REPORT ABOUT ENVISAT GOMOS NRT PRODUCTS (GOM_RR__2P) FOR SEPTEMBER 2009

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October 8, 2009

1. Key points for September 2009

- The amount of GOMOS observations available in September 2009 was again higher than that available during the first half of 2009.
- The quality of the GOMOS data was found generally stable during September 2009, and comparable with that of August.
- The mean temperature first guess and analysis departures were typically within $\pm$1% at most levels in the stratosphere. Larger departures up to -4% (about -8K) were seen in the mesosphere. The mean standard deviation of the first-guess and analysis departures were typically about 1% in the stratosphere and within 1 and 2% in the mesosphere at all the available latitudinal bands.
- The stratospheric ozone first guess and analysis departures were within -5 and +30% at all stratospheric levels in the global average and in the mean over the mid and high latitudes in the SH. In the tropics, the ozone residuals were typically within -5 and +10% for p$<$40hPa. Larger departures ($>$50% in places) were found elsewhere. The standard deviations of the departures were larger than 10% at all levels and latitudinal bands.
- The comparisons between the GOMOS water vapour retrievals and the ECMWF water vapour first guess and analyses showed a poor level of agreement also in September 2009, with GOMOS water vapour observations being from one to three orders of magnitude larger than their model equivalent at all available vertical levels and latitudes.
- The monitoring statistics for September were produced with the operational ECMWF model, CY35R3.

2. Quality and amount of received data

Data coverage and amount of received data during September 2009 are shown in figures 1 and 2 in the temperature, ozone and water vapour reports. Overall, just under 1700 (good) observations were available for temperature, about 1600 were available for ozone and just over 480 (good) observations for water vapour, with an overall amount of observations in September slightly smaller than that received in August 2009. The largest number of observations were sampled 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 observations at mid and high latitudes in the NH, and a very limited amount in the equatorial band, particularly in the case of water vapour.

3. GOMOS temperature data

The profile plots (temperature report: Figures 3-6) show that, in the global average and in the mean over the midlatitudes in the SH, the first-guess and analysis departures were almost zero in the stratosphere (for pressures larger than 20hPa), while small negative departures up to -0.5% (about 1K) can be found in the upper stratosphere. In the mesosphere, the mean temperature departures were up to -4% (about -8K). In the tropics, the first guess and analysis departures were negative and up to -1% (-2K) in all the stratosphere, and up to -4% (-8K) in the mesosphere. At high latitudes in the SH, positive departures up to +1% (2 K) were found in the lower stratosphere (for pressures larger than 20hPa), and negative up to -1% (-2 K) in the rest of the stratosphere. Departures within -3 and +2% (between -6 and +4K) were found in the mesosphere at these latitudes. The mean standard deviation of the first-guess and analysis departures were about 1% in the whole stratosphere and within 1 and 2% in the mesosphere at all the available latitudinal bands.

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 analyses, 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 profile plots (ozone report: Figures 3-6) show that both the ozone first guess and analyses were within the observation one-standard deviation range at all levels and latitudinal bands. In the global average, the first-guess departures were within -5 and +30% in the stratosphere. Larger departures ($>$50% in places) were found in the mesosphere. 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 +10% were found in most of the stratosphere ($p<40$hPa) in the tropical band. Large biases were seen in the tropical lower Stratosphere ($p>40$hPa), while in the mesosphere the first guess and analysis departures were typically within -15 and +7%. At midlatitudes in the SH, the GOMOS ozone values and their model equivalent showed residuals typically within -10 and +25% in the stratosphere. Larger departures were found elsewhere. Positive first guess and analysis departures within +1 and +20% were found in most of the stratosphere and mesosphere at high latitudes in the SH.

The standard deviations of the analysis and first guess departures were larger than 10% 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

Water vapour data were only available at mid and high latitudes in the SH during August 2009, in the ratio of about one third and two thirds, respectively. A statistically insignificant number of observations (up to 3) were available in the tropical band (see bottom panel of figure 3 in the water vapour report). 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 three orders of magnitude larger than those given by the model at all vertical levels and available latitudinal bands. The level of agreement at high latitudes in the SH was generally found higher than that at midlatitudes, although differences of about one order of magnitude were still seen in the first-guess and analysis departures at most levels in the Stratosphere, with the model being drier than the GOMOS observations.

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 low number of data and their poor quality.

6. Remarks

This monitoring report was produced with the operational ECMWF model (CY35R3). Ozone layers from SBUV/2 on NOAA-17 and NOAA-18, SCIAMACHY total column ozone (produced by KNMI), and OMI total column ozone were actively assimilated. MERIS total column water vapour (TCWV) was also assimilated from September 2009.

A variational bias correction for retrieved products became operational in September 2009 in the ECMWF model CY35R3. All the assimilated ozone products (with the only exception of the SBUV/2 data) and the MERIS TCWV were bias corrected.

The results presented in this reports made use of only the observations acquired in dark-limb conditions as implemented in the PDS2BUFR converter in May 2007.

All ozone values are in Dobson Units (DU), temperatures are in K, and water vapour partial columns are in mg/m^2.

REPORT ABOUT ENVISAT GOMOS NRT OZONE DATA (GOM_RR__2P) FOR SEPTEMBER 2009

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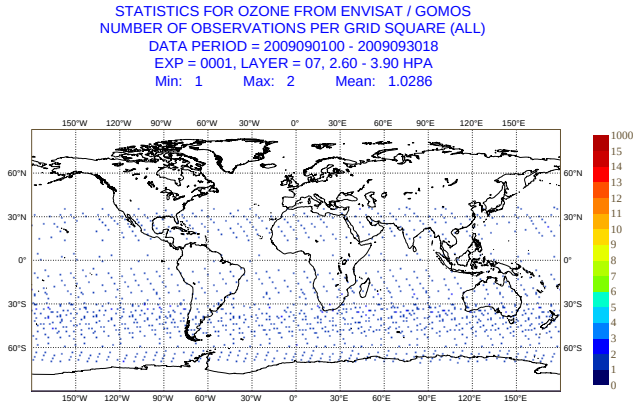


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT ozone data for layer 7 (2.60-3.90 hPa) for September 2009.

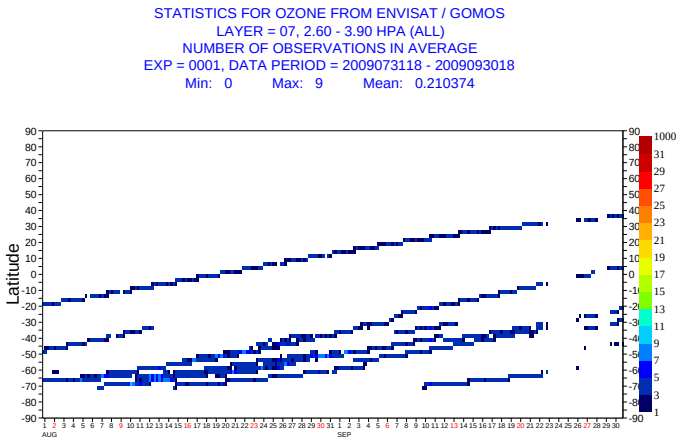


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT ozone data per 6-hour cycle for layer 7 (2.60-3.90 hPa) for August-September 2009.

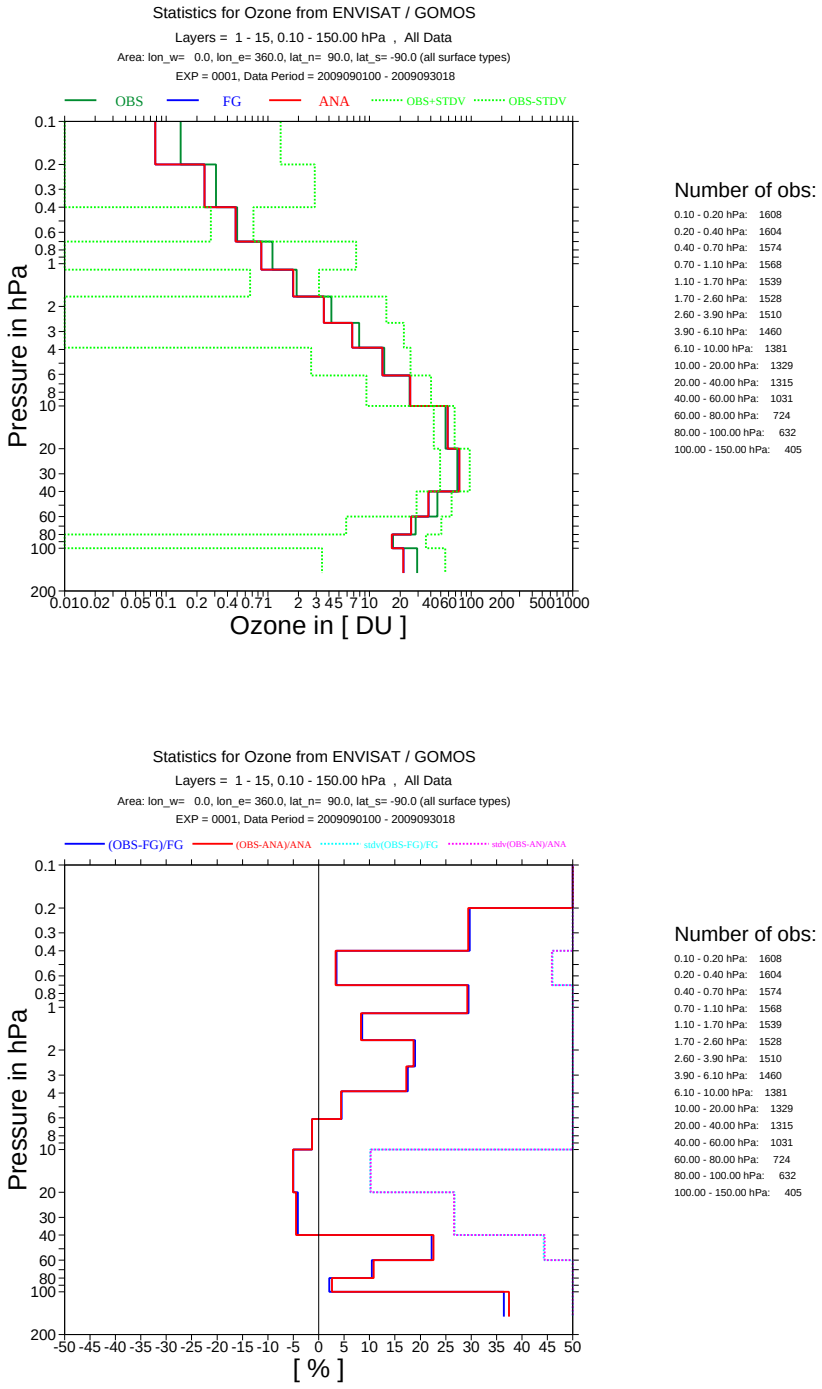
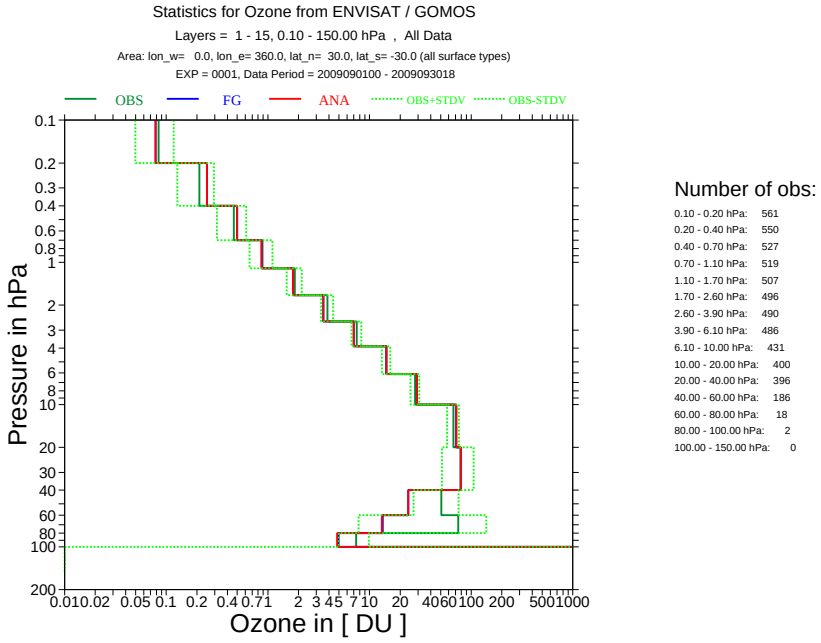


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT ozone data in DU for September 2009 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (red), and the mean observation (green) +/- 1 standard deviation (green dotted lines). The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



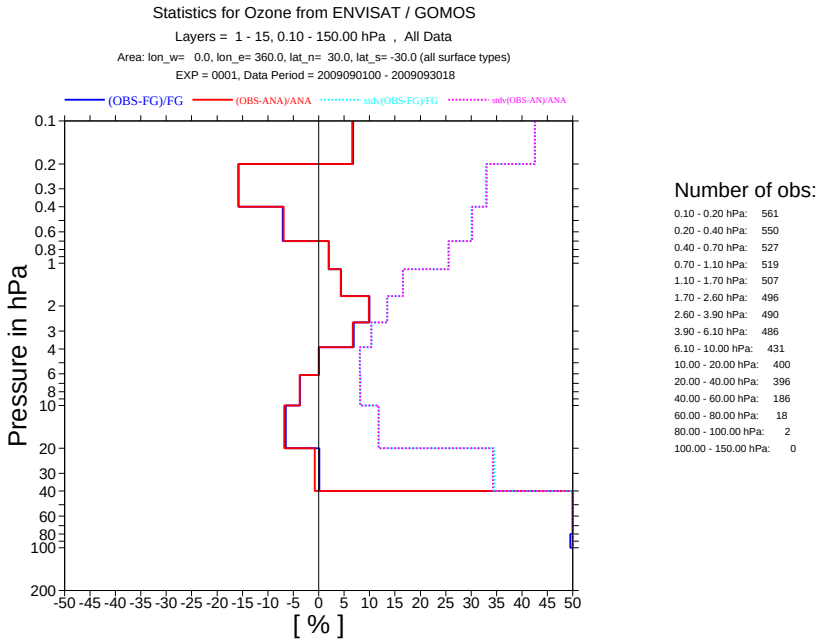
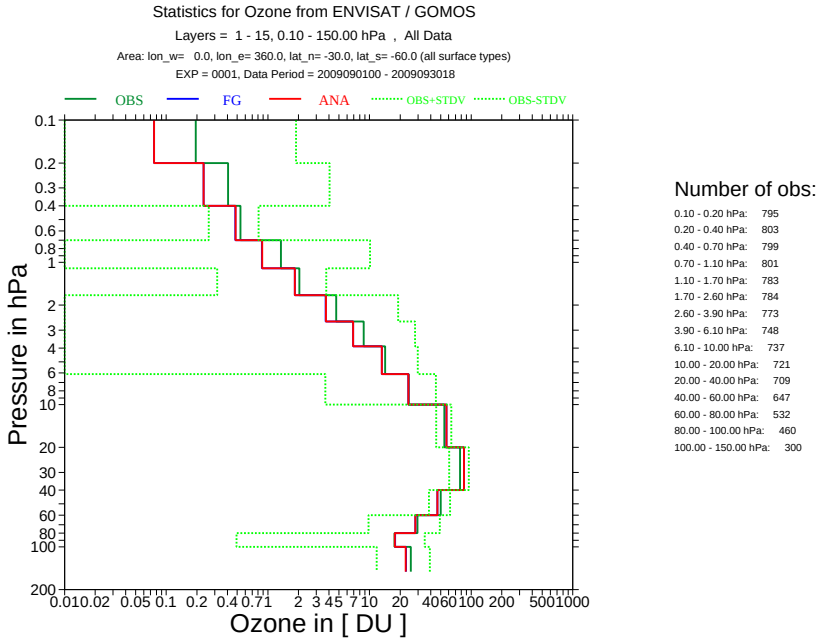


Fig. 4. As Fig. 3 but for 30N-30S.



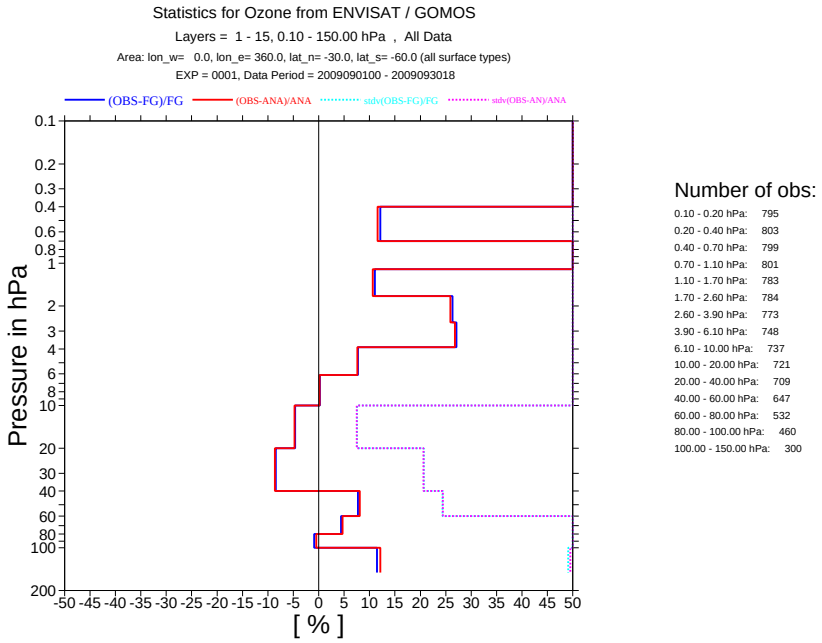
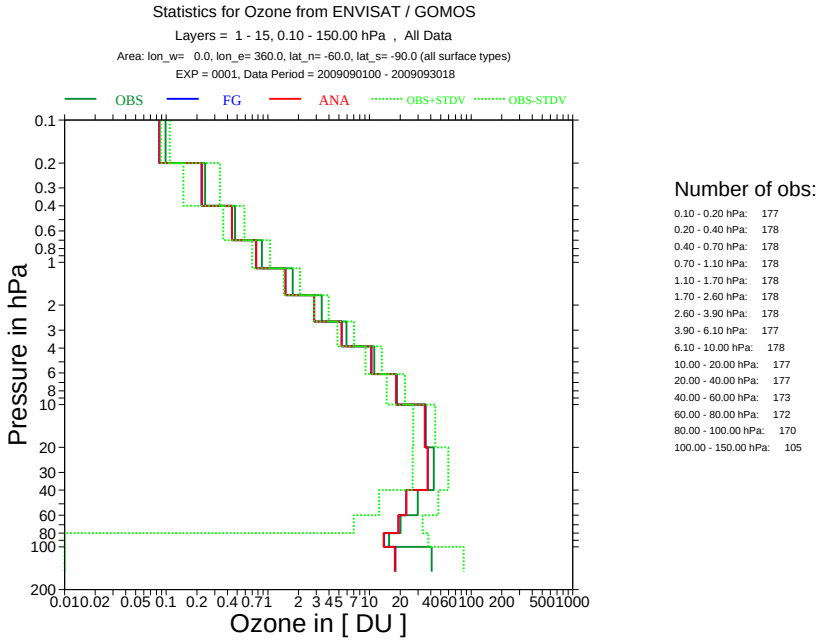


Fig. 5. As Fig. 3 but for 30S-60S.



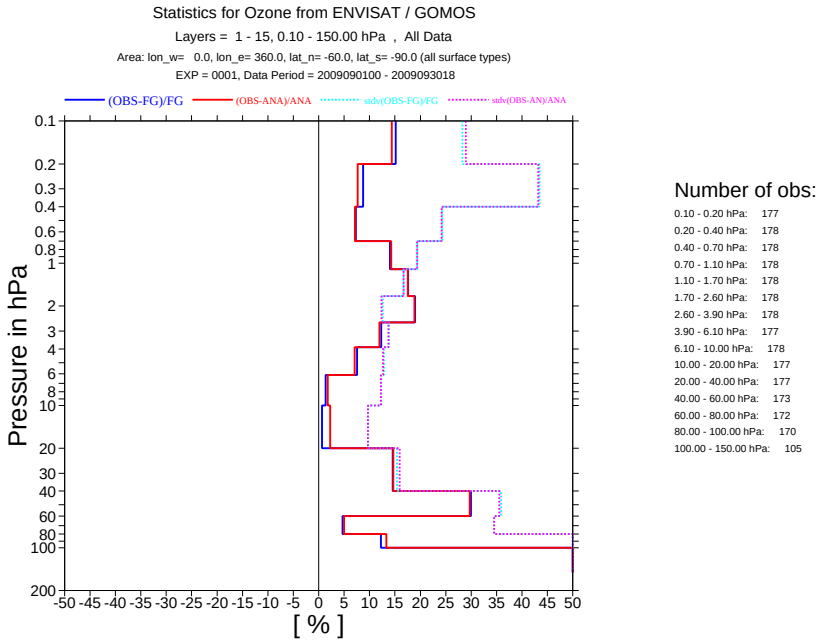


Fig. 6. As Fig. 3 but for 60-90S.

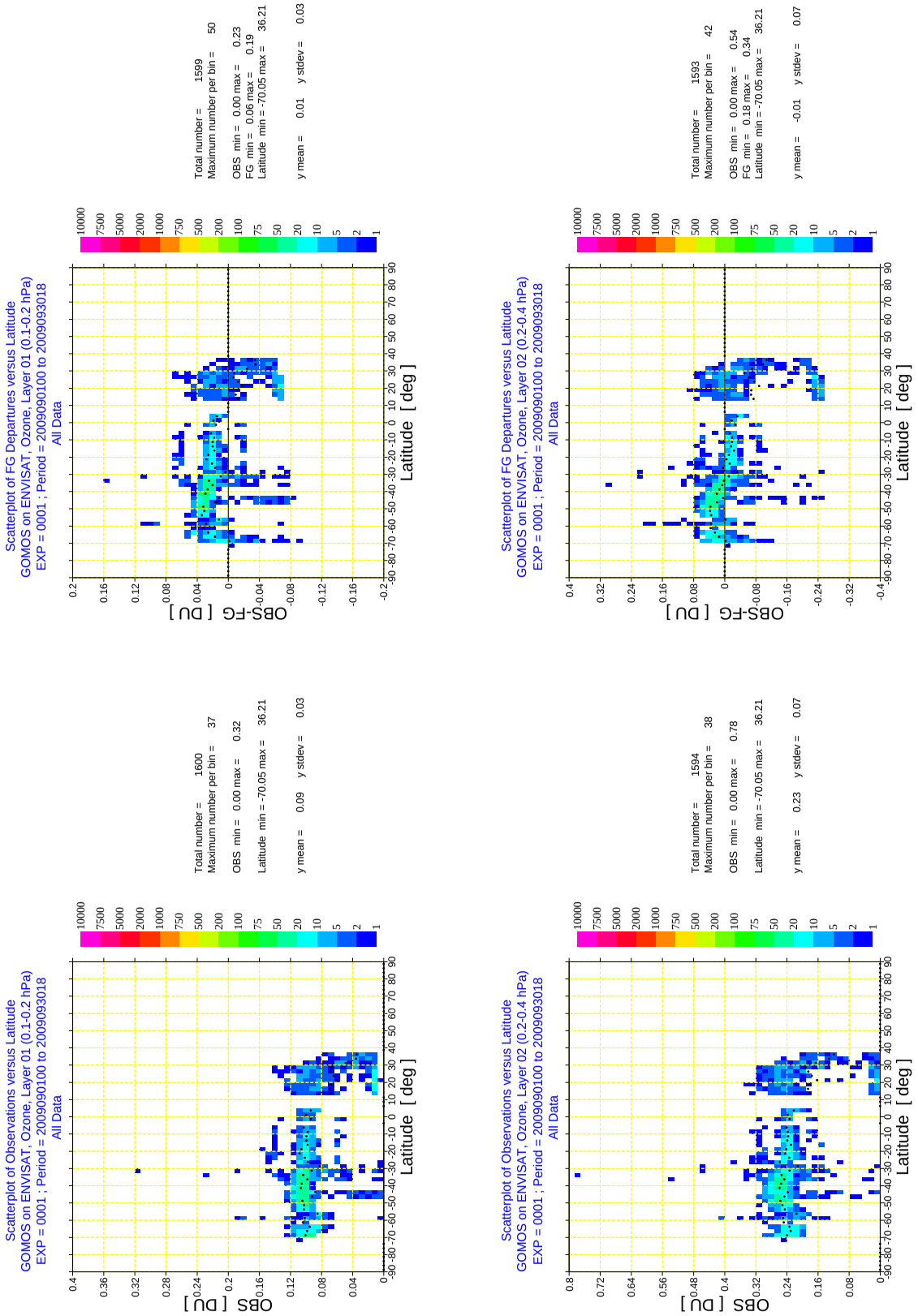


Fig. 7. Scatter plot of ENVISAT GOMOS NRT ozone data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT ozone data against latitude (right) for September 2009 for layer 1 (0.1-0.2 hPa) and layer 2 (0.2-0.4 hPa). The colours show the number of data per bin, the black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

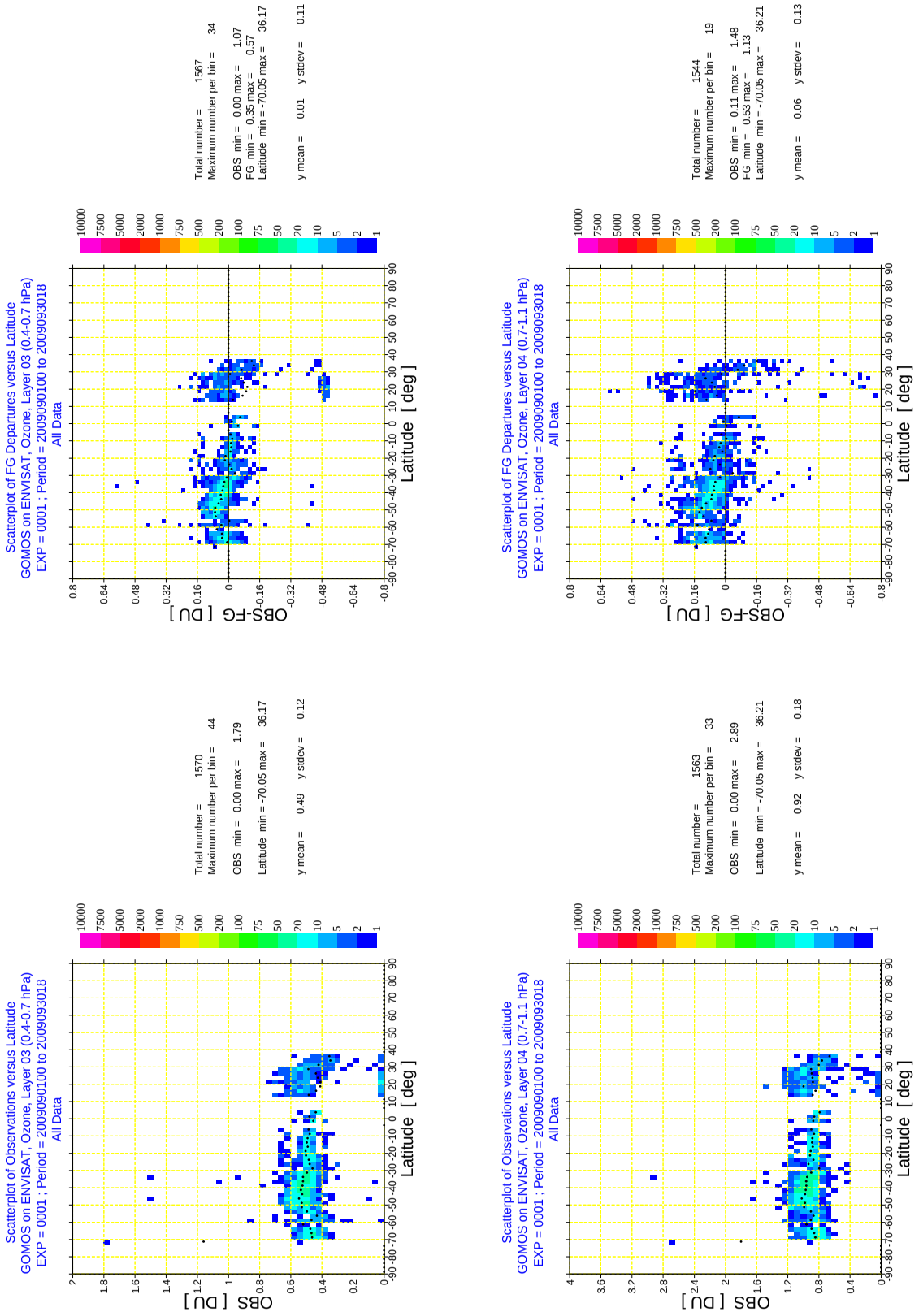


Fig. 8. As Fig. 7 but for layer 3 (0.4-0.7 hPa) and layer 4 (0.7-1.1 hPa).

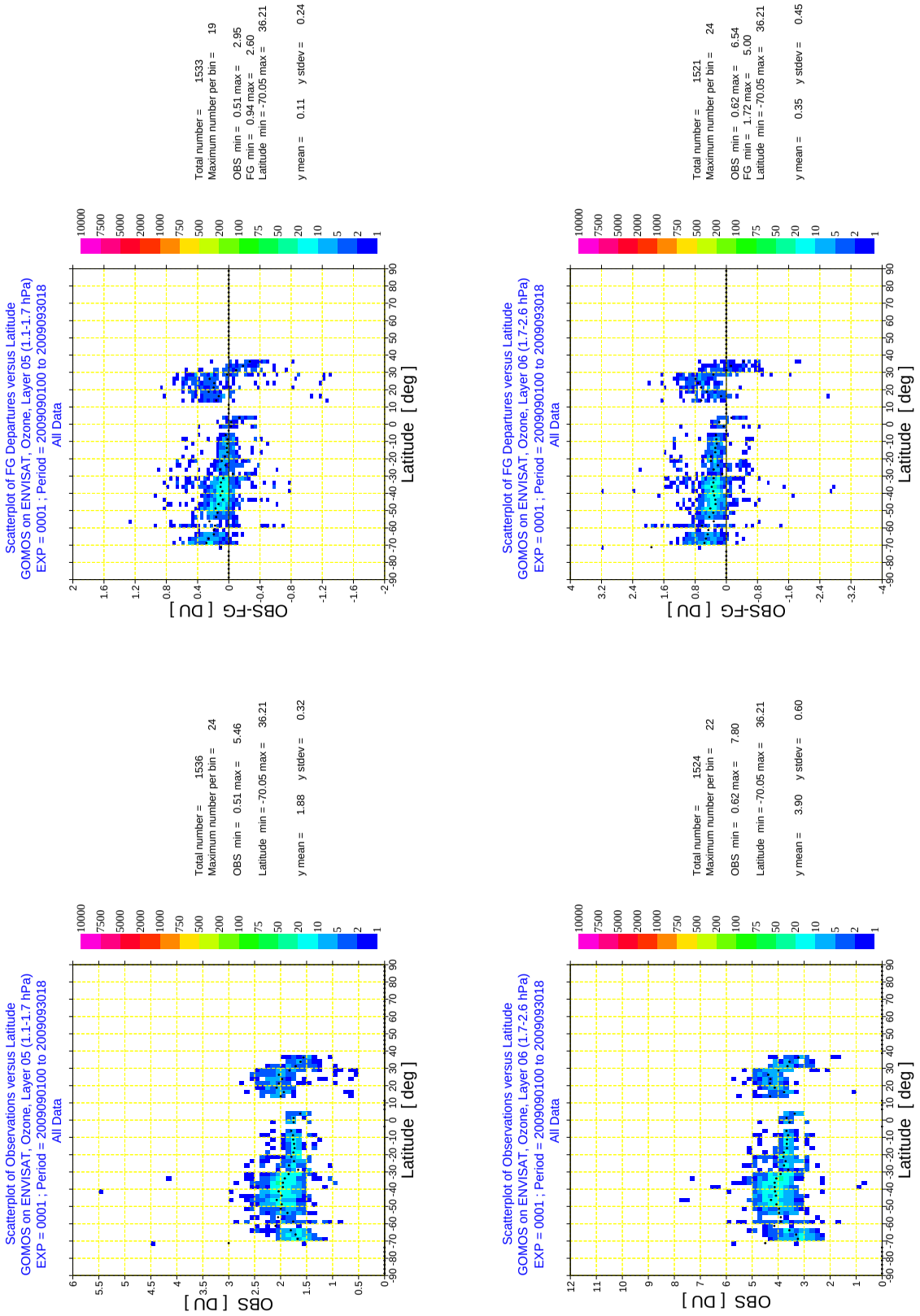


Fig. 9. As Fig. 7 but for layer 5 (1.1-1.7 hPa) and layer 6 (1.7-2.6 hPa).

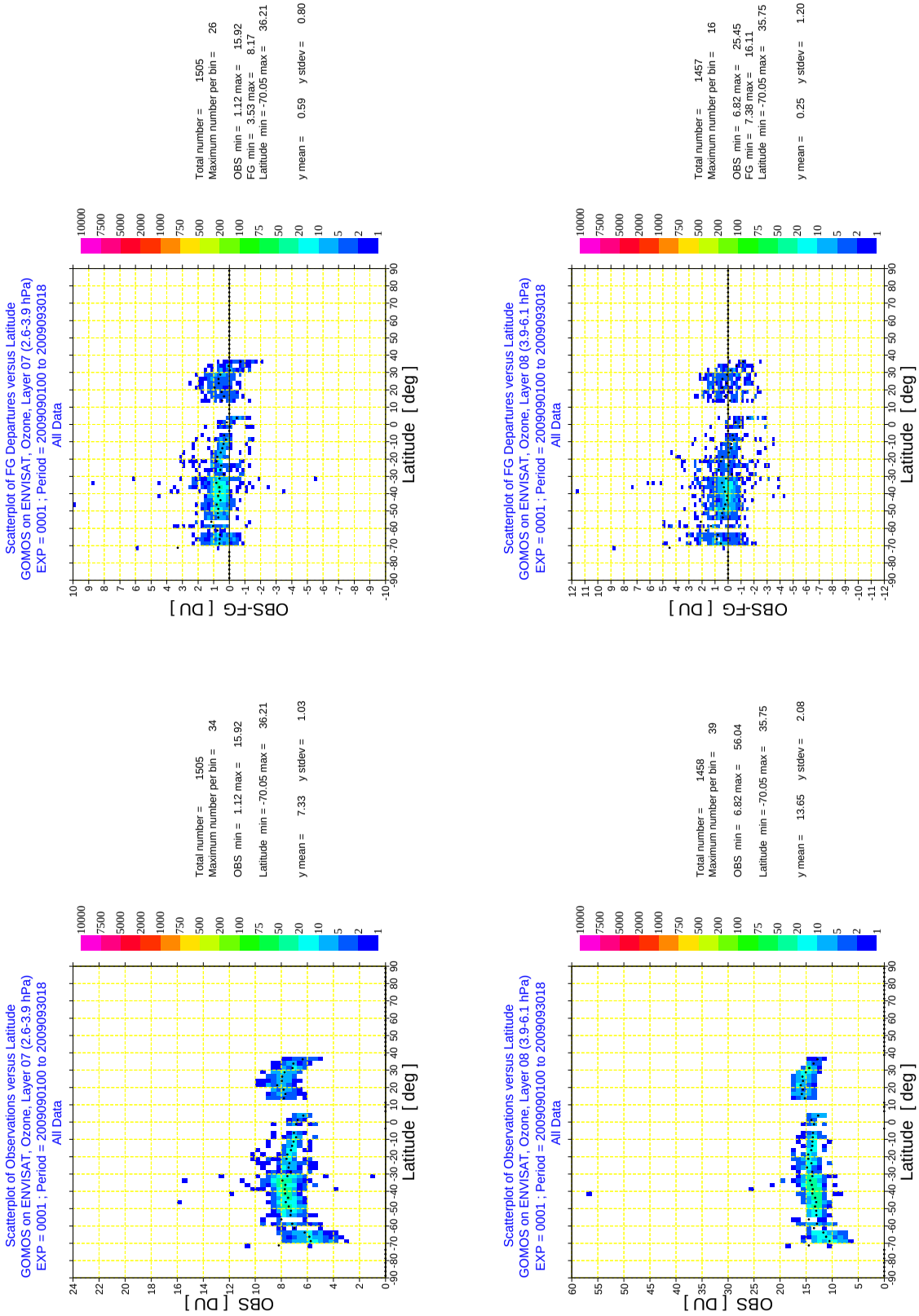


Fig. 10. As Fig. 7 but for layer 7 (2.6-3.9 hPa) and layer 8 (3.9-6.1 hPa).

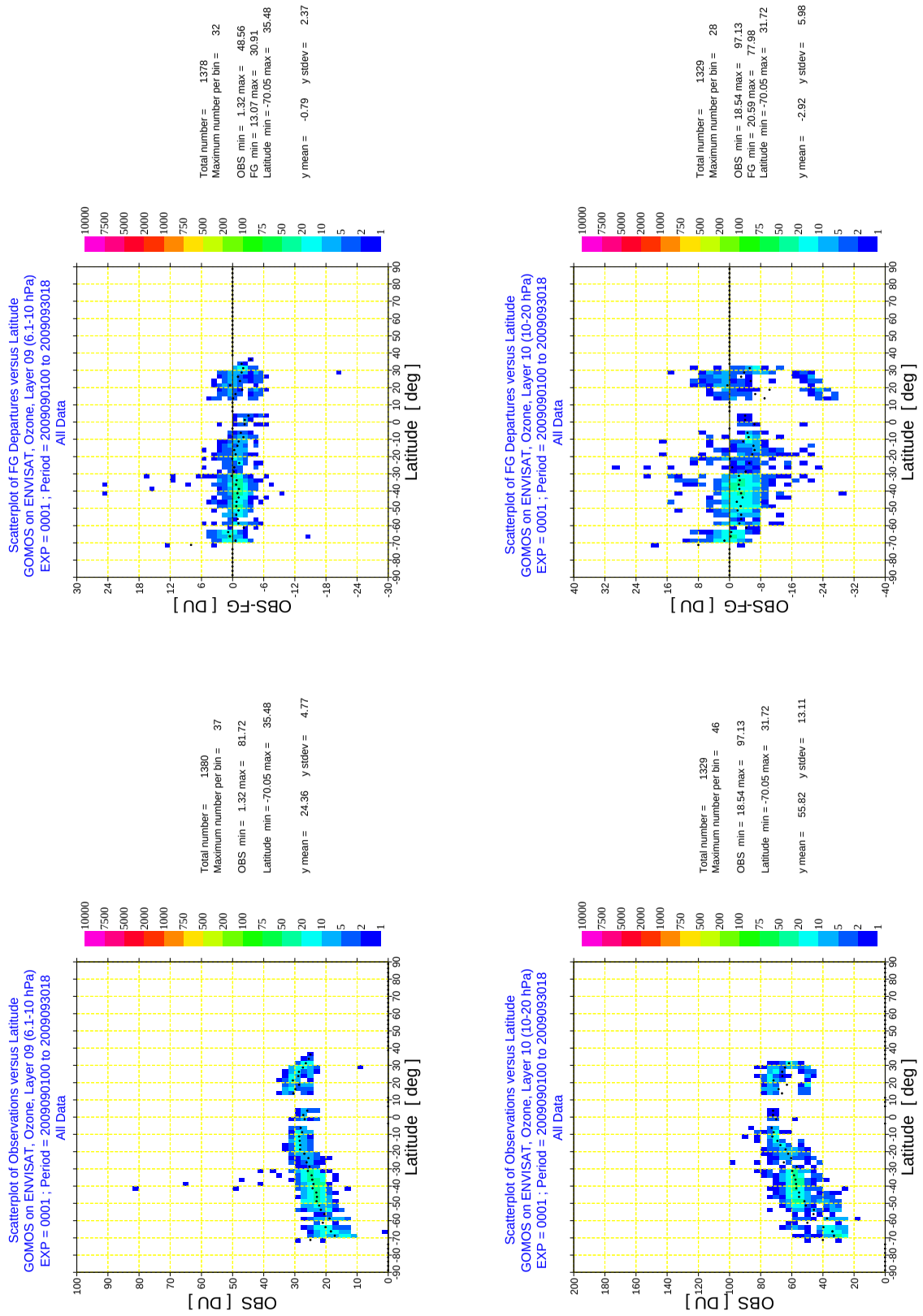


Fig. 11. As Fig. 7 but for layer 9 (6.1-10 hPa) and layer 10 (10-20 hPa).

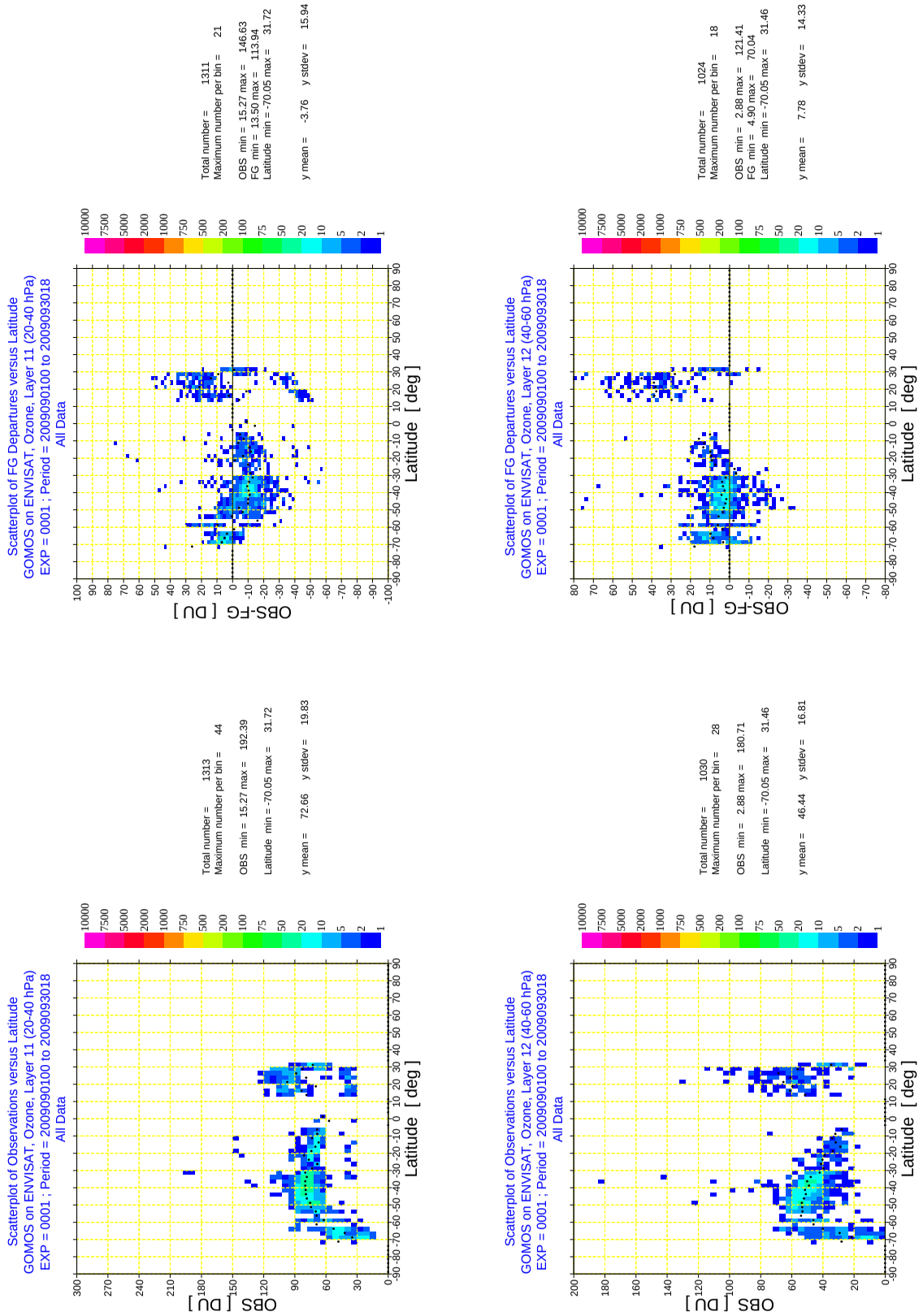


Fig. 12. As Fig. 7 but for layer 11 (20-40 hPa) and layer 12 (40-60 hPa).

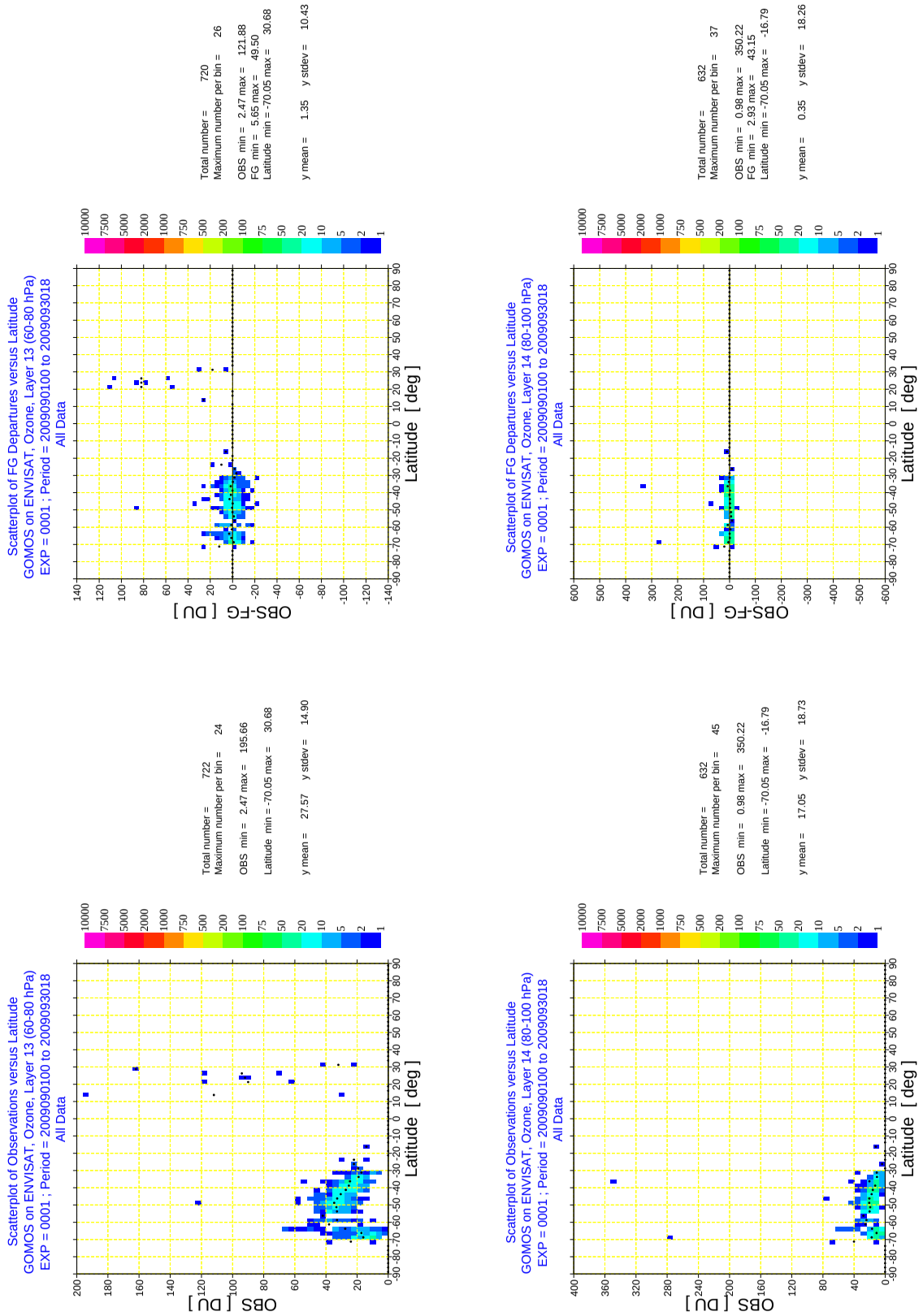


Fig. 13. As Fig. 7 but for layer 13 (60-80 hPa) and layer 14 (80-100 hPa).

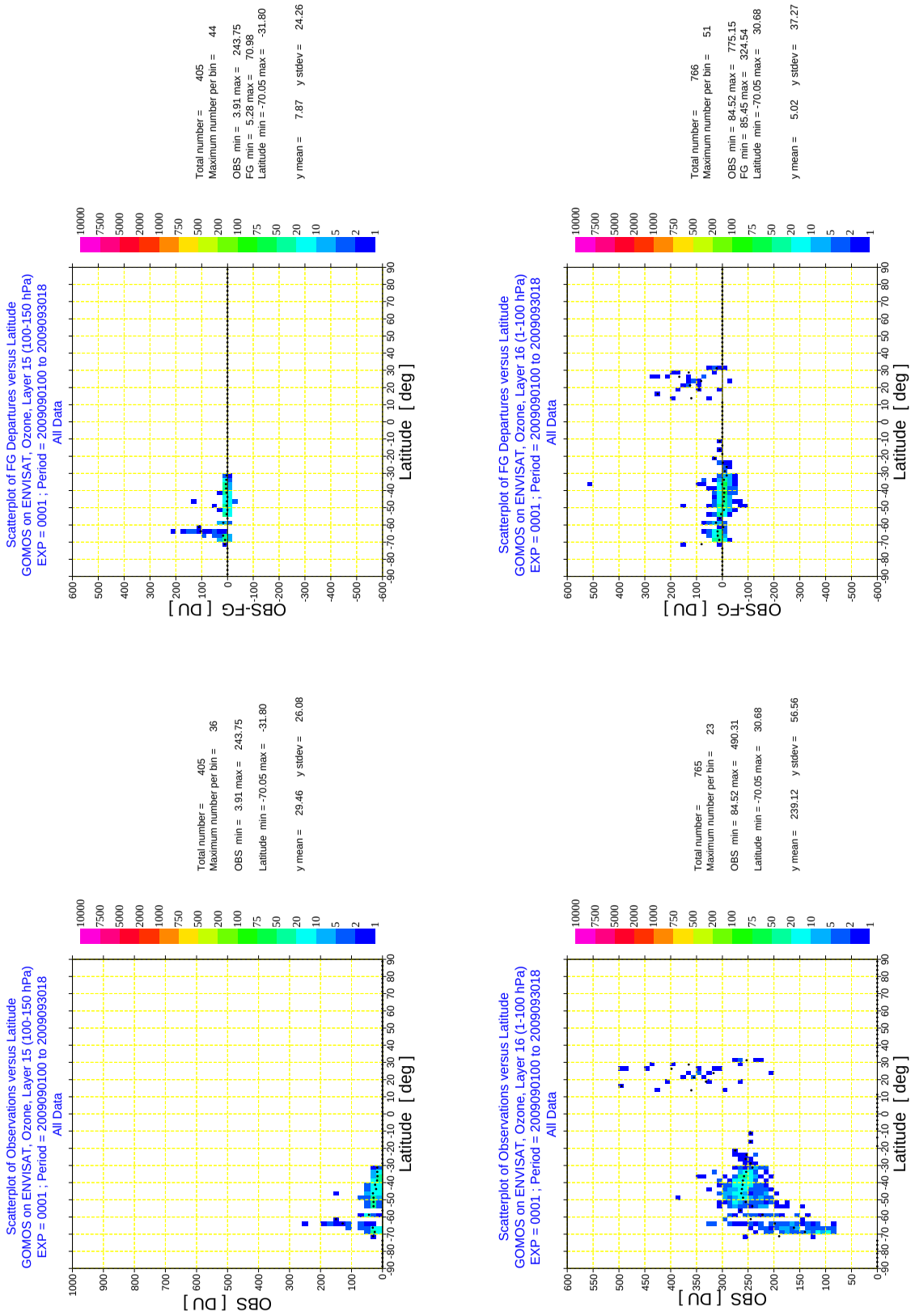


Fig. 14. As Fig. 7 but for layer 15 (100-150 hPa) and layer 16 (1-100 hPa).

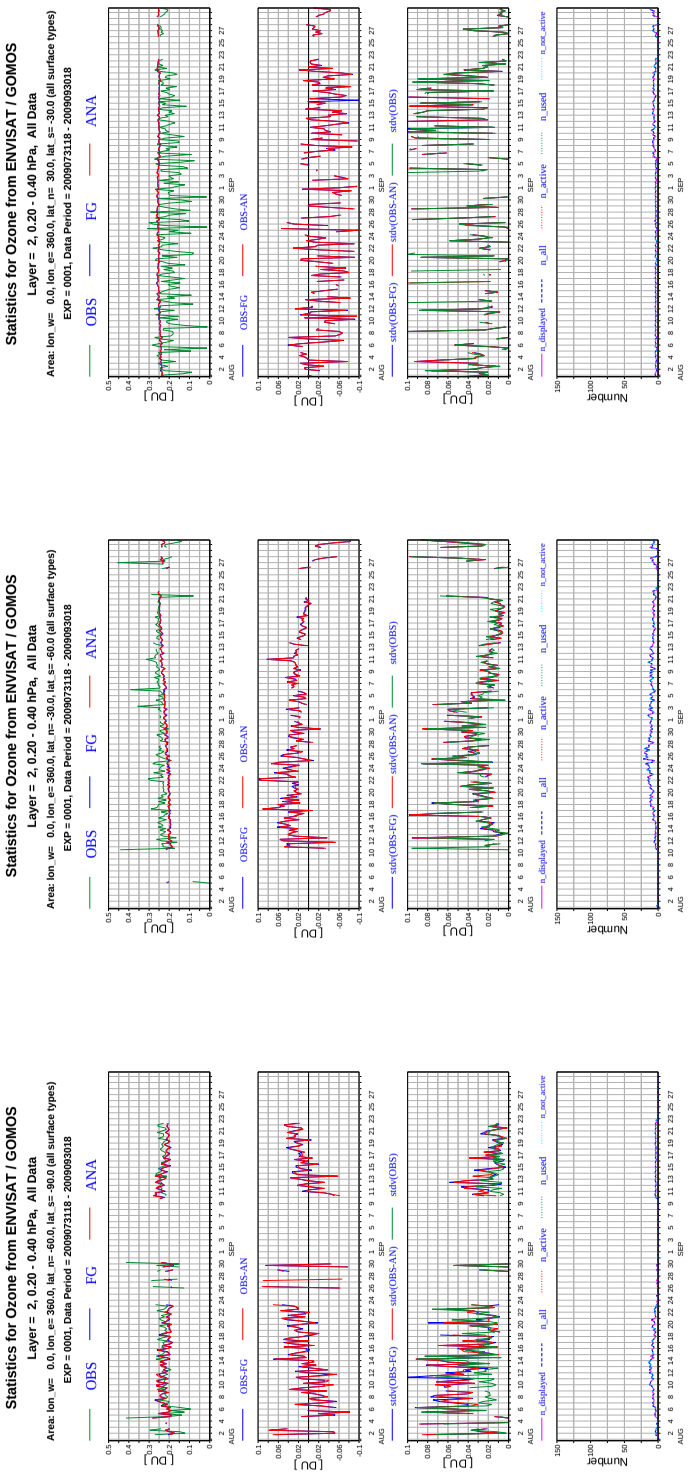


Fig. 15. Timeseries of mean ENVISAT GOMOS NRT ozone data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 2 (0.2-0.4 hPa) 30N-30S, 30-60S, and 60-90S for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

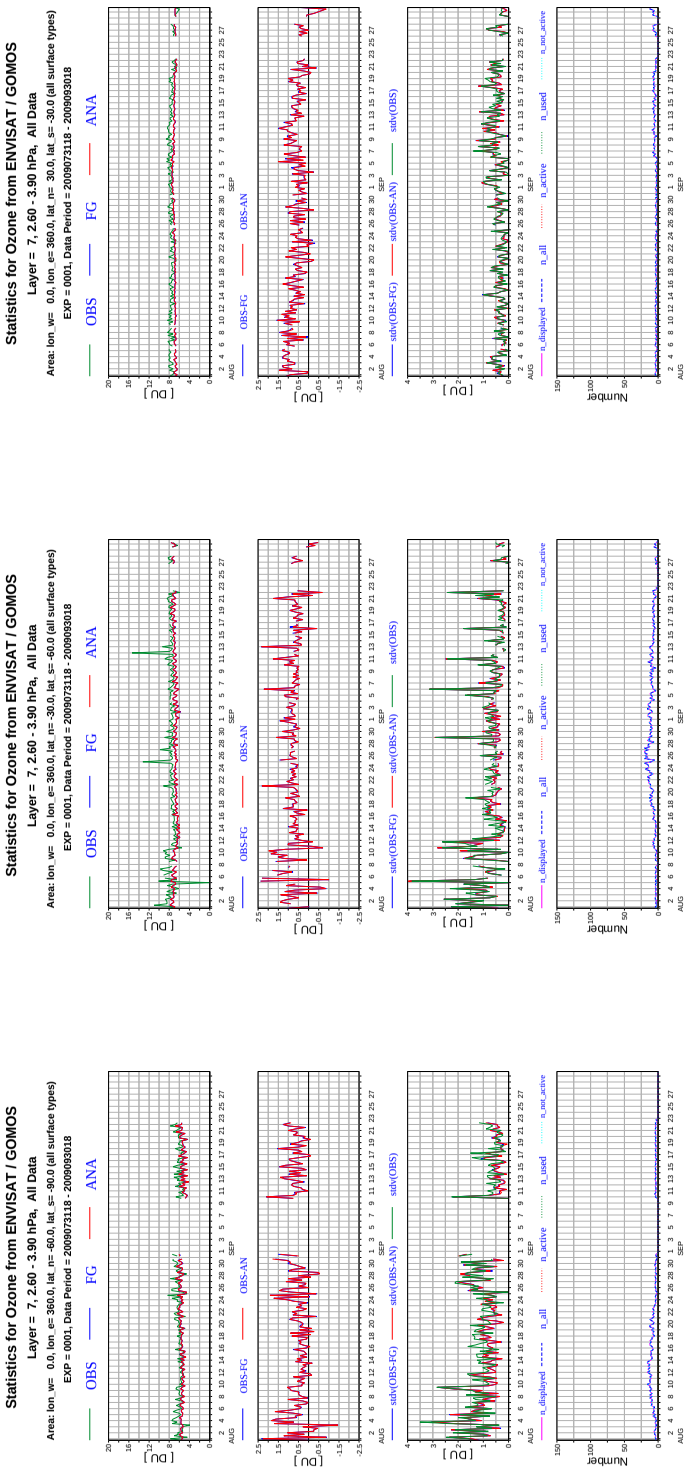


Fig. 16. As Figure 15, but for layer 7 (2.6-3.9 hPa).

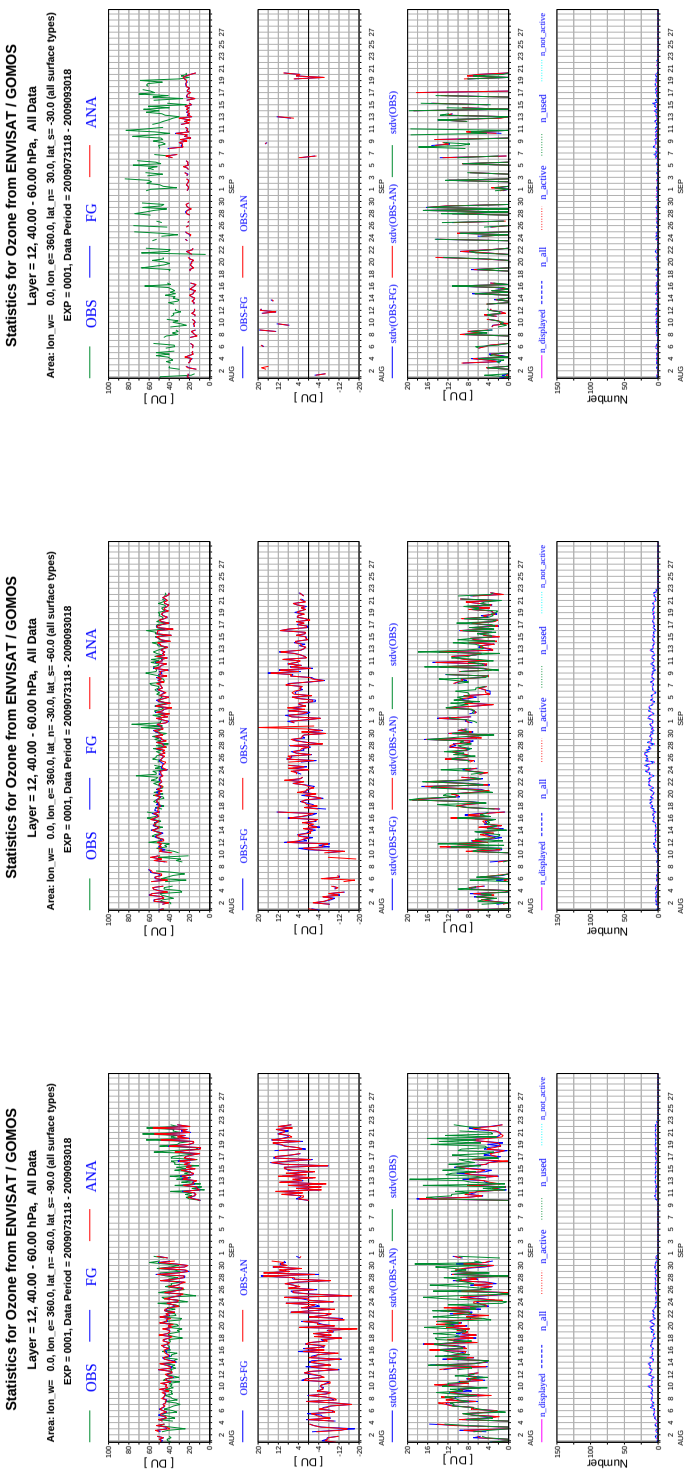


Fig. 17. As Figure 15, but for layer 12 (40-80 hPa).

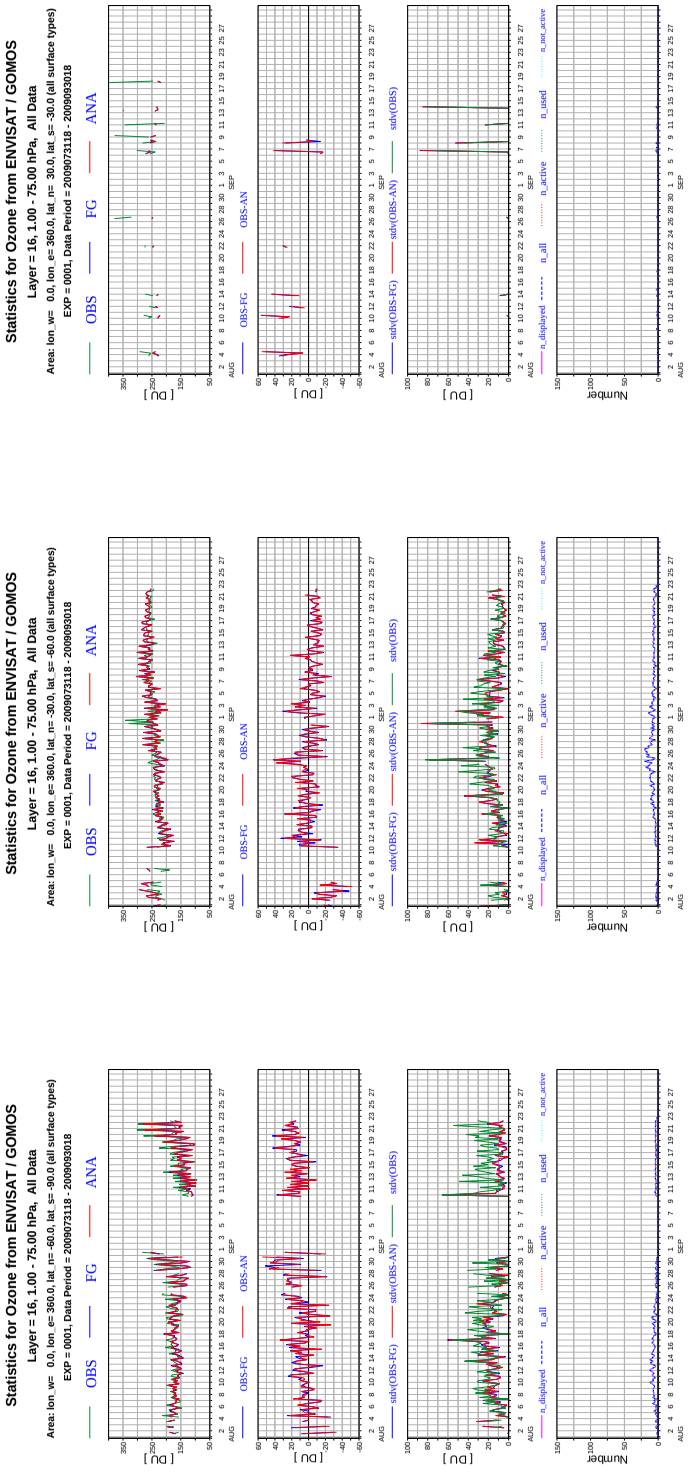


Fig. 18. As Figure 15, but for layer 16 (1-100 hPa).

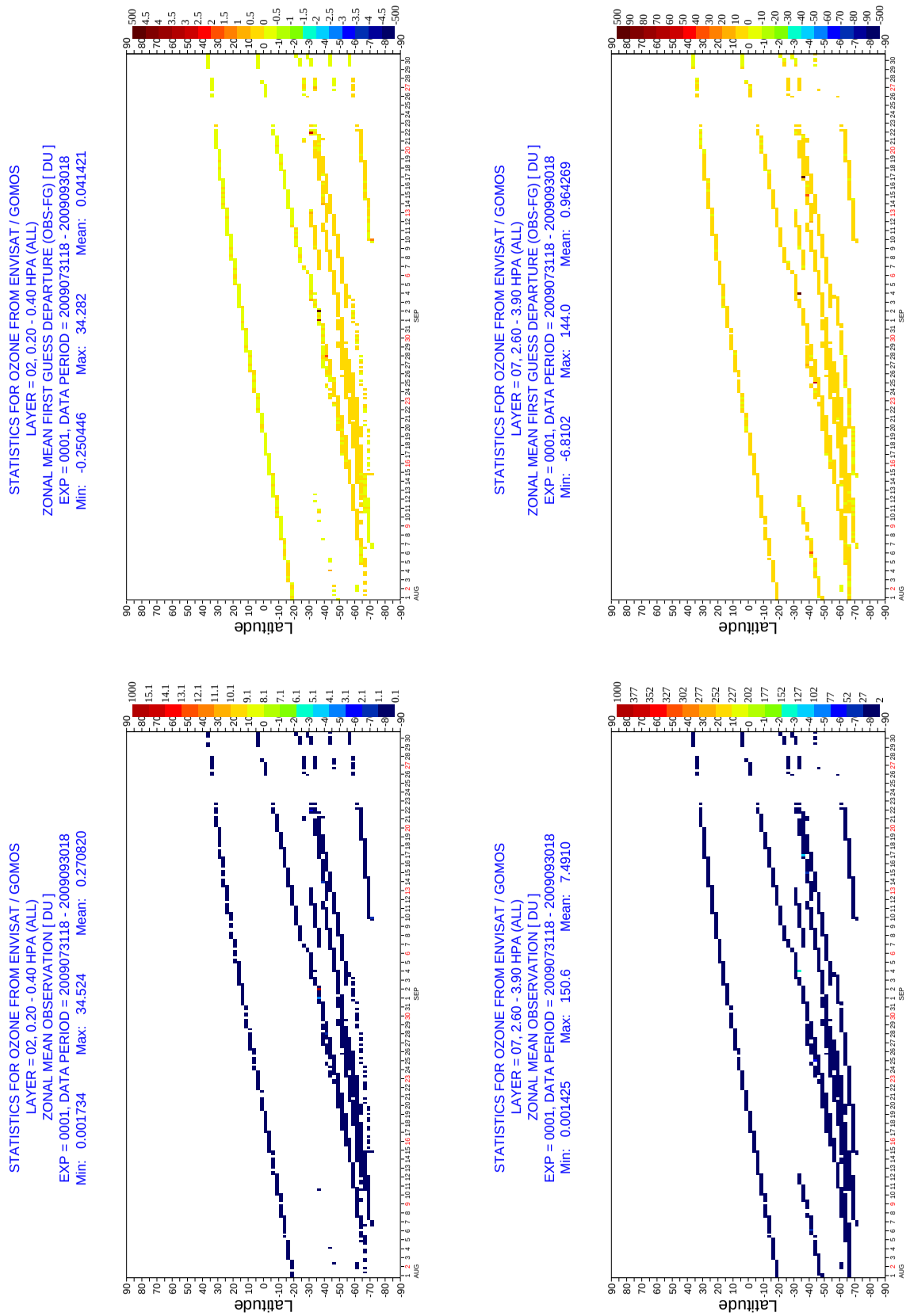


Fig. 19. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT ozone data per 6-hour cycle for August-September 2009 and of the zonal mean first-guess departures for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

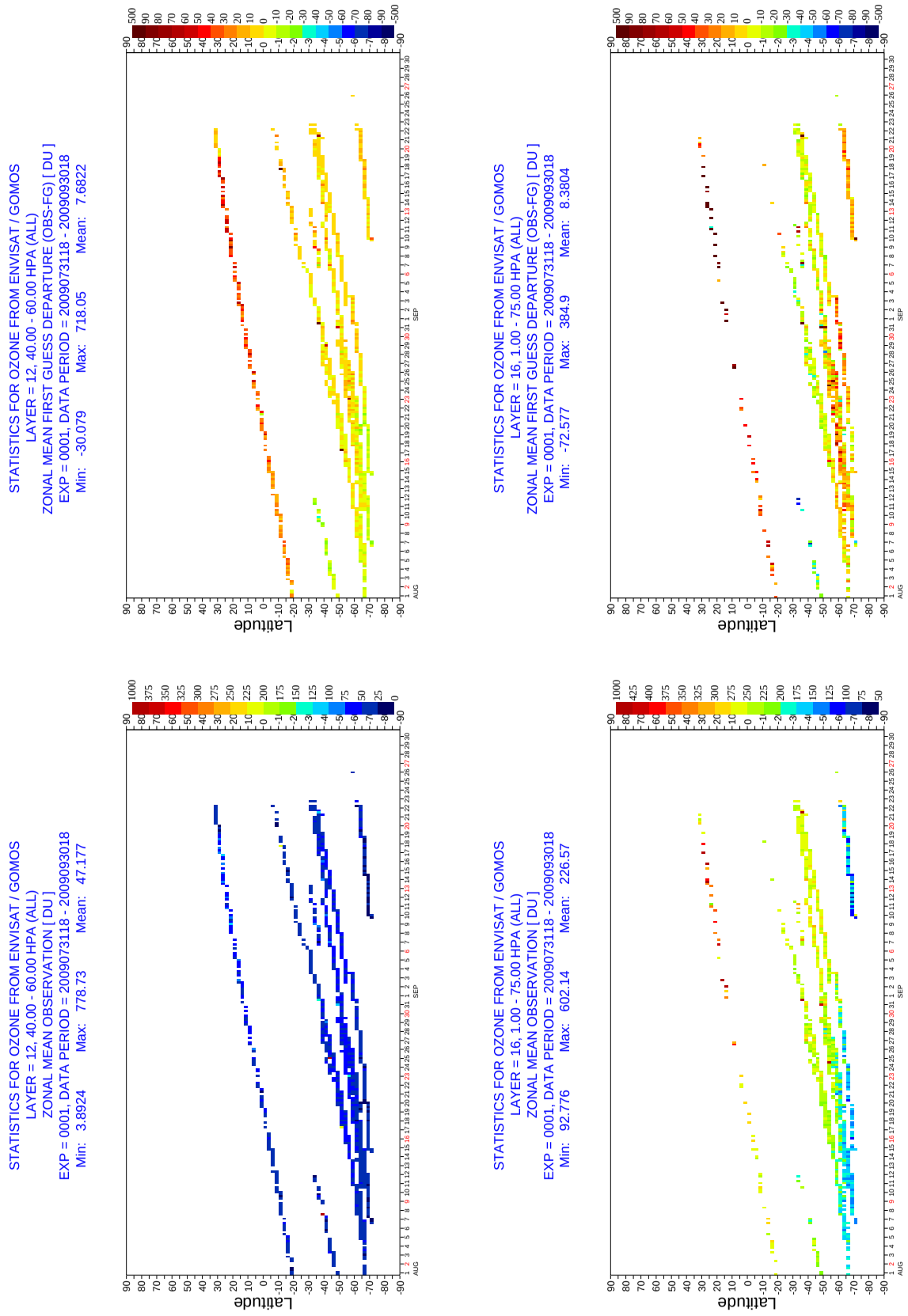


Fig. 20. As Fig. 19 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

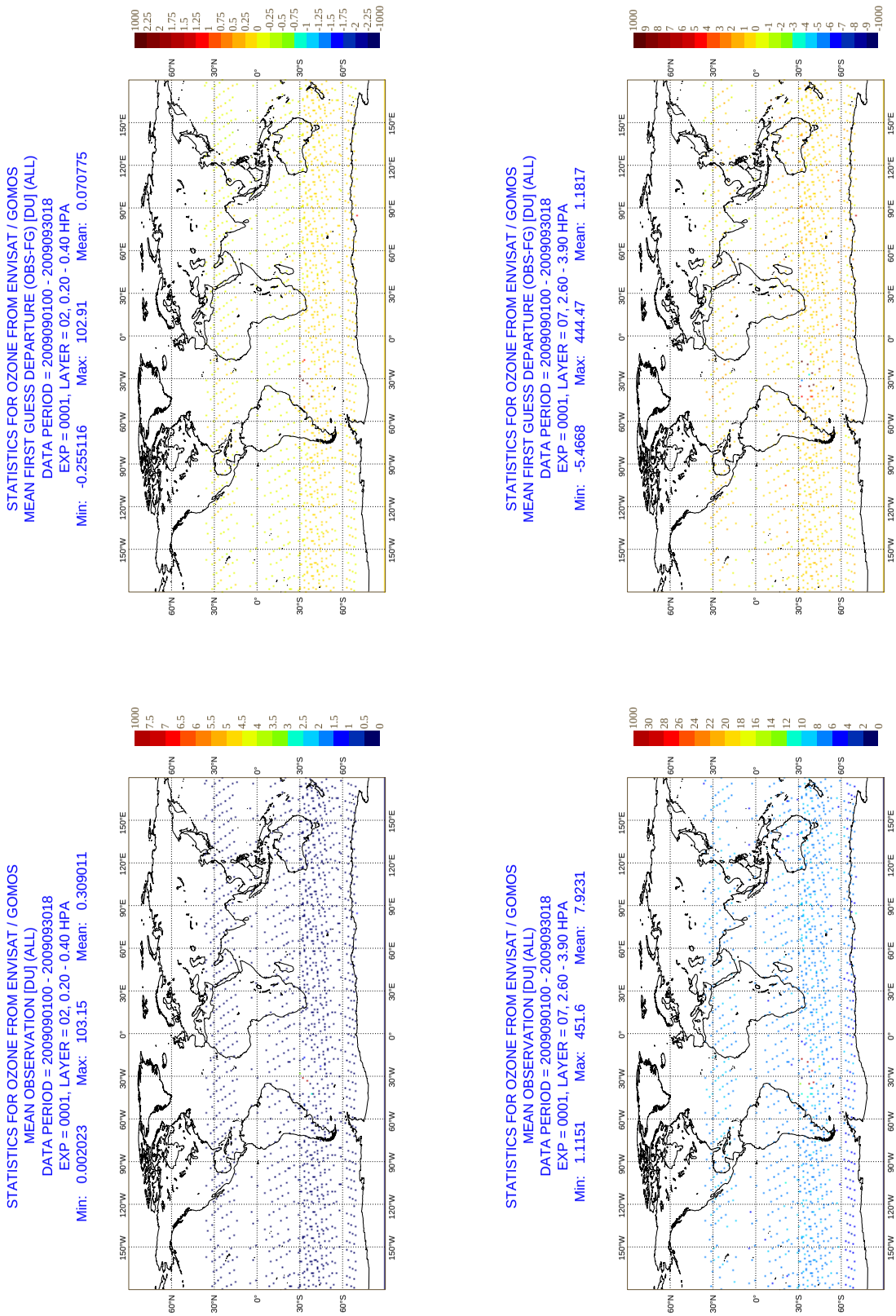


Fig. 21. Geographical distribution of mean ENVISAT GOMOS NRT ozone data and mean first-guess departures for September 2009 for layer 2 (0.2-0.4 hPa) and layer 7 (2.6-3.9 hPa).

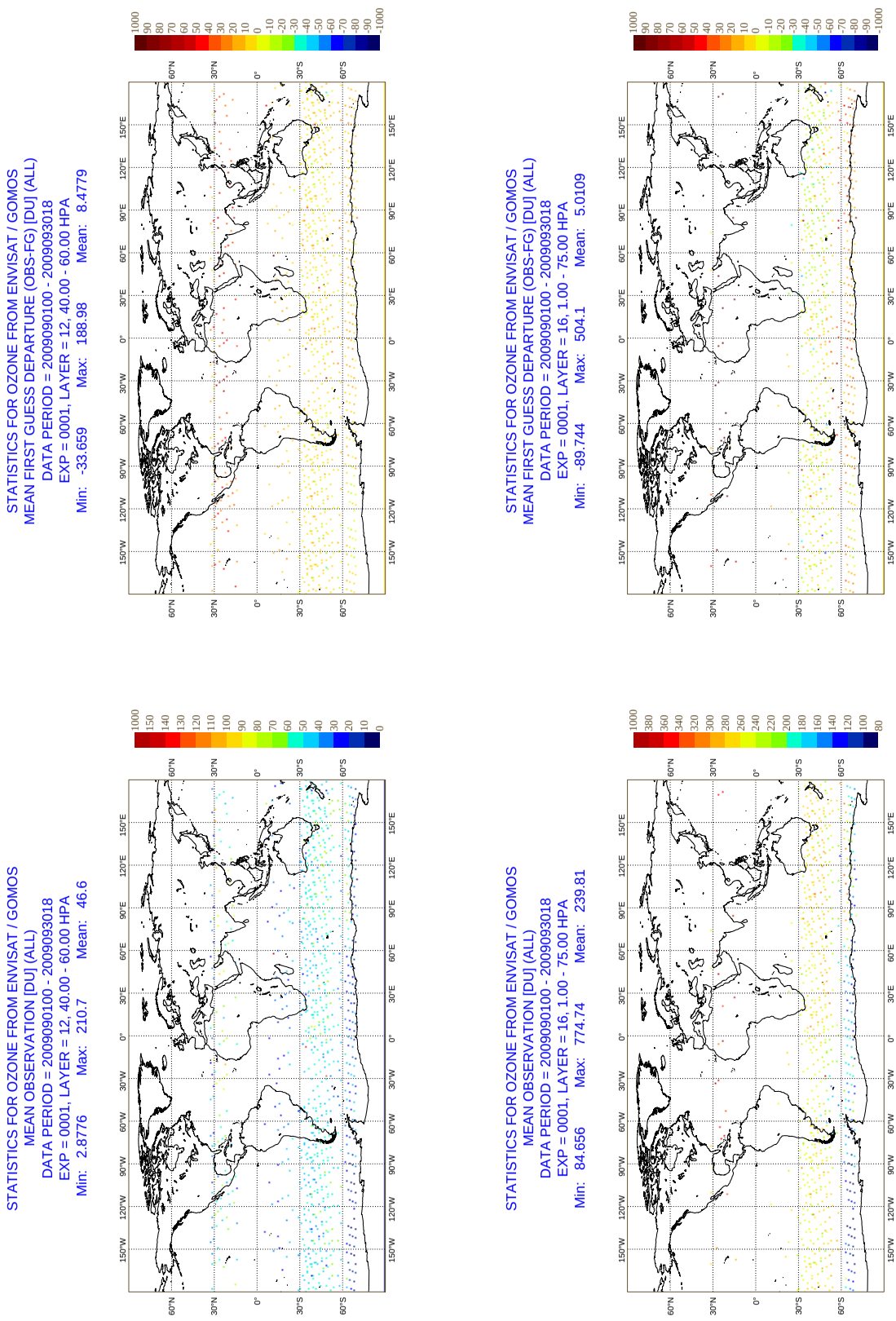


Fig. 22. As Fig. 21 but for layer 12 (40-60 hPa) and layer 16 (1-100 hPa).

REPORT ABOUT ENVISAT GOMOS NRT TEMPERATURE DATA (GOM_RR__2P) FOR SEPTEMBER 2009

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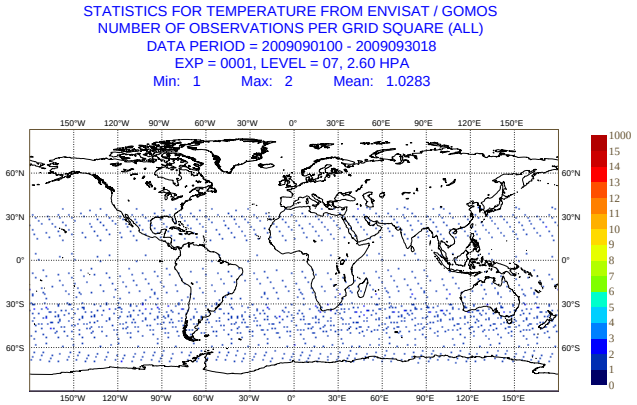


Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT temperature data for level 7 (2.6 hPa) for September 2009.

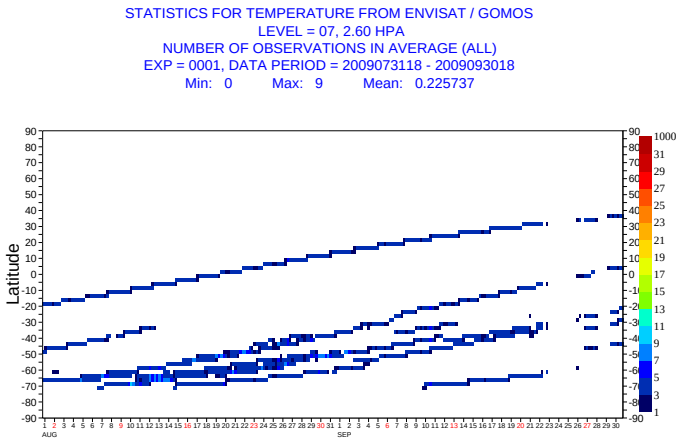


Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT temperature data per 6-hour cycle for level 7 (2.6 hPa) for August-September 2009.

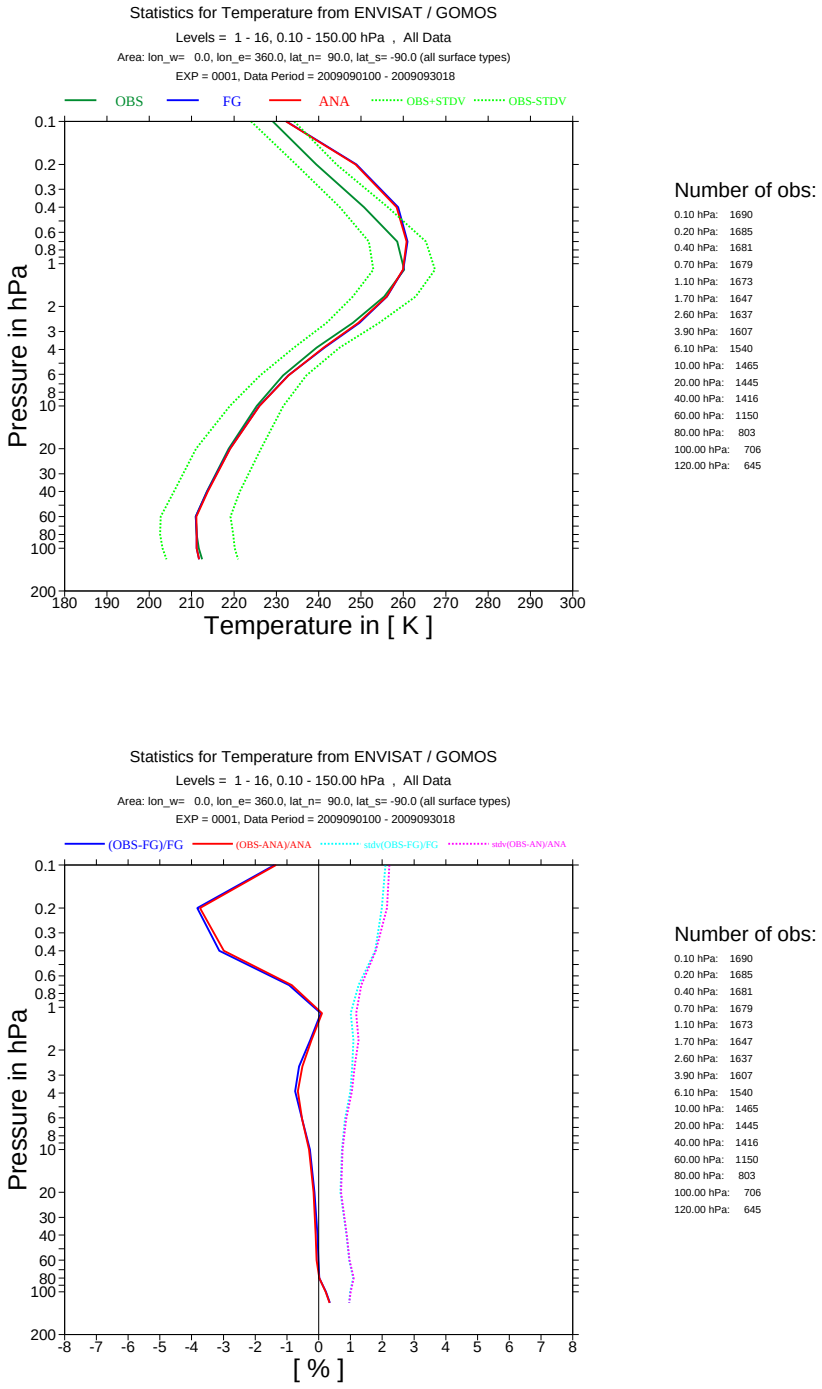
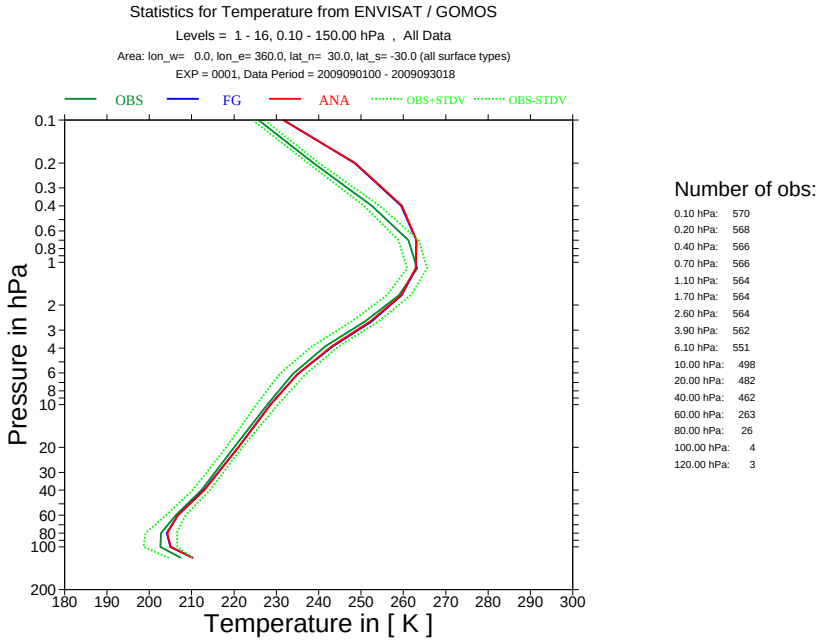


Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT temperature data in K for September 2009 (global mean). The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green), and the mean observation +/- 1 standard deviation (green dotted lines). The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



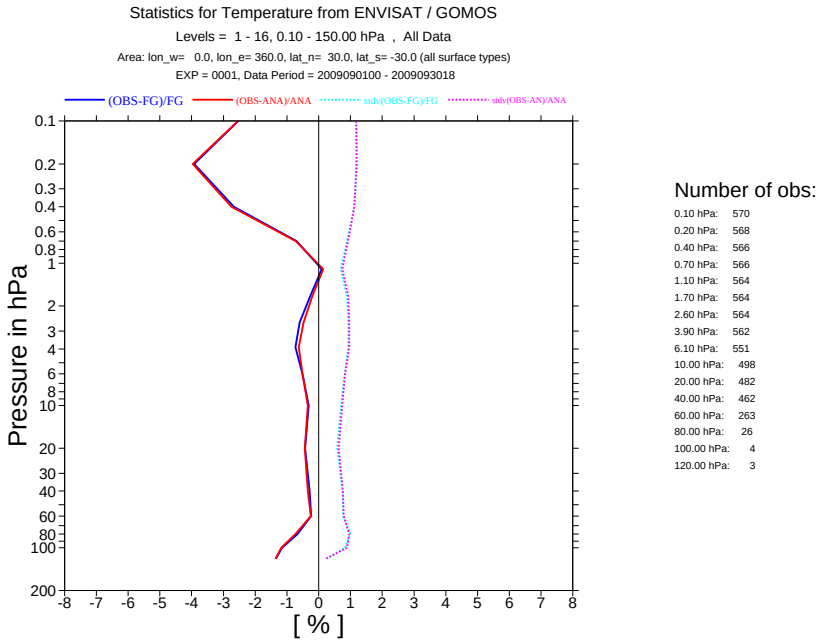
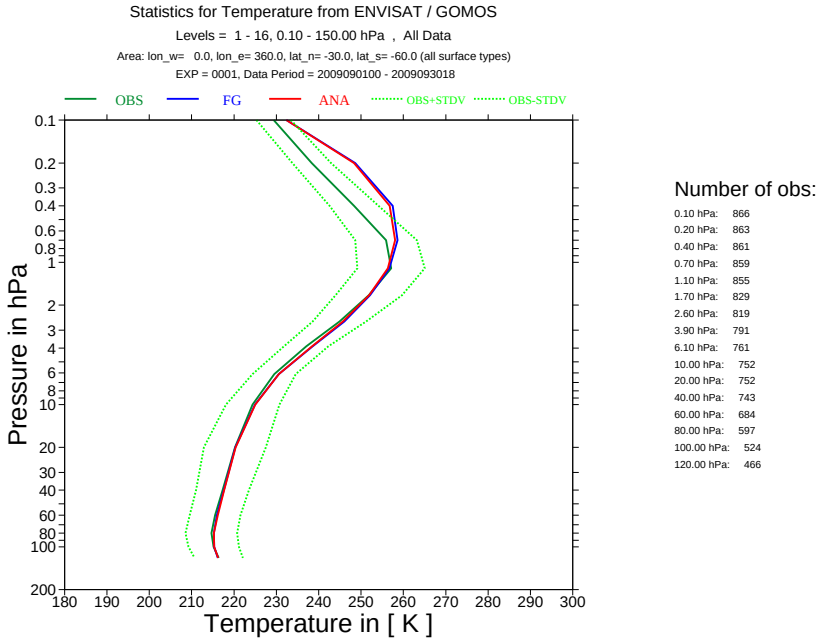


Fig. 4. As Fig. 3 but for 30N-30S.



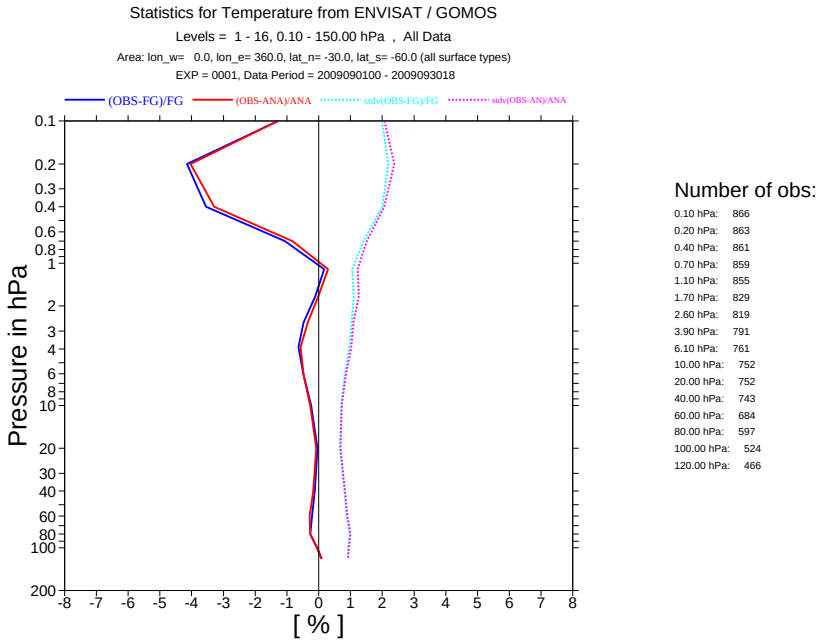
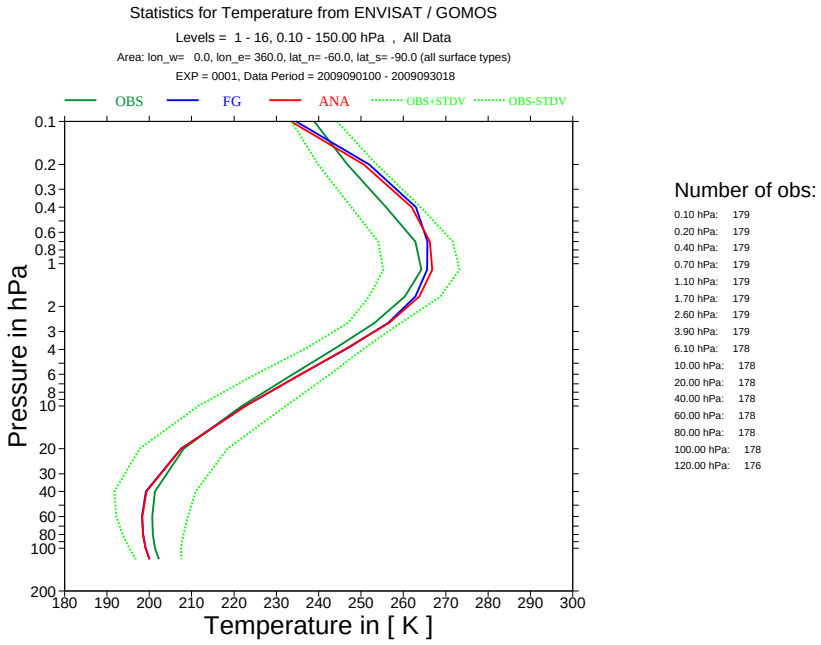


Fig. 5. As Fig. 3 but for 30-60S.



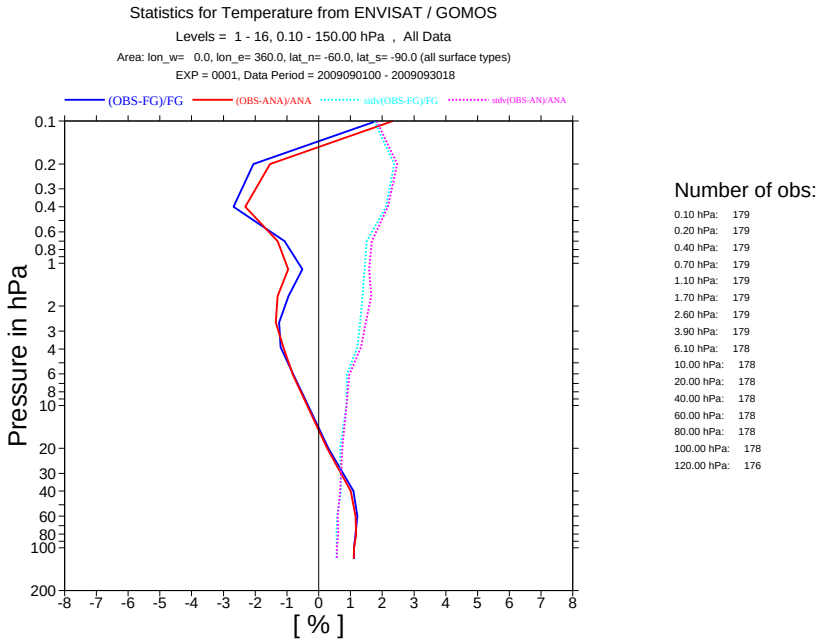


Fig. 6. As Fig. 3 but for 60-90S.

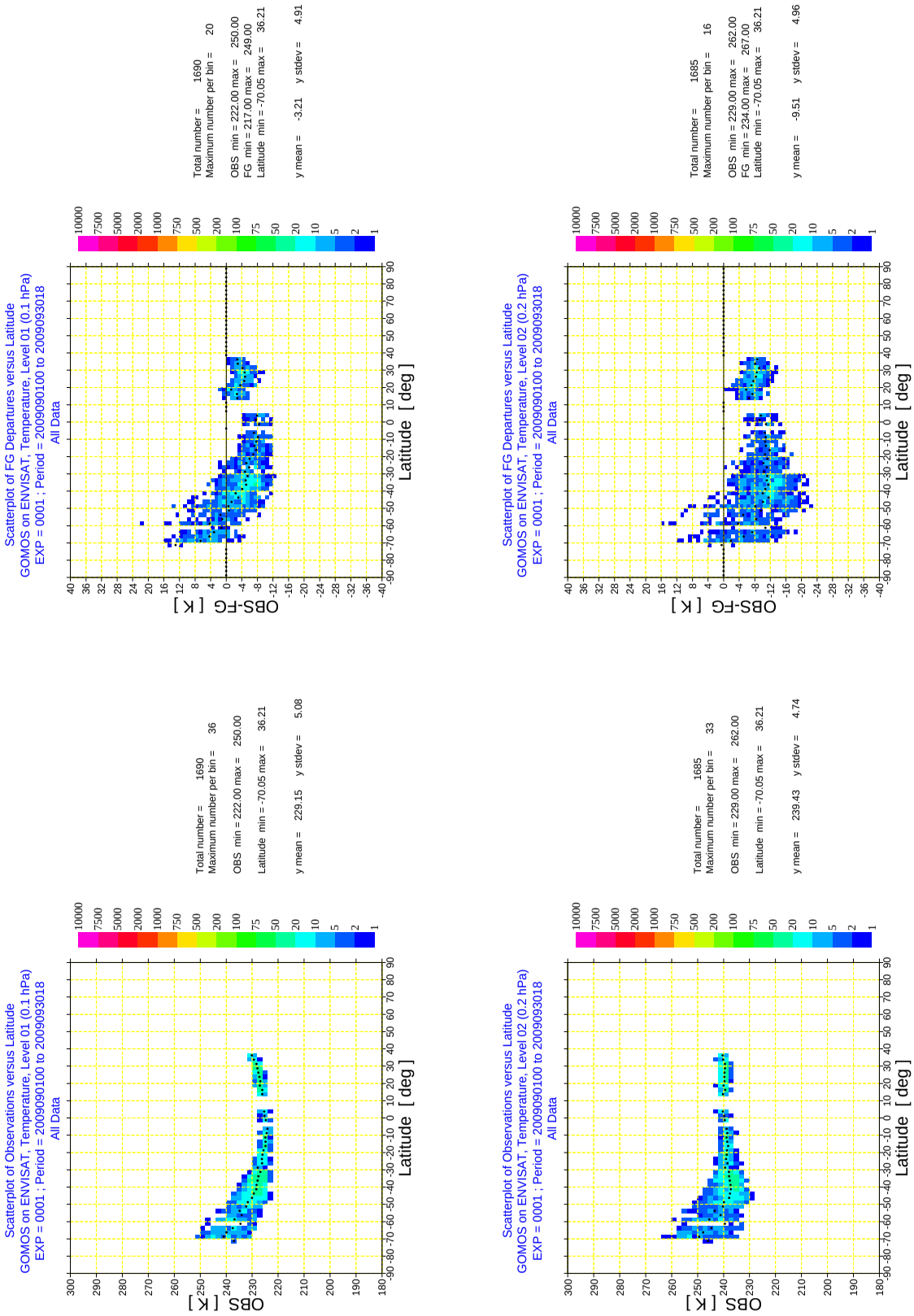


Fig. 7. Scatter plot of ENVISAT GOMOS NRT temperature data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT temperature data against latitude (right) for September 2009 for level 1 (0.1 hPa) and level 2 (0.2 hPa). The colours show the number of data per bin, and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

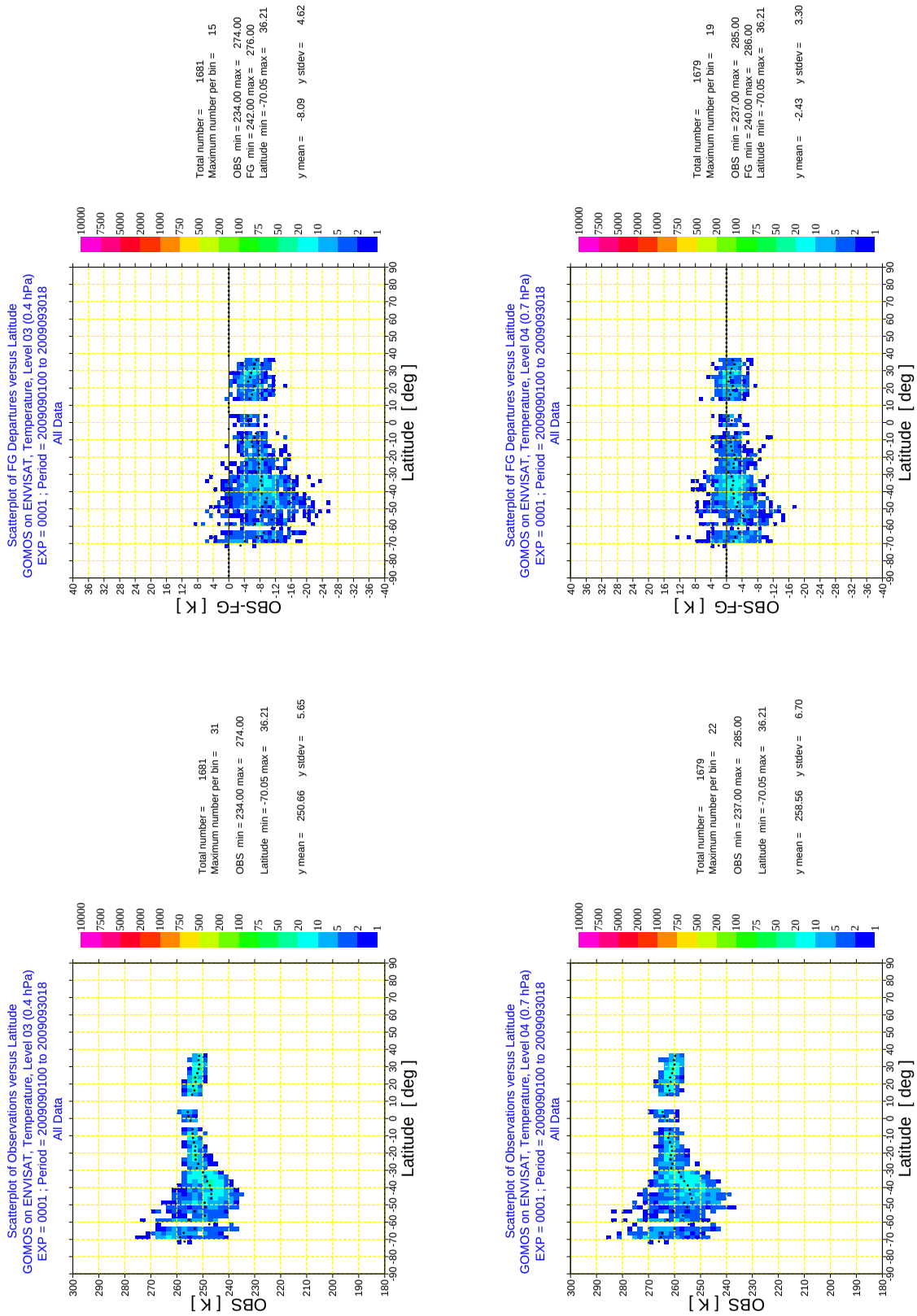


Fig. 8. As Fig. 7 but for level 3 (0.4 hPa) and level 4 (0.7 hPa).

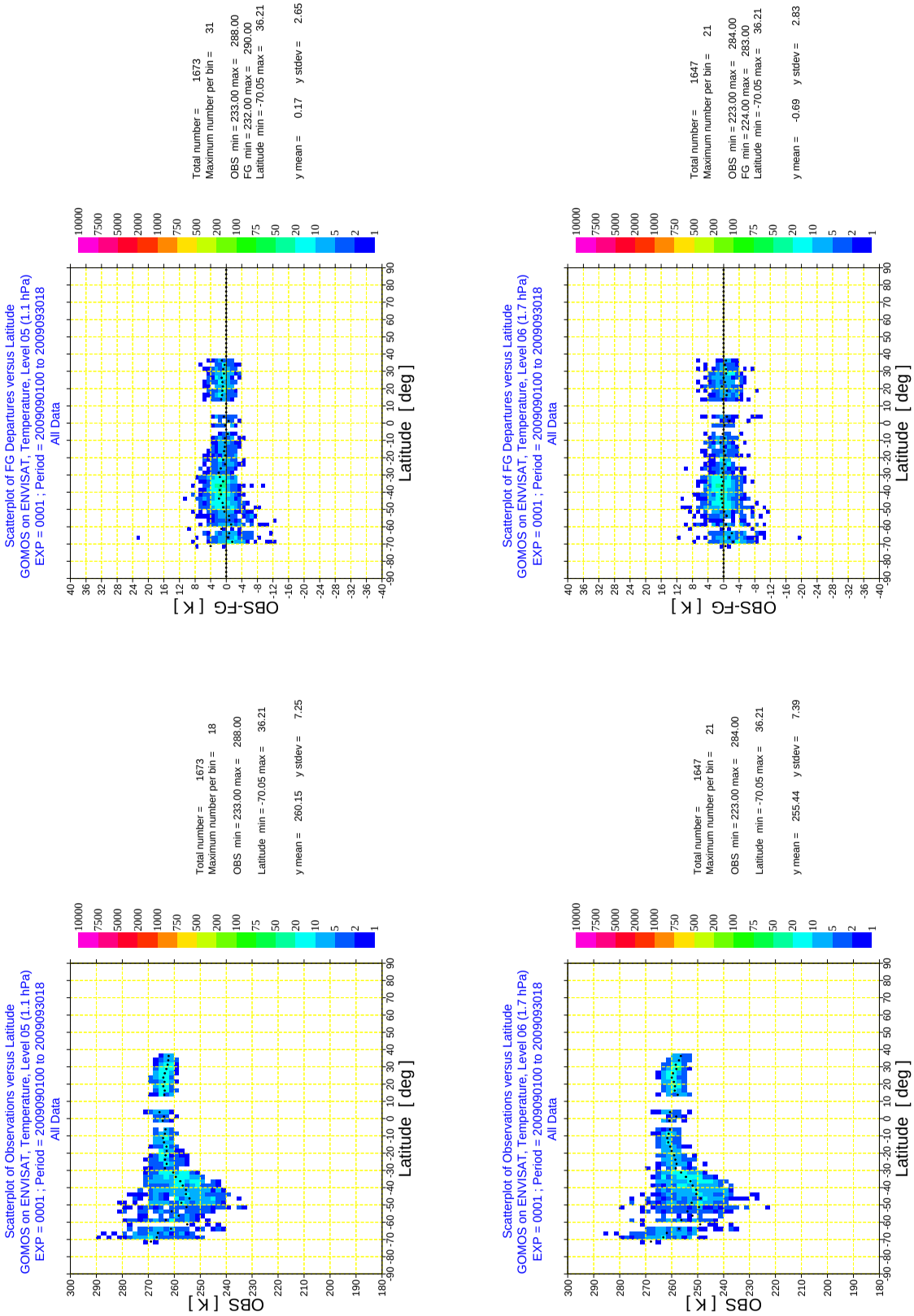


Fig. 9. As Fig. 7 but for level 5 (1.1 hPa) and level 6 (1.7 hPa).

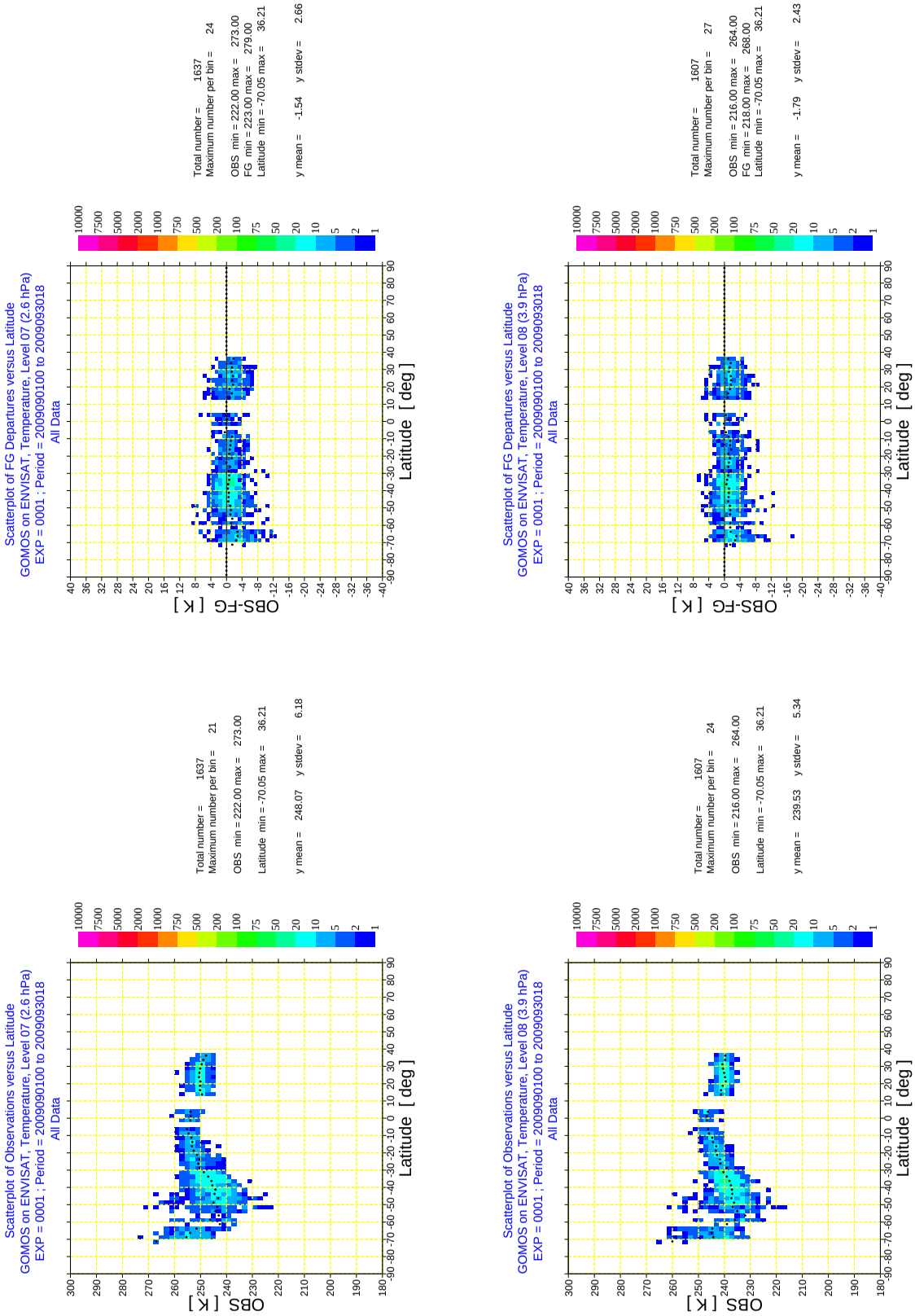


Fig. 10. As Fig. 7 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

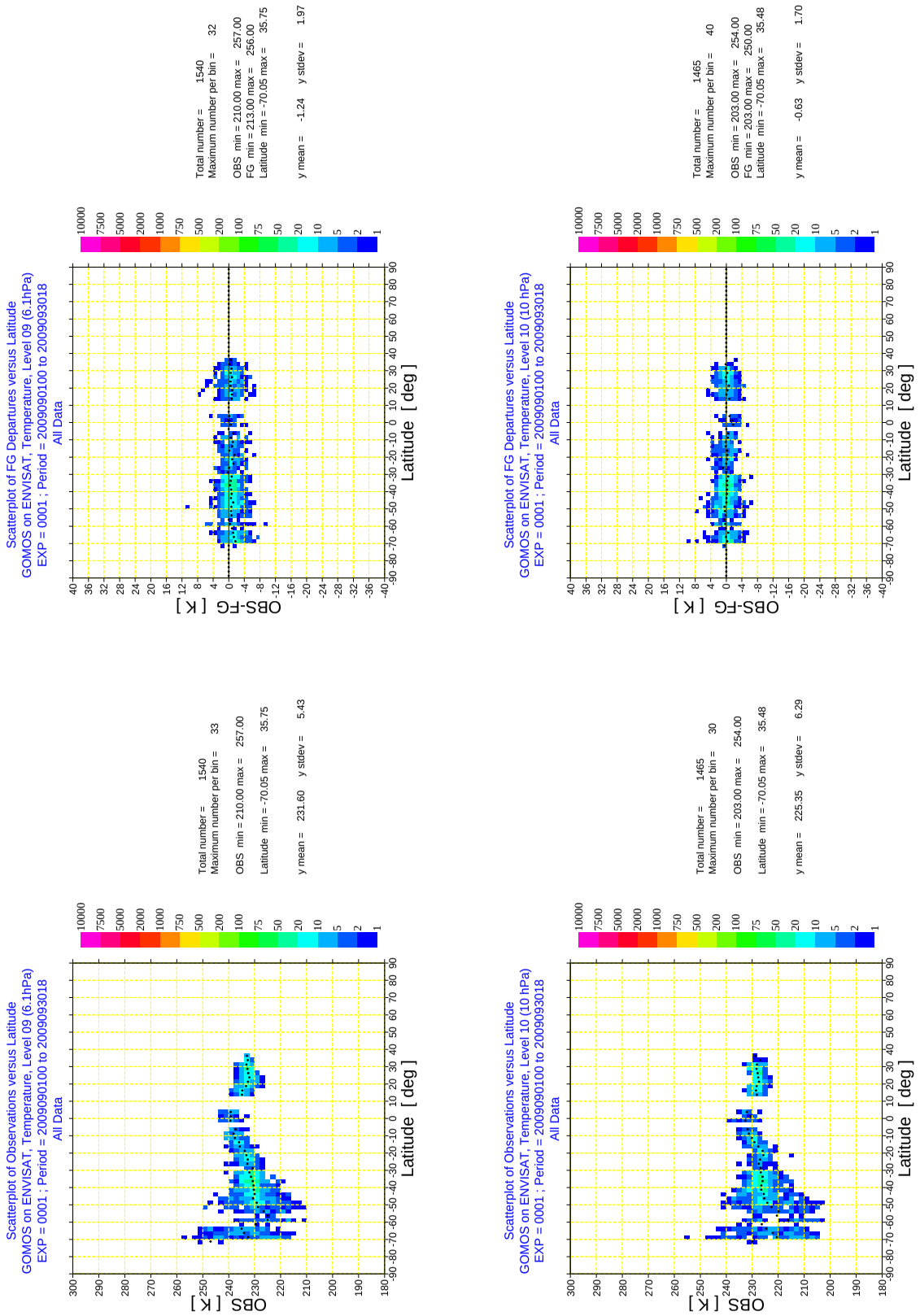


Fig. 11. As Fig. 7 but for level 9 (6.1 hPa) and level 10 (10 hPa).

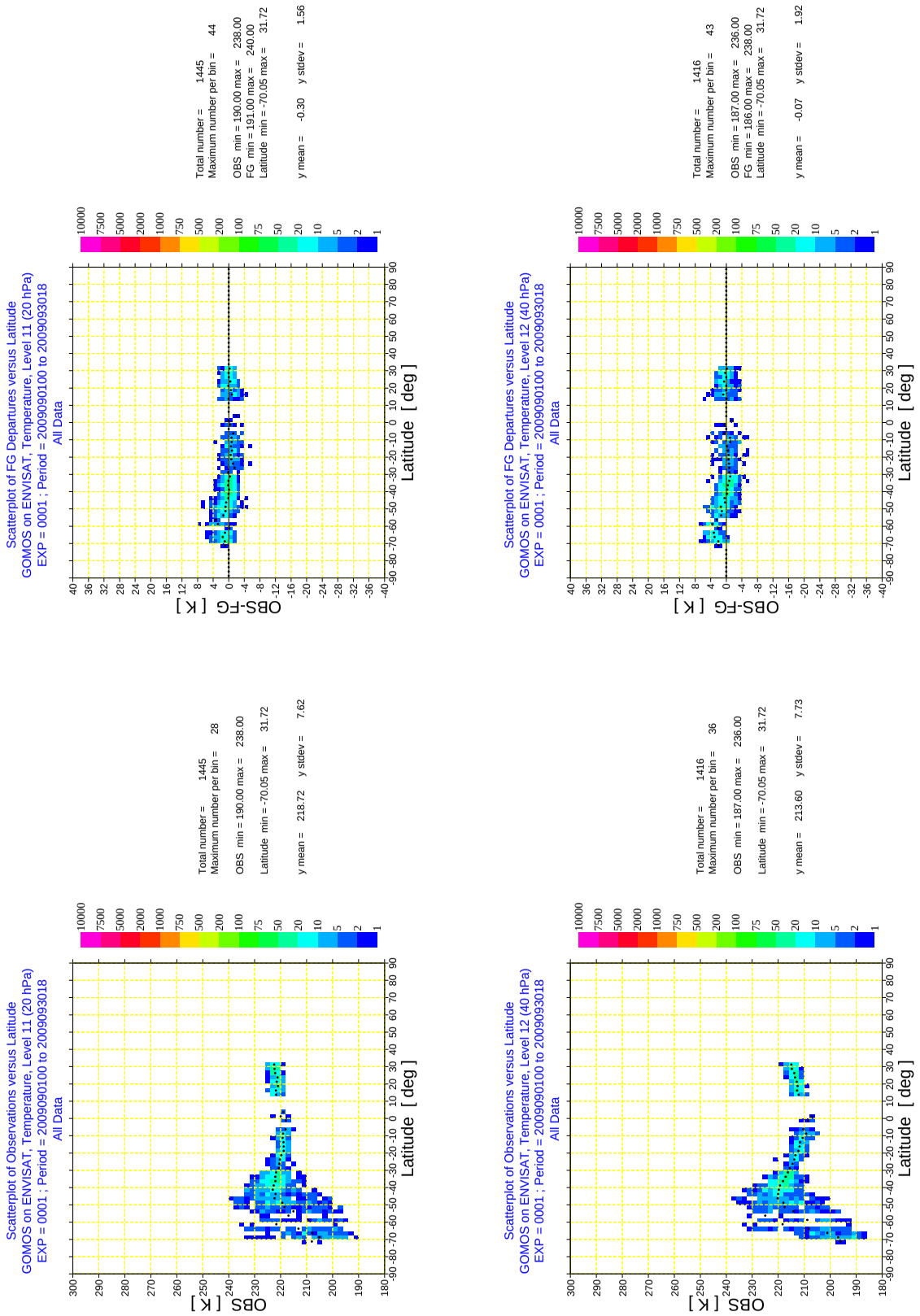


Fig. 12. As Fig. 7 but for level 11 (20 hPa) and level 12 (40 hPa).

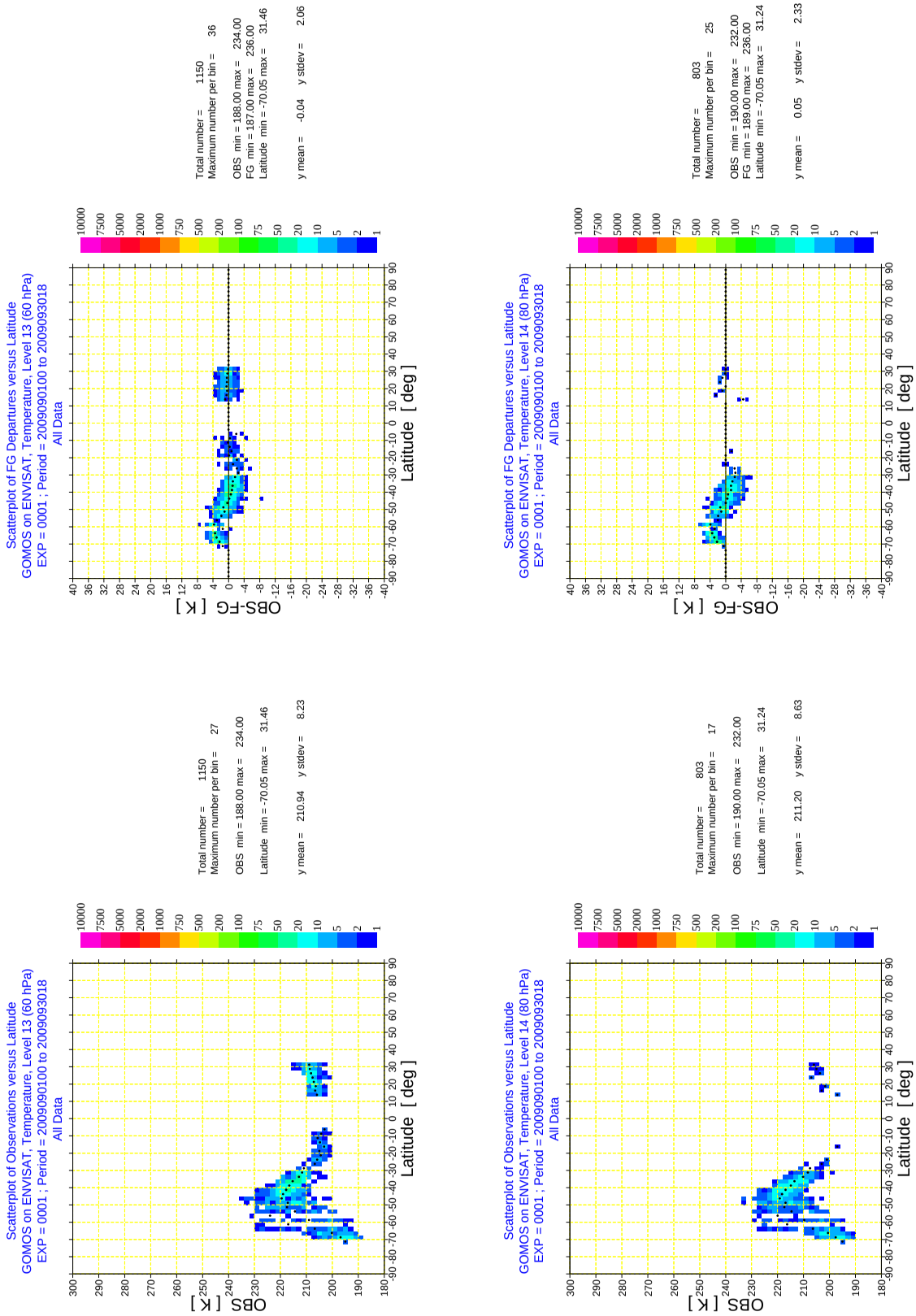


Fig. 13. As Fig. 7 but for level 13 (60 hPa) and level 14 (80 hPa).

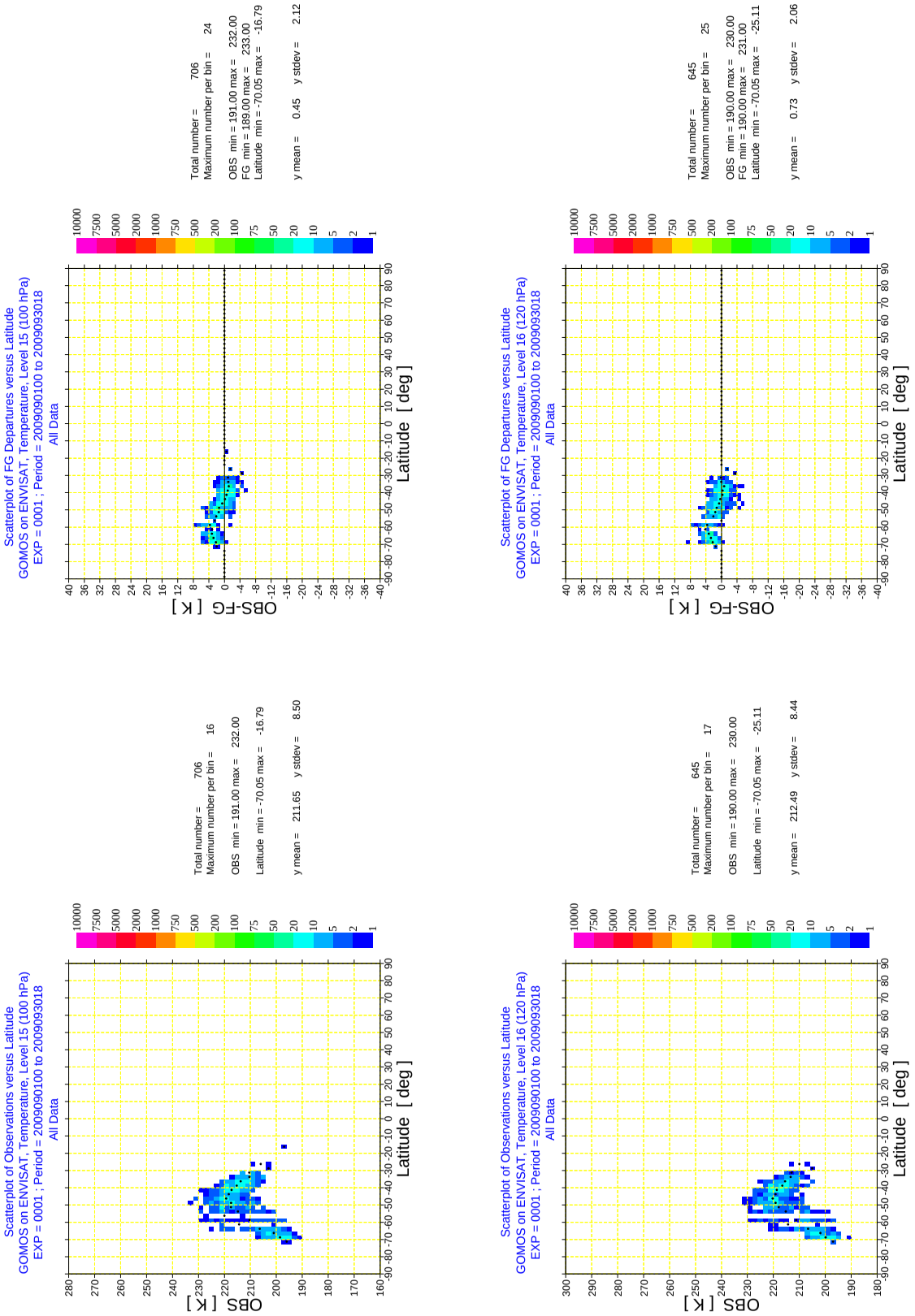


Fig. 14. As Fig. 7 but for level 15 (100 hPa) and level 16 (120 hPa).

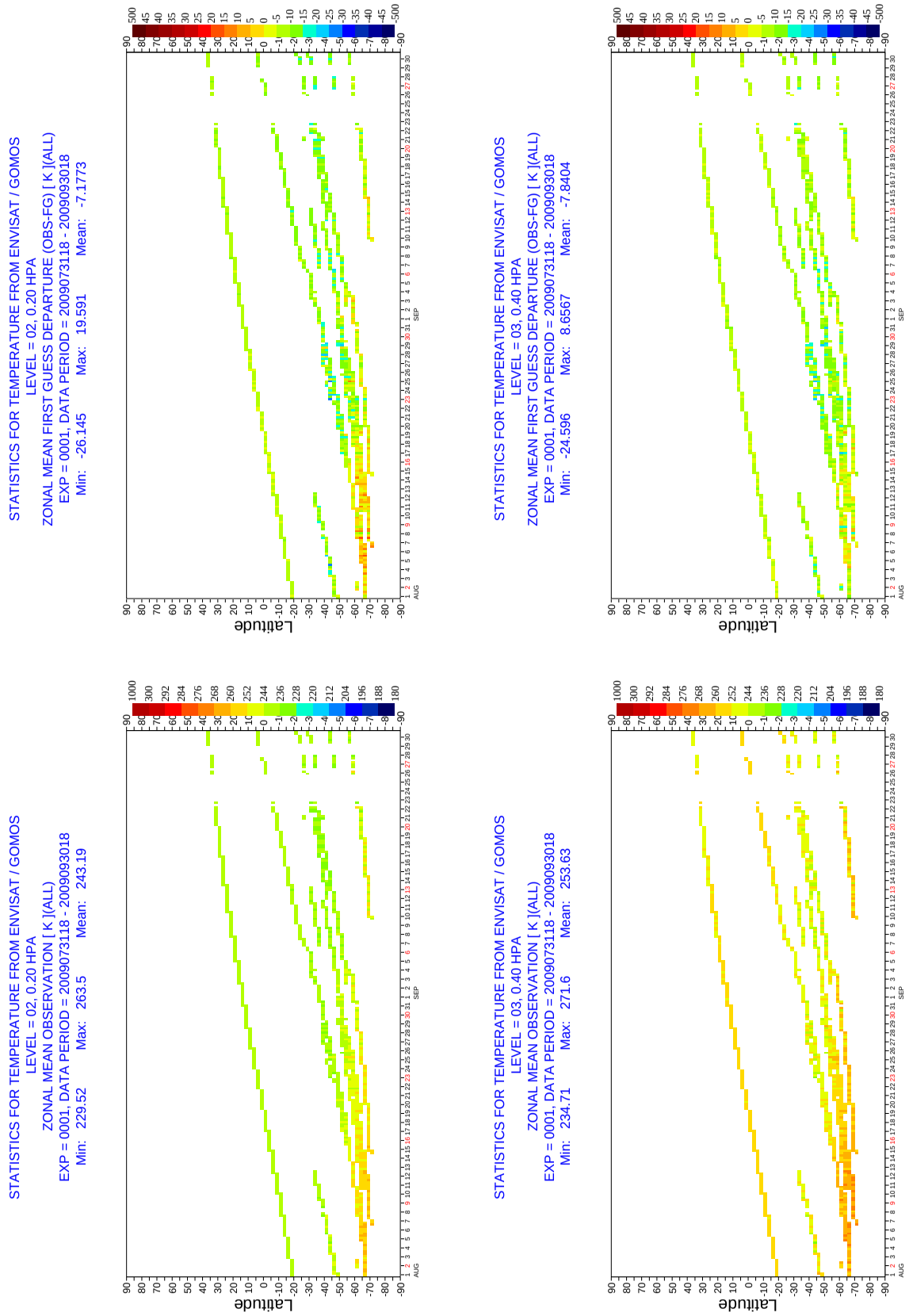


Fig. 15. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT temperature data per 6-hour cycle and of the zonal mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for August-September 2009.

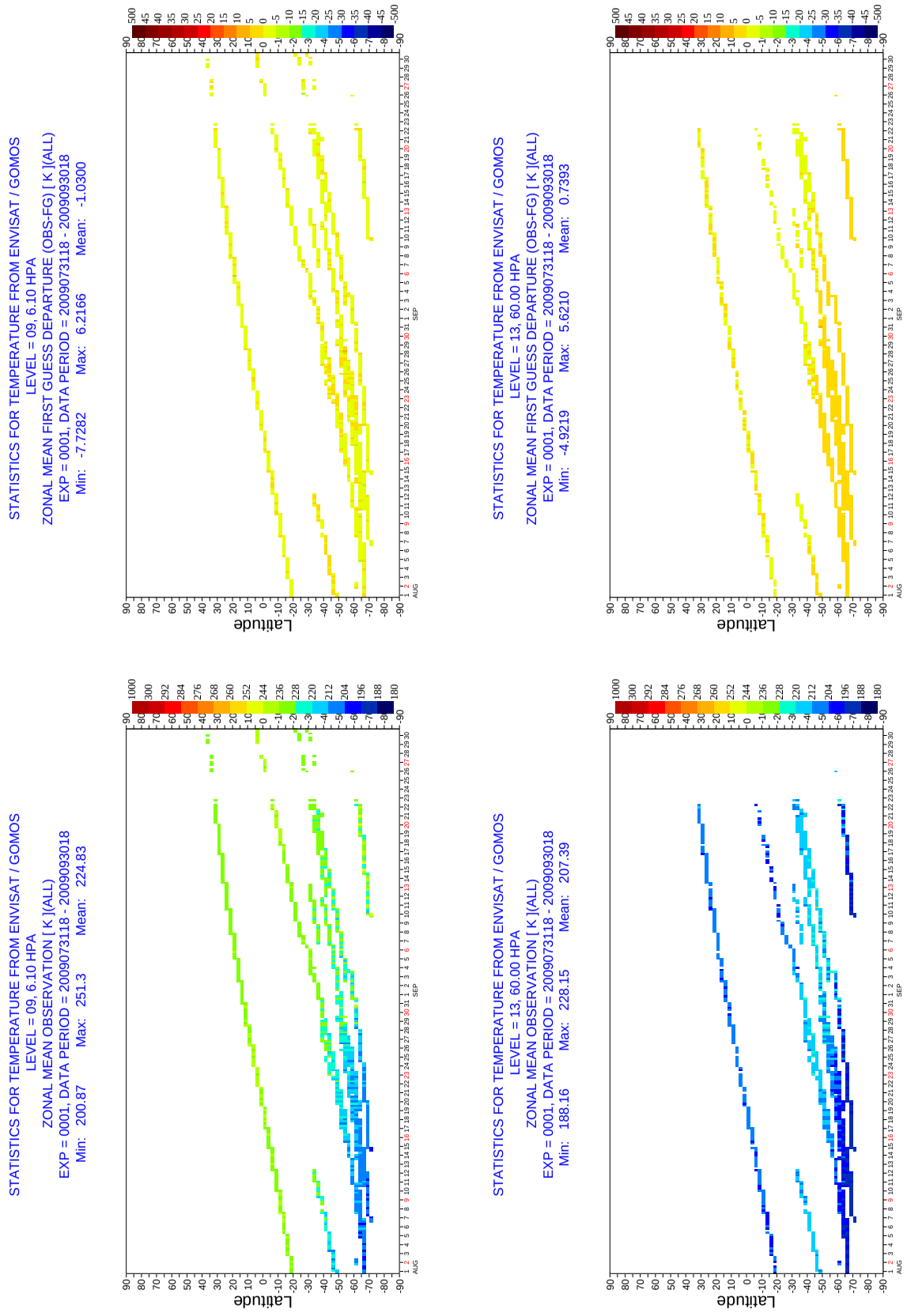


Fig. 16. As Fig. 15 but for level 9 (6.1 hPa) and level 13 (60 hPa).

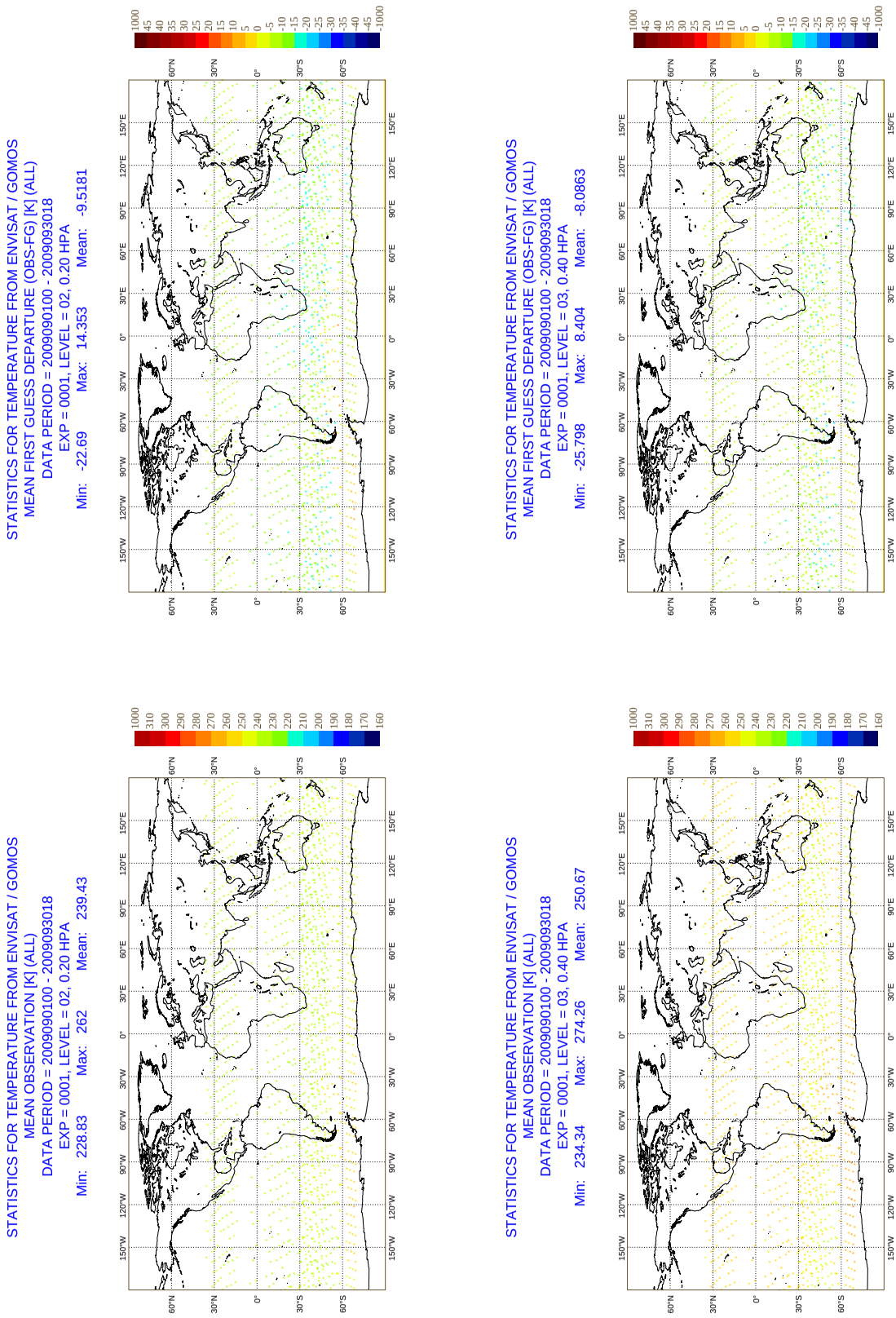


Fig. 17. Geographical distribution of mean ENVISAT GOMOS NRT temperature data and mean first-guess departures for level 2 (0.2 hPa) and level 3 (0.4 hPa) for September 2009.

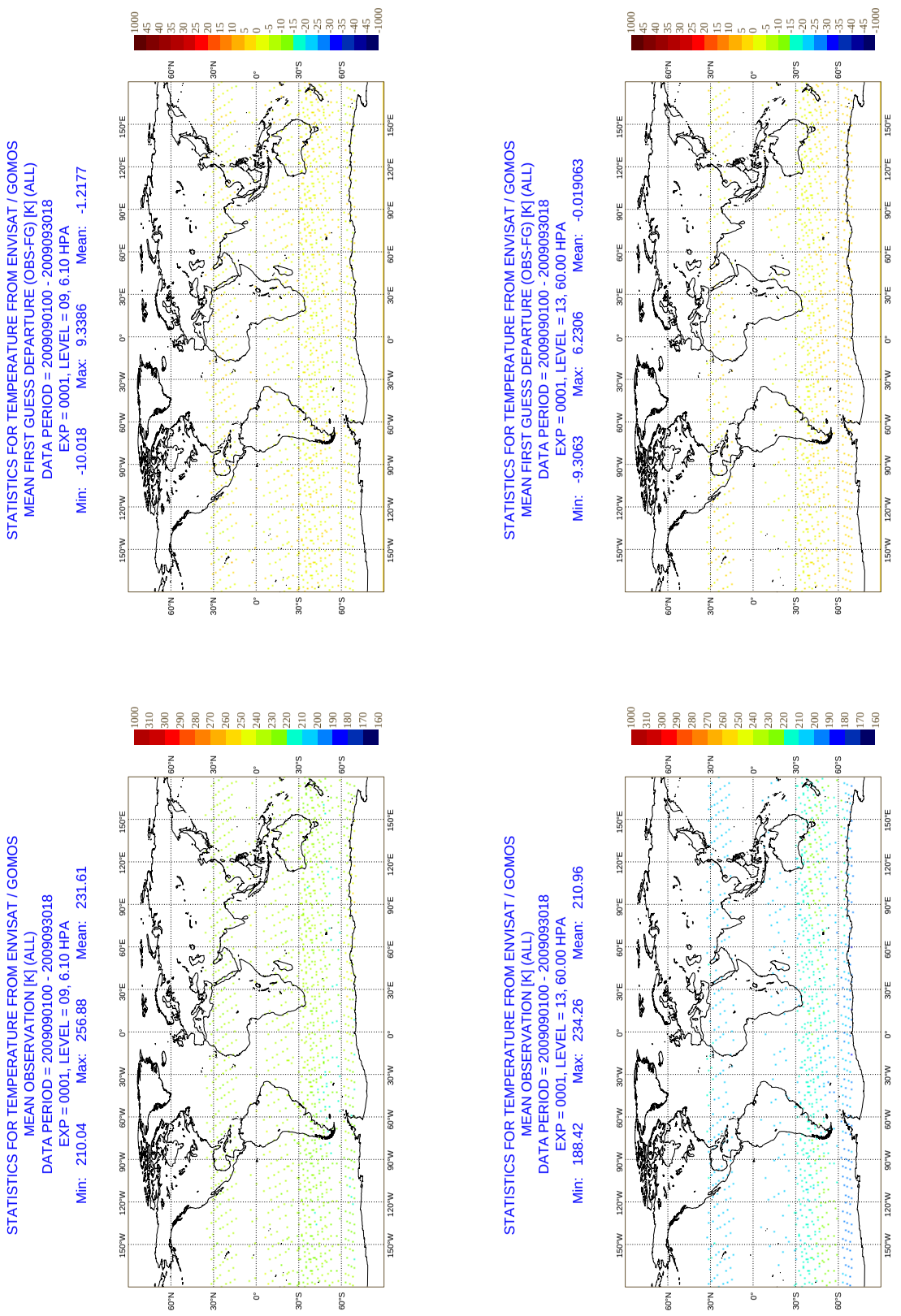


Fig. 18. As Fig. 17 but for level 9 (6.1 hPa) and level 13 (60 hPa).

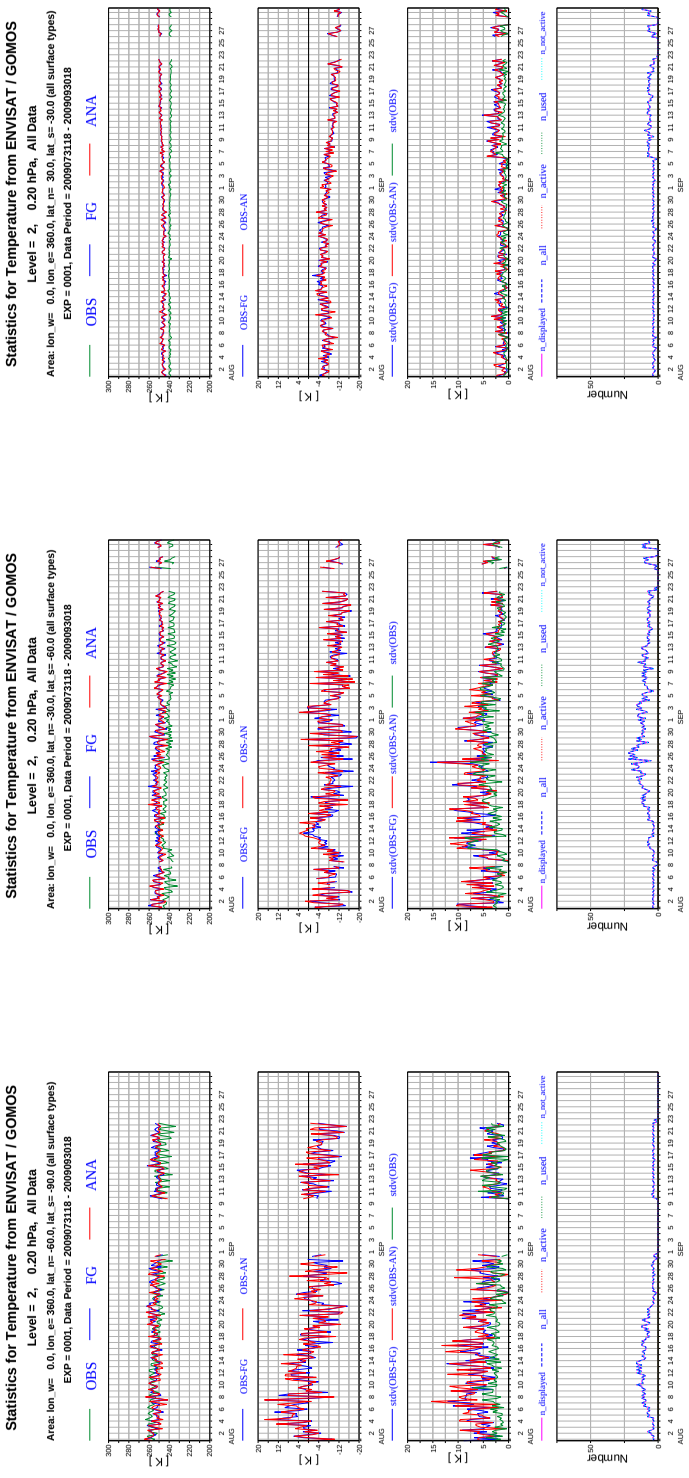


Fig. 19. Timeseries of mean ENVISAT GOMOS NRT temperature data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for level 2 (0.2 hPa) 30N-30S, 30-60S, and 60-90S for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

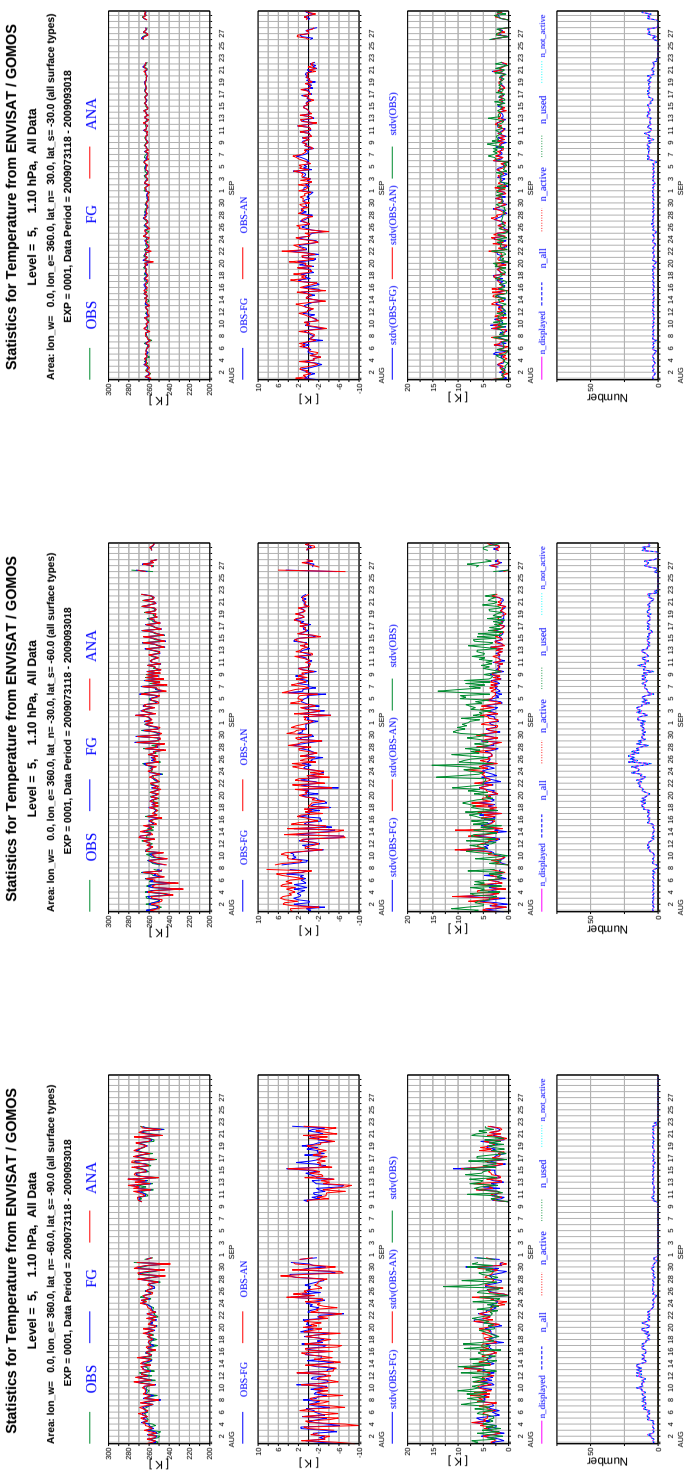


Fig. 20. As Figure 19, but for level 5 (1.1 hPa).

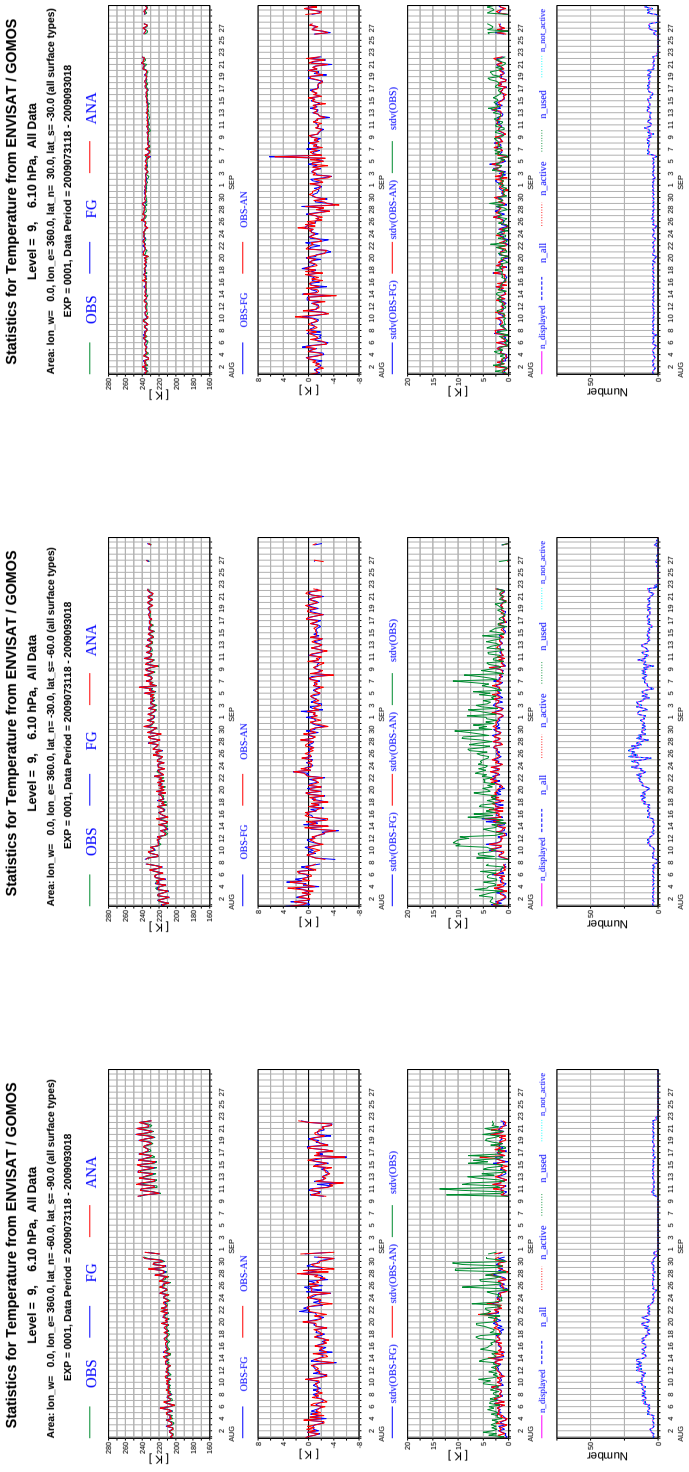


Fig. 21. As Figure 19, but for level 9 (6.1 hPa).

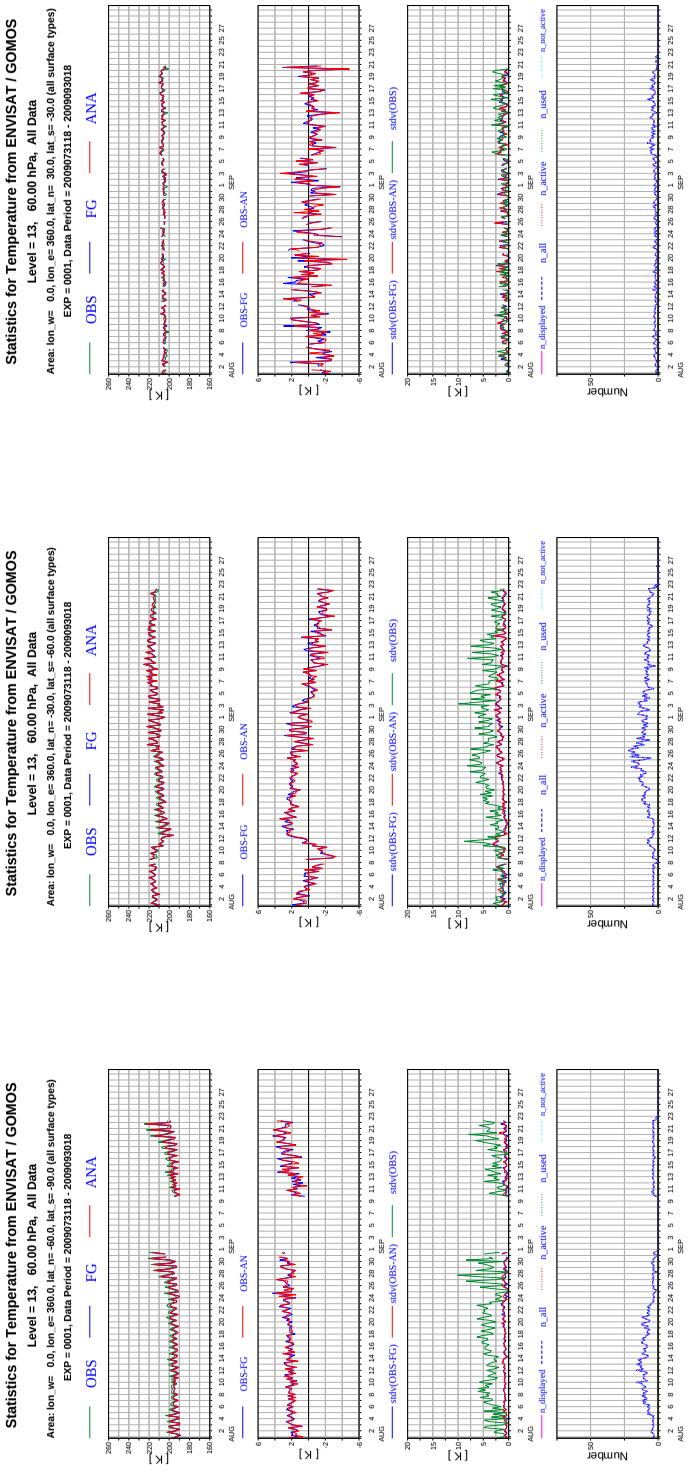


Fig. 22. As Figure 19, but for level 13 (60 hPa).

REPORT ABOUT ENVISAT GOMOS NRT WATER VAPOUR DATA (GOM_RR__2P) FOR SEPTEMBER 2009

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October 8, 2009

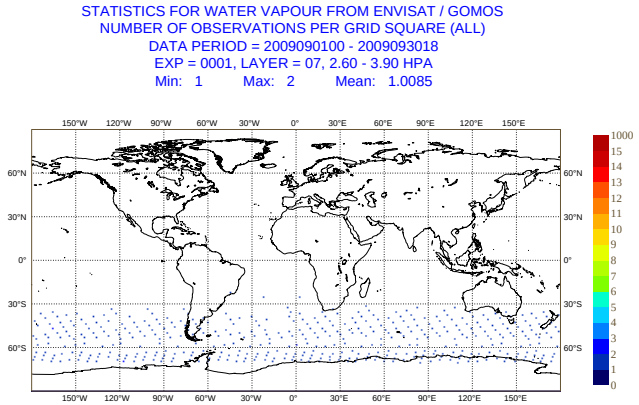

Fig. 1. Geographical distribution of mean number of ENVISAT GOMOS NRT water vapour data for level 7 (2.6-3.9 hPa) for September 2009.

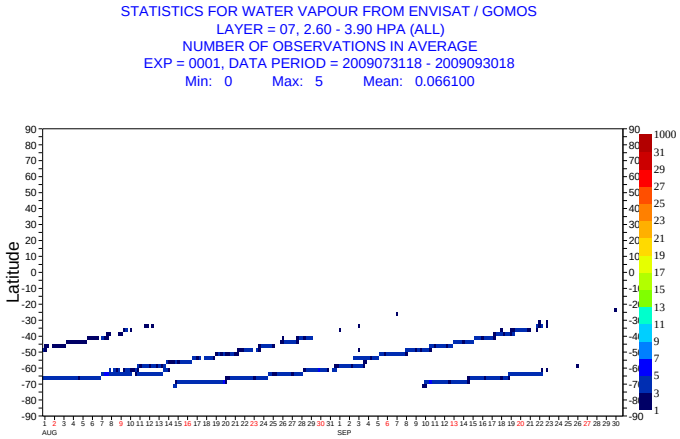

Fig. 2. Hovmoeller diagram of zonal mean number of data of ENVISAT GOMOS NRT water vapour data per 6-hour cycle for level 7 (2.6-3.9 hPa) for August-September 2009.

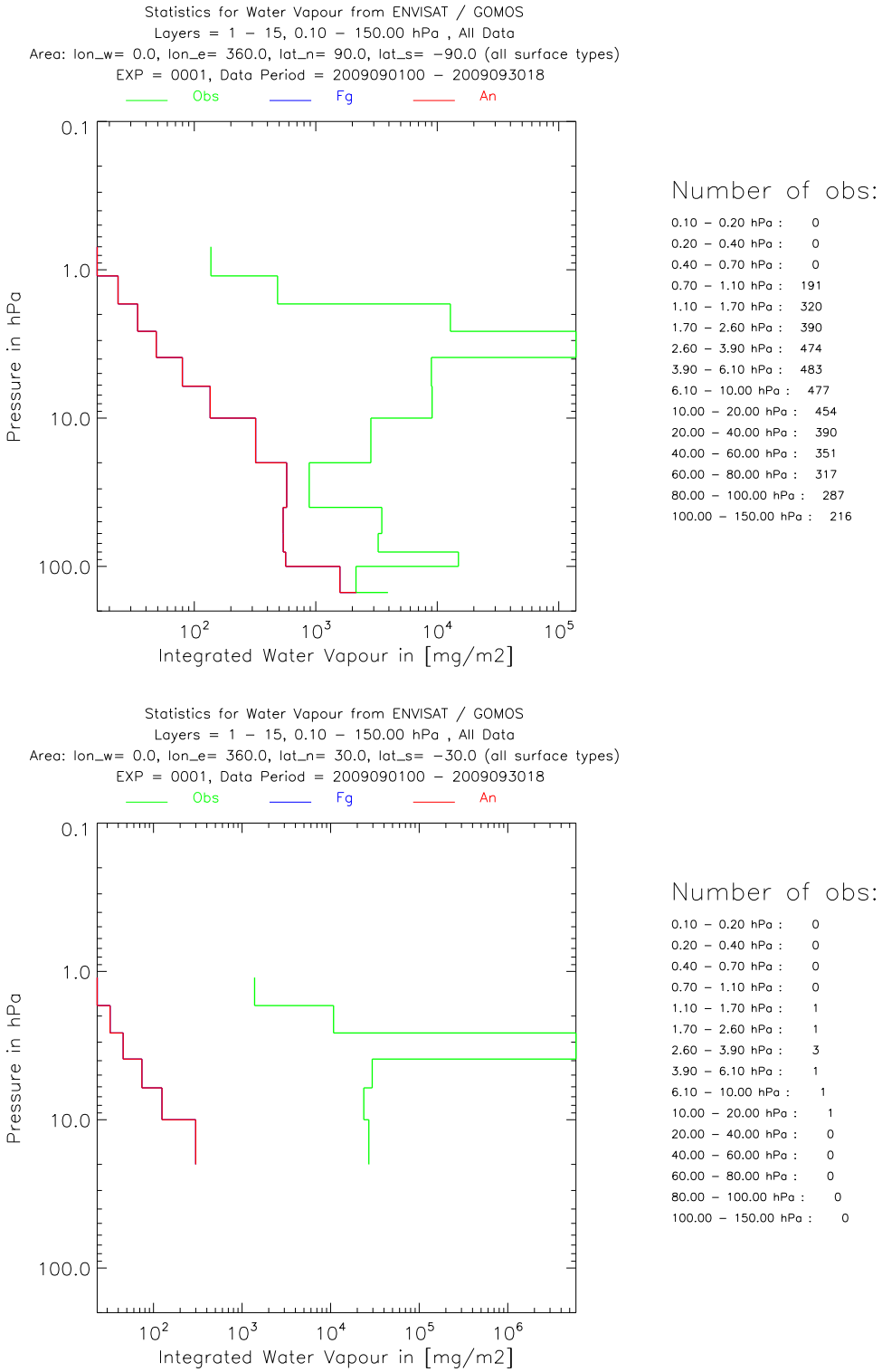

Fig. 3. Time mean vertical distribution of ENVISAT GOMOS NRT water vapour data in mg/m^2 for September 2009. The top plot shows the mean analysis values (red), the mean first-guess (blue), the mean observation (green) globally averaged. The bottom plot shows a similar plot for the tropical band (30N-30S).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

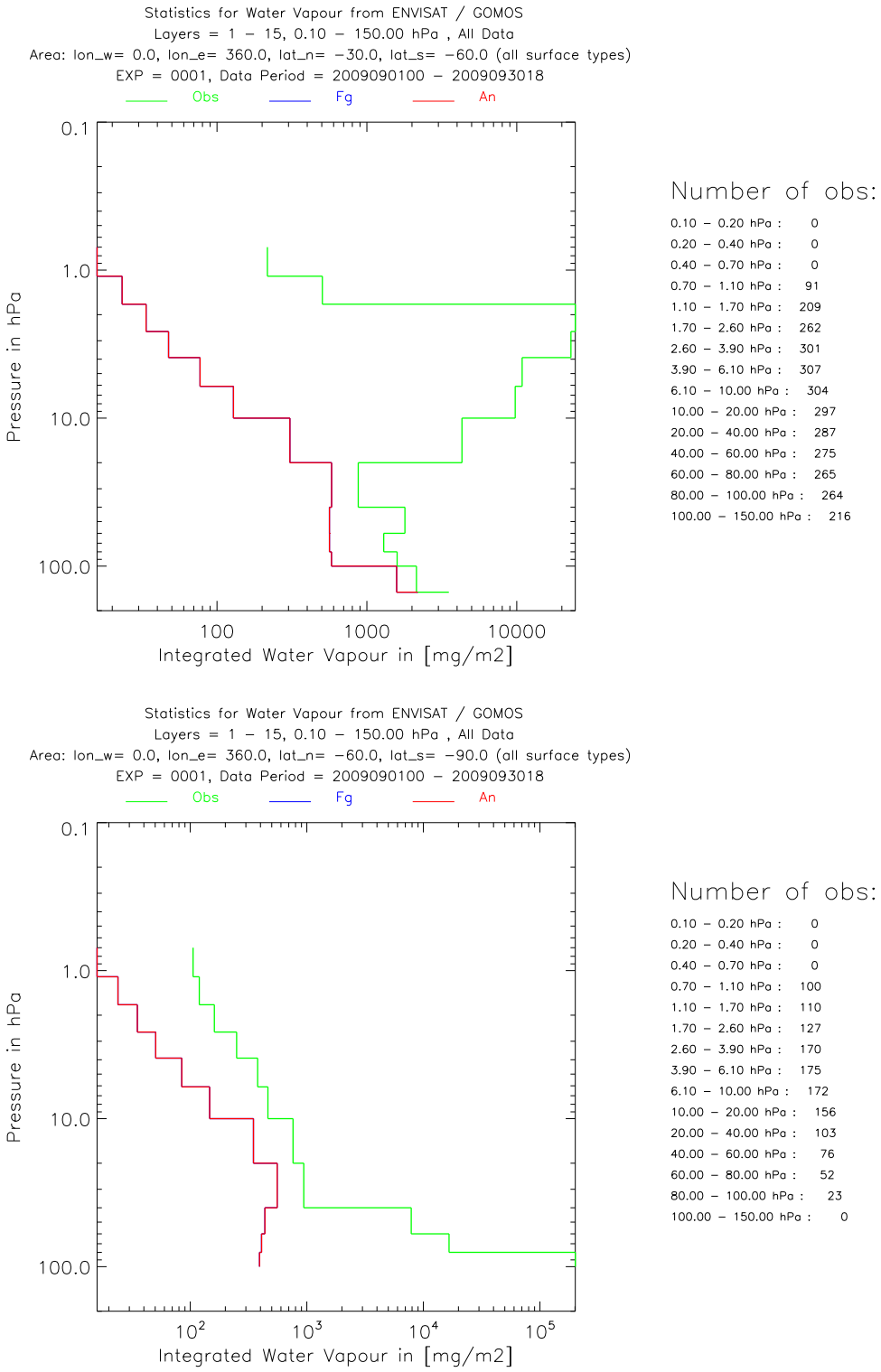

Fig. 4. As Fig. 3 but for the latitudinal band 30-60S (top panel) and 60-90S (bottom panel).

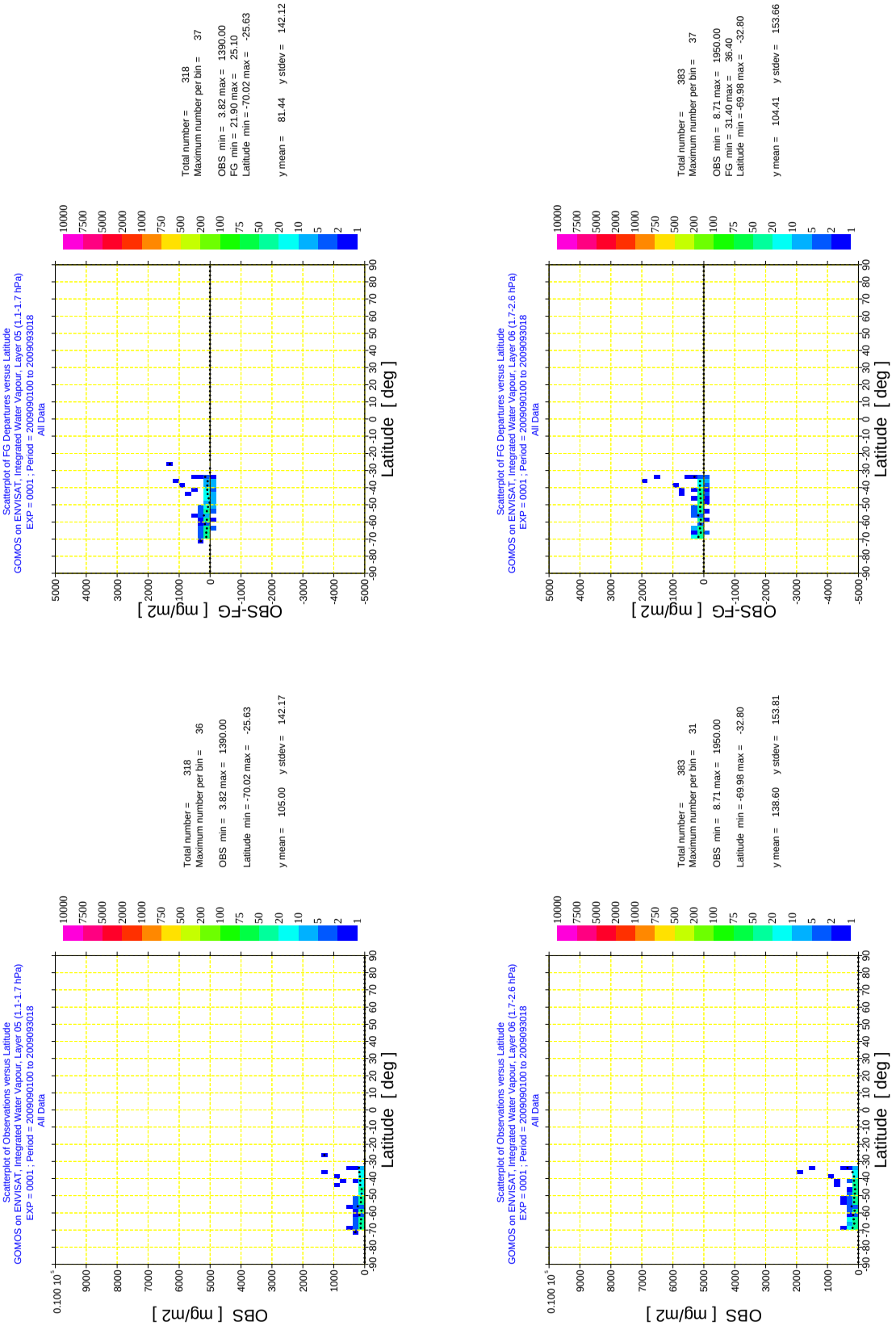

Fig. 5. Scatter plot of ENVISAT GOMOS NRT water vapour data against latitude (left) and scatter plot of first-guess departures of ENVISAT GOMOS NRT water vapour data against latitude (right) for September 2009 for level 5 (1.1 hPa) and level 6 (1.7 hPa). The colours show the number of data per bin, and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

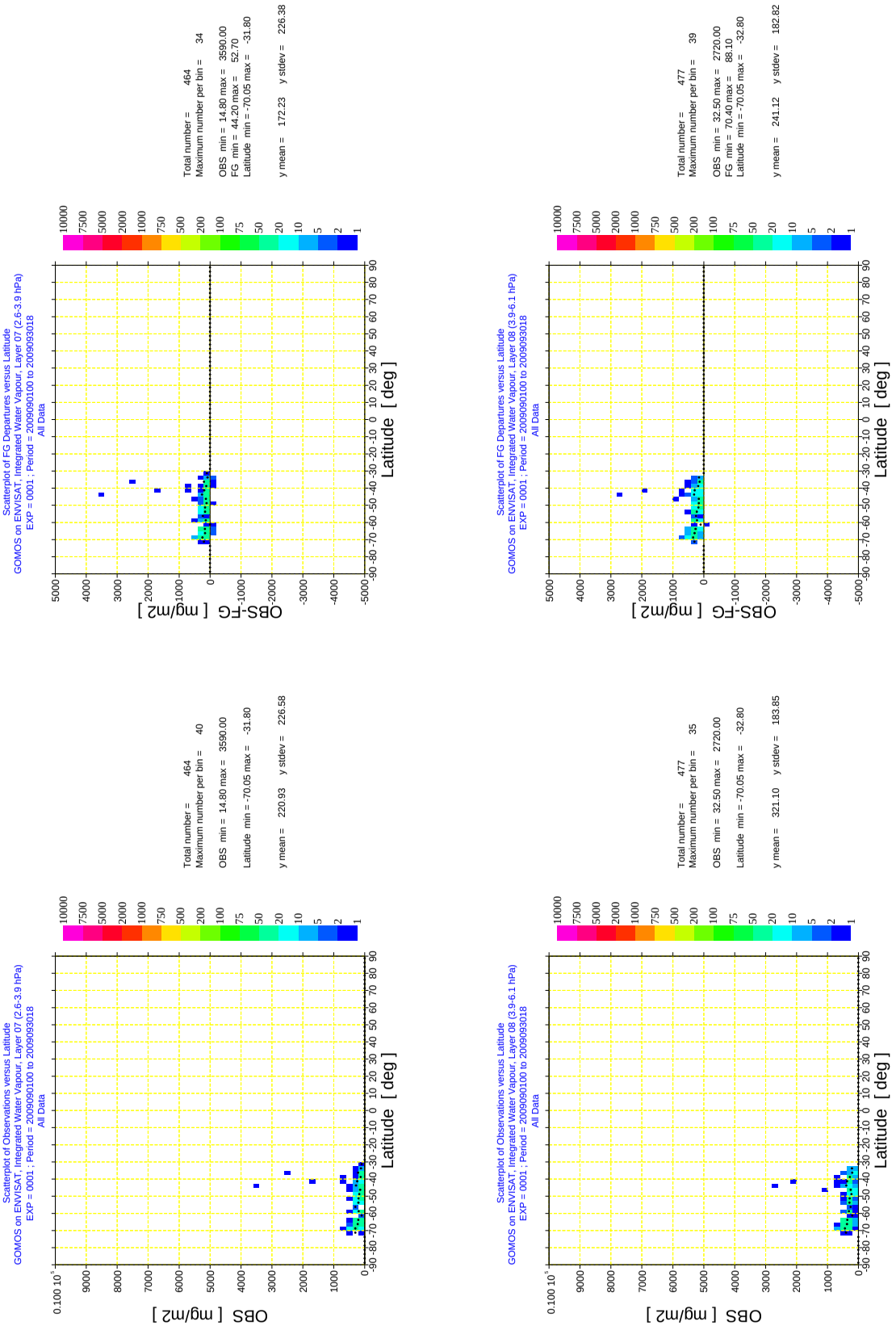

Fig. 6. As Fig. 5 but for level 7 (2.6 hPa) and level 8 (3.9 hPa).

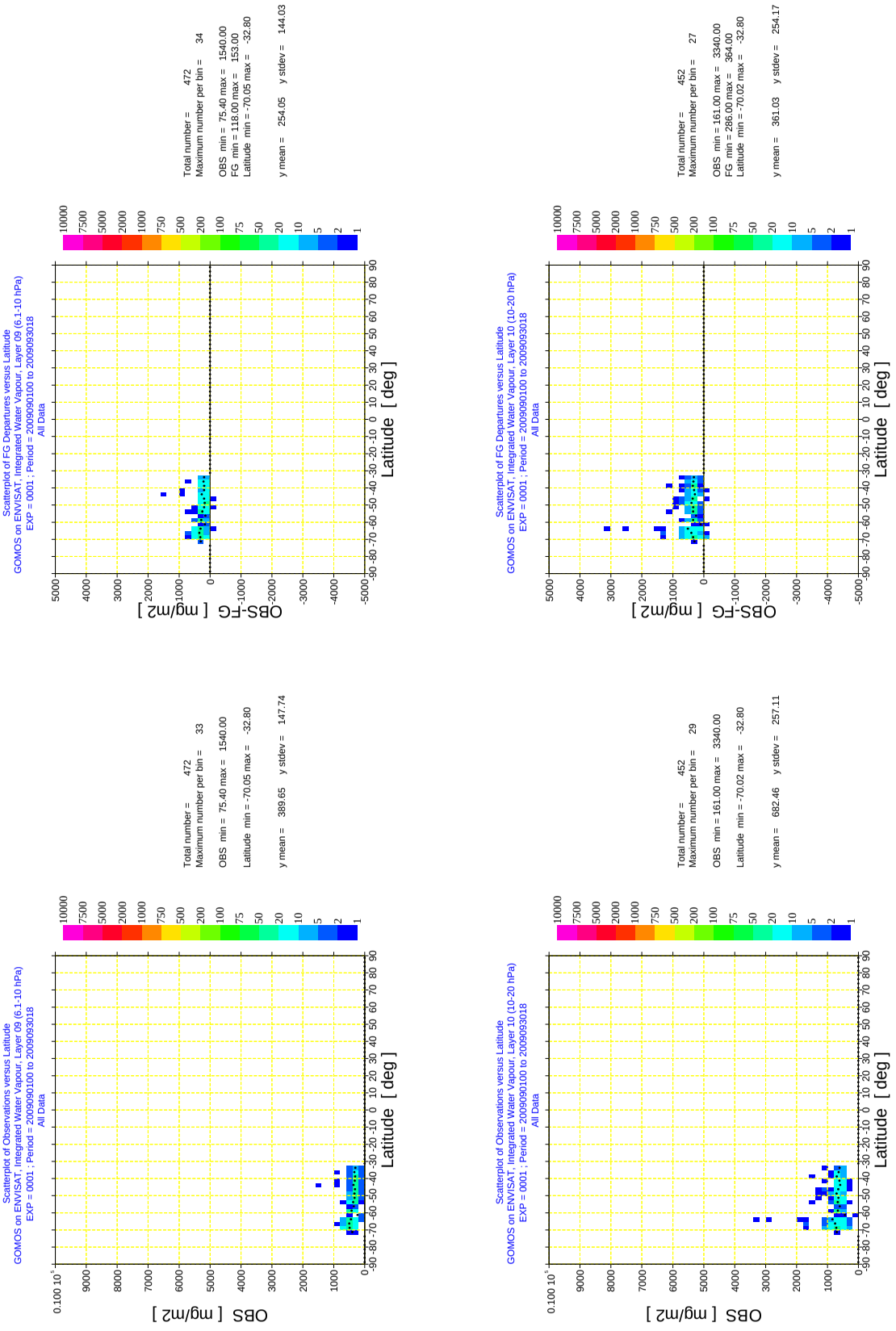

Fig. 7. As Fig. 5 but for level 9 (6.1 hPa) and level 10 (10 hPa).

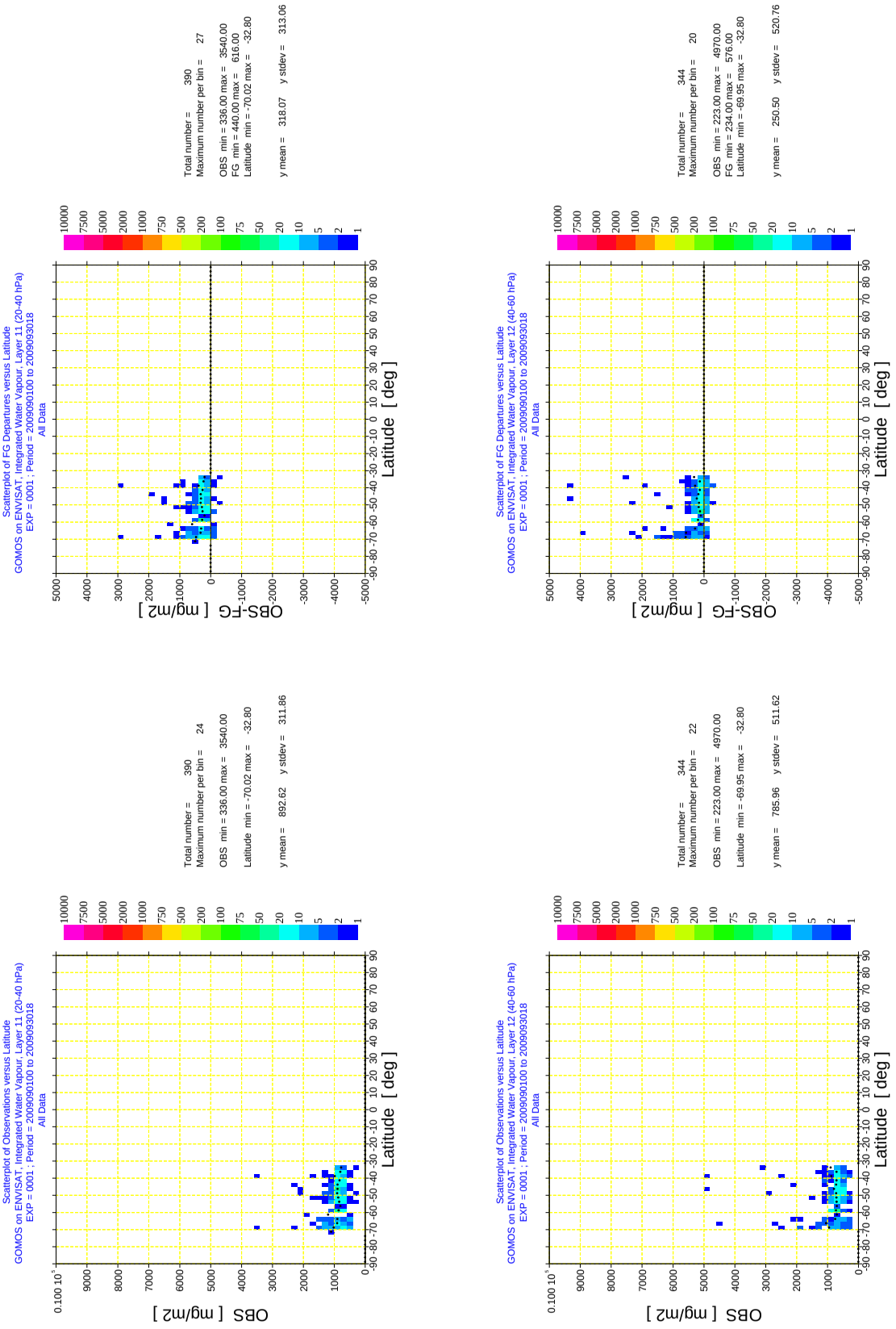

Fig. 8. As Fig. 5 but for level 11 (20-40 hPa) and level 12 (40-60 hPa).

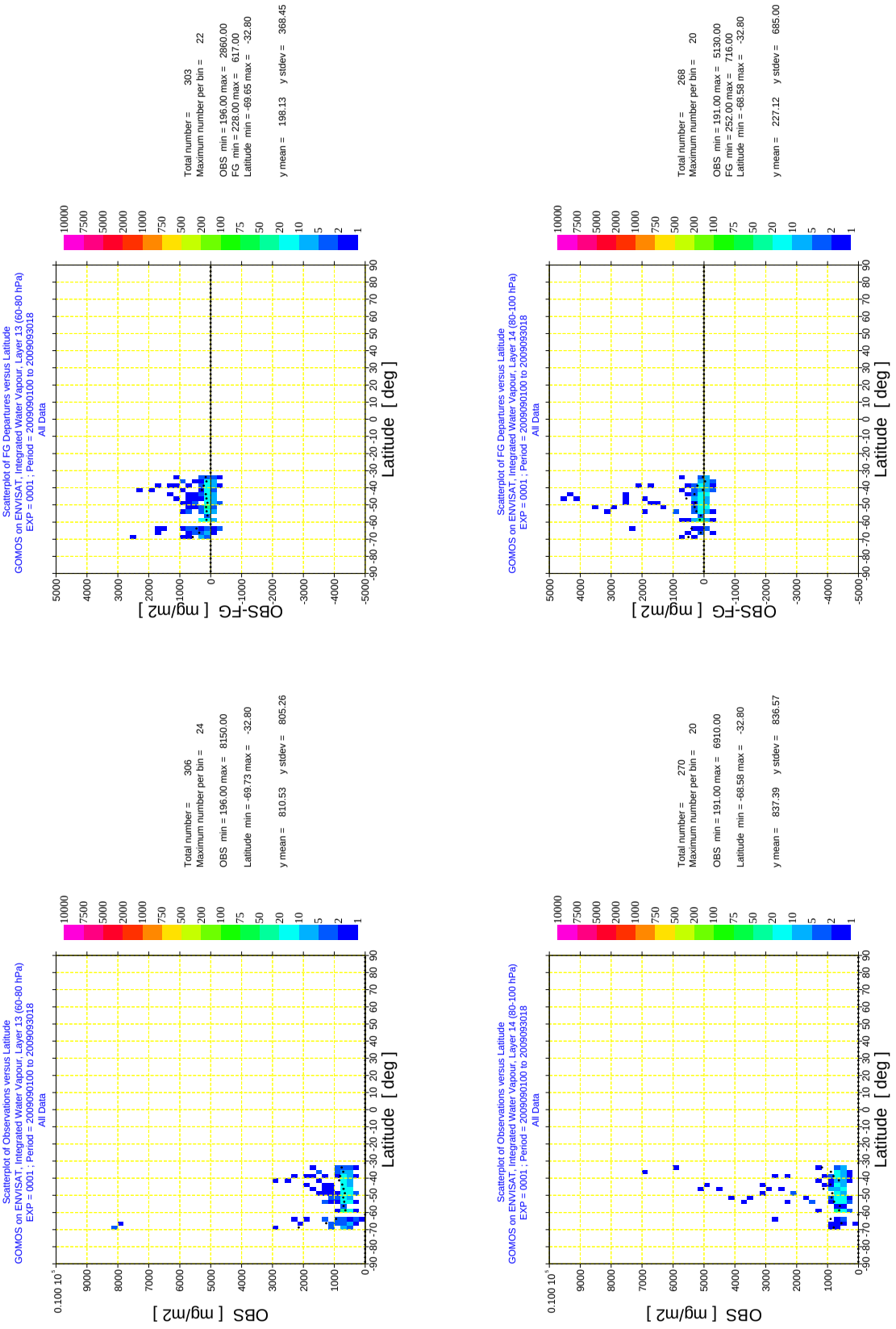

Fig. 9. As Fig. 5 but for level 13 (60-80 hPa) and level 14 (80-100 hPa).

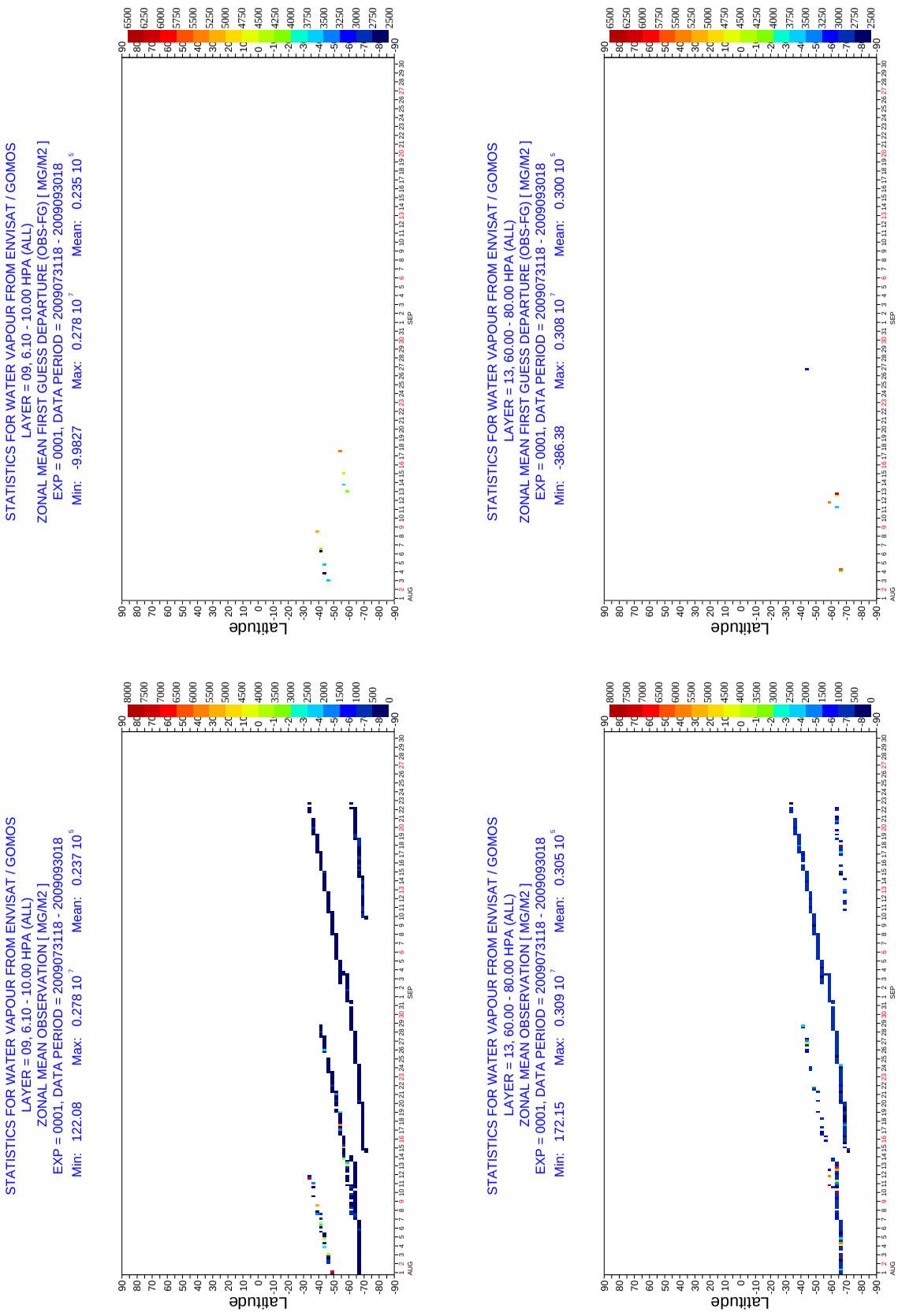

Fig. 10. Hovmoeller diagram of zonal mean ENVISAT GOMOS NRT water vapour data per 6-hour cycle and of the zonal mean first-guess departures for level 13 (60-80 hPa) and level 15 (100-150 hPa) for August-September 2009.

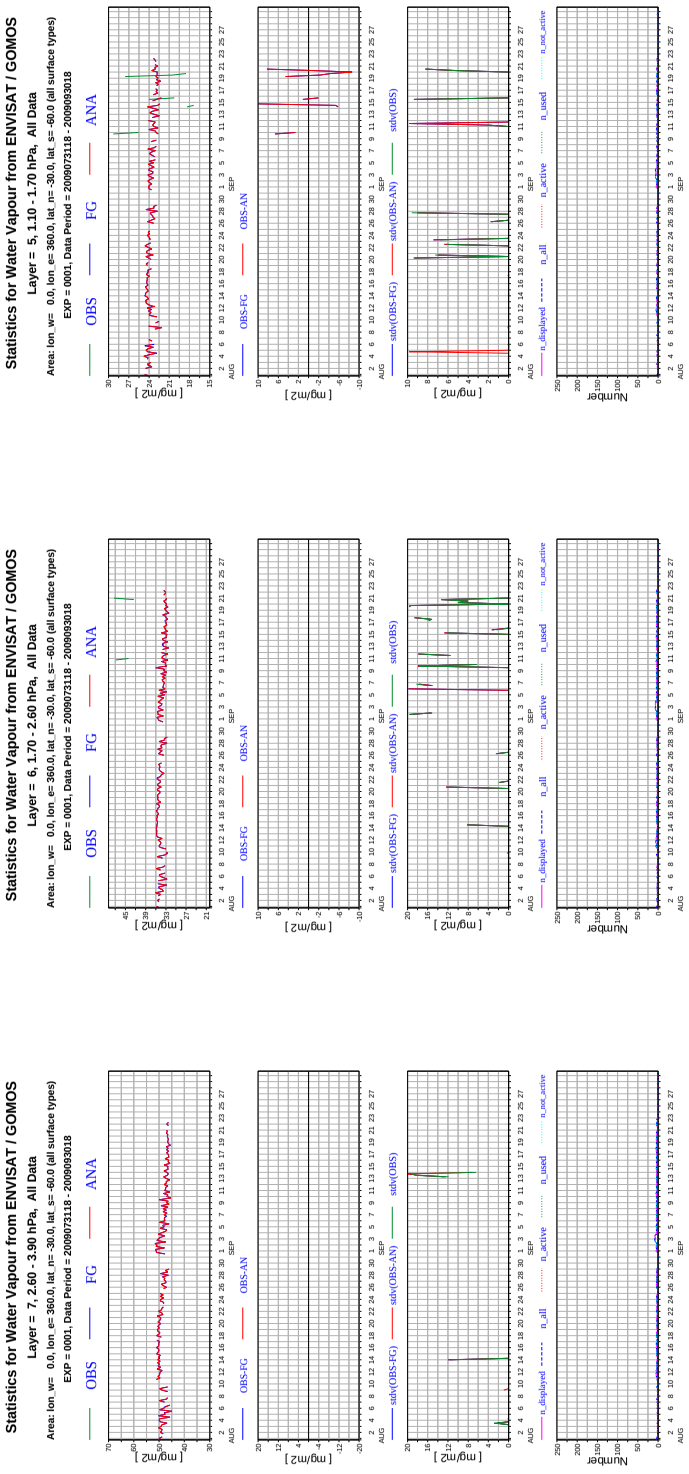

Fig. 11. Timeseries of mean ENVISAT GOMOS NRT water vapour data, first guess and analysis values (top panels), first-guess and analysis departures (second panels), standard deviations (third panels) and number of data (bottom panels) per 6-hour cycle for layer 11 (20-40 hPa), level 13 (60-80 hPa), and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