Funding provided by NOAA
Sectoral Applications Research Project

CLIMATE

Basic Climatology

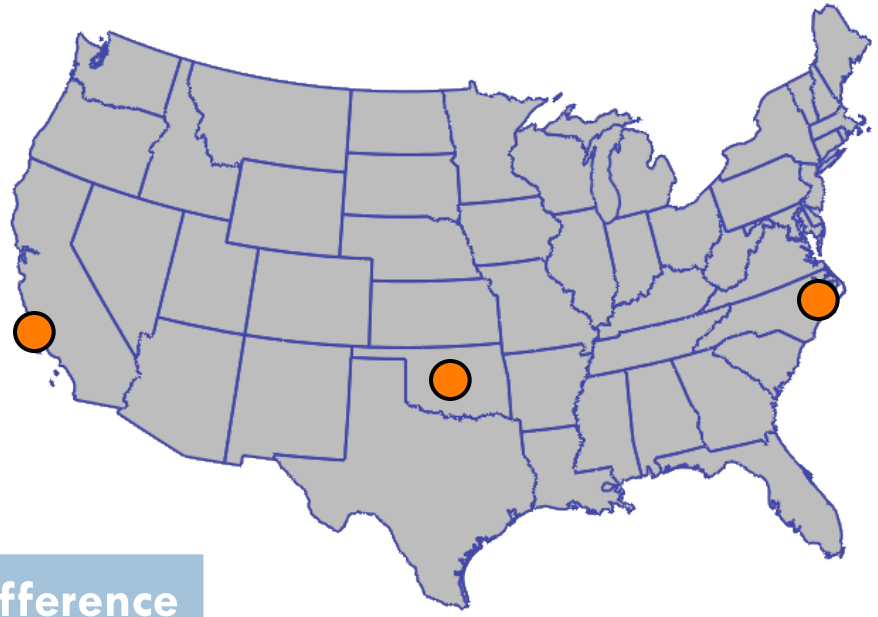
Oklahoma Climatological Survey

Remember These?

- Factor 1: Our Energy Source
- Factor 2: Revolution & Tilt
- Factor 3: Rotation!
- Factor 4: Latitude
- Factor 5: Altitude
- Factor 6: Land & Water are Different

The Influence of Water

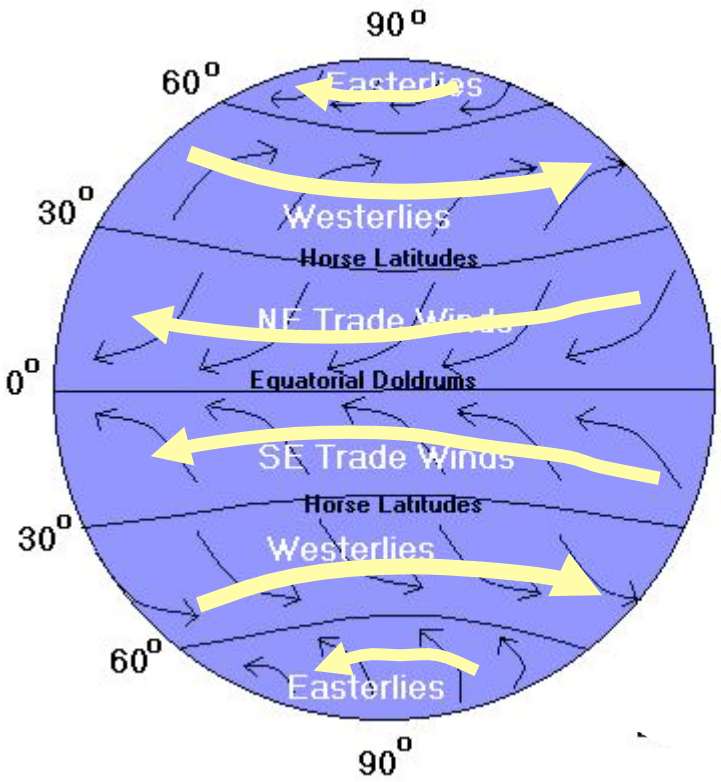
- Average January / July temperatures for three cities at latitude 35N:

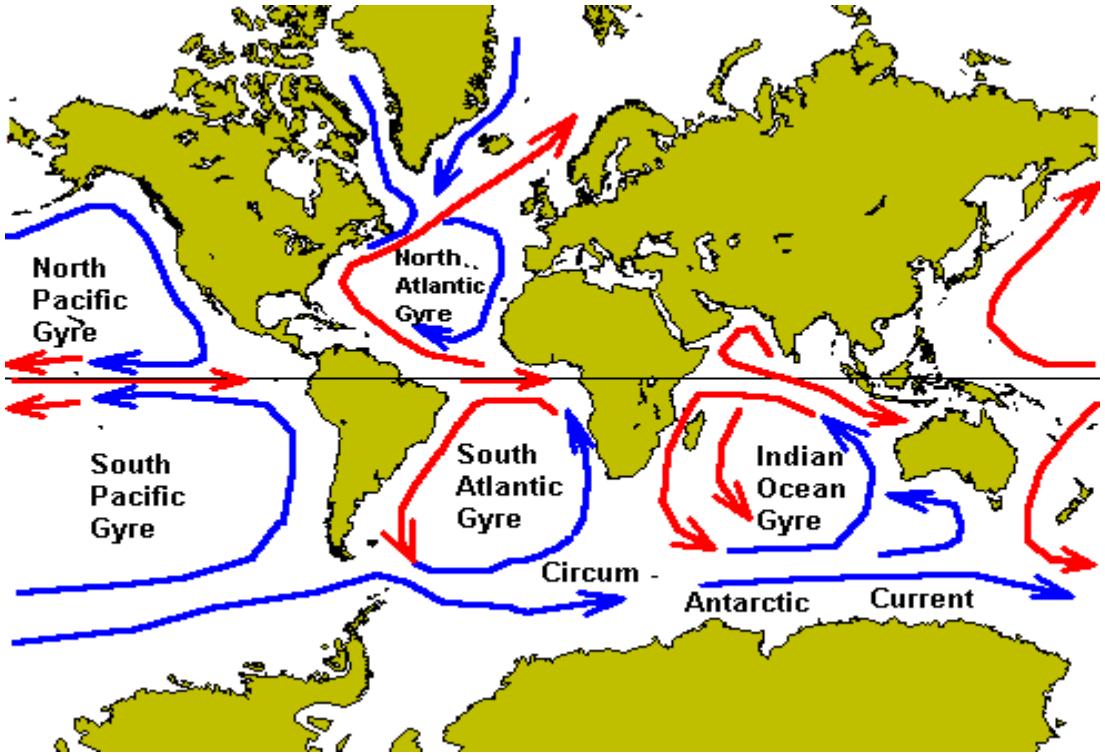


Location	January	July	Difference
Santa Monica, CA	51.6	63.5	11.9
Oklahoma City, OK	36.7	82.0	45.3
Hatteras, NC	46.1	79.2	33.1

Factors that Influence Climate

- Which side of the ocean you're on!





The winds help stir ocean currents. Generally, western shores get cold water from the poles, eastern shores get warm from the equator.

Climate Zones

A - Tropical Climates
Tropical moist climates extend north and south from the equator to about 15° to 25° latitude. In these climates all months have **average temperatures** greater than 64°F (18°C) and **annual precipitation** greater than 59".

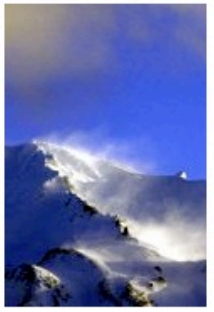
B - Dry Climates
The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation. These climates extend from 20°-35° North and South of the equator and in large continental regions of the mid-latitudes often surrounded by mountains.

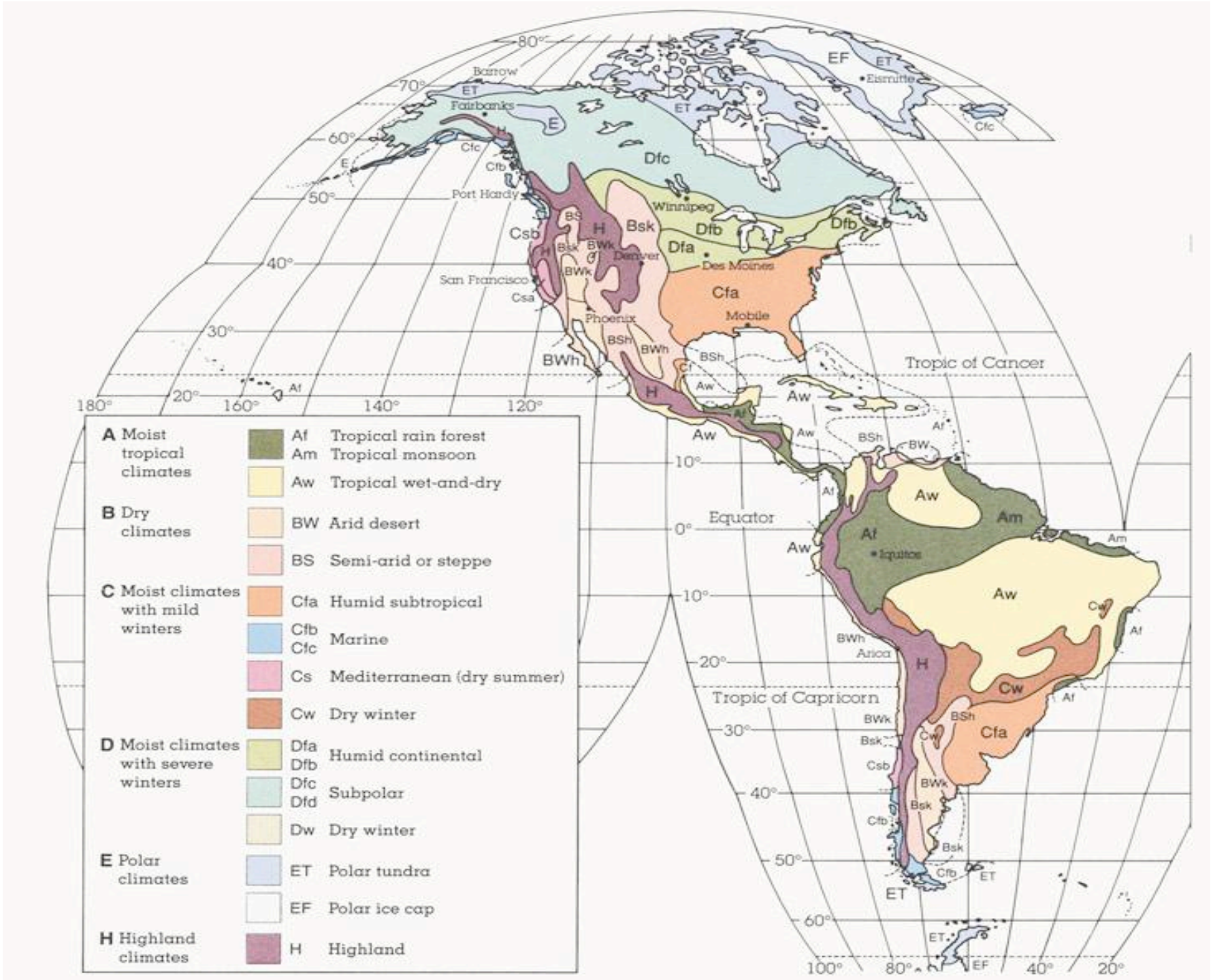
C - Moist Subtropical Mid-Latitude Climates
This climate generally has warm and humid summers with mild winters. Its extent is from 30°50° of latitude mainly on the eastern and western borders of most continents. During the winter, the main weather feature is the mid-latitude cyclone. Convective thunderstorms dominate summer months.

D - Moist Continental Mid-latitude Climates
Moist continental mid-latitude climates have warm to cool summers and cold winters. The location of these climates is poleward of the **C** climates. The average temperature of the warmest month is greater than 50°F (10°C), while the coldest month is less than -22°F (-30°C). Winters are severe with snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses.

E - Polar Climates
Polar climates have year-round cold temperatures with the warmest month less than 50°F (10°C). Polar climates are found on the northern coastal areas of North America, Europe, Asia, and on the landmasses of Greenland and Antarctica.

H - Highlands
Unique climates based on their elevation. Highland climates occur in mountainous terrain where rapid elevation changes cause rapid climatic changes over short distances.




A Moist tropical climates
Af Tropical rain forest
Am Tropical monsoon
Aw Tropical wet-and-dry
B Dry climates
BW Arid desert
BS Semi-arid or steppe
C Moist climates with mild winters
Cfa Humid subtropical
Cfb Cfc Marine
Cs Mediterranean (dry summer)
Cw Dry winter
D Moist climates with severe winters
Dfa Dfb Humid continental
Dfc Dfd Subpolar
Dw Dry winter
E Polar climates
ET Polar tundra
EF Polar ice cap
H Highland climates
H Highland
Tropic of Cancer
Equator
Tropic of Capricorn
Barrow
Fairbanks
Port Hardy
Winnipeg
Denver
Des Moines
San Francisco
Phoenix
Mobile
Iquitos
Arica
Eismitte

Limitations to "Naming" Climates

- Implies sharp boundary between climate zones
  - in reality there is a gradual transition (Oklahoma is a great example!)
- Relates too strongly to vegetation
  - useful in areas with little climate data, but it is better to use temp/precip measurements
- Some of the groups (esp. Moist subtropical mid-latitude) are very broad, including what appear to be very different climate types

A WORD ABOUT NORMALS

What is Normal?

- A tool helpful when comparing conditions to the long term
- A 30-year average
- Updated every 10 years
- There are normals for:
  - Days, months and years
  - Temperature, rainfall, snowfall, and more!

September Rainfall: OKC

1971	**4.25”**	1976	**1.53”**	1981	**1.48”**	1986	**9.54”**	1991	**11.85”**	1996	**5.88”**
1972	**2.05”**	1977	**1.21”**	1982	**2.86”**	1987	**4.58”**	1992	**2.92”**	1997	**1.38”**
1973	**8.00”**	1978	**0.96”**	1983	**0.90”**	1988	**5.19”**	1993	**7.17”**	1998	**4.39”**
1974	**6.24”**	1979	**0.72”**	1984	**1.02”**	1989	**4.51”**	1994	**2.15”**	1999	**4.88”**
1975	**1.92”**	1980	**2.21”**	1985	**4.59”**	1990	**7.35”**	1995	**6.05”**	2000	**1.73”**

The average of all these numbers is 3.98”

– the normal September rainfall at Oklahoma City.

The 1st Dirty Secret of Normals:

Normals only tell you the *average* for a particular month, day or year.
They don’t tell you anything about natural variability!

All Normals Work the Same Way

- Oklahoma City's …
  - Normal September Rainfall: 3.98"
  - Normal September Temperature: 73.2 degrees
  - Normal September 26th High: 81 degrees
  - Normal "First Freeze of Fall": November 4

- *All of these are based on 30 numbers recorded between 1971-2000!*

Normal vs. "supposed to"

- A normal is just an average!
- It doesn't mean "supposed to"
- It's not "supposed to" rain 3.98" at OKC in September
- It doesn't "usually" rain 3.98" at OKC in September
- It has *never* rained exactly 3.98" at OKC during *any* September dating back to 1896

The 2nd Dirty Secret of Normals:

For rainfall, most months are below-normal!

Normal vs. "Supposed To"

- From 1971-2000, the average OU-OSU score was OU 31, OSU 14.
  - This doesn't mean OU is "supposed to" win 31-14 each following year.
  - OU *never* won 31-14!
  - In 2001, OSU won 16-13.
  - Each year's score (*individual event*) was decided by factors other than the 30-year "normal"

So, what's my point?

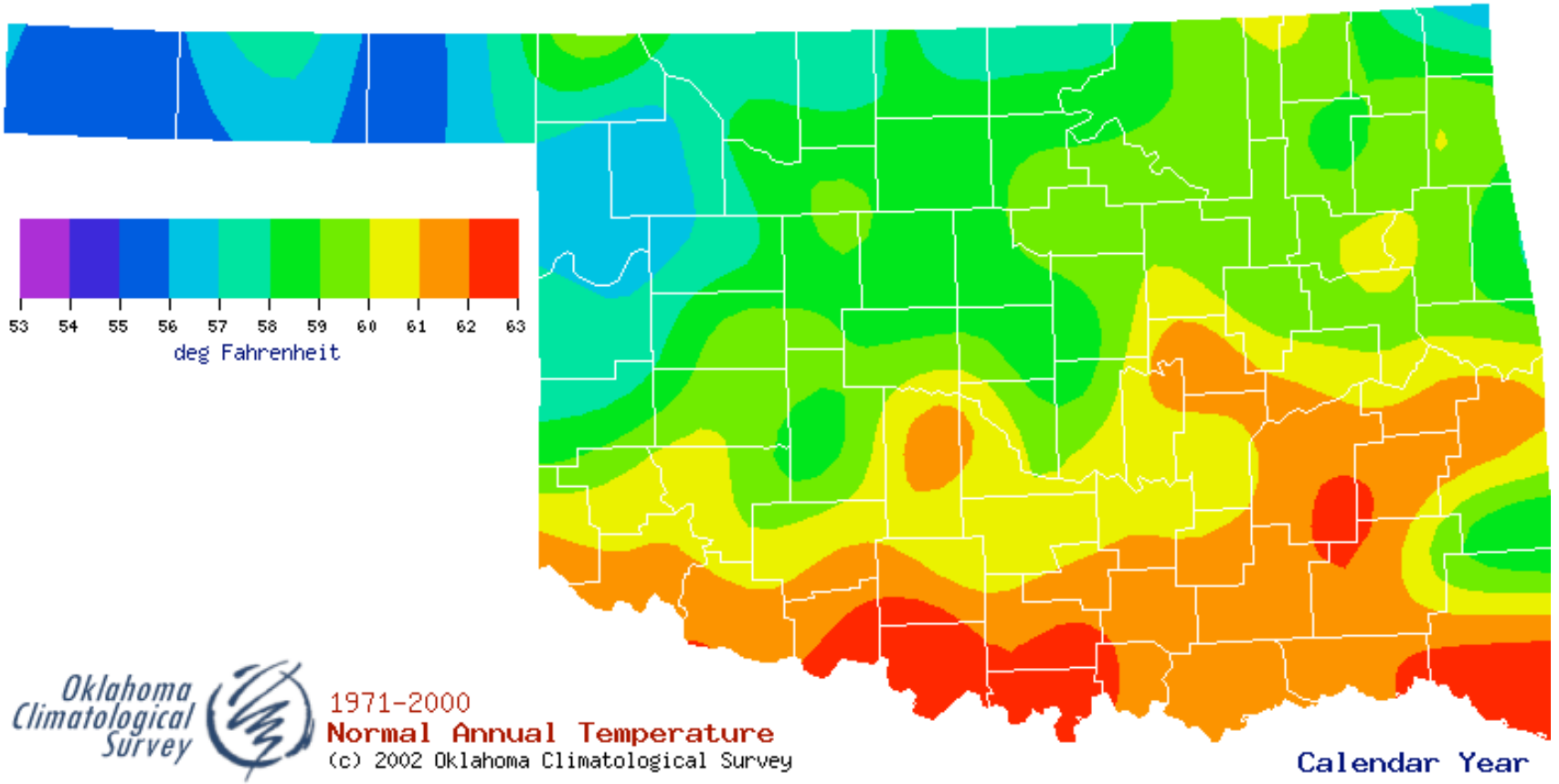
- In Oklahoma, and in much of the U.S., climate values are *highly variable*.
- Large variability makes "supposed to", "usually" and even the word "about" pretty meaningless on a month-to-month basis.
- However, for *longer-term* rainfall (seasonal, annual, and beyond), departures from "normal" mean more.

So, why have normals?

- People adjust their practices (ag, water resources, etc.) based on recent history
- Normals are exactly that: recent history
  - About a generation of history, to be exact
- Normals are a good diagnostic tool to put events in perspective
- Normals are a *great* planning tool (again: agriculture, water resources, etc.)

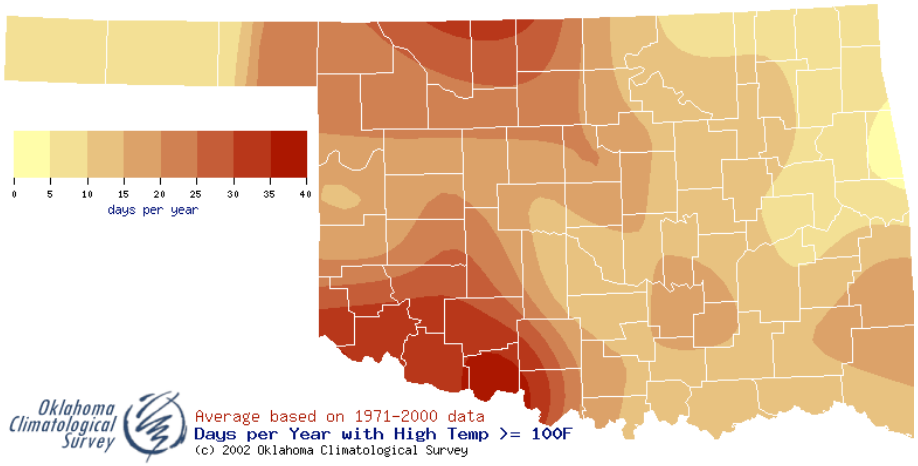
OKLAHOMA'S CLIMATE

Oklahoma's Climate



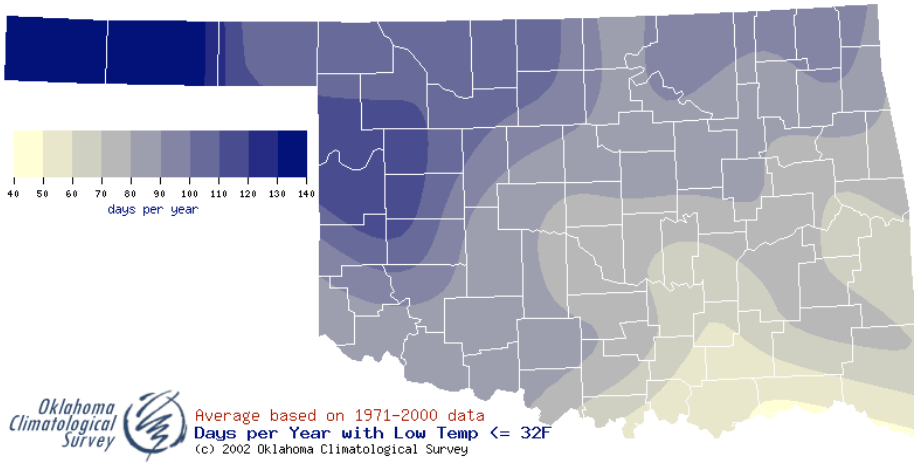
Remember … the Earth's average temperature is about 58 degrees

Oklahoma's *Variable* Climate

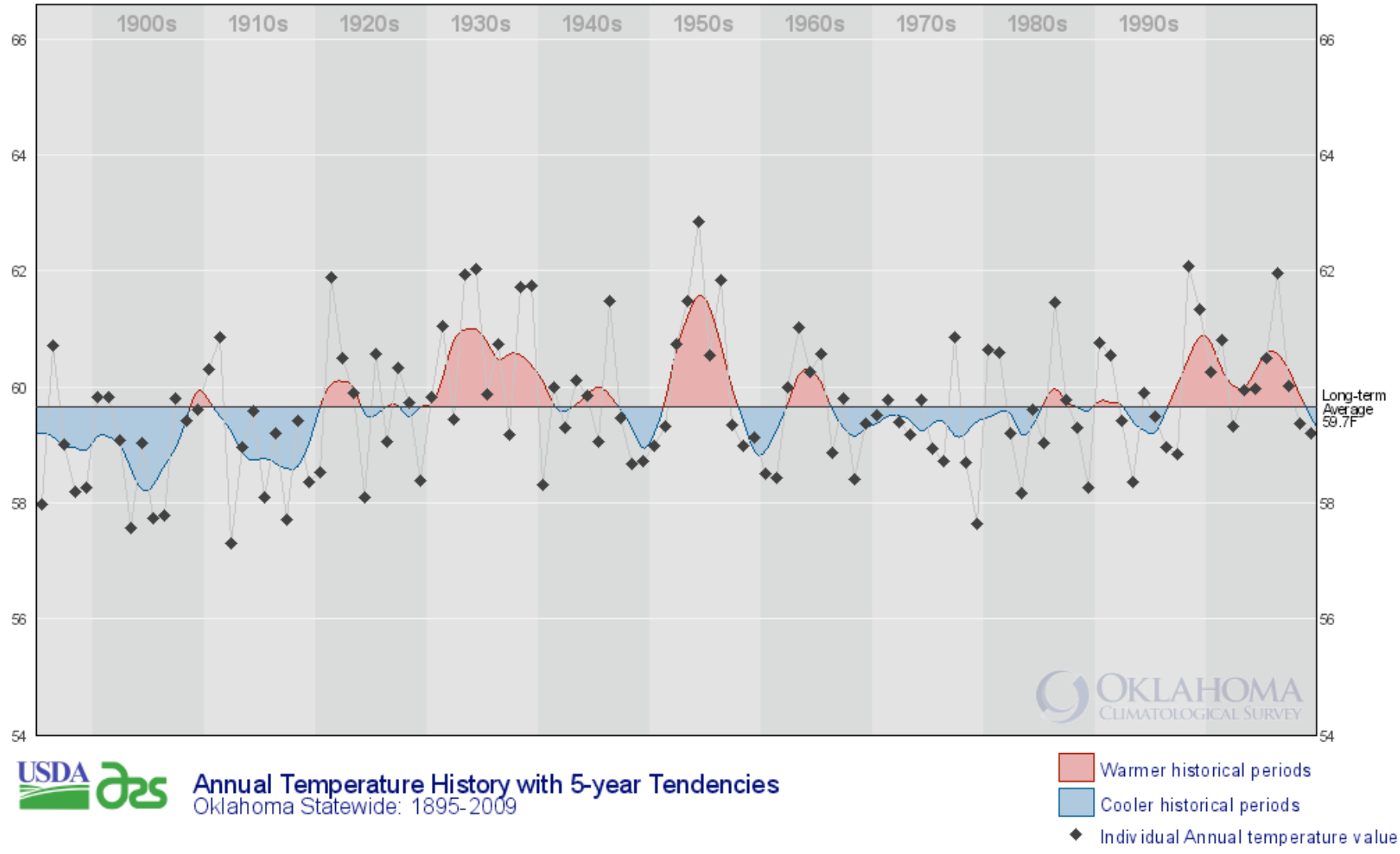


A whole bunch of really hot days for such a middle-of-the-road climate…

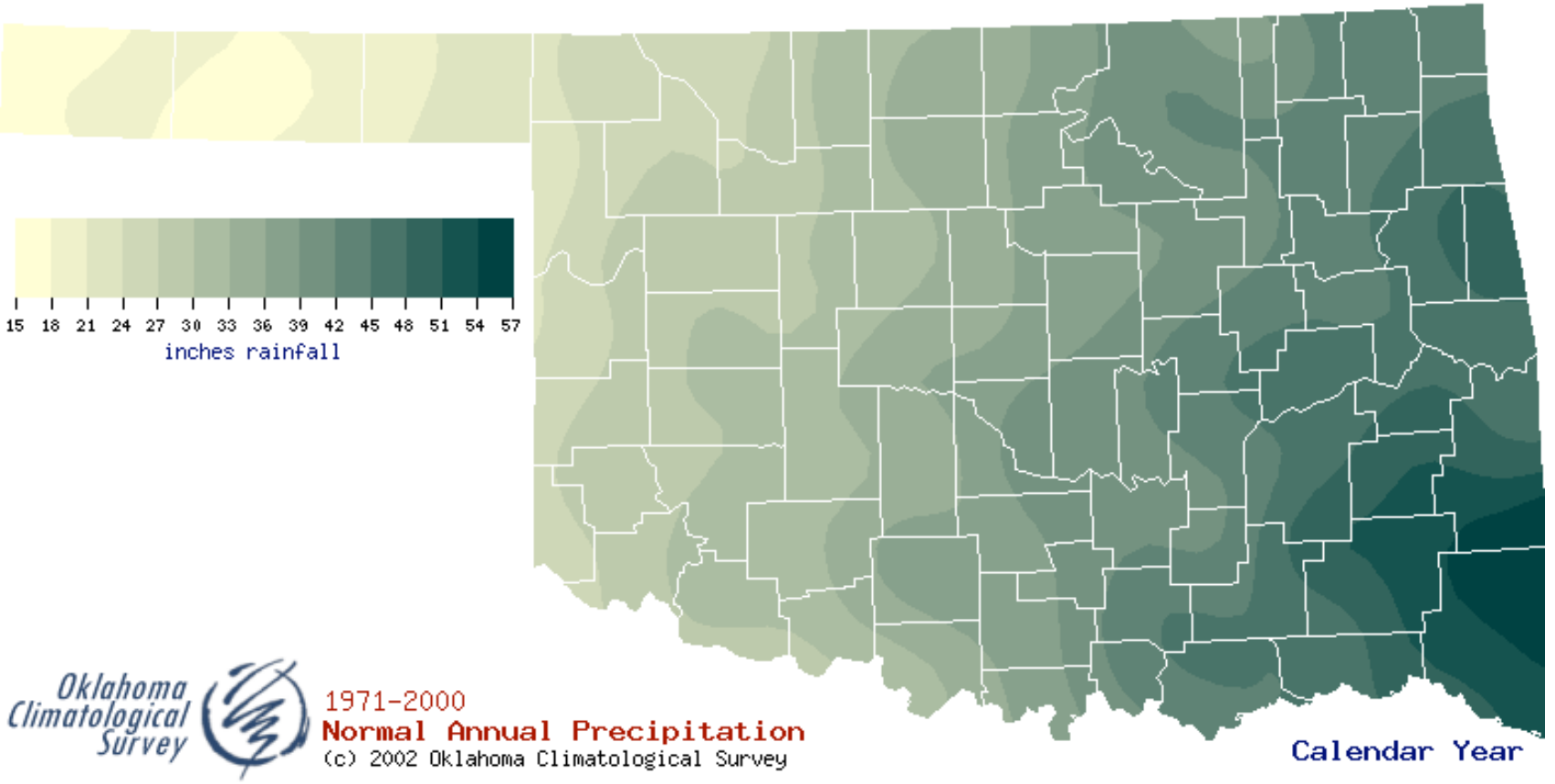
…and it gets cold in the winter too!



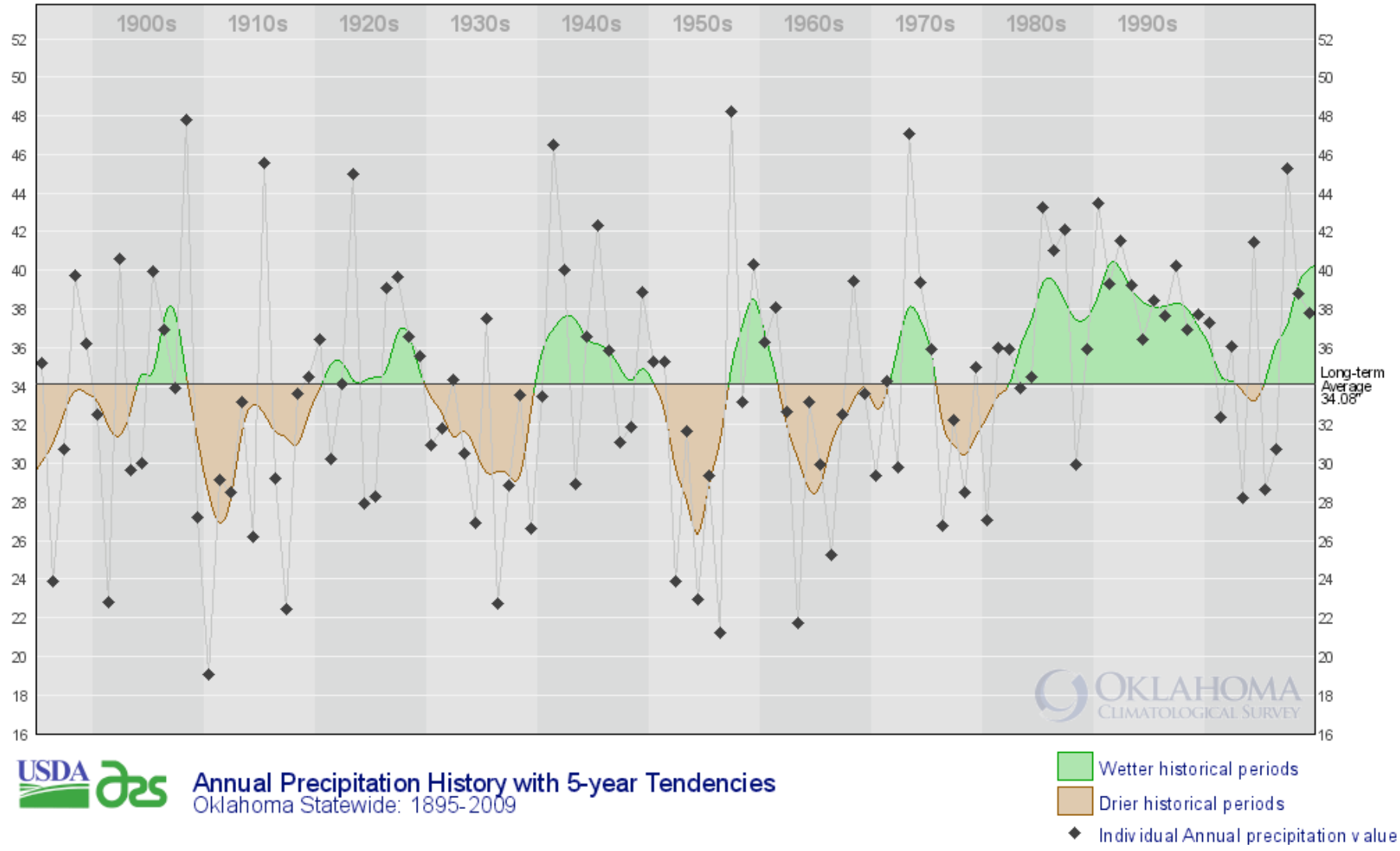
Year-to-Year Variability



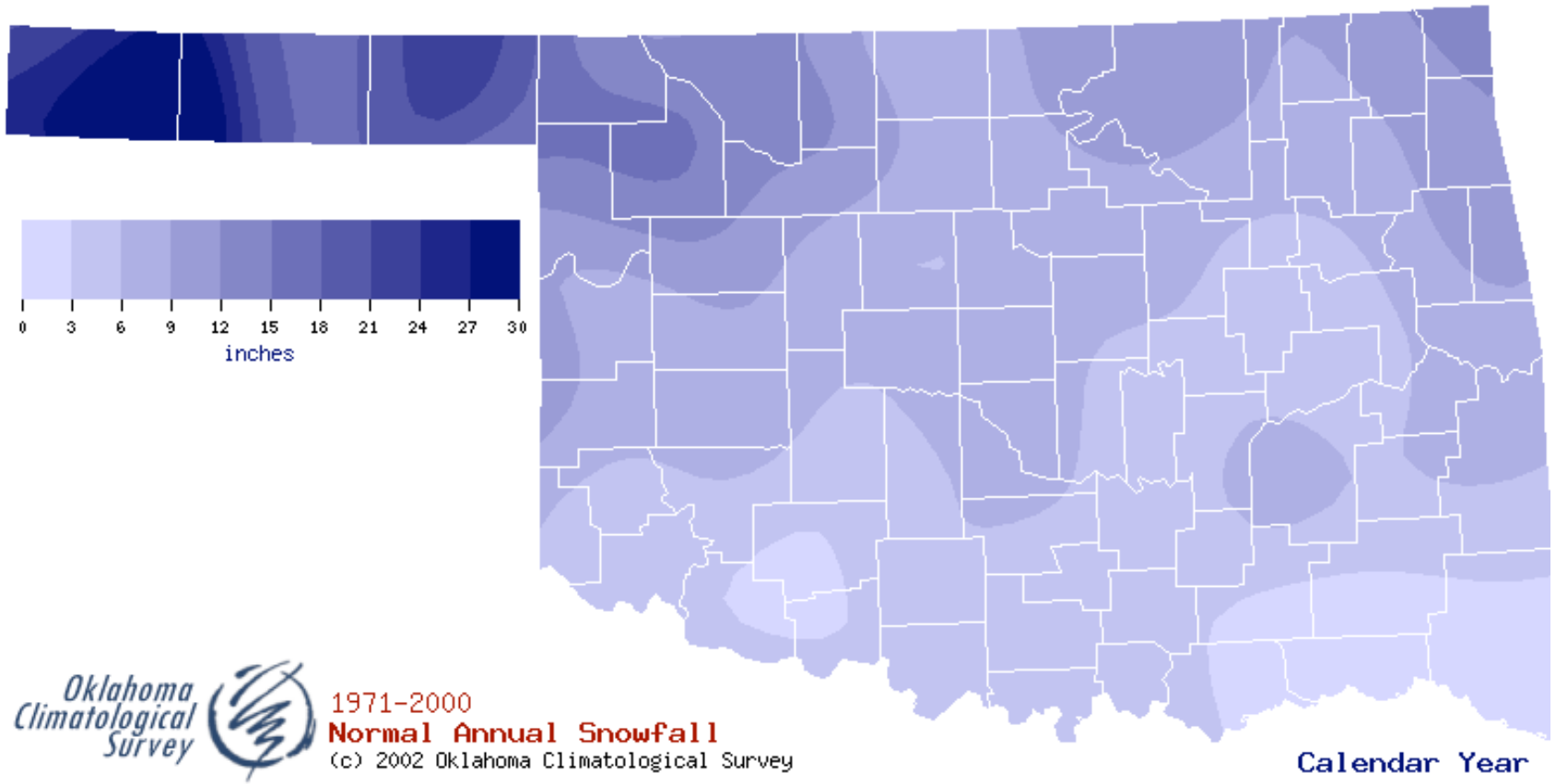
It Rains … In Places



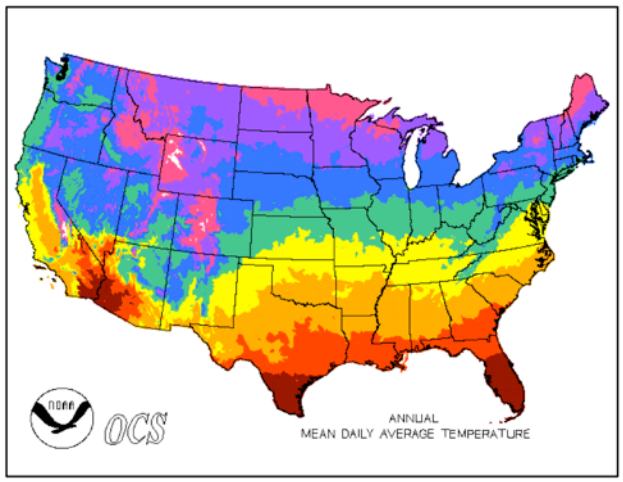
Even more variable rainfall!

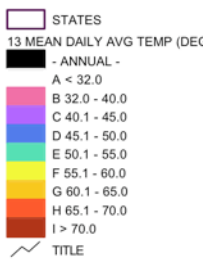


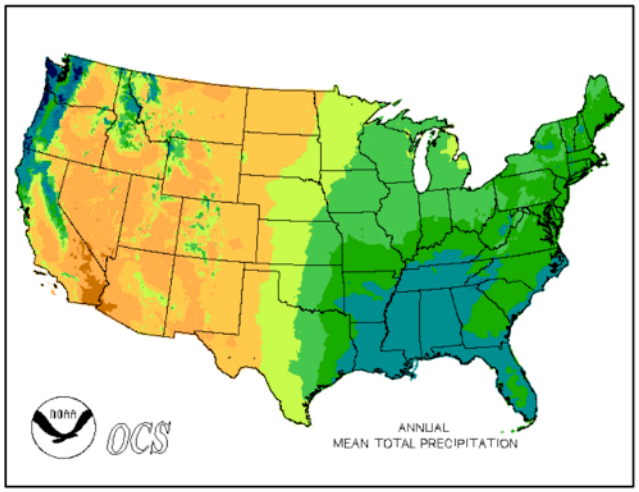
It Even Snows!

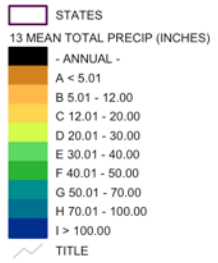


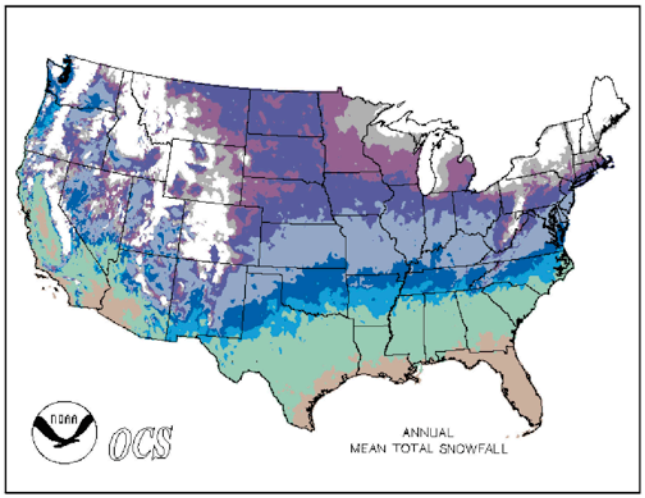
So How Does This Compare?

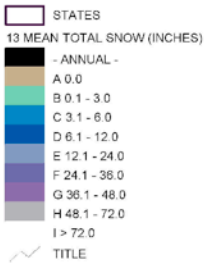


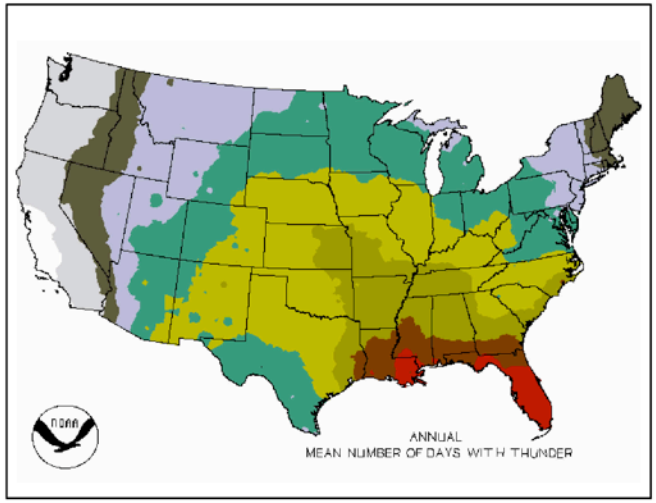


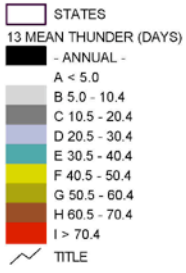






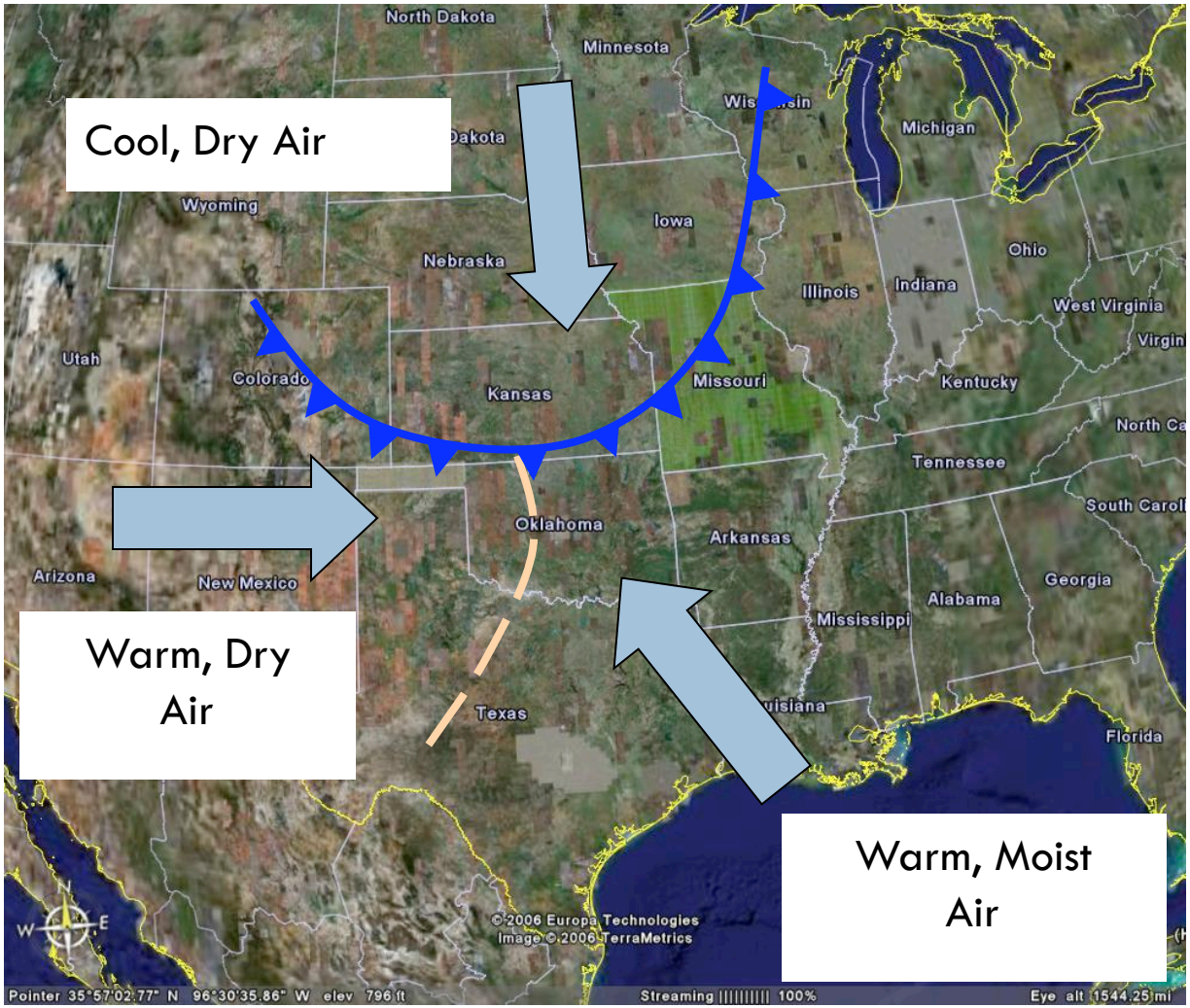






Source: National Climatic Data Center

What Makes Oklahoma's Weather?



Oklahoma Climate Hazards

- Tornadoes

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- Severe Storms (winds, hail, lightning)

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- Severe Storms (winds, hail, lightning)
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- Winter Storms

Oklahoma Climate Hazards

- Tornadoes
- Severe Storms (winds, hail, lightning)
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- Wildfires

Oklahoma Climate Hazards

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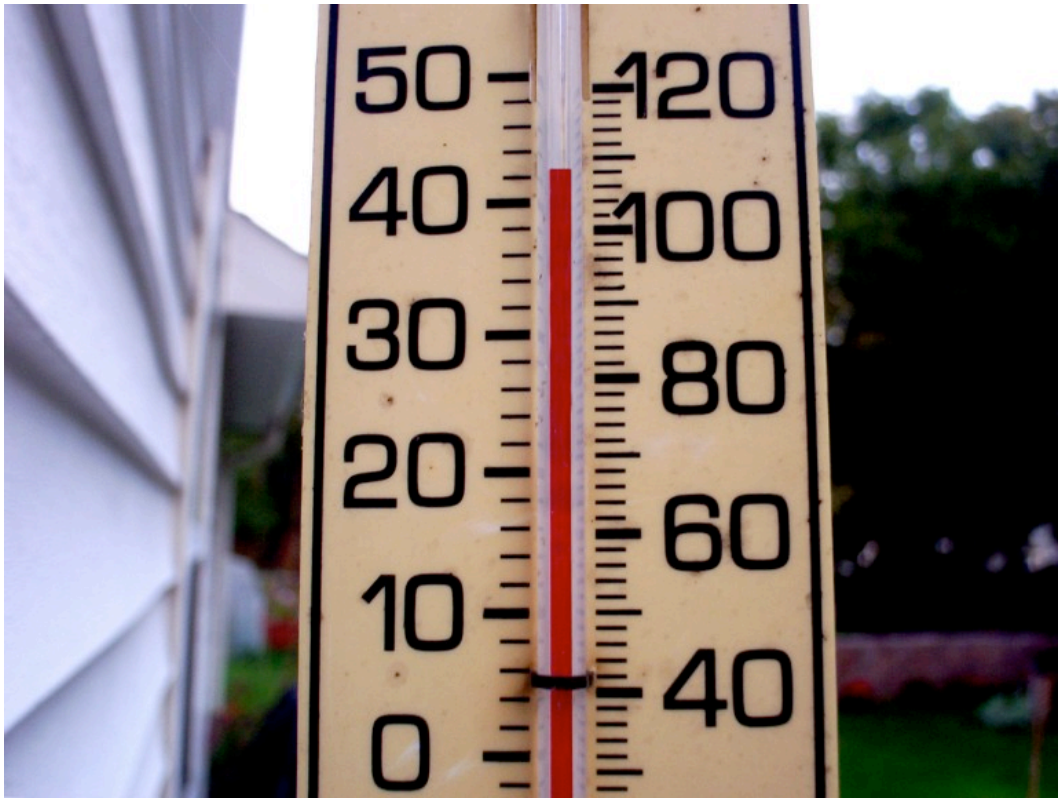
Oklahoma Climate Hazards

- Tornadoes
- Severe Storms (winds, hail, lightning)
- Flooding
- Winter Storms
- Wildfires
- Drought
- Extreme Heat



Oklahoma Climate Hazards

- Tornadoes
- Severe Storms (winds, hail, lightning)
- Flooding
- Winter Storms
- Wildfires
- Drought
- Extreme Heat
- Expansive Soils

But all of that…

Photo Credit: University of Oklahoma

…makes THIS possible!