Problems Week 4

Due Thursday, October 26, 2017

For week 3 you looked closely at a least-squares fit of tidal constituents. Now let's try the same thing with a Fourier transform. Use the same 2015 pressure data (and the same time interval) that you considered for problem set #3.

1. Fourier transform your data. (Don't worry about any of the details of computing a spectrum for this exercise—just Fourier transform.) Plot the real and imaginary parts of the Fourier transform. Find the peaks. What frequencies correspond to these peaks? Are they what you'd expect based on the known tidal frequencies?

2. Use the Fourier coefficients to identify the mean pressure and the amplitudes of the major peaks. (Hint: to determine the amplitudes of the oscillatory modes, you'll need to multiply by a factor of 2 to account for both the positive and negative frequencies.)

3. Do these spectral peaks align with the results from the least-squares fit? Is there anything you could do to further check your results? As a reminder, you were fitting to the following period signals:

Symbol	Name	period (hours)
O1	Principal lunar diurnal	25.82
K1	Luni-solar diurnal	23.93
M2	Principal lunar	12.42

4. Now plot the spectral energy (based on the squared magnitude of the Fourier coefficients) as a function of frequency. Is the spectrum red, white, or blue? How does it change if you first differentiate your time series in time, before Fourier transforming? Why?