Precipitation Study using Radar and Rain Gauges during Hurricane Jeanne and a main Rain Event in May 2004 over Puerto Rico

Roger Saltares, Soralis Pimentel, Luis D. Pérez, Sonymar Pérez, Carlos Rodríguez, Nesmary Hernández and Ricardo Ríos
Under supervision of Dr. Sandra Cruz Pol
Comparing Two Data Sets

- NASA TRMM Precipitation Radar
- USGS Rain Gauges
• **Launched:** November 28, 1997

• Has an orbit at 35 degrees from the equator.

• **Orbit Duration:** 91 minutes (16 Orbit a day)

• **Time Spent over P.R. during each orbit:** 1.14 minutes

• **Total Time spent over P.R. per day:** 18.2 minutes
• Around 100 rain gauges in P.R.
• Real-time data typically are recorded at 15-60 minute intervals.
• Recording and transmission times may be more frequent during critical events.
Hurricane Jeanne, May 12 and May 23
Methodology

- Selection of the day with highest precipitation during each event
- Evaluation of the overall data to identify region of the island to study
- Obtaining the data
  - Selection of rain gauges in the region
  - Selection of coordinates to obtain data from TRMM
- Work with the data to make them comparable
  - Accumulated rainfall instead of hourly measurements
  - Information at TRMM presented in regions vs USGS data are points of information in the map
- Percent of difference calculation
- Conclusion
Obtaining data from Rain Gauges and TRMM Satellite

http://lake.nascom.nasa.gov/tovas/3B42RT/index2.shtml

Parameter:
- Accumulated Rainfall
- Hourly Rain Rate (mm/hr)

Color Level Option:
- Pre-defined
- Dynamic
- Customize: Min [ ] Max [ ]

Plot type: Area Plot

Begin date: 2004 May 23 00Z
End date: 2004 May 23 21Z

(Data Begin: 2002/01/29 00Z)
(Data End: 2005/03/07 03Z)

Generate Plot ASCII Output Reset Form

Alert: A new window will be opened when “Generate Plot” or “ASCII Output” is selected.
Sept 15, 2005
During T.S. Jeanne pass over PR

Obtaining data from Rain Gauges and TRMM Satellite

Accumulated Rainfall

[mm] (00Z15Sep2004–21Z15Sep2004)

Accumulated Rainfall

[mm] (00Z14May2004–21Z14May2004)

Accumulated Rainfall

[mm] (00Z23May2004–21Z23May2004)
Obtaining data from Rain Gauges and TRMM Satellite

Obtaining data from Rain Gauges and TRMM Satellite

Daily Data for Puerto Rico

Select Sites

Select sites which meet all of the following criteria: --- or select new criteria

County -- select one or more

Available parameters -- select sites that have data for the following parameters:

- Gage height, ft (98 sites)
- Streamflow, ft³/s (98 sites)
- Air temperature, °C (1 site)
- Air temperature, °F (3 sites)
- Barometric pressure, mmHg (3 sites)
- Wind speed, mi/h (3 sites)
- Wind direction, degrees clockwise from north (3 sites)

USGS
Results: Hurricane Jeanne

% difference

TRMM vs USGS
Hurricane Jeanne

% difference

Region

Ponce  Hato Rey  Naguabo  Hormigueros  Utuado  LMM Airport

Percent of Difference

0.00%  10.00%  20.00%  30.00%  40.00%  50.00%  60.00%
Results: May 23, 2004

% difference

TRMM vs USGS
May 23, 2004

Percent of Difference

Rio Grande
Fajardo
Ceiba
Luquillo
Naguabo
Rio Piedras
Cupey

Region

0.00%
5.00%
10.00%
15.00%
20.00%
25.00%
30.00%
35.00%
40.00%
Conclusions

- USGS rain gauges could be considered more accurate in this case because they are in-situ measurements, whereas the radar provides a spatial average over a large area.
- The satellite radar is good for pinpointing location of heavy rains and tracking the storm movement.
- USGS rain gauges are well distributed around the island, yet some of them are not operational all the time.
- The accuracy of the information from the radars can be affected by retrieval algorithms and other factors.
- The resolution of the radar can also affect the % difference significantly because we are looking at different points in space and time.
- Ground-based radars can provide the advantages of both sensors mentioned above.
NEXRAD (local NWS radar)

Future Work
Questions