EDGES MEMO #450

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To: EDGES group

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Subject: Correlation of the peak at 65 MHz in the EDGES-3 data from the WA with solar activity

The bump in the spectra at about 65 MHz which is reported in memos 438, 448 and 449 was thought to be the result of scintillations of 3c273 has been examined in more detail and found to be present when 3c273 is well below the horizon. Following this discovery I follow up with a more complete examination of the statistics having already shown that it is not present when only using data with the sun more than 20 degrees below the horizon in memo 448.

Figure 1 shows that the bump at 65 MHz has been present from about day 249 in 2023 to day 174 of 2024 with a strength which peaks around day 310 in 2023 and is even stronger in the 10 day blocks which end at days 164 and 174 of this year. The day number of each 10 day averages is the last day of each 10 day block.

Figure 2 shows that there is little variation in the spectra from day to day when averaged over a day. Figure 3 shows that there is some variation from hour to hour. The lack of a bump for GHA from 18 to 04 hours is because that sun is more than 20 degrees below the horizon at these GHA. Figure 4 shows the lack of any bump at 65 MHz on the same day number in 2023. This is consistent with a lack of sufficient solar activity on this day in 2023 for the solar wind coming from the sun along the sun's magnetic field to penetrate the earth's magnetic field to reach the ionosphere with suprathermal electrons if this is the process involved.

Figure 5 shows that when averaged over an hour the spectrum is fairly constant for one hour to next. There is also good consistency at sunrise at GHA = 06 and sunset at GHA = 19. Figure 6 shows that scintillations of 3c273 are unlikely to be the mechanism for the bump at 65 MHz as the bump is still present when 3c273 is more than 20 degrees below the horizon. I also checked that CTA59 had no effect on the signal at 65 MHz so that scintillation of this strong radio source is not involved. The lack of a bumps at GHA 2 to 5 are because the sun is more than 20 degrees below the horizon at these GHA.

Figure 7 shows the bump at GHA=11.9 is much stronger than the average and figure 8 shows the details of this bump on a time scale of 36 seconds. Figure 9 shows how the bump at 65 MHz extends over all GHA for which the sun gets above -20 degrees. The added source of the radio noise at 65 MHz is unknown but is dependent on solar activity. The frequency range in Figure 9 is extended down to 55 MHz with 5-terms removed to see the structure of the bump in more detail.

In summary the mechanism of the added emissions at 65 MHz is dependent on the sun being above -20 degrees below the horizon and is not from the scintillation of 3c273 or other strong radio sources. While the mechanism of the generation of the emission is unkown it most likely involves the solar wind. Emission is prevalent and highly variable on a time scale of minutes but averages to a fairly constant value on a scale on an hour. The overall scale of long term variation is consistent with the solar rotation period of 37 days and on this scale are correlated with the X5 solar events which peak on

31 December 2023 and 10 May 2024. While it is likely that the origin of the bump is related to signals generated by the sun other mechanisms like emissions from the power conversion electronics connected to the solar panels of satellites which would depend on illumination of the panels by the sun is under study.

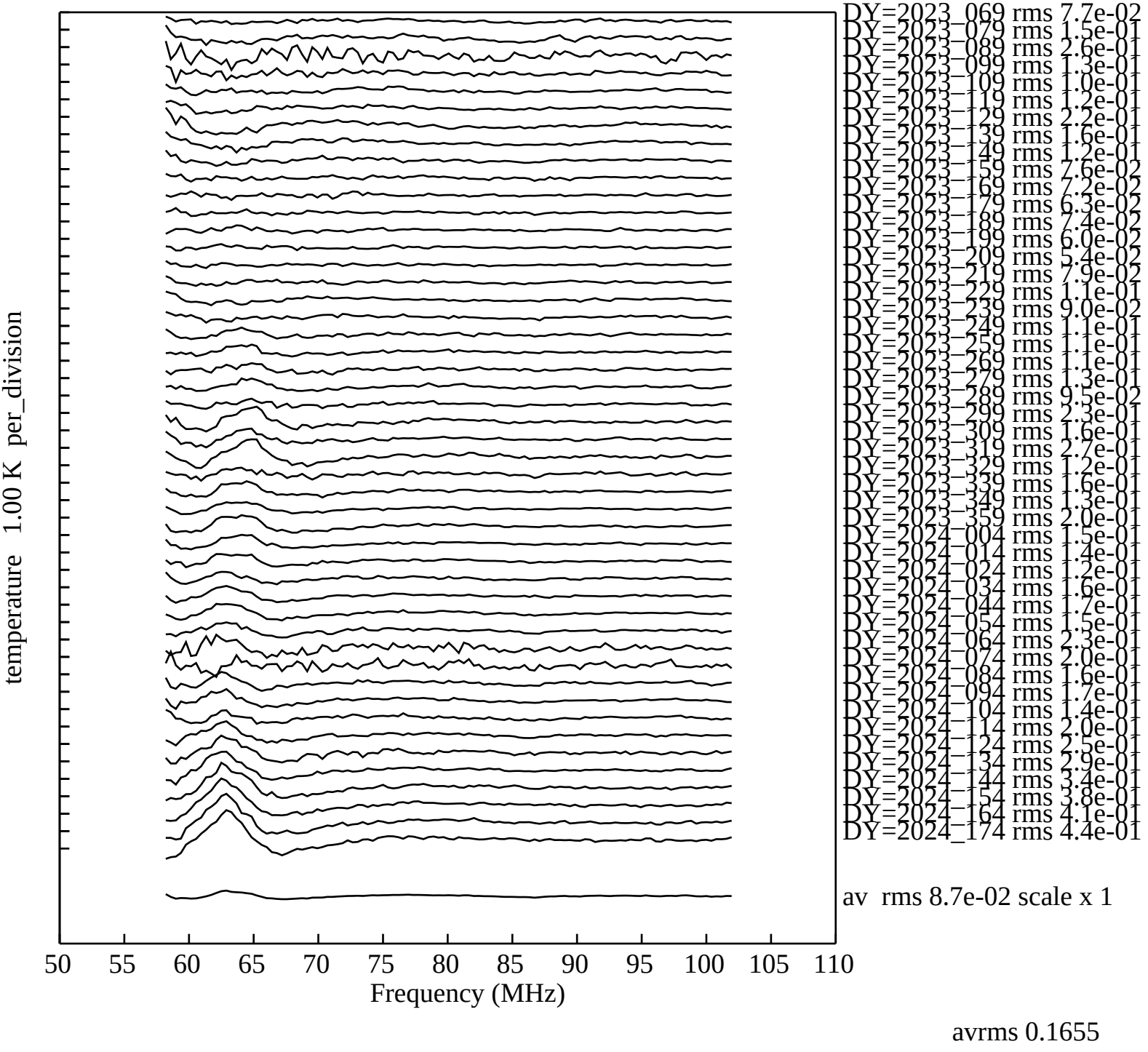

Figure 1. Data blocks centered at GHA = 12 with 5-terms removed in 10day blocks 2023-2024

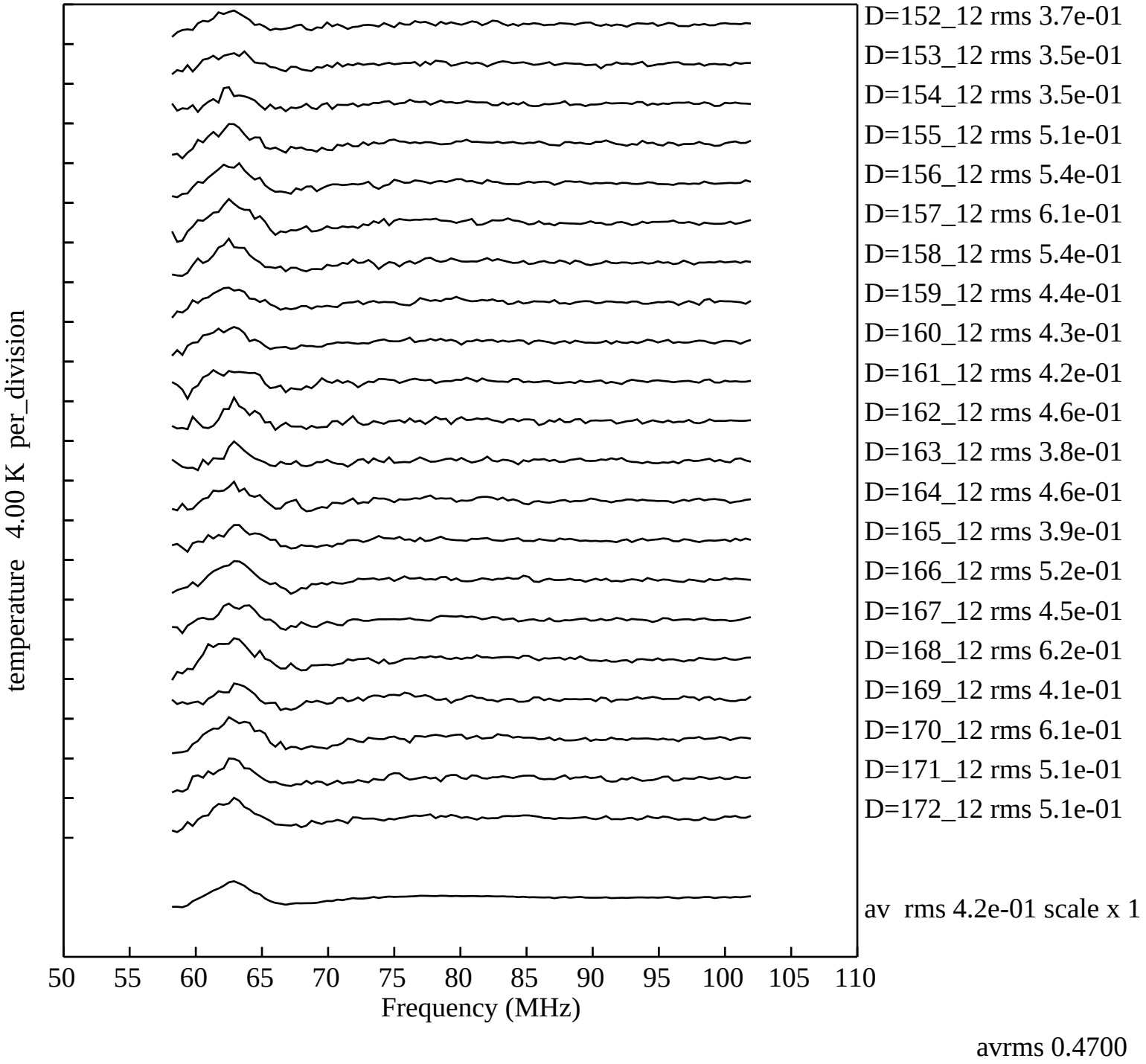

Figure 2. 12 hour data blocks centered at GHA = 12 with 5-terms removed for 2024 day 152 to 172

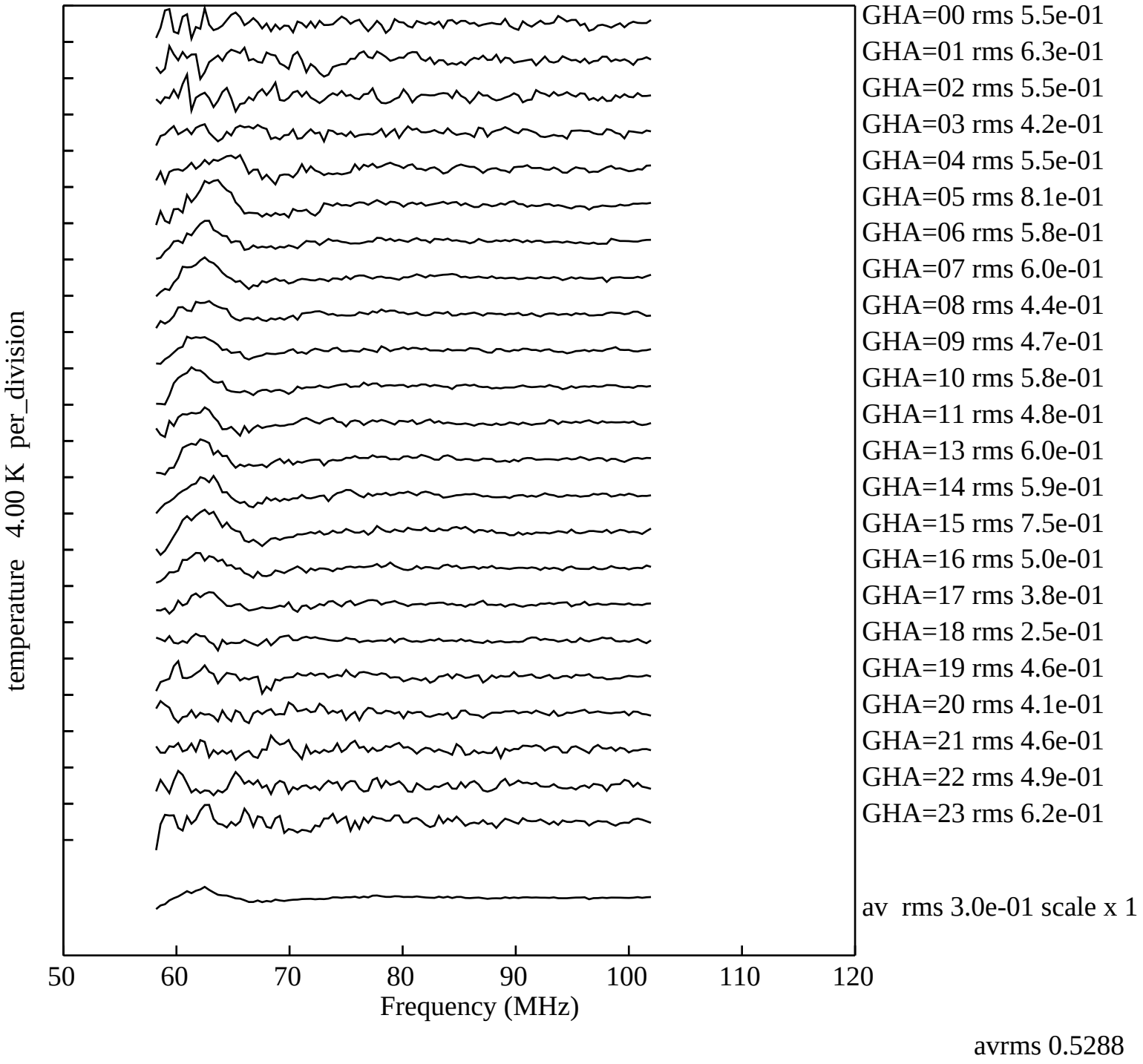

Figure 3. 1 hour blocks of GHA for day 149 in 2024

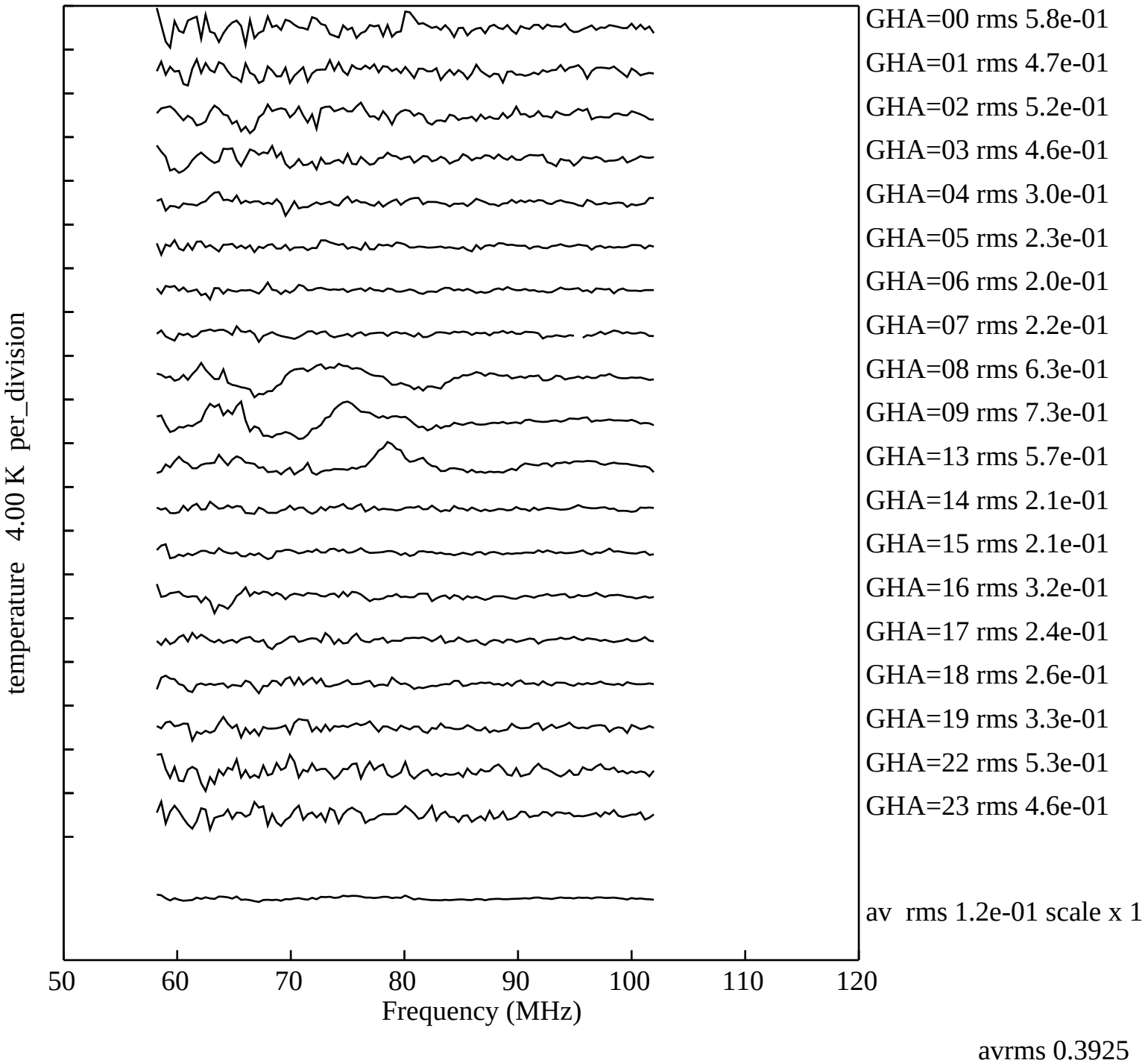

Figure 4. 1 hour blocks of GHA for day 149 in 2023

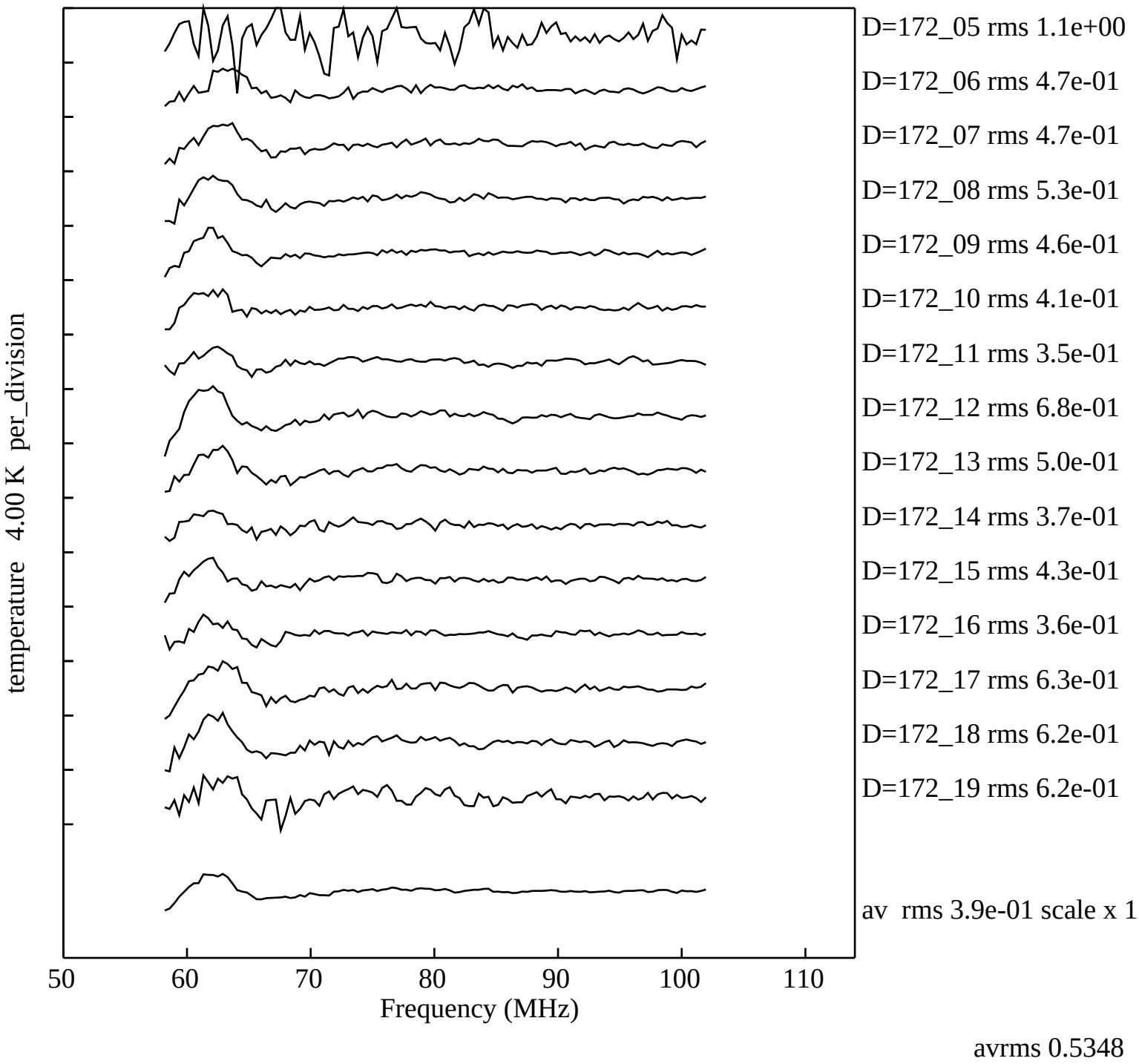

Figure 5. 1 hour blocks of GHA for day 172 in 2024 when sun above -20 degrees

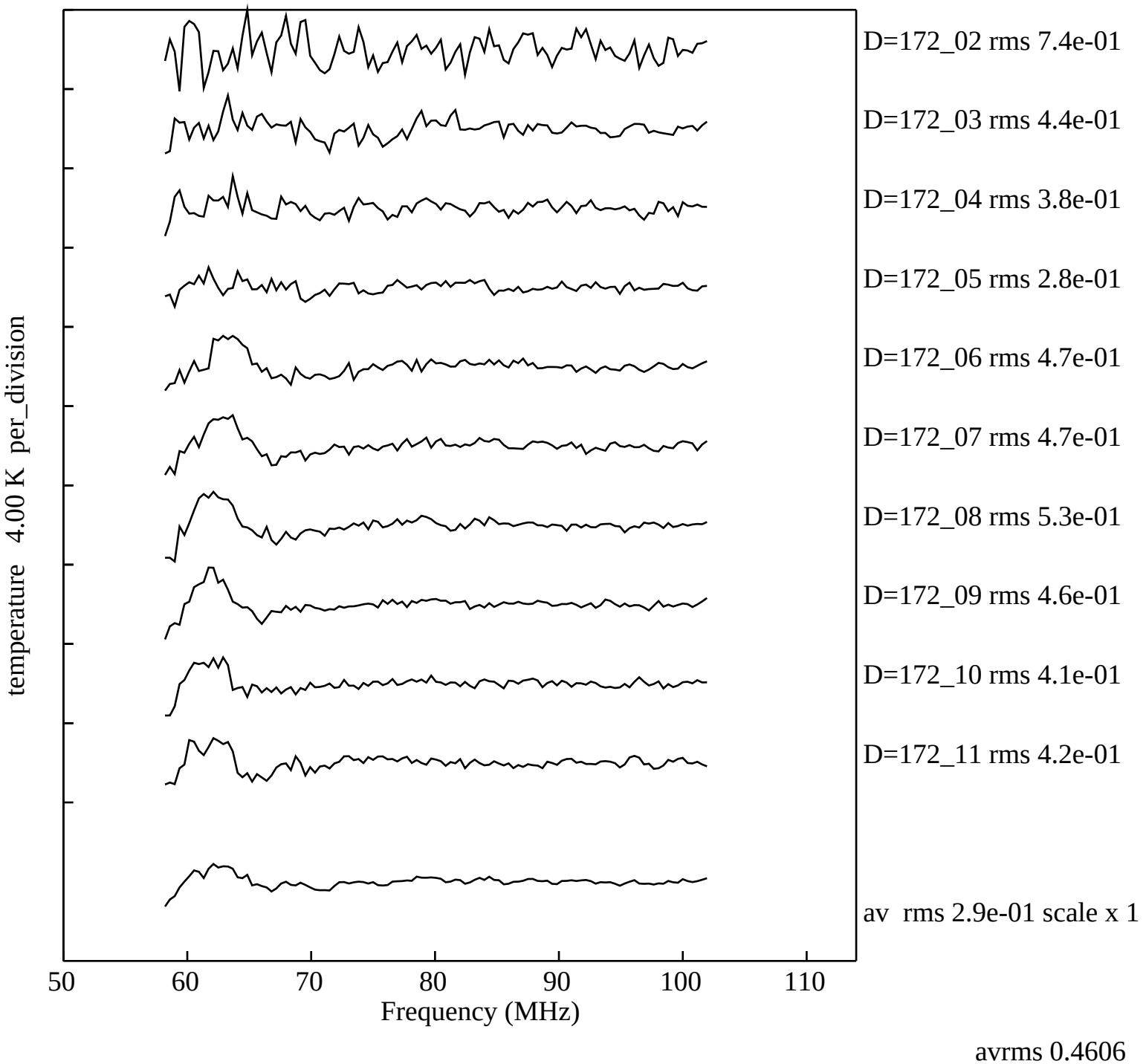

Figure 6. same as figure 5 but with 3c273 more than 20 degrees below the horizon

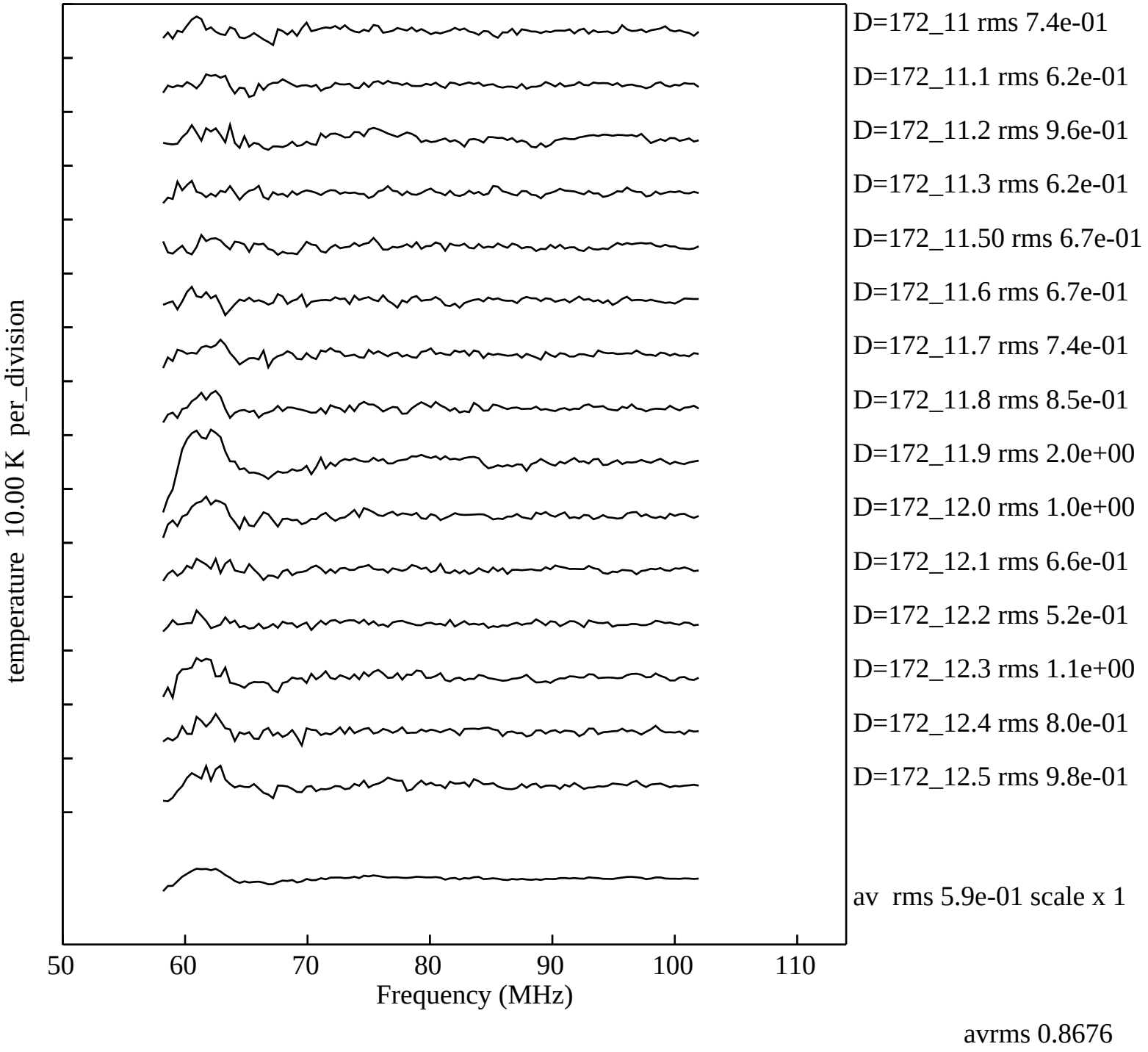

Figure 7. same as figure 5 for GHA 11.0 to 12.5 in 6 minute blocks

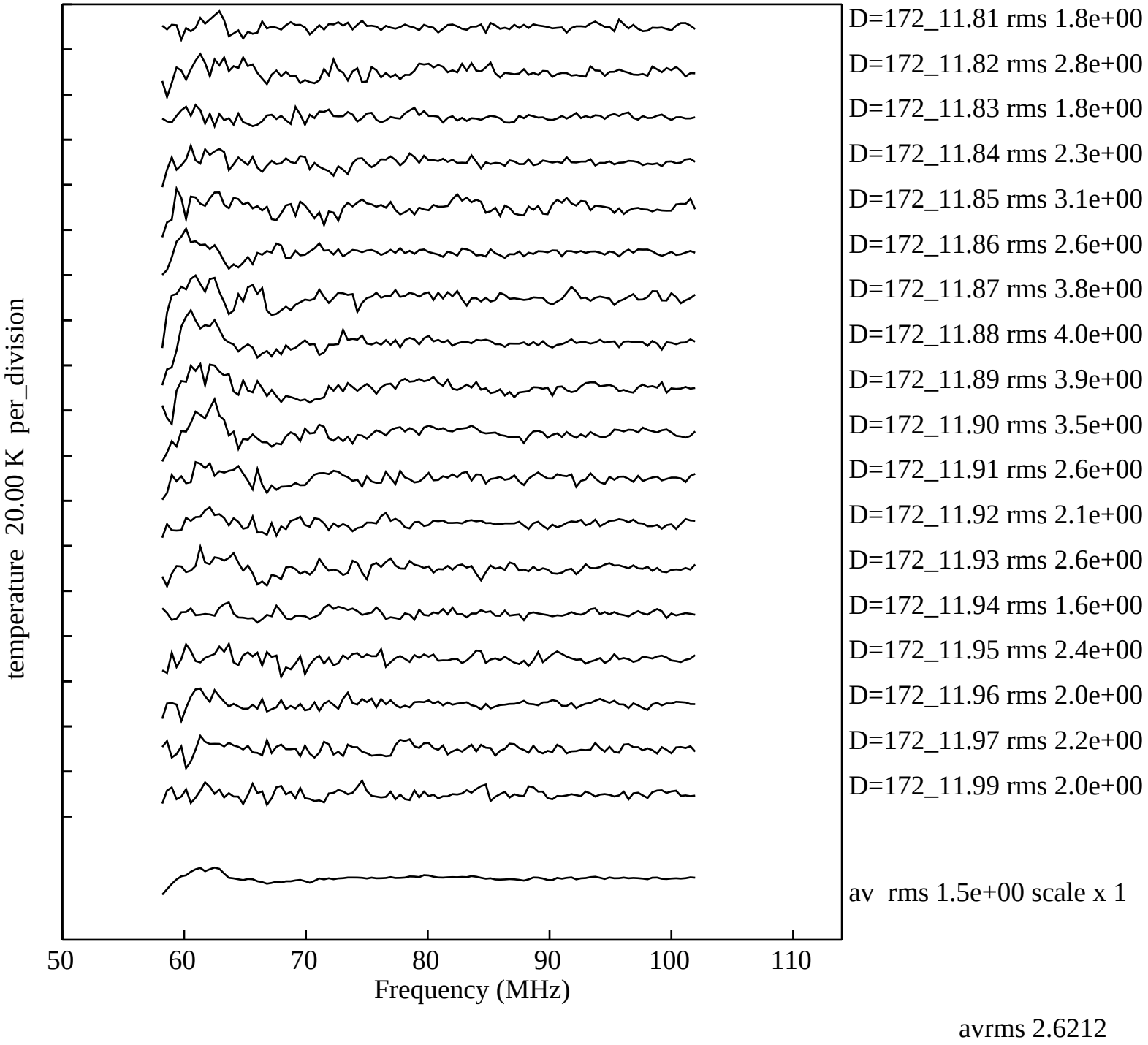

Figure 8. same as figure 5 for GHA 11.81 to 11.99 in 36 second blocks

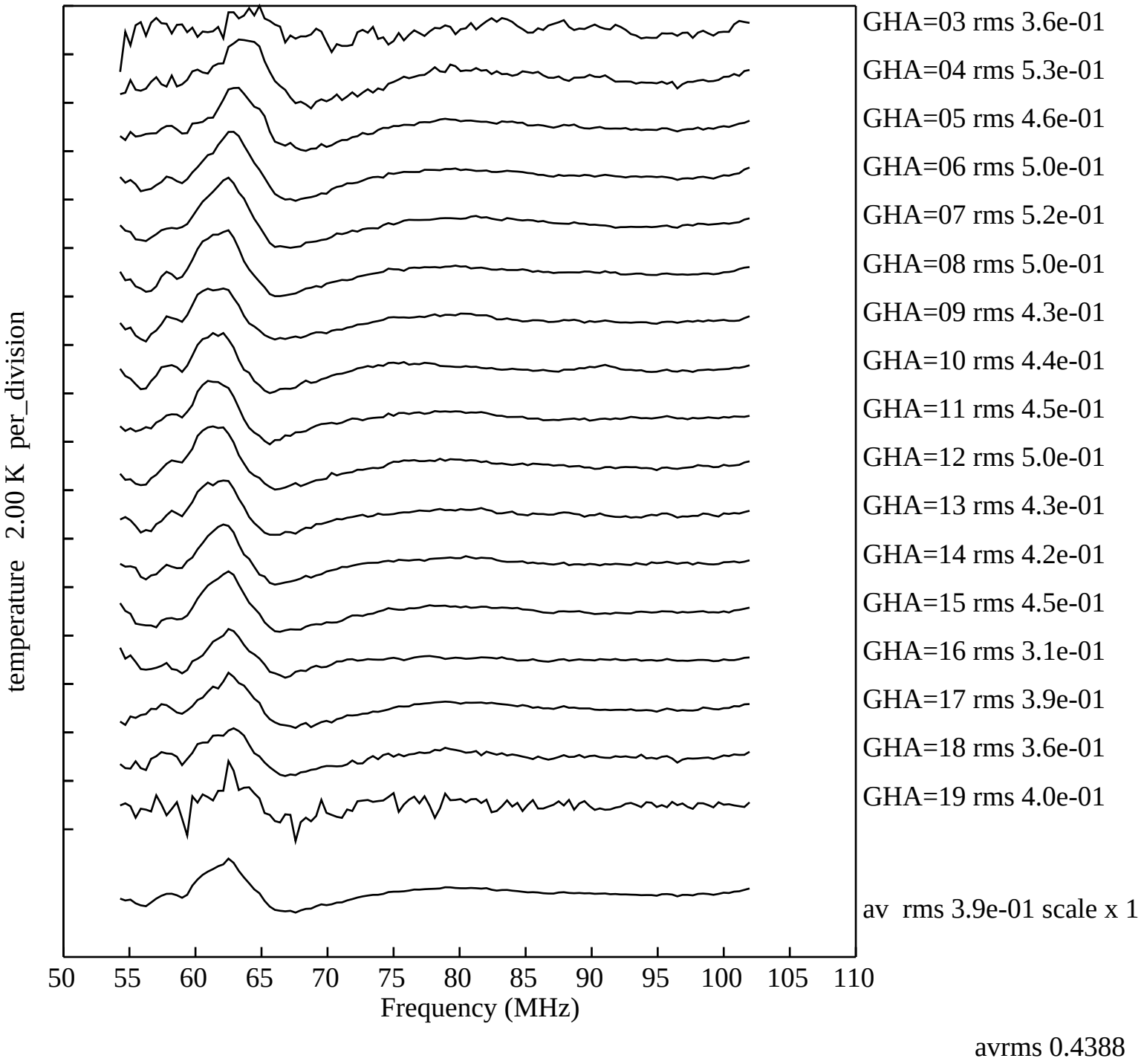

Figure 9. 1 hour blocks of GHA averaged from 2024 day 130 to 172 with the sun above -20 deg