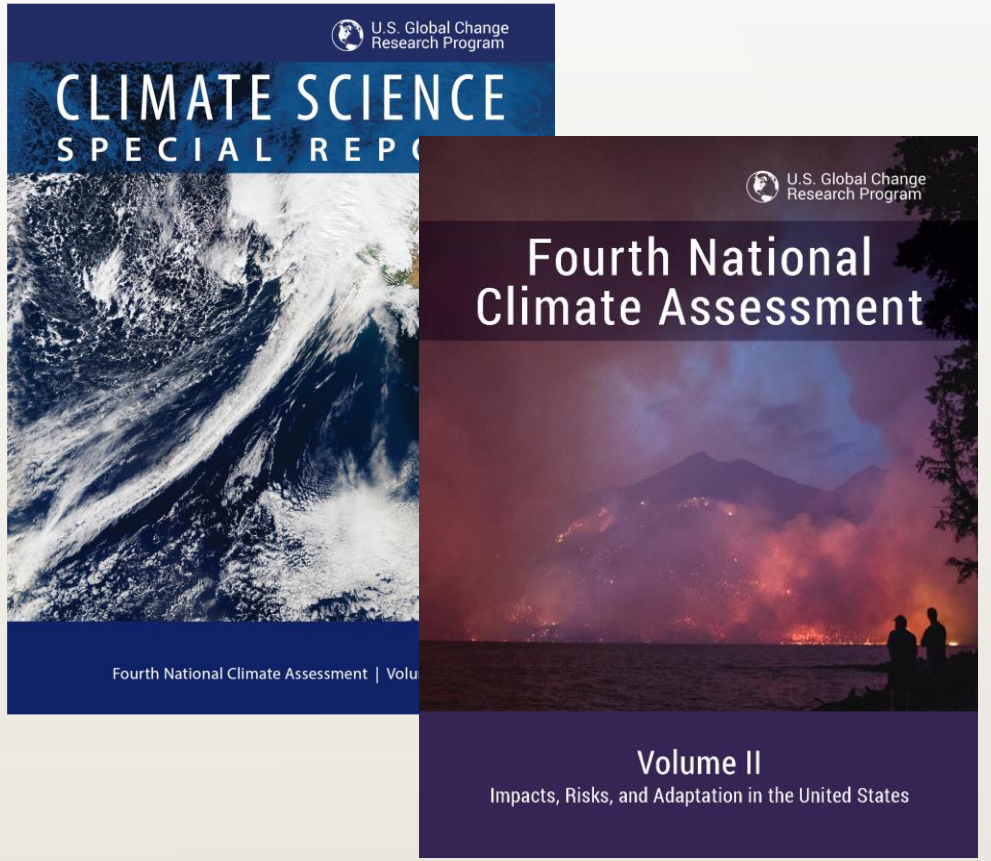
Overview of the Fourth National Climate Assessment

Presented to the Broward Climate Change Task Force

February 28, 2019

4th National Climate Assessment (NCA 4)

- Released November 23, 2019
- NCA Volume I: Climate Science Special Report (CSSR)
- NCA Volume II: Impacts, Risks and Adaptation
- On-line web document
- Fewer technical reports



Key Findings

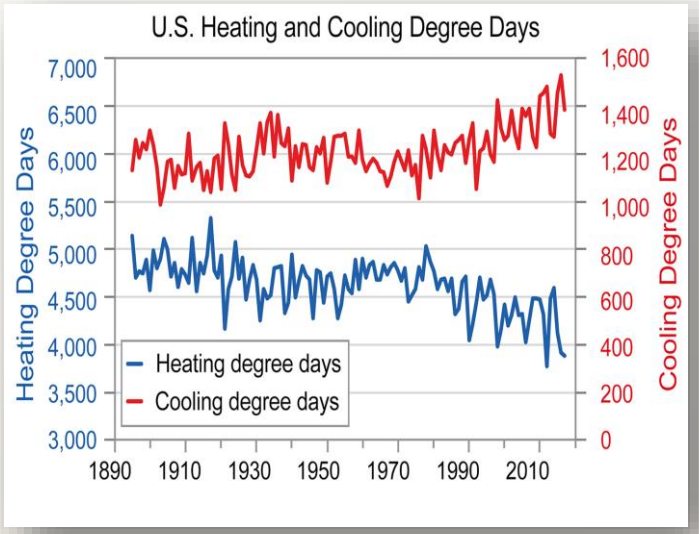
- The global, long-term, and unambiguous warming trend has continued during recent years.
- Since the last National Climate Assessment was published,
  - 2014 became the warmest year on record globally;
  - 2015 surpassed 2014 by a wide margin; and
  - 2016 surpassed 2015.
- Sixteen of the warmest years on record for the globe occurred in the last 17 years (1998 was the exception).

Key Findings

- Communities – climate change creates new risks and exacerbates others, a growing challenge to health, safety, quality of life, and economic growth
- Economy – without adaptation, impacts to infrastructure will cause growing losses to infrastructure and impede the rate of economic growth
- Interconnected impacts – natural, built, and social systems are connected and impacts cascade
- Actions to reduce risk – Efforts to reduce risk and the cost of impacts, but scale is in adequate

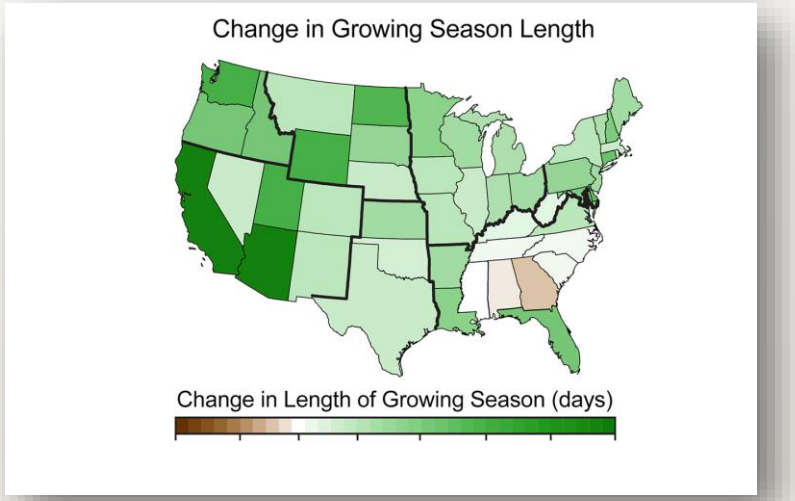
Key Findings

- Water – the quality and quantity of water available for people and ecosystems is being affected across the country, with risks to ag., energy, industry, recreation and the env.
- Health – impacts (extreme weather, heat, air quality and disease) increasingly threaten the well-being of the American people.
- Indigenous people – disruptions to interconnected social, physical, and ecological systems (e.g., livelihoods, cultural identity)
- Ecosystem services – reefs and sea ice already experiencing transformational change



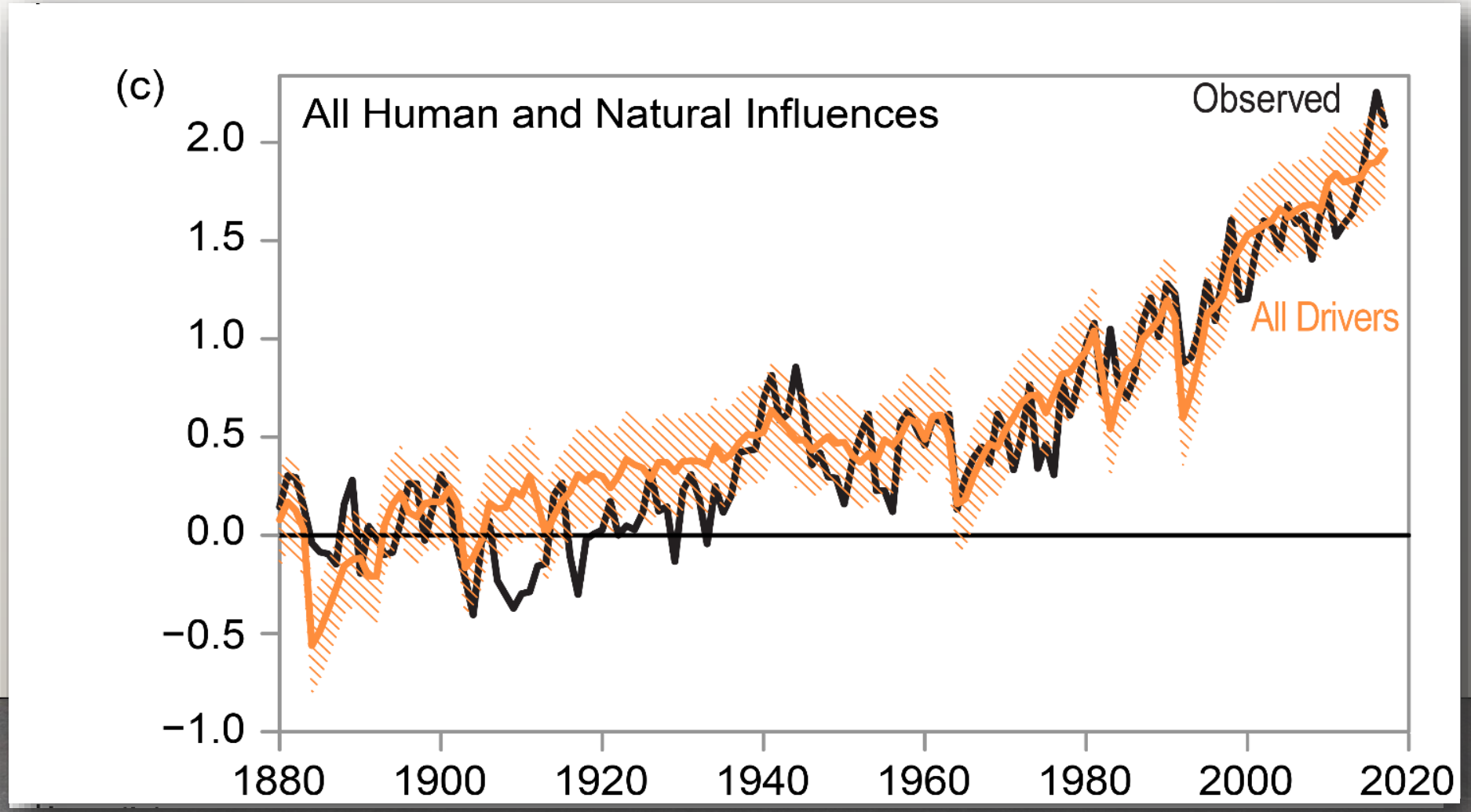
Key Findings

- Agriculture – wide impacts of heat, drought, fire on crop productivity and price stability
- Infrastructure – degradation stressed by heavy rainfall, coastal flooding, heat and fires
- Oceans and Coasts – Even under low scenarios, predictions for financial impacts due to high losses and lower property values
- Tourism and Recreation – Degradation of outdoor recreation and tourist economies where natural environment is impacted.



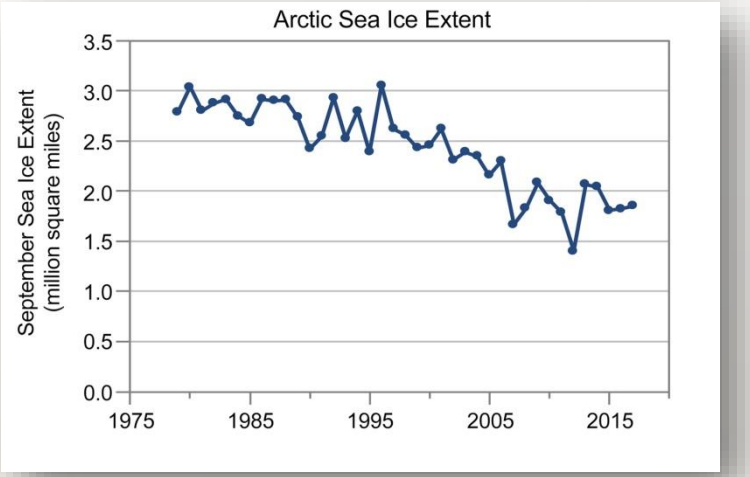
Key Scientific Advancements Since NCA3

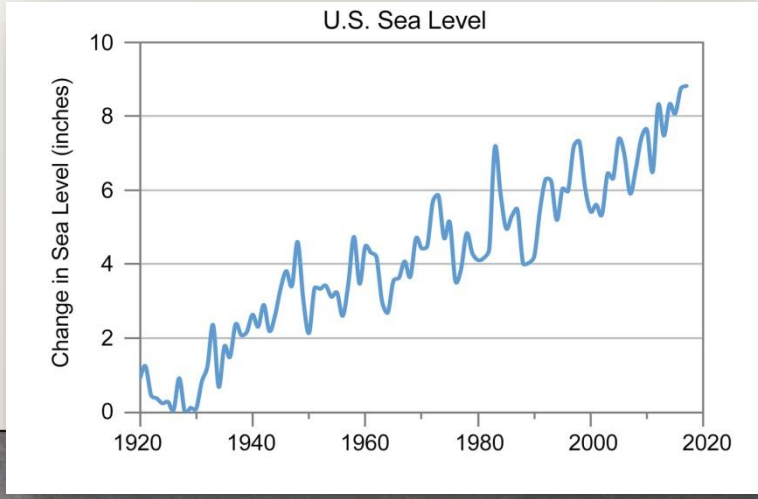
- Human attribution



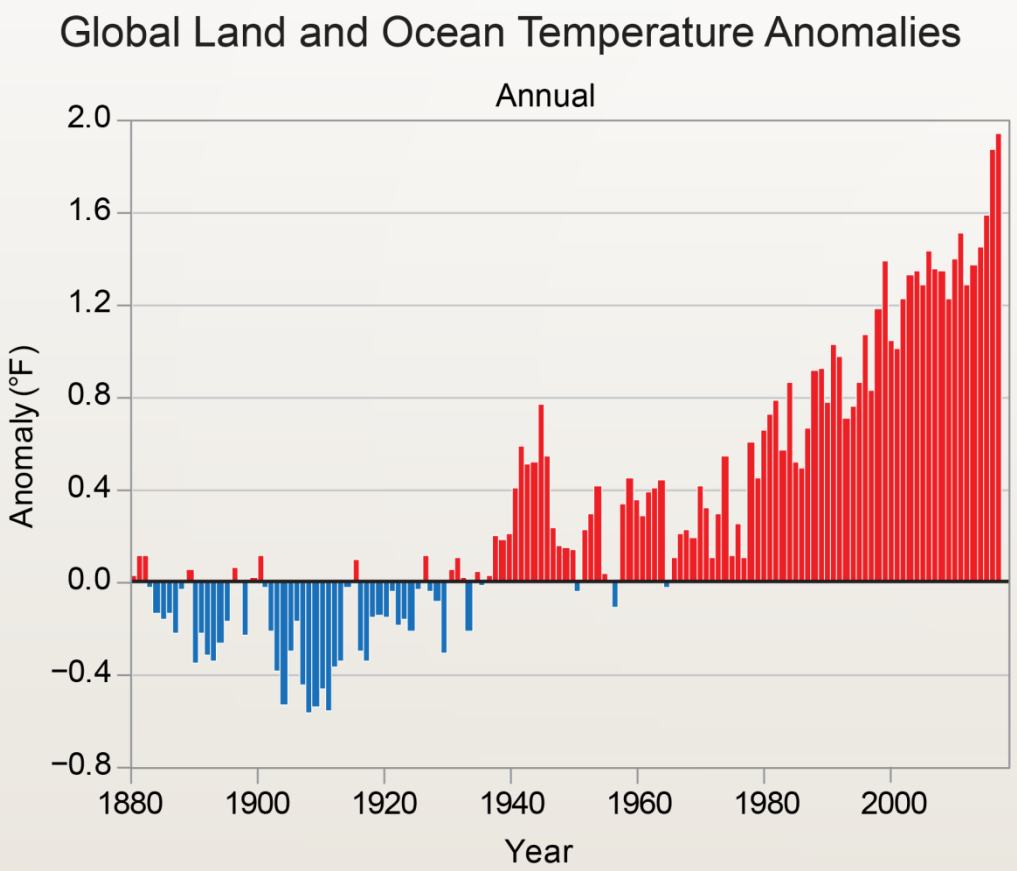
Key Scientific Advancements since NCA3

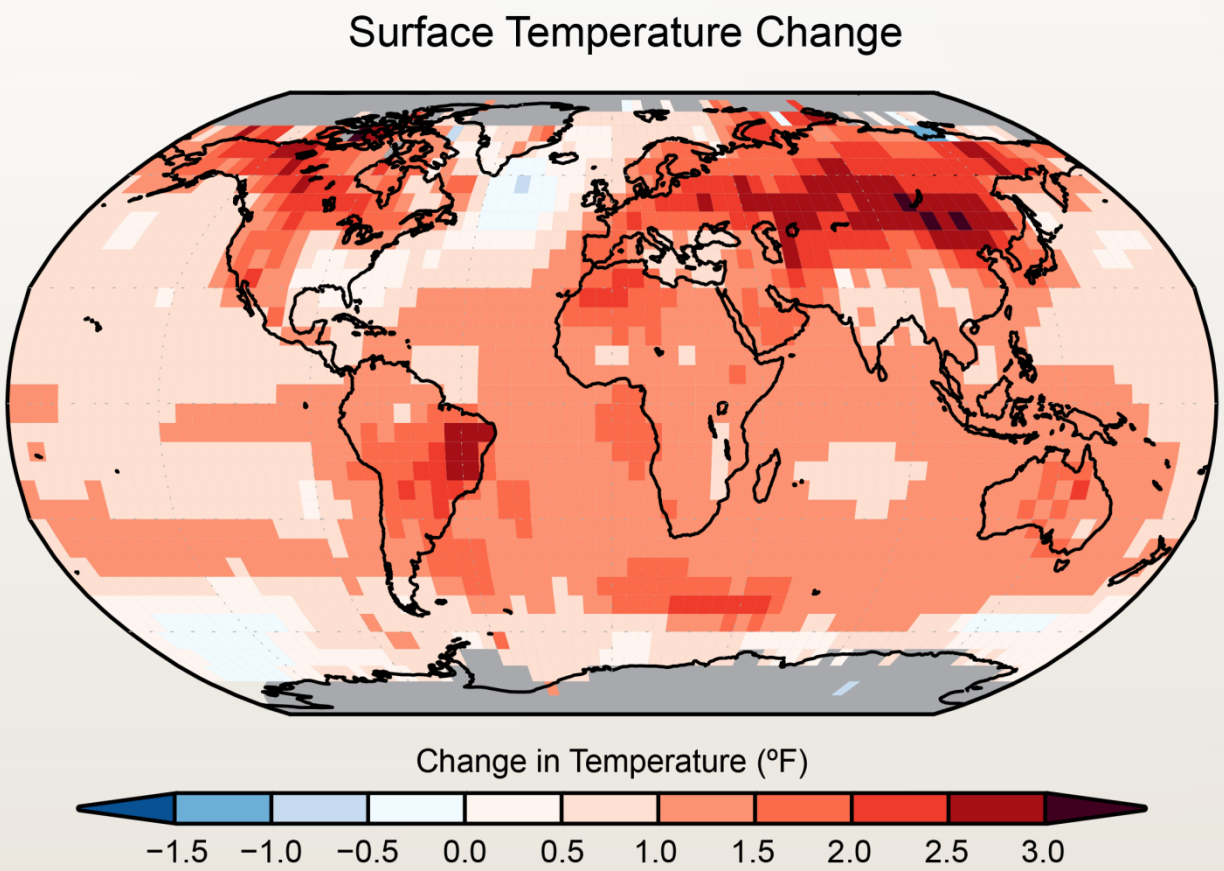
- Human attribution
- Refinements to climate models to better represent atmospheric circulation
- Finer scale modeling, local resolution (but limited inclusion of results)
- Understanding of impacts is improving, relative to global averages (ocean acidification and warming)
- Measured rates of change in sea ice coverage
- Potential surprises: tipping points associated with large-scale shifts and compounded extremes





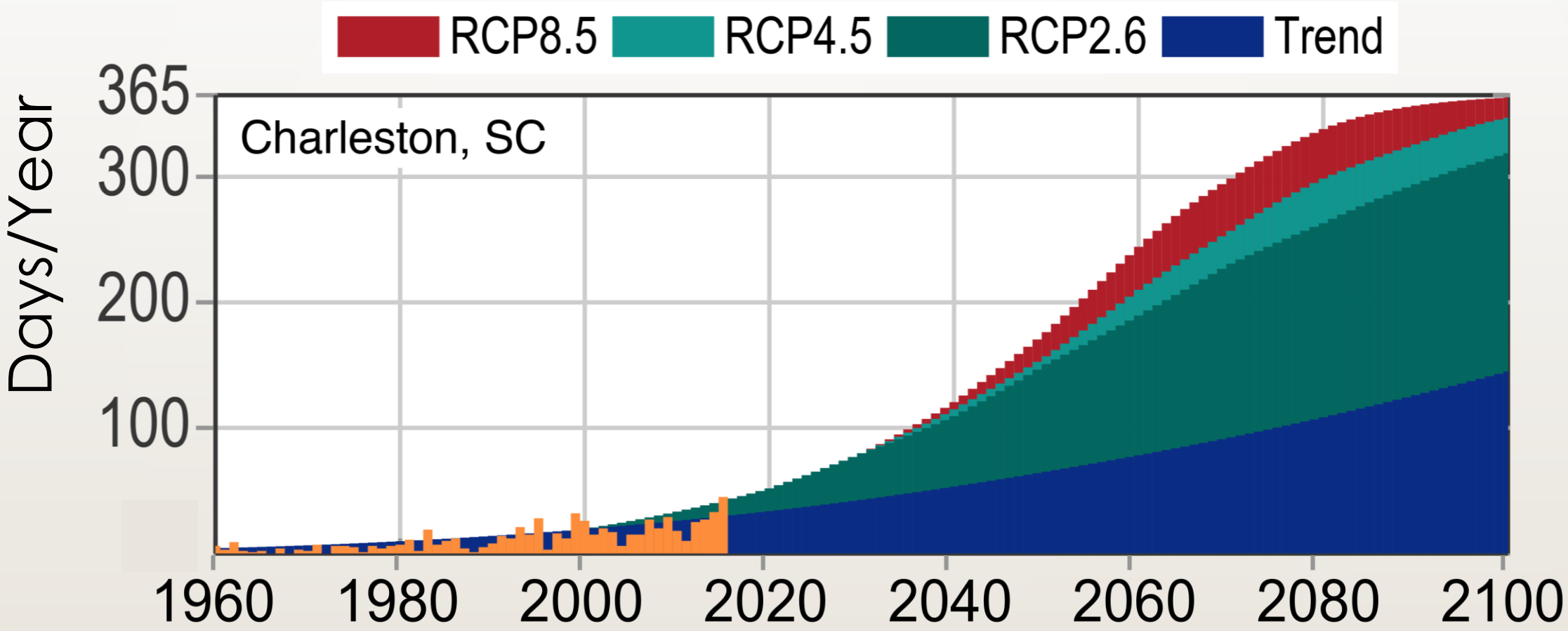
Temperature Trends





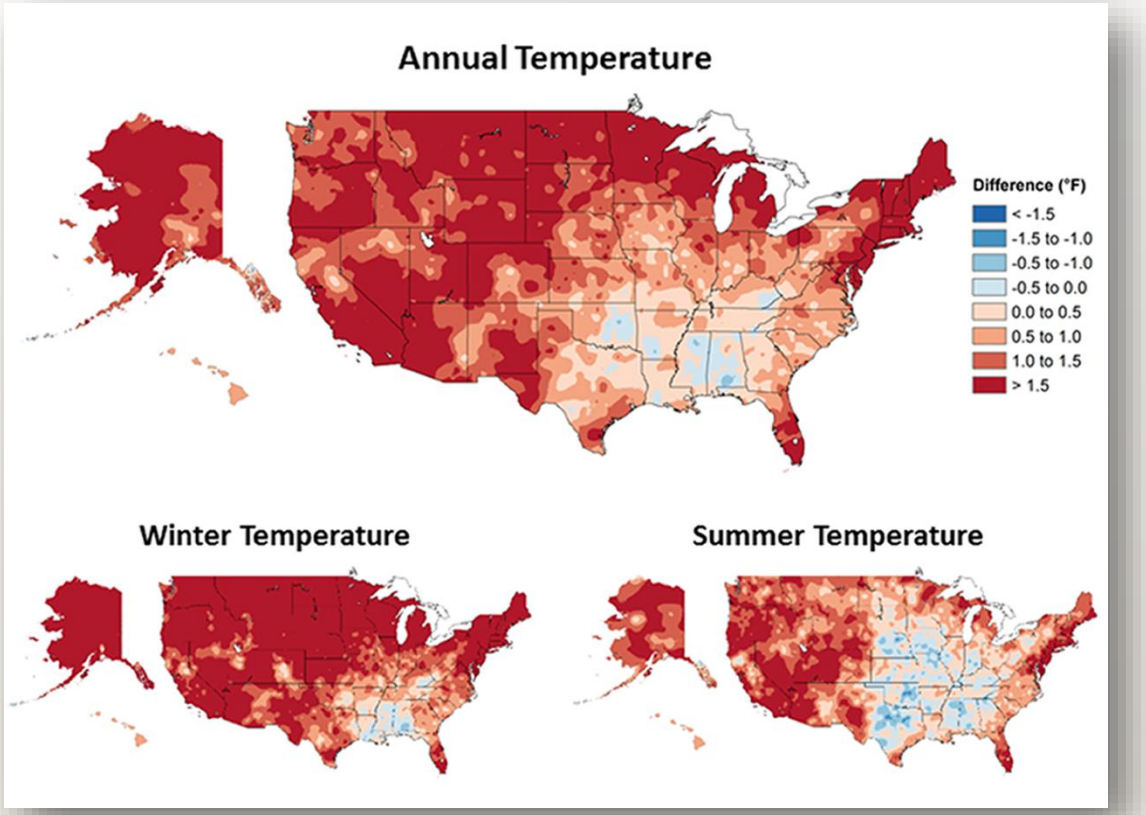
Global annual average temperature has increased by more than 1.2°F (0.65°C) for the period 1986–2016 relative to 1901–1960

Minor Tidal Flooding



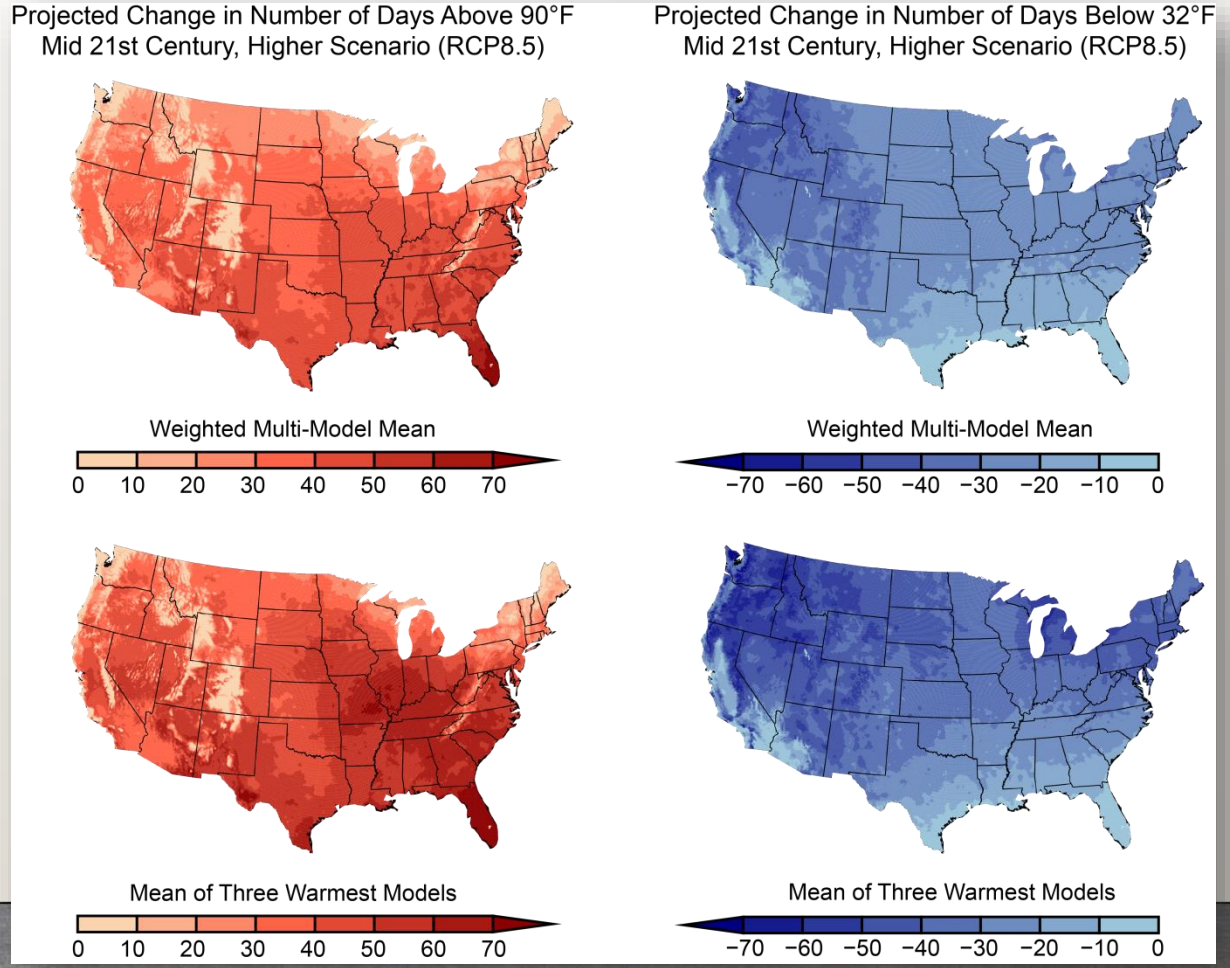
Regional Temperature Trends

A Region	Change in Annual Average Temperature	Change in Annual Average Maximum Temperature	Change in Annual Average Minimum Temperature
Contiguous U.S.	1.23°F	1.06°F	1.41°F
Northeast	1.43°F	1.16°F	1.70°F
Southeast	0.46°F	0.16°F	0.76°F
Midwest	1.26°F	0.77°F	1.75°F
Great Plains North	1.69°F	1.66°F	1.72°F
Great Plains South	0.76°F	0.56°F	0.96°F
Southwest	1.61°F	1.61°F	1.61°F
Northwest	1.54°F	1.52°F	1.56°F
Alaska	1.67°F	1.43°F	1.91°F
Hawaii	1.26°F	1.01°F	1.49°F
Caribbean	1.35°F	1.08°F	1.60°F



Temperature Trend Predictions

NCA Region	RCP4.5 Mid-Century (2036–2065)	RCP8.5 Mid-Century (2036–2065)	RCP4.5 Late-Century (2071–2100)	RCP8.5 Late-Century (2071–2100)
Northeast	3.98°F	5.09°F	5.27°F	9.11°F
Southeast	3.40°F	4.30°F	4.43°F	7.72°F
Midwest	4.21°F	5.29°F	5.57°F	9.49°F
Great Plains North	4.05°F	5.10°F	5.44°F	9.37°F
Great Plains South	3.62°F	4.61°F	4.78°F	8.44°F
Southwest	3.72°F	4.80°F	4.93°F	8.65°F
Northwest	3.66°F	4.67°F	4.99°F	8.51°F



Extreme Rainfall and the 2017 Hurricane Season

- Climate change is unlikely to increase the overall number of storms on average, however the trend is for storms to rapidly intensify in a warmer world.
  - Harvey total rainfall amount estimated to be 38% greater as a result of human-induced climate change, with the three-day rainfall to be approximately 15% more intense and the event itself three times more likely.
  - Wilma delivered 37 inches of rainfall in the 3-day window
  - Irma shattered the existing record for the length of time over which it sustained winds of 185 miles per hour.

Warming and Acidifying Oceans

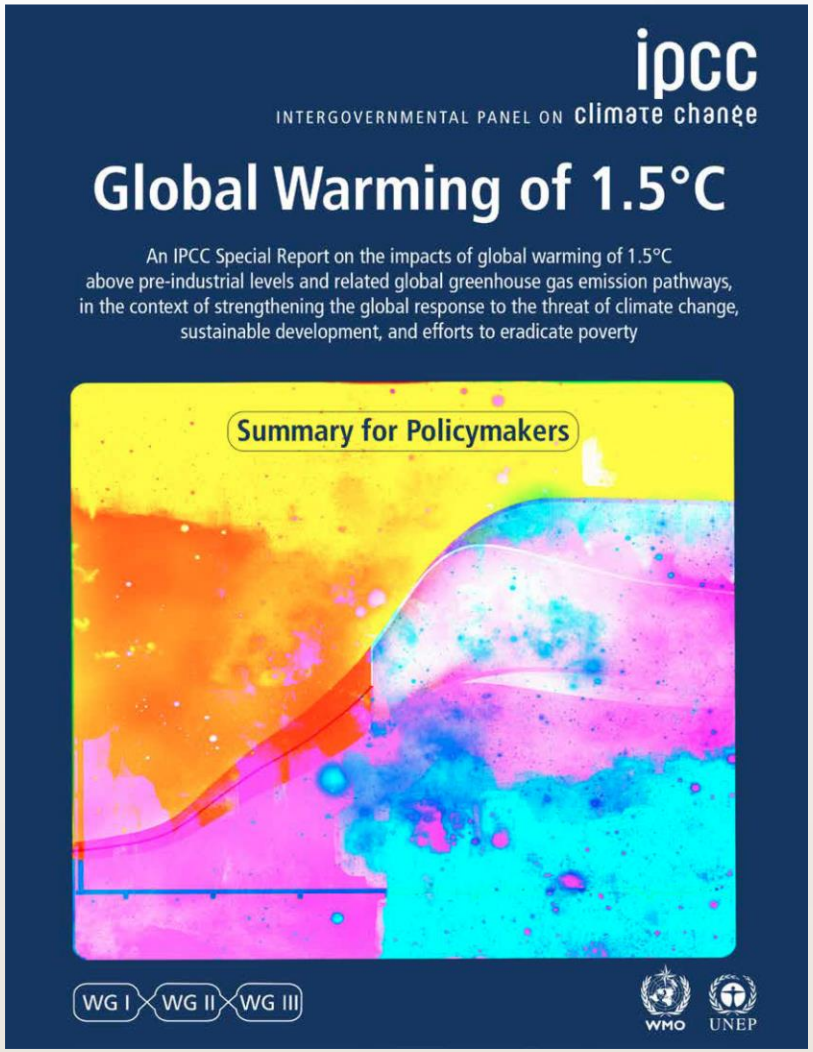
- Since the 1950s, the oceans have absorbed 93% of the excess heat in the earth system that has built up as a result of increasing concentrations of greenhouse gases in the atmosphere.
- Over the last 50 years, declining oxygen levels have been observed in many inland seas, estuaries, and nearshore coastal waters (SST and SLR)
- By 2100, under a higher scenario (RCP8.5)
  - average SST is projected to increase by 4.9° ± 1.3°F (2.7° ± 0.7°C)
  - ocean oxygen levels are projected to decrease by 3.5%,
  - global average surface ocean acidity is projected to increase by 100% to 150%.
  - This rate of acidification would be unparalleled in at least the past 66 million years.

Sea Level Rise

- Paleo sea level records suggest that 1.8°F (1°C) of warming may already represent a long-term commitment to more than 20 feet (6 meters) of global average sea level rise;
- 3.6°F (2°C) warming represents a 10,000-year commitment to about 80 feet (25 m),
- 21st-century emissions consistent with the higher scenario (RCP8.5) represent a 10,000-year commitment to about 125 feet (38 m) of global average sea level rise

Summary on Climate Science

- To stabilize global average temperature at or below specific long-term warming targets such as 3.6°F (2°C), or the more ambitious target of 2.7°F (1.5°C)
  - would require substantial reductions in net global carbon emissions relative to present-day values well before 2040,
  - would likely require net emissions to become zero or possibly negative later in the century (NCA4 Volume I)
- See also IPCC 1.5°C Global Warming Report



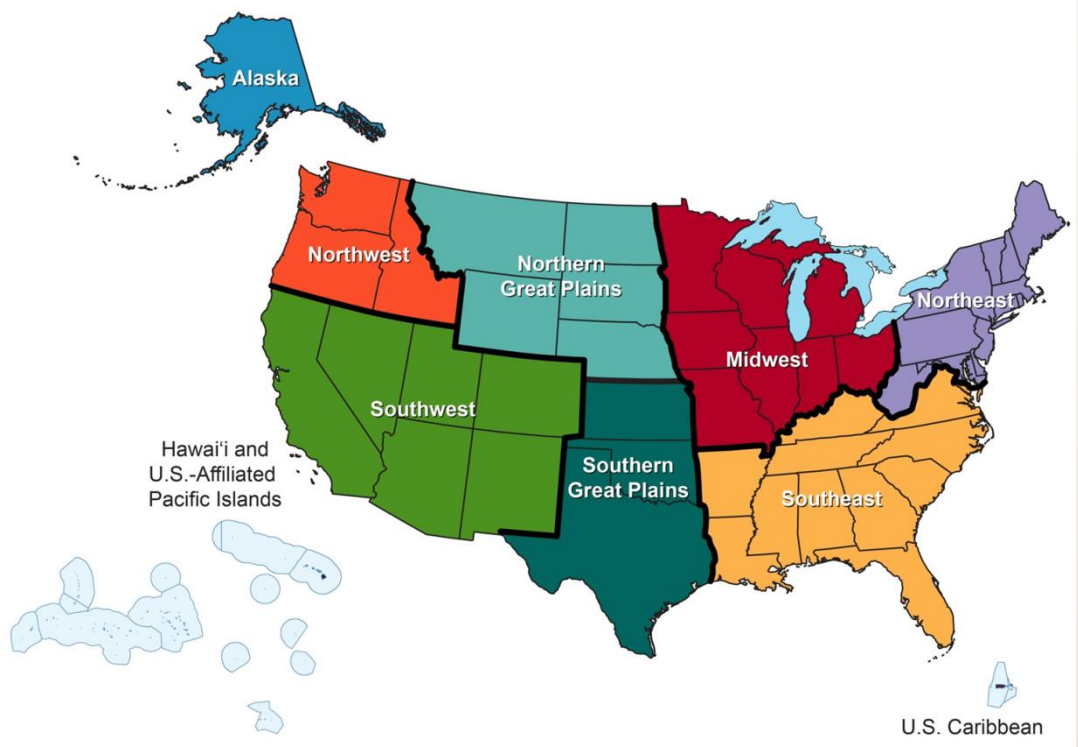
Volume II: What's New?

Additional Chapters

- Chapter 13: Air Quality
- Chapter 16: Climate Effects on U.S. International Interests
- Chapter 17: Sectoral Interactions, Multiple Stressors, and Complex Systems

Additional Regions

- Great Plains divided to North and South
- U.S. Caribbean is now distinct from SE Region



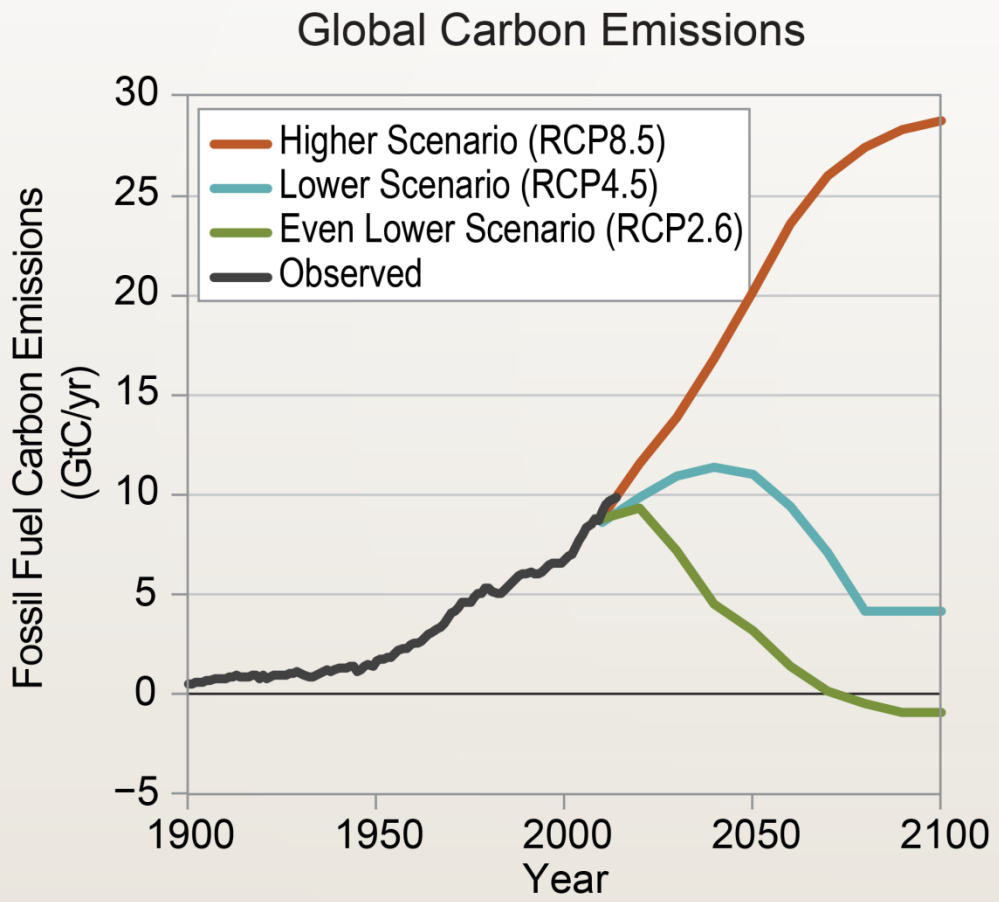
Response Chapters

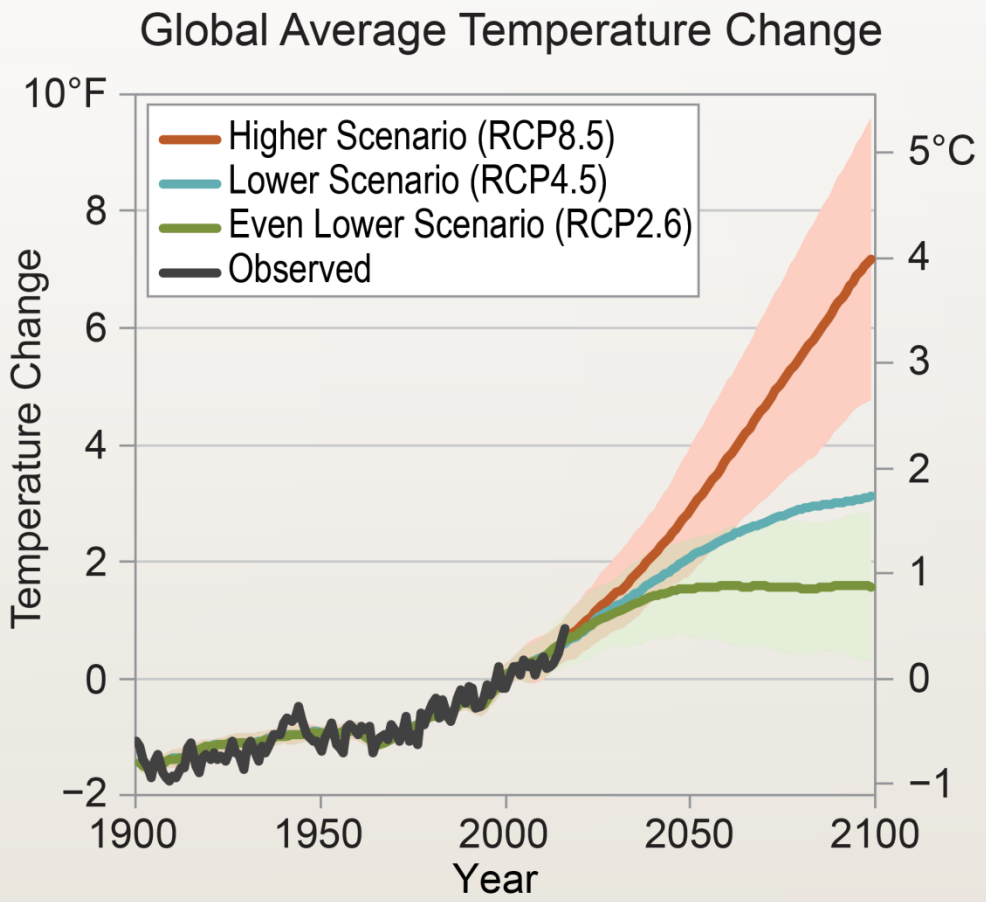
- Use of Scenarios
  - Climate projections under 4 RCP (Representative Concentration Pathways)
    - RCP 8.5 – more warming (current trends, assuming leveling off of GHG in 2100)
    - RCP 6.0 - moderate warming
    - RCP 4.5 – less warming (85% less GHG than RPC 8.5)
    - RCP 2.6 – very low (instructive)
- Assess adaptation and mitigation
  - Benefits, tradeoffs, best practices
  - Quantification of avoided impacts with GHG reductions
- Do not directly address policy

Dominant Pathways in the Impacts Analysis

- RCP 8.5 – Warming of 9°F by 2100
- RCP 4.5 – 85% lower emissions than RCP 8.5
- RCP 2.6 – Could constrain warming to less than 2°C (3.6°F)
- Marked divergence in scenarios in 2050
  - Temperature
  - Precipitation
  - Sea level rise

Divergence of RCPs





Temperature Trend Scenarios

- Regardless of future scenario, additional increases in temperatures across the contiguous United States of at least 2.3°F relative to 1986–2015 are expected by the middle of this century.

- By late this century, increases of 2.3°–6.7°F are expected under a lower scenario (RCP4.5) and 5.4°–11.0°F under a higher scenario (RCP8.5) relative to 1986–2015 (Figure 1.3)

Major Uncertainties

- Magnitude of SLR that will occur and how it will vary across different regions,
- Adaptive responses to SLR risk and impacts, including individual action and public policy development (e.g., future development patterns)
- Future flood insurance policy, matters of affordability could change behaviors.
- Economic and social value of key sectors, such as real estate and insurance/reinsurance

Additional Information

- Reducing risk via adaptation
- Reducing risk via mitigation
- Tools and toolkits
- Case studies
- Looking abroad – other national climate assessments

https://nca2018.globalchange.gov