

**MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886**
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Telephone: 617-715-5533

To: EDGES group

From: Alan E.E. Rogers

Subject: Analysis of EDGES-3 data from the WA using different data block sizes

A block size of one hour has been chosen for the analysis of most of the EDGES data using the c-code pipeline. The block size determines the amount of data for which a rms residual threshold with a polynomial, typically of five terms, is used for the acceptance fully calibrated and beam corrected data. The choice of one hour is long enough to obtain enough sensitivity to filter out RFI that is not filtered out in the first stage of the processing of the individual 3-position switched data blocks.

Ideally the data should be filtered with a rms residual threshold over a range of block sizes to obtain the global 21-cm signal with the highest probability of being accurate and most free of systematic error. In practice and in the long run this will be achieved using the new Bayesian pipeline. In this memo a preliminary analysis is made using one hour and 12 hour data blocks. In addition a 24 hour block is used to cover all GHA each day, that are accepted in the first stage of processing. In this analysis only data when the sun is below -30 degree elevation is used.

center MHz	SNR	amp	Kwidth MHz	rms1 mK	rms2 mK	block size	GHA range	# terms	limit	K	Tsky K	case
78.5	25	0.49	20.9	49	20	12 hr	06-18	5	0.5	1878		a
78.5	8	0.37	20.9	42	40	24 hr	00-24	5	0.35	2811		
78.5	14	0.53	20.9	36	24	24 hr	00-24	6	0.17	2581		b
78.1	27	0.55	20.9	51	21	1 hr	06-18	5	0.35	1875		c
77.7	19	0.49	20.9	47	24	1 hr	00-24	5	0.25	1880		d
78.5	15	0.53	20.9	41	24	1 hr	18-06	6	0.40	2780		

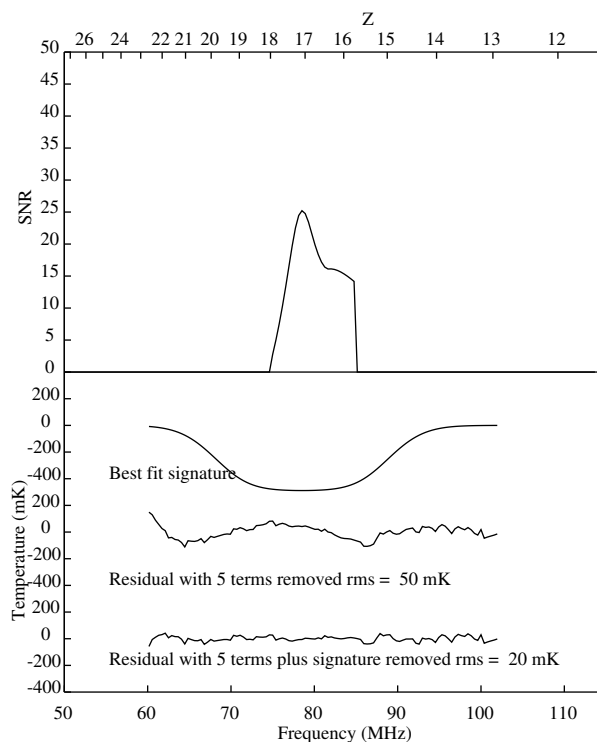
Table 1. Grid search for global 21-cm using 2025 days 1-331 tau = 4 60 - 102 MHz

These results show that a 1 hour block size in case d is better than a 24 hour block size in case b which required the use of 6 terms to get a reasonable result. The 1 hour block size in case c is marginally better than a 12 hour block size in case a.

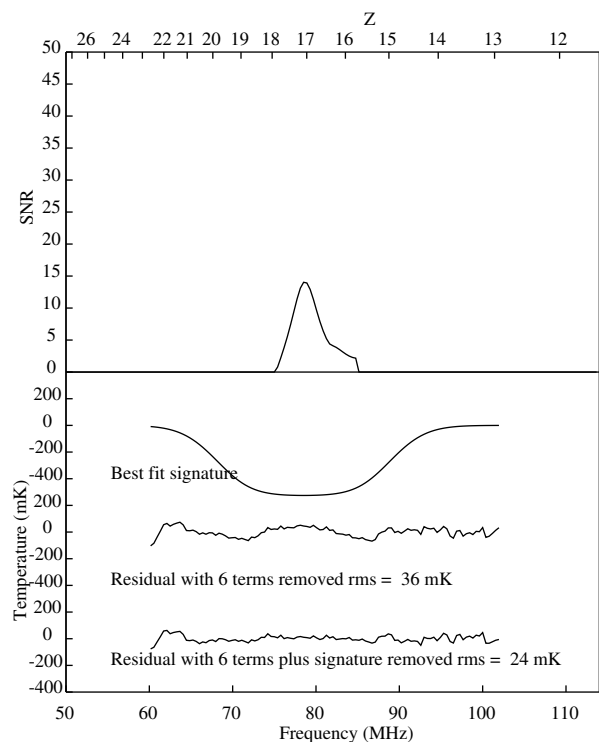
The last entry in table 1 is for a range of 12 hr centered on GHA = 0 for “Galaxy up” data which has a higher average sky temperature as a test for the presence of systematics. The residuals rms1 and rms2 are the residuals before and after the grid search for the 21-cm absorption. Tsky the sky temperature obtained at 75 MHz.

Figure 1 shows the grid search plots of the global 21-cm absorption for the results in Table 1. Several tests have been made to determine the original of the slight rise in the temperature and noise at 88 MHz, which is the start of the FM band. Little if any difference is seen if the data when the moon is below the horizon is excluded as is seen in the more sensitive tests made on data from 2024 in memo 468 but the level of FM reflections from satellites and meteors are the most likely source.

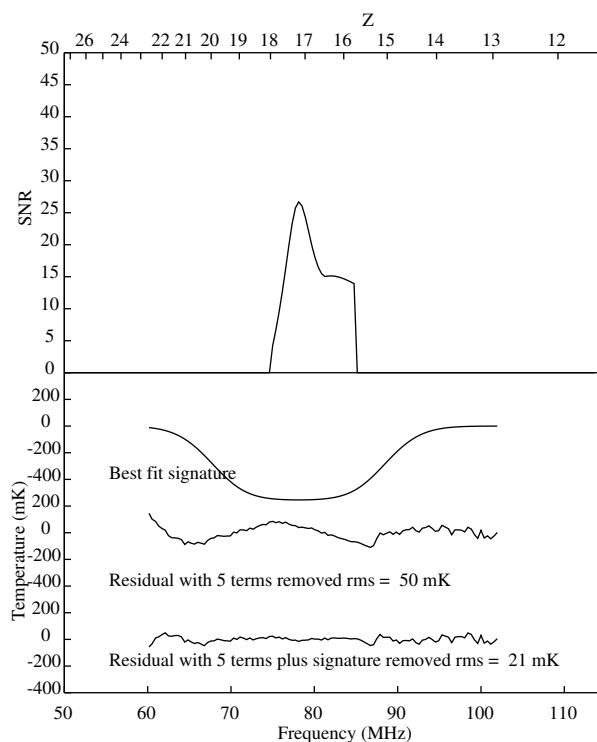
Figure 2 shows that the slight rise at 88 MHz is most significant at GHA = 5 hr and is very weak or absent at GHA 12, 19 and 20 hrs.



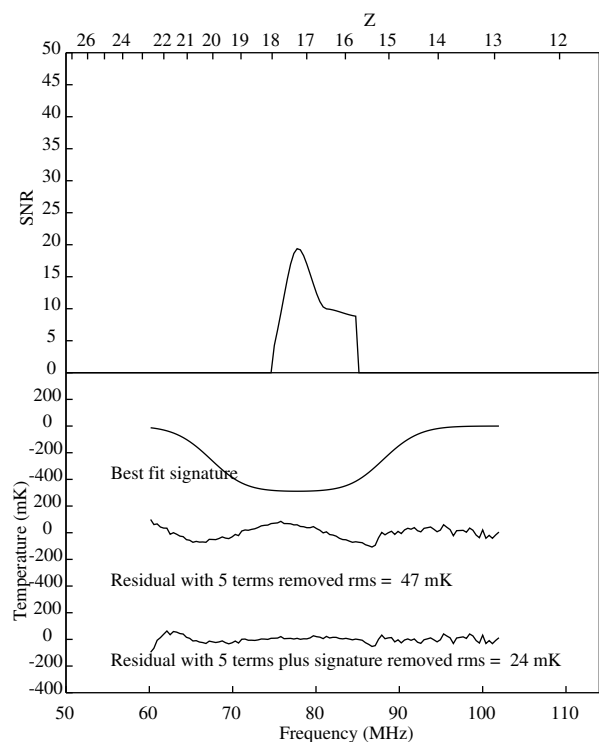
freq 78.5 snr 25.2 sig 0.49 wid 20.90 tau 4 rmsin 0.0496 rms 0.0198 60 - 102



freq 78.5 snr 14.0 sig 0.53 wid 20.90 tau 4 rmsin 0.0358 rms 0.0245 60 - 102

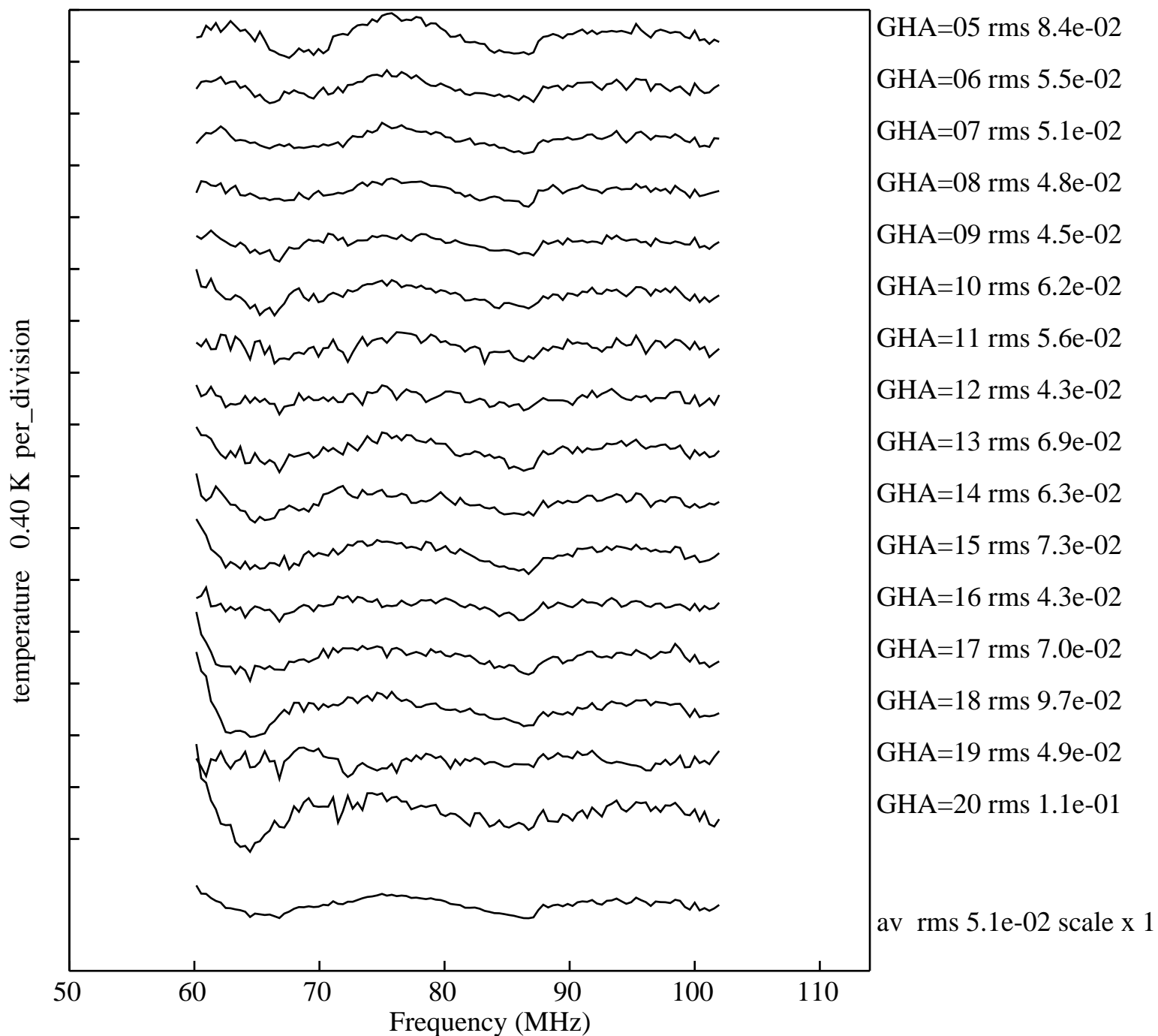


freq 78.1 snr 26.7 sig 0.55 wid 20.90 tau 4 rmsin 0.0504 rms 0.0206 60 - 102



freq 77.7 snr 19.4 sig 0.49 wid 20.90 tau 4 rmsin 0.0466 rms 0.0243 60 - 102

Figure 1. Plots of the results listed in table 1 cases a,b,c,d from top left to bottom right



avrms 0.0638

Figure 2. Plot of the 5-term residuals to data from 2025 days 1-331 vs GHA