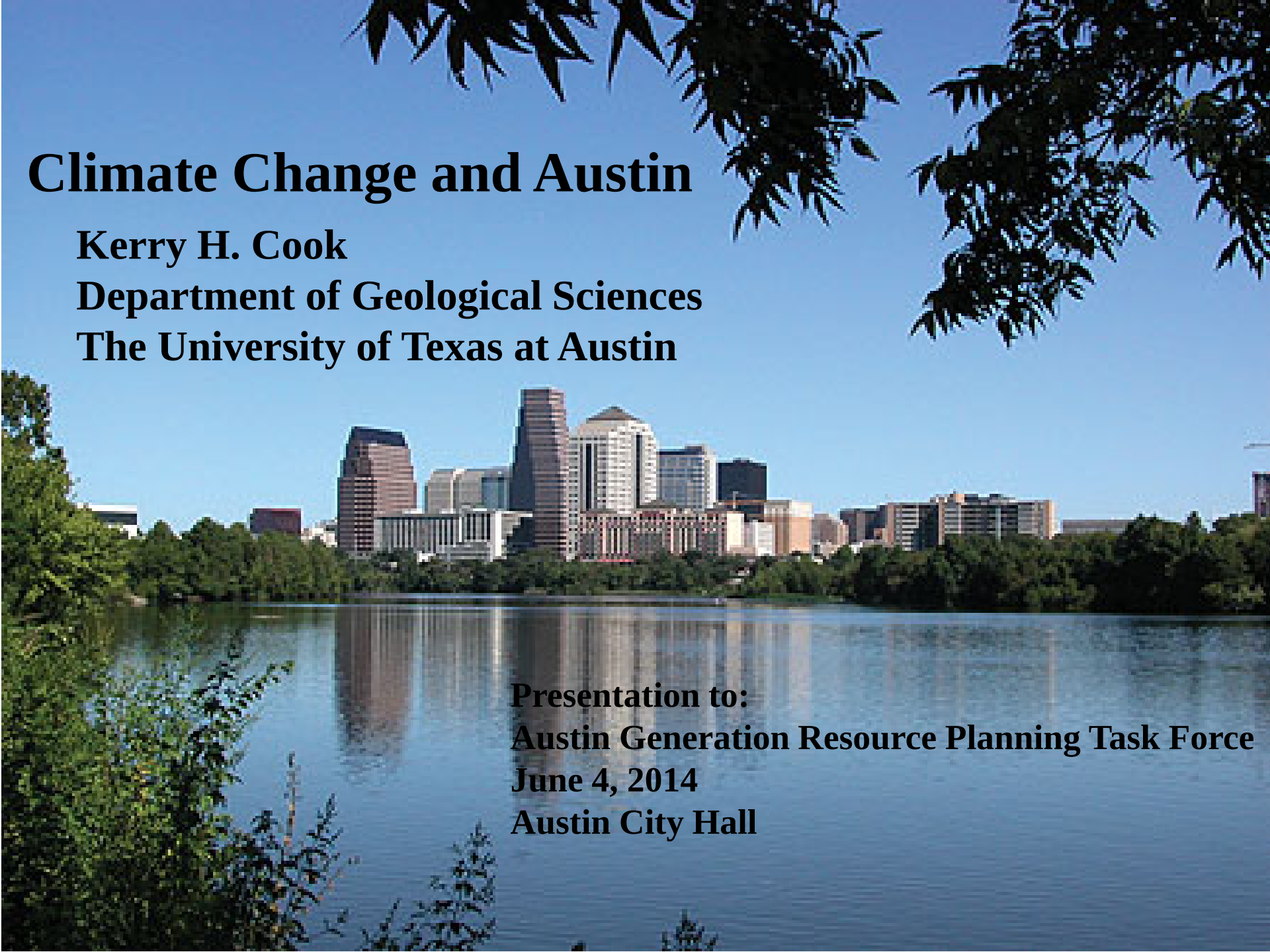


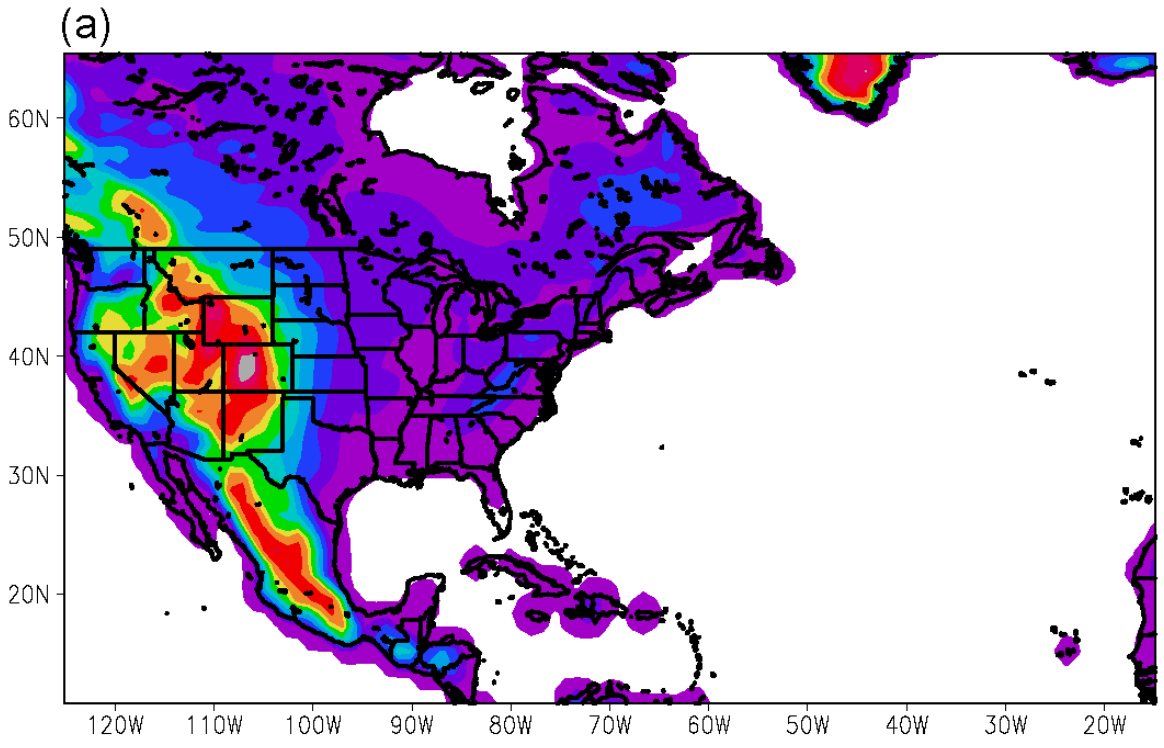
Climate Change and Austin

Kerry H. Cook
Department of Geological Sciences
The University of Texas at Austin

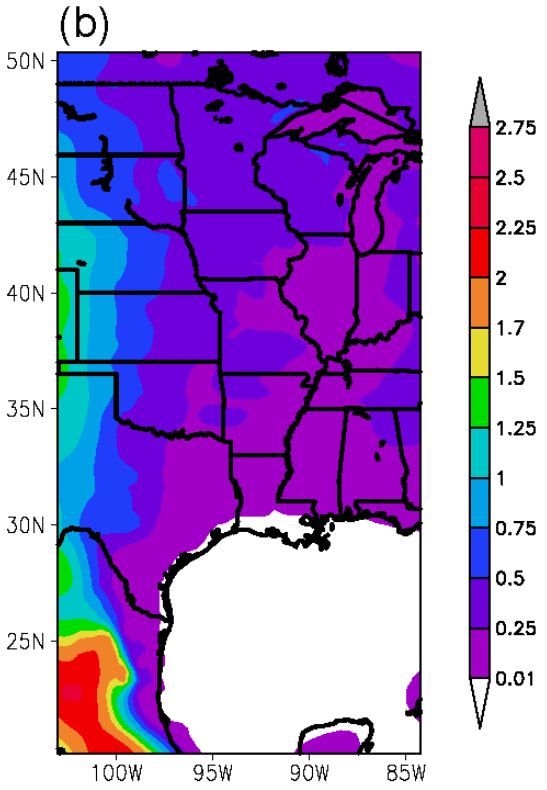
Presentation to:
Austin Generation Resource Planning Task Force
June 4, 2014
Austin City Hall

Projections from Regional Model Simulations

Cross-checked with IPCC projections on coarser resolution and validated against observation of current climate



Outer domain with 90-km resolution (~10,000 grid points)



Inner domain with 30-km resolution (~7,500 gridpoints)

Climate models are governed by the laws of physics:

- F = ma
- 1st law of thermo
- conservation of mass for air
- conservation of mass for water vapor
- heat balance calculation at the surface

Two 20-year simulations

- 1981 – 2000 late 20th century

Observed lateral and surface boundary conditions; observed greenhouse gas concentrations (340 ppm to 371 ppm)

- 2041 – 2060 mid 21st century

Observed lateral and surface boundary conditions + anomalies; CO_2 increased (533 ppm to 578 ppm according to an IPCC business-as-usual emissions scenario)

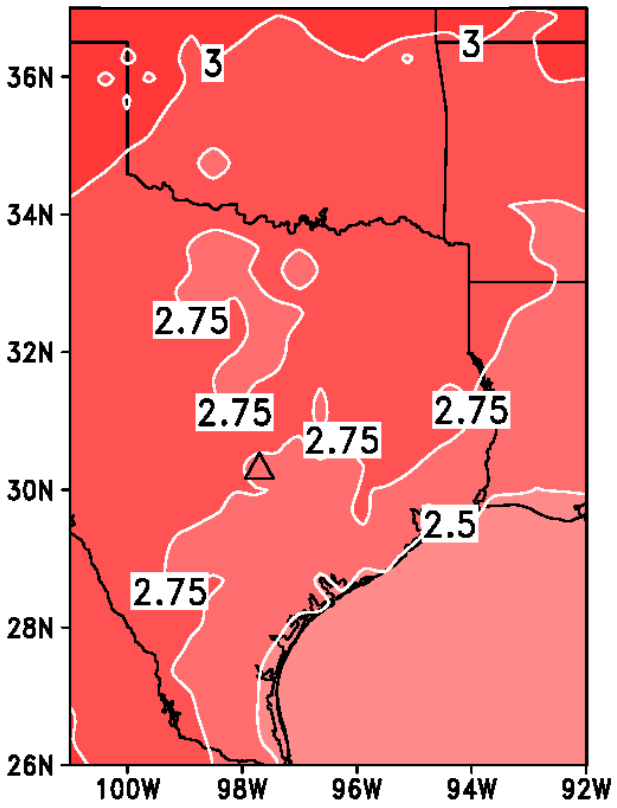
References:

Patricola, C. M., and K. H. Cook, 2013a: Mid-twenty first century climate change in the central United States. Part I: Regional and global model predictions. *Climate Dynamics*, **40**, 551-568.

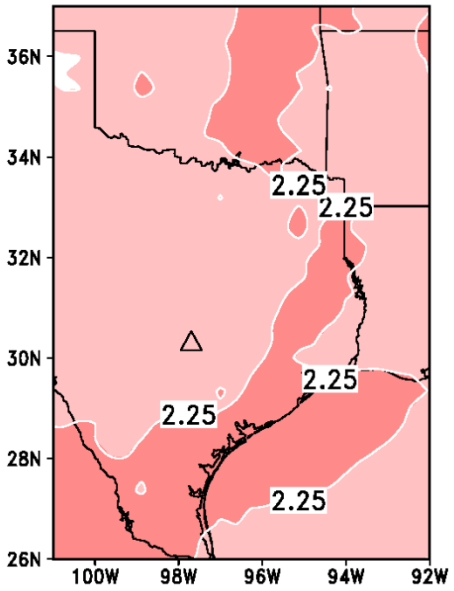
Patricola, C. M., and K. H. Cook, 2013b: Mid-twenty first century climate change in the central United States. Part II: Climate change processes. *Climate Dyn*amics, **40**, 569-583.

Projections for 2050: Surface Temperature Difference (°F)
Business-as-Usual Emissions

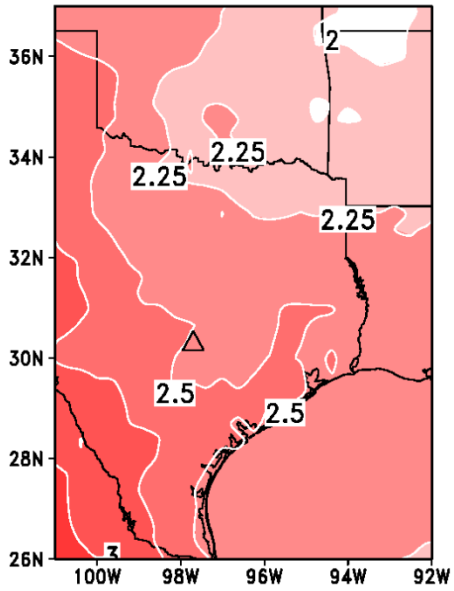
Annual Mean



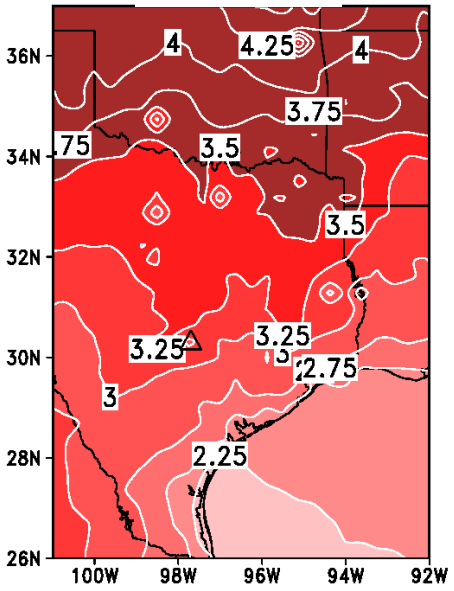
Winter



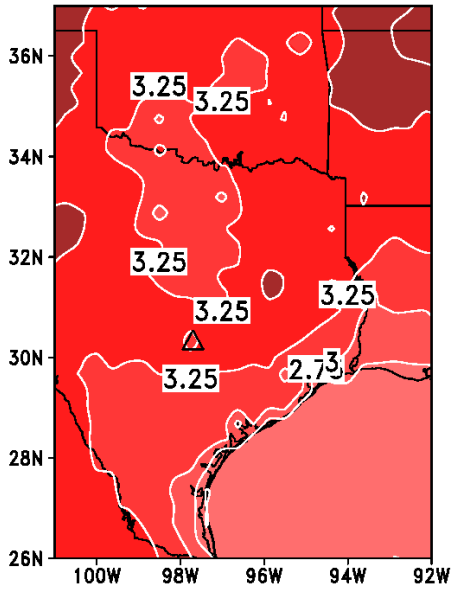
Spring



Summer



Fall

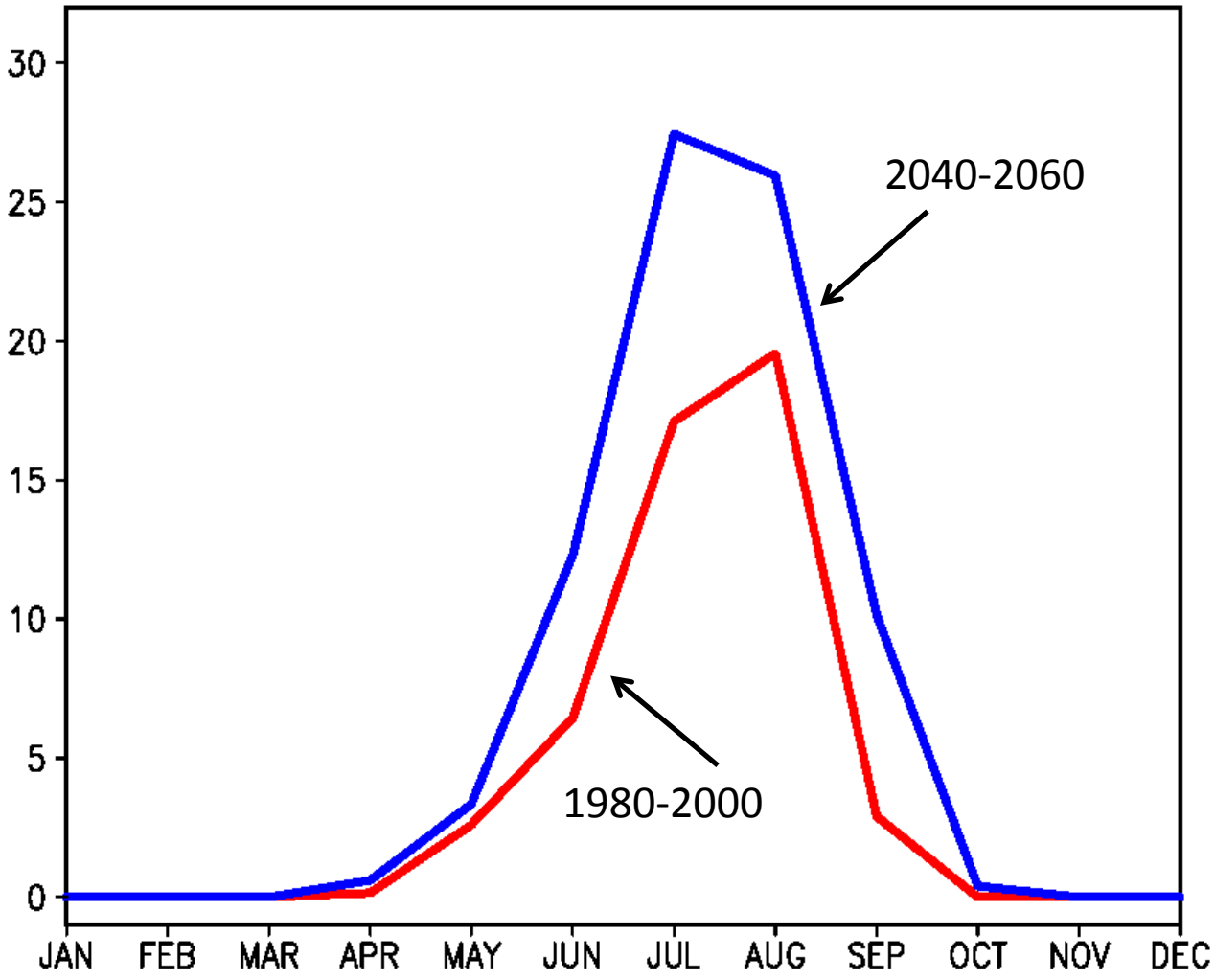


Source: Professor Kerry H. Cook,
Dept. Geological Sciences,
The University of Texas at Austin

Changes in the number of 100°F days for the Austin area

late 20th c.

mid 21st c.



Source: Professor Kerry H. Cook, Dept. Geological Sciences, The University of Texas at Austin

Heat Stress Categories: Apparent Temperature (A)

90 < A < 105 “extreme caution”
fatigue, heat cramps

105 < A < 120 “danger”
heat exhaustion likely

120 > A “extreme danger”
heat stoke imminent

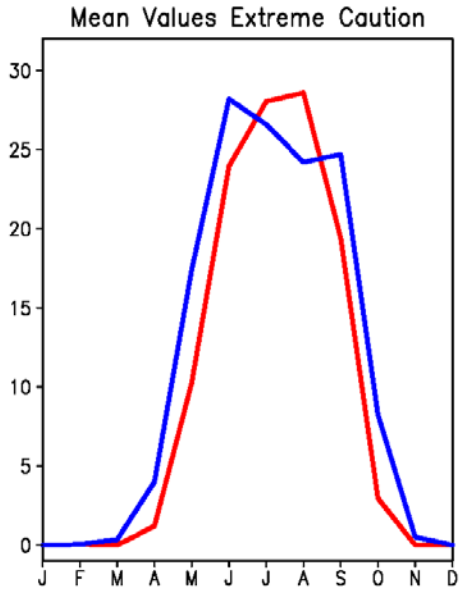
Projected monthly changes in the number of Extreme Caution and Danger heat stress days for the Greater Austin averaging region (30°N-30.5°N; 97°W-98.5°W)

late 20th c.

mid 21st c.

2040-2060

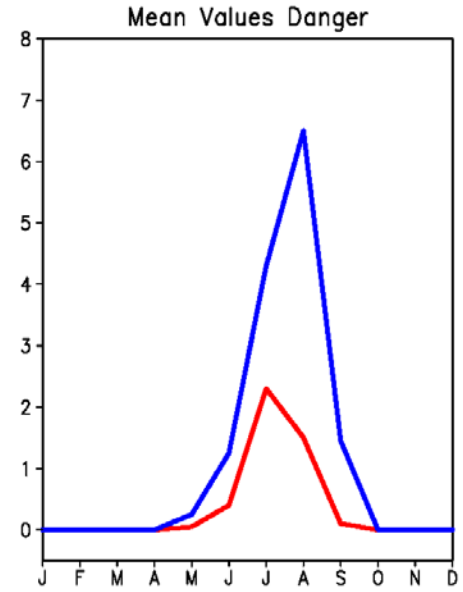
1980-2000



Change in extreme caution heat stress days

2040-2060

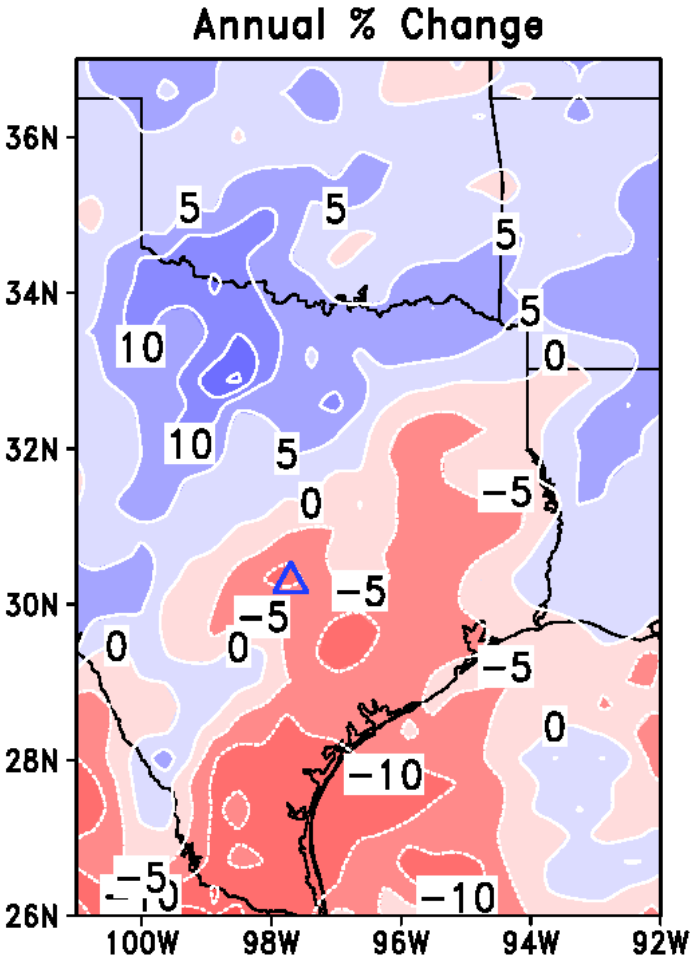
1980-2000



Change in danger heat stress days

Annual Precipitation Differences (%)

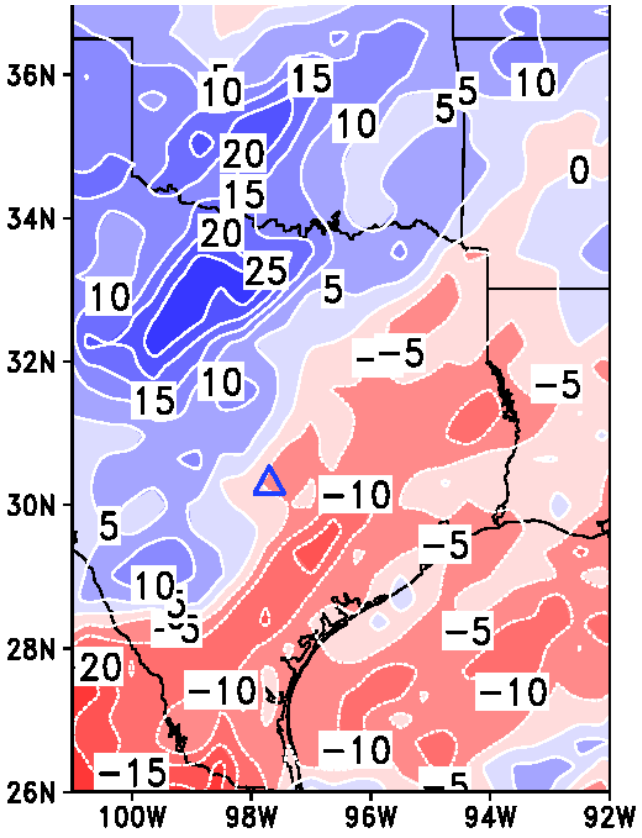
7.5% reduction in annual rainfall (blue triangle = Austin)



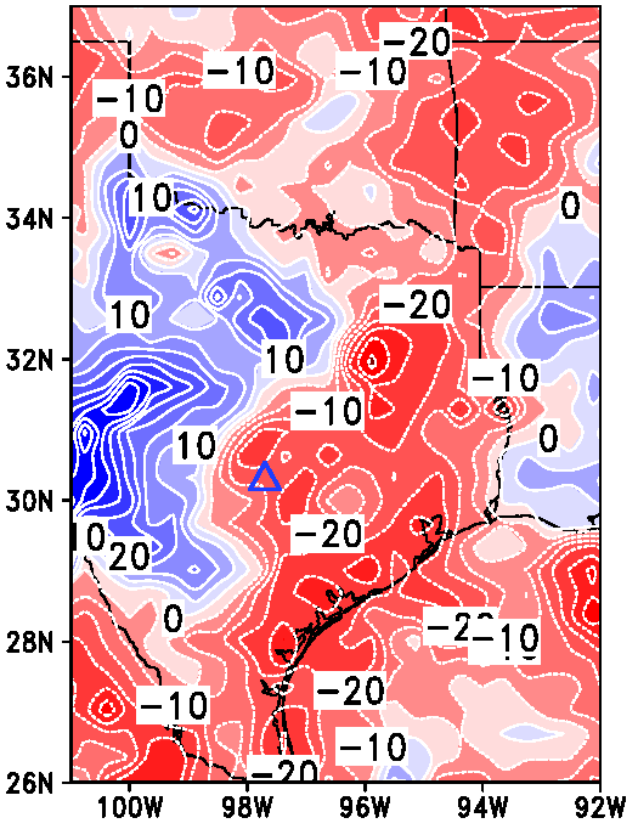
Source: Professor Kerry H. Cook, Dept. Geological Sciences, The University of Texas at Austin

Seasonal Precipitation Differences (%)

Winter: 5% reduction

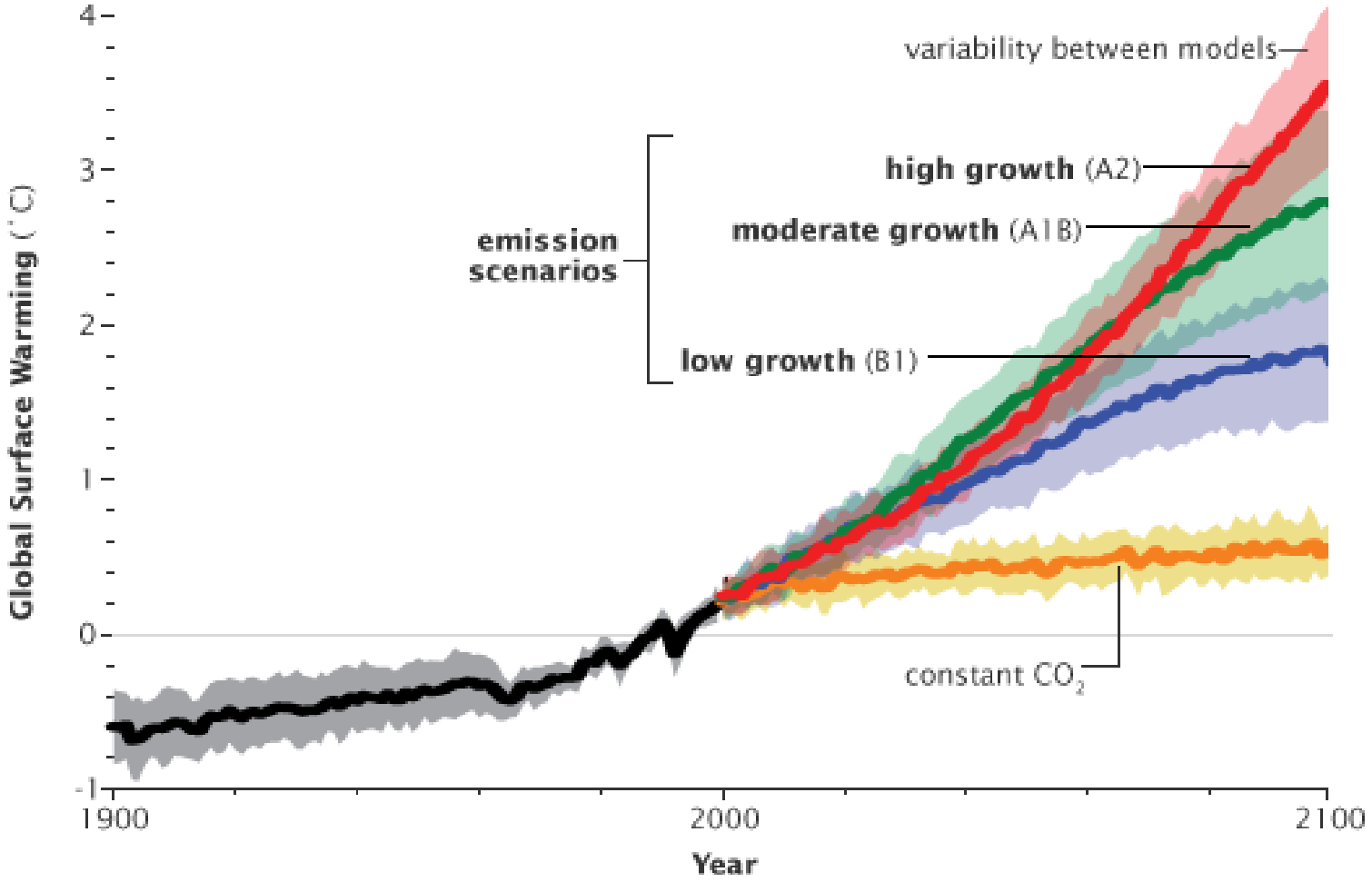


Summer: 15% reduction



Source: Professor Kerry H. Cook, Dept. Geological Sciences, The University of Texas at Austin

Future Emissions Rates are Crucial for Determining How Much Climate Will Change



Two sources of uncertainty:

1. Variations in the temperature prediction from one model to another
2. Future emissions

Source: Intergovernmental Panel on Climate Change (IPCC)

Thank you