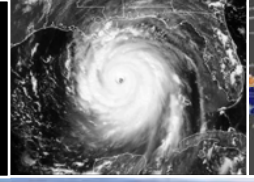
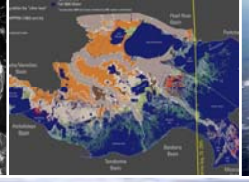
OVERVIEW: GD
Science in the Gulf





Dawn Lavoie

USGS Science Coordinator:

Gulf of Mexico

April 23, 2009

USGS Science Groups working on Gulf Coast Issues

Florida Integrated Science Center
- Gainesville
- St. Petersburg
- Ft. Lauderdale

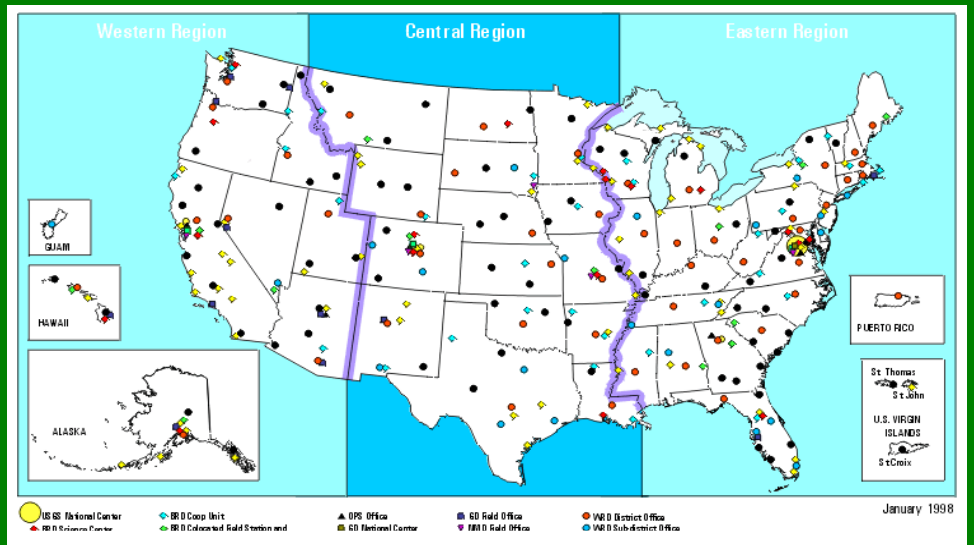
Science Centers
- Upper Midwest Environmental
- Patuxent Wildlife
- Leetown
- Wisconsin Water
- National Wetlands Research
- Louisiana Water
- Columbia Environmental Research
- Colorado Water
- Mississippi Water
- Texas Water
- Menlo Park CMG
- Santa Cruz CMG

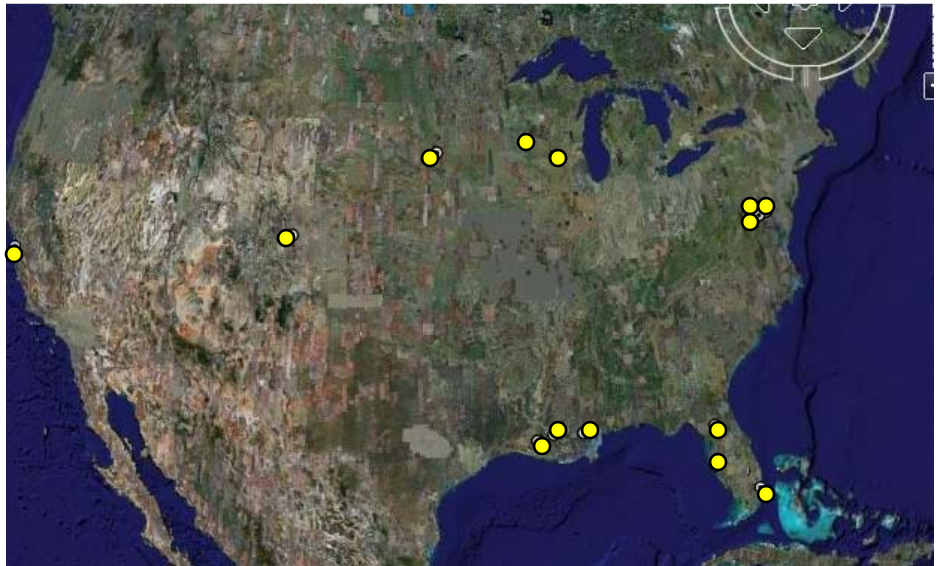
Reston Teams
- CMG Regional Investigations
- Earth Surface Processes
- Energy Resources Team

Hydrologic Instrumentation Facility

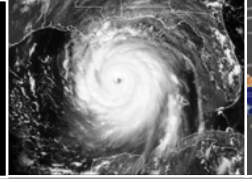
Regional Research Branch (W and E)

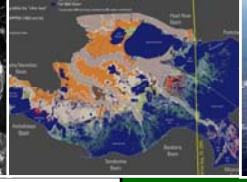
EROS Data Center

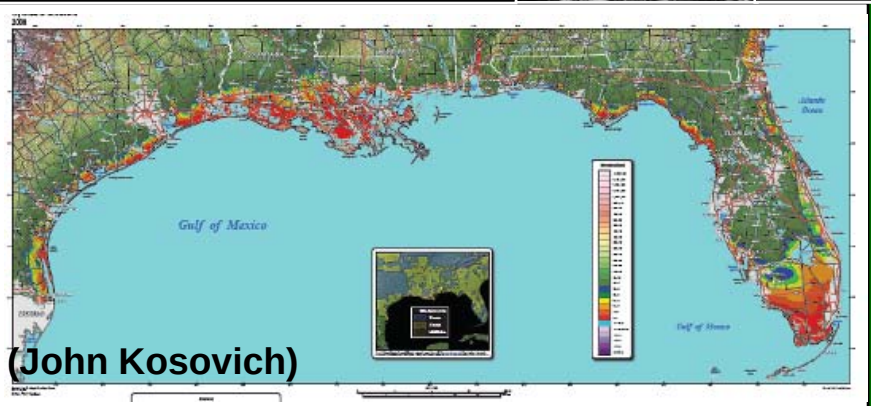




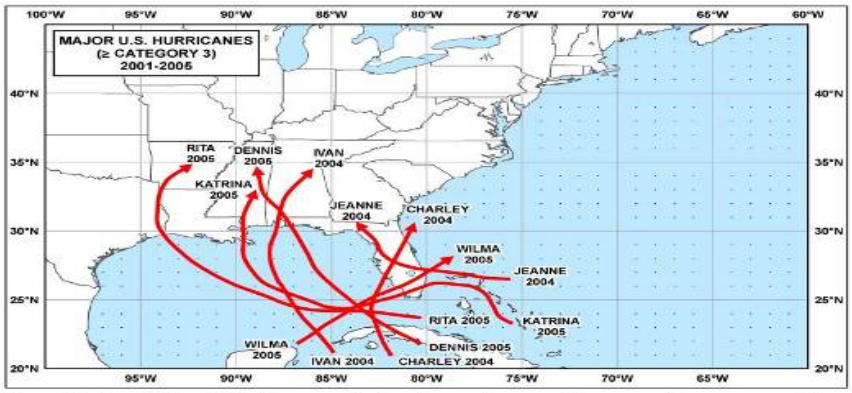
Coastal Vulnerability

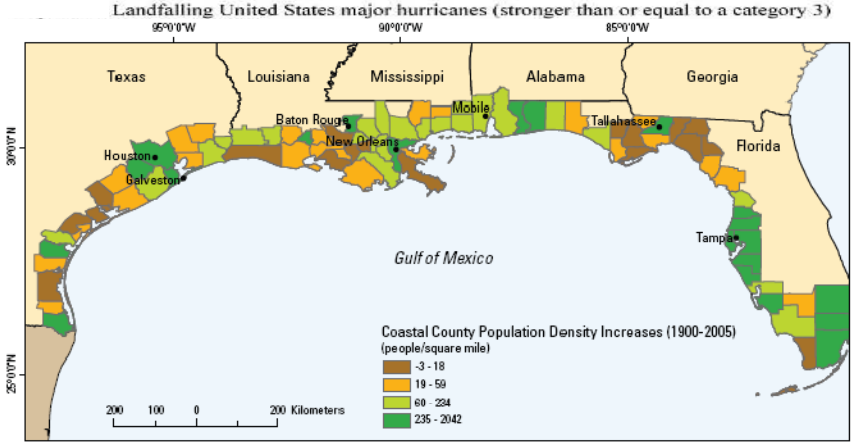


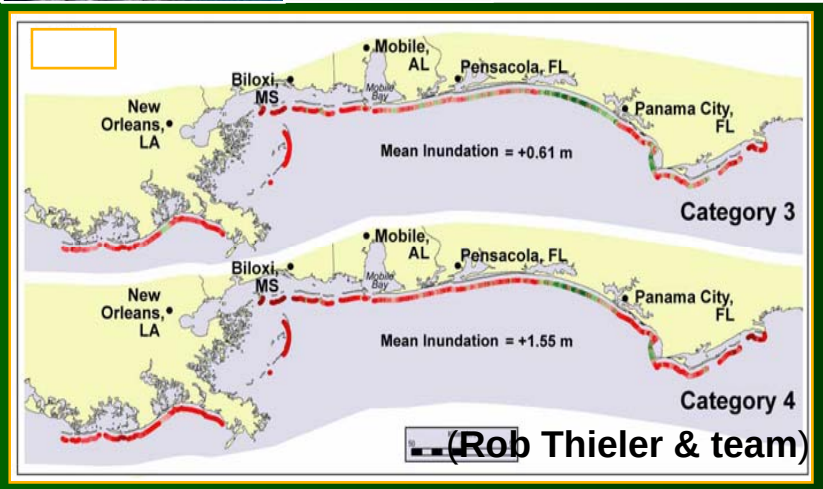




(John Kosovich)







(Rob Thieler & team)

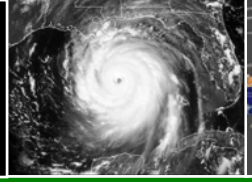
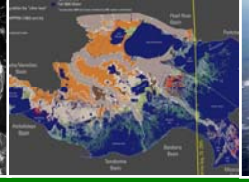
Long term critical parameters:

- Coastal geomorphology & tide range.
- Wave height, relative SLR & coastal slope
- Subsidence

Short-term critical parameters:

- Erosion and accretion rates,

Coastal & Marine Geology Program


* Northern Gulf Coast Ecosystem Change and Hazard Susceptibility (NGOM) Project (USGS)

National Assessment of Coastal Change Hazards (USGS)

Barrier Island Comprehensive Monitoring (BICM: LCA S&T/ USGS)

Predicting the Resilience of the Chandeleur Islands (FWS)

Barrier Island Mapping: subaerial and submarine (NPS)

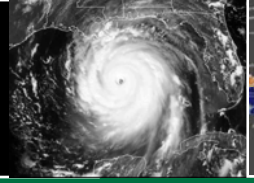
Coastal Vulnerability (NPS/USGS)

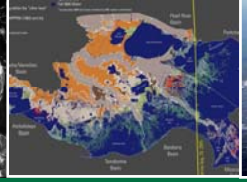
Marine Aggregate Resources and Processes (USGS)

Regional Sediment Transport & Modeling (USGS)

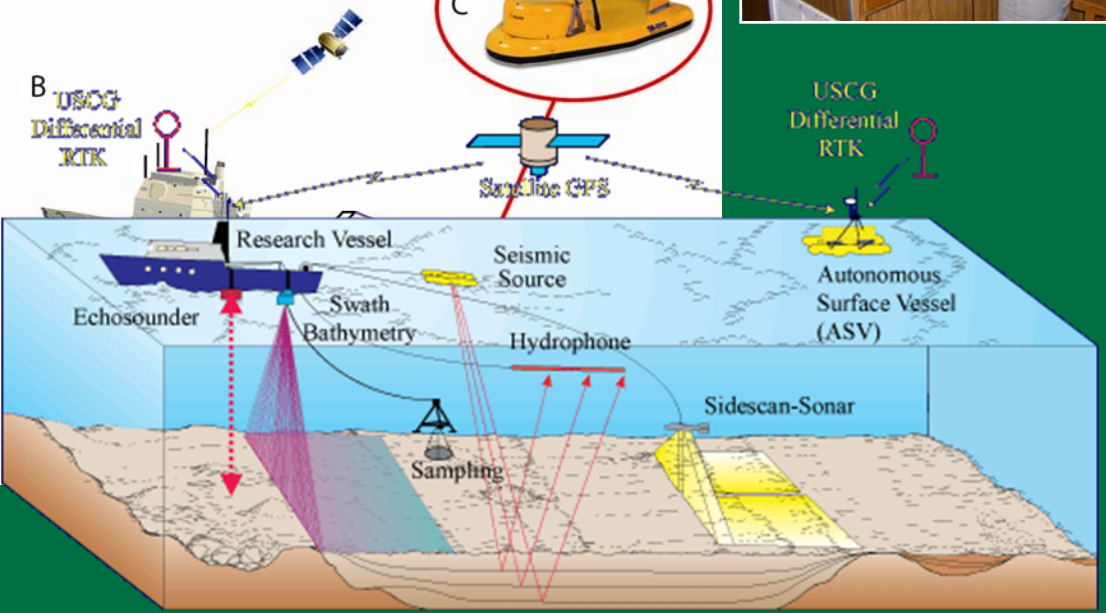
Gas Hydrates (USGS/DOE)

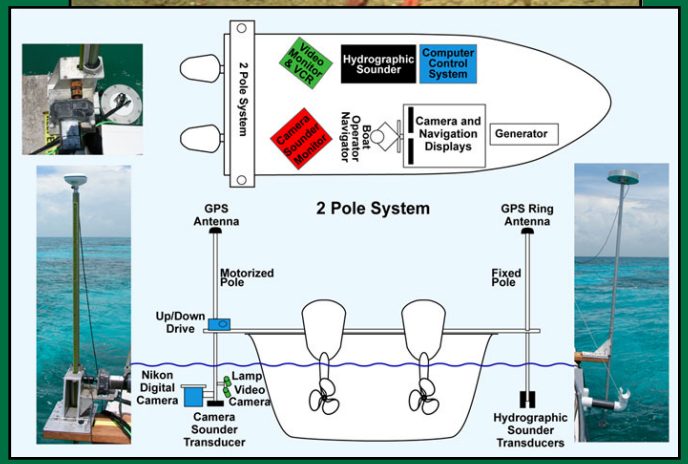
TOOLS



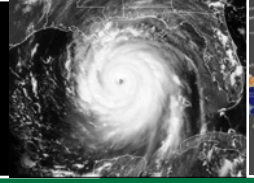


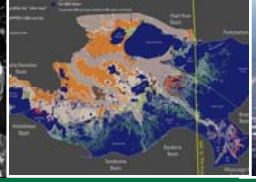
USGS R/V Gilbert With vibracore





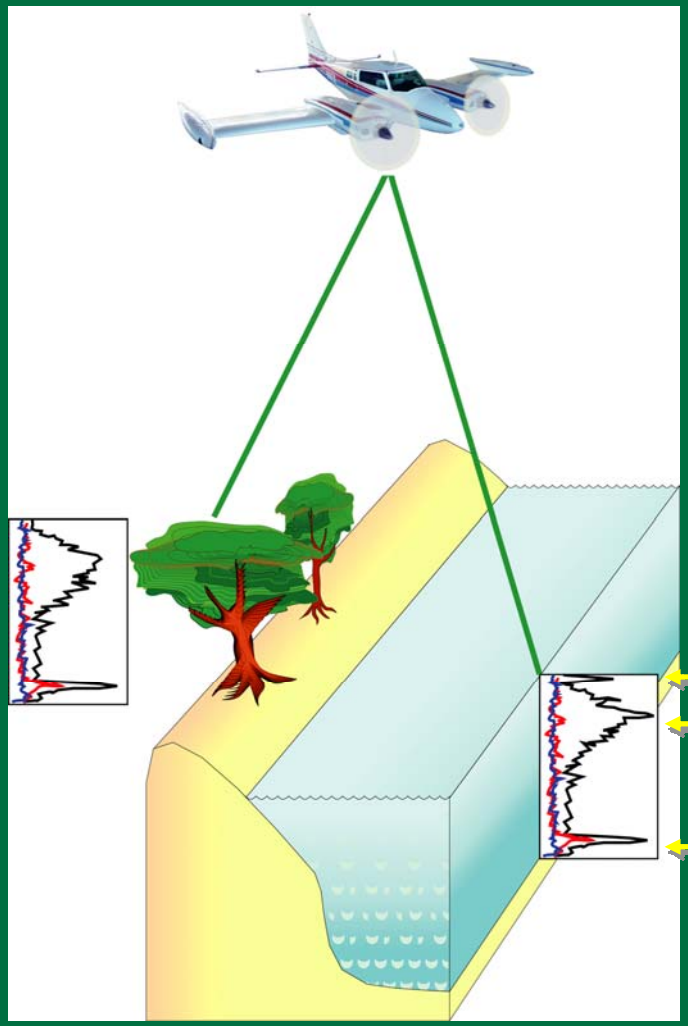
EAARL





USGS Experimental Advanced Airborne Research Lidar (EAARL)

- Cross Environment Topo/Bathy Capabilities
- Detailed topography of Shallow Marine Substrates & Vegetated Canopies
- Precision navigation
- Digital camera photography (RGB and CIR)



USGS

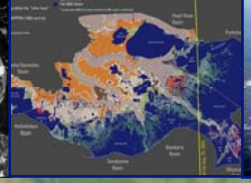
Northern Gulf Coast Ecosystem Change and Hazard Susceptibility (NGOM) Project

A better understanding of the northern Gulf of Mexico coastal system, including human activities, is a basic requirement for sustainable restoration, redevelopment, and sound natural resource management strategies.

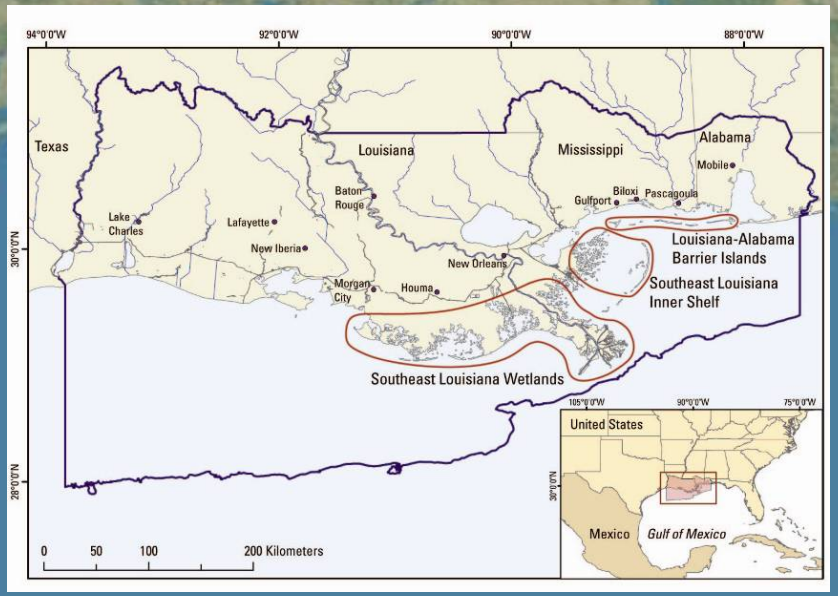
USGS
science for a changing world

John C. Brock, John Barras, Charles Demas, James Flocks, Joyce Frye, Ioannis Georgiou, Dean Gesch, Collin Homer, Mark Kulp, Dawn Lavoie, Michael Miner, Robert Morton, Amar Nayegandhi, Richard Poore, Gregory Steyer, David Twichell, S. Jeffress Williams, and C. Wayne Wright

NGOM Ecosystem Change and Hazard Susceptibility



Goal - Determine the susceptibility of northern gulf region ecosystems and human communities to landscape change, and hazards due to severe storms now and into the next 100 yrs

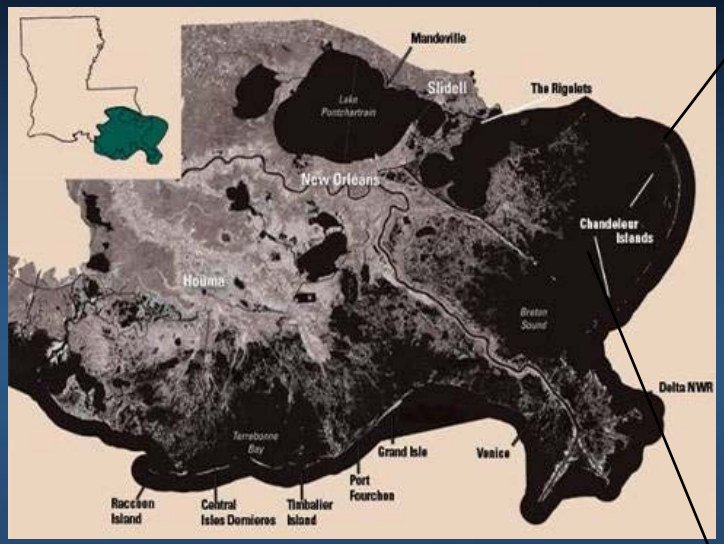


Project Objectives

- *Past* - Reconstruct the Holocene geologic stratigraphy, paleoenvironments, climate, and sea-level histories. Evaluate the evolution of the NGOM landscape as a function of SLR, subsidence, storms & humans.
- *Present* - Provide a regional synthesis of present day NGOM ecosystems including human communities.
- *Future* - Forecast the vulnerability of NGOM ecosystems and human communities to severe storms (100 yrs)

USGS

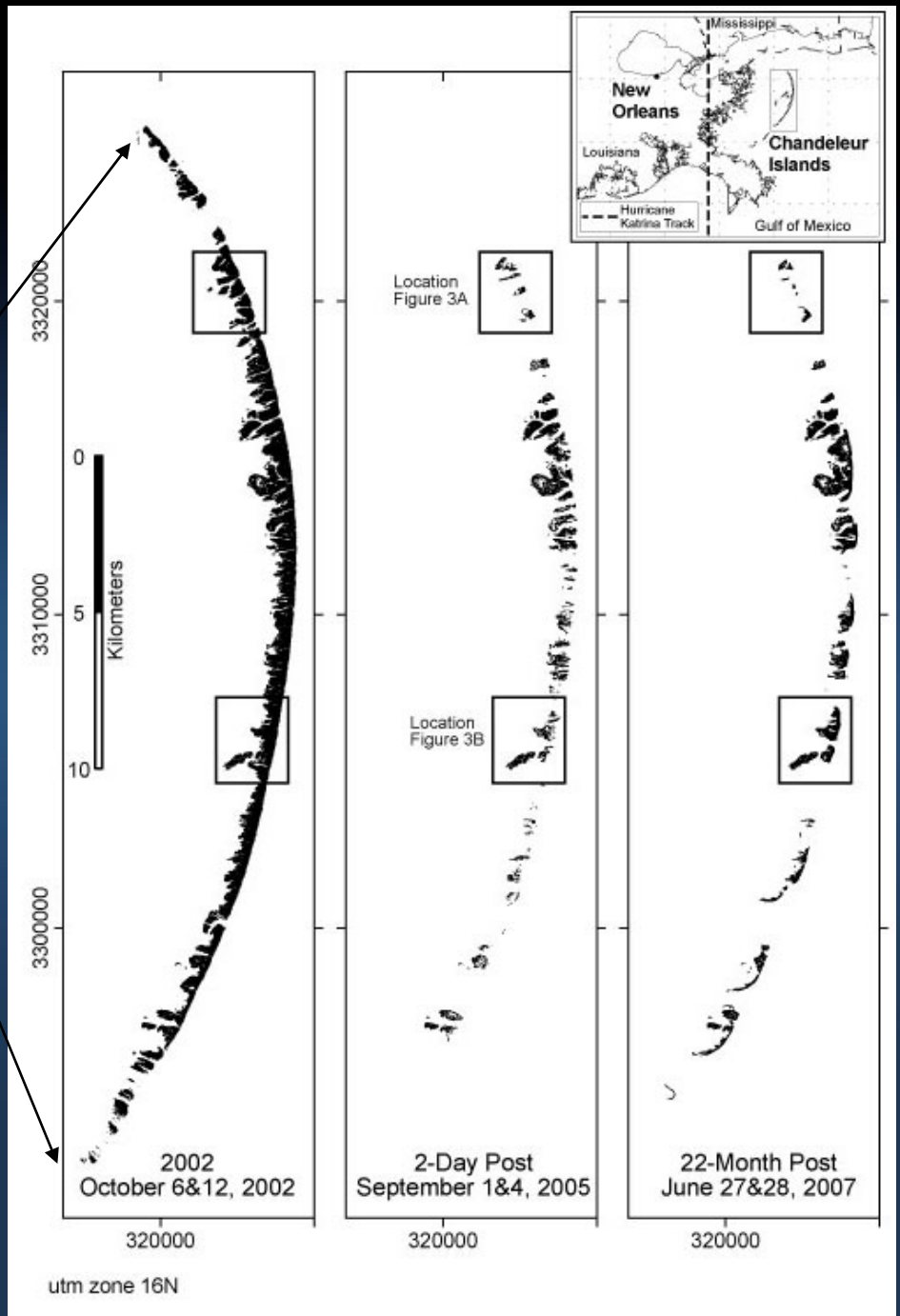
Extreme coastal change



Island Area and Volume (% change)

ΔA = - 84.4%

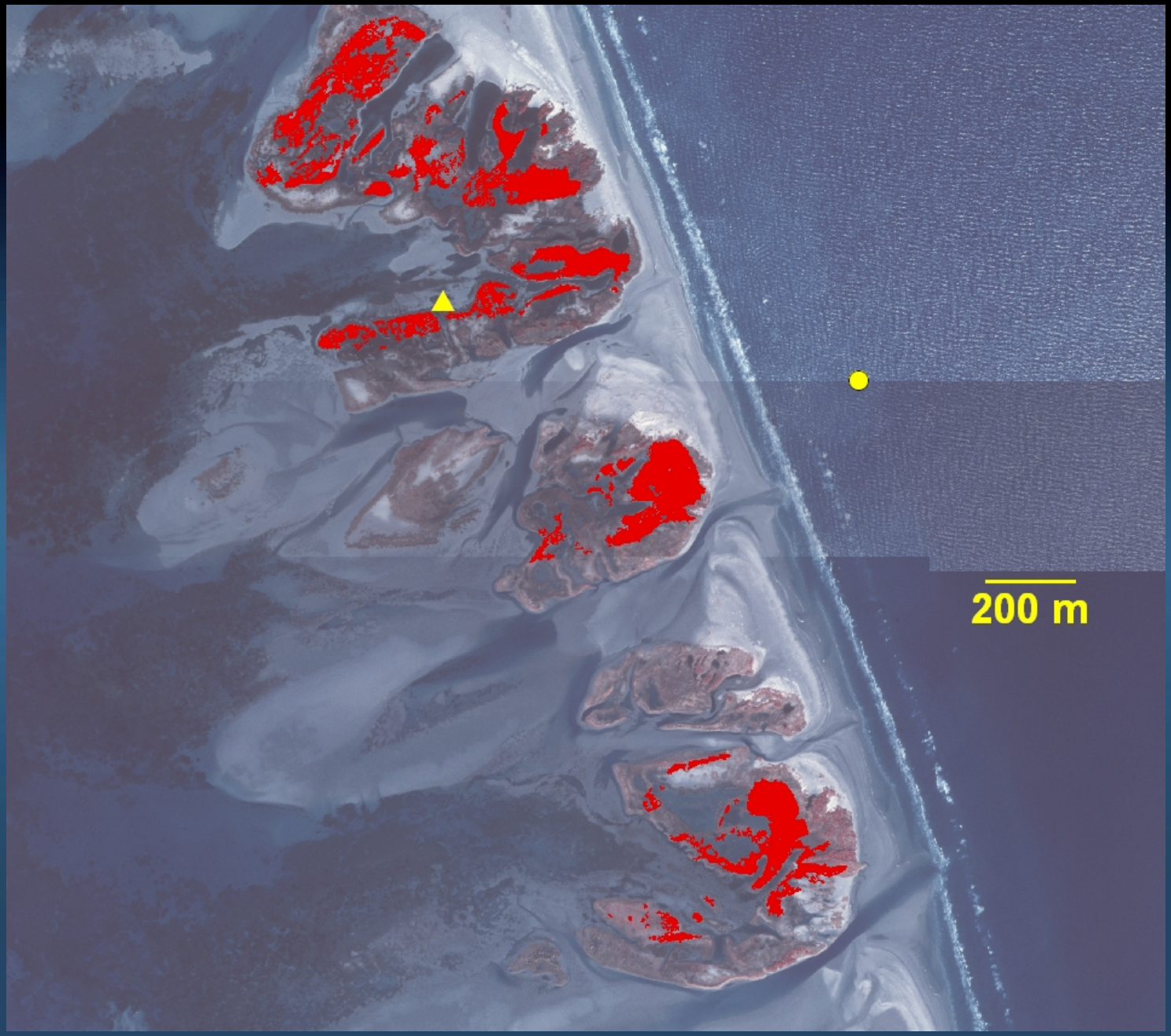
ΔV = - 91.7%

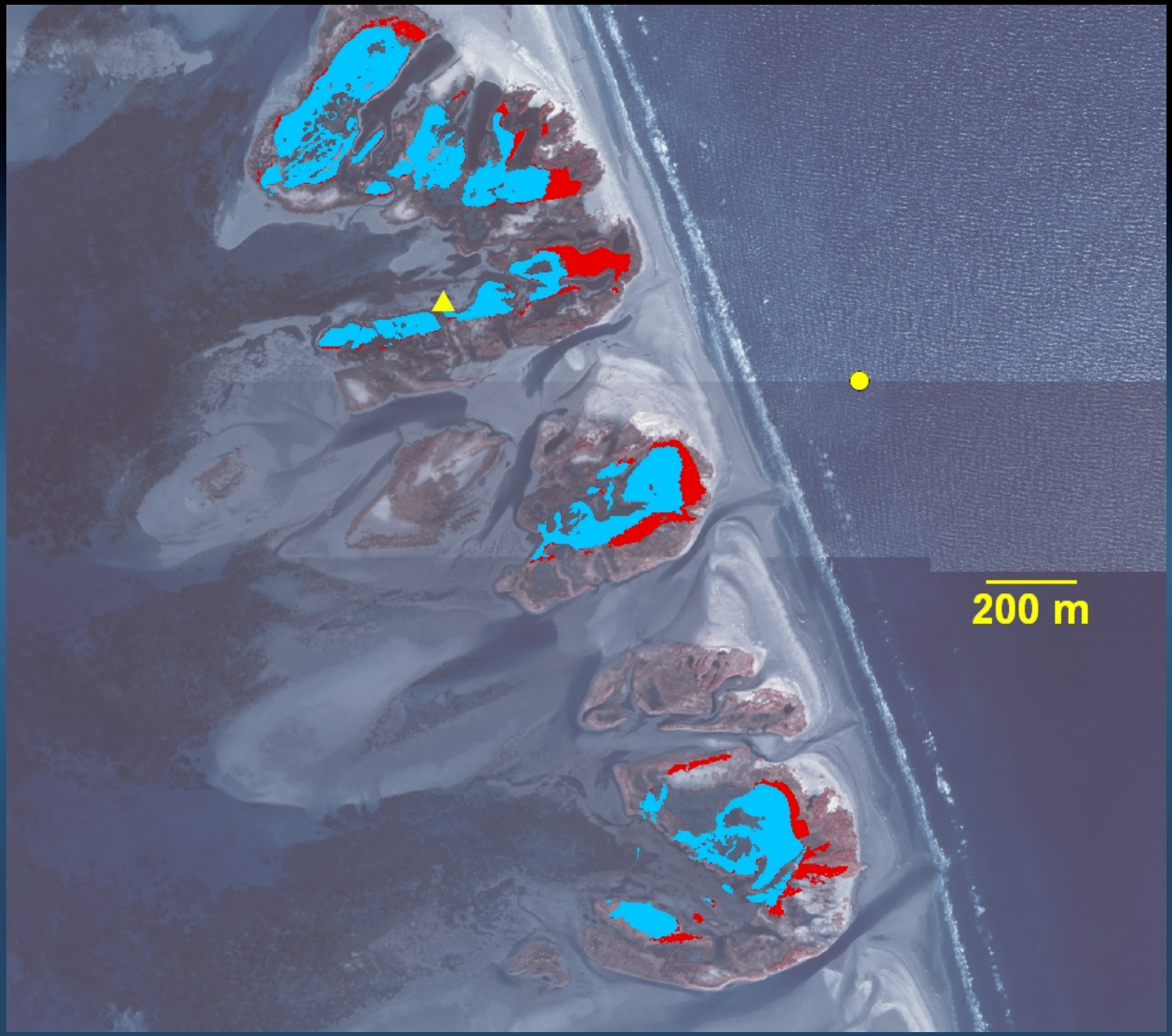


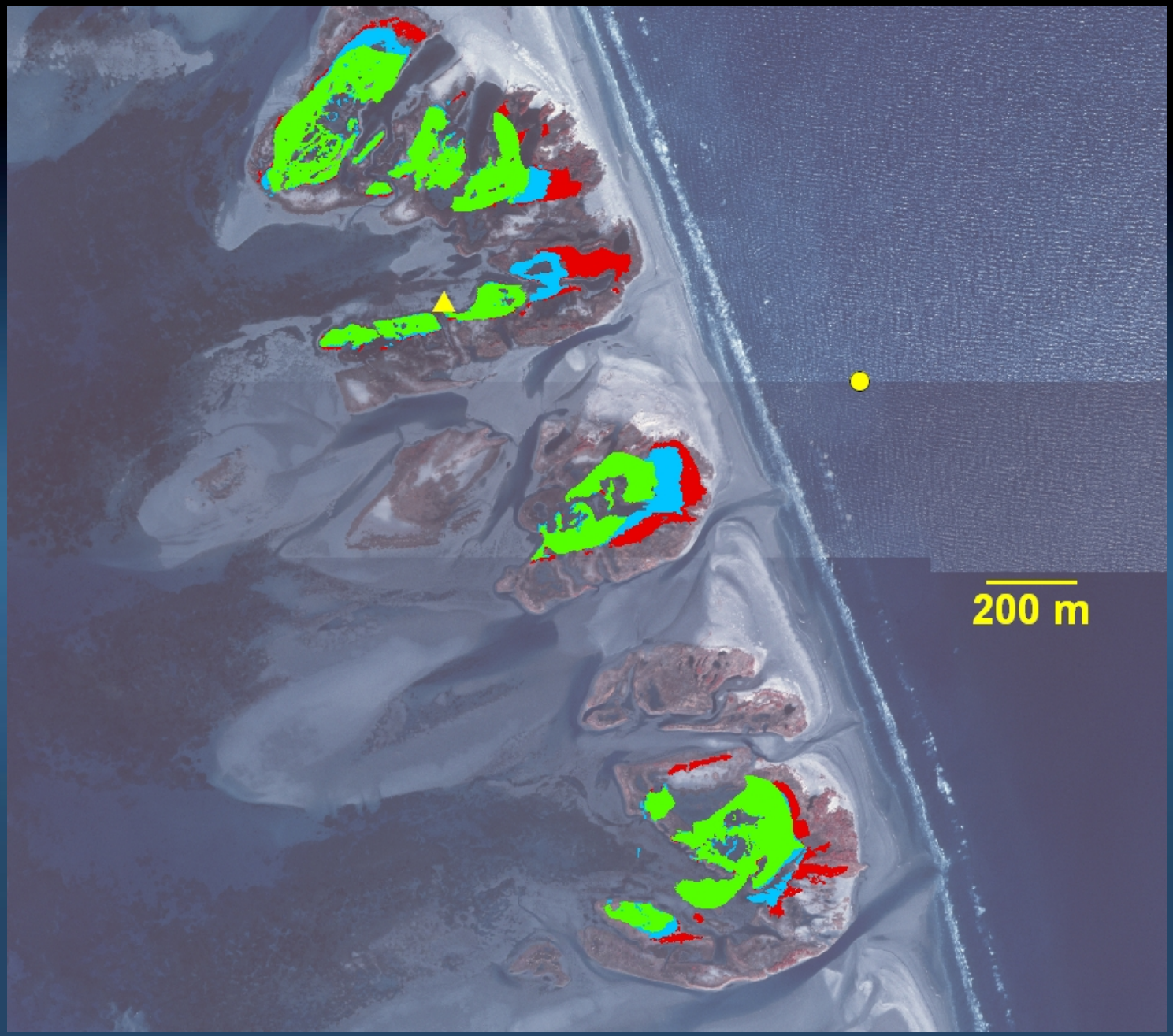
USGS science for a changing world

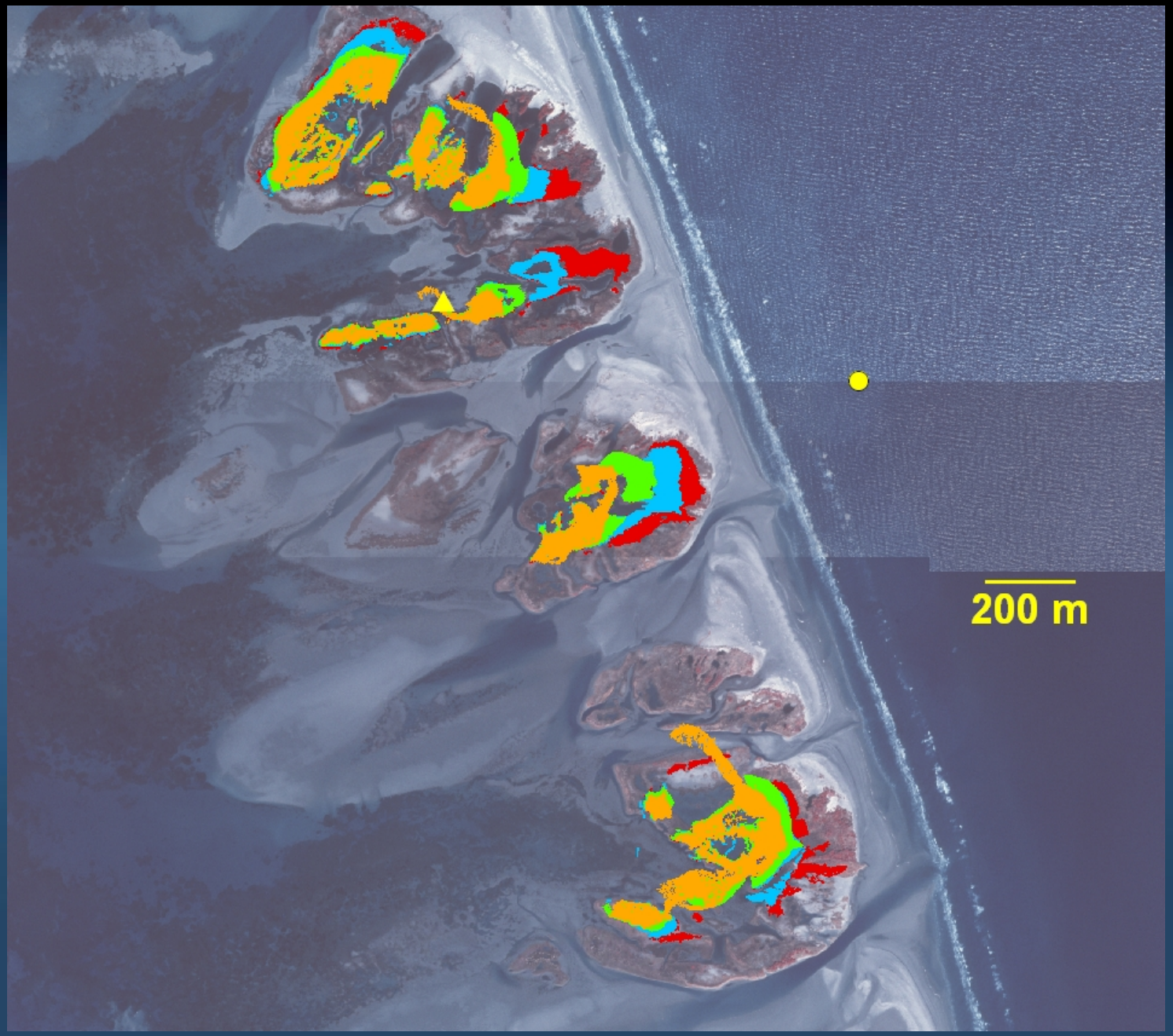
Chandeleur Islands, LA

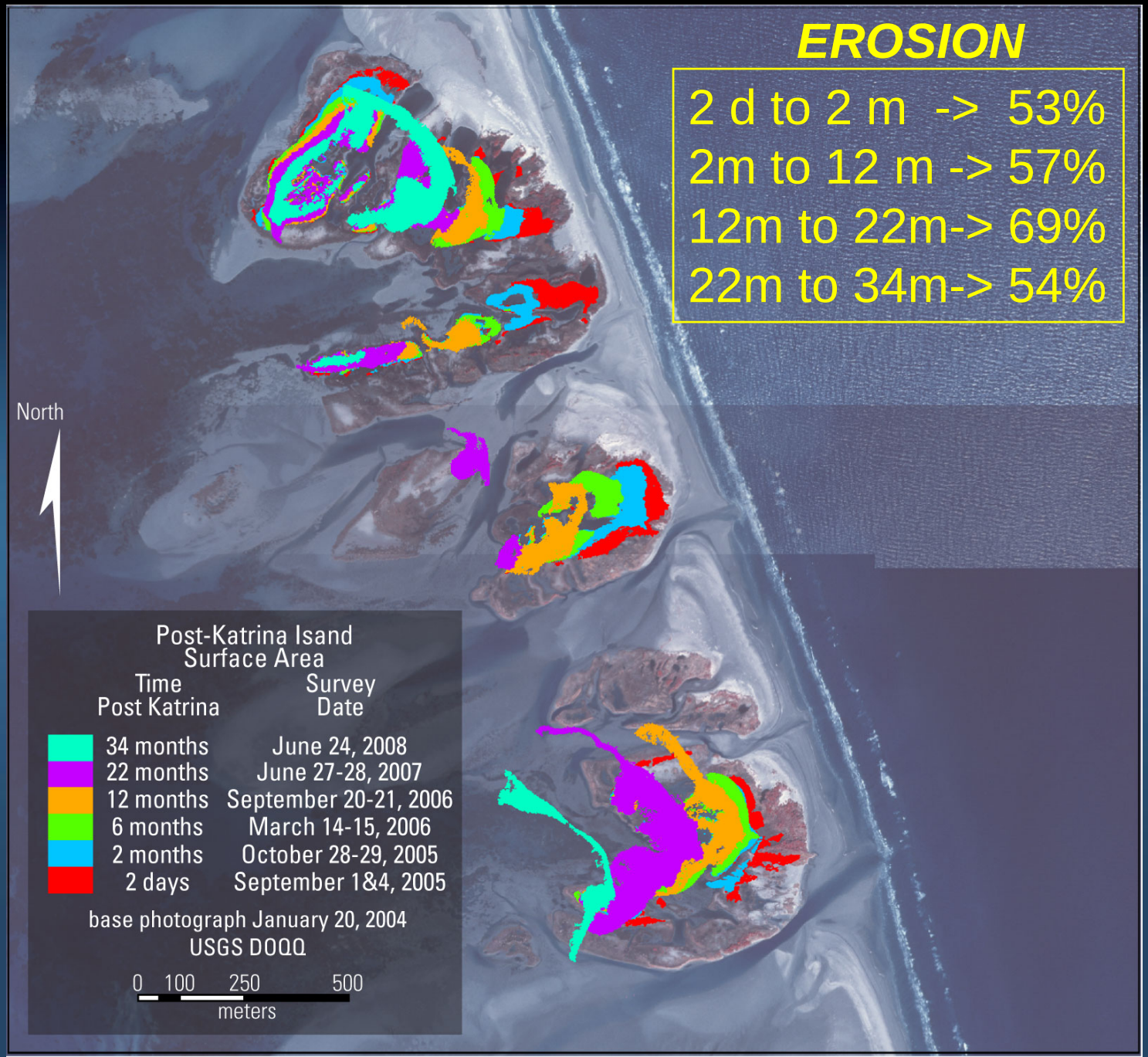
Earthquakes ★ Floods ★ Hurricanes ★ Landslides ★ Tsunamis ★ Volcanoes ★ Wildfires

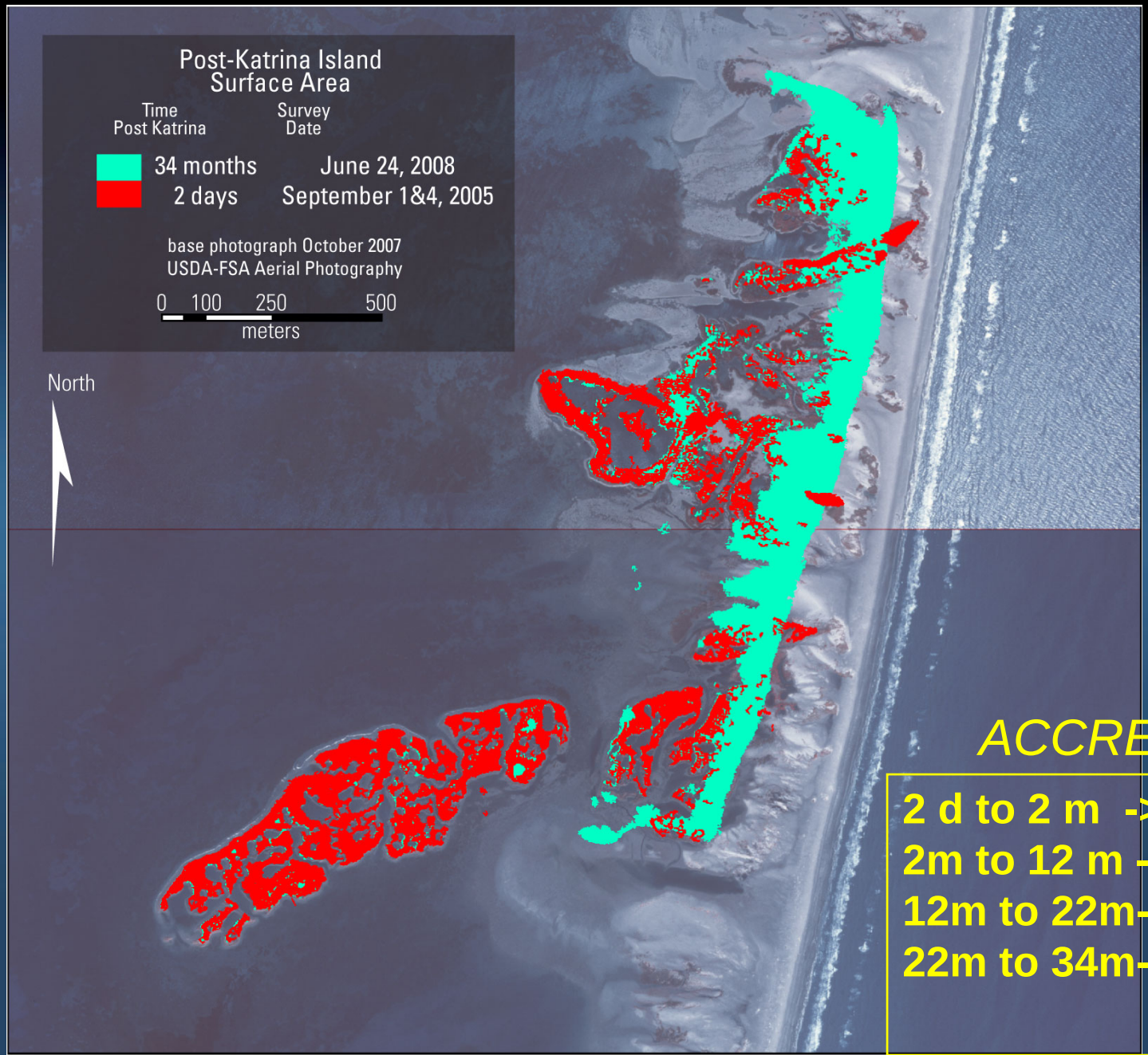



200 m


200 m


200 m

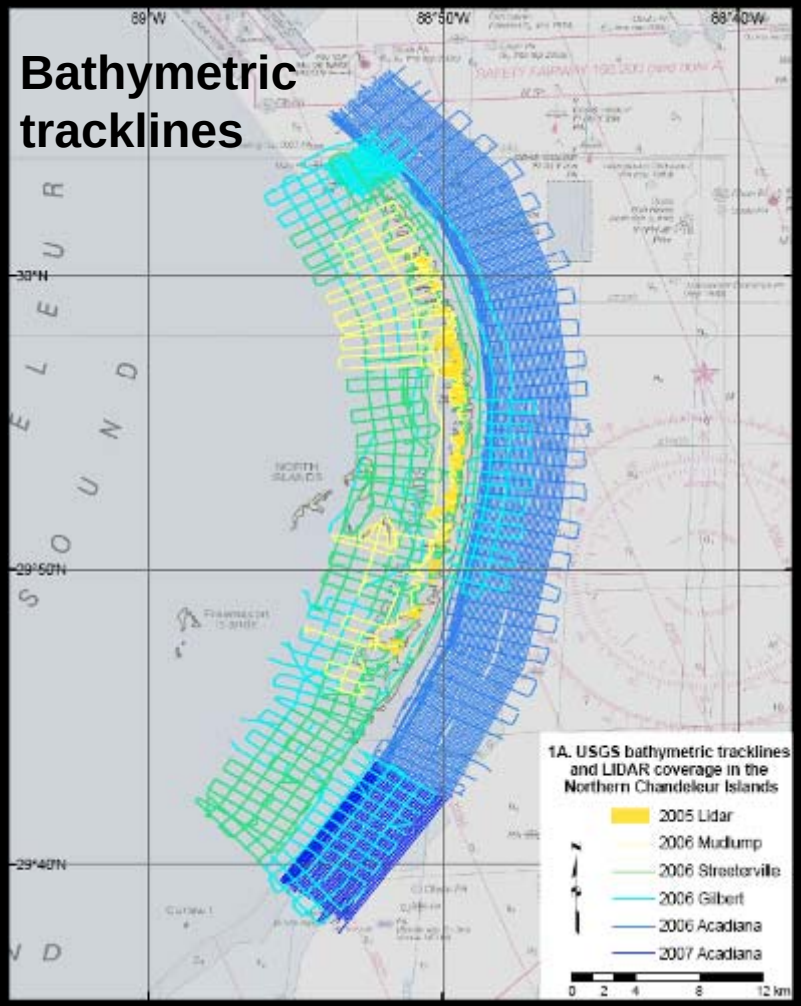

EROSION
2 d to 2 m -> 53%
2m to 12 m -> 57%
12m to 22m-> 69%
22m to 34m-> 54%
North
Post-Katrina Isand
Surface Area
Time Post Katrina
Survey Date
34 months June 24, 2008
22 months June 27-28, 2007
12 months September 20-21, 2006
6 months March 14-15, 2006
2 months October 28-29, 2005
2 days September 1&4, 2005
base photograph January 20, 2004
USGS DOQQ
0 100 250 500
meters

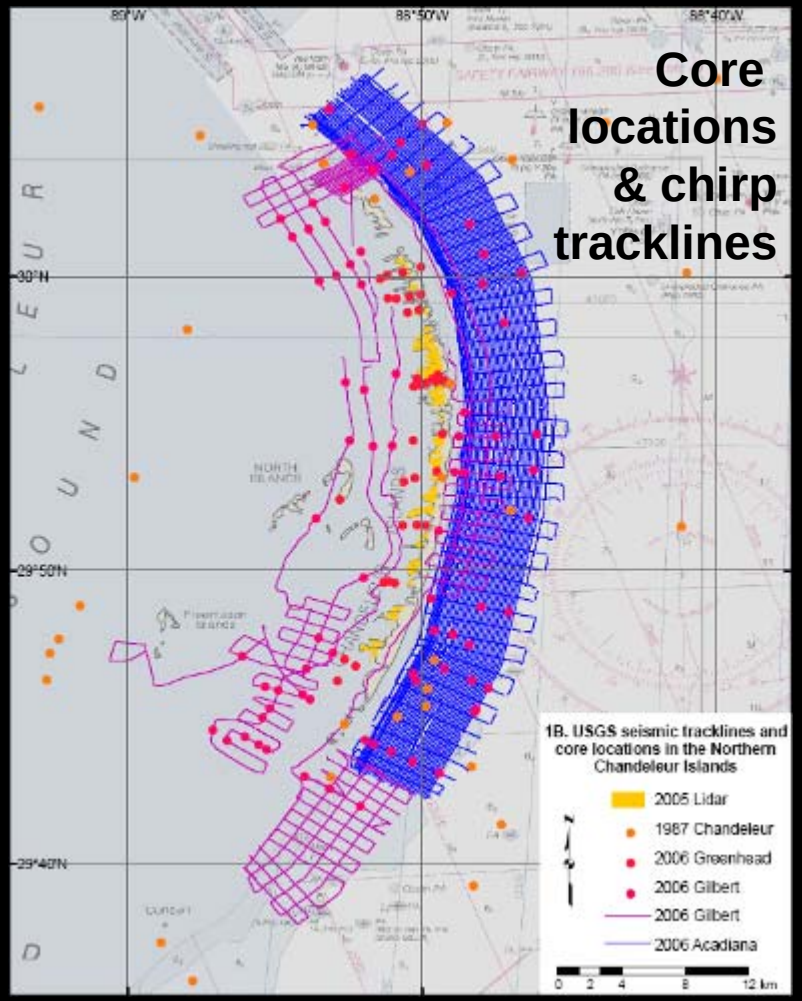


ACCRETION

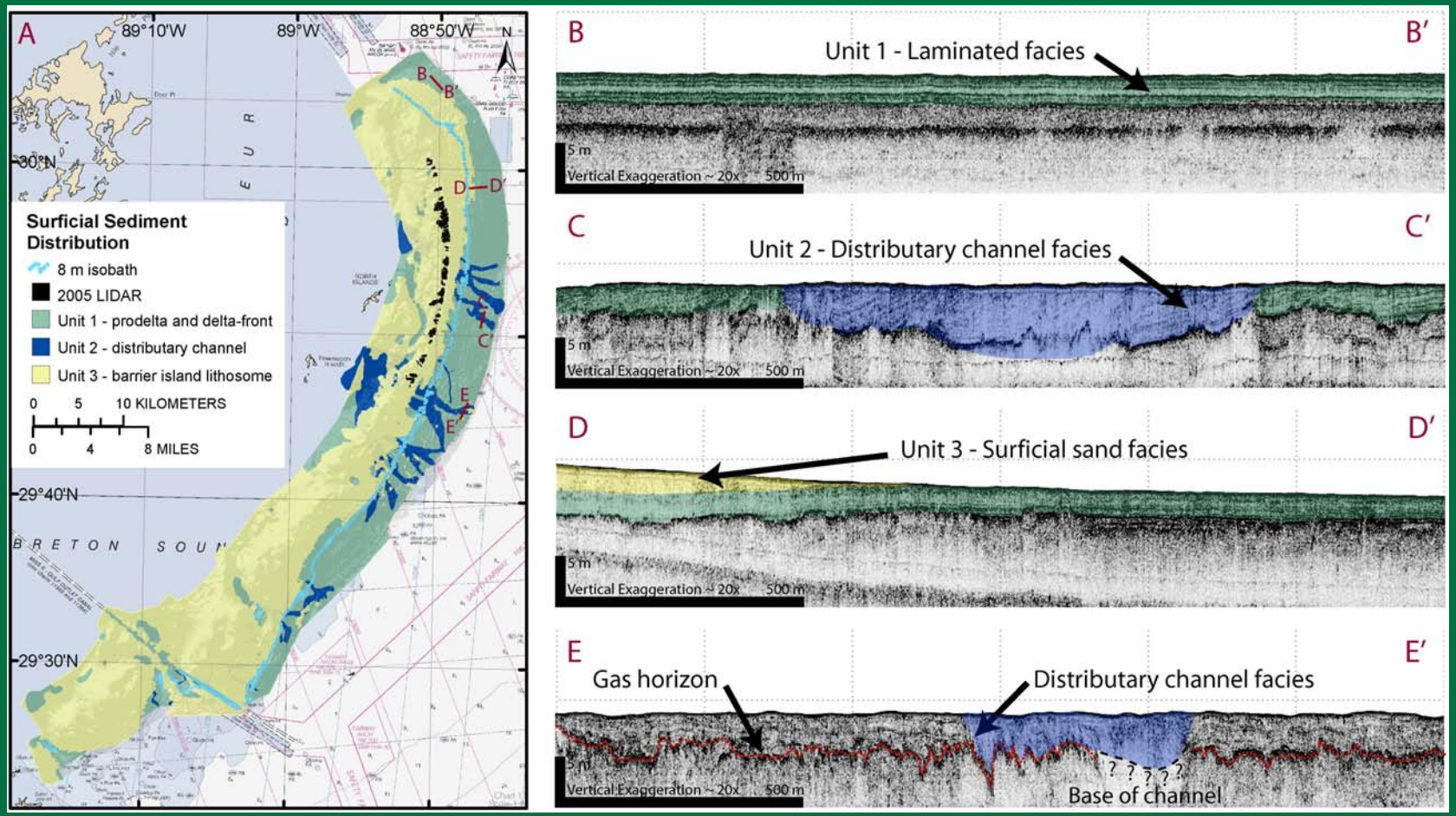
2 d to 2 m -> 45%
2m to 12 m -> 43%
12m to 22m-> 30%
22m to 34m-> 46%

Data Coverage: seismics, cores, & bathymetry



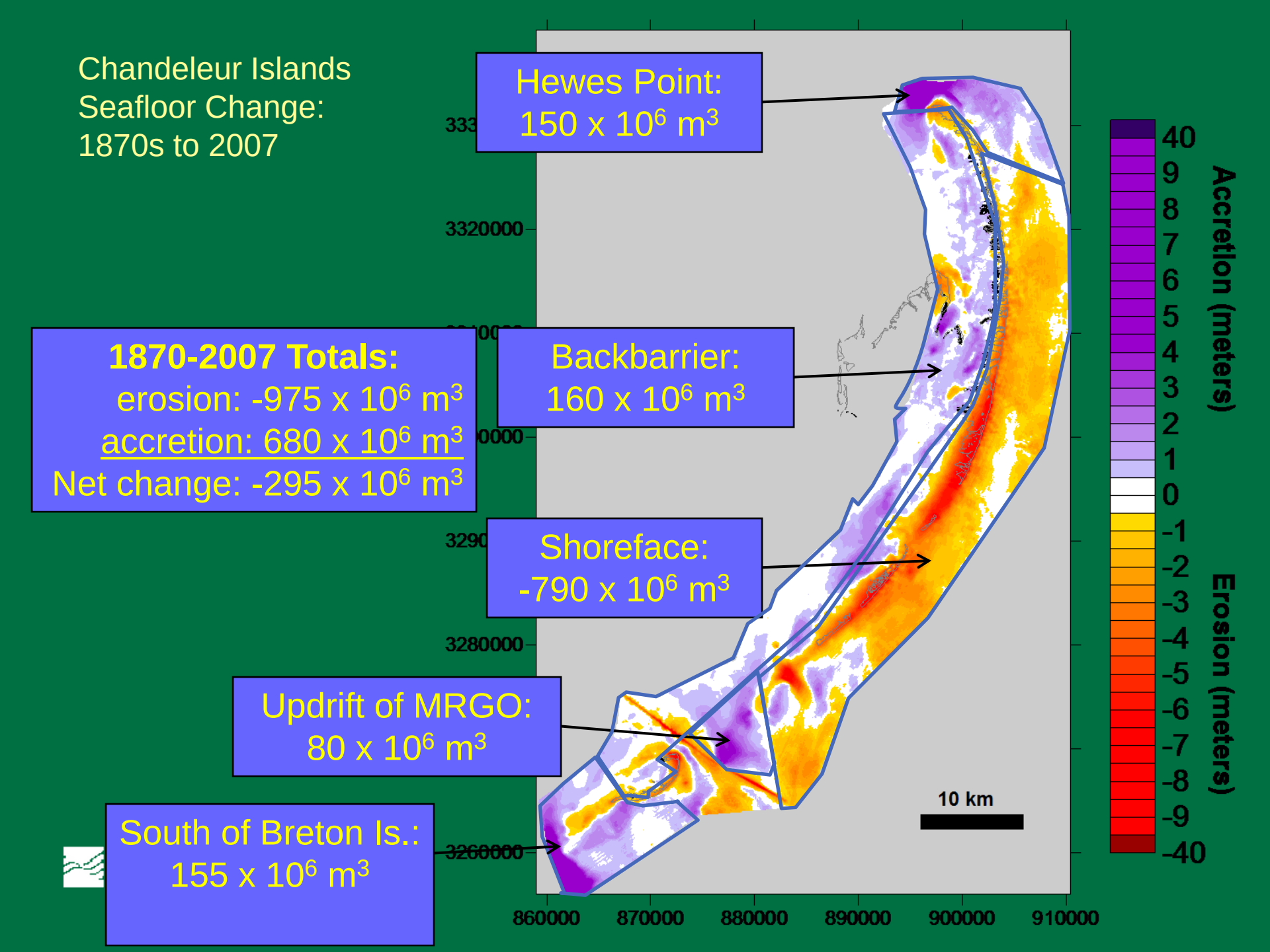


USGS

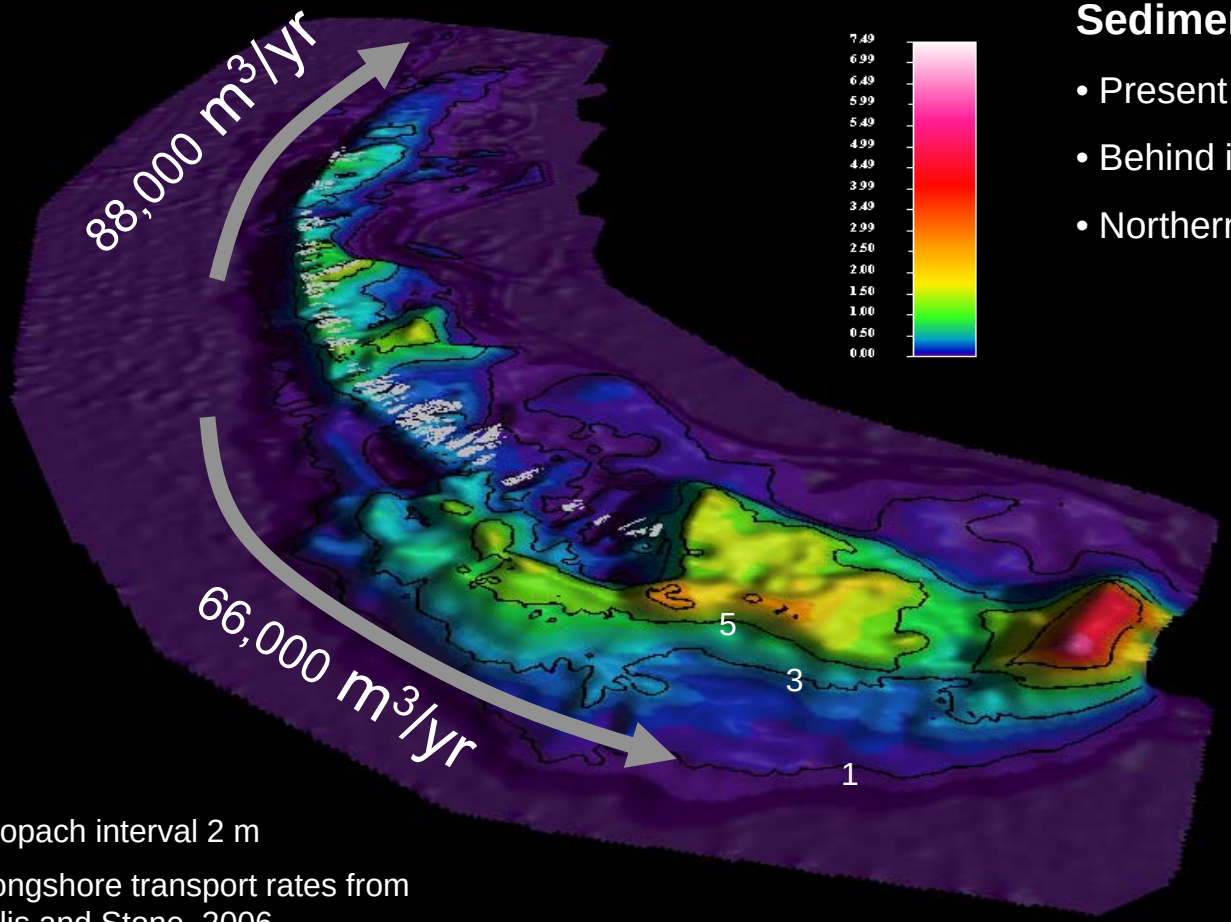

A
89°10'W
89°W
88°50'W
N
30°N
29°40'N
29°30'N
B
B'
D
D'
C
C'
E
E'
Surficial Sediment Distribution
8 m isobath
2005 LIDAR
Unit 1 - prodelta and delta-front
Unit 2 - distributary channel
Unit 3 - barrier island lithosome
0 5 10 KILOMETERS
0 4 8 MILES
B
B'
Unit 1 - Laminated facies
5 m
Vertical Exaggeration ~ 20x
500 m
C
C'
Unit 2 - Distributary channel facies
5 m
Vertical Exaggeration ~ 20x
500 m
D
D'
Unit 3 - Surficial sand facies
5 m
Vertical Exaggeration ~ 20x
500 m
E
E'
Gas horizon
Distributary channel facies
5 m
Vertical Exaggeration ~ 20x
500 m
Base of channel

USGS

Chandeleur Islands
Seafloor Change:
1870s to 2007



Summary and Implications



Isopach interval 2 m

Longshore transport rates from Ellis and Stone, 2006

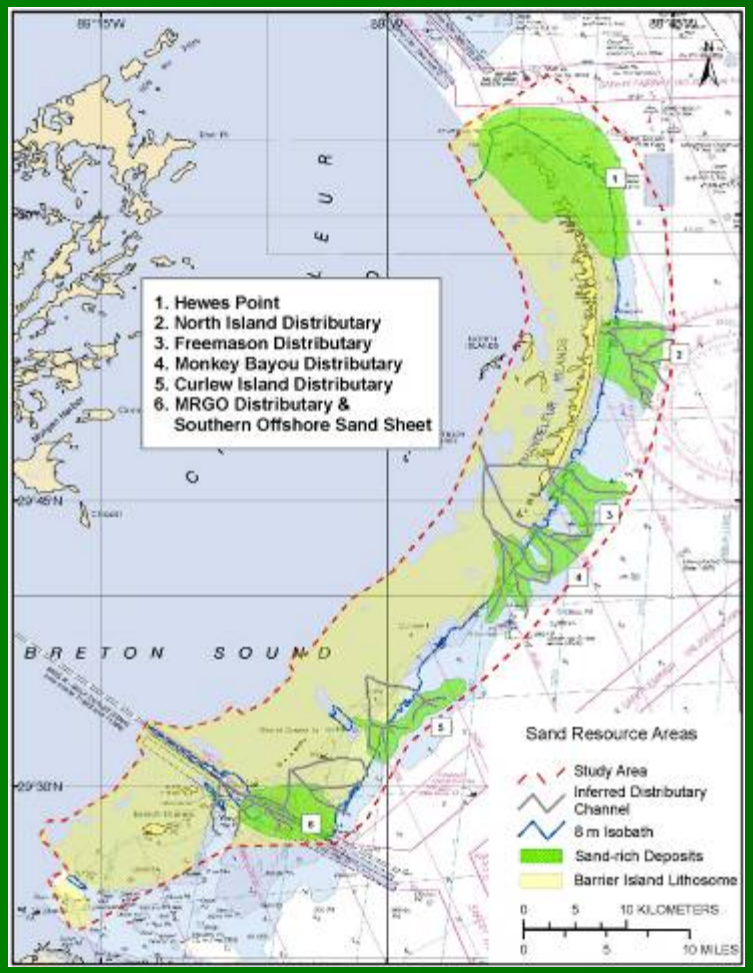
Sediment distribution

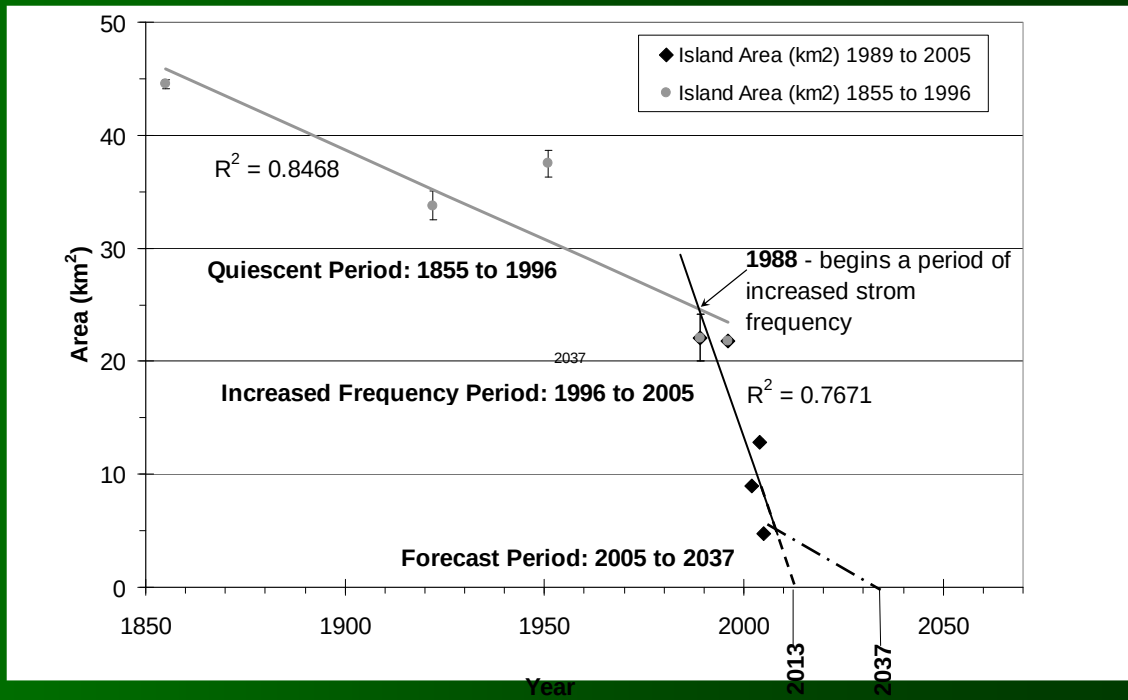
- Present islands ~ 28%
- Behind islands (shoreward) ~ 24%
- Northern spit (alongshore) ~ 48%

- *Alongshore transport dominates over shoreward transport*
- *Relative importance of fair-weather transport vs. storm transport needs to be assessed*
- *Geologic setting provides accommodation space north of the islands for alongshore transported sediment that then is lost to the system*

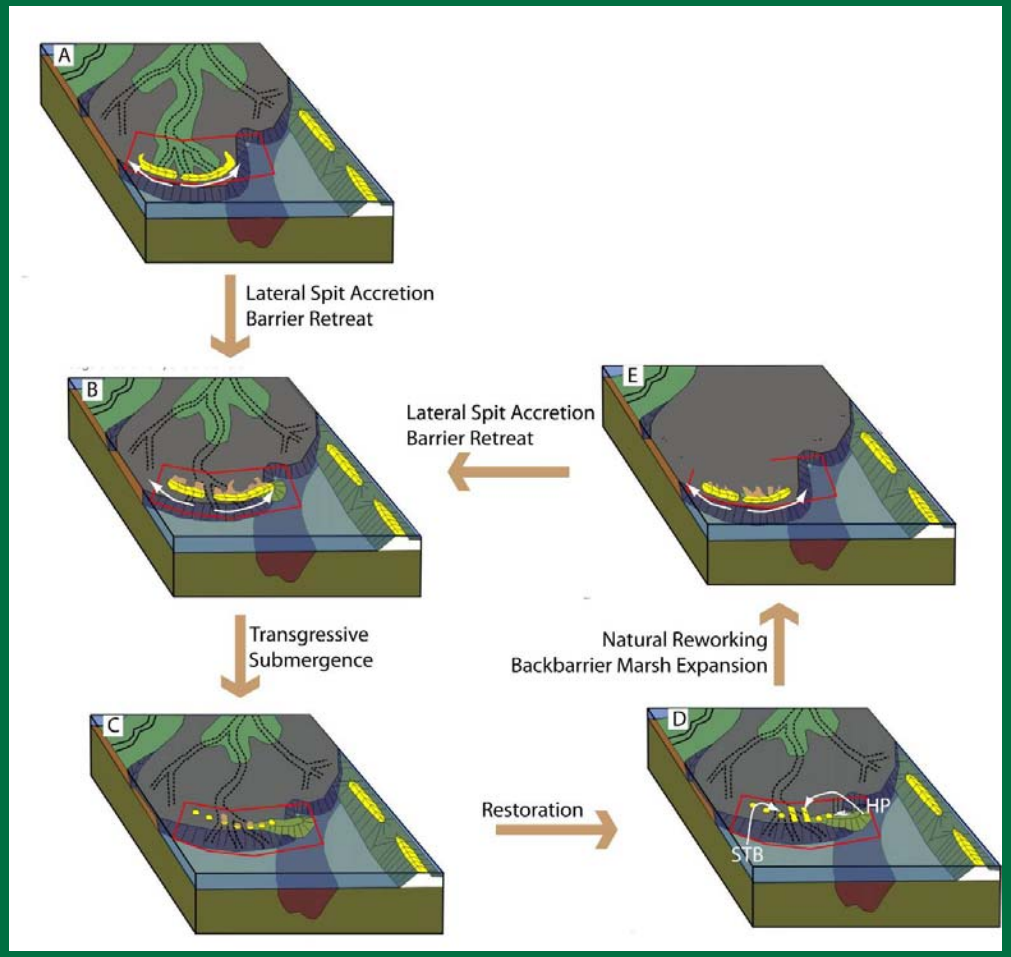
USGS

Implications for Island Management

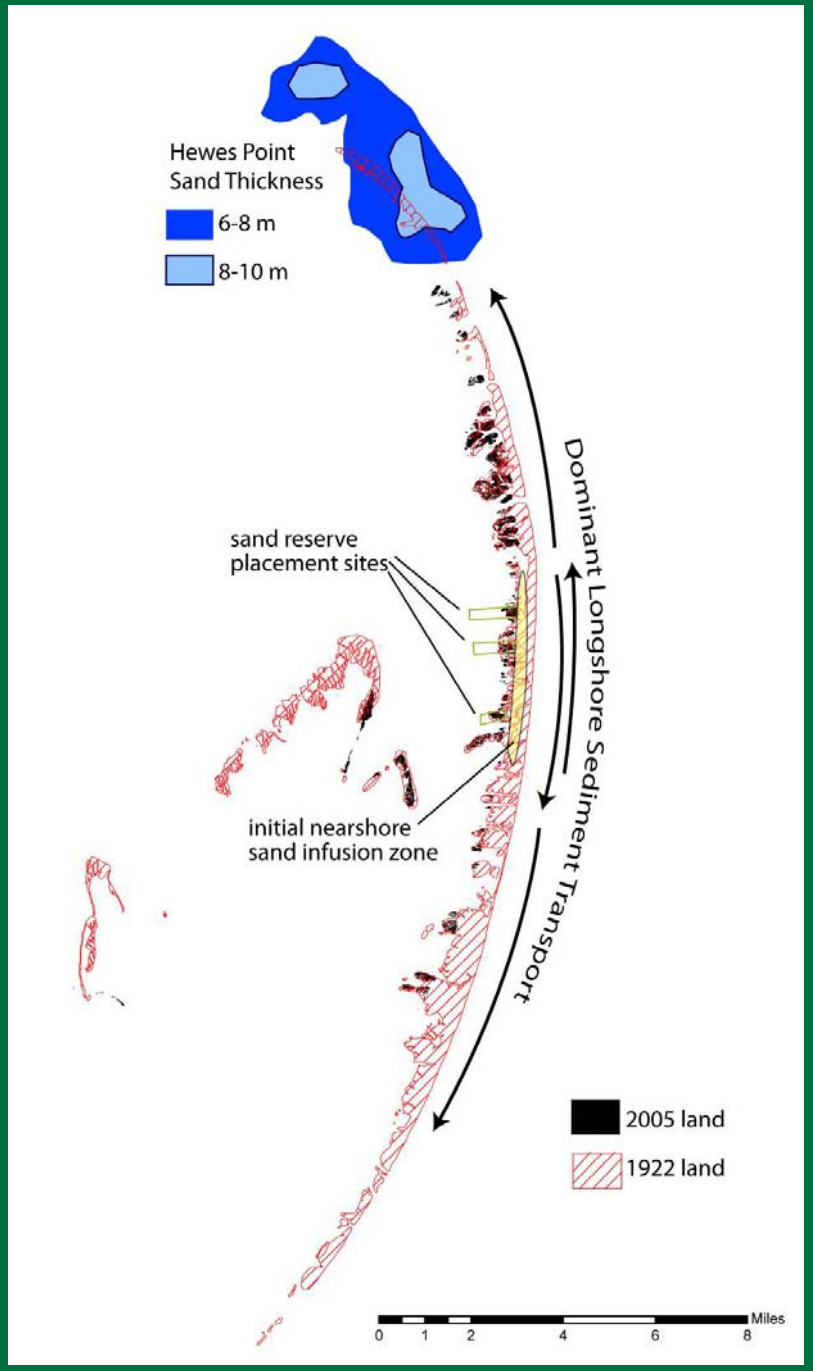




Barrier Island Management Approach



USGS



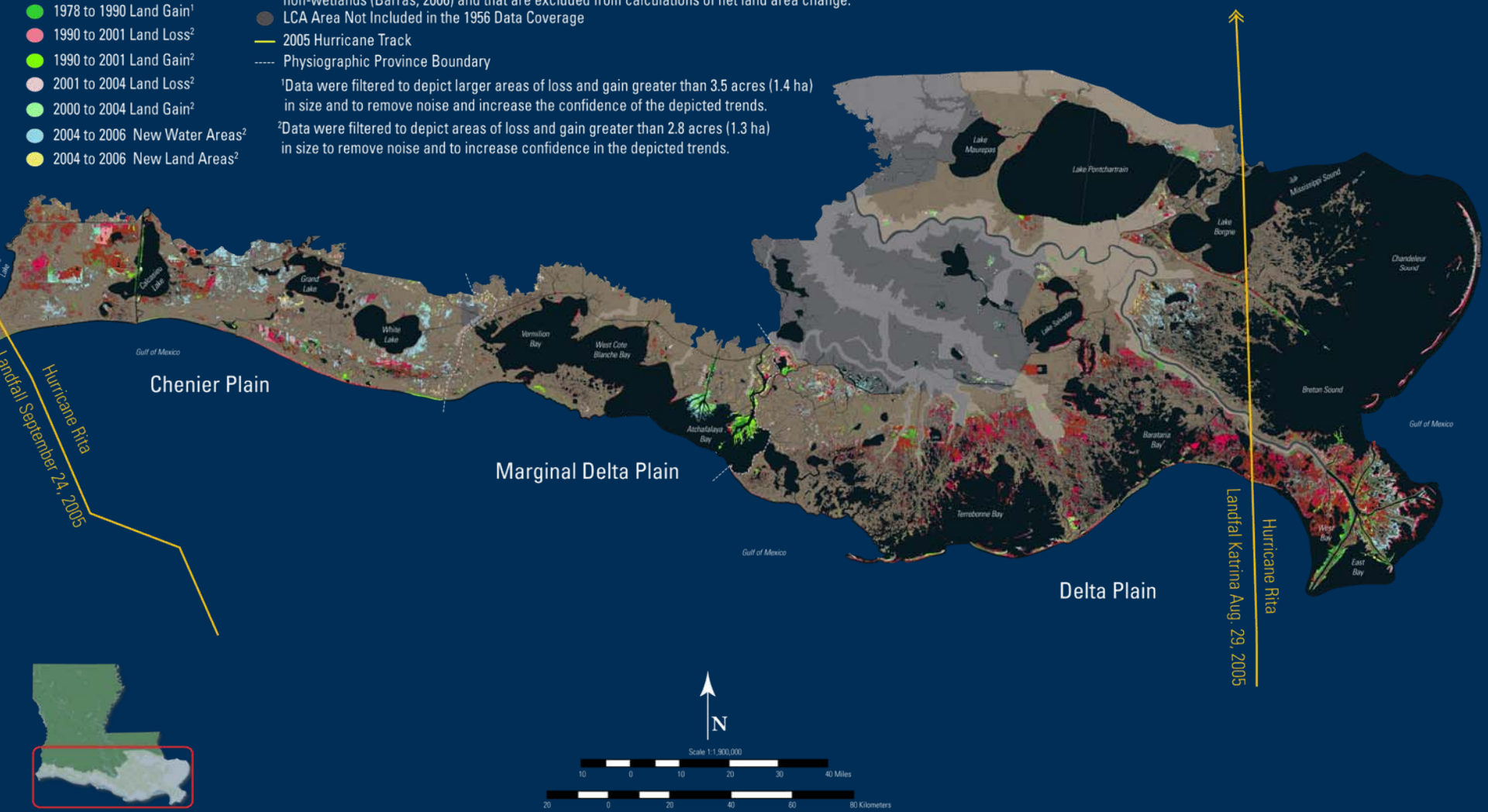
USGS
science for a changing world

Land Area Change in Coastal Louisiana: A Multidecadal Perspective (from 1956 to 2006)

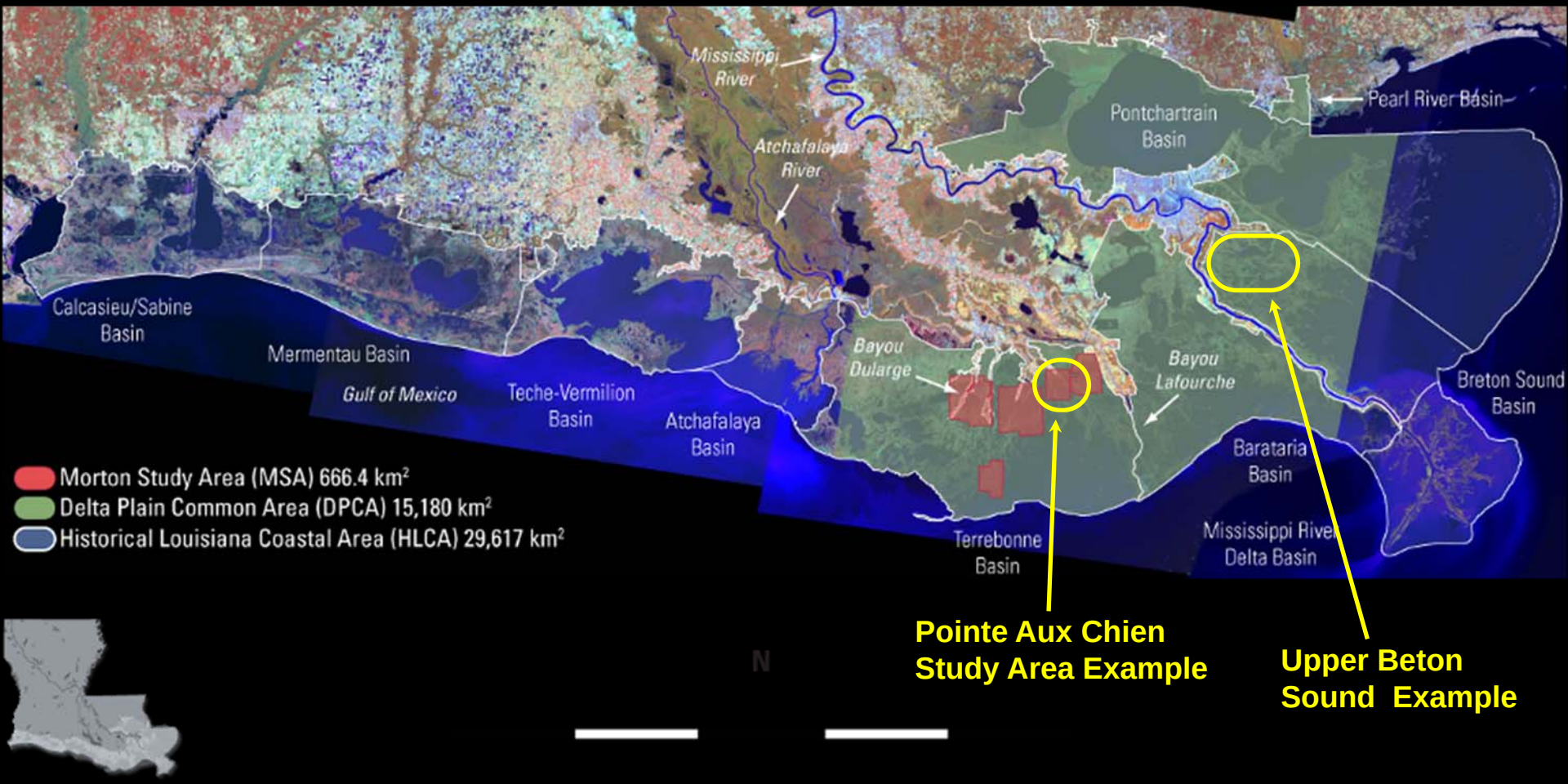
- 1956 to 1978 Land Loss[1]
- 1956 to 1978 Land Gain[1]
- 1978 to 1990 Land Loss[1]
- 1978 to 1990 Land Gain[1]
- 1990 to 2001 Land Loss[2]
- 1990 to 2001 Land Gain[2]
- 2001 to 2004 Land Loss[2]
- 2000 to 2004 Land Gain[2]
- 2004 to 2006 New Water Areas[2]
- 2004 to 2006 New Land Areas[2]
- 2005 Land
- 2005 Water
- Fastlands: Agricultural, developed, and upland areas that are generally considered non-wetlands (Barras, 2006) and that are excluded from calculations of net land area change.
- LCA Area Not Included in the 1956 Data Coverage
- 2005 Hurricane Track
- Physiographic Province Boundary

[1]Data were filtered to depict larger areas of loss and gain greater than 3.5 acres (1.4 ha) in size and to remove noise and increase the confidence of the depicted trends.

[2]Data were filtered to depict areas of loss and gain greater than 2.8 acres (1.3 ha) in size to remove noise and to increase confidence in the depicted trends.



Multi-temporal & Multi-scale Assessment

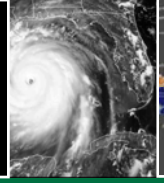
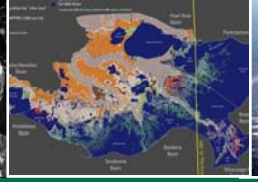


USGS

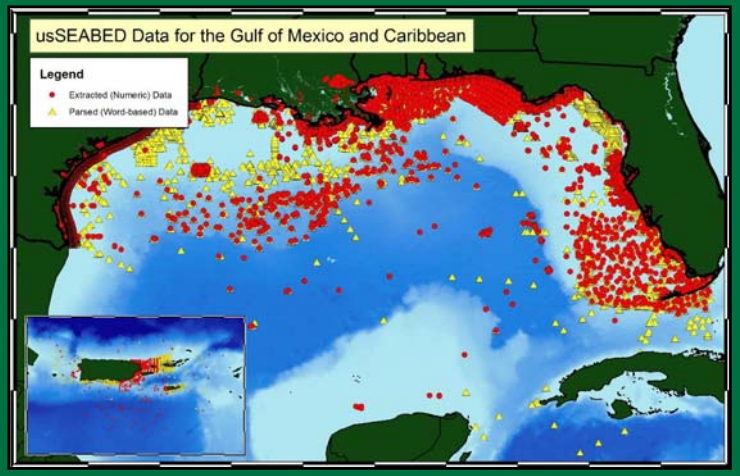
Landsat TM Path 22 Rows 39-40

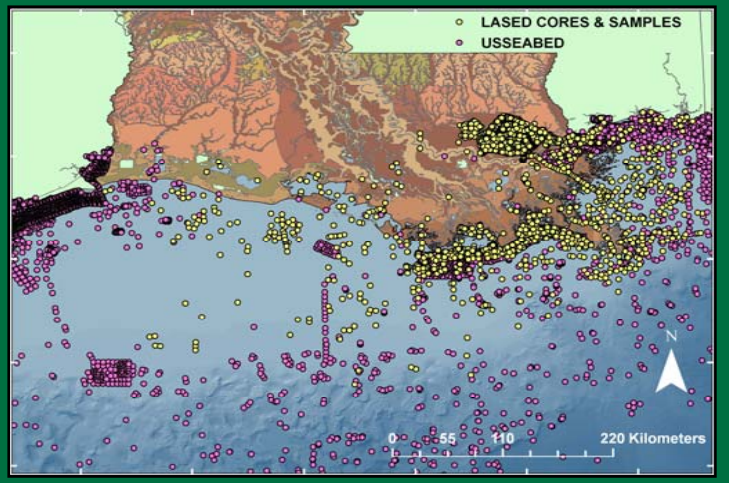
- Acquired in 30-40 seconds

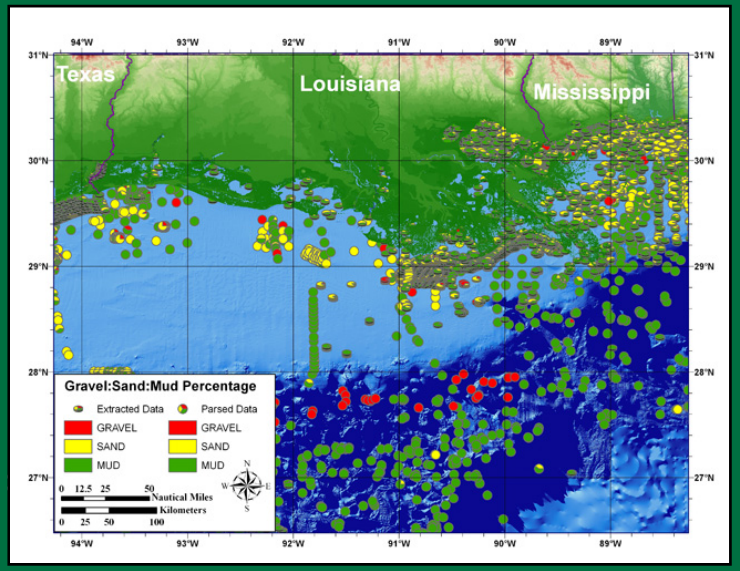
Marine Aggregates

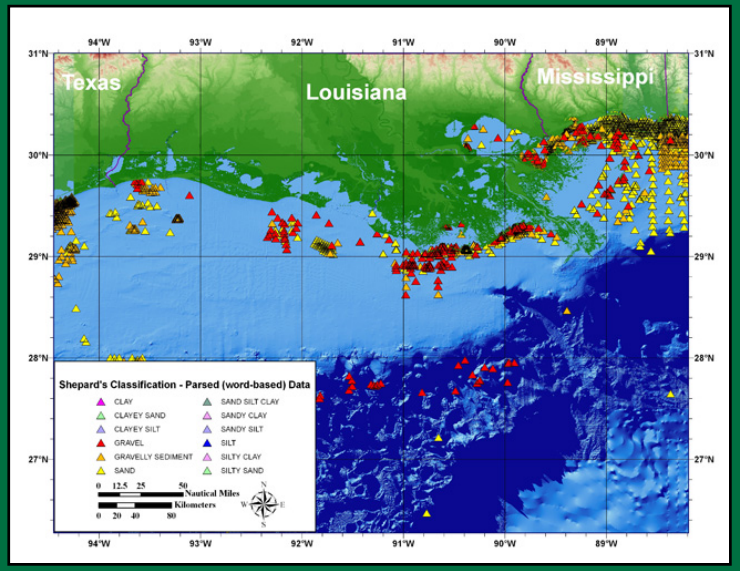



usSEABED/LASED Cores & Samples







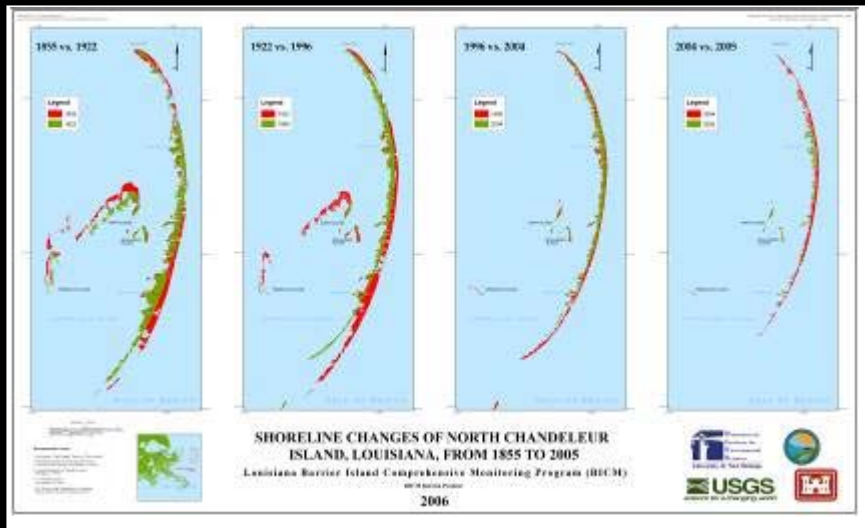


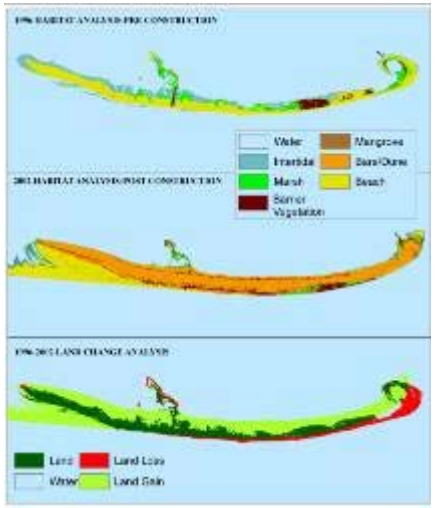
Barrier Island Comprehensive Monitoring (BICM)

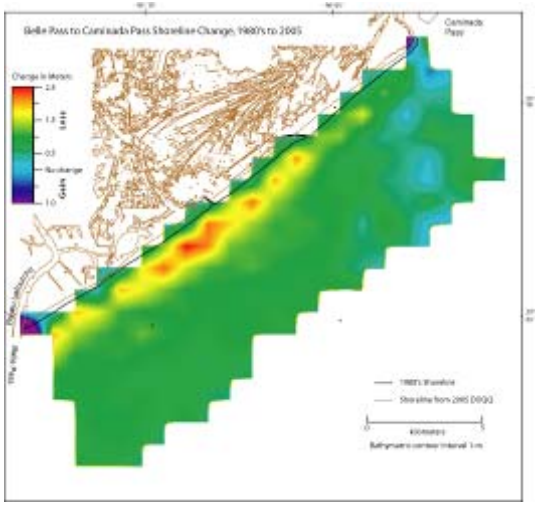
Shoreline Change/Land Loss

Habitat Change

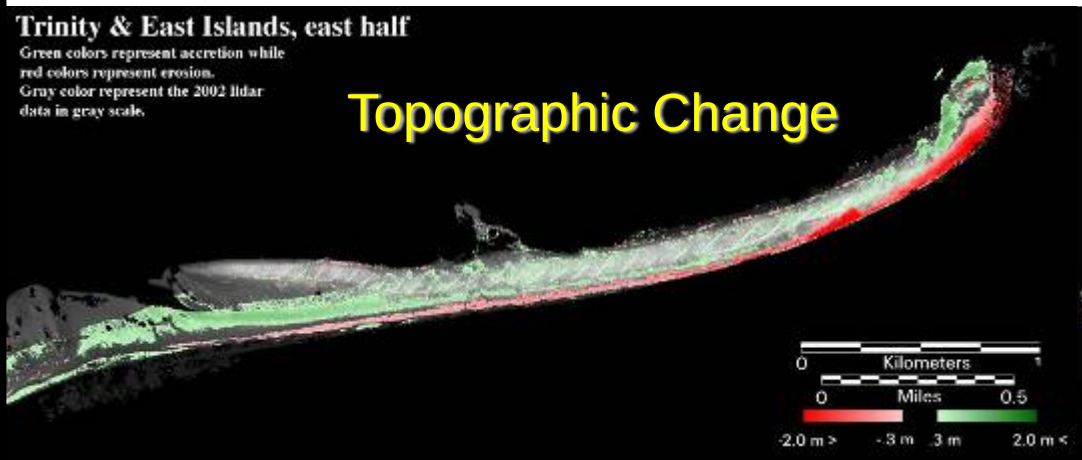
Bathymetric Change

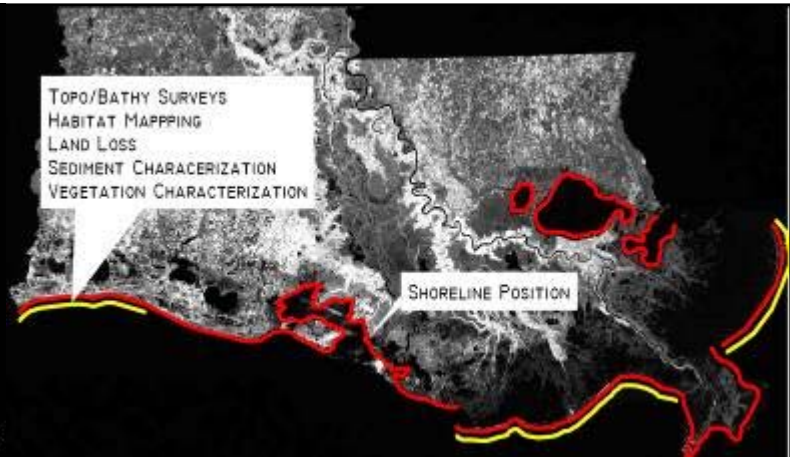




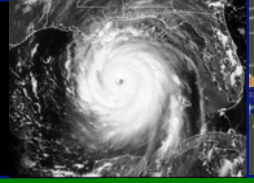


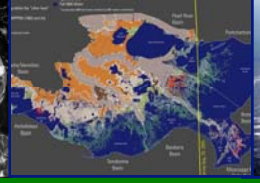
Topographic Change

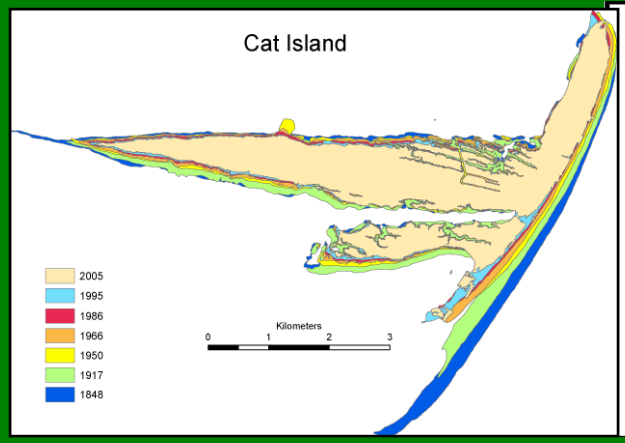


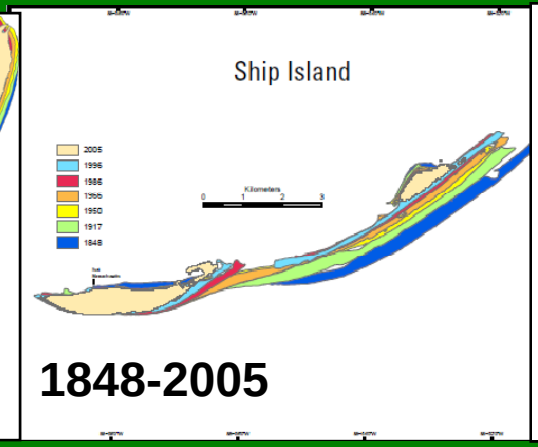


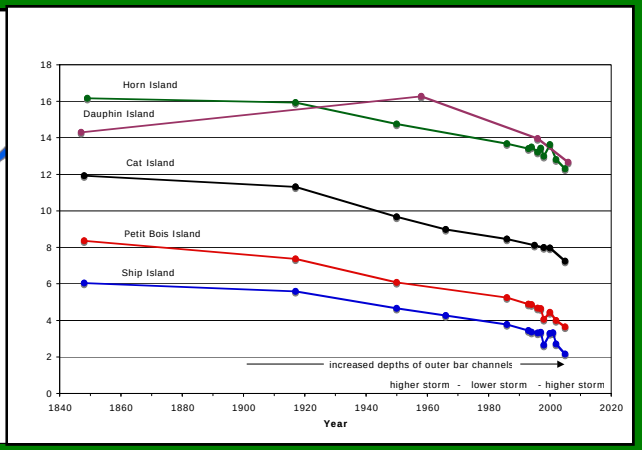
Moving East

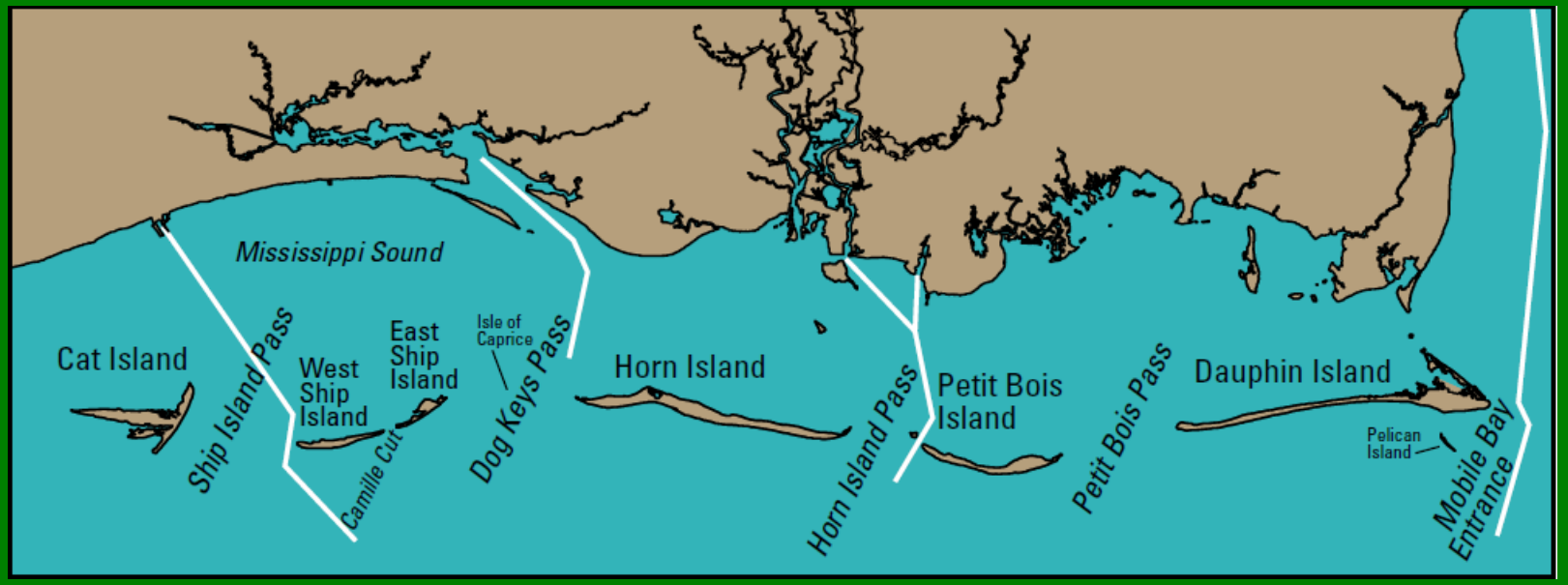








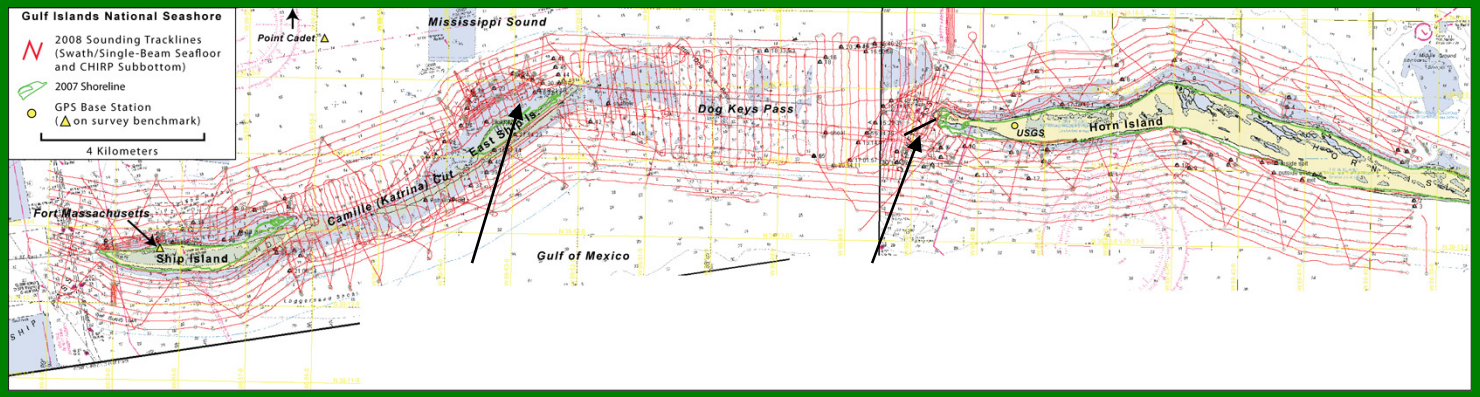




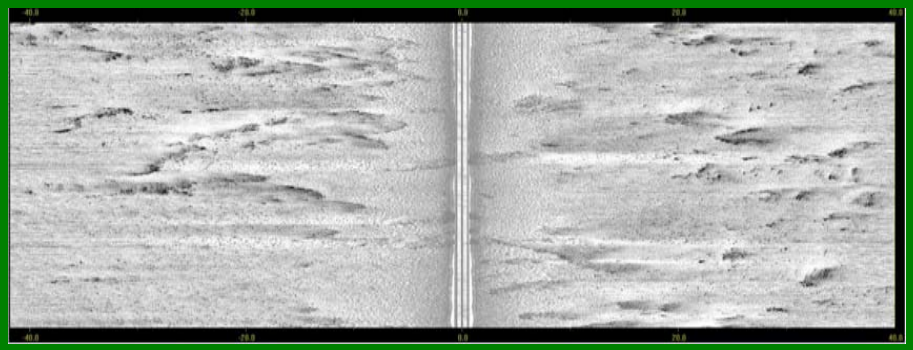
USGS

From Bob Morton, Historical Changes in the Mississippi-Alabama Barrier Islands and the Roles of Extreme Storms, Sea Level and Human Activities

Gulf Islands National Seashore, Mississippi. 2008 USGS bathymetric/subbottom coverage, East and West Ship Islands, Dog Keys Pass, and Horn Island

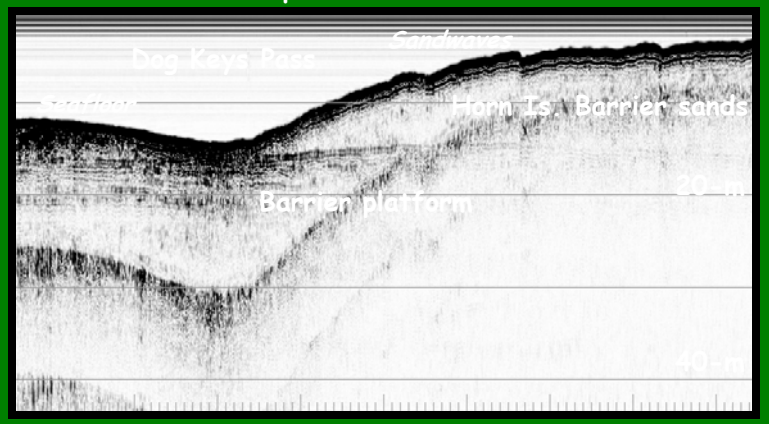


High-resolution swath backscatter imagery



Submerged aquatic vegetation, East Ship Is. 10-m

High-resolution single-channel seismic profile

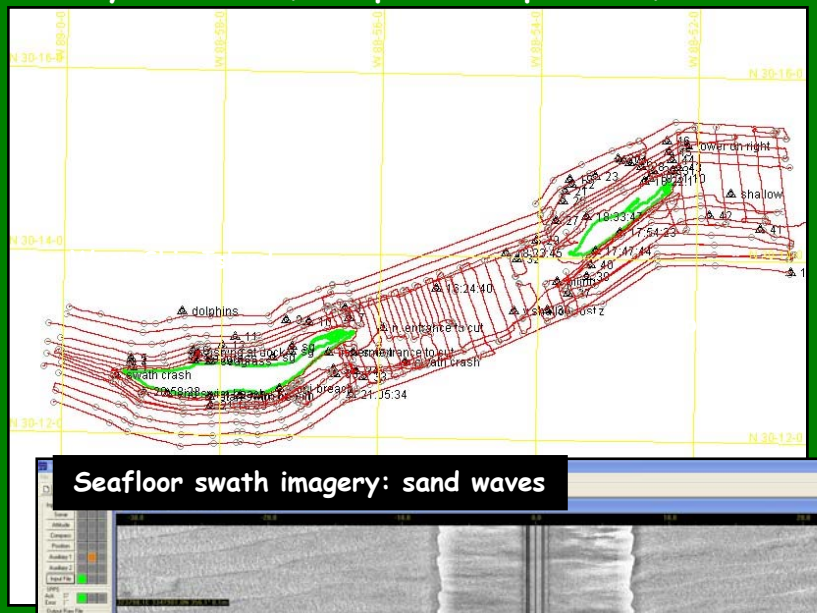


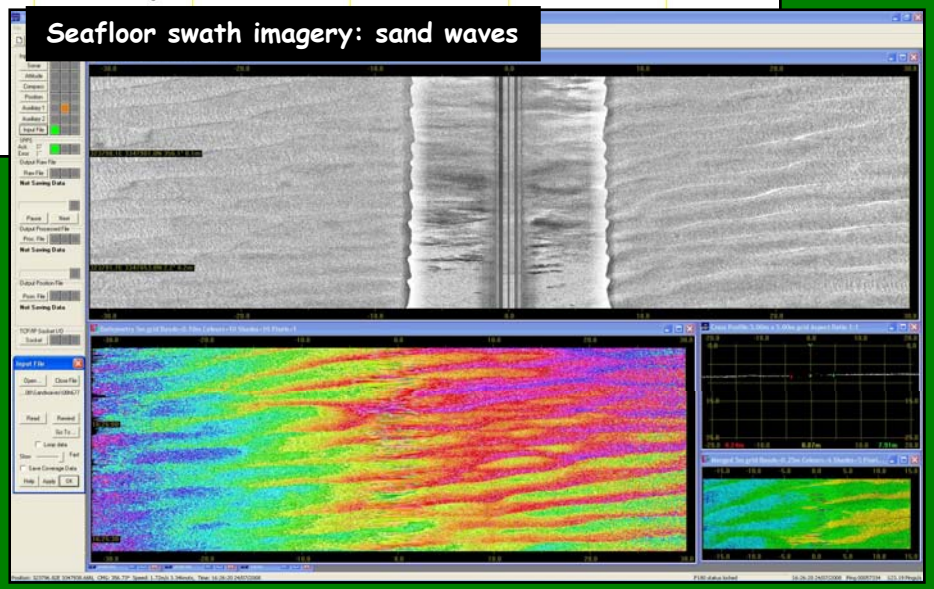
Horn Island prograding into Dog Keys Pass

Post hurricanes Gustav/Ike storm-impact resurvey

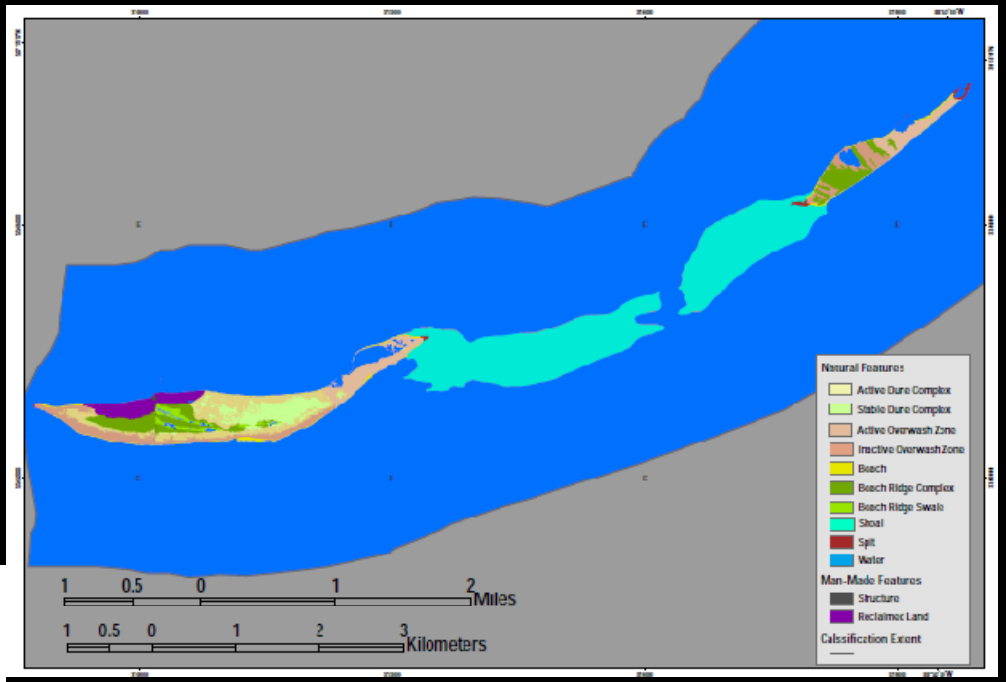
NOAA imagery of East Ship Island following Hurricane Gustav

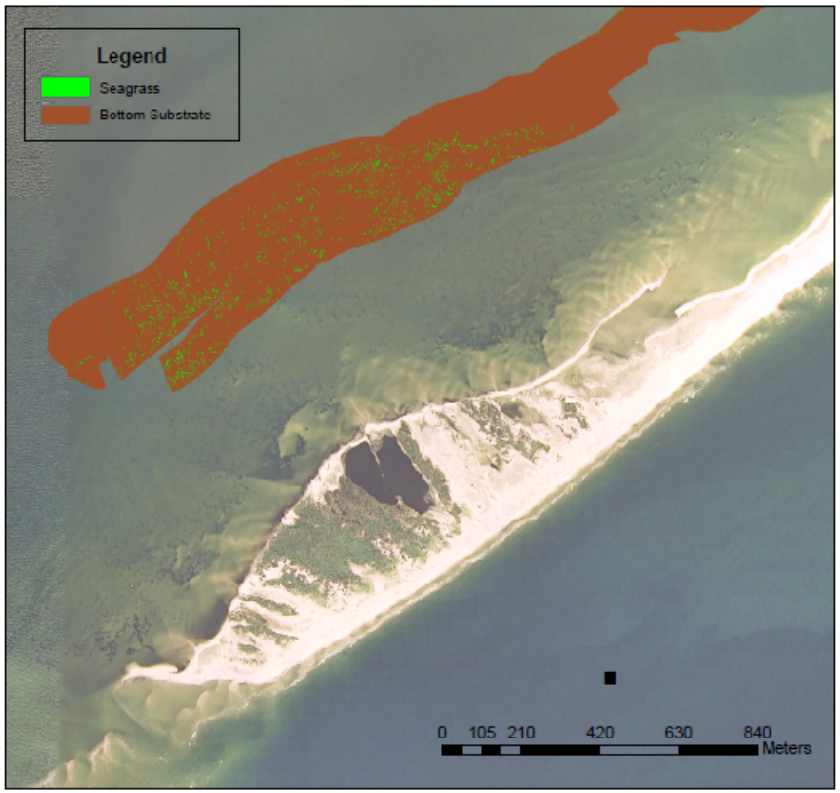
Post Hurricanes Ike and Gustav bathymetric survey tracklines, completed September,





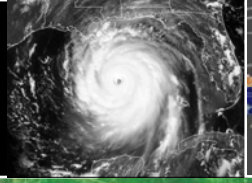
Ship Island: habitat classification

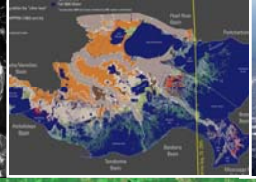




Ship Island: preliminary seafloor characterization (e.g. seagrass)

Moving East





Planned NGOM 2009 survey area