



# Kentucky's Changing Climate

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# Kentucky's Climate is...



A natural resource that helps to support a way of life.



But also,



An ever-present threat of natural disasters



# Weather and Climate *Matter*



- Growing population and a growing economy
- Societal expectations of mobility
- An economic system based on just-in-time shipping
- Intensity of economic competition on a global scale
- The challenge and opportunity of uncertainty

# Dynamics of Risk

**AIRTIME** Scenes from the Madison Co. Fair PHOTOS, PAGE A3

Couple of t-storms, hot, 90° WEATHER, PAGE A2

**REDS** of

# RICHMOND REGISTER

www.richmondregister.com

1 SOURCE FOR NEWS IN MADISON COUNTY, KY., SINCE 1917

## WATER, WATER EVERYWHERE

### Heavy rains cause flooding in Richmond



Auto sits stalled in the aptly named Water Street at Madison Avenue on Friday evening after a heavy downpour of rain caused flooding in several areas of the city. A red vehicle on Madison Avenue appears to have floated toward the street from where it was parked.

## Court system shut down

Furlough day prompted by

By Sarah Hogstedt  
Register News Writer

Anyone in Kentucky wishing to get a driver's license, bond out an inmate, pay a court fine or file a lawsuit Monday will be out of luck as the court system closes down for a day to deal with budget cuts.

The judicial branch's services will resume Tuesday morning. However, two more furlough days are scheduled this year — the Tuesday after Labor Day, Sept. 4, and Monday, Oct. 15.

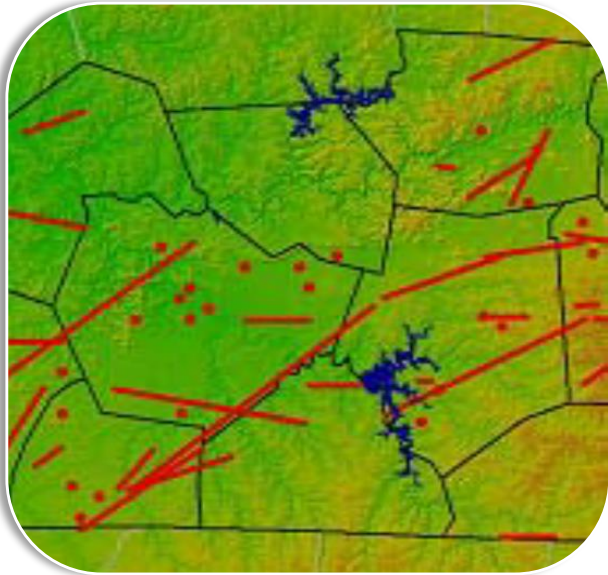
While the circuit clerk's office at the Madison County Courthouse will be

Southern N

- Land use change
- Climate change
- Mitigation efforts

# Hazards Overview

- Many types of hazards impact Kentucky, varying in spatial impact



## Random

- Tornadoes
- Hail Storms
- Damaging Winds
- Lightning



## Confined

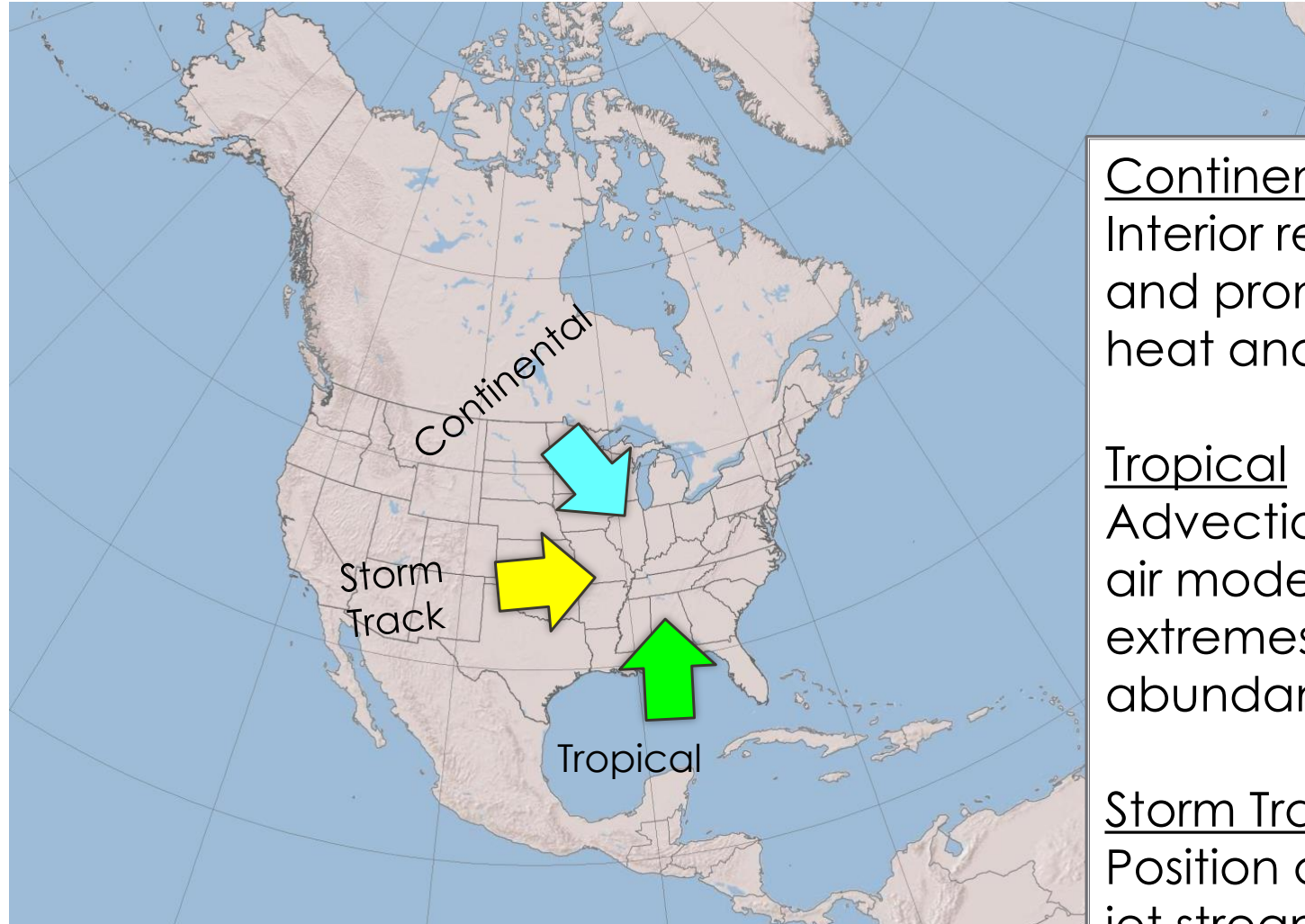
- Flooding
- Landslides



## Extensive

- Drought
- Heat Wave
- Ice Storms
- "Arctic Blasts"/"Polar Vortex"

# Key Climate Influences



## Continental

Interior regions are often dry and prone to extremes of heat and cold

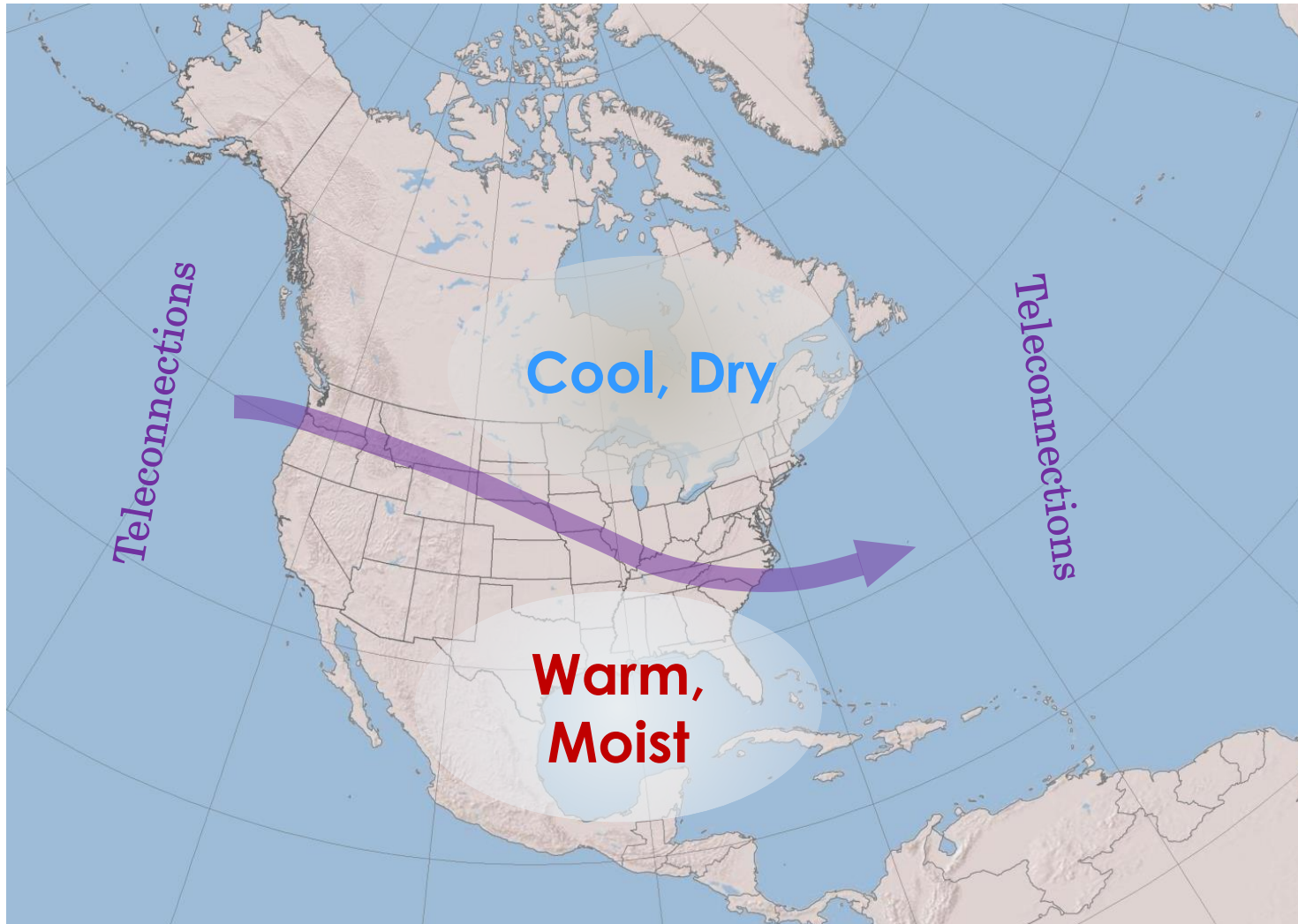
## Tropical

Advection of moist tropical air moderates temperature extremes and contributes to abundant precipitation

## Storm Track

Position and strength of the jet stream greatly influences day-to-day weather

# Polar Jet Stream Impact on Kentucky



Winter – strengthens and moves southward

Summer – weakens and moves northward

Position fluctuates but can persist or recur in a favored area due to **teleconnections**, particularly during winter

Kentucky's climate is very sensitive to La Nina/El Nino

# Collecting Kentucky's Climatological Record

Newport Barracks, July 1825

A handwritten page from a meteorological journal titled "Meteorological Register for July 1825 at Newport Barracks". The page contains a table with columns for "Date", "Wind", "Bar", "Therm", "Rain", and "Remarks". The "Remarks" column is filled with detailed handwritten notes describing weather conditions, such as "Clear", "Breeze", "Thunder", and "Rain". The handwriting is in cursive and the paper shows signs of age.

1825 – U.S. Army

1861 – Smithsonian Institute

1874 – U.S. Army Signal Corps

1891 – U.S. Department of Agriculture

1940 – U.S. Department of Commerce

2007 – Kentucky Climate Center

NWS COOP - Manual



NWS COOP - Automated



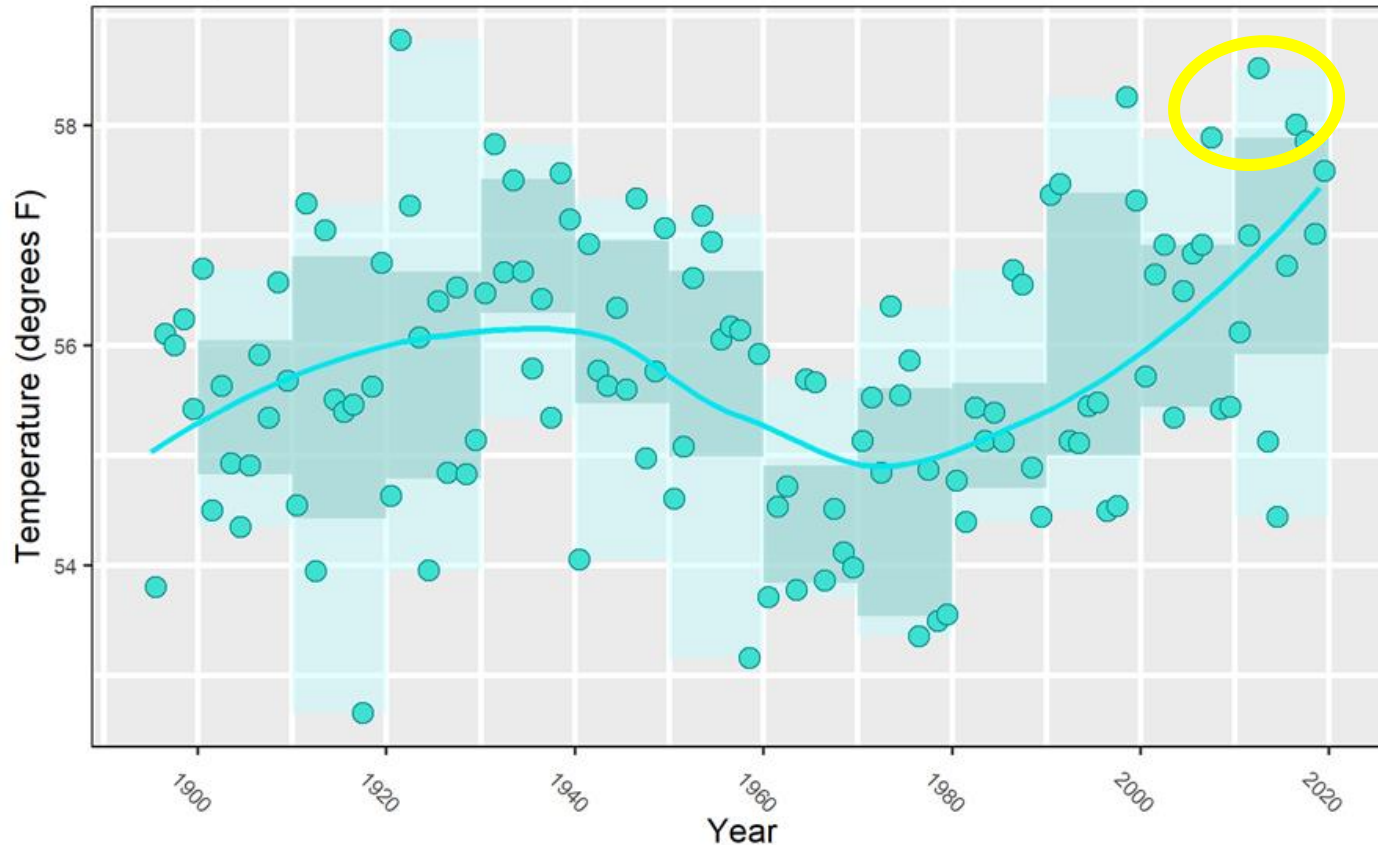
Kentucky Mesonet





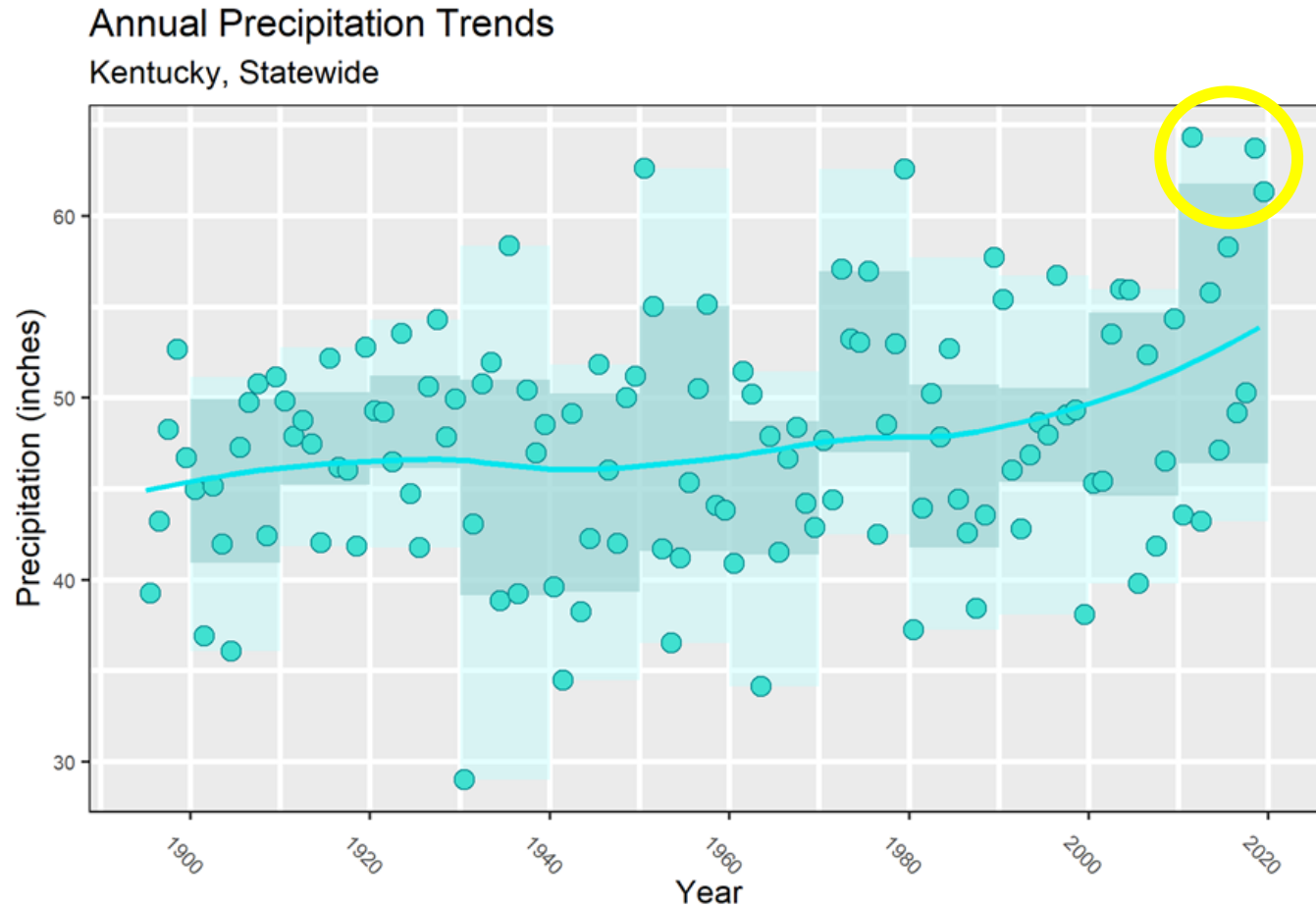
# Kentucky's Climate is becoming Warmer

Annual Average Temperature Trends  
Kentucky, Statewide



- While 1921 remains the warmest year on record, three of the five warmest years have occurred over the past decade.

# Kentucky's Climate is becoming Wetter

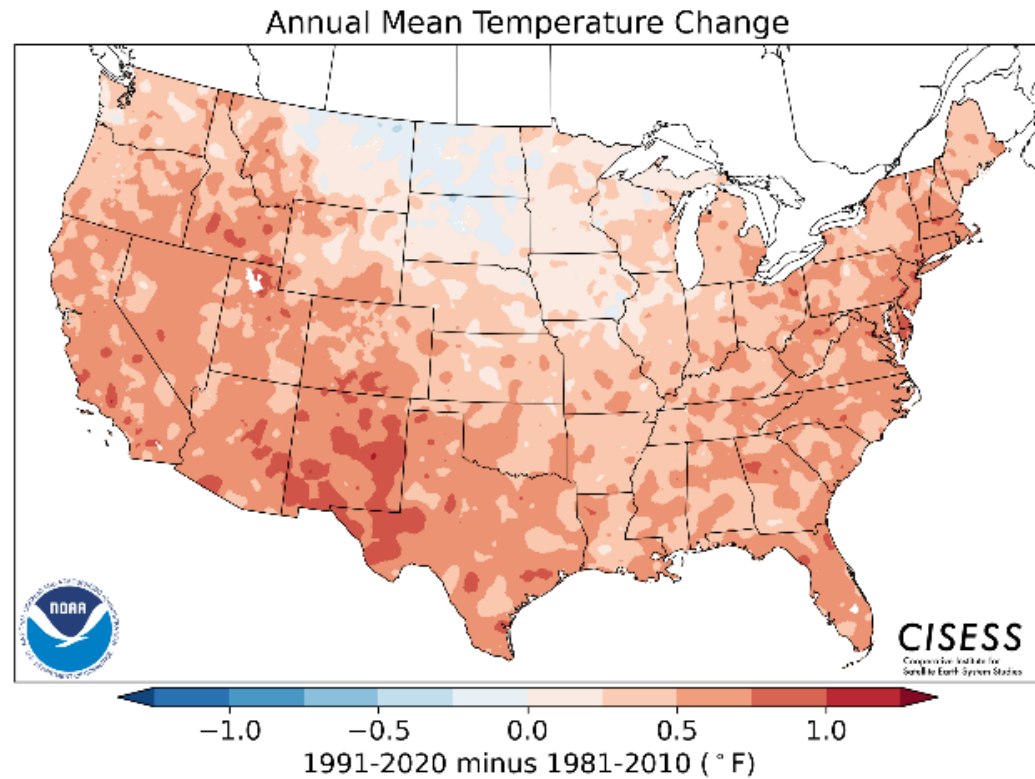
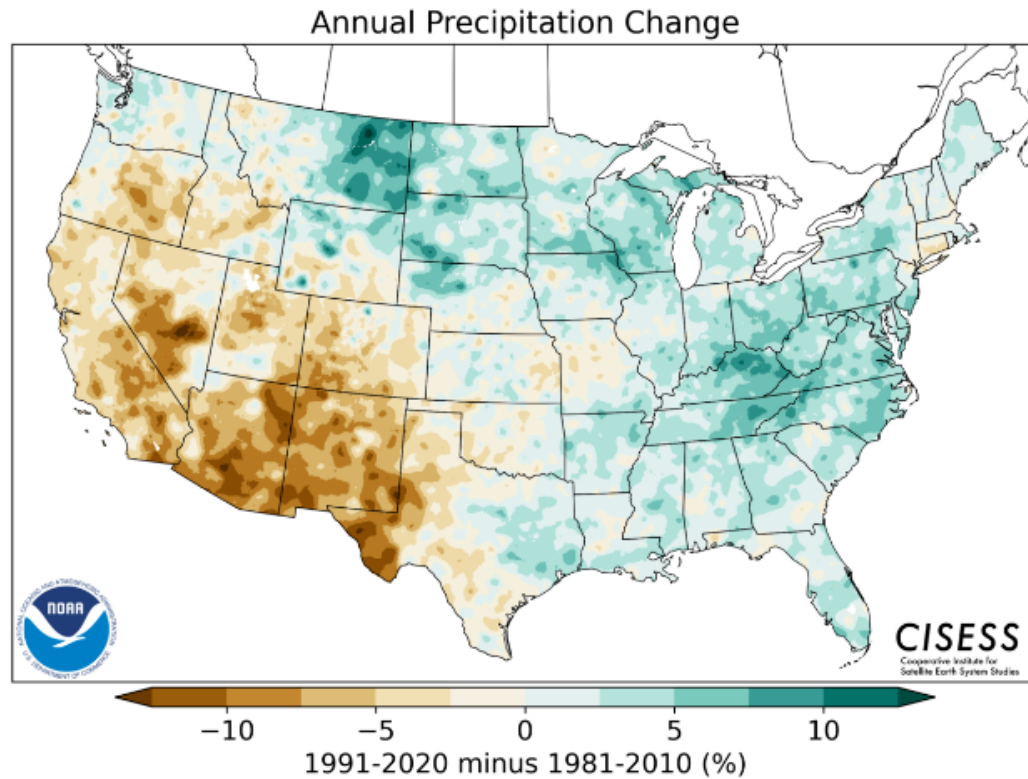


Any way you look at it ...

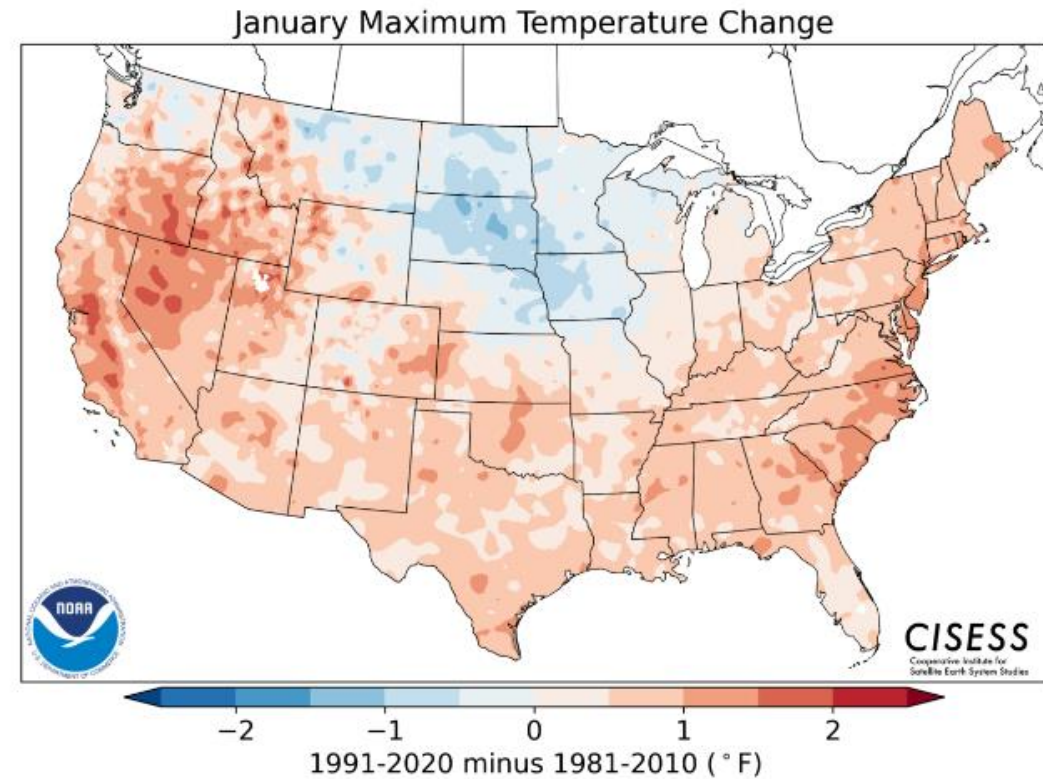
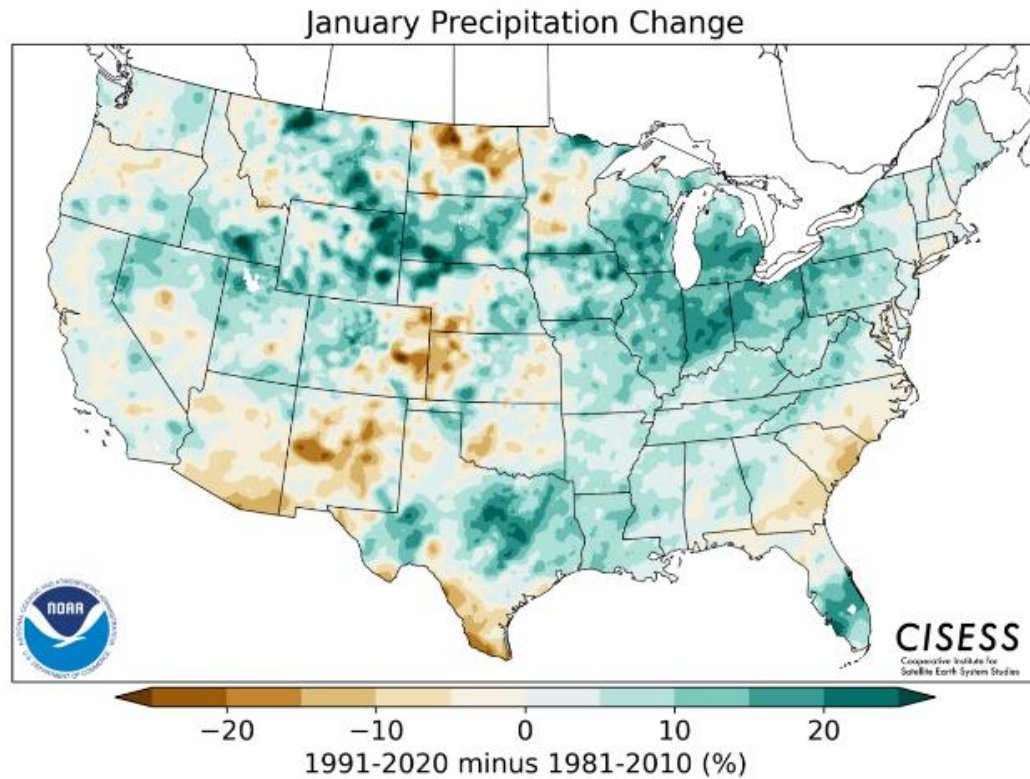
- Mean precipitation has trended from the mid 40s to over 50 inches.
- Three of the five wettest years have occurred over the past decade.
- Extremely dry years have become less frequent.

# 1991-2020 Climate Normals Highlight Decadal Change

## --- Annual ---

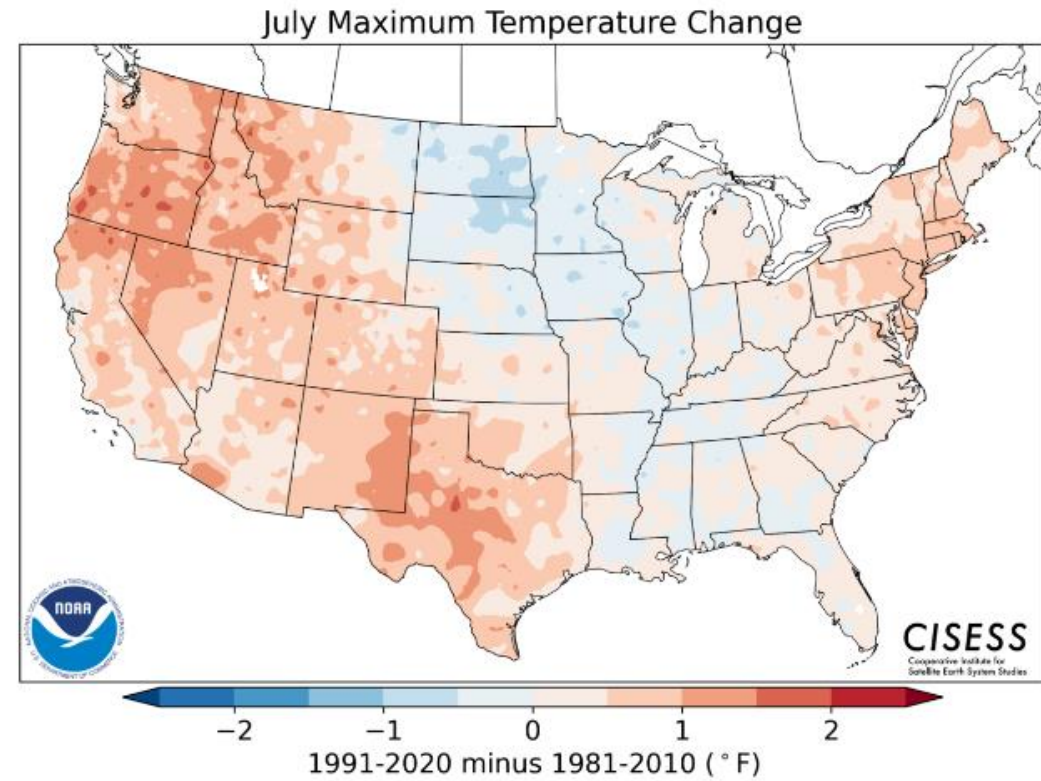
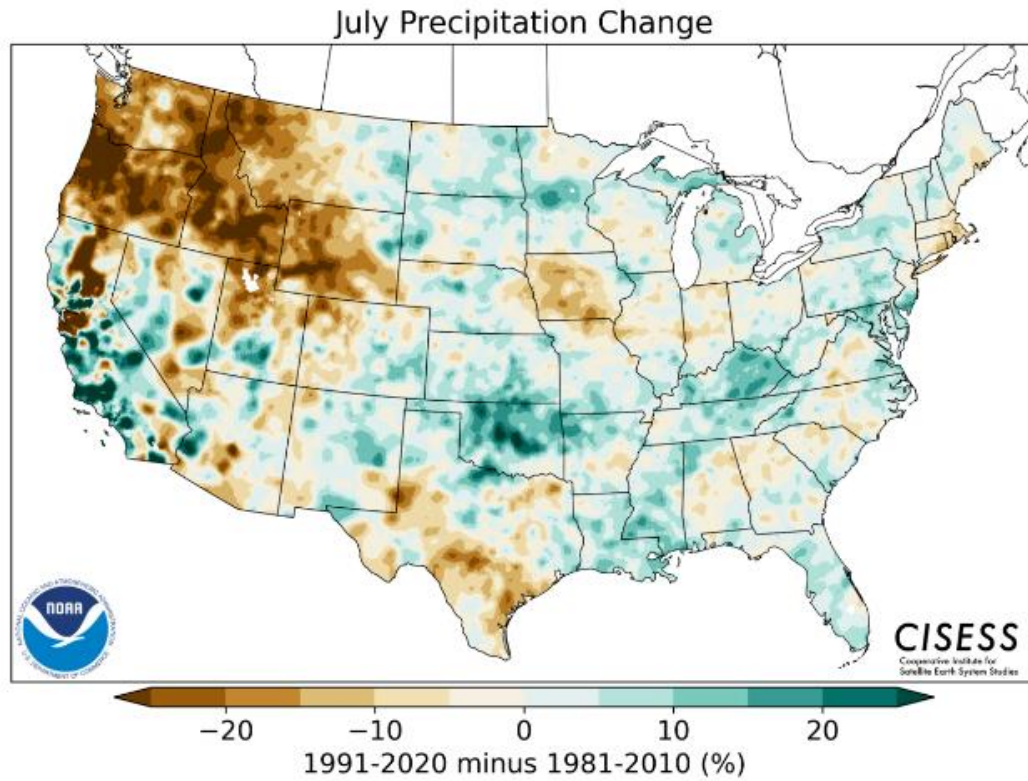


# 1991-2020 Climate Normals Highlight Decadal Change --- January ---

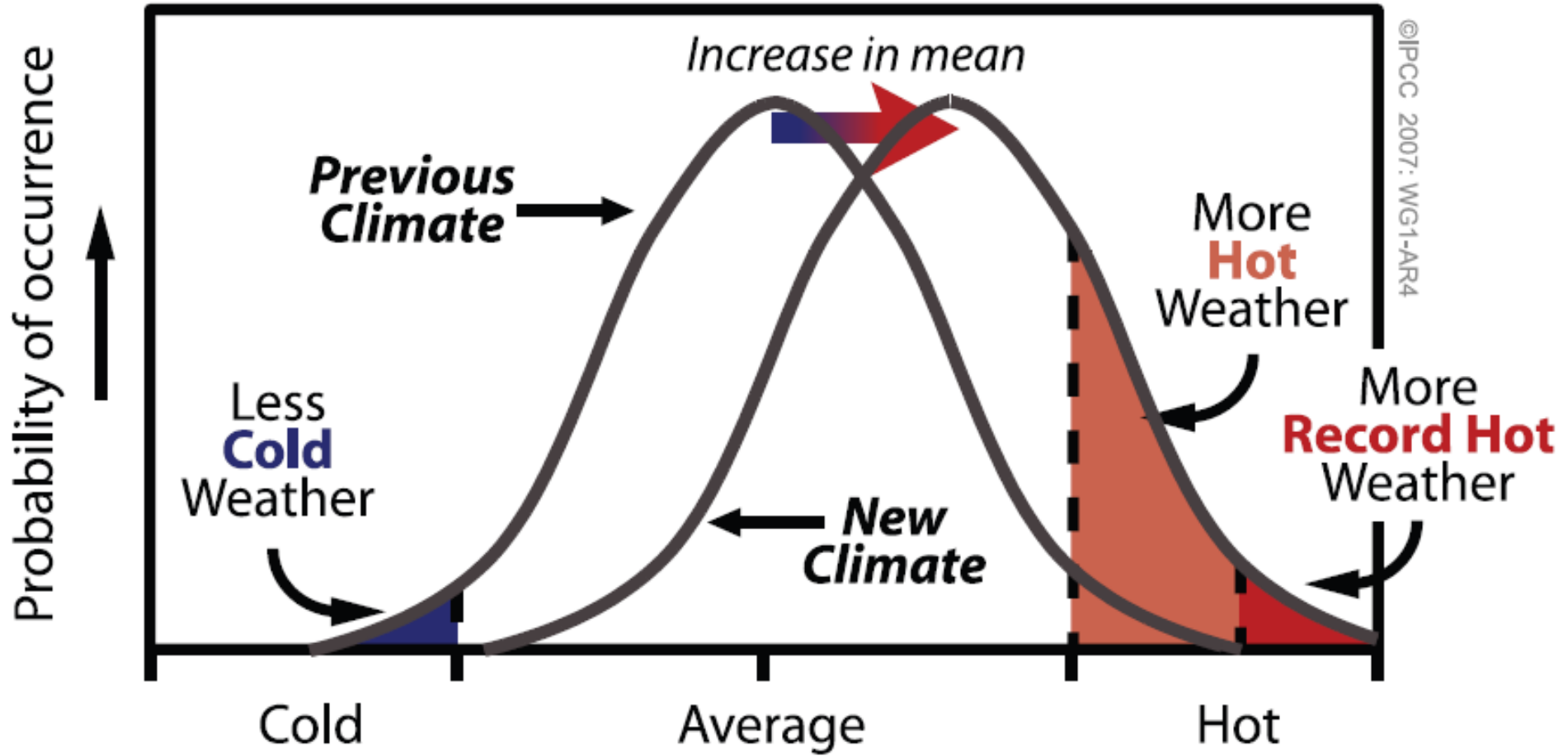


# 1991-2020 Climate Normals Highlight Decadal Change

## --- July ---



# Mean and Extreme Conditions



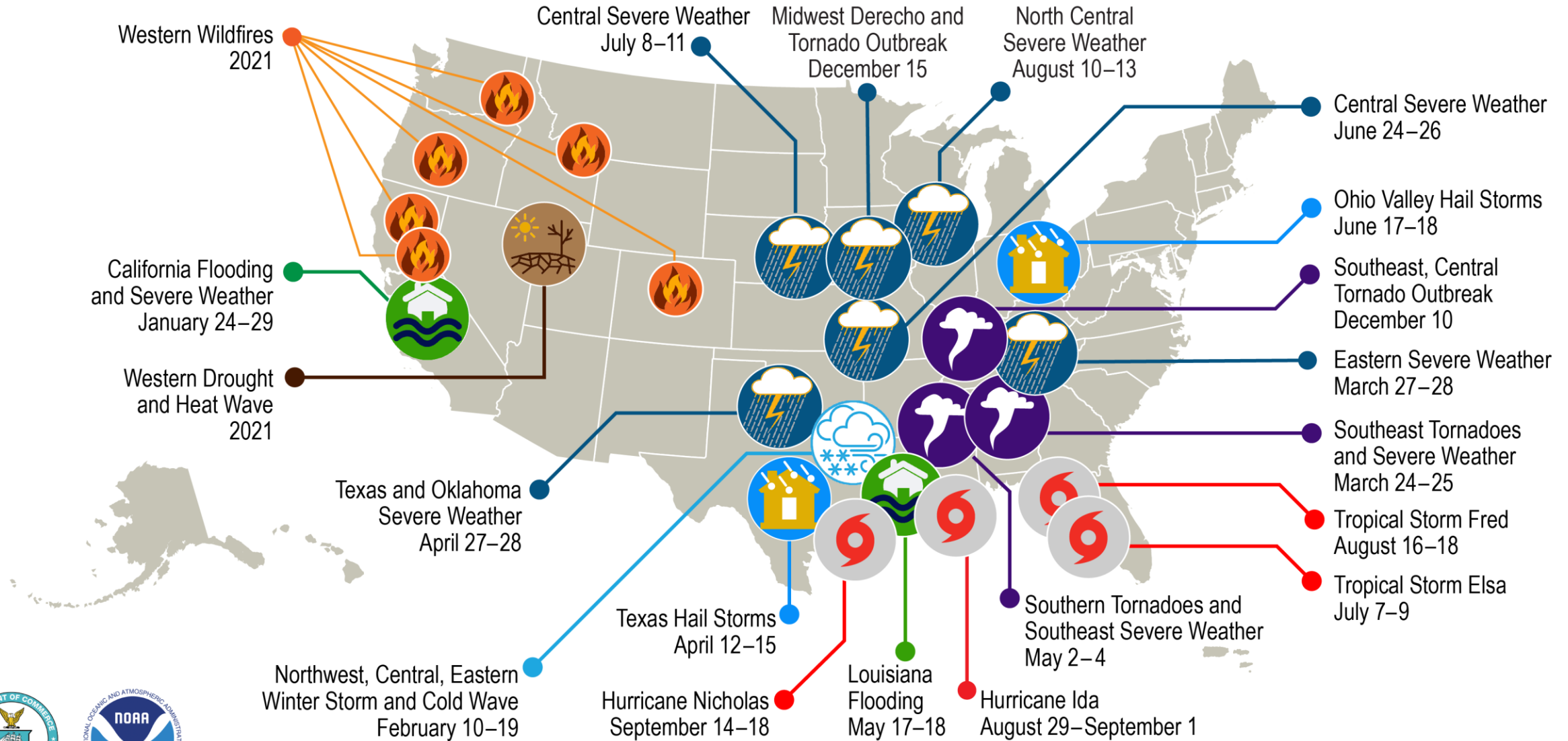
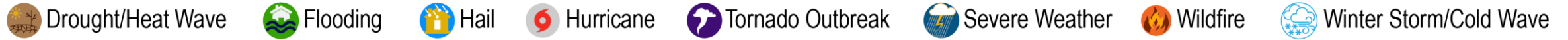
# Extreme Weather Events in a Changing Climate



April 21, 2021 Snow Event, Shelby County, KY

- Heavy snow
- Ice storms
- Extreme cold
- Early- and late-season freezes
- Extreme heat
- Severe thunderstorms
- Heavy downpours

# U.S. 2021 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the **20 separate billion-dollar weather and climate disasters that impacted the United States in 2021**



# From Average to Extreme: Floods and Drought in a Changing Climate



- In a wetter climate with increased frequency of heavy precipitation events, flood and flash flood risk is likely to increase.
- While a warmer climate may contribute to intense flash droughts, it is unclear whether extreme, persistent droughts will occur more frequently.

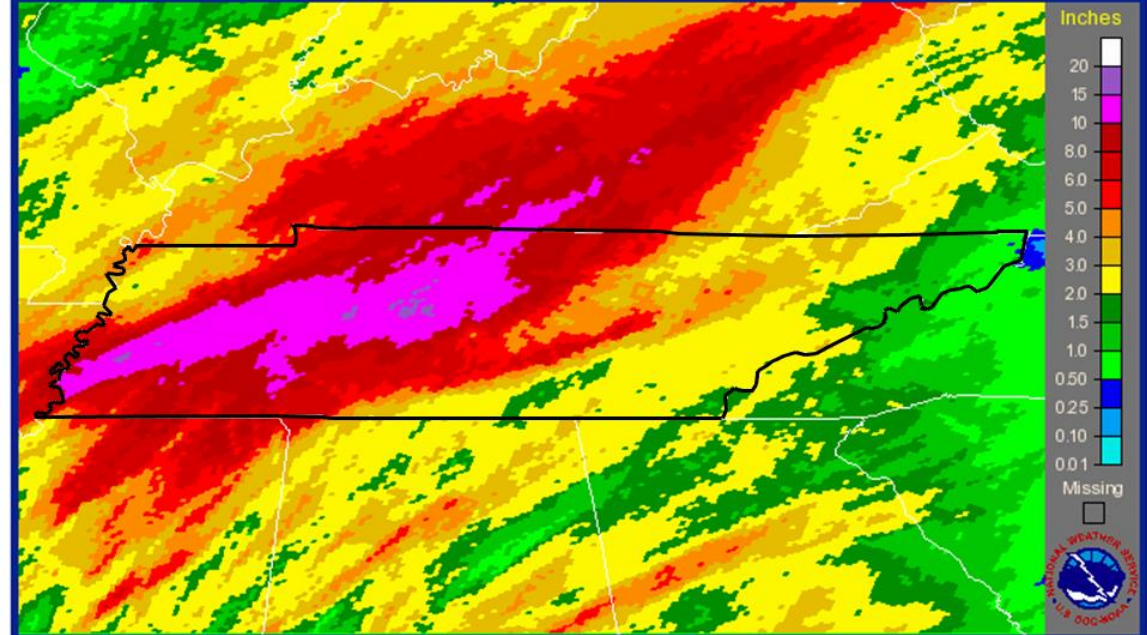
May 2010

# Flooding

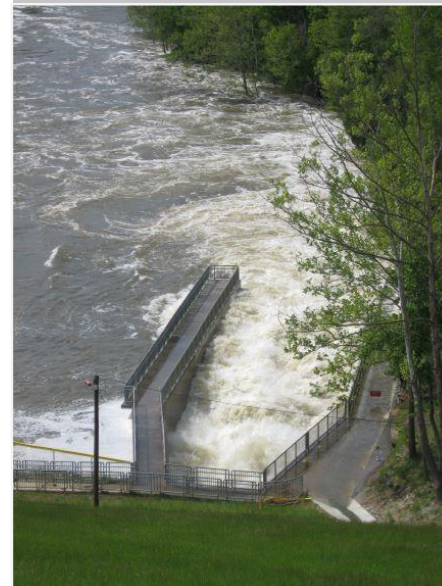
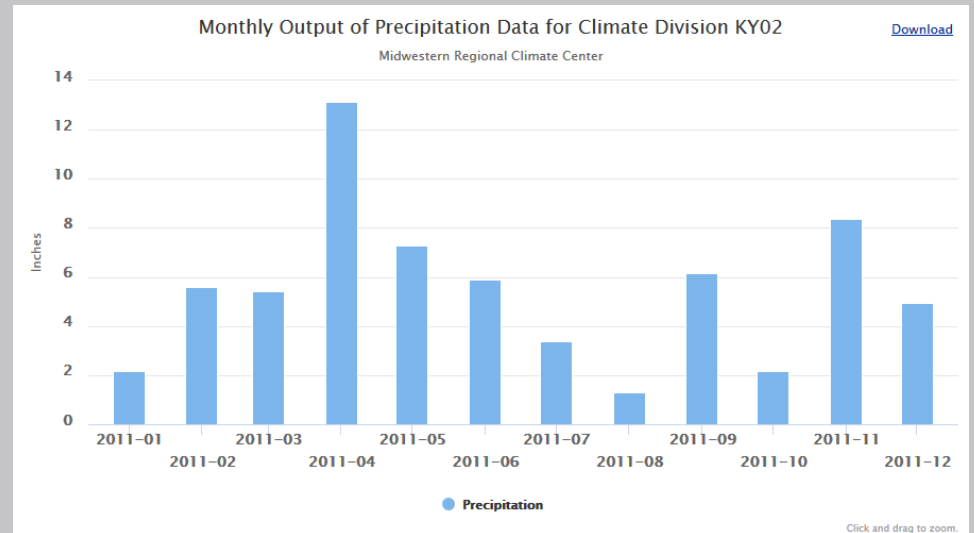
May 2011



Tennessee  
7-Day Observed Precipitation - Valid 5/5/2010 1200 UTC



Topo Pcpn Amount Counties Rivers States Highway/City RFC Boundary Last Update: 5/5/2010 1422 UTC



# Drought Impacts



- Agricultural
- Environmental
- Municipal

# Drought Years

- 1854
- 1881
- 1901
- 1904
- 1908
- 1913-14
- **1930**
- 1936
- 1941
- 1953-54
- 1963-64
- 1988
- 1999-2000
- 2007
- 2012
- 2016
- 2019

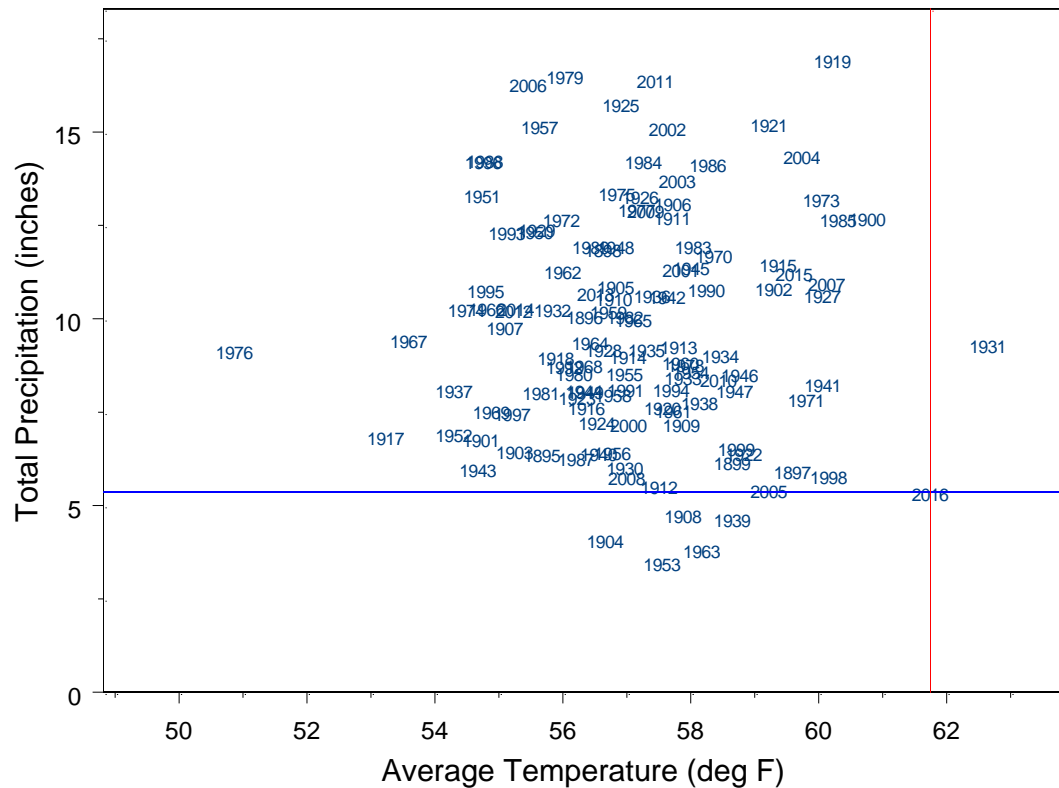


2012

# 2016 Flash Drought

2

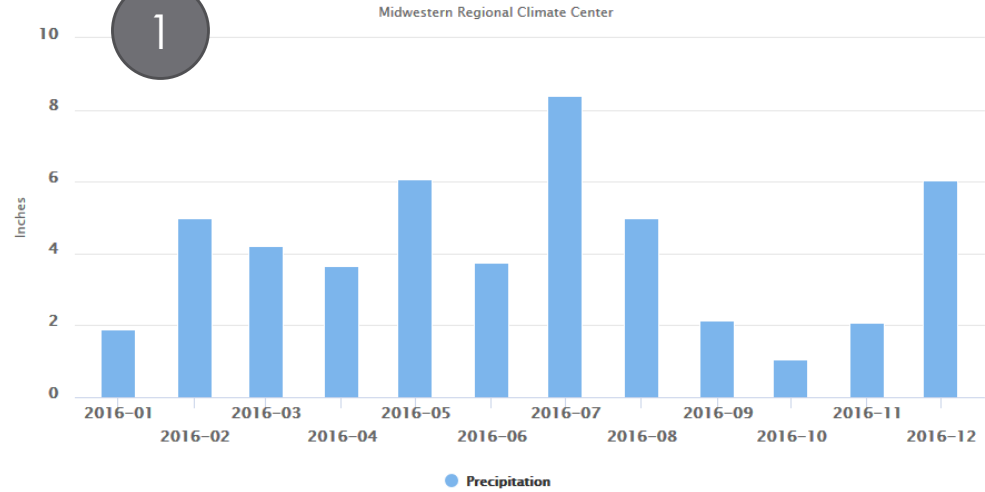
Sep - Oct - Nov  
Kentucky Statewide Average



1

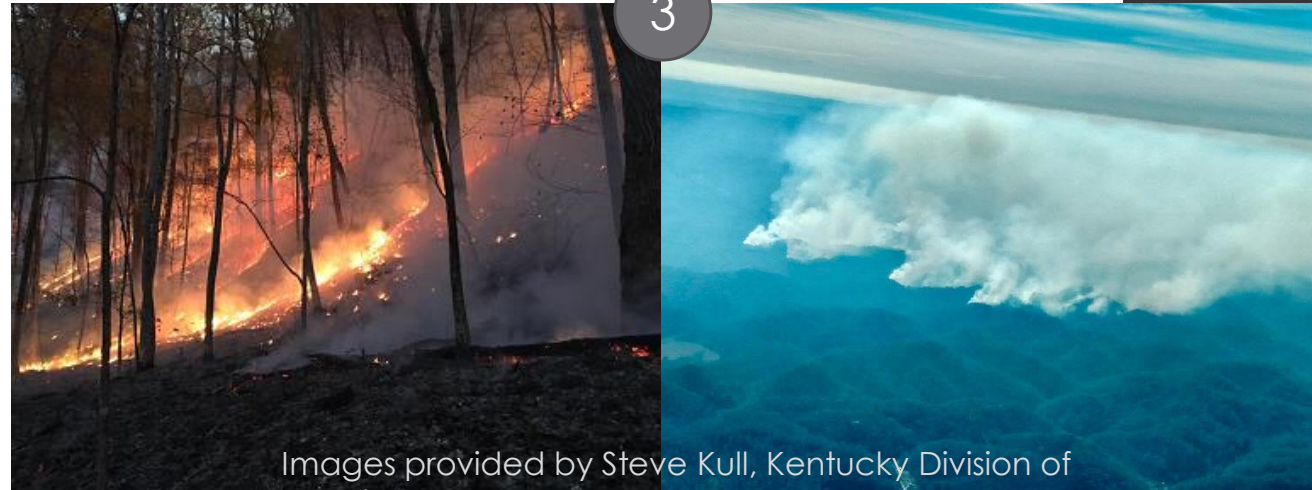
Monthly Output of Precipitation Data for Kentucky

[Download](#)



2016 was in the top 10% of the wettest years since 1895

3

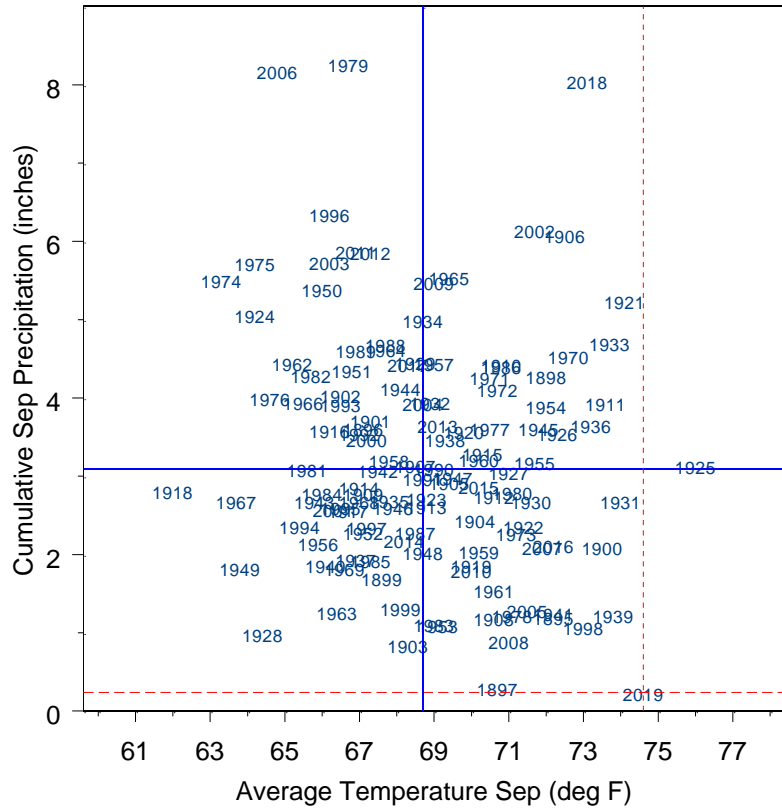


Images provided by Steve Kull, Kentucky Division of Forestry

# 2019 Flash Drought

## 3 Temperature-Precipitation for September

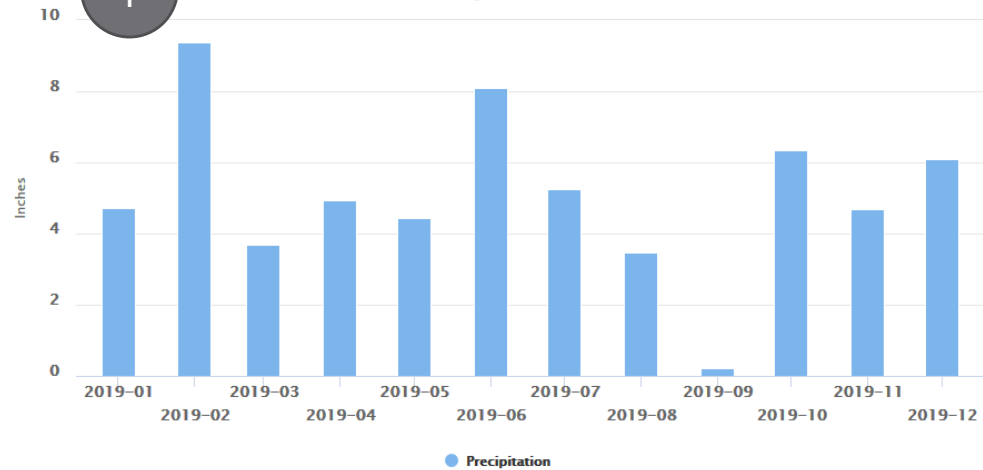
Kentucky Statewide



## 1 Monthly Output of Precipitation Data for Kentucky

Midwestern Regional Climate Center

[Download](#)



2019 was in the top 5% of the wettest years since 1895

## 2

- September was the hottest month of the year.
- Bowling Green and Louisville recorded 22 days with a high temperature reaching 90° F.

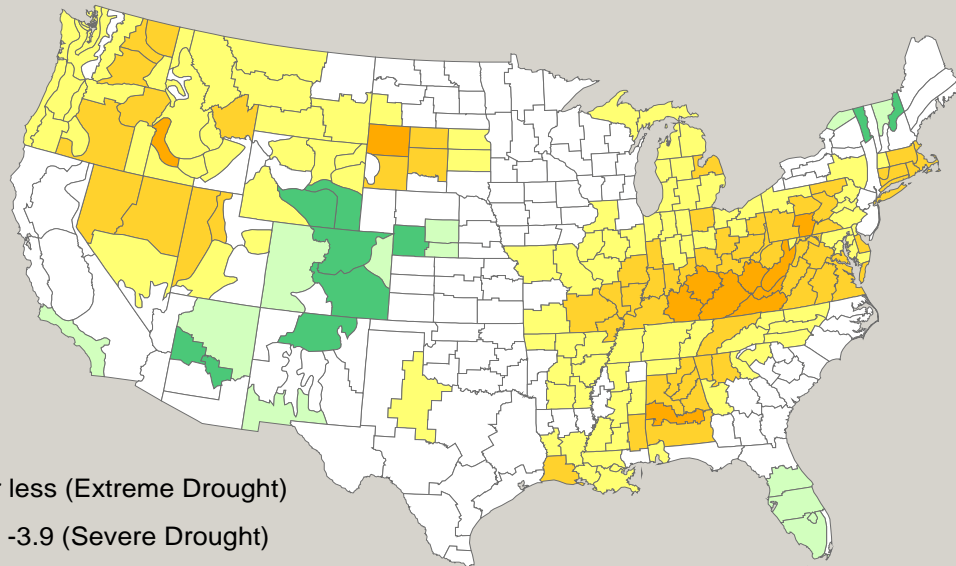
- Horizontal solid blue line represents median precipitation.
- Vertical solid blue line represents median temperature.
- Horizontal dashed red line highlights 2019 precipitation.
- Vertical dashed red line highlights 2019 temperature.

2019 values are estimates based on data from the Kentucky Mesonet. All other historical values are from the Midwestern Regional Climate Center

# Kentucky's Drought of Record

*The Drought of 1930 was not part of a larger Dust Bowl drought.*

Palmer Drought Severity Index July 1930



- Peak 12-month precipitation deficits reached 50% of normal.
- A record high temperature was set in Greensburg of 114°F in. Daily maximum temperature exceeded 100F on 15 days in July.

# Summary

- Kentucky's climate is becoming wetter and warmer
  - 3 of the top 5 warmest year in the past decade
  - 3 of the top 5 wettest years in the past decade
- Extremes will likely become more common (and more costly)
- While year-to-year variability is expected, trends are expected to become more apparent through time.

