A Look at 100-Degree Days in Amarillo

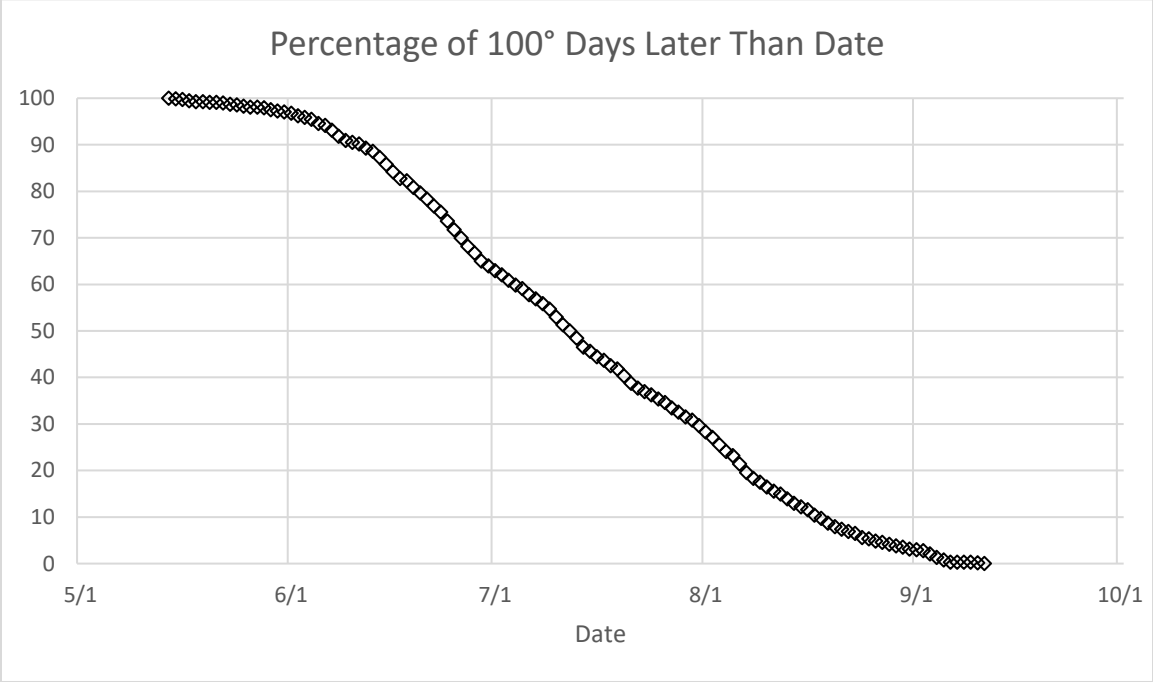
By Robert Ashcraft
Retired Program Scientist - Pantex

Any day in which the high temperature exceeds 99° is called a "100-degree day" or a "triple digit day." I looked at Amarillo's 100-degree days back to 1892 by accessing the NOAA Online Weather Data (NOWData) website. The first recorded 100-degree day was June 9, 1892, and it was the only one that year.

Through the end of the summer of 2020, 100-degree days have occurred 682 times, and have occurred in 96 of the 129 years. We had 19 100-degree days this summer. All 100-degree days have occurred from May 15 (set in 1996) to September 11 (set in 1910).

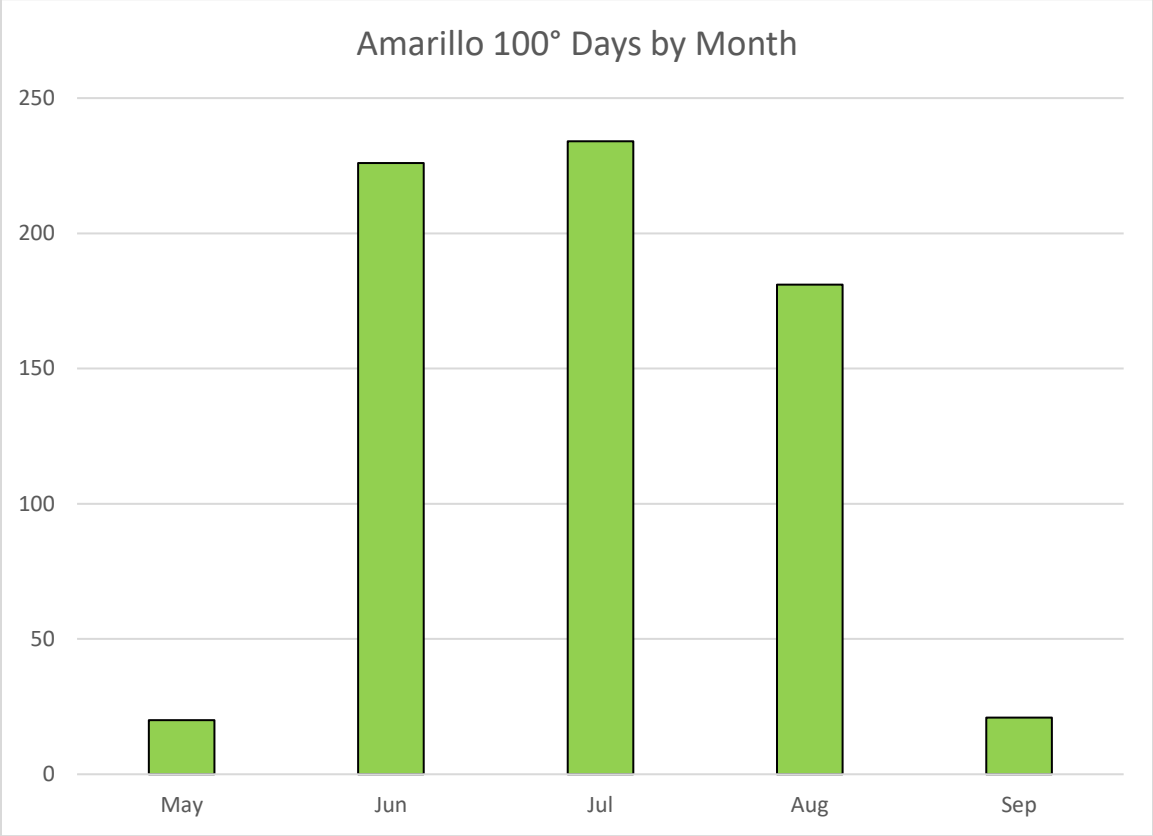
From the database, I was able to generate a frequency distribution (Appendix 1) of 100-degree days for each day in the range. June 24, June 25, July 14, and August 7 are tied for the most 100-degree days (13).

By generating a cumulative distribution (Appendix 2), we can determine how many 100-degree days have occurred after a specific day and convert these values to percentages. For example, 100% of all 100-degree days have occurred later than May 14, and 0% have occurred after September 11. The results for the entire range are shown in the following plot.

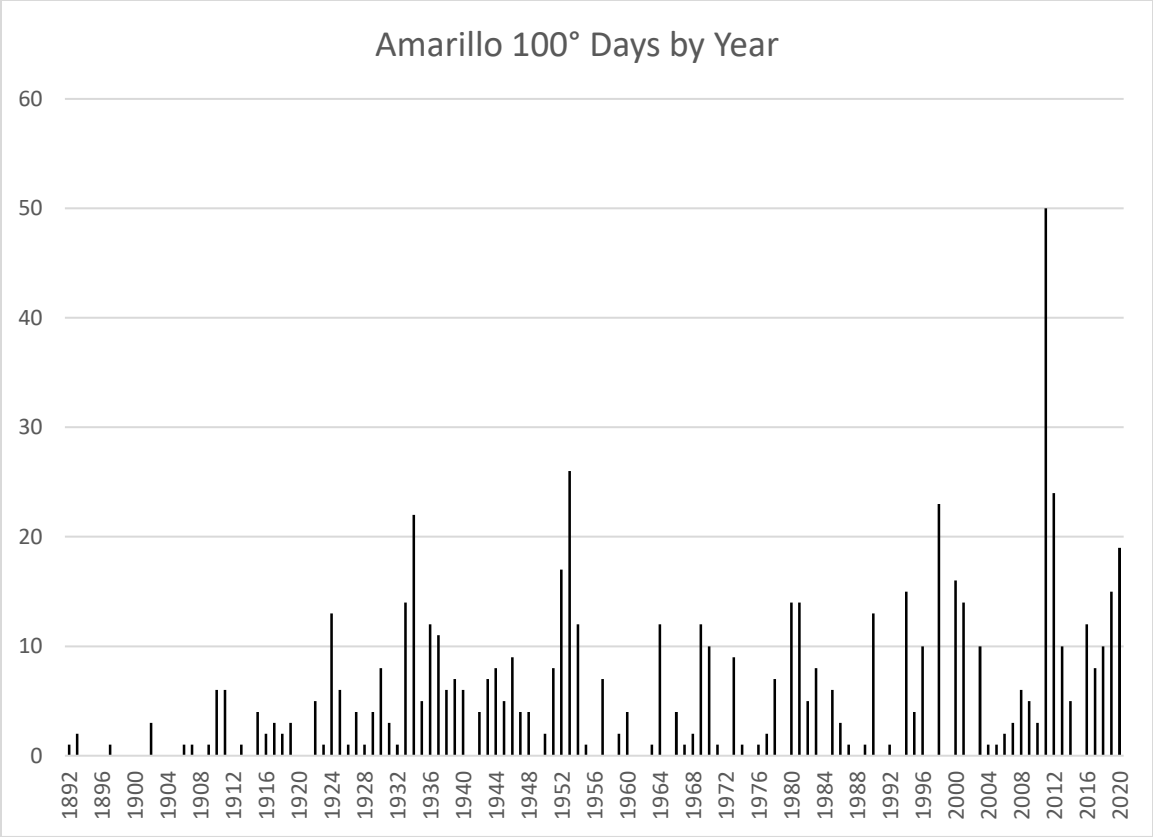


Thus, as the summer progresses without a 100-degree day, the chances for having one decrease. For example, only 10.41% of Amarillo's 100-degree days have occurred later than August 17.

I was also able to determine the number of 100-degree days per month, and those numbers are shown in the following graph. The month of July has the most occurrences (234), and June is the runner up with 226 occurrences.



I was also able to determine from the database the number of 100-degree days per year, and those numbers are shown in the following graph:



The graph enables us to see just how severe the summer of 2011 was, with 50 occurrences of 100-degree days. Until 2011, 1953 had been the most severe summer with 26 occurrences.

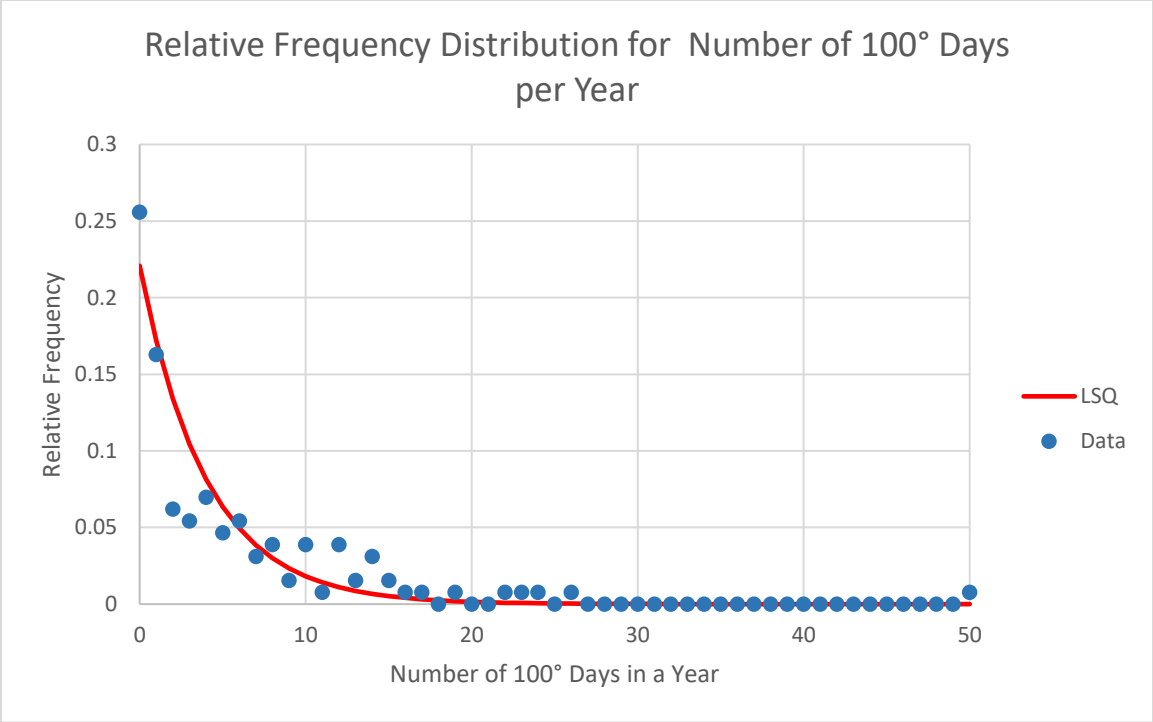
Next, I was able to find the frequency distribution for the number of 100-degree days in a year. For a given number of 100-degree days, the distribution tells us how many years that number of 100-degree days has occurred. For example, seven of the 129 years have had three 100-degree days.

The distribution is shown in Appendix 3, along with the relative frequency distribution. The relative frequencies are computed by dividing the frequencies by 129, the total number of years.

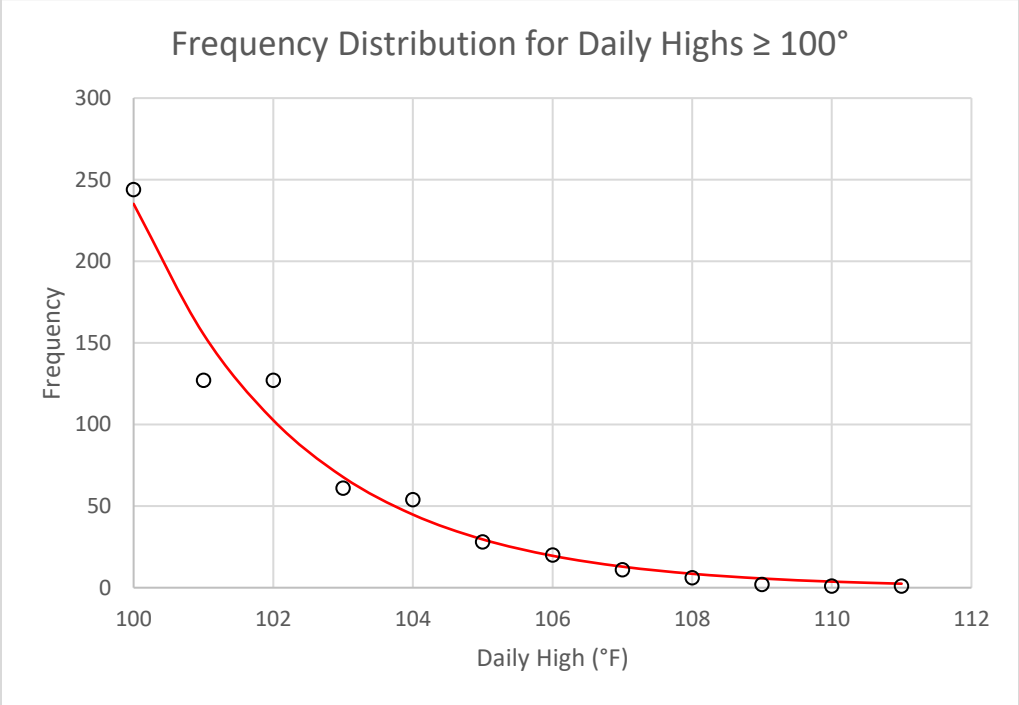
The following plot shows the relative frequency distribution, along with a regression model of the form

$$rf(n) = (1-p)^n p$$

where *rf* is the relative frequency, *n* is the number of 100-degree days in the year, and *p* is the regression parameter. For these data, the value of *p* is 0.220814.


Relative Frequency Distribution for Number of 100° Days per Year
0.3
0.25
0.2
0.15
0.1
0.05
0
Relative Frequency
0
10
20
30
40
50
Number of 100° Days in a Year
LSQ
Data

Finally, I was able to create a frequency distribution for the number of occurrences of daily highs of 100° and higher. The distribution is shown in Appendix 4 and here is a graph:



For example, during the 129-year period of record, Amarillo has experienced a daily high of 104° a total of 54 times. This year was the first time in 129 years that we had a daily high of 110°.

The red curve is the best fit exponential of the form

$$f(T) = Ae^{k(T-100)}$$

where f(T) is the frequency, T is the daily high, and A and k are the curve fit parameters. Their values are A = 235.1917 and k = -0.41453.

With the exception of 101° (too few) and 102° (too many), the exponential curve is an excellent fit to the data.

APPENDIX 1

Frequency Distribution for Amarillo's 100-Degree Days per Day

Example: 100-degree days have occurred 9 times on August 1.

Day	Count
5/14	0
5/15	1
5/16	1
5/17	2
5/18	1
5/19	0
5/20	1
5/21	0
5/22	1
5/23	2
5/24	1
5/25	2
5/26	1
5/27	0
5/28	1
5/29	3
5/30	2
5/31	1

Day	Count
6/1	2
6/2	4
6/3	2
6/4	3
6/5	6
6/6	3
6/7	7
6/8	9
6/9	6
6/10	3
6/11	2
6/12	6
6/13	5
6/14	9
6/15	10
6/16	11
6/17	10
6/18	3
6/19	10
6/20	8
6/21	9
6/22	10
6/23	9
6/24	13
6/25	13
6/26	12
6/27	12
6/28	10
6/29	12
6/30	7

Day	Count
7/1	7
7/2	6
7/3	8
7/4	7
7/5	5
7/6	9
7/7	6
7/8	7
7/9	8
7/10	12
7/11	11
7/12	9
7/13	11
7/14	13
7/15	6
7/16	8
7/17	5
7/18	8
7/19	5
7/20	10
7/21	11
7/22	7
7/23	5
7/24	5
7/25	6
7/26	5
7/27	8
7/28	6
7/29	7
7/30	5
7/31	8

Day	Count
8/1	9
8/2	8
8/3	11
8/4	10
8/5	6
8/6	12
8/7	13
8/8	8
8/9	6
8/10	7
8/11	6
8/12	4
8/13	7
8/14	7
8/15	5
8/16	4
8/17	8
8/18	5
8/19	7
8/20	5
8/21	4
8/22	3
8/23	3
8/24	6
8/25	2
8/26	3
8/27	2
8/28	3
8/29	2
8/30	2
8/31	3

Day	Count
9/1	1
9/2	1
9/3	5
9/4	5
9/5	4
9/6	3
9/7	0
9/8	0
9/9	0
9/10	1
9/11	1
9/12	0

APPENDIX 2

Cumulative Relative Frequency Distribution for Amarillo's 100-Degree Days per Day

Example: 2.93% of Amarillo's 100-degree days have occurred after September 1.

Day	Pct.
5/14	100.00
5/15	99.85
5/16	99.71
5/17	99.41
5/18	99.27
5/19	99.27
5/20	99.12
5/21	99.12
5/22	98.97
5/23	98.68
5/24	98.53
5/25	98.24
5/26	98.09
5/27	98.09
5/28	97.95
5/29	97.51
5/30	97.21
5/31	97.07

Day	Pct.
6/1	96.77
6/2	96.19
6/3	95.89
6/4	95.45
6/5	94.57
6/6	94.13
6/7	93.11
6/8	91.79
6/9	90.91
6/10	90.47
6/11	90.18
6/12	89.30
6/13	88.56
6/14	87.24
6/15	85.78
6/16	84.16
6/17	82.70
6/18	82.26
6/19	80.79
6/20	79.62
6/21	78.30
6/22	76.83
6/23	75.51
6/24	73.61
6/25	71.70
6/26	69.94
6/27	68.18
6/28	66.72
6/29	64.96
6/30	63.93

Day	Pct.
7/1	62.90
7/2	62.02
7/3	60.85
7/4	59.82
7/5	59.09
7/6	57.77
7/7	56.89
7/8	55.87
7/9	54.69
7/10	52.93
7/11	51.32
7/12	50.00
7/13	48.39
7/14	46.48
7/15	45.60
7/16	44.43
7/17	43.70
7/18	42.52
7/19	41.79
7/20	40.32
7/21	38.71
7/22	37.68
7/23	36.95
7/24	36.22
7/25	35.34
7/26	34.60
7/27	33.43
7/28	32.55
7/29	31.52
7/30	30.79
7/31	29.62

Day	Pct.
8/1	28.30
8/2	27.13
8/3	25.51
8/4	24.05
8/5	23.17
8/6	21.41
8/7	19.50
8/8	18.33
8/9	17.45
8/10	16.42
8/11	15.54
8/12	14.96
8/13	13.93
8/14	12.90
8/15	12.17
8/16	11.58
8/17	10.41
8/18	9.68
8/19	8.65
8/20	7.92
8/21	7.33
8/22	6.89
8/23	6.45
8/24	5.57
8/25	5.28
8/26	4.84
8/27	4.55
8/28	4.11
8/29	3.81
8/30	3.52
8/31	3.08

Day	Pct.
9/1	2.93
9/2	2.79
9/3	2.05
9/4	1.32
9/5	0.73
9/6	0.29
9/7	0.29
9/8	0.29
9/9	0.29
9/10	0.15
9/11	0.00

APPENDIX 3

Frequency Distribution for Amarillo's 100-Degree Days per Year

Examples: 33 years have had no 100-degree days, 21 years have had one 100-degree day, 8 years have had two 100-degree days, etc.

Number of 100° Days	Frequency	Relative Frequency
0	33	0.25581395
1	21	0.1627907
2	8	0.0620155
3	7	0.05426357
4	9	0.06976744
5	6	0.04651163
6	7	0.05426357
7	4	0.03100775
8	5	0.03875969
9	2	0.01550388
10	5	0.03875969
11	1	0.00775194
12	5	0.03875969
13	2	0.01550388
14	4	0.03100775
15	2	0.01550388
16	1	0.00775194
17	1	0.00775194
18	0	0
19	1	0.00775194
20	0	0
21	0	0
22	1	0.00775194
23	1	0.00775194
24	1	0.00775194
25	0	0

Number of 100° Days	Frequency	Relative Frequency
26	1	0.00775194
27	0	0
28	0	0
29	0	0
30	0	0
31	0	0
32	0	0
33	0	0
34	0	0
35	0	0
36	0	0
37	0	0
38	0	0
39	0	0
40	0	0
41	0	0
42	0	0
43	0	0
44	0	0
45	0	0
46	0	0
47	0	0
48	0	0
49	0	0
50	1	0.00775194

APPENDIX 4

Frequency Distribution for the number of Occurrences of Daily Highs

Example: During the 129-year period of record, Amarillo has experienced a daily high of 104° a total of 54 times.

T (°F)	f(T)
100	244
101	127
102	127
103	61
104	54
105	28
106	20
107	11
108	6
109	2
110	1
111	1