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To: EDGES group

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Subject: Summary of EDGES-3 results from the WA from 2024

Table 1 shows the results of an absorption grid search of EDGES-3 data taken for 21 day blocks at the WA in 2024. The rms1 is the rms residual prior to fitting an absorption with fixed $\tau = 4$. The number of terms to take out the foreground was reduced from 5 to 4 terms where possible. The rms filter threshold, listed in the last column of the table, on each 1 hour of data was trimmed for an acceptable result.

2024	center MHz	SNR	amp K	width MHz	# terms	rms1 mK	rms2 mK	K
01 - 20	79.3	14	0.50	22.6	5	44	27	0.27
20 - 40	80.1	24	0.61	19.6	5	71	28	0.29
40 - 60	80.1	21	0.66	19.5	5	79	36	0.27
60 - 80	79.7	13	0.85	19.9	5	108	68	0.27
80 -100	80.1	18	0.60	19.6	5	74	37	0.25
100-120	80.1	24	0.66	18.0	5	93	38	0.36
120-140	80.1	8	0.34	18.5	5	72	58	0.42
140-160	80.5	5	0.65	20.5	5	137	122	0.60
160-180	77.0	7	0.40	21.5	4	89	75	0.37
180-200	77.0	9	0.61	22.6	4	98	74	0.29
200-220	76.6	17	0.57	20.9	4	86	44	0.50
220-240	77.3	23	0.57	21.9	4	69	29	0.36
240-260	77.3	23	0.56	19.4	4	87	36	0.40
260-280	77.3	16	0.59	21.3	4	83	46	0.19
280-300	77.0	30	0.67	21.3	4	86	28	0.36
300-320	77.0	35	0.61	21.2	4	79	22	0.30
320-340	77.3	28	0.66	21.3	4	83	29	0.40
340-360	78.1	23	0.62	20.9	4	80	33	0.36

Table 1. Results of 21-cm absorption grid search

The key parameters used were:

Sun limit: Below -30 degrees

Frequency range: 58-102 MHz

GHA range: 06-18 hours except for 160-180 and 180-200

Beam correction: azelq_box_perf_48_2e-2.txt at 269 deg. azimuth

Sky map: 408 MHz Haslam map

Polynomial: Physical as in equation (1) of Bowman et al. 2018

RFI filter: 2.1 sigma

maxrmsf: 50

maxfm: 2000

The GHA range had to be increased to cover all GHA with the sun 30 degrees below the horizon for data taken for days 160 to 200. Figures 1 and 2 are plots of the 4-term grid search for days 300-320 and 320-340 respectively.

Tests on the data from day 300-360 which provides more data in the GHA range 06-18 with the sun more than 30 degrees below the horizon than other days of the year are listed in Table 2. The last entry is without beam correction which required 5 physical terms to obtain the best fit to an absorption with $\tau = 4$ in the frequency range 58-102 MHz. Figure 3 shows the plot of the result for 06-18 GHA with sun limit of 20 degrees and Figure 4 shows the result the result of the 2018 absorption subtraction on the data from day 300-320 shown in Figure 1. The details of the method are described in memo 441 and the result of the subtraction tests on 2023 data are shown in figure 1e of memo 441.

These results complement those obtained for days 54-298 of 2023 in memo 432 but the subtraction made with only 4 terms on the 2024 data shows a drop by a factor of more than two from 79 mK rms in Figure 1 before subtraction to a relatively flat 33 mK rms curve in Figure 4. This is a more significant test than the tests on 2023 data made with 5 terms for which the rms values only drop by a factor of about one and a half.

center MHz	SNR	amp K	width MHz	# terms	rms1 mK	rms2 mK	K
77.3	34	0.59	21.5	4	70	21	0.22 All GHA sunlim -30
77.3	36	0.59	21.5	4	71	20	0.22 06-18 GHA sunlim -20
77.3	18	0.43	22.1	5	35	18	0.32 06-18 GHA sunlim -30

Table 2. Tests of sun limit using 2024 300-360 in one hour blocks last entry is without beam correction

In summary the data from the WA using EDGES-3 is consistent with the Bowman et al. 2018 global 21-cm result but tends to get lower residuals to the absorption fit using $\tau = 4$ than with $\tau = 7$. The subtraction test which requires only 4 terms to model the foreground is solid evidence that the 0.5 K deep 21-cm absorption is truly present in the sky and not a systematic. Figure 5 shows that a good result with slightly a wider bandwidth can be obtained for the data used in figure 3 using the 45 MHz Guzman sky map instead of the 408 MHz Haslam map for the beam correction.

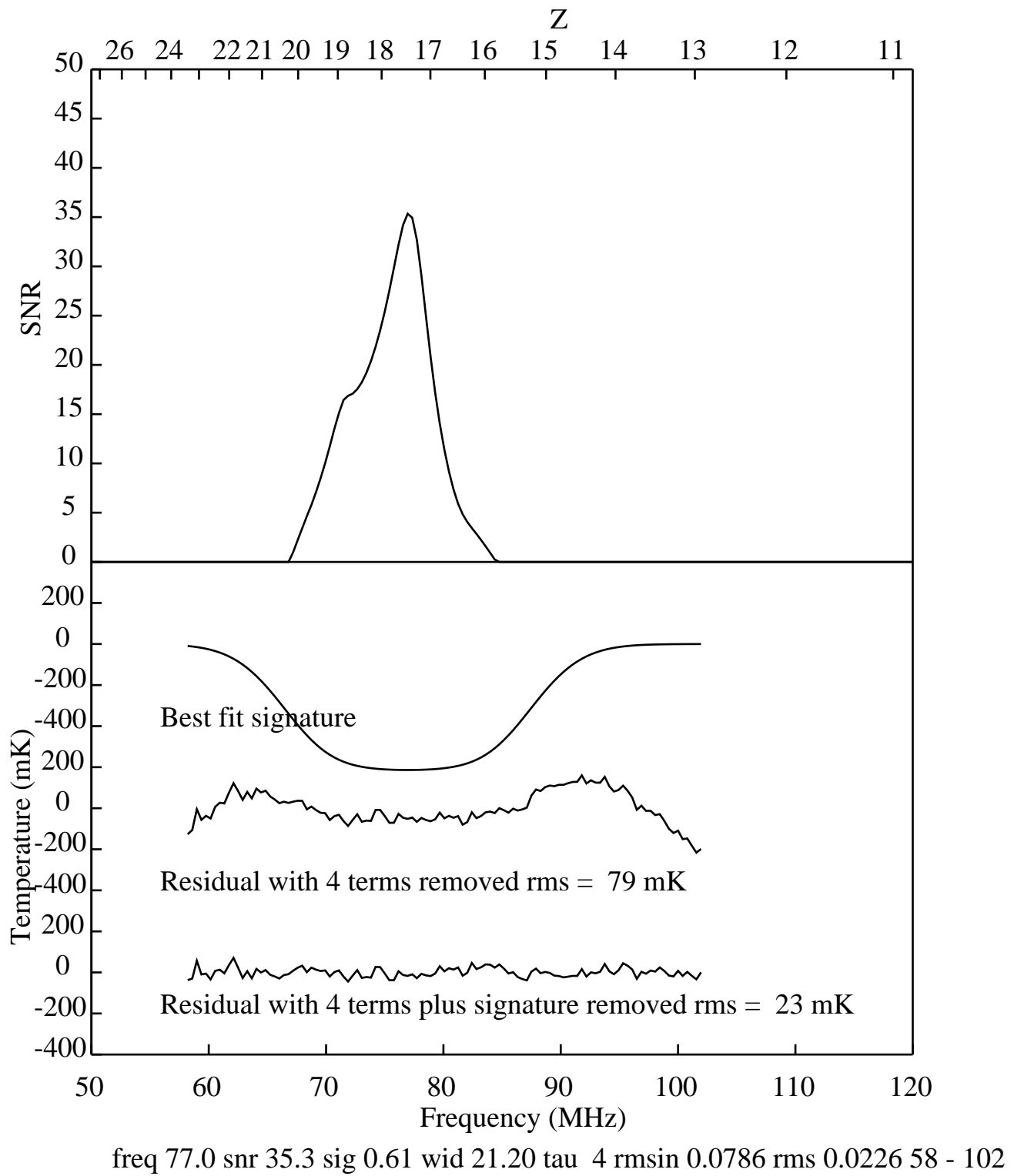


Figure 1. 21-cm absorption result for 1 hour blocks from 2024 days 300 to 320

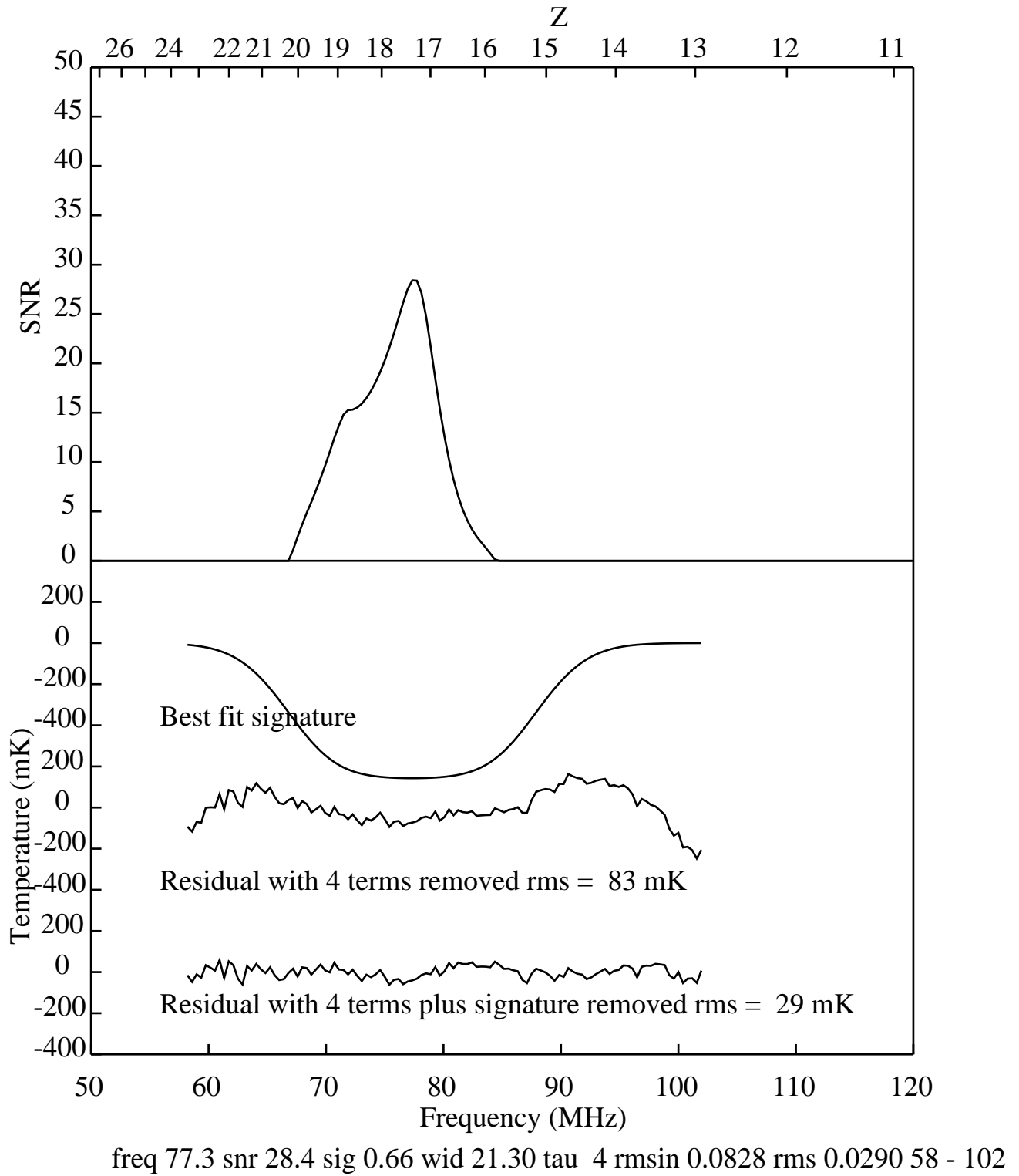


Figure 2. 21-cm absorption result for 1 hour blocks from 2024 days 320 to 340

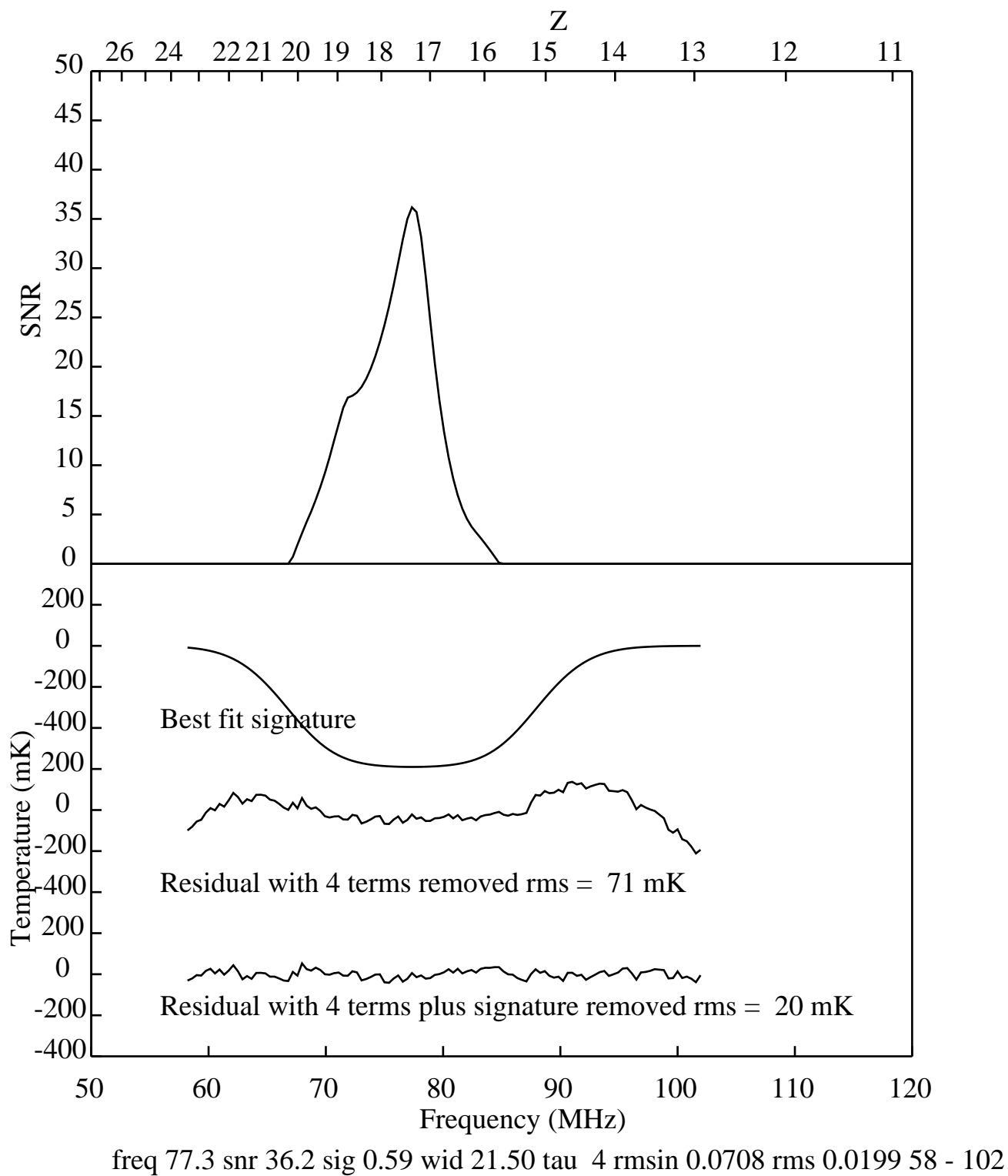


Figure 3. 21-cm absorption result for 1 hour blocks from 2024 days 300 to 360

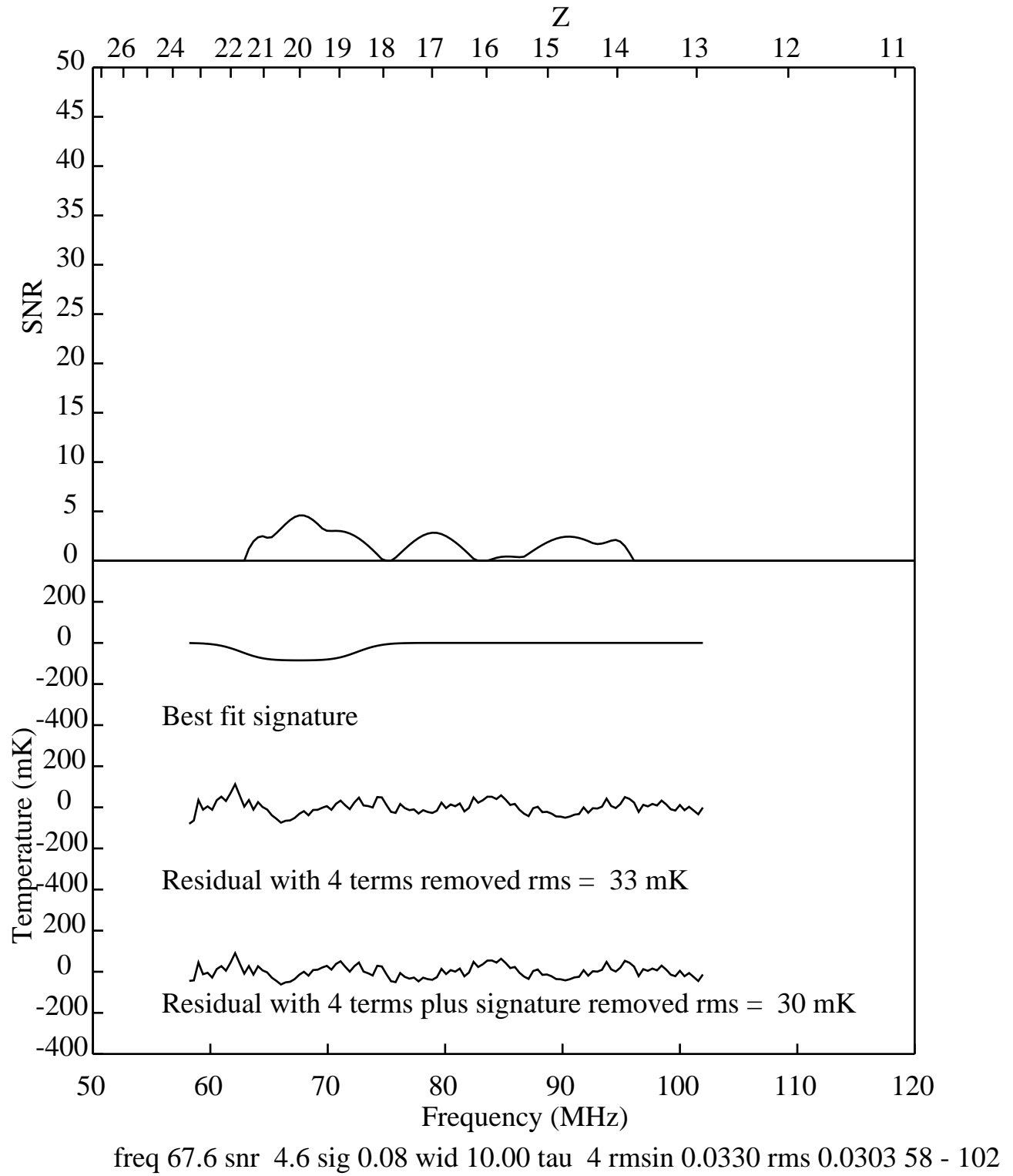
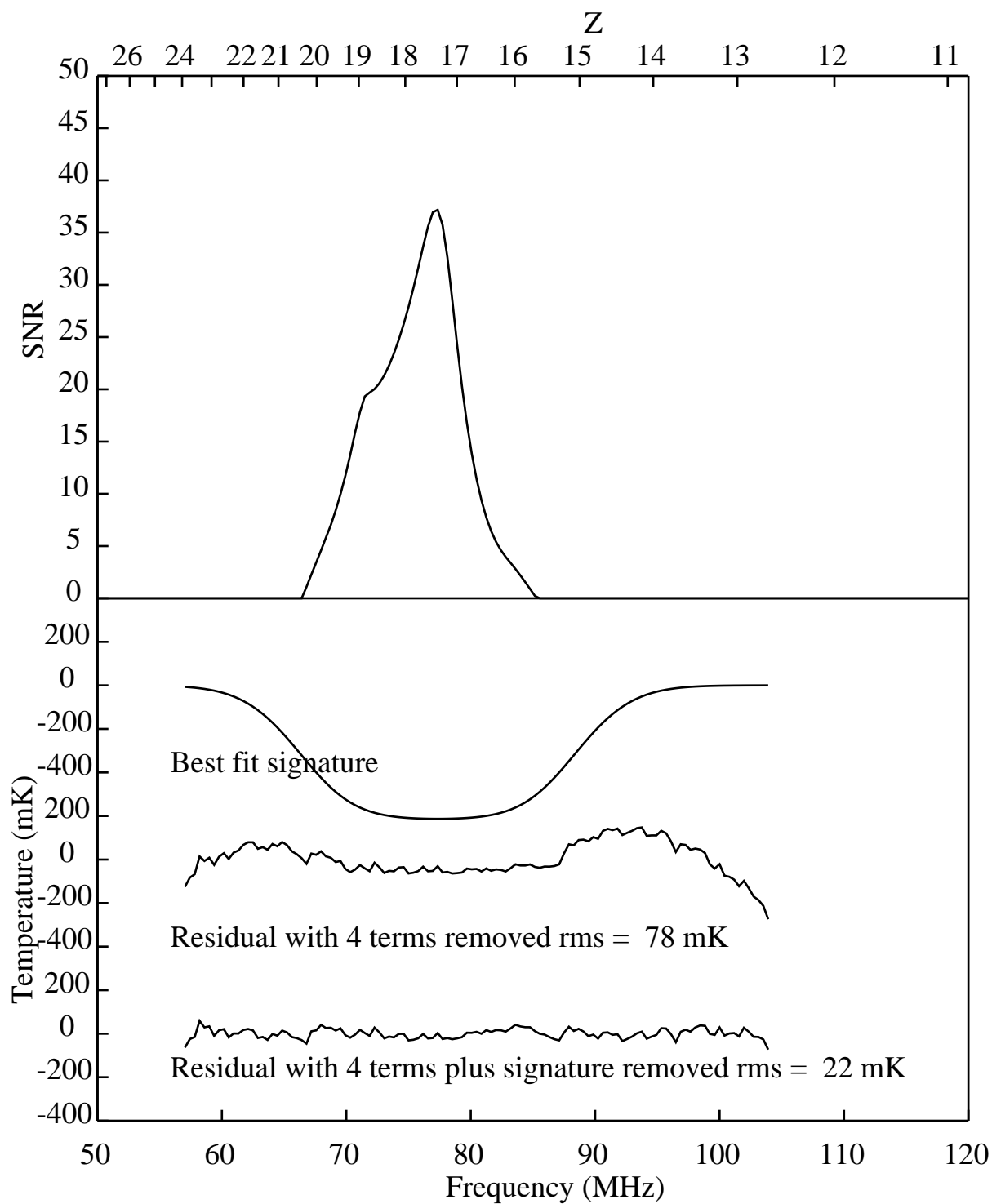


Figure 4. Subtraction of 2018 result from sky map test on 2024 days 300 to 320



freq 77.3 snr 37.2 sig 0.61 wid 22.30 tau 4 rmsin 0.0779 rms 0.0221 57 - 104

Figure 5. 2024 days 300 to 360 using Guzman 45 MHz map for beam correction