

NOAA Technical Report NWS 26



Frequency and Motion of Atlantic Tropical Cyclones

Washington, D. C.

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No. 26

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National Weather Service Series



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- WB 12 Weekly Synoptic Analyses, 5-, 2-, and 0.4-Millibar Surfaces for 1967. Staff, Upper Air Branch, National Meteorological Center, January 1970, 169 p.

NOAA Technical Reports

- NWS 13 The March-April 1969 Snowmelt Floods in the Red River of the North, Upper Mississippi, and Missouri Basins. Joseph L. H. Paulhus, Office of Hydrology, October 1970, 92 p. (COM-71-50269)
- NWS 14 Weekly Synoptic Analyses, 5-, 2-, and 0.4-Millibar Surfaces for 1968. Staff, Upper Air Branch, National Meteorological Center, May 1971, 169 p. (COM-71-50383)
- NWS 15 Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States. Francis P. Ho, Richard W. Schwerdt, and Hugo V. Goodyear, May 1975, 87 p. (COM-75-11088)

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U. S. DEPARTMENT OF COMMERCE

Malcolm Baldrige, Secretary

National Oceanic and Atmospheric Administration

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FREQUENCY AND MOTION OF ATLANTIC TROPICAL CYCLONES

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ABSTRACT. Over the period 1899-1978, 663 tropical storms and hurricanes were recorded over the Atlantic area. This study presents a statistical analysis of these storms and includes charts of: (1) average storm frequency per unit area per 100-year interval, (2) mean resultant speed and direction, and (3) storm tracks upon which (1) and (2) are based. Tables also present the means and standard deviations of storm translation speed. The charts and tables are stratified by overlapping 30-day periods and by storm intensity.

1. INTRODUCTION

Over the past decade, statistical studies relating to frequency and motion of Atlantic tropical cyclones have been prepared in various formats, each study being tailored to the needs of a particular user group. For example, Simpson and Lawrence (1971), Sugg et al. (1971), and Hebert and Taylor (1975, 1978) dealt with statistical aspects of hurricanes that have affected the United States. These studies, conducted at the National Hurricane Center (NHC), were prompted by disaster preparedness needs. Additional studies by the NOAA/NWS Office of Hydrology in connection with the Federal Flood Insurance Program also focused on storms that affected the United States, but in relation to the storm surge (coastal inundation) problem. Examples within this category include Ho et al. (1975) and Schwerdt et al. (1979).

Other studies treat the entire Atlantic tropical cyclone basin. These include reports by Jarvinen and Neumann (1978), Neumann et al. (1978), and Crutcher (1971). Our analysis also treats the entire basin, but in greater temporal and spatial detail than before. It can be considered an update to the report of Hope and Neumann (1969), an out-of-print but often requested NHC publication.

The material presented here should be useful to both coastal and maritime interests. Included are charts and tables that depict frequency and motion characteristics for various storm intensities. The data are summarized for overlapping periods within the June through November Atlantic hurricane season.

2. DATA SOURCE

Tropical cyclone track and associated storm intensity data, 1899 through 1978, as described by Neumann et al. (1978) and Jarvinen and Caso (1978),

¹ Study partially supported by NOAA/ERL AOML-National Hurricane Research Laboratory (NHRL).

were the sole data sources used in the preparation of the charts. The question arises as to the accuracy of these data. Observations over oceanic areas traversed by tropical cyclones have always been meager and, before the era of aircraft reconnaissance that began in 1944, virtually nonexistent. Typically, pre-1944 track and intensity data were inferred from indirect evidence, such as peripheral ship and island reports. Even with the aid of aircraft weather reconnaissance, it was not until 24-hour weather satellite coverage began in the mid-1970s that frequent tropical cyclone position and wind estimates became available. Consequently, the quality of the data, particularly in the early years, is considerably better near populated land areas (such as the Gulf of Mexico or Caribbean Sea) than over the ocean. Many other factors relate to the quality and interpretation of the data. Users should be aware of these factors and refer to Neumann et al. (1978) before making further interpretations.

Although track and intensity data are available for years before 1899, these were excluded because they were considered questionable and too fragmented to be of value. Between 1899 and 1978, 663 tropical cyclones (sustained 1-minute average wind speeds of at least 34 knots) were recorded and used in this study. Of these storms, 383 (58%) became hurricanes (sustained 1-minute average wind speeds of at least 64 knots). After moving inland or over colder waters, tropical cyclones often became extratropical. These extratropical stages were included in the computations, provided the intensity criteria were satisfied. Tropical depressions (sustained wind speeds below 34 knots) were excluded.

3. COMPUTATIONAL PROCEDURES

3.1 Requirement for Interpolation

The data set (Jarvinen and Caso, 1978) upon which all computations were based gives the position and intensity of tropical cyclones at 6-hour intervals, 0000, 0600, 1200, and 1800 GMT. For the purposes of this study, positions and intensities were required at hourly intervals, rather than at the 6-hour intervals given on the tape. A bivariate scheme described by Akima (1970) was used for the interpolation.

3.2 Grid System

The computational procedure required that a grid system be established across the Atlantic tropical cyclone basin. For convenience, a grid was selected having equally spaced points on a Mercator projection, true at 22.5°N. The domain of the grid extended from the Equator to 50°N and from 15°W to 105°W. A 60-n.mi. (111.2-km) grid spacing at the Equator resulted in a grid array having 54 rows and 91 columns (4,914 points).

For digital counting purposes, a circle of 75-n.mi. (139-km) radius was centered at each of the 4,914 grid points. Hourly positions of the 663 storms were passed through the grid network and the following data were computed for each circular area:

- 1) The number of storms passing through the area
- 2) The average meridional component of storm motion
- 3) The average zonal component of storm motion
- 4) The average translation speed without regard to direction
- 5) The standard deviation of item 4.

The choice of a 75-n.mi. circle was prompted by the fact that this is the average area typically associated with damage, damage potential, or damage concern. The area of a 75-n.mi. circle approximates the area of the 2 1/2-degree latitude/longitude boxes used by Hope and Neumann (1969) in a similar study.

The speed and motion component tabulations were calculated so as to avoid bias toward slower moving storms, which have a greater number of hourly positions within a given area. We made this calculation by computing average components of motion and the means and standard deviations of storm speed for each storm and area. A similar procedure was used by Hope and Neumann (1969).

3.3 Additional Computations

Storm frequency - The tabulation procedure outlined above yields the number of tropical cyclones passing through each circular area over the 80-year period. For user convenience, a 100-year frequency was estimated by multiplying the 80-year frequencies by the factor 100/80. The data were also passed through the nine-point smoothing-desmoothing filter discussed by Gerrity (1977) and Shuman (1957). After smoothing, the fields were analyzed by a digital objective procedure.

Storm motion - To portray expected storm motion vectors graphically, the meridional and zonal components of storm motion were interpolated bi-linearly to a less dense grid (fig. 1) with points distributed every 2 1/2 degrees of latitude/longitude over the tropical cyclone basin. Storm translation speeds and standard deviations were similarly interpolated.

4. CHARTS AND TABLES

Charts and tabular data depicting frequency and motion characteristics are presented in appendix A for portions of the hurricane season and for three wind speed criteria. Chart Series A (pp. A-3 through 44) is based on all tropical cyclone track segments having winds of at least tropical storm strength (1-minute sustained winds of at least 34 knots). Chart Series B (pp. A-45 through 53) and C (pp. A55 through 57) are similar to Series A, except they are based on track segments that have at least 64 knots (hurricane strength) and 100 knots, respectively. Because sample sizes decrease with increasing wind speed, the number of stratifications in each series is greater with the lower wind speeds. Temporal stratifications included in each chart series are listed in the introduction to each series.

5. DISCUSSION

Graphical and tabular data presented in the appendix should satisfy the needs of many interests. Some of the more obvious uses are determination of storm tracks and frequencies by area and assessment of seasonal shifts in this activity. Since the essential purpose of the study is presentation rather than discussion of the data, no attempt will be made to further analyze the charts and tabular listings. However, several less obvious applications of the data are discussed in this section.

5.1 Variability of Tropical Cyclone Motion

It is known that tropical cyclone motion is much more persistent in some areas than others. A measure of this "steadiness" can be obtained by dividing mean resultant storm speed for a given site (column D in the appendix tabular data) by the average speed (column E). When this ratio is high (approximately 0.90 or greater), the resultant direction (column C) can be relied upon to represent the most likely direction of motion through that area. When the ratio is low (approximately 0.75 or less), the interpretation is that the resultant direction has been computed from storms moving in a variety of directions. Consequently, it is likely that a storm might move in a direction quite different from that of the resultant direction.

As an example, consider the 2 1/2-degree latitude/longitude box number 122 (fig. 1, p. A-2) for 1 May - 30 Nov. in Chart Series A (p. A-44). Note that the resultant direction and speed are 279° at 13 knots, while the mean speed is also 13 knots. The interpretation is that storms moving through this area of the Caribbean would not be expected to deviate from the 279°/13 knot vector motion. Such information is very useful for forecasting.

As a contrasting example, consider box number 296, in the Gulf of Mexico. The resultant direction and speed on page A-44 are 354°/7 knots and the mean speed is 10 knots. The ratio 0.70 of resultant to mean speed is low. Accordingly, storms in this area can be expected to move in a variety of directions during the season. Further discussion relative to these "steadiness" values is given by Hope and Neumann (1971).

5.2 Tropical Storms Versus Hurricanes

Tropical cyclones tend to be more intense in certain areas of the Atlantic basin. A measure of this intensity index can be obtained from the ratio of the number of expected hurricanes (given in Chart Series B) to the number of expected hurricanes and tropical storms combined (given in Chart Series A).

As an example, consider the Miami, Fla., area (box number 298 in fig. 1) and the northeastern Gulf of Mexico (box number 332) during the May-November season. In the Miami area, 51 storms can be expected per 100 years (p. A-44). Of these, 31, or 61%, attained hurricane strength (p. A-53). In the northeastern Gulf of Mexico, the number of storms passing within 75 n.mi. of the center of the box is 55 per 100 years, which is higher than for the Miami area, but the number reaching hurricane strength (21 per 100 years) is much lower than for the Miami area, giving a percentage of 38. Further information relative to the ratio of hurricanes to combined hurricanes and tropical storms along the Gulf and Atlantic coasts is given by Ho et al. (1975).

5.3 Poisson Probabilities of Storm Occurrence

As shown by Hope and Neumann (1969), the number of tropical cyclones passing through a given area for a given time interval is described by the Poisson distribution function,

$$P(x) = e^{-m} m^x/x!, \quad (1)$$

where $P(x)$ is the probability ($0 \leq P \leq 1$) of exactly x tropical cyclones, e is the base of natural logarithms (~ 2.7183), m is the mean occurrence rate over the interval, and $x!$ refers to x -factorial.

As an example of the computations, consider the 1 May - 30 Nov. period for box number 445 (off Cape Hatteras) on Chart Series A (p. A-44), where 76 storms can be expected per 100 years, giving a mean annual occurrence rate of 0.76. From eq. (1), the probability of having no storms pass within 75 n.mi. of the center of this box in a given year is 0.47. Similarly, the probability of observing exactly one, exactly two, or exactly three storms in a given year is 0.36, 0.14 and 0.03, respectively. The probability of having at least one storm is 0.53, at least two storms is 0.17, etc. Depending upon user requirements, the Poisson probabilities often provide a better measure of storm activity than the mean number of storms.

The chances of obtaining exactly x storms in N consecutive years can also be obtained by estimating an N -year mean by the algebraic product, $N \times m$. For example, over a 2-year consecutive period, the mean occurrence rate is 1.52 storms. From eq. (1), the chance of no storms passing through the area is 0.22 and of at least one storm, 0.78. The chance of obtaining at least one storm over 5 consecutive years is 0.98.

5.4 Storm Translation Speeds

Mean storm translation speeds in each area are included in the tables under column E. The occurrence of speeds other than the mean can be accomplished by fitting the data to a statistical distribution. Since storm speeds are bounded at the lower end by zero but are theoretically unbounded at the upper end, the Gamma distribution may be expected to adequately describe the distribution of observed translation speeds. Properties of the distribution are described in detail by Crutcher et al. (1973, 1977, and 1978) and briefly by Burington and May (1958). The means and standard deviations of storm speeds given in columns E and F, respectively, are sufficient to provide moment estimates of the required shape and scale parameters of the Gamma distribution. Once the distribution has been fitted, inferences can be made as to the likelihood of storms moving through the area at speeds other than the mean.

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APPENDIX A — CHARTS AND TABLES

A.1 Introduction

Charts and tabular data depicting frequency and motion characteristics are presented for various portions of the hurricane season and for three wind speed criteria. Chart Series A (pp. A-3 through 44) is based on all tropical cyclone track segments having winds of at least tropical storm strength (1-minute sustained winds of at least 34 knots). Chart Series B (pp. A-45 through 53) and C (pp. A-55 through 57) are similar to Series A, except they are based on track segments having at least 64 knots (hurricane strength) and 100 knots, respectively. Because sample sizes decrease with increasing wind speed limits, the number of stratifications in each series is greater in the case of the smaller wind speed limits (20 stratifications are given for Chart Series A, four for Chart Series B, and one for Chart Series C).

A.2 Chart Descriptions

Charts and associated tabular data are arranged in pairs on facing pages as follows:

UPPER LEFT: The initial panel in each set of charts depicts storm frequency. Isolines are at intervals of three storms passing within 75 n.mi. per 100 years, except in the case of the 1 May - 30 Nov. and 16 Jul. - 20 Sep. periods of Chart Series A where isolines are at intervals of five storms per 100 years.

LOWER LEFT: The lower left panel gives the vector speed (knots) and direction (toward which storms are moving) averaged over 2 1/2-degree latitude/longitude boxes. Vector motions were not computed when frequencies were less than five storms per 80 years.

UPPER RIGHT: This panel gives specific storm tracks used in the computations. Solid lines depict portions of storm tracks meeting speed and temporal stratification criteria. Dashed portions refer to track segments that do not meet at least one of the criteria and, thus, are excluded from the computations.

LOWER RIGHT: Data used in construction of the upper-left and lower-left charts, as well as additional statistics for the given temporal and wind stratification, are tabulated on the lower portion of the right-hand page. Columnar headings A through F are identified as follows:

Column A: The index number of the 2 1/2-degree latitude/longitude box as specified in fig. 1

Column B: Expected number of tropical cyclones passing within 75 n.mi. (139 km) of given box center per 100 years

Column C: Resultant (vector) direction in degrees toward which the storm is expected to move on the average

Column D: Resultant (vector) speed in knots

Column E: Average translation speed without regard to direction (knots)

Column F: Standard deviation (knots) of column E data

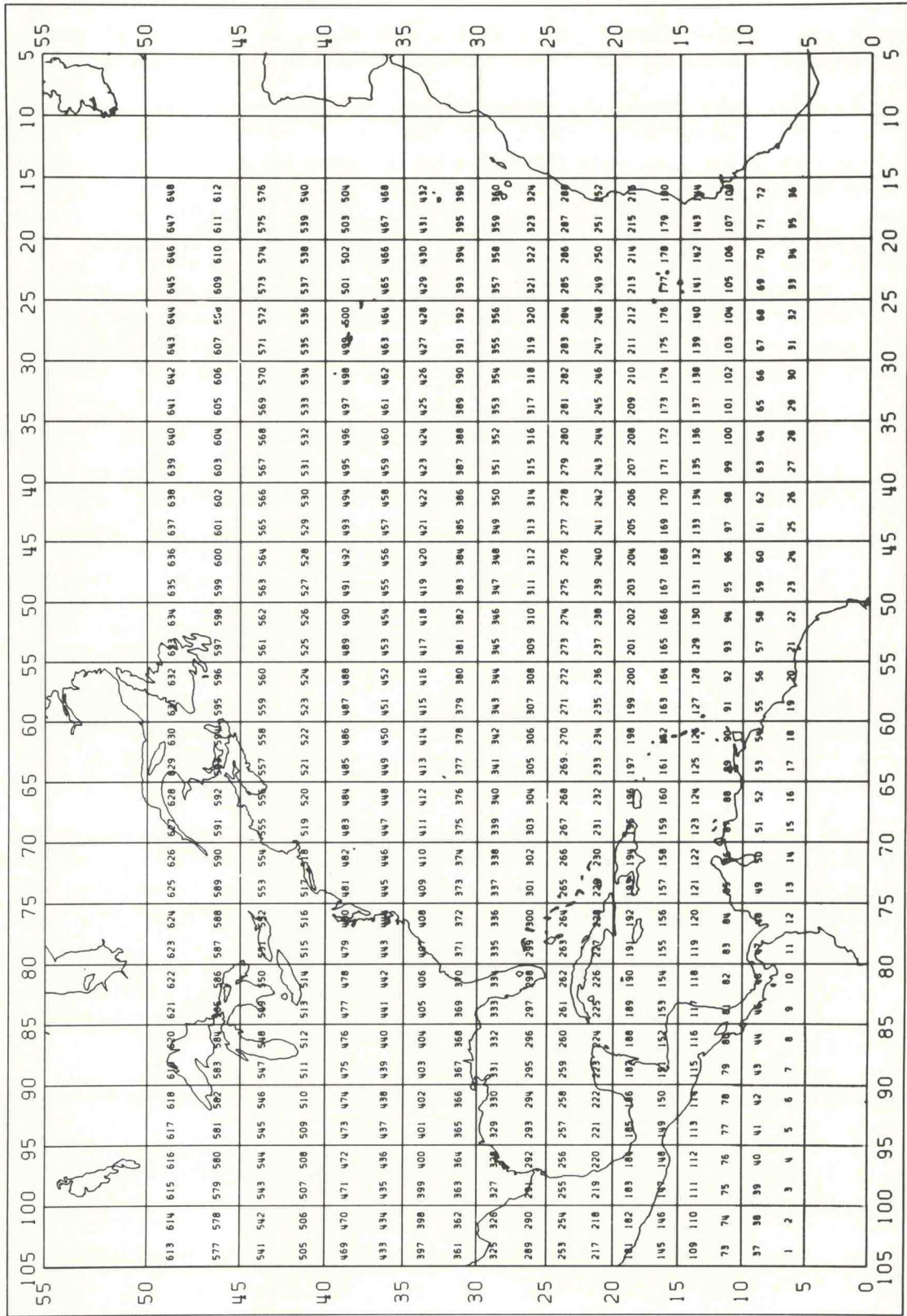
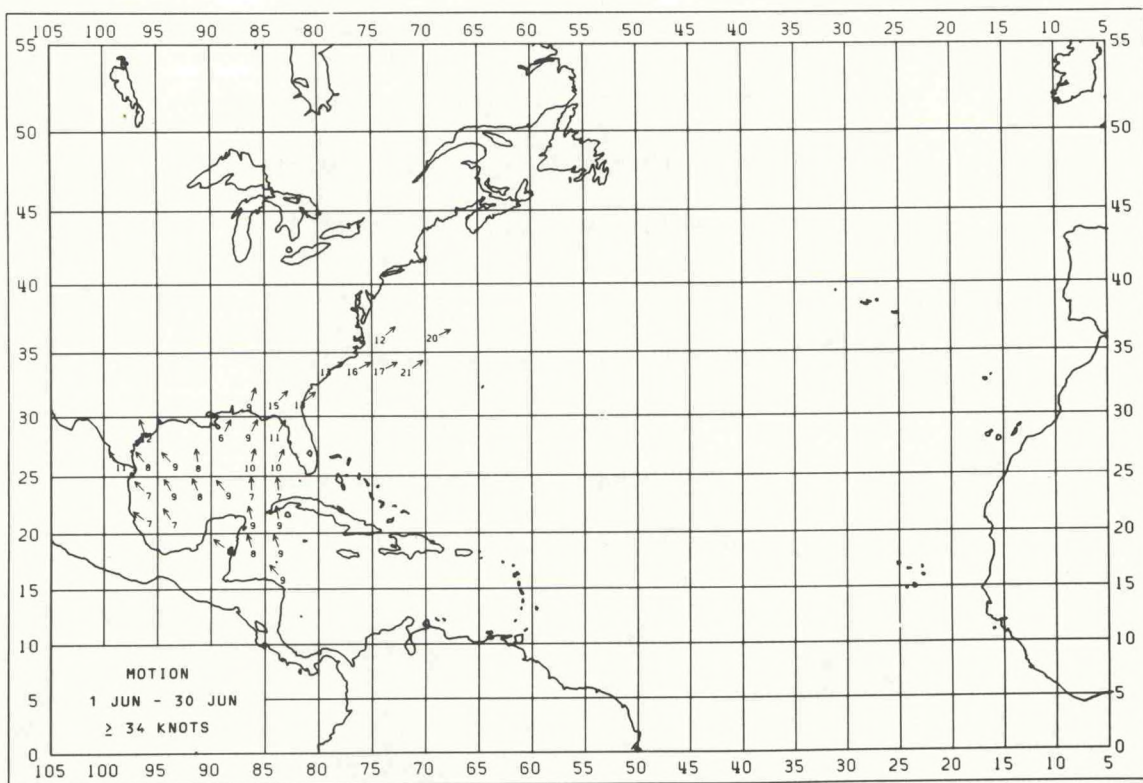
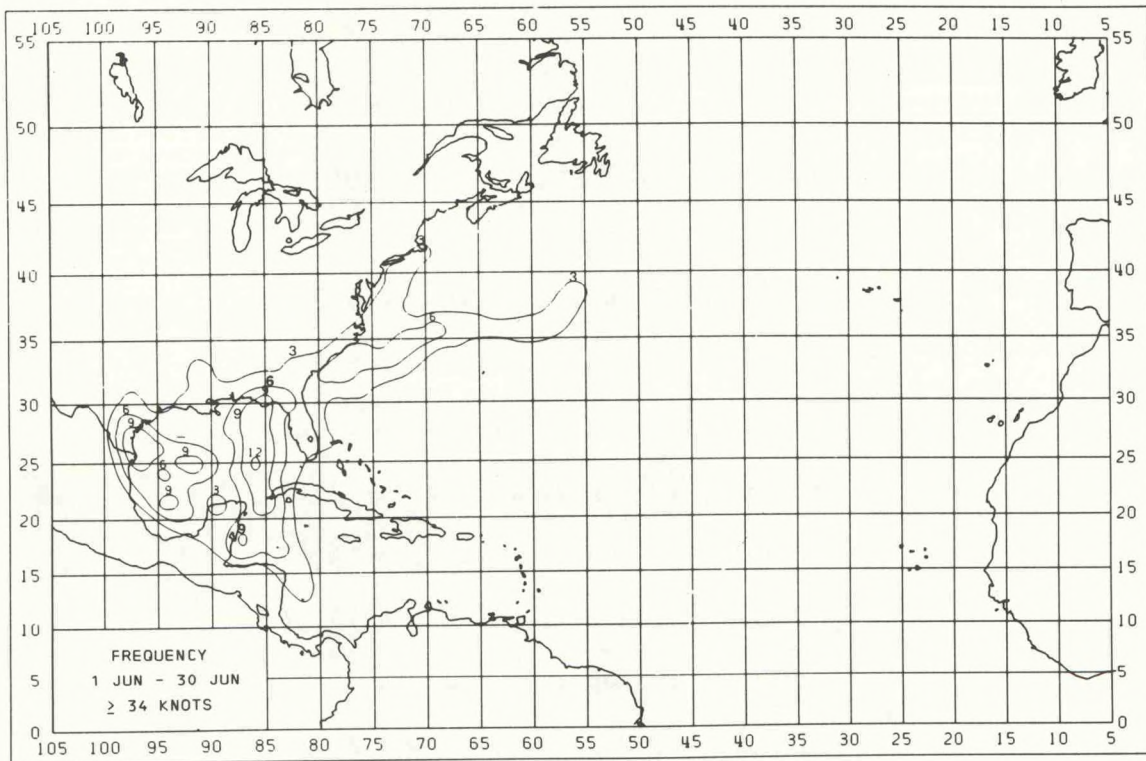


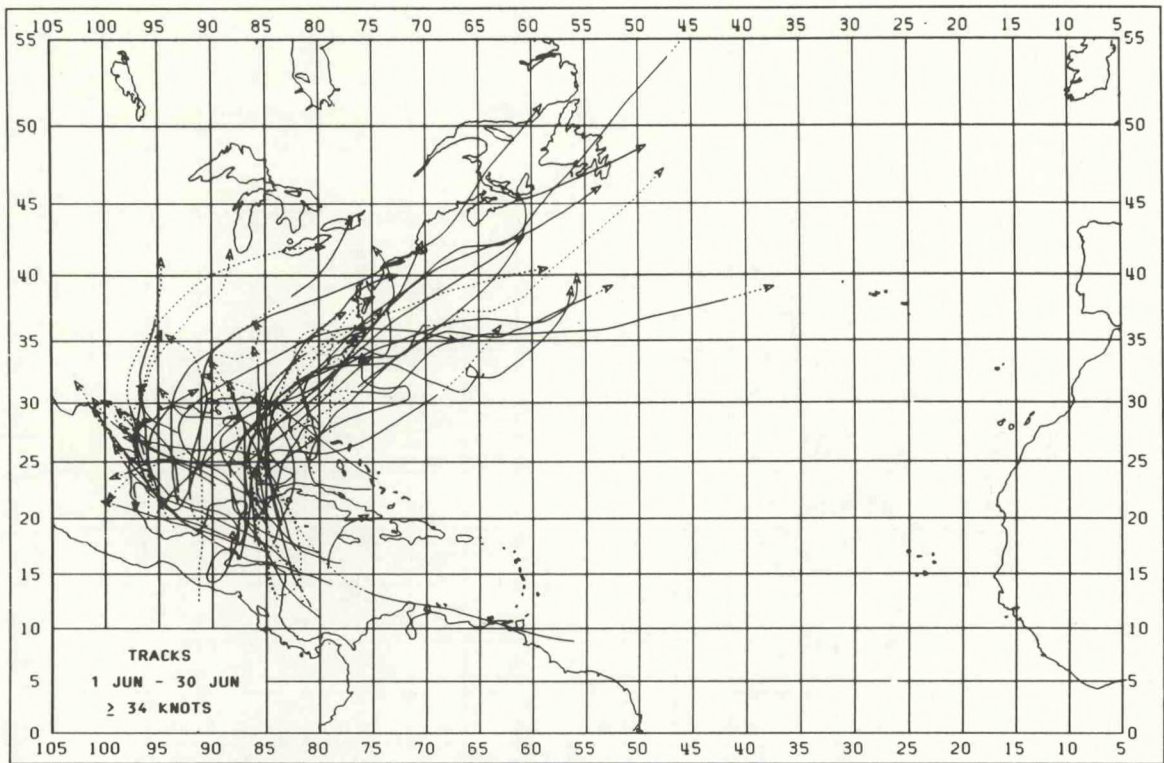
Figure 1.--Index numbers for 2 1/2-degree latitude/longitude boxes.

A.3 Chart Series A

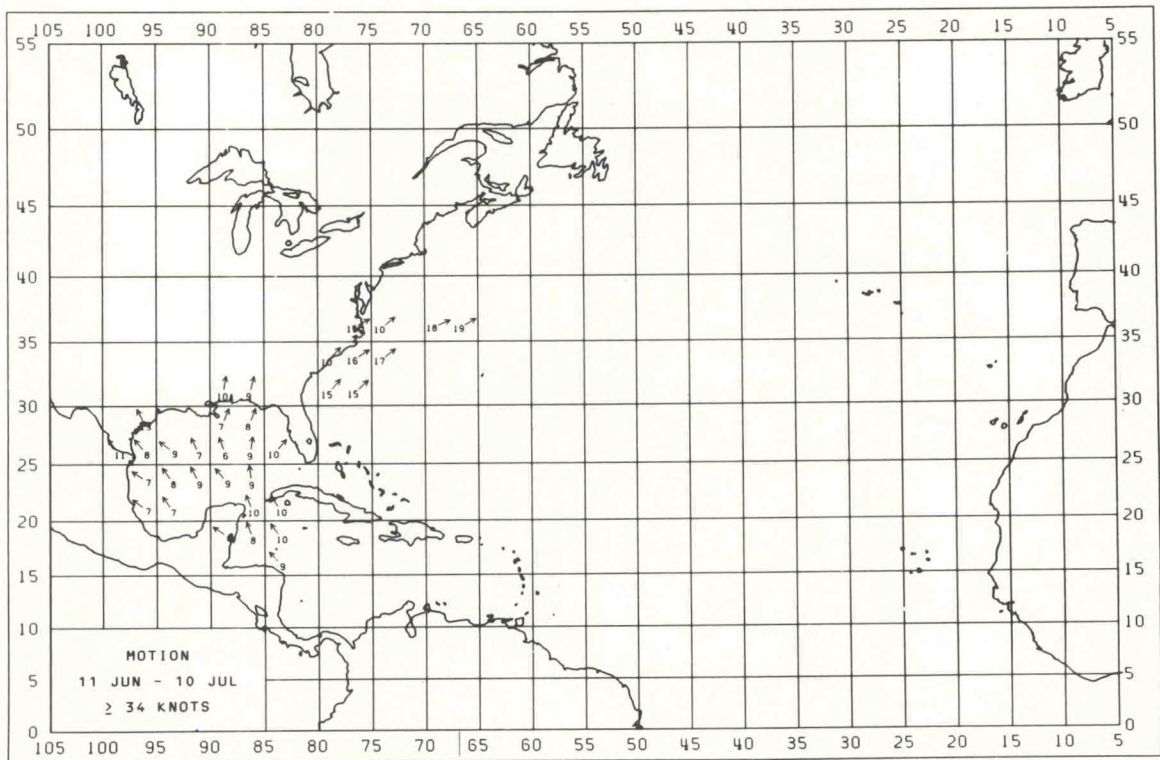
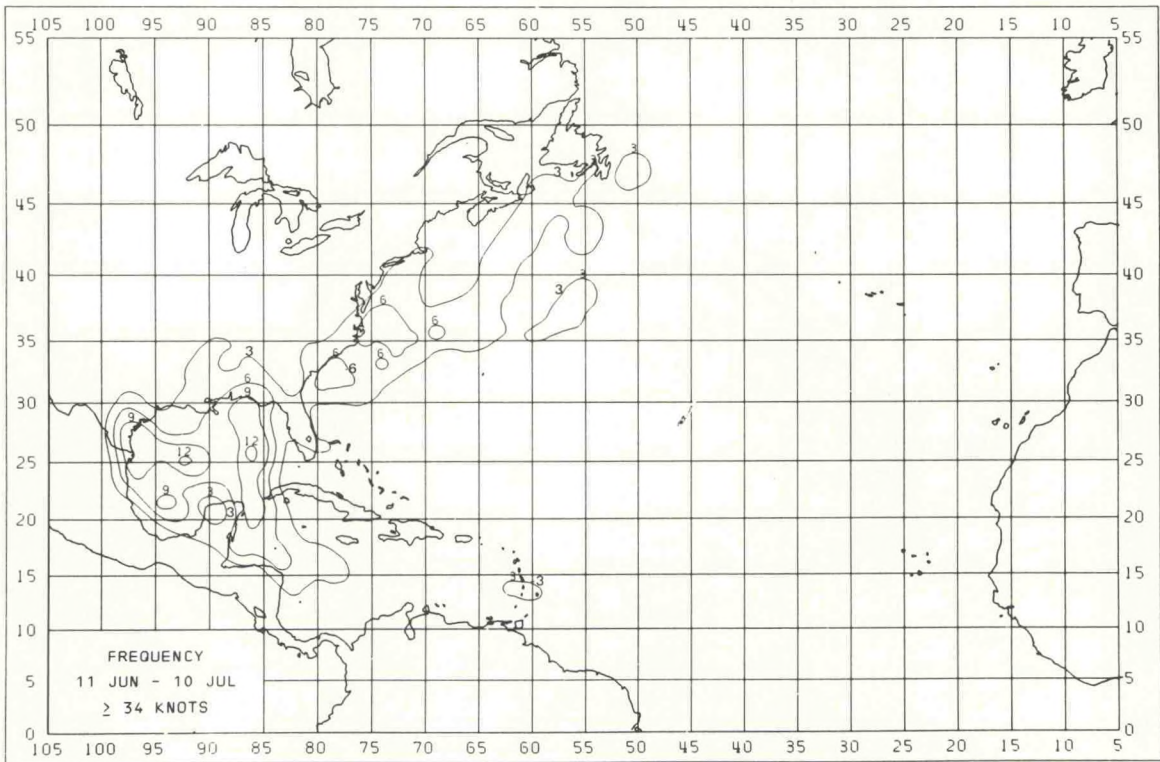
Charts and tabular data in this series are based on portions of storm tracks having intensities of at least 34 knots and for the following periods:

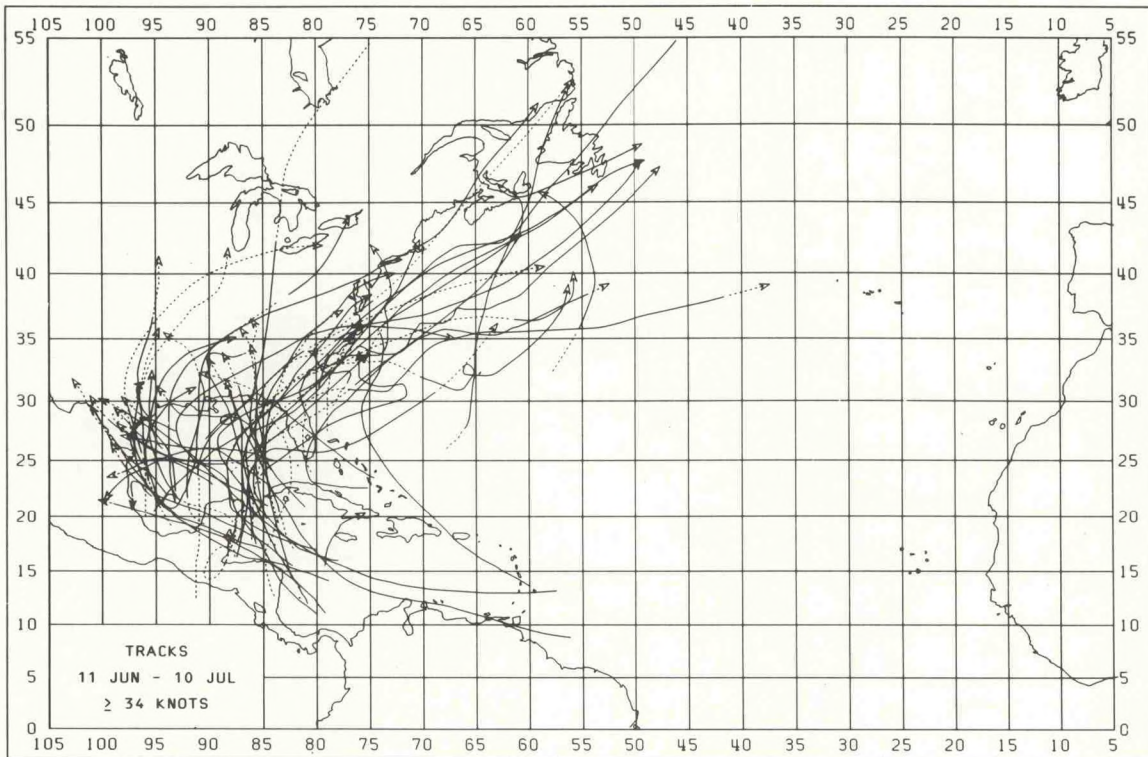
<u>STRATIFICATION PERIOD</u>	<u>PAGES</u>
1 Jun - 30 Jun.....	A-4,5
11 Jun - 10 Jul.....	A-6,7
21 Jun - 20 Jul.....	A-8,9
1 Jul - 31 Jul.....	A-10,11
11 Jul - 10 Aug.....	A-12,13
21 Jul - 20 Aug.....	A-14,15
1 Aug - 31 Aug.....	A-16,17
11 Aug - 10 Sep.....	A-18,19
21 Aug - 20 Sep.....	A-20,21
1 Sep - 30 Sep.....	A-22,23
11 Sep - 10 Oct.....	A-24,25
21 Sep - 20 Oct.....	A-26,27
1 Oct - 31 Oct.....	A-28,29
11 Oct - 10 Nov.....	A-30,31
21 Oct - 20 Nov.....	A-32,33
1 Nov - 30 Nov.....	A-34,35
1 May - 15 Jul.....	A-36,37
16 Jul - 20 Sep.....	A-38,39
21 Sep - 30 Nov.....	A-40,41
1 May - 30 Nov.....	A-42,44



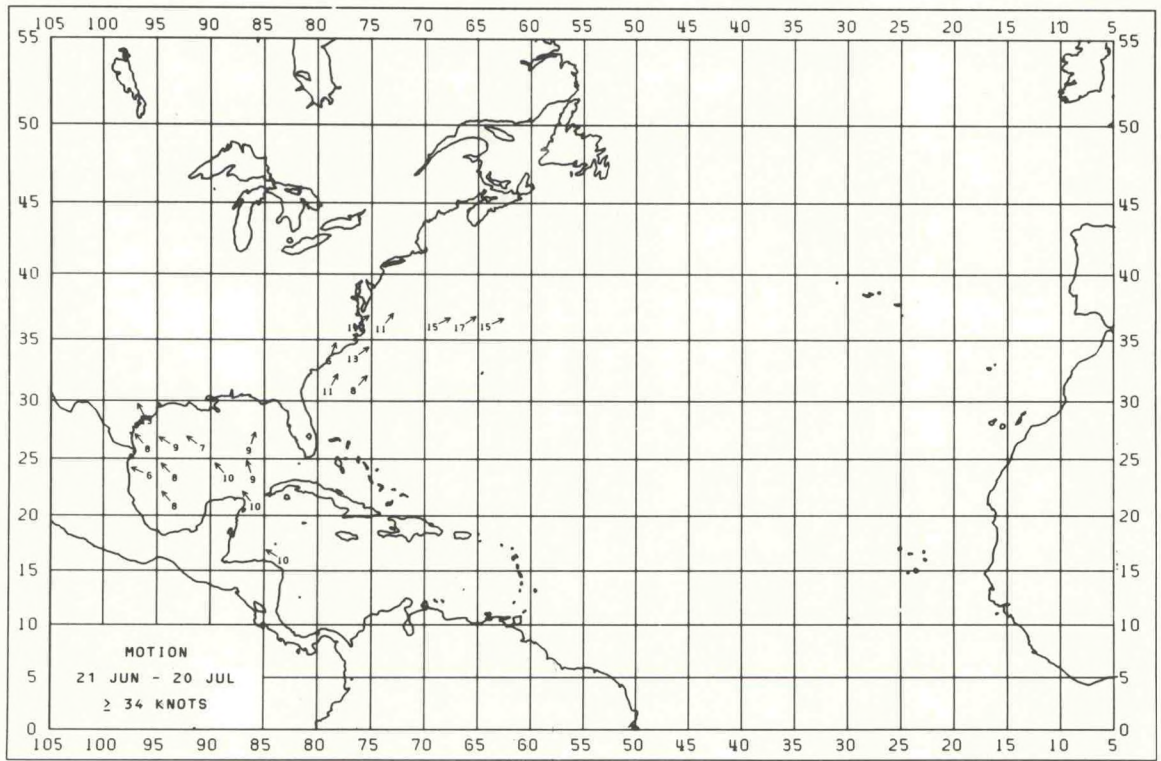
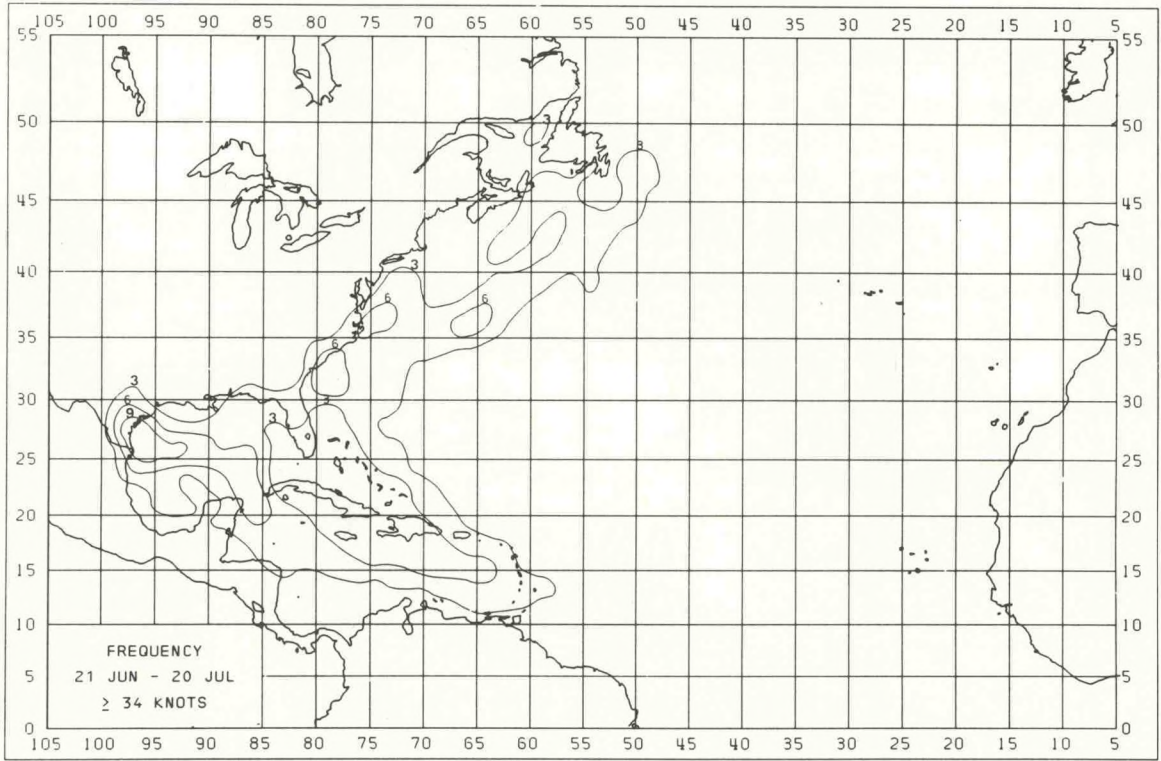


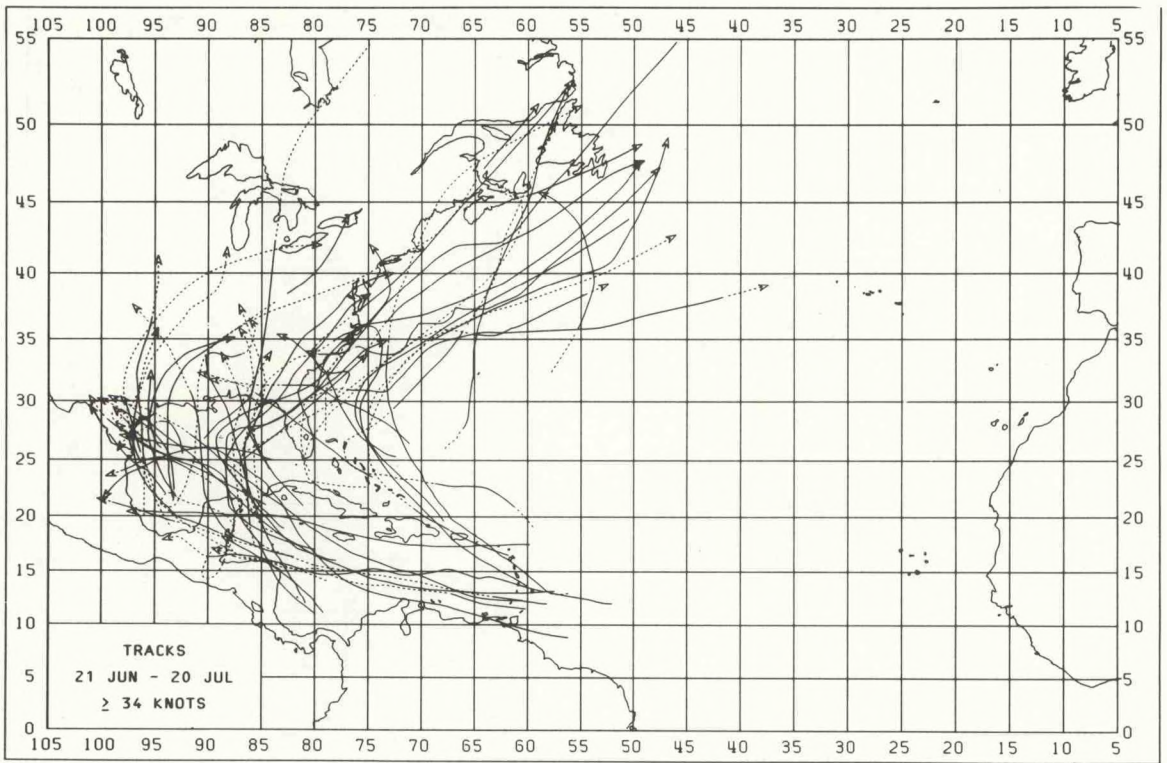
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188	7	343	8	10	2.48	
189	6	339	9	9	3.73	
220	5	307	7	8	3.05	
221	9	326	7	9	3.97	
224	9	347	9	11	3.04	
225	9	350	9	10	3.15	
256	8	316	7	8	3.23	
257	6	330	9	10	3.88	
258	8	337	8	10	5.48	
259	5	322	9	10	4.88	
260	11	358	7	9	4.46	
261	7	354	7	8	3.29	
291	6	323	11	11	3.79	
292	11	322	8	9	4.42	
293	8	316	9	10	2.84	
294	6	353	8	11	5.23	
296	12	014	10	12	7.95	
297	8	022	10	13	8.83	
328	5	341	12	13	3.99	
331	5	027	6	12	3.89	
332	12	028	9	12	6.76	
333	7	031	11	15	6.62	
368	6	016	9	12	6.55	
369	6	043	15	15	7.48	
370	6	050	13	14	5.95	
407	5	060	13	14	4.48	
408	7	063	16	17	10.34	
409	7	064	17	19	14.73	
410	5	055	21	21	16.66	
445	5	050	12	14	4.97	
447	6	066	20	21	20.21	



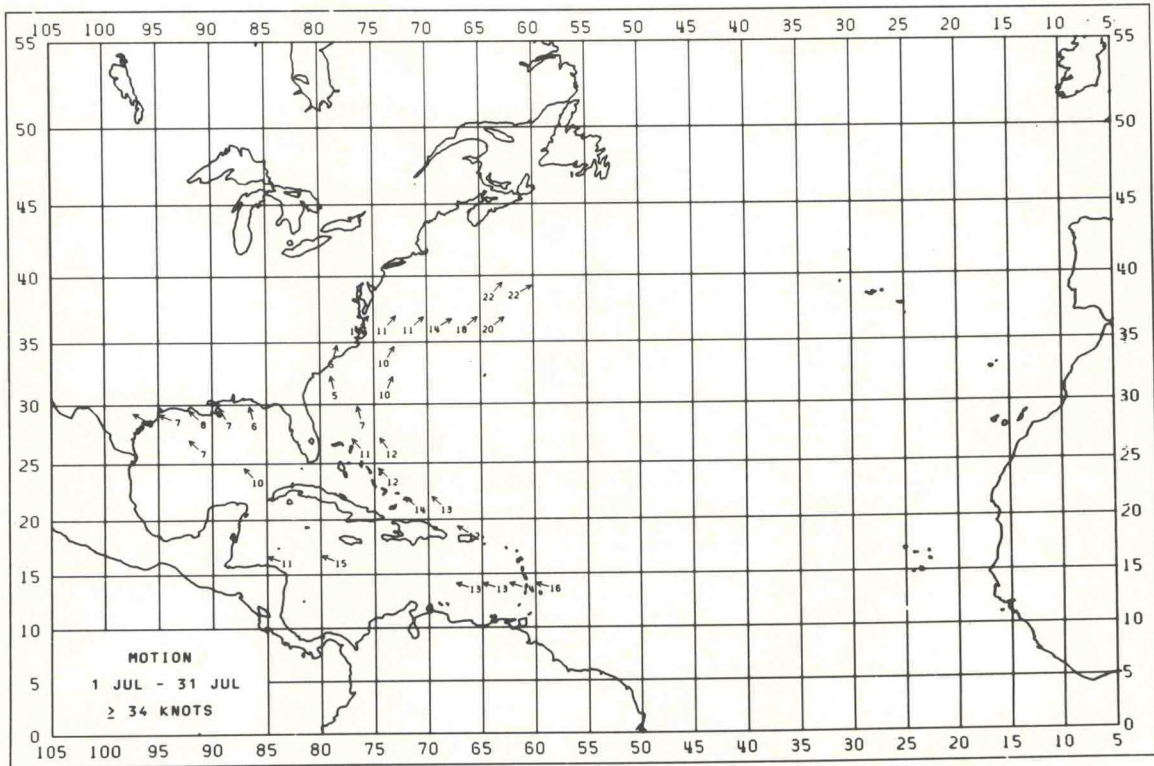
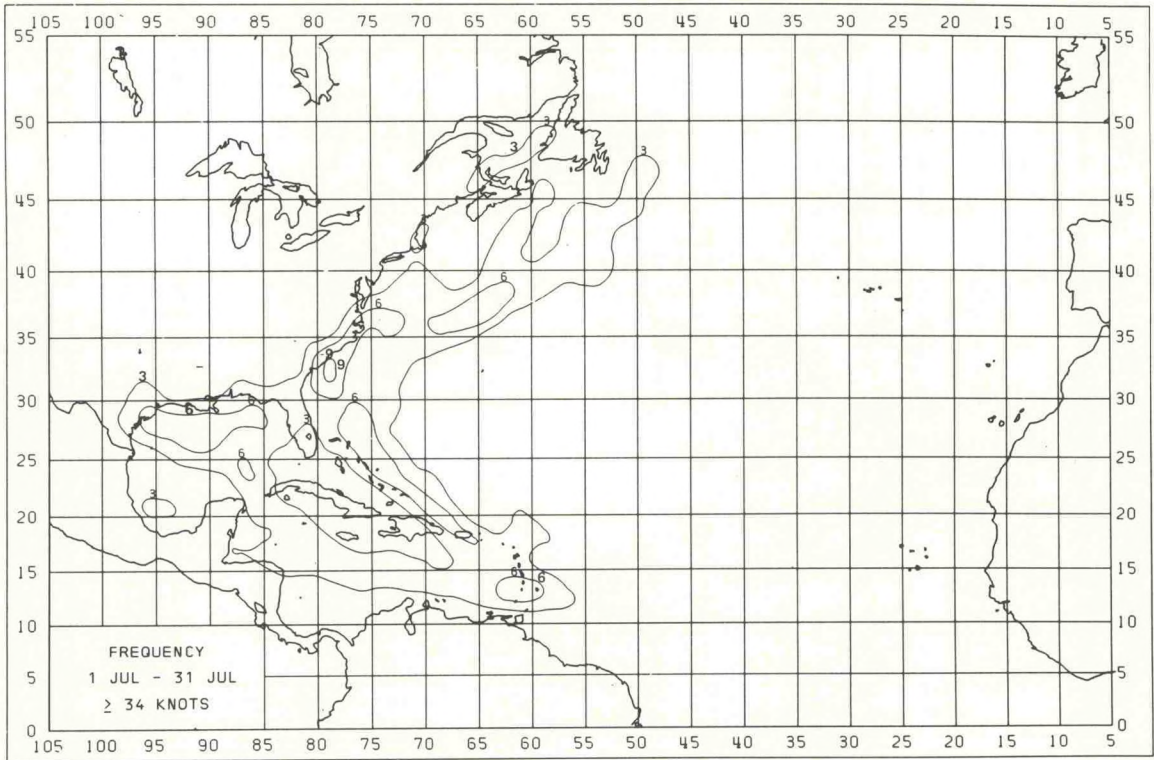


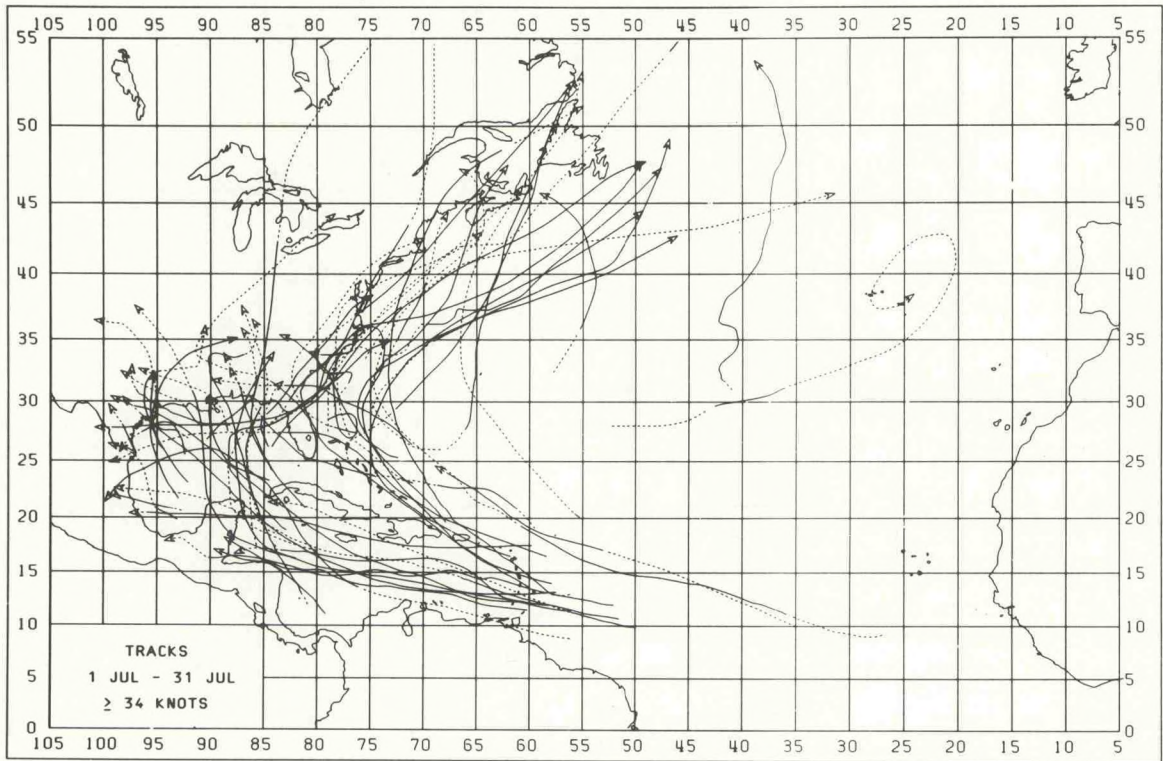
A	B	C	D	E	F
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220	5	307	7	8	3.05
221	9	326	7	9	3.97
224	10	338	10	11	2.79
225	6	330	10	10	3.12
256	9	304	7	9	3.21
257	6	326	8	10	3.72
258	9	333	9	10	5.10
259	6	321	9	10	4.11
260	10	353	9	10	4.05
291	6	323	11	11	3.79
292	12	321	8	9	4.47
293	10	309	9	11	3.10
294	9	336	7	11	4.58
295	6	341	6	9	2.29
296	12	007	9	11	7.15
297	6	039	10	13	10.82
328	6	334	13	14	3.61
331	8	022	7	11	3.18
332	12	021	8	10	4.63
367	5	010	10	13	6.40
368	8	014	9	11	5.91
371	6	043	15	16	12.26
372	6	049	15	16	11.29
407	6	042	10	11	4.70
408	5	056	16	17	12.92
409	6	052	17	18	16.71
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447	6	066	18	19	19.89
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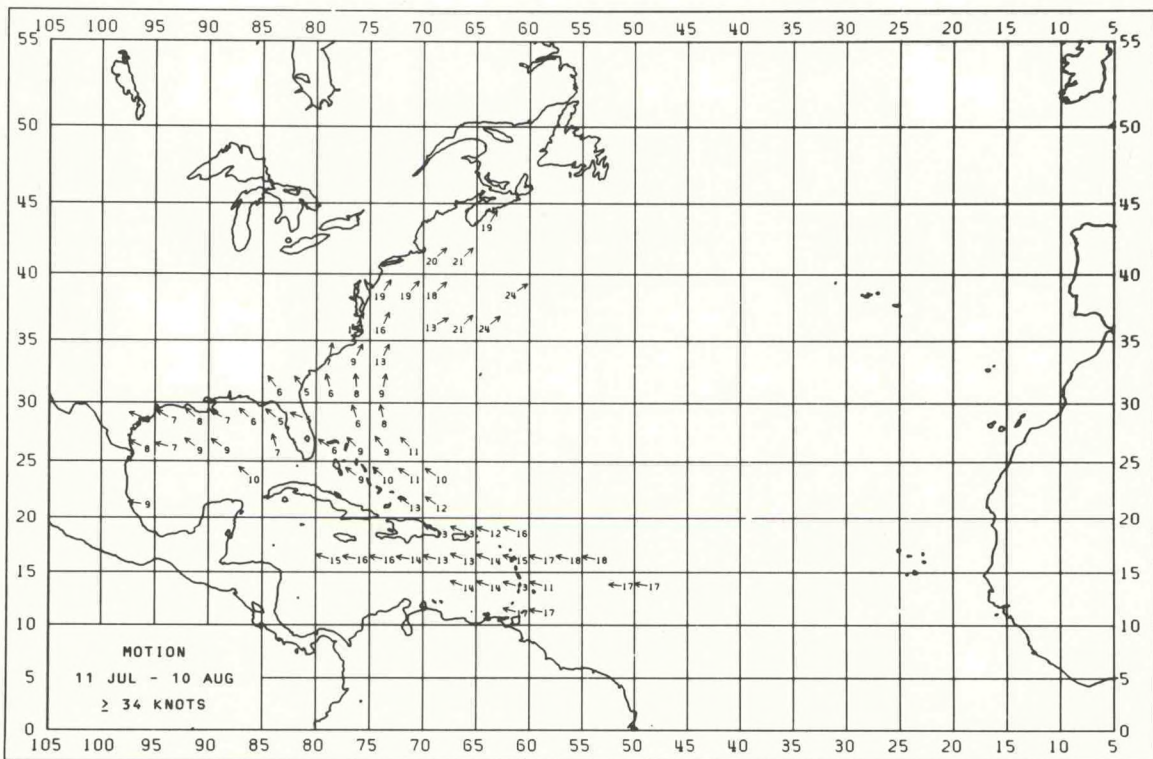
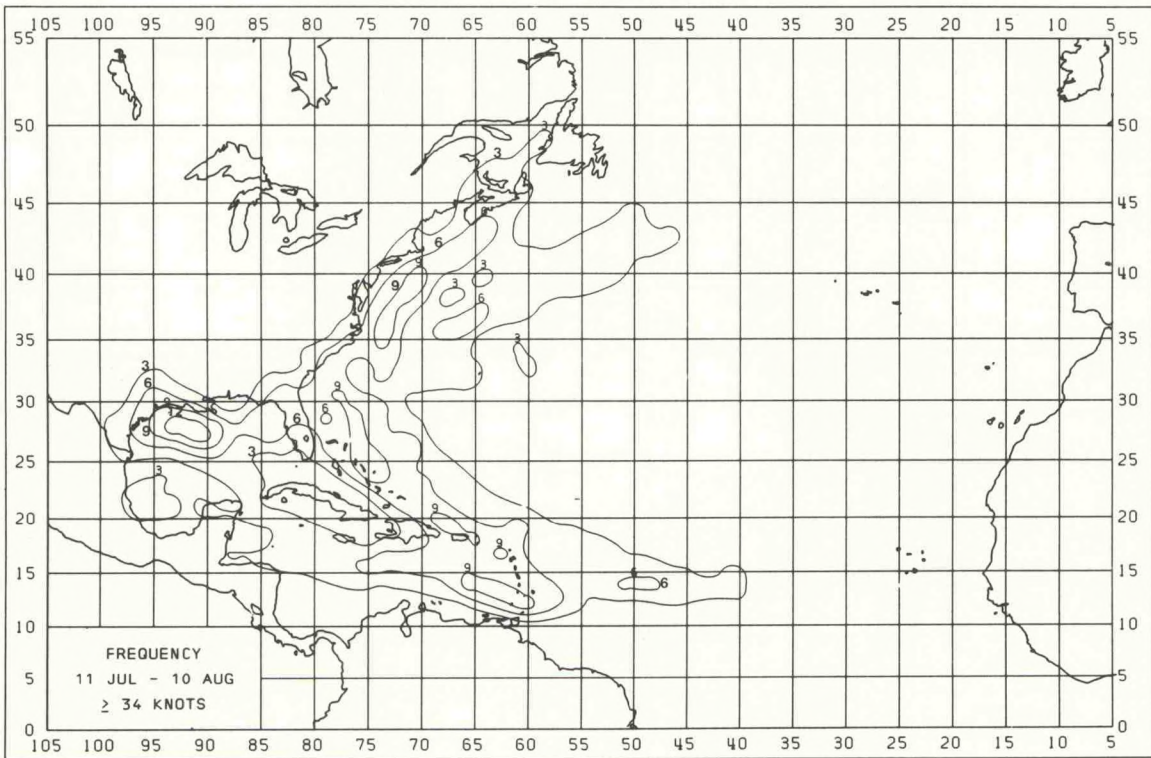


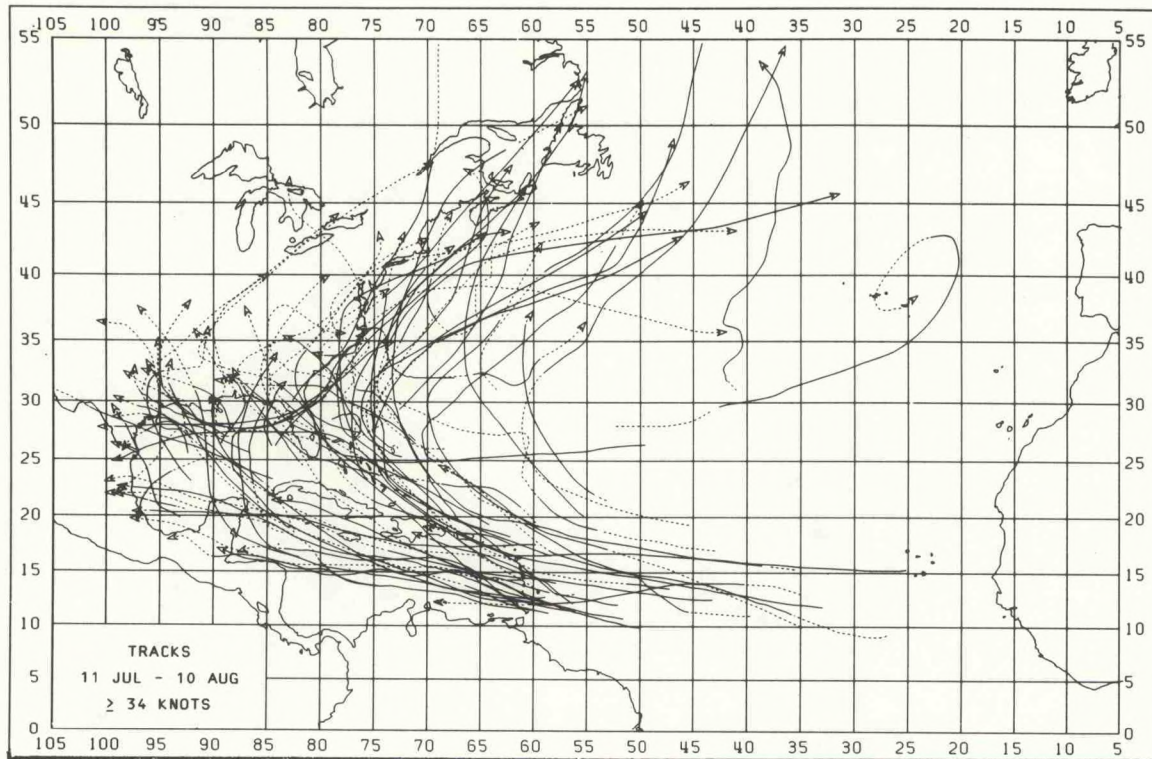
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257	5	317	8	10	2.63	
259	6	319	10	11	3.13	
260	8	342	9	11	4.34	
292	11	321	8	9	4.47	
293	9	303	9	10	3.08	
294	8	308	7	9	3.17	
296	6	018	9	12	10.47	
328	6	334	13	14	3.61	
371	8	029	11	14	10.56	
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407	7	018	6	9	4.60	
408	5	052	13	16	14.23	
444	6	052	11	14	5.08	
445	7	038	11	12	4.17	
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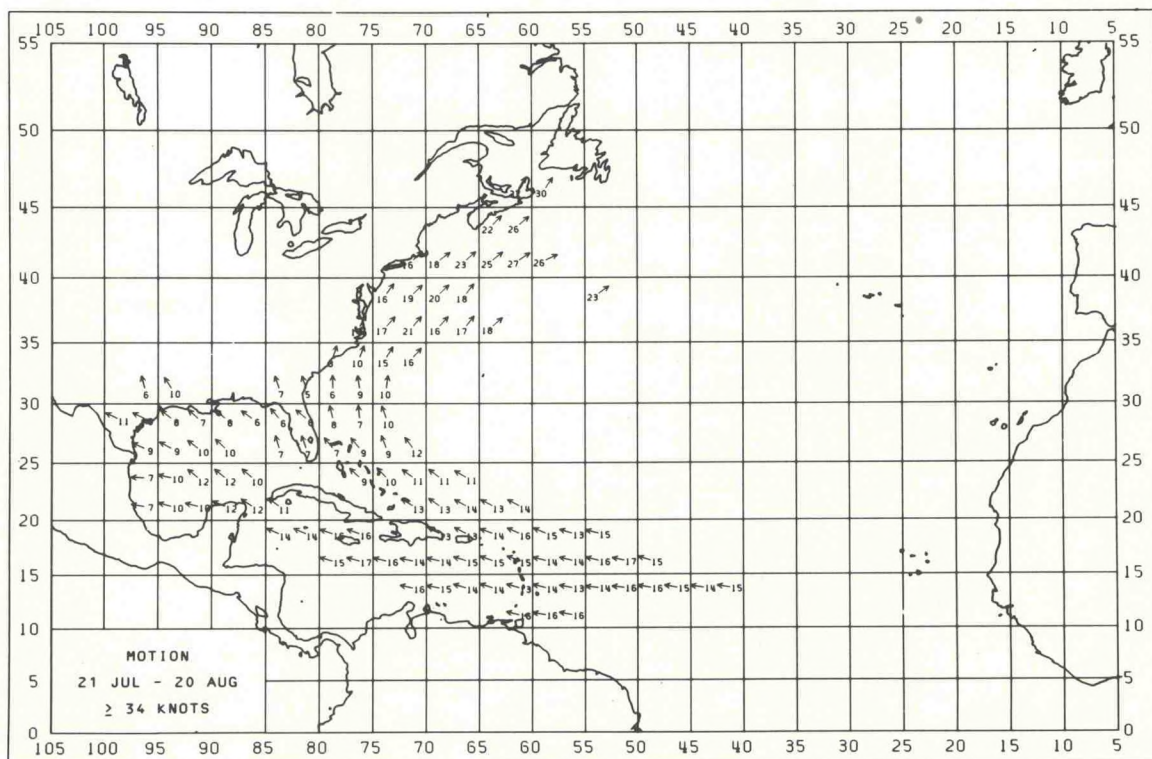
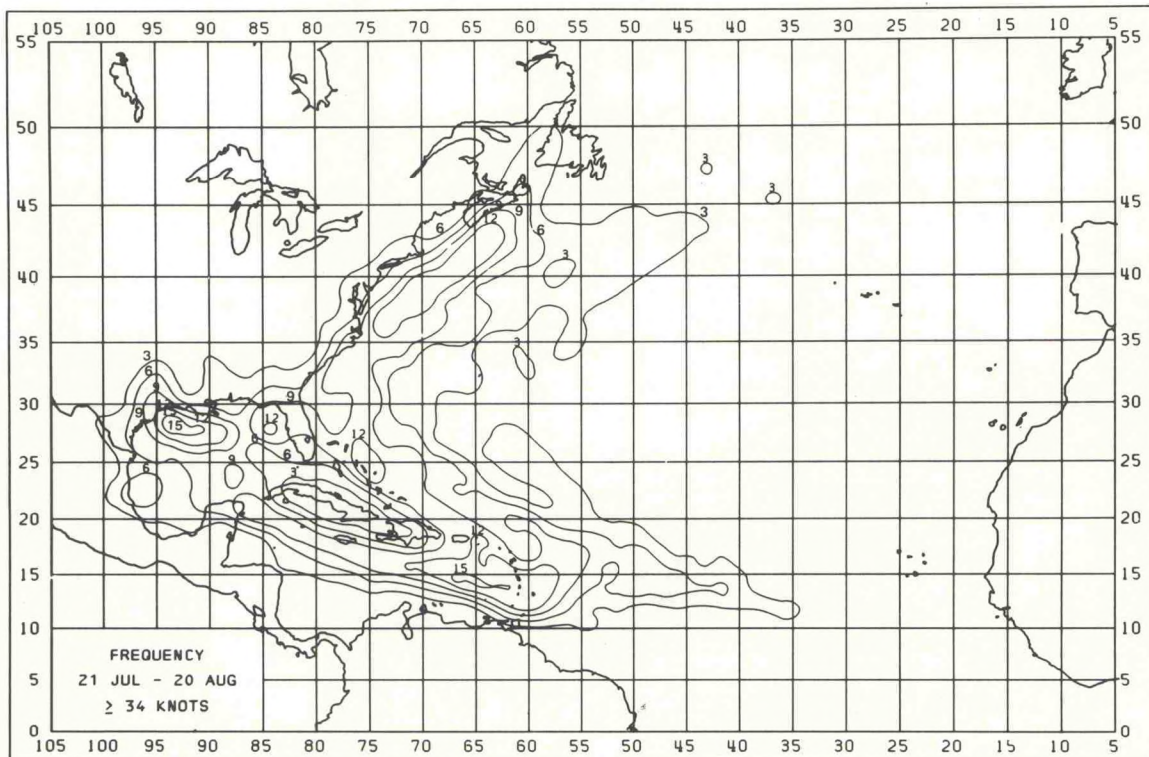


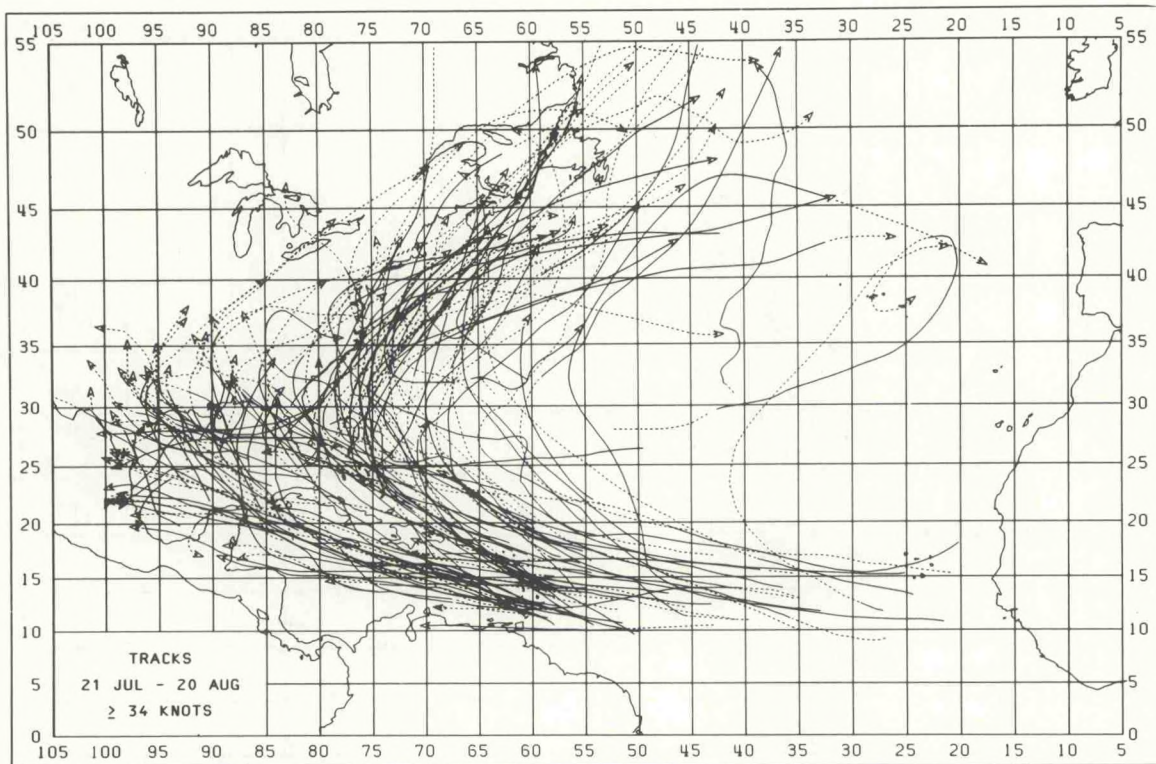
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155	6	292	15	16	4.08	
196	6	302	12	12	3.62	
230	6	310	14	14	5.27	
231	5	313	13	13	6.84	
260	6	318	10	11	3.09	
265	8	315	12	12	4.72	
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328	7	299	9	11	4.53	
329	6	292	7	7	2.34	
330	6	314	8	10	4.09	
331	7	331	7	11	2.81	
332	7	346	6	10	2.20	
336	8	345	7	10	3.96	
371	8	347	5	9	3.64	
373	5	023	10	11	3.85	
407	9	015	5	9	6.57	
409	5	031	10	11	2.51	
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447	7	060	14	16	5.74	
448	7	050	18	19	9.81	
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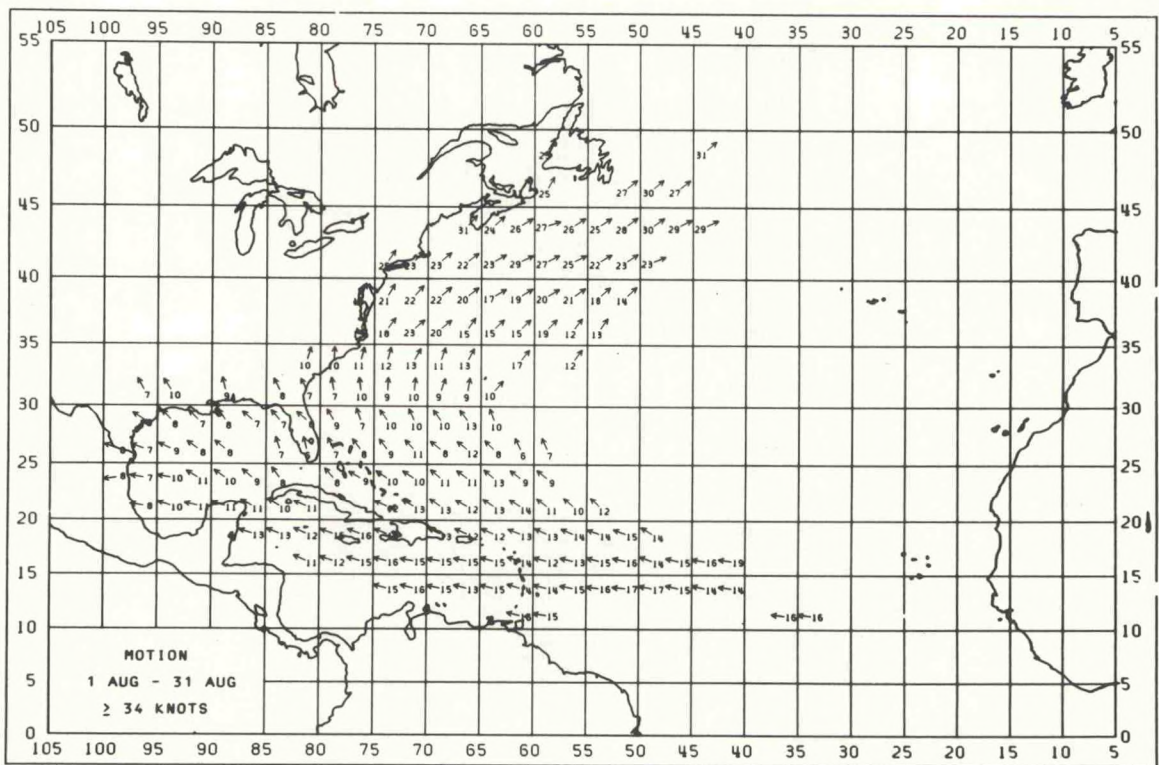
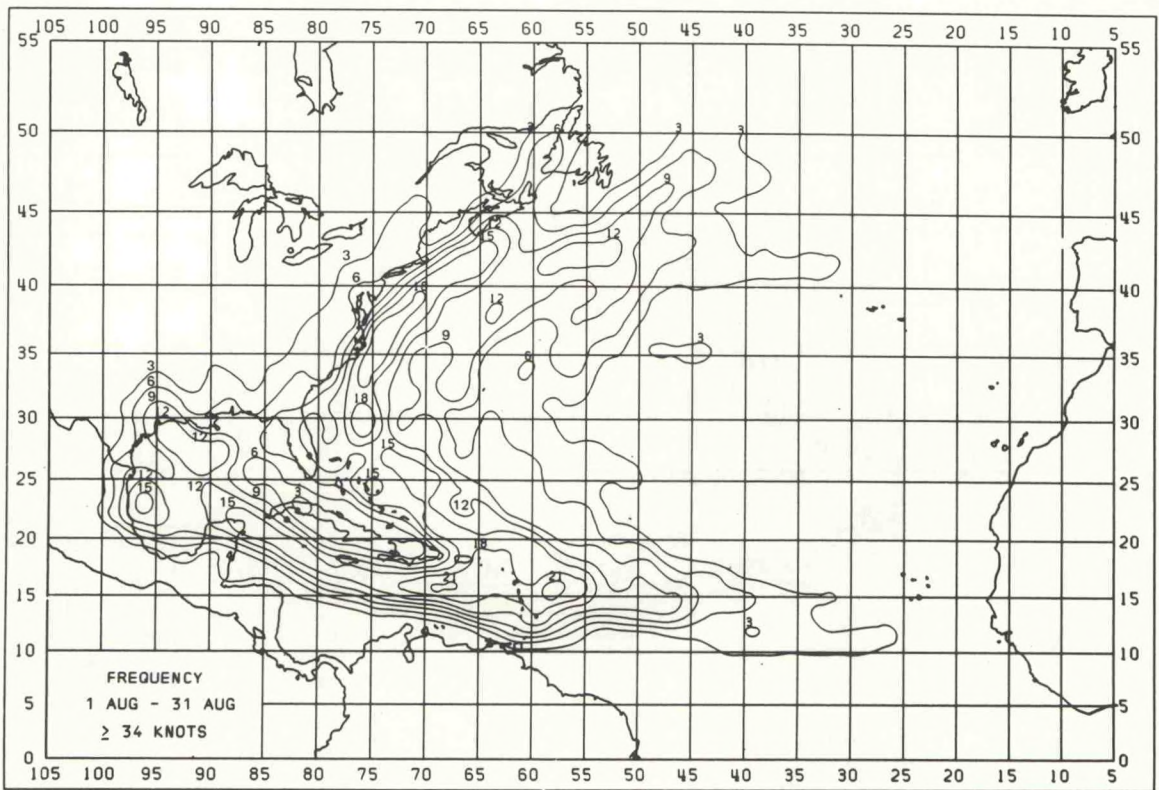


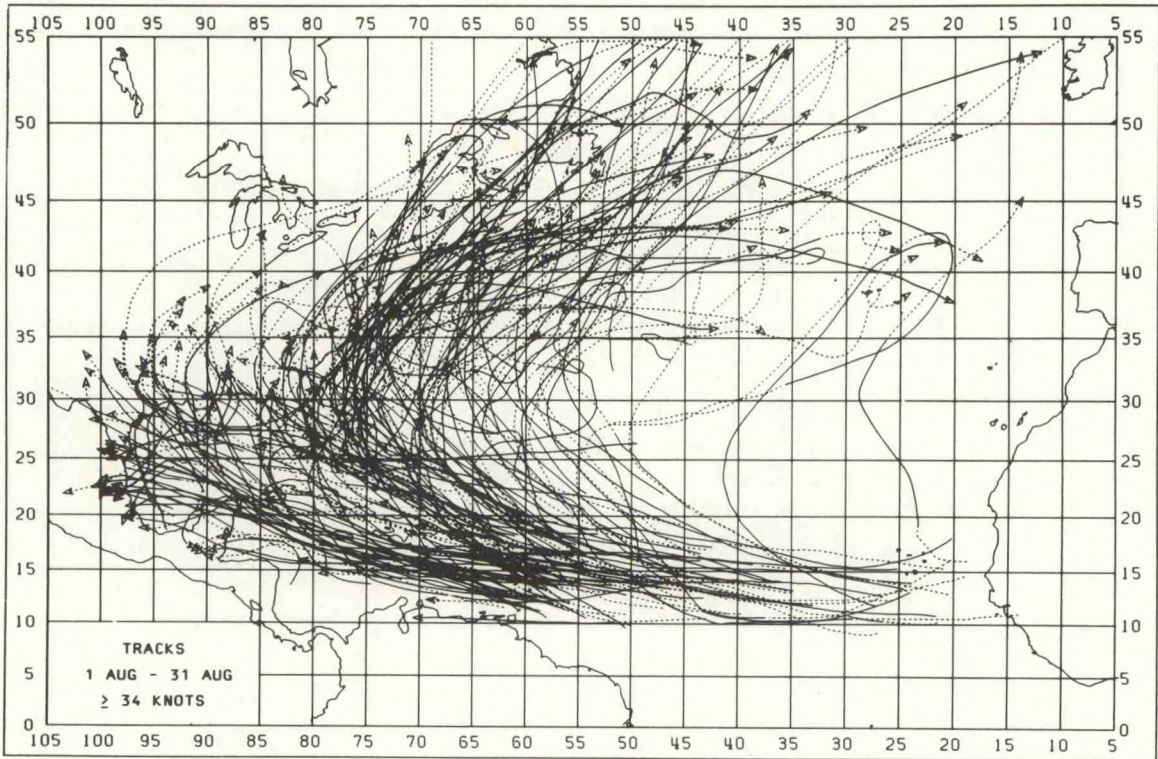
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124	10	291	14	15	5.27		408	6	026	9	12	6.43	
125	10	290	14	15	4.27		409	8	025	13	14	7.09	
126	9	287	13	14	4.02		444	5	031	13	16	9.67	
127	7	286	11	12	3.77		445	10	026	16	18	8.00	
130	7	275	17	17	3.96		447	7	060	13	15	5.87	
131	7	279	17	17	2.21		448	6	044	21	23	7.21	
155	6	287	15	15	5.67		449	5	051	24	25	8.54	
156	6	281	16	16	6.39		481	6	034	19	20	5.44	
157	7	281	16	16	6.12		482	10	042	19	21	8.68	
158	7	279	14	14	6.09		483	5	047	18	20	11.40	
159	7	283	13	13	4.45		486	5	056	24	26	6.79	
160	8	292	13	4	2.41		519	7	046	20	20	6.78	
161	7	289	14	15	2.68		520	7	046	21	22	7.27	
162	7	285	15	15	3.14		557	6	031	19	21	10.04	
163	5	283	17	17	3.66								
164	5	283	18	19	5.65								
165	5	281	18	18	3.85								
195	8	298	13	13	2.20								
196	9	293	13	13	3.76								
197	7	288	12	13	4.01								
198	7	290	16	16	5.44								
220	5	279	9	11	3.12								
230	7	305	13	13	2.07								
231	8	306	12	12	4.41								
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264	7	308	9	9	2.43								
265	10	311	10	11	2.98								
266	7	304	11	12	2.96								
267	6	304	10	10	2.82								
292	6	297	8	10	2.62								
293	6	285	7	9	3.17								
294	8	310	9	10	3.78								
295	7	307	9	10	4.08								
297	5	345	7	9	3.37								
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300	10	317	9	10	5.19								
301	8	324	9	10	4.08								
302	7	318	11	12	7.28								
328	8	291	9	10	3.97								
329	13	300	7	8	3.58								
330	11	313	8	9	4.32								
331	6	301	7	10	4.03								
332	7	313	6	8	2.78								
333	7	310	5	10	3.72								
334	8	290	5	10	4.09								
336	10	342	6	8	2.69								
337	7	348	8	9	3.88								
369	6	324	6	8	3.37								
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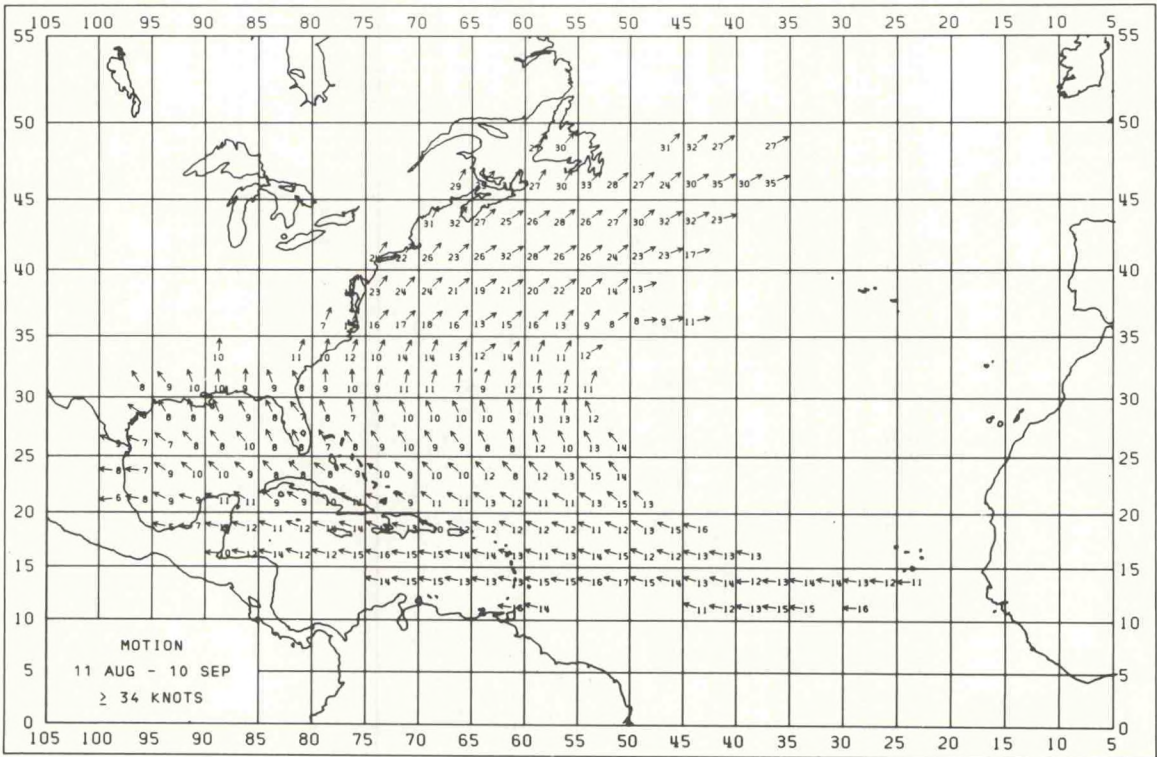
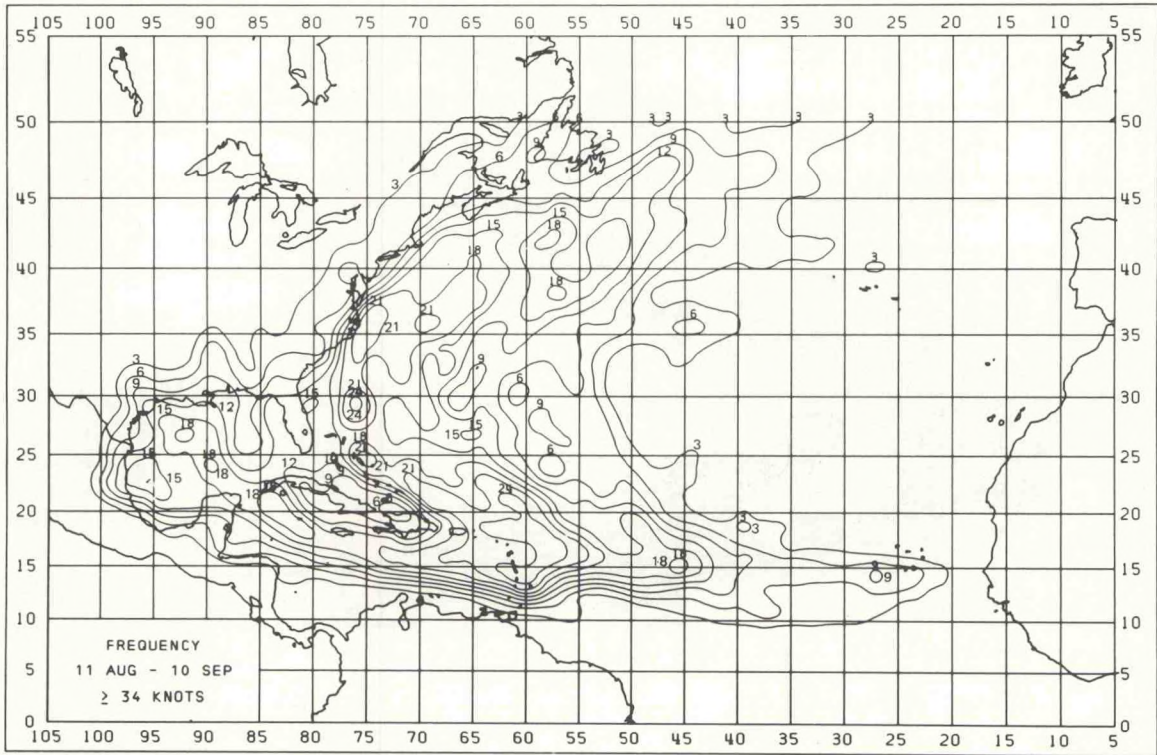


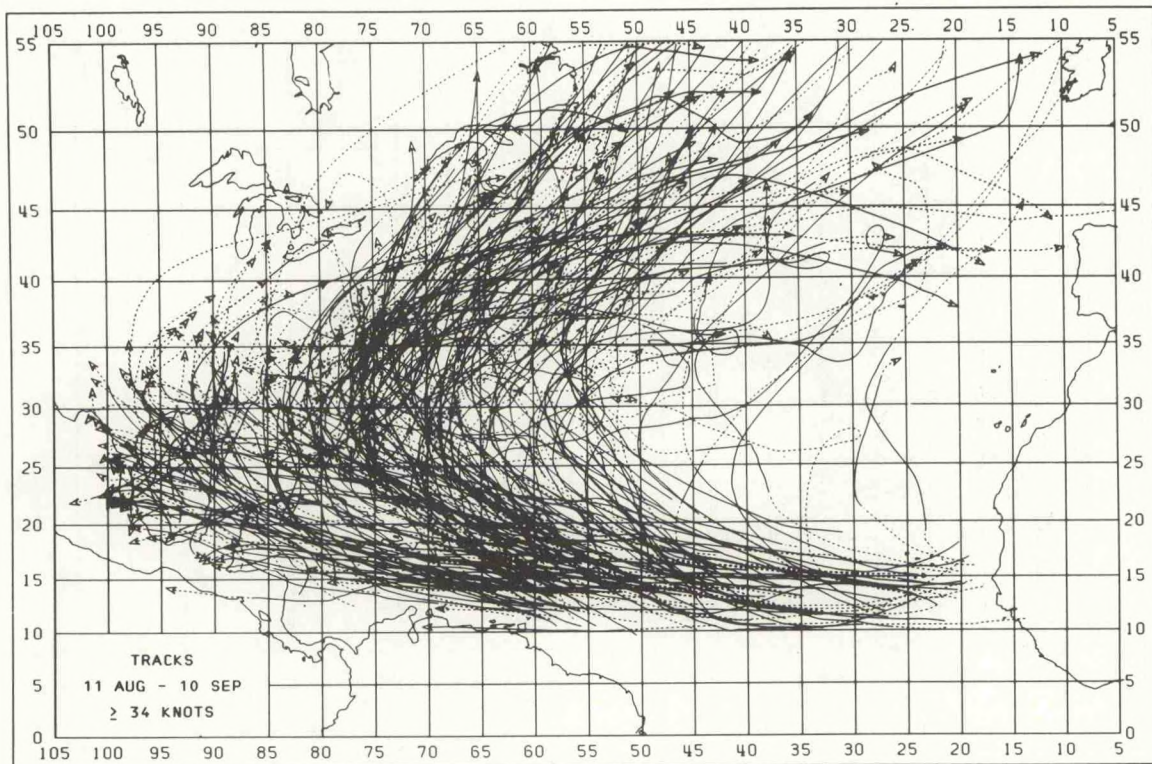
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92	6	280	16	16	6.63	260	8	310	10	10	3.37	522	8	056	27	29	15.69
122	5	283	16	16	6.78	264	9	313	9	10	2.58	523	6	066	26	27	14.73
123	7	281	15	16	6.14	265	12	316	10	11	3.16	557	12	044	22	23	11.34
124	14	287	14	14	4.92	266	10	306	11	12	4.16	558	9	049	26	27	10.33
125	15	288	14	14	3.75	267	8	306	11	11	4.82	594	6	032	27	28	8.59
126	15	286	13	14	3.04	268	6	300	11	11	6.34	595	5	034	30	31	10.75
127	14	285	14	14	3.74	292	8	295	9	10	4.08						
128	8	281	13	14	4.12	293	8	299	9	11	4.90						
129	6	276	14	14	3.29	294	10	307	10	11	3.49						
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132	7	280	15	15	2.41	298	6	341	7	10	5.22						
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192	6	289	16	16	2.42	370	6	342	5	12	4.03						
195	8	299	13	13	2.67	371	10	359	6	10	3.93						
196	11	298	13	14	2.66	372	9	352	9	10	2.97						
197	9	291	14	14	3.52	373	9	007	10	11	4.04						
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199	9	294	15	15	5.69	408	11	019	10	11	5.29						
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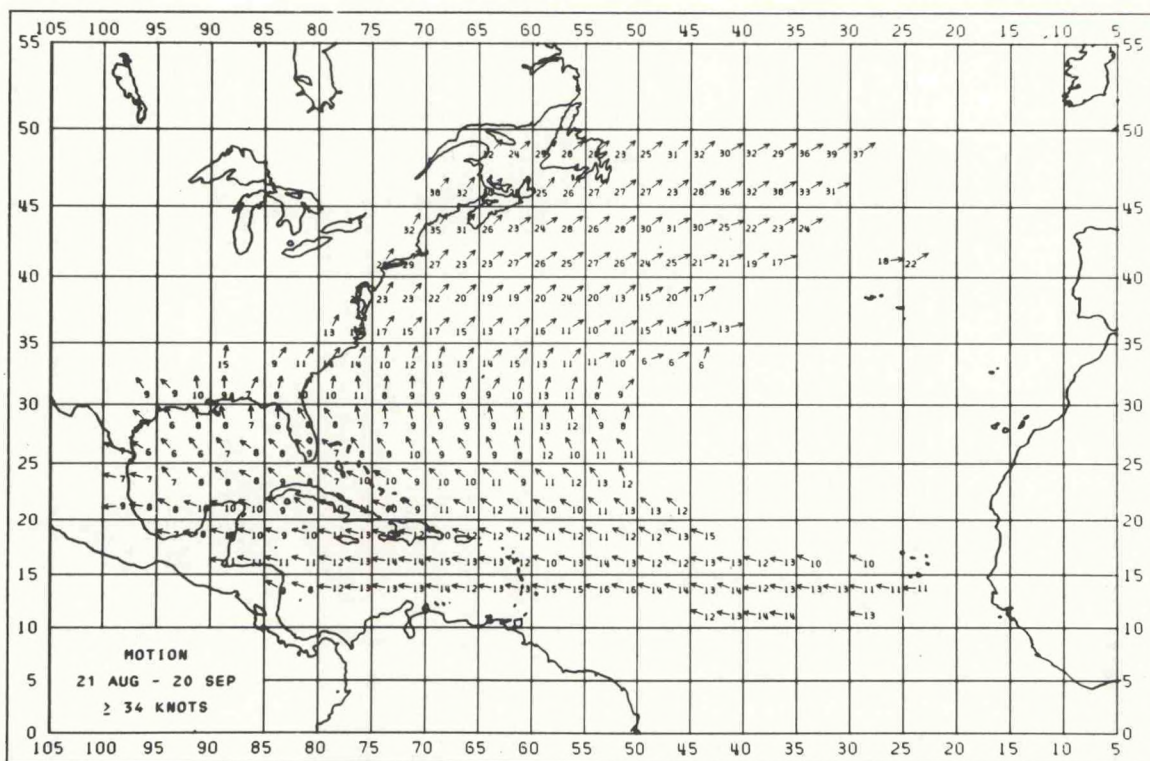
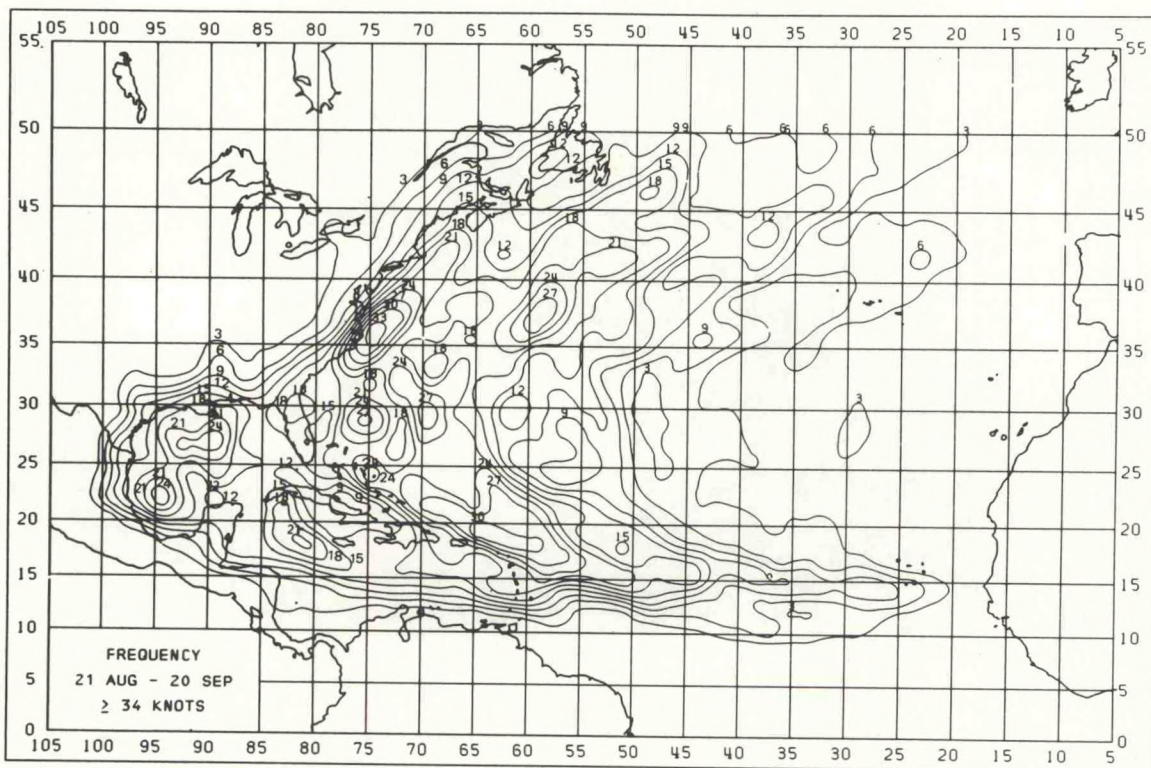


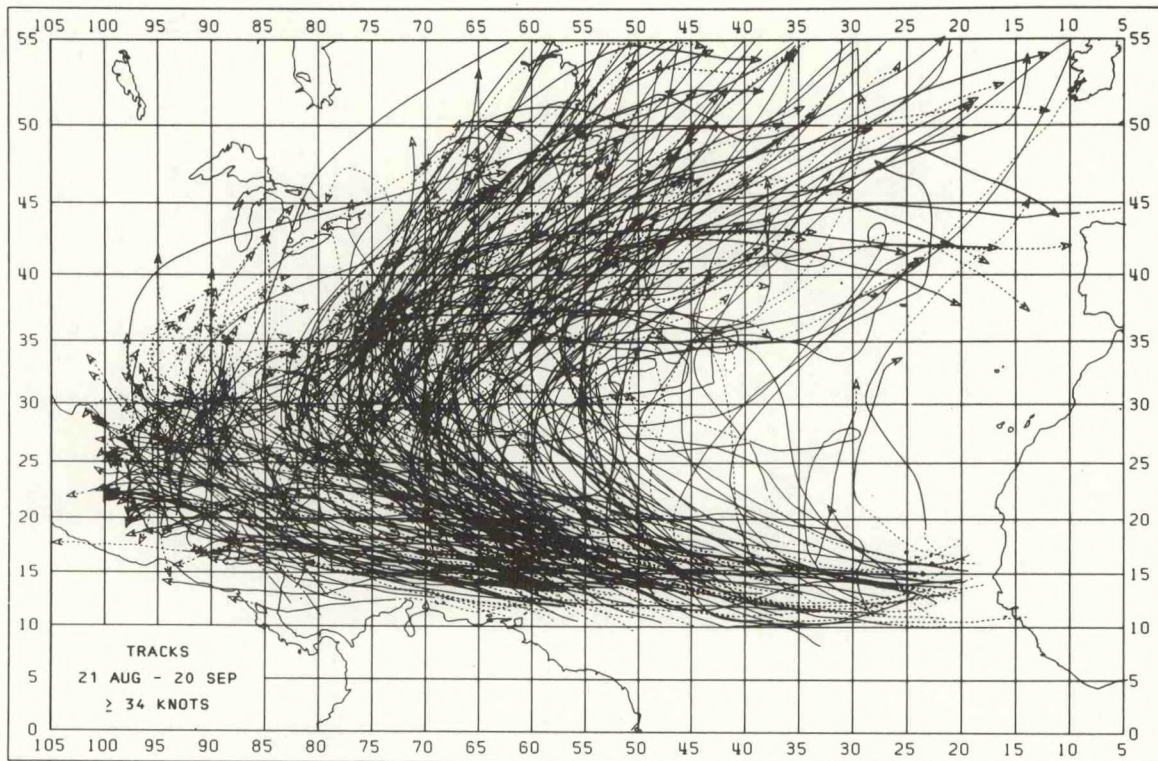
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123	10	282	15	15	5.66	231	18	307	13	13	3.84	344	8	332	7	7	2.25	556	6	042	31	31	14.32
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193	6	291	15	15	2.84	303	10	310	8	9	3.97	483	14	050	22	24	9.83						
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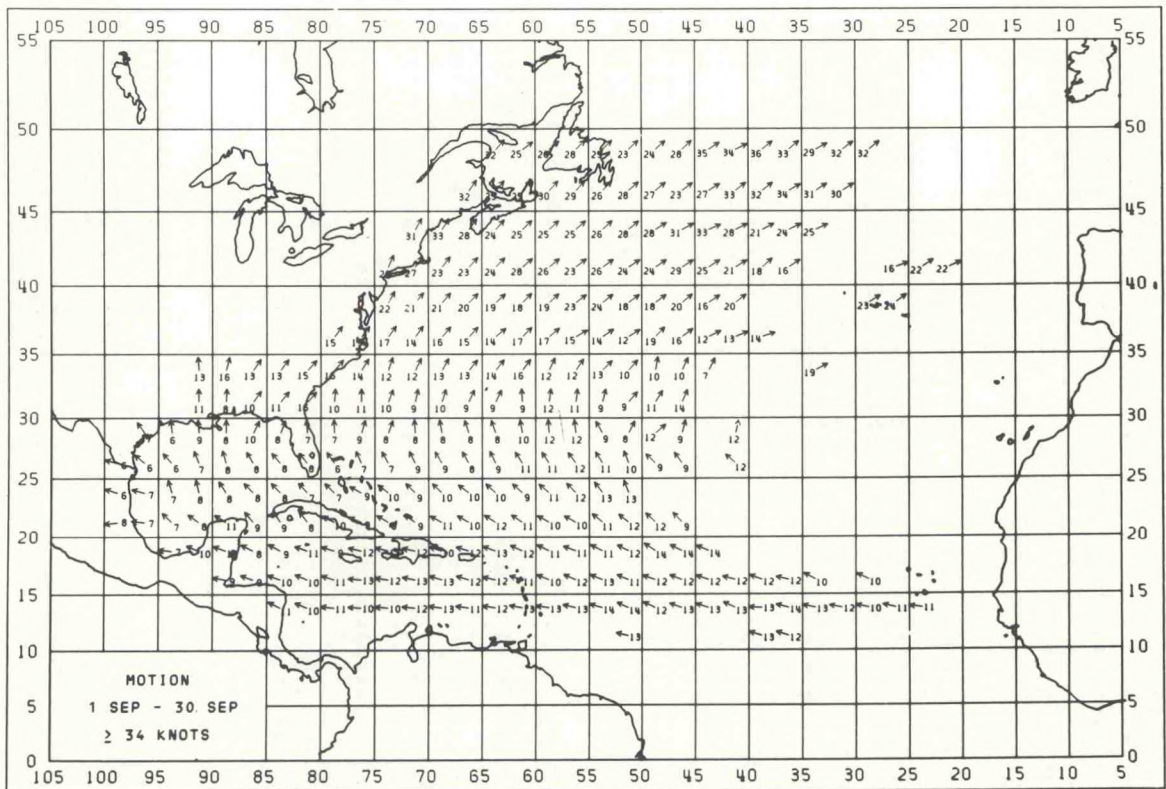
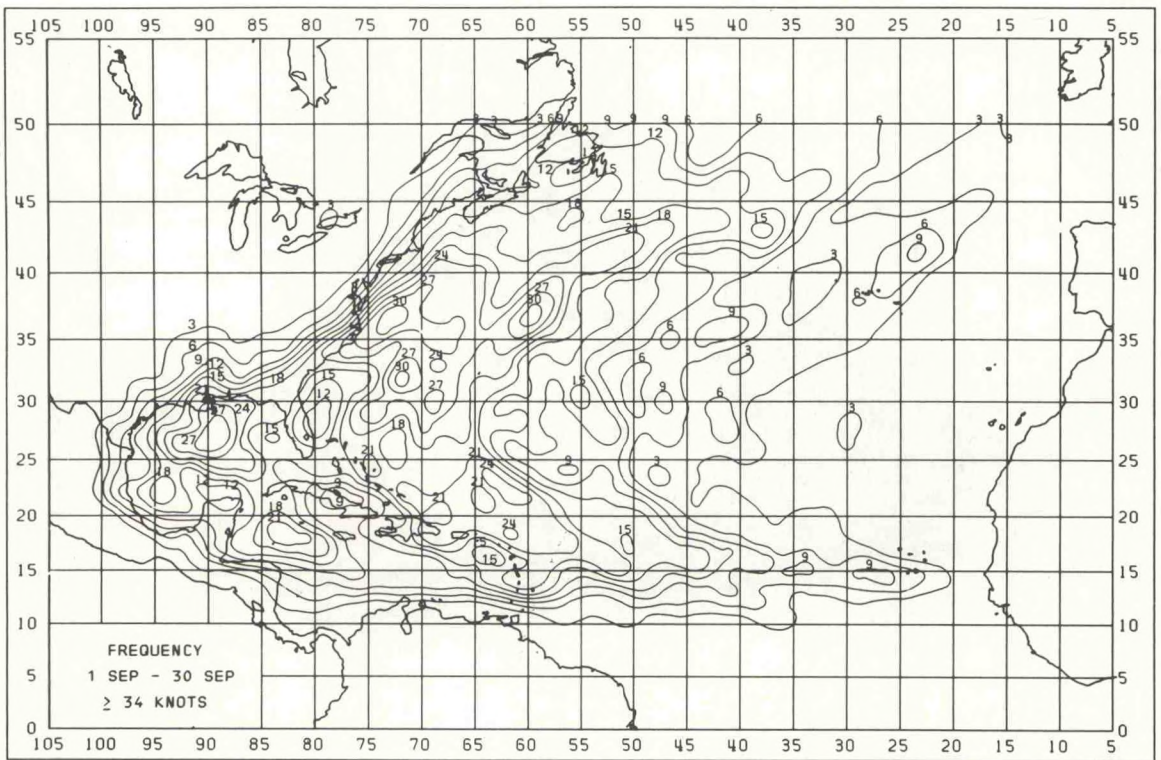


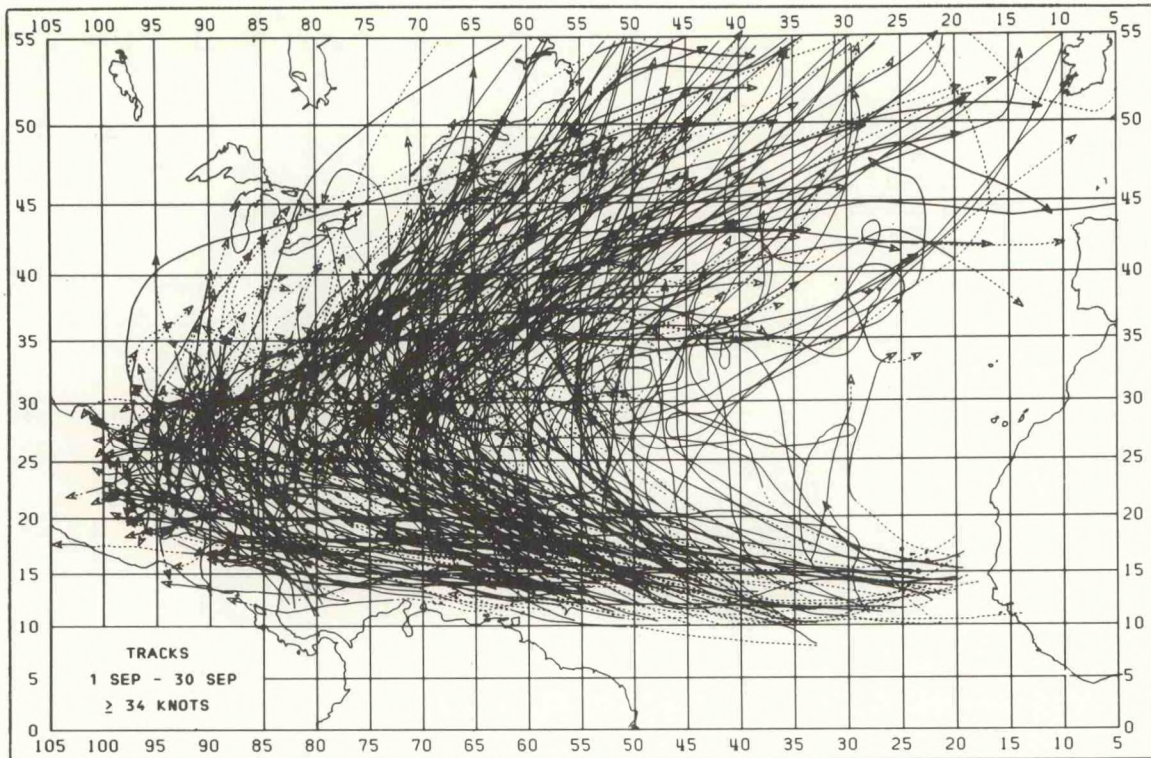
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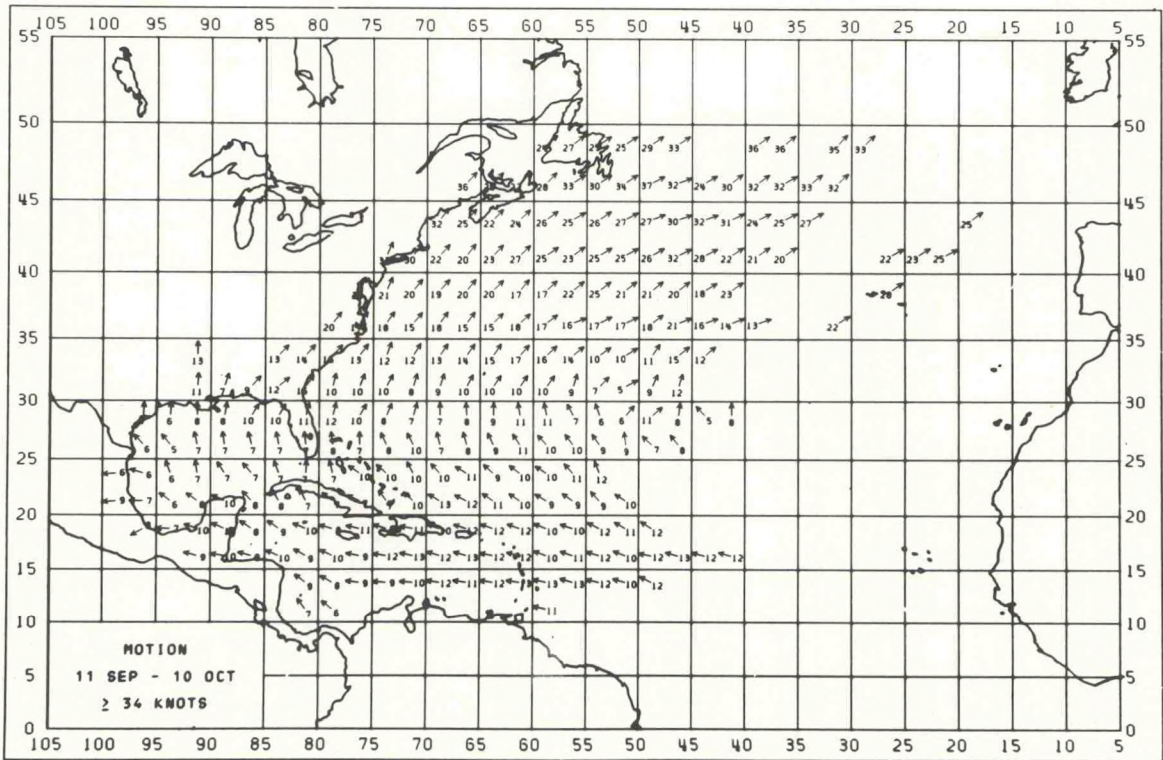
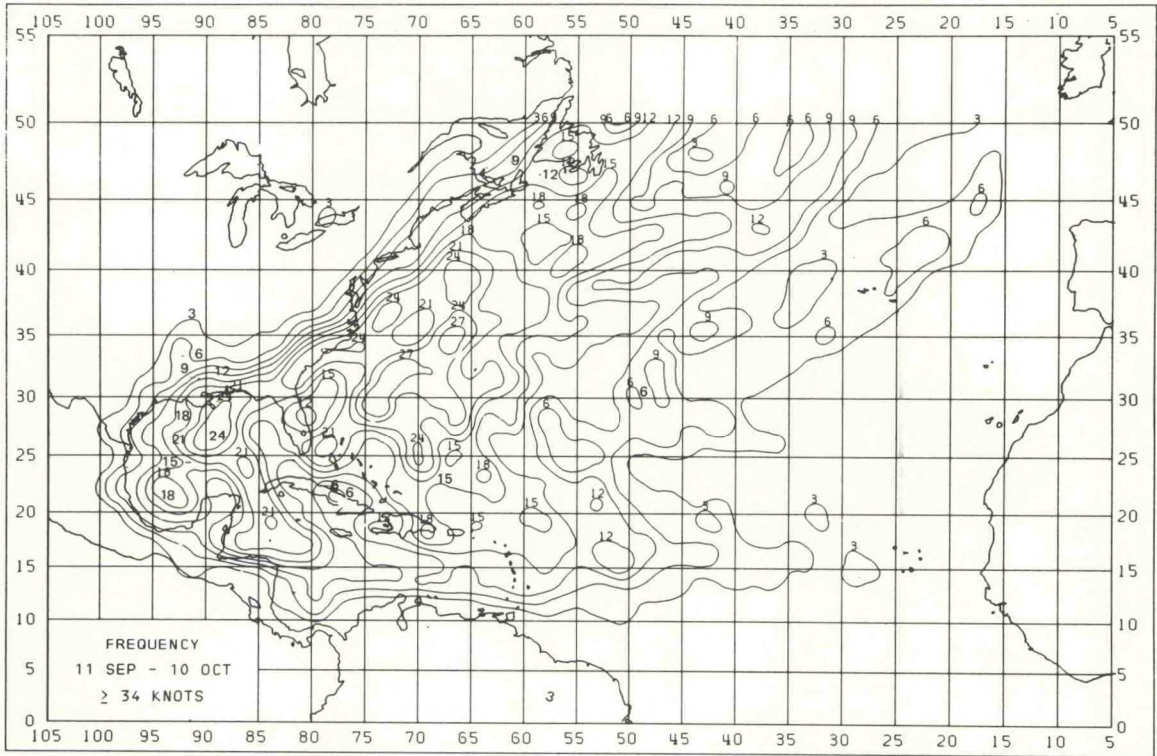


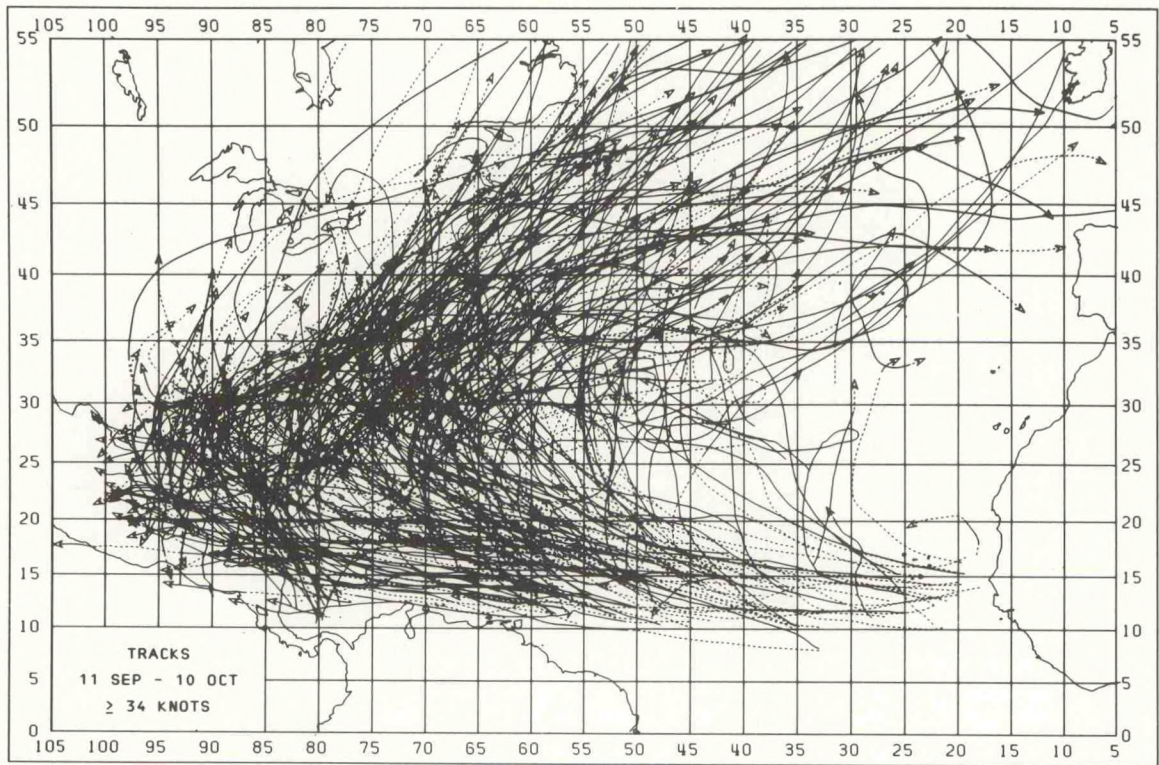
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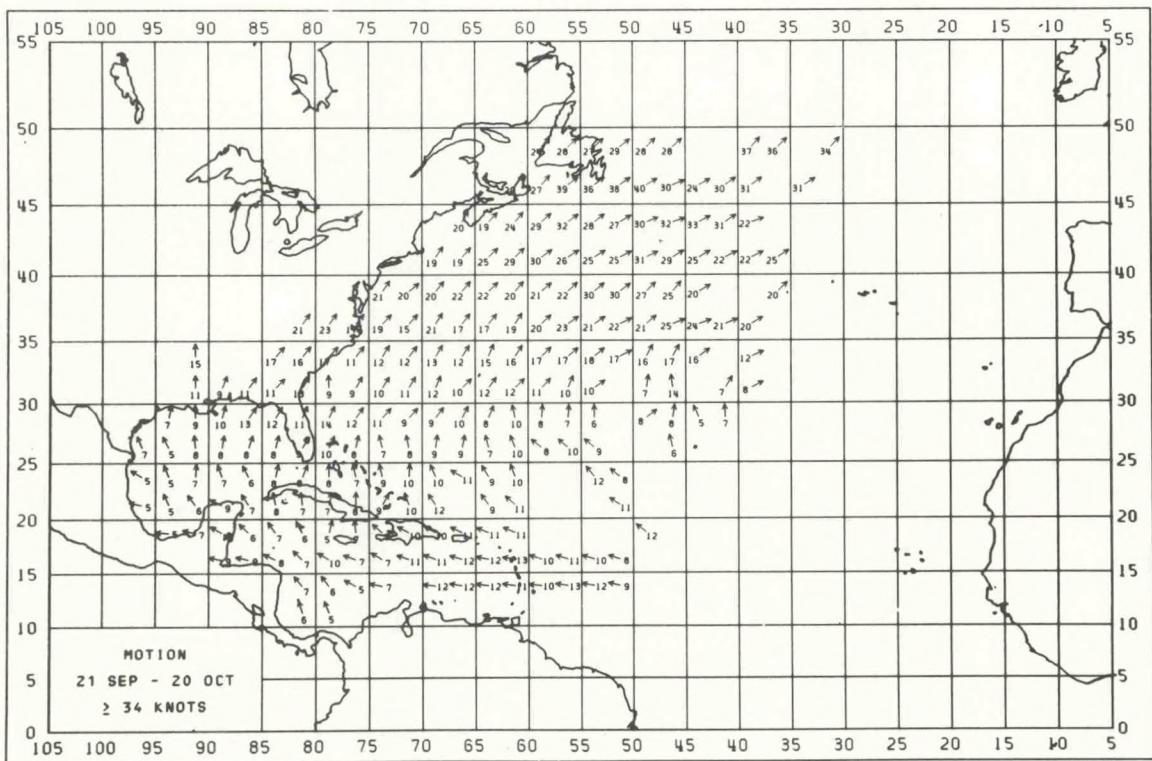
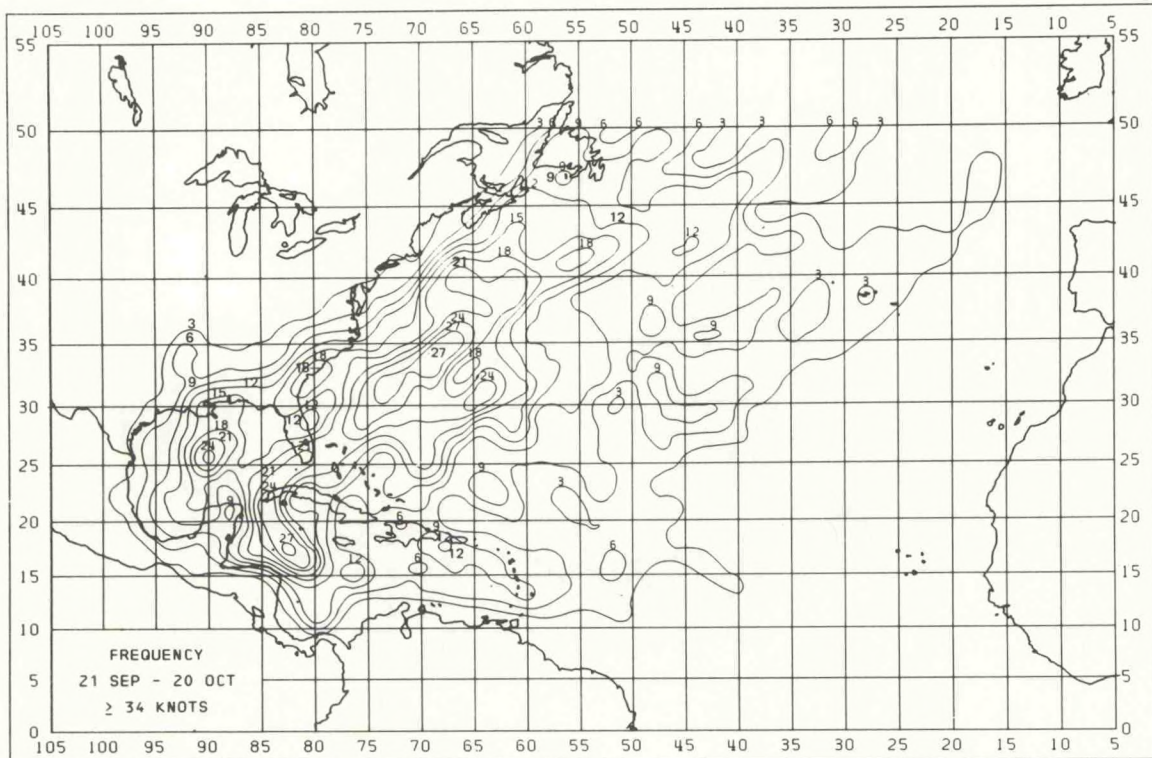


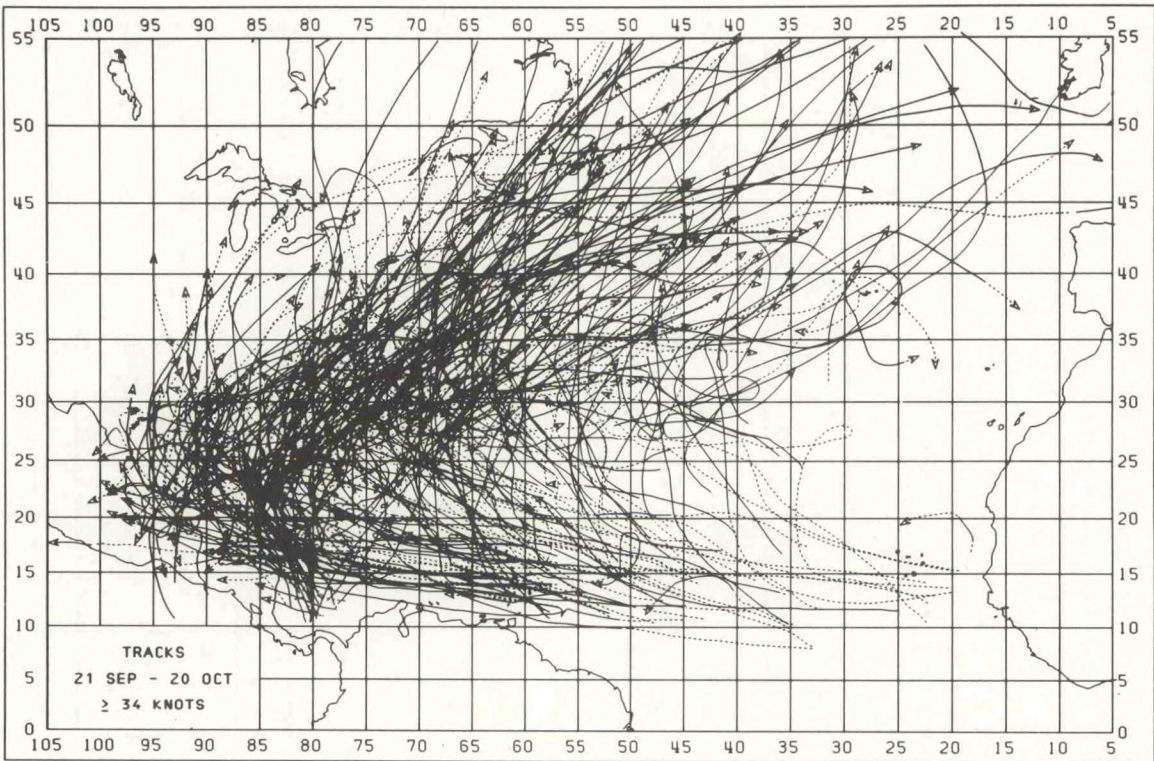
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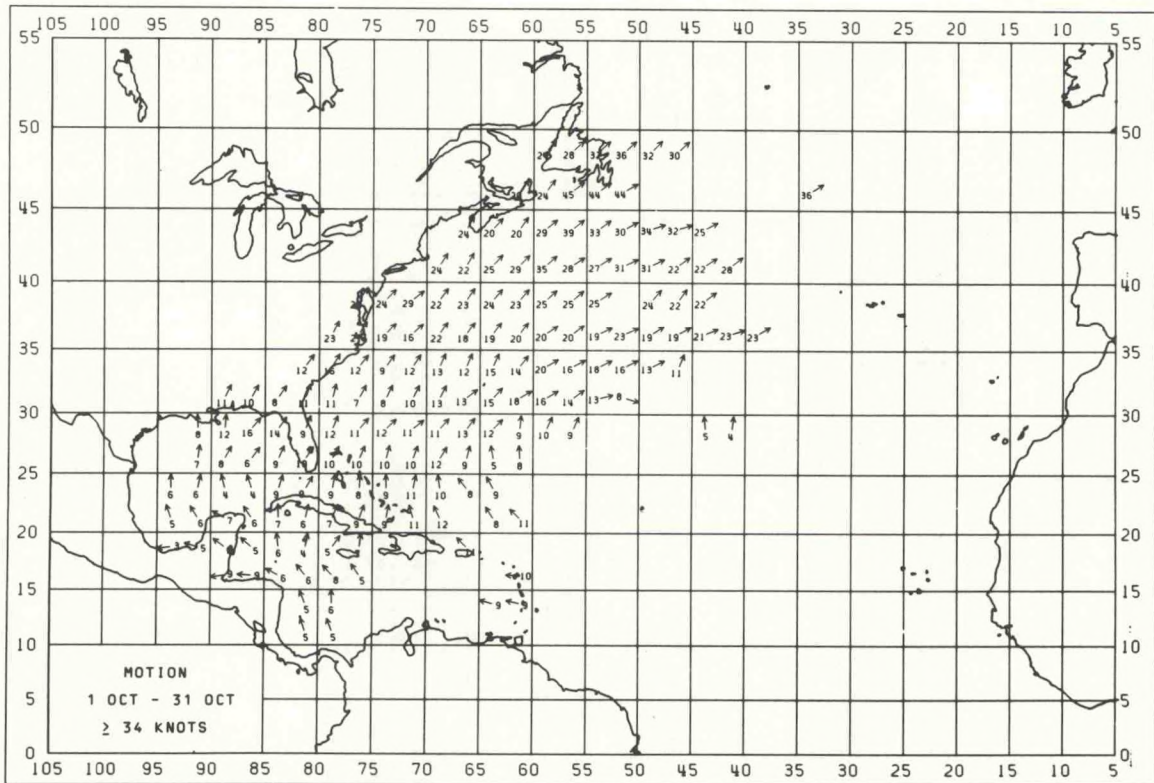
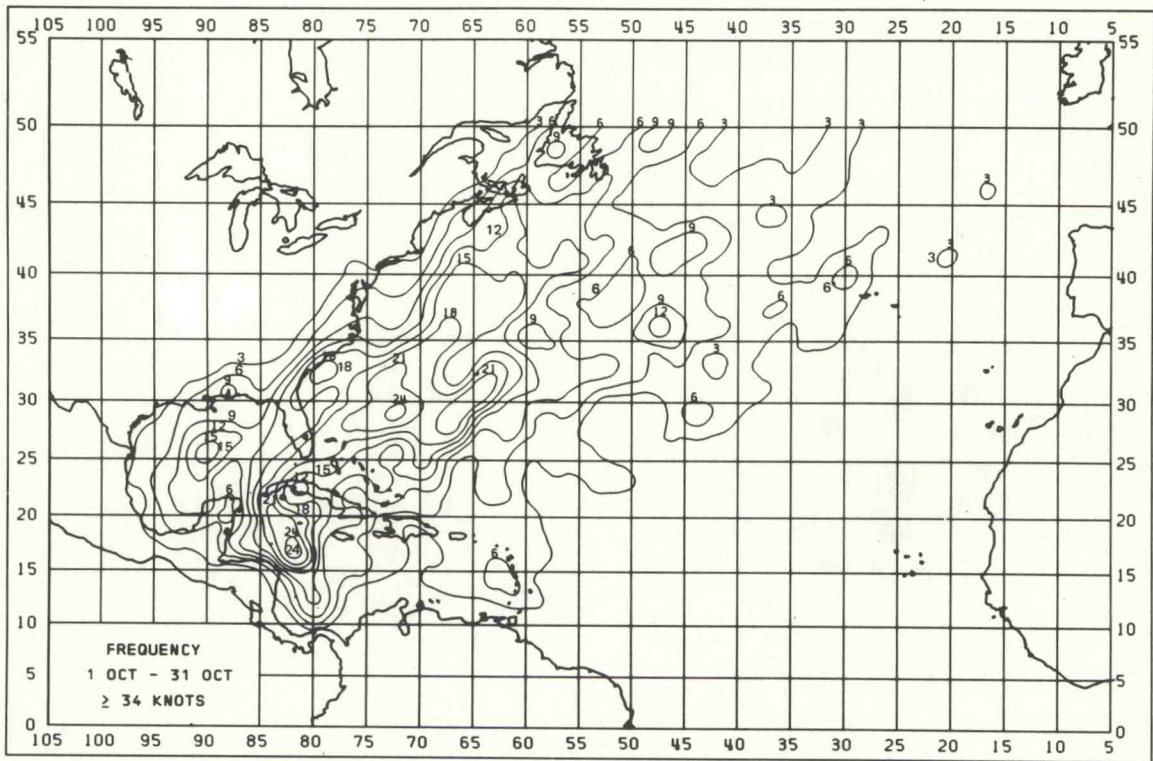


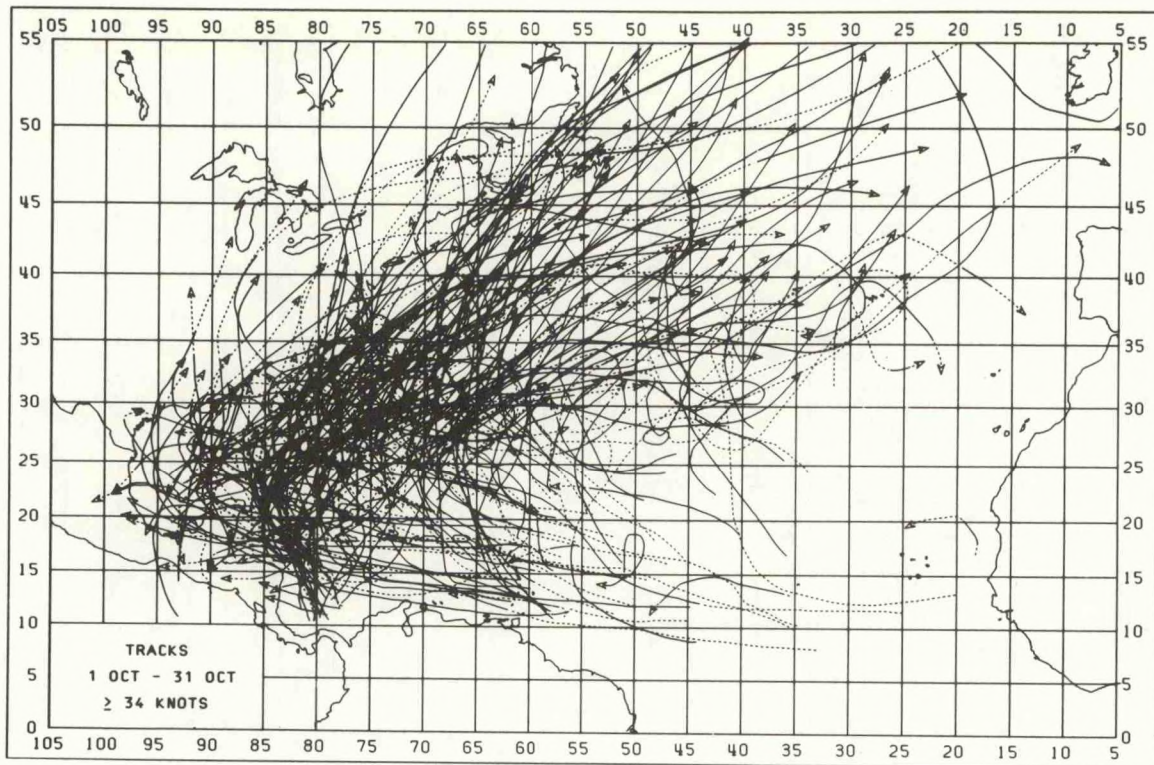
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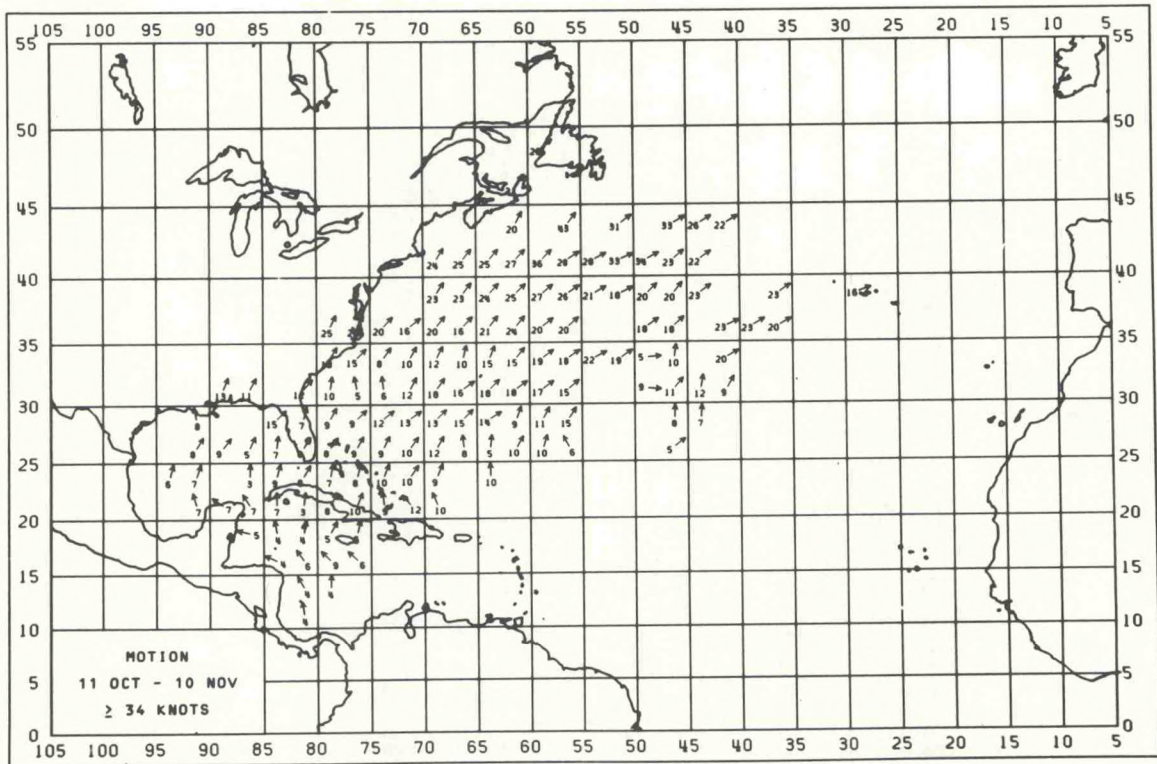
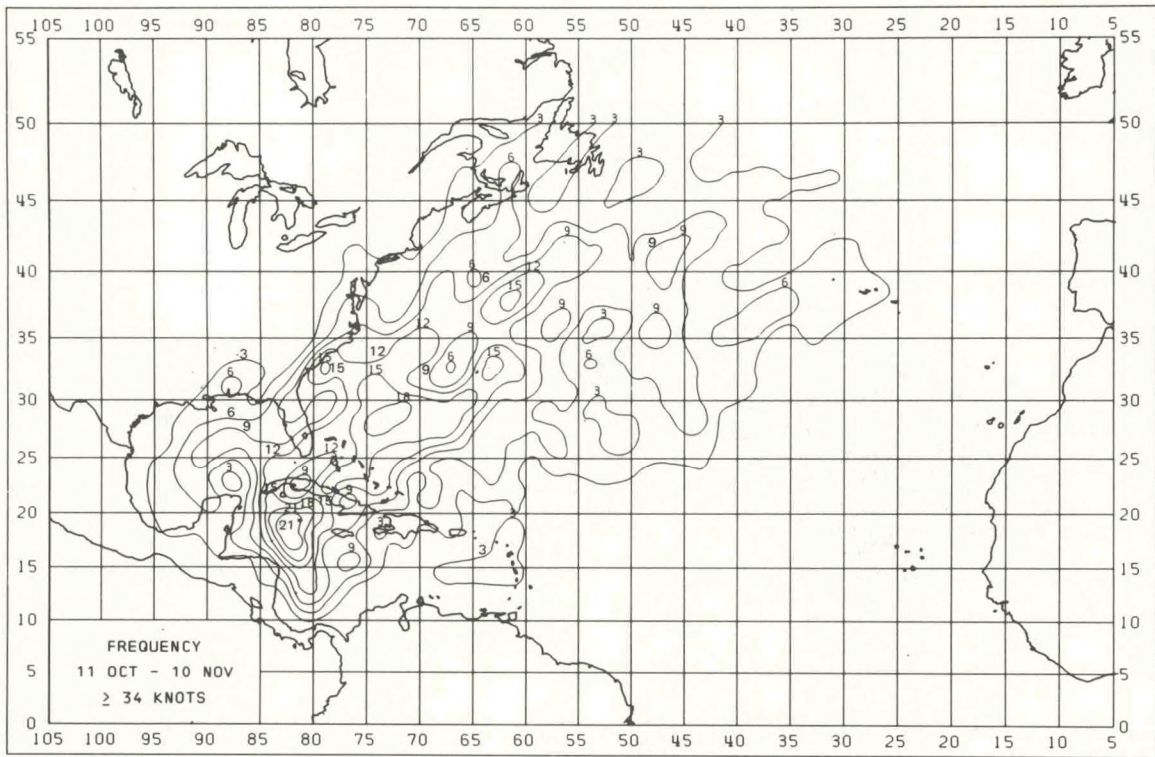


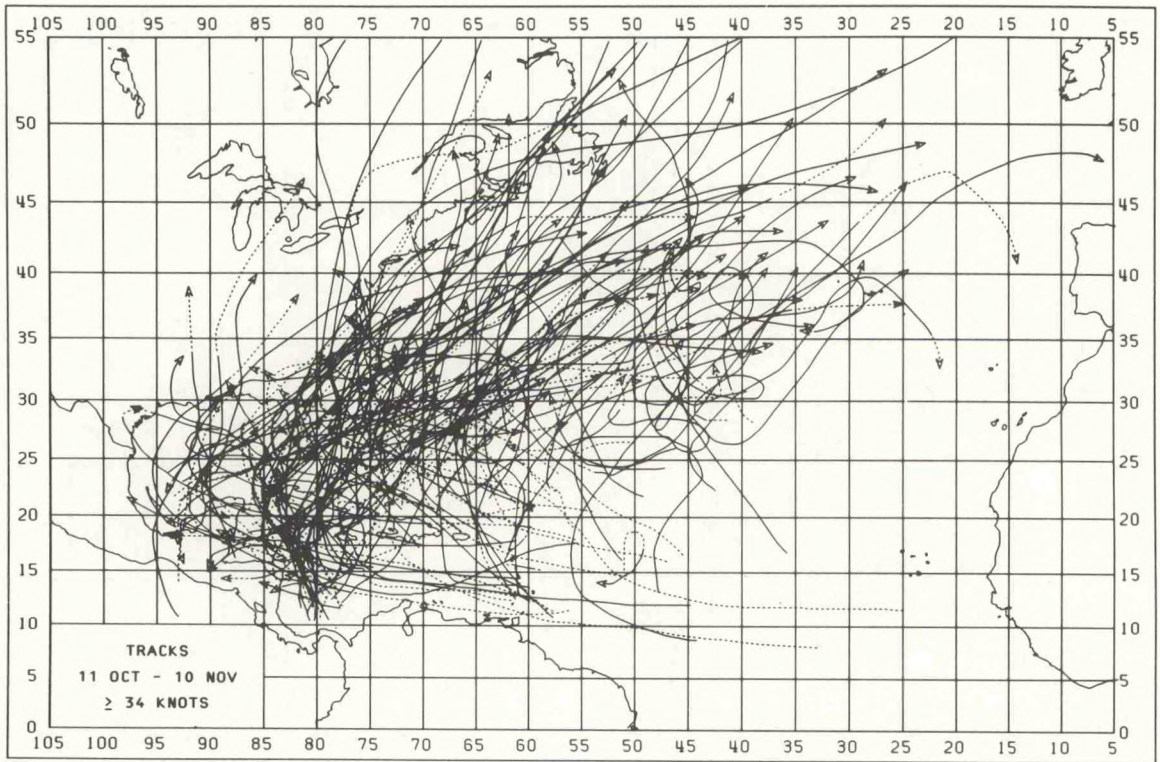
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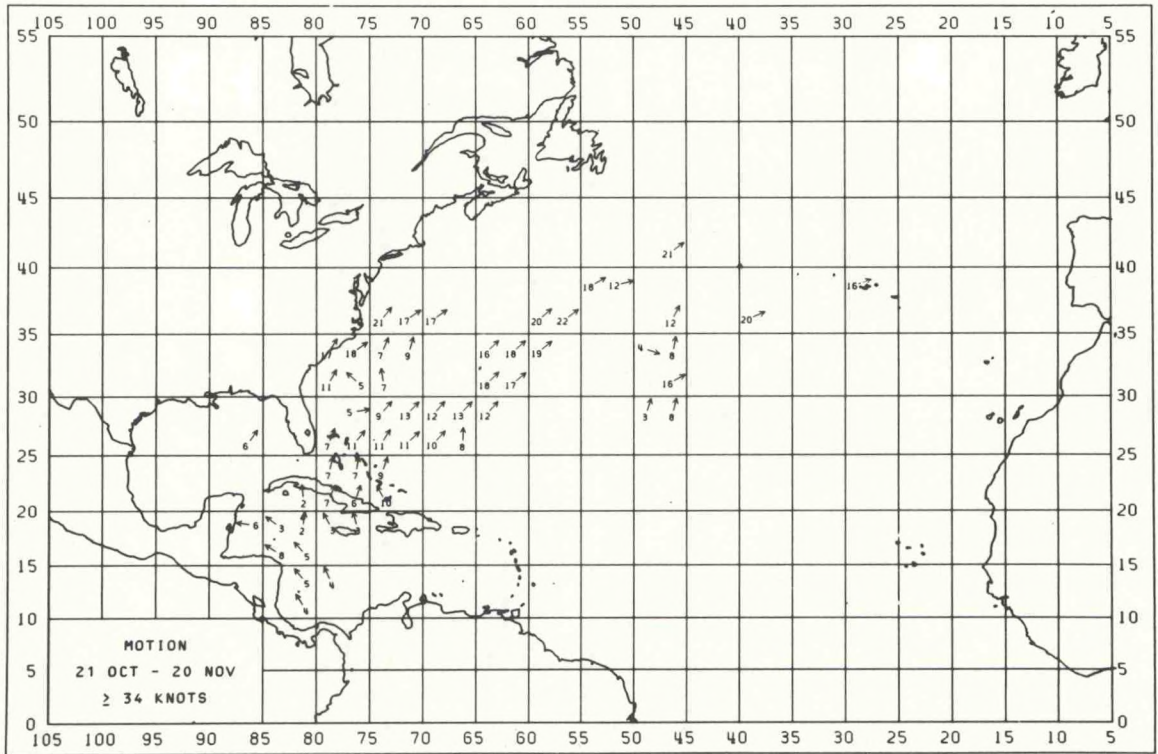
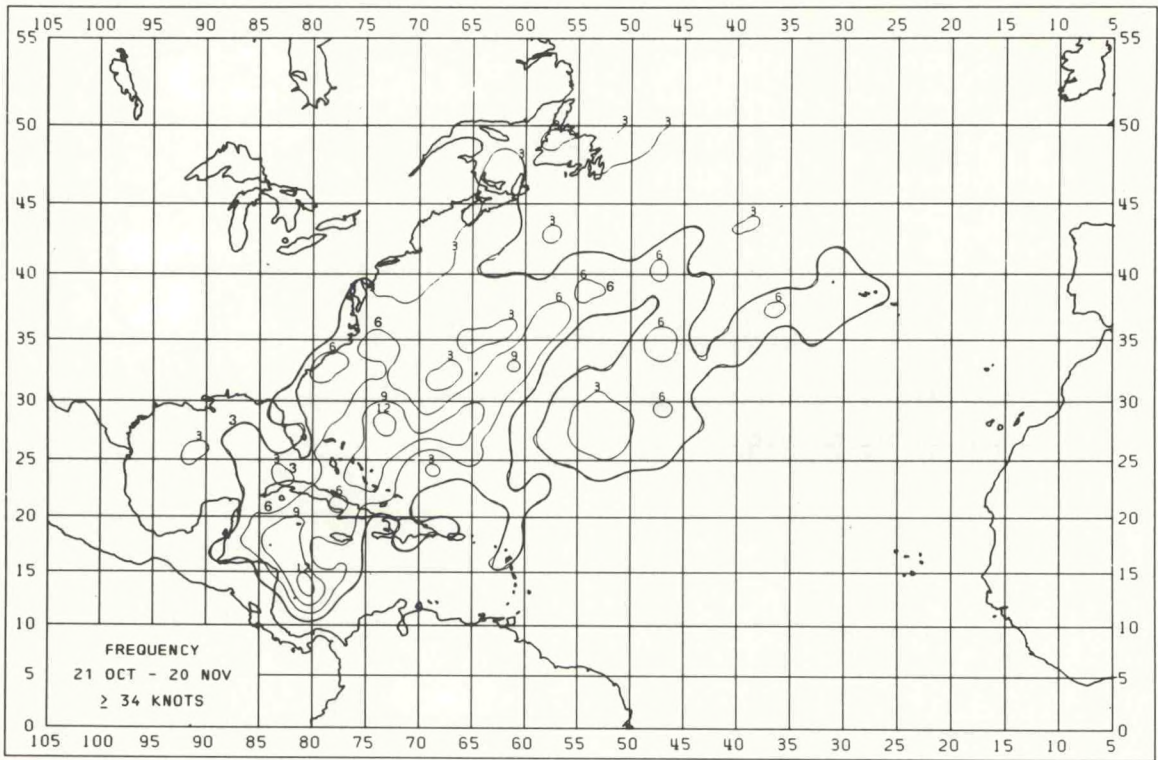
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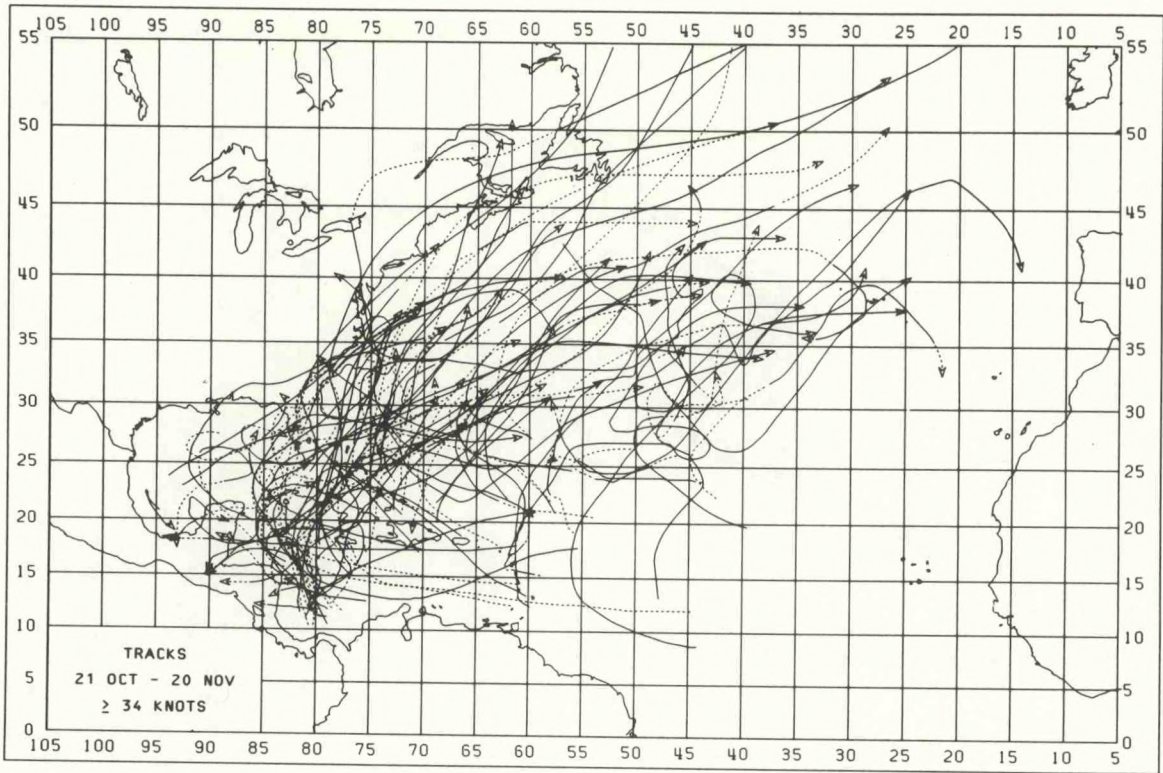




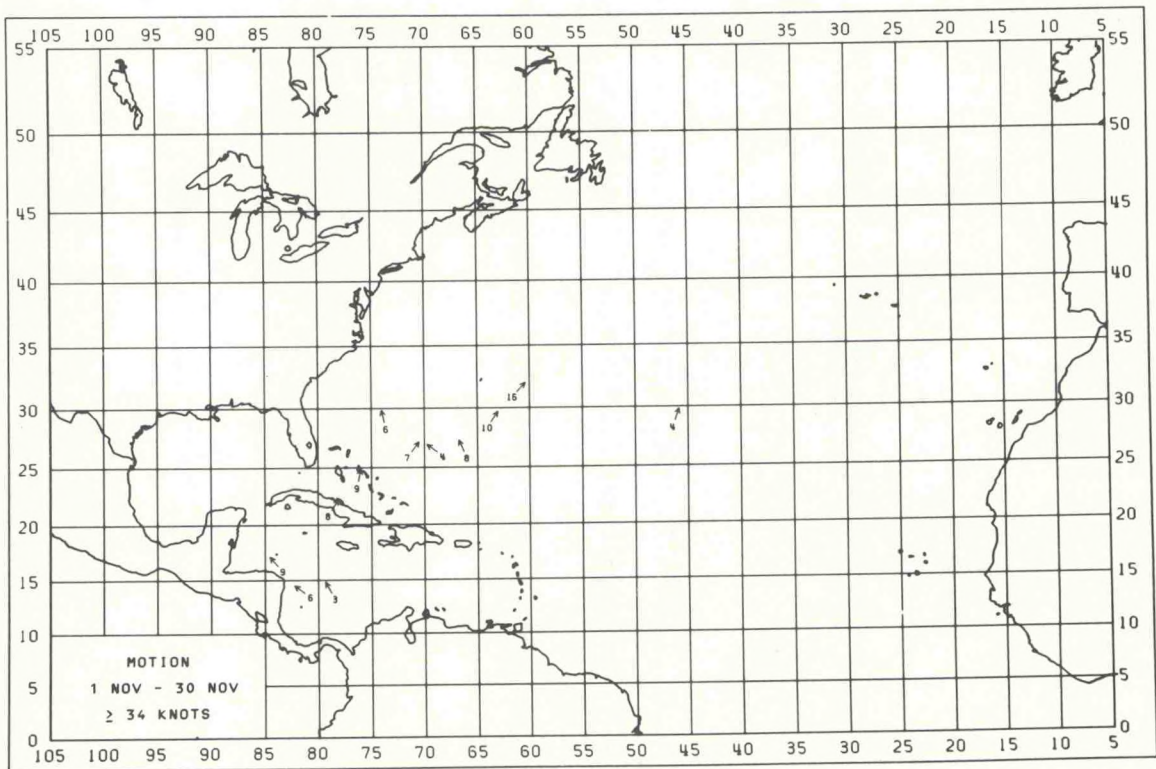
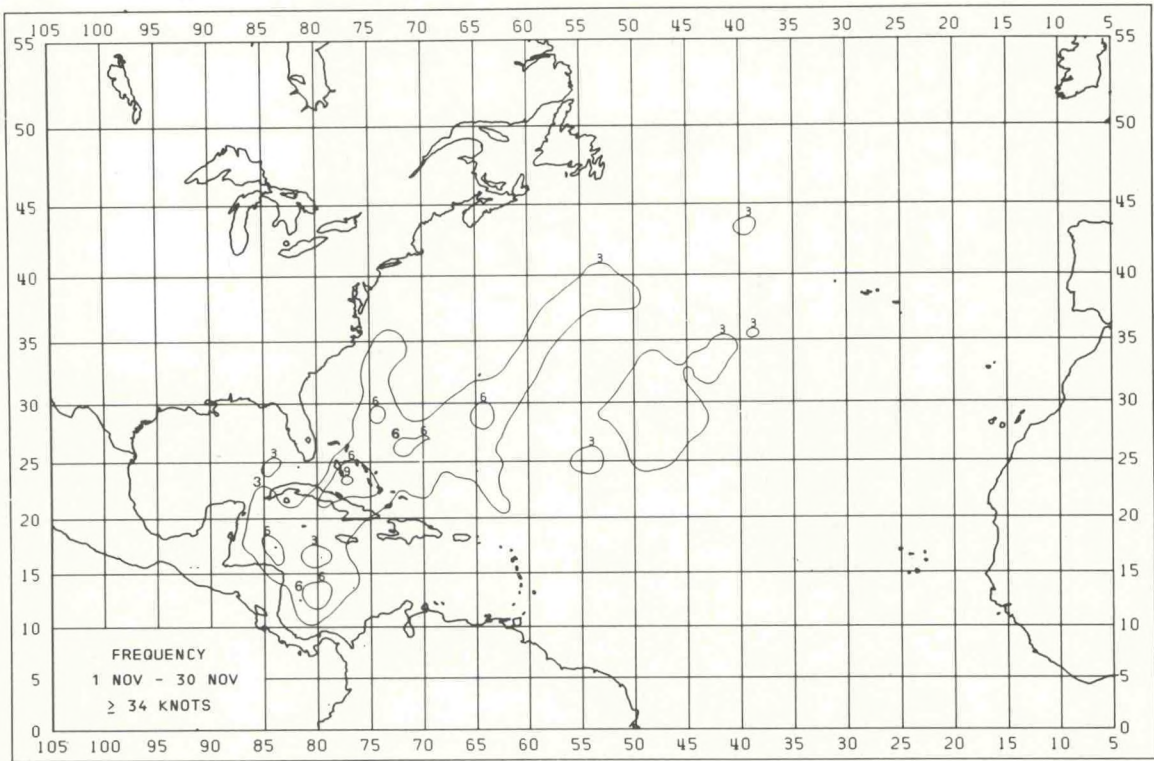
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312	6	052	5	12	8.40	448	11	043	16	19	4.90						
330	6	349	8	14	5.54	449	12	038	21	24	11.48						
333	8	045	15	16	12.10	450	10	039	24	25	10.38						
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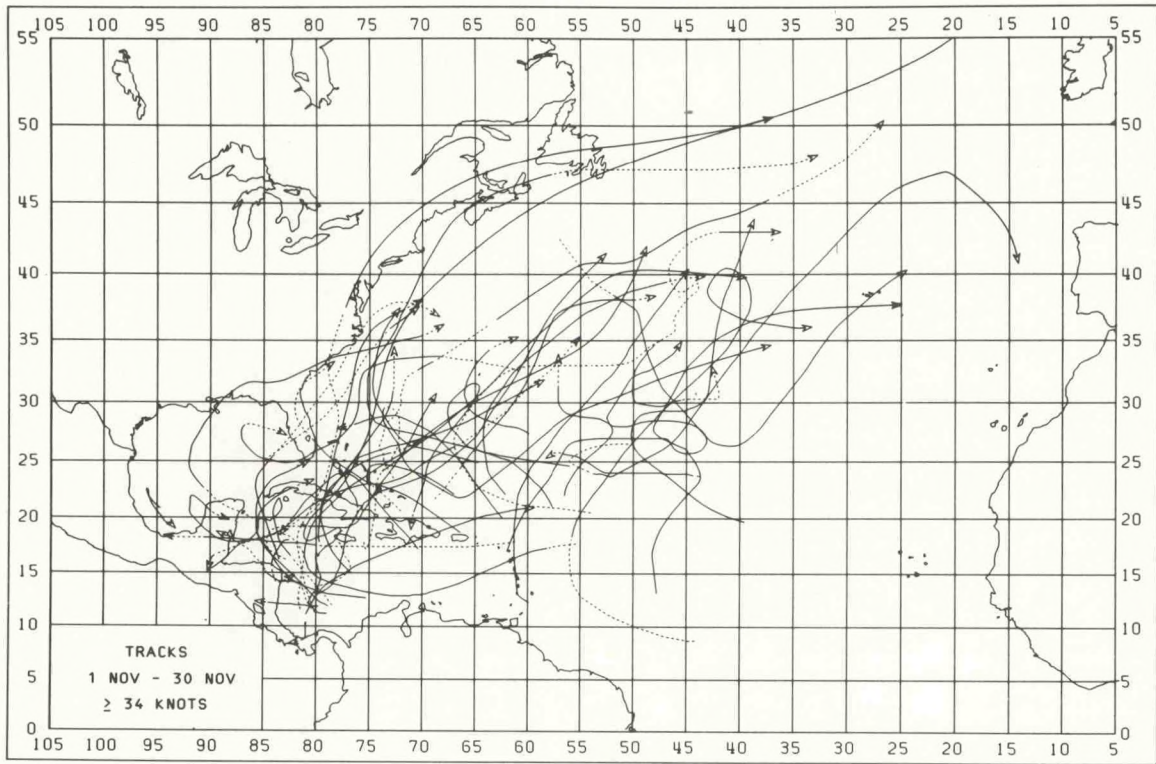
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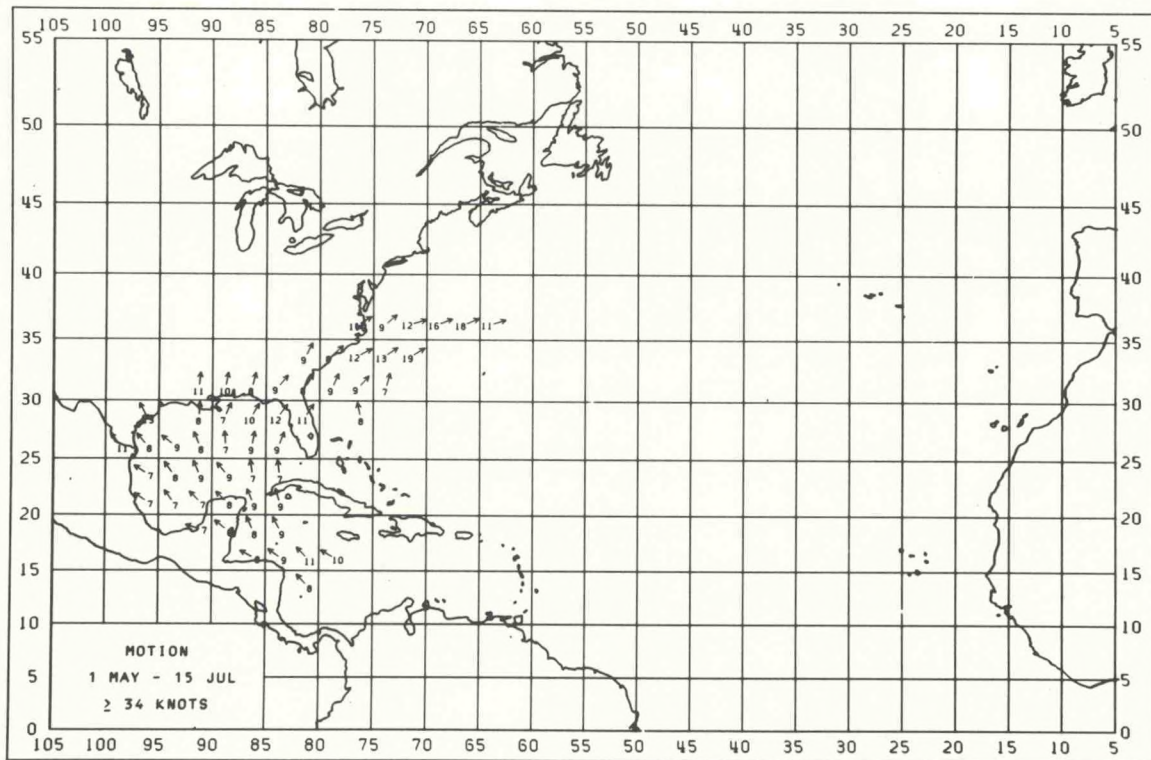
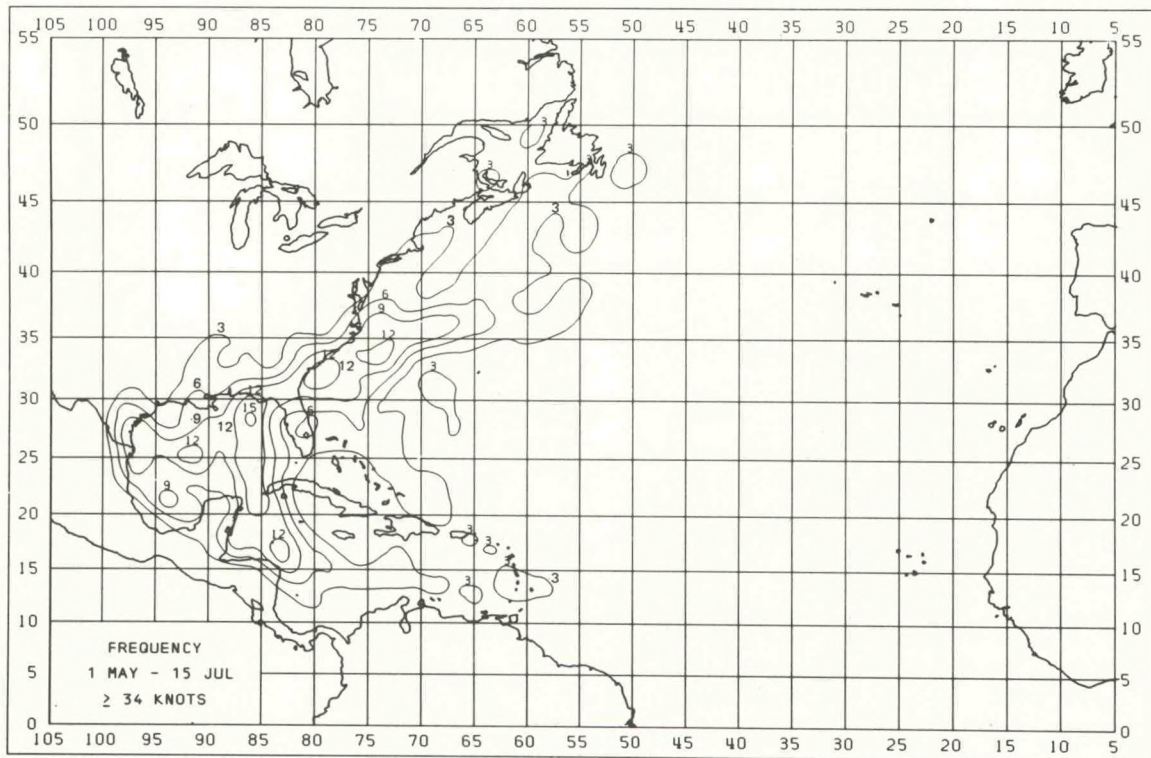


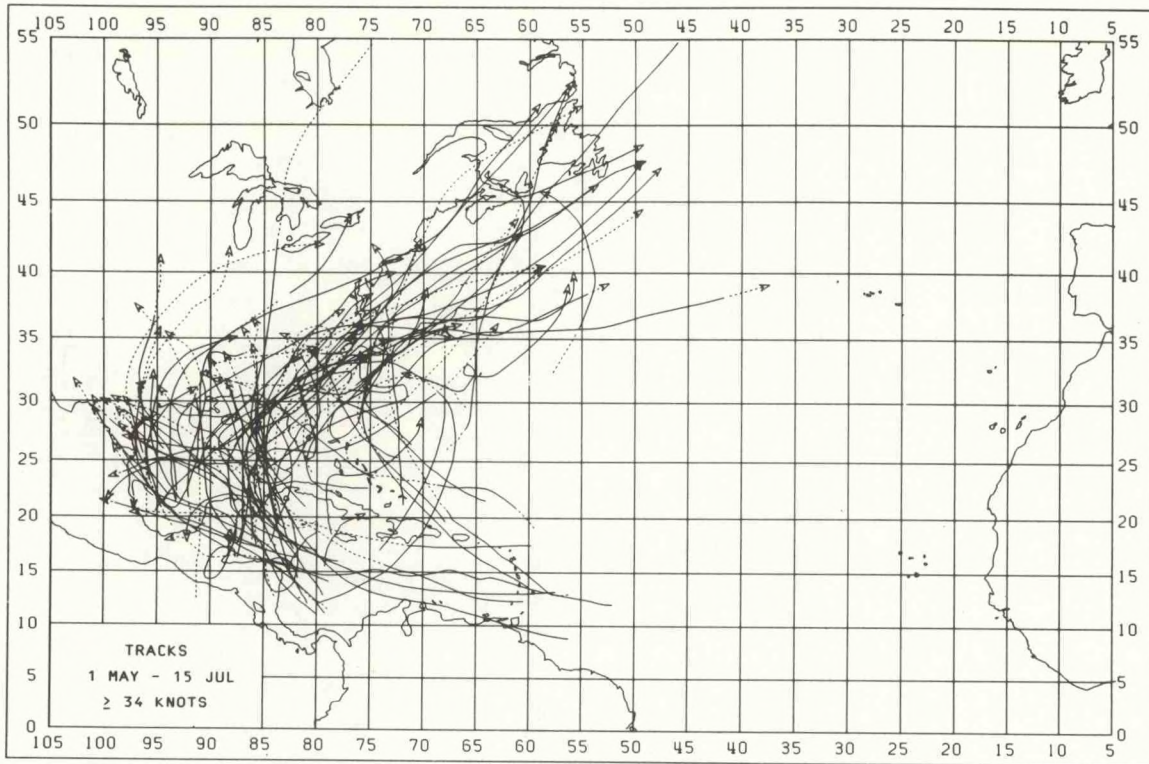
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119	9	336	4	6	2.87	490	5	076	12	13	6.06
153	9	303	8	10	3.62	499	6	071	16	20	6.81
154	10	318	5	7	2.25	528	5	052	21	22	13.61
188	6	278	6	8	2.81						
189	9	308	3	9	3.43						
190	9	008	2	7	2.66						
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192	7	346	3	6	2.05						
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227	6	023	7	12	4.08						
228	6	017	6	9	6.37						
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265	9	019	9	12	3.85						
296	5	035	6	9	8.25						
299	6	021	7	14	3.78						
300	8	039	11	14	8.42						
301	10	032	11	13	6.70						
302	10	047	11	16	6.17						
303	7	043	10	16	5.98						
304	9	002	8	14	4.22						
336	6	081	5	13	6.58						
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339	6	040	12	16	3.09						
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341	8	041	12	14	7.10						
347	5	017	3	12	4.50						
348	5	013	8	20	9.85						
371	5	029	11	15	13.38						
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373	7	352	7	11	4.20						
377	6	046	18	18	5.49						
378	7	050	17	18	5.85						
384	6	062	16	20	14.41						
407	7	033	17	21	11.01						
408	5	055	18	20	14.58						
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413	5	046	16	19	8.85						
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415	7	051	19	20	6.12						
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446	6	056	17	18	5.59						
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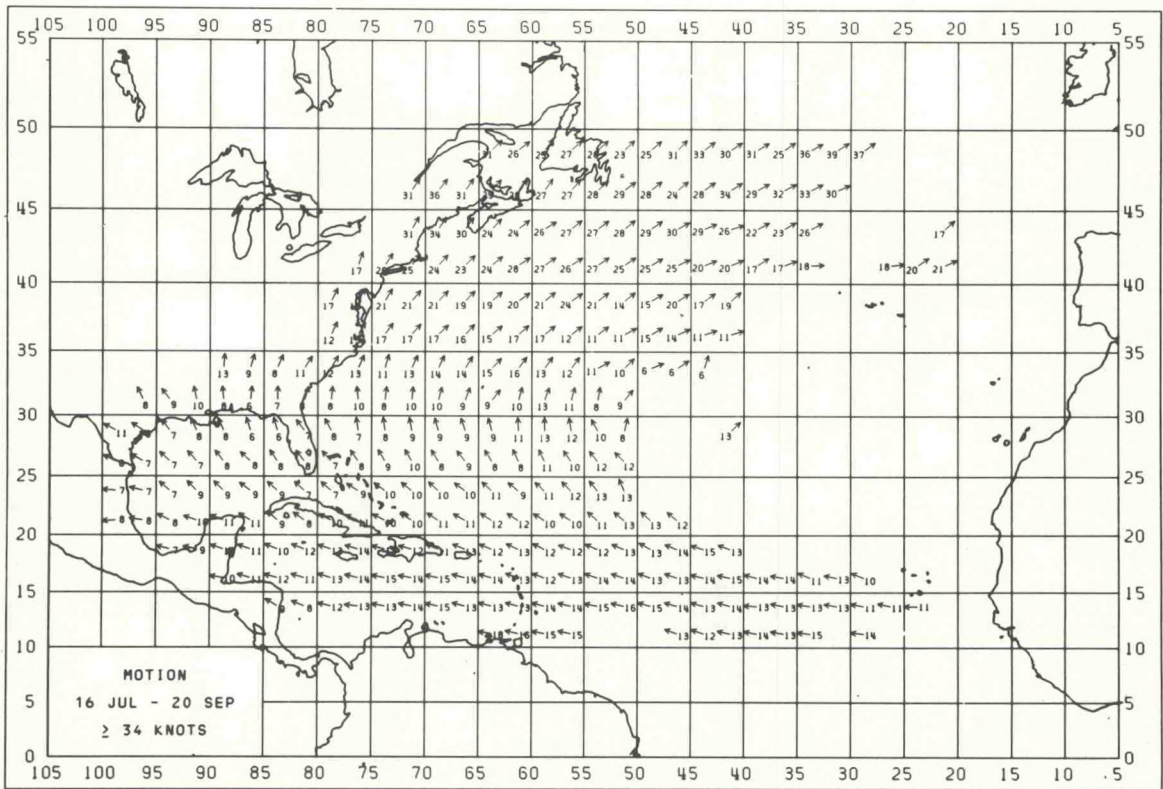
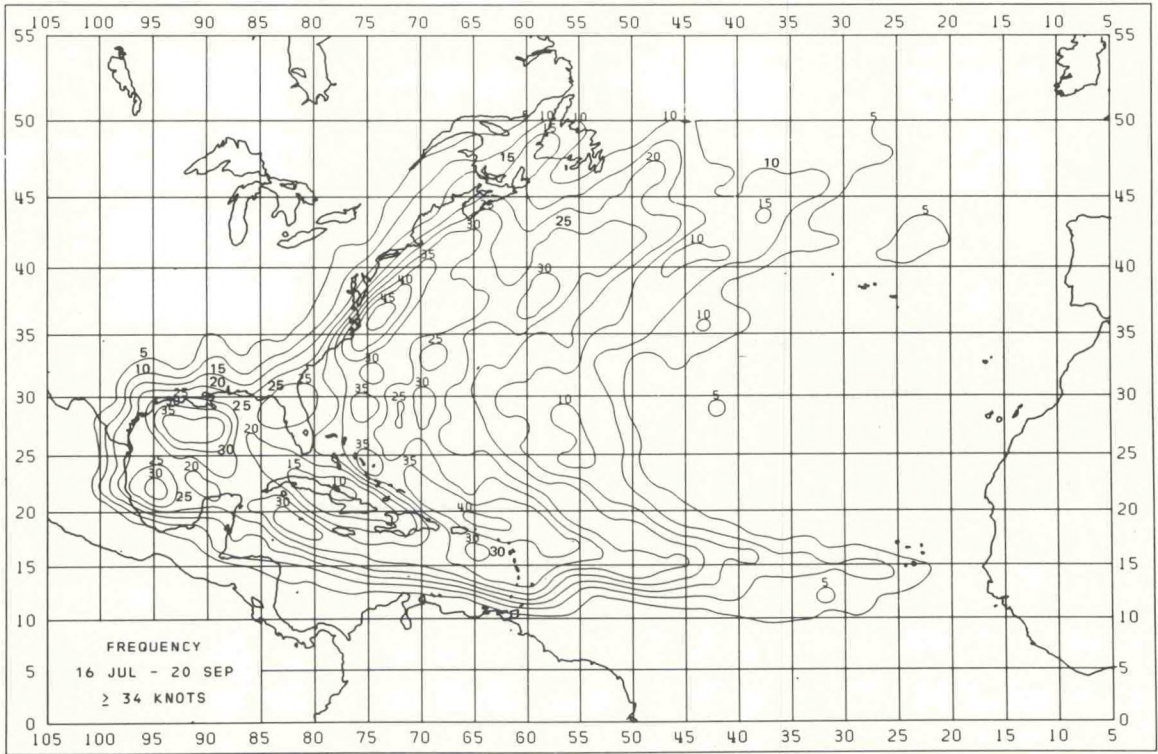


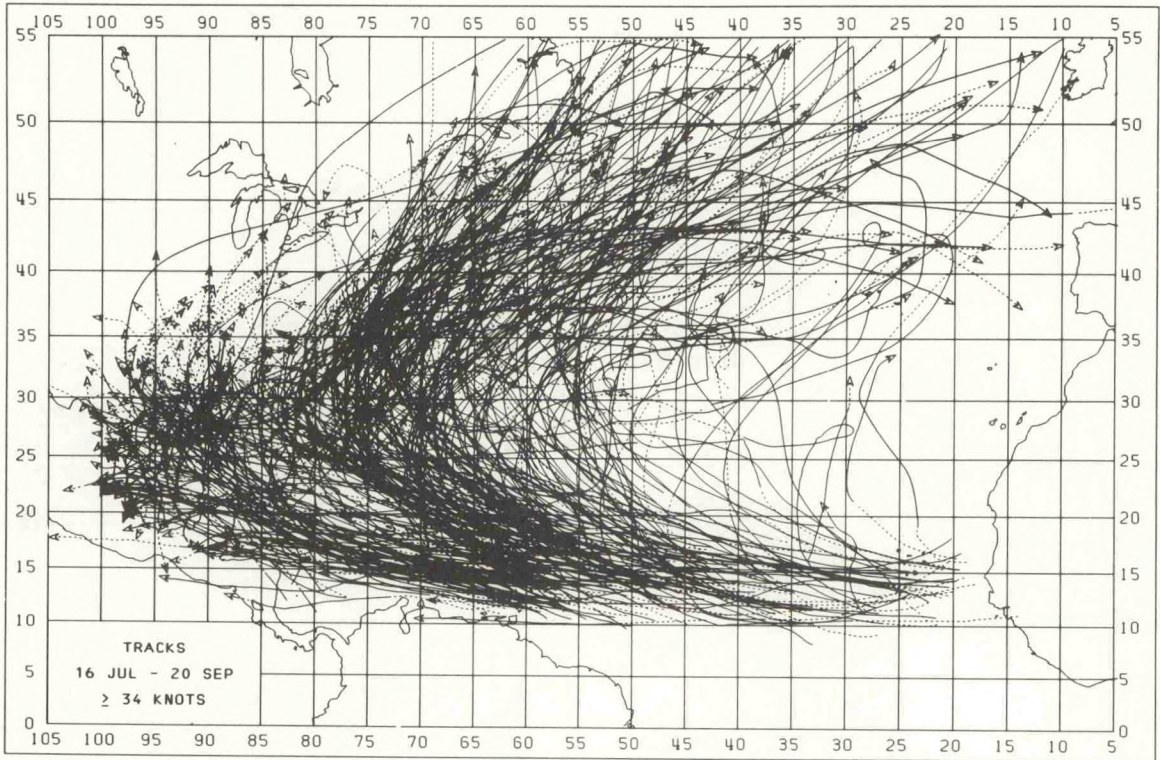
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303	6	307	4	14	4.46	
304	6	337	8	14	4.63	
337	6	347	6	14	5.73	
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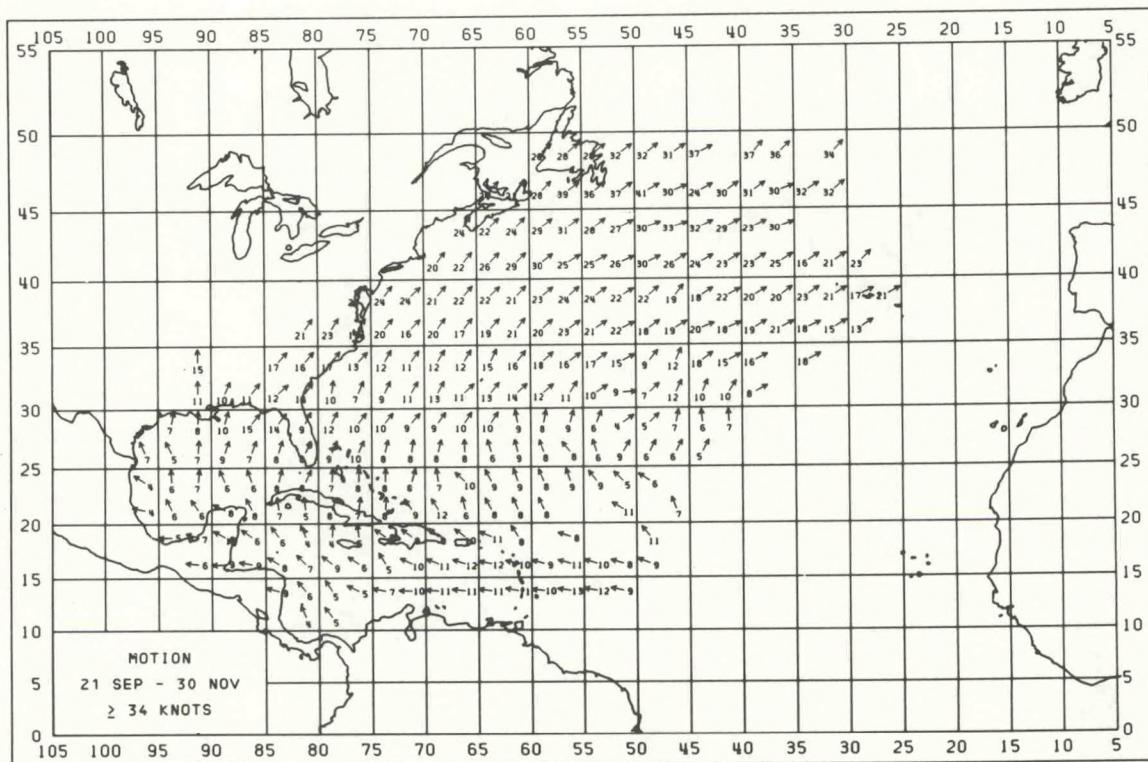
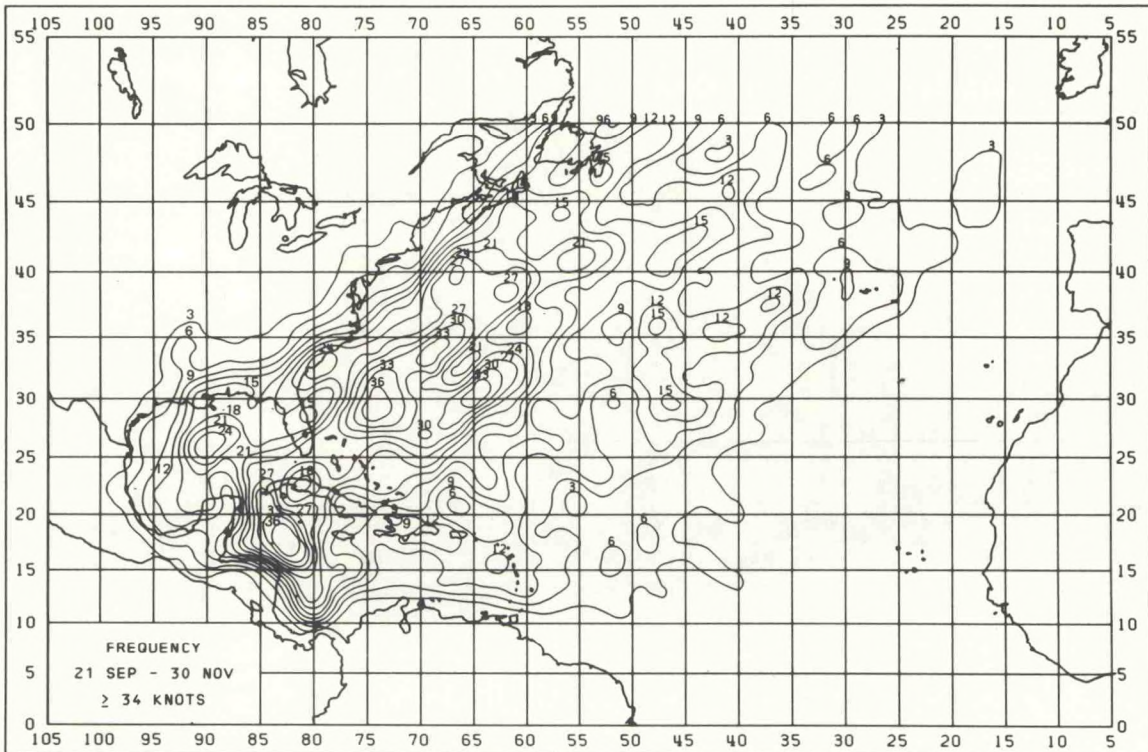


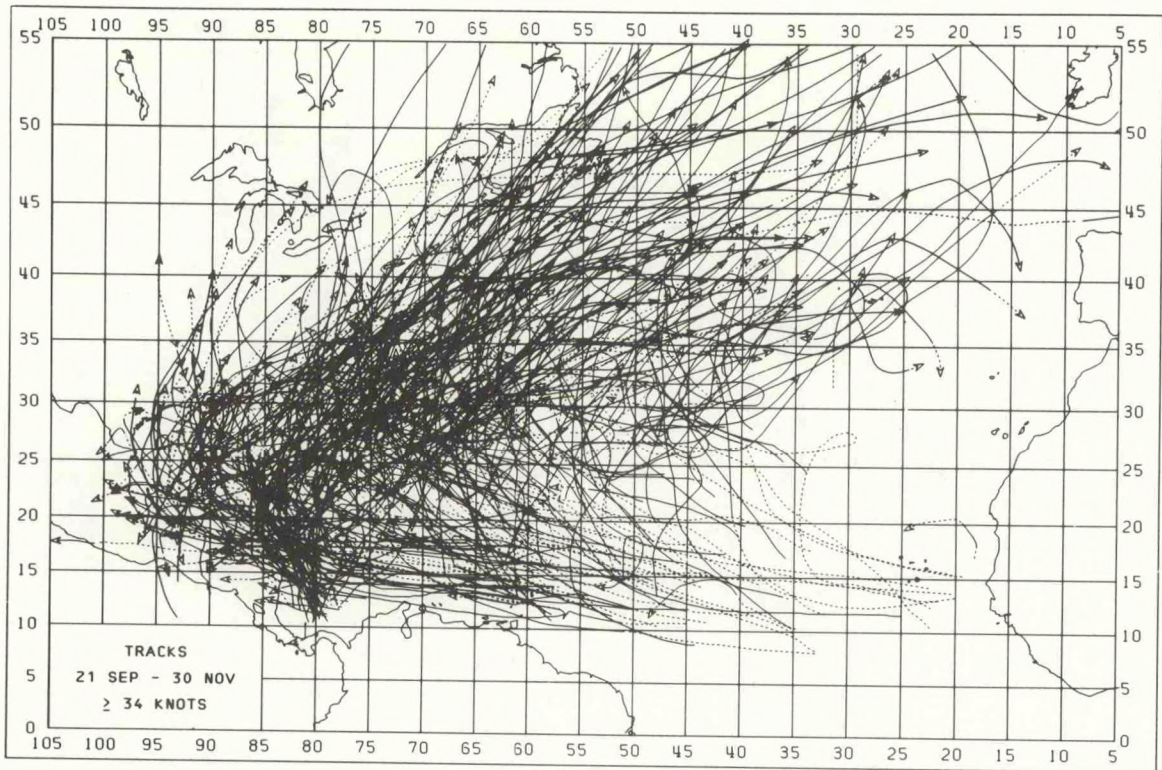
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155	6	301	10	11	4.75						
186	5	288	7	8	3.08						
187	7	309	8	9	2.58						
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189	10	332	9	10	3.24						
220	5	307	7	8	3.05						
221	10	326	7	9	3.97						
222	7	317	7	10	5.04						
223	6	316	8	9	1.56						
224	12	338	9	11	2.52						
225	11	345	9	10	3.43						
256	9	304	7	9	3.21						
257	6	326	8	10	3.72						
258	10	336	9	11	4.84						
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260	13	351	7	9	4.05						
261	9	353	7	8	2.80						
291	6	323	11	11	3.79						
292	12	321	8	9	4.47						
293	10	309	9	11	3.10						
294	11	338	8	11	4.27						
295	9	355	7	11	3.96						
296	14	009	9	11	7.31						
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367	5	010	10	13	6.40						
368	9	014	8	10	5.88						
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370	11	030	8	14	4.93						
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373	6	013	7	14	5.31						
406	7	026	9	14	8.55						
407	10	046	8	11	5.04						
408	12	062	12	14	9.39						
409	13	056	13	16	11.23						
410	7	058	19	20	14.25						
444	7	059	11	14	4.33						
445	10	049	9	12	4.54						
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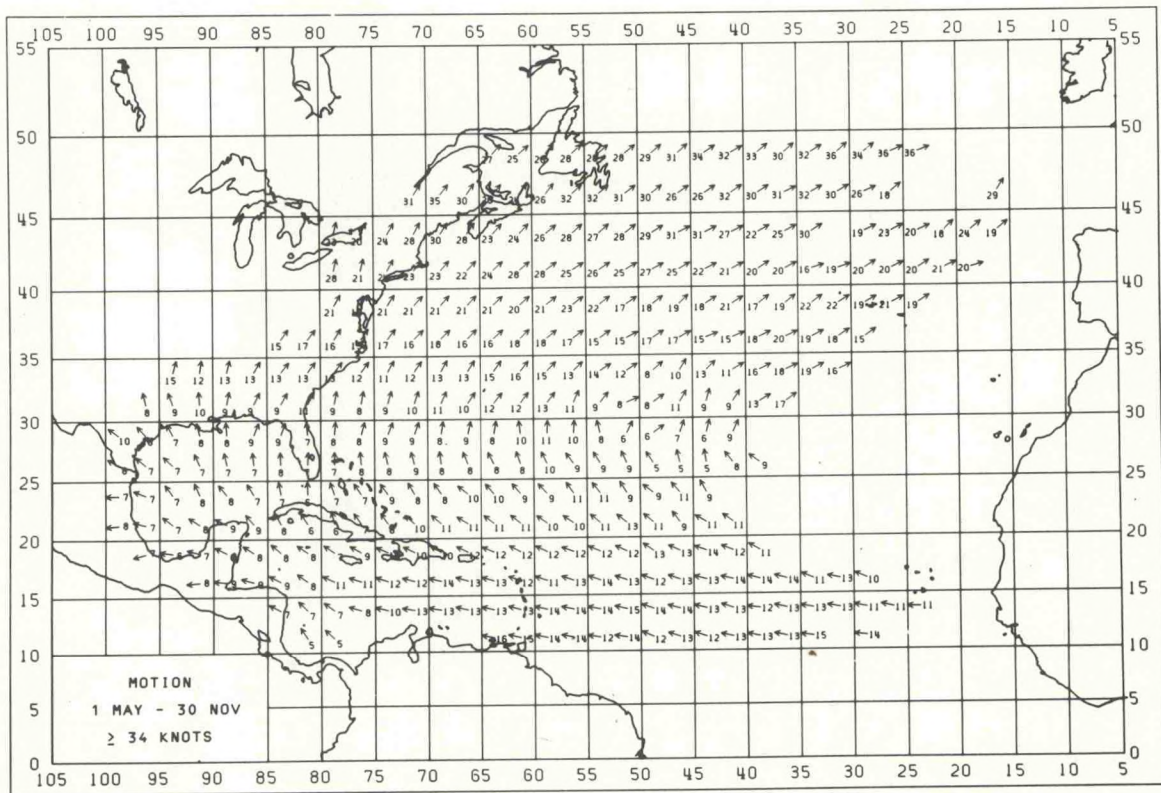
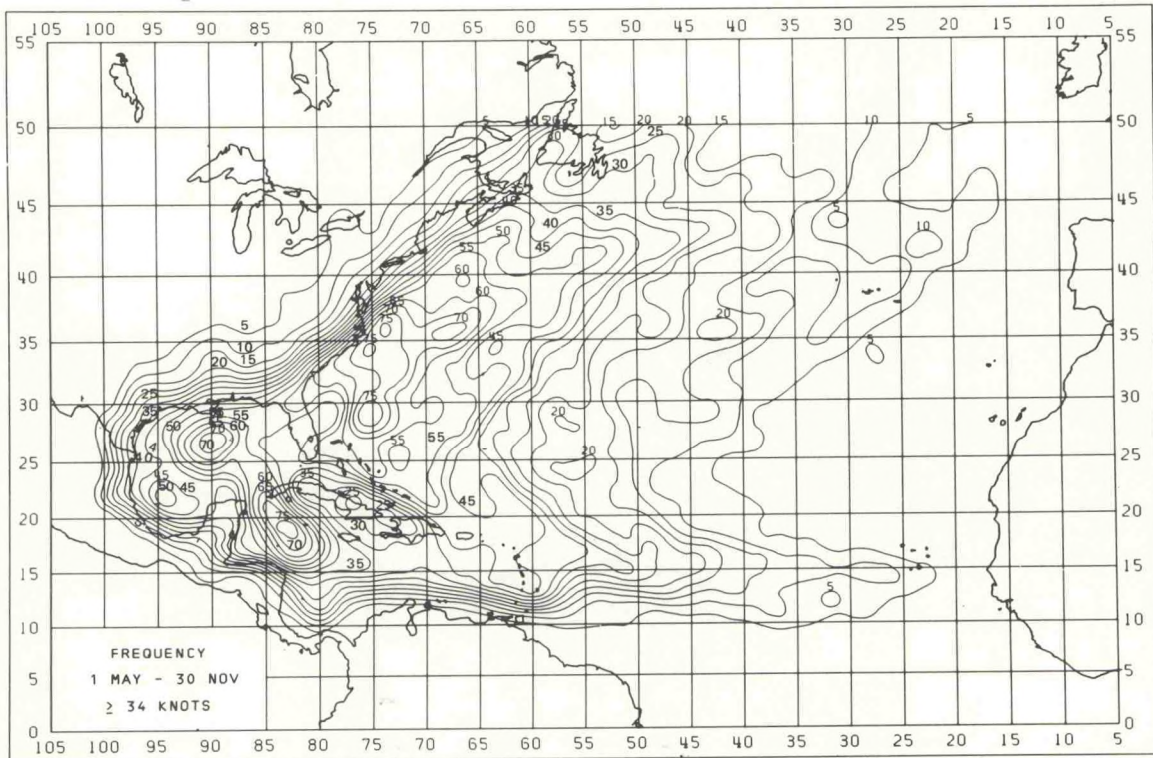


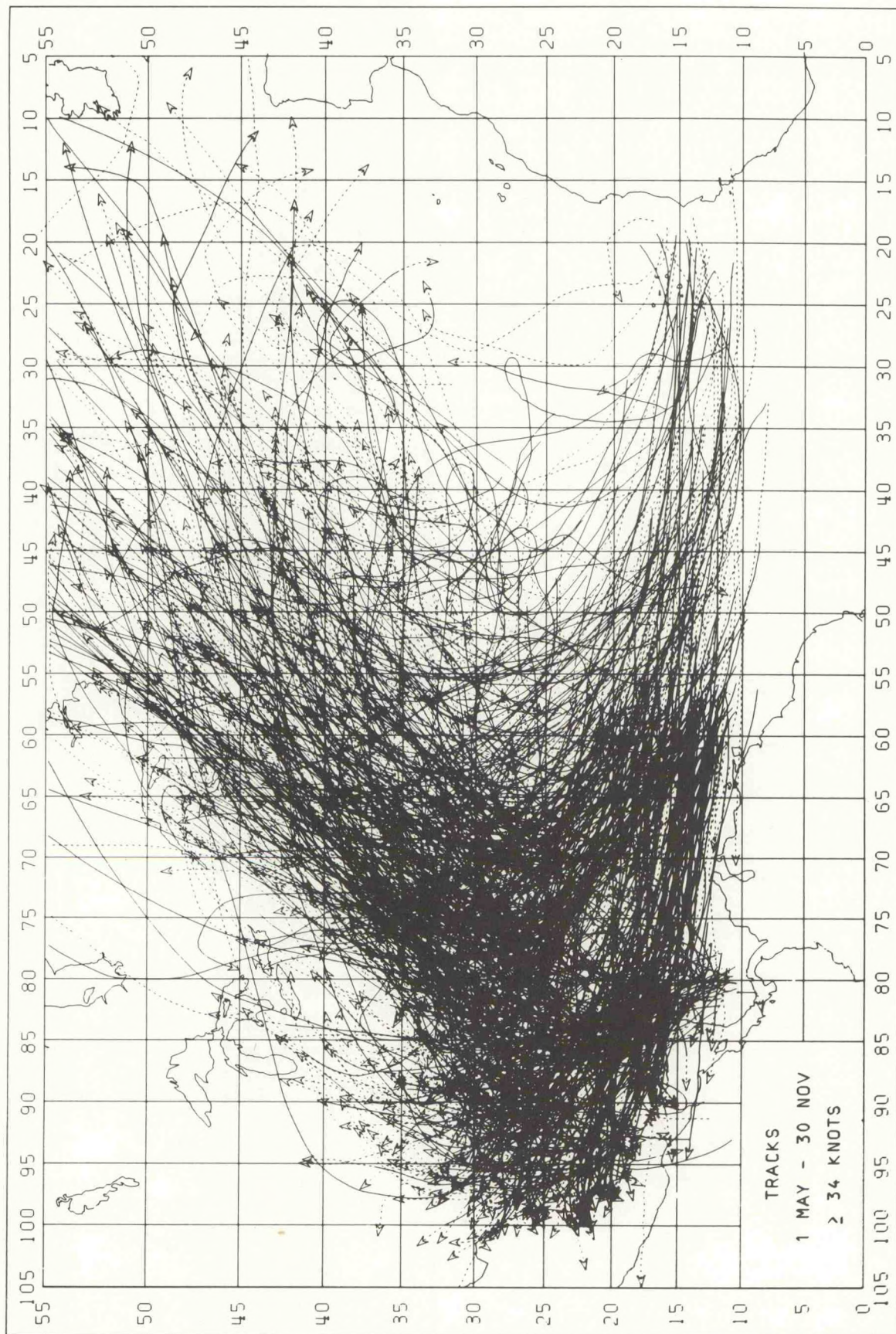
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89	5	279	18	18	4.90	168	23	288	13	13	4.07	256	24	284	7	9	2.42	341	20	345	9	12	4.06	451	27	051	17	19	9.14	562	25	052	28	30	10.09
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91	13	280	15	16	4.94	170	16	282	15	15	6.17	258	20	316	9	11	4.51	343	13	000	13	16	7.50	453	18	054	11	15	7.44	564	20	061	30	32	8.63
92	9	282	15	15	5.46	171	15	284	14	14	6.77	259	27	316	9	11	3.83	344	9	351	12	15	8.35	454	18	062	11	16	8.27	565	17	068	29	31	9.82
96	6	289	13	14	2.96	172	8	280	14	14	4.59	260	22	307	9	10	2.76	345	12	332	10	12	3.93	455	13	059	15	18	8.77	566	13	074	26	27	10.65
97	6	288	12	12	3.58	173	10	291	11	13	4.37	261	17	313	9	10	3.12	346	7	013	8	11	4.54	456	8	066	14	17	9.50	567	15	062	22	24	10.80
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100	10	280	13	14	4.27	185	9	284	7	8	3.80	264	26	303	9	10	3.40	365	13	323	9	11	4.02	479	6	028	17	18	7.11	574	5	049	17	23	13.90
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120	10	276	13	13	4.91	191	23	288	13	13	4.86	270	22	310	9	10	3.58	372	29	005	8	11	4.88	485	26	049	19	21	10.75	595	13	036	27	29	8.34
121	14	280	13	13	4.75	192	19	287	14	14	3.73	271	15	312	11	11	5.06	372	29	354	10	11	3.98	486	26	055	20	21	9.08	596	10	041	27	30	9.22
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129	18	281	15	16	4.41	200	28	290	12	13	3.00	295	33	322	8	10	3.53	380	13	011	11	15	6.31	494	6	049	19	20	9.51	604	10	063	32	34	14.68
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133	18	285	13	14	3.55	204	11	292	14	14	7.06	299	28	318	7	9	3.45	405	5	016	9	9	4.91	519	31	042	24	25	10.67	630	9	053	26	28	15.86
134	15	285	14	14	3.08	205	7	288	15	16	4.89	300	32	325	8	10	4.18	405	8	023	8	10	6.16	520	33	045	23	24	8.26	631	17	040	25	27	12.34
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157	27	281	15	15	4.92	231	40	303	11	12	4.26	330	31	335	8	10	4.63	419	6	069	6	10	4.47	536	6	084	18	20	11.81						
158	27	280	14	14	5.02	232	37	2																											





A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F						
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83	12	325	5	6	4.01	224	23	334	8	9	4.32	311	8	027	6	13	6.68	410	30	036	11	15	7.99	496	9	053	20	21	8.55	635	15	050	32	35	11.31
117	7	286	9	9	4.83	225	30	352	7	9	4.05	312	9	026	6	13	8.58	411	35	032	12	15	6.64	497	5	054	23	23	10.48	636	12	055	31	34	13.82
118	23	320	6	7	3.99	226	21	354	5	9	3.42	313	6	027	5	10	3.23	412	26	032	12	15	6.17	498	7	058	21	23	9.40	637	6	063	37	39	10.74
119	18	328	5	8	3.43	227	20	018	8	11	4.14	314	6	010	7	10	4.44	413	23	026	15	18	6.84	499	9	064	17	21	9.51	639	5	041	37	38	8.82
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121	7	281	7	9	3.38	229	15	004	8	12	5.48	316	15	039	15	17	10.16	415	19	049	18	20	6.57	519	12	036	20	23	10.34						
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124	10	276	11	12	1.62	232	5	348	6	13	3.70	319	14	027	9	14	5.68	418	10	063	15	17	10.89	522	20	045	29	30	12.12						
125	11	277	11	12	3.15	233	11	332	8	12	2.22	320	19	025	12	15	6.32	419	12	040	9	16	10.91	523	17	052	30	32	13.13						
126	10	280	11	11	4.03	234	11	336	8	12	3.33	321	37	038	10	15	7.26	420	11	024	12	16	9.01	524	21	058	25	27	13.04						
127	8	276	10	13	4.82	235	7	334	8	11	3.89	322	30	040	9	14	7.64	421	10	054	18	20	11.94	525	22	060	25	27	11.53						
128	7	279	13	13	4.87	236	5	339	7	11	3.98	323	28	035	9	14	7.56	422	8	062	15	18	13.36	526	17	063	30	32	13.07						
129	7	279	12	12	3.81	237	5	303	4	8	3.76	324	31	033	10	14	6.49	423	9	064	16	19	11.69	527	13	065	30	32	13.80						
130	5	282	9	10	4.04	238	5	301	11	12	4.15	325	20	031	10	15	6.59	424	6	063	18	20	7.38	528	15	057	26	28	11.76						
131	6	276	6	10	3.64	239	18	006	7	9	3.61	326	14	027	9	14	5.68	425	8	034	21	23	6.83	529	12	060	24	26	12.31						
132	15	279	9	10	3.48	240	24	340	6	9	3.86	327	13	014	9	15	5.33	426	10	035	19	21	11.44	530	9	058	23	25	13.93						
133	27	302	8	9	3.31	241	25	014	8	10	3.88	328	7	053	4	11	3.82	427	23	036	20	22	8.00	531	7	056	23	26	16.46						
134	36	316	7	8	3.55	242	20	026	8	11	3.73	329	11	045	5	12	5.92	428	30	039	17	19	6.94	532	5	056	21	27	18.87						
135	16	309	9	11	4.33	243	25	003	7	11	4.56	330	14	011	7	15	9.59	429	26	042	19	21	9.82	533	5	057	16	17	11.92						
136	16	305	8	10	5.28	244	24	002	8	12	4.93	331	8	357	7	13	4.83	430	16	038	21	23	9.25	534	6	056	21	22	10.76						
137	7	330	5	12	3.30	245	21	002	8	13	5.00	332	15	024	10	12	5.08	431	20	047	20	22	8.62	535	7	045	23	27	11.53						
138	8	295	10	13	3.30	246	19	016	8	13	5.44	333	11	359	11	13	3.79	432	17	054	23	24	9.86	536	8	032	24	25	12.62						
139	8	292	11	12	3.49	247	19	351	7	13	4.51	334	8	357	7	13	4.83	433	13	056	21	22	8.21	537	15	043	22	23	8.98						
140	10	288	12	13	2.56	248	13	313	10	13	3.93	335	17	039	11	14	6.56	434	17	054	23	24	9.86	538	20	040	24	25	10.56						
141	12	281	12	12	3.80	249	17	332	9	13	4.96	336	15	048	12	15	7.63	435	13	053	18	24	11.69	539	17	049	29	30	13.19						
142	11	284	10	13	5.14	250	17	332	9	13	4.96	337	24	036	14	20	9.94	436	12	058	19	22	12.06	540	15	051	31	34	17.73						
143	9	285	9	10	3.17	251	9	341	9	13	4.97	338	15	048	12	15	7.63	437	11	068	20	21	11.05	541	13	049	28	31	10.84						
144	6	286	11	11	4.29	252	7	334	8	10	3.04	339	18	008	10	15	8.50	438	12	066	18	19	11.44	542	12	058	27	30	10.48						
145	5	287	10	11	4.16	253	27	341	9	11	2.80	340	29	023	7	13	7.15	439	11	058	19	21	10.38	543	10	064	23	26	14.89						
146	7	287	8	9	4.21	254	11	322	9	11	5.29	341	35	024	9	13	6.99	440	8	062	21	22	7.21	544	6	069	30	32	16.58						
147	6	293	9	13	4.00	255	6	303	6	10	4.25	342	14	355	6	14	9.24	441	6	065	18	22	9.03	545	9	067	30	33	25.50						
148	12	269	5	9	4.40	256	6	303	6	10	4.25	343	24	030	11	15	7.00	442	6	065	18	22	9.03	546	13	059	29	32	14.13						
149	10	288	7	8	4.95	257	6	338	7	11	3.28	344	24	028	13	16	6.30	443	6	065	18	22	9.03	547	9	067	30	33	25.50						
150	10	300	10	11	4.38	258	9	334	5	9	4.71	345	24	047	11	16	8.74	444	6	065	18	22	9.03	548	6	067	30	33	25.50						
151	11	306	6	9	4.02	259	22	004	7	11	5.35	346	34	039	13	18	7.22	445	6	065	18	22	9.03	549	12	041	21	22	7.98						
152	15	324	6	10	4.24	260	24	019	9	12	6.10	347	26	047	11	16	8.74	446	7	032	21	25	11.64	550	14	043	28	29	9.99						
153	27	339	4	8	4.11	261	18	019	7	11	5.92	348	19	050	12	17	6.09	447	8	037	24	28	13.67	551	12	052	39	41	19.79						
154	19	003	4	8	4.08	262	19	017	8	11	5.13	349	14	033	11	17	5.87	448	12	047	24	25	11.85	552	14	052	36	39	19.76						
155	14	352	5	9	5.79	263	24	026	8	13	4.42	350	12	057	10	15	8.55	449	27	040	21	23	8.98	553	12	054	37	41	20.22						
156	11	307	8	10	3.48	264	28	023	9	14	5.85	351	8	087	9	15	10.24	450	26	046	22	25	10.56	554	9	059	41	45	25.48						
157	11	307	9	13	2.87	265	30	024	10	14	7.39	352	13	047	7	15	9.35	451	20	047	20	22	8.62	555	6	069	30	32	16.58						
158	13	311	8	12	3.16	266	31	013	8	13	7.32	353	13	025	12	19	11.02	452	17	054	23	24	9.86	556	9	061	24	26	8.99						
159	10	307	10	14	3.72	267	32	008	8	13	5.83	354	9	022	10	14	8.49	453	19	051	23	23	11.74	557	6	061	24	26	8.99						
160	7	293	11	12	4.24	268	30	013	8	14	5.92	355	18	032	10	13	8.02	454	18	049	24	24	10.14	558	9	054	31	33	11.66						
161	10	329	8	12	3.55	269	30	020	8	14	4.62	356	6	063	8	11																			



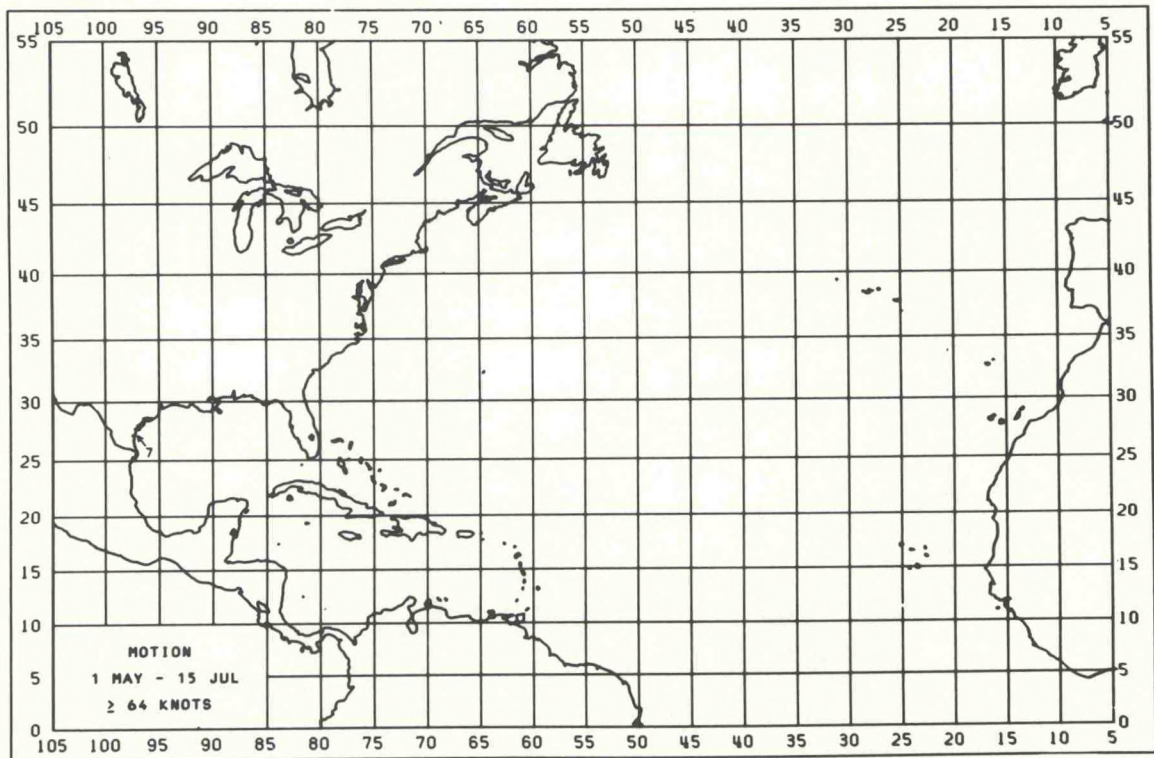
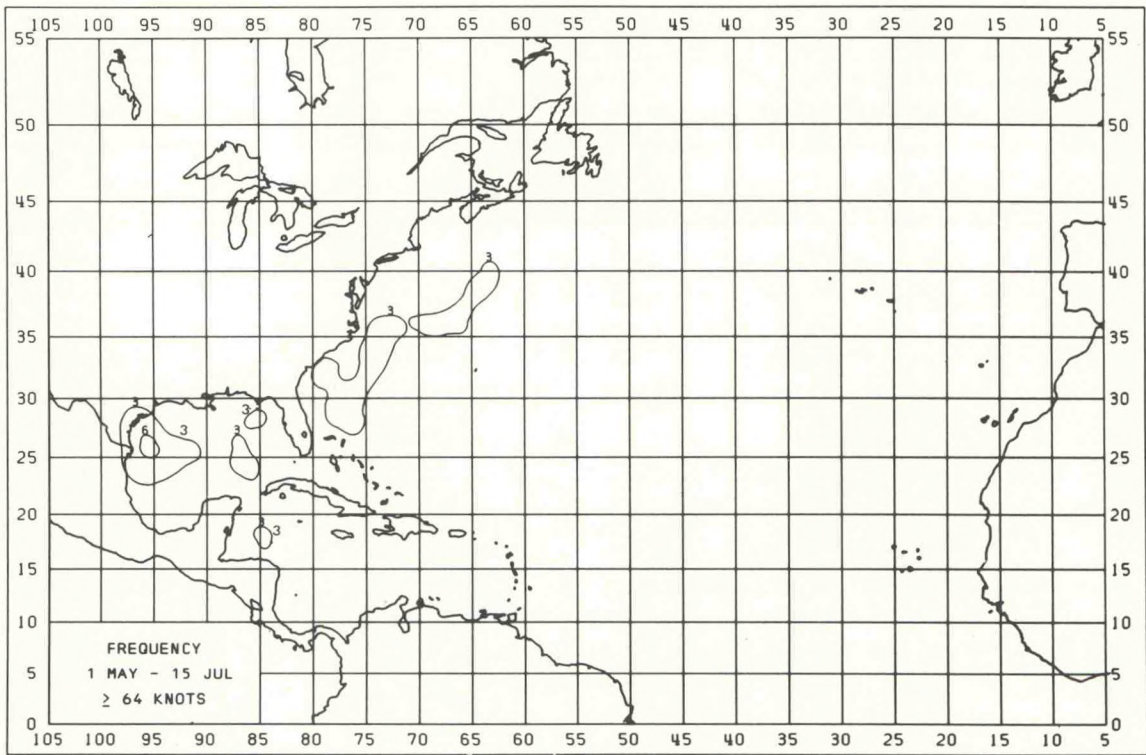


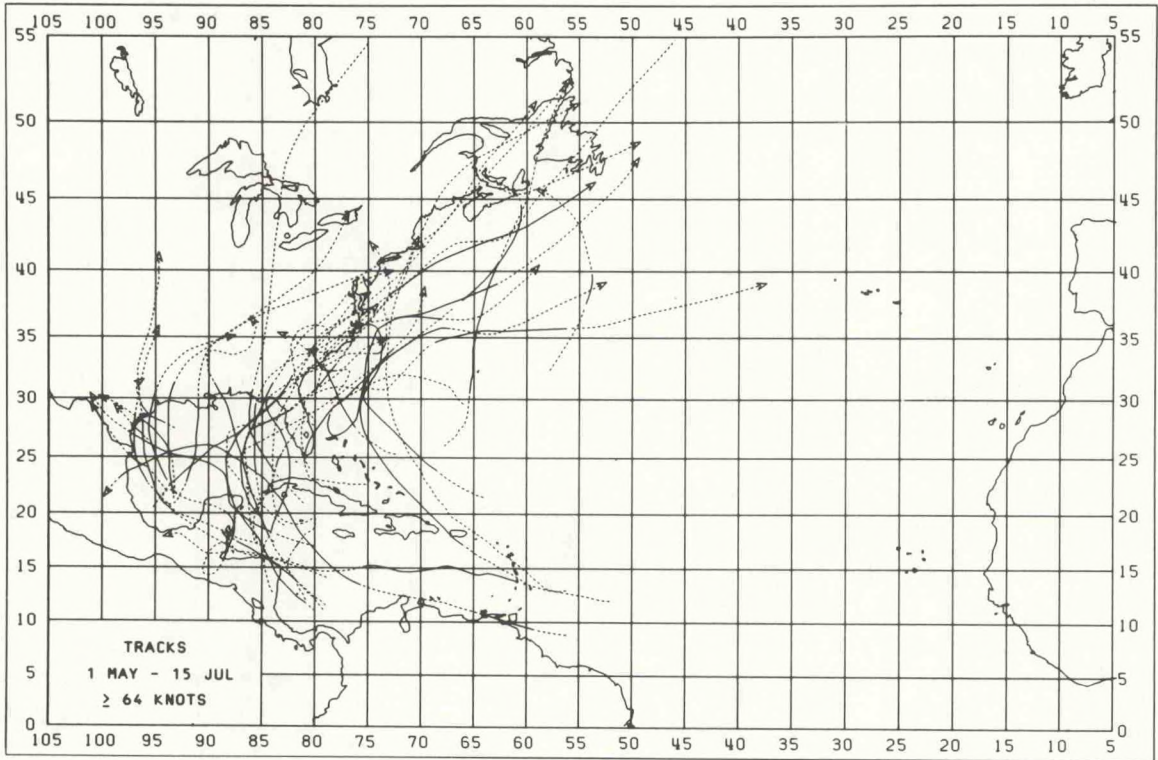
See next page for tabular data.

A.4 Chart Series B

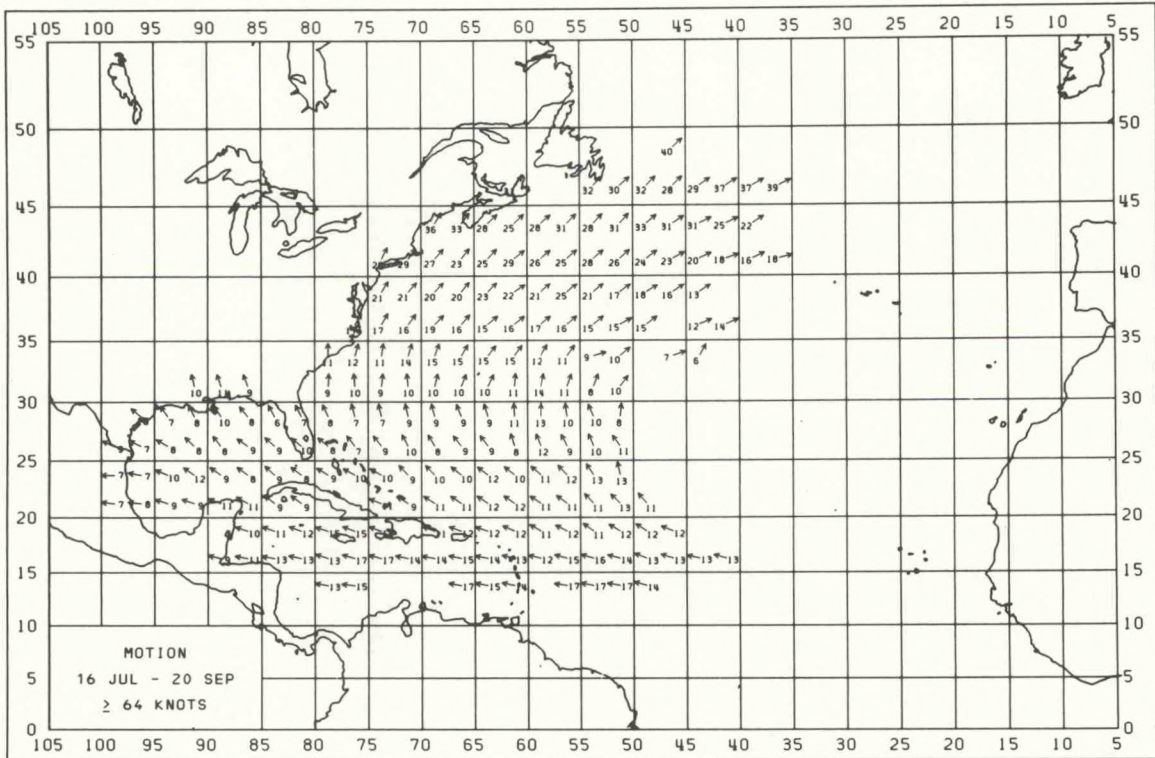
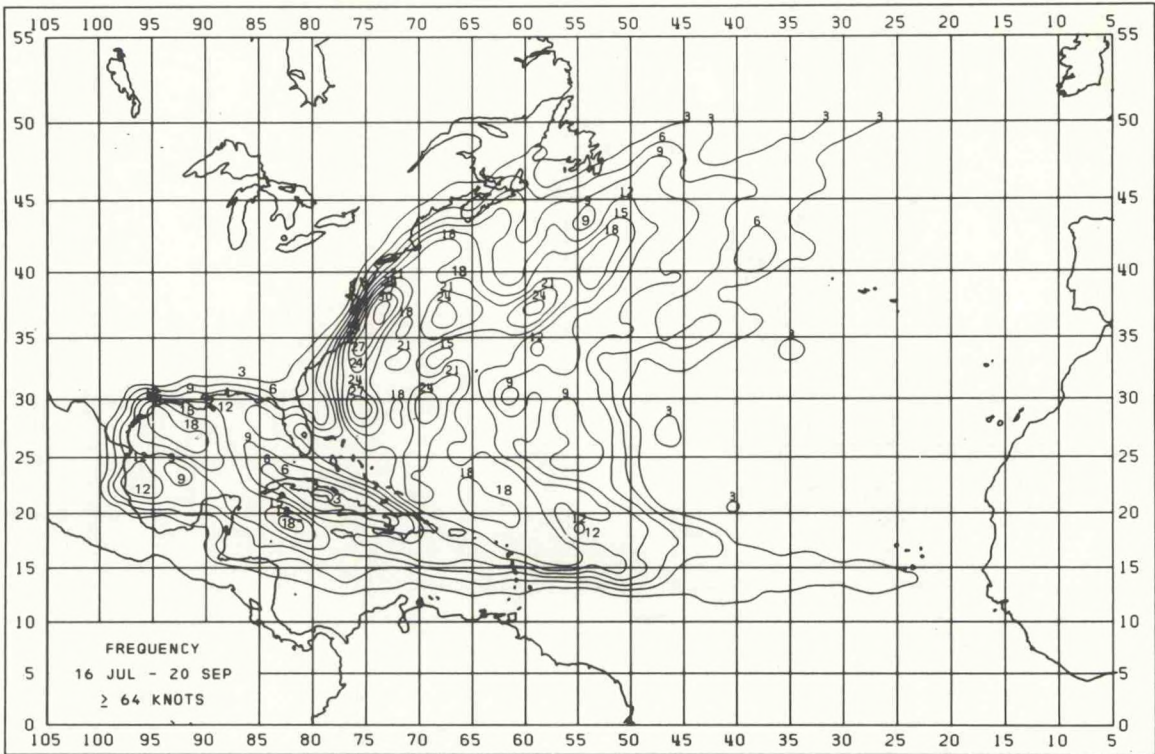
Charts and tabular data in this series are based on portions of storm tracks having intensities of at least 64 knots and for the following periods:

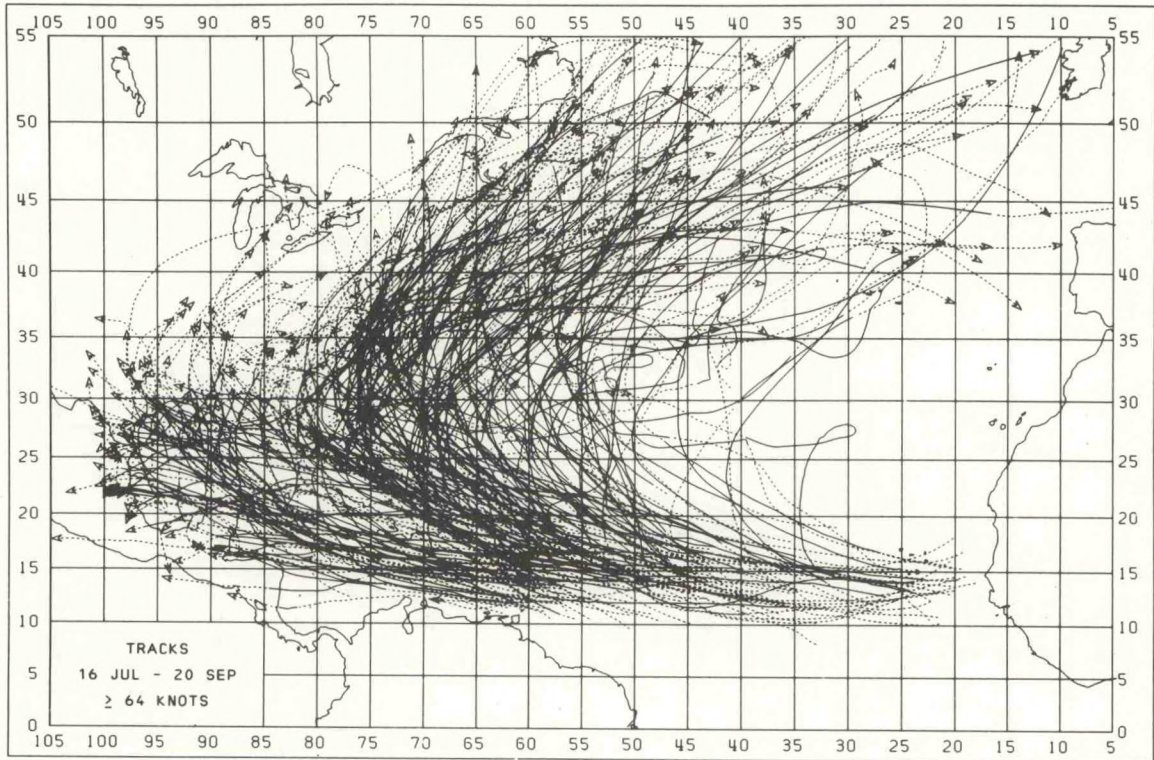
<u>STRATIFICATION PERIOD</u>	<u>PAGES</u>
1 May - 15 Jul	A-46,47
16 Jul - 20 Sep	A-48,49
21 Sep - 30 Nov	A-50,51
1 May - 30 Nov	A-52,53



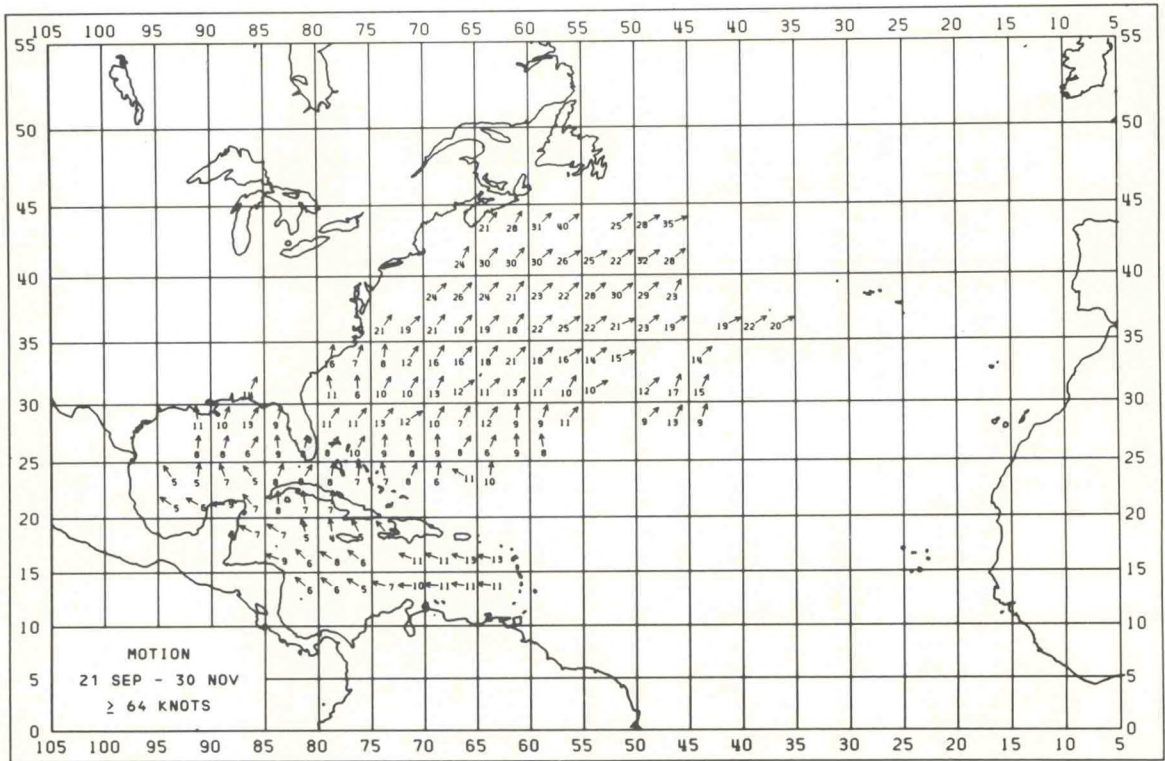
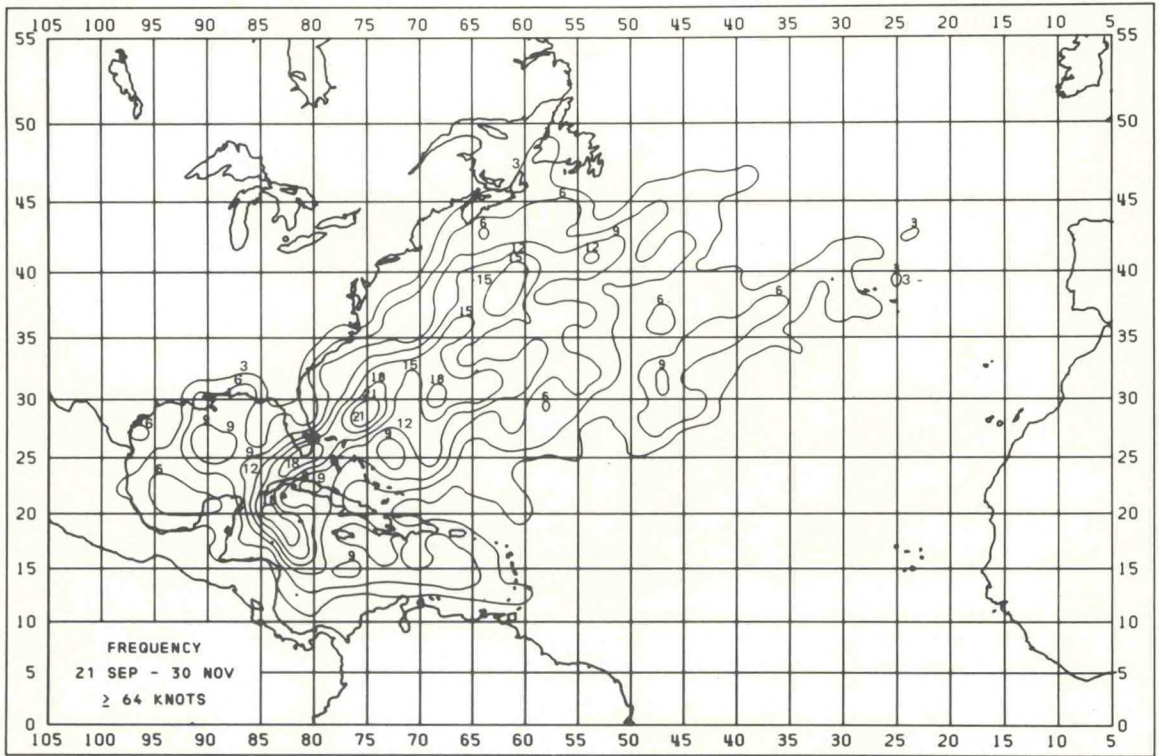


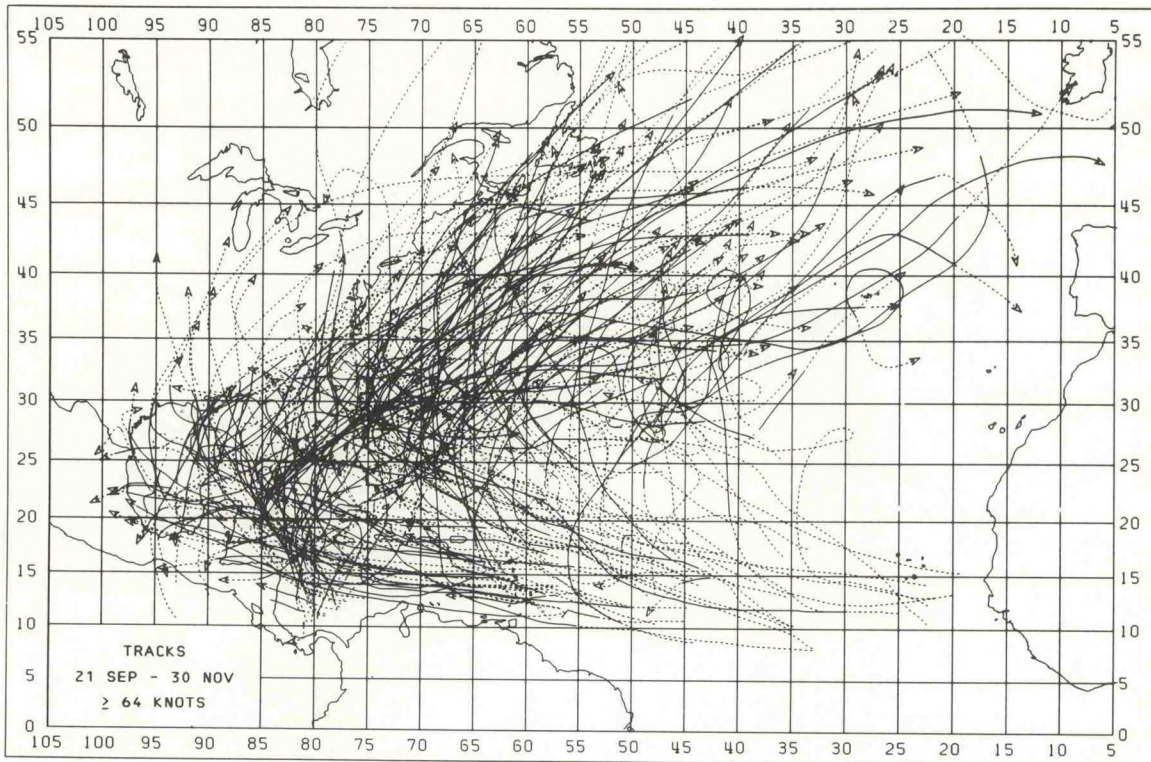
A	B	C	D	E	F
292	5	323	7	8	3.80



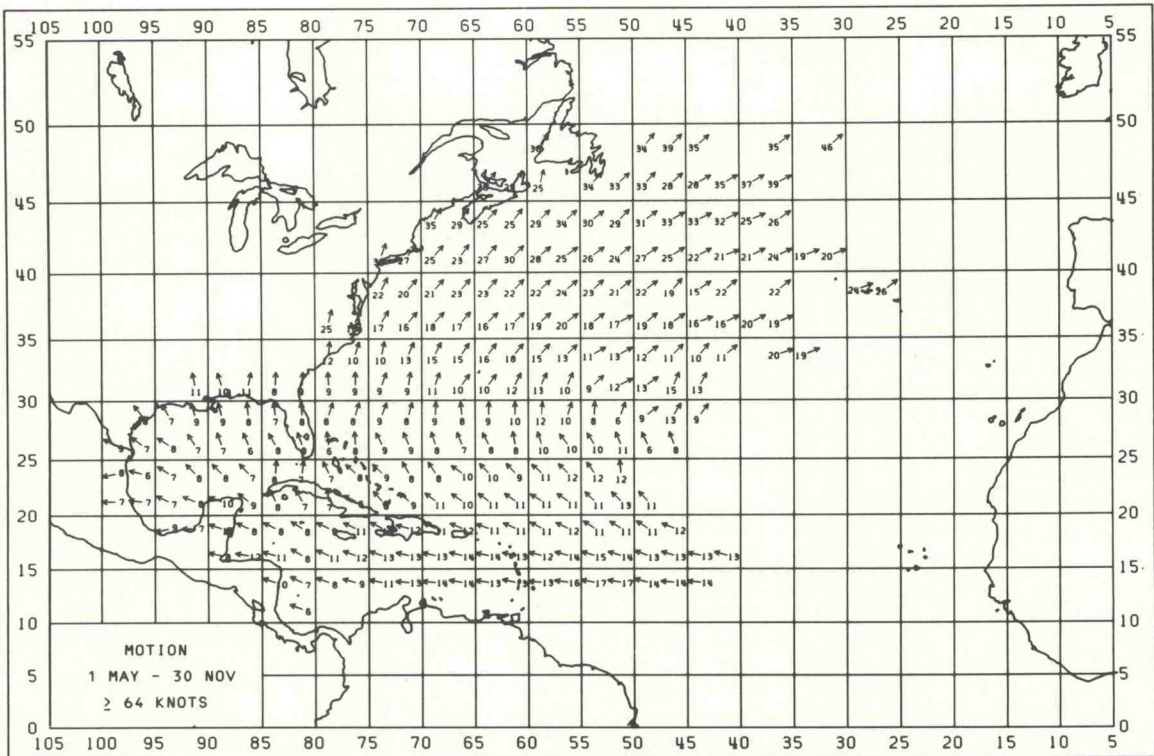
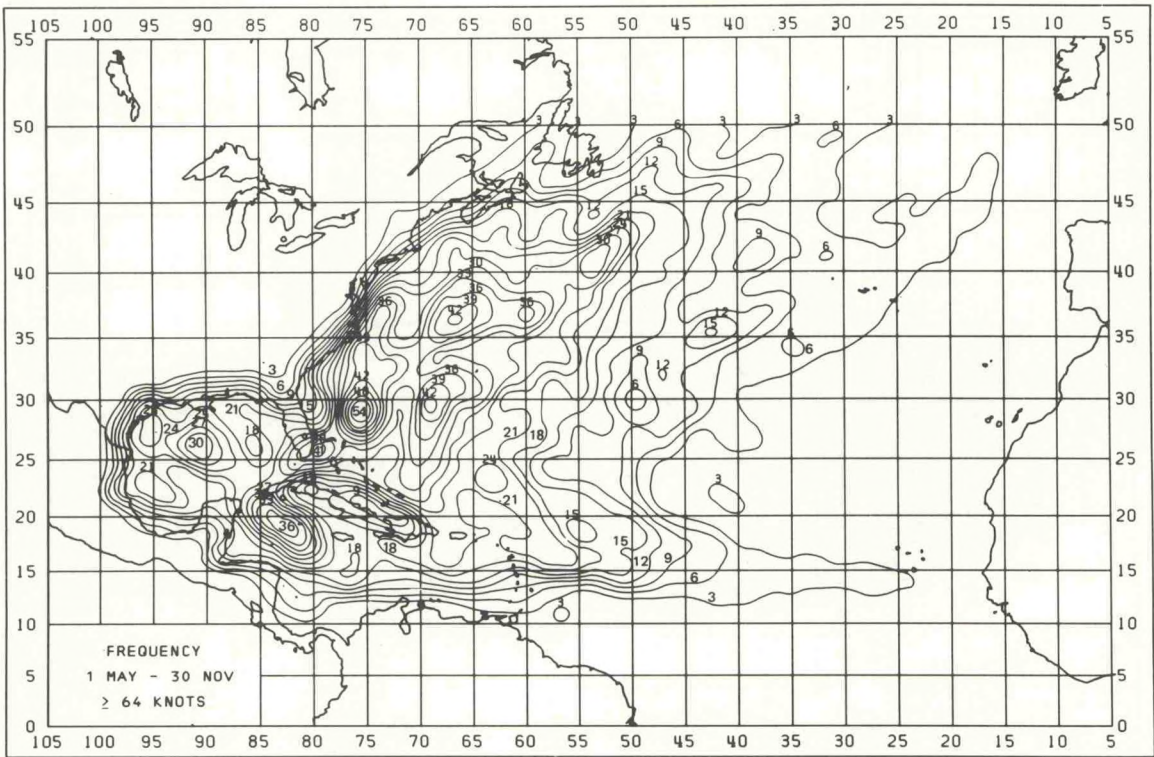


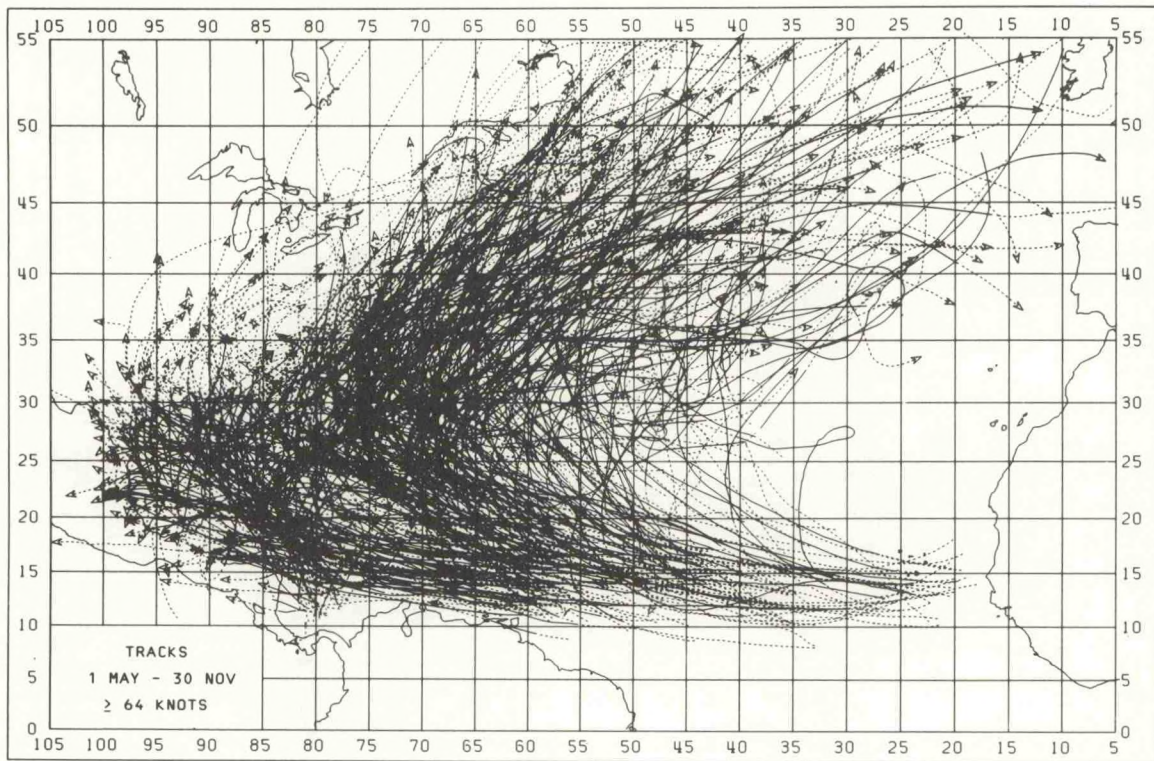
A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F						
119	5	281	13	13	5.22	229	8	291	11	11	3.19	330	14	335	8	10	4.58	451	21	050	17	18	9.62	600	7	044	28	30	10.80
120	6	277	15	15	5.33	230	19	302	9	10	3.51	331	12	328	10	11	4.93	452	13	049	16	17	6.17	601	6	055	29	31	10.03
124	6	280	17	18	3.97	231	21	303	11	12	4.47	332	13	322	8	9	5.02	453	10	049	15	18	5.50	602	7	057	37	38	8.91
125	8	281	15	16	5.29	232	20	303	11	12	5.13	333	12	332	6	8	2.73	454	9	061	15	19	7.56	603	6	060	37	38	11.13
126	5	282	14	14	2.12	233	18	304	12	12	4.12	334	14	334	7	9	3.54	455	8	052	15	19	7.94	604	5	063	39	40	13.43
128	6	278	17	17	5.25	234	18	304	12	12	4.26	335	8	337	8	9	3.09	457	7	066	12	14	7.42	605	5	064	40	43	3.59
129	7	280	17	17	5.03	235	18	303	11	12	4.85	336	27	346	7	9	4.41	458	6	066	14	16	6.54						
130	12	280	17	17	4.22	236	16	306	11	12	3.61	337	23	347	7	11	4.38	481	21	030	21	23	9.22						
131	9	286	14	15	4.00	237	16	316	11	13	4.98	338	20	347	9	12	4.22	482	23	040	21	22	9.13						
151	6	283	9	9	4.35	238	11	314	13	14	5.77	339	27	346	9	12	4.17	483	19	041	20	23	9.96						
152	8	281	11	12	5.09	239	6	319	11	12	3.26	340	18	339	9	11	4.34	484	21	038	20	23	9.66						
153	7	280	13	14	4.55	255	5	268	7	8	3.56	341	17	344	9	12	4.10	485	15	043	23	25	9.55						
154	7	282	13	13	5.31	256	13	280	7	8	2.22	342	12	357	11	14	5.19	486	13	055	22	23	9.74						
155	10	289	13	13	5.44	257	9	293	10	11	5.98	343	12	001	13	16	7.79	487	20	049	21	23	10.84						
156	9	286	17	17	4.32	258	10	305	12	13	4.69	344	8	352	10	14	8.08	488	18	051	25	25	10.42						
157	10	285	17	17	4.82	259	14	306	9	10	3.72	345	10	337	10	12	3.79	489	17	049	21	22	9.29						
158	13	282	14	15	3.91	260	10	306	8	9	2.31	346	6	006	8	11	4.65	490	13	053	17	19	8.23						
159	15	280	14	15	3.84	261	5	313	9	9	2.96	366	7	347	10	13	4.23	491	9	058	18	20	6.37						
160	13	282	15	15	4.36	262	8	307	8	9	2.87	367	6	342	11	12	3.58	492	7	055	16	17	5.28						
161	15	281	14	14	4.46	263	11	302	9	9	3.23	368	5	341	9	9	4.16	493	5	056	13	14	4.05						
162	17	283	13	13	4.26	264	16	299	10	10	3.46	371	13	003	9	11	5.51	517	5	028	28	30	10.70						
163	19	284	12	13	4.01	265	16	299	10	11	3.09	372	23	356	10	11	3.99	518	14	037	29	30	10.27						
164	21	286	15	15	5.55	266	21	316	9	10	3.31	373	20	006	9	11	5.06	519	18	042	27	27	11.67						
165	17	287	16	16	5.88	267	20	316	10	11	4.39	374	21	354	10	12	5.94	520	18	039	23	25	7.22						
166	14	285	14	15	5.99	268	19	308	10	11	4.39	375	21	013	10	13	6.64	521	14	044	25	27	9.72						
167	10	292	13	14	5.52	269	20	307	12	12	4.23	376	22	021	10	12	5.79	522	10	051	29	31	10.79						
168	8	288	13	14	5.07	270	19	308	10	10	3.71	377	14	025	10	12	5.12	523	13	051	26	28	12.37						
169	6	282	13	13	3.06	271	12	310	11	12	4.90	378	10	005	11	15	8.89	524	15	050	25	26	11.14						
170	6	286	13	13	3.24	272	9	316	12	13	3.31	379	10	013	14	16	8.20	525	18	050	28	29	11.47						
188	10	290	10	11	3.89	273	9	326	13	15	5.71	380	10	019	11	14	7.02	526	17	048	26	28	10.56						
189	15	290	11	11	3.89	274	8	348	13	14	5.69	381	10	019	8	12	5.50	527	10	053	24	25	8.63						
190	21	291	12	13	4.21	291	5	294	9	10	3.14	382	5	037	10	14	8.37	528	8	062	23	24	7.14						
191	11	289	15	15	4.03	292	15	296	7	10	3.77	407	9	359	11	13	5.96	529	7	065	20	21	10.02						
192	11	291	15	15	3.58	293	16	301	8	10	4.11	408	27	015	12	13	5.87	530	5	072	18	19	9.86						
193	8	290	13	13	3.54	294	19	314	8	9	3.58	409	21	009	11	14	4.66	531	9	065	16	19	6.65						
195	16	291	11	12	3.01	295	14	322	8	10	3.21	410	21	017	14	16	7.10	532	5	076	18	20	8.33						
196	18	290	12	13	3.08	296	8	306	9	10	3.92	411	16	019	15	17	7.51	533	7	031	36	37	13.57						
197	20	289	12	12	3.47	297	12	313	9	10	3.05	412	17	030	15	16	7.28	534	9	038	33	34	11.37						
198	19	294	12	12	3.39	298	14	310	10	11	2.67	413	17	038	15	18	7.28	535	12	047	28	29	10.99						
199	21	300	11	12	3.43	299	18	310	8	10	2.70	414	15	036	15	17	7.46	536	12	046	25	26	10.60						
200	15	297	12	12	2.88	300	16	323	7	9	4.27	415	12	030	12	14	8.49	537	9	050	28	30	11.14						
201	14	307	11	12	3.77	301	20	322	9	10	3.50	416	16	036	11	14	5.82	538	11	045	31	33	8.79						
202	13	301	12	12	3.92	302	21	332	10	11	3.59	417	8	074	9	12	4.02	539	7	043	28	30	11.30						
203	13	303	12	12	3.96	303	21	330	8	10	4.02	418	6	050	10	14	6.58	540	15	042	31	32	10.83						
204	9	292	12	13	7.04	304	18	321	9	10	4.30	420	6	070	7	10	5.34	541	11	050	33	34	10.94						
219	5	277	7	8	3.38	305	16	324	9	10	4.75	421	5	028	6	8	4.87	542	11	056	31	33	9.86						
220	10	276	8	9	3.73	306	11	343	8	11	3.62	444	15	029	17	18	9.98	543	9	064	31	32	11.04						
221	10	288	9	9	2.76	307	12	338	12	14	5.36	445	30	029	17	19	7.30	544	5	065	25	27	9.19						
222	10	288	9	10	3.16	308	10	334	9	13	4.06	446	16	036	16	19	8.44	545	5	058	22	24	7.66						
223	12	291	11	12	2.55	309	7	338	10	11	3.88	447	25	042	19	20	7.41	546	8	039	31	31	13.51						
224	14	299	11	12	3.18	310	8	325	11	12	2.94	448	25	040	16	18	7.14	547	6	043	32	34	6.74						
225	12	307	9	10	3.70	328	15	311	8	10	4.21	449	20	049	15	17	8.26	548	9	048	30	32	7.63						
226	6	306	9	11	4.39	329	20	326	7	9	4.54	450	22	051	16	18	9.57	549	10	044	32	34	9.30						





A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
118	7	311	6	7	5.83	305	6	023	6	10	2.63	450	11	034	18	20	5.07
119	7	307	6	7	4.24	306	8	359	9	14	5.89	451	12	045	22	24	7.42
120	8	302	5	8	2.33	307	7	351	8	13	5.34	452	9	052	25	27	9.10
121	6	285	7	9	3.37	330	7	353	11	13	5.81	453	10	054	22	23	8.88
122	6	272	10	10	2.44	331	7	020	10	12	3.84	454	6	067	21	23	9.45
123	7	275	11	11	2.64	332	6	030	13	15	6.17	455	5	049	23	30	12.29
124	8	277	11	12	1.72	333	6	016	9	12	3.72	456	7	056	19	24	12.60
125	6	277	11	11	2.22	335	10	035	11	14	5.76	458	8	064	19	20	9.29
153	6	289	9	10	5.01	336	23	039	11	15	6.29	459	6	058	22	22	7.57
154	17	316	6	8	3.50	337	19	041	13	16	6.94	460	5	062	20	21	6.94
155	8	302	8	9	3.04	338	10	058	12	14	9.38	483	9	045	24	25	8.72
156	8	309	6	9	2.98	339	17	028	10	12	7.45	484	12	042	26	27	11.21
158	6	291	11	13	3.74	340	11	027	7	12	4.75	485	15	042	24	26	10.09
159	6	291	11	12	3.67	341	7	033	12	15	8.07	486	16	036	21	23	8.08
160	7	287	13	14	2.36	342	12	003	9	11	5.72	487	9	049	23	23	11.28
161	5	281	13	14	2.71	343	6	018	9	12	5.22	488	8	048	22	23	8.09
188	9	298	7	10	5.10	344	8	038	11	16	5.67	489	7	049	28	29	9.49
189	15	304	7	9	4.10	347	6	044	9	12	6.99	490	6	052	30	30	8.58
190	15	345	5	7	2.65	348	8	027	13	16	10.76	491	5	048	29	31	7.00
191	8	353	4	7	2.06	349	7	018	9	15	10.31	492	6	026	23	25	14.70
192	5	333	5	7	3.13	368	6	025	14	15	8.34	520	9	027	24	27	11.63
193	6	320	7	10	3.34	371	10	349	11	13	6.96	521	11	040	30	33	12.13
221	8	305	5	8	1.99	372	14	358	6	10	6.01	522	13	040	30	32	11.22
222	7	299	6	8	2.06	373	17	028	10	13	6.87	523	11	050	30	31	14.26
223	6	271	9	10	3.98	374	13	032	10	16	7.48	524	9	059	26	27	14.80
224	11	320	7	9	3.79	375	17	026	13	17	6.77	525	12	061	25	26	13.21
225	16	358	8	9	3.39	376	15	054	12	15	9.27	526	10	056	22	23	13.57
226	10	352	7	8	3.05	377	18	046	11	16	7.14	527	5	057	32	34	13.24
227	10	007	7	11	4.58	378	14	040	13	17	6.05	528	7	052	28	29	11.30
257	6	327	5	9	1.69	379	10	041	11	15	6.05	557	6	036	21	22	10.07
258	6	006	5	8	2.95	380	8	028	10	15	5.36	558	6	028	28	29	12.04
259	7	341	7	9	3.05	381	9	060	10	17	8.96	559	9	045	31	34	14.39
260	10	324	5	9	1.94	383	6	048	12	20	10.43	560	7	052	40	43	17.62
261	17	020	8	11	3.47	384	9	020	17	22	11.37	562	5	052	25	27	14.68
262	14	031	9	11	3.77	385	5	027	15	16	10.78	563	6	060	28	28	14.31
263	11	009	8	11	5.22	407	7	010	16	18	11.54	564	5	068	35	36	10.99
264	7	005	7	14	5.92	408	10	020	7	10	5.84						
265	10	348	7	12	4.12	409	11	005	8	13	8.66						
266	9	023	8	13	3.59	410	13	034	12	16	8.61						
267	10	006	6	13	3.64	411	16	030	16	17	5.29						
268	5	299	11	13	5.08	412	12	041	16	17	5.78						
269	6	006	10	15	6.40	413	11	036	18	19	5.54						
294	10	004	8	11	5.33	414	10	044	21	23	4.24						
295	10	013	8	10	3.31	415	13	048	18	21	5.37						
296	6	028	6	10	4.18	416	10	059	16	19	7.06						
297	8	356	9	11	4.77	417	8	052	14	16	9.25						
298	16	012	8	12	4.31	418	6	069	15	17	10.51						
299	17	032	8	13	4.70	421	7	048	14	16	7.61						
300	13	029	10	14	7.23	445	5	036	21	23	11.80						
301	9	002	9	13	6.62	446	7	046	19	19	9.03						
302	11	348	8	12	3.93	447	9	036	21	23	6.34						
303	15	000	9	13	4.66	448	16	042	19	20	7.52						
304	7	031	8	14	4.63	449	15	044	19	19	7.65						



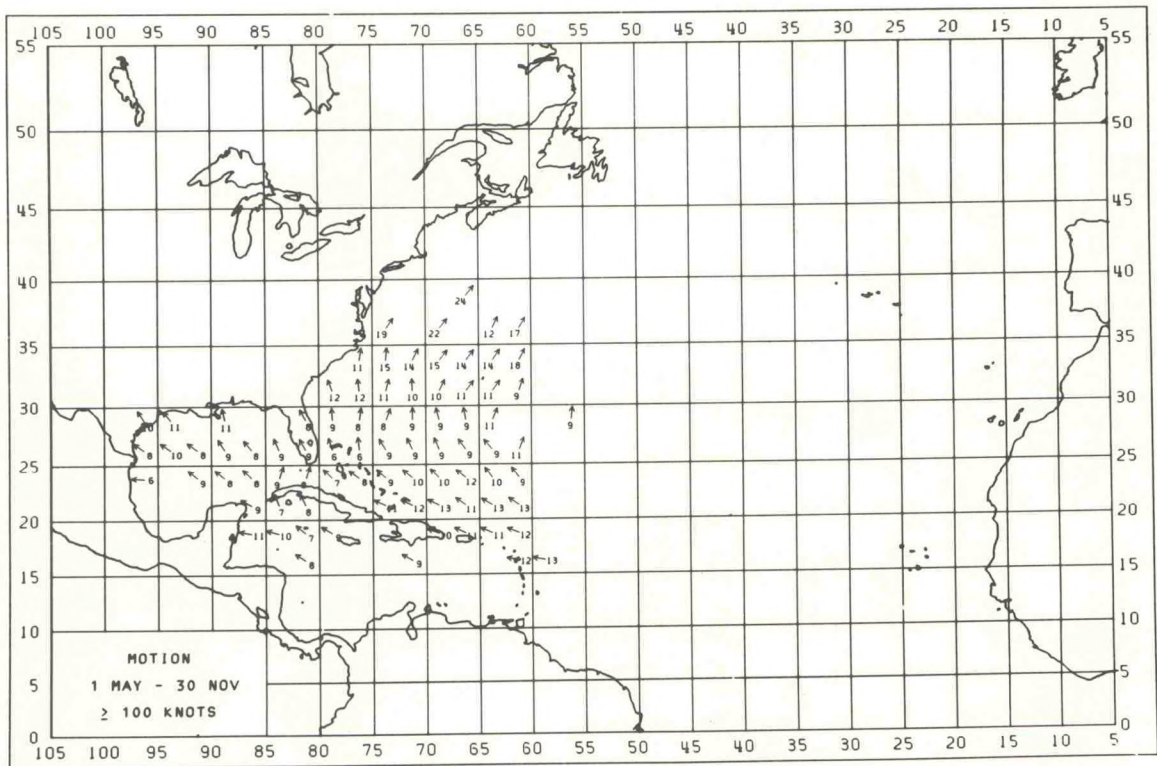
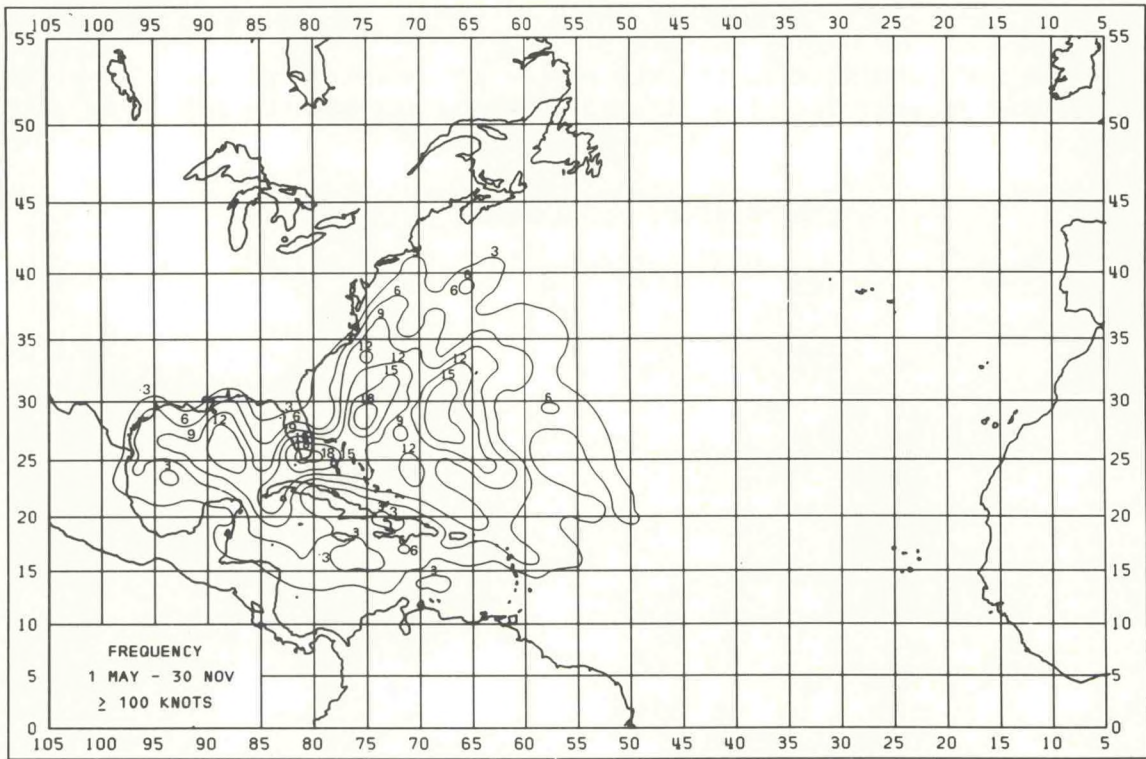


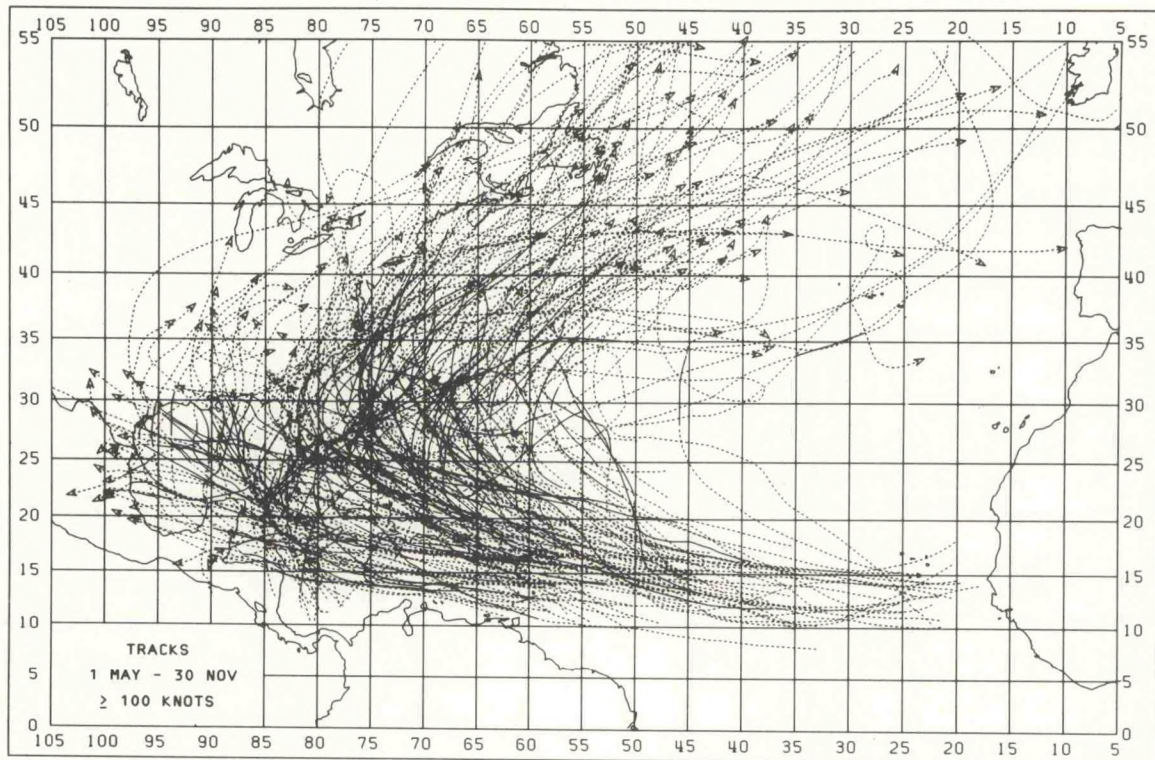
A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
82	6	291	6	6	3.62	200	16	297	12	12	2.79	298	31	341	8	11	3.58	382	10	064	12	17	10.40	494	6	050	22	22	14.08
117	7	289	10	11	4.32	201	15	305	11	12	3.70	299	36	352	6	11	4.11	383	8	055	13	20	9.38	496	5	051	22	22	9.22
118	11	296	7	9	5.28	202	15	303	11	12	4.18	300	31	357	8	11	6.10	384	12	023	15	20	11.09	499	5	070	24	27	14.47
119	13	291	8	10	5.21	203	15	305	11	12	4.24	301	30	333	9	11	4.76	385	6	028	13	14	10.88	500	6	052	26	27	14.77
120	15	285	9	11	4.99	204	9	292	12	13	7.04	302	32	337	9	12	3.66	407	18	005	12	14	8.39	517	7	020	30	32	11.27
121	11	282	11	12	4.56	219	7	271	7	8	3.02	303	35	343	8	11	4.57	408	39	017	10	12	5.78	518	16	036	27	28	11.91
122	11	274	13	13	4.90	220	14	277	7	9	3.71	304	26	338	7	11	4.77	409	37	011	10	13	5.91	519	22	041	25	26	11.83
123	13	275	14	14	4.57	221	20	296	7	8	2.48	305	22	334	8	10	4.23	410	35	024	13	16	7.42	520	28	035	23	25	8.76
124	15	280	14	14	3.90	222	16	292	8	9	2.78	306	19	350	8	13	4.74	411	33	026	15	17	6.28	521	27	041	27	29	10.68
125	15	279	13	14	4.54	223	18	290	10	11	3.10	307	19	342	10	14	5.18	412	30	034	15	17	6.60	522	24	044	30	32	10.08
126	9	283	13	13	2.58	224	26	309	9	10	3.49	308	14	322	10	13	4.11	413	29	037	16	18	6.67	523	24	051	28	29	13.01
127	7	275	13	14	1.63	225	31	336	8	10	3.43	309	10	329	10	12	4.26	414	25	039	18	19	6.89	524	24	054	25	27	12.32
128	6	278	16	17	5.42	226	16	332	7	10	3.68	310	9	338	11	14	4.98	415	25	041	15	17	7.64	525	31	053	26	28	11.94
129	7	280	17	17	5.03	227	13	353	7	11	4.30	311	7	336	6	12	6.51	416	25	047	13	15	6.64	526	27	051	24	26	11.61
130	12	280	17	17	4.22	228	8	296	6	9	4.53	312	6	340	8	16	7.07	417	16	061	11	14	7.15	527	16	055	27	28	10.64
131	9	286	14	15	4.00	229	13	319	6	11	3.13	328	21	324	8	10	4.14	418	12	061	13	16	8.44	528	15	057	25	27	9.12
132	6	275	14	15	3.41	230	24	312	9	11	4.55	329	21	330	7	9	4.53	419	9	054	12	17	11.37	529	12	061	22	23	13.65
133	6	275	14	14	2.58	231	26	309	11	12	4.79	330	23	343	9	11	4.99	420	11	045	11	15	9.41	530	7	070	21	22	13.46
151	12	283	8	10	3.19	232	21	306	10	12	5.04	331	20	346	9	11	4.29	421	12	039	10	12	7.65	531	11	063	21	24	10.53
152	15	280	12	12	4.06	233	20	307	11	12	3.89	332	21	354	8	11	5.45	422	6	050	11	13	8.05	532	8	064	24	26	12.73
153	16	287	11	12	4.58	234	23	306	11	12	4.08	333	21	354	7	10	3.45	424	5	071	20	22	9.39	533	6	070	19	21	11.49
154	25	302	8	10	4.45	235	20	303	11	12	4.60	334	20	357	8	11	4.03	425	7	067	19	22	10.38	534	6	068	20	22	12.98
155	20	295	11	12	4.84	236	16	305	11	12	3.58	335	22	017	8	12	4.97	443	5	014	25	26	11.75	555	7	030	35	35	14.54
156	18	291	12	13	5.62	237	16	316	11	13	4.95	336	53	016	8	11	5.82	444	17	026	16	18	10.21	556	14	036	29	30	12.39
157	15	289	13	15	4.81	238	12	314	13	14	5.45	337	42	020	9	13	6.17	445	39	030	17	18	8.29	557	18	044	25	26	10.79
158	19	284	13	14	3.74	239	6	319	11	12	3.25	338	30	015	8	13	6.31	446	25	042	16	18	8.35	558	20	038	25	27	10.48
159	22	282	13	14	3.78	255	8	258	8	9	3.46	339	43	003	9	12	5.55	447	38	043	18	20	7.49	559	19	047	29	31	12.55
160	21	284	14	14	3.83	256	21	285	6	8	2.40	340	29	354	8	12	4.42	448	45	042	17	18	7.28	560	18	048	34	37	13.49
161	20	281	14	14	3.99	257	18	305	7	10	4.40	341	24	001	9	13	5.48	449	37	048	16	18	7.77	561	11	052	30	33	11.75
162	19	283	13	13	4.06	258	18	317	8	11	4.62	342	24	000	10	13	5.45	450	34	047	17	19	8.17	562	20	044	29	31	11.68
163	21	283	12	13	3.86	259	22	316	8	10	3.31	343	18	006	12	15	7.09	451	34	049	19	20	8.97	563	17	053	31	32	12.04
164	23	286	14	15	5.59	260	23	318	7	9	2.02	344	16	017	10	15	6.72	452	24	053	20	21	8.44	564	16	060	33	34	9.92
165	18	287	15	16	6.15	261	24	005	8	10	3.35	345	14	003	8	13	6.26	453	20	052	18	21	7.62	565	12	065	33	34	10.66
166	15	286	14	14	6.00	262	23	006	7	11	3.52	346	9	019	6	11	4.21	454	16	064	17	20	8.20	566	9	064	32	34	11.70
167	12	290	13	14	5.16	263	22	336	7	10	4.32	347	8	053	9	12	6.33	455	13	051	19	23	10.83	567	7	068	25	28	10.92
168	10	288	13	14	4.72	264	23	313	8	12	4.56	348	11	031	13	16	9.29	456	11	055	18	22	11.70	568	5	055	26	27	8.53
169	8	282	13	13	2.82	265	27	314	9	11	3.85	349	8	036	9	16	9.43	457	11	070	16	18	9.77	593	5	038	36	37	13.55
170	6	286	13	13	3.18	266	32	332	8	11	3.85	366	10	349	11	13	3.85	458	14	065	16	18	8.09	594	11	039	29	30	12.36
185	5	256	9	10	4.64	267	30	328	8	12	4.27	367	11	343	10	11	3.77	459	10	063	20	21	6.42	595	6	017	25	26	10.95
186	7	271	7	8	5.14	268	24	306	10	11	4.53	368	11	011	11	13	7.14	460	7	067	19	20	5.97	597	8	043	34	36	8.73
187	9	289	10	11	5.55	269	25	318	10	13	4.77	369	6	003	8	10	4.27	481	23	027	22	24	9.75	598	11	046	33	34	9.68
188	21	296	8	10	4.23	270	22	318	9	11	4.54	370	10	004	9	13	3.68	482	27	040	20	22	9.25	599	13	043	33	35	9.89
189	31	298	8	10	4.12	271	13	312	11	12	4.81	371	27	357	9	12	5.89	483	27	042	21	23	9.39	600	10	048	28	30	9.84
190	37	303	8	10	4.30	272	10	316	12	13	3.20	372	40	000	9	11	4.73	484	36	041	23	25	10.99	601	11	060	28	30	8.80
191	18	297	9	12	5.48	273	11	326	12	16	5.56	373	40	019	9	12	5.88	485	33	042	23	25	9.71	602	12	059	35	37	10.01
192	16	296	11	13	5.10	274	9	355	12	15	5.37	374	34	009	9	14	6.75	486	28	044	22	24	8.17	603	9	060	37	38	9.88
193	14	299	10	12	3.68	291	7	299	9	10	3.37	375	38	020	11	15	6.79	487	29	049	22	23	10.72	604	5	062	39	40	13.24
194	9	286	12	12	2.58	292	23	308	7	9	3.72	376	38	036	10	13	7.47	488	26	050	24	25	9.68	631	6	041	30	31	11.99
195	22	296	11	12	3.40	293	23	304	8	10	3.75	377	33	037	10	14	6.41	489	25	048	23	24	9.46	635	6	039	34	36	13.19
196	23	293	12	13	2.84	294	31	328	7	10	3.98	378	24	027	12	16	7.26	490	19	052	21	22	9.81	636	8	043	39	41	10.46
197	22	290	11	12	3.35	295	26	341	7	10	3.08	379	19	026	13	16	7.09	491	14	053	22	24	8.47	637	6	048	35	36	7.35
198	21	295	11	12	3.26	296	17	338	6	10	3.57	380	17	023	10	15	6.12												

A.5 Chart Series C

Charts and tabular data in this series are based on portions of storm tracks having intensities of at least 100 knots and for the following periods:

<u>STRATIFICATION PERIOD</u>	<u>PAGES</u>
1 May - 30 Nov	A-56,57





A	B	C	D	E	F	A	B	C	D	E	F
154	6	304	8	11	5.69	334	6	334	8	10	3.13
158	5	300	9	11	2.18	335	5	356	9	12	5.80
162	6	280	12	13	4.64	336	18	007	8	12	6.30
163	6	281	13	14	4.06	337	17	019	8	13	6.62
188	7	281	11	11	5.09	338	12	000	9	14	5.86
189	9	286	10	10	4.44	339	17	346	9	11	4.00
190	7	310	7	8	3.57	340	13	351	9	12	4.99
191	6	302	9	10	4.19	341	9	021	11	15	7.39
195	5	291	10	10	2.02	344	5	006	9	15	6.86
196	7	295	11	12	3.77	371	6	341	12	13	8.96
197	10	293	11	11	2.56	372	13	354	12	13	5.35
198	6	291	12	13	3.08	373	14	013	11	12	6.73
224	7	301	9	11	3.68	374	12	358	10	13	6.73
225	15	340	7	10	3.35	375	13	025	10	14	6.50
226	6	336	8	10	3.45	376	15	056	11	13	7.75
229	6	296	11	11	2.91	377	8	034	11	13	7.32
230	7	296	12	12	3.50	378	6	017	9	11	6.52
231	10	298	13	13	4.94	408	11	009	11	13	4.40
232	12	307	11	13	5.50	409	11	004	15	17	6.88
233	6	302	13	13	4.93	410	10	026	14	17	10.41
234	7	305	13	14	5.29	411	7	039	15	15	7.62
236	6	274	6	7	2.04	412	9	038	14	15	4.12
258	7	312	9	11	5.21	413	10	035	14	15	4.38
259	10	312	8	10	2.91	414	6	030	18	18	8.18
260	11	316	8	9	1.72	445	10	034	19	20	6.98
261	12	017	9	11	3.14	447	7	039	22	22	6.04
262	13	017	8	11	3.32	449	5	025	12	12	2.94
263	12	316	7	9	4.06	450	5	032	17	17	5.50
264	13	308	8	10	3.62	484	6	039	24	25	13.38
265	11	314	9	12	3.50						
266	13	311	10	10	3.82						
267	10	316	10	11	4.28						
268	7	310	12	12	4.58						
269	12	324	10	14	5.72						
270	10	325	9	12	5.88						
292	8	306	8	10	4.97						
293	9	306	10	11	4.57						
294	10	307	8	9	2.51						
295	15	329	9	11	2.23						
296	8	321	8	10	2.96						
297	8	337	9	12	3.93						
298	17	332	9	12	3.81						
299	16	342	6	12	5.25						
300	13	354	6	11	5.84						
301	12	329	9	10	2.72						
302	10	335	9	11	3.29						
303	14	338	9	10	3.47						
304	15	324	9	10	4.60						
305	10	319	9	10	4.83						
306	5	022	11	12	7.47						
328	6	328	10	11	5.83						
329	5	322	11	12	2.33						
331	10	348	11	12	3.29						

(Continued from inside front cover)

- NWS 16 Storm Tide Frequencies on the South Carolina Coast. Vance A. Myers, June 1975, 79 p. (COM-75-11335)
- NWS 17 Estimation of Hurricane Storm Surge in Apalachicola Bay, Florida. James E. Overland, June 1975. 66 p. (COM-75-11332)
- NWS 18 Joint Probability Method of Tide Frequency Analysis Applied to Apalachicola Bay and St. George Sound, Florida. Francis P. Ho and Vance A. Myers, November 1975, 43 p. (PB-251123)
- NWS 19 A Point Energy and Mass Balance Model of a Snow Cover. Eric A. Anderson, February 1976, 150 p. (PB-254653)
- NWS 20 Precipitable Water Over the United States, Volume I: Monthly Means. George A. Lott, November 1976, 173 p. (PB-264219)
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- NWS 21 Interduration Precipitation Relations for Storms - Southeast States. Ralph H. Frederick, March 1979, 66 p. (PB-297192)
- NWS 22 The Nested Grid Model. Norman A. Phillips, April 1979, 89 p. (PB-299046)
- NWS 23 Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States. Richard W. Schwerdt, Francis P. Ho, and Roger R. Watkins, September 1979, 348 p. (PB-80 117997)
- NWS 24 A Methodology for Point-to-Area Rainfall Frequency Ratios. Vance A. Myers and Raymond M. Zehr, February 1980, 180 p. (PB80 180102)
- NWS 25 Comparison of Generalized Estimates of Probable Maximum Precipitation With Greatest Observed Rainfalls. John T. Riedel and Louis C. Schreiner, March 1980, 75 p. (PB80 191463)

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