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To: EDGES Group

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Subject: Study of feature at 115 MHz

A positive feature with a width of about 20 MHz centered at about 115 MHz shows up in the 2015 EDGES Data. It is strongest on day 20 and is shown in Figure 1 as a function of sidereal time. The curves in Figure 1 are the residuals to calibrated data after the removal of a 6 term polynomial. The integration time is 0.25 hours centered at the times and Galactic center hour (GHA) angles shown. The spectral resolution has been smoothed to 1.5 MHz. The feature, which is strongest on day 20, when its amplitude is about 500 mK is variable and is typically at 200 mK but is not always present. So far no significant correlation has been made with the presence of rain or other events. All days from 16 thru 30 have been examined and all days except 16, 17, 18 and 28 have a discernable “bump” at 115 MHz. Days 29, 30, 31 and 32 are effected by rain. In all cases when the feature is evident it is present for about 1 hour centered at -5 GHA. In order to look for the feature in data from 2012, 13 and 14 another technique is used in which spectra are derived by taking the difference between a 1 hour integration and the scaled average spectrum for 1 hour integrations on either side. In this case uncalibrated data can be used and the data is fit with 3 parameters as follows:

- 1] Minimize the rms difference by adjusting the scale of the average.
- 2] Removed a constant and a slope from the difference with best scale.

An example of this method is shown in Figure 2 for day 20. The range of Galactic center hour angles (GHA) covered are those for which the all 3 hours of data used in each case are at night. So far search of data from previous years has not shown any similar feature. In some cases these are features which are certainly the result of RFI. For example Figure 3 shows a search of data from day 71 of 2013 for which the “dip” at -3 hours GHA at 110 MHz is the result of some FM RFI which can be removed using more aggressive RFI excision. All attempts to remove the feature in the 2015 data with more aggressive RFI excision have not been successful. More data will be needed to see if the feature continues to appear at the same sidereal time. At this point it is noted that if the feature is the result of some “new” resonance in the antenna it would be expected to be present for longer than 1 hour. In fact all attempts to simulate a feature by adding a spectral source to the sky map and using the sky convolved with the antenna beam have failed to produce a feature that is present for less than about 3 hours.

In order to produce a beam that changes rapidly with angle the structure has to be large. One possibility under study is the effect of the edge of the ground plane in producing finer structure in the antenna beampattern. In this case changing ground conditions would effect the beampattern.

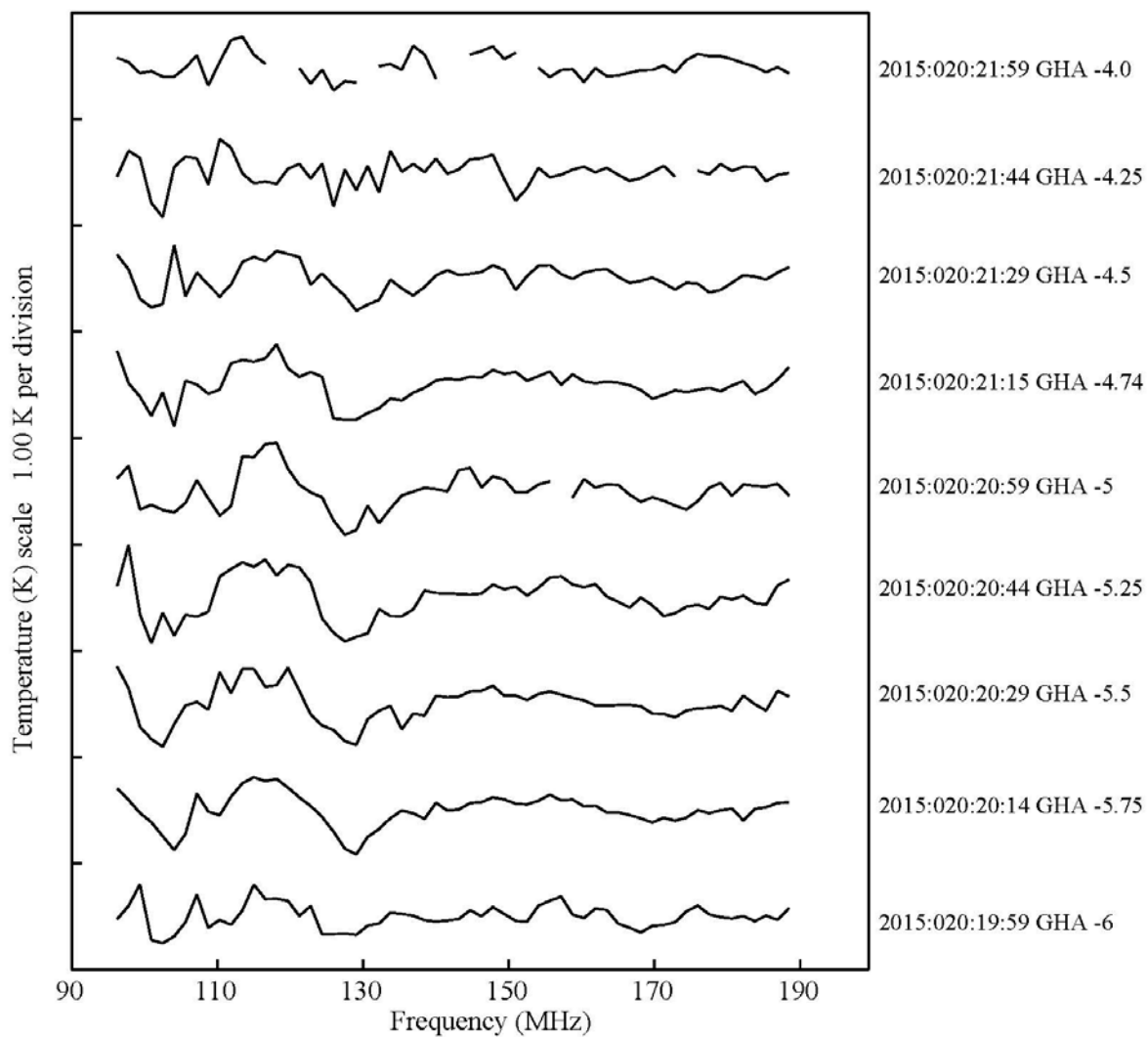


Figure 1. Example of a day with a feature at about 115 MHz which peaks at about 5 hrs before the transit of the Galactic center.

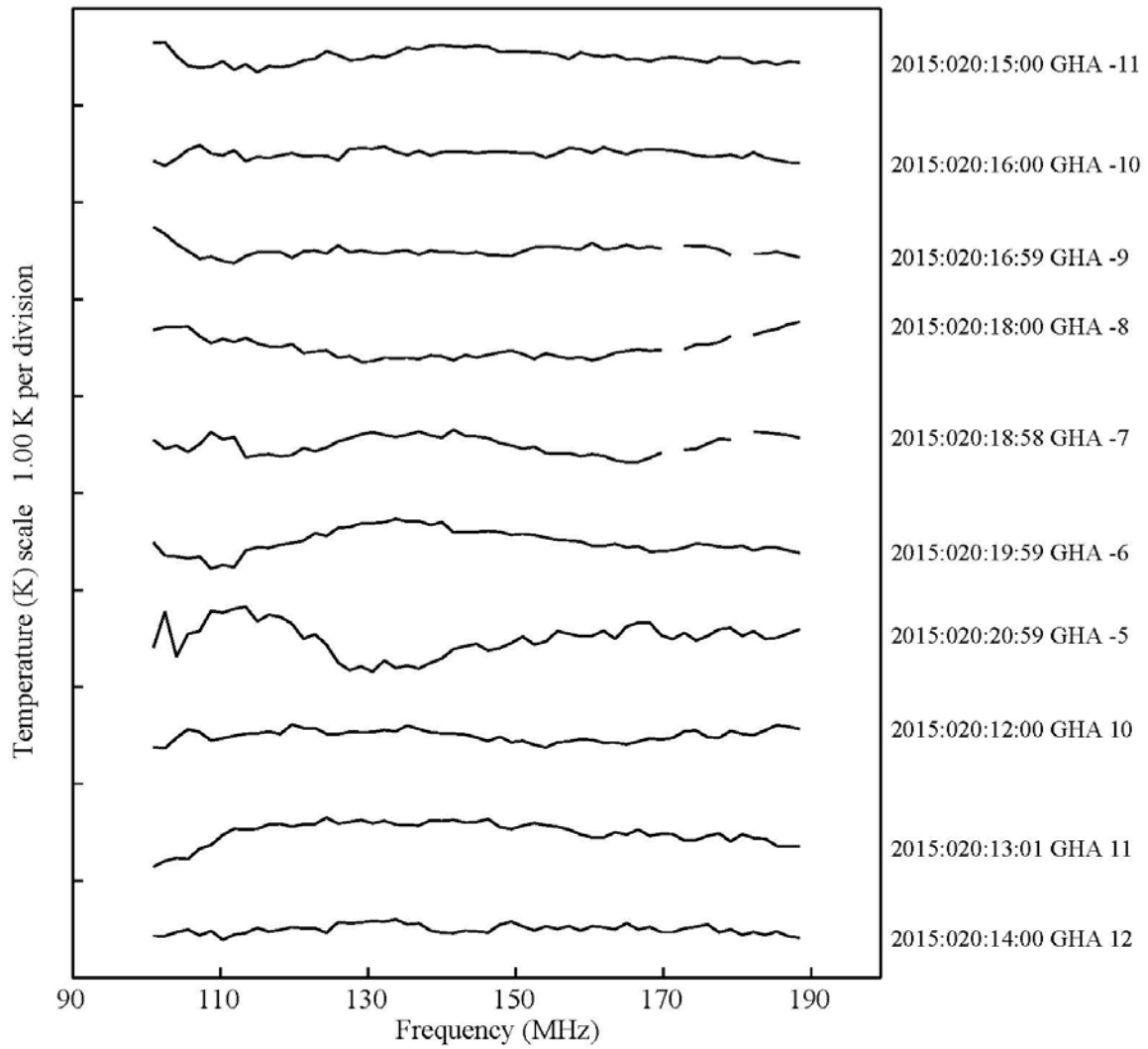


Figure 2. Spectra obtained from the difference between a 1 hour integration and the average of 1 hour integrations on either side of the same GHA.

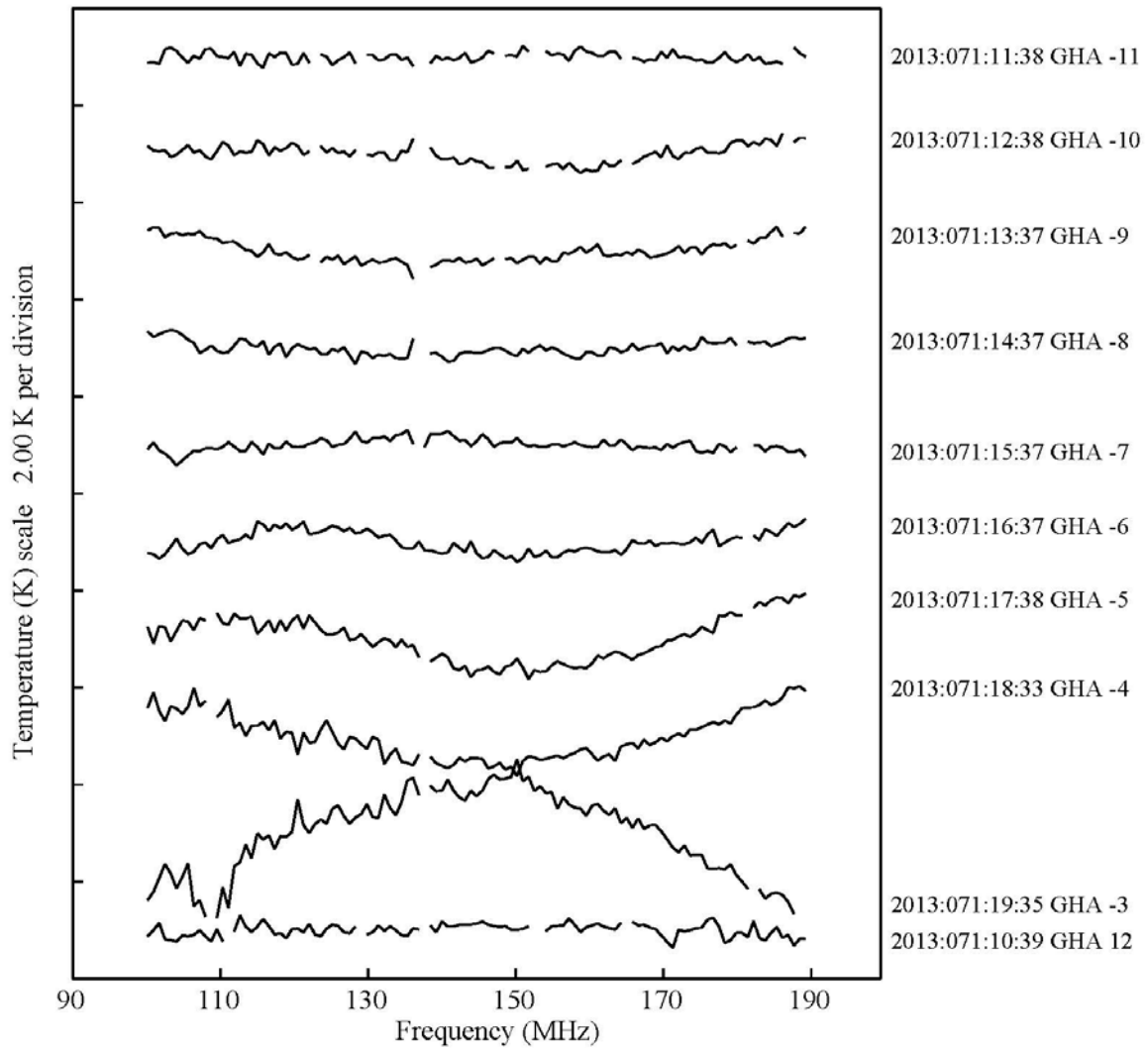


Figure 3. Example of using the difference spectra to look for weak features in uncalibrated data.