

Preliminary report
Hurricane Bret
18-25 August, 1999

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Bret was a small hurricane that made landfall along a sparsely-populated section of the south Texas coast with sustained winds up to 100 knots. Bret was the first hurricane to strike the Texas coast since Hurricane Jerry in October 1989. It was the first hurricane to affect south Texas since Hurricane Allen in August 1980, and it was the strongest since Hurricane Alicia in 1983.

a. Synoptic History

Bret formed as a tropical depression over the Bay of Campeche on 18 August. Both a tropical wave and an upper-level low contributed to the formation of Bret. A tropical wave moved from Africa to the tropical Atlantic Ocean on 5 August. Continuity and soundings from Merida, Mexico place this weak tropical wave in the vicinity of the Yucatan Peninsula on the 18th. The second feature, an upper-level cyclonic circulation, appeared on water vapor imagery over the north central Caribbean moving westward on 15 August. The circulation initiated a thunderstorm complex on the night of the 17th over the Yucatan Peninsula and a weak surface low formed in the same location early on the 18th.

Later on the 18th, the surface low moved over the Bay of Campeche. Early morning visible satellite imagery showed a low level cloud circulation center and, a few hours later, a U.S. Air Force Reserve Unit reconnaissance mission confirmed the existence of a closed circulation. With some deep convection and banding present, the system was upgraded to a tropical depression at 1800 UTC on the 18th over the Bay of Campeche. The best track begins at this time, as shown in Table 1, which is a listing of Bret's best track positions, wind speeds, and central pressures, every six hours. Fig. 1 shows a map of this track.

The depression did not strengthen right away due to vertical shear caused by an upper-level trough over the extreme western Gulf of Mexico. But the trough moved away and Bret reached tropical storm strength late on the 19th while beginning to move slowly northward. The vertical shear decreased. Bret rapidly became more organized and then steadily strengthened to a 125-knot category four hurricane on the Saffir/Simpson scale on the morning of the 22nd, while approaching south Texas coast near Brownsville. Responding to the presence of a weak mid-tropospheric ridge over the northwest Gulf of Mexico and to a mid-tropospheric cyclonic circulation over the Rio Grande valley, Bret turned northwestward and slowed its forward speed down to about 5 knots. The forward speed had earlier been as high as 9 knots.

Bret's center crossed the Texas coast over the central portion of Padre Island, midway between Brownsville and Corpus Christi, at 0000 UTC, 23 August. It had weakened to a category three hurricane with 100 knot winds and a pressure of 951mb by the time of landfall. After moving inland, Bret's movement became more westward with a slow forward speed. Bret continued to weaken as it moved across south Texas and into the high terrain of north central Mexico where it dissipated on the 25th.

b. Meteorological Statistics

Figures 2 and 3 depict the best track curves and data plots of the maximum sustained 1-min surface winds (10m above ground level) and minimum central pressure, respectively, as a function of time. These plots include data gathered by aircraft reconnaissance and Dvorak satellite classification estimates and an occasional ship or land report.

Aircraft reconnaissance coverage began at 2000 UTC 18 August and continued until just after the hurricane's landfall at 0100 UTC 23 August. The maximum 1-min surface wind speed of 125 knots at 0600 and 1200 UTC on the 22nd is based on GPS-sonde vertical wind speed profiles. Fig. 4 shows one of these profiles and shows that winds reached near 150 knots within 1000 feet (300 meters) above the surface and were near 125 knots near the surface. Bret's pressure dropped 35 millibars to 944 millibars in the 24 hours ending at 1200 UTC on the 22nd and dropped 21 millibars in the six hours ending at 0000 UTC of the same day.

This episode of intensification coincides with the hurricane's track over a maximum in the sea surface temperature (SST) field over the west central Gulf of Mexico. Analyses from the Johns Hopkins University Applied Physics Laboratory shows 31°C SST values along Bret's track during this intensification period. In addition, estimates of the upper oceanic heat content (described by Shay et al.1999) under portions of the hurricane's circulation in the western Gulf of Mexico were rather high.

During the 12 hours prior to landfall, the hurricane weakened from 125 to 100 knots. It was also at this time that the western edge of the eyewall was coming into contact with Padre Island.

Bret was a small hurricane. At its peak, hurricane force winds were confined to a narrow radius of 30-40 miles from the center in the north semicircle and only 10-20 miles in the south semicircle. Thus only a small segment of the Texas coast was affected by the core of the hurricane. Kennedy County received most of the hurricane force winds which are estimated as high as 100 knots over a small portion of the coast of Padre Island. With the center moving inland over a sparsely populated area, few surface reports were available substantiating strong winds. Table 2 lists a selection of available surface observations, provided by the National Weather Service offices at Brownsville, Corpus Christi, and Houston/Galveston. The highest reported sustained wind in Table 2 is 63 knots at Rincon del San Jose on Padre Island. The instrument there failed at 2230 UTC on the 22nd just before the center passed close by.

The Port Aransas C-MAN station reported maximum sustained winds of 41 knots as the center of the hurricane passed about 60 n mi to the south.

Bret was slow moving and Doppler radar estimates suggest maximum storm total precipitation amounts of over 30 inches in Kennedy county. None of the rainfall totals in Table 2 come close to that value. Aransas Pass is north of the area of peak rainfall and it reported a storm total of 12.60 inches. The heavy rains accompanying the weakening tropical cyclone caused notable river flooding in the Rio Grande Valley. The Rio Grande River at Laredo and the Aransas River near Skidmore and at Oso Creek crested slightly above flood stage, causing local flooding in these respective areas.

A 24-hour rainfall total of over 14 inches was reported from the Mexican state of Nuevo Leon and the state of Tamaulipas is believed to have received similar rainfall.

Theoretical values from the SLOSH storm surge model indicate that a narrow region along Central and North Padre Island had a storm surge of 8 to 10 feet. A report from Port Mansfield Pass suggests that three to five feet of water penetrated this coastal location. Several cuts were observed in the dunes surrounding Padre Island. The largest of these, near mile marker 50 near the eye's passage, was mistaken by aircrews inspecting the damage as the Mansfield Pass. Substantial beach erosion was reported near Port Mansfield.

In Aransas County around 2145 UTC 22 August, a tornado reportedly destroyed a recreational vehicle, along with a barn and a shed, and uprooted trees. Other reports indicate that a tornado touched down in Kingsville around 2245 UTC on the 22nd and a tornado was reported in Alice, time unknown. Little damage was reported with the latter two.

c. Casualty and Damage Statistics

Despite Bret's intensity, damage was generally reported to be fairly light. Much of this owed to its landfall over a sparsely populated region in south Texas and its small size. The nearest population centers, Brownsville and Corpus Christi, were spared the brunt of the hurricane's core.

Property insurance damage claims total 30 million dollars as reported by the Property Claims Services Division of the Insurance Services Office. Multiplying by a factor of 2.0 gives an estimated damage total of 60 million dollars.

There have been no reports of loss of life.

d. Forecast and Warning Critique

The average forecast track errors for Bret are as follows: 65 n mi at 24 hours, 155 n mi at 48 hours, and 255 n mi (5 cases) at 72 hours. These values are just slightly below the previous 10-year averages. The GFDL model had a left bias and brought the

hurricane inland over Mexico on a northwest to westward track for several forecasts as Bret moved northward. It has been suggested that the use of high-resolution topography with 18,000-foot mountains over Mexico in the GFDL model is the reason for the left bias.

The official forecast issued at 1800 UTC on the 19th, when Bret first became a tropical storm, had a 72-hour wind speed error of -85 knots. This was caused by the GFDL bias and resultant official forecast which placed the storm inland in 72 hours, rather than strengthening in the Gulf of Mexico.

REFERENCES

Shay, L. K., G. J. Gustavo, J. Goni, and P. G. Black, 1999: Effects of a warm oceanic feature on Hurricane Opal. Accepted for publication in *Mon. Wea. Rev.*

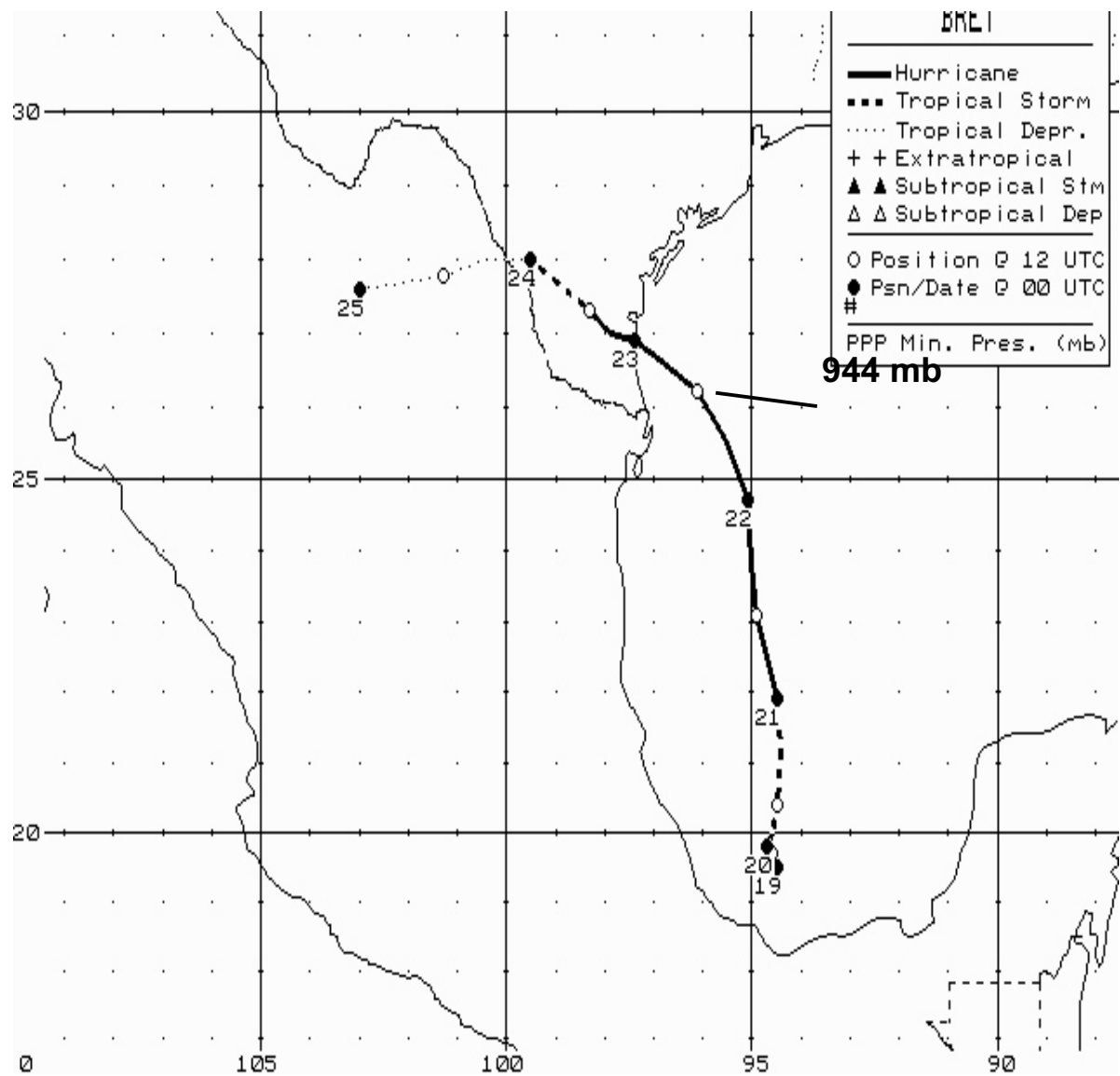


Fig. 1. Best track positions for Hurricane Bret, 18-25 August 1999.

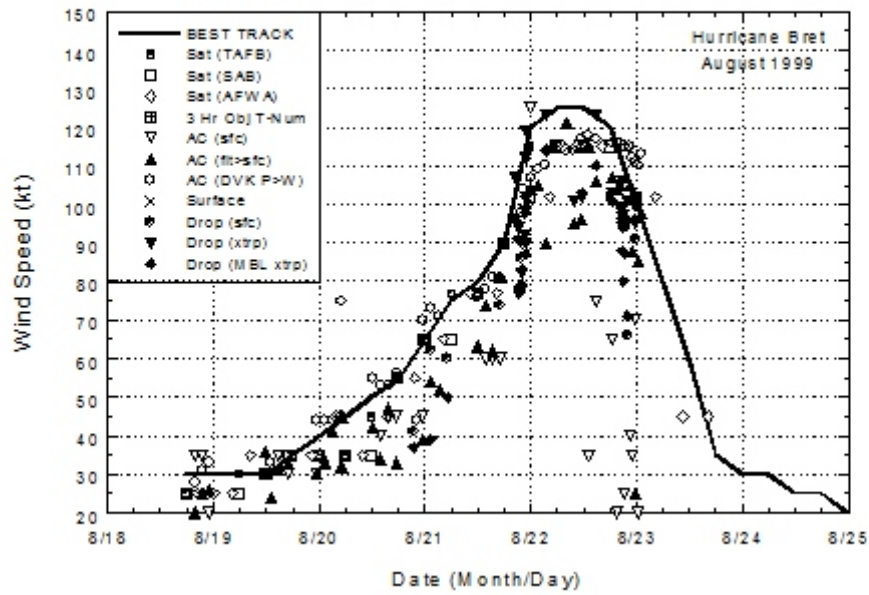


Fig. 2. Best track maximum sustained wind speed curve for Hurricane Bret.

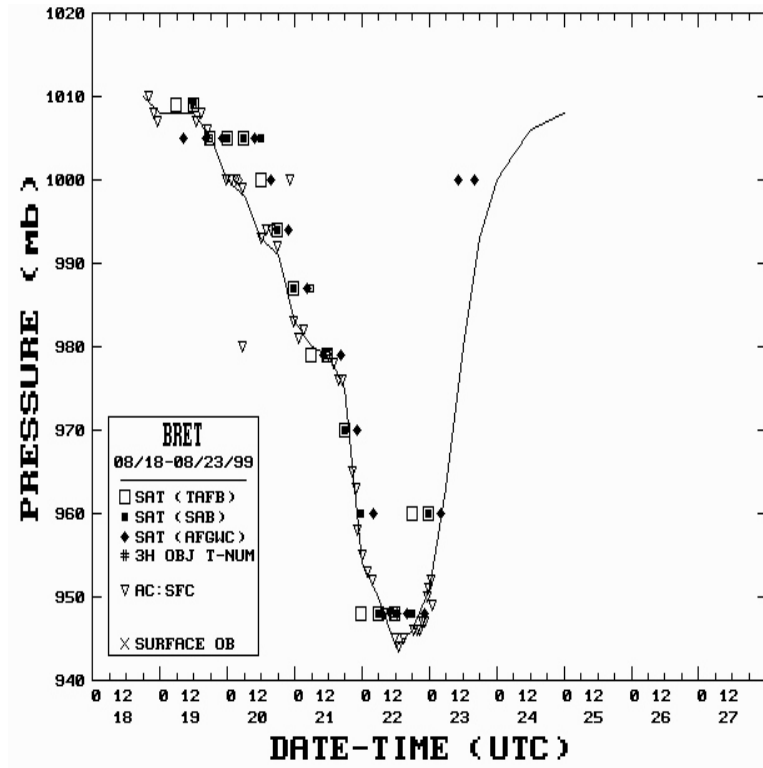


Fig. 3. Best track minimum central pressure curve for Hurricane Bret.

**Hurricane Bret - Eyewall
GPS Dropsonde Wind Profile
1445 UTC 22 August 1999**

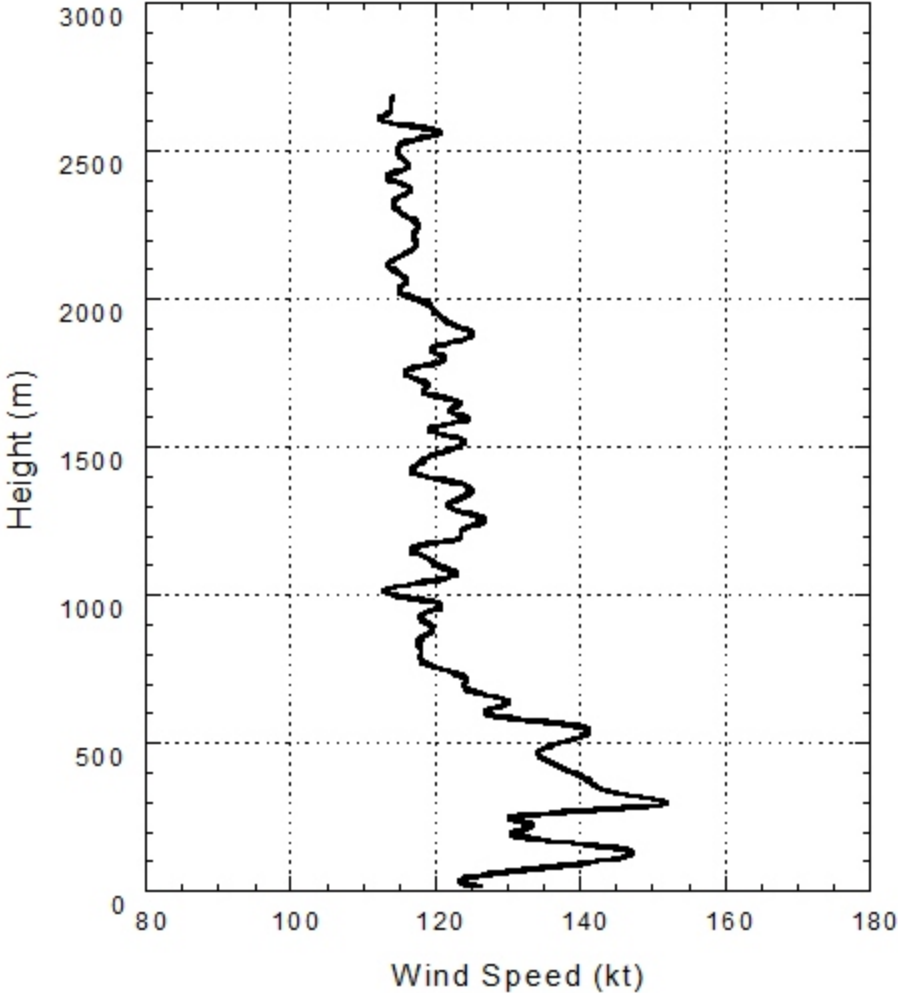


Fig. 4. GPS dropsonde vertical wind speed profile for Hurricane Bret.

Table 1. Preliminary Best Track - Hurricane Bret, 18-25 August, 1999.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
18/1800	19.5	94.4	1010	30	tropical depression
19/0000	19.5	94.5	1008	30	"
0600	19.6	94.6	1008	30	"
1200	19.7	94.6	1008	30	"
1800	19.8	94.7	1005	35	tropical storm
20/0000	19.8	94.7	1000	40	"
0600	20.0	94.6	998	45	"
1200	20.4	94.5	993	50	"
1800	21.2	94.4	991	55	"
21/0000	21.9	94.5	983	65	hurricane
0600	22.5	94.7	980	75	"
1200	23.1	94.9	979	80	"
1800	23.8	95.0	975	90	"
22/0000	24.7	95.1	954	120	"
0600	25.5	95.5	950	125	"
1200	26.2	96.1	944	125	"
1800	26.6	96.8	946	120	"
23/0000	26.9	97.4	951	100	"
0600	27.0	97.9	963	80	"
1200	27.3	98.3	980	60	tropical storm
1800	27.6	98.8	993	35	"
24/0000	28.0	99.5	1000	30	tropical depression
0600	28.0	100.4	1003	30	"
1200	27.8	101.3	1006	25	"
1800	27.7	102.1	1007	25	"
25/0000	27.6	103.0	1008	20	"
0600	dissipated				
22/1200	26.2	96.1	944	125	minimum pressure
23/0000	26.9	97.4	951	100	landfall at central Padre Island, Texas

Table 2. Hurricane Bret selected surface observations, August 1999.

location	press. (mb)	date/time (UTC)	sust. wind (kts) ^a	peak gust (kts)	date/time (UTC) ^b	storm surge (ft) ^c	storm tide (ft) ^d	total rain (in)
Texas								
Brownsville Airport ASOS	1002.4	22/2131	29	47	22/1830			1.99
Cameron City Airport ASOS	999.7	22/2035	36	46	22/1841			3.49
Harlingen Airport ASOS	999.0	22/2310	38	48	22/2208			2.55
Port Isabel						1.1		
McAllen Airport ASOS	1003.1	23/0023	28	37	22/2209			2.93
South Padre Island	998.6	22/1815	38	48	22/1915			3.88
Arroyo Colorado			43	57	22/1900			
Port Mansfield	985.4	22/2000	42	66	22/2200			
Rincon del San Jose			63*	78*	22/2230			
Falfurrias Airport	976.6	22/0330		85*	23/0330			
Edinburg								3.41
El Sauz								2.00
Falcon								1.19
Garciasville								2.72
Harlingen								2.94
Hebbronville								4.57
Laguna Atascosa								4.16
La Joya								4.65
Los Fresnos								2.56
McAllen								3.10
Mercedes								1.02
Monte Alto								4.06
Rancho Viejo								1.45
Raymondville								3.07
Rincon								1.80 [#]
Rio Grande City								4.14
Santa Ana NWR								3.82
Santa Rosa								3.54
Sarita(Kenedy Co.) County co								13.18
Weslaco								6.84
Zapata								2.48
Bob Hall Pier							2,6	
Corpus Christi	1002.4	23/0322	39	48	23/0326			5.18
Kingsville NAS ASOS	1001.7		35	44	22/1843			3.09
Rockport ASOS	1006.4	22/2228	34	41	23/1506		1.8	2.29
Victoria ASOS	1008.8	23/0900	22	28	24/1811			0.69
Alice ASOS	998.3	23/1217	39	48	23/1748			3.97
Cotulla ASOS	1006.4	23/1753	33	40	23/2332			4.27
McMullen Target ASOS			38		22/2124			
Port Aransas C-MAN	1003.1	22/2200	41	52	23/2200			
Aransas Pass				57	23/2115			12.60
Freer								2.68
Benavides								5.10
Calliham								2.00
Concepcion								7.38 [#]

Table 2(continued). Hurricane Bret selected surface observations, August 1999.

location	press. (mb)	date/time (UTC)	sust. wind (kts) ^a	peak gust (kts)	date/time (UTC) ^b	storm surge (ft) ^c	storm tide (ft) ^d	total rain (in)
Texas (cont'd)								
Fowlerton								4.07
George West								5.30
Point Comfort								0.21 [#]
Portland								7.95
Robstown								5.36 [#]
Sinton								5.46
Victoria CP&L								0.52
Alice								3.00
Buoy 42019	1007.	22/2200	37		23/1600			
Buoy 42020	982.9	22/1900	58	73	22/1900			
Freeport							2.4	
Palacios ASOS	1008.	23/0353	23	27	22/1012			0.42
Galveston ASOS	1010.	23/0425	19	22	23/1032			0.02
Angleton/L. Jackson ASOS	1010.	23/0602	20	26				0.26

^a NWS ASOS and C-MAN averaging periods are 2 min; buoys are 8 min.

^b Date/time is for sustained wind when both sustained and gust are listed.

^c Storm surge is water height above normal astronomical tide level.

^d Storm tide is water height above NGVD.

^e Estimated.

* Equipment failed or power outage experienced.

[#] 24-hour rainfall total.

Table 3. Watch and warning summary, Hurricane Bret, 18-25 August, 1999.

Date/Time (UTC)	A c t i o n	L o c a t i o n
19/2100	tropical storm warning issued	Tampico to Coatzacoalcos, Mexico
20/1500	hurricane watch and tropical storm warning issued	La Pesca to Veracruz, Mexico
20/1500	tropical storm warning discontinued	Veracruz to Coatzacoalcos, Mexico
21/0900	hurricane watch issued	Tuxpan, Mexico to Baffin Bay Texas
21/0900	hurricane watch/tropical storm warning discontinued	Tuxpan to Vera Cruz, Mexico
21/1500	hurricane warning issued	La Pesca, Mexico to Baffin Bay, Texas
21/2100	hurricane watch/tropical storm warning issued	Baffin Bay to Port Aransas, Texas
22/0300	hurricane warning issued	Baffin Bay to Port O'Connor, Texas
22/0300	hurricane watch/tropical storm warning issued	Port O'Connor to Freeport, Texas
22/0900	hurricane watch discontinued	Tuxpan to Tampico, Mexico
22/1500	hurricane watch discontinued	Tampico to La Pesca, Mexico
22/2100	hurricane watch discontinued	Port O'Connor to Freeport, Texas
23/0100	hurricane warning discontinued	La Pesca to U.S./Mexican border
23/0300	hurricane warning downgraded to tropical storm warning	north of Port Aransas to Port O'Connor, Texas
23/0300	tropical storm warning discontinued	north of Port O'Connor to Freeport, Texas
23/0900	hurricane warning downgraded to tropical storm warning	Brownsville to Port Aransas, Texas

23/2100	tropical storm warning discontinued	Brownsville to Port Aransas, Texas
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