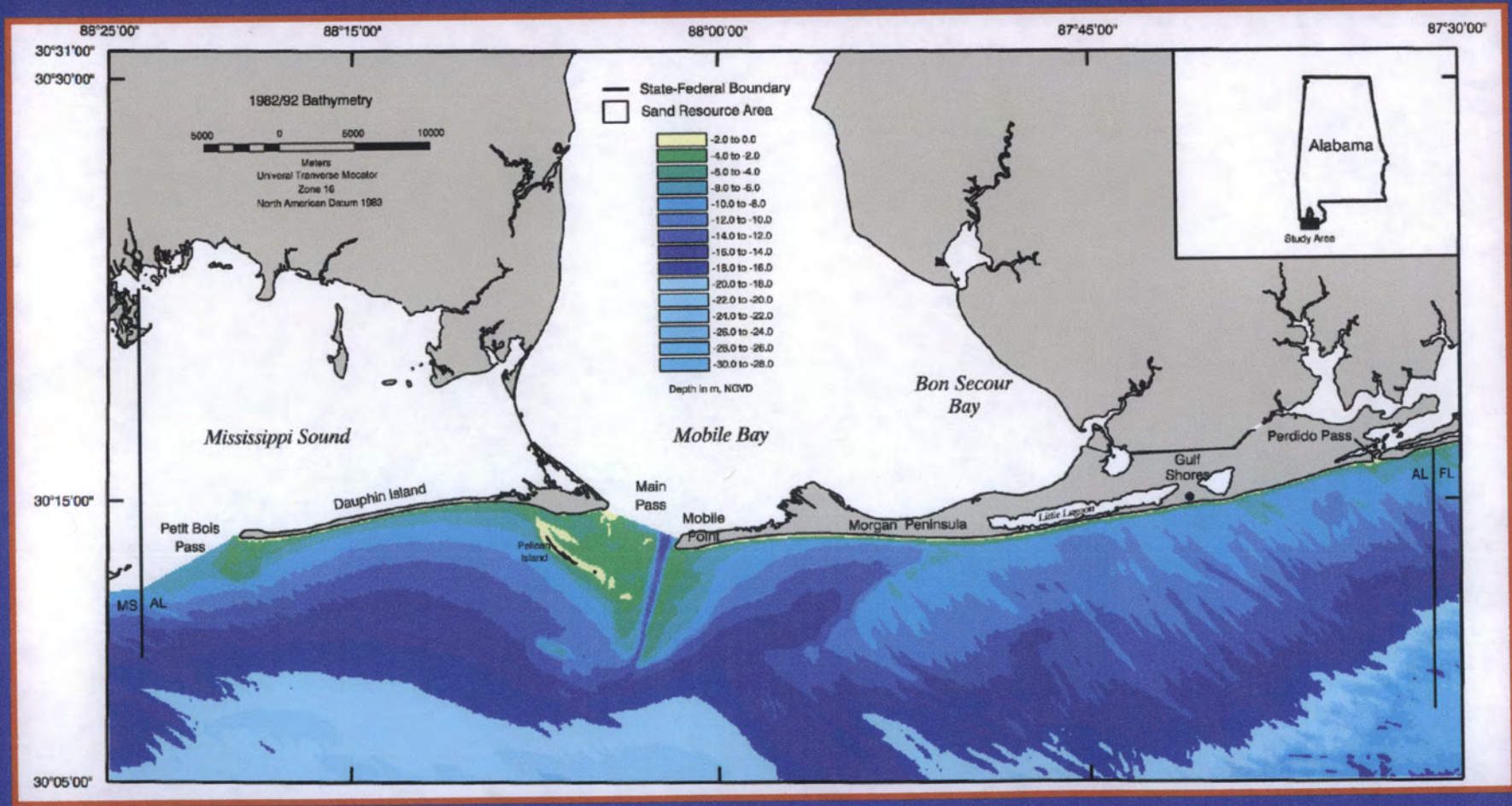
Evaluating the Impact of Channel Dredging on Shoreline Response at and Adjacent to Main Pass, Mobile Bay Entrance, Alabama



Study Purpose

Quantify the impact of channel construction and maintenance dredging on shoreline response at Mobile Pass

Using:

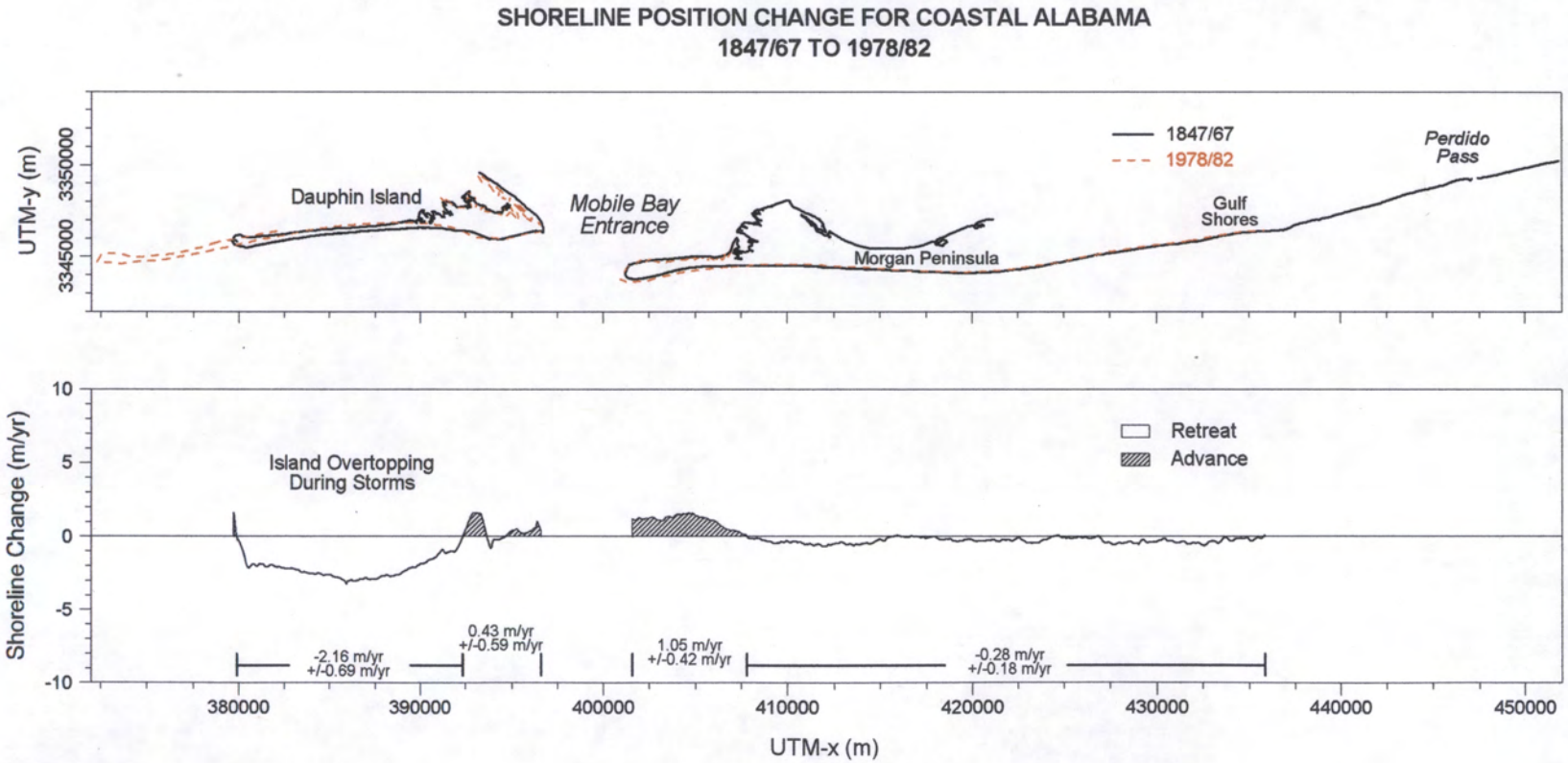
- Shoreline Position Surveys and Beach Profiles
- Bathymetry Data Sets and Dredging Records
- Coastal Processes Measurements (Water Level, Waves, Currents)

Study Elements

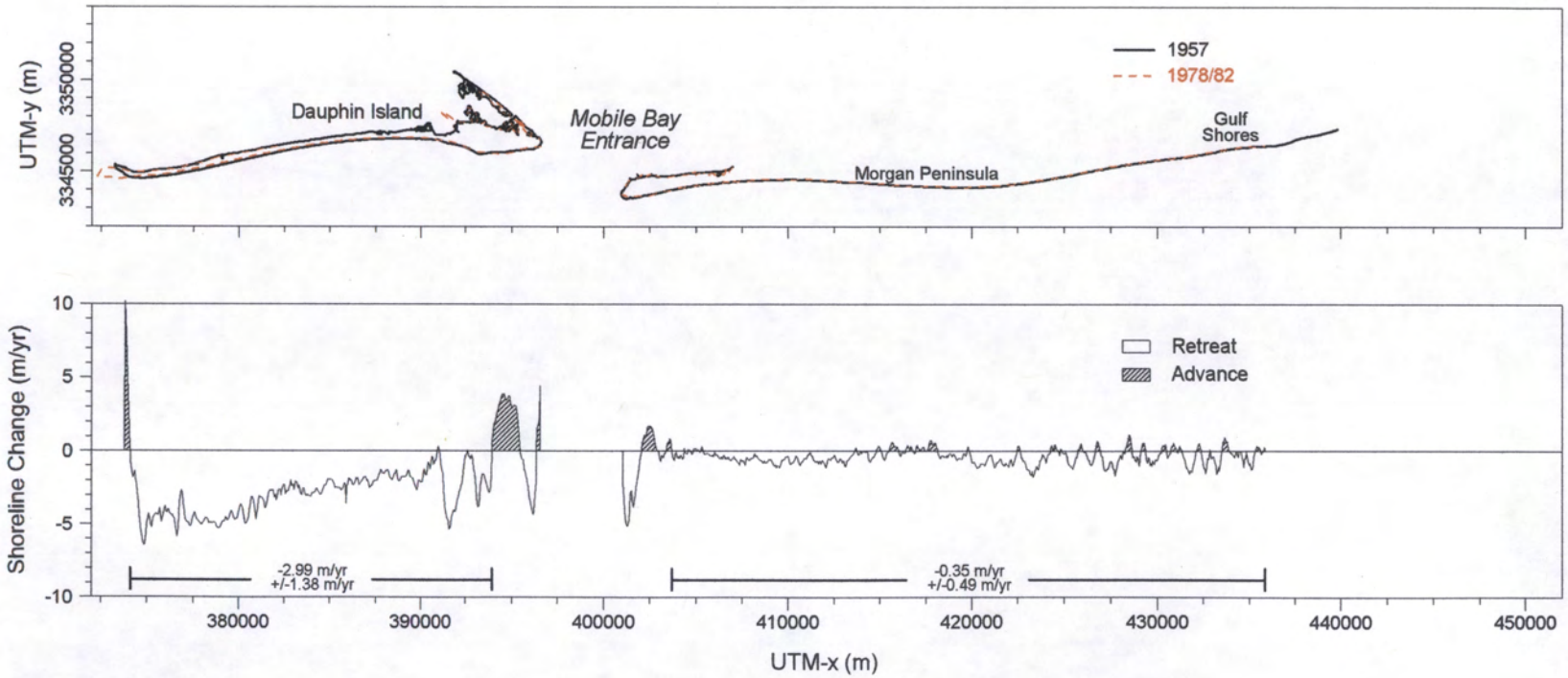
1. Regional and Site-Specific Analysis of Historical Data
2. Hydrodynamic Modeling
3. Wave Modeling
4. Field Data Collection
5. Report Preparation and Presentations

Regional and Site-Specific Analysis of Historical Data (mid-1800s to present)

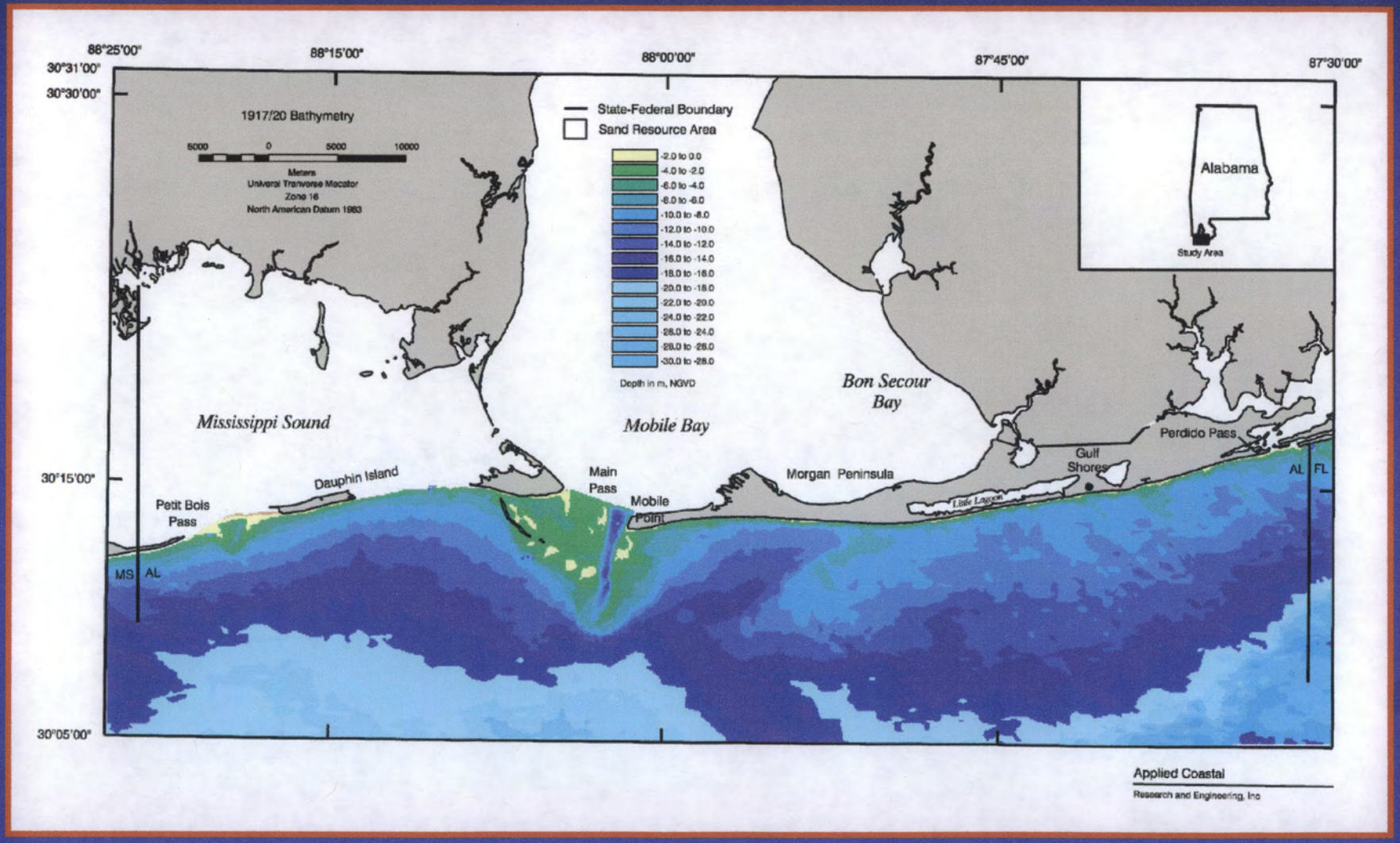
- USC&GS T-sheets, near-vertical aerial photography, ground surveys
- USC&GS H-sheets, USACE bathymetric surveys, beach profiles
- Dredging quantities and sediment type
- Wave and current patterns; water level fluctuations; storm frequency and magnitude
- Results from existing studies


SHORELINE POSITION CHANGE FOR COASTAL ALABAMA
1847/67 TO 1978/82
UTM-y (m)
3350000
3345000
1847/67
1978/82
Dauphin Island
Mobile Bay
Entrance
Morgan Peninsula
Gulf
Shores
Perdido
Pass
Shoreline Change (m/yr)
10
5
0
-5
-10
Retreat
Advance
Island Overtopping
During Storms
-2.16 m/yr
+/-0.69 m/yr
0.43 m/yr
+/-0.59 m/yr
1.05 m/yr
+/-0.42 m/yr
-0.28 m/yr
+/-0.18 m/yr
380000
390000
400000
410000
420000
430000
440000
450000
UTM-x (m)

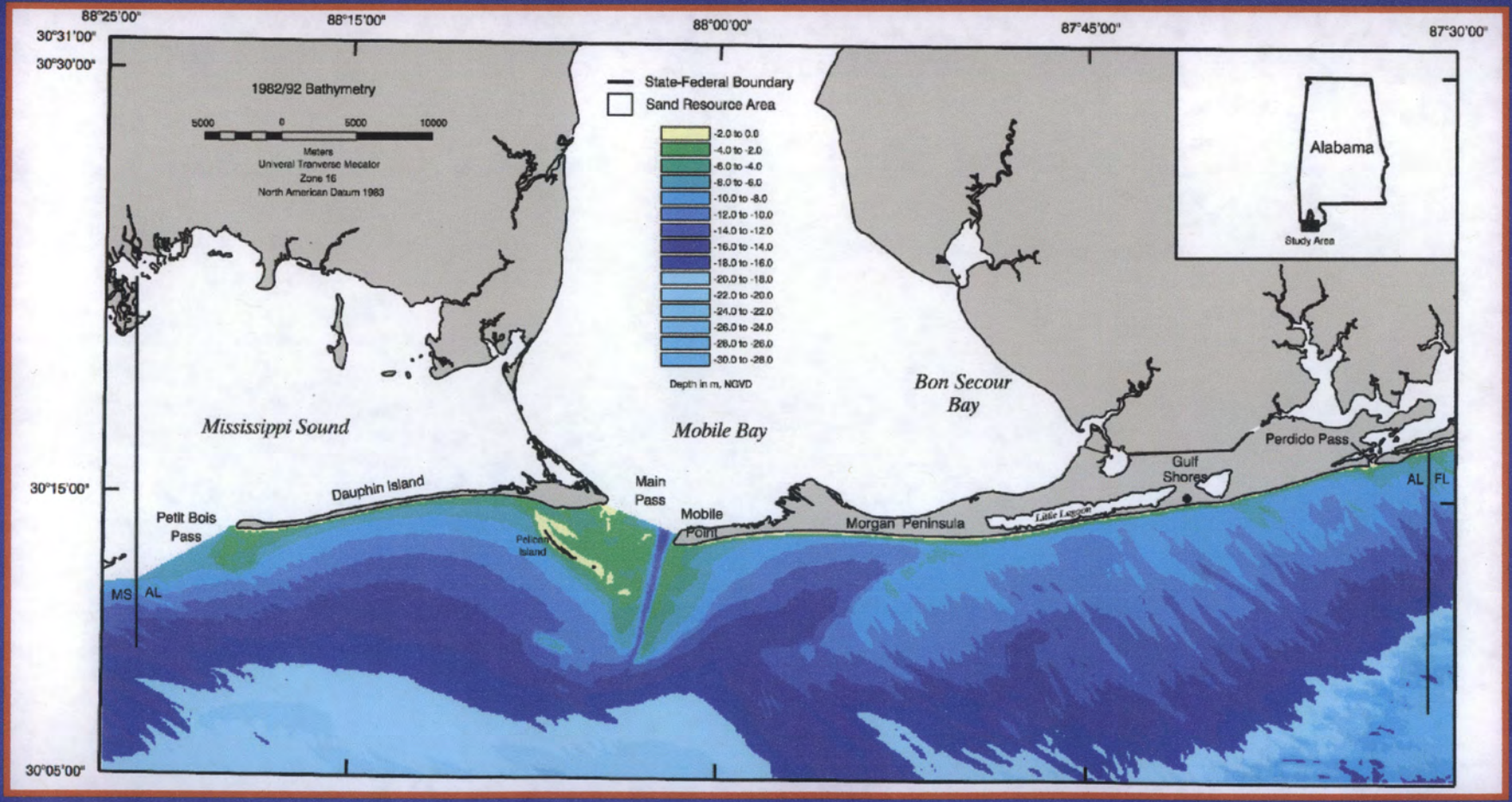
SHORELINE POSITION CHANGE FOR COASTAL ALABAMA
1957 TO 1978/82



1917/20 Bathymetry



1985/91 Bathymetry

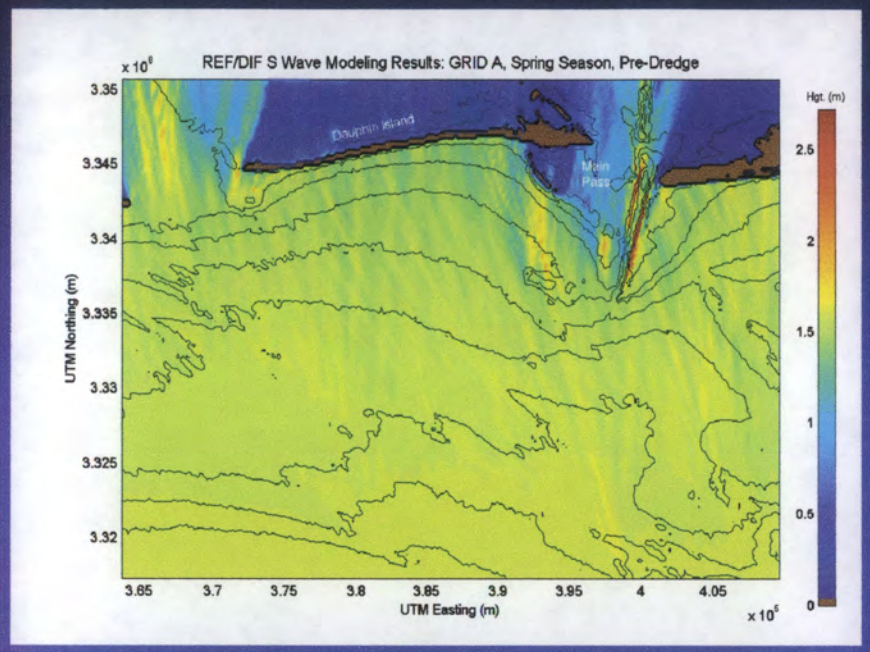


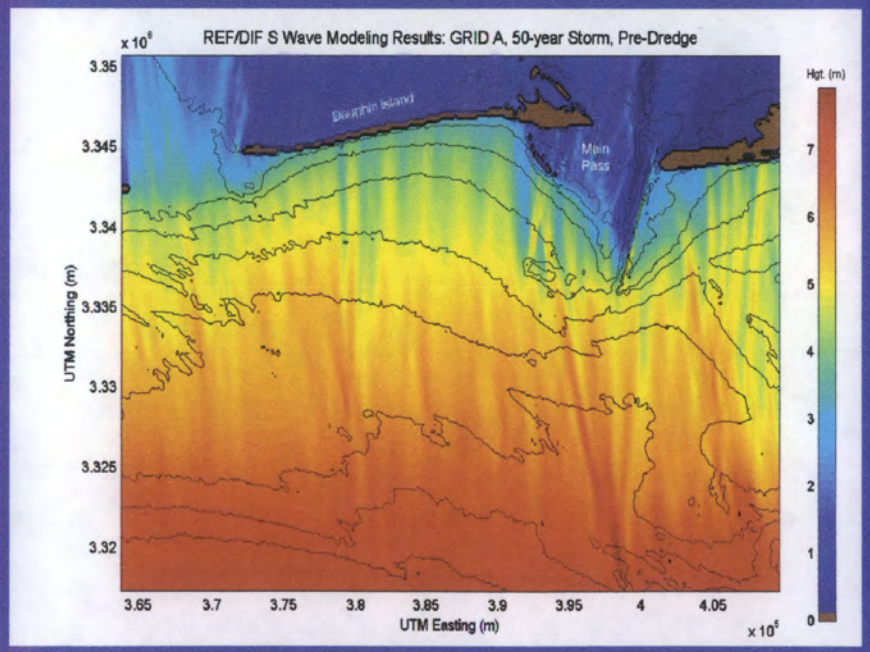
Hydrodynamic Modeling

- Document spatial changes in flow at and adjacent to Main Pass relative to engineering activities
- Apply USACE Advanced CIRCulation (ADCIRC) model to document variations in tidal current speed and direction relative to historical dredging activities
- Complete model runs using historical bathymetry and more recent data sets; potential impacts should be documented in process simulations

Wave Modeling

- Conduct updated 20-yr wave hindcast simulation to provide accurate wave time series information (OCTI-East Coast to provide 1981 to 2000 WIS-type time series results)
- Apply USACE STeady Spectral WAVE (STWAVE) model to evaluate potential impacts of channel engineering activities on wave transformation and potential sediment transport
- Compare predictions with historical data sets to gauge the reliability of wave and sediment transport simulations





Spring Condition

$H_s = 1.6$ m

$T_p = 6.8$ s

$\theta = 15$ deg

$d \approx 30$ m

Storm Condition

$H_s = 7.5$ m

$T_p = 10.6$ s

$\theta = 5$ deg

$d \approx 30$ m

Field Data Collection

- Deploy offshore water-level gage near Pelican Island for at least 30 days for comparison with (ADCIRC) model output
- Measure temporal and spatial variation in currents (ADCP) over a complete tidal cycle for the area around Pelican Pass and Main Pass
- Collect shoreline, beach profile, and bathymetry data as needed

Report Preparation and Presentations

- Provide information for improved dredging practice
- Present interim and final results at periodic study meetings
- Document study results in a technical report

Long-Term Project Benefits

- Information generated from this study should form the basis for an inlet management plan
- Data collected and analyzed should address the broader mission of regional sediment management
- Study results should provide direction for future data collection and modeling efforts