Midterm Problems Week 6-7

Due Thursday, November 10, 2016

This problem set is to be completed independently, without collaborating with your classmates. At the top of your problem set, please write and sign the following statement: "I certify that this represents my own work and that I have not worked with classmates or other individuals to complete this assignment." If you have questions, you may e-mail me.

For this set of problems, we'll consider atmospheric and ocean temperatures from the TOGA/TAO mooring located on the Equator at 165°E. You can download the high resolution surface meteorological from here:

http://www.pmel.noaa.gov/tao/data_deliv/frames/main.html

or retrieve it from TritonEd (in the Lecture 11 folder). The goals of this exercise are to show that you can compute spectra of real data and carry out some basic interpretation.

1. **Inspect the data. (10 points)** Retrieve the data, plot time series of sea surface temperature (SST, identified as T_25)) and surface air temperature (T_a, identified as AT_21), with appropriately labeled axes. Be sure to substitute NaN for the flag values in the netcdf data file. What do you notice about the data? You'll see some gaps in the data. For the purposes of this assignment, I suggest using data with indices from about 345,000 through 525,000 (corresponding to about mid-2004 through the end of 2007 and replacing any remaining missing values (NaN) with the mean of the non-missing values (nanmean(data)).

2. **Compute the spectra for SST and T_a. (30 points)** Use the segmenting approach that we discussed in class to compute the spectra. Please follow the "best" practices that we have discussed and explain your approach. Be sure to do the following:

   a Verify Parseval's theorem.
   b Be attentive in labeling your x axis.
   c Be attentive in labeling your y axis.
   d Provide an uncertainty estimate.
   e Compute the Nyquist frequency.
   f Identify the frequency resolution.
   g Identify and discuss the spectral peaks.
   h Ignoring spectral peaks, roughly what is the spectral slope for each variable?

3. **Bonus: Show a variance preserving version of your spectrum** as well as a version in log-log space. What is highlighted by the variance preserving spectrum?