Look through the invert_clean script and match up code to equations in slides (core inversion piece)

Using the batch_demo script:

1.) Run the script as is making sure you can step through an example and create plots

2.) See if you can set errors and/or choose number of constraining observations to make estimate:

   a. As good as possible (tight boxplot/confidence bounds)
   b. As poor as possible (loose boxplot/confidence bounds)

   Describe the above estimates:

      1) Monthly and annual flux estimates for oceans vs land, how are they different?

      2) Which land regions appear more difficult to constrain with limited global observations?

3.) Using knowledge from (2) above, about how much of these 1,100,000 observations would you think you need to reasonably constrain most of the land flux regions?

4.) How much data do you think you'd need to simply constrain the global annual CO2 flux (all regions summed together) ?

Using the chi square script:

1.) Step through the analysis, the 3 inversions presented and the resulting boxplots with estimates of surface flux:

   a. Describe the risks of being overconfident of your observation errors?

   b. Do there appear to be any risks of being underconfident of your observation errors?

Using the Kalman_gain script:

1.) Using the NOAA CarbonTracker website, https://gml.noaa.gov/ccgg/carbontracker/co2tser.php, investigate the sites returned as "most important" to the individual state estimates. Do they make intuitive sense?

2.) Do you see large difference in which sites are important in the northern midlatititudes, e.g. Europe and North America, vs the tropics, e.g. Africa and S. America? Any ideas why?

3.) Perform the following test, remove all the observations (using LATITUDE and LONGITUDE to subset) for either Europe or North America and try to guess *which* sites will emerge as most important to contraining fluxes?

Using the explore_prior_flux_covariance script:

1.) Use the very minimal set of data (used in constraining fluxes) in the original script to estimate prior and posterior covariances for the posterior flux estimates. Can you explain whether there should or should not be a difference here?

2.) Play around with how much data is necessary to make prior and posterior covariances significantly different

3.) Do these differences, under a stronger data constraint, make sense?

Using the impose_bias_case:

1.) Run the "bias over N. Africa case", the first of the two biases
    a. What is effect on annual flux estimate over N. Africa ?
    b. What is effect over globe?
    c. Are there other regions impacted by this bias besides N. Africa, where the bias occurs? Any thoughts why?

2.) Run the "bias over Ocean Glint observations", the second of the two biases
    a. In general, how does this bias affect the ocean regions vs the land regions
    b. Can you think of a way, within the inversion framework that you might mitigate this and "force" the inversion towards your ocean prior?