

SEVERE FLOODS OF OCTOBER 12-15, 1954 IN PUERTO RICO

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INTRODUCTION

During October 12-15, 1954, Puerto Rico experienced one of the worst floods in its history. It reached proportions observed before only during the passage of great hurricanes. The San Ciriaco hurricane of 1899 produced floods considered to date to be the most intense suffered by Puerto Rico in history, but the records at that time were not complete and the network of rainfall stations was inadequate. The indications are that the flood conditions observed in the present situation at least equalled those of the San Ciriaco hurricane in intensity and damages produced. The intensity of the rainfall at the Toro Negro station (28.00 inches in 24 hours) during the San Felipe hurricane of September 13-14, 1928 exceeded that in connection with hurricane Hazel at this station; however, the extent and duration of the heavy rains during the passage of Hazel were greater.

Puerto Rico has a range of mountains, called the Central Cordillera, extending almost east-west across the south-central portion of the Island with elevations up to 5,000 feet on the highest peaks. Ordinarily, southerly currents of warm moist air from the Caribbean Sea produce heavy rains on the southern slopes and some flooding occurs occasionally in the southern and eastern coastal areas. The north-central coastal areas normally are not subject to as much flooding even though considerable rain from the prevailing winds falls on the northern and eastern slopes. In the present case, however, due to the peculiar synoptic situation that developed over the area, excessive precipitation was widespread over the whole island and flood conditions ensued not only in the eastern and southern sections but also in the northern coastal areas.

SYNOPTIC SITUATION

Hurricane Hazel passed westward 350 miles south of Puerto Rico on October 6, 1954. The winds and weather conditions observed at Puerto Rico were normal for such a situation. On October 9 an unstable easterly wave, which followed the one that had developed into hurricane Hazel, made its appearance over the Lesser Antilles. During October 9 and 10 this wave was followed very carefully as it moved westward over the eastern Caribbean. For a time it looked as if a development might take place on this wave and all interested agencies were alerted ac-

ordingly. However, the situation improved and late on October 10 the easterly wave, of only moderate intensity at the time, passed westward over Puerto Rico. Shower activity of moderate to heavy intensity prevailed as the wave passed.

At this time hurricane Hazel was beginning to recurve to the north-northeast over the Caribbean and a particular circulation began to take form in the low levels over the Windward Islands. The winds at San Juan in the lower 10,000 feet, which were easterly before the passage of the easterly wave, shifted to southeast and south-southeast behind the wave, but during October 11 and early October 12, instead of backing to the east as they normally do, they shifted more to the south and persisted with moderate speeds. An east-west oriented shear line had developed between the southerly to southwesterly flow to the east of hurricane Hazel and the easterly trades which still prevailed northward of Puerto Rico. The map for 1800 GMT, October 12 (fig. 1), shows this particular situation. The positions of the shear line 24 hours before and after the time of the map also are indicated. The shear line extended eastward from hurricane Hazel to the region of the Leeward Islands. It moved north of Puerto Rico on

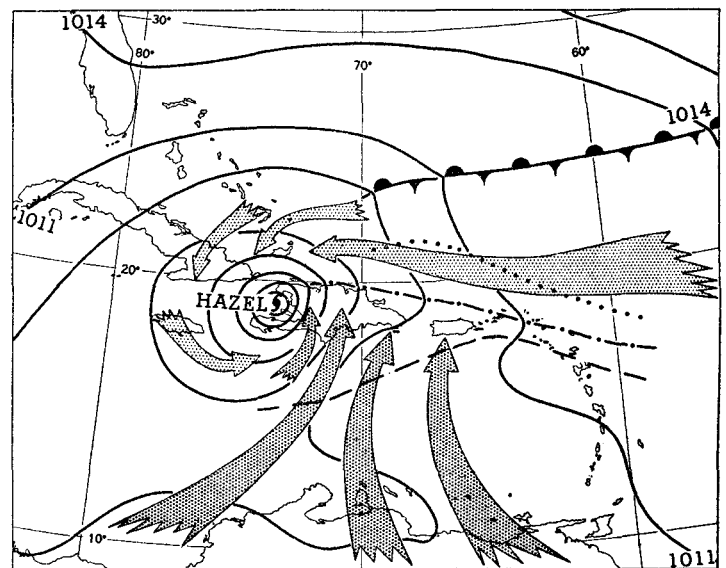


FIGURE 1.—Surface weather map for 1800 GMT, October 12, 1954. The position of the shear line is shown for 1800 GMT on October 11 (dashed line), October 12 (dot dashed line) and October 13 (dotted line). Large arrows show main air currents.

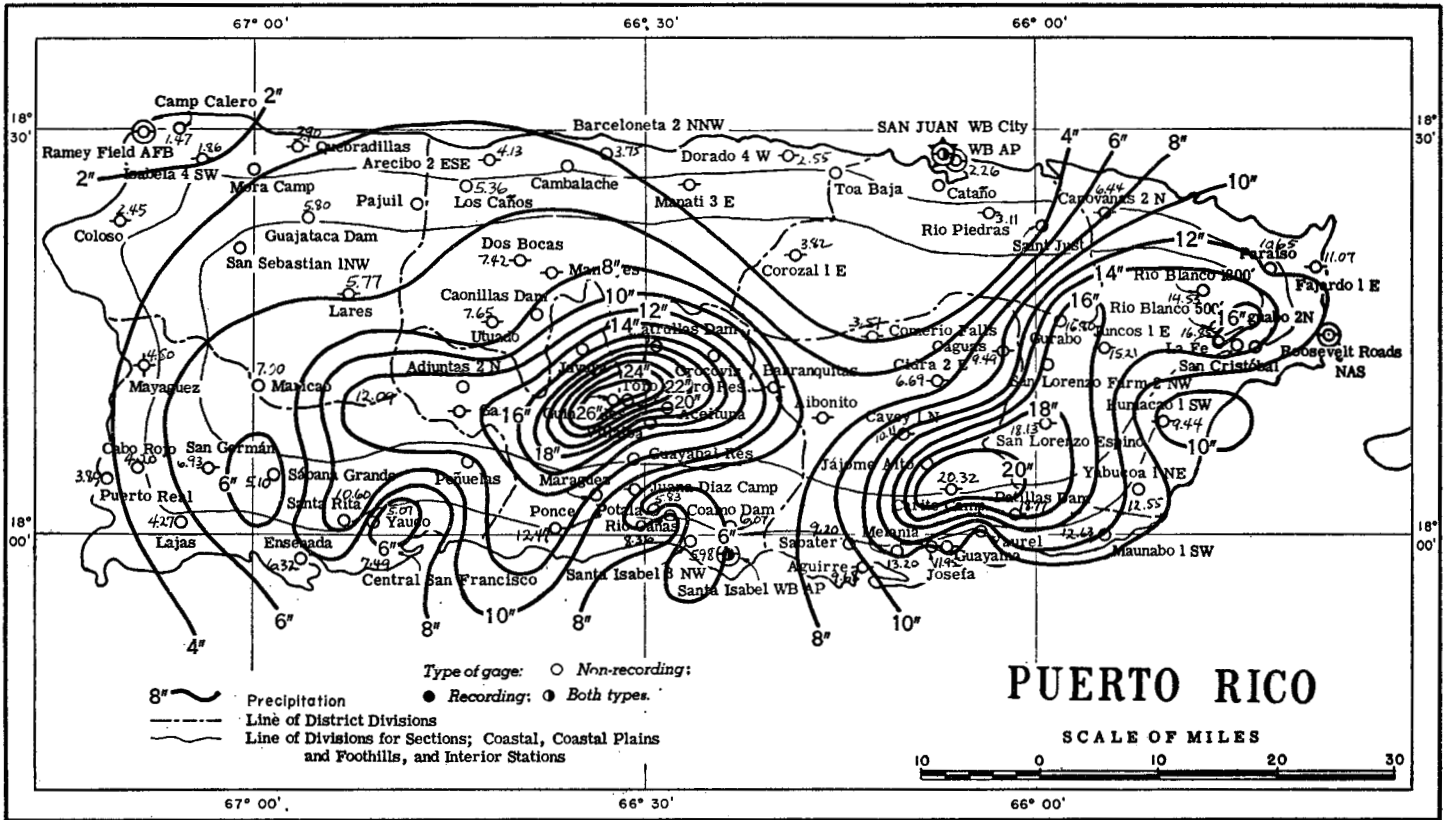


FIGURE 2.—Rainfall distribution over Puerto Rico for the period October 11-16, 1954. Amounts are in inches.

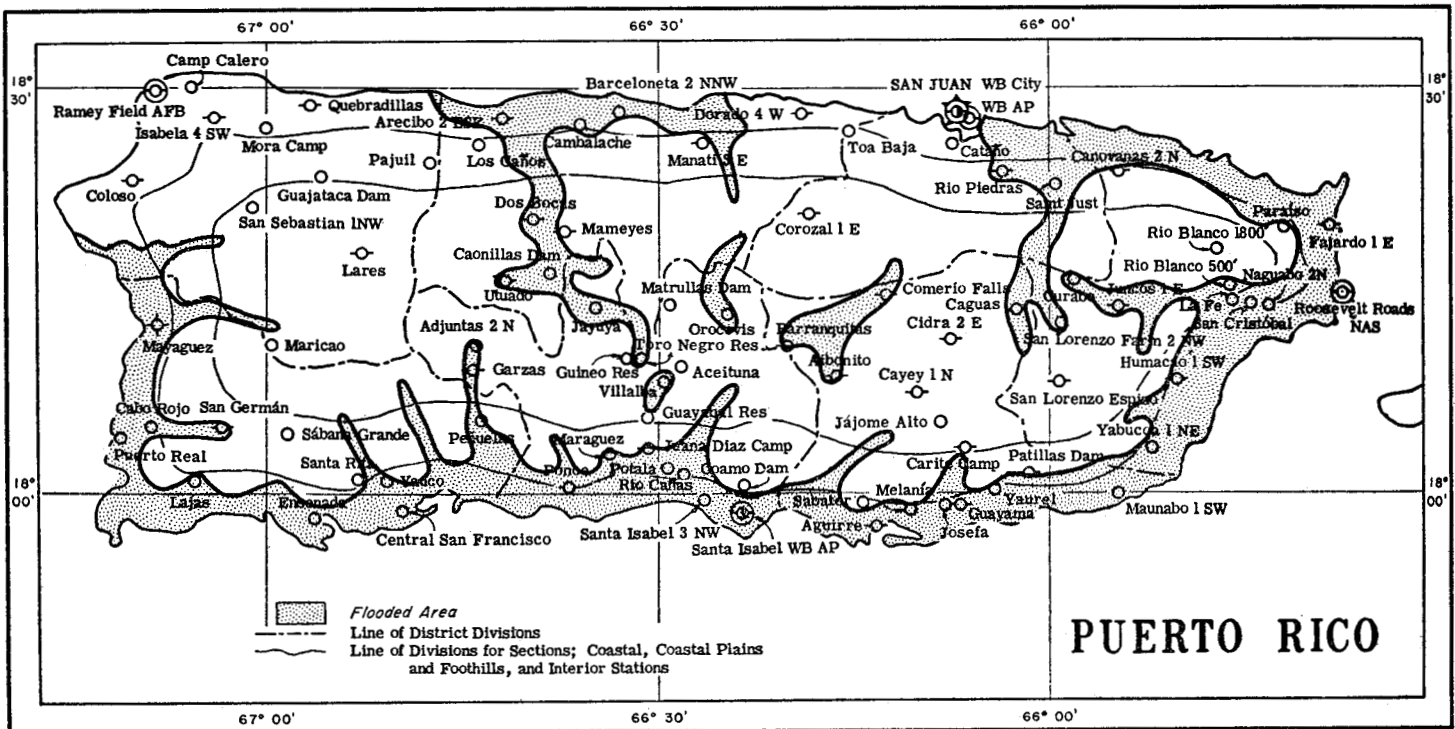


FIGURE 3.—Areas of Puerto Rico subjected to floods during October 12-15, 1954, are indicated by stippling.

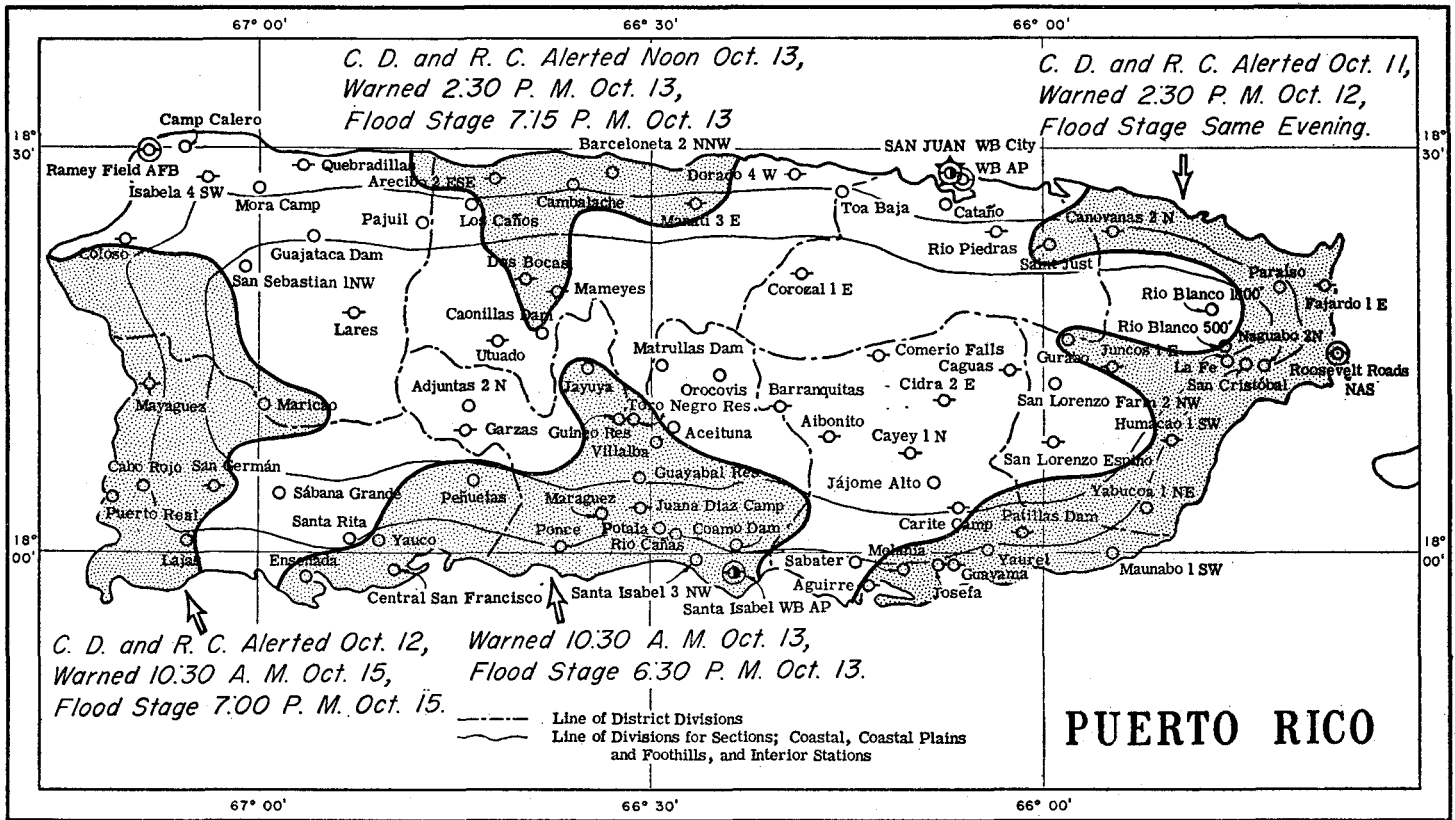


FIGURE 4.—Area of Puerto Rico covered by flood warnings are indicated by stippling. Times of issue of warnings, times of alerting Civil Defense (CD) and Red Cross (RC) and times rivers were at flood stage are indicated.

October 12 and persisted in the area until Hazel moved northward out of the region on October 14. Strong southerly flow prevailed over Puerto Rico until October 15. The radiosonde ascents at San Juan during the period showed this air to be saturated up to the 500-mb. level. The strong convergence and instability present in the area due to the effect of this shear line combined with the orographic effect on the southern slopes of Puerto Rico produced torrential rains of extraordinary intensity and duration.

RAINFALL AND FLOODS

Rains previous to October 11 which occurred in connection with the easterly wave described, saturated the soil and caused a high percentage of runoff. Thus the excessive precipitation which started on October 12 flowed immediately into the rivers and reservoirs and severe floods followed. The intensity of the rainfall is indicated by such observations as that at Toro Negro Dam where 26.07 inches fell during the period October 11–16. Figure 2 shows the rainfall distribution for October 11–16 and table 1 gives a breakdown by 24-hour periods for October 11 through 16.

Figure 3 shows the areas subjected to floods during October 12–15. The eastern coastal areas from Carolina-Fajardo to Salinas including Humacao, Maunabo, Na-

guabo, Las Piedras, Yabucoa, and Guayama, suffered severe floods on October 12. This area had already received copious rainfall from the easterly wave. The next day, October 13, the rivers in the area from Santa Isabel to Guànica began to rise and by late afternoon and early evening Ponce had 6 feet of water in the streets in some sections of the city. Other towns in the south-central

TABLE 1.—Rainfall for the 24-hour periods ending at 6 p. m. AST, Oct. 11–16, 1954

Puerto Rico Water Resources Authority reporting stations	Oct. 11	Oct. 12	Oct. 13	Oct. 14	Oct. 15	Oct. 16	Total
Caonillas Dam.....	0.37	0.27	8.30	0.50	0.20	0.00	9.64
Carite Dam.....	1.82	3.01	4.84	3.66	2.42	1.52	17.27
Carite Plant No. 1.....	3.65	2.67	4.71	5.53	2.27	.93	19.76
Carite Tunnel.....	3.60	2.78	4.00	5.05	3.61	1.28	20.32
Coamo Dam.....	.64	2.00	1.19	.83	1.26	.15	6.07
Colonia Sabater (Salinas).....	1.15	1.60	.50	3.85	1.80	.30	9.20
Comerio Falls.....	.89	.48	1.04	1.00	.08	.02	3.51
Dos Bocas.....	0.00	.27	5.85	.10	.63	.58	7.42
Guayabal Reservoir.....	1.15	2.10	3.40	2.79	.55	.05	10.04
Guayama.....	1.98	2.92	3.47	1.76	1.90	.72	12.75
Guineo Reservoir.....	1.13	4.90	12.05	5.05	.41	0.00	23.54
Juana Díaz.....	1.20	.76	3.66	2.11	.46	0.00	8.19
Matrullas Dam.....	.78	3.80	10.45	1.09	.05	1.42	17.59
Melania (Salinas).....	2.30	1.75	4.15	2.40	2.25	.35	13.20
Patillas Dam.....	5.47	2.86	5.37	2.18	1.81	1.08	18.77
Ponce.....	1.90	.68	6.47	2.54	.48	.40	12.47
Río Blanco (500 ft.).....	2.95	3.38	3.04	1.93	1.18	.57	13.05
Río Blanco (1,800 ft.) (Hicaco Dam).....	3.20	3.65	3.33	2.88	.53	.94	14.53
Río Canas (Juana Díaz).....	.52	1.85	2.89	2.25	.79	.06	8.36
Río Jueyes (Salinas).....	2.74	1.96	.91	2.42	1.00	.15	9.18
Toro Negro Plant No. 1.....	.92	1.85	6.50	2.87	1.94	.06	14.14
Toro Negro Tunnel.....	.90	6.37	13.50	4.98	.32	0.00	26.07
Yauco.....	.80	2.80	1.32	.80	.15	.07	5.07
Yaurel Flume (Arroyo).....	3.50	2.40	2.25	1.25	1.65	.90	11.96

area including Villalba, Santa Isabel, Jayuya, Adjuntas, Guánica, Orocovis, Yauco, Peñuelas, and Juana Díaz were also flooded. Rainfall over this area was heaviest during the night of the 12th and early morning of the 13th.

A report from the Puerto Rico Water Resources Authority at noon on the 13th indicated that the water level at the Dos Bocas and Caonillas reservoirs on the northern slopes of the Cordillera was rising rapidly despite the opening of the sluices and tunnels and would go over the tops of the dams. This gave the first indication that heavy rain was also falling in the northern slopes and that the northern coastal areas, including Arecibo and Manatí, two important cities in the north-central coast, as well as Mayaguez, the third largest city of the island, on the west coast, were threatened.

On the night of October 13, at the same time that the southern coastal areas around Ponce were under severe floods, the Río Grande de Arecibo and Río Grande de Manatí were at flood stage. At Dos Bocas the water stood at 10.5 feet above the top of the dam which meant that 24,000,000 gallons per minute were being discharged into the Arecibo river. At the same time Caonillas Reservoir was discharging 7,200,000 gallons per minute into the same river.

Heavy precipitation with additional flood conditions and damage to property persisted, specially in the southern slopes until October 15, when the situation finally abated.

FLOOD DAMAGES

There were nine persons killed; eight by drowning and one by a landslide.

Damage to agriculture, livestock, homes, businesses, highways, bridges, municipal street and sewer systems, personal property losses (including homes destroyed and damaged) will exceed all previous floods since 1899. Reports of damages are slow coming in, and from many areas the reports of the total damages (all kinds) are incomplete. For example, one warehouse at Mayaguez reported a loss of \$85,000 due to flooding, yet the official report from that area showed total damages of only \$60,000. The official reports are underestimates because either the people fail to report promptly to the appropriate authority, or their reports fail to cover damages for rural and urban as well as metropolitan districts. A summary of the flood damages based upon incomplete reports is given in table 2.

It is significant to note that more than 550 houses were destroyed and about 1,000 (estimated) were damaged. Ponce bore the brunt of houses destroyed with 253. No mention is made of the houses destroyed or damaged in the rural areas.

Some 11,000 people were successfully evacuated by the Civil Defense and Red Cross in the inundated areas. Helicopters of the U. S. Air Force from Ramey Field assisted in taking the people out of the flooded sections

TABLE 2.—Summary of the flood damages in Puerto Rico, Oct. 12–15, 1954 (based upon incomplete reports)

Damages	Amounts
Number of houses destroyed.....	555
This does not represent the entire number, but based on the value of approximately \$1,000 per house and appurtenances.....	\$555,000
Number of houses or buildings damaged (estimated).....	1,000
Incomplete report; damages (all kinds) including business, warehouses, sugar mills, etc., at \$200 each.....	200,000
State roads, bridges.....	\$650,000
Municipal streets and sewers.....	451,000
Municipal reserves for repair.....	15,459
Other Government organizations ¹	302,533
Other Government entities ¹	212,494
Total Government losses.....	1,631,486
Agriculture:	
Sugarcane.....	1,154,854
Tobacco.....	317,500
Farm equipment.....	24,850
Livestock (cattle, hogs, and poultry).....	(²)
Coffee (in some districts 80 percent of coffee crops were destroyed; taken from Department of Agriculture, Civil Defense, and Land Office files).....	400,000
Bananas, citrus fruits, truck crops.....	299,000
Pastures.....	6,000
Personal property losses:	
Household effects.....	299,448
Domestic animals.....	6,203
Automobiles, trucks, etc., ruined or damaged by the flood waters.....	(²)
Hydroelectric dams.....	305,651
Indirect damages.....	155,000
Total loss based on incomplete data.....	5,045,341

NOTE.—As additional information on damages filters in these figures will be revised upward.

¹ Taken from files of Civil Defense.

² No figures.

³ Incomplete.

in the north coast. There were 45 municipalities affected by the floods.

WARNING SERVICE

The warnings were timely and adequate. On the night of October 11 the Civil Defense and Red Cross were alerted to the possible danger of floods through the Island. The Civil Defense and Red Cross had been alerted on the night of the 10th to the possible development of a disturbance on the easterly wave previously noted, and remained on the alert through the flood threat. It was due to the work of evacuation, housing, and feeding of people by these two organizations that greater loss of life was averted. All available communication means were used to disseminate the warnings to the people. The Puerto Rico Association of Radio Broadcast Stations carried the warnings to threatened areas every half hour. State Police Radio alerted every police precinct on the Island and the Puerto Rican Amateur Net not only disseminated the warnings, but collected rainfall observations from important locations. A map indicating the areas covered by the warnings, with the time of issue, times the rivers were at flood stage, and time of alerting cognizant authorities, is shown in figure 4.

The cooperation and assistance rendered this Weather Bureau office by the Puerto Rico Water Resources Authority in providing information on the intensity of the rainfall, regular rainfall observations, and the height of the water level in the reservoirs, was of inestimable value in determining the duration and extent of the floods.