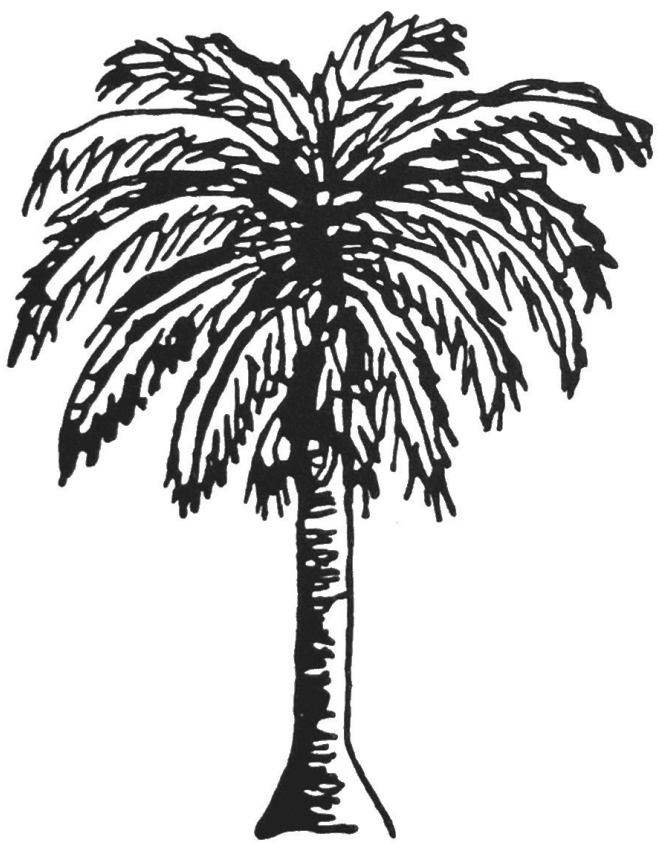
CLIMATE REPORT NO. G-36

TROPICAL STORM CHRIS 1988



STATE OF SOUTH CAROLINA
WATER RESOURCES COMMISSION
SOUTH CAROLINA STATE CLIMATOLOGY OFFICE

OCTOBER 1988

TROPICAL STORM CHRIS 1988

by

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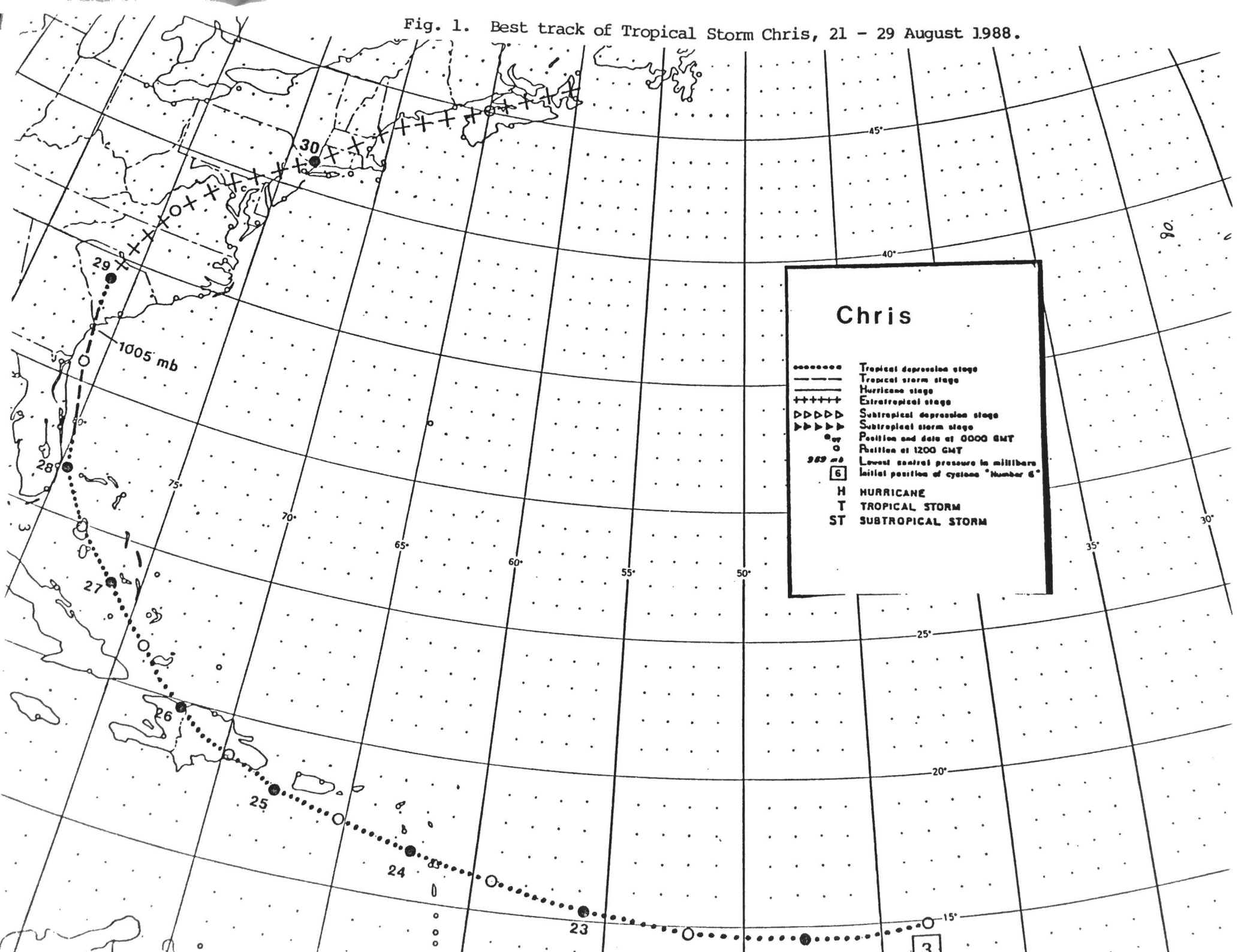
PREFACE

The writers thank Mr. Miles Lawrence for furnishing much of the data concerning Tropical Storm Chris. Mr. Lawrence is a meteorologist on the staff of the National Hurricane Center, Miami, Florida.

Appreciation is also given to Ms. Verger Ashley of the South Carolina Water Resources Commission for typing this publication, as well as a special thanks to Mr. Yarbrough and the staff of the South Carolina Water Resources Commission for assistance in the preparation of the maps.

Fig. 1. Best track of Tropical Storm Chris, 21 - 29 August 1988.



A. Synoptic History

Chris was first detected as a tropical wave near the west coast of Africa on 15 August. It became a tropical depression on the 21st in the tropical Atlantic midway between Africa and the Lesser Antilles when a low level cloud circulation was identified on satellite imager.

Chris' track is shown in Figure 1 and Table 1 lists the best track statistics. The track is a smooth parabola in the shape of the periphery of the Atlantic subtropical surface high pressure ridge. Chris remained a depression for seven days as it moved from the tropical Atlantic across portions of the Lesser and greater Antilles and over the Bahamas. It became a tropical storm for only twelve hours, during which time it moved inland near Savannah, Georgia.

Figures 2 and 3 show the wind and pressure curves for this storm as a function of time, along with the various data from which the curves were constructed. Satellite analyses indicated that a tropical cyclone was being tracked from the 21st until landfall on the 28th. However, 13 separate investigative reconnaissance flights on the 23rd through the 27th were unable to find a well defined low level circulation center and, at best, the system was a marginal tropical cyclone during this time. Also, even though many of the satellite intensity estimates were for tropical storm status, surface and reconnaissance observations clearly showed that surface wind speeds were well below 35 knots.

Finally, on the 28th, reconnaissance aircraft located a low level circulation center at 0600 UTC just east of Melborune, Florida and a ship located about 50 n.m. northeast of the center reported 40-knot sustained winds and the system was upgraded to Tropical Storm Chris on this basis. AT 1000 UTC, a tropical storm watch was issued from Edisto Beach, South Carolina to Cape Hatteras, North Carolina and tropical storm warnings were issued at 1200 UTC from Savannah, Georgia to cape Hatteras.

The system had been moving at about twelve knots for several days prior to becoming a tropical storm. However, when it came abeam of Florida, its motion for the next 24 hours averaged 18 knots and for the period from 0600 to 1200 UTC on the 28th, its speed of motion was 27 knots. It is believed that this almost discontinuous acceleration was at least partially the result of the reformation of the circulation center.

The center of Chris made landfall at 1500UTC on the 28th near Jasper County. Table 2 lists selected surface observations in the warning area. The highest observed sustained wind speed was 37 knots at the Savannah Light Tower with an anemometer elevation of 70 feet. Storm surge tides ranged up to 1.5 feet above normal astronomical tide levels. Rainfall totals near the coast were less than three inches.

Chris continued to move north-northwest, and accelerated as it moved over the land. At this time, Civil Defense Officials in Georgetown County, South Carolina notified residents and property owners of the South end of Pawley's Island and Garden City that onshore winds could with spring tides may produce coastal flooding at high tide that evening.

There was a well organized eye associated with Chris until nearly 3:00 p.m. EDT, when the storm was centered between Allendale and Hampton Counties.

There was localized wind damage during a thunderstorm ahead of Chris in Olanta in Florence County during the morning of the 28th. Two mobile homes were blown over and several trees blown down. Luckily, no one was injured from that event.

At 4:15 p.m. EDT, a tornado (F2) touched down approximately 2.2 miles southwest of Manning, in Clarendon County, South Carolina. This tornado moved from southeast to northwest causing extensive damage. At least 63 mobile homes were damaged 50 of which were unsalvageable. The path length was 0.8 miles, and the width about 200 yards. A 78 year old woman was killed and a young girl injured as the tornado destroyed their mobile home.

The heavy rains associated with Chris totaled from two to more than six inches in central and eastern South Carolina. Bishopville, South Carolina reported rains totaling 7.68". There was urban flooding with many tree limbs snapped and power disruption reported across central and eastern South Carolina. The National Weather Service Forecast Office at the Columbia Metropolitan Airport recorded wind gusts to 48 mph, prior to the eye's passage. The State Climatology Office's anemometer elevation 375' on the top of the AT&T Building in downtown Columbia recorded a peak gust of 58 kts (67 MPH) at 7:10 p.m. (EDT) on the 28th.

Overall Chris brought much needed rain to the eastern and central portions of South Carolina. Damage from Chris and the associated tornado and thunderstorms was approximately $750,000.

B. Forecast and Warning Critique

Forecast verification statistics are limited since Chris was a tropical storm for only twelve hours. The very short tropical storm warning lead time was unavoidable since Chris became a storm only nine hours prior to landfall.

Table 1.

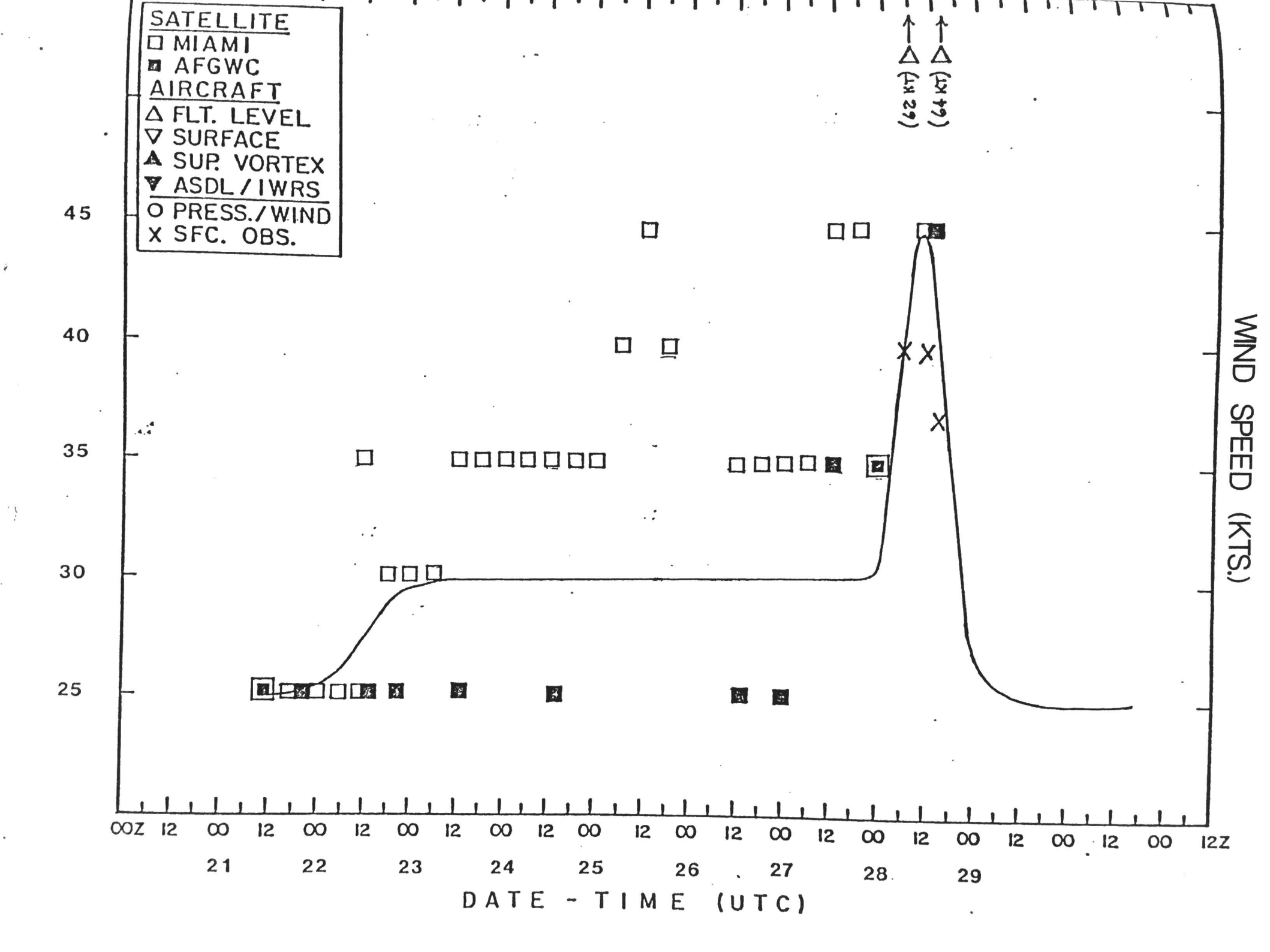
Preliminary best track, Tropical Storm Chris, 21-30 August 1988.

date/time (UTC)	position lat.	lon.	pressure (mb)	wind speed (knots)	stage
21/1200	14.9	43.3	1009	25	tropical depression
1800	14.6	45.7	1009	25	"
22/0000	14.6	47.8	1009	25	"
0600	14.7	49.9	1009	25	"
1200	14.8	51.9	1009	30	"
1800	15.1	54.0	1009	30	"
23/0000	15.3	55.7	1009	30	"
0600	15.6	57.5	1009	30	"
1200	16.0	59.2	1009	30	"
1800	16.3	61.0	1009	30	"
24/0000	16.7	62.4	1009	30	"
0600	16.9	63.8	1009	30	"
1200	17.2	65.2	1009	30	"
1800	17.5	66.7	1009	30	"
25/0000	17.8	67.8	1009	30	"
0600	18.2	68.8	1009	30	"
1200	18.5	69.8	1008	30	"
1800	19.1	70.9	1008	30	"
26/0000	19.8	72.1	1008	30	"
0600	20.5	73.2	1008	30	"
1200	21.5	74.2	1008	30	"
1800	22.5	75.4	1008	30	"
27/0000	23.3	76.2	1008	30	"
0600	24.1	77.2	1008	30	"
1200	24.9	78.1	1008	30	"
1800	25.8	79.0	1008	30	"
28/0000	26.8	79.7	1008	30	"
0600	28.2	80.0	1008	40	tropical storm
1200	30.8	80.8	1005	45	"
1800	32.8	81.1	1006	35	"
29/0000	34.1	81.1	1008	25	tropical depression
0600	35.8	80.6	1009	20	extratropical
1200	37.5	79.5	1009	20	"
1800	39.2	77.6	1010	20	"
30/0000	41.2	73.6	1008	20	"
0600	43.5	69.9	1008	20	"
1200	45.0	65.0	1008	25	"
1800	46.5	60.0	1008	25	"
Landfall					
28/1500	32.0	80.9	1005	40	tropical storm
Maximum intensity					
28/1200	30.8	80.8	1005	45	tropical storm

Table 2. Tropical Storm Chris selected observations, August 1988

Location	Minimum sea level pressure (mb)		Maximum surface wind speed (kt)			Storm surge (ft)	Rain (in)
	Pressure	Date/time (UTC)	1-minute average	Peak Gust	Date/time (UTC)[1]	Tide height above normal	Storm total
Georgia							
Fort Pulaski						+1.5	
Savannah Light Tower (SVLSI 70 ft ele.)			37	43	28/1500		
Savannah (SAV)	1009.6	28/1554	15		28/1351		
Tybee MARS			30		28/1545		
South Carolina							
Beaufort (NBC)	1008.7	28/1610	23	33	28/1155		1.95
Charleston (CHS)	1013.9	28/1800	29	35	28/1257		2.66
Charleston City						+0.5	0.69
Myrtle Beach (MYR)			19	35	28/1455	+1.0	1.63
North Carolina							
Cape Hatteras (HAT)	1019.9	29/0850	14	22	29/1650		
Oak Island			20	28	28/1745		
Wilmington (ILM)	1017.7	29/0850	14	23	28/1450		0.01
Wrightsville Beach			20		28/1745		

[1]Time of 1-minute wind, except when only a gust is given.


SATELLITE
MIAMI
AFGWC
AIRCRAFT
FLT. LEVEL
SURFACE
SUP. VORTEX
ASDL / IWRS
PRESS./WIND
SFC. OBS.
(27 KT)
(44 KT)
45
40
35
30
25
WIND SPEED (KTS.)
00Z 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12Z
21 22 23 24 25 26 27 28 29
DATE - TIME (UTC)

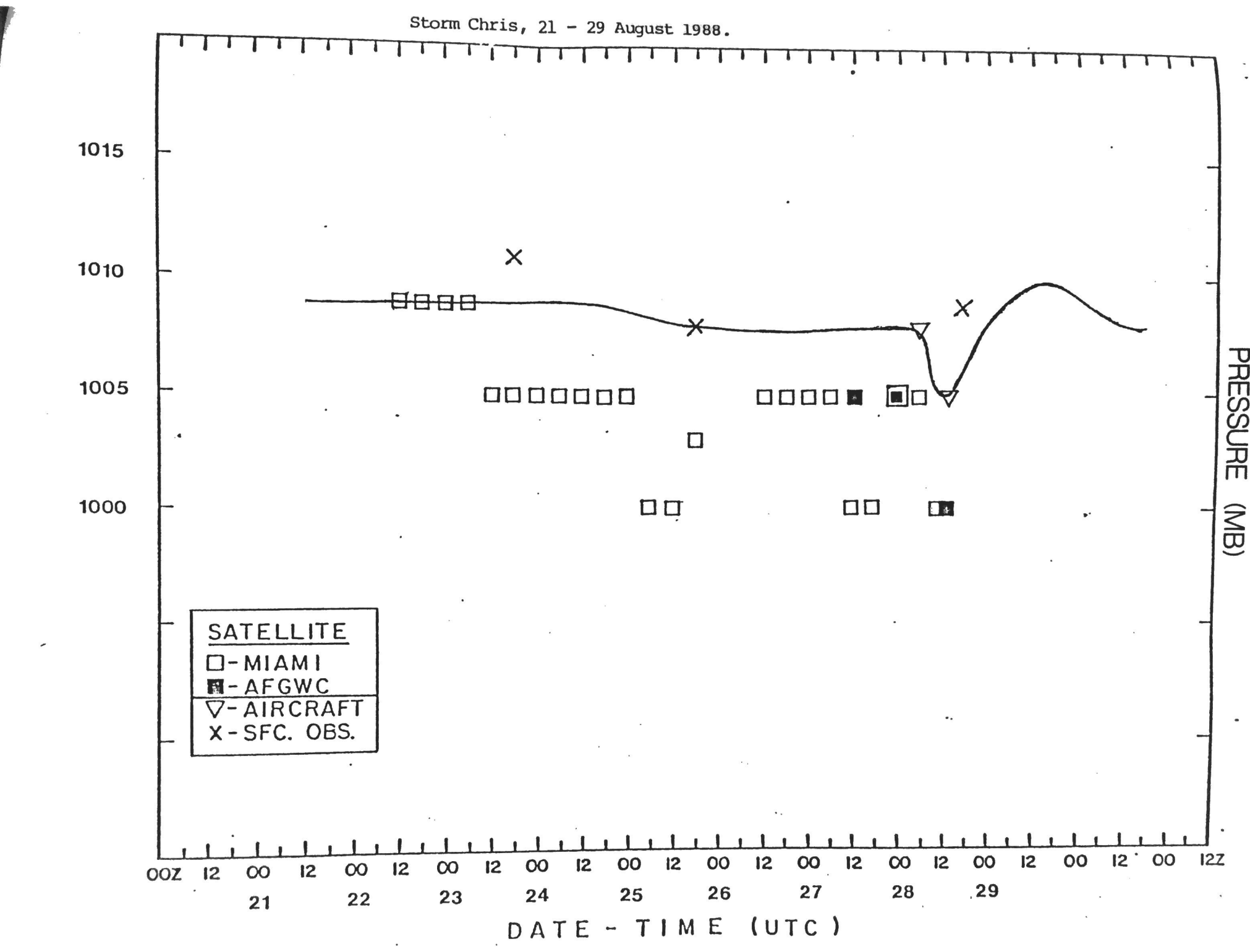

Storm Chris, 21 - 29 August 1988.
1015
1010
1005
1000
PRESSURE (MB)
SATELLITE
□ - MIAMI
■ - AFGWC
▽ - AIRCRAFT
X - SFC. OBS.
00Z 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12 00 12Z
21 22 23 24 25 26 27 28 29
DATE - TIME (UTC)

Figure Captions:

Fig. 1. Best track of Tropical Storm Chris, 21 - 29 August 1988.

Fig. 2. Maximum sustained wind speed versus time for Tropical Storm Chris, 21 - 29 August 1988.

Fig. 3. Minimum central surface pressure versus time for Tropical Storm Chris, 21 - 29 August 1988.