An Analysis of Oceanographic and Meteorological Data from N-7 Tower

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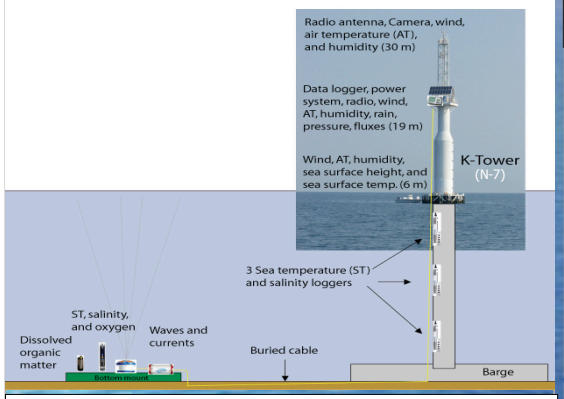
FSU's Young Scholars Program

Introduction

For our project we examined meteorological and oceanographic data from different sensors located on the N-7 Tower in the Gulf of Mexico. Our purpose was to analyze and graph the data so that it could be used for further research, such as a research project by Austin Todd on how oceanic circulation can affect the movement of Gag Grouper larvae from deep waters into sea-grass beds closer to shore.

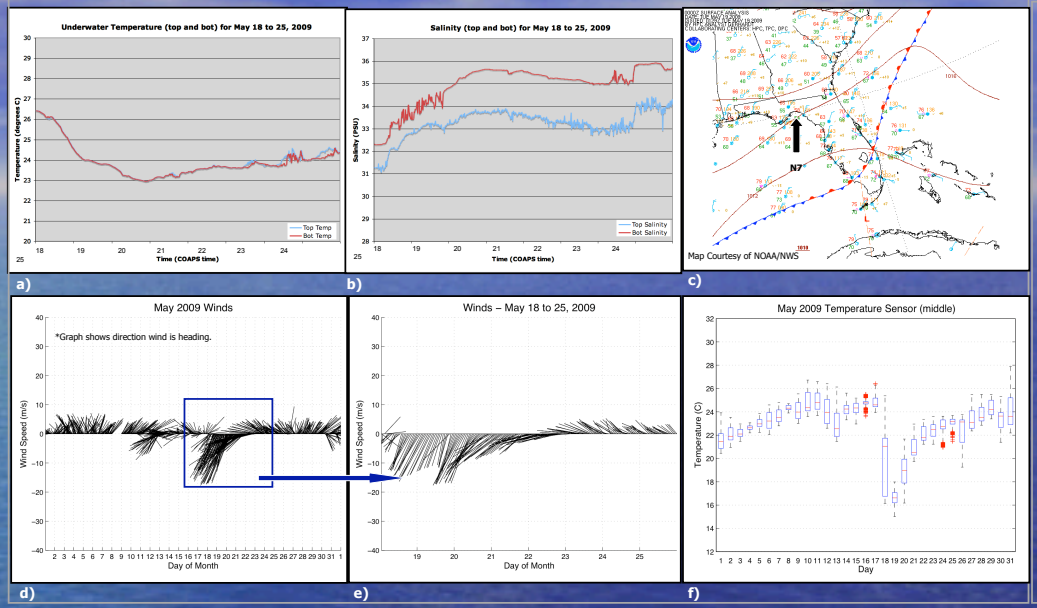
Background Information



N7 Instrumentation		
Atmospheric		
Measurement	Units	Height (m)
Wind Speed (bottom, middle, top)	m/s	4, 19, 30
Wind Direction (bottom, middle, top)	Degrees from true north	4, 19, 30
Air Temperature (bottom, middle, top)	Celsius	4, 19, 30
Atmospheric Pressure	Millibars	19
Underwater		
Measurement	Units	Depth (m)
Underwater Temperature (bottom, top)	Celsius	9, 3
Salinity	PSU (practical salinity units)	9, 3

The N7 tower is located at latitude 29.6˚N and longitude 275.7˚E, which is in the Gulf of Mexico. It has three sets of meteorological sensors at different heights, and two underwater sensors at different depths. In our research, we used only select parameters, excluding those like dew point temperature. We then compared the data collected from different sensors to examine not only the relationships among different aspects of the data, but also to determine if there were malfunctions in the sensors.

Oceanic Response to Atmospheric Conditions

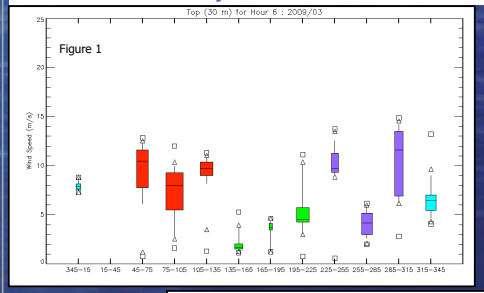


Data Analysis

We looked for noteworthy changes in oceanic temperature and salinity and proceeded to observe any correlated atmospheric occurrences . One such event occurred in May 2009, from which we could determine the following:

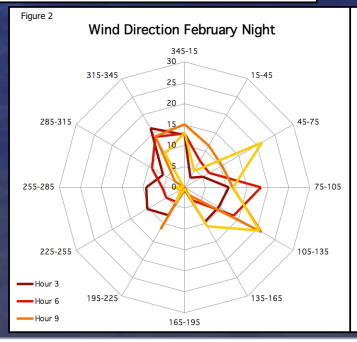
- **Figure (a)**--we first observed a 3.5˚C drop in the underwater temperature for both sensors of the N7 tower between May 18th and 25th.
- **Figure (b)**--shows, on average, a 2 PSU difference between salinity at 3 meters and salinity at 9 meters.
- **Figure (d & e)**--the wind data from the same time period showed an increase from 5 m/s to 15 m/s when the winds changed from southerly to northeasterly direction.
- **Figure (f)**--this graph shows that, like the underwater temperature, the daily median air temperature dropped from 25˚C to 16˚C in a 48 hour period.

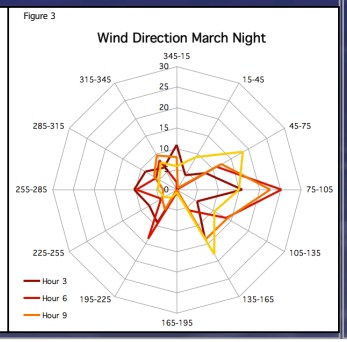
Nocturnal Easterly Winds



This portion of the project focuses on wind direction and speed in the Gulf of Mexico. We hypothesize that in the spring there would be a nocturnal increase in easterly winds in Apalachee Bay. Figure 1 is a box-and-whisker plot with the x-axis displaying the wind direction and the y-axis the speed. The width of each box is a function of the number of times wind came from that direction. Colors indicate winds from the north (blue), east (red), south (green), and west (purple) quadrants, respectively.

Figures 2 and 3 are wind roses that plot the percentage of the time that wind is coming from a certain direction during a specific hour. Data points from every minute within the hour were used to construct these graphs.





Discussion / Conclusion

Through our analysis of the oceanographic data, we were able to come to several conclusions. We first hypothesized that the drop in the temperatures (both oceanic and atmospheric) was caused by a cold front from the north, which would have resulted in the strong north easterly winds we observed. However, after looking at a weather map prepared by the National Weather Service (figure c), we found a sub-tropical low pressure in combination with a high to the northwest, resulting in a strong pressure gradient. This led to extremely strong winds from the northeast, which in turn brought colder northern temperature.

These findings are helpful in that they show the ocean's responses to various atmospheric changes. Understanding these responses is crucial to drawing conclusions about the movement of gag grouper larvae.

Our second hypothesis proposed the existence of a nocturnal easterly wind, most likely in the months of Spring. This was supported by the data we compiled and analyzed. We found that in the month of March, easterly winds were observed during the nighttime hours more frequently than other wind directions. We also found that for these winds, the average speed increased. However, in order to fully support this hypothesis, we would need to collect and further analyze data from multiple years.