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To: EDGES Group
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Subject: ADC saturation by lightning

In February 2020 EDGES low2 and midband were restarted at the MRO. Some ADC saturations were seen at both the low2 and midband systems which were initially thought to be caused by local RFI but after looking at the data it was found that the antenna spectra with an ADC flag indicating at least one time sample saturation within the 10 second block looking at the antenna were correlated with broadband noise. Figure 1 shows a “waterfall” plot from day 58 low2. The “red” portions of the total power in the graph at the top indicate the presence of an ADC saturation. These only occur in the time range of about 08 to 13 hours UT and appear to be associated with vertical streaks in the spectra and not the RFI from Orbcomm and other narrow band signals in the range 100 to 140 MHz. A waterfall plot shown in Figure 2 obtained for midband had ADC saturations at the same times within the 30 second resolution but not identical because the time blocks are not synchronized.

The individual RF bursts from lightning are probably relatively short compared with the 10 second integration of an individual spectrum and may come from lightning a few 100 km away because the lightning could be as high as 50 km but most likely at an altitude of about 10 km. Some references estimate peak radiated power at 50 MHz of tens of KW but with durations of only a few microseconds. A burst of 10 kW 10 km away results in a peak power at the LNA of about 0.02 milliwatts.

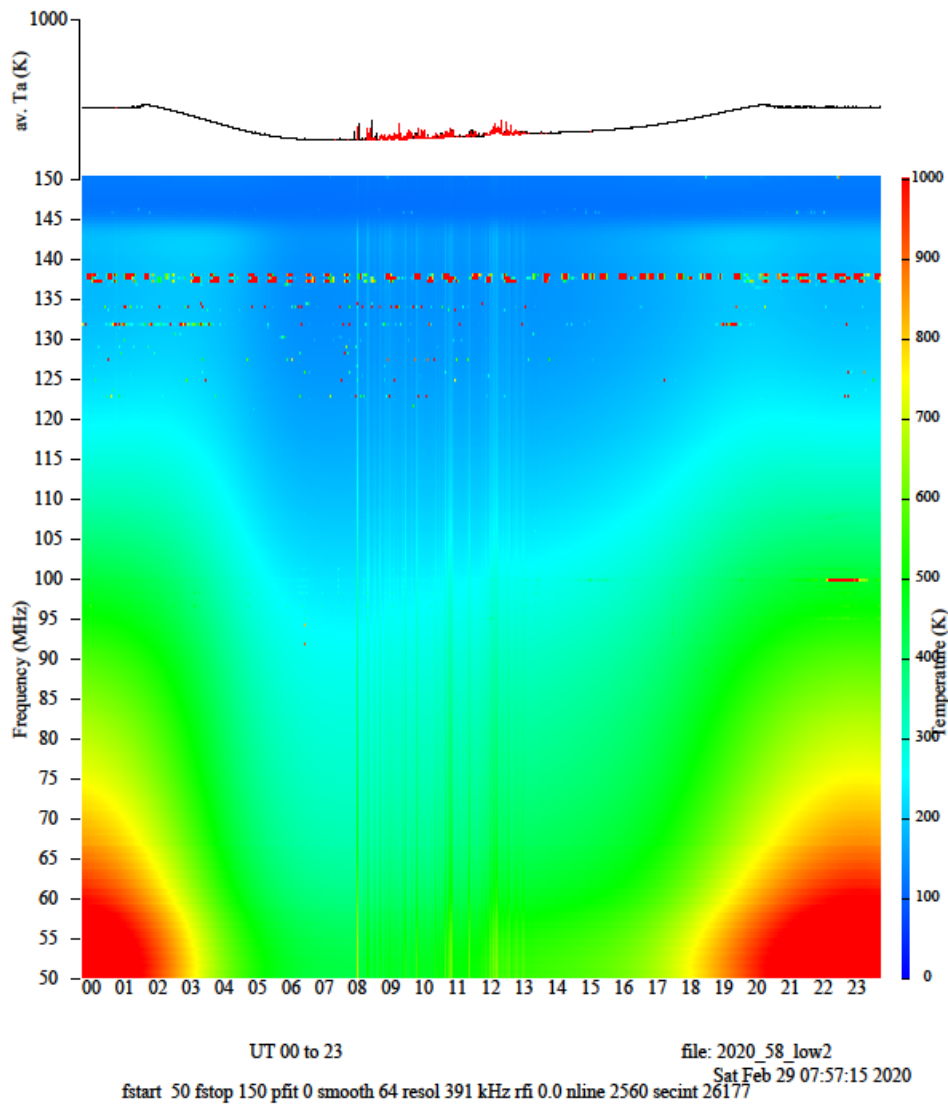


Figure 1. Low2 spectra with red points in av.Ta indicating ADC saturation.

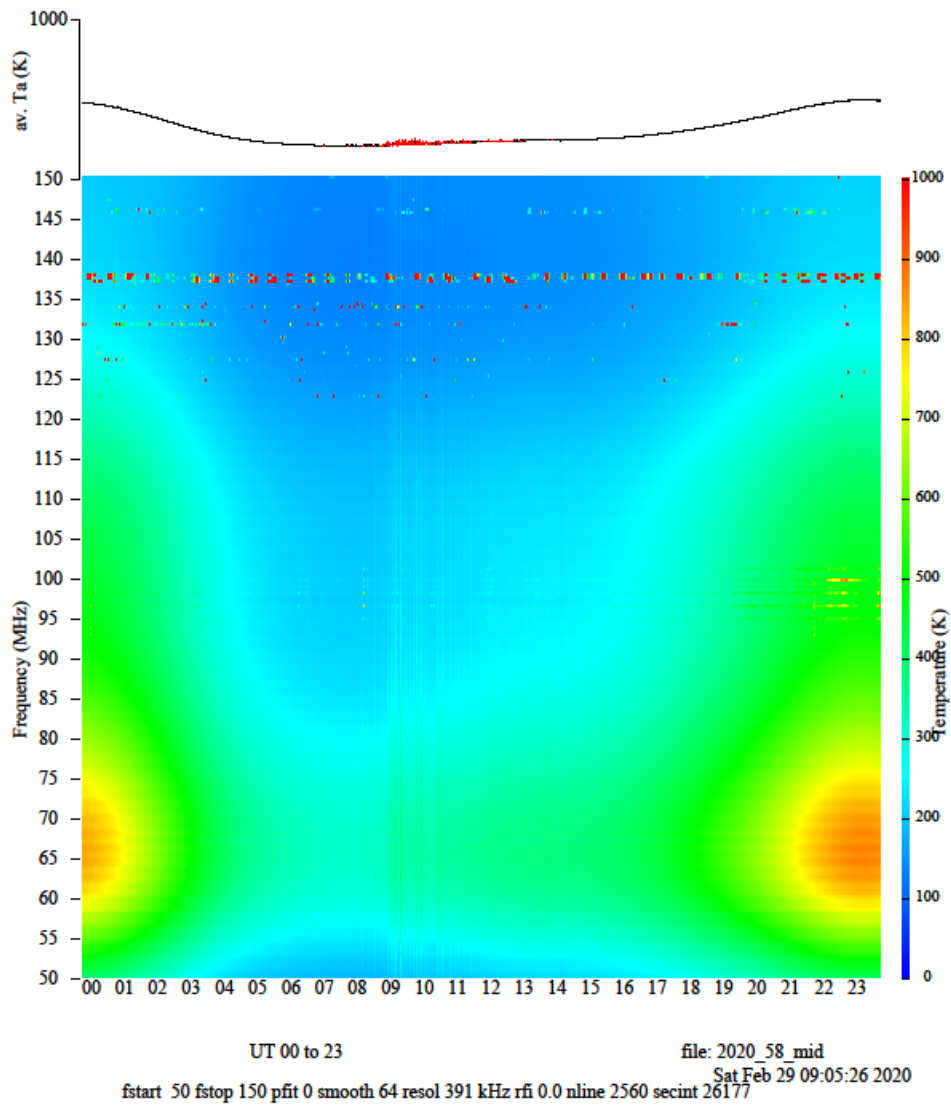


Figure 2. Midband spectra.