



Study of 2010 Monthly Rainfall Rates and Comparison with Significant Precipitation Events in Puerto Rico



Janice M. Maldonado-Jaime ⁽¹⁾, Israel Matos ⁽²⁾ and Gary Votaw ⁽³⁾

(1) Department of Physics, University of Puerto Rico, Mayagüez, Puerto Rico

(2) Meteorologist in Charge (MIC)- National Weather Service- Weather Forecast Office, San Juan, Puerto Rico

(3) Science and Operations Officer (SOO)-National Weather Service- Weather Forecast Office, San Juan, Puerto Rico

Introduction

• Puerto Rico is a tropical island located between the Atlantic Ocean and the Caribbean, specifically at the latitude and longitude, 18° 15' N and 66° 30' W, respectively. The Island has a small territorial extension of 110 miles (180 kilometers) east-west and 39 miles (60 kilometers) north-south. The complexity in precipitation in Puerto Rico is due to trade winds (easterly winds) and the topography (Figure 1).



Figure 1. Caribbean Map. Puerto Rico is the smallest of the Greater Antilles.

• Due to this significant location and topography, the precipitation in Puerto Rico is significant even in dry season. In fact, the precipitation of Puerto Rico is divided in two seasons: dry and wet. The dry season covers the months from January to April and the wet season envelop the months from May to November.

• During 2010 year, some weather stations had experience considerable increase in monthly rainfall amounts where the actual values were above the normal.

• The objective of this study is to analyze the monthly precipitation rates from 2010 and to compare these quantities with events of similar behavior for the years where a significant weather occurred.

Methodology

• The data was retrieved from the climatological local data of Puerto Rico provided by National Climatic Data Center (NCDC) and Xm Applied Climate Information System (XmACIS) database.



Figure 2. Puerto Rico map illustrating the weather stations sites.

• This research was developed in two phases.

Phase 1: Were analyzed the monthly data of some weather stations for 2010 to observe the behavior in rainfall rates. For this study, the stations chosen were: Coloso, Paraiso, Ponce 4E, Rio Piedras Experimental Station and San Juan (TJSJ) (see Figure 2). The monthly precipitation was analyzed for each weather station from January to November.

Phase 2: Were based to investigate if there exists or not any correlation between 2010 precipitation amounts and those years where there were significant precipitation events. The years chosen were the following: 1956, 1975, 1985, 1989, 1996, 1998 and 2004. The Table 1 shows the detailed information of the events per year.

2010 Monthly Rainfall

- *dry season*- January was the wettest month with 5% of rainfall accumulated in the year.
- *wet season*- May and July were the wettest months with 15% and 18% of rainfall accumulated, respectively (Figure 3).

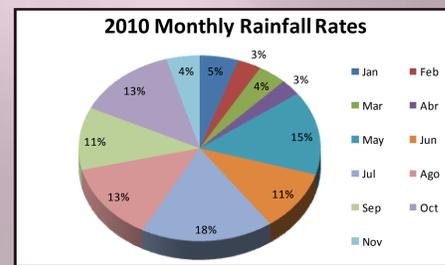


Figure 3. A percentage of 2010 monthly precipitation. May and July were the months of more rainfall accumulated with 15% and 18%, respectively

• *San Juan station:* All months, except February and April were above normal rainfall values. The climatology shows that January is the third driest month of the year with a rainfall quantity of 3.02". In contrast, this month obtained an incredible rainfall quantity that is 7.60" in 1977 (see Figure 3a).

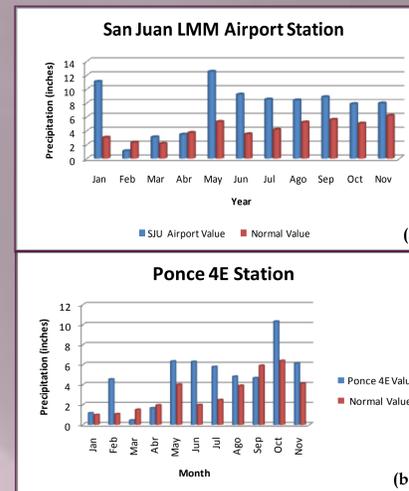


Figure 3. Monthly rainfall amounts vs. normal values (a) San Juan International Airport station (b) Ponce 4E station

• Ponce 4E is the driest station compared with the other four stations but February obtained 4.54" of rainfall accumulated, 3.54" above normal value.

Comparison with significant years

• The following years had a correlation in rainfall accumulated with 2010: 1956, 1975, 1985, 1996 and 1998 with approximately 11% to 14% of rainfall accumulated.

• The accumulated rainfalls during 2010 are not reflected in the statistics for January, April, July, September and November.

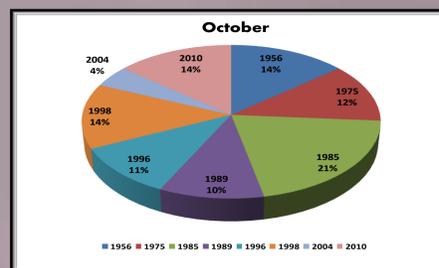


Figure 4. A percentage of difference in significant years with 2010 monthly precipitation for October. The years 1956 and 1998 obtained the same rainfall accumulated than 2010.

• *Rio Piedras* and *San Juan* stations are located in the same city but the rainfall quantity are not identical. *Rio Piedras* was the station which only 4 months (January, March, June and August) were above normal values.

• Coloso and Paraiso stations acquired values above normal almost every months.

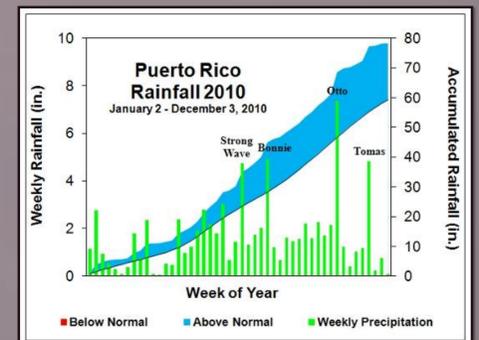


Figure 4. WFO-San Juan data. Puerto Rico rainfall for 2010 from January to November. An average of weekly precipitation and normal.

• Since beginning of the year, 2010 rainfall rates were increasing, positioning the year as one of the wettest for the climatological data (Figure 4).

Summary

• San Juan (TJSJ) and Rio Piedras stations have been the stations where the rainfall amounts have broken the record for January.

• In general, the precipitation amounts have increased 49% above normal values.

• The data illustrates that 2010 was one of the wettest years for Puerto Rico climatology.

• There was a relation between 2010 and years where occurred significant events.

Future Project

The next project is concentrated in the study of the effects in synoptic scale levels where the following variables are important: wind vector, precipitable water and sea surface temperatures.

Acknowledgements

The author thanks God for this opportunity, Mr. Israel Matos and Mr. Gary Votaw for their mentoring for the development of this research. Also, thanks to WFO-San Juan staff for their help and suggestions and UPRM-Department of Physics

References

NWS, cited 2010: Weekly Summary of Cooperative Weather Data from Puerto Rico and the U.S. Virgin Islands [Available online at <http://www.srh.noaa.gov/sju/?n=coopdata>]

NWS, cited 2010: 2010 Climate Report [Available online at <http://www.srh.noaa.gov/sju/?n=2010climatereport>]

Southeast Regional Climate Center, cited 2010: Historical Climate Summaries for Puerto Rico and the U.S. Virgin Islands [Available online at http://www.sercc.com/climateinfo/historical/historical_pr.html]

The ocean Adventure, cited 2010: The Caribbean Map [Available online at <http://www.theoceanadventure.com/Vlie02/VICaribmap.html>]

SIGNIFICANT PRECIPITATION EVENTS	
Year	Event
1956	Hurricane Betsy (Santa Clara) crossed Puerto Rico in a SE to NW direction.
1975	Tropical Depression developed into Tropical Storm Eloise just as it reached within 1° north of the northeastern tip of Puerto Rico as it passed in a E to W direction.
1985	Strong Tropical Wave that 12 hours later became Tropical Storm Isabel
1989	Hurricane Hugo passed over St Croix...then Vieques and Culebra and the northeast corner of Puerto Rico in a SE to NW direction. Hurricane Dean passed almost 2° northeast of Puerto Rico in a SE to NW direction.
1996	Hurricane Bertha passed just northeast of Puerto Rico and the U.S. Virgin Islands in a SE to NW direction. Hurricane Hortense passed over the southwest corner of Puerto Rico in a SE to NW direction.
1998	Hurricane Georges passed over St Croix in the U.S. Virgin Islands and then entered Puerto Rico near Humacao and traveled through the interior of the island exiting just south of Mayagüez in Cabo Rojo.
2004	Tropical Storm Jeanne passed just south of St Croix and then entered southeast Puerto Rico near Maunabo and traveled west then north and west again across Puerto Rico and exited over the northwest tip of the island near Aguadilla.
2010	There were not significant weather event reported

Table 1. WFO- SJU data. List of the Tropical Storms and Hurricanes which passed within two degrees of latitude of Puerto Rico and the Virgin Islands during the years chosen to study.