USGS
science for a changing world

USGS: Assessing Vulnerability

Annual Ocean and Coastal Program Manager's Meeting

Washington, DC

24 February 2009

John Haines

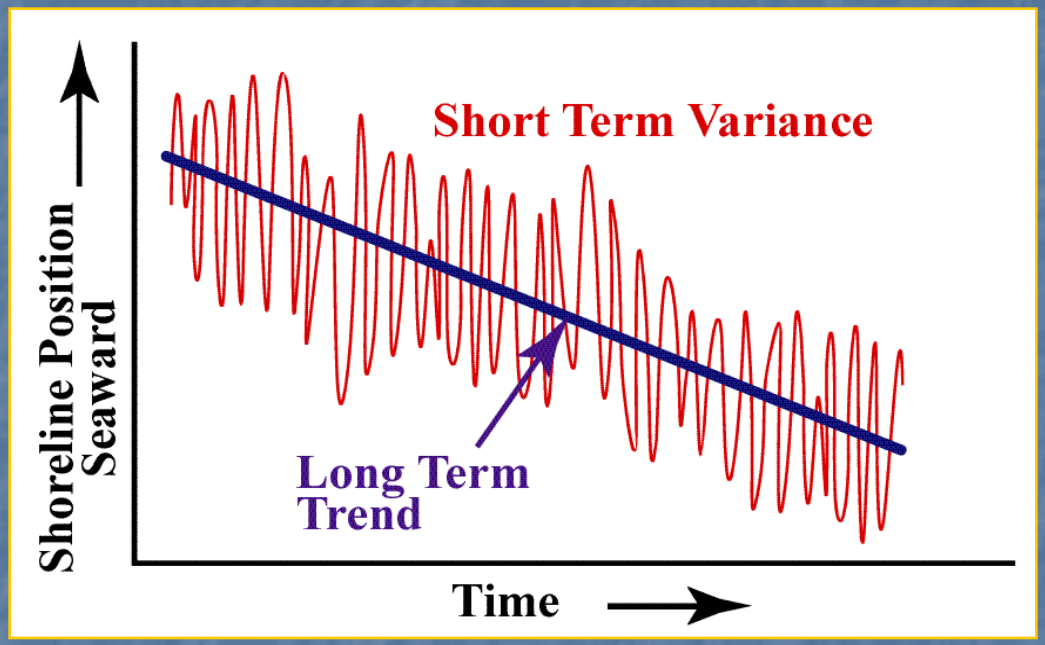
USGS, Coastal and Marine Program Coordinator

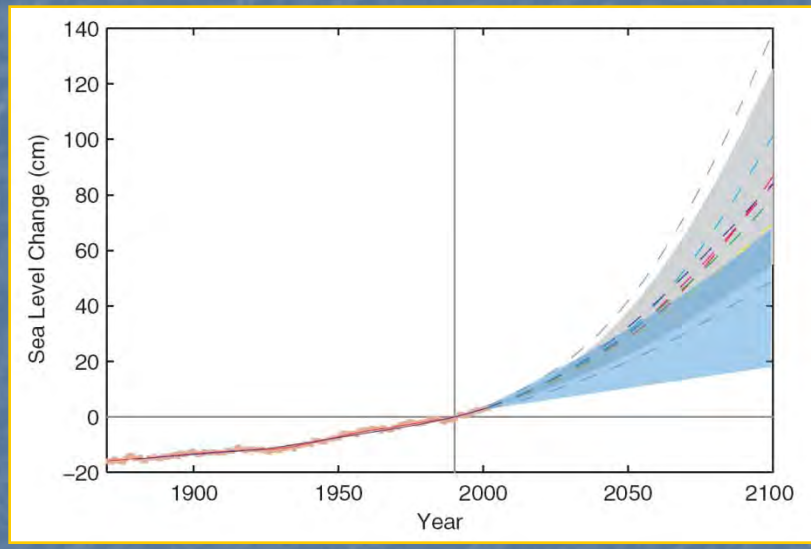
Outline

1. Coastal Change – Outlining the Complexity
2. Foundation in Observations – Mapping
3. Simple “Observation-based” Assessments
4. Understanding the Critical Processes
5. Embracing the Complexity

USGS

1. Coastal Change - from Storms to Sea-Level Rise





(modified after Bindoff, 2007; Rahmstorf, 2007)

Short-term Variance

(hours to decade)

Storm impact/recovery
Annual cycles
El Niño
(Tsunami)

Long-term Trend

(decades to centuries)

Sediment deficit or surplus
Sea-level rise

Focus on Inundation Hazards –

How Landforms, Risk, and Vulnerability evolve in response to natural and human factors.

USGS

1. Coastal Change: Complex Systems + Complex Responses ⇒ Comprehensive, Integrated Research & Assessments

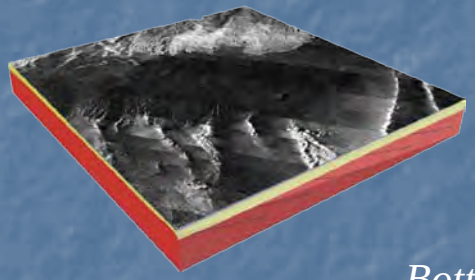
- Multiple human and natural drivers spanning multiple time scales
- Diversity of systems – glaciated coasts to tropical atolls; wetlands and barriers responding dynamically
- Observations – Research – Modeling
- Needs span policy/management scales – National and Regional
- Modeling/Assessment needs from simple to complex

USGS

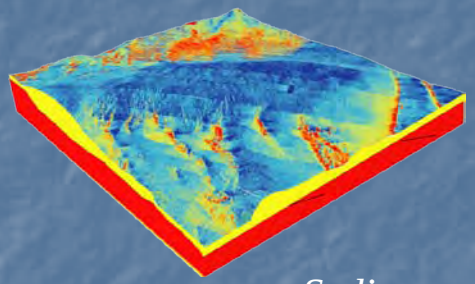
2. Mapping as the Foundation

Documenting and Understanding Change and Vulnerability, Assessing Sand Resources, Managing Living Resources, Developing the Seabed (Alternative Energy)

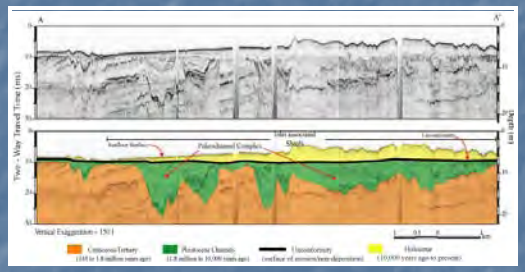
Sidescan Sonar



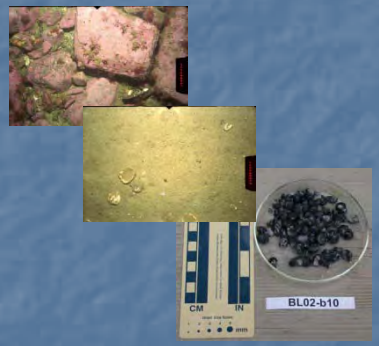
Swath Bathymetry



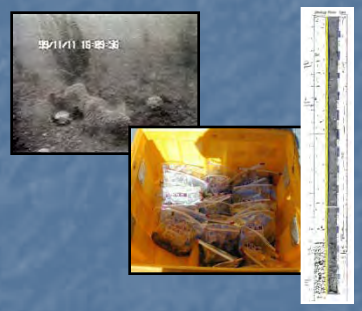
Seismic Reflection

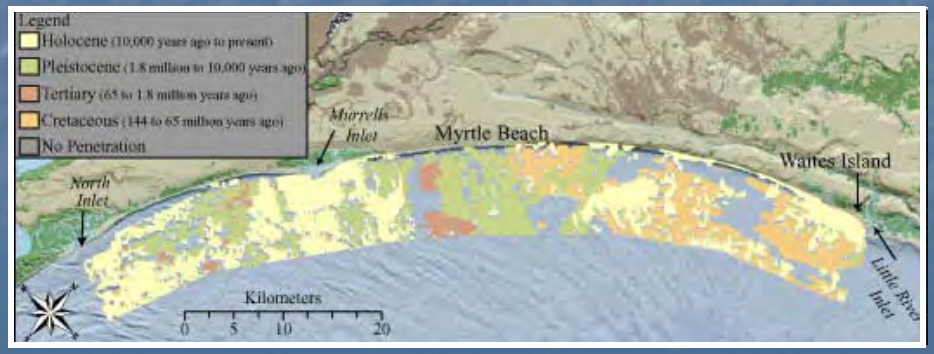


Bottom Video and Photographs Samples



Sediment Core and Grab Samples



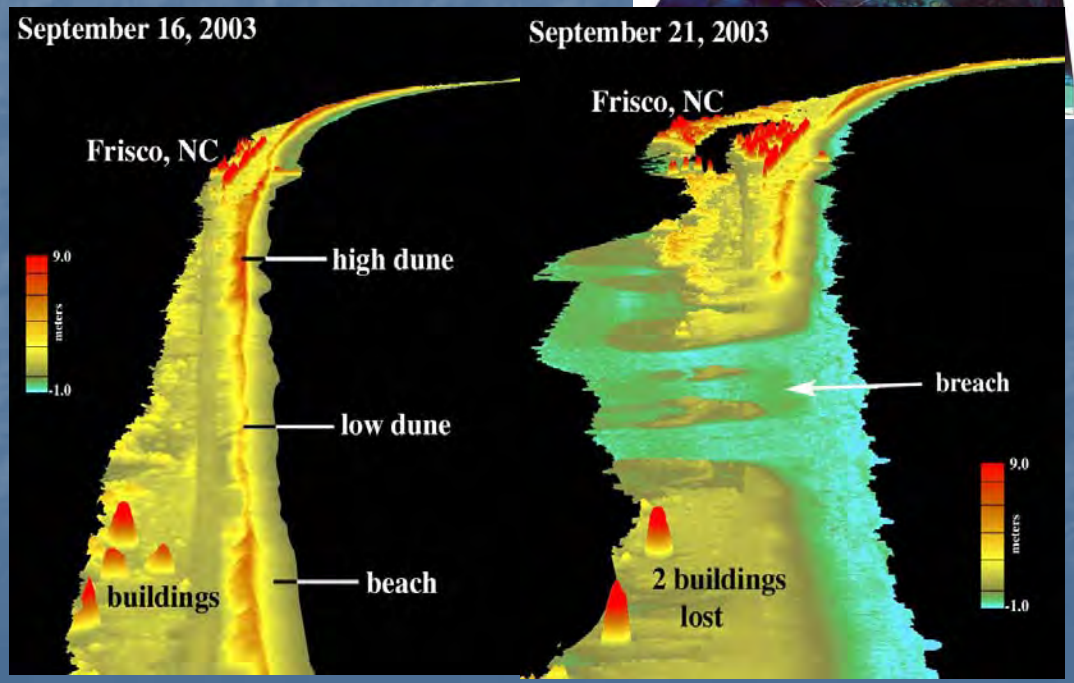


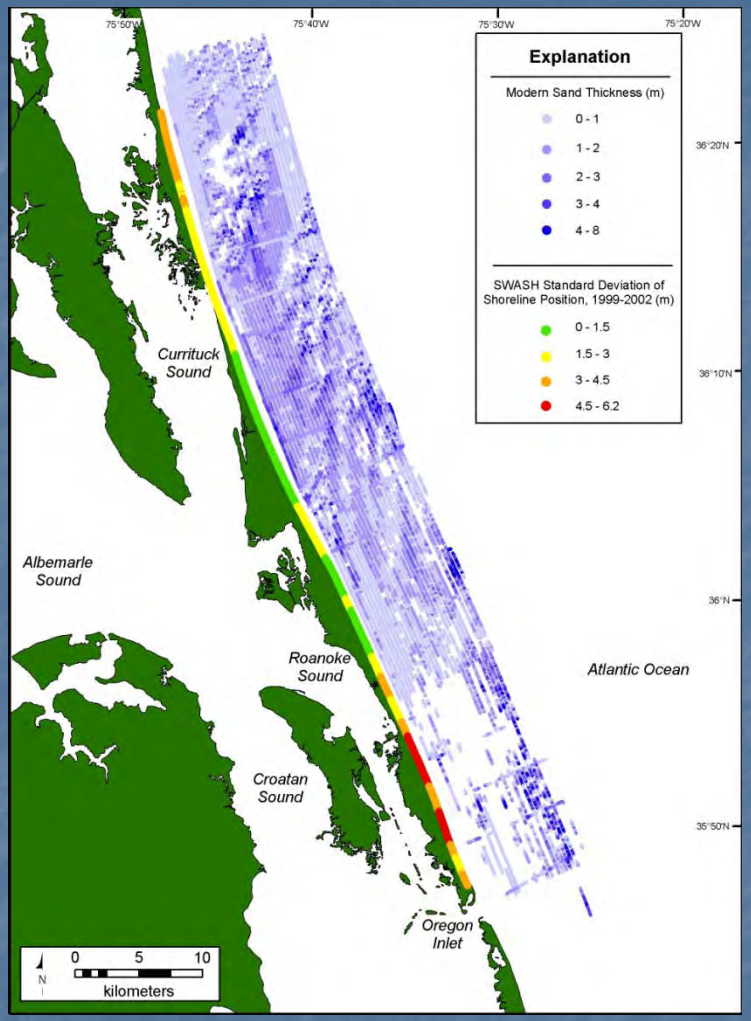
USGS

2. Mapping as the Foundation

Coastal Zone Mapping

Elevation is the Primary Variable

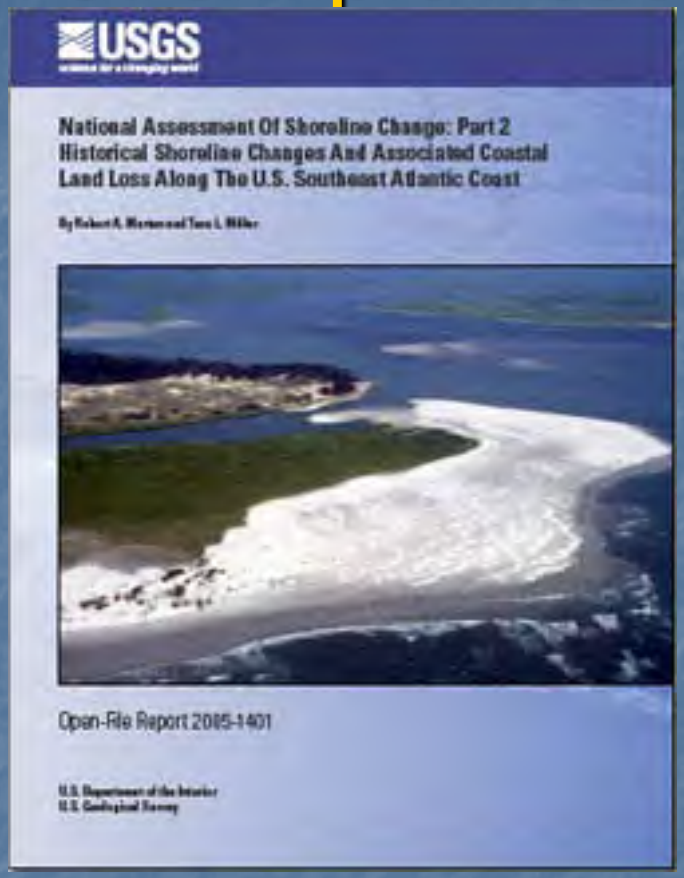


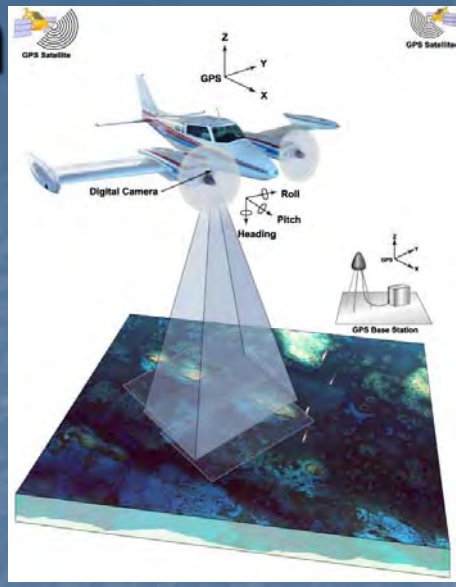


USGS

Hurricane Isabel Inlet Breaching NC

3. Simple Assessments - Erosion





http://coastal.er.usgs.gov/shoreline-change/

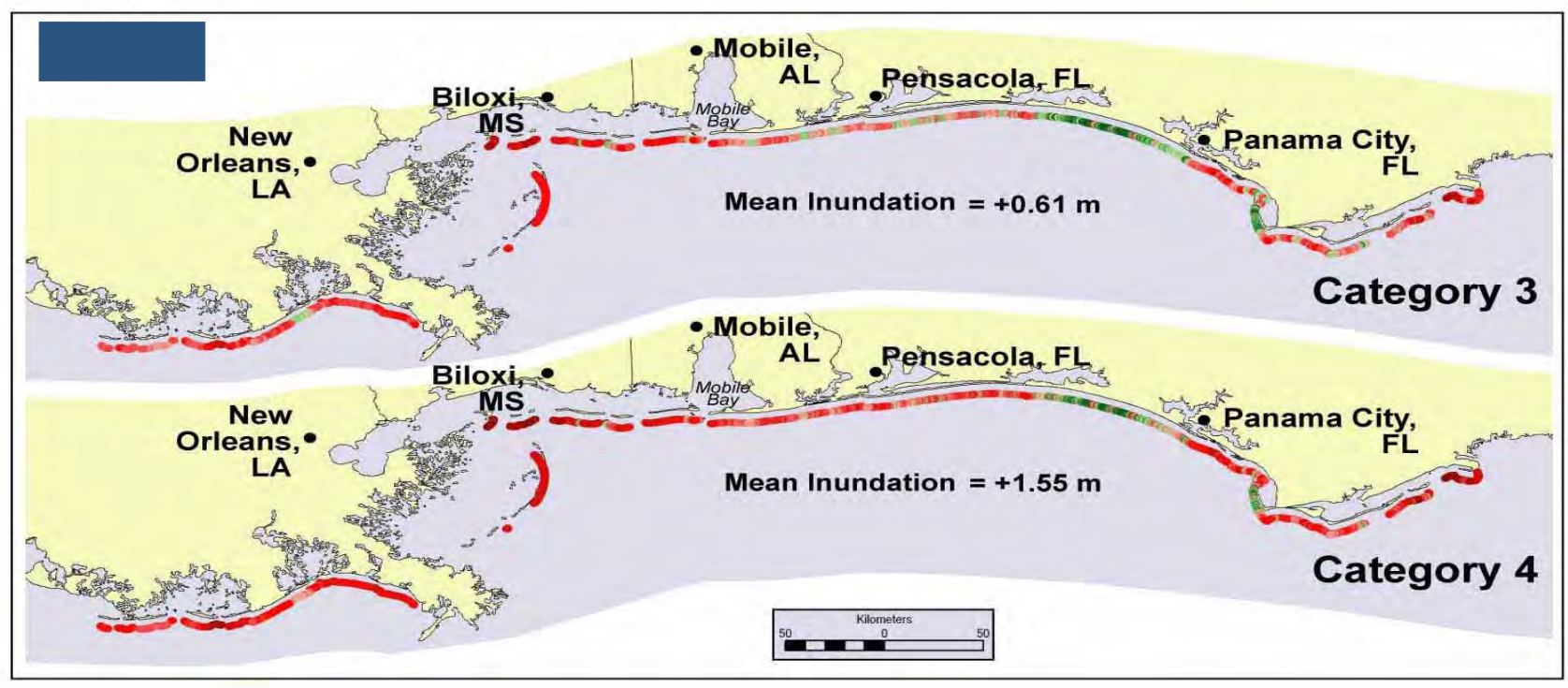
Consistent Shoreline/Morphology

Historic Change Rates over multiple time-scales

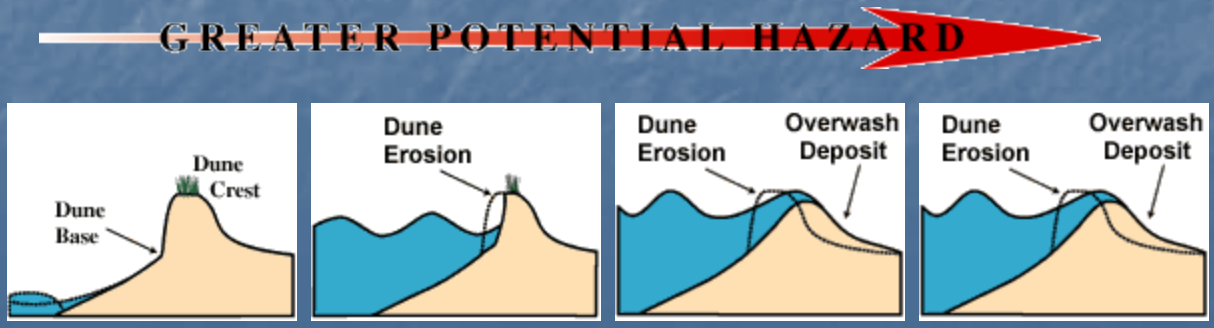
- Trends and Uncertainties

USGS

3. Simple Assessments – Storm Vulnerability

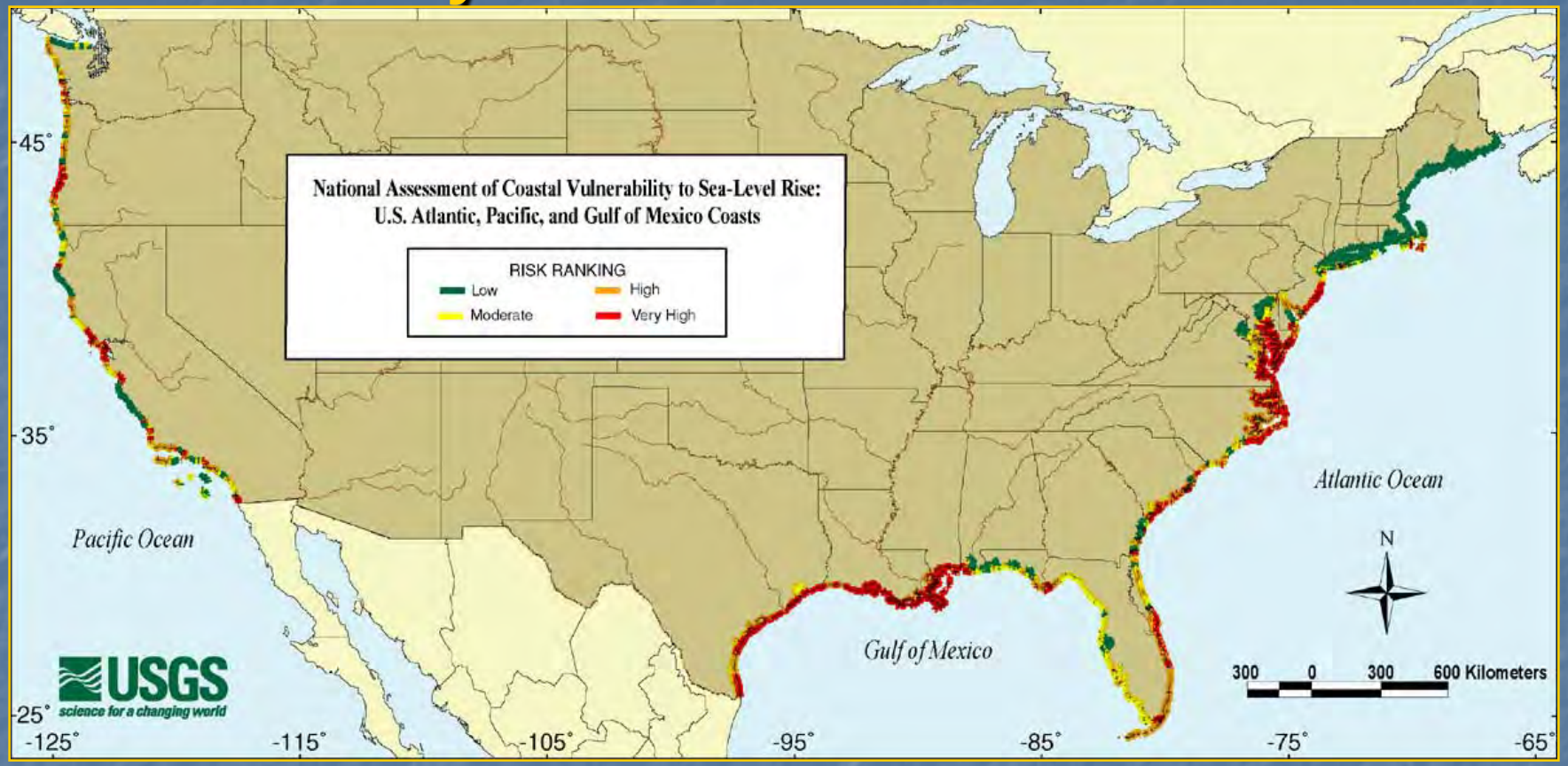


http://coastal.er.usgs.gov/hurricanes/cch.html



USGS

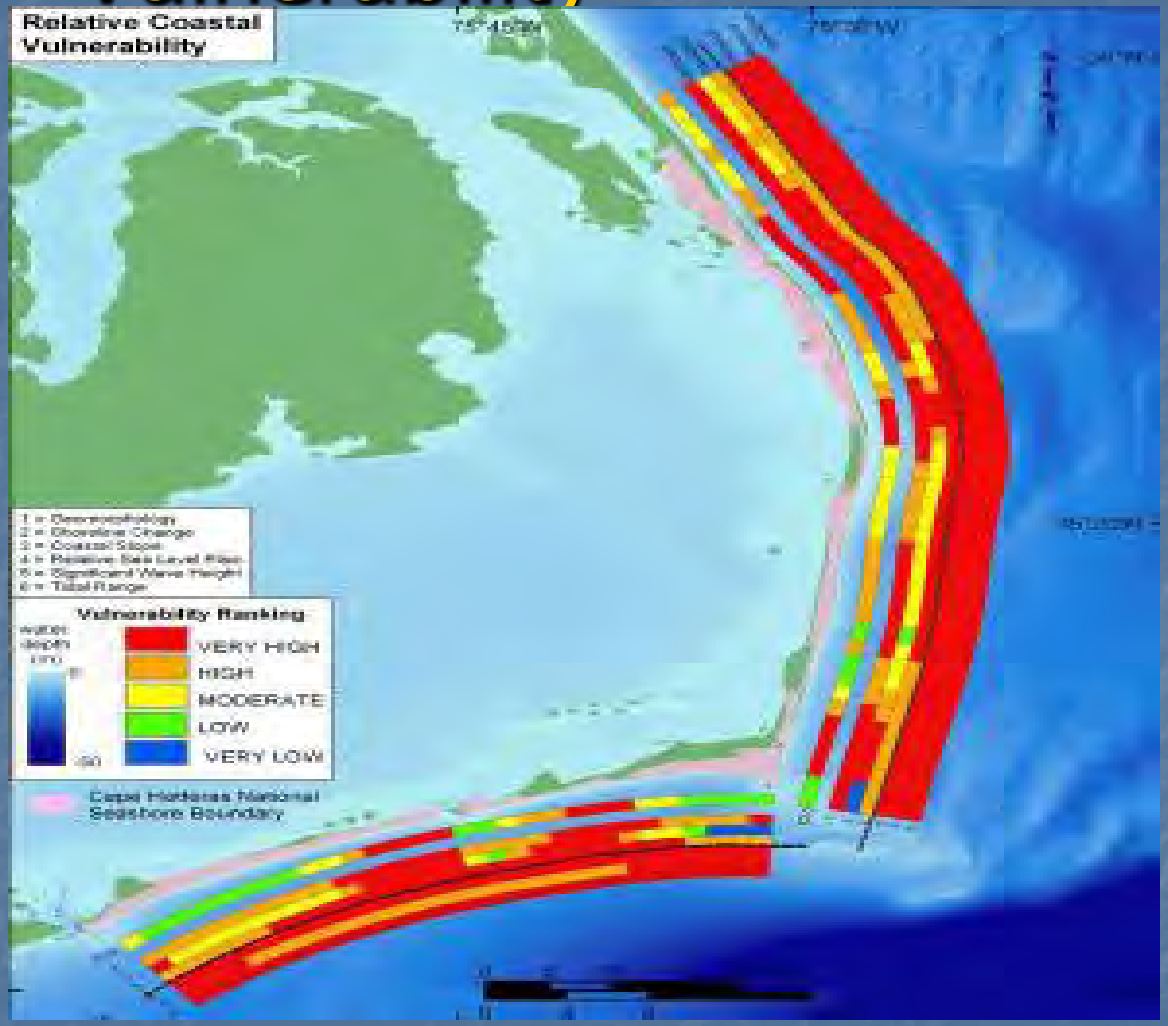
3. Simple Assessments – Sea-Level Rise Vulnerability



http://woodshole.er.usgs.gov/project-pages/cvi/

USGS

3. Simple Assessments – Sea-Level Rise Vulnerability

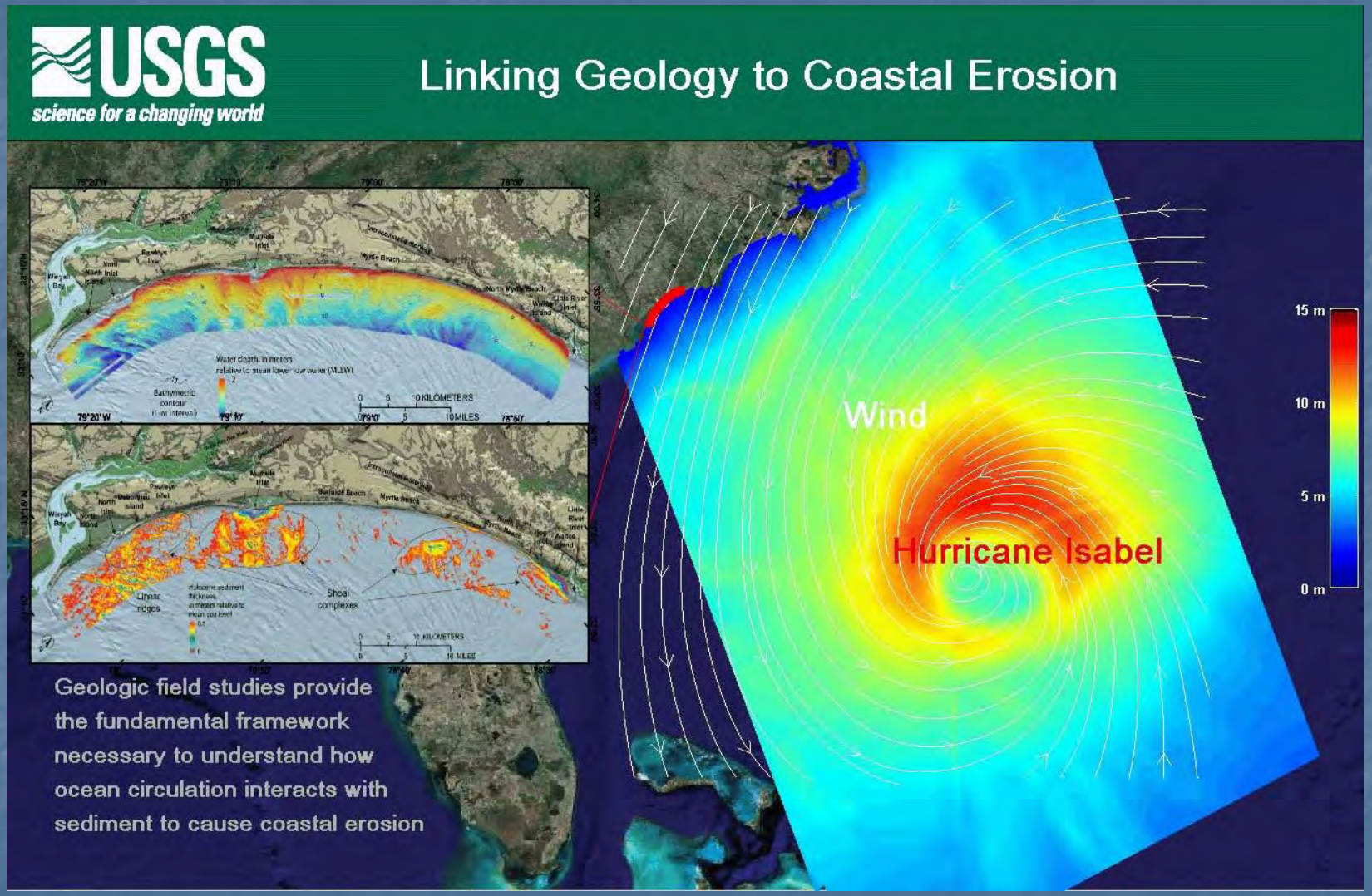


- Geomorphology
- Historic shoreline change
- Coastal Slope
- Relative sea-level rise rate
- Mean sig. wave heigh
- Mean tidal range

http://woodshole.er.usgs.gov/project-pages/nps-cvi/parks/CAHA.htm

USGS

4. Understanding the Critical Processes



USGS

5. Embracing the Complexity

Required Input

LIDAR OBS

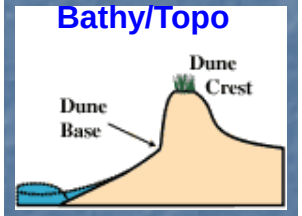
Area for collaboration: prioritize national observation resources to provide accurate and up-to-date elevation/process data

Evaluate output

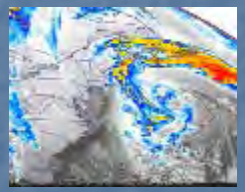
LIDAR OBS

Area for collaboration: prioritize national observation resources to minimize uncertainty

Bathy/Topo

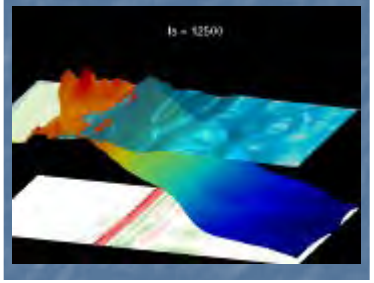


\+ Weather

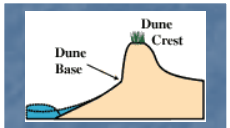


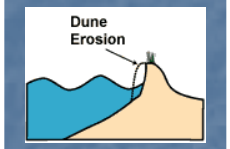
Observations

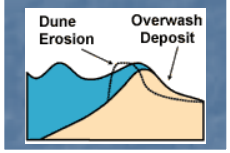
Overwash and Erosion models



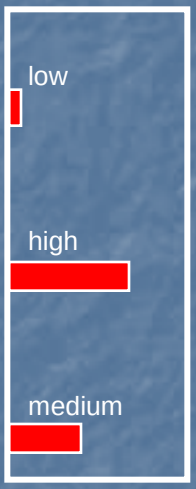
Processes



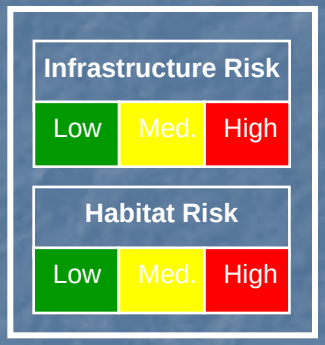




Response



Probability



Risk Analysis

wave/water OBS

wave/water MODELS

Areas for collaboration

1. Nested modeling using national observation resources and large scale models to support high resolution models—we need accurate Boundary Condition inputs
2. Scenario exploration for likely climate changes and extreme storms

USGS