

Preliminary Report
Hurricane Gustav
24 August to 3 September 1990

a. Synoptic History

The tropical wave that spawned Gustav moved off the northwest coast of Africa on 18 August with some signs of organization. However, the system became embedded within the ITCZ on its westward journey across the tropical Atlantic and didn't begin strengthening until late on the 23rd and early on the 24th. It is estimated that the system became Tropical Depression Eight 840 nautical miles east of Barbados near 0600 UTC on the 24th.

Tropical Depression Eight gradually strengthened while moving west to west northwestward at 10 knots and, based on satellite imagery, reached tropical storm strength 620 nautical miles east of Barbados near 0000 UTC on the 25th.

Tropical Storm Gustav continued the same general motion under the influence of weak ridging to the north. There was some concern that a cold low that was located to the northwest of Gustav would inhibit development during the next day or so. However, the low had little impact and Gustav reached hurricane strength 240 nautical miles east northeast of Barbados near 1200 UTC on the 26th. The first of 53 reconnaissance aircraft fixes in Gustav had 65-knot winds at the 1500-ft flight level with 70-knot winds estimated at the surface at 1217 UTC on the 26th.

A hurricane watch was issued soon thereafter for the northern Lesser Antilles and a portion of that area was placed under hurricane warnings at 2200 UTC on the 26th. However, the ridge to the north was breaking down and Gustav began responding by taking a gradual northwestward and then northward turn with the center of the system by-passing the Lesser Antilles 180 nautical miles to the east.

Gustav reached a central pressure of 965 mb near the beginning of its northward trek while centered 200 nautical miles east of Antigua at 1800 UTC on the 27th. Some minor weakening occurred thereafter in response to shearing conditions aloft. Dynamic models indicated a possibility that a ridge would build to the north of Gustav which would impart a northwestward motion to the hurricane thereby posing a threat to Bermuda. That scenario did not verify. Instead, a trough to the west of Bermuda and ridging to the east of Gustav kept the hurricane moving northward nearly along the 58th meridian.

During the next three days while Gustav was moving northward, Tropical Storm Hortense, later Tropical Depression Hortense, was approaching Gustav from the east. While there was some tendency for Hortense to rotate counterclockwise around Gustav, it probably was due to different steering currents rather than an actual

Fujiwhara effect. The two centers were separated by only 400 nautical miles at 0600 UTC on 31 August when reconnaissance reports indicated that Gustav reached its minimum central pressure of 956 mb 390 nautical miles east southeast of Bermuda.

Late on the 31st, the upper trough west of the system imparted a northeastward motion to Gustav and its outflow created shearing over Hortense. As a result, Hortense eventually dissipated. On the 1st of September, Gustav began merging and interacting with a frontal zone to the north which started the weakening process. During the 2nd, the ridge to the east of Gustav strengthened thereby imparting a north northeast jog to the hurricane's motion just southeast of the Grand Banks. Ship reports indicated that the radius of the 34-knot winds by then had spread out to at least 200 nautical miles in the northwest quadrant over the cold waters of the North Atlantic. Thus, with the center only 240 nautical miles southeast of Cape Race, Newfoundland at 1800 UTC, a more northerly jog would have brought those winds to the extreme southeast coast of Newfoundland. However, a trough moving eastward across the Maritime Provinces accelerated the center in a northeast direction and Gustav was declared extratropical at 0600 UTC on 3 September. METEOSAT satellite imagery showed that the remnants of Gustav passed less than 200 nautical miles to the south of Iceland.

b. Meteorological Statistics

The best track positions, the central pressure, and the maximum sustained wind speeds every six hours are summarized in Figures 1-3 and in Table 1. Gustav was primarily of concern to the marine community and at least two ships reported sustained winds of hurricane force. Ship C6BB, "Trinidad & Tobago", a merchant marine ship registered in the Bahamas reported 65-knot winds at 0000 UTC on 27 August 210 nautical miles northeast of Barbados. Ship FNWT, "Galion", a vessel of French registry, appears to have gone through or near the edge of the eye with winds 030/70 knots at 0000 UTC on 2 September, and 280/70 knots at 1800 UTC on the same date. A pressure of 994.5 mb was reported from the Galion at 1200 UTC on the 2nd. Very likely that ship experienced hurricane conditions for 24 hours except for whatever period it may have been in the eye.

c. Casualty and Damage Statistics

There were no reports of deaths or damage attributed to Gustav. The U.S. Navy Ship "Antares" was potentially threatened by both Hortense and Gustav but the U.S. Navy Tug "Apache" towed the disabled Antares to safety.

d. Forecast and Warning Critique

Although weakening of the ridge north of Gustav was evident as the system was approaching the Lesser Antilles, the sharp northward turn was not anticipated by the track models or the forecasters. Thus, the northern portion of the Lesser Antilles were over-warned.

A summary of the warnings issued for the Lesser Antilles is presented in Table 2.

Probabilities associated with Gustav are shown in Table 3. The highest probabilities were focusing on Guadeloupe (TFFR) before Gustav turned away from the Lesser Antilles.

A preliminary analysis of the forecast errors indicates that NHC90 had the smallest track error at 24 and 36 hours, whereas CLIPER was superior to all of the models at 48 and 72 hours.

Dr. Hal Gerrish

Figure Captions:

- Fig. 1. Best track positions for Hurricane Gustav, 24 August to 3 September 1990.
- Fig. 2. Best track minimum central pressure curve for Hurricane Gustav, 24 August to 3 September 1990.
- Fig. 3. Best track maximum sustained wind speed curve for Hurricane Gustav, 24 August to 3 September 1990.

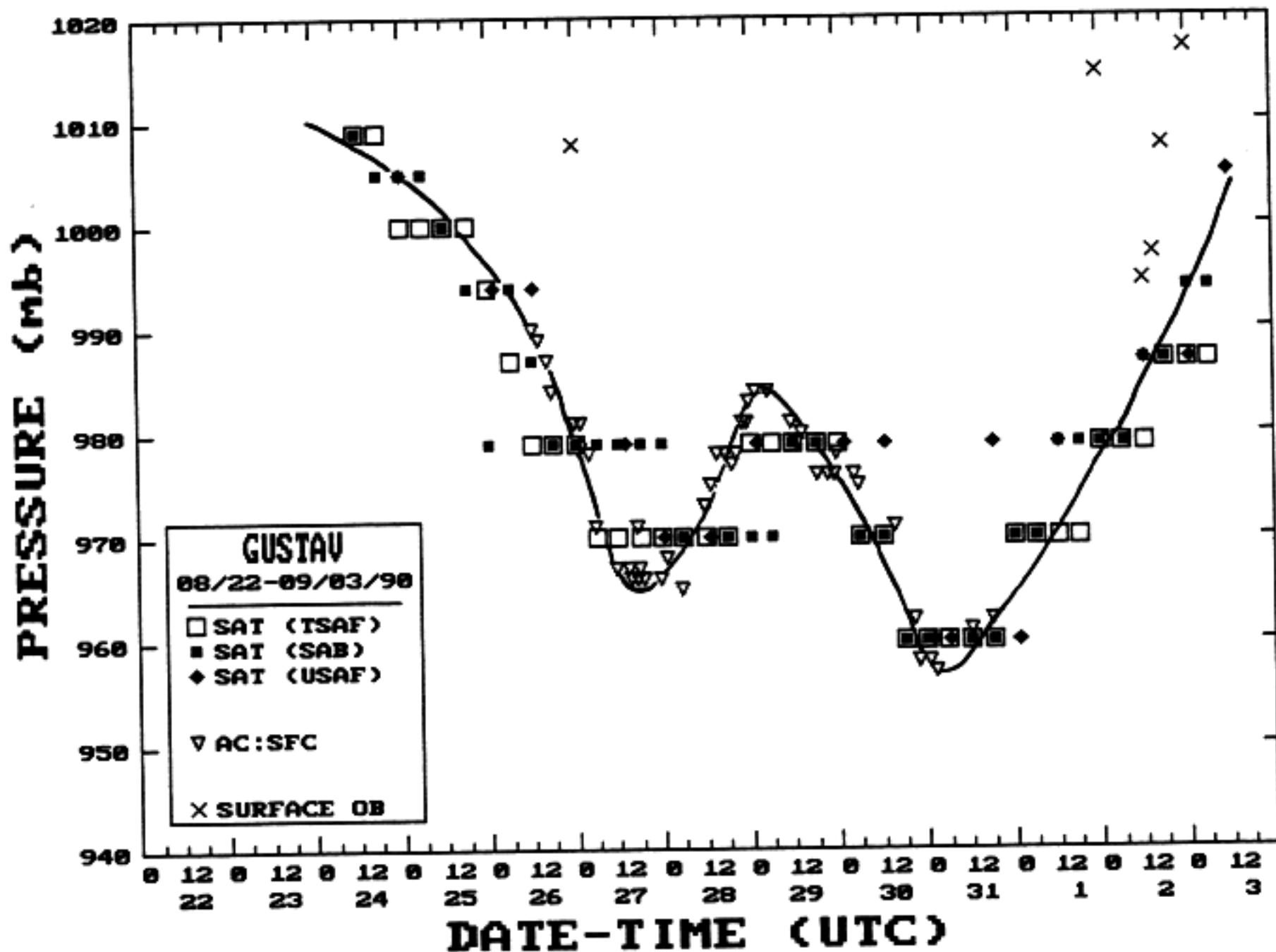


Fig. 2. Best track minimum central pressure curve for Hurricane Gustav, 24 August to 3 September 1990.

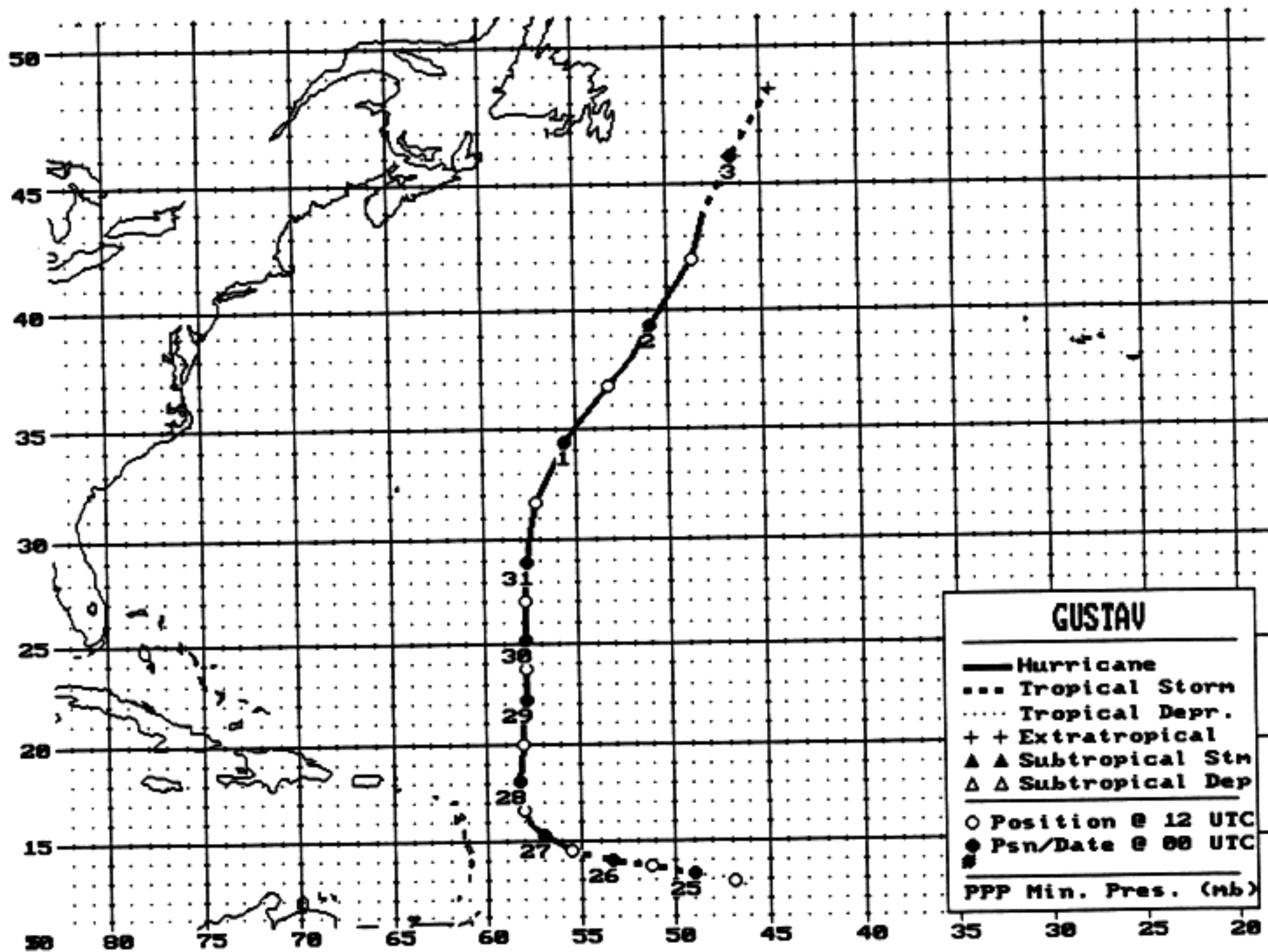


Fig. 1. Best track positions for Hurricane Gustav, 24 August to 3 September 1990.

Table 1. Preliminary best track, Hurricane Gustav,
24 August to 3 September 1990.

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
	Lat. (°N)	Lon. (°W)			
24/0600	12.6	45.9	1010	25	Tropical Depression
1200	12.9	46.9	1009	30	" "
1800	13.2	48.0	1007	30	" "
25/0000	13.3	49.0	1005	35	Tropical Storm
0600	13.5	50.1	1004	40	" "
1200	13.7	51.2	1002	45	" "
1800	13.8	52.3	1000	50	" "
26/0000	14.0	53.3	997	55	" "
0600	14.2	54.4	993	60	" "
1200	14.5	55.5	990	65	Hurricane
1800	15.0	56.4	984	70	"
27/0000	15.3	57.0	980	75	"
0600	15.9	57.7	973	85	"
1200	16.6	58.0	967	90	"
1800	17.3	58.2	965	95	"
28/0000	18.1	58.2	966	95	"
0600	19.0	58.1	969	90	"
1200	20.0	58.0	973	85	"
1800	21.1	58.0	978	80	"
29/0000	22.2	57.8	981	75	"
0600	22.9	57.8	984	70	"
1200	23.7	57.8	982	75	"
1800	24.4	57.8	979	75	"
30/0000	25.2	57.8	975	80	"
0600	26.0	57.8	972	85	"
1200	27.0	57.8	968	90	"
1800	27.8	57.8	963	95	"
31/0000	28.9	57.7	958	100	"
0600	30.3	57.5	956	105	"
1200	31.7	57.2	959	100	"
1800	33.0	56.5	961	100	"
01/0000	34.4	55.6	964	95	"
0600	35.6	54.5	967	90	"
1200	36.8	53.2	970	85	"
1800	38.0	52.0	974	80	"
02/0000	39.4	50.9	978	75	"
0600	40.7	49.8	982	70	"
1200	42.1	48.6	985	65	"
1800	43.8	48.0	988	60	Tropical Storm
03/0000	46.0	46.5	993	55	" "
0600	48.5	44.5	997	55	Extratropical
31/0600	30.3	57.5	956	105	Minimum Pressure

Table 2. Warnings issued for Hurricane Gustav,
August 1990.

Action Location	Effective Date/Time	Discontinue Date/Time
Hurricane Watch Dominica, Martinique	26/1600 UTC	27/1300 UTC
Hurricane Watch St. Martin, Anguilla and Surrounding Islands	26/1600 UTC	27/1600 UTC
Hurricane Watch Guadeloupe, Antigua, Barbuda, Montserrat, Nevis and St. Kitts	26/1600 UTC	26/2200 UTC
Hurricane Warning Guadeloupe, Antigua, Barbuda, Montserrat, Nevis and St. Kitts	26/2200 UTC	27/1600 UTC
Tropical Storm Warning Antigua, Barbuda and Surrounding Islands	27/1600 UTC	27/1900 UTC
Tropical Storm Watch St. Martin and Surrounding Islands	27/1600 UTC	27/1900 UTC

Table 3. Chances of the center of Hurricane Gustav passing within 65 miles of listed locations by date and time AST indicated; probabilities in percent.

ADVISORY DATE/TIME PROBABILITY TIME	24/NOON 27/8AM	24/6PM 27/2PM	24/1030PM 27/8PM	25/6AM 28/2AM	25/NOON 28/8AM
SKPG 12.5N 71.7W					
TNCC 12.2N 69.0W			2	2	2
SVMG 11.0N 64.0W	2	2	3	3	2
TTPP 10.6N 61.4W	2	3	3	3	2
TTPT 11.2N 60.8W	3	4	4	4	3
TGPY 12.0N 61.8W	4	4	5	5	4
TBPB 13.1N 59.5W	4	7	9	10	9
TVSV 13.1N 61.2W	7	6	7	8	7
TLPL 13.8N 61.0W	5	7	9	10	9
TFFF 14.6N 61.0W	6	7	11	11	11
TDPR 15.3N 61.4W	6	7	11	11	12
TFFR 16.3N 61.5W	6	7	12	12	13
TAPA 17.1N 61.8W	6	7	12	12	14
TKPK 17.3N 62.7W	6	6	10	10	12
TNCM 18.1N 63.1W	5	5	10	10	12
TISX 17.7N 64.8W	4	3	8	8	10
TIST 18.3N 65.0W	3	3	8	8	10
TJPS 18.0N 66.6W	2	2	6	6	8
MDSO 18.5N 69.7W			3	3	4
MDCB 17.6N 71.4W			2	2	3
MTPP 18.6N 72.4W					2
MTCA 18.3N 73.8W					
MUGM 20.0N 75.1W					
TJSJ 18.4N 66.1W	2	2	6	6	8
MDPP 19.8N 70.7W				2	3
MBJT 21.5N 71.2W					2
MYMM 22.4N 73.0W					
MYSM 24.1N 74.5W					
BERMUDA					

Table 3. Chances of the center of Hurricane Gustav passing (contd) within 65 miles of listed locations by date and time AST indicated; probabilities in percent.

ADVISORY DATE/TIME	25/6PM	25/1030PM	26/6AM	26/NOON	26/6PM
<u>PROBABILITY TIME</u>	<u>28/2PM</u>	<u>28/8PM</u>	<u>29/2AM</u>	<u>29/8AM</u>	<u>29/2PM</u>
SKPG 12.5N 71.7W	2		3		
TNCC 12.2N 69.0W	2	2	3		
SVMG 11.0N 64.0W	2	2	2		
TTPP 10.6N 61.4W	2		2		
TTPT 11.2N 60.8W	3	2			
TGPY 12.0N 61.8W	4	3	4		
TBPB 13.1N 59.5W	10	10	11	10	5
TVSV 13.1N 61.2W	8	7	10	8	6
TLPL 13.8N 61.0W	11	10	15	15	10
TFFF 14.6N 61.0W	13	13	21	23	16
TDPR 15.3N 61.4W	14	14	24	26	19
TFFR 16.3N 61.5W	15	16	26	29	24
TAPA 17.1N 61.8W	15	16	24	26	23
TKPK 17.3N 62.7W	14	14	21	22	19
TNCM 18.1N 63.1W	13	14	18	19	17
TISX 17.7N 64.8W	11	11	15	16	14
TIST 18.3N 65.0W	11	11	14	16	14
TJPS 18.0N 66.6W	9	9	12	13	11
MDSO 18.5N 69.7W	6	6	8	9	7
MDCB 17.6N 71.4W	4	4	6	7	5
MTPP 18.6N 72.4W	3	4	5	6	4
MTCA 18.3N 73.8W	2	3	4	4	3
MUGM 20.0N 75.1W		2	2	3	2
TJSJ 18.4N 66.1W	9	10	13	14	12
MDPP 19.8N 70.7W	5	5	6	8	6
MBJT 21.5N 71.2W	4	4	5	6	5
MYMM 22.4N 73.0W	2	2	3	4	3
MYSM 24.1N 74.5W					
BERMUDA					

Table 3. Chances of the center of Hurricane Gustav passing
(contd) within 65 miles of listed locations by date and
time AST indicated; probabilities in percent.

ADVISORY DATE/TIME 28/6AM
PROBABILITY TIME 31/2AM

TAPA	17.1N	61.8W	2
TKPK	17.3N	62.7W	2
TNCM	18.1N	63.1W	3
TISX	17.7N	64.8W	2
TIST	18.3N	65.0W	2
TJSJ	18.4N	66.1W	2
MBJT	21.5N	71.2W	2

ADVISORY DATE/TIME PROBABILITY TIME BERMUDA HIBERNIA OIL FIELD

28/6AM	31/2AM	3	
28/NOON	31/8AM	5	
28/6PM	31/2PM	5	
28/1030PM	31/8PM	6	
29/6AM	01/2AM	6	
29/NOON	01/8AM	8	
29/6PM	01/2PM	8	
29/1030PM	01/8PM	9	
30/6AM	02/2AM	7	
30/NOON	02/8AM	6	
30/6PM	02/2PM	2	
30/1030PM	02/8PM	2	
31/6AM	03/2AM		2
31/NOON	03/8AM		3
31/6PM	03/2PM		4
31/1030PM	03/8PM		3
01/6AM	04/2AM		6
01/NOON	04/8AM		4
01/6PM	04/2PM		4
01/1030PM	04/8PM		7
02/6AM	05/2AM		11
02/NOON	05/8AM		8
02/6PM	05/2PM		42
02/1030PM	05/8PM		2