Barrier Island Evolution

Linking morphodynamics with framework geology

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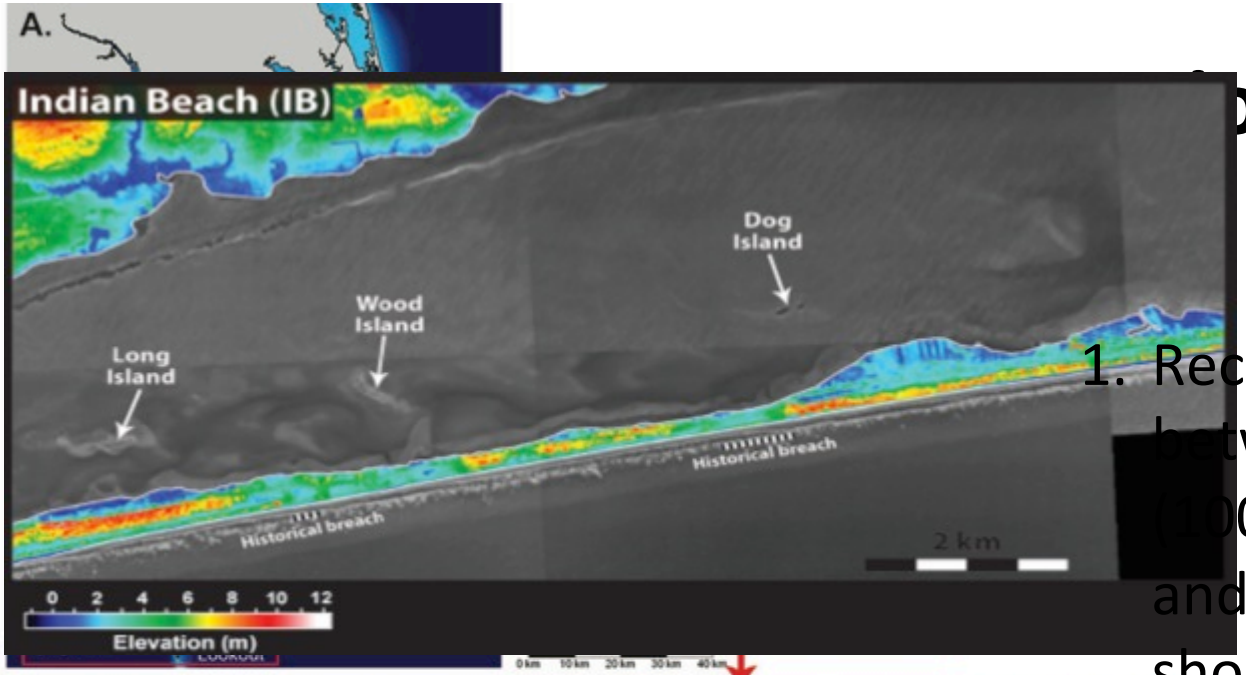
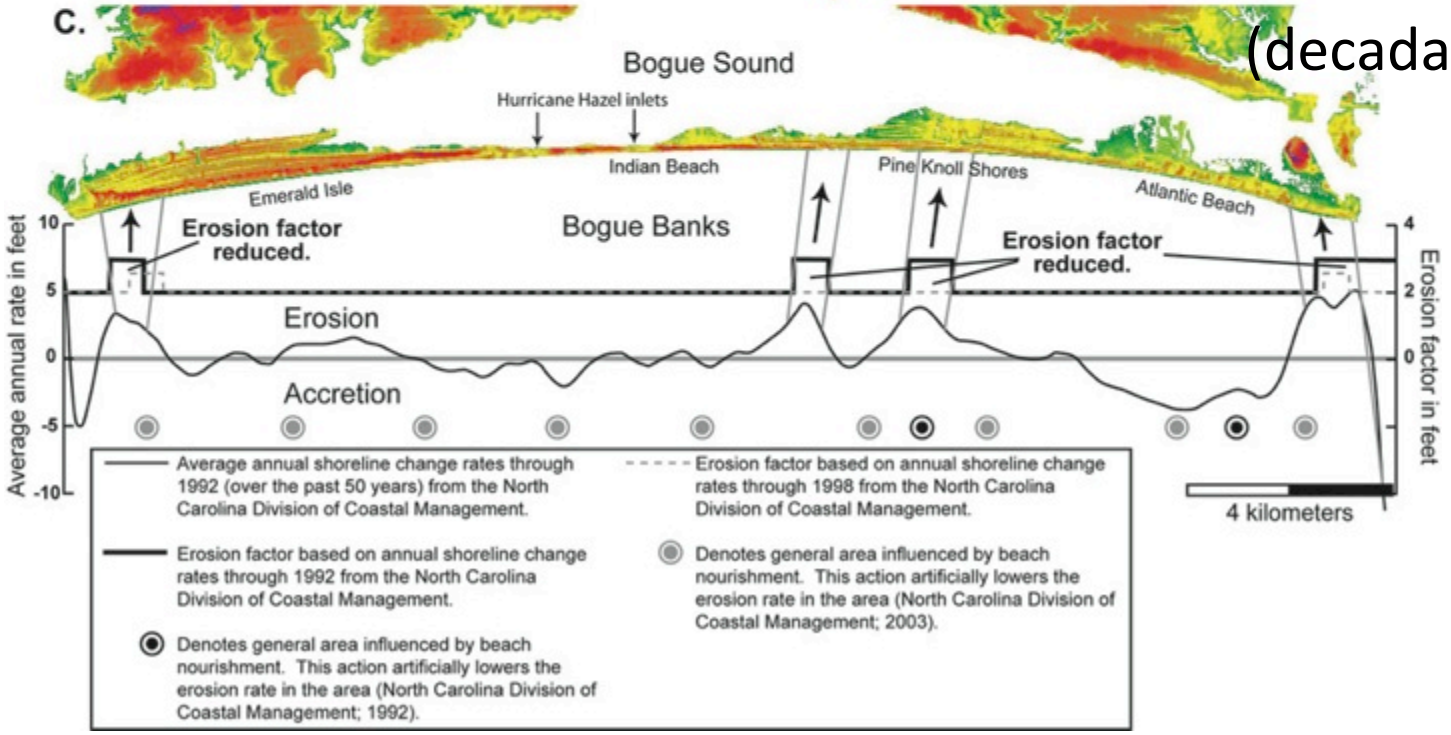
NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

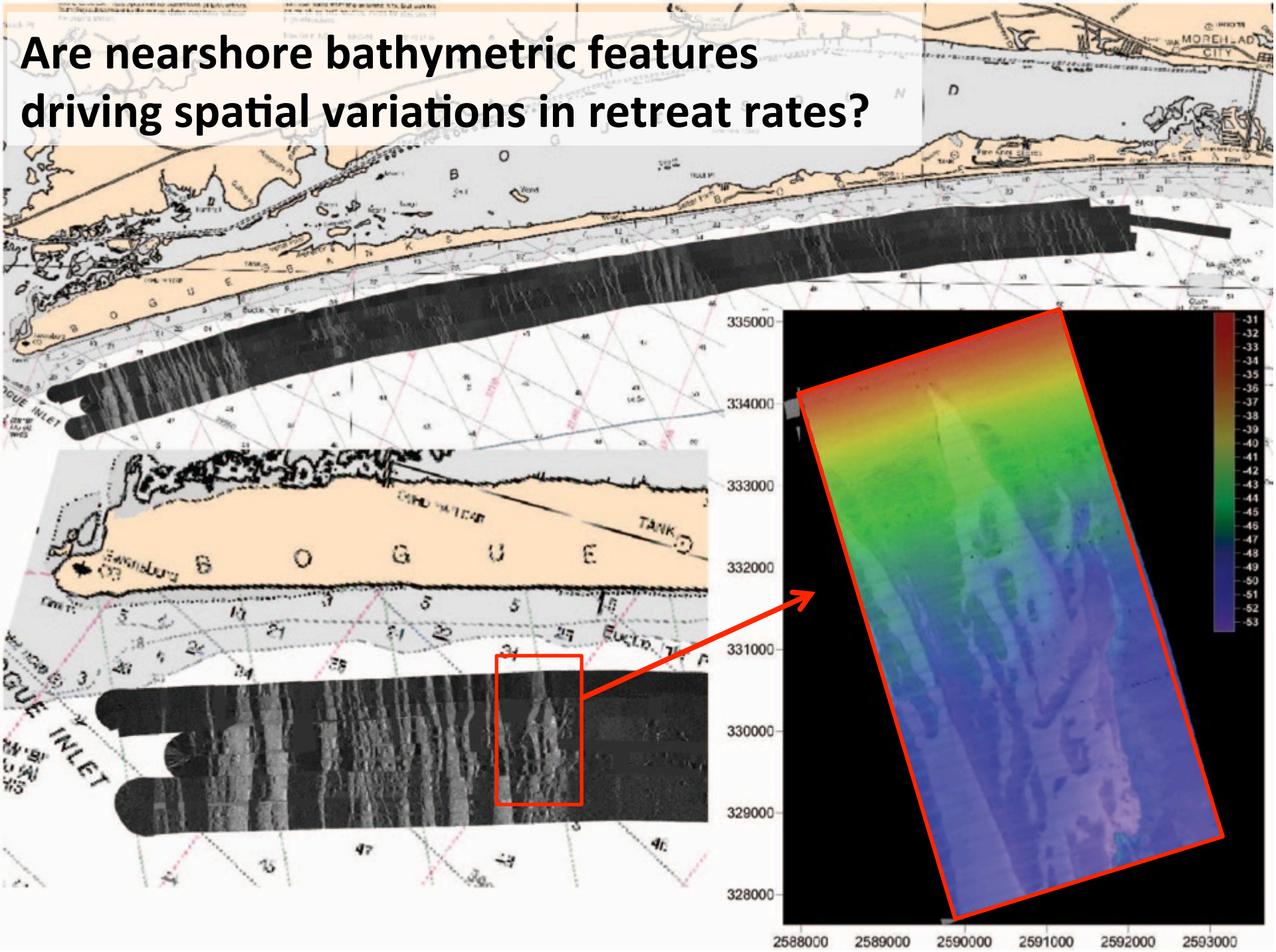
on rates vary Bogue Banks.

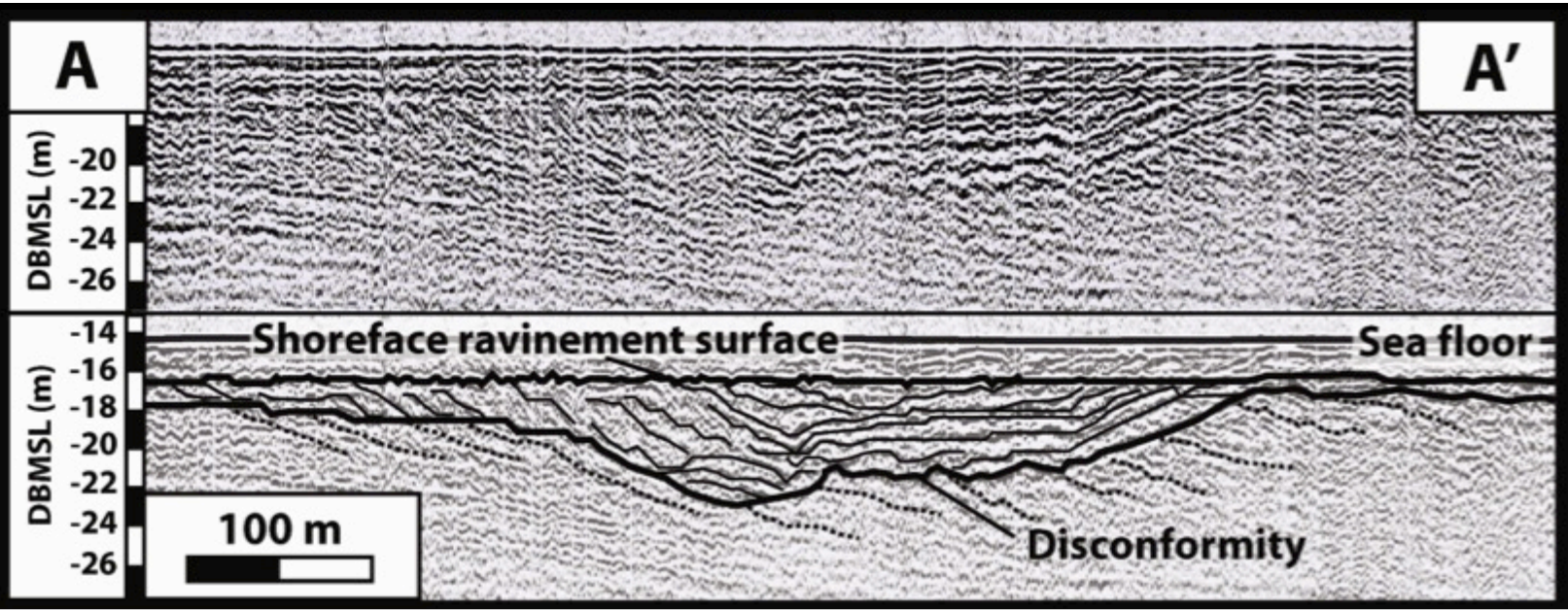


1. Reconcile disparity between island evolution (1000-year time scale) and historical rates of shoreline movement (decadal time scale).
   a) Offshore sand resources.
   b) Future island trajectory.
   c) Improve monitoring methods.

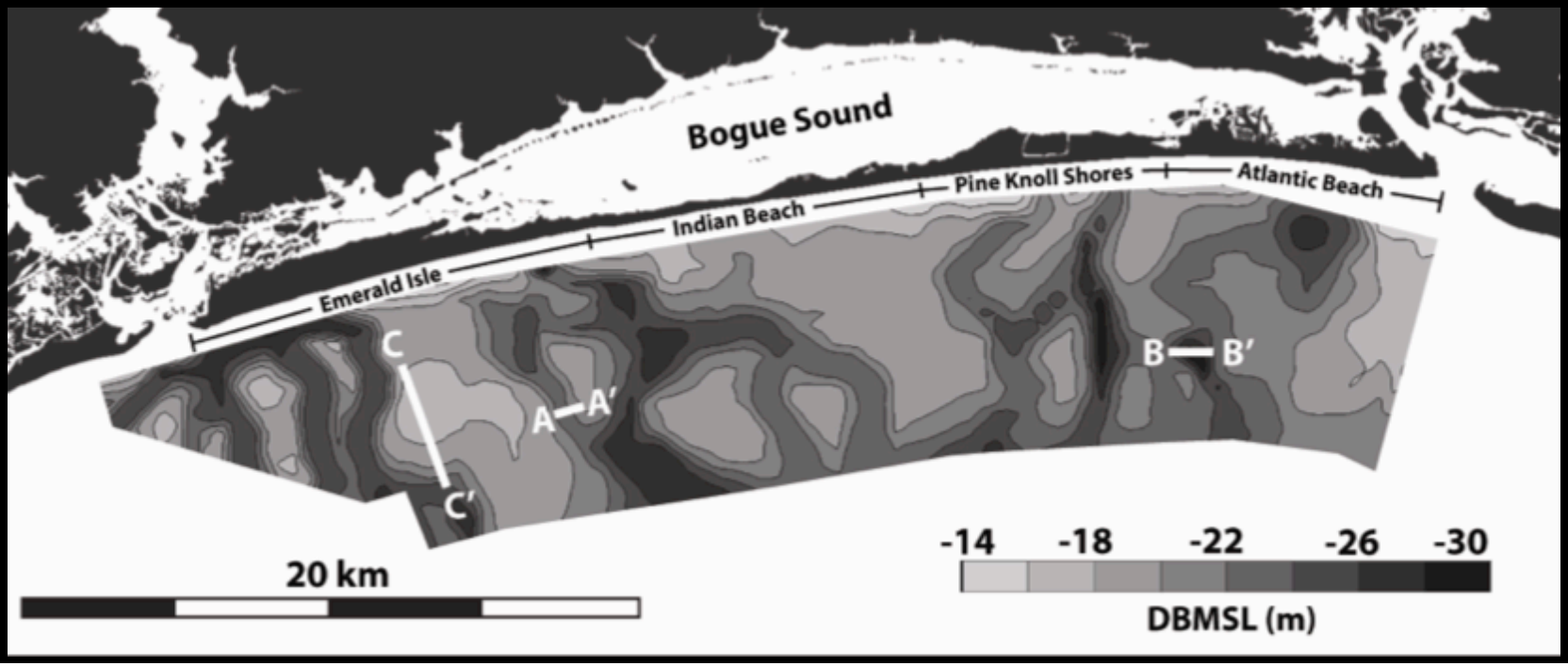


Are nearshore bathymetric features driving spatial variations in retreat rates?





Paleochannels intersect the regressive parts of the island.

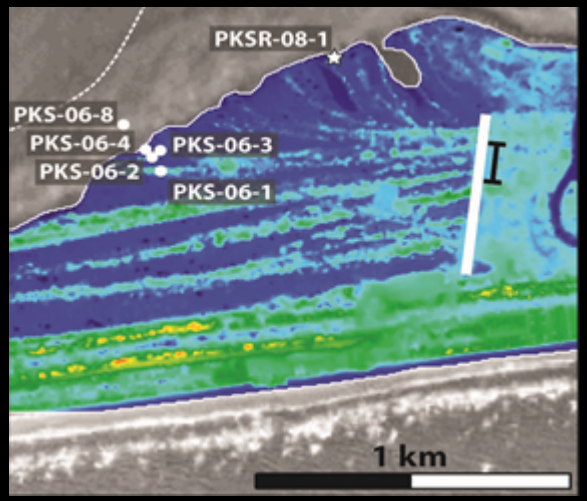


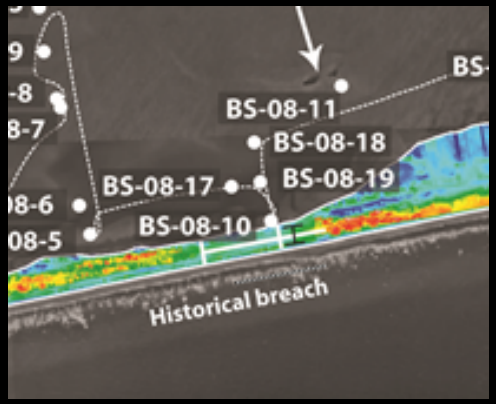
Long Island and Archer Pt. once connected.

Optically Stimulated Luminescence Dating

- Formed around 2,000 years ago.
- Long Island has the same sedimentology as a beach ridge.
- Ridges in PKS about the same age as Long Island and EI.

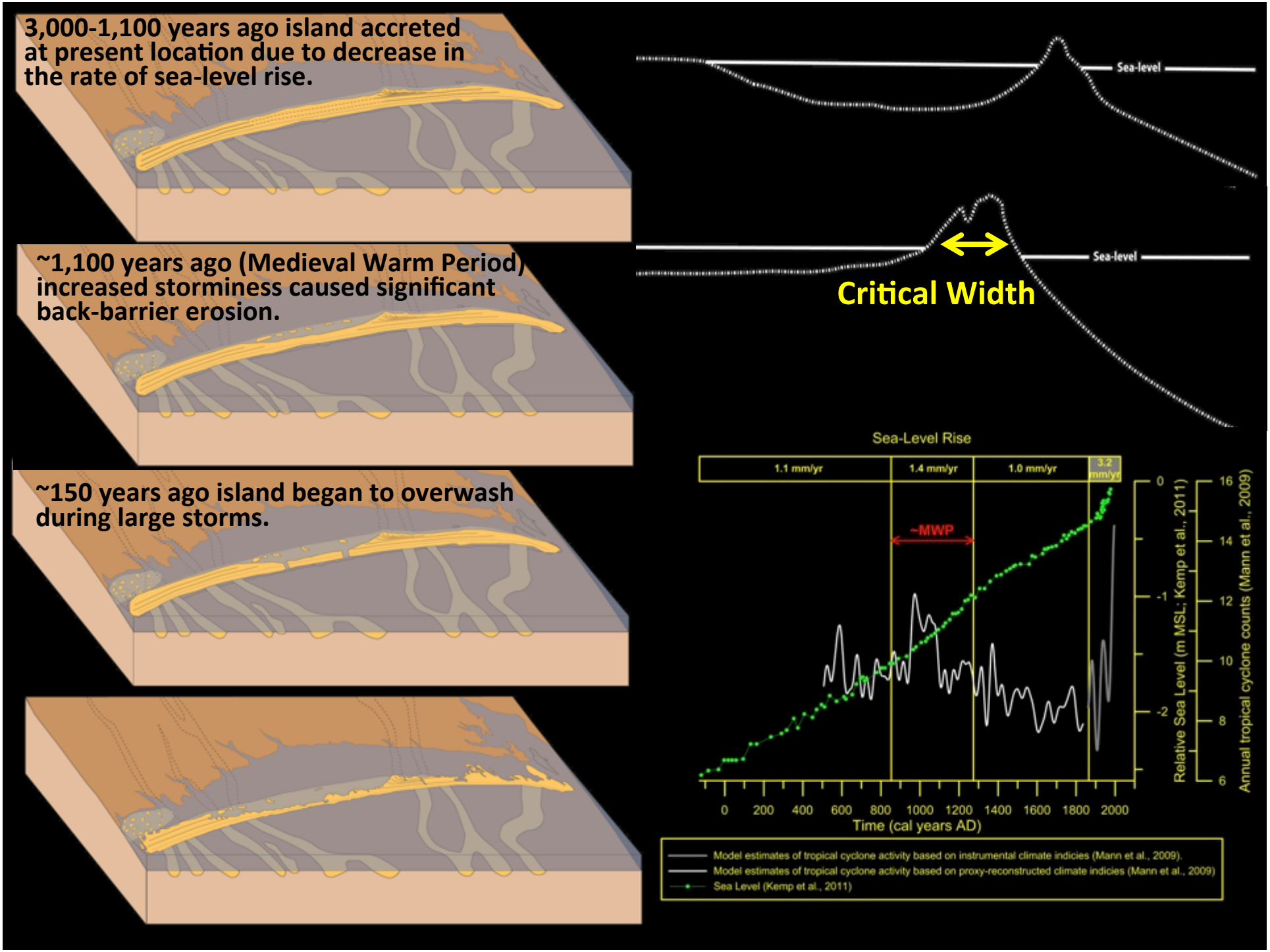
Island narrowed due to estuarine-shoreline erosion…which is evident today





Long Island 1958

Long Island 2011


3,000-1,100 years ago island accreted at present location due to decrease in the rate of sea-level rise.
~1,100 years ago (Medieval Warm Period) increased storminess caused significant back-barrier erosion.
~150 years ago island began to overwash during large storms.
Sea-level
Sea-level
Critical Width
Sea-Level Rise
1.1 mm/yr
1.4 mm/yr
1.0 mm/yr
3.2 mm/yr
~MWP
0
-1
-2
Relative Sea Level (m MSL; Kemp et al., 2011)
16
14
12
10
8
6
Annual tropical cyclone counts (Mann et al., 2009)
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Time (cal years AD)
Model estimates of tropical cyclone activity based on instrumental climate indicies (Mann et al., 2009).
Model estimates of tropical cyclone activity based on proxy-reconstructed climate indicies (Mann et al., 2009)
Sea Level (Kemp et al., 2011)

1958

2011

Translating science into practice

- Partners Rudi Rudolph (CC Beach Manager) and Chris Freeman (Geodynamics) facilitated information exchange.
  - Two public lectures to CC Beach Commission
  - Results used as a guide for identifying near-shore sand resources (important component of beach management plan).
  - Data delivered to county and coastal-engineering firm.
- Four peer-reviewed publications. One resulted in comment-reply exchange between Rudolph and authors Theuerkauf and Rodriguez.

Erosion or Error: Are Profiles and the Mean High Water Shoreline Appropriate Proxies for Measuring Subaerial Beach Volume Change?

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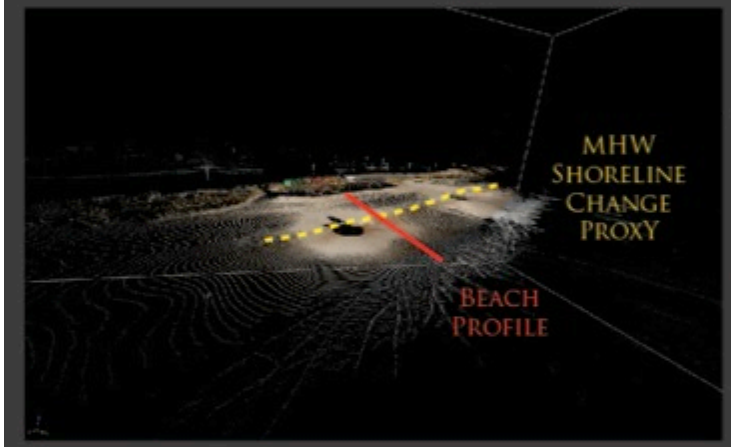
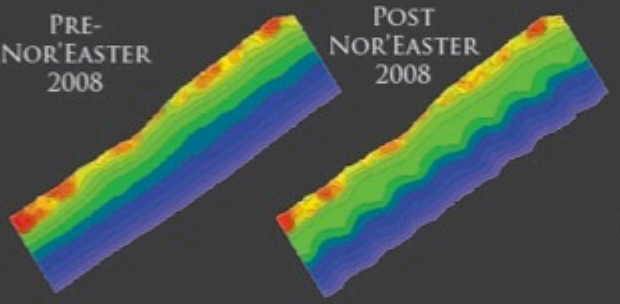
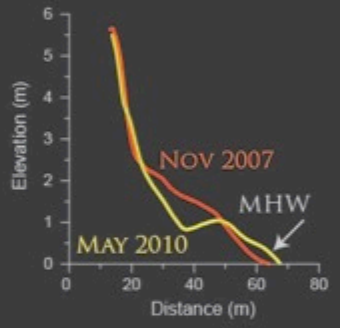


Ideal method for mapping beach changes should be accurate on both short and long time scales

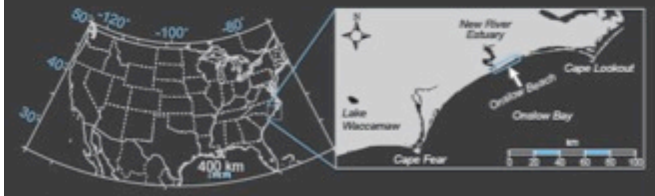


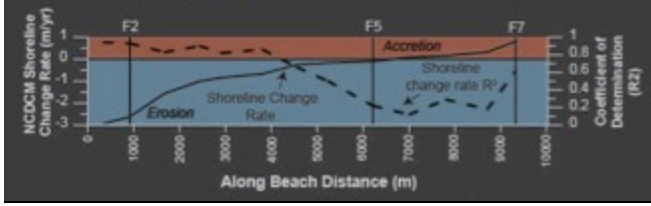
Profiles do not work well on short-time scales at beaches with morphologic variability, such as beach cusps

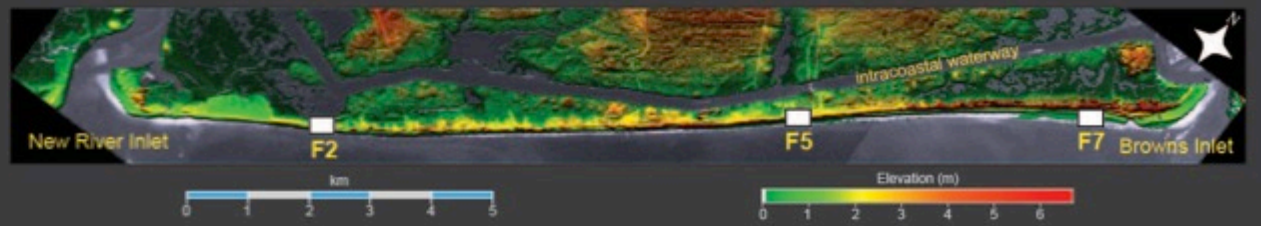


The shoreline-change proxy does not work well when profile shape is variable on short-time scales;- improves with time because magnitude of change exceeds profile variability

Do Estimates of Volume Change from Beach Profiles and the Shoreline Change Proxy Improve with Time at Beaches with Varying Morphologies and Shoreline Response?







F2 constantly eroding; ephemeral beach cusps
F5- near-neutral erosion rate; high decadal variability in the rate; ephemeral beach cusps
F7- Nourished Bi-Annually