OKLAHOMA
MONTHLY SUMMARY
SEPTEMBER 1989

TABLE OF CONTENTS
September 1989 Oklahoma Summary...................... 2
Table of September 1988/1989 Comparisons.............. 5
September 1989 Data Summary Tables.................... 7
September 1989 State Map Summary...................... 14
November Climatological Normals....................... 17
30- and 90-Day National Weather Service Outlook.... 18
Explanation of Tables and Maps......................... 20
November 1989 Climate Calendar......................... 22
SEPTEMBER 1989 OKLAHOMA SUMMARY

Temperatures early in September this year's summer-autumn transition month, contrasted sharply with those of the latter half of the month (see Figure 1). On the first, many stations recorded their first 100-degree readings of 1989. One of these stations, Oklahoma City, later recorded a record-breaking low temperature as unseasonably cool Arctic air dominated the last three weeks of the month. The cool spell produced the earliest fall freezes (32 degrees) ever recorded at several sites (see Table 1). The month ranked as the fourth coolest September on record, extending the string of consecutive months of below normal temperatures to four (see The Extremely Cool and Wet Summer of 1989 feature). Widespread and active frontal storms during the first half of the month accounted for above normal precipitation across most of the State.

Temperatures topped 100 degrees over the southern two-thirds of the State on September 1 when sunshine further heated an already warm air mass. The heat combined with unstable conditions to aid the development of severe thunderstorms along a cold front. The storms dropped dime to quarter size hail on several central and western Oklahoma counties, and over 2 inches of rain in southeastern Oklahoma.

The frontal disturbance weakened rapidly, allowing a quick return of warm moist air to the State. On September 4, a surface low pressure system produced widespread rainfall of .5 to 2 inches over the northern two-thirds of the State.

The leading edge of a large mass of Arctic air entered Oklahoma September 9. Maximum temperatures dropped by 10 to 15 degrees between September 9 and 10 under the influence of this cold air. A stronger surge of cold air followed a violent frontal passage on September 12. A tornado struck Henryetta where winds destroyed several mobile homes and damaged over 20 houses. Rainfall exceeded 1 inch at numerous stations Statewide, and local totals in excess of 5 inches were reported at Arcadia (6.80") and Tinker AFB (5.499'). Three-day rainfall accumulations exceeded 4 inches over much of the State. Cottonwood Creek flooded in Guthrie forcing 20 families to evacuate their homes. Cool air and cloudiness associated with this rainfall produced several days of lower temperatures. Many stations broke records of daily low maximum temperatures by several degrees on September 13 through 15 as temperatures reached only into the 50's (see Table 2). During the 7-day period ending the 16th, Oklahoma City's average maximum temperature of 68.5 degrees resembled typical late October readings.

Clearing skies and southerly winds gradually restored near-normal, 80-85 degree readings by September 17. A second Arctic air mass, however, entered the State on September 22. Daily high temperatures in the 60's Statewide approached record low maximums on subsequent days. Scattered freezing temperatures occurred as far south as Tishomingo on the morning of September 24. Frost damage appeared limited to cotton in Washita County and late-planted soybeans.

Temperatures climbed daily during a warming trend through the end of September, finally reaching into the low to mid 80's across the State. A weak low pressure system produced rain showers over southeastern Oklahoma on the 29th and 30th. This was the State's only precipitation recorded during the second half of the month. The overall dry weather accommodated wheat-planting efforts, but stunted peanut growth.

-R. J. Slaweksi
Figure 7: The sharp contrast of daily maximum temperatures between the first and middle of the month is quite evident. The arrival and persistence of Arctic air masses is also apparent.

Table 1: Early frost dates of 1989 compared to the earliest occurrences ever recorded for selected Oklahoma stations (1948-1989).

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Table 2: Record-breaking low daily maximum temperatures for selected Oklahoma stations (1948-1989).

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* = One of 3 consecutive record-breaking days.
* = One of 2 consecutive record-breaking days.
THE EXTREMELY COOL AND WET SUMMER OF 1989

June, July and August 1989 have gone into the record book as comprising one of the coolest and wettest summers ever recorded in Oklahoma.

The past summer ranks as the sixth wettest in 98 years -- 15.01 inches of rainfall -- and is the coolest since 1950. Rainfall totals at reporting stations across the state varied from slightly above to nearly two-and-one-half times normal seasonal levels.

The majority of the summer rainfall was received during June, when a series of weather systems during the first two weeks of the month tapped moisture from the Gulf of Mexico.

In late July and early August, rain associated with the remnants of Hurricane Chantal continued the trend of above-average precipitation. The state’s observing stations reported some precipitation on an average of 30 days during the summer, exceeding the 30-year average by six days.

The 1989 state average temperature of 76.5 degrees was the coolest since 1915 and ranks as the third coolest in the state since 1892. Cooler than normal weather persisted throughout June, July and August.

Prolonged hot spells were cut short by unusual surges of cool Canadian air, producing temperatures 5 to 20 degrees below 30-year daily normals. Cloudy conditions associated with the remnants of Hurricanes Allison and Chantal also contributed to unusually cool temperatures.

Cool, moist weather prevailed during much of September. Consequently, the 4-month (June-September) temperature average of 75.2 degrees ranks second only to 1915’s 75.0 degrees. The 4-month precipitation total ranks as the 4th highest since 1892.

FIGURE 1
OKLAHOMA SUMMER SEASON PRECIPITATION

FIGURE 2
OKLAHOMA MEAN SUMMER TEMPERATURES
### Table of 1988/1989 Comparisons

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### Extremes

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The University of Oklahoma's School of Meteorology is observing and archiving incoming solar radiation data as part of a cooperative effort with the Agricultural Research Service, USDA at Durant, OK. The observation site, operated continuously since September 1987, is located at Max Westheimer Airport in Norman. The data are representative of central Oklahoma and available through the Oklahoma Climatological Survey. The table and chart below depict the September 1989 daily observations.

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### SEPTEMBER 1989 SUMMARY FOR SOUTHWEST DIVISION (CD7)

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SEPTEMBER 1989 TOTAL PRECIPITATION
( Inches )

SEPTEMBER 1989 DEVIATION FROM NORMAL PRECIPITATION
( Inches )

Below Normal
(-4.0 to -2.0)

Near Normal
(-2.0 to 2.0)

Above Normal
(2.0 to 4.0)
SEPTEMBER 1989 AVERAGE MONTHLY TEMPERATURES (Degrees F)

SEPTEMBER 1989 DEVIATION FROM NORMAL TEMPERATURES (Degrees F)

Much Below Normal (-6.0 to -4.0)
Below Normal (-4.0 to -2.0)
Near Normal (-2.0 to 2.0)
SEPTEMBER 1989 COOLING DEGREE DAYS

Below Normal
(Less than -100)

Near Normal
(-100 to 100)

Above Normal
(Greater than 100)

SEPTEMBER 1989 DEVIATION FROM NORMAL COOLING DEGREE DAYS
November wind roses for Oklahoma City and Tulsa for 10-year (1965-1974) mean winds (data adapted from NOAA Atcom Climitology Series). Percents represent the percentage for winds coming from a direction. The numbers at the end of the bars indicate the average speed (miles per hour) of winds from that direction.

**Oklahoma City**

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**Tulsa**

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**NOVEMBER 1989 SUNRISE AND SUNSET**
30-YEAR MEAN NOVEMBER MAXIMUM TEMPERATURE

30-YEAR MEAN NOVEMBER DAILY MINIMUM TEMPERATURE
30- and 90-DAY NATIONAL WEATHER SERVICE OUTLOOK

30-DAY OUTLOOK (OCTOBER)
Precipitation - Near Normal Statewide
Temperature - Below Normal Statewide

90-DAY OUTLOOK (OCTOBER-DECEMBER)
Precipitation - Near Normal Statewide
Temperature - Below Normal Statewide
CLIMATE DIVISIONS (CD)
1 - Panhandle
2 - North Central
3 - Northeast
4 - West Central
5 - Central
6 - East Central
7 - Southwest
8 - South Central
9 - Southeast

EXPLANATION OF TABLES

Two kinds of tables appear in this summary. The first is a set of tables containing all reporting stations grouped by climate divisions. The figure above shows the locations of the climate divisions. Each table contains the following information for each station:

Station Name:  
Station Identification Number: These are usually assigned by the National Climatic Data Center.
Climate Division: See the figure above.
Number of Temperature Observations: These are the actual number of temperature reports recorded at the station during the current month. Missing observations may result in artificially high or low mean monthly temperatures.

Deviation from Normal: The deviation of the observed mean monthly temperature from the monthly station normal. A positive value indicates the month was warmer than normal. A negative value indicates the month was cooler than normal. Normal monthly temperatures may be calculated by subtracting the deviation from the observed temperature.

Maximum Daily Minimum: The maximum daily minimum temperature observed during the current month and year and the day which it occurred.
Minimum Daily Minimum: The minimum daily minimum temperature observed during the current month and year and the day which it occurred.

Heating Degree Days: HDD are calculated each day of the month for which there is a temperature report and summer. They are a qualitative measure of how much heat was required to maintain a comfortable indoor temperature. Missing observations may result in an artificially high or low value. For February 1984 HDD would be calculated as:

\[ \Sigma 65 - (\text{MAX} + \text{MIN})/2 \]

Deviation from Normal Heating Degree Days: A positive value indicates higher than normal heating requirements for the month as a whole. A negative value indicates lower than normal heating requirements for the month as a whole. Normal HDD may be calculated by subtracting the deviation from observed HDD.
Cooling Degree Days: CDD are calculated each day of the month for which there is a temperature report and summed. They are a proxy measure of how much cooling was required to maintain a comfortable indoor temperature. Missing observations may result in an artificially high or low value. For June, CDD would be calculated as:

\[ \sum \left( \frac{\text{MAX} + \text{MIN} + 1}{2} - 65 \right) \]

Deviation from Normal Cooling Degree Days: A positive value indicates higher than normal cooling requirements for the month as a whole. A negative value indicates lower than normal cooling requirements for the month as a whole. Normal cooling degree days may be found by subtracting the deviation from the observed cooling degree days.

Total Precipitation: Often incorrectly referred to as mean precipitation, this value is the sum of all precipitation reported during the month at a station. If snow occurred, it is to be melted and its water equivalent recorded.

Number of Precipitation Observations: The number of days a rain or no-rain observation was reported. Missing observations frequently result in artificially low total precipitation values.

Deviation from Normal Precipitation: A positive value indicates more rain than normal was received. A negative value indicates less than was expected rain was received. Normal rainfall may be calculated by subtracting the deviation from monthly total.

Maximum 24-Hour Report and Day: The maximum amount of precipitation recorded during the station's 24-hour observation period for the current month and year and the day on which it was recorded.

The second set of tables contain similar information but are the average or extreme over all the stations reporting in each climate division.

EXPLANATION OF MAPS

To give a statewide perspective, a series of maps is produced each month from the information contained in the station tables. Each map is calculated using between 50 and 200 observations. Only stations with complete monthly records are used. Each observation is put into one of three categories and assigned a plus (+), minus (-), or a dot (.). The minus is the lowest numeric category, the dot is the middle and the plus the highest numeric category. If a map location has no report, a value is estimated. Each map is accompanied by its own legend. The categories will vary from month to month throughout the year. The categories for the deviations from normal maps will always remain constant. This is to facilitate comparisons between months and across years.
### NOVEMBER 1989

#### CLIMATE CALNDAR

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#### NOVEMBER AVERAGES

- Temperature : 48.8°F
- Precipitation : 1.67"n
- Heating Degree Days: 463
- Cooling Degree Days: 1