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THE STATE UNIVERSITY OF NEW JERSEY

The State Of New Jersey's Climate

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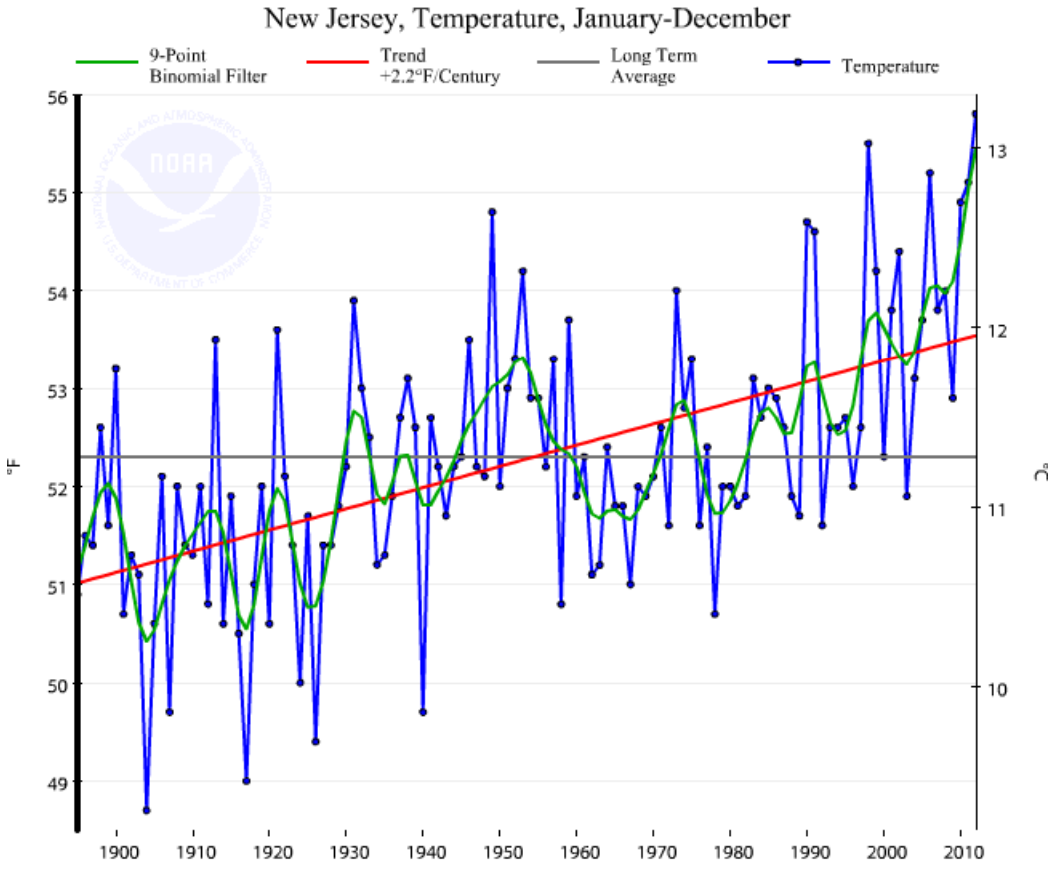
"Climate Change Preparedness in New Jersey:
Leading Practices and Policy Priorities"
New Brunswick, NJ
May 22, 2013

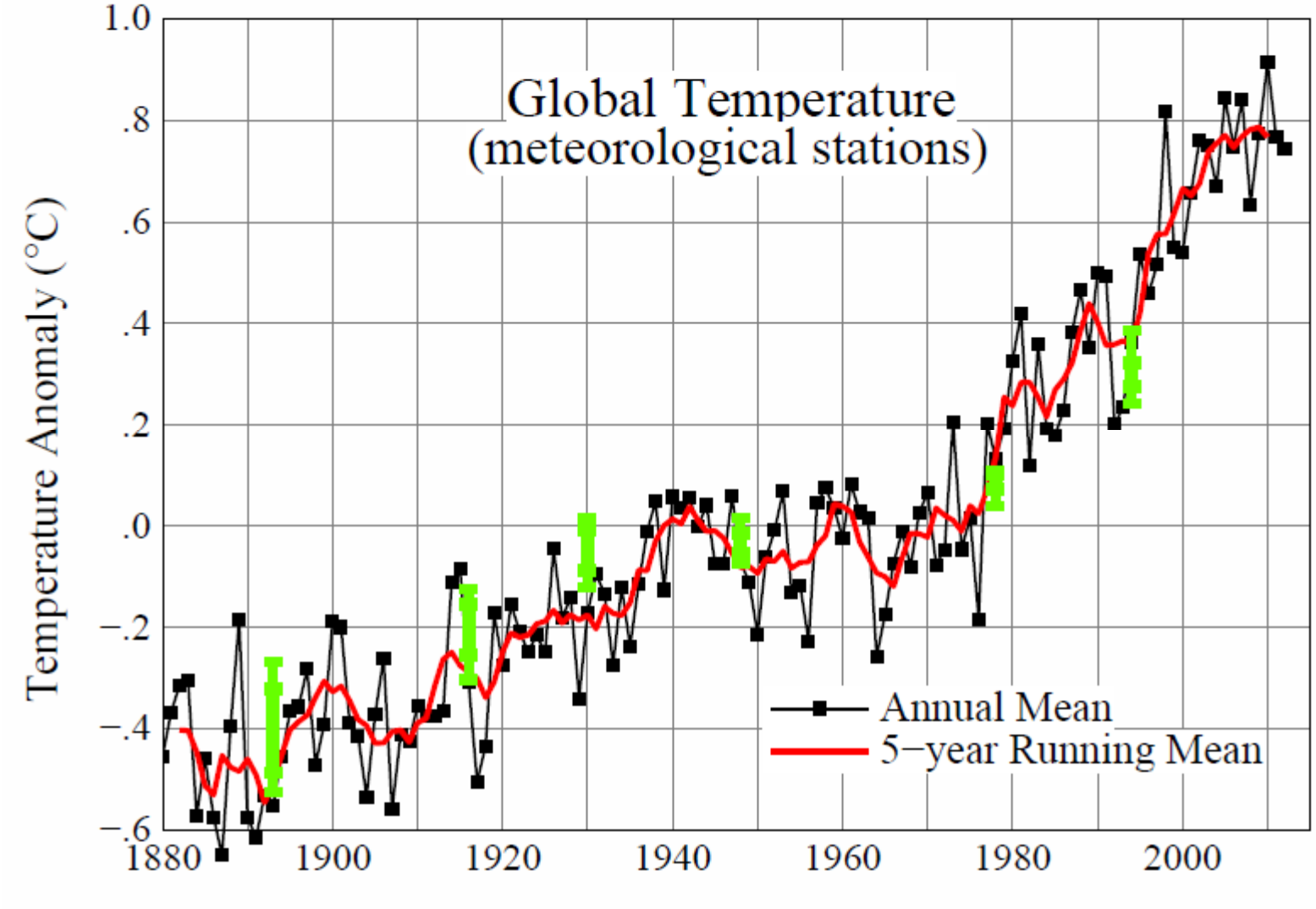
Temperature

Trends in annual mean New Jersey temperature

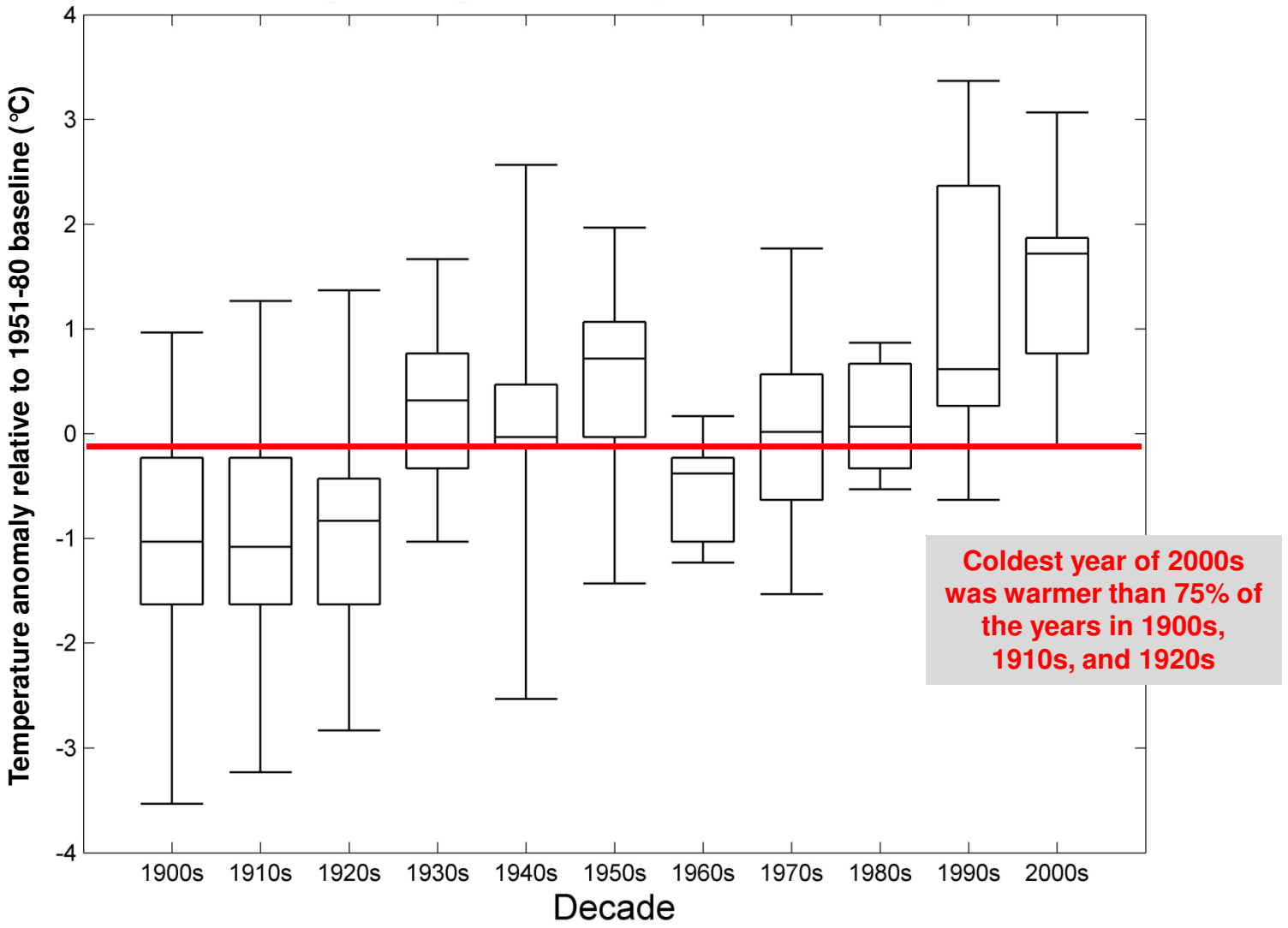


- Long-term upward trend of 2.2°F per 100 years
- More rapid warming since 1980
- The three warmest years have occurred since 1998
- 2012 was the warmest year on record

Source: National Climatic Data Center

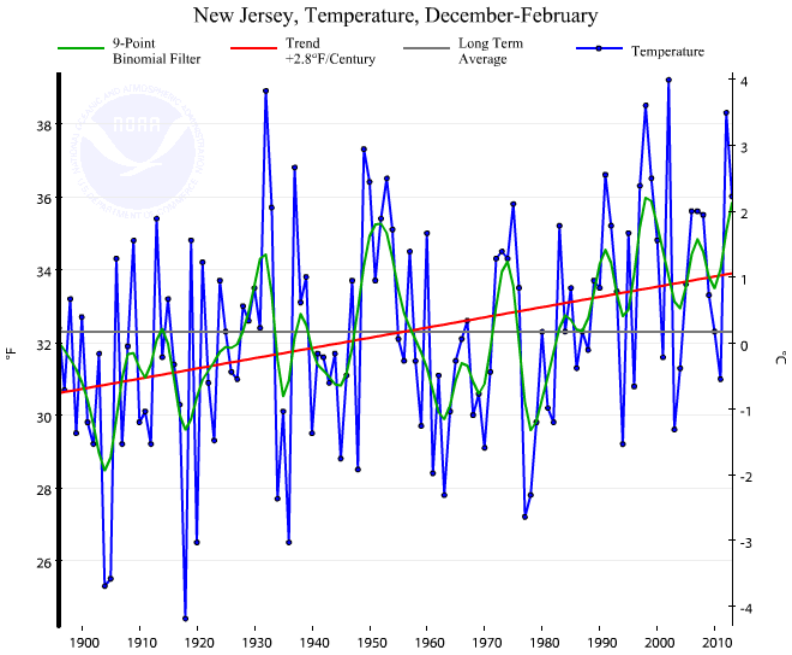


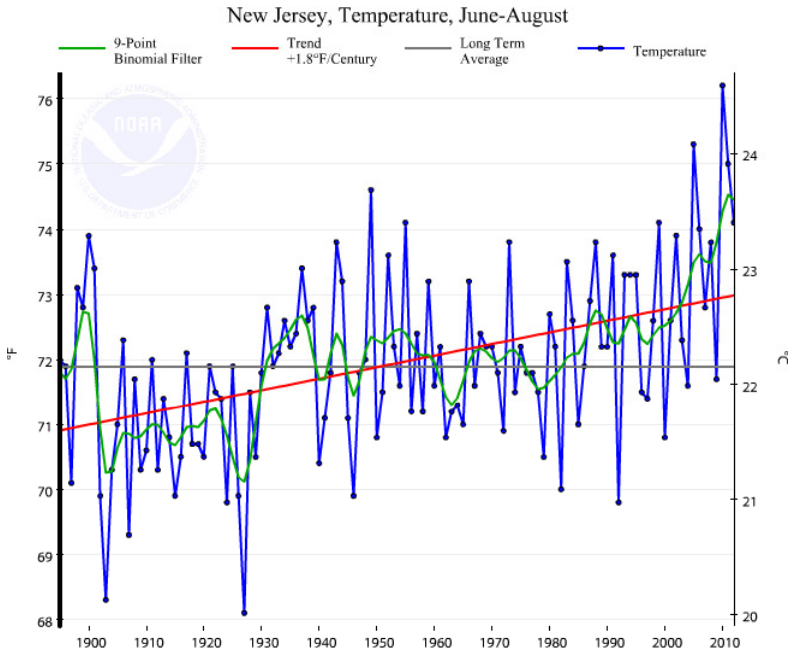
Source: NASA/Goddard Institute for Space Studies



Data source: Office of the New Jersey State Climatologist

Trends in winter and summer temperature in N.J.





- Larger warming trend in winter (2.8°F/100 yrs) than in summer (1.8°F/100 yrs)
- Year-to-year temperature variability is much larger in winter, which can mask long-term trends
- The three warmest summers have occurred since 2005

Source: National Climatic Data Center

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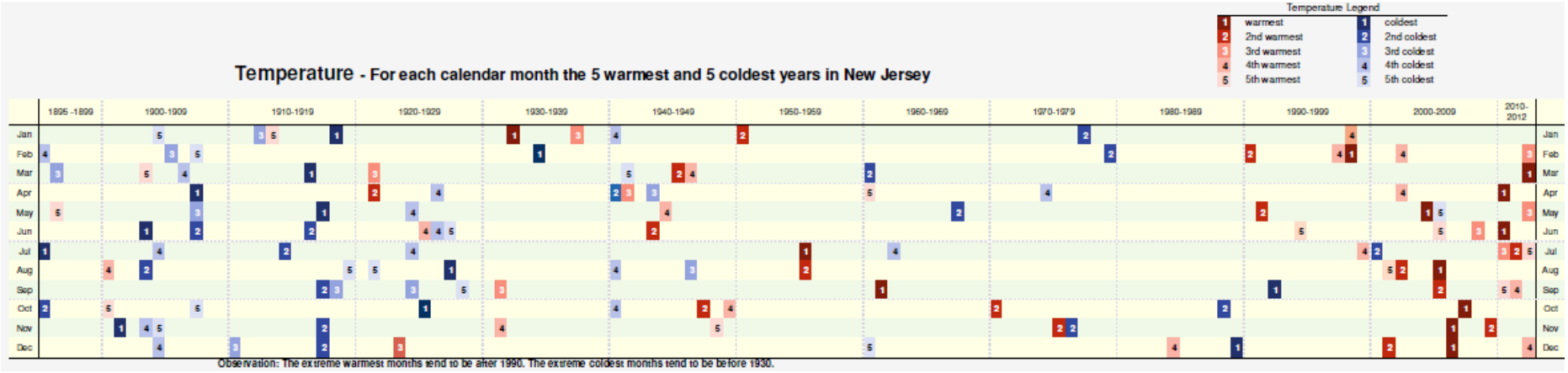
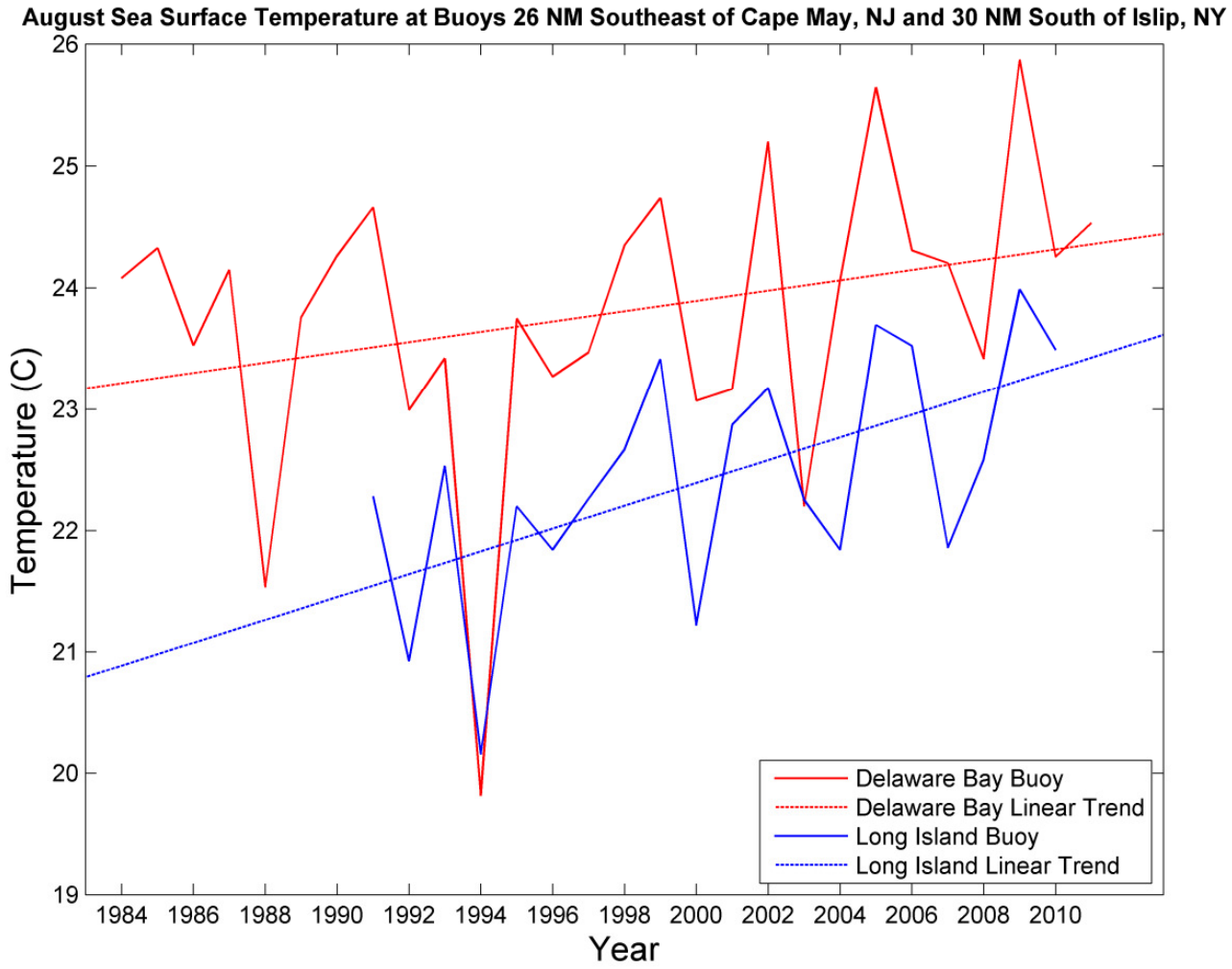
Unusually warm and cold months in New Jersey



- Unusually warm and cold months are defined as the five warmest and coldest for each calendar month (total of 60 warm and 60 cold plus ties)
- 41 cold months occurred before 1930
- 32 warm months occurred since 1990
- Since 2000, there have been 25 warm months and 2 cold months

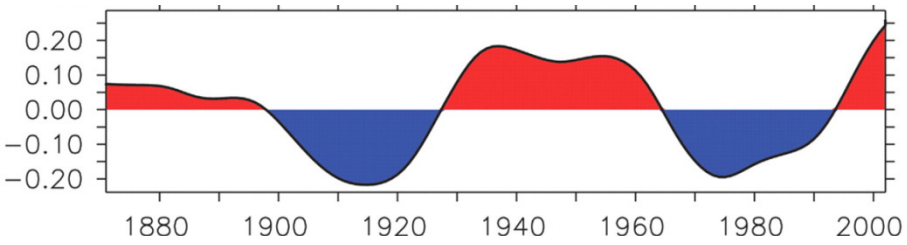
Source: David Robinson (NJ State Climatologist) and Jeffrey Hoffman (NJDEP)

Offshore water temperatures in August

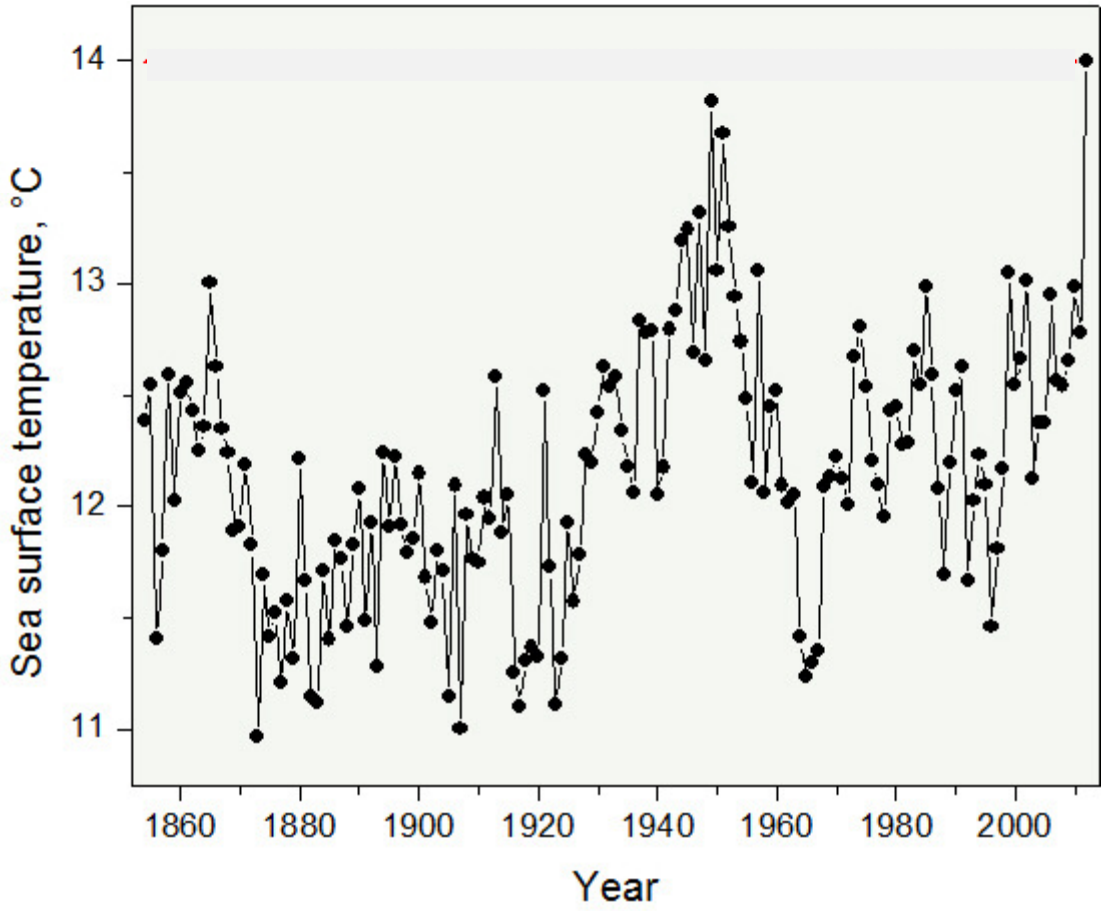


Trends

- 0.7°F/10 yrs at Delaware Bay Buoy
- 1.7°F/10 yrs at Long Island Buoy

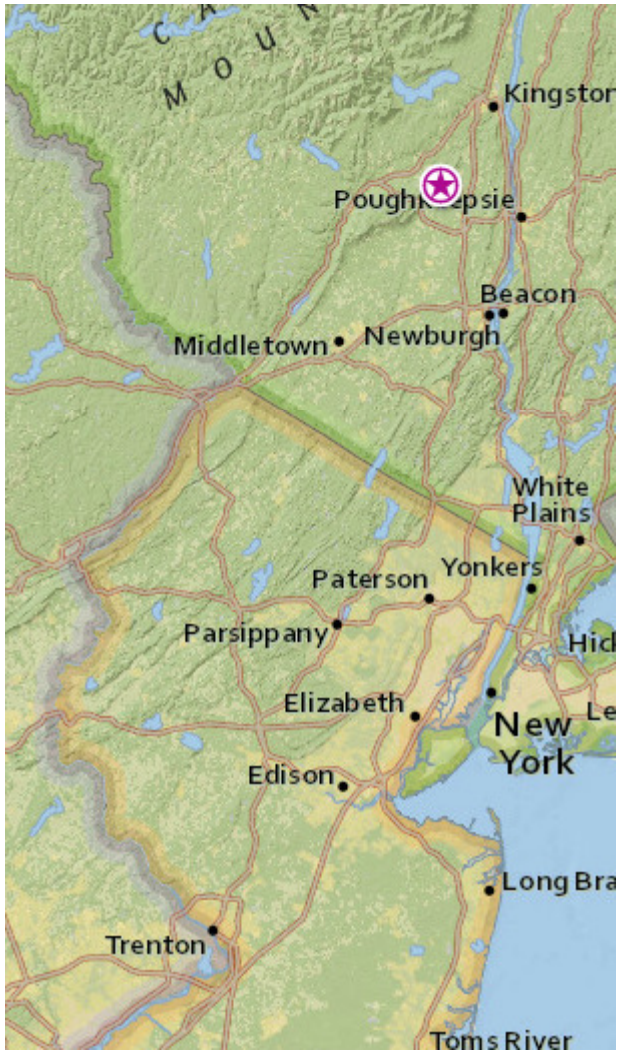


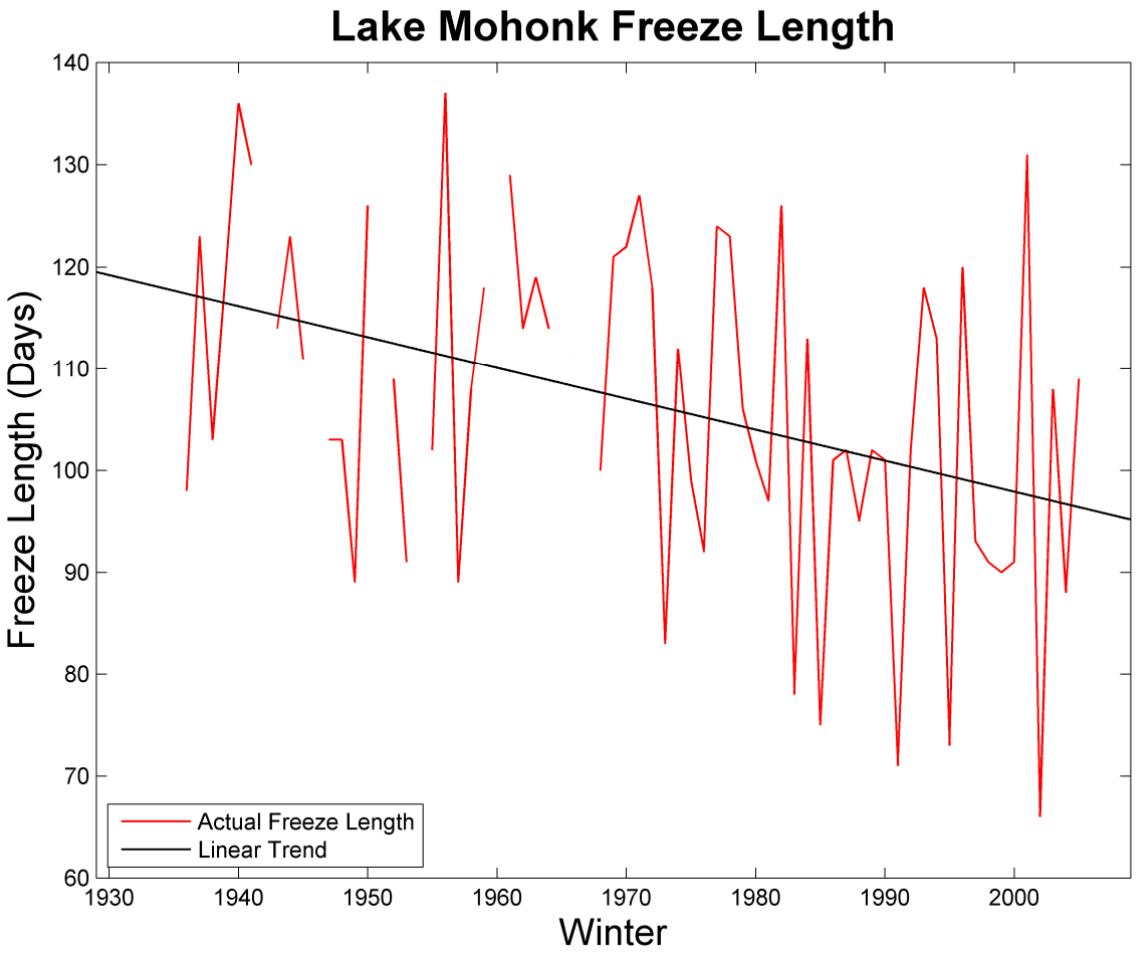
Atlantic Multidecadal Oscillation Index
(Source: Sutton and Hodson 2005)



Sea surface temperatures in Northeast Shelf region
(Source: National Marine Fisheries Service)

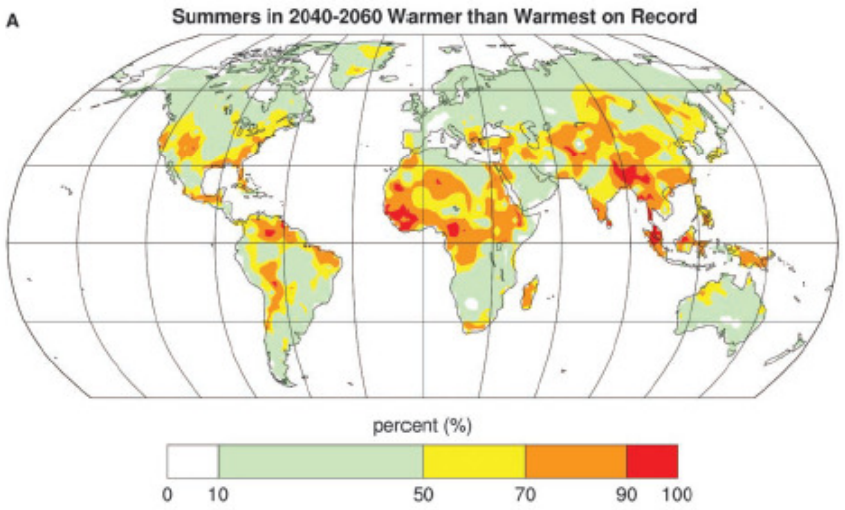
Trends in lake ice cover

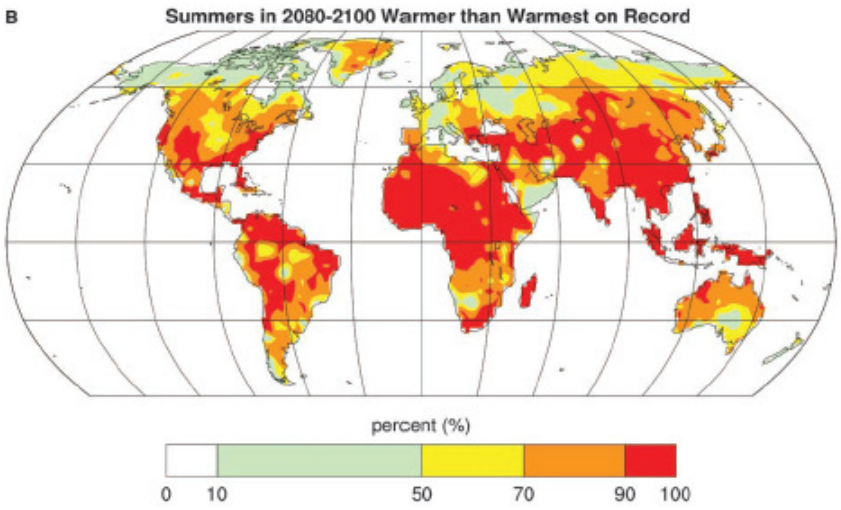




Warmer summers ahead

Question: How many summers will be warmer than what would now be the warmest summer on record?





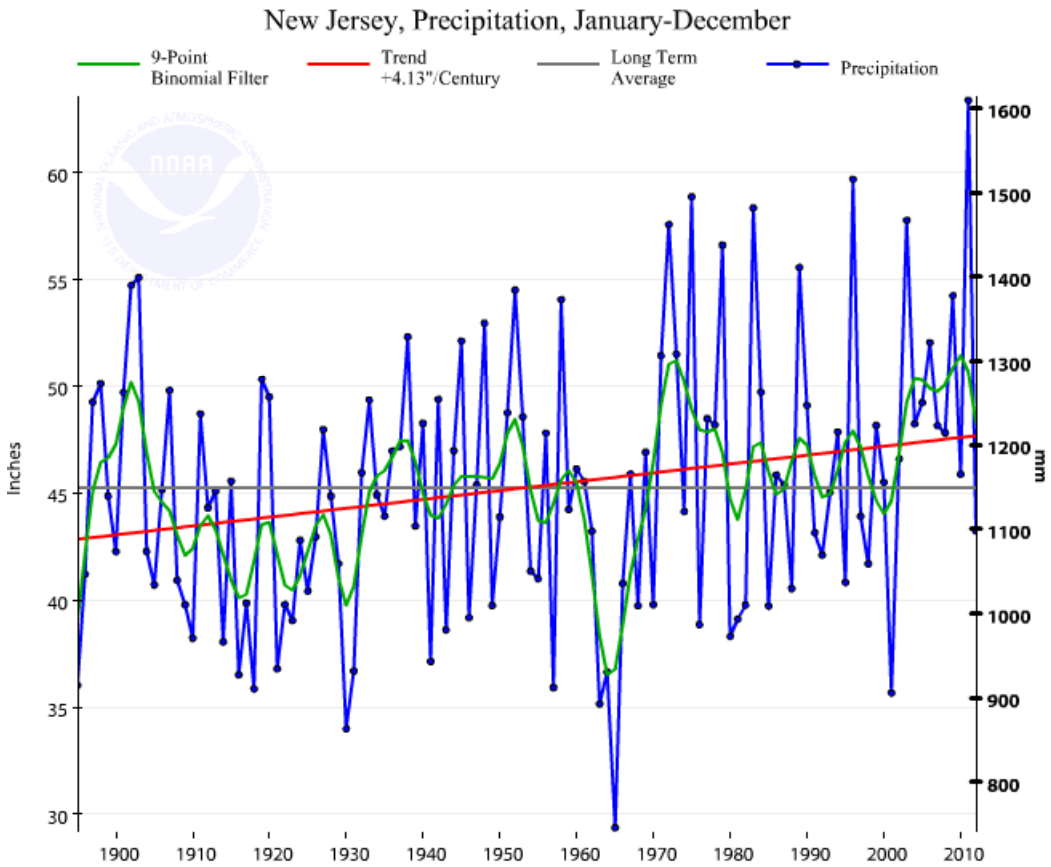
NJ: about 70%

NJ: about 90%

Source: Battisti and Naylor, *Science*, 2009

Precipitation

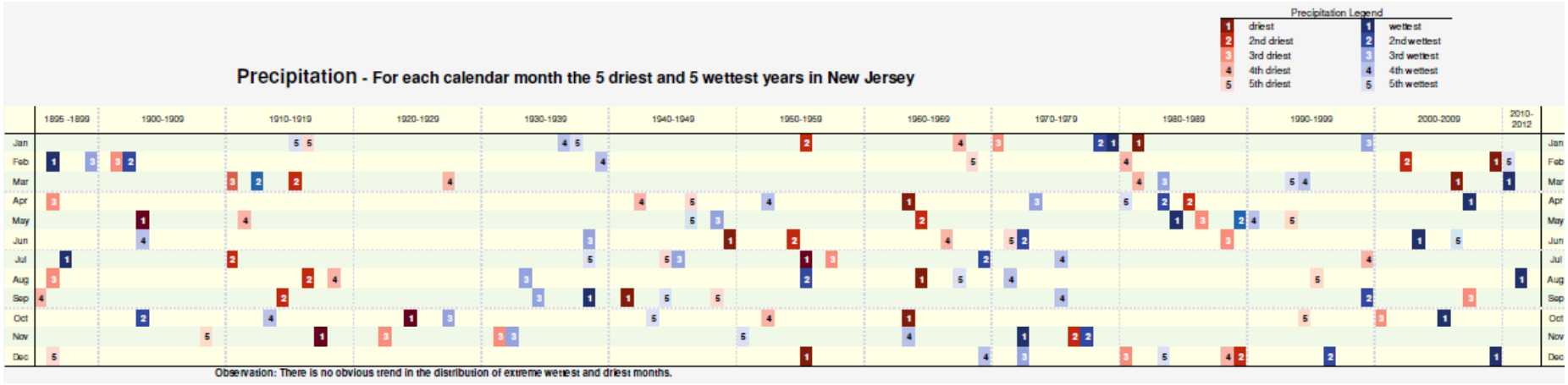
Trends in annual mean New Jersey precipitation



- Long-term upward trend of 4.1” per 100 years
- Large decadal variability (early 1960s drought, wet 1970s, very wet in last decade)
- Most of the upward trend comes from changes in spring and fall

Source: National Climatic Data Center

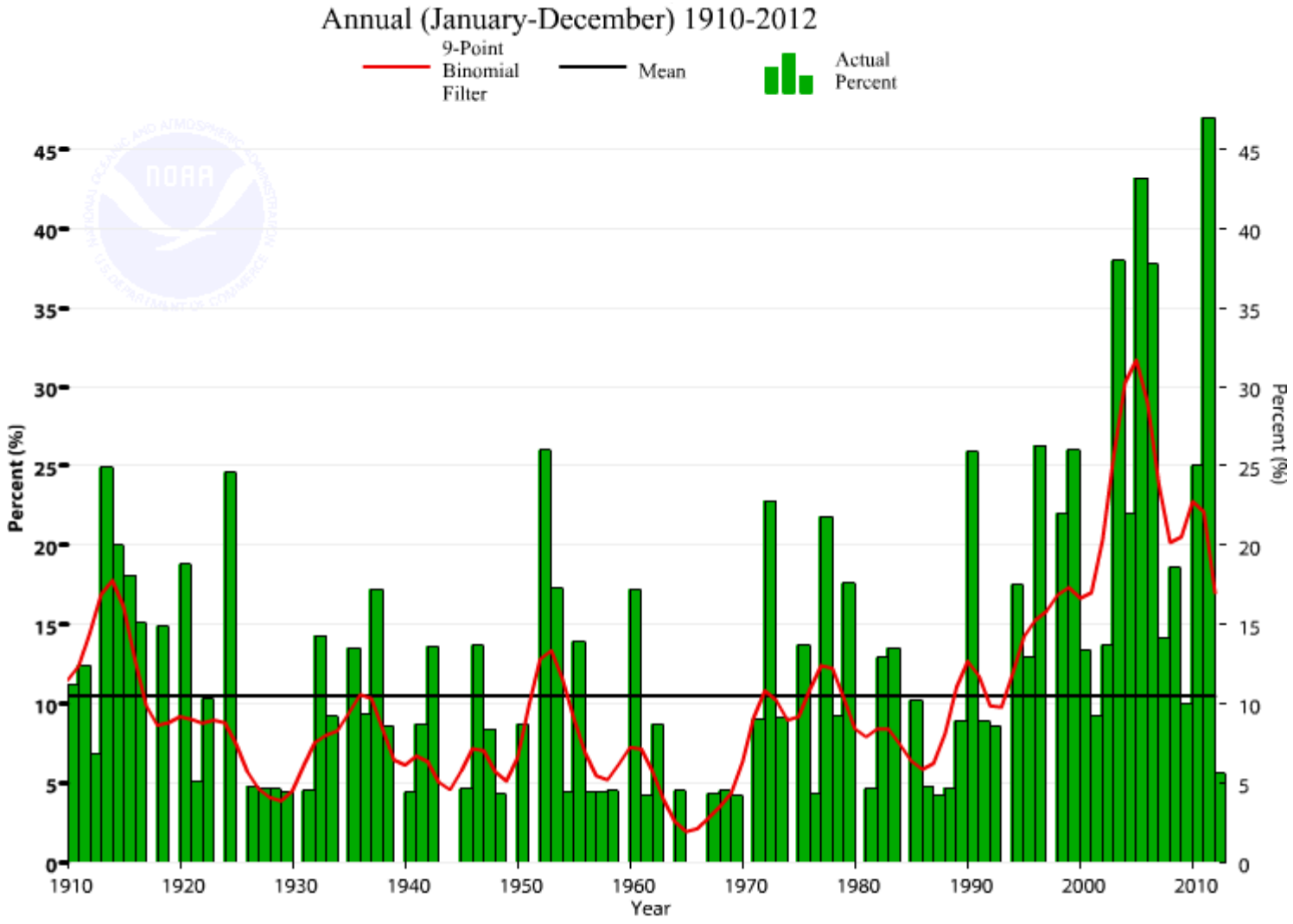
Unusually wet and dry months in New Jersey



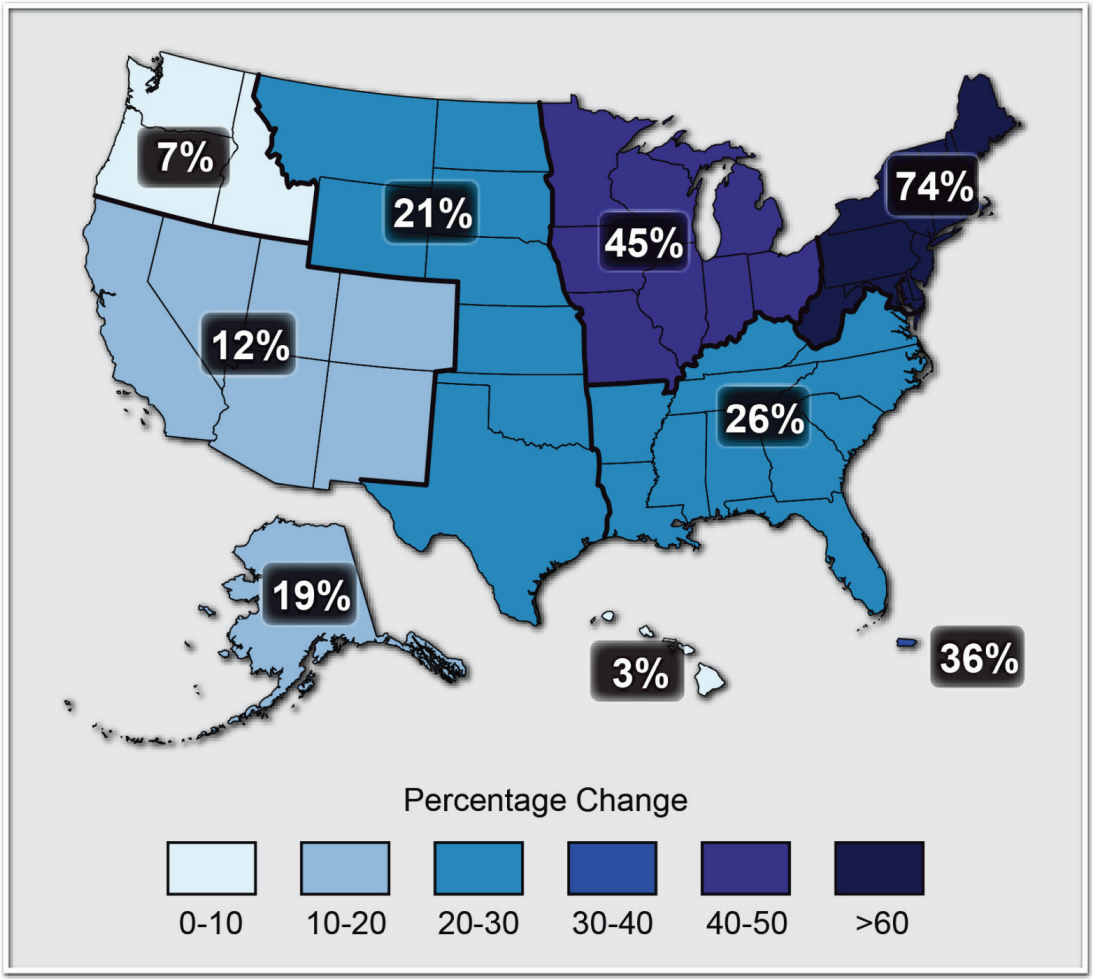
- Unusually wet and dry months are defined as the five wettest and driest for each calendar month (total of 60 wet and 60 dry plus ties)
- No obvious long-term trend in frequency of wet or dry months
- Wettest month for 6 of 12 calendar months (March, April, June, August October, and December) has occurred since 2003

Source: David Robinson (NJ State Climatologist) and Jeffrey Hoffman (NJDEP)

Percentage of area with a much greater than normal fraction of precipitation derived from extreme 1-day precipitation events



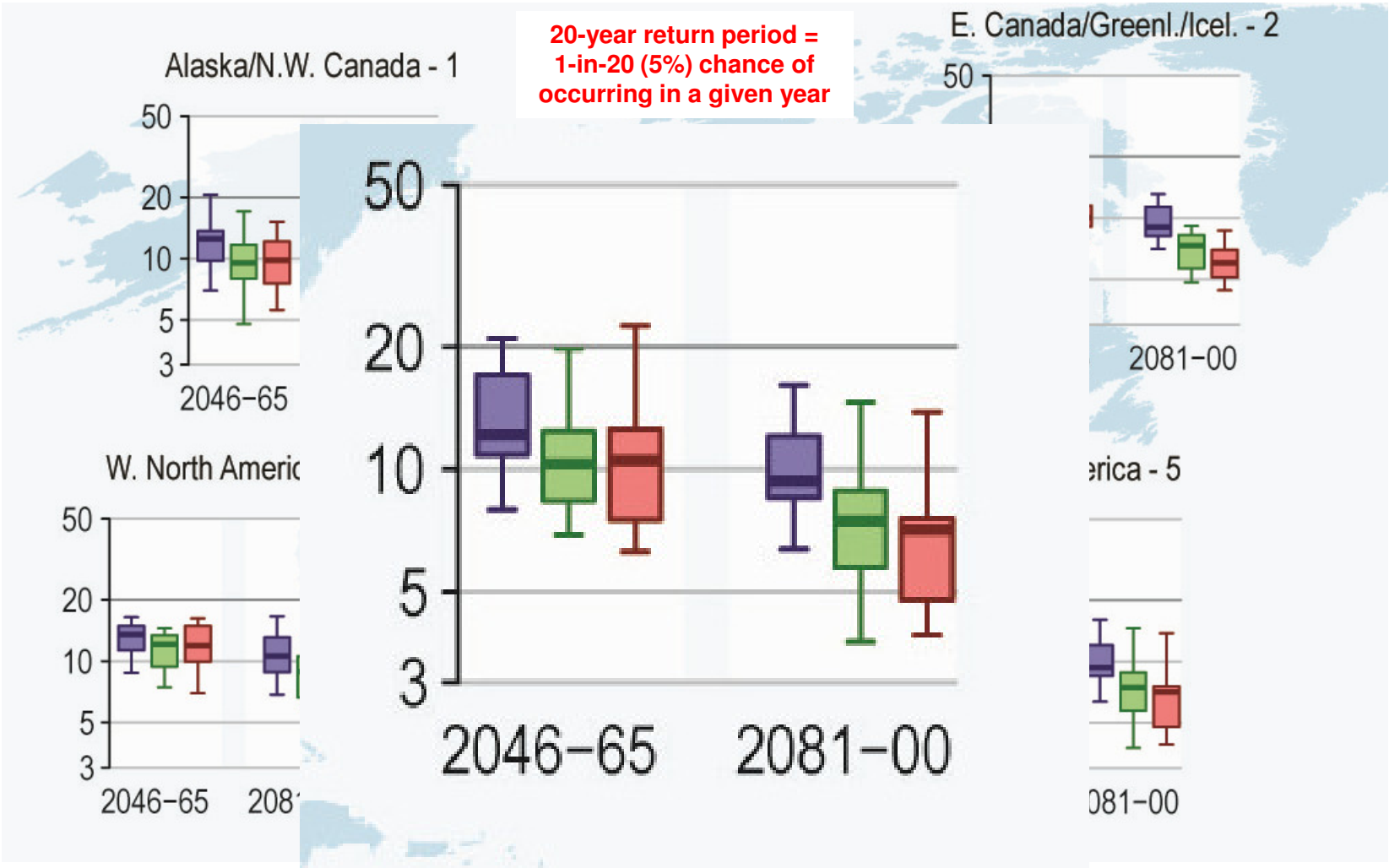
Change in amount of precipitation from very heavy events



- Period: 1958 to 2011
- Very heavy = the heaviest 1% of precipitation events
- A similar analysis indicates that recent decades have are also higher than the first half of the 20th century

Source: Draft National Climate Assessment

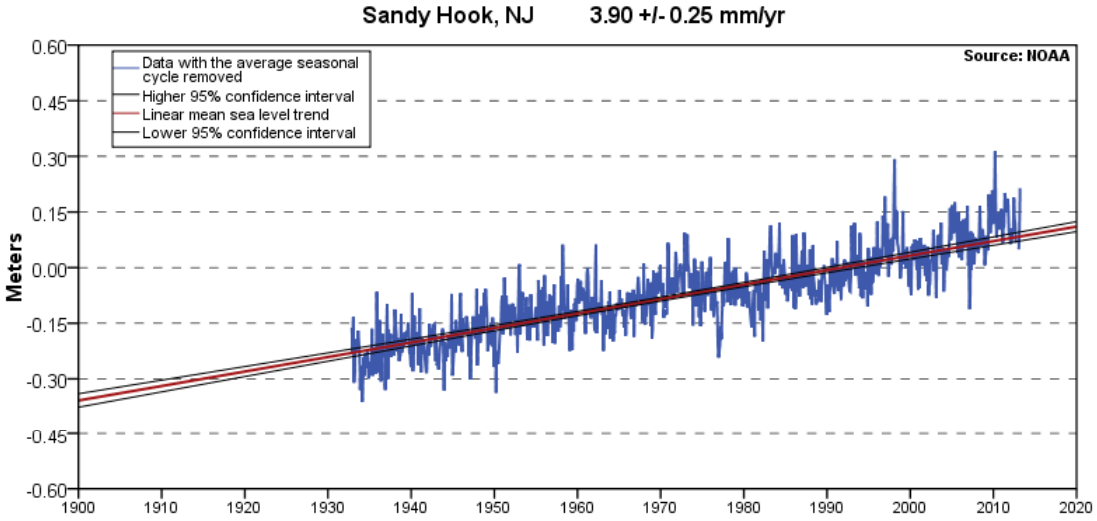
Changes in return period for annual maximum 24-hr precipitation rate

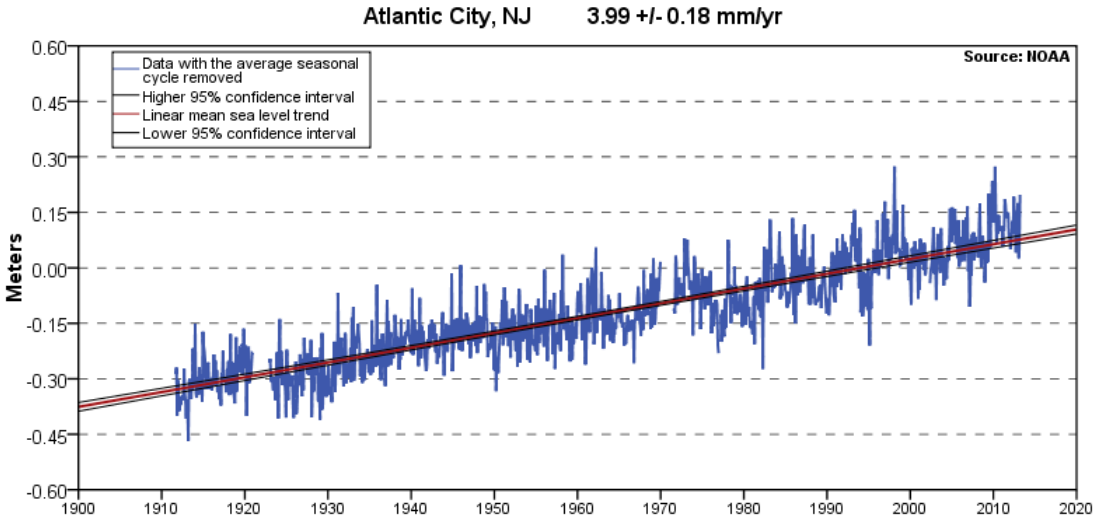


Source: IPCC SREX Report

Sea level

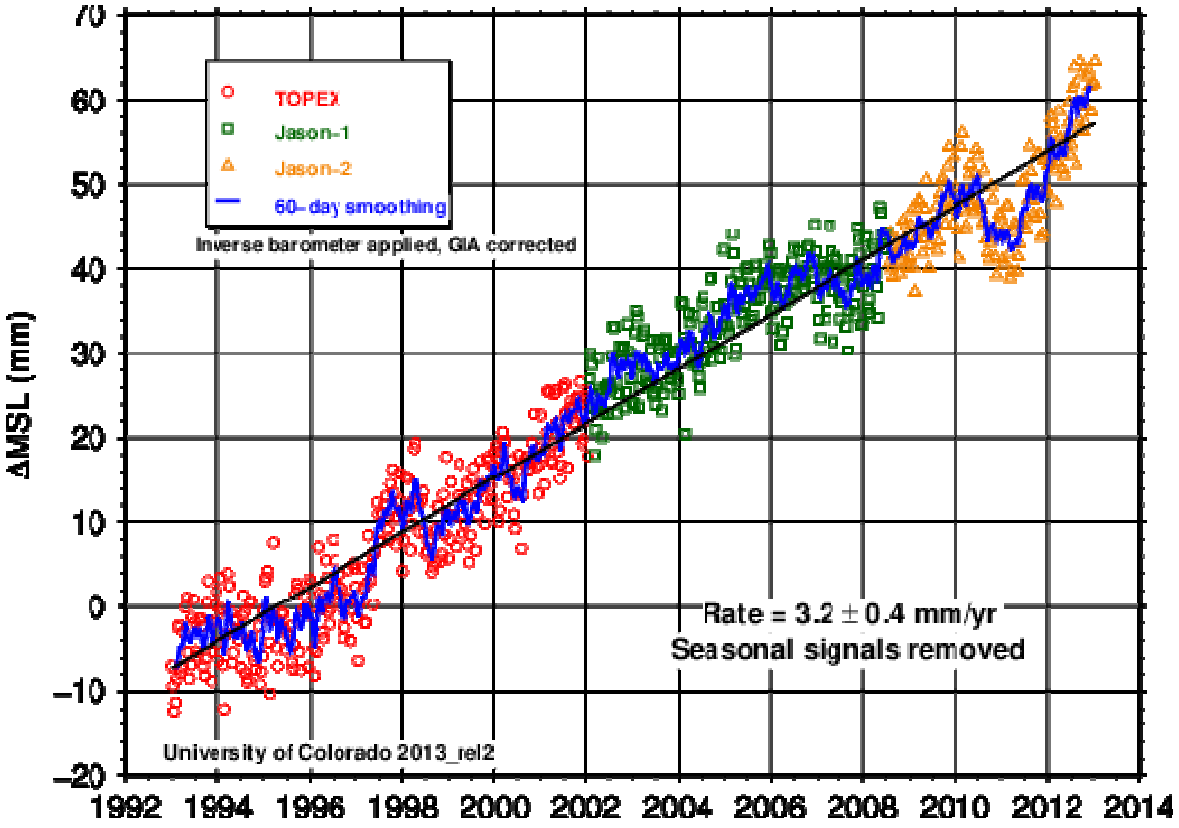
New Jersey sea level trends





- Century-scale global sea level rise has been 1.7±0.3 mm/yr
- Local sea level rise along the NJ coast has been more rapid than the global rise due to land subsidence (combination of post-glacial movement of earth's crust and compaction of coastal plain sediments)

Acceleration of global sea level rise



- Global trend during past two decades (satellite-derived) has been 3.2±0.4 mm/yr
- Miller et al. (in prep.) project the following sea level rise on the NJ coastal plain (relative to 2000)

  2050: 17”
  (range 13-27”)

  2100: 41”
  (range 29-69”)
- Projected ranges are relatively wide due to uncertainties in future emissions, ice sheet response, etc.

Historic water levels at Sandy Hook

- >13.2 FT — October 29, 2012 (Sandy)
- 10.1 FT — September 12, 1960 (Hurricane Donna) / December 11, 1992.
- 9.8 FT — August 28, 2011 (Hurricane Irene).
- 9.7 FT — November 7, 1953.
- 9.4 FT — September 14, 1944 (Hurricane) / March 6, 1962.
- 9.0 FT — November 25, 1950.
- 8.9 FT — January 23, 1966.
- 8.8 FT — November 12, 1968.

+3.5 feet

- **8.7 FT — MAJOR TIDAL FLOODING BEGINS.**
- March 29, 1984 / March 13, 1993.
- 8.6 FT — September 27, 1985 (Hurricane Gloria) / January 2, 1987 / October 31, 1991.
- 8.5 FT — April 13, 1961.
- 8.3 FT — February 19, 1972 / March 19, 1996 / March 13, 2010.
- 8.2 FT — October 18, 2009.
- 8.1 FT — January 31, 2006 / April 16, 2007.
- 8.0 FT — October 14, 1955 / December 26, 1969 / December 2, 1974 / April 16, 2011.
- 7.9 FT — August 31, 1954 (Hurricane Carol) / December 22, 1972 / October 25, 1980 / February 24, 1998 / December 25, 2002 / November 14, 2009.
- 7.8 FT — October 14, 1977 / November 8, 1977 / March 3, 1994 / December 20, 1995 / January 29, 1998 / March 30, 2010.
- **7.7 FT — MODERATE TIDAL FLOODING BEGINS.**
- March 20, 1958 / October 22, 1961 / November 10, 1962 / December 25, 1978 / December 3, 1986 / January 4, 1994 / December 13, 1996 / November 14, 1997 / January 3, 2003 / January 3, 2006 / February 12, 2006 / October 7, 2006 / May 12, 2008 / December 12, 2008 / May 17, 2011.
- **6.7 FT — MINOR TIDAL FLOODING BEGINS**

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Many thanks to…

- The Office of the New Jersey State Climatologist (Dave Robinson, Mat Gerbush, Dan Zarrow)
- Jimmy Danco (Rutgers Meteorology Program)
- Jeff Hoffman (NJDEP)
- Ken Miller, Bob Kopp, Ben Horton, Jim Browning, Andrew Kemp (Rutgers, Tufts)
- All of the agencies and individuals who have collected and developed the data used in these analyses