Problems Week 3

Due Thursday, October 13, 2016

We've talked about least-squares fitting, and we've talked about the Fourier transform, so it's time for us to test both strategies out using the same data set. Here we'll use the automated pressure data from the Scripps Pier. (As a reminder, you can download it here:)

http://sccoos.org/thredds/catalog/autoss/catalog.html,

I suggest considering the first part of 2015, though you are welcome to choose a different time interval.

1. **Visual evaluation.** Plot the time series of pressure data from 2015, and examine the time increments between adjacent measurements. (You can do this in Matlab using the "diff" command, for example.) Are the data always uniformly spaced? What is the increment between measurements? Choose a time period with consistent spacing—for example, roughly the first month of 2015. How long is your record?

2. **Least-squares fit.** Least-squares fit a mean and 3 major tidal constituents to your data. What is the mean, and what are the total amplitudes of the tidal constituents? (Total amplitude should be determined from the square root of the sum of the squares of the sine and cosine amplitudes.)

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

3. **Fourier transform.** Now 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? Now 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.) Do these spectral peaks align with the results from the least-squares fit? Is there anything you could do to further check your results?