

ADVANCED ENVIRONMENTAL DATA ANALYSIS

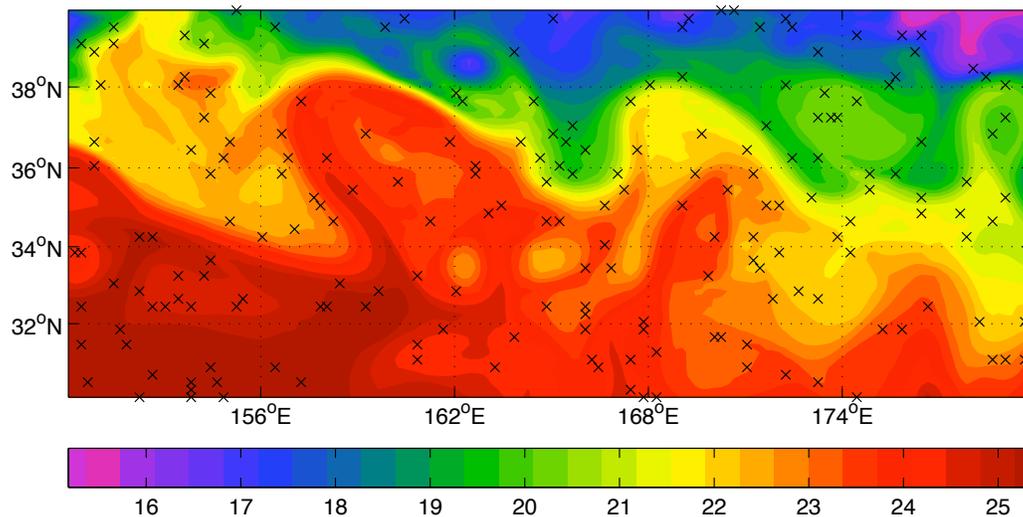
HOMEWORK #6

Covariance Modeling in Time (e.g. ENSO Forecasting)

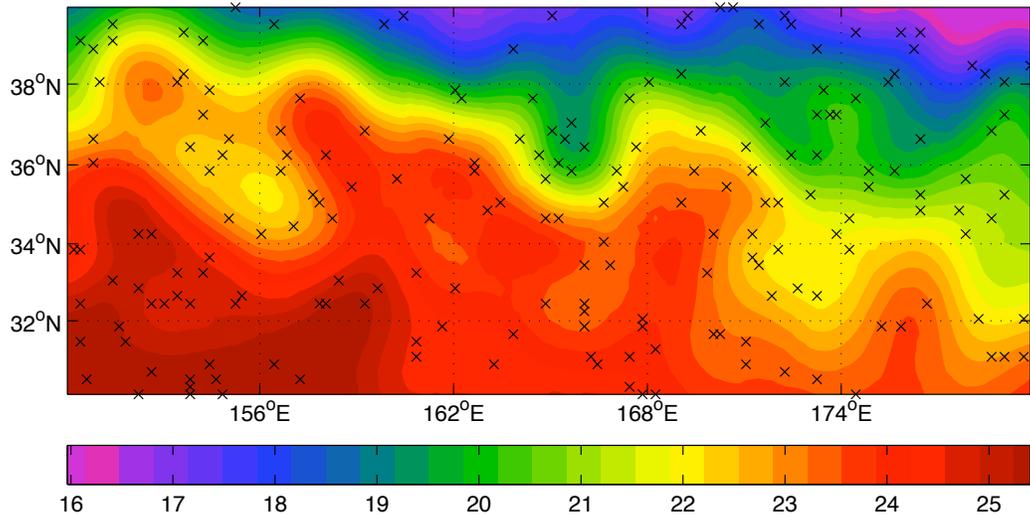
Download the Niño 3.4 index and the North Pacific Oscillation index (NPO) from the web. Use these two indices as predictors to predict future values of the Niño 3.4 index. To do so build an autoregressive model of order N, where you choose the order N for both predictors. After building the model (1) assess the forecast skill of the model (e.g. explained variance) on different timescales (e.g. prediction on 1 to 12 months), and (2) assess how the prediction skill varies based on the season when you begin your forecast. Produce some summary plots with this information along with some examples of good and bad forecast. Discuss your results and figures.

Covariance Modeling in Space (e.g. Mapping Sea Surface Temperature data)

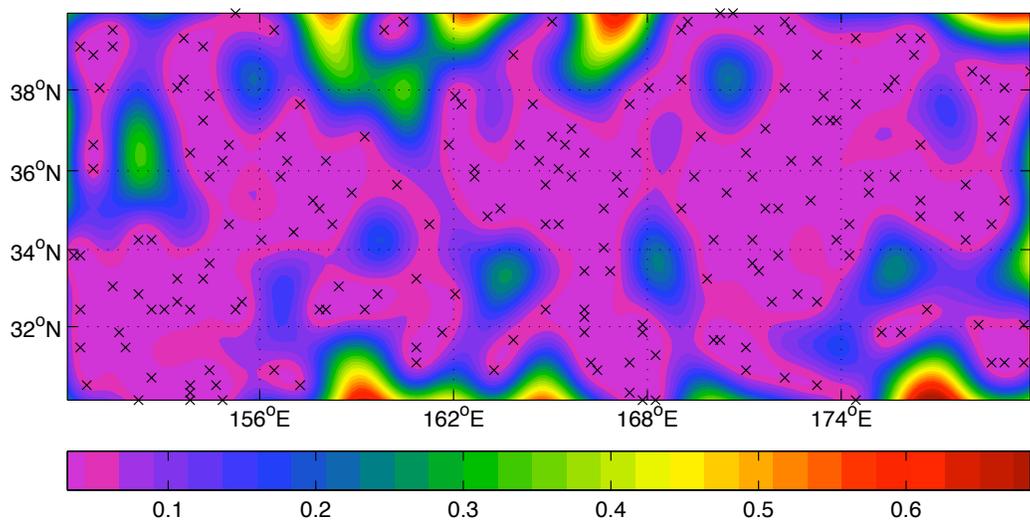
You collected a set of sea surface temperature (SST) observations of the ocean near Japan. The figure below shows the locations where you observed (black x) the SST field.



Use the covariance modeling to map the data on a regular grid with longitudes from 150E to 180E, and latitude from 30N to 40N with a spatial interval of 0.2 degrees. Estimate the decorrelation length scale from the available observations and make a plot of the spatial auto-correlation function. The mapped data should look something like this:



Plot the normalized error map (0 to 1) associated with your estimate (see figure below as an example). Explore what happens to the error map and the mapped SST if you increase or decrease the decorrelation length scale. Explain and comment on the results.



Now re-map the data but use different decorrelation length scales for the longitudinal and latitudinal direction. Which one should be longer? How does it change the map? Can you see the changes?