

# Hurricanes and Climate Change: Implications for New England

Amanda Staudt, Ph.D.  
National Wildlife Federation

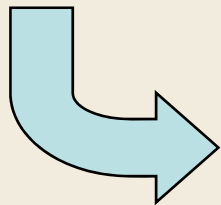
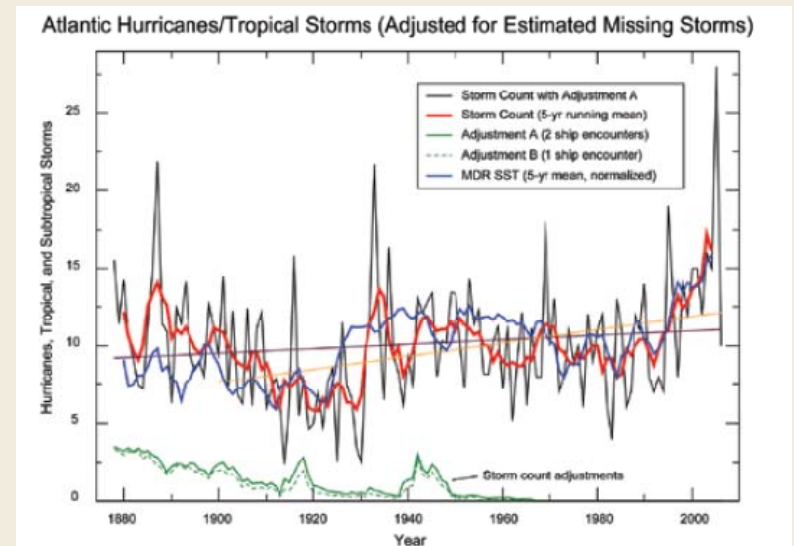
July 11, 2008

Northeast Hurricane Mitigation Leadership Conference



# Lots of uncertainties...

- Developing a good record of past hurricanes
- The roles of natural variability and human activities in recent trends
- How much can we trust models of future hurricanes, especially regional changes
- Etc.



We could debate for days!! 😊

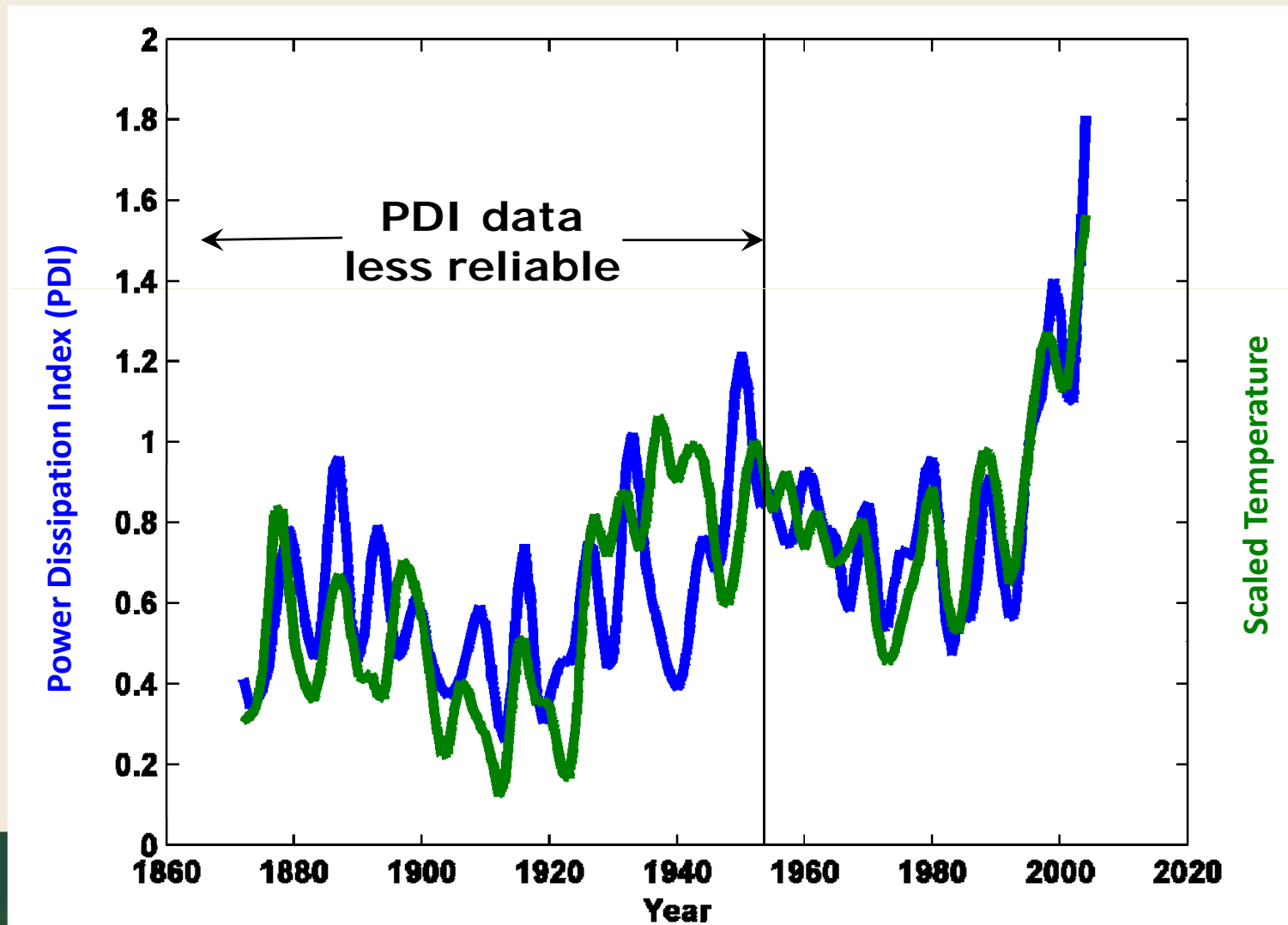


# What we know about past hurricanes:

- Sea surface temperatures (SST) have increased by 0.5-0.7°C (0.9-1.3°F) over the last century in the main development area for cyclones in the North Atlantic
- It is very likely that human-caused greenhouse warming contributed to this trend
- Warm SST are required for hurricane genesis
- SST and hurricane power dissipation index (PDI - which combines storm intensity, duration, and frequency) are closely correlated in the North Atlantic since about 1950.



# Atlantic Sea Surface Temperatures and Storm Max Power Dissipation



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Figure provided by Kerry Emanuel, MIT; Data Sources: NOAA/TPC, UKMO/HADSST1

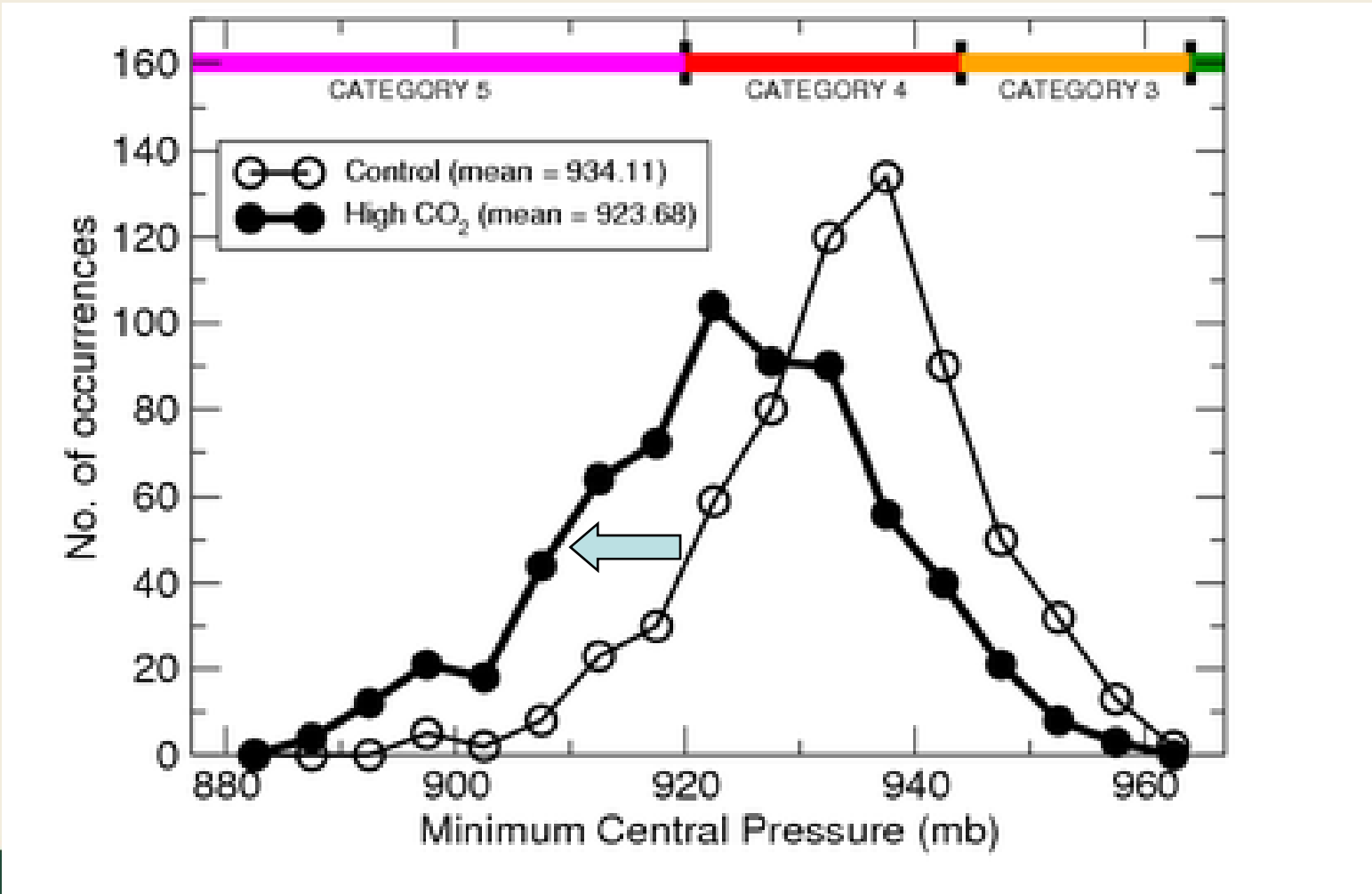


# What we know about future trends: HURRICANE INTENSITY

- Tropical SST expected to increase
  - about 1.7°C (3.1°F) over 21<sup>st</sup> century if no reductions in emissions
- Most models project a modest increase in hurricane intensity
  - Maximum windspeeds to increase 2-13% over this century
  - Core rainfall rates to increase 10-31%



# Projected Increase in Hurricane Intensity



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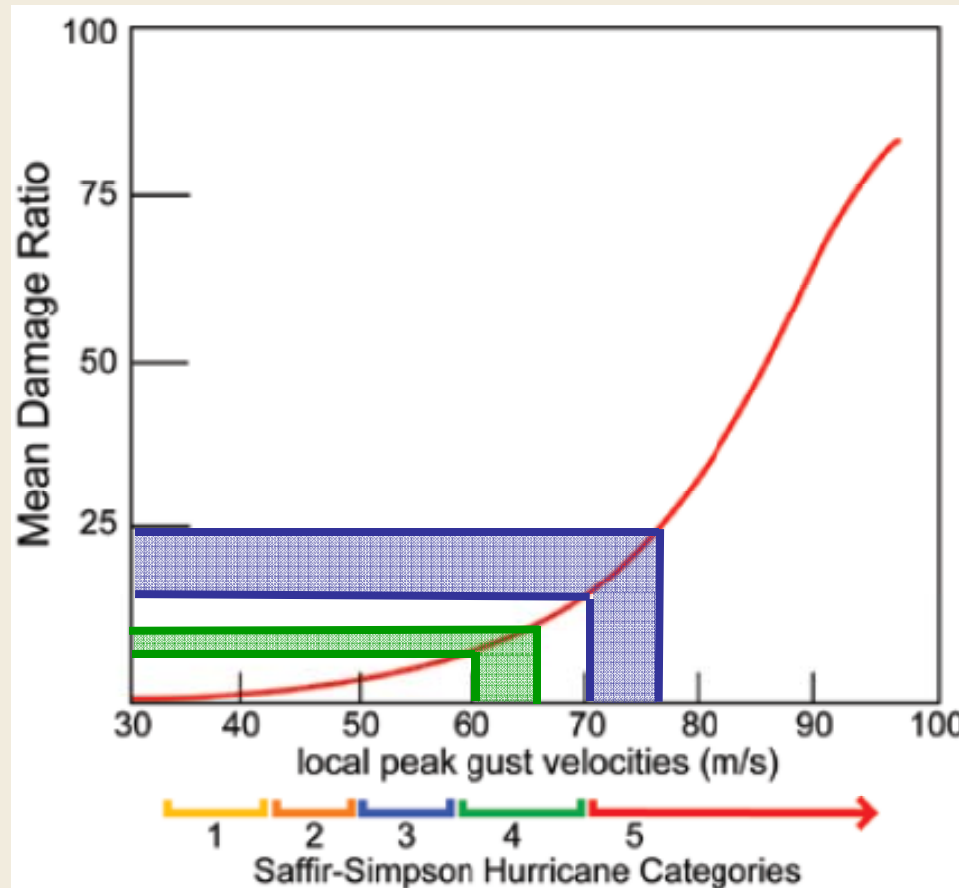
Knutsen and Tuleya (2008)



# Small increases in intensity mean big increases in damages

Damage ratio increases by about 66%

Damage ratio increases by about 50%



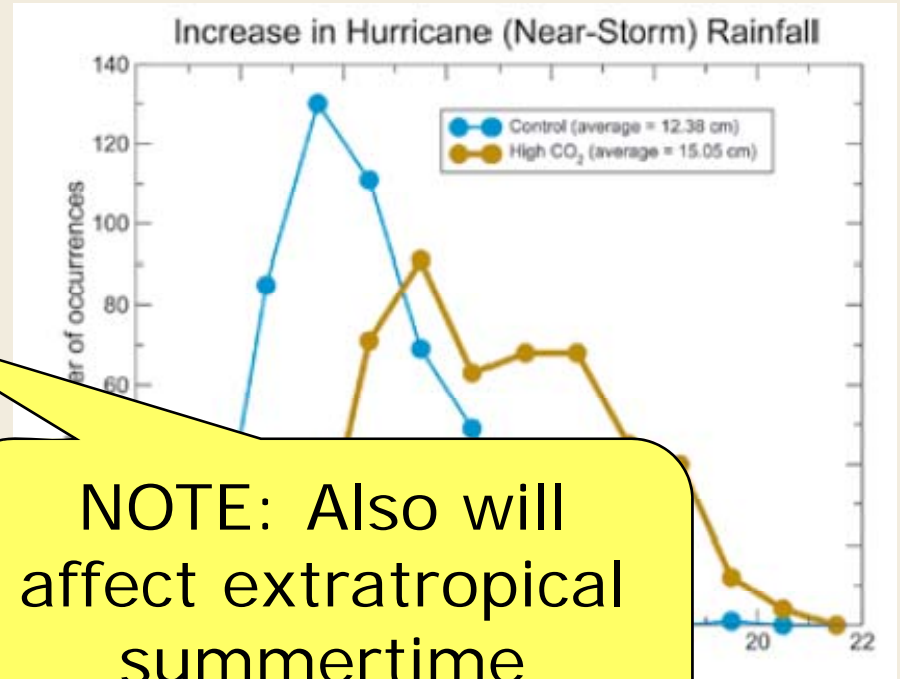
Cat 5 windspeed increases by 10%

Cat 4 windspeed increases by 10%



# What we know about future trends: FLOODING POTENTIAL

- Increase in rainfall per storm because of increasing moisture content of warmer air
- Storms may be moving more slowly, more rainfall in one place
- Sea level is rising globally (9 m): coastal areas vulnerable to higher storm surge



NOTE: Also will affect extratropical summertime convective storms.



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Hurricanes are rare in New England	Easy to forget and be lax about preparations

# Where do we go from here?

- Some future global warming impacts are avoidable:
  - **Transition to a clean energy future**
  - **Reduce global warming pollution 80% by 2050.**
- Some global warming impacts are unavoidable:
  - **Develop adaptation strategies.**
    - Implications for building codes of increasing max wind speeds
    - Implications for floodplain designation of increased heavy rainfall + slower moving storms + sea-level rise
- Further research needed to resolve remaining uncertainties about hurricanes and climate change



# Backup slides

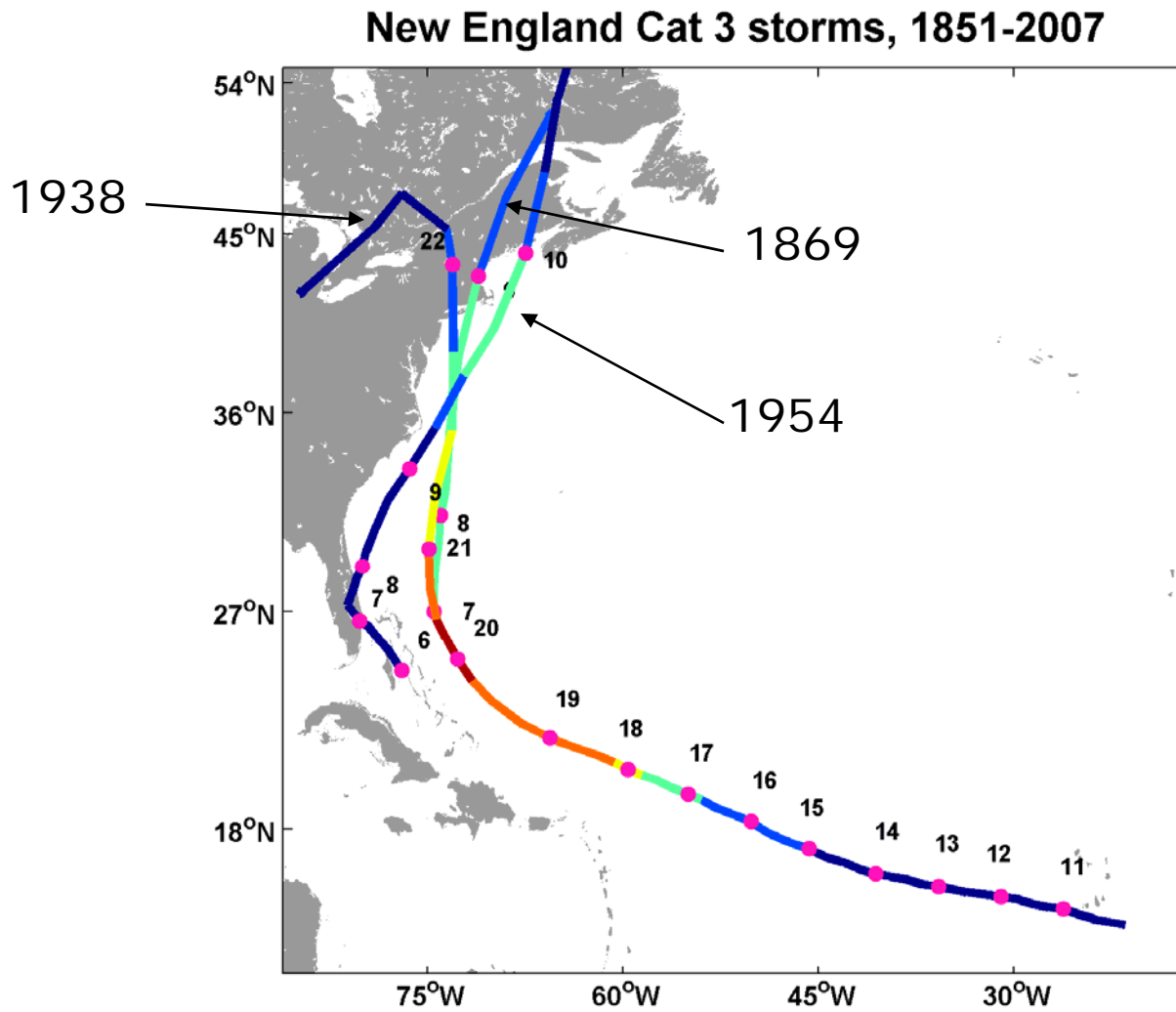


## Other extreme weather phenomena expected to become more severe:

- heat waves
- heavy downpours are very likely to further increase in frequency and intensity.
- The strongest cold season storms are likely to become more frequent, with stronger winds and more extreme wave heights.
- droughts



# 3 Cat 3 Storms in New England



# 3 Cat 5 Storms in U.S. History

## U.S. Cat 5 Storms, 1851-2007

