Wave and Wind Analysis of the Northern Big Bend Region

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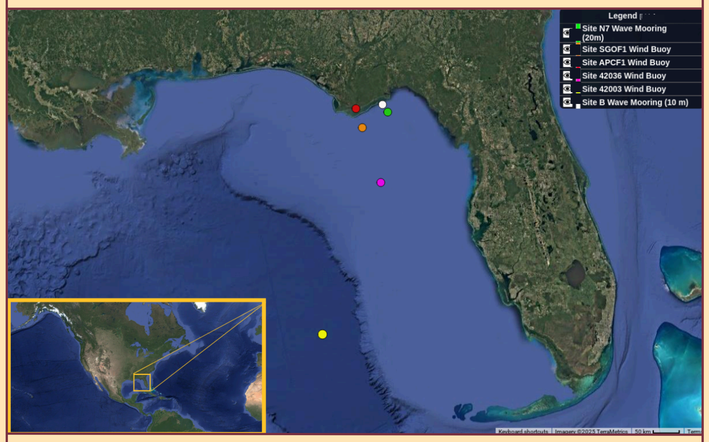
Introduction

The Northern Big Bend Region of Florida is characterized by its low-energy wave environment and frequent tropical cyclones. However, most of the current research is focused heavily on high-wave energy wave environments, not low-energy wave environments. Unlike most regions, the wind-generated waves of the Big Bend region are controlled less by wind duration, and more by fetch (the distance wind travels over water) (An Evaluation of Nine Dimensionless Fetch-Limited). Both that fact, its status as a low-wave energy environment, and frequent tropical cyclones make the region unique and in need of further research. The research presented here seeks to understand how different kinds of wind events affect the wave environment of the Big Bend Region of Florida. This research seeks to inform future projects researching the Big Bend's wave environment.

Methodology

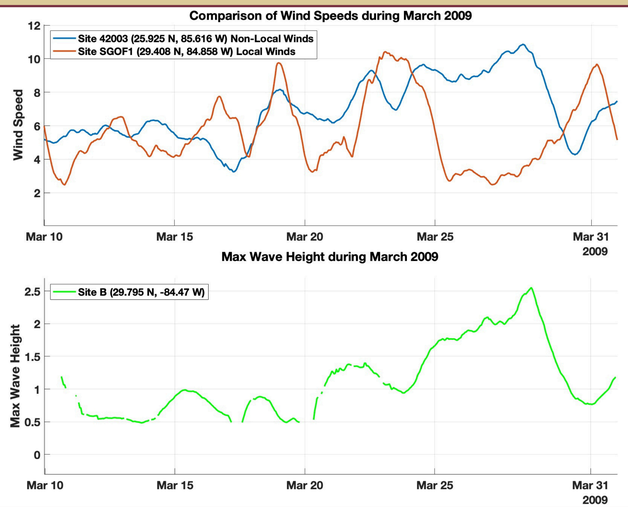
- Wind data was collected from four buoys in the Northern Big Bend Region of Florida from 2008-2012.
  - The data measured were wind speed and direction.
- Wave height data was also collected via two moorings in the same region over the same period.



(Map of all observation sites)

- Basic statistical analysis was used to compare the two types of data.
- This analysis was done via code in MatLab.

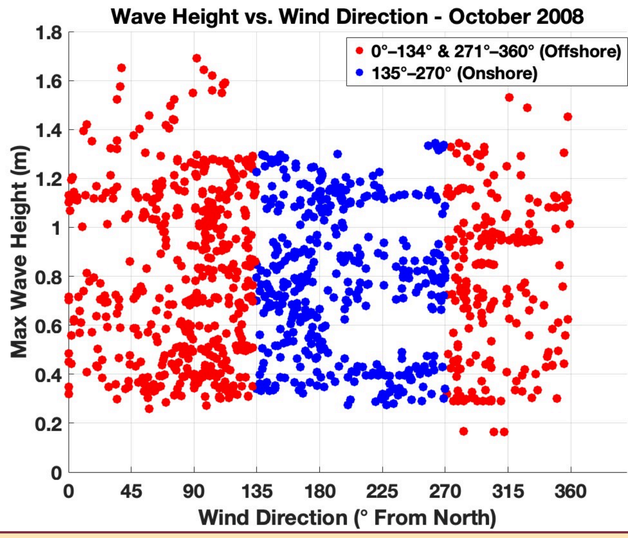
Results: Wind



The graph above is comparing the wind speeds of both local (Site SGOF1) and non-local winds (Site 42003) and how they correlate with max wave height (Site B) during March 2009.

Both non-local and local winds affect the wave height found within the Big Bend's wave environment.

- In most instances, local wind speed is closely aligned with wave height during the same period.
- In the instances where that doesn't occur, non-local wind speeds are correlated with wave height (Mar. 25-28). The most probable explanation is that those non-local winds are causing the increase in wave height.

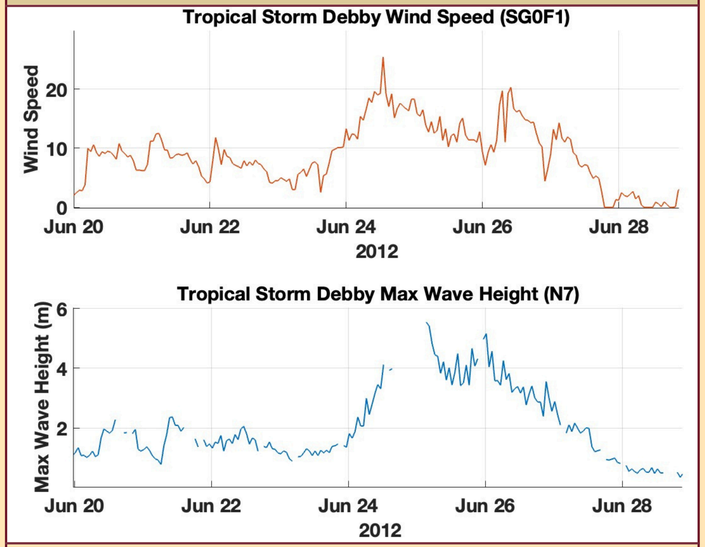


The graph above compares the difference in max wave height between both offshore and onshore wind speed.

Offshore winds are correlated with higher wave heights than onshore winds in the wave environment of the Big Bend Region. This can be mainly attributed to offshore winds having longer fetches than onshore winds.

- The only instances of wave height reaching above 1.4 meters occur during offshore wind events.

Results: Tropical Storm Debby



This graph compares the wind speeds and max wave height during Tropical Storm Debby.

The high wind speeds from the tropical storm are correlated with high wave heights that aren't typically found in the region's low wave energy environment. Tropical cyclones are capable of generating high wave energy, adding more complexity in understanding the region's wave environment.

Discussion

Our research seeks to answer how different kinds of wind events affect the wave environment of the Northern Big Bend Region of Florida. The analysis concluded that non-local and local wind speeds are correlated with high wave heights in the Big Bend Region. It also concluded that offshore wind events are correlated with higher wave heights than onshore wind events in the region. Frequent tropical cyclones also introduce uncommonly high wave heights. These findings can inform future studies in the region. Research is still ongoing as there are other wind variables, that have yet to be analyzed, that could be affecting the wave environment. The study duration is a limiting factor due to the sheer amount of data that has yet to be analyzed. Future research should consider the fetch as a variable to gain a greater understanding of the wave environment.

References/Acknowledgments

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