

# Climate Change Primer

## SAP 4.4

### National Forests Chapter Stakeholder Workshop

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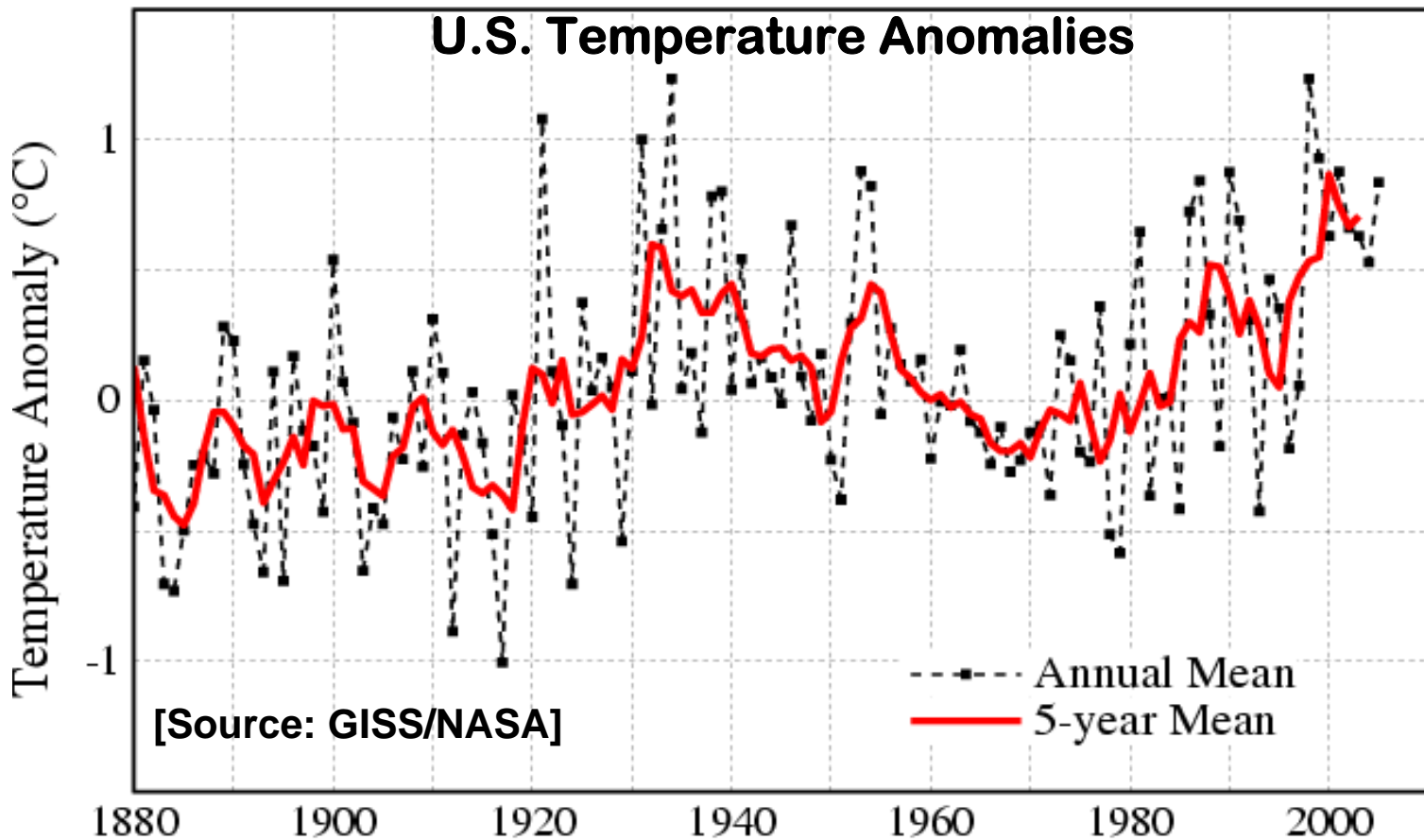
Climate: mean and variability of weather—  
temperature & precipitation—over a period  
of time in a particular geographic region

## ***Observed changes in US over past 100 years***

- **Temperature**
  - Annual vs. seasonal
  - Mean, max., min., range
- **Precipitation**
  - Annual vs. seasonal
  - Form (snow vs. rain)
  - Intensity
- **Hydrology**
  - Snowpack
  - Runoff timing and quantity
- **Altered disturbance regimes**
- **Sea level rise**
- **The future**

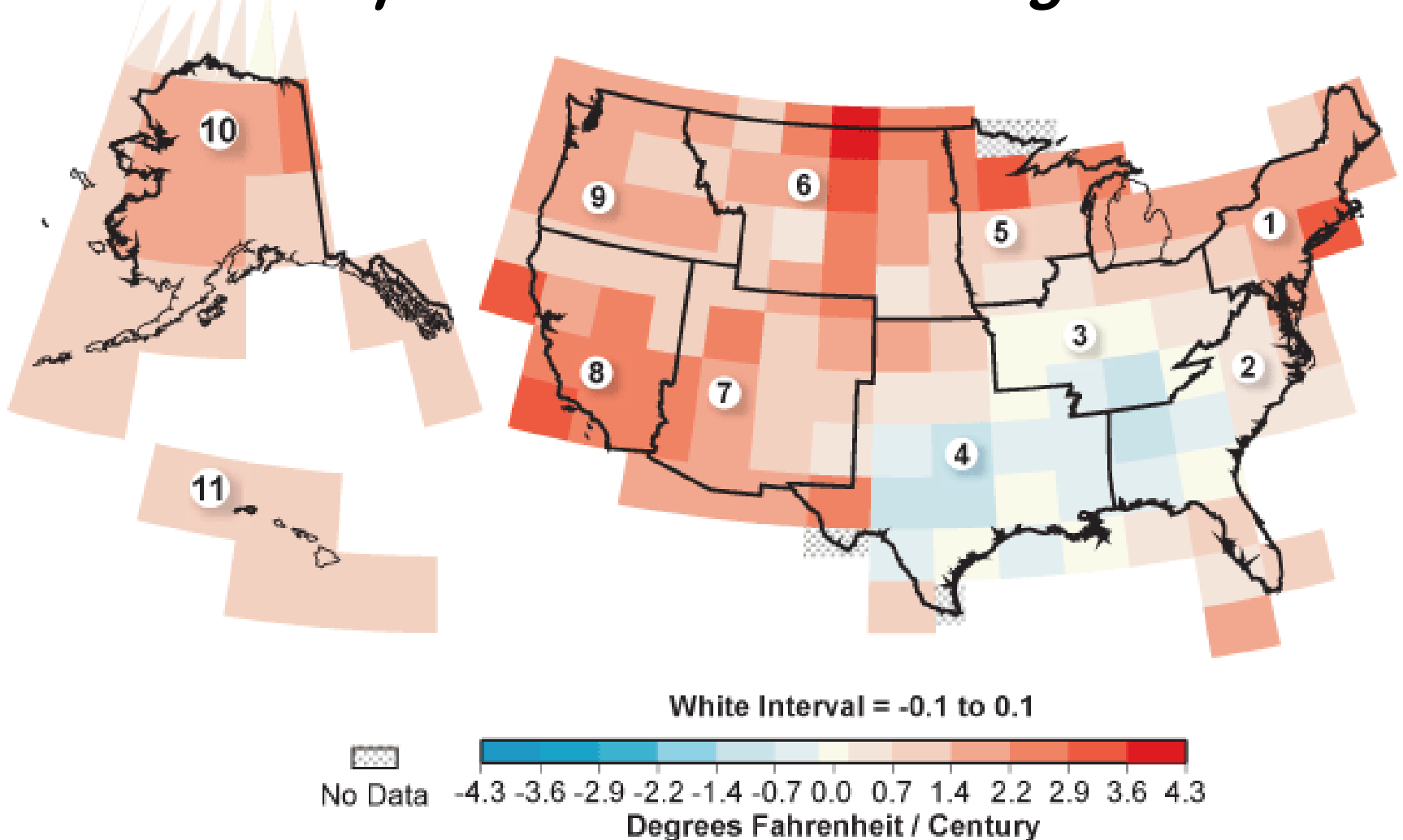
# 20<sup>th</sup> Century Mean US Temperature Anomalies

***Mean temperature anomalies increased from 0.5 to 1.0 °C in the past 100 years***

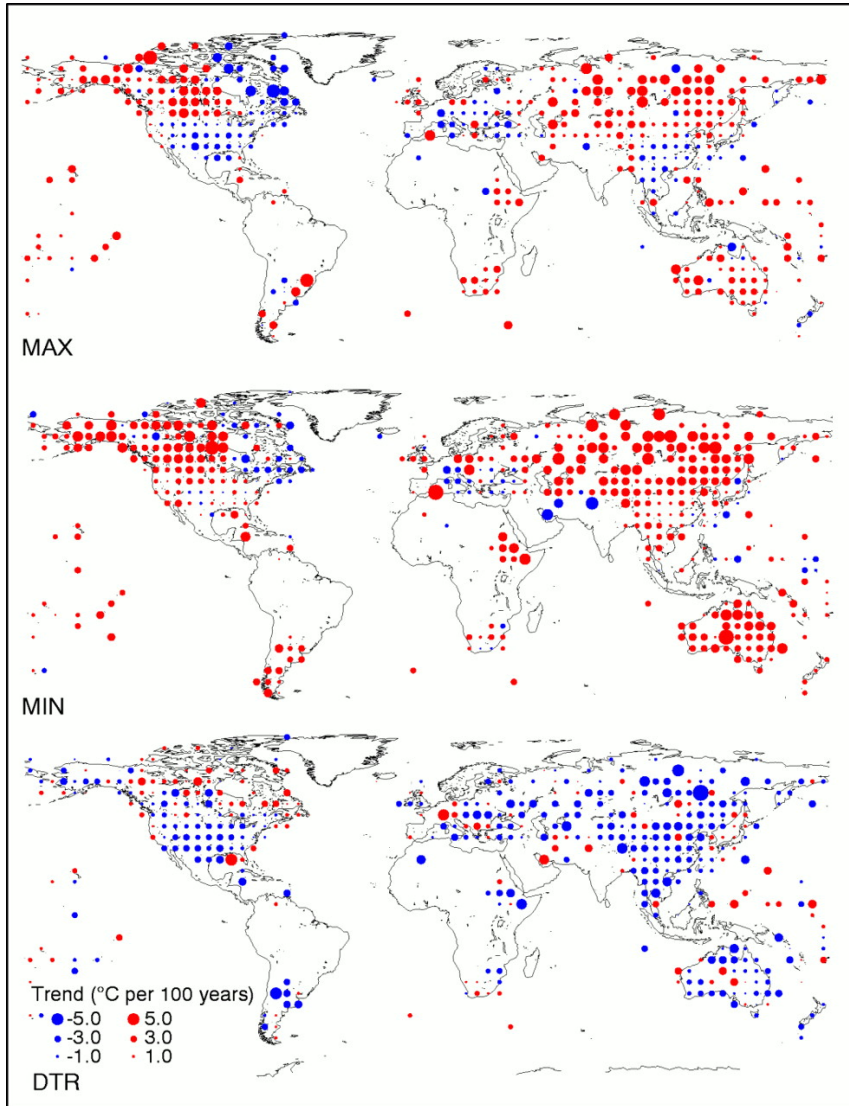


# Annual Mean US Temperature Trends 1901-2003

***Greater temperature increases at high latitudes***



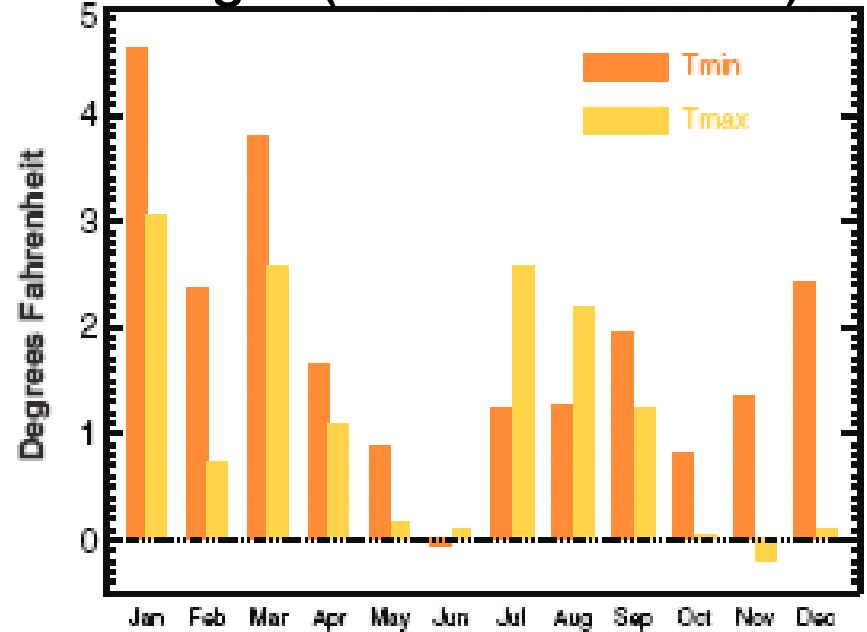
## Global trends in annual Tmax, Tmin, & diurnal temperature range for 1950 to 1993



*Easterling et al. 1997*

# Daily Minimum Temperatures Are Increasing

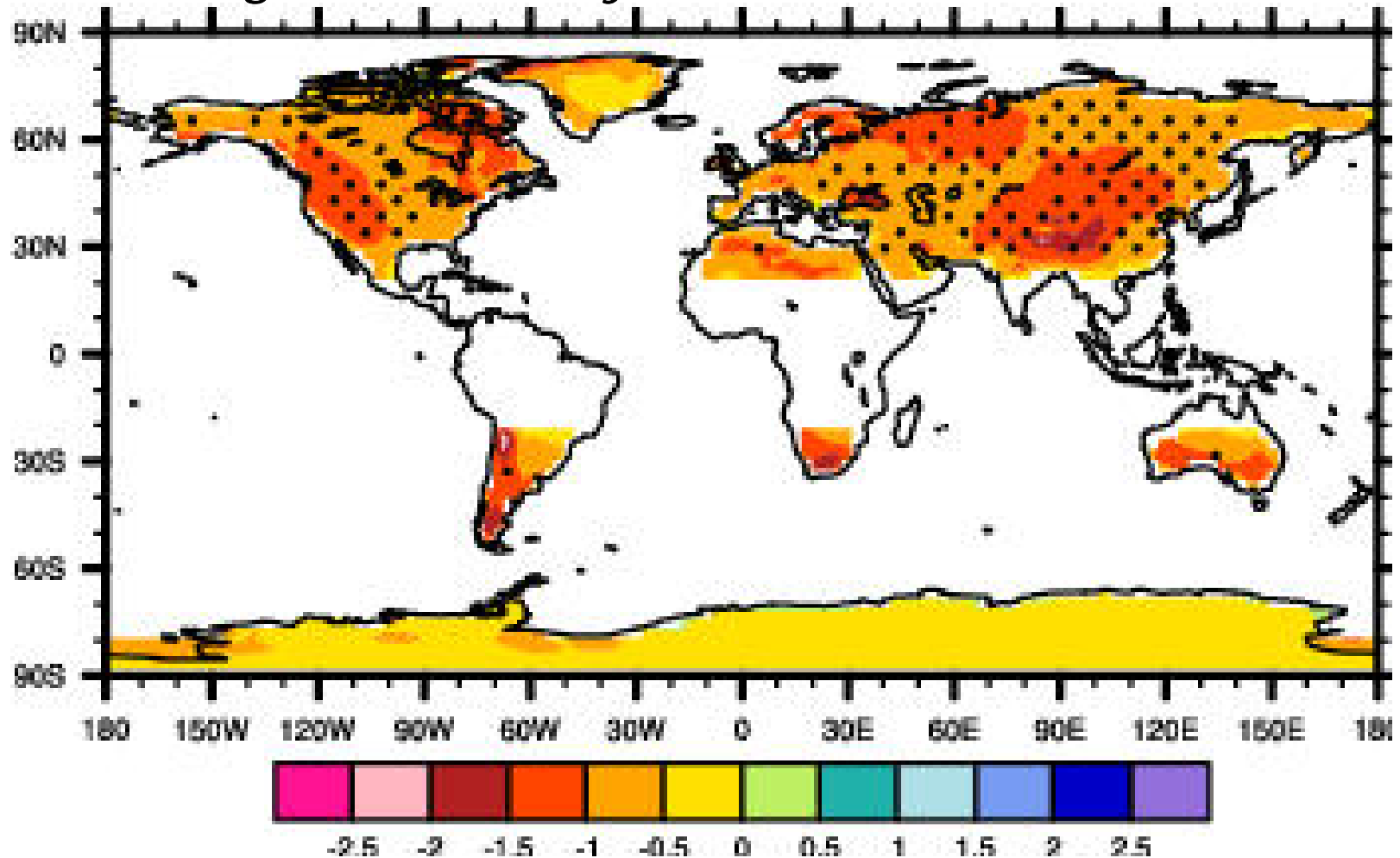
For Tmin & Tmax, difference in monthly means from 1996 to 2005, versus historical averages (Yellowstone area)



*Saunders et al. 2006*

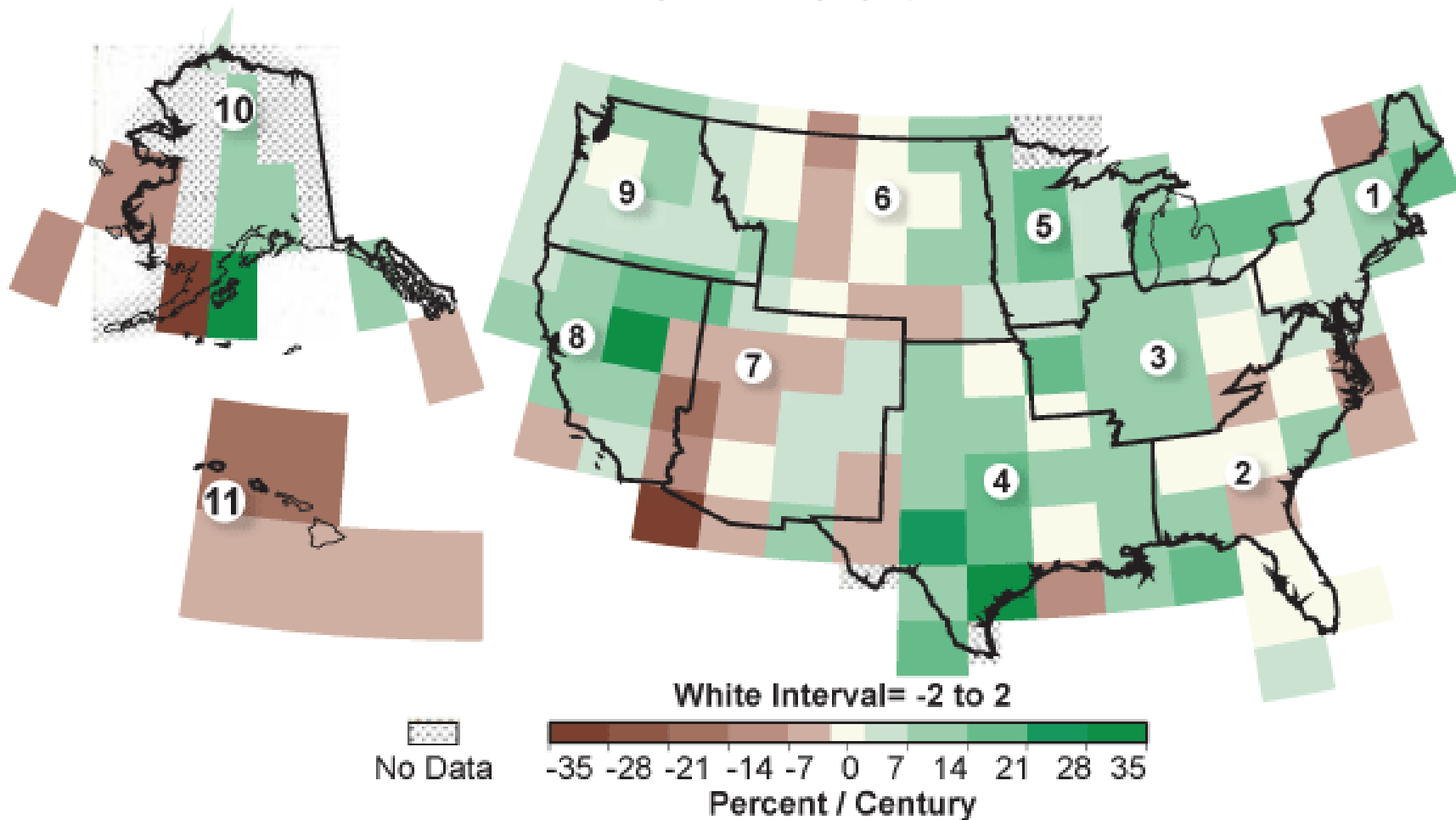
# Frost-Free Days Are Increasing

*Changes in frost days 1980-1999 vs. 1900-1919*



*Tebaldi et al. 2006. Climatic Change*

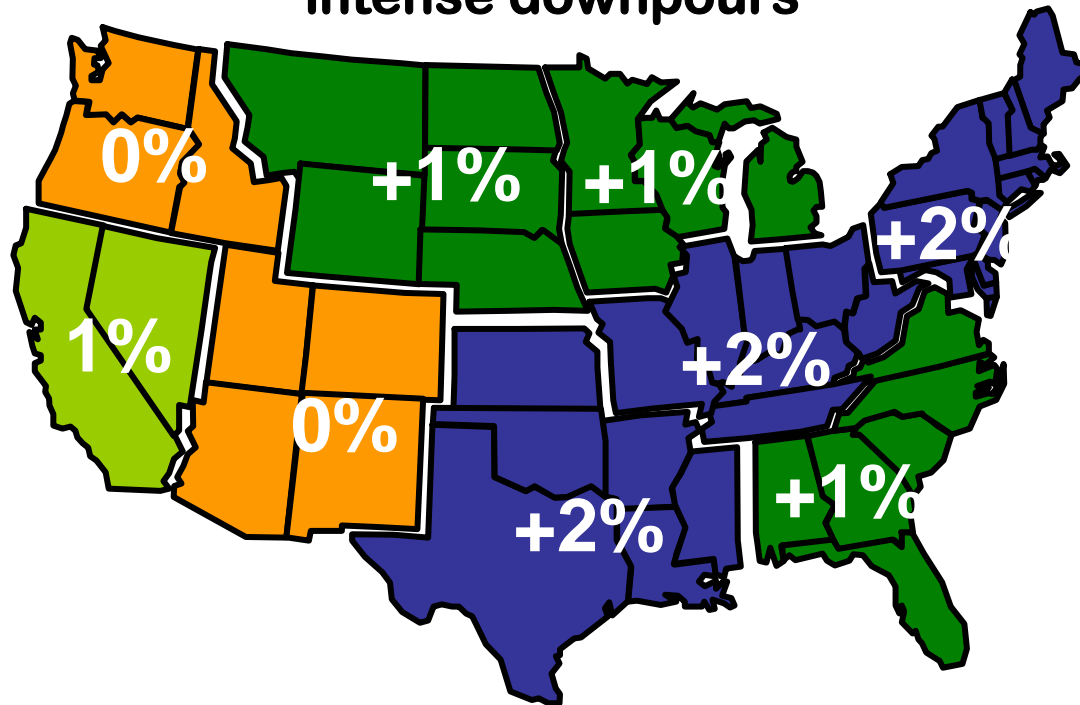
# Precipitation Increases & Decreases depending on Region 1901-2003



Data from NOAA/NCDC; See: [http://www.epa.gov/climatechange/science/recentpsc\\_precipar](http://www.epa.gov/climatechange/science/recentpsc_precipar)

# Changes in Precipitation Patterns

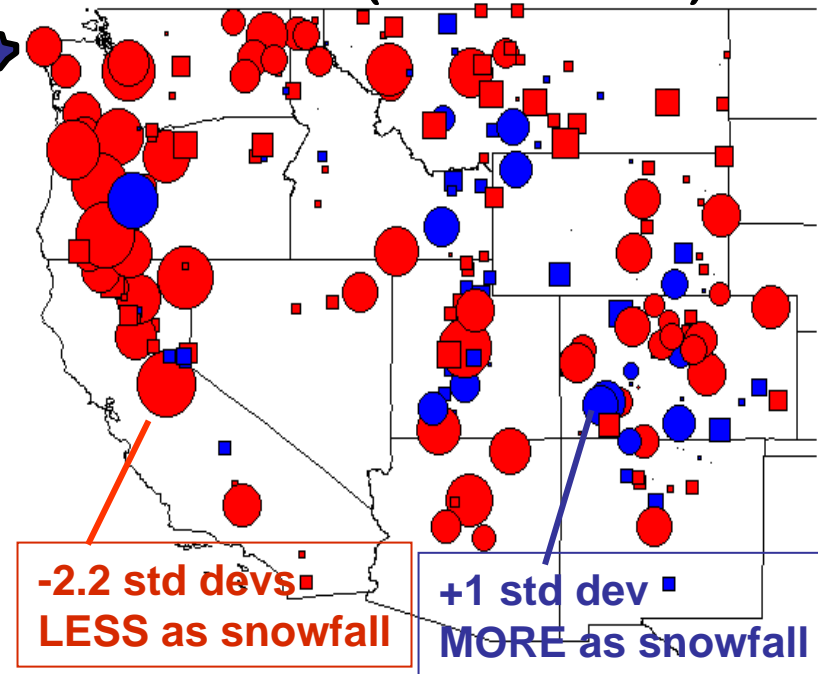
More precipitation from  
intense downpours



Trends in proportion of annual  
precipitation of extreme intensity  
( $> 2''$  per day): 1910 – 1995

*Karl & Knight 1998*

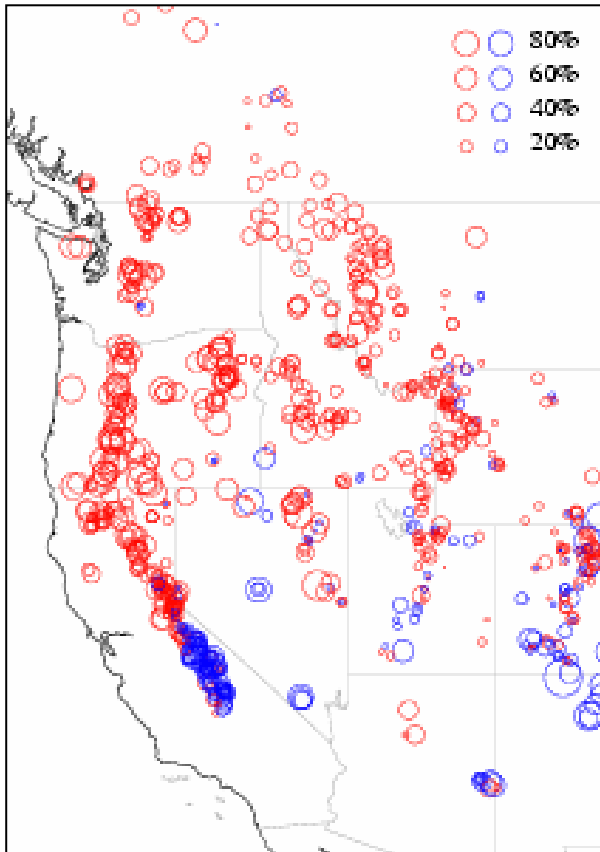
More precipitation as rain  
vs. snow (1949 – 2004)



*Knowles et al. 2006*

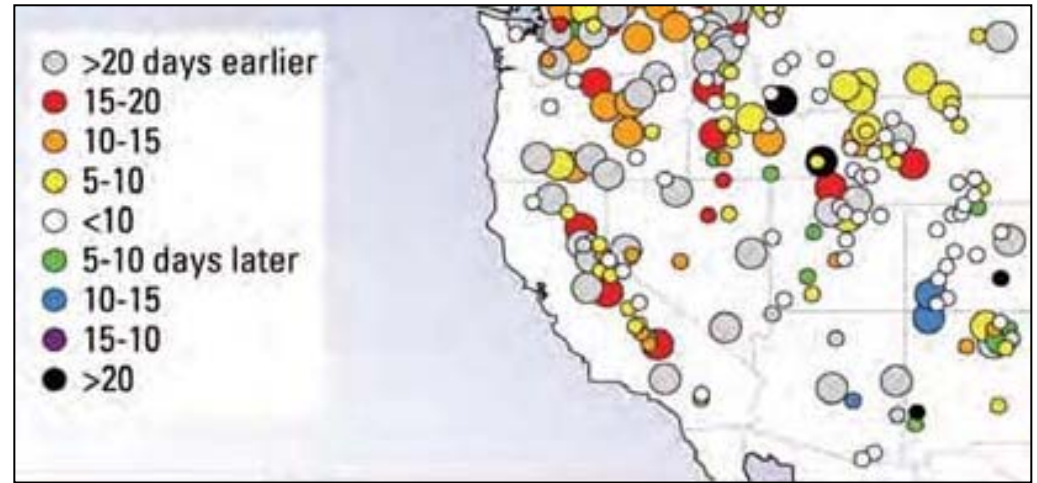


# Earlier onset of spring snowmelt & less snowpack



**Less spring snowpack**

*Mote, 2003*

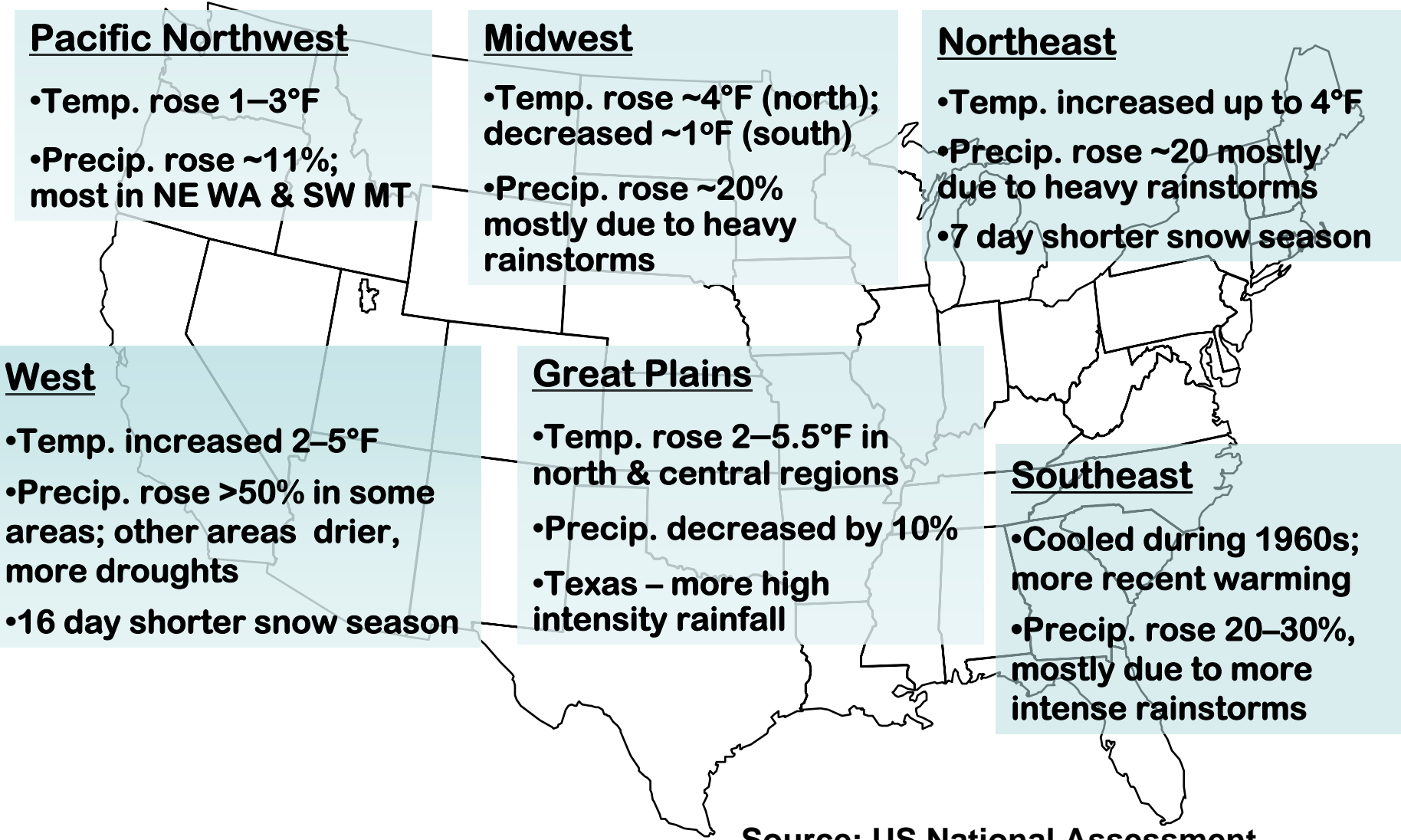


**Earlier snowmelt runoff**

*Stewart et al., 2005*

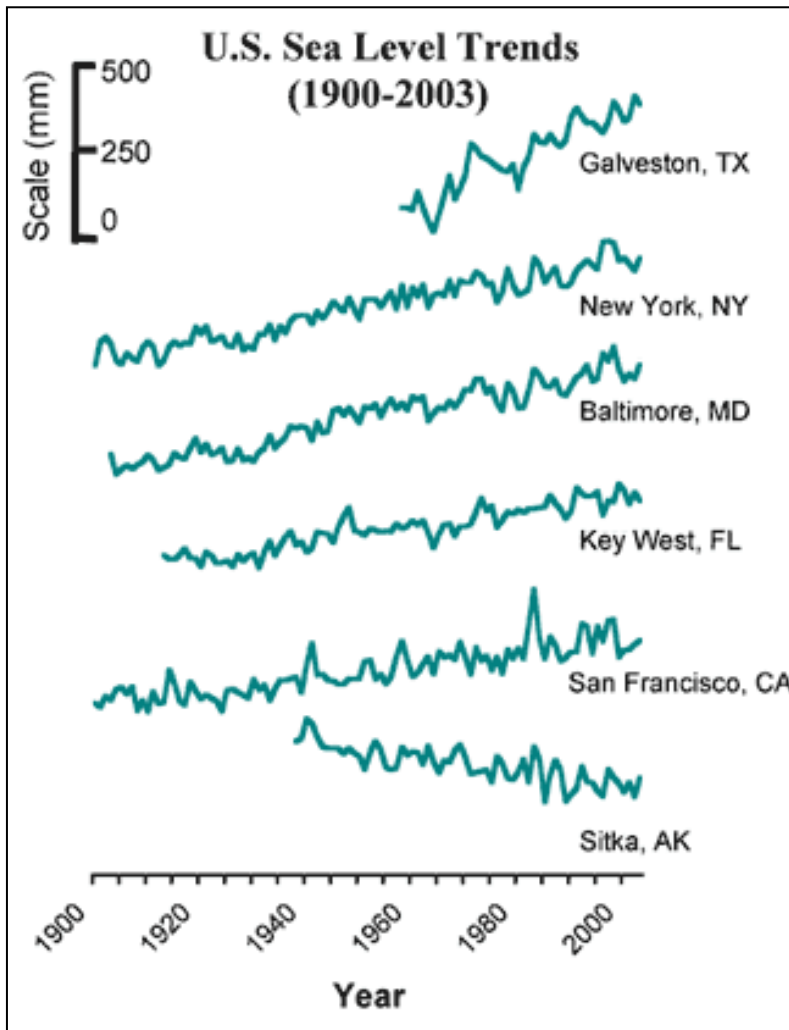
**Snow season 16 days shorter in CA & NV (1951-1996)**

# Regional Climate Trends in Last 100 Years

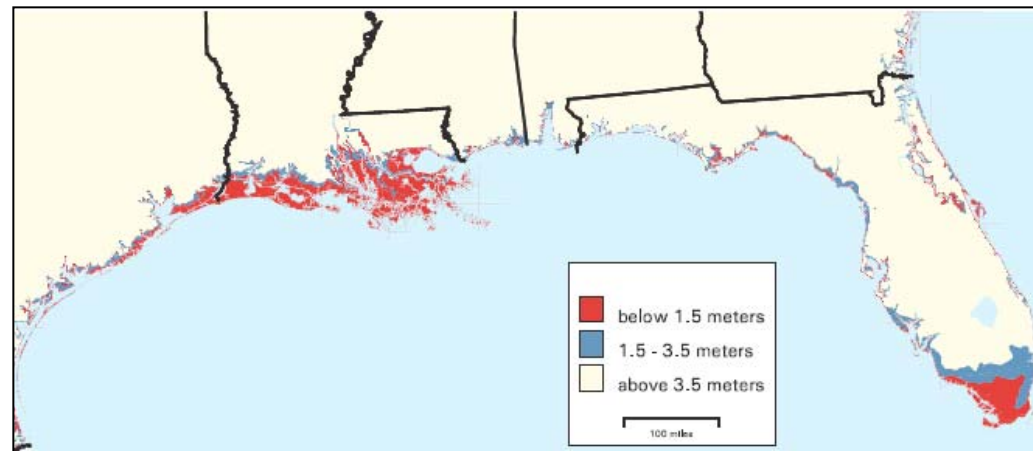


Source: US National Assessment

# Sea Levels Are Rising Along Most US Coasts



## Gulf Coast lands vulnerable to sea level rise



Source:

[www.epa.gov/climatechange/effects/coastal/slrmap](http://www.epa.gov/climatechange/effects/coastal/slrmap)

Source:

[www.epa.gov/climatechange/science/recent](http://www.epa.gov/climatechange/science/recent)

# Conclusions from the IPCC

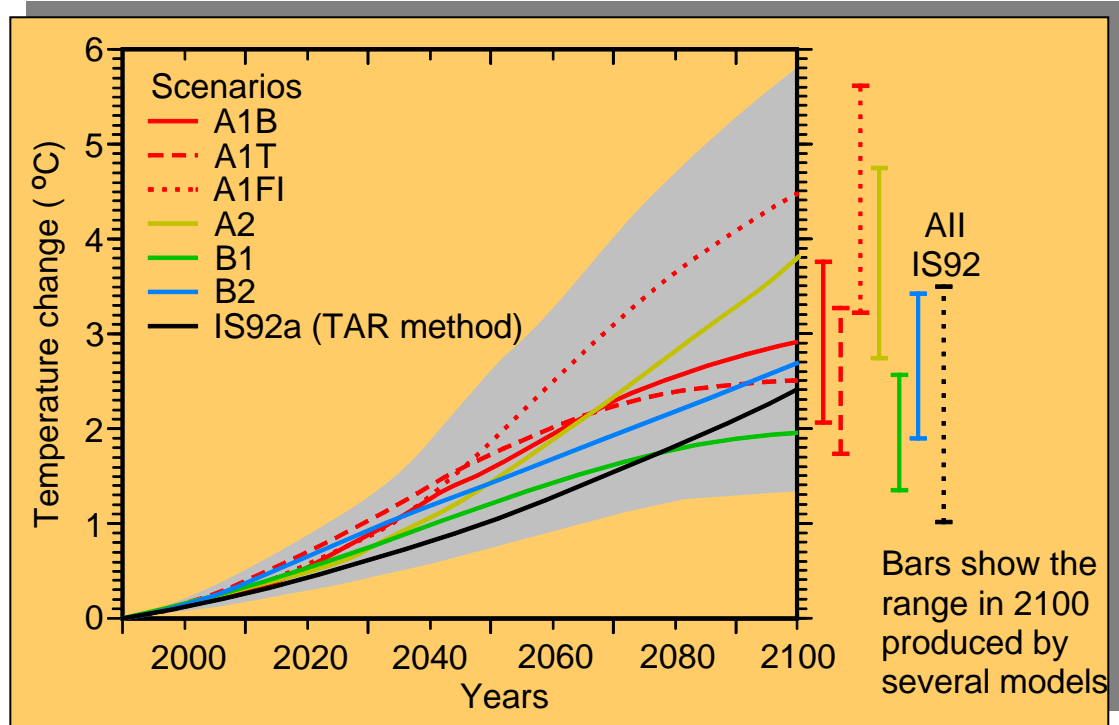
(Intergovernmental Panel on Climate Change)

- ***An increasing body of observations gives a collective picture of a warming world and other changes in the climate system.***
- ***Emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate throughout the 21<sup>st</sup> century.***

# Future Outlook

- **Global mean temperature is projected to rise from 1.4 to 5.8 °C depending on future emissions. (IPCC)**

- **Sea levels are expected to rise from 0.3 to 2.9 feet (IPCC)**



**Source:**  
**IPCC**

- **Even if we stabilize emissions now, we are committed to additional warming and sea level rise from the radiative forcing already in the system. (Meehl et al. 2005)**