



# High-Impact Weather and Climate Change

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# October 2012 - Hurricane Sandy

- Affected 20 states
- Fatalities: 185 (US: 113)
- Damage (estimated): \$52 billion



**New Jersey**

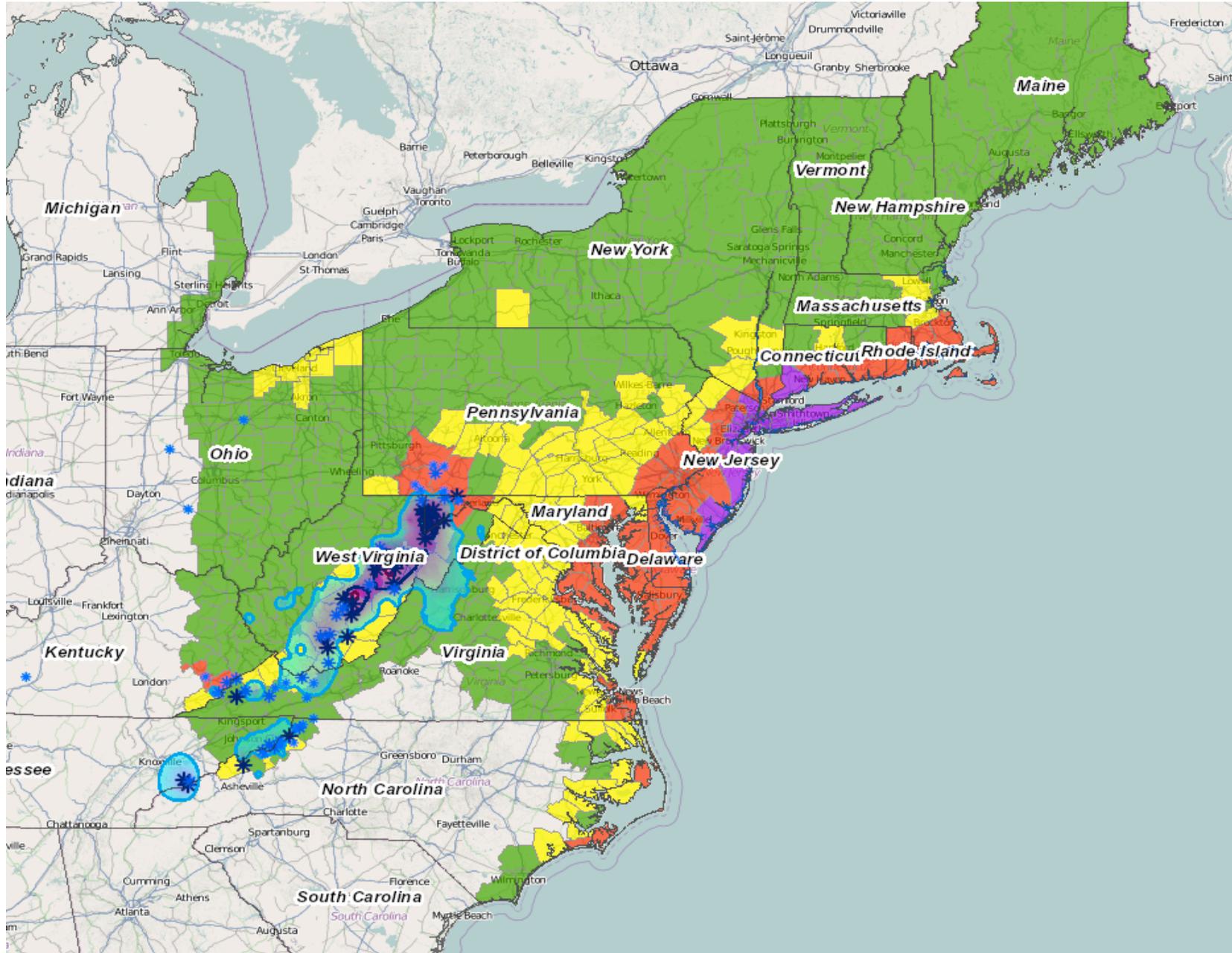


**New York**

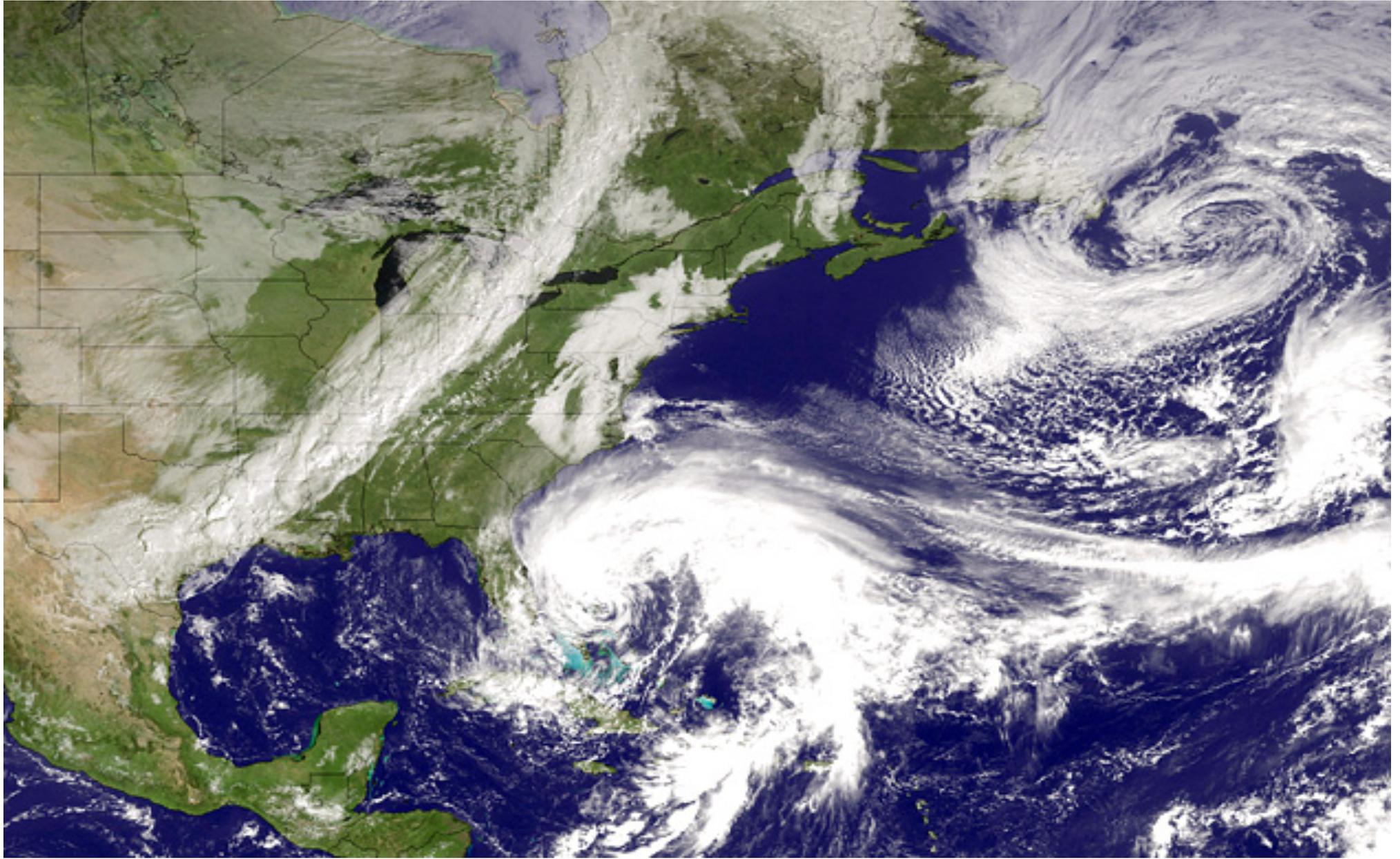


**Rhode Island**

# FEMA: Sandy's Impact



# Sandy and Surrounding Weather Systems



# Hurricane Sandy and Climate Change: Media

- “It’s Global Warming stupid” Bloomberg Businessweek
- “Will Climate Change get some respect now?” NY Times
- “Hurricane Sandy: Is climate change to blame?” Week Magazine.
- “Effect of climate change increases risk of storms’ impacts” Boston Globe

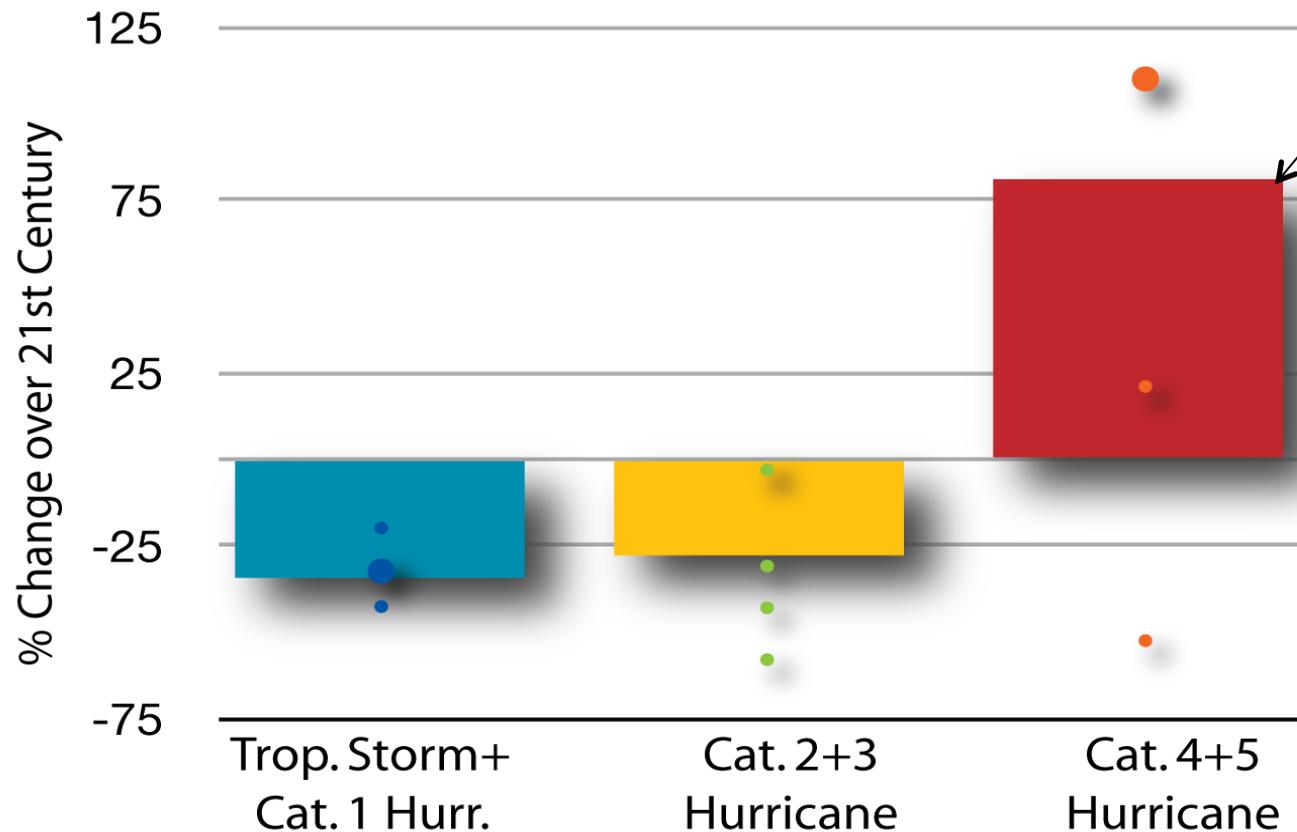
# Hurricane Sandy and Climate Change

## Scientists: More studies are needed

- Possible contributing factors:
  - Record breaking sea surface temperatures off the US east coast
  - Weaker jet stream, which favors slow-moving weather systems, possibly due to reduced poleward temperature gradients
  - Large “blocking” Arctic weather system north of Sandy, possibly enhanced by ice melting and Arctic warming.

# Projected Late 21<sup>st</sup> Century Changes in Atlantic Hurricanes

Projected Changes in Atlantic Hurricane Frequency over 21st Century

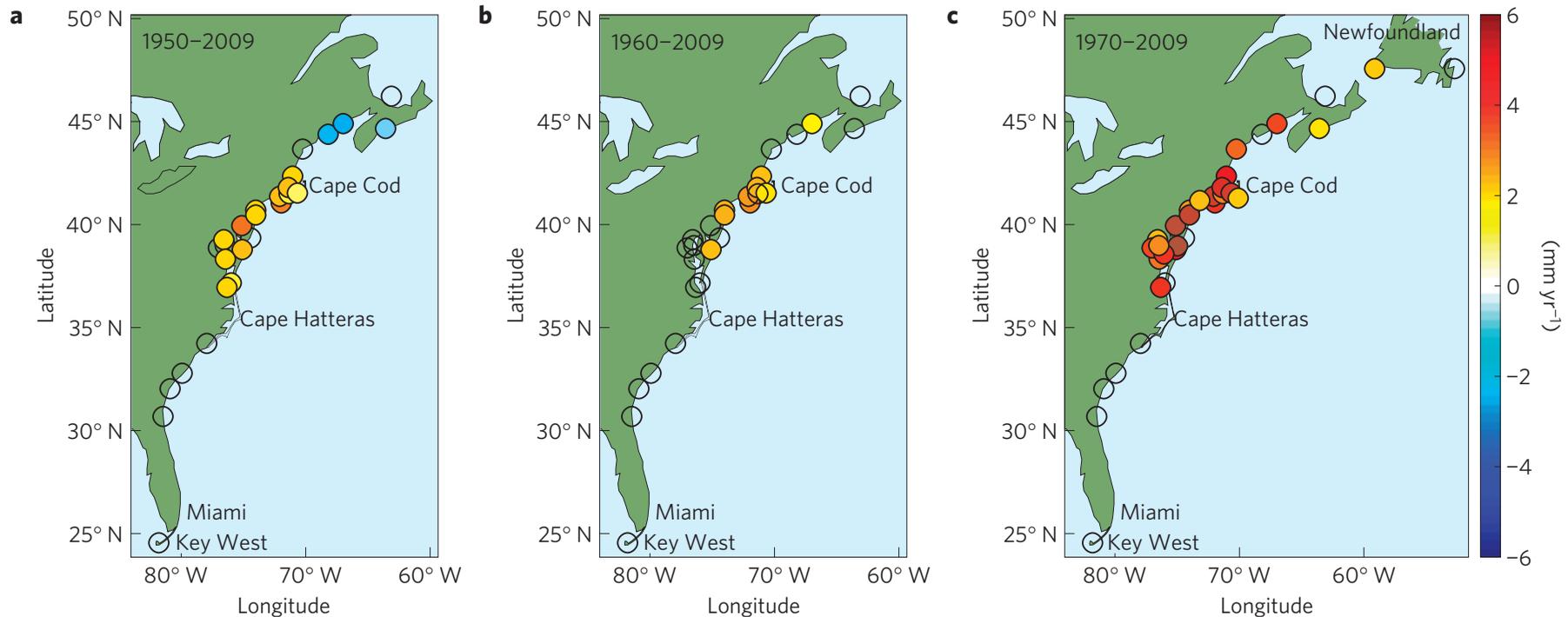


Cat 4+5 frequency:  
81% increase, or 10%  
per decade

Estimated net impact of  
these changes on  
damage potential:  
**+28%**

• Colored bars show changes for the 18 model CMIP3 ensemble (27 seasons); dots show range of changes across 4 individual CMIP models (13 seasons).

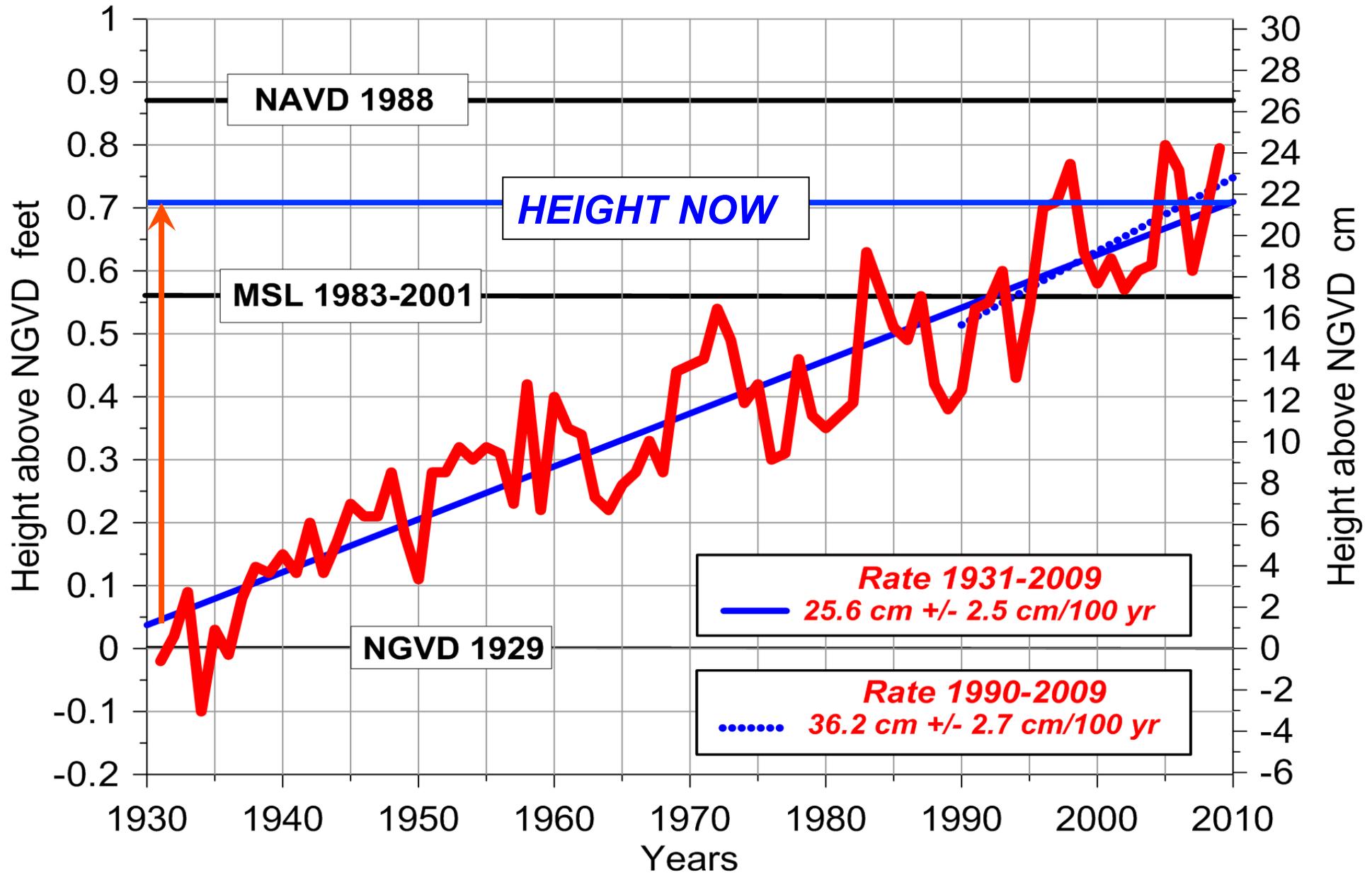
# Accelerated sea level rise in the Northeast



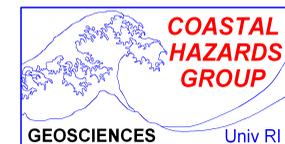
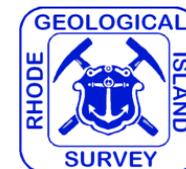
North of Cape Hatteras, sea level rise rate is 4 times higher than the global average, making the region more vulnerable to storm surges and flooding.

**Source:** Sallenger et al: Hotspot of accelerated sea-level rise on the Atlantic coast of North America, *Nature Climate Change*, June 2012

# HISTORIC SEA-LEVEL RISE - Newport, RI



Adapted from:  
[http://tidesandcurrents.noaa.gov/sltrends/sltrends\\_station.shtml?stnid=8452660%20Newport,%20RI](http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660%20Newport,%20RI)



Source: Boothroyd 2011

# IPCC Special Report, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

<http://ipcc-wg2.gov/SREX/>

One of the most dangerous implications of climate change is worsening of extreme weather events around the world in respect to:



# February 2009 - Wildfires, Australia

Largest on record  
More than 175 fatalities



2010

# Pakistan



# Russia

The hottest recorded summer in Russian history. 56,000 died.



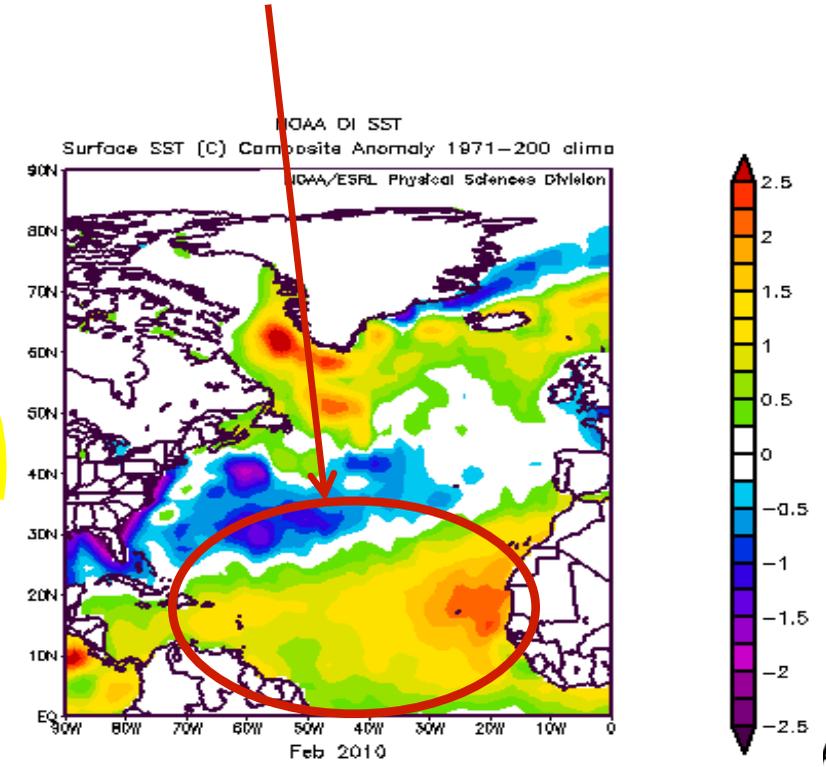
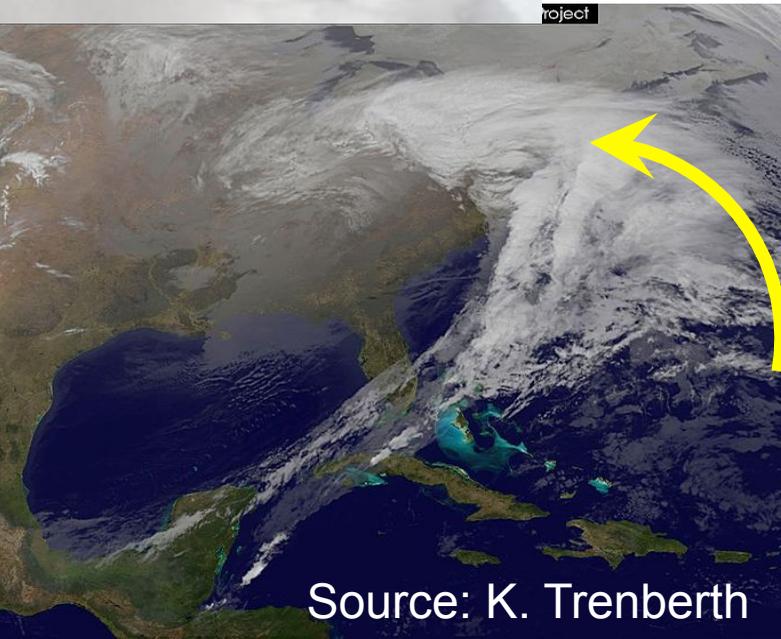
# China



# February 2010 Snowmageddon in the U.S



Moisture from storm 2000 miles away:  
subtropical Atlantic where  
ocean temperatures at record  
high levels!



Source: K. Trenberth

# Blizzard February 2011

affected at least 30 U.S. states,  
more than 100 million people

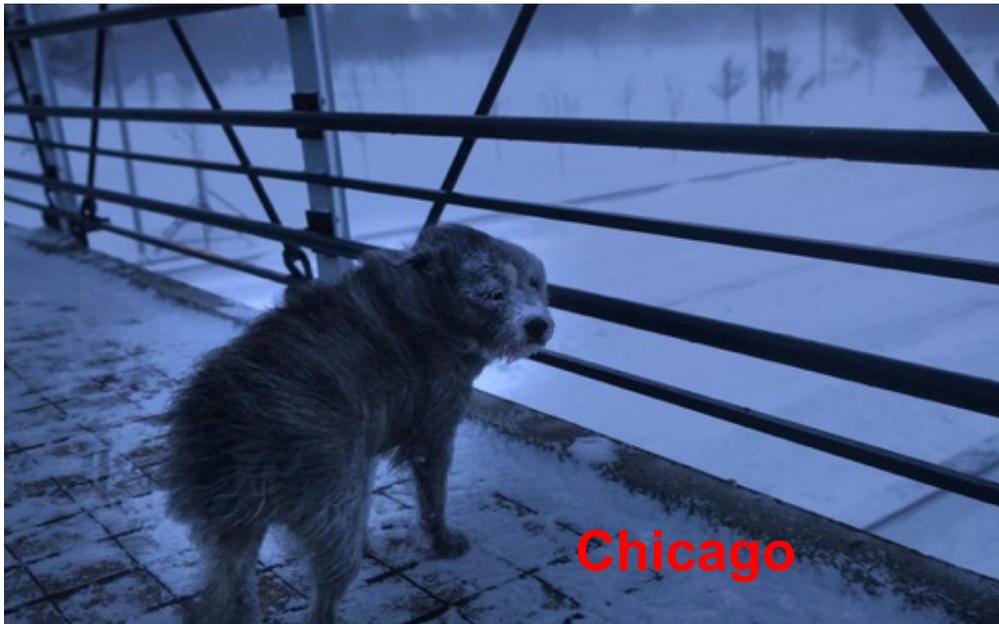
New Hampshire



Wisconsin



Chicago



Milwaukee



# 2011 Southern US Drought



Texas experienced  
driest July-August  
period on record

Losses: \$5.2 billion

# August 2011 - Hurricane Irene

- Landfall in NC, NJ, NY, CT
- Affected 11 states
- Fatalities: 56
- Damage: \$15.6 billion



Philadelphia



Vermont



Rhode Island

# November 2012 - Nor'easter



**New Jersey**

- Snow: 4-13 in
- Winds: 40-60 mph



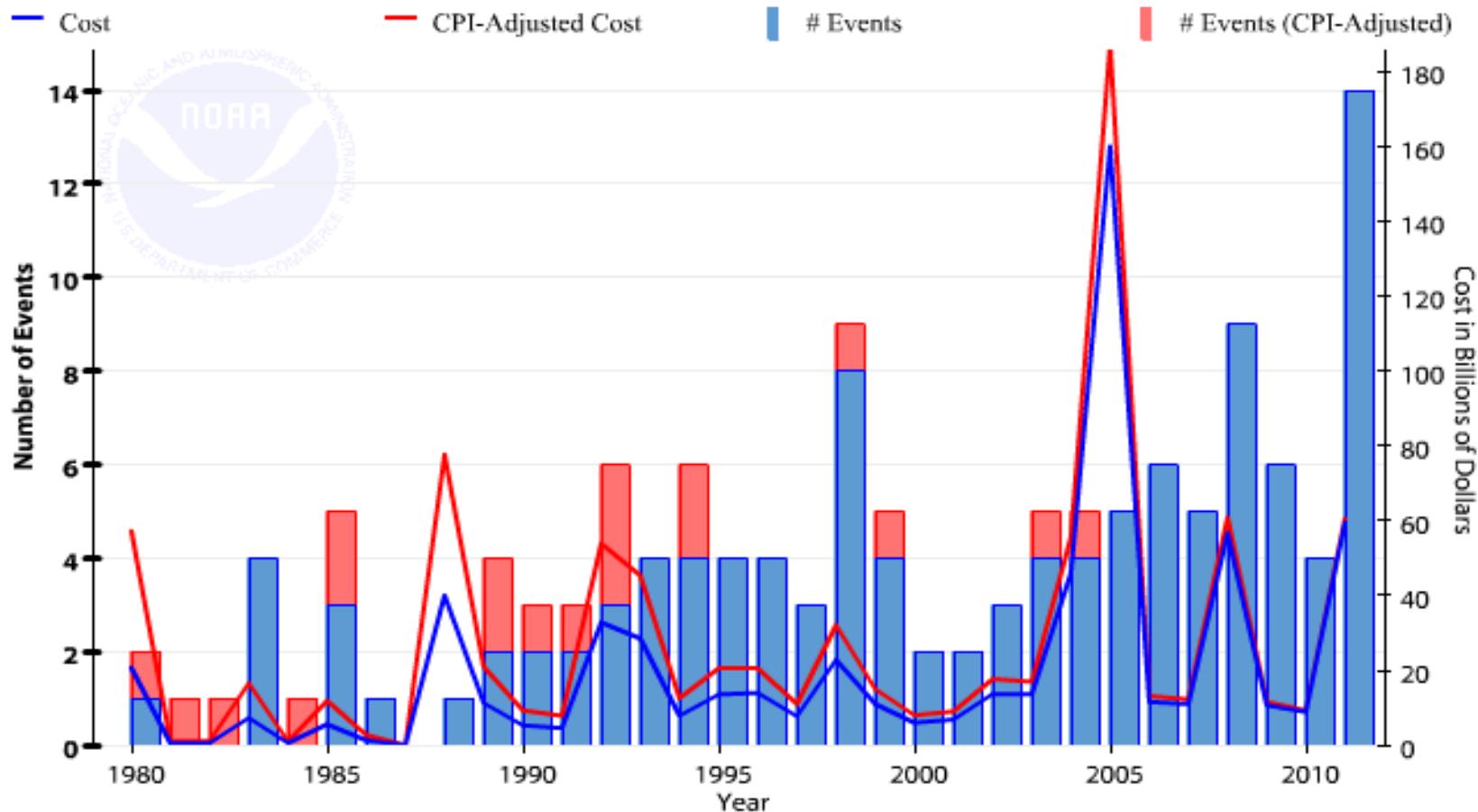
**New York**



**Massachusetts**

# Weather Disasters in U.S.

## The Cost and Number of Events Exceeding \$1 Billion



**Total disasters since 1980: 136**

**1980-1995 disasters: 46**

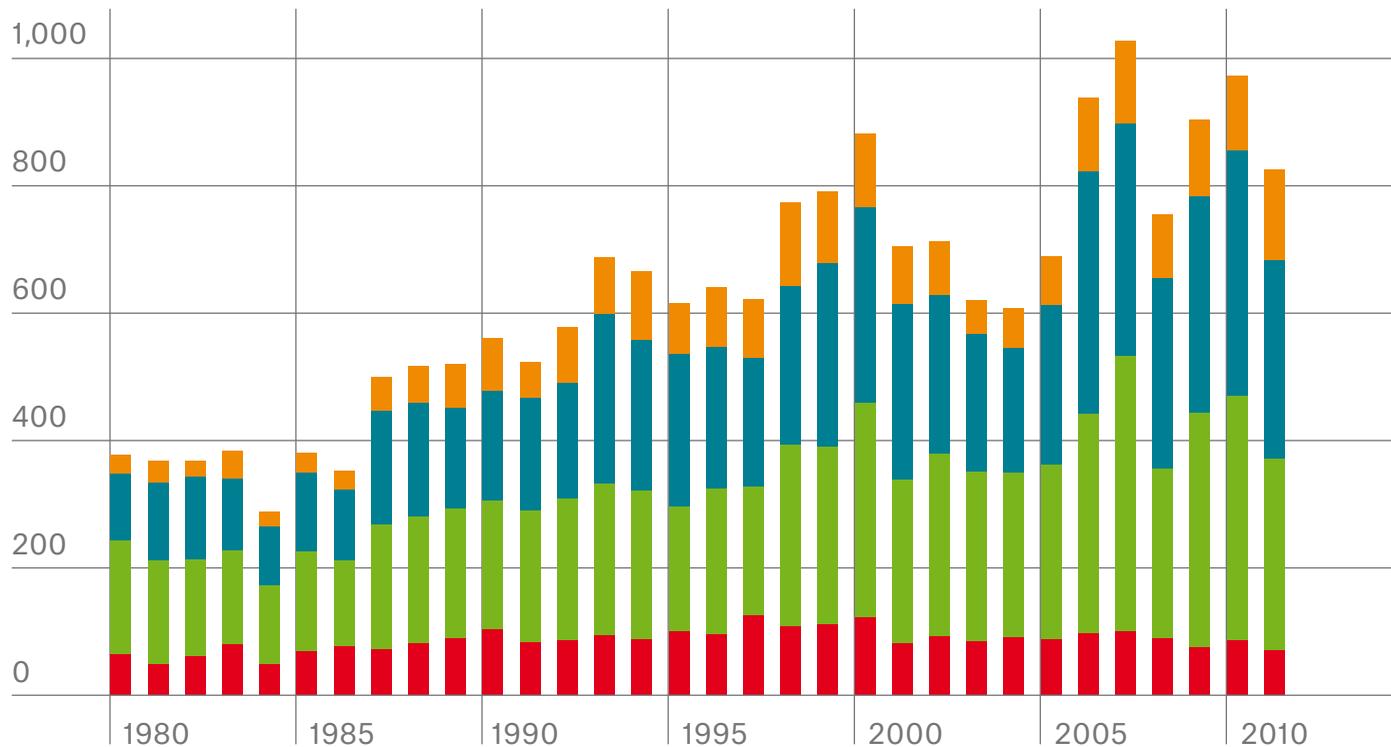
**1996-2012 disasters: 90**

**Total damage: \$897b**

Source: [www.ncdc.noaa.gov/oa/reports/billionz.html](http://www.ncdc.noaa.gov/oa/reports/billionz.html)

# World Natural Catastrophes: 1980-2011

Number of natural catastrophes 1980-2011



- Geophysical events: Earthquake, volcanic eruption
- Meteorological events: Tropical storm, winter storm, severe weather, hail, tornado, local storm
- Hydrological events: Storm surge, river flood, flash flood, mass movement (landslide)
- Climatological events: Heat-wave, cold wave, wildfire, drought

# Summary

- New 2012 IPCC report confirms that extreme weather is worsening due to climate change
- Scientists are virtually certain – 99% – world will have more periods of high-impact weather events through 21<sup>st</sup> century

