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To: EDGES group
From: Alan E.E. Rogers
Subject: Tests of filtering EDGES-3 data from the MRO in 2023

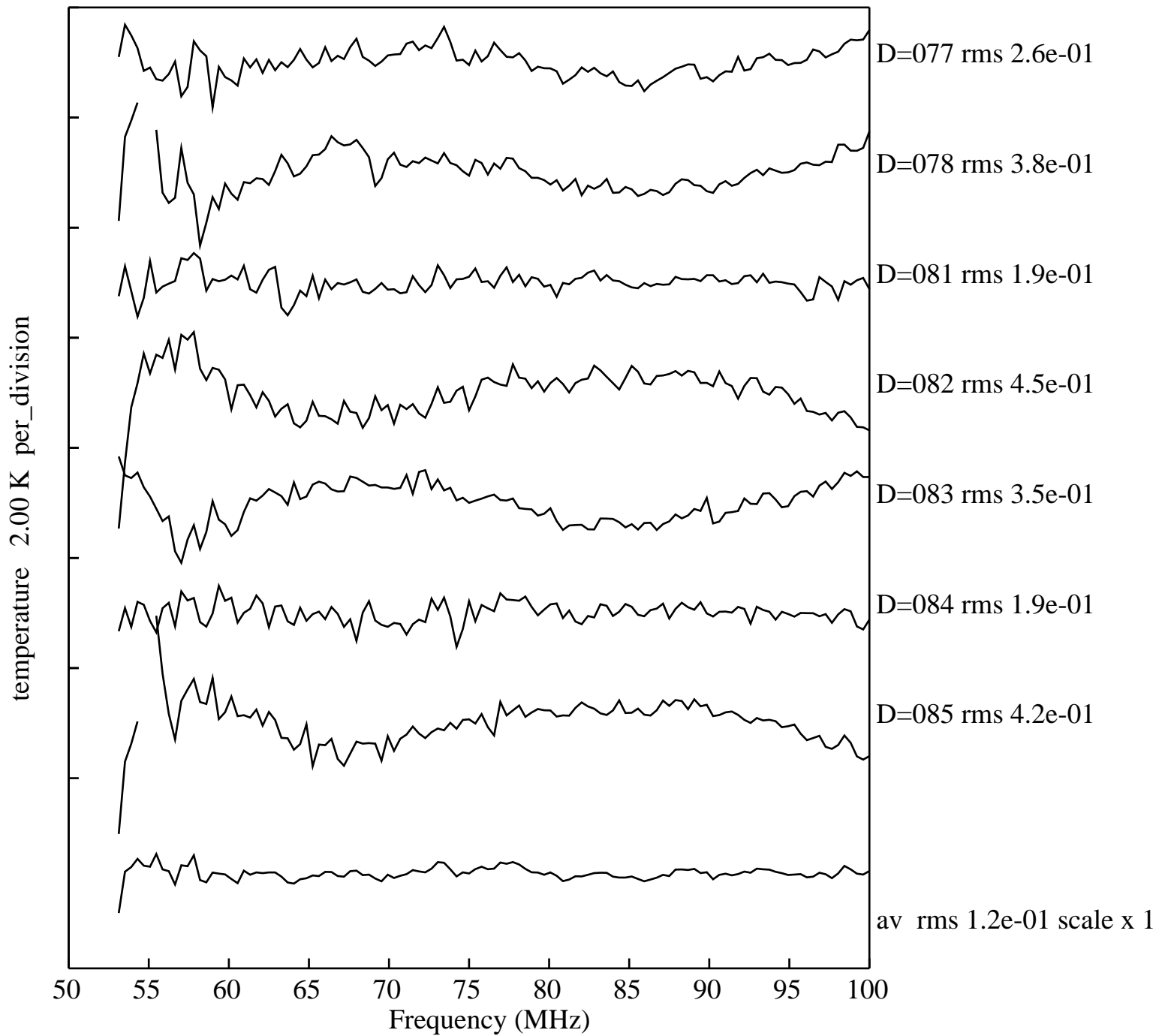
The EDGES data from the MRO in 2023 is subject to a significantly higher level of RFI from Sporadic E compared with the RFI at the same time of year in 2017. This is the result of the increase in the solar activity as we move up towards the peak of solar cycle “number 25”.

Figures 1 and 2 compare data from the MRO on the same day numbers for 2023 and 2017. These plots show the residuals made with 4 physical terms removed. In both cases a beam chromaticity correction has been made using the 408 MHz Haslam sky map scaled to the 50-100 MHz frequency band with a spectral index of -2.5. The only major difference from the processing of the 2017 data is that the FM threshold for excluding individual 3-position switch cycles of data is normally set at 200 has to be set to 1000 in order to get a reasonable amount of the 2023 data. Even though both the 2017 and 2023 data are only averaged over time for which the sun is 5 degrees below the horizon the effects of Sporadic E and other effects of the ionosphere are much more significant in 2023. Figure 3 shows that dropping the FM threshold from 1000 to 200 increases the rms on all days.

A study is currently being made of the “trade-off” between raising the FM threshold so more data is included the application of an rms threshold on blocks of averaged data so that data with RFI which is passed with the high FM threshold will be eliminated. For example if a high level of FM is mostly accompanied with other RFI which degrade the region of the spectrum being used for the absorption feature measurement then it can be an overall advantage to using the lower FM threshold to also excise the lower level RFI. The optimum FM threshold and the optimum block size in the range of 6 minutes to several hours is still under study and depends on the particular data set.

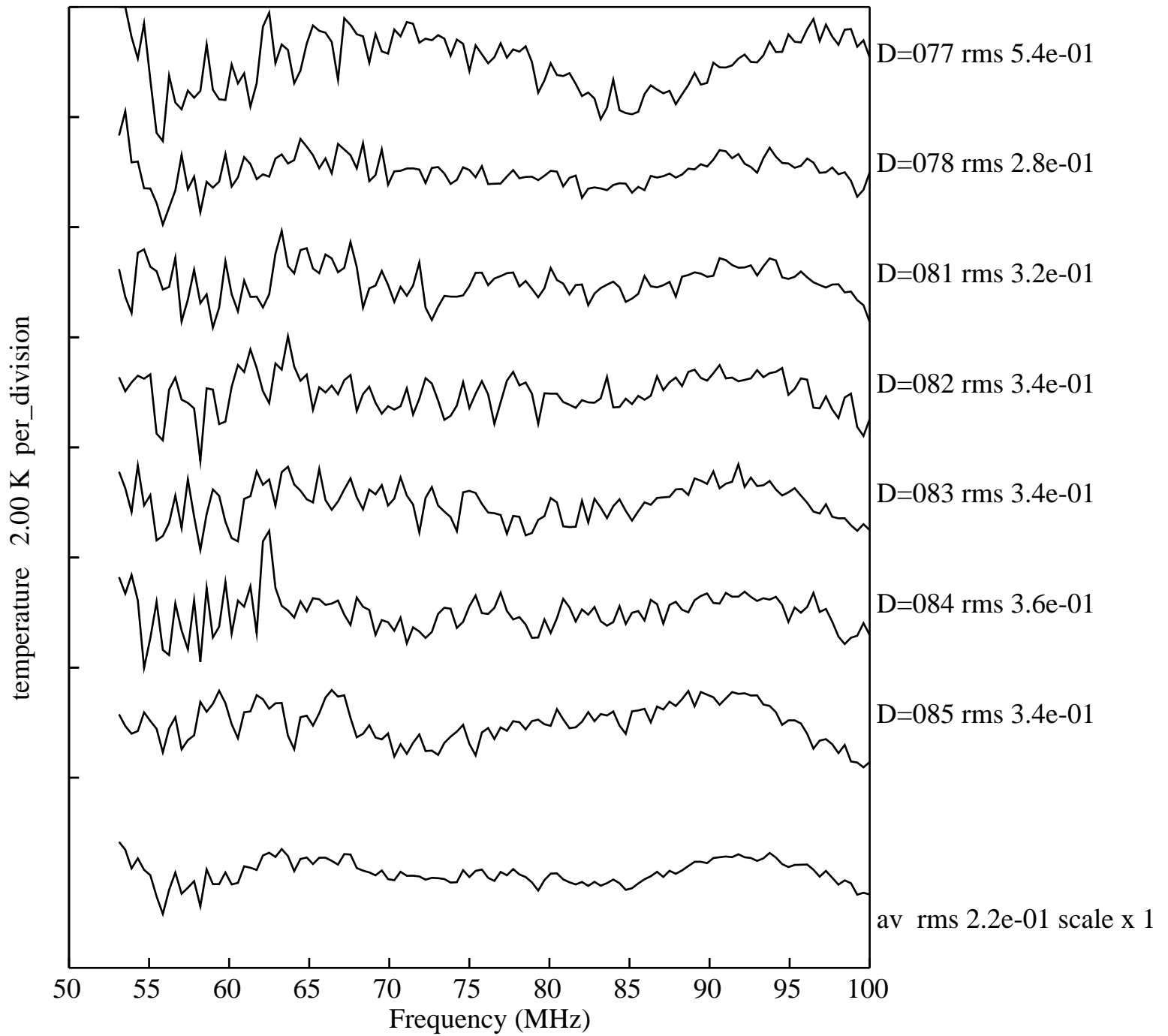
Figure 4 and 5 show that at Devon Island and at the MRO there are significant changes in the spectrum on a time scale of the 25 seconds of a single 3-position switch cycle. While the sun was above the horizon at Devon Island the sun was well below the horizon at 14.6 hours UT at the MRO. As a result of these rapid changes it was found that there is an advantage of discarding data based on a rms threshold of the calibrated spectral from each 3-position cycle. However with the current software the time needed for this process is too intensive and is not worth the small gain over setting a threshold on 30 minute blocks of data. In each plot of the residuals 5 loglog terms have been removed.

At this point in the deployment of EDGES-3 at the MRO there are some small changes in the antenna box separation, which are temporally being held together by a strap. Plastic parts have been designed to ensure a constant separation which we hope to install in the near future.



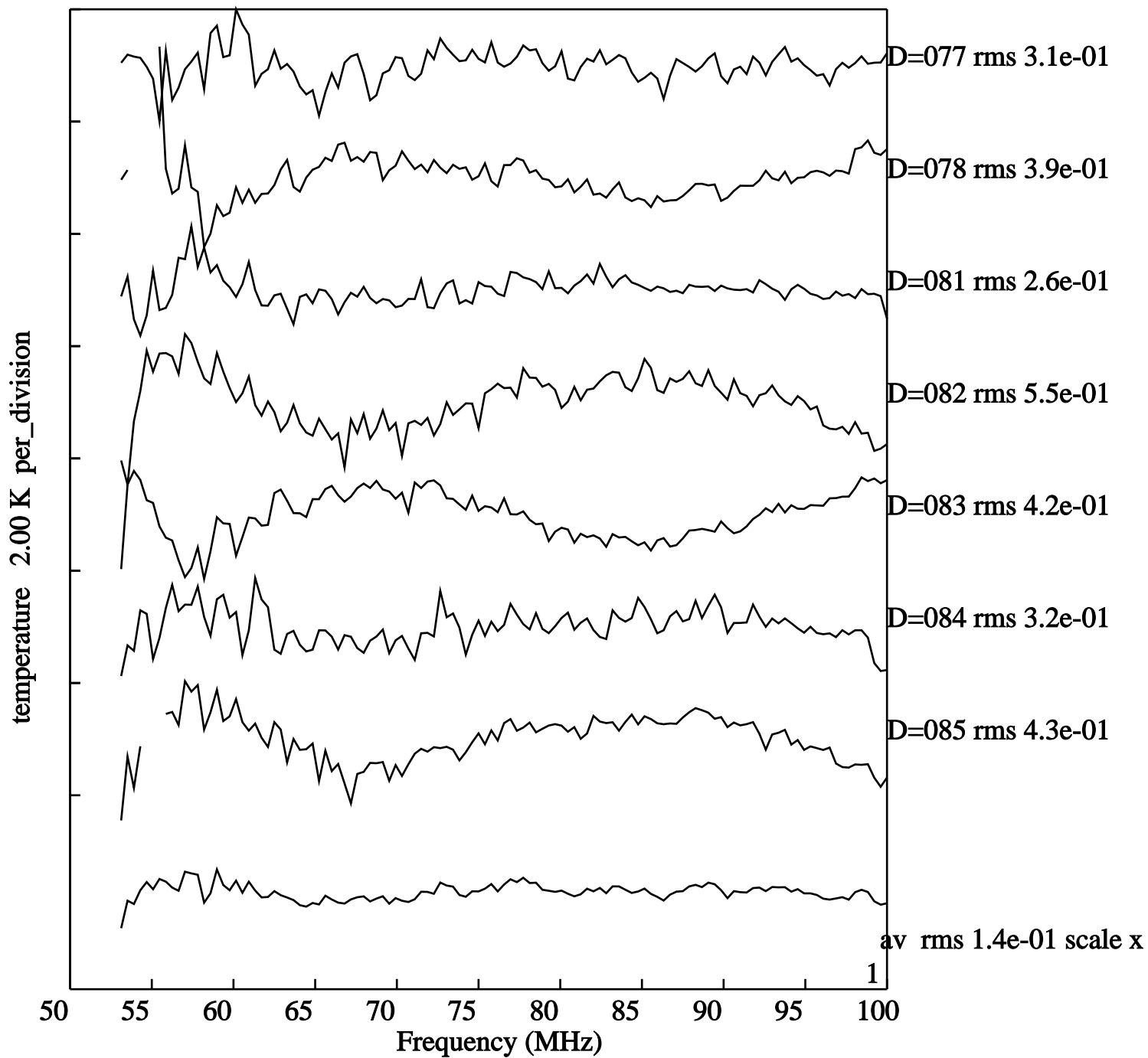
avrms 0.3203

Figure 1. Data from EDGES-3 at the MRO in 2023 with 4 physical terms removed.



avrms 0.3606

Figure 2. Data from EDGES-2 at the MRO in 2017 with 4 physical terms removed.



avrms 0.3825

Figure 3. Data from EDGES-3 at the MRO in 2023 as in Figure 1 with FM threshold 200.

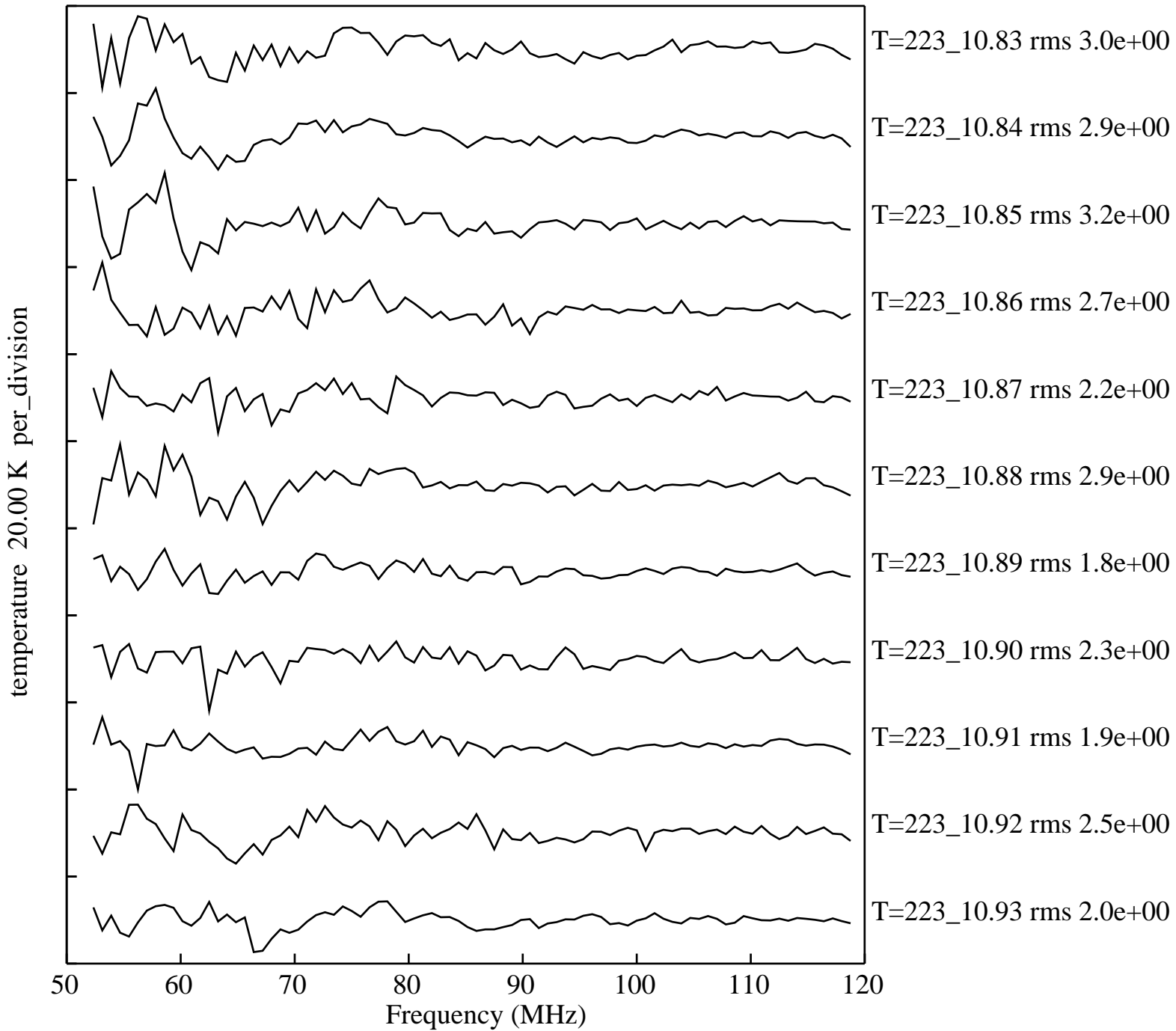


Figure 4. Data from EDGES-3 at Devon Island 2022 for sample of 3-position cycles on day 223

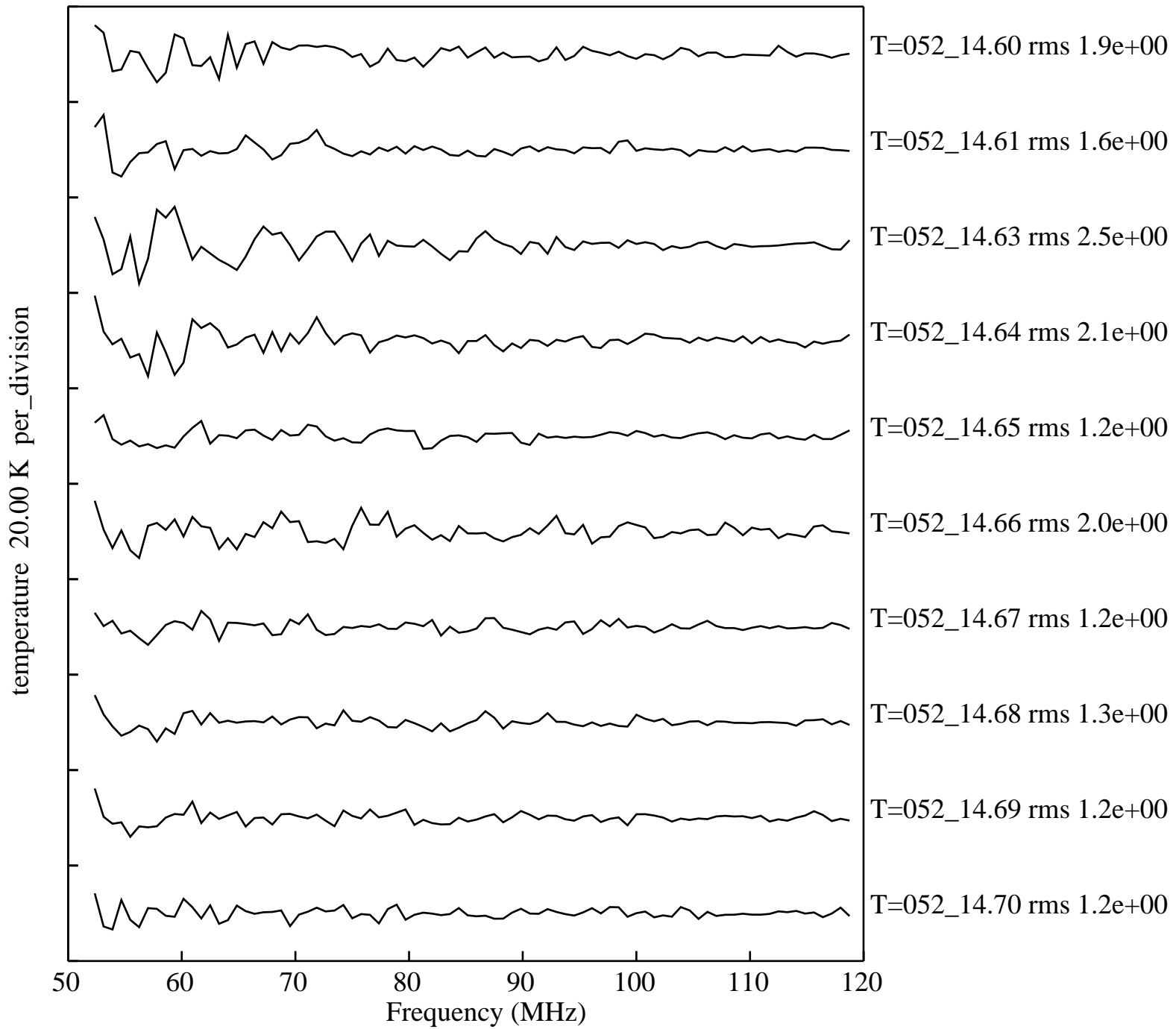


Figure 5. Data from EDGES-3 at the MRO in 2023 for sample of 3-position cycles on day 52