

Coastal Ocean Institute
Final Project Report COI:PALEO-HURRICANE INTENSITY

What were the primary questions you were trying to address with this research? (Or, if more appropriate, was there a hypothesis or theory that you were trying to prove or disprove?)

This project focuses on examining the potential use of marine microfossil assemblages found in washover deposits as indicators for gauging storm intensity/wave magnitude in the Florida Panhandle using instrumental, historic and modeled data as validation. The marine microfossils, benthic foraminifera, living on the sea floor are excavated during surge and increased wave climates and re-deposited landward. The depth from which they were excavated and distance traveled may provide valuable insight on past storm conditions and variability over time.

What have you discovered or learned that you didn't know before you started this work?

In the Florida panhandle at Mullet pond, offshore foraminifera were excavated from greater depths and distances during the most severe historic storms.

What is the significance of your findings for others working in this field of inquiry and for the broader scientific community?

The development of our approach will allow reconstructions of how storm intensity may have varied temporally. The development of regional records of this nature will enable the evaluation of climate forcing links to frequency and intensity.

What is the significance of this research for society?

These research findings can provide insight on past storm intensity (in terms of surge and wave climate) which are important factors to consider when preparing and planning for present and future storm scenarios. Understanding the range in scales of storm characteristics is imperative for coastal planners, economies and livelihoods.

What were the most unusual or unexpected results and opportunities in this investigation?

The coastal offshore bathymetry in the panhandle region has a shallow slope therefore small changes in depth resulted in greater distances offshore, some in excess of 7km to excavate over 5m depth. Offshore foraminifera found in a handful of deposits suggest that in some instances storms have been much more intense than those that have been experienced in the historic and instrumental record.

What were the greatest challenges and difficulties?

The time and precision required to enumerate foraminifera (modern and fossil) from sites and develop good modern datasets from the offshore environment with which to compare to fossil assemblages found in cores. Hundreds of foraminiferal samples were analyzed.

When and where was this investigation conducted? (For instance, did you conduct new field research, or was this a new analysis of existing data?)

The investigation started prior to this COI study in 2007 with exploratory stratigraphy of several (10's) of coastal ponds in the Florida panhandle. Sampling of cores and offshore sampling were pursued from 2008-2011.

What were the key tools or instruments you used to conduct this research?

Tools pertinent to the research were radiographs of cores to detect denser sand layers, grain-size analysis to quantify the distribution of grains within sand deposits, and fossil foraminifera preserved in cores from areas that archive storm overwash. SLOSH surge models were used to estimate historic storm surge and tide gauges records enabled modeled surge to incorporate the tide level and for comparison of surge between SLOSH, historic tides and foraminiferal estimates. Key instruments include microscope, vibracore, ekman grab sampler and depth sounder.

Is this research part of a larger project or program?

In conjunction with this project a regional study with similar goals was undertaken in New England with the hopes of utilizing the offshore benthic foraminifera in the same way. That project is almost complete and data looks positive for its utilization although there is variability (not a smoking gun). This will also be the first regional use of fossil foraminifera in washover deposits to estimate surge and wave climate scenarios for paleohurricanes.

What are your next steps?

Future goals aim to continue to develop benthic foraminifera as proxies for storm surge intensity and wave climate in paleohurricane deposits. One particular goal is to apply the proxy to longer regional records to test over what temporal and spatial scales the method may be applicable.

Have you published findings or web pages related to this research? Please provide a citation, reprint, and web link (when available).

Some of the results can be seen in Lane et al. (2011) and Hawkes et al. (2012). Two further publications are pending submittal.

Please provide photographs, illustrations, tables/charts, and web links that can help illustrate your research.

<http://www.sciencedirect.com/science/article/pii/S0025322711001472>