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Statistical Aspects of North Atlantic Basin Tropical Cyclones During the Weather Satellite Era, 1960–2013: Part 1

Robert M. Wilson
Marshall Space Flight Center, Huntsville, Alabama

July 2014

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Marshall Space Flight Center • Huntsville, Alabama 35812

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LIST OF ACRONYMS AND DESIGNATORS

ACE	accumulated cyclone energy
<ACE>	mean seasonal ACE
AMO	Atlantic Multidecadal Oscillation (index)
DOY	day of year
ENY	El Niño year
FSD	first storm day
H	hurricane
HISACE	highest individual storm ACE
HISPDI	highest individual storm PDI
HURDAT	Hurricane Database (old)
HURDAT2	Hurricane Database (new)
<LAT>	mean seasonal latitude
LISNSD	longest individual storm NSD
<LONG>	mean seasonal longitude
LOS	length of season
LP	lowest pressure
<LP>	mean seasonal LP
LSD	last storm day
MH	major hurricane
NENY	non-El Niño year

LIST OF ACRONYMS AND DESIGNATORS (Continued)

NH	number of hurricanes
NHD	number of hurricane days
NMH	number of major hurricanes
NMHD	number of major hurricane days
NSD	number of storm days
<NSD>	mean seasonal NSD
NTC	number of tropical cyclones
NTCA	Net Tropical Cyclone Activity
NUSLFH	number of USFLH
ONI	Oceanic Niño Index
PDI	Power Dissipation Index
<PDI>	mean seasonal PDI
PWS	peak wind speed
<PWS>	mean seasonal PWS
SS	substorm
TC	tropical cyclone
TP	Technical Publication
U.S.	United States
USLFH	U.S. land-falling hurricanes

NOMENCLATURE

a	y-intercept
b	slope of the inferred regression line
cl	confidence level
n	number
na	number above median
nb	number below median
nra	number of positive runs
P	probability
$P(r)$	probability of r events
r	coefficient of correlation
r^2	coefficient of determination
r/nr	random/nonrandom
sd	standard deviation
se	standard error of estimate
t	t-statistic for independent samples
x	independent variable
y	dependent variable
z	normal deviate for the sample results

TECHNICAL PUBLICATION

STATISTICAL ASPECTS OF NORTH ATLANTIC BASIN TROPICAL CYCLONES DURING THE WEATHER SATELLITE ERA, 1960–2013: PART 1

1. INTRODUCTION

A tropical cyclone is described as a warm-core, nonfrontal, synoptic-scale system that originates over tropical or subtropical waters, having organized deep convection and closed surface wind circulation (counterclockwise in the Northern Hemisphere) about a well defined center.[1] When its sustained wind speed equals 34–63 kt, it is called a tropical (or subtropical) storm and is given a name (i.e., alternating male and female names, beginning in 1979); when its sustained wind speed equals 64–95 kt, it is called a hurricane (at least in the Eastern Pacific and North Atlantic basin); and when its sustained wind speed equals 96 kt or higher, it is called an intense or major hurricane (i.e., categories 3–5 on the Saffir-Simpson Hurricane Wind Scale[2]).

Although tropical cyclones have been reported and described since the voyages of Columbus,[3] a detailed record of their occurrences extends only from 1851 to the present, with the most reliable portion extending only from about 1945 to the present, owing to the use of near-continuous routine reconnaissance aircraft monitoring flights[4] and the use of satellite imagery (beginning in 1960; see Davis[5,6]). Even so, the record may still be incomplete,[7–14] possibly missing at least one tropical cyclone per yearly hurricane season, especially prior to the use of continuous satellite monitoring. In fact, often an unnamed tropical cyclone is included in the year-end listing of events at the conclusion of the season, following post-season analysis (e.g., as happened in 2011 and 2013, each having one unnamed event).

In this two-part Technical Publication (TP), statistical aspects of the North Atlantic basin tropical cyclones are examined for the interval 1960–2013, the weather satellite era. Part 1 examines some 25 parameters of tropical cyclones (e.g., frequencies, peak wind speed (PWS), accumulated cyclone energy (ACE), etc.), while part 2 examines the relationship of these parameters against specific climate-related factors. These studies are a continuation of nearly two decades of previous tropical cyclone-related investigations.[15–28]

2. RESULTS AND DISCUSSION

The tropical cyclone data used in this TP were determined using the National Hurricane Center's original HURDAT database, which was retired at the end of the 2013 hurricane season.[29,30] It has since been supplanted by HURDAT2, which reformats the tropical cyclone data, giving additional data not included in the older HURDAT, especially wind field radii determinations for the 34-kt, 50-kt, and 64-kt wind fields since 2004 for each of the four quadrants of the tropical cyclone: northeast, southeast, southwest, and northwest. In the appendix, table 10 provides a listing of the individual tropical cyclones that formed during the interval 1960–2013, giving the individual tropical cyclone parametric values used in this TP. Also, in the appendix, table 11 provides a listing of the 25 parametric values for each year and for the intervals 1960–2013, 1960–1994, and 1995–2013, including the statistics (means and standard deviations) and the results of specific statistical testing.

2.1 First Storm Day, Last Storm Day, and Length of Season

Conventionally, the North Atlantic basin hurricane season is said to extend from June 1 to November 30 each year, spanning some 183 days in overall length. In actuality, tropical cyclones are found to have originated in all months of the year (except March), based on the record since 1945.[26] For the interval 1960–2013 (54 years), all the tropical cyclones are found to have originated in the months of April–December, with one exception: a lone January 1978 subtropical storm (ST1) that was well removed from other previous year or same year storms and considered herein to be a statistical outlier with regard to month of origin. Table 1 shows the distribution of the monthly frequencies of tropical cyclone formation in the North Atlantic basin for the interval 1960–2013. Some 615 tropical cyclones are observed to have occurred, with all but 18 having originated during the conventional June–November timeframe. Obviously, the peak months occur in the late-summer, early-fall months of August–October, accounting for about 77% of the total. The fewest number (4) of tropical cyclones occurred in 1983 (an El Niño year (ENY)) and the most (28) in 2005 (a non-El Niño year (NENY)).

The first storm day (FSD) and last storm day (LSD) of a yearly hurricane season are important statistics for tropical cyclones, since they determine the yearly length of season (LOS). Previously, on the basis of the 1851–2007 'best track' record of North Atlantic basin tropical cyclone activity, Kossin suggested that the hurricane season is increasing in length due to the occurrences of both earlier and later seasonal storms, attributing the increased lengthening to warming sea surface temperature.[31] On the basis of the best track hurricane record for 1945–2011, Wilson[27] confirmed the results of Kossin, showing that the length of the hurricane season has indeed increased due to both early season and late season storms occurring more frequently and that warmer temperature appears to be the driving force for the lengthening (see also Wilson[28]). Furthermore, Wilson showed that the LOS is highly dependent upon FSD and predicted that the LOS for the 2012 hurricane season would be about 173 ± 23 days, based on the observed FSD of May 19 (day of year, or DOY = 140). In fact,

Table 1. Monthly frequencies of tropical cyclones (1960–2013).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1960						1	2	2	2				7
1961							1		6	2	2		11
1962								2	1	2			5
1963								2	5	2			9
1964						1	1	3	5	1	1		12
1965						1		2	2	1			6
1966						1	4	1	4		1		11
1967								1	4	3			8
1968						3		1	3	1			8
1969							1	5	6	5	1		18
1970					1		1	3	3	2			10
1971							1	4	6	1	1		13
1972					1	1		2	2		1		7
1973							2	2	2	2			8
1974						1	1	4	4	1			11
1975						1	1	2	3	1		1	9
1976					1		1	5	2	1			10
1977								1	3	2			6
1978	1*						1	4	3	3			12
1979						1	2	3	2	1			9
1980								3	5	1	2		11
1981					1	1		2	5	1	2		12
1982						2		1	2	1			6
1983								2	2				4
1984								4	6	1	1	1	13
1985							2	3	3	2	1		11
1986						2		1	2		1		6
1987								3	3	1			7
1988								3	7	1	1		12
1989						1	2	4	2	1	1		11
1990							2	6	2	4			14
1991							1	1	3	3			8
1992				1				1	4	1			7
1993						1		4	3				8
1994							1	2	2		2		7
1995						1	4	7	3	4			19
1996						1	2	4	2	3	1		13
1997						1	4		1	2			8
1998							1	4	6	2	1		14
1999						1		4	3	3	1		12
2000								4	7	4			15
2001						1		3	4	4	3		15

Table 1. Monthly frequencies of tropical cyclones (1960–2013) (Continued).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2002							1	3	8				12
2003				1		1	2	3	4	3		2	16
2004								8	4	2	1		15
2005						2	5	5	5	7	3	1	28
2006						1	2	3	4				10
2007					1	1	1	2	8	1		1	15
2008					1		3	4	4	3	1		16
2009								4	2	2	1		9
2010						1	1	4	8	5			19
2011						1	3	7	6	1	1		19
2012					2	2		8	2	5			19
2013						2	2	2	4	2	1	1	14
Total	1*	0	0	2	8	34	58	168	204	101	32	7	615

* Storm is considered an outlier

the 2012 hurricane season actually turned out to span 164 days, from May 19 to October 29, inclusive. (The FSD is defined as the first day of the yearly hurricane season when sustained PWS of a tropical cyclone attains at least 34 kt, and the LSD is defined as the last day of the yearly hurricane season when the sustained PWS of a tropical cyclone is at least 34 kt. The LOS is simply the inclusive difference between FSD and LSD.)

Figure 1 displays the yearly variations of (a) FSD, (b) LSD, and (c) LOS for the interval 1960–2013. Concerning FSD, it is found to span from DOY = 110 (in 2003; April 20) to DOY = 242 (in 1967 and again in 1977; August 30), averaging about DOY = 180 and having a standard deviation (*sd*) equal to 33 days and a median equal to 177 days. For the 54 years spanning 1960–2013, FSD has had values equal to or above the median for 27 years and below the median for 27 years, occurring in 15 positive yearly runs, thus yielding the normal deviate for the sample results $z = 0.54$, which by hypothesis testing suggests that FSD is distributed randomly.[32] However, on the basis of hypothesis testing of the means of two independent samples (1960–1994 and 1995–2013), one finds that the t-statistic for independent samples[33] is equal to 1.6, a value of marginal statistical importance (i.e., confidence level $cl > 90\%$). During the first subinterval (1960–1994), FSD averaged about DOY = 185 (near the end of June), while during the latter subinterval (1995–2013), FSD has averaged about DOY = 170 (near the middle of June). Hence, on average, FSD is observed to be occurring about 2 weeks earlier now than it did during the earlier interval. (The division of the data set into two independent samples is prompted by the observation that the Atlantic Mutidecadal Oscillation (AMO) index changed phase about 1995 from being one of negative phase indicative of cooler North Atlantic Ocean water temperature prior to 1995 to one of positive phase indicative of warmer North Atlantic Ocean water temperature since 1995.[34])

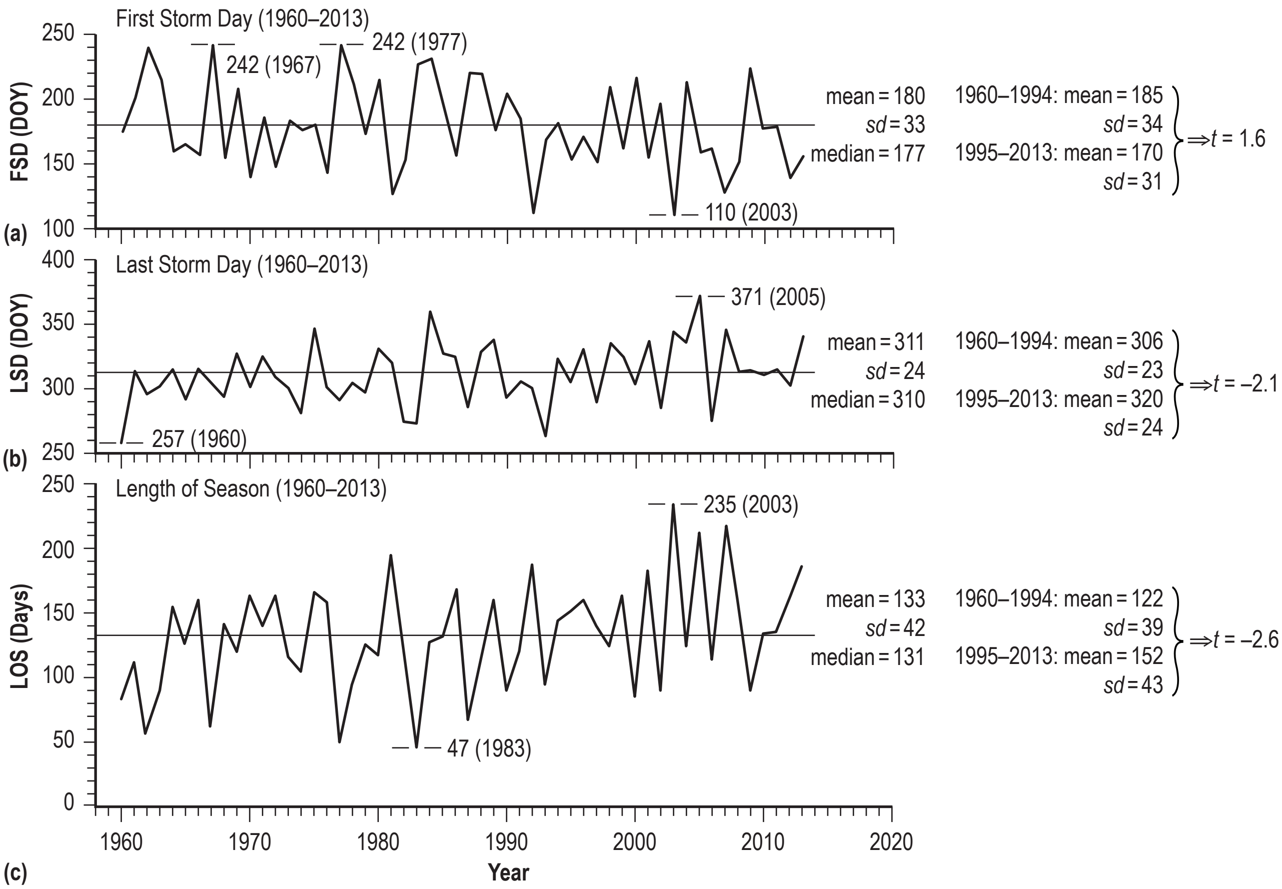

Figure 1. Variation of (a) FSD, (b) LSD, and (c) LOS for the interval 1960–2013.

Regarding LSD and LOS, they are found to average about DOY = 311 (early November) and 133 days, respectively, having medians of DOY = 310 and 131 days, respectively, with each having 27 yearly values equal to or greater than the median and 27 yearly values below the median occurring in 16 positive yearly runs, thereby yielding $z = 1.08$ (inferring that their yearly values are distributed randomly). However, based on their t-statistic values of –2.1 and –2.6, respectively, for the two independent intervals, one finds statistically important differences between the two subintervals at $cl > 95\%$ and $cl > 98\%$, respectively. The earliest LSD (DOY = 257; September 19) occurred in 1960, while the latest LSD (DOY = 371; January 6) occurred in 2006 (but associated with the 2005 hurricane season). The shortest LOS (47 days) occurred in 1983 (an ENY), and the longest LOS (235 days) occurred in 2003 (a NENY).

Figure 2 depicts the inferred relationship between LOS and FSD. Linear regression analysis suggests that the inferred correlation equation is $y = 321.587 - 1.052x$, where y represents LOS and x is FSD (in terms of its DOY). The inferred correlation (represented by the diagonal line) has a linear coefficient of correlation $r = -0.828$, meaning that the inferred relationship is an inverse relationship (i.e., early FSD suggests longer LOS and later FSD suggests shorter LOS). The coefficient of determination $r^2 = 0.686$, meaning that about 69% of the variance in LOS can be explained by the

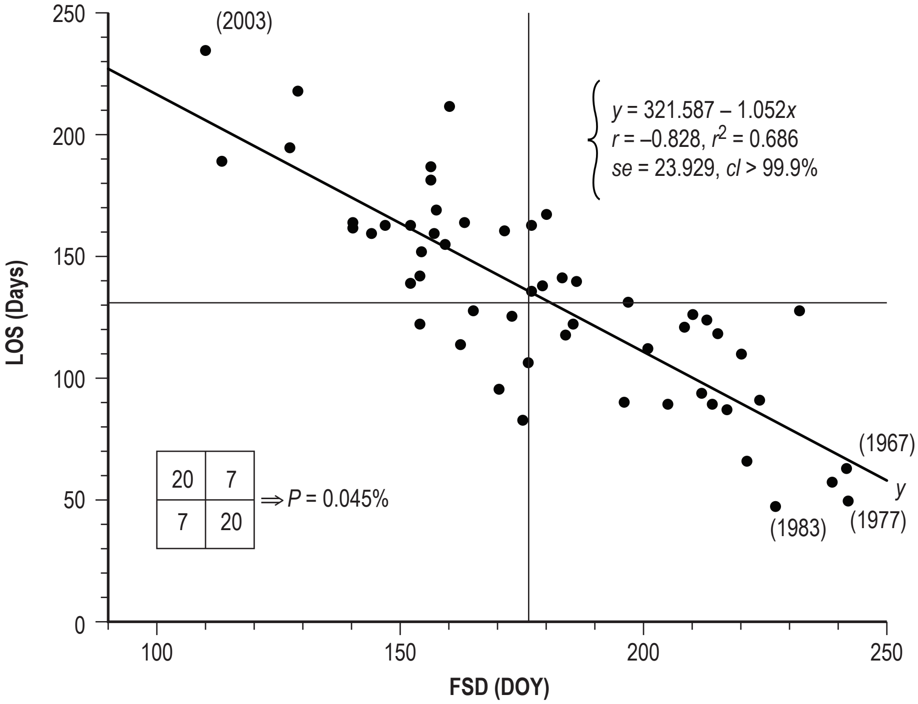

Figure 2. Scatterplot of LOS versus FSD.

variation in FSD alone. The inferred correlation has a standard error of estimate (*se*) equal to 23.929 days and is inferred to be highly statistically important $cl > 99.9\%$. Alternatively, the statistical importance of the inferred correlation can be determined using Fisher's exact test for 2×2 contingency tables.[35] In figure 2, the vertical and horizontal lines represent the medians for FSD and LOS, respectively. The probability (P) of obtaining the observed result, or one more suggestive of a departure from independence (chance), equals 0.045%. Hence, if the FSD for a hurricane season is earlier (later) than its median (177 days), one infers that it is about 3 times more likely that the LOS for that season will be longer (shorter) than its median (131 days). As an example, suppose the FSD of a yearly hurricane season occurs on June 1 of a nonleap year (DOY = 152). From the 2×2 contingency table, one infers that the LOS is expected to be 131 days or longer, inferring that the LSD should not be expected until DOY = 283 or later (i.e., on or later than about October 10). From the inferred linear regression, FSD = 152 suggests LOS = 162 ± 24 days (the ±1 *se* prediction interval), inferring that the LSD should be expected about DOY 314 ± 24 (i.e., about November 10 ± 24 days), with only about a 16% chance of either occurring before October 16 or after December 4.

2.2 Number of Tropical Cyclones, Hurricanes, Major Hurricanes, and United States Land-Falling Hurricanes

Figure 3 displays the number of tropical cyclones (NTC) per year that formed in the North Atlantic basin during the interval 1960–2013, the weather satellite era. As previously noted from table 1, some 615 tropical cyclones have been documented during the overall interval 1960–2013, from a low of 4 in 1983 to a high of 28 in 2005, averaging about 11 per year with $sd = 5$. However,

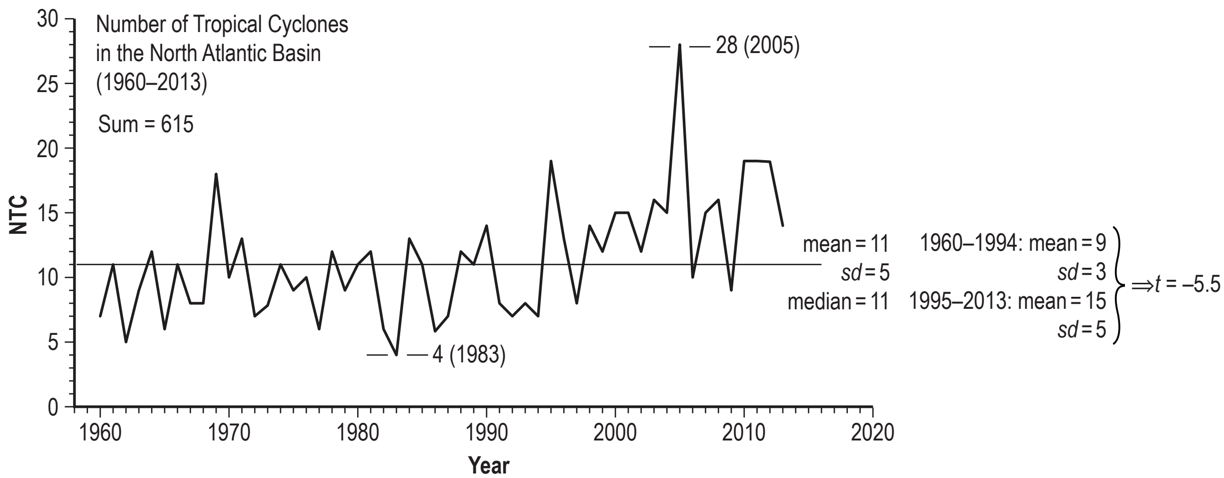

Figure 3. Variation of NTC for the interval 1960–2013.

based on the subintervals 1960–1994 and 1995–2013, the mean NTC for the 1995–2013 subinterval (15) is found to be nearly 67% larger than the mean NTC for the earlier 1960–1994 subinterval (9), with the difference in the means for the two intervals being highly statistically important at $cl > 99.9\%$ ($t = -5.5$). Presuming that NTC for the 2014 hurricane season will be more akin to the more recent 1995–2013 subinterval than for the earlier 1960–1994 subinterval, one infers that NTC for the 2014 season should be expected to be about 15 ± 5 (the ± 1 *sd* prediction interval), with no fewer than 8 tropical cyclones expected (the fewest observed during the more recent subinterval). Should the year 2014 be characterized as an ENY, then one probably should expect NTC to be slightly below the mean (perhaps about 10–15 in number). For January–May 2014, El Niño-neutral conditions have prevailed, although indications presently suggest warming, especially later in the year; hence, as of June 2014, the Climate Prediction Center and the International Research Institute for Climate and Society suggest the chance of El Niño developing during the Northern Hemisphere summer in 2014 to be about 70% and to be about 80% during the fall and winter.[36]

Figure 4 depicts the (a) number of hurricanes (NH), (b) number of major hurricanes (NMH), and (c) the number of United States (U.S.) land-falling hurricanes (NUSLFH) (USLFH) per year that occurred in the North Atlantic basin during the interval 1960–2013. For NH, some 333 events have been documented, inferring an average of about 6 per year ($sd = 3$). The most (15) occurred in 2005, while the least (2) occurred in 2013. As with NTC, the mean NH for the subinterval 1995–2013 is higher than the mean for the subinterval 1960–1994 (8 per year versus 5 per year; about 60% higher) and the difference in the subinterval means appears statistically important ($cl > 99.9\%$; $t = -4.4$). For NMH, some 132 events have been documented, inferring an average of about 2 per year ($sd = 2$). The most (7) occurred in 1961 and 2005, and the least (0) occurred in 1968, 1972, 1986, 1994, and 2013. While the mean for the subinterval 1995–2013 is slightly higher than the mean for the subinterval 1960–1994 (3 per year versus 2 per year), the difference in the subinterval means is only of marginal statistical importance ($cl > 90\%$; $t = -1.8$). For NUSLFH, some 78 events have been documented, inferring an average of about 1 per year ($sd = 1$), with 54 (69%) occurring in the months of August and September. The most (6) occurred in 1985, 2004, and 2005, and the least (0) occurred in 1962,

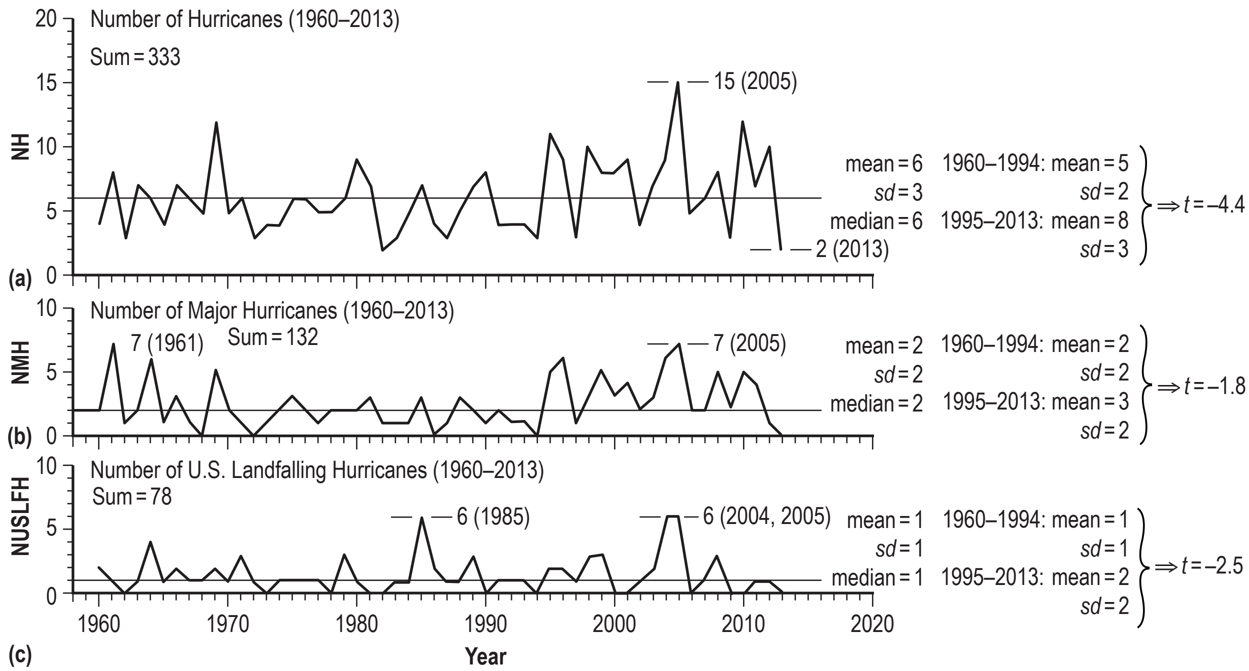

Figure 4. Variation of (a) NH, (b) NMH, and (c) NUSLFH for the interval 1960–2013.

1973, 1978, 1981, 1982, 1990, 1994, 2000, 2001, 2006, 2009, 2010, and 2013. The mean for the more recent subinterval 1995–2013 is higher than the mean for the earlier subinterval 1960–1994 and the difference is of statistical importance ($cl > 98\%$; $t = -2.5$). As before for NTC, presuming that NH, NMH, and NUSLFH for the 2014 hurricane season will be more akin to the more recent subinterval 1995–2013 than for the earlier subinterval 1960–1994, one infers that NH, NMH, and NUSLFH for the 2014 season should be expected to be about 8 ± 3, 3 ± 2, and 2 ± 2 (the ± 1 *sd* prediction intervals), respectively. (It should be noted that, while the listing of USLFH based on the original HURDAT indicated that Ophelia struck North Carolina as a minimal hurricane in 2005, it is not listed as a USLFH in the current listing based on HURDAT2. Also, the current listing includes Isaac as a land-falling hurricane in 2012, striking the Louisiana coastline as a minimal hurricane.[37])

Table 2 gives the Poisson probabilities for NTC, NH, NMH, and NUSLFH based on the overall interval 1960–2013 and separately for each subinterval 1960–1994 and 1995–2013. Presuming that the 2014 hurricane season is more akin to the more recent subinterval 1995–2013, one should expect NTC = 15 ± 4, having $P(11–19) = 75.7\%$, with $P(<11) = 11.8\%$ and $P(>19) = 12.5\%$; NH = 8 ± 3, having $P(5–11) = 78.9\%$, with $P(<5) = 10.0\%$ and $P(>11) = 11.2\%$; NMH = 3 ± 2, having $P(1–5) = 86.6\%$, with $P(0) = 5\%$ and $P(>5) = 8.4\%$; and NUSLFH = 2 ± 1, having $P(1–3) = 72.2\%$, with $P(0) = 13.5\%$ and $P(>3) = 14.3\%$. (Poisson probabilities are more appropriate for random events that occur within a given space or time interval.)

Table 2. Poisson probabilities for NTC, NH, NMH, and NUSLFH based on the interval 1960–2013.

	1960–2013 P(r)				1960–1994 P(r)				1995–2013 P(r)			
r	NTC (mean = 11)	NH (mean = 6)	NMH (mean = 2)	NUSLFH (mean = 1)	NTC (mean = 9)	NH (mean = 5)	NMH (mean = 2)	NUSLFH (mean = 1)	NTC (mean = 15)	NH (mean = 8)	NMH (mean = 3)	NUSLFH (mean = 2)
0	0.0000	0.0025	0.1353	0.3679	0.0001	0.0067	0.1353	0.3679	0.0000	0.0003	0.0498	0.1353
1	0.0002	0.0149	0.2707	0.3679	0.0011	0.0337	0.2707	0.3679	0.0000	0.0027	0.1494	0.2707
2	0.0010	0.0446	0.2707	0.1839	0.0050	0.0842	0.2707	0.1839	0.0000	0.0107	0.2240	0.2707
3	0.0037	0.0892	0.1804	0.0613	0.0150	0.1404	0.1804	0.0613	0.0002	0.0286	0.2240	0.1804
4	0.0102	0.1339	0.0902	0.0153	0.0337	0.1755	0.0902	0.0153	0.0006	0.0573	0.1680	0.0902
5	0.0224	0.1606	0.0361	0.0031	0.0607	0.1755	0.0361	0.0031	0.0019	0.0916	0.1008	0.0361
6	0.0411	0.1606	0.0120	0.0005	0.0911	0.1462	0.0120	0.0005	0.0048	0.1221	0.0504	0.0120
7	0.0646	0.1377	0.0034	0.0001	0.1171	0.1044	0.0034	0.0001	0.0104	0.1396	0.0216	0.0034
8	0.0888	0.1033	0.0009	0.0000	0.1318	0.0653	0.0009	0.0000	0.0194	0.1396	0.0081	0.0009
9	0.1085	0.0688	0.0002		0.1318	0.0363	0.0002		0.0324	0.1241	0.0027	0.0002
10	0.1194	0.0413	0.0000		0.1186	0.0181	0.0000		0.0486	0.0993	0.0008	0.0000
11	0.1194	0.0225			0.0970	0.0082			0.0663	0.0722	0.0002	
12	0.1094	0.0113			0.0728	0.0034			0.0829	0.0481	0.0001	
13	0.0926	0.0052			0.0504	0.0013			0.0956	0.0296	0.0000	
14	0.0728	0.0022			0.0324	0.0005			0.1024	0.0169		
15	0.0534	0.0009			0.0194	0.0002			0.1024	0.0090		
16	0.0367	0.0003			0.0109	0.0000			0.0960	0.0045		
17	0.0237	0.0001			0.0058				0.0847	0.0021		
18	0.0145	0.0000			0.0029				0.0706	0.0009		
19	0.0084				0.0014				0.0557	0.0004		
20	0.0046				0.0006				0.0418	0.0002		
21	0.0024				0.0003				0.0299	0.0001		
22	0.0012				0.0001				0.0204	0.0000		
23	0.0006				0.0000				0.0133			
24	0.0003								0.0083			
25	0.0001								0.0050			
26	0.0000								0.0029			
27	0.0000								0.0016			
28	0.0000								0.0009			
29	0.0000								0.0004			
30	0.0000								0.0002			
31	0.0000								0.0001			
32	0.0000								0.0000			

Table 3 gives the Poisson probabilities for NTC, NH, NMH, and NUSLFH based on the overall interval 1960–2013, but now incorporating whether the year is classified as either an ENY or a NENY, where an ENY is simply defined as one having an Oceanic Niño Index (ONI) monthly value ≥0.5 °C for at least 6 months within the year, and a NENY is one having an ONI ≥ 0.5 °C for fewer than 6 months within the year. Presuming the year 2014 to be an ENY, one should expect NTC = 9 ± 3, having P(6–12) = 76.1%, with P(<6) = 11.6% and P(>12) = 12.4%; NH = 5 ± 2, having P(3–7) = 74.2%, with P(<3) = 12.5% and P(>7) = 13.3%; NMH = 2 ± 1, having P(1–3) = 72.2%, with P(0) = 13.5% and P(>3) = 14.3%; and NUSLFH = 1 ± 1, having P(0–2) = 92.0%, with P(0) = 36.8% and P(>2) = 8.0%. Instead, presuming the year 2014 to be a NENY, one should expect NTC = 12 ± 3, having P(9–15) = 69.0%, with P(<9) = 15.5% and P(>15) = 15.6%; NH = 7 ± 2, having P(5–9) = 65.8%, with P(<5) = 17.3% and P(>9) = 17.0%; NMH = 3 ± 1, having P(2–4) = 61.6%, with P(<2) = 19.9% and P(>4) = 18.5%; and NUSLFH being the same as if the year is an ENY (i.e., 1 ± 1, having P(0–2) = 92.0%, with P(0) = 36.8% and P(>2) = 8.0%). (The definition as used in this TP for the year being called an ENY differs from the usual definition of El Niño, which requires at least 5 consecutive months having ONI ≥ 0.5 °C; see reference 38.)

Table 3. Poisson probabilities for NTC, NH, NMH, and NUSLFH based on the interval 1960–2013 incorporating ENY and NENY.

	ENY $P(r)$				NENY $P(r)$			
r	NTC (mean = 9)	NH (mean = 5)	NMH (mean = 2)	NUSLFH (mean = 1)	NTC (mean = 12)	NH (mean = 7)	NMH (mean = 3)	NUSLFH (mean = 1)
0	0.0001	0.0067	0.1353	0.3679	0.0000	0.0009	0.0498	0.3679
1	0.0011	0.0337	0.2707	0.3679	0.0001	0.0064	0.1494	0.3679
2	0.0050	0.0842	0.2707	0.1839	0.0004	0.0223	0.2240	0.1839
3	0.0150	0.1404	0.1804	0.0613	0.0018	0.0521	0.2240	0.0613
4	0.0337	0.1755	0.0902	0.0153	0.0053	0.0912	0.1680	0.0153
5	0.0607	0.1755	0.0361	0.0031	0.0127	0.1277	0.1008	0.0031
6	0.0911	0.1462	0.0120	0.0005	0.0255	0.1490	0.0504	0.0005
7	0.1171	0.1044	0.0034	0.0001	0.0437	0.1490	0.0216	0.0001
8	0.1318	0.0653	0.0009	0.0000	0.0655	0.1304	0.0081	0.0000
9	0.1318	0.0363	0.0002		0.0874	0.1014	0.0027	
10	0.1189	0.0181	0.0000		0.1048	0.0710	0.0008	
11	0.0970	0.0082			0.1144	0.0452	0.0002	
12	0.0728	0.0034			0.1144	0.0263	0.0001	
13	0.0504	0.0013			0.1056	0.0142	0.0000	
14	0.0324	0.0005			0.0905	0.0071		
15	0.0194	0.0002			0.0724	0.0033		
16	0.0109	0.0000			0.0543	0.0014		
17	0.0058				0.0383	0.0006		
18	0.0029				0.0255	0.0002		
19	0.0014				0.0161	0.0001		
20	0.0006				0.0097	0.0000		
21	0.0003				0.0055			
22	0.0001				0.0030			
23	0.0000				0.0016			
24					0.0008			
25					0.0004			
26					0.0002			
27					0.0001			
28					0.0000			

2.3 Latitude and Longitude Genesis Location

Figure 5 displays the yearly mean genesis location latitude (<LAT>) and longitude (<LONG>) of the tropical cyclones for the interval 1960–2013. The genesis location of a tropical cyclone is defined as the latitude and longitude at which the tropical cyclone first attains a sustained PWS of at least 34 kt. The yearly mean genesis location is simply the average of all tropical cyclone genesis locations within a single yearly season. As an example, the genesis latitude and longitude locations of the four tropical cyclones occurring in 1983 were 27.2° N., 91.0° W. (Alicia); 27.4° N., 76.3° W. (Barry); 31.6° N., 63.3° W. (Chantal); and 28.0° N., 73.0° W. (Dean). Hence, one computes the <LAT> and <LONG> for the four tropical cyclones of 1983 to be 28.6° N., 75.9° W.

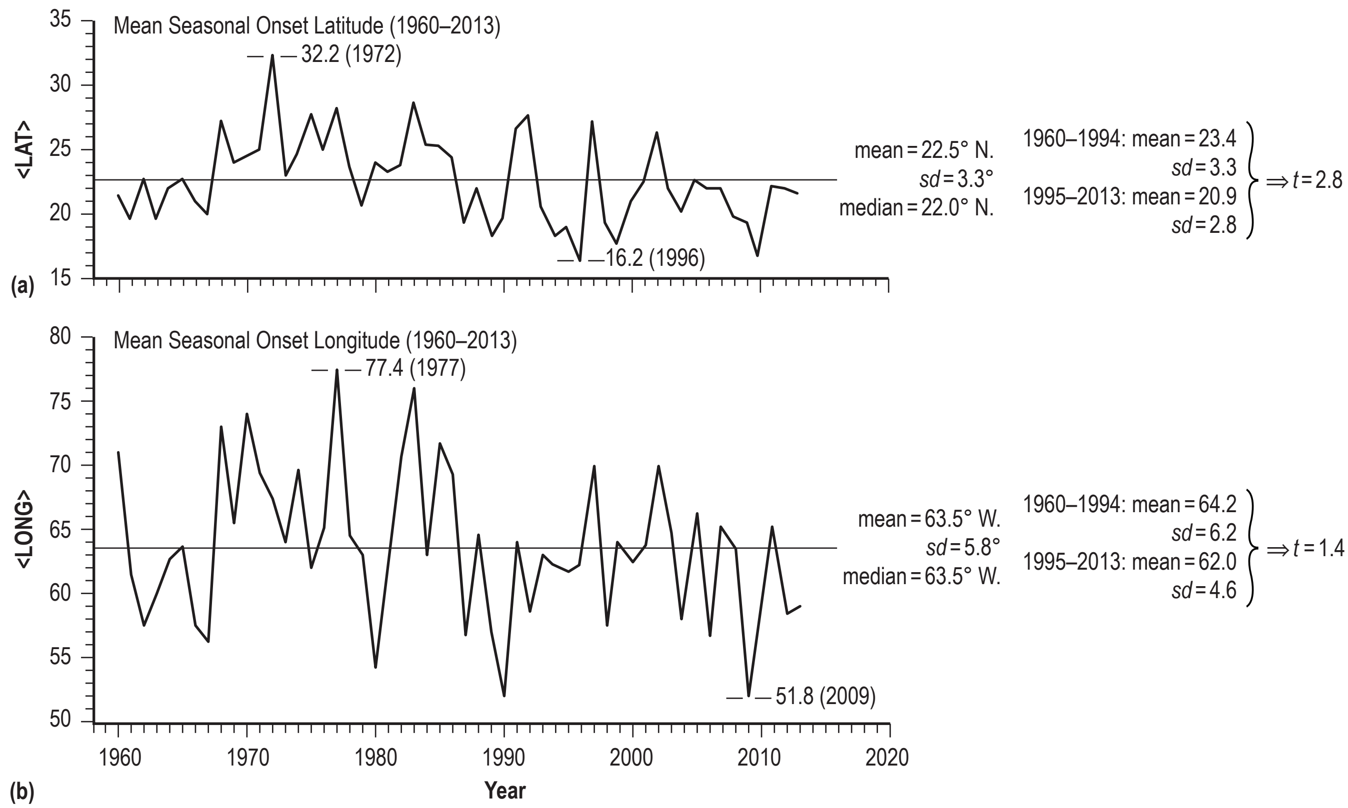

Figure 5. Variation of (a) <LAT> and (b) <LONG> for the interval 1960–2013.

Concerning <LAT>, for the entire interval 1960–2013, it averages 22.5° N. and has $sd = 3.3°$. The highest and lowest values of <LAT> measure, respectively, 32.2° N. in 1972 (an ENY) and 16.2° N. in 1996 (a NENY). Runs-testing of <LAT> reveals that there are 28 years having <LAT> equal to or greater than the median (22.0° N.) and 26 years having <LAT> below the median, occurring in 9 positive yearly runs, inferring that the distribution of <LAT> is nonrandom ($z = –2.7$; $cl > 99\%$). Indeed, it appears (to the eye) that <LAT> has progressively decreased over time between the 1970s and the 1990s. Certainly, <LAT> typically is below the mean prior to the mid-to-late 1960s and again after the late 1980s, while it typically is above the mean during the late 1960s through the mid-to-late 1980s. A comparison of the two independent subintervals 1960–1994 and 1995–2013 shows that the mean <LAT> for subinterval 1995–2013 (20.9° N.) is about 2.5° lower than the mean <LAT> for the subinterval 1960–1994 (23.4° N.) and that the difference in the means is statistically important ($t = 2.8$; $cl > 99\%$). Thus, tropical cyclones during the current epoch of time tend to form at lower latitudes than they did during the earlier epoch of time.

Concerning <LONG>, for the entire interval 1960–2013, it averages 63.5° W. and has $sd = 5.8°$. The most westward <LONG> measures 77.4° W. in 1977 (an ENY) and the least westward <LONG> measures 51.8° W. in 2009 (an ENY). Runs-testing of <LONG> reveals that there are 27 years having <LONG> equal to or more westward than the median (63.5° W.) and 27 years having <LONG> more eastward than the median, occurring in 14 positive yearly runs, inferring that the distribution of <LONG> is random ($z = 0$). Likewise, a comparison of the two independent subintervals 1960–1994 and 1995–2013 shows that, while the mean <LONG> for subinterval 1995–2013 (62.0° W.) is about 2.2° more eastward than the mean <LONG> for the subinterval 1960–1994 (64.2° W.), the difference in the means is not statistically important ($t = 1.4$; $cl < 90\%$).

Figure 6 shows the scatterplot of <LAT> versus <LONG> for the interval 1960–2013. Linear regression analysis suggests that there exists a direct linear relationship between <LAT> and <LONG>, given by $y = 1.371 + 0.334x$, where y is now <LAT> and x is <LONG>. The inferred regression has $r = 0.581$ and $r^2 = 0.337$, with $se = 2.719°$ and $cl > 99.9\%$. Likewise, Fisher's exact test for the 2×2 contingency table yields the probability of obtaining the observed result, or one more suggestive of a departure from independence, $P = 0.0014\%$. Hence, if the <LONG> is equal to or more westward than 63.5° W., it is about 4 times more likely that the <LAT> will be equal to or higher than 22° N., while if the <LONG> is more eastward than 63.5° W., it is about 3.5 times more likely that the <LAT> will be below 22° N. Because lower <LAT> tends to be associated with the more recent subinterval 1995–2013 and higher <LAT> with the earlier subinterval 1960–1994, this suggests that tropical cyclone formation in the North Atlantic basin is cyclic by nature (probably strongly related to the variation as described by the AMO index).

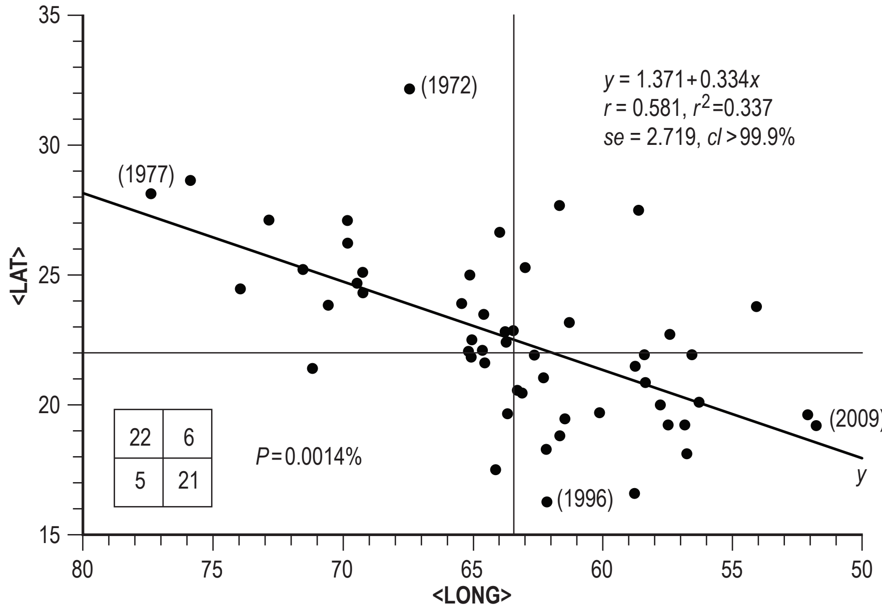

Figure 6. Scatterplot of <LAT> versus <LONG>.

Table 4 sorts the tropical cyclones using a broader genesis formation scheme, groups 1–5, where group 1 refers to tropical cyclones forming in the region of the Gulf of Mexico (above the Caribbean Sea); group 2, those forming in the region of the Caribbean Sea; group 3, those forming in the region off the eastern coast of the U.S.; group 4, those forming in the region of the lower North Atlantic open ocean; and group 5, those forming in the upper North Atlantic open ocean farther away from the U.S. coastline. Of the 615 tropical cyclones, 117 (19%) are observed to have formed in the region of the Gulf of Mexico, 83 (13.5%) formed in the Caribbean Sea region, 155 (25.2%) formed in the region off the eastern U.S. coastline, 175 (28.5%) formed in the lower North Atlantic open ocean region, and 85 (13.8%) formed in the upper North Atlantic open ocean region farther away from the U.S. coastline. The means (and standard deviations) for these groupings for the overall interval 1960–2013 are 2.2 (1.3), 1.5 (1.6), 2.9 (1.7), 3.2 (2.2), and 1.6 (1.4), respectively. For the two subintervals, the means (and standard deviations) for the groupings are 1.8 (1.2), 1.0 (1.0), 2.8 (1.6), 2.5 (1.9), and 1.3 (1.1), respectively, for subinterval 1960–1994, and 2.8 (1.3), 2.5 (2.0), 3.1 (1.8), 4.7 (2.1), and 2.1 (1.9), respectively, for subinterval 1995–2013. Clearly, the mean for every group is higher during the more recent subinterval than for the earlier subinterval, with groups 2 and 4 having the greatest increase (150% and 88%, respectively). Interesting, however, is that whereas group 3 had the largest mean during the earlier subinterval, group 4 now has the largest mean in the more recent subinterval. The greatest yearly frequencies, respectively, are 5 in 2003 and 2013 (group 1), 7 in 2005 (group 2), 7 in 2005 (group 3), 9 in 1995 and 2010 (group 4), and 8 in 2005 (group 5).

Table 4. Frequencies of tropical cyclones by groups (1960–2013).

	Group					
Year	**1**	**2**	**3**	**4**	**5**	**Total**
1960	2	1	3	1		7
1961	1	3	2	4	1	11
1962			3	2		5
1963	1		1	6	1	9
1964	3	1	2	4	2	12
1965	1	1		1	3	6
1966	2		1	5	3	11
1967	1	1	2	2	2	8
1968	3		4	1		8
1969	4	2	5	4	3	18
1970	4	1	3	1	1	10
1971	1	4	5	1	2	13
1972	1		3		3	7
1973	2	1	3	2		8
1974	1	2	6	2		11
1975	1	1	3	1	3	9
1976	2		5	2	1	10
1977	2	1	3			6
1978	3	1	3	3	2	12
1979	3	1	1	3	1	9
1980	2	1	2	4	2	11
1981	1	3	4	3	1	12
1982	3		2	1		6
1983	1		3			4
1984	1	1	6	3	2	13
1985	4	1	5	1		11
1986	1		3	1	1	6
1987	1	1	1	3	1	7
1988	3	2	2	4	1	12
1989	4			7		11
1990	1	1	2	8	2	14

Table 4. Frequencies of tropical cyclones by groups (1960–2013) (Continued).

	Group					
Year	**1**	**2**	**3**	**4**	**5**	**Total**
1991	1		3	1	3	8
1992			4	1	2	7
1993	1	2	2	2	1	8
1994	2	2		2	1	7
1995	3	3	3	9	1	19
1996	1	5	1	6		13
1997	1		6	1		8
1998	4	1	1	5	3	14
1999	2	3	1	5	1	12
2000	3	1	4	5	2	15
2001	3	4	2	3	3	15
2002	3	1	4	2	2	12
2003	5	2	2	4	3	16
2004	2	2	4	5	2	15
2005	4	7	7	2	8	28
2006	1	1	2	4	2	10
2007	4	2	3	5	1	15
2008	2	6	2	3	3	16
2009	1	1	1	5	1	9
2010	3	4	3	9		19
2011	4	3	6	5	1	19
2012	2	2	4	7	4	19
2013	5		2	4	3	14
1960–2013 (*n* = 54)						
sum	117	83	155	175	85	615
mean	2.2	1.5	2.9	3.2	1.6	
sd	1.3	1.6	1.7	2.2	1.4	
1960–1994 (*n* = 35)						
sum	64	35	97	86	45	
mean	1.8	1.0	2.8	2.5	1.3	
sd	1.2	1.0	1.6	1.9	1.1	
1995–2013 (*n* = 19)						
sum	53	48	58	89	40	
mean	2.8	2.5	3.1	4.7	2.1	
sd	1.3	2.0	1.8	2.1	1.9	

2.4 Peak Wind Speed and Lowest Pressure

Figure 7 depicts the variation of the observed yearly tropical cyclone (a) PWS, (b) the mean seasonal PWS (<PWS>), (c) the lowest pressure (LP), and (d) the mean seasonal LP (<LP>) during the interval 1960–2013. Continuing the example for the 1983 tropical cyclones, Alicia had the highest PWS (100 kt) and lowest LP (963 mb), and the four storms together had <PWS> = 72.5 kt (= [100 + 70 + 65 + 55] / 4) and <LP> = 985.5 mb (= [963 + 986 + 994 + 999] / 4).

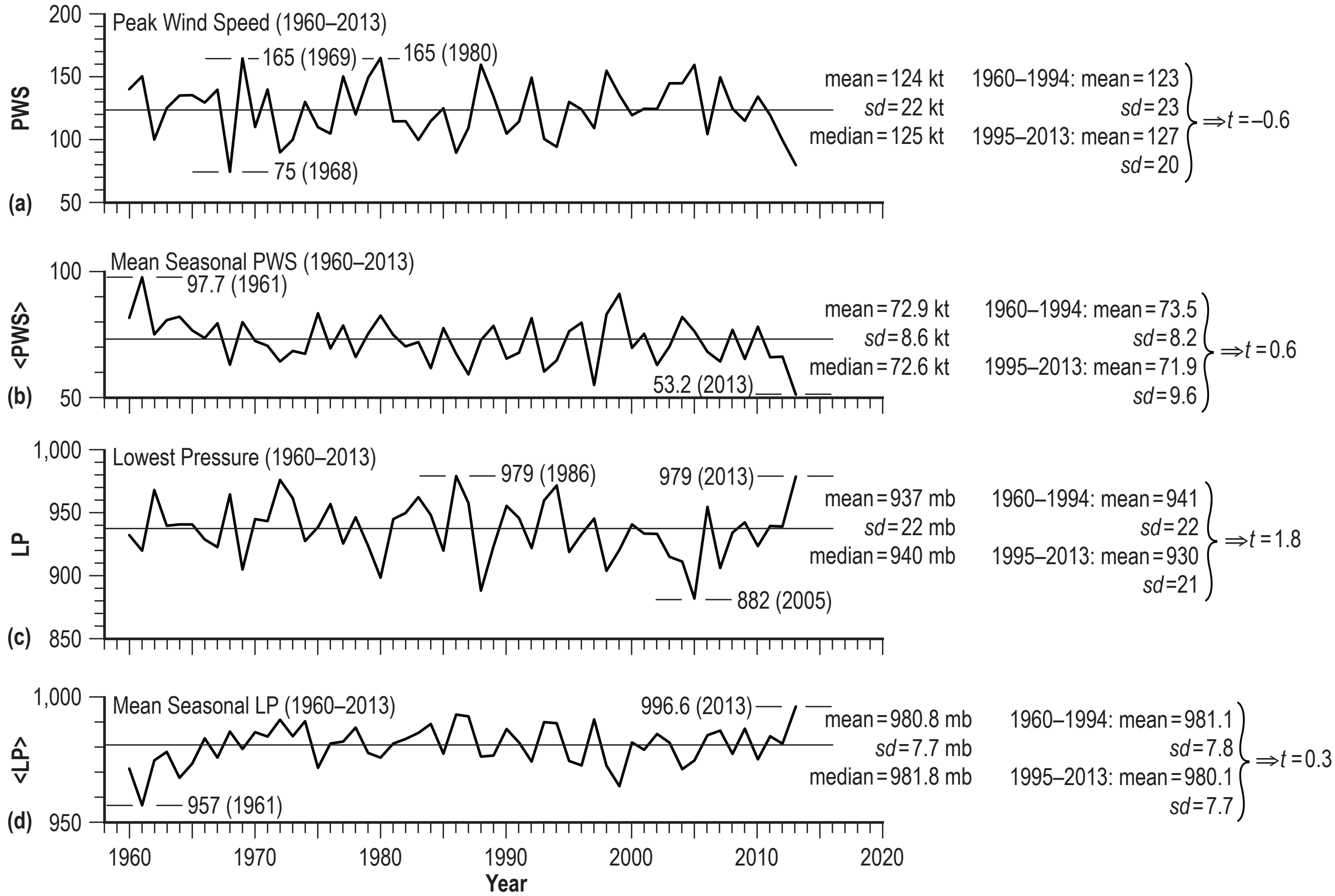

Figure 7. Variation of (a) PWS, (b) <PWS>, (c) LP, and (d) <LP> for the interval 1960–2013.

Concerning PWS, the mean PWS for the overall interval 1960–2013 is 124 kt (*sd* = 22 kt), with the highest yearly PWS (165 kt) occurring in 1969 (an ENY) and 1980 (a NENY), associated with Camille and Allen, respectively, and the lowest yearly PWS (75 kt) occurring in 1968 (a NENY), associated with Gladys. Comparison of the two subintervals reveals that, while the more recent subinterval 1995–2013 averages about 4 kt higher than the earlier subinterval 1960–1994, the difference in means is not statistically important (t = –0.6; cl < 90%).

For <PWS>, it averages about 72.9 kt ($sd = 8.6$ kt) for the overall interval 1960–2013, from a high of 97.7 kt in 1961 (a NENY) to a low of 53.2 kt in 2013 (a NENY). Comparison of the two subintervals reveals that, while <PWS> has actually decreased from a mean of 73.5 kt for the earlier subinterval 1960–1994 to 71.9 kt, for the more recent subinterval 1995–2013, the difference in the means is not statistically important ($t = 0.6$; $cl < 90\%$).

For LP, it averages about 937 mb ($sd = 22$ mb) for the overall interval 1960–2013. The lowest LP measured 882 mb in 2005 (a NENY), associated with Wilma, and the highest LP measured 979 mb in 1986 and 2013 (both NENYs), associated with Earl and Humberto, respectively. Comparison of the two subintervals reveals that, while the mean LP for the more recent subinterval 1995–2013 is about 11 mb lower than the mean for the earlier subinterval 1960–1994, the difference in the means is only of marginal statistical importance ($t = 1.8$; $cl > 90\%$).

For <LP>, it averages about 980.8 mb ($sd = 7.7$ mb) for the overall interval 1960–2013. The lowest <LP> measures 957 mb in 1961 (a NENY), and the highest <LP> measures 996.6 mb in 2013 (a NENY). Comparison of the two subintervals reveals that, while the mean <LP> for the more recent subinterval 1995–2013 is about 1 mb lower than the mean <LP> for the earlier subinterval 1960–1994, the difference in the means is not statistically important ($t = 0.3$; $cl < 90\%$).

Figure 8 displays the scatterplots of (a) LP versus PWS and (b) <LP> versus <PWS> for the interval 1960–2013. Obviously, the parameters are inversely related, associating low (high) values of LP and <LP> with high (low) values of PWS and <PWS>, respectively. Within each panel, the inferred regression equations are given, both in terms of using x and y as the independent variable. Hence, for LP versus PWS, the inferred regression is $y = 1{,}052.554 - 0.929x$, having $r = -0.921$, $r^2 = 0.847$, $se = 8.705$, and cl » 99.9%, while for PWS versus LP, the inferred regression is $x = 979.461 - 0.913y$, having $r = -0.921$, $r^2 = 0.847$, $se = 8.597$, and cl » 99.9%. As an example, given a tropical cyclone having PWS = 150 kt, one expects it to have LP = 913.2 ± 8.6 mb (the ±1 se prediction interval). Likewise, given a tropical cyclone having LP = 910 mb, one expects it to have PWS = 148.6 ± 8.7 kt. The strongest storm during the interval 1960–2013, based on its observed LP, is Wilma in 2005 (a NENY), having LP = 882 mb, inferring PWS = 174.2 ± 8.6 kt; its PWS actually measured only 160 kt. (Lowest pressure does not always occur concurrently with PWS or vice versa, owing to the evolving nature of tropical cyclones. Also, it should be noted that LP measurements, especially in the 1960s, are incomplete; consequently, the listed LP for a specific tropical cyclone may not be truly representative of the LP for that specific tropical cyclone. A case in point is the LP for major hurricane Ethel in 1960, which is listed as 981 mb; in reality, it should be considerably lower given its PWS = 140 kt.)

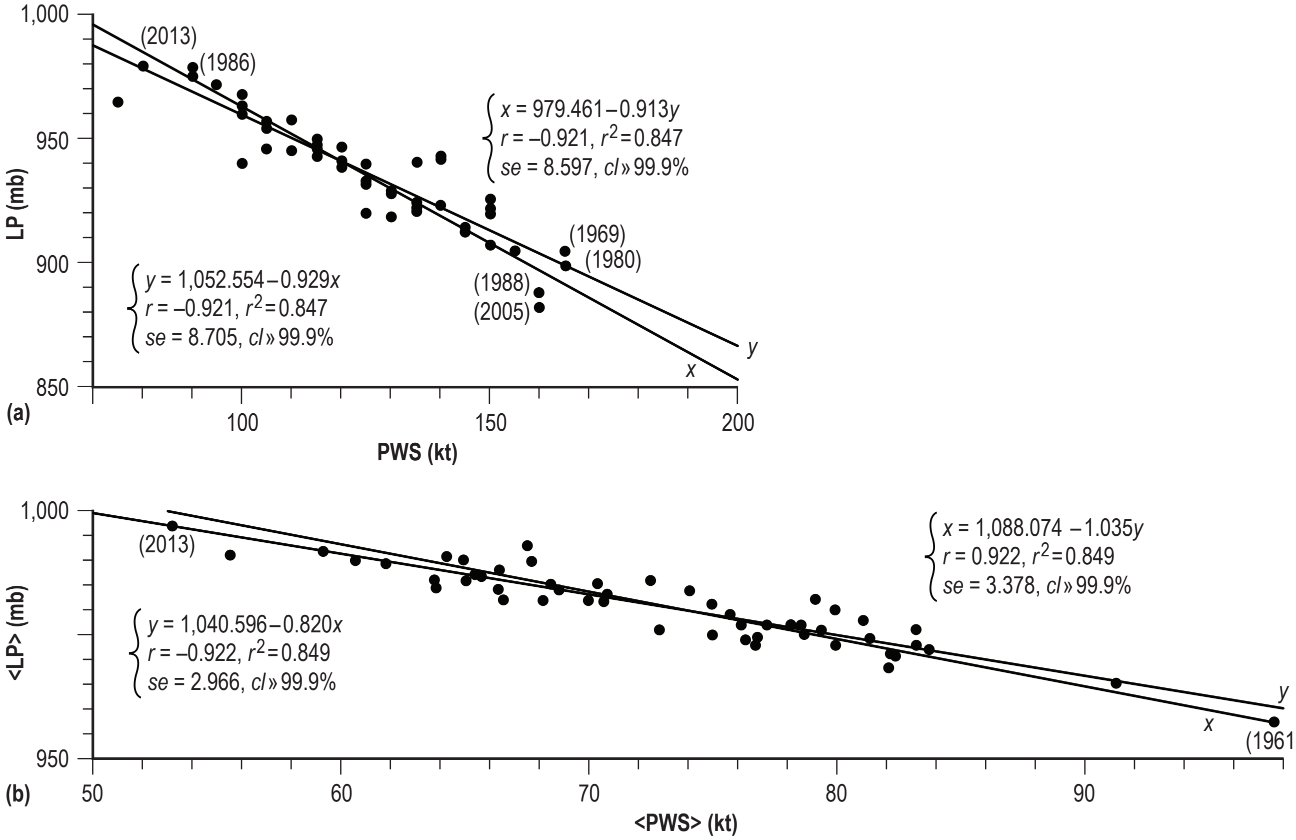

Figure 8. Scatterplots of (a) LP versus PWS and (b) <LP> versus <PWS>.

Similarly, one finds that the year 2013 (a NENY) is the weakest yearly season (based on <LP> and <PWS>) during the interval 1960–2013, having <LP> = 996.6 mb and <PWS> = 53.2 kt. From the inferred regression equations, given its <LP> = 996.6 mb, one should have expected it to have <PWS> = 56.6 ± 3.4 kt, or given its <PWS> = 53.2 kt, one should have expected it to have <LP> = 997.0 ± 3.0 mb. The strongest yearly season (based on <LP> and <PWS>) during the interval 1960–2013 is the year 1961 (a NENY), having <LP> = 957.0 mb and <PWS> = 97.7 kt. From the inferred regression equations, given its <LP> = 957.0 mb, one should have expected it to have <PWS> = 97.6 ± 3.4 kt, or given its <PWS> = 97.7 kt, one should have expected it to have <LP> = 960.5 ± 3.0 mb.

For convenience, table 5 lists the 22 tropical cyclones that had PWS ≥ 140 kt, and table 6 lists the 39 tropical cyclones that had LP ≤ 935 mb during the interval 1960–2013. Clearly, all tropical cyclones that met these criteria were classified as major hurricanes (MHs). From table 5, one finds that there were 6 that occurred in the 1960s, 3 in the 1970s, 3 in the 1980s, 2 in the 1990s, and 8 since 2000, with the last MH that occurred with PWS ≥ 140 kt being Felix in 2007. On average, one expects one such tropical cyclone about once every 2–3 years. Also, one finds that only one occurred in July (Emily, 2005), and three occurred in October (Hattie, 1961; Mitch, 1988; and Wilma, 2005), with the bulk occurring in August (8) and September (10).

Table 5. Tropical cyclones having PWS = 140 kt or higher (1960–2013).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat.	Genesis Location W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1960	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
	Ethel	MH	09/14	09/16	23.9	90.6	1	140	981	5.5	5.3	2.25	1.00	0.50	MS1
1961	Carla	MH	09/05	09/13	16.3	82.7	2	150	931	33.4	30.0	8.00	6.00	4.25	BTX4
	Hattie	MH	10/27	11/01	11.6	81.5	2	140	920	25.2	21.7	5.00	3.75	3.50	
1967	Beulah	MH	09/07	09/22	13.9	60.8	2	140	923	49.1	47.9	15.00	10.75	5.50	ATX3
1969	Camille	MH	08/14	08/22	19.4	82.0	1	165	905	29.8	23.5	6.00	3.25	2.25	LA5, MS5
1971	Edith	MH	09/07	09/17	12.7	69.1	2	140	943	13.5	16.4	9.75	3.75	1.00	LA2
1977	Anita	MH	08/30	09/03	26.8	89.8	1	150	926	13.6	12.8	4.00	3.25	1.00	
1979	David	MH	08/26	09/06	11.6	42.2	4	150	924	51.3	44.0	11.50	8.75	4.50	CFL2, DFL2, GA2, SC2
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
1988	Gilbert	MH	09/09	09/17	14.5	60.1	2	160	888	38.0	32.8	8.00	6.25	4.50	
1989	Hugo	MH	09/11	09/22	12.5	29.2	4	140	918	46.3	42.7	11.25	8.75	5.50	SC4, INC1
1992	Andrew	MH	08/17	08/27	12.3	42.0	4	150	922	31.5	28.4	9.75	4.50	3.50	CFL5, BFL4, LA3
1998	Mitch	MH	10/22	11/05	11.6	77.9	2	155	905	42.5	35.9	10.75	5.50	3.75	
2003	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
2004	Ivan	MH	09/03	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
2005	Emily	MH	07/12	07/21	11.0	46.8	4	140	929	35.7	32.9	9.25	7.00	4.25	
	Katrina	MH	08/24	08/30	24.5	76.5	3	150	902	22.1	20.0	6.00	4.00	2.25	CFL1, BFL1, LA3, MS3, AL1
	Rita	MH	09/18	09/25	22.2	72.3	3	155	897	29.5	25.1	6.50	4.25	3.25	BFL1, LA3, CTX2
	Wilma	MH	10/17	10/25	16.9	79.6	2	160	882	45.7	38.9	8.75	7.50	4.75	BFL3, CFL2
2007	Dean	MH	08/14	08/22	11.8	38.3	4	150	907	40.8	35.2	8.50	6.75	4.00	
	Felix	MH	09/01	09/05	12.1	59.4	4	150	930	22.1	18.0	4.25	3.00	2.00	

From table 6, one finds that there were 7 that occurred in the 1960s, 3 in the 1970s, 4 in the 1980s, 10 in the 1990s, and 14 since 2000, with the last MH that occurred with LP ≤ 935 mb being Igor in 2010. On average, one expects one such tropical cyclone about once every 1–2 years. Also, one finds that only two occurred in July (Dennis and Emily, 2005), four occurred in October (Hattie, 1961; Joan, 1988; Mitch, 1998; and Wilma, 2005), and two in November (Lenny, 1999; and Michelle, 2001), with the bulk occurring in August (13) and September (18).

Table 6. Tropical cyclones having LP = 935 mb or lower (1960–2013).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat.	Genesis Location W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1960	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
1961	Carla	MH	09/05	09/13	16.3	82.7	2	150	931	33.4	30.0	8.00	6.00	4.25	BTX4
	Esther	MH	09/11	09/26	14.4	36.7	4	125	927	55.5	52.2	15.00	9.75	8.50	
	Hattie	MH	10/27	11/01	11.6	81.5	2	140	920	25.2	21.7	5.00	3.75	3.50	
1966	Inez	MH	09/24	10/10	14.8	48.7	4	130	929	55.2	54.6	16.25	13.75	6.50	BFL1
1967	Beulah	MH	09/07	09/22	13.9	60.8	2	140	923	49.1	47.9	15.00	10.75	5.50	ATX3
1969	Camille	MH	08/14	08/22	19.4	82.0	1	165	905	29.8	23.5	6.00	3.25	2.25	LA5, MS5
1974	Carmen	MH	08/30	09/08	17.0	67.4	2	130	928	24.7	25.6	9.50	5.75	2.75	LA3
1977	Anita	MH	08/30	09/03	26.8	89.8	1	150	926	13.6	12.8	4.00	3.25	1.00	
1979	David	MH	08/26	09/06	11.6	42.2	4	150	924	51.3	44.0	11.50	8.75	4.50	CFL2, DFL2, GA2, SC2
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
1985	Gloria	MH	09/17	09/27	14.6	28.3	4	125	920	18.6	21.2	9.25	6.25	1.50	NC3, NY3, CT2, NH2, ME1
1988	Gilbert	MH	09/09	09/17	14.5	60.1	2	160	888	38.0	32.8	8.00	6.25	4.50	
	Joan	MH	10/11	10/23	10.1	45.0	4	125	932	18.6	23.7	12.25	5.00	2.00	
1989	Hugo	MH	09/11	09/22	12.5	29.2	4	140	918	46.3	42.7	11.25	8.75	5.50	SC4, INC1
1992	Andrew	MH	08/17	08/27	12.3	42.0	4	150	922	31.5	28.4	9.75	4.50	3.50	CFL5, BFL4, LA3
1995	Felix	MH	08/08	08/22	15.5	36.4	4	120	929	23.7	29.4	14.00	9.25	1.75	
	Luis	MH	08/29	09/11	11.6	29.0	4	120	935	57.3	53.5	13.50	11.75	8.00	
	Opal	MH	09/30	10/05	21.1	88.5	1	130	919	9.8	11.1	5.00	2.75	1.00	AFL3, IAL1
1996	Edouard	MH	08/22	09/03	13.2	31.6	4	125	933	54.3	49.3	12.00	10.50	7.75	
	Hortense	MH	09/07	09/15	15.4	58.3	4	120	935	19.5	21.8	8.50	6.25	2.00	
1998	Mitch	MH	10/22	11/05	11.6	77.9	2	155	905	42.5	35.9	10.75	5.50	3.75	
1999	Floyd	MH	09/08	09/17	15.3	48.2	4	135	921	29.9	29.4	9.25	6.25	3.00	NC2
	Gert	MH	09/12	09/23	14.2	31.9	4	130	930	44.9	42.3	11.00	9.50	6.00	
	Lenny	MH	11/14	11/21	16.4	79.9	2	135	933	19.7	19.9	6.75	4.75	2.00	
2001	Michelle	MH	11/01	11/05	15.8	83.1	2	120	934	15.7	15.7	5.00	3.50	2.00	
2002	Isidore	MH	09/18	09/26	17.1	78.1	2	110	934	15.0	17.8	8.75	3.75	1.75	
2003	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
2004	Ivan	MH	09/03	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
2005	Dennis	MH	07/05	07/11	13.0	65.9	2	130	930	19.4	18.8	5.75	4.00	2.50	AFL3, IAL1
	Emily	MH	07/12	07/21	11.0	46.8	4	140	929	35.7	32.9	9.25	7.00	4.25	
	Katrina	MH	08/24	08/30	24.5	76.5	3	150	902	22.1	20.0	6.00	4.00	2.25	CFL1, BFL1, LA3, MS3, AL1
	Rita	MH	09/18	09/25	22.2	72.3	3	155	897	29.5	25.1	6.50	4.25	3.25	BFL1, LA3, CTX2
	Wilma	MH	10/17	10/25	16.9	79.6	2	160	882	45.7	38.9	8.75	7.50	4.75	BFL3, CFL2
2007	Dean	MH	08/14	08/22	11.8	38.3	4	150	907	40.8	35.2	8.50	6.75	4.00	
	Felix	MH	09/01	09/05	12.1	59.4	4	150	930	22.1	18.0	4.25	3.00	2.00	
2008	Ike	MH	09/01	09/14	17.3	38.4	4	125	935	37.7	39.2	13.00	10.00	4.25	CTX2, LA1
2010	Earl	MH	08/25	09/04	14.3	29.7	4	125	927	26.7	27.7	10.50	6.00	3.50	
	Igor	MH	09/08	09/21	13.8	23.3	4	135	924	44.5	41.9	12.25	9.75	5.00	

2.5 Accumulated Cyclone Energy and Power Dissipation Index

Figure 9 displays the yearly seasonal variation of (a) ACE and (b) the total Power Dissipation Index (PDI) for the interval 1960–2013.[39–41] For each tropical cyclone in a yearly season, its ACE is computed as the sum of the squares of its measured maximum sustained wind speed at each of the four daily time points (i.e., at 0000, 0600, 1200, and 1800 hours) during its lifetime (i.e., when its wind speed is ≥34 kt and it is not classified as being extratropical; in units of 10^4 kt^2). The yearly seasonal total ACE then is simply the sum of each of the yearly seasonal individual tropical cyclone ACEs. As an example, the four tropical cyclones of 1983 had individual ACE values of 6.4 (Alicia), 3.1 (Barry), 4.3 (Chantal), and 3.6 (Dean), thus yielding a total ACE = 17.4, the lowest total ACE in the interval 1960–2013.

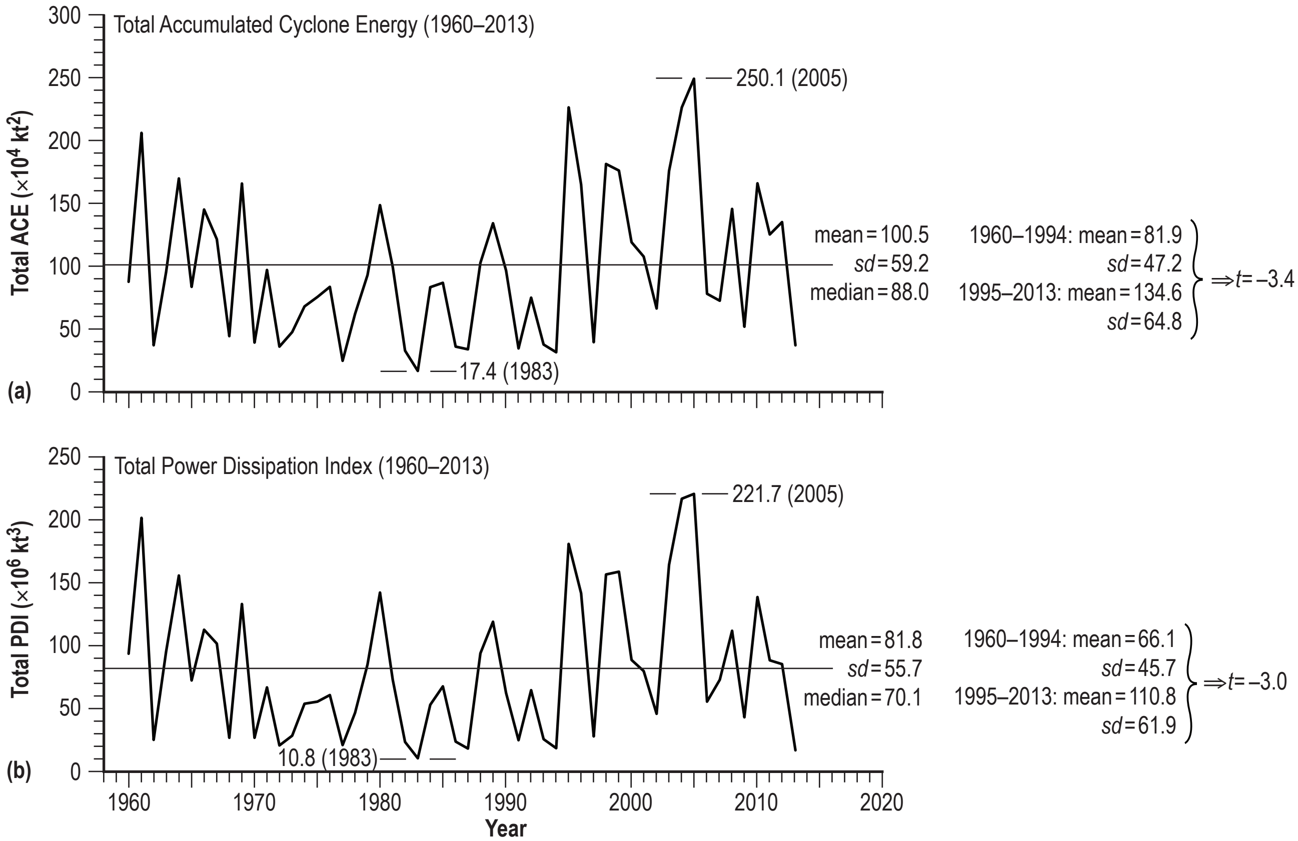

Figure 9. Variation of (a) total ACE and (b) total PDI for the interval 1960–2013.

Akin to total ACE is the total PDI, which is simply the sum of the cubes of the measured maximum sustained wind speed at each of the four daily time points during the lifetimes of the yearly seasonal tropical cyclones (in units of 10^6 kt^3). As an example, the four tropical cyclones of 1983 had individual PDI values of 4.9 (Alicia), 1.7 (Barry), 2.4 (Chantal), and 1.8 (Dean), thus yielding a total PDI = 10.8, the lowest total PDI in the interval 1960–2013.

For the total ACE, its mean measures 100.5, having $sd=59.2$ and a peak value of 250.1 in 2005 (a NENY). Comparison of the two subintervals reveals that the more recent subinterval 1995–2013 is about 64% larger (134.6) than the earlier subinterval 1960–1994 (81.9), and the difference in the means is statistically important ($t=-3.4$; $cl>99.8\%$). To the eye, the total ACE appears to vary cyclically, being greater in the 1960s and since 1995 as compared to the 1970s and 1980s, although the recent trend in the total ACE may now be towards lower values. (Runs-testing, however, suggests that the yearly seasonal values of the total ACE vary randomly.)

For the total PDI, its mean measures 81.8, having $sd=55.7$ and a peak value of 221.7 in 2005. Comparison of the two subintervals reveals that the more recent subinterval 1995–2013 is about 68% larger (110.8) than the earlier subinterval 1960–1994 (66.1), and the difference in the means is statistically important ($t=-3.0$; $cl>99.5\%$). As is the case for the total ACE, the total PDI appears to vary cyclically, being greater in the 1960s and since 1995 as compared to the 1970s and 1980s, although the trending for the total PDI may now be towards lower values. (In contrast to the total ACE, runs-testing suggests that the yearly seasonal values of the total PDI vary nonrandomly, having $z=-2.12$.)

Figure 10 shows the yearly seasonal variation of (a) the highest individual storm ACE (HISACE) and (b) the highest individual storm PDI (HISPDI) for the interval 1960–2013. For HISACE, its mean measures 30.9, having $sd=16.1$ and a peak of 70.4 (Ivan) in 2004 (an ENY), and for HISPDI, its mean measures 30.8, having $sd=20.2$ and a peak of 83.5 (Ivan) in 2004. Comparison of the two subintervals reveals that, while the more recent subinterval 1995–2013 is about 27% and 33% larger in terms of HISACE and HISPDI, respectively, than the earlier subinterval 1960–1994, the differences in the means are not statistically important. Both HISACE and HISPDI appear to vary randomly.

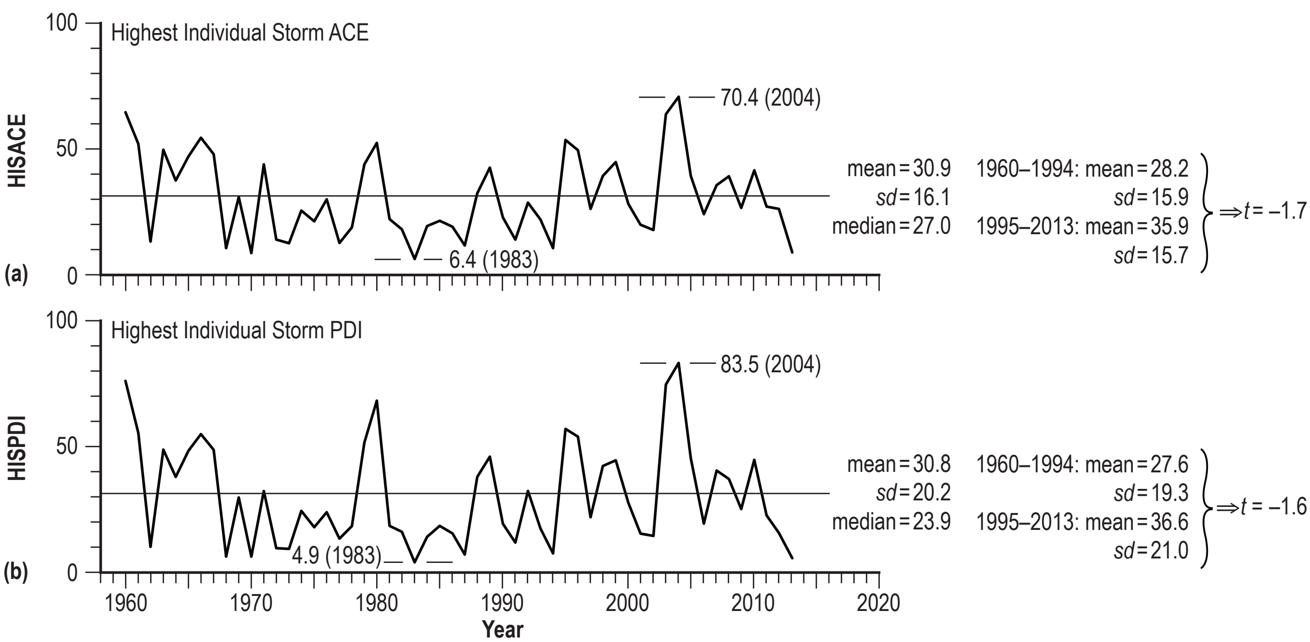

Figure 10. Variation of (a) HISACE and (b) HISPDI for the interval 1960–2013.

Figure 11 displays scatterplots of (a) the total PDI versus the total ACE and (b) the HISPDI versus the HISACE. All inferred correlations have $r \geq 0.980$ and $cl \gg 99.9\%$. Hence, given the yearly seasonal total ACE, one can easily estimate the total PDI (or vice versa), and given the yearly seasonal HISACE, one can easily estimate the HISPDI (or vice versa).

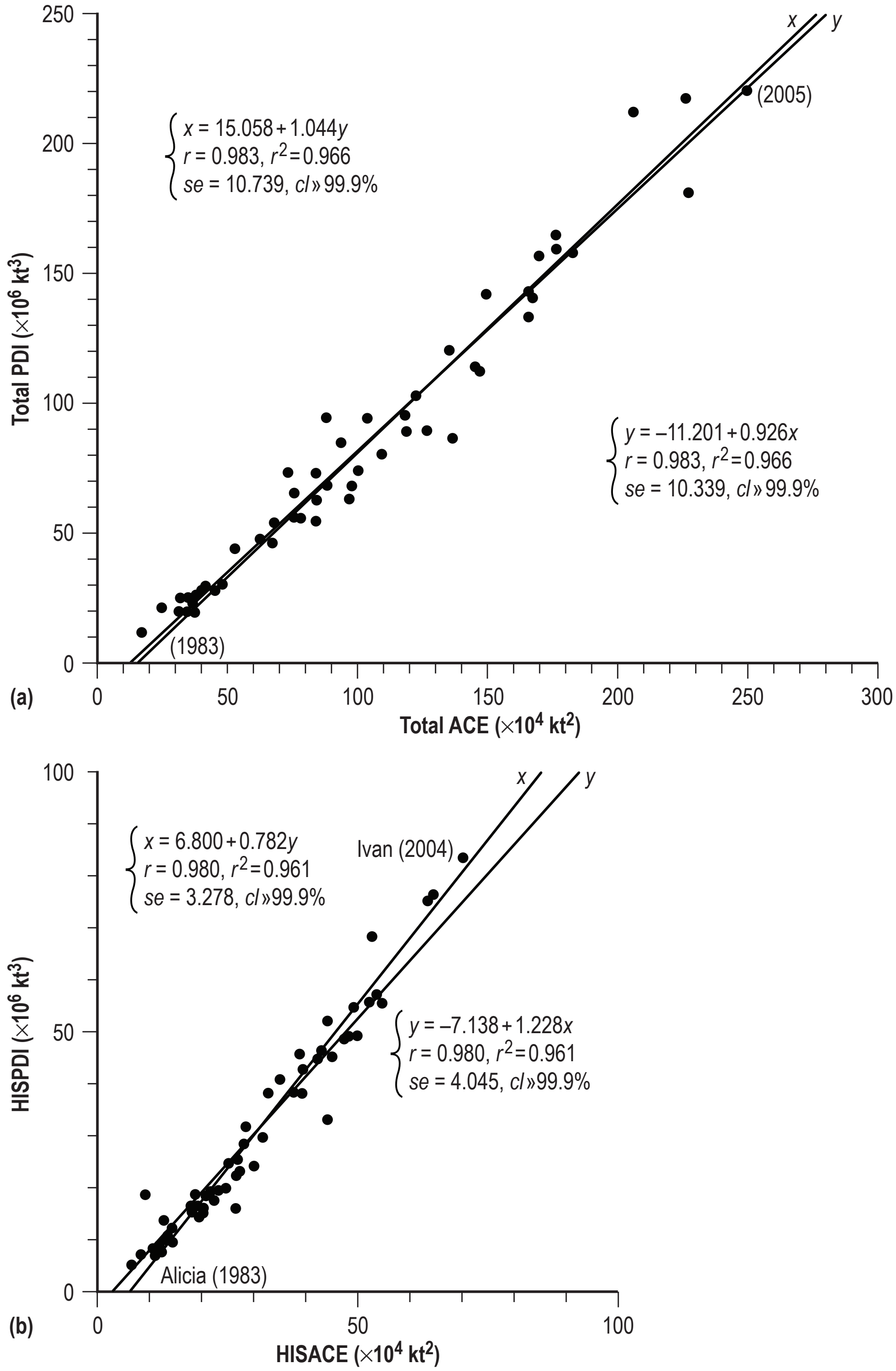

Figure 11. Scatterplots of (a) total PDI versus total ACE and (b) HISPDI versus HISACE.

Figure 12 depicts the variation of (a) the mean seasonal ACE (<ACE>) and (b) the mean seasonal PDI (<PDI>) for the interval 1960–2013. For <ACE>, its mean is 8.6, having $sd = 3.7$ and extremes of 18.7 in 1961 (a NENY) and 2.7 in 2013 (a NENY). Comparison of the means for the two subintervals reveals that the difference in means is not statistically important ($t = -0.3$; $cl < 90\%$). For <PDI>, its mean is 6.9, having $sd = 3.9$ and extremes of 18.3 in 1961 and 1.3 in 2013. Comparison of the means for the two subintervals reveals that the difference in means is not statistically important ($t = -0.4$; $cl < 90\%$). (The <ACE> or <PDI> is simply the average ACE or PDI per tropical cyclone within the yearly season; i.e., total ACE or PDI for a yearly season divided by the NTC for the same yearly season. As an example, for 1983 the four tropical cyclones had a total ACE and PDI of 17.4 and 10.8, respectively, thus yielding <ACE> = 4.4 and <PDI> = 2.7.)

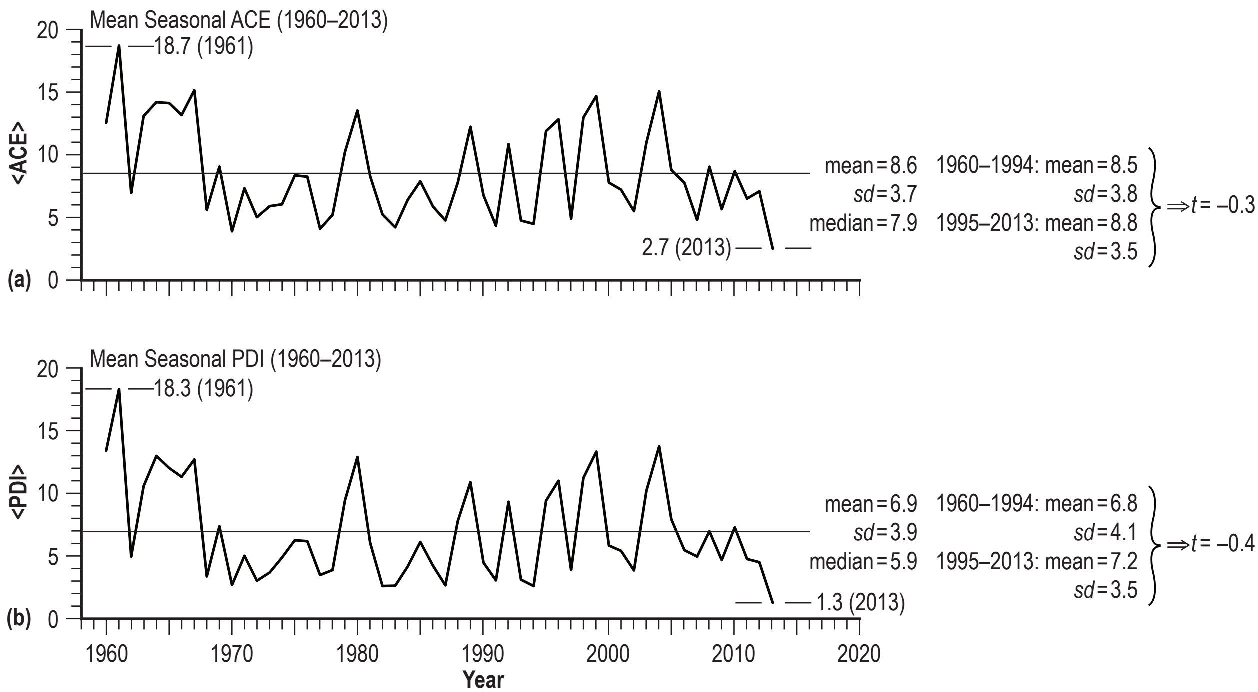

Figure 12. Variation of (a) <ACE> and (b) <PDI> for the interval 1960–2013.

Table 7 identifies the 22 tropical cyclones (all MHs except one: Ginger, 1971) that had individual ACE and/or PDI values >40. From table 7, one finds that there were 7 that occurred in the 1960s, 2 in the 1970s, 2 in the 1980s, 4 in the 1990s, and 7 since 2000, with the last MH that occurred with ACE and/or PDI ≥ 40 being Igor in 2010. On average, one expects one such tropical cyclone about once every 2–3 years. Also, one finds that only two occurred in October (Mitch, 1998; and Wilma, 2005), with the bulk occurring in August (10) and September (10).

Table 7. Tropical cyclones having ACE and/or PDI > 40 (1960–2013).

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat.	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1960	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
1961	Esther	MH	09/11	09/26	14.4	36.7	4	125	927	55.5	52.2	15.00	9.75	8.50	
1963	Flora	MH	09/29	10/12	10.0	52.8	4	125	940	49.1	49.4	13.25	12.75	6.25	
1965	Betsy	MH	08/29	09/11	19.2	63.4	2	135	941	48.8	47.0	12.75	11.75	7.50	CFL3, LA3
1966	Faith	MH	08/22	09/06	14.3	28.0	4	110	950	40.5	45.4	15.50	14.00	1.50	
	Inez	MH	09/24	10/10	14.8	48.7	4	130	929	55.2	54.6	16.25	13.75	6.50	BFL1
1967	Beulah	MH	09/07	09/22	13.9	60.8	2	140	923	49.1	47.9	15.00	10.75	5.50	ATX3
1971	Ginger	H	09/10	10/01	27.7	66.1	3	95	959	32.8	44.2	21.25	19.50	–	NC1
1979	David	MH	08/26	09/06	11.6	42.2	4	150	924	51.3	44.0	11.50	8.75	4.50	CFL2, DFL2, GA2, SC2
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
1989	Hugo	MH	09/11	09/22	12.5	29.2	4	140	918	46.3	42.7	11.25	8.75	5.50	SC4, INC1
1995	Luis	MH	08/29	09/11	11.6	29.0	4	120	935	57.3	53.5	13.50	11.75	8.00	
1996	Edouard	MH	08/22	09/03	13.2	31.6	4	125	933	54.3	49.3	12.00	10.50	7.75	
1998	Mitch	MH	10/22	11/05	11.6	77.9	2	155	905	42.5	35.9	10.75	5.50	3.75	
1999	Gert	MH	09/12	09/23	14.2	31.9	4	130	930	44.9	42.3	11.00	9.50	6.00	
2003	Fabian	MH	08/28	09/08	15.0	36.2	4	125	939	45.6	43.2	11.25	9.75	7.25	
	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
2004	Frances	MH	08/25	09/07	11.5	39.8	4	125	937	48.0	45.9	12.50	10.00	6.75	CFL2, BFL1
	Ivan	MH	0903	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
2005	Wilma	MH	10/17	10/25	16.9	79.6	2	160	882	45.7	38.9	8.75	7.50	4.75	BFL3, CFL2
2007	Dean	MH	08/14	08/22	11.8	38.3	4	150	907	40.8	35.2	8.50	6.75	4.00	
2010	Igor	MH	09/08	09/21	13.8	23.3	4	135	924	44.5	41.9	12.25	9.75	5.00	

2.6 Total Number of Storm Days, Hurricane Days, and Major Hurricane Days

Figure 13 displays the yearly seasonal total (a) number of storm days (NSD), (b) number of hurricane days (NHD), and (c) number of major hurricane days (NMHD) during the interval 1960–2013. Within each yearly season, the NSD for a single tropical cyclone is simply the number of days when its maximum sustained wind speed equals or exceeds 34 kt and it is not classified as extratropical. The sum of the individual NSD for all tropical cyclones during the yearly season gives the total NSD for that yearly season. For the year 1983, the four tropical cyclones had individual NSD of 2.75 days (Alicia), 3.00 days (Barry), 4.00 days (Chantal), and 4.00 days (Dean), thus yielding the total NSD = 13.75 days for 1983. Similarly, for 1983, the total NHD = 3.50 days (meaning that the maximum sustained wind speed equaled or exceeded 64 kt for 3.50 days) and the total NMHD = 0.25 day (meaning that the maximum sustained wind speed equaled or exceeded 96 kt for 0.25 day).

For the total NSD, its mean is 58.12 days, having $sd = 32.44$ days and a peak of 191.25 days in 2010 (which also happens to be the warmest year on record, based on the Global Land-Ocean Temperature Index[42] for 1880–2013, and it was a NENY) and a minimum of 13.75 days in 1983 (an ENY). Comparison of the means for the two subintervals reveals that the more recent subinterval 1995–2013 is about 82% longer than the earlier subinterval 1960–1994 (82.05 days versus 45.12 days), and the difference in the means is statistically important ($t = -4.23$; $cl > 99.9\%$).

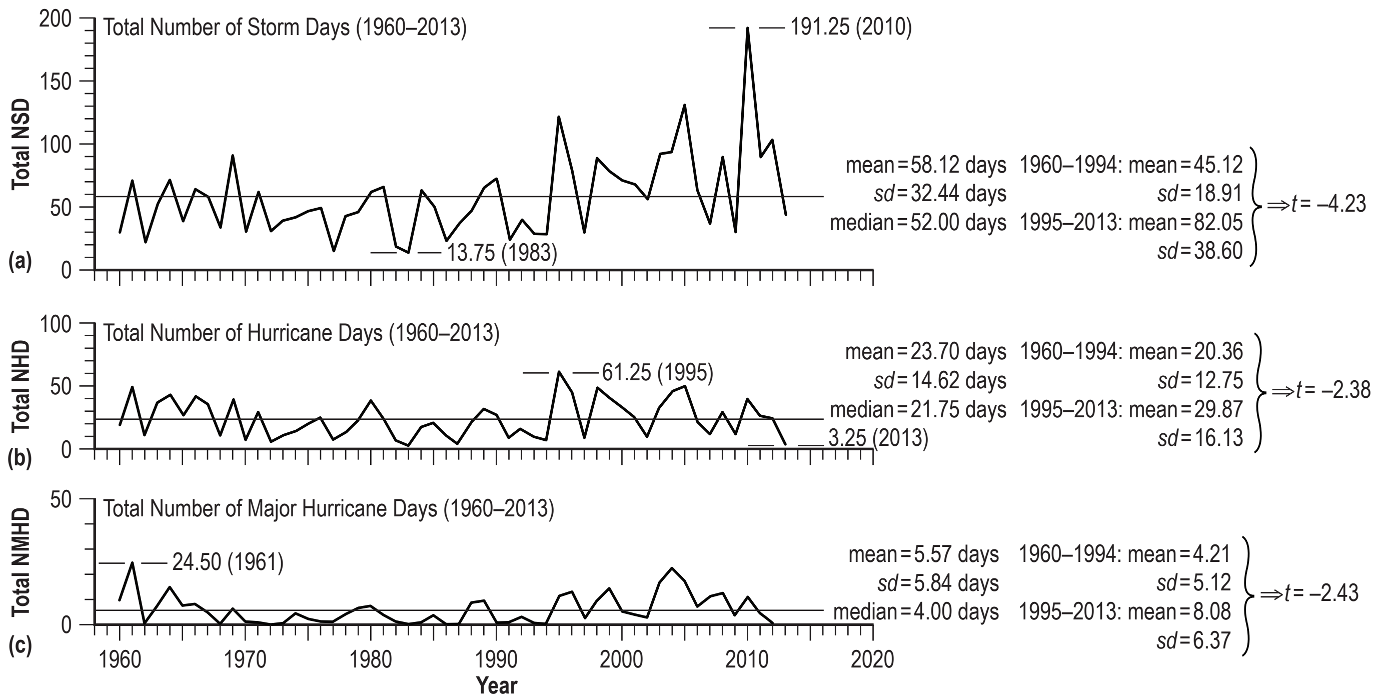

Figure 13. Variation of (a) total NSD, (b) total NHD, and (c) total NMHD for the interval 1960–2013.

For the total NHD, its mean is 23.70 days, having $sd = 14.62$ days and extremes of 61.25 days in 1995 (a NENY) and 3.25 days in 2013 (a NENY). Comparison of the means for the two subintervals reveals that the more recent subinterval 1995–2013 is about 47% longer than the earlier subinterval 1960–1994 (29.87 days versus 20.36 days), and the difference in the means is statistically important ($t = –2.38$; $cl > 95\%$).

For the total NMHD, its mean is 5.57 days, having $sd = 5.84$ days and extremes of 24.50 days in 1961 (a NENY) and 0 days in 1968 (a NENY), 1972 (an ENY), 1986 (a NENY), 1994 (a NENY), and 2013 (a NENY). Comparison of the means for the two subintervals reveals that the more recent subinterval 1995–2013 is about 92% longer than the earlier subinterval 1960–1994 (8.08 days versus 4.21 days), and the difference in the means is statistically important ($t = –2.43$; $cl > 98\%$). During the most recent subinterval, only the years 2012 and 2013 had NMHD < 1 day.

Figure 14 shows the variation of the mean seasonal NSD (<NSD>) for the interval 1960–2013. The <NSD> is simply the total NSD divided by the NTC for the same yearly season. As an example, the total NSD for 1983 is 13.75 days, and there were four tropical cyclones, thus yielding <NSD> = 3.44 days per tropical cyclone in 1983, on average. For <NSD>, its mean is 4.9 days per tropical cyclone per yearly season, having $sd = 1.3$ days per tropical cyclone per yearly season and extremes of 10.1 days per tropical cyclone per yearly season in 2010 (a NENY) and 2.5 days per tropical cyclone per yearly season in 1977 (an ENY). Comparison of the two subintervals reveals that, while the mean for the more recent subinterval 1995–2013 is about 12% longer than the mean for the earlier subinterval 1960–1994 (5.31 versus 4.74 days per tropical cyclone per yearly season), the difference in the means is not statistically important ($t = –1.50$; $cl < 90\%$).

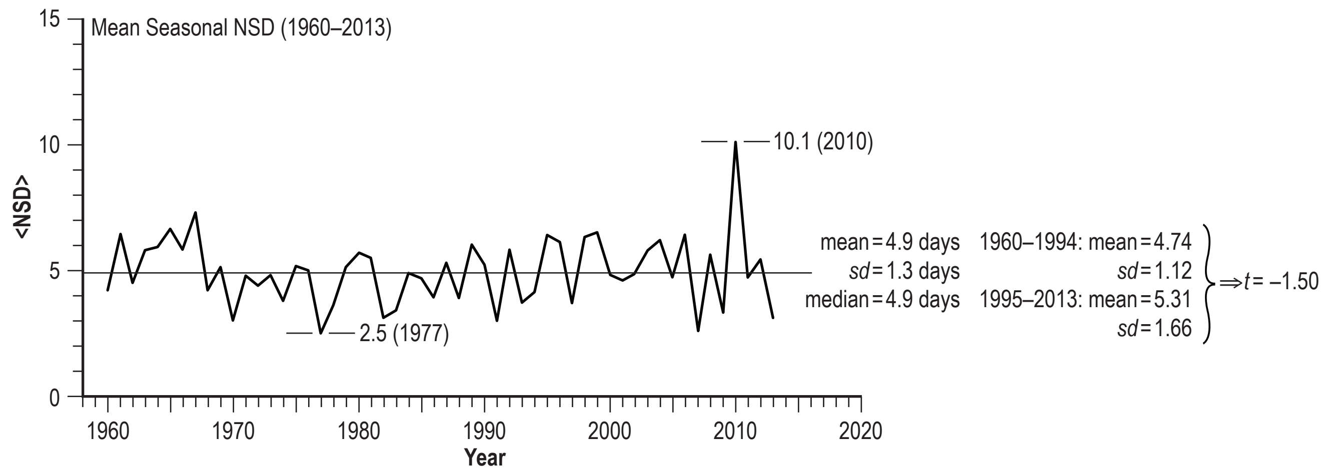

Figure 14. Variation of <NSD> for the interval 1960–2013.

Figure 15 depicts the yearly seasonal variation of the longest individual storm NSD (LISNSD) for the interval 1960–2013. The LISNSD is simply the longest NSD for an individual tropical cyclone in a yearly season. As an example, the LISNSD for the year 1983 measures 4.00 days, associated with both Chantal and Dean. For LISNSD, its mean is 11.76 days, having $sd = 3.74$ days and extremes of 21.25 days in 1971 (Ginger) and 4.00 days in 1977 (Anita) and 1983 (Chantal and Dean). Comparison of the two subintervals reveals that, while the mean for the more recent subinterval 1995–2013 is about 19% longer than the mean for the earlier subinterval 1960–1994 (13.09 versus 11.04 days), the difference in the means is only of marginal statistical importance ($t = -1.92$; $cl > 90\%$). (Although not shown, tropical cyclone Ginger in 1971 also had the longest NHD, 19.50 days, and tropical cyclone Ivan in 2004 had the longest NMHD, 10.00 days.)

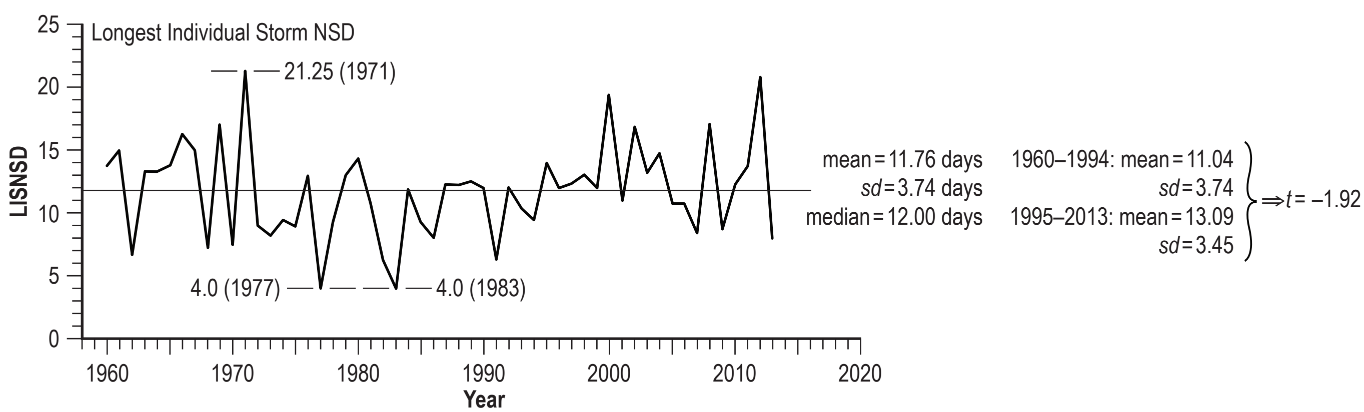

Figure 15. Variation of LISNSD for the interval 1960–2013.

Table 8 lists the 154 (25%) tropical cyclones having NSD ≥ 7 days that occurred in the interval 1960–2013. Examination of the table reveals that 27 occurred in the 1960s, falling to 16 in the 1970s, and growing in number each decade afterwards: 25 in the 1980s, 33 in the 1990s, 37 in the 2000s, and 16 thus far in the 2010s. Only one event originated in June, two in December, six each in July and November, and 17 in October. Overwhelmingly, the vast majority originate in August (48) and September (74). Of the 154 events, 87 became MHs, 60 of hurricane strength only, and 7 of tropical storm strength only (the longest being 8.50 days: Nicholas in 2003).

Table 8. Tropical cyclones having NSD = 7 days or more (1960–2013).

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat.	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1960	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
1961	Betsy	MH	09/02	09/11	13.3	41.7	4	120	945	31.3	32.2	9.75	8.50	2.75	
	Carla	MH	09/05	09/13	16.3	82.7	2	150	931	33.4	30.0	8.00	6.00	4.25	BTX4
	Debbie	MH	09/06	09/16	15.1	24.1	4	105	970	19.9	24.3	10.00	9.75	1.75	
	Esther	MH	09/11	09/26	14.4	36.7	4	125	927	55.5	52.2	15.00	9.75	8.50	
	Frances	MH	09/30	10/09	16.1	58.7	4	110	948	17.9	20.3	9.00	4.75	2.25	
1963	Beulah	MH	08/21	08/28	15.5	52.8	4	105	958	14.2	17.1	7.00	5.75	0.75	
	Flora	MH	09/29	10/12	10.0	52.8	4	125	940	49.1	49.4	13.25	12.75	6.25	
	Ginny	H	10/19	10/29	30.8	71.8	3	95	958	17.0	22.2	10.25	8.75	–	
1964	Cleo	MH	08/21	09/05	13.4	46.8	4	135	950	38.1	37.7	13.25	9.50	3.50	CFL2
	Dora	MH	09/01	09/14	11.7	47.0	4	115	942	32.8	35.4	13.00	8.25	4.00	DFL2
	Ethel	MH	09/04	09/15	18.0	37.0	4	100	969	19.2	23.9	11.25	8.50	0.50	
	Gladys	MH	09/13	09/24	15.4	46.0	4	125	945	32.6	34.4	11.25	10.25	2.75	
1965	Betsy	MH	08/29	09/11	19.2	63.4	2	135	941	48.8	47.0	12.75	11.75	7.50	CFL3, LA3
	Carol	H	09/17	10/01	12.4	30.7	4	85	974	14.9	22.4	13.75	10.50	–	
1966	Alma	MH	06/06	06/13	18.1	84.2	1	110	970	11.3	14.4	7.25	4.00	0.50	AFL2
	Dorothy	H	07/23	07/30	31.8	41.9	5	75	989	6.9	10.9	7.25	4.50	–	
	Faith	MH	08/22	09/06	14.3	28.0	4	110	950	40.5	45.4	15.50	14.00	1.50	
	Inez	MH	09/24	10/10	14.8	48.7	4	130	929	55.2	54.6	16.25	13.75	6.50	BFL1
1967	Beulah	MH	09/07	09/22	13.9	60.8	2	140	923	49.1	47.9	15.00	10.75	5.50	ATX3
	Chloe	H	09/08	09/21	22.7	38.0	5	95	958	24.5	30.6	13.00	11.00	–	
	Doria	H	09/09	09/17	27.8	79.2	3	75	973	8.6	13.0	8.25	5.50	–	
	Heidi	H	10/20	10/31	21.4	61.5	3	80	981	12.9	18.9	11.25	6.50	–	
1968	ST1	SS/H	09/16	09/23	34.8	67.6	3	70	979	5.9	9.9	7.25	1.75	–	
1969	Debbie	MH	08/15	08/25	14.0	41.5	4	105	951	26.0	28.9	10.25	8.50	3.25	
	Inga	MH	09/21	10/13	16.7	50.2	4	100	964	23.6	31.6	17.00	10.50	0.25	
	Kara	H	10/09	10/18	27.2	73.3	3	90	978	8.6	13.2	9.25	3.50	–	
1970	Unnamed	H	10/21	10/28	34.8	45.8	5	65	988	4.5	8.3	7.50	0.50	–	
1971	Edith	MH	09/07	09/17	12.7	69.1	2	140	943	13.5	16.4	9.75	3.75	1.00	LA2
	Ginger	H	09/10	10/01	27.7	66.1	3	95	959	32.8	44.2	21.25	19.50	–	NC1
	Laura	TS	11/14	11/21	16.6	82.5	2	60	994	4.7	8.6	7.50	–	–	
1972	Betty	H	08/24	09/01	37.2	56.2	5	90	976	9.8	13.9	9.00	3.25	–	

Table 8. Tropical cyclones having NSD = 7 days or more (1960–2013) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location			PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat.	W. Long.	Group								
1973	Ellen	MH	09/15	09/22	14.0	25.7	4	100	962	9.5	12.8	8.25	4.25	0.25	
	Gilda	TS	10/18	10/27	19.5	79.9	2	60	984	4.1	8.0	8.00	–	–	
1974	Carmen	MH	08/30	09/08	17.0	67.4	2	130	928	24.7	25.6	9.50	5.75	2.75	LA3
1975	Eloise	MH	09/16	09/23	19.0	65.6	2	110	955	7.5	10.6	8.00	1.75	0.50	AFL3, AL1
	Faye	H	09/19	09/29	20.0	39.0	5	90	977	8.3	11.8	8.25	3.50	–	
	Gladys	MH	09/24	10/03	13.5	40.4	4	120	939	18.1	21.4	9.00	8.00	1.25	
1976	Emmy	H	08/22	09/04	16.2	56.0	4	90	974	23.9	30.0	13.00	10.00	–	
1978	Flossie	H	09/04	09/15	14.2	41.2	4	85	976	7.7	11.7	9.25	3.25	–	
1979	David	MH	08/26	09/06	11.6	42.2	4	150	924	51.3	44.0	11.50	8.75	4.50	CFL2, DFL2, GA2, SC2
	Frederic	MH	08/30	09/14	11.5	36.0	4	115	943	15.9	20.7	13.00	4.00	1.25	AL3, MS3
	Gloria	H	09/06	09/15	22.0	33.8	5	85	975	12.6	17.4	8.75	7.00	–	
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
	Frances	MH	09/06	09/20	12.7	21.8	4	100	958	31.4	37.4	14.25	12.25	0.75	
	Ivan	H	10/04	10/11	35.6	24.6	5	90	970	15.6	18.6	7.25	6.00	–	
1981	Dennis	H	08/08	08/21	11.3	31.3	4	70	995	2.9	6.5	9.00	0.50	–	
	Emily	H	09/01	09/11	29.9	69.7	3	80	966	9.8	15.2	10.75	4.00	–	
	Floyd	MH	09/04	09/12	19.0	64.0	2	100	975	11.0	13.8	8.00	3.00	1.00	
	Irene	MH	09/23	10/02	12.5	40.8	4	105	959	19.0	22.2	9.00	6.25	1.50	
1984	Diana	MH	09/08	09/16	28.5	77.4	3	115	949	12.1	15.2	7.75	3.25	0.75	NC2
	Hortense	H	09/23	10/02	29.2	59.1	5	65	993	3.5	7.5	9.25	0.50	–	
	Josephine	H	10/08	10/18	24.1	71.4	3	90	965	14.1	19.5	10.25	7.00	–	
	Klaus	H	11/06	11/13	17.0	66.7	2	80	971	9.1	12.9	7.00	4.75	–	
	Lili	H	12/12	12/24	34.5	60.5	3	70	980	9.8	16.2	11.75	2.75	–	
1985	Gloria	MH	09/17	09/27	14.6	28.3	4	125	920	18.6	21.2	9.25	6.25	1.50	NC3, NY3, CT2, NH2, ME1
	Kate	MH	11/15	11/23	21.1	63.8	3	105	954	16.2	19.1	8.00	5.75	1.00	AFL2, IGA1
1986	Earl	H	09/11	09/18	22.4	51.6	5	90	979	16.0	19.7	8.00	7.25	–	
1987	Arlene	H	08/11	08/23	29.4	74.4	3	65	987	6.2	11.9	12.25	1.75	–	
	Dennis	TS	09/10	09/17	10.8	25.0	4	45	1,000	1.5	4.1	7.50	–	–	
1988	Gilbert	MH	09/09	09/17	14.5	60.1	2	160	888	38.0	32.8	8.00	6.25	4.50	
	Helene	MH	09/20	09/30	13.2	33.8	4	125	938	29.9	31.5	10.25	9.00	2.50	
	Joan	MH	10/11	10/23	10.1	45.0	4	125	932	18.6	23.7	12.25	5.00	2.00	
1989	Dean	H	08/01	08/09	15.8	49.3	4	90	968	11.8	15.9	8.25	6.00	–	
	Erin	H	08/19	08/27	18.5	32.7	4	90	968	10.7	14.2	7.50	4.50	–	
	Felix	H	08/26	09/09	17.2	22.9	4	75	979	5.5	9.7	9.25	2.00	–	
	Gabrielle	MH	08/31	09/12	11.3	24.8	4	125	937	38.5	38.2	12.50	9.25	4.25	
	Hugo	MH	09/11	09/22	12.5	29.2	4	140	918	46.3	42.7	11.25	8.75	5.50	SC4, INC1
1990	Gustav	MH	08/25	09/03	13.3	49.0	4	105	956	19.3	23.0	9.50	7.25	1.00	
	Isidore	H	09/05	09/17	10.0	32.7	4	80	979	12.9	19.5	12.00	8.25	–	
	Josephine	H	09/24	10/06	19.3	34.2	4	75	980	3.6	6.6	7.00	1.50	–	
	Lili	H	10/06	10/14	36.0	44.0	5	65	987	6.1	10.7	8.75	2.50	–	
1992	Andrew	MH	08/17	08/27	12.3	42.0	4	150	922	31.5	28.4	9.75	4.50	3.50	CFL5, BFL4, LA3
	Bonnie	H	09/18	09/30	33.7	58.0	5	95	965	17.9	23.1	12.00	5.75	–	
1993	Emily	MH	08/25	09/04	28.0	60.4	3	100	960	17.5	22.1	10.25	7.25	0.75	NC3

Table 8. Tropical cyclones having NSD = 7 days or more (1960–2013) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat.	Genesis Location W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1994	Chris	H	08/17	08/23	11.7	41.2	4	70	979	4.3	7.5	7.00	2.00	–	
	Gordon	H	11/10	11/20	14.6	82.7	2	75	980	4.3	8.4	9.50	1.00	–	
1995	Felix	MH	08/08	08/22	15.5	36.4	4	120	929	23.7	29.4	14.00	9.25	1.75	
	Humberto	H	08/22	09/01	13.7	34.3	4	95	968	17.6	22.5	10.00	8.50	–	
	Iris	H	08/22	09/04	13.3	50.6	4	95	965	16.3	22.7	12.75	7.50	–	
	Luis	MH	08/29	09/11	11.6	29.0	4	120	935	57.3	53.5	13.50	11.75	8.00	
	Marilyn	MH	09/13	09/22	11.8	52.7	4	100	950	17.3	21.6	9.25	7.75	0.50	
	Noel	H	09/27	10/07	12.1	40.6	4	65	987	6.2	11.1	9.75	2.50	–	
	Roxanne	MH	10/09	10/18	16.5	83.1	2	100	958	11.2	16.2	10.00	5.00	0.25	
1996	Bertha	MH	07/05	07/14	11.0	39.0	4	100	960	13.1	17.4	9.00	5.50	0.50	NC2
	Edouard	MH	08/22	09/03	13.2	31.6	4	125	933	54.3	49.3	12.00	10.50	7.75	
	Fran	MH	08/27	09/06	14.6	44.9	4	105	946	18.7	22.9	10.25	7.75	2.00	NC3
	Hortense	MH	09/07	09/15	15.4	58.3	4	120	935	19.5	21.8	8.50	6.25	2.00	
	Lili	MH	10/16	10/27	17.5	83.8	2	100	960	17.0	22.6	11.00	9.25	0.25	
1997	Erika	MH	09/03	09/15	12.3	47.1	4	110	946	22.3	26.6	12.25	7.25	2.25	
1998	Bonnie	MH	08/20	08/30	17.3	57.3	4	100	954	21.7	24.8	10.25	6.50	3.50	NC2
	Danielle	H	08/24	09/03	14.2	37.9	5	90	960	18.0	23.1	10.25	9.50	–	
	Georges	MH	09/16	09/29	10.6	31.3	4	135	937	37.6	39.4	13.00	11.25	2.00	BFL2, MS2
	Ivan	H	09/20	09/27	16.0	32.6	5	80	975	6.3	9.9	7.25	3.25	–	
	Jeanne	H	09/21	09/30	11.0	19.4	4	90	969	14.3	18.8	9.25	7.00	–	
	Mitch	MH	10/22	11/05	11.6	77.9	2	155	905	42.5	35.9	10.75	5.50	3.75	
1999	Cindy	MH	08/20	08/31	13.6	26.6	4	120	942	21.3	24.6	11.00	5.25	1.75	
	Dennis	H	08/24	09/05	22.4	70.0	3	90	962	14.5	20.2	12.00	5.75	–	
	Floyd	MH	09/08	09/17	15.3	48.2	4	135	921	29.9	29.4	9.25	6.25	3.00	NC2
	Gert	MH	09/12	09/23	14.2	31.9	4	130	930	44.9	42.3	11.00	9.50	6.00	
	Jose	H	10/18	10/25	10.9	52.8	4	85	979	6.4	10.1	7.25	2.25	–	
2000	Alberto	MH	08/04	08/23	12.0	22.3	4	110	950	28.1	36.9	19.25	11.75	1.00	
	Isaac	MH	09/22	10/01	12.3	25.9	4	120	943	26.3	28.4	9.75	7.75	2.75	
2001	Erin	MH	09/02	09/15	13.2	37.5	4	105	968	14.4	20.1	11.00	6.00	1.00	
	Felix	MH	09/11	09/18	18.6	47.7	4	100	962	12.3	15.2	7.25	4.50	0.50	
	Olga	H	11/24	12/03	29.3	50.3	5	80	973	7.0	10.7	8.50	2.75	–	
2002	Isidore	MH	09/18	09/26	17.1	78.1	2	110	934	15.0	17.8	8.75	3.75	1.75	
	Kyle	H	09/21	10/12	30.4	51.6	5	75	980	8.2	15.2	16.75	1.75	–	
	Lili	MH	09/23	10/04	12.1	54.6	4	125	940	13.7	16.5	9.25	3.25	1.25	LA1
2003	Claudette	H	07/08	07/16	14.8	70.0	4	75	982	5.1	9.2	8.25	0.75	–	BTX1
	Fabian	MH	08/28	09/08	15.0	36.2	4	125	939	45.6	43.2	11.25	9.75	7.25	
	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
	Kate	MH	09/27	10/07	21.0	44.2	5	110	952	17.7	21.9	10.25	6.00	1.50	
	Nicholas	TS	10/14	10/23	10.9	41.9	4	60	990	3.5	7.3	8.50	–	–	
2004	Frances	MH	08/25	09/07	11.5	39.8	4	125	937	48.0	45.9	12.50	10.00	6.75	CFL2, BFL1
	Ivan	MH	09/03	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
	Jeanne	MH	09/14	09/27	16.4	62.6	2	105	951	18.4	24.2	13.00	6.50	0.75	CFL3, BFL1, AFL1
	Karl	MH	09/16	09/24	11.2	32.1	4	125	938	28.5	28.4	8.25	7.00	3.50	
	Lisa	H	09/20	10/03	13.5	35.4	5	65	987	6.3	12.2	11.75	0.50	–	

Table 8. Tropical cyclones having NSD = 7 days or more (1960–2013) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat.	Genesis Location W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2005	Emily	MH	07/12	07/21	11.0	46.8	4	140	929	35.7	32.9	9.25	7.00	4.25	
	Franklin	TS	07/22	07/29	25.7	75.9	3	60	997	3.2	6.7	8.00	–	–	
	Irene	H	08/07	08/18	20.2	45.0	5	90	970	8.9	13.1	8.75	3.00	–	
	Maria	MH	09/02	09/10	21.1	49.4	5	100	962	10.3	14.3	8.00	4.75	0.25	
	Ophelia	H	09/07	09/17	27.9	78.8	3	75	976	9.8	15.7	10.75	3.75	–	NC1
	Wilma	MH	10/17	10/25	16.9	79.6	2	160	882	45.7	38.9	8.75	7.50	4.75	BFL3, CFL2
	Epsilon	H	11/29	12/08	31.5	49.2	5	75	981	8.3	13.4	9.25	5.00	–	
	Zeta	TS	12/30	01/06	24.2	36.1	5	55	994	3.1	6.3	7.00	–	–	
2006	Ernesto	H	08/25	09/01	13.7	65.8	2	65	985	2.8	5.7	8.00	0.25	–	
	Florence	H	09/05	09/12	16.8	46.1	4	80	974	5.9	9.6	7.75	2.75	–	
	Gordon	MH	09/11	09/20	20.9	56.3	5	105	955	18.3	22.2	9.50	8.00	1.25	
	Helene	MH	09/14	09/24	12.9	31.9	4	105	955	19.4	24.3	10.75	8.25	0.75	
2007	Dean	MH	08/14	08/22	11.8	38.3	4	150	907	40.8	35.2	8.50	6.75	4.00	
2008	Bertha	MH	07/03	07/20	13.1	24.0	4	105	955	20.1	28.4	17.00	7.50	0.75	
	Fay	TS	08/15	08/23	18.5	68.8	2	60	986	3.5	7.3	8.25	–	–	
	Gustav	MH	08/25	09/02	15.1	69.6	2	125	943	16.0	18.2	8.00	3.25	1.25	LA2
	Hanna	H	08/28	09/07	20.1	58.6	5	75	977	5.6	10.4	9.75	0.75	–	
	Ike	MH	09/01	09/14	17.3	38.4	4	125	935	37.7	39.2	13.00	10.00	4.25	CTX2, LA1
2009	Bill	MH	08/15	08/24	11.2	34.5	4	115	943	25.3	26.5	8.75	7.00	3.00	
2010	Earl	MH	08/25	09/04	14.3	29.7	4	125	927	26.7	27.7	10.50	6.00	3.50	
	Igor	MH	09/08	09/21	13.8	23.3	4	135	924	44.5	41.9	12.25	9.75	5.00	
	Julia	MH	09/12	09/20	13.1	22.1	4	120	948	13.0	15.5	8.00	3.50	1.25	
	Tomas	H	10/29	11/07	9.8	55.3	4	85	982	7.6	11.9	8.75	3.00	–	
2011	Irene	MH	08/21	08/28	15.0	59.0	4	105	942	15.4	18.8	8.00	6.25	0.50	NC1
	Katia	MH	08/30	09/10	11.0	29.6	4	120	942	22.5	27.0	11.50	9.50	1.25	
	Maria	H	09/07	09/16	11.9	37.5	4	70	983	4.8	9.2	9.00	1.00	–	
	Ophelia	MH	09/21	10/03	12.5	39.7	4	120	940	15.9	18.7	9.75	3.50	2.00	
	Philippe	H	09/24	10/08	11.1	26.1	4	80	976	9.3	15.9	13.75	2.50	–	
2012	Ernesto	H	08/02	08/10	13.0	53.6	4	85	973	5.4	9.2	8.00	1.25	–	
	Isaac	H	08/21	08/30	15.2	53.1	4	70	965	6.1	10.8	9.50	1.50	–	
	Leslie	H	08/30	09/11	13.8	42.6	4	70	968	7.8	16.3	12.00	3.25	–	
	Michael	MH	09/04	09/11	26.2	43.0	5	100	964	13.5	16.7	7.50	5.25	0.25	
	Nadine	H	09/12	10/03	17.5	44.8	4	80	978	15.6	26.3	20.75	5.25	–	
	Sandy	H	10/22	10/29	12.7	78.7	2	100	940	12.8	16.1	8.00	5.75	–	NJ1
2013	Humberto	H	09/09	09/18	13.3	22.4	4	80	979	5.3	8.9	8.00	1.75	–	

Table 9 lists the 62 (10%) tropical cyclones having NHD ≥ 7 days that occurred in the interval 1960–2013. Examination of the table reveals that 18 occurred in the 1960s, 5 in the 1970s, 7 in the 1980s, 16 in the 1990s, 14 in the 2000s, and just 2 thus far in the 2010s. The overwhelming majority of events originated in August (23) and September (33), with only two events originating in July and four events in October. Some 49 of the 62 events (79%) became MHs. (Although not shown separately in tabular form, from table 9, one finds that only 8 events had NMHD ≥ 7 days, including Donna in 1960, Esther in 1961, Betsy in 1965, Luis in 1995, Edouard in 1996, Fabian and Isabel in 2003, and Ivan in 2004.)

Table 9. Tropical cyclones having NHD = 7 days or more (1960–2013).

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat.	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1960	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
1961	Betsy	MH	09/02	09/11	13.3	41.7	4	120	945	31.3	32.2	9.75	8.50	2.75	
	Debbie	MH	09/06	09/16	15.1	24.1	4	105	970	19.9	24.3	10.00	9.75	1.75	
	Esther	MH	09/11	09/26	14.4	36.7	4	125	927	55.5	52.2	15.00	9.75	8.50	
1963	Flora	MH	09/29	10/12	10.0	52.8	4	125	940	49.1	49.4	13.25	12.75	6.25	
	Ginny	H	10/19	10/29	30.8	71.8	3	95	958	17.0	22.2	10.25	8.75	–	
1964	Cleo	MH	08/21	09/05	13.4	46.8	4	135	950	38.1	37.7	13.25	9.50	3.50	CFL2
	Dora	MH	09/01	09/14	11.7	47.0	4	115	942	32.8	35.4	13.00	8.25	4.00	DFL2
	Ethel	MH	09/04	09/15	18.0	37.0	4	100	969	19.2	23.9	11.25	8.50	0.50	
	Gladys	MH	09/13	09/24	15.4	46.0	4	125	945	32.6	34.4	11.25	10.25	2.75	
1965	Betsy	MH	08/29	09/11	19.2	63.4	2	135	941	48.8	47.0	12.75	11.75	7.50	CFL3, LA3
	Carol	H	09/17	10/01	12.4	30.7	4	85	974	14.9	22.4	13.75	10.50	–	
1966	Faith	MH	08/22	09/06	14.3	28.0	4	110	950	40.5	45.4	15.50	14.00	1.50	
	Inez	MH	09/24	10/10	14.8	48.7	4	130	929	55.2	54.6	16.25	13.75	6.50	BFL1
1967	Beulah	MH	09/07	09/22	13.9	60.8	2	140	923	49.1	47.9	15.00	10.75	5.50	ATX3
	Chloe	H	09/08	09/21	22.7	38.0	5	95	958	24.5	30.6	13.00	11.00	–	
1969	Debbie	MH	08/15	08/25	14.0	41.5	4	105	951	26.0	28.9	10.25	8.50	3.25	
	Inga	MH	09/21	10/13	16.7	50.2	4	100	964	23.6	31.6	17.00	10.50	0.25	
1971	Ginger	H	09/10	10/01	27.7	66.1	3	95	959	32.8	44.2	21.25	19.50	–	NC1
1975	Gladys	MH	09/24	10/03	13.5	40.4	4	120	939	18.1	21.4	9.00	8.00	1.25	
1976	Emmy	H	08/22	09/04	16.2	56.0	4	90	974	23.9	30.0	13.00	10.00	–	
1979	David	MH	08/26	09/06	11.6	42.2	4	150	924	51.3	44.0	11.50	8.75	4.50	CFL2, DFL2, GA2, SC2
	Gloria	H	09/06	09/15	22.0	33.8	5	85	975	12.6	17.4	8.75	7.00	–	
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
	Frances	MH	09/06	09/20	12.7	21.8	4	100	958	31.4	37.4	14.25	12.25	0.75	
1984	Josephine	H	10/08	10/18	24.1	71.4	3	90	965	14.1	19.5	10.25	7.00	–	
1986	Earl	H	09/11	09/18	22.4	51.6	5	90	979	16.0	19.7	8.00	7.25	–	
1988	Helene	MH	09/20	09/30	13.2	33.8	4	125	938	29.9	31.5	10.25	9.00	2.50	
1989	Gabrielle	MH	08/31	09/12	11.3	24.8	4	125	937	38.5	38.2	12.50	9.25	4.25	
	Hugo	MH	09/11	09/22	12.5	29.2	4	140	918	46.3	42.7	11.25	8.75	5.50	SC4, INC1
1990	Gustav	MH	08/25	09/03	13.3	49.0	4	105	956	19.3	23.0	9.50	7.25	1.00	
	Isidore	H	09/05	09/17	10.0	32.7	4	80	979	12.9	19.5	12.00	8.25	–	
1993	Emily	MH	08/25	09/04	28.0	60.4	3	100	960	17.5	22.1	10.25	7.25	0.75	NC3
1995	Felix	MH	08/08	08/22	15.5	36.4	4	120	929	23.7	29.4	14.00	9.25	1.75	
	Humberto	H	08/22	09/01	13.7	34.3	4	95	968	17.6	22.5	10.00	8.50	–	
	Iris	H	08/22	09/04	13.3	50.6	4	95	965	16.3	22.7	12.75	7.50	–	
	Luis	MH	08/29	09/11	11.6	29.0	4	120	935	57.3	53.5	13.50	11.75	8.00	
	Marilyn	MH	09/13	09/22	11.8	52.7	4	100	950	17.3	21.6	9.25	7.75	0.50	
1996	Edouard	MH	08/22	09/03	13.2	31.6	4	125	933	54.3	49.3	12.00	10.50	7.75	
	Fran	MH	08/27	09/06	14.6	44.9	4	105	946	18.7	22.9	10.25	7.75	2.00	NC3
	Lili	MH	10/16	10/27	17.5	83.8	2	100	960	17.0	22.6	11.00	9.25	0.25	

Table 9. Tropical cyclones having NHD = 7 days or more (1960–2013) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location			PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat.	W. Long.	Group								
1997	Erika	MH	09/03	09/15	12.3	47.1	4	110	946	22.3	26.6	12.25	7.25	2.25	
1998	Danielle	H	08/24	09/03	14.2	37.9	5	90	960	18.0	23.1	10.25	9.50	–	
	Georges	MH	09/16	09/29	10.6	31.3	4	135	937	37.6	39.4	13.00	11.25	2.00	BFL2, MS2
	Jeanne	H	09/21	09/30	11.0	19.4	4	90	969	14.3	18.8	9.25	7.00	–	
1999	Gert	MH	09/12	09/23	14.2	31.9	4	130	930	44.9	42.3	11.00	9.50	6.00	
2000	Alberto	MH	08/04	08/23	12.0	22.3	4	110	950	28.1	36.9	19.25	11.75	1.00	
	Isaac	MH	09/22	10/01	12.3	25.9	4	120	943	26.3	28.4	9.75	7.75	2.75	
2003	Fabian	MH	08/28	09/08	15.0	36.2	4	125	939	45.6	43.2	11.25	9.75	7.25	
	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
2004	Frances	MH	08/25	09/07	11.5	39.8	4	125	937	48.0	45.9	12.50	10.00	6.75	CFL2, BFL1
	Ivan	MH	09/03	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
	Karl	MH	09/16	09/24	11.2	32.1	4	125	938	28.5	28.4	8.25	7.00	3.50	
2005	Emily	MH	07/12	07/21	11.0	46.8	4	140	929	35.7	32.9	9.25	7.00	4.25	
	Wilma	MH	10/17	10/25	16.9	79.6	2	160	882	45.7	38.9	8.75	7.50	4.75	BFL3, CFL2
2006	Gordon	MH	09/11	09/20	20.9	56.3	5	105	955	18.3	22.2	9.50	8.00	1.25	
	Helene	MH	09/14	09/24	12.9	31.9	4	105	955	19.4	24.3	10.75	8.25	0.75	
2008	Bertha	MH	07/03	07/20	13.1	24.0	4	105	955	20.1	28.4	17.00	7.50	0.75	
	Ike	MH	09/01	09/14	17.3	38.4	4	125	935	37.7	39.2	13.00	10.00	4.25	CTX2, LA1
2009	Bill	MH	08/15	08/24	11.2	34.5	4	115	943	25.3	26.5	8.75	7.00	3.00	
2010	Igor	MH	09/08	09/21	13.8	23.3	4	135	924	44.5	41.9	12.25	9.75	5.00	
2011	Katia	MH	08/30	09/10	11.0	29.6	4	120	942	22.5	27.0	11.50	9.50	1.25	

2.7 Net Tropical Cyclone Activity

Figure 16 displays the yearly seasonal Net Tropical Cyclone Activity (NTCA)[43] for the interval 1960–2013. The NTCA, developed by Dr. Brian McNoldy, a senior research associate at the University of Miami's (Florida) Rosentiel School of Marine and Atmospheric Science, is a parameter that uses the NTC, NSD, NH, NHD, NMH, and NMHD for a specific yearly season in comparison to long-term averages for the base period 1950–2000 (i.e., 9.6, 49.1 days, 5.9, 24.5 days, 2.3, and 5.0 days, respectively) to generate a percentage of relative activity. When the percentage is >100%, the yearly season is described as being more active than the base period, whereas when the percentage is <100%, the yearly season is described as being less active than the base period. For the interval 1960–2013, the mean of NTCA measures 109.6%, having $sd=60.7\%$ and extremes of 278.3% in 2005 (a NENY) and 30.5% in 1983 (an ENY). Comparison of the two subintervals reveals that the more recent subinterval 1995–2013 is about 67% more active than the earlier subinterval 1960–1994 (148.3% versus 88.6%), and the difference in the means is statistically important ($t=-3.9$; $cl>99.9\%$). As with total ACE and total PDI, to the eye, the NTCA's behavior appears cyclic, being greater in the 1960s and since 1995 and lesser in the 1970s and 1980s; however, runs-testing suggests that values of NTCA are distributed randomly ($z=-1.08$).

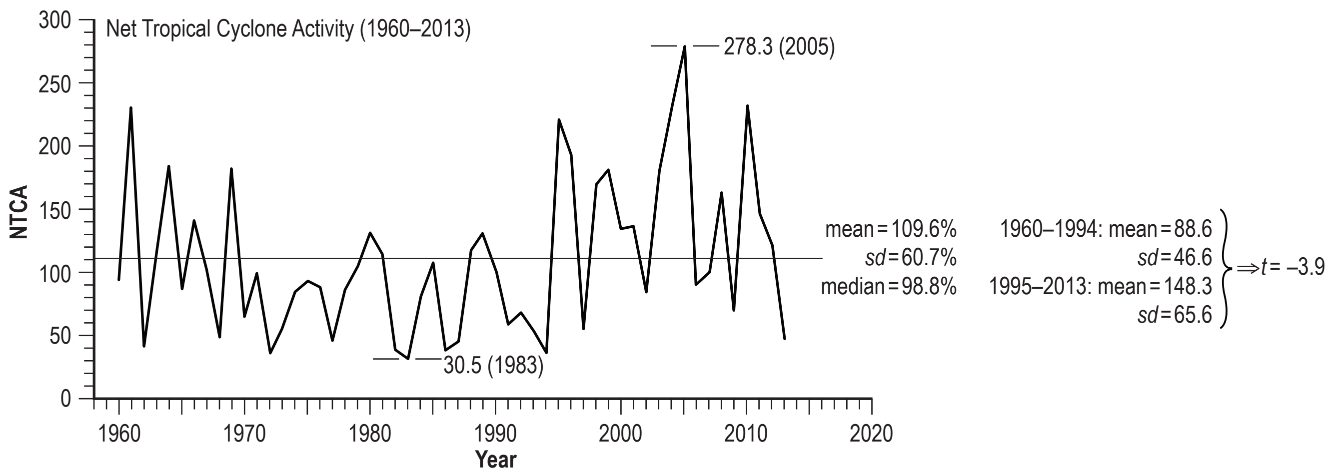

Figure 16. Variation of NTCA for the interval 1960–2013.

3. SUMMARY

With the launch of TIROS-1 in April 1960, a new era for monitoring the Earth's weather systems began, one especially well-suited for monitoring wind speeds and movements of tropical cyclones that form too far from the U.S. coastline for routine monitoring by reconnaissance aircraft. Over the years, tremendous strides have been made in instrumentation and, in particular, through the use of geostationary satellites for monitoring atmospheric temperature and moisture and cloud cover in the North Atlantic basin and in the Eastern Pacific. For the interval 1960–2013, the weather satellite era, some 615 tropical cyclones have been observed to form in the North Atlantic basin, including some 333 that became hurricanes (54%), with 132 becoming major hurricanes (21%), and 78 tropical cyclones (13%) striking the U.S. coastline with wind speeds of at least minimal hurricane strength (≥64 kt), causing loss of life and billions of dollars in destruction.[44] This TP has examined statistical aspects of some 25 parameters associated with these North Atlantic basin tropical cyclones. Part 2 (published separately) will examine the inferred statistical relationships between these 25 parameters and specific climate-related factors.

While the hurricane season is usually described as being the 183-day interval that spans June 1 to November 30 of each year, in reality, its start has occasionally been earlier and its end occasionally later, although clearly the bulk of tropical cyclone activity is found to occur during the months of August, September, and October. Indeed, evidence has been presented that the hurricane season appears to be lengthening, especially during the mid-1990s to the present, with storms now occurring both slightly earlier and ending slightly later. For the interval 1960–2013, one finds that the LOS is inversely related to the FSD, such that if the FSD of a yearly hurricane season occurs before (after) DOY = 177 (June 26), it is about 3 times more likely to have an LOS longer (shorter) than 131 days, inferring that the LSD likely will occur after (before) about DOY = 308 (November 4). Based on linear regression analysis, the inferred regression is given approximately as $y = 322 - 1.05x$, with $se = 24$ days. (As of the writing of this TP in mid-June 2014, the FSD for the 2014 season has not yet occurred.)

While the long-term mean for the interval 1960–2013 is about 11 tropical cyclones per yearly hurricane season, with $sd = 5$ and extremes of 4 (1983) and 28 (2005), the more recent subinterval 1995–2013 is found to be considerably more active than the preceding subinterval 1960–1994, averaging about 15 versus 9 tropical cyclones and having a lower extreme of only 8 events (1997). Also, during the more recent subinterval, it has averaged about 8 hurricanes per yearly season, as compared to about 5 for the previous subinterval. While true, the year 2013 saw the lowest NH for the entire 54-year interval 1960–2013, with only 2 of the 14 tropical cyclones becoming hurricanes (PWS ≥ 64 kt) and none becoming major hurricanes (PWS ≥ 96 kt). Based on Poisson statistics for the more recent subinterval 1995–2013, one expects the 2014 hurricane season to have NTC = 15 ± 4 ($P = 76\%$), NH = 8 ± 3 ($P = 79\%$), NMH = 3 ± 2 ($P = 87\%$), and NUSLFH = 2 ± 1 ($P = 72\%$). Instead, presuming that the year 2014 will be an ENY, one expects the 2014 hurricane season to have NTC = 9 ± 3 ($P = 76\%$), NH = 5 ± 2 ($P = 74\%$), NMH = 2 ± 1 ($P = 72\%$), and NUSLFH = 1 ± 1 ($P = 92\%$).

Regarding <LAT> for the overall interval 1960–2013, it has averaged 22.5° N., with *sd* = 3.3° and 14 of the 19 years in the more recent subinterval 1995–2013 having <LAT> equal to or below the long-term median of 22.0° N. Hence, one expects the <LAT> for the 2014 season probably to be ≤22.0° N. as well. Regarding <LONG>, it has averaged 63.5° W. (which is also the median value), with *sd* = 5.8°, but with only 10 of the 19 years in the more recent subinterval 1995–2013 having <LONG> ≤ 63.5° W. For the entire interval 1960–2013, one infers a strong direct correlation between <LAT> and <LONG>, such that when <LAT> < 22.0° N., one expects <LONG> ≤ 63.5° W. For the 2013 season, its values of <LAT> and <LONG> measured 21.5° N. and 58.7° W., respectively. While all subregions in the North Atlantic basin have shown increases in activity when comparing the more recent subinterval with the earlier subinterval, the regions of greatest increase are the regions of the Caribbean Sea (group 2) and the lower North Atlantic open ocean (group 4), with frequency increases of 150% and 88%, respectively.

Regarding PWS, <PWS>, LP, and <LP>, the long-term averages of these parameters are 124 kt, 72.9 kt, 937 mb, and 980.8 mb, respectively. While both PWS and LP perhaps suggest the occurrences of stronger storms in the more recent subinterval 1995–2013, as compared to the earlier subinterval 1960–1994 (127 kt versus 123 kt and 930 mb versus 941 mb), the mean seasonal averages, as expressed by <PWS> and <LP>, are found to be either weaker (as is the case for <PWS>, 71.9 kt versus 73.5 kt) or only slightly stronger (as is the case for <LP>, 980.1 mb versus 981.1 mb). Indeed, statistical testing suggests that the differences in the means are not statistically important. For 2013, PWS = 80 kt, the second lowest PWS in the overall interval 1960–2013 and the lowest since 1994 (95 kt); <PWS> = 53.2 kt, the lowest in the overall interval; LP = 979 mb, the highest LP in the overall interval; and <LP> = 996.6 mb, the highest <LP> in the overall interval. (Recall that PWS and LP, as well as <PWS> and <LP>, are inversely correlated, such that strong (weak) storms tend to have high (low) PWS and low (high) LP, and strong (weak) yearly seasons tend to have high (low) <PWS> and low (high) <LP>.)

Regarding the total ACE and total PDI, the long-term averages are 100.5 and 81.8, respectively, with both having peak values (250.1 and 221.7, respectively) in 2005. While the parametric means for the more recent subinterval 1995–2013 are considerably higher than for the preceding subinterval 1960–1994 (134.6 versus 81.9 and 110.8 versus 66.1, respectively), the trend now seems to be towards lower values. For 2013, the total ACE and total PDI measured 37.2 (the lowest since 1994 (32.1)) and 18.7 (the lowest since 1994 (19.2)), respectively. Because both the total ACE and total PDI are cumulative values based on the sums of individual storm ACE and PDI values, which are in themselves dependent on the duration and sustained wind speed of the yearly tropical cyclones, clearly, long-lived storms (i.e., those of long NSD) and storms of higher sustained wind speed produce higher individual storm ACE and PDI values, which when coupled with greater NTC, produces higher values of total ACE and total PDI. Since the NTC, NSD, and sustained wind speed (in the 6-hour intervals) are greater during the more recent subinterval than during the earlier subinterval, obviously, this seems to explain the observed variations in the total ACE and total PDI.

To determine whether individual tropical cyclones are now actually growing stronger with the passage of time, one should examine the HISACE and HISPDI. For the overall interval 1960–2013, the HISACE and HISPDI average 30.9 (*sd* = 16.1) and 30.8 (*sd* = 20.2), respectively, having peaks of 70.4 and 83.5, respectively, in 2004 (Ivan). Comparison of the two subintervals reveals that, while the more recent subinterval is about 27% and 33% larger, respectively, than the preceding subinterval, the differences in the means are not statistically important. Furthermore, runs-testing suggests that the overall variation of HISACE and HISPDI appears random.

Likewise, to determine whether individual hurricane seasons are actually getting stronger with the passage of time, one should examine the <ACE> and <PDI>. For the overall interval 1960–2013, the <ACE> and <PDI> average 8.6 ($sd = 3.7$) and 6.9 ($sd = 3.9$), respectively, having extremes of 18.7 (1961) and 2.7 (2013), and 18.3 (1961) and 1.3 (2013), respectively. Comparison of the two subintervals reveals that, while the more recent interval is about 4% and 6% larger, respectively, than the preceding subinterval, the differences in the means are not statistically important. Also, runs-testing suggests that the overall variation in <ACE> and <PDI> appears random.

Examination of the total NSD, total NHD, and total NMHD reveals that their overall means are about 58 days ($sd = 32$ days), 24 days ($sd = 15$ days), and 6 days ($sd = 6$ days), respectively. The longest total NSD measures 191.25 days in 2010, while the longest total NHD measures 61.25 days in 1995, and the longest total NMHD measures 24.50 days in 1961. Comparison of the two subintervals reveals that the means for the more recent subinterval are 82%, 47%, and 92% larger, respectively, than the means for the earlier subinterval and that the differences in the means appear to be statistically important. Runs-testing, however, suggests that each parameter varies randomly.

For <NSD>, one finds that its mean is 4.9 days per tropical cyclone per yearly season, having $sd = 1.3$ days per tropical cyclone per yearly season, with extremes of 10.1 days per tropical cyclone per yearly season in 2010 to only 2.5 days per tropical cyclone per yearly season in 1977. Comparison of the two subintervals reveals that, while the mean for the more recent subinterval is about 12% longer than the mean for the earlier subinterval, the difference in the means is not statistically important. Furthermore, runs-testing suggests that the variation of <NSD> is random.

For LISNSD, its mean is about 11.8 days, having $sd = 3.7$ days and extremes of 21.25 days in 1971 (Ginger) and 4.00 days in 1977 (Anita) and 1983 (Chantal and Dean). Comparison of the two subintervals reveals that, while the mean for the more recent subinterval is about 19% longer than the mean for the earlier subinterval, the difference in the means is only of marginal statistical importance. Runs-testing suggests that the variation of LISNSD is random.

For NTCA, its mean measures about 110%, having $sd = 61\%$ and extremes of 278% in 2005 and 31% in 1983. Comparison of the two subintervals reveals that the more recent subinterval is about 67% more active than the earlier subinterval and that the difference in means is highly statistically important ($cl > 99.9\%$). While variation of the NTCA values hints of being cyclic in nature (as does the total ACE and total PDI), runs-testing suggests instead that its variation is random.

APPENDIX

Table 10 provides a listing of the 615 tropical cyclones by year for the interval 1960–2013 and a summary for each year of the 25 parameters examined in this TP. Table 11 provides a convenient listing of the yearly parametric values and includes statistics (means and standard deviations) and the results of statistical testing. For USLFH, the state where landfall occurred and the strength of the hurricane at landfall are given.

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era).

Year	Name	Class.	FSD	LSD	Genesis Location		Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat	W. Long.									
1960	Unnamed	TS	06/23	06/24	24.7	96.3	1	40	1002	0.2	0.6	1.00	–	–	
	Abby	H	07/10	07/15	13.8	61.0	2	85	–	6.7	9.6	5.50	3.75	–	
	Brenda	TS	07/29	07/31	31.5	81.5	3	50	–	0.6	1.4	1.75	–	–	
	Cleo	H	08/17	08/21	24.4	75.5	3	80	–	3.8	5.6	3.50	1.75	–	
	Donna	MH	08/30	09/13	10.3	26.9	4	140	932	76.4	64.6	13.75	11.75	9.25	BFL4, NC3, NY3, DFL2, CT2, RI2, MA1, NH1, ME1
	Ethel	MH	09/14	09/16	23.9	90.6	1	140	981	5.5	5.3	2.25	1.00	0.50	MS1
	Florence	TS	09/18	09/19	21.2	66.8	3	40	–	0.3	0.9	1.75	–	–	

Summary: FSD = 175, LSD = 263, LOS = 89, NTC = 7, NH = 4, NMH = 2, NUSLFH = 2, <N. Lat.> = 21.4, <W. Long.> = 71.2, PWS = 140, <PWS> = 82.1, LP = 932, <LP> = 971.7, Total PDI = 93.5, <PDI> = 13.4, HISPDI = 76.4, Total ACE = 88.0, <ACE> = 12.6, HISACE = 64.6, Total NSD = 29.50, <NSD> = 4.21,LISNSD = 13.75,Total NHD = 18.25, Total NMHD = 9.75, NTCA = 92.9%

Year	Name	Class.	FSD	LSD	Genesis Location		Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat	W. Long.									
1961	Anna	MH	07/20	07/24	11.5	60.2	2	100	976	12.8	14.3	5.00	4.00	1.50	
	Betsy	MH	09/02	09/11	13.3	41.7	4	120	945	31.3	32.2	9.75	8.50	2.75	
	Carla	MH	09/05	09/13	16.3	82.7	2	150	931	33.4	30.0	8.00	6.00	4.25	BTX4
	Debbie	MH	09/06	09/16	15.1	24.1	4	105	970	19.9	24.3	10.00	9.75	1.75	
	Esther	MH	09/11	09/26	14.4	36.7	4	125	927	55.5	52.2	15.00	9.75	8.50	
	Unnamed	TS	09/14	09/15	34.7	77.9	3	35	–	0.2	0.6	1.25	–	–	
	Frances	MH	09/30	10/09	16.1	58.7	4	110	948	17.9	20.3	9.00	4.75	2.25	
	Gerda	TS	10/19	10/20	31.5	71.5	3	60	987	0.9	1.6	1.25	–	–	
	Hattie	MH	10/27	11/01	11.6	81.5	2	140	920	25.2	21.7	5.00	3.75	3.50	
	Jenny	H	11/06	11/08	28.8	47.0	5	70	974	2.3	3.9	2.75	1.00	–	
	Inga	TS	11/05	11/08	20.8	94.7	1	60	992	2.4	4.4	3.75	–	–	

Summary: FSD = 201, LSD = 312, LOS = 112, NTC = 11, NH = 8, NMH = 7, NUSLFH = 1, <N. Lat.> = 19.5, <W. Long.> = 61.5, PWS = 150, <PWS> = 97.7, LP = 920, <LP> 957.0, Total PDI = 201.8, <PDI> = 18.3, HISPDI = 55.5, Total ACE = 205.5, <ACE> = 18.7, HISACE = 52.2, Total NSD = 70.75, <NSD> = 6.43, LISNSD = 15.00, Total NHD = 47.50, Total NMHD = 24.50, NTCA = 230.4%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1962	Alma	H	08/27	08/30	30.6	79.7	3	85	986	3.6	5.2	3.25	1.50	–	
	Becky	TS	08/28	08/31	19.5	23.3	4	35	–	0.4	1.2	2.50	–	–	
	Celia	TS	09/12	09/20	16.4	48.7	4	60	995	1.0	2.8	3.75	–	–	
	Daisy	H	10/02	10/08	21.8	63.2	3	95	968	9.7	12.6	6.00	4.75	–	
	Ella	MH	10/15	10/22	25.0	72.1	3	100	950	10.5	13.7	6.75	4.50	0.50	

Summary: FSD = 239. LSD = 295, LOS = 57, NTC = 5, NH = 3, NMH = 1, NUSLFH = 0, <N. Lat.> = 22.7, <W. Long.> = 57.4, PWS = 100,
<PWS> = 75.0, LP = 968, <LP> = 974.8, Total PDI = 25.2, <PDI> = 5.0, HISPDI = 10.5, Total ACE = 35.5, <ACE> = 7.1,
HISACE = 13.7, Total NSD = 22.25, <NSD> = 4.45, LISNSD = 6.75, Total NHD = 10.75, Total NMHD = 0.50, NTCA = 40.9%

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1963&	Arlene	H	08/02	08/10	11.5	46.0	4	90	969	3.7	10.8	5.50	4.00	–	
	Beulah	MH	08/21	08/28	15.5	52.8	4	105	958	14.2	17.1	7.00	5.75	0.75	
	Unnamed	TS	09/11	09/14	34.8	59.7	5	50	992	1.4	2.9	3.50	–	–	
	Cindy	H	09/16	09/18	26.7	93.7	1	70	996	1.8	2.8	2.00	1.25	–	CTX1
	Debra	H	09/21	09/24	19.9	47.9	4	65	999	2.4	4.2	3.75	1.50	–	
	Edith	H	09/24	09/28	12.9	56.5	4	85	990	5.0	7.2	4.50	3.25	–	
	Flora	MH	09/29	10/12	10.0	52.8	4	125	940	49.1	49.4	13.25	12.75	6.25	
	Ginny	H	10/19	10/29	30.8	71.8	3	95	958	17.0	22.2	10.25	8.75	–	
	Helena	TS	10/25	10/28	15.3	59.4	4	45	1001	0.5	1.2	2.25	–	–	

Summary: FSD = 214, LSD = 302, LOS = 89, NTC = 9, NH = 7, NMH = 2, NUSLFH = 1, <N. Lat.> = 19.7, <W. Long.> = 60.1, PWS = 125,
<PWS> = 81.1, LP = 940, <LP> = 978.1, Total PDI = 95.1, <PDI> = 10.6, HISPDI = 49.1, Total ACE = 117.8, <ACE> = 13.1,
HISACE = 49.4, Total NSD = 52.00, <NSD> = 5.78, LISNSD = 13.25, Total NHD = 37.25, Total NMHD = 7.00, NTCA = 116.2%

					Genesis Location										
Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1964#	Unnamed	TS	06/07	06/11	32.5	78.6	3	50	–	1.3	3.1	4.50	–	–	
	Unnamed	TS	07/31	08/02	33.7	57.2	5	45	–	0.7	1.6	2.00	–	–	
	Abby	TS	08/07	08/08	28.5	94.4	1	55	1000	0.2	0.8	0.75	–	–	
	Brenda	TS	08/08	08/10	32.4	64.9	3	45	1006	0.8	1.9	2.50	–	–	
	Cleo	MH	08/21	09/05	13.4	46.8	4	135	950	38.1	37.7	13.25	9.50	3.50	CFL2
	Dora	MH	09/01	09/14	11.7	47.0	4	115	942	32.8	35.4	13.00	8.25	4.00	DFL2
	Ethel	MH	09/04	09/15	18.0	37.0	4	100	969	19.2	23.9	11.25	8.50	0.50	
	Florence	TS	09/08	09/10	21.4	29.4	5	40	–	0.6	1.5	2.50	–	–	
	Glayds	MH	09/13	09/24	15.4	46.0	4	125	945	32.6	34.4	11.25	10.25	2.75	
	Hilda	MH	09/29	10/04	22.0	84.2	1	130	941	20.4	18.9	5.00	3.75	2.75	LA3
	Isbell	MH	10/13	10/16	20.0	85.0	1	110	964	9.2	9.9	3.50	2.75	1.25	BFL2, CFL2
	Unnamed	TS	11/06	11/08	13.9	81.4	2	35	997	0.3	0.9	1.75	–	–	

Summary: FSD = 159, LSD = 313, LOS = 155, NTC = 12, NH = 6, NMH = 6, NUSLFH = 4, <N. Lat.> = 21.9, <W. Long.> = 62.7, PWS = 135,
<PWS> = 82.1, LP = 941, <LP> = 968.2, Total PDI = 156.2, <PDI> = 13.0, HISPDI = 38.1, Total ACE = 170.0, <ACE> = 14.2,
HISACE = 37.7, Total NSD = 71.25, <NSD> = 5.94, LISNSD = 13.25, Total NHD = 43.00, Total NMHD = 14.75, NTCA = 183.9%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	N. Lat (Genesis Location)	W. Long. (Genesis Location)	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1965&	Unnamed	TS	06/14	06/15	24.1	91.1	1	45	–	0.5	1.3	2.00	–	–	
	Anna	H	08/21	08/25	32.4	51.8	5	80	–	4.0	6.1	4.75	2.25	–	
	Betsy	MH	08/29	09/11	19.2	63.4	2								
	Carol	H	09/17	10/01	12.4	30.7									
	Debbie	TS	09/28	09/29	26.5	89.7									
	Elena	H	10/14	10/18	22.0	54.1									

Summary: FSD = 165, LSD = 291, LOS = 127, NTC = 6, NH = 4, NMH = 1, NUSLFH = 1, <N. Lat.> = 22.8, <W. Long.> = 63.5, PWS = 135, <PWS> = 76.7, LP = 941, <LP> = 973.3, Total PDI = 72.7, <PDI> = 12.1, HISPDI = 48.8, Total ACE = 84.4, <ACE> = 14.1, HISACE = 47.0, Total NSD = 39.50, <NSD> = 6.58, LISNSD = 13.75, Total NHD = 27.25, Total NMHD = 7.50, NTCA = 85.9%

Year	Name	Class.	FSD	LSD	N. Lat (Genesis Location)	W. Long. (Genesis Location)	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1966	Alma	MH	06/06	06/13	18.1	84.2									
	Becky	H	07/02	07/03	35.8	55.3									
	Celia	H	07/14	07/21	21.3	61.8									
	Dorothy	H	07/23	07/30	31.8	41.9									
	Ella	TS	07/24	07/28	16.8	52.2									
	Faith	MH	08/22	09/06	14.3	28.0									
	Greta	TS	09/04	09/06	19.8	59.0									
	Hallie	TS	09/21	09/		95.4									
	Inez	MH	09/24	10/10	14.8	48.7									
	Judith	TS	09/28	09/29	12.2	51.2									
	Lois	H	11/06	11/11		53.5									

Summary: FSD = 157, LSD = 315, LOS = 159, NTC = 11, NH = 7, NMH = 3, NUSLFH = 2, <N. Lat.> = 20.9, <W. Long.> = 57.4, PWS = 130, <PWS> = 74.1, LP = 929, <LP> = 983.6, Total PDI = 113.2, <PDI> = 11.4, HISPDI = 55.2, Total ACE = 145.1, <ACE> = 13.2, HISACE = 54.6, Total NSD = 64.00, <NSD> = 5.82, LISNSD = 16.25, Total NHD = 42.00, Total NMHD = 8.50, NTCA = 139.2%

Year	Name	Class.	FSD	LSD	N. Lat (Genesis Location)	W. Long. (Genesis Location)	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1967	Arlene	H	08/30	09/04	20.9	44.8									
	Beulah	MH	09/07	09/22	13.9	60.8									
	Chloe	H	09/08	09/21	22.7	38.0									
	Doria	H	09/09	09/17	27.8	79.2									
	Edith	TS	09/28	09/30	14.4	55.1									
	Fern	H	10/02	10/04	21.5	93.0									
	Ginger	TS	10/06	10/07	18.0	18.1									
	Heidi	H	10/20	10/31	21.4	61.5									

Summary: FSD = 242, LSD = 304, LOS = 63, NTC = 8, NH = 6, NMH = 1, NUSLFH = 1, <N. Lat.> = 20.1, <W. Long.> = 56.3, PWS = 140, <PWS> = 79.4, LP = 923, <LP> = 975.8, Total PDI = 101.5, <PDI> = 12.7, HISPDI = 49.1, Total ACE = 121.9, <ACE> = 15.2, HISACE = 47.9, Total NSD = 58.0, <NSD> = 7.25, LISNSD = 15.00, Total NHD = 36.25, Total NMHD = 5.50, NTCA = 100.8%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1968	Abby	H	06/02	06/07	21.4	84.8	1	65	965	3.1	5.7	5.00	0.75	–	
	Brenda	H	06/21	06/26	30.9	76.3	3	65	990	4.1	6.9	5.00	1.50	–	
	Candy	TS	06/23	06/24	26.4	96.6	1	60	999	0.3	0.6	0.50	–	–	
	Dolly	H	08/12	08/16	35.0	71.3	3	70	985	3.8	6.0	4.00	2.75	–	
	Edna	TS	09/15	09/18	15.8	34.9	4	55	1005	1.9	3.7	3.50	–	–	
	ST1	SS/H	09/16	09/23	34.8	67.6	3	70	979	5.9	9.9	7.25	1.75	–	
	Frances	TS	09/26	09/29	33.2	68.2	3	50	1001	1.0	2.1	2.50	–	–	
	Gladys	H	10/15	10/21	19.4	83.3	1	75	965	6.8	10.3	6.00	5.00	–	AFL2, DFL1

Summary: FSD = 154, LSD = 295, LOS = 142, NTC = 8, NH = 5, NMH = 0, NUSLFH = 1, <N. Lat.> = 27.1, <W. Long.> = 72.9, PWS = 75, <PWS> = 63.8, LP = 965, <LP> = 986.1, Total PDI = 26.9, <PDI> = 3.4, HISPDI = 6.8, Total ACE = 45.2, <ACE> = 5.7, HISACE = 10.3, Total NSD = 33.75, <NSD> = 4.22, LISNSD = 7.25, Total NHD = 11.75, Total NMHD = 0.00, NTCA = 47.5%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1969&	Anna	TS	07/27	08/03	11.2	36.0	4	60	1002	2.4	4.8	5.50	–	–	
	Blanche	H	08/11	08/12	32.5	71.1	3	75	997	1.6	2.2	1.25	1.00	–	
	Camille	MH	08/14	08/22	19.4	82.0	1	165	905	29.8	23.5	6.00	3.25	2.25	LA5, MS5
	Debbie	MH	08/15	08/25	14.0	41.5	4	105	951	26.0	28.9	10.25	8.50	3.25	
	Eve	TS	08/25	08/26	29.8	76.0	3	50	996	0.4	1.0	1.25	–	–	
	Francelia	MH	08/30	09/04	14.3	72.2	2	100	973	7.7	10.2	5.25	2.50	0.25	
	Gerda	MH	09/08	09/10	29.7	79.7	3	110	979	4.9	5.3	2.00	1.50	0.50	ME1
	Holly	H	09/15	09/18	12.7	48.5	4	75	984	3.4	5.5	4.00	2.25	–	
	Inga	MH	09/21	10/13	16.7	50.2	4	100	964	23.6	31.6	17.00	10.50	0.25	
	Unnamed	H	09/21	09/26	34.1	70.5	3	65	985	3.4	5.7	4.50	1.75	–	
	Unnamed	TS	09/25	09/30	35.0	38.5	5	60	990	3.2	5.7	4.50	–	–	
	ST1	SS/TS	09/29	10/01	24.0	85.7	1	50	998	0.8	1.6	1.75	–	–	
	Jenny	TS	10/02	10/03	25.5	82.1	1	40	1000	0.1	0.3	0.50	–	–	
	Kara	H	10/09	10/18	27.2	73.3	3	90	978	8.6	13.2	9.25	3.50	–	
	Laurie	H	10/19	10/24	21.5	89.5	1	90	973	6.0	8.5	5.25	2.75	–	
	Unnamed	TS	10/29	10/31	32.0	44.5	5	60	990	1.7	3.2	2.75	–	–	
	Unnamed	H	10/31	11/07	39.5	54.0	5	65	988	5.2	9.0	6.75	1.00	–	
	Martha	H	11/21	11/24	10.3	81.0	2	80	979	3.6	5.5	3.50	1.50	–	

Summary: FSD = 208, LSD = 328, LOS = 121, NTC = 18, NH = 12, NMH = 5, NUSLFH = 2, <N. Lat.> = 23.9, <W. Long.> = 65.4, PWS = 165, <PWS> = 80.0, LP = 905, <LP> = 979.6, Total PDI = 132.6, <PDI> = 7.4, HISPDI = 29.8, Total ACE = 165.7, <ACE> = 9.2, HISACE = 31.6, Total NSD = 91.25, <NSD> = 5.07, LISNSD = 17.00, Total NHD = 40.00, Total NMHD = 6.50, NTCA = 181.2%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1970#	Alma	H	05/20	05/22	15.5	82.5	2	70	993	1.2	2.2	2.25	0.50	–	
	Becky	TS	07/20	07/22	23.3	86.4	1	55	1003	0.9	1.9	2.00	–	–	
	Celia	MH	08/01	08/04	23.3	85.8	1	110	945	6.9	8.2	3.50	2.25	0.50	ATX3
	Unnamed	TS	08/18	08/18	37.0	72.5	3	60	992	0.6	1.1	1.00	–	–	
	Dorothy	TS	08/19	08/22	12.8	50.7	4	60	996	1.7	3.5	3.75	–	–	
	Ella	MH	09/10	09/13	22.0	89.0	1	110	967	5.2	6.1	2.75	2.00	0.50	
	Felice	TS	09/15	09/16	26.5	86.5									
	Greta	TS	09/26	09/27	22.4	75.4									
	Unnamed	H	10/13	10/17	25.9	65.5									
	Unnamed	H	10/21	10/28	34.8	45.8									

Summary: FSD = 140, LSD = 301, LOS = 162, NTC = 10, NH = 5, NMH = 2, NUSLFH = 1, <N. Lat.> = 24.4, <W. Long.> = 74.0, PWS = 110, <PWS> = 72.5 LP = 945, <LP> = 986.0, Total PDI = 26.5, <PDI> = 2.7, HISPDI = 6.9, Total ACE = 40.0, <ACE> = 4.0, HISACE = 8.3, Total NSD = 30.25, <NSD> 3.03, LISNSD = 7.50, Total NHD = 6.75, Total NMHD = 1.00, NTCA = 64.2%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1971#	Arlene	TS	07/05	07/07	36.7	72.9									
	Unnamed	H	08/05	08/07	40.5	58.5									
	Beth	H	08/14	08/16	34.4	72.3									
	Chloe	TS	08/20	08/21	14.3	63.5									
	Doria	TS	08/27	08/28	29.2	77.2									
	Edith	MH	09/07	09/17	12.7	69.1									
	Fern	H	09/08	09/12	26.9	92.6									
	Ginger	H	09/10	10/01	27.7	66.1									
	Heidi	TS	09/12	09/14	29.2	74.0									
	Irene	H	09/17	09/19	12.5	73.0									
	Janice	TS	09/22	09/24	12.0	45.8									
	Kristy	TS	10/20	10/21	33.5	52.8									
	Laura	TS	11/14	11/21	16.6	82.5									

Summary: FSD = 186, LSD = 325, LOS = 140, NTC = 13, NH = 6, NMH = 1, NUSLFH = 3, <N. Lat.> = 25.1, <W. Long.> = 69.3, PWS = 140, <PWS> = 70.4, LP = 943, <LP> = 984.6, Total PDI = 66.6, <PDI> = 5.1, HISPDI = 32.8, Total ACE = 96.8, <ACE> = 7.4, HISACE = 44.2, Total NSD = 61.75, <NSD> = 4.75, LISNSD = 21.25, Total NHD = 28.75, Total NMHD = 1.00, NTCA = 97.9%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location		Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat	W. Long.									
1972&	Alpha	SS/TS	05/26	05/27	34.0	73.5	3	60	991	1.1	2.1	2.00	–	–	
	Agnes	H	06/16	06/23	20.0	86.2	1	75	977	4.1	6.8	5.25	1.50	–	AFL1, NY1, CT1
	Betty	H	08/24	09/01	37.2	56.2	5	90	976	9.8	13.9	9.00	3.25	–	
	Carrie	TS	08/31	09/03	32.5	72.0	3	60	993	1.6	3.4	4.00	–	–	
	Dawn	H	09/06	09/12	27.3	77.9	3	70	997	3.6	6.6	6.25	1.25	–	
	Charli	SS/TS	09/20	09/21	39.5	59.0	5	55	1001	0.5	1.1	1.25	–	–	
	Delta	SS/TS	11/02	11/04	34.7	48.0	5	40	1001	0.7	1.8	3.00	–	–	

Summary: FSD = 147, LSD = 309, LOS = 163, NTC = 7, NH = 3, NMH = 0, NUSLFH = 1, <N. Lat.> = 32.2, <W. Long.> = 67.5, PWS = 90, <PWS> = 64.3, LP = 976, <LP> = 990.9, Total PDI = 21.2, <PDI> = 3.0, HISPDI = 9.8, Total ACE = 35.7, <ACE> = 5.1, HISACE = 13.9, Total NSD = 30.75, <NSD> = 4.39, LISNSD = 9.00, Total NHD = 6.00, Total NMHD = 0.00, NTCA = 35.1%

Year	Name	Class.	FSD	LSD	Genesis Location		Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat	W. Long.									
1973#	Alice	H	07/03	07/07	27.8	66.0									
	Alfa	SS/TS	07/31	08/01	35.0	72.5									
	Brenda	H	08/18	08/21	21.2	86.0									
	Christine	TS	08/28	09/03	10.5	30.0									
	Delia	TS	09/03	09/0		88.0									
	Ellen	MH	09/15	09/2		25.7									
	Fran	H	10/09	10/12		62.3									
	Gilda	TS	10/18	10/2		79.9									

Summary: FSD = 184, LSD = 300, LOS = 117, NTC = 8, NH = 4, NMH = 1, NUSLFH = 0, <N. Lat.> = 22.8, <W. Long.> = 63.8, PWS = 100, <PWS> = 68.8, LP = 962, <LP> = 984.3, Total PDI = 29.4, <PDI> = 3.7, HISPDI = 9.5, Total ACE = 47.9, <ACE> = 6.0, HISACE = 12.8, Total NSD = 38.75, <NSD> = 4.84, LISNSD = 8.25, Total NHD = 10.50, Total NMHD = 0.25, NTCA = 53.6%

Year	Name	Class.	FSD	LSD	Genesis Location		Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
					N. Lat	W. Long.									
1974#	ST1	SS/TS	06/25	06/25	25.4	86.2									
	ST2	SS/TS	07/17	07/19	35.0	68.8		45	1006	0.7	1.7	2.50	–		
	ST3	SS/TS	08/10	08/15	38.0	70.0									
	Alma	TS	08/13	08/15	10.1	52.0									
	Becky	MH	08/28	09/02	32.1	69.0									
	Carmen	MH	08/30	09/08	17.0	67.4									
	Dolly	TS	09/03	09/05	30.2	72.0									
	Elaine	TS	09/09	09/13	32.3	72.1									
	Fifi	H	09/16	09/22	17.0	77.8									
	Gertrude	H	09/28	10/02	10.8	51.8									
	ST4	SS/TS	10/06	10/08	23.8	77.0									

Summary: FSD = 176, LSD = 281, LOS = 106, NTC = 11, NH = 4, NMH = 2, NUSLFH = 1, <N. Lat.> = 24.7, <W. Long.> = 69.5, PWS = 130, <PWS> = 67.7, LP = 928, <LP> = 990.2, Total PDI = 54.2, <PDI> = 4.9, HISPDI = 24.7, Total ACE = 68.2, <ACE> = 6.2, HISACE = 25.6, Total NSD = 42.25, <NSD> = 3.84, LISNSD = 9.50, Total NHD = 14.25, Total NMHD = 4.25, NTCA = 83.1%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1975#	Amy	TS	06/29	07/04	34.4	75.8	3	60	981	3.6	6.5	5.50	–	–	
	Blanche	H	07/26	07/28	32.2	74.6	3	75	980	2.2	3.4	2.25	1.25	–	
	Caroline	MH	08/29	08/31	23.1	92.6	1	100	963	4.3	5.4	2.75	1.75	0.50	
	Doris	H	08/28	09/04	33.3	46.3	5	95	965	10.9	13.8	6.75	4.00	–	
	Eloise	MH	09/16	09/23	19.0	65.6	2	110	955	7.5	10.6	8.00	1.75	0.50	AFL3, AL1
	Faye	H	09/19	09/29	20.0	39.0	5	90	977	8.3	11.8	8.25	3.50	–	
	Gladys	MH	09/24	10/03	13.5	40.4	4	120	939	18.1	21.4	9.00	8.00	1.25	
	Hallie	TS	10/26	10/27	32.5	78.7	3	45	1002	0.3	0.7	1.00	–	–	
	ST2	SS/TS	12/09	12/12	41.6	42.9	5	60	985	1.2	2.5	3.00	–	–	

Summary: FSD = 180, LSD = 346, LOS = 167, NTC = 9, NH = 6, NMH = 3, NUSLFH = 1, <N. Lat.> = 27.7, <W. Long.> = 61.8, PWS = 120, <PWS> = 83.9, LP = 939, <LP> = 971.9, Total PDI = 56.4, <PDI> = 6.3, HISPDI = 18.1, Total ACE = 76.1, <ACE> = 8.5,

HISACE = 21.4, Total NSD = 46.50, <NSD> = 5.17, LISNSD = 9.00, Total NHD = 20.25, Total NMHD = 2.25, NTCA = 91.4%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1976	ST1	SS/TS	05/23	05/25	26.3	89.0	1	45	994	0.8	2.0	3.00	–	–	
	Anna	TS	07/30	08/01	29.8	42.0	5	40	999	0.5	1.3	2.50	–	–	
	Belle	MH	08/07	08/10	25.6	73.2	3	105	957	8.4	9.5	3.75	2.25	0.75	NY1
	Candice	H	08/18	08/24	33.4	67.5	3	80	964	5.7	8.8	6.00	3.50	–	
	Dottie	TS	08/19	08/21	25.0	81.7	1	45	996	0.4	1.0	1.75	–	–	
	Emmy	H	08/22	09/04	16.2	56.0	4	90	974	23.9	30.0	13.00	10.00	–	
	Frances	MH	08/28	09/04	14.7	45.3	4	100	963	11.6	14.7	6.75	5.50	0.25	
	ST3	SS/TS	09/14	09/15	31.0	81.2	3*	40	1011	0.2	0.7	1.25	–	–	
	Gloria	H	09/27	10/04	25.7	58.0	3	90	970	8.2	11.5	6.75	3.00	–	
	Holly	H	10/23	10/28	22.5	58.0	3	65	990	2.3	4.5	5.00	1.00	–	

Summary: FSD = 144, LSD = 302, LOS = 159, NTC = 10, NH = 6, NMH = 2, NUSLFH = 1, <N. Lat.> = 25.0, <W. Long.> = 65.2, PWS = 105, <PWS> = 70.0, LP = 957, <LP> = 981.8, Total PDI = 62.0, <PDI> = 6.2, HISPDI = 23.9, Total ACE = 84.0, <ACE> = 8.4, HISACE = 30.0, Total NSD = 49.75, <NSD> = 4.98, LISNSD = 13.00, Total NHD = 25.25, Total NMHD = 1.00, NTCA = 86.2%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1977&	Anita	MH	08/30	09/03	26.8	89.8	1	150	926	13.6	12.8	4.00	3.25	1.00	
	Babe	H	09/03	09/05	27.6	88.5	1	65	995	1.3	2.3	2.25	0.50	–	LA1
	Clara	H	09/08	09/11	35.1	71.7	3	65	993	2.0	3.7	3.50	0.75	–	
	Dorothy	H	09/27	09/29	30.9	65.8	3	75	980	2.2	3.4	2.25	1.25	–	
	Evelyn	H	10/14	10/15	30.9	64.9	3	70	994	1.5	2.4	1.75	1.00	–	
	Frieda	TS	10/17	10/18	17.2	83.9	2	50	1005	0.3	0.8	1.00	–	–	

Summary: FSD = 242, LSD = 291, LOS = 50, NTC = 6, NH = 5, NMH = 1, NUSLFH = 1, <N. Lat.> = 28.1, <W. Long.> = 77.4, PWS = 150, <PWS> = 79.2, LP = 926, <LP> = 982.2, Total PDI = 20.9, <PDI> = 3.5, HISPDI = 13.6, Total ACE = 25.4, <ACE> = 4.2, HISACE = 12.8, Total NSD = 14.75, <NSD> = 2.46, LISNSD = 4.00, Total NHD = 6.75, Total NMHD = 1.00, NTCA = 44.7%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1978	ST1	SS/TS	01/19	01/22	23.5	47.6	5	40	1002	0.6	1.7	3.00	–	–	
	Amelia	TS	07/31	07/31	26.4	97.4	1	45	1005	0.2	0.5	0.75	–	–	
	Bess	TS	08/06	08/08	23.9	94.0	1	45	1005	0.5	1.2	1.75	–	–	
	Cora	H	08/08	08/11	14.0	41.5	4	80	980	2.8	4.4	3.00	1.25	–	
	Debra	TS	08/28	08/29	28.7	94.1	1	50	1000	0.2	0.4	0.50	–	–	
	Ella	MH	08/30	09/05	27.3	63.1	3	120	956	18.7	19.2	6.00	5.00	2.50	
	Flossie	H	09/04	09/15	14.2	41.2	4	85	976	7.7	11.7	9.25	3.25	–	
	Greta	MH	09/14	09/19	12.5	67.5	2	115	947	10.3	11.6	5.00	2.75	1.00	
	Hope	TS	09/15	09/21	32.9	64.8	3	55	987	2.6	5.4	6.50	–	–	
	Irma	TS	10/04	10/05	35.1	31.5	5	45	1001	0.4	0.9	1.25	–	–	
	Juliet	TS	10/08	10/11	18.8	58.7									
	Kendra	H	10/29	11/01	24.2	73.2									

Summary: FSD = 212, LSD = 305, LOS = 94, NTC = 12, NH = 5, NMH = 2, NUSLFH = 0, <N. Lat.> = 23.5, <W. Long.> = 64.6, PWS = 120, <PWS> = 66.3, LP = 947, <LP> = 987.9, Total PDI = 47.2, <PDI> = 3.9, HISPDI = 18.7, Total ACE = 63.2, <ACE> = 5.3 HISACE = 19.2, Total NSD = 43.50, <NSD> = 3.63, LISNSD = 9.25, Total NHD = 13.50, Total NMHD = 3.50, NTCA = 85.1%
(ST1 is a statistical outlier)

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1979	Ana	TS	06/22	06/23	14.2	54.7									
	Bob	H	07/10	07/11	23.5	93.8									
	Claudette	TS	07/17	07/25	17.8	60.3									
	David	MH	08/26	09/06	11.6	42.2	4	150	9						
															SC2
	Elena	TS	08/30	09/01	26.8	91.8									
	Frederic	MH	08/30	09/14	11.5	36.0	4								
	Gloria	H	09/06	09/		33.8									
	Henri	H	09/16	09/1		92.2									
	ST1	SS/H	10/24	10/25		64.0									

Summary: FSD = 173, LSD = 298, LOS = 126, NTC = 9, NH = 6, NMH = 2, NUSLFH = 3, <N. Lat.> = 20.5, <W. Long.> = 63.2, PWS = 150, <PWS> = 76.1, LP = 924, <LP> = 977.4, Total PDI = 85.3, <PDI> = 9.5, HISPDI = 51.9, Total ACE = 92.9, <ACE> = 10.3, HISACE = 44.0, Total NSD = 45.75, <NSD> = 5.08, LISNSD = 13.00, Total NHD = 21.75, Total NMHD = 5.75, NTCA = 103.8%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1980	Allen	MH	08/02	08/11	11.0	42.8	4	165	899	68.6	52.3	9.50	8.00	6.50	ATX3
	Bonnie	H	08/14	08/19	14.7	37.3	4	85	975	6.0	8.8	5.25	3.75	–	
	Charley	H	08/21	08/25	34.0	68.0	3	70	989	2.9	5.1	4.50	1.25	–	
	Danielle	TS	09/05	09/06	29.4	93.4	1	50	1004	0.2	0.5	0.75	–	–	
	Earl	H	09/05	09/10	17.8	26.7	4	65	985	3.8	6.7	5.75	2.25	–	
	Frances	MH	09/06	09/20	12.7	21.8	4	100	958	31.4	37.4	14.25	12.25	0.75	
	Georges	H	09/07	09/08	34.4	67.9	3	70	993	1.8	2.8	2.00	1.00	–	
	Hermine	TS	09/21	09/25	15.1	81.6	2	60	993	2.3	4.5	4.50	–	–	
	Ivan	H	10/04	10/11	35.6	24.6	5	90	970	15.6	18.6	7.25	6.00	–	
	Jeanne	H	11/09	11/14	20.8	85.1	1	85	986	4.5	7.4	5.50	1.50	–	
	Karl	H	11/25	11/27	36.0	46.0	5	75	985	3.5	5.2	3.00	2.25	–	

Summary: FSD = 215, LSD = 332, LOS = 118, NTC = 11, NH = 9, NMH = 2, NUSLFH = 1, <N. Lat.> = 23.8, <W. Long.> = 54.1, PWS = 165, <PWS> = 83.2, LP = 899, <LP> = 976.1, Total PDI = 141.6, <PDI> = 12.9, HISPDI = 68.6, Total ACE = 149.3, <ACE> = 13.6, HISACE = 52.3, Total NSD = 62.25, <NSD> = 5.66, LISNSD = 14.25, Total NHD = 38.25, Total NMHD = 7.25, NTCA = 130.3%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1981	Arlene	TS	05/07	05/08	19.0	80.6									
	Bret	TS	06/29	07/01	36.0	65.0									
	Cindy	TS	08/03	08/05	38.7	64.9									
	Dennis	H	08/08	08/21	11.3	31.3									
	Emily	H	09/01	09/11	29.9	69.7									
	Floyd	MH	09/04	09/12	19.0	64.0									
	Gert	H	09/08	09/14	15.6	60.6									
	Harvey	MH	09/12	09/19	19.4	56.3									
	Irene	MH	09/23	10/02	12.5	40.8									
	Jose	TS	10/30	11/01	27.7	46.6									
	Katrina	H	11/04	11/07	18.3	81.4									
	ST3	SS/TS	11/12	11/17	31.0	74.0									

Summary: FSD = 127, LSD = 321, LOS = 195, NTC= 12, NH = 7, NMH = 3, NUSLFH = 0, <N. Lat.> = 23.2, <W. Long.> = 61.3, PWS = 115, <PWS> = 75.0, LP = 946, <LP> = 981.8, Total PDI = 72.8, <PDI> = 6.1, HISPDI = 19.0, Total ACE = 100.4, <ACE> = 8.4, HISACE = 22.2,, Total NSD = 66.00, <NSD> = 5.50, LISNSD = 10.75Total NHD = 22.50, Total NMHD = 3.75, NTCA = 112.6%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1982&	Alberto	H	06/03	06/04	22.8	85.0	1	75	985	1.2	2.1	1.75	0.50	–	
	ST1	SS/TS	06/18	06/20	28.7	82.8	1	60	984	1.8	3.0	2.25	–	–	
	Beryl	TS	08/28	09/02	13.9	22.7	4	60	989	2.9	5.3	5.00	–	–	
	Chris	TS	09/10	09/11	27.3	94.2	1	55	994	0.6	1.3	1.50	–	–	
	Debby	MH	09/14	09/20	23.5	71.9	3	115	950	16.6	18.2	6.25	5.25	1.25	
	Ernesto	TS	10/01	10/02	26.5	67.8	3	60	997	0.8	1.6	1.75	–	–	

Summary: FSD = 154, LSD = 275, LOS = 122, NTC = 6, NH = 2, NMH = 1, NUSLFH = 0, <N. Lat.> = 23.8, <W. Long.> = 70.7, PWS = 115, <PWS> = 70.8, LP = 950, <LP> = 983.2, Total PDI = 23.9, <PDI> = 2.7, HISPDI = 16.6, Total ACE = 31.5, <ACE> = 5.3, HISACE = 18.2, Total NSD = 18.50, <NSD> = 3.08, LISNSD = 6.25, Total NHD = 5.75, Total NMHD = 1.25, NTCA = 37.7%

Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1983&	Alicia	MH	08/15	08/19	27.2	91.0	1	100	963	4.9	6.4	2.75	1.75	0.25	CTX3
	Barry	H	08/24	08/29	27.4	76.3	3	70	986	1.7	3.1	3.00	0.50	–	
	Chantal	H	09/11	09/14	31.6	63.3	3	65	994	2.4	4.3	4.00	1.25	–	
	Dean	TS	09/26	09/30	28.0	73.0	3	55	999	1.8	3.6	4.00	–	–	

Summary: FSD = 227, LSD = 273, LOS = 47, NTC = 4, NH = 3, NMH = 1, NUSLFH = 1, <N. Lat.> = 28.6, <W. Long.> = 75.9, PWS = 100, <PWS> = 72.5, LP = 963, <LP> = 985.5, Total PDI = 10.8, <PDI> = 2.7, HISPDI = 4.9, Total ACE = 17.4, <ACE> = 4.4, HISACE = 6.4, Total NSD = 13.75, <NSD> = 3.44, LISNSD = 4.00, Total NHD = 3.50, Total NMHD = 0.25, NTCA = 30.5%

Year	Name	Class.	FSD	LSD	N. Lat	W. Long.	Genesis Location Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1984	ST1	SS/TS	08/19	08/21	38.0	56.4									
	Arthur	TS	08/29	08/31	11.2	55.0		45	1004	0.5	1.3	2.25	–		
	Bertha	TS	08/31	09/01	14.9	45.3		35	1007	0.2	0.5	1.00	–		
	Cesar	TS	08/31	09/02	38.9	65.0									
	Diana	MH	09/08	09/16	28.5	77.4									
	Edouard	TS	09/14	09/15	20.5	96.2									
	Fran	TS	09/16	09/20	14.8	24.8									
	Gustav	TS	09/18	09/19	32.1	64.7									
	Hortense	H	09/23	10/02	29.2	59.1									
	Isidore	TS	09/26	09/30	24.7	77.0									
	Josephine	H	10/08	10/18	24.1	71.4									
	Klaus	H	11/06	11/13	17.0	66.7									
	Lili	H	12/12	12/24	34.5	60.5									

Summary: FSD = 232, LSD = 359, LOS = 128, NTC = 13, NH = 5, NMH = 1, NUSLFH = 1, <N. Lat.> = 25.3, <W. Long.> = 63.0, PWS = 115, <PWS> = 61.9, LP = 949, <LP> = 989.2, Total PDI = 54.2, <PDI> = 4.2, HISPDI = 14.1, Total ACE = 84.4, <ACE> = 6.5, HISACE = 19.5, Total NSD = 63.25, <NSD> = 4.87, LISNSD = 11.75, Total NHD = 18.25, Total NMHD = 0.75, NTCA = 80.3%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1985#	Ana	TS	07/16	07/19	31.3	66.6	3	60	996	1.0	2.1	2.50	–	–	
	Bob	H	07/22	07/25	26.2	83.8	1	65	1002	1.5	2.8	3.00	0.50	–	SC1
	Claudette	H	08/11	08/16	34.0	74.0	3	75	980	4.2	7.2	6.00	1.75	–	
	Danny	H	08/14	08/16	23.7	87.8	1	80	988	2.3	3.5	2.50	1.00	–	LA1
	Elena	MH	08/28	09/03	22.6	80.0	1*	110	953	14.4	15.8	5.50	4.25	1.50	AL3, MS3, AFL3
	Fabian	TS	09/16	09/19	26.0	66.5	3	55	994	1.8	3.3	3.00	–	–	
	Gloria	MH	09/17	09/27	14.6	28.3	4	125	920	18.6	21.2	9.25	6.25	1.50	NC3, NY3, CT2, NH2, ME1
	Henri	TS	09/23	09/24	35.3	74.3	3	50	996	0.5	1.1	1.75	–	–	
	Isabel	TS	10/07	10/10	18.5	70.5	2	60	997	2.0	3.8	3.75	–	–	
	Juan	H	10/26	11/01	23.8	92.5	1	75	971	5.0	8.1	6.00	1.75	–	LA1
	Kate	MH	11/15	11/23	21.1	63.8	3	105	954	16.2	19.1	8.00	5.75	1.00	AFL2, IGA1

Summary: FSD = 197, LSD = 327, LOS = 131, NTC = 11, NH = 7, NMH = 3, NUSLFH = 6, <N. Lat.> = 25.2, <W. Long.> = 71.6, PWS = 125, <PWS> = 78.2, LP = 920, <LP> = 977.4, Total PDI = 67.5, <PDI> = 6.1, HISPDI = 18.6, Total ACE = 88.0, <ACE> = 8.0, HISACE = 21.2, Total NSD = 51.25, <NSD> = 4.66, LISNSD = 9.25, Total NHD = 21.25, Total NMHD = 4.00, NTCA = 105.8%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1986	Andrew	TS	06/06	06/08	29.7	77.5	3	45	999	0.9	2.2	3.00	–	–	
	Bonnie	H	06/24	06/26	26.6	89.5	1	75	992	1.8	2.9	2.25	1.00	–	CTX1
	Charley	H	08/15	08/20	32.2	78.5	3	70	987	3.1	5.6	5.25	1.00	–	NC1
	Danielle	TS	09/07	09/09	11.2	55.8	4	50	1000	0.7	1.6	2.00	–	–	
	Earl	H	09/11	09/18	22.4	51.6	5	90	979	16.0	19.7	8.00	7.25	–	
	Frances	H	11/19	11/21	23.9	62.9	3	75	1000	2.4	3.8	2.75	1.25	–	

Summary: FSD = 157, LSD = 325, LOS = 169, NTC = 6, NH = 4, NMH = 0, NUSLFH = 2, <N. Lat.> = 24.3, <W. Long.> = 69.3, PWS = 90, <PWS> = 67.5, LP = 979, <LP> = 992.8, Total PDI = 24.9, <PDI> = 4.2, HISPDI = 16.0, Total ACE = 35.8, <ACE> = 6.0, HISACE = 19.7, Total NSD = 23.25, <NSD> = 3.88, LISNSD = 8.00, Total NHD = 10.50, Total NMHD = 0.00, NTCA = 36.8%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1987&	Unnamed	TS	08/09	08/10	27.3	94.0									
	Arlene	H	08/11	08/		74.4									
	Bret	TS	08/18	08/22	15.1	26.0									
	Cindy	TS	09/07	09/10	24.6	39.3									
	Dennis	TS	09/10	09/17	10.8	25.0									
	Emily	MH	09/20	09/2		56.4									
	Floyd	H	10/10	10/1		82.2									

Summary: FSD = 221, LSD = 286, LOS = 66, NTC = 7, NH = 3, NMH = 1, NUSLFH = 1, <N. Lat.> = 19.2, <W. Long.> = 56.8, PWS = 110, <PWS> = 59.3, LP = 958, <LP> = 992.3, Total PDI = 19.0, <PDI> = 2.7, HISPDI = 7.7, Total ACE = 34.4, <ACE> = 4.9, HISACE = 11.9, Total NSD = 37.25, <NSD> = 5.32, LISNSD = 12.25, Total NHD = 4.00, Total NMHD = 0.50, NTCA = 44.9%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1988#	Alberto	TS	08/07	08/08	41.5	69.0	3*	35	1002	0.2	0.5	1.00	–	–	
	Beryl	TS	08/08	08/09	29.7	89.4	1	45	1001	0.4	1.1	1.50	–	–	
	Chris	TS	08/28	08/28	28.2	80.0	3*	45	1005	0.2	0.5	0.75	–	–	
	Debby	H	09/02	09/03	20.7	95.2	1	65	987	0.7	1.6	1.50	0.50	–	
	Ernesto	TS	09/03	09/05	35.2	53.1	5	55	994	0.6	1.3	1.50	–	–	
	Unnamed	TS	09/07	09/09	13.8	18.5	4	50	994	0.8	1.7	2.25	–	–	
	Florence	H	09/07	09/10	22.7	90.2	1	70	983	1.7	3.0	2.75	0.50	–	LA1
	Gilbert	MH	09/09	09/17	14.5	60.1	2	160	888	38.0	32.8	8.00	6.25	4.50	
	Helene	MH	09/20	09/30	13.2	33.8	4	125	938	29.9	31.5	10.25	9.00	2.50	
	Isaac	TS	09/30	10/01	11.4	56.0	4	40	1005	0.1	0.4	0.75	–	–	
	Joan	MH	10/11	10/23	10.1	45.0	4	125	932	18.6	23.7	12.25	5.00	2.00	
	Keith	TS	11/20	11/24	17.8	84.5	2	60	985	2.7	5.0	4.25	–	–	

Summary: FSD = 220, LSD = 329, LOS = 110, NTC = 12, NH = 5, NMH = 3, NUSLFH = 1, <N. Lat.> = 21.6, <W. Long.> = 64.6, PWS = 160, <PWS> = 72.9, LP = 888, <LP> = 976.2, Total PDI = 93.9, <PDI> = 7.8, HISPDI = 38.0, Total ACE = 103.1, <ACE> = 8.6, HISACE = 32.8, Total NSD = 46.75, <NSD> = 3.90, LISNSD = 12.25, Total NHD = 21.25, Total NMHD = 9.00, NTCA = 117.0%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1989	Allison	TS	06/26	06/27	27.8	95.8	1	45	999	0.4	0.9	1.50	–	–	
	Barry	TS	07/11	07/13	17.7	48.2	4	45	1005	0.7	1.8	2.75	–	–	
	Chantal	H	07/31	08/02	25.4	91.0	1	70	984	1.5	2.5	2.00	0.75	–	CTX1
	Dean	H	08/01	08/09	15.8	49.3	4	90	968	11.8	15.9	8.25	6.00	–	
	Erin	H	08/19	08/27	18.5	32.7	4	90	968	10.7	14.2	7.50	4.50	–	
	Felix	H	08/26	09/09	17.2	22.9									
	Gabrielle	MH	08/31	09/12	11.3	24.8									
	Hugo	MH	09/11	09/22	12.5	29.2	4								
	Iris	TS	09/18	09/20	11.9	53.2									
	Jerry	H	10/13	10/1		93.0									
	Karen	TS	11/30	12/04	20.8	84.2									

Summary: FSD = 177, LSD = 338, LOS = 162, NTC = 11, NH = 7, NMH = 2, NUSLFH = 3, <N. Lat.> = 18.1, <W. Long.> = 56.8, PWS = 135, <PWS> = 78.6, LP = 923, <LP> = 976.5, Total PDI = 119.9, <PDI> = 10.9, HISPDI = 46.3, Total ACE = 135.0, <ACE> = 12.3 HISACE = 42.7, Total NSD = 65.75, <NSD> = 5.98, LISNSD = 12.50, Total NHD = 31.75, Total NMHD = 9.75, NTCA = 129.8%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1990	Arthur	TS	07/24	07/27	10.5	56.8	4	60	995	1.1	2.3	2.75	–	–	
	Bertha	H	07/28	08/02	28.6	75.8	3	70	973	5.0	7.9	5.25	3.50	–	
	Cesar	TS	08/02	08/06	15.4	32.3	4	45	1000	1.5	3.4	4.50	–	–	
	Diana	H	08/05	08/08	16.6	83.6	2	85	980	2.6	4.3	3.50	0.75	–	
	Edouard	TS	08/03	08/10	39.2	23.3	5	40	1003	0.6	1.6	3.00	–	–	
	Fran	TS	08/13	08/14	9.0	53.6	4	35	1007	0.2	0.5	1.00	–	–	
	Gustav	MH	08/25	09/03	13.3	49.0	4	105	956	19.3	23.0	9.50	7.25	1.00	
	Hortense	TS	08/26	08/29	14.4	40.0	4	55	993	1.6	3.3	3.75	–	–	
	Isidore	H	09/05	09/17	10.0	32.7	4	80	979	12.9	19.5	12.00	8.25	–	
	Josephine	H	09/24	10/06	19.3	34.2	4	75	980	3.6	6.6	7.00	1.50	–	
	Klaus	H	10/03	10/09	16.2	59.6	4	70	985	3.4	6.1	5.50	0.75	–	
	Lili	H	10/06	10/14	36.0	44.0	5	65	987	6.1	10.7	8.75	2.50	–	
	Marco	TS	10/10	10/11	24.1	82.0	1	55	989	0.7	1.4	1.75	–	–	
	Nana	H	10/16	10/20	22.1	62.1	3	75	989	4.0	6.2	4.25	2.25	–	

Summary: FSD = 205, LSD = 293, LOS = 89, NTC = 14, NH = 8, NMH = 1, NUSLFH = 0, <N. Lat.> = 19.6, <W. Long.> = 52.1, PWS = 105, <PWS> = 65.4, LP = 956, <LP> = 987.1, Total PDI = 62.6, <PDI> = 4.5, HISPDI = 19.3, Total ACE = 96.8, <ACE> = 6.9, HISACE = 23.0, Total NSD = 72.50, <NSD> = 5.18, LISNSD = 12.00, Total NHD = 26.75, Total NMHD = 1.00, NTCA = 100.3%,

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1991&	Ana	TS	07/04	07/05	36.2	70.7	3	45	1000	0.5	1.3	1.75	–	–	
	Bob	MH	08/16	08/20	26.4	75.8	3	100	950	5.7	8.0	4.00	2.25	0.25	NY2, CT2, RI2, MA2
	Claudette	MH	09/05	09/11	26.2	56.0	5	115	946	12.0	14.0	6.25	3.75	1.00	
	Danny	TS	09/08	09/11	10.3	35.0	4	45	998	0.9	2.1	3.00	–	–	
	Erika	TS	09/09	09/12	29.3	53.1	5	50	997	0.9	2.0	2.50	–	–	
	Fabian	TS	10/15	10/16	20.3	84.1	1	40	1002	0.3	0.8	1.25	–	–	
	Grace	H	10/26	10/29	27.2	65.5	3	85	980	3.2	5.0	3.50	1.75	–	
	Unnamed	H	10/31	11/02	36.7	71.5	5	65	980	1.5	2.5	2.00	0.50	–	

Summary: FSD = 185, LSD = 306, LOS = 122, NTC = 8, NH = 4, NMH = 2, NUSLFH = 1, <N. Lat.> = 26.6, <W. Long.> = 64.0, PWS = 115, <PWS> = 68.1, LP = 946, <LP> = 981.6, Total PDI = 25.0, <PDI> = 3.1, HISPDI = 12.0, Total ACE = 35.7, <ACE> = 4.5, HISACE = 14.0, Total NSD = 24.25, <NSD> = 3.03, LISNSD = 6.25, Total NHD = 8.25, Total NMHD = 1.25, NTCA = 57.7%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1992&	ST1	SS/TS	04/22	04/23	24.9	61.5	3	45	1002	0.5	1.1	1.50	–	–	
	Andrew	MH	08/17	08/27	12.3	42.0	4	150	922	31.5	28.4	9.75	4.50	3.50	CFL5, BFL4, LA3
	Bonnie	H	09/18	09/30	33.7	58.0	5	95	965	17.9	23.1	12.00	5.75	–	
	Charley	H	09/22	09/27	31.6	34.0	5	95	965	8.5	10.9	5.25	3.50	–	
	Danielle	TS	09/22	09/26	32.8	74.2	3	55	1001	1.3	2.9	3.75	–	–	
	Earl	TS	09/29	10/03	29.7	79.3	3	55	990	1.5	3.3	4.00	–	–	
	Frances	H	10/23	10/27	27.7	61.4	3	75	976	4.2	6.5	4.00	2.00	–	

Summary: FSD = 113, LSD = 301, LOS = 189, NTC = 7, NH = 4, NMH = 1, NUSLFH = 1, <N. Lat.> = 27.5, <W. Long.> = 58.6, PWS = 150, <PWS> = 81.4, LP = 922, <LP> = 974.4, Total PDI = 65.4, <PDI> = 9.3, HISPDI = 31.5, Total ACE = 76.2, <ACE> = 10.9, HISACE = 28.4, Total NSD = 40.25, <NSD> = 5.75, LISNSD = 12.00, Total NHD = 15.75, Total NMHD = 3.50, NTCA = 66.7%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1993	Arlene	TS	06/19	06/20	25.9	95.9	1	35	1000	0.1	0.5	1.00	–	–	
	Bret	TS	08/05	08/09	10.4	43.4	4	50	1002	1.7	3.9	4.50	–	–	
	Cindy	TS	08/14	08/16	14.5	60.9	2	40	1007	0.4	1.1	2.25	–	–	
	Dennis	TS	08/24	08/27	15.4	34.0	4	45	1000	0.9	2.1	3.00	–	–	
	Emily	MH	08/25	09/04	28.0	60.4	3	100	960	17.5	22.1	10.25	7.25	0.75	NC3
	Floyd	H	09/07	09/10	26.2	68.2	3	65	990	1.7	3.1	3.00	1.25	–	
	Gert	H	09/15	09/21	11.3	83.0	2	85	970	2.2	3.6	3.50	1.00	–	
	Harvey	H	09/20	09/21	31.5	59.0	5	65	990	1.1	2.0	1.75	0.25	–	

Summary: FSD = 170, LSD = 264, LOS = 95, NTC = 8, NH = 4, NMH = 1, NUSLFH = 1, <N. Lat.> = 20.4, <W. Long.> = 63.1, PWS = 100, <PWS> = 60.6, LP = 960, <LP> = 989.9, Total PDI = 25.6, <PDI> = 3.2, HISPDI = 17.5, Total ACE = 38.4, <ACE> = 4.8, HISACE = 22.1, Total NSD = 29.25, <NSD> = 3.66, LISNSD = 10.25, Total NHD = 9.75, Total NMHD = 0.75, NTCA = 51.5%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1994	Alberto	TS	07/02	07/03	23.7	87.1	1	55	993	0.7	1.6	2.00	–	–	
	Beryl	TS	08/15	08/16	29.7	85.6	1	50	1000	0.4	0.8	1.00	–	–	
	Chris	H	08/17	08/23	11.7	41.2	4	70	979	4.3	7.5	7.00	2.00	–	
	Debby	TS	09/10	09/11	13.7	60.2	2	60	1006	0.7	1.4	1.25	–	–	
	Ernesto	TS	09/22	09/24	11.8	30.3	4	50	997	0.7	1.5	2.00	–	–	
	Florence	H	11/02	11/08	23.2	47.7	5	95	972	8.1	10.9	6.00	4.25	–	
	Gordon	H	11/10	11/20	14.6	82.7	2	75	980	4.3	8.4	9.50	1.00	–	

Summary: FSD = 183, LSD = 324, LOS = 142, NTC = 7, NH = 3, NMH = 0, NUSLFH = 0, <N. Lat.> = 18.3, <W. Long.> = 62.1,, PWS = 95, <PWS>= 65.0, LP = 972, <LP> = 989.6, Total PDI = 19.2, <PDI> = 2.7, HISPDI = 8.1, Total ACE = 32.1, <ACE> = 4.6, HISACE = 10.9, Total NSD = 28.75, <NSD> = 4.11, LISNSD = 9.50, Total NHD = 7.25, Total NMHD = 0.00, NTCA = 35.3%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1995	Allison	H	06/03	06/05	19.3	85.7	2	65	988	1.8	3.1	2.50	0.75	–	
	Barry	TS	07/07	07/10	31.6	71.0	3	60	989	1.6	3.2	3.25	–	–	
	Chantal	TS	07/14	07/20	21.1	64.4	3	60	991	3.3	6.5	6.75	–	–	
	Dean	TS	07/30	07/31	28.6	94.0	1	40	999	0.1	0.3	0.50	–	–	
	Erin	H	07/31	08/04	22.3	73.2	3	80	974	4.9	7.3	4.50	2.50	–	CFL1, AFL2
	Felix	MH	08/08	08/22	15.5	36.4	4	120	929	23.7	29.4	14.00	9.25	1.75	
	Gabrielle	TS	08/10	08/11	23.5	96.5	1	60	990	0.7	1.4	1.50	–	–	
	Humberto	H	08/22	09/01	13.7	34.3	4	95	968	17.6	22.5	10.00	8.50	–	
	Iris	H	08/22	09/04	13.3	50.6	4	95	965	16.3	22.7	12.75	7.50	–	
	Jerry	TS	08/23	08/24	26.4	79.7	2	35	1004	0.2	0.6	1.25	–	–	
	Karen	TS	08/28	09/02	16.6	41.5	4	45	1000	1.4	3.4	5.25	–	–	
	Luis	MH	08/29	09/11	11.6	29.0	4	120	935	57.3	53.5	13.50	11.75	8.00	
	Marilyn	MH	09/13	09/22	11.8	52.7	4	100	950	17.3	21.6	9.25	7.75	0.50	
	Noel	H	09/27	10/07	12.1	40.6	4	65	987	6.2	11.1	9.75	2.50	–	
	Opal	MH	09/30	10/05	21.1	88.5	1	130	919	9.8	11.1	5.00	2.75	1.00	AFL3, IAL1
	Pablo	TS	10/05	10/08	10.2	37.5	4	50	994	1.1	2.5	3.00	–	–	
	Roxanne	MH	10/09	10/18	16.5	83.1	2	100	958	11.2	16.2	10.00	5.00	0.25	
	Sebastien	TS	10/21	10/23	16.0	55.1	4	55	1001	0.9	2.1	3.00	–	–	
	Tanya	H	10/27	11/01	26.2	57.9	5	75	972	5.8	8.7	5.50	3.00	–	

Summary: FSD = 154, LSD = 305, LOS = 152, NTC = 19, NH = 11, NMH = 5, NUSLFH = 2, <N. Lat.> = 18.8, <W. Long.> = 61.7, PWS = 130,
<PWS> = 76.3, LP = 919, <LP> = 974.4, Total PDI = 181.2, <PDI> = 9.5, HISPDI = 57.3, Total ACE = 227.2, <ACE> = 12.0
HISACE = 53.5, Total NSD = 121.25, <NSD> = 6.38, LISNSD = 14.00, Total NHD = 61.25, Total NMHD = 11.50, NTCA = 221.4%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1996	Arthur	TS	06/19	06/20	31.5	78.7	3	40	1004	0.3	0.8	1.50	–	–	
	Bertha	MH	07/05	07/14	11.0	39.0	4	100	960	13.1	17.4	9.00	5.50	0.50	NC2
	Cesar	H	07/25	07/28	12.1	68.1	2	70	990	2.3	4.0	3.50	1.00	–	
	Dolly	H	08/19	08/23	18.2	83.0	2	70	989	2.1	3.9	3.75	0.50	–	
	Edouard	MH	08/22	09/03	13.2	31.6	4	125	933	54.3	49.3	12.00	10.50	7.75	
	Fran	MH	08/27	09/06	14.6	44.9	4	105	946	18.7	22.9	10.25	7.75	2.00	NC3
	Gustav	TS	08/28	09/01	10.6	32.7	4	40	1005	0.8	2.4	4.50	–	–	
	Hortense	MH	09/07	09/15	15.4	58.3	4	120	935	19.5	21.8	8.50	6.25	2.00	
	Isidore	MH	09/25	10/01	10.3	28.5	4	100	960	10.3	12.9	6.25	3.75	0.50	
	Josephine	TS	10/06	10/08	25.1	91.8	1	60	981	0.9	1.6	1.50	–	–	
	Kyle	TS	10/11	10/12	16.9	87.1	2	45	1001	0.2	0.5	0.75	–	–	
	Lili	MH	10/16	10/27	17.5	83.8	2	100	960	17.0	22.6	11.00	9.25	0.25	
	Marco	H	11/19	11/26	13.8	80.9	2	65	983	3.1	6.1	6.50	0.50	–	

Summary: FSD = 171, LSD = 331, LOS = 161, NTC = 13, NH = 9, NMH = 6, NUSLFH = 2, <N. Lat.> = 16.2, <W. Long.> = 62.2, PWS = 125,
<PWS> = 80.0, LP = 933, <LP> = 972.8, Total PDI = 142.6, <PDI> = 11.0, HISPDI = 54.3, Total ACE = 166.2, <ACE> = 12.8,
HISACE = 49.3, Total NSD = 79.00, <NSD> = 6.08, LISNSD = 12.00, Total NHD = 45.00, Total NMHD = 13.00, NTCA = 192.2%,

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1997&	ST	SS/TS	06/01	06/02	33.2	75.3	3	45	1003	0.3	0.8	1.25	–	–	
	Ana	TS	07/01	07/03	31.8	75.4	3	40	1000	0.5	1.3	2.50	–	–	
	Bill	H	07/11	07/13	31.8	68.9	3	65	987	1.0	2.3	2.00	0.50	–	
	Claudette	TS	07/13	07/16	31.9	73.0	3	40	1003	0.6	1.6	2.75	–	–	
	Danny	H	07/17	07/26	28.3	91.4	1	70	984	3.6	6.0	4.75	1.75	–	LA1, AL1
	Erika	MH	09/03	09/15	12.3	47.1	4	110	946	22.3	26.6	12.25	7.25	2.25	
	Fabian	TS	10/05	10/08	26.3	63.1	3	35	1004	0.5	1.3	2.75	–	–	
	Grace	TS	10/16	10/17	21.2	64.4	3	40	999	0.3	0.9	1.50	–	–	

Summary: FSD = 152, LSD = 290, LOS = 139, NTC = 8, NH = 3, NMH = 1, NUSLFH = 1, <N. Lat.> = 27.1, <W. Long.> = 69.8, PWS = 110,
<PWS> = 55.6, LP = 946, <LP> = 990.8, Total PDI = 29.1, <PDI> = 3.9, HISPDI = 22.3, Total ACE = 40.8, <ACE> = 5.1,
HISACE = 26.6, Total NSD = 29.75, <NSD> = 3.72, LISNSD = 12.25, Total NHD = 9.50, Total NMHD = 2.25, NTCA = 53.7%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1998#	Alex	TS	07/29	08/02	13.3	36.8	4	45	1002	1.1	2.8	4.75	–	–	
	Bonnie	MH	08/20	08/30	17.3	57.3	4	100	954	21.7	24.8	10.25	6.50	3.50	NC2
	Charley	TS	08/21	08/22	26.0	94.5	1	60	1001	0.4	0.8	1.00	–	–	
	Danielle	H	08/24	09/03	14.2	37.9	5	90	960	18.0	23.1	10.25	9.50	–	
	Earl	H	08/31	09/03	22.4	93.8	1	85	985	2.5	3.9	3.00	1.00	–	AFL1
	Frances	TS	09/09	09/11	24.2	95.5	1	55	990	0.7	1.6	2.25	–	–	
	Georges	MH	09/16	09/29	10.6	31.3	4	135	937	37.6	39.4	13.00	11.25	2.00	BFL2, MS2
	Hermine	TS	09/19	09/20	27.5	91.3	1	40	999	0.2	0.6	1.00	–	–	
	Ivan	H	09/20	09/27	16.0	32.6	5	80	975	6.3	9.9	7.25	3.25	–	
	Jeanne	H	09/21	09/30	11.0	19.4	4	90	969	14.3	18.8	9.25	7.00	–	
	Karl	H	09/24	09/28	33.2	60.7	3	90	970	5.4	7.5	4.00	2.50	–	
	Lisa	H	10/05	10/09	14.2	47.1	4	65	995	2.7	5.0	4.75	0.50	–	
	Mitch	MH	10/22	11/05	11.6	77.9	2	155	905	42.5	35.9	10.75	5.50	3.75	
	Nicole	H	11/24	12/01	27.9	29.1	5	75	979	4.5	7.6	6.25	1.50	–	

Summary: FSD = 210, LSD = 335, LOS = 126, NTC = 14, NH = 10, NMH = 3, NUSLFH = 3, <N. Lat.> = 19.2, <W. Long.> = 57.5, PWS = 155,
<PWS> = 83.2, LP = 905, <LP> = 972.7, Total PDI = 157.9, <PDI> = 11.3, HISPDI = 42.5, Total ACE = 181.7, <ACE> = 13.0
HISACE = 39.4, Total NSD = 87.75, <NSD> = 6.27, LISNSD = 13.00, Total NHD = 48.50, Total NMHD = 9.25, NTCA = 167.9%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
1999#	Arlene	TS	06/12	06/16	28.3	57.3	5	50	1006	1.5	3.4	4.50	–	–	
	Bret	MH	08/19	08/23	19.8	94.7	1	125	944	11.6	11.6	4.25	2.50	1.25	ATX3
	Cindy	MH	08/20	08/31	13.6	26.6	4	120	942	21.3	24.6	11.00	5.25	1.75	
	Dennis	H	08/24	09/05	22.4	70.0	3	90	962	14.5	20.2	12.00	5.75	–	
	Emily	TS	08/24	08/28	11.5	53.8	4	45	1004	1.0	2.4	4.00	–	–	
	Floyd	MH	09/08	09/17	15.3	48.2	4	135	921	29.9	29.4	9.25	6.25	3.00	NC2
	Gert	MH	09/12	09/23	14.2	31.9	4	130	930	44.9	42.3	11.00	9.50	6.00	
	Harvey	TS	09/20	09/22	26.3	87.4	1	50	995	0.9	1.9	2.25	–	–	
	Irene	H	10/13	10/19	18.5	83.4	2	95	960	7.4	10.4	5.75	4.00	–	BFL1
	Jose	H	10/18	10/25	10.9	52.8	4	85	979	6.4	10.1	7.25	2.25	–	
	Katrina	TS	10/29	10/30	13.2	82.9	2	35	999	0.1	0.2	0.50	–	–	
	Lenny	MH	11/14	11/21	16.4	79.9	2	135	933	19.7	19.9	6.75	4.75	2.00	

Summary: FSD = 163, LSD = 325, LOS = 163, NTC = 12, NH = 8, NMH = 5, NUSLFH = 3, <N. Lat.> = 17.5, <W. Long.> = 64.1, PWS = 135, <PWS> = 91.3, LP = 921, <LP> = 964.6, Total PDI = 159.2, <PDI> = 13.3, HISPDI = 44.9, Total ACE = 176.4, <ACE> = 14.7 HISACE = 42.3, Total NSD = 78.50, <NSD> = 6.54, LISNSD = 12.00, Total NHD = 40.25, Total NMHD = 14.00, NTCA = 180.4%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2000#	Alberto	MH	08/04	08/23	12.0	22.3	4	110	950	28.1	36.9	19.25	11.75	1.00	
	Beryl	TS	08/14	08/15	23.1	94.6	1	45	1007	0.4	0.9	1.25	–	–	
	Chris	TS	08/18	08/18	16.2	55.4	5	35	1008	0.04	0.1	0.25	–	–	
	Debby	H	08/20	08/24	13.3	46.8	4	75	993	3.6	5.8	4.25	2.25	–	
	Ernesto	TS	09/02	09/03	16.2	49.5	4	35	1008	0.3	0.7	1.50	–	–	
	Florence	H	09/11	09/17	30.4	72.2	3	70	985	5.0	8.5	6.50	2.25	–	
	Gordon	H	09/16	09/18	22.5	86.7	1	70	981	2.0	3.4	2.50	1.00	–	
	Helene	TS	09/21	09/25	24.9	86.6	1	60	986	1.8	3.5	3.75	–	–	
	Isaac	MH	09/22	10/01	12.3	25.9	4	120	943	26.3	28.4	9.75	7.75	2.75	
	Joyce	H	09/26	10/01	11.5	31.9	4	80	975	4.8	7.6	5.75	2.25	–	
	Keith	MH	09/29	10/06	17.4	84.8	2	120	941	10.7	12.2	5.25	3.25	1.25	
	Leslie	TS	10/05	10/07	29.9	77.3	3	40	1006	0.5	1.3	2.25	–	–	
	Michael	H	10/16	10/19	29.9	71.8	3	85	965	3.6	5.6	4.00	2.25	–	
	Nadine	TS	10/20	10/21	30.4	57.2	5	50	999	0.6	1.2	1.50	–	–	
	ST	SS/TS	10/25	10/29	24.5	71.7	3	55	978	1.5	3.1	3.50	–	–	

Summary: FSD = 217, LSD = 303, LOS = 87, NTC = 15, NH = 8, NMH = 3, NUSLFH = 0, <N. Lat.> = 21.0, <W. Long.> = 62.3, PWS = 120, <PWS> = 70.0, LP = 941, <LP> = 981.7, Total PDI = 89.2, <PDI> = 5.9, HISPDI = 28.1, Total ACE = 119.2, <ACE> = 7.9, HISACE = 36.9, Total NSD = 71.25, <NSD> = 4.75, LISNSD = 19.25, Total NHD = 32.75, Total NMHD = 5.00, NTCA = 133.5%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2001	Allison	TS	06/05	06/11	27.5	95.0	1	50	1000	0.4	1.0	1.50	–	–	
	Barry	TS	08/02	08/06	26.2	84.9	1	60	990	1.2	2.3	3.00	–	–	
	Chantal	TS	08/17	08/21	13.7	64.6	2	60	997	2.4	4.6	4.50	–	–	
	Dean	TS	08/22	08/28	17.9	64.3	2	60	994	1.5	2.9	2.75	–	–	
	Erin	MH	09/02	09/15	13.2	37.5	4	105	968	14.4	20.1	11.00	6.00	1.00	
	Felix	MH	09/11	09/18	18.6	47.7	4	100	962	12.3	15.2	7.25	4.50	0.50	
	Gabrielle	H	09/13	09/19	25.3	84.9	1	70	975	3.7	6.6	5.75	1.00	–	
	Humberto	H	09/22	09/27	27.9	66.3	3	90	970	7.0	9.9	5.50	4.00	–	
	Iris	MH	10/05	10/09	14.8	64.5	2	125	948	9.2	10.0	4.00	2.50	0.75	
	Jerry	TS	10/07	10/08	11.0	53.8	4	45	1004	0.5	1.2	1.75	–	–	
	Karen	H	10/12	10/15	31.8	64.7	3	70	982	3.1	5.1	3.75	0.75	–	
	Lorenzo	TS	10/30	10/31	28.5	44.6	5	35	1007	0.3	0.7	1.50	–	–	
	Michelle	MH	11/01	11/05	15.8	83.1	2	120	934	15.7	15.7	5.00	3.50	2.00	
	Noel	H	11/04	11/06	33.9	50.4	5	65	986	1.7	3.0	2.50	0.50	–	
	Olga	H	11/24	12/03	29.3	50.3	5	80	973	7.0	10.7	8.50	2.75	–	

Summary: FSD = 156, LSD = 337, LOS = 182, NTC = 15, NH = 9, NMH = 4, NUSLFH = 0, <N. Lat.> = 22.4, <W. Long.> = 63.8, PWS = 125, <PWS> = 75.7, LP = 934, <LP> = 979.3, Total PDI = 80.4, <PDI> = 5.4, HISPDI = 15.7, Total ACE = 109.0, <ACE> = 7.3, HISACE = 20.1, Total NSD = 68.25, <NSD> = 4.55, LISNSD = 11.00, Total NHD = 25.50, Total NMHD = 4.25, NTCA = 135.1%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2002&	Arthur	TS	07/15	07/16	35.5	73.3	3	50	997	0.7	1.5	1.75	–	–	
	Bertha	TS	08/05	08/05	29.3	89.2	1	35	1008	0.1	0.2	0.50	–	–	
	Cristobal	TS	08/06	08/08	30.4	76.4	3	45	999	0.7	1.6	2.25	–	–	
	Dolly	TS	08/29	09/04	9.7	32.2	4	50	997	1.7	3.9	5.75	–	–	
	Edouard	TS	09/02	09/05	30.1	79.7	3	55	1002	0.7	1.8	3.00	–	–	
	Fay	TS	09/06	09/07	27.8	93.9	1	50	998	0.6	1.3	1.50	–	–	
	Gustav	H	09/08	09/12	30.2	71.1	3	85	960	3.1	4.8	3.75	1.00	–	
	Hanna	TS	09/12	09/14	26.7	86.4	1	50	1001	0.8	1.8	2.50	–	–	
	Isidore	MH	09/18	09/26	17.1	78.1	2	110	934	15.0	17.8	8.75	3.75	1.75	
	Josephine	TS	09/18	09/19	34.7	52.7	5	35	1004	0.2	0.6	1.25	–	–	
	Kyle	H	09/21	10/12	30.4	51.6	5	75	980	8.2	15.2	16.75	1.75	–	
	Lili	MH	09/23	10/04	12.1	54.6	4	125	940	13.7	16.5	9.25	3.25	1.25	LA1

Summary: FSD = 196, LSD = 285, LOS = 90, NTC = 12, NH = 4, NMH = 2, NUSLFH = 1, <N. Lat.> = 26.2, <W. Long.> = 69.9, PWS = 125, <PWS> = 63.8, LP = 934, <LP> = 985.0, Total PDI = 45.5, <PDI> = 3.8, HISPDI = 15.0, Total ACE = 67.0, <ACE> = 5.6, HISACE = 17.8, Total NSD = 57.00, <NSD> = 4.75, LISNSD = 16.75, Total NHD = 9.75, Total NMHD = 3.00, NTCA = 82.6%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2003	Ana	TS	04/20	04/24	32.7	68.9	3	50	994	1.5	3.2	4.00	–	–	
	Bill	TS	06/29	07/01	23.4	90.5	1	50	997	0.6	1.4	1.75	–	–	
	Claudette	H	07/08	07/16	14.8	70.0	4	75	982	5.1	9.2	8.25	0.75	–	BTX1
	Danny	H	07/17	07/20	32.5	55.2	5	65	1000	2.6	4.6	3.75	1.00	–	
	Erika	H	08/14	08/16	26.4	83.3	1	65	988	1.1	2.1	2.25	0.25	–	
	Fabian	MH	08/28	09/08	15.0	36.2	4	125	939	45.6	43.2	11.25	9.75	7.25	
	Grace	TS	08/30	08/31	24.9	93.3	1	35	1007	0.2	0.5	1.00	–	–	
	Henri	TS	09/05	09/05	27.7	85.1	1	50	997	0.2	0.5	0.75	–	–	
	Isabel	MH	09/06	09/19	13.9	32.7	4	145	915	75.2	63.3	13.25	11.75	8.00	NC2, VA1
	Juan	H	09/25	09/29	28.4	62.0	3	90	969	7.2	9.4	4.75	3.00	–	
	Kate	MH	09/27	10/07	21.0	44.2	5	110	952	17.7	21.9	10.25	6.00	1.50	
	Larry	TS	10/01	10/06	21.0	93.2	1	55	993	2.0	4.1	4.50	–	–	
	Mindy	TS	10/10	10/12	19.1	68.8	2	40	1002	0.3	0.8	2.50	–	–	
	Nicholas	TS	10/14	10/23	10.9	41.9	4	60	990	3.5	7.3	8.50	–	–	
	Odette	TS	12/04	12/07	13.3	75.7	2	55	993	1.4	2.8	3.00	–	–	
	Peter	TS	12/07	12/10	27.5	34.5	5	60	990	0.9	2.1	2.75	–	–	

Summary: FSD = 110, LSD = 344, LOS = 235, NTC = 16, NH = 7, NMH = 3, NUSLFH = 2, <N. Lat.> = 22.0, <W. Long.> = 64.7, PWS = 145, <PWS> = 70.6, LP = 915, <LP> = 981.8, Total PDI = 165.1, <PDI> = 10.3, HISPDI = 75.2, Total ACE = 176.4, <ACE> = 11.0, HISACE = 63.3, Total NSD = 92.50, <NSD> = 5.78, LISNSD = 13.25, Total NHD = 32.50, Total NMHD = 16.75, NTCA = 178.6%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2004&	Alex	MH	08/01	08/06	31.6	79.2	3	105	957	9.5	11.4	5.00	3.25	0.75	NC1
	Bonnie	TS	08/09	08/12	22.5	87.6	1	55	1001	1.2	2.6	3.25	–	–	
	Charley	MH	08/10	08/14	12.9	65.3	2	125	947	9.0	10.6	4.75	3.00	0.50	BFL4, CFL1, DFL1 SC1, NC1
	Danielle	H	08/14	08/20	12.6	24.2	4	95	964	9.5	12.1	6.75	3.50	–	–
	Earl	TS	08/14	08/15	10.5	53.5	4	45	1009	0.3	0.8	1.25	–	–	
	Frances	MH	08/25	09/07	11.5	39.8	4	125	937	48.0	45.9	12.50	10.00	6.75	CFL2, BFL1
	Gaston	H	08/28	09/01	31.3	78.2	3	65	986	1.3	2.7	3.25	0.25	–	SC1
	Hermine	TS	08/29	08/31	31.1	69.8	3	50	1002	0.5	1.3	2.00	–	–	
	Ivan	MH	09/03	09/23	9.7	30.3	4	145	910	83.5	70.4	14.75	11.50	10.00	AL3, AFL3
	Jeanne	MH	09/14	09/27	16.4	62.6	2	105	951	18.4	24.2	13.00	6.50	0.75	CFL3, BFL1, AFL1
	Karl	MH	09/16	09/24	11.2	32.1	4	125	938	28.5	28.4	8.25	7.00	3.50	
	Lisa	H	09/20	10/03	13.5	35.4	5	65	987	6.3	12.2	11.75	0.50	–	
	Matthew	TS	10/08	10/10	24.1	94.2	1	40	997	0.4	1.0	1.75	–	–	
	Nichole	SS/TS	10/10	10/11	31.0	66.3	3	45	986	0.5	1.2	1.75	–	–	
	Otto	TS	11/29	12/02	29.6	47.9	5	45	996	0.8	1.9	3.00	–	–	

Summary: FSD = 214, LSD = 337, LOS = 124, NTC = 15, NH = 9, NMH = 6, NUSLFH = 6, <N. Lat.> = 20.0, <W. Long.> = 57.8, PWS = 145, <PWS> = 82.3, LP = 912, <LP> = 971.2, Total PDI = 217.7, <PDI> = 13.8, HISPDI = 83.5, Total ACE = 226.7, <ACE> = 15.1, HISACE = 70.4, Total NSD = 93.00, <NSD> = 6.15, LISNSD = 14.75, Total NHD = 45.50, Total NMHD = 22.25, NTCA = 231.4%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2005	Arlene	TS	06/09	06/11	18.2	83.9	2	60	990	1.3	2.6	2.75	–	–	
	Bret	TS	06/29	06/29	20.0	95.8	1	35	1005	0.1	0.4	0.75	–	–	
	Cindy	H	07/05	07/06	25.1	90.2	1	65	992	0.8	1.5	1.50	0.25	–	LA1
	Dennis	MH	07/05	07/11	13.0	65.9	2	130	930	19.4	18.8	5.75	4.00	2.50	AFL3, IAL1
	Emily	MH	07/12	07/21	11.0	46.8	4	140	929	35.7	32.9	9.25	7.00	4.25	
	Franklin	TS	07/22	07/29	25.7	75.9	3	60	997	3.2	6.7	8.00	–	–	
	Gert	TS	07/24	07/25	20.8	95.0	1	40	1005	0.2	0.5	1.00	–	–	
	Harvey	TS	08/03	08/08	29.5	68.6	3	55	994	2.6	5.4	5.75	–	–	
	Irene	H	08/07	08/18	20.2	45.0	5	90	970	8.9	13.1	8.75	3.00	–	
	Jose	TS	08/22	08/23	19.6	95.0	1	45	1001	0.2	0.4	0.75	–	–	
	Katrina	MH	08/24	08/30	24.5	76.5	3	150	902	22.1	20.0	6.00	4.00	2.25	CFL1, BFL1, LA3, MS3, AL1
	Lee	TS	08/31	08/31	29.0	50.4	5	35	1006	0.1	0.2	0.50	–	–	
	Maria	MH	09/02	09/10	21.1	49.4	5	100	962	10.3	14.3	8.00	4.75	0.25	
	Nate	H	09/06	09/10	28.4	66.6	3	80	979	4.7	7.2	4.75	2.25	–	
	Ophelia	H	09/07	09/17	27.9	78.8	3	75	976	9.8	15.7	10.75	3.75	–	NC1
	Philippe	H	09/17	09/23	13.5	54.9									
	Rita	MH	09/18	09/25	22.2	72.3	3	155							
	Stan	H	10/02	10/04		87.2									
	ST	SS/TS	10/04	10/05		28.5									
	Tammy	TS	10/05	10/06	27.3	79.7									
	Vince	H	10/08	10/1		20.6									
	Wilma	MH	10/17	10/25	16.9	79.6	2								
	Alpha	TS	10/22	10/2		68.5									
	Beta	MH	10/27	10/30		81.3									
	Gamma	TS	11/15	11/20	14.3	66.0									
	Delta	TS	11/22	11/2		40.5									
	Epsilon	H	11/29	12/08	31.5	49.2									
	Zeta	TS	12/30	01/06	24.2	36.1									

Summary: FSD = 160, LSD = 371, LOS = 212, NTC = 28, NH = 15, NMH = 7, NUSLFH = 6, <N. Lat.> = 22.5, <W. Long.> = 66.0, PWS = 160, <PWS> = 76.8, LP = 882, <LP> = 974.4, Total PDI = 221.1, <PDI> = 7.9, HISPDI = 45.7, Total ACE = 250.1, <ACE> = 8.9, HISACE = 38.9, Total NSD = 131.25, <NSD> = 4.69, LISNSD = 10.75, Total NHD = 49.50, Total NMHD = 17.50, NTCA = 278.3%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2006	Alberto	TS	06/11	06/14	22.5	86.3	1	60	995	1.4	2.8	3.25	–	–	
	Unnamed	TS	07/17	07/18	40.0	65.1	3*	45	998	0.3	0.6	1.00	–	–	
	Beryl	TS	07/18	07/21	33.0	73.3	3	50	1000	1.0	2.3	3.00	–	–	
	Chris	TS	08/01	08/03	16.8	58.9	4	55	1001	1.0	2.2	2.50	–	–	
	Debby	TS	08/23	08/26	14.9	28.1	4	45	999	1.0	2.3	3.25	–	–	
	Ernesto	H	08/25	09/01	13.7	65.8	2	65	985	2.8	5.7	8.00	0.25	–	
	Florence	H	09/05	09/12	16.8	46.1	4	80	974	5.9	9.6	7.75	2.75	–	
	Gordon	MH	09/11	09/20	20.9	56.3	5	105	955	18.3	22.2	9.50	8.00	1.25	
	Helene	MH	09/14	09/24	12.9	31.9	4	105	955	19.4	24.3	10.75	8.25	0.75	
	Isaac	H	09/28	10/02	27.4	54.0	5	75	985	4.0	6.5	4.75	2.00	–	

Summary: FSD = 162, LSD = 275, LOS = 114, NTC = 10, NH = 5, NMH = 2, NUSLFH = 0, <N. Lat.> = 21.9, <W. Long.> = 56.6, PWS = 105, <PWS> = 68.5, LP = 955, <LP> = 984.7, Total PDI = 55.1, <PDI> = 5.5, HISPDI = 19.4, Total ACE = 78.5, <ACE> = 7.9 HISACE = 24.3, Total NSD = 63.75, <NSD> = 6.38, LISNSD = 10.75, Total NHD = 21.25, Total NMHD = 2.00, NTCA = 88.7%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2007	Andrea	SS/TS	05/09	05/10	30.8	78.7	3	50	1001	0.4	0.9	1.25	–	–	
	Barry	TS	06/01	06/02	23.6	85.7	1	50	997	0.3	0.8	1.00	–	–	
	Chantal	TS	07/31	08/01	37.1	65.5	3	45	994	0.3	0.7	1.00	–	–	
	Dean	MH	08/14	08/22	11.8	38.3	4	150	907	40.8	35.2	8.50	6.75	4.00	
	Erin	TS	08/15	08/16	25.8	94.0	1	35	1003	0.1	0.4	0.75	–	–	
	Felix	MH	09/01	09/05	12.1	59.4	4	150	930	22.1	18.0	4.25	3.00	2.00	
	Gabrielle	TS	09/08	09/10	30.1	71.8	3	50	1004	0.6	1.5	2.25	–	–	
	Humberto	H	09/12	09/13	27.8	95.1	1	80	985	1.1	1.8	1.50	0.50	–	CTX1, LA1
	Ingrid	TS	09/13	09/15	13.7	46.7	4	40	1002	0.5	1.3	2.50	–	–	
	Jerry	TS	09/23	09/24	36.2	46.1	5	35	1003	0.2	0.7	1.50	–	–	
	Karen	H	09/25	09/29	10.3	37.0	4	65	988	1.9	3.6	4.00	0.50	–	
	Lorenzo	H	09/27	09/28	20.6	95.1	1	70	990	0.9	1.5	1.00	0.50	–	
	Melissa	TS	09/29	09/30	14.5	27.4	4	35	1005	0.2	0.5	1.00	–	–	
	Noel	H	10/28	11/02	16.3	71.6	2	70	980	3.1	5.6	5.50	1.00	–	
	Olga	TS	12/11	12/12	18.4	64.7	2	50	1003	0.6	1.3	2.25	–	–	

Summary: FSD = 129, LSD = 346, LOS = 218, NTC = 15, NH = 6, NMH = 2, NUSLFH = 1, <N. Lat.> = 21.9, <W. Long.> = 65.1, PWS = 150, <PWS> = 65.0, LP = 907, <LP> = 986.1, Total PDI = 73.1, <PDI> = 4.9, HISPDI = 40.8, Total ACE = 73.8, <ACE> = 4.9, HISACE = 35.2, Total NSD = 38.25, <NSD> = 2.55, LISNSD = 8.50, Total NHD = 12.25, Total NMHD = 6.00, NTCA = 98.8%,

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2008#	Arthur	TS	05/31	06/01	17.5	87.5	2	40	1004	0.3	0.8	1.50	–	–	
	Bertha	MH	07/03	07/20	13.1	24.0	4	105	955	20.1	28.4	17.00	7.50	0.75	
	Cristobal	TS	07/19	07/23	32.4	78.8	3	55	998	1.8	3.7	4.00	–	–	
	Dolly	H	07/20	07/24	17.8	83.6	2	85	967	3.3	5.4	4.50	1.25	–	ATX1
	Edouard	TS	08/04	08/05	28.1	88.5	1	55	996	0.8	1.7	2.00	–	–	
	Fay	TS	08/15	08/23	18.5	68.8	2	60	986	3.5	7.3	8.25	–	–	
	Gustav	MH	08/25	09/02	15.1	69.6	2	125	943	16.0	18.2	8.00	3.25	1.25	LA2
	Hanna	H	08/28	09/07	20.1	58.6	5	75	977	5.6	10.4	9.75	0.75	–	
	Ike	MH	09/01	09/14	17.3	38.4	4	125	935	37.7	39.2	13.00	10.00	4.25	CTX2, LA1
	Josephine	TS	09/02	09/05	12.7	23.2	4	55	994	1.4	3.1	3.75	–	–	
	Kyle	H	09/25	09/29	22.0	69.4	3	75	984	3.4	5.4	4.00	1.75	–	
	Laura	TS	09/29	10/01	37.0	47.0	5	50	994	1.1	2.2	3.25	–	–	
	Marco	TS	10/06	10/07	18.9	93.7	1	55	998	0.7	1.3	1.25	–	–	
	Nana	TS	10/12	10/13	16.0	37.1	5	35	1004	0.2	0.5	1.00	–	–	
	Omar	MH	10/14	10/18	14.5	69.6	2	115	958	7.2	9.3	5.00	3.00	0.25	
	Paloma	MH	11/06	11/09	14.8	82.1	2	125	944	8.9	9.2	3.50	2.25	1.00	

Summary: FSD = 152, LSD = 314, LOS = 163, NTC = 16, NH = 8, NMH = 5, NUSLFH = 3, <N. Lat.> = 19.7, <W. Long.> = 63.7, PWS = 125, <PWS> = 77.2, LP = 935, <LP> = 977.3, Total PDI = 112.0, <PDI> = 7.0. HISPDI = 37.7, Total ACE = 146.1, <ACE> = 9.1, HISACE = 39.2, Total NSD = 89.75, <NSD> = 5.61, LISNSD = 17.00, Total NHD = 29.75, Total NMHD = 7.50, NTCA = 162.3%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2009&	Ana	TS	08/12	08/16	14.4	33.3	4	35	1003	0.3	0.9	1.75	–	–	
	Bill	MH	08/15	08/24	11.2	34.5	4	115	943	25.3	26.5	8.75	7.00	3.00	
	Claudette	TS	08/16	08/17	28.2	84.2	1	50	1005	0.3	0.7	1.00	–	–	
	Danny	TS	08/26	08/29	24.6	70.1	3	50	1006	0.9	2.0	2.75	–	–	
	Erika	TS	09/01	09/03	16.7	57.3	4	45	1004	0.5	1.3	2.00	–	–	
	Fred	MH	09/08	09/12	11.7	25.4	4	105	958	8.1	9.9	4.75	2.75	0.50	
	Grace	TS	10/04	10/06	38.5	29.5	5	55	986	1.0	2.0	2.00	–	–	
	Henri	TS	10/06	10/08	16.1	50.5	4	45	1005	0.5	1.2	2.00	–	–	
	Ida	H	11/04	11/10	11.4	81.8	2	90	975	5.7	8.1	5.00	2.25	–	

Summary: FSD = 224, LSD = 314, LOS = 91, NTC = 9, NH = 3, NMH = 2, NUSLFH = 0, <N. Lat.> = 19.2, <W. Long.> = 51.8, PWS = 115, <PWS> = 65.6, LP = 943, <LP> = 987.2, Total PDI = 42.6, <PDI> = 4.7, HISPDI = 25.3, Total ACE = 52.6, <ACE> = 5.8, HISACE = 26.5, Total NSD = 30.00, <NSD> = 3.33, LISNSD = 8.75, Total NHD = 12.00, Total NMHD = 3.50, NTCA = 68.6%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2010#	Alex	H	06/26	07/01	16.7	84.9	2	90	948	4.9	7.7	5.75	1.50	–	
	Bonnie	TS	07/23	07/23	23.1	75.9	3	40	1005	0.1	0.4	0.75	–	–	
	Colin	TS	08/03	08/07	13.7	46.6	4	50	1006	1.1	2.8	4.75	–	–	
	Danielle	MH	08/22	08/30	11.8	33.1	4	115	942	18.0	21.1	8.75	7.00	1.00	
	Earl	MH	08/25	09/04	14.3	29.7	4	125	927	26.7	27.7	10.50	6.00	3.50	
	Fiona	TS	08/30	09/03	14.9	47.7	4	55	998	1.4	3.1	4.25	–	–	
	Gaston	TS	09/01	09/01	12.7	35.0	4	35	1005	0.1	0.2	0.50	–	–	
	Hermine	TS	09/06	09/07	21.8	95.1	1	55	990	0.8	1.6	1.75	–	–	
	Igor	MH	09/08	09/21	13.8	23.3	4	135	924	44.5	41.9	12.25	9.75	5.00	
	Julia	MH	09/12	09/20	13.1	22.1	4	120	948	13.0	15.5	8.00	3.50	1.25	
	Karl	MH	09/14	09/18	18.1	83.6	1	110	956	4.9	6.3	3.50	1.25	0.25	
	Lisa	H	09/21	09/26	16.8	31.9	4	75	982	2.1	4.1	4.75	0.50	–	
	Matthew	TS	09/23	09/25	13.9	76.2	2	50	998	0.7	1.5	2.00	–	–	
	Nicole	TS	09/28	09/29	20.4	83.0	1	40	995	0.3	0.7	1.25	–	–	
	Otto	H	10/06	10/10	22.6	67.8	3	75	976	3.4	5.4	3.75	1.50	–	
	Paula	H	10/11	10/15	14.4	82.5	2	90	981	5.6	7.5	4.00	2.50	–	
	Richard	H	10/21	10/25	16.7	80.6	2	85	978	3.1	5.0	4.25	1.25	–	
	Shary	H	10/29	10/30	26.8	63.0	3	65	989	1.2	2.1	1.75	0.75	–	
	Tomas	H	10/29	11/07	9.8	55.3	4	85	982	7.6	11.9	8.75	3.00	–	

Summary: FSD = 177, LSD = 311, LOS = 135, NTC = 19, NH = 12, NMH = 5, NUSLFH = 0, <N. Lat.> = 16.6, <W. Long.> = 58.8, PWS = 135, <PWS> = 78.7, LP = 924, <LP> = 975.3, Total PDI = 139.5, <PDI> = 7.3, HISPDI = 44.5, Total ACE = 166.5, <ACE> = 8.8, HISACE = 41.9, Total NSD = 191.25, <NSD> = 10.07, LISNSD = 12.25, Total NHD = 38.50, Total NMHD = 11.00, NTCA = 230.9%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2011#	Arlene	TS	06/28	06/30	20.7	93.5	1	55	993	0.9	1.9	2.25	–	–	
	Bret	TS	07/18	07/21	27.5	78.1	3	60	995	1.5	3.3	4.00	–	–	
	Cindy	TS	07/20	07/22	33.4	57.0	5	60	994	1.2	2.3	2.50	–	–	
	Don	TS	07/27	07/30	22.0	86.7	1	45	997	0.7	1.6	2.50	–	–	
	Emily	TS	08/02	08/07	14.9	61.4	2	45	1003	1.0	2.1	3.25	–	–	
	Franklin	TS	08/13	08/13	37.6	61.1	3	40	1004	0.1	0.3	0.50	–	–	
	Gert	TS	08/14	08/16	27.7	62.3	3	55	1000	0.9	1.9	2.25	–	–	
	Harvey	TS	08/19	08/22	15.9	83.4	2	55	994	0.7	1.5	2.00	–	–	
	Irene	MH	08/21	08/28	15.0	59.0	4	105	942	15.4	18.8	8.00	6.25	0.50	NC1
	Jose	TS	08/27	08/28	27.9	63.4	3	40	1006	0.3	0.8	1.50	–	–	
	Katia	MH	08/30	09/10	11.0	29.6	4	120	942	22.5	27.0	11.50	9.50	1.25	
	Unnamed	TS	09/01	09/02	37.4	63.7	3	40	1002	0.3	0.8	1.50	–	–	
	Lee	TS	09/02	09/05	27.2	91.4	1	50	986	0.7	1.8	2.75	–	–	
	Maria	H	09/07	09/16	11.9	37.5	4	70	983	4.8	9.2	9.00	1.00	–	
	Nate	H	09/07	09/11	20.3	92.9	1	65	994	2.3	4.4	4.50	0.50	–	
	Ophelia	MH	09/21	10/03	12.5	39.7	4	120	940	15.9	18.7	9.75	3.50	2.00	
	Philippe	H	09/24	10/08	11.1	26.1	4	80	976	9.3	15.9	13.75	2.50	–	
	Rina	MH	10/24	10/28	16.0	81.9	2	100	966	8.2	10.1	4.75	2.75	0.75	
	Sean	TS	11/08	11/11	27.7	69.8	3	55	982	1.9	3.7	3.75	–	–	

Summary: FSD = 179, LSD = 315, LOS = 137 NTC = 19, NH = 7, NMH = 4, NUSLFH = 1, <N. Lat.> = 22.0, <W. Long.> = 65.2, PWS = 120, <PWS> = 66.3, LP = 940, <LP> = 984.2, Total PDI = 88.6, <PDI> = 4.7, HISPDI = 22.5, Sum ACE = 126.1, <ACE> = 6.6, HISACE = 27.0, Total NSD = 90.00, <NSD> = 4.74, LISNSD = 13.75, Total NHD = 26.00, Total NMHD = 4.50, NTCA = 145.0%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2012	Alberto	TS	05/19	05/22	32.5	77.3	3	50	995	0.8	1.9	3.00	–	–	
	Beryl	TS	05/26	05/30	32.3	75.0	3	60	992	1.2	2.5	3.00	–	–	
	Chris	H	06/18	06/22	38.0	61.3	3	75	974	2.3	4.1	3.75	0.75	–	
	Debby	TS	06/23	06/26	25.5	87.6	1	55	990	1.3	2.9	3.75	–	–	
	Ernesto	H	08/02	08/10	13.0	53.6	4	85	973	5.4	9.2	8.00	1.25	–	
	Florence	TS	08/04	08/06	14.1	28.6	4	50	1002	0.7	1.5	2.00	–	–	
	Gordon	H	08/16	08/20	30.5	55.4	5	95	965	6.4	8.6	4.75	2.25	–	
	Helene	TS	08/07	08/18	20.3	95.9	1	40	1004	0.1	0.3	0.50	–	–	
	Isaac	H	08/21	08/30	15.2	53.1	4	70	965	6.1	10.8	9.50	1.50	–	
	Joyce	TS	08/23	08/23	14.8	41.1	4	35	1006	0.1	0.2	0.50	–	–	
	Kirk	H	08/29	09/02	24.0	44.5	5	90	970	5.3	7.7	5.00	2.00	–	
	Leslie	H	08/30	09/11	13.8	42.6	4	70	968	7.8	16.3	12.00	3.25	–	
	Michael	MH	09/04	09/11	26.2	43.0	5	100	964	13.5	16.7	7.50	5.25	0.25	
	Nadine	H	09/12	10/03	17.5	44.8	4	80	978	15.6	26.3	20.75	5.25	–	
	Oscar	TS	10/03	10/05	18.2	41.8	4	45	994	0.6	1.5	2.00	–	–	
	Patty	TS	10/11	10/13	25.4	72.2	3	40	1005	0.4	1.1	2.00	–	–	
	Rafael	H	10/12	10/17	14.7	62.7	2	80	969	5.0	7.4	5.00	2.50	–	
	Sandy	H	10/22	10/29	12.7	78.7	2	100	940	12.8	16.1	8.00	5.75	–	NJ1
	Tony	TS	10/24	10/25	26.5	49.6	5	45	1000	0.5	1.2	1.75	–	–	

Summary: FSD = 140, LSD = 303, LOS = 164, NTC = 19, NH = 10, NMH = 1, NUSLFH = 1, <N. Lat.> = 21.9, <W. Long.> = 58.4, PWS = 100, <PWS> = 66.6, LP = 940, <LP> = 981.8, Total PDI = 85.9, <PDI> = 4.5, HISPDI = 15.6, Total ACE = 136.3, <ACE> = 7.2, HISACE = 26.3, Total NSD = 102.75, <NSD> = 5.41, LISNSD = 20.75, Total NHD = 24.50, Total NMHD = 0.25, NTCA = 120.9%

Year	Name	Class.	FSD	LSD	Genesis Location N. Lat	Genesis Location W. Long.	Group	PWS	LP	PDI	ACE	NSD	NHD	NMHD	USLFH
2013	Andrea	TS	06/05	06/07	25.1	86.6	1	55	992	0.9	1.9	2.00	–	–	
	Barry	TS	06/19	06/20	19.5	94.0	1	40	1003	0.4	0.9	1.25	–	–	
	Chantal	TS	07/07	07/10	9.3	41.4	4	55	1003	1.1	2.5	3.25	–	–	
	Dorian	TS	07/24	07/27	13.5	27.1	4	50	1002	1.1	2.6	3.50	–	–	
	Erin	TS	08/15	08/18	14.1	24.6	4	40	1006	0.6	1.5	3.00	–	–	
	Fernand	TS	08/25	08/26	18.9	95.1	1	50	1001	0.4	0.9	0.75	–	–	
	Gabrielle	TS	09/10	09/13	29.0	65.0	3	55	1003	0.8	1.7	2.50	–	–	
	Humberto	H	09/09	09/18	13.3	22.4	4	80	979	5.3	8.9	8.00	1.75	–	
	Ingrid	H	09/13	09/16	19.3	95.1	1	75	983	3.2	5.2	3.50	1.50	–	
	Jerry	TS	09/30	10/03	27.2	46.8	3	45	1005	0.7	1.9	3.50	–	–	
	Karen	TS	10/03	10/05	21.5	86.8	1	55	998	1.2	2.6	2.75	–	–	
	Lorenzo	TS	10/21	10/23	28.2	55.6	5	45	1000	0.7	1.6	2.50	–	–	
	Melissa	TS	11/18	11/21	29.1	53.4	5	55	980	1.7	3.5	3.50	–	–	
	Unnamed	STS	12/05	12/07	32.4	27.5	5	45	997	0.6	1.5	2.25	–	–	

Summary: FSD = 156, LSD = 341, LOS = 186 NTC = 14, NH = 2, NMH = 0, NUSLFH = 0, <N. Lat.> = 21.5, <W. Long.> = 58.7, PWS = 80, <PWS> = 53.2, LP = 979, <LP> = 996.6, Total PDI = 18.7, <PDI> = 1.3, HISPDI = 5.3, Total ACE = 37.2, <ACE> = 2.7, HISACE = 8.9, Total NSD = 42.25, <NSD> = 3.13, LISNSD = 8.00, Total NHD = 3.25, Total NMHD = 0.0, NTCA = 46.5%

Table 10. Listing of North Atlantic basin tropical cyclones, 1960–present (the weather satellite era) (Continued).

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Note:
Group 1 (Gulf of Mexico area):              18.0N-30.0N, 80.0W-99.9W and 15.0N-19.9N, 90.0W-94.9W
Group 2 (Caribbean Sea area):               10.0N-19.9N, 60.0W-89.9W
Group 3 (East coast area):                  20.0N-39.9N, 60.0W-79.9W
Group 4 (Lower N. Atlantic-Cape Verdi area):  5.0N-19.9N, 15.0W-59.9W
Group 5(Open N. Atlantic area):             20.0N-46.0N, 15.0W-59.9W
P/1 means the tropical cyclone formed in the Pacific Ocean then moved into the Gulf of Mexico
* means it belongs in the group, even though it does not fall within the areal bounds as given above
# means the year is classified as a LNY (i.e., NLNM >5 months)
& means the year is classified as an ENY (i.e., NENM >5 months)
ACE is wind speed squared; in units of 10E4 kt-sq
PDI is wind speed cubed; in units of 10E6 kt-cu
NTCA is based on NTC, NH, NMH, NSD, NHD and NMHD against averages for the interval 1950-2000, using formulation given at
  <http://andrew.rsmas.miami.edu/bmcnoldy/tropica/NTC.html>
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Table 11. Summary of tropical cyclone counts and parametric values for the North Atlantic basin, 1960–2013.

Year	DOY FSD	DOY LSD	LOS	NTC	Frequencies NH	Frequencies NMH	Frequencies NUSLFH	Origin <LAT>	Origin <LONG>	PWS	<PWS>	LP	<LP>	<ACE>	Total ACE	HISACE	<PDI>	Total PDI	HISPDI	<NSD>	LISNSD	Total NSD	Total NHD	Total NMHD	NTCA
1960	175	257	83	7	4	2	2	21.4	71.2	140	82.1	932	971.7	12.6	88.0	64.6	13.4	93.5	76.4	4.21	13.75	29.50	18.25	9.75	92.9%
1961	201	312	112	11	8	7	1	19.5	61.5	150	97.7	920	957.0	18.7	205.5	52.2	18.3	201.8	55.5	6.43	15.00	70.75	47.50	24.50	230.4%
1962	239	295	57	5	3	1	0	22.7	57.4	100	75.0	968	974.8	7.1	35.5	13.7	5.0	25.2	10.5	4.45	6.75	22.25	10.75	0.50	40.9%
1963	214	302	89	9	7	2	1	19.7	60.1	125	81.1	940	978.1	13.1	117.8	49.4	10.6	95.1	49.1	5.78	13.25	52.00	37.25	7.00	116.2%
1964	159	313	155	12	6	6	4	21.9	62.7	135	82.1	941	968.2	14.2	170.0	37.7	13.0	156.2	38.1	5.94	13.25	71.25	43.00	14.75	183.9%
1965	165	291	127	6	4	1	1	22.8	63.5	135	76.7	941	973.3	14.1	84.4	47.0	12.1	72.7	48.8	6.58	13.75	39.50	27.25	7.50	85.9%
1966	157	315	159	11	7	3	2	20.9	57.4	130	74.1	929	983.6	13.2	145.1	54.6	11.4	113.2	55.2	5.82	16.25	64.00	42.00	8.50	139.2%
1967	242	304	63	8	6	1	1	20.1	56.3	140	79.4	923	975.8	15.2	121.9	47.9	12.7	101.9	49.1	7.25	15.00	58.00	36.25	5.50	100.8%
1968	154	295	142	8	5	0	1	27.1	72.9	75	63.8	965	986.1	5.7	45.2	10.3	3.4	26.9	6.8	4.22	7.25	33.75	11.75	0.00	47.5%
1969	208	328	121	18	12	5	2	23.9	65.4	165	80.0	905	979.6	9.2	165.7	31.6	7.4	132.6	29.8	5.07	17.00	91.25	40.00	6.50	181.2%
1970	140	301	162	10	5	2	1	24.4	74.0	110	72.5	945	986.0	4.0	40.0	8.3	2.7	26.5	6.9	3.03	7.50	30.25	6.75	1.00	64.2%
1971	186	325	140	13	6	1	3	25.1	69.3	140	70.4	943	984.6	7.4	96.8	44.2	5.1	66.6	32.8	4.75	21.25	61.75	28.75	1.00	97.9%
1972	147	309	163	7	3	0	1	32.2	67.5	90	64.3	976	990.9	5.1	35.7	13.9	3.0	21.2	9.8	4.39	9.00	30.75	6.00	0.00	35.1%
1973	184	300	117	8	4	1	0	22.8	63.8	100	68.8	962	984.3	6.0	47.9	12.8	3.7	29.4	9.5	4.84	8.25	38.75	10.50	0.25	53.6%
1974	176	281	106	11	4	2	1	24.7	69.5	130	67.7	928	990.2	6.2	68.2	25.6	4.9	54.2	24.7	3.84	9.50	42.25	14.25	4.25	83.1%
1975	180	346	167	9	6	3	1	27.7	61.8	120	83.9	939	971.9	8.5	76.1	21.4	6.3	56.4	18.1	5.17	9.00	46.50	20.25	2.25	91.4%
1976	144	302	159	10	6	2	1	25.0	65.2	105	70.0	957	981.8	8.4	84.0	30.0	6.2	62.0	23.9	4.98	13.00	49.75	25.25	1.00	86.2%
1977	242	291	50	6	5	1	1	28.1	77.4	150	79.2	926	982.2	4.2	25.4	12.8	3.5	20.9	13.6	2.46	4.00	14.75	6.75	1.00	44.7%
1978	212*	305	94	12	5	2	0	23.5	64.6	120	66.3	947	987.9	5.3	63.2	19.2	3.9	47.2	18.7	3.63	9.25	43.50	13.50	3.50	85.1%
1979	173	298	126	9	6	2	3	20.5	63.2	150	76.1	924	977.4	10.3	92.9	44.0	9.5	85.3	51.9	5.08	13.00	45.75	21.75	5.75	103.8%
1980	215	332	118	11	9	2	1	23.8	54.1	165	83.2	899	976.1	13.6	149.3	52.3	12.9	141.6	68.6	5.66	14.25	62.25	38.25	7.25	130.3%
1981	127	321	195	12	7	3	0	23.2	61.3	115	75.0	946	981.8	8.4	100.4	22.2	6.1	72.8	19.0	5.50	10.75	66.00	22.50	3.75	112.6%
1982	154	275	122	6	2	1	0	23.8	70.7	115	70.8	950	983.2	5.3	31.5	18.2	2.7	23.9	16.6	3.08	6.25	18.50	5.75	1.25	37.7%
1983	227	273	47	4	3	1	1	28.6	75.9	100	72.5	963	985.5	4.4	17.4	6.4	2.7	10.8	4.9	3.44	4.00	13.75	3.50	0.25	30.5%
1984	232	359	128	13	5	1	1	25.3	63.0	115	61.9	949	989.2	6.5	84.4	19.5	4.2	54.2	14.1	4.87	11.75	63.25	18.25	0.75	80.3%
1985	197	327	131	11	7	3	6	25.2	71.6	125	78.2	920	977.4	8.0	88.0	21.2	6.1	67.5	18.6	4.66	9.25	51.25	21.25	4.00	105.8%
1986	157	325	169	6	4	0	2	24.3	69.3	90	67.5	979	992.8	6.0	35.8	19.7	4.2	24.9	16.0	3.88	8.00	23.25	10.50	0.00	36.8%
1987	221	286	66	7	3	1	1	19.2	56.8	110	59.3	958	992.3	4.9	34.4	11.9	2.7	19.0	7.7	5.32	12.25	37.25	4.00	0.50	44.9%
1988	220	329	110	12	5	3	1	21.6	64.6	160	72.9	888	976.2	8.6	103.1	32.8	7.8	93.9	38.0	3.90	12.25	46.75	21.25	9.00	117.0%
1989	177	338	162	11	7	2	3	18.1	56.8	135	78.6	923	976.5	12.3	135.0	42.7	10.9	119.9	46.3	5.98	12.50	65.75	31.75	9.75	129.8%
1990	205	293	89	14	8	1	0	19.6	52.1	105	65.4	956	987.1	6.9	96.8	23.0	4.5	62.6	19.3	5.18	12.00	72.50	26.75	1.00	100.3%
1991	185	306	122	8	4	2	1	26.6	64.0	115	68.1	946	981.6	4.5	35.7	14.0	3.1	25.0	12.0	3.03	6.25	24.25	8.25	1.25	57.7%
1992	113	301	189	7	4	1	1	27.5	58.6	150	81.4	922	974.4	10.9	76.2	28.4	9.3	65.4	31.5	5.75	12.00	40.25	15.75	3.50	66.7%
1993	170	264	95	8	4	1	1	20.4	63.1	100	60.6	960	989.9	4.8	38.4	22.1	3.2	25.6	17.5	3.66	10.25	29.25	9.75	0.75	51.5%
1994	183	324	142	7	3	0	0	18.3	62.1	95	65.0	972	989.6	4.6	32.1	10.9	2.7	19.2	8.1	4.11	9.50	28.75	7.25	0.00	35.3%
1995	154	305	152	19	11	5	2	18.8	61.7	130	76.3	919	974.4	12.0	227.2	53.5	9.5	181.2	57.3	6.38	14.00	121.25	61.25	11.50	221.4%
1996	171	331	161	13	9	6	2	16.2	62.2	125	80.0	933	972.8	12.8	166.2	49.3	11.0	142.6	54.3	6.08	12.00	79.00	45.00	13.00	192.2%
1997	152	290	139	8	3	1	1	27.1	69.8	110	55.6	946	990.8	5.1	40.8	26.6	3.9	29.1	22.3	3.72	12.25	29.75	9.50	2.25	53.7%
1998	210	335	126	14	10	3	3	19.2	57.5	155	83.2	905	972.7	13.0	181.7	39.4	11.3	157.9	42.5	6.27	13.00	87.75	48.50	9.25	167.9%
1999	163	325	163	12	8	5	3	17.5	64.1	135	91.3	921	964.6	14.7	176.4	44.9	13.3	159.2	44.9	6.54	12.00	78.50	40.25	14.00	180.4%
2000	217	303	87	15	8	3	0	21.0	62.3	120	70.0	941	981.7	7.9	119.2	28.1	5.9	89.2	28.1	4.75	19.25	71.25	32.75	5.00	133.5%
2001	156	337	182	15	9	4	0	22.4	63.8	125	75.7	934	979.3	7.3	109.0	20.1	5.4	80.4	15.7	4.55	11.00	68.25	25.50	4.25	135.1%
2002	196	285	90	12	4	2	1	26.2	69.9	125	63.8	934	985.0	5.6	67.0	17.8	3.8	45.5	15.0	4.75	16.75	57.00	9.75	3.00	82.6%
2003	110	344	235	16	7	3	2	22.0	64.7	145	70.6	915	981.8	11.0	176.4	63.3	10.3	165.1	75.2	5.78	13.25	92.50	32.50	16.75	178.6%
2004	213	336	124	15	9	6	6	20.0	57.8	145	82.3	912	971.2	15.1	226.7	70.4	13.8	217.7	83.5	6.15	14.75	93.00	45.50	22.25	231.4%
2005	160	371	212	28	15	7	6	22.5	66.0	160	76.8	882	974.4	8.9	250.1	38.9	7.9	221.1	45.7	4.69	10.75	131.25	49.50	17.50	278.3%
2006	162	275	114	10	5	2	0	21.9	56.6	105	68.5	955	984.7	7.9	78.5	24.3	5.5	55.1	19.4	6.38	10.75	63.75	21.25	2.00	88.7%
2007	129	346	218	15	6	2	1	21.9	65.1	150	65.0	907	986.1	4.9	73.8	35.2	4.9	73.1	40.8	2.55	8.50	38.25	12.25	6.00	98.8%
2008	152	314	163	16	8	5	3	19.7	63.7	125	77.2	935	977.3	9.1	146.1	39.2	7.0	112.0	37.7	5.61	17.00	89.75	29.75	7.50	162.3%
2009	224	314	91	9	3	2	0	19.2	51.8	115	65.6	943	987.2	5.8	52.6	26.5	4.7	42.6	25.3	3.33	8.75	30.00	12.00	3.50	68.6%
2010	177	311	135	19	12	5	0	16.6	58.8	135	78.7	924	975.3	8.8	166.5	41.9	7.3	139.5	44.5	10.07	12.25	191.25	38.50	11.00	230.9%
2011	179	315	137	19	7	4	1	22.0	65.2	120	66.3	940	984.2	6.6	126.1	27.0	4.7	88.6	22.5	4.74	13.75	90.00	26.00	4.50	145.0%
2012	140	303	164	19	10	1	1	21.9	58.4	100	66.6	940	981.8	7.2	136.3	26.3	4.5	85.9	15.6	5.41	20.75	102.75	24.50	0.25	120.9%
2013	156	341	186	14	2	0	0	21.5	58.7	80	53.2	979	996.6	2.7	37.2	8.9	1.3	18.7	5.3	3.13	8.00	43.75	3.25	0.00	47.0%

Table 11. Summary of tropical cyclone counts and parametric values for the North Atlantic basin, 1960–2013 (Continued).

1960–2013 (n = 54)																									
sum	–	–	–	615	333	132	78	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–
mean	180	311	133	11	6	2	1	22.5	63.5	124	72.9	937	980.8	8.6	100.5	30.9	6.9	81.8	30.8	4.94	11.76	58.12	23.70	5.57	109.6
sd	33	24	42	5	3	2	1	3.3	5.8	22	8.6	22	7.7	3.7	59.2	16.1	3.9	55.7	20.2	1.35	3.74	32.44	14.62	5.84	60.7
high	242	371	235	28	15	7	6	32.2	77.4	165	97.7	979	997.2	18.7	250.1	70.4	18.3	221.1	83.5	10.07	21.25	191.25	61.25	24.50	278.3
low	110	257	47	4	2	0	0	16.2	51.8	75	50.6	882	957.0	2.9	17.4	6.4	1.3	10.8	4.9	2.46	4.00	13.75	3.25	0.00	30.5
med	177	310	131	11	6	2	1	22.0	63.5	125	72.9	940	981.8	7.9	88.0	27.0	5.9	70.1	24.3	4.87	12.00	52.00	21.75	4.00	98.8
na	27	27	27	30	28	33	41	28	27	29	27	28	28	27	28	27	27	27	27	27	30	27	27	27	27
nb	27	27	27	24	26	21	13	26	27	25	27	26	26	27	26	27	27	27	27	27	24	27	27	27	27
nra	15	16	16	14	14	10	10	9	14	15	14	14	13	13	13	13	13	10	12	16	12	12	12	12	12
z	0.54	1.08	1.08	0.06	0.00	–1.94	–0.45	–2.70	0.00	0.56	0.00	0.00	–0.54	–0.54	–0.54	–0.54	–0.54	–2.12	–1.08	1.08	–1.03	–1.08	–1.08	–1.08	–1.08
r/nr	r	r	r	r	r	r	r	nr	r	r	r	r	r	r	r	r	r	nr	r	r	r	r	r	r	r
1960–1994 (n = 35)																									
sum	–	–	–	327	187	66	46	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–
mean	185	306	122	9	5	2	1	23.4	64.2	123	73.5	941	981.1	8.5	81.9	28.2	6.8	66.1	27.6	4.74	11.04	45.12	20.36	4.21	88.6
sd	34	23	39	3	2	2	1	3.3	6.2	23	8.2	22	7.8	3.8	47.2	15.9	4.1	45.7	19.3	1.12	3.74	18.91	12.75	5.12	46.6
1995–2013 (n = 19)																									
sum	–	–	–	288	146	66	32	–	–	–	–	–	–	–	–	–	–	–	–	–		–	–	–	–
mean	170	320	152	15	8	3	2	20.9	62.0	127	71.9	930	980.1	8.8	134.6	35.9	7.2	110.8	36.6	5.31	13.09	82.05	29.87	8.08	148.3
sd	31	24	43	5	3	2	2	2.8	4.6	20	9.6	21	7.7	3.5	64.8	15.7	3.5	61.9	21.0	1.66	3.45	38.60	16.13	6.37	65.6
t test (1960–1994) and (1995–2013)																									
t	1.6	–2.1	–2.6	–5.5	–4.4	–1.8	–2.5	2.8	1.4	–0.6	0.6	1.8	0.3	–0.3	–3.4	–1.7	–0.4	–3.0	–1.6	–1.50	–1.92	–4.73	–2.38	–2.43	–3.9

Legend:

FSD	First Storm Day
LSD	Last Storm Day
LOS	Length of Season
NTC	Number of Tropical Cyclones
NH	Number of Hurricanes
NMH	Number of Major Hurricanes
NUSLFH	Number of US Land–Falling Hurricanes
<LAT>	mean Latitude (at onset)
<LONG>	mean Longitude (at onset)
PWS	Peak Wind Speed
<PWS>	mean Peak Wind Speed (for season)
LP	Lowest Pressure
<LP>	mean Lowest Pressure (for season)
<ACE>	mean Accumulated Cyclone Energy
Total ACE	Total Accumulated Cyclone Energy (for season)
HISACE	Highest Individual Storm Accumulated Cyclone Energy (in units of 10E4 kt–sq)
<PDI>	mean Lower Dissipation Index (for season)
Total PDI	Total Power Dissipation Index (for season)
HISPDI	Highest Individual Storm Power Dissipation Index (in units of 10E6 kt–cu)
<NSD>	mean Number of Storm Days
Total NSD	Total Number of Storm Days (for season)
Total NHD	Total Number of Hurricane Days (for season)
Total NMHD	Total Number of Major Hurricane Days (for season)
NTCA	Net Tropical Cyclone Activity
*	excludes DOY 019 FSD event (ST1) considered a statistical outlier

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Weather satellites have been viewing the Earth's weather systems almost continuously since the launch of TIROS-1 in April 1960. During the weather satellite era (1960–2013), some 615 tropical cyclones have been observed to form in the North Atlantic basin, varying in yearly number from a low of 4 in 1983 (an El Niño year) to a high of 28 in 2005 (a non-El Niño year) and averaging about 11 tropical cyclones per year. A comparison of the subintervals 1960–1994 and 1995–2013 clearly shows, however, that the number of tropical cyclones forming in the North Atlantic basin has substantially increased from about 9 per year in the earlier subinterval to about 15 per year during the more recent subinterval, with the fewest number during the more recent subinterval (8) occurring in 1997 (an El Niño year). Examined in this Technical Publication (part 1) are the statistical aspects of some 25 tropical cyclone parameters. Part 2 of this study (published separately) examines the inferred statistical relationships between these tropical cyclone parameters and specific climate-related factors.

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Huntsville, Alabama 35812