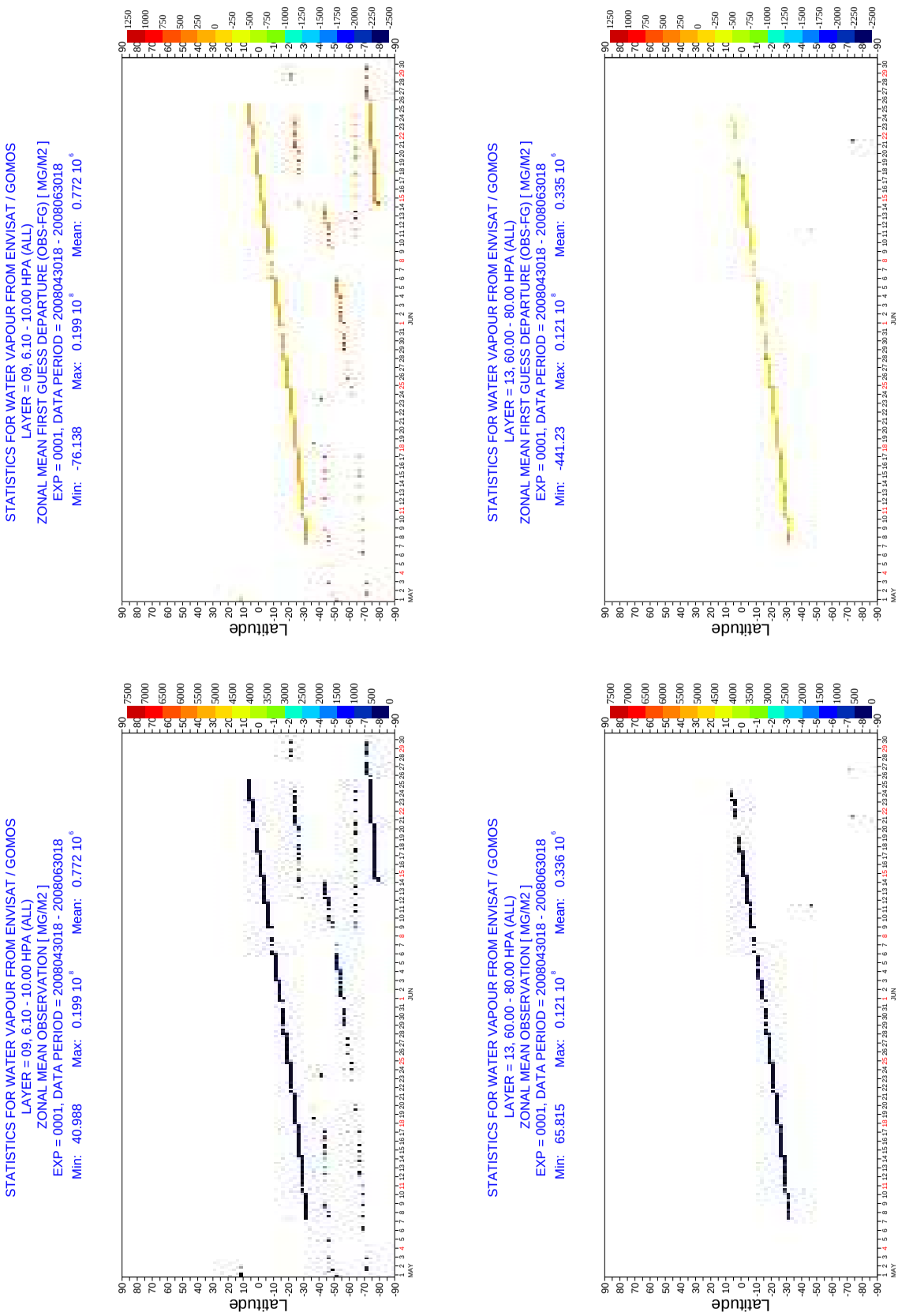


Fig. 11. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for May-June 2008.

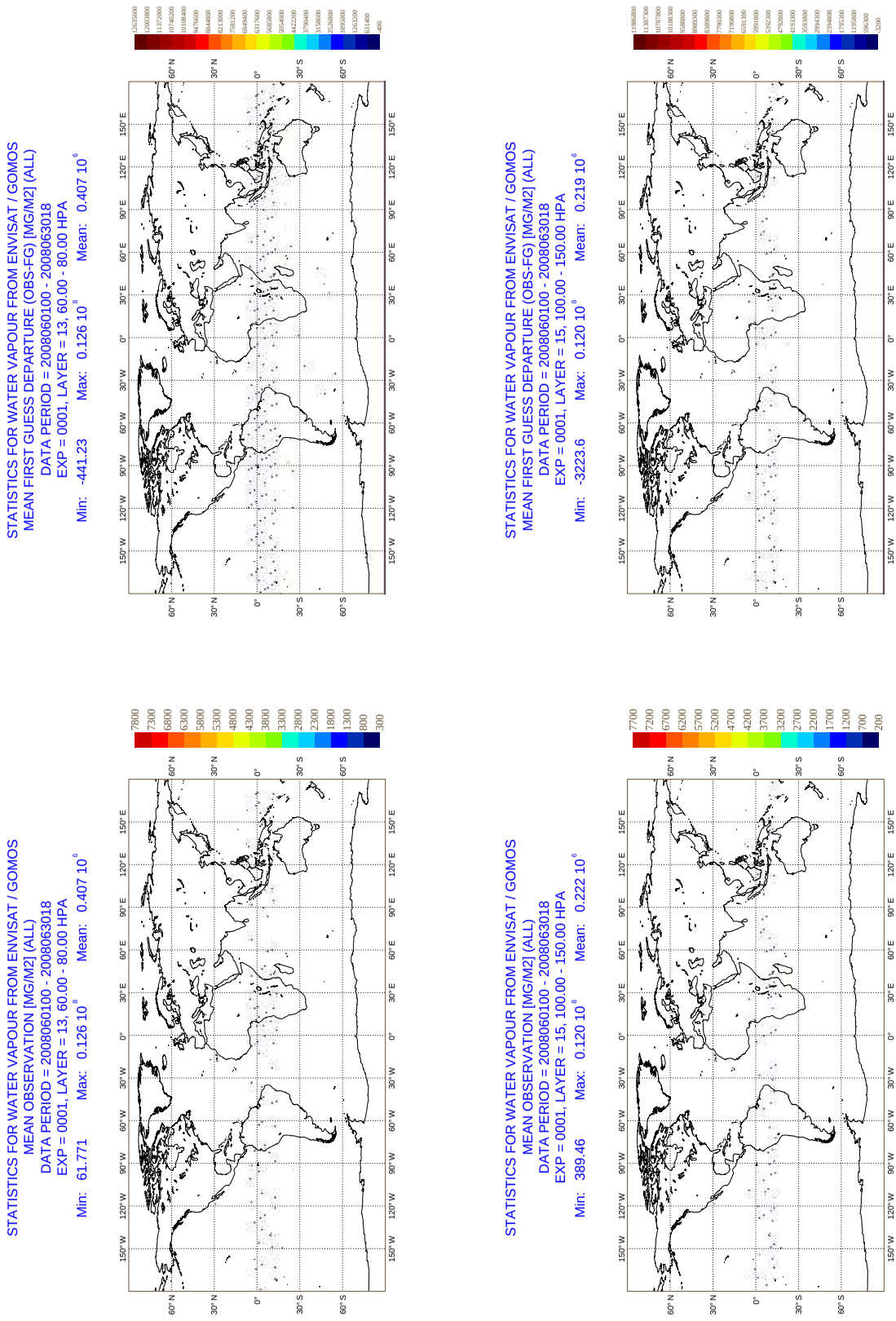


Fig. 12. Geographical distribution of mean ENVISAT GOMOS NRT water vapour data and mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for June 2008.

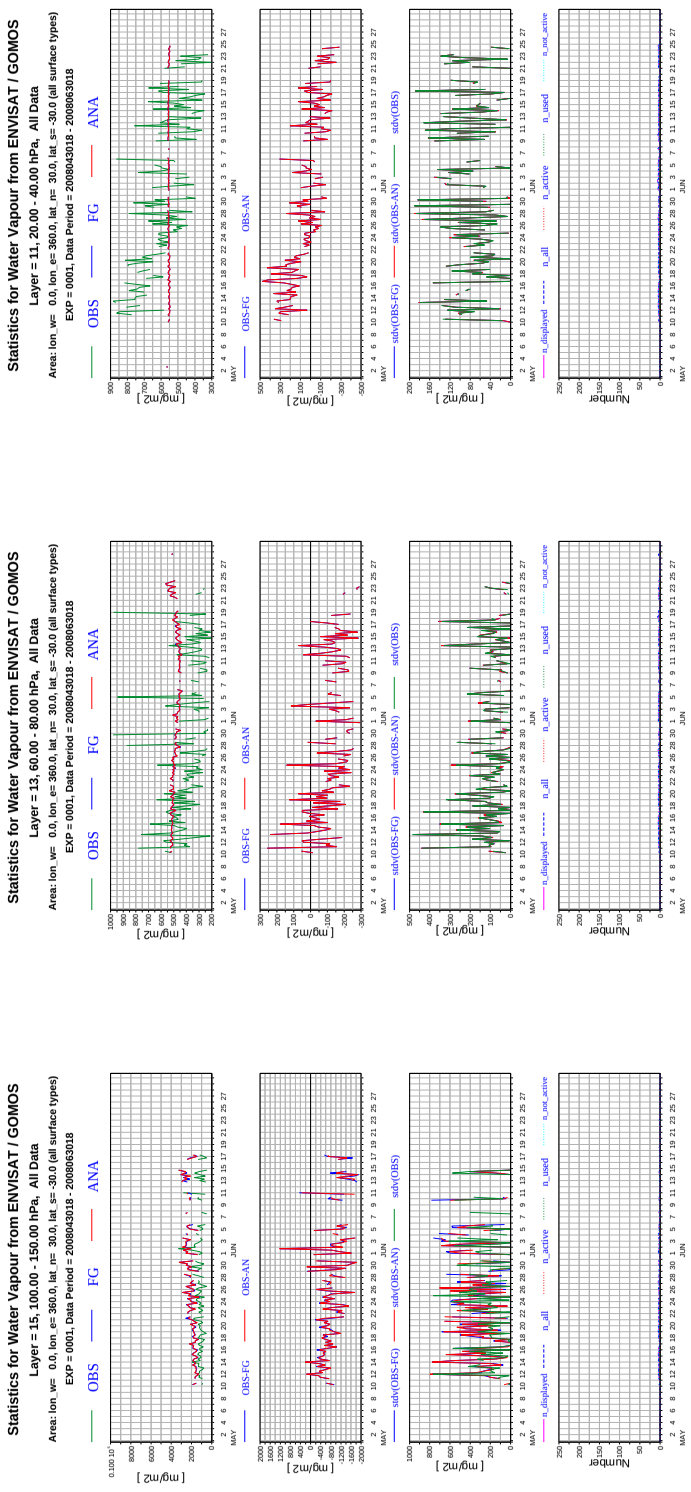


Fig. 13. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 11 (20-40 hPa), level 13 (60-80 hPa), and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