

# **Extended Period of Heavy Rain and Flooding in Puerto Rico and the U.S. Virgin Islands May 12 – June 16, 2011**

## **Weather Summary**

Frequent periods of heavy showers and thunderstorms occurred during May and early June across Puerto Rico and the U.S. Virgin Islands in 2011. Table 1 shows selected stations that received 2 to 4 times the normal rainfall for the same time period while Fig. 1 shows their locations across the islands. San Juan Luis Munoz Marin Airport reported the highest ever rainfall amount for a 36 day period since records began there in 1955. Current COOP stations over the southwest part of Puerto Rico are limited though radar data suggests that region experienced above normal rainfall. However, rainfall amounts and impacts were not as noticeable as on other parts of the island.

The surface pattern during this time was subtle but featured a persistent trough extending northeast from a low in the southwest Caribbean Sea, placing Puerto Rico and the U.S. Virgin Islands in low level southeast flow. More dominant were the middle and upper level flows during the time. Fig. 2 shows a composite of the 500 mb heights for the first half of this event while Fig. 3 is a composite of the latter half. Figures 4 and 5 show wind vectors at 250 mb during the same 2 periods indicating that the region was persistently under the right rear portion of the subtropical upper jet, providing divergence at jet level and lift potential below. During these same 2 periods, Figures 6 and 7 show the precipitable water that was available, normally ranging from 47 mm to 51 mm (1.85 to 2.01 inches). Though the upper dynamics were not as strong during the latter (May 30 – June 16) period the precipitable water was higher. These conditions led to frequent heavy rain throughout late May and early June, usually induced by afternoon surface heating but often prolonged to other times by the favorable dynamic flow.

Location	Rainfall (inches) for May 12 – June 16, 2011	
	Normal	Observed (missing days)
<b>Puerto Rico</b>		
Luis Munoz Marin Airport (San Juan)	5.13	21.53
Aibonito 1S	4.35	25.08 (1)
Adjuntas 1S	8.11	14.57 (11)
Arecibo Observatory	9.63	18.04
Colero Camp	8.24	15.59 (1)
Coloso	12.05	20.66 (2)
Guajataca Dam	11.15	22.44
Guayama 2E	5.97	19.11 (1)
Gurabo Substation	4.71	19.15
Isabela Substation	8.72	22.17
Jajome Alto	7.02	19.82
Juncos 1SE	7.18	16.91 (2)
Roosevelt Roads	6.08	14.98
Montpelier	4.05	18.63 (2)
<b>U.S. Virgin Islands</b>		
Christiansted Airport (St. Croix)	3.52	10.41
Charlotte Amalie Airport (St. Thomas)	3.70	14.13

Table 1. Normal and observed rainfall for selected stations, May 12 – June 16, 2011.



Fig. 1 Locations of stations in table 1.

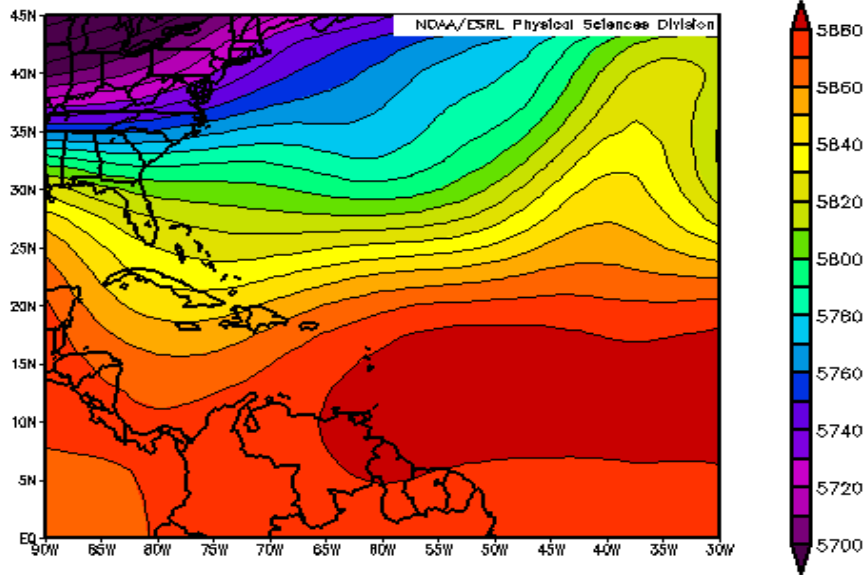


Fig. 2. Composite NCEP/NCAR Reanalysis of 500 mb height contours for May 12 – May 29, 2011.

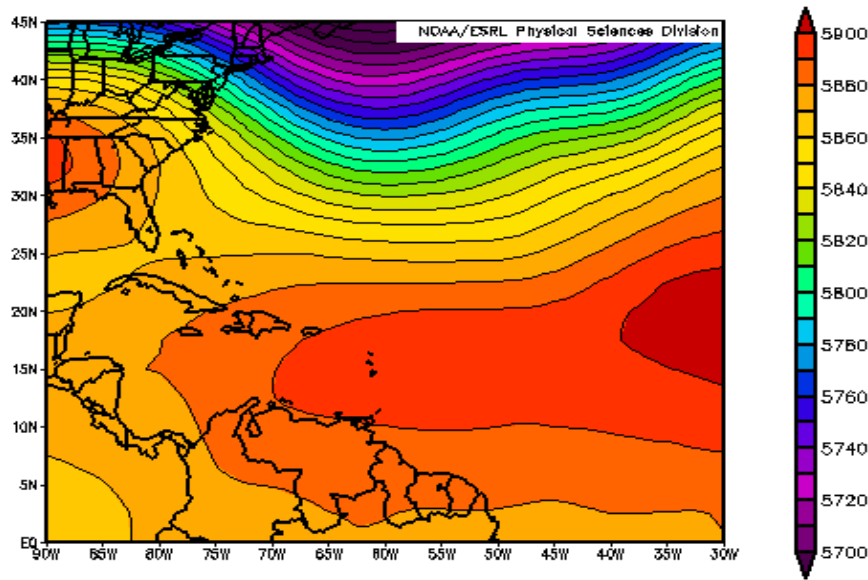


Fig. 3. Composite NCEP/NCAR Reanalysis of 500 mb height contours for May 30 – June 16, 2011.

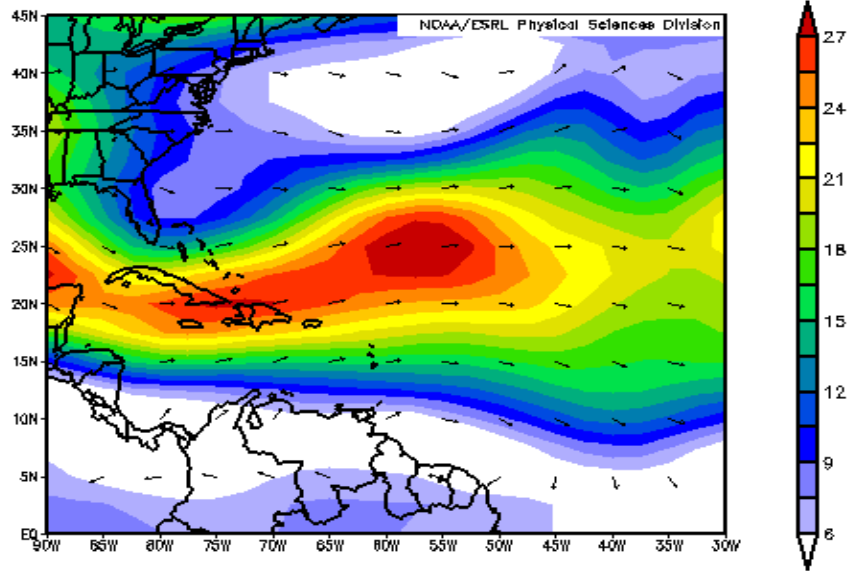


Fig. 4. Composite NCEP/NCAR Reanalysis of 250 mb wind vectors for May 12 – May 29, 2011.

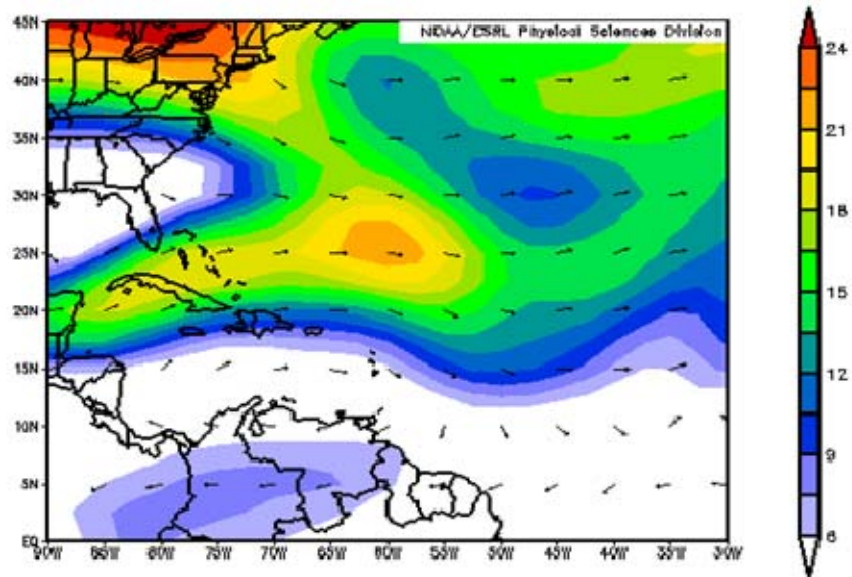


Fig. 5. Composite NCEP/NCAR Reanalysis of 250 mb wind vectors for May 30 – June 16, 2011.

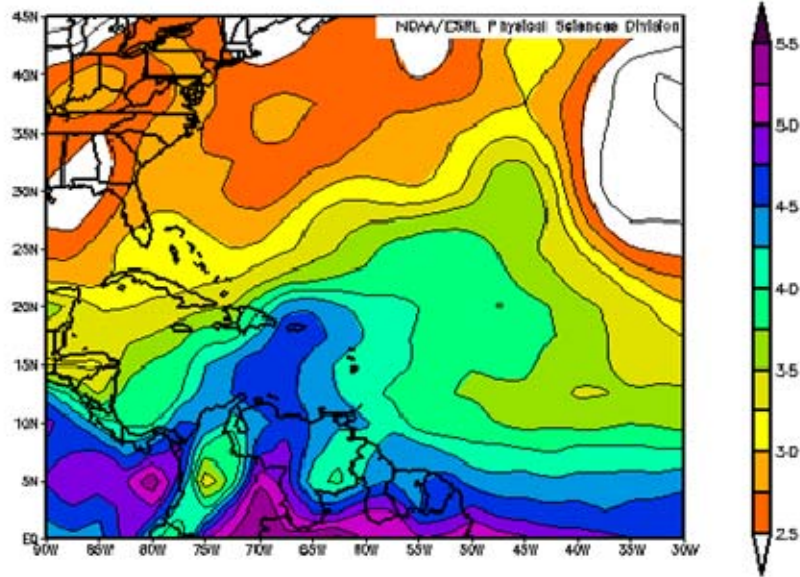


Fig. 6. Composite NCEP/NCAR Reanalysis of precipitable water for May 12 – May 29, 2011.

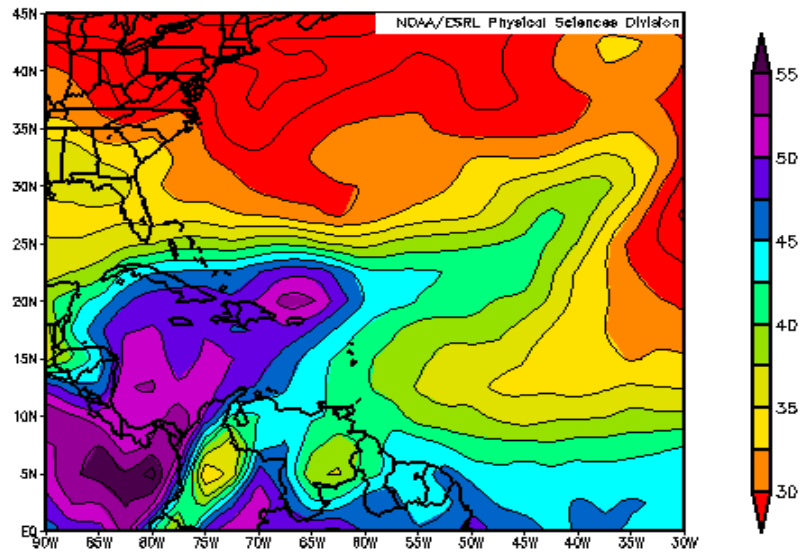


Fig. 7. Composite NCEP/NCAR Reanalysis of precipitable water for May 30 – June 16, 2011.

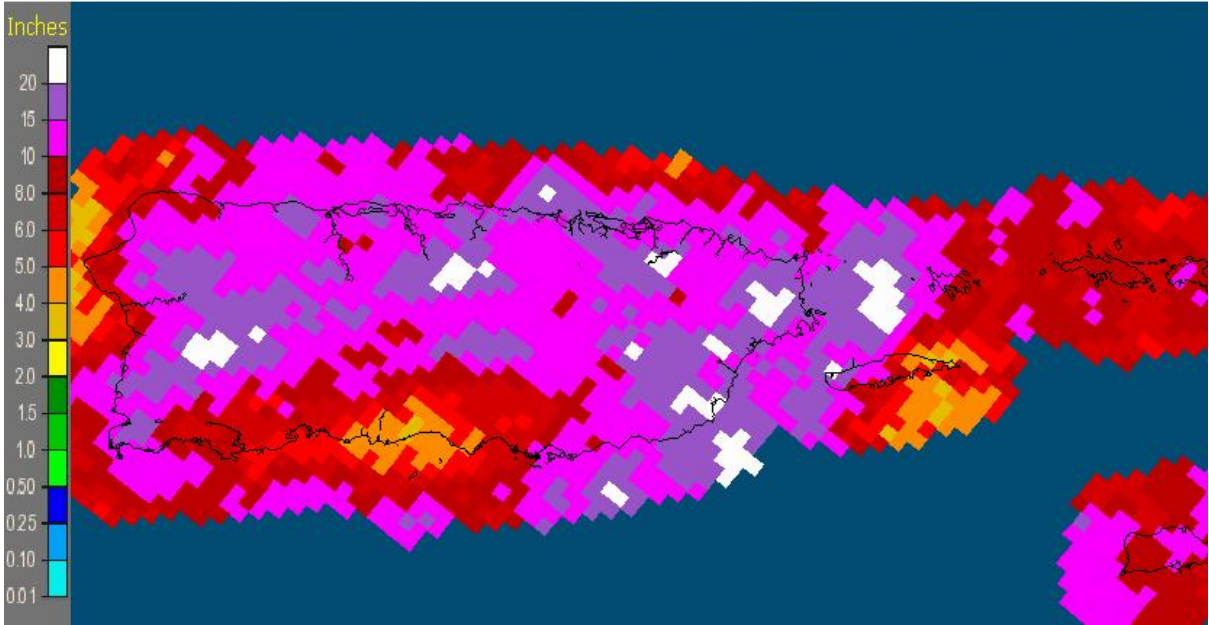
## Hydrological Summary

A wet April transitioned into a wet May and June which left its mark across the region with flash floods, urban flooding, extreme flow from lakes and reservoirs and mud and landslides. While none of the forecast area was spared from significant rainfall during the month of May, the heaviest rainfall did occur across the Eastern third of Puerto Rico and the US Virgin Islands. Moderate flooding occurred along the Rio Grande de Loiza on May 21<sup>st</sup> from two day rainfall amounts of 5 to 8 inches that capped off a week of steady rain. The runoff from this rainfall caused the Carraizo Dam to open gates that increased flows downstream of the dam to between 60,000 and 70,000 cfs; resulting in flooding in the communities of Canovanas, Trujillo Alto and Loiza. Significant flooding was also reported on St. Croix where their week's rainfall totals were on the order of 6 to 7 inches. The consistent rainfall continued to result in landslides across the Islands.

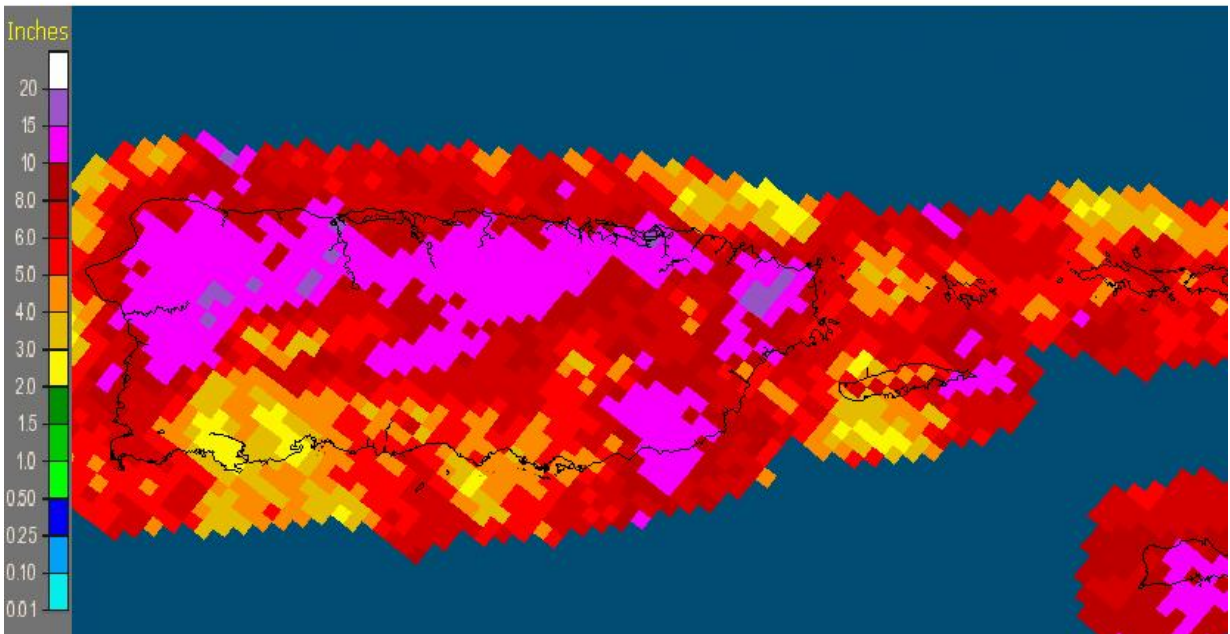
Only extreme southwestern Puerto Rico seemed to escape significant flooding during this period; for the remainder of the forecast area, flooding was significant and persistent. From the guts of the U.S. Virgin Islands to the smaller and "larger" basins of Puerto Rico, the flooding waxed and waned with the pulsing of energy and convective activity from day to day. Because of the pulsing nature of the event, the rivers, guts and streams remained swollen over an extended period of time which complicated the hydrologic impact.

The monthly "radar totals" using the archive of the Advanced Hydrologic Prediction Service (AHPS for San Juan, Puerto Rico are available via the following links. Please note that the 24 hour totals are from 12z – 12z (8am to 8am AST) - [AHPS archive of radar totals/ images](#). Here are the [May 2011 totals](#) and the [June 2011 totals](#).

San Juan, PR (SJU): May, 2011 Monthly Observed Precipitation  
Valid at 6/1/2011 1200 UTC- Created 6/3/11 21:38 UTC



San Juan, PR (SJU): June, 2011 Monthly Observed Precipitation  
Valid at 7/1/2011 1200 UTC- Created 7/3/11 21:38 UTC



The Flood Stage Reports for May and June 2011 are extensive with multiple crests noted on many of the rivers across the forecast area. Very impressive and recurring flooding was experienced by residents along the larger river basins; Rio Grande de Loiza, Rio Grande de Manati and the Rio de La Plata in Puerto Rico. Multiple flood reports were also noted in the U.S. Virgin Islands especially on the island of St. Croix; samples of which can be seen within the Flooding and Landslide Reports in the tables below.

For specific River Crests ... see the [Flood Stage Report for May](#) and the [Flood Stage Report for June](#).

<b>Flooding and Landslide Reports for May 2011</b> <b>(not all reports are posted here)</b>			
..TIME...	...EVENT...	...CITY LOCATION...	...LAT.LON...
..DATE...	....MAG.....	..COUNTY LOCATION..ST...	....SOURCE....
	..REMARKS..		
1228 PM 05/20/2011	HEAVY RAIN U0.00 INCH	MAUNABO MAUNABO	18.01N 65.90W PR EMERGENCY MNGR
	ROAD 3 NEAR SECTOR MALA PASCUA WAS IMPASSABLE.		
1230 PM 05/20/2011	HEAVY RAIN U0.00 INCH	PATILLAS PATILLAS	18.01N 66.01W PR EMERGENCY MNGR
	RIO LAGO CAME OUT OF ITS BANKS AND FLOODED ROAD 184.		
1255 PM 05/20/2011	HEAVY RAIN U0.00 INCH	PATILLAS PATILLAS	18.01N 66.01W PR EMERGENCY MNGR
	RIO MARIN CAME OUT OF ITS BANK AND FLOODED ROAD 181 NEAR INT. 7759.		
0425 PM 05/20/2011	HEAVY RAIN U0.00 INCH	FREDERIKSTED SAINT CROIX	17.71N 64.88W VI EMERGENCY MNGR
	SEVERAL ROADS FLOODED AND BLOCKED ACROSS THE WESTERN END OF ST CROIX.		
0811 PM 05/20/2011	FLOOD	VEGA BAJA VEGA BAJA	18.44N 66.40W PR EMERGENCY MNGR
	ROAD 2 WAS REPORTED IMPASSABLE NEAR NUEVO HOSPITAL AND FEW CREEKS OUT OF ITS BANKS.		
0446 PM 05/20/2011	AVALANCHE	HUMACAO HUMACAO	18.15N 65.82W PR EMERGENCY MNGR
	ROAD 446 IN BARRIO JUNQUITO SECTOR INVASION WAS REPORTED CLOSED DUE TO A LANDSLIDE.		
0447 PM	AVALANCHE	SAN LORENZO	18.19N 65.97W



05/20/2011		SAN LORENZO	PR	EMERGENCY MNGR
		INTERSECTION BETWEEN ROAD 313 AND 5TH STREET AT URB. ROOSEVELT WAS REPORTED CLOSED DUE TO A LANDSLIDE.		
0445 PM 05/20/2011	FLASH FLOOD	CEIBA CEIBA	PR	18.27N 65.65W EMERGENCY MNGR
		A FLOODED HOUSE IN BARRIO SACO ON ROAD 975.		
0447 PM 05/20/2011	FLASH FLOOD	SAN LORENZO SAN LORENZO	PR	18.19N 65.97W EMERGENCY MNGR
		A FLOODED HOUSE IN BARRIO QUEMADO ON ROAD 181 NEAR KM 3.7		
1008 PM 05/20/2011	AVALANCHE	UTUADO UTUADO	PR	18.27N 66.71W EMERGENCY MNGR
		ROAD 603,523 AND 123 WERE REPORTED CLOSED DUE TO LANDSLIDES.		
0445 PM 05/20/2011	AVALANCHE	NAGUABO NAGUABO	PR	18.21N 65.74W EMERGENCY MNGR
		HIGHWAY 53 NEAR KM 12.3 WAS PARTIALLY BLOCKED DUE TO A LANDSLIDE.		
0445 PM 05/20/2011	AVALANCHE	HUMACAO HUMACAO	PR	18.15N 65.82W EMERGENCY MNGR
		ROAD 189 NEAR RAMAL 914 PARTIALLY BLOCKED DUE TO A LANDSLIDE.		
0445 PM 05/20/2011	FLOOD	AGUADA AGUADA	PR	18.38N 67.19W EMERGENCY MNGR
		FLOODED BRIDGE ALONG ROAD 416 NEAR PITUSA DEPARTMENT STORE.		
0312 PM 05/27/2011	FLOOD	CAGUAS CAGUAS	PR	18.23N 66.04W BROADCAST MEDIA
		ROAD 763 AT BARRIO BORINQUEN IN CAGUAS WAS REPORTED FLOODED WITH A CAR STRANDED.		
0312 PM 05/27/2011	FLOOD	CAGUAS CAGUAS	PR	18.23N 66.04W BROADCAST MEDIA
		ROAD 1 BETWEEN THE MUNICIPALITY OF CAYEY AND CAGUAS WAS REPORTED IMPASSABLE.		
0312 PM 05/27/2011	FLOOD	CAGUAS CAGUAS	PR	18.23N 66.04W EMERGENCY MNGR
		DEGETAU AVENUE IN THE MUNICIPALITY OF CAGUAS WAS REPORTED FLOODED.		

0312 PM 05/27/2011	HEAVY RAIN E0.00 INCH	CAGUAS CAGUAS	PR	18.23N 66.04W EMERGENCY MNGR
URB. TURABO HEIGHTS IN CAGUAS WAS REPORTED FLOODED.				
0312 PM 05/27/2011	AVALANCHE	JUNCOS JUNCOS	PR	18.23N 65.92W EMERGENCY MNGR
A MUDSLIDE WAS REPORTED AT ROAD 929 BARRIO QUEBRADA NEAR COCK PIT SAN CARLOS.				
0301 PM 05/30/2011	FLOOD	CAROLINA CAROLINA	PR	18.41N 65.98W PUBLIC
URBAN FLOODING. ROUTE 3 IN FRONT OF THE CAROLINA SHOPPING COURT FLOODED.				
0400 PM 05/30/2011	FLOOD	MOROVIS MOROVIS	PR	18.33N 66.41W EMERGENCY MNGR
ROUTE 567 KM.5.9 BARRIO SAN LORENZO FLOODED.				
0400 PM 05/30/2011	FLOOD	TRUJILLO ALTO TRUJILLO ALTO	PR	18.36N 66.02W EMERGENCY MNGR
ROUTE 851 BARRIO DOS BOCAS FLOODED.				
0632 AM 05/31/2011	FLOOD	QUEBRADILLAS QUEBRADILLAS	PR	18.48N 66.94W NEWSPAPER
ROUTE 113 KM 12.5 FLOODED IN URB. SANTA MARINA AND VILLA JULIA.				
0632 AM 05/31/2011	FLOOD	ARECIBO ARECIBO	PR	18.46N 66.74W NEWSPAPER
ROUTE PR-2 KM 68.5 IN SANTANA AND PR-2 KM 77.4 MANUEL T GUILLAN STREET FLOODED.				

**Flooding and Landslide Reports for June 2011  
(not all reports are posted here)**

..TIME...	...EVENT...	...CITY LOCATION...	...LAT.LON...
..DATE...	....MAG....	..COUNTY LOCATION..ST..	...SOURCE....
	..REMARKS..		
0655 PM 06/04/2011	FLOOD	MAYAGUEZ MAYAGUEZ	PR TRAINED SPOTTER
ROAD 102 FLOODED NEAR PARQUE DE LOS PROCERES.			
0658 PM	FLOOD	HORMIGUEROS	18.14N 67.12W

06/04/2011		MAYAGUEZ	PR	TRAINED SPOTTER
		SEVERAL AREAS ALONG ROAD 114 FLOODED.		
0701 PM	FLOOD	MAYAGUEZ		18.20N 67.14W
06/04/2011		MAYAGUEZ	PR	TRAINED SPOTTER
		ROAD 64 FLOODED NEAR SECTOR EL MANI.		
0811 PM	FLOOD	W MANATI		18.43N 66.48W
06/04/2011		MANATI	PR	EMERGENCY MNGR
		RIVER RIO GRANDE DE MANATI WAS BEGINNING TO OVERFLOW ITS BANKS AT SECTOR CACHETE, HIGHWAY 2 AT THE INTERSECTION WITH PR-666.		
0300 AM	FLOOD	FREDERIKSTED		17.71N 64.88W
06/07/2011		SAINT CROIX	VI	COUNTY OFFICIAL
		HUMAN SERVICES BUILDING FLOODED		
1000 AM	FLOOD	FREDERIKSTED		17.71N 64.88W
06/07/2011		SAINT CROIX	VI	COUNTY OFFICIAL
		AREAS OF FLOODING INCLUDED SAINT PETERS REST...HIGHWAY EAST OF THE AIRPORT...QUEEN MARY AGRICULTURE AREA...BENJAMIN DRIVE RICHMOND SENIOR CENTER...ALDERSVILLE SENIOR CENTER		
0401 AM	FLASH FLOOD	MANATI		18.43N 66.48W
06/08/2011		MANATI	PR	EMERGENCY MNGR
		RIVER RIO GRANDE DE MANATI WAS BEGINNING TO OVERFLOW ITS BANKS AT HIGHWAY 2 BETWEEN KM.50 AND THE BORDER OF BARCELONETA AND MANATI.		
0615 PM	FLOOD	VEGA ALTA		18.42N 66.32W
06/14/2011		VEGA ALTA	PR	EMERGENCY MNGR
		ROAD 620 IN FATIMA SECTOR, 647 IN OJO DE AGUA SECTOR, AND ROADS 675,676 AND 690 IN BAJURA SECTOR WERE REPORTED IMPASSABLE DUE TO RIO CIBUCO OUT OF ITS BANKS.		

Not surprisingly, May 2011 and June 2011 were above normal in terms of precipitation, with the San Juan area averaging 5.60” and 10.08” of rainfall above normal respectively. This surplus made May 2011 the eighth wettest May on record, while June 2011 ended as the wettest June on record. In fact, June 2011 was also the sixth wettest month on record since 1956. Statistically, June 2011 also ended as the second wettest June on record in Saint Croix, with the total accumulated precipitation of 20.73” through the end of June representing the seventh wettest start to a year across the island.