

A Climatology of Landfalling Hurricane Central Pressures Along the Gulf of Mexico Coast

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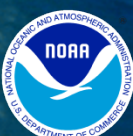
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Raleigh, NC*

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*USACE /ERDC Coastal & Hydraulics Laboratory
Vicksburg, MS*

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Outline & Motivation for Study

- ✓ Analyze the climatological characteristics of landfalling Gulf of Mexico hurricanes *specifically for wave and surge modeling*:
 - 10-m wind (U_{10}), Wind stress (τ), drag coefficient (C_D), central pressure (C_p), peripheral pressure (P_o), and central pressure deficit (ΔP)
 - Central Pressure (C_p) - *directly observed* measure of TC max intensity
- ✓ Discuss the historical observations of C_p related to Gulf Coast hurricanes
 - Return periods and along-shore variability of C_p over different sections of Gulf Coast
- ✓ Analyze the changes in C_p prior to, and during, landfall
 - 12-hr change in Gulf hurricane ΔP and C_p

Methodology

- ✓ Examine 6-hr C_p observations from HURDAT
 - Assess best period of record for analysis
- ✓ Correlate Pre-Landfall & Landfall C_p with ΔP
 - Analyze by sub-region along Gulf Coast
- ✓ Assess along-shore variability:
 - C_p return periods
 - Correlate pre-landfall and landfall ΔP for different sections of Gulf Coast

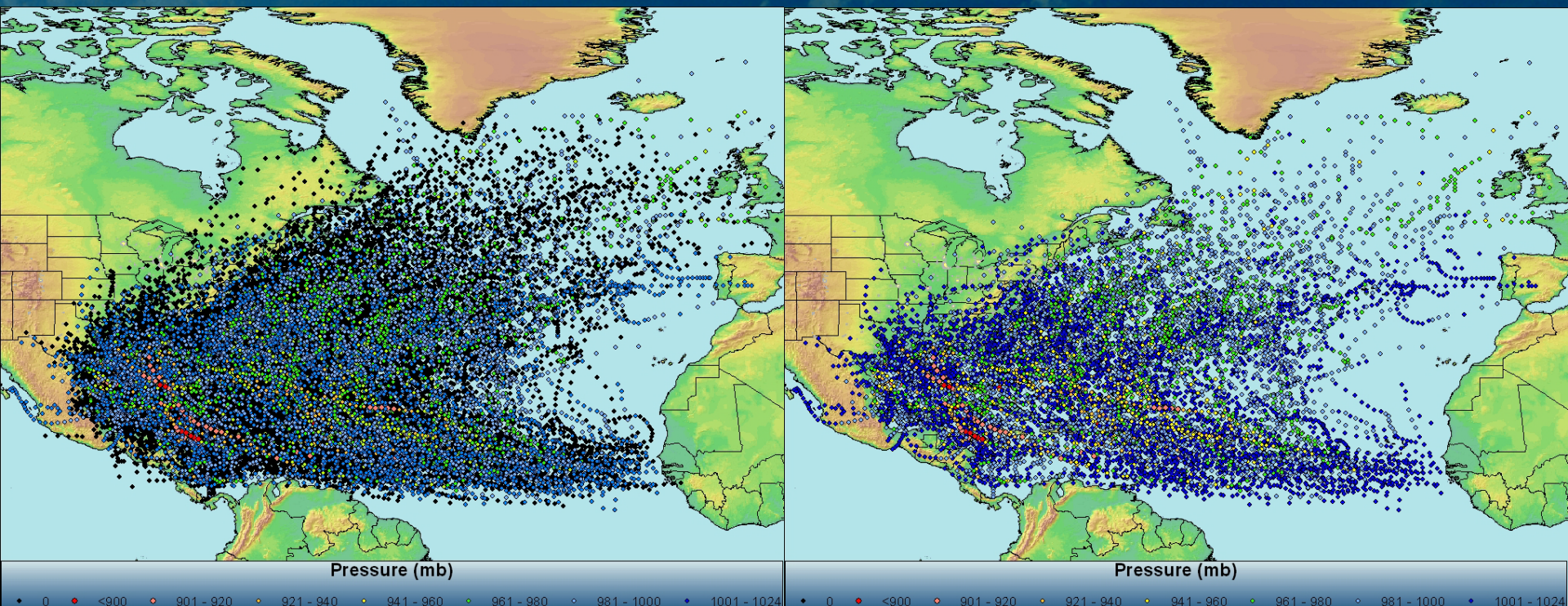
Conclusions

- ✓ Significant along-shore variability in C_p return period
 - Lowest in the central Gulf Coast region (LA & MS)
 - Period of record strongly affects results
 - Broad confidence limits!
- ✓ Correlation of 12-hr change in Pressure Differential (ΔP) and C_p
 - Pre-landfall C_p has higher correlation than landfall C_p
 - Highest correlations found for LA and FL Panhandle
 - Best correlations using data since 1980
- ✓ Levinson, D.H., P.J. Vickery and D.T. Resio, 2009: A review of the climatological characteristics of landfalling Gulf hurricanes for wind, wave, and surge hazard. *Ocean Engineering*, doi:10.1016/j.oceaneng.2009.07.014.

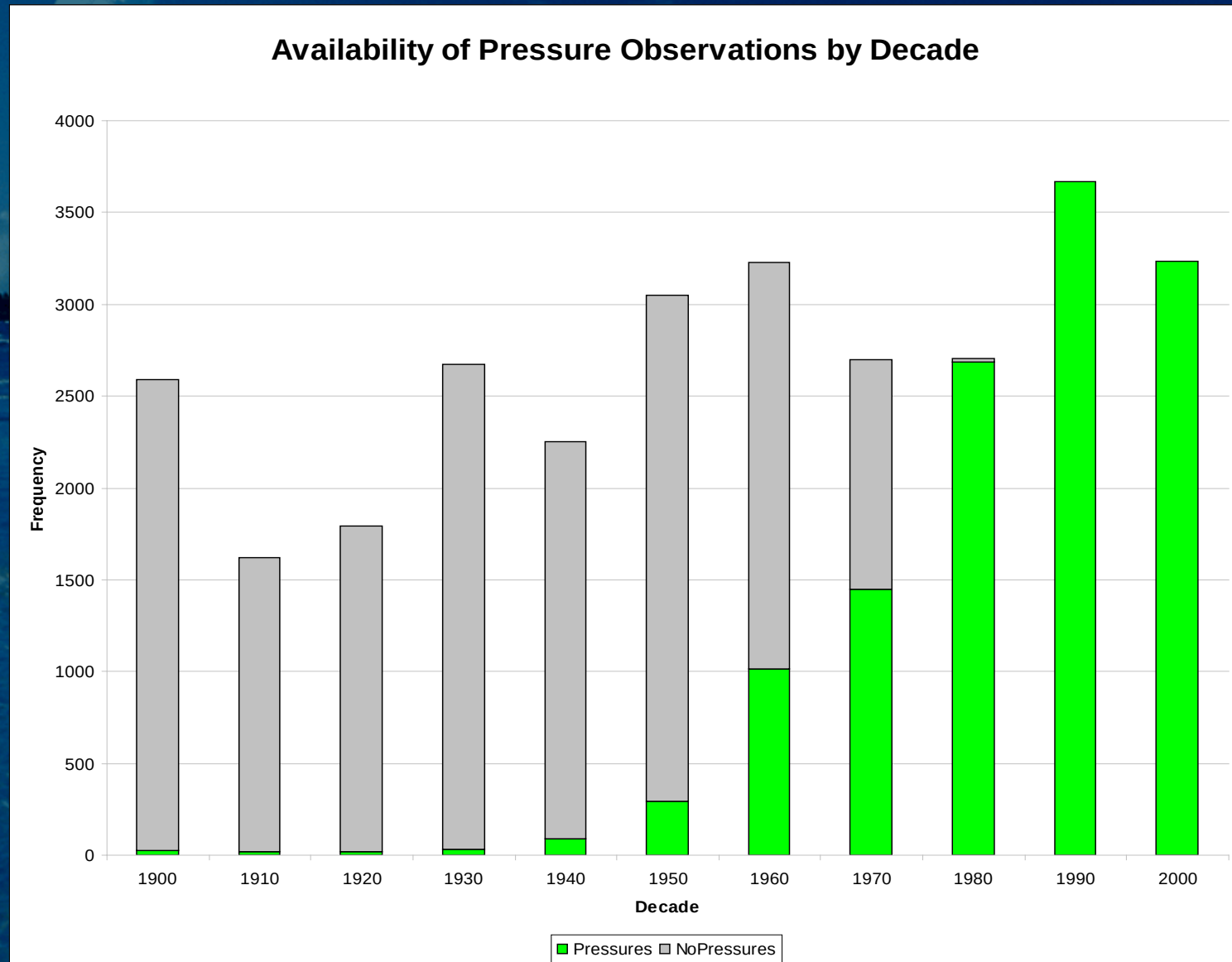
HURDAT Since 1851

All Observations Including Missing
Pressures: 37,854 points

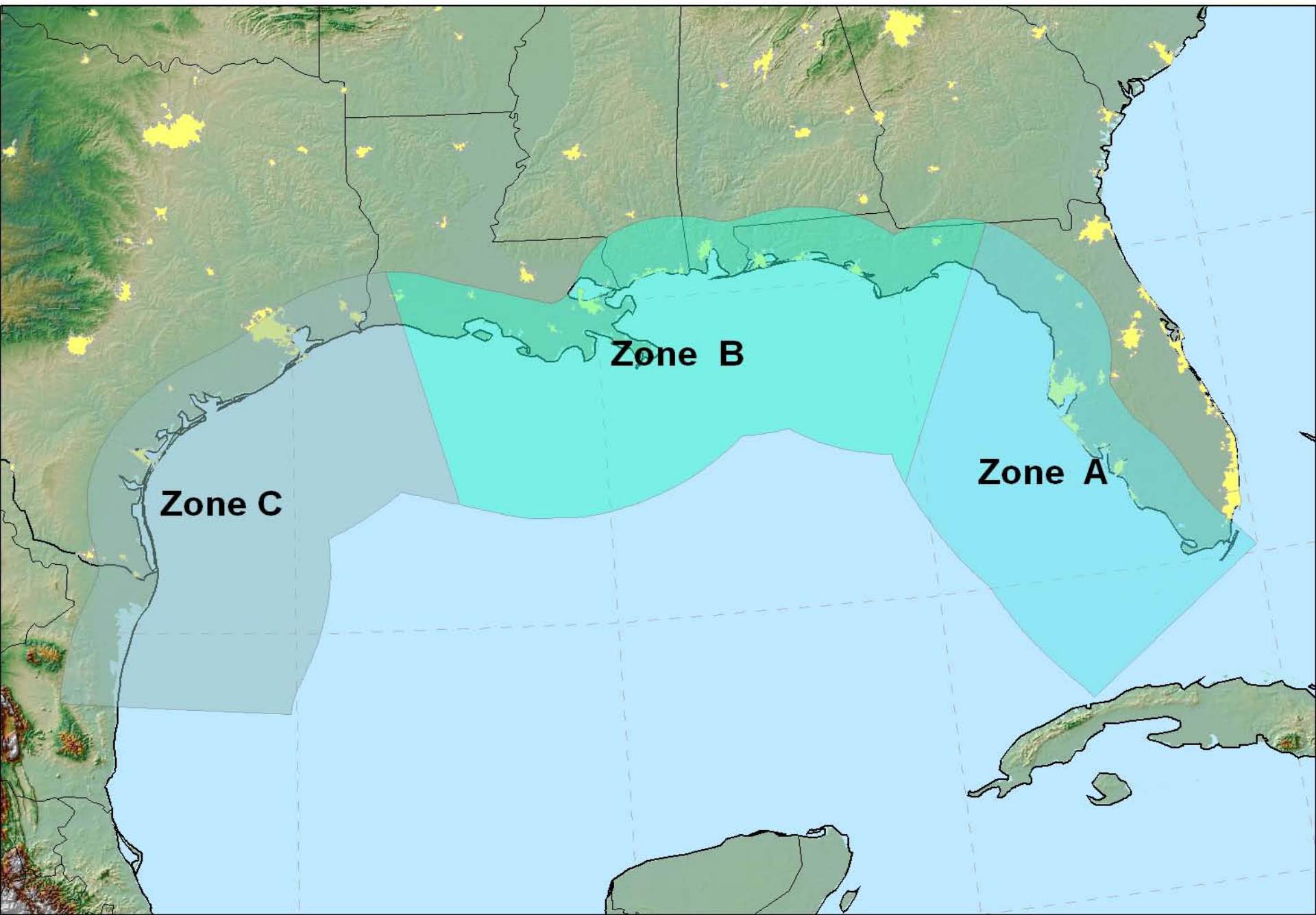
Observations w/ Pressures: 12,095 points



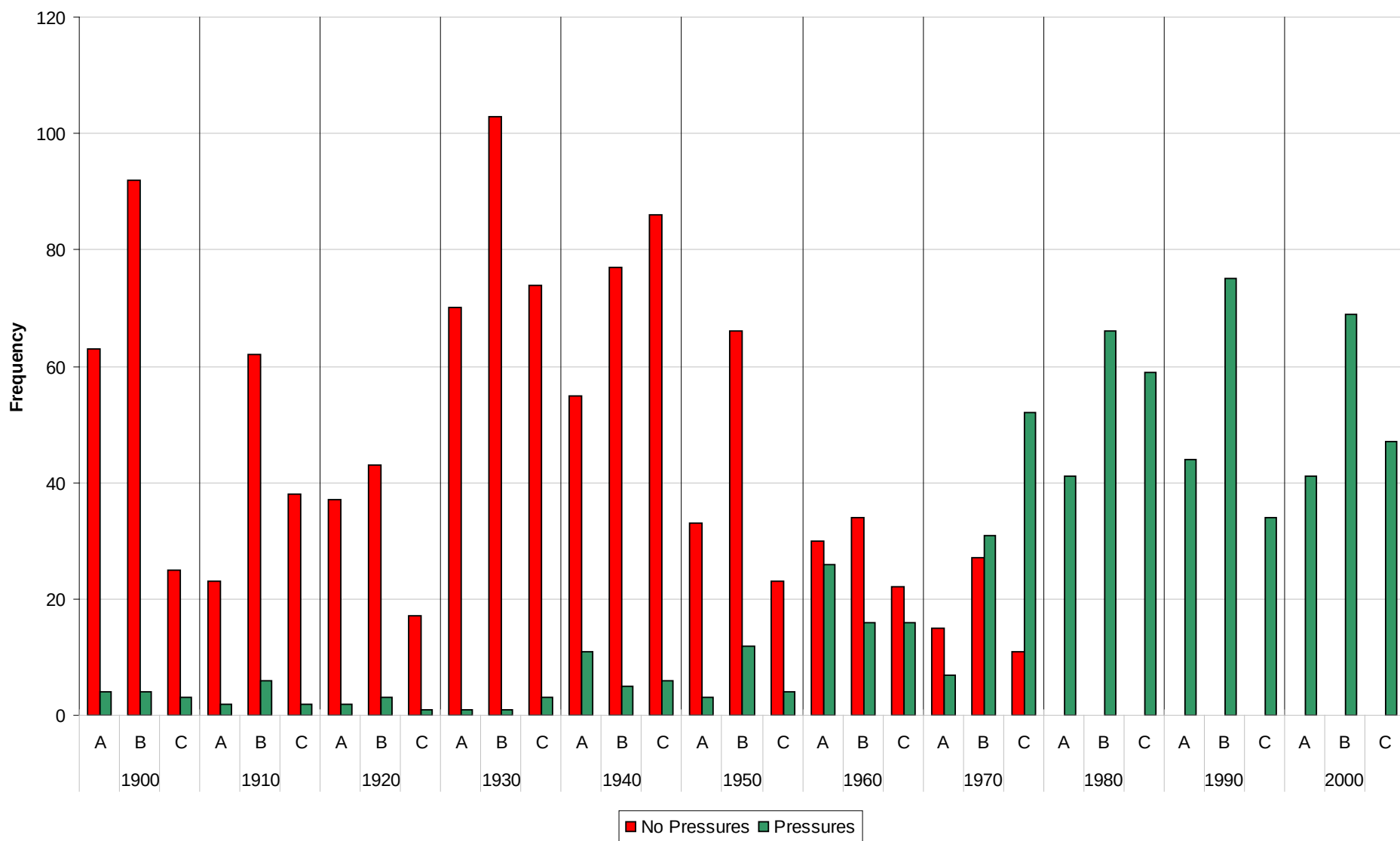
HURDAT Pressure Counts 1900-2005



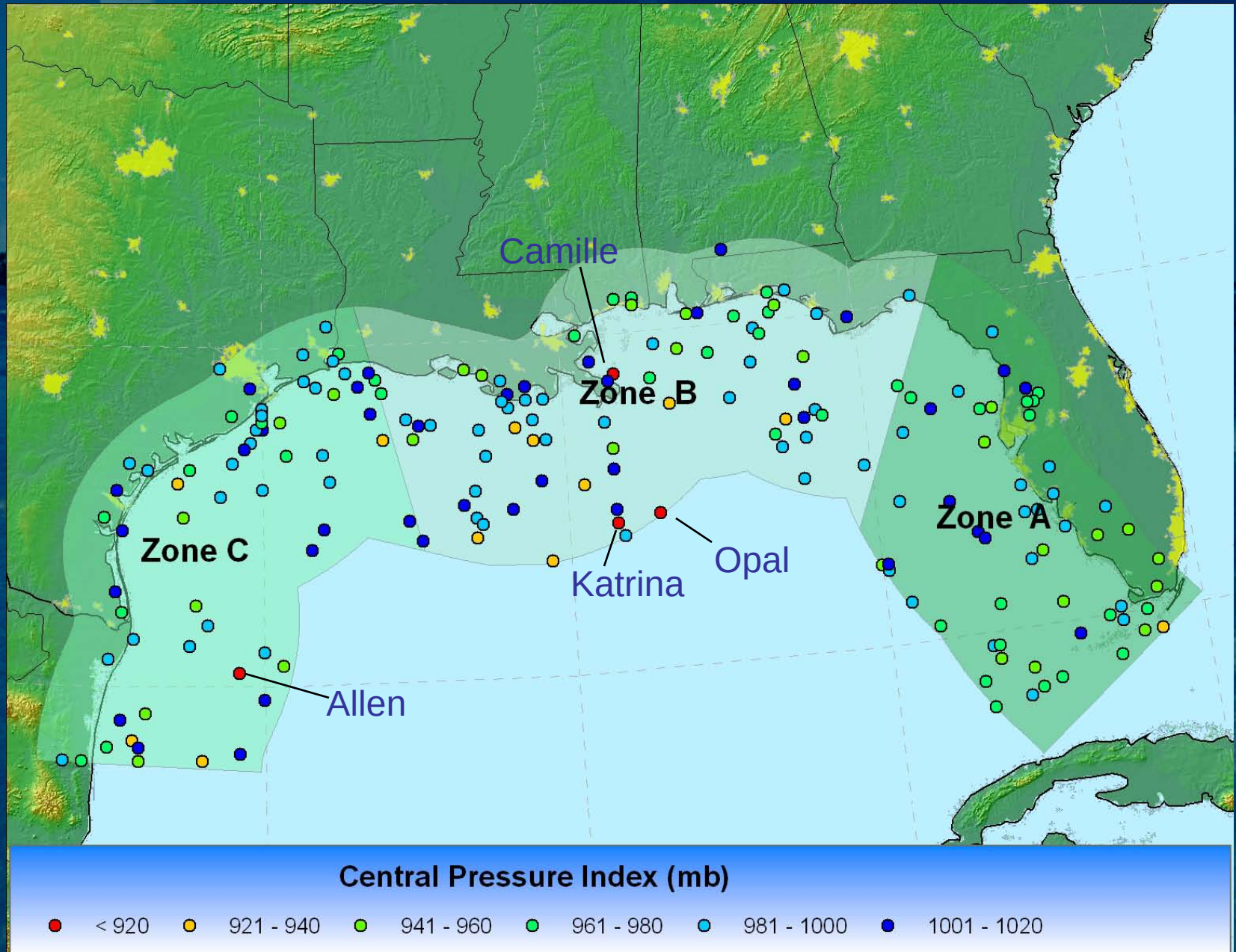
Gulf Coast Zones



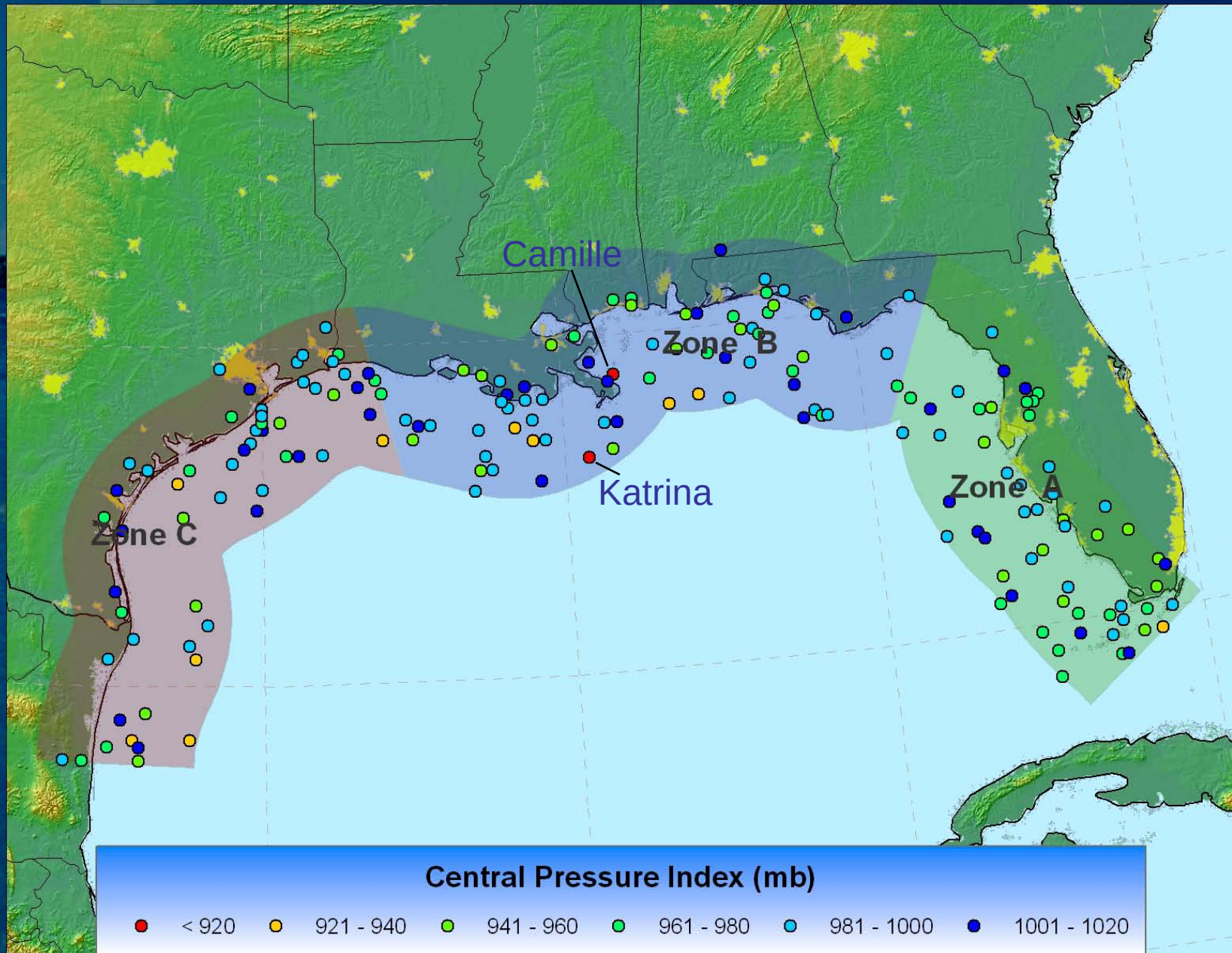
Availability of Pressure Observations by Decade and Zone



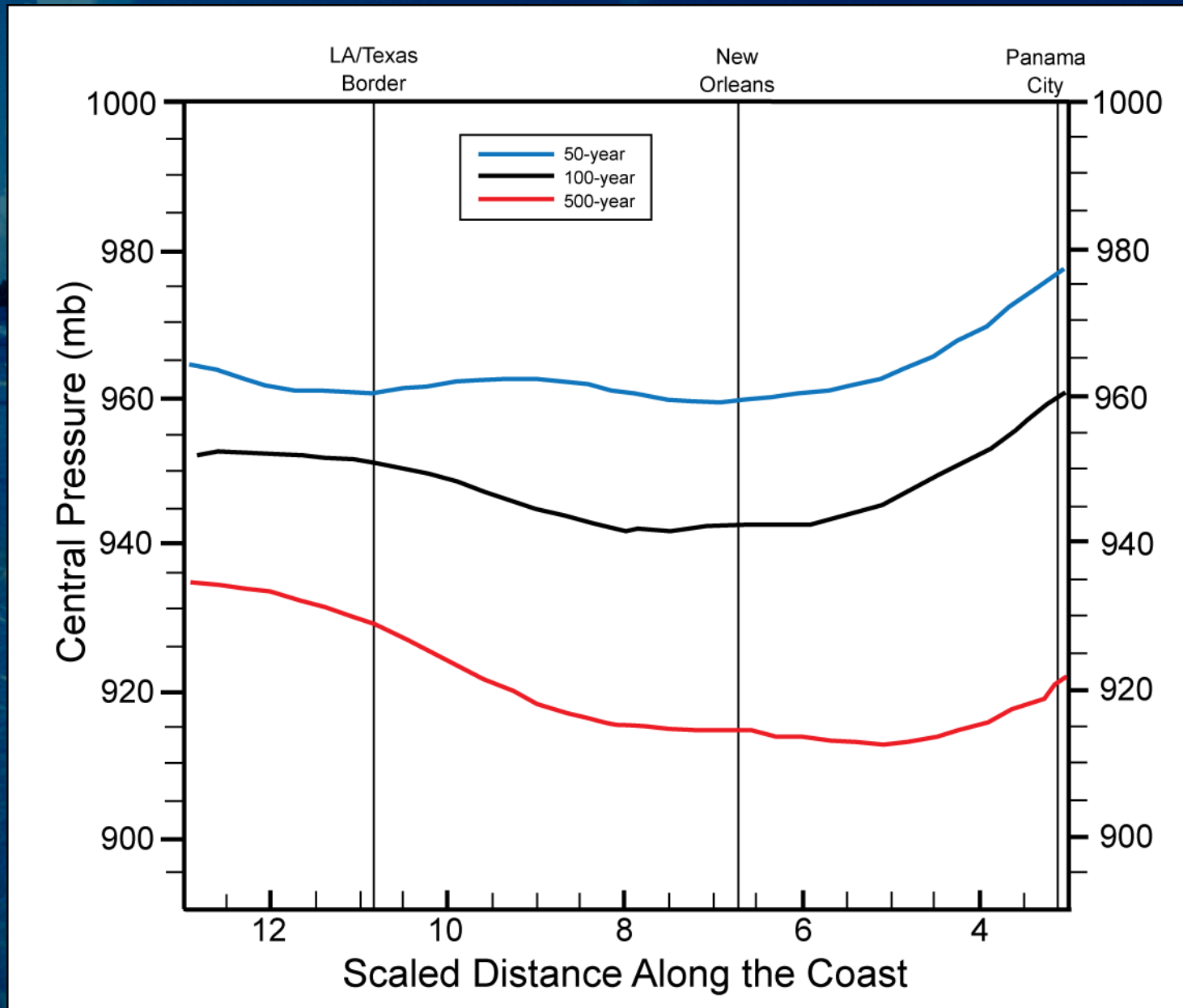
150 N Mile Gulf Coast C_p (1900-2005)



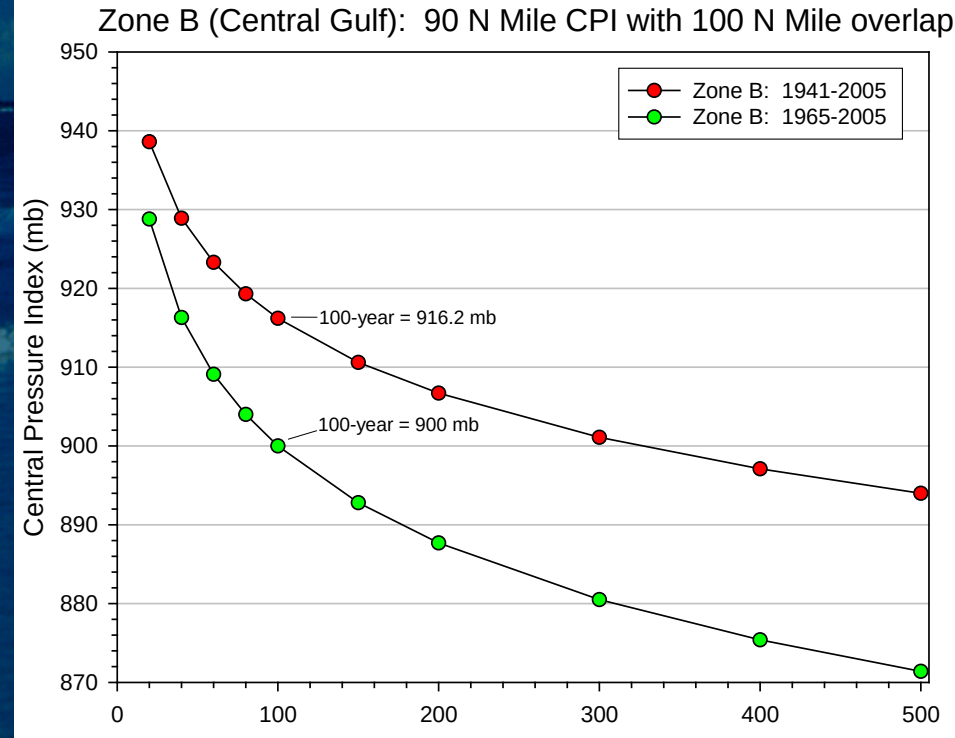
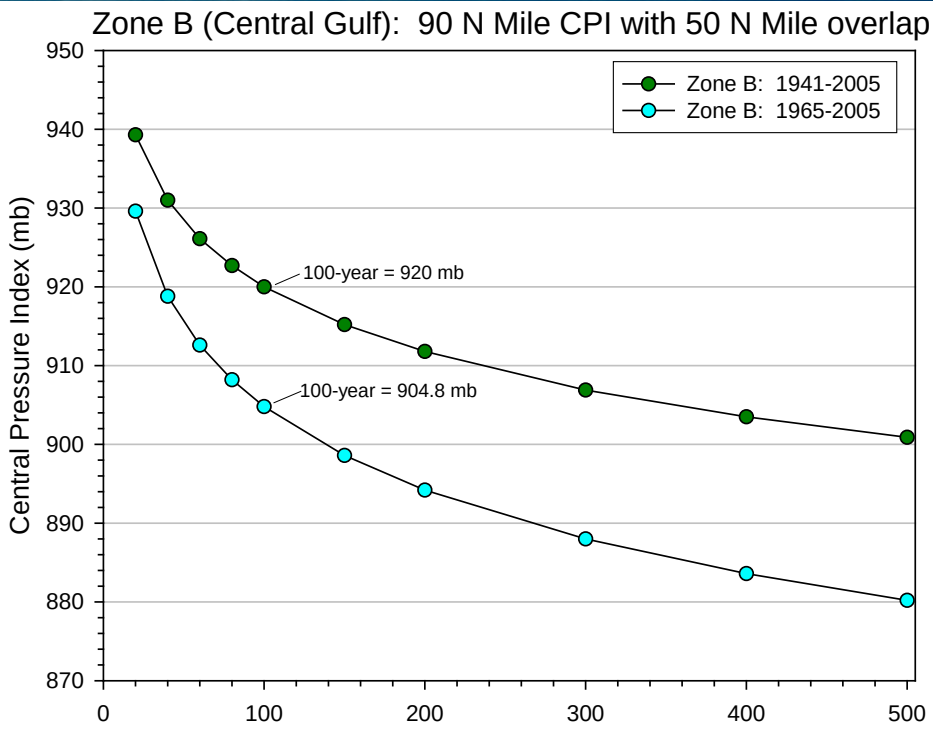
90 N Mile Gulf Coast C_p (1900-2005)



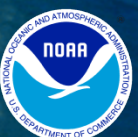
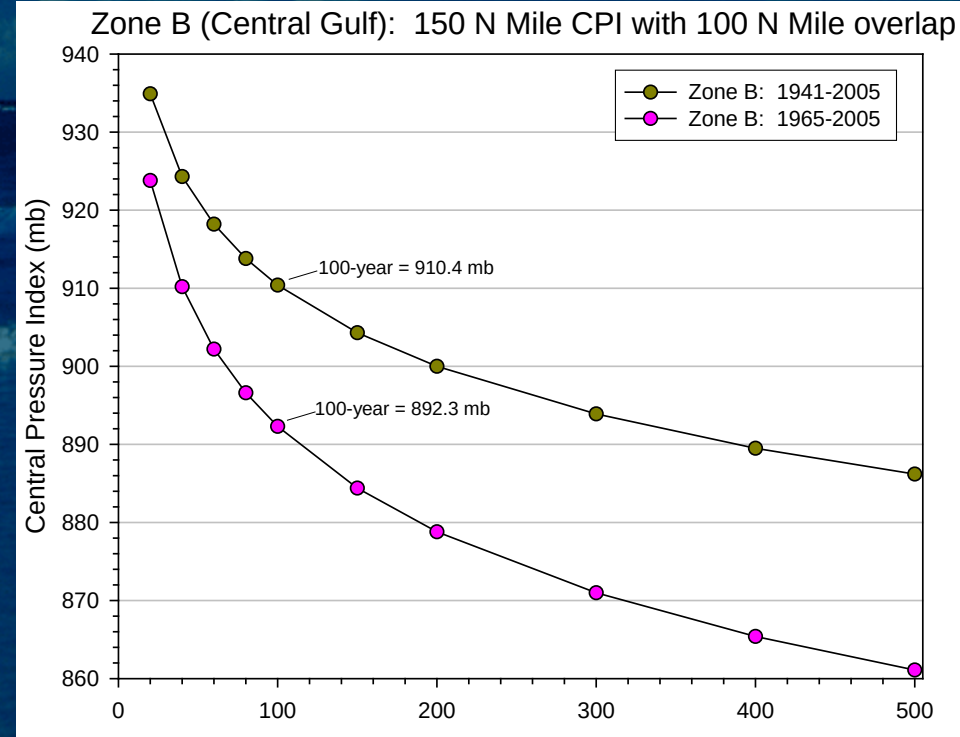
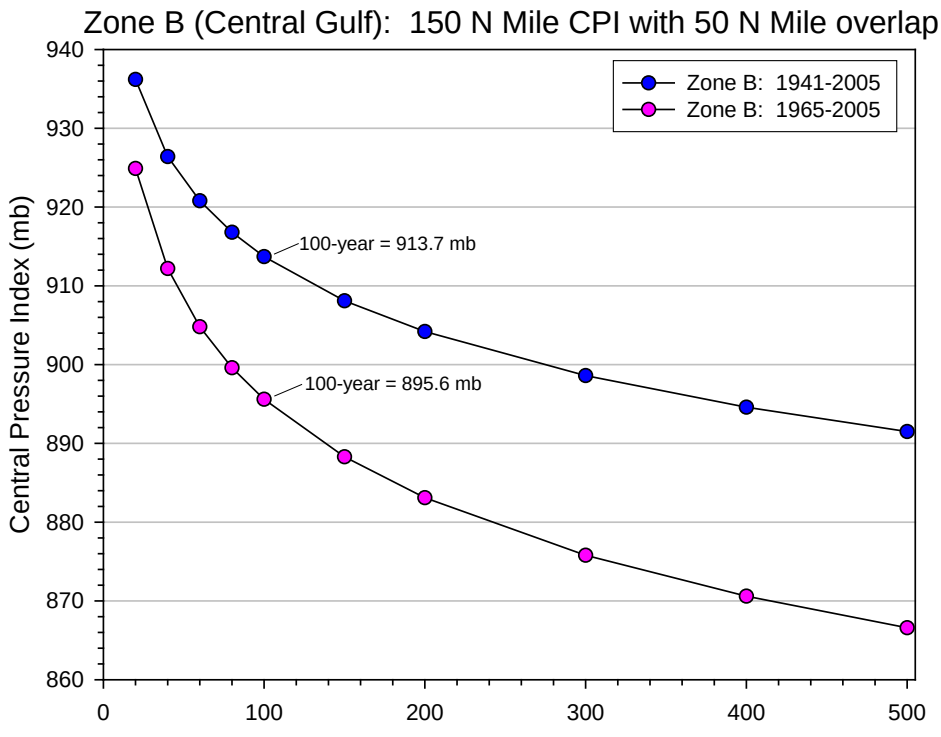
Along Coast C_p Return Periods



C_p Return Periods for Zone B: *90 N Mile Offshore Extent* *50 & 100 N Mile Lateral Extensions*

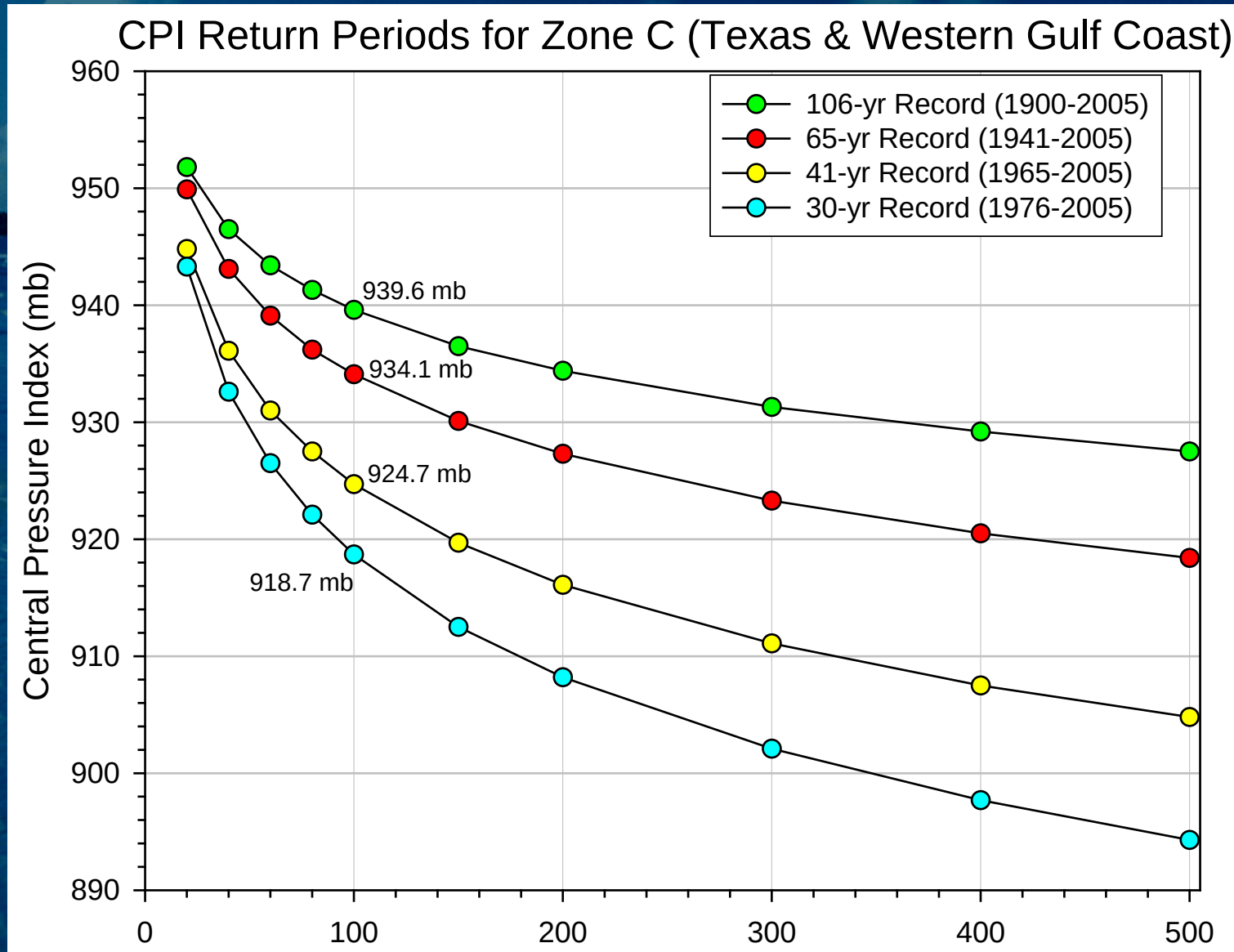


CPI Return Periods for Zone B: 150 N Mile Offshore Extent 50 & 100 N Mile Lateral Extensions

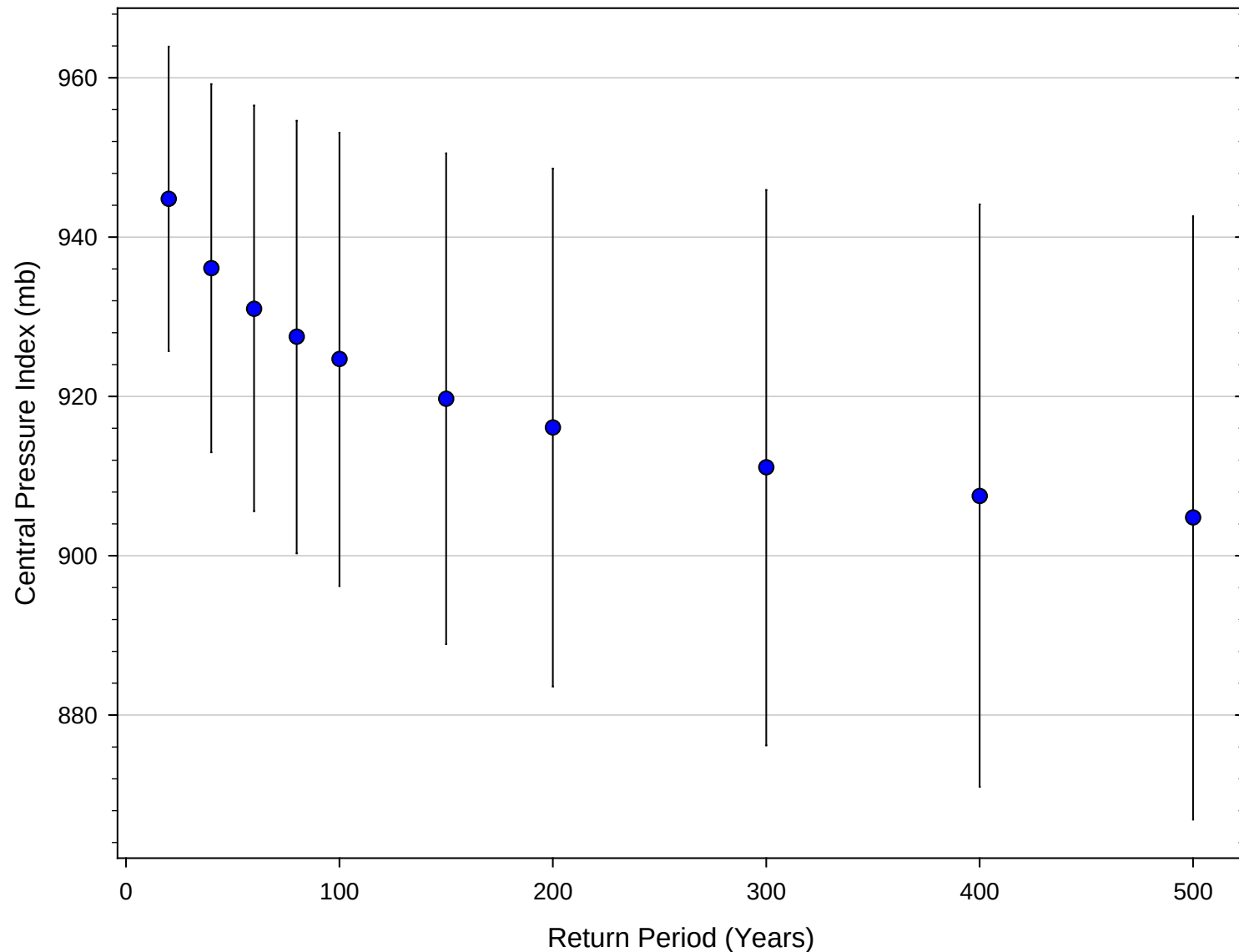


C_p Return Periods (150 N Mi offshore)

Zone C: Texas & Western Gulf Coast

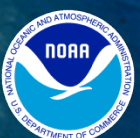


Western Gulf Coast (Zone C) Return Periods and 90% Confidence Intervals
Satellite Era 40-year Period (1965-2005)

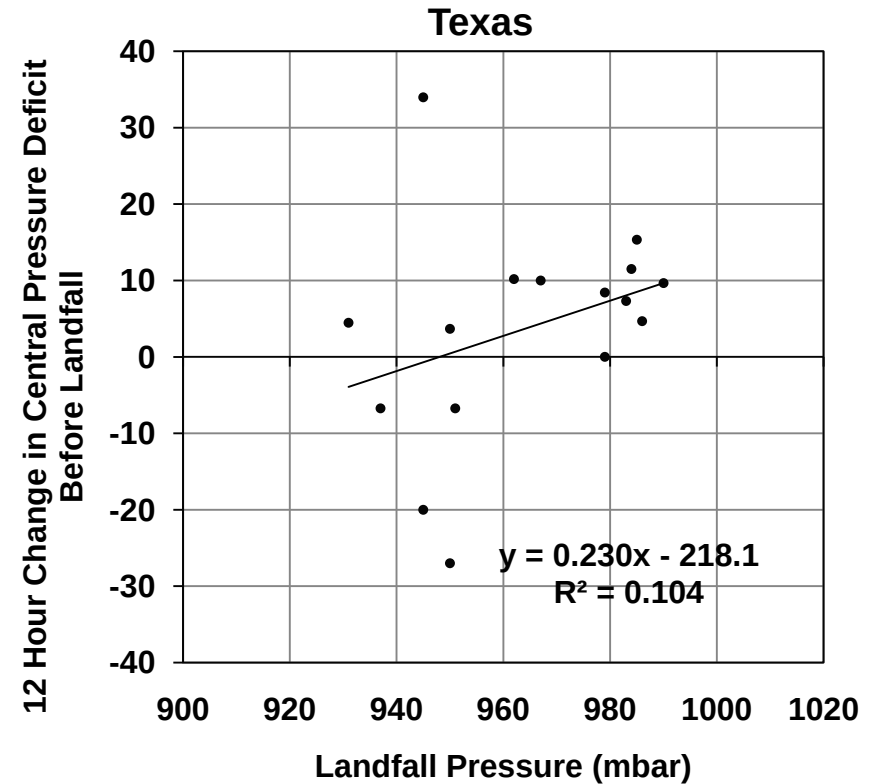
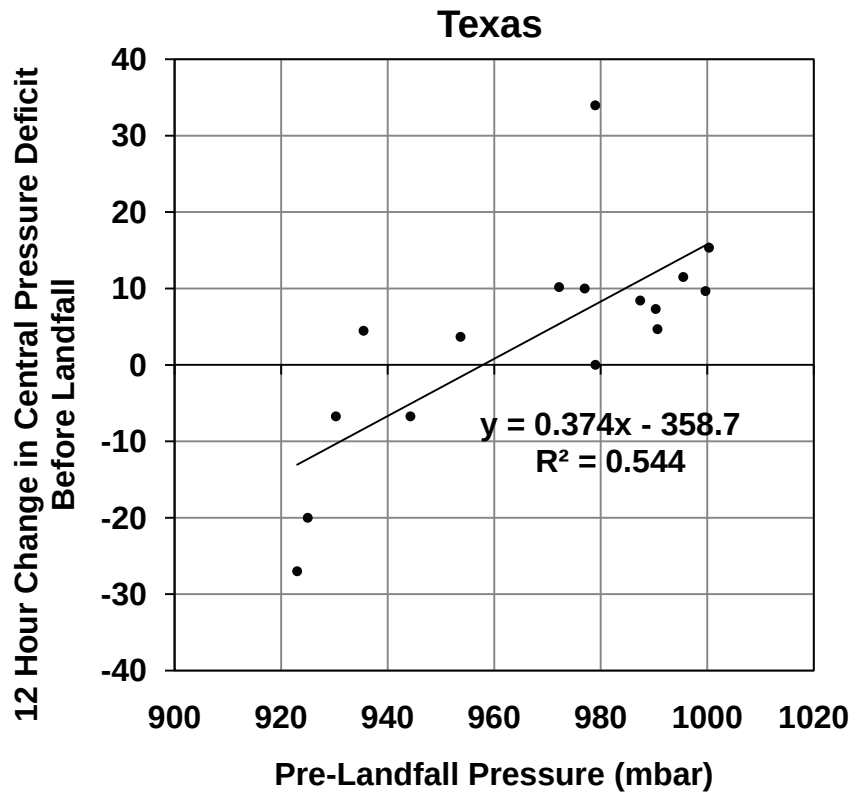


NOAA/NESDIS National Climatic Data Center:

11th Int'l Workshop on Wave Hind-casting and Forecasting & 2nd Coastal Hazards Symposium

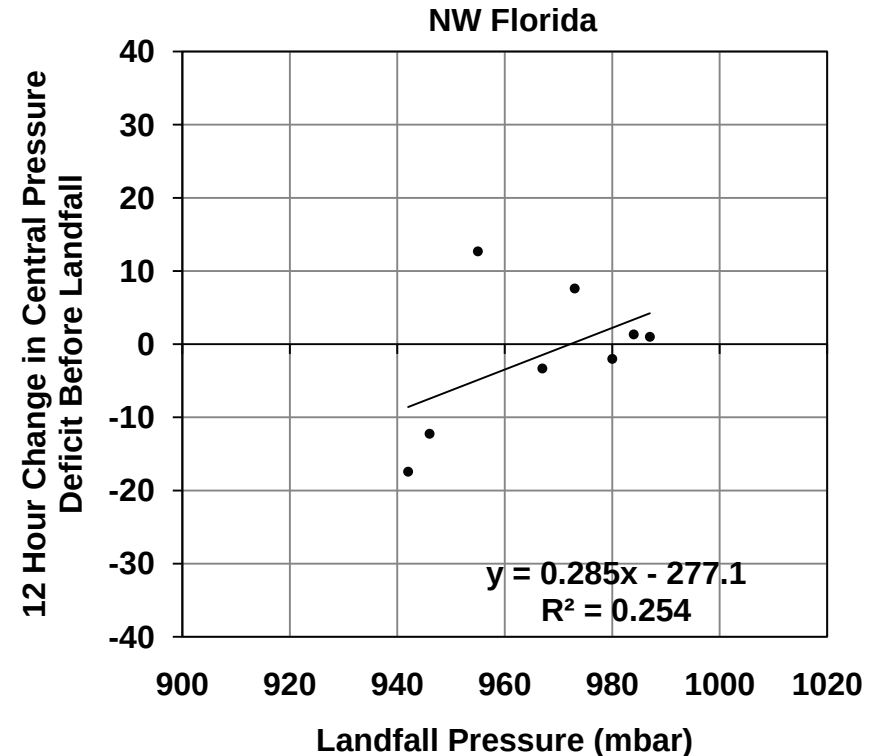
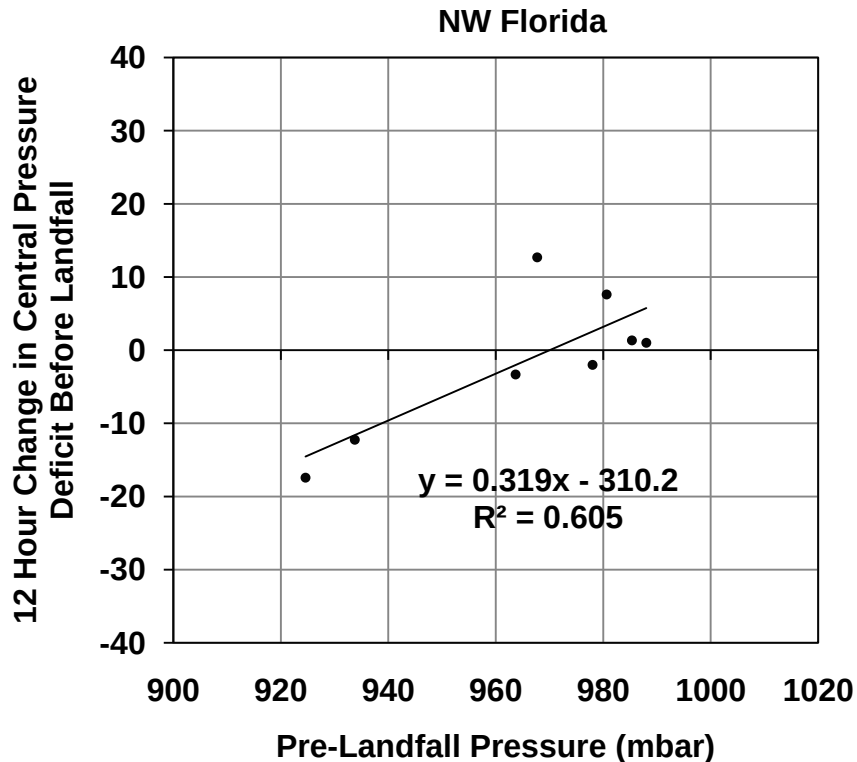


Texas: C_p vs. ΔP



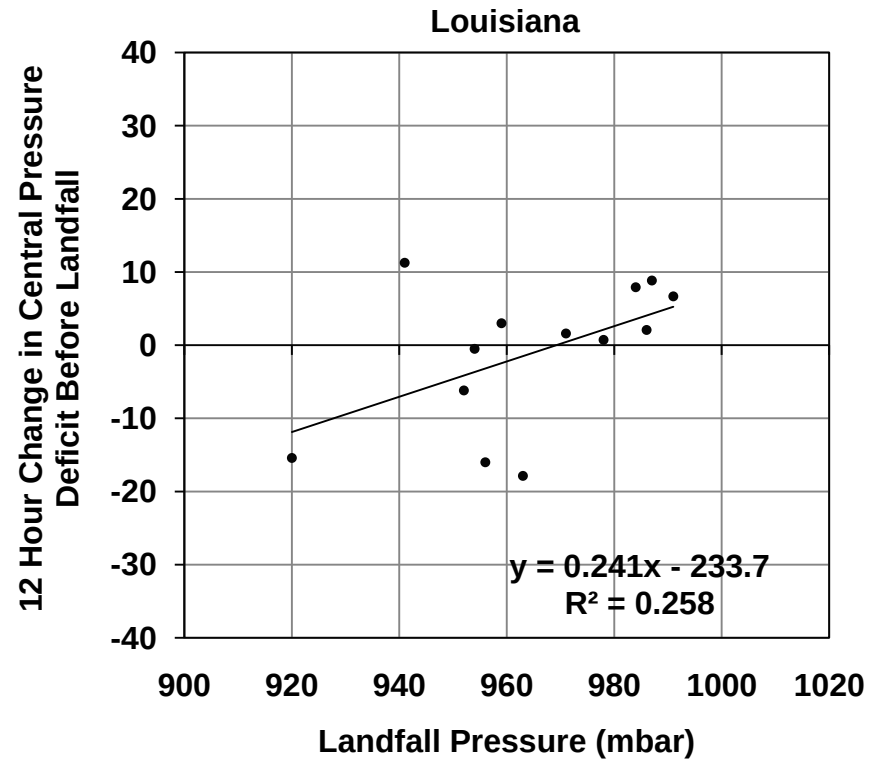
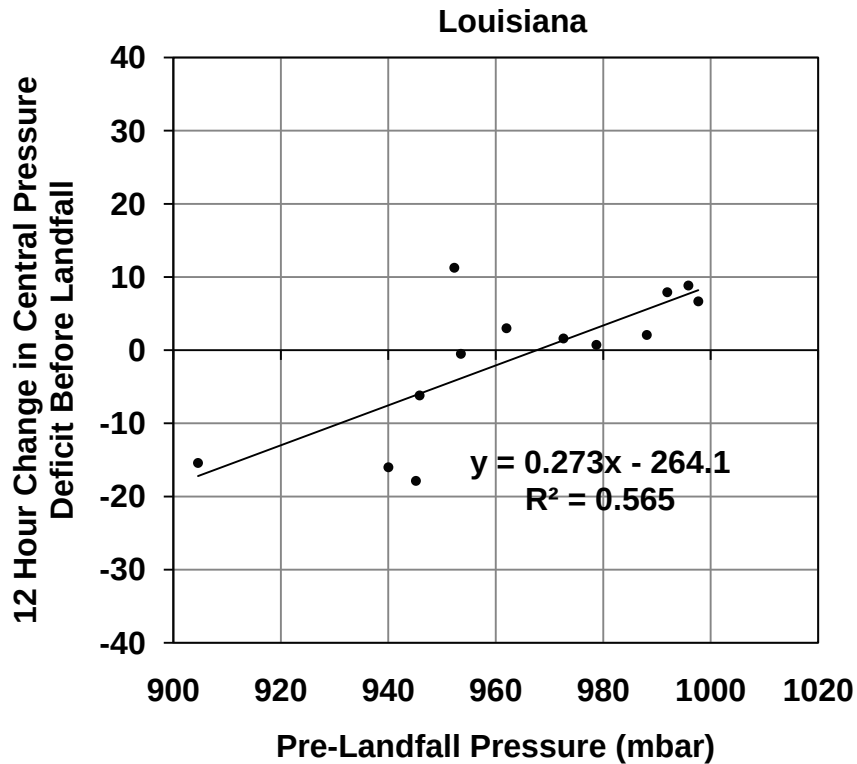
Data coverage: 1964-2008

Florida Panhandle: C_p vs. ΔP



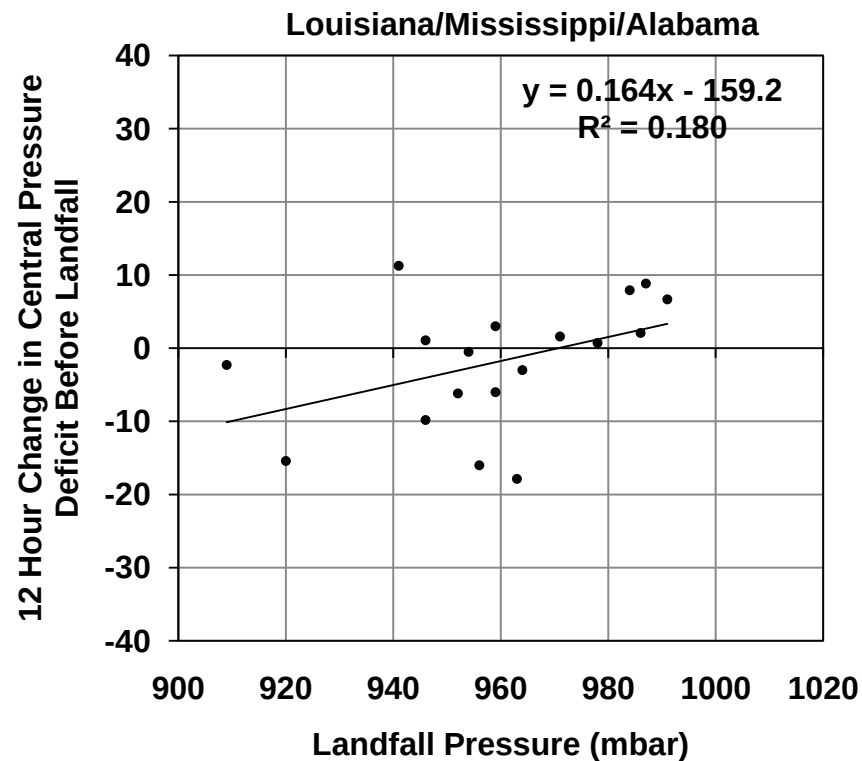
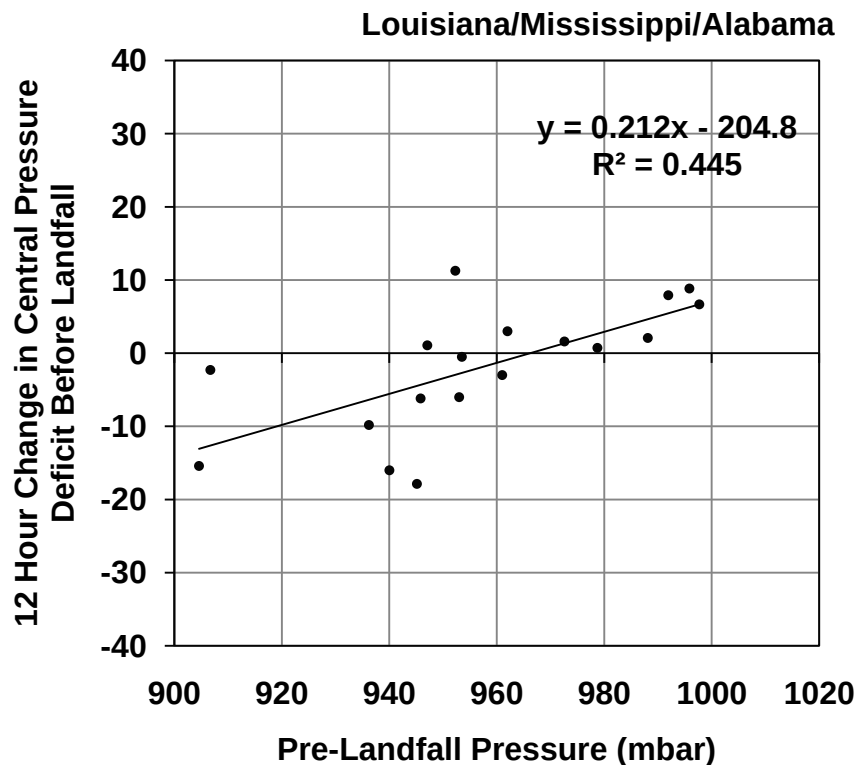
Data coverage: 1964-2008

Louisiana: C_p vs. ΔP



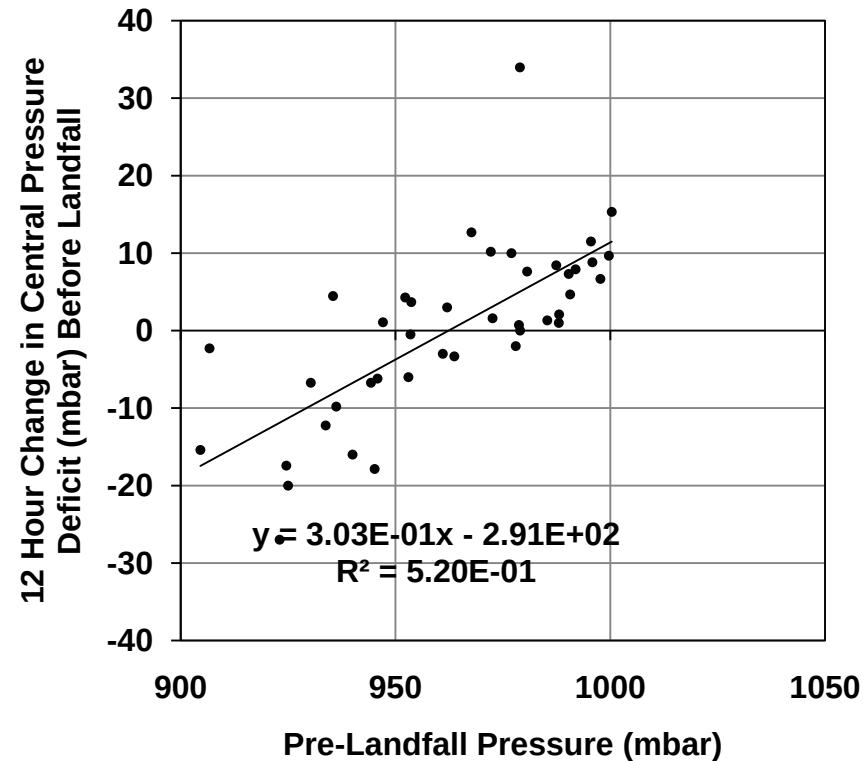
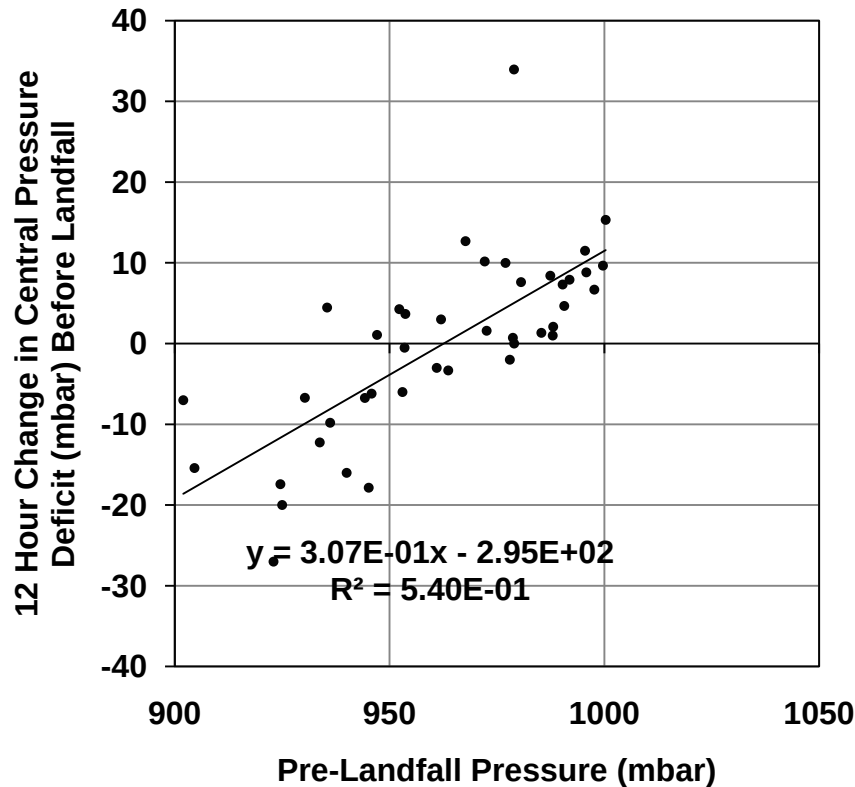
Data coverage: 1964-2008

LA, MS & AL: C_p vs. ΔP



Data coverage: 1964-2008

All Gulf Coast Hurricanes



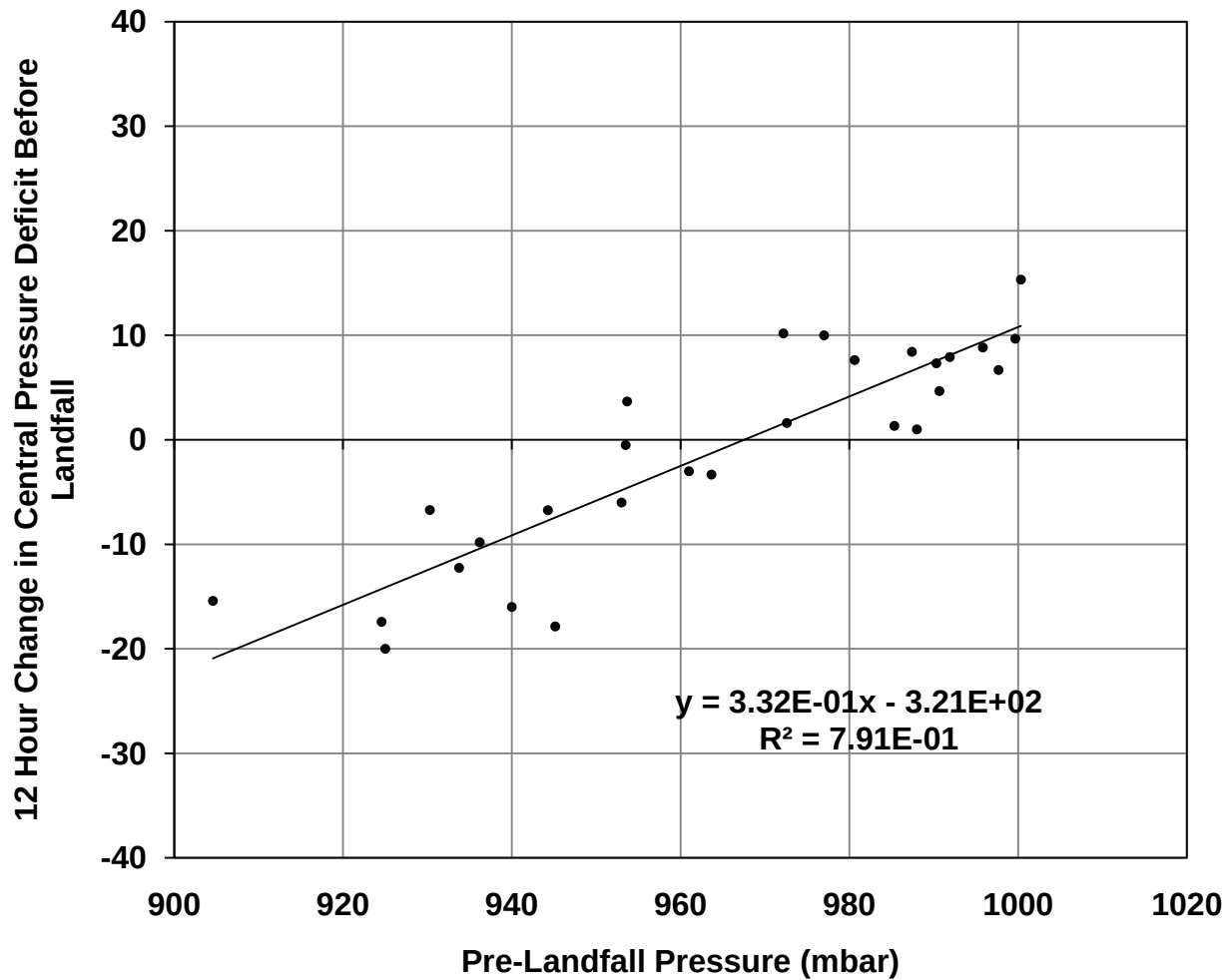
Data coverage: 1959-2008

with Camille

without Camille

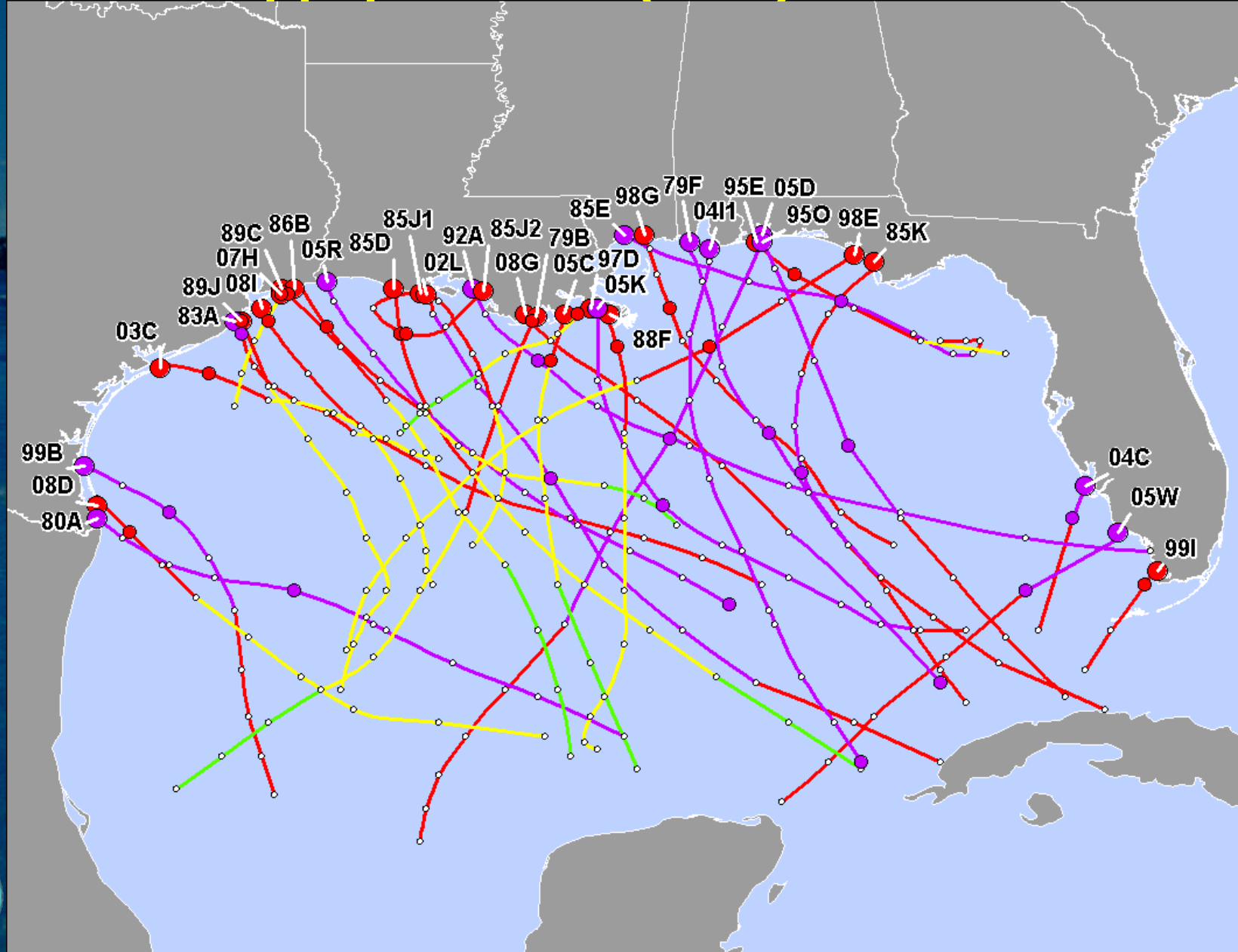


Gulf Coast 1980-2008 Data Only



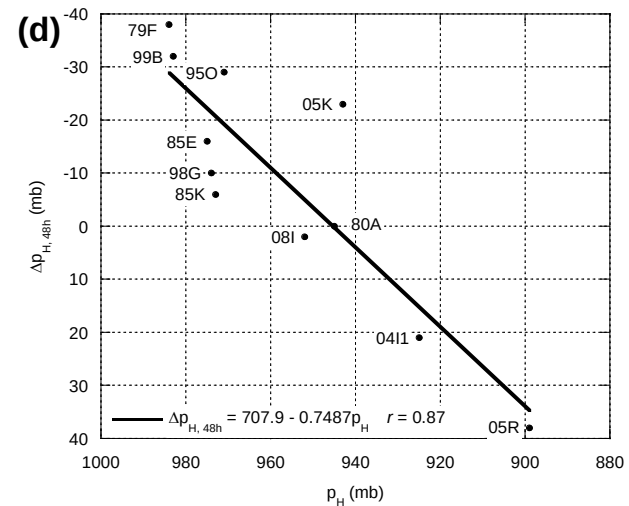
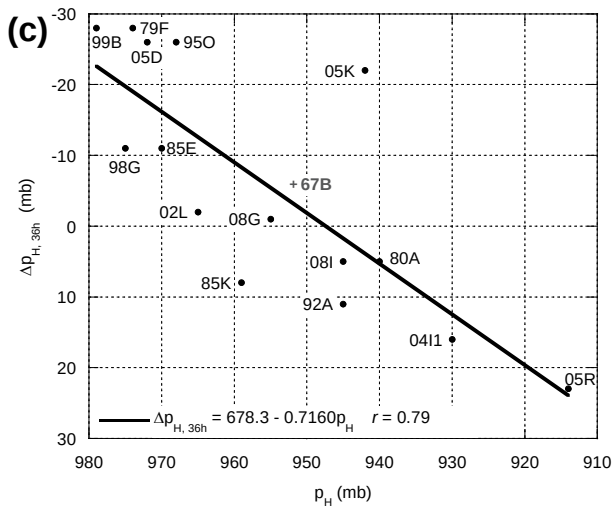
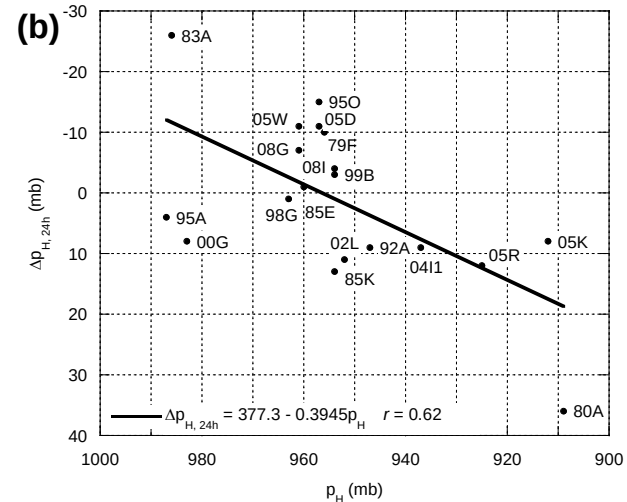
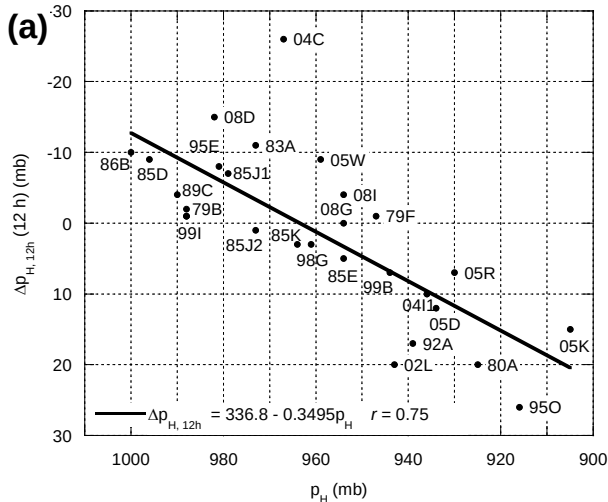
TC Intensity Changes Along Gulf Coast

From Rappaport et al. (2009) *Wea. Forecast.*



48-hr ΔC_p Landfalling Hurricanes

From Rappaport et al. (2009) *Wea. Forecast.*



Data coverage: 1979-2008

Concluding Remarks

✓ Future Work

- EOF analysis Atlantic basin MSLP
 - with Ocean Weather, Inc. and USACE/CHL
- Correlate EOFs of MSLP with hurricane activity, tropical Atlantic SST and wind shear (850-200 hPa)

✓ International Best Track Archive for Climate Stewardship (IBTrACS)

- Comprehensive Global Best Track Dataset
- Version 2 released in July 2009
- Includes updated files through the end of 2008





DOC > NOAA > NESDIS > NCDC

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Search NCDC

<http://www.ncdc.noaa.gov/oa/ibtracs>

Introduction

IBTrACS Data

- Status
- Parameters
- Formats & samples
- Access
- WMS, WFS & KML

Data Summary

- Statistics
- Images
- Track maps

Processing

- Merging storms
- Merging data
- Quality control

Data Sources

FAQ

Bibliography

Contact

IBTrACS

News

WMS, WFS and KML access to IBTrACS now available

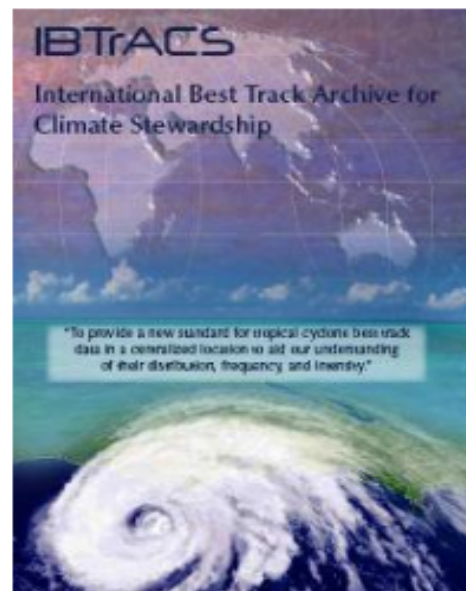
Vision

Providing tropical cyclone best track data in a centralized location to aid our understanding of the distribution, frequency, and intensity of tropical cyclones worldwide.

Introduction

The intent of the IBTrACS project is to overcome data availability issues, and to freely disseminate this new global dataset. This was achieved by working directly with all the Regional Specialized Meteorological Centers and other international centers and individuals to create a global best track dataset, merging storm information from multiple centers into one product and archiving the data for public use.

One of the goals of the project is for the data processing methods to remain open, such that desired user feedback on data quality is more easily collected. Also, data provenance is completely recorded so all observations and corrections, either through rigorous quality control or user feedback, may be tracked. Data are then provided in various formats given the diversity of the tropical cyclone (TC) data user community.



IBTrACS brochure (524KB PDF)





Thank you!

