EDGES MEMO #477

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To: EDGES group

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Subject: Summary of EDGES-3 results from Adak from 2024 day 345 to 2025 day 92

Occasional data has been obtained from Adak Island despite the great difficulty to run EDGES-3 in the very wet and windy conditions at the site. Simulations of the effects of moisture were made in memos 458 and 459. Initial data reported memo 465 showed that high residuals were obtained when only 5 physical terms were removed. Results reported in memo 471 show that despite the correlation of the rms residuals with the weather a very tentative confirmation of the EDGES 2018 absorption could be obtained using 6 loglog polynomial terms in figure 4 of memo 471 using the limited data of only 4 days. The biggest problem limiting the amount of data has been the ability to maintain reliable operation of the generator and fix the effects of corrosion reported in memos 470 and 476.

Figure 1 shows the 6 loglog polynomial residuals of data simulated using the best average "good" antenna s11 data processed with antenna s11 data that was acquired which shows that days 346, 29, 44, 46, 47, 48 and 72 had reasonable antenna s11 close to what was expected while the other days were effected by the poor connections on the antenna due to corrosion documented in memo 476. Following the trip to the site to fix the antenna connection the VNA could no longer be accessed, presumably by some internal failure. However it was decided to continue getting antenna spectral data and by April 4 we had the spectra from 2024 day 345 and 346 along with 2025 days 30, 35, 38, 41, 43, 46, 47, 48, 74, 75, 77, 81, 84, 85, 86, 91 and 92 with 6 loglog polynomial terms removed which are shown in Figure 2 for the sun more than -30 degrees below the horizon.

An analysis of the spectral data obtained so far from Adak for the global 21-cm absorption is made using 6 loglog polynomial terms with a grid search. It was found that 6 terms are primarily needed to account for changes in conditions to lower the rms residuals enough to get a residual at the noise level following the grid search for the best fit absorption parameters and then perform the tests on this data set which are summarized in Table 1 below.

center MHz	SNR	amp K	width MHz	rms1 mK	rms2 mK	range MHz	tau	details of tests
78.9	18	0.73	17.6	53	24	60-98	4	absorption grid search 1 hr blocks
82.8	6	0.38	23.1	39	26	60-98	4	subtraction of 2018 result tau = 7
79.3	6	0.29	16.9	43	26	60-98	4	subtraction of 2018 result tau = 4
78.9	19	0.77	17.9	59	24	60-98	4	without beam correction
78.9	18	0.46	17.4	54	24	60-88	7	used tau = 7 instead of 4 in search
78.9	18	0.74	17.5	61	24	60-88	4	s11ant_072 instead of average

Table 1. Results of grid search for 21-cm absorption and tests of subtraction tests.

The plot of the absorption search using 1 hr data blocks is shown in Figure 3. Tests of the beam correction (azelq_adak_cable_box29.txt) and change of antenna s11 used have only a small effect.

Figure 4 shows that the result of subtracting the 2018 absorption from the sky noise reduces the residual before searching for an absorption from 53 to 39 mK rms and leaves the residual after another fit to 26 mK. Another subtraction test using a flattening of tau = 4 has a similar result.

Figure 5 shows that the solar emission at about 65 MHz seen at the EDGES-3 at WA plotted in figure 2 of memo 474 is also seen in the data from Adak.

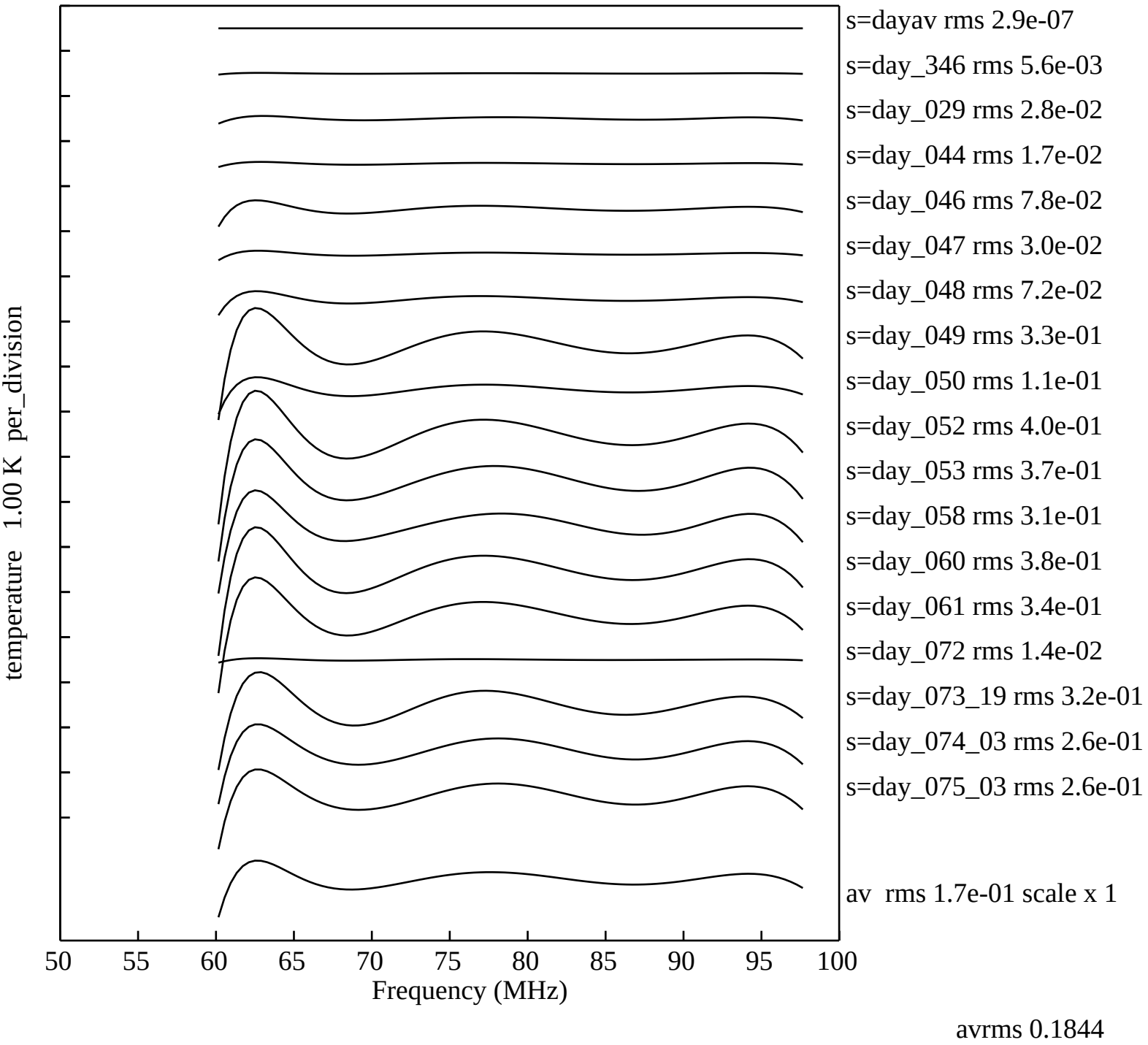

Figure 1. Residuals with 6-terms removed of antenna S11 different days

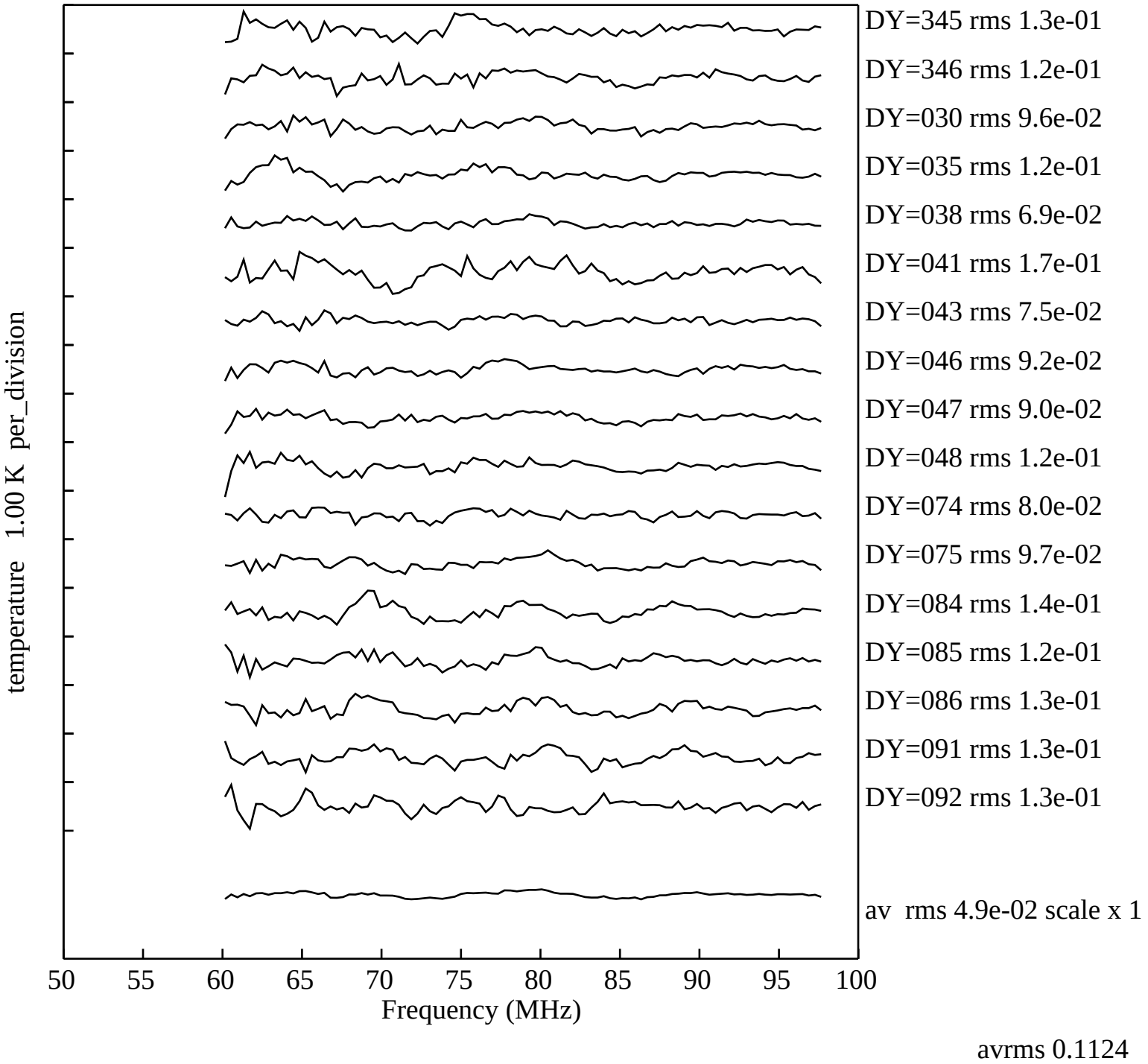

Figure 2. Residuals with 6-terms removed for the sun below -30 degrees for each day

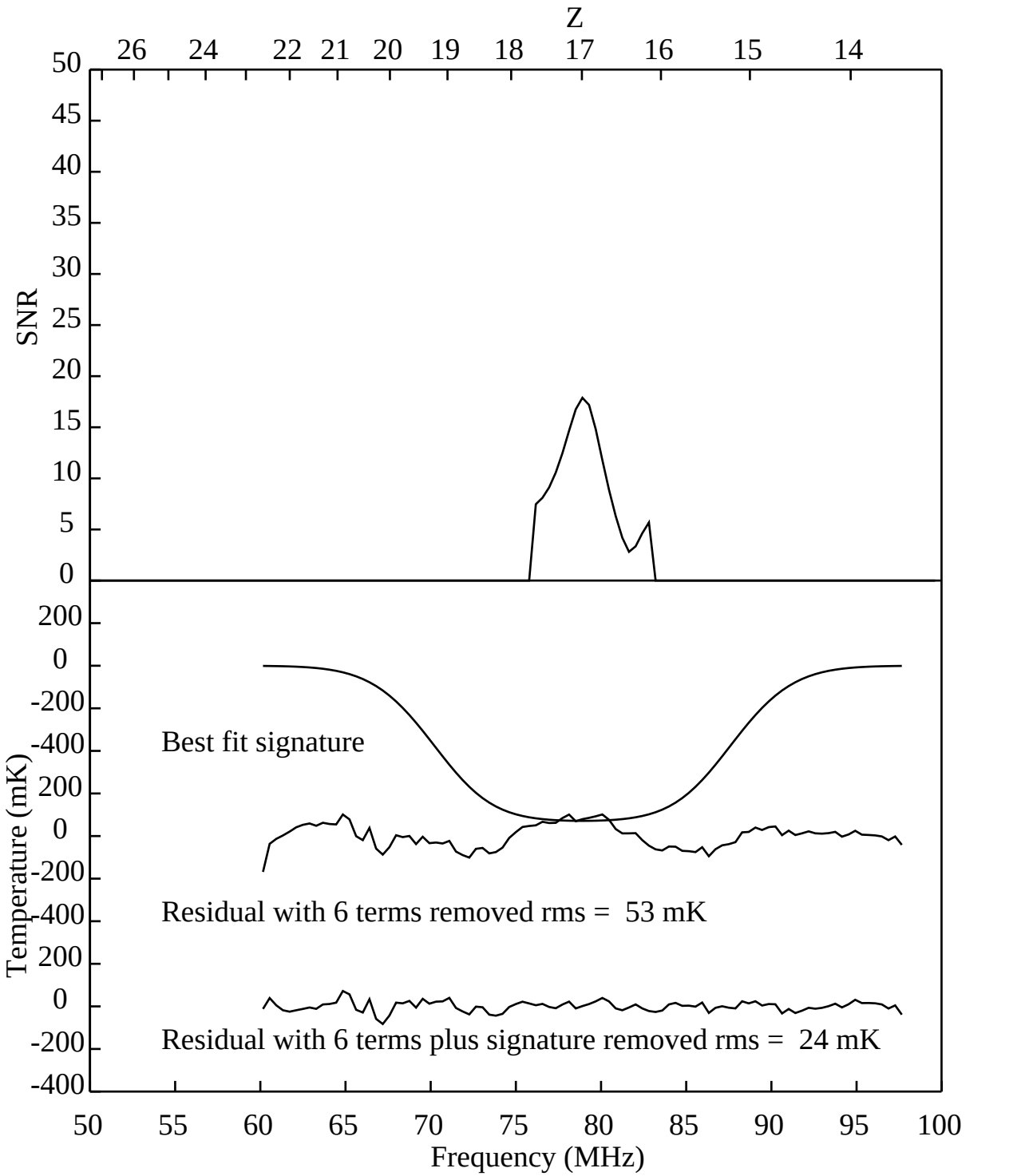

Figure 3. Plot of the 21-cm absorption grid search listed in the first entry of Table 1

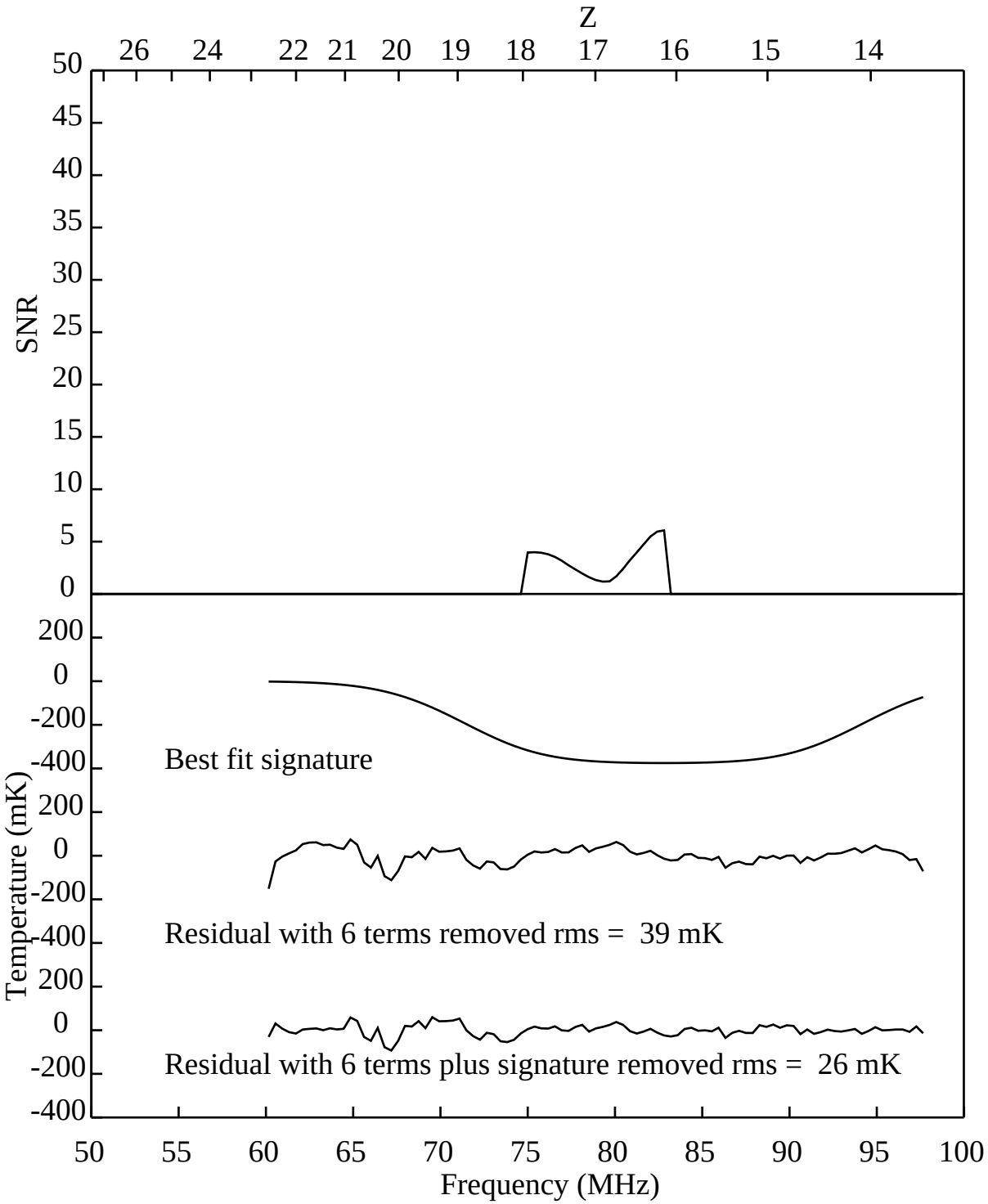

Figure 4. Plot of the 21-cm absorption 2018 result subtraction test listed in the second entry of Table 1

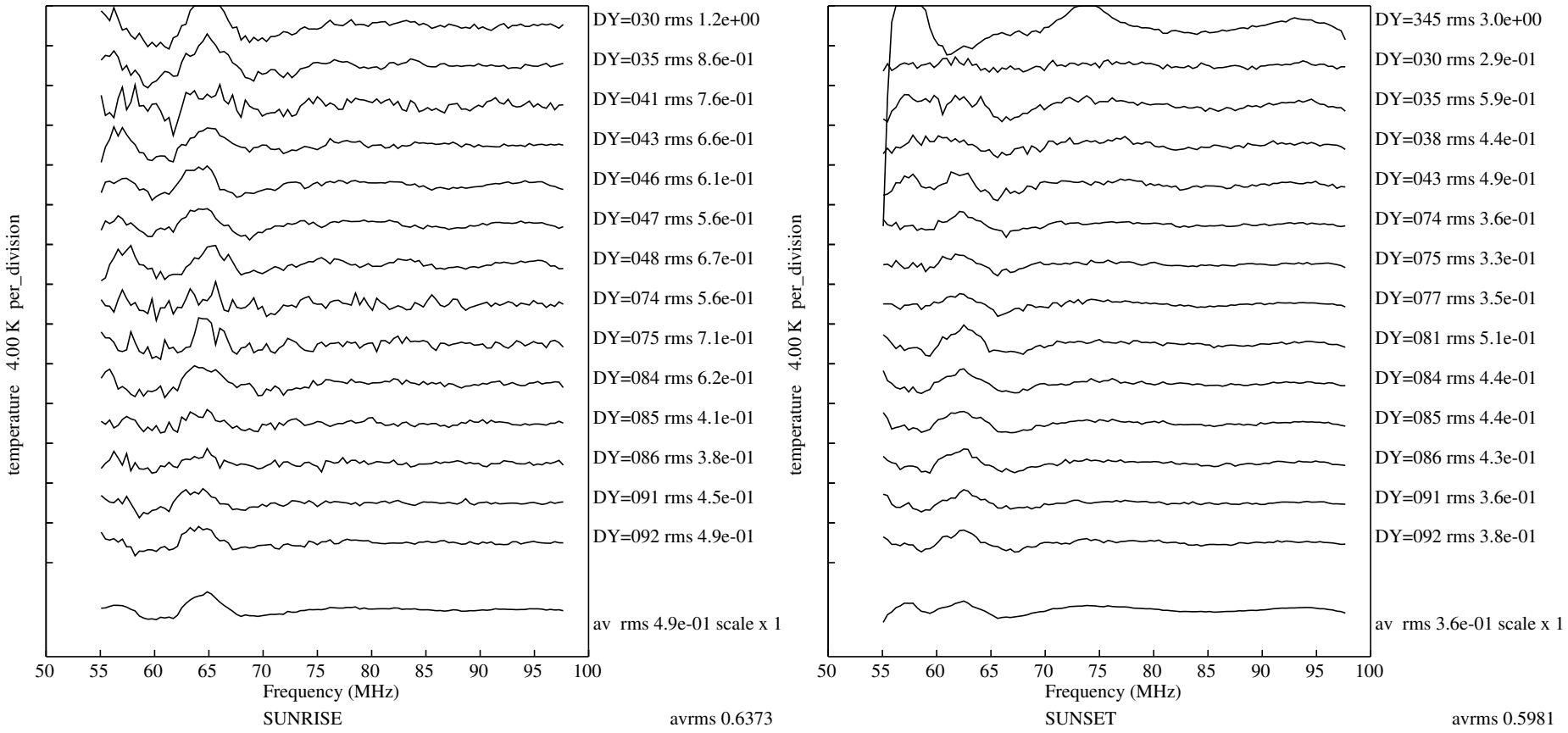

Figure 5. Spectra with 6-terms removed sun elevation from -20 to 0 degrees at sunrise and sunset