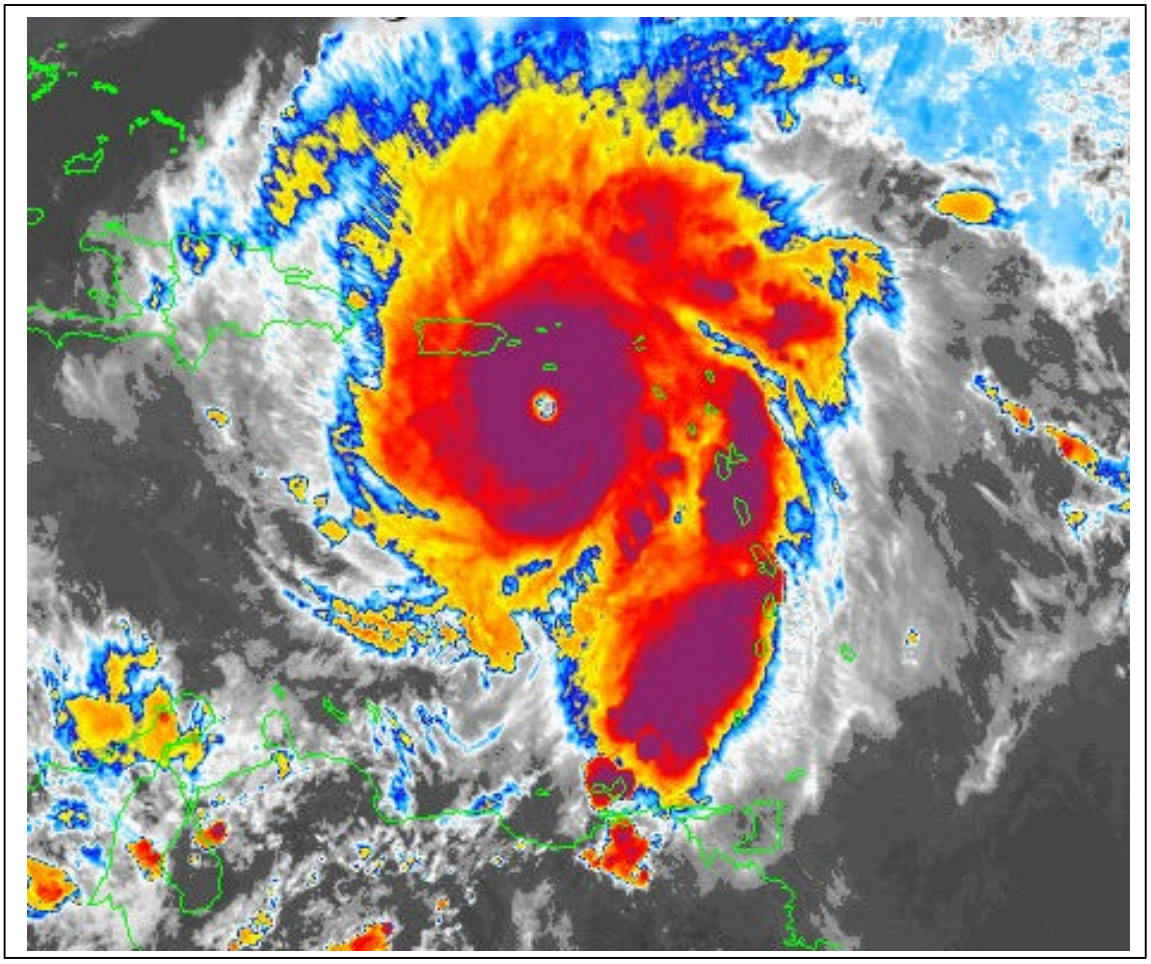
TROPICAL CYCLONES

AFFECTING TRINIDAD AND TOBAGO,

1725 TO 2000



Trinidad and Tobago
Meteorological Service

This Brochure was Collated

By

C. B. Daniel and R. Maharaj (1986)
An updated
By
G. De Souza (May 2001)

This brochure seeks only to give information on the position and tracks of tropical cyclones, which have either passed "close" to or affected Trinidad and Tobago.

Meteorological Services of Trinidad and Tobago
Ministry of the Environment
Rawinsonde Building
Piarco International Airport
Republic of Trinidad and Tobago
Tel: 669-5465 Fax: 669-4009
Email: synop@tstt.net.tt
www.tntmet.gov.tt (from Sept 2002)

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TROPICAL CYCLONES
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INTRODUCTION

This report provides available information on tropical cyclones, which passed over, or "close" to Trinidad and Tobago, during the period 1725 to 2000. Any cyclone whose centre passed through the geographical area bounded by Latitude 1O°N to 12°N and Longitude 60°W to 62°W is defined as "close".

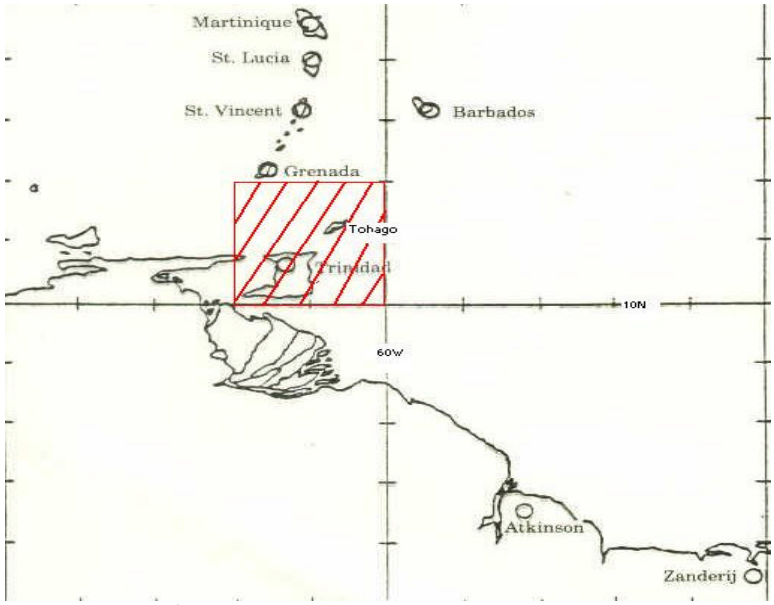

Figure 1: Area defined as "close" (hatched area)

The history of Atlantic Tropical Cyclones extends back to the early voyages of Columbus, leading to the discovery of the island in the late 15th Century. Those early records are incomplete, fragmentary, and largely unavailable.

The task of assembling the record of the Tropical Cyclone History of Trinidad and Tobago is monumental. This report relies heavily, therefore, on work already done, as shown in the references to source material. The original data up to 1945 was collated from various sources such as newspaper reports, ships' journals, and diaries of citizens with an interest in weather, etc.

The British Air Ministry, established a first order meteorological observing station for the first time in Trinidad in July 1945. Data subsequent to 1945 is verified and compiled in the records of the Piarco Meteorological Service.

In assembling this report, an effort has been made to present recorded descriptions of weather where this is available.

Cyclone Intensity

A judgment as to the intensity of early tropical cyclones passing close to or affecting Trinidad and Tobago before 1945, whether of full hurricane strength or not, is mainly subjective, as instruments for measuring wind speed did not come into use in this country prior to this time.

Judgment as to the wind strength is based therefore, on the damage associated with buildings, ships and the type of trees uprooted among others.

Currently, tropical cyclones are usually detected by Weather Satellite images. Hurricane reconnaissance aircrafts are used to probe areas suspected of tropical cyclone formation or well-formed cyclones, if close to land. Weather radar is used close to land within radar range to determine the spatial characteristics of tropical cyclone and the speed and direction of translation of the system.

Tropical cyclones usually form between 9^{o}N and 30^{o}N in the Atlantic Basin comprising the North Atlantic Ocean, Caribbean Sea and the Gulf of Mexico

Cyclone Classification

Any closed circulation in which the winds rotate counter-clockwise in the northern hemisphere or clockwise in the southern hemisphere is called a cyclone. The term tropical cyclone refers to such a circulation, non-frontal in origin, which develops over tropical waters, between latitude 30°N and 30°S.

Cyclones, which form outside the tropics, are known as extra-tropical cyclones. One type of extra-tropical cyclone is the sub-tropical cyclone, which is usually found in the indefinite belt between the tropics and temperate regions. This is important because occasionally, they hybridize into tropical cyclones.

Further classification depends upon the wind speed near the centre of the circulation.

Tropical Depression—A circulation in which the sustained winds at the earth's surface are equal to or less than 62km/h.

Tropical Storm—A circulation in which the sustained winds at the earth's surface are in the range of 63 km/h to 118 km/h.

Hurricane—A circulation in which the sustained winds at earth's surface are greater than 118 m/h.

Hurricane Season

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. Trinidad and Tobago is affected generally during the months of August and September as shown in Figures 2 and 3. Tropical cyclones have been known to affect the islands outside the season i.e., off-season storms. The best known example being "Alice" which lasted from December 30, 1954 to January 5, 1955, fizzling out 70 km to the west of Trinidad. Statistically, in any year, ten tropical storms to form in the Atlantic Basin, six of these reaching hurricane strength.

Records of cyclone tracks are available only since 1850 For completeness this compilation accounts for information gleaned from all available sources.

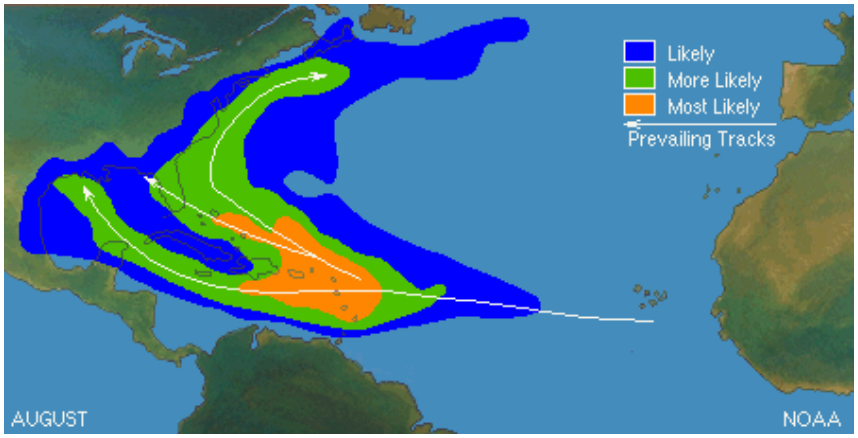

Figure 2: Paths of Tropical Cyclones for August

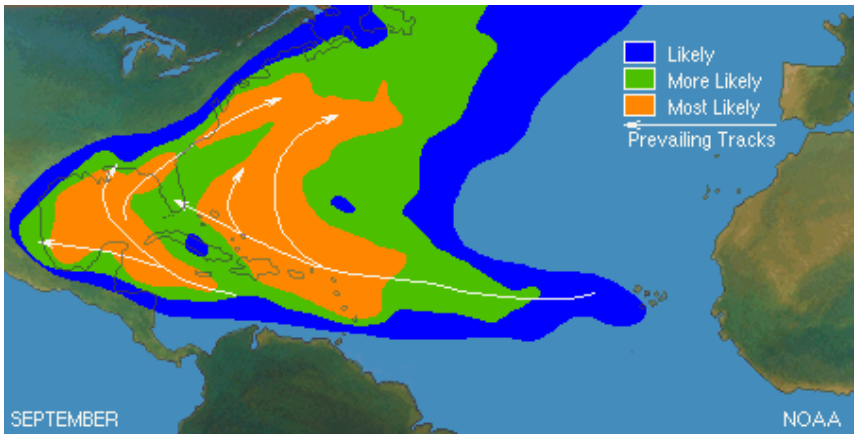

Figure 3: Patch of Tropical Cyclone for September

Table 1 therefore, gives information on storms affecting Trinidad and Tobago during the period 1725 to 1847, as derived from literature on the subject.

TABLE 1: Tropical Cyclones Affecting Trinidad 1725 to 1847

Date	Area Affected	Sources
1725	Trinidad	Millas Joseph
1773 August	Tobago	Millas Joseph
1790 August 10th	Tobago	Millas, Tannehill, Carmichael
1809 October 18th	Trinidad	Tannehill, Schamburgk, Gariott
1810 August 12th	Trinidad	Tannehill, Schamburgk
1831 June 23rd	Trinidad and Tobago	Tannehill, Gariott, Schamburgk
1847 October 10th	Trinidad and Tobago	Tannehill, Gariott

Selected newspaper reports of two cyclones during this period read as follows:

1. *Storm at Trinidad—l2th* August 1810. (Source: *Trinidad Gazette* of 16th August, 1810.)

> "About noon the wind blew tempestuously from the north-west and with the exception of about half an hour, continued with increasing violence, attended with heavy rain until about four, having veered round at a little before three to the South. The shipping in the

harbour presented a most dreadful aspect, having been almost all driven ashore by the violence of the storm."

2. *Storm at Trinidad—23rd* June 1831. (Source: *Port-of-Spain Gazette* of 25th June, 1831.)

"The wind, after shifting several times East, Northwest and South finally settled at South-west. The Gulf at this moment exhibited a most frightful appearance: the sea was dreadfully agitated; the vessels began to drive considerably, and the surf along the wharves, towards which they were drifting, so heavy away."

At the time of writing there are still no known records available for the period 1847 to 1860.

It should be noted that until 1949 numbers designated cyclones. In 1950, numbers gave way to aviators' letter-code phonetic alphabet, e.g. A—Able, B—Baker, C—Charlie etc. In 1953 U.S. pilots identified storms by women's names, a practice which persisted up to 1978. In 1979 names of both women and men were used for the first time in alternating sequence.

Tropical Cyclones Affecting Trinidad and Tobago

The center of a tropical cyclone does not have to pass over any given area for that area to be affected by the mass field envelope of 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 hatched area, labeled as "close" identified in Figure 1.

Table 2: Tropical Cyclones affecting Trinidad and Tobago 1850-2000

(MAIN SOURCES – *Tropical Cyclones of the North Atlantic Ocean* 1861-1986 published by the U.S. Department of Commerce – NOAA and Trinidad and Tobago Meteorological Service.)

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

DANIELLE … 4	1986 Sept. 8th	TS	90km NE of Tobago
JOAN … 11	1988 Oct. 14th	TS	70km N of Tobago
ARTHUR … 1	1990 July 25th	TS	Tobago
FRAN … 6	1990 Aug. 14th	TS	Southern Trinidad
BRET … 2	1993 Aug. 7th	TS	Northern Trinidad
JOYCE … 10	2000 Oct. 1st	TS	Tobago

TS – Tropical Storm
H – Hurricane

Total number of cyclones in Table 2 is twenty-six (26), of which twenty (20) were tropical storms and six (6) were hurricanes.

Land falling Cyclones on Trinidad and Tobago

During the period from 1850 to 2000, two (2) hurricanes and five (5) tropical storms made land fall on Trinidad and Tobago.

In 1933, Tropical Cyclone number 2 passed over the extreme southwest tip of Trinidad (as shown in Figure 4), with winds estimated at 120km/h. An excerpt taken from "*Study of the Feasibility of Establishing a Caribbean Hurricane Insurance Scheme*" by P. Wyckoff (1973), describes some of the damage.

> **Tannehill***: "In June 1933 the hurricane in Trinidad caused the death of 13 persons, 1000 were rendered homeless and (there was significant) property damage particularly in the southern portions of Trinidad. Damage totalled US $3 million.*"

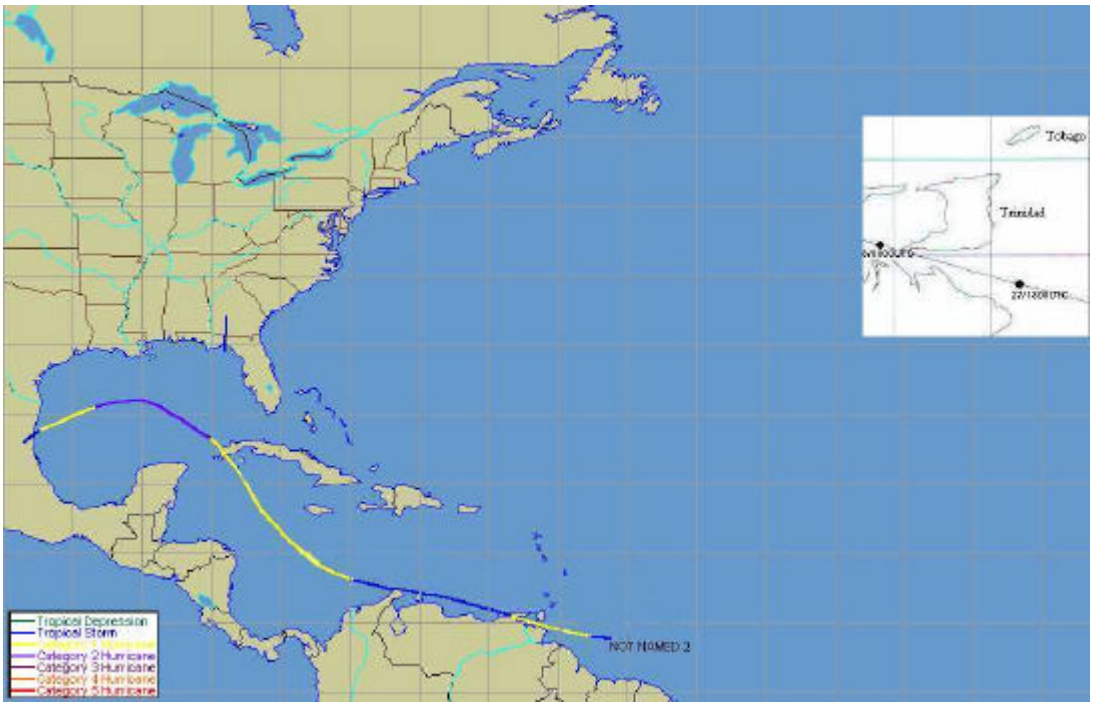

Figure 4: Track of Tropical Cyclone Number 2 (1933), with inset of the passage over Cedros

Hurricane Flora of 1963 caused the greatest damage to Trinidad and Tobago when it slammed into Tobago on September 30th (as shown in Figure 5), with winds estimated at 195km/h. Of the approximately 7,500 houses on the island 2,750 were destroyed; 3,500 were damaged causing US $30 million in losses (1963 US dollars).

Approximately 50 percent of the coconut trees suffer utter destruction, another 16 percent suffered severe damage. Fifty (50%) percent of the cocoa crop was destroyed. Heavy but un-estimated damage to other crops, such as bananas, vegetables, and other crops was reported. Approximately 75 percent of the tress forming the forestry reserve fell, while most of the remainder severely damaged. Little damage was reported with respect to roads, bridges and culverts. The estimated damage in Trinidad by comparison was put at TT$100,000 (US$60,000).

Hurricane Flora caused eighteen (18) deaths in Tobago and two (2) in Trinidad due to drowning.

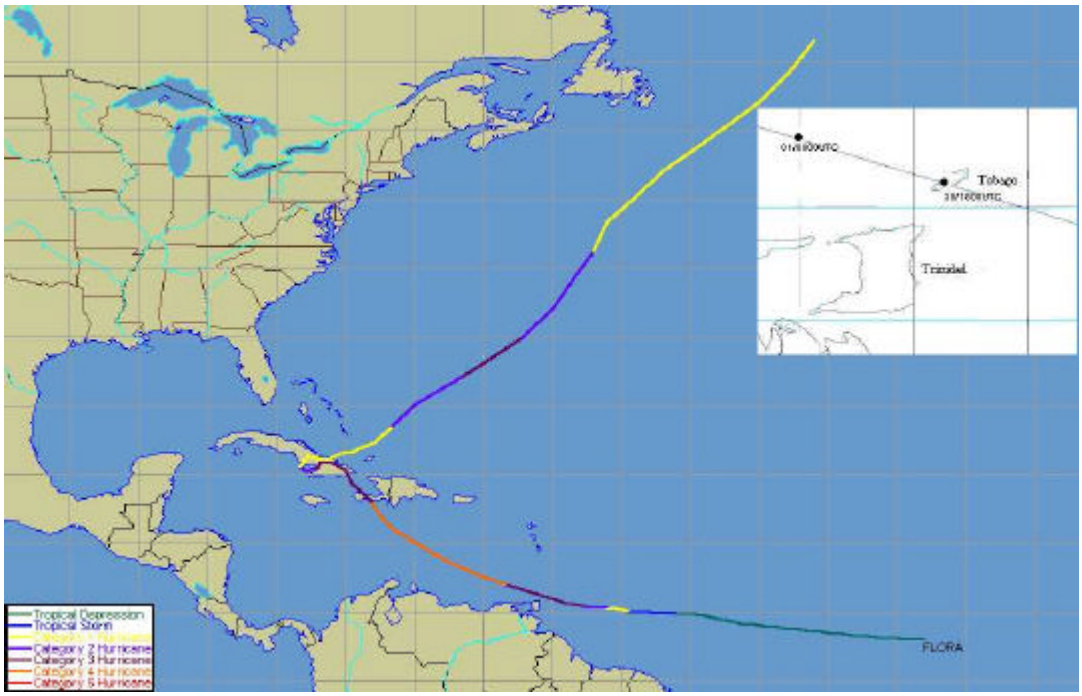

Figure 5: Track of Hurricane Flora (1963), with inset of the passage over Tobago

Tropical Storm Alma of 1974 made land fall on Trinidad on August 14th (as shown in Figure 6), with estimated winds of 74km/h. However, wind gusts of 91km/h were measured in Matura and 147km/h in Savonetta. Damage was extensive especially along the strip from Plum Mitan to California. The storm was responsible for one death directly and another indirectly during its passage over Trinidad.

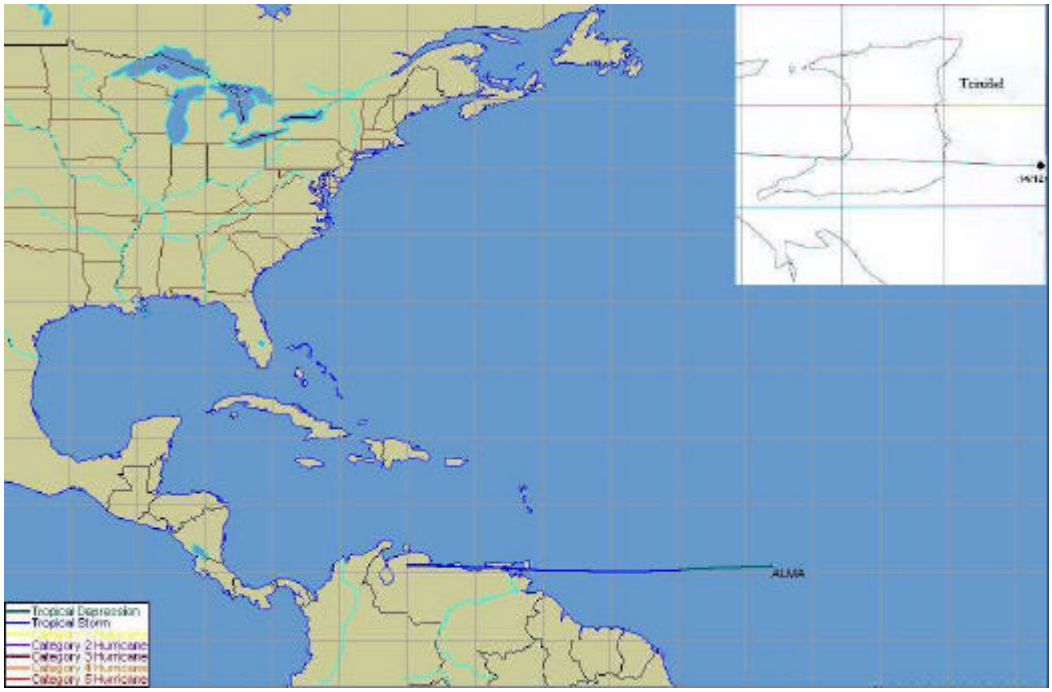

Figure 6: Track of Tropical Storm Alma (1974), with inset of passage over Trinidad

Three Tropical Storms made landfall on Trinidad and Tobago in the 1990s, Arthur and Fran in 1990 (Figure 7), and Bret in 1993 (Figure 8). None of these storms produced significant wind damage but like Joyce in 2000 (Figure 9), there was localized heavy rainfall, which led to flooding and landslides.

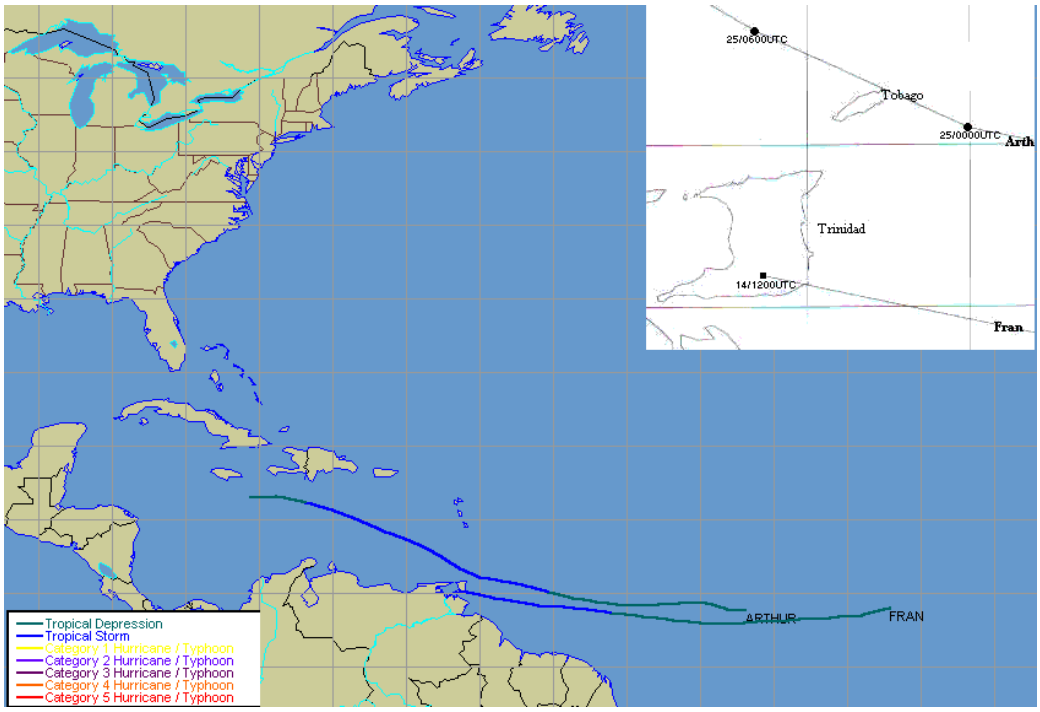

Figure 7: Tracks of Tropical Storms Arthur and Fran (1990), with inset of passage over the islands

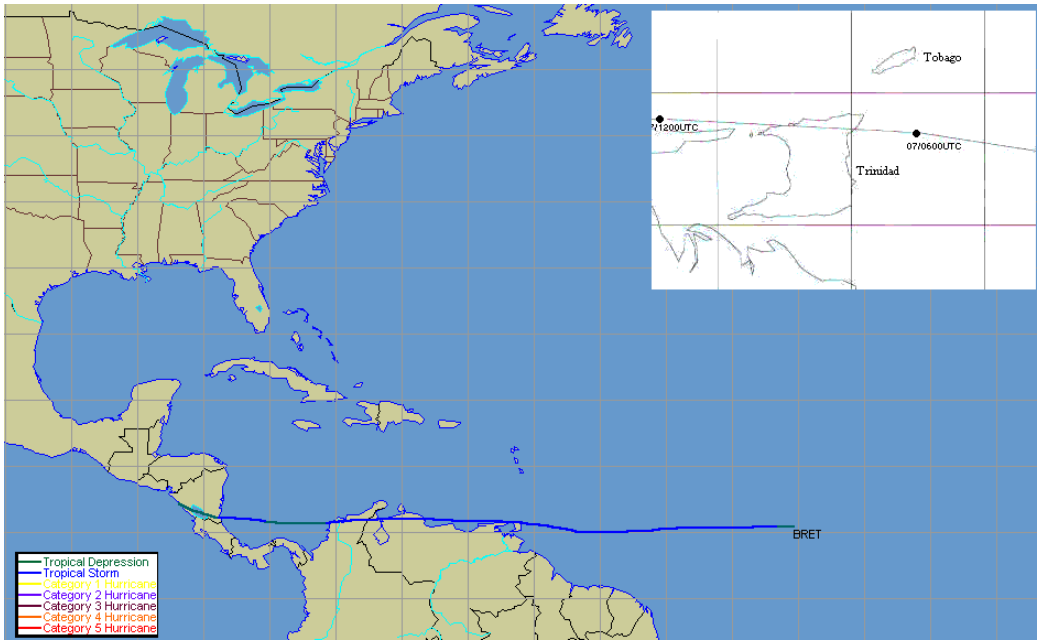

Figure 8: Track of Tropical Storm Bret (1993), with inset of passage over Trinidad

Infrastructural damage in Trinidad and Tobago was caused by wind, rainfall accumulation and storm surge. Prolonged periods of rainfall associated with these cyclones also produce landslides and mudslides, which contributed significantly to the extent of the destruction. There were thirty-five (35) deaths associated with the passage of tropical cyclones over Trinidad and Tobago. Table 3 shows the intensities and other salient parameters, which characterized land falling cyclones on Trinidad and Tobago.

Table 3: Tropical cyclones which affected Trinidad and Tobago and their associated damaging fields

Cyclone	Wind (km/h)	Rainfall (mm)	Storm Surge (meters)
#2 (1933)	120	No Record	No Record
Flora	195	No Record	1.5 to 2.1
Alma	74	75	1.5 to 2.5
Arthur	31	50	No Record
Fran	46	67	No Record
Bret	44	111	No Record
Joyce	50	50	1.0

Near Passages

The tropical cyclone varies in horizontal extent between diameters of 150km to 1000km. Some cyclones passed just outside our area defined as "close" – see Table 4.

Table 4 Tropical cyclones passing within 100km of the area bounded by 10°N-12°N latitude and 60°W-62°W longitude

Designated No. for the year	Date of Passage	Intensity	Area of Centre Passage
3	1872 Sept. 8th -9th	TS	60km Northeast of area
4	1877 Sept. 21st	TS	20km North of area
2	1887 July 20th	H	10km North of area
3	1887 Aug. 1st – 3rd	TS	95km North of area
17	1887 Dec. 7th	TS	95km North of area
5	1894 Oct. 11th	H	40km Northeast of area
5	1895 Oct. 15th	H	90km North of area
4	1897 Oct 10th	TS	30km North of area
8	1898 Oct 2nd-3rd	TS	30km North of area
2	1901 Oct July 2nd	TS	100km North of area
3	1909 July 13th	TS	40km North of area
4	1909 July 29th	TS	70km North of area
1	1910 Aug. 20th	TS	30km North of area
12	1916 Oct 6th-7th	TS	60km Northeast of area
1	1918 Aug. 1st	TS	40km Northeast of area
2	1918 Aug. 22nd	TS	20km Northeast of area
3	1921 Sept. 8th	TS	20km Northeast of area
2	1928 Aug 7th	TS	20km Northeast of area
5	1931 Sept. 5th	TS	70km Northeast of area
15	1933 Sept 16th	TS	60km Northeast of area
4	1944 Aug. 16th-17th	TS	80km Northeast of area
HAZEL … 9	1954 Oct. 5th	H	50km Northeast of area
ALICE … 11	1955 Jan. 5th	TS	70km West of area
JANET … 10	1955 Sept. 22nd	H	25km North of area

GERTRUDE … 10	1974 Oct. 1st	TS	30km North of area
EMILY … 6	1987 Sept. 22nd	TS	40km Northeast of area

Total number of cyclones in Table 4 is twenty-six (26), of which twenty-one (21) were tropical storms and five (5) were hurricanes.

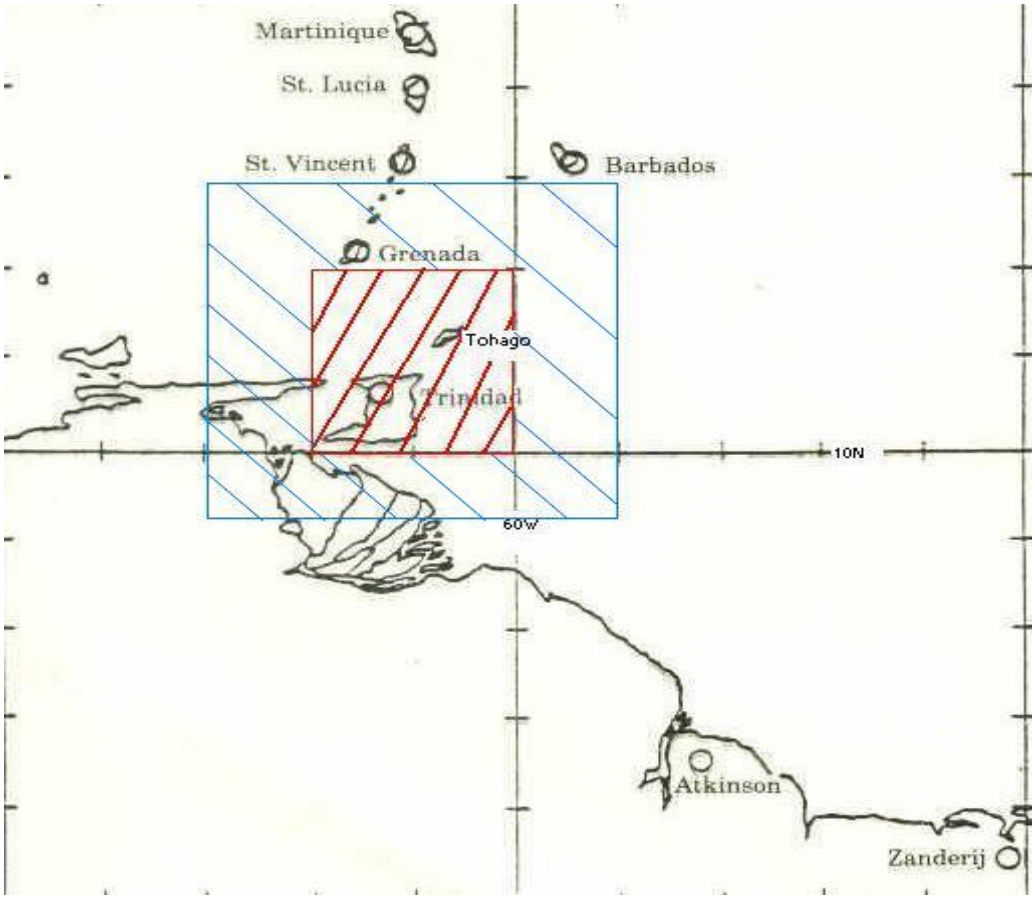

Figure 10: Area referred to in Table 4 (area bounded by blue square)

1. *Hurricane Passing Trinidad – September 8th, 1921*
   "*The storm attained its intensity at about 5:30pm and this lasted until 7:00pm. At this stage, the rising tide was lashed into foam and breaking clear of the retaining wall of the pier head, it washed over the shore for the distance of fully 60 to 80 yards*".

   Sometimes, storm-generated ocean swells cause damage far from their origin. Hurricane Faith passed through Guadeloupe on August 26th, 1966, yet the sea swells generated by this hurricane were felt as far south as Trinidad.

2. *Hurricane Passing Trinidad* – August 26th 1966. (Source: *Trinidad Guardian of August 27th, 1966*)
   "The tail end of hurricane Faith pounded Trinidad's northern peninsula with rough seas yesterday but wrought little damage. Between 1:00 to 1:30pm, unusually rough seas, accompanied by waves ten to fifteen feet high, pounded the Trinidad and Tobago Coast Guard's two jetties at Staubles Bay, smashing a small craft to bits and sinking another. The compound of the navy's barracks was inundated and in Port of Spain the raging seas left its mark. The slipway jetty was damaged and workers were trying late yesterday to salvage several jetty boards".

3. Tropical Storm "DANIELLE" – September 8th, 1986 – see Table 2 (*Source Trinidad Guardian – September 10th, 1986*)
   "Tropical Storm Danielle has caused millions of dollars in damage to property and livestock in Trinidad and Tobago… the tail end of the storm drenched both islands on Monday…"
   "Central and South Trinidad and … parts of Tobago were badly affected".
   "Flooding was reported…with water up to four (4) feet on the Siparia-Erin Road, in Los Bajos, Palo Seco, Rancho Quemado, Caparo and … in Scarborough, Tobago, business places were submerged by four (4) feet of water. (Source Express –September 11th, 1986)

   Danielle's tail end leaves $8 million damage in Tobago (*Trinidad Guardian* – September 12th, 1986)"*…there were about twenty-seven (27) major landslides between Roxborough and Bloody Bay caused by Monday night's storm… four (4) bridges were also destroyed.*

   Trinidad Guardian –September 15th, 1986
   "*Danielle causes $9 million loss in St. Vincent bananas*."

4. Excerpt from *"The Joan Experience"* – October 14th 1988 By A. Achang Trinidad and Tobago Meteorological Service
   "…Tropical Storm Joan was but a minor inconvenience for most citizens of Trinidad and Tobago. What impacted more on their lives was the incessant rain that came over the next four days following Joan's passage".

Damage Caused by other Tropical Cyclones

Tropical Cyclones have caused damage in Trinidad and Tobago even though their centers were outside of the area labeled as "near". During the past decade there have been at least three cyclones, which have caused damage in parts of the country, namely Hurricane Iris (1995), Hurricane Lenny (1999) and Hurricane Debby (2000).

The causative factors would have been as a result of wind, rainfall accumulation, storm surge or any combination of these factors.

Iris on the night of 26th August 1995 was located approximately 340km to the northeast of Trinidad with winds of 85km/h. A feeder band into Iris developed over the west coast Trinidad with the wind coming from the south with speeds of 60km/h. The strength and direction of the winds produced heavy seas in the Gulf of Paria. Seawater bought by waves entered the ground floors of some homes through the windows. Boats anchored in the Gulf suffered wind damage.

Hurricane Lenny affected the coast of Trinidad and Tobago from 18th November to 21st November 1999, storm surge generated by Lenny, which was over 700km away, lashed all the island in the Eastern Caribbean. Damaged was done to boats, buildings and road infrastructure in all the islands. Headlines from the Daily Express on November 19th read "*Worst North Coast seas in 50 years," "Tobago resort loses beach."*

Hurricane Debby passed through the Northern Leewards on the morning of the 22nd August 2000. After its passage a feeder band developed over Trinidad and Tobago and flooding resulted in the Barrackpore area.

Conclusion

Trinidad and Tobago lies on the southern fringe of the Atlantic Hurricane Basin (Figures 2 &3), as clearly shown from the empirical evidence in this report and is likely to be hit by a tropical cyclone at any time. Tobago though is more vulnerable despite the fact that it is only about 35 km to the northeast of Trinidad. Of the twenty-six (26) cyclones passing near the area (Table 4), twenty-five (25) passed north of Tobago, sufficiently close to pose a threat to the island.

Recent history has also shown that cyclones, which are relatively far from the twin island state, can adversely affect Trinidad and Tobago. Hurricanes Iris (1995), Lenny (1999) and Debby (2000) caused significant damage to localized infrastructure and contributing to loss of productivity.

Damage caused by tropical cyclones range from minimal to catastrophic depending not only on the intensity of the storm, but upon other contributory factors such as the size of the storm, the translation speed etc. The coastal configuration, astronomical tides, terrain features, urbanization and industrialization also determine the extent of damage. Finally, public awareness and preparedness can limit and mitigate the disaster associated with the impact of any tropical cyclone in the country, thus reducing the damages and the socio-economic impacts immeasurably.

The main message is that Trinidad and Tobago can be affected by a tropical storm or hurricane from time to time as was quite evident in the 1990's with respect to tropical storms and in 1933 with respect to the more powerful and dreaded hurricane.

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