

A Comparison of Ten, Twenty-five and Fifty Year Climatic Records

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In many problems in Climatology it is necessary to use data from stations distributed over wide area. Usually it is desirable to use as many stations as possible. Doubts constantly arise, however, because the records from these widespread stations are seldom of uniform length and one is constantly questioning the propriety of comparing records of say 50 years with those of shorter periods. It is the purpose of this paper to investigate the significance of the length of the climatic record on certain selected data; the absolute high temperature and the absolute low temperature for the months of January and July recorded at eighty-nine stations in the United States. An attempt was made to determine how accurately records of 25 years and records of 10 years in length reflect the conditions recorded during 50 years. Data were obtained from the Climatic Summary of the United States (Bulletin W) U. S. Department of Agriculture, Weather Bureau. The stations were chosen because they had records of more than 50 years.

In selecting the samples, the 50 years and the 25 years immediately preceding 1930 (the most recent date in bulletin W) were chosen. The 10 year periods were randomly selected from the 50 year data.

The records for 25 years are essentially the same as the 50 year records. For the January high temperature, the mean is 70 for the 50 year period and 69 for the 25 year period. The difference in the means of the two periods for both the high and low July temperatures were also one degree (50 year July high 104; 25 year July high 103; 50 year July low 49; 25 year July low 50.) The difference in the January low temperatures was a little greater, -13° for the 50 year period, -9° for the 25 year period. Tests of the differences between the means and the difference between the variance² in the two series show that there is no statistically significant difference between the two series.

The differences between the 50 year records and the ten year records are shown in Table 1.

Once again the greatest departure from the 50 year record occurs in the ten year record for maximum January low temperature and this departure amounts to five degrees.

A comparison of all the values from both records indicates a mean deviation of 2 degrees and a standard error of estimate of 4 degrees. This means that if the values obtained from the ten year record are used to predict the values for the 50 year period they would be in error by 4 degrees or less in 66 per cent of the cases.

The greatest departure for an individual station occurs in the January high temperature of Oswego, New York. The ten year record indicates a maximum high temperature of 40 degrees, the fifty year record, 69 degrees; a difference of 29 degrees. There was one other difference greater than 20 degrees. This occurred in the data for Marquette, Michigan, when the 10 year January high temperature was

24 degrees less than that recorded in the 50 year period. Two stations, Phoenix and Shreveport, had differences of 19 degrees and two others, Helena and LaCrosse, had differences of 18 degrees between the 10 year and 50 year records.

TABLE 1
Difference between 50 year and 10 year records

	MEAN (°F)		STANDARD DEVIATION (°F)	
	50 year	10 year	50 year	10 year
Absolute Max. January	70	67	11	9
Absolute Min. January	—13	—8	2	2
Absolute Max. July	104	101	5	5
Absolute Min. July	49	51	8	8
All values	53	52	44	41

These departures seem to be random. They are scattered all over the country, which rules out any pattern of a regional variation. It was thought that a station with a great range in the temperatures might show a greater departure than those with a small range. Five of the six stations having differences of 18 degrees or more between the 50 year and 10 year records had these differences occur in the January data. The mean range of the January absolute temperature is 83 degrees, standard deviation 13 degrees for the 50 year record. Only two of the five (Helena range 105 degrees, LaCrosse range 99 degrees) had a range in their absolute January temperature greater than one standard deviation from the mean. The mean range in the July temperature was 55 degrees, standard deviation 9 degrees. Phoenix, which had a difference of 19 degrees between the 10 and 50 year records in the absolute low July temperature, had a July range in temperature of 72 degrees.

The time interval between the dates on which the absolute high and low temperature were recorded was also investigated. In the 50 year records, this interval averaged 17 years for the January data and 16 years for the July data. Portland, Oregon, recorded its absolute high (62°) and absolute low temperature (—2°) the same year (1884) and Boise, Idaho, recorded its absolute July high (111°) and absolute July low (40°) in 1898. The interval between the absolute high and low temperature for both January and July averaged 8 years in the 25 year sample and five stations had either the January or the July maximum and minimum occur in the same year. For the ten year record, the average time interval between the date in which the high for the month and the low for the same month was recorded was 4 years. Fifteen stations recorded the ten year maximum and minimum for either January or July the same year. There does not seem to be any relationship, however, between these time intervals and the differences between the fifty year and ten year record.

In conclusion, this study has shown that in regard to the absolute maximum and absolute minimum temperatures in the United States, a 25 year record is essentially the same as a 50 year record and that a

ten year record will be within 4 degrees of the 50 year record 66% of the time. Differences of 18° or more between the 10 and 50 year records are small in number and seem to be randomly distributed.

Literature Cited

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