

Precipitation Study using radar and rain gauges

Hurricane Jeanne

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Introduction

- This study is based on a comparison of precipitation data collected during Hurricane Jeanne
- The sources were the NASA Tropical Rainfall Measuring Mission (TRMM) Radar and United States Geological Survey (USGS) Rain Gauges



How was the data collected?

- Determine area to be evaluated
Naguabo, Ponce, San Juan, Utuado and Hormigueros
- Find the days of the trajectory and rain peak hours
- Find the localizations of rain gauges (latitudes and longitudes) at USGS
- Compare with TRMM

Procedure

- Designate what area is going to be analyzed by the NASA radar. (200 m² aprox.)
- Calculate the earth area that is going to be analyzed using earth distance formula that is:

$$\text{Distance} = 3963.0 * \arctan[\sqrt{1-x^2})/x]$$

$$x = [\sin(\text{lat}_1/57.2958) * \sin(\text{lat}_2/57.2958)] + \\ [\cos(\text{lat}_1/57.2958) * \cos(\text{lat}_2/57.2958) * \\ \cos(\text{lon}_2/57.2958 - \text{lon}_1/57.2958)]$$

Using the formula..

- We discovered that if we add and subtract the decimal coordinate by .0005, we will obtain the position transposed approximately by 50 meters.
- By this conversion, we found the area that encircles the rain gauges to compare with the radar

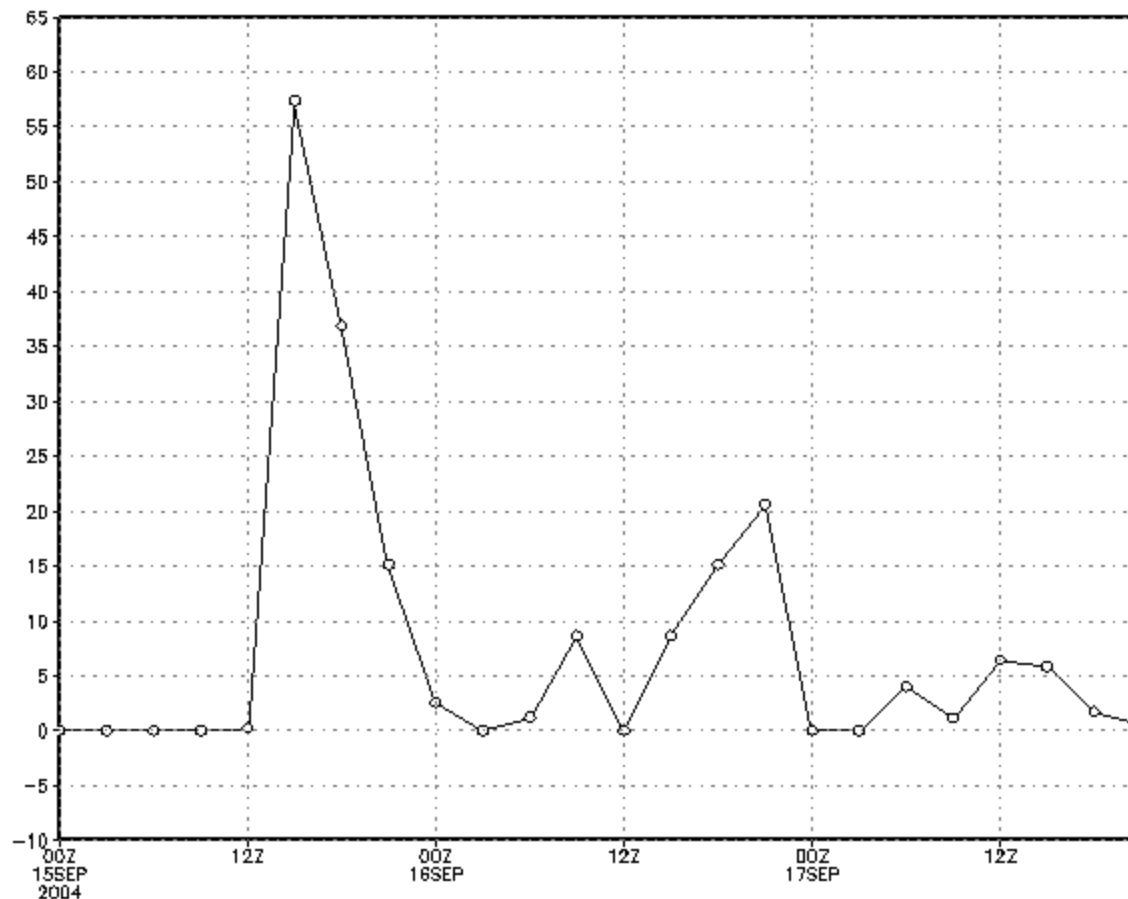


Latitudes and longitudes

Ponce	Hato rey	Naguabo	Hormigueros	Utado
18.0841286 -66.5623947	18.40744778 -66.0690547	18.28189889 -65.7884961	18.1413464 -67.1487908	18.22884417 -66.80712
Area	Area	Area	Area	Area
Boundary 1 18.0836286 -66.5618947	Boundary 1 18.40694778 -66.0685547	Boundary 1 18.28139889 -65.7879961	Boundary 1 18.1408464 -67.1482908	Boundary 1 18.22834417 -66.80662
Boundary 2 18.0846286 -66.5673947	Boundary 2 18.40794778 -66.0740547	Boundary 2 18.28239889 -65.7934961	Boundary 2 18.1418464 -67.1537908	Boundary 2 18.22934417 -66.81212

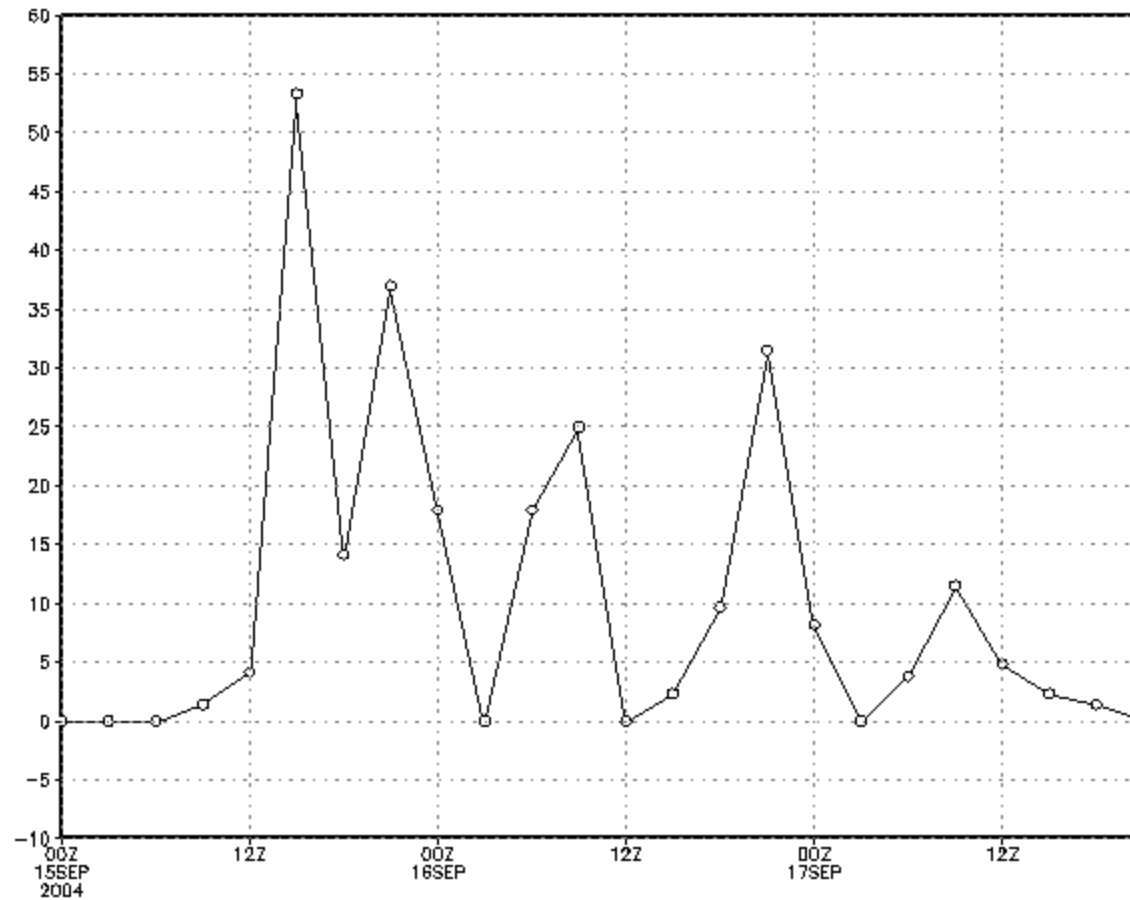
San Juan

[mm] (Lat:18.40694778-18.40794778, Lon:-66.0740547--66.06855)
Accumulated Rainfall



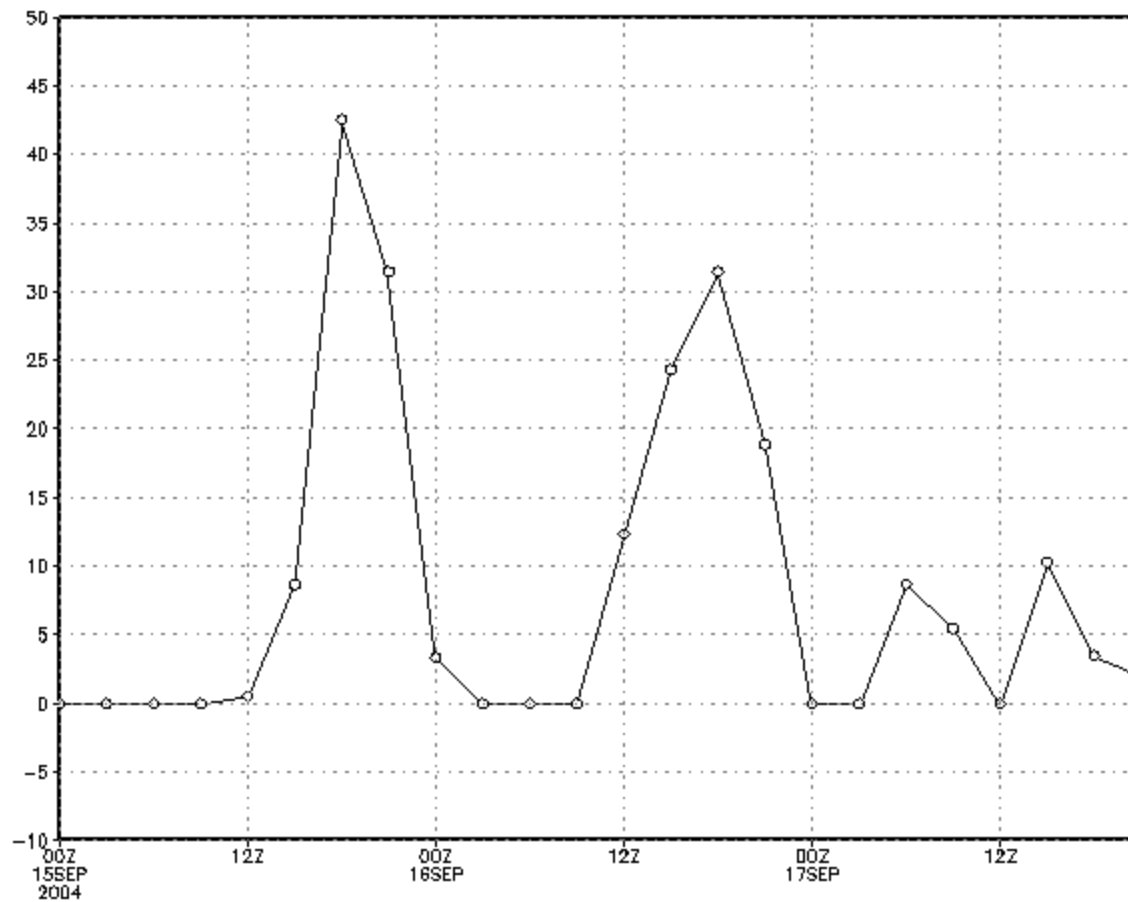
Naguabo

[mm] (Lat:18.28139889-18.28239889, Lon:-65.7934961--65.78799
Accumulated Rainfall



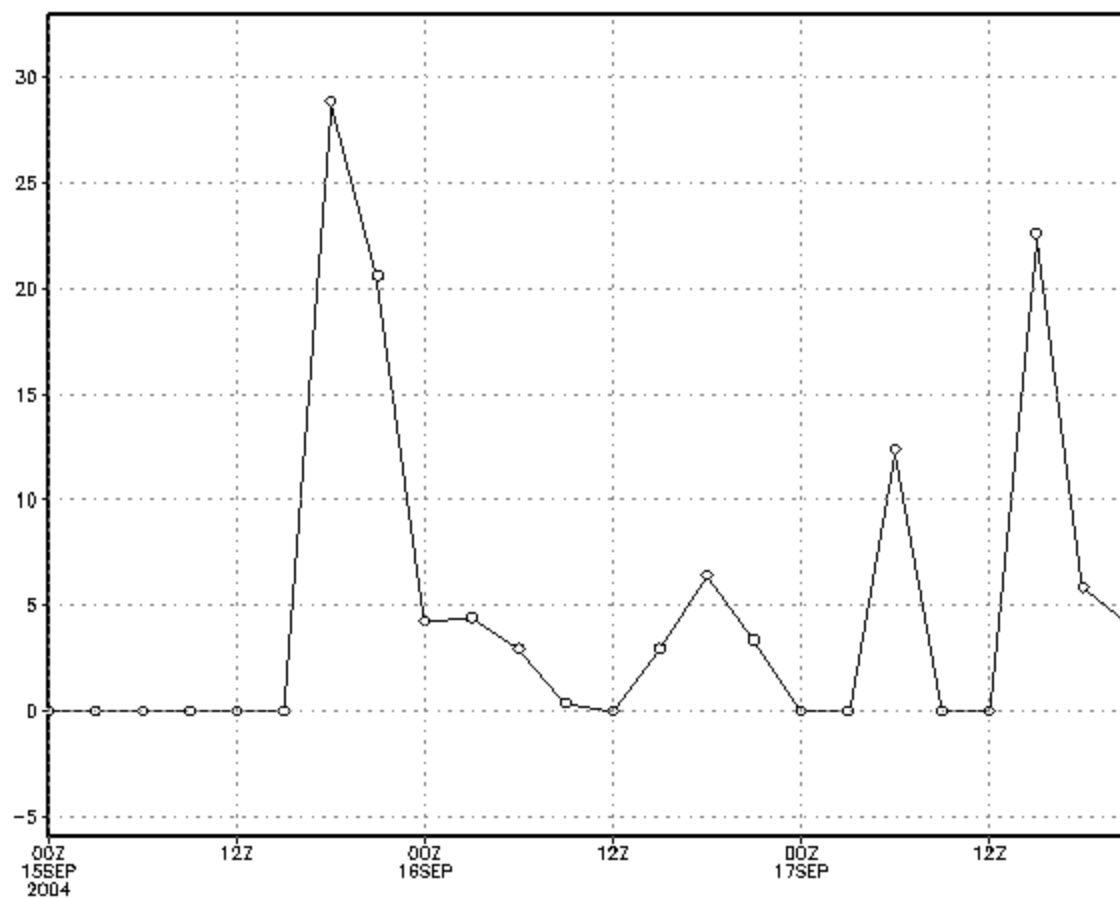
Ponce

[mm] (Lat:18.0836286-18.0846286, Lon:-66.5673947--66.561894
Accumulated Rainfall



Utuado

[mm] (Lat:18.22834417-18.22934417, Lon:-66.81212--66.80662)
Accumulated Rainfall



USGS Data

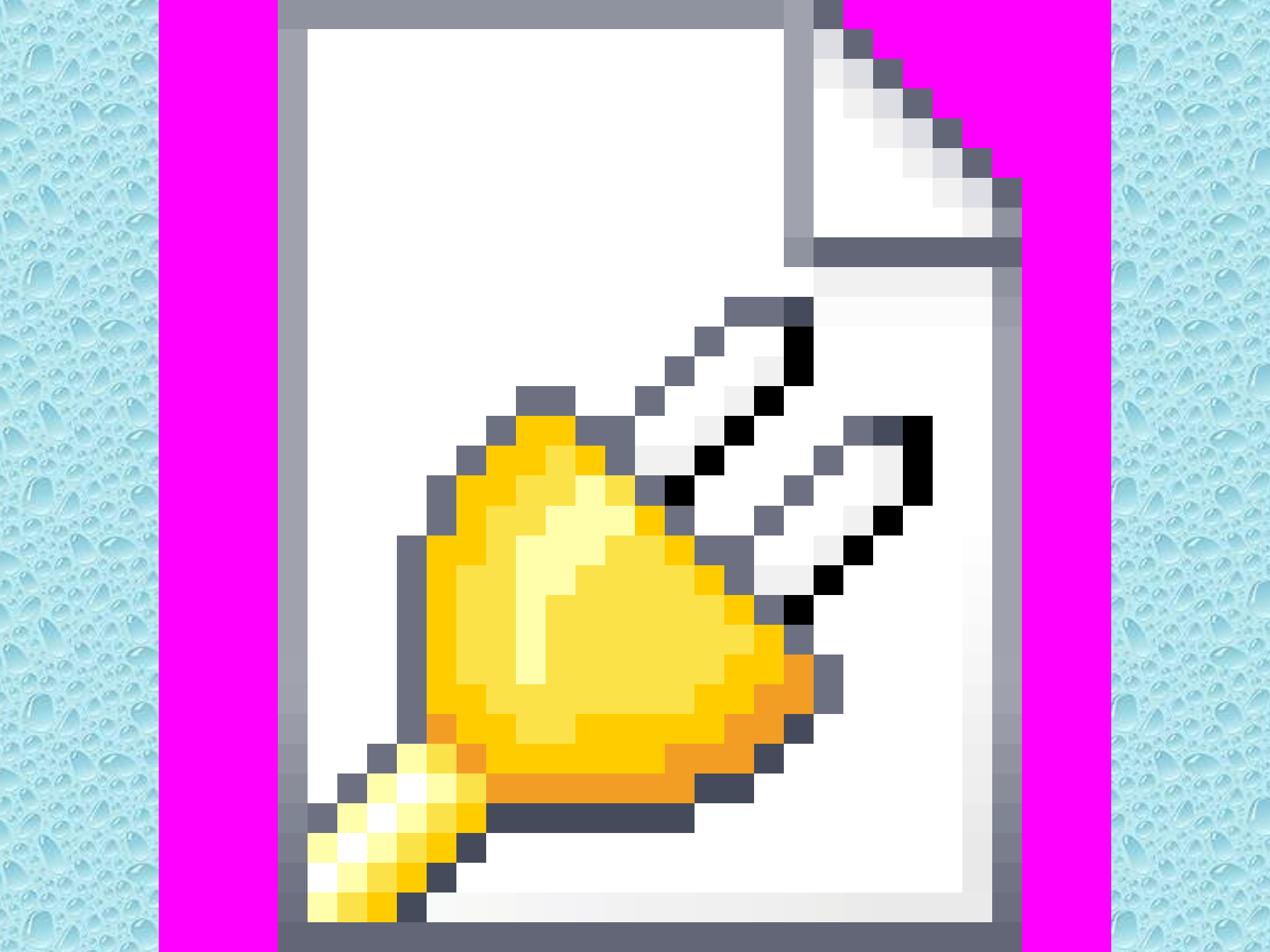
Ponce	Hato rey	Naguabo	Hormigueros	Utuado
Precipitacion(mm)	Precipitacion(mm)	Precipitacion(mm)	Precipitacion(mm)	Precipitacion(mm)
144.969	60.214	86.02	38.6	91.44
Localizacion	Localizacion	Localizacion	Localizacion	Localizacion
18.0841286	18.40744778	18.28189889	18.17079	18.22884417
-66.5623947	-66.0690547	-65.7884961	-67.0749017	-66.80712
Area	Area	Area	Area	Area
Boundary 1	Boundary 1	Boundary 1	Boundary 1	Boundary 1
18.0836286	18.40694778	18.28139889	18.17029	18.22834417
-66.5618947	-66.0685547	-65.7879961	-67.0744017	-66.80662
Boundary 2	Boundary 2	Boundary 2	Boundary 2	Boundary 2
18.0846286	18.40794778	18.28239889	18.17129	18.22934417
-66.5673947	-66.0740547	-65.7934961	-67.0799017	-66.81212

Comparative Analysis between Rain Gauges and Radar

	NASA TRMM	USGS rain gauge	Error difference
Ponce	121.89	144.969	17.30%
Hato Rey	72	60.214	17.83%
Naguabo	141.45	86.36	48.36%
Hormigueros	36.99	38.6	4.26%
Utuado	88.12	91.44	3.70%

Comparison

Localization	LMM Airport Rain gauge	NASA TRMM
Precipitation (Total)	143.256 mm	165.69 mm
% difference	14.52%	14.52%



Conclusions:

- The error percentages were in the range of 17% and 4%, except one data point
- The widest range of error occurred in the counties with larger amount of rain
- There were consistent information ; differences can be attributed to space/time resolution differences.
- Either source of precipitation compared fairly well

