

# LoCo Lab EDGES Memo 164

## Diffuse Foreground Parameters from Mid-Band Data

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### 1 Description

Here we present the result of fitting to Mid-Band data the following model:

$$T_{\text{fg}}(\nu) = a_0 \left( \frac{\nu}{\nu_0} \right)^{\sum_{i=1}^{N_{\text{fg}}-1} a_i \left[ \log\left(\frac{\nu}{\nu_0}\right) \right]^{i-1}}. \quad (1)$$

We fit between 2 and 5 parameters, including the reference temperature ( $a_0$ ). To determine the optimum number of fit parameters, in each fit we also compute the Bayesian Information Criterion (BIC) as a metric, defined as:

$$\text{BIC} = \chi^2 + N_{\text{fg}} \ln(N_{\text{sp}}), \quad (2)$$

where  $N_{\text{fg}}$  is the number of fit parameters and  $N_{\text{sp}}$  is the number of data points in the spectrum.

We perform this fit on nighttime Mid-Band data from every day, averaged in LST into 20-minute spectra, and binned in frequency at 390 kHz resolution.

### 2 Summary

1. When using data in the range 60-100 MHz (or 60-90 MHz), the results are broadly consistent with Mozdzen et al. (2019) for Low-Band.
2. When using data in the range 90-120 MHz, the results are broadly consistent with Mozdzen et al. (2017) for High-Band.
3. Over the full range 60-120 MHz, for 20-minute integrations, the BIC supports using 4 foreground parameters, and 5 parameters in the high-foreground range LST~14-20.

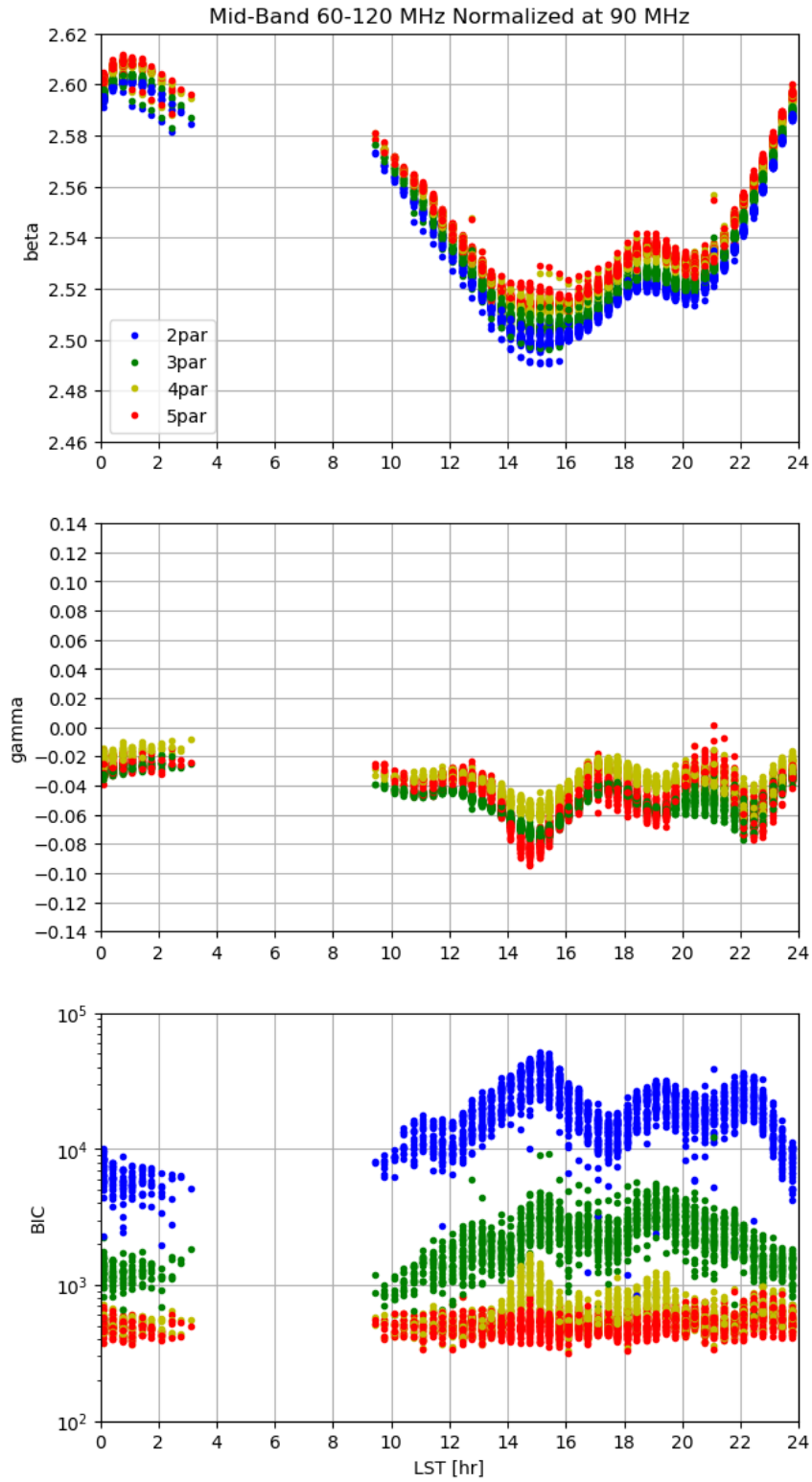


Figure 1: Main results. Beta (spectral index,  $a_1$ ), gamma (curvature,  $a_2$ ), and BIC from Mid-Band data in range 60-120 MHz, normalized at 90 MHz.

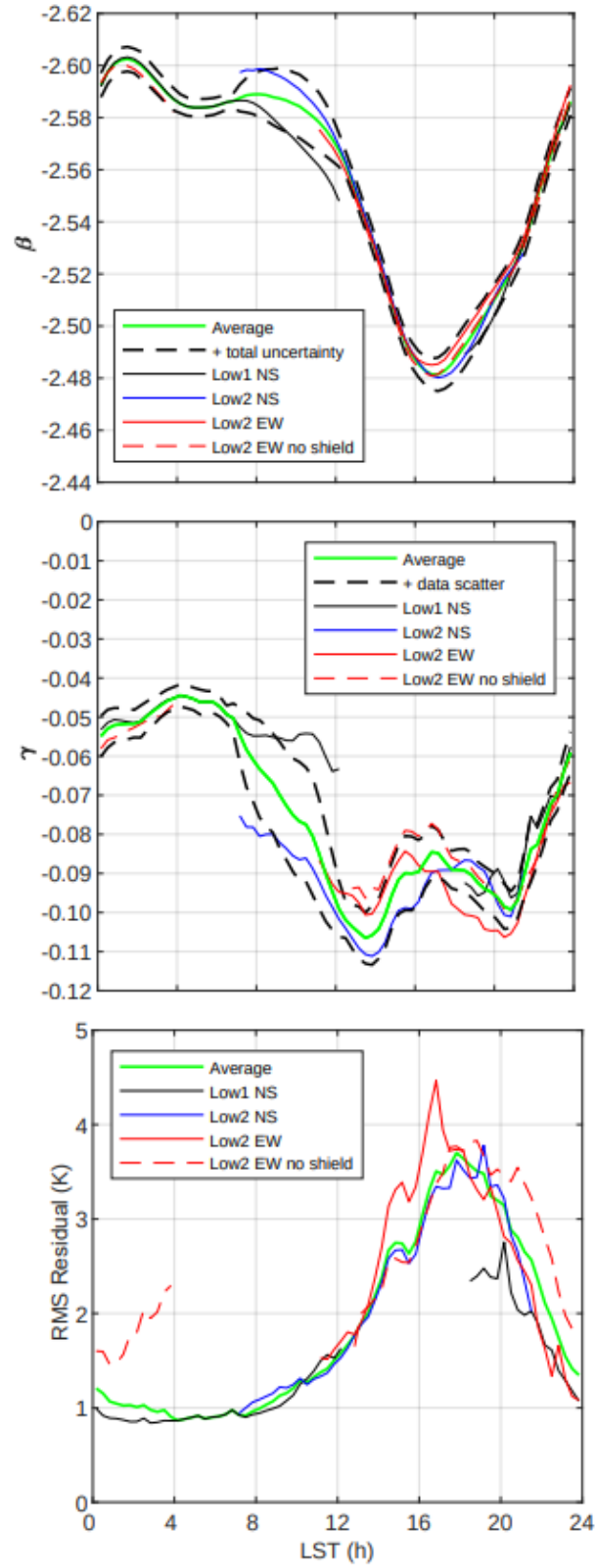


Figure 2: Beta, gamma, and RMS residuals from Low-Band data in range 50-100 MHz normalized at 75 MHz (Mozdzen et al. 2019).

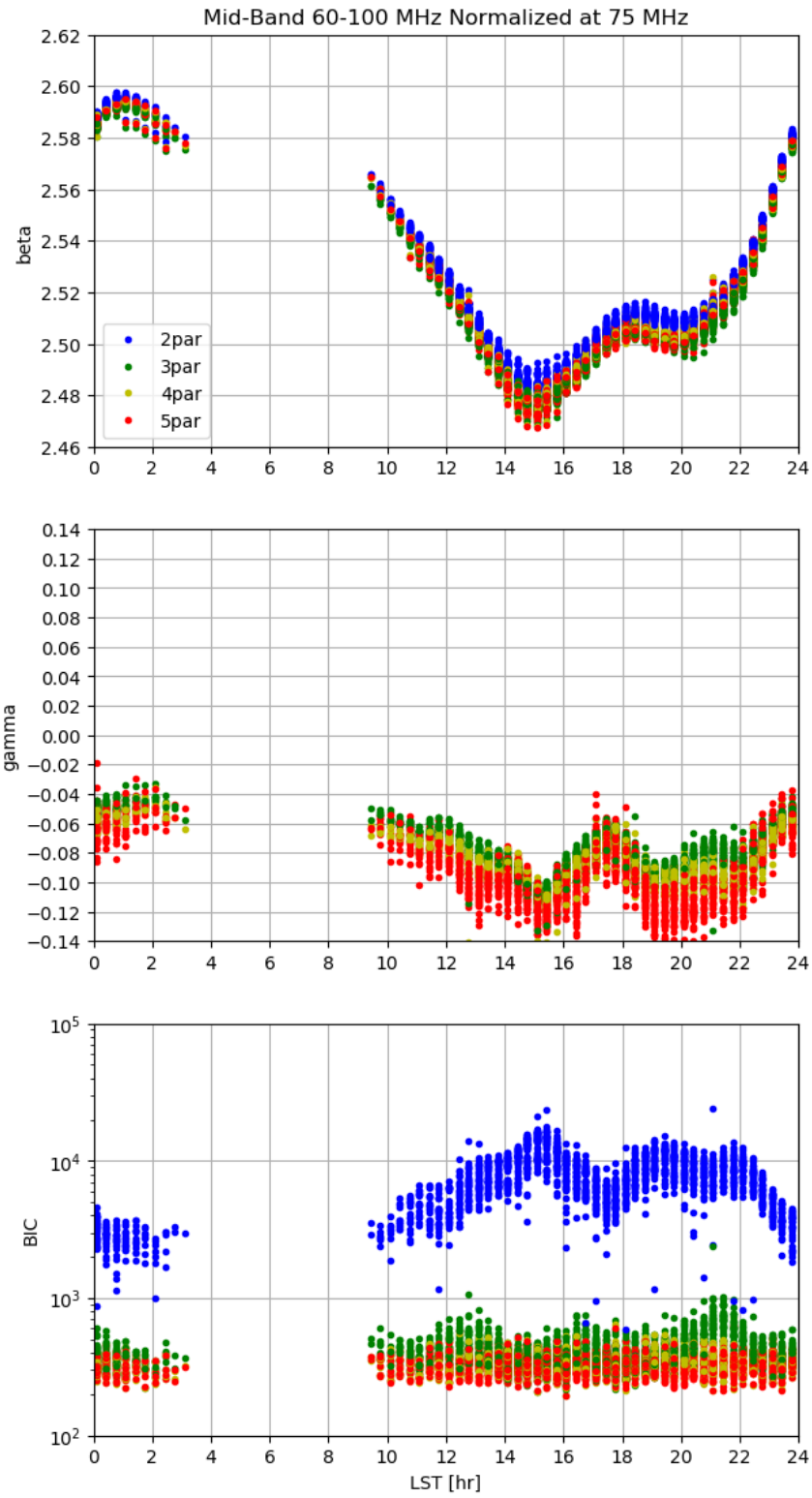


Figure 3: Beta, gamma, and BIC from Mid-Band data in range 60-100 MHz normalized at 75 MHz.

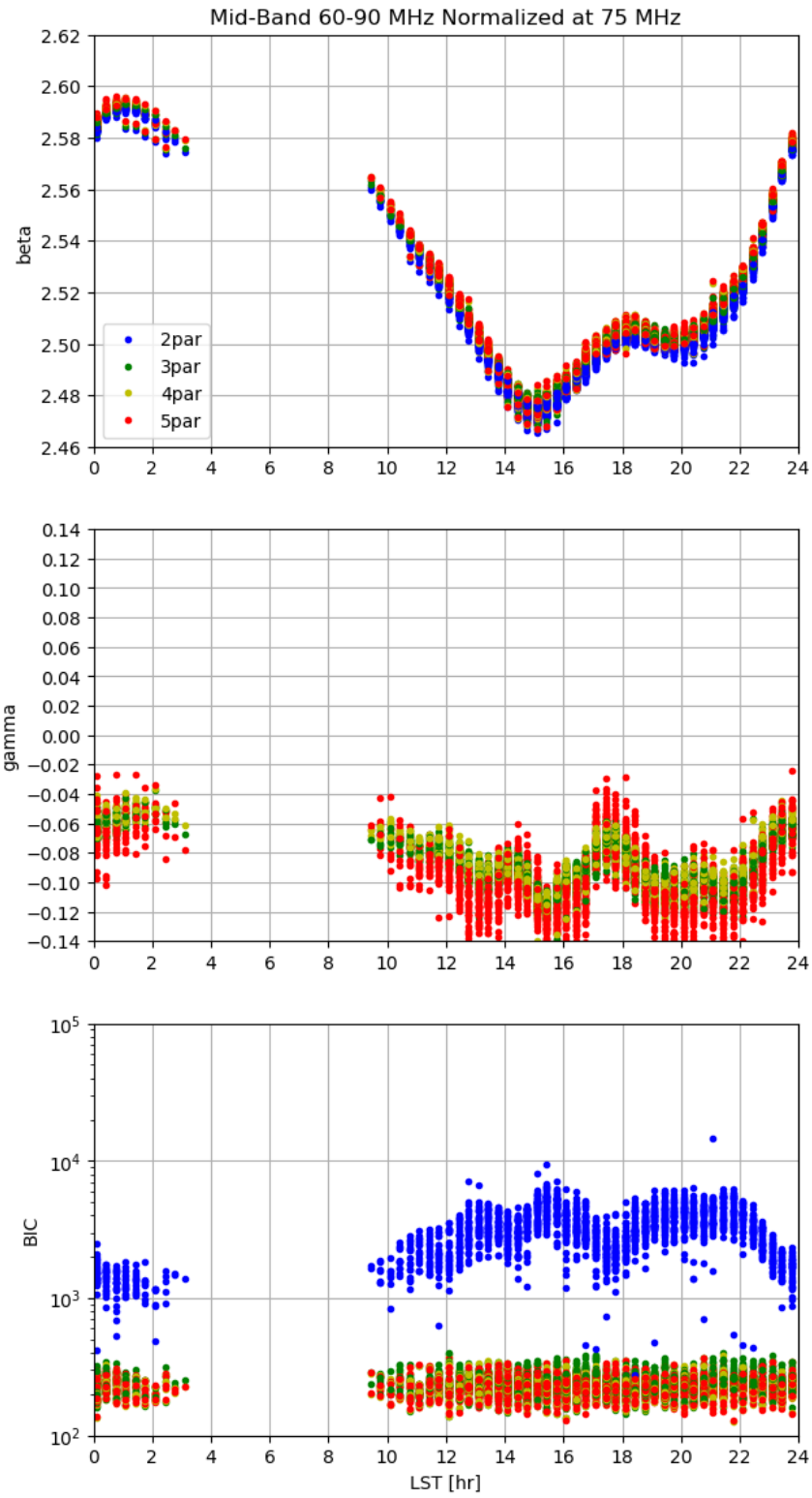


Figure 4: Beta, gamma, and BIC from Mid-Band data in range 60-90 MHz normalized at 75 MHz.

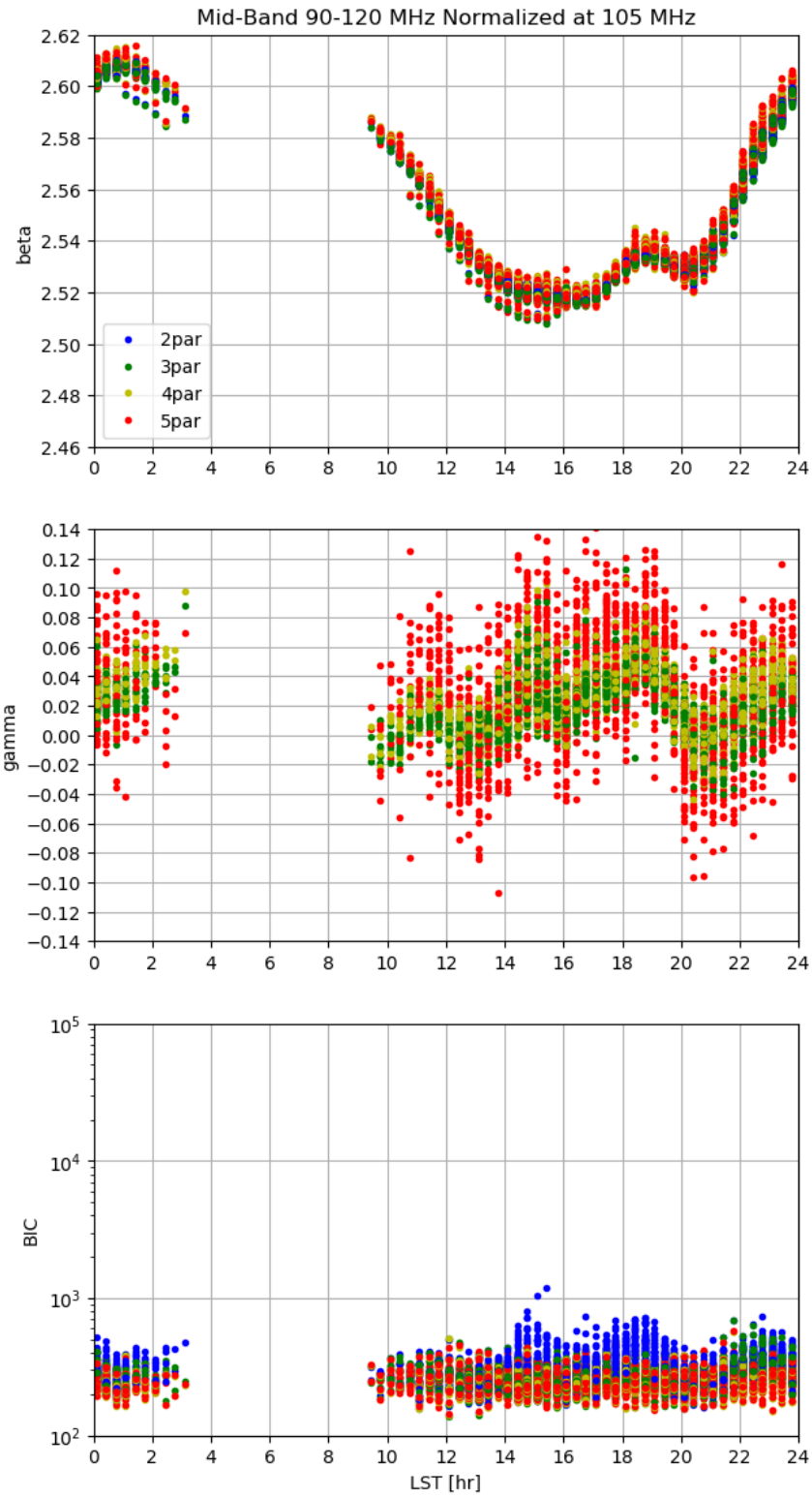


Figure 5: Beta, gamma, and BIC from Mid-Band data in range 90-120 MHz normalized at 105 MHz.

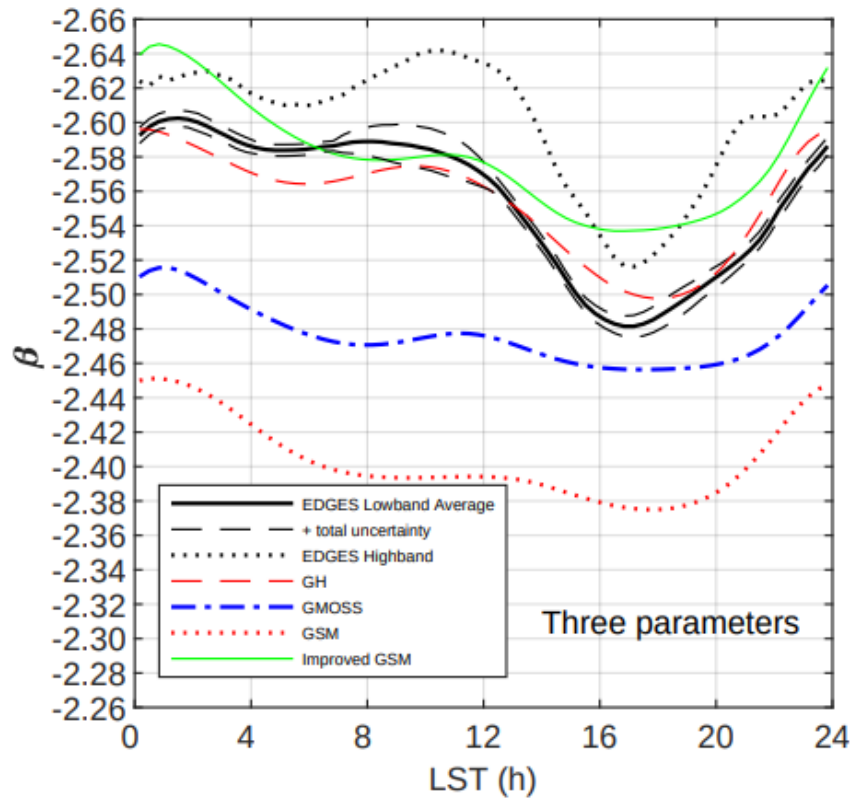
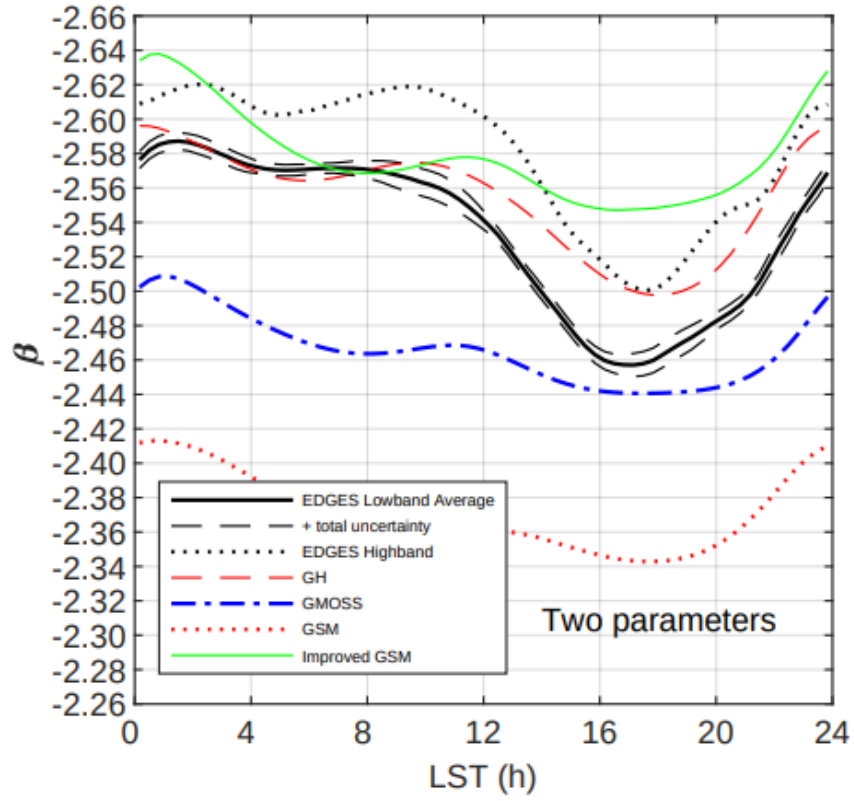


Figure 6: Beta for two and three parameter fits from Low-Band data in the range 50-100 MHz (solid black line, Mozdzen et al. 2019) and High-Band data in the range 90-190 MHz (dotted black line, Mozdzen et al, 2017).