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To: EDGES group

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Subject: Solar bursts and the earliest detection of the peak at 65 MHz

Peaks in the spectra at 65 MHz were noticed in RFI bursts of uncertain origin in memo 430. One possibility was the propagation of signals from the RELAMPAGO radar which operates in the TV channel 3 in Argentina. Another possibility is from solar bursts. EDGES does see peaks in the spectra at 65 MHz from solar bursts as in figure 2 of memos 430,449,451 and in the time scans of figure 5 in memo 452 and figures 1 and 2 of memo 453. But these are strong signals that are normally filtered out in the processing of the data for measurement of the global 21-cm absorption.

Figure 1 shows the feature from the average of the EDGES-3 data for each day over a range of sunrise for which the sun's elevation is between -12 to + 5 degrees. To limit the number of plots only one day in about 20 days is plotted. The limitation of the small range of the sun's elevation where the feature is almost always present shows that the amplitude of the feature does not change much from 2023 day 292 to 2024 day 207. With this limited range for which the peak at 65 MHz is almost always present shows that the frequency of occurrence is fairly constant. The larger noise level around day 70 is because the galactic center is overhead at sunrise. Figure 2 shows that the noise is lowered and the peak at 65 MHz only drops a little using by going up to a sun elevation of 10 degrees. Figure 3 shows that the peak at 65 MHz is not evident with the sun below 20 degrees.

If the same selected days are used to run a grid search for the 21cm absorption the result is shown in Figure 4 with a residual of 34 mK after a 5-loglog term fit using only data with the sun more than -25 degrees below the horizon. Using data with the sun more than -20 degrees below the horizon increases the residual to the fit to 36 mK. This tests shows that good 21cm data can still be obtained but an understanding of the peak at 65 MHz is needed for future deployments given the increased level of solar activity.

Figure 5 shows a different selection of days than those shown in figure 1. Days 245 and 246 are shown because they are a marginal indication of an earlier presence of the peak at 65 MHz. More days around 2024 87 are shown to show the level of repeatability from day to day. There is also a shift to a higher frequency in days around 87 than the later days in 2024.

In summary the peak at 65 MHz may have started as early as in August 2023, built up strength in October, and remained at the same strength but increased in frequency of occurrence in 2024.

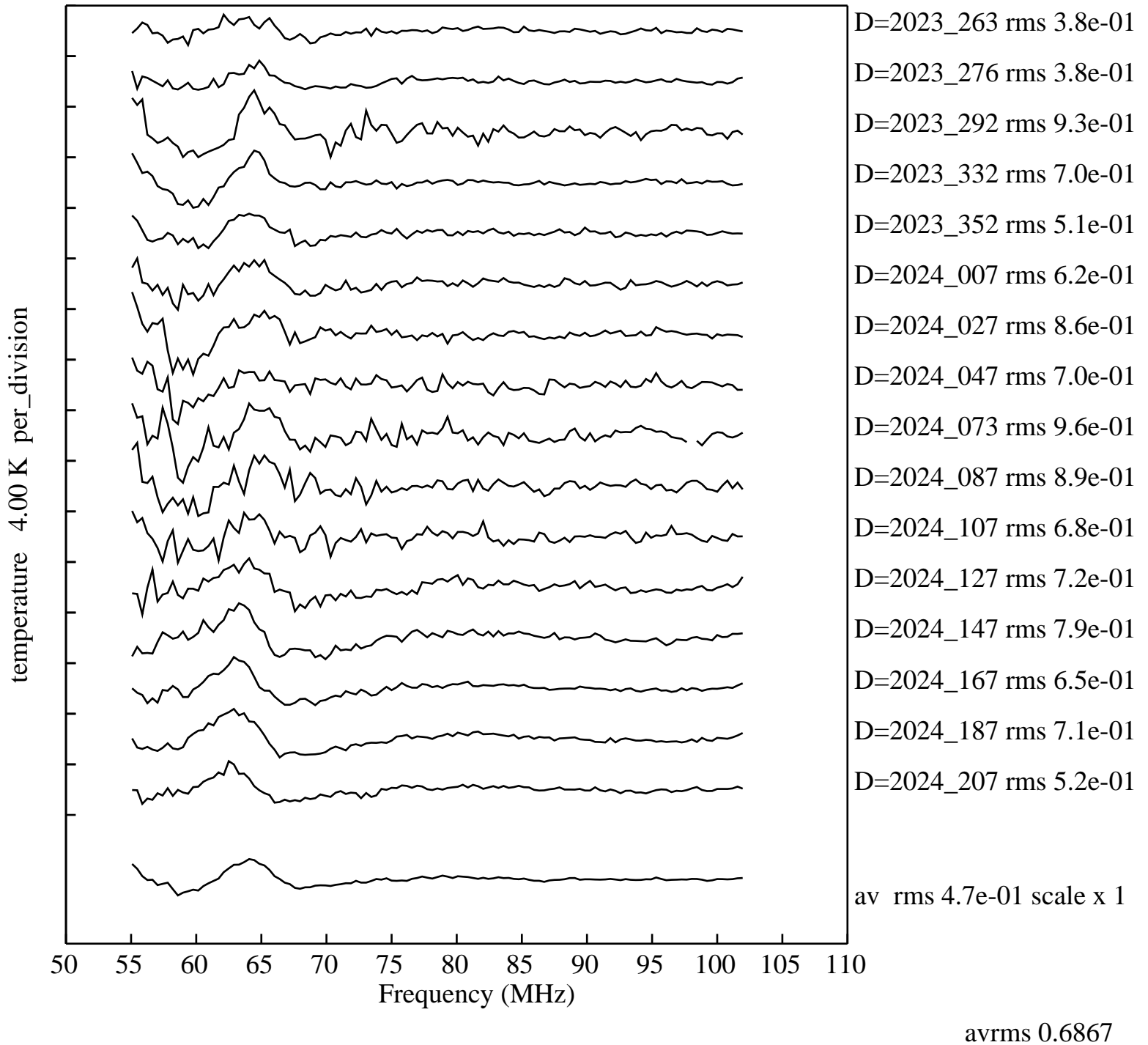


Figure 1. Residuals with 5-terms removed sun elevation -12 to +5 degrees of sunrise on selected days.

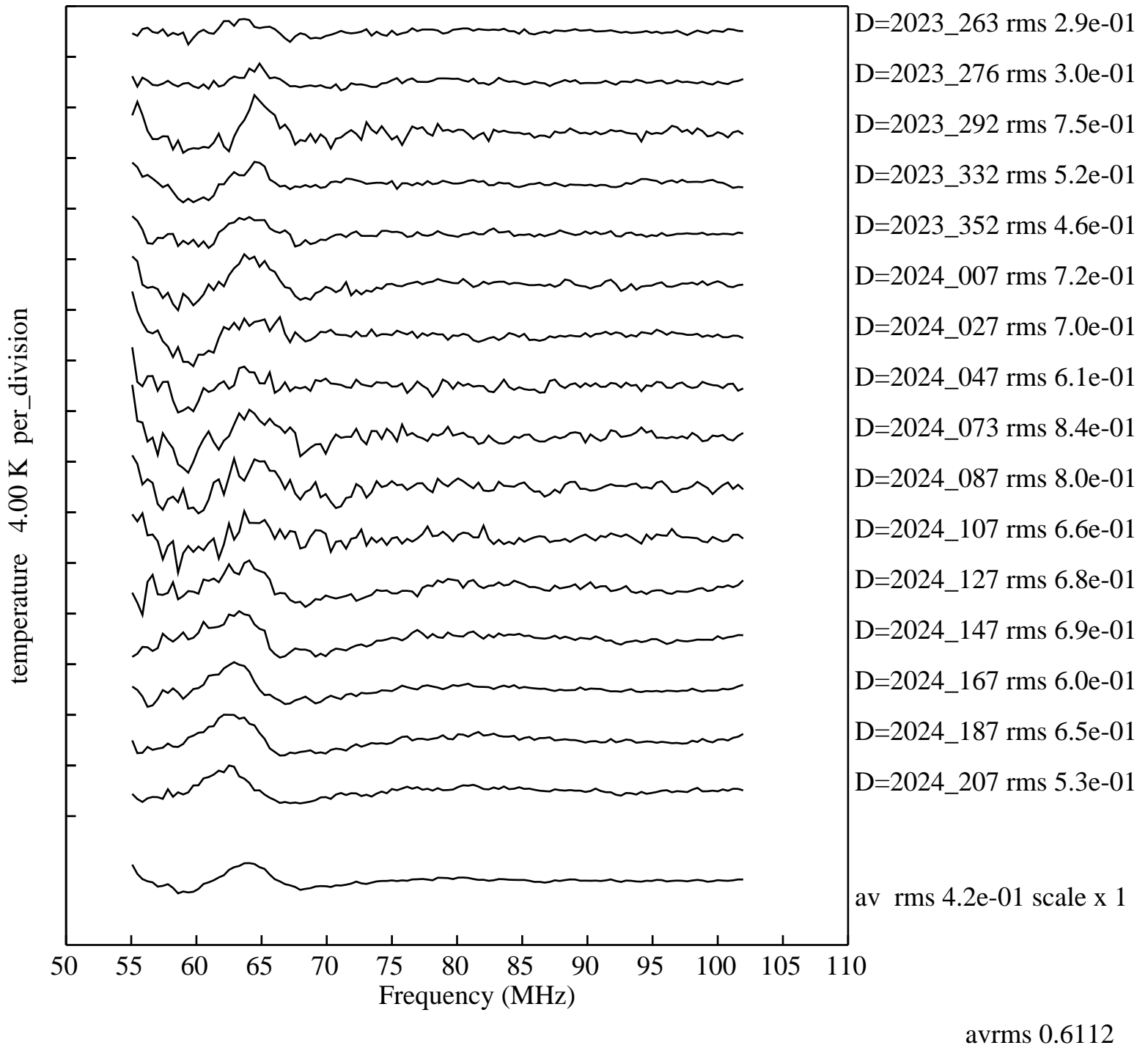
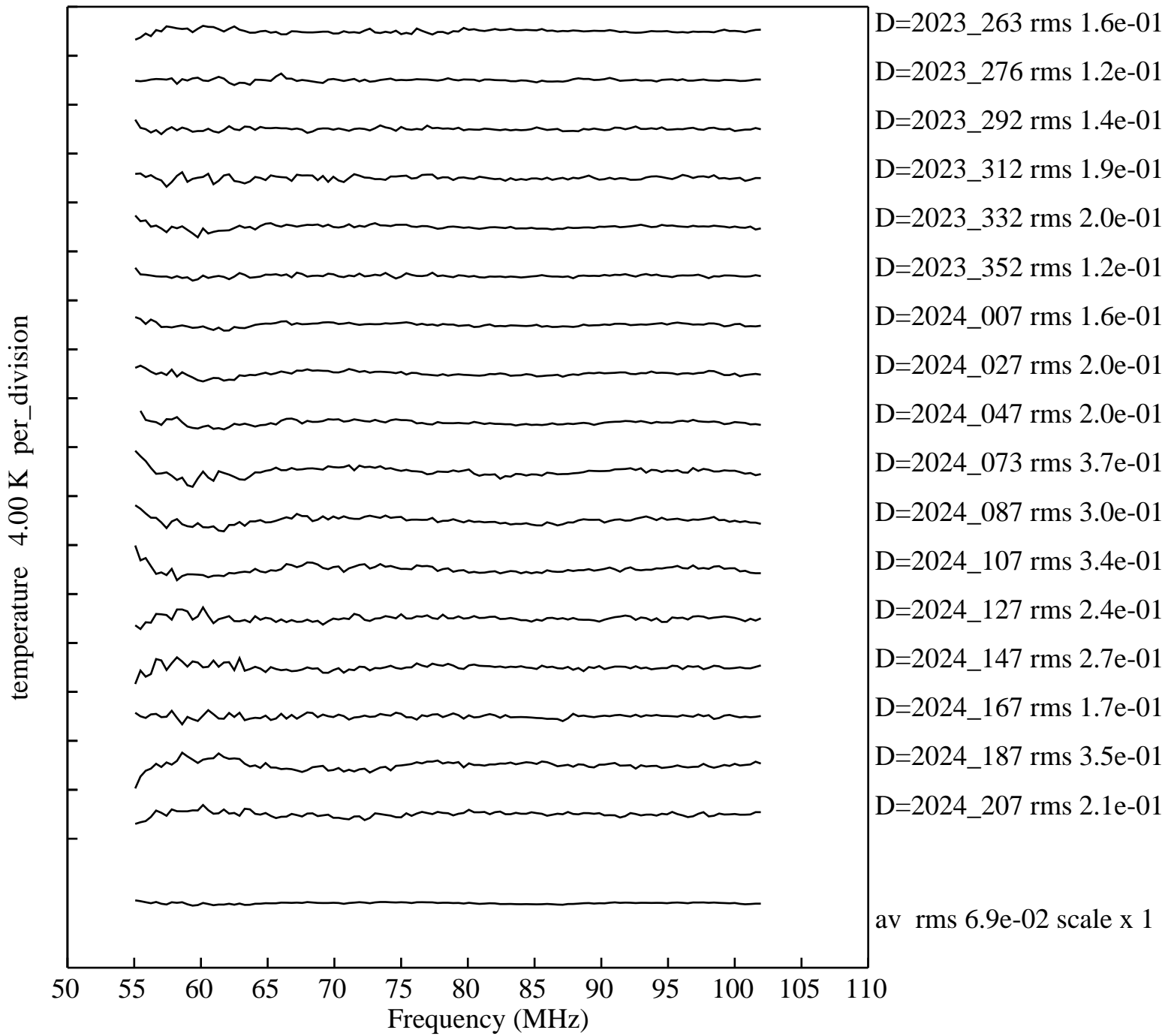


Figure 2. Residuals with 5-terms removed sun elevation -12 to +10 degrees of sunrise on selected days.



avrms 0.2195

Figure 3. Residuals with 5-terms removed sun elevation below -20 degrees on selected days.

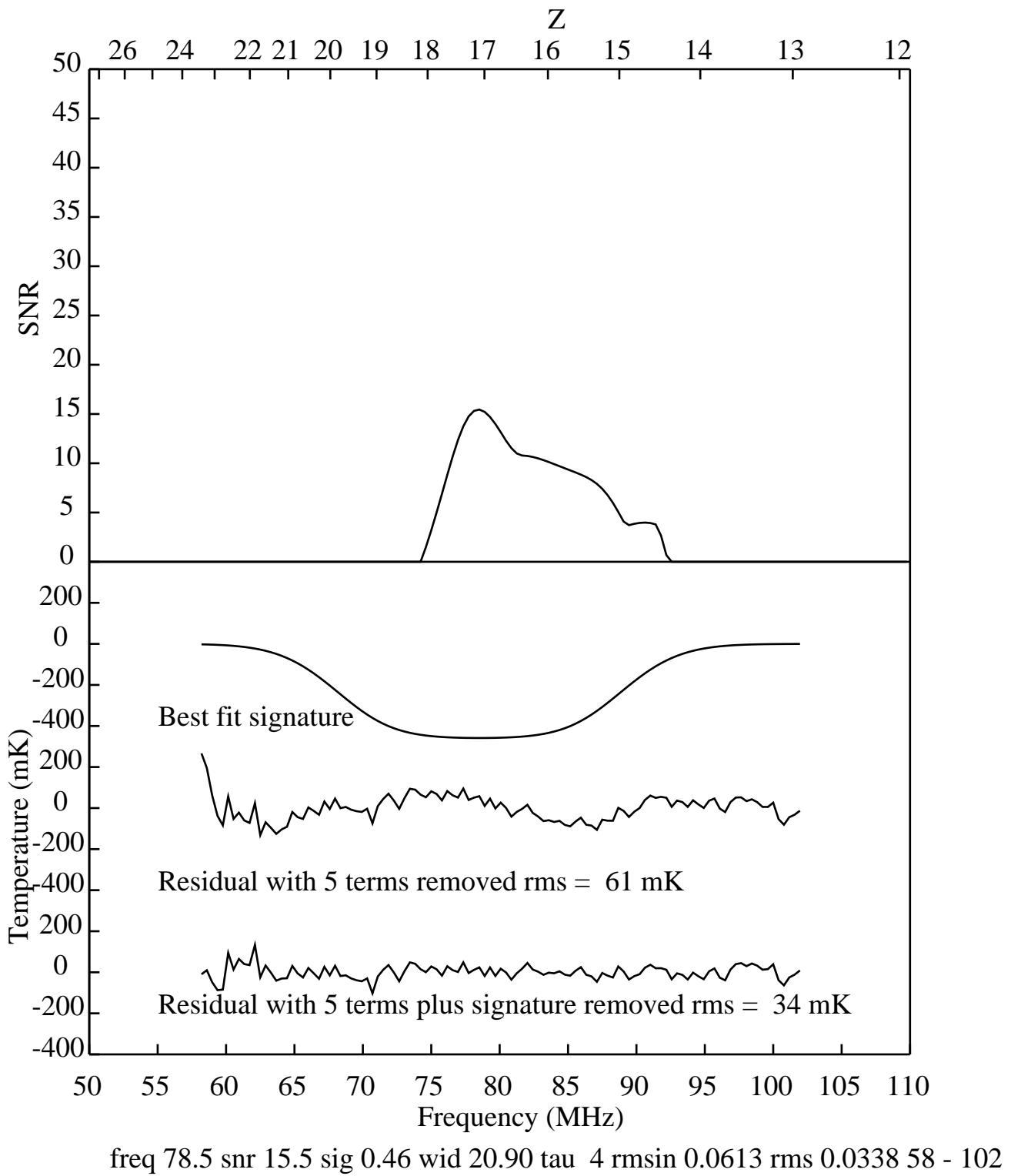
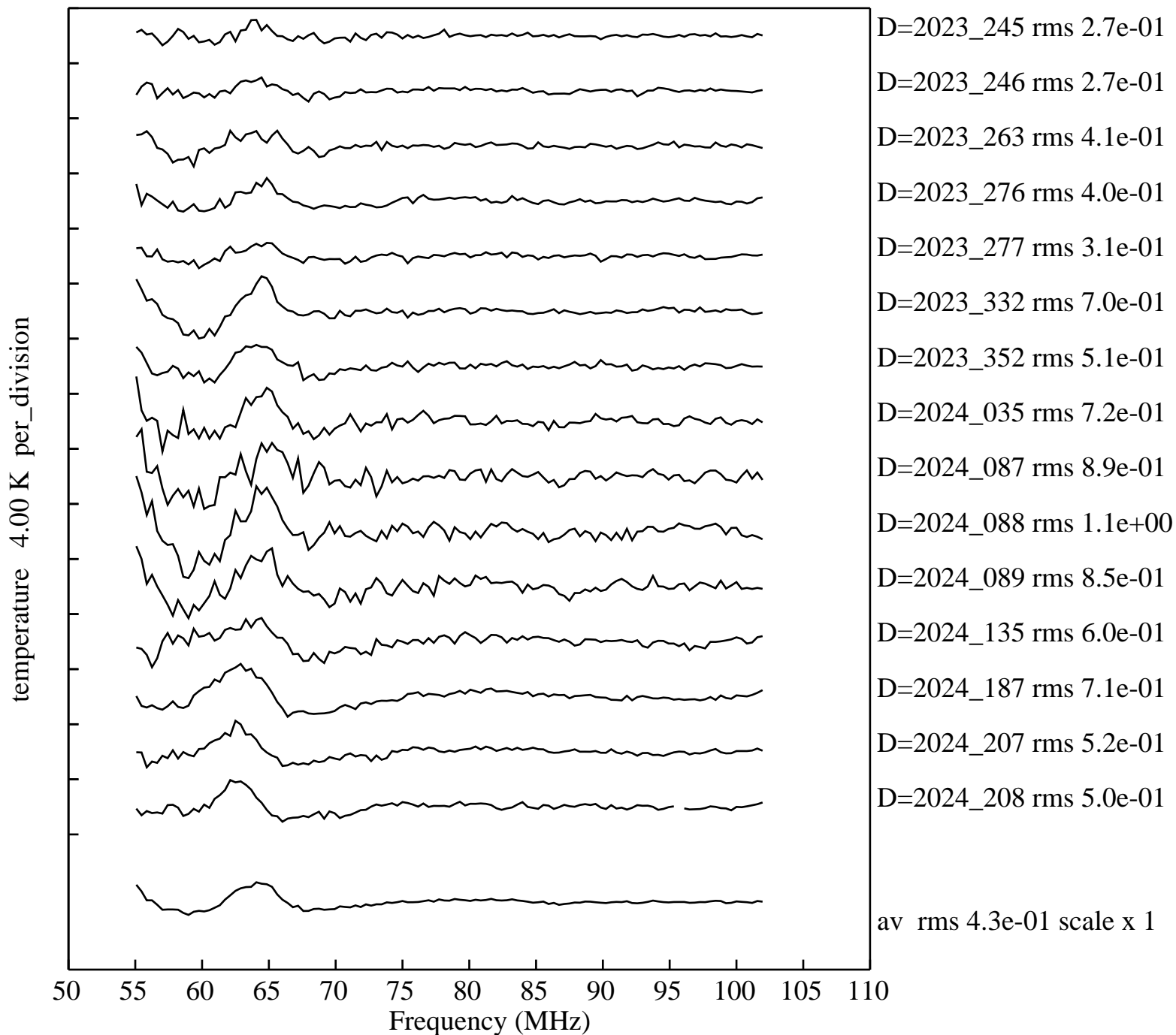


Figure 4. 21-cm absorption 5-loglog terms tau = 4 58-102 MHz sun elevation below -25 degrees.



avrms 0.5828

Figure 5. Residuals with 5-terms removed sun elevation -12 to +5 degrees of sunrise on different selected days.