

## **Lake Havasu City 2017 Weather Summary**

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### **Introduction**

2017 was the third warmest year on record globally and in the United States and the warmest in Arizona's history. Unlike 2016 when the Lake Havasu City area temperatures were nominal with no monthly averages breaking either warmest or coolest records, one month (June) in 2017 marked record high temperature average and three months (February, July, and November) highest recorded low temperature averages. June temperatures reached as high as 125.4°F at the Fire Station #5 weather station, less than 3°F below the all-time record of 128°F set in 1994, and seven days over 120°F, the most since 1995. There were no days below freezing and no snow anywhere. Total rainfall was at or just above the 4.12" average. Details of this year's weather are given below.

### **Temperatures**

Lake Havasu City's 2017 mean temperature was 76.78°F over 5 stations, 0.42°F higher than last year's average mean (76.36°F) and 1.99°F higher than the city's 40-year average of 74.79°F. The 2017 high temperature average was 87.91°F compared to the 40-year average of 86.77°F, while the 2017 low temperature average was 65.66°F compared to 62.82°F for the 40-year average.

Fifteen official record temperatures (those reported to the National Weather Service from the Operations Maintenance Facility on London Bridge Road) were reported in 2017, eight daily record highs, four ties for high temperatures, four record daily lows, and no ties for record lows (Table 1). Unofficially, ten other record high temperatures, variously reported from the Fire Station #5 station (FS#5), the Airport station, the City Hall Station, and South Lake Havasu (SLHC), were reported with the highest temperature of the year at 125.4°F at FS#5 on June 20<sup>th</sup> (123°F averaged over all stations). This is the third highest recorded temperature in the City's history. There were also two high temperature ties for record, both at FS#5.

Monthly temperature averages in 2017 also broke records, including three months with record highest average low temperatures (February (52.66°F), July (89.22°F), and November (57.26°F)) and one month, June, with record high temperature (109.04°F). Three individual stations (FS#5, City Hall and the Airport) averaged over 90°F, the first time in history. Other months above the 40-year normal for average high temperatures (Table 2) include February, March, April, July,

Table 1: Record and tied-record temperatures reported in 2015.

Date	Temperature	Previous Record	Weather Station	Comments
2/10/17	82°F - Unofficially 84°F at FS#5	Tied	OMF	Daily high temp.
4/1/17	46.1°F	47°F in 1995	SLHC	Unofficial record daily low temp.
5/4/17	106°F	Tied unofficially	FS#5	Daily high temp.
5/5/17	108°F	Tied unofficially	FS#5	Daily high temp.
6/11/17	66°F	68°F in 2008	OMF	Daily low temp
6/12/17	61°F	67°F in 2008	OMF	Daily low temp
6/13/17	65°F	66°F in 1998	OMF	Daily low temp
6/14/17	66°F	69°F in 1998	OMF	Daily low temp
6/17/17	116.3°F	115°F in 1985	FS#5	Unofficial Record daily high
6/18/17	119.7°F	118°F in 1985	FS#5	Unofficial Record daily high
6/19/17	119°F – Unofficially 123.3°F @ FS#5	118°F in 1999	OMF	Daily high temp. Unofficial Record daily high
6/20/17	122°F - Unofficially 125.4°F @ FS#5	Tied	OMF	Unofficial Record daily high
6/21/17	119°F – Unofficially 112.9°F @ FS#5	117°F in 1981	OMF	Record daily high temp. Unofficial Record daily high
7/7/17	120°F – Unofficially 122.9°F @ FS#5	119°F in 1994	OMF	Record daily high temp. Unofficial Record daily high
11/22/2017	88°F	84°F in 2002	OMF	Record high daily temp.
11/23/2017	85°F – Unofficially 86.4°F @ Airport	84°F in 1995	OMF	Record high daily temp. Unofficial Record daily high
11/24/2017	83°F – Unofficially 86°F @ SLHC	82°F in 1995	OMF	Record high daily temp. Unofficial Record daily high @ 3 stations
11/25/2017	85°F	81°F in 1995	OMF	Record high daily temp.

11/26/2017	83°F - Unofficially 86.3°F @ SLHC	Tied	OMF	Unofficial Record daily high @ 3 stations
11/27/2017	82°F	76°F in 1998	OMF	Record high daily temp.
12/3/2017	80°F – Unofficially 81°F @ City Hall	Tied	OMF	Unofficial Record daily high

Table 2: Lake Havasu City average monthly high and low daily temperatures and the average daily temperature range within the past 10 years and for the entire 40-year record keeping period. Included are the mean temperatures over both time frames.

10-year monthly averages				40-year monthly averages		
Month	High Temp	Low Temp	Temp Difference	High Temp	Low Temp	Temp Difference
January	65.48	44.90	20.58	65.12	44.30	20.81
February	71.31	48.48	22.83	70.29	47.72	22.57
March	79.54	54.94	24.60	77.89	53.52	24.36
April	85.61	61.05	24.56	85.91	60.18	25.73
May	93.58	69.81	23.77	95.31	69.48	25.83
June	105.80	80.52	25.28	105.55	78.25	27.30
July	108.16	87.18	20.99	109.35	85.19	24.17
August	106.28	85.11	21.18	107.40	84.04	23.35
September	101.31	77.44	23.87	98.75	74.36	24.38
October	88.77	64.62	24.15	88.74	63.60	25.13
November	75.56	52.59	22.97	74.33	51.57	22.76
December	63.87	44.81	19.06	62.59	42.65	19.94
ANNUAL	87.11	64.29	22.82	86.77	62.91	23.86

10-year Mean Temperature

**75.70**

40-year Mean  
Temperature

**74.84**

October, November, and December. Every month in 2017, except May, experienced average low temperatures above the 40-year low temperature average for each month. The average elevated departure among those months was 3.17°F, with November having the most separation at 5.75°F.

The first 100°F day this year was on April 23<sup>rd</sup> (100.4°F at FS#5) and the first temperature at or above 110°F was on June 3<sup>rd</sup> (111.3°F at FS#5). There were 117 days at or above 100°F (113 days at OMF and 115 days at FS#5); however, 67 of those days were at or above 110°F, and seven days at or over 120°F (the most since 1994). There were officially only 2 days with low temperatures below 40°F (at OMF) and 10 days at SLHC, with the lowest temperature of the year at 34.5°F on January 26<sup>th</sup>.

On the other side of the coin, there were 22 days with overnight official lows above 90°F and none at or above 95°F. Unofficially, overnight lows at FS#5 included 33 days at or above 90°F and 2 days above 95°F, the City Hall weather station recorded the highest low temperature of the year at 97.0°F on August 28<sup>th</sup>, which was also the warmest overnight low averaged over all stations (94.3°F). High and low temperature relationships for 2017 and comparisons with 10 and 40-year averages along with daily records are given in Figures 1 and 2. Figures 3 and 4 show 40-year historic trends for number of days above or below specified temperatures and the highest and lowest daily temperature of each year. The most significant trends occur in Figures 2 and 4, with rising daily low temperatures almost year round and the number of days above 90°F for low temperatures, respectively.

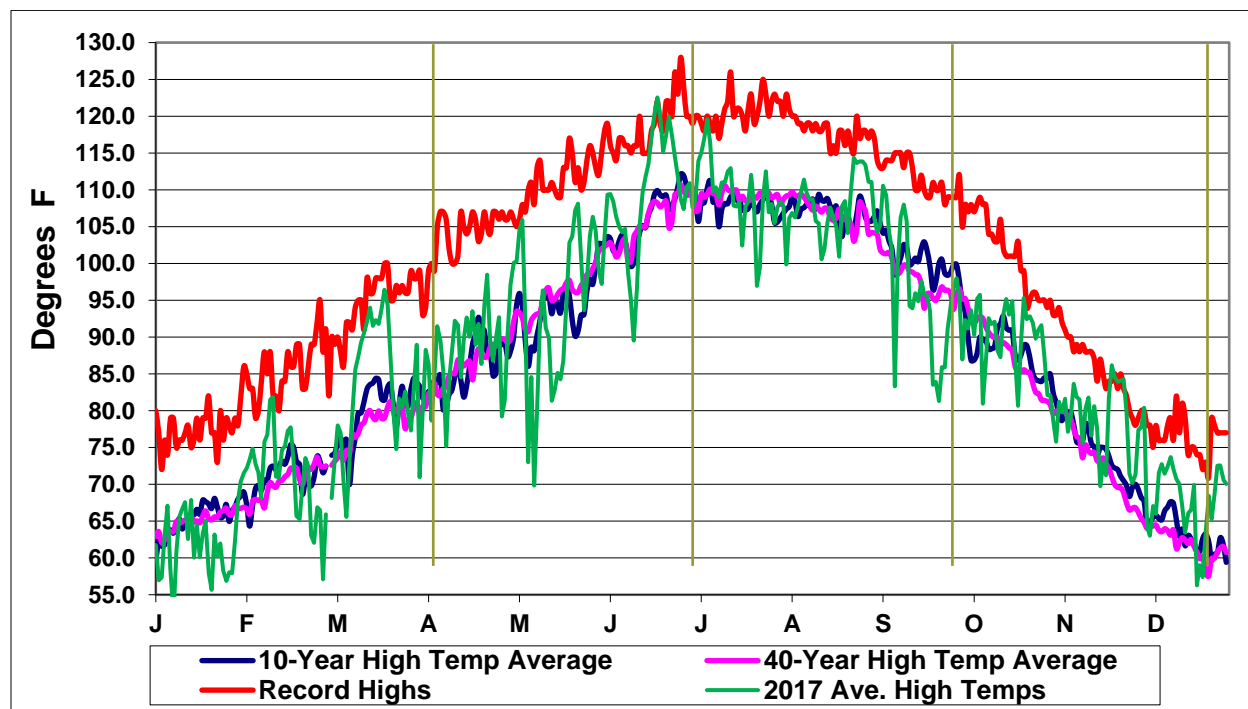


Figure 1: High daily temperatures for 2016 and comparison with 10 and 39 year averages and record high temperatures.

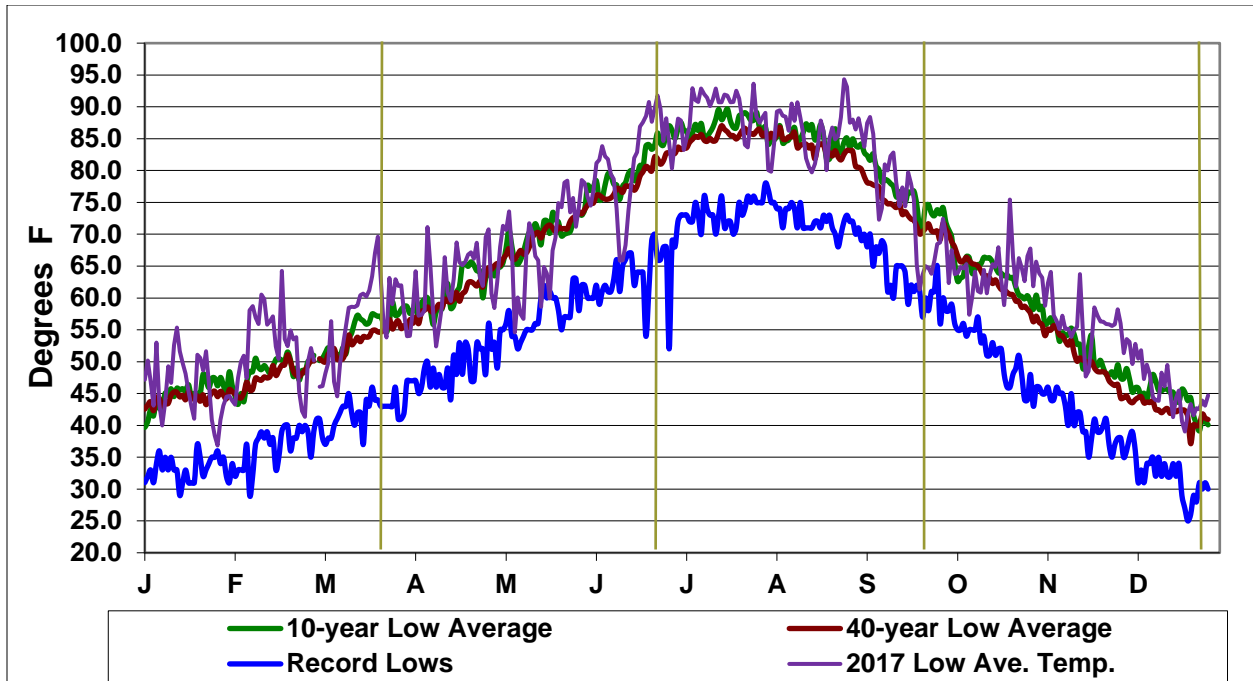


Figure 2: 2017 low daily temperatures and comparisons with 10 and 40 year averages and record daily low temperatures.

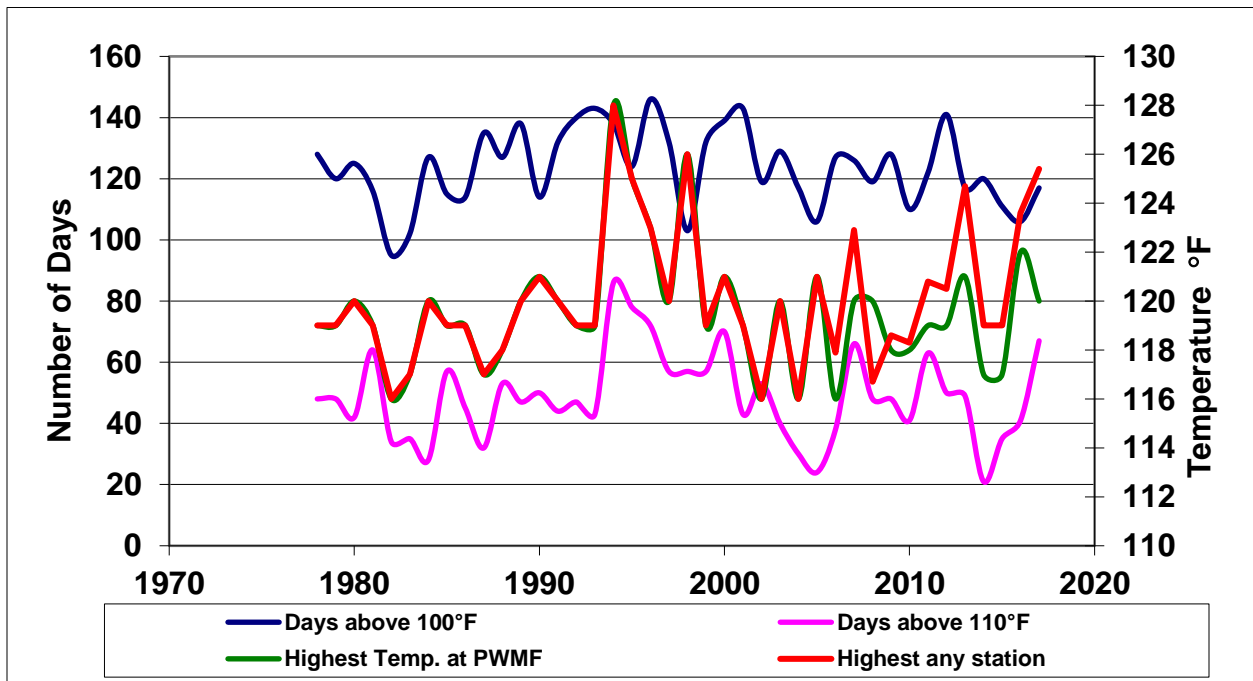


Figure 3: 40-year historical trends for number of days above 100°F, above 110°F, official highest yearly temperature, and unofficial highest yearly temperature.

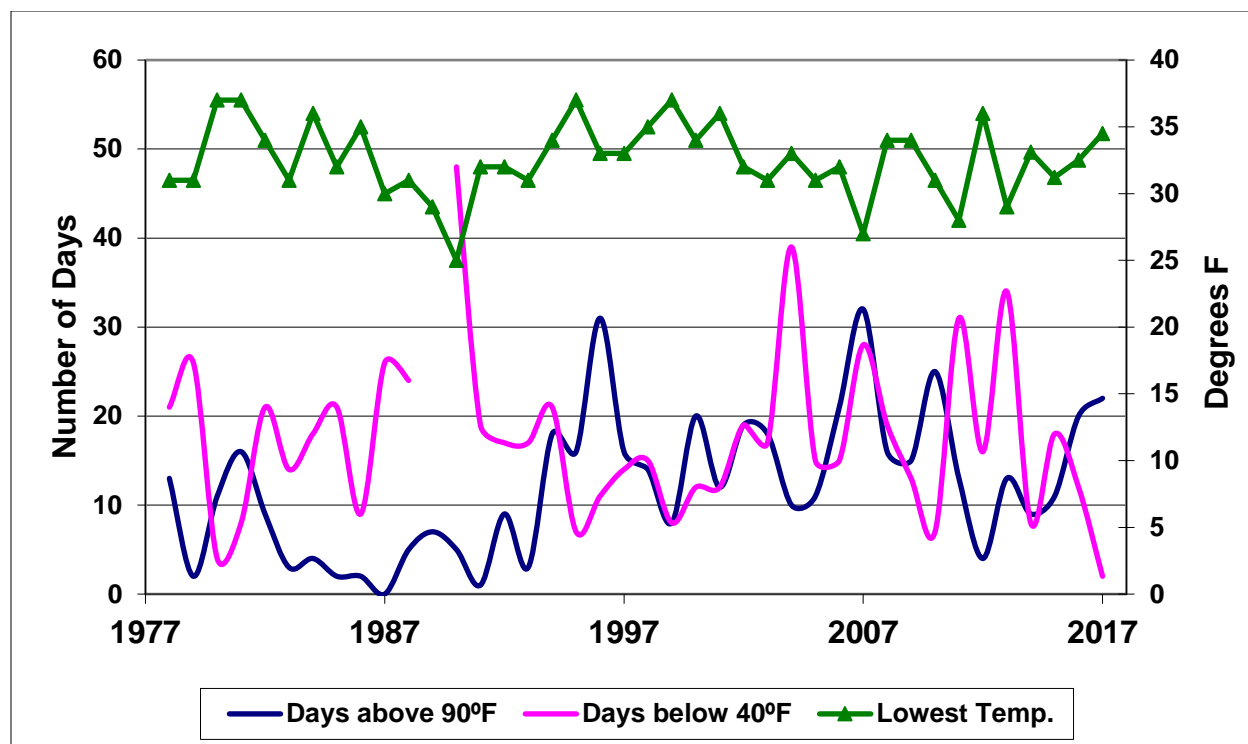


Figure 4: 40-year historical trend of number of days below 40°F, number of days the lowest daily temperature was above 90°F, and the official lowest temperature of the year.

As in other years, cold fronts passed through the area in the afternoon or evening such that the lowest daily temperature would occur just before mid-night, followed quickly by the lowest temperature of the next day only a few hours later. This phenomenon was quite common in 2017 as it happened 3 times in January and once each in March, April, May, July, August, September, October, November, and December.

April provided an odd cool to warm to cool low daily temperature cycle on successive days with two cold fronts (troughs) passing through, as overnight low temperatures increased from the upper 50's on April 6<sup>th</sup> to the lower 70's on the 7<sup>th</sup> and down to the mid 60's (near mid-night) on the 8<sup>th</sup>. May provided typical rapid heating trends (23°-24°F high daily temperature increase over 5 days) experienced in the spring as an existing low pressure trough (cold front) leaves and high pressure settles over the area (May 19<sup>th</sup> – 24<sup>th</sup> – Figure 5)

A late summer cold front passed through on September 9<sup>th</sup>, dropping temperatures by 20°F from the day before (103°F to 83°F at OMF). The cool air did not last long as the high temperature for the next day shot back up 17°F.

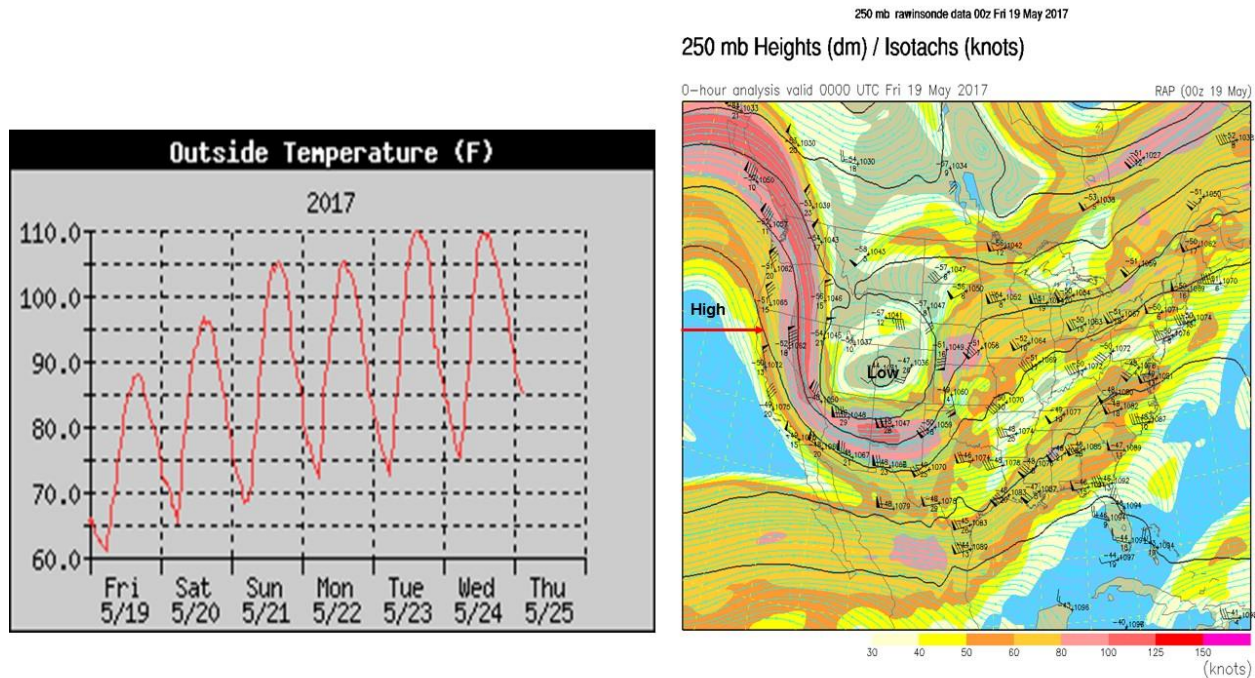


Figure 5: Rapid high daily temperature heating trend over LHC during mid-May of almost  $25^{\circ}\text{F}$  as a cold front (Low) passes through, paving a way for an entering High pressure ridge (250mb pressure map).

Lastly, June is usually one of the most diverse months for high to low daily temperatures and can show rapid increases in temperature as the sun moves to its solstice (highest point) position in the sky. The seven-day temperature trend leading to the highest yearly temperature at FS#5, along with the barometer trend are illustrated below (Figure 6). Just within this short period, there was a  $50^{\circ}\text{F}$  difference between the high ( $125.4^{\circ}\text{F}$  on the 20th) and low ( $75.3^{\circ}\text{F}$  on the 16<sup>th</sup>) daily temperatures.

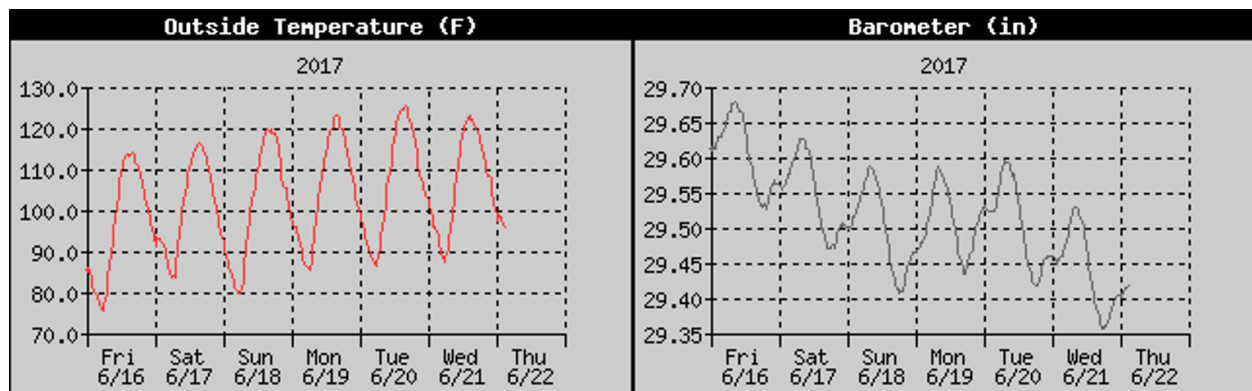


Figure 6: Mid-June warm-up to the highest temperature of the year recorded at FS#5 ( $125.4^{\circ}\text{F}$ ) and the corresponding downward trend of the air pressure.

## Precipitation

Rain was scarcer in 2017 than in 2016. Two out of the five stations used for temperatures and other parameters just surpassed the 47-year average of 4.21", OMF at 4.32" and South Lake Havasu City at 4.59". The average annual rainfall over the five stations was 3.99". Five months did not record any rainfall, including April, June (no surprise there), October, November, and December, and just a few hundredths of an inch in March and July. January, February and September were the rainiest months, closely followed by August. The rainfall amounts for each month of 13 rain gauges in the Lake Havasu City area are given in Table 3. Eight rain gauges beyond the five weather stations used in this report are operated and maintained by the Mohave County Flood Control District. Note that the higher elevations of the Mohave Mountains have the propensity to accumulate more rainfall (e.g. Crossman Peak gauge = 6.18"), primarily due to orographic lifting of moist air that cools and condenses water vapor into water droplets. The zero rain amount for August at the Pittsburg Mine gauge in the Mohave Mountains foothills may not be correct as all other stations recorded rainfall, yet this is during the monsoon season and scattered thundershowers can be very spotty.

Table 3: 2017 Precipitation monthly totals (in inches) for 14 rain gauges in the Lake Havasu City area. Note that the rainfall amount for May at FS#5 is unavailable and the rain amount at Pittsburg Mine in August may not be correct.

Elevations	472'	503'	1057'	730'	716'	4688'	2410'	1260'	682'	675'	605'	2395'	1045'	1556'
	PWMF (OMF)	LHCFS	SLHC	City Hall	Airport	Crossman Peak	Pittsburg Mine	Horizon Six	Desert Hills	Crystal Beach	North Havas	Ram Peak	Castle Rock Wash	Mohave Mtns.
January	1.80	1.48	2.05	1.58	1.69	2.13	2.13	1.85	1.66	1.7	1.49	1.42	1.73	1.57
February	0.97	0.89	0.97	0.82	0.78	2.28	1.65	0.9	0.74	0.78	0.75	0.67	0.63	0.67
March	0.02	0.04	0.06	0.04	0.04	0.16	0.20	0.00	0.00	0.00	0.00	0.11	0.00	0.08
April	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
May	0.14	0.15	0.21	0.16	0.13	0.35	0.16	0.16	0.08	0.12	0.12	0.24	0.16	0.20
June	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
July	0.06		0.02	0.00	0.08	0.00	0.00	0.00	0.40	0.08	0.00	0.00	0.04	0.00
August	0.39	0.52	0.51	0.47	0.59	0.16	0.00	0.63	0.12	0.43	0.12	0.04	0.94	0.16
September	0.94	0.88	0.77	0.55	0.74	1.10	0.47	0.79	0.91	0.28	0.78	0.94	0.51	0.43
October	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	4.32	3.96	4.59	3.62	4.06	6.18	4.61	4.33	3.91	3.39	3.26	3.42	4.01	3.11



## Humidity-Dew Point Temperatures and Monsoon

Unlike 2015 and 2016, dew point temperatures dipped near or below 0°F a few times in April, May and June with the lowest recorded dew point temperatures between -11.5°F and -12.2°F from 3:00-6:30pm on June 27<sup>th</sup> at the SLHC station. These dew points happened during this station's daily high temperature of 110.2°F and the relative humidity during this time was 1%. Summer humidity arrived with a spike around June 23<sup>rd</sup>, but did not last long (Figure 7). The monsoon season really started approximately July 5<sup>th</sup> and held a pretty tight grip over our area until about September 22<sup>nd</sup> when a cold passed through (Figure 8). There was only temporary respite for a couple of days (August 14-16<sup>th</sup>), otherwise the elevated humidity was consistent. A difference this year from many previous years is that the start and end of the monsoon season was fairly sharp. Most years, the end of the season is quite ragged.

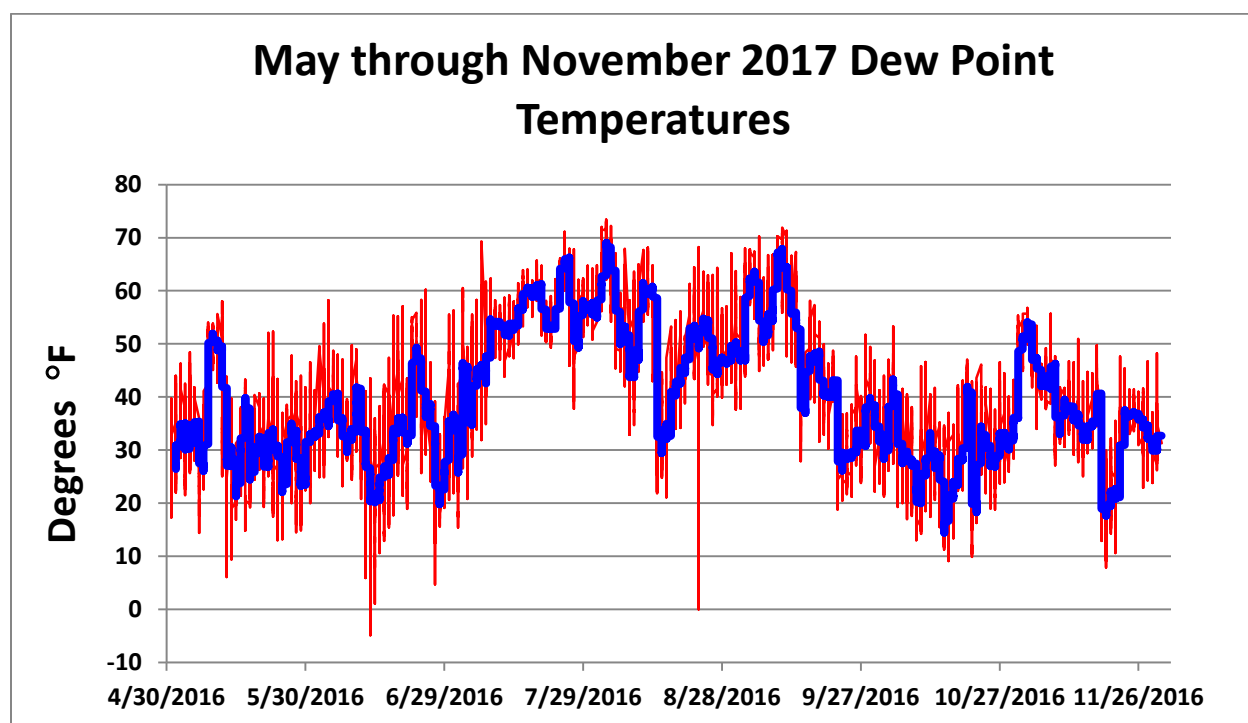


Figure 7: Dew point temperatures from May through November, 2017 from Fire Station #5 weather station. The blue bold line is the daily dew point temperature average, which more clearly illustrates the overall humidity level. The dew point spike in early November is related to a cold front.

250 mb rawinsonde data 00z Mon 25 Sep 2017

**250 mb Heights (dm) / Isotachs (knots)**

0-hour analysis valid 0000 UTC Mon 25 Sep 2017

RAP (00z 25 Sep)

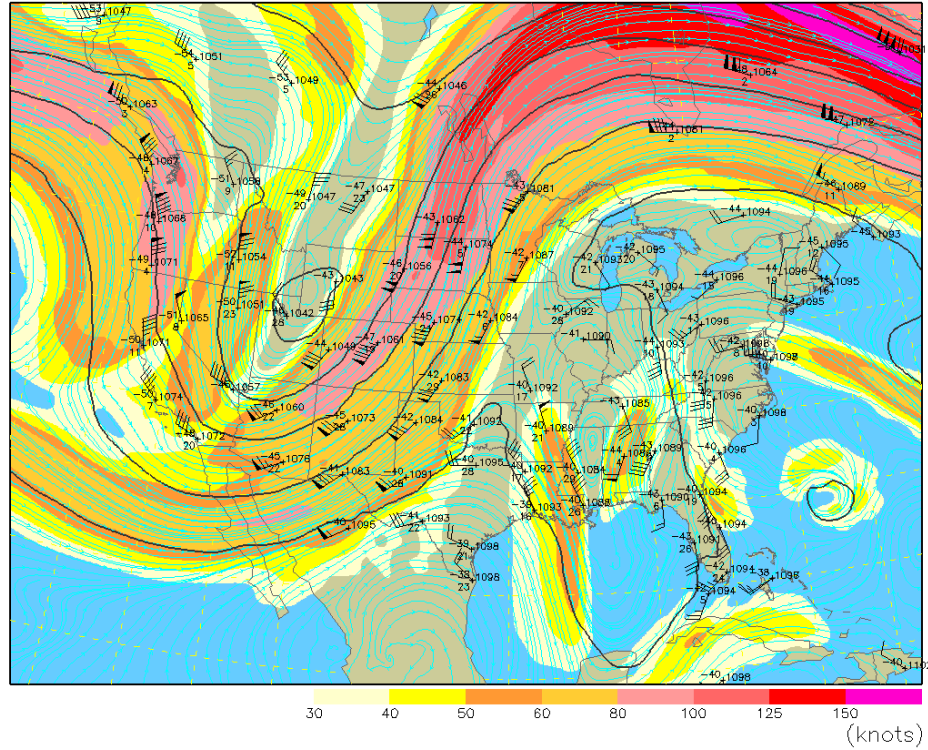


Figure 8: 250 mb air pressure map (represents the upper troposphere) for September 25<sup>th</sup> showing a very large low pressure trough and associated cold front (leading edge of the “U” shaped lines) that passed through LHC 1-2 days earlier. This front blew out humid monsoonal flow from the south.

## Peak Winds

Peak wind averages over four stations (FS#5, SLHC, City Hall, and Airport) were almost the same as in 2016 at 9.37 mph (Table 4). July was the windiest month this year, followed by May and April, averaging 11.65, 11.13, and 10.51 mph, respectively. The airport station continues to show that that area is the windiest every month. The highest peak wind gust recorded at the station was 68 mph on July 8<sup>th</sup> during a monsoonal thunderstorm. This is the highest wind gust recorded since records started in 2007. Gusts of 57 and 55 mph were also recorded at that station in March and August, respectively. The July high wind event was interesting in that the gust front along with large temperature drops from the storm could be tracked from station to station:

- From 7:00-7:30pm the temperatures at FS#5 dropped from 114.5°F to 97.1°F and further to 94°F a half hour later. The peak winds during this interval were 46mph and sustained gusts to 34 mph until mid-night. Daily low temperature at this station was 92.7°F at 11:30pm.

- The airport station also recorded the 68 mph peak winds at 7:30pm with 28-49 mph gusts thereafter until 10:00pm. A 10 °F temperature drop from 112.3°F to 102.3°F occurred between 7:30-8:00pm and a second notable temperature drop of 10 °F + occurred between 9:30-10:00pm (the daily low temperature at that station was 90.9°F at 11:00pm).

- The South LHC station first noted the storm's effects at 7:30-7:45pm with winds picking up quickly from 11 mph to 41 mph and they sustained in the 20 to almost 40 mph range until 10:15pm. Temperatures dropped from 109.1°F to 97°F in the first 15 minutes and further to 88.7°F at 8:15pm, the daily low temperature for the day at this station (Note that at the time of the normal daily low in the morning (5:00am), the temperature was 100°F – it would have been the highest low temperature ever recorded in Lake Havasu City).

A period in December was interesting in that sustained high winds (FS#5) occurred from 11:00pm on 12-3-17 to 11:00pm on 12-7-17 (but airport station area shorter 12/3 to 12/5). Average peak winds over that time were 23 mph at FS#5 and 24 mph at the airport station (high of 30 mph).

Table 4: 2017 monthly average of peak wind speeds for four weather stations recording wind speed. The airport monthly and annual averages are consistently higher than the other three stations.

Month	LHCFS	MCC	City Hall	Airport	ave.
January	10.19	7.73	8.98	10.74	<b>9.41</b>
February	9.03	7.78	8.18	10.03	<b>8.75</b>
March	8.84	7.59	8.30	10.80	<b>8.88</b>
April	10.44	8.90	9.65	13.04	<b>10.51</b>
May	10.81	9.51	n/a	13.06	<b>11.13</b>
June	9.60	8.97	n/a	10.81	<b>9.79</b>
July	11.91	10.36	10.96	13.36	<b>11.65</b>
August	9.62	9.05	9.19	11.13	<b>9.75</b>
September	9.33	8.19	8.77	10.71	<b>9.25</b>
October	9.21	7.38	8.46	9.94	<b>8.75</b>
November	5.96	n/a	6.12	7.05	<b>6.38</b>
December	8.66	n/a	7.68	n/a	<b>8.17</b>
Yearly Average	<b>9.47</b>	<b>8.55</b>	<b>8.63</b>	<b>10.97</b>	<b>9.37</b>

## Anatomy of a Developing Closed Low Pressure System

The southwestern United States may experience low pressure systems that can be closed or entirely cut-off from the jet stream that normally steers low pressure systems (and associated cold fronts) from west to east. Sometimes the isolated low pressure can bring in rain, but in December 2017, a slow developing closed low did not. It did form a complicated ridge (high pressure)-trough (low pressure) configuration as seen on 250 mb pressure maps (Figure 9). These maps represent that pressure at different altitudes, which is given in decameters (1 decameter = 10 meters) above the Earth's surface. The altitude difference between the dark contour lines is 10 decameters with the altitude increasing to the south.

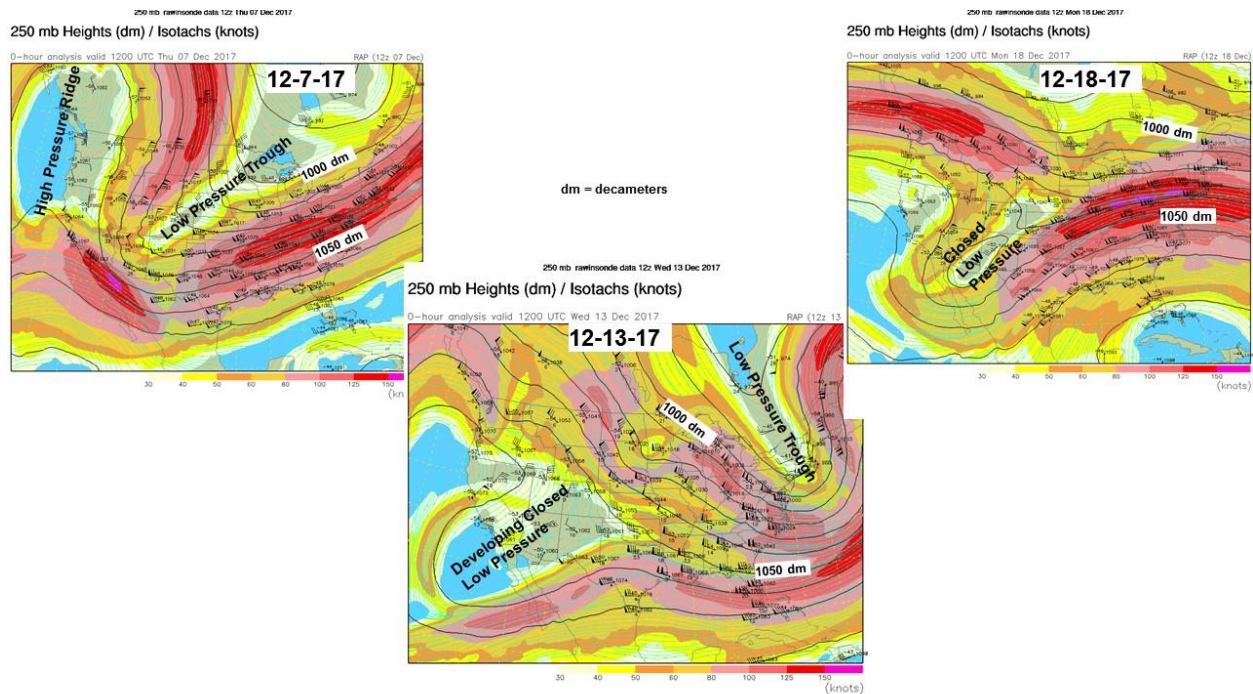


Figure 9: Three 250 mb air pressure maps showing a developing closed low pressure system over an 11-day period in December. The pink and red colors represent high wind speeds of the jet stream that occurs within this pressure regime in the upper troposphere.

### **Selected 2017 Weather in Photos**

The following are a few photos of clouds, showers, and lightning over the Lake Havasu City area in 2017.



Figure 10: January 4<sup>th</sup> fog over Lake Havasu.

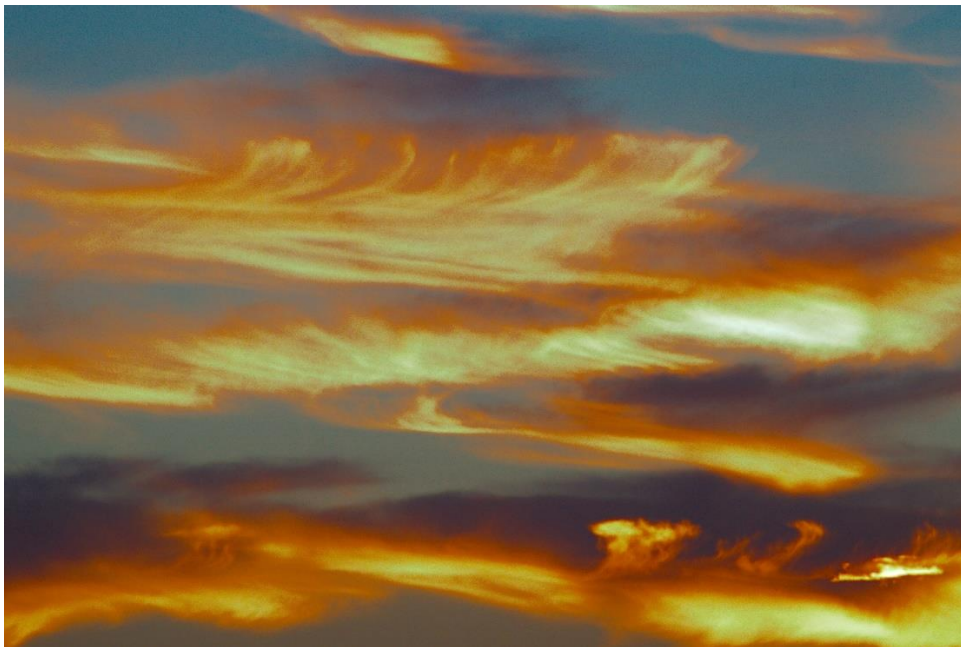


Figure 11: Feathery cirrus clouds at sunset 7-13-2017.





Figure 12: August 1<sup>st</sup> monsoonal showers from cumulonimbus cloud.



Figure 13: August 2<sup>nd</sup> monsoon thunderstorm and lightning.



Figure 14: Altostratus and heavily wind-influenced cirrus clouds at sunset 11-5-2017.



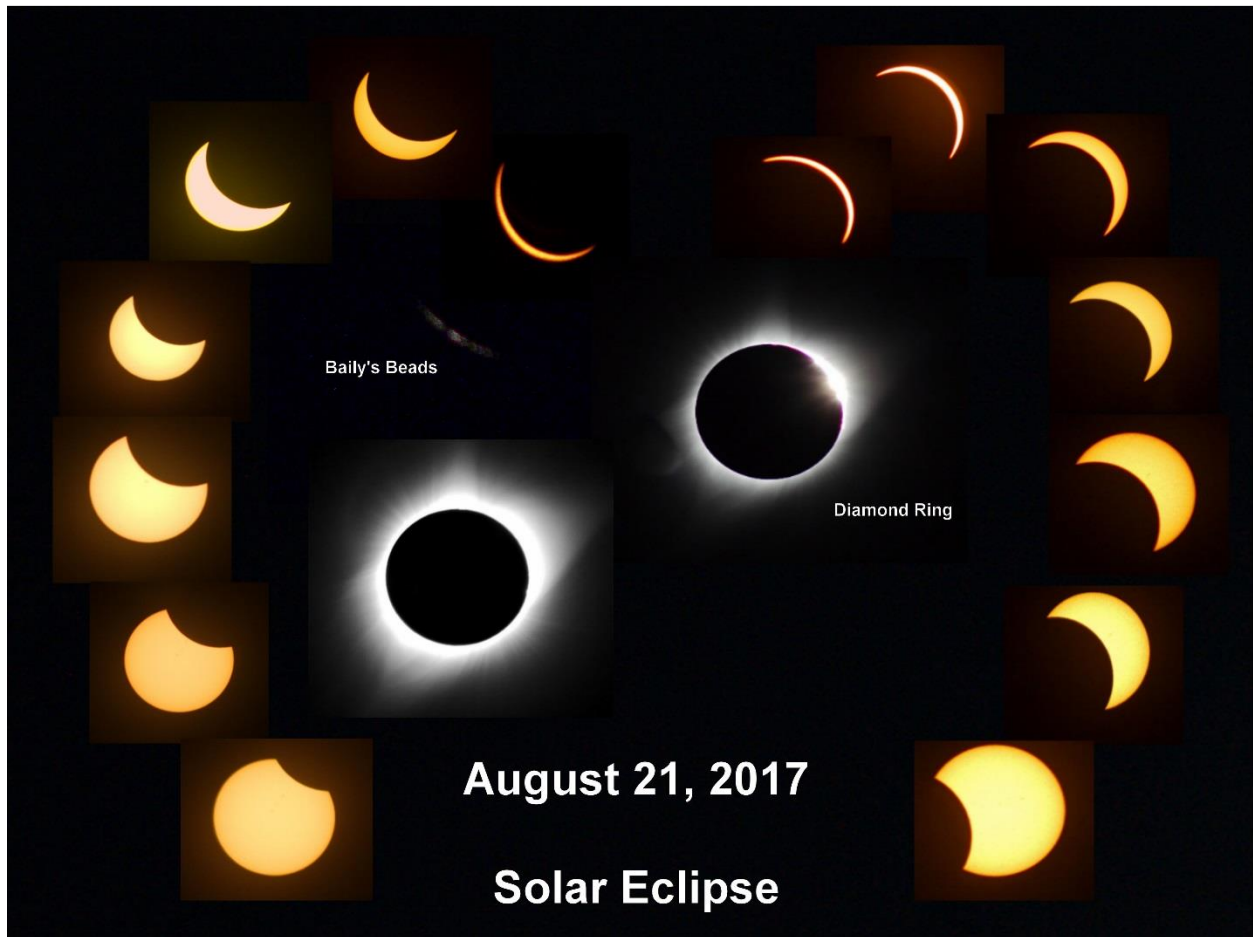


Figure 15: I know this has nothing to do with LHC weather, but this was the first total solar eclipse in the western United States in almost 100 years. These photos were taken in eastern Wyoming. Maximum coverage of the sun by the moon in the LHC area was ~60%.