Climate Change Impacts and Adaptation in the National Capital Region

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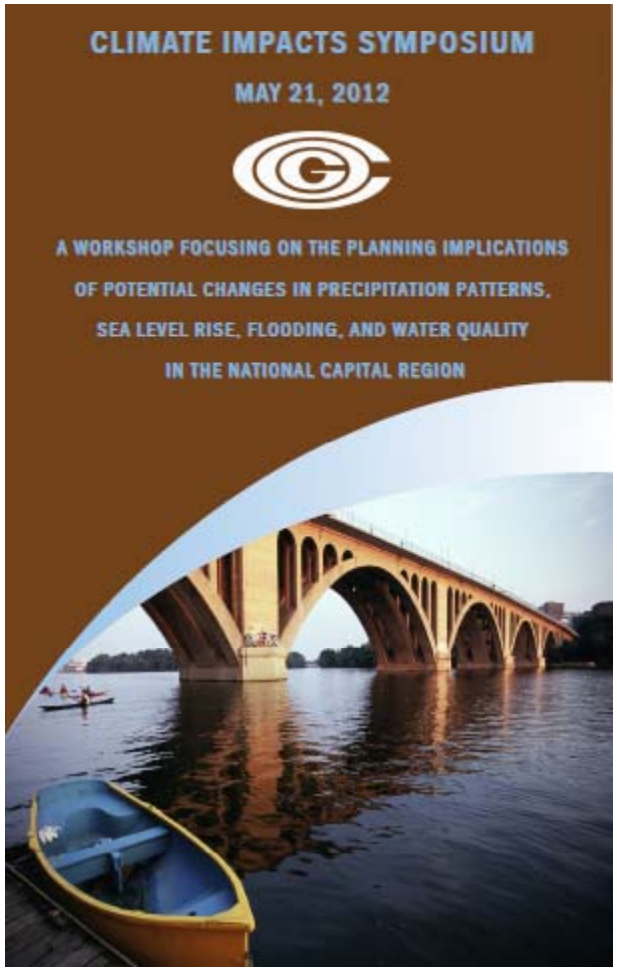
Metropolitan Washington Council of Governments (COG)
Air and Climate Public Advisory Committee (ACPAC)
June 18, 2012

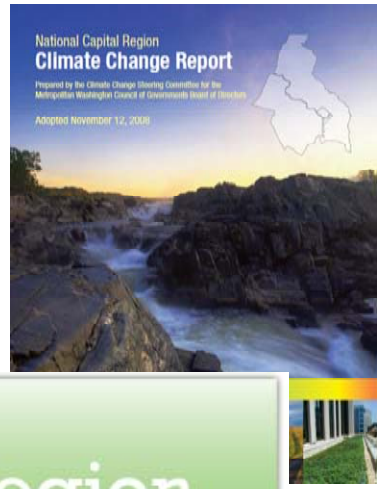
Presentation Outline

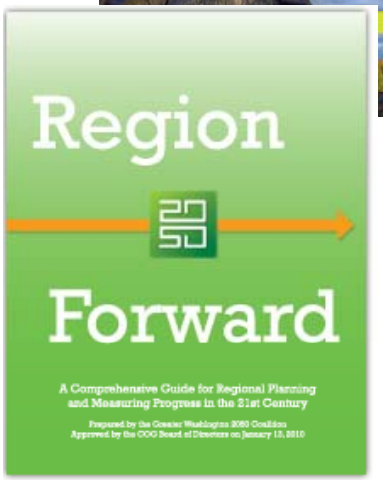
1. COG Climate Initiatives and Adaptation Project Overview
2. Climate Science: Global to Regional Trends and Predictions
3. Adaptation Planning and Resources
4. Transportation Climate Impacts and Approaches
5. Lessons Learned, Needs Identified



COG Climate Initiatives Background

- COG Board began Climate Change Initiative (2007)
  - National Capital Region Climate Change Report (11/08)
- COG Board created CEEPC - Climate, Energy and Environment Policy Committee (2009)
  - 2010-2012 Regional Climate and Energy Workplan (1/10)
- *Region Forward* Compact adopted (2010)
  - Foundation for COG's efforts to build a sustainable metropolitan Washington region
  - Draws climate related goals from Climate Change Report





Addressing Climate Risks

- **Mitigation** = cost effective strategies to reduce emissions
- **Adaptation** = prepare for unavoidable impacts of climate change
- **"Win-Win" Strategies** = adaptation steps that also reduce greenhouse gas emissions and save energy.

Source: Chicago Area Climate Change Quick Guide

EPA Smart Growth Implementation Assistance (SGIA) Program

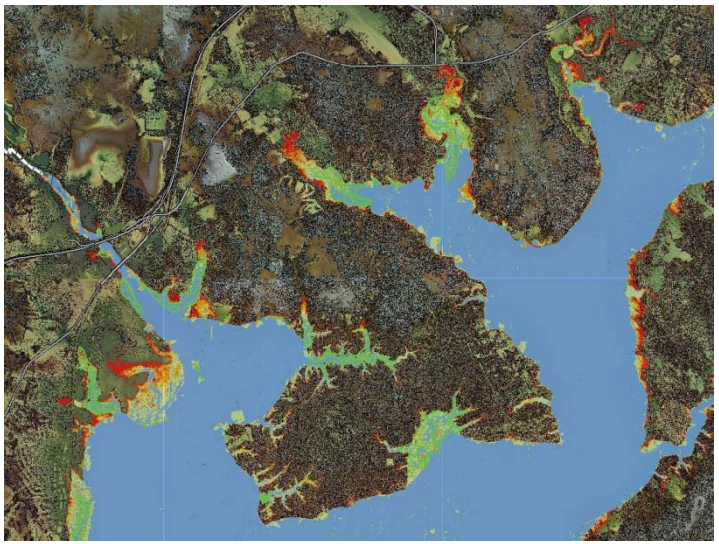
- EPA initiated the SGIA program in 2005 with three goals in mind:
  - Support communities interested in implementing smart growth policies;
  - Create regional examples that can catalyze similar projects in the area; and
  - Identify barriers , opportunities and tools
- EPA provides the assistance through a contractor team – not a grant.
- In 2010, COG applied to SGIA and was awarded technical assistance to support adaptation efforts
  - Contractor: SRA
  - End Product: EPA Climate Adaptation Guidebook
  - Focus on four sectors: transportation, land use, buildings, water

Smart Growth and Adaptation Project

Timeframe	Milestones
10/10	**EPA Award Announced -** Smart Growth Implementation Assistance
12/10	**Technical Expert Panel** identified pertinent regional climate info.
1/12-3/12	**Educate COG Committees** on adaptation and SGIA project
3/11	**NOAA Workshop** - Roadmap for Adapting to Climate Risks to review tools for risk and vulnerability assessment
1/11-5/11	**George Mason students** evaluate local govt adaptation knowledge
6/11-8/11	SRA Consultants conduct local and national **policy inventory**
7/11-8/11	COG **review of vulnerabilities** for transportation, land use, building and water sectors
9/11	EPA, COG and SRA held **stakeholder workshops** for each sector to identify challenges and share experiences
10/11	SRA delivers **draft local approaches** list for guidebook
12/11-1/12	**Draft guidebook** issued for stakeholder review
5/12	**Climate Impacts Symposium**

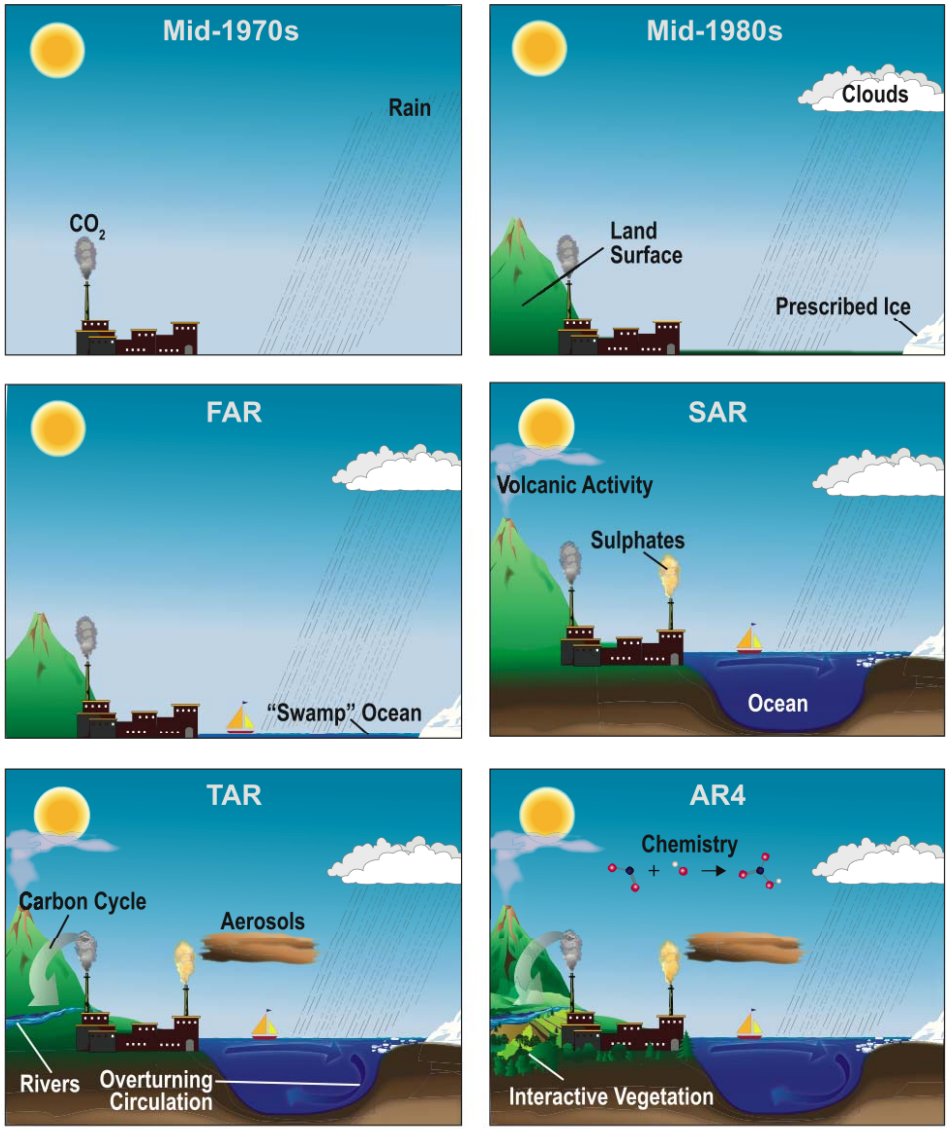
Guidebook Organization

- Plan for Climate Change
  - Tools for developing a risk/vulnerability assessment
- Regional Approaches
- Local Approaches
  - Protect vulnerable areas from development
  - Protect people and assets in vulnerable areas
  - Encourage sustainable growth in appropriate, less vulnerable areas



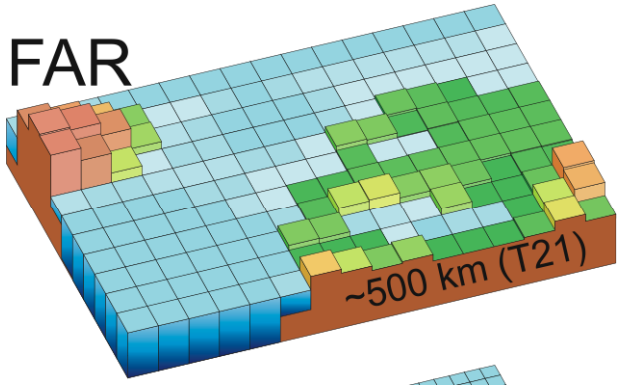
This map shows potential hot spot areas that could be inundated by projected sea level rise in the Mason Neck area of Virginia along the Potomac River. The area is currently primarily park and military lands. (Source: Northern Virginia Regional Commission)

The World in Global Climate Models

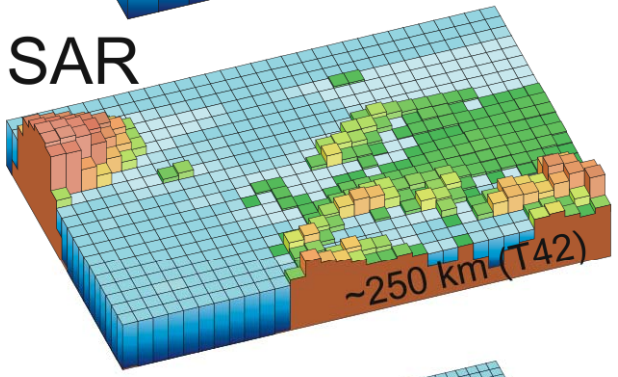


Source: IPCC;
Presented by Antonio Busalacchi,
University of Maryland ESSIC,
at COG Climate Impacts Symposium
May 21, 2012

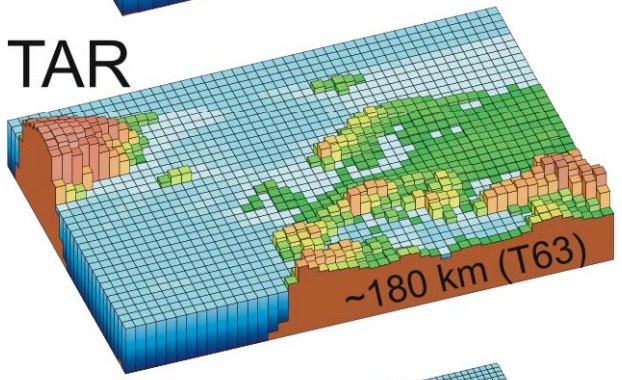
Geographic resolution characteristic of the generations of global climate models used in the IPCC Assessment Reports



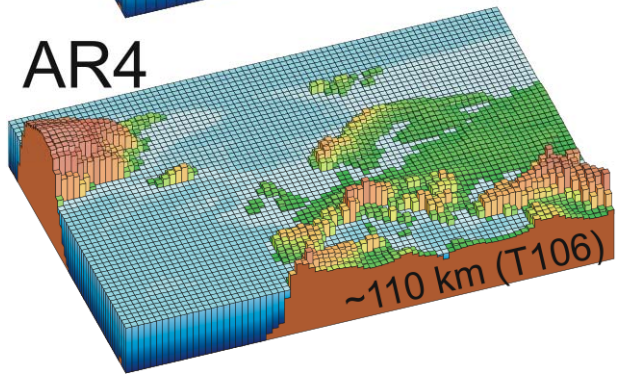
1990



1996



2001



2007

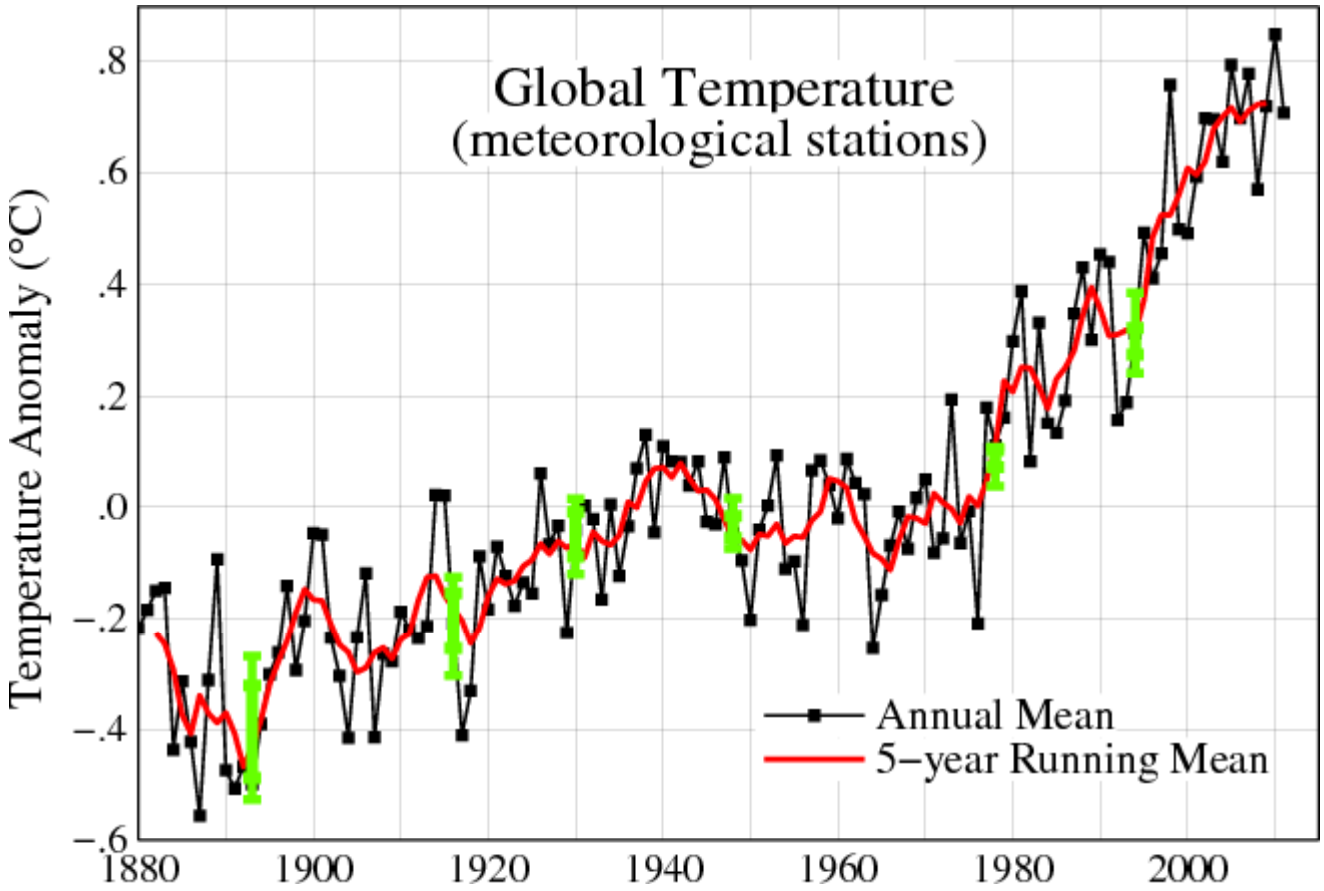
Source: IPCC;
Presented by Antonio Busalacchi,
University of Maryland ESSIC, at COG Climate Impacts Symposium May 21, 2012

Scientific Consensus

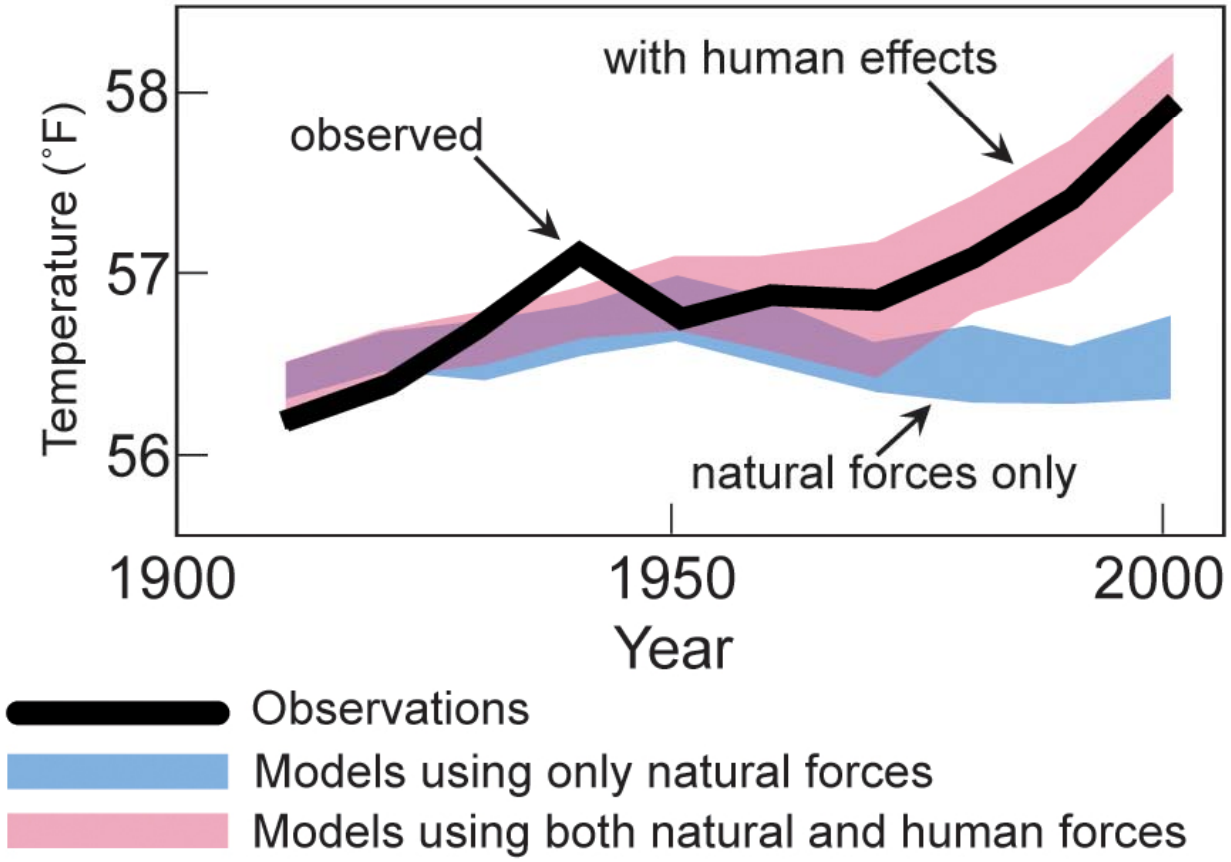
- Climate change is **occurring**, is caused **largely by human activities**, and **poses significant risks** for—and in many cases is already affecting—a broad range of human and natural systems.
- These risks indicate a pressing need for substantial action to **limit the magnitude of climate change** and **prepare for adapting** to its impacts.

Source: America's Climate Choices

Unequivocal Warming Trend



Source: NASA Goddard Institute of Space Studies



Hegerl *et al.*[49]

The blue band shows how global average temperatures would have changed due to natural forces, only as simulated by climate models. The red band shows model projections of the effects of human and natural forces combined. The black line shows actual observed global average temperatures. As the blue band indicates, without human influences, temperature over the past century would actually have first warmed and then cooled slightly over recent decades.

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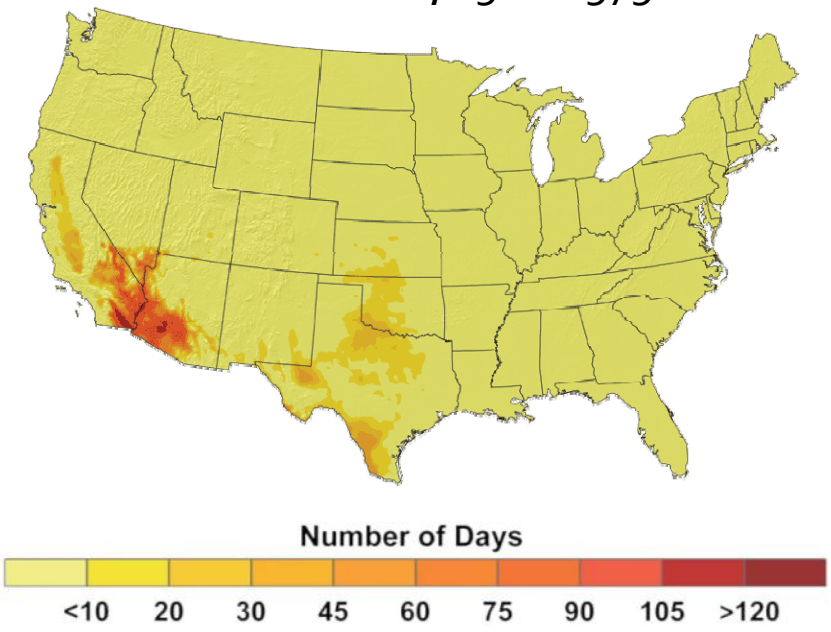
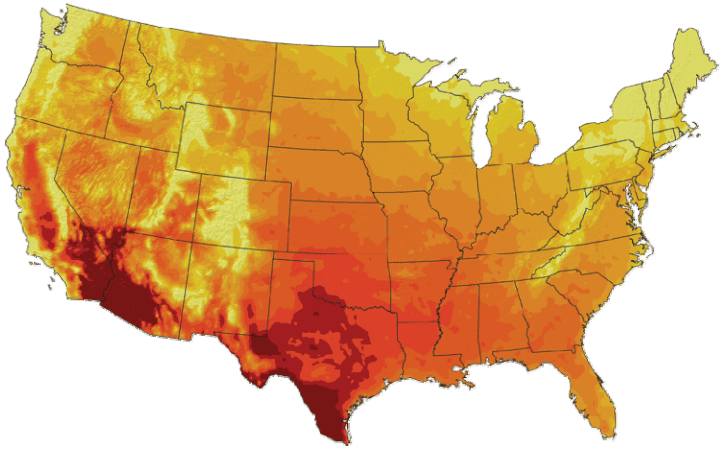
Source: Presented by Antonio Busalacchi, University of Maryland ESSIC, at COG Climate Impacts Symposium May 21, 2012

Emissions Matter: Days Over 100°F

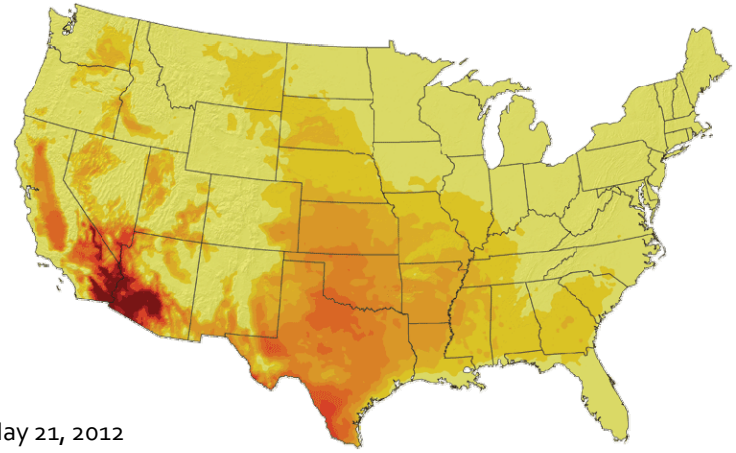
Recent Past, 1961-1979

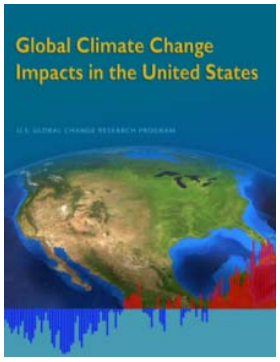


Higher Emissions Scenario 2080-2099



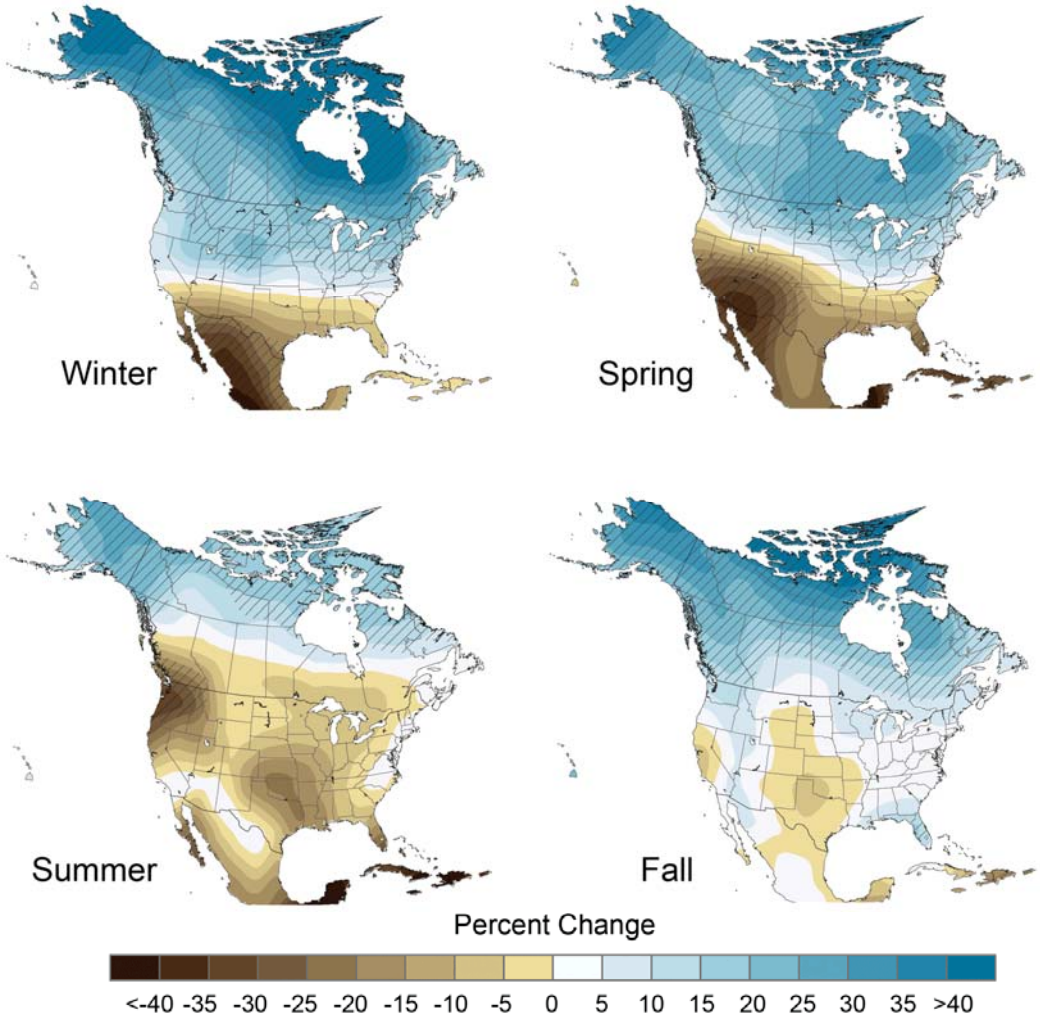
Lower Emissions Scenario, 2080-2099

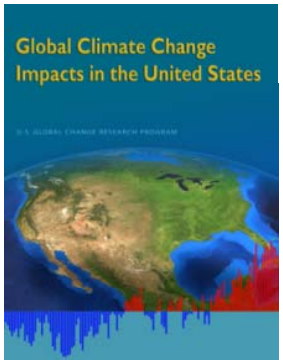




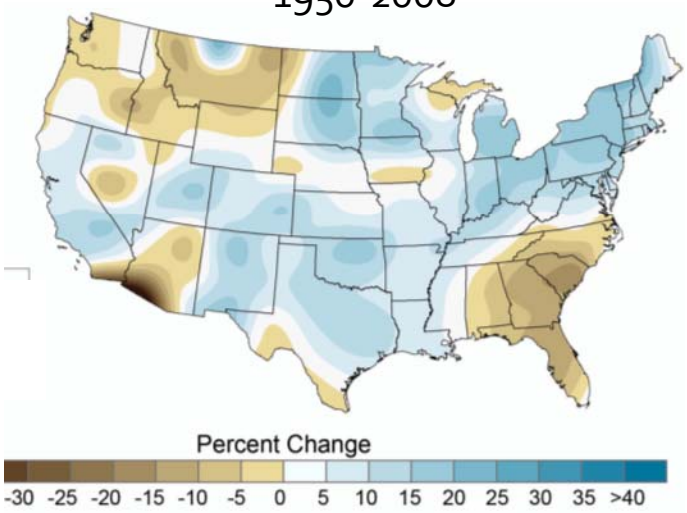
Source: www.globalchange.gov/
Presented by Don Boesch, University of Maryland Center for Environmental Science, at COG Climate Impacts Symposium May 21, 2012

Projecting Changes in Precipitation



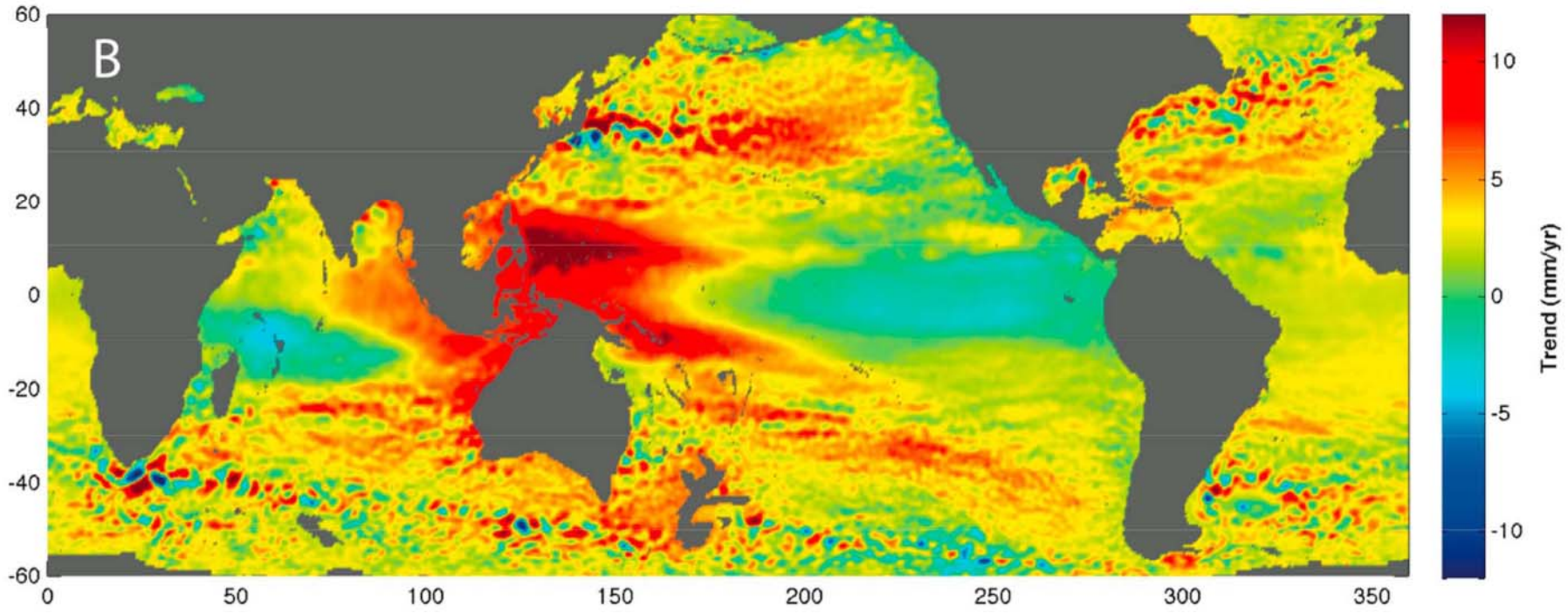


Observed annual change
1950-2008



Source: www.globalchange.gov/

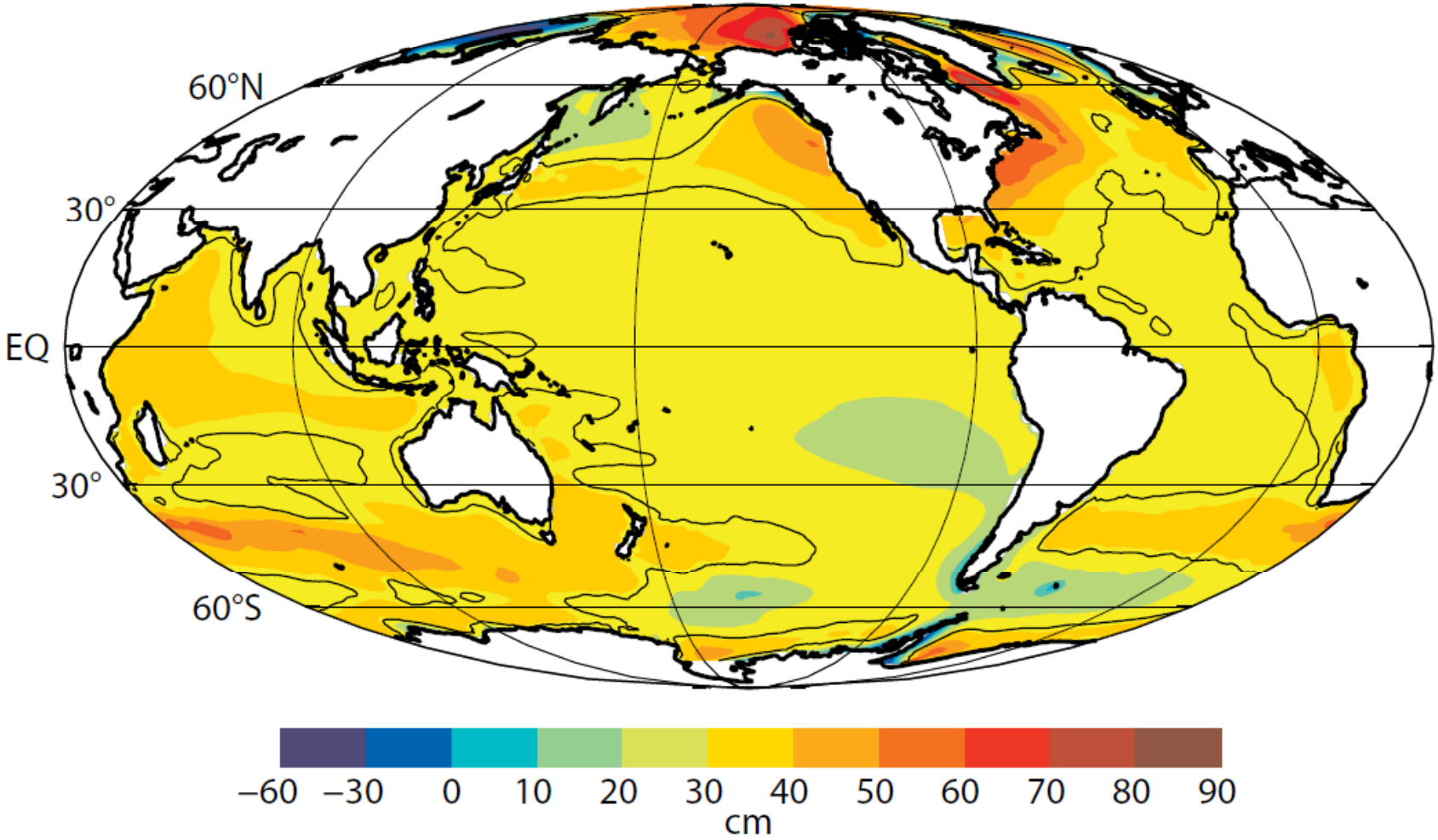
Sea Level Isn't Level



Global mean sea level rise
1950-2009 1.97 mm/yr
1993-2009 3.22 mm/yr

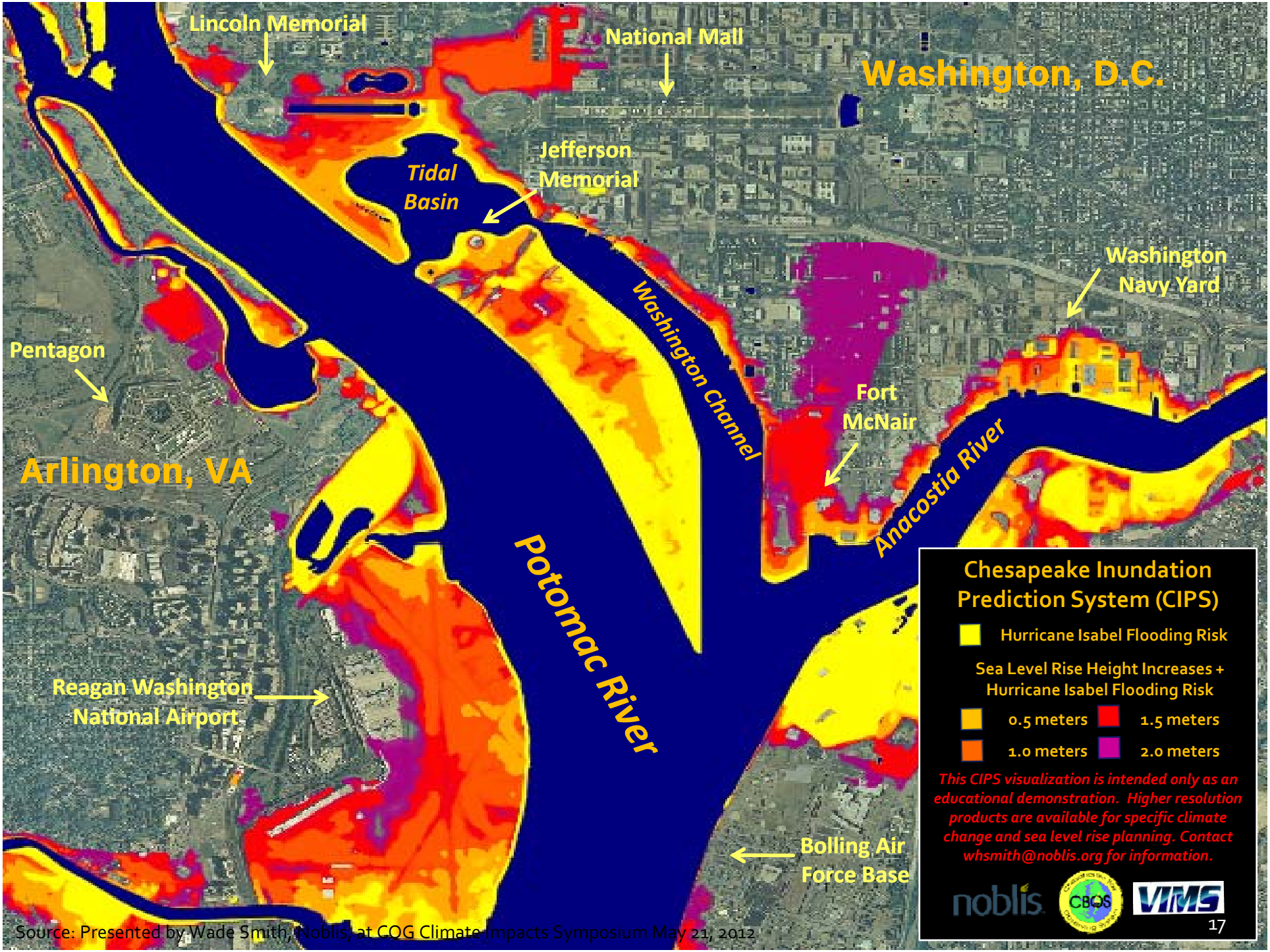
Source: Hamlington et al. 2011. *Journal of Geophysical Research*

Regional Distribution of SL Rise



Source: Church et al 2011 *Oceanus*

Presented by Don Boesch, University of Maryland Center for Environmental Science, at COG Climate Impacts Symposium May 21, 2012

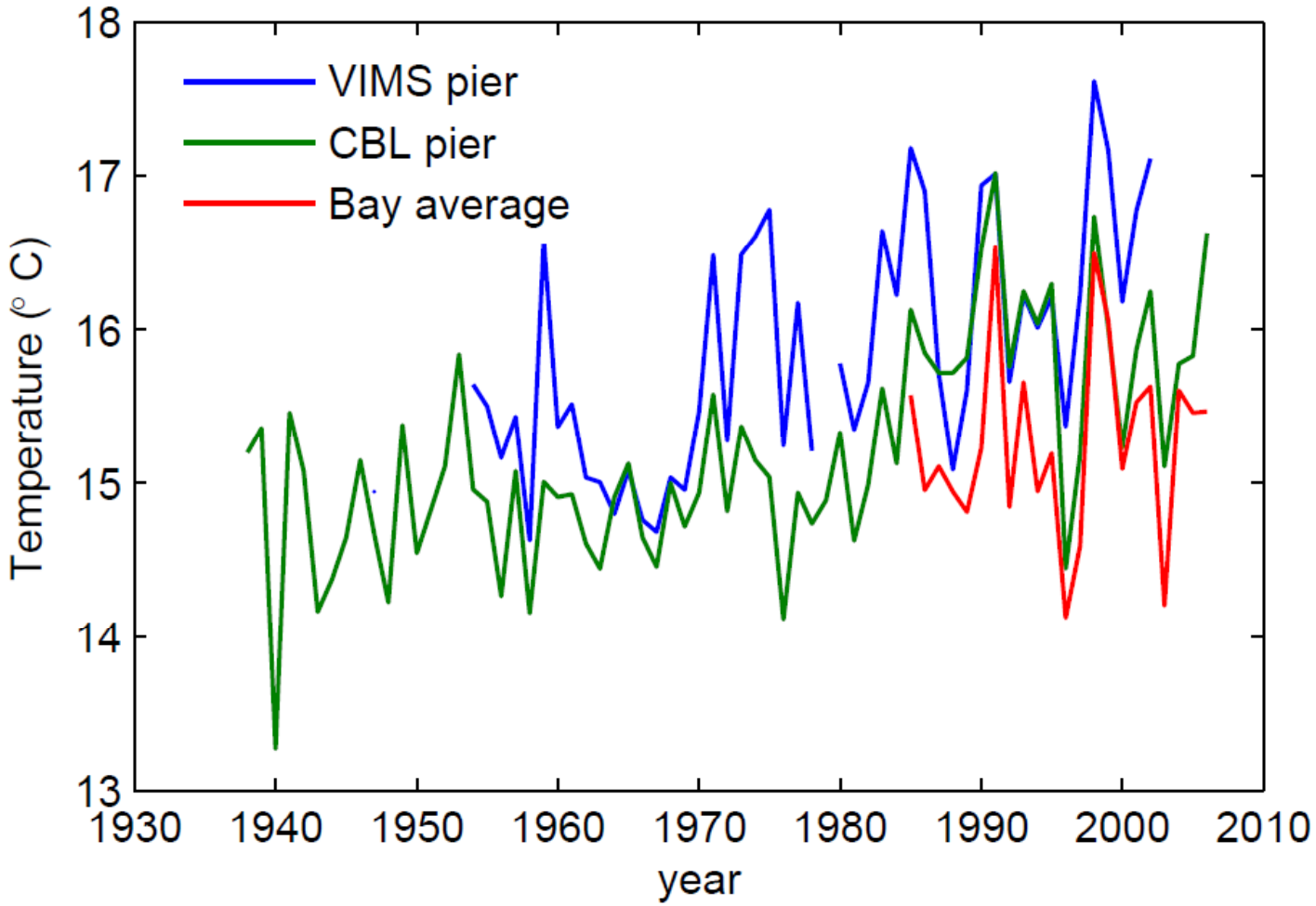


Source: Presented by Wade Smith, Noblis, at COG Climate Impacts Symposium May 21, 2012

Flooding in the Washington, DC Metropolitan Area

Source: Presented by Wade Smith, Noblis, at COG Climate Impacts Symposium May 21, 2012

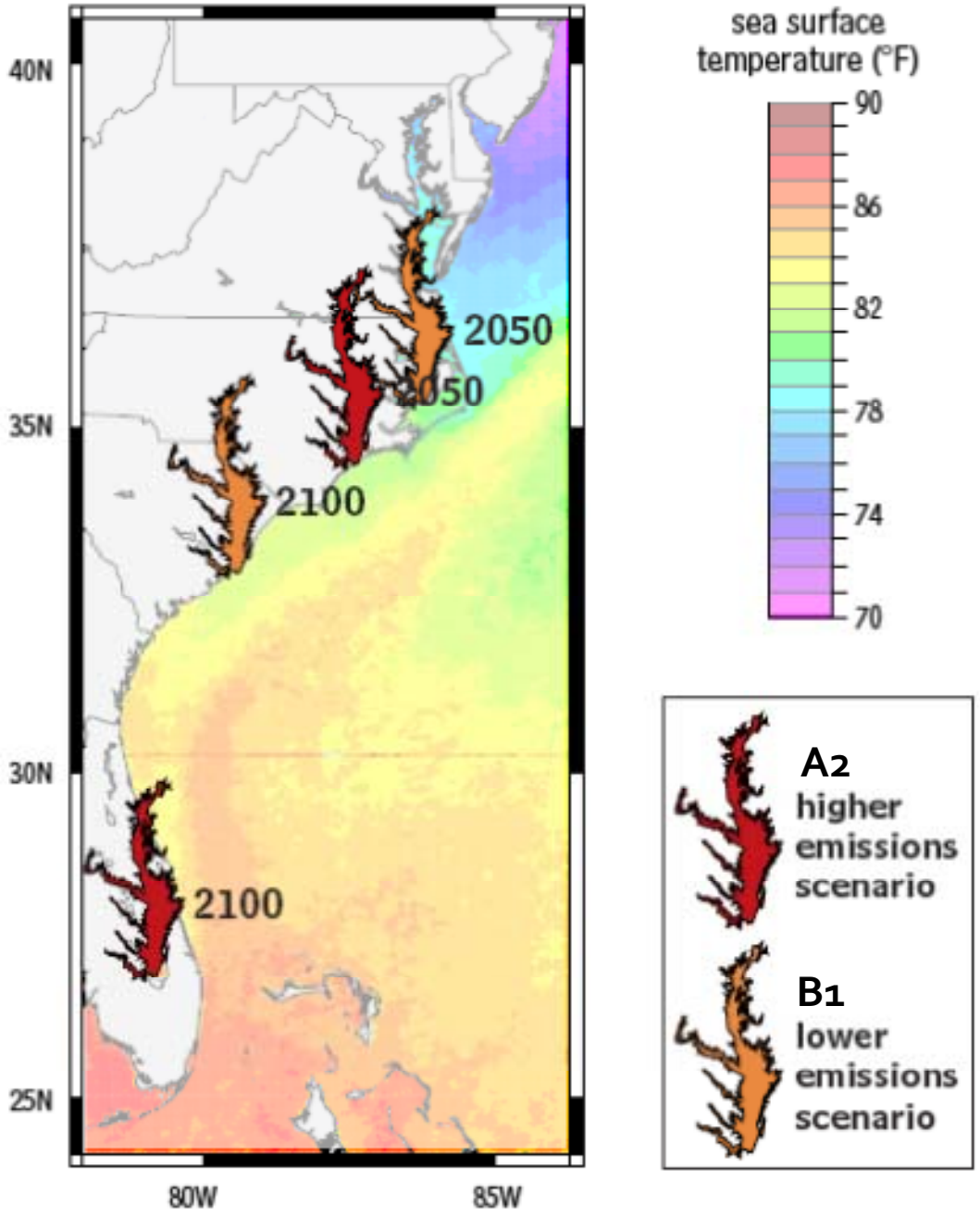
Chesapeake Bay is Warming



Source: CBP & VIMS archive, Kaushal et al. (2010)

Presented by Raymond Najjar, Penn State University, at COG Climate Impacts Symposium May 21, 2012

Moving Estuary Analogue: Summer Temperature Change



Source: Boesch (2008)
Presented by Raymond Najjar, Penn State University, at COG Climate Impacts Symposium May 21, 2012

Projected Climate Change in the Chesapeake Region

Virtually certain (>99%):

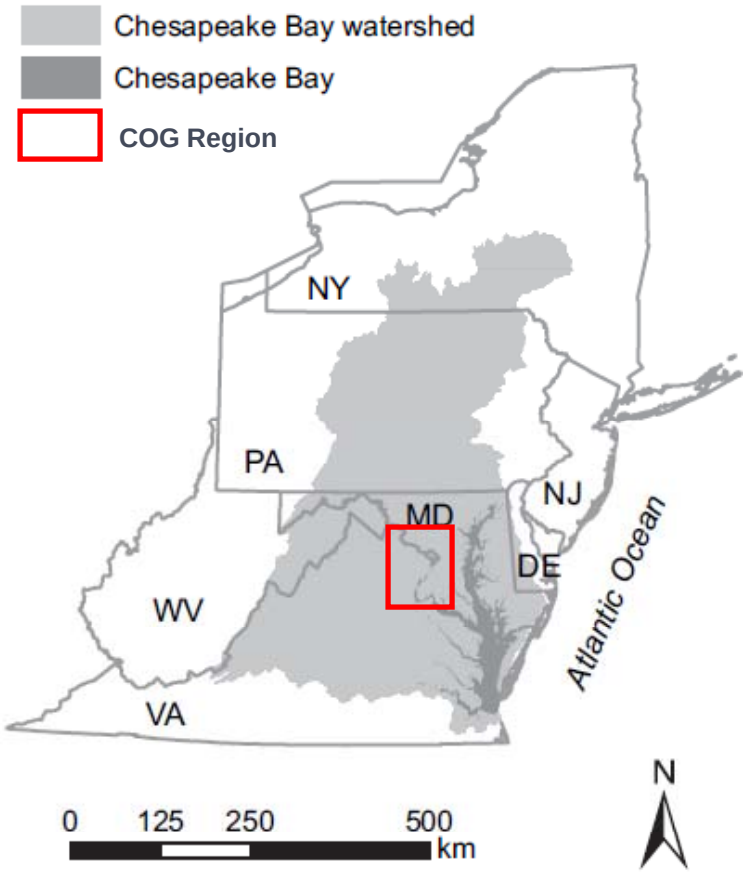
- Higher CO_2
- Higher sea level

Very likely (90-99%):

- Warmer
- Higher winter & spring precipitation

Likely (66-90%):

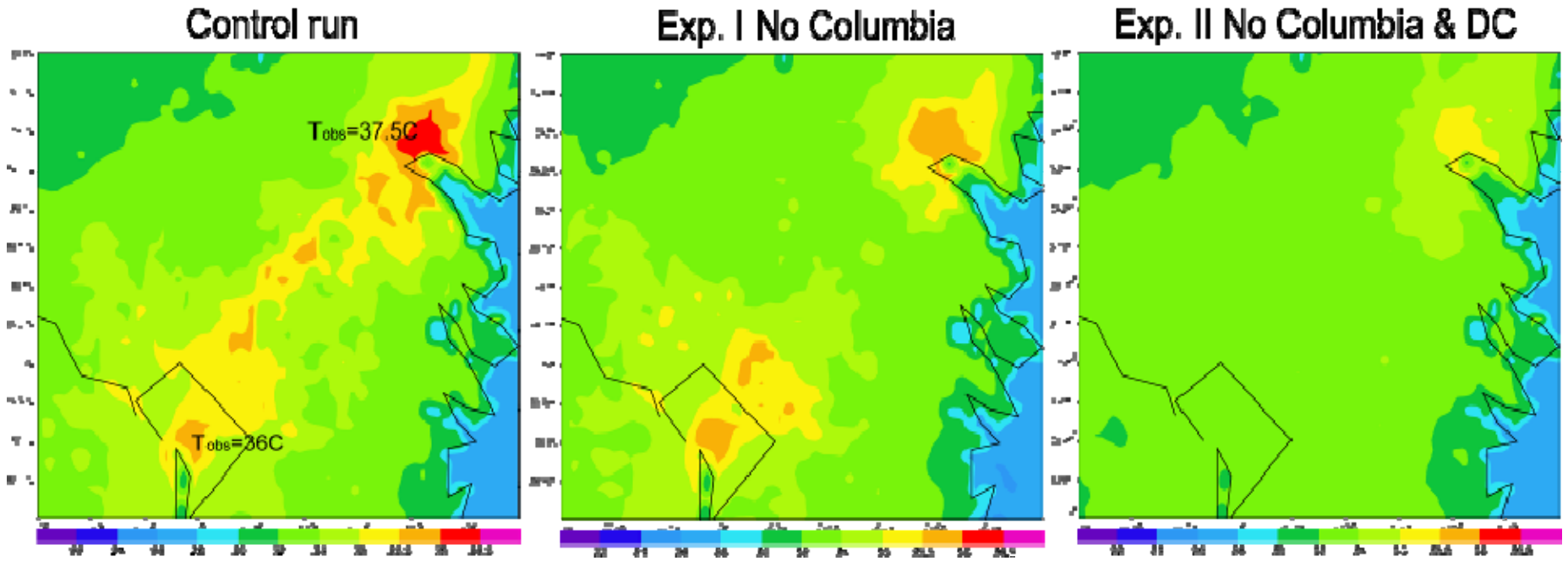
- More intense precipitation
- Flashier streamflow
- Increased winter streamflow
- Increased storm intensity



Source: Najjar et al. (2010), Boesch (2008)

Presented by Raymond Najjar, Penn State University, at COG Climate Impacts Symposium May 21, 2012

Simulated Surface Temperatures



Simulated surface temperatures at 15:30 LST 9 July 2007: (a) Control run; (b) No Columbia run; and (c) No upstream urban run.

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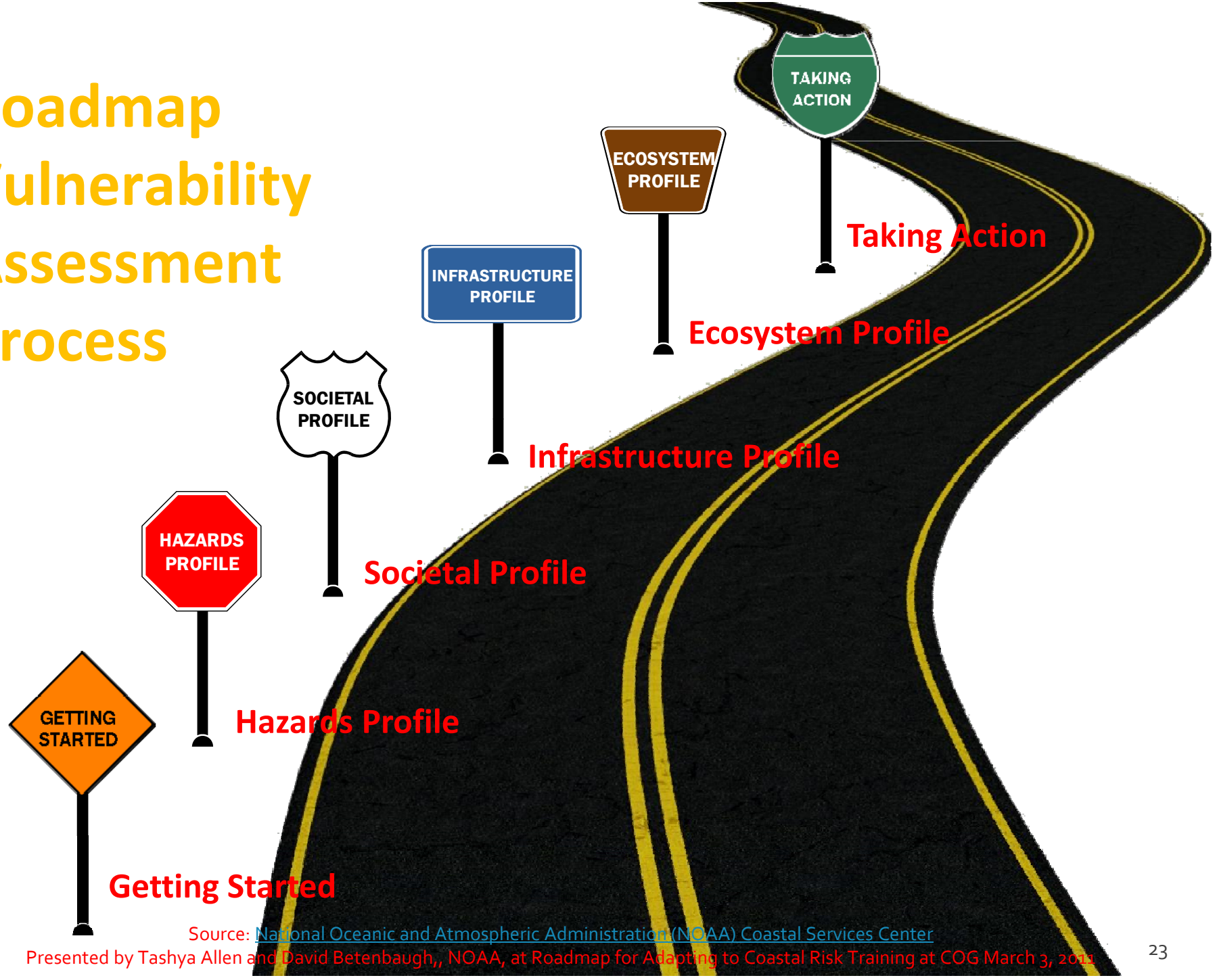
Source: Presented by Antonio Busalacchi, University of Maryland ESSIC, at COG Climate Impacts Symposium May 21, 2012

Roadmap Vulnerability Assessment Process

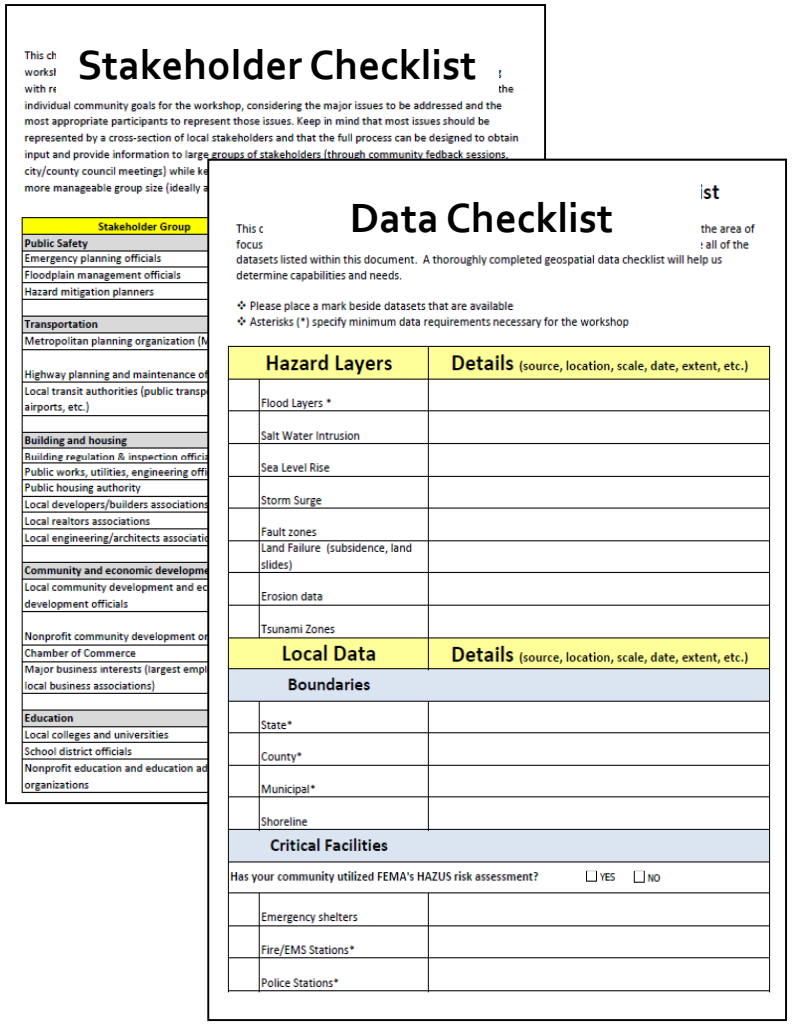


Source: National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center

Presented by Tashya Allen and David Betenbaugh,, NOAA, at Roadmap for Adapting to Coastal Risk Training at COG March 3, 2011

Vulnerability Assessment Resources

- NOAA Adaptation Roadmap Resources
  - Data and stakeholder checklists
  - Participatory process resources
  - U.S. GCRP Regional Fact Sheets
  - SHELDUS Database
  - Coastal Inundation Toolkit
  - SLOSH Model
  - Online sea level trends mapping
  - Flooding exposure snapshots
  - Land cover/change atlas/data
  - Funding opportunities/programs
  - NOAA Adaptation Share Point site
- Georgetown Adaptation Clearinghouse



Stakeholder Checklist

individual community goals for the workshop, considering the major issues to be addressed and the most appropriate participants to represent those issues. Keep in mind that most issues should be represented by a cross-section of local stakeholders and that the full process can be designed to obtain input and provide information to large groups of stakeholders (through community fedback sessions, city/county council meetings) while ke more manageable group size (ideally a

Stakeholder Group
Public Safety
Emergency planning officials
Floodplain management officials
Hazard mitigation planners
Transportation
Metropolitan planning organization (M
Highway planning and maintenance of
Local transit authorities (public transp airports, etc.)
Building and housing
Building regulation & inspection offici
Public works, utilities, engineering offi
Public housing authority
Local developers/builders associations
Local realtors associations
Local engineering/architects associatio
Community and economic developme
Local community development and ec development officials
Nonprofit community development or
Chamber of Commerce
Major business interests (largest empl local business associations)
Education
Local colleges and universities
School district officials
Nonprofit education and education ad organizations

Data Checklist

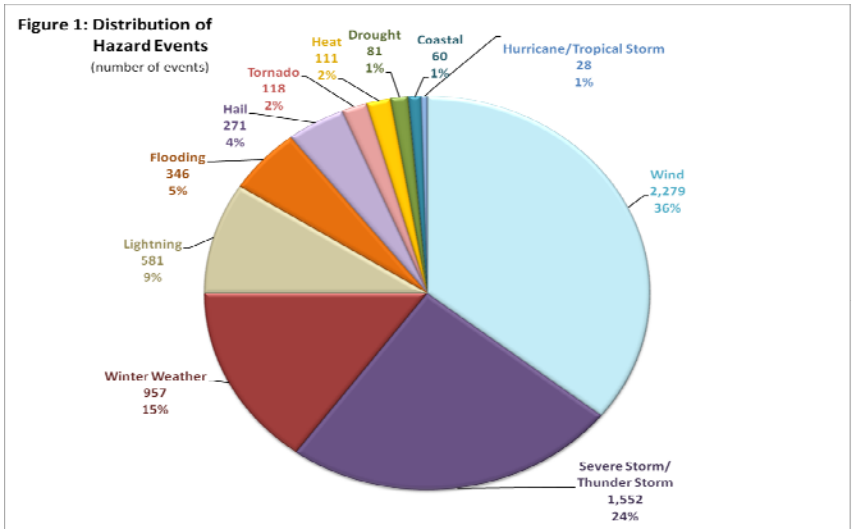
datasets listed within this document. A thoroughly completed geospatial data checklist will help us determine capabilities and needs.

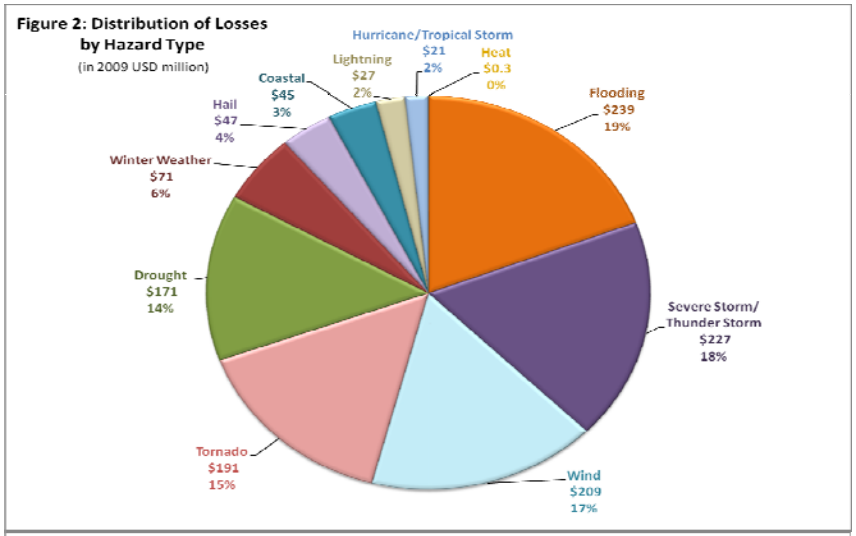
- Please place a mark beside datasets that are available
- Asterisks (*) specify minimum data requirements necessary for the workshop

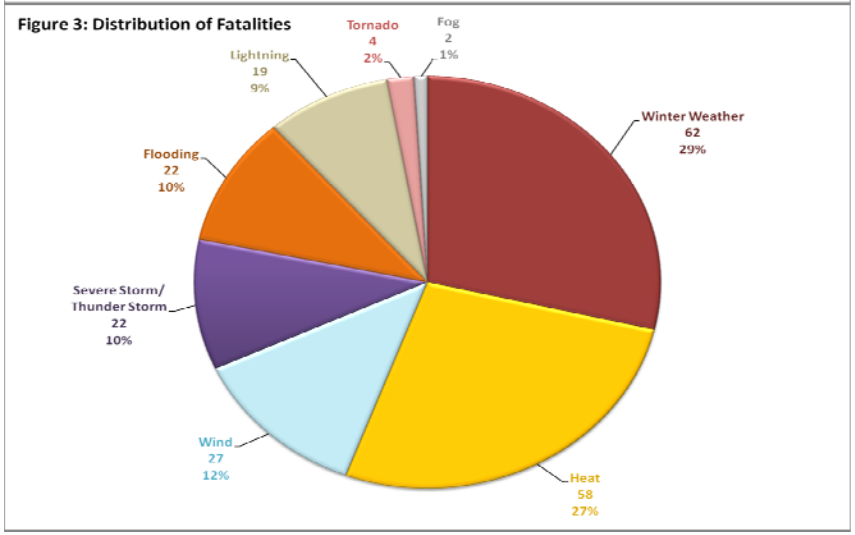
Hazard Layers	Details (source, location, scale, date, extent, etc.)
Flood Layers *	
Salt Water Intrusion	
Sea Level Rise	
Storm Surge	
Fault zones	
Land Failure (subsidence, land slides)	
Erosion data	
Tsunami Zones	
Local Data	**Details (source, location, scale, date, extent, etc.)**
Boundaries	
State*	
County*	
Municipal*	
Shoreline	
Critical Facilities	
Has your community utilized FEMA's HAZUS risk assessment? ☐ YES ☐ NO	
Emergency shelters	
Fire/EMS Stations*	
Police Stations*	

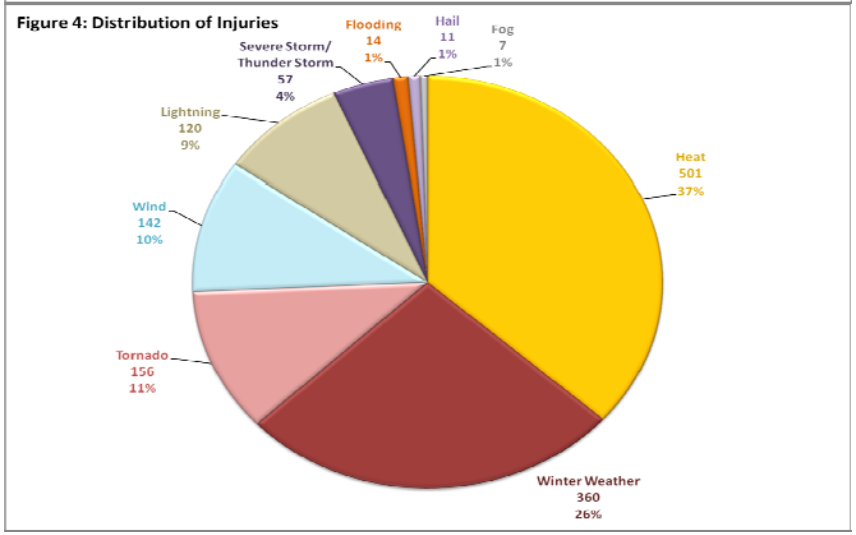
Source: NOAA Roadmap Training Resources

Spatial Hazard Events and Losses









Source: [Hazards and Vulnerability Research Institute SHELDUS Database]

Climate Impacts by Sector

		CLIMATE-RELATED DRIVER			
	IMPACT	Heat	Precip. Intensity	Severe Storms	Sea Level Rise
Transportation	More frequent travel disruptions (downed trees, power outages, etc.)	X	X	X	X
	Change in infrastructure maintenance needs	X	X	X	X
	Increase in property damage from severe events and flooding		X	X	X
	Possible increased road surface damage	X	X	X	X
	Increase in erosion around bridge footings and roads		X	X	X
	Increased rail delays (commute and delivery of goods)	X	X	X	X
	Increase in rail infrastructure deterioration from buckling and expansion	X			
	Change in replacement and maintenance needs for vehicle fleets	X	X	X	
	Increase in poor outdoor air quality days	X			
Land Use	Increased threat of drought, wildfires, invasive species, disease, and storm damage to natural areas	X	X	X	
	Increased stress on urban tree canopy	X	X	X	
	More frequent street tree replacement and maintenance needs	X	X	X	
	Increase in ozone damage to crops	X			
	Possible increased irrigation needs and crop loss	X			

Source: COG Vulnerability Assessments Presented at September 2011 Adaptation Stakeholders Meetings

Transportation Sector Adaptation Approaches

- Identify vulnerable critical transportation assets
- Maintain & Manage
  - Update standards for infrastructure to better accommodate heat waves, runoff, floods and SLR
  - Higher maintenance costs
- Protect, Strengthen
  - Sea walls and buffers
  - Design changes when rebuilding
- Relocate & Avoid
  - Move key facilities, site new facilities in less vulnerable locations
- Abandon and Disinvest
- Enhance Redundancy

Sources: WSDOT and Caltrans

Source: Presented by Robert Kafalenos, Federal Highway Administration, at COG Climate Impacts Symposium May 21, 2012

Lessons Learned

- Communicate "climate impacts" vs. "adaptation"
- Touchy topics!?!: mapping vulnerabilities and smart growth
- Kick off with Climate Impacts Symposium
- Gap exists between climate data produced by scientists and the data needs of engineers and planners
- Limiting project scope to 1 sector or impact ⇨ more specific next steps

Needs Identified

- Bridge the gap between climate data produced by scientists and the data needs of engineers and planners
- Risk and adaptation priorities for inland, non-coastal watersheds
- Risks and impacts to other sectors such as public health and emergency planning
- No-regrets, multi-benefit policies
- Regional modeling and modeling comparison chart

For additional project resources go to:

http://www.mwcog.org/environment/climate/adaptation.asp

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