Atlantic Hurricane Season of 1975

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ABSTRACT

A seasonal summary of the 1975 Atlantic hurricane season is followed by accounts of the individual storms and hurricanes.

1. Seasonal summary

The 1975 hurricane season gave some evidence of a return to statistical normals after five years of rather suppressed activity. The total of eight named tropical cyclones was below the most recent 30-year average of nine for the fourth consecutive year. However, the six hurricanes equaled the 30-year average, and were the most since 1969. In addition, there were 26 hurricane days[1]—the most since 1971—with the average intensity of the hurricanes also being the greatest since 1969. The continued upward trend of hurricane days since the 1972 minimum has reversed the trend of the five-year running averages presented by Hope (1975). Fig. 1 shows the tracks of the 1975 named storms and Table 1 gives a statistical symmary of them.

Three of the named storms (Amy, Doris, Hallie) exhibited subtropical characteristics during some part of their life cycle, but only Doris was designated a subtropical storm before being named. Originating in baroclinic (westerly) environments, they reached a stage where the role of latent heat became the dominant driving mechanism, and were designated tropical cyclones. Figure 2 shows the subtropical portion of Doris and a late season subtropical storm, and Table 2 gives a statistical symmary. Since aerial reconnaissance is usually not available for these storms, winds in these systems were estimated by a new technique for satellite classification of subtropical cyclones by Hebert and Poteat (1975).

The dominance of the vertical shear of the horizontal winds as a controlling factor in both seasonal and individual tropical cyclone development has been presented in this annual article since the 1968 hurricane season (e.g., Sugg and Hebert, 1969; Simpson and Hebert, 1973). The last reference also initiated a mean sea-surface temperature anomaly field (Jarvinen, 1973) and mean vertical wind shear field for the period 15 August–15 September, normally the most active part of the hurricane season. Figure 3 has combined this year's charts of shear and sea-surface temperature anomalies. A review of these two parameters over the past four years indicates a gradual decrease in both the magnitude and areal extent of the colder-than-normal sea-surface temperatures and strong vertical shears in the Atlantic. One exception is in the central and eastern Caribbean Sea where 10 kt or greater shears returned after having diminished in 1974.

An examination of Fig. 3 south of latitude 35°N reveals a rather strong correlation between the axis of 10 kt or greater shear isotachs and below normal temperature anomalies, which are displaced to the right. While not as pronounced, areas of 5 kt or less shear agree quite well with temperature anomalies that are near or above normal. These same relationships have been in evidence in previous years. The great persistence of these features throughout a hurricane season are of valuable operational assistance in assessing the potential of tropical systems for development and intensification. A careful examination of the 1975 storm tracks (including those portions outside the period analyzed) shows with few exceptions that initial development, strengthening and weakening trends, and track locations are highly correlated with areas of light shears and near or above normal sea-surface temperatures. Ballenzweig (1957, 1959) and Hebert and Miller (1969) have shown the effect of anomalies in the planetary wave fields on hurricane formation. Namias (1959, 1969) has shown both causal relationships between the height anomalies and sea-surface temperature anomalies and their persistence from year to year. The location of the large-scale planetary features and their anomalies during the 1975 hurricane season agreed quite well with hurricane developments (e.g., Taubensee, 1975). These features frequently change phase (trough to ridge) in less than two weeks, however, and they do not always indicate the presence of the strong but more persistent shears in the tropics (Krueger and Winston, 1975).

Eloise was the most deadly and destructive hurricane

[1] When more than one hurricane is in existence on the same day, each one is counted as a hurricane day.

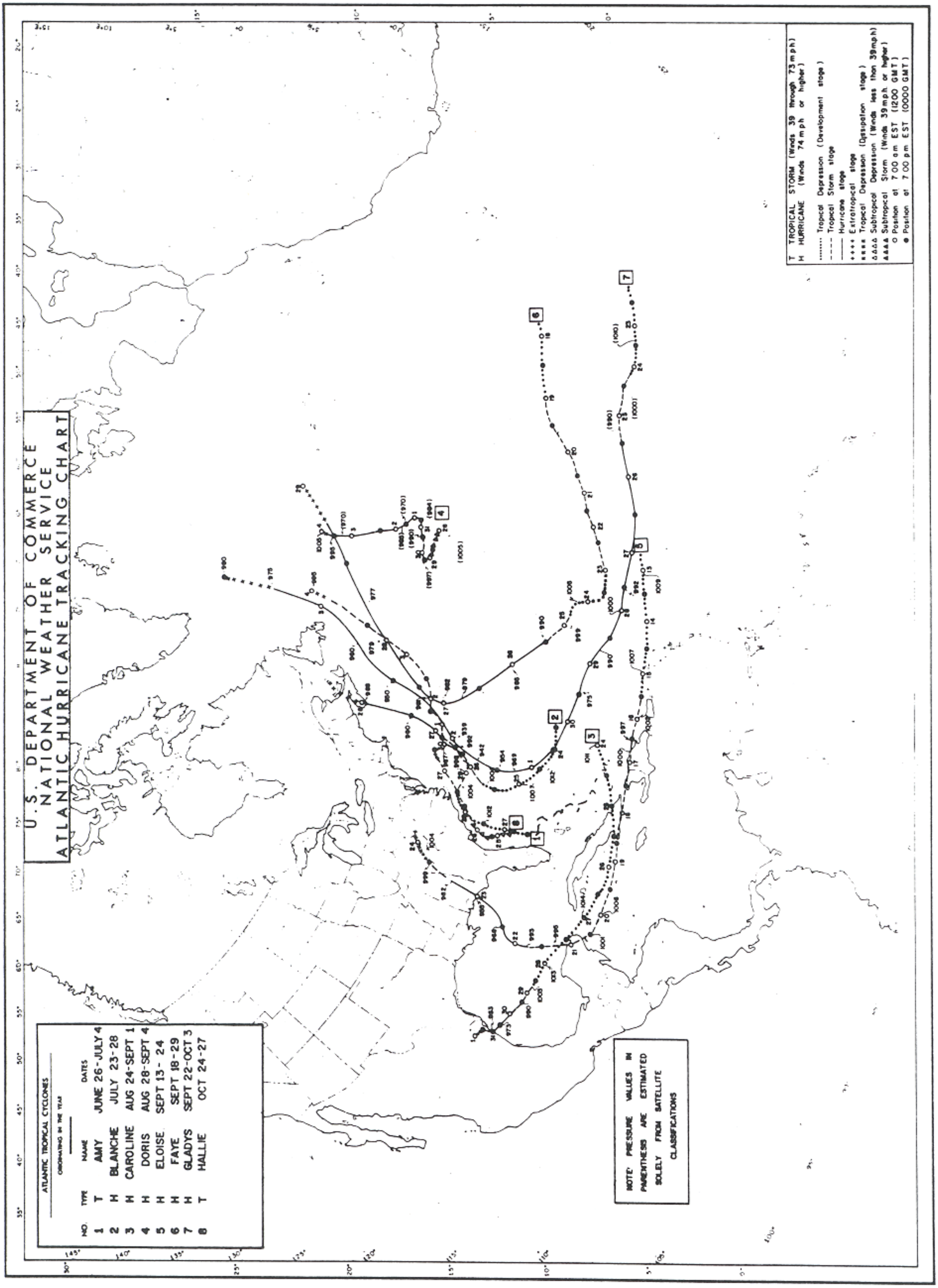

FIG. 1. Tracks of North Atlantic tropical cyclones, 1975.

Table 1. Summary of North Atlantic tropical cyclone statistics, 1975.

No.	Name	Class	Dates	Maximum sustained winds (kt)	Lowest pressure (mb)	U. S. damage ($ millions)	Deaths
1.	Amy	T	26 June–4 July	60	981		
2.	Blanche	H	23–28 July	75	980		
3.	Caroline	H	24 Aug.–1 Sept.	100	963		
4.	Doris	H	28 Aug.–4 Sept.	95	965		
5.	Eloise	H	13–24 Sept.	110	955	550[1]	U. S. 21, Puerto Rico 34, Hispaniola 25
6.	Faye	H	18–29 Sept.	90	977		
7.	Gladys	H	22 Sept.–3 Oct.	120	939		
8.	Hallie	T	24–28 Oct.	45	1002		

[1] Includes $60 million in Puerto Rico.

of the season, and the only one to make landfall in the United States. It was the first major hurricane to strike the Panama City area in this century. This was the fourth consecutive year with only one U. S. landfall of a named storm in contrast to a long-term average of three per year. Once again no hurricane affected the Atlantic coast or peninsular Florida. This continued lull in major hurricanes striking densely populated coastal areas of the United States is of great concern to preparedness officials. Statistics from Hebert and Taylor (1975) show that over 75% of the people living along Gulf and Atlantic coasts have never experienced a direct hit (that is, the 50–100 mi wide swath of major destruction near and under the eyewall)

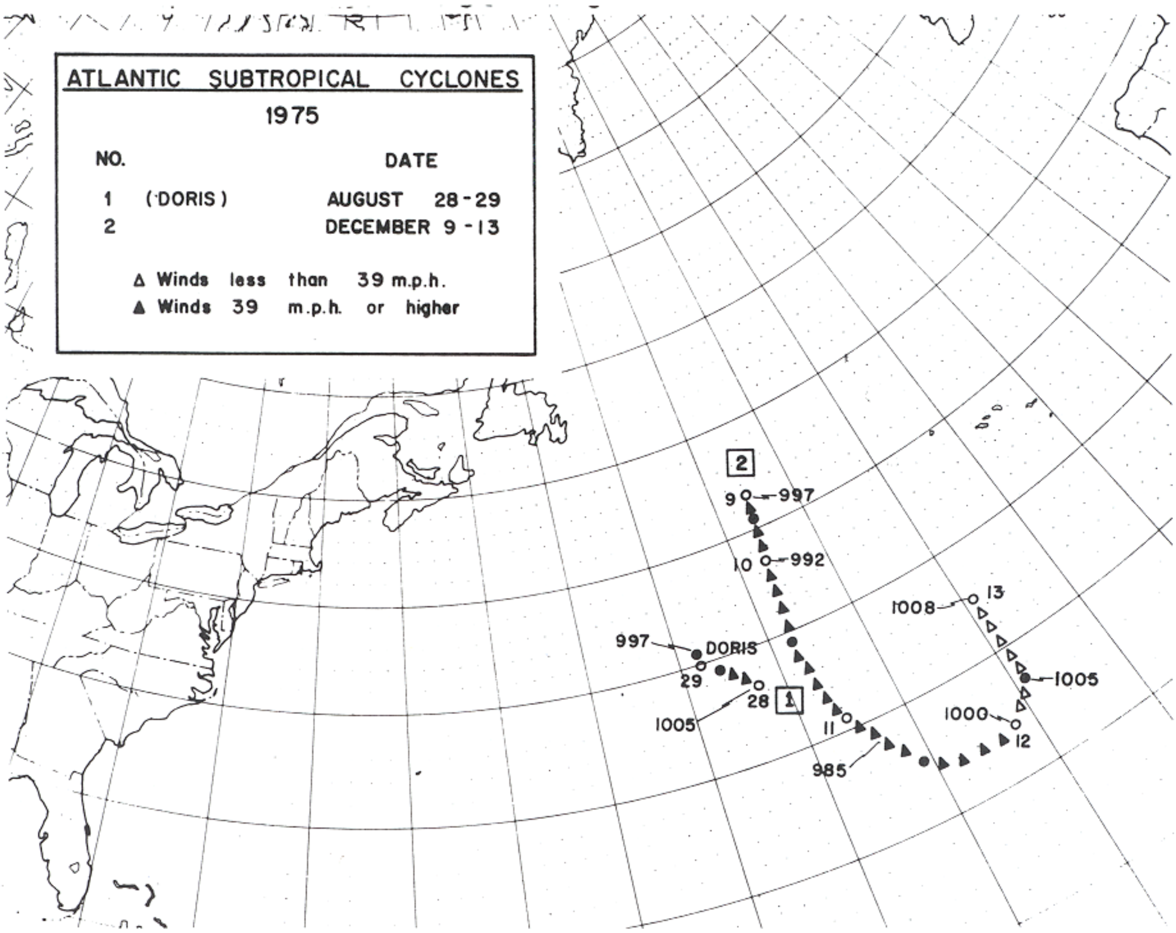

Fig. 2. Tracks of North Atlantic subtropical cyclones, 1975.

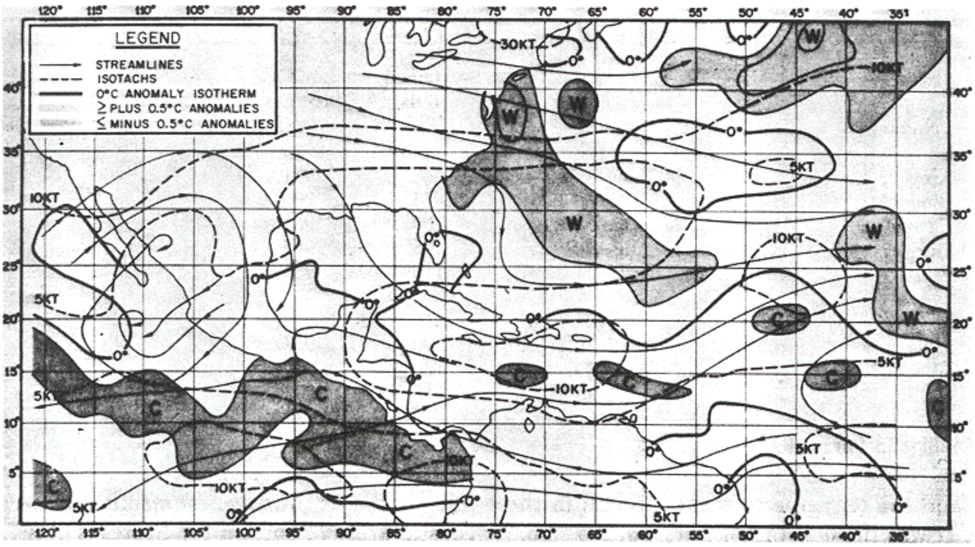

FIG. 3. NHC tropospheric mean vertical wind shear field (600–200 mb upper mean minus the 1000–600 mb lower mean) and sea-surface temperature anomalies (°C) for the period 15 August–15 September 1975.

by a hurricane as strong or stronger than Eloise. It was this swath which accounted for the estimated $100 million property damage in northwest Florida and $100 million agricultural damage in eastern Alabama.

The re-establishment of the strong westerly shear through the eastern Caribbean Sea contributed to the ninth consecutive year in the Lesser Antilles without a hurricane. The longest period without a hurricane passing through that area was the 17 years from 1933–49. It is interesting to note that this strong shear area (Fig. 3) exists where torrential rains from Eloise produced an estimated $60 million damage in Puerto Rico and a total of 69 deaths (34 in Puerto Rico).

2. Individual named storms

a. Tropical Storm Amy, 26 June–4 July

A weak surface trough of low pressure attended by scattered convection had persisted over Florida and the adjacent Atlantic waters during 24–25 June. This trough was a reflection of an upper tropospheric low over Georgia. A weak surface circulation formed just north of the western Bahamas late on 26 June. Satellite photographs showed a significant increase in organized convection associated with the depression during the next 48 h, as the upper tropospheric low over Georgia moved westward and a well-developed warm anticyclone formed to its east.

TABLE 2. Summary of North Atlantic subtropical cyclone statistics, 1975.

No.	Dates	Maximum sustained winds (kt)	Lowest pressure (mb)
1. (Doris)	28–29 Aug.	60	997
2.	9–13 Dec.	60	985

The low pressure system attained winds of gale force late on 28 June as the center was skirting the North Carolina outer banks. The approach of a trough in the westerlies caused the storm to turn sharply eastward during the night. Upper air and reconnaissance data on 28–29 June indicated tropical characteristics and the system was named Amy. Strong vertical shears associated with the trough in the westerlies, however, had given Amy characteristics much more typical of a subtropical storm by evening of 29 June. The maximum sustained winds were located 50–80 n mi from the pressure center and the convective cloud mass became detached from the low-level circulation center. Nonetheless, intensification continued as the system drew on both latent heat and the baroclinic energy of the westerly trough.

During the next three days Amy meandered generally northeastward with minor fluctuations in response to the rapid passage of troughs to the north. Maximum sustained winds hovered near 60 kt. While the system occasionally approached hurricane strength and made attempts to reacquire tropical characteristics, it remained predominantly subtropical in nature. However, the name was retained because of the close proximity to land in order to avoid confusion in public releases. The lowest pressure of 981 mb was reached on 2 July. On 3 July a major trough developed over northeastern Canada and caused Amy to accelerate rapidly northeastward. The center of Amy passed about 150 mi southeast of Cape Race, Newfoundland, on 4 July, and lost all tropical characteristics that afternoon.

No attempt has been made to delineate the subtropical portions of the storm on the track charts.

The high winds and heavy rains associated with Amy remained offshore of both North Carolina and Newfoundland. However, the slow movement off the North Carolina coast caused prolonged northeasterly winds which produced large swells and tides of 2–4 ft above normal along the North Carolina outer banks. This caused some beach erosion and temporary flooding of highways, but damage was minor.

b. Hurricane Blanche, 23–28 July

The first hurricane of the season developed from an African wave which moved off the coast on 14 July. By 18 July satellite photographs showed increasing organization in the stratocumulus field associated with the wave and the enhancement of convection on the ITCZ to the southwest. As the wave approached the Caribbean region on 20 July, the convective system which had developed within the stratocumulus field moved northwestward in response to an approaching trough in the westerlies, while the lower latitude system continued westward. This latter system approached tropical storm strength as it passed near Tampico, Mexico, on 26 July, and is discussed under other strong systems at the end of the section on individual named storms.

Convection associated with the Atlantic system increased markedly on 21 July. Unfavorable strong northwesterly shear over it gradually diminished during the next 48 h, and a tropical depression developed about 500 n mi north of Hispaniola late on 23 July. With the passage of the trough in the westerlies both low level and upper level environmental conditions became increasingly favorable, and slow but steady intensification occurred. Sustained winds reached gale force late on 25 July when the center was located about 300 n mi south of Cape Hatteras, N. C., although squalls to gale force were probably occurring as early as that morning. The eye appeared briefly on the Cape Hatteras radar about midday on 26 July.

Blanche turned to the northeast in advance of a cold front and associated trough in the westerlies. However, the front weakened rapidly before cooler, drier air could penetrate the storm's inner core, while Blanche steadily deepened, partly in response to the baroclinic effect of the upper trough. Blanche reached hurricane strength early on 27 July about 300 n mi east of Cape Hatteras as the central pressure fell to 987 mb. At this time the hurricane was at the same location crossed by Tropical Storm Amy two weeks earlier. As high pressure built over the western Atlantic in the wake of the trough in the westerlies, Blanche turned towards the north-northeast, reaching its minimum central pressure of 980 mb and maximum sustained winds of 75 kt late on 27 July. The hurricane weakened only slightly before striking the southern tip of Nova Scotia about daybreak on 28 July. It became extratropical before reaching the Gulf of St. Lawrence at midday.

Halifax, Nova Scotia, measured sustained winds of 45 kt with gusts to 70 kt, and observed the eye of Blanche on radar. Western Head, near Cape Sable, had sustained winds of 47 kt at 1200 GMT, and a minimum pressure of 987 mb at 1330 GMT. Nearby Shelbourne had a minimum pressure of 989 mb after a 3 h pressure fall of 18 mb. As the system was becoming extratropical, Grindstone Island in the Gulf of St. Lawrence reported sustained winds of 60 kt at 1800 GMT.

In view of the strengthening and acceleration towards the north-northeast, gale warnings were issued from Rockland to Eastport, Maine, at 0400 GMT 28 July. The Canadian Weather Service issued a hurricane warning for Nova Scotia about the same time.

There was no loss of life attributed to Blanche. Damage in Nova Scotia was minor, consisting of small boats washed ashore and trees blown down. As is frequently the case, rainfall with Blanche proved beneficial, bringing an end to a prolonged dry period over the region. The greatest accumulation was 3.1 inches at Chatham, New Brunswick.

c. Hurricane Caroline, 24 August–1 September

The tropical disturbance from which Caroline developed left the African west coast on 15 August. The main covection associated with the system broke away from the ITCZ on 18 August and moved generally northwestward during the next four days. While there were occasional evidences from ships and satellite photographs of a possible weak circulation center in the lower troposphere, a definite surface low pressure center first formed on 24 August when the system was about 200 n mi north of Hispaniola. The system had been moving southwestward since 22 August when it had come under the circulation around the southeast periphery of a large, middle level anticyclone over the southeastern United States. Satellite photograph movie loops showed little evidence of outflow at upper levels and the depression failed to strengthen before encountering the mountainous terrain of eastern Cuba on 25 August. There was only the slightest evidence of a closed surface wind circulation for the next 48 h, but convection associated with the system increased as some outflow became apparent on satellite photograph movie loops.

The depression had turned toward the west-northwest on 27 August. As it moved past the Yucatan Peninsula and into the southwest Gulf of Mexico on 28 August an upper level anticyclone became established over the system. An Air Force reconnaissance plane found winds of tropical storm strength late that day, when the center was located about 400 n mi east-southeast of Brownsville, Texas. Caroline reached hurricane force the next day, and intensified rather rapidly beginning late on

30 August, as it moved west-northwestward at the rather slow forward speed of 5 kt. The center first appeared on the Brownsville, Texas, radarscope about 1230 GMT 30 August and was under continuous surveillance until landfall about 100 n mi south of Brownsville about the same time on 31 August. The central pressure fell from 987 mb at 1800 GMT 30 August to 963 mb at 0600 GMT 31 August. The minimum central pressure of 963 mb and maximum sustained winds of 100 kt were reported by reconnaissance aircraft several hours prior to landfall. During the period of rapid deepening reconnaissance aircraft and radar observations indicated the eye diameter shrunk from 20 to 8 n mi. The hurricane weakened rapidly to a tropical depression within 12 h of landfall and dissipated over the higher terrain of northeast Mexico without producing any significant flooding from rainfall.

A hurricane watch was issued for the Brownsville area on the morning of 30 August with interests along the northeast Mexican coast advised of the likelihood of hurricane conditions within 24 h.

The highest wind reported by a land station was a gust to 42 kt at Brownsville at 1642 GMT 30 August. An air tour of the Mexican coast from Brownsville to the point of landfall, by Antonio Dreumont, Meteorologist-in-Charge of the Brownsville National Weather Service Office, indicated that some rather significant flooding occurred with several small communities destroyed, presumably from the storm surge effect. There have been no reports from Mexico of any casualties.

d. Hurricane Doris (Subtropical Storm No. 1) 28 August–4 September

Hurricane Doris developed from a subtropical system in the mid-Atlantic. The initial low pressure center of 1017 mb developed from a frontal wave which formed on 27 August near 31°N, 46°W. Satellite photographs on the morning of 28 August showed a cloud structure typical of many subtropical storms investigated by Hebert and Poteat (1975) in the development of their subtropical cyclone classification technique. There was no central dense overcast (CDO), and a band of strong convection existed about 5° of latitude to the southeast of the center. The system at this time remained connected to the baroclinic frontal band. By 1800 GMT a ship indicated the central pressure was 1005 mb and another reported winds of gale force 100 n mi from the center. Although no reconnaissance data were available to determine the system's temperature structure, since the storm was beyond the authorized range, satellite photograph movie loops indicated a cyclonic circulation at 200 mb directly over the surface center.

Satellite photographs and ship reports on 29 August indicated the system was acquiring tropical characteristics. It had become detached from the old frontal zone, was becoming circular and developing a CDO, while maximum sustained winds were now located near the low pressure center. The Dvorak (1975) technique indicated winds had reached hurricane force late on 30 August and the system was designated Doris. The minimum central pressure of 965 mb and maximum sustained winds of 95 kt in Doris, occurring on both 1 and 2 September, were estimates based on the Dvorak technique. There is some evidence from the study of Hebert and Poteat (1975) as well as examinations of other storms of subtropical origin that they do not generally intensify beyond approximately 960 mb and 100 kt. This may be attributable in part to the fact that they develop in a somewhat drier and cooler environment than systems of tropical origin, and partly because their tropical life cycle is frequently shorter than that of lower latitude systems.

The system center had meandered westward, then eastward, and slowly northward during the five-day period 28 August to 2 September. It was only 250 n mi from its starting point on 2 September. This slow movement, especially while Doris was a hurricane, enabled ships to easily avoid it, and none reported even a gale after 31 August. The National Meteorological Center (NMC) 500 mb prognostic charts indicated both the development and nearly stationary character of the upper low which evolved into Doris, allowing the official forecasts of little movement during the early stages to be made with a fairly high degree of confidence. On 3 September the hurricane moved northward ahead of a deepening low in the Canadian Maritime Provinces, losing all tropical characteristics early on 4 September.

The hurricane was never a threat to any land area and no marine casualties have been reported.

e. Hurricane Eloise, 13–24 September

1) METEOROLOGICAL HISTORY

The disturbance which spawned Eloise left the African west coast on 6 September as a rather unimpressive system on satellite photographs although the Dakar, Senegal, upper air sounding gave evidence of a fairly strong cyclonic circulation at lower levels. The disturbance moved westward at an average speed of 13 kt during the next six days. Satellite photographs and ship reports gave evidence of a very gradual increase in convection and organization during this time.

The first sign that a weak depression had formed came early on 13 September when the Netherlands tanker *Gulf Hansa* reported northerly winds of 20 kt and seas of 10 ft. Later that morning an Air Force reconnaissance aircraft located the center about 500 n mi east of the Virgin Islands. Satellite photographs, and ship and reconnaissance reports during the next 48 h confirmed a trend of slow intensification. The upper level anticyclone which had been associated with the system became somewhat distorted during this period. The

200 mb level winds fluctuated between northeasterly and southwesterly over the depression, tending to inhibit outflow towards the north.

A reconnaissance aircraft found that winds had reached tropical storm strength by the early morning hours of 16 September, and the first advisory on Eloise was issued by the San Juan Hurricane Warning Office at 0600 AST. Previously, bulletins had been issued since 13 September warning the northern Leewards, Virgin Islands and Puerto Rico of heavy rains and gusty winds to gale force. Eloise strengthened rapidly as the upper level anticyclone became better organized over the surface center. A NOAA reconnaissance aircraft reported winds reached minimal hurrican force prior to the center striking the northeast coast of the Dominican Republic late on 16 September.

Falling pressure to the northwest of Eloise was expected to keep the center north of the Dominican Republic and Cuba. However, the center tracked westward across extreme southeastern Cuba into the northwestern Caribbean Sea north of Jamaica. The center and much of the circulation was over land for the next 36 h. The mountainous terrain of Hispaniola and Cuba caused Eloise to weaken to a minimal tropical storm with a marked decrease in associated rainfall by the time the center finally emerged over open water late on 19 September. A favorable upper level flow pattern continued over the storm for the next two days with anticyclonic outflow enhanced by a cold low traveling westward about 500 n mi in advance. However, the low level circulation had been distorted by the encounter with land and the weakening of the surface ridge to the north. Eloise remained poorly organized until it approached the Yucatan peninsula late on 20 September. Winds of gale force were mainly in squalls to the northeast of the center.

From the time the center approached the Dominican Republic until it moved into the central Gulf of Mexico, Eloise varied from 40–60 n mi in diameter. Reconnaissance reports and upper air soundings suggested a fairly large slope of the center with height from the surface prior to its reaching the Gulf of Mexico. Satellite photographs continually showed the heaviest convection a good distance south and east of the center. Lack of reconnaissance and surface reports while the broad center was over the Dominican Republic, Cuba, and adjacent waters has led to more than normal uncertainty in the locations and intensities on the best track from 0000 GMT 17 September to 1200 GMT 21 September.

Few storms fail to intensify as they move through the Yucatan Channel into the Gulf of Mexico, and Eloise was no exception. An approaching upper level trough in the westerlies caused Eloise to turn to the north on 21 September after crossing the Yucatan Peninsula just north of Cozumel, Mexico. The trough enhanced an already favorable outflow pattern aloft, while rising pressures around the storm had made low level conditions more favorable for intensification. Eloise began a steady strengthening north of the Yucatan peninsula regaining hurricane force on the morning of 22 September in the central Gulf of Mexico about 300 n mi south of New Orleans.

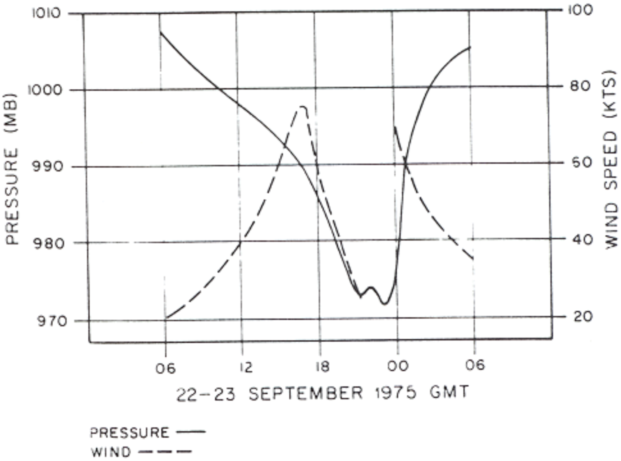

Fig. 4. Reproduction of the barogram and wind observations of the *Exxon San Francisco* while passing through Eloise on 22–23 September 1975.

Among numerous ships encountering Eloise that day was the American tanker *Exxon San Francisco* which passed through the center. Figure 4 reproduces the pressure and wind records of the *Exxon San Francisco.* Eloise also passed over two of the experimental data buoys stationed in the northern Gulf of Mexico. Figure 5 reproduces the pressure and wind data from the buoys,[2] based on data from a report by Withee and Johnson (1975). Hourly observations were available during the hurricane's progress, and aided forecasters in the tracking of the center.

Eloise continued strengthening until landfall about midway between Fort Walton Beach and Panama City shortly after 1200 GMT 23 September. At that time it was moving towards the north northeast at better than 20 kt. The hurricane weakened rapidly after landfall as drier, cooler air was drawn into its circulation. Eloise was downgraded to a tropical storm by 1600 GMT 23 September while over east central Alabama, a tropical depression by early evening while over eastern Tennessee, and lost all tropical characteristics by the time it reached extreme western Virginia on the morning of 24 September. A low pressure center identifiable as the remnant of Eloise was no longer discernable later that day. However, the moisture brought northward by the hurricane combined with an old frontal system over the northeastern United States to produce heavy rainfall and serious flooding until skies cleared on 27 September.

[2] Pressure and wind averaged over 40 min for EB04 and 15 min for EB10.

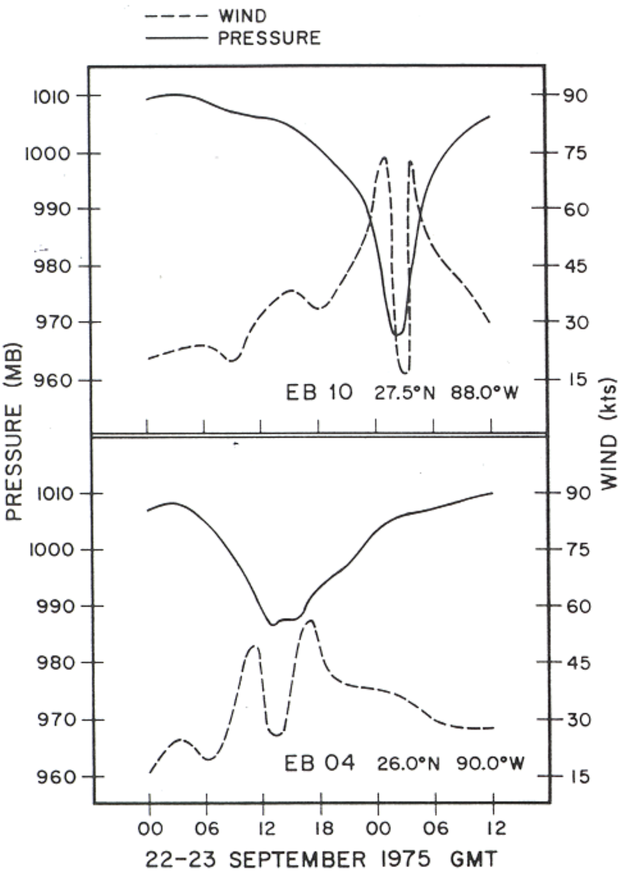

FIG. 5. Reproduction of the pressure and wind profiles from EB04 and EB10 during passage of Eloise on 22–23 September 1975.

2) METEOROLOGICAL DATA, DEATHS, DAMAGE ESTIMATES

i. Northern Leeward Islands, Virgin Islands, Puerto Rico, Dominican Republic and Haiti. The primary effects of Eloise in these areas was flooding resulting from torrential rains and consequent deaths and damages. Total storm rainfall amounts ranged from 5–10 inches from St. Kitts and St. Martin westward across St. Croix to Puerto Rico with amounts of 10–20 inches common over eastern and southwestern Puerto Rico. The greatest total reported was 26.7 inches near Sabana Grande in southwest Puerto Rico. Figure 6 shows the storm rainfall distribution over Puerto Rico. Lesser amounts of 1–3 inches fell at St. Thomas and other northern Leeward Islands. No storm totals are available from Hispaniola but incomplete rainfall observations and satellite photographs indicate torrential rains occurred over the eastern and southern portions of the Dominican Republic and southern Haiti.

River and flash floods and land slides caused most of the deaths in this area. Press accounts report 18 deaths in southern Haiti and 7 deaths in the Dominican Republic. There were 34 confirmed deaths in Puerto Rico. Property damage in Puerto Rico is estimated in excess of $60 million with no estimates elsewhere.

The strongest winds were north of the center and remained offshore from Puerto Rico and the Dominican Republic. St. Croix had a gust to 45 kt on 15 September. Ponce and Mayaguez, in Puerto Rico, had gusts to 35 kt on 16 September. The maximum sustained wind of 45 kt early on 17 September was reported from Cape Engano on the northeastern tip of the Dominican Republic.

ii. Extreme southeastern Bahamas, Cuba, Jamaica, Cayman Islands, northeast Yucatan. Eloise weakened throughout most of the period it was affecting these areas. In addition, satellite photographs indicated most of the heavier rainfall missed the land areas. A squall of 45 kt occurred on Cayman Brac during the afternoon of 19 September. Sustained winds of 40 kt were reported along the southeast coast of Cuba on 18 September. There were no other reports of high winds, and no deaths or significant damage reports from this region.

iii. United States

a) Southeast: Eloise strengthened until reaching the coast with the minimum pressure of 955 mb observed at Destin, Fla. A group of Florida State University meteorology students observed a somewhat lower reading of 950 mb on an aneroid barometer in Niceville, Fla., while sitting in a car during the passage of the eye. They indicated considerable pumping of the barometer, however, and the reading of 955 mb is considered a more conservative estimate of the hurricane's minimum central pressure. The maximum sustained surface winds during Eloise's lifetime were estimated to be 110 kt, also at landfall, although reconnaissance aircraft reported somewhat higher 700 mb flight level winds during the previous night.

The highest sustained winds along the coast were not measured because of the sparseness of observing stations and the failure of wind measuring equipment. However, sustained winds near 80 kt with a gust to 135 kt were measured on a 98 ft tower located 13 mi offshore from Panama City. Winds of hurricane force

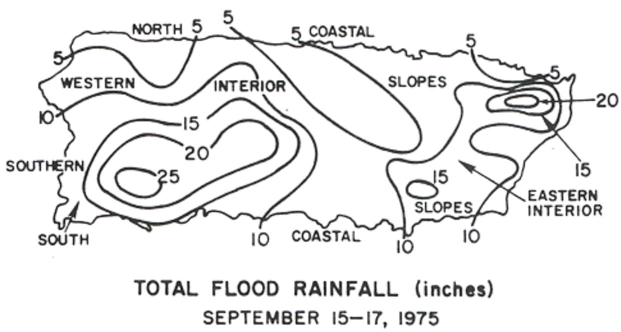

FIG. 6. Isohyetal map of storm rainfall in Puerto Ricco, 15–17 September 1975 (courtesy San Juan Forecast Office).

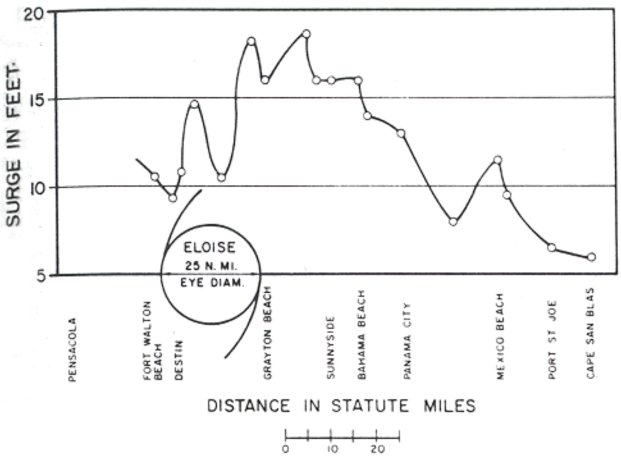

Fig. 7. Storm surge profile for hurricane Eloise relative to eye diameter at landfall 1200 GMT 23 September 1975.

were reported from Fort Walton Beach to Panama City and northward into extreme southeastern Alabama. Gales were reported from the southeastern Louisiana delta and New Orleans area to Cedar Key, Fla., and northward over most of Alabama and western Georgia into extreme southeastern Tennessee.

Measurements of high water marks by the U. S. Corps of Engineers, Mobile District, indicate hurricane tides of 12–16 ft above mean sea level (MSL) occurred from just east of Fort Walton Beach to south of Panama City. Figure 7 shows the storm surge profile for Eloise relative to the approximated eye diameter at landfall. The highest inside high water mark of 18.2 ft above MSL occurred near Dune Allen Beach. Tides of 6–12 ft above MSL were reported eastward to Port St. Joe with 3–5 ft above MSL elsewhere in the warning area, and 2–3 ft above MSL along the Florida west coast from Naples northward to Cedar Key.

Preliminary reports indicate at least 10 tornadoes occurred from northwestern Florida to western North Carolina, causing no deaths and only minor damage. A complete tabulation of tornadoes associated with Eloise can be obtained from U. S. Department of Commerce Storm Data and Unusual Weather Phenomena for the individual states affected.

Rainfall amounts ranged from 4–8 inches from extreme southeastern Louisiana to the Panama City area, and over the extreme western positions of the Carolinas. The greatest storm total was 14.9 inches at Elgin Air Force Base in Valparaiso. The heaviest rainfalls occurred west and north of the storm track as the warm, moist air associated with Eloise overran cooler air behind a stagnant frontal zone extending from northern Alabama southwestward into the Gulf of Mexico. By contrast most stations to the east of the center beyond the eyewall had less than one inch of rain as a tongue of dry air behind the frontal zone was drawn into the area by Eloise's circulation.

Additional meteorological data for Hurricane Eloise is presented in Table 3.

There were four storm-related deaths, although none occurred as a direct result of the winds or storm surge during the passage of Eloise. The combined effects of the winds and hurricane tides undermined or demolished numerous structures along the beach strip from Fort Walton to Panama City. The Red Cross estimates 8000 families suffered losses and more than 500 small businesses were destroyed or suffered major damage, mostly in northwest Florida. Damage in the area will probably exceed $100 million. Most of the damage along the coast occurred seaward of the setback line recently established by the State of Florida, illustrating the potential for even greater losses along coastal sections of the United States in a more severe hurricane if sound building and zoning codes are not followed. The high winds over eastern Alabama caused extreme damage to property and crops with losses estimated near $100 million.

Approximately 100 000 residents from southeastern Louisiana to northwestern Florida evacuated before Eloise reached the coast.

b) Northeast: A low pressure center identifiable as the remnant of Eloise was no longer apparent late on 24 September. However, the combination of the moisture brought northward by Eloise and a stagnant frontal zone produced rainfall amounts greater than 5 inches over eastern Virginia, extreme eastern West Virginia, Maryland, New Jersey, the eastern half of Pennsylvania, and southeastern and south central New York state. Storm totals exceeded 10 inches along some of the eastern mountain slopes and in southeastern New York with the maximum of slightly over 14 inches recorded near Harrisburg, Pa. Major flooding took place on the Chemung, Susquehannah, Potomac and Shenandoah rivers with flash floods along smaller rivers and streams.

The 17 deaths in the area were mostly drownings. Damages are estimated at $300 million with the bulk of it occurring as crop and road damage.

3) Forecasts and warnings

Warnings of flooding from heavy rains were given for Puerto Rico and the Virgin Islands 24 h or more in advance. Hurricane warnings for the Dominican Republic were issued less than 12 h in advance because of the rapid intensification of Eloise.

Although hurricane warnings were issued 24 h in advance for the Gulf coast area devastated by Eloise, and the forecast error for landfall was about the average for landfall in U. S. storms/hurricanes, the rather early mention of a landfall point led to some mis-interpretation of the warnings, and a subsequent delay in action on evacuation.

Eloise generated hurricane tides somewhat higher than previous numerical and empirical techniques had

TABLE 3. Hurricane Eloise, 13–24 September 1975, Meteorological Data.

Station	Date	Pressure (inches) Low	Pressure Time[b]	Wind (mph) Fastest mile		Time[b]	Peak gust		Time[b]	Tide (ft.) Highest MSL	Tide Time[b]	Rainfall (inches) Storm total	Dates	Remarks
Florida														
Apalachicola WSO	23	29.47	0456	SW	40	0347	SW	53	0436[c]	4.7	06–07	0.12	22–23	
Bahama Beach	23									16.0				
Blountstown	23							45–50[d]	0630					
Cedar Key	23							41	0900	3.0				
Crestview FAA	23	28.82	0658				N	81	0641			9.48	22–24	
Destin	23	28.20								10.6				
Dune Allen Beach	23									13.8				
Mexico Beach	23									11.6				
Panama City (Tyndall AFB)	23	29.23		SE	55	0723	SSE	78	0743			0.74	23	
Panama City FAA	23							75[d]	0545[b]					
Panama City (13 n mi south, 98 ft tower)	23							155						
Panama City Beach	23									14.9				
Pensacola FAA	23	29.25	0605	N	32	0357	NNW	53	0623	1.8	1200	5.62	20–23	
Sunnyside	23									16.2				
Tallahassee WSO	23	29.55	0656[c]	S	35	0928	S	48	0919			0.91	23	
Valparaiso (Elgin AFB)	23	28.55			81[a]			115[a]				14.90	21–23	
Valparaiso (Hurlburt Field)	23	28.69			67			85				13.74	21–23	
Alabama														
Anniston FAA	23	29.15	1230				N	59	1210			4.77	22–24	
Auburn ESSC	23	29.10	1030					74	1030			2.62	23–24	
Birmingham WSFO	23	29.46	1257	NW	26	1209	N	35	1215			2.93	21–24	
Dauphin Island	23	29.55	0430	N	39	0130	N	54	0150[c]			5.22	22–23	
Dothan FAA	23	29.18	0900	ESE	52	0900	ESE	88	0900			1.00	22–23	
Huntsville	23	29.52	1418[c]	N	28	1418	N	40	1346			3.41	21–24	
Mobile WSO	23	29.54	0620				N	37	22/2351[c]			1.74	22–23	
Montgomery WSO	23	29.15	1044	NW	42	1046	NW	64	1048			5.54	22–23	
Ozark (5 NW)	23				104	0855		120	0855					Wind 10–20 mph 0915 CST
Ozark (Fort Rucker)	23	28.85		S	46	0910	S	82				2.25	23	
Georgia														
Atlanta WSFO	23	29.36	1500	S	42	1354	S	58	1415			0.55	22–24	
Columbus WSO	23	29.84	1056	ESE	35	1056	SE	61	1115			0.44	23	
Louisiana														
Boothville WSMO	23	29.64	0145					50	22/2245			4.72	21–23	
Buras	22							75–80						
New Orleans WSMO	22	29.72	23/0330	N	30	2253	N	46	1743					
New Orleans FAA	22							58						
Mississippi														
Bay St. Louis	23	29.75	0545				N	40	22/2000			8.72		
Tennessee														
Chattanooga WSO	23	29.36	1455				NE	52	1455			3.59	23	

[a] Instrument failed.
[b] Central Standard Time.
[c] First of several occurrences.
[d] Estimated.

indicated for a hurricane of this strength. The peak surge rose rapidly, lasting about 30 min. The presence of sand dunes in the landfall area may have contributed to some of these effects, but further study is needed before any definite conclusions can be made. There is little doubt, however, that the erosion of the sane dunes led to much of the destruction along the beaches.

f. Hurricane Faye, 18–29 September

A tropical disturbance moved westward off the African coast on 14 September. The disturbance became detached from the ITCZ by 18 September, and satellite information indicated a depression had formed about 500 n mi west of Cape Verde Islands. Ship reports and satellite photographs on 19 September indicated winds had attained tropical storm strength near 20°N 39°W and the system was designated Faye. As the storm moved steadily westward during the next four days, however, it encountered ever-increasing westerly shear. It finally weakened to a tropical depression on 23 September while located about 500 n mi northeast of the Leeward Islands.

The depression drifted northward and then westward during the next 48 h passing through the mid-Atlantic upper trough axis. As it moved under southeasterly flow aloft, Faye regained storm and then hurricane strength on 25 September, while beginning a northwesterly course that would continue until 27 September.

When the center was about 100 n mi southeast of

Bermuda at 1900 GMT 26 September, it first appeared on the U. S. Naval Air Station radar. About the same time the German ship *Blexen* sent a plain language message indicating the ship was very close to the center and experiencing 90 kt winds together with 35 ft seas. The center passed about 30 n mi east of Bermuda about 2300 GMT.

The hurricane turned sharply to the northeast on the morning of 27 September. By afternoon it came under the influence of strong westerly flow which dominated the Atlantic north of latitude 40°N. Thereafter, Faye developed an east-northeasterly to easterly course with rapid acceleration. The hurricane lost all tropical characteristics on 29 September as it moved eastward at 40 kt some 200 n mi north of the Azores.

Damage on Bermuda was minor since the island remained on the weak side of the hurricane. The lowest pressure at Kindley Field was 993 mb at 0001 GMT 27 September. The peak wind gust there was 42 kt about 2300 GMT 26 September. The maximum sustained wind of 90 kt in Faye occurred on 26–27 September. The lowest pressure of 977 mb was measured by reconnaissance aircraft on 28 September.

g. *Hurricane Gladys, 22 September–3 October*

The African disturbance which developed into Gladys left the coast on 17 September. As it crossed the tropical eastern Atlantic, it followed the one from which Faye formed by about four days. Faye took a more northern course near latitude 20°N, while the precursor of Gladys followed to the southeast near latitude 11°N.

Neither reconnaissance data nor ship reports were available in the immediate vicinity of the system from the time it left the African coast until two days after it was designated a hurricane. Therefore, estimates of the maximum wind and central pressure during the period are based on the Dvorak (1975) satellite classification technique. These classifications indicate that a depression formed on 22 September near 35°W and reached tropical storm strength on 24 September near 40°W. These were the same longitudes at which Faye had reached those stages of development. However, Gladys was able to reach hurricane intensity on 25 September before encountering the same unfavorable vertical shears that Faye had met between 45–55°W about four days earlier. Gladys barely maintained hurricane strength for the next four days, and winds may have dropped below the hurricane threshold on the morning of 28 September as the central pressure rose to 1000 mb.

After passing through the mid-Atlantic upper trough axis, which was now oriented more ENE-WSW, Gladys began intensifying late on 28 September as the center came under the influence of upper level southeasterly flow. By evening of 29 September, the hurricane had a central pressure of 975 mb and sustained winds of 80 kt with a clearly defined eye visible on satellite photographs, as it was passing about 350 n mi north of Puerto Rico. However, for the next 36 h the intensity remained remarkably constant around 975 mb as the hurricane continued towards the U. S. mainland. The reason for the abrupt halt to the intensification process is not readily apparent from an investigation of the synoptic charts. The development of a weak frontal wave and destruction of the surface ridge to the northwest may have been an inhibiting factor. The hurricane was also located well to the southwest of the upper level anticyclone and under rather strong southeasterly flow during this time.

As Gladys began to recurve on the morning of 1 October, a well-defined 200 mb anticyclone appeared over the hurricane. A period of rapid deepening ensued, culminating in an Air Force reconnaissance measurement of the hurricane's minimum central pressure of 939 mb at 0846 GMT 2 October. Maximum surface winds were estimated to be 120 kt, and flight level winds at 700 mb were measured as high as 169 kt. The eye appeared on the Cape Hatteras radar at this time even though located over 225 n mi away. Very few hurricane eyes are observed on radar beyond the 200 n mi range. Another reconnaissance aircraft found a central pressure of 940 mb at 1530 GMT 2 October when the center was a little over 400 n mi east of Norfolk, Va. This is one of the lowest recorded pressures in a hurricane located that far north.

Gladys accelerated to the northeast later on 2 October and briefly threatened Newfoundland. The hurricane weakened only slightly before crossing the north Atlantic shipping lanes. It was moving at a forward speed of better than 45 kt around daybreak of 3 October as it passed about 70 n mi southeast of Cape Race, Newfoundland. Widespread gales covered the western Atlantic as Gladys merged with a strong cold front and became extratropical that afternoon.

The threat to the North Carolina outer banks was deemed sufficient to issue a hurricane watch from Cape Lookout to Kitty Hawk at 2200 GMT 1 October. The Cape Hatteras National Seashore road and campground was closed for awhile because of rising tides and swells up to 8 ft. No casualties or damage connected with Gladys have been reported. However, residents of the eastern seaboard were fortunate that the most intense hurricane to threaten the area since Hazel of 1954 remained at sea.

h. *Tropical Storm Hallie, 24–27 October*

Hallie developed from a subtropical depression which had originated on 24 October in an old frontal zone off the Florida east coast. The front had moved into the western Bahamas on 19 October. By 21 October a cutoff cold low developed over the frontal zone and convection increased markedly. A surface low pressure center developed in the vicinity by 22 October, and on 23 October was located near 29°N, 75°W with a minimum pressure of 1005 mb. The complexity of the situation was further increased by the movement of a tropical wave and its associated convection into the area during 22–23 October. Because of the very cold middle tropospheric temperatures and the absence of a well-defined low level circulation on satellite photograph movie loops, the low was evaluated to be extratropical during this time.

In response to a building high pressure area over the northeastern United States, the low moved slightly south of west during the next 24 h. Morning upper air data along the southeast coast on 24 October indicated warming of the environment, and satellite photographs first showed some of the cloud features associated with tropical or subtropical cyclones. The Daytona Beach National Weather Service radar and an Air Force reconnaissance plane located the center about 100 n mi east of Daytona Beach late that day. The depression moved slowly northward parallel to and within 100 n mi of the Florida and Georgia coastline, gradually acquiring tropical characteristics. High level northerly winds over the depression suppressed convection on 25 October. These winds diminished on 26 October and by afternoon a circular CDO with a clearly defined center was evident on satellite photographs. Winds reached tropical storm strength about 100 n mi east of Charleston, S. C. The storm turned northeastward that evening, reaching maximum intensity of 45 kt and minimum pressure of 1002 mb while skirting the North Carolina outer banks. Hallie merged with a frontal zone several hundred miles east of Norfolk, Va., late on 27 October and became extratropical.

Gale warnings were issued at 0100 GMT 27 October for the outer banks from Cape Lookout to Oregon Inlet, but the area remained on the weak side of the storm. However, a severe thunderstorm caused wind gusts estimated in excess of hurricane force at *Frying Pan Lightship*. Tides were 1–2 ft above normal along the Virginia and Carolina coasts but damage was not significant, and there were no casualties.

3. Subtropical storms

a. Subtropical Storm No. 2, 9–13 December

A late season storm which evolved from an extratropical storm in the north central Atlantic exhibited characteristics of a subtropical system by 9 December. The storm followed a rather unusual track, moving southward at 25 kt between 10 and 11 December before curving eastward and weakening rapidly on 12 December. An unidentified ship reported northwesterly winds of 60 kt on 10 December as the low intensified. The lowest pressure of 985 mb occurred on 11 December.

4. Other strong systems

The most noteworthy of the tropical depressions which failed to acquire named storm status moved into southern Mississippi on 29 July and continued slowly northwestward during the next few days. It had developed within the same frontal trough of low pressure that Blanche avoided. The combination of the depression and a building high pressure system over the western Atlantic created a strong convergence zone. This convergence zone produced rainfall amounts up to 20 inches along northwest Florida coastal sections, and 5 inches or more over extreme southeastern Louisiana, the extreme southern portions of Mississippi and Alabama, and extreme southwestern Georgia. Above normal tides of 1–3 ft along the coast and inland stream flooding produced by the heavy rains resulted in flood damage estimated at $8.5 million in northwest Florida with lesser amounts elsewhere.

Two other depressions were at the threshold of becoming tropical storms as they made landfall.

A depression formed in the southwest Gulf of Mexico during the early morning hours of 26 July. It developed from the convective disturbance which had continued westward as the forerunner of Blanche had turned toward the northwest. The depression strengthened during the day and an Air Force reconnaissance flight indicated winds reached gale force as the center moved inland near Tampico, Mexico, that afternoon. The highest sustained winds at Tampico were 32 kt and the lowest pressure was 1007.5 mb.

A depression developed in the Bay of Campeche on 13 October. It initially moved northwestward but turned to the northeast in advance of an approaching cold front, moving into southern Louisiana on the afternoon of 16 October. A few squalls to gale force and tides of 2–3 ft above normal occurred along the coast from southeastern Louisiana to northwestern Florida. Locally heavy rains exceeded 10 inches in central Mississippi. Some heavy rains occurred later over the northeastern U. S. in connection with the remnants of the depression.

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Atlantic Tropical Systems of 1975

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ABSTRACT

The 1975 hurricane season produced 113 "tropical systems", of which 28 acquired the closed circulation of a depression. Over half of these (61) originated over the African Continent. This is the most African systems observed since our annual summary began in 1968. African seedlings initiated five of the eight named Atlantic storms and thirteen of the sixteen East Pacific storms.

1. Introduction

This is the eighth consecutive year a seasonal disturbance summary has been attempted. We anticipated that knowledge gained during the GATE field program last summer might require some alterations in our counting procedures this year. However, apparently this is not so. The general philosophy of our counting method as outlined in previous articles (Simpson *et al.*, 1968, 1969) appears to be valid, although our understanding is certainly being updated and adjusted by GATE results. Several of these early conclusions have a direct bearing on our interpretations and are worthy of a few brief comments.

Simpson and Simpson (1975) found that the predominate cloud type in the "inverted V" pattern over the eastern Atlantic is altocumulus and altostratus rather than stratocumulus. They used recently developed dropwindsondes to define the flow pattern associated with the "inverted V" cloud feature, and found little evidence of a closed wind circulation at any level despite what at times appears to be closed spirals of cloud bands. This conclusion challenges the results of Burlutsky (1975), who used satellite pictures and movies to track what he interpreted to be numerous lows moving westward from Africa.

Burlutsky also found that cloud elements move across the legs of the "V." This confirms a result we noted several years ago. Fig. 1 shows a picture of an "inverted V" we observed on 27 July 1971. Cloud motion vectors have been superimposed on the picture. Even though the cloud elements move across the legs of the "V," there is a definite cyclonic turning of the flow across the axis of the "V." Since the level of maximum vorticity is generally around 700 mb or higher, we speculated that the influence of the mid-tropospheric flow on the preexisting low-level stratocumulus was minimal.

From the beginning we have acknowledged that the weakest element of our counting procedure has been the identification of disturbances in the ITCZ. Burpee (1975) found there were many circulations in the ITCZ that were completely independent of the trade wind waves. These circulations are usually very transient and have very little day-to-day continuity. Zipser (1975) described the formation of one ITCZ circulation that weakened within a few hours and Smith (1975) documented another rapidly dissipating cloud cluster that was associated with a low-level low. Martin (1975) found that the lifetime of most cloud clusters in the ITCZ was generally less than 24 to 36 hours. In our counting scheme, we do not include ITCZ disturbances unless their cloud clusters persist for at least 48 h. This means that we probably identify only the stronger ITCZ disturbances, but this is consistent with our desire to only document synoptic features whose time scale is days.

Hebert (1976) speculates that the tropics may be returning to normal. Residents within the Atlantic hurricane zone have enjoyed a relatively quiet period that extends back to 1971. During the last four years the breeding grounds for Atlantic hurricanes have been characterized by extensive upper-level westerlies and below-normal sea temperatures. Last year the magnitude and area of both anomalies decreased. The one exception is the eastern Carribean, where strong upper-level flow persisted and shielded the Antilles from strong storms.

2. Census of 1975 tropical systems

The results of the 1975 hurricane season census are given in Table 1 and several categories are summarized in Table 2 and Fig. 2. Table 1 describes the history of the 113 systems, giving the dates when they passed three key stations: Dakar, Senegal; Barbados; and San Andres Island. The table also lists the spawning date of seedlings that formed and weakened along the intertropical convergence zone (ITCZ) in the Atlantic, and the dates of formation of subtropical cyclones over

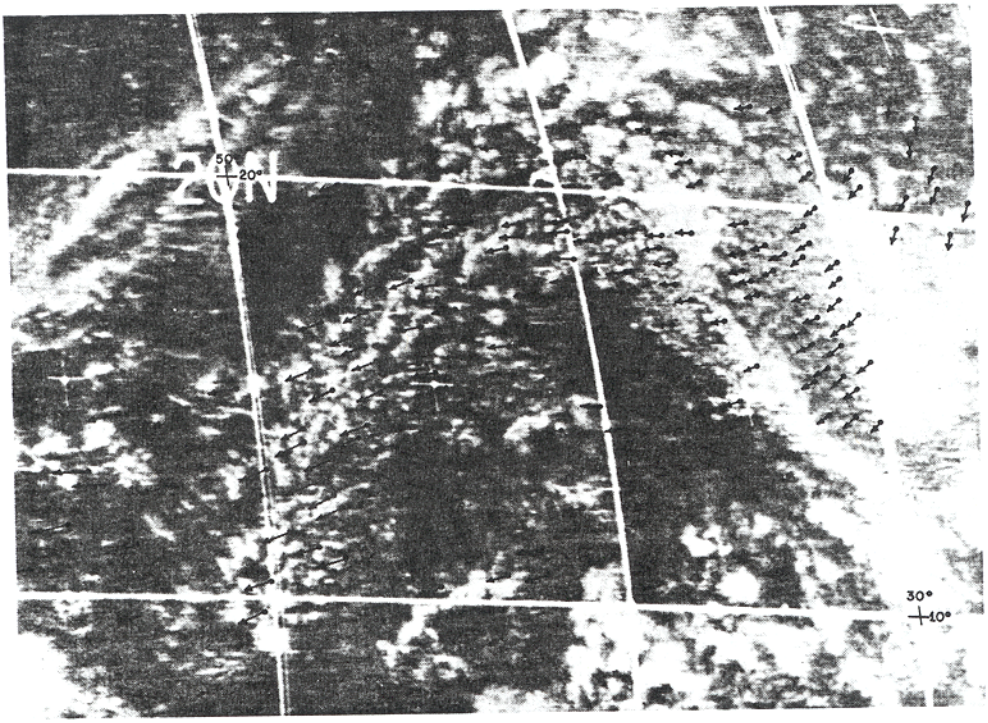

Fig. 1. Low-level cloud motion vectors superimposed on an ATS 3 picture of an "inverted V" cloud pattern. The picture was taken at 1500 GNT 27 July 1971.

the Gulf of Mexico and the Atlantic north of latitude 20°N. The Atlantic and eastern Pacific storms that were initiated by Atlantic seedlings are listed in the last four columns.

Table 2 summarizes the systems according to type and geographical area of formation. The numbers in parentheses indicate systems that were counted in a weaker stage of development. For example, Caroline and four of the six depressions that formed in the Gulf of Mexico were initiated by three African waves and two Caribbean ITCZ disturbances. Once again we see that nearly half of the systems were wave perturbations in the trades whose origin was over Africa. This observation has been true every year we have completed the survey and stresses the importance of Africa as a seed-bed for Atlantic disturbances.

Figure 2 tabulates the total number of systems passing Dakar, Barbados, and San Andres Island as well as the number that maintained their identity while traversing the Atlantic and Caribbean. Statistics are also presented on the seedlings that developed within four geographical areas: the Gulf of Mexico, the Caribbean Sea, and the subtropical and tropical Atlantic, where latitude 20°N has been used as a dividing line. Of the 61 African systems, 55 were tracked to the Caribbean and 37 all the way to the Pacific Ocean. Over the tropical Atlantic, 18 disturbances formed with 14 eventually passing through the Antilles. Another four were identified along the ITCZ and followed for at least 48 hours before dissipating. A total of 69 systems crossed the Antilles (55 from Africa plus 14 that formed in the Atlantic), of which 43 maintained their identity while traversing the Caribbean. The 21 disturbances that formed over the Caribbean added to the number from the Antilles resulted in 64 seedlings entered Central America.

One unusual aspect of the 1975 season was the early appearance of a well-defined African wave that moved by Dakar on 14 May. The first African system of the season does not generally occur until late May or early June when the easterly subtropical jet becomes established across tropical Africa in the upper troposphere.

The depression tracks for the months June through December are shown in Fig. 3. The first three depressions formed in June over the southwestern Atlantic along old baroclinic zones. The third depression acquired tropical characteristics on 28 June and strengthened near Cape Hatteras, N. C., to become the first named storm of the season, Amy.

The last depression was an unusually late season development in December. A frontal wave formed east of Bermuda, started to move toward the northeast, then became trapped on the 9th and plunged rapidly southward while strengthening. Hebert (1976) lists this development as a subtropical storm. A second subtropical storm formed over the central Atlantic on 27 August, then developed a warm core on the 29th and was designated Doris.

Five of the depressions deserve special comment, the most significant being the system that formed over

TABLE 1. Summary of the tropical systems in 1975.*

Dakar Passage	Nature	Formed in Atlantic	Weak-ened Atlantic	Barbados Passage	Nature	Weak-ened Carib-bean	Formed Carib-bean	San Andres Passage	Nature	Formed Gulf of Mexico	Formed North Atlantic	Atlantic de-pression	Atlantic storm	Pacific depres-sion	Pacific storm
May 14	Wave			May 19	Wave	5/20									
May 16	Wave			May 21	Wave	5/22									
							5/22	May 23	ITCZ						
May 18	Wave			May 24	Wave			May 27	Wave					#1	Agatha
May 21	Wave			May 26	Wave			May 28	Wave						
May 24	Wave			May 29	Wave	5/29									
							5/29	May 30	ITCZ						
May 26	Wave			May 30	Wave	6/1									
							6/2	June 3	ITCZ						
May 29	Wave			June 3	Wave			June 7	Wave						
June 1	Wave			June 6	Wave			June 9	Wave						
											6/6	#1			
		6/6		June 9	Wave	6/10									
							6/9	June 10	ITCZ						
June 6	Wave			June 11	Wave			June 14	Wave						
		6/12		June 14	Wave			June 17	Wave						
June 9	Wave			June 16	Wave			June 20	Wave						
				June 19	Wave			June 22	Wave						
		6/15													
June 13	Wave		6/18											# 2	Bridget
June 15	Wave			June 20	Wave			June 23	Wave					# 3	Carolotta
June 18	Wave			June 24	Wave			June 26	Wave						
		6/21	6/23												
June 22	Wave			June 26	Wave			June 28	Wave						
											6/24	# 2			
											6/27	# 3	Amy		
								June 30	Wave						
June 24	Wave			June 28	Wave			July 3	Wave					# 5	Denise
June 26	Wave			July 1	Wave			July 6	Wave					# 6	Eleanor
June 28	Wave			July 3	Wave										
											7/4	# 4			
		7/3		July 6	ITCZ	7/6									
				July 7	Wave			July 10	Wave						
July 3	Wave														
											7/12	# 5			
												# 6			
								July 15	Wave	7/19					
July 6	Wave			July 13	Wave										
		7/15		July 17	Wave	7/18									
				July 20	Wave						7/24	# 7	Blanche		
July 13	Wave														
July 15	Wave		7/20												

*Dep. indicates depression; stm, storm.

TABLE 1 (*continued*)

Dakar Passage	Nature	Formed in Atlantic	Weak-ened Atlantic	Barbados Passage	Nature	Weak-ened Carib-bean	Formed Carib-bean	San Andres Passage	Nature	Formed Gulf of Mexico	Formed North Atlantic	Atlantic de-pression	Atlantic storm	Pacific depres-sion	Pacific storm
July 19	Wave			July 24	Wave	7/25									
		7/24		July 26	Wave	7/27								# 7	Francine
							7/20	July 21	ITCZ						
							7/21	July 22	ITCZ			# 8			
							7/24	July 25	ITCZ						
							7/27	July 29	ITCZ						
										7/28		# 9			
							7/30	July 31	ITCZ						
							8/1	Aug. 2	ITCZ					# 8	Georgette
								Aug. 4	Wave						
July 23	Wave			July 31	Wave			Aug. 7	Wave					# 9	Hilary
July 27	Wave			Aug. 4	Wave										
July 30	Wave			Aug. 5	Wave	8/7									
Aug. 2	Wave			Aug. 8	Wave	8/9									
							8/9	Aug. 10	ITCZ						
Aug. 4	ITCZ			Aug. 11	Wave			Aug. 13	Wave						
Aug. 6	Wave			Aug. 13	Wave			Aug. 15	Wave					#10	Ilsa
Aug. 10	Wave			Aug. 16	Wave			Aug. 20	Wave					#11	Jewel
		8/15		Aug. 17	ITCZ	8/18									
Aug. 13	Wave			Aug. 20	Wave			Aug. 24	Wave						
Aug. 15	Wave			Aug. 22	Dep.			Aug. 26	Dep.			#10	Caroline		
Aug. 20	Wave			Aug. 24	Wave			Aug. 28	Wave						
Aug. 23	Wave			Aug. 27	Wave			Aug. 30	Wave						
		8/25	8/29												
											8/27	#11 (S.T.)	Doris		
							8/31	Sep. 2	ITCZ	9/3		#12			
														#13	
Aug. 26	Wave			Sep. 1	Wave			Sep. 5	Wave						
Aug. 27	Wave			Sep. 3	Wave			Sep. 6	Wave						
		9/4		Sep. 5	ITCZ	9/6									
Aug. 30	Wave			Sep. 6	Wave			Sep. 9	Wave			#13		#14	Lily
Sep. 2	Wave			Sep. 9	Wave			Sep. 12	Wave			#14			
Sep. 3	Dep.		9/6												
							9/15	Sep. 16	ITCZ						
											9/11	#15			
Sep. 6	Wave			Sep. 14	Stm.			Sep. 19	Stm.			#16	Eloise	#15	Monica
		9/10	9/14												
Sep. 11	Wave			Sep. 18	Wave			Sep. 22	Wave					#16	Nanette
Sep. 14	Wave			Sep. 23	Stm.							#17	Faye		
Sep. 16	Wave		9/17												
							9/26	Sep. 28	ITCZ						

TABLE 1 (*continued*)

Dakar Passage	Nature	Formed in Atlantic	Weak-ened Atlantic	Barbados Passage	Nature	Weak-ened Carib-bean	Formed Carib-bean	San Andres Passage	Nature	Formed Gulf of Mexico	Formed North Atlantic	Atlantic de-pression	Atlantic storm	Pacific depres-sion	Pacific storm
Sep. 18	Wave			Sep. 28	Stm.							#18	Gladys		
Sep. 21	ITCZ		9/22											#17	
		9/25		Sep. 26	ITCZ			Sep. 30	Wave						
							9/26	Sep. 28	ITCZ			#19			
Sep. 24	Wave		9/27												
							10/2	Oct. 3	ITCZ						
Sep. 26	Wave			Oct. 2	Wave			Oct. 5	Wave						
Sep. 29	ITCZ			Oct. 5	Wave			Oct. 9	Wave						
										10/1		#20			
											10/3	#21			
												#22			
Oct. 1	Wave			Oct. 9	Wave			Oct. 12	Wave					#18	Olivia
Oct. 5	Wave			Oct. 13	Wave			Oct. 16	Wave						
Oct. 8	Wave			Oct. 14	Wave			Oct. 18	Wave						
												#23			
		10/14		Oct. 16	Dep.	10/17									
		10/15		Oct. 18	Wave			Oct. 21	Wave						
Oct. 12	Wave			Oct. 20	Wave	10/21									
		10/18		Oct. 21	Wave			Oct. 25	Wave						
											10/23	#24	Hallie		
								Oct. 28	Dep.			#25		#19	Priscilla
Oct. 17	Wave			Oct. 24	Wave										
		10/22		Oct. 25	Wave	10/25									
Oct. 20	Wave			Oct. 28	Wave	10/29									
							11/1	Nov. 2	ITCZ						
Oct. 25	Wave			Oct. 31	Wave			Nov. 3	Wave						
Oct. 27	Wave			Nov. 2	Wave			Nov. 5	Wave						
Oct. 30	ITCZ			Nov. 4	Wave			Nov. 8	Wave			#26			
		11/3		Nov. 7	Wave	11/8									
Nov. 3	Wave			Nov. 8	Wave	11/9									
Nov. 5	Wave			Nov. 11	Wave	11/12								#20	
							11/10	Nov. 11	Wave						
Nov. 10	Wave			Nov. 18	Wave	11/18									
							11/14	Nov. 15	ITCZ						
Nov. 14	Wave			Nov. 21	Wave	11/21									
Nov. 19	Wave			Nov. 24	Wave	11/24									
							11/16	Nov. 19	Wave						
							11/18	Nov. 22	Wave						
		11/21	11/25												
											11/29	#27 (S.T.)			
											12/9	#28			

TABLE 2. Summary of 1975 tropical systems according to type and geographical area of formation. The numbers in parentheses indicate systems that were counted in a weaker stage.

	Africa	Tropical Atlantic	Subtropical Atlantic	Caribbean	Gulf of Mexico	Total
Waves	56	10	0	3	0	69
ITCZ	4	8	0	18	0	30
Depression	1	(5)	11 (2)	(3)	2 (4)	14 (14)
Named storms	0	(1)	(7)	0	(1)	(9)
	61	18 (6)	11 (9)	21 (3)	2 (5)	113 (23)

the northeastern Gulf of Mexico on 28 July. This depression moved west-northwest and made landfall in southern Mississippi on 29 July spreading torrential rains over the coastal sections.

Rainfall amounts of 15 to 20 inches were reported in northwest Florida and 5 inches or more in southeastern Louisiana, the southern portions of Mississippi and Alabama, and southwestern Georgia. The rain fell during a 3-day period, 29–31 July.

In the coastal sections, several homes were flooded along Pensacola Beach, the sewage system on Santa Rosa Island overflowed into the bay, numerous streets and roads were closed due to high water, and a 1000 ft stretch of bank along the Intercoastal Waterway collapsed between Pensacola and Panama City. Choctawhatchee Bay was reported to be the highest it had been in 20 years at Ft. Walton Beach as water overflowed bulkheads and flooded several buildings. Damage was estimated near 8.5 million dollars in northwest Florida, where 22 homes were destroyed and 500 damaged.

Another mid-October depression played havoc with the rehabilitation programs in North Florida. Residents of the Florida panhandle were still in the midst of clean up operations in the aftermath of Hurricane Eloise, and this depression caused additional misery. Rainfall amounts ranged from 10 inches over southeastern Louisiana to 6 inches in the Florida panhandle. Tides up to 4 ft above normal, wind gusts of 45 mph, and at least two tornadoes were observed in northwestern Florida.

Two other depressions were approaching storm strength as they moved inland near Tampico, Mexico. If either one had remained over the waters of the Gulf for another day, winds would probably have acquired storm strength. Reconnaissance aircraft measured winds near 50 mph on July 26th just a few hours before that depression moved inland. The second depression caused 35 mph winds at Tampico on September 7th.

The final near miss occurred on 9 and 10 November. Reconnaissance aircraft measured winds of 35 to 40 mph and a central pressure of 1004 mb in a depression as it moved through the Yucatan Channel. It appeared a tropical storm was going to form over the Gulf of Mexico, then the circulation pattern changed. The system was forced southward and weakened.

Fig. 4 summarizes the source of eastern Pacific named storms. As we have observed in earlier years, most of the storms are initiated by seedlings whose origin is on the Atlantic side of Central America. African systems play a very important role in the development of eastern Pacific storms.

3. Comparison with other years

Table 3 compares the tropical systems in 1975 with averages determined over the previous seven years within several categories. The total number of systems in 1975 was slightly higher than the previous seven-year average. It is also interesting to note that the totals in almost every category were the highest observed during the period of record. There is no obvious explanation for the across the board increase in 1975.

TABLE 3. Results of 1975 compared with the previous seven years.

	1968	1969	1970	1971	1972	1973	1974	7-year average	1975
Total systems (all types)	107	105	85	103	113	95	96	101	113
Dakar systems	57	58	54	56	57	56	52	56	61
Barbados systems	59	44	53	56	56	58	58	55	69
San Andres systems	40	43	45	58	49	54	52	49	64
Depressions	19	28	24	23	24	24	25	24	28
Named storms	7	13	7	12	4	7	7	8	8
Subtropical storms	?	?	?	?	4	1	4		2

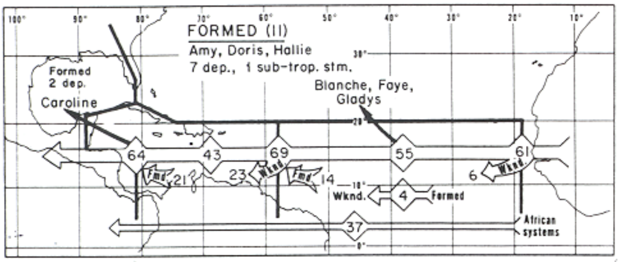

FIG. 2. Summary of tropical disturbances that passed three key stations (Dakar, Barbados, and San Andres) in 1975 and those maintaining their identity while crossing the Atlantic and Caribbean.

Last year Frank (1974) introduced a simple parameter that seems to be useful in describing the overall character of the hurricane season. This is computed by forming the ratio of the number of depressions of tropical origin to the total number of depressions. The 1975 value has been added in Fig. 5 and we observed a continuation of the regime that has persisted for the past four years. Low values of this ratio indicate a high number of baroclinic depressions; we have observed this to be associated with anomalous baroclinic conditions over the tropics.

The story of the 1975 hurricane season is well summarized in Table 4, in which we see that half of the

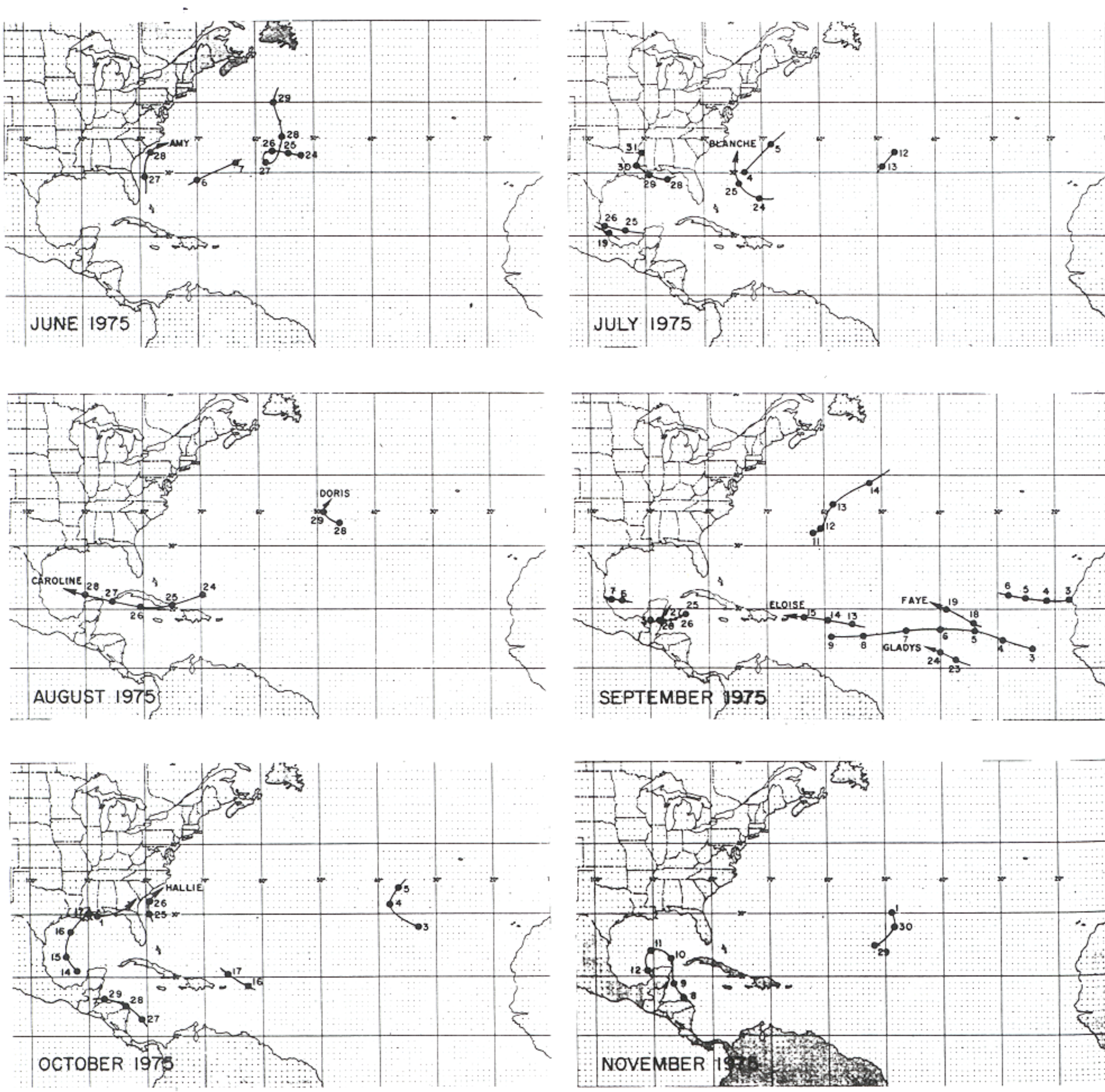

FIG. 3. Tracks of 1975 depressions.

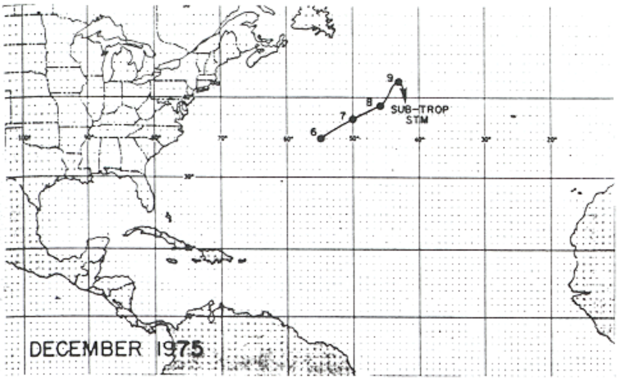

FIG. 3 (*continued*)

depressions (14) were initiated by baroclinic seedlings. In the table, the 1975 results can be compared with the averages for the past eight years; however, a more meaningful comparison can be made by dividing the past eight years into two four-year periods. The years from 1967 to 1970 were characterized by normal storm activity, while a lull has been observed during the period 1971 to 1974. Even though there is little difference in the total number of depressions, there is a very significant difference in the character of the disturbances that initiated the depressions. During the four-year normal period, two-thirds to three-fourths of the depressions were spawned by tropical-type seedlings, and subtropical cyclones were not very common. But during the last four years, over half of the depressions were initiated by baroclinic disturbances and subtropical cyclones were much more frequent. The character of the season is directly related to the amount of activity in the subtropical latitudes.

Another perspective of the season is shown in Table 5, which compares the monthly incidents of depressions with the past 8-year average. The number of August depressions was significantly below normal, while the number of early and late season depressions were above normal. This is consistent with the observation that conditions over the tropics in 1975 were abnormally baroclinic. A southward displacement of the westerlies favors baroclinic cyclonic activity over the subtropical latitudes during the spring and fall and discourages typical tropical development during the peak of the hurricane season. Even though both the magnitude and area of the anomalous upper westerlies and cool water temperatures decreased some last summer, conditions over the tropics remained more baroclinic than normal in 1975.

TABLE 4. Summary of the type of seedling that initiated Atlantic named storms and depressions during 1975 compared with annual averages from previous years.

Year	Tropical: African systems	Tropical: Disturbance	Baroclinic: Upper Troposphere	Baroclinic: Lower Troposphere	Totals
		Named storms			
1975	5	0	0	3	8
Average 1967–1974	4.0	2.0	1.0	1.0	8.0
Average 1967–1970	4.2	2.8	1.0	0.8	8.8
Average 1971–1974	3.8	1.2	1.5	1.2	7.8
		Depressions			
1975	11	3	3	11	28
Average 1967–1974	10.5	4.0	4.0	6.5	25.0
Average 1967–1970	12.8	5.0	3.2	4.5	25.5
Average 1971–1974	7.8	2.8	4.7	8.7	24.0

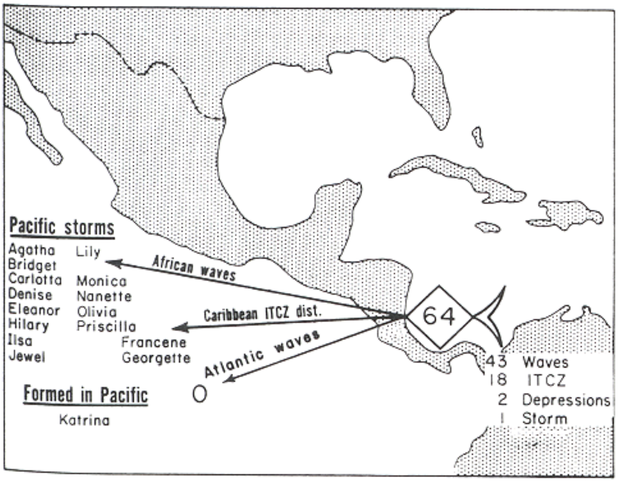

FIG. 4. Summary of the type of seedlings that initiated east Pacific storms in 1975.

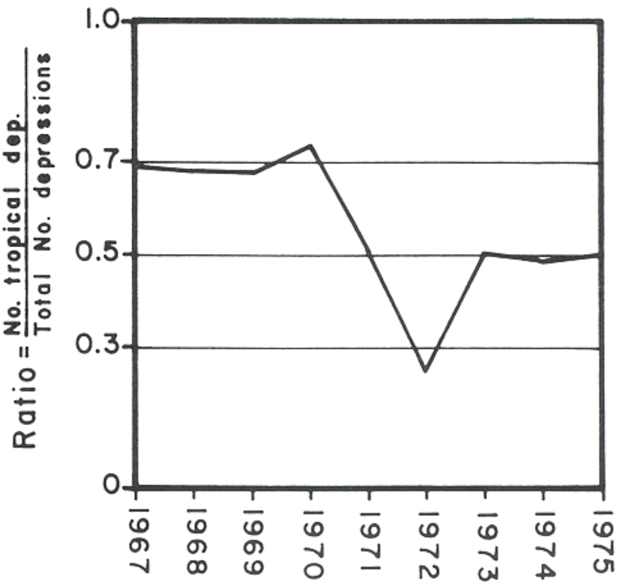

FIG. 5. Ratio of the number of depressions of tropical origin to the total number of depressions, 1967 to 1975.

TABLE 5. Number of depressions that formed each month compared with monthly averages determined over the 8-year period 1967 through 1974.

	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1975	1	1	2.5	3.5	6.0	7.5	4.0	0.5	0	26
Average (1967–74)	0	0	3	6	2	8	6	2	1	28

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