Midband Spectral Index

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This report summarizes the midband spectral index estimation done using the days 2018_147 to 2018_222. The initial processing of the midband data was done with my processing pipeline. That involved the following:

1.) S11:
   a.) File: 2018_147_17_03_25*
   b.) Fit: 13 Polynomial terms
   c.) LNA fit: 37 Fourier terms
2.) Cal_file: Rcv01 Memo#122
   a.) cterms - 6, wterms - 8
3.) Beam:
   a.) ● Type: Real ground
   b.) ● Fit: 9 polynomial terms
4.) Balun Loss: applied

To estimate the spectral index the following fitting equations were used:

$$T_\nu = T_{75}\left(\frac{\nu}{\nu_o}\right)^{beta}$$

$$T_\nu = T_{75}\left(\frac{\nu}{\nu_o}\right)^{beta + gamma(log(\frac{\nu}{\nu_o}))}$$

$$T_\nu = T_{75} * e^{-\tau\left(\frac{\nu}{\nu_o}\right)^2} * \left(\frac{\nu}{\nu_o}\right)^{beta}$$

$$T_\nu = T_{75} * e^{-\tau\left(\frac{\nu}{\nu_o}\right)^2} * \left(\frac{\nu}{\nu_o}\right)^{beta + gamma(log(\frac{\nu}{\nu_o}))}$$

Where tau is taken to be 0.005

The data was binned into **125 bins in frequency (60-160 MHz, i.e, 800KHz)** and 72 GHA bins (20min) resolution

1.) ***Fitting:*** **<u>60 to 160 MHz</u>**

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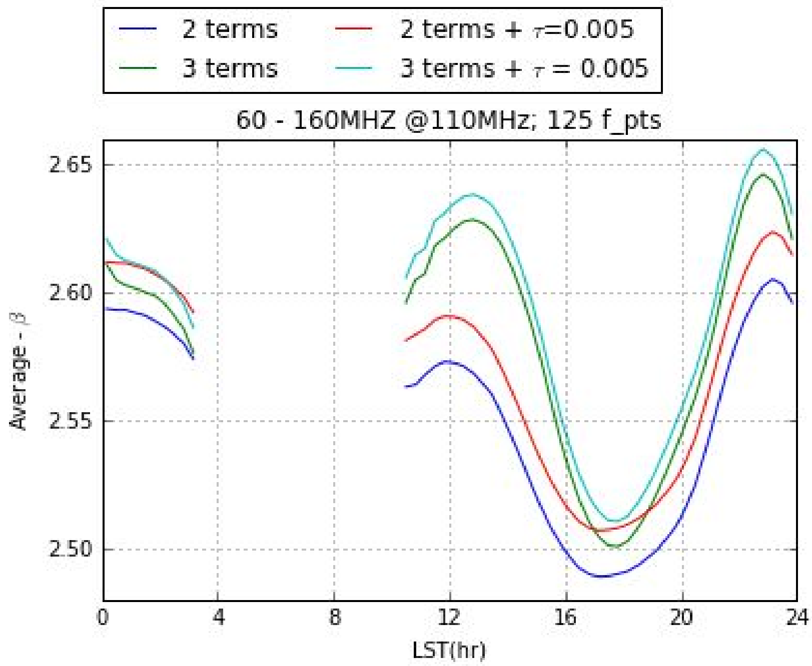

Figure1: Two parameter & three parameter fits averages of beta for each LST value taken over days for which nighttime data was available. A modest ionosphere contribution of 0.005 was added to each fit and the beta value is seen to become more negative.

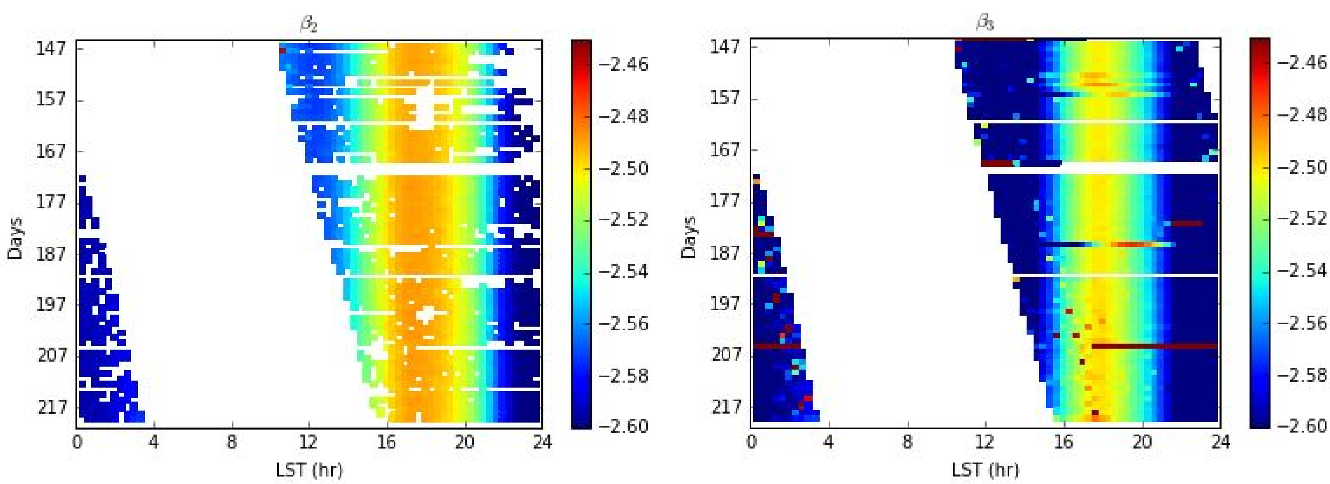

Figure2: [Left:] Two parameter waterfall graphs of the spectral index. [Right:] Three parameter waterfall graphs of the spectral index. RFI and other spurious signals were purged from the spectra before performing the fit. The data were binned into 800 kHz wide bins from 60 to 160 MHz and corrected for beam chromaticity. The results show excellent stability from day to day as the data collection ran for a span of 76 days from day 147 2018 to day 222 2018. Data from sun elevations greater than - 10 deg were suppressed.

2.) ***Fitting:*** **<u>60 to 100 MHz</u>**

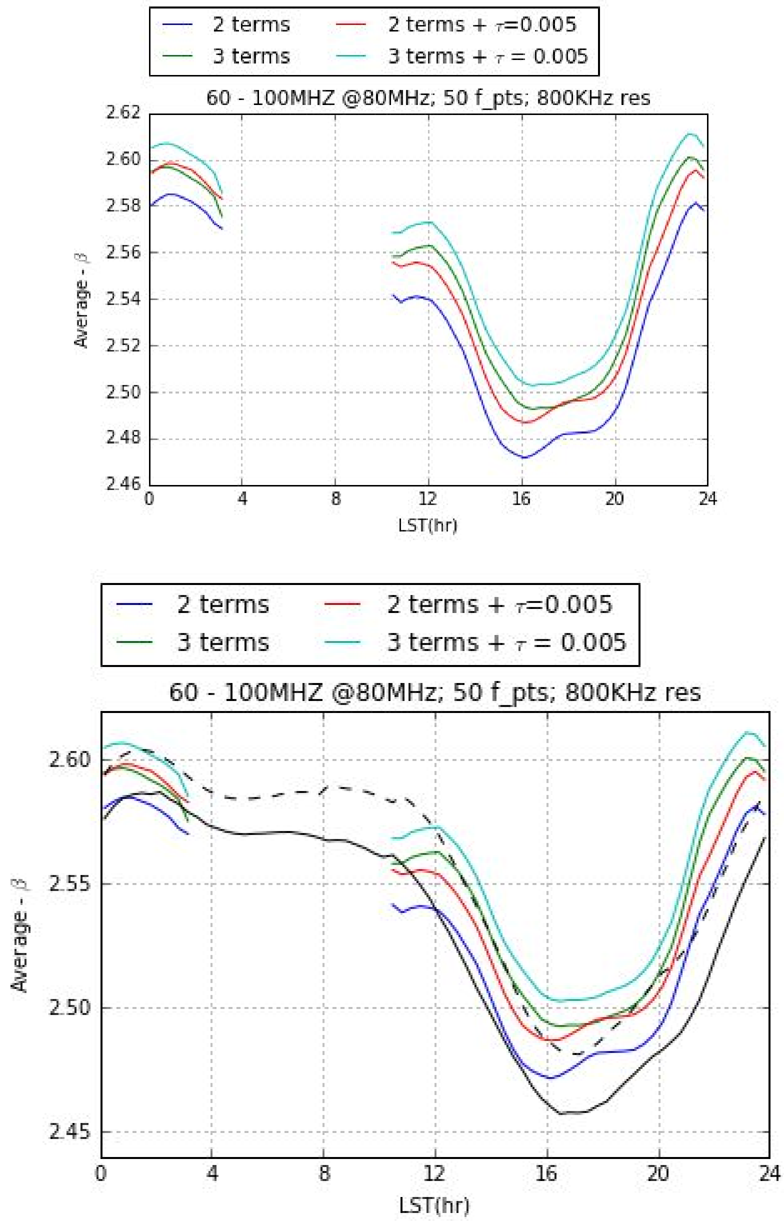

Figure3: Two parameter & three parameter fits averages of beta for each LST value taken over days for which nighttime data was available. A modest ionosphere contribution of 0.005 was added to each fit and the beta value is seen to become more negative.

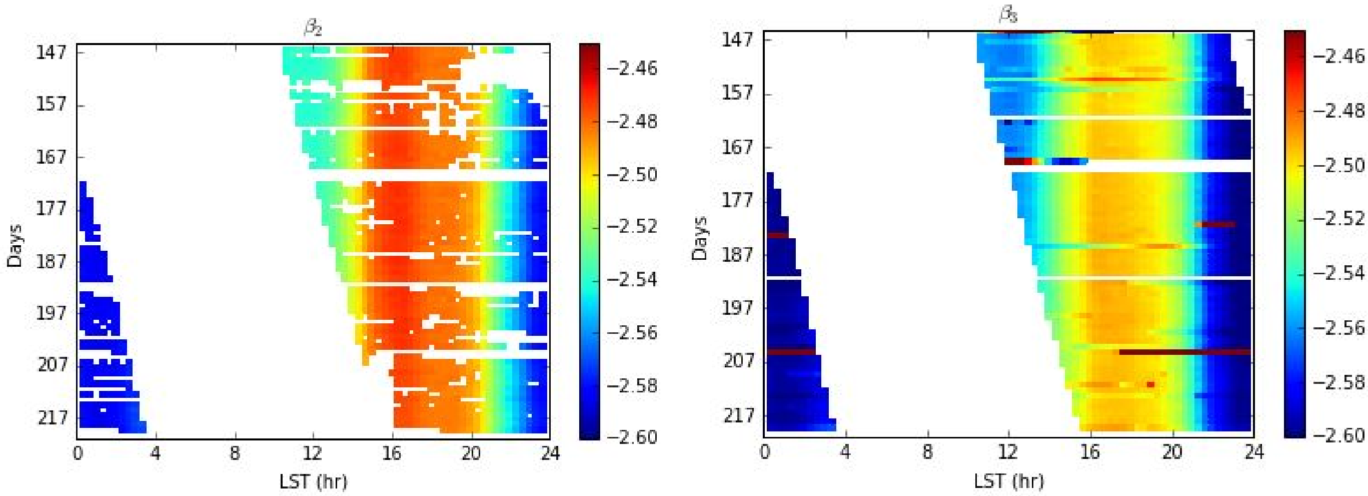

Figure4: [Left:] Two parameter waterfall graphs of the spectral index. [Right:] Three parameter waterfall graphs of the spectral index. RFI and other spurious signals were purged from the spectra before performing the fit. The data were binned into 800 kHz wide bins from 60 to 100 MHz and corrected for beam chromaticity. The results show excellent stability from day to day as the data collection ran for a span of 76 days from day 147 2018 to day 222 2018. Data from sun elevations greater than - 10 deg were suppressed.

3.) ***Fitting:*** **<u>60 to 120 MHz</u>**

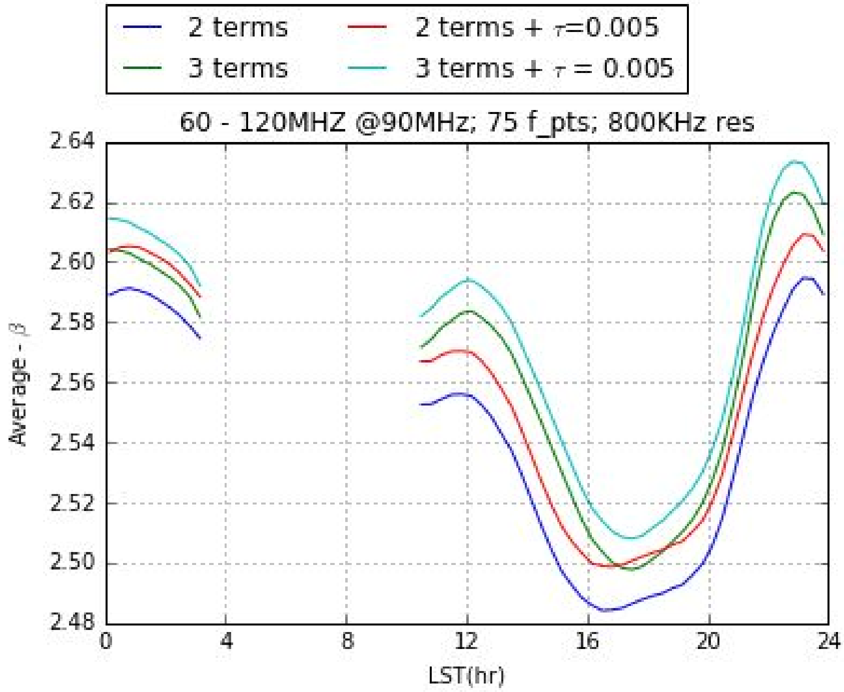

Figure5: Two parameter & three parameter fits averages of beta for each LST value taken over days for which nighttime data was available. A modest ionosphere contribution of 0.005 was added to each fit and the beta value is seen to become more negative.

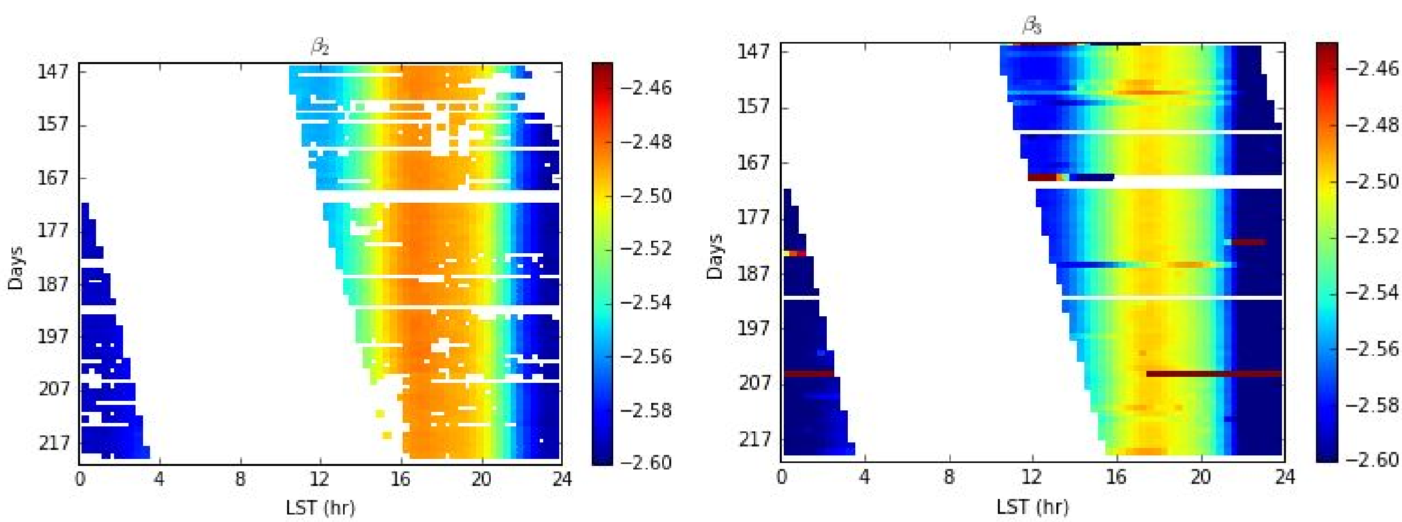

Figure6: [Left:] Two parameter waterfall graphs of the spectral index. [Right:] Three parameter waterfall graphs of the spectral index. RFI and other spurious signals were purged from the spectra before performing the fit. The data were binned into 800 kHz wide bins from 60 to 100 MHz and corrected for beam chromaticity. The results show excellent stability from day to day as the data collection ran for a span of 76 days from day 147 2018 to day 222 2018. Data from sun elevations greater than - 10 deg were suppressed.

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Fitting 2 & 3 without beam correction