

## Atlantic Tropical Systems of 1978

NEIL L. FRANK AND GILBERT CLARK

*National Hurricane Center, National Weather Service, NOAA, Miami, FL 33124*

### ABSTRACT

The 1978 hurricane season produced 98 "tropical systems", of which 33 acquired the closed circulation of a depression. Over half of these 65 originated over the African Continent. African seedlings initiated 6 of the 11 named Atlantic storms, and 13 of the 18 east Pacific storms.

### 1. Introduction

This is the eleventh consecutive year a seasonal summary has been completed. An article by Lawrence (1979) describes the systems that strengthened into named storms or hurricanes. The general philosophy used in our counting method was presented in previous articles by Simpson *et al.* (1968, 1969).

The tropical Atlantic was relatively quiet during the seventies. Not only have there been fewer named storms than normal, but most of the major hurricanes that did form remained over the ocean. Hebert (1979) observed that only three major hurricanes have struck the United States so far this decade and unless there is a rapid turn around in 1979, this will be the lowest decadal total this century.

Abnormal environmental conditions over the tropics were unfavorable for hurricane activity over the past decade. Cold water and strong upper westerlies over the hurricane breeding grounds discouraged development. However, there are indications conditions are returning to normal. In 1976 Hebert (1976) noted ocean temperatures near normal and last year Lawrence (1978) observed a more common flow pattern in the upper part of the tropical atmosphere. Lawrence (1978) related the inactivity last year to a weak subtropical ridge of high pressure and thus an unfavorable horizontal shear of the surface winds.

This year with near-normal conditions of these three parameters, we observed a sharp increase in the number of both depressions and named storms. The number of depressions that developed during the primary hurricane months (1 June–20 November) was the highest observed in the 11 years of our summaries, and the 11 named storms were only exceeded by 12 in 1971 and 13 in 1969. In conclusion, 1978 must be considered an active season even though we had no serious problem in the United States. We were fortunate. The major hurricanes that did develop remained over the open Atlantic

with the exception of Greta that struck Honduras. The minor storms that did pose a threat to the United States developed so close to the coast that they made landfall before significant strengthening could occur.

### 2. Census of 1978 tropical systems

The systems observed during the 1978 hurricane season are given in Table 1 and results for several categories are summarized in Table 2 and Fig. 1. Table 1 describes the history of the 98 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 or depressions over the Gulf of Mexico and the Atlantic north of 20°N.

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, Cora, Flossie and Juliet formed in the tropical Atlantic south of 20°N and were initiated by African waves. Once again, we see that nearly half 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.

Fig. 1 shows 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 63 African systems, 60 were tracked to the Caribbean and 46 all the way to the

TABLE 1. Summary of the tropical systems of 1978.

Date	Dakar passage	Name	Date formed Atlantic	Atlantic crossing	Date weakened Atlantic	Date Barbados passage	Name	Date weakened Caribbean	Caribbean crossing	Date formed Caribbean	Date San Andres passage	Name	Date formed Gulf of Mexico	Date formed Atlantic	Atlantic depression	Atlantic storm	Pacific depression	Pacific storm	Africa to Pacific crossing
5/5		wave	5/4			5/10	wave	5/12			5/17	wave							x
5/12		wave		x		5/13	wave		x		5/22	wave							x
		wave		x		5/19	wave		x	5/23	ITCZ								x
										5/24	ITCZ								
										5/24	ITCZ			5/25	#2		Aletta		
5/16		wave		x		5/23	wave		x		5/27	wave							x
5/20		wave	5/25	x	5/27	5/27	wave		x		5/31	wave							x
5/25		wave		x		5/30	wave	5/31											
5/27		wave		x		6/2	wave		x		6/3	ITCZ							x
5/30		wave		x	6/1						6/5	wave							x
6/1		wave		x		6/7	wave		x	6/11	wave								x
6/3		wave		x		6/10	wave		x	6/11	ITCZ					#2	Bud Carlotta		x
6/6		wave		x		6/12	wave		x	6/14	wave					#3			x
6/9		wave		x		6/15	wave		x	6/16	wave								x
6/14		wave		x		6/19	wave		x	6/19	wave				#3				x
6/17		wave		x		6/23	wave		x	6/23	wave						#4	Daniel	x
6/20		wave		x		6/26	wave		x	6/27	wave								x
6/23		wave		x		6/29	wave		x	6/30	wave						#6	Emila	x
6/26		wave		x		7/2	wave		x	7/2	wave						#7	Fico	x
						7/6	wave		x	7/6	ITCZ								x
6/30		wave		x		7/6	wave		x	7/7	ITCZ						#8	Gijima	x
7/4		wave		x		7/8	wave		x	7/13	wave								x
7/6		wave		x		7/12	wave		x	7/15	wave								x
7/9		wave		x		7/14	wave		x	7/18	wave				#4			Hector	x
7/10		wave		x		7/16	wave	7/17											x
						7/18	wave		x	7/23	wave		7/21						x
7/12		wave		x		7/22	wave		x										x
7/14		wave		x	7/16	7/16	wave		x										x
7/17		wave		x		7/25	wave	7/23			7/27	wave			#7	Amelia			x
7/19		wave		x		7/27	wave		x	7/30	wave								x
7/23		wave	7/29	x		7/30	wave		x	8/2	wave								x
									x	8/3	wave		8/3						x
7/25		wave		x		8/1	wave		x	8/6	wave								x
7/29		wave		x		8/4	wave	8/5											x
8/1		wave		x		8/8	dep		x	8/10	dep								x
8/4		wave		x		8/10	dep		x	8/13	wave						#14	Lane	x
8/7		wave		x		8/13	wave		x	8/16	wave						#13	Kristy	x
8/10		wave		x		8/15	wave		x	8/18	wave						#15	Miriam	x
									x										x
8/13		wave	8/13	x	8/15	8/15	wave		x	8/22	wave								x
									x										x
8/15		wave		x		8/21	wave		x	8/25	wave		8/26						x
8/17		wave		x		8/24	wave		x	8/27	wave								x
8/20		wave	8/23	x	8/25	8/26	wave		x	8/29	wave							Norman	x

TABLE 1. (Continued)

Date Dakar passage	Date formed Atlantic	Date weakened Atlantic	Date Barbados passage	Date San Andres passage	Date formed Gulf of Mexico	Date formed Atlantic	Date formed North Atlantic	Atlantic depression	Atlantic storm	Pacific depression	Pacific storm	Africa to Pacific crossing
—	8/28	—	8/30	8/31	—	—	—	—	—	—	—	—
—	—	—	—	9/4	—	—	8/29	—	—	—	—	—
8/25	—	—	9/2	9/6	—	—	—	#14	Ella	—	—	—
8/28	—	—	9/3	—	—	—	—	#18	—	—	—	—
—	—	—	—	—	—	—	9/6	—	—	—	—	—
9/1	—	—	9/7	—	—	—	—	#17	—	—	—	—
9/3	—	9/8	—	—	—	—	—	#15	Flossie	—	—	—
—	—	—	—	9/12	—	—	—	#16	—	—	—	—
9/8	—	—	9/13	—	9/11	—	9/12	—	—	—	—	—
9/10	—	—	9/16	9/17	—	—	—	#19	Hope	—	—	—
9/13	—	—	9/19	9/19	—	—	—	#20	Greta	—	—	—
—	—	—	9/19	9/22	—	—	—	#22	—	—	—	—
—	—	—	—	9/24	9/23	—	—	—	—	—	—	—
9/15	—	—	9/24	9/27	—	—	—	#23	—	—	—	—
—	—	—	9/26	—	9/30	—	—	#24	—	—	—	—
9/18	—	—	9/28	—	—	—	—	#21	—	—	—	—
9/23	—	—	—	10/3	—	—	10/1	—	—	—	—	—
—	—	—	10/1	10/4	—	—	—	#25	—	—	—	—
9/25	—	—	10/4	—	—	—	—	—	—	—	—	—
9/27	—	—	10/8	—	—	—	—	—	—	—	—	—
9/28	—	—	—	—	—	—	—	#27	Juliet	—	—	—
—	—	—	—	—	—	—	10/2	#26	Irma	—	—	—
10/4	—	—	10/10	10/13	—	—	—	—	—	—	—	—
—	10/9	—	10/12	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	10/11	#28	—	—	—	—
—	10/13	—	10/15	10/19	—	—	—	—	—	—	—	—
—	10/13	—	10/17	10/22	—	—	—	—	—	—	—	—
—	—	—	—	10/28	10/27	—	—	—	—	—	—	—
10/12	—	—	10/21	10/31	—	—	—	#30	Kendra	—	—	—
—	10/17	10/19	10/25	—	—	—	—	—	—	—	—	—
10/19	—	—	10/30	—	—	—	—	—	—	—	—	—
10/23	—	—	11/2	11/5	—	—	—	#29	—	—	—	—
10/24	—	—	11/2	11/4	—	—	11/3	#31	—	—	—	—
—	—	—	11/5	—	—	—	—	—	—	—	—	—
10/28	—	—	11/8	11/8	—	—	—	—	—	—	—	—
10/31	—	—	11/8	11/14	—	—	—	—	—	—	—	—
—	—	—	—	11/10	—	—	11/15	#32	—	—	—	—
—	—	—	11/10	—	—	—	—	—	—	—	—	—
11/3	—	—	11/16	11/21	—	—	—	—	—	—	—	—
11/5	—	—	11/18	—	—	—	—	—	—	—	—	—
11/9	—	—	11/21	—	—	—	—	—	—	—	—	—
11/14	—	—	—	—	—	—	11/19	#33	—	—	—	—
—	—	—	11/22	11/26	—	—	—	—	—	—	—	—
11/16	—	—	11/25	11/28	—	—	—	—	—	—	—	—
11/20	—	—	11/29	—	—	—	—	—	—	—	—	—
11/23	—	—	—	—	—	—	1/18	#1	STS	—	—	—
Total 63	6	10	66	60	50	10	11	4	4	11	46	46

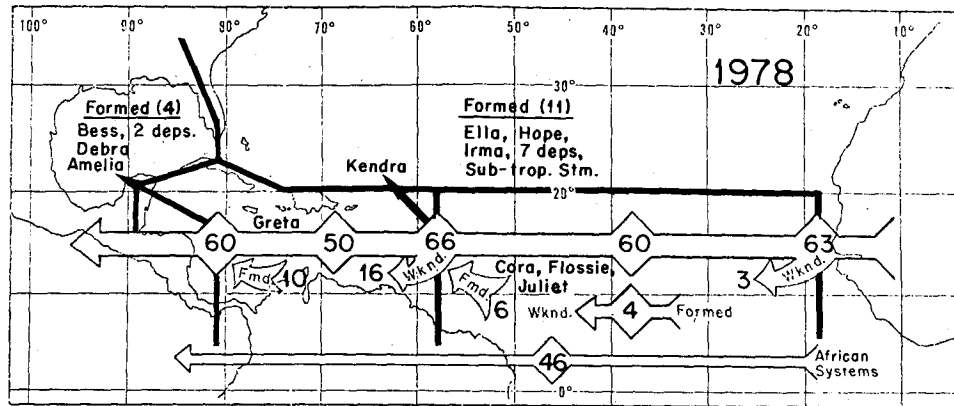


FIG. 1. Summary of tropical disturbances that passed these key stations (Dakar, Barbados, San Andres) in 1978 and those maintaining their identity while crossing the Atlantic and Caribbean.

Pacific. Over the tropical Atlantic, ten disturbances formed with six eventually passing through the Antilles. Four of these were identified along the ITCZ and were followed for at least 48 h before dissipating. A total of 66 systems crossed the Antilles

(60 from Africa plus six that formed in the Atlantic) of which 50 maintained their identity into Central America. Ten additional systems formed over the Caribbean and added to the number from the Antilles resulted in 60 seedlings entering Central America.

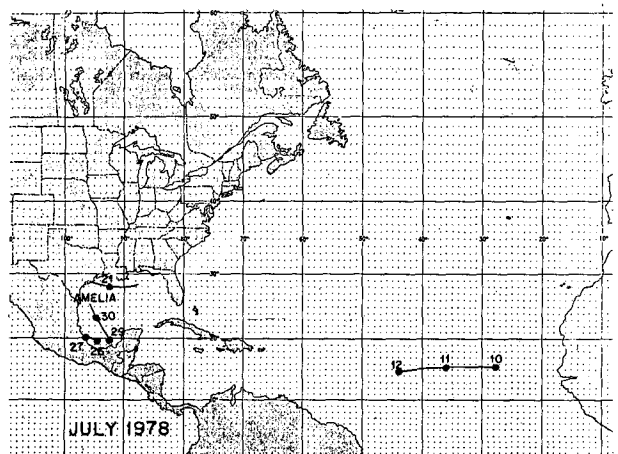
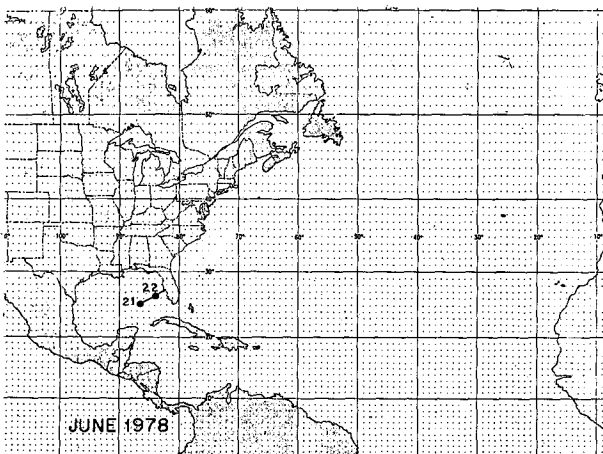
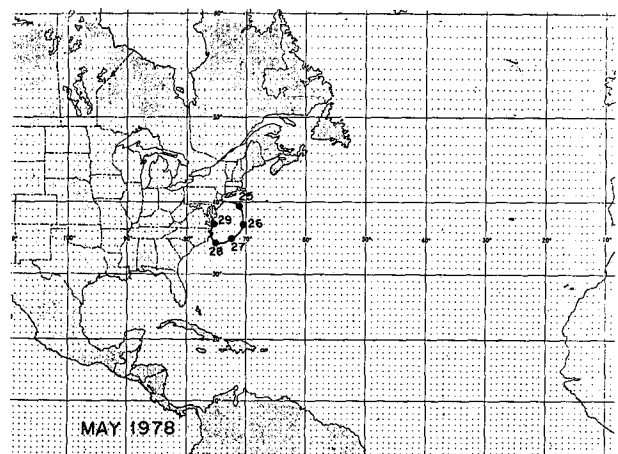
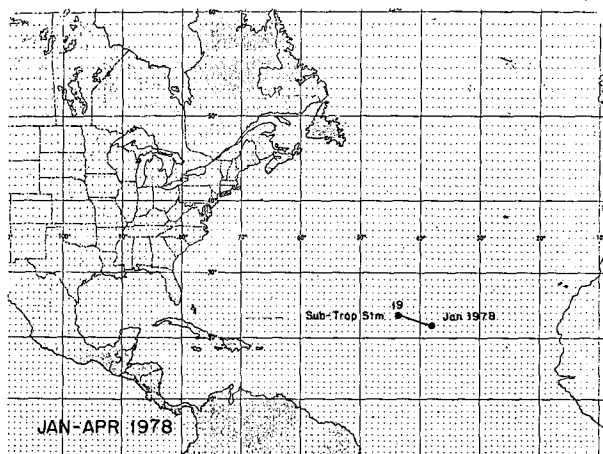


FIG. 2. Tracks of 1978 depressions.

TABLE 2. Summary of 1978 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	Sub-tropical Atlantic	Caribbean	Gulf of Mexico	Total
Waves	61	5	0	0	0	66
ITCZ	1	5	0	10	0	16
Depression	1	— (8)	11 (2)	— (1)	4 (7)	16 (18)
Named storms	0	— (3)	(5)	— (1)	— (3)	(12)
Total	63	10 (11)	11 (7)	10 (2)	4 (10)	98 (30)

The first wave of the season moved by Dakar on 5 May and was tracked all the way to the eastern Pacific. The last African disturbance of the summer moved off the continent on 23 November.

The depression tracks for the months January–November are shown in Fig. 2. The first depression of the year was an off-season subtropical cyclone in January that strengthened into a subtropical storm. This system is described by Lawrence (1979). Another early season depression of baroclinic origin

TABLE 3. Number of depressions over the past 10 years compared with 1978.

Year	Number of depressions during the hurricane season (1 June–30 November)	Total number of depressions during the year
1968	19	22
1969	28	34
1970	24	26
1971	23	23
1972	23	24
1973	20	24
1974	24	25
1975	27	28
1976	22	23
1977	19	19
10-year average	23	25
1978	31	33

formed along the eastern coast of the United States in late May where it was cut off from the westerlies for five days before weakening. The first depression spawned by an African disturbance occurred over

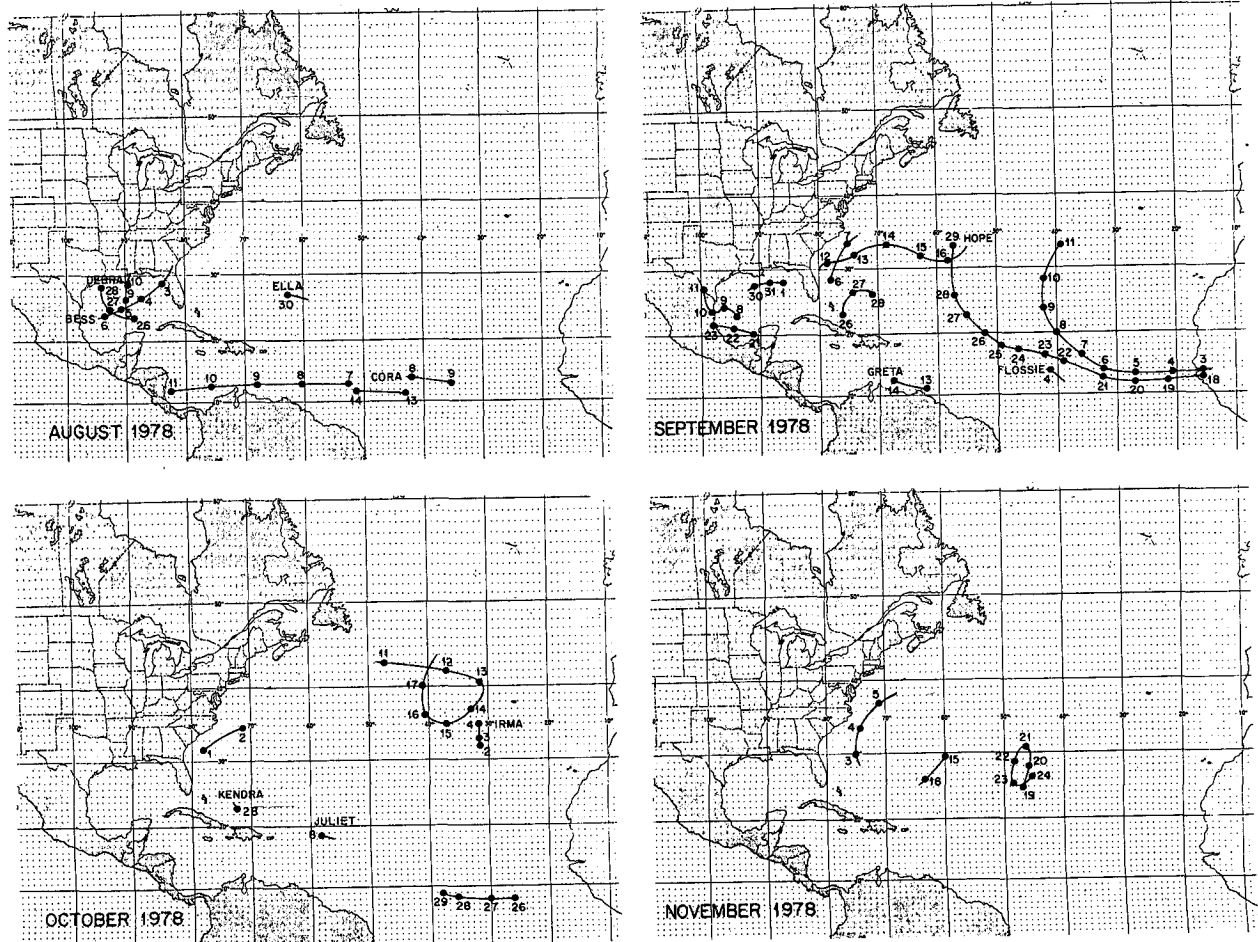


FIG. 2. (Continued)

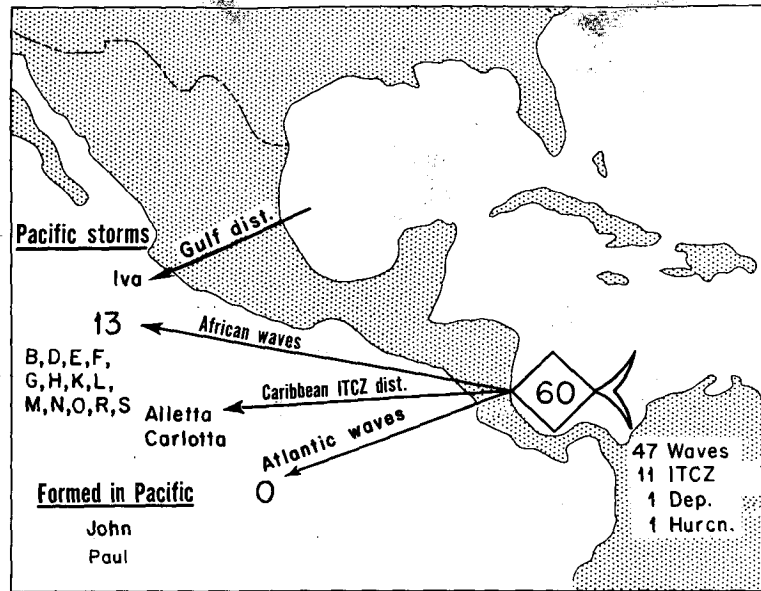


FIG. 3. Summary of the type of seedlings that initiated east Pacific storms in 1978.

the Gulf of Mexico in June. The last depression of the year was initiated by an upper cold low over the South Central Atlantic in the latter part of November.

The total number of depressions in 1978 exceeded the annual average for the past decade by nearly 50%. This is seen in Table 3 where the number of depressions over the past decade is compared with 1978. The 31 depressions in 1978 were the highest number observed during the heart of the hurricane season (1 June–30 November) since our summaries began in 1968. The primary reason for the increase was the very active period from September through November when the number of depressions were seven above the decade averages for this three-month period.

One interesting aspect of the 1978 season was that three of the Atlantic storms weakened after moving inland over Central America, then later spawned named storms in the eastern Pacific. Bess initiated Iva in the Pacific, Cora became Kristy, and finally Greta turned into Olivia. Fig. 3 summarizes the source of eastern Pacific named storms in 1978. The

18 storms in the eastern Pacific are three more than the decade average of 15. Thirteen of the Pacific storms were initiated by African disturbances.

3. Comparison with other years

Table 4 compares the tropical systems in 1978 with averages and ranges over the past 10 years. The number for 1978 is a little above normal for all categories of systems except the total number which is a little below the 10-year average. The number of named storms and depressions are almost 50% above normal indicating an active year.

Table 5 summarizes the source of Atlantic depressions and named storms in 1978 compared with pre-

TABLE 4. 1978 summary compared with the past 10 years.

	10-year average (1968–77)	Range	1978
Total systems	104	85–113	98
Dakar systems	58	52–69	63
Barbados systems	60	44–74	66
San Andres systems	54	40–67	60
Depressions	25	22–34	33
Named storms	8	4–13	11
Subtropical storms	—	0–4	1

TABLE 5. Summary of the type of seedling that initiated Atlantic named storms and depressions during 1978 compared with annual averages from previous years.

Year	Tropical		Baroclinic		Totals
	African systems	Dis-turbance	Upper tropo-sphere	Lower tropo-sphere	
Named storms					
1978	6	0	2	3	11
1967–71	4.5	2.5	1.5	1.0	9.5
1972–77	3.5	1.0	1.0	1.5	7.0
1967–77	4.0	1.5	1.5	1.0	8.0
Depressions*					
1978	18	0	5	8	31
1967–71	12.5	4.0	4.0	4.0	24.5
1972–77	8.5	2.0	4.0	8.0	22.5
1967–77	10.0	3.0	4.0	6.5	23.5

\* Only the depressions that occurred from June through November.

vious years. In the tables, the 1978 results are compared to averages for the past 11 years and to an "active" versus "inactive" period. The past 11 years can be divided into two periods. The years from 1967 to 1971 were characterized by normal storm activity, and the next six years were relatively quiet. The table suggests that the number for 1978 is a little more consistent with the "active" rather than "inactive" years.

In conclusion, the 1978 hurricane season was characterized by near normal environmental conditions, many depressions and storms, with the major hurricanes occurring over the open Atlantic.

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