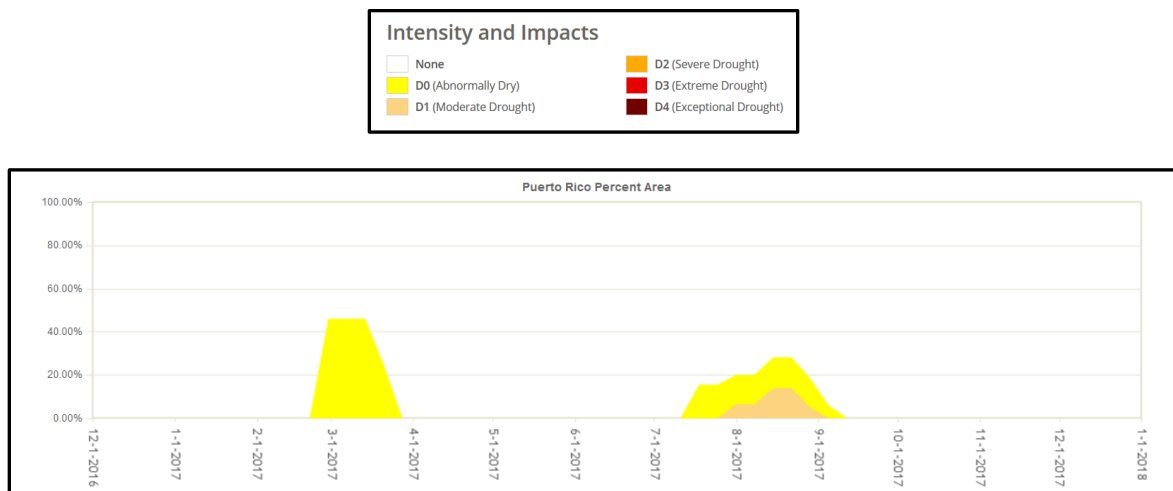


# 2017 Climate Review for Puerto Rico and the U.S. Virgin Islands.

**Synopsis:** Near to above normal rainfall was observed across the local islands during 2017 with March and September as extremely wet months. Record rainfall and Record flooding were observed during September as the result of the extremely active 2017 Hurricane Season. Above normal temperatures were also observed.

**Summary:** A seasonable weather pattern prevailed across the islands during January and February with only two significant weather features observed. The first event was the passage of a cold front between January 10<sup>th</sup> and January 11<sup>th</sup>, which caused widespread shower activity and very hazardous marine conditions. The next significant rainfall event was between February 2<sup>nd</sup> and February 5<sup>th</sup> due to surges of moisture that produced persistent rounds of diurnally and locally induced showers across the western half of Puerto Rico. Significant flooding was even observed in Hatillo on February 4<sup>th</sup>, where over 4 inches of rain were observed during a very short period of time. An active weather pattern was then observed during March giving several sectors of the islands above to well above normal rainfall. During the first week of April, a fair weather pattern prevailed, however from approximately the 10<sup>th</sup> of the month onwards wetter conditions persisted. May through August featured a combination of wet and dry periods. Most of the rainfall activity came from a series of tropical waves moving across the eastern Caribbean as well as troughiness. The seasonably dry weather observed early in 2017 as well as those periods of dryness between May and August, which in fact were associated with the mid-summer drought, resulted in abnormally dry to moderate drought conditions particularly across SE Puerto Rico (Fig 1).



**Figure 1.** Percent Area of PR under U.S. Drought Monitor - Drought Categories 2017.

September featured the passage of two major hurricanes, [Irma](#) and [Maria](#). Hurricane Irma affected the region on September 6<sup>th</sup>. Even though the center of the storm passed just north of the islands, St. Thomas, Saint John, and Culebra observed wind gusts over 100 mph as the southern eyewall clipped these islands. Mainland Puerto Rico and Saint Croix felt mostly sustained tropical storm force winds. Hurricane Maria affected the region September 19<sup>th</sup> - 20<sup>th</sup>. This storm was much more severe than Irma as the center of the storm made landfall over mainland Puerto Rico as a strong category 4. Major hurricane force winds were observed across St. Croix, Vieques, and Mainland Puerto Rico. Severe flooding was also observed across Mainland Puerto Rico as 30 rivers reached major flood stage with 13 at or above record flood stage. Maria was considered the worst hurricane to impact Puerto Rico since 1928, when Hurricane San Felipe II made a direct landfall over the island as a category 5.

The first half of the October featured a very active weather pattern. Frequent troughiness combined with several tropical waves moving through created favorable conditions for several days of heavy rainfall activity. Given

the excessive rainfall observed in September, due mainly to the passage of both Hurricanes Irma and Maria, the terrain was saturated to the point that flooding was frequently observed with these heavy rainfall events. The weather pattern, however, after the 18<sup>th</sup> of the month changed to a generally drier and more stable pattern. Statistically, November and December were near normal with passing showers observed along windward areas in the morning, followed by locally induced showers and thunderstorms in the afternoon. However, one thunderstorm with heavy rainfall left 2.73 inches at the Luis Muñoz Marín Airport on November 7<sup>th</sup>. Based on the Cooperative Observer Network Data (COOP), 130 percent of the normal rainfall was observed across Puerto Rico. Preliminarily, an average rainfall total of 80.95 inches was measured, which is 19.45 inches above normal. 2017 ended as the 12<sup>th</sup> wettest year across Puerto Rico (Table 1).

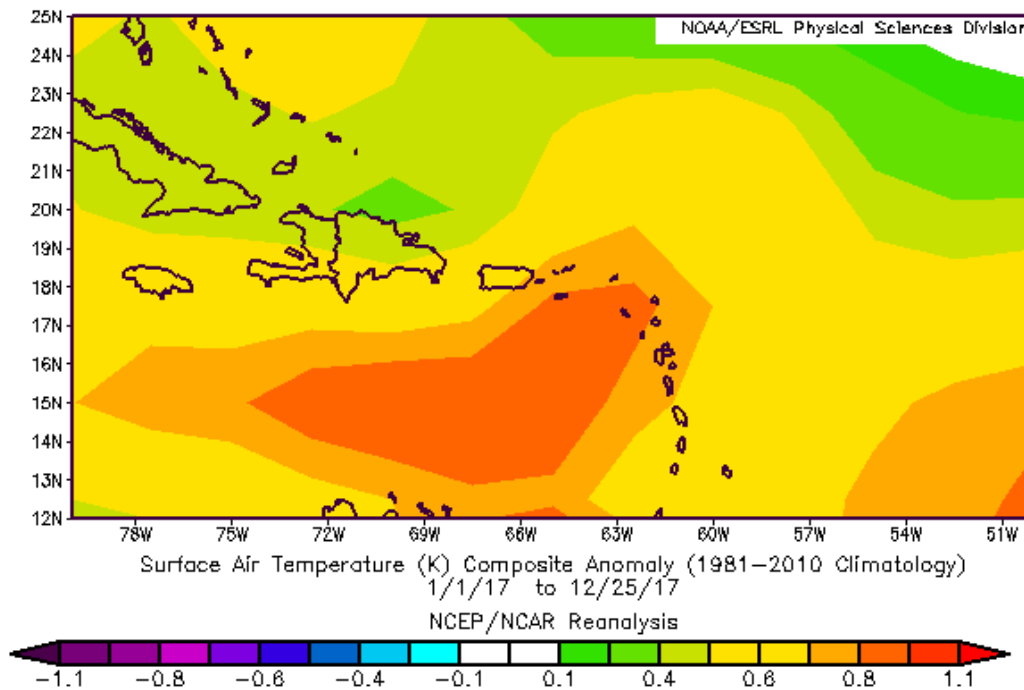
For rainfall accumulation and percent of normal per climate division visit:

<http://www.weather.gov/sju/averagerainfall>

For the driest and wettest years on record visit:

<http://www.weather.gov/media/sju/climo/stats/TopYears.pdf>

In terms of temperature, the mean annual temperature for Puerto Rico was 77.6°F, which is approximately 0.8°F warmer than the 30-year average from the National Centers for Environmental Information (NCEI). Temperatures across Puerto Rico ranged from 97°F in Ponce 4E on the 2<sup>nd</sup> of August, to 50°F in Adjuntas on the 19<sup>th</sup> of January. This pattern of above normal temperatures was observed across most of the Caribbean region (Fig 2).



**Figure 2.** Surface Air Temperature Anomaly for the Caribbean from Jan 1<sup>st</sup> 2017 through Dec 25<sup>th</sup> 2017.

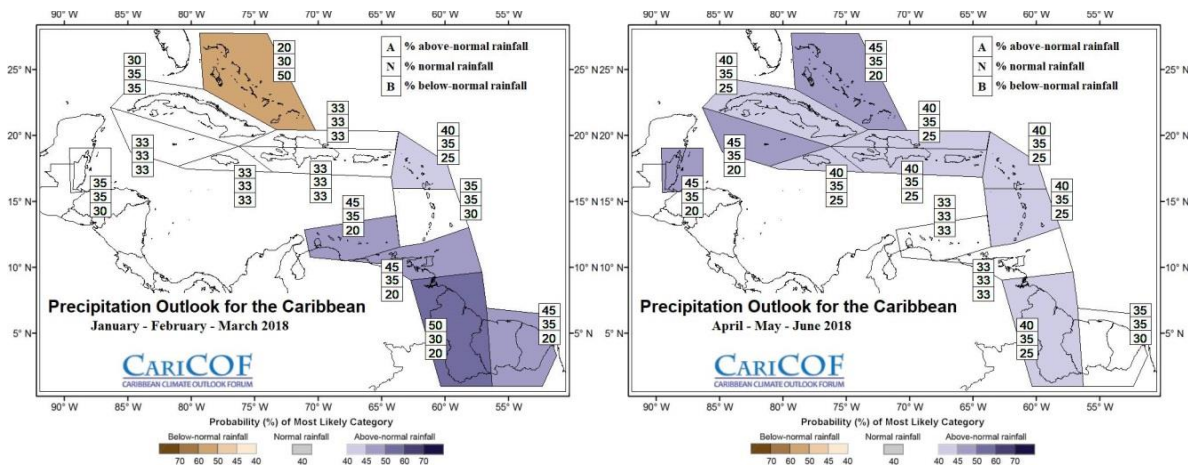
## Monthly Rainfall Accumulations

|                            | JAN        | FEB       | MAR        | APR        | MAY        | JUN        | JUL        | AUG        | SEP        | OCT        | NOV        | DEC        |
|----------------------------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Observed</b>            | 3.48       | 1.56      | 6.22       | 8.02       | 6.41       | 5.52       | 7.11       | 8.43       | 12.98      | 11.27      | 6.74       | 3.21       |
| <b>Normal</b>              | 3.33       | 2.60      | 2.86       | 4.68       | 6.98       | 4.53       | 5.01       | 6.01       | 7.81       | 7.94       | 6.69       | 4.06       |
| <b>% PON per month</b>     | <b>105</b> | <b>60</b> | <b>217</b> | <b>171</b> | <b>92</b>  | <b>122</b> | <b>142</b> | <b>140</b> | <b>166</b> | <b>142</b> | <b>101</b> | <b>79</b>  |
| <b>Accumulated</b>         | 3.48       | 5.04      | 11.26      | 19.28      | 25.69      | 31.21      | 38.32      | 46.75      | 59.73      | 71.00      | 77.74      | 80.95      |
| <b>Normal accumulation</b> | 3.33       | 5.93      | 8.79       | 13.47      | 20.45      | 24.98      | 29.99      | 36.00      | 43.81      | 51.75      | 58.44      | 62.50      |
| <b>% PON accumulated</b>   | <b>105</b> | <b>85</b> | <b>128</b> | <b>143</b> | <b>126</b> | <b>125</b> | <b>128</b> | <b>130</b> | <b>136</b> | <b>137</b> | <b>133</b> | <b>130</b> |

**Table 1. 2017 Rainfall Totals and Percent of Normal (PON) across Puerto Rico based on COOP.**

At the primary climatological data sites, 132, 108, 109 percent of the normal rainfall was observed at Luis Muñoz Marín Airport (**JSJ**) in San Juan, Cyril E. King Airport (**IST**) in Saint Thomas, Henry E Rohlsen Airport (**ISX**) in Saint Croix, respectively. This does not include all the rain that fell at IST and ISX between September and December. Unfortunately, there are several days of missing data due to sensor failure. A preliminary rainfall total of 74.57 inches was measured at TJSJ, which is 18+ inches above normal. In terms of temperature, the mean annual temperature at TJSJ was 81.7°F, which is approximately 0.7°F warmer than the 30-year average from the National Centers for Environmental Information (NCEI).

## Looking Ahead



**Image 1. CariCOF forecast for Jan-Feb-Mar and Apr-May-Jun**

Cool Sea Surface Temperatures (SST) anomalies remained in the El Niño region of the Pacific, exhibiting weak La Niña conditions. Most models suggest temperature anomalies to fluctuate around a weak to moderate La Niña for Jan-Feb-Mar. ENSO conditions are predicted to remain La Niña and will drive chances for drier conditions in the northwest Caribbean, while increasing chances for wetter conditions southeast of the region through February 2018. Warm SSTs around the Caribbean may lead to above-average humidity during the dry season, as well as enhanced

atmospheric instability. With SSTs remaining above average throughout much of the region, air temperatures are also expected to be warmer than average.

More Info: <http://rcc.cimh.edu.bb/long-range-forecasts/caricof-climate-outlooks/>

## Highlights for Primary Climatological Data Sites

1. 2017 ended as the year with the 2<sup>nd</sup> highest number of 80 degree nights at the Luis Muñoz Marin Airport.

| Rank | Year | Number of days |
|------|------|----------------|
| 1st  | 2009 | 59             |
| 2nd  | 2017 | 54             |
| 3rd  | 2012 | 43             |

2. September 2017 ended as the 6<sup>th</sup> wettest month for any given year at Luis Muñoz Marin Airport.

| Rank | Month/Year | Inches |
|------|------------|--------|
| 1st  | Aug 2011   | 18.56  |
| 2nd  | Nov 2016   | 17.65  |
| 3rd  | May 1936   | 16.88  |
| 4th  | Dec 1981   | 16.81  |
| 5th  | Nov 1979   | 15.96  |
| 6th  | Sep 2017   | 15.79  |

3. 8<sup>th</sup> wettest day for any given year at the Luis Muñoz Marin Airport.

| Rank | Year                      | Inches |
|------|---------------------------|--------|
| 1st  | Aug 15 <sup>th</sup> 1944 | 9.67   |
| 2nd  | Jul 18 <sup>th</sup> 2013 | 9.23   |
| 3rd  | Sep 18 <sup>th</sup> 1989 | 8.84   |
| 4th  | Dec 14 <sup>th</sup> 1910 | 8.84   |
| 5th  | Sep 10 <sup>th</sup> 1996 | 8.20   |
| 6th  | Nov 11 <sup>th</sup> 1931 | 7.92   |
| 7th  | Sep 13 <sup>th</sup> 1925 | 7.39   |
| 8th  | Sep 20 <sup>th</sup> 2017 | 7.11   |

## 2017 Monthly & Seasonal Highlights for Primary Climatological Data Sites

|     | Dec (2016) | Jan                            | Feb                            | Season |
|-----|------------|--------------------------------|--------------------------------|--------|
| JSJ | ---        | 5 <sup>th</sup> warmest 78.7°F | 3 <sup>rd</sup> warmest 79.5°F | ---    |
| IST | ---        | 8 <sup>th</sup> driest 1.17"   | ---                            | ---    |
| ISX | ---        | ---                            | 9 <sup>th</sup> driest 0.81"   | ---    |

Table 2. Winter 2016-17

|     | Mar                           | Apr                           | May | Season                         |
|-----|-------------------------------|-------------------------------|-----|--------------------------------|
| JSJ | 4 <sup>th</sup> wettest 6.04" | ---                           | --- | ---                            |
| IST | 2 <sup>nd</sup> wettest 5.83" | 7 <sup>th</sup> driest 1.05"  | --- | ---                            |
| ISX | Wettest 6.40"                 | 3 <sup>rd</sup> wettest 7.69" | --- | 3 <sup>rd</sup> wettest 16.14" |

Table 3. Spring 2017

|     | Jun | Jul  | Aug                            | Season                         |
|-----|-----|--|--------------------------------|--------------------------------|
| JSJ | --- | 7 <sup>th</sup> warmest 84.1°F                                     | 3 <sup>rd</sup> warmest 84.5°F | 8 <sup>th</sup> warmest 83.9°F |
| IST | --- | 8 <sup>th</sup> warmest 84.4°F                                     | ---                            | ---                            |
| ISX | --- | 5 <sup>th</sup> driest 1.08" and<br>6 <sup>th</sup> warmest 84.6°F | ---                            | ---                            |

**Table 4.** Summer 2017

|     | Sep   | Oct     | Nov                            | Season  |
|-----|---|---------|--------------------------------|---|
| JSJ | 3 <sup>rd</sup> warmest 84.5°F<br>and wettest 15.79"        | ---     | 3 <sup>rd</sup> warmest 81.8°F | 3 <sup>rd</sup> wettest 32.56"<br>and 5 <sup>th</sup> warmest<br>83.1°F |
| IST | 5 <sup>th</sup> wettest 11.40"<br>(several days<br>missing) | ---     | missing                        | ---   |
| ISX | 2 <sup>nd</sup> wettest 11.12"                              | missing | missing                        | ---   |

**Table 5.** Fall 2017

|     | Dec                             | 2017                          |
|-----|---------------------------------|-------------------------------|
| JSJ | 6 <sup>th</sup> warmest 80.0 °F | 6 <sup>th</sup> warmest 81.7F |
| IST | ---                             | ---                           |
| ISX | ---                             | ---                           |

**Table 6.** December and 2017 Highlights

## Additional Highlights Based on COOP Data

### Wettest Days

\*Rainfall accumulations associated with María and Irma are not included. For rainfall accumulations associated with the hurricanes, please see the preliminary report\*\*

| Station             | Rainfall | Date      |
|---------------------|----------|-----------|
| TRUJILLO ALTO 2 SSW | 5.8      | 7/8/2017  |
| ARECIBO OBSERVATORY | 5.5      | 4/12/2017 |
| PALMA SOLA          | 5.16     | 4/17/2017 |

### Hottest Days

| Station          | Temperature (°F) | Date      |
|------------------|------------------|-----------|
| PONCE 4 E        | 97               | 8/2/2017  |
| GUAYAMA 2E       | 96               | 8/11/2017 |
| LAJAS SUBSTATION | 95               | 7/29/2017 |

### Coolest Nights

| Station           | Temperature (°F) | Date      |
|-------------------|------------------|-----------|
| TORO NEGRO FOREST | 50               | 1/19/2017 |
| PONCE 4 E         | 55               | 2/21/2017 |
| LAJAS SUBSTATION  | 57               | 1/21/2017 |

**Data are preliminary and have not undergone final quality control by the National Centers for Environmental Information / NCEI/. Therefore, these data are subject to revision.**