

Climate Adaptation & Mitigation

4th National Climate Assessment ***Climate Science Special Report***

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21st Energy & Climate Research Seminar

Hosted by Electric Power Research Institute

May 17, 2018



U.S. Global Change Research Program

- The U.S. Global Change Research Program (USGCRP) began as an initiative under President Ronald Reagan in 1989
- Mandated by Congress in the Global Change Research Act of 1990 (P.L. 101-606), “to assist the Nation and the world to **understand, assess, predict** and **respond** to human-induced and natural process of global change”
- The GCRA was signed into law by President George H. W. Bush in November 1990



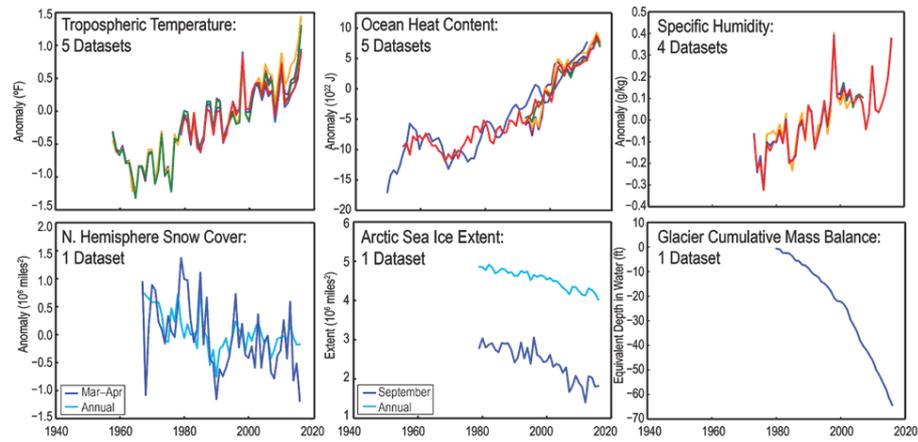
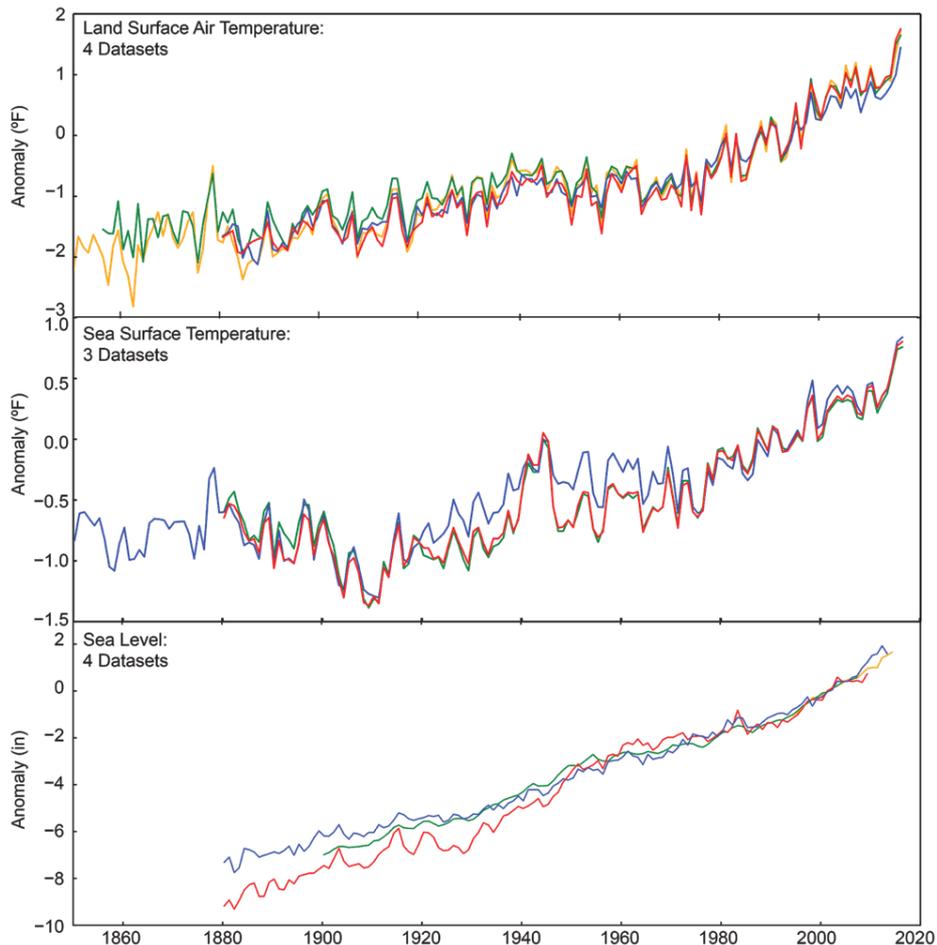
National Climate Assessment mandate

From the Global Change Research Act of 1990:

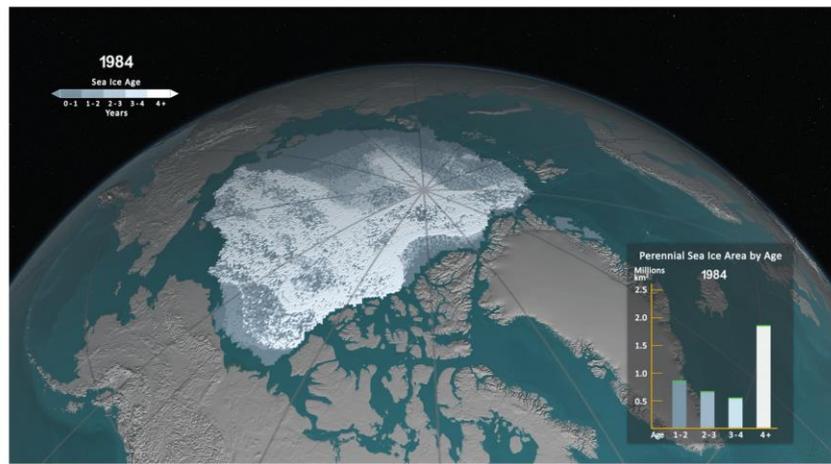
Not less frequently than every 4 years [the Program] shall prepare and submit to the President and Congress an assessment which:

- Integrates, evaluates, and interprets the findings [of the Program] and discusses the scientific uncertainties associated with such findings
- Analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity
- Analyzes current trends in global change, both human- induced and natural, and projects major trends for the subsequent 25 to 100 years.

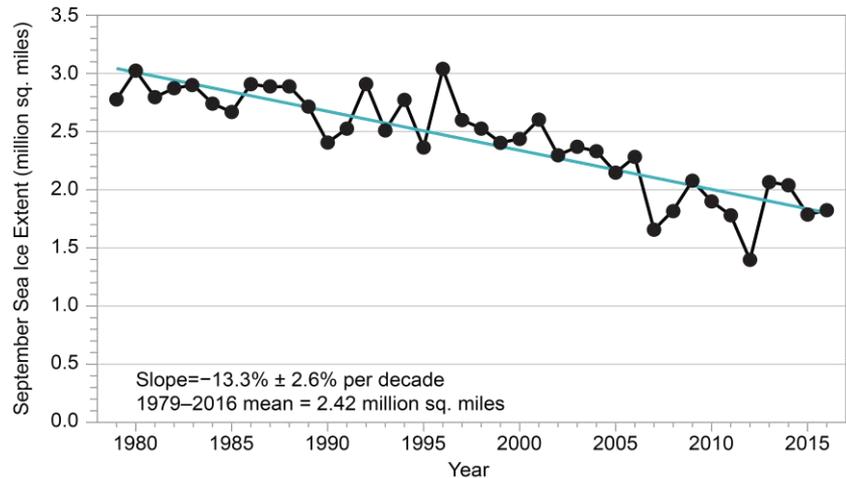
Global and Large Regional Indicators of Human-Induced Changes in Global Climate



Arctic land and sea ice loss observed in the last three decades continues, in some cases accelerating (*very high confidence*)



Arctic-wide ice loss is expected to continue through the 21st century, very likely resulting in nearly sea ice-free late summers by the 2040s (*very high confidence*)



Key Finding:

Rising Alaskan permafrost temperatures are causing permafrost to thaw and become more discontinuous; this process releases additional carbon dioxide and methane, resulting in an amplifying feedback and additional warming (*high confidence*). The overall magnitude of the permafrost–carbon feedback is uncertain; however, it is clear that these emissions have the potential to compromise the ability to limit global temperature increases.

Trends in permafrost temperatures range from 0.2 to 0.7°C per decade.

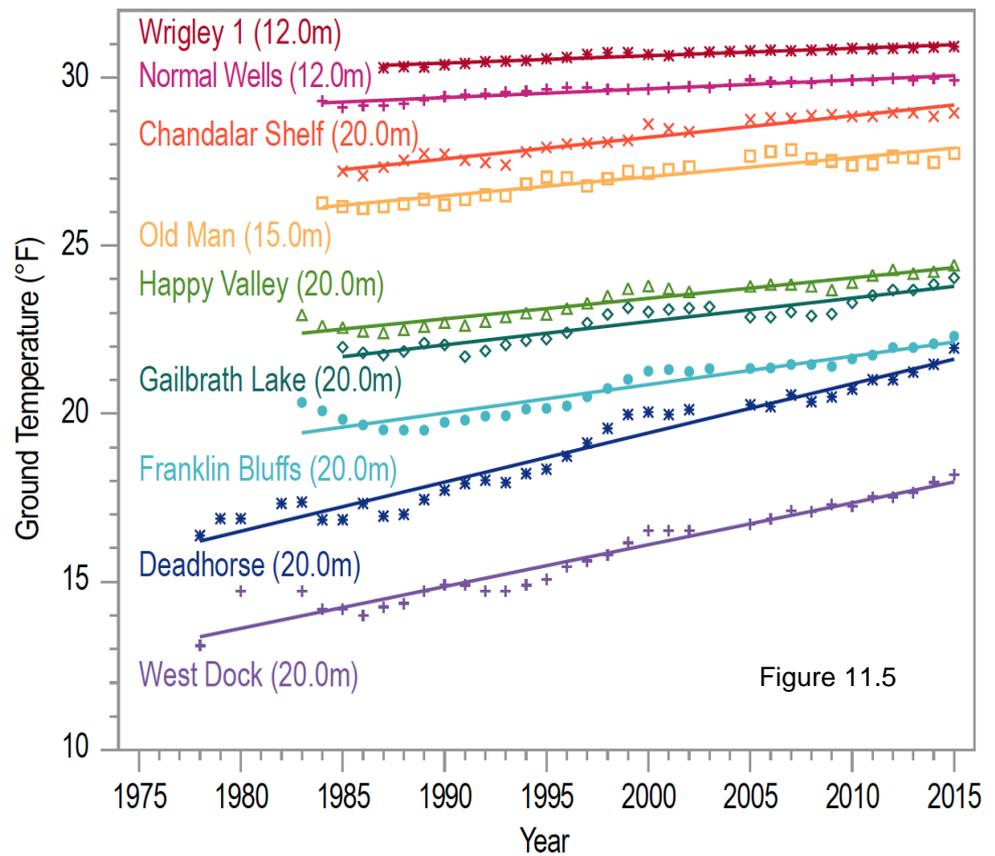


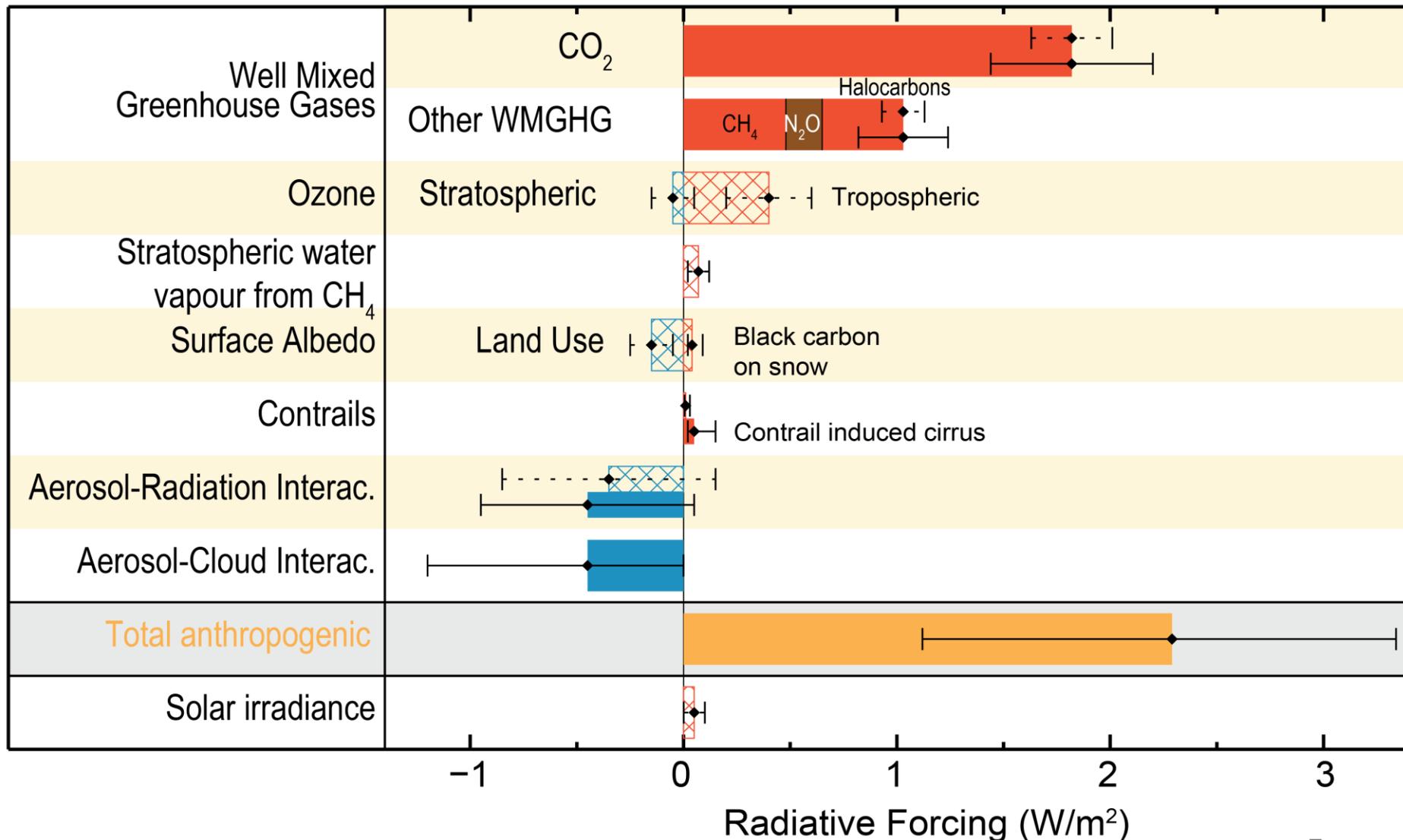
Figure 11.5

Radiative Forcing of Climate Between 1750 and 2011

Forcing agent

Anthropogenic

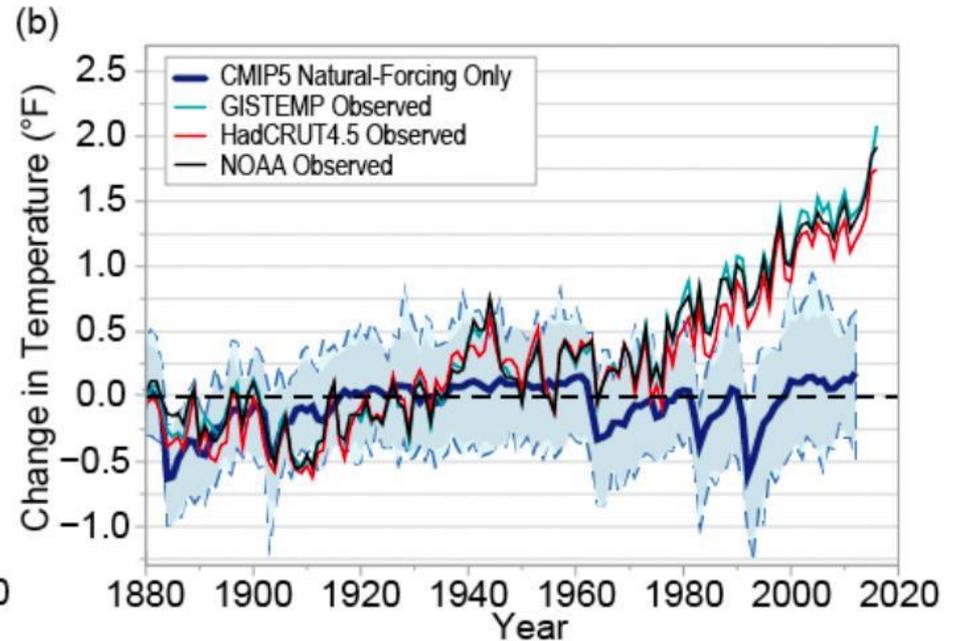
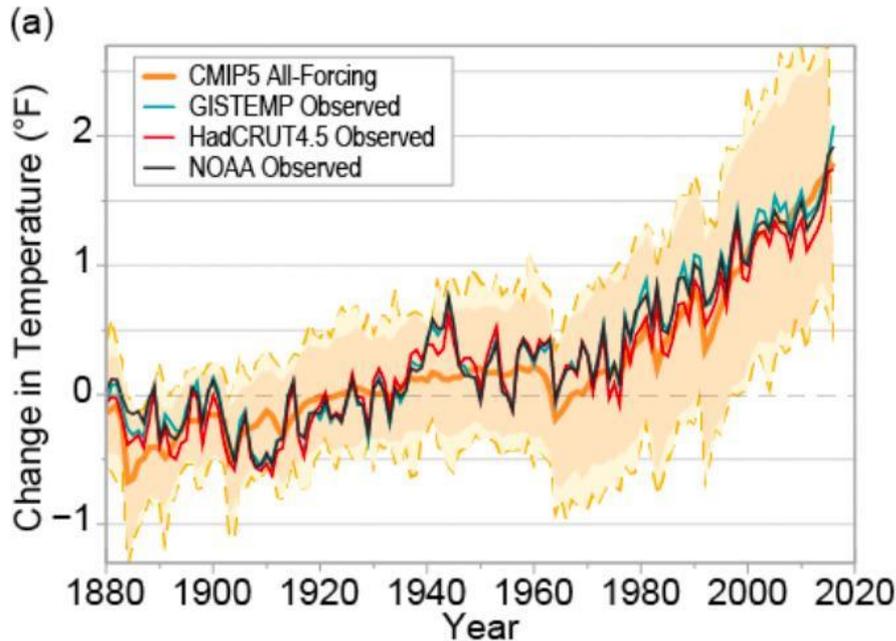
Natural



The likely range of the human contribution to the global mean temperature increase over the period 1951-2010 is 1.1 to 1.4°F, and the central estimate of the observed warming of 1.2°F lies within this range (*high confidence*).

This translates to a likely human contribution of 93-123% of the observed 1951-2010 change. The likely contributions of natural forcing and internal variability to global temperature change over that period are minor (*high confidence*).

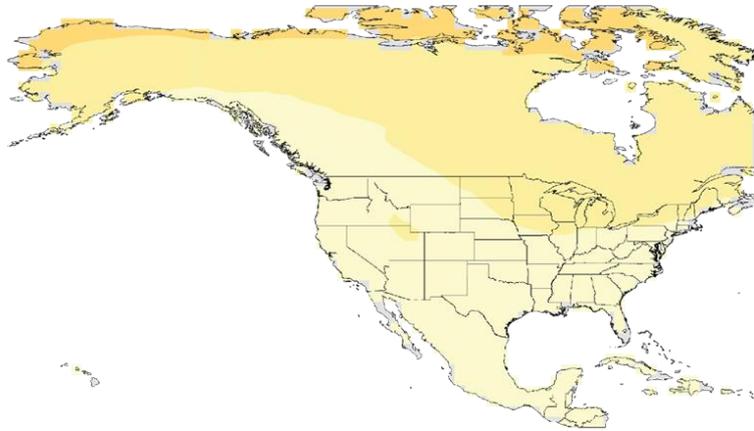
Global Mean Temperature Change



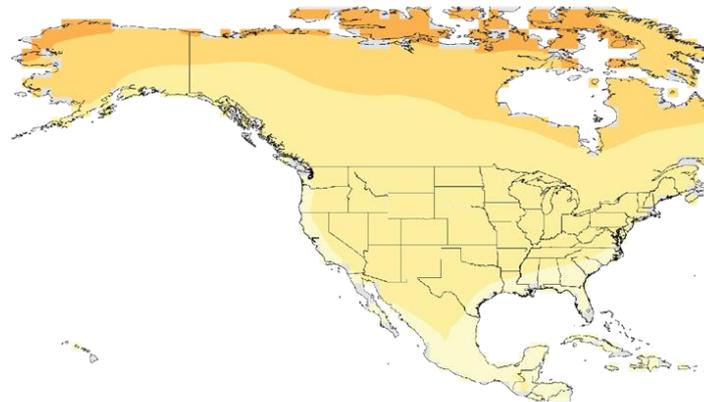
Projected Changes in Average Annual Temperature

Mid 21st Century

Lower Scenario (RCP4.5)

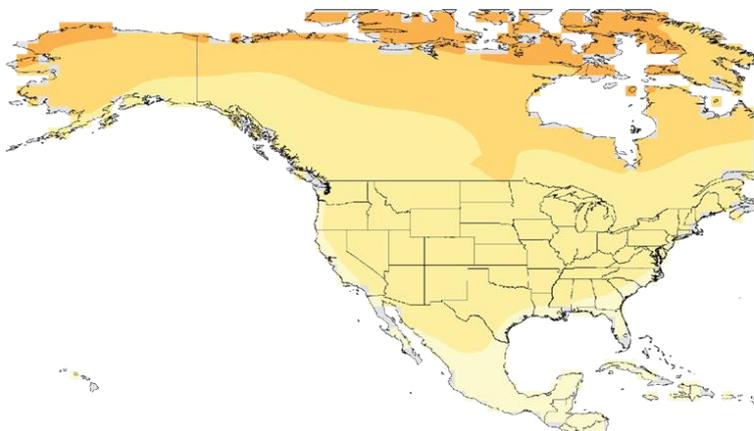


Higher Scenario (RCP8.5)

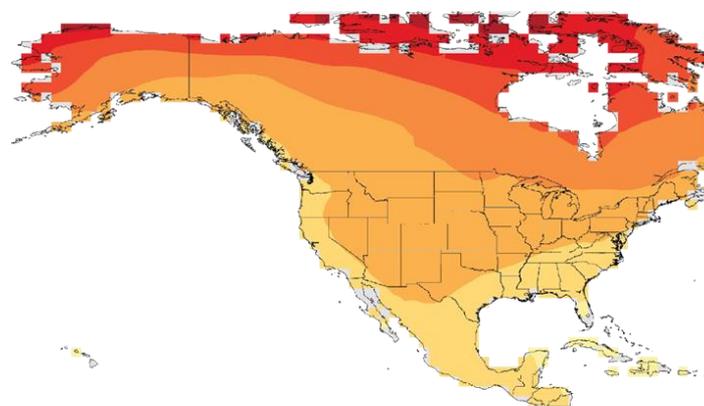


Late 21st Century

Lower Scenario (RCP4.5)



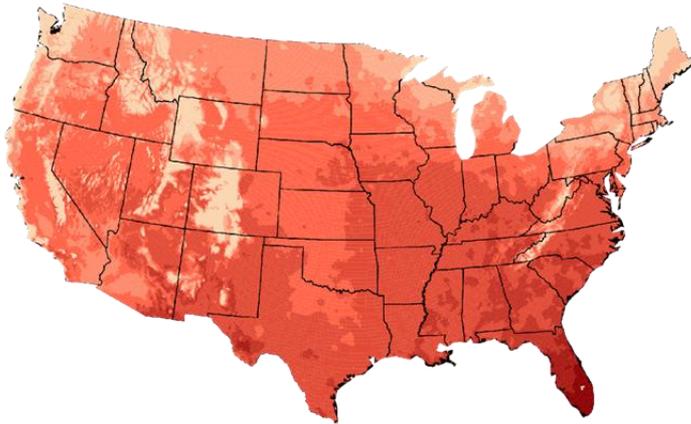
Higher Scenario (RCP8.5)



Change in Temperature (°F)



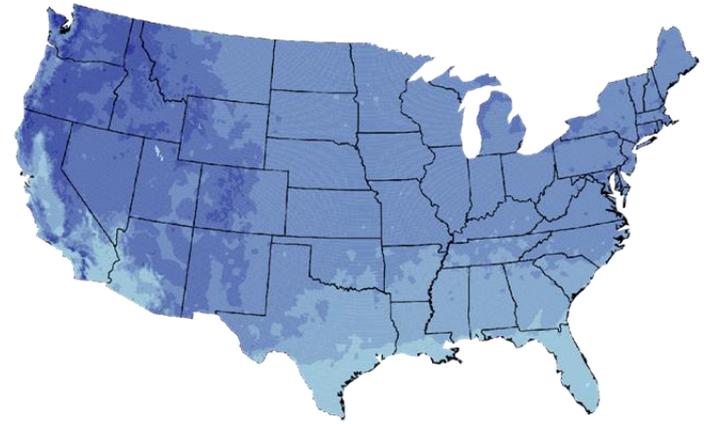
Projected Change in Number of Days Above 90°F
Mid 21st Century, Higher Scenario (RCP8.5)



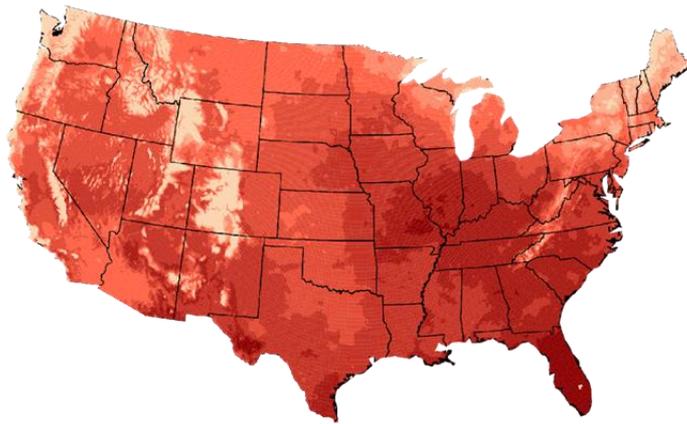
Weighted Multi-Model Mean



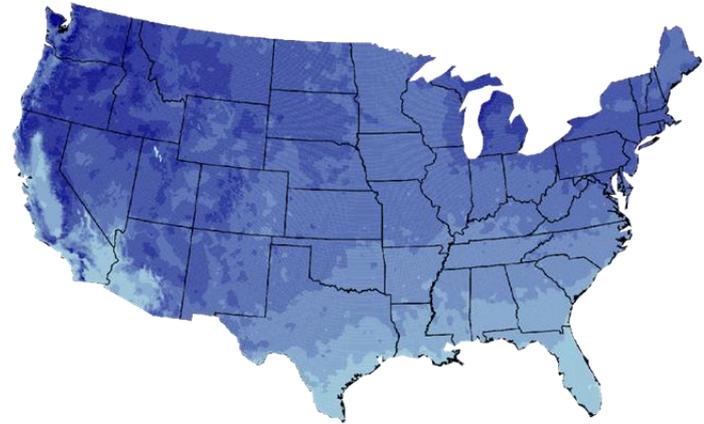
Projected Change in Number of Days Below 32°F
Mid 21st Century, Higher Scenario (RCP8.5)



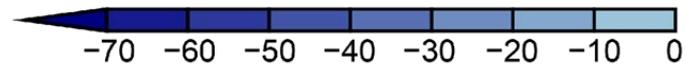
Weighted Multi-Model Mean



Mean of Three Warmest Models

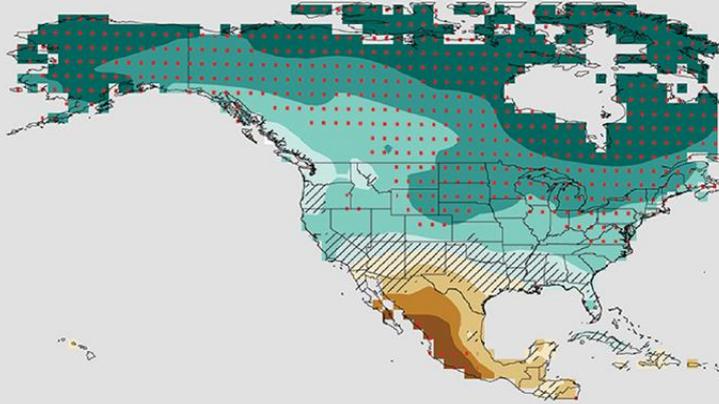


Mean of Three Warmest Models

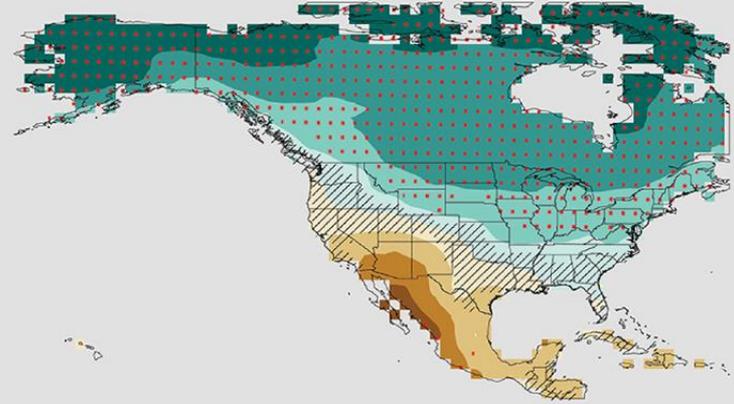


Projected Change (%) in Seasonal Precipitation

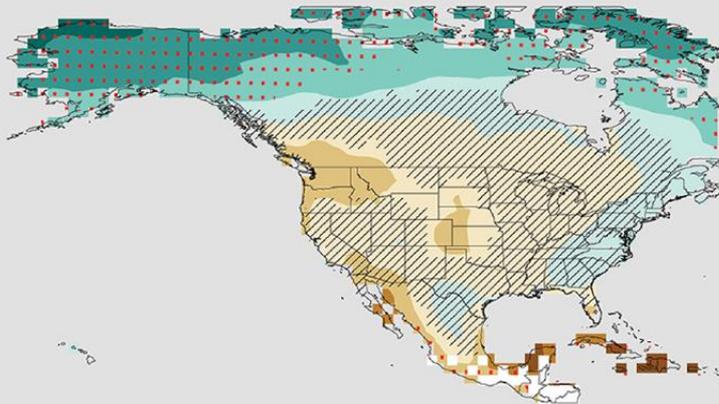
Winter



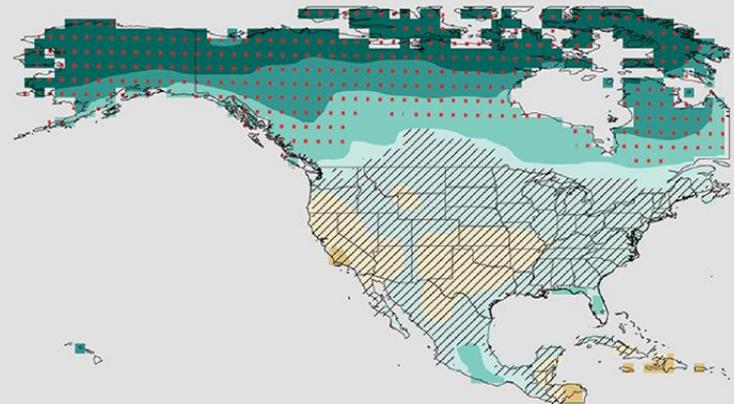
Spring



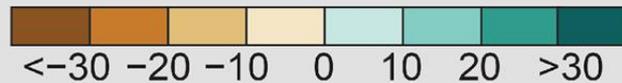
Summer



Fall

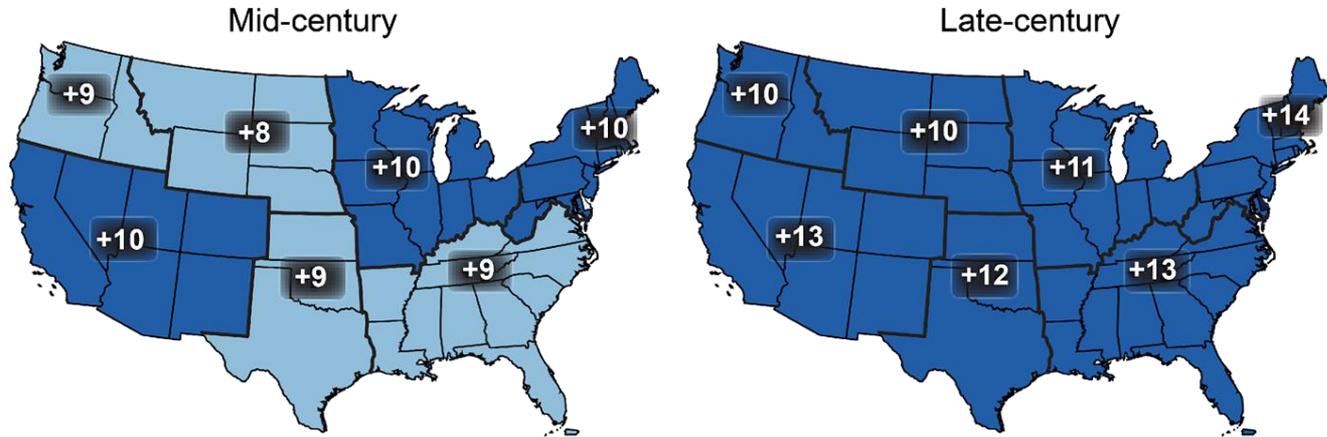


Change (%)

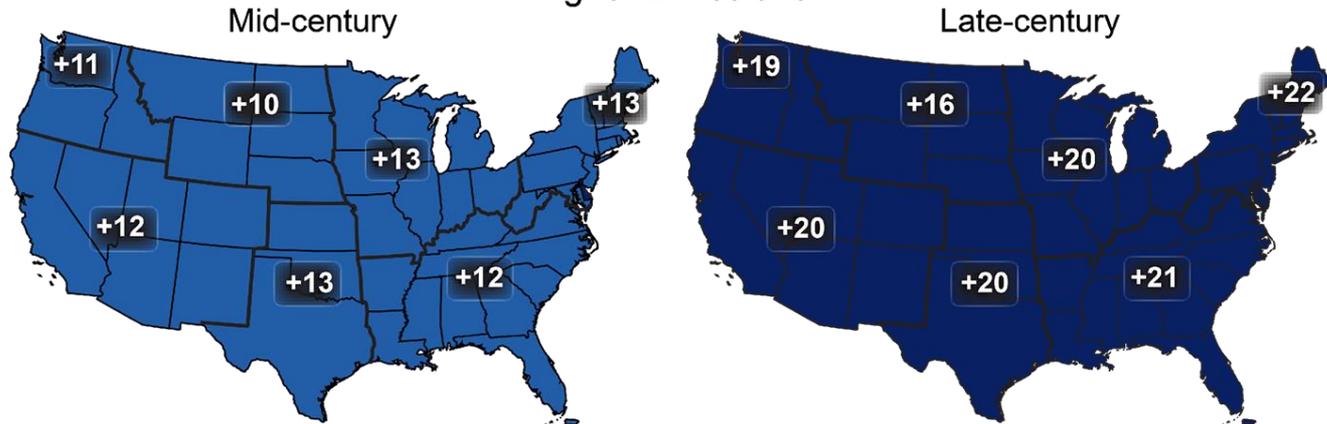


Projected Change in Daily, 20-year Extreme Precipitation

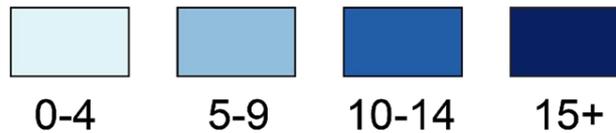
Lower Emissions



Higher Emissions



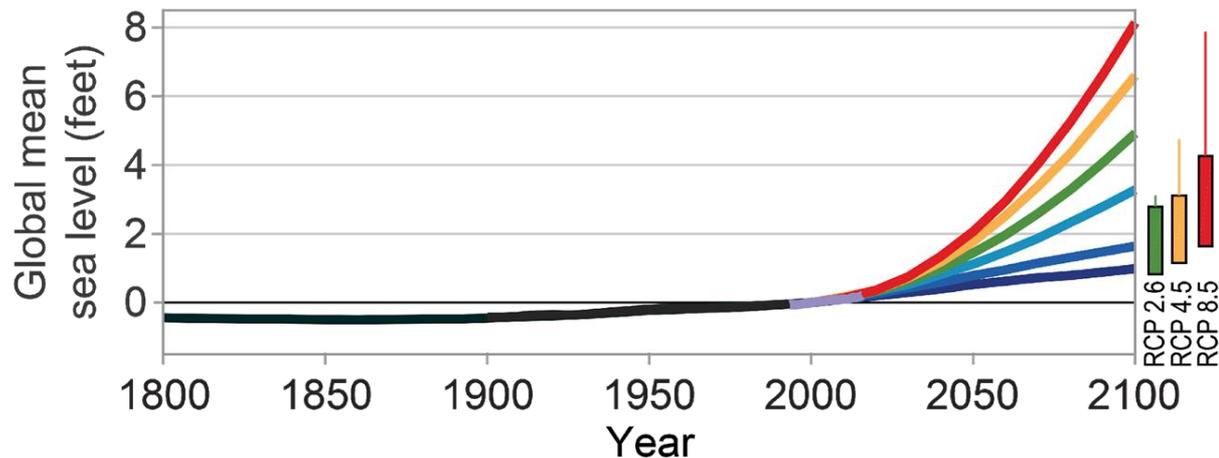
Change (%)



Global average sea level is very likely to continue to rise, by at least the current rate if not more, by 1–4 feet (0.3–1.3 m) by 2100 relative to 2000 levels.

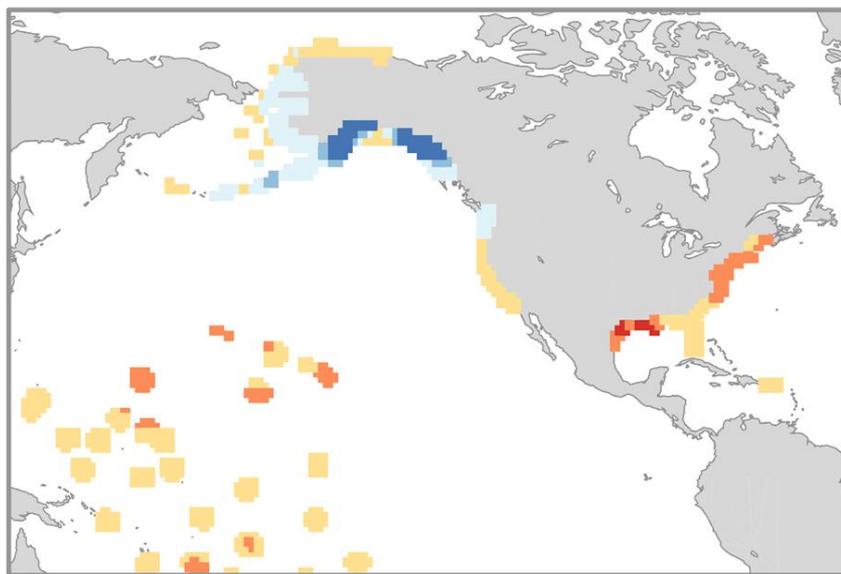
Emerging science regarding Antarctic ice sheet stability suggests that, for higher scenarios, a rise exceeding 8 feet (2.4 m) by 2100 is physically possible, although the probability of such an extreme outcome cannot currently be assessed.

(a)

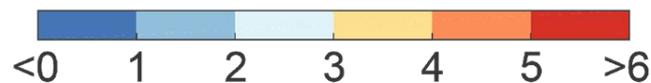


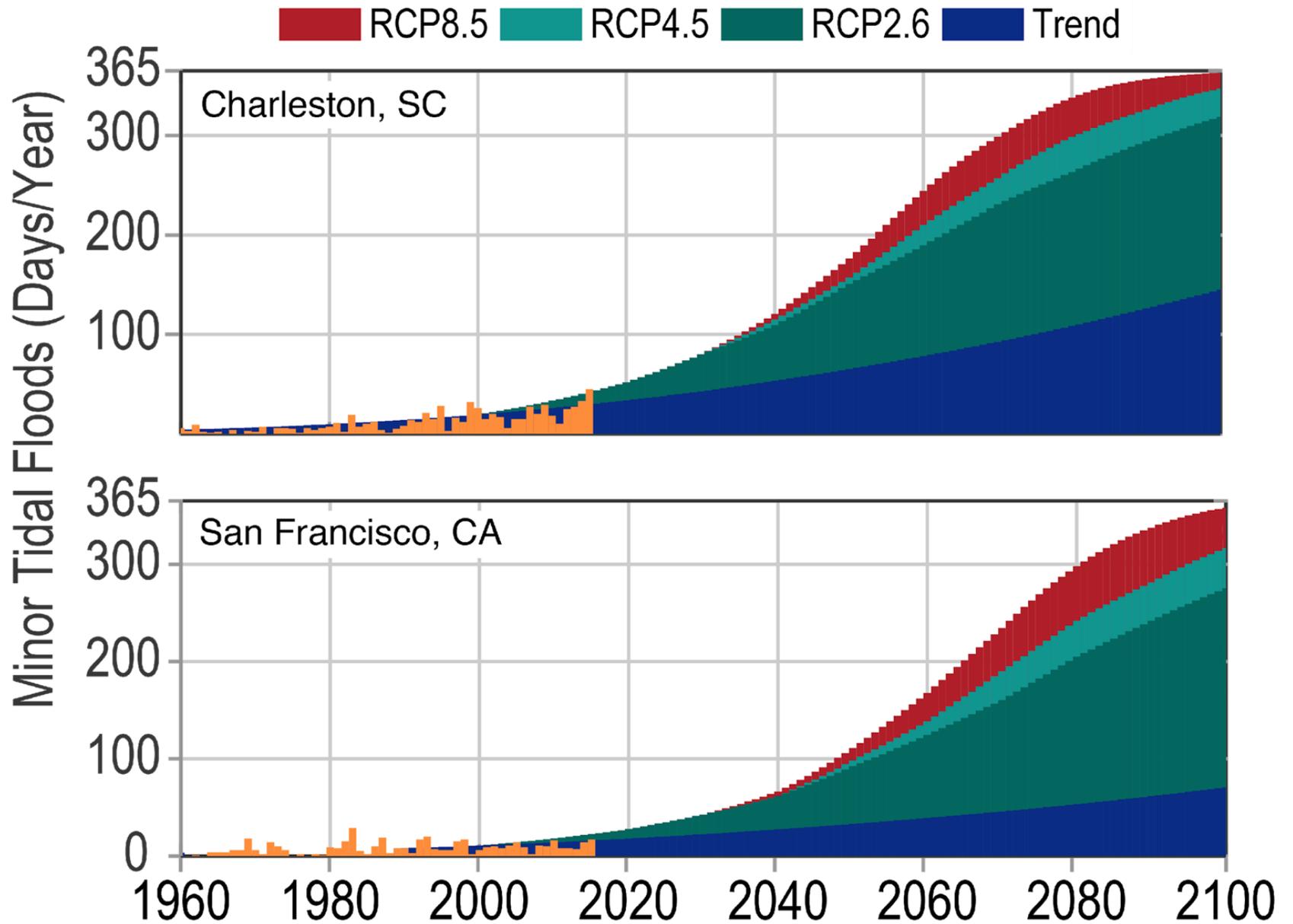
(b)

Projected Relative Sea Level Change for 2100 under the Intermediate Scenario

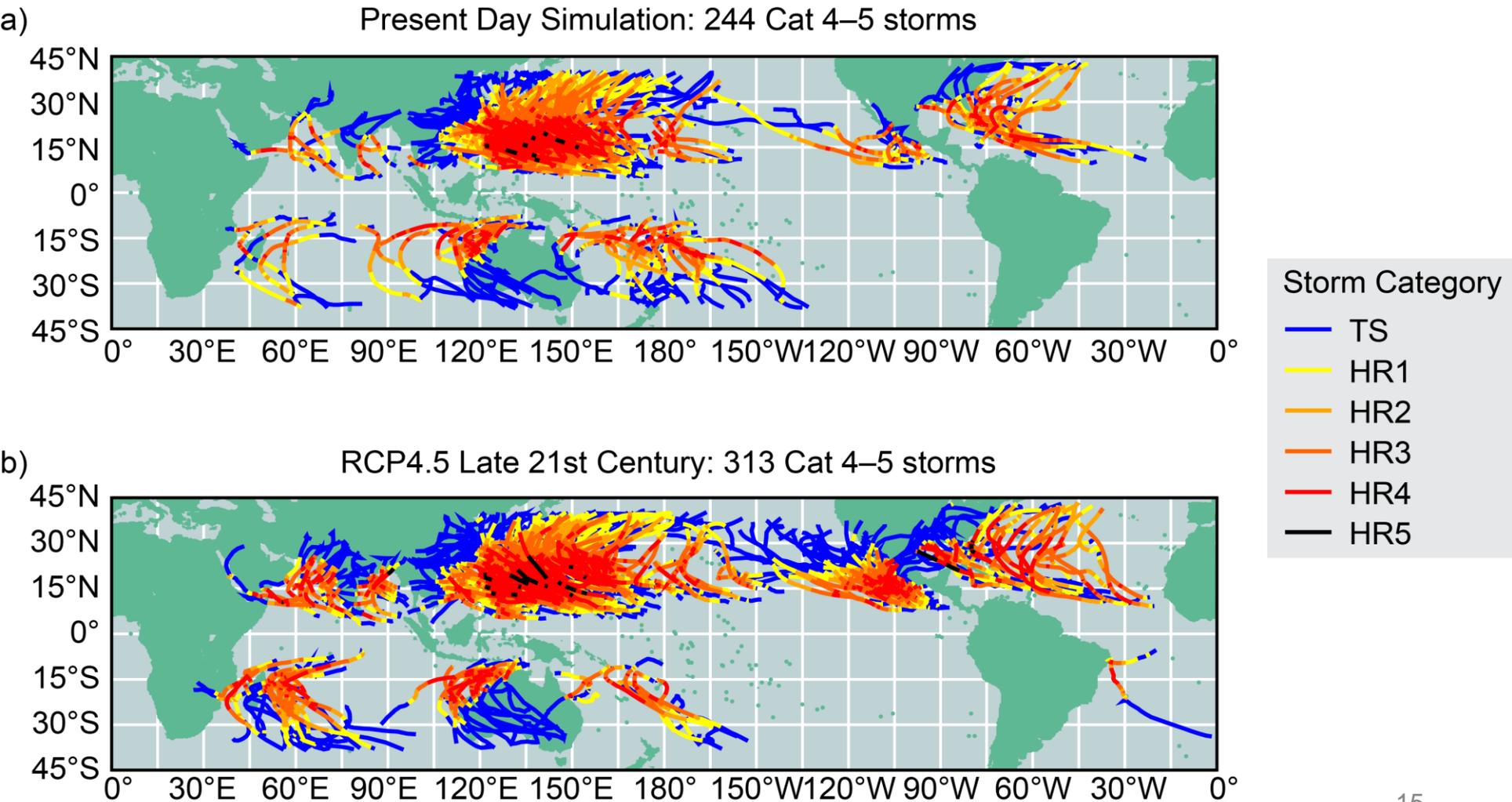


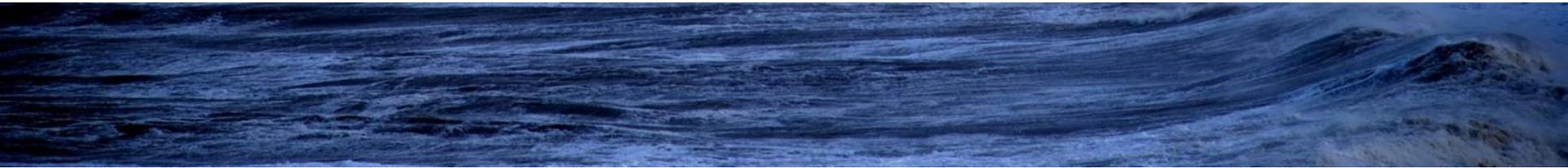
Change in Sea Level (feet)





The total number of tropical storms is generally projected to remain steady, or even decrease, but the most intense storms are generally projected to become more frequent, and the amount of rainfall associated with a given storm is also projected to increase

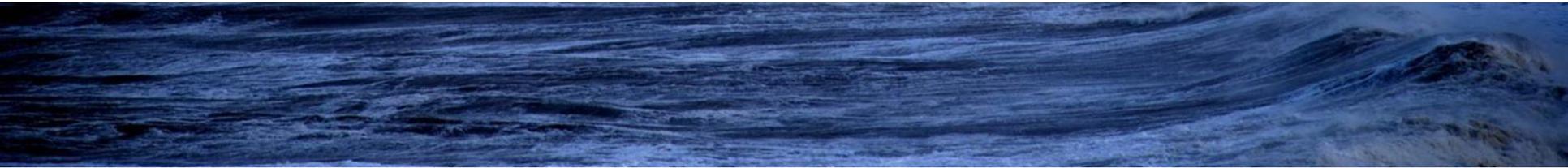




NCA4 Vol. II chapters

Currently in final interagency review

- I. Overview**
- II. Our Changing Climate**
- III. National Topics**
 - Water
 - Energy Supply, Delivery, and Demand
 - Land Cover and Land Use Change
 - Forests
 - Ecosystems, Ecosystem Services, and Biodiversity
 - Coastal Effects
 - Oceans and Marine Resources
 - Agriculture and Rural Communities
 - Built Environment, Urban Systems, and Cities
 - Transportation
- Air Quality
- Human Health
- Tribes and Indigenous Peoples
- Climate Effects on U.S. International Interests
- Sector Interactions, Multiple Stressors, and Complex Systems
- IV. Regional Chapters**
 - Northeast
 - Southeast
 - U.S. Caribbean
 - Midwest
 - Northern Great Plains
 - Southern Great Plains
 - Northwest
 - Southwest
- Alaska
- Hawai`i and U.S. Affiliated Pacific Islands
- V. Response**
 - Near-term Adaptation Needs and Increased Resiliency
 - Reducing Risks through Emissions Mitigation
- VI. Appendices**
 - Process
 - Information Quality Act
 - Data Tools and Scenarios
 - International
 - Frequently Asked Questions



Thank you!

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Resources:

<https://science2017.globalchange.gov/>

<https://globalchange.gov/>

<https://cpo.noaa.gov/>

<https://www.climate.gov/>