**Empirical Orthogonal Functions**

The goal of this project is simply to explore the different sorts of EOFs. The project is a little open-ended in that there is not an explicit objective. EOFs are simple to calculate (especially in MATLAB): if you can diagonalize a matrix you are essentially done. However, subtleties of how you normalize and what matrix you diagonalize are what make the different flavors of EOFs unique. I will make suggestions for things you might try to do, but I really want you to explore and see what happens.

Use the FASINEX mooring data. You can find EOFs for individual moorings for the array as a whole, or for a subset of the array. Try different things with the goal of learning about EOFs and the data. By the end of the project you should have a reasonable understanding for what the different sorts of EOFs do.

Here are a few things to try

1. Time-domain EOFs of temperature. These are the simplest EOFs I can imagine. They maximize variance summed over all the data. What about the mean?

2. Time-domain EOFs of velocity. What covariance matrix should you form? Shove all the data into one covariance or form the covariance of u+iv. What’s the difference?

3. What if you add wind stress as data to the velocity EOFs? What are you going to do about the different units?

4. Can you think of a way of normalizing that will make the EOF maximize variance integrated over the volume defined by the array rather than summed over the instrument locations?

5. Calculate frequency-domain (or complex) EOFs. Here you average over frequency bands.

6. Use the temperature and velocity data together to calculate principal estimator patterns and canonical correlates. Principal estimator patterns are the modes of one set of data that best describe another set of data. Canonical correlates are the combinations of both sets of data that are most correlated.