

Preliminary Report
Hurricane Frances
23-27 October 1992

a. Synoptic History

Frances formed about 400 n mi to the south-southeast of Bermuda. Satellite pictures and surface analyses indicate that the formation occurred within a broad area of low pressure that developed near the tail end of a weak, quasi-stationary frontal trough. A south-southwesterly vertical wind shear, associated with a nearly stationary upper-level trough located over the U.S. east coast and the southwestern Atlantic Ocean, kept the western portion of the low free of deep convection from the 18th through the 21st of October. In contrast, the eastern portion of the low remained under a long, 200 n mi wide band of clouds that extended from north-northwest to south-southeast. Satellite pictures suggest that the section of the band extending south-southeast from the low was periodically invigorated for several days by the northern portion of tropical waves.

Water vapor imagery on the 22nd and 23rd showed an upper-level cyclonic circulation system "cutting-off" to the southwest of the low, within the upper-level trough. The shear then decreased and, with the possible enhancing effects of a tropical wave, the low quickly strengthened and became a gale center of about 1004 mb by 1800 UTC on the 22nd (Table 1). The deep convection then began to wrap cyclonically around the circulation center and quickly grow in lateral extent. This indicates that the system was making a transition from a gale center to Tropical Storm Frances. The transformation was completed shortly after 0600 UTC 23 October (Fig. 1).

Several ship reports from the *Migaea* and *Sparrow* document that the cyclone strengthened during the transition period (Figs. 2 and 3). The *Migaea* observed a pressure of 1000 mb about 150 n mi from the circulation center at 2230 UTC on the 22nd. By 0200 UTC on 23 October it was closer to the center and observed 997 mb with sustained winds of 50 kt and gusts to 74 kt. The *Sparrow* reported sustained winds of 50 kt near 0000 UTC. Before sunrise, sustained winds approached 65 kt at the *Sparrow*, but then dropped temporarily to 34 kt while the wind direction switched from southeast to northwest. Those changes coincided with the sky partially clearing and the pressure reaching 996 mb after falling rapidly for several hours. These observations suggest that the first stages in the formation of an eye occurred early on the 23rd. It is also noted that the pressures shown in the "best track" (Fig. 1 and Table 1) are a little lower than the pressures discussed above because the observations were not made at the site of minimum pressure (see Fig. 2).

Frances continued to strengthen through the 23rd. The ship *TSL Bold*, located 30-45 n mi southeast of the center of Frances,

reported a pressure of 994 mb at 1600 UTC and a southwest wind of 65 kt four hours later. An eye appeared for the first time on satellite images during that period. The initial reconnaissance mission in the cyclone found a 979 mb central pressure at 2238 UTC. From these data it is estimated that Frances reached hurricane strength near 1800 UTC.

Frances initially drifted northward, in the general direction of Bermuda. By late on the 23rd, however, the trough to the west of Frances was reinforced by a new mid-latitude shortwave trough approaching from the eastern United States. The associated steering flow accelerated Frances northeastward to about 20 kt on the 24th. Frances reached its peak intensity, with estimated 75 kt sustained winds and 976 mb central pressure, on that day.

The track toward the northeast carried Frances over colder water. The eye became indistinct on the 25th, although relatively deep convection persisted near the circulation center through early on the 27th. Analyses of surface weather maps indicate a gradual broadening of the wind field during that period. Frances became extratropical at about 0600 UTC on the 27th. Over the following three days, Frances moved generally to the east as a complex extratropical gale.

b. Meteorological Statistics

The best track was derived from the ship reports, aircraft data, Dvorak tropical cyclone technique estimates, Hebert/Poteat subtropical cyclone technique estimates, and surface analyses. Figures 2 and 3 show the curves of minimum central pressure and maximum one-minute wind speed versus time, respectively, and the observations on which they were based. The Air Force Global Weather Center (AFGWC; USAF in figures), National Hurricane Center (NHC) Tropical Satellite Analysis and Forecast (TSAF) unit and the NESDIS Synoptic Analysis Branch (SAB) supplied the estimates based on satellite data.

Table 2 lists ship reports of 34 kt or stronger winds.

c. Casualty and Damage Statistics

Sailor Mike Plant was reported missing over the North central Atlantic during the latter part of October. The U.S. Coast Guard has not, to date, concluded that Mr. Plant's disappearance is directly related to Frances.

Ms. Anita Page was the only person aboard the 35 ft sailboat Sparrow. She suffered a broken rib and the boat was partially disabled during her encounter with the cyclone on the 22nd and 23rd.

No other reports of damage or casualties related to Frances have been received by the NHC.

d. Forecast and Warning Critique

The first tropical cyclone advisory on Frances was issued by the NHC at 1500 UTC on the 23rd. Prior to that time, information about the system, first as a low center and then as a gale center, was provided in Atlantic High Seas Forecasts issued by the NHC TSAF unit.

A post-analysis of Frances' formation using all the currently available data indicates that although satellite imagery provided qualitative clues about Frances' initial transformation, the intensity estimates using satellite data were much too low, particularly from the 22nd-24th (Figs. 2 and 3). It is also unfortunate that the *Migaea* and *Sparrow* ship reports were not available operationally to the NHC. Such data deficiencies are not uncommon and in this case contributed to underestimates of the intensity of the cyclone in the NHC High Seas Forecasts and Tropical Cyclone Advisories during that period. The dearth of quantitative surface data will likely continue to limit the NHC's ability to assess accurately the intensity of cyclones that undergo rapid strengthening and/or structural change.

A hurricane watch and tropical storm warning were issued by the government of Bermuda for that island at 2100 UTC on the 22nd. Both were discontinued at 1500 UTC on the 24th when the threat ended there. There were no other tropical storm or hurricane watches or warnings associated with Frances. Table 3 lists the "strike probabilities" for Frances.

The NHC track forecast errors during Frances ranged from 56 n mi in 13 forecasts at 12 hours to 254 n mi in 3 forecasts at 72 hours. The errors were a little larger than the 10-year average at the short time periods, but smaller at 72 hours. The official forecasts beat the track models at 12 hours, but were not as good as most of the guidance at the longer forecast periods.

Once the actual intensity of Frances became accurately diagnosed late on the 23rd, the NHC intensity forecasts became excellent, never erring at any time period by more than 10 kt.

Acknowledgment. Ms. Page graciously provided a detailed account of the weather she observed aboard the *Sparrow*.

Table 1. Preliminary best track, Hurricane Frances.

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
	Lat. (°N)	Lon. (°W)			
22/1200	26.3	60.8	1009	30	Extrat. Low
1800	26.6	61.2	1004	40	Extrat. Gale
23/0000	27.1	61.4	996	50	Extrat. Storm
0600	27.7	61.4	992	55	Transition to Trop.
1200	28.3	61.3	990	60	Tropical Storm
1800	28.7	61.1	986	65	Hurricane
24/0000	29.0	60.6	978	65	" "
0600	29.6	59.9	977	70	" "
1200	30.6	58.8	976	75	" "
1800	32.1	57.4	976	75	" "
25/0000	33.8	56.2	978	70	" "
0600	35.7	54.9	980	65	" "
1200	37.7	53.7	982	65	" "
1800	39.6	52.7	983	60	Tropical Storm
26/0000	41.4	51.7	985	60	" "
0600	43.2	50.2	986	60	" "
1200	44.8	48.6	987	60	" "
1800	46.0	46.9	988	55	" "
27/0000	47.0	44.9	989	55	" "
0600	47.6	42.7	992	50	Extratropical
1200	48.0	40.0	994	45	" "
1800	48.0	37.0	998	40	" "
28/0000	48.0	34.0	1002	40	" "
0600	47.5	31.0	1004	35	" "
1200	47.0	27.5	1002	35	" "
1800	46.0	24.0	999	35	" "
29/0000	45.0	20.0	999	40	" "
0600	44.0	16.0	1001	35	" "
1200	43.5	12.0	1002	35	" "
1800	43.0	9.0	1003	30	" "
30/0000	43.0	7.0	1002	30	" "
<hr/>					
24/1200	30.6	58.8	976	75	Minimum Pressure

Table 2. Ship reports of 34 kt or higher winds associated with Frances prior to its losing tropical characteristics. Times and locations are approximate for the Migaea and Sparrow. ELOV9 wind is considered unrepresentative.

Ship Name or ID	Date/Time (UTC)	Lat. (*N)	Lon. (*W)	Wind (kt) Dir./Spd./Gust	Pressure (mb)
ELOV9	22/1200	27.2	63.3	060/44	1012.5
Migaea	22/2230	26.3	64.3	110/25/35	1000.0
Sparrow	22/2300	27.7	60.7	---/50	-----
Migaea	23/0200	27.7	61.5	225/50/74	997.0
Migaea	23/4 hours	----	----	315/40/50	-----
Solaris	23/0600	27.1	54.5	130/40	1010.8
Sparrow	23/0900	27.7	60.7	---/64	996.0
Sparrow	23/1500	27.7	60.7	---/45	-----
TSL Bold	23/1600	28.0	61.1	225/55	994.0
(unknown)	23/1945	27.8	62.3	290/44	1002.0
TSL Bold	23/2000	28.0	60.8	225/65	994.0
Barentzgracht	24/0000	31.0	63.5	010/37	1008.7
Reed Voyageur	24/0300	28.5	65.3	315/35	-----
TSL Bold	24/0400	27.5	61.5	290/40-45	1005.0
Westward	24/0800	32.1	58.9	060/35	1002.0
Westward	24/1100	32.1	59.5	060/35	999.5
Westward	24/1500	31.0	60.0	310/55	1002.7
Pacific Teal	24/1500	27.8	56.3	220/40	1009.0
Ultramar	24/1800	27.5	59.5	320/50	1010.2
PITB	24/1800	29.7	55.5	220/42	1005.0
Northern Enterprise	24/1800	33.4	56.4	130/40	997.1
PITB	25/0000	29.3	56.3	240/40	1009.8
Northern Enterprise	25/0000	32.9	57.9	330/42	998.2
Professor Szafer	25/1200	31.9	54.7	250/50	1012.2
Sheldon Lykes	25/1200	35.7	50.2	210/35	1008.9
Star Florida	25/1200	40.4	56.3	030/38	1006.0
Paleisgracht	25/1200	40.2	55.5	040/34	1003.1
Tampa Bay	25/1500	39.1	56.9	020/50	1002.0
Paleisgracht	25/1800	39.3	55.5	330/38	997.8
WWDY	25/1800	41.3	55.6	020/40	998.0
Baron	25/2100	42.0	53.8	360/45	993.0
Star Florida	26/0000	39.4	54.8	280/38	1004.0
Baron	26/0000	41.6	53.8	350/45	992.5
CGDV	26/0000	43.6	51.6	070/45	998.1
Baron	26/0300	41.2	53.6	300/45	997.0
CGDV	26/0600	43.5	51.5	030/35	988.1
Baron	26/0600	40.8	53.4	270/44	1002.0
Baron	26/0900	40.6	52.5	270/38	1006.0
Scandutch Gallia	26/1200	40.0	47.7	240/35	1010.0
3EMV8	26/1200	40.6	44.3	200/40	-----
Sealand Commitment	26/1200	43.7	44.7	200/35	1004.0
CGDV	26/1200	43.9	51.2	320/35	997.6
Poliarnii Kroug	26/1200	47.8	47.5	090/37	1012.2
Sealand Commitment	26/1500	43.6	45.6	210/48	-----
Sheldon Lykes	26/1800	35.8	58.2	260/35	1007.1
3EMV8	26/1800	40.6	46.0	220/36	1009.5

Table 3. Chances of the center of Hurricane Frances passing within 65 miles of listed locations by date and time (EDT) indicated; probabilities in percent with X for less than 2 percent.

ADVISORY ISSUE TIME:	23/11AM	23/5PM	23/11PM	24/5AM	24/11AM
PROBABILITY END TIME:	26/8AM	26/2PM	26/8PM	27/2AM	27/8AM
BERMUDA	13	16	8	X	X
YARMOUTH NS	5	5	5	X	X
HALIFAX NS	6	6	6	X	X
SABLE ISLAND NS	8	8	8	7	4
SYDNEY NS	6	6	6	5	3
EDDY POINT NS	6	6	6	X	2
ILE ST PIERRE	5	6	6	7	7
BURGEO NFLD	X	5	5	5	5
CAPE RACE NFLD	X	5	7	9	10
MONCTON NB	X	X	4	X	X
ST JOHN NB	X	X	4	X	X
PTX BASQUES NFLD	X	X	5	X	3
HIBERNIA OILFLD	X	X	6	9	11
ADVISORY ISSUE TIME:	24/5PM	25/5AM	25/11AM	25/5PM	25/11PM
PROBABILITY END TIME:	27/2PM	28/2AM	28/8AM	28/2PM	28/8PM
SABLE ISLAND NS	3	X	X	X	X
SYDNEY NS	2	X	X	X	X
ILE ST PIERRE	5	7	X	2	X
BURGEO NFLD	3	4	X	X	X
CAPE RACE NFLD	9	11	8	13	14
PTX BASQUES NFLD	2	2	X	X	X
HIBERNIA OILFLD	11	13	21	30	34
ADVISORY ISSUE TIME:	26/5AM	26/11AM	26/5PM		
PROBABILITY END TIME:	29/2AM	29/8AM	29/2PM		
CAPE RACE NFLD	8	X	X		
HIBERNIA OILFLD	34	26	16		

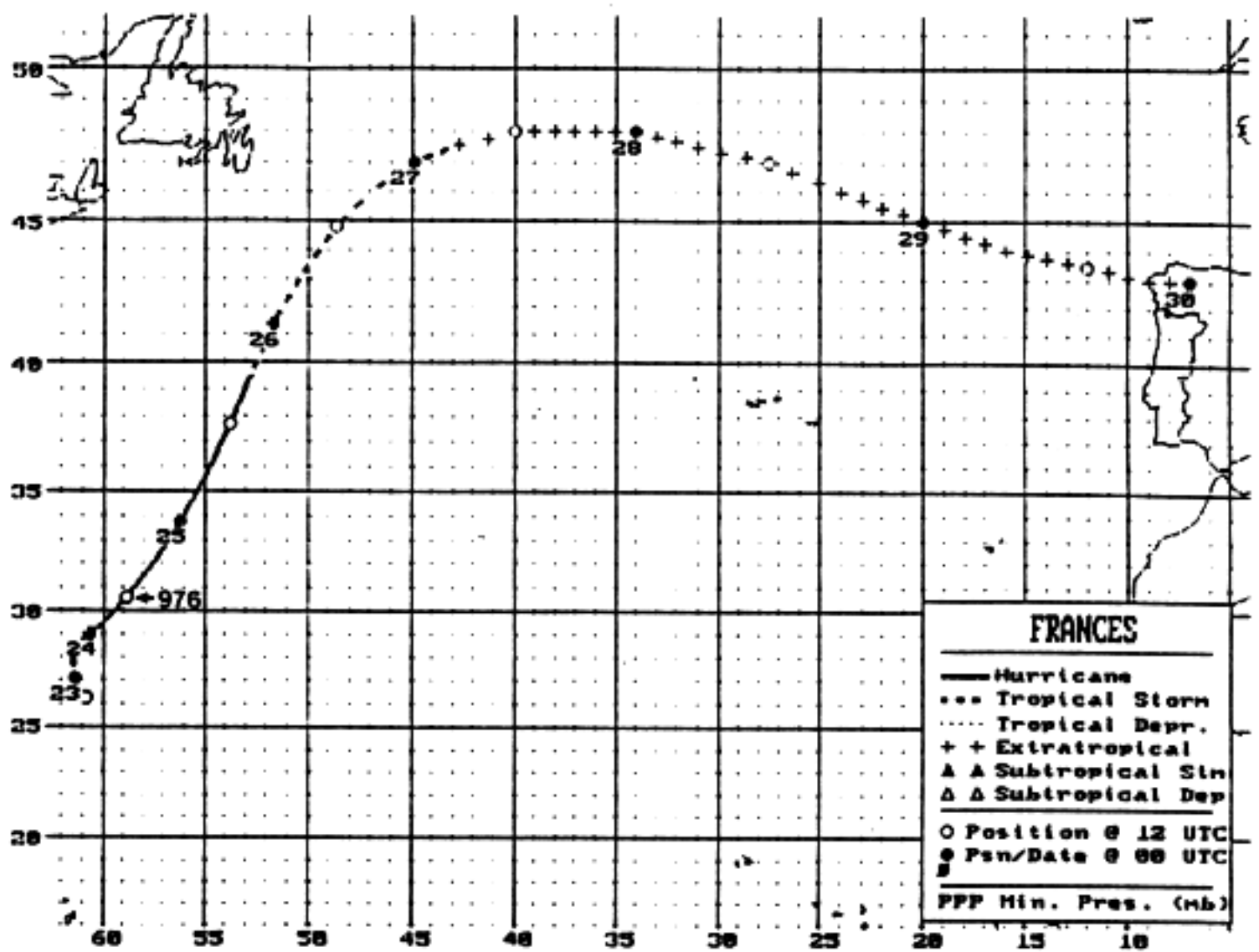


Fig. 1a. Best track positions for Hurricane Frances, 23-27 October 1992.

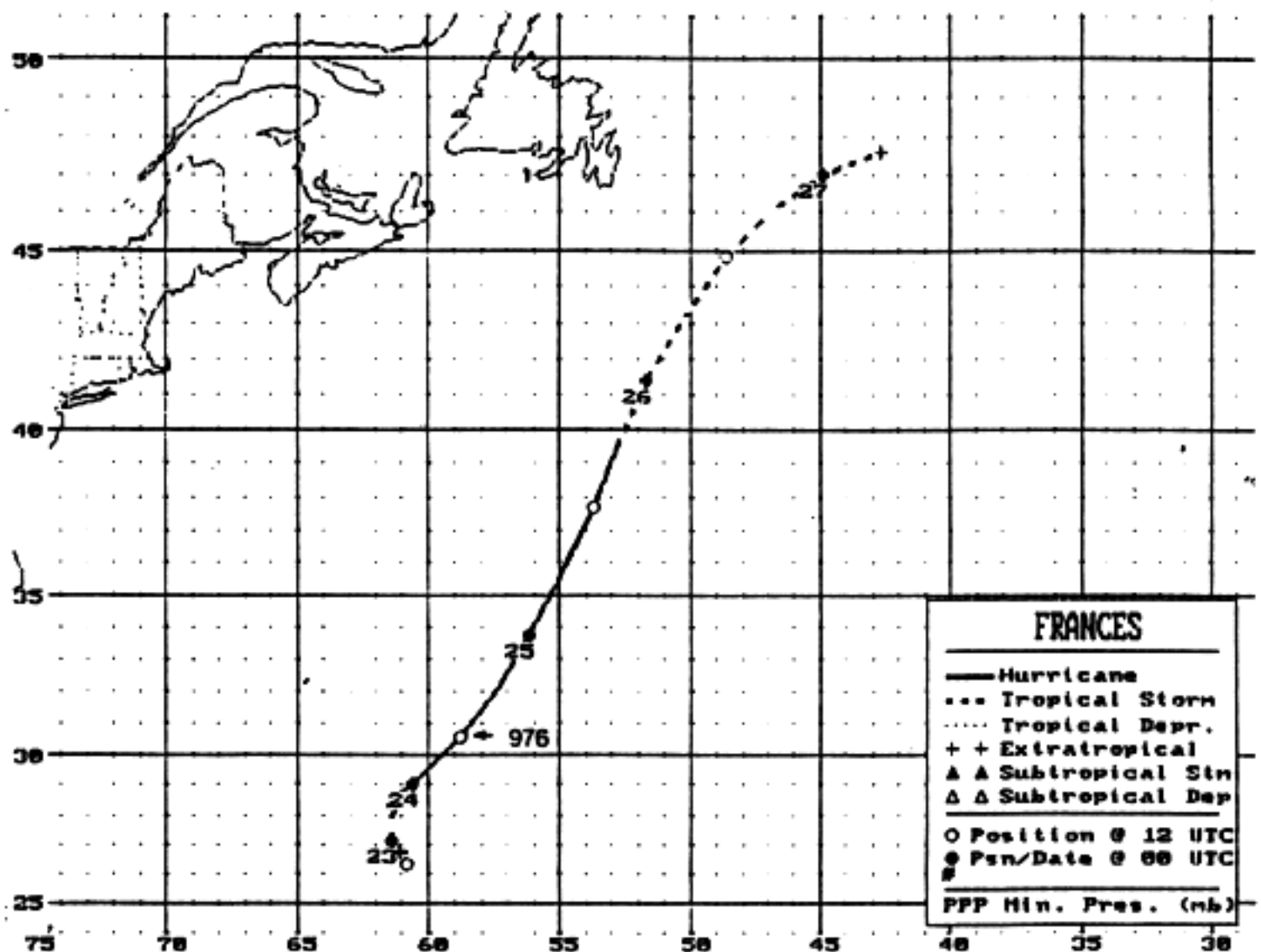


Fig. 1b. Best track positions for Hurricane Frances, until becoming extratropical on 27 October 1992.

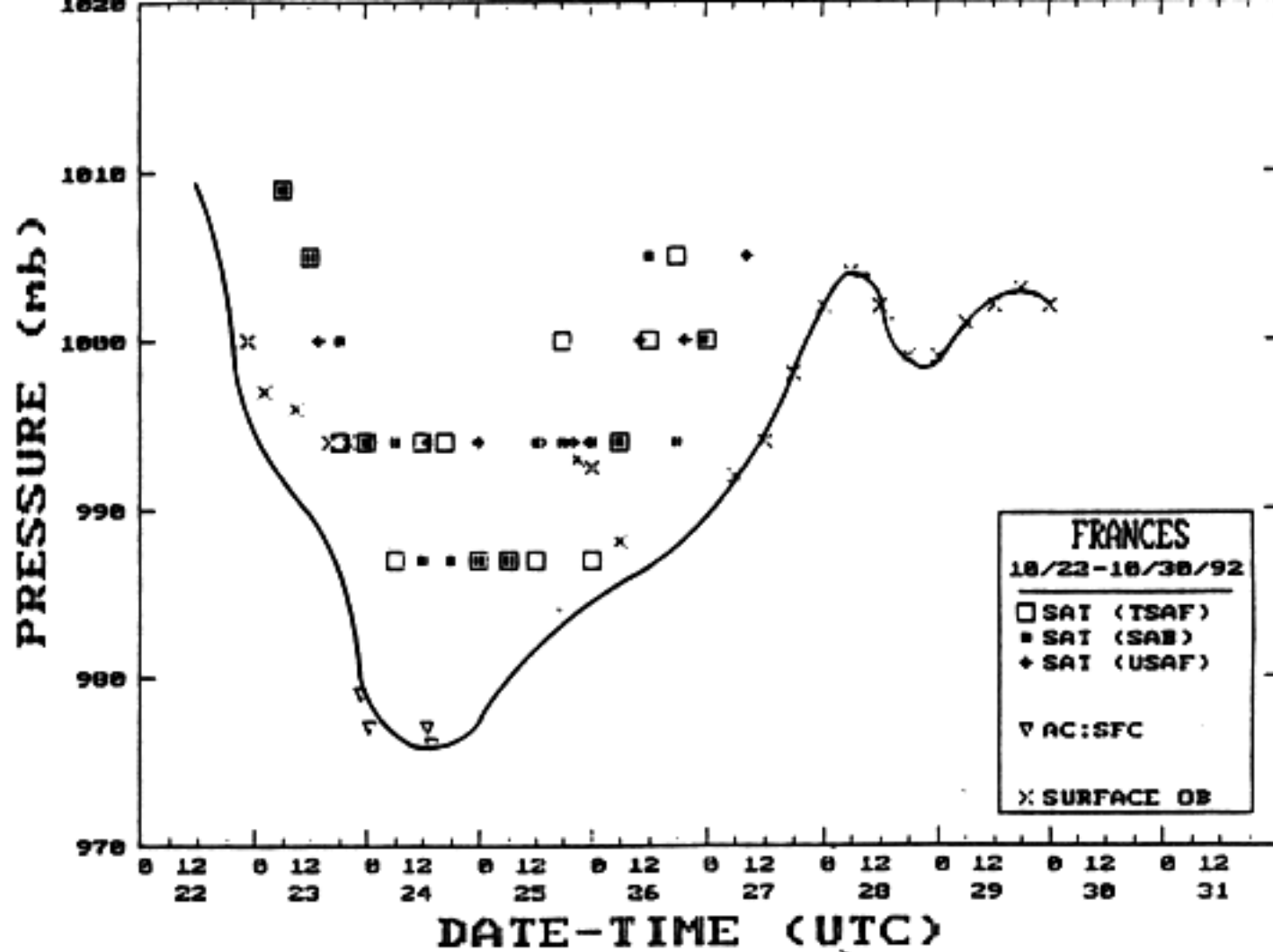


Fig. 2. Best track minimum central pressure curve for Hurricane Frances. X denotes ship observation prior to the 27th and estimates based on surface analyses beginning that date.

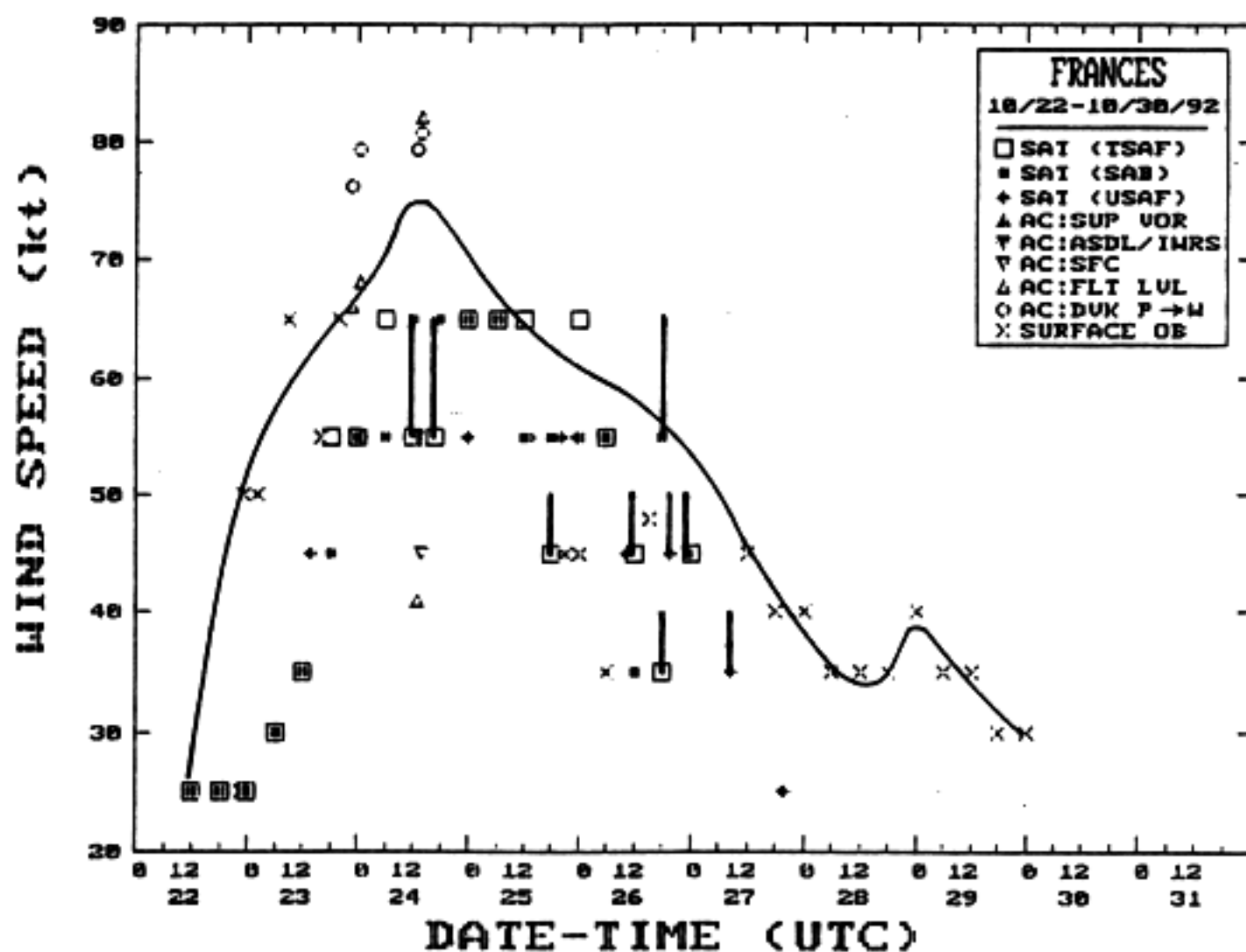


Fig. 3. As in Fig.2, except for maximum sustained wind speed curve. Vertical bars denote range for sub-tropical classifications.