Problems Week 6

Due Monday, November 16, 2020

1. **Testing degrees of freedom for windowed spectra.** Using the same white data records that you used last week, evaluate how many degrees of freedom you have if you apply a *Blackman-Harris* window and use records that overlap by 50%. (*Bonus: test this for a 75% overlap as well.*) To do this, repeat the Monte Carlo-based analysis of white noise that you carried out in part 3 of last week's problem set. Are the total degrees of freedom consistent with results inferred with a Hanning window or a boxcar window?

2. **Aliasing.** The Tropospheric Emissions Spectrometer (TES) flew on a 16-day repeat, with a "sun-synchronous", so the time period was exactly 16 days. How are the following tidal frequencies aliased by the satellite orbit? How long did the satellite need to sample in order to provide multiple realizations of the tidal amplitude?

Symbol	Name	period (hours)
S_1	Solar diurnal	24.00
$2N_2$	Second-order elliptical lunar	12.9054
N_2	Larger elliptical lunar	12.6583
M_2	Principal lunar	12.4206
S_2	Principal solar semidiurnal	12.00
K_2	Declinational solar	11.9672