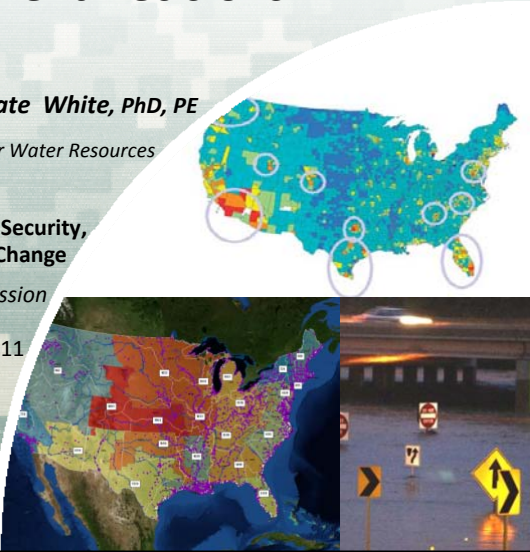




Integrating Climate Change Adaptation and Mitigation Strategies for Smart Water Management Decisions

Jeff Arnold, PhD & Kate White, PhD, PE
 US Army Corps of Engineers | Institute for Water Resources

ACCO Workshop on Defense, National Security, and Climate Change
 Integrating Adaptation Strategies Session

Washington, DC | 31 March 2011

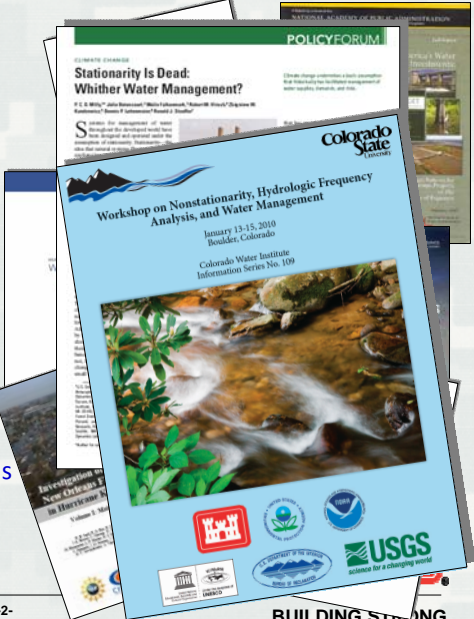







US Army Corps of Engineers
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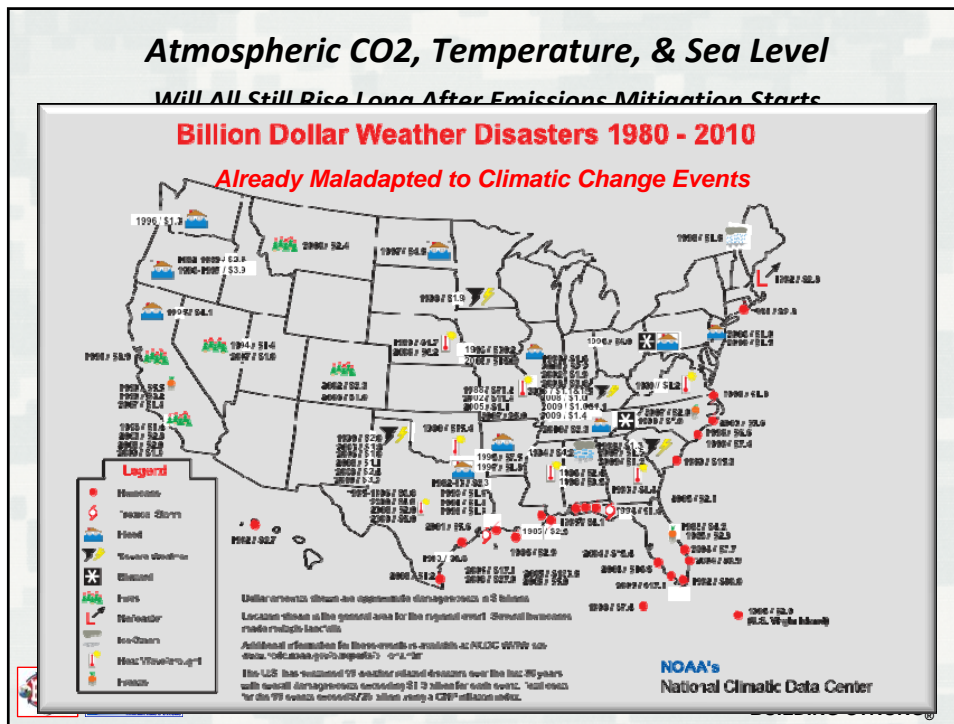
What's Driving Climate Change Work at USACE ?

- ✓ **Internal & External Reviews –**
 IPET / HPDC, ASCE, NRC, others – followed Hurricane Katrina showed that USACE needed to incorporate methods for characterizing *new & changing conditions, both foreseen & surprise*, in its programs & projects
- ✓ **Hydrologic Stationarity –**
 water management & water science agencies work to understand operations for a continually changing environment



-2- **BUILDING STRONG®**



Sustainability Big and Small

Small : Mitigation & Conservation Measures



Avoid the Unmanageable

- ✓ conserve energy & water, decreasing GHG emissions
- ✓ increase GHG sinks
- ✓ methods, processes, & elements well characterized ('tame problem')
- ✓ inherently quantifiable – inventorying, accounting, reporting, & verifying
- ✓ results closely tied to implementation scales
- ✓ relatively low costs

Big : Adaptation Measures

Manage the Unavoidable

- ✓ ensure robust & resilient mission & operations in an uncertain future
- ✓ problems not well characterized ('wicked problem') & require *actionable science for informed decisions*
- ✓ methods & processes still nascent & not completely quantified / quantifiable
- ✓ cause & effect often separated in space & time
- ✓ long-term monitoring & adjustments required
- ✓ costs run from low to very high

Climate Change Will Affect Nearly All USACE Programs

Military Programs

- ✓ MILCON for Modular Force Global Positioning
- ✓ BRAC
- ✓ Field Force Engineering
- ✓ MILCON Transformation
- ✓ Environmental Restoration

Homeland Security

- ✓ Critical Infrastructure
- ✓ Antiterrorism
- ✓ Intelligence
- ✓ Facilities

Civil Works

- ✓ Navigation
- ✓ Hydropower
- ✓ Flood Control & Shore Protection
- ✓ Reservoir Management & Water Supply
- ✓ Emergency & Disaster Response
- ✓ Environmental Restoration
- ✓ Recreation

Research & Development

- ✓ Water Resources
- ✓ Projects & Installations
- ✓ Environmental
- ✓ Warfighter

Real Estate

- ✓ DOD Real Estate

Interagency Support

- ✓ Federal
- ✓ State
- ✓ Local
- ✓ International

Regulatory Planning

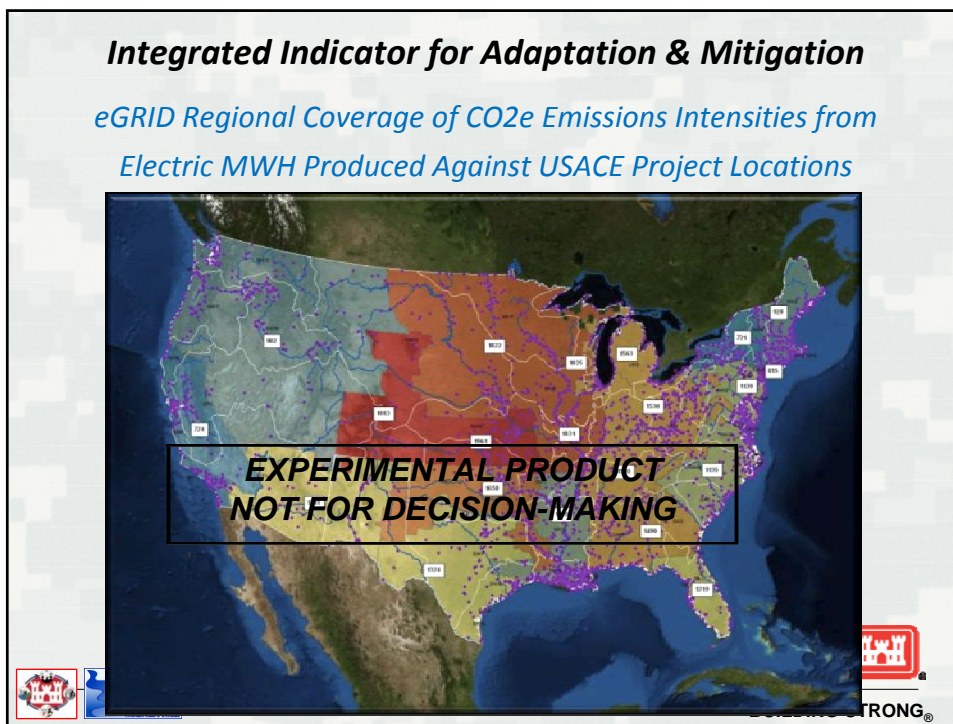
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Managing These Resources & Programs Under Climate & Global Non-Stationarity Means Explicitly Characterizing Their Vulnerabilities

Loarie et al., *Science* (2009), 'The Velocity of Climate Change' – an index representing the Earth's surface

Coping range
Vulnerability
Coping range plus adaptation

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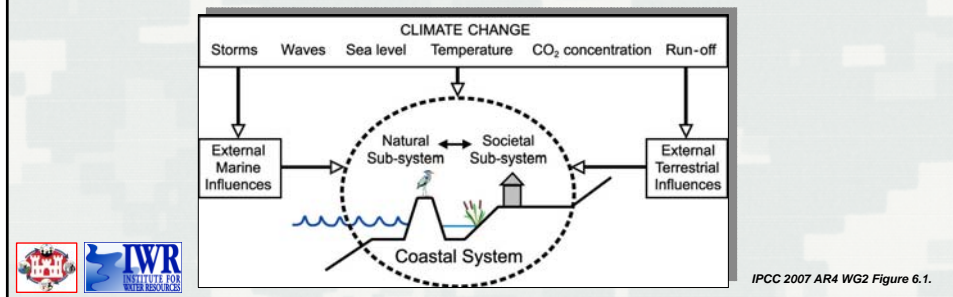
Specific Example: Sea-Level Change

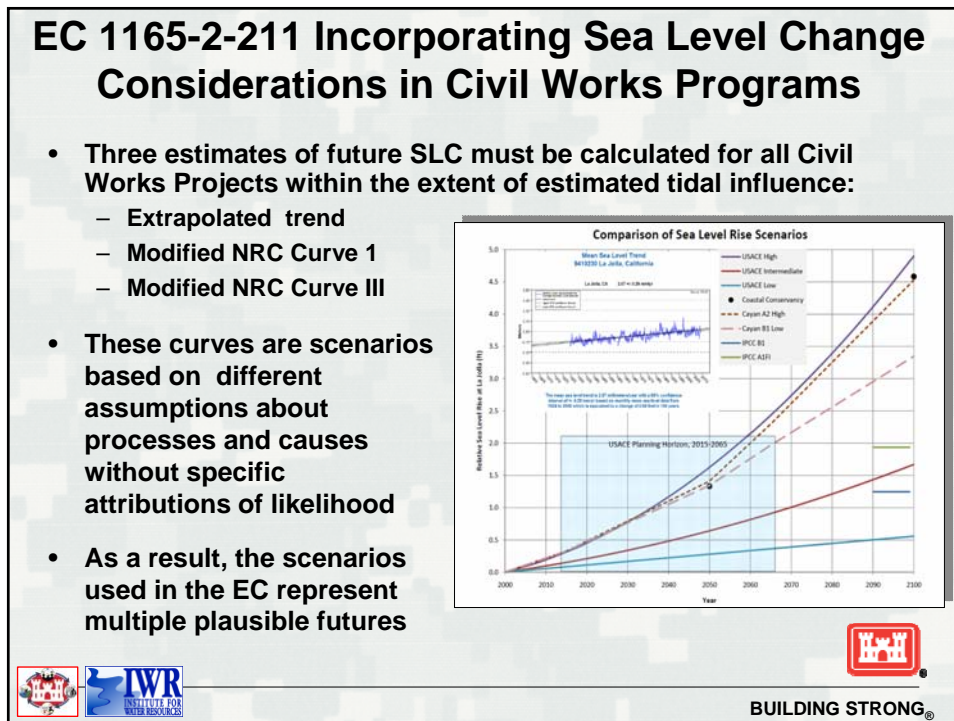
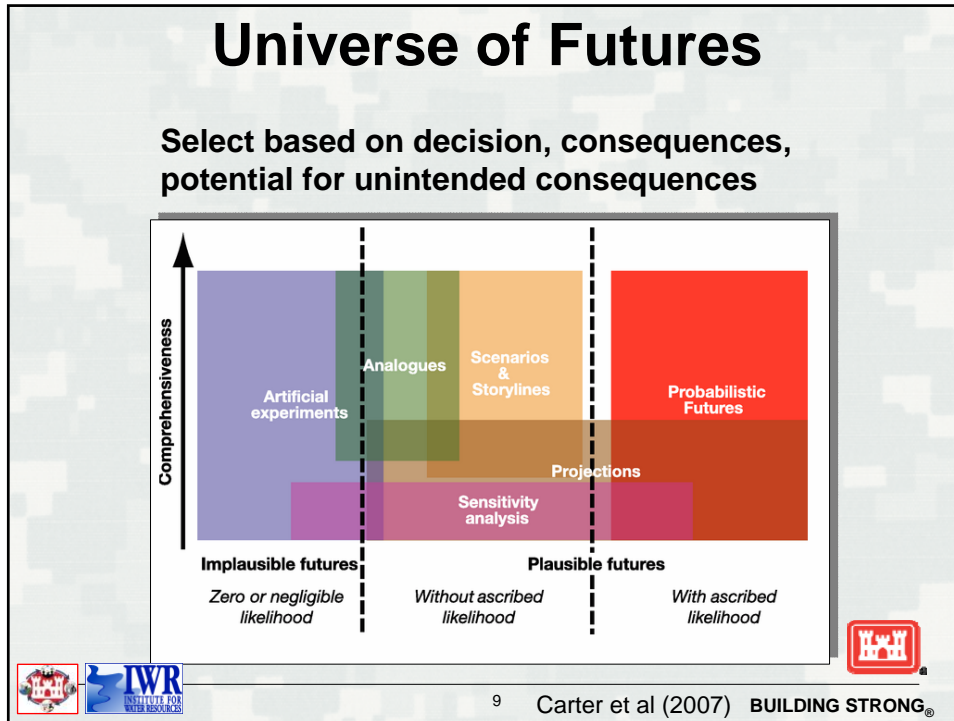
Local

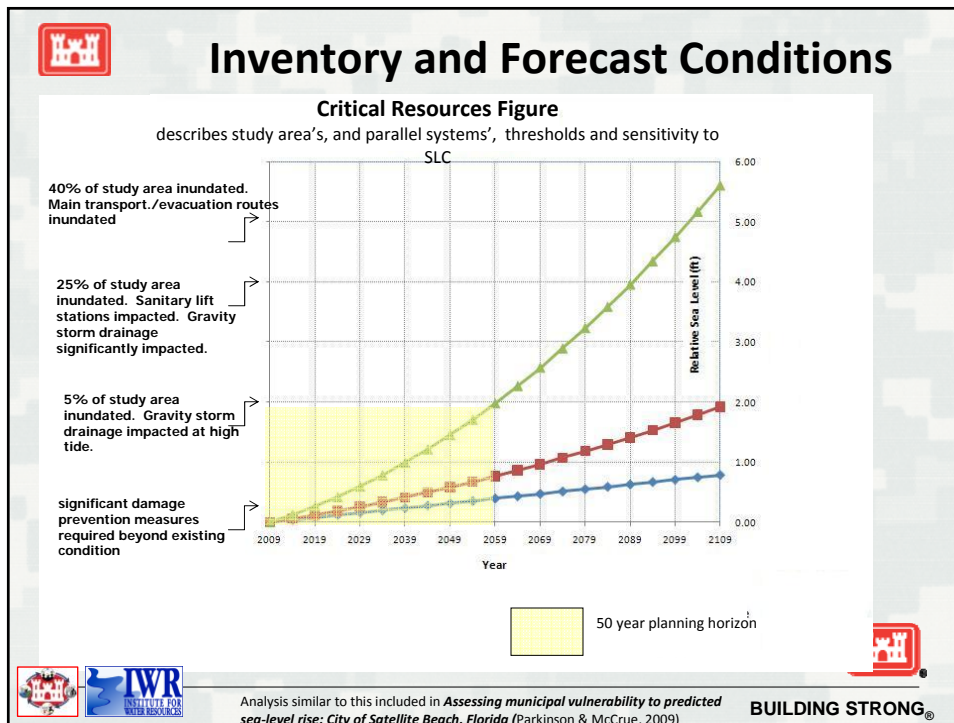
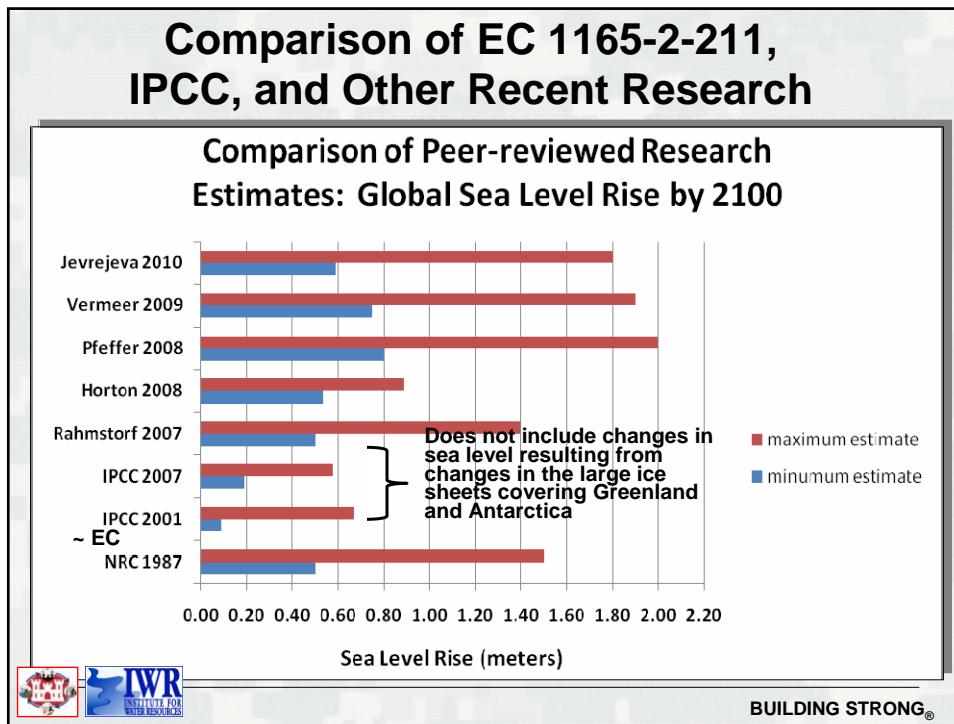
- Land surface processes such as subsidence, resource extraction, glacial rebound
- Can estimate future conditions and uncertainties

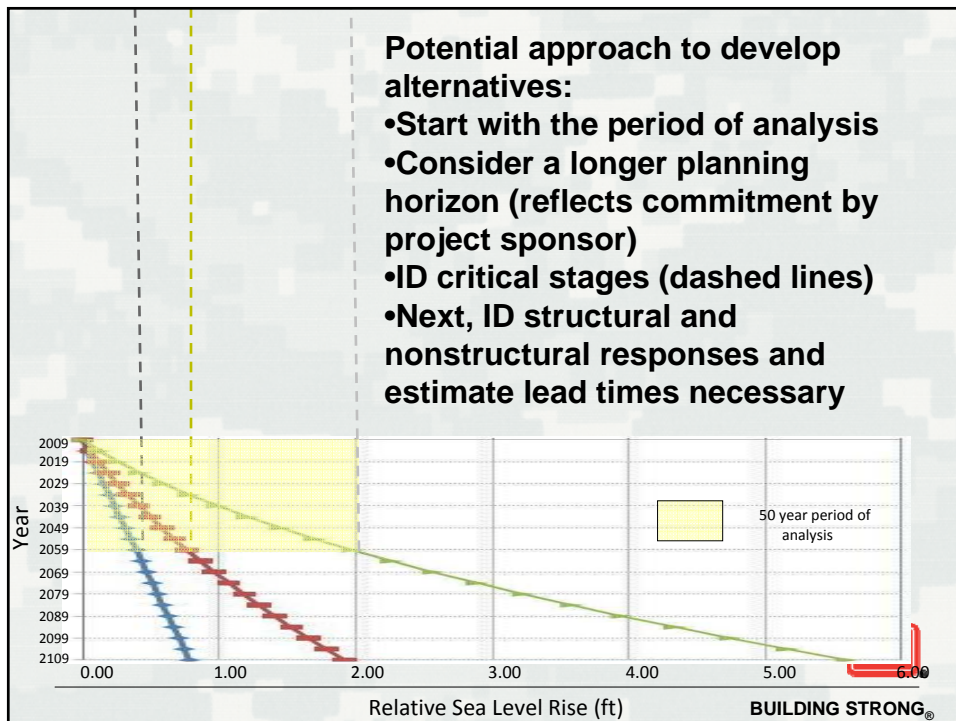
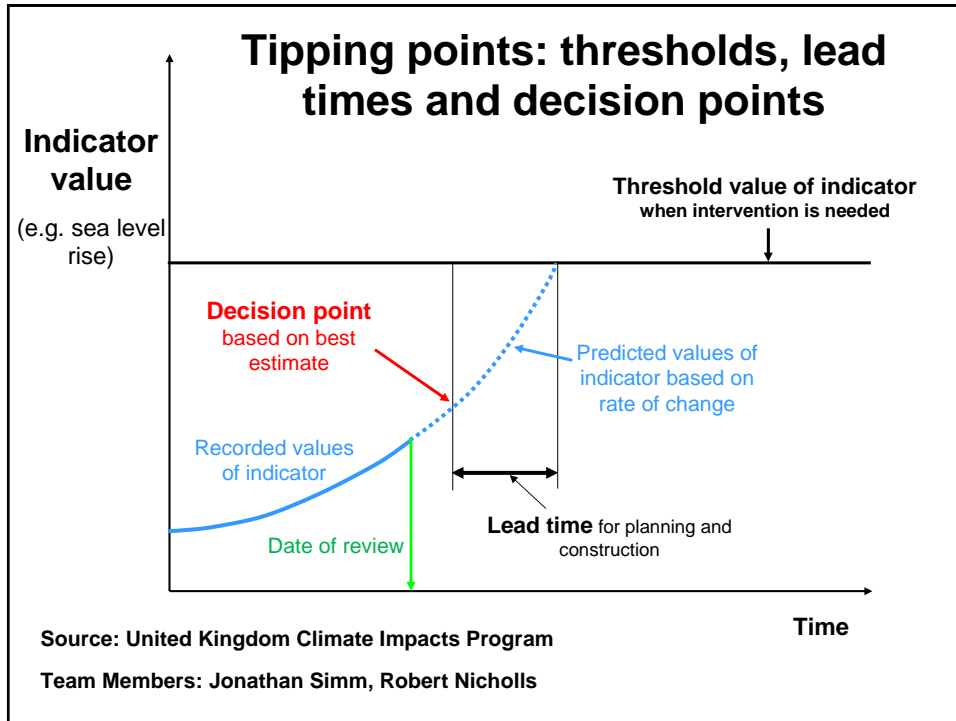
Global

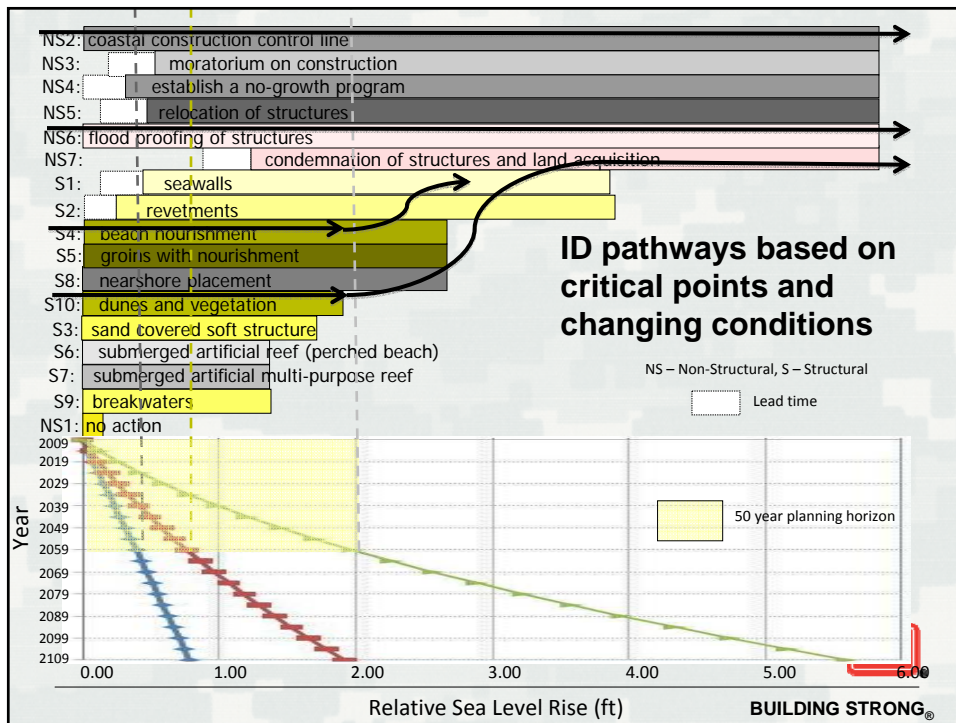
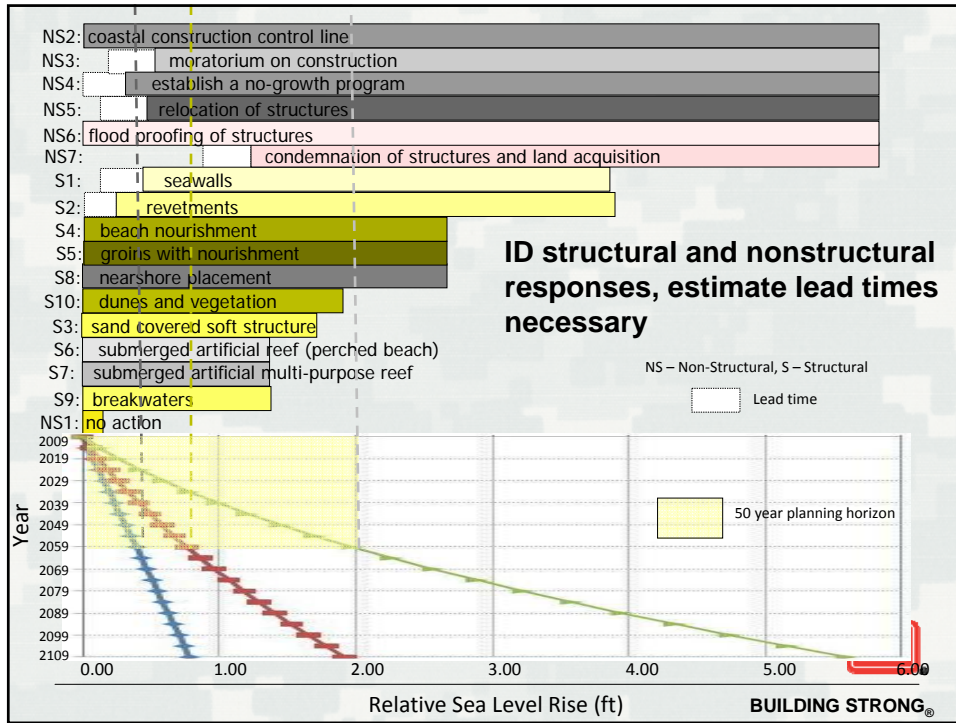
- Global processes that depend on complex systems interactions
- Uncertainties are large
- Difficult to bound temporally











Summary

- **Begin with the decisions**
 - Encourage thorough exploration of future conditions through appropriate selections from “universe of futures”
 - ID performance thresholds
 - Consider all alternatives
- **Integrate adaptation and mitigation**
- **Comfort level is increased when DoD and USACE independently arrive at similar approaches**

