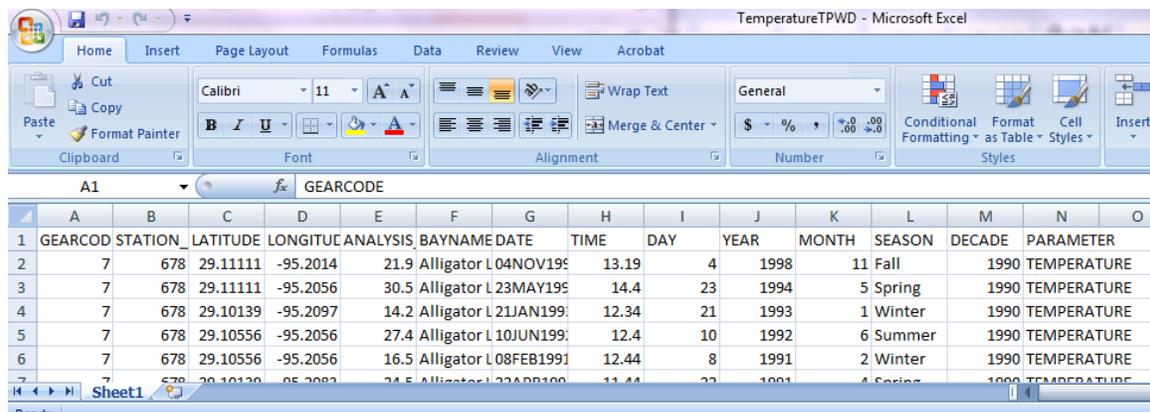# Galveston Bay DO Studies – TN 6

Peter Higgins, October 26, 2018

Introduction

Early attempts have been made to visualize trends in dissolved oxygen compared to temperature, salinity, PH and nitrates from Excel data posted on the TAMUG CTBSatlas website. Data in these sheets are presented by station for sample times in months and years. Figure 1 shows the sheet layout for temperature.

Figure 1 – CTBSatlas data sheet for temperature

This data has been read by a Python program and compared in several ways. The visualizations are given without conclusions.

Method

Python includes a function for reading Excel data:

wb = xlrd.open_workbook(fname)
sheet = wb.sheet_by_index(0)

Functions were written to sort the data arrays, and to retrieve station coordinates permitting plotting stations that were processed in QGis (the open source alternative to ERSI's ARCGIS) as shown in Figure 2. The Python MatPlotLib, which enables Matlab styled graphics was used for contours, bars and points visualizations as seen in Figure 5-7.

Correlations given on the figures are Pierson.

Results

QGis

The background image of Galveston Bay was done by geocoding an image from Google Earth. This involves adding markers on the image, and recording the latitude and longitude these markers point to. The image is added as a layer in QGis, and the georeferencer (under raster tag) is then used to associate the image to spatial coordinates. Doing this allows project data and shapefiles to be superimposed properly for context.

The large dot clusters in Figure 2 show the stations whose data was processed in this preliminary study. The fact that a station orbits a location over the samples indicates the station was floating (a buoy or a small boat).

The small red dots mark places where dissolved oxygen is =< 2.0. This is an initial attempt to show a pattern related to the processed stations
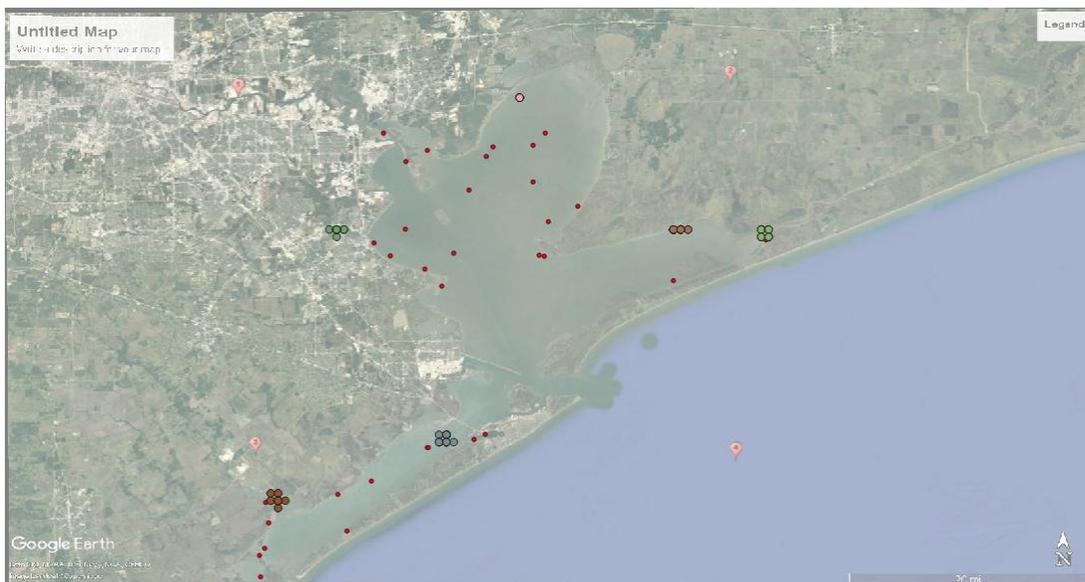

Figure 2 –Stations processed (large dots), and dissolved oxygen below 2 (small red dots)

Access

Microsoft's Access is being evaluated as a project tool. Left to be done is adding the capability in my Python code to construct Access queries and retrieving results. This promises to be an alternative to opening each table and constructing the same query by filtering.
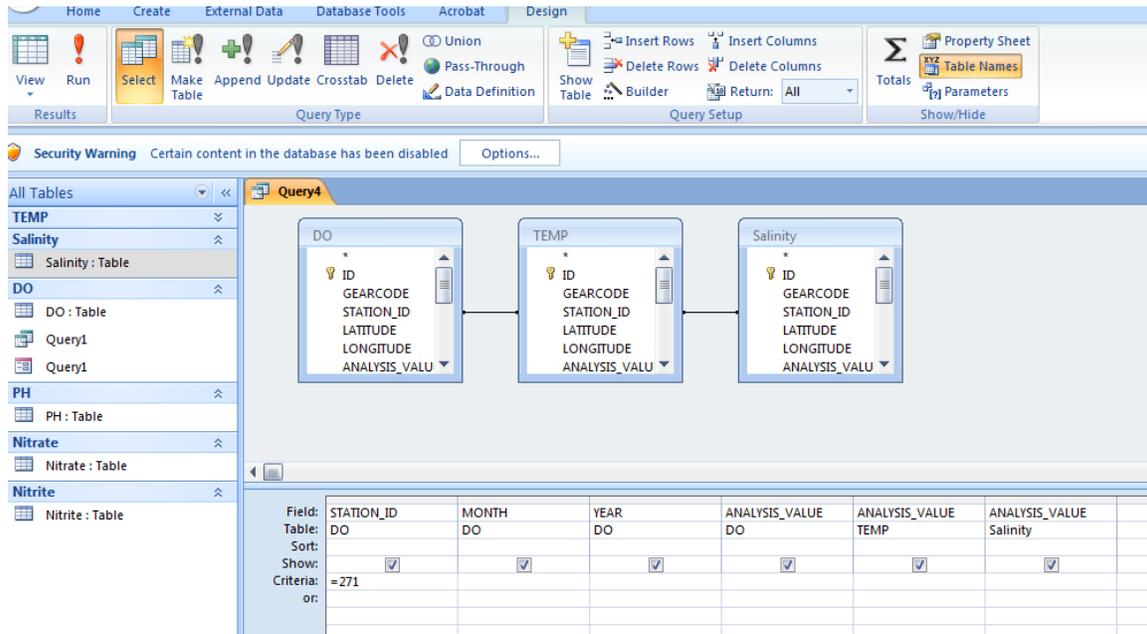

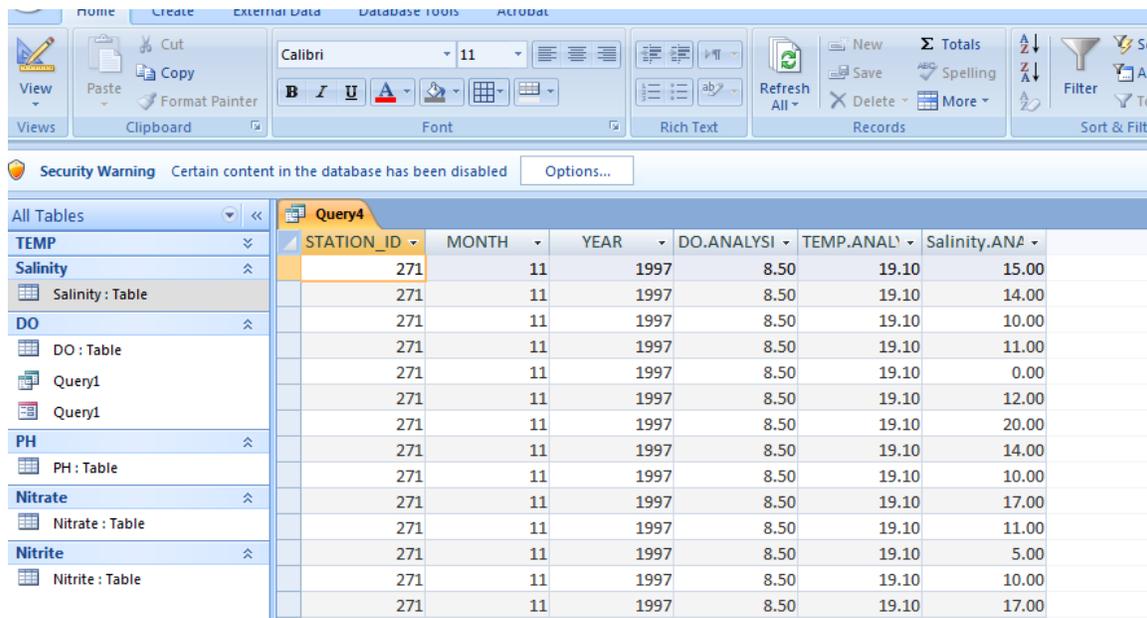Figure 3 – Excel files for DO, Temp and Salinity joined on station id in Access

Figure 4 – Query of values based on station id = 271

Python graphics of DO compared with temp, salinity, ph and nitrates

Bar plot

Figure 5 shows a bar plot of all Galveston Bay stations in December, 1984. Analysis values have been normalized by subtracting the mean from all points then dividing bt standard deviation. The result is Pierson correlated. The positive correlation between do and temperature, for example, results from this being a spatial, not time series analysis. The expected negative correlation is shown in Figure 6.
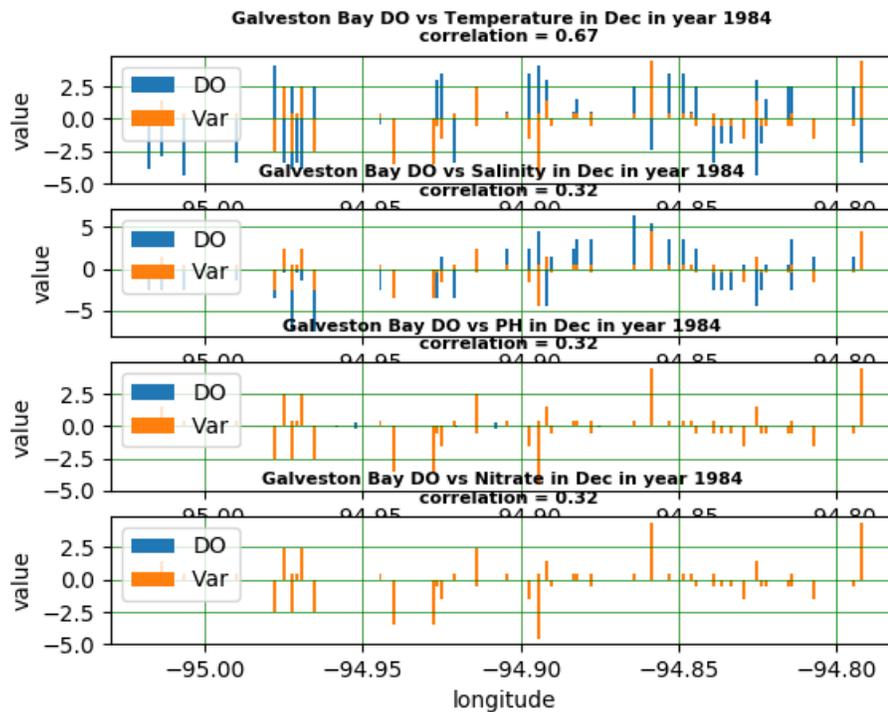

Figure 5 –Bar chart of data in Galveston Bay December, 1984

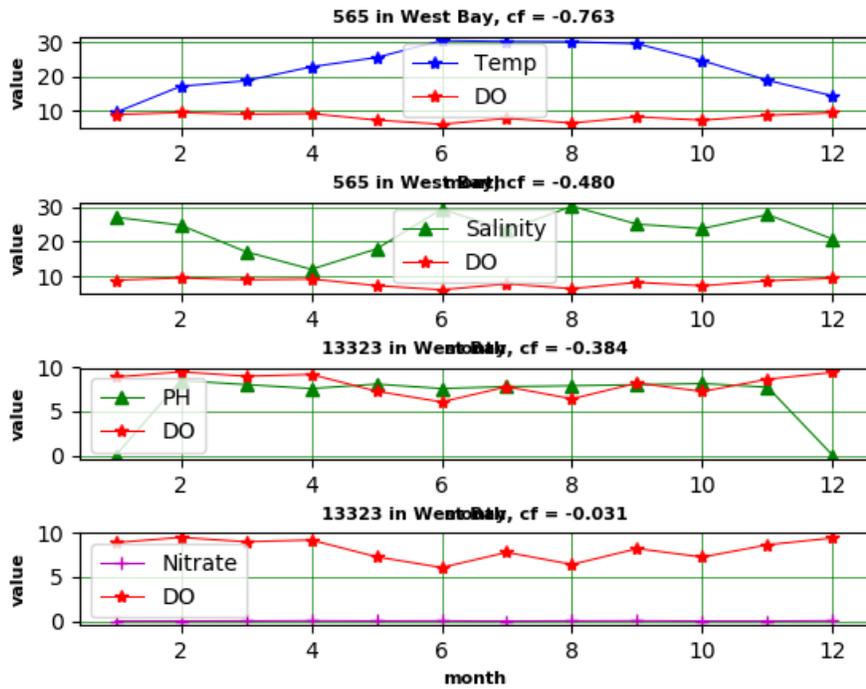**Time series plot for a single station, all months and years**

Figure 6 –Time series point data for station 565 n West Bay

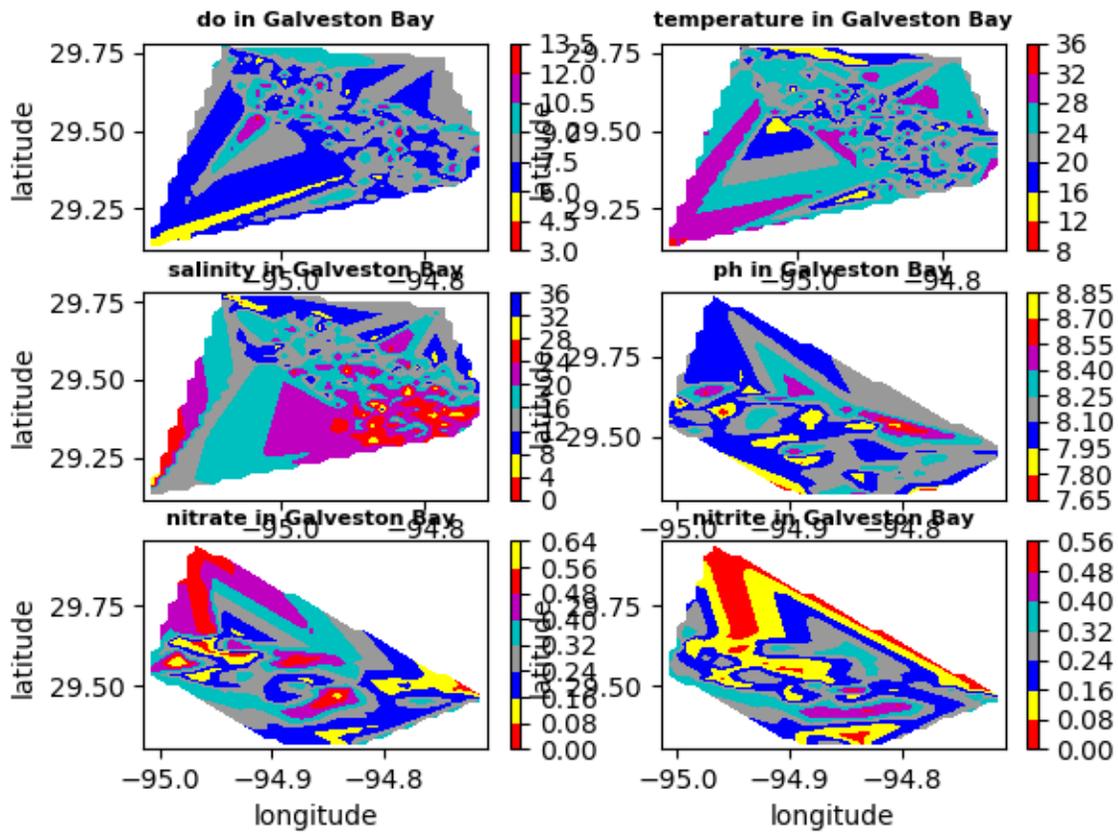## Contour plot of variables in Galveston Bay, all stations, all samples

Figure 7 –Contour chart of all data in Galveston Bay