

PRELIMINARY REPORT  
Hurricane Cesar  
24-29 July 1996

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National Hurricane Center  
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(update)

Hurricane Cesar caused at least 51 deaths and considerable destruction along its path through the southern Caribbean Sea and Central America.

a. Synoptic History

The precursor of Hurricane Cesar was a tropical wave which passed Dakar, Africa on 17 July and moved westward for a few days without development. The wave was accompanied by a large 200-mb anticyclone which suggested a very favorable upper-level environment for development. Cloudiness and showers began to increase when the wave was about 900 n mi east of the southern Windward Islands on 22 July. When the wave neared these islands, the 24-hour surface pressure changes were of the order of -3.0 mb, (which is the threshold value that forecasters have typically found to be associated with a developing system) and a surface circulation center began to develop. The incipient center of circulation moved over Trinidad and Tobago early on 24 July. This system produced rains and gusty winds through a large portion of the Lesser Antilles. A post-analysis of the surface data and satellite images indicate that a tropical depression formed from the disturbed weather at 1800 UTC 24 July when the circulation center was moving just to the north of the island of Margarita along the north coast of Venezuela.

The depression moved westward through the southern Caribbean Sea and reached tropical storm status at 1200 UTC 25 July in the vicinity of Curacao. Figure 1a shows the well defined upper-level anticyclone (200mb) which accompanied the tropical cyclone at that time and Fig. 1b shows an area of above-normal surface pressure located to the north of the tropical cyclone from the Bahamas westward into the Gulf of Mexico. The latter probably reflects an

anomalously strong and persistent high pressure system which forced Cesar to move westward and even south of due west for several days. In addition, this dipole in the pressure field is operationally recognized as a favorable pattern for disturbances to develop and strengthen.

Cesar continued its general westward track very close to the coast of South America and gradually intensified. However, the development was inhibited by the close proximity to land and it was not until 1200 UTC 27 July that Cesar reached hurricane status over the open waters of the southwestern Caribbean Sea. Cesar began strengthening more rapidly prior to landfall just north of Bluefields, Nicaragua, and it reached its maximum intensity of 75 knots and minimum pressure of 985 mb near landfall at 0400 UTC 28 July. Rapid intensification of tropical cyclones near landfall has been observed in the past; e.g., Hurricanes Andrew and Cleo over south Florida in August 1992 and September 1964.

Cesar crossed Nicaragua and moved into the eastern North Pacific where it reintensified and became Hurricane Douglas. The most recent hurricane to hit Nicaragua before Cesar was Joan, a category 4 hurricane on the Saffir-Simpson Hurricane Scale, in October 1988. Joan also redeveloped over the eastern Pacific and became Tropical Storm Miriam. Cesar's track is shown in Fig. 2. Table 1 is a listing, at six-hour intervals, of the "best-track" position, estimated minimum central pressure and maximum 1-minute surface wind speed.

#### b. Meteorological Statistics

The best track pressure and wind curves as a function of time are shown in Figures 2 and 3 and are based on reconnaissance and surface observations, satellite intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) of the Tropical Prediction Center, and denoted as TSAF in the figures. It also includes estimates from the Satellite Analysis Branch (SAB) and the Air Force Global Weather Central (AFGWC).

Cesar was upgraded to tropical storm status based on a 40-knot 1-minute sustained wind and gusts to 50 knots observed in Curacao at 1155 UTC 25 July. The central pressure in the best track associated with Cesar while moving near the coast of Colombia is estimated to be 1 or 2 mb lower than reported by the reconnaissance plane at that time because the storm's close proximity to land

prevented the plane from reaching the pressure center. Ship observations and the Hurricane Research Division (HRD) surface wind analysis indicate that 34-knot winds extended northward from the center for about 240 n mi. San Andres experienced calm winds at 2128 UTC followed by 64-knot gusts marking the passage of a portion of Cesar's center. The strengthening just prior to landfall is supported observations from the reconnaissance plane just before it departed the storm center. Data indicate the formation of an eye at 0050 UTC 28 July, a closed eyewall of 15 n mi diameter at 0256 UTC and a drop in the surface pressure of 3 mb in 1 hour. Satellite images confirmed the strengthening at landfall by showing an embedded center within cold tops between -54 to -63°C corresponding to a T-number of 4.5 on the Dvorak scale. Tables 2 and 3 contain selected surface observations and ships reporting 34-knot winds or higher.

#### c. Casualty and Damage Statistics

Cesar was responsible for at least 51 deaths on its trek through the Caribbean Sea and Central America. Most of the deaths were attribute to heavy rainfall which caused flash flooding and mudslides. The death total includes 26 people in Costa Rica which was not in the direct path of the hurricane but was hit by floods and mud slides.

#### d. Forecast and Warning Critique

Table 4 summarizes the watches and warnings associated with Cesar. Hurricane warnings for Nicaragua were issued about 30 hours before landfall. In general, the official forecast always kept the tropical cyclone on a general westward track with about the correct amount of intensification. The official forecast errors increased from 56 n mi at 12 hours to 150 n mi at 72 hours. The 10-year average errors are 50 and 296 n mi respectively. The GFDI (an interpolated version of the GFDL model) performed much better than the official forecast at all periods and the errors ranged from 36 n mi at 12 hour to 90 n mi at 72 hours. Most of the other dynamical models including UKMI, LBAR, BAMB and BAMS produced errors larger that 300 n mi at 72 hours.

Figure Captions:

Fig. 1 (a) 200 mb wind anomalies for 0000 UTC 25 July and (b) surface pressures for the same time. Anomalies are computed from the Aviation model analysis for the specified time minus aviation model climatology from 1979 to 1995. Dot represents the center of the tropical cyclone.

Fig. 2. Best track positions for Hurricane Cesar, 24 - 28 July 1996.

Fig. 3. Best track one-minute surface wind speed curve for Hurricane Cesar.

Fig. 4. Best track minimum central pressure curve for Hurricane Cesar.

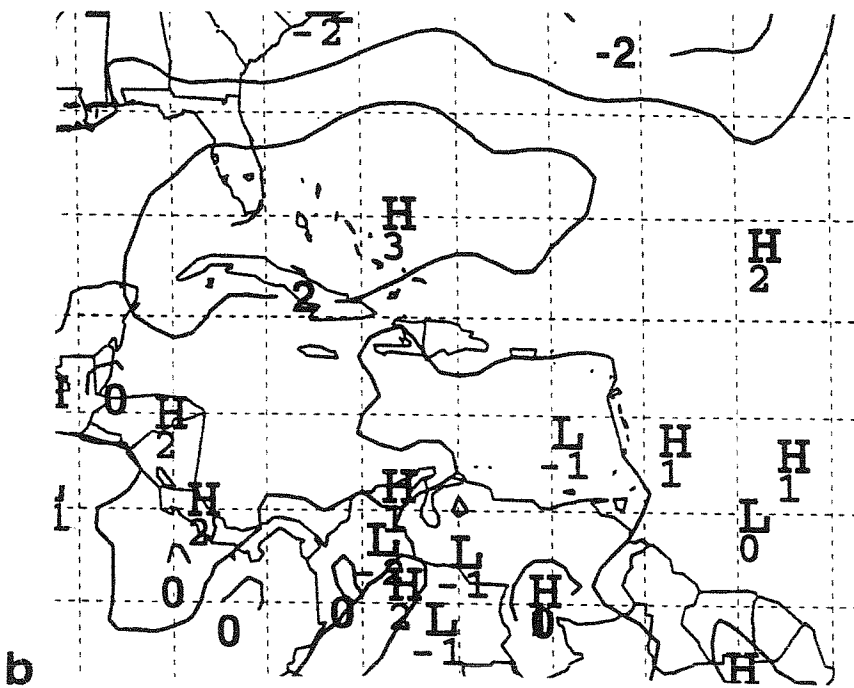
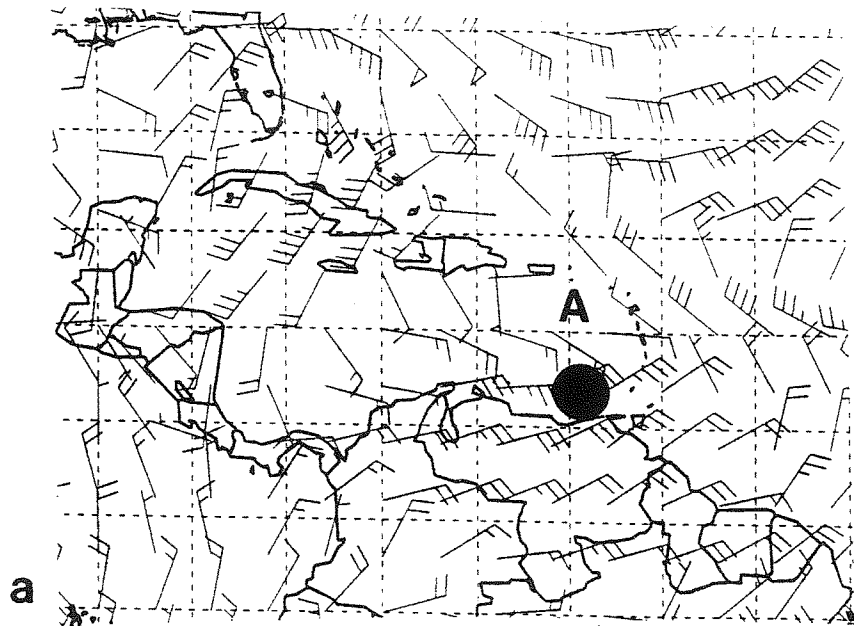


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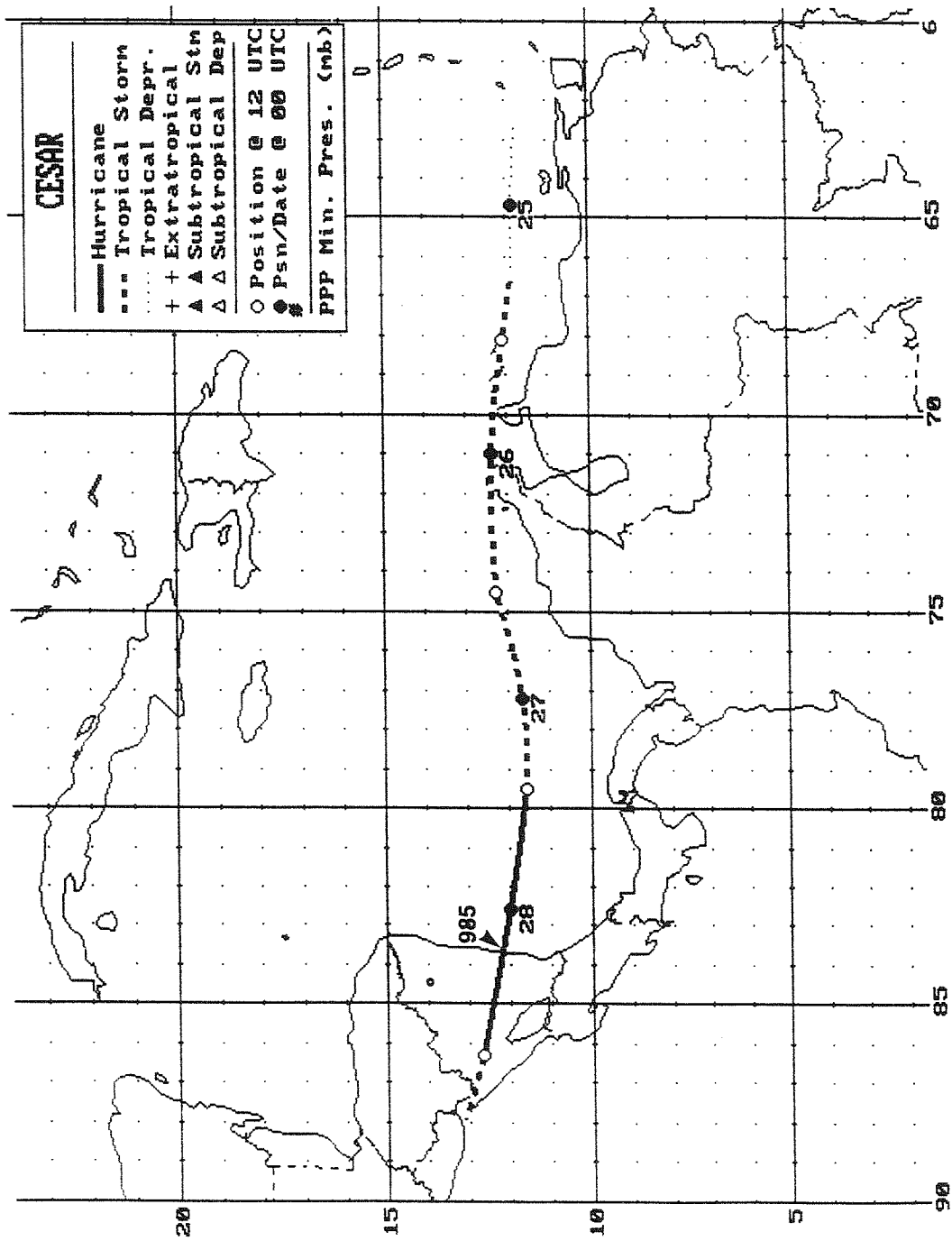


Fig. 2. Best track positions for Hurricane Cesar, 24 - 28 July 1996.

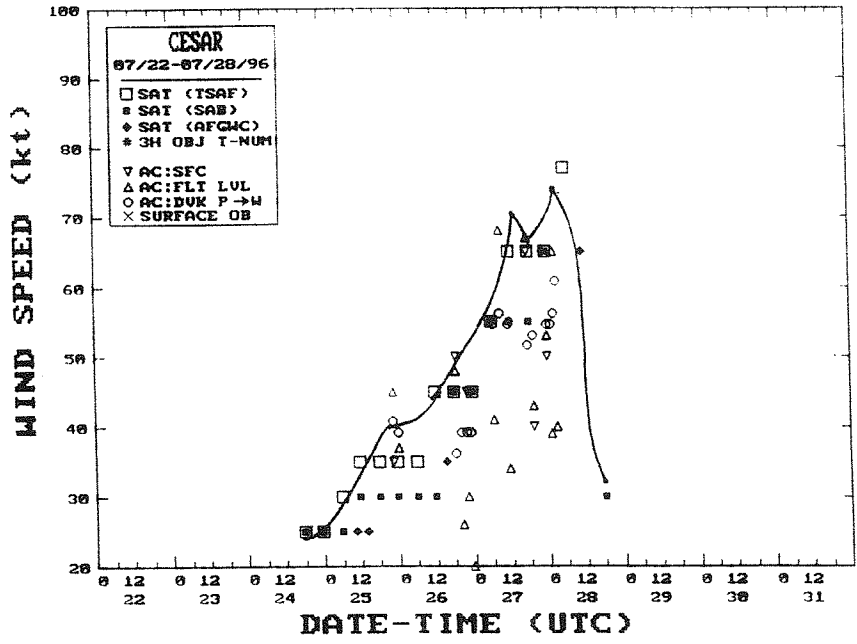


Fig. 3. Best track one-minute surface wind speed curve for Hurricane Cesar.

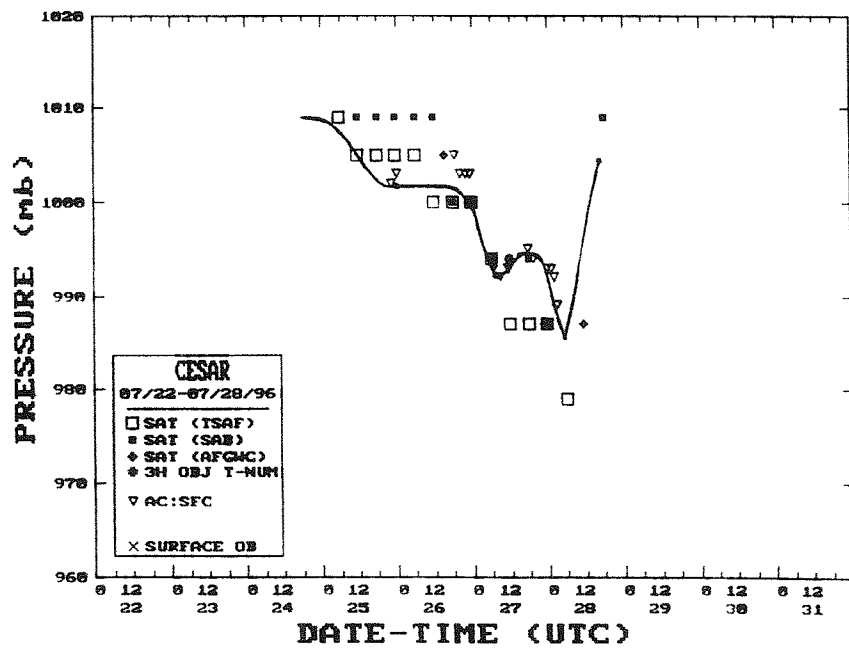


Fig. 4. Best track minimum central pressure curve for Hurricane Cesar.

Table 1. Preliminary best track, Hurricane Cesar, 24-28 July, 1996.

Date/time (UTC)	Position		Pressure	Wind speed(kt)	Stage
	Lat. (°N)	Lon. (°W)			
24/1800	11.8	62.6	1009	25	TD
25/0000	11.9	64.7	1009	25	“
0600	11.9	66.5	1007	30	“
1200	12.1	68.1	1004	40	TS
1800	12.3	69.6	1002	40	“
26/0000	12.4	71.0	1002	40	“
0600	12.4	72.7	1002	40	“
1200	12.3	74.5	1002	45	“
1800	11.9	76.1	1002	50	“
27/0000	11.7	77.2	1000	50	“
0600	11.6	78.1	992	60	“
1200	11.6	79.5	992	70	H
1800	11.8	81.0	994	65	“
28/0000	12.0	82.6	992	70	“
0600	12.3	84.2	990	70	“
1200	12.7	86.2	995	50	TS
1800	13.1	87.9	1004	35	“
29/0000					Douglas*
<b>28/0400<sup>1</sup></b>	<b>12.2</b>	<b>83.9</b>	<b>985</b>	<b>75</b>	

\* Best track continues as Hurricane Douglas in the northeastern Pacific Ocean.

<sup>1</sup> Landfall and minimum pressure just north of Bluefields Nicaragua.

TD: Tropical Depression

TS: Tropical Storm

H: Hurricane



Table 2. Hurricane Cesar selected surface observations, July 1996.

Location	Date/time (UTC)	Pressure (mb)	one-minute wind(kt)	Peak gust	Total rain(in)
Curacao	25/1155	1004.9	40	50	.15
Aruba	25/2100	1002.2			
San Andres	27/2220			64	
<b>Nicaragua</b>					
Bluefields	28/0600	999.0			10.7
Masatepe					9.4
Corinto					8.2

Table 3. Ship reports of 34 knots or higher wind speed, associated with Hurricane Cesar, July 1996.

date/time (UTC)	ship name	latitude °N	longitude °W	wind dir/speed knots	pressure (mb)
26/1200	<i>Rio Euphates</i>	13.1	71.9	120/58	1021.5 ?
26/1200	<i>Star Herdla</i>	13.6	74.3	110/36	1011.0
26/1200	<i>PJPT*</i>	17.3	73.8	060/50	1012.2
26/1800	<i>Autanan</i>	13.9	73.5	110/36	1009.2
26/1800	<i>PJPT*</i>	16.8	72.6	100/35	1012.8
27/0000	<i>Chesapeake Bay</i>	12.8	77.2	080/35	1006.5
27/0000	<i>Autanan</i>	13.5	72.5	100/35	1010.0
27/0600	<i>Cr. Marseille</i>	16.4	78.2	080/45	1012.0
27/0600	<i>Cr. Marseille</i>	16.1	77.6	060/35	1010.8
27/1200	<i>Cr. Marseille</i>	15.5	77.1	060/40	1011.2

\* name unknown

Table 4. Watch and warning summary, Hurricane Cesar, July 1996.

Date/time (UTC)	Action	Location
25/1200	tropical storm warning issued	Curacao; Aruba; Vela del Coro, Venezuela to Barranquilla Colombia
25/2100	tropical storm warning discontinued	Curacao
26/0000	tropical storm warning discontinued	Aruba. Coast of Venezuela to Barranquilla, Colombia.
26/0900	hurricane watch issued	San Andres;, Providencia. Bluefields Nicaragua to Limon, Honduras.
26/2100	hurricane warning issued	San Andres; Providencia; Bluefields to Limon.
28/0900	hurricane warning discontinued	San Andres; Providencia; Bluefields to Limon.