

CHAPTER 12

NATURAL HAZARDS



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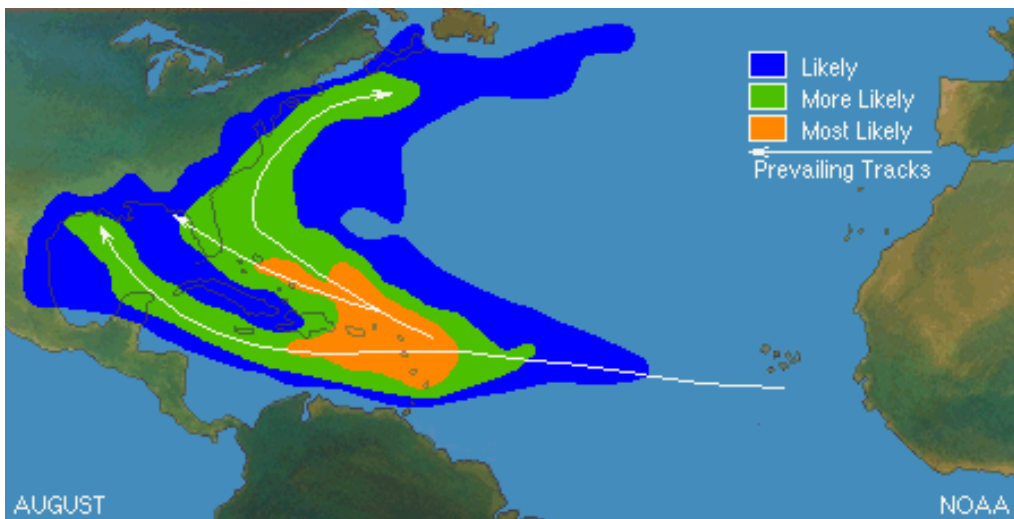
Photograph courtesy Richard Edwards

12 NATURAL HAZARDS

12.1 Tropical Cyclones Affecting Trinidad and Tobago

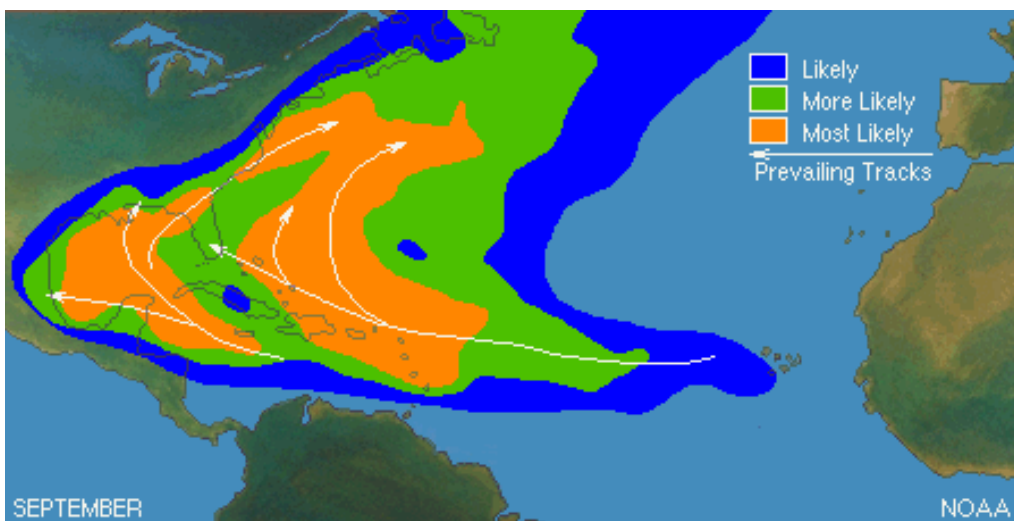
The official Atlantic Hurricane Season extends from June 1st through to November 30th. However, the cyclones favour certain areas at different times of the season and Trinidad and Tobago is most likely to be affected during the months of August and September as shown in Figures 12.1 and 12.2. Statistically, in any given year, an average of ten tropical storms form in the Atlantic Hurricane Season with six of these reaching hurricane strength.

FIGURE 12.1: TROPICAL CYCLONE TRACKS FOR AUGUST IN THE CARIBBEAN REGION



Source: National Oceanic Atmospheric Administration

FIGURE 12.2: TROPICAL CYCLONE TRACKS FOR SEPTEMBER IN THE CARIBBEAN REGION



Source: National Oceanic Atmospheric Administration

The centre of a tropical cyclone does not have to pass over an area for that area to be affected by the cyclone. Cyclones passing to the north of Trinidad and Tobago have adversely affected Trinidad and Tobago. Table 2 list those cyclones, which have passed within the area labeled as “close” given in Figure 12.3.

FIGURE 12.3: TROPICAL CYCLONE AREA DEFINED AS “CLOSE” (HATCHED AREA) FOR TRINIDAD AND TOBAGO



Source: Meteorological Office

TABLE 12.1: TROPICAL CYCLONES¹ AFFECTING TRINIDAD AND TOBAGO, 1878-2000

Designated No. for the year	Date of Passage	Intensity	Area of Centre Passage
3	1878 Sept. 1-2	TS	NE Tobago
5	1886 Aug. 12 th	H	30km N of Tobago
6	1886 Aug. 16 th	H	70km N of Tobago
8	1888 Nov. 1 st	H	70km N of Tobago
10	1891 Oct. 12 th	H	100km N of Trinidad
7	1892 Oct. 6 th	H	Between Trinidad and Tobago
1	1928 Aug. 3 rd	TS	Northern Tobago
2	1933 June 27 th	H	Cedros, Trinidad
6	1933 Aug. 12 th	TS	60km NE of Tobago
7	1933 Aug. 16 th	TS	30km NE of Tobago
2	1938 August 9 th	TS	25km N of Tobago
2	1944 July 24 th	TS	60km N of Tobago
ANNA ... 1	1961 July 20 th	TS	30km N of Tobago
FLORA ... 7	1963 Sept. 30 th	H	Tobago
FRANCELLA ... 6	1969 August 20 th	TS	80km NNW of Port of Spain
EDITH ... 6	1971 Sept. 5 th	TS	40km N of Tobago
IRENE ... 10	1971 Sept. 13 th	TS	100km NW of Tobago
ALMA ... 4	1974 Aug 14 th	TS	Southern Trinidad
GRETA ... 8	1978 Aug. 10 th	TS	70km N of Tobago
CORA ... 4	1978 Sept. 13 th	TS	30km WNW of Port of Spain
DANIELLE ... 4	1986 Sept. 8 th	TS	90km NE of Tobago
JOAN ... 11	1988 Oct. 14 th	TS	70km N of Tobago
ARTHUR ... 1	1990 July 25 th	TS	Tobago
FRAN ... 6	1990 Aug. 14 th	TS	Southern Trinidad
BRET ... 2	1993 Aug. 7 th	TS	Northern Trinidad
JOYCE ... 10	2000 Oct. 1 st	TS	Tobago

Source: National Emergency Management Agency (NEMA 2001) and Trinidad & Tobago Meteorological Service, 2001

TS – Tropical Storm
H – Hurricane

¹ All Tropical Cyclones are numbered as they form; however, only cyclones, which attain tropical storm intensity, are named. See Appendix for intensity scale.

12.2 Earthquake History

In Trinidad and Tobago an earthquake may be felt as often as once per month. These felt earthquakes are only about 2-6% of the earthquakes, which are recorded by seismometers. Earthquakes occur in the region because the Eastern Caribbean forms the eastern margin of the Caribbean Plate, which is moving eastwards at the rate of 2 cm/yr and riding over the North and South American Plates, which are subducted.

Although earthquakes occur within the earth's rigid crust, which in the region is about 35 km thick, the depths at which they are located in the Eastern Caribbean range from less than 10 km to about 200 km. This is possible because the subducted plate material maintains its rigidity as it descends and can still allow earthquakes to be generated within the descending slab.

Prior to 1982 most of the earthquakes were concentrated in two significant zones west of Trinidad. One zone is north of the Paria Peninsula with events trending northeast- southwest. The other is in the Gulf of Paria where events have a northwest-southeast trend. In March 1982 however, a swarm of earthquakes (several hundred tremors) occurred off the southwest coast of Tobago. The largest of these was a magnitude of 5.26 on the Richter scale.

Similarly, during March 1988, the area east of Trinidad, which up to that time had been the location of few, low magnitude events, generated a magnitude 6.2¹⁰, which was followed by hundreds of aftershocks over a period of years.

Between 1926 and 1960, thirteen (13) earthquakes exceeded magnitude 6.2 in the southeastern Caribbean. Table 12.2 lists some of the large earthquakes to have affected the islands of Trinidad and Tobago.

TABLE 12.2: EARTHQUAKES GREATER THAN MAGNITUDE 5 OR MMI VIII, 1766-2000

DATE	MAGNITUDE	INTENSITY	NOTE
21 October, 1766	-	7.9	Capital San Jose destroyed
20 September, 1825	VIII	-	
24 February, 1918	VIII		
04 December, 1954	VIII	> 6.5	One death; several injured
September, 1968	V - VII	5.1	Damages to churches
March, 1982		5.4	Tobago swarm
March, 1983		5.8	Several injured at the coast
March, 1988		6.2	East Coast swarm
01 January, 1996	VI	5.0	
02 April, 1997		5.6	One home destroyed; several damaged
22 April, 1997		5.9	Over \$ 18 million TT in estimated damage in Tobago
09 July, 1997		5.7	
04 October, 2000		5.8	

Source: <http://nema.gov.tt/resources/downloads/earthquakeriskintrinidadandtobago.pdf>

The largest earthquake on historical record directly affecting Trinidad and Tobago was the 1766 event. There have been eight (8) earthquakes of magnitude greater than 6.0 between 1899 and 1952 within 250 km of Trinidad. One of these on 23 January 1910 was of magnitude 7.2. The 1825 and 1954 earthquakes also caused severe damage. The former affected all the buildings in Port-of-Spain, which at that time, were a maximum of 2 storeys and of un-reinforced masonry. The earthquake swarm of 1988 and the aftershocks did little damage because the focal point was at some depth (56 km within the earth) and some distance off shore.

The inverse relationship between hypo-central distance from populated centres and damage was demonstrated by the fact that there was damage in the two largest Tobago events of 1997 where the focal points were shallow (approx. 28 km and < 5 km) and the epicentres were only 30 km and 15 km from Scarborough.

Whereas the July 1997 Venezuela earthquake, which was of similar magnitude and also shallow in depth, occurred some distance from Trinidad (a full 2 degrees longitude to the west), while traumatic, caused little damage. In Venezuela, the area in immediate proximity to the source suffered many collapsed buildings and more than 80 deaths.

12.3 Major Flooding in Trinidad

Major flooding in Trinidad generally occurs in the Caroni, Caparo and Santa Cruz basins. However, flooding can occur with devastating effect in smaller basins such as the Diego Martin Valley, San Fernando, Barrackpore, Sangre Grande and Penal.

The Major causes of flooding in Trinidad include but are not limited to:

- ◆ Topography
- ◆ Land use practices
- ◆ Rainfall
- ◆ Soil types

Flooding in the Caroni basin usually has its genesis in rainfall along the Northern Range and within the basin. The run-off on the slopes of the Northern Range, which is generally over 2000 feet, is swift. However, the floodplains in the Caroni basin are less than 100 feet above sea level and consist of alluvium and hydromorphic soils with low permeability, which inhibit infiltration.

The Caparo basin has a similar soil structure as the Caroni basin and in both basins, the land use practices on the slopes increases swift run-off into the flood plains into watercourses prone to siltation.

TABLE 12.3: MAJOR FLOODING IN TRINIDAD AND TOBAGO, 1981-2004

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
1981	October	9 – 11	Island-wide	Severe floods, Caroni divided north from south
1984	Mid January & November		Across country	Moderate floods
1985	December	2 – 05	Island-wide	Severe floods, Caroni divided north from south
1986	October	14 & 15	Caroni	Severe floods
1986	November	2		500 houses damaged – destructive flooding
1988	September	6	Central and Southern Trinidad	Severe flooding
1988	September – October	30 – 01	Northern Trinidad	Destroyed food crops and caused extreme property damage
1988	November	3	Maracas, St. Joseph Belmont Hills	Mudslide (1 child buried) Raging floodwaters from Belmont hills (1 child swept away)
1988	November	13, 19, 24	Island-wide	Widespread flooding
1989	November	15	Central Trinidad	Damaging floods
1990	December	15	Debe, Penal, Siparia, Barrackpore, Mafeking	\$7,000,000 in losses, 2 persons lost lives
1991	August	16	Caroni	Widespread flooding. Thousands of dollars of crops were lost, poultry drowned and several persons were prisoners in their homes
1992	July	8 – 12	Central and Southern Trinidad	Flooding on large scale. Losses of livestock, crops
1993	August	7	South Western Trinidad East West corridor, Port of Spain and Western peninsula	Widespread flooding. Damage to houses and other building Damage from strong gusts (Tropical Storm Bret)

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
1993	September	6 - 13	8 - Sangre Grande	Flash flooding
		9 & 10	Arena, Caparo, Montrose Arena/St. Helena	Flash flooding
1993	November	19 - 22	Central Trinidad	Flooding, Caroni and Caparo rivers overflowed their banks
			Diego Martin and Barataria	Flash flooding
1994	November	23/25	Tobago	Flash flooding
			Caparo, Longdenville, Lange Park	Severe flooding
1998	May	28/29	Barrackpore, Penal	Flooding along Ciperio River
1998	June	2	South Trinidad	Flash flood. Ciperio River overflowed its banks and bridge partly collapsed.
1998	June	13-15	Central Trinidad	Riverine flooding. Caroni River Basin and Caparo River Basin flooded. Both rivers overflowed their banks.
1999	January	24	Central and South	Caroni (1975) forced to scale down operations
1999	June	28/29	Central	Caparo River overflowed
1999	August	16	Port of Spain to Aranguez	9-year old boy drowned in flooded drain, heavy losses to Aranguez framers
1999	December	14	North Trinidad	Severe flooding in El Socorro Extension. Flooding and landslides in Diego Martin. Landslides on North Coast Road
2000	March	24 - 26	North Trinidad	Mild flooding in Barataria, Malick, San Juan, Santa Cruz and Barrackpore. Landslides in Matelot destroyed a house (26 th)

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2000	November	26 - 30	North and Central Trinidad	Extensive flooding from Curepe to Manzanilla in the north to Caparo Basin. Landslides in
				Santa Cruz, Mt. Lambert, Lopinot and Arima
2000	December	1	South Trinidad	Penal, Barrackpore, Debe, Gasparillo and Marabella
2001	December	14 - 15	North-eastern, Central and Southern Trinidad	Massive flooding in Sangre Grande, Valencia, Caparo, Caroni, Barrackpore, San Fernando
2002	September	18	South Trinidad	Flash floods in San Fernando, Green Acres and Marabella. Mudslides in San Fernando.
2002	September	27 - 29	South Trinidad	Flooding in St. Mary's Village Moruga, Barrackpore and Woodlands
2002	November	5	North Trinidad	Massive Flooding from Aranguez in the west to Tacarigua
2002	November	13 - 15	Central Trinidad	The Caroni and Caparo rivers overflowed their banks. Flooding in St. Helena, El Carmen, Kelly Village and Las Lomas
2003	June	23	South West Tobago	Flooding in areas such as Bon Accord, Lowlands Trace, Hampden, Milford Road, Scipio Trace and Canaan
2003	July	12	South and Central Trinidad	Flooding in Cedar Hill, Forrest Park Road, Laloo Trace, Macaulay Road Claxton Bay, Gasparillo,
2003	July	24	Central Trinidad	Flooding in Caparo Valley Area
2003	August	13	South Trinidad	Flooding in Tarouba, Macaulay Road and Claxton Bay

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2003	August	17	Southwest Trinidad	Flooding Reid Road, Point Fortin
2003	September	1	South Trinidad	Flooding in Macaulay Junction, Claxton Bay
2003	September	3	Northwest Trinidad	Flash flooding in Morne Coco Road, Diego Martin
2003	September	18	South Trinidad	Flooding in Green Acres, Marabella and Cocoyea, Circular Road, San Fernando
2003	September	27	South Trinidad	Flooding in Moruga
2003	September	28	South Trinidad	Flooding in Woodland, Barrackpore, Clarke Road, Rochard Douglas, Monkey Town and surrounding areas
2003	October	3	Central Trinidad	Street and Flash Flooding in Chaguanas
2003	October	11	North West Trinidad	Street and Flash Flooding in North West Trinidad
2003	October	15	South Trinidad	Flooding in Harmony Hall, Gasparillo, San Fernando and Marabella
2003	November	19	North Trinidad	Flooding in East /West Corridor
2003	November	20	Central Trinidad	Flooding in Caparo and Todds Road areas
2003	November	21	North Trinidad	Flooding in South Quay and Sea Lots areas of Port of Spain
2003	November	25	North Trinidad	Flooding in Western Main Road Cocorite

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2003	December	3 & 4	Central Trinidad	Flooding in Caparo Basin at Todds Road, Caparo valley Road and Caparo Main Road
2003	December	12	South Tobago	Flooding in Scarborough Tobago
2004	April	10	North Trinidad	Flooding in Diego Martin Area
2004	May	4	South Trinidad	Flooding in Rochard Douglas
2004	May	30	Central Trinidad	Flooding in Main Road
2004	June	7 & 8	East and Central Trinidad	Flooding in Cumuto, Caparon Valley, Talparo
2004	July	8	North Trinidad	Flooding in Port of Spain
2004	August	9 - 10	Northwest Trinidad	Flooding in NW Trinidad, Street Flooding in Port of Spain and Belmont
2004	August	11	Northwest Trinidad	Flooding in parts of Port of Spain and St. Anns
2004	August	18		Grandville
2004	September	8	Central and South Trinidad	Flooding in Caparo Basin areas and Penal
2004	October	2	South Trinidad	Flooding in Various Parts of Trinidad Including Claxton Bay and Couva
2004	October	3	Central Trinidad	Flooding in Caparo Valley
2004	October	7	Central Trinidad	Flooding in South Bound High Way in Vicinity of Freeport Fly Over
2004	November	2	Tobago	Flooding in Lowlands
	November	8	North Trinidad	Flooding in Trinidad
2004	November	12	South Trinidad	Severe Flooding in South Trinidad, in areas such as Rochard Road, Barrackpore, Ghandi Village, Debe, Lothians Road, PrincesTown, Siparia Road, Fyzabad, Green Acres, San Fernando

YEAR	MONTH	DATE/S	AREA AFFECTED	SEVERITY OF DAMAGE
2004	November	12	Tobago	Severe Mudslides and Flooding in Windward Tobago particular in areas such as Delaford to Charlotteville, also Lambeau, along Claude Noel Highway, Canaan, Bon Accord, Carnbee, Mt Pleasant
2004	November	21	North Trinidad	Flooding in Barataria, Port of Spain, Maraval, Debe Road Long Circular, San Juan along East/West Corridor to Aranguez
2004	November	22	Central Trinidad	Flooding in parts of Central Trinidad
2004	December	5 & 6	Central Trinidad	Flooding in Caparo, Todd's Road and Chickland, Parts of Caparo Main Road, Points on the Brasso Caparo Valley Road
2004	December	11	Central Trinidad	Flooding in Caparo

Source: Trinidad and Tobago Meteorological Service, Flood Data (1981 – 2004)