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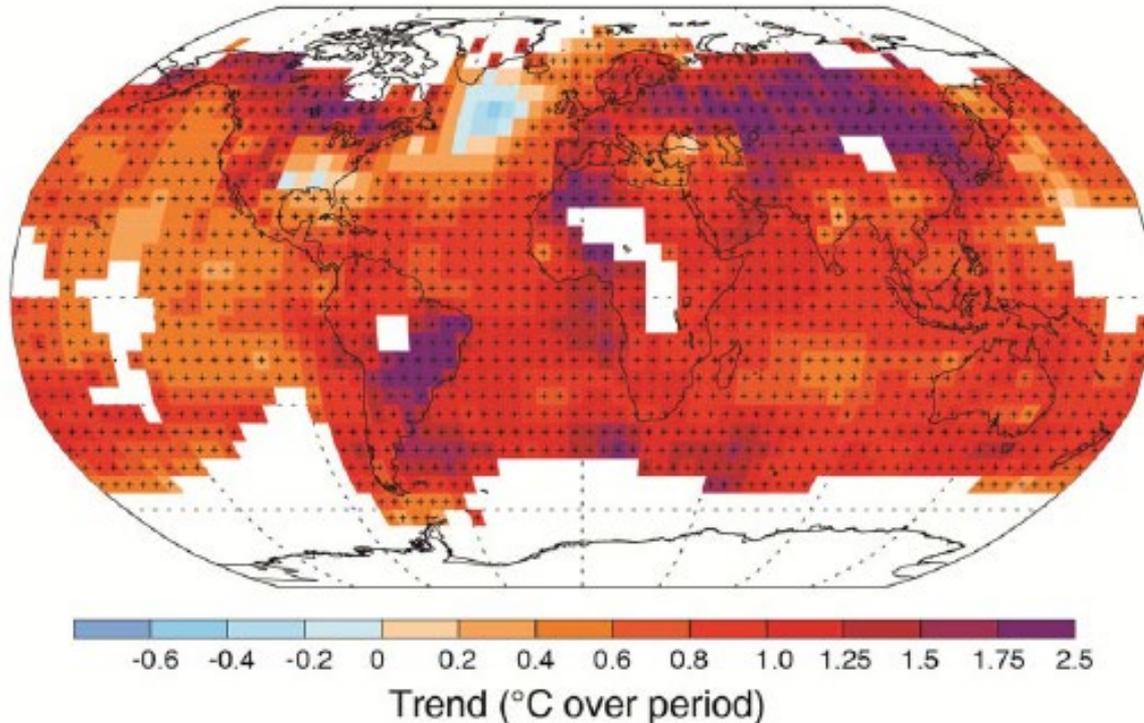
Climate Hazards, Impacts, and Opportunities

Dr. Radley Horton

March 3, 2020

Observed Temperature Trends

(b) Observed change in average surface temperature 1901–2012



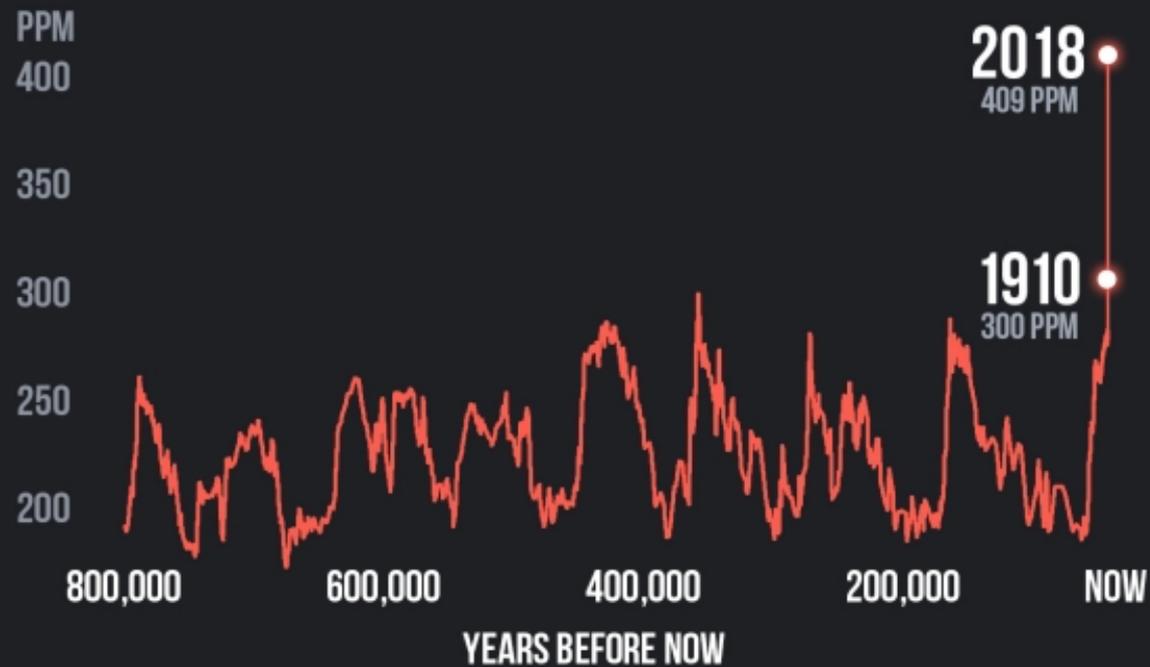
“Each of the last three decades has been successively warmer at the Earth’s surface than any preceding decade since 1850). In the Northern Hemisphere, 1983–2012 was likely the warmest 30-year period of the last 1400 years).”

Source: IPCC, 2013

Carbon Dioxide Concentrations

CHANGING OUR ATMOSPHERE

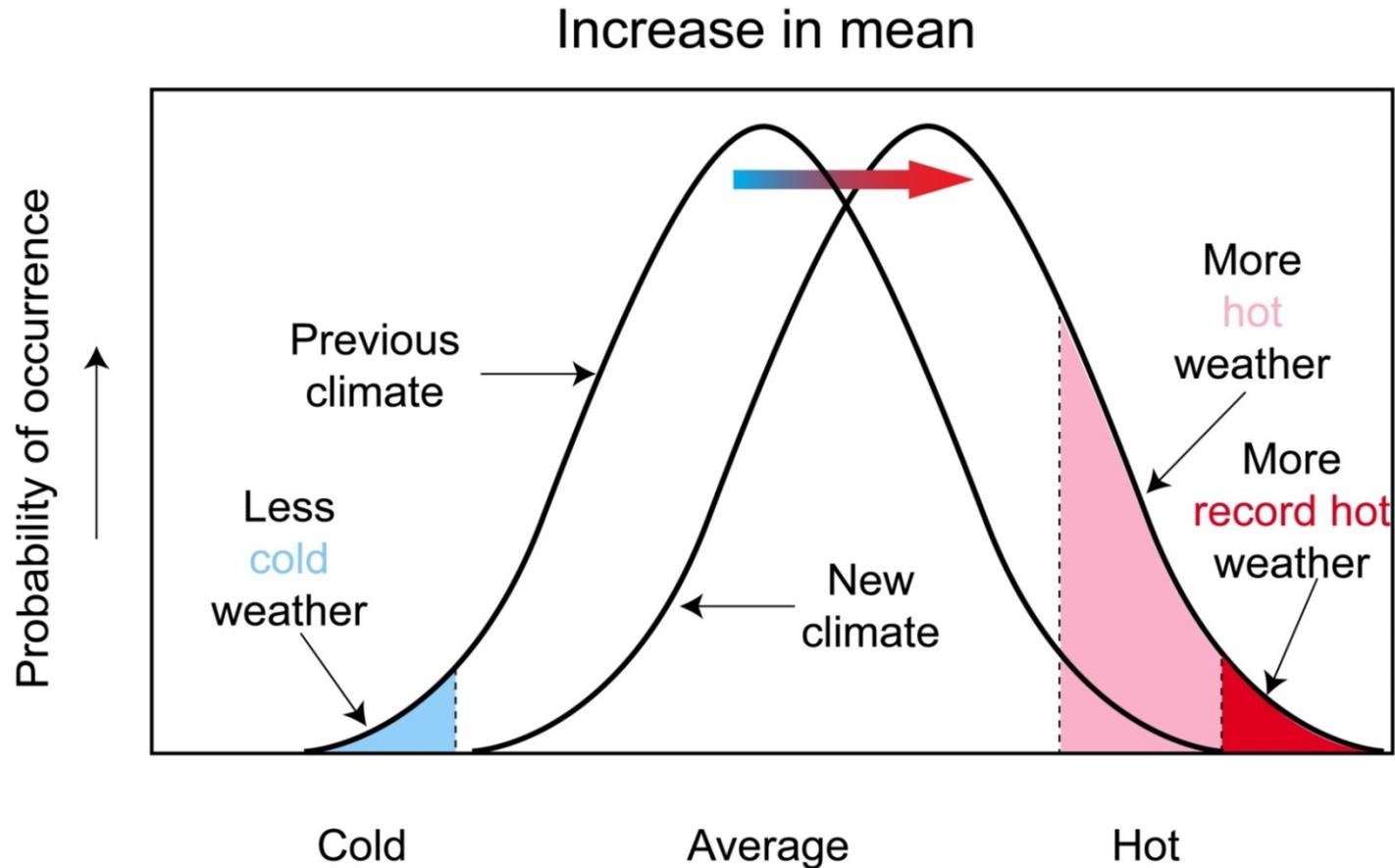
800,000 Years of Carbon Dioxide



Source: Luthi et al (2008) (cdiac.ornl.gov) & NOAA ESRL (esrl.noaa.gov)

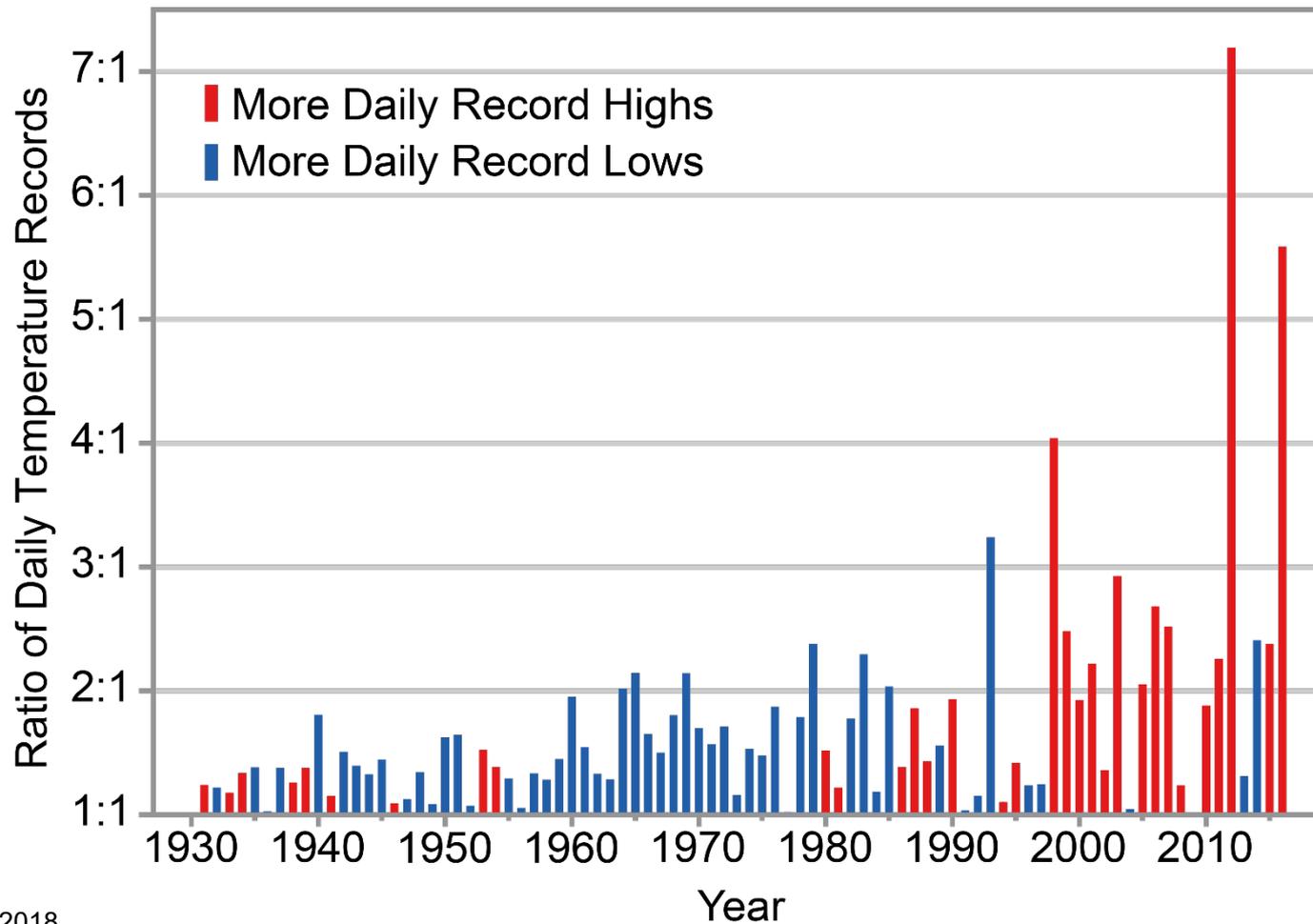
CLIMATE CENTRAL

Shifting Climate Extremes



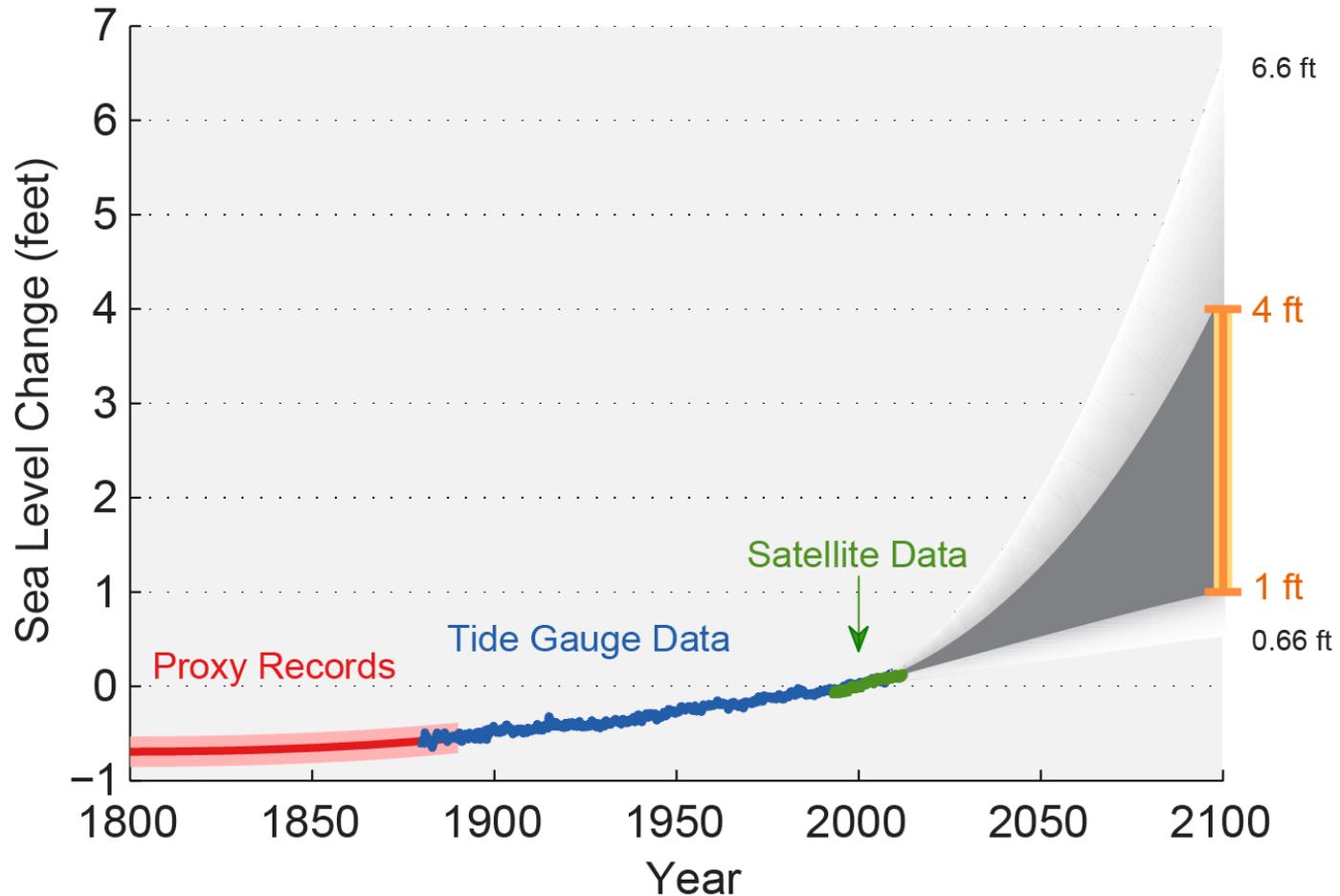
- Natural variability will continue to occur
- However, small shifts in mean values can lead to large changes in the frequency of extremes

Warming = Shifting Statistics of Temperature Extremes



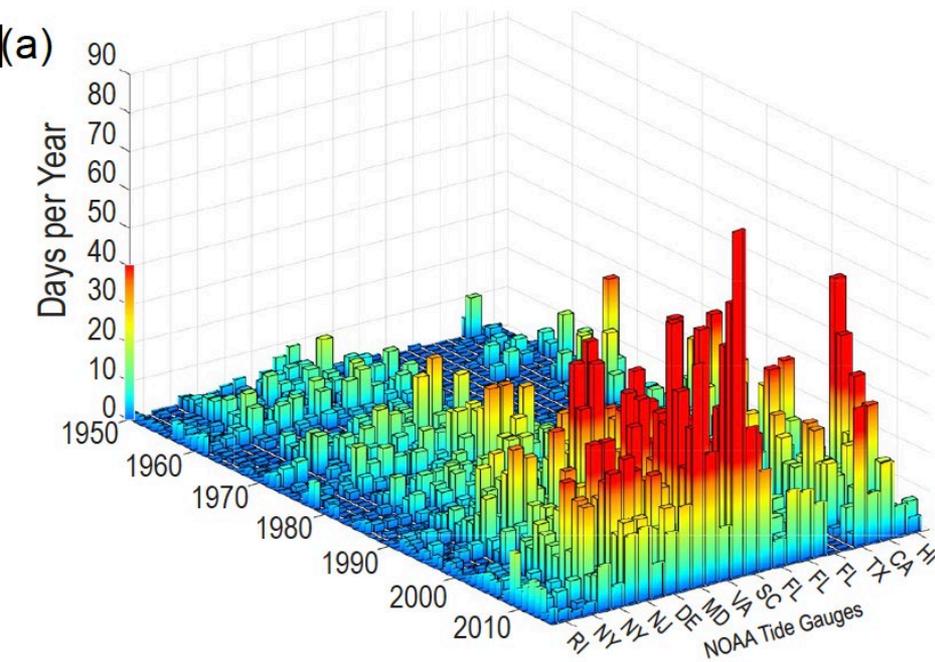
Source: USGCRP, 2018

Sea Level Trends and Projections

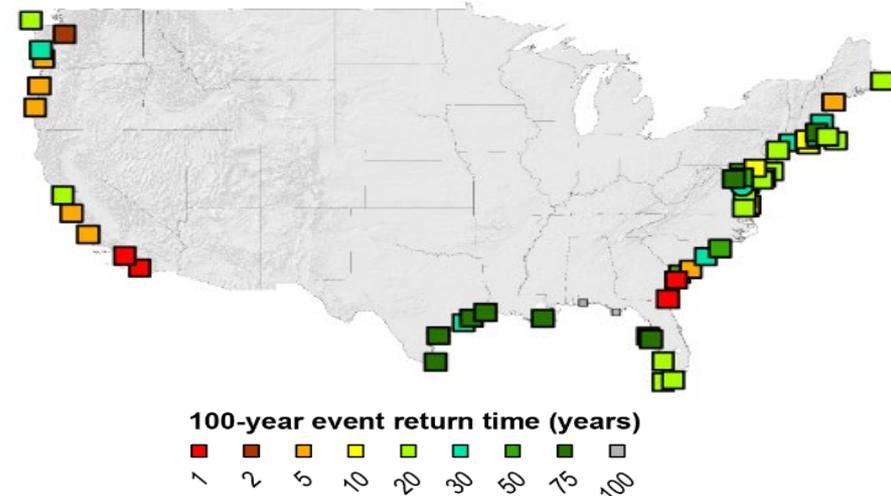


Source: USGCRP, 2014

Sea Level Rise = More Coastal Flooding



Revised Return
Time for Current 100-Year Event



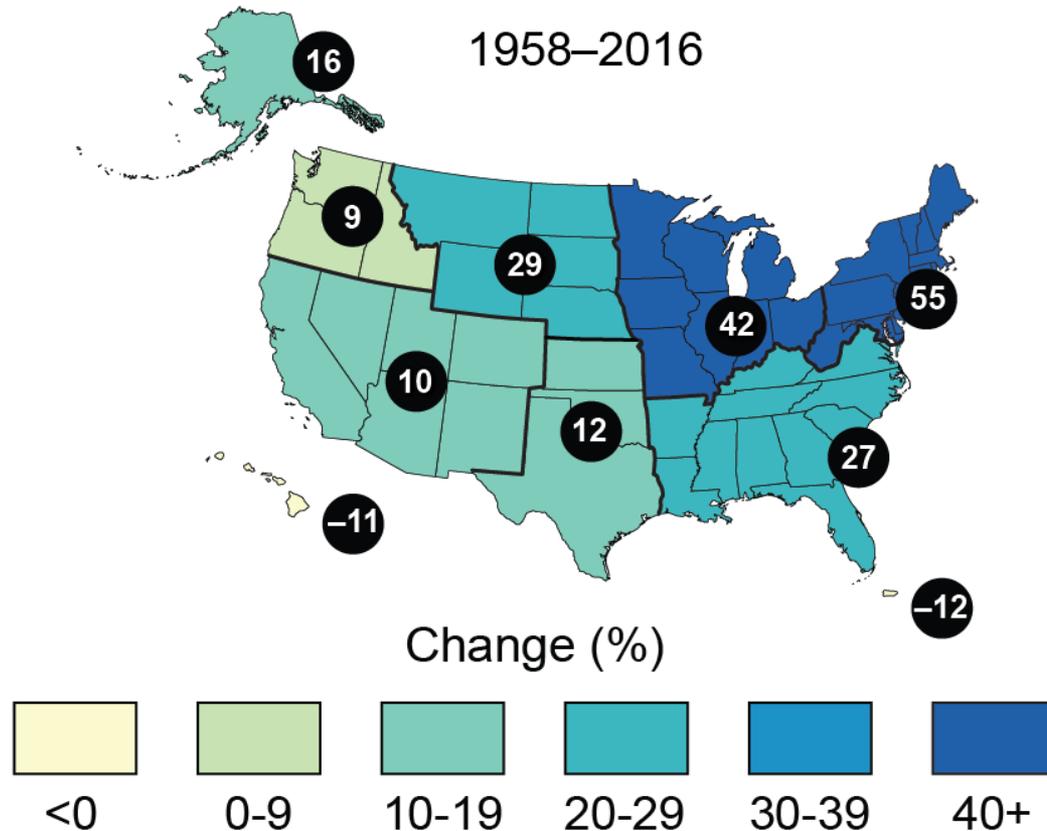
Many coastal cities are already experiencing 'nuisance' flooding far more frequently than they did two generations ago

Even if coastal storms do not change at all, moderate amounts of sea level rise (1-2 ft.) alone would make historically-rare extreme coastal flooding far more common

Source: Sweet et al., 2017 (left); Moser et al., 2014 (right)

Extreme Precipitation

Observed Change in Total Annual Precipitation
Falling in the Heaviest 1% of Events



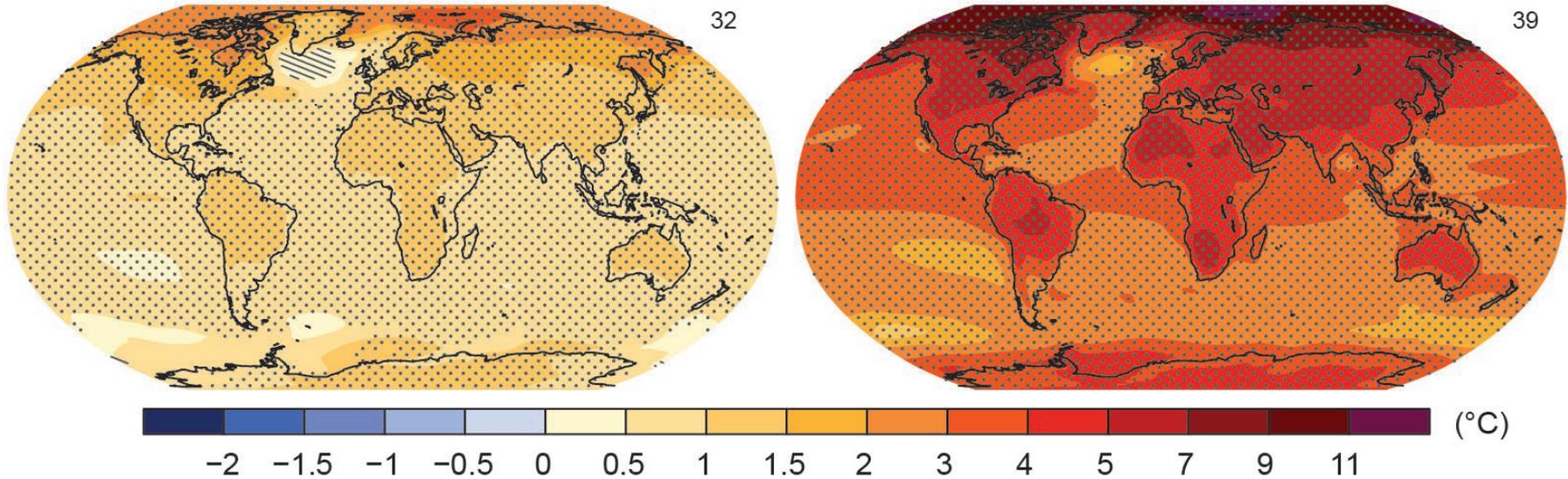
Source: USGCRP, 2018

Global Temperature Projections

RCP 2.6

RCP 8.5

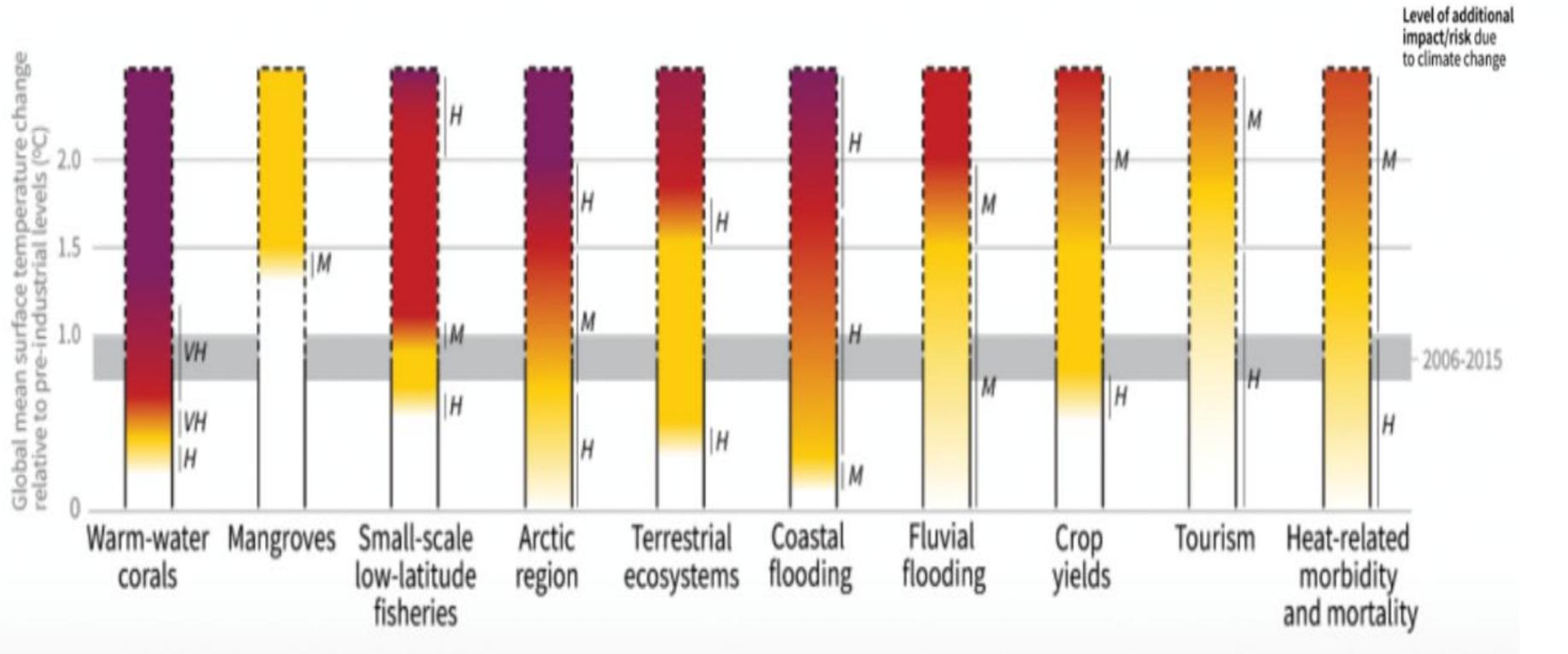
(a) Change in average surface temperature (1986–2005 to 2081–2100)



Source: IPCC

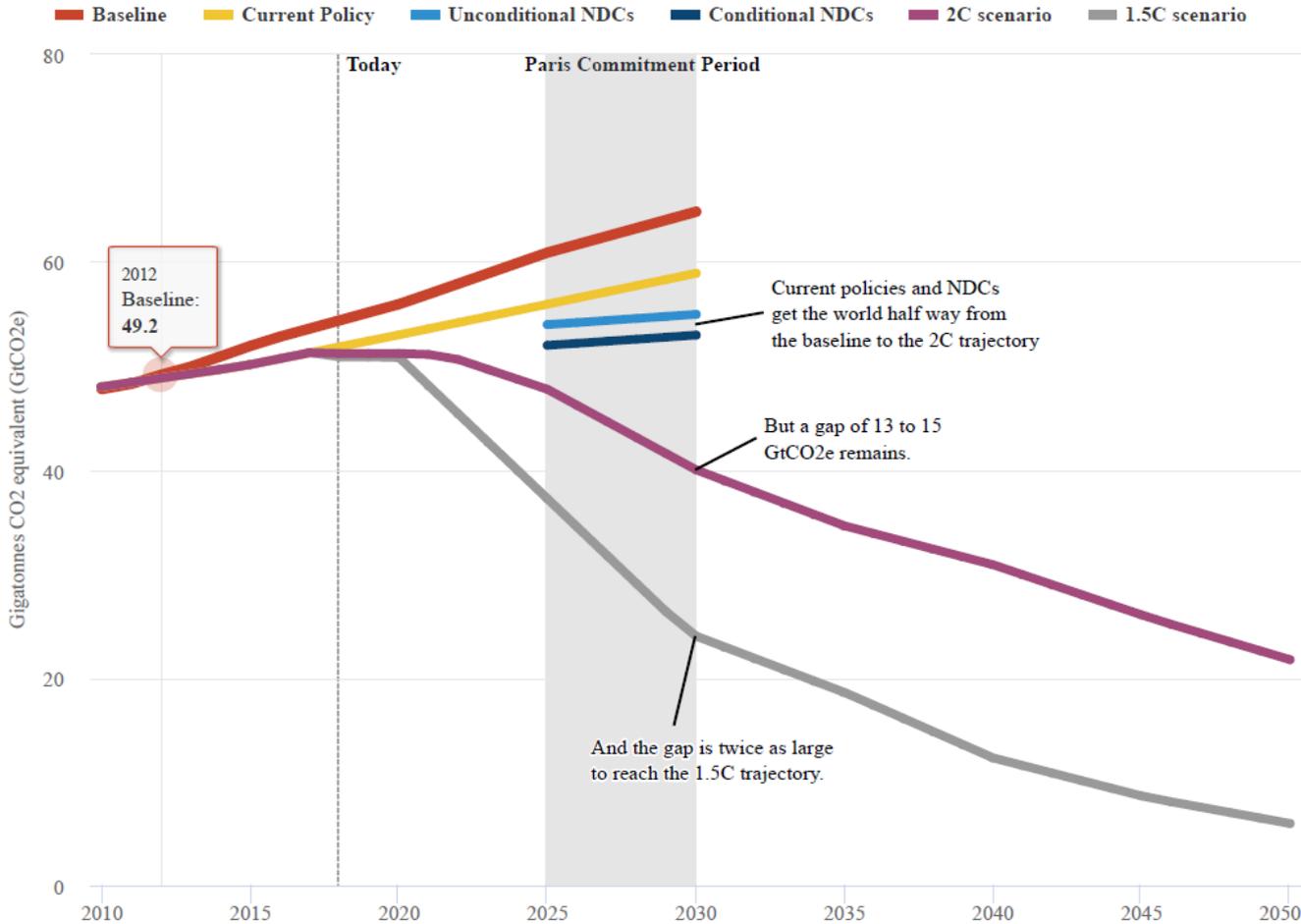
Climate Impacts

Impacts and risks for selected natural, managed and human systems



Source: Schellnhuber et al., 2016

UNEP Emissions Gap Report 2018



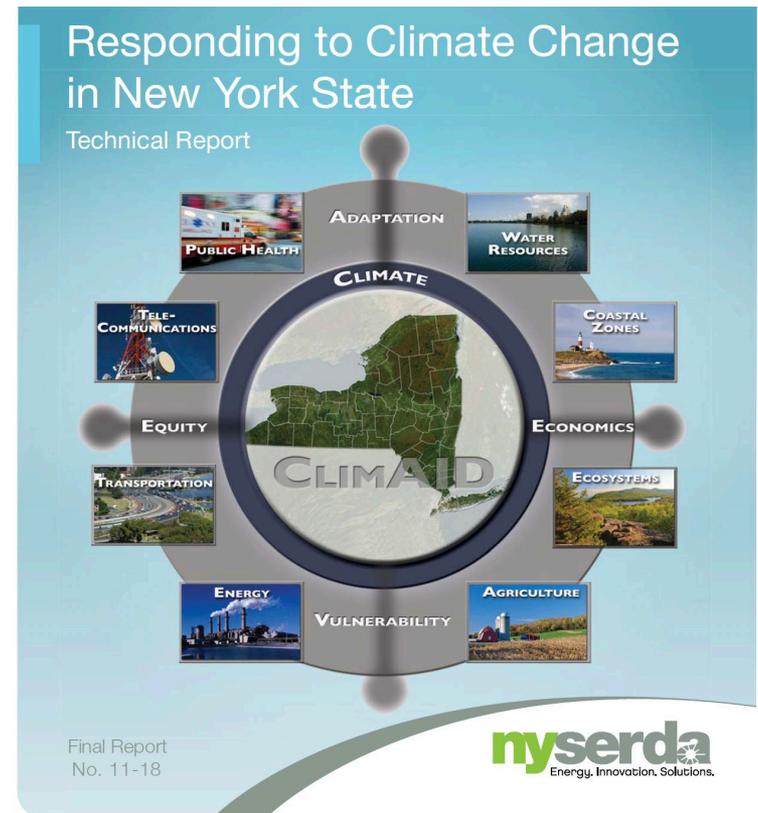
- 2°C – 3X emission reductions
- 1.5°C – 5X emission reductions
- Steep declines before 2030

Responding to Climate Change in New York State

The Responding to Climate Change in New York State (ClimAID) Assessment Report was published in 2011

Climate projections for New York State were updated in 2014

These climate projections are now codified by the NYSDEC CRRA



Local Climate Hazards

Temperature

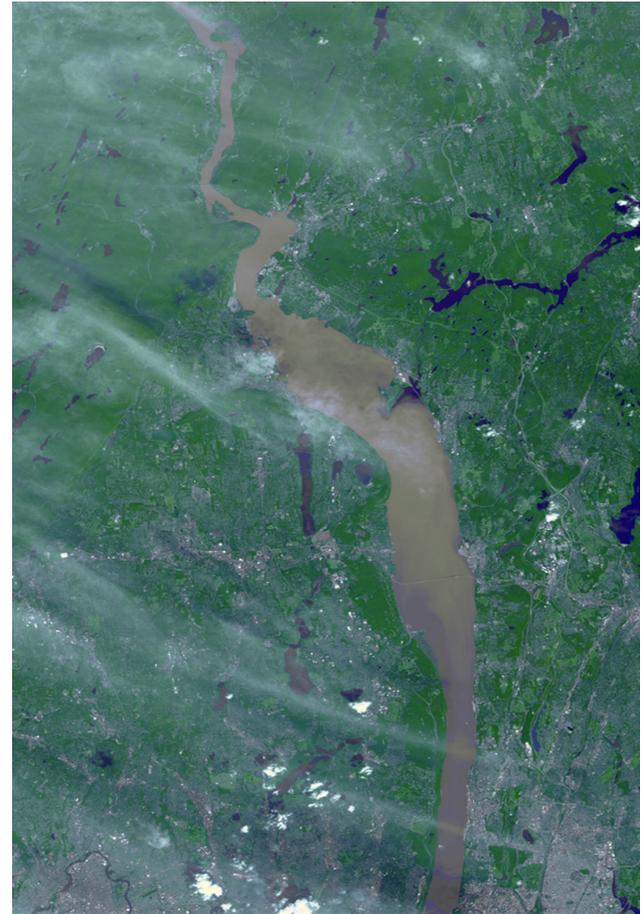
- Heat waves, cold snaps

Precipitation

- Heavy downpours, snowfall, riverine flooding

Sea Level Rise

- Coastal flooding, coastal storms (rainfall and winds)

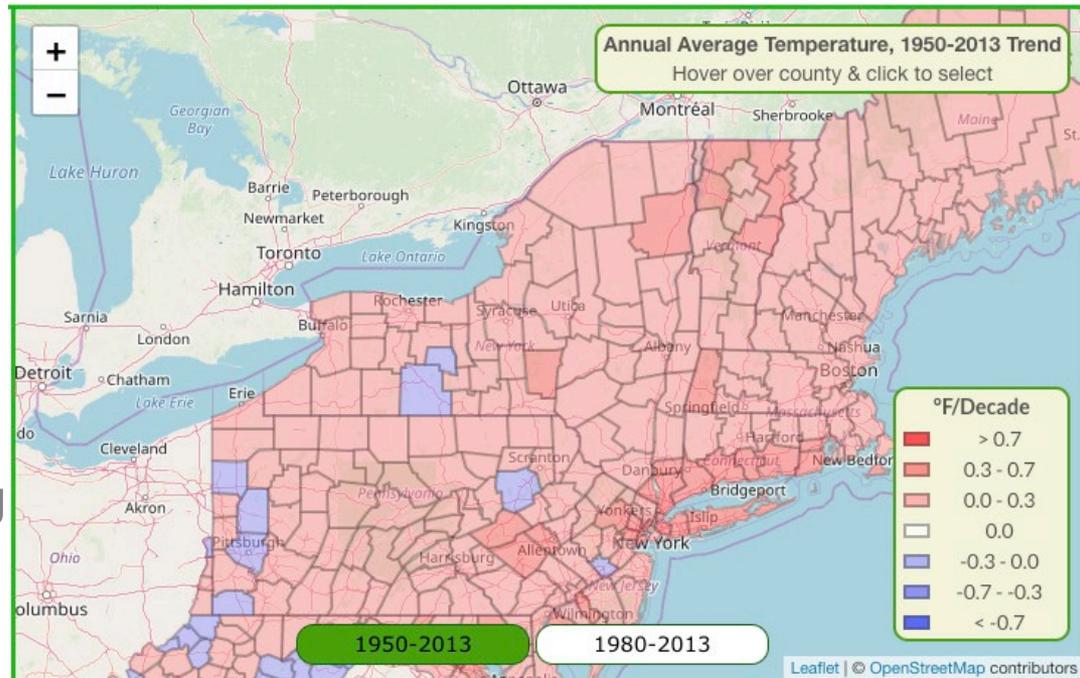


Hudson River Flooding after Hurricane Irene

Observed Trends – Temperature

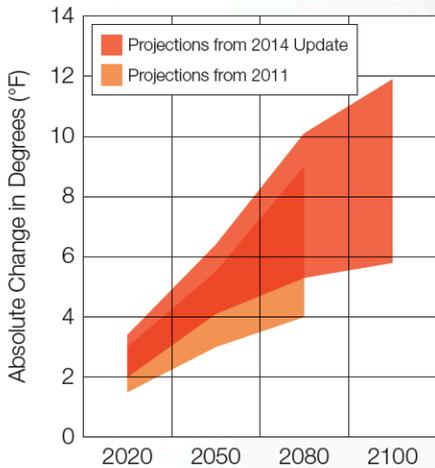
Annual mean temperature across New York increased at a rate of 0.18 F/decade from 1950 to 2013.

For the same time period, warming by ClimAID region ranges from 0.13 F/decade in the Tug Hill Plateau to 0.32 F/decade in New York City/Long Island

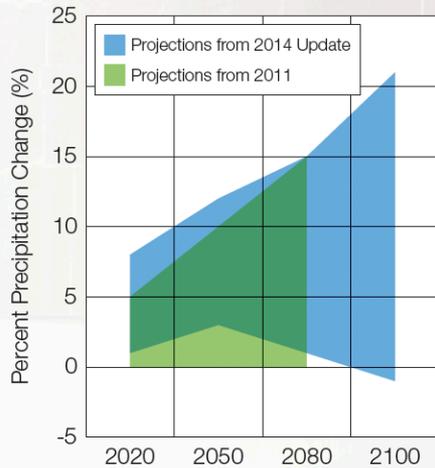


Climate Projections for New York State

 Comparison of 2011 and 2014 Temperature Projections



 Comparison of 2011 and 2014 Precipitation Projections



 Middle-Range Projected Sea Level Rise in New York City and Coastal Long Island

Incremental rise above 2000–2004 average baseline level



**Refers to the middle range (25th – 75th percentile) of model-based projections*

Climate Impacts – Temperature

Higher temperatures and increased heaves have the potential to:

- Increase stresses on water, energy, transportation, and telecommunications Infrastructure
- Cause a greater frequency of summer heat stress on people, plants, and animals.
- Alter pest populations and habitats, affecting agriculture and ecosystems.
- Lead to declines in air quality that are linked to respiratory illness and cause more heat-related deaths.



Climate Impacts – Precipitation

Increased frequency of heavy downpours has the potential to:

- Affect drinking water supply
- Heighten risk of river flooding
- Flood key rail lines, roadways, and transportation hubs



Climate Impacts – Sea Level Rise

Sea level rise and coastal flooding have the potential to:

- Increase risk of storm surge-related flooding along the coast and expand areas at risk of coastal flooding
- Increase vulnerability of infrastructure (e.g., energy facilities, transportation yards) in the floodplain.
- Cause saltwater intrusion into some freshwater supplies near the coasts.



Flooding in Stony Point, NY during Hurricane Sandy

Key Points

- **The statistics of many types of extreme events have already shifted in recent decades**
- **As long as greenhouse gas concentrations rise, we expect to see an acceleration of many of these changes in extreme event statistics**
- **Even small climate changes could be associated with large changes in impacts**
- **The further we push the climate system, the greater the potential for disruption**
- **Innovations in greenhouse gas mitigation, and adaptation, could also lead to disruptive opportunities**