A Look at Amarillo's Annual and Monthly Snowfall Totals

By Robert Ashcraft

I looked at Amarillo's annual and monthly snowfall totals by accessing the NOAA Online Weather Data (NOWData) website. For some reason the data are complete only back to 1931.

Since the snowfall for a given season begins in the fall and ends in the following spring, it is necessary to use two years to describe the season. For example, the first season of recorded snowfall occurred in 1931 - 1932.

Summary Statistics

	Total	Average	Maximum
Sep	0.3	0.003	0.3
Oct	26.1	0.293	5.5
Nov	170.6	1.917	13.8
Dec	277.2	3.115	21.2
Jan	356.8	4.009	15.9
Feb	326.3	3.666	25.6
Mar	228.4	2.595	21.5
Apr	58.5	0.657	6.9
May	7.4	0.083	4.7
Annual	1451.6	16.310	47.9

This table shows summary statistics for the monthly and annual snowfall totals. All numbers in the table are in inches.

During the 89 winter seasons, Amarillo has received snowfall as early as September and as late as May. It has snowed only once in September; 0.3 inches occurred in 1984. It has snowed only three times in May; 2.2 inches in 1935, 0.5 inches in 1978, and 4.7 inches in 2005.

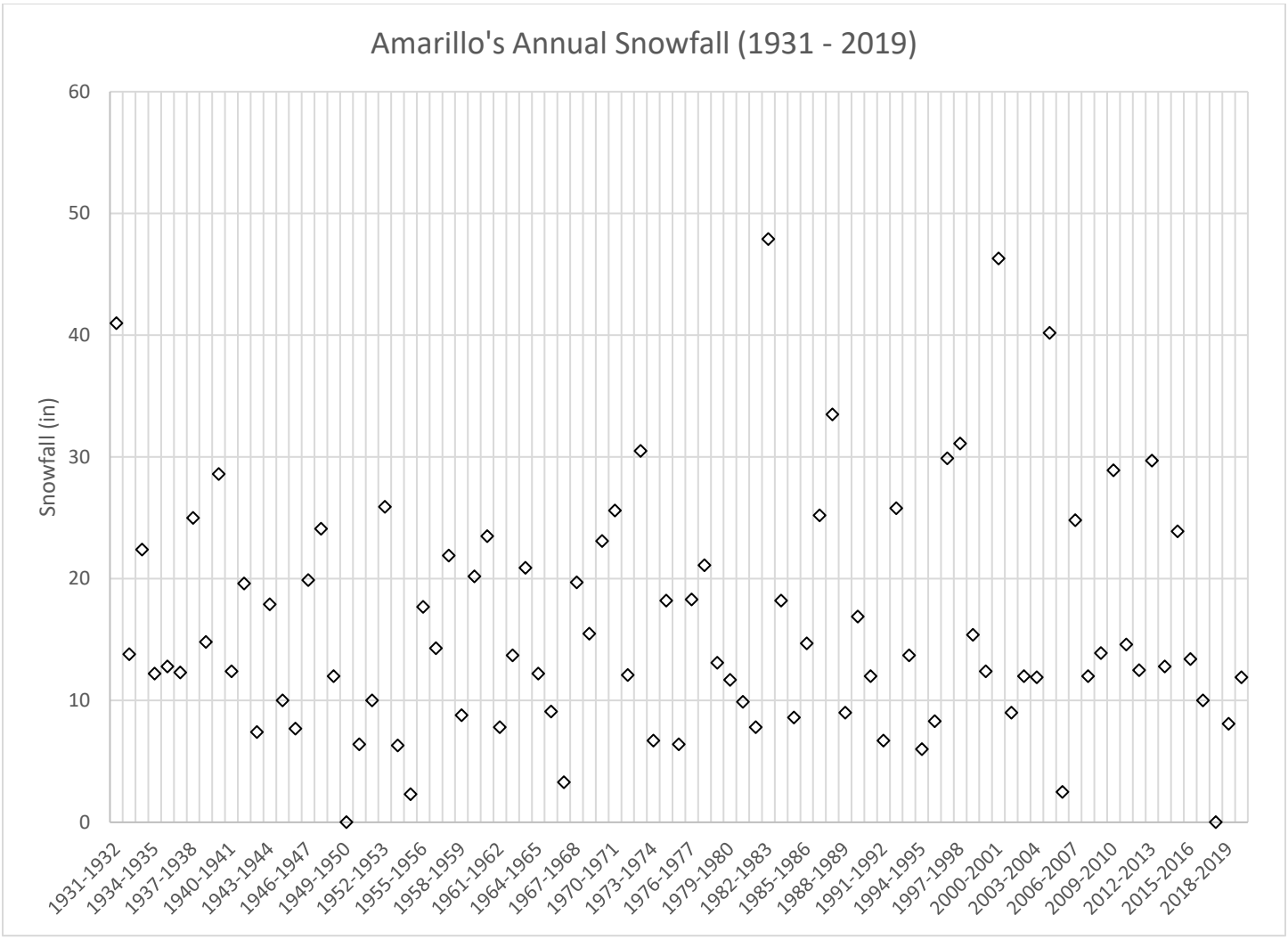
Overall, Amarillo has received a total of 1451.6 inches of snow (nearly 121 feet!), for an average of 16.310 inches per season. Extremes reported over the seasons range from 0 inches in 1949 – 1950 and 2017 - 2018 to 47.9 inches in 1982 - 1983.

The most snow has occurred during the months of January, but the most snow for a single month (25.6 inches) occurred in February of 2013.

Time Series Plot

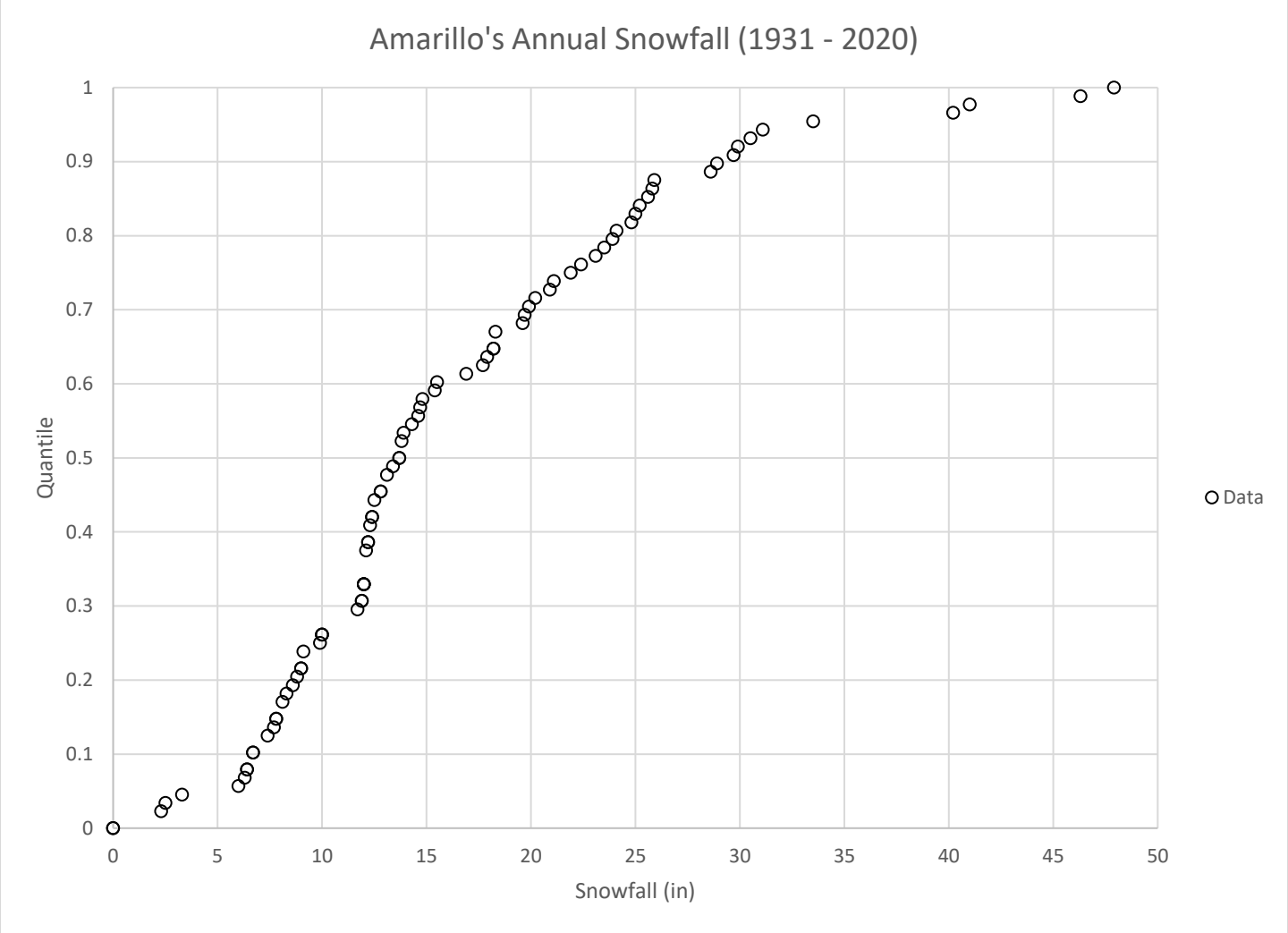
The following time series plot shows no trend in the annual snowfall totals. The top ten seasons for snowfall have been

1982 - 1983 47.9 inches
2000 - 2001 46.3 inches
1931 - 1932 41.0 inches
2004 - 2005 40.2 inches
1987 - 1988 33.5 inches
1997 - 1998 31.1 inches
1972 - 1973 30.5 inches
1996 - 1997 29.9 inches
2012 - 2013 29.7 inches
2009 - 2010 28.9 inches



Cumulative Distribution Regression

After sorting the annual snowfall totals, I was able to calculate the quantiles for each season, resulting in a cumulative distribution. Here is a plot of the cumulative distribution:



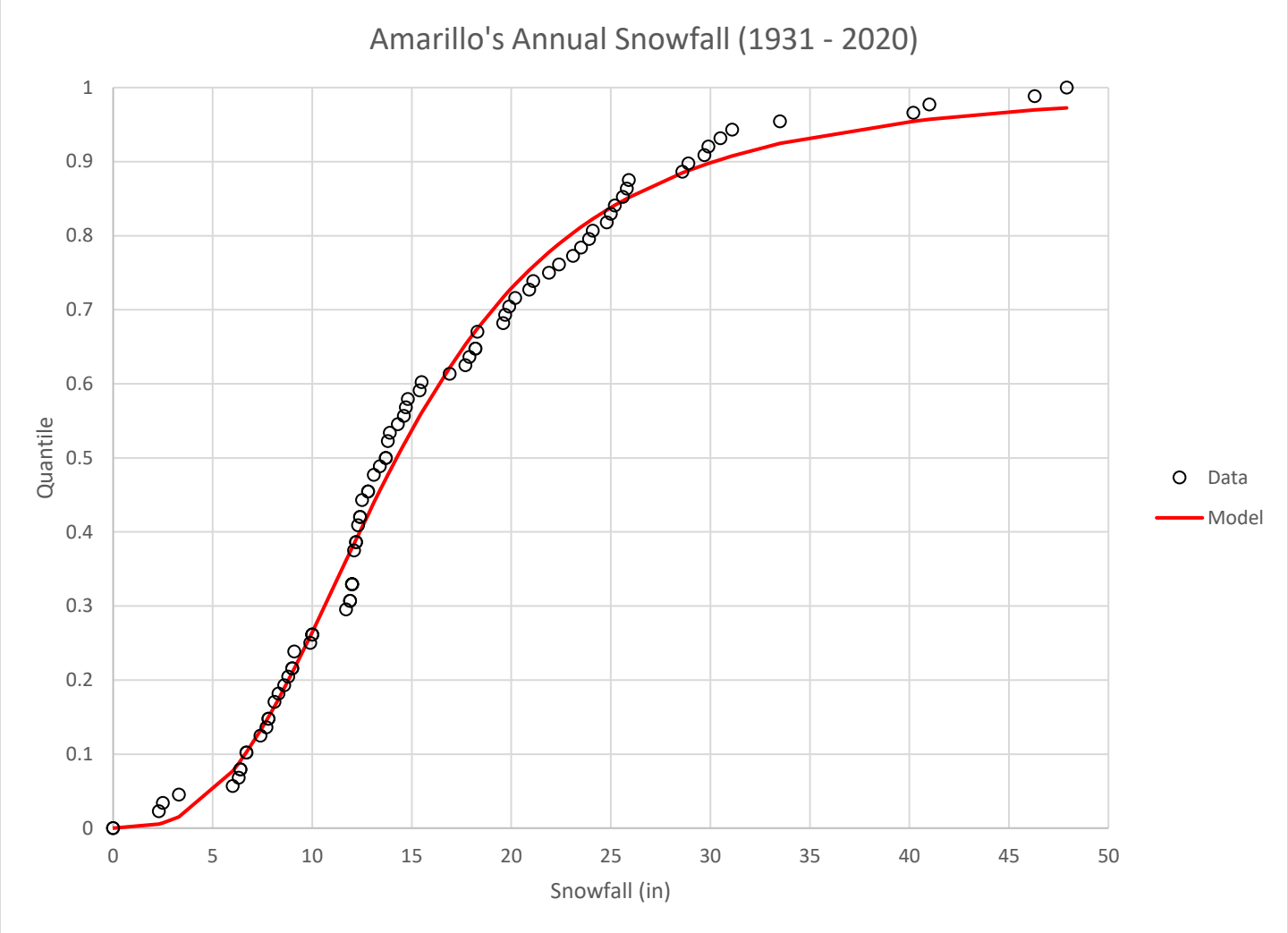
The data points tend to be irregular and have gaps, so a smooth curve might not provide a good fit. The model chosen for these data is

$$Q = \frac{1}{1 + exp\left(\frac{\alpha - x^{\gamma}}{\beta}\right)}$$

Q is the quantile, x is the annual snowfall total in inches, and α, β, and γ are the regression parameters. The parameters are

$\alpha = 1.0609801$
$\beta = 0.0081516$
$\gamma = 0.0222811$

The R^2 value for the model is 0.9911690, i.e., the model accounts for 99.12% of the variation in the quantiles. Here is a plot of the data with the resulting regression model.



The end (until next season).