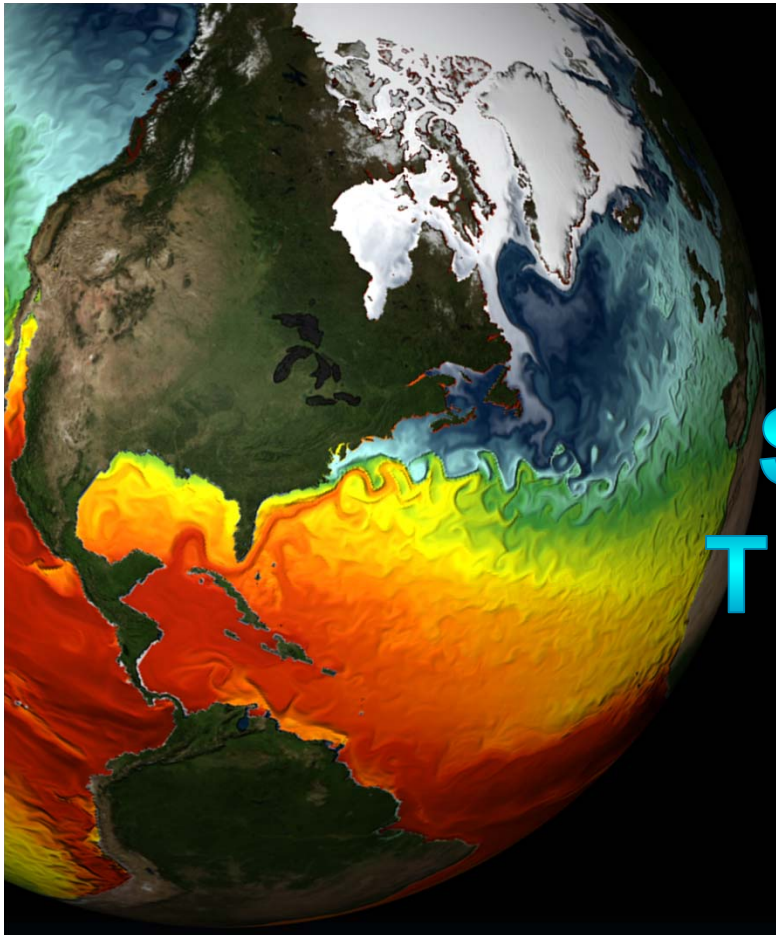


WHAT DOES THE SCIENCE TELL US? THE 2013 DRAFT U.S. NATIONAL ASSESSMENT

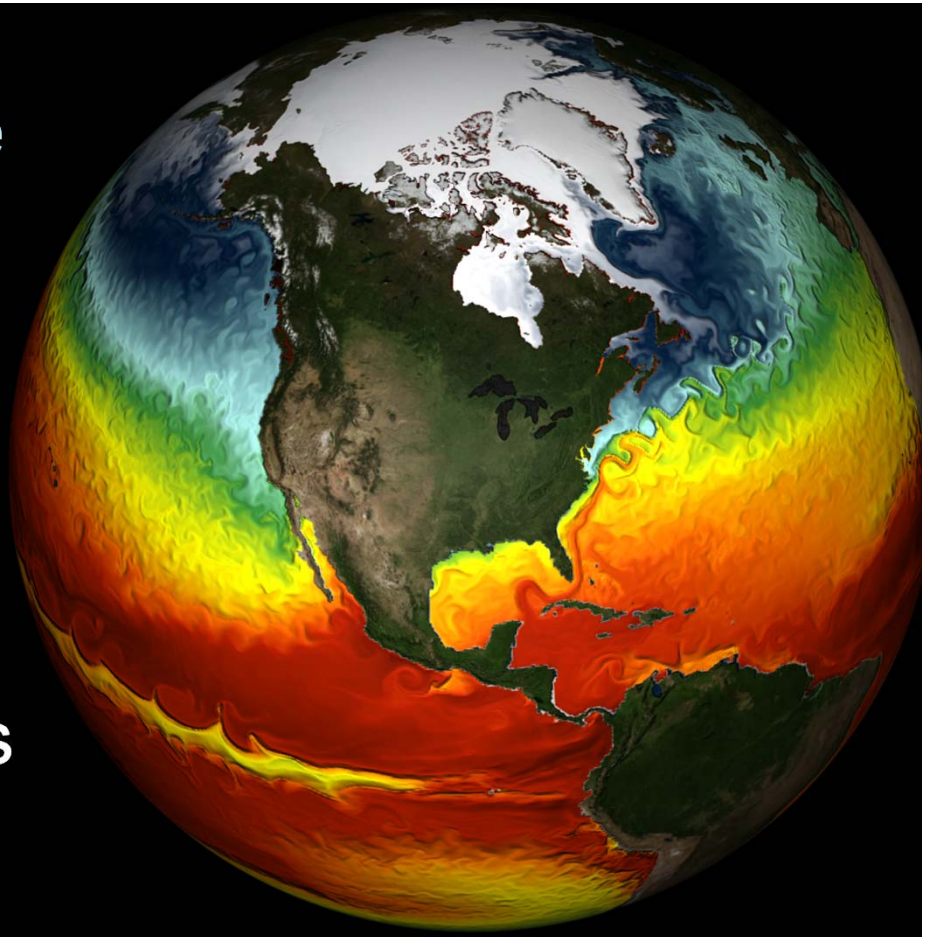
Ellen L. Mecray
NOAA Regional Climate Services Director, Eastern Region
Taunton, MA

Regions of the US National Climate Assessment

National Climate Assessment
U.S. Global Change Research Program

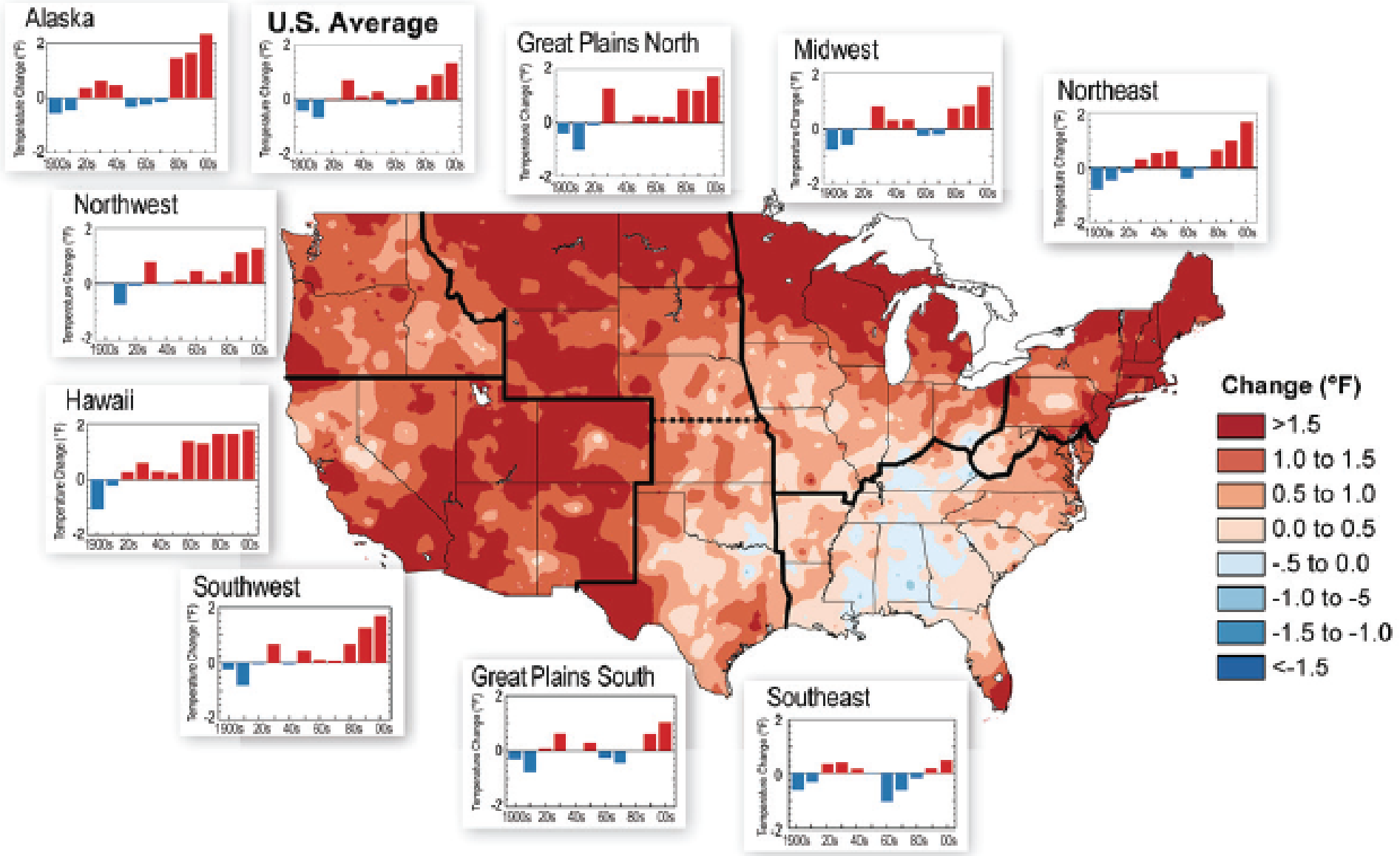
What we Observe: Climate changes and impacts

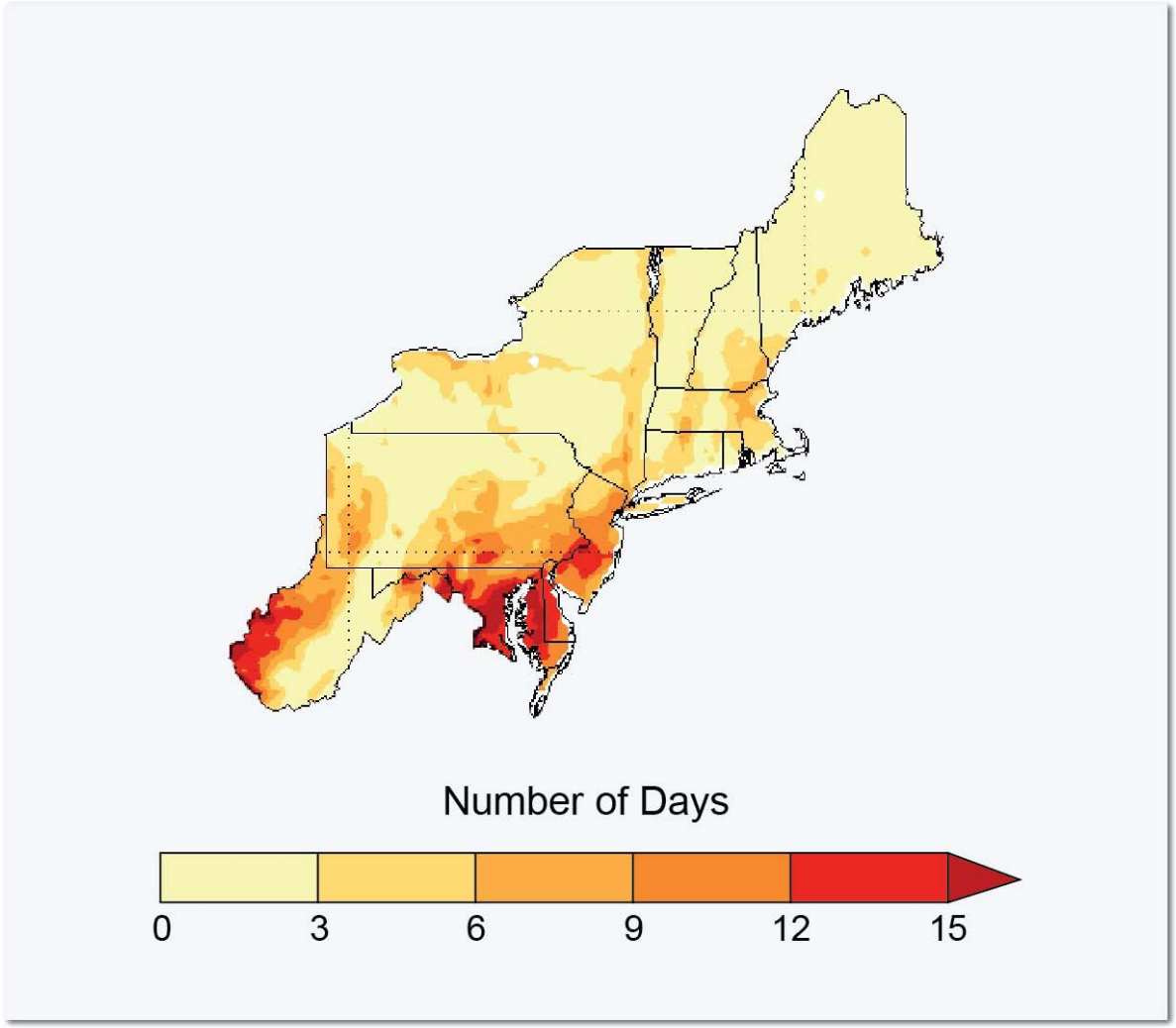
- Increasing temperature
- Increasingly intense downpours
- Rising sea level
- Rapidly retreating glaciers
- Thawing permafrost
- Longer growing season
- Longer ice-free season in the ocean and on lakes and rivers
- Earlier snowmelt
- Changes in river flows



GFDL CM2.4 climate model SSTs

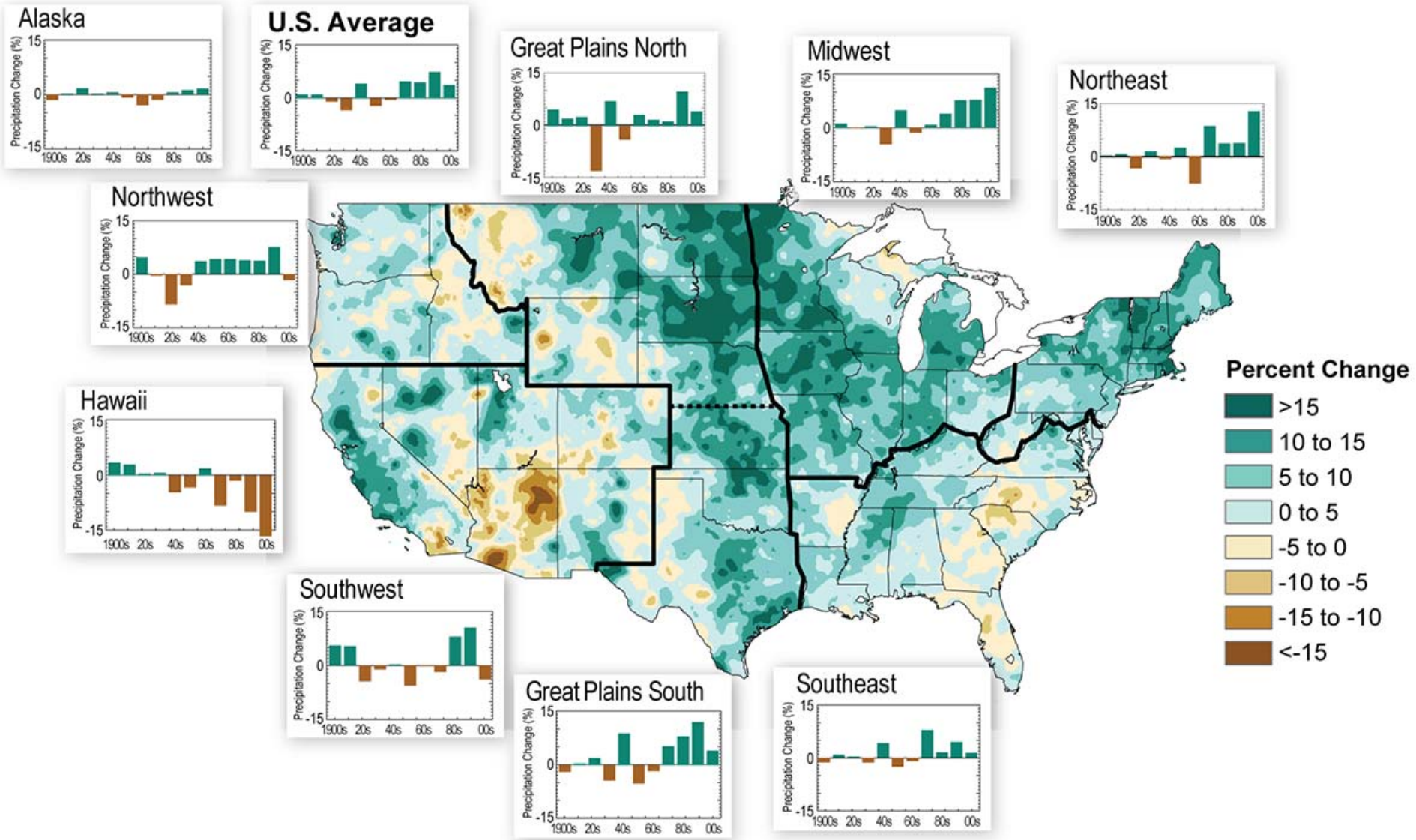
Trends in U.S. Temperature: Decadal trends and 1991-2011 relative to 1901-1960





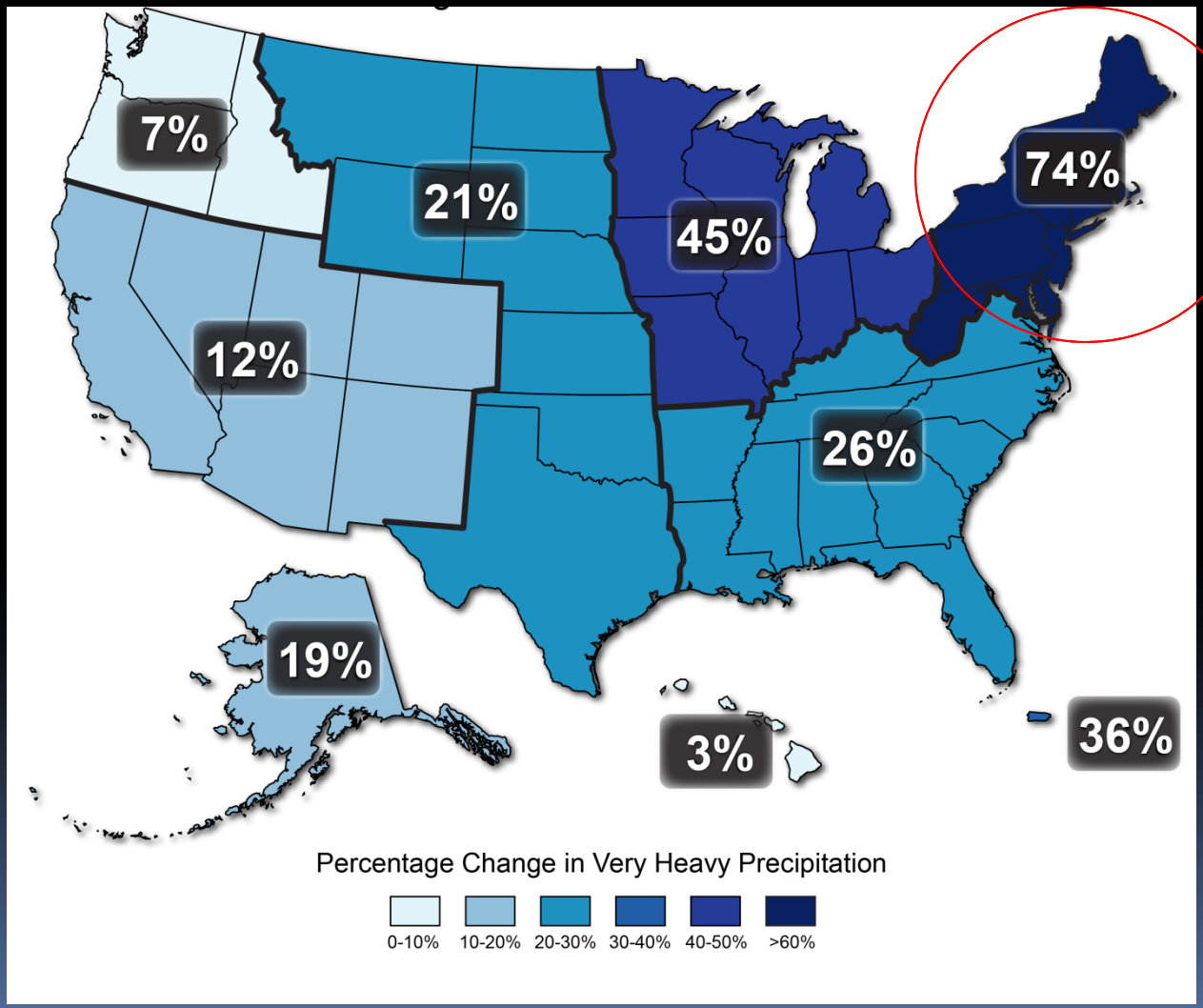
Projected average increases in the number of days with a maximum 12 temperature greater than 95°F between 2041-2070, compared to 1971-2000 assuming 13 continued increases in global emissions (A2 scenario). (Figure source: NOAA NCDC / 14 CICS-NC. Data from CMIP3 Daily Multi-model Mean.)

Trends in U.S. Precipitation: Decadal trends and 1991-2011 relative to 1901-1960



Change in Heavy Rainfall Events

*U.S. Increase in the amount falling in very heavy rain events**

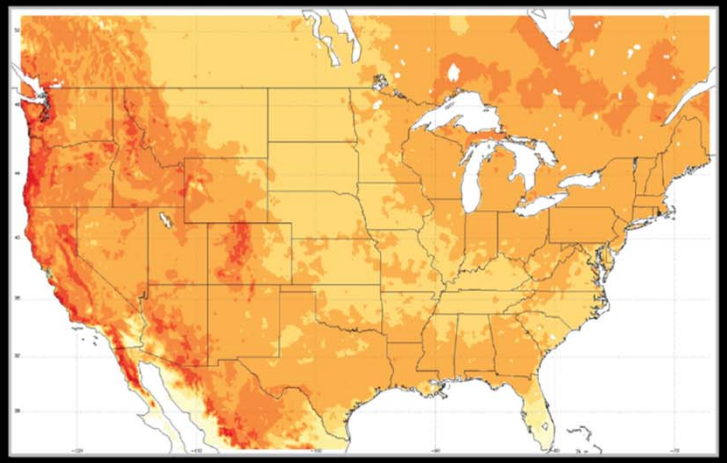


2009 Report for the Northeast: 67% increase relative to 1958 to 2007

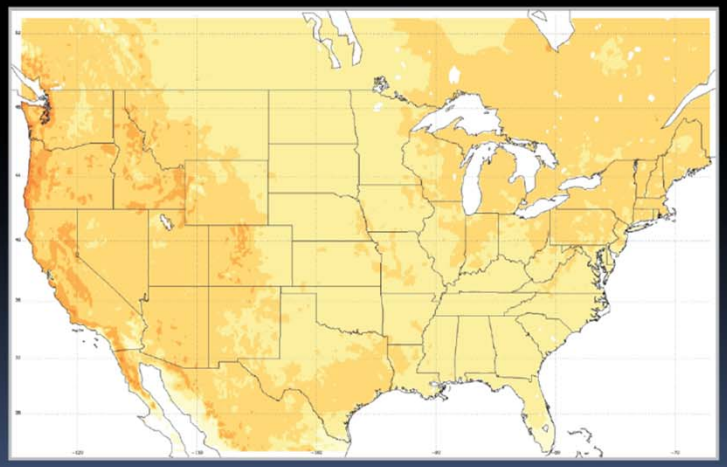
*** Defined as the heaviest 1 percent of all daily events from 1958 to 2010**

2013 National Climate Assessment, in preparation

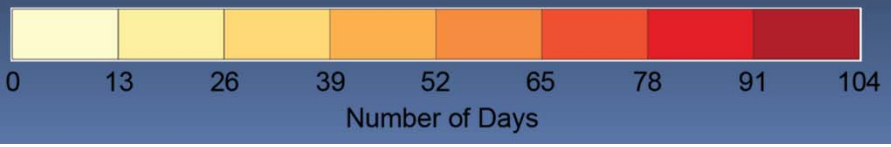
PROJECTED CHANGES IN FROST-FREE SEASON LENGTH 2081-2100 COMPARED TO 1971-2000



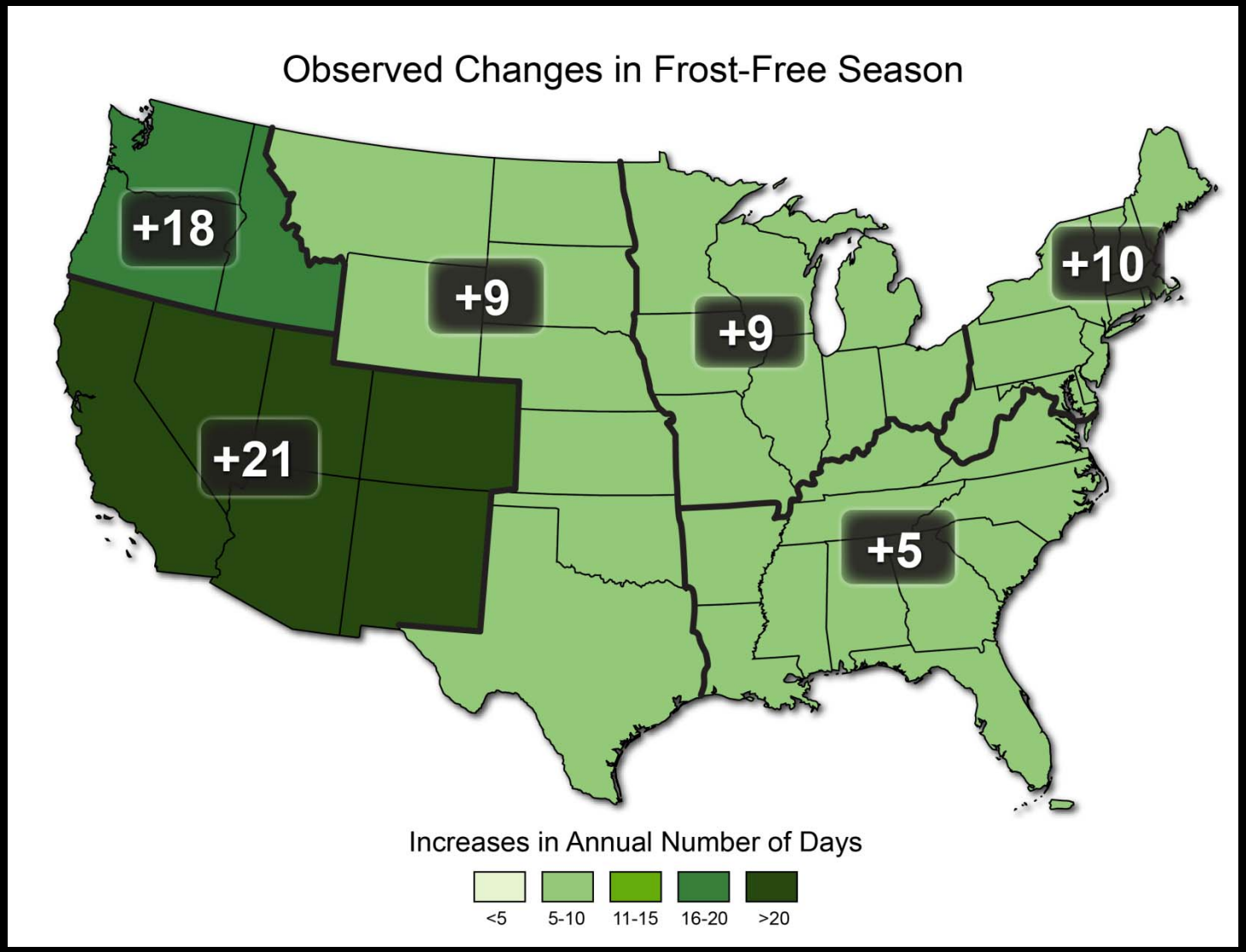
Higher emissions



Lower emissions

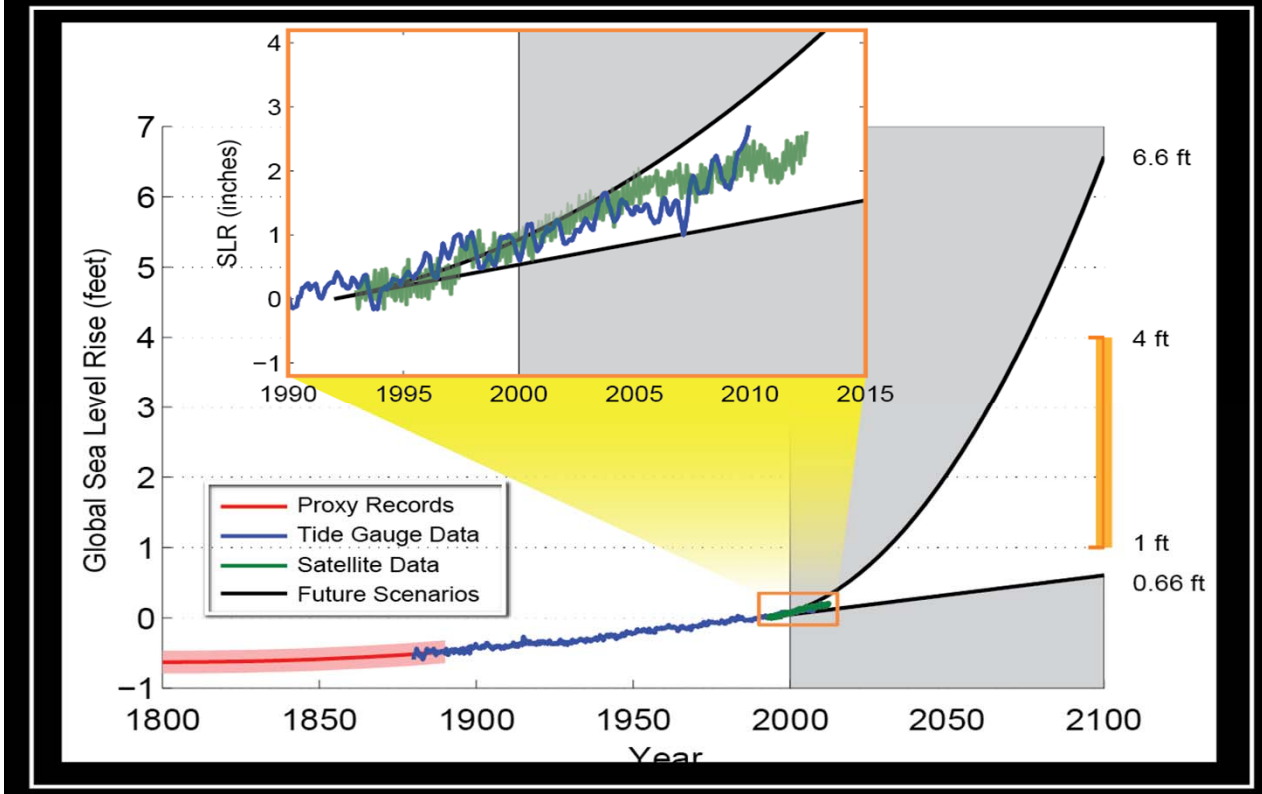


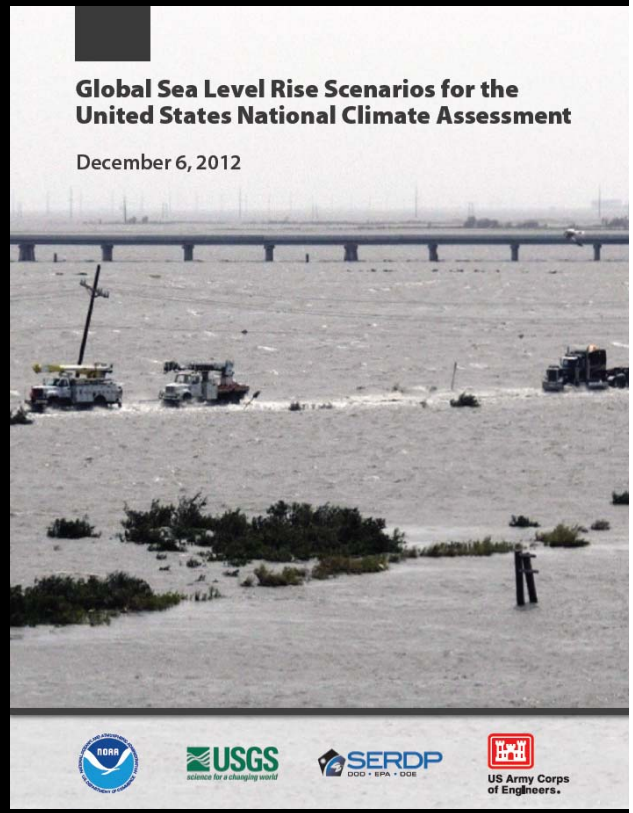
U.S. Growing season is lengthening



Observed Trends: 1991-2011 relative to 1901-1960

Sea Level Rise

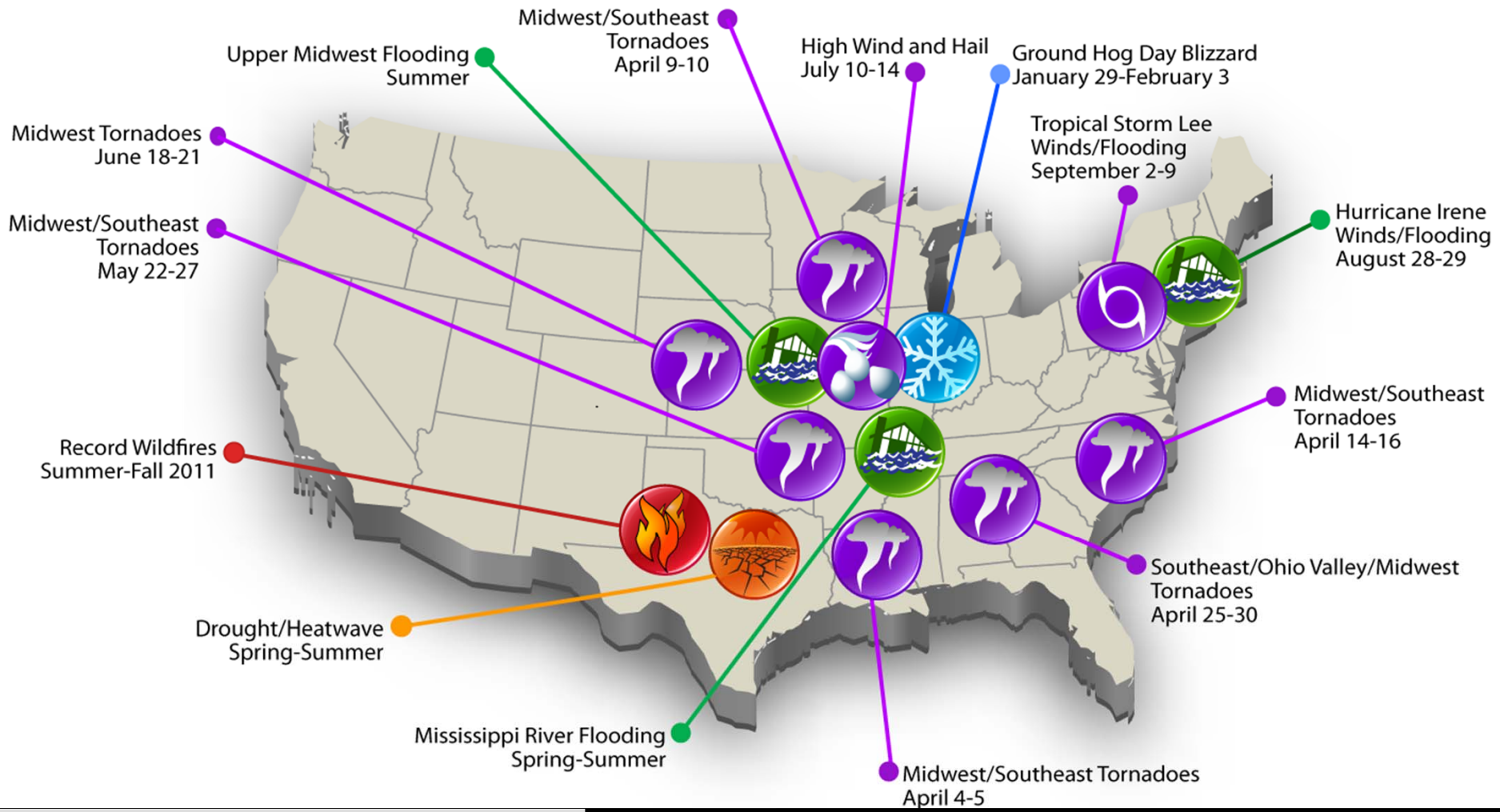




We have very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100.

Parris et al. 2012

Billion-Dollar Weather and Climate Disasters 2011



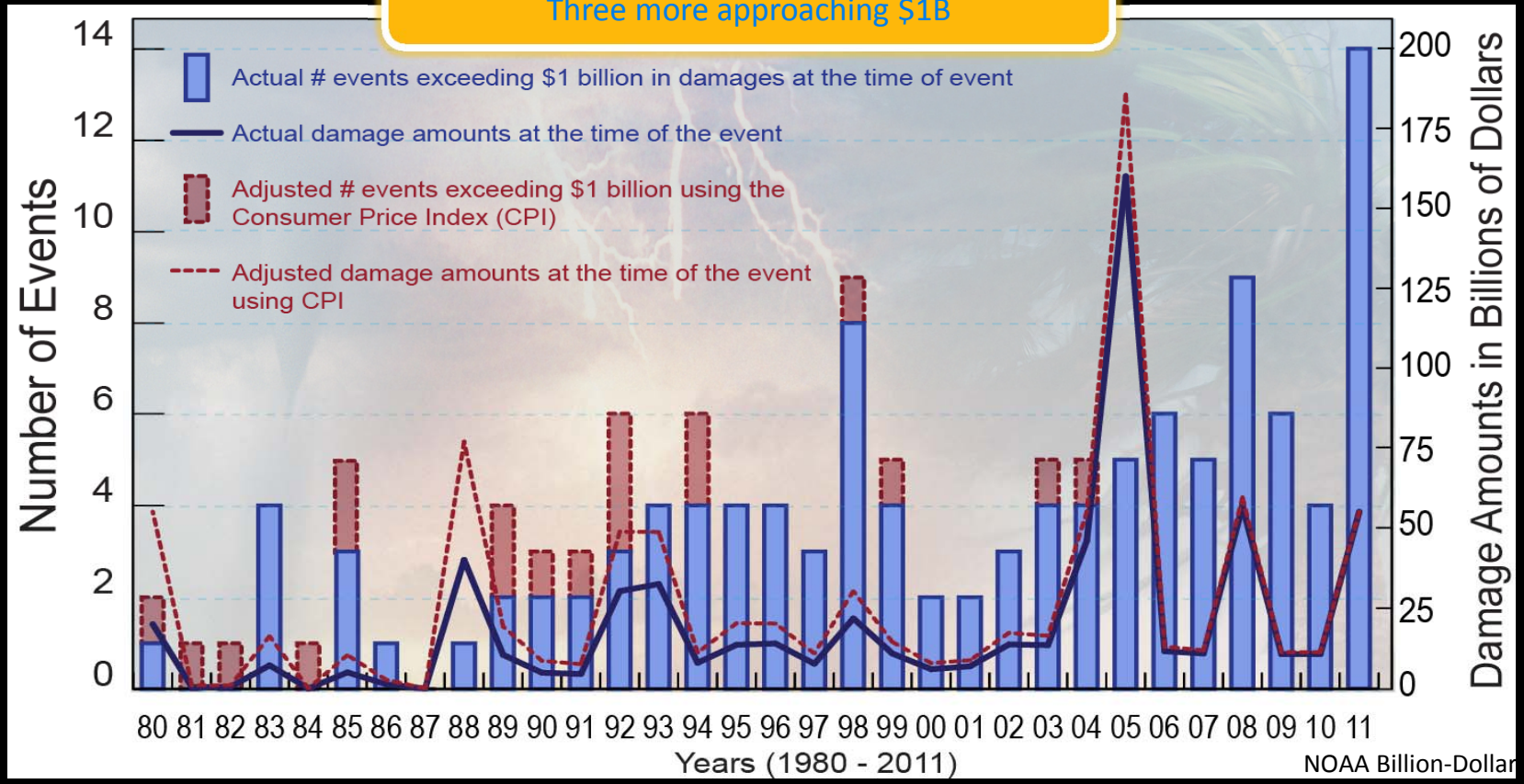
Three more in 2011 approaching $1B

1. Late-October Northeast winter storm
2. April 19-20 Midwest and Southeast tornadoes
3. August 18-21 Midwest and East high wind & hail

Billion-Dollar Weather and Climate Disasters

- Since 1980, 114 billion-dollar weather and climate disasters in U.S.
- Total losses since 1980 of billion-dollar disasters exceed $800 billion.
- Is the U.S. becoming more exposed and/or sensitive to severe events?

A Record 14 Disasters in the U.S. in 2011
Three more approaching $1B

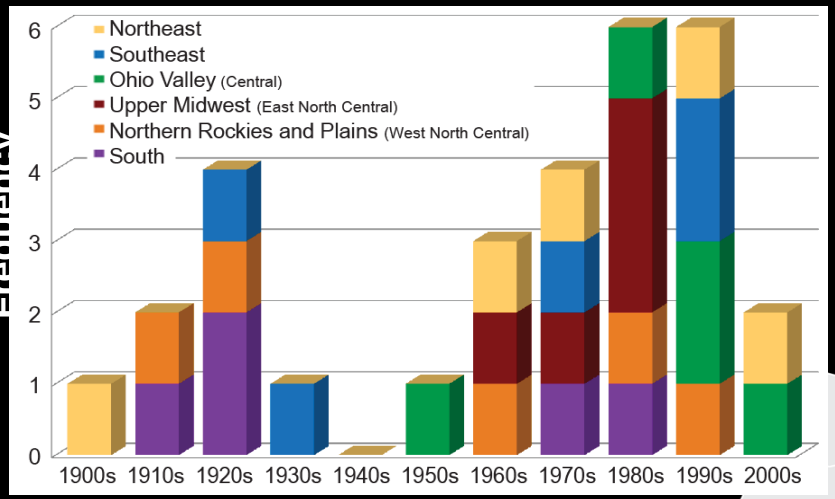


NOAA Billion-Dollar

http://www.ncdc.noaa.gov/oa/reports/billionz.html

Extreme Snowstorms

Most severe storms for each of the six climate regions from 1900 to 2010

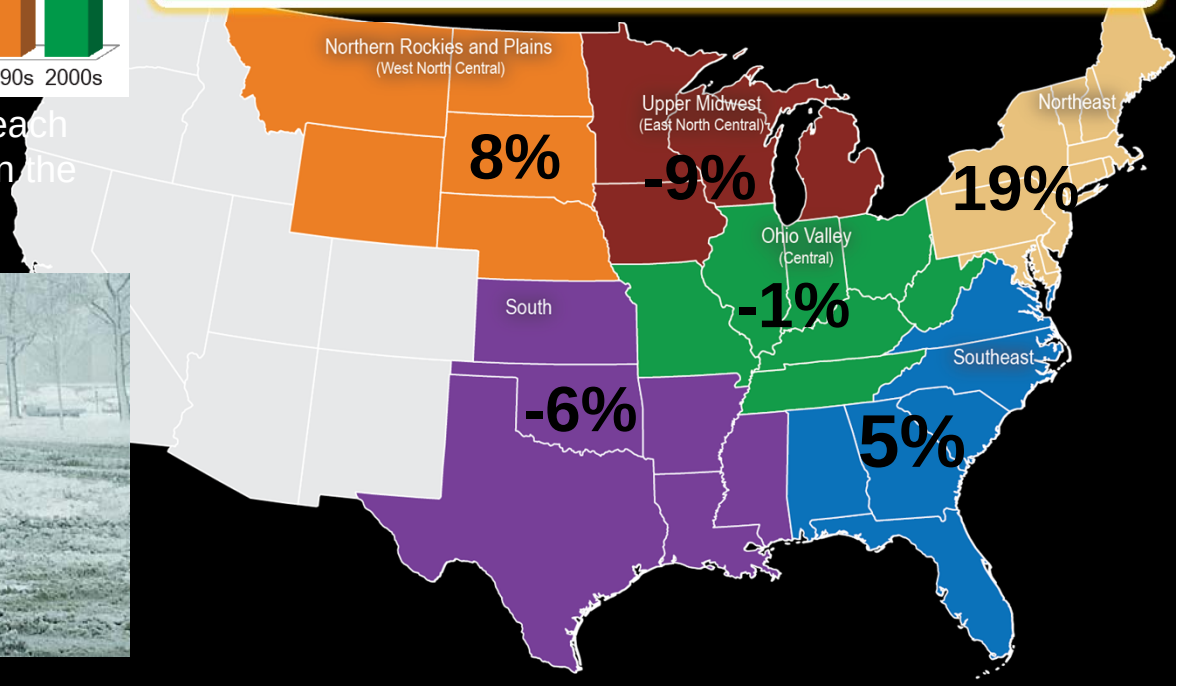


Number of extreme snowstorms occurring each decade within the six U.S. climate regions in the eastern two-thirds of the contiguous U.S.

Temperature Anomalies During Season of Extreme Events

- Every region had two of the five storms of record occurring during seasons with above average temperatures

Precipitation Anomalies During Season of Extreme Events

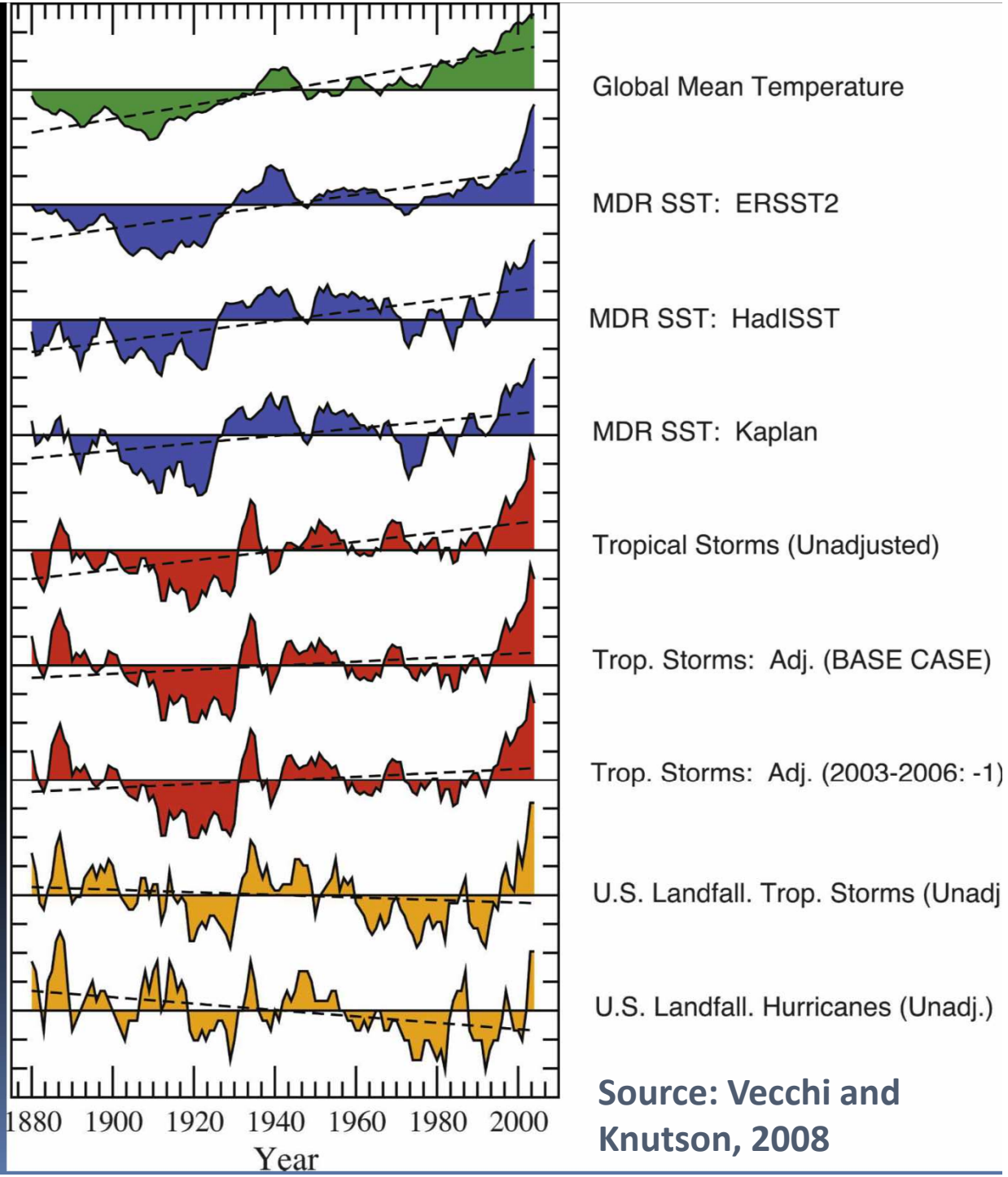


Kunkel, K.E., et al., 2012 (Tentatively Accepted). *BAMS*.

Hurricanes and climate change

There has been a vigorous debate over the impacts of warming on hurricanes:

1. Methodology for "counting" hurricanes has changed over time;
2. Hurricane development is cyclical;
3. While SST have increased, so have other factors such as wind shear, atmospheric stability & humidity.



Source: Vecchi and Knutson, 2008

Key Messages

- Heat waves, coastal flooding due to sea level rise, and river flooding due to more extreme precipitation events will pose a growing challenge to the region's environmental, social, and economic systems.

- Infrastructure will be increasingly compromised by climate-related hazards including sea level rise and coastal flooding, and intense precipitation events

- Agriculture and ecosystems will be increasingly stressed by climate-related hazards, including higher temperatures, sea level rise and coastal flooding, and more extreme precipitation events.

- While a majority of states and several municipalities have begun to incorporate the risk of climate change into their planning activities, implementation of adaptation measures is still at early stages.

Observed Climate Change

- Temperatures across the region have increased by an average of 2˚F since 1895
- Annual precipitation across the region has increased by about 5 inches since 1895
- Sea level has risen approximately 1 foot and coastal flooding has increased since 1900
- Precipitation from extreme events has increased 74% since 1958, more than any other US region

Projected Climate Change

- Will be highly dependent on future greenhouse gas emissions
  - Projections for temperature increase by the 2080s ranges from 3˚F to 6˚F under a low emissions scenario to 4.5˚F to 10˚F under a high emissions scenario
  - Frequency, intensity and duration of heat waves expected to increase
    - May be most pronounced in parts of MD, WV, DE and NJ
  - Frequency, intensity and duration of cold air outbreaks expected to decrease
  - Precipitation changes less certain, although extreme events and flooding are expected to increase
  - Global sea levels projected to rise 1-4 feet, with the Northeast exceeding global average by roughly 4 inches
  - Hurricane intensity and frequency of more intense hurricanes expected to increase, but overall frequency expected to decrease
  - Arctic Sea Ice melting may be significant factor