NOAA's Regional Climate Services: Opportunities and Tools for State DOTs

Ellen L. Mecray
NOAA's Regional Climate Services Director, Eastern Region

AASHTO, DC, May 21, 2013

Outline

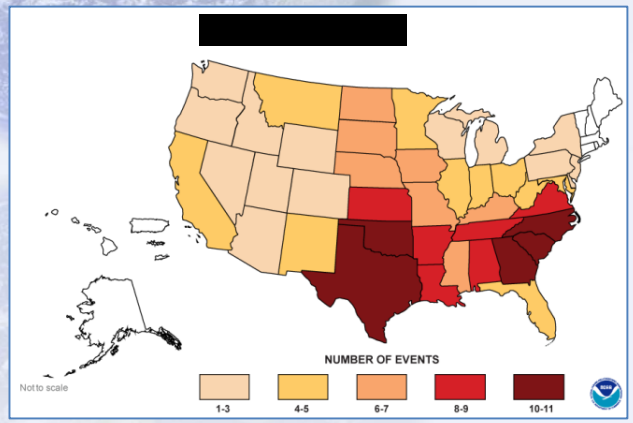
- Drivers to understand extreme events in a changing climate
- Additional resources for State DOTs
- Existing Products and Tools for State DOTs
- Examples from State DOTs working on adaptation measures
- Discussion: State DOT needs for knowledge on extreme events and climate

Drivers:
Understanding Extreme Events in a Changing Climate

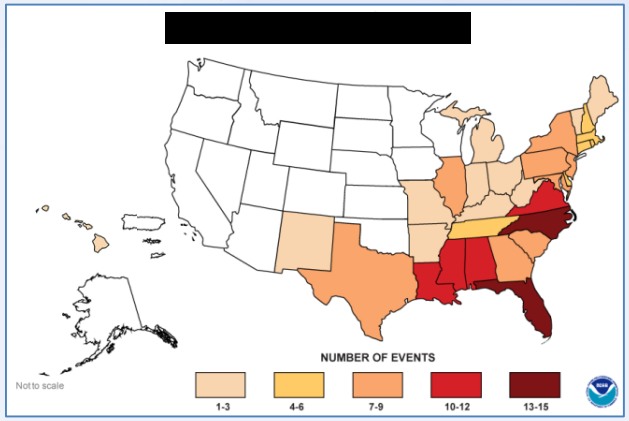
The Nation Is Climate-Conscious… for Good Reason

U.S. Billion-Dollar Weather and Climate Disasters: 1980 – 2011

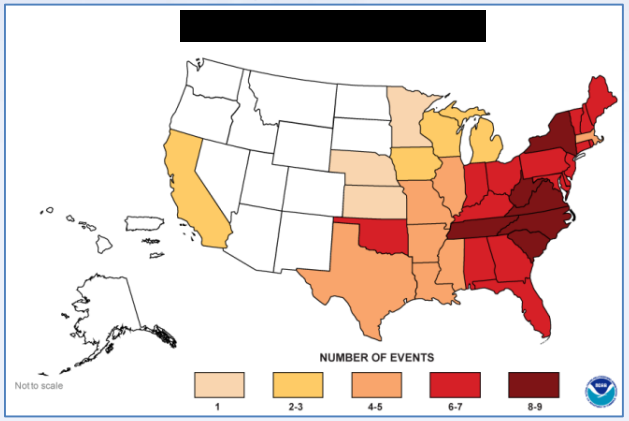
Drought and Heatwaves



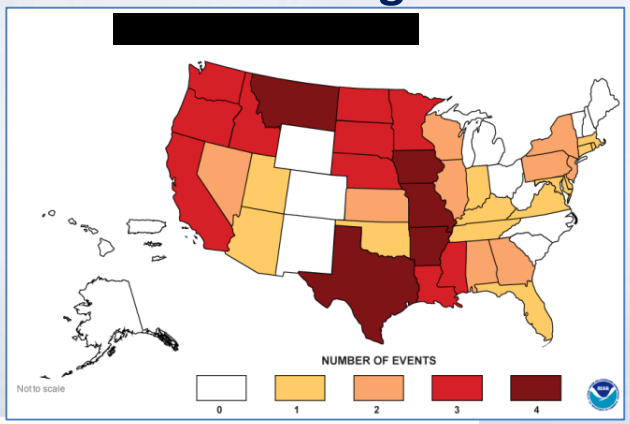
Hurricanes and Tropical Storms



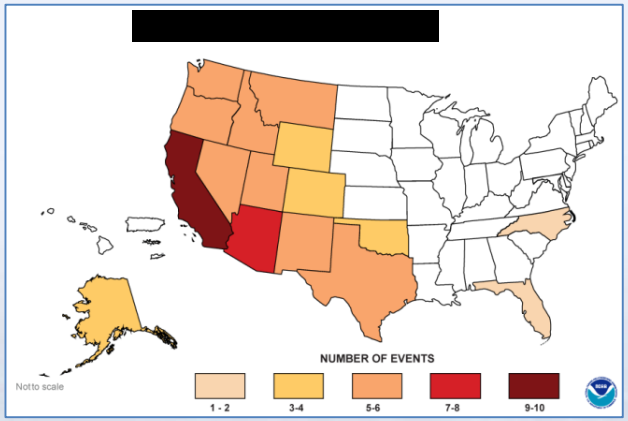
Winter Storms and Crop Freezes



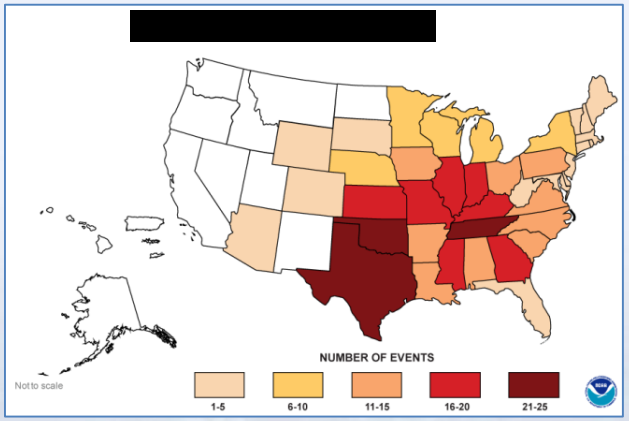
Flooding



Wildfires



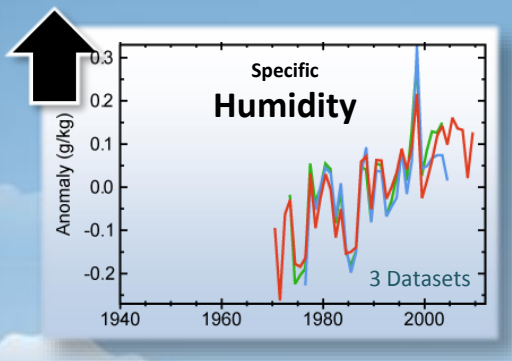
Severe Local Storms

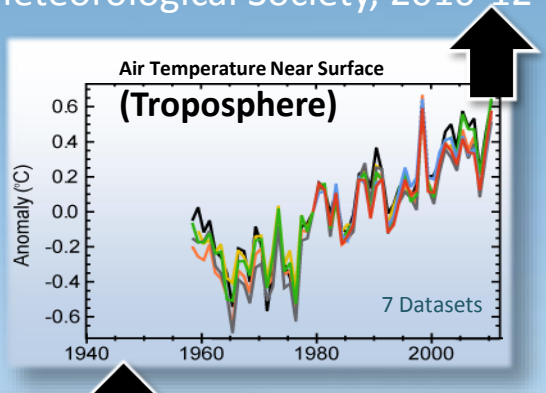


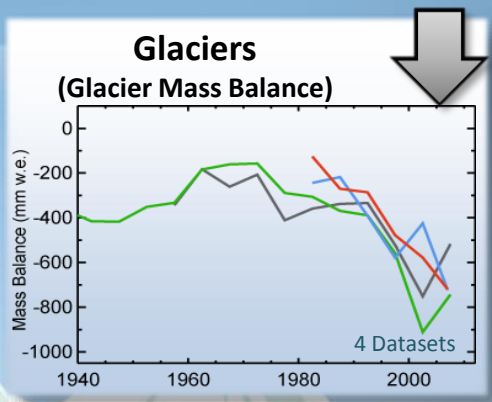
NOAA's National Climatic Data Center

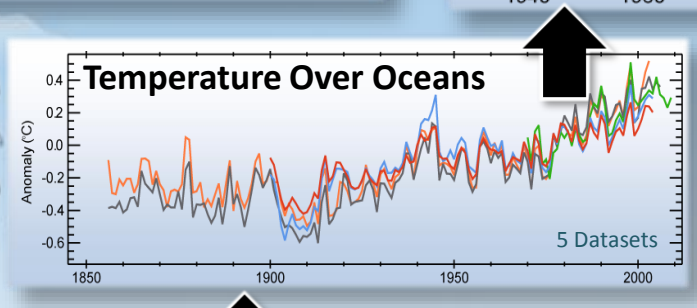
The Changing State of the Climate

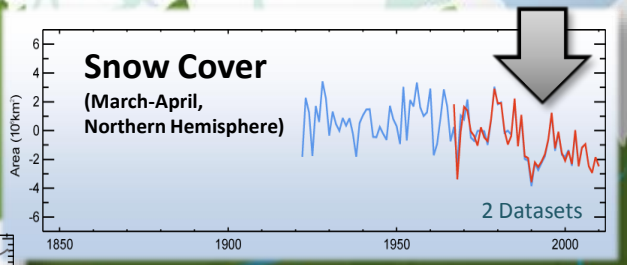
Updated from Bulletin of the American Meteorological Society, 2010-12

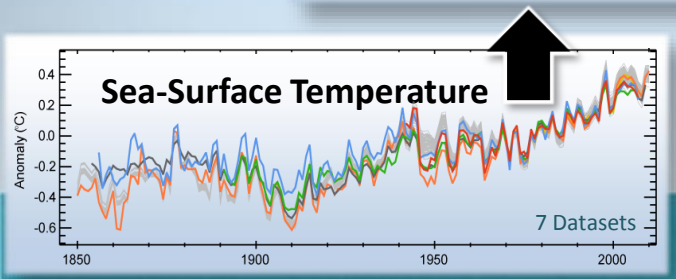


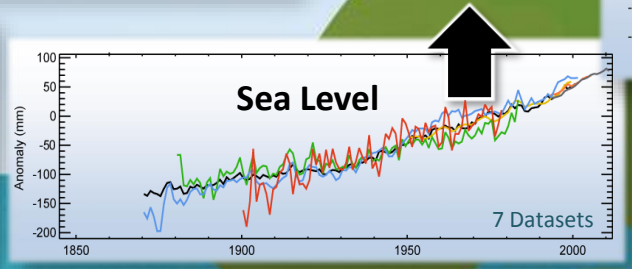


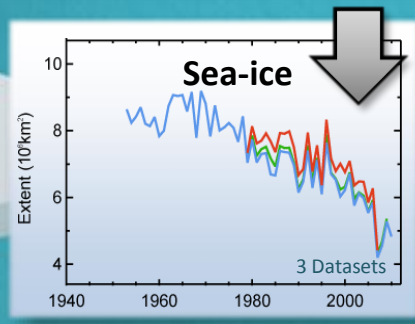


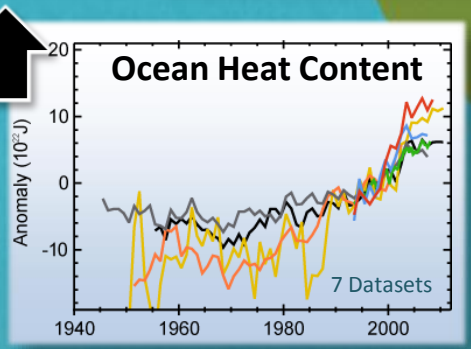


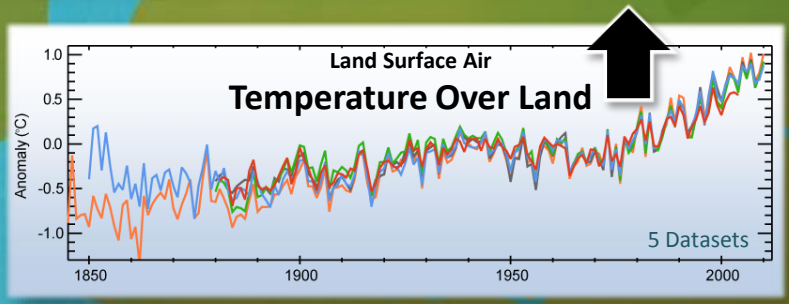






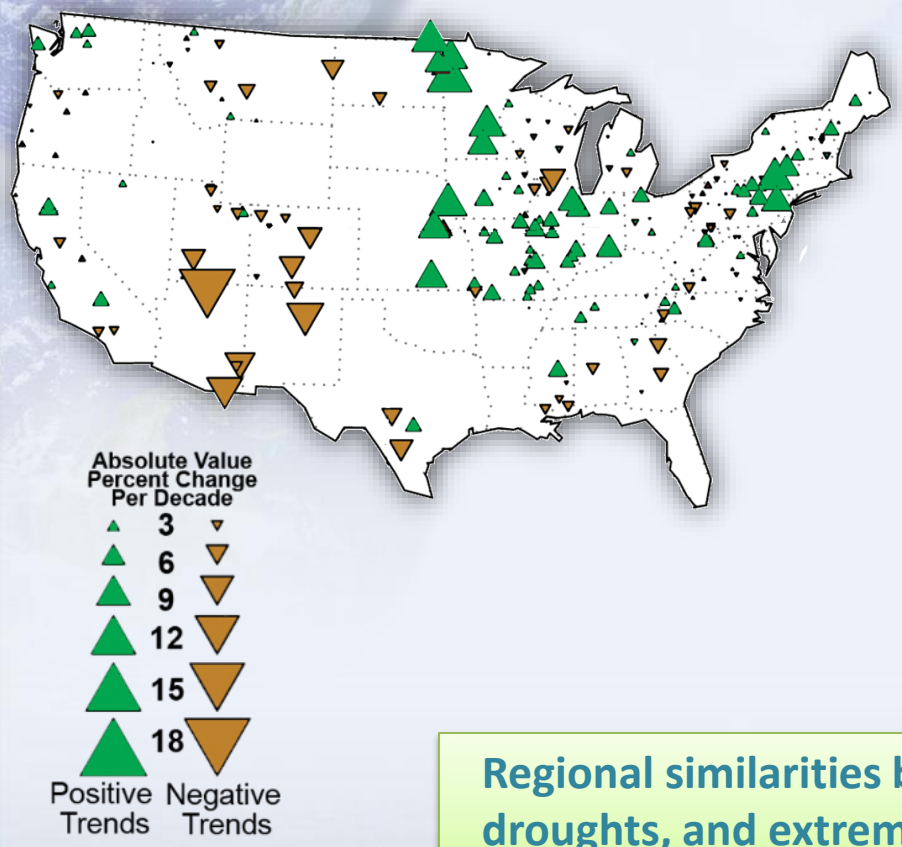




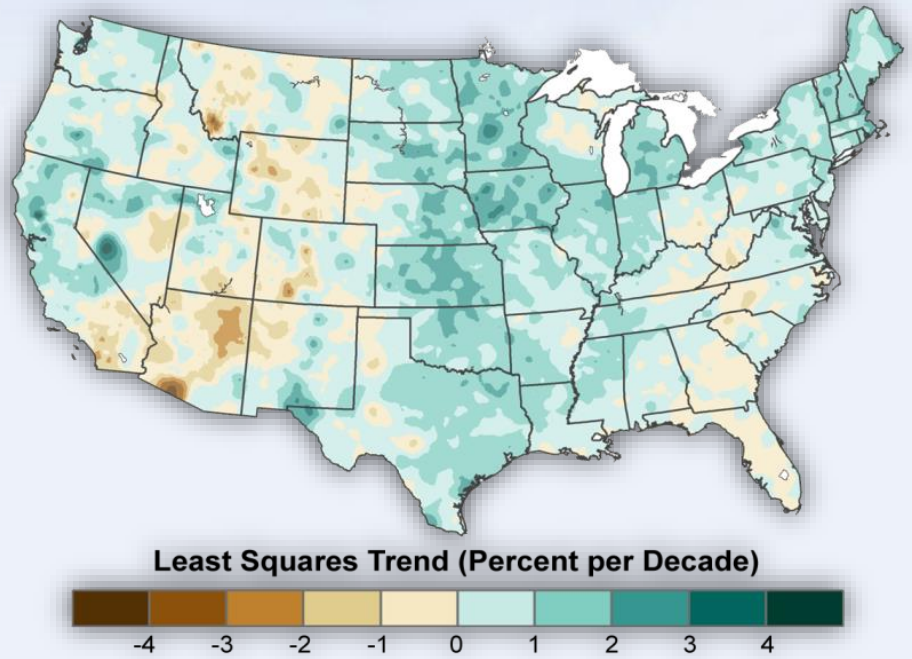


Flooding and Precipitation

River-Flow Trends in Annual Maximum: 85-127 years ending 2008



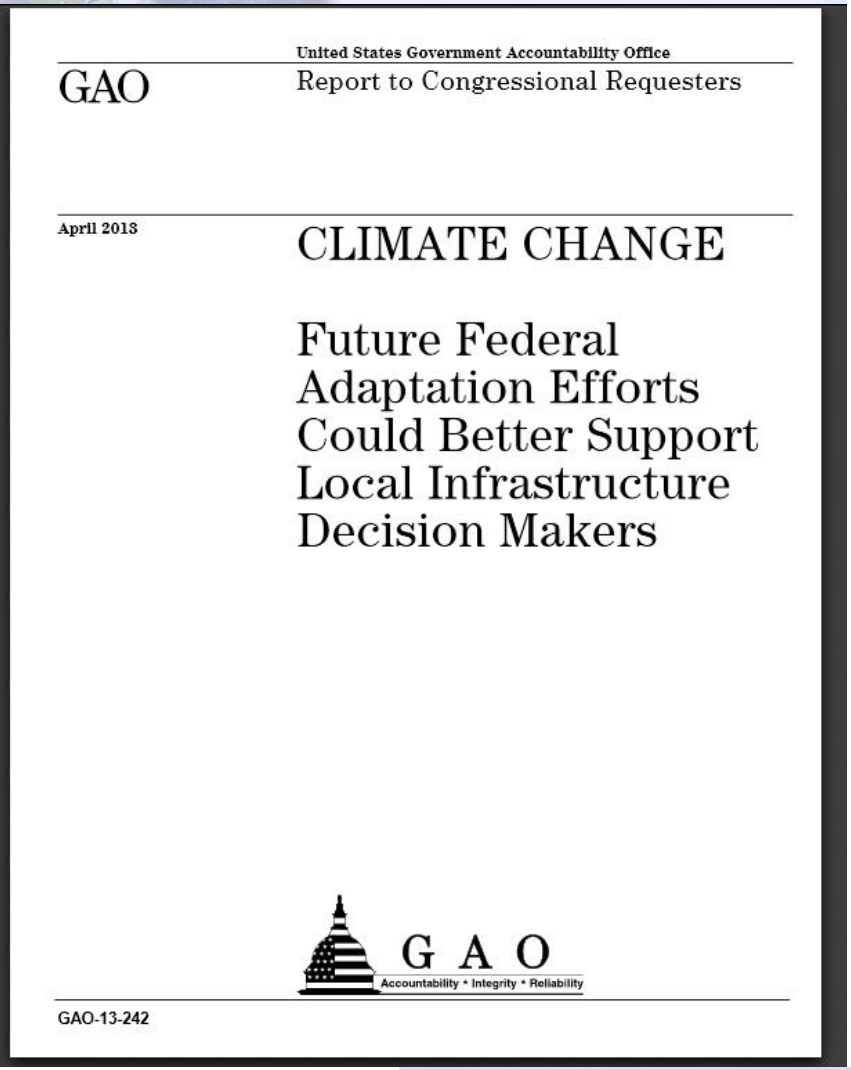
Trends in Total Annual Precipitation: 1909-2008



Regional similarities between trends of annual precipitation, droughts, and extremes of river flooding

Peterson, T. C. et al., 2012 (In Review). Monitoring and Understanding Changes in Heat Waves, Cold Waves, Floods and Drought in the United States: State of Knowledge. *BAMS*.

GAO Report, April 2013


United States Government Accountability Office

GAO

Report to Congressional Requesters

April 2013

CLIMATE CHANGE

Future Federal Adaptation Efforts Could Better Support Local Infrastructure Decision Makers

G A O

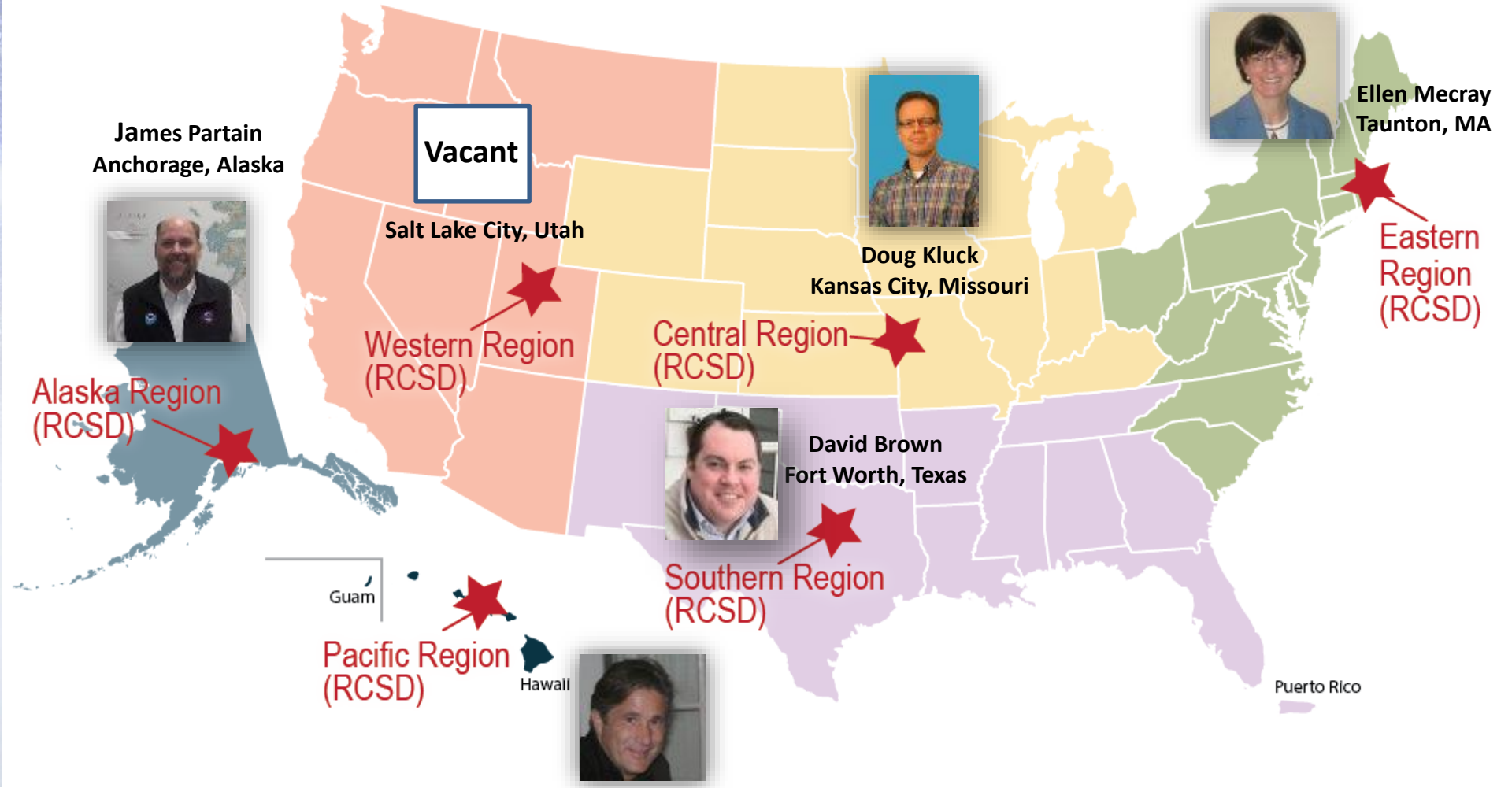
Accountability * Integrity * Reliability

GAO-13-242

- decision makers …have generally not included adaptive measures in their planning
- decision makers are unsure about where to go for information and what information they should use
- Decision makers do not know where to find climate information translators.
- Federal agencies should provide access and translation

Key Resources for climate information

RCSD Locations and Regions



Connecting Science, Services and People: Regional Climate Service Enterprise

State and Local Engagement, Education & Service Delivery

- **Weather Forecast Offices**
- **Sea Grant Education & Extension**
- **Marine Sanctuaries, Monuments & Estuarine Reserves**
- **River Forecast Centers**
- **Data Centers**
- ***DOC Commerce Connect (in development)***
- **Other agencies** (e.g., National Science Foundation, Dept. of Education, Health & Human Services, Dept. of Energy, Dept of Interior, Dept of Agriculture)
- Dept. of Agriculture Extension
- State Climatologists
- Federal Protect Area Programs
- USGCRP Climate Literacy Partners
- Etc…

Regional Climate Services Partnerships

- ***NOAA Regional Climate Service Programs***
  - **Weather Service Regions**
  - **Regional Climate Centers**
  - **Coastal Services Center**
  - **River Forecast Centers**
  - **Regional Collaboration Teams**
  - **Data Centers**
- **Relevant Regional Offices from other agencies** (e.g., Environmental Protection Agency, Dept. of Agriculture, Dept. of Interior, Health and Human Services, Dept. of Transportation, Dept of Energy, etc.)

Regional Climate Science

- **Regional Integrated Science & Assessments (RISA)**
- **NOAA Labs**
- **Sea Grant**
- **Cooperative Institutes**
- **Applied Research Centers**
- **Data Centers**
- **Other agencies** (e.g., National Aeronautics and Space Administration, Dept. of Interior, Dept. of Agriculture, National Science Foundation & other USGCRP agencies)
- **Etc…**

USER ENGAGEMENT

- *Development, Delivery & Evaluation of Products & Tools*
- *Understanding and Translating User Needs*
- *Informing Program Requirements*

Government
Private Sector
Academia
NGO's

ICNet
INFRASTRUCTURE & CLIMATE NETWORK

Developing a collaborative research network of climate scientists and transportation infrastructure engineers

Accelerating new research in climate change transportation infrastructure impacts and adaptation

PIs: Jennifer Jacobs & Jo Daniel, UNH
Principals (4): UNH, USM, Umass Boston, Texas Tech

Steering Committee (12): BU, NOAA, ME DOT, WPI, Tufts, UVM, CMA Eng

Full Network (50): UMass Amherst, UConn, UNH, UVM, Northeastern, URI, RPI, UMaine, NHDOT, UMass Dartmouth, NOAA, MADOT, Cambridge Sys.

Senior Advisory Committee:
U Illinois, Texas A&M, NCAR

Products and Tools for State DOT's

Review of Science Needs for Infrastructure

DATA
Lidar elevation data and usable Lidar products
Downscaled precipitation and long term temperature data

MAPPING
Revised storm specifications
Revised floodplain maps
Locations of vulnerable infrastructure

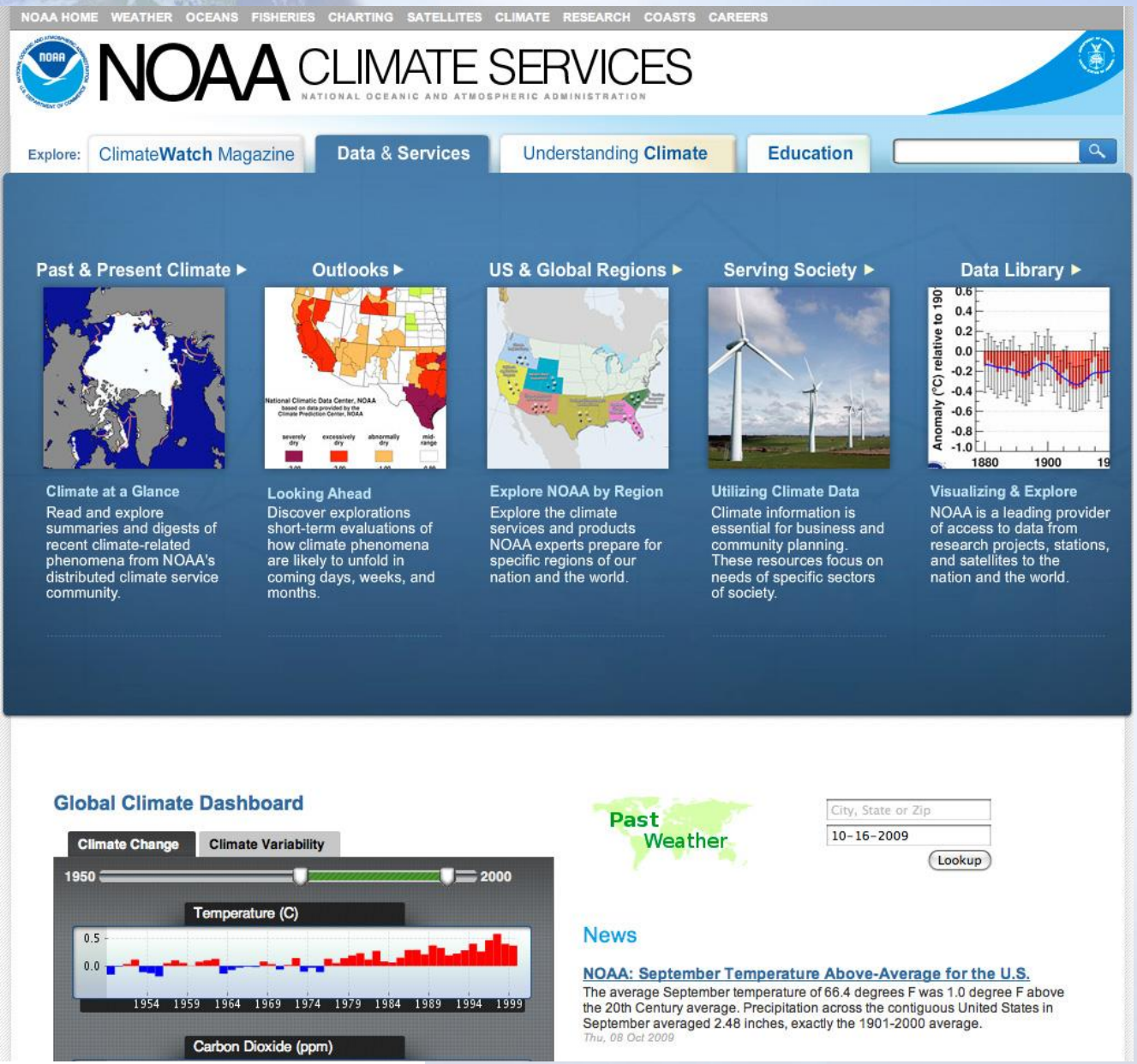
ASSESSMENTS
Infrastructure at risk from sea level rise and flooding
Vulnerability of critical public facilities

PUBLIC RESPONSE
Risk notification for homebuyers
Improved coordination between FEMA and states to notify public about risk

ADDITIONAL ITEMS ("items to improve climate change efforts")
Incorporate climate change information into determination of flood zones
Technical assistance through partnerships with industry and government

NOAA's Climate Services Portal

http://www.climate.gov



The NCS Portal Prototype offers one well-integrated, online presentation of NOAA's climate data & services.

The prototype features four audience-focused sections:

- ClimateWatch for the public
- Data & Services for scientists and data users
- Understanding Climate for policy leaders
- Education for educators & students

The Dashboard is a data-driven synoptic overview of the state of the global climate system.

Past Weather allows users to easily retrieve weather data for any given location & date.

NEclimateUS.org

HOME | NEEDS | DATA, PRODUCTS & SERVICES | PROJECTS & ACTIVITIES | PROGRAMS & PARTNERS | BIBLIOGRAPHY

- HOME
- NEEDS
- DATA AND PRODUCTS
- PROJECTS AND ACTIVITIES
- PROGRAMS & PARTNERS
- BIBLIOGRAPHY
- ABOUT
- CONTACT US

This website was developed through the collaborative efforts of NOAA, NALCC, NWF and EPA.

NEclimateUS.org (a.k.a. 'neXus') is a searchable online database that provides a gateway to climate information for the Eastern US. It summarizes needs for climate information as articulated in publications; identifies available data, products and services; and captures planned and on-going projects. The goal is to offer a tool to search for regionally relevant climate information, and to facilitate collaborative opportunities across the network of climate-focused programs and partners in the Eastern US. NeclimateUS.org is in its early stages of development. Content will change with time to reflect developments in climate work within the region, and in response to individual sector needs when necessary. For detailed information about the content of NEclimateUS.org and tips for using the site, please visit *about NEclimateUS.org*.

nexus ['nɛksəs] *n pl nexus*

1. a means of connection between members of a group or things in a series; link; bond

2. a connected group or series [from Latin: a binding together, from nectere to bind]

DIGITAL COAST
NOAA COASTAL SERVICES CENTER

Home | About | Data | Tools | Training | Apply It | Stories

TOOLS

TOP PICKS

- Sea Level Rise Viewer
- Coastal County Snapshots
- Multipurpose Marine Cadastre
- ENOW Explorer
- Land Cover Atlas

You've Selected

Focus Area >
Land Use Planning (Clear)

Data Type >
Land Cover (Clear)

Clear all

NARROW YOUR RESULTS

Platform
Desktop (8)
Web (9)

Function
Data Analysis (8)
Classification (9)
Change (9)
Spatial Visualization (15)
Non spatial Visualization (2)

Type
Data Graphic (1)
Model (6)
Participatory (3)
Viewer (7)

Items per page 25

C-CAP Land Cover Atlas
National Oceanic and Atmospheric Administration
Enables users to view regional Coastal Change Analysis Program (C-CAP) land cover data and explore land cover changes and trends

Coastal County Snapshots
National Oceanic and Atmospheric Administration
Turns complex data into easy-to-understand stories, complete with charts and graphs

Coastal Resilience Decision-Support Framework
The Nature Conservancy
Provides a framework that supports decisions to reduce the ecological and socioeconomic risks of coastal hazards

Community Resource Inventory (South Carolina)
Clemson University Baruch Institute
Provides an online mapping atlas of the natural and cultural resources in a community

FEATURED TOOL

NOAA's State of the Coast
Delivers quick facts and detailed statistics through interactive visualizations about coastal communities, ecosystems and the economy

TOOL RESOURCES

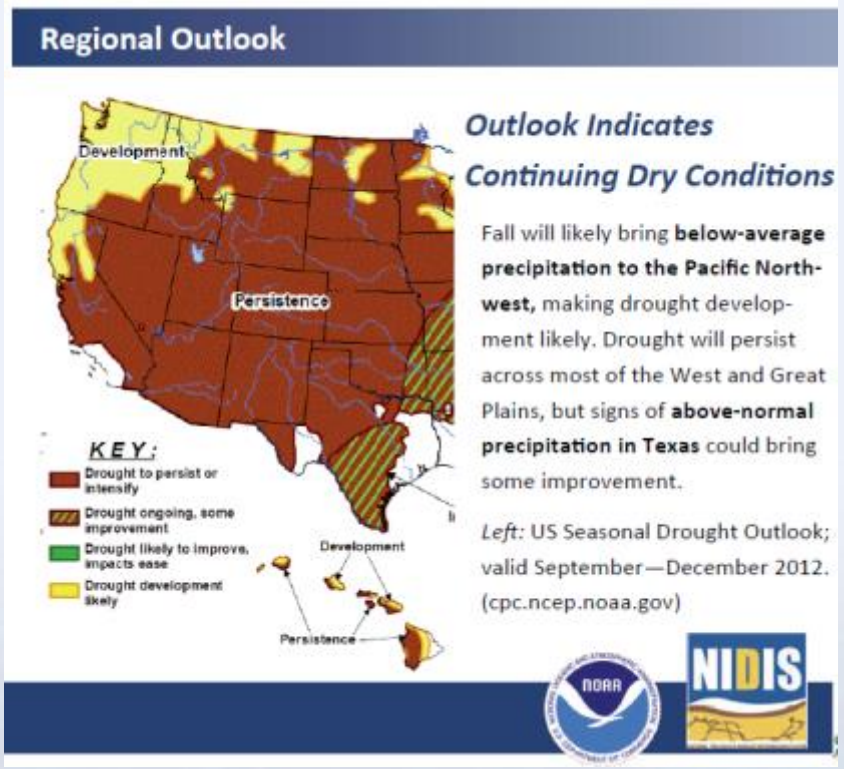
Ecosystem-Based Management Tools Network
Supports the implementation of ecosystem-based management tools in coastal and marine environments and the terrestrial environments that affect them

Quarterly Regional Climate Outlooks

- Regional outlooks
  - Led by RCSDs with core NOAA and external partner engagement
  - Regional extension of NCDC's monitoring and assessment capacity
  - Informs NCDC product and service requirements

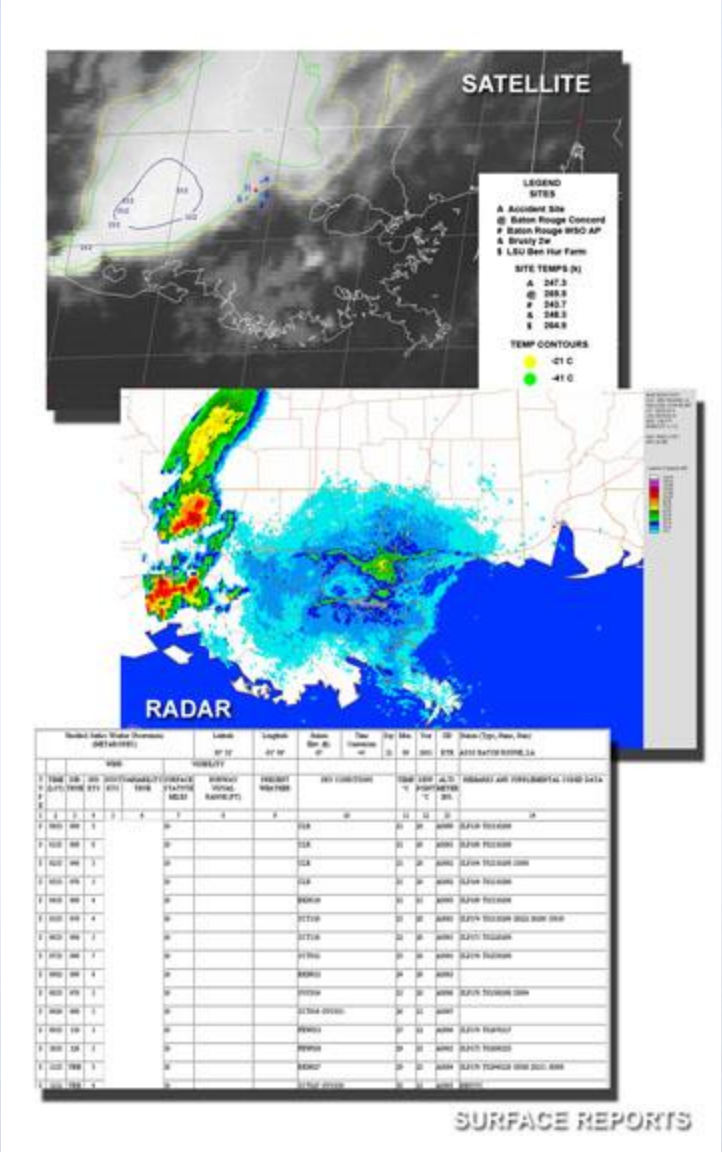
"The Governors have been particularly focused on this year's drought and related wildfires. NOAA staff were helpful to us in preparing briefing materials for a conference call of the Governors and discussions at their meetings. In addition, we have gotten good feedback on the new quarterly outlook we started jointly producing this year."

- Chris McKinnon, Acting Executive Director, Western Governors Association



Sample State DOT Data Request Highway Incident

- State DOT use NCDC archives
  - To defend against wrongful death lawsuit
  - Reduce settlement claims
  - Retrospective analysis of incident
- Reportedly monies saved can be better used to maintain highways and build safer roads
- Blending satellite, radar, and surface data creates compelling products
- NCDC services thousands of requests for weather data at or near accident sites
- Future plans - MADIS archive - Immediate benefits to State DOTs foreseen from archive of highway weather and road condition.



NOAA/DOT: Partnering to improve safety, mobility and efficiency of surface transportation

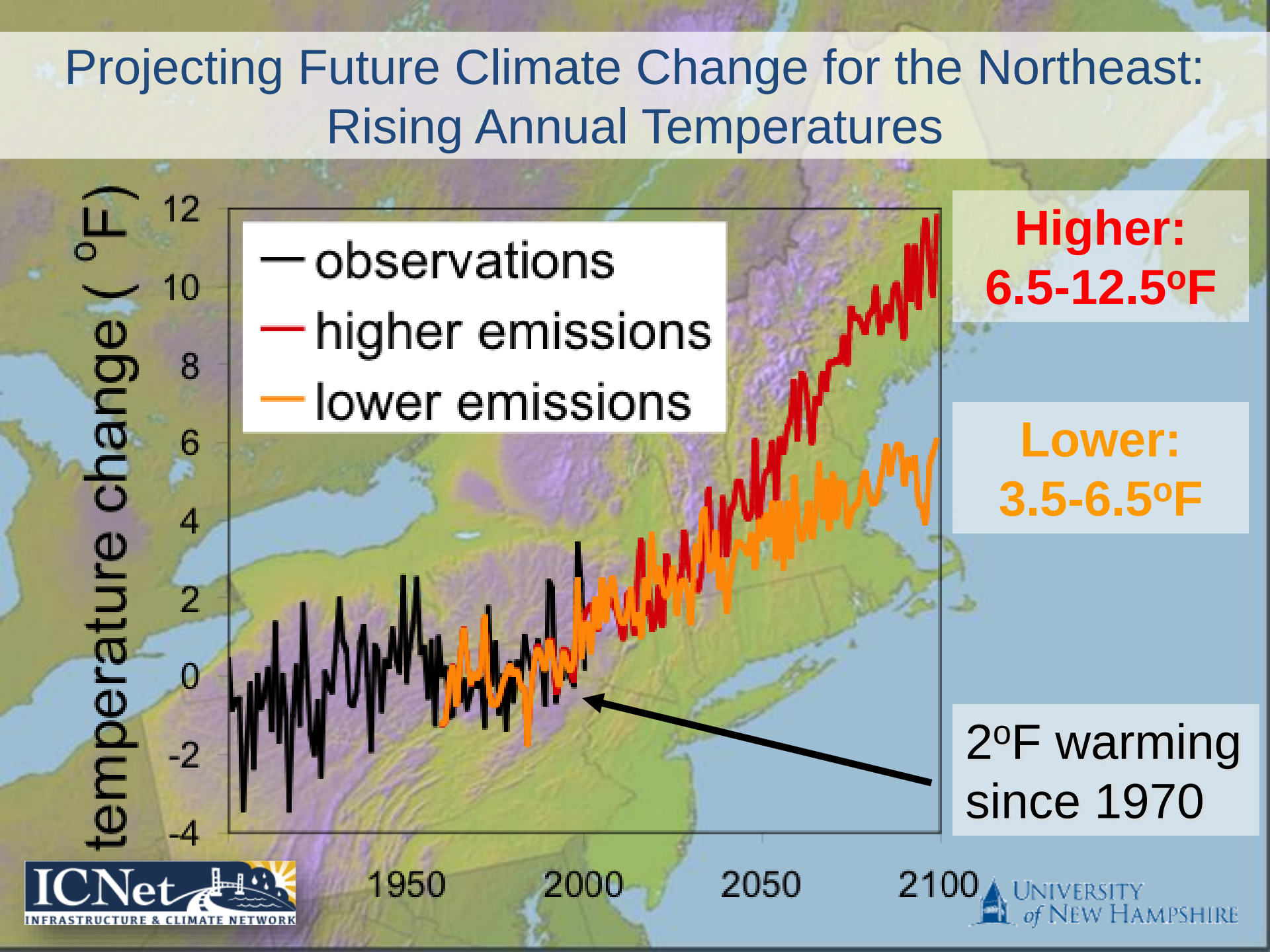
Sensors report dew point, humidity, air temperature and wind velocity, pavement temperatures, amount of anti-icing chemicals present, friction measurements installed in vehicles

Models predict the start of ice formation on pavements, Suggest anti-icing treatment, type, amount, when to apply, speed reduction for visibility, wet pavement conditions

DOT traffic monitoring control center

Examples from States in Region
Who is integrating climate info?

Projecting Future Climate Change for the Northeast: Rising Annual Temperatures



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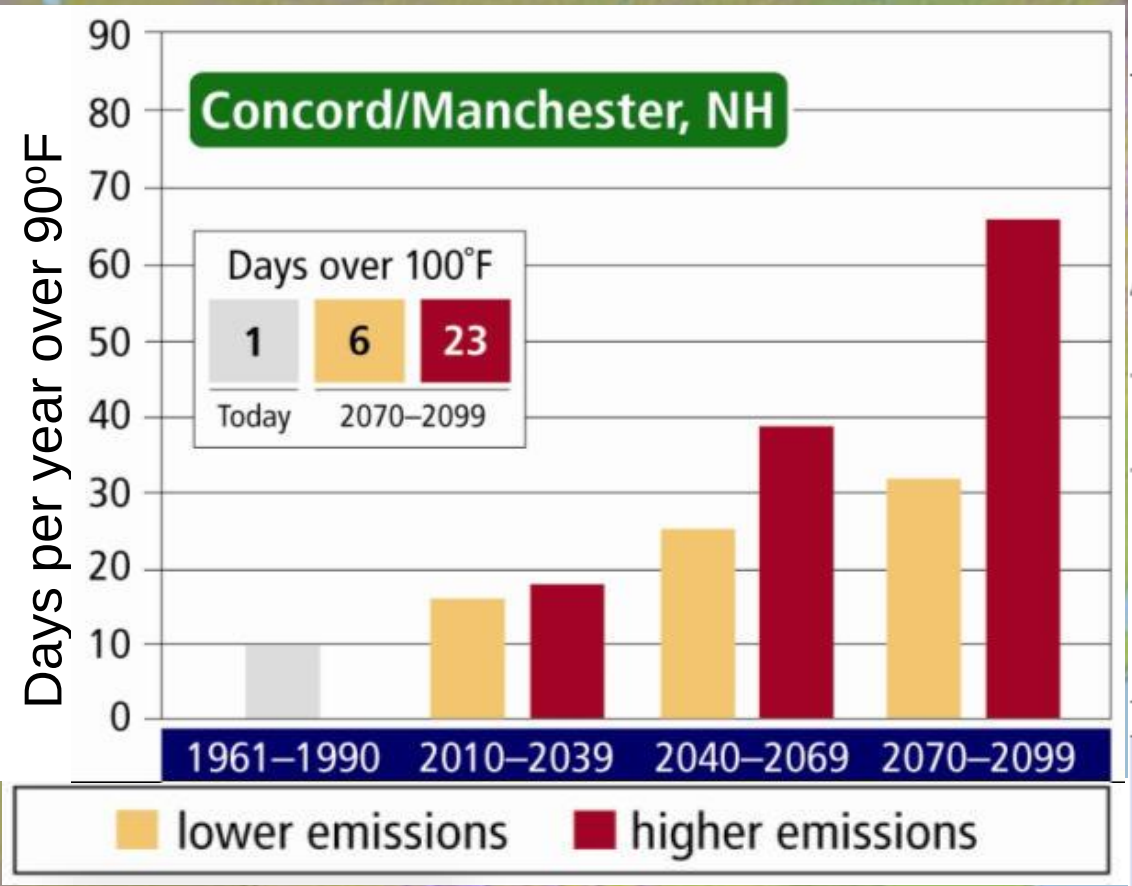
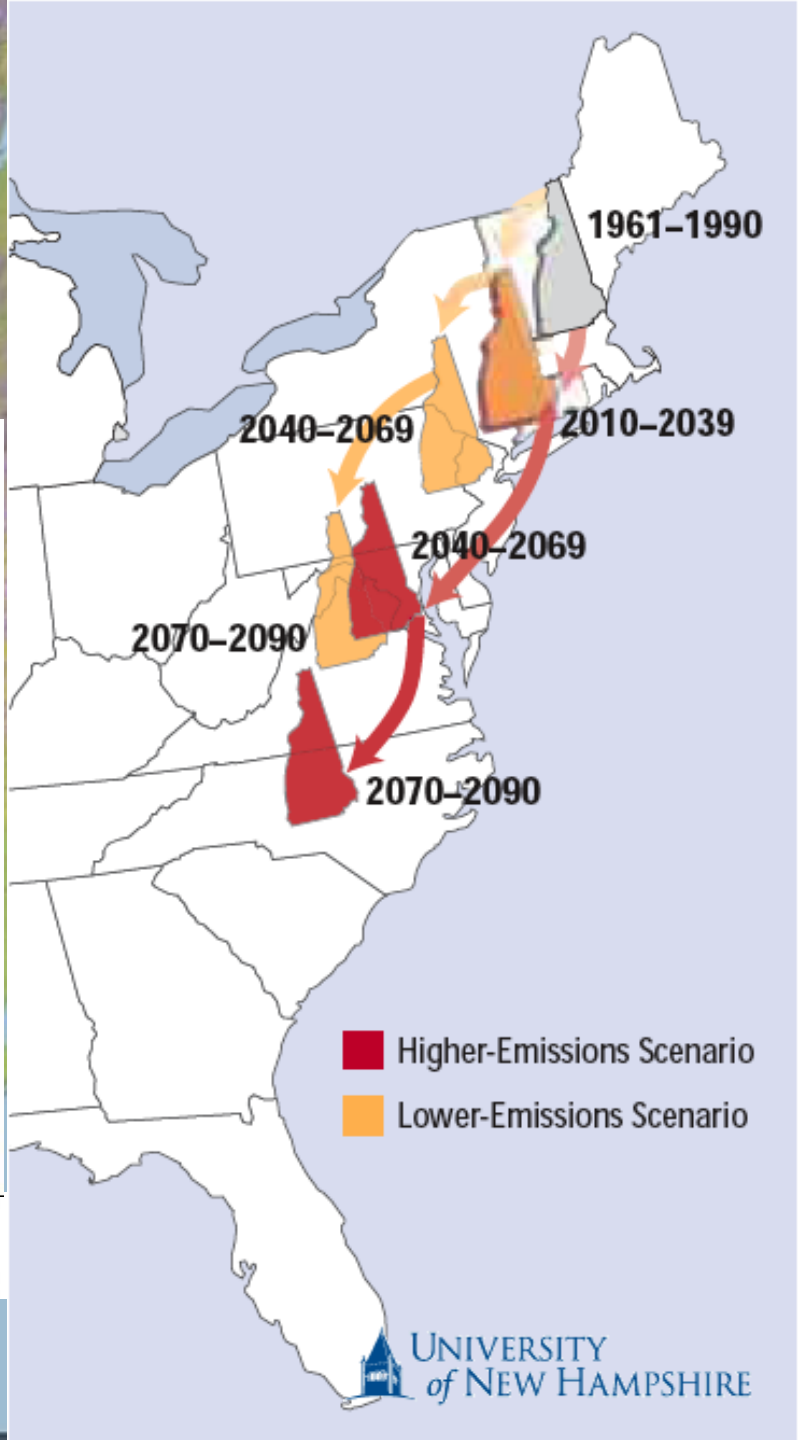
University of New Hampshire

Summer heat index:

How hot summers will "feel" in

New Hampshire





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Preparing For The Rising Tide

Project Team: Ellen Douglas, Paul Kirshen, Vivien Li, Chris Watson, Julie Wormser

- Identifies Boston's vulnerability to larger storms and higher seas
- Encourages property owners and public agencies to know and decrease risks
- Supports flexible, co-benefit, cost-effective solutions

The Boston Harbor Association

Rising Tide: Summary of Findings

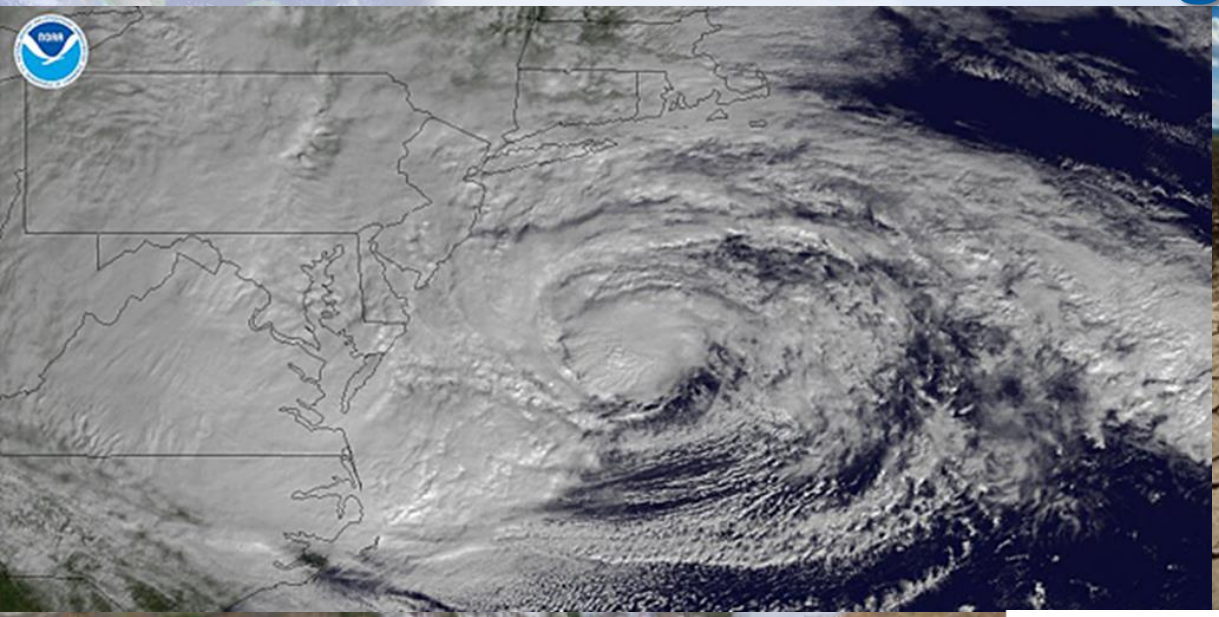
- Today's 100-year flood could be 2050's annual flood and 2100's high tide.
- Private sector can and should develop building-specific preparedness plans
- Public sector should help property owners overcome barriers, step in when private action is insufficient.

Climate Adaptation and Transportation

- What climate information or data would make a difference to the decisions being made today regarding transportation?
- What is the best way to handle uncertainty in assessing future changes and impacts?
- To what extent should economic and other second order effects be analyzed?
- Can thresholds be set for risk to specific infrastructure?
- Can new techniques be developed to help assess future risks due to climate change?

Backup slides

Are Recent Extreme Events Related to Climate Change?



> $1B DISASTERS in 2011

Extreme Precipitation Events Increase

- Heavy rainfall events are becoming more frequent across the Northeast
- Under both emissions scenarios
  - -rainfall is expected to become more intense
  - -periods of heavy rainfall are expected to become more frequent

Bridge over Axe Handle Brook, Rochester, NH May 2006.

credit: Associated Press

ICNet
INFRASTRUCTURE & CLIMATE NETWORK

University of New Hampshire

Cross-agency partnerships and products

OVERVIEW: Climate Adaptation Activities

National level:

CEQ directive to all federal agencies

- Interagency Adaptation Task Force
- Each agency preparing its own Adaptation Plan in concert with other agencies, states, etc.

National Climate Assessment (scenarios); Northeast chapter

U.S. Global Change Research Program (www.globalchange.gov)

Cooperative ventures, MOUs, multi-agency grants

New guidances eg. Army Corps sea level rise , EPA grant criteria, NEPA

Regional Climate Efforts

- Federal level:
  - New England Federal Partners, climate workgroup;
  - Federal Climate Partners for the Mid-Atlantic
- Federal/state level, by sector:
  - DOI/LCC and CSC,
  - ROGs (NROC/MARCO) and GOMC,
  - AdaptNE,
  - ICNet,
  - CoP fish/cli
- State level: Climate adaptation planning within each state
- Municipal level: climate adaptation planning/scenario planning

New England Federal Partners

- Regional Coordination & Collaboration (*climate adaptation team*):
  - A venue to coordinate regional climate science activities
  - A review team for needs-based, collaborative, climate science and services
  - A team to consider regional pilot projects that coordinate and integrate resources and programs around an issue
  - An opportunity to demonstrate cooperation across federal agencies as well as with state agencies, interstate organizations, NGOs, tribes, and industry.

Sources of Information

Weather Information for Surface Transportation – Office of the Federal Coordinator for Meteorology - 2002

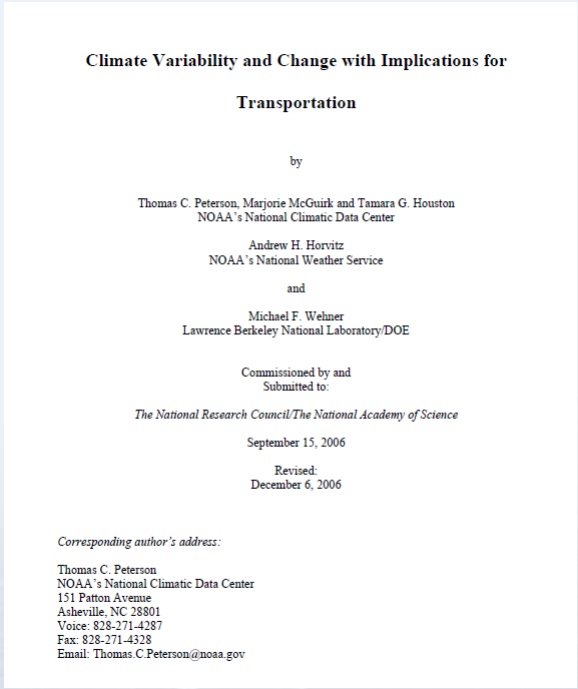
The Potential Impacts of Climate Change on U.S. Transportation – Transportation Research Board, March 2008

Climate Variability and Change with Implications for Transportation – Thomas C. Peterson, Marjorie McGuirk et. al., National Research Council TRB, March 2008

Impacts of Climate Variability and Change on Transportation Systems and Infrastructure – Gulf Coast Study, CCSP 4.7, March 2008

Bulletin of the World Meteorological Organization, Weather and climate change implications for surface transportation in the USA by Marjorie McGuirk, Scott Shuford, et. al. April 2009

Global Climate Change Impacts on the United States, USGCRP



Climate Variability and Change with Implications for Transportation

by

Thomas C. Peterson, Marjorie McGuirk and Tamara G. Houston
NOAA's National Climatic Data Center

Andrew H. Horvitz
NOAA's National Weather Service

and

Michael F. Wehner
Lawrence Berkeley National Laboratory/DOE

Commissioned by and
Submitted to:

The National Research Council/The National Academy of Science

September 15, 2006

Revised:
December 6, 2006

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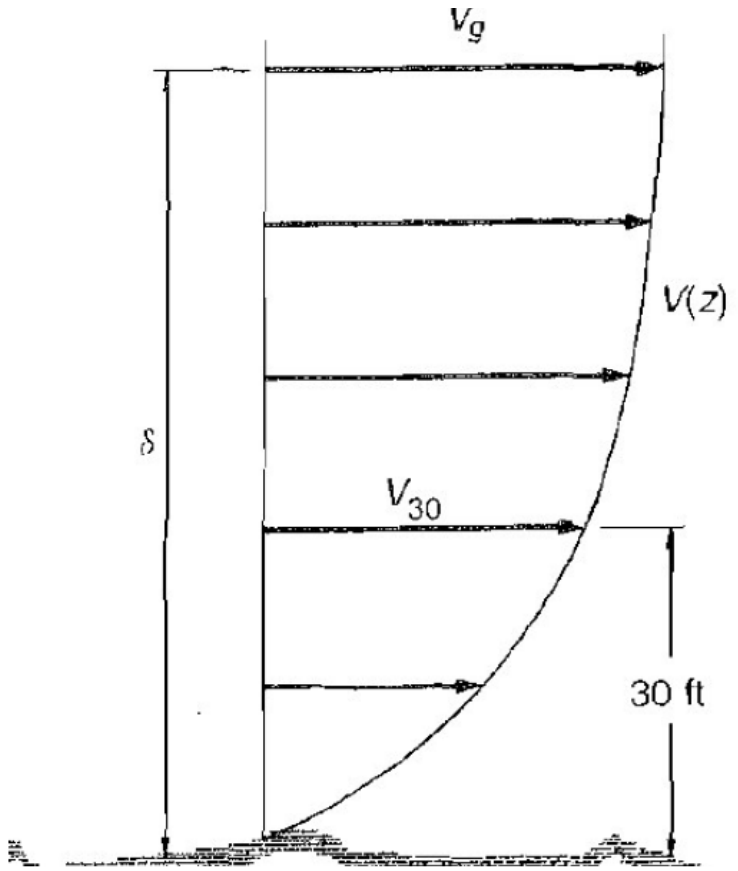
Wind WL; WS [AASHTO 3.8]

$$V_{dz} = 2.5 V_o \left(\frac{V_{30}}{V_b}\right) \ln\left(\frac{z}{z_o}\right) \quad AASHTO\ 3.8.1.1 - 1$$

V_{dz} = Design Wind Velocity
V_{30} = wind velocity at 30-ft above ground
V_b= assumed based wind speed
(100mph)
Z_o= friction length of upstream fetch

Use Design Wind Speed to Determine Design Pressure on Structures (WS)



[Barker and Puckett Figure 4.3]

Ice [AASHTO 3.9]

www.cbc.ca

3.9.2.1 Effective Ice Strength

In the absence of more precise information, the following values may be used for effective ice crushing strength:

- 8.0 ksf, where breakup occurs at melting temperatures and the ice structure is substantially disintegrated;
- 16.0 ksf, where breakup occurs at melting temperatures and the ice structure is somewhat disintegrated;
- 24.0 ksf, where breakup or major ice movement occurs at melting temperatures, but the ice moves in large pieces and is internally sound; and
- 32.0 ksf, where breakup or major ice movement occurs when the ice temperature, averaged over its depth, is measurably below the melting point.

ICNet INFRASTRUCTURE & CLIMATE NETWORK

UNIVERSITY of NEW HAMPSHIRE

Public Sector Actions

- Accelerate implementation of Boston's climate action plan.
- Improve flood zone maps.
- Require buildings in flood zones to be flood resilient throughout lifespan.
- Assist landowners in overcoming barriers to action.

Private Sector Actions

- Assess building vulnerability and develop time-phased preparedness plans.
- Incorporate preparedness plans into maintenance schedules.
- Work with public sector to protect infrastructure and public realm.