Appendix C: SAMS Time Histories and Color Spectrograms TSH B

The Principal Investigator Microgravity Services (PIMS) group has further processed SAMS data to produce the plots shown here. This appendix presents power spectral density versus frequency versus time (spectrogram) plots of SAMS TSH B (f_c=10 Hz) data.

Color spectrograms are used to show how the microgravity environment varies in intensity with respect to time and frequency. These spectrograms are provided as an overview of the frequency characteristics of the SAMS data. Each spectrogram is a composite of 6 hour's worth of data. The time resolution used to compute the spectrograms seen here is 40.960 seconds. This corresponds to a frequency resolution of 0.0244 Hz.

These data were collected at 50 samples per second, and a 10 Hz lowpass filter was applied to the data by the SAMS unit prior to digitization. Prior to plot production, the raw SAMS data were compensated for gain changes, and then de-meaned. De-meaning was accomplished by analyzing individual sections with a nominal length of 60 minutes. Since this de-meaning operation operates on time periods longer than the plot's time resolution, an artificial dc component may be seen in the extreme lower frequency regime of these spectrograms. Since these are data processing artifacts, the low frequency regime (f<0.05 Hz) should be ignored. Users who are interested in further details for either of these operations are encouraged to contact the PIMS group.

Power Spectral Density versus Frequency versus Time Calculations

In order to produce the spectrogram image, Power Spectral Densities were computed for successive time intervals (the length of the interval is equal to the time resolution). For the PSD computation, a Hanning window was applied. In order to combine all three axes into a single plot to show an overall level, a Vector-Magnitude (VM) operation was performed. Stated mathematically:

$$VM_k = \sqrt{PSD_{x_k}^2 + PSD_{y_k}^2 + PSD_{z_k}^2}\ .$$

By imaging the base 10 logarithm $\left(\log_{10}\right)$ magnitude as a color and stacking successive PSDs from left to right, variations of acceleration magnitude and frequency are shown as a function of time. Colors are assigned to discrete magnitude ranges, so that there are 64 colors assigned to the entire range of magnitudes shown.

The colorbar limits are chosen in order to maximize the data value and visibility in a given set of spectrogram plots. Data which fall outside of these limits will be imaged as either the highest or lowest magnitude, depending on which side they have saturated. For this report, less than 1% of the total points lie below the lower limit, and less than 1% of the total points lie above the upper limit. If an area of interest seems to be saturated, care should be taken in that the actual values may lie above or below the color mapping shown on the plot.

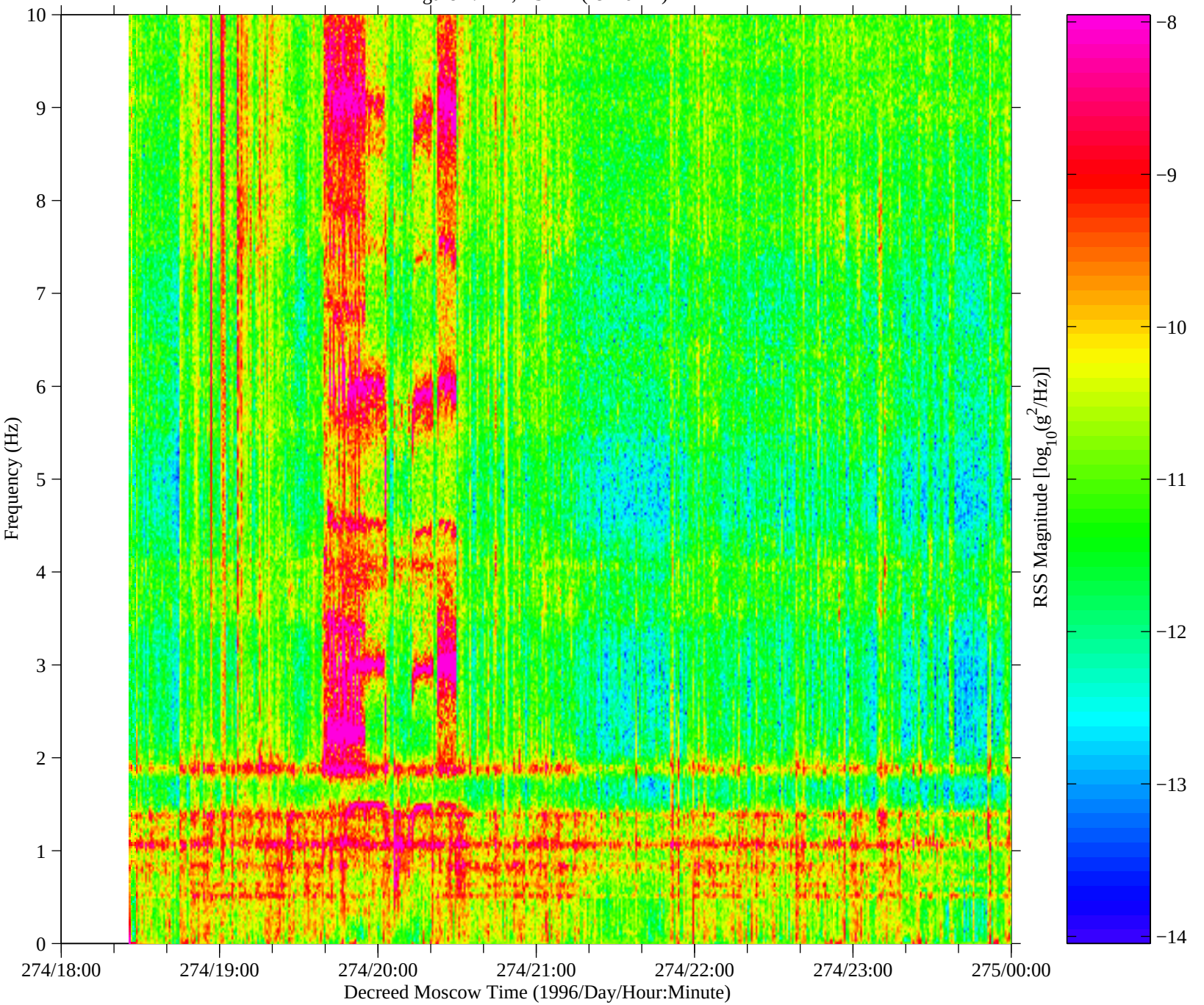
Due to the nature of spectrograms, care should be taken to not merely read a color's numeric value as being the acceleration magnitude that is present at a given frequency. In order to get this type of information, the PSDs must be integrated between two frequencies. These frequencies (lower and upper) form the band of interest. The result of this integration is the g_{RMS} acceleration level in the $\left[f_{lower}, f_{upper}\right]$ band. The PIMS group is able to provide this type of analysis on a per-request basis.

Plot gaps (if any exist) are shown by either white or dark blue areas on the page. Care should be taken to not mistake a plot gap (represented by a blue vertical band) with a quiet period. If a plot gap exists for an entire plot (or series of successive plots), a comment is placed on the page to let the user know there is a gap in the data. These "No data are available" comments will not show exact times for which the data are not available, but will only indicate missing plots.

Contacting PIMS

To request additional analysis or information, users are encouraged to send an e-mail to pims@lerc.nasa.gov, or FAX a request to (216) 433-8660.

Figure 1: Mir, TSH B (fc=10 Hz)



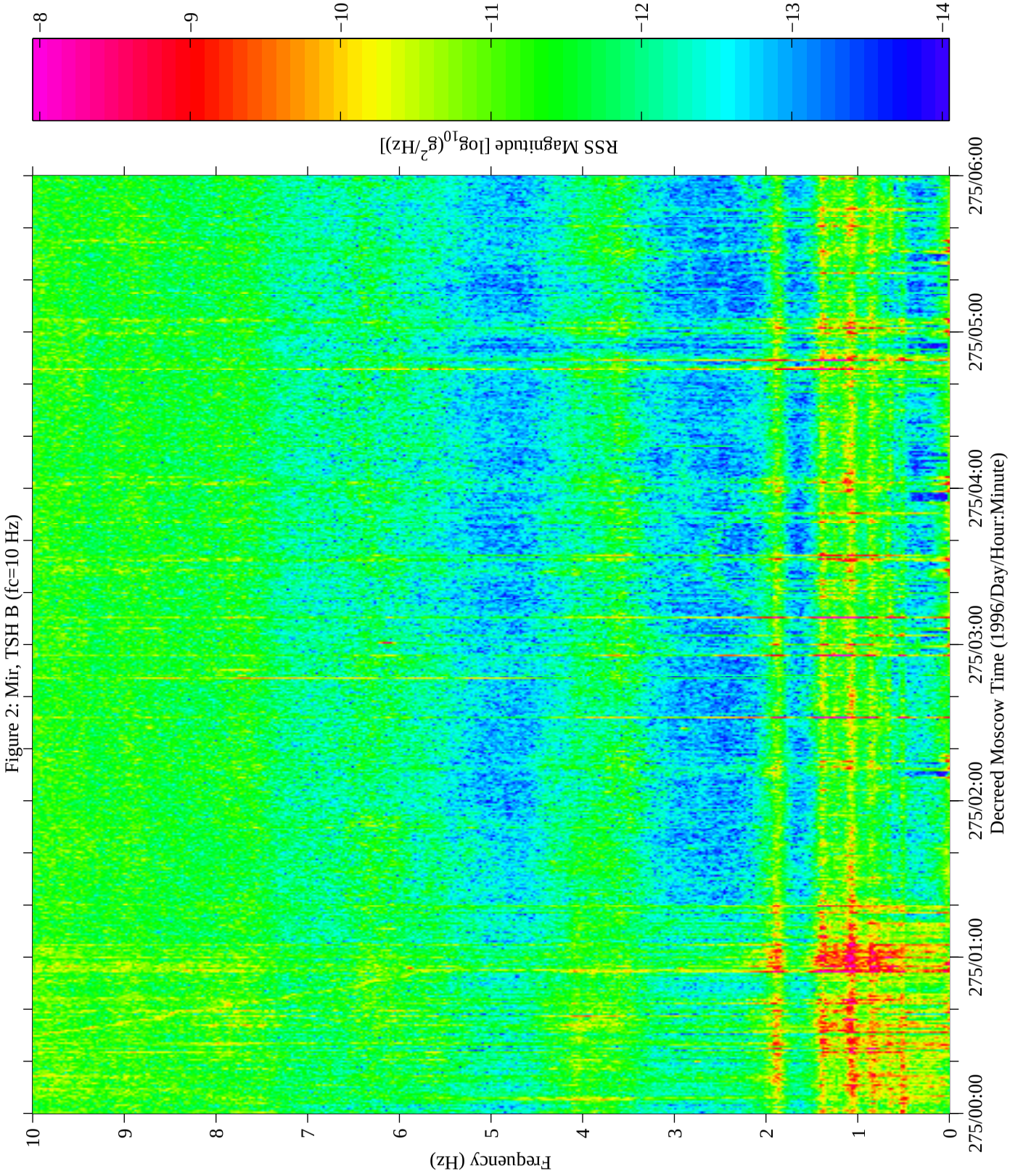


Figure 2: Mir, TSH B (fc=10 Hz)

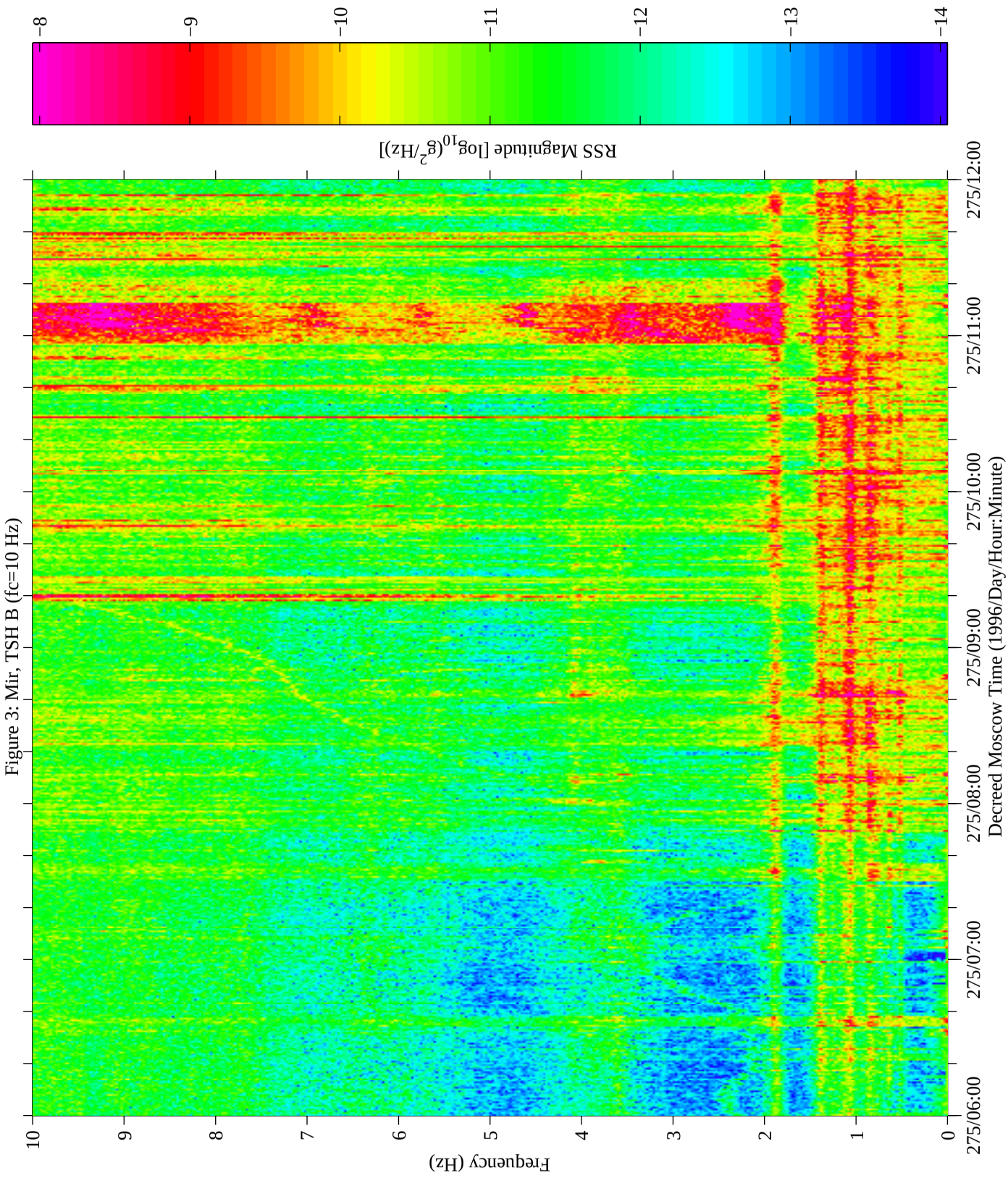
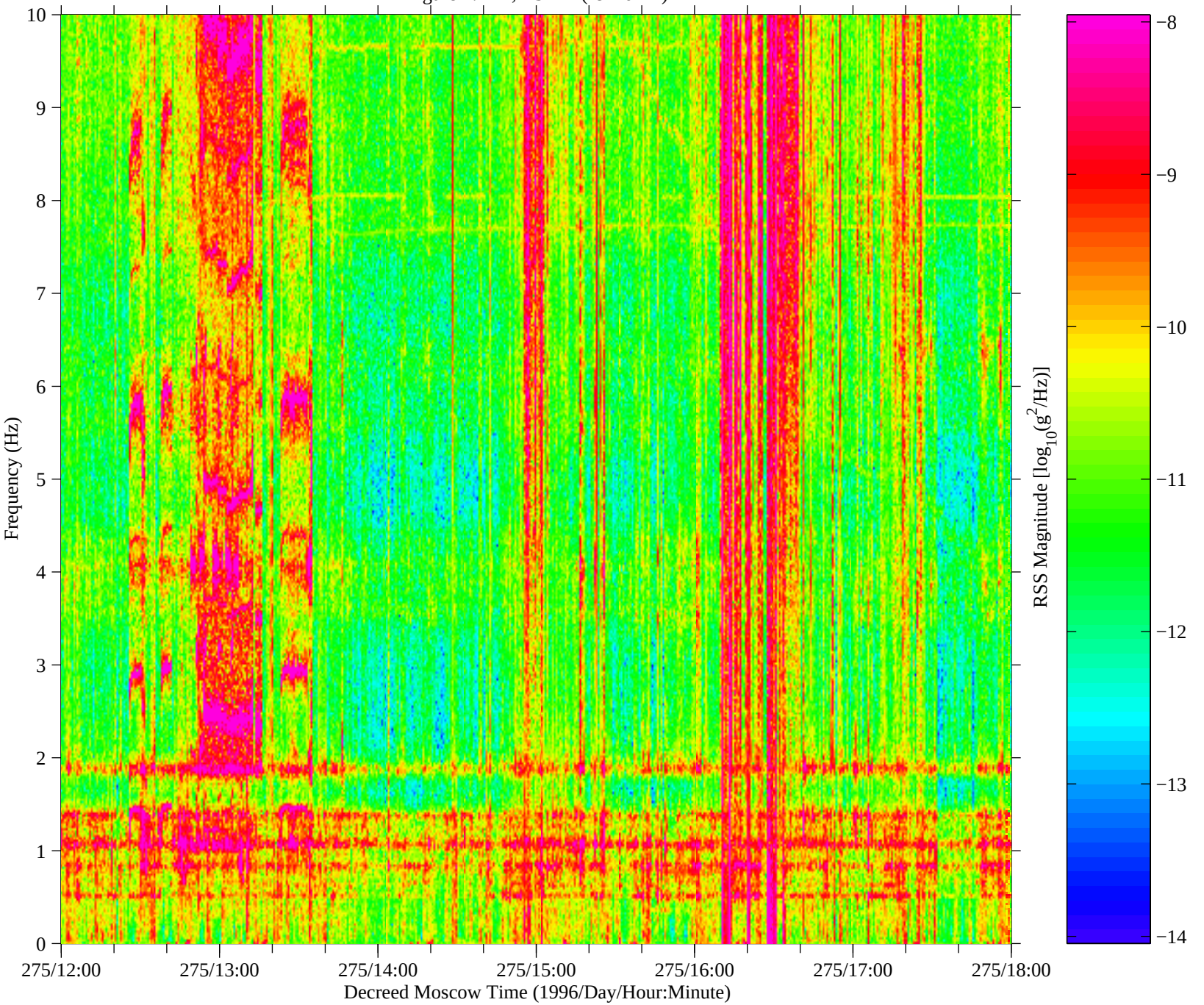


Figure 3: Mir, TSH B (fc=10 Hz)

Figure 4: Mir, TSH B (fc=10 Hz)



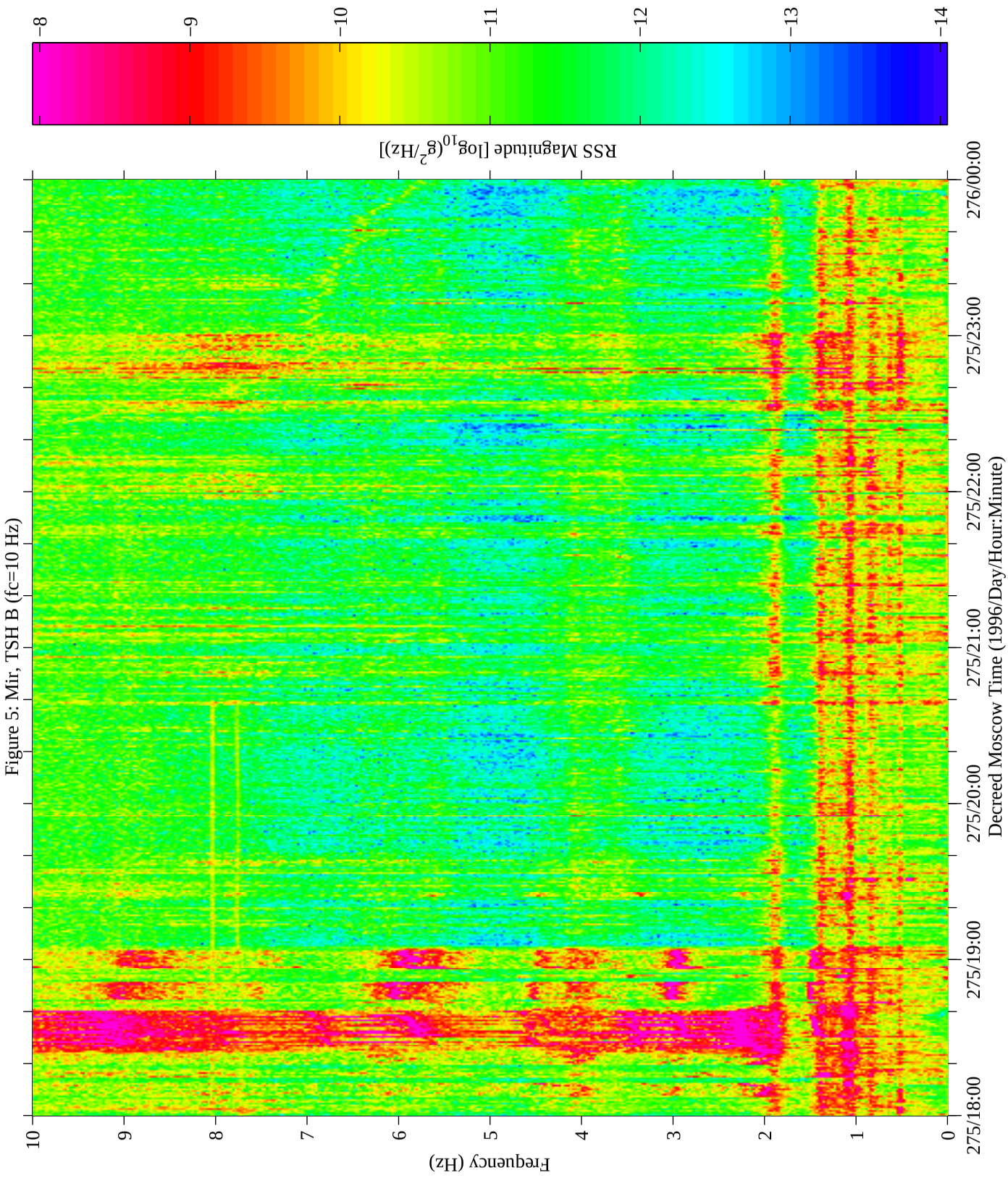


Figure 5: Mir, TSH B (fc=10 Hz)

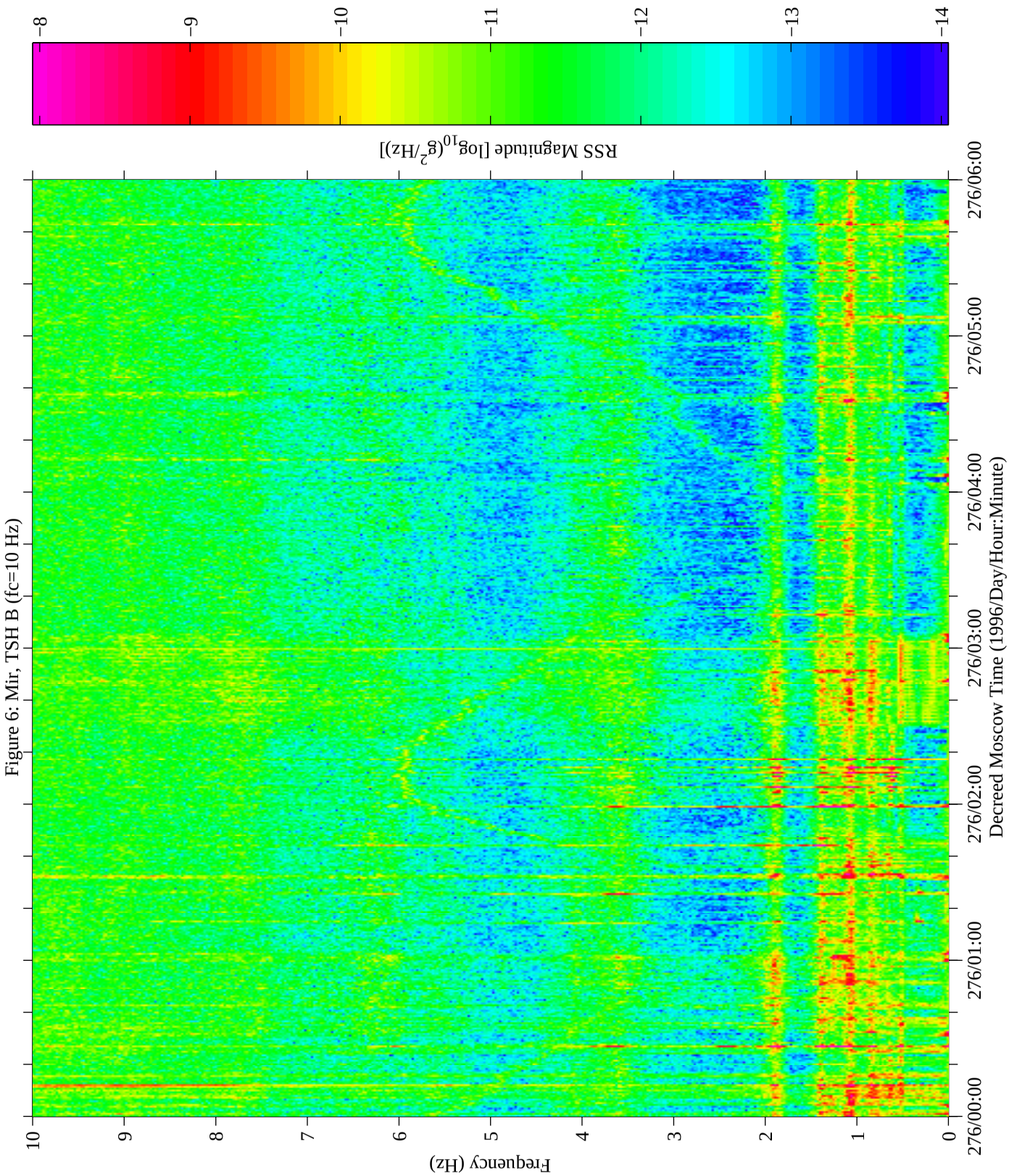


Figure 6: Mir, TSH B (fc=10 Hz)

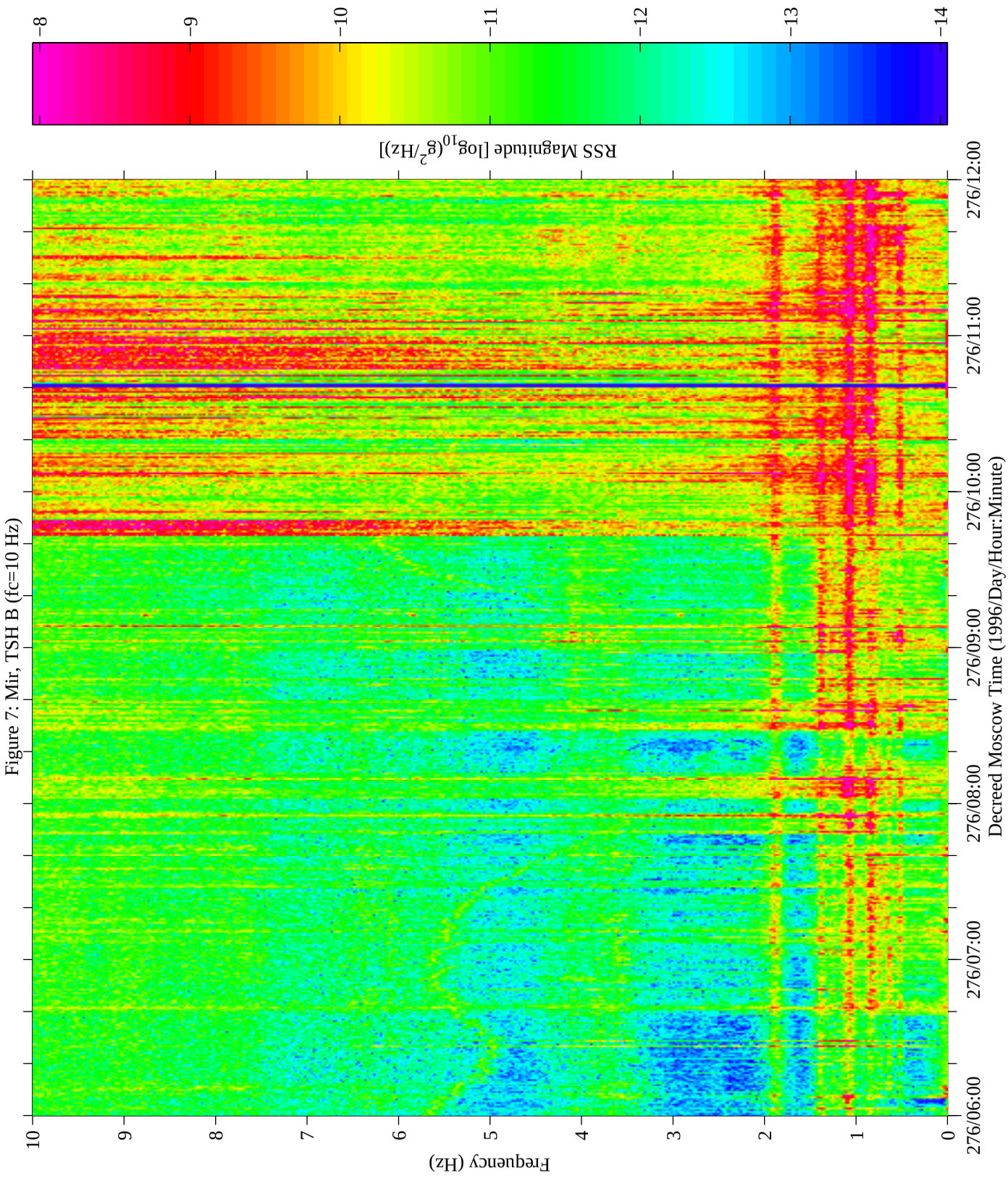


Figure 7: Mir, TSH B (fc=10 Hz)

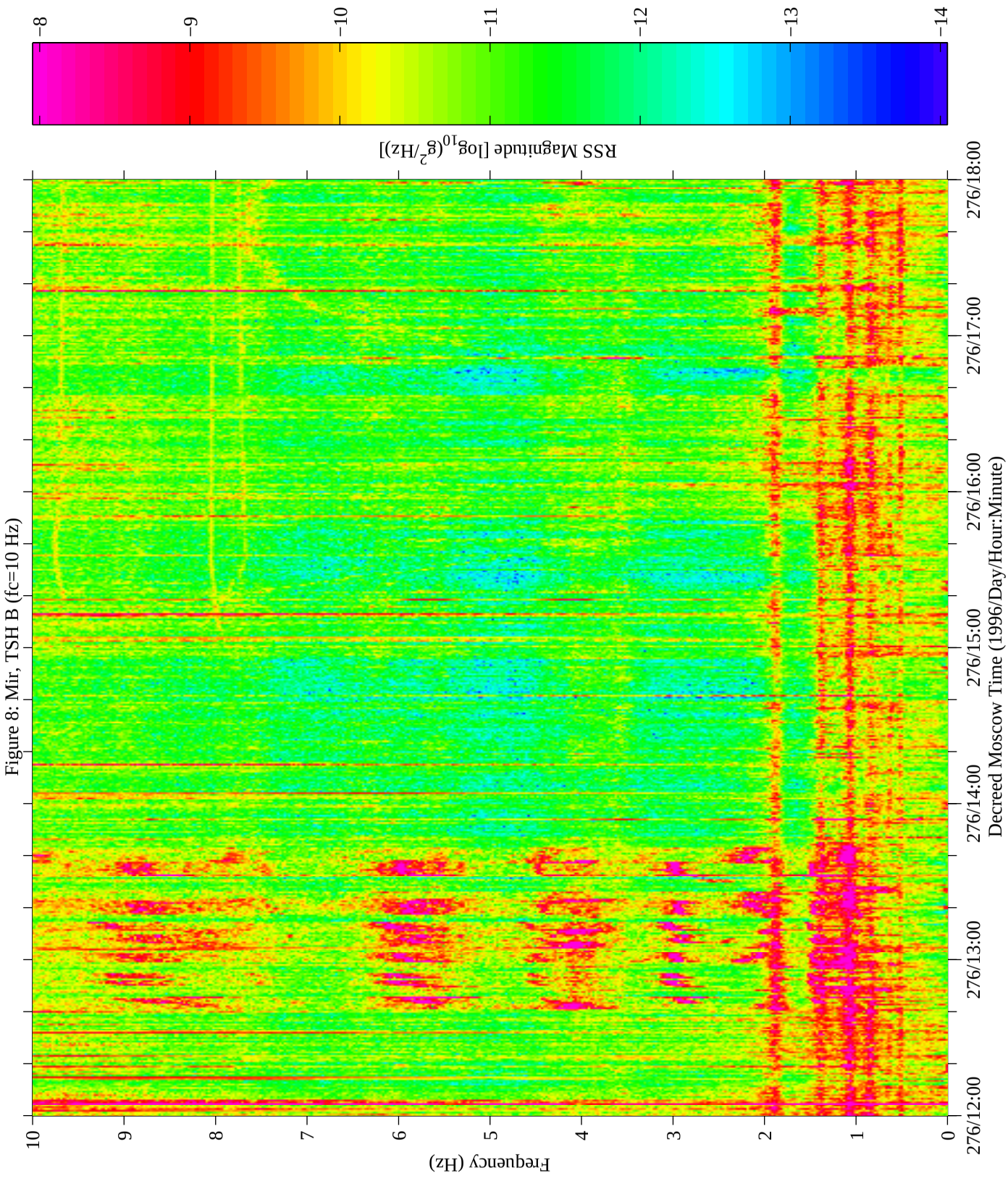


Figure 8: Mir, TSH B (fc=10 Hz)

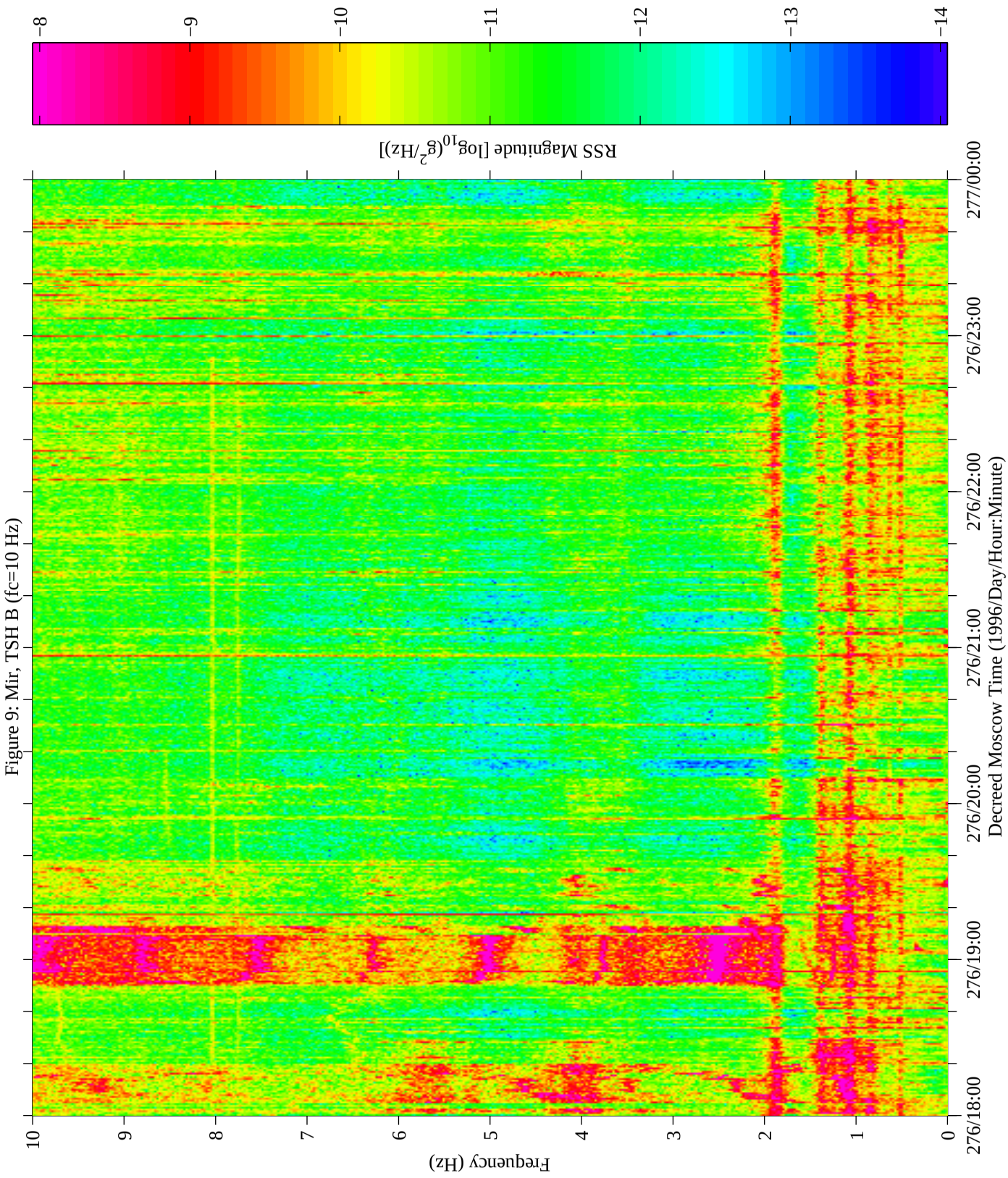
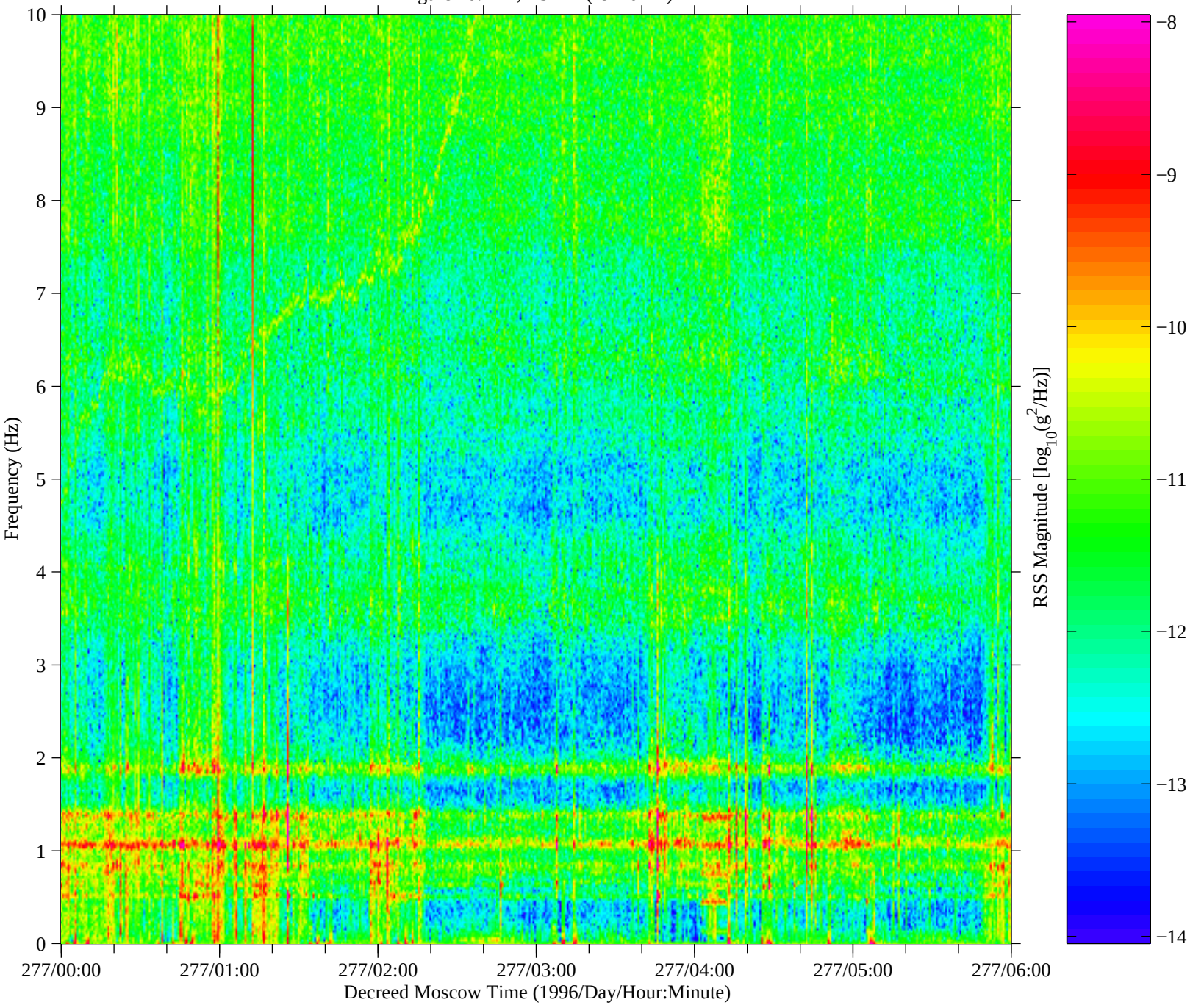


Figure 9: Mir, TSH B (fc=10 Hz)

Figure 10: Mir, TSH B (fc=10 Hz)



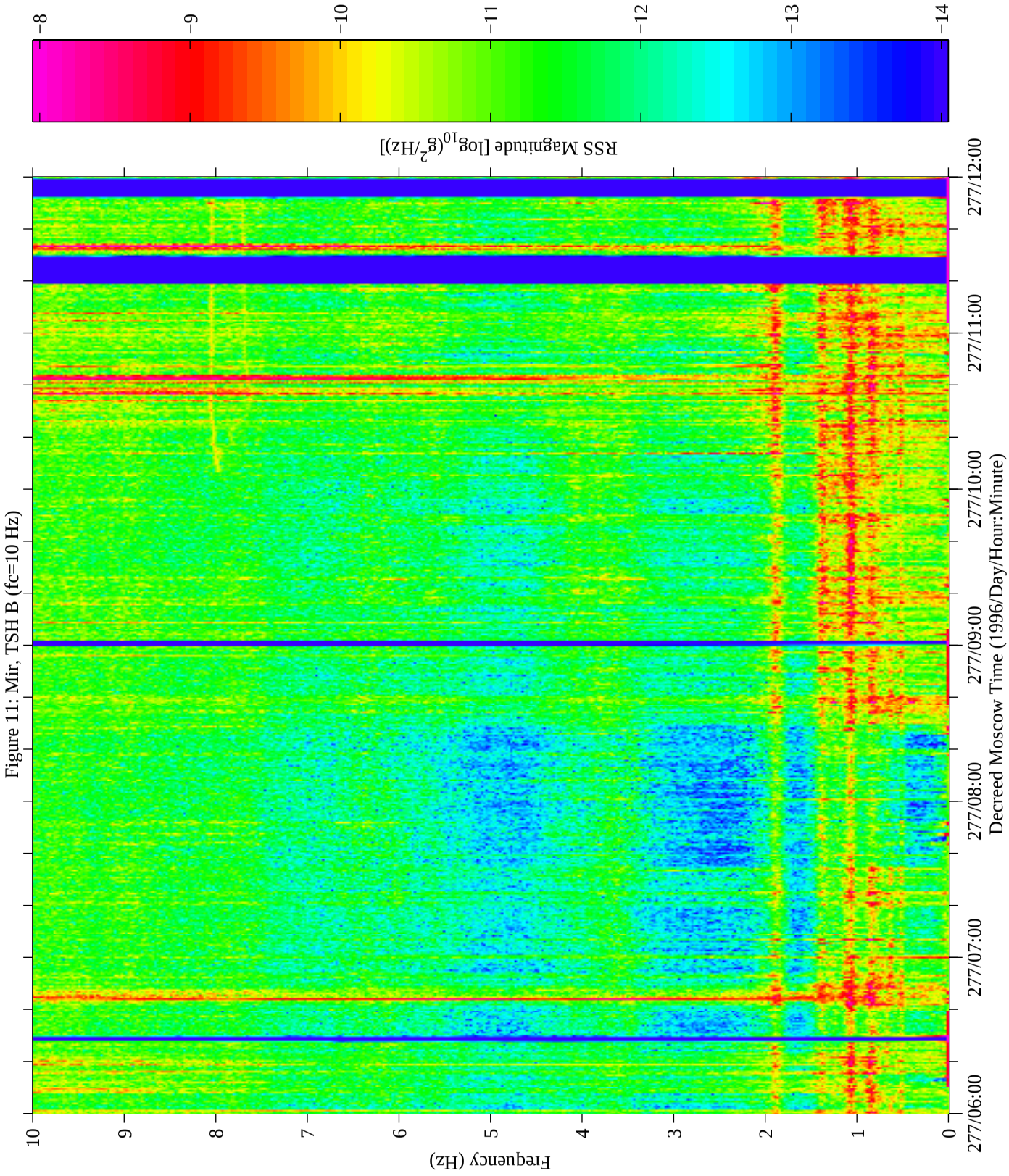


Figure 11: Mir, TSH B (fc=10 Hz)

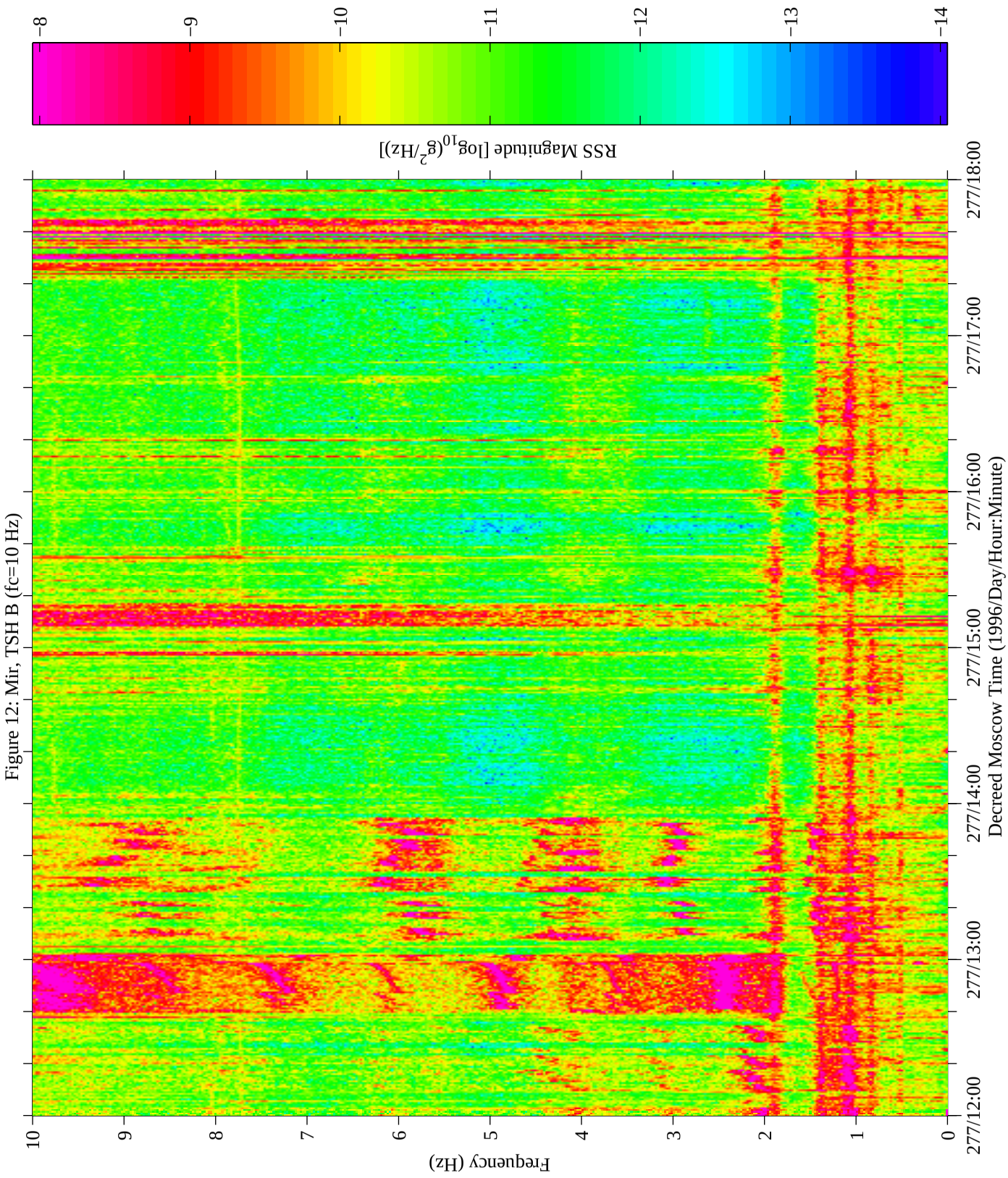
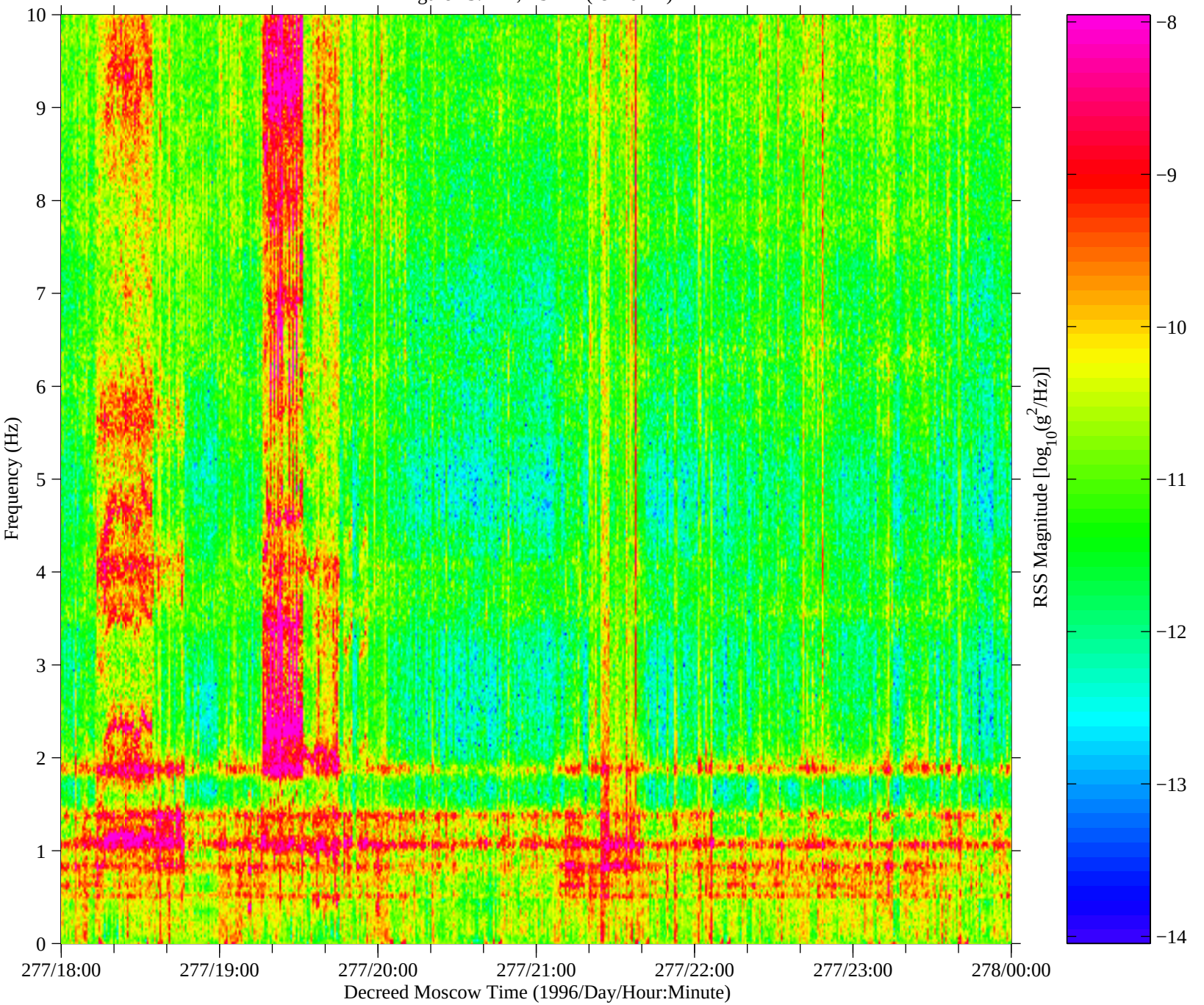


Figure 12: Mir, TSH B (fc=10 Hz)

Figure 13: Mir, TSH B (fc=10 Hz)



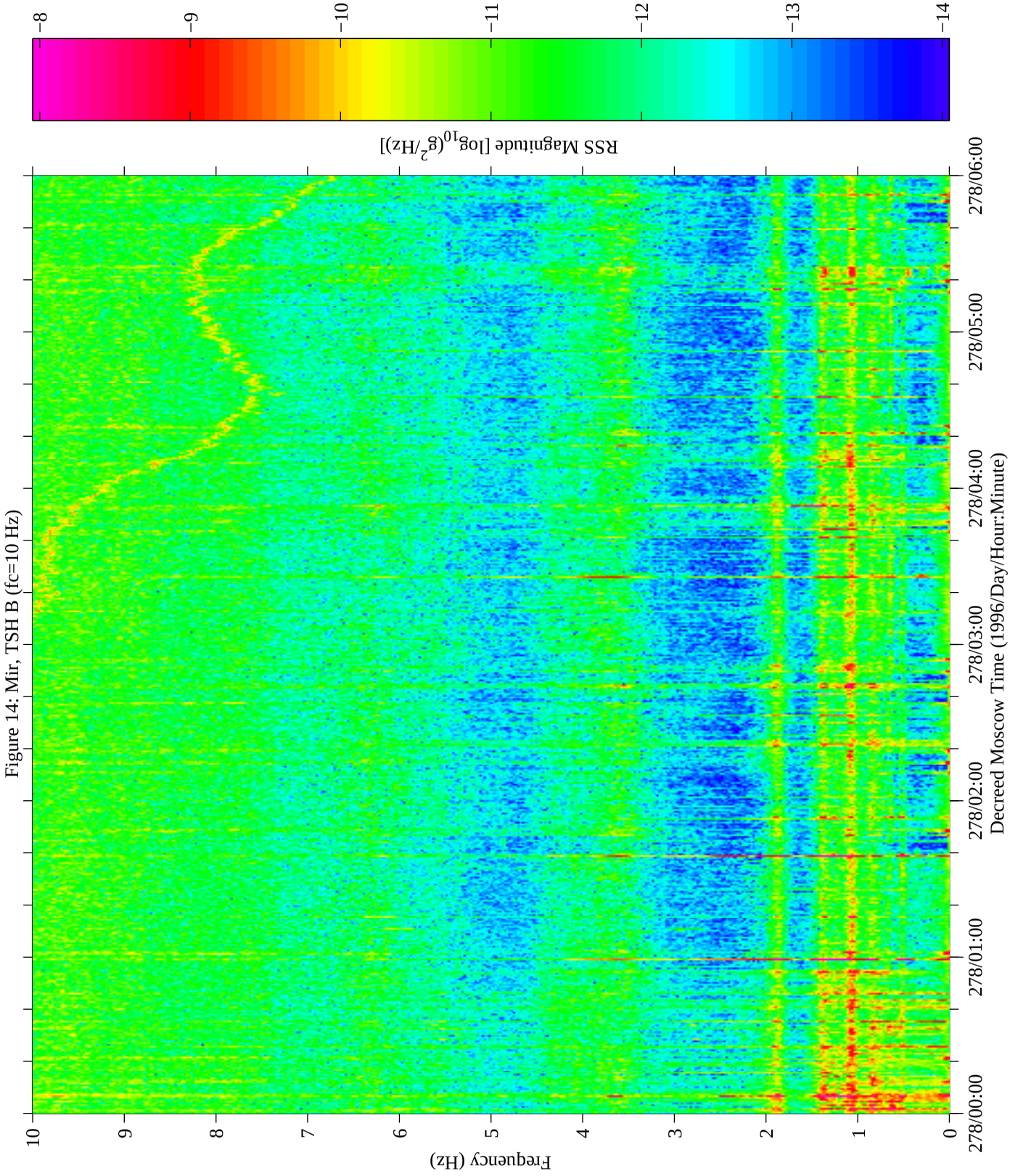
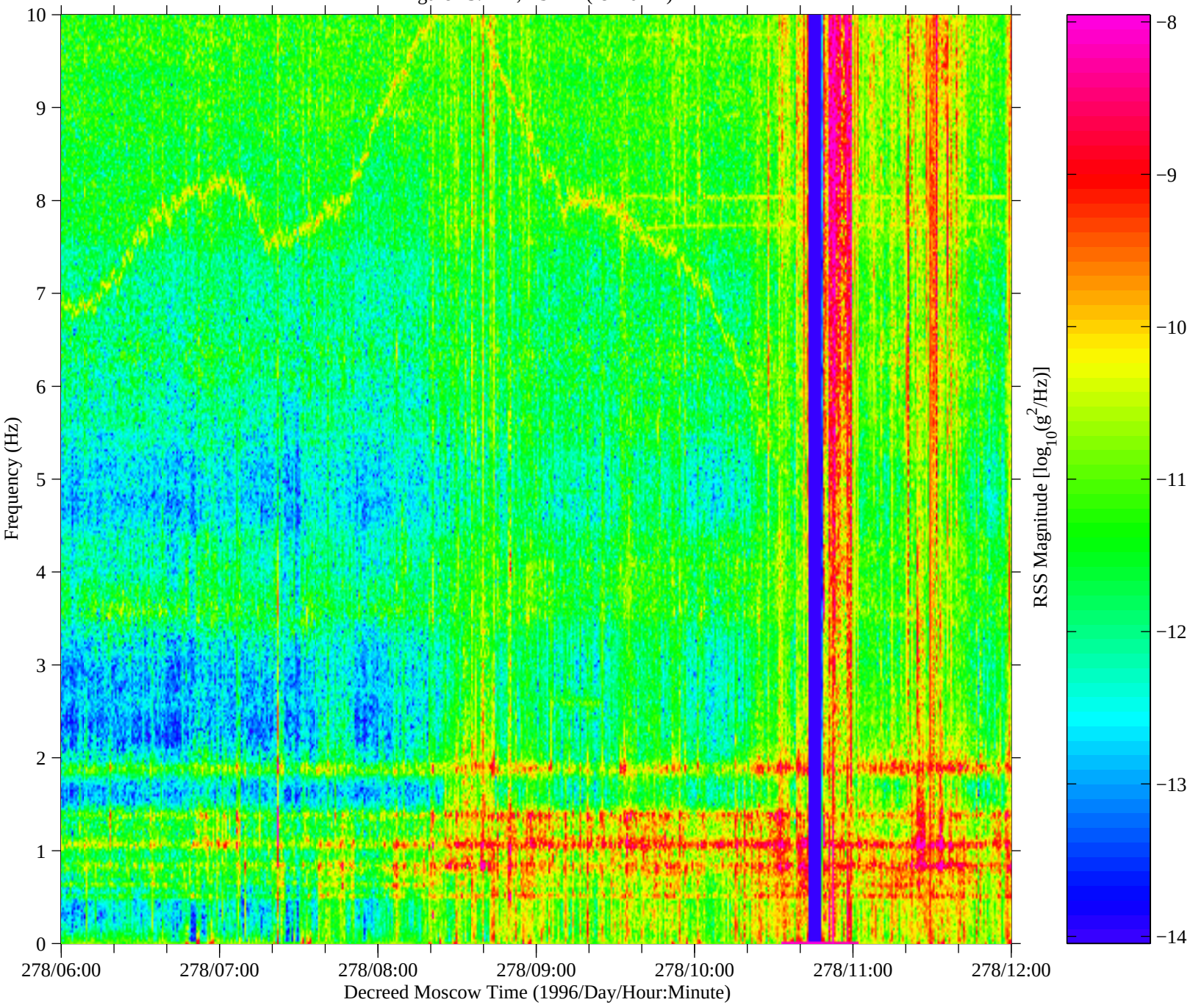


Figure 14: Mir, TSH B (fc=10 Hz)

Figure 15: Mir, TSH B (fc=10 Hz)



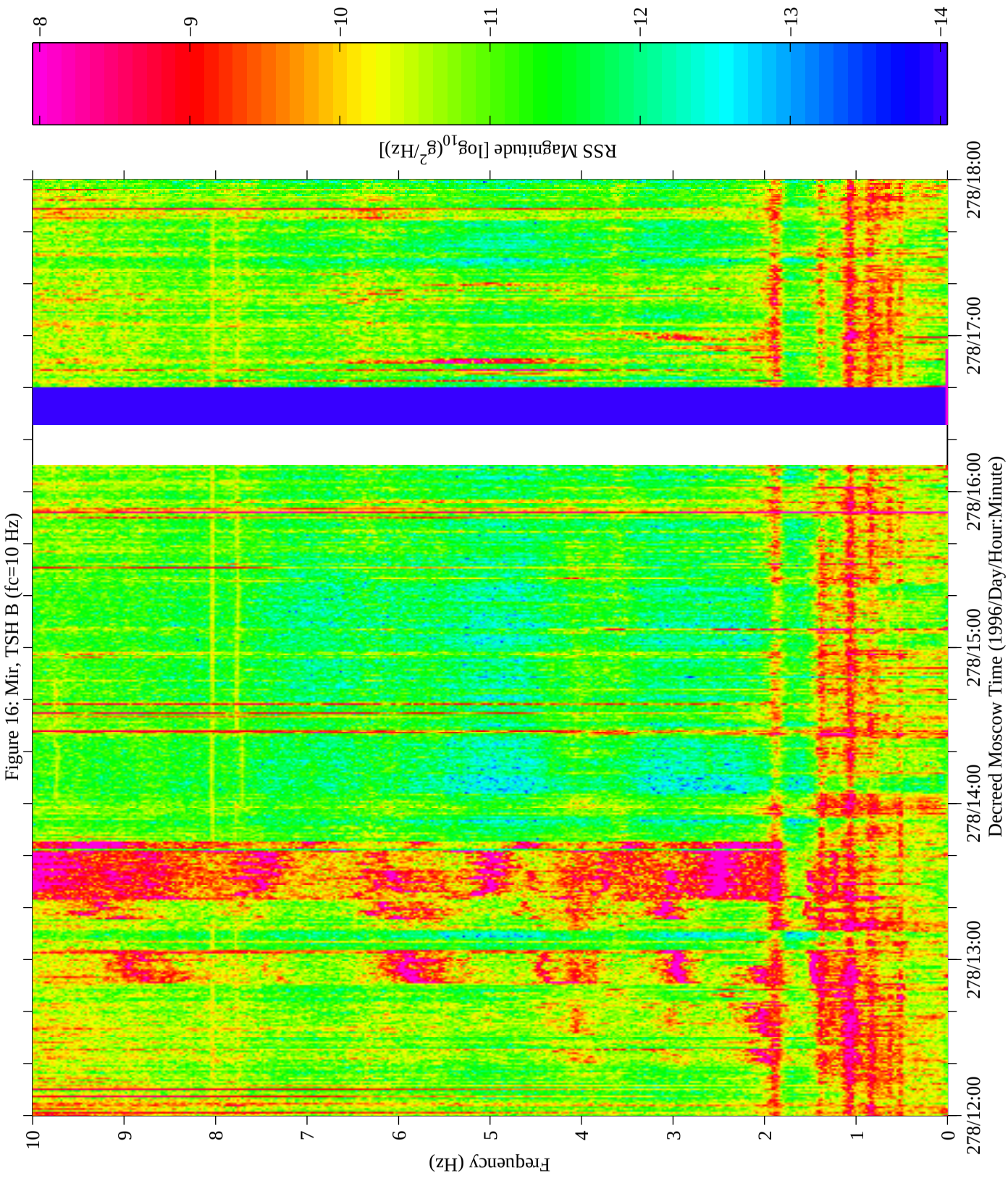


Figure 16: Mir, TSH B (fc=10 Hz)

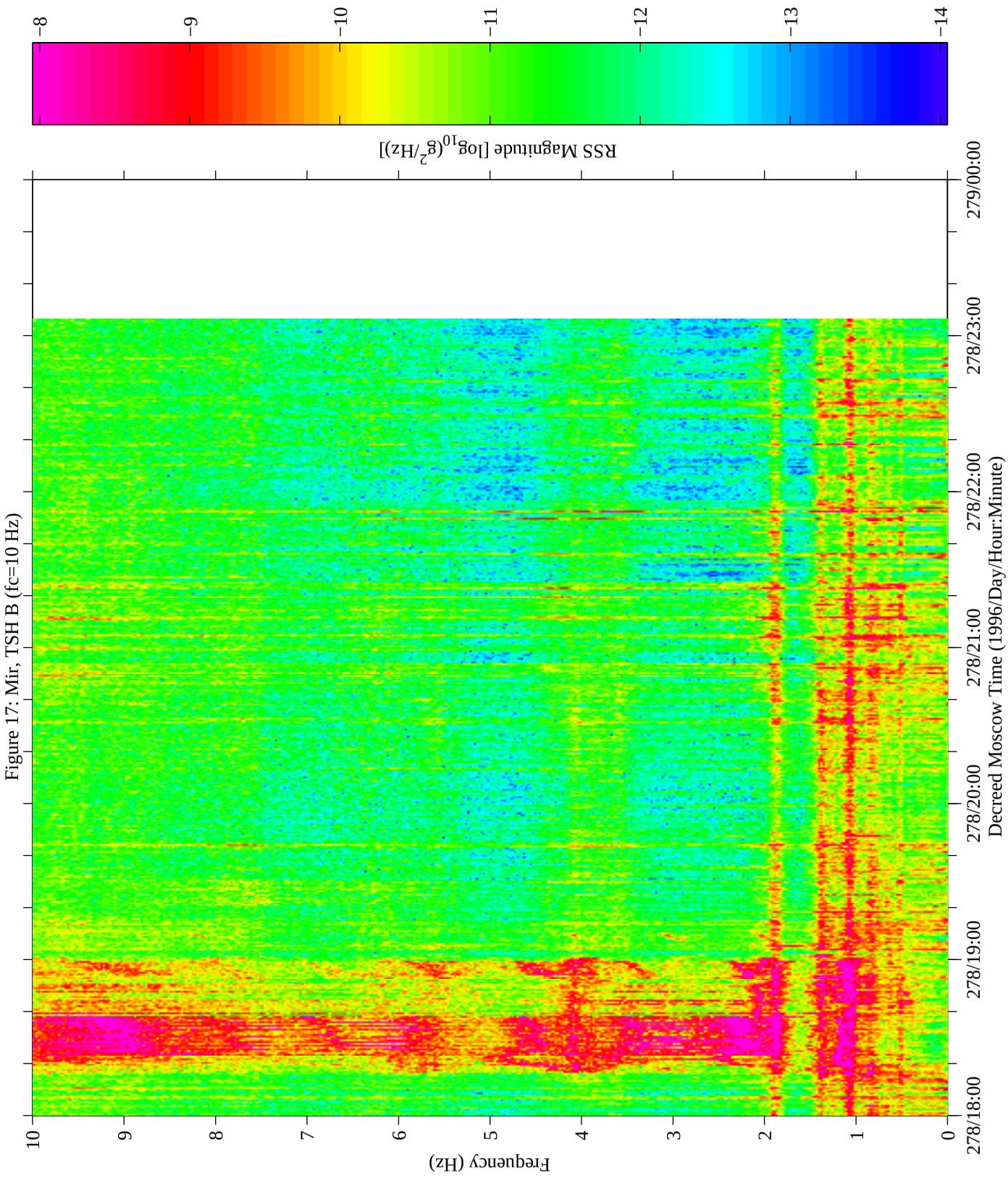


Figure 17: Mir, TSH B (fc=10 Hz)

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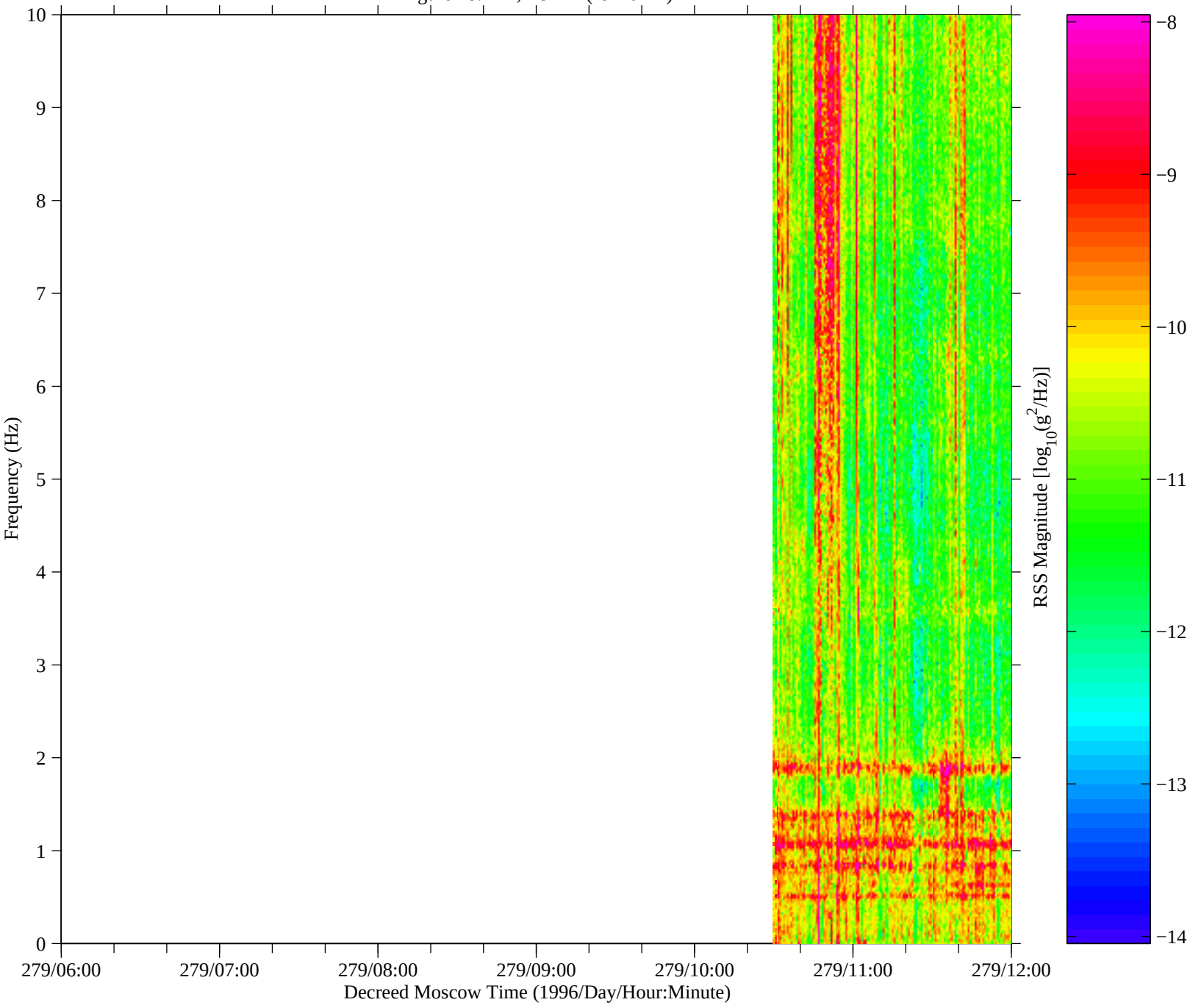
from 279/00:00:00 to 279/06:00:00

Figure 18: Mir, TSH B (fc=10 Hz)



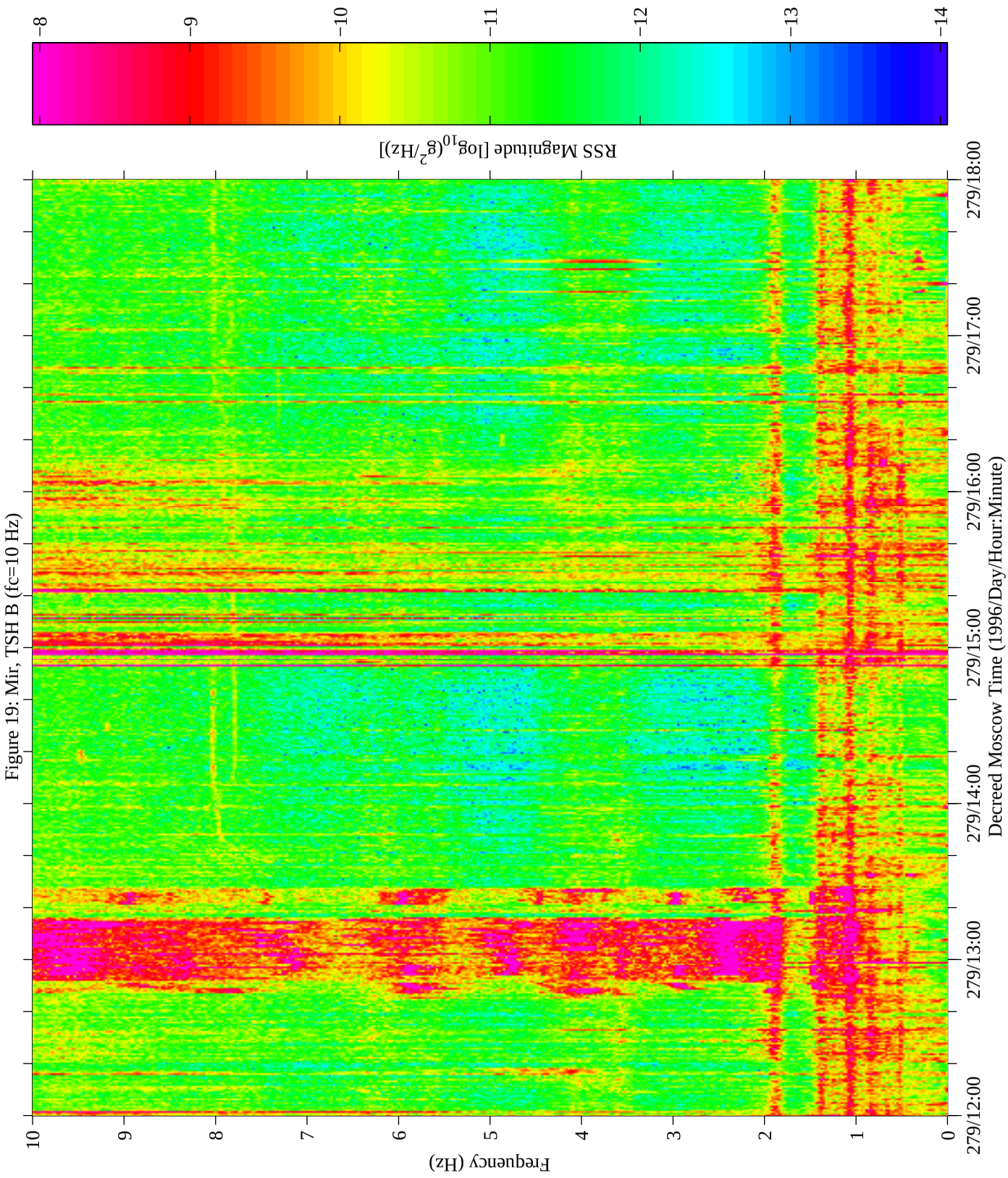


Figure 19: Mir, TSH B (fc=10 Hz)

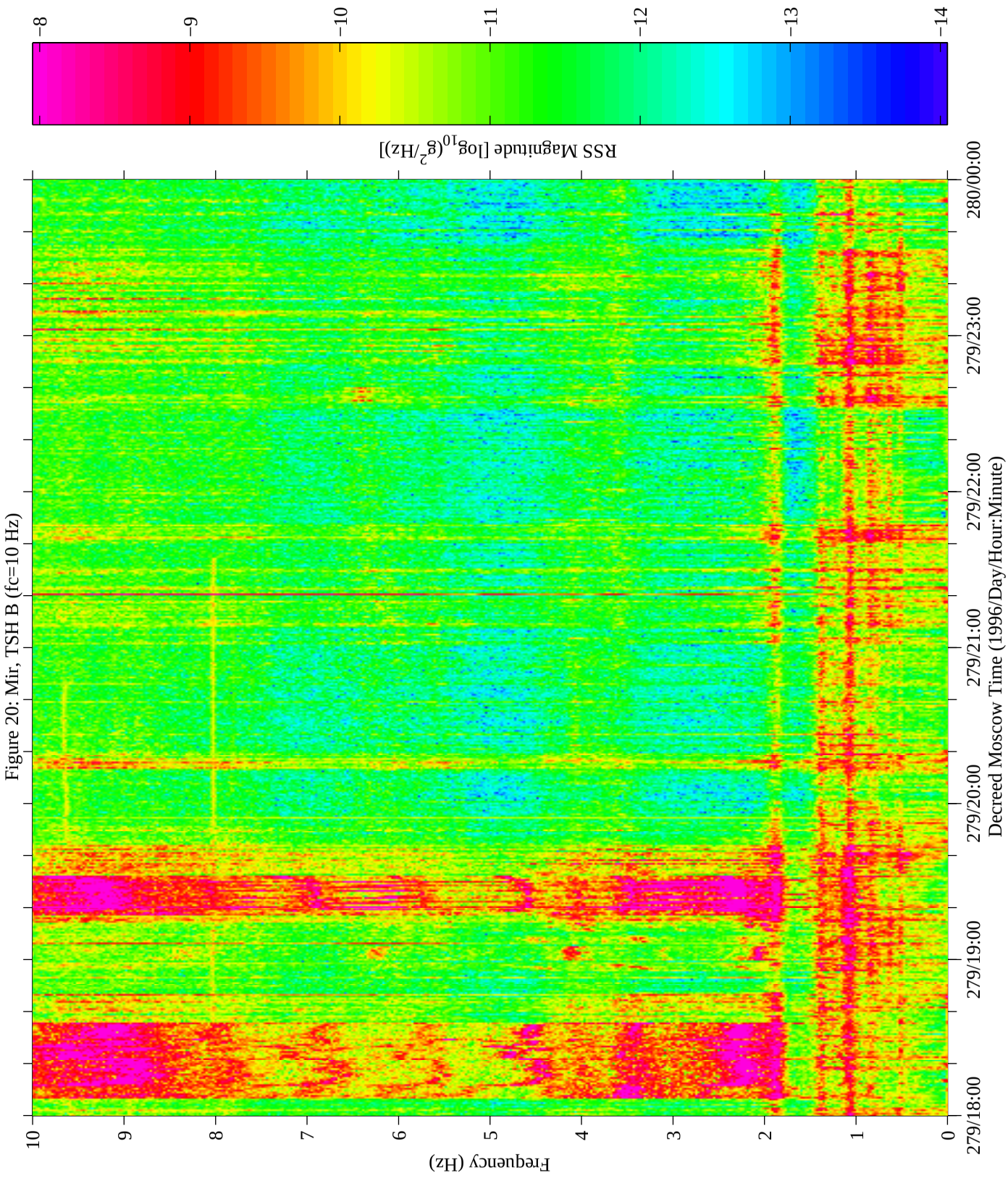


Figure 20: Mir, TSH B (fc=10 Hz)

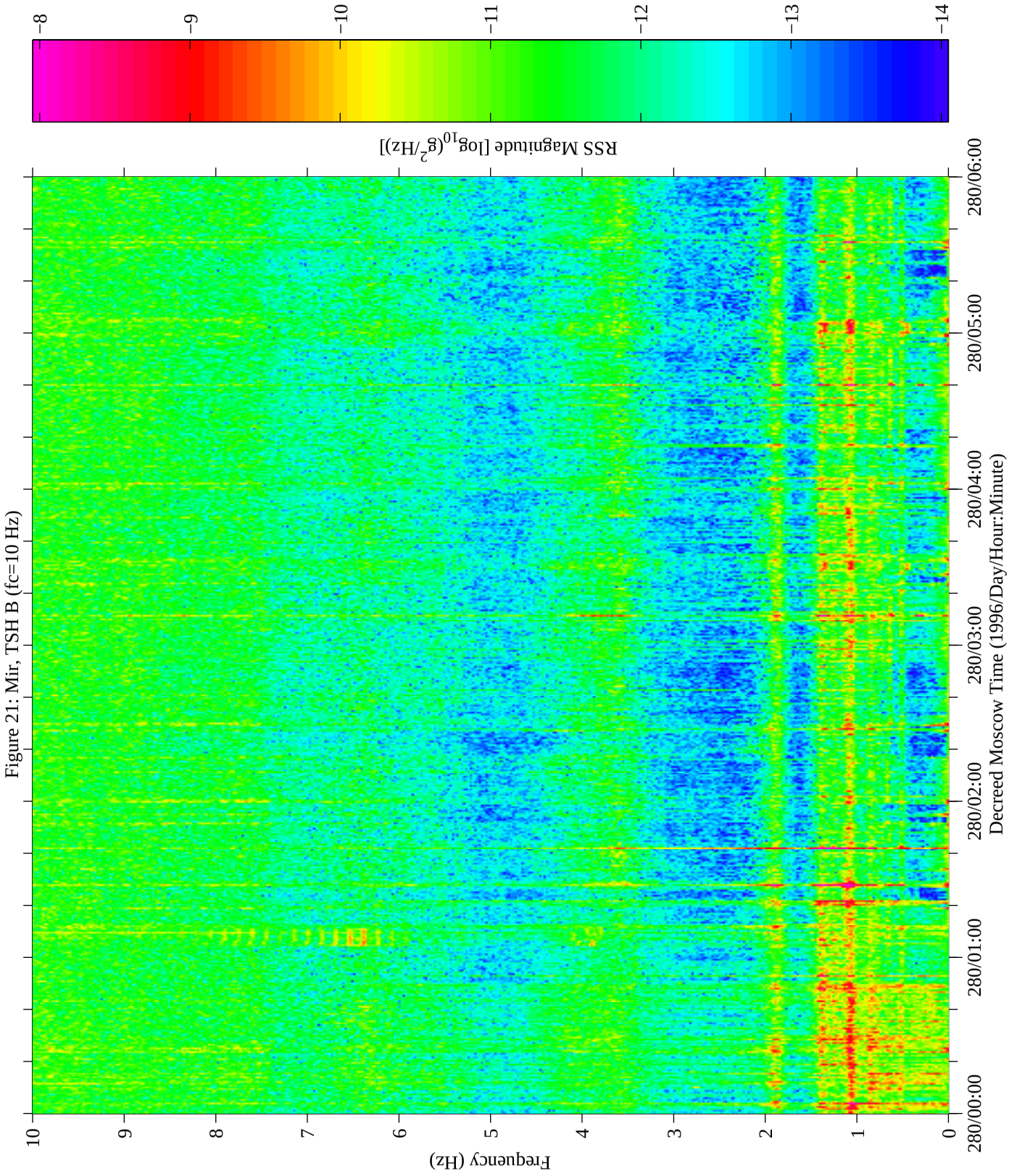


Figure 21: Mir, TSH B (fc=10 Hz)

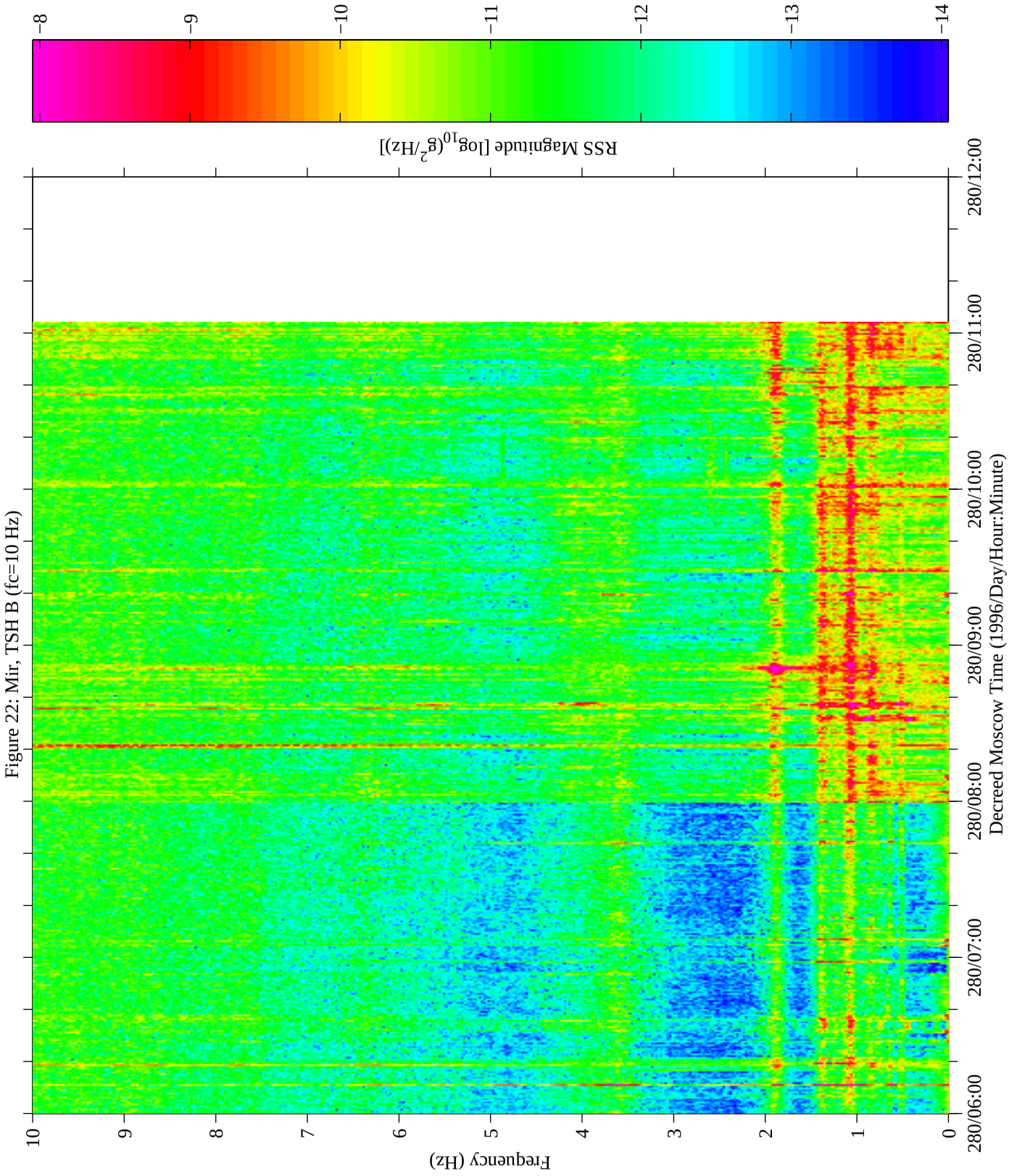


Figure 22: Mir, TSH B (fc=10 Hz)

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from 280/12:00:00 to 282/06:00:00

Figure 23: Mir, TSH B (fc=10 Hz)

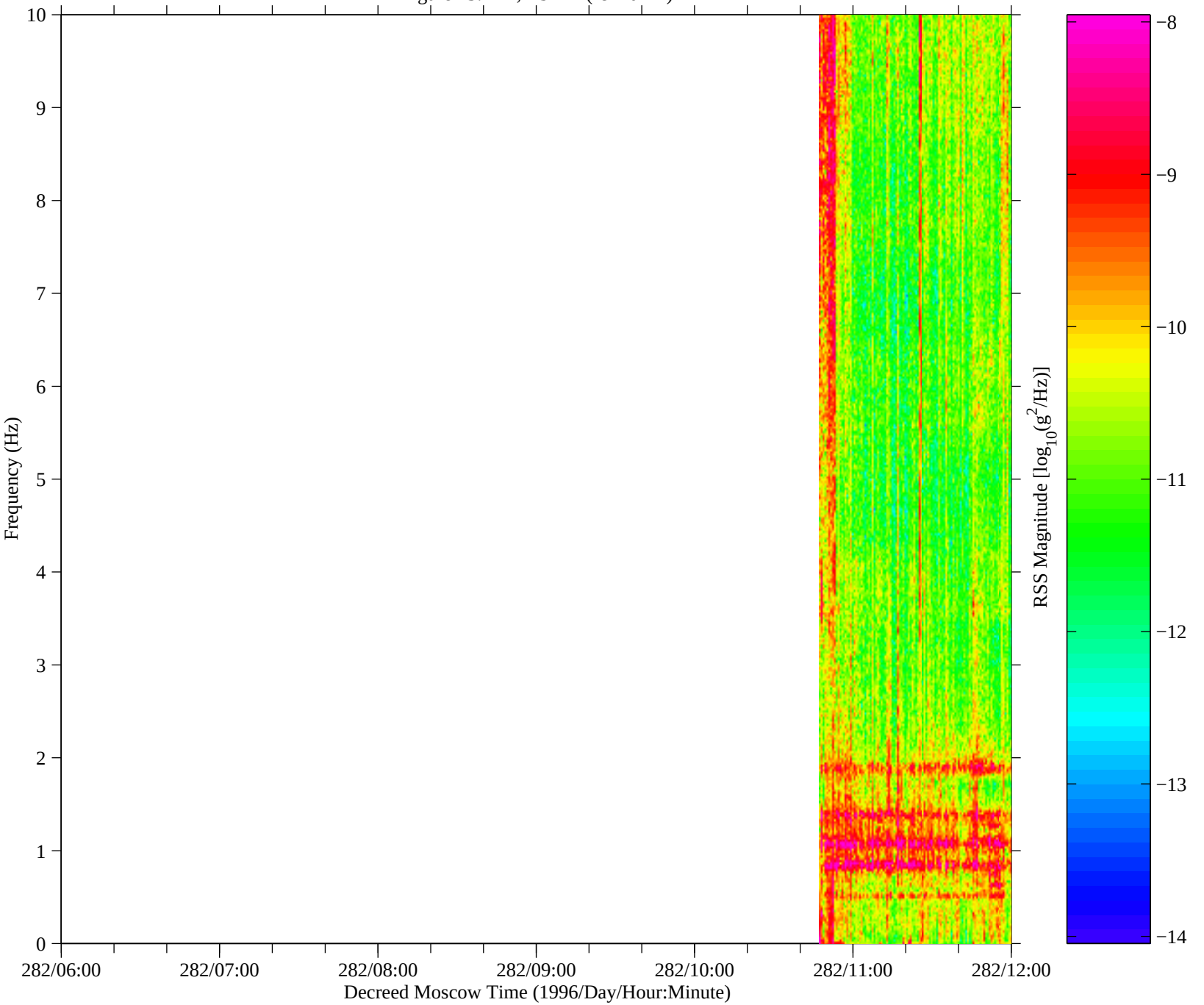


Figure 24: Mir, TSH B (fc=10 Hz)

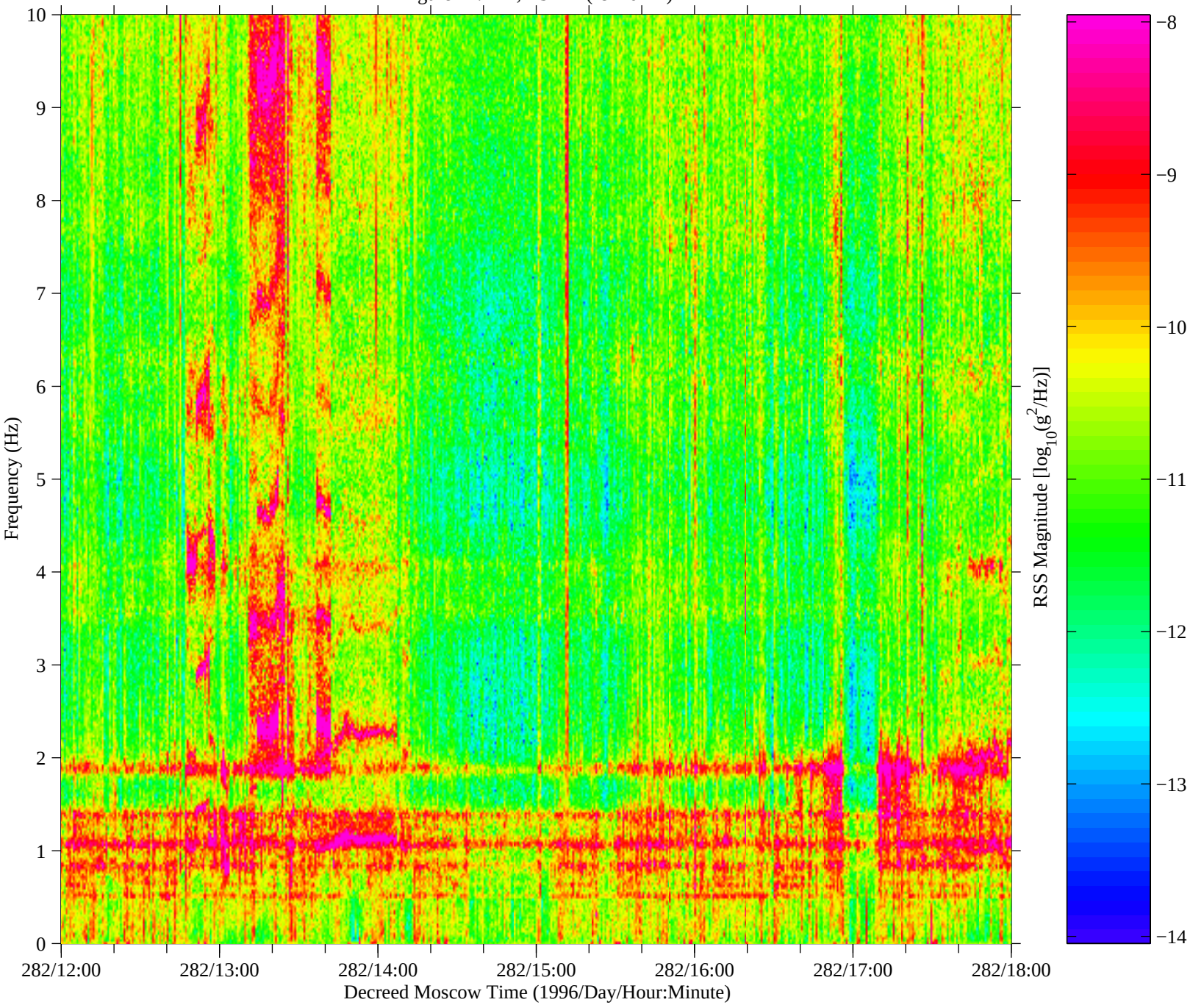


Figure 25: Mir, TSH B (fc=10 Hz)

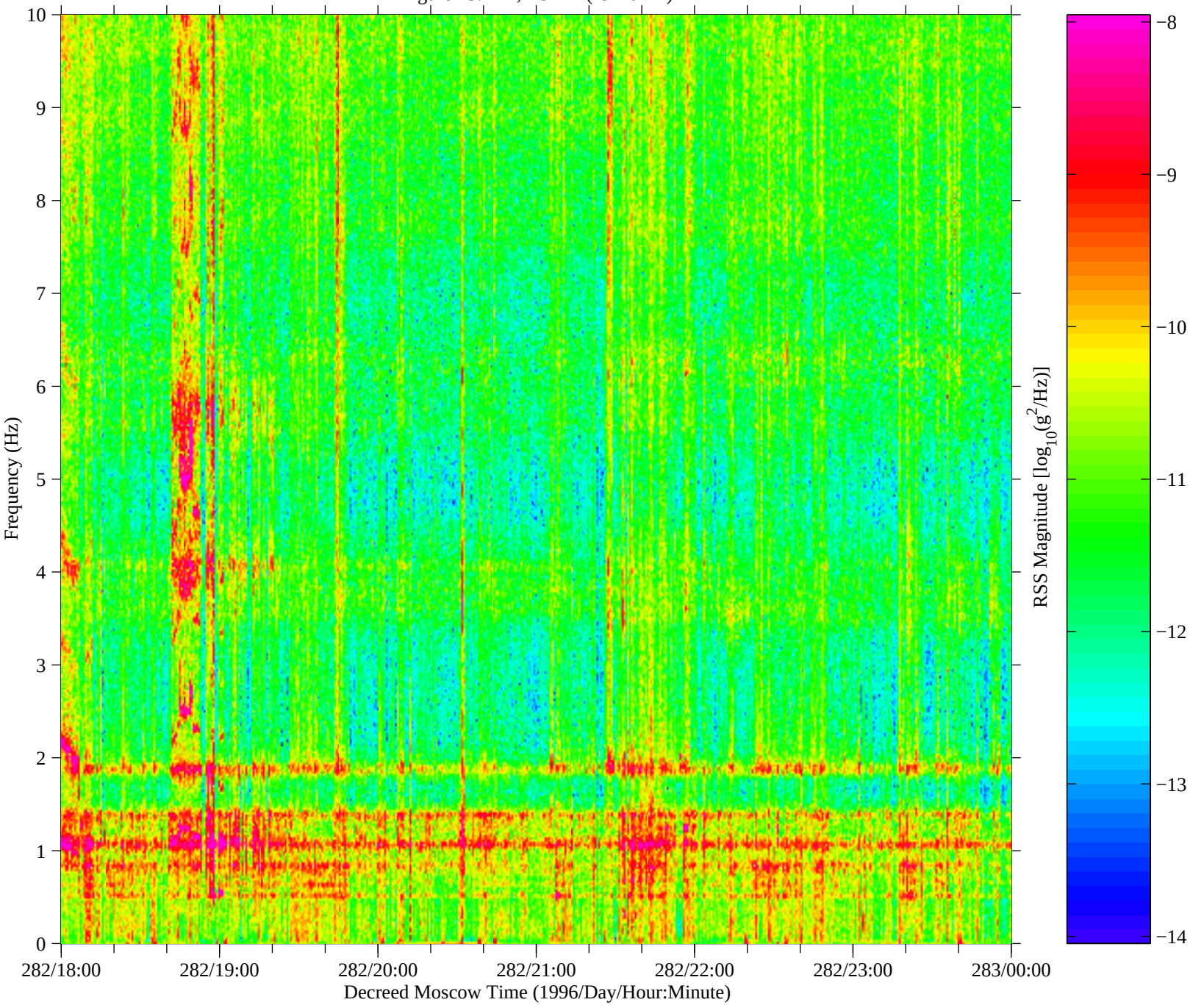


Figure 26: Mir, TSH B (fc=10 Hz)

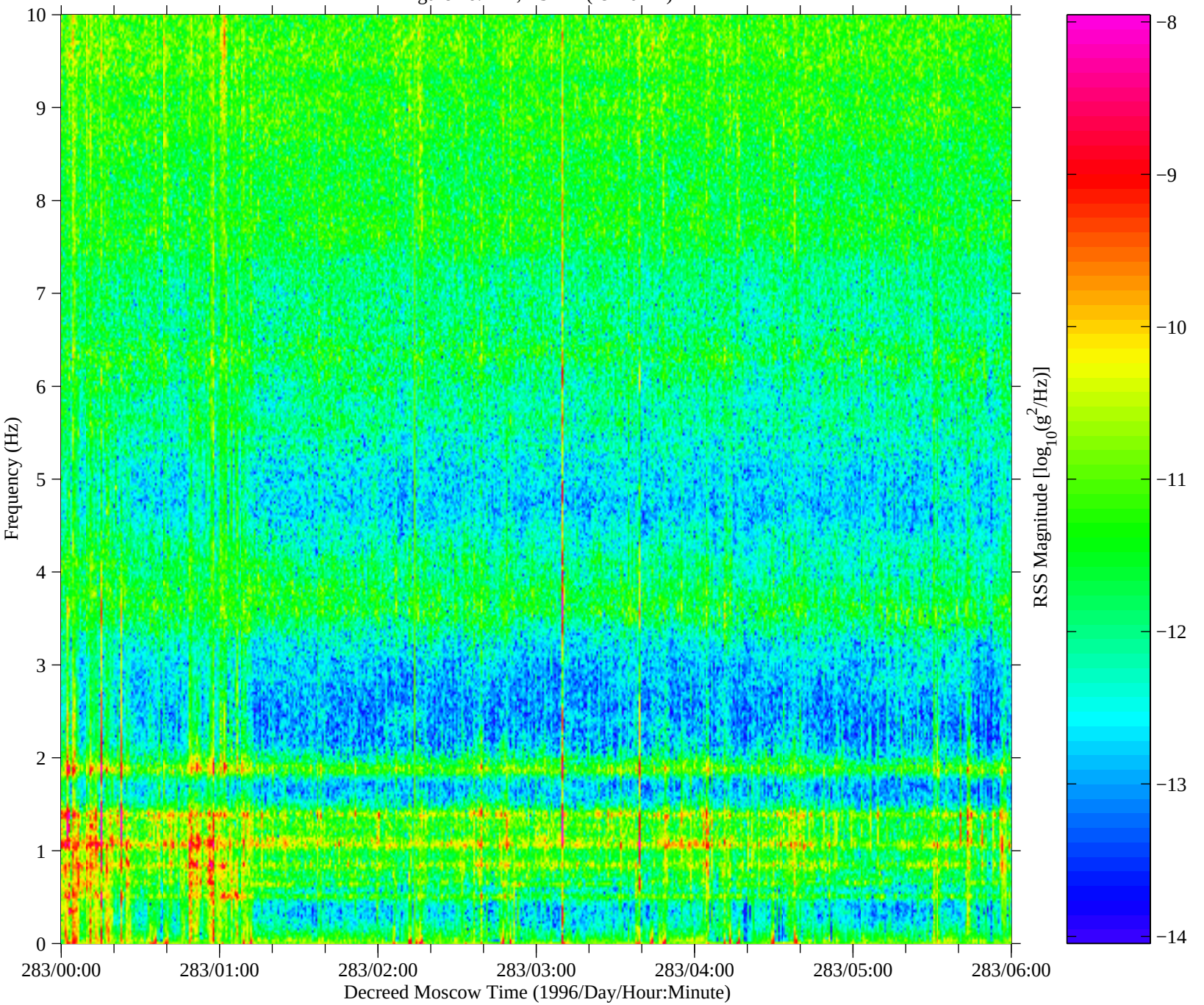


Figure 27: Mir, TSH B (fc=10 Hz)

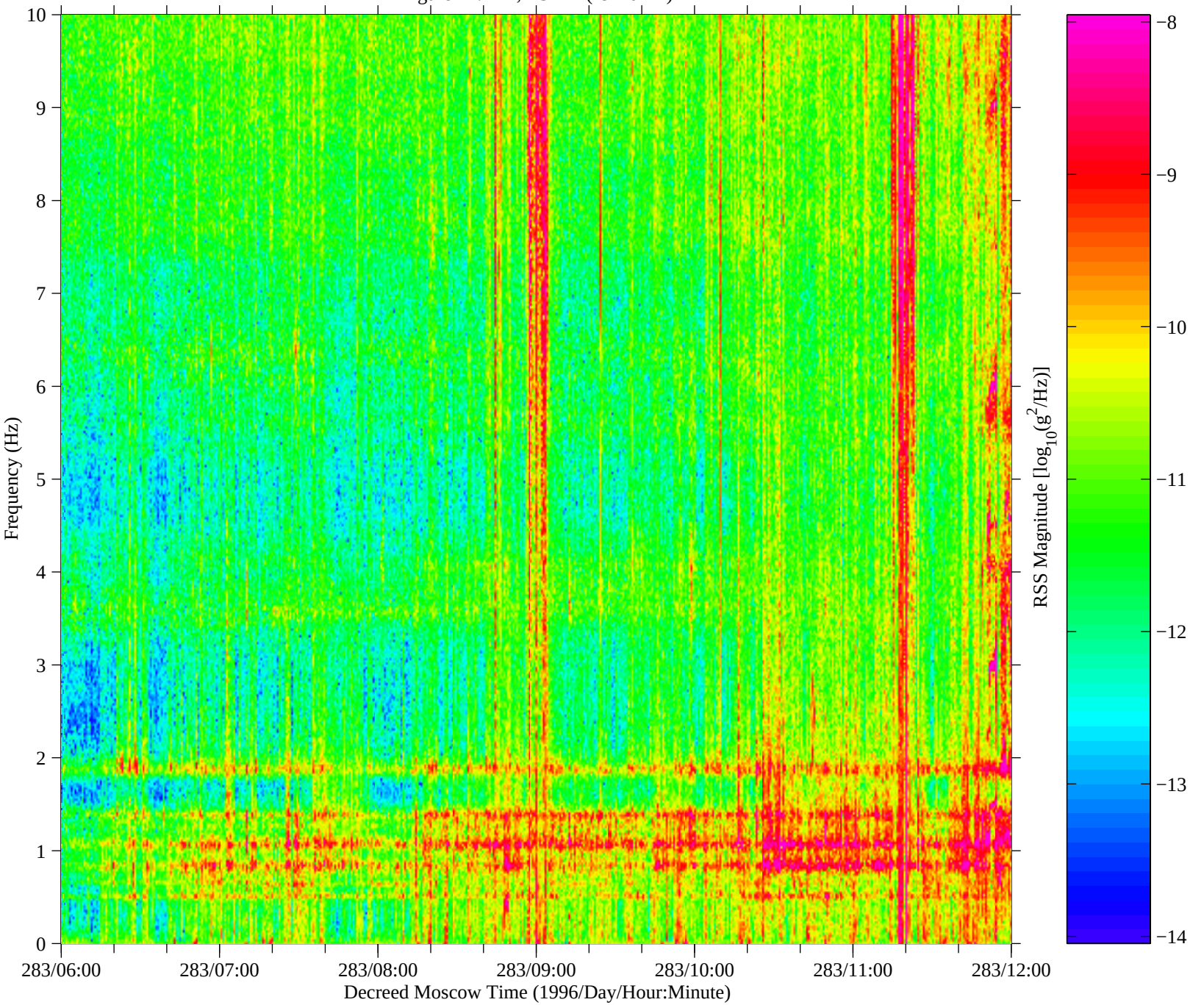


Figure 28: Mir, TSH B (fc=10 Hz)

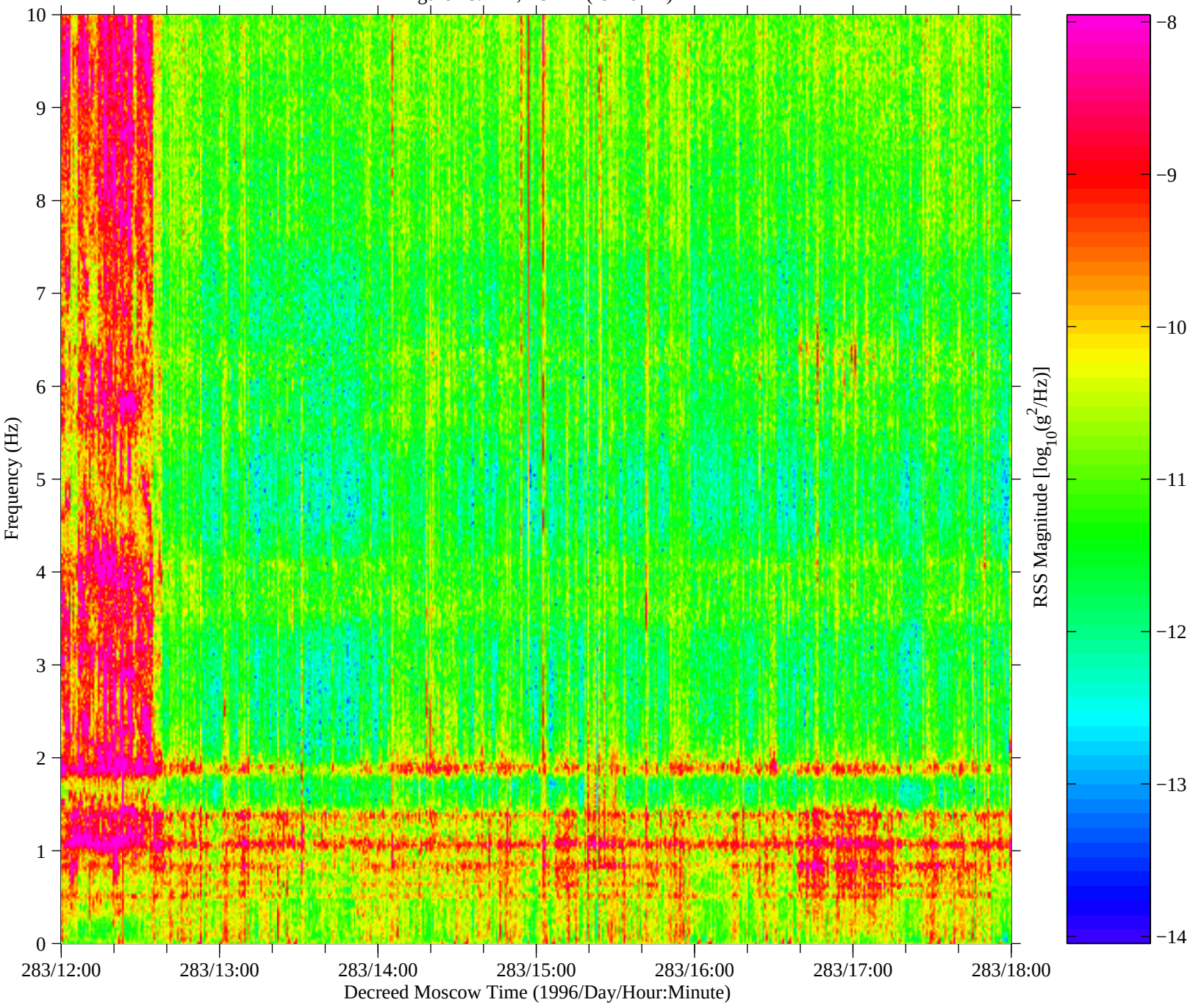
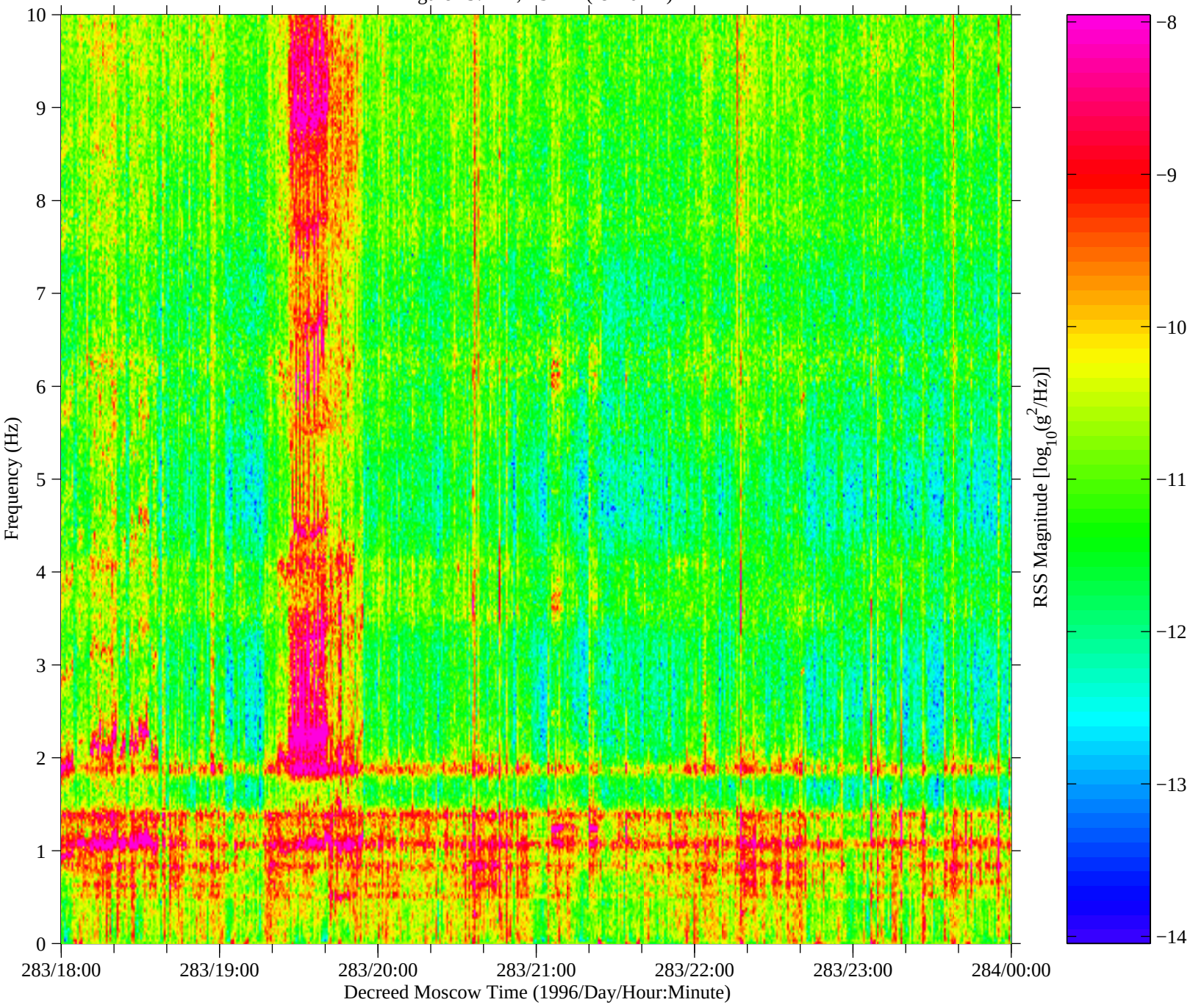


Figure 29: Mir, TSH B (fc=10 Hz)



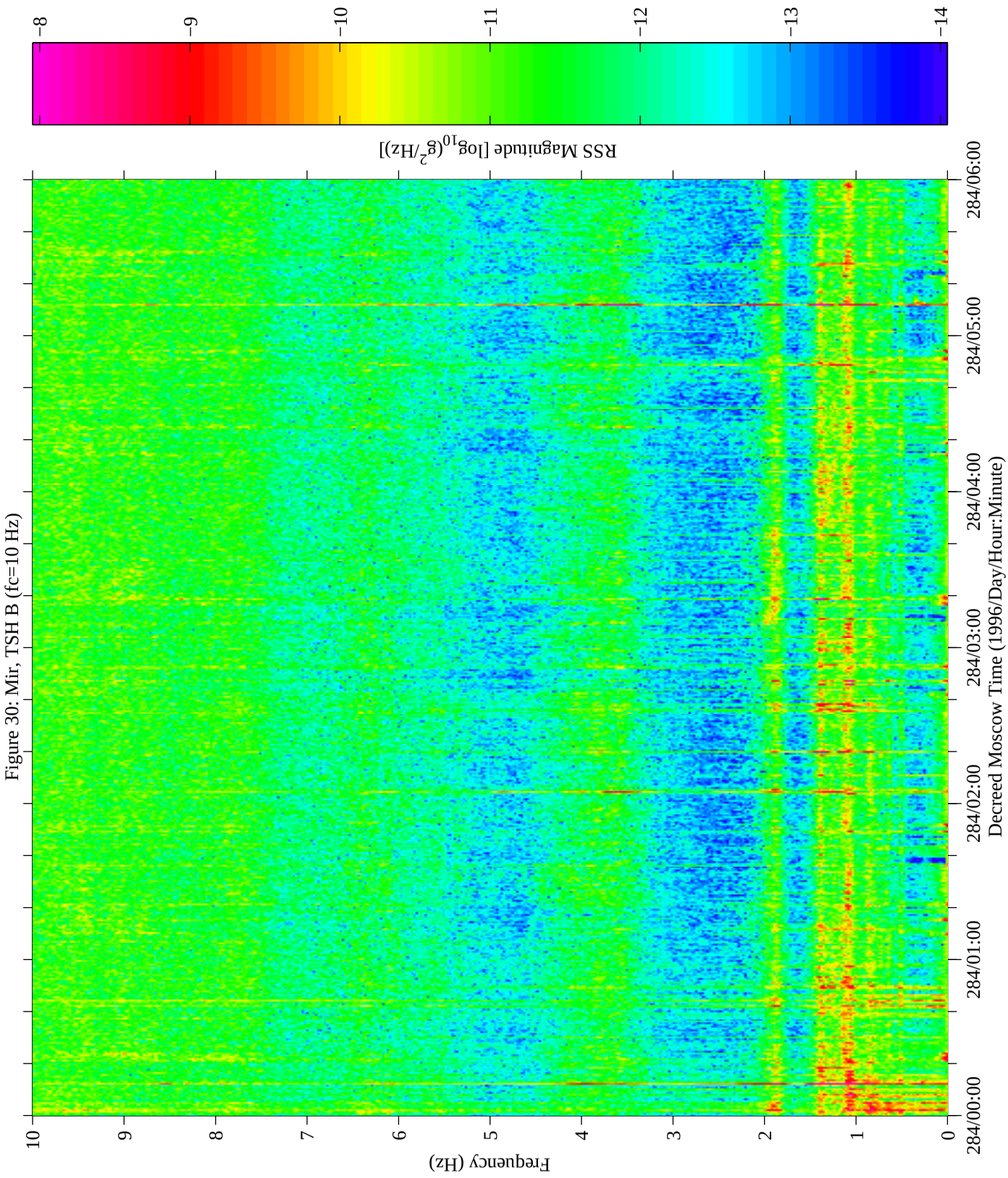


Figure 30: Mir, TSH B (fc=10 Hz)

Figure 31: Mir, TSH B (fc=10 Hz)

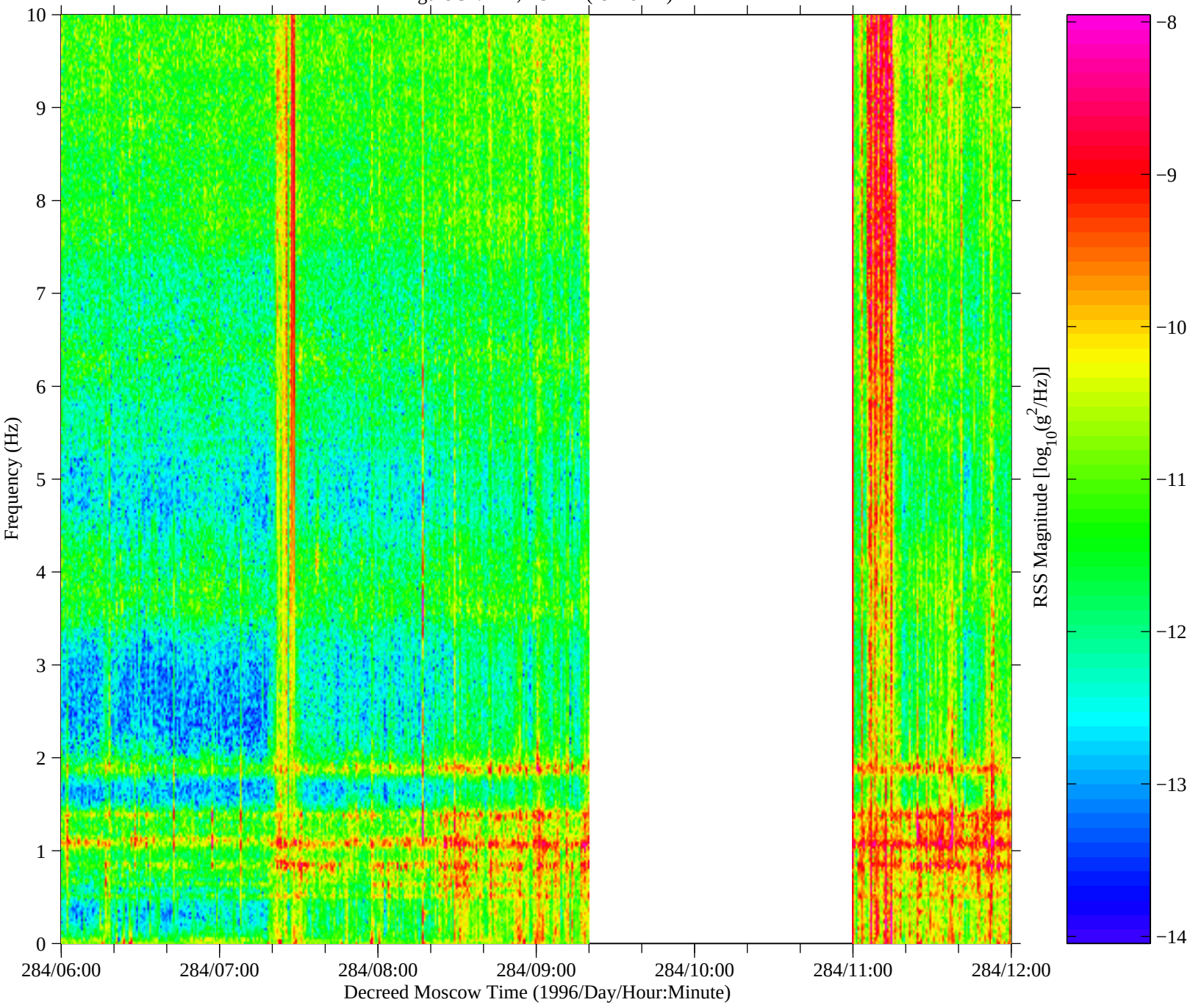


Figure 32: Mir, TSH B (fc=10 Hz)

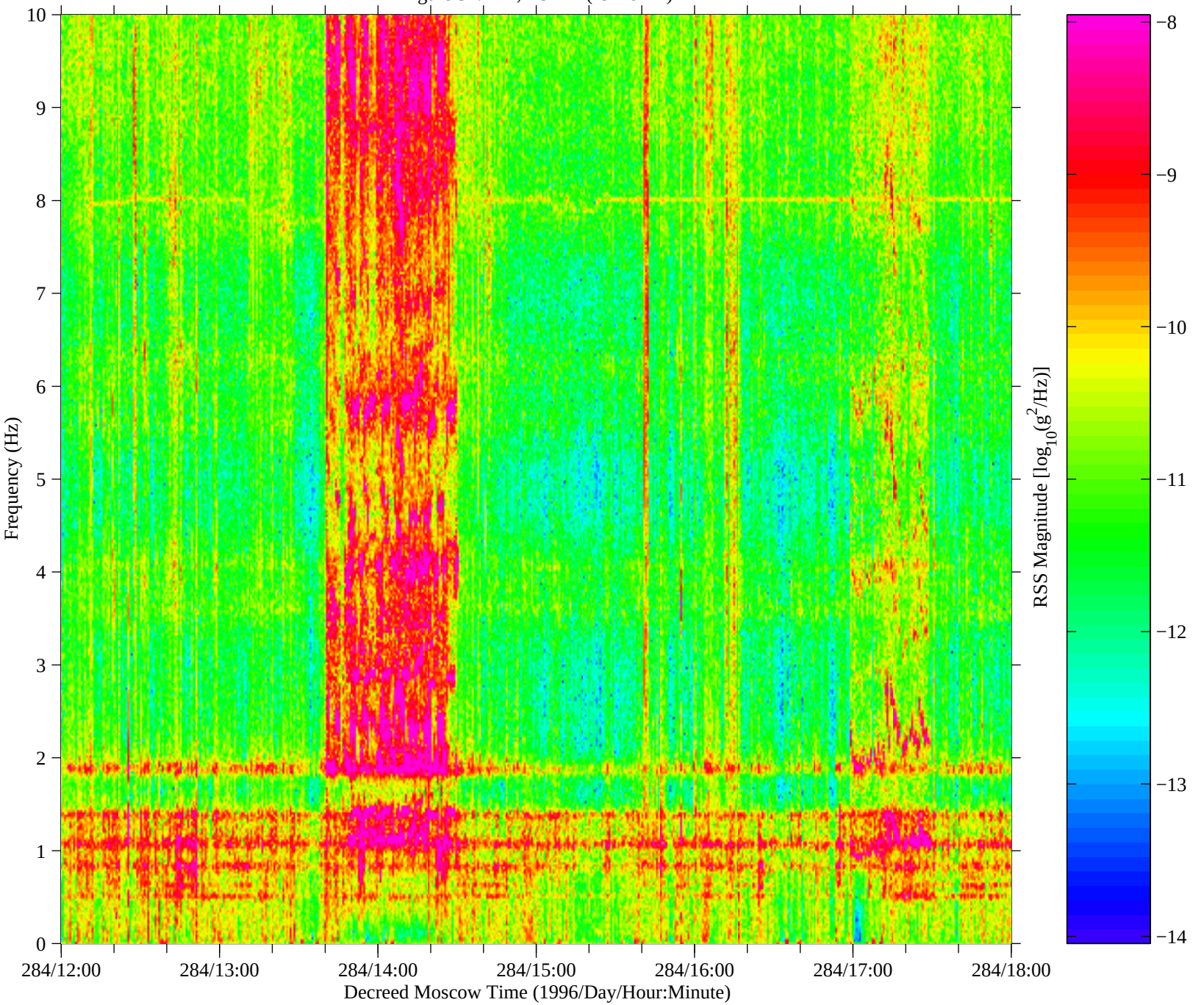


Figure 33: Mir, TSH B (fc=10 Hz)

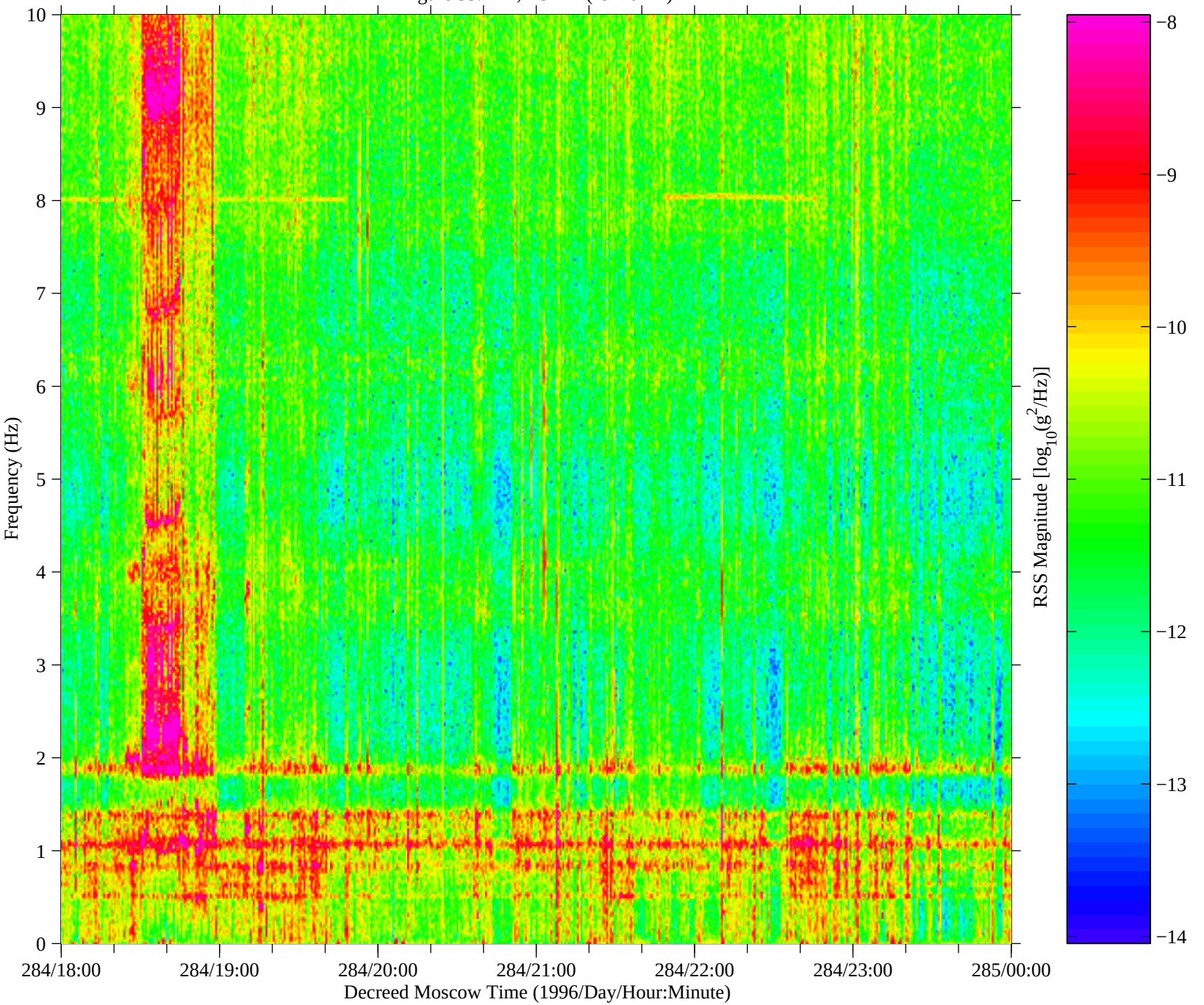


Figure 34: Mir, TSH B (fc=10 Hz)

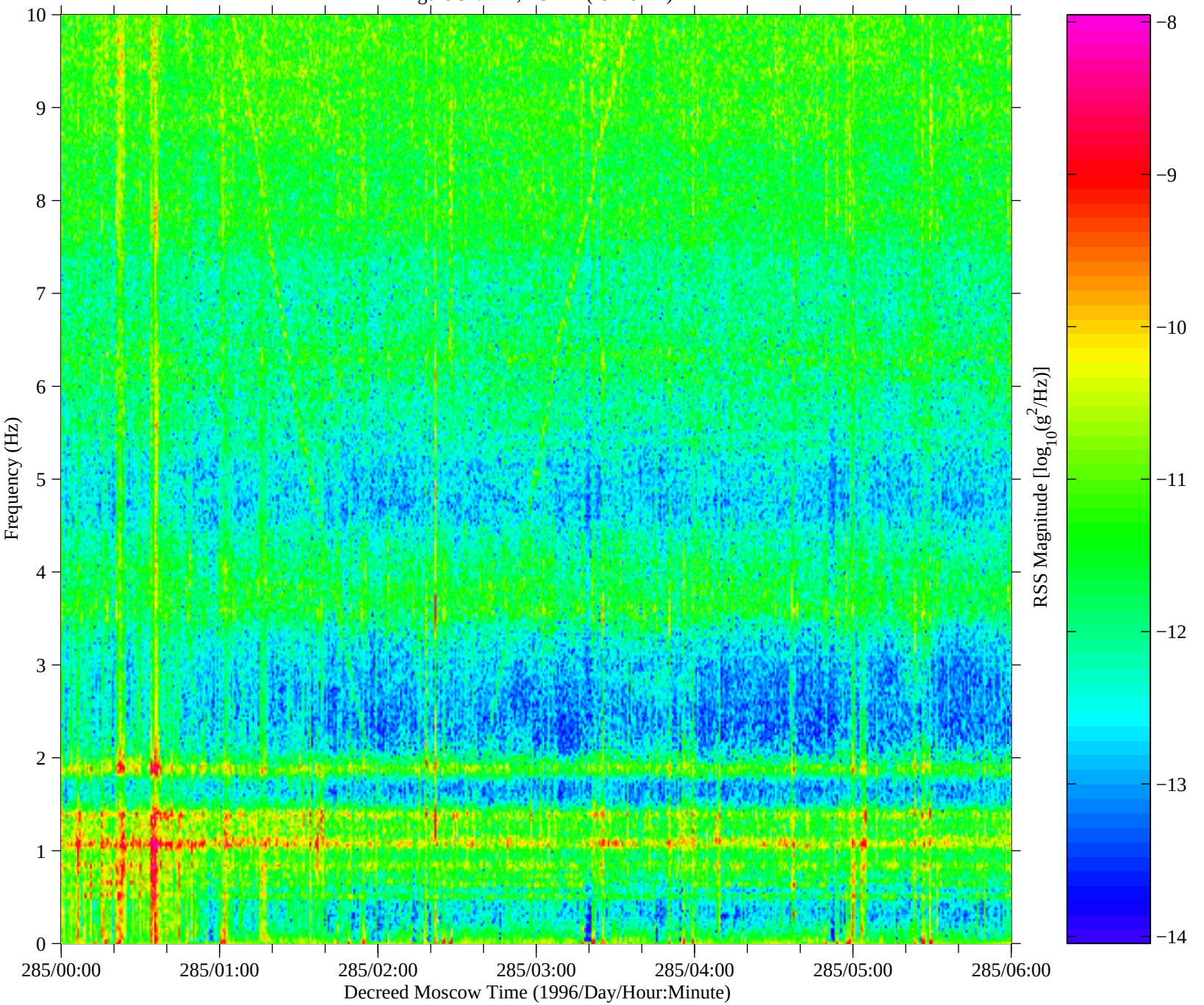


Figure 35: Mir, TSH B (fc=10 Hz)

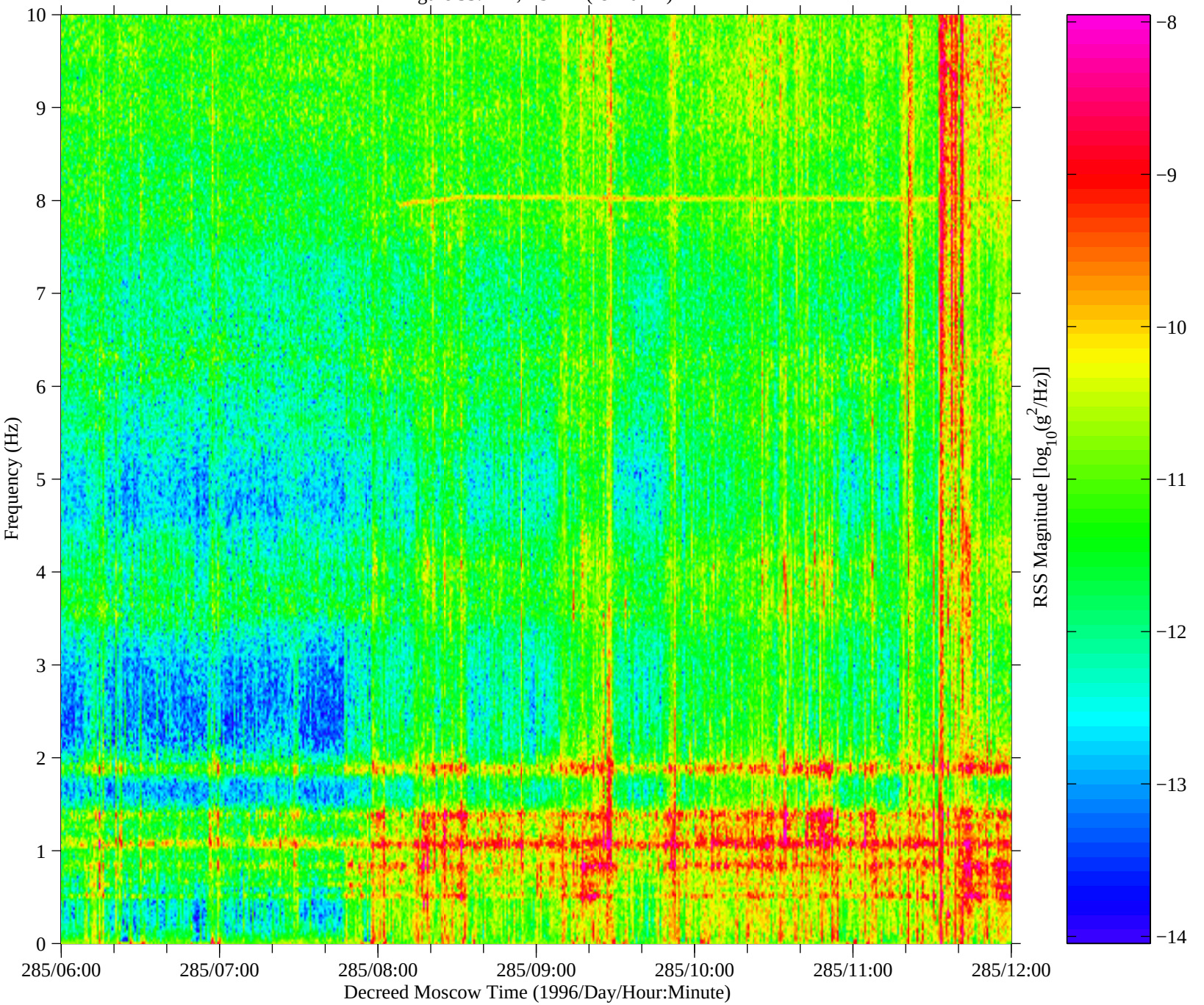


Figure 36: Mir, TSH B (fc=10 Hz)

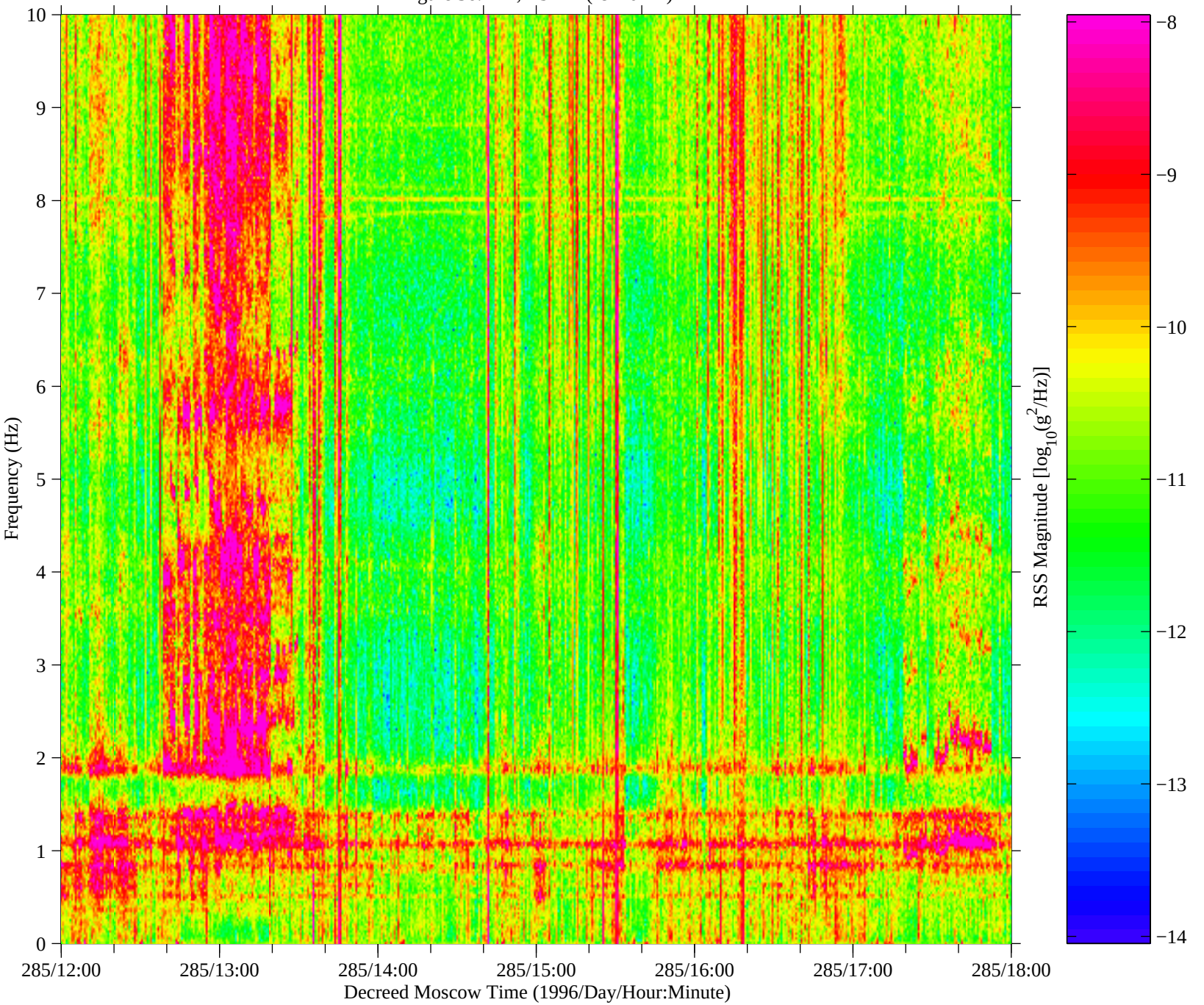
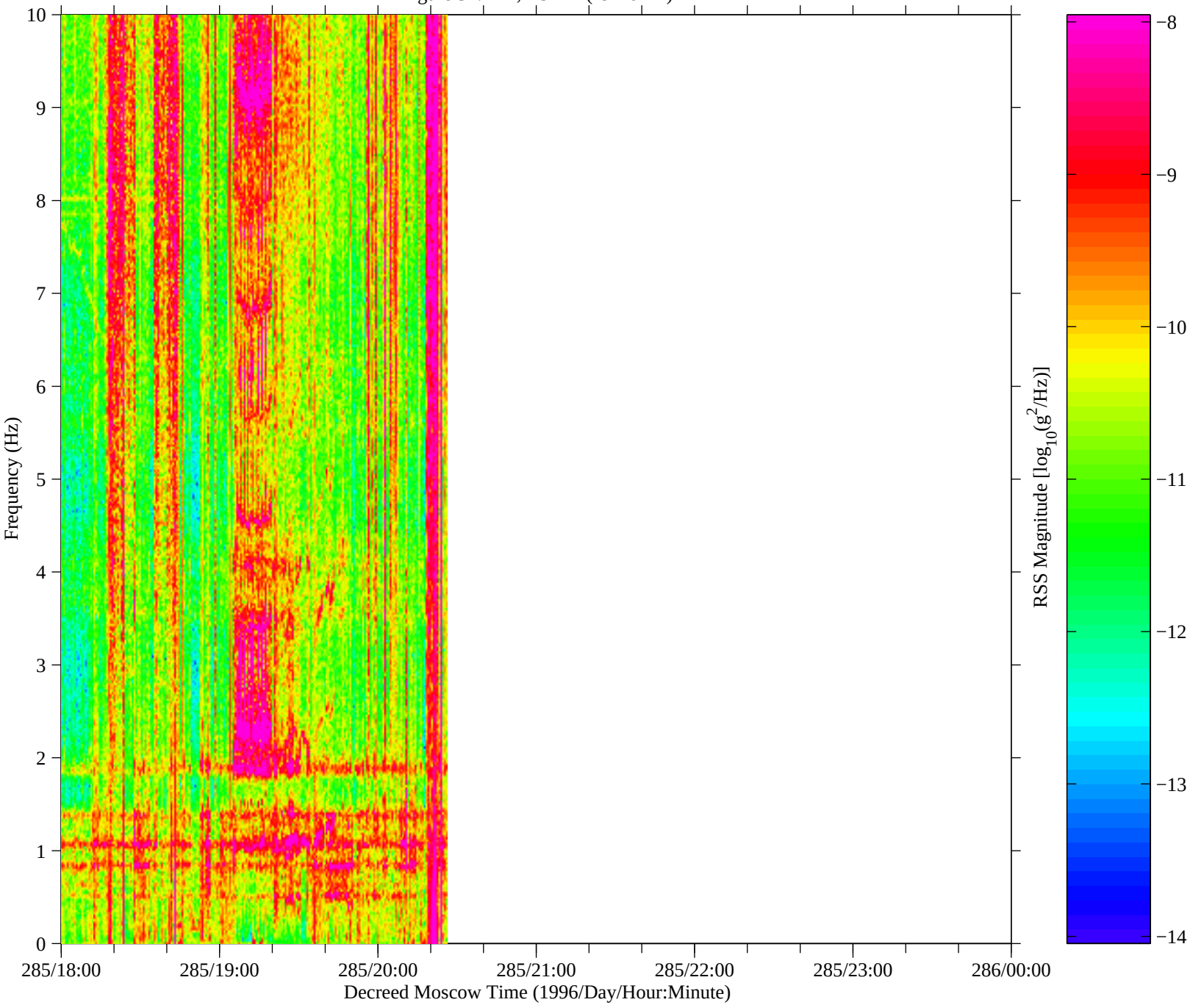


Figure 37: Mir, TSH B (fc=10 Hz)



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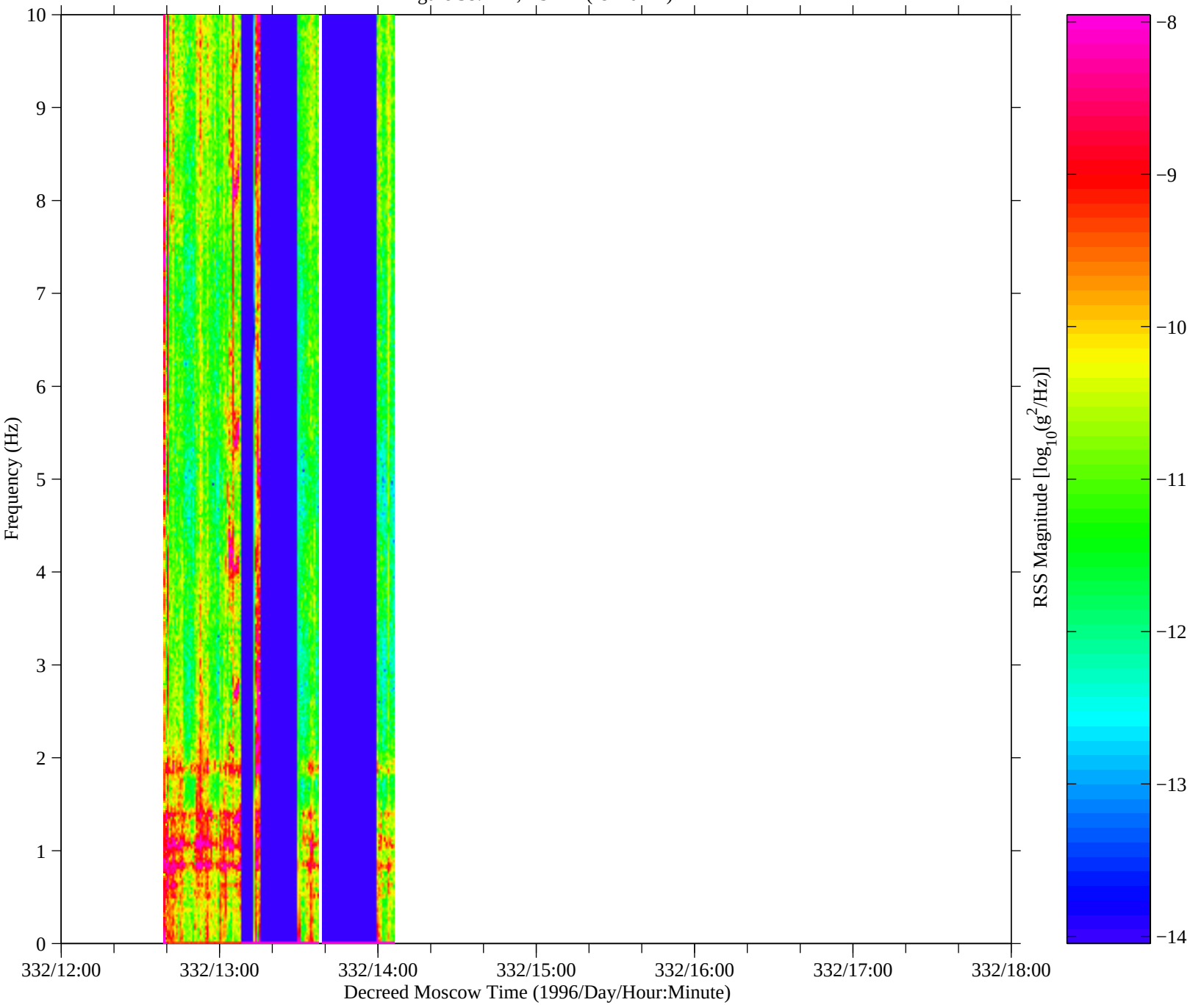
from 286/00:00:00 to 332/12:00:00

Figure 38: Mir, TSH B (fc=10 Hz)



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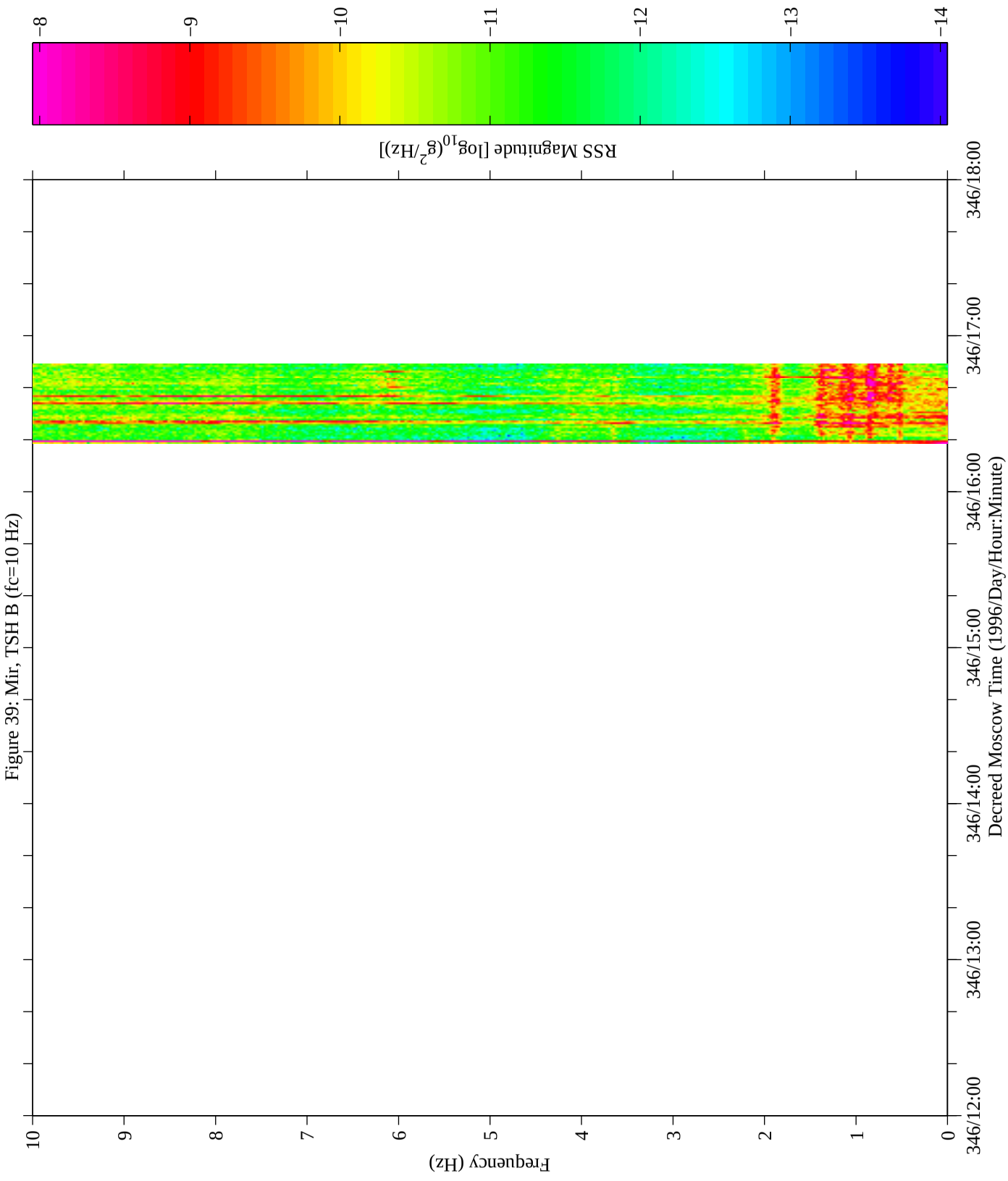


Figure 39: Mir, TSH B (fc=10 Hz)

No data are available
from 346/18:00:00 to 354/12:00:00

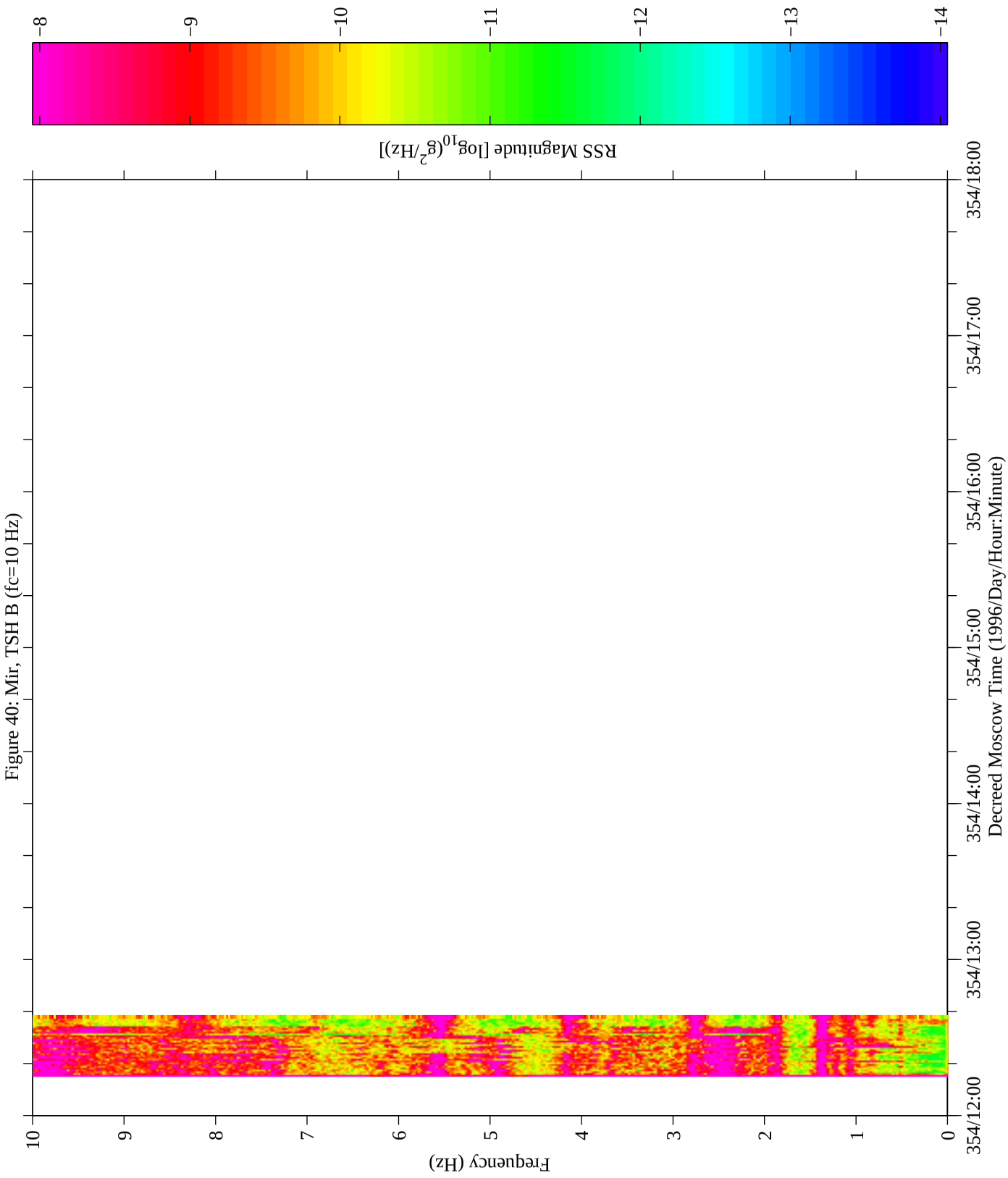
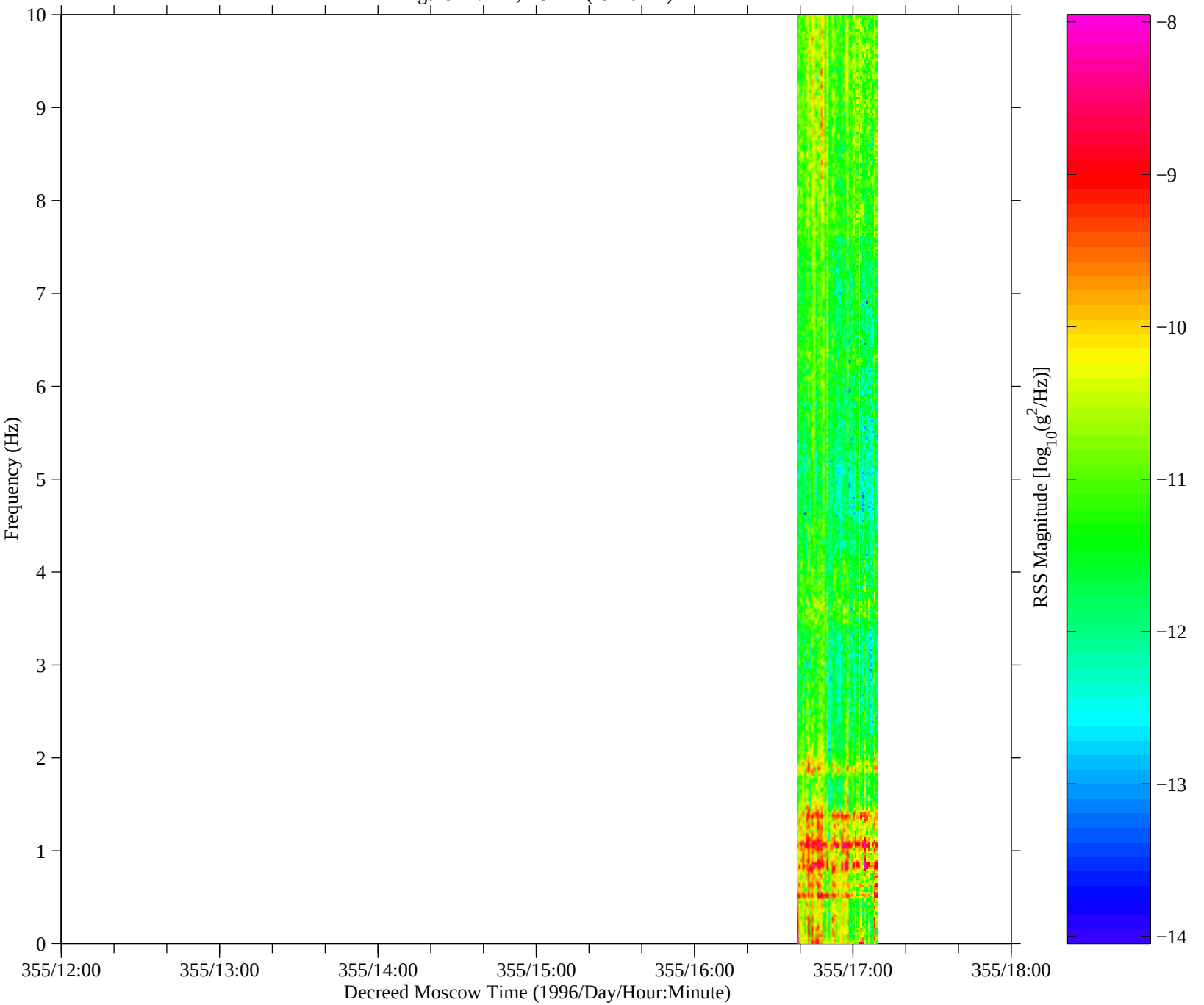


Figure 40: Mir, TSH B (fc=10 Hz)

No data are available
from 354/18:00:00 to 355/12:00:00

Figure 41: Mir, TSH B (fc=10 Hz)



No data are available
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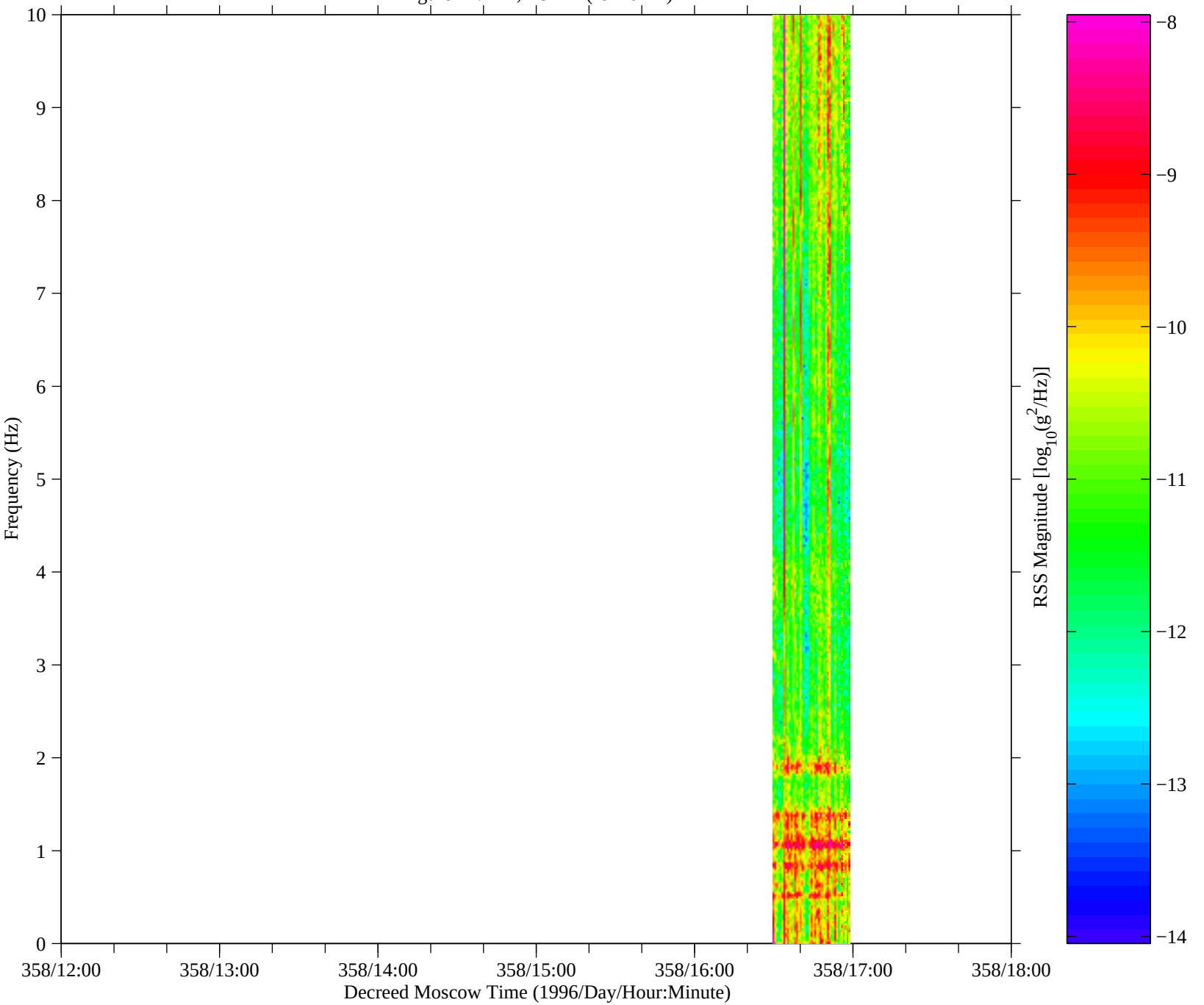
Figure 42: Mir, TSH B (fc=10 Hz)



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from 358/18:00:00 to 359/06:00:00

Figure 43: Mir, TSH B (fc=10 Hz)

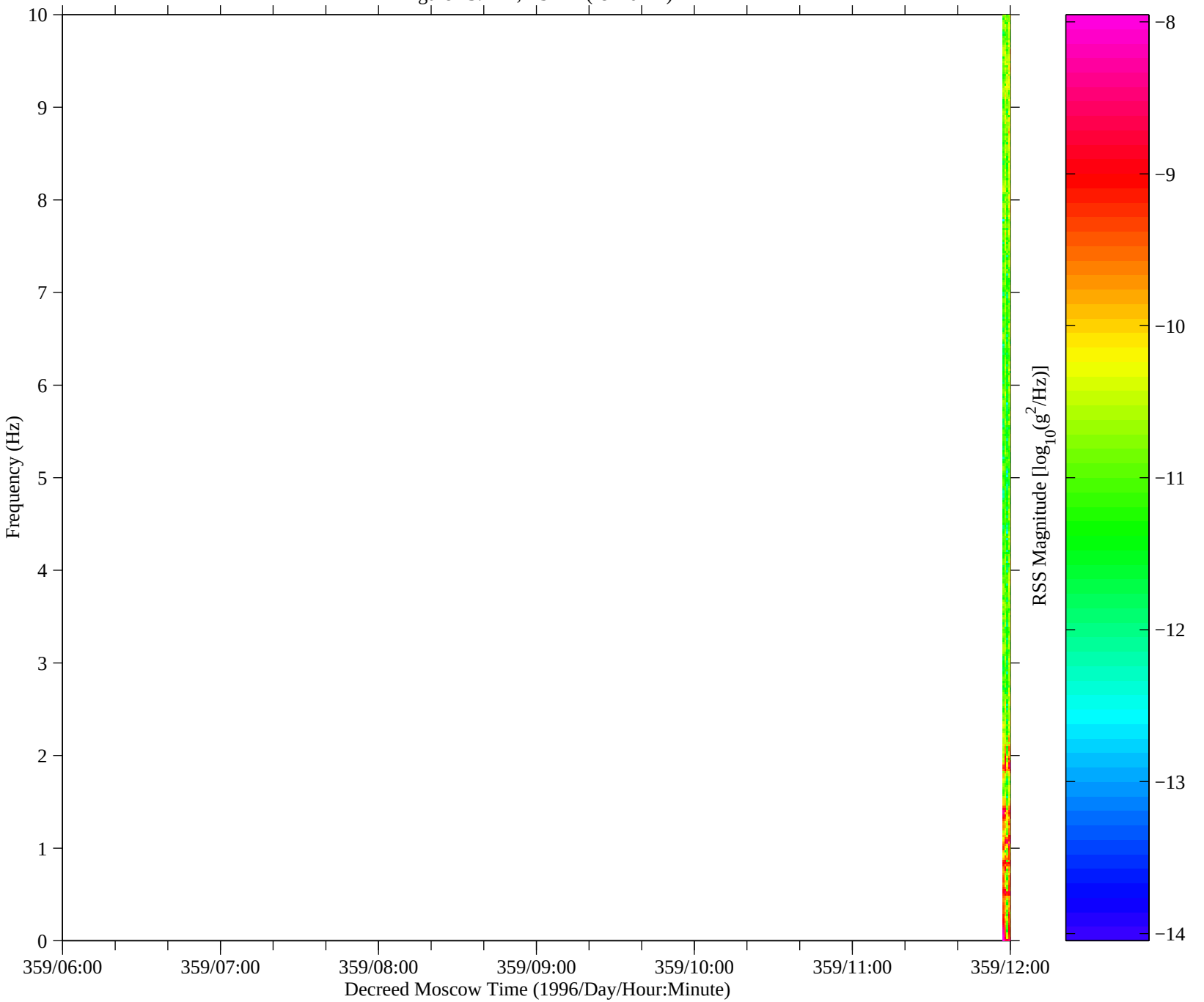
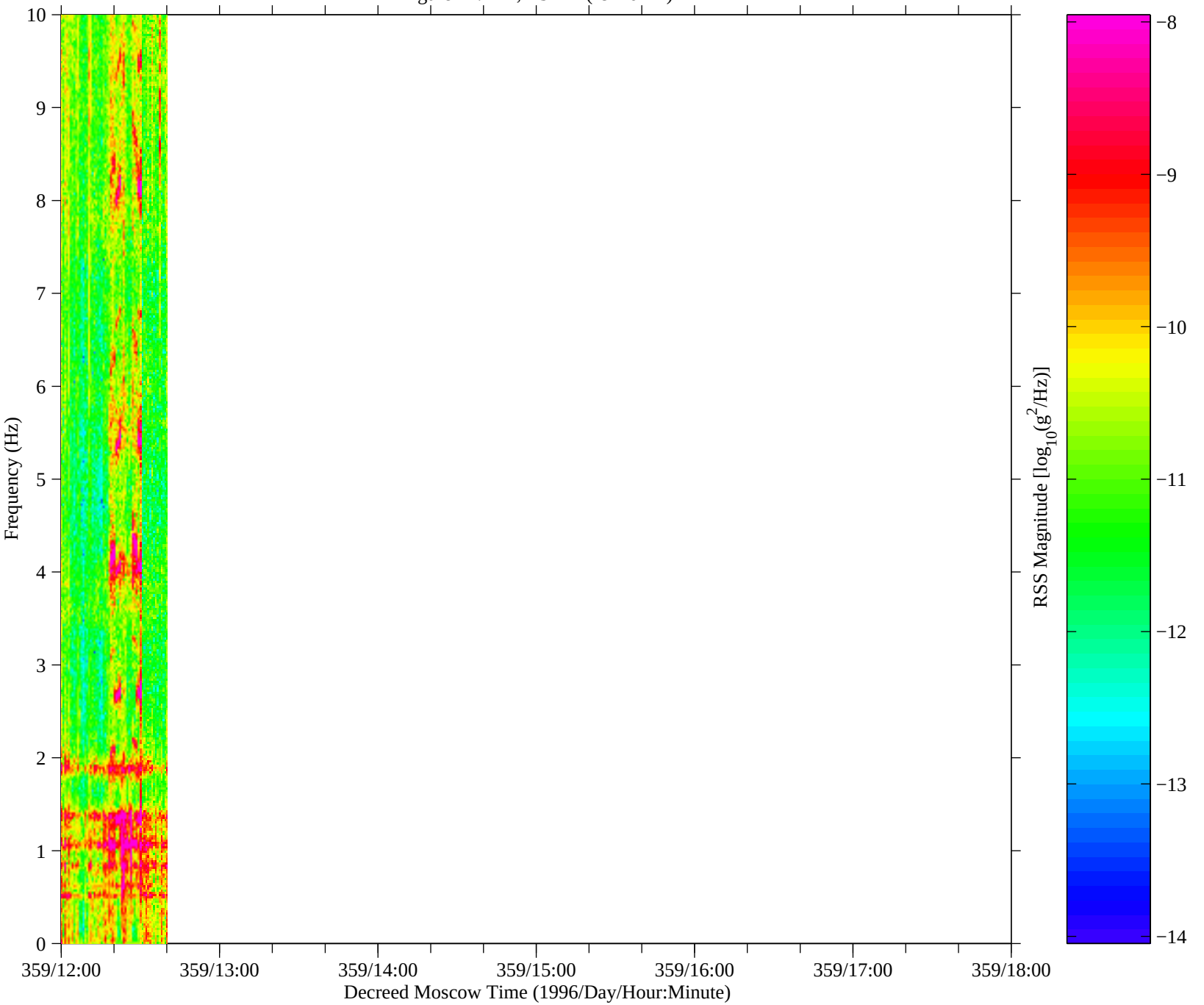
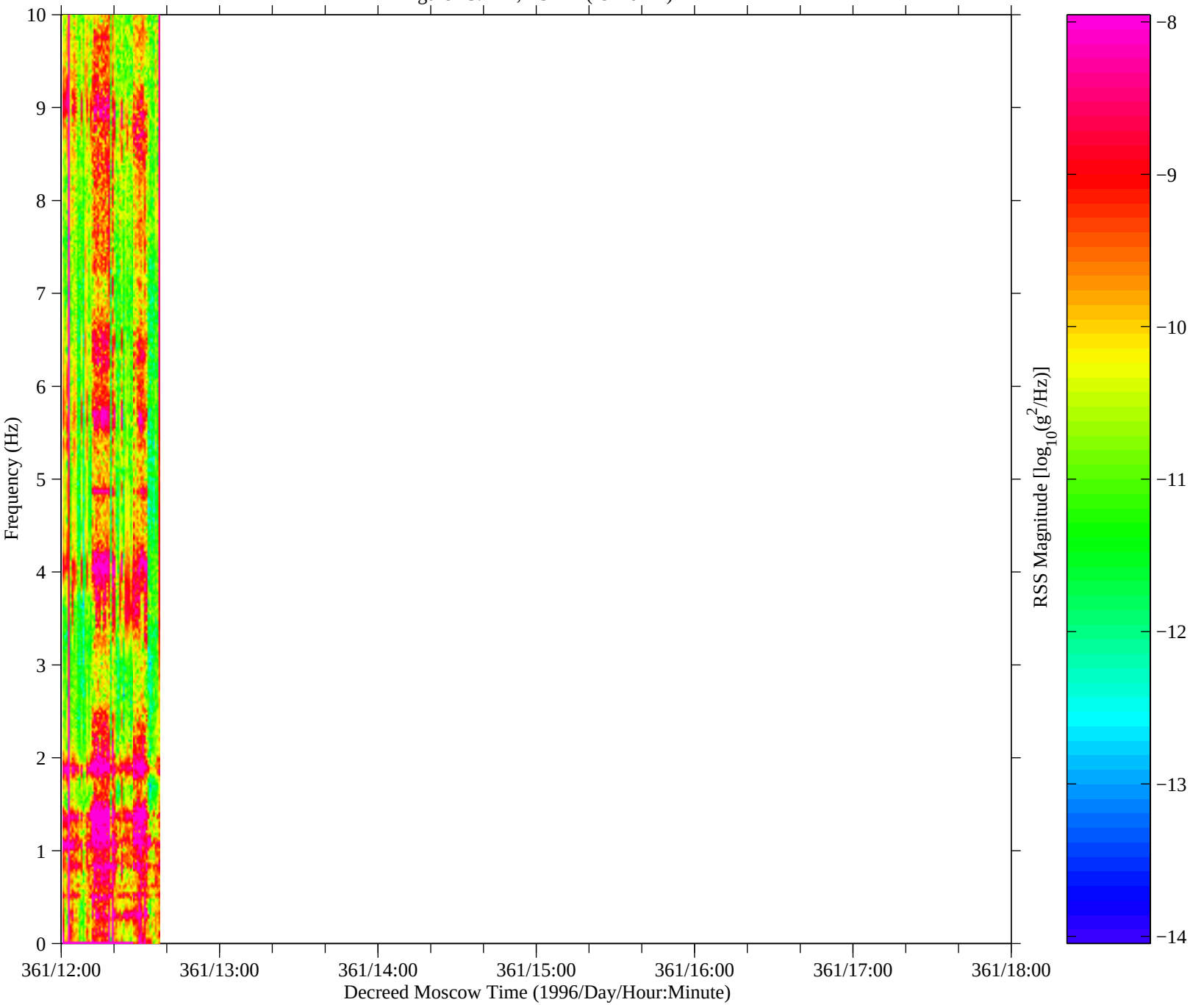


Figure 44: Mir, TSH B (fc=10 Hz)



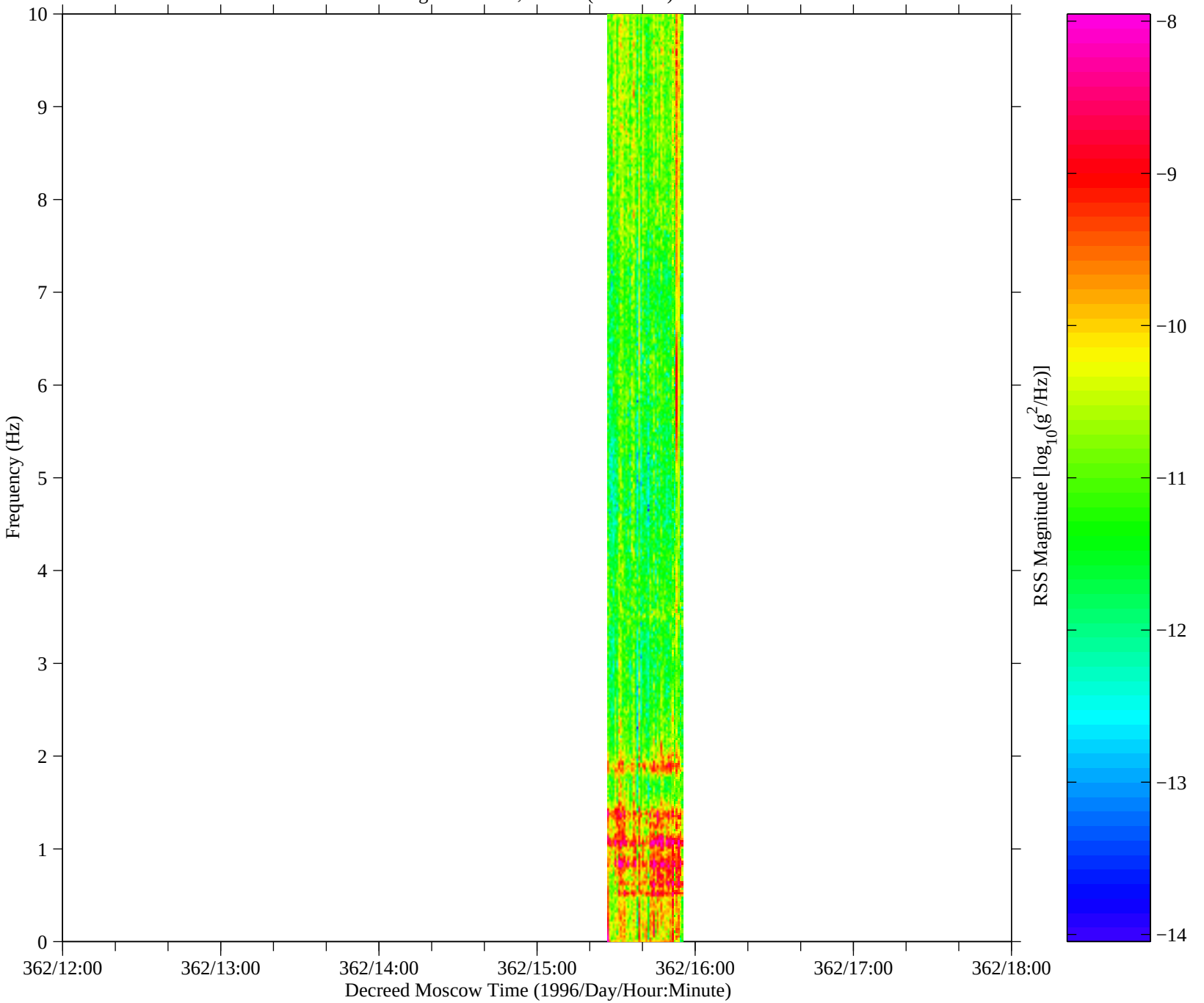
No data are available
from 359/18:00:00 to 361/12:00:00

Figure 45: Mir, TSH B (fc=10 Hz)



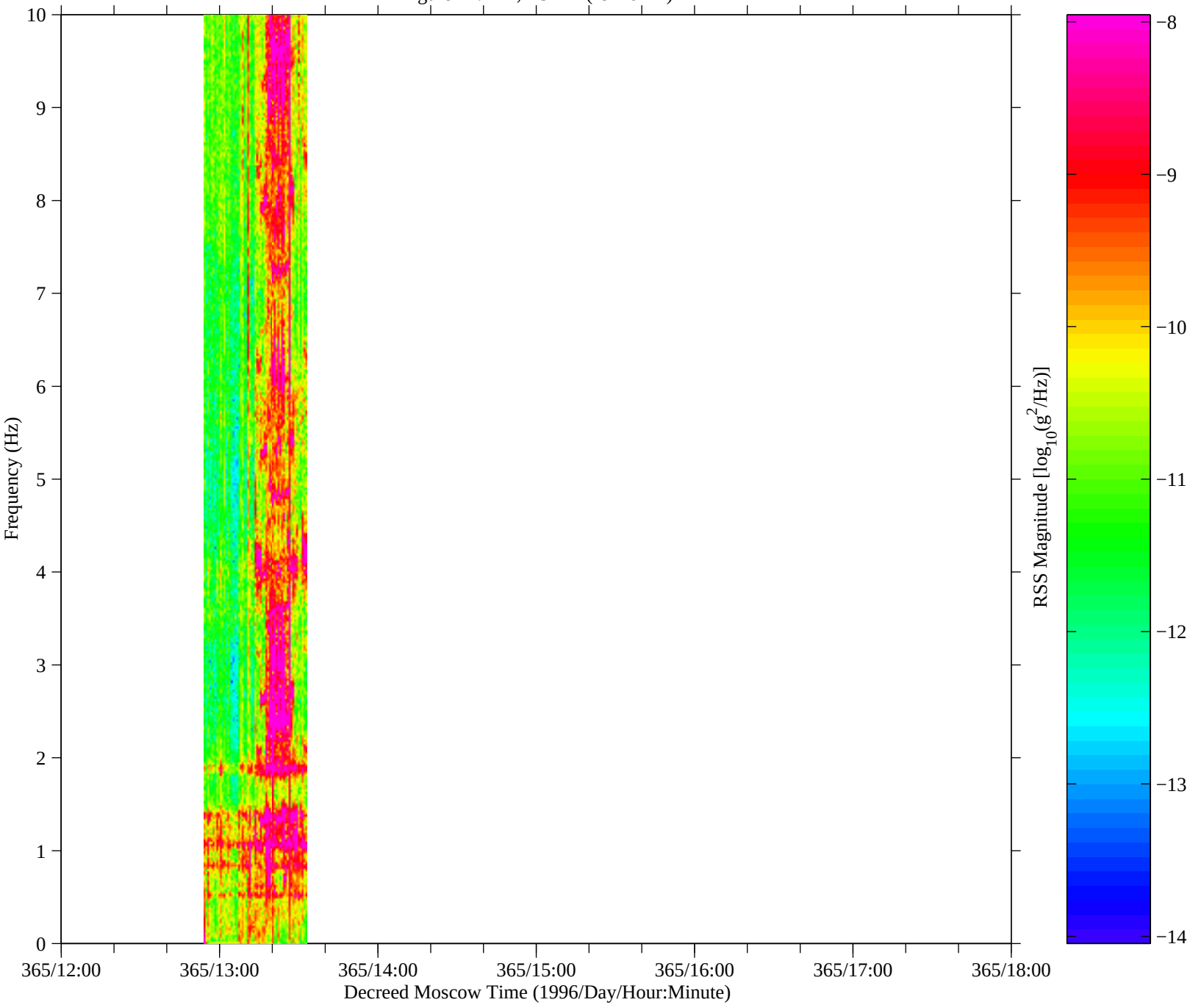
No data are available
from 361/18:00:00 to 362/12:00:00

Figure 46: Mir, TSH B (fc=10 Hz)



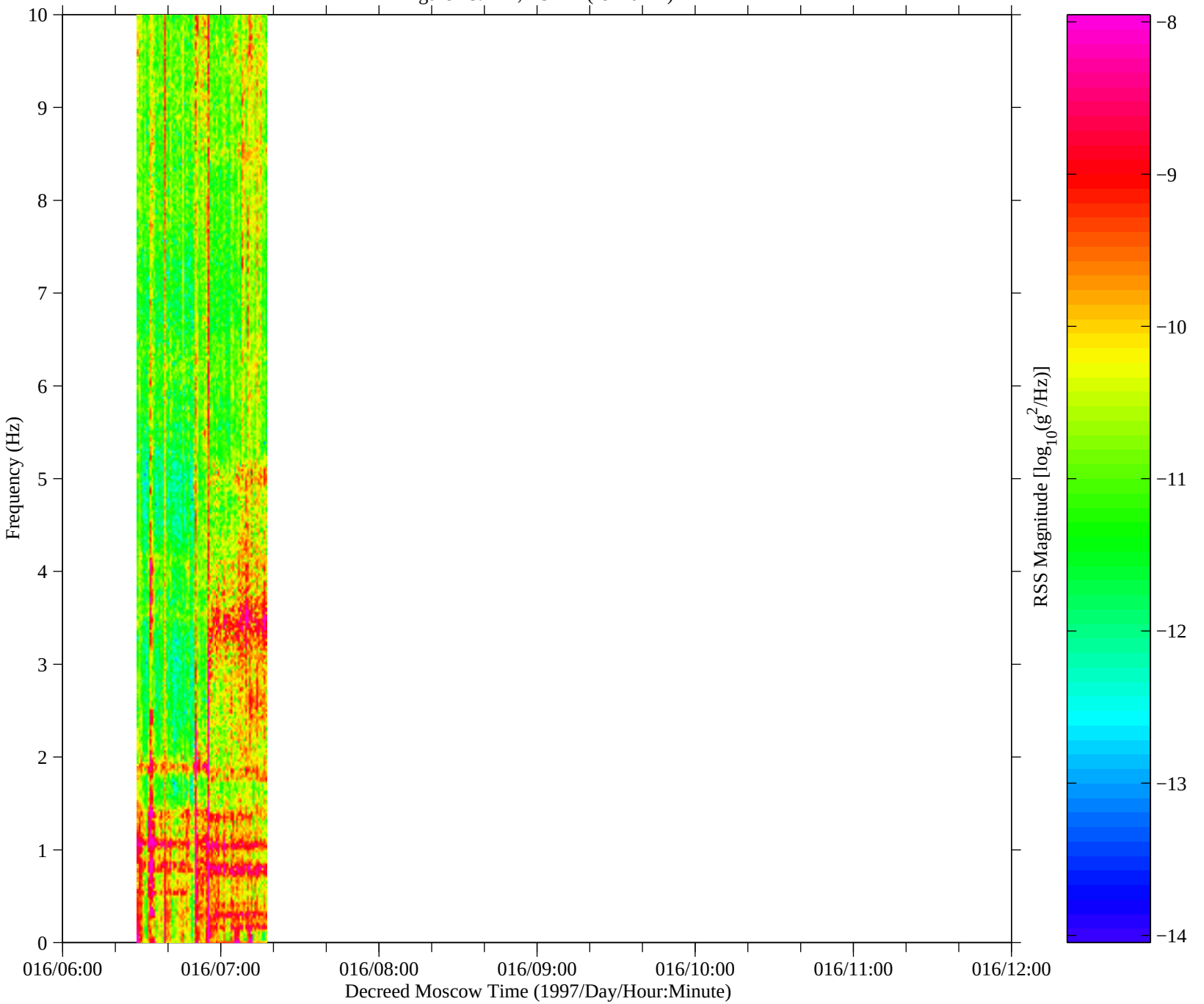
No data are available
from 362/18:00:00 to 365/12:00:00

Figure 47: Mir, TSH B (fc=10 Hz)



No data are available
from 1996 365/18:00:00 − 1997 016/00:00

Figure 48: Mir, TSH B (fc=10 Hz)



No data are available
from 016/12:00:00 to 018/06:00:00

Figure 49: Mir, TSH B (fc=10 Hz)