DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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WATER RESOURCES INVESTIGATIONS REPORT 84-4184

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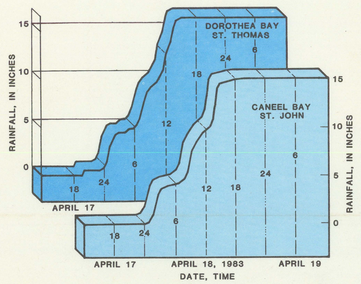

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FLOODS OF APRIL 18, 1983 ON ST. THOMAS AND ST. JOHN, U.S. VIRGIN ISLANDS

By
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ABSTRACT

The U.S. Virgin Islands of St. Thomas and St. John experienced the most intense rainfall event in recorded history on April 18, 1983. Rainfall intensities of 2.5 inches per hour, and more than 16 inches in 18 hours were recorded. Almost instantaneous runoff caused widespread flooding near the coastlines of both islands. Parts of Charlotte Amalie in St. Thomas were inundated with four feet or more of mud and flood water. Harry S. Truman Airport was flooded for two days with two to three feet of ponded water. On St. John, rural areas near Guinea Gut, Fish Bay, and Coral Bay were flooded.

INTRODUCTION

Severe flooding as a result of intense rainfall occurred in St. Thomas and St. John, U.S. Virgin Islands during April 18, 1983. Rainfall intensities of 2.5 in./hr, and more than 16 in. in 18 hrs were recorded at St. Thomas and St. John. The almost instantaneous runoff turned the usually dry streams on both islands into raging rivers of sediment-laden water and debris.

The U.S. Geological Survey, Caribbean District initiated a project to document the extent of the flooding and the magnitude of the discharges at the most important streams and guts in both islands. A team of 10 hydrologists and technicians was detailed to survey flood- marks immediately after the flood event. Flood elevations were measured and marked, for later surveys on St. Thomas along the south coast area from Long Bay to Harry S. Truman Airport. The gathered and computed records will be essential for future basin planning, emergency management activities and to help define actual flood frequencies.

LOCATION

The Virgin Islands, forming part of the Lesser Antilles separating the Caribbean Sea from the Atlantic Ocean, are about 1,400 mi southeast of New York and almost 1,000 mi east-southeast of Miami. The three U.S. Virgin Islands are St. Thomas, St. John, and St. Croix. St. Thomas is located about 50 mi east of Puerto Rico; St. John, another 5 mi to the east, and St. Croix is about 40 mi due south of St. John (fig. 1).

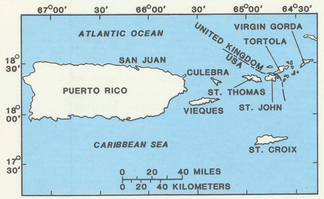

Figure 1. Geographic setting of U.S. Virgin Islands.

CLIMATE

Average-annual rainfall in the U.S. Virgin Islands is about 45 in.,ranging from a low of about 30 in. in the flat lowlands to a high of about 60 in. at the mountain peaks (fig. 2). The weather is dominated by the almost constant easterly trade winds. Most rainfall is caused by the lifting and cooling of the humid air as it passes the islands. February and March are usually the dryest months and September and October the rainiest. Most rainfall occurs during brief showers. Heavy intense rains result from the passage of easterly "waves", tropical depressions, tropical storms, and hurricanes.

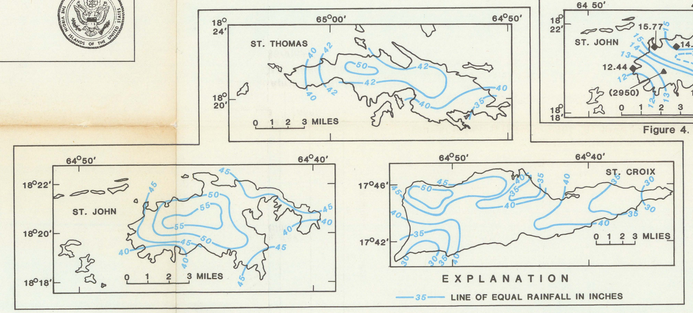

Figure 2. Average-annual rainfall in the U.S. Virgin Islands (Prepared by R.J. Calvesbert, NOAA, NWS).

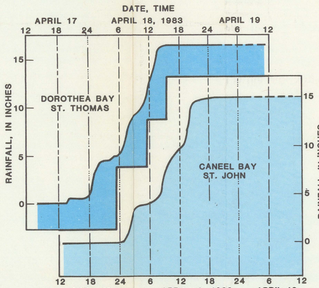

Figure 3. Precipitation patterns for April 17-18, 1983, St. Thomas and St. John, U.S. Virgin Islands (NOAA, National Weather Service).

THE STORM

The intense rainfall of April 18, 1983 was caused by an upper-level trough located west of Puerto Rico. After 3 months of unusually dry conditions affecting Puerto Rico and the Virgin Islands, a low-pressure weather system moved into the area late on April 17 and remained stagnant for most of April 18.

A cell of heavy showers developed over water south of Puerto Rico at about 5 p.m. on April 17. It moved northeastward into southern Puerto Rico and continued into the northern Virgin Islands. Amounts of 2 to 3 in. were recorded during the night in southern and eastern Puerto Rico. In the U.S. Virgin Islands, the trough produced one of the most intense rainfall events of record (R.J. Calvesbert, NOAA-NWS, oral commun., 1983).

The most important storm development occurred over the islands of St. Thomas and St. John. Recording rain gages maintained by NOAA-National Weather Service at Dorothea Agricultural Station in St. Thomas and at Caneel Bay in St. John provided data on the intensity of the rainfall (fig. 3). Rain started in St. Thomas around 7 p.m. on the 17th and about 0.6 in. had accumulated by midnight when a period of heavy rainfall started.

THE STORM

Between midnight and 2 a.m., on the 18th of April about 3.5 in. of rainfall were recorded. Relatively light rain continued during the remainder of the night as the cell of heavy rain moved eastward into the Leeward Islands. Around sunrise an east-west line of heavy showers developed over St. Thomas and St. John. By 6 a.m. about 5.3 in. of rain had accumulated at Dorothea. Intense rain contributed about 4 in. during the 3-hour period from 6 to 9 a.m. Moderate steady rain continued until about 11 a.m. when the final and most intense downpour began. By 2 p.m. another 6.0 in. had accumulated as the storm subsided.

A total of 16.5 in. of rainfall were recorded in the 19-hour period from 7 p.m. on April 17 to 2 p.m. on April 18. During that period, there were amounts of 2.5 in. in 1 hour (twice), 6.0 in. in 3 hours, 8.0 in. in 6 hours, 12.3 in. in 12 hours, and 16.0 in. in 18 hours.

The recorded rainfall-data for the station at Caneel Bay, St. John show an almost identical pattern of timing and intensity.

The storm totals on St. Thomas ranged from 14.5 in. in the extreme east to 18.7 in. in the west. On St. John, totals ranged from 12 in. in the extreme east and west coasts up to 16 in. in the higher elevations of the interior (fig. 4).

In contrast, the storm affected St. Croix about a day later and totals were relatively small (4.0 to 6.7 in.).

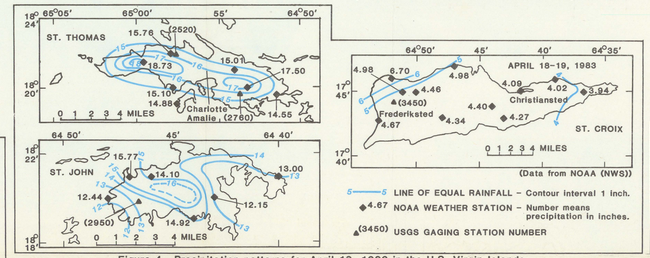

Figure 4. Precipitation patterns for April 18, 1983 in the U.S. Virgin Islands, (Prepared by R.J. Calvesbert, NOAA, NWS).

THE FLOOD

The unusually intense rainfall produced almost instantaneous runoff on St. Thomas and St. John because the drainage basins are very steep. Normally-dry creeks or "guts" overflowed as the tremendous quantity of floodwater and accompanying mud, rocks and debris discharged toward the sea. The areas of most widespread flooding were those near the coastline as the floodwaters could not discharge to the sea fast enough.

The flood consisted of three distinct periods of intensive runoff, each more severe than the previous one. The flow pattern for Bonne Resolution Gut, St. Thomas (fig. 5), exemplifies the progression of the flood as well as the intensity. Runoff was equal to 12.9 in. of rainfall. By midday a major emergency had developed along the heavily-populated south coast. Most businesses along the main street of Charlotte Amalie in St. Thomas were flooded with up to 4.7 ft of water and mud (fig. 6). A resident drowned when he slipped into a drainage gutter and was swept away by the current. At Harry S. Truman Airport, the runway and the terminal building were under 2-3 ft of mud and water. The airport remained closed several days for cleanup operations. On St. John, the rural areas near Guinea Gut, Fish Bay and Coral Bay were flooded. Numerous landslides blocked roads and brought down utility poles; the islands were without electric power or telephone sevice for several days. The National Guard was called to assist the clearing of roads and to prevent looting. Flood-related damages in the two islands were estimated at 12-13 million dollars. St. Thomas and St. John were declared disaster areas by Federal Officials (San Juan Star, April 1983).

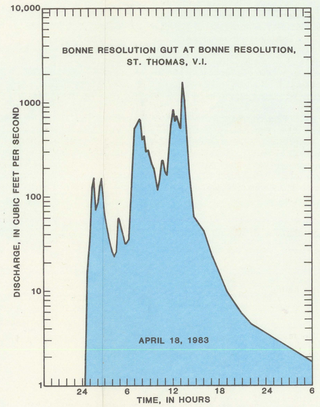

Figure 5. Flow pattern for Bonne Resolution Gut at Bonne Resolution, St. Thomas.

The following factors may be used to convert the inch-pound units to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{-2}	cubic meters per second (m^3/s)

THE FLOOD

The flood heights were measured at the two stream-gaging stations on St. Thomas and the one on St. John (fig. 4). Indirect measurements of the rates of flow at these sites during the flood peak are shown in Table 1. Note the large unit discharges, all exceeding 2,500 cfs/mi^2. Based on data for similar streams in Puerto Rico (López, 1979, p. 26), flooding of this magnitude can be expected to occur on the average less than once every one-hundred years. Figure 7 is a reprint of López's figure 13 with the 1983 peak flow rates for the three gaging stations plotted for comparison to other outstanding floods. Although these do not exceed the upper peaks, they are in the same range as other maximum known floods. According to local residents, this was the worst flooding ever experienced in these islands.

The effects of sediment and debris on the flood peaks cannot be fully evaluated because of lack of data. However, it is likely that runoff rates and volumes are subject to more error than normal because of the unknown effects of these factors.

Federal Emergency Management Administration officers estimated the damages on St. Thomas and St. John were 3.5 million dollars to structures and contents, 5 million dollars to public works and schools, and 4 million dollars to roads, bridges and culverts (San Juan Star, April, 1983).

Table 1. Peak discharges at gaging stations in St. Thomas and St. John, U.S. Virgin Islands.

Station number	Station name	Drainage area (mi^2)	Period of record	Maximum previously known discharge			Maximum discharge for April 18, 1983			
				Date	Discharge (ft^3/s)	Unit discharge	Time	Discharge (ft^3/s)	Unit discharge ($ft^3/sec\ mi^2$)	Frequency (years)
	St. Thomas									
50252000	Bonne Resolution Gut at Bonne Resolution	0.49	1963-64, 1979-83	9-4-79	218	445	1315	1,650	3,370	100+
50276000	Turpentine Run at Mariendal	2.97	1963-69 1979-83	9-4-79	2,500	840	-	9,710	3,270	100+
	St. John									
50295000	Guinea Gut at Bethany	0.37	1963-66, 1982-83	11-4-65	111	300	-	946	2,560	100+

SELECTED REFERENCES

Curtis, Russell E., and Others, 1984, Water resources data, Puerto Rico and the U.S. Virgin Islands, 1983: U.S. Geological Survey Water-Data Report.

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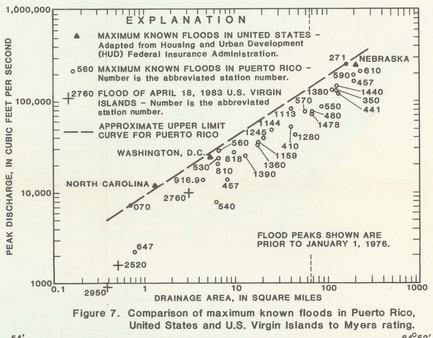

Figure 7. Comparison of maximum known floods in Puerto Rico, United States and U.S. Virgin Islands to Myers rating.

Figure 6. Areas inundated April 18, 1983 in vicinity of Charlotte Amalie, St. Thomas.