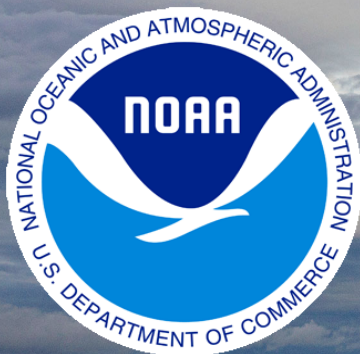
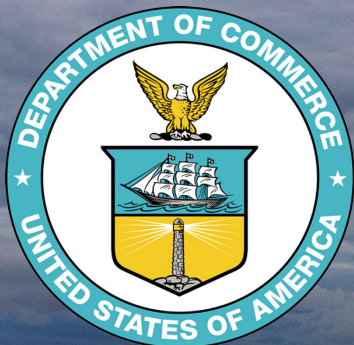


Getting to Business Decisions Using Climate Change Assessments?

Presented to the Center for Climate and Energy Solutions



Thomas R. Karl, L.H.D.

*Director, NOAA's National Climatic Data Center
Chair, U.S. Subcommittee on Global Change Research
November 4, 2013*

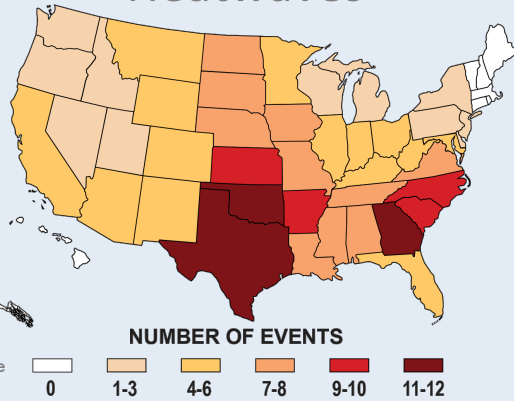
Outline

- **Climate as a Motivation**
- **Scientific Assessments**
 - National and International
 - Is the information adequate for effective business decisions?
- **Example: Extreme Precipitation and Flooding**
 - How to build on scientific climate assessments, e.g., IPCC, National Assessments
 - Flash Flooding
 - Riverine and Lake Flooding
 - Tidal and Storm Surge
- **How can we best ensure information needed for business decisions is effective?**
 - Public-private partnership?

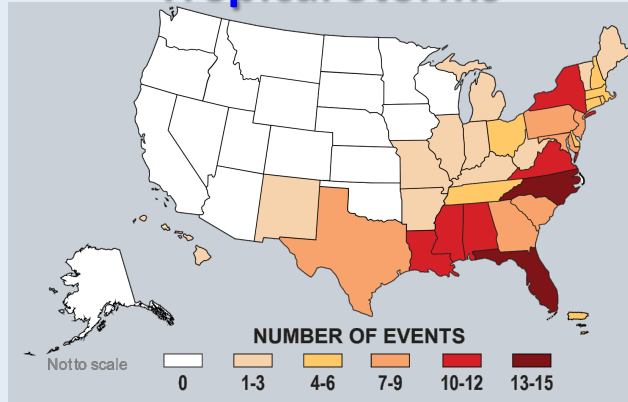
The Nation Is Climate-Conscious... for Good Reason

U.S. Billion-Dollar Weather and Climate Disasters: 1980 – 2012*

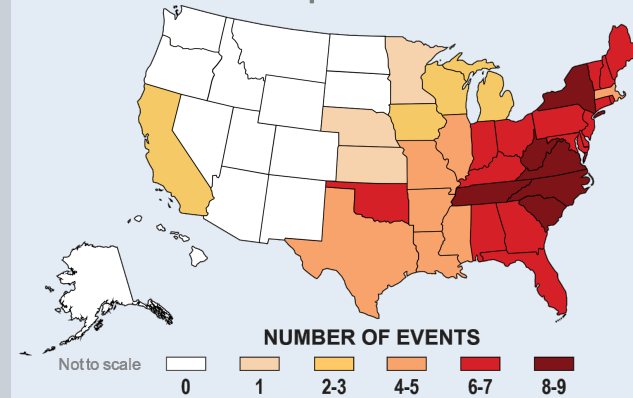
Drought and Heatwaves



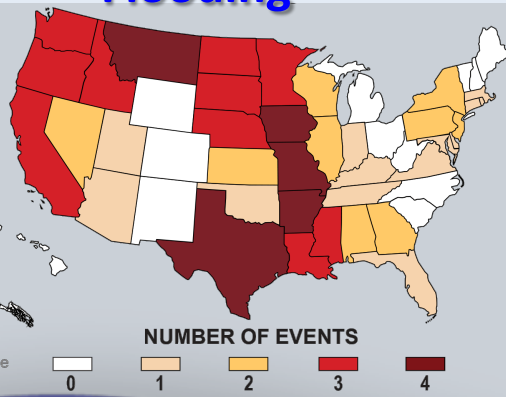
Hurricanes and Tropical Storms



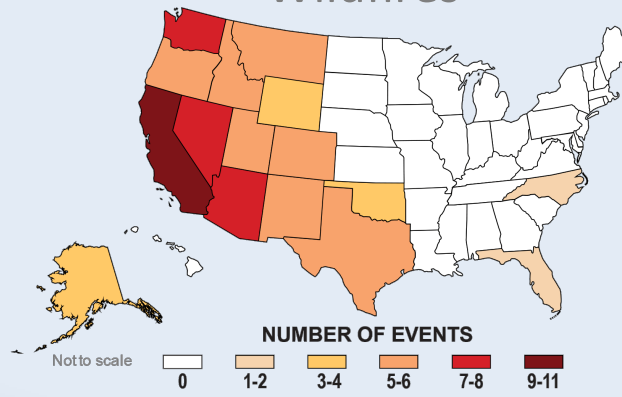
Winter Storms and Crop Freezes



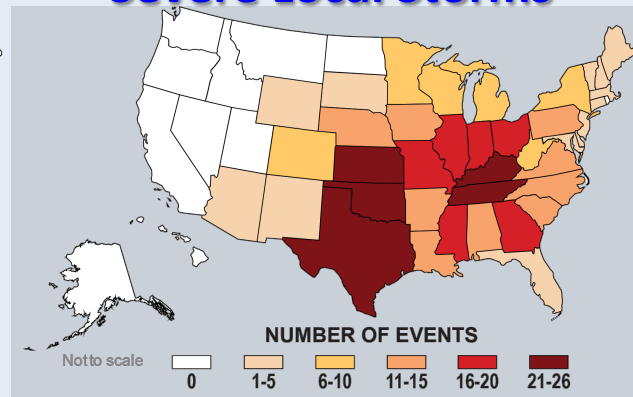
Flooding



Wildfires



Severe Local Storms

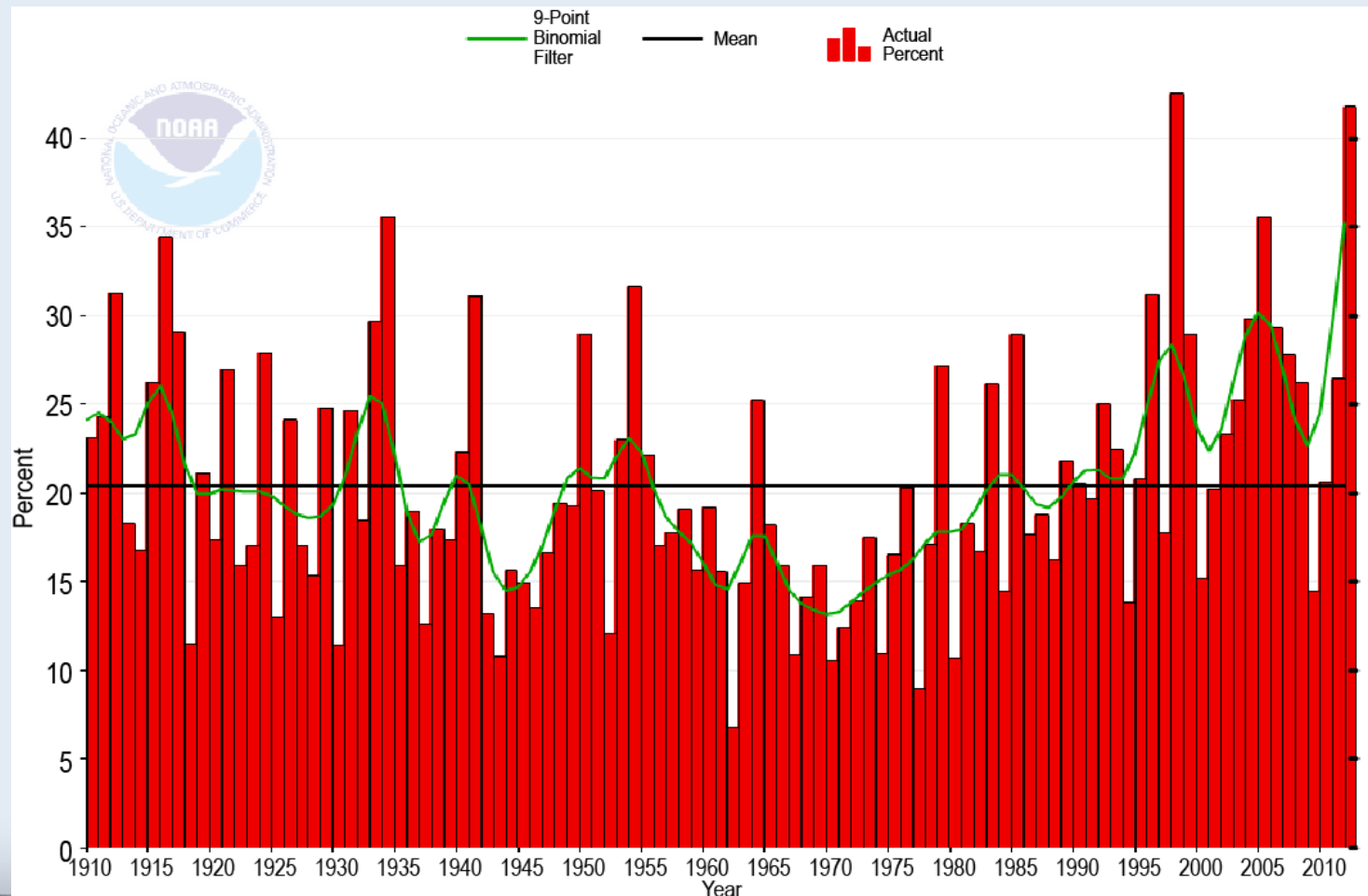


*144 weather and climate disasters reached or exceeded \$1 billion during this period



U.S. Climate Extremes Index

Contiguous U.S. With Tropical Cyclone Indicator
Annual (January-December 1910-2012)



IPCC 2013

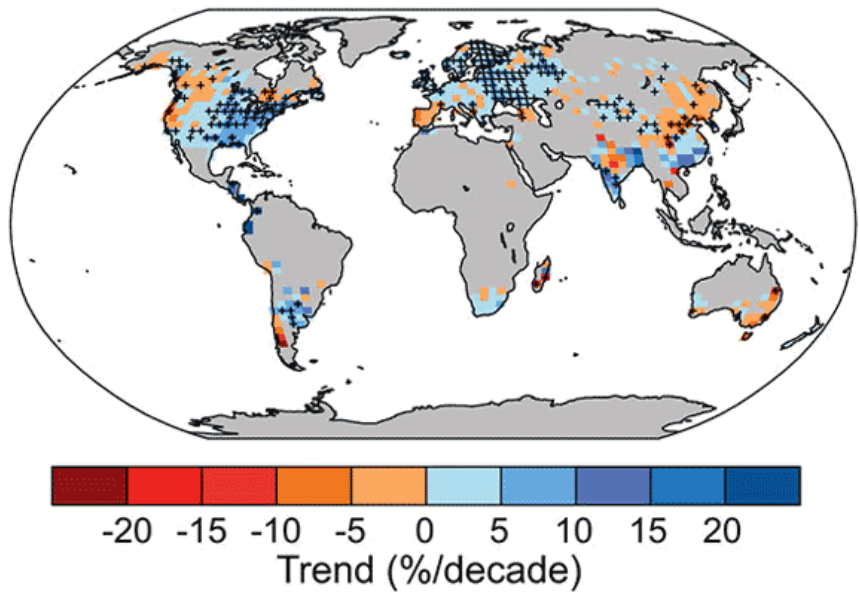
Heavy Precipitation Events

Direction of trend	Assessment that changes occurred (typically since 1950 unless otherwise indicated)	Assessment of a human contribution to observed changes	Likelihood of further changes	
			Early 21 st century	Late 21 st century
Increase in the frequency, intensity, and/or amount of heavy precipitation	<i>Likely</i> more land areas with increases than decreases	Medium confidence	<i>Likely</i> over many land areas	<i>Very likely</i> over most of the mid-latitude land masses and over wet tropical regions

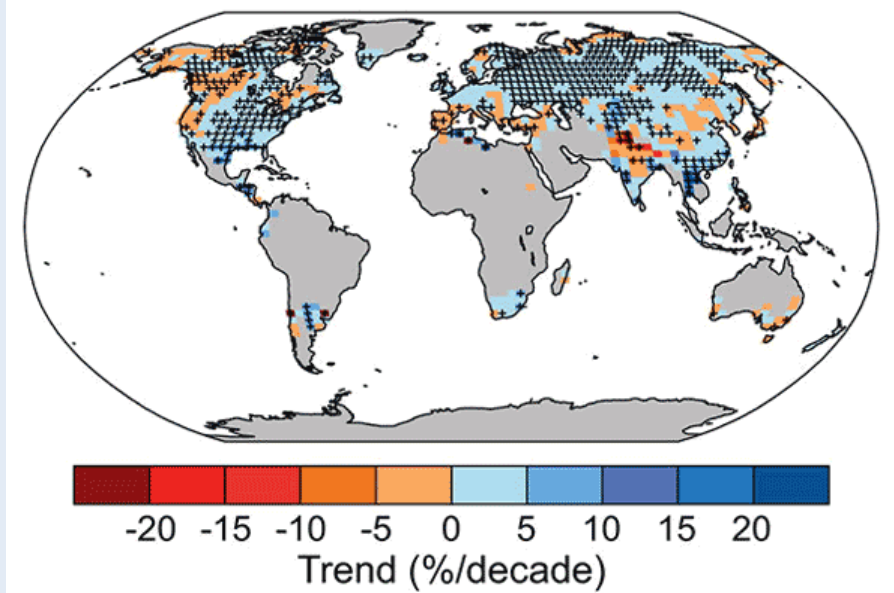
Is this actionable business information?

Trends in Precipitation Trends (IPCC 2013)

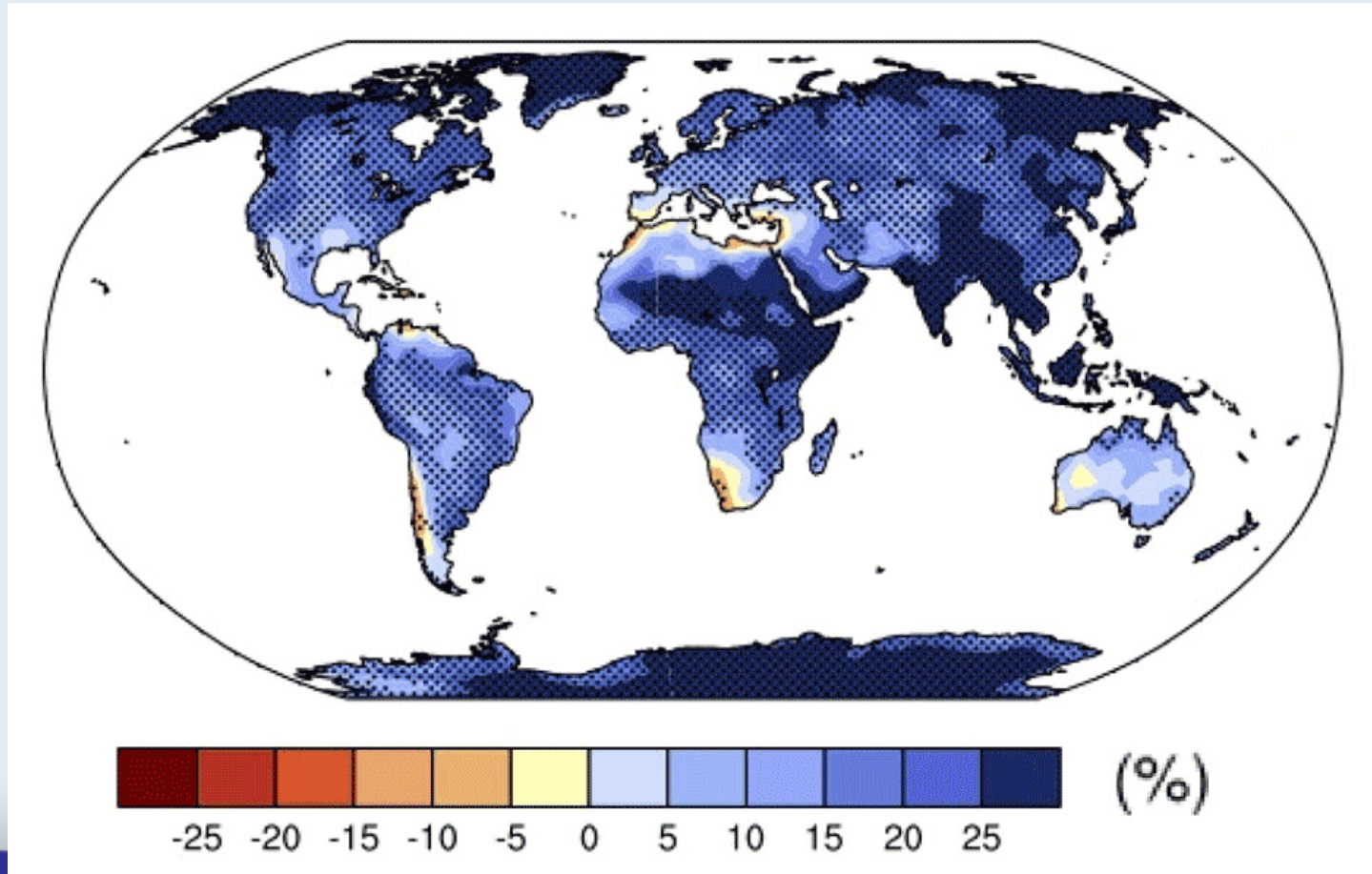
Annual Amount of Precipitation from
Days >95th Percentile 1951-2010



Daily Precipitation Intensity 1951-2010



Maximum 5-Day Precipitation 2081-2100 Minus 1986-2005 (IPCC 2013)



Understanding the Impact of Excessive Precipitation on Different Types of Floods

- Flash flooding
- Riverine and lake flooding
- Tidal and storm surge



- Can occur separately or together
- **Different causes and effects – must be understood individually and collectively**

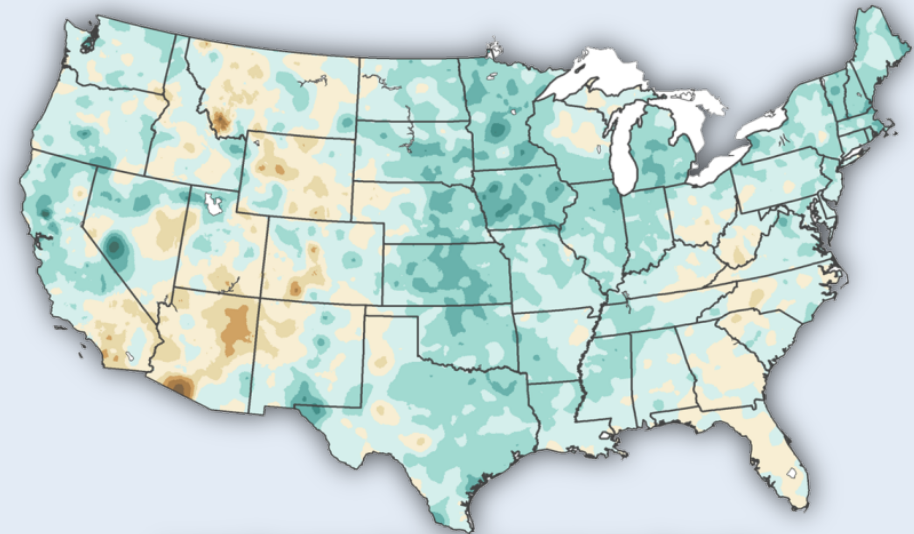
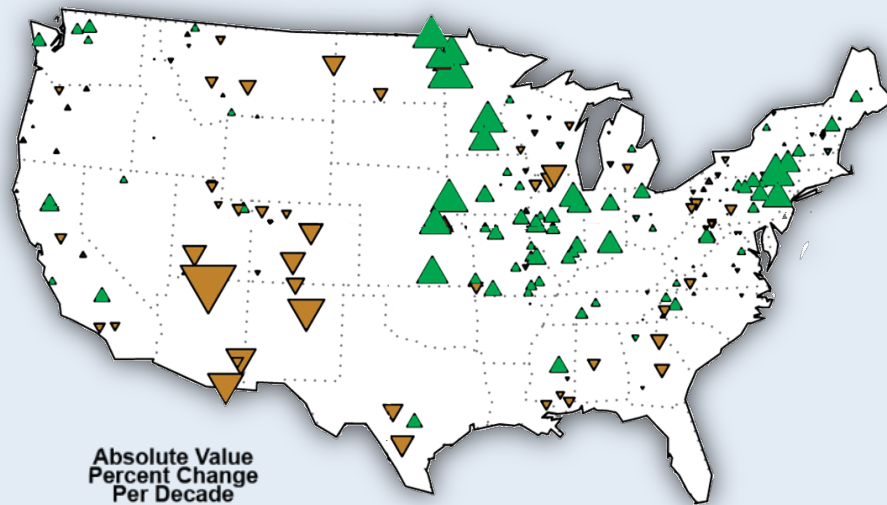
Riverine and Lake Flooding



Trends in Riverine Flooding and Precipitation

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

Trends in Total Annual Precipitation:
1909-2008



Absolute Value
Percent Change
Per Decade



Positive Trends Negative Trends

Least Squares Trend (Percent per Decade)



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

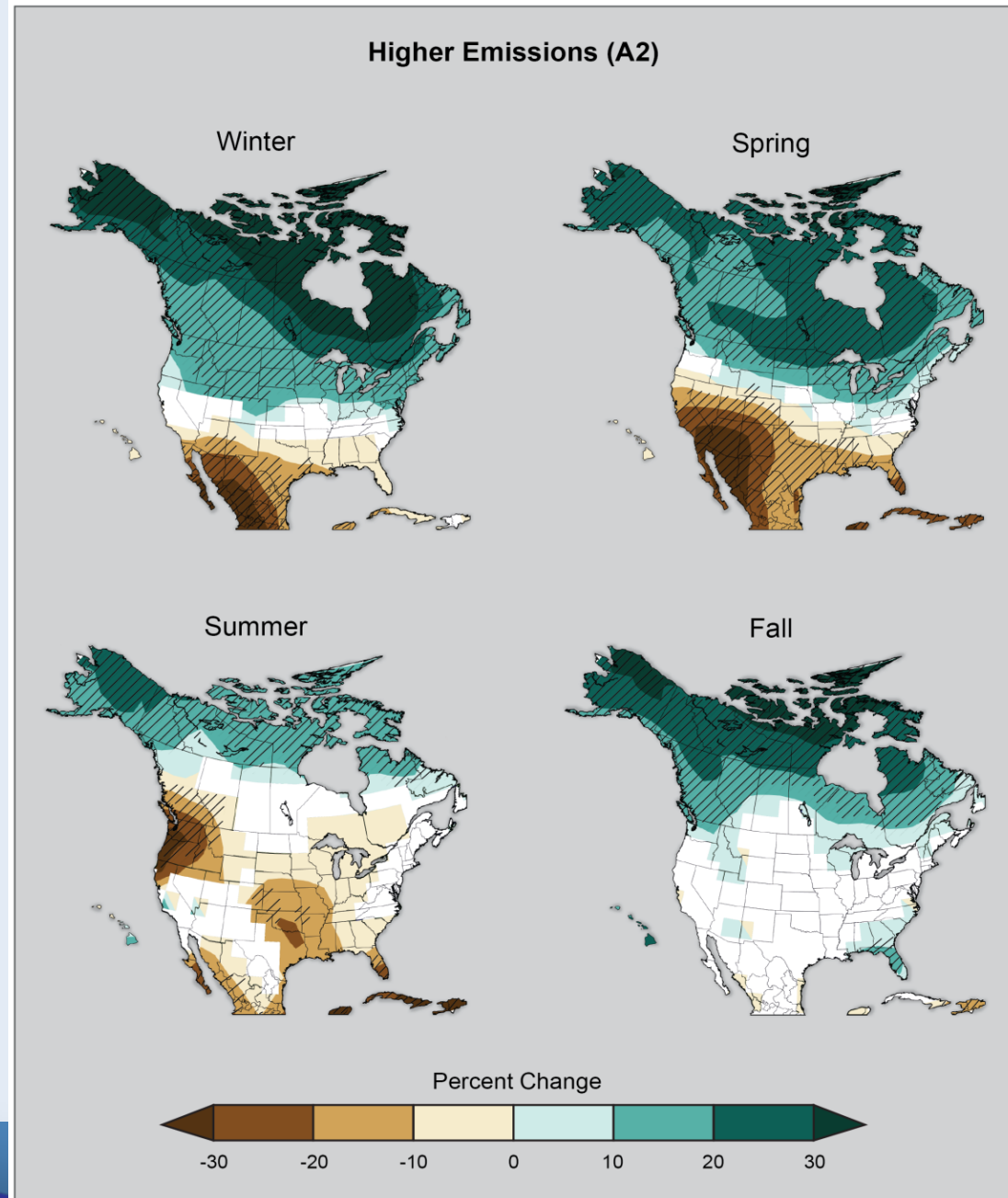
Peterson, T. C. et al., 2013.



Projected Precipitation Change By Season

- 2070-2099 compared to 1971-2000 (with business as usual scenario)

Melillo et al. 2013 National Climate Assessment Draft for Public Comment



Flash Flooding

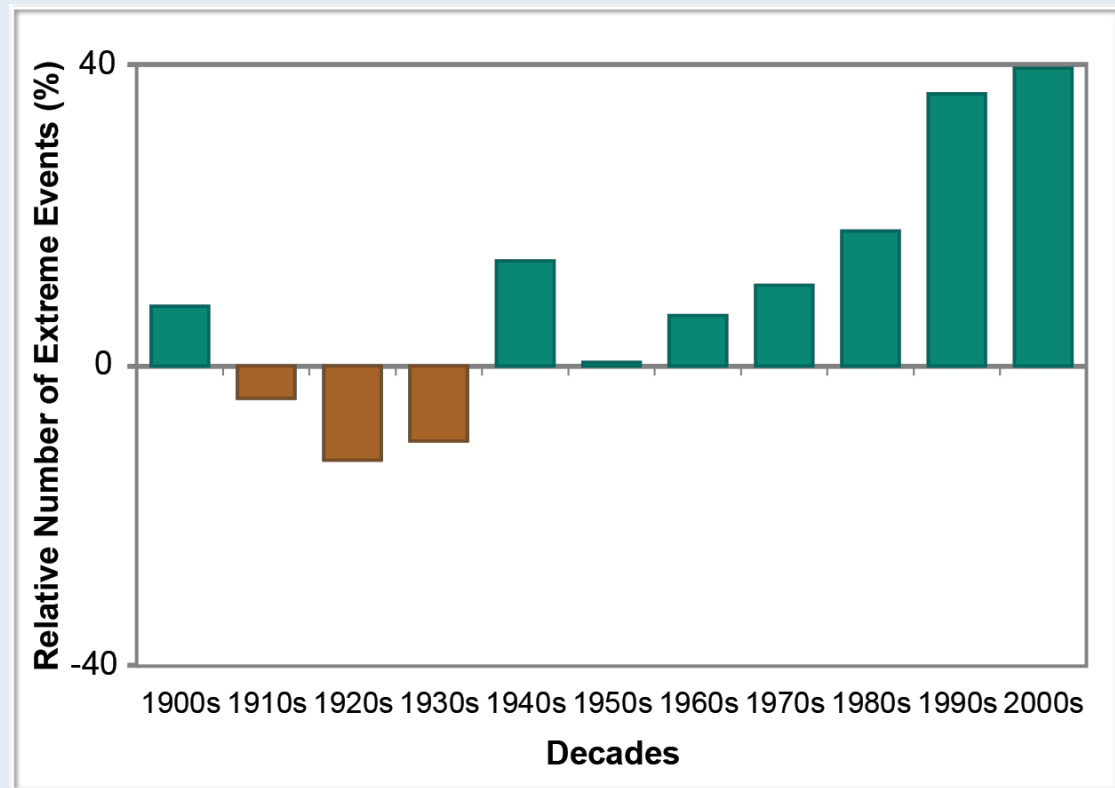


Galloway Wash floods Spur Cross Road, 10.30 AM. Oct 10, 2003. (There is no bridge.) TMcG

Image Credit: NASA, http://wmp.gsfc.nasa.gov/projects/project_FlashFlood.php

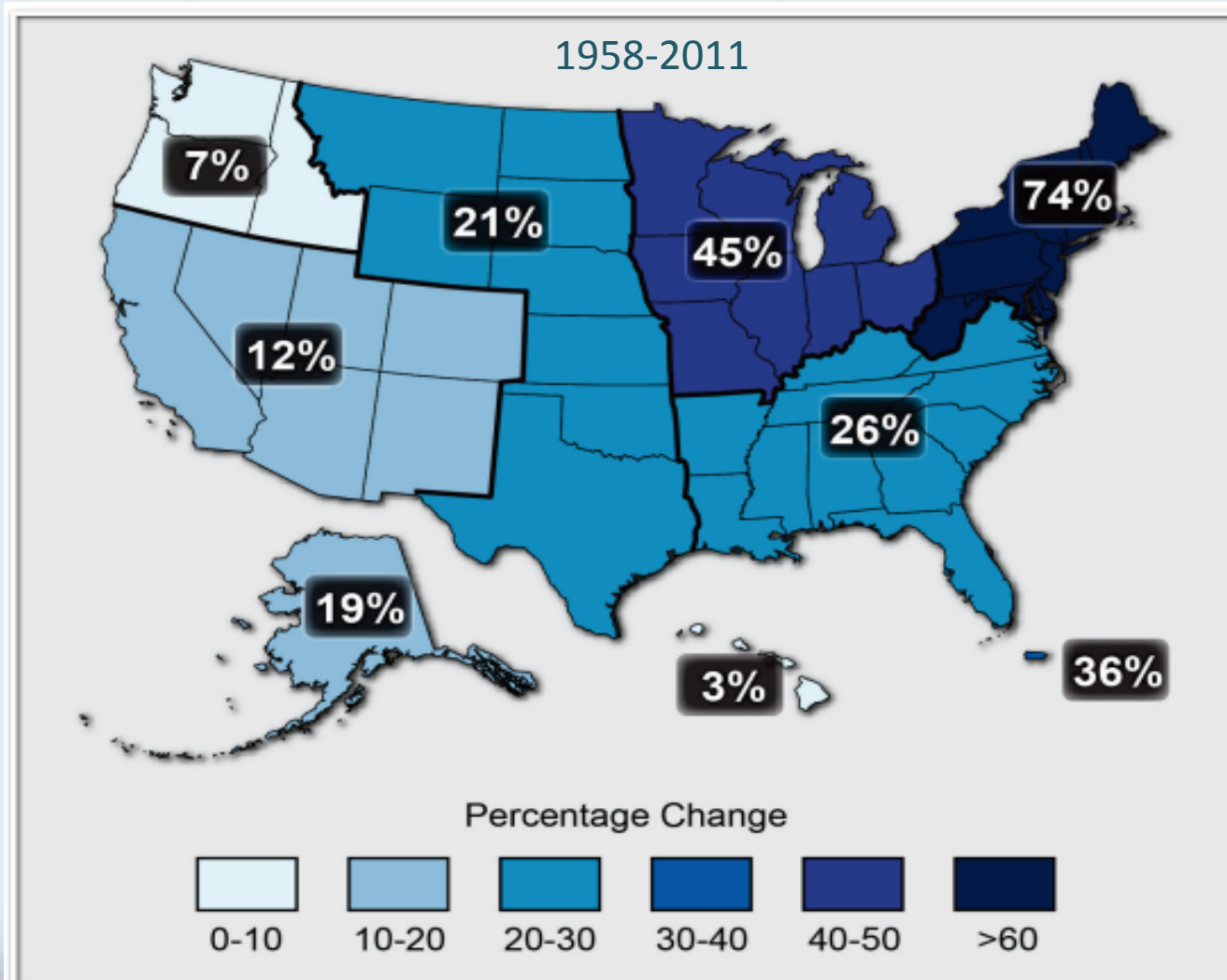
Observed U.S. Trends in Heavy Precipitation “Events”

- Once-in-five-year 2-day total
- Changes are compared to the period 1901-1960 and do not include Alaska or Hawaii.
- The 2000s decade (far right bar) includes 2001-2011



Melillo et al. 2013 National Climate Assessment Draft for Public Comment

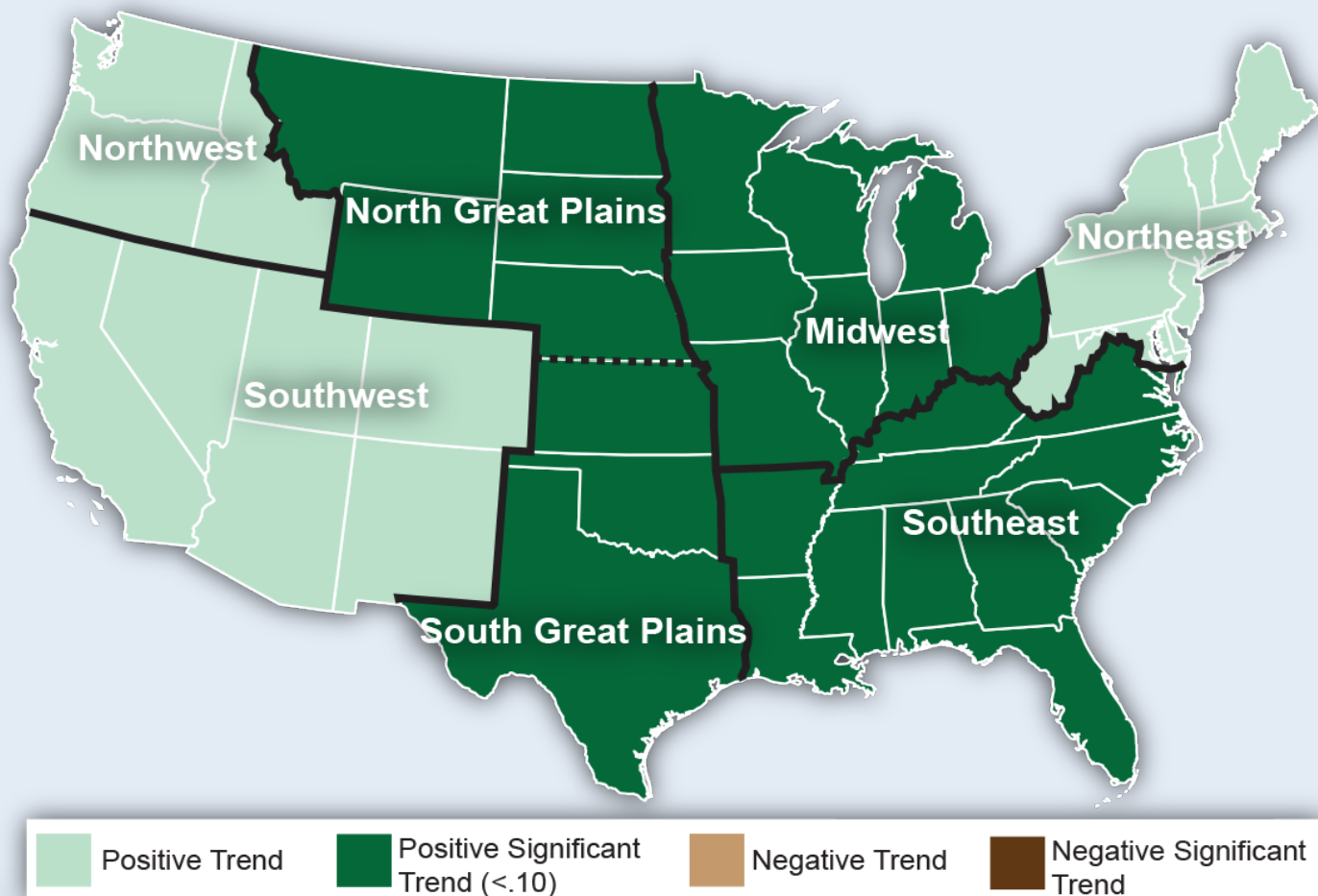
Observed Change in Very Heavy Daily Precipitation Events (Heaviest 1%)



Melillo et al. 2013 National Climate Assessment Draft for Public Comment

Precipitable Water Difference

1990-2009 minus 1971-1989 for daily, 1-in-5-year extreme events

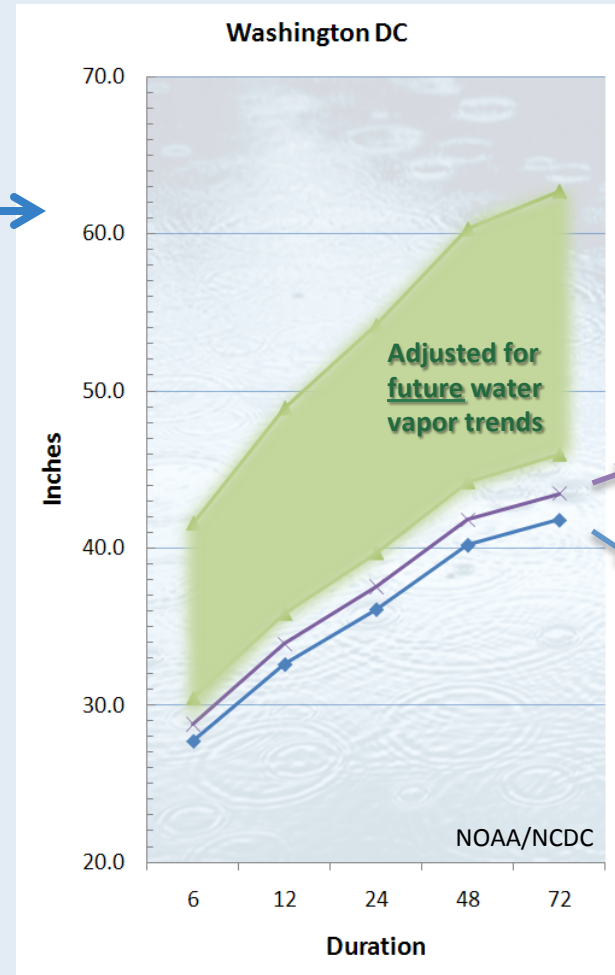
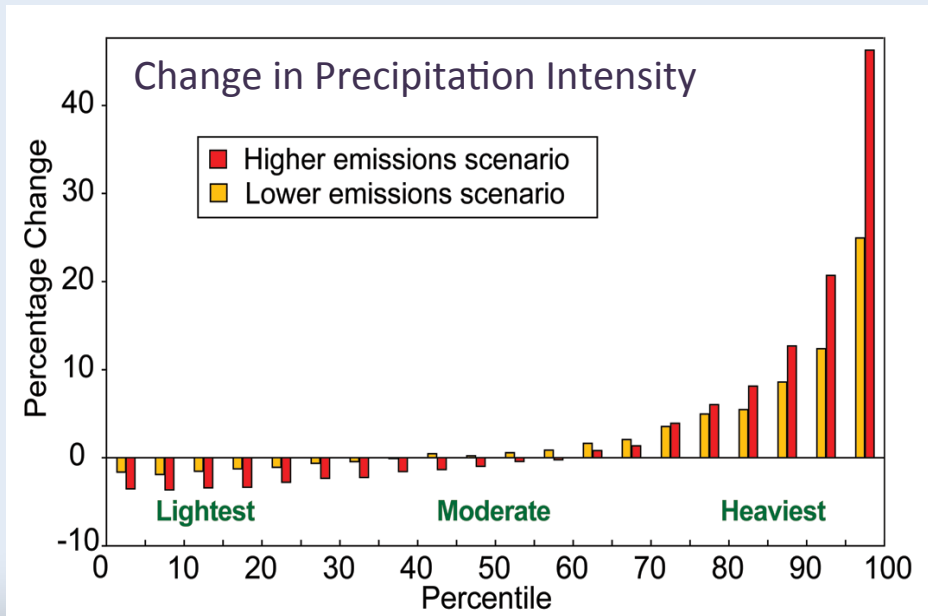


NOAA/NCDC

Extreme Precipitation: Projected Future Trends

- Potential Maximum Precipitation likely to increase with increases in atmospheric water vapor due to warming oceans and increased evaporation

Potential Maximum Precipitation

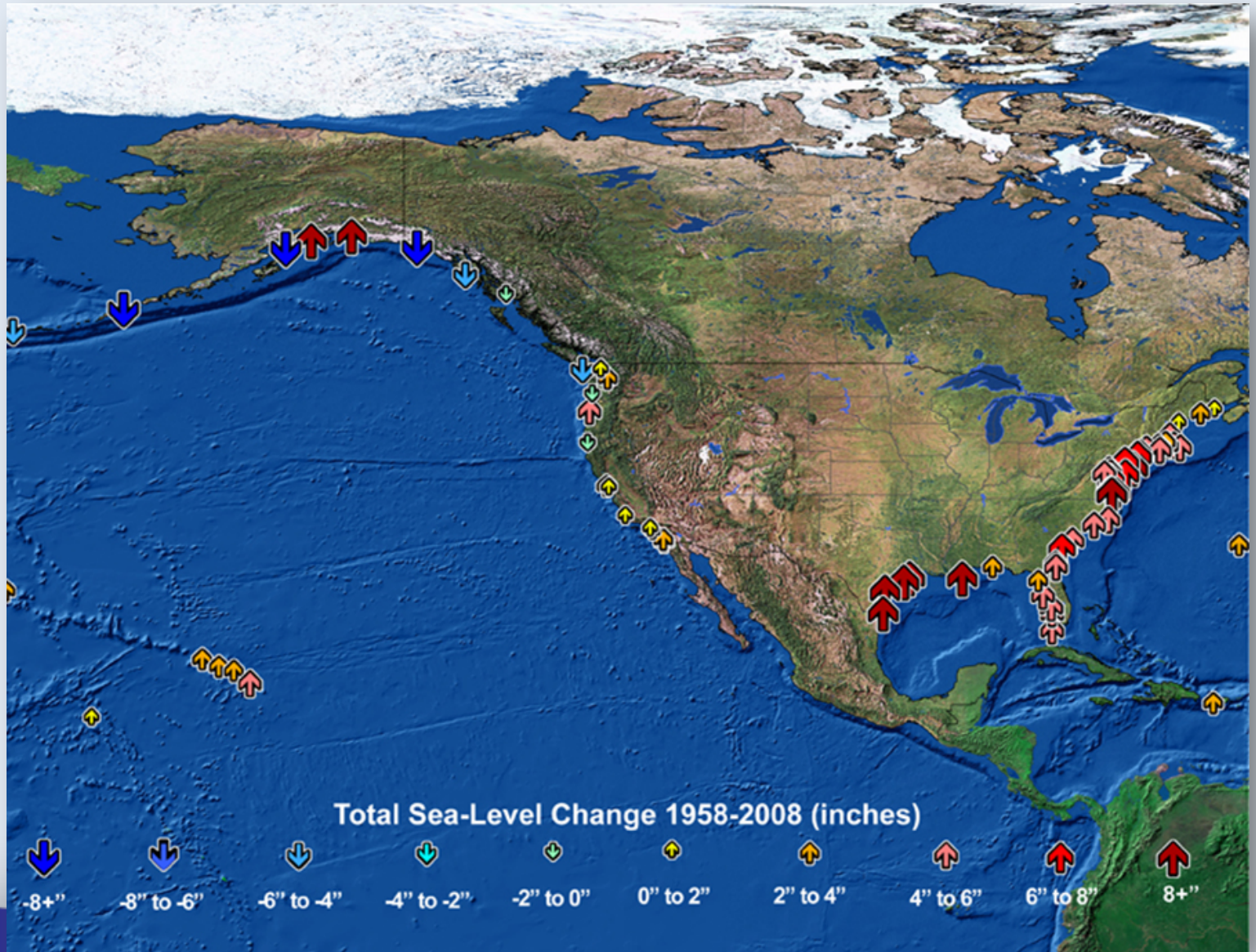


Tidal and Storm Surge



Hurricane Sandy coastal flooding in Mantoloking, N.J.
Image Credit: New Jersey National Guard/Scott Anema.

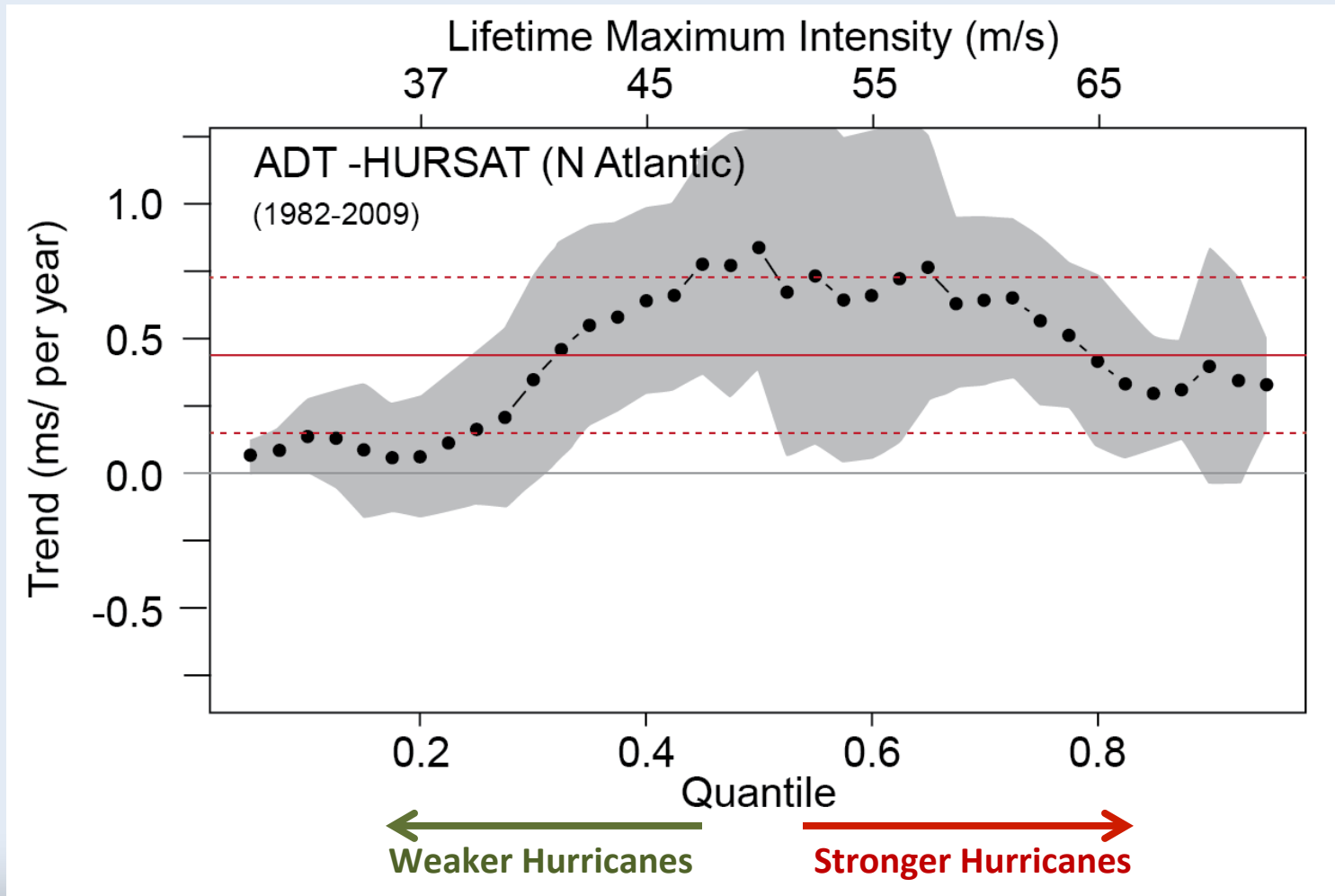
Sea Level Trends



Karl et al. (eds.)
2009 Global
Climate
Change
Impacts in the
United States

North Atlantic Hurricane Intensity Trends

Storm Surge Relevant



Kossin et al. 2013, in press Journal of Climate

Questions?

- **Can a public-private partnership help to sort out what is needed for business plans?**
 - Potential partners
 - Government
 - Business
 - Weather/climate service private sector providers



Public-Private Partnerships

Some Desirable Attributes

Informed by National Council for Public-Private Partnerships

1. Champions

- Recognized figures serve as spokespersons and advocates



2. Statutory Environment

- Statutory foundation for the implementation of partnership programs

3. Public Sector's Organized Structure

- Dedicated team for PPP projects/programs
- Develops requests for proposals that includes performance metrics/goals

4. Business Plan

- Responsibilities, risks, and benefits of both public and private partners

5. Clearly Defined Revenue Stream for a Secretariat

6. Stakeholder Support

- An open access way of doing business

7. Partners

- Experience and expertise critical in maintaining the relationship

Questions?

