

AASHTO/FHWA Climate Change Symposium

***Climate Change: An Adaptation
Challenge for US Transportation***

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August 6, 2010***

Arctic warming will reduce sea ice causing erosion and thaw permafrost damaging infrastructure

- The USACE has identified over 180 communities that are threatened by erosion in Alaska



Loss of Shore-fast Sea Ice



**These photos were taken 2 hours apart
This road no longer exists**

Hurricane Katrina Damage to Highway 90 at Bay St. Louis, MS

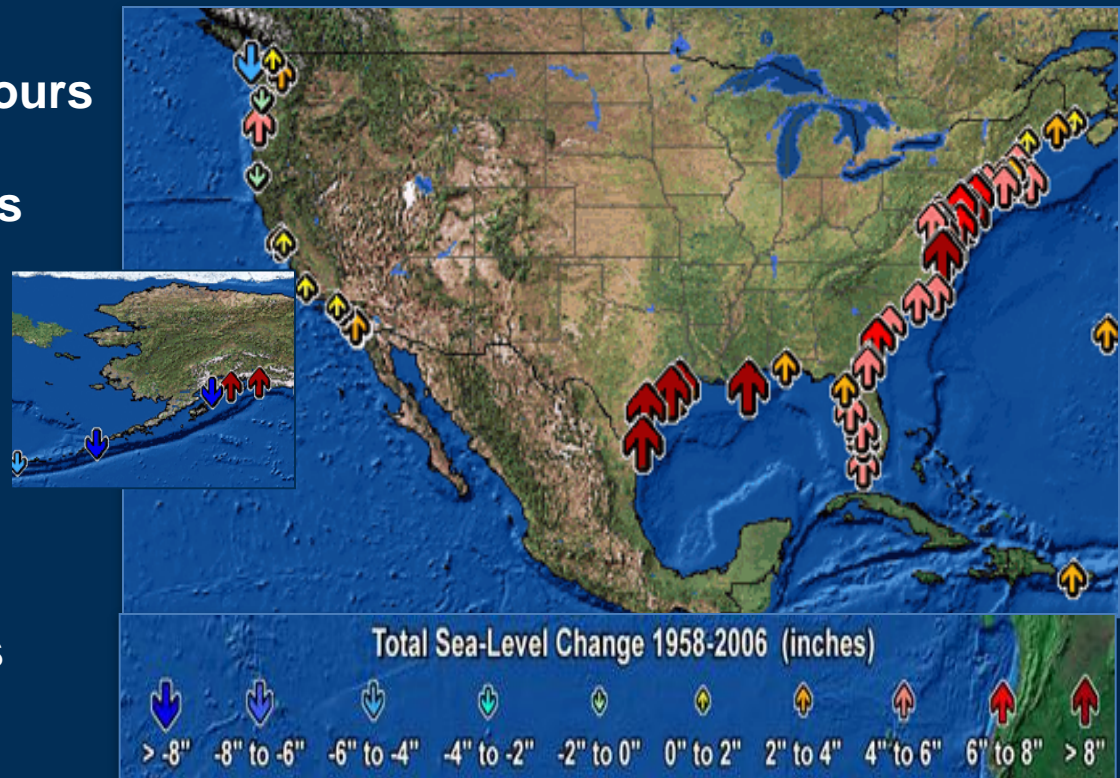


Source: NASA Remote Sensing Tutorial.

Climate changes are underway in the U.S. and are projected to grow

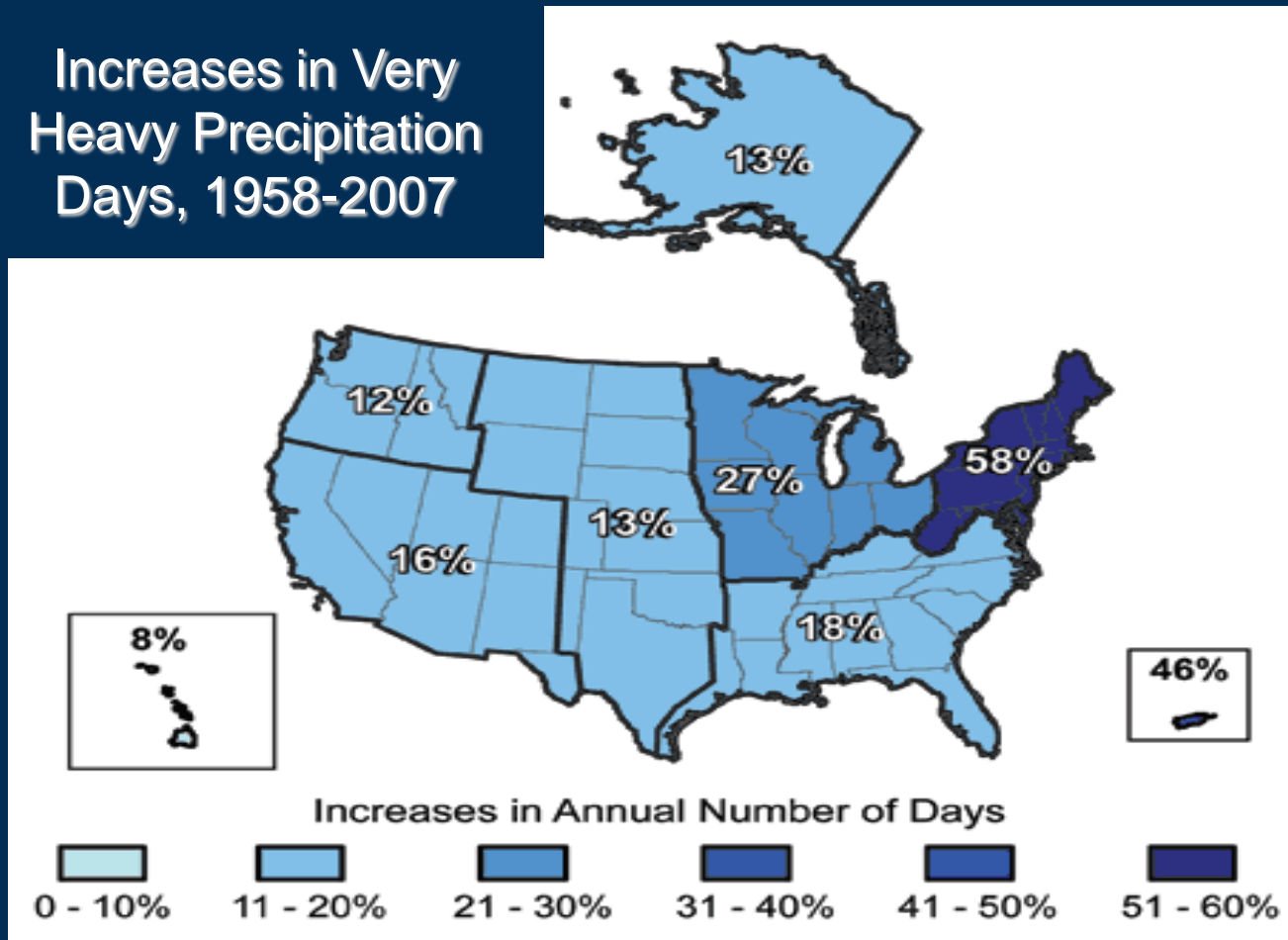
- Temperature rise
- Sea-level rise
- Increase in heavy downpours
- Rapidly retreating glaciers
- Thawing permafrost
- Longer growing season
- Longer ice-free season in the ocean and on lakes and rivers
- Earlier snowmelt
- Changes in river flows

Observed U.S. Sea-Level Changes



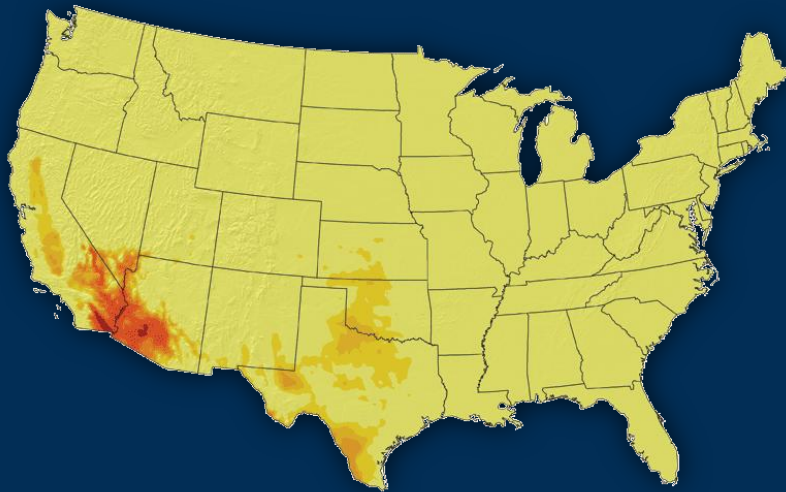
Floods and Droughts will become more common

Increases in Very Heavy Precipitation Days, 1958-2007

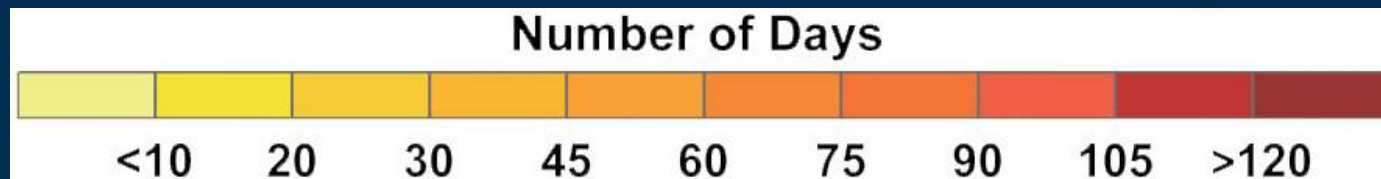
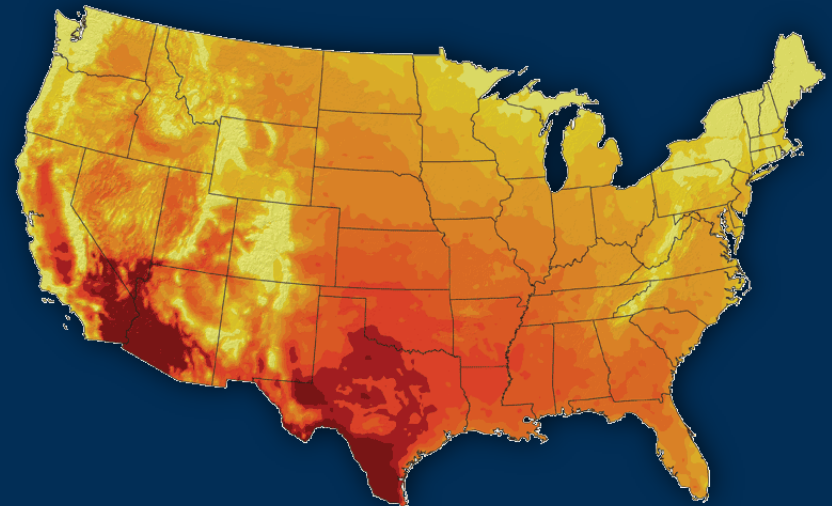


Increases in extreme heat

Number of Days Over 100°F
Recent Past, 1961-1979



Higher Emissions Scenario,
2080-2099



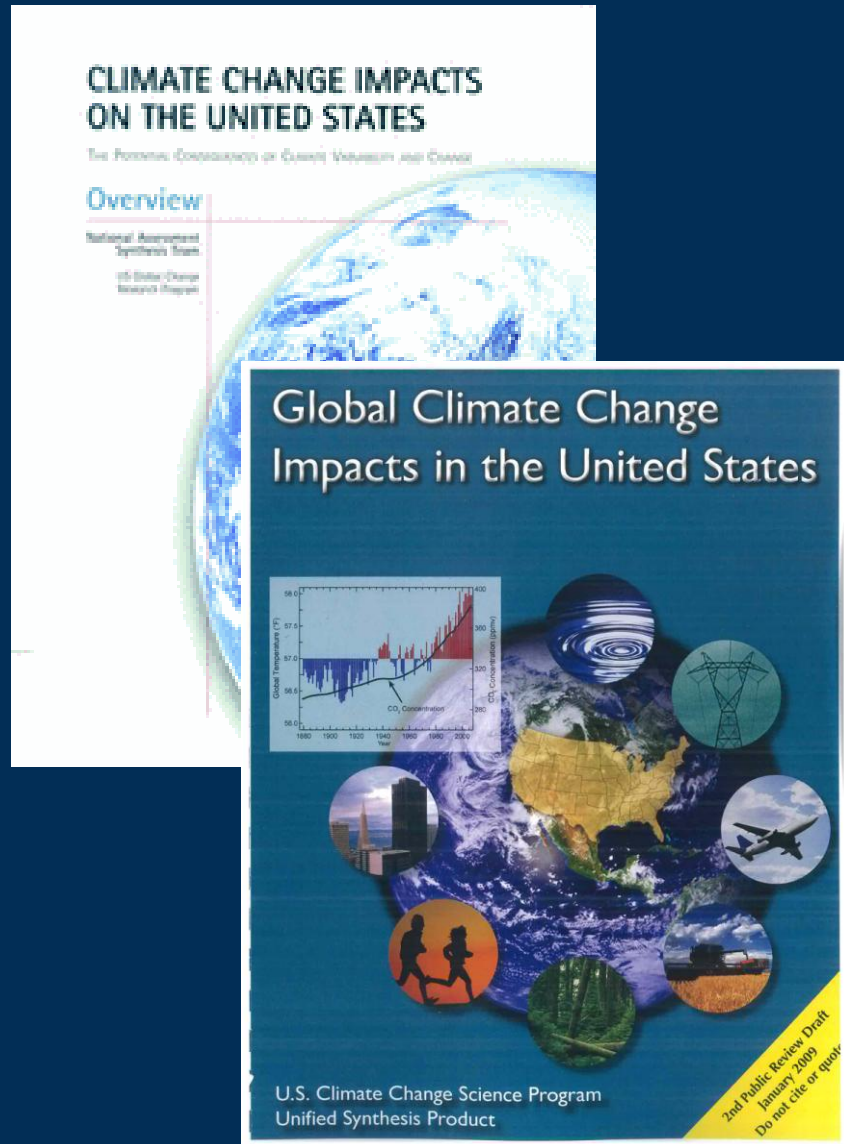
Why this matters: Transportation Impacts

CLIMATE EFFECT	IMPACTS
Higher high temperatures, more hot days	<ul style="list-style-type: none">• Asphalt deterioration• Thermal expansion of bridge joints, paved surfaces• Changes to biodiversity (impacting pest management, wetlands commitments)• More night time work, longer construction season• Pavement & structural design changes
Wind speeds	<ul style="list-style-type: none">• More frequent sign damage, truck rollovers• Changes to testing of and design factors for wind speed• Need for stronger materials
More frequent, intense precipitation	<ul style="list-style-type: none">• Loss of visibility, lane obstruction• Increase in weather-related delays, traffic disruption• Increased flooding of roads, evacuation routes• Increased peak stream flow could affect scour rates, influence size requirements for culverts• Standing water could affect road base adversely

Why this matters: Transportation Impacts

CLIMATE EFFECT	IMPACTS
Increased coastal storm intensity	<ul style="list-style-type: none">• Increased storm surge and wave impacts on roads, bridge structures , signs, etc.• Decreased expected lifetime of highways exposed to surge• Damage to infrastructure caused by the loss of coastal wetlands and barrier islands• Erosion of land supporting coastal infrastructure
Sea level rise	<ul style="list-style-type: none">• Permanent inundation of some roads and areas, reduced route options/redundancy• Erosion of road base• Reduced clearance under bridges• Exposes new areas to effects of surge/wave action, potentially causing interruptions to coastal roads• May amplify storm surges in some cases, requiring greater evacuations

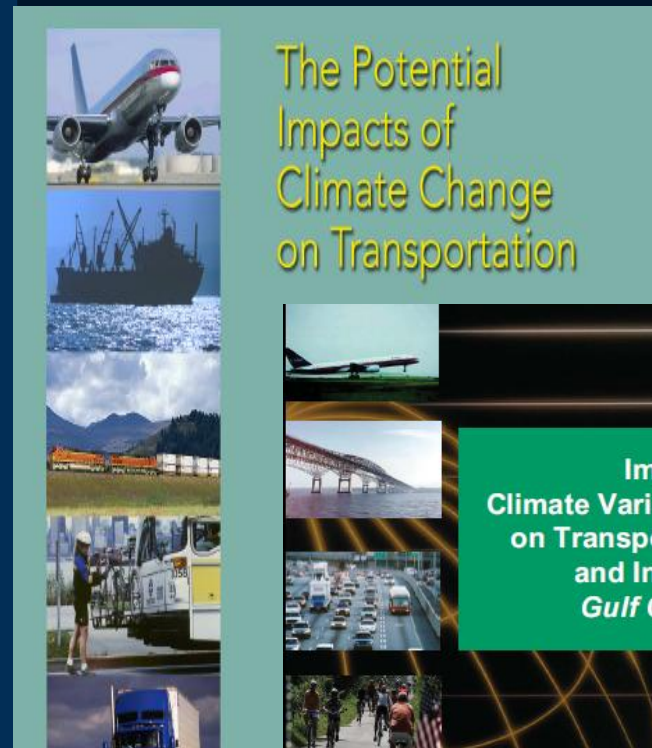
More Focus/Better Information: A Growing National Concern



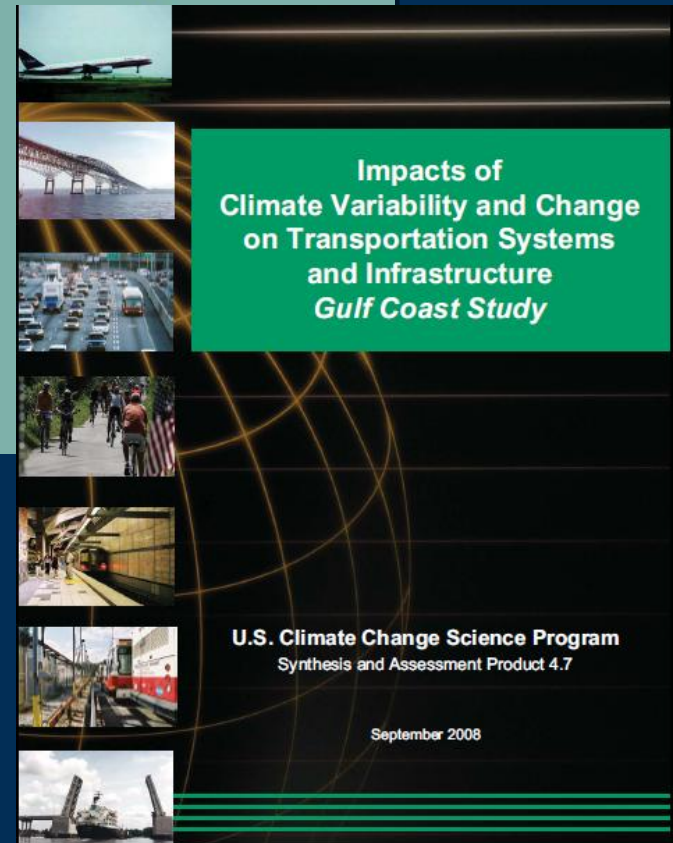
- **First National Assessment, 2000**
- **21 Synthesis and Assessment Products**
- **Second National Assessment, 2009**
- **National Academies: America's Climate Choices, 2009 and 2010**
- **Third National Assessment, underway**

More Focus/Better Information US DOT Efforts

- **Potential Impacts Workshop, 2002**
- **Gulf Coast Study, Ph. I, 2008**
- **Current US DOT Efforts**
 - Adaptation Strategy
 - Regional Typology
 - Vulnerability and Risk Pilots
 - Gulf Coast, Ph. II
 - Peer Exchanges



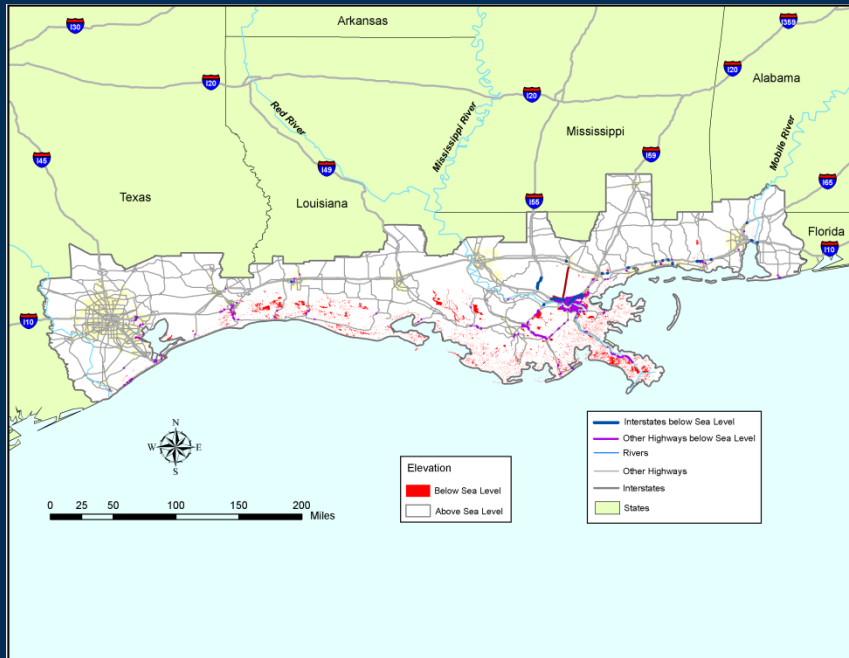
The Potential
Impacts of
Climate Change
on Transportation



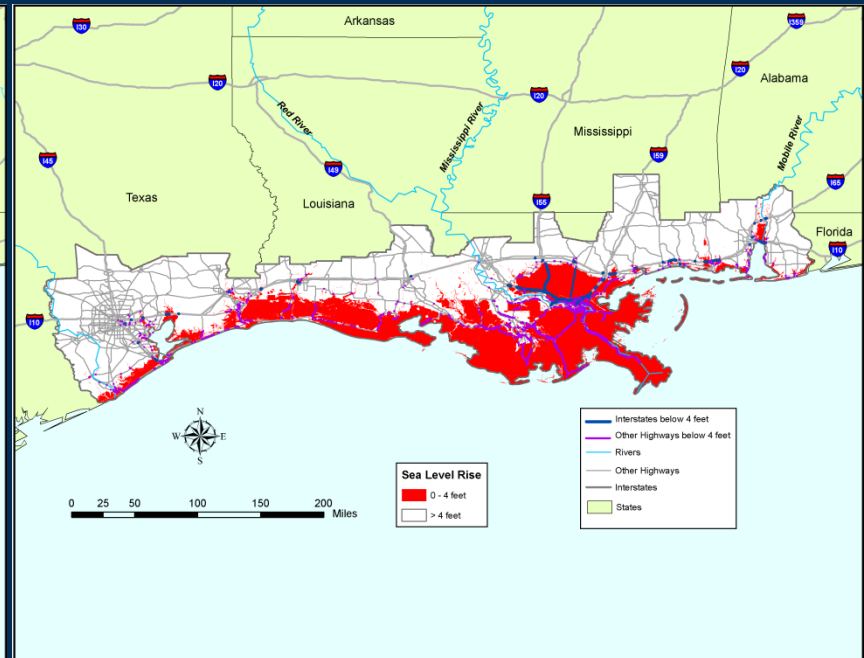
Results – Gulf Coast Study

Highways Vulnerable to Relative Sea Level Rise

Baseline (Present Day)



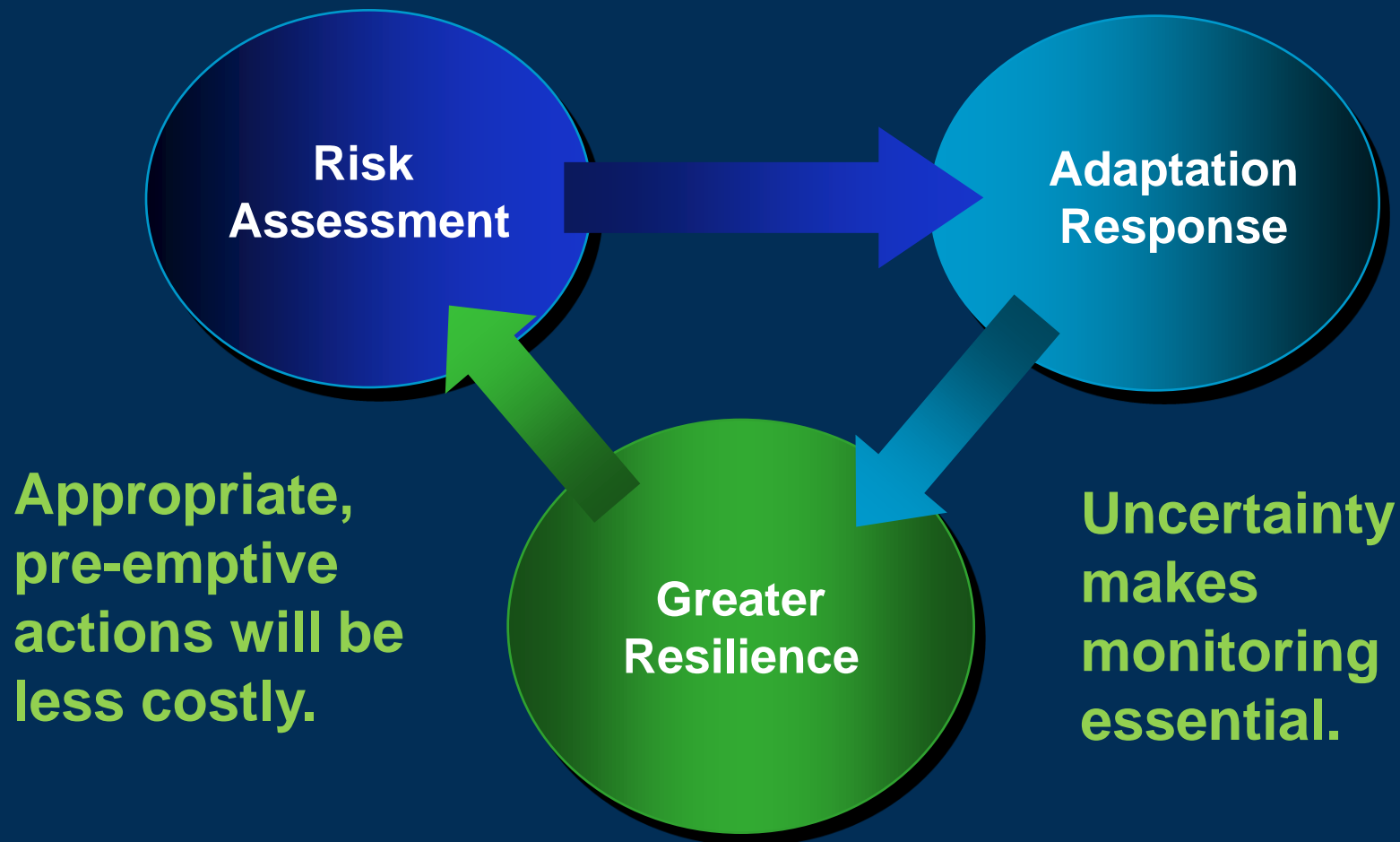
4 Feet of Sea Level Rise



Study ('08) results based on IPCC4: 7 – 23" SLR
Global Climate Change Impacts in US ('09): 36 – 48"

Thoughts on Effective Adaptation: Reliability under a range of conditions

New approaches to decision-making:
scenario planning and risk assessment



Thoughts on Effective Adaptation Levels of Implementation

- **Planning or Strategic Level**

- Regional scale
- Land uses
- Critical services

- **Transportation Facility Level**

- Local scale
- Public and Private sectors

- **Research and Development**

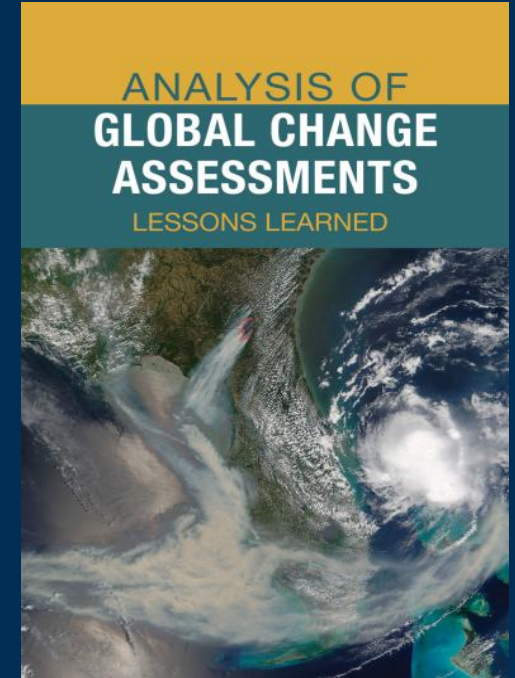


Third National Climate Assessment Principles

- **Maximize engagement of federal agencies**
- **Maximize engagement of stakeholders and lasting partnerships**
- **Prioritize information that helps minimize risk associated with climate change impacts**
- **Ensure a sustainable process that supports science, adaptation, climate services and mitigation efforts (as appropriate)**

Third National Climate Assessment Principles (*continued*)

- **Efficiently coordinate efforts across regions and sectors at multiple scales**
- **Ensure an adaptive approach that responds to new information over time**
- **Include consideration of economic implications action and inaction**



USG Climate Change Adaptation Task Force

- **Managed by Council on Environmental Quality (with OSTP and NOAA)**
- **Initial Workgroups:**
 - Agency adaptation; international; science; insurance; water
 - Expanded topics: urban, health, ecosystems, etc.
- **Working on recommendations towards a national strategy in October, 2010**
 - ***Focused on US Government actions***