



# FLORIDA KEYS

## National Weather Service Forecast Office

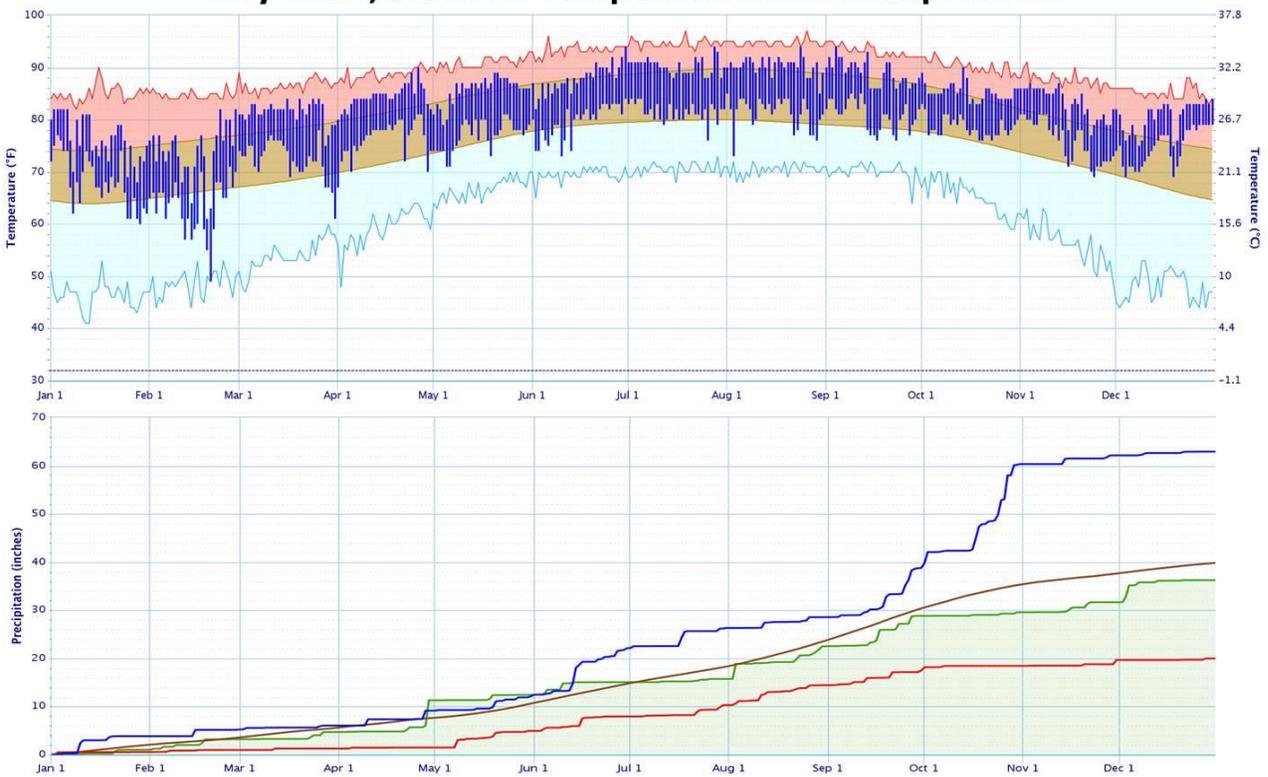


<http://www.weather.gov/keywest>

## 2015 ANNUAL CLIMATE SUMMARY

HOTTEST YEAR ON RECORD IN KEY WEST  
ABOVE AVERAGE TEMPERATURES ACROSS THE ENTIRE ISLAND CHAIN  
BELOW NORMAL PRECIPITATION OBSERVED WITH A FEW EXTREME EVENTS

### Key West, FL: 2015 Temperature and Precipitation



The image above is a graphical depiction of the daily observed temperatures (top) and the daily accumulated precipitation (bottom) for the Key West International Airport in 2015. On the top, the dark blue lines are the observed high/low temperatures, while the red/light blue areas represent the high/low temperature records. The brown shaded area in the middle is the normal high/low temperature range. On the bottom, the brown line is the normal accumulated precipitation for the year, while the light green line/area represents the 2015 observed accumulated rainfall. The blue line represents the highest annual accumulated precipitation, which was 1969, while the red line represents the lowest annual accumulated precipitation recorded in 1974.

## Synopsis

The year of 2015 is the year of record warmth across the Florida Keys and Key West. In fact, 2015 was the warmest year ever measured in Key West, surpassing the 143 years' worth of temperature records with an average temperature of 79.9 degrees Fahrenheit. This eclipsed the 30 year "normal" temperature by 2.1 degrees Fahrenheit (see "Note" below). Rainfall across the Florida Keys Island Chain was below normal for the year. However, a number of extreme precipitation events were observed, including an early December heavy rainfall event across the Upper Keys where more than 17 inches of rain fell within the first two weeks of the month.

The Automated Surface Observation System (ASOS) located at the Key West International Airport is the latest observational site for the long-term Key West climate record. This climate record of daily high and low temperatures, and precipitation spans over 143 years. No other location in the Florida Keys has such a long-running climate history. Therefore, much of the following analysis will focus on the 2015 observations at the Key West ASOS. This will insure that comparisons will be made against a robust baseline climatology that dates back to the 1870's.

**Note:** For this report, the term "normal", as used in the climate community, describes the average of a particular observation (temperature, humidity, precipitation) over a 30 year period. However, an "average" measurement may encompass a time period that is either shorter or longer than the 30 year "normal". Therefore, in this review, the term "normal" will refer to a 30 year average, and "average" will refer to other measurement timeframes – mainly annual. However, they are both averages in the mathematical sense. The "Normal Period" referred to in the rest of the review is the 30 year period between 1981 and 2010.

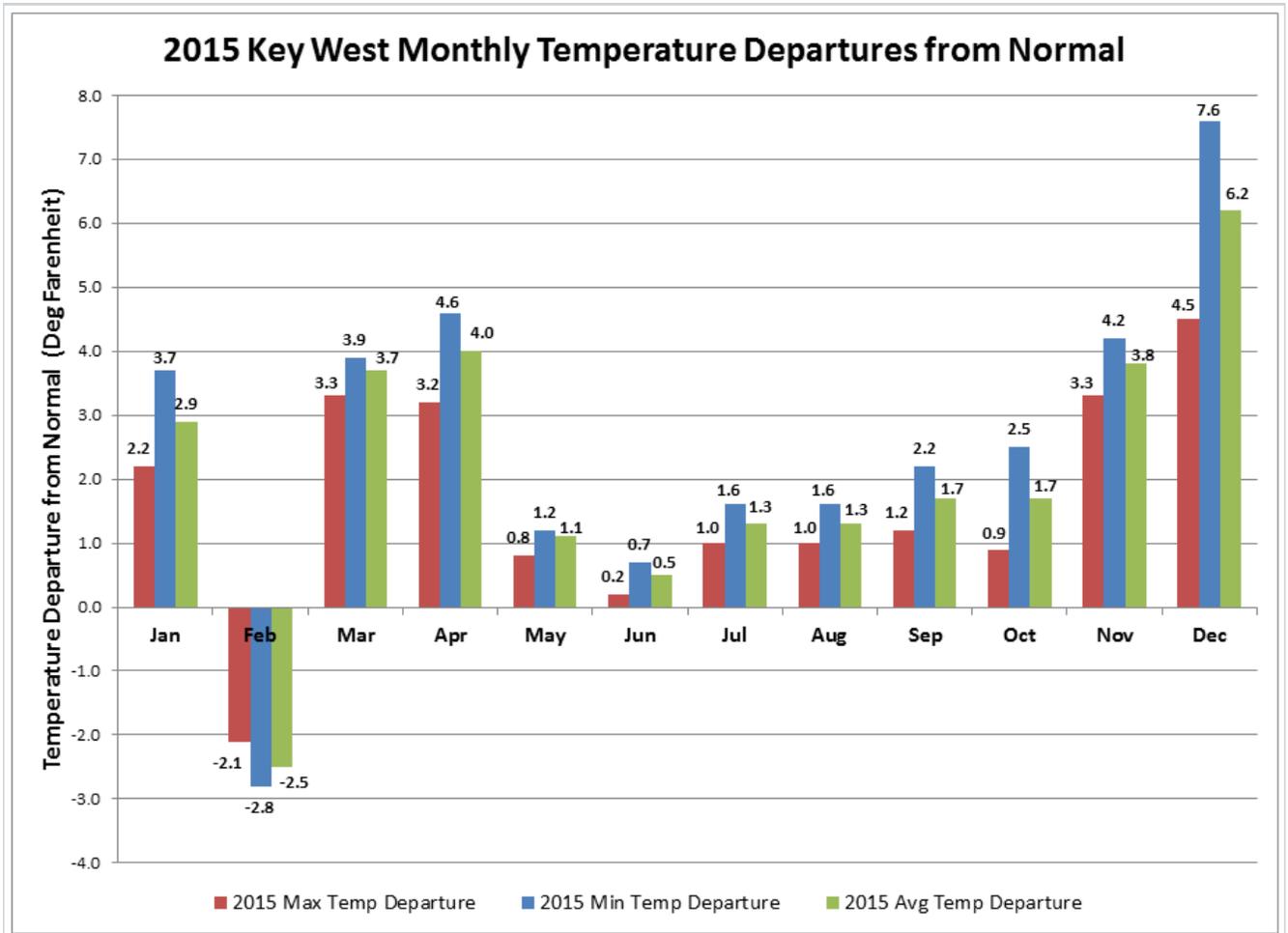
## TEMPERATURE TRENDS

The 2015 calendar year was highlighted by well above normal temperatures in Key West, seeing 64 temperature records being tied or broken. After a below normal month of February, the Spring of 2015 (March – May) was the warmest on record, coming in with an average temperature of 79.6 degrees Fahrenheit. This was followed by two top ten finishes with the 8<sup>th</sup> warmest Summer and the 2<sup>nd</sup> warmest Fall on record.

### WARM SEASONAL TEMPERATURE RANKINGS

Season	Avg Temp	Rank
Winter (DJF) (2014-2015)	71.2°	60 <sup>th</sup>
Spring (MAM)	79.6°	1 <sup>st</sup>
Summer (JJA)	85.1°	8 <sup>th</sup>
Fall (SON)	82.1°	2 <sup>nd</sup>

The temperature progression throughout the year can be visualized with the temperature departure bar graph below. The red bars indicate the Maximum Temperature Departure, the blue bars indicate Minimum Temperature Departure, and the green bars highlight the Average Temperature Departure. As you can see, a very warm period was evident for the bulk of the year when compared to the normal values. February came in as the only month to exhibit below normal temperatures.



One month that clearly sticks out above the rest is December, where well above normal temperatures were observed. Temperatures averaged an astounding 6.2 degrees above normal, which ranks as the 2<sup>nd</sup> highest temperature departure for any month dating back to 1872, falling only behind a 7.7 degree departure in January 1937 where an average temperature of 77.0 degrees Fahrenheit was measured.

Comparing how temperatures fared each month against its 143 year record in Key West, only the month of December ranked as the warmest on record in 2015 with respect to the average temperature. However, 7 of the other 11 months finished in the top 10 warmest months on record, including July through years end.

In the Florida Keys, due to being surrounded by water and limited land masses, a lot of the warmth this year was more evident in our overnight temperatures. The months of September and December finished ranked 1<sup>st</sup> with Warm Minimum Temperature records, and 5 other months landed in the top 10 rankings.

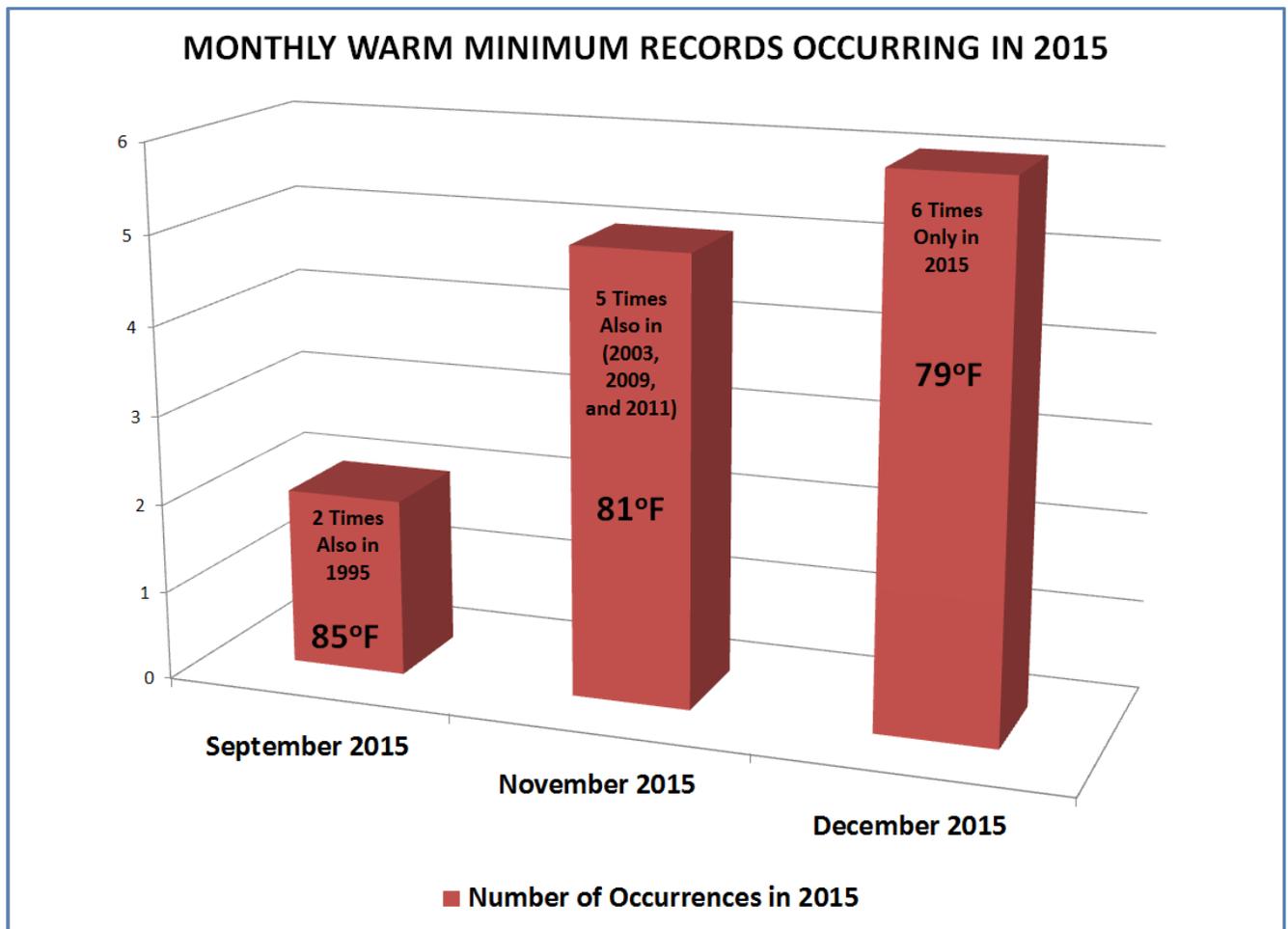
**2015 MONTHLY  
AVERAGE TEMPERATURES**

**2015 MONTHLY  
AVERAGE MINIMUMS**

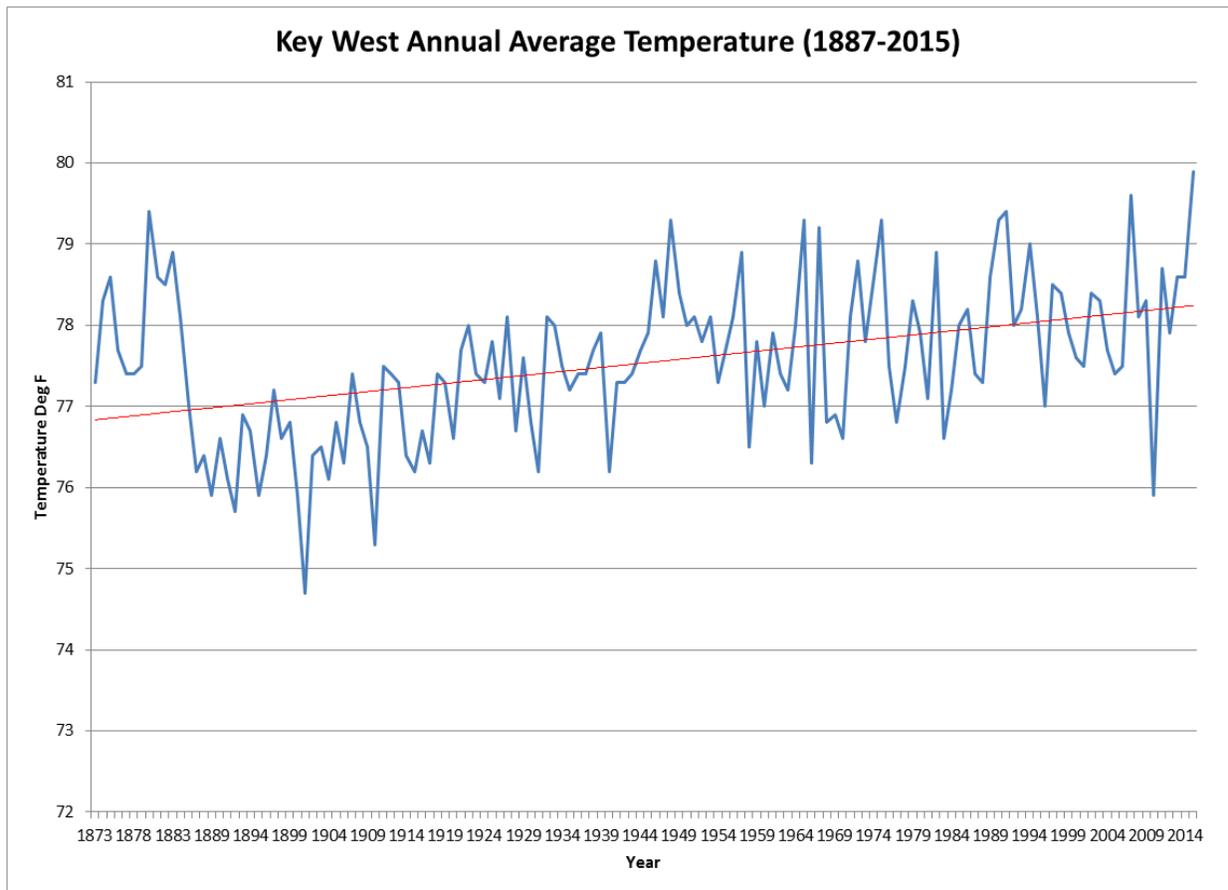
MONTH	AVG TEMP	RANK	MONTH	AVG TEMP	RANK
JAN	72.2°	32 <sup>ND</sup>	JAN	67.9°	26 <sup>TH</sup>
FEB	68.5°	108 <sup>TH</sup>	FEB	63.2°	113 <sup>TH</sup>
MAR	76.9°	10 <sup>TH</sup>	MAR	67.9°	T-12 <sup>TH</sup>
APR	80.4°	3 <sup>RD</sup>	APR	76.2°	2 <sup>ND</sup>
MAY	81.4°	T-25 <sup>TH</sup>	MAY	76.9°	19 <sup>TH</sup>
JUN	83.8°	29 <sup>TH</sup>	JUN	79.5°	T-12 <sup>TH</sup>
JUL	85.8°	10 <sup>TH</sup>	JUL	81.4°	6 <sup>TH</sup>
AUG	85.8°	9 <sup>TH</sup>	AUG	81.2°	5 <sup>TH</sup>
SEP	84.9°	6 <sup>TH</sup>	SEP	80.7°	1 <sup>ST</sup>
OCT	81.9°	T-8 <sup>TH</sup>	OCT	78.5°	3 <sup>RD</sup>
NOV	79.6°	3 <sup>RD</sup>	NOV	75.9°	2 <sup>ND</sup>
DEC	77.6°	1 <sup>ST</sup>	DEC	74.5°	1 <sup>ST</sup>

Through the year, a total of 13 Monthly Warm Minimum Temperature records were tied or set in Key West. The bar graph below shows the months of September, November, and December when these records occurred. It should be no surprise to see September and December listed, since they did rank 1<sup>st</sup> as the warmest monthly average minimum temperatures on record.

One stat that does stand out above the rest is the six times that the minimum temperature of 79 degrees Fahrenheit was measured during the month of December. Prior to 2015, a minimum temperature of 79 degrees Fahrenheit had never been recorded during the month of December, but it was achieved six out of the last seven days of the month. This was an historic streak that had never been observed in Key West.



The graph below depicts how 2015 lined up with the previous years of record in terms of the annual average temperature. As you can see, 2015 stood out above the rest as the warmest year on record, with the trend line (red) indicating the increase in temperatures over time.



**WARMEST YEARS  
IN KEY WEST**

In terms of how temperatures faired annually in Key West, 2015 was the warmest year on record as stated earlier. With an average temperature of 79.9 degrees Fahrenheit, 2015 surpassed 2007 as the warmest year on record by 0.3 degrees.

The months of November and December produced well above normal temperatures, which virtually ensured the fact that Key West would observe its warmest year ever. The Fall of 2015 was the 2<sup>nd</sup> warmest on record, followed by the warmest month of December on record.

RANK	AVG TEMP	YEAR
1	79.9°	2015
2	79.6°	2007
3	79.4°	1991
	79.4°	1880
5	79.3°	1990
	79.3°	1975
	79.3°	1965
	79.3°	1948
9	79.2°	1967
10	79.0°	1994

## DAILY RECORDS SET AT KEY WEST

As you can imagine, the overall warmth of 2015 led to dozens of daily records being tied or broken. A total of 67 records were tied or broken in 2015 at the Key West International Airport ASOS. 53 of the records were Warm Minimum Temperature records. The month of December had the majority with 15 total records, 11 of which were new warm minimum temperature records.

### Records broken or tied during 2015 at the Key West International Airport

	Maximum Temperature	Cold Maximum Temperature	Warm Minimum Temperature	Minimum Temperature	Precipitation
<b>Broke</b>	<b>2</b>	<b>-</b>	<b>31</b>	<b>1</b>	<b>3</b>
<b>Tied</b>	<b>8</b>	<b>-</b>	<b>22</b>	<b>-</b>	<b>-</b>
<b>Total</b>	<b>10</b>	<b>0</b>	<b>53</b>	<b>1</b>	<b>3</b>

Even though 2015 finished as the warmest year on record in Key West, the individual daily records did not surpass the all-time extreme values. The all-time extremes and the records for 2015 are listed in the table below. Additional daily records for 2015 can be found at the end of this review.

<u>ALL-TIME EXTREMES AT KEY WEST</u>				
Maximum Temperature (°F)	Cold Maximum Temperature (°F)	Warm Minimum Temperature (°F)	Minimum Temperature (°F)	Precipitation (inches)
97° on Jul 19, 1880 Aug 26, 1956	48° on Dec 29, 1894	87° on Jul 26, 2007 Aug 4, 2007	41° on Jan 13, 1981	22.75" on Nov 11, 1980
<u>EXTREMES DURING 2015 AT KEY WEST</u>				
Maximum Temperature (°F)	Cold Maximum Temperature (°F)	Warm Minimum Temperature (°F)	Minimum Temperature (°F)	Precipitation (inches)
94°, Jun 30*	61°, Feb 19	85°, Aug 1*	49°, Feb 20*	5.28", Apr 29
94°, Jul 28		85°, Sep 9*		
94°, Aug 24*		85°, Sep 12*		
94°, Sep 4*				
<i>* Daily record established</i>				

## RECORD WARM DECEMBER IN KEY WEST

December 2015 was the warmest December on record, exceeding the previous record by 0.8 degrees Fahrenheit. The minimum temperatures throughout the month averaged 74.6 degrees Fahrenheit, which was 7.6 degrees above normal. The minimum temperatures exhibited record values for the month, but the maximum temperatures averaged 80.6 degrees Fahrenheit, which was good enough to rank as the 3<sup>rd</sup> warmest ever in the month of December.

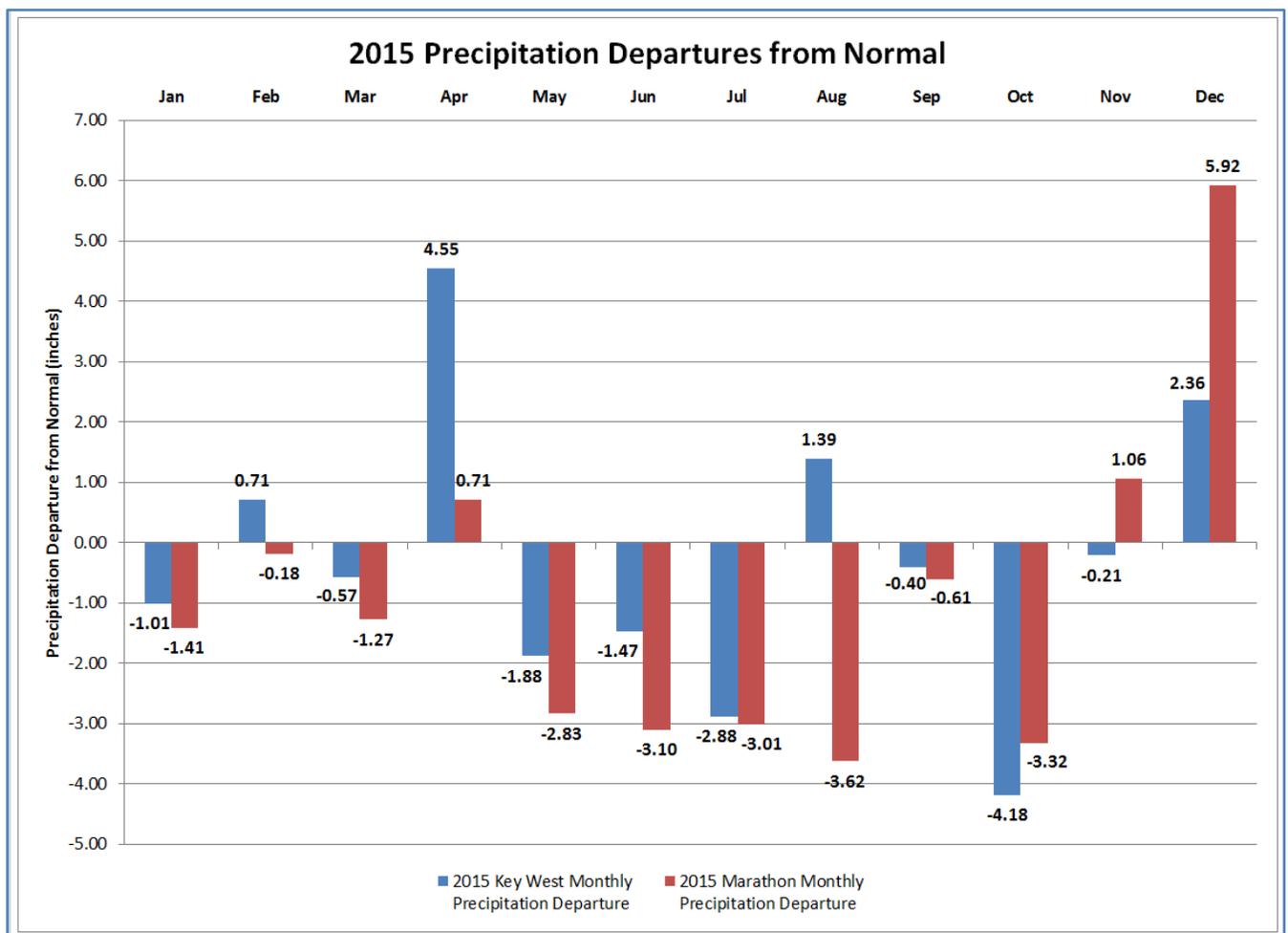
<u>WARMEST DECEMBER</u>			<u>WARMEST DECEMBER MINIMUMS</u>			<u>WARMEST DECEMBER MAXIMUMS</u>		
RANK	AVG TEMP	YEAR	RANK	AVG TEMP	YEAR	RANK	AVG TEMP	YEAR
<b>1</b>	<b>77.6°</b>	<b>2015</b>	<b>1</b>	<b>74.6°</b>	<b>2015</b>	1	80.9°	1951
2	76.6°	1931	2	72.6°	1931	2	80.7°	1931
3	76.2°	1971	3	72.4°	1971	<b>3</b>	<b>80.6°</b>	<b>2015</b>
4	76.1°	1978	4	72.1°	2013	4	80.5°	1978
5	76.0°	1948	5	71.7°	1978		80.5°	1948
6	75.7°	2013	6	71.6°	1948	6	80.0°	1971
7	75.5°	1951	7	71.3°	1879	7	79.7°	2007
8	75.3°	1879	8	70.7°	2006	8	79.6°	1941
9	75.1°	1941		70.7°	1998	9	79.4°	2013
10	75.0°	1998	10	70.6°	1986		79.4°	1956

The warm minimum temperatures were the primary driver for the warmest December dating back to 1872. Prior to December 2015, the warmest minimum temperature ever observed in the month of December, was 78 degrees Fahrenheit, which occurred in 6 other years, and last observed in 2007. However, on Christmas Day, a low temperature of 79 degrees Fahrenheit was observed, setting a new daily and monthly warm minimum record. A low temperature of 79 degrees Fahrenheit would then go on to be recorded five additional times to close out the month. This abnormally warm stretch in December ensured that 2015 would be the warmest year ever in Key West.

## PRECIPITATION TRENDS

Unlike the temperatures of 2015, precipitation totals in general did not reach either a dry or wet extreme for the entire year. Total for the year in Key West was 36.24 inches, or -3.59 inches below normal. In Marathon, however, more of a dry extreme was exhibited with a total of 34.51 inches, or -11.66 inches below normal.

The graph below depicts the departure from normal for precipitation at both the Key West International Airport and the Marathon Florida Keys Airport. For the majority of the year, precipitation was below normal, with two extreme events occurring in April and December that helped alleviate the deficits seen.

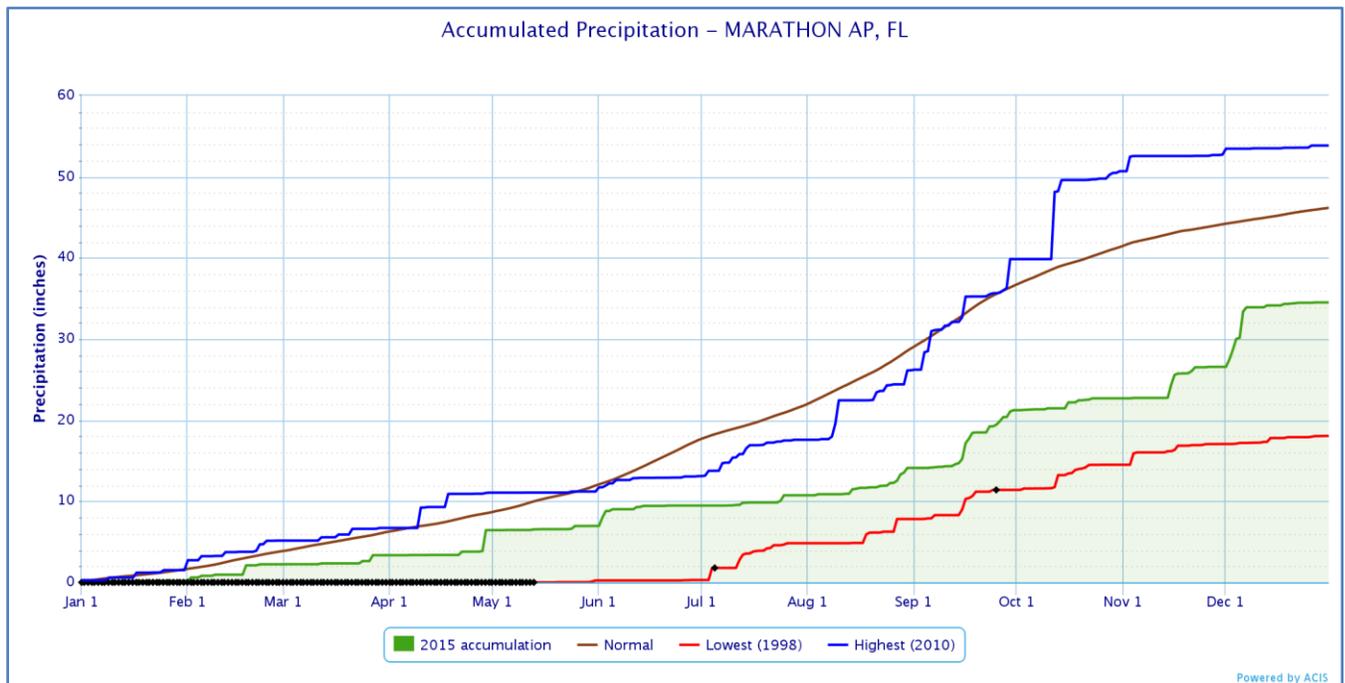


One abnormal period identified was how dry the rainy season actually was at both Key West and Marathon. The rainy season in the Florida Keys typically runs from June through October, covering the bulk of the hurricane season, which ends on November 30<sup>th</sup>. The table below compares how the 2015 rainy season stacked up to normal precipitation values at both Key West and Marathon. Key West ranked as the 19<sup>th</sup> driest rainy season on record, coming in with 17.14 inches, resulting in a deficit of 7.54 inches.

### 2015 RAINY SEASON PRECIPITATION

	2015	NORMAL	DEPARTURE
<b>Key West</b>	<b>17.14</b>	<b>24.68</b>	<b>-7.54</b>
<b>Marathon</b>	<b>15.73</b>	<b>29.39</b>	<b>-13.66</b>

The Accumulated Precipitation for the Marathon Florida Keys Airport shows how rainfall (green line/shade) accumulation for 2015 steadily stayed below normal (brown line) values. The deficit really began to grow as the rainy season began in June and continued through October. Some help was received in the form of abundant rainfall in early December, where a spike in rainfall accumulation can be seen.



Taking a look at some other annual precipitation totals across the Florida Keys, the Upper Keys received more rainfall than observed in the Lower and Middle Keys. The COOP station at the John Pennekamp State Park in Key Largo, FL finished off 2015 with a total of 55.41 inches of rain. Many other locations along the Florida Keys Island Chain did exceed 40 inches, including the CoCoRaHS site Key West 1.3 ENE, located in Key West. Notice that the Key West WFO, which is our forecast office, received 32.97 inches of rainfall. Our office is located approximately two miles from the Key West 1.3 ENE location, but there is a difference of nearly 10 inches between the two sites.

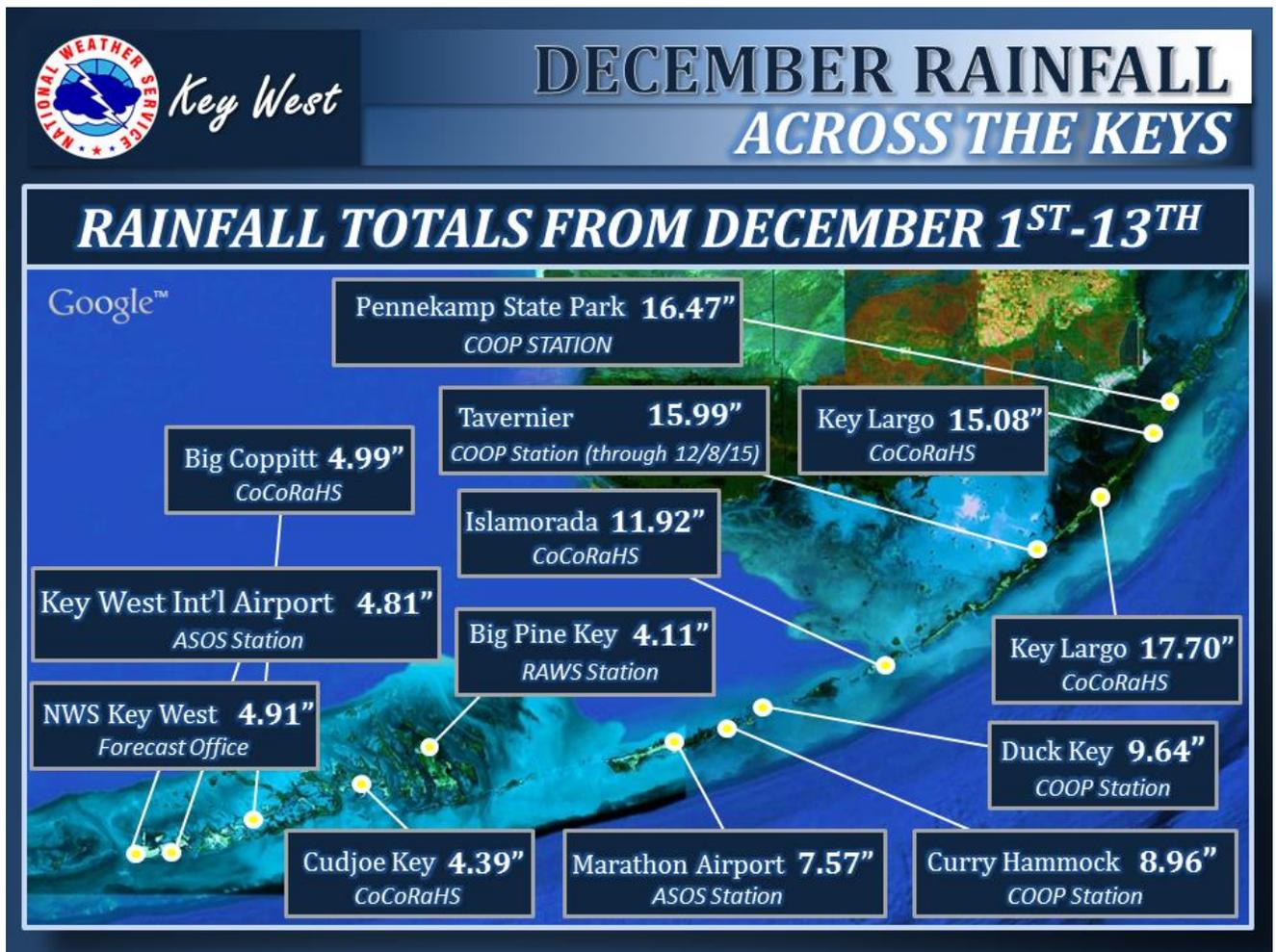
## **ADDITIONAL 2015 PRECIPITATION TOTALS** **ACROSS THE FLORIDA KEYS**

STATION NAME	TYPE	TOTAL
John Pennekamp State Park	COOP	55.41
Islamorada 7.8 SW	CoCoRaHS	46.60
Key West 1.3 ENE	CoCoRaHS	42.61
Cudjoe Key 0.9 SSW	CoCoRaHS	42.29
Curry Hammock State Park	COOP	39.69
Duck Key	COOP	37.66
Key West 0.5 SW	CoCoRaHS	37.62
Key West WFO	CoCoRaHS	32.97
Bahia Honda State Park	COOP	30.10

A very rare rainfall event (50-100 year occurrence) occurred on the 4<sup>th</sup> of August, where 4.75 inches of rain fell in a 90 minute period at the Key West 1.3 ENE location, while just 1.38 inches of rain fell at the WFO Key West, just two miles away. This event was deemed as a cloudburst, which according to the AMS Glossary of Meteorology is a rate of fall equal to or greater than 100 mm (3.94 inches) per hour. This demonstrates how localized rainfall events across the Florida Keys can really impact rainfall totals from one location to another.

Another extreme precipitation event occurred in early December and was responsible for much of the higher annual rainfall totals seen across the Florida Keys. During the first week of December, a stalled frontal boundary positioned itself across the Florida Keys Island Chain and the Florida Straits south of the islands. What resulted was an abnormally wet period, in what is usually a very dry December, with just 2.22 inches of normal rainfall in Key West.

The graphic below shows rainfall totals across the Florida Keys, with highest values evident along the Upper Keys, where some sites received over 17 inches of rain. These totals are from the 1<sup>st</sup> of December through the 13<sup>th</sup>, but this particular event produced the majority of this rain in the first 8 days of the month, which makes these totals even more impressive.



**Daily Records Set or Tied During 2015 at Key West**

<b>Record Type (Set or Tied)</b>	<b>Date Set in 2015</b>	<b>Record Value</b>	<b>Previous Record</b>	<b>Previous Record Year</b>
Warm Minimum Temp (Tied)	Jan-02	75	75	1985
Warm Minimum Temp	Jan-03	77	76	1985
Warm Minimum Temp	Jan-04	76	75	2007
Low Temperature	Feb-20	49	52	1958
Warm Minimum Temp (Tied)	Mar-10	76	76	1992
Warm Minimum Temp (Tied)	Mar-11	77	77	1948
Warm Minimum Temp (Tied)	Mar-12	76	76	1977
Warm Minimum Temp (Tied)	Mar-13	76	76	1997
Warm Minimum Temp	Mar-26	78	77	2005
Warm Minimum Temp	Apr-20	80	79	1982
Warm Minimum Temp	Apr-21	80	79	1982
High Temperature (Tied)	Apr-24	89	89	1991
Warm Minimum Temp	Apr-25	80	79	1991
High Temperature (Tied)	Apr-26	90	90	1991
Warm Minimum Temp (Tied)	Jan-02	75	75	1985
Warm Minimum Temp	Apr-26	81	80	1991
Warm Minimum Temp	Apr-27	81	80	1997
Warm Minimum Temp (Tied)	May-11	80	80	2014
Warm Minimum Temp (Tied)	Jun-27	83	83	2010
High Temperature (Tied)	Jun-30	94	94	1881

<b>Record Type (Set or Tied)</b>	<b>Date Set in 2015</b>	<b>Record Value</b>	<b>Previous Record</b>	<b>Previous Record Year</b>
<b>Warm Minimum Temp</b>	<b>Jun-30</b>	<b>84</b>	<b>83</b>	<b>2008</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Jul-01</b>	<b>83</b>	<b>83</b>	<b>2011</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Jul-02</b>	<b>84</b>	<b>84</b>	<b>2014</b>
<b>Warm Minimum Temp</b>	<b>Jul-04</b>	<b>84</b>	<b>83</b>	<b>2005</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Jul-05</b>	<b>84</b>	<b>84</b>	<b>2014</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Aug-01</b>	<b>85</b>	<b>85</b>	<b>2014</b>
<b>Precipitation</b>	<b>Aug-03</b>	<b>3.14</b>	<b>2.14</b>	<b>1990</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Aug-06</b>	<b>84</b>	<b>84</b>	<b>1993</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Aug-19</b>	<b>84</b>	<b>84</b>	<b>2014</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Aug-20</b>	<b>84</b>	<b>84</b>	<b>2009</b>
<b>High Temperature (Tied)</b>	<b>Aug-24</b>	<b>94</b>	<b>94</b>	<b>1956</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Aug-25</b>	<b>84</b>	<b>84</b>	<b>2008</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Sep-02</b>	<b>84</b>	<b>84</b>	<b>2007</b>
<b>High Temperature (Tied)</b>	<b>Sep-04</b>	<b>94</b>	<b>94</b>	<b>1877</b>
<b>Warm Minimum Temp</b>	<b>Sep-08</b>	<b>84</b>	<b>83</b>	<b>1994</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Sep-09</b>	<b>85</b>	<b>85</b>	<b>2011</b>
<b>Warm Minimum Temp (Tied)</b>	<b>Sep-10</b>	<b>84</b>	<b>84</b>	<b>1957</b>
<b>Warm Minimum Temp</b>	<b>Sep-12</b>	<b>85</b>	<b>84</b>	<b>2007</b>
<b>Warm Minimum Temp</b>	<b>Oct-01</b>	<b>83</b>	<b>82</b>	<b>2014</b>
<b>High Temperature (Tied)</b>	<b>Oct-14</b>	<b>90</b>	<b>90</b>	<b>2009</b>

<b>Record Type (Set or Tied)</b>	<b>Date Set in 2015</b>	<b>Record Value</b>	<b>Previous Record</b>	<b>Previous Record Year</b>
Warm Minimum Temp (Tied)	Oct-26	80	80	1997
Warm Minimum Temp (Tied)	Oct-31	80	80	1997
Warm Minimum Temp (Tied)	Nov-01	81	81	1995
Warm Minimum Temp	Nov-02	81	80	2007
Warm Minimum Temp	Nov-03	80	79	2004
High Temperature (Tied)	Nov-04	87	87	1992
Warm Minimum Temp	Nov-04	80	79	1988
Warm Minimum Temp	Nov-06	79	78	2002
Warm Minimum Temp	Nov-07	81	80	1986
Warm Minimum Temp	Nov-08	81	79	2003
Warm Minimum Temp	Nov-09	81	79	2003
Warm Minimum Temp (Tied)	Nov-12	79	79	1979
Precipitation	Nov-21	0.76	0.69	1923
Precipitation	Dec-03	1.15	0.61	1905
Warm Minimum Temp	Dec-16	77	76	2009
Warm Minimum Temp	Dec-17	77	76	1961
Warm Minimum Temp	Dec-23	78	76	2014
Warm Minimum Temp	Dec-24	78	76	2006
Warm Minimum Temp	Dec-25	79	76	1941
Warm Minimum Temp	Dec-26	78	76	1997

<b>Record Type (Set or Tied)</b>	<b>Date Set in 2015</b>	<b>Record Value</b>	<b>Previous Record</b>	<b>Previous Record Year</b>
<b>Warm Minimum Temp</b>	<b>Dec-27</b>	<b>79</b>	<b>75</b>	<b>1942</b>
<b>Warm Minimum Temp</b>	<b>Dec-28</b>	<b>79</b>	<b>76</b>	<b>1942</b>
<b>High Temperature</b>	<b>Dec-29</b>	<b>84</b>	<b>82</b>	<b>2007</b>
<b>Warm Minimum Temp</b>	<b>Dec-29</b>	<b>79</b>	<b>76</b>	<b>2007</b>
<b>High Temperature (Tied)</b>	<b>Dec-30</b>	<b>83</b>	<b>83</b>	<b>1953</b>
<b>Warm Minimum Temp</b>	<b>Dec-30</b>	<b>79</b>	<b>77</b>	<b>2007</b>
<b>High Temperature</b>	<b>Dec-31</b>	<b>84</b>	<b>83</b>	<b>1981</b>
<b>Warm Minimum Temp</b>	<b>Dec-31</b>	<b>79</b>	<b>75</b>	<b>2006</b>

## References

Climate Prediction Center

<http://www.cpc.ncep.noaa.gov/>

National Centers For Environmental Information (NCEI)

<https://www.ncdc.noaa.gov/cdo-web/>

Community Collaborative Rain, Hail & Snow Network (CoCoRaHS)

<http://www.cocorahs.org/>

xmACIS2

<http://xmacis.rcc-acis.org/>

Additional Resources can be found on the NWS Key West Climate Page:

[http://w2.weather.gov/climate/local\\_data.php?wfo=key](http://w2.weather.gov/climate/local_data.php?wfo=key)

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