

# ILLINOIS AGRICULTURE CLIMATE ASSESSMENT

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University of Illinois**

# Our Priorities

We are focusing on these key areas in order to achieve our ambitious mission.



Tackle Climate  
Change



Protect Land &  
Water



Provide Food &  
Water Sustainably



Build Healthy  
Cities

# THE NATURE CONSERVANCY

- ▶ Identify key features of our changing climate
- ▶ Examine projections of future climate change
- ▶ Assess the impacts of climate change on society and environment in Illinois

## CLIMATE ASSESSMENT OF ILLINOIS



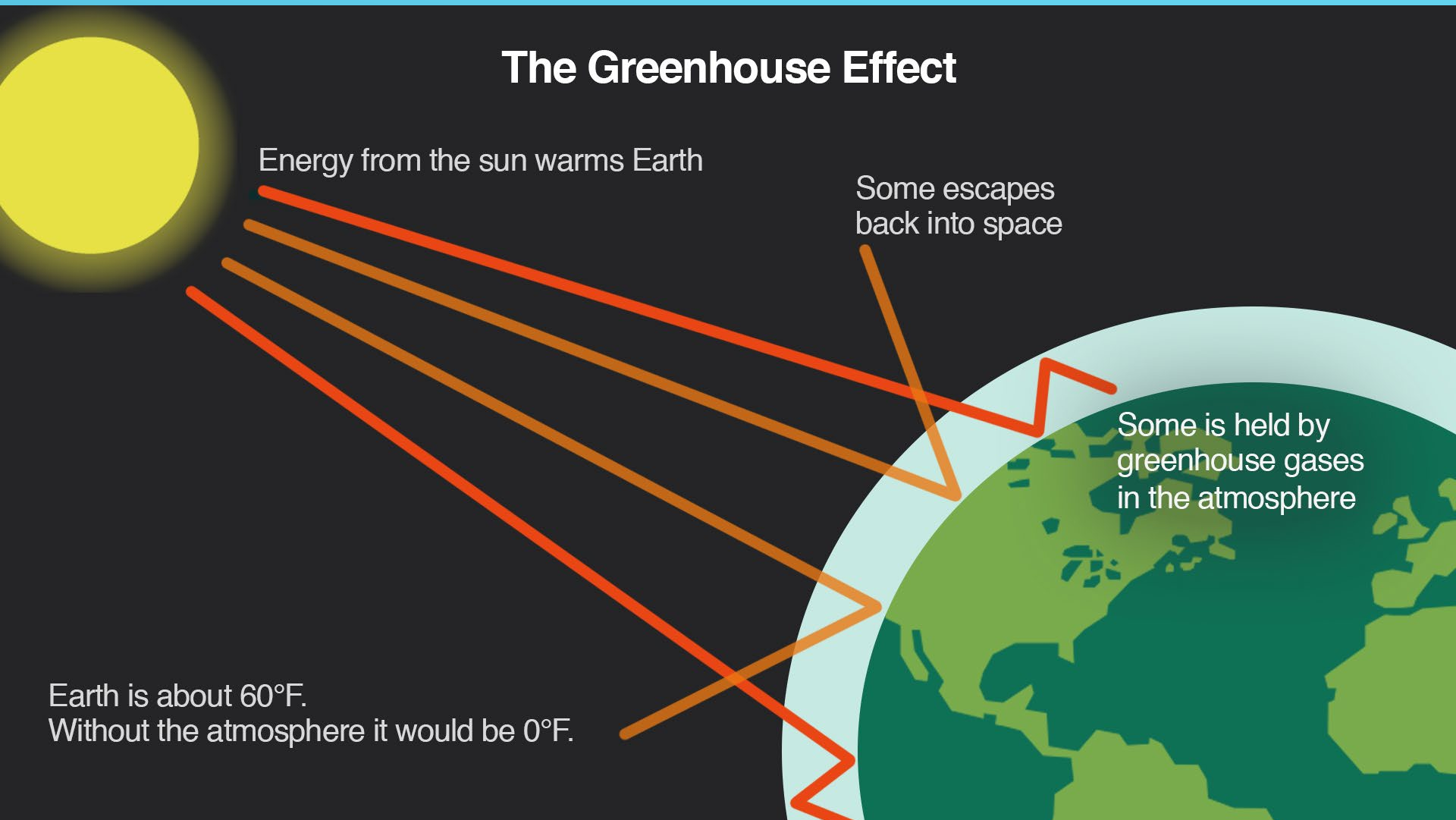
- ▶ Regional climate
- ▶ Hydrology
- ▶ Agriculture
- ▶ Ecosystems
- ▶ Economics and Policy
- ▶ Health

## EXPERTS

Scientists from the Prairie Research Institute, University of Illinois, and Northwestern University



# The Greenhouse Effect



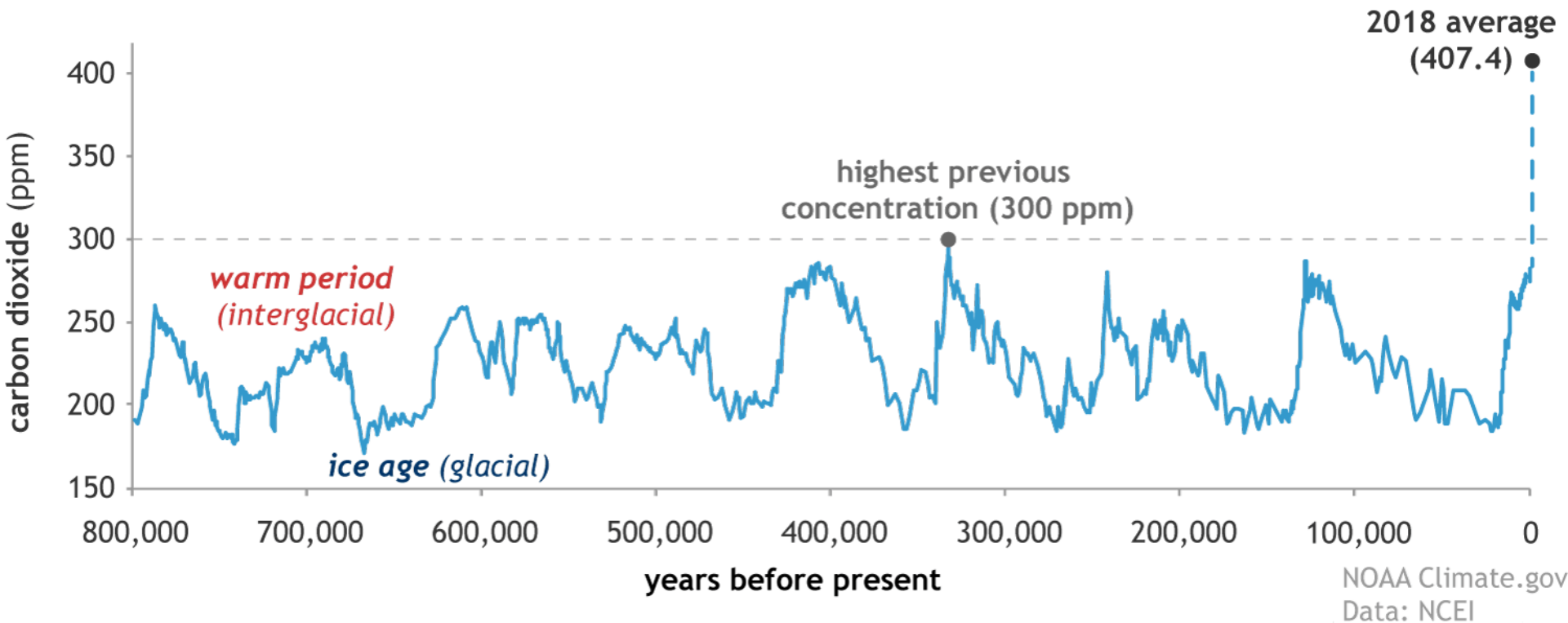
Energy from the sun warms Earth

Some escapes back into space

Some is held by greenhouse gases in the atmosphere

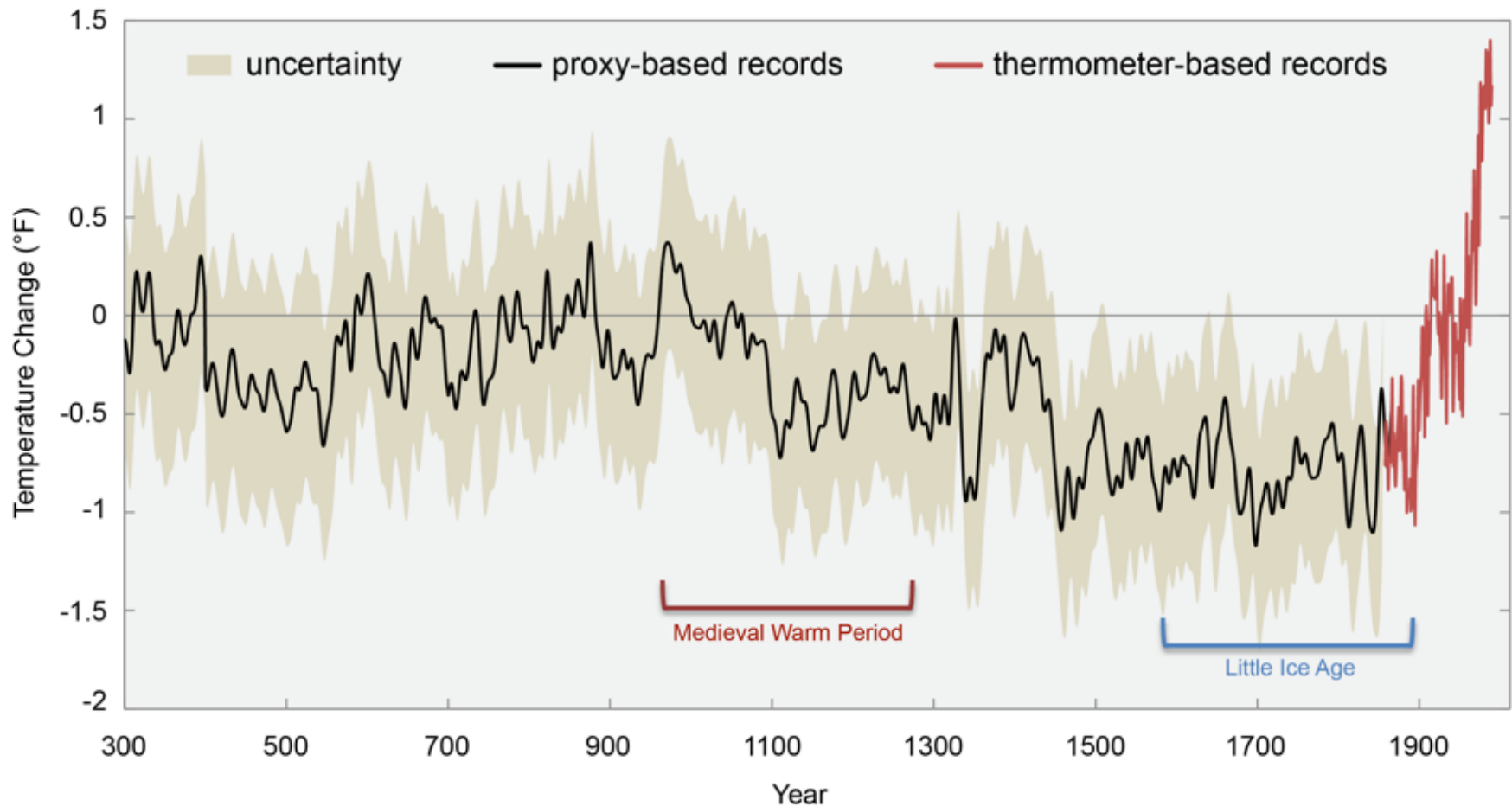
Earth is about 60°F.  
Without the atmosphere it would be 0°F.

## CO<sub>2</sub> during ice ages and warm periods for the past 800,000 years



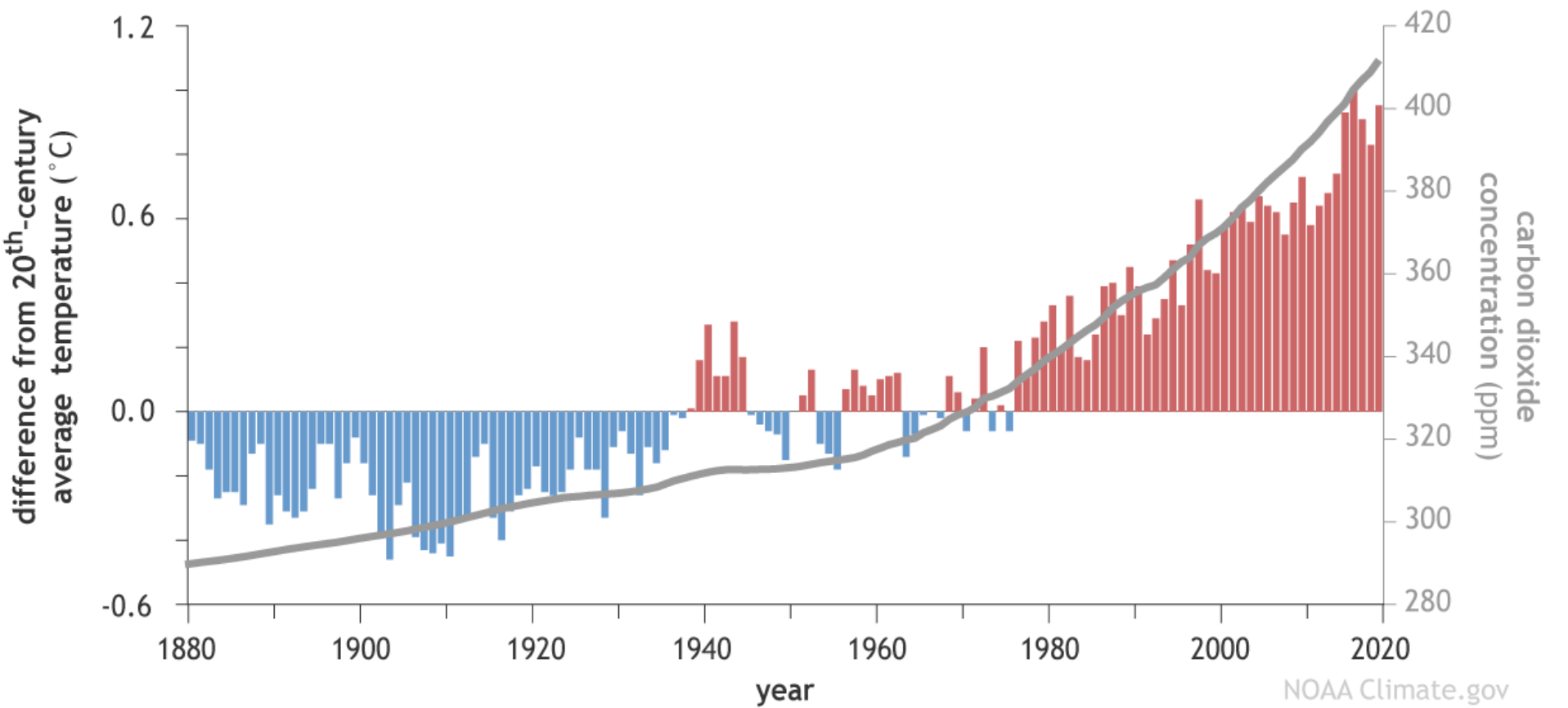
Global atmospheric carbon dioxide concentrations (CO<sub>2</sub>) in parts per million (ppm) for the past 800,000 years. The peaks and valleys track ice ages (low CO<sub>2</sub>) and warmer interglacials (higher CO<sub>2</sub>). During these cycles, CO<sub>2</sub> was never higher than 300 ppm. In 2018, it reached 407.4 ppm. On the geologic time scale, the increase (blue dashed line) looks virtually instantaneous. NOAA Climate.gov, based on EPICA Dome C [data](#) (Lüthi, D., et al., 2008) provided by NOAA NCEI Paleoclimatology Program.

## 1700 Years of Global Temperature Change from Proxy Data



Studies of past climates suggest that current global temperatures were *likely* last observed during the Eemian period—the last interglacial—125,000 years ago.

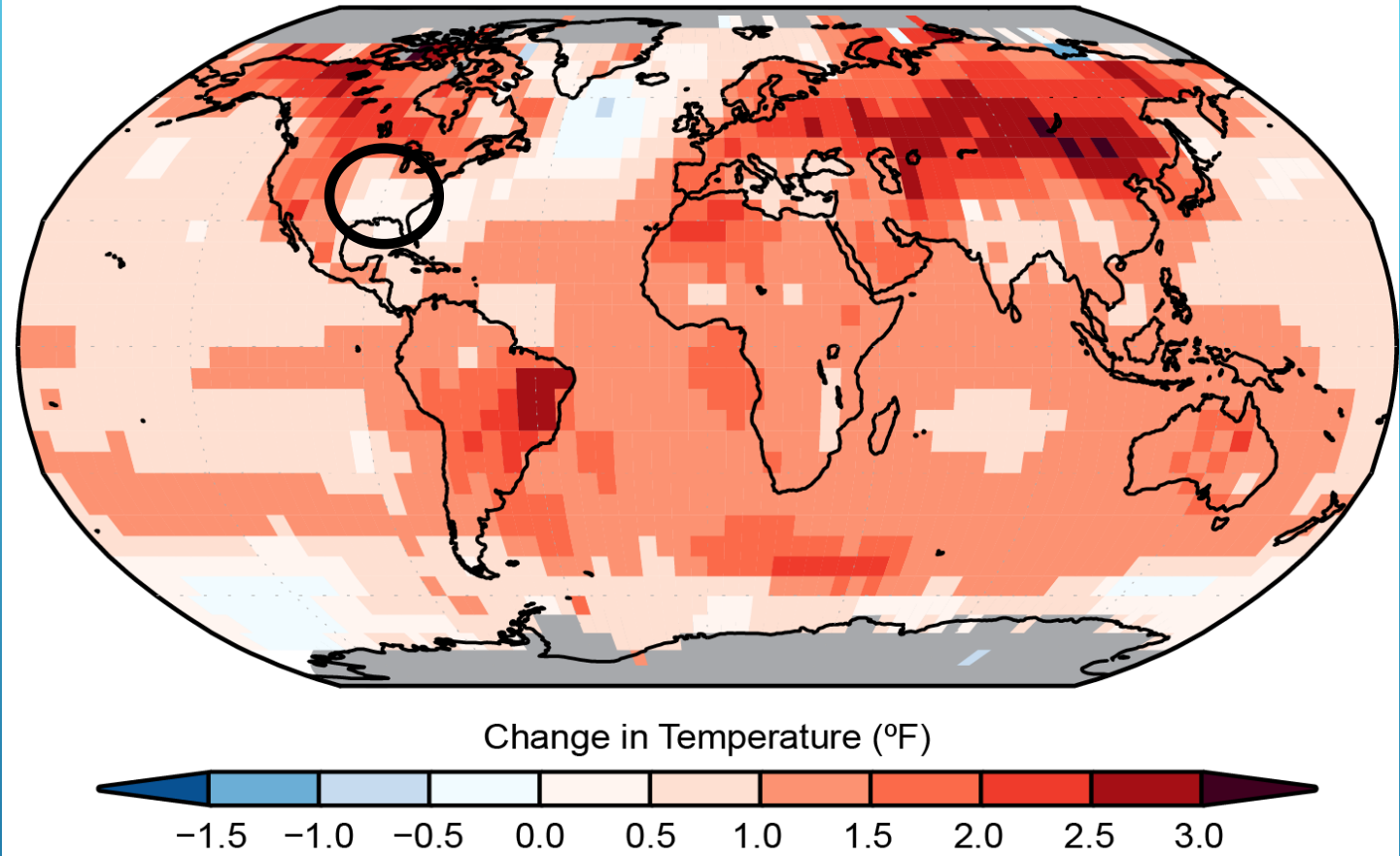
# Atmospheric carbon dioxide and Earth's surface temperature (1880-2019)



NOAA Climate.gov  
Data: ESRL/ETHZ/NCEI

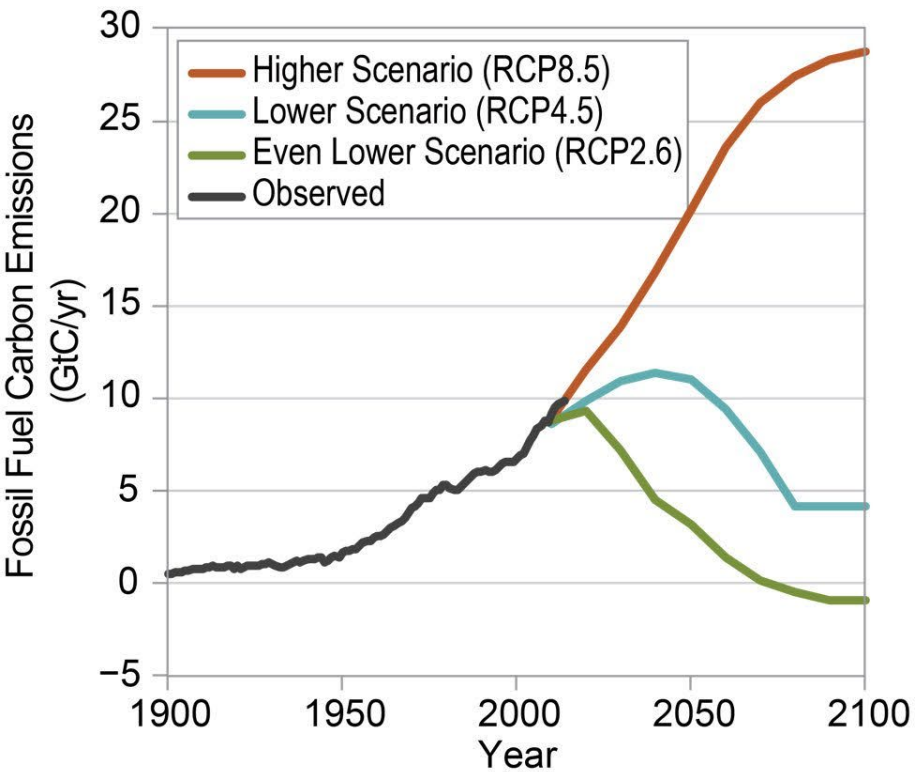


## Surface Temperature Change

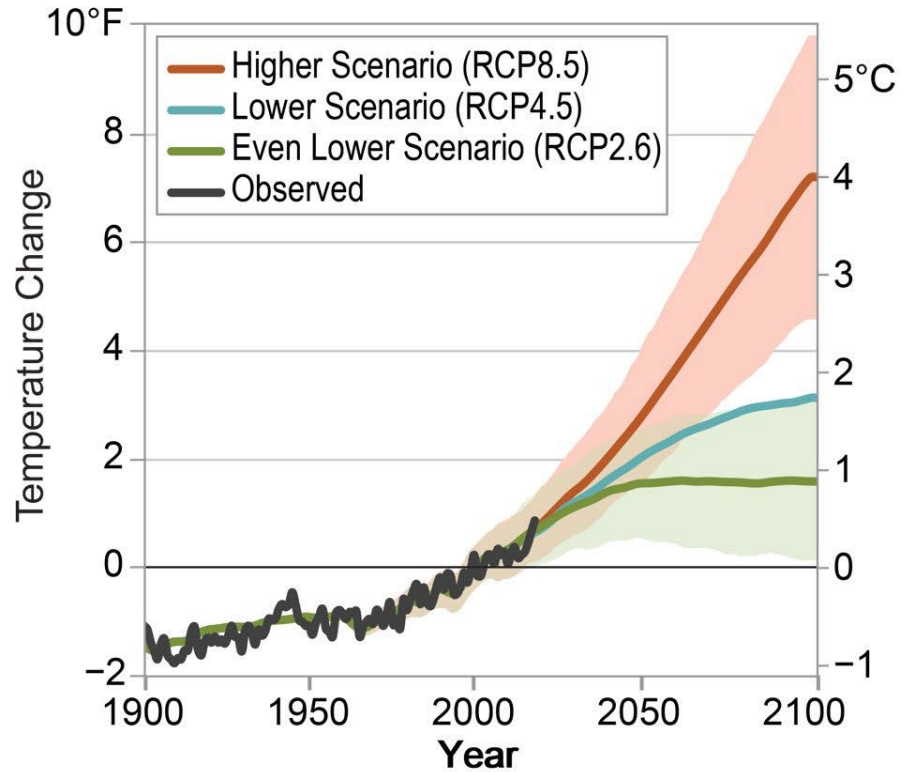


**Caption:** (left) Global annual average temperature has increased by more than 1.2°F (0.7°C) for the period 1986–2016 relative to 1901–1960. Red bars show temperatures that were above the 1901–1960 average, and blue bars indicate temperatures below the average. (right) Surface temperature change (in °F) for the period 1986–2016 relative to 1901–1960. Gray indicates missing data. From Figures 1.2. and 1.3 in [Chapter 1](#).

### Global Carbon Emissions

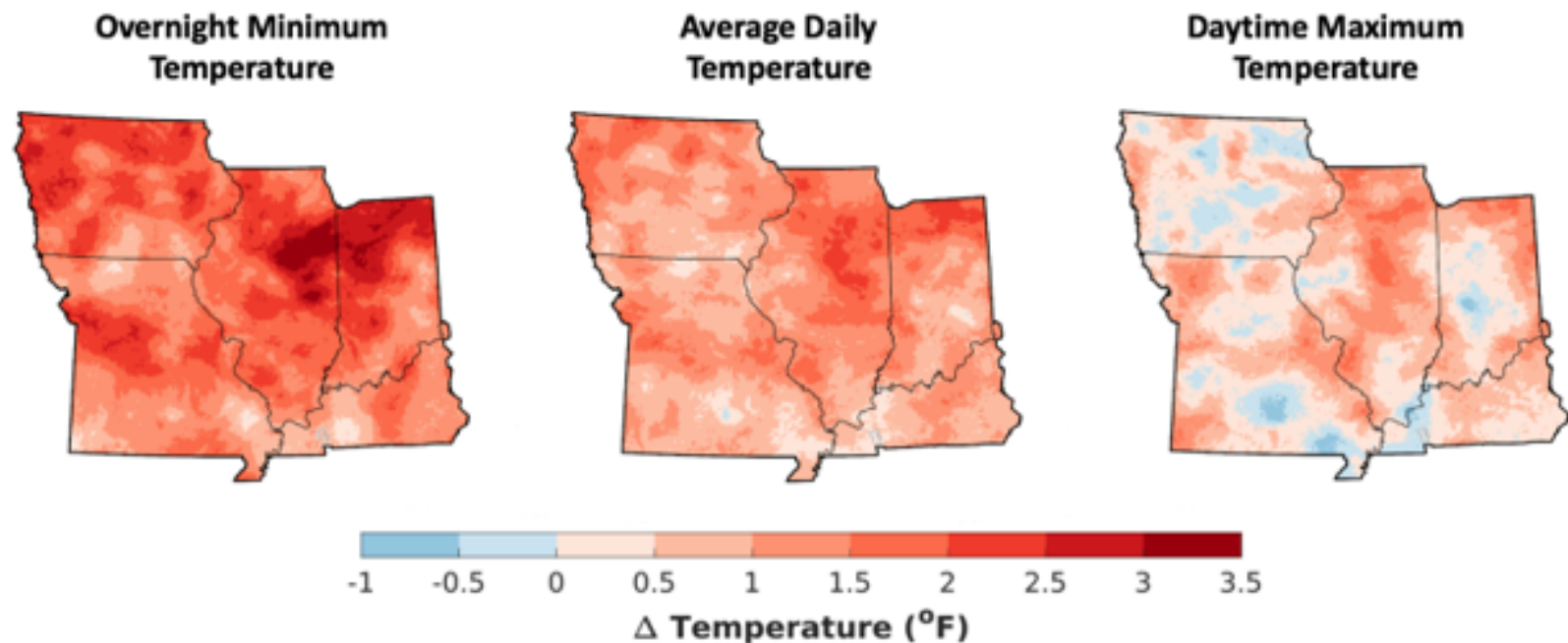


### Global Average Temperature Change



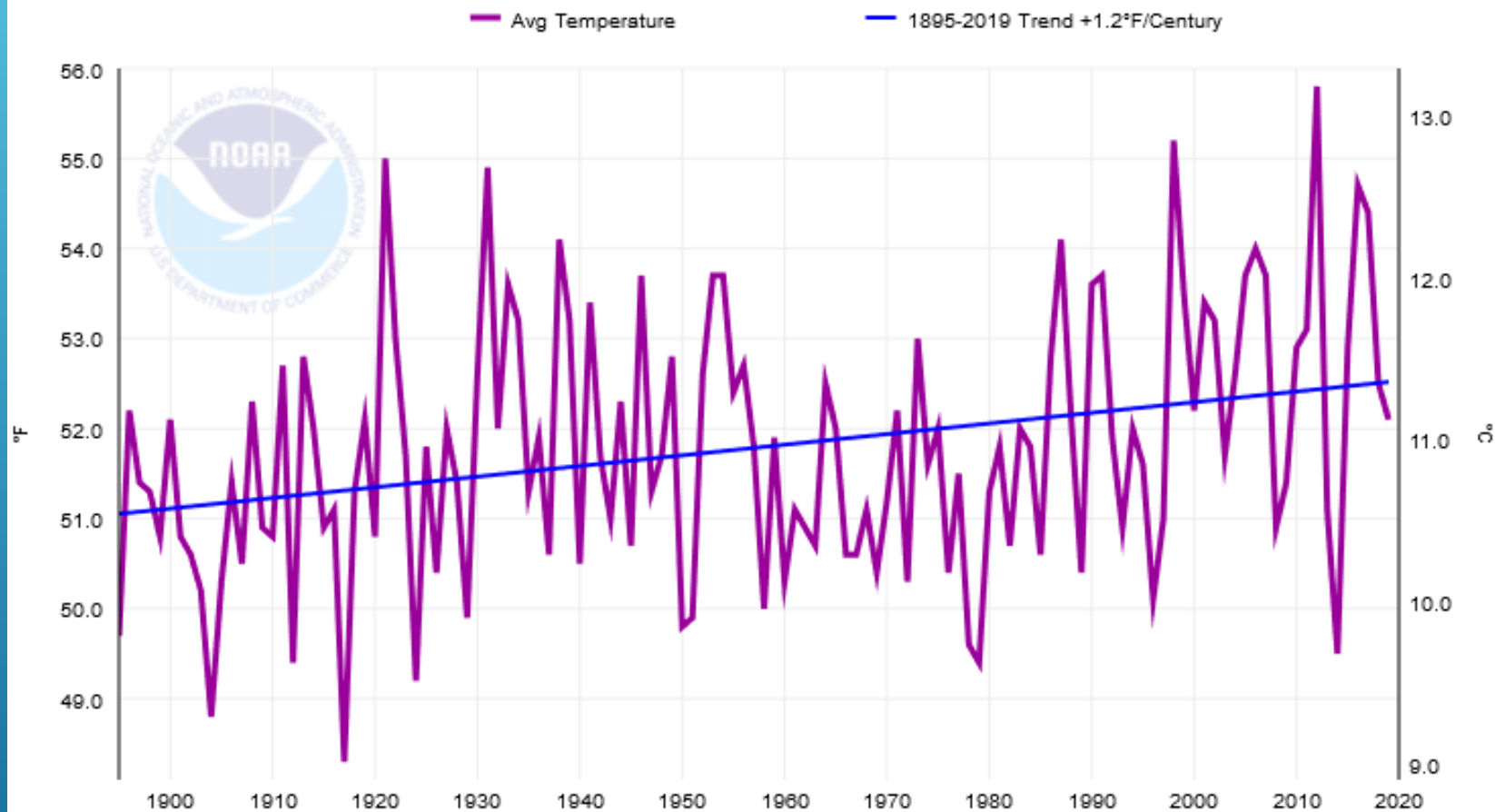
# TEMPERATURE





**Figure 2.1:** Maps of observed changes ( $^{\circ}\text{F}$ ) for 1990-2019 relative to 1895-1924 for average overnight minimum temperature (left panel), average daily mean temperature (middle panel), and average daytime maximum temperature (right panel) for the midwest U.S. Sources: NCICS and The University of Edinburgh.

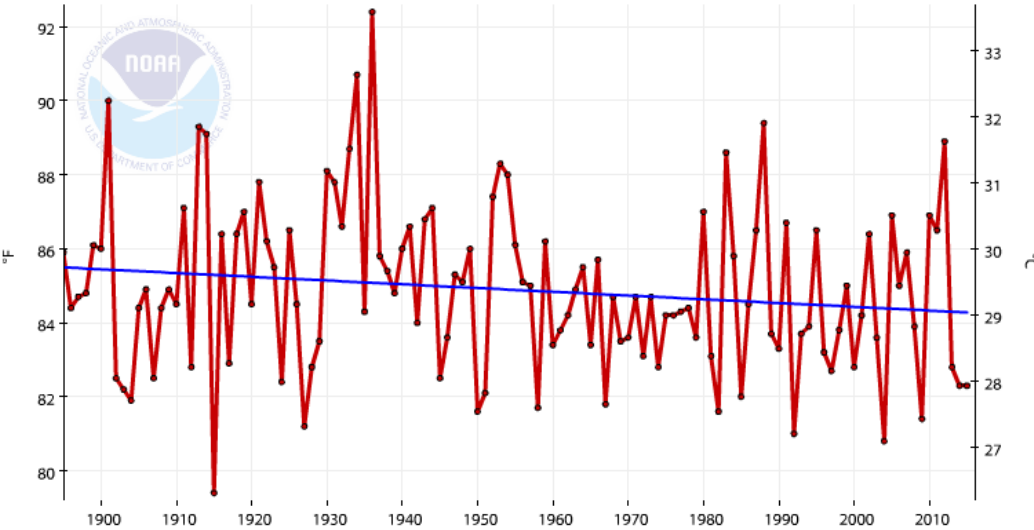
## Illinois, Average Temperature, January-December



# SUMMER TEMPERATURE

Illinois, Maximum Temperature, June-August

— 1895-2015 Trend  
-1.0°F/Century    ● Max Temperature

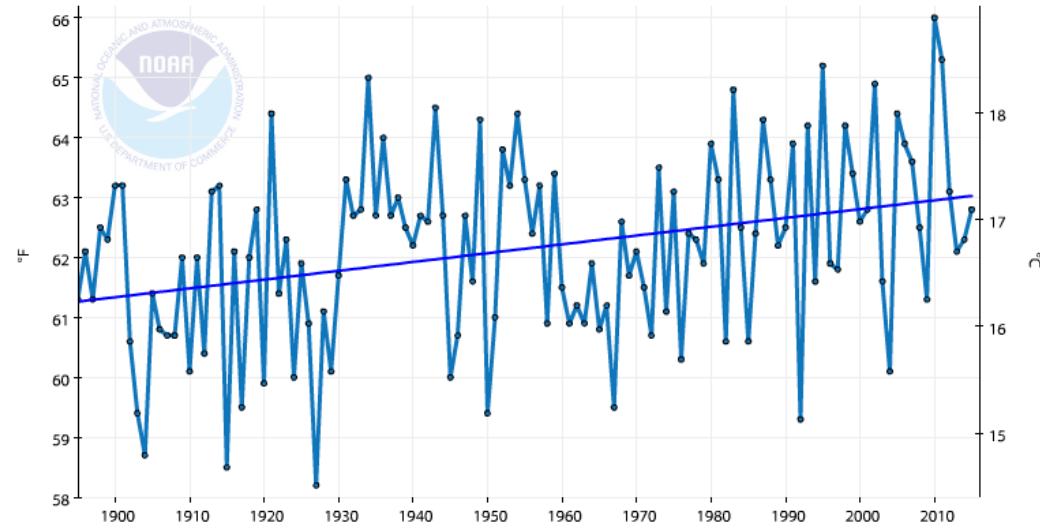


Daytime highs down

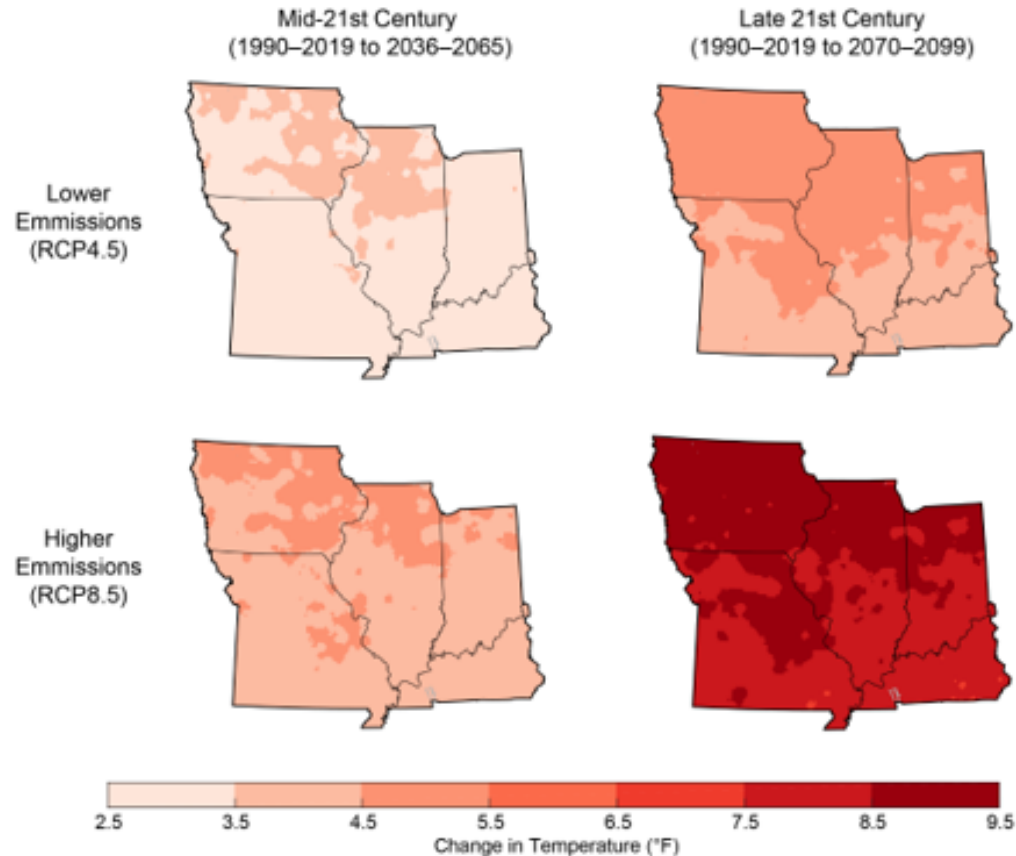
Nighttime lows up

Illinois, Minimum Temperature, June-August

— 1895-2015 Trend  
+1.5°F/Century    ● Min Temperature

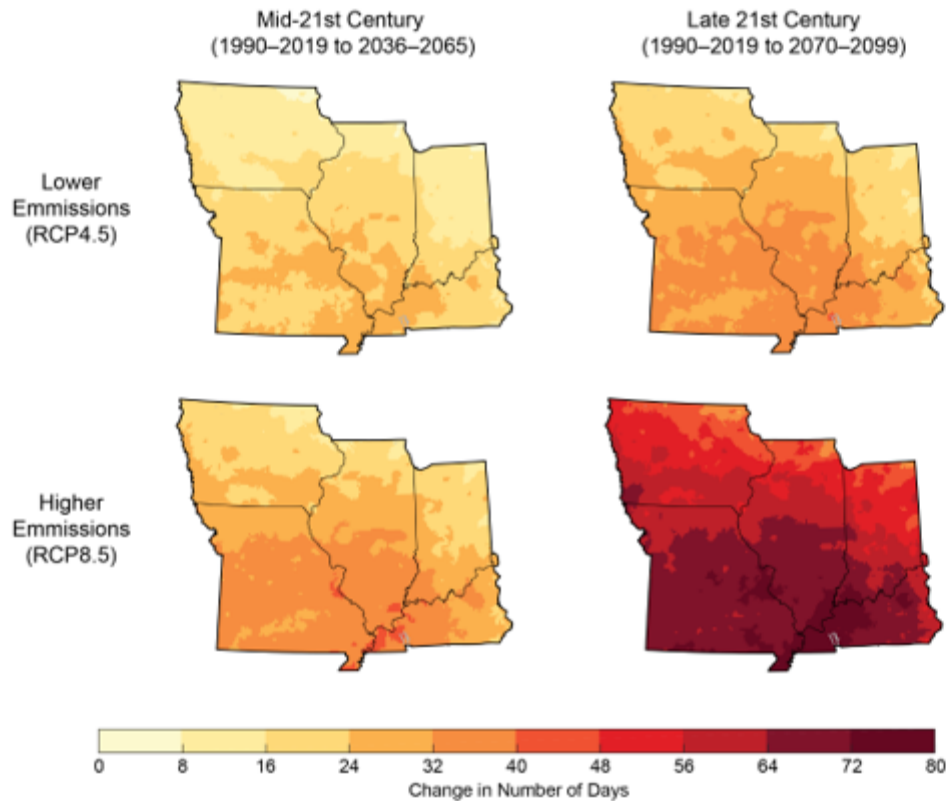


## Change in Annual Average Mean Temperature



**Figure 2.2:** The maps show projected changes (°F) in the annual mean temperature for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.

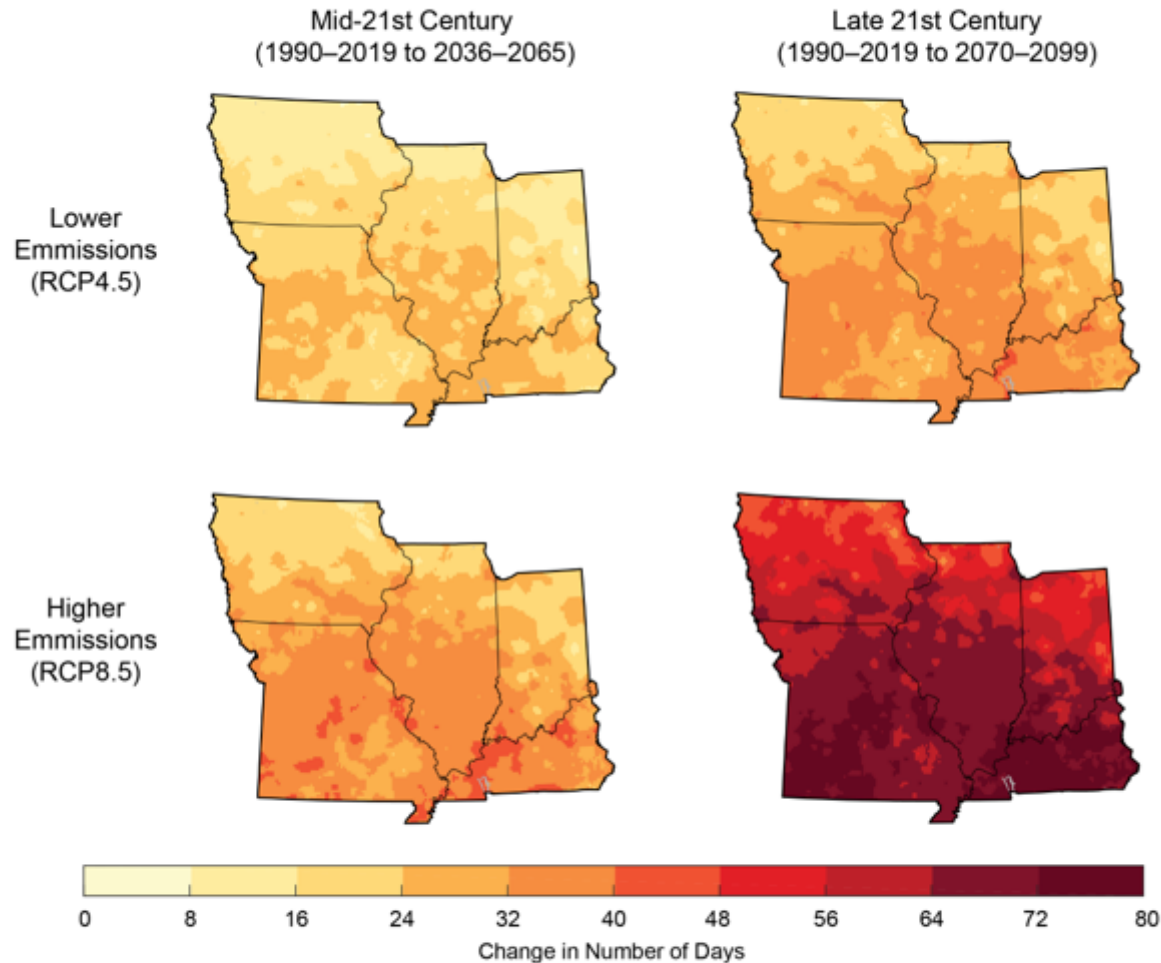
Change in Annual Number of Very Hot Days  
Daily Maximum Temperature of 95°F or Higher



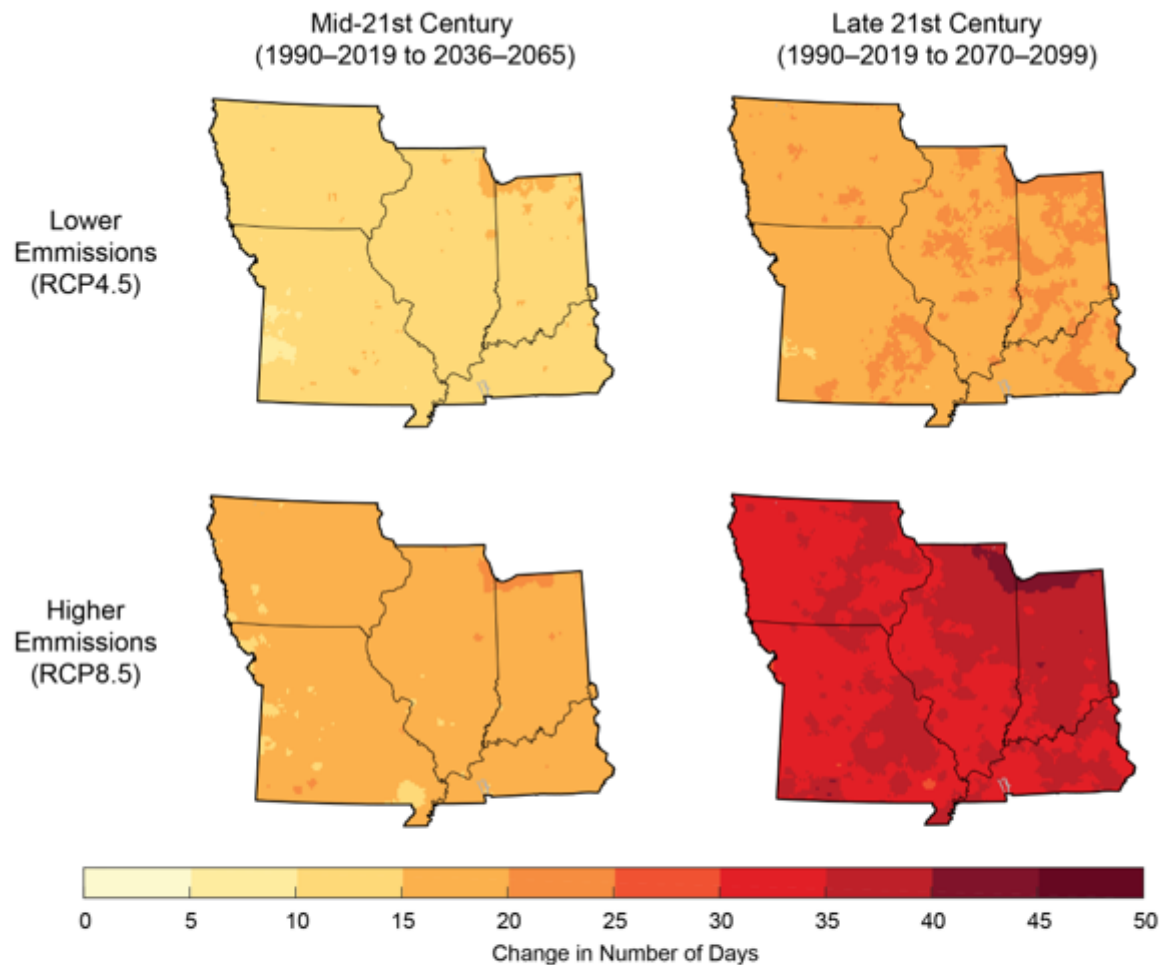
**Figure 2.13:** The maps show projected changes in the number of very hot days (maximum temperature of 95°F or higher) for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.



## Change in Annual Number of Warm Nights Nighttime Minimum Temperature of 70°F or Higher

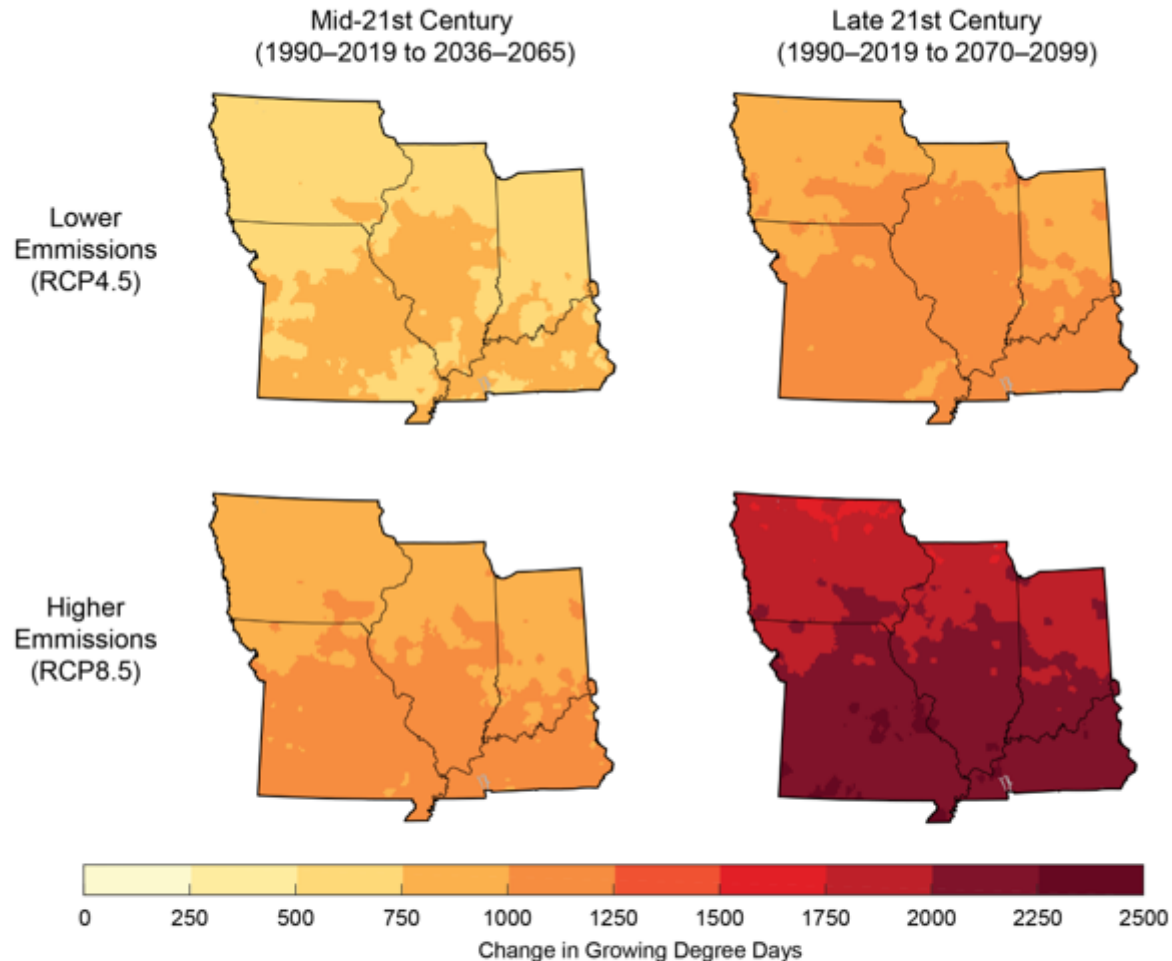


**Figure 2.17:** The maps show projected changes in the number of warm nights (nighttime minimum temperature of 70°F or higher) for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.



**Figure 2.25:** The maps show projected changes in the length of the freeze-free season (between the last spring and first fall occurrences of 32°F) for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.

## Change in Annual Number of Growing Degree Days (modified base 50°F)



**Figure 2.25:** The maps show projected changes in the number of growing degree days (modified base 50°F) for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.

# PRECIPITATION



**WARMER AIR**



**MORE EVAPORATION**



**MORE PRECIPITATION**

Available  
water

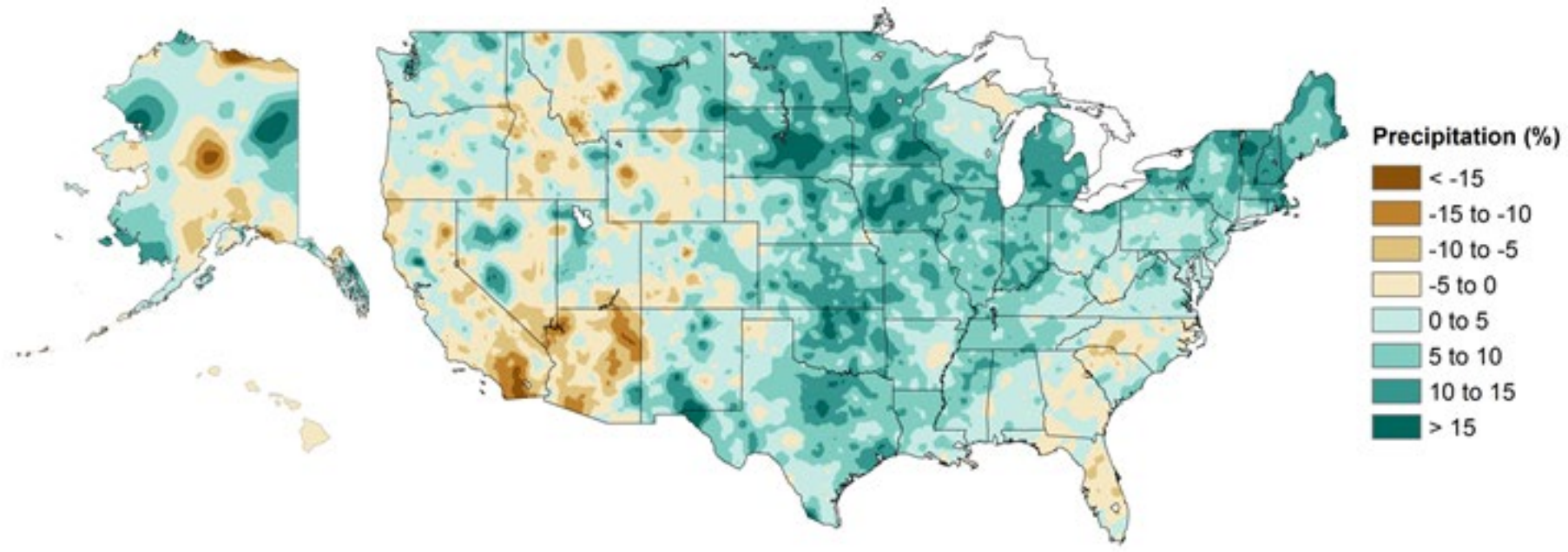
**1°F increase =  
4% more water vapor**

- Temperature +

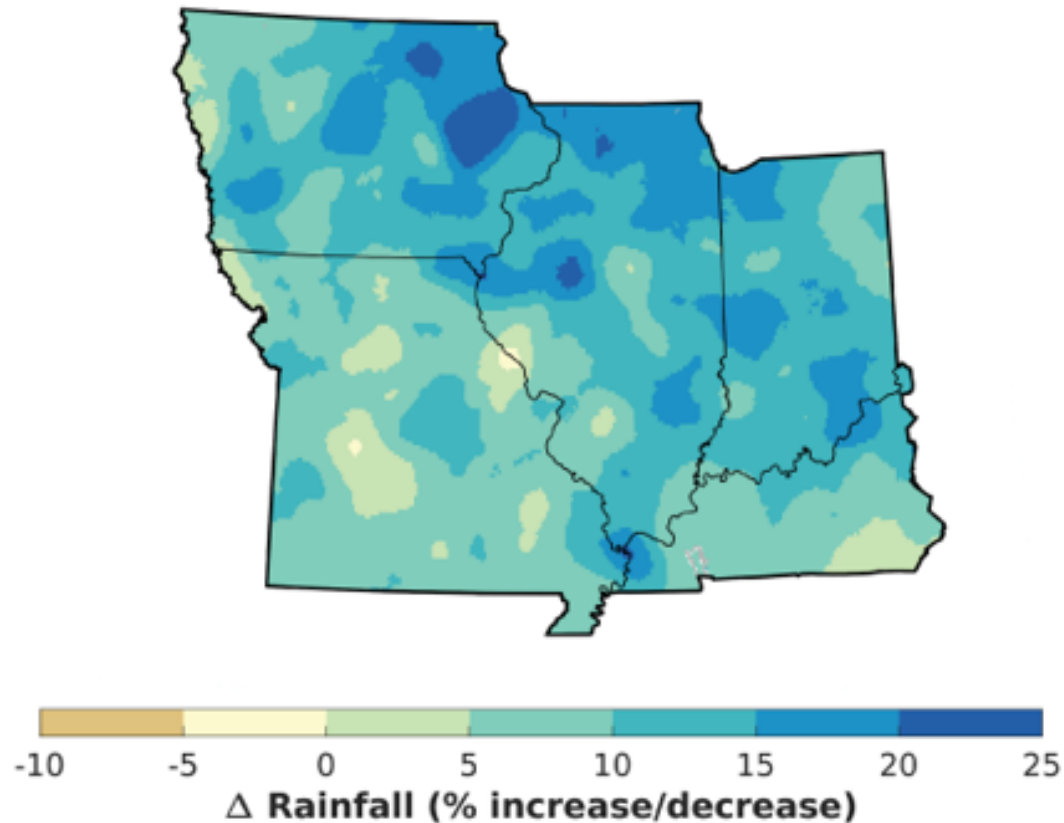


1986-2015 minus 1901-1960

# Annual Precipitation



**Change in Annual Total Rainfall**  
**Observed: 1895 - 1924 to 1990 - 2019**



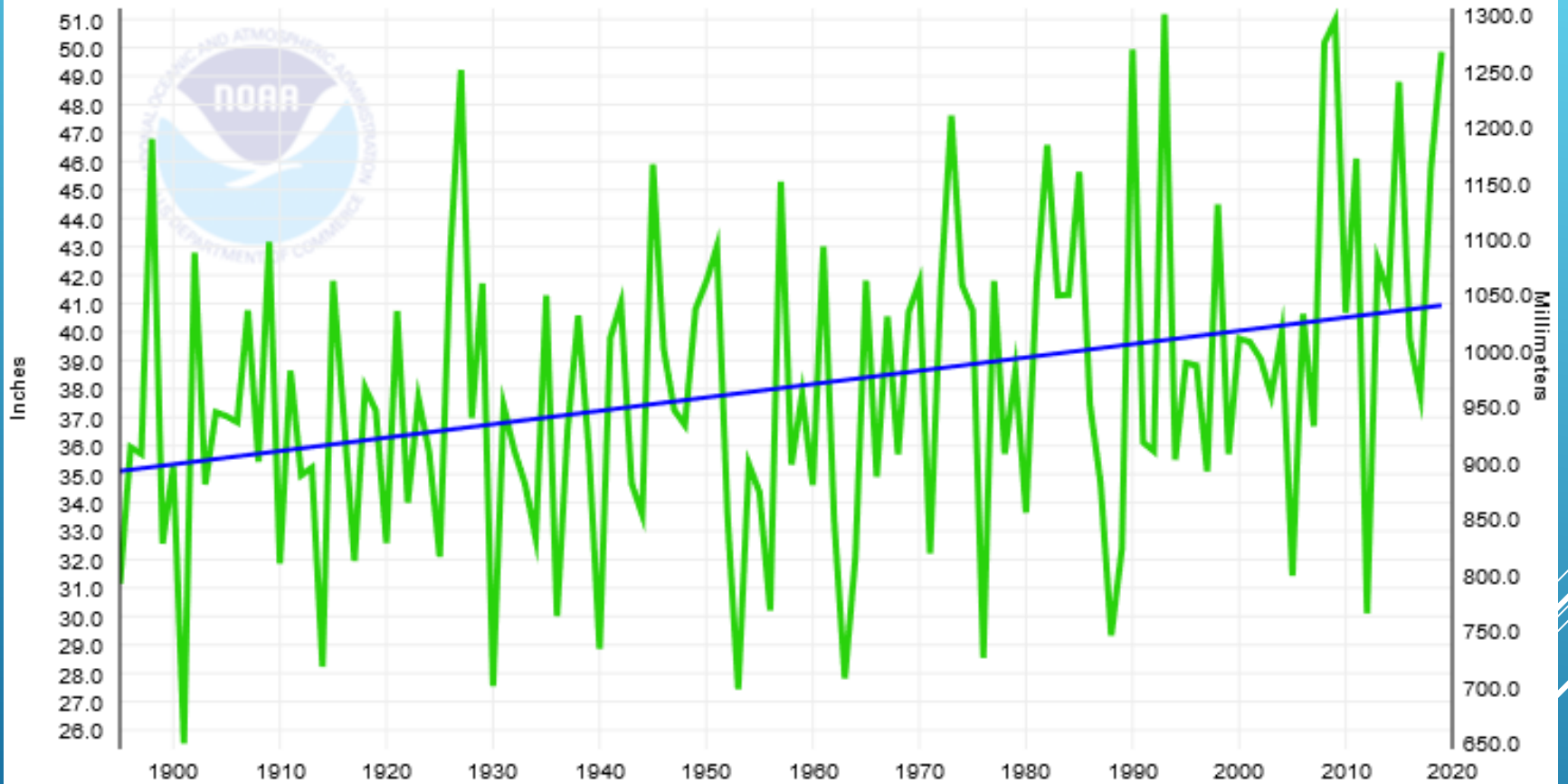
**Figure 2.4:** Maps of observed changes (%) in annual total rainfall for 1990-2019 relative to 1895-1924 for the midwest U.S. Sources: NCICS and The University of Edinburgh.



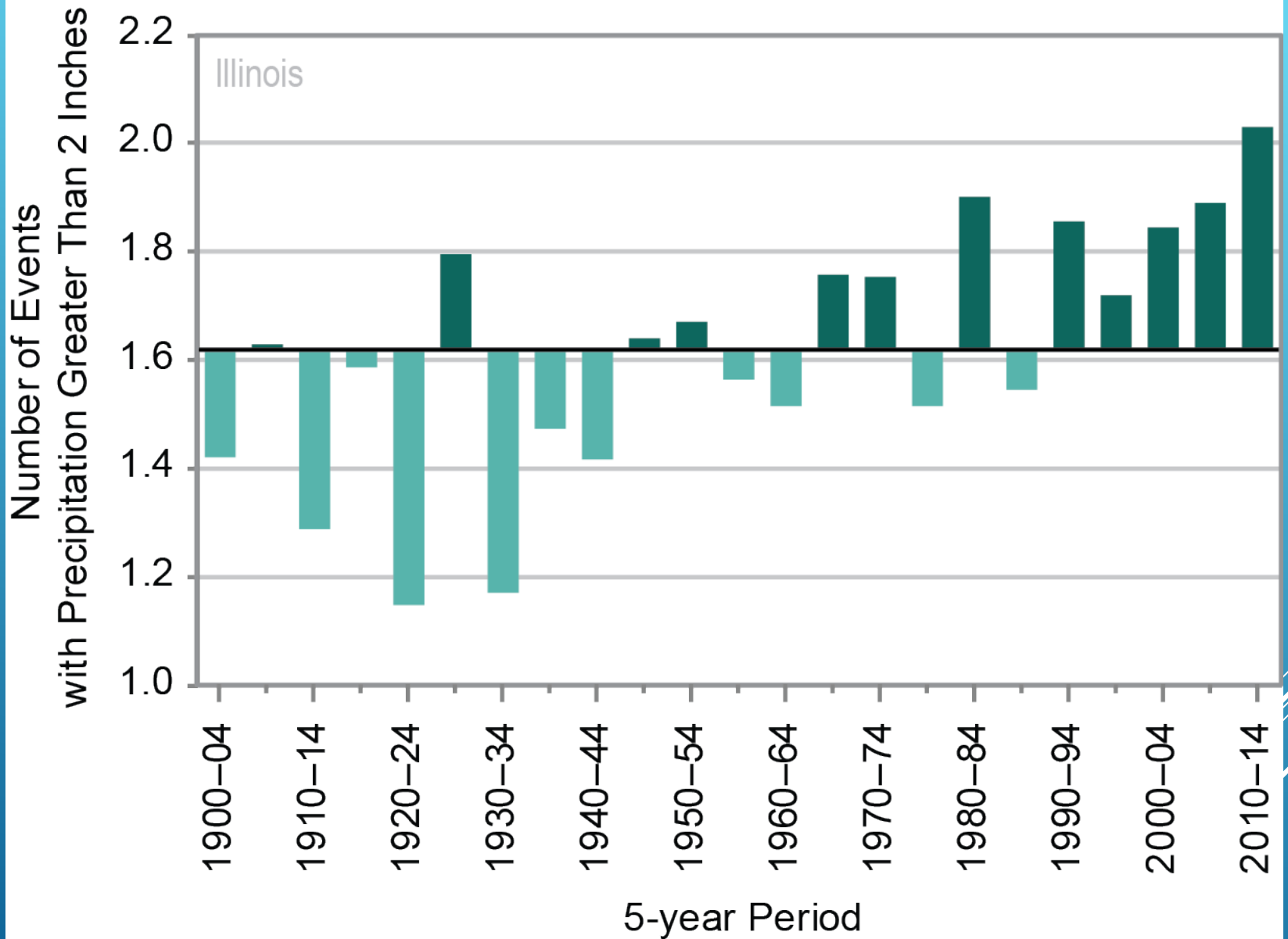
# Illinois, Precipitation, January-December

Precip

1895-2019 Trend +4.70"/Century

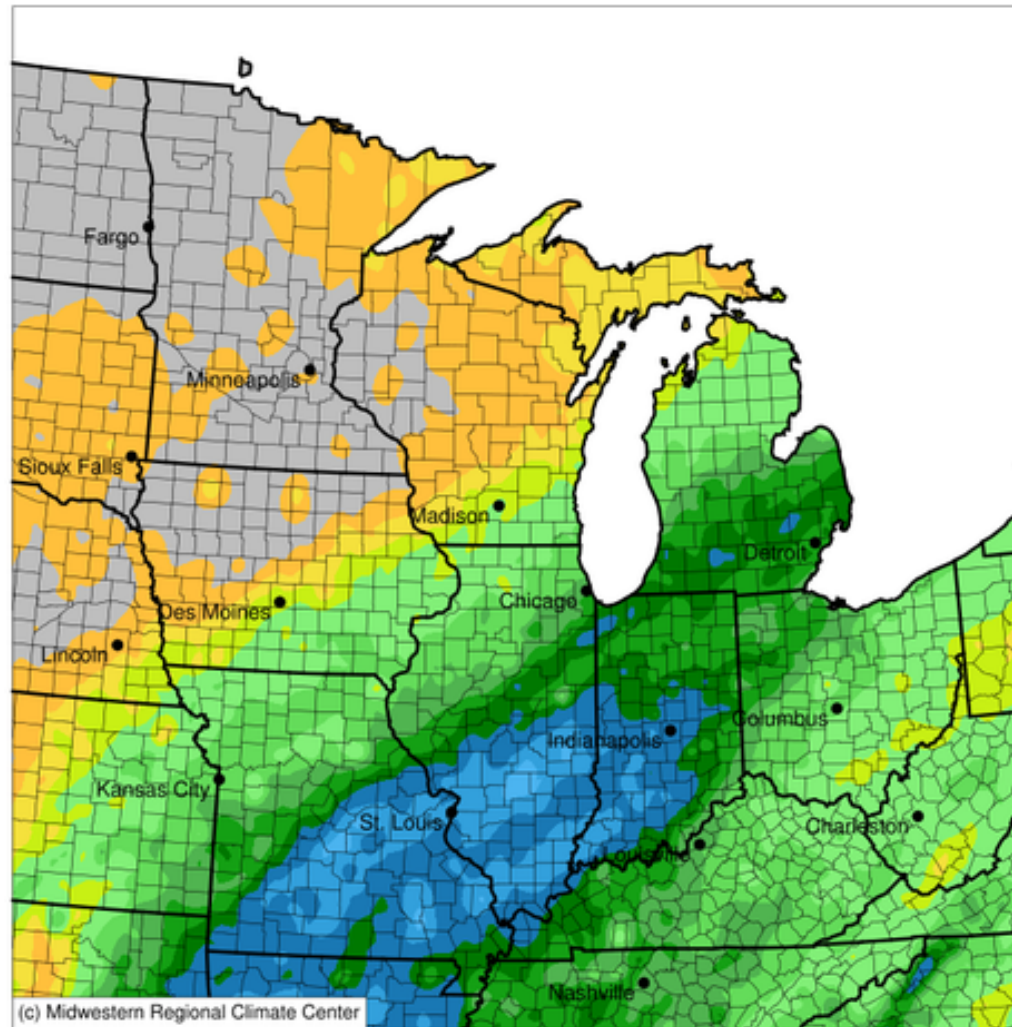


# Observed Number of Extreme Precipitation Events



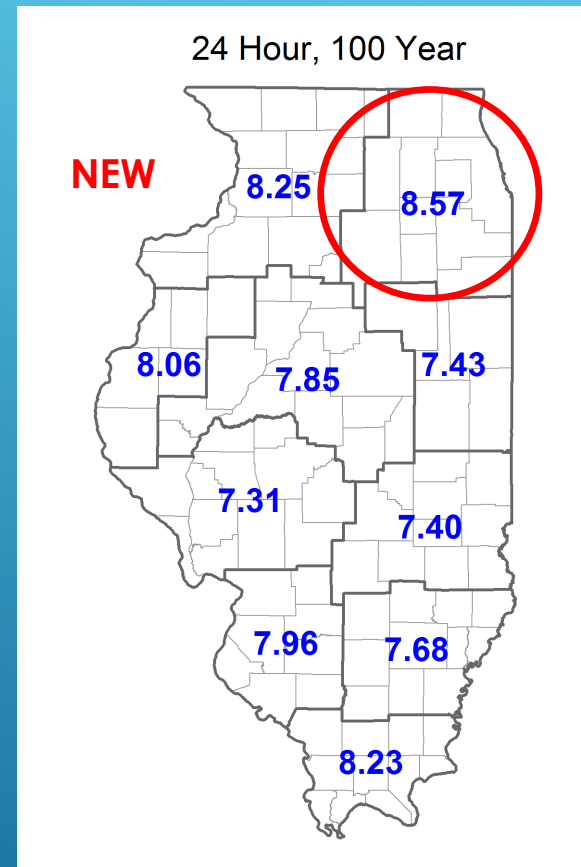
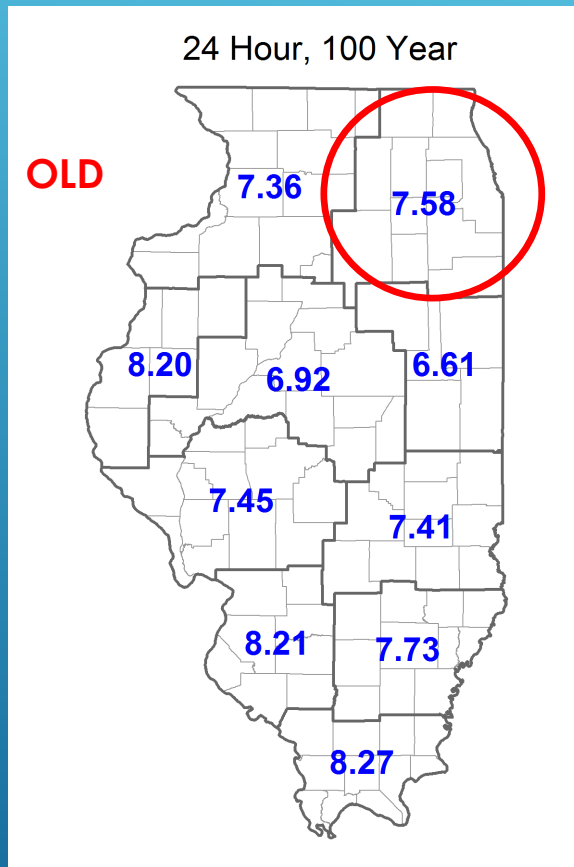
# Accumulated Precipitation (in)

January 10, 2020 to January 12, 2020

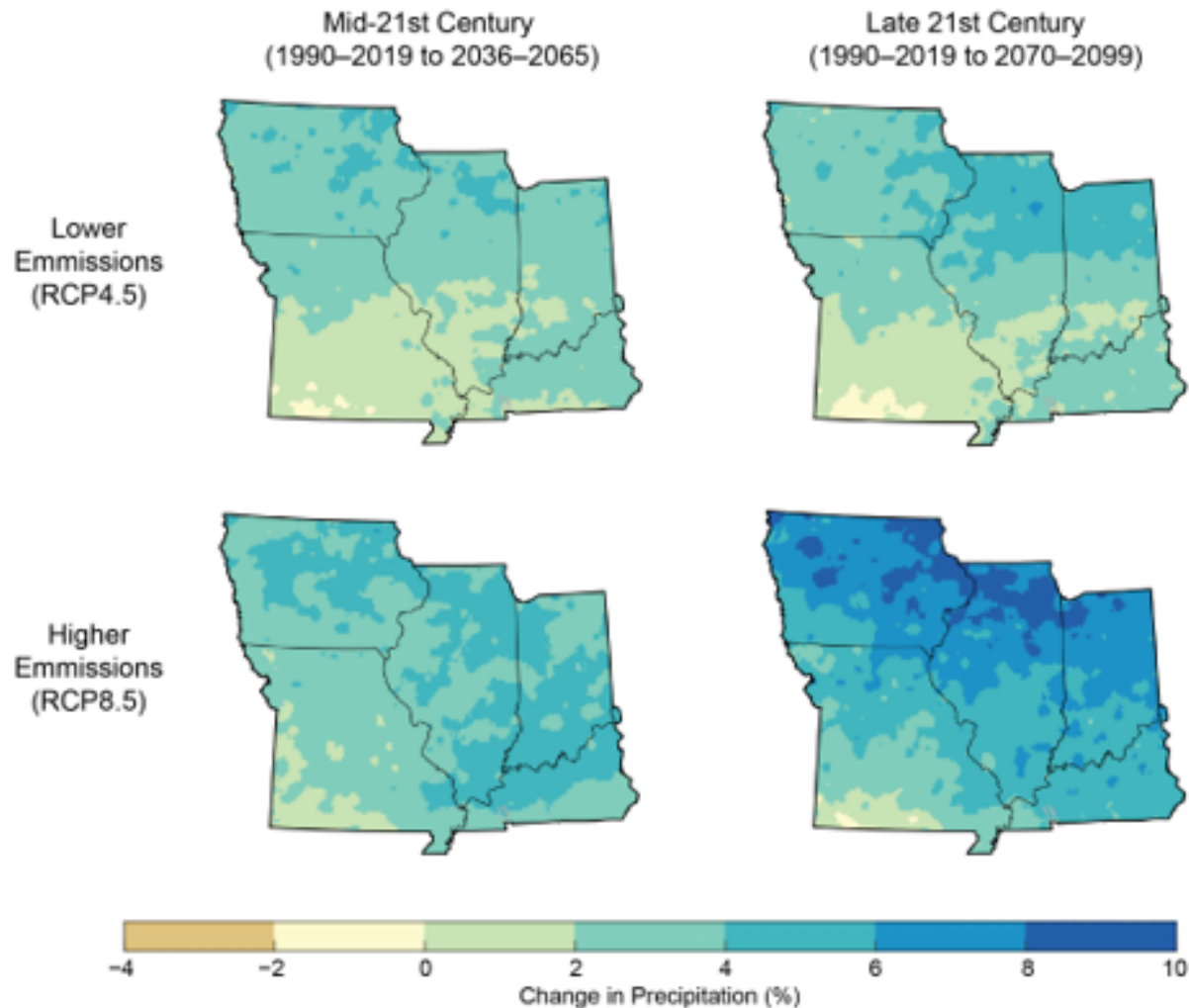


0.01 0.1 0.25 0.5 1 1.5 2 2.5 3 4 5 6 8  
Stations from the following networks used: WBAN, COOP, FAA, GHCN, ThreadEx, CoCoRaHS, WMO, ICAO, NWSLI, Missouri FSA, Missouri Mesonet, Midwestern Regional Climate Center  
cli-MATE: MRCC Application Tools Environment  
Generated at: 8/25/2020 11:20:55 PM CDT

# OLD AND NEW 100-YR, 24-HOUR STORM

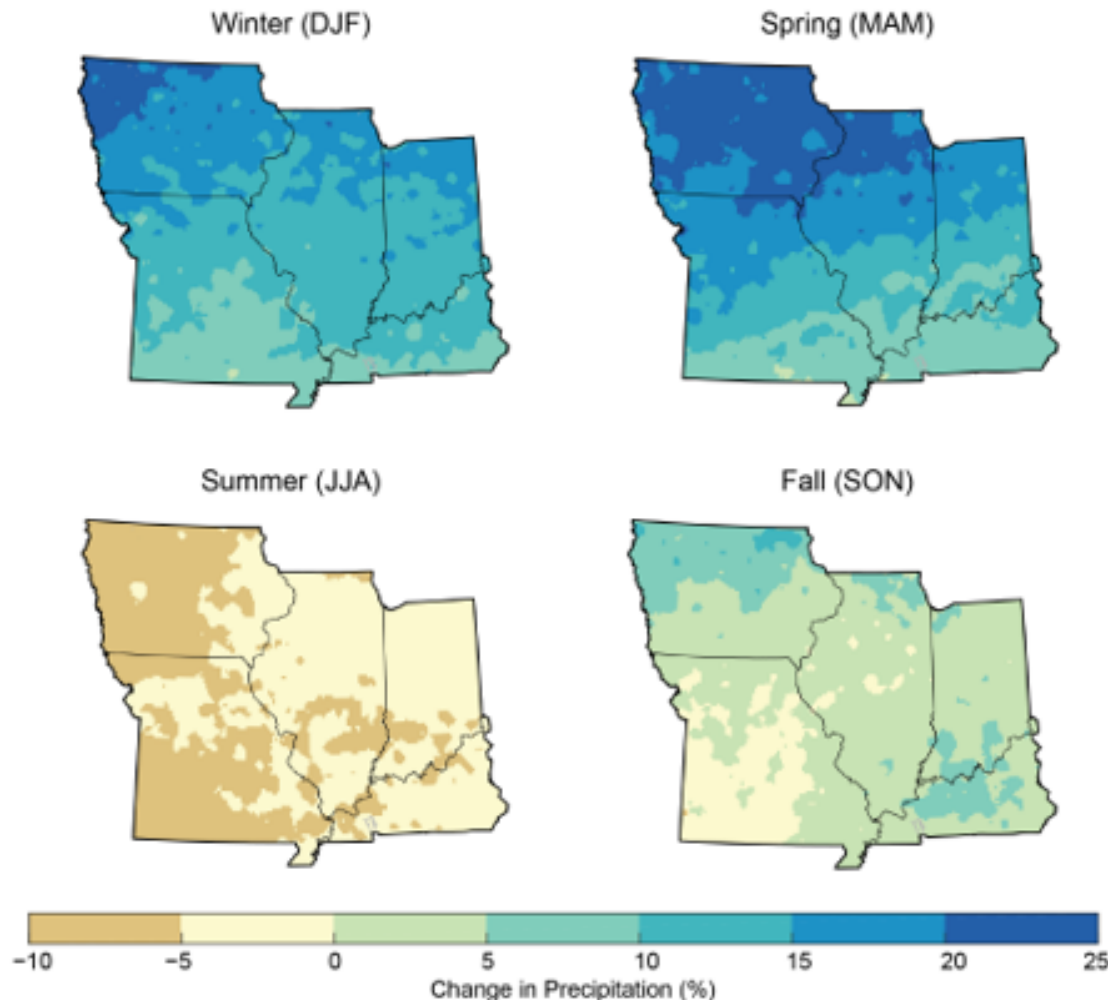


## Change in Annual Total Precipitation



**Figure 2.5:** The maps show projected changes (%) in the annual total precipitation for mid-21<sup>st</sup> Century (left column) and late 21<sup>st</sup> Century (right column) under a lower (RCP4.5) scenario (top row) and a higher (RCP8.5) scenario (top row) for the midwest U.S. All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.

Change in Seasonal Total Precipitation  
Higher Emissions (RCP8.5)  
Late 21st Century (1990–2019 to 2070–2099)



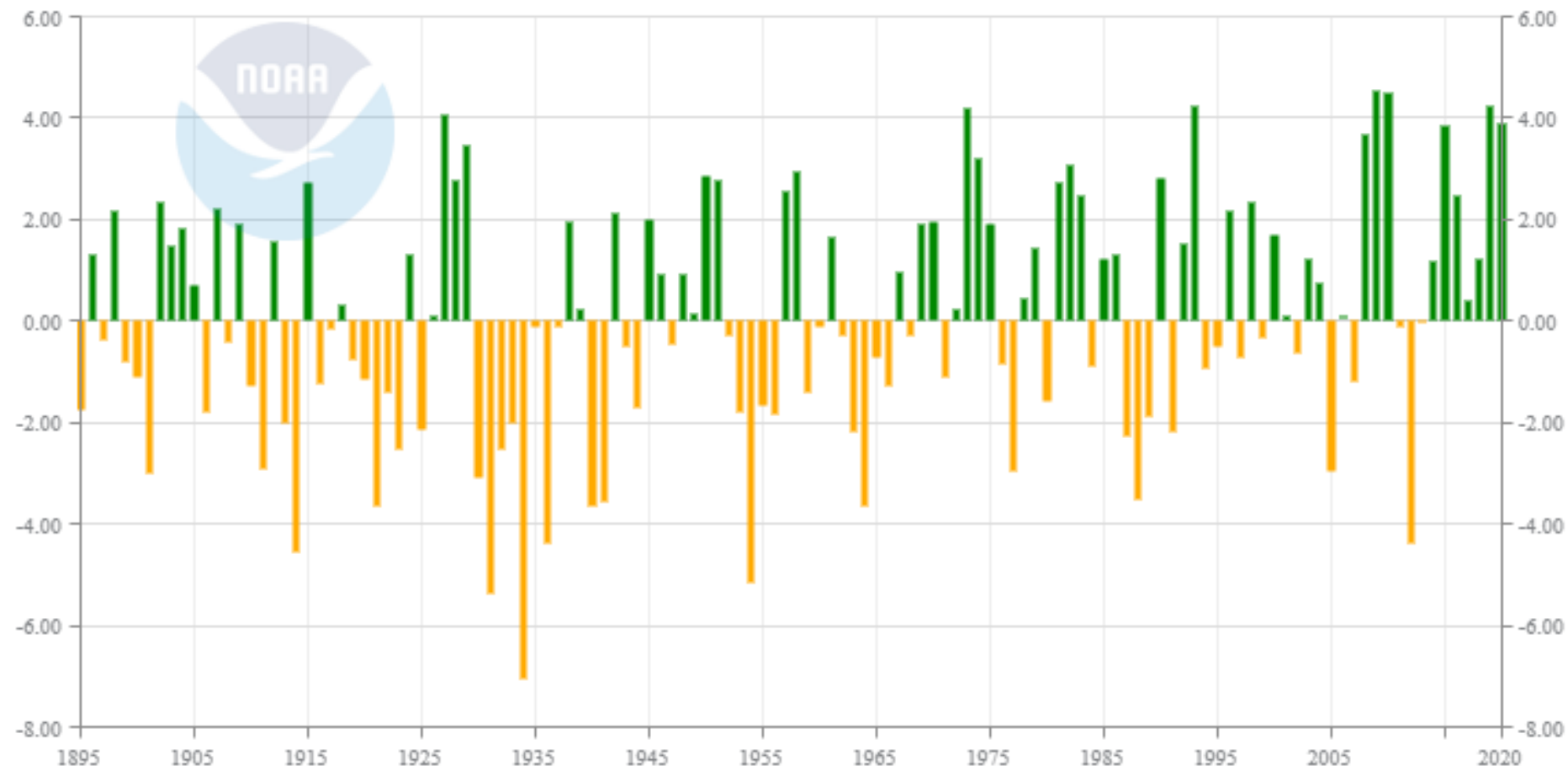
**Figure 2.7:** The maps show projected changes (%) in the seasonal total precipitation for late 21<sup>st</sup> Century under a higher (RCP8.5) scenario for the midwest U.S for winter (upper left), spring (upper right), summer (lower left), and fall (lower right). All projected values are shown as changes compared to 1990–2019 averages. Sources: NCICS and The University of Edinburgh.

# DROUGHT IN ILLINOIS



# Illinois Palmer Drought Severity Index (PDSI)

July

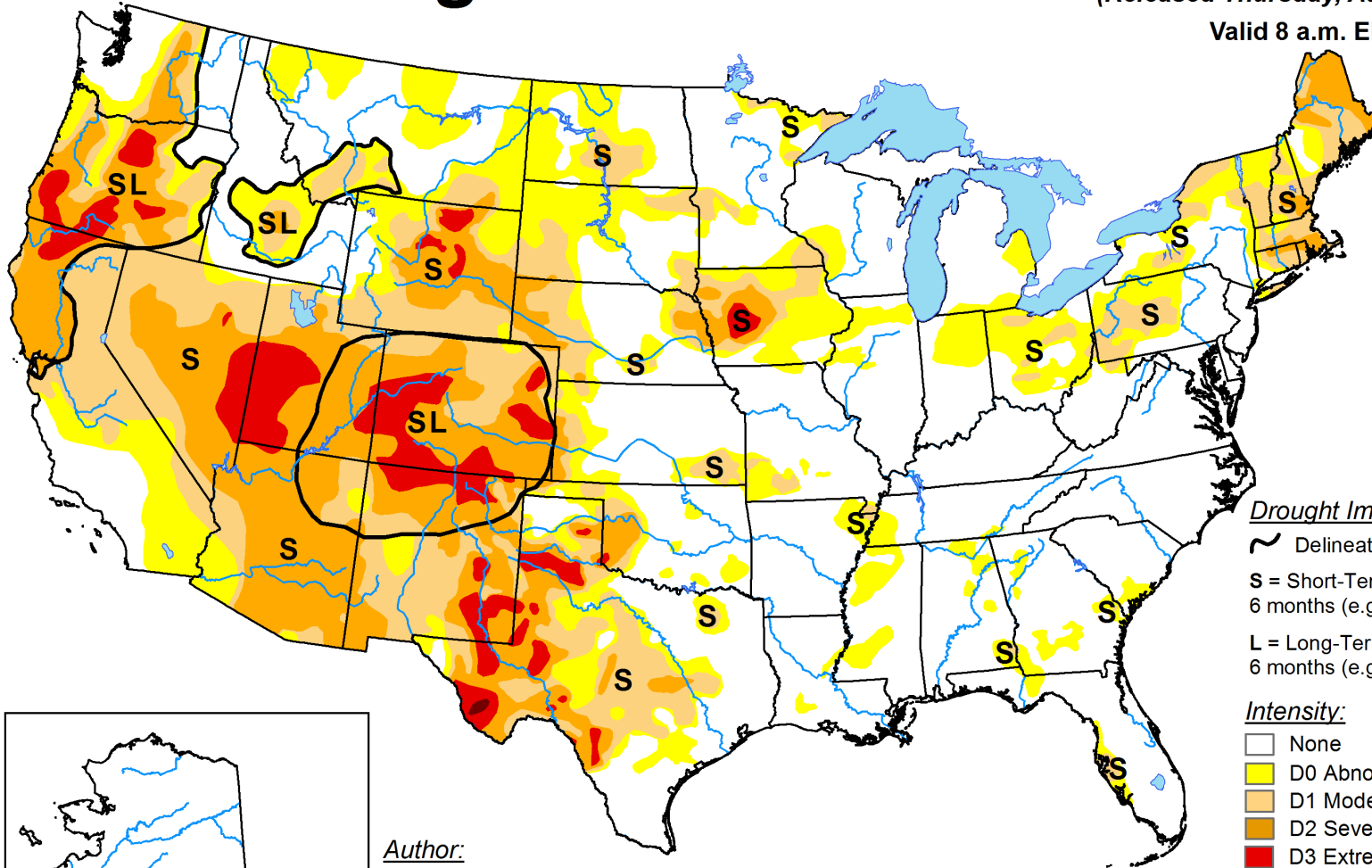




# U.S. Drought Monitor

August 18, 2020  
(Released Thursday, Aug. 20, 2020)

Valid 8 a.m. EDT



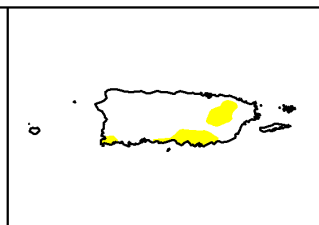
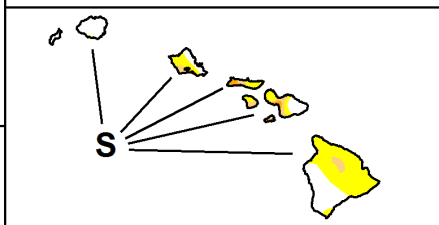
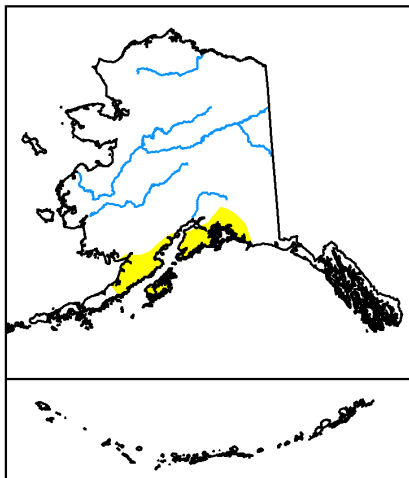
### Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

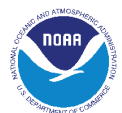
### Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Author:  
David Simeral  
Western Regional Climate Center

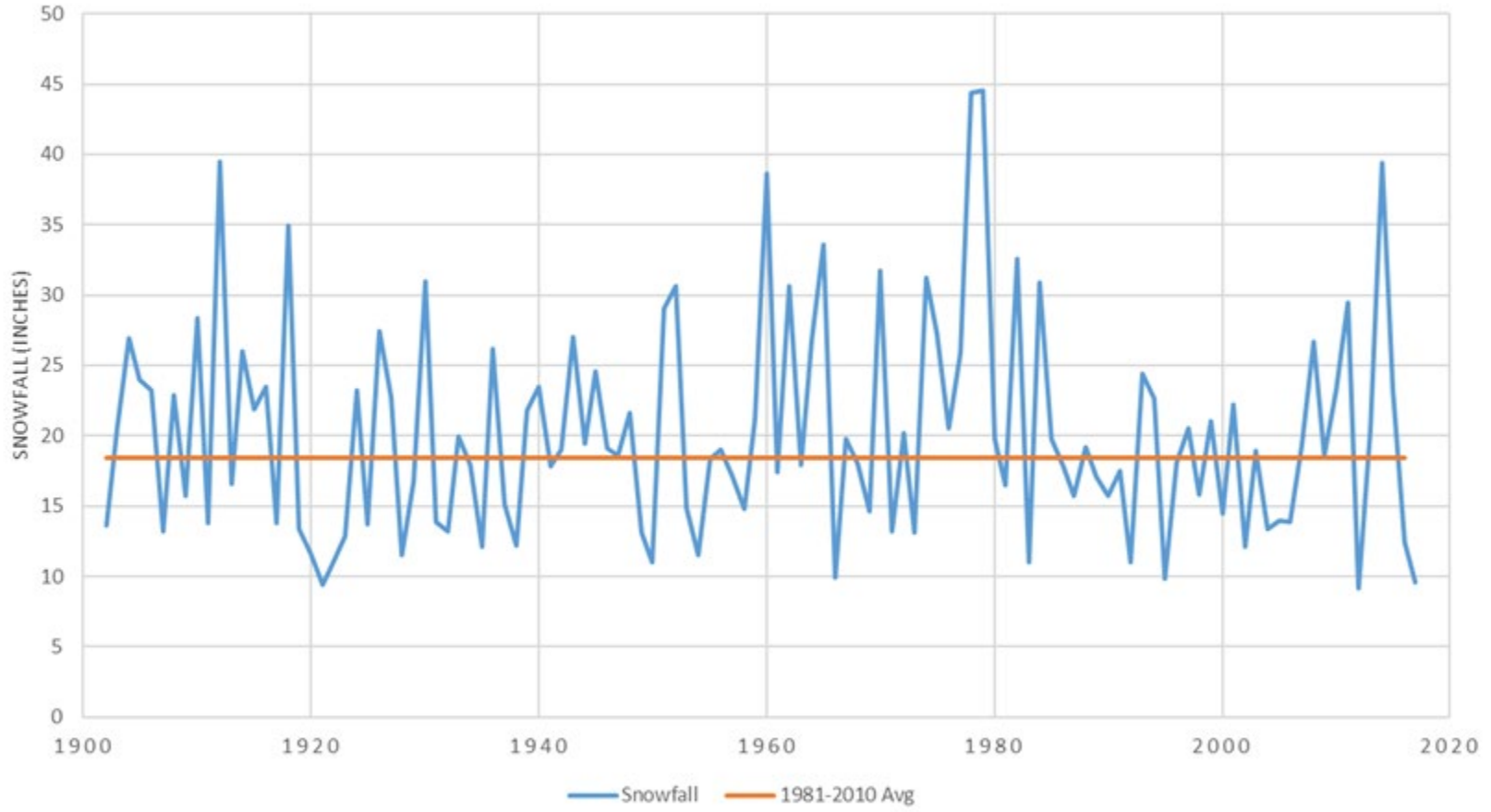


The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



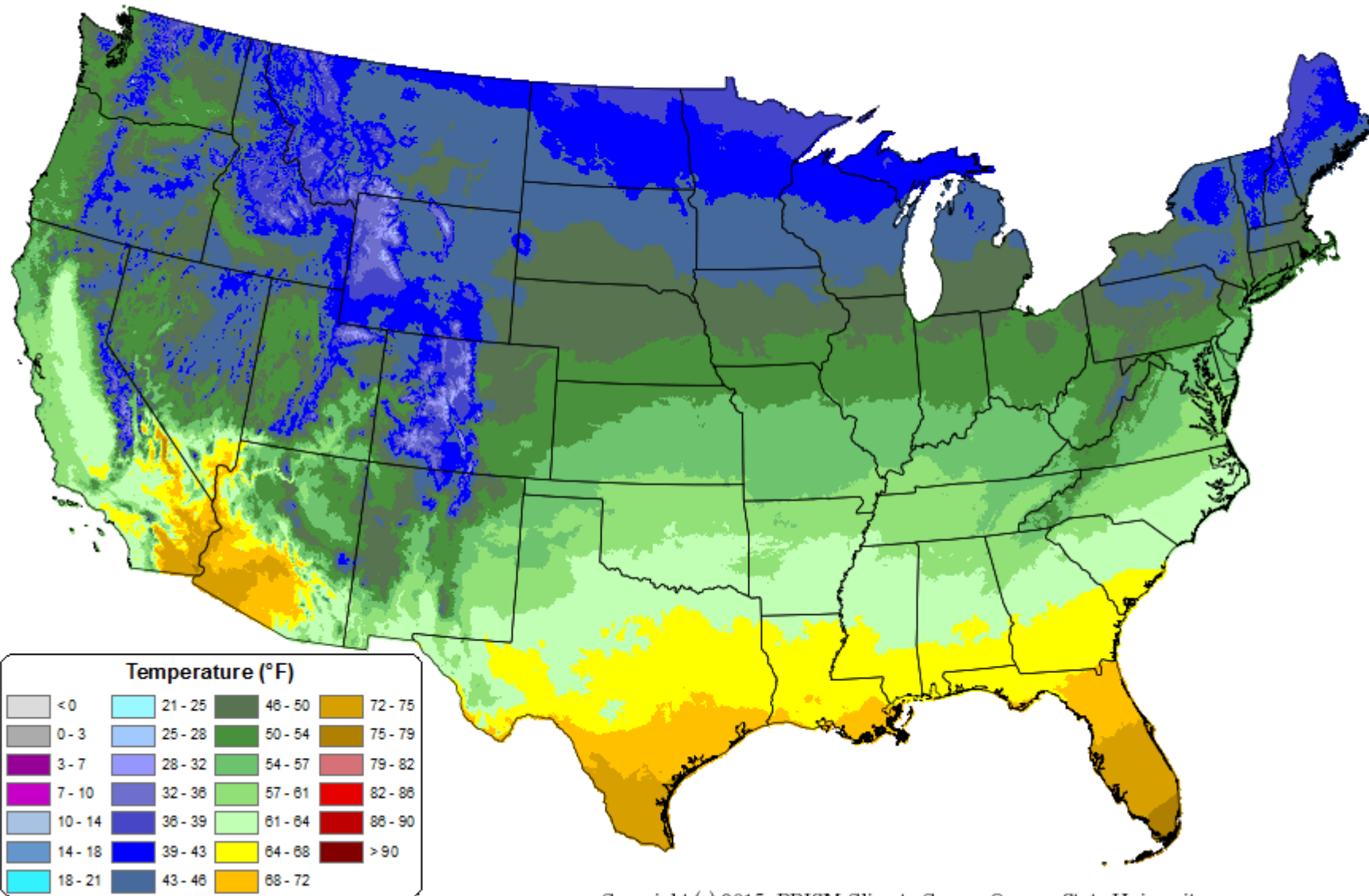
[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

## STATEWIDE AVERAGE SNOWFALL FOR ILLINOIS



# 30-yr Normal Mean Temperature: Annual

Period: 1981-2010



# SUMMARY FOR ILLINOIS AND THE MIDWEST

- **We have become wetter over the last century and that is likely to continue.**
- **More importantly, we have seen a significant rise in extreme rainfall events that is very likely to continue.**
- **We have warmed over the last century by about 1.2°F with significant warming of 4-5°F by mid-century.**
- 



THANK YOU

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