REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR__2P) FOR SEPTEMBER 2007

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October 5, 2007

1. Key points for September 2007

- There were no data in BUFR format at latitudes northern than 30N as the observations did not fulfil the dark limb illumination condition set in the new PDS2BUFR converter (see report for May 2007).
- The quality of the temperature in the GOMOS files was found stable and in good agreement with the ECMWF temperature. The monitoring statistics showed that, in the global average, the first guess and analysis departures were within -0.3 and 0.5% (-0.6 - 1 K) up to 20 hPa, and up to -1% (about -2K) in the upper Stratosphere above 20hPa. Larger first guess and analysis departures were found in the Mesosphere with differences up to -4% (-8K) between 0.4 and 0.2hPa.
- The departures between GOMOS and ECMWF ozone profiles were within -5 and +30% in the global mean in most of the Stratosphere and lower Mesosphere. Larger departures were found at the highest mesospheric levels and near 100hPa. The standard deviations of the departures were within 15 and 35% in the mid Stratosphere, but larger than 50% elsewhere.
- When averaging over latitudinal bands, GOMOS observations exhibited higher ozone values than the ECMWF ozone at most vertical levels and latitudinal bands, with departures from the ECMWF first guess and analyses between -5 and +15% in the tropics above 40 hPa, between -5 and 35% in Stratosphere at midlatitudes, and between -15 and 35% at high latitudes.
- 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 still from one to three orders of magnitude larger than those given by the model at all vertical levels and latitudinal bands. The largest differences between GOMOS WV and ECMWF WV were found in the tropical lower Stratosphere and in the upper Stratosphere at midlatitudes. In constrast, a much higher level of agreement between GOMOS WV and ECMWF WV was found at high latitudes in the SH.
- The monitoring statistics for September 2007 were produced with the operational ECMWF model, CY32R2.

2. Quality and amount of received data

Data coverage and amount of received data during September 2007 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Overall, just below 2000 (good) observations were available for both temperature and ozone, with the largest number of observations available in the mesosphere and upper stratosphere, and only a fraction of them were available in the lower stratosphere (see figure 3 in the

attached temperature and ozone reports). For what concerning the water vapour, up to 850 observations were available in the period under consideration, with the largest number in the stratosphere (see figure 3 in the attached water vapour report). There were no data in the BUFR files at latitudes northen than 30N for the period under consideration, as they did not fulfil the selection criterion of the dark illumination condition set in the PDS2BUFR converter.

3. GOMOS temperature data

The global mean profile plot (temperature report: Figure 3) in September showed that the temperature in the GOMOS BUFR files was on average colder than the operational ECMWF temperature at all vertical levels, with the only exception of the 120hPa level. In the global average, the first guess and analysis departures were within -0.3 and 0.5% (-0.6 - 1 K) up to 20 hPa, and up to -1% (about -2K) in the upper Stratosphere above 20hPa. Larger first guess and analysis departures were found in the Mesosphere with the largest difference of -4% (-8K) between 0.4 and 0.2 hPa. The standard deviations of the departures were typically 1% in most of the Stratosphere, and up to 2% in the Mesosphere.

As reported in August, in the tropical Stratosphere the first guess and analysis departures were just below -1%, but larger differences up to -3% were found in the Mesosphere, where the mean first guess and analysis no longer were within the observation one-standard deviation range. At midlatitudes in the SH, negative departures up to -0.6K were found in the lower Stratosphere (up to 20-25hPa), and up to -2K were found between 20 and 4 hPa. Larger departures up to -5% were found in the Mesosphere. At high latitudes in the SH, a positive bias (up to 2K) was found in the lower Stratosphere (up to 20hPa), negative bias up to -2% (about -4K) was seen in the rest of the Stratosphere with the largest values between 10 and 3 hPa. Larger biases were found 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. As already noted above, larger departures were seen in the Mesosphere with differences of even 30K between single measurements and their model equivalent.

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) showed that both the ozone first guess and analyses were within the observation one-standard deviation range at all latitudinal bands. In the global average, the first-guess departures were within -5 and +30% in most of the stratosphere and lower mesosphere. Larger departures were found at the highest mesospheric levels and near 100hPa. The standard deviations of the departures are within 15 and 30% in the mid Stratosphere, but larger than 50% elsewhere.

When averaged over latitudinal bands, the level of agreement between GOMOS ozone observations and the ECMWF ozone fields found in the global mean was generally confirmed. In the tropics, the GOMOS observations exhibit higher ozone values at most vertical levels, with departures from the ECMWF first guess and analyses between -5 and +15%. Larger biases were seen in the tropical lower Stratopshere up to 40 hPa. The standard deviations of the analysis and first guess departures were within 5 and 25% in the Stratosphere above 40 hPa and lower Mesosphere, and larger than 50% elsewhere. At midlatitudes in the SH, the departures were typically positive, and larger than 10%, except between 6 and 40 hPa, where they were about -5%. The

standard deviation of the departures were between 10 and 40% at most vertical levels in the Stratosphere, and larger than 50% in the Mesosphere. At high latitudes in the SH, the departures between observations and model ozone were between -15 and 30% at all vertical layers in the Stratosphere and Mesosphere. The standard deviations of the first guess and analysis departures were found larger than 10% at all vertical levels, larger than 50% near the stratopause and in the Mesosphere.

The scatter plots (ozone report: Figures 7-14) are consistent with the results presented in the August 2007 report, and confirmed the above analysis.

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. The time series still show a drift of the observations that move apart from the first-guess and the analyses in the tropical stratosphere during the period under consideration.

5. Water vapour data

As it was found in August, also in September the level of agreement between the GOMOS water vapour and the ECMWF water vapour first guess and analyses remained quite poor.

The profile plots (Water Vapour report: Figures 3-4) showed that the GOMOS water vapour values were from one to three orders of magnitude larger than those given by the model at all vertical levels in the global average. One to three orders of magnitude difference were found in the tropics and at midlatitudes. The largest differences between model and observations were found in the tropical lower Stratosphere and at mid latitudes in the upper Stratosphere. In the first case (tropics), the GOMOS WV content was on average about $3kg/m^2$ (between 20 and 40 hPa) as opposite to $0.6g/m^2$ given by the model; in the second case (midlatitudes), the GOMOS WV content wass on average about $40g/m^2$ (between 4 and 6 hPa) as opposite to about $70mg/m^2$ given by the model. In contrast, a much higher level of agreement between ECMWF WV and the GOMOS observations was found at high latitudes in the SH.

The scatter plots (water vapour report: Figures 5-10) also showed large scatter in the GOMOS water vapour data at all vertical levels and midlatitudes, and as a consequence of that they also showed large scatter in the first guess departures.

The Hovmoeller plots and the timeseries of GOMOS water vapour and departures at several levels are presented in Figures 11, and 13-15 of the water vapour report, respectively. Because of the very large difference between the ECMWF WV and the GOMOS WV, almost no signal was detected in the time series at stratospheric levels especially in the tropics.

As already noted in the previous reports, the number of observations at some levels and latitudinal bands is sometimes too low to be statistically significant.

6. Corrigendum

The section *Water vapour data* in the August 2007 report stated:

We also note that at mid latitudes the GOMOS WV content increases with height in the Stratosphere, with values of about 100kg/m^2 just below the stratopause.

The correct statement is:

We also note that at mid latitudes the GOMOS WV content increases with height in the Stratosphere, with values of about 1kg/m^2 just below the stratopause.

7. Remarks

This monitoring report was produced with the operational ECMWF model (CY32R2). Ozone layers from SBUV/2 on NOAA-16 and SCIAMACHY total column ozone data produced by KNMI 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 SEPTEMBER 2007

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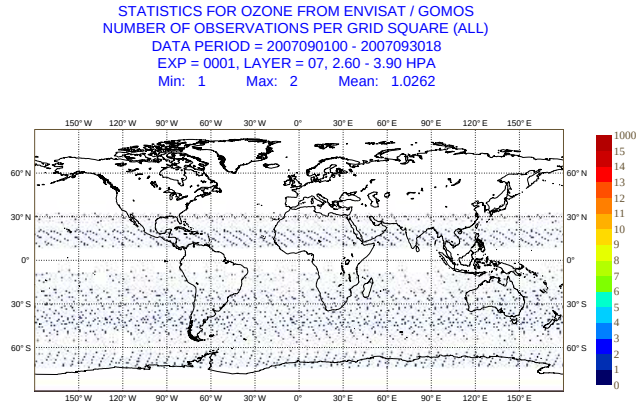


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for September 2007.

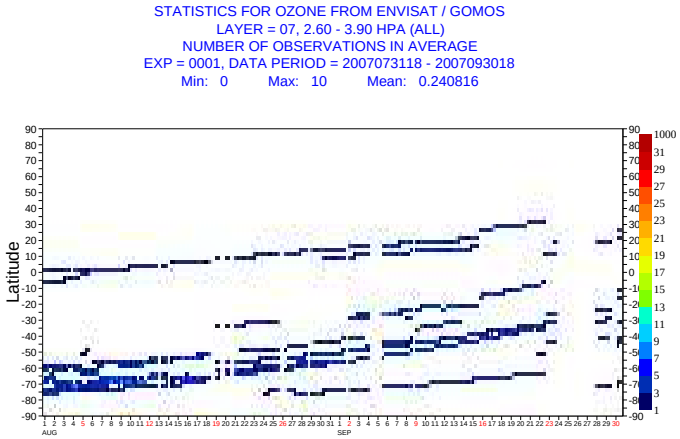


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for August-September 2007.

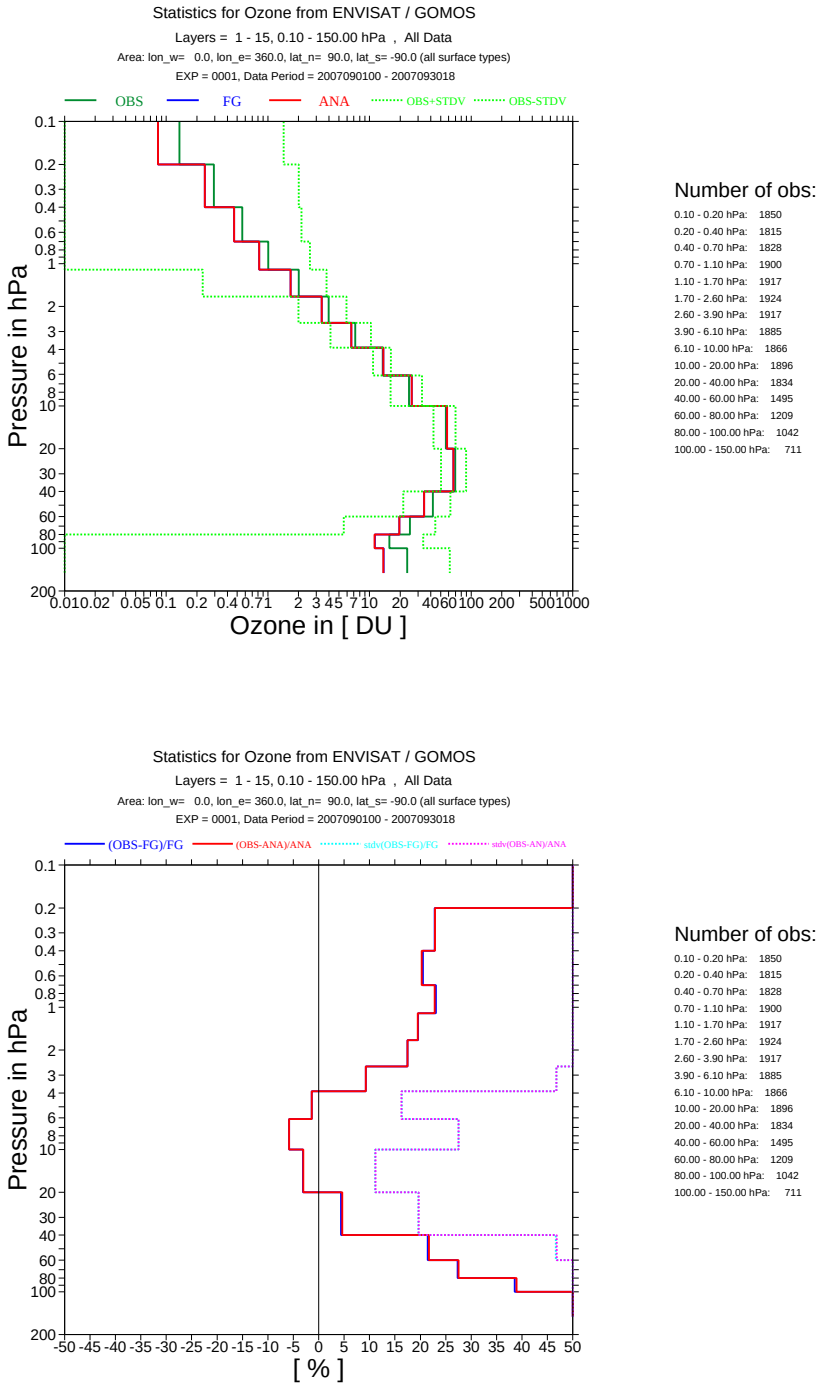
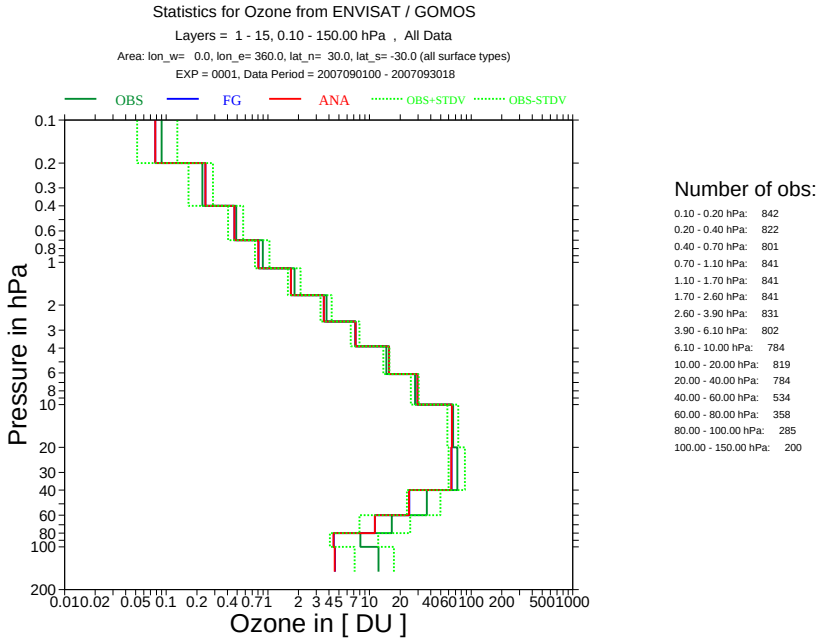


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for September 2007 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) +/- 1 standard deviation (green dotted lines). The 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.



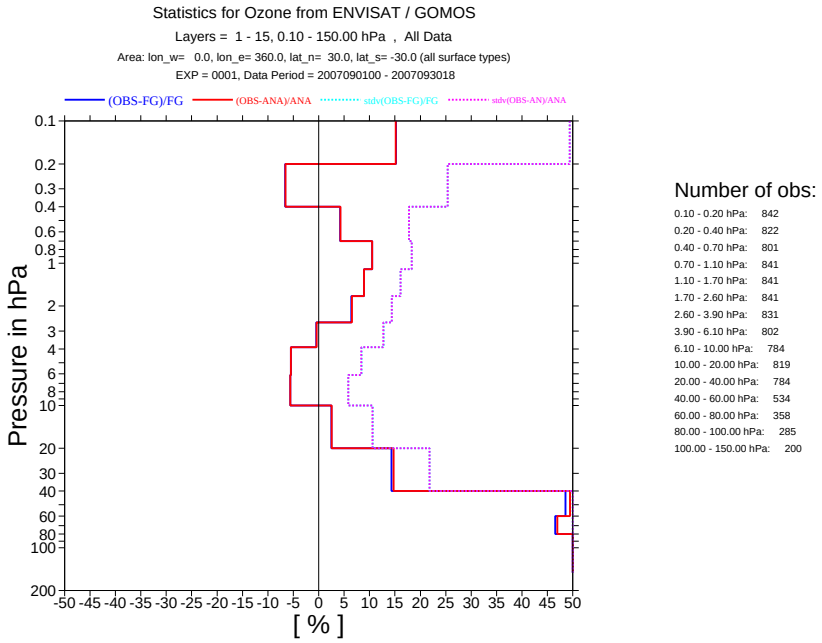
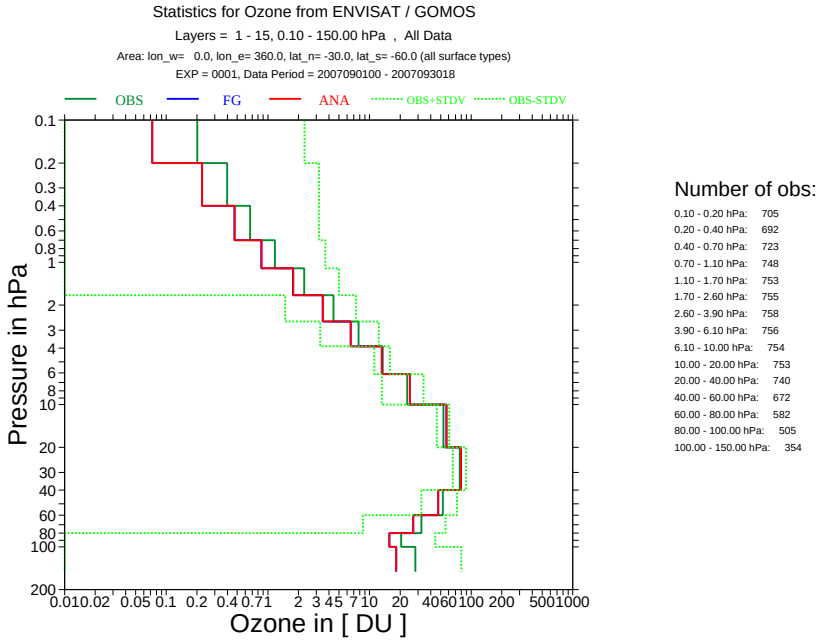


Fig. 4. As Fig. 3 but for 30N-30S.



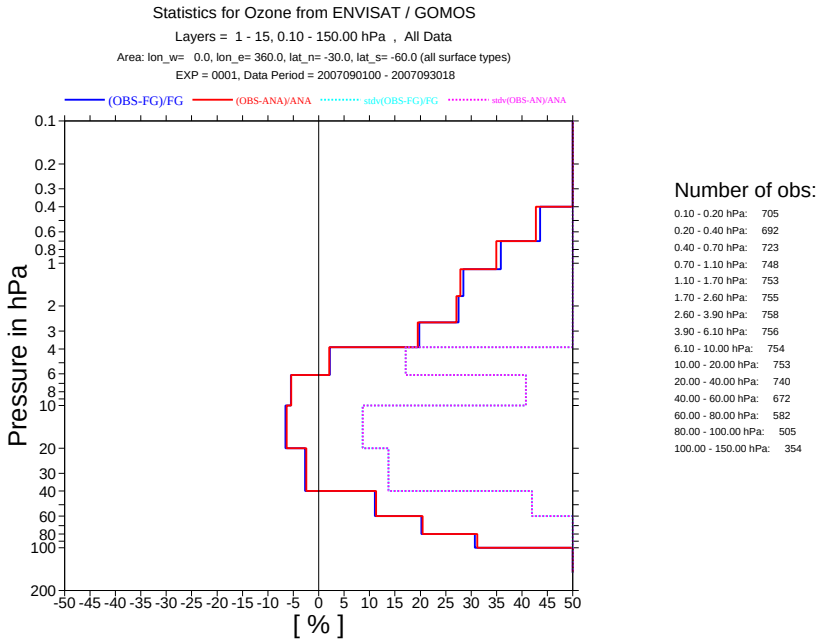
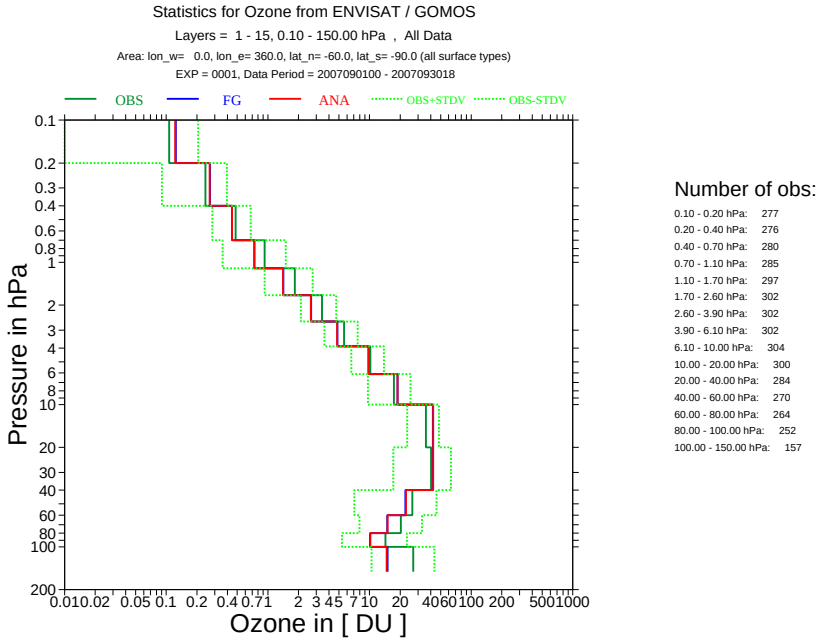


Fig. 5. As Fig. 3 but for 30S-60S.



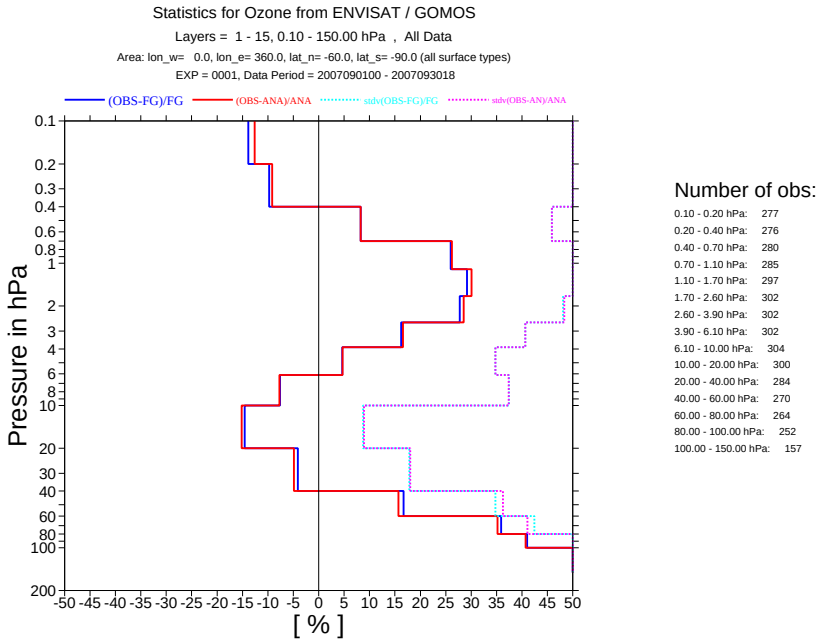


Fig. 6. As Fig. 3 but for 60-90S.

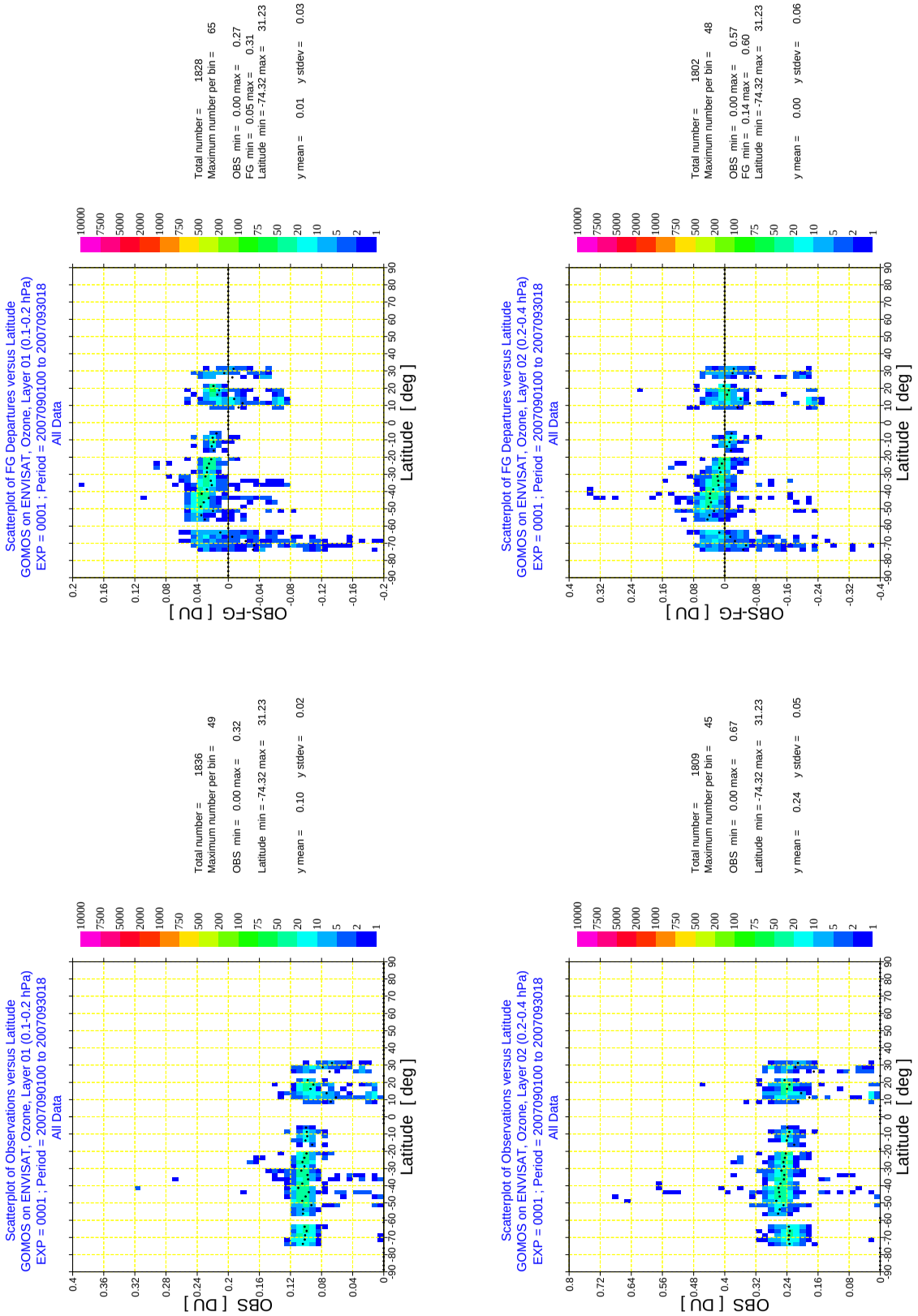


Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-uess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for September 2007 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black dots the mean value per bin.

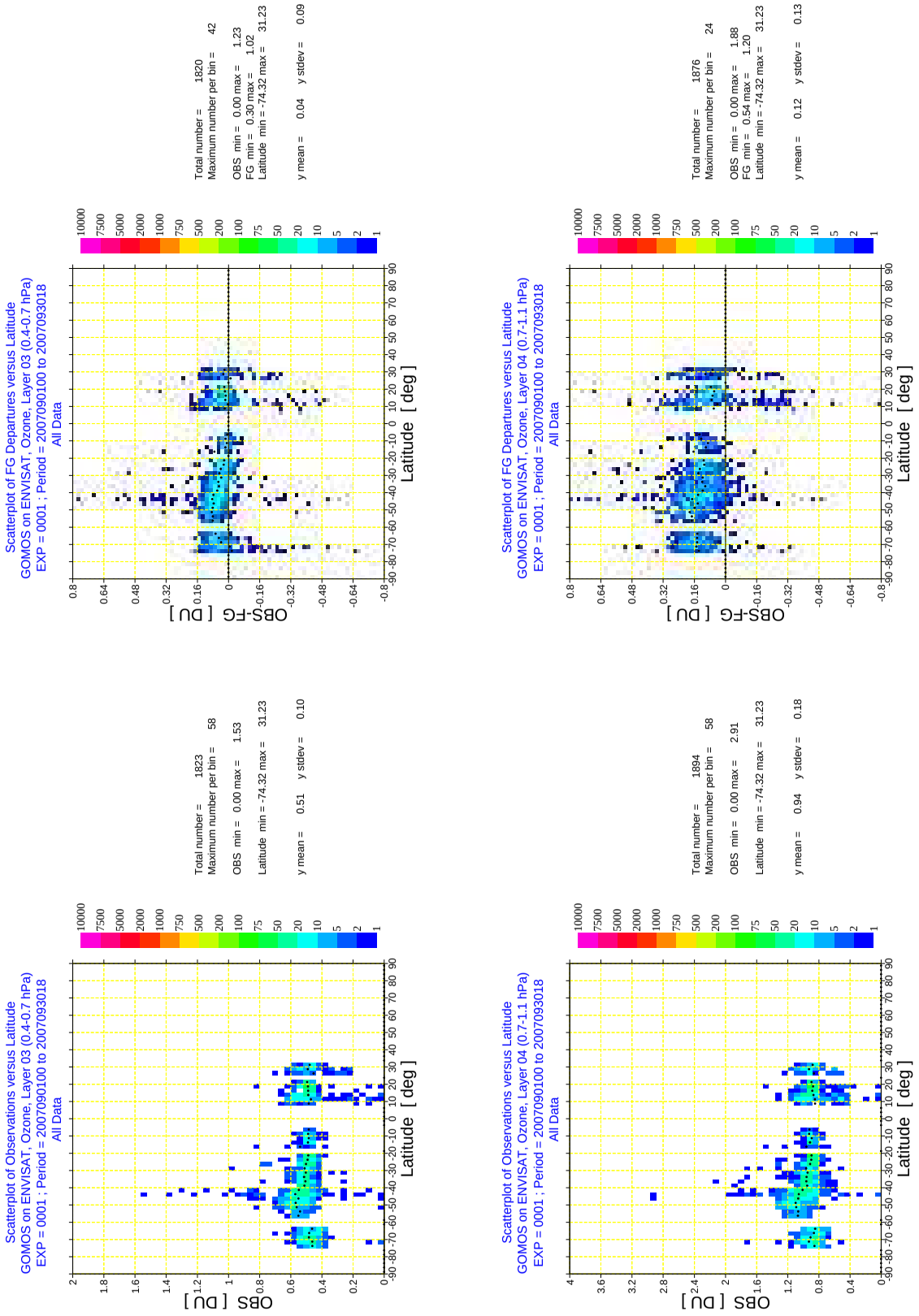


Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

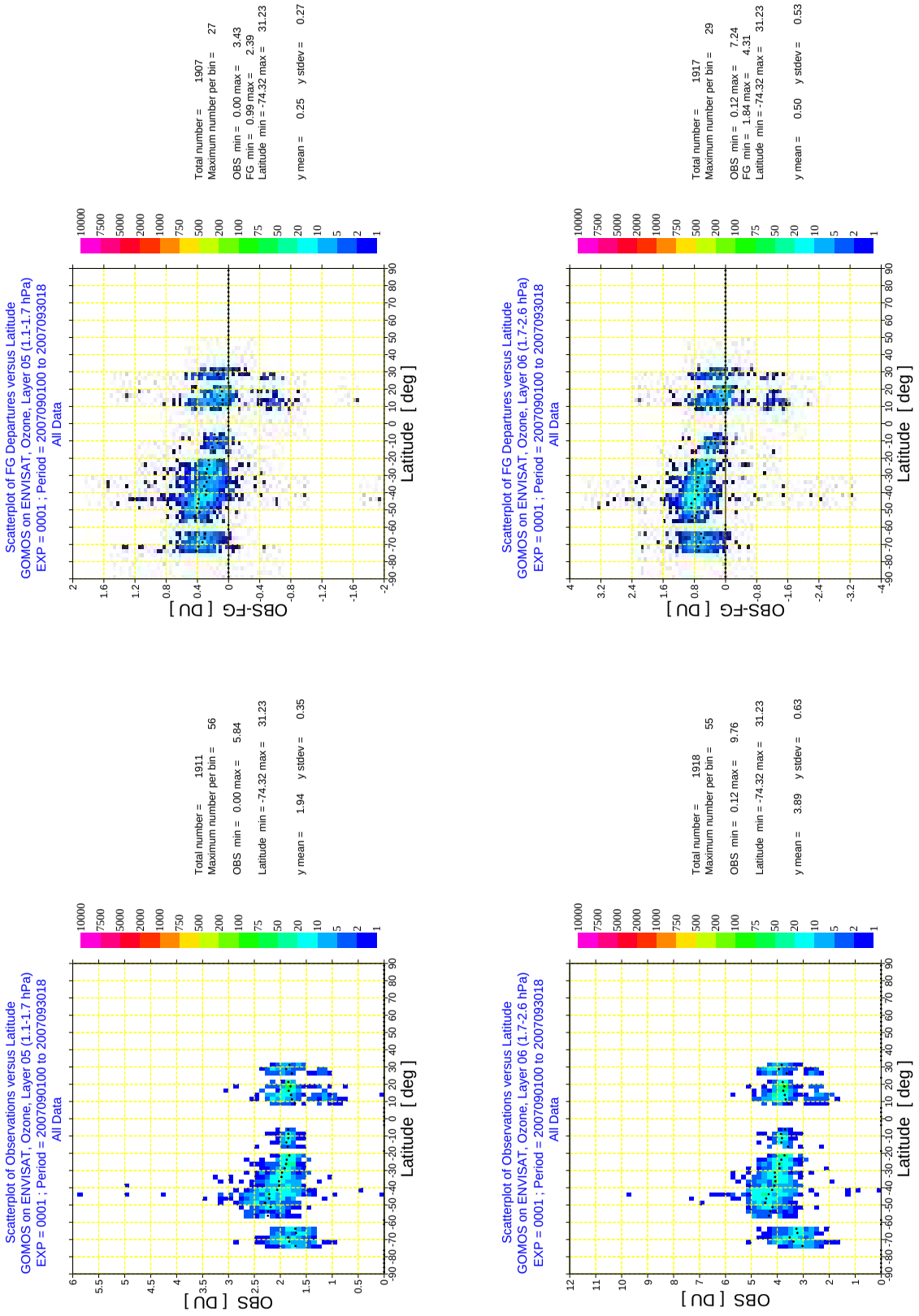


Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

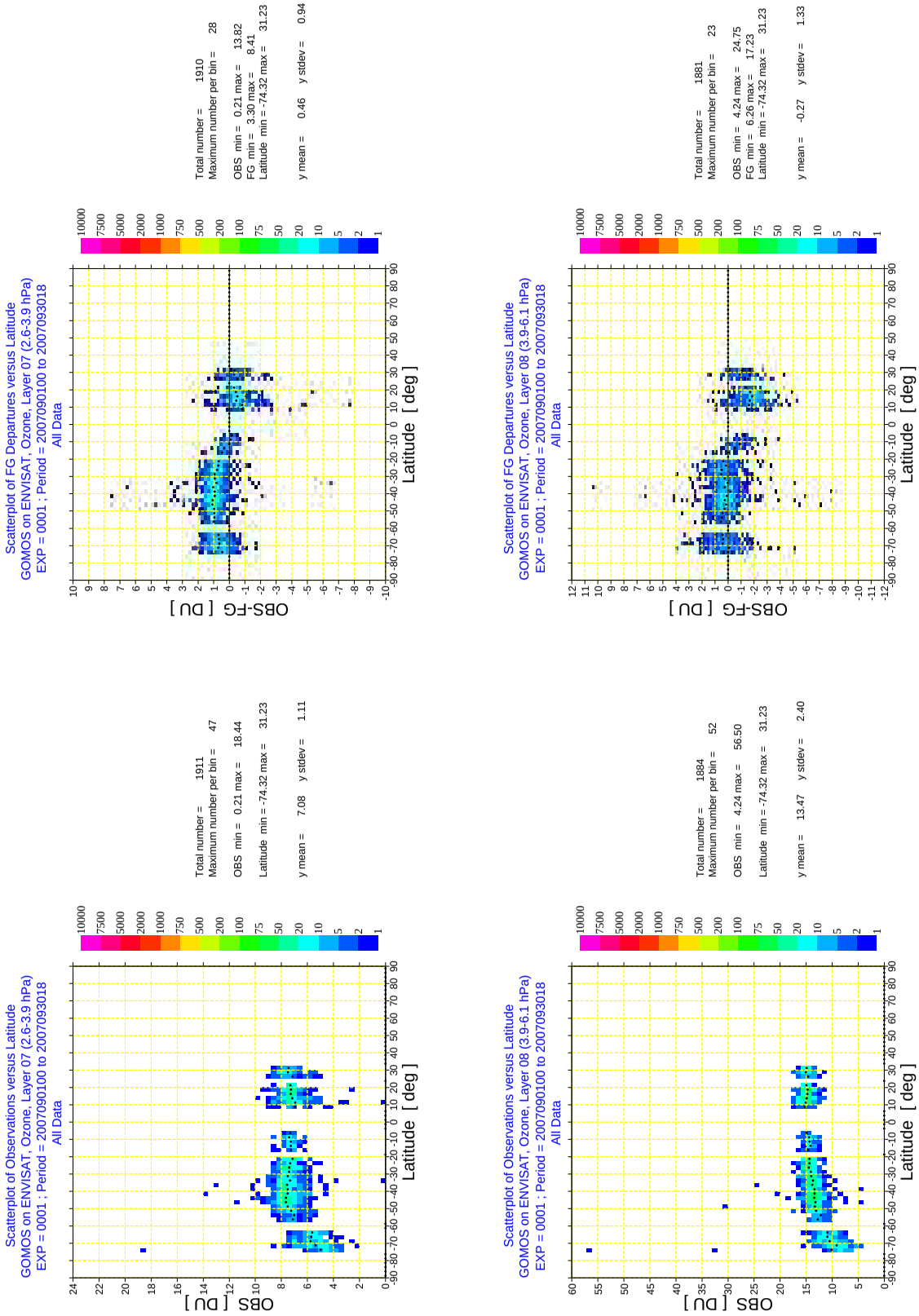


Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

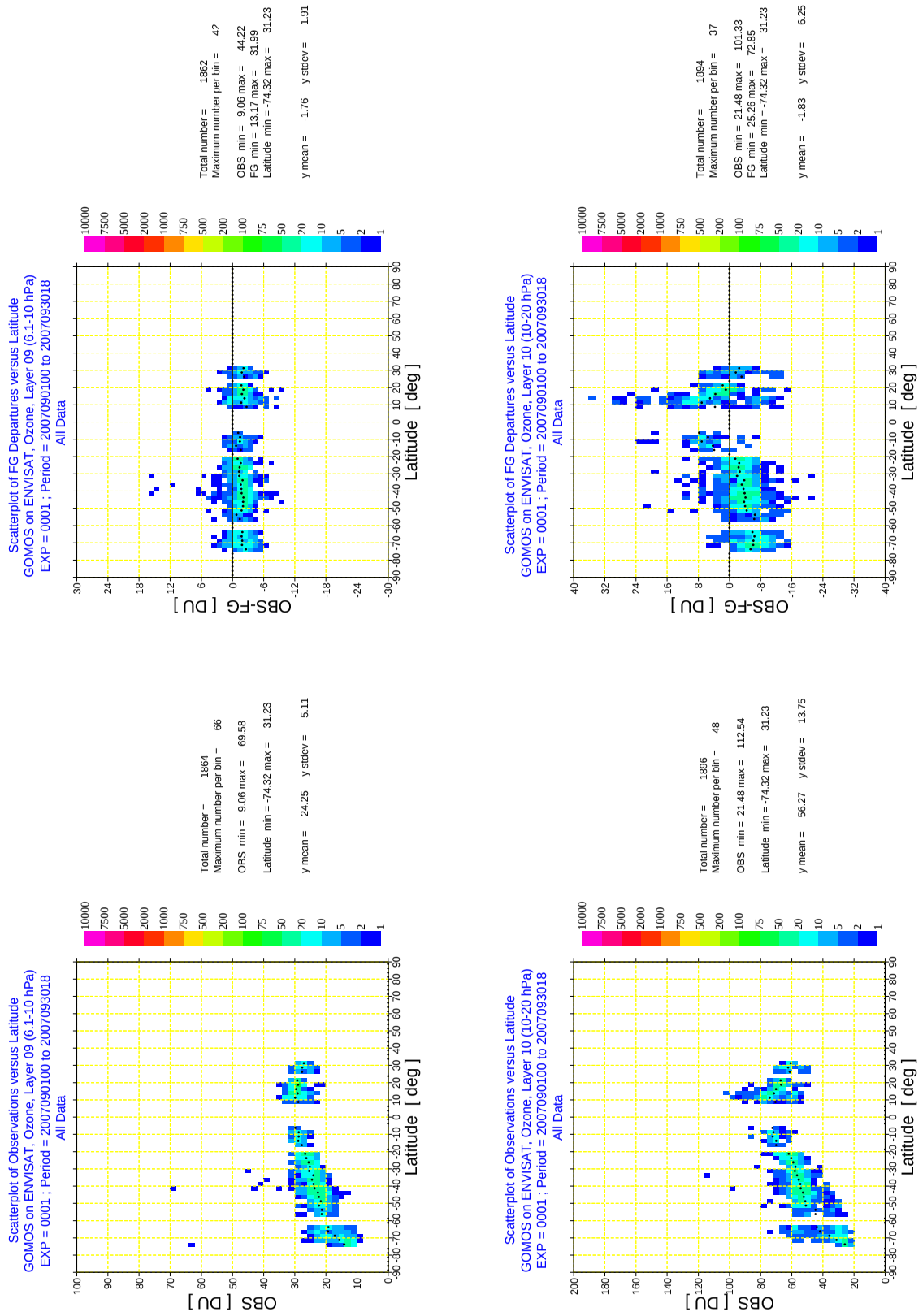


Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

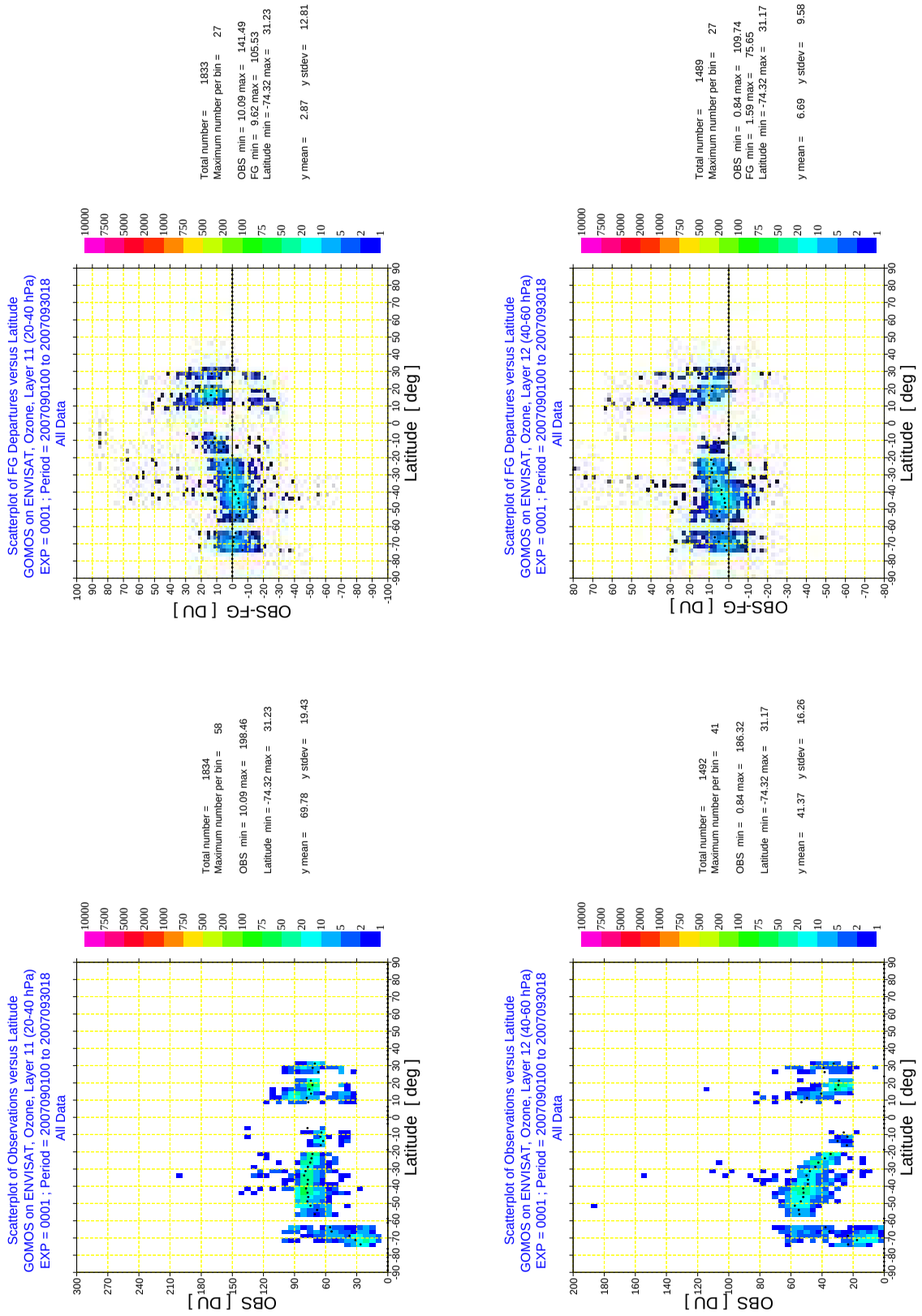


Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

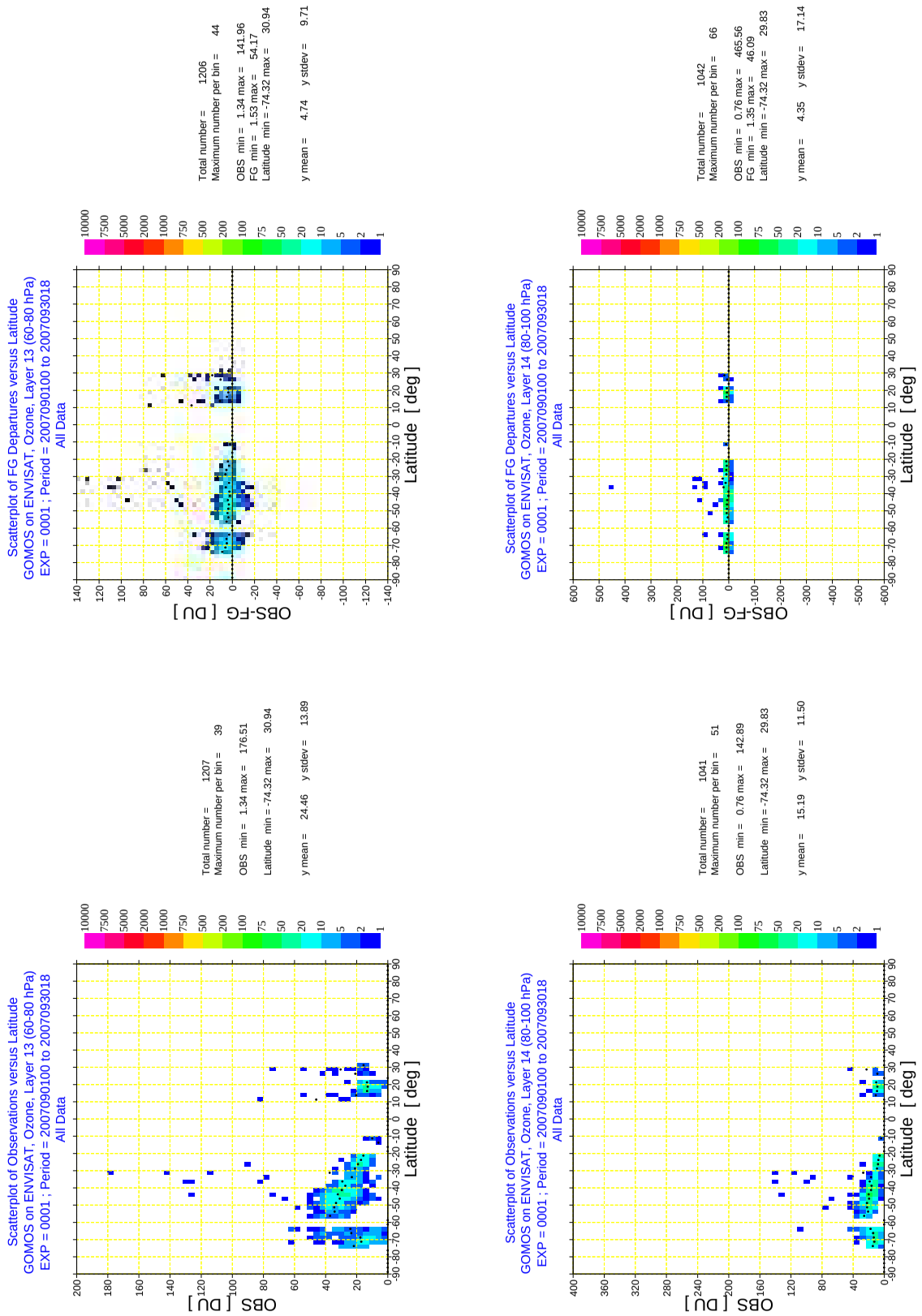


Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

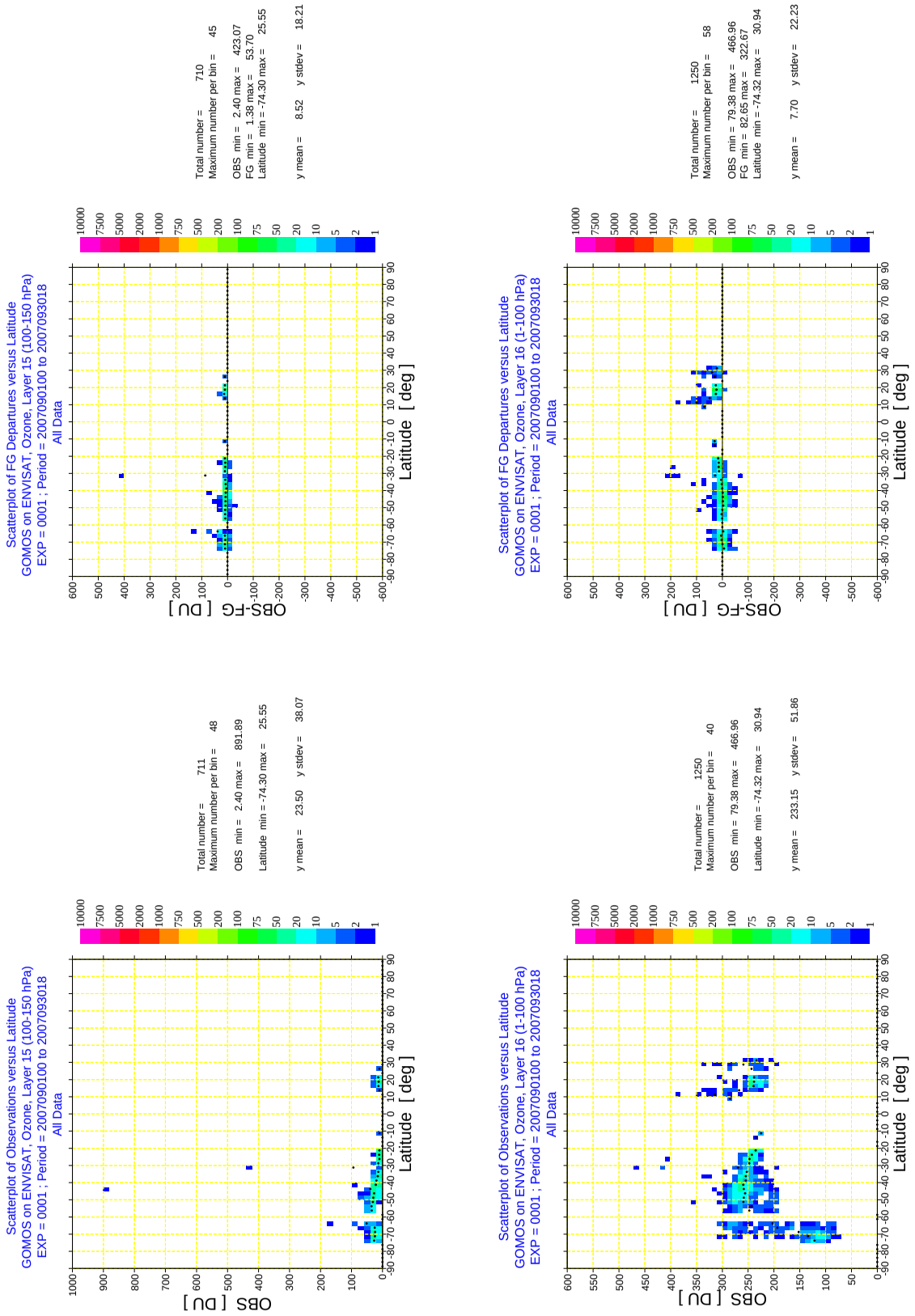


Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

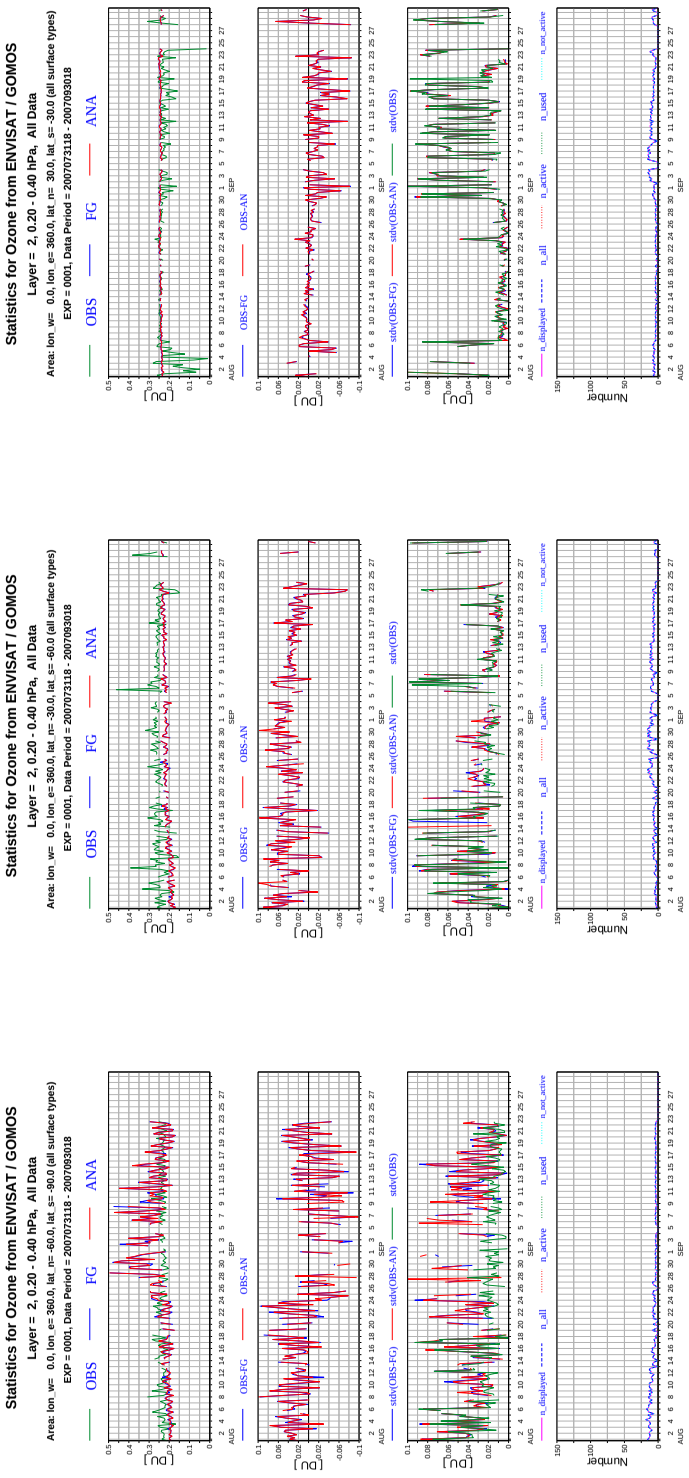


Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for the period August-September 2007.

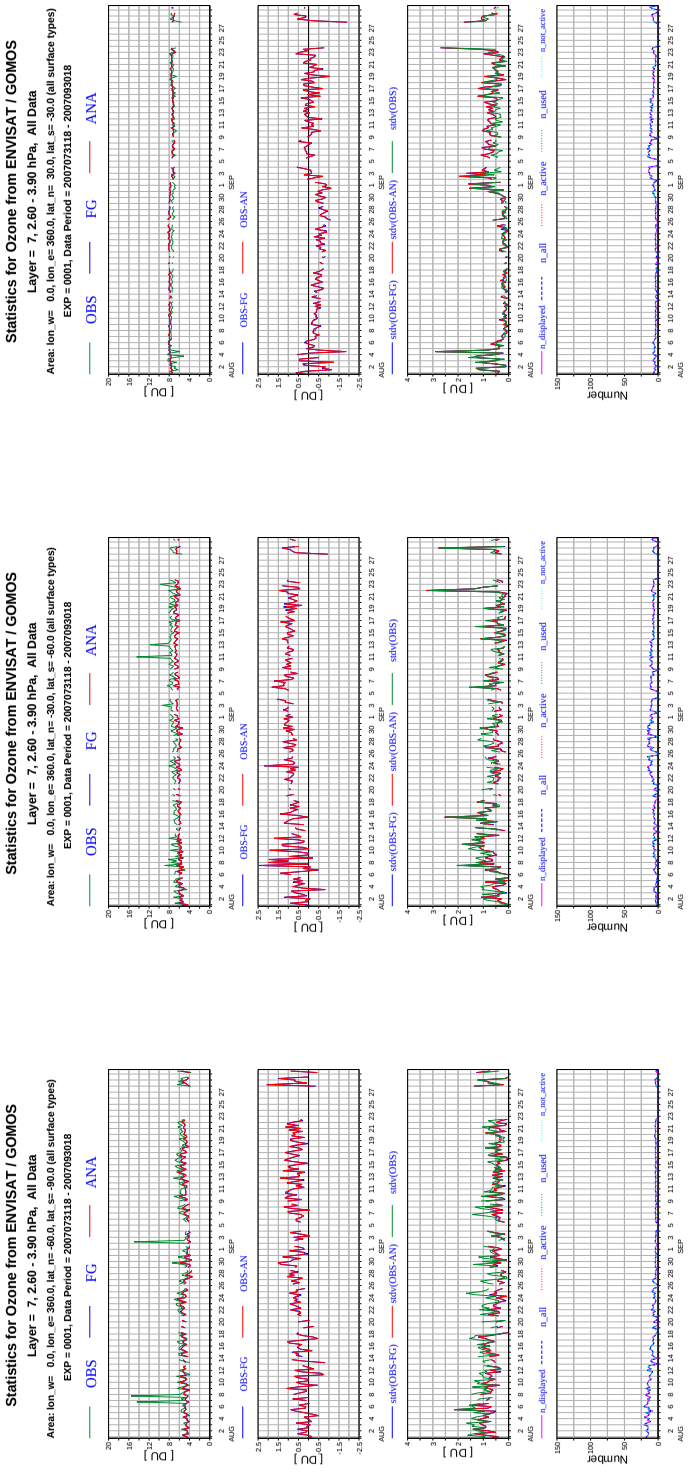


Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

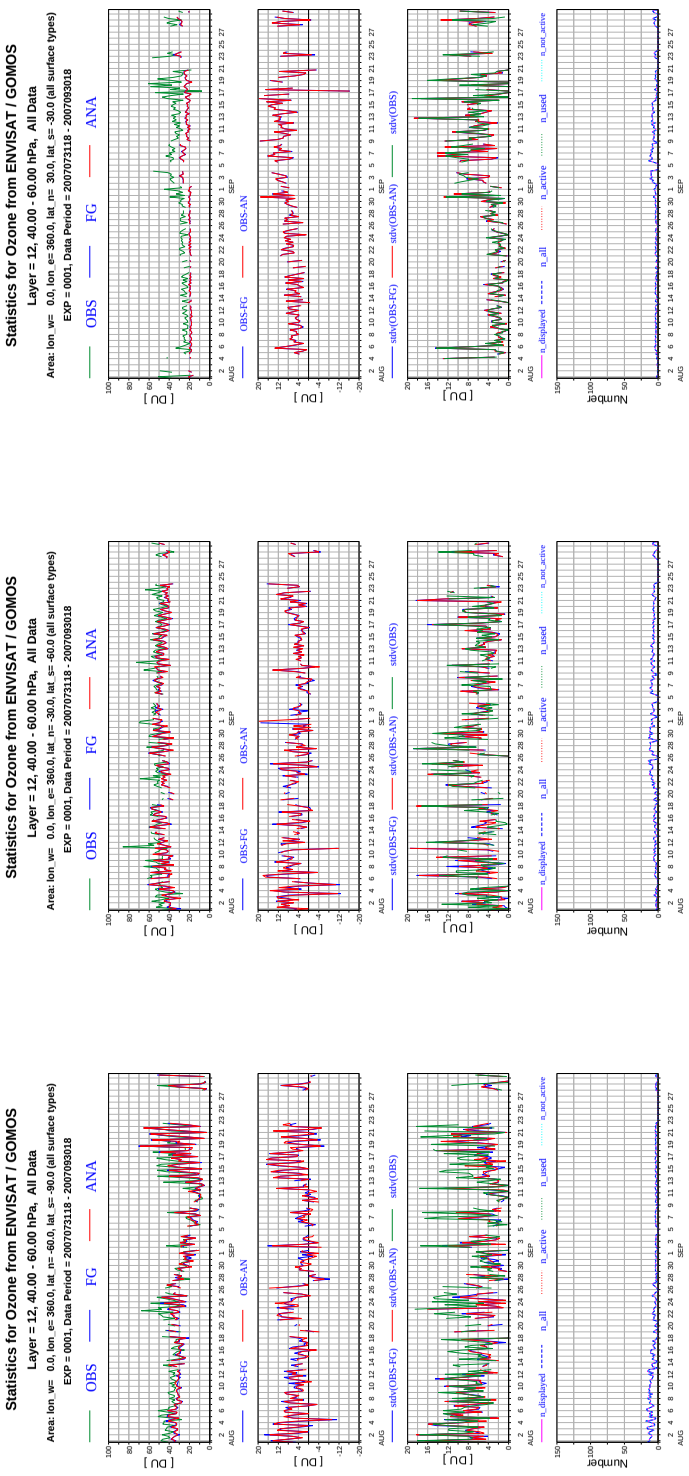


Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

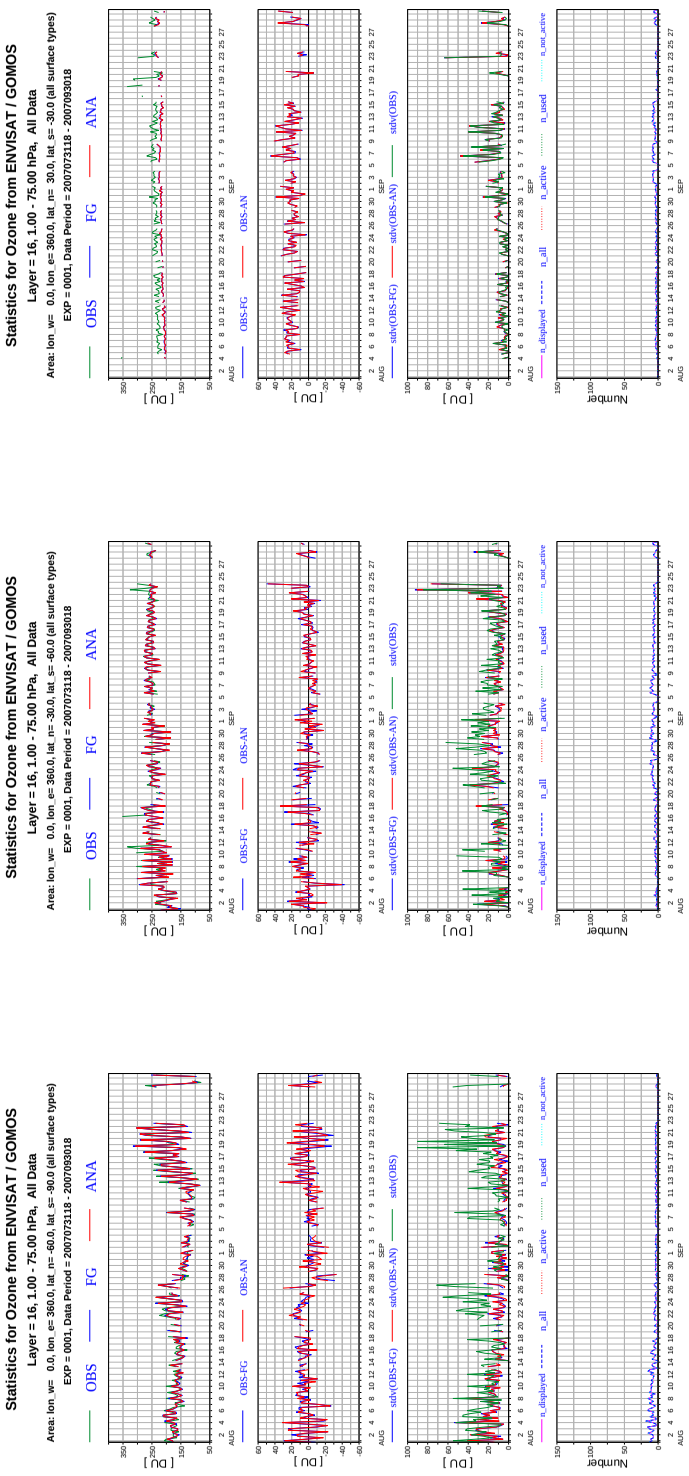


Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

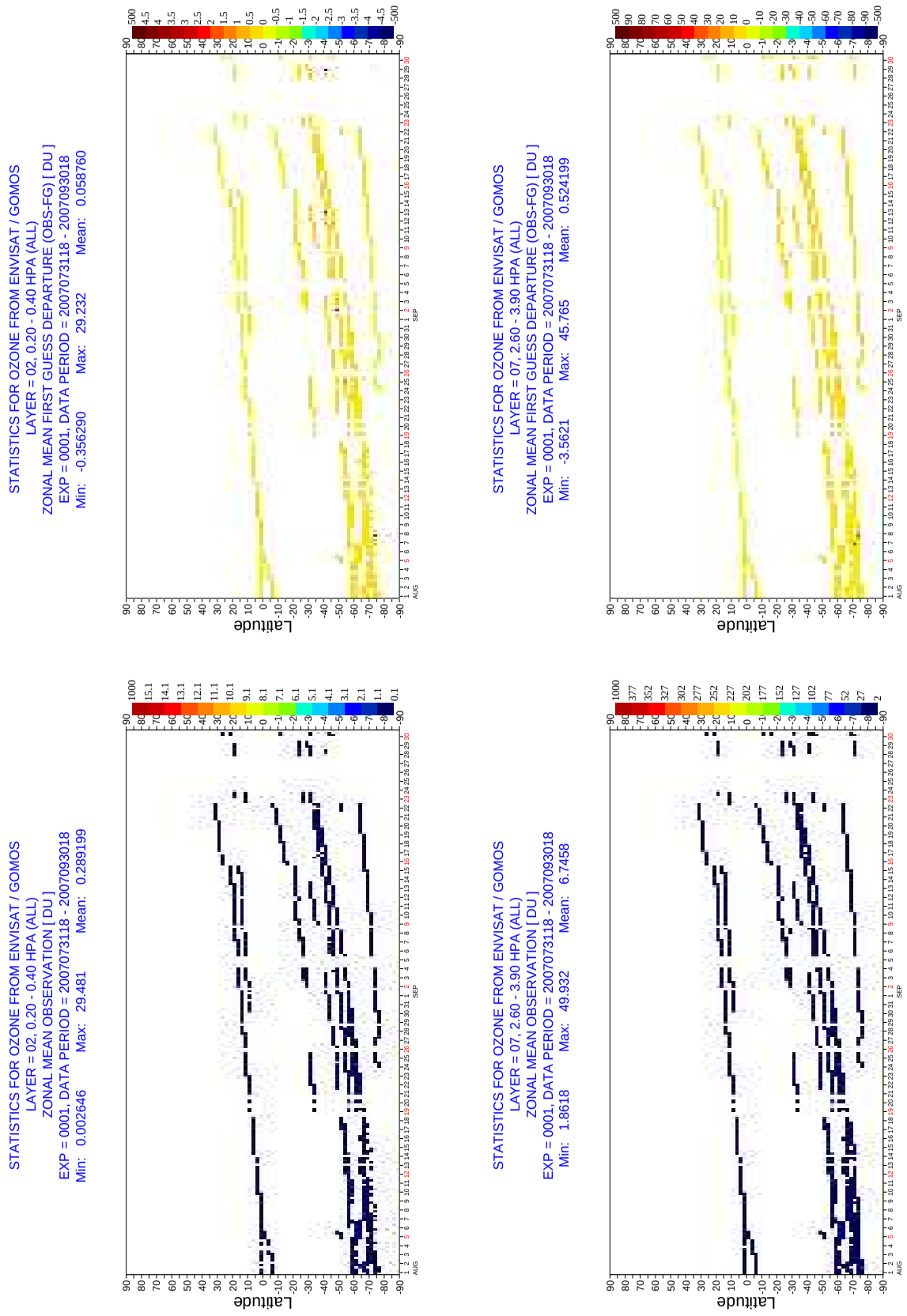


Fig. 19. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for August-September 2007 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

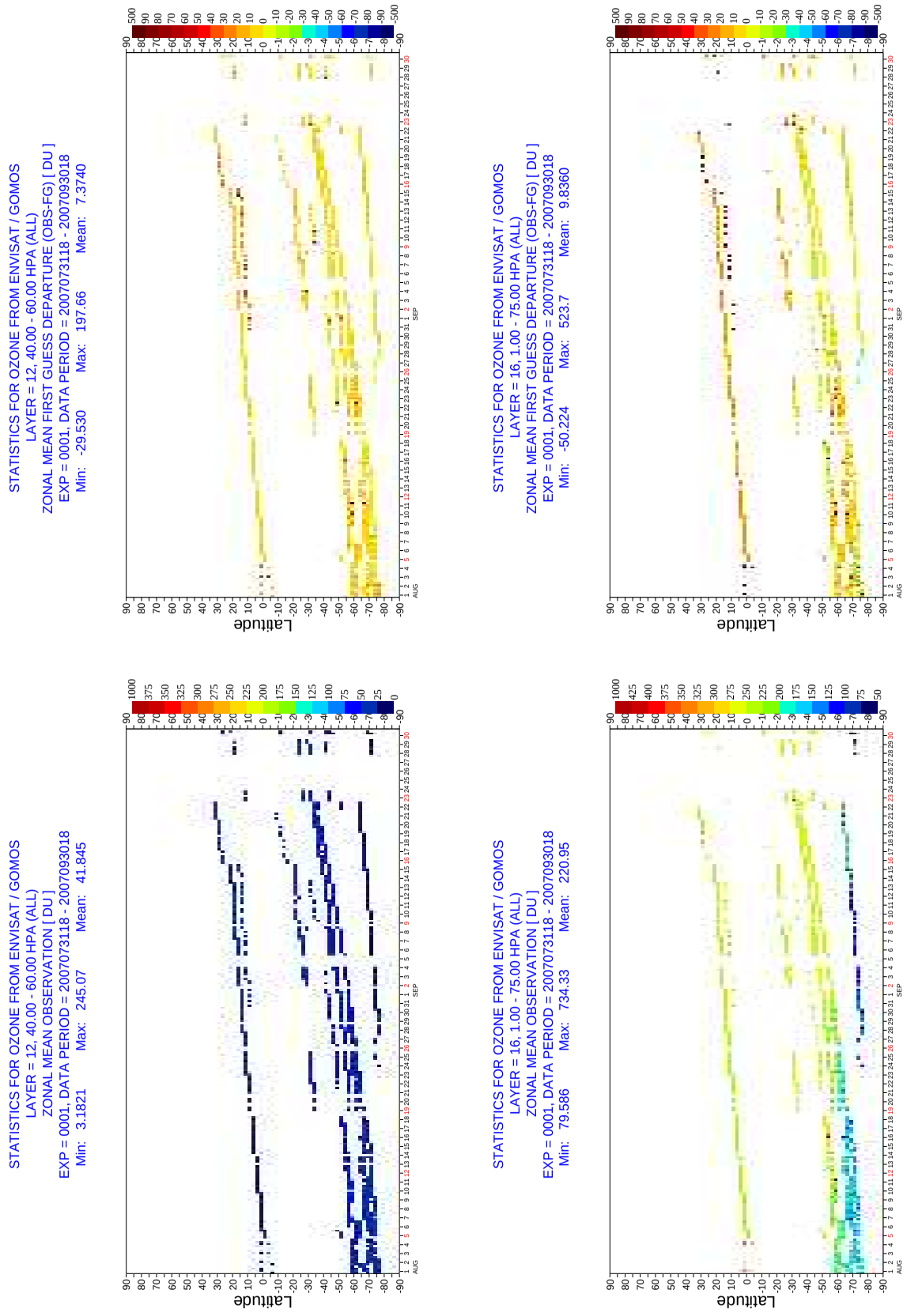


Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

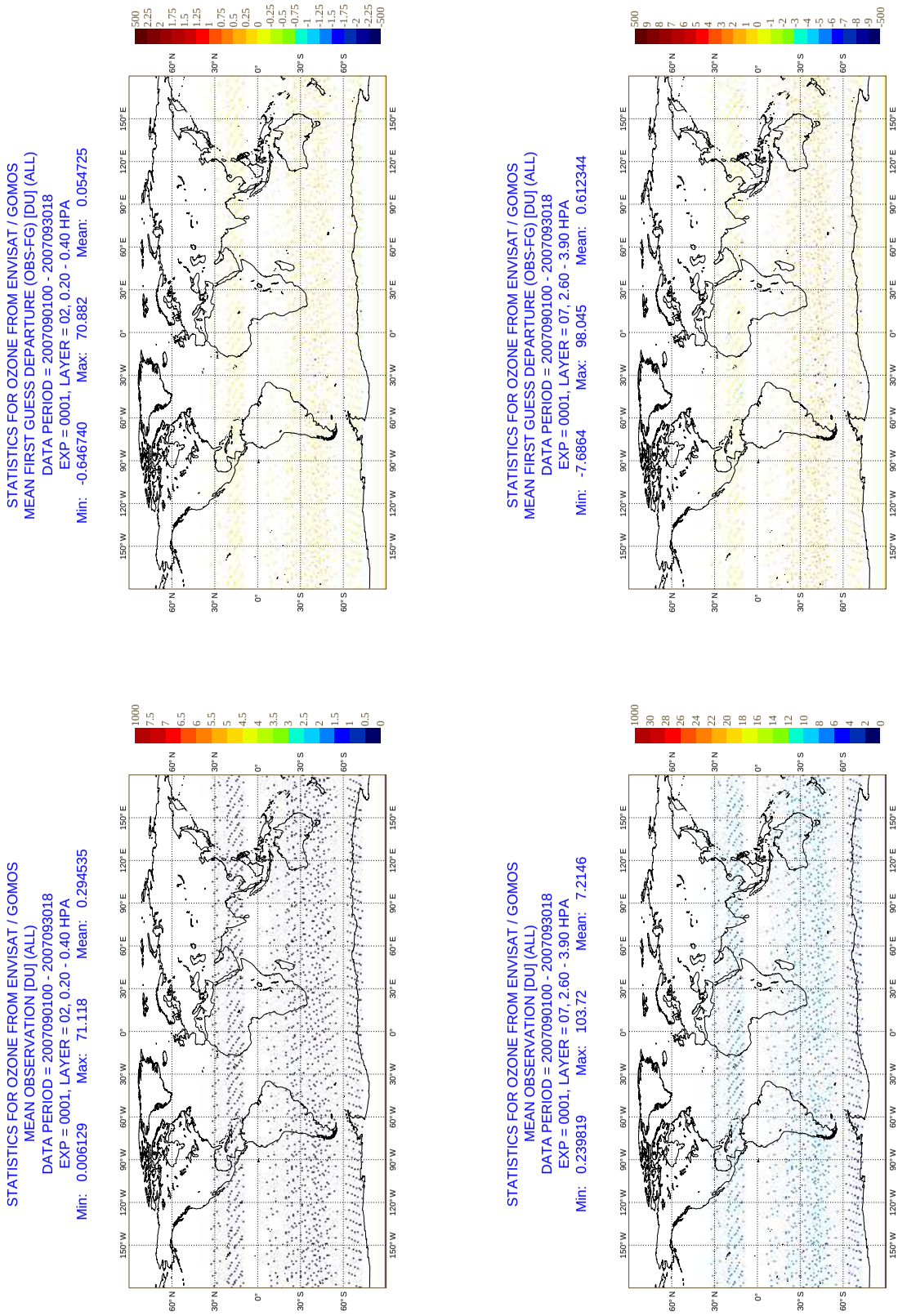


Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for September 2007 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

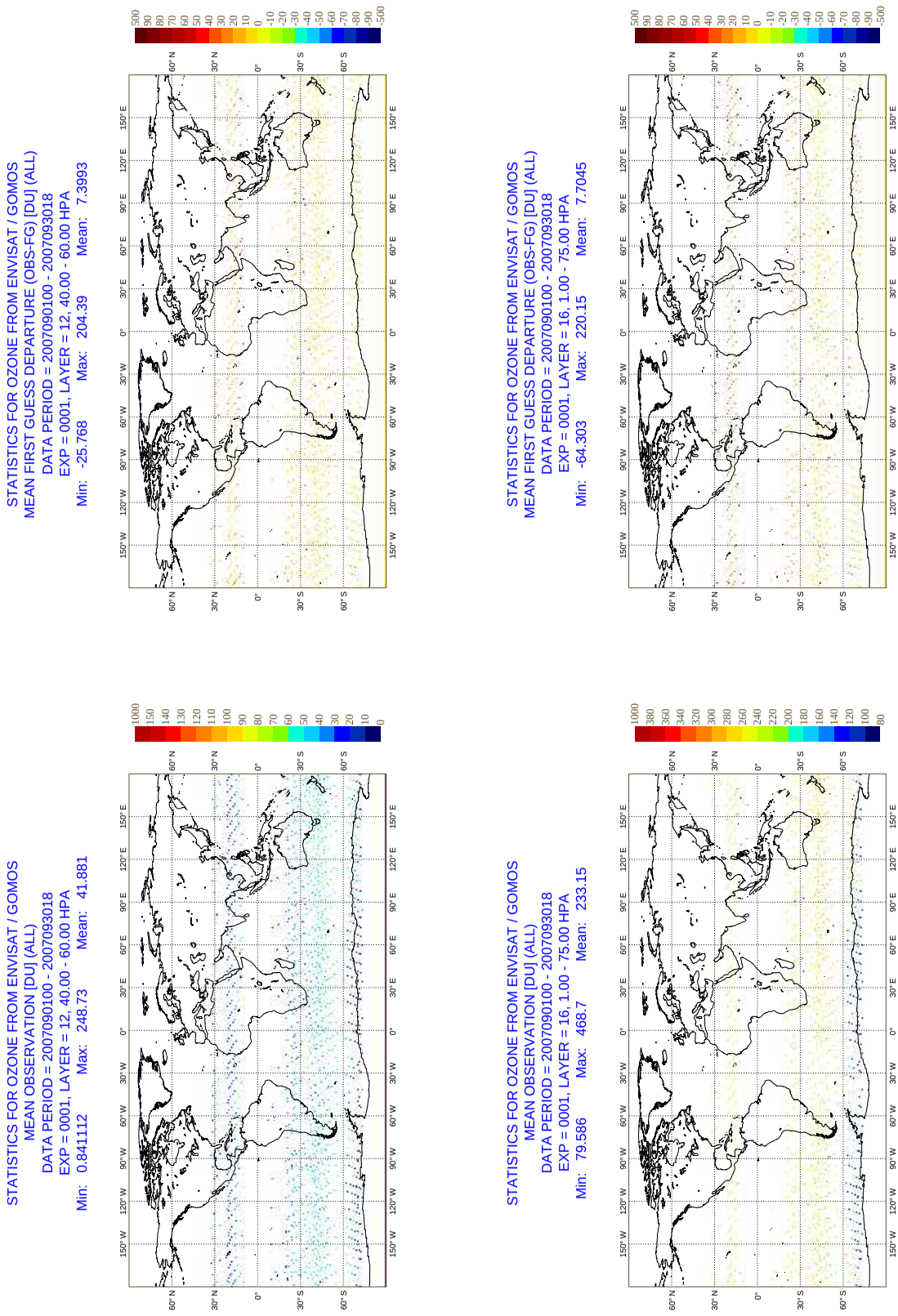


Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR__2P) FOR SEPTEMBER 2007

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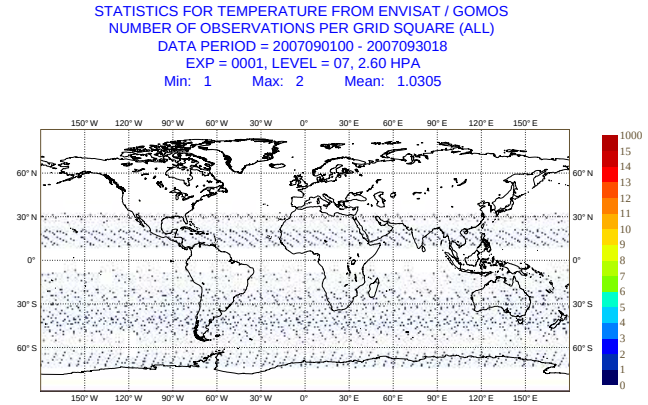


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for September 2007.

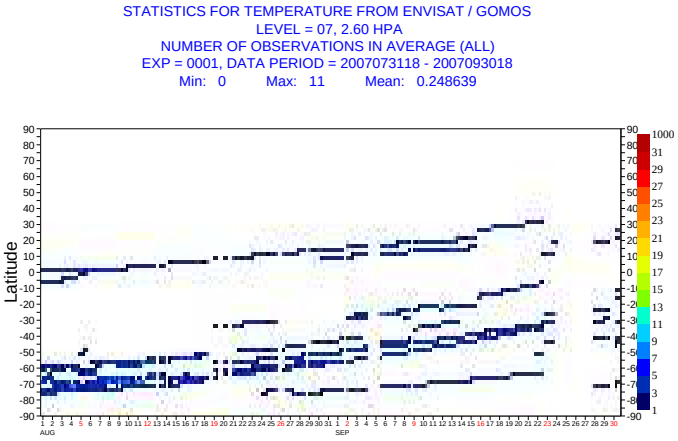


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for August-September 2007.

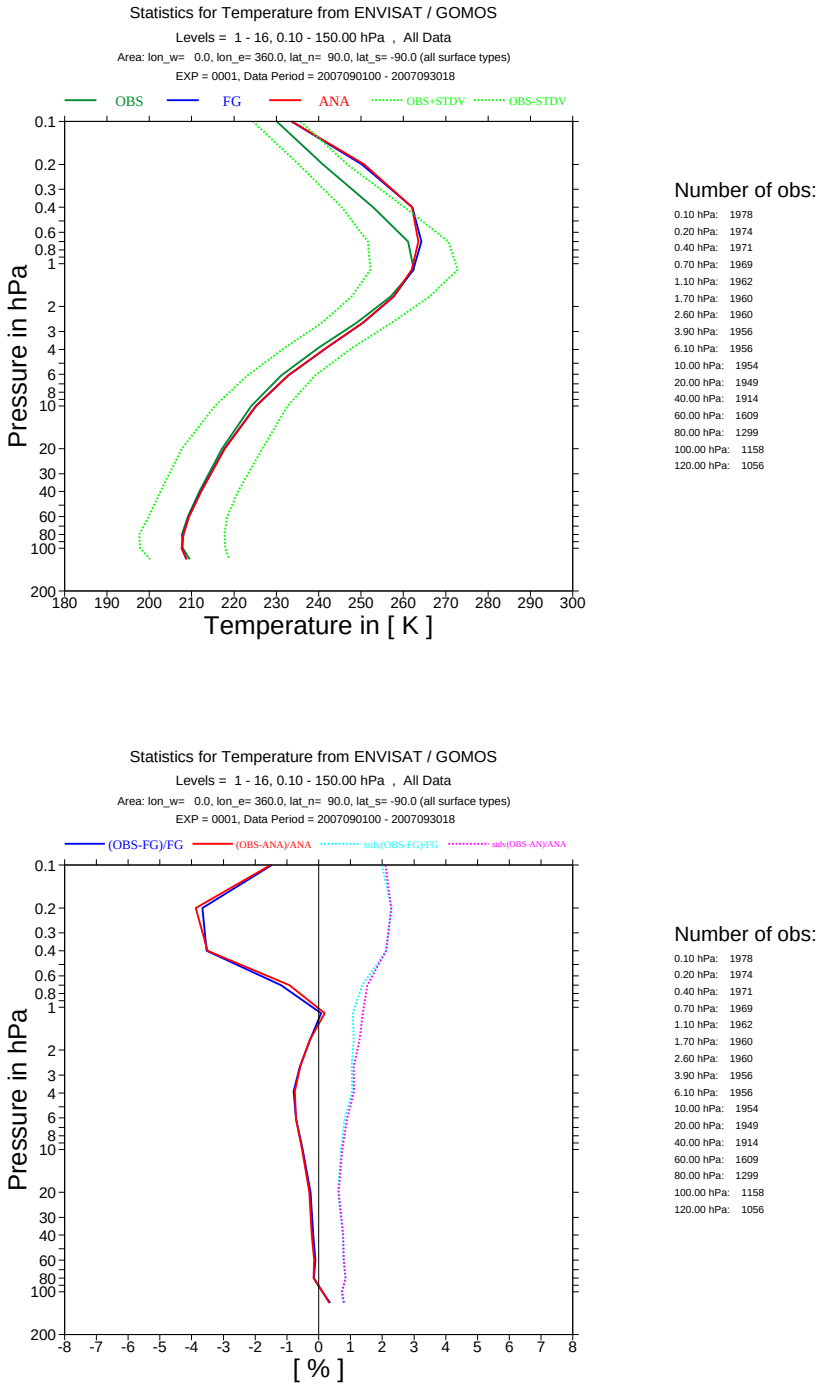
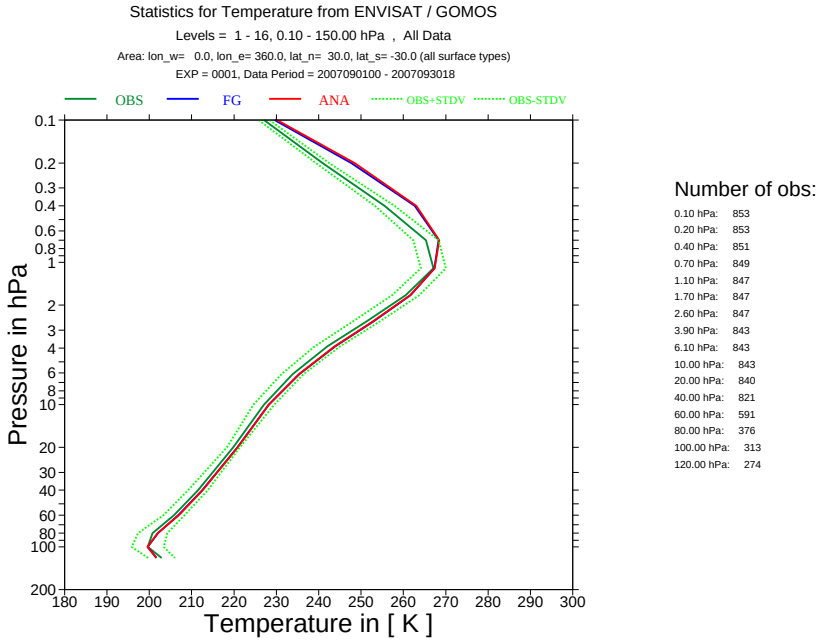


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for September 2007 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation +/- 1 standard deviation (green dotted lines). The 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.



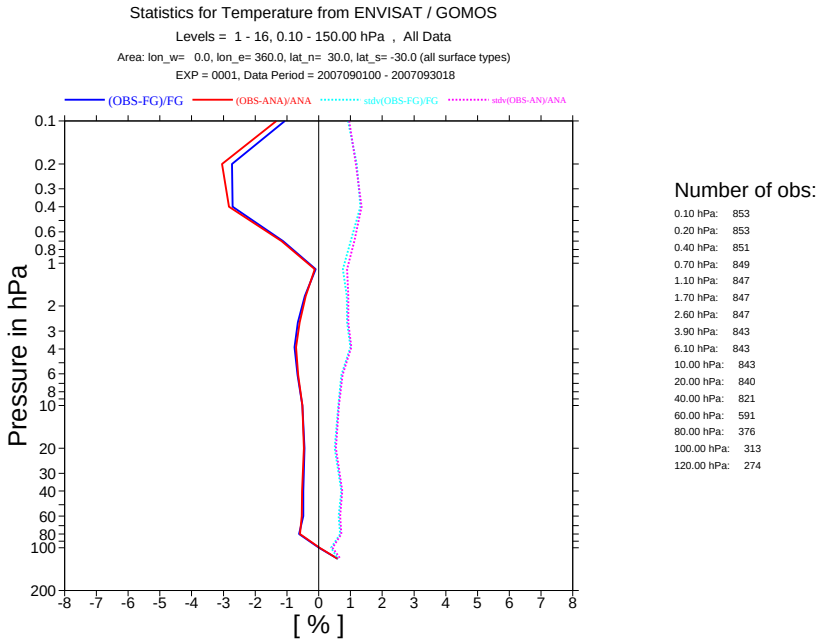
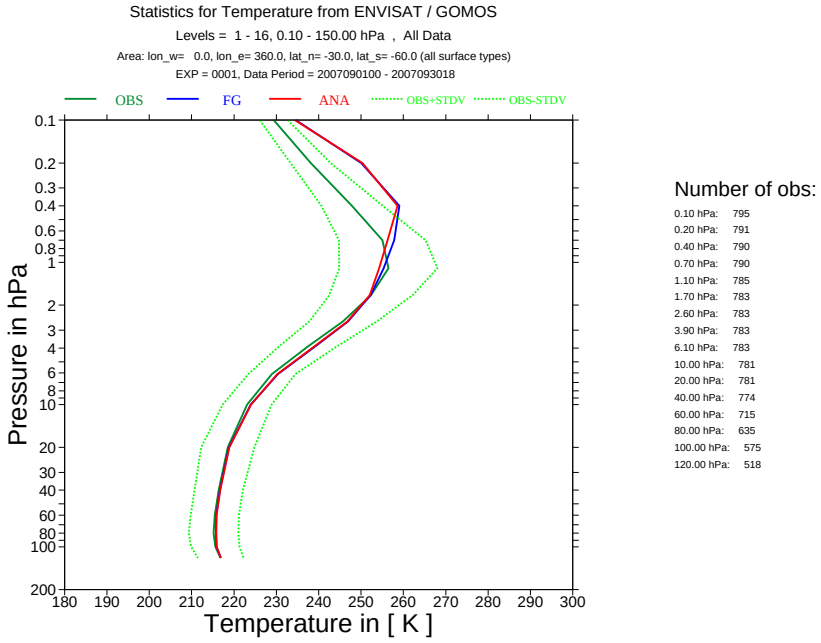


Fig. 4. As Fig. 3 but for 30N-30S.



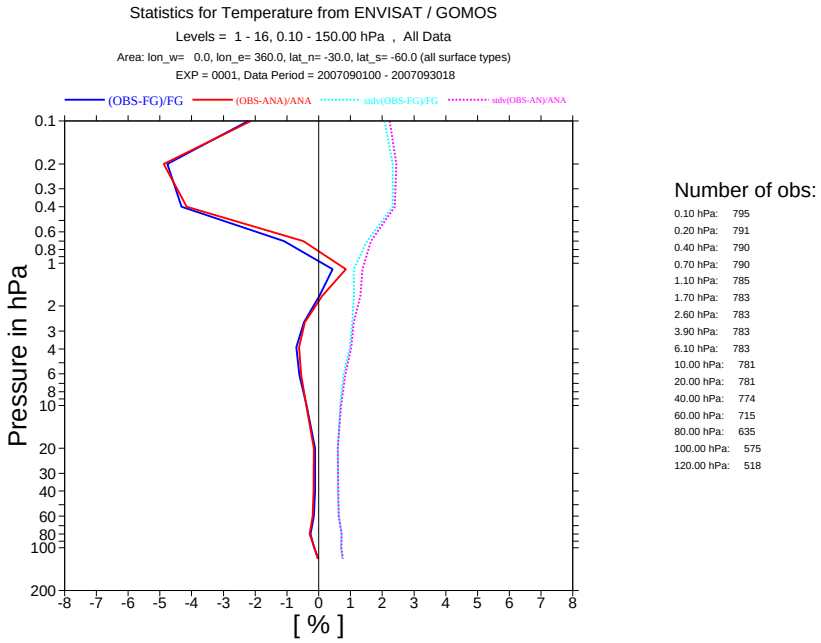
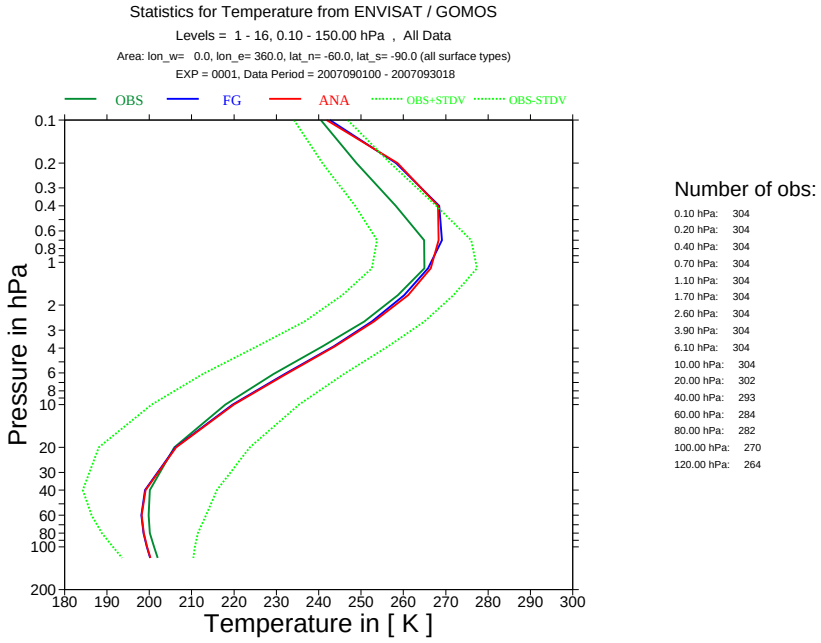


Fig. 5. As Fig. 3 but for 30-60S.



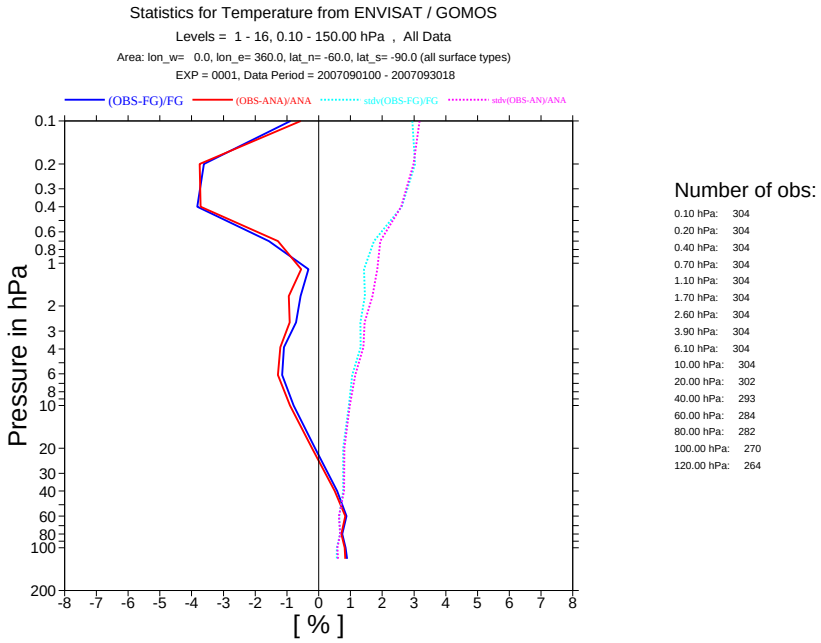


Fig. 6. As Fig. 3 but for 60-90S.

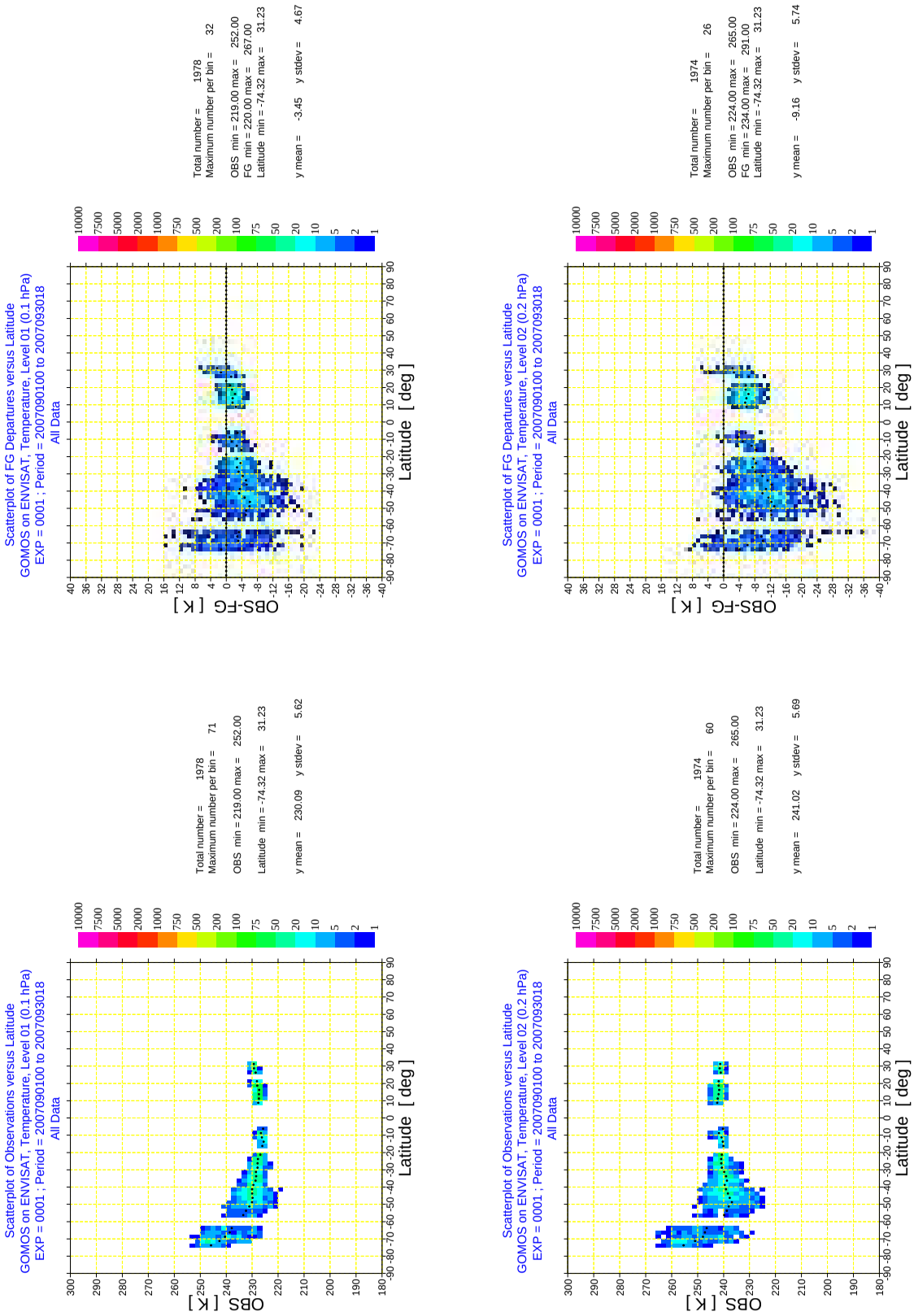


Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for September 2007 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

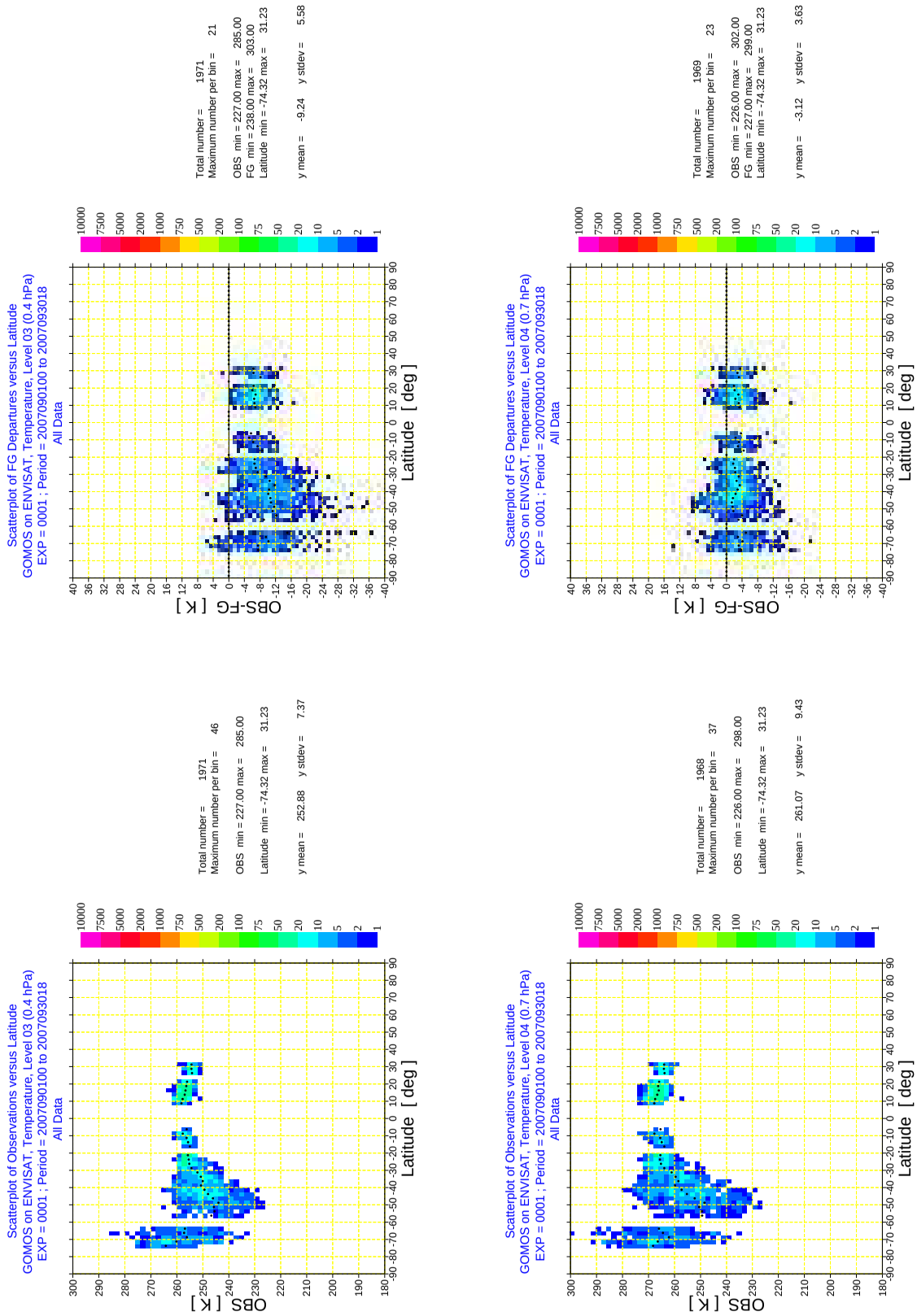


Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

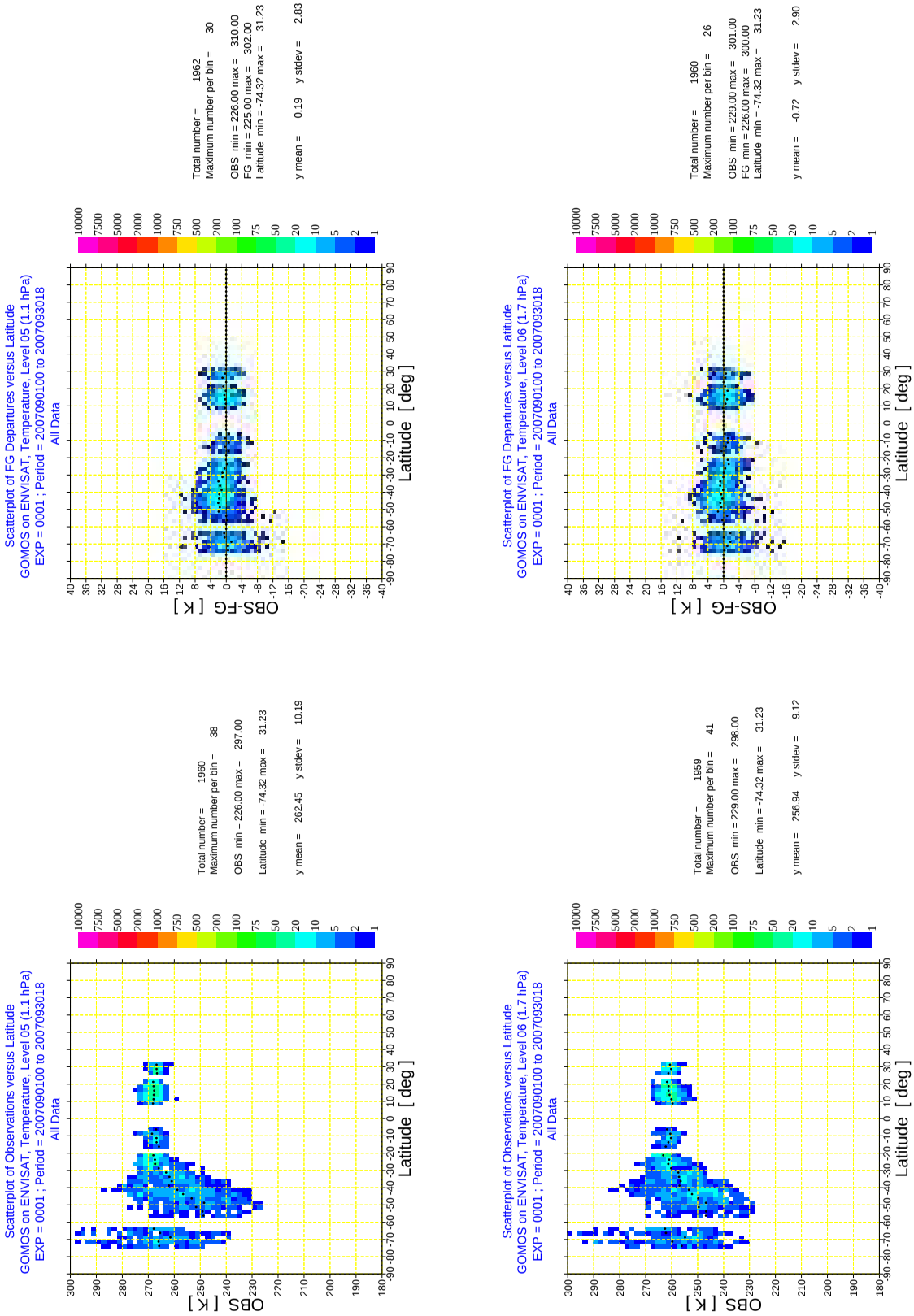


Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

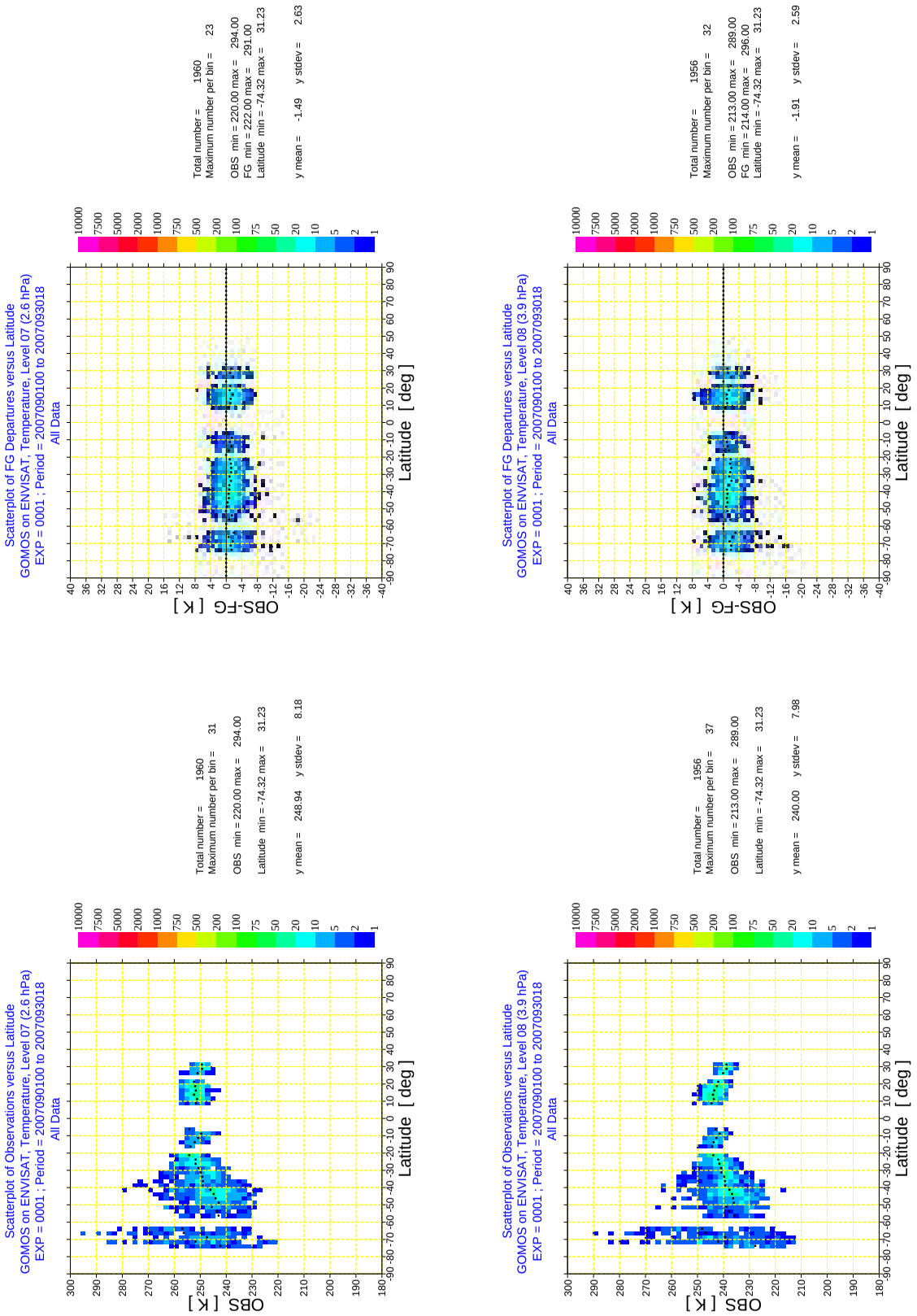


Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

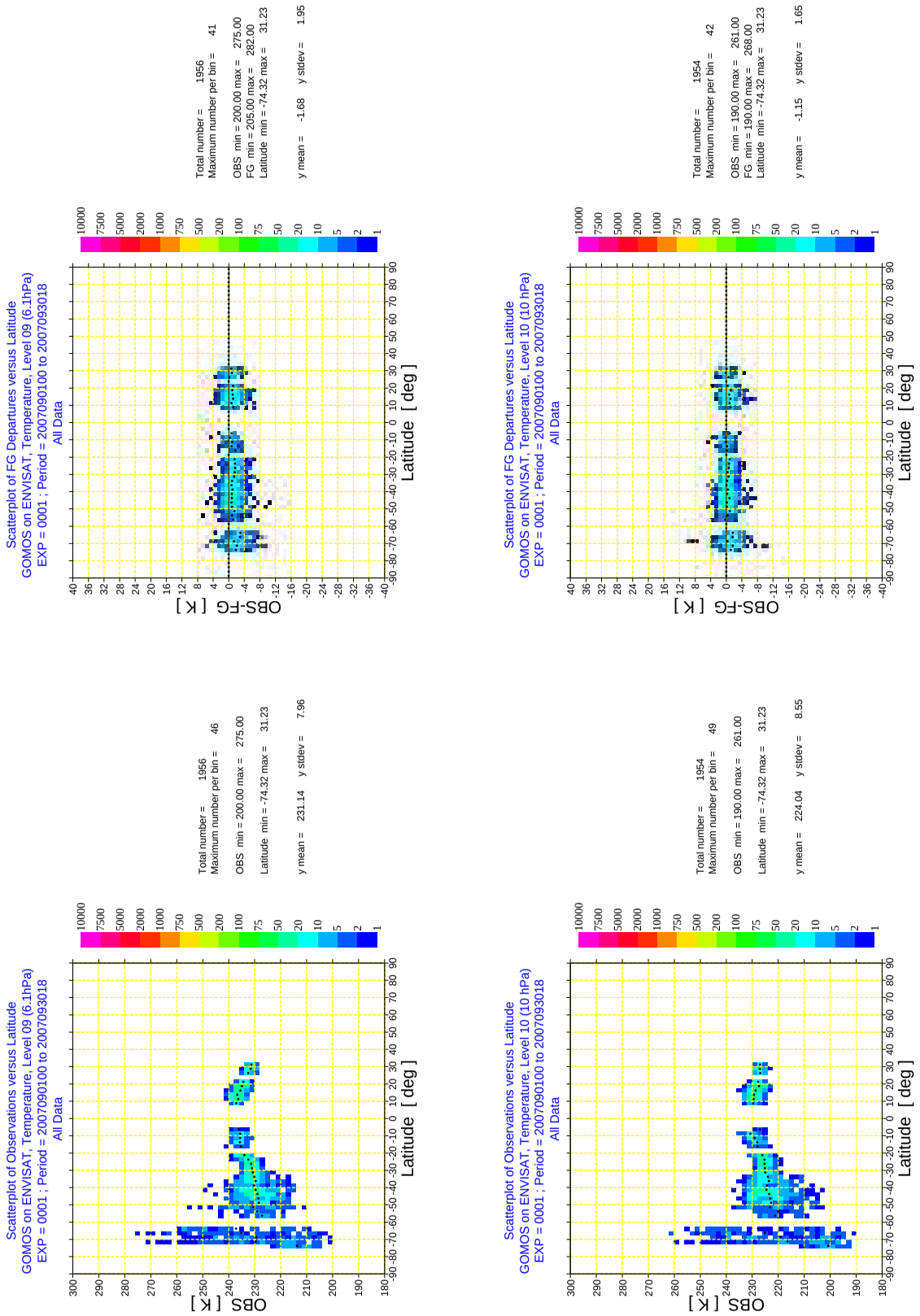


Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

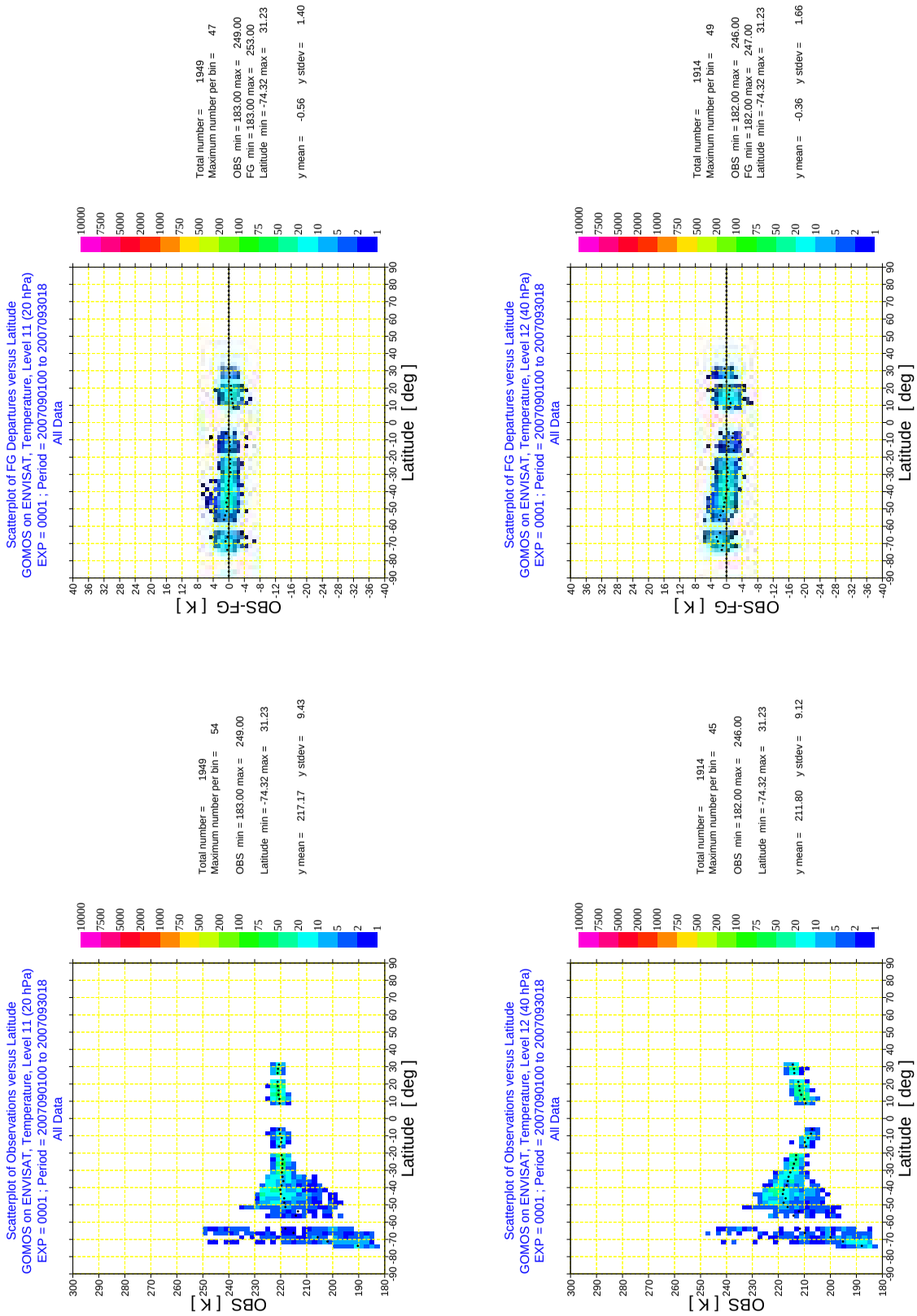


Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

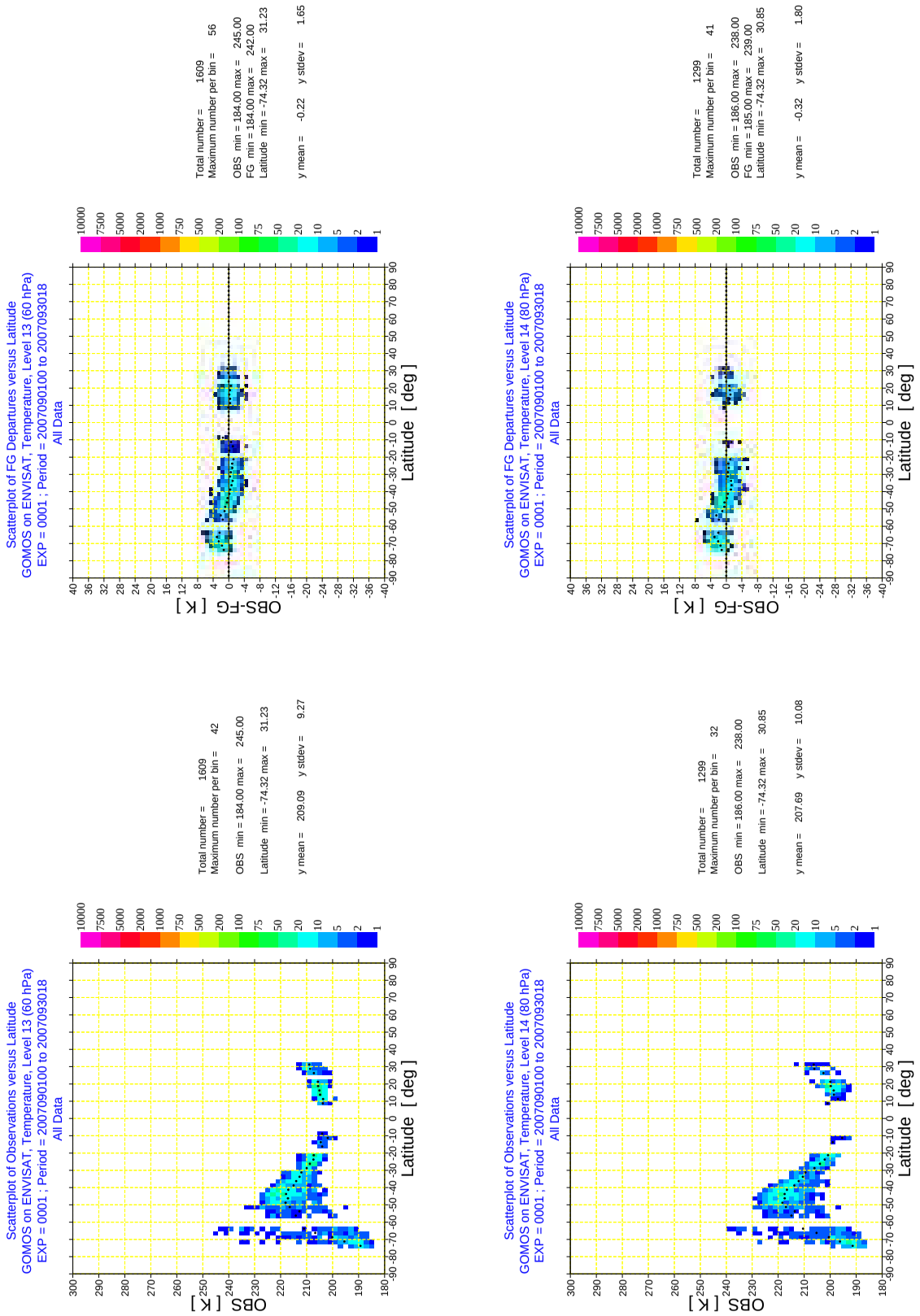


Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

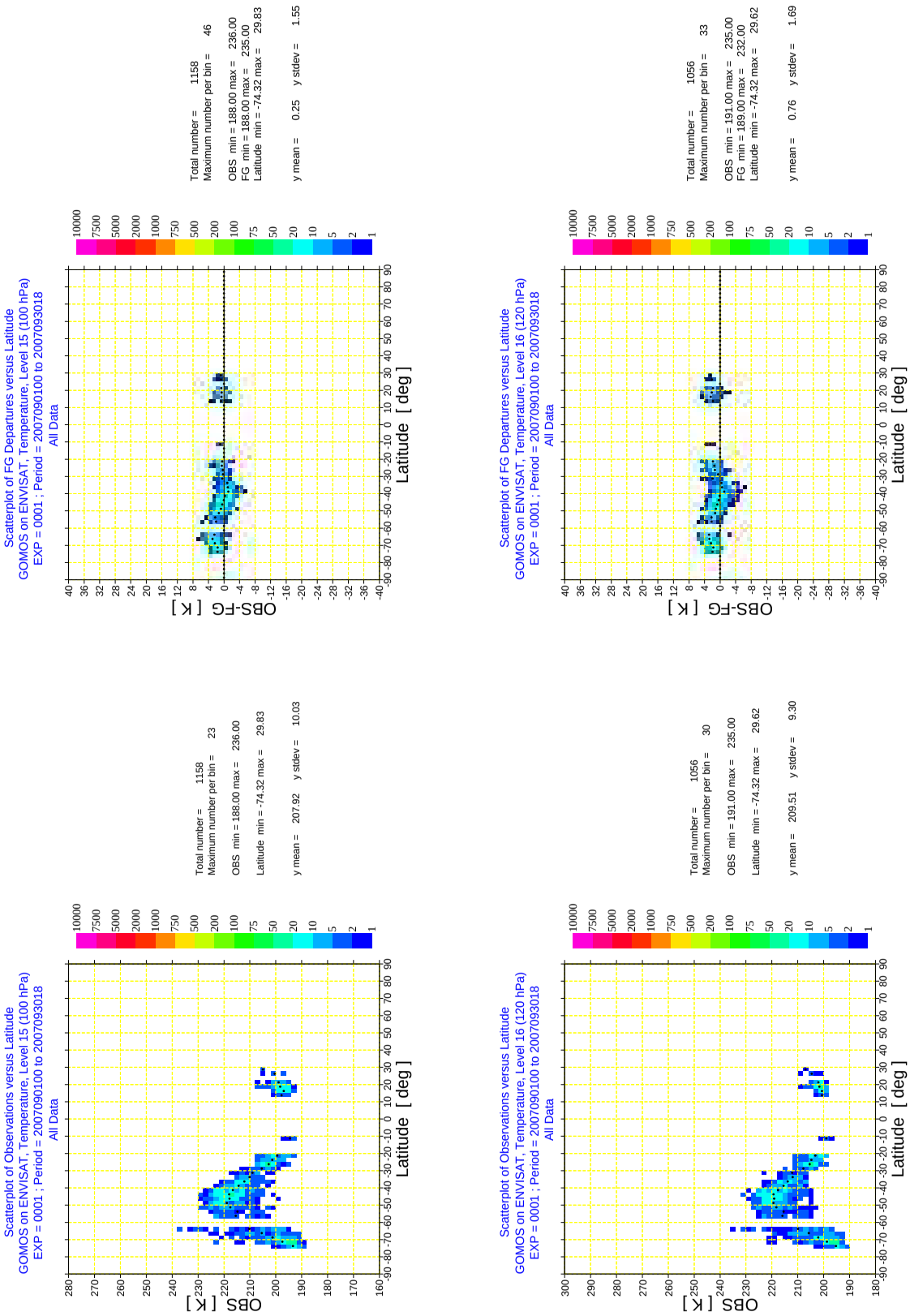


Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

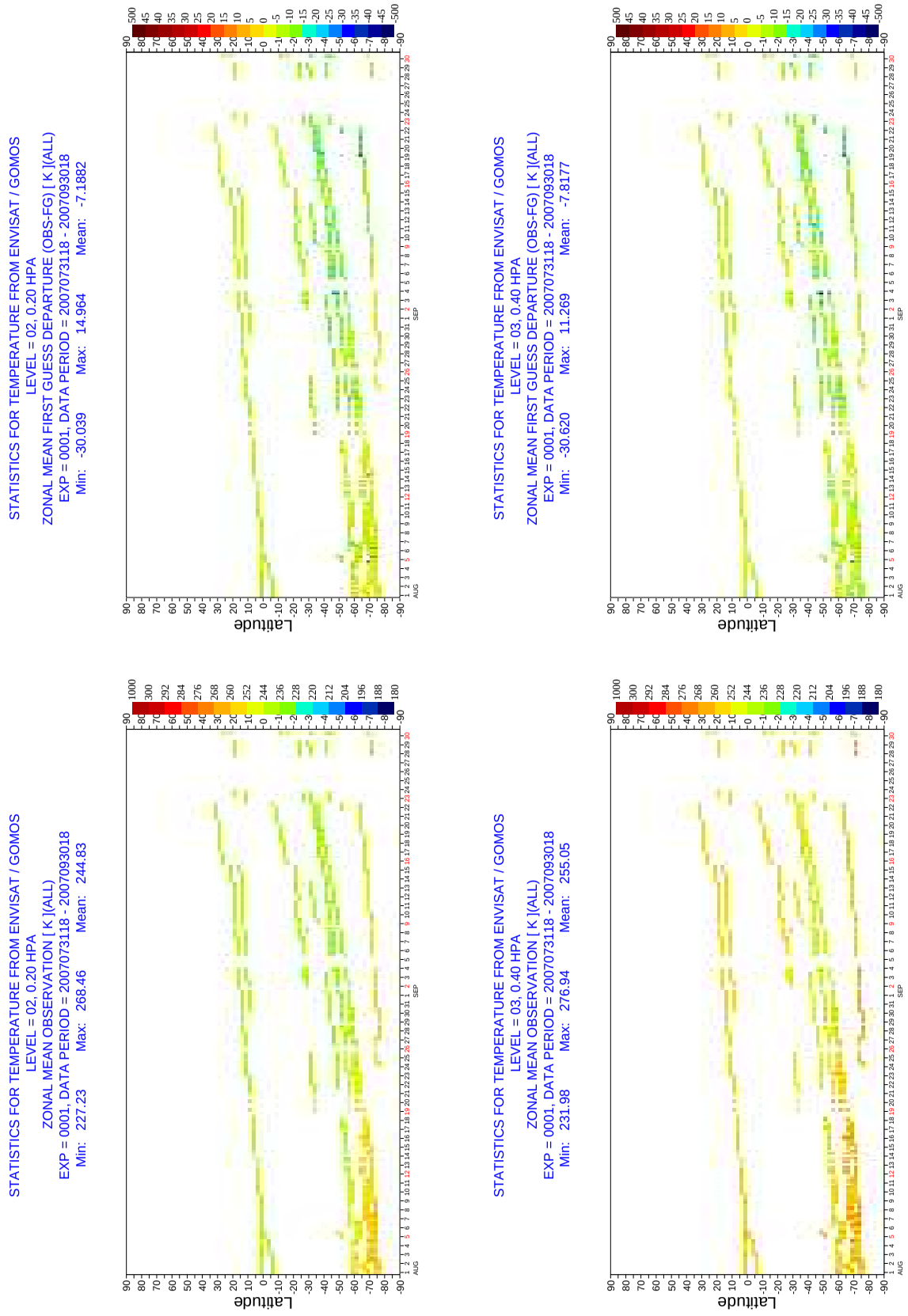


Fig. 15. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for August-September 2007.

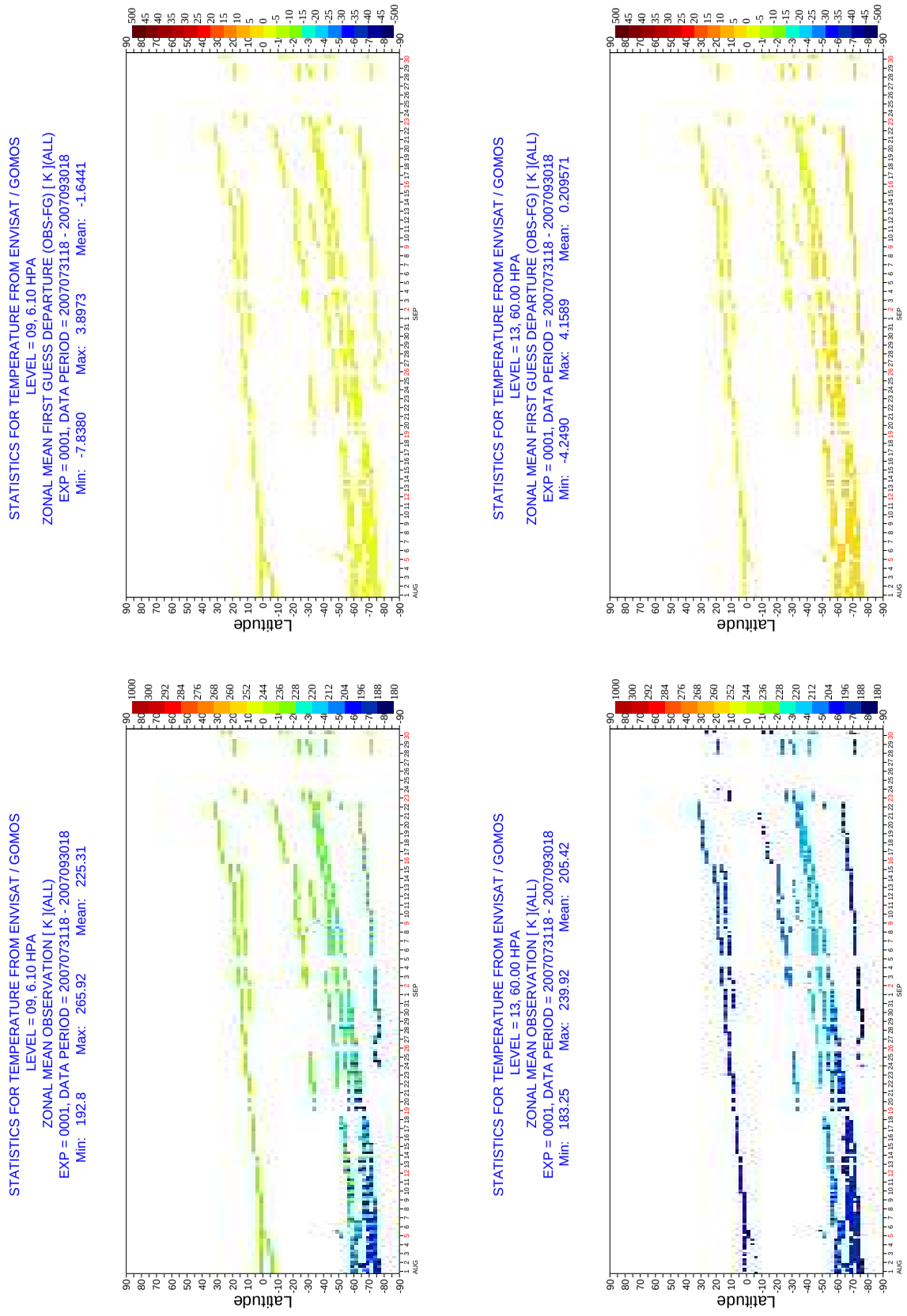


Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

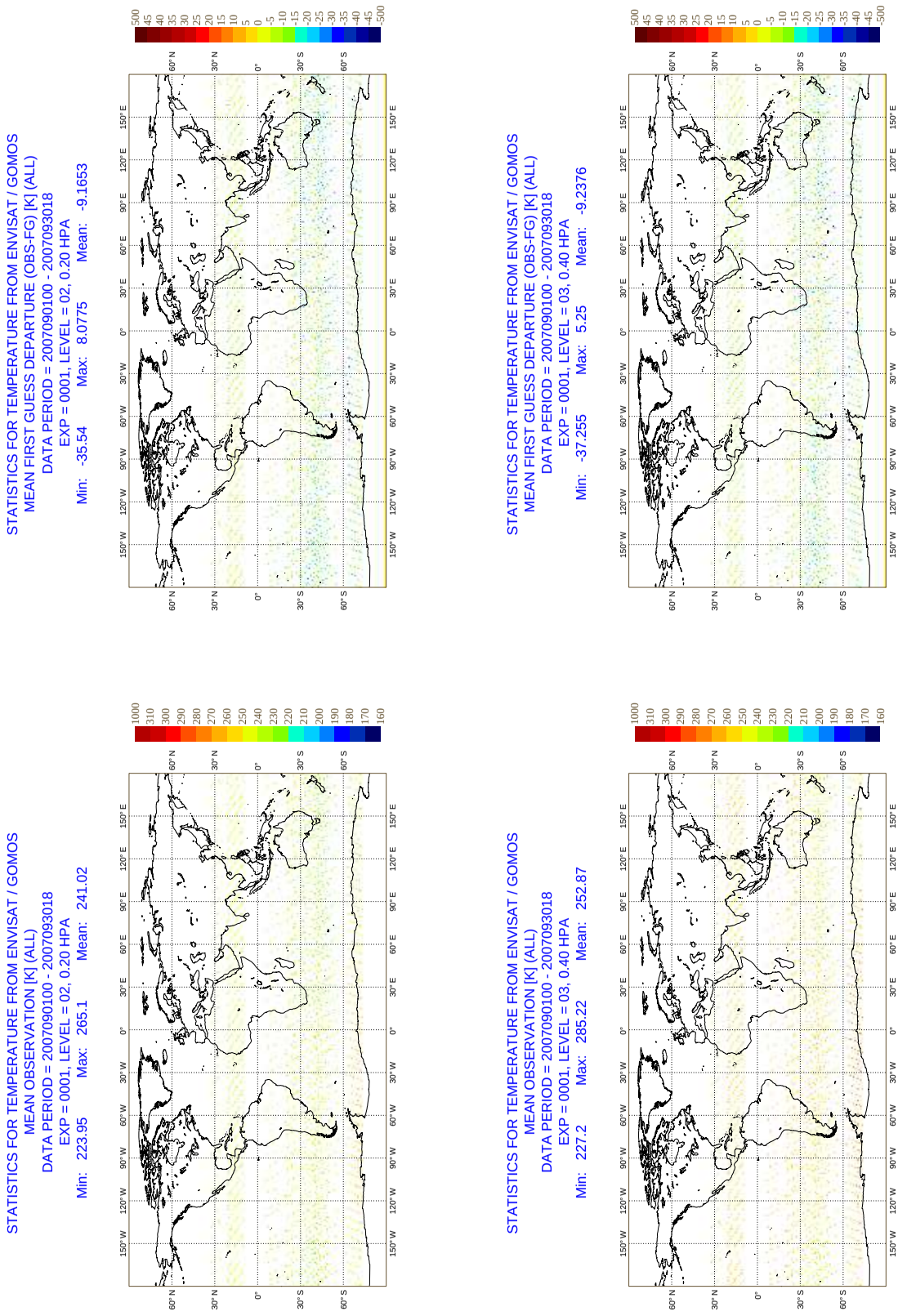


Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for September 2007.

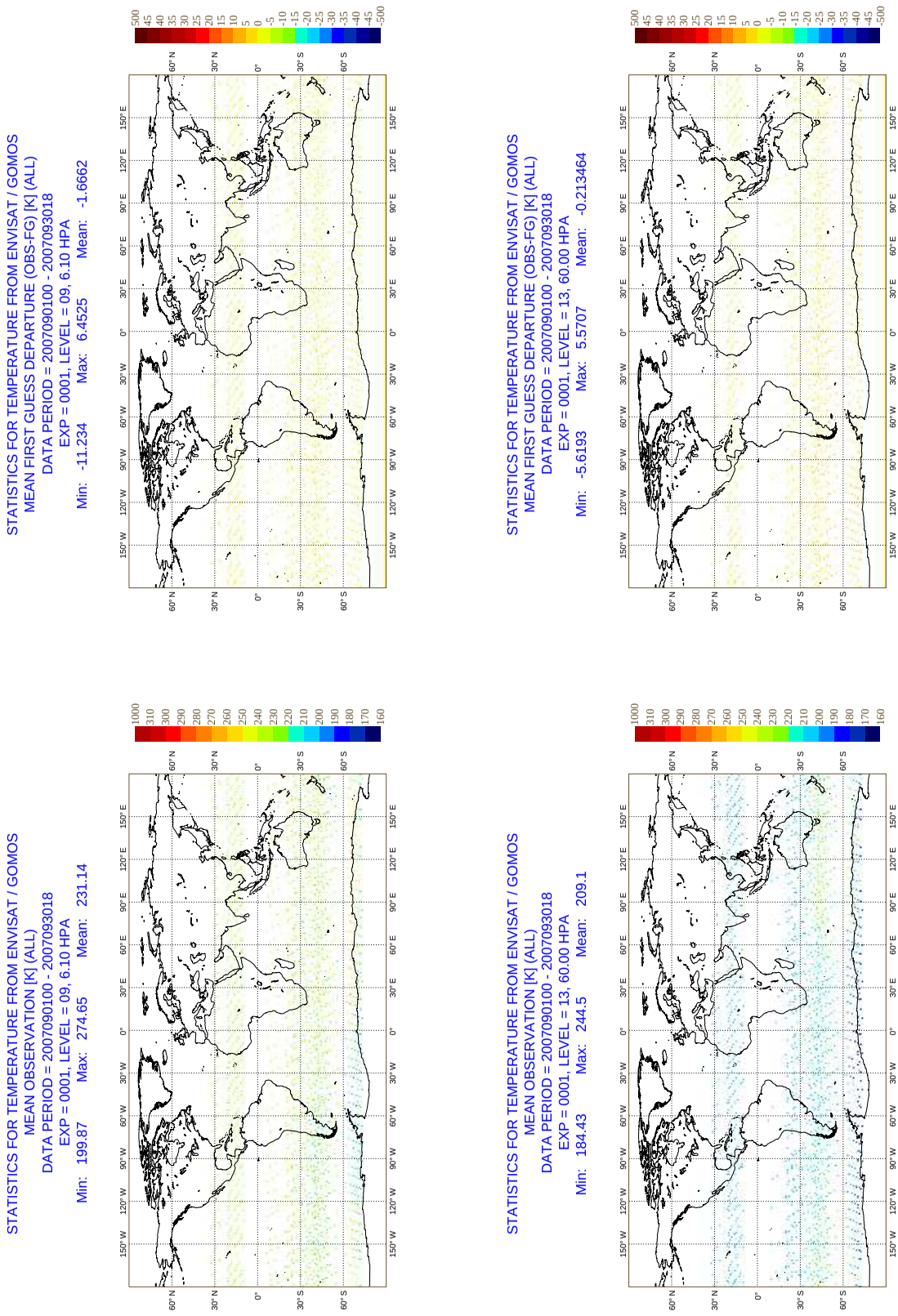


Fig. 18. As Fig. 18 but for level 9 (6.1 hPa) and level 13 (60 hPa).

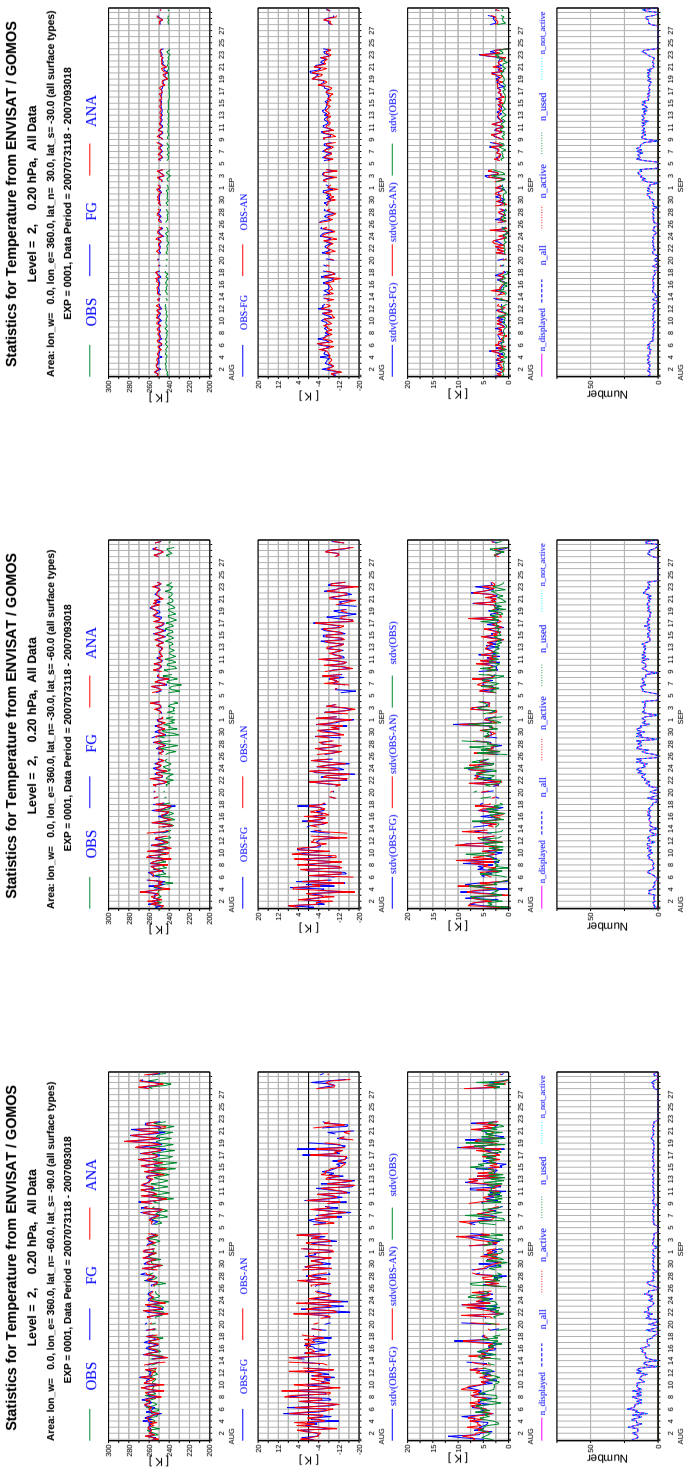


Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) 30N-30S, 30-60S, and 60-90S for the period August-September 2007.

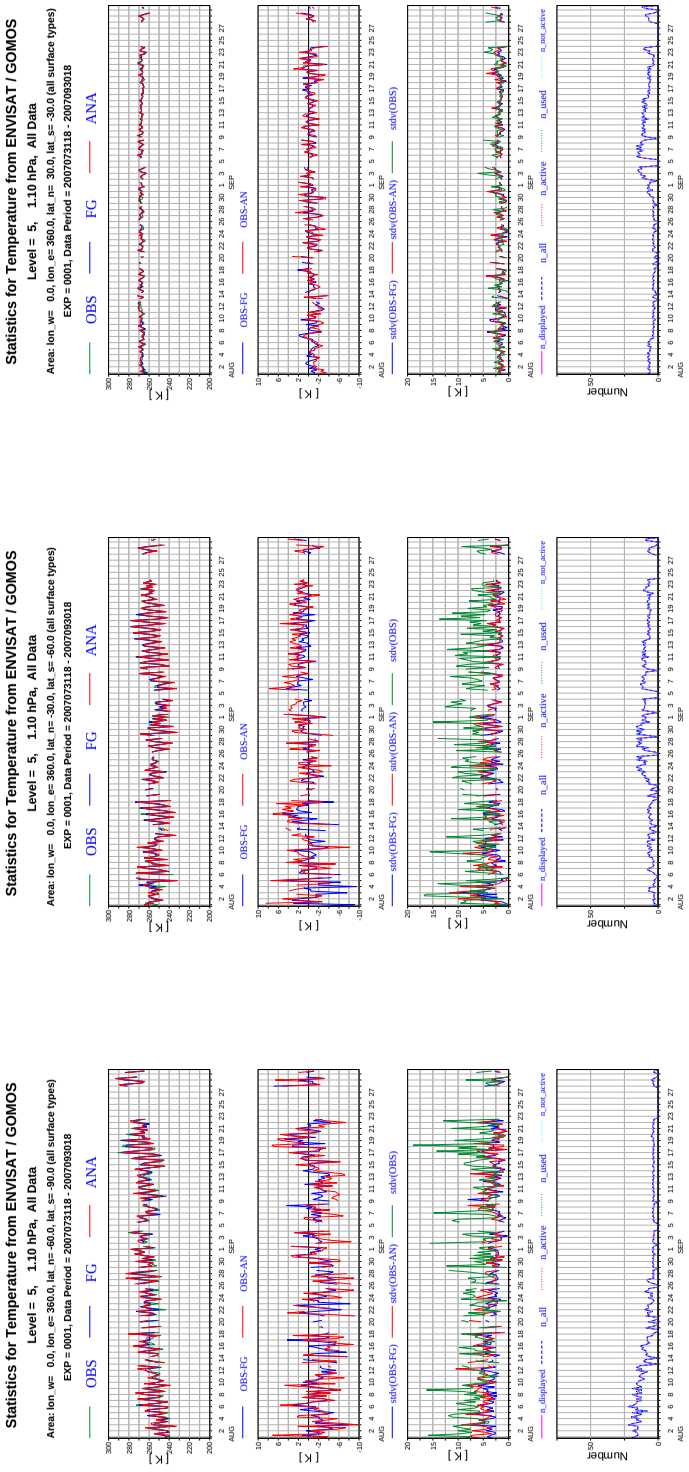


Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

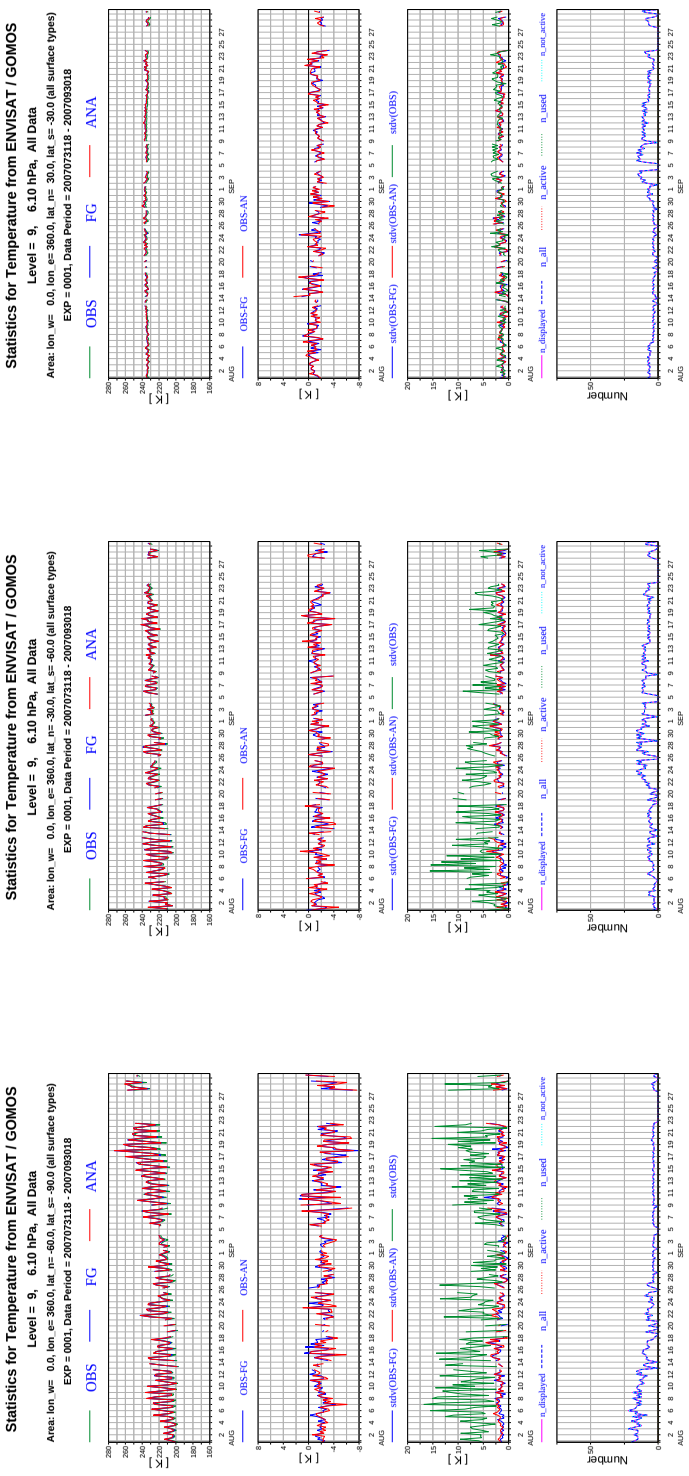


Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

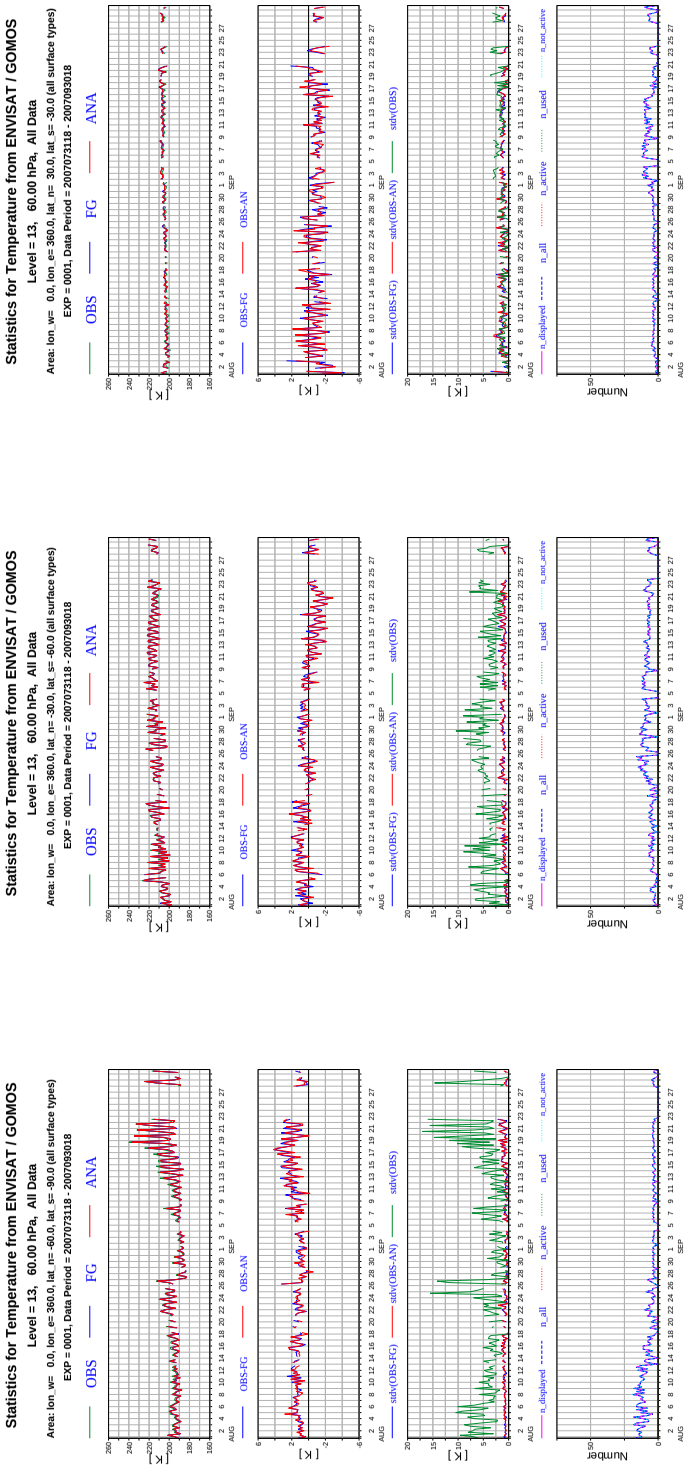


Fig. 22. As Figure 19, but for level 13 (60 hPa).

REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR__2P) FOR SEPTEMBER 2007

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October 5, 2007

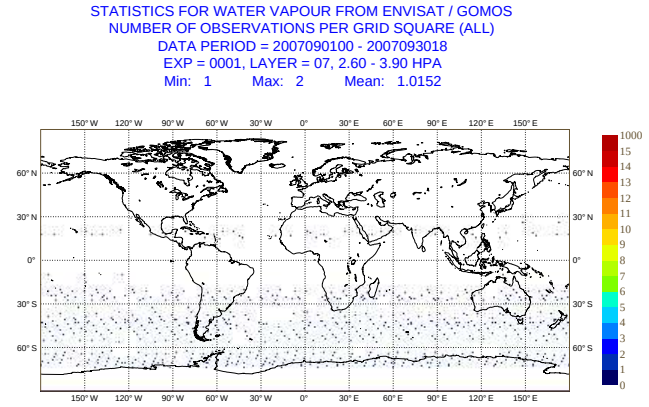

Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for September 2007.

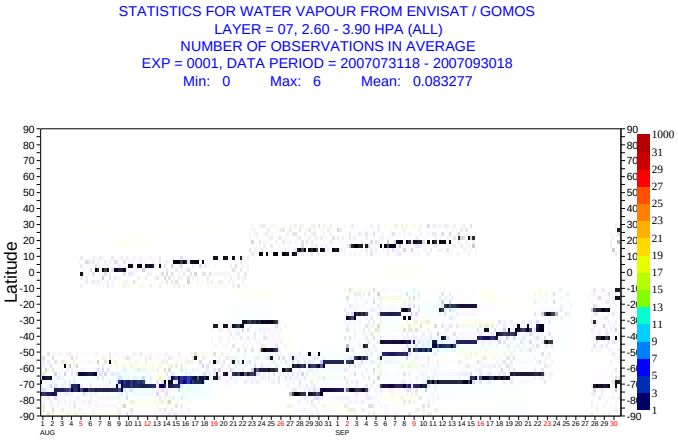

Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for August-September 2007.

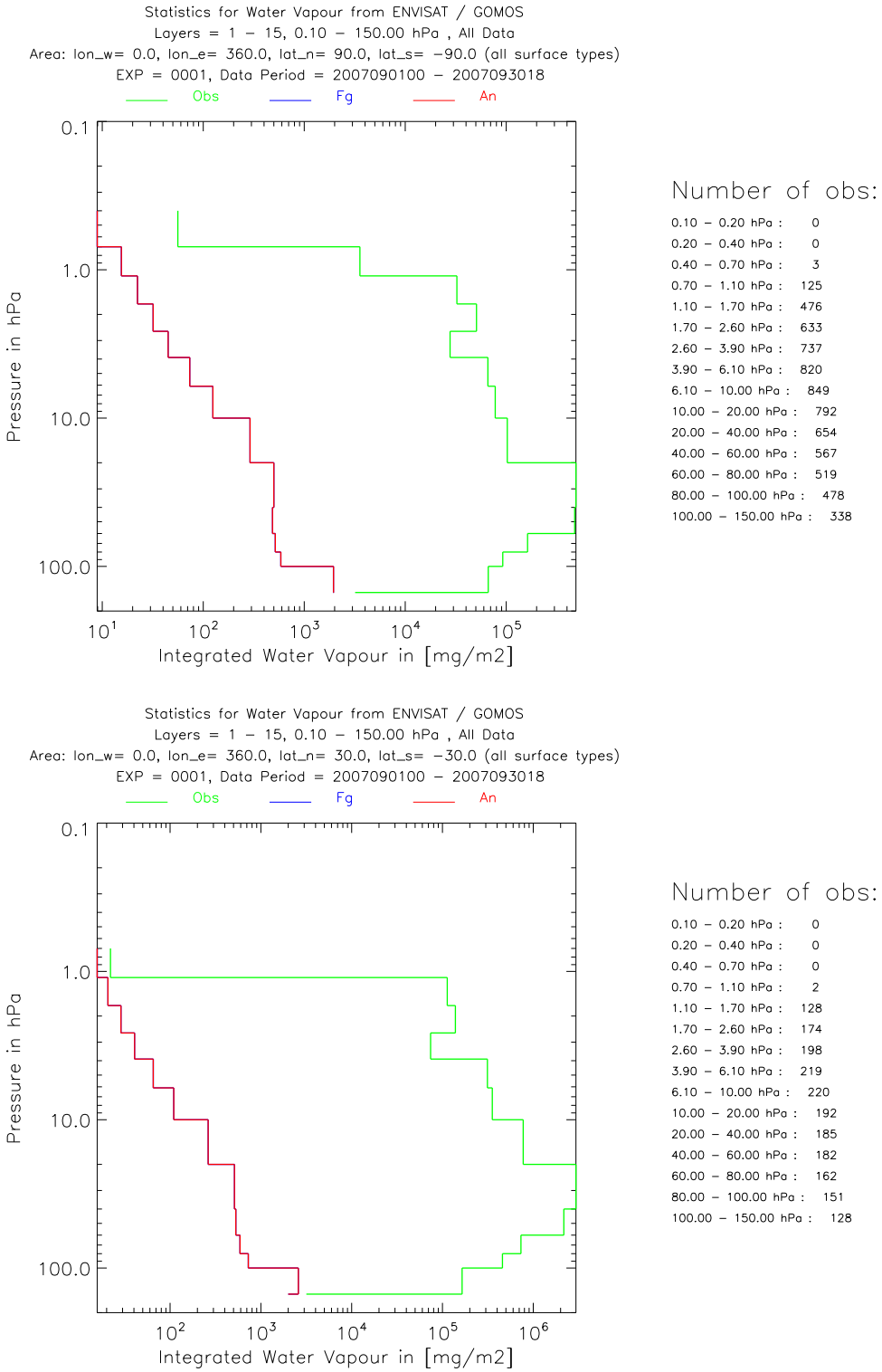

Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m^2 for September 2007. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S) Plotted are the partial columns for the 16 levels listed to the right of the diagrams.

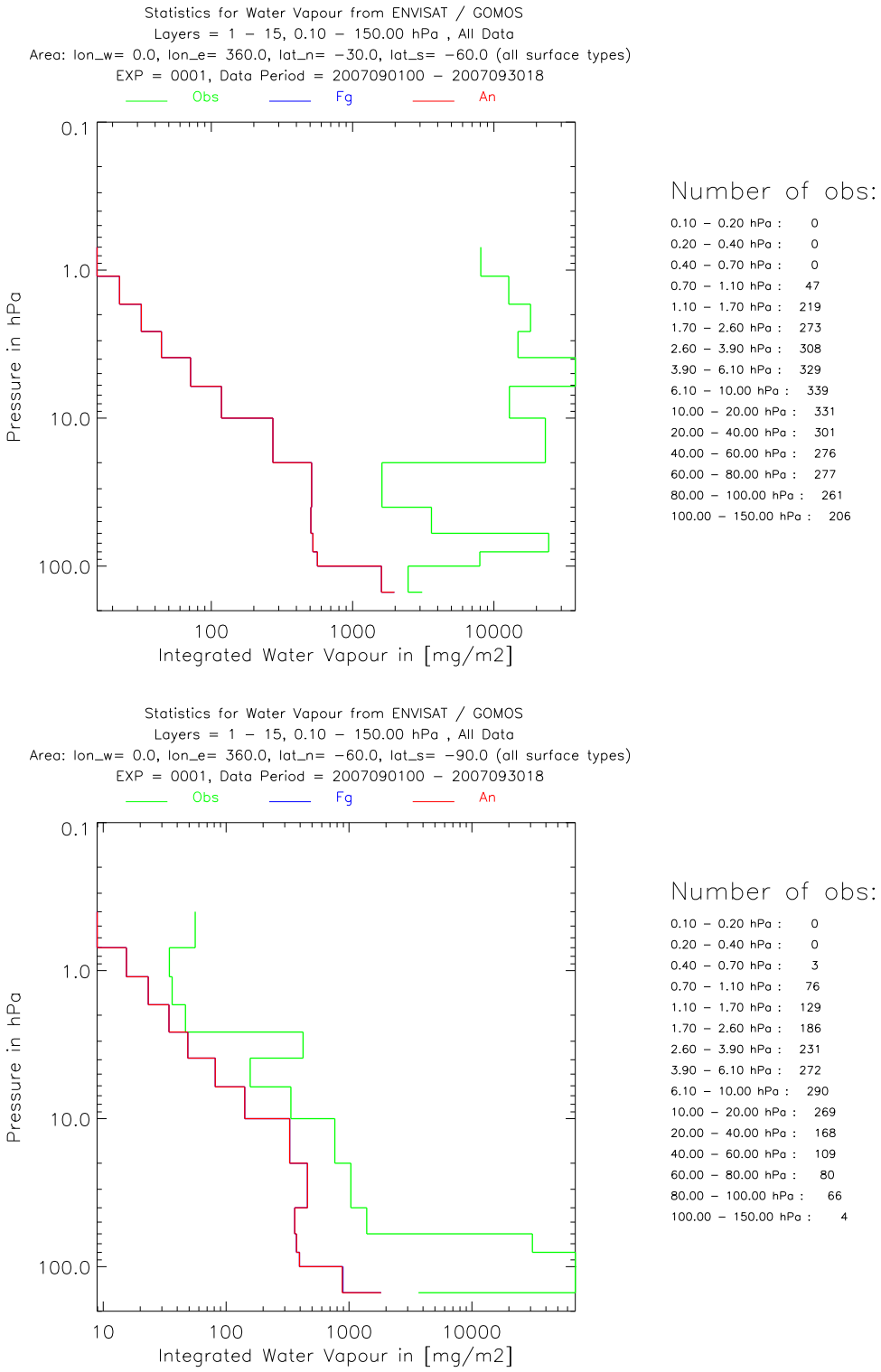

Fig. 4. As Fig. 3 but for 30-60S (top panel) and 60-90S (bottom panel).

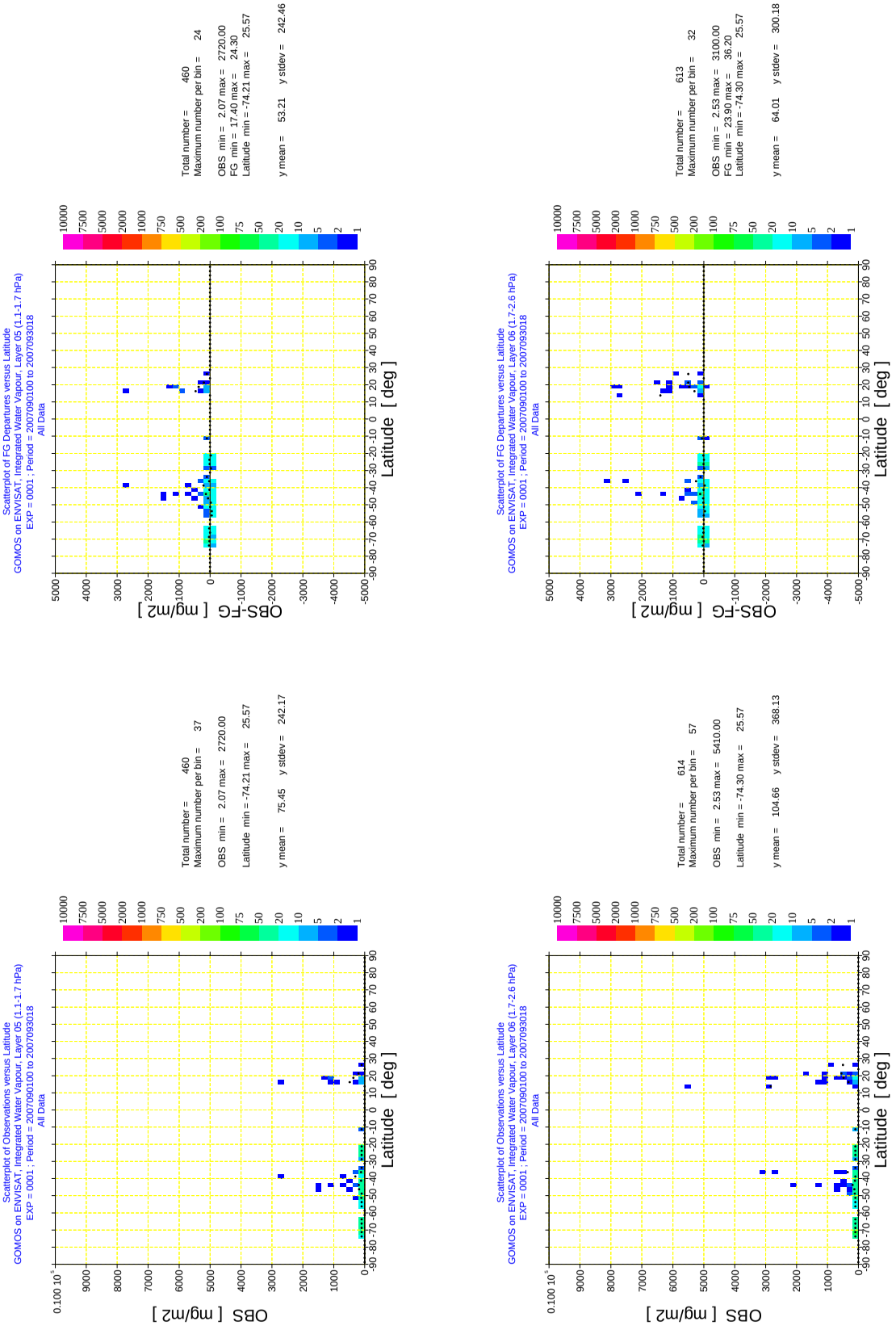

Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for September 2007 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and the black dots the mean value per bin.

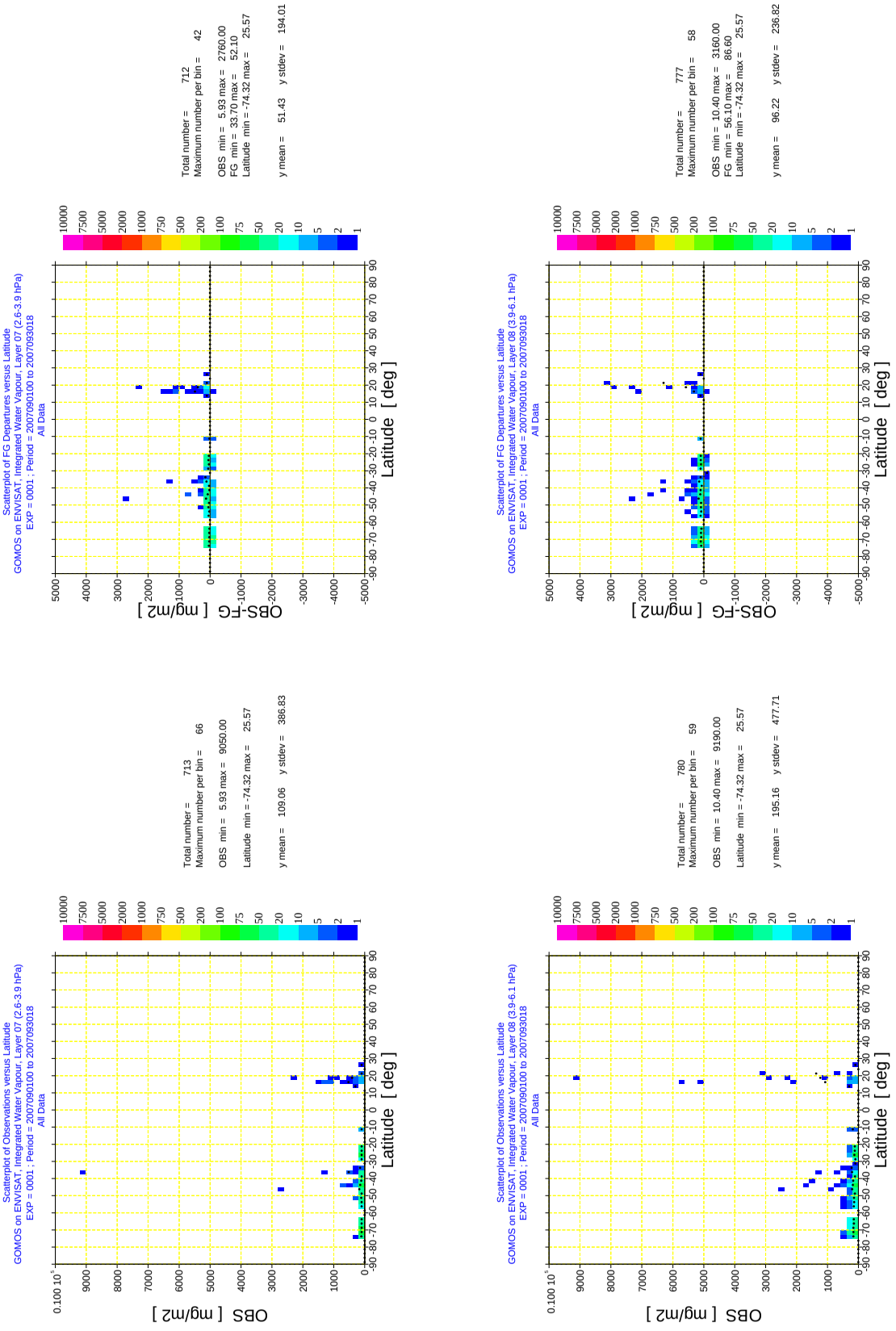

Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

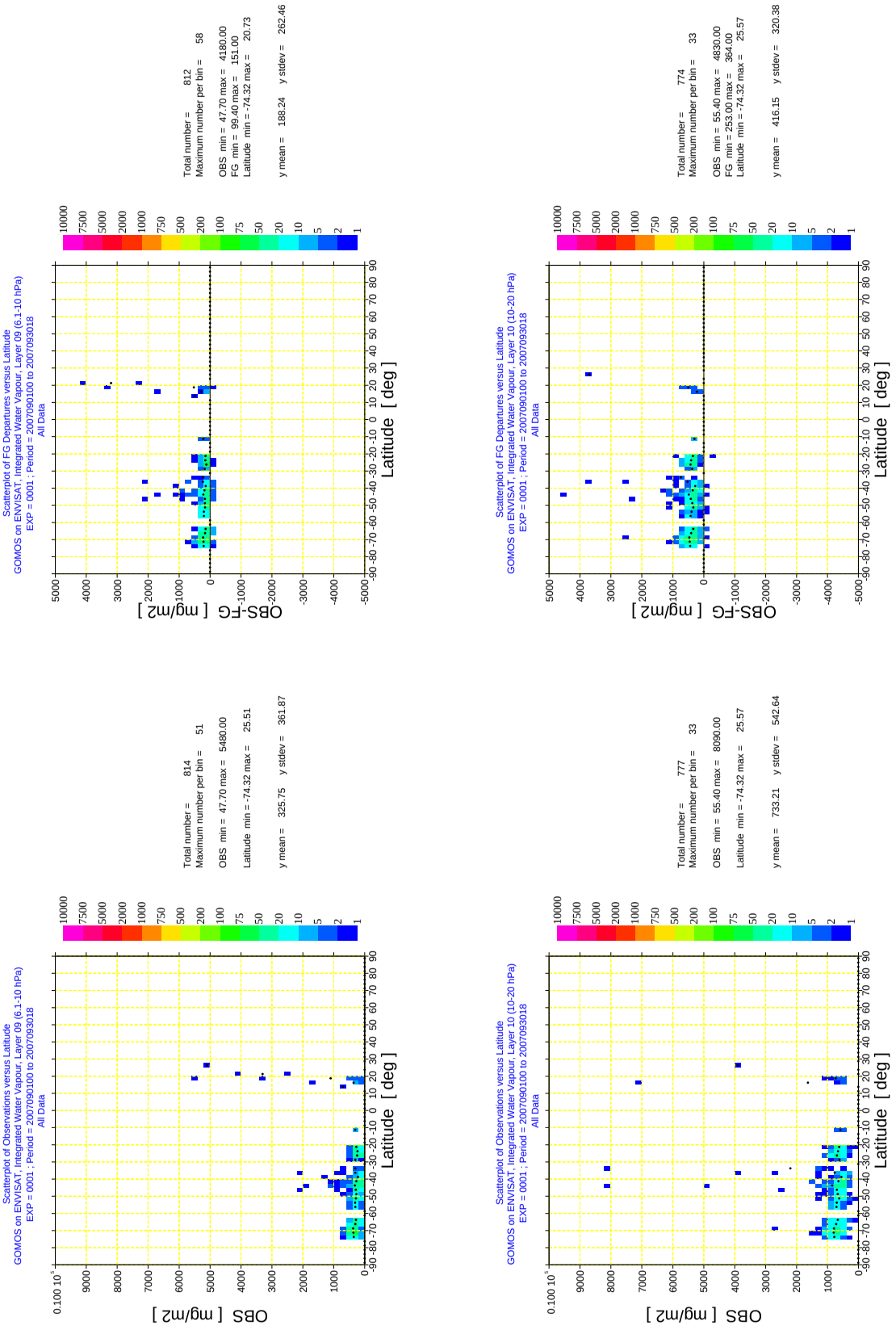

Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

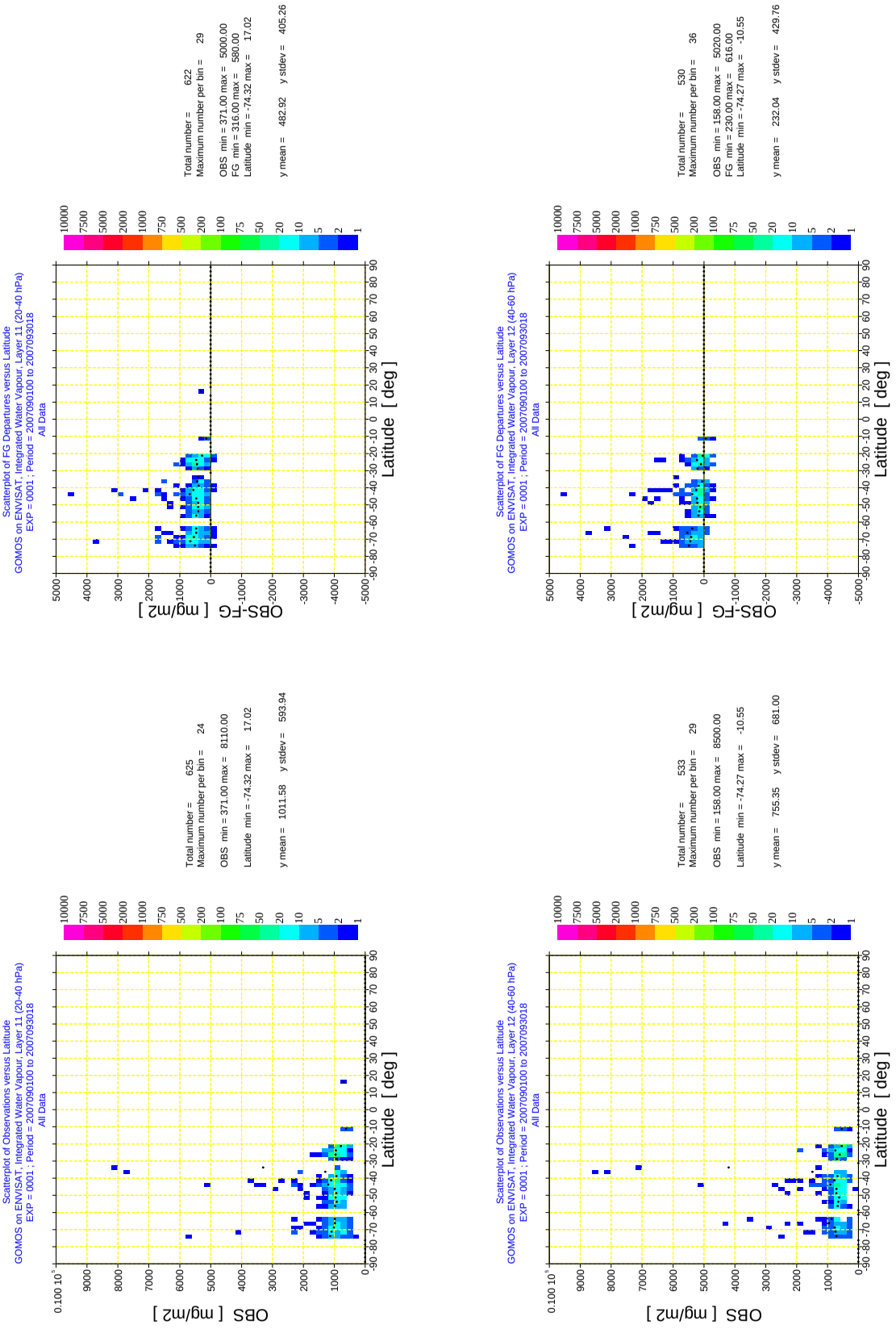

Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

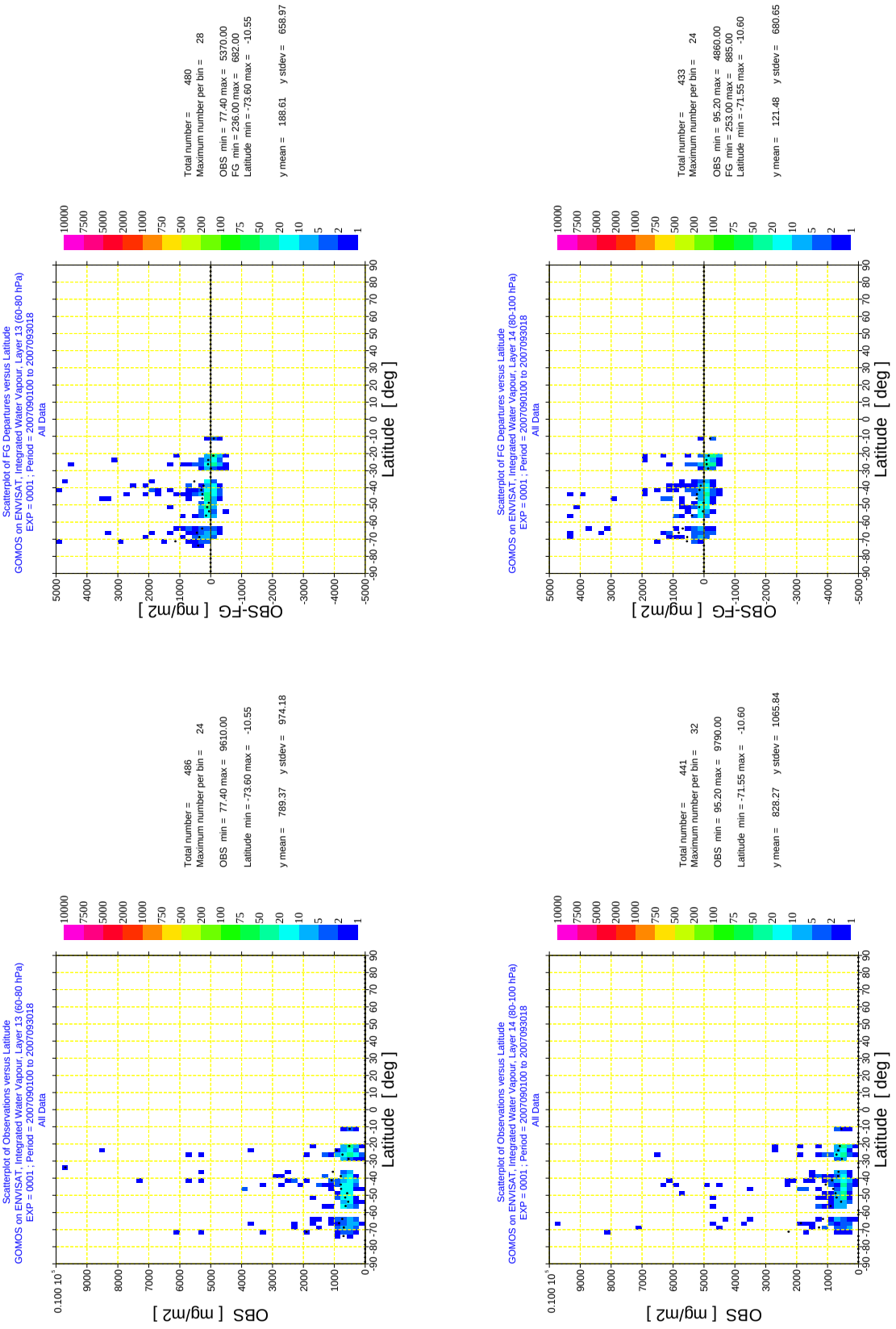

Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

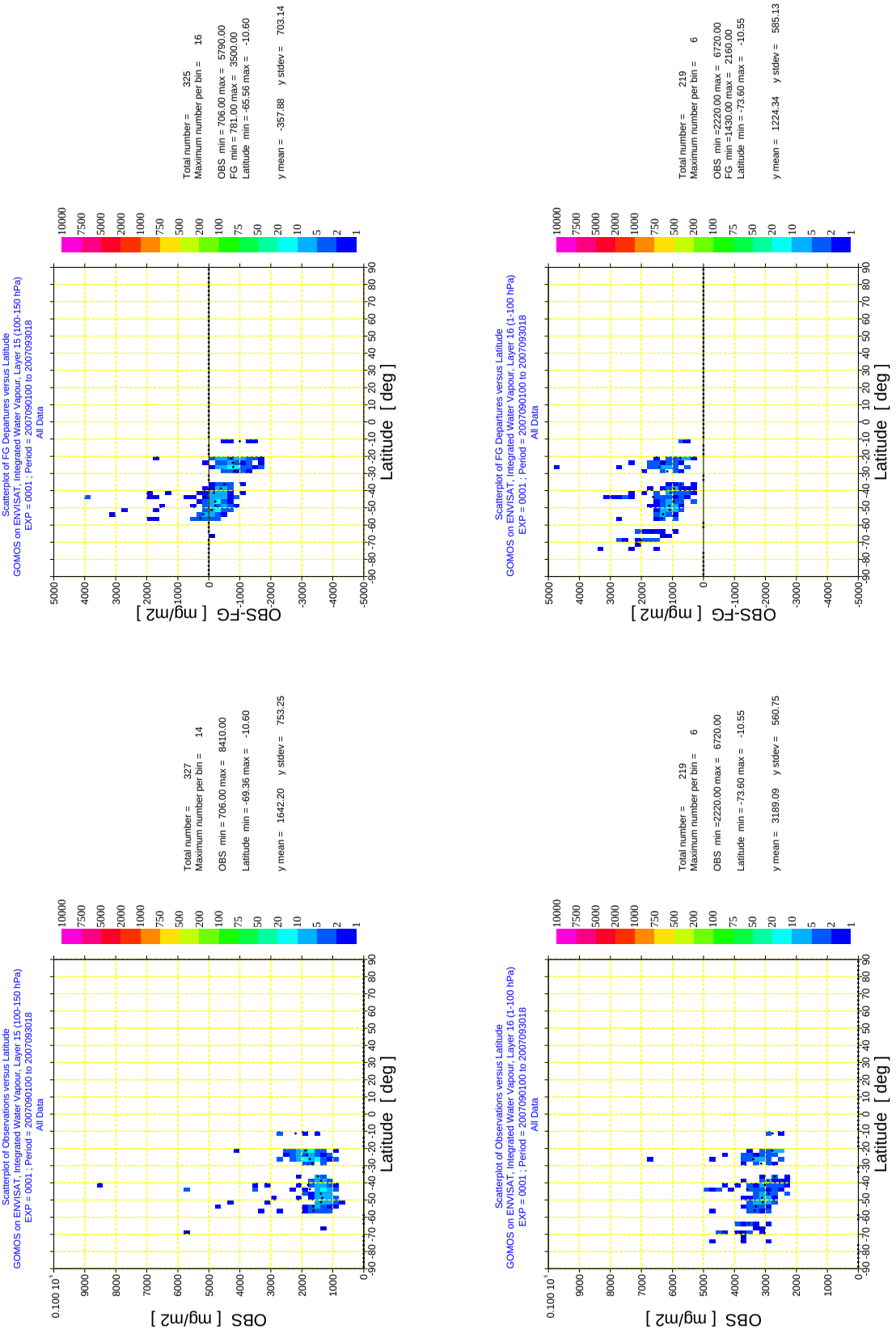

Fig. 10. As Fig. 5 but for level 15 (100-150 hPa) and level 16 (1-100 hPa).

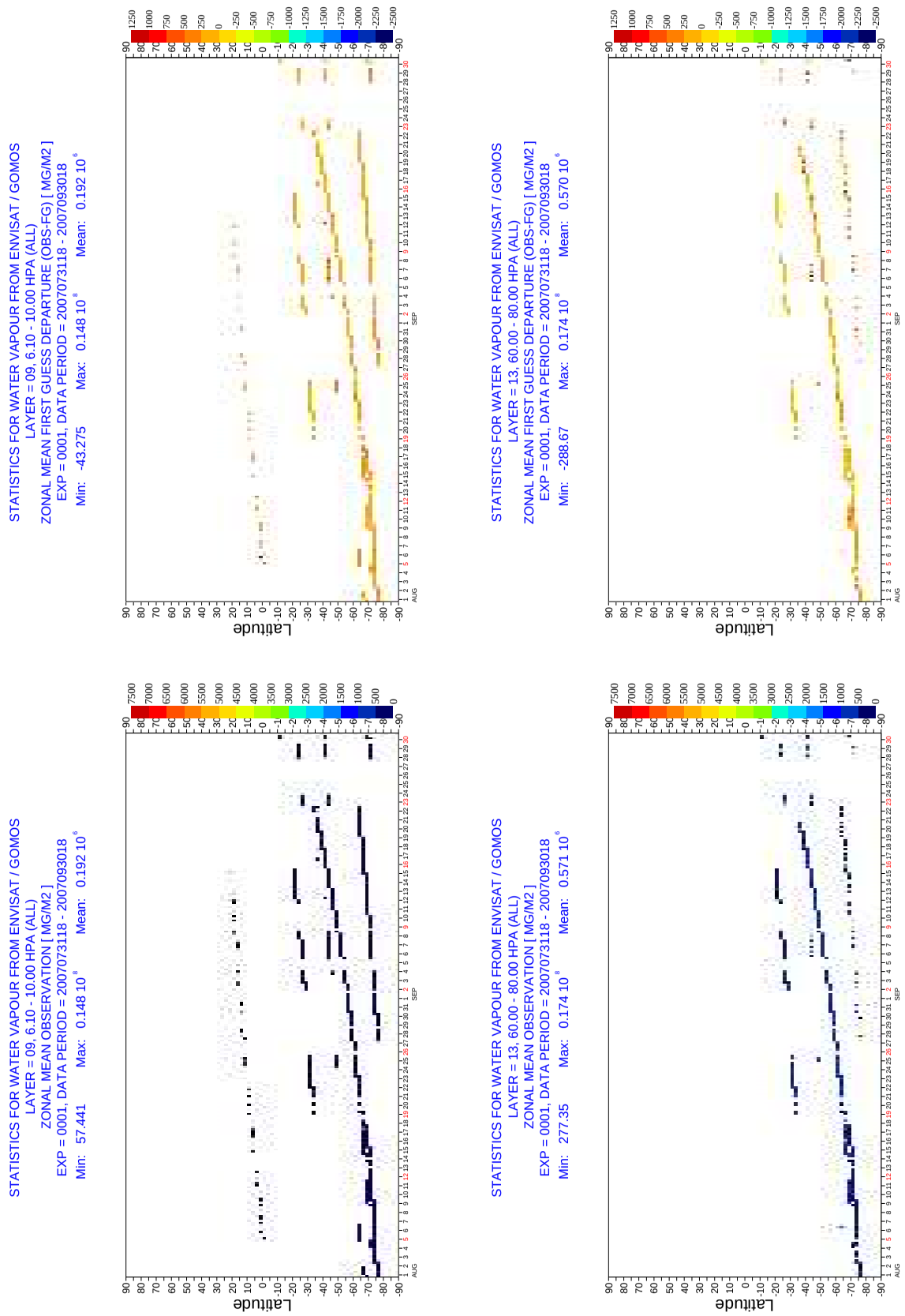

Fig. 11. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for August-September 2007.

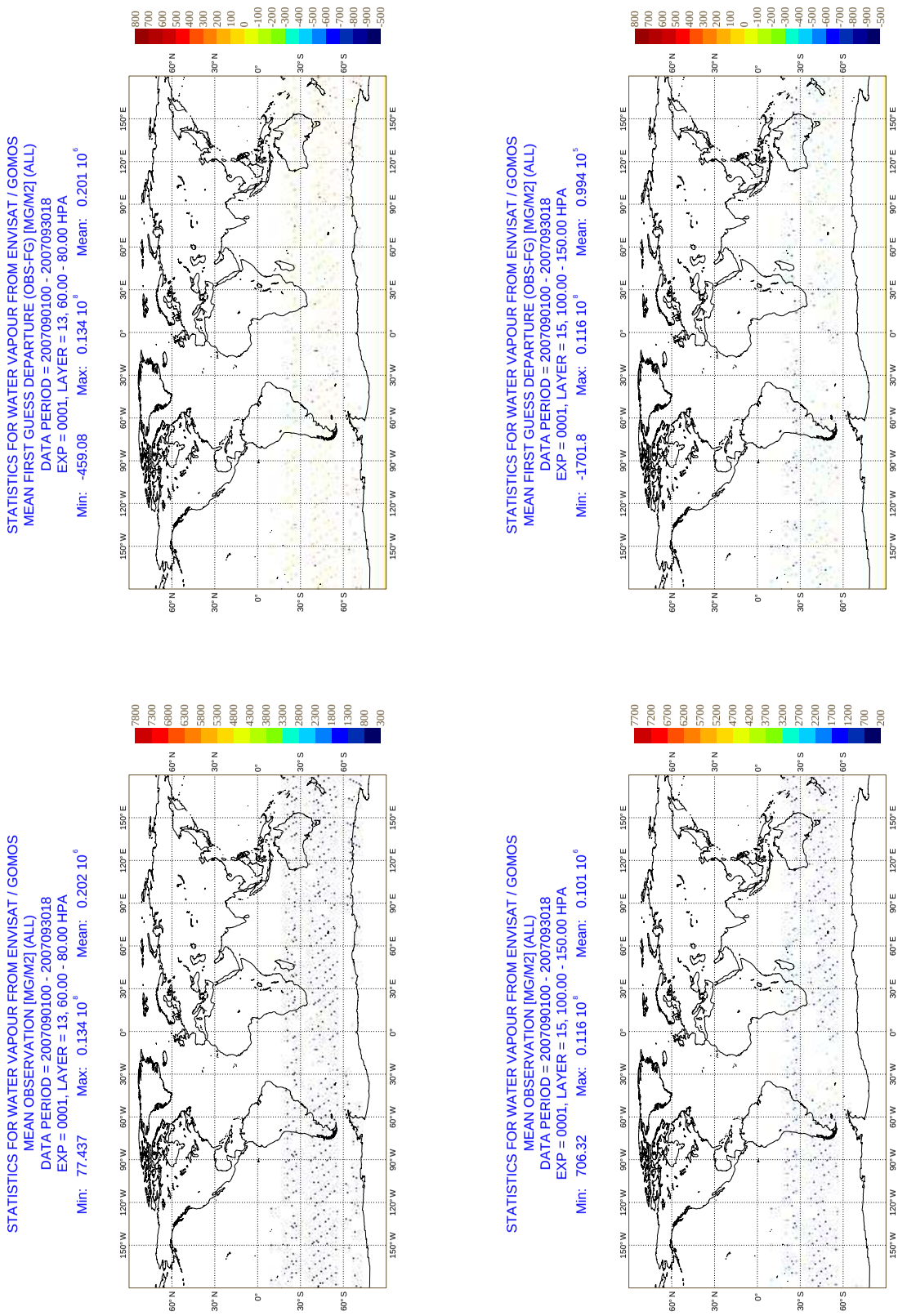

Fig. 12. Geographical distribution of mean ENVISAT GOMOS NRT water vapour data and mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for September 2007.

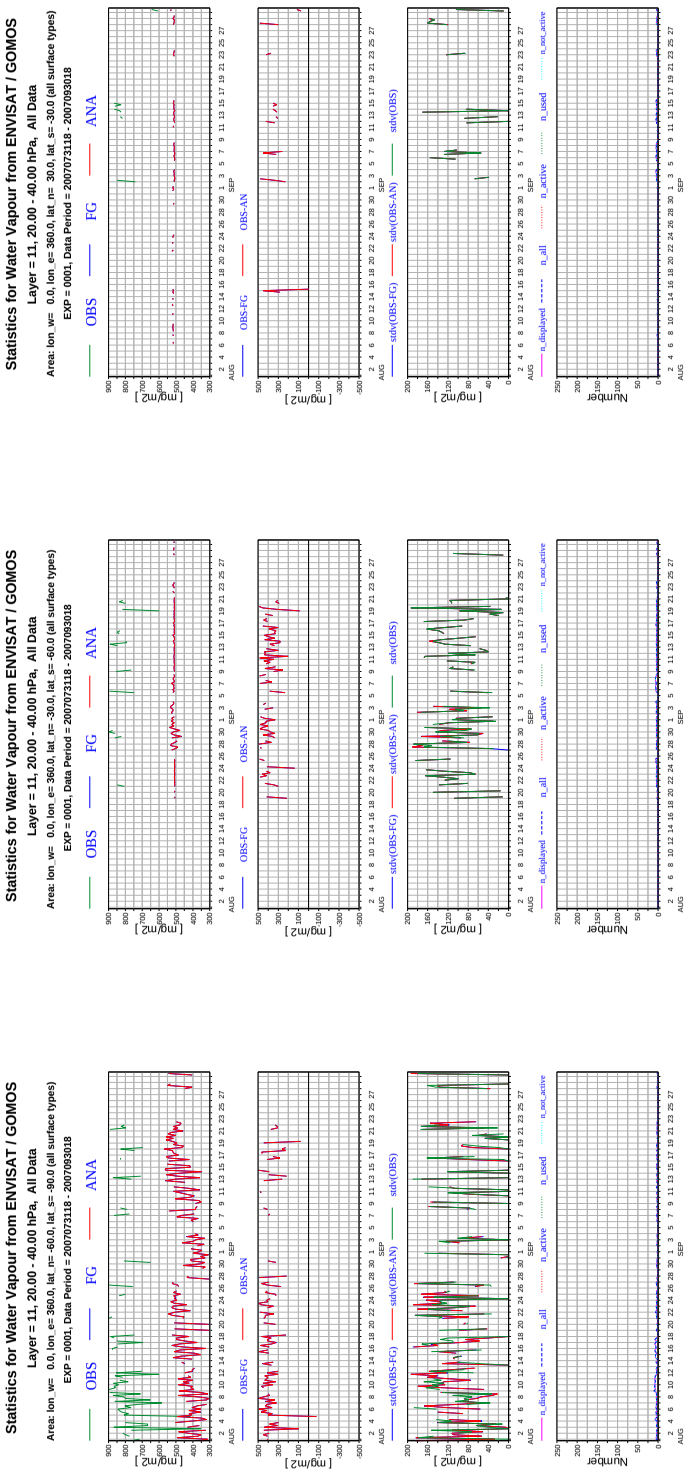

Fig. 13. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 11 (20-40 hPa) 30N-30S, 30-60S, and 60-90S for the period August-September 2007.

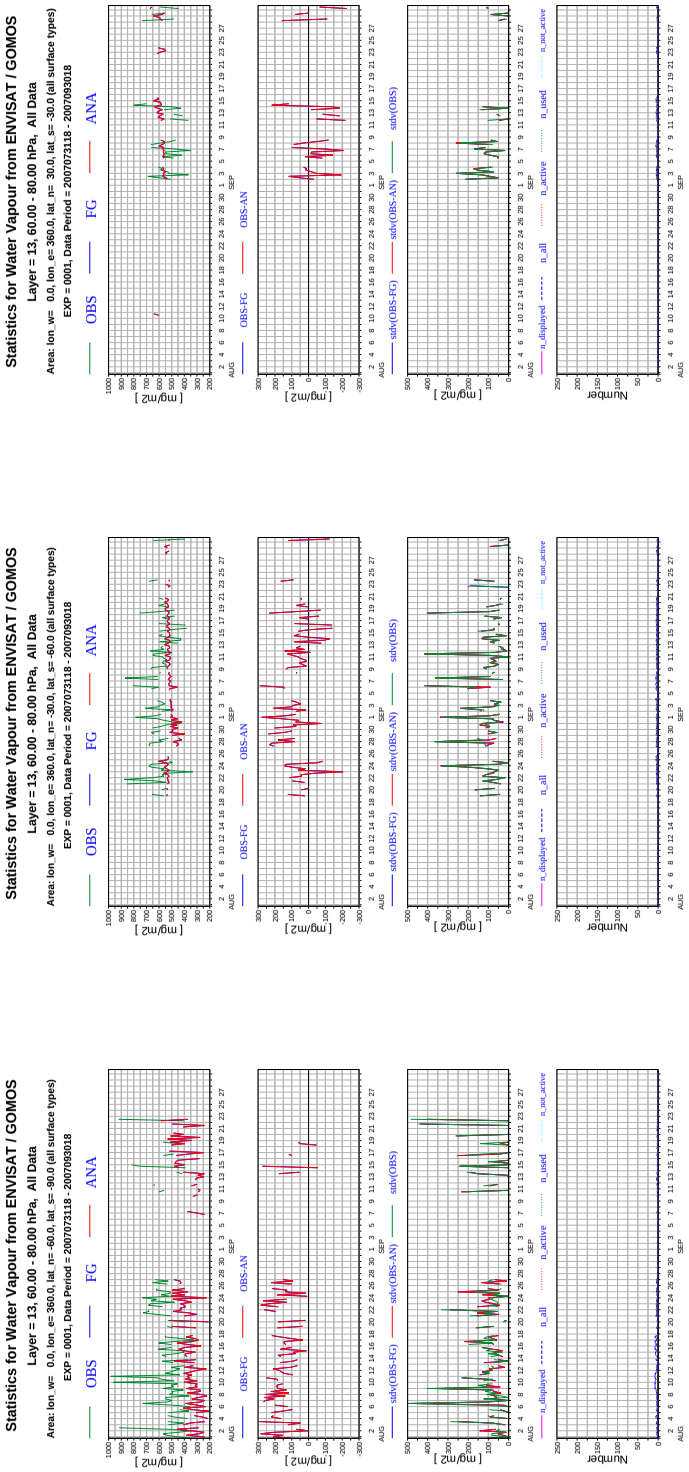

Fig. 14. As Figure 13, but for level 13 (60-80 hPa).

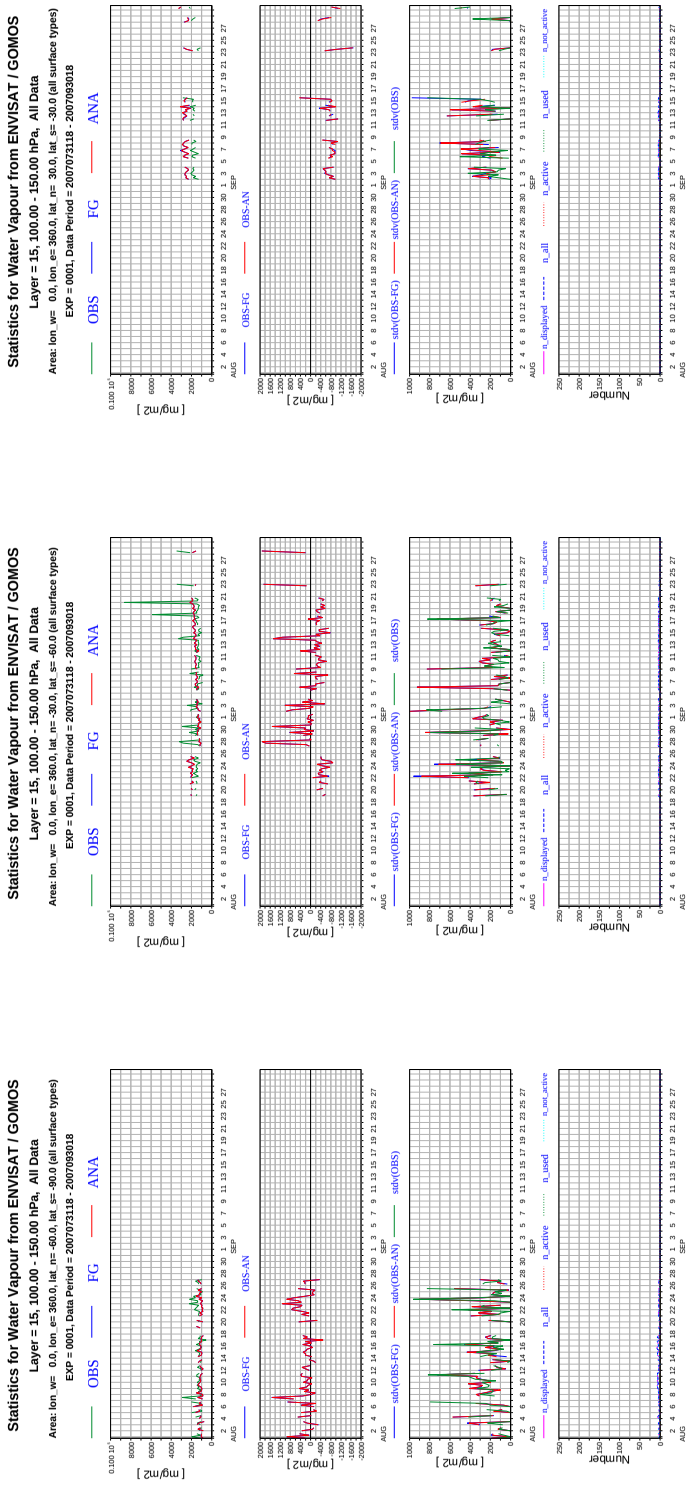

Fig. 15. As Figure 13, but for level 15 (100-150 hPa).