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CENTRAL REGION TECHNICAL ATTACHMENT 87-11

A LOOK AT SOME DIFFERENT USES OF CLIMATOLOGY

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Climatology can provide some interesting and useful information to forecasters. Although traditional uses of climatology have mainly dealt with average values and departures from the average, here are three climatological studies dealing with somewhat different variables.

1. Summertime Dew Points at Cheyenne, Wyoming

In doing research on the flash flood that struck Cheyenne on the evening of August 1, 1985, it was noted that during the morning and afternoon prior to the flood, very high dew points (for this area) were observed. Dew points were as high as 63°F around 1:00 pm MDT, with an average value during the day between 58 and 60°.

This observation of high dew points led to the questions - just how often are abnormally high dew points observed at Cheyenne in the summer? And, is there any correlation between high surface dew points and observed cases of heavy rains/flooding?

To answer these questions, all the hourly observations at Cheyenne from 1939 to 1985 were reviewed. The period chosen was from July 1st to August 15th since this encompasses the "monsoon" period in Wyoming when heavy convective rains are most likely. Finally, only observations in which the dew point was 58° or higher were noted.

The results were interesting. For the period indicated, Cheyenne had a dew point of 58° or higher only about 2 percent of the time, making it a rather rare event. The majority of these high dew points were observed just after an afternoon or evening thunderstorm, or during the early morning hours. The rest were observed during the daytime prior to thunderstorm development.

To answer the question about any correlation between high surface dew points and heavy rains, the publication Storm Data was reviewed to document cases of heavy rains and/or flooding in southeast Wyoming.

From the time Storm Data began in 1959, there have been 16 cases of flooding or heavy rains in southeast Wyoming. In eight of these 16 cases, dew

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points of 58° or more were observed at Cheyenne on the day of the event. And in another five cases, Cheyenne observed 58° or greater dew points sometime in the 3-day period centered on the event.

Summarizing the two results, dew points of 58° or higher are a rare event in Cheyenne in the summer, and there is a fairly good correlation between these high dew points and observed cases of heavy rains/flooding. In fact, Cheyenne forecasters now consider this critical value of 58° as a "flag" for possible flash flooding or heavy rains in southeast Wyoming.

2. Frequency of Rain During the Summer "Monsoon" at Cheyenne

This climatological study was done because of a concern by local officials about rainfall during the Cheyenne Frontier Days, a 10-day event staged outside each year during the last full week in July.

To determine the frequency of rainfall during this period, precipitation records were reviewed for Cheyenne for each day from July 1st to August 15th for the period from 1871 to 1985. Amounts were limited to those of .01" or more.

The frequency of rain on each day was charted (Fig. 1, bottom graph). (A smoothing technique of Tukey (1977) called "3RSSH3RSSH, thrice" was performed before plotting, for all three curves shown here.) This graph shows that the frequency of rain reaches a broad peak roughly during the last part of July into early August.

However, if each date's rainfall is categorized according to amounts, (.01 to .10, .11 to .25, etc.) and the frequency of rain in each category is tabulated with heavier rains counting more, then a "weighted" frequency of rainfall can be computed for each date. Using this method shows the more damaging effects that a one inch rain would have on outdoor events compared with a tenth of an inch of rain.

This "weighted" frequency graph is shown in the top part of Fig. 1. It clearly shows that not only does the frequency of rain reach a peak during the last part of July into early August, but the rains that fall during that period tend to be heavier.

Meteorologically, these graphs illustrate quite well the "monsoon" that invades southern Wyoming during this time. Tropical moisture from the Gulf of California and Mexico swings north into Arizona and Utah, and then turns northeast into southern Wyoming and Colorado. An upper high typically is over eastern New Mexico with this monsoonal flow.

As would be expected, most of the heavy rains and flash floods occur during this monsoon period in southeast Wyoming. Going back to those heavy rain cases documented in Storm Data (from Part 1), 12 of the 16 cases occurred from the middle of July into the first week of August.

3. Pleasant Weather Days in the Summer at Charleston, West Virginia

While I was an intern at the Charleston WSFO, a senior forecaster had noticed that about every summer, a nice period of weather occurred around the middle to end of August. This aroused my interest, so I decided to investigate this phenomenon in more detail.

Daily weather records were reviewed for Charleston during the months of July and August for the period 1943 to 1982. A day was classified as a "pleasant" day if it met all of these criteria:

- 1 No precipitation
- 2 Cooler than normal (highs - 70's to mid 80's; lows - 50's to low 60's)
- 3 Less humid than normal (dew points in the 50's to low 60's)
- 4 Partly to mostly sunny with visibilities 7 or more miles (very little haze).

The frequency of occurrence of these "pleasant" days was then determined for each date in July and August (Fig. 2). This clearly shows that more of these pleasant weather days do indeed occur during the middle to end of August. Also, notice that the minimum number occurs about the third week of July.

Almost all of these pleasant days occurred as a period of nice weather lasting anywhere from two to seven days, with the average about four days. Each summer in the study generally had about three to four periods of pleasant weather, except for the summer of 1980 which had almost no nice days. (The summer of 1980 was an anomaly in other ways in West Virginia.)

Meteorologically, the peak in the middle and end of August corresponds to about the first really significant cold front sweeping through the eastern part of the United States as autumn approaches. The much cooler, drier, and clearer air that follows this strong cold front is usually in stark contrast to the hot, humid, and hazy conditions that prevail during much of the summer.

All of these studies show the value of studying climatological records in order to get some useful data. The dew point study yielded a critical value for flash flood/heavy rain possibilities in southeast Wyoming. Although the information from the other two studies was less operationally significant, in both cases the results were linked to meteorological causes, with "preferred" periods of occurrence indicated in each study.

However, a final note must be mentioned about the usefulness of the last two studies. Since both of them dealt with a parameter over a number of years, what actually happens in a particular year can be quite different from what the climatological study shows. Still, the studies have merit in that they do show "preferred" periods of occurrence which can be used for planning purposes.

Reference

Tukey, J. W., 1977: Exploratory Data Analysis. Addison-Wesley, 506 pp.

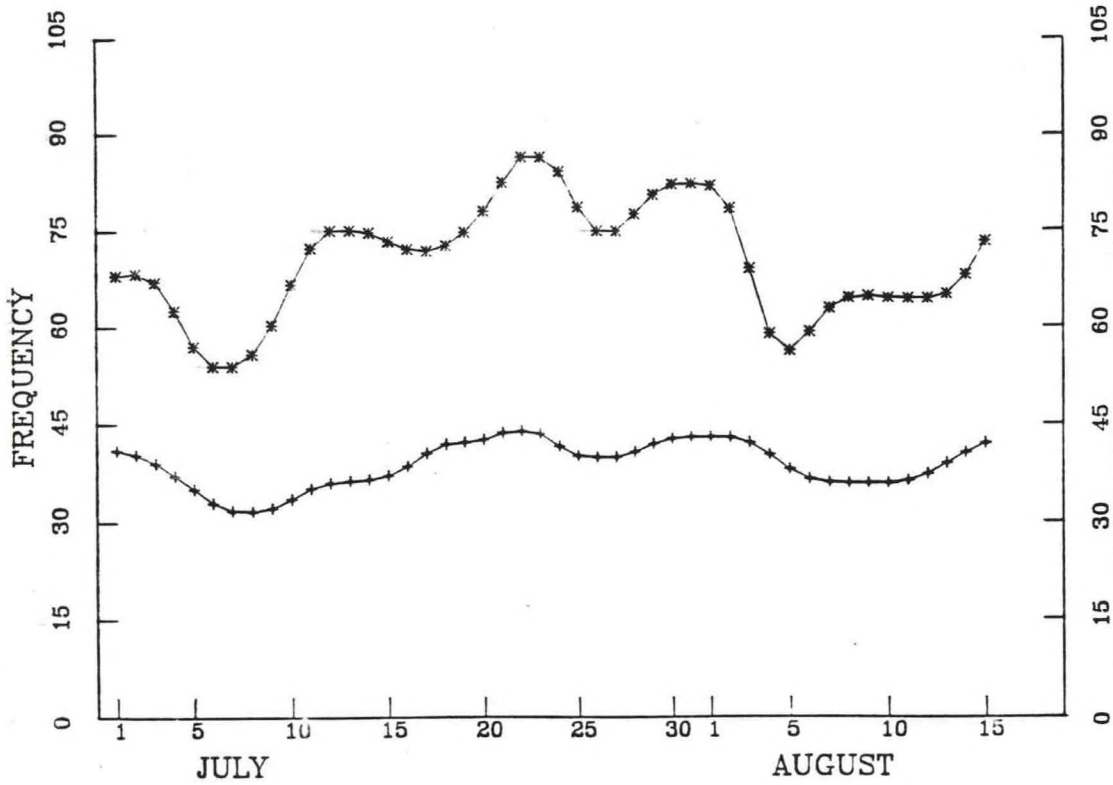


Figure 1. Bottom Graph - Frequency of rain (.01" or more) at Cheyenne, WY for each day from July 1 to August 15 for the period 1871-1985.
Top Graph - "Weighted" frequency of rain for each day.

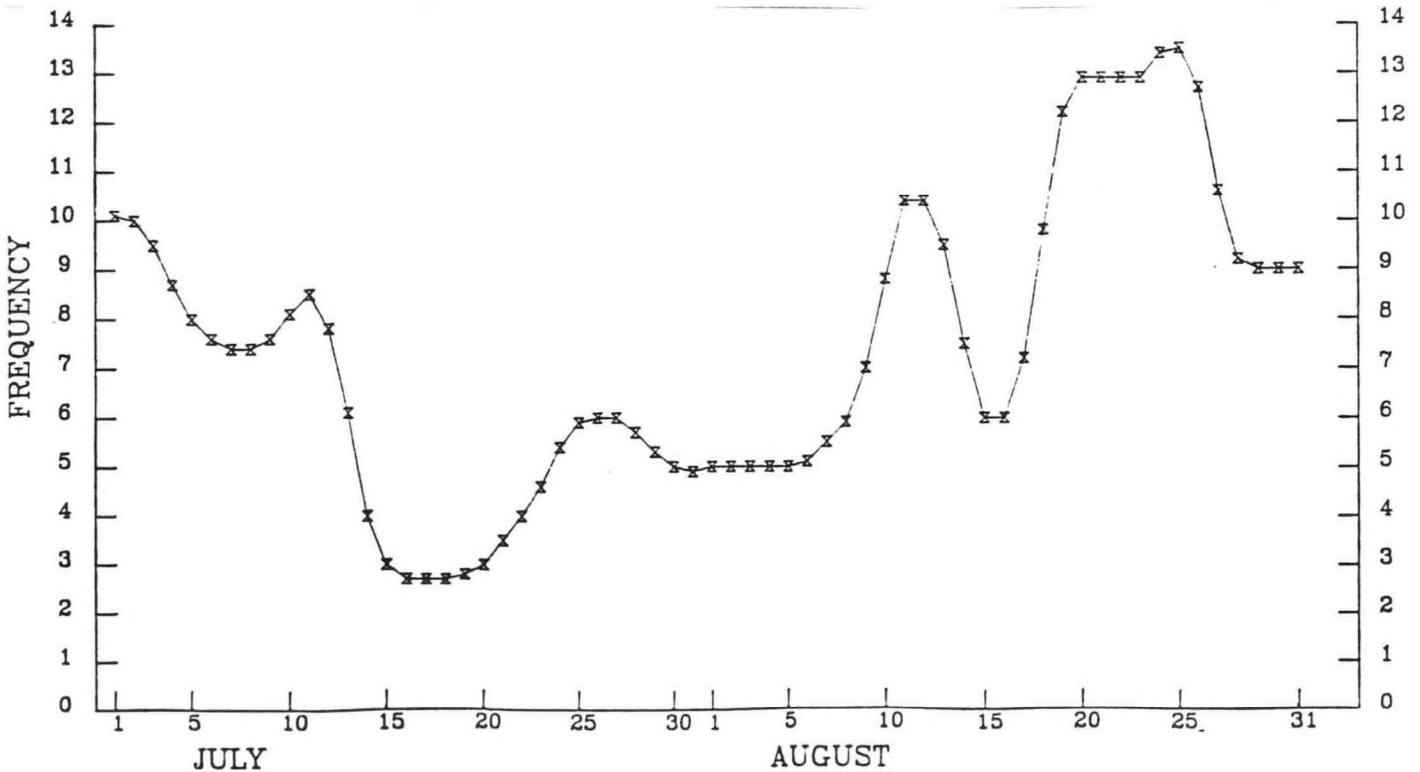


Figure 2. Frequency of occurrence of "pleasant" weather days in July and August at Charleston, WV for the period 1943 to 1982.