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CLIMATOLOGY OF ATLANTIC TROPICAL CYCLONES BY TWO AND ONE-HALF DEGREE LATITUDE-LONGITUDE BOXES

SOUTHERN REGION HEADQUARTERS
SCIENTIFIC SERVICES DIVISION
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CLIMATOLOGY OF ATLANTIC TROPICAL CYCLONES BY TWO AND ONE-HALF DEGREE LATITUDE-LONGITUDE BOXES

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This paper presents a climatology and brief statistical analysis of Atlantic tropical storms and hurricanes by 2½-degree latitude-longitude boxes. It extends and refines the climatological charts of Colon (1953) to include data for the years 1950-1968. The period of record used in this study extends from 1886 through 1968, a total of 83 years, and includes 667 storms and hurricanes passing through a total of 12,340 2½-degree latitude-longitude boxes.

In the previous study by the authors (1968) it was found necessary to compute storm frequencies by 2½-degree boxes instead of 5-degree boxes because there were large differences in the number of storms which passed through the four 2½-degree boxes comprising the larger boxes. It was decided, therefore, to compute certain climatological data by 2½-degree boxes for the entire hurricane season, for the early season 1 May through 15 July, for the middle season 16 July through 20 September, and for the late season 21 September through 30 November. In addition, computations were made for 16 overlapping 30-day periods beginning every 10 days between 1 June and 30 November.

The basic data source was the North Atlantic Tropical Cyclone deck, number 988, compiled by the National Weather Records Center at Asheville, N. C.. This deck was previously used by the authors (1968) at which time corrections were applied where needed and the deck brought up to date through the 1968 season. The original hurricane deck is based on tracks given by Cry, Haggard, and White (1959), and Cry (1965).

The following information was computed for all periods:

1. The number of tropical storms or hurricanes passing through each 2½-degree latitude-longitude box. Tropical depression stages are not included.

2. Resultant direction and mean scalar speed of storms or hurricanes as they entered each 2½-degree latitude-longitude box. These computations were not made for any box if the storm count was less than five.

For early, middle, and late season storms the 95 percentile scalar speed of storms as they entered each box was computed, assuming a normal distribution of the scalar speeds. Finally the Poisson probability of occurrence of no storms; at least 1 storm; and at least 2 storms in each of the boxes was computed for early, middle, and late storms, and for the entire season. The computations were performed and the charts printed by the University of Miami IBM 7040 computer.

Except for the following remarks the charts described above are presented in this paper without analysis or interpretation.

On the charts depicting direction and speed of storm movement, the ratios of resultant to scalar speed measure the steadiness or constancy of direction of storm movement.

It was found that a simple Poisson probability function, using the sample mean as the maximum likelihood estimate of the population mean, yields probability values that are in good agreement with the observed relative frequencies of the events considered. Considering the entire hurricane season, a comparison of observed relative frequencies and computed Poisson probabilities for three boxes which are near or include Cape Hatteras, Miami, and New Orleans respectively, is shown in Table I.

TABLE I

Comparison of Observed Relative Frequencies and Poisson Probabilities of Specified Occurrences of Tropical Storms or Hurricanes, 1 May through 30 November, 1886-1968

Box	Observed Relative Frequency of Occurrence			Poisson Probability of Occurrence		
	0	at least 1	at least 2	0	at least 1	at least 2
35.0-37.5N 72.5-75.0W	.43	.57	.21	.41	.59	.23
25.0-27.5N 80.0-82.5W	.46	.54	.19	.43	.57	.22
28.5-30.0N 85.0-87.5W	.53	.47	.16	.54	.46	.13

The preliminary results shown in this paper provide material which is being used for further study in hurricane climatology and forecasting at the National Hurricane Center in Miami.

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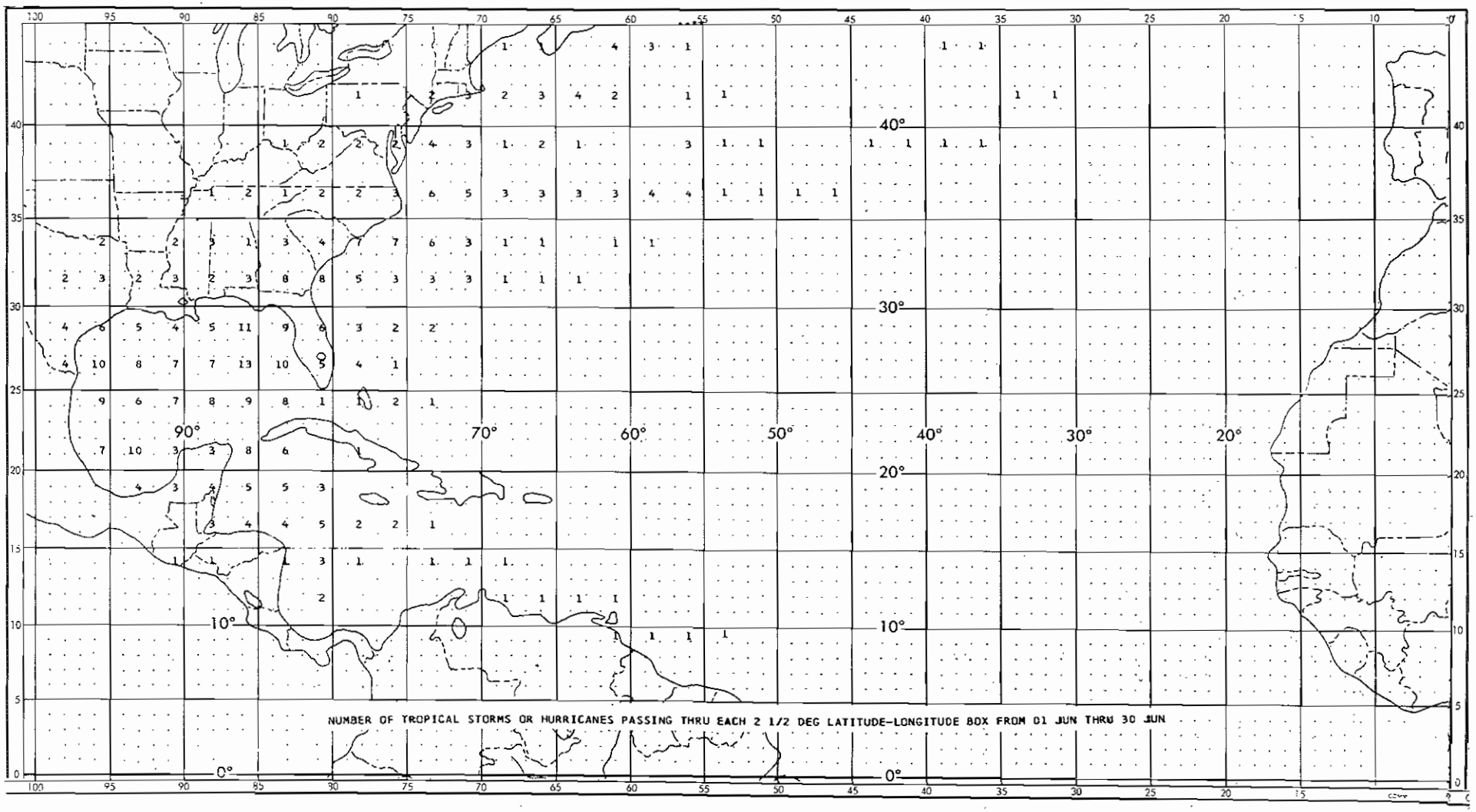
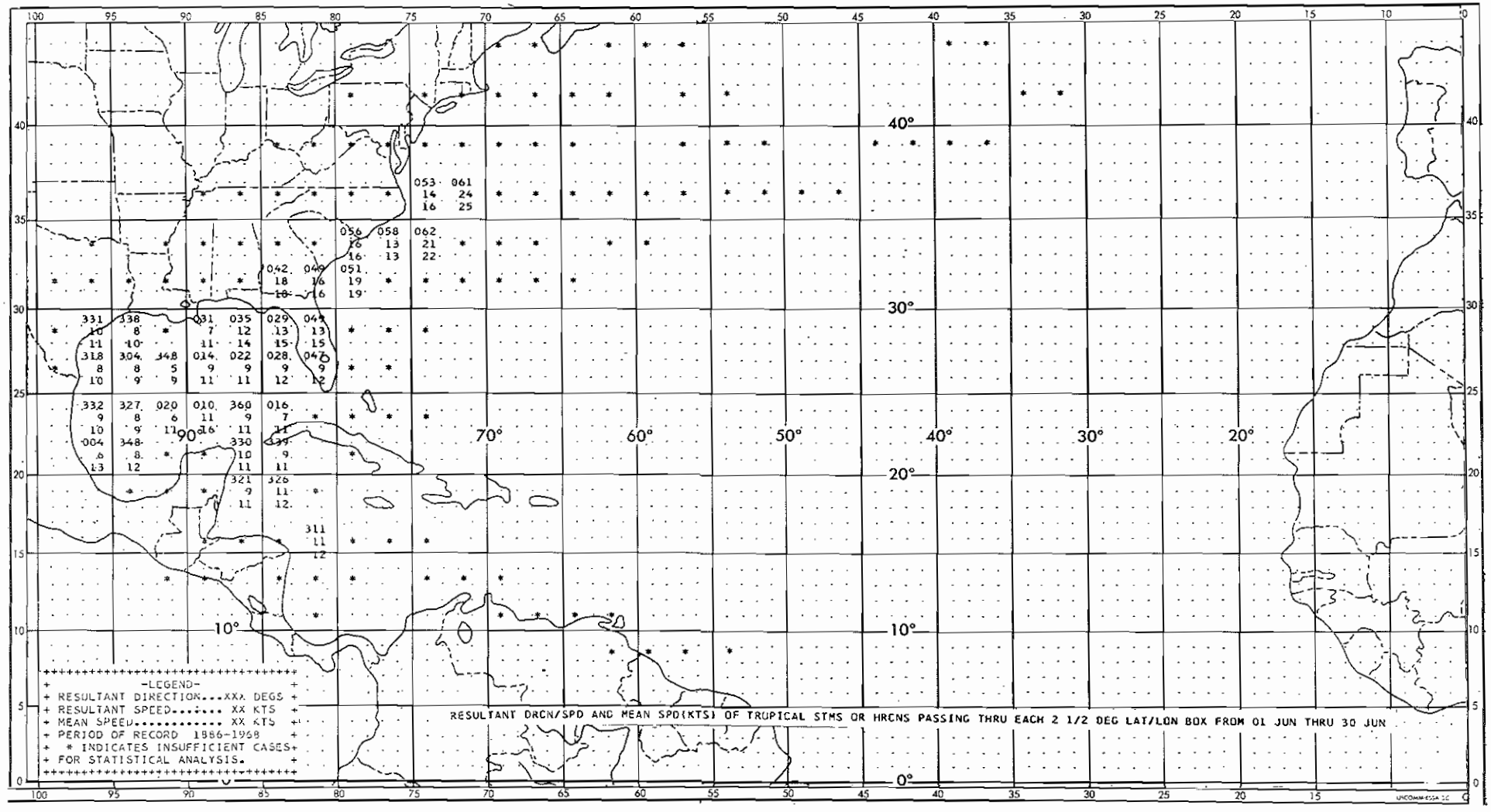
Colon, Jose A., 1953. A Study of Hurricane Tracks for Forecasting Purposes. Monthly Weather Review 81, 53-36.

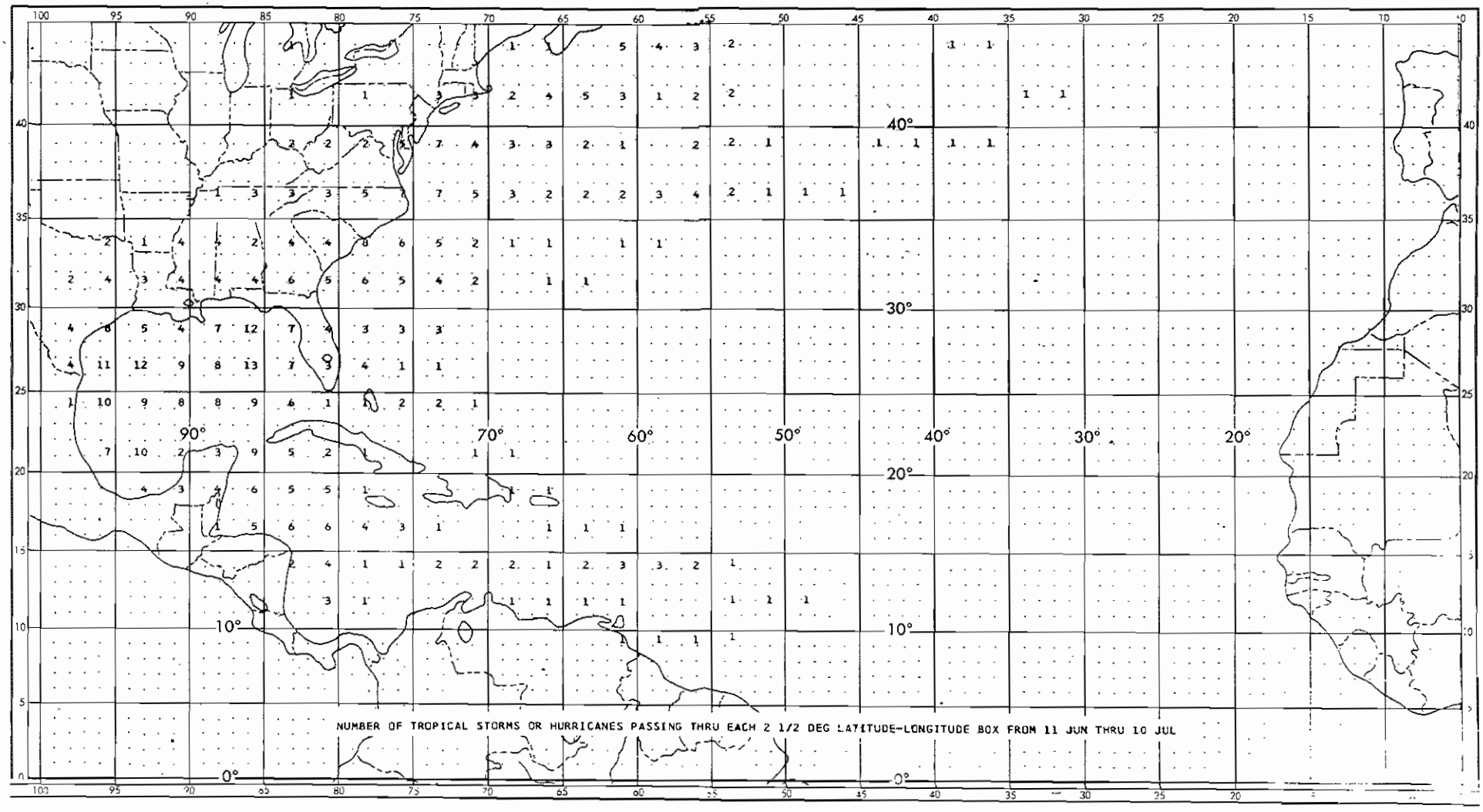
Cry, G. W., W. H. Haggard, and H. S. White, 1959: North Atlantic Tropical Cyclones, Technical Paper No. 36, U. S. Weather Bureau, Washington, D. C. 214 pp.

Hope, J. R., and C. J. Neumann, 1968: Probability of Tropical Cyclone Induced Winds at Cape Kennedy. Technical Memorandum WBTM SOS-1. Weather Bureau, Space Operations Support Division, Silver Spring, Maryland, 67 pp.

Cry, G. W., 1965: Tropical Cyclones of the North Atlantic Ocean. Technical Paper No. 55, U. S. Weather Bureau, Washington, D. C., 148 pp.


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 01 JUN THRU 30 JUN
90°
70°
60°
50°
40°
30°
20°
10°
0°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 JUN THRU 30 JUN
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
90°
70°
60°
50°
40°
30°
20°
10°
0°


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 11 JUN THRU 10 JUL
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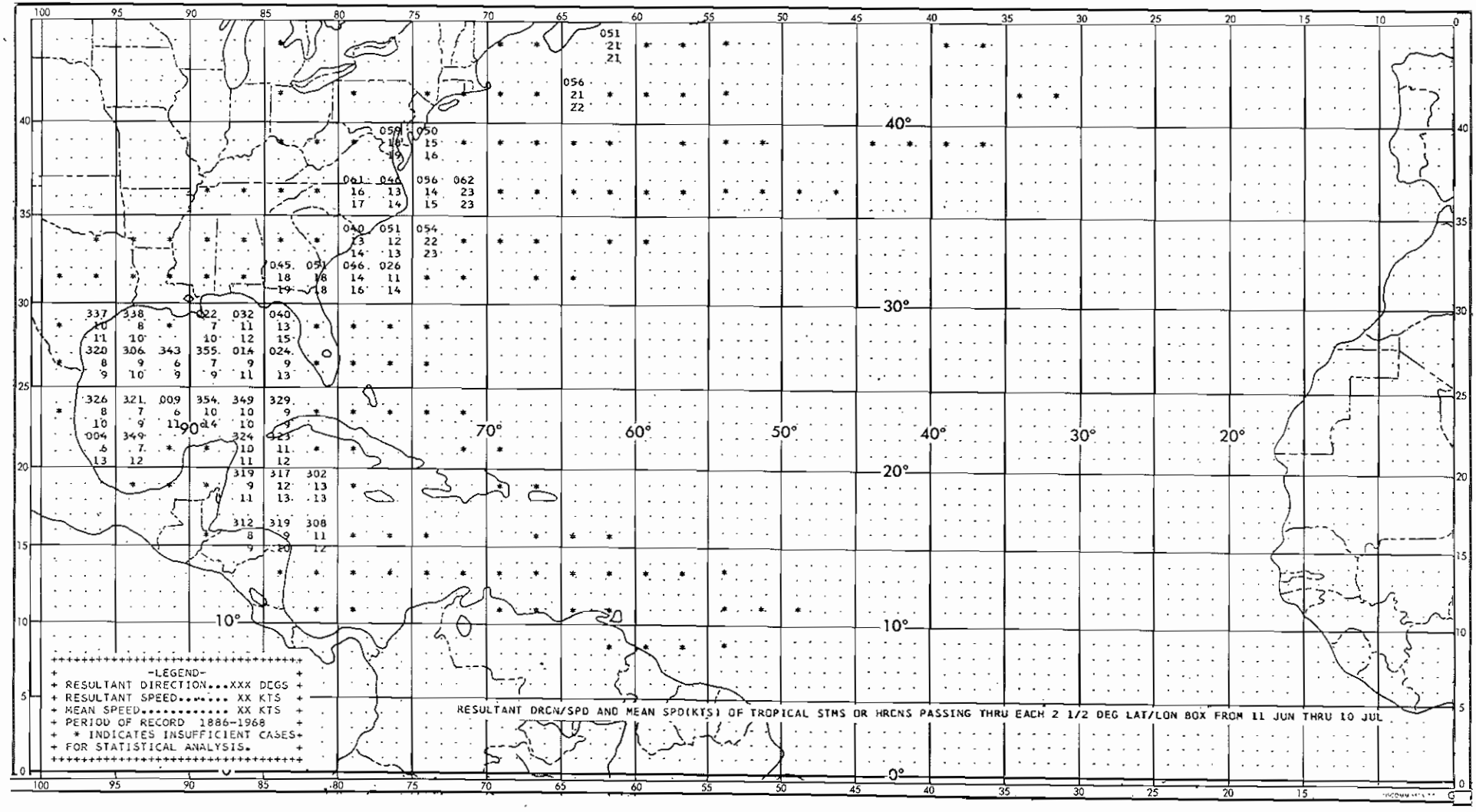
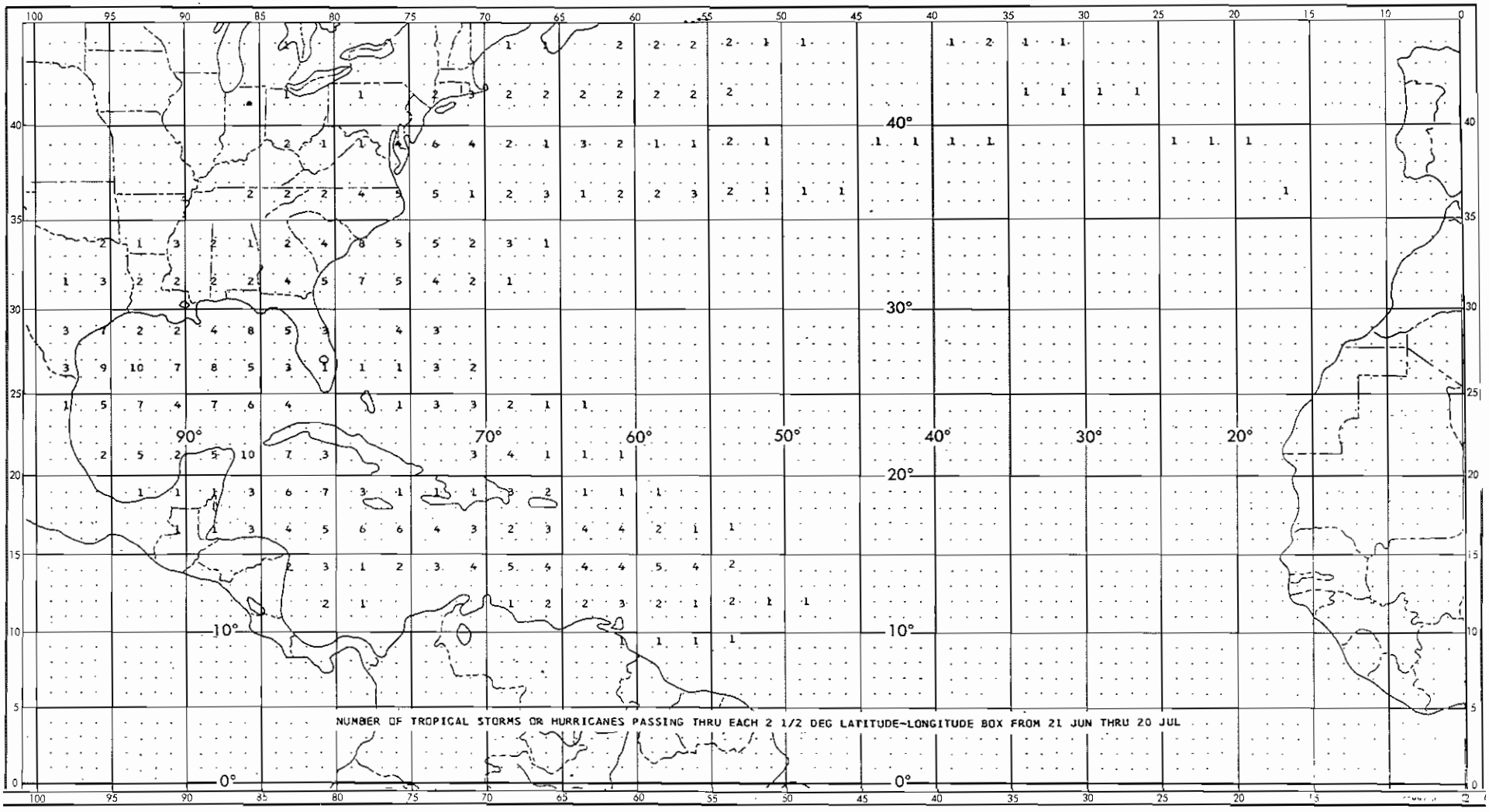
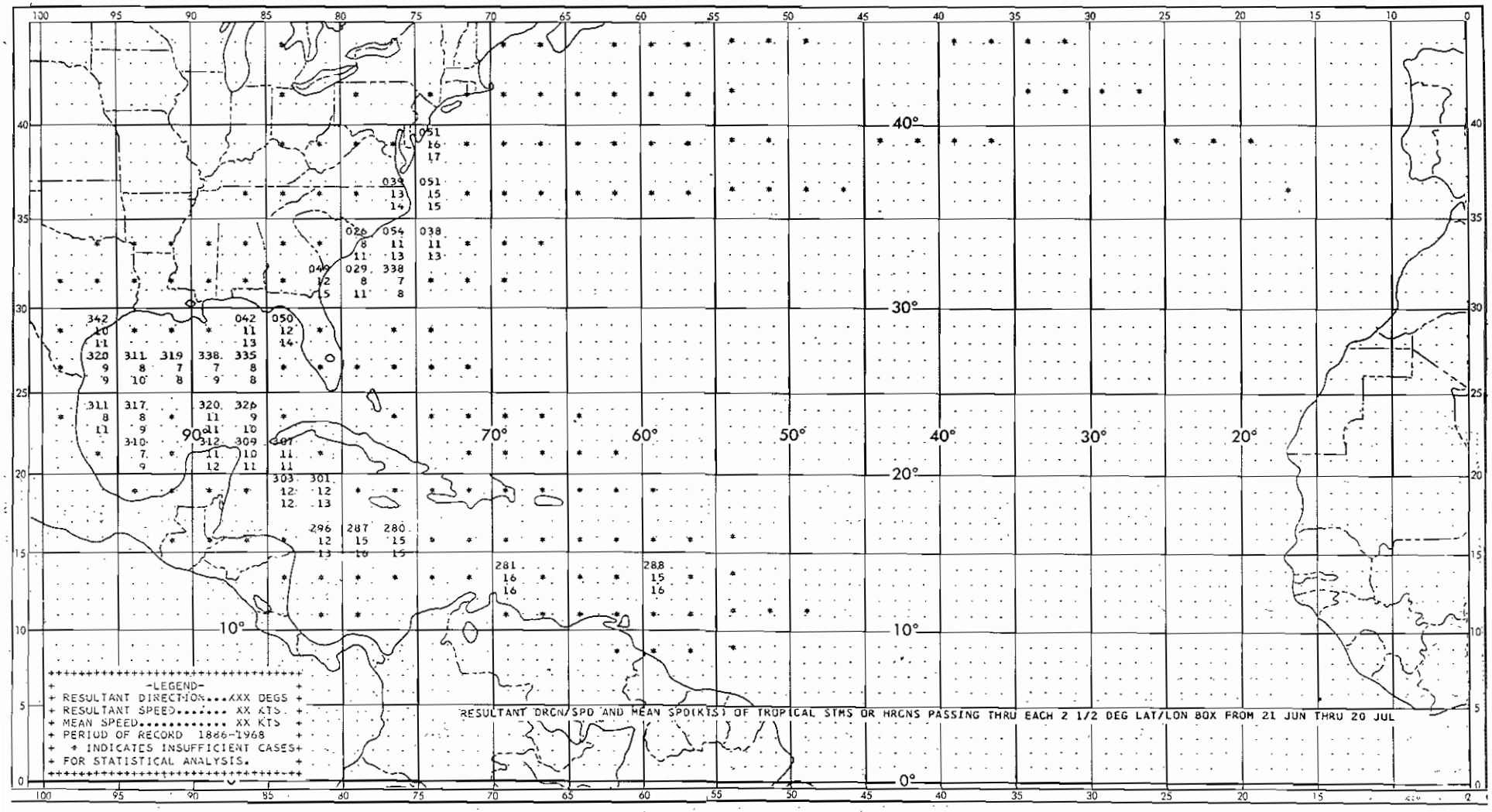
90° 70° 60° 50° 40° 30° 20°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 11 JUN THRU 10 JUL
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 21 JUN THRU 20 JUL
90°
70°
60°
50°
40°
30°
20°
10°
0°


-LEGEND-
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RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1866-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
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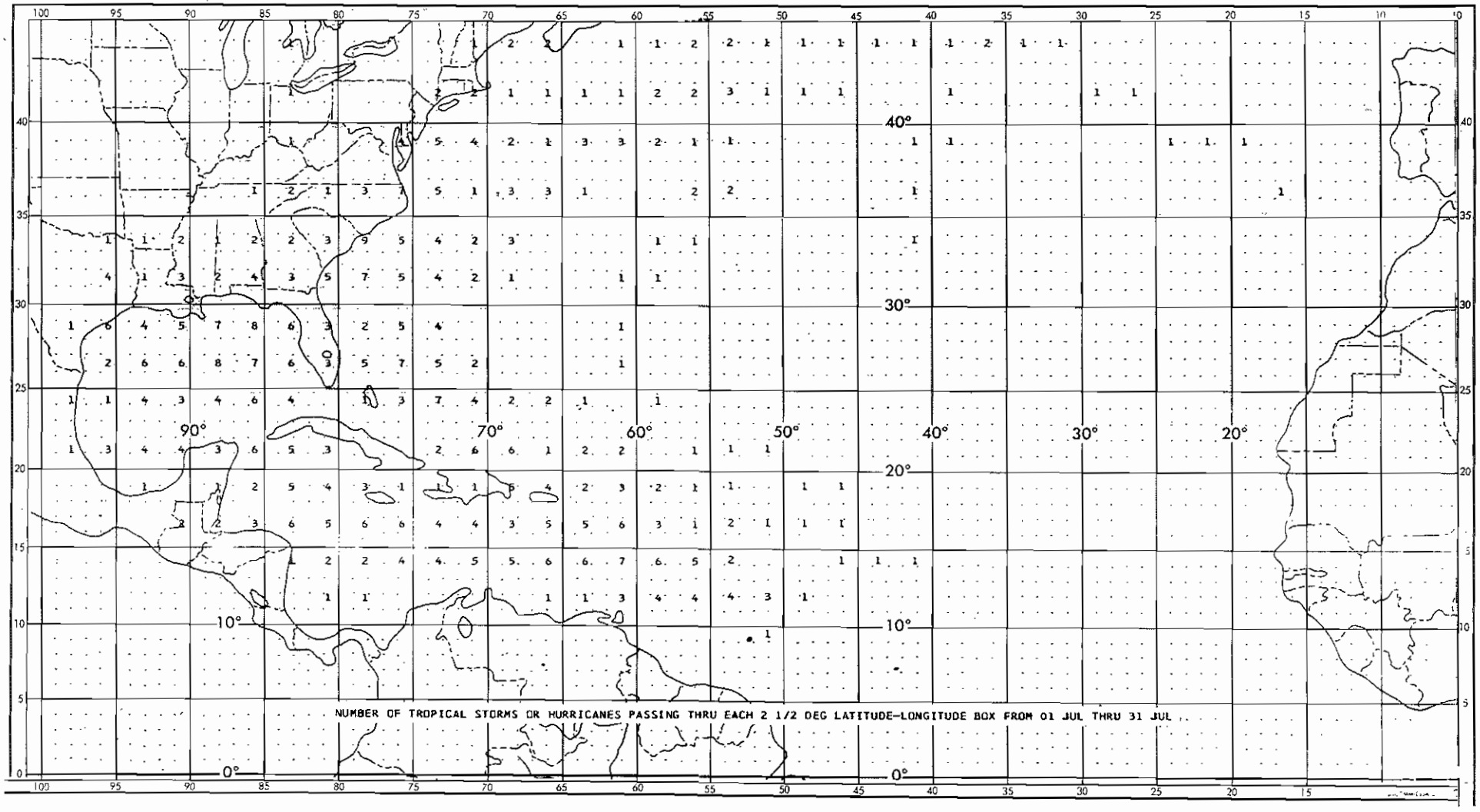
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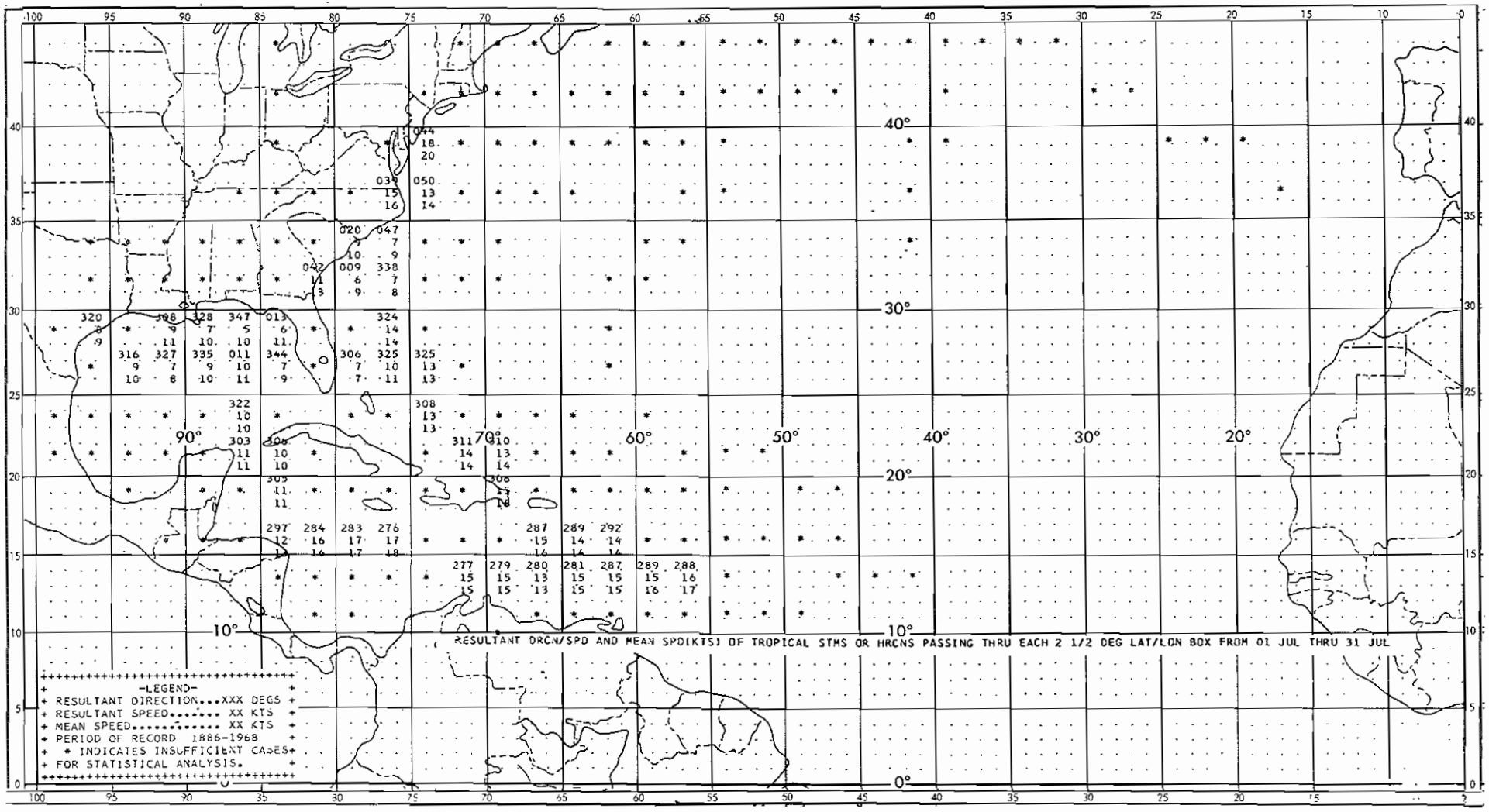
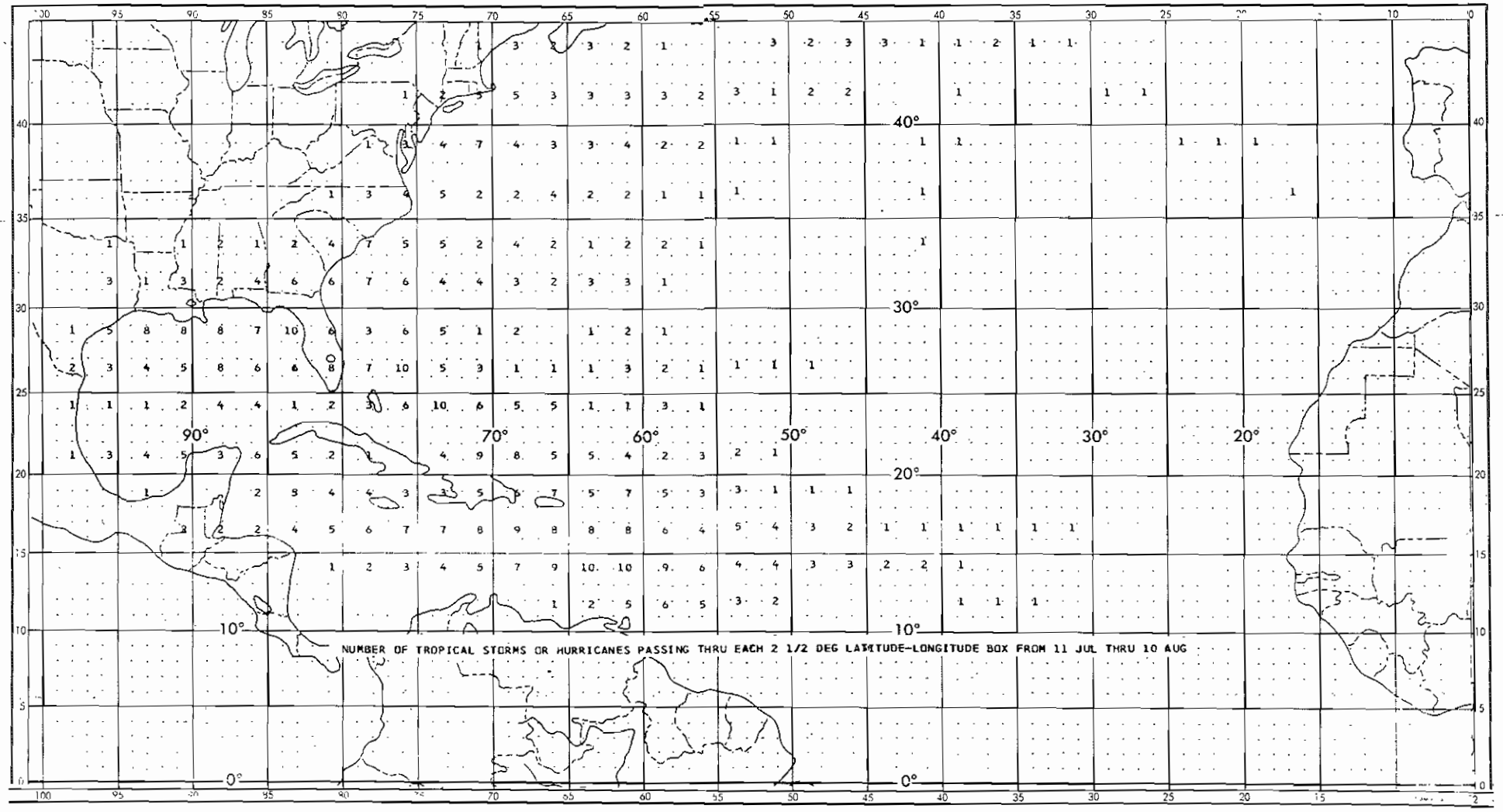
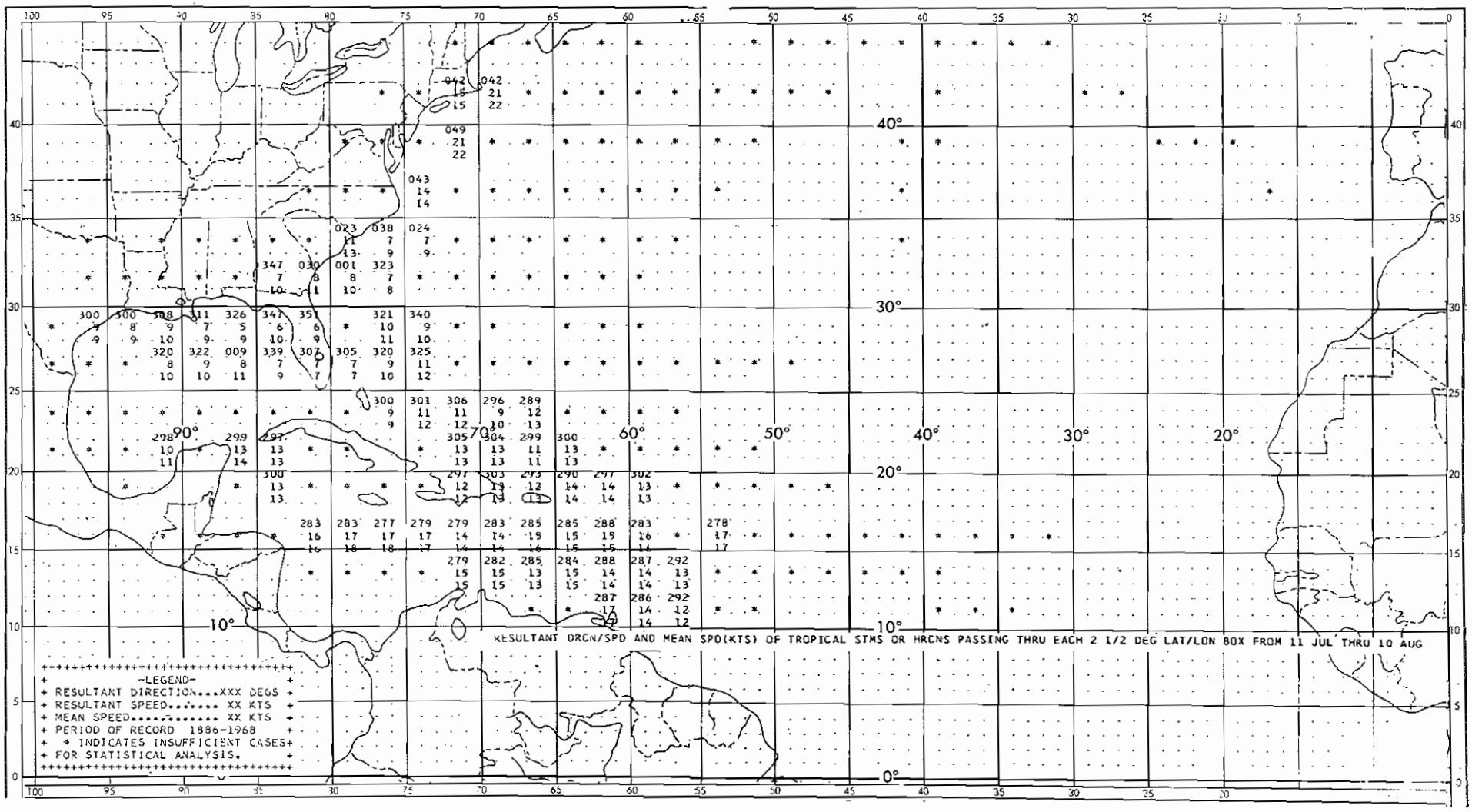
90° 70° 60° 50° 40° 30° 20°
40° 30° 20° 10° 0°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 JUL THRU 31 JUL
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 11 JUL THRU 10 AUG
40°
30°
20°
10°
0°
90°
70°
60°
50°
40°
30°
20°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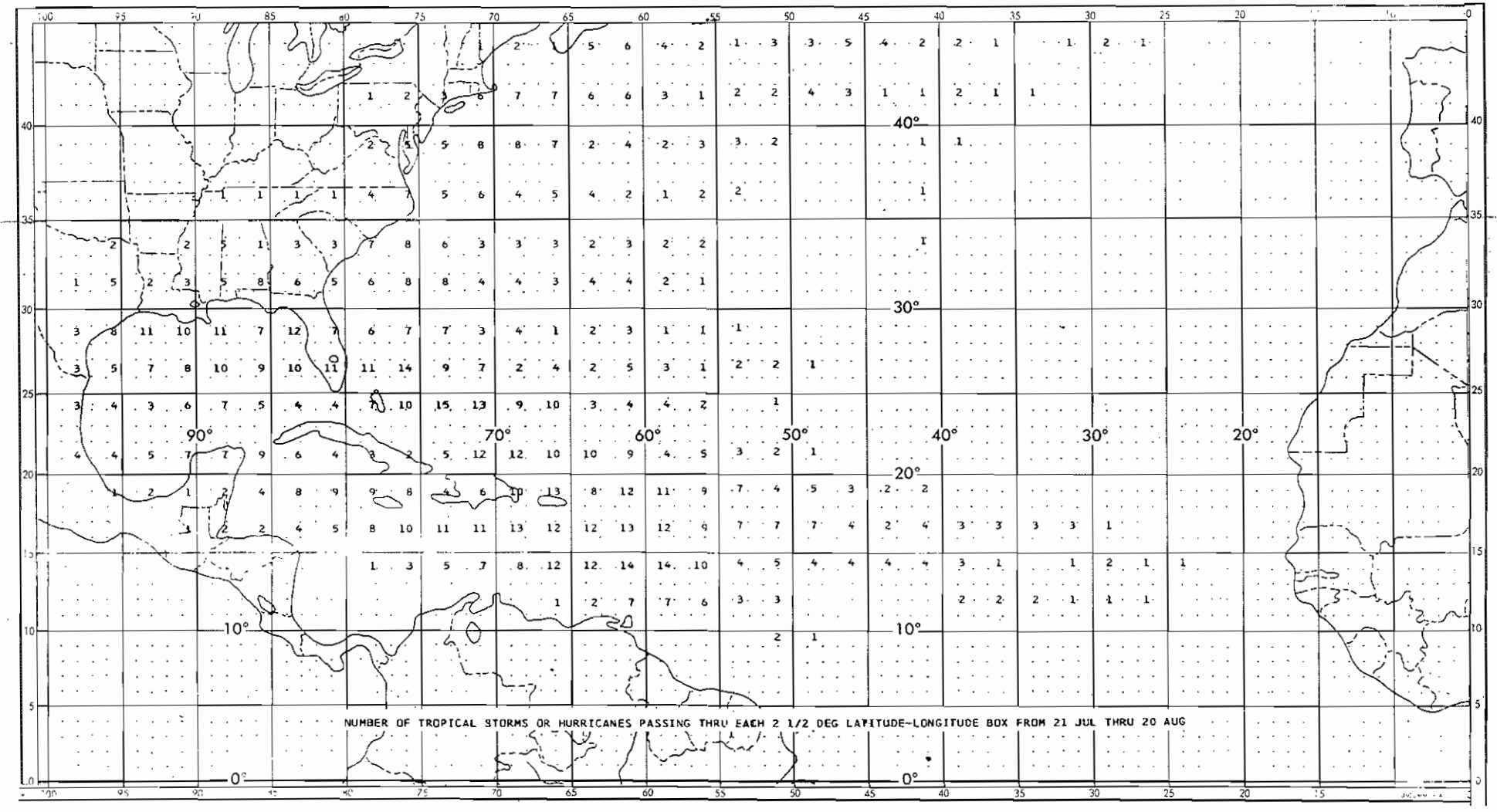
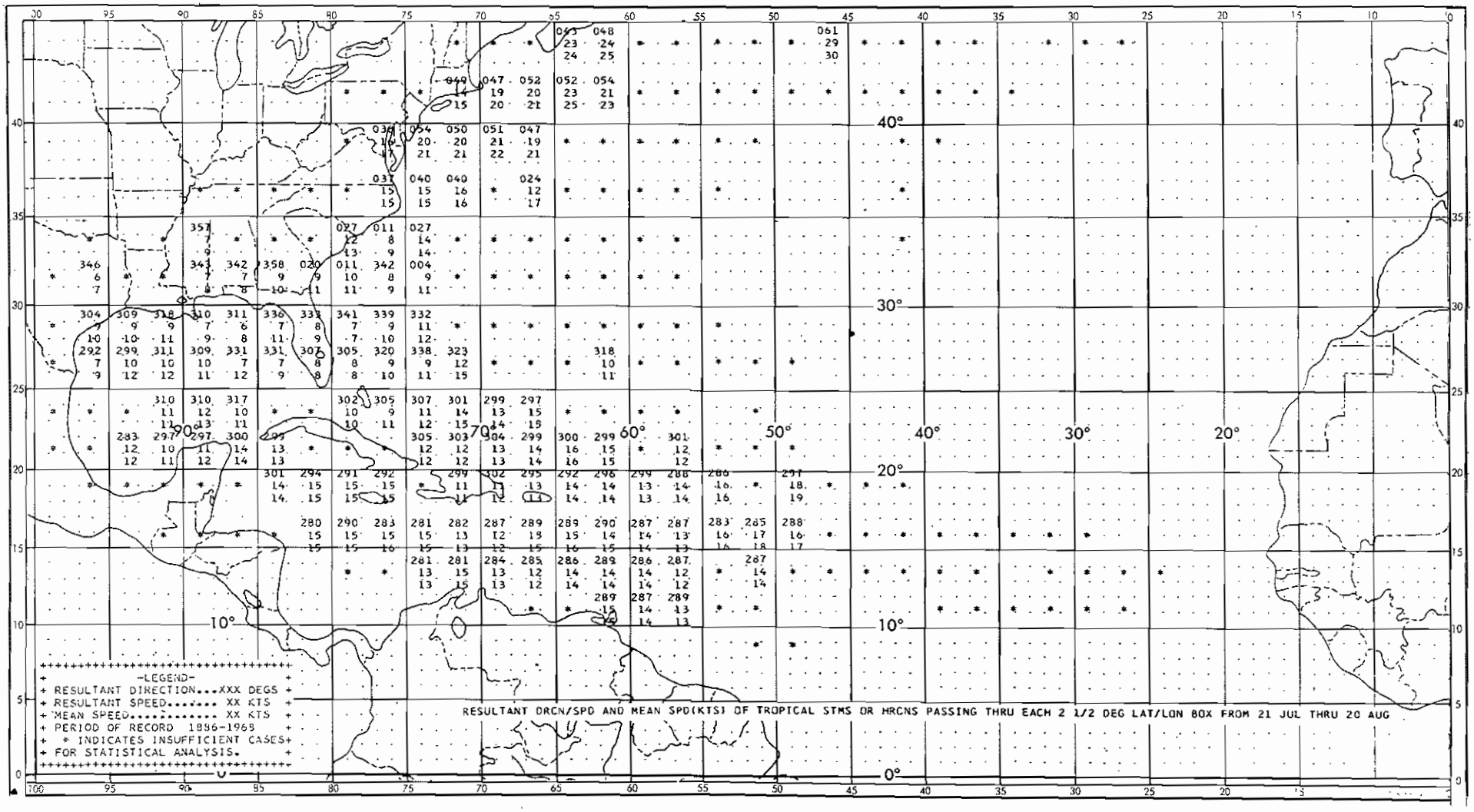
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 21 JUL THRU 20 AUG
90°
70°
60°
50°
40°
30°
20°
10°
0°


-LEGEND-
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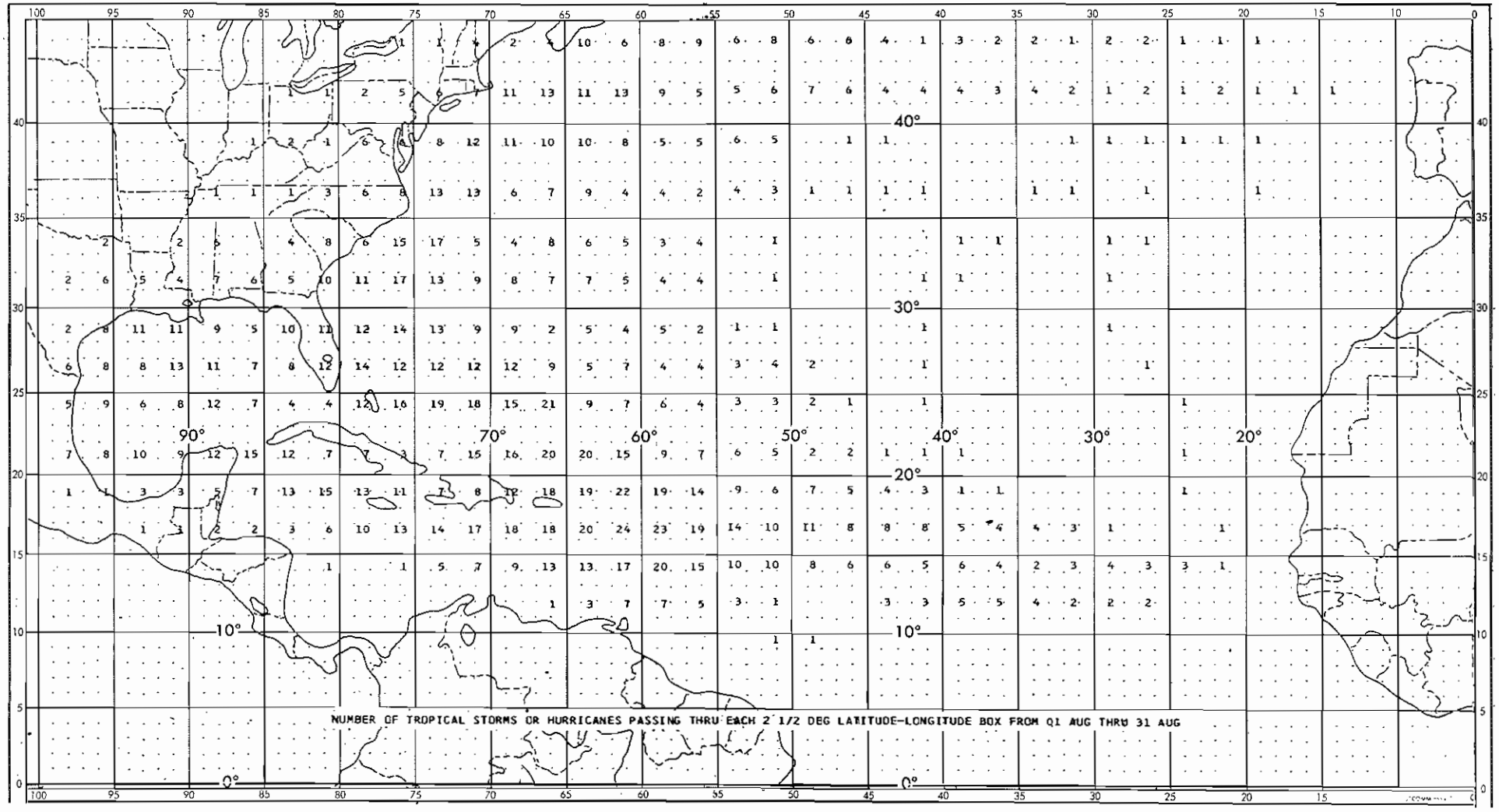
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1896-1965
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 JUL THRU 20 AUG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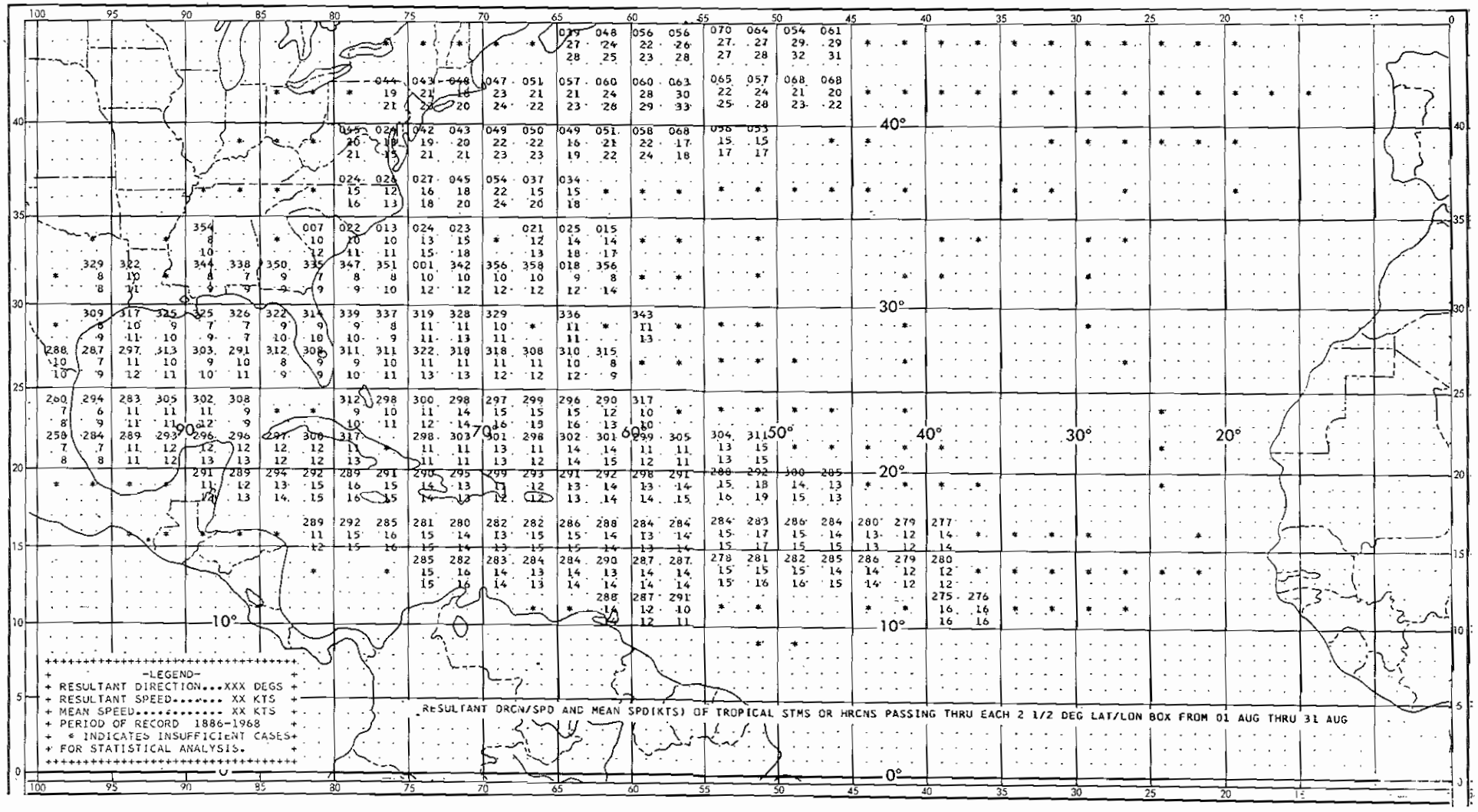
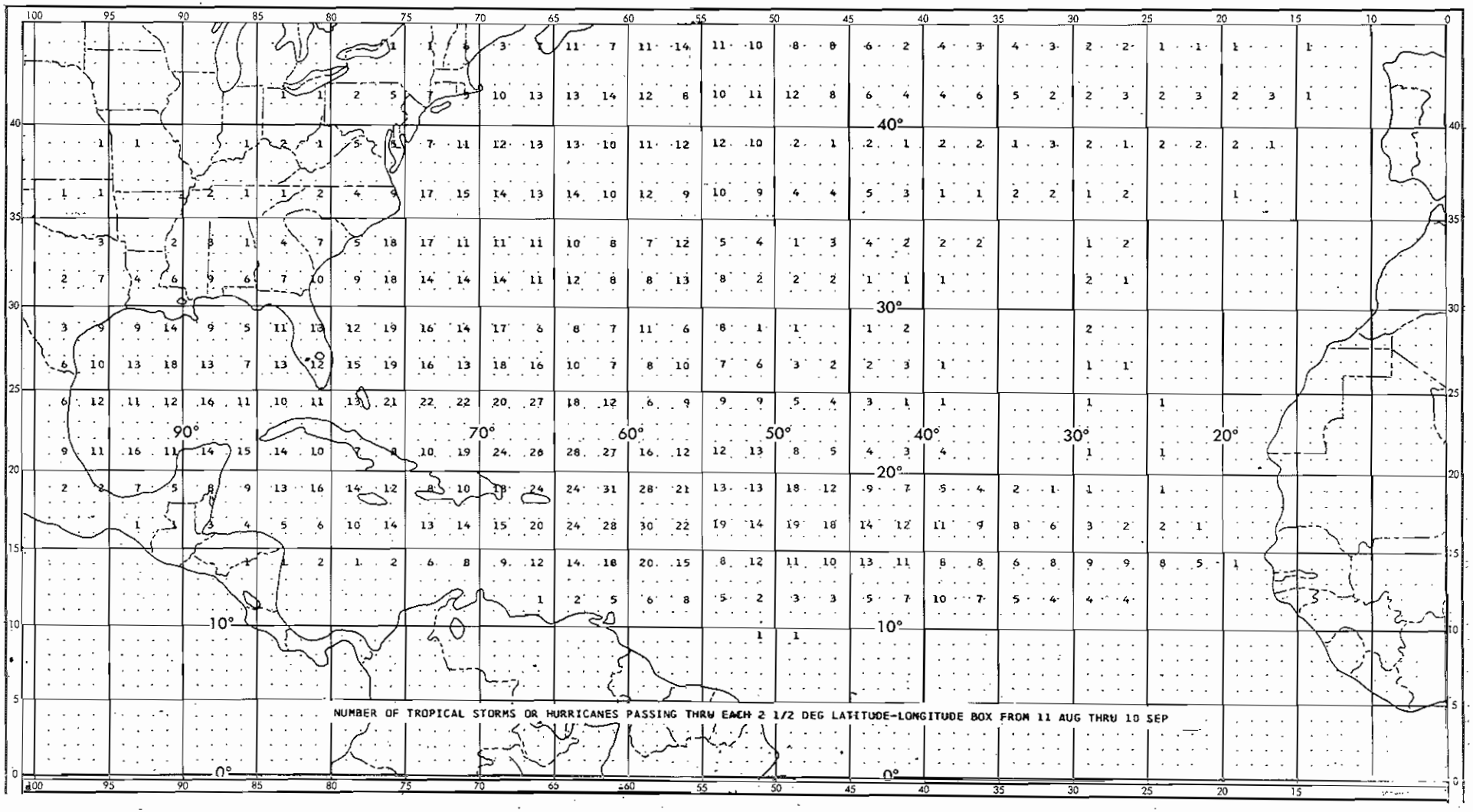
100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 0
40 35 30 25 20 15 10 5 0
40°
30°
20°
10°
0°
90°
70°
60°
50°
40°
30°
20°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 AUG THRU 31 AUG
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°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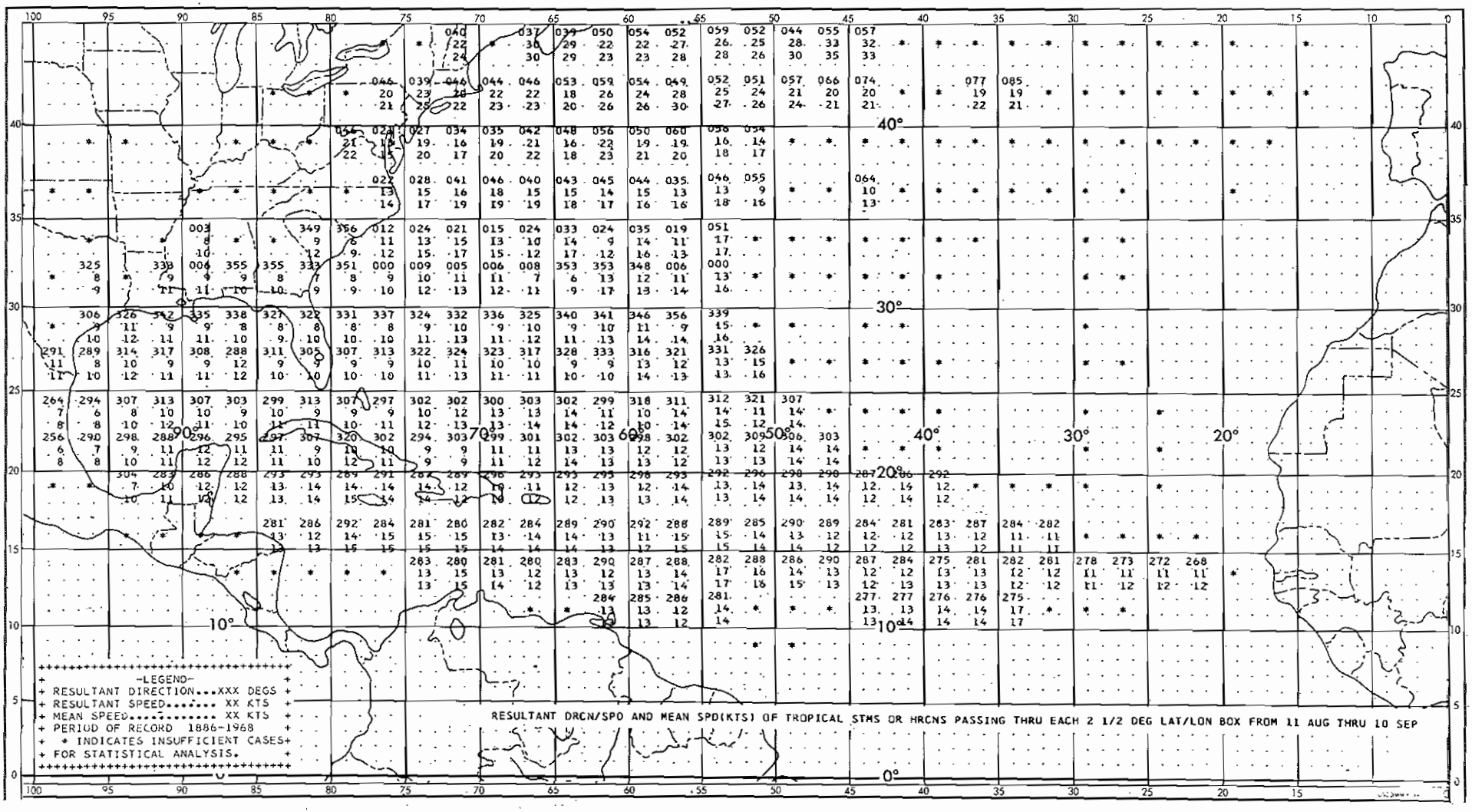
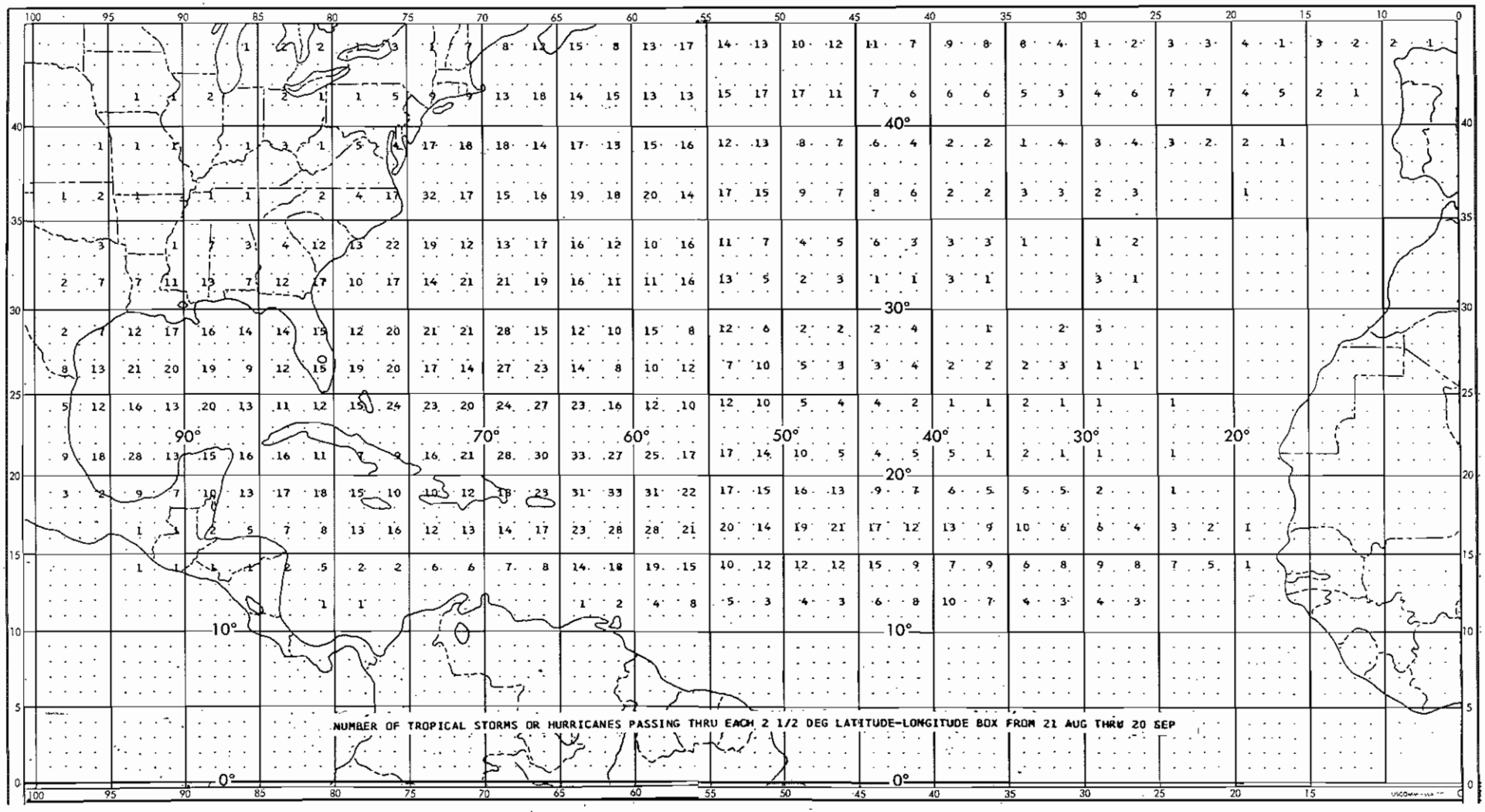
40 35 30 25 20 15 10 5 0
90° 70° 60° 50° 40° 30° 20° 10° 0°


-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 11 AUG THRU 10 SEP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100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 0
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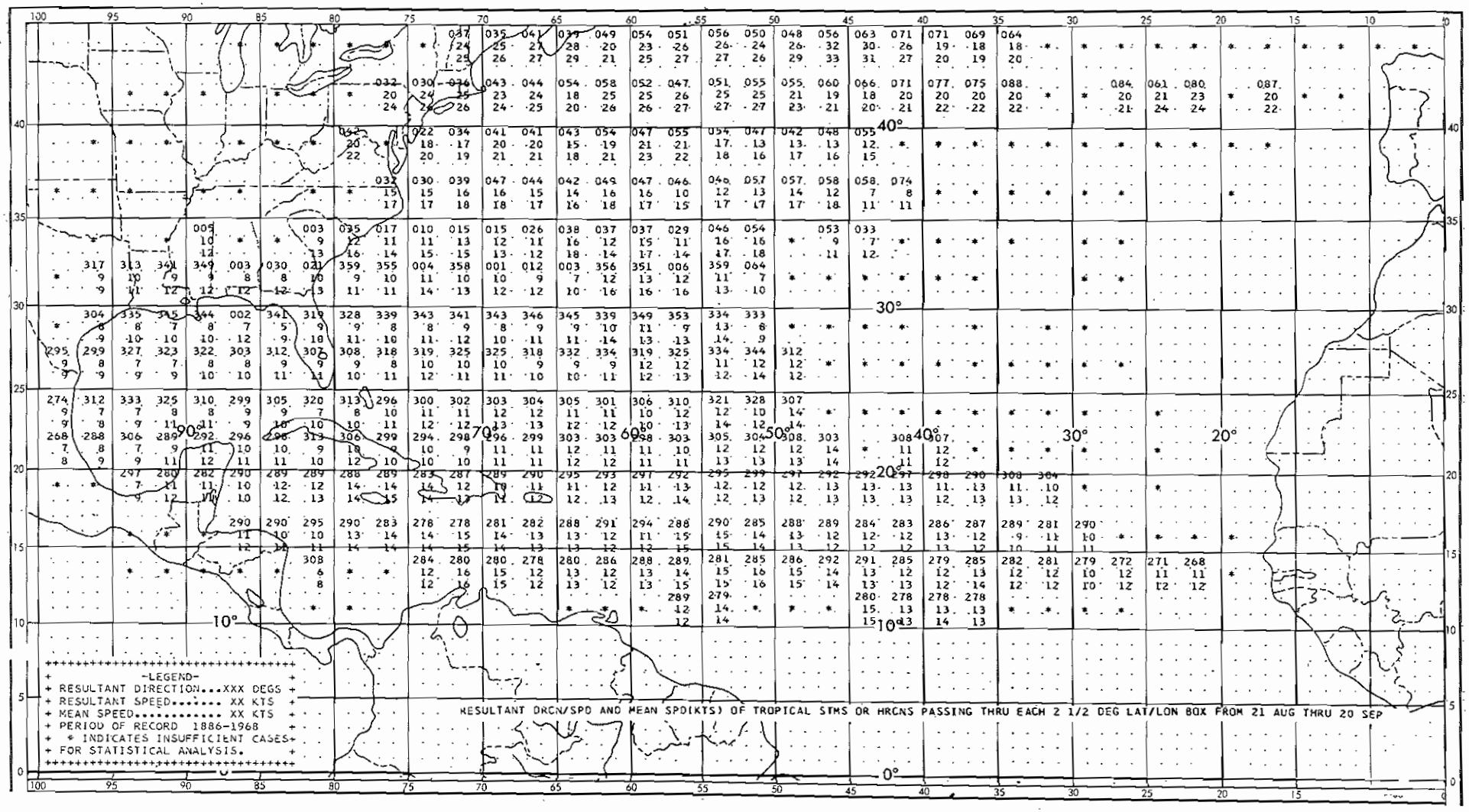
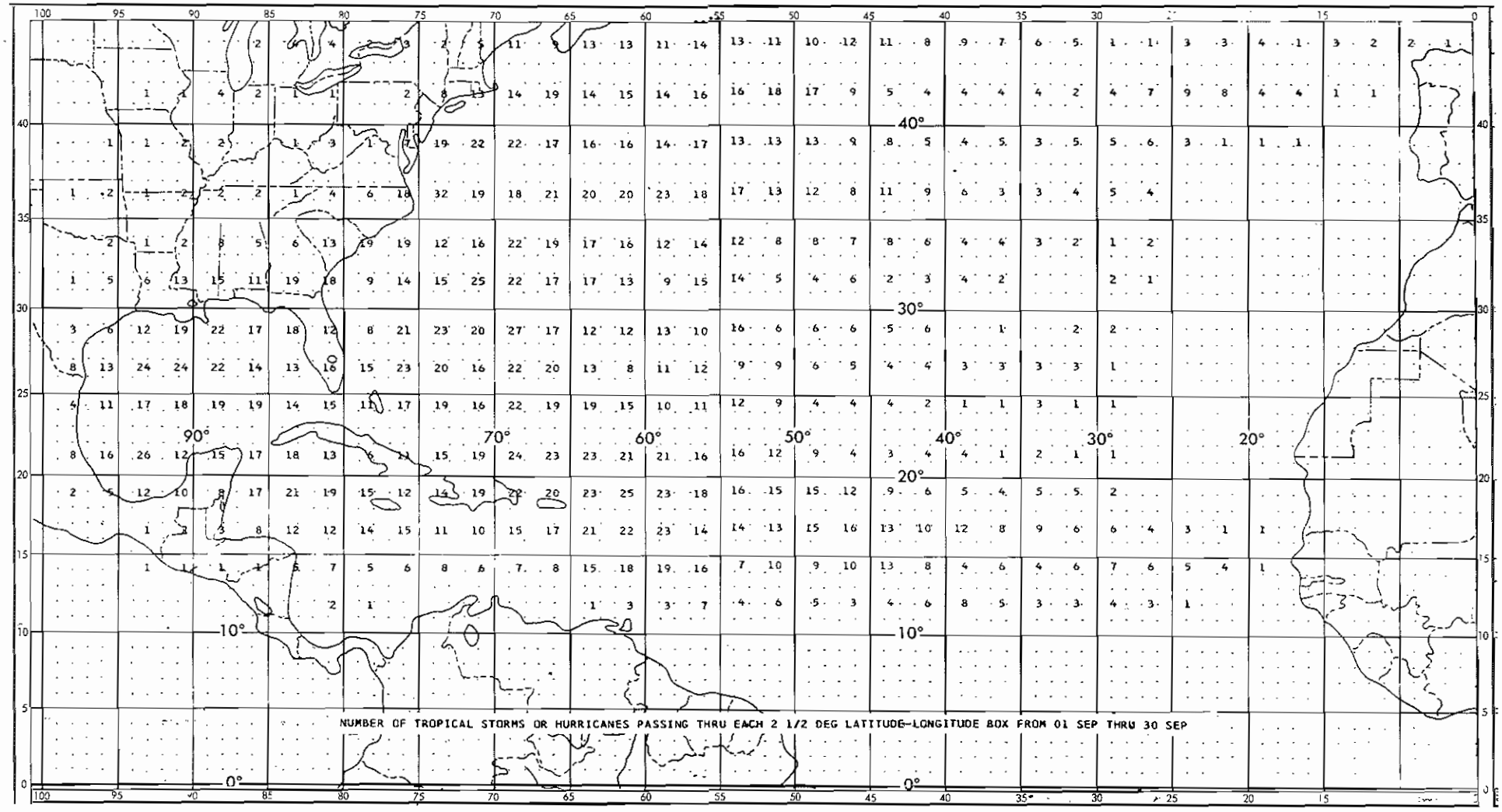
40° 30° 20° 10° 0°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 AUG THRU 20 SEP
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.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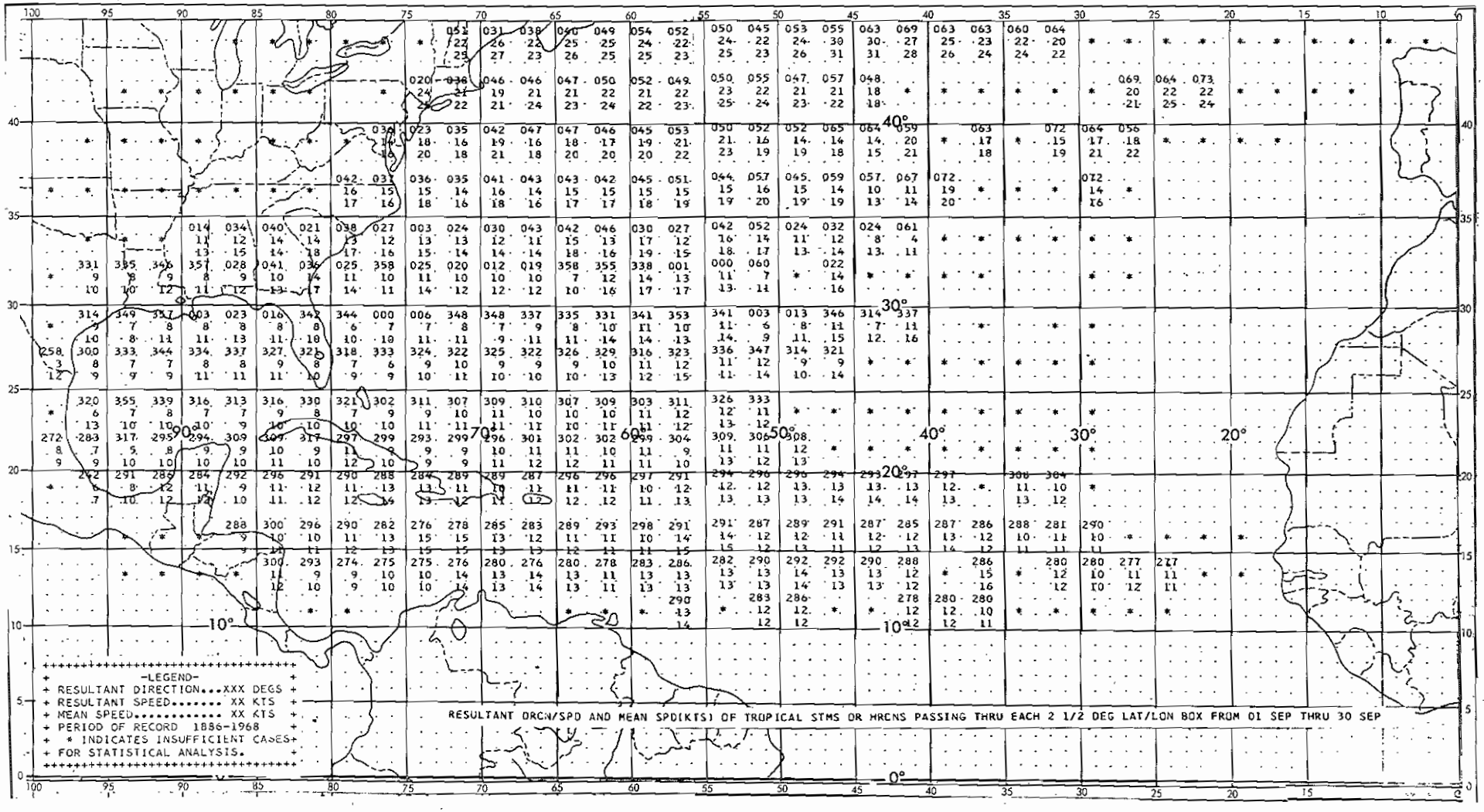
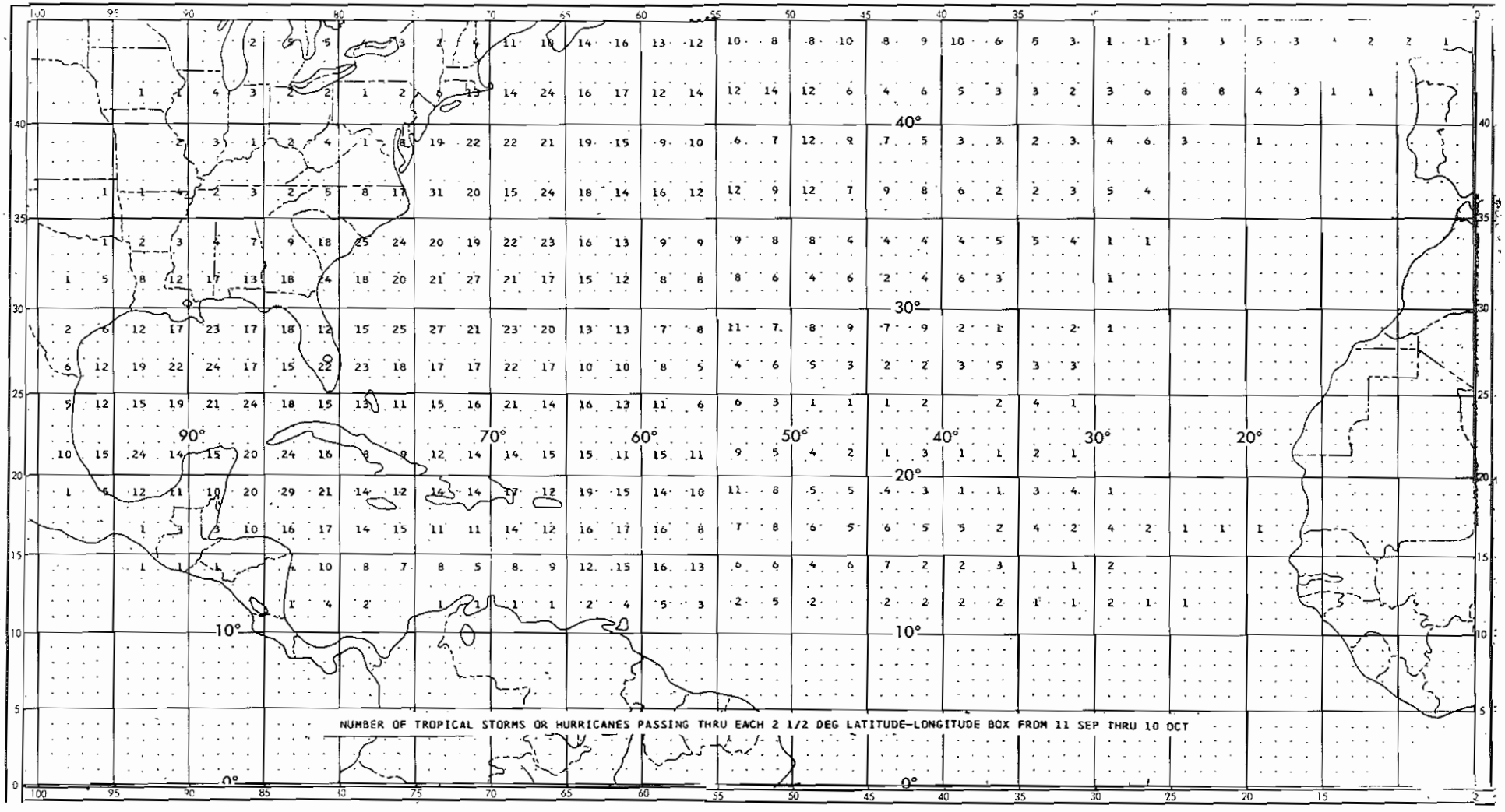
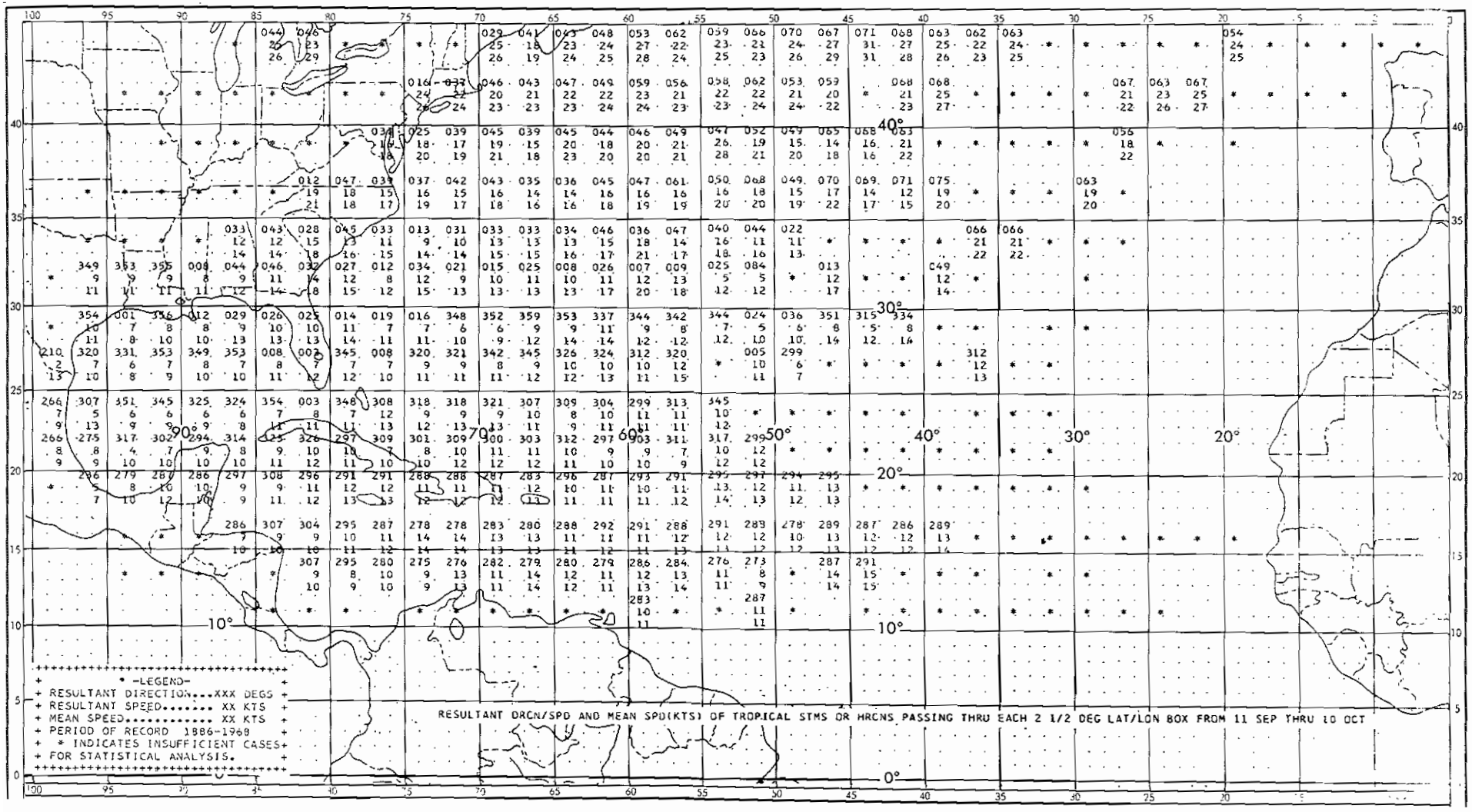
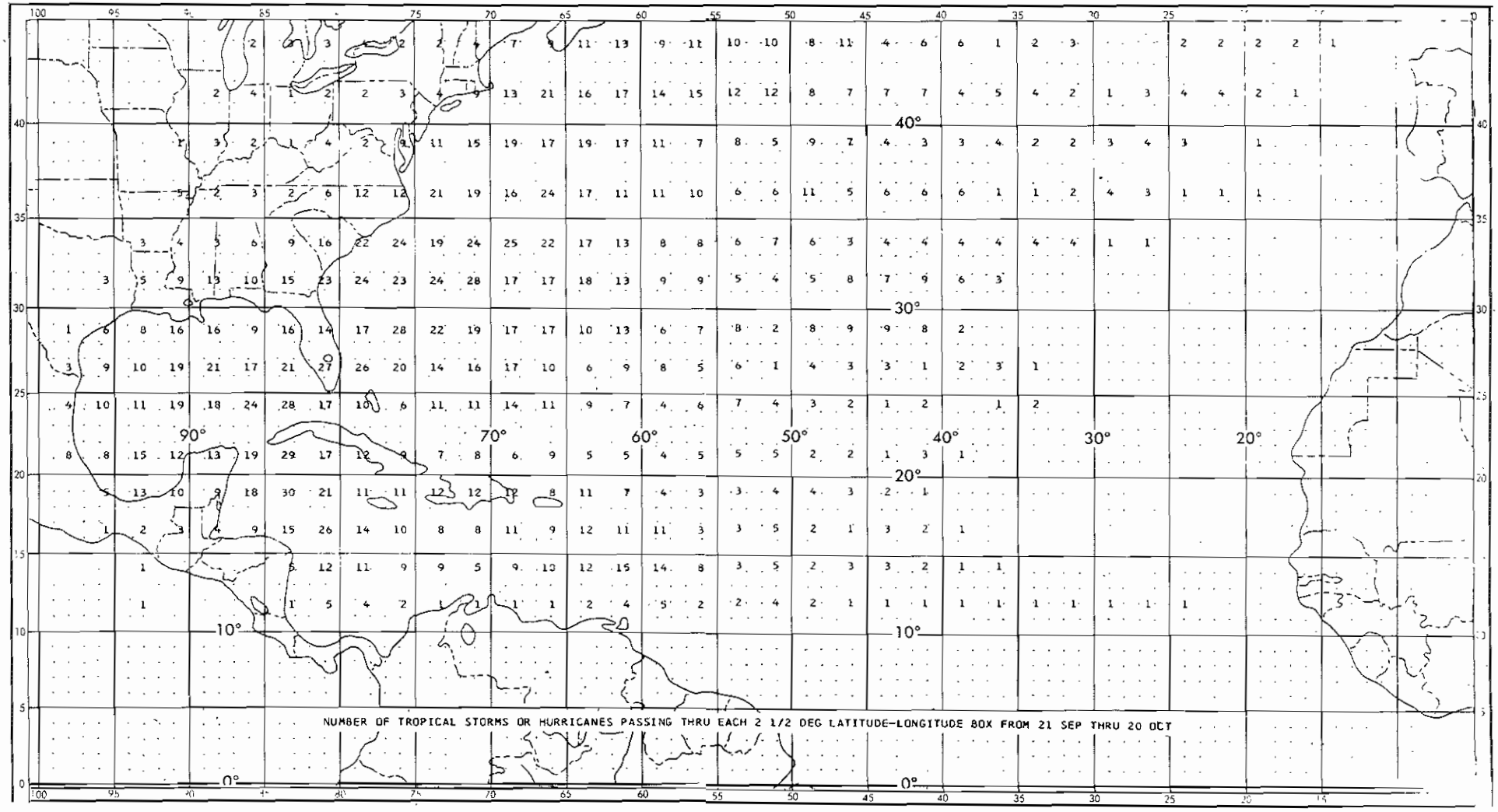
90° 70° 60° 50° 40° 30° 20° 10° 0°


RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 SEP THRU 30 SEP
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 11 SEP THRU 10 OCT
40°
30°
20°
10°
0°
90°
70°
60°
50°
40°
30°
20°


* -LEGEND-
RESULTANT DIRECTION....XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 11 SEP THRU 10 OCT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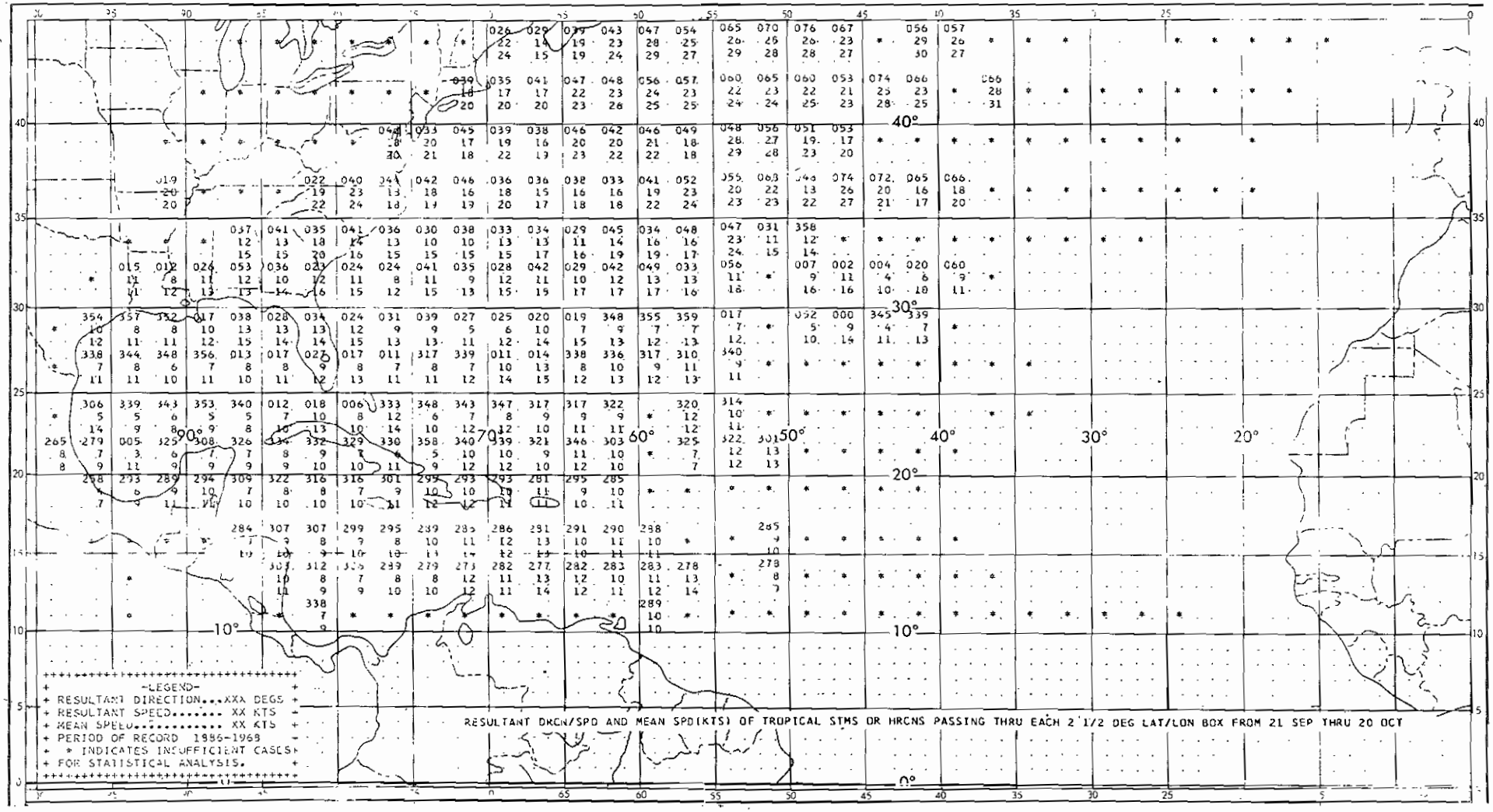
40 35 30 25 20 15 10 5 0
40° 30° 20° 10° 0°
90° 70° 60° 50° 40° 30° 20° 10° 0°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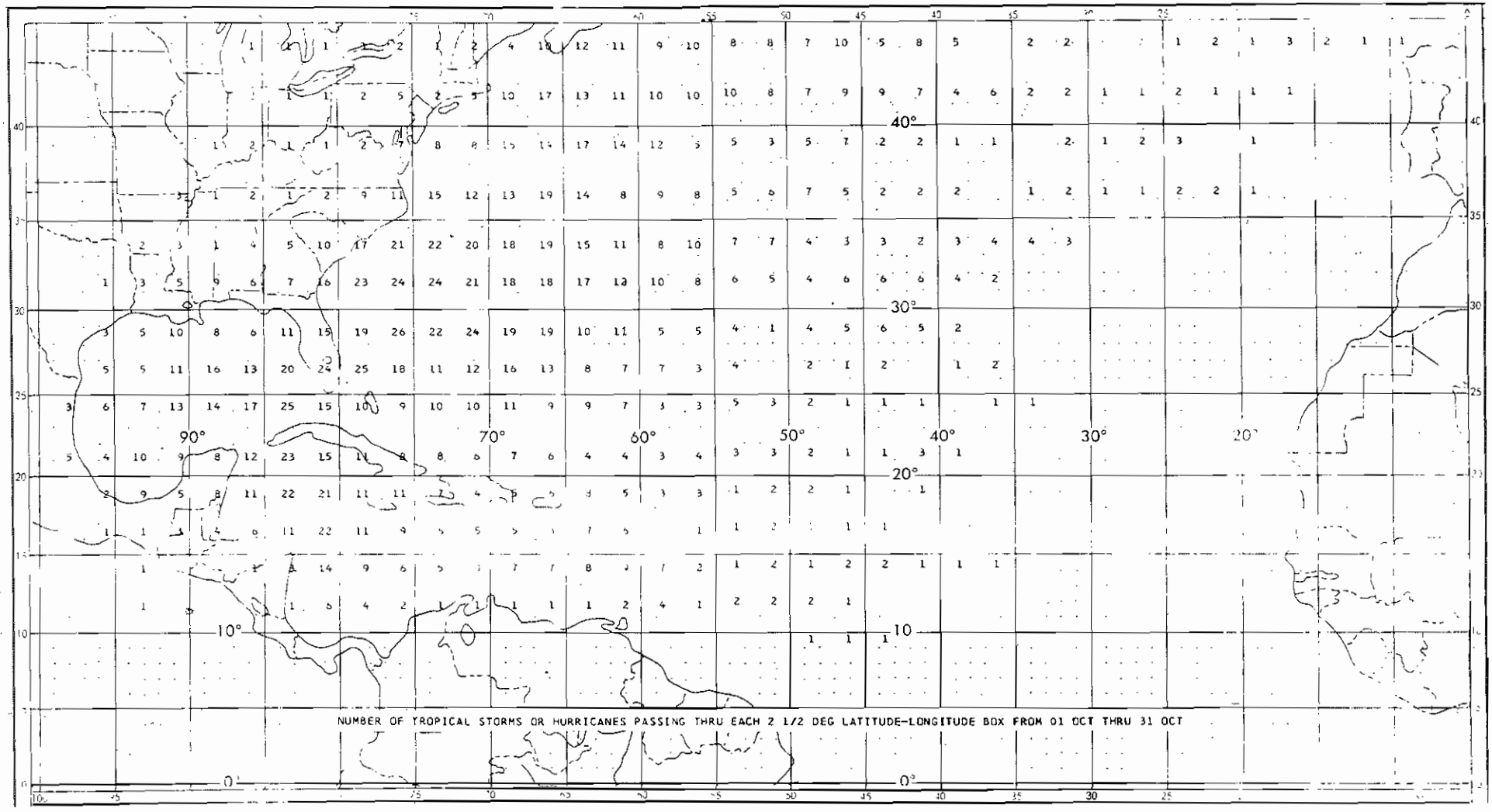
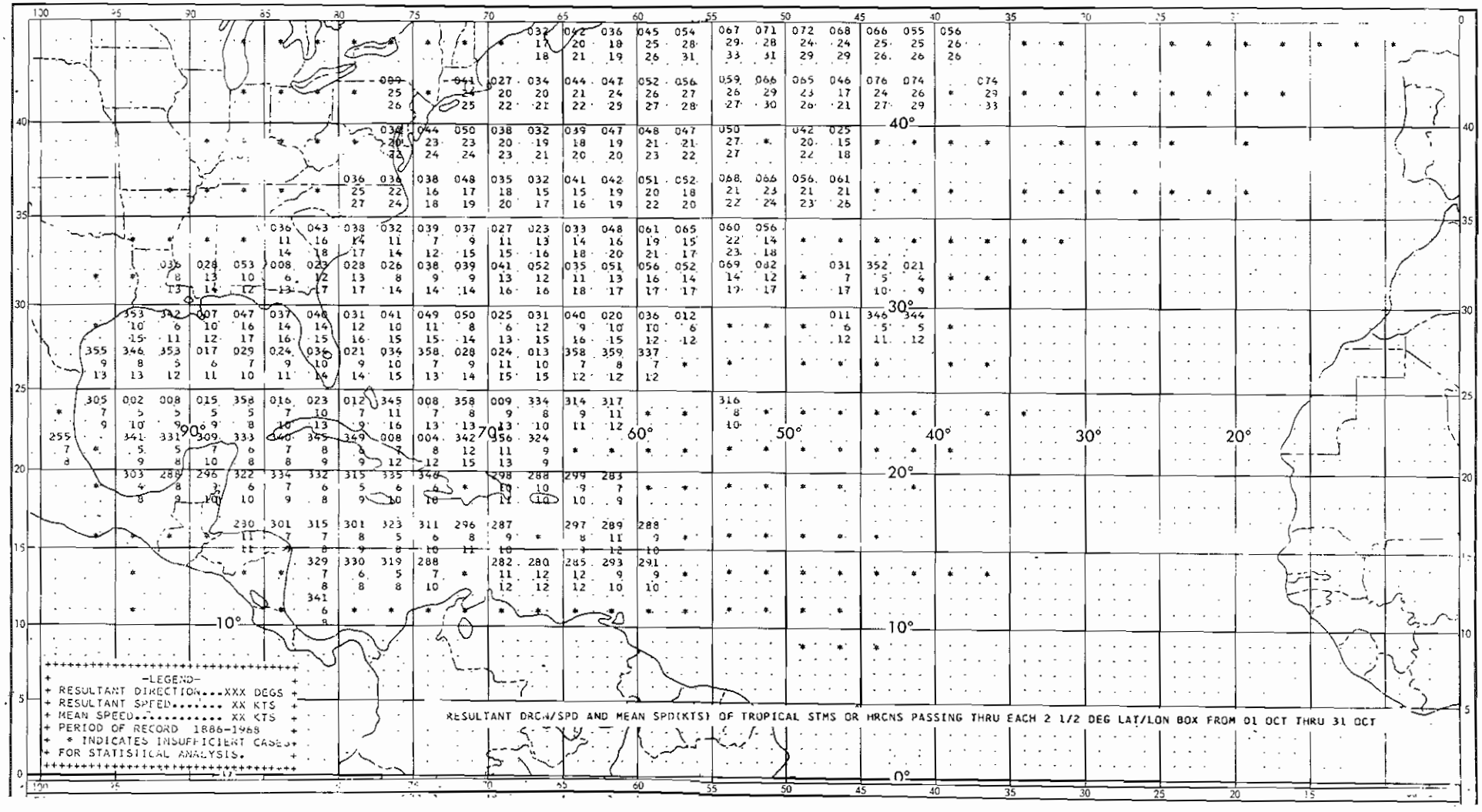
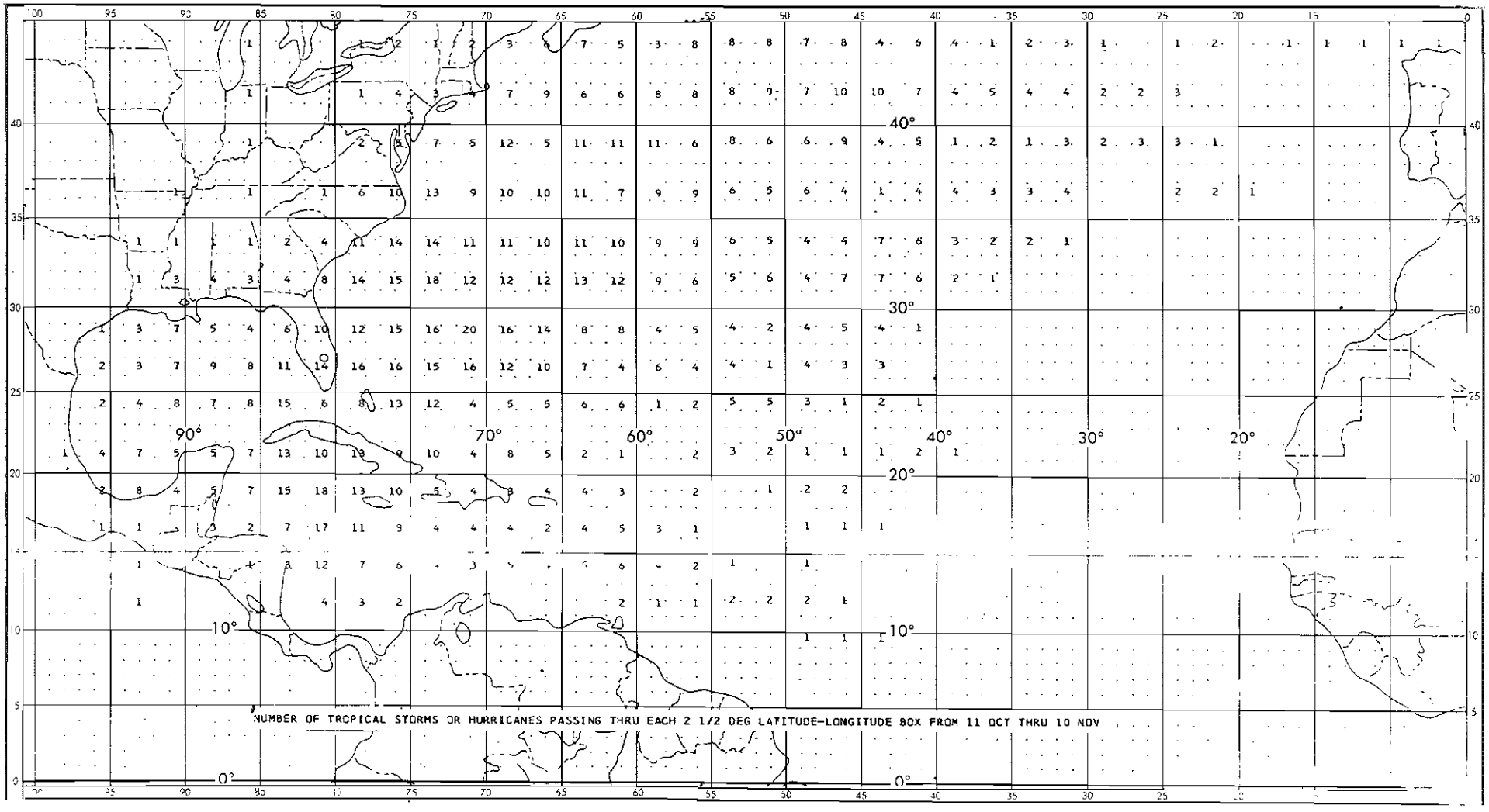
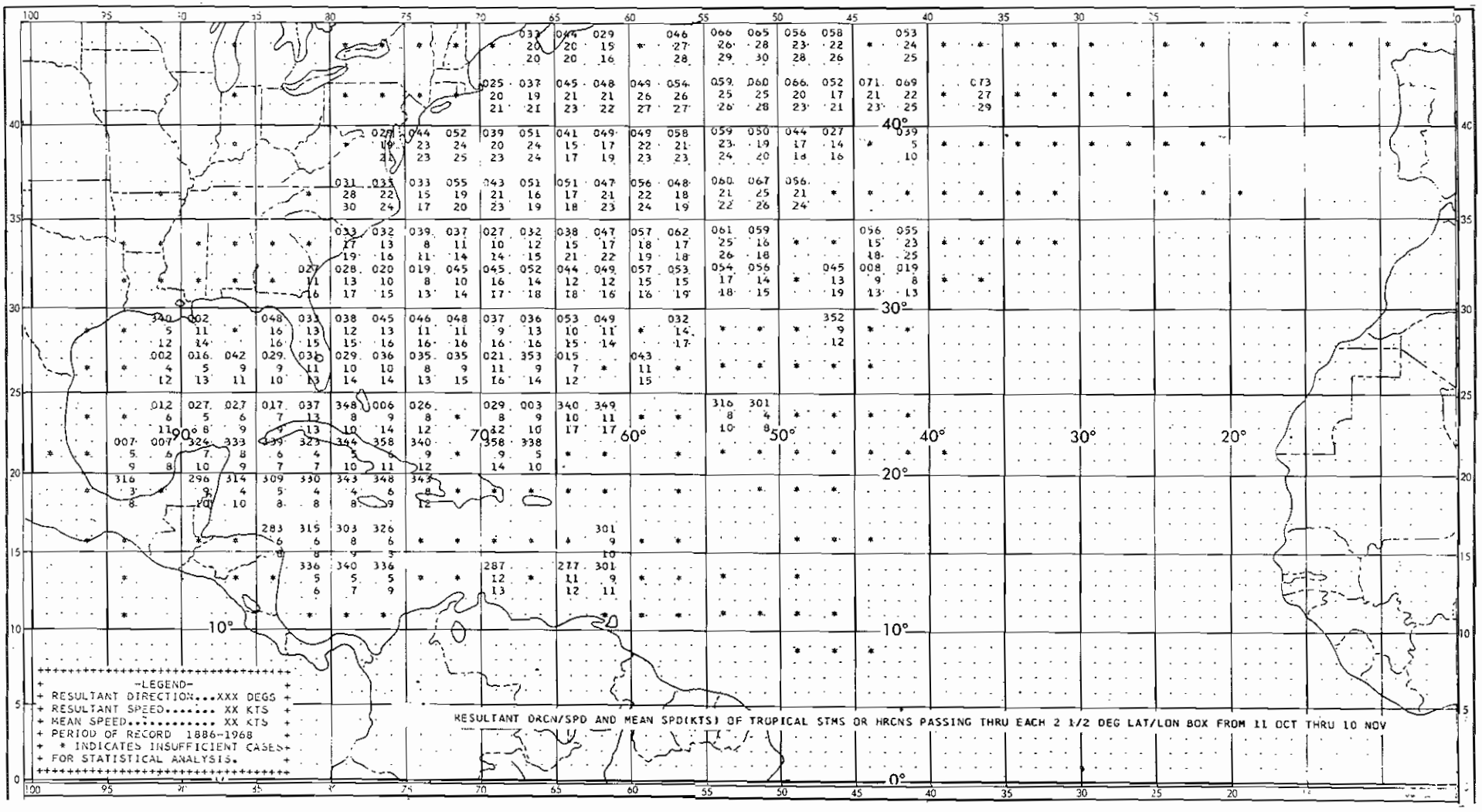
-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1969
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°

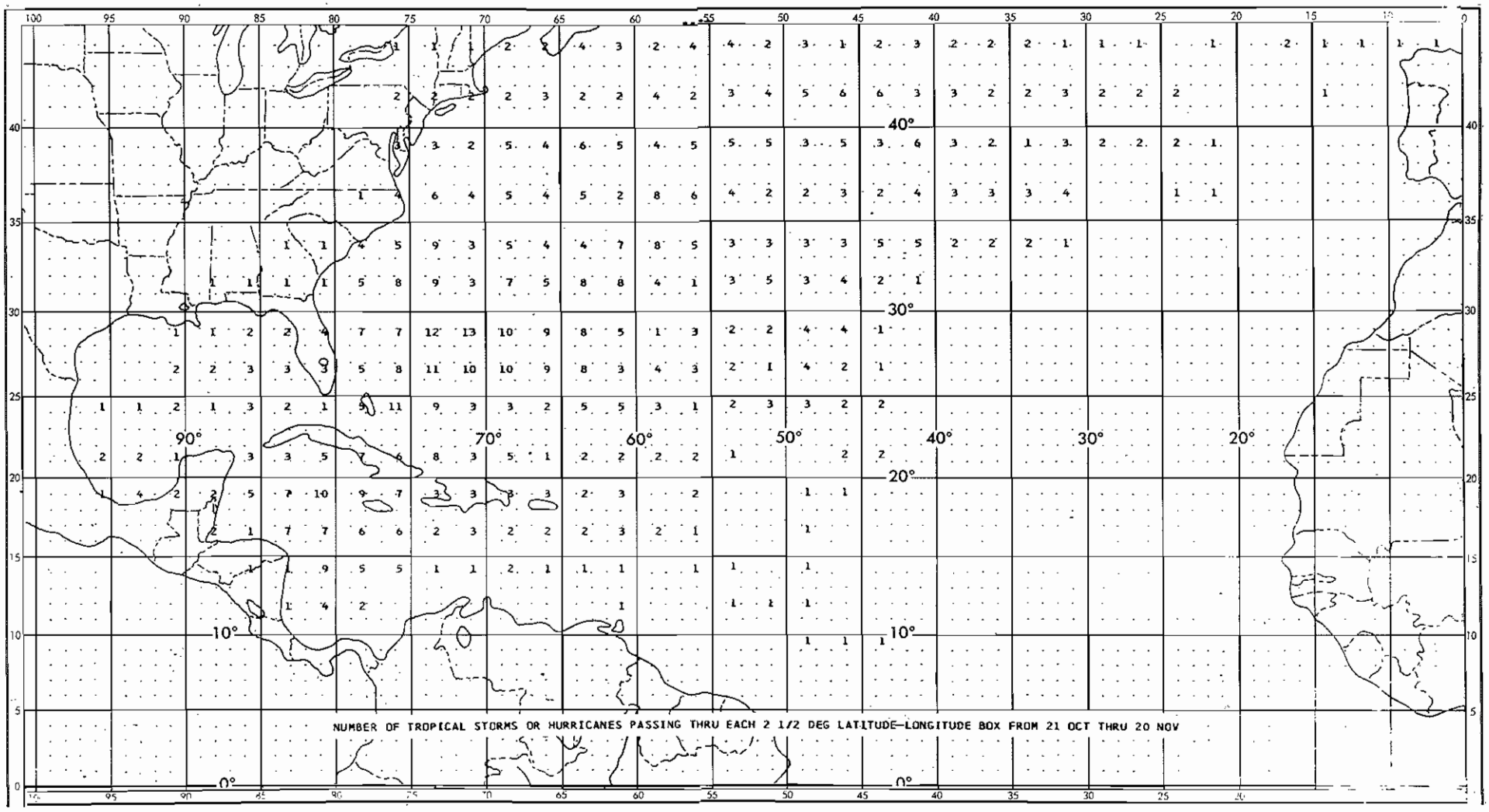


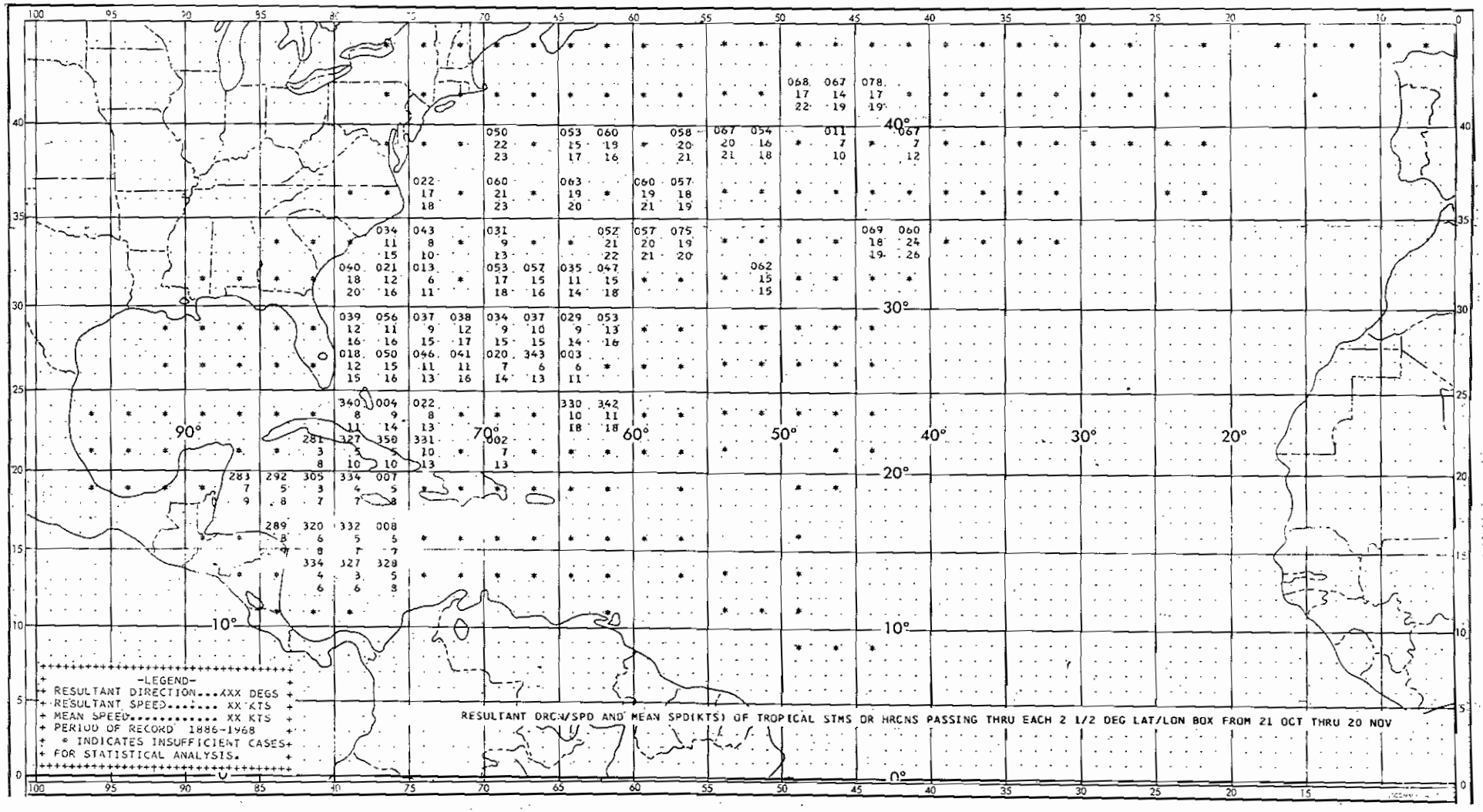
NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 01 OCT THRU 31 OCT

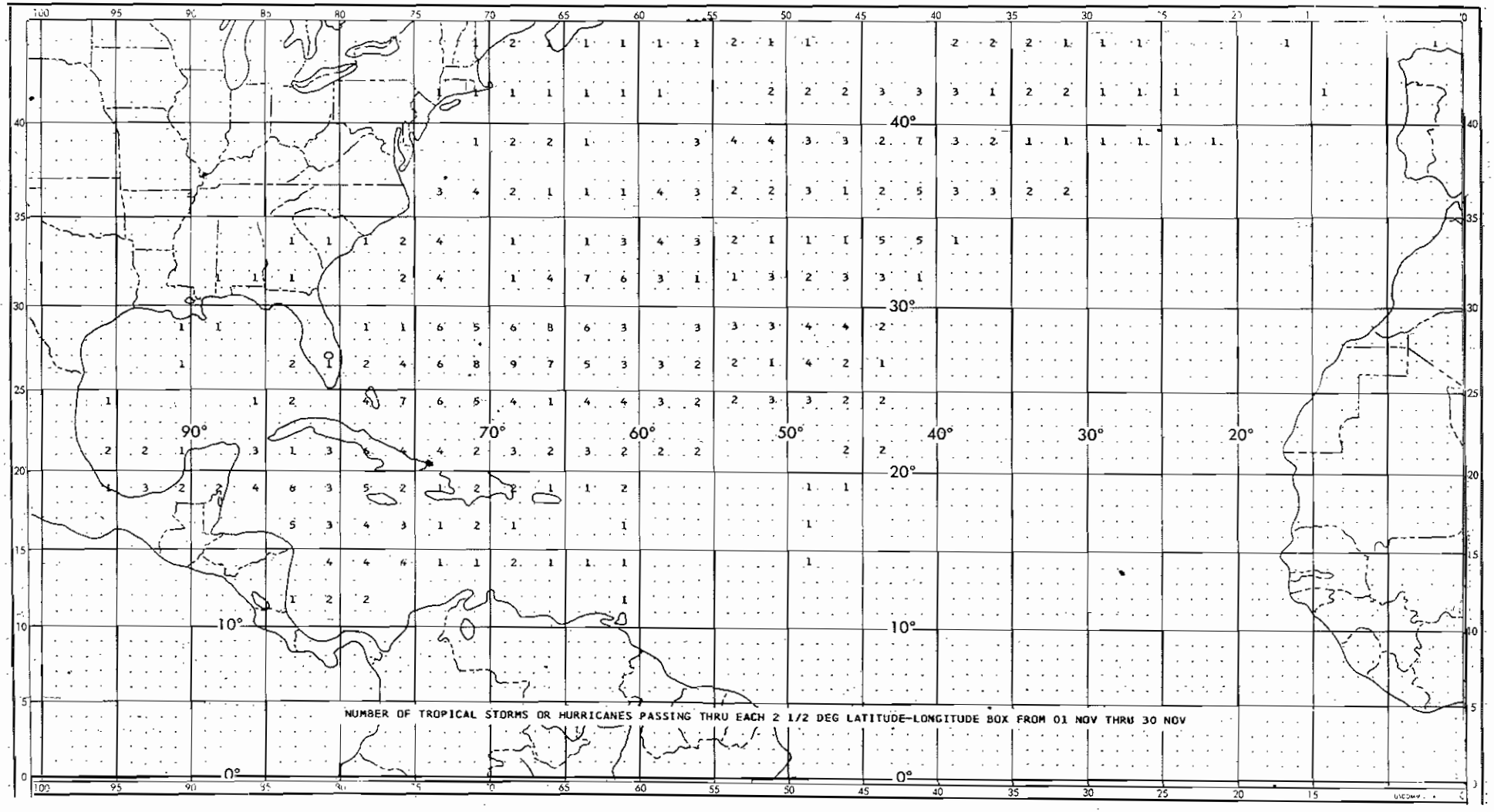

-LEGEND-
RESULTANT DIRECTION....XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 OCT THRU 31 OCT

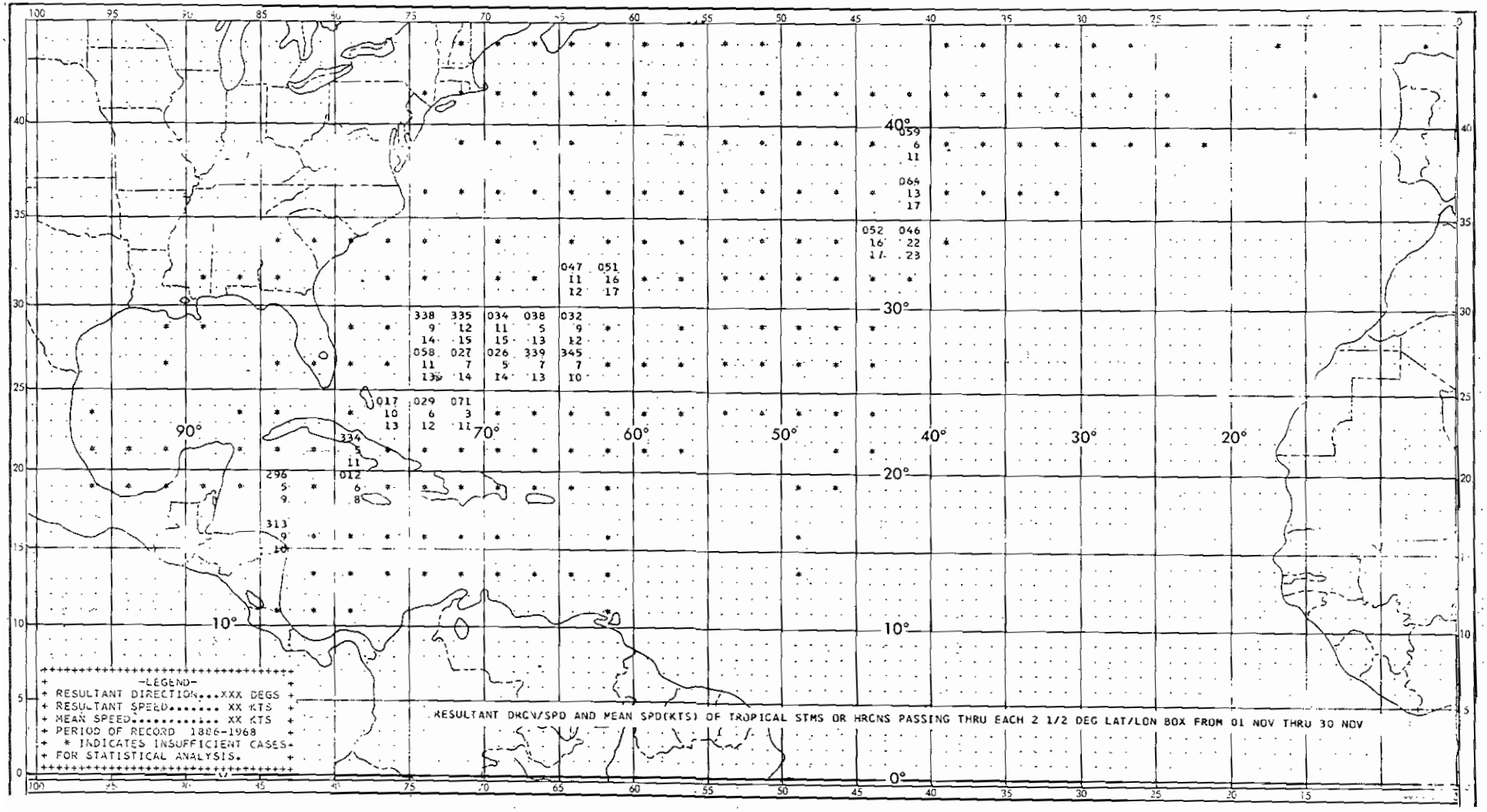

NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 11 OCT THRU 10 NOV
90°
70°
60°
50°
40°
30°
20°
10°
0°

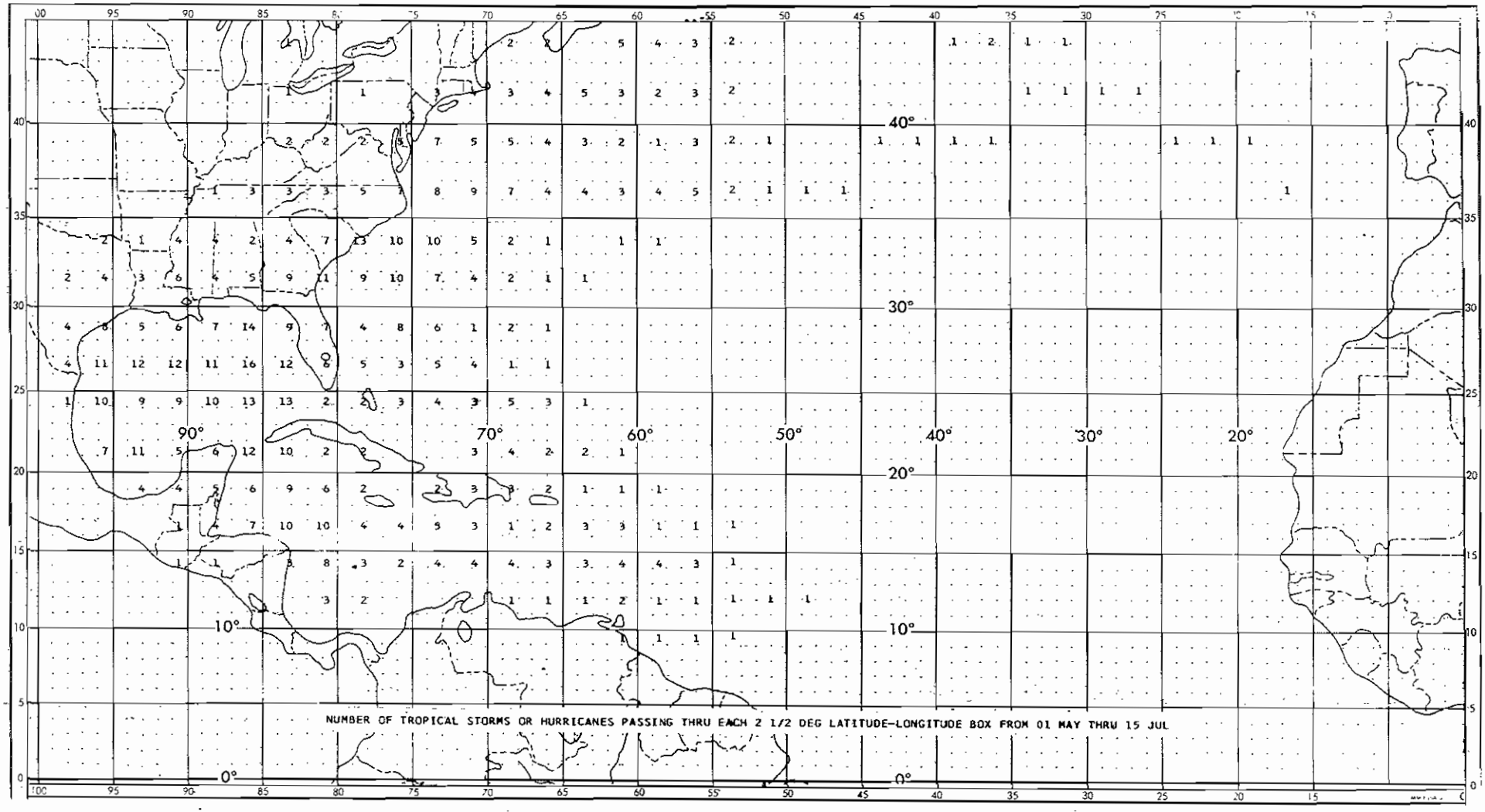

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 11 OCT THRU 10 NOV

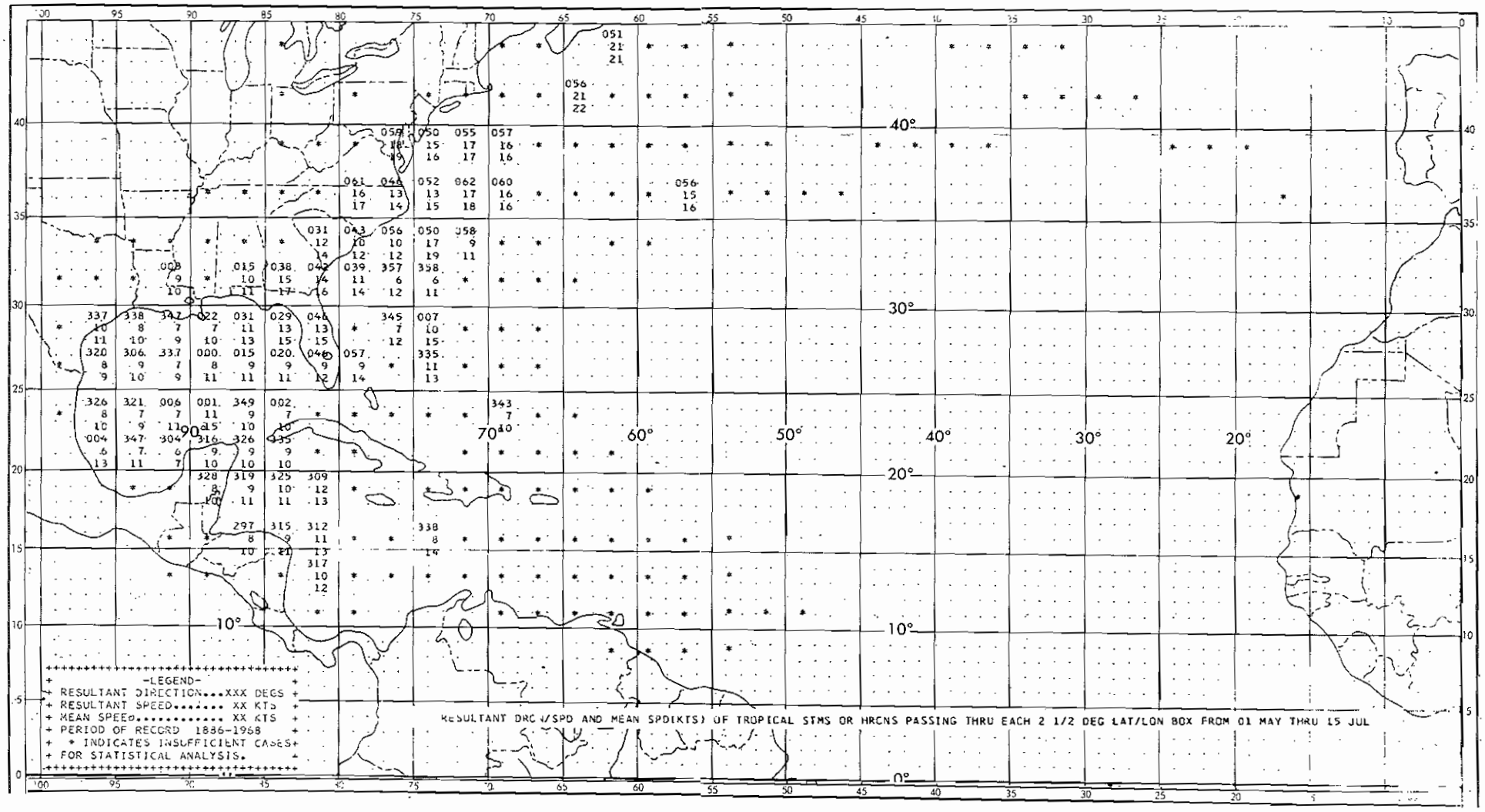

NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 21 OCT THRU 20 NOV
90°
70°
60°
50°
40°
30°
20°
10°
0°

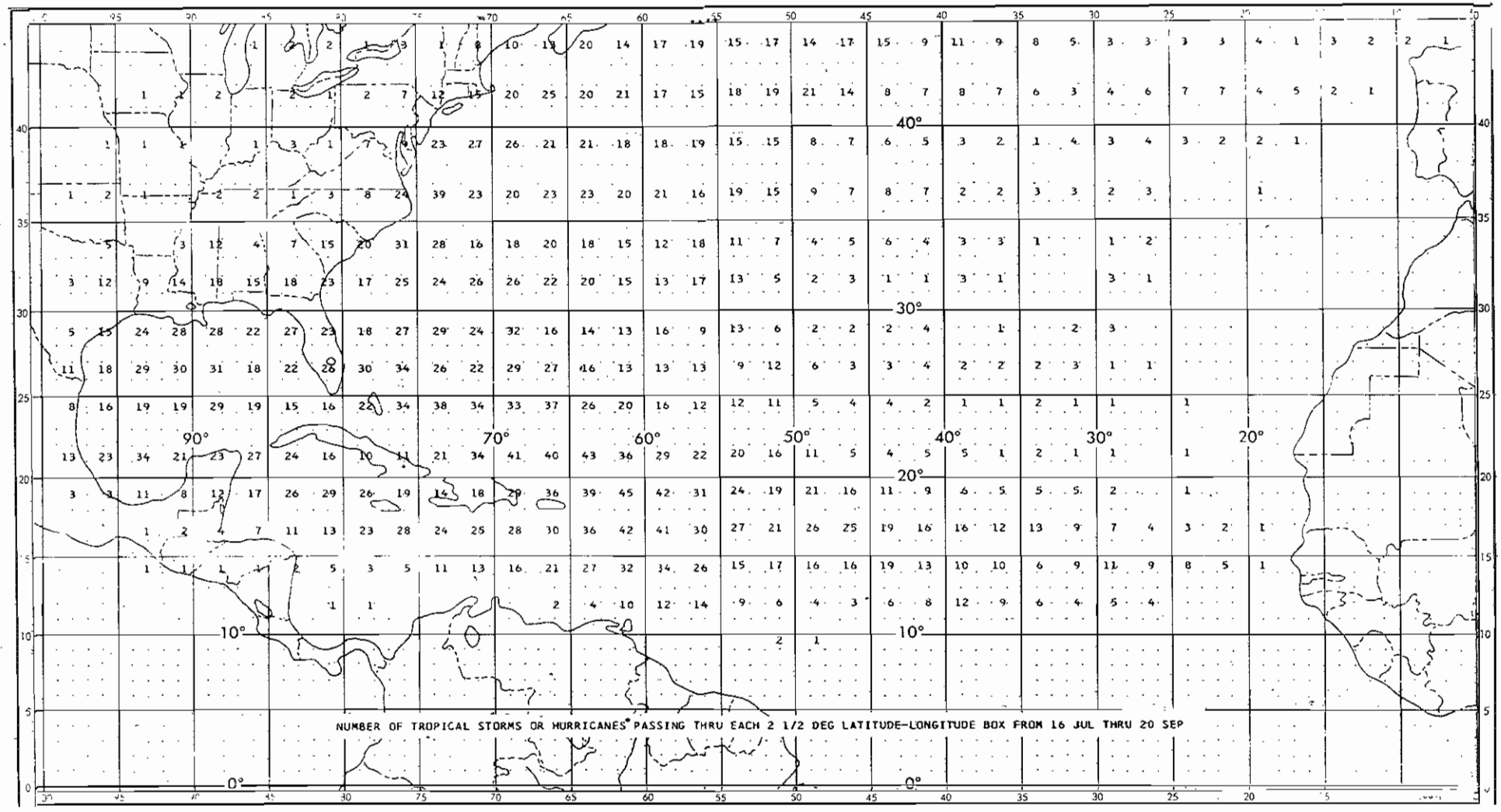

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 OCT THRU 20 NOV


NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 01 NOV THRU 30 NOV
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
40°
30°
20°
10°
0°
90°
70°
60°
50°
40°
30°
20°

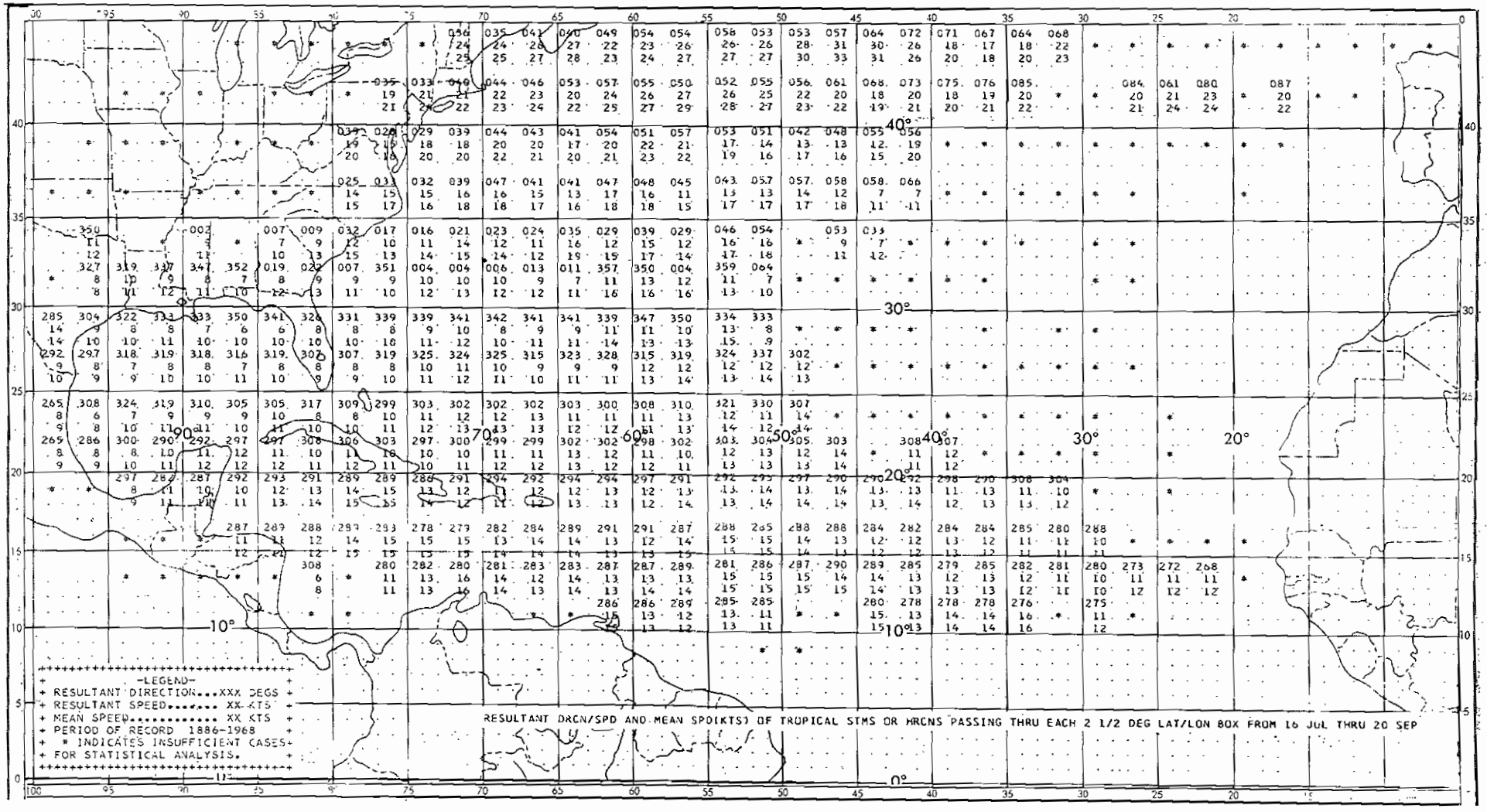

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 NOV THRU 30 NOV

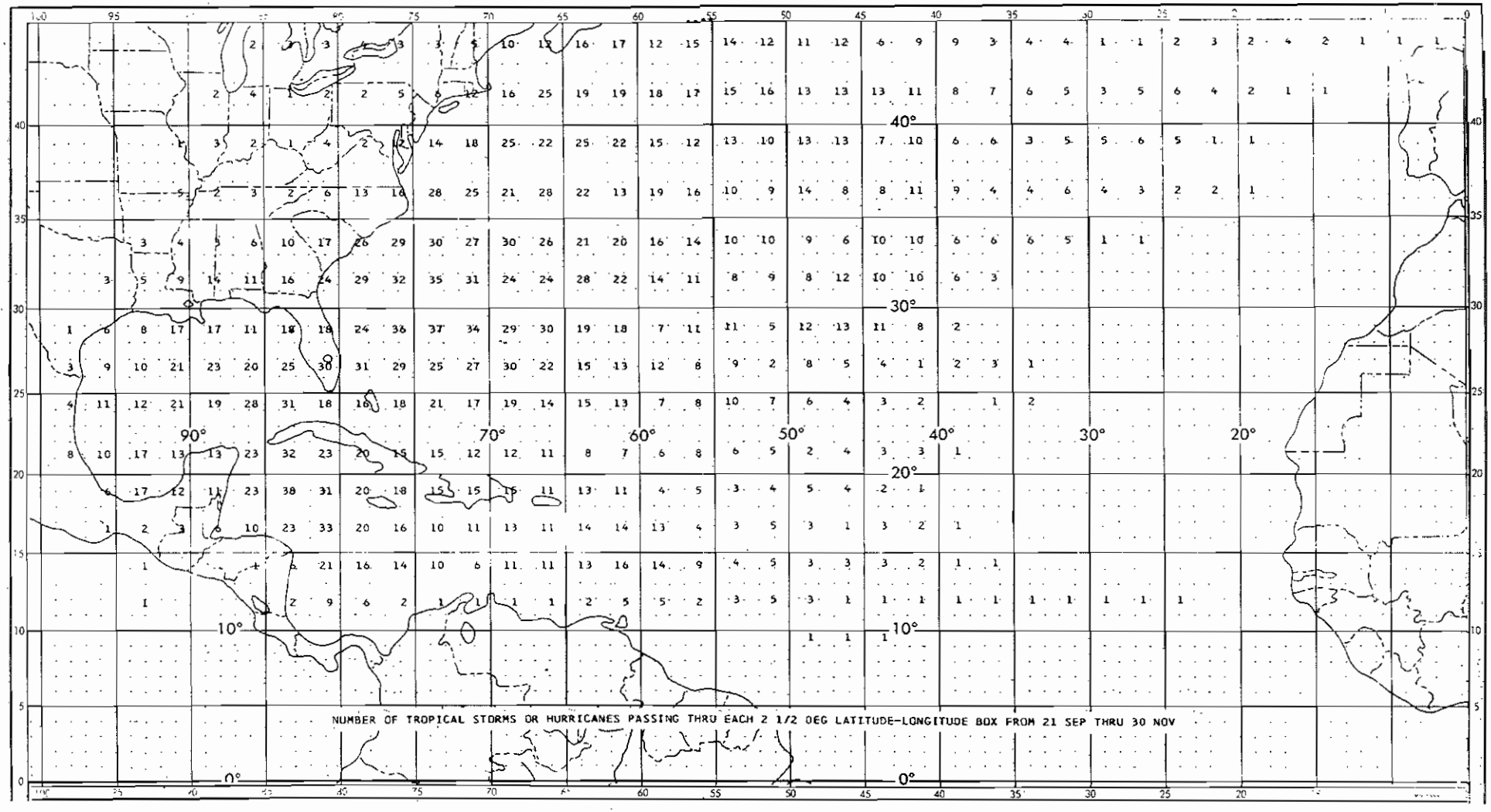

NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 01 MAY THRU 15 JUL
40°
30°
20°
10°
0°
90°
70°
60°
50°
40°
30°
20°

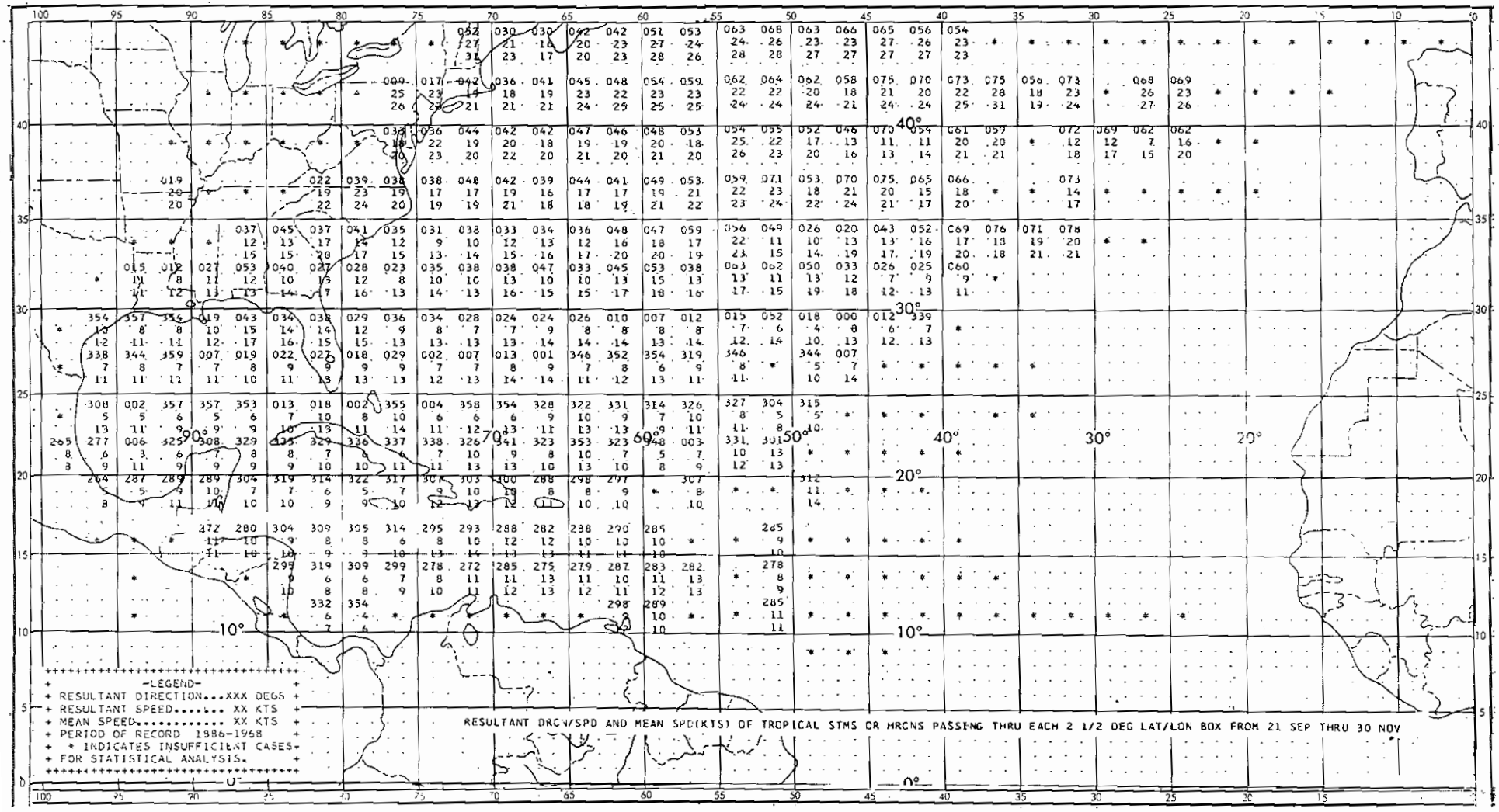

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 MAY THRU 15 JUL

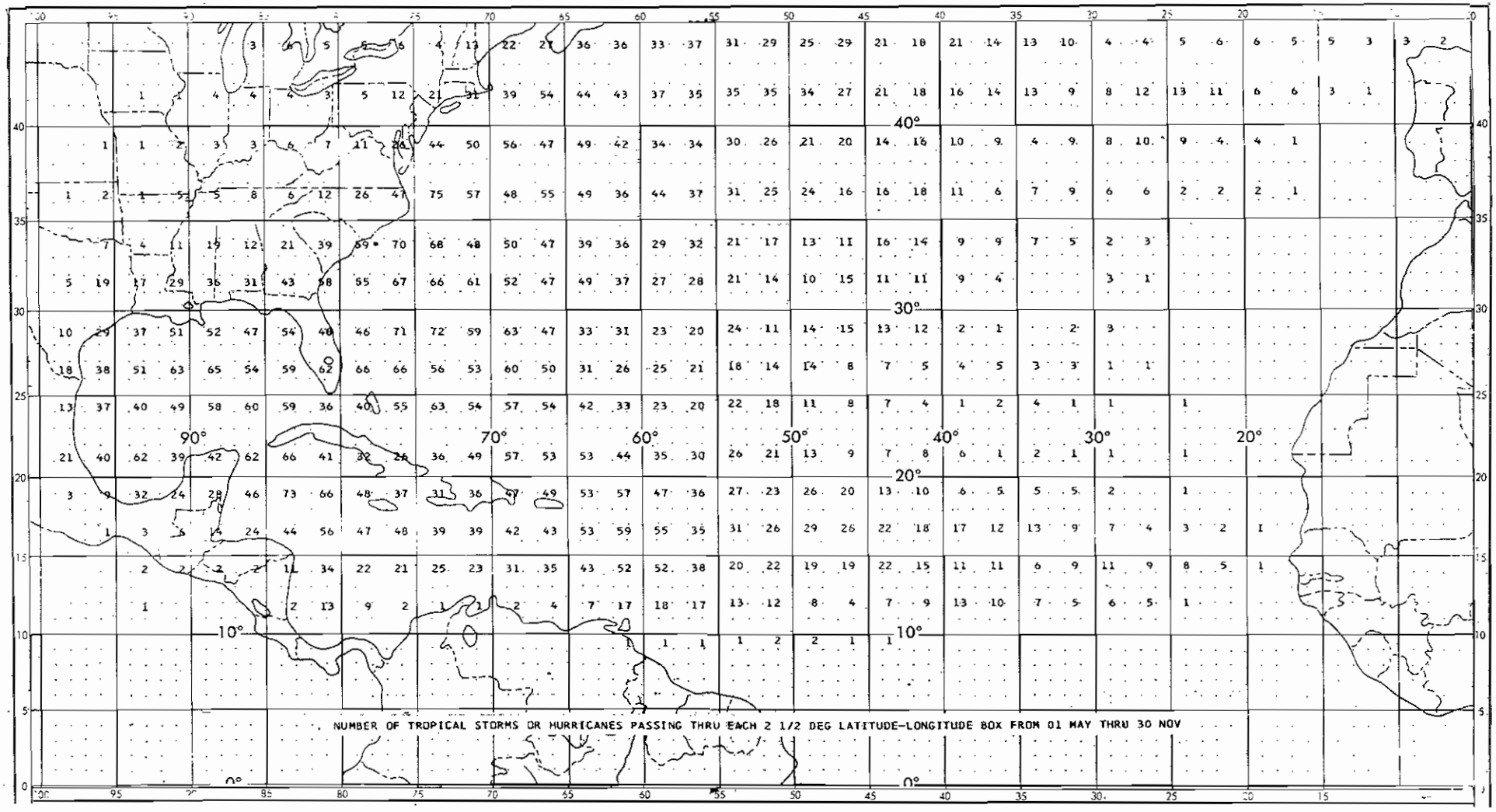


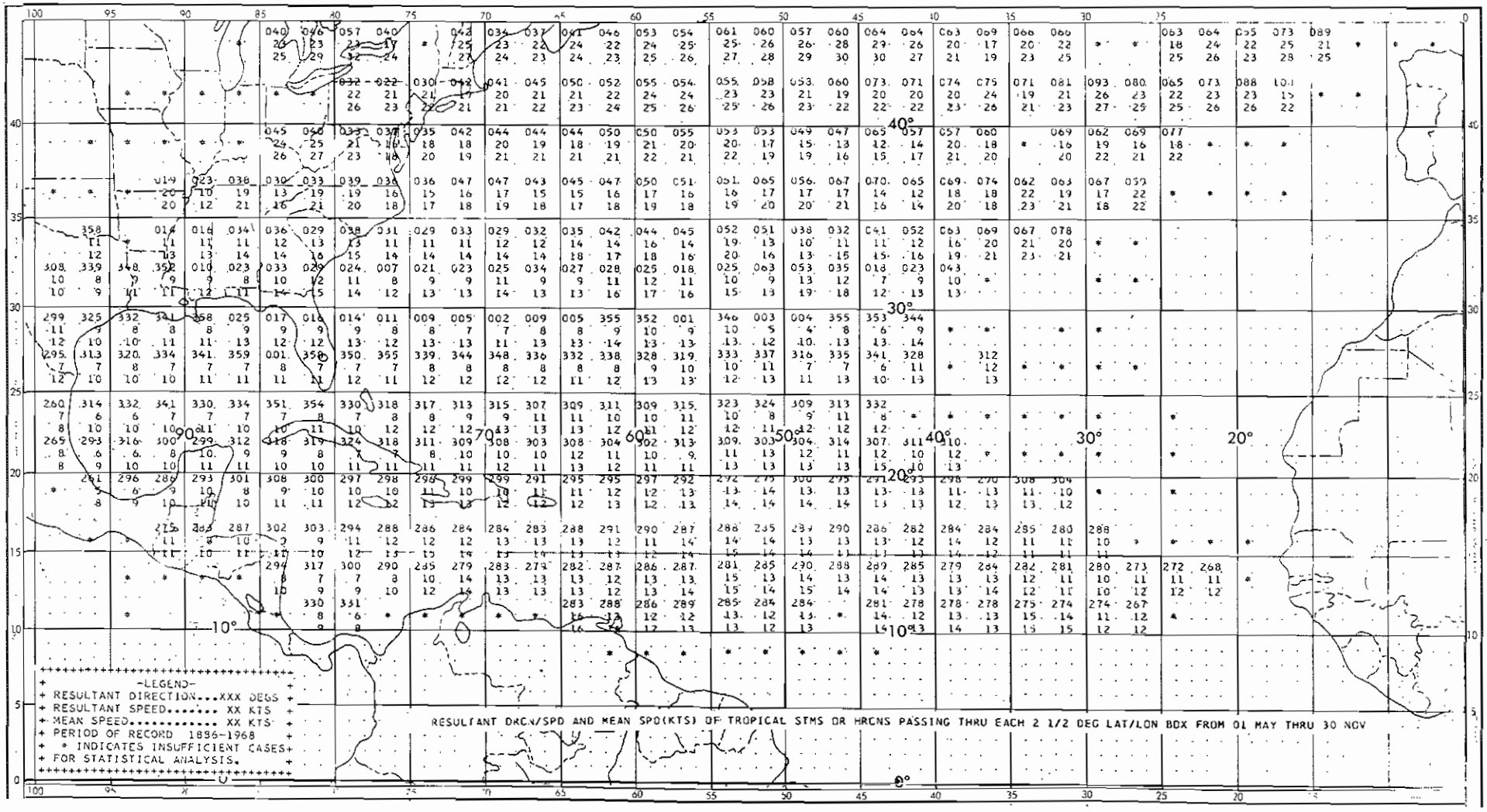
NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 16 JUL THRU 20 SEP

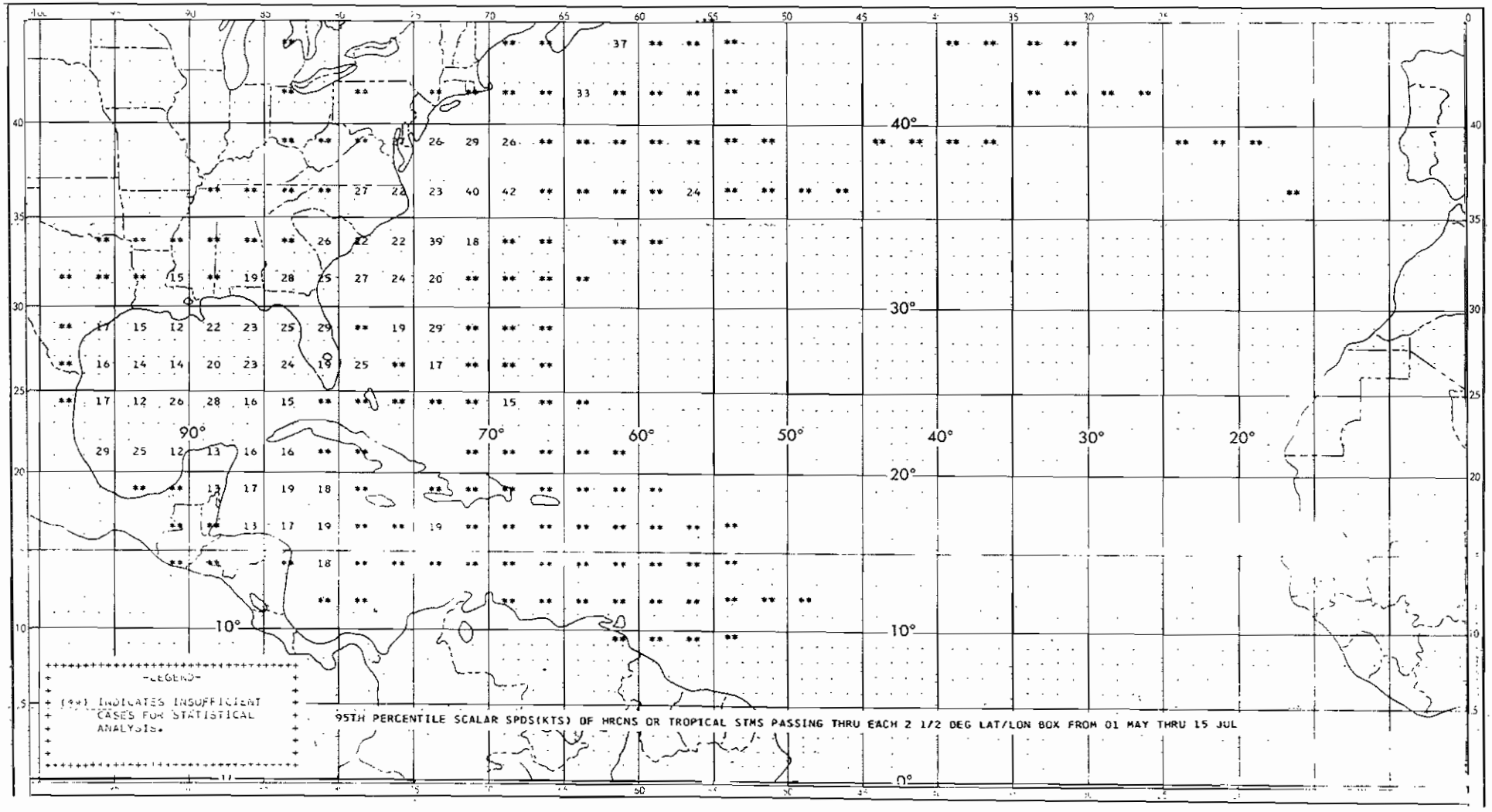

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 16 JUL THRU 20 SEP

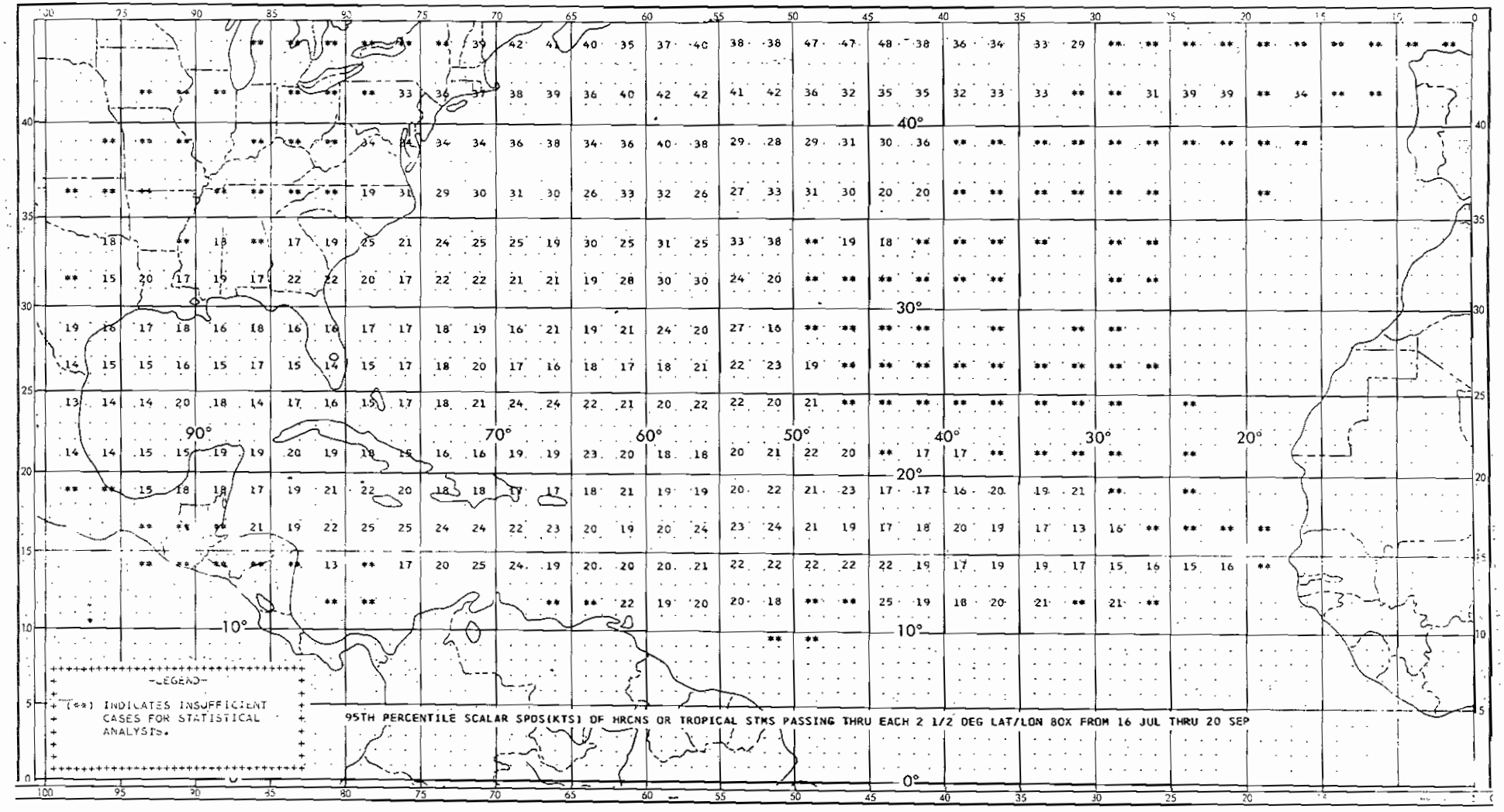

NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 21 SEP THRU 30 NOV
90°
70°
60°
50°
40°
30°
20°
10°
0°

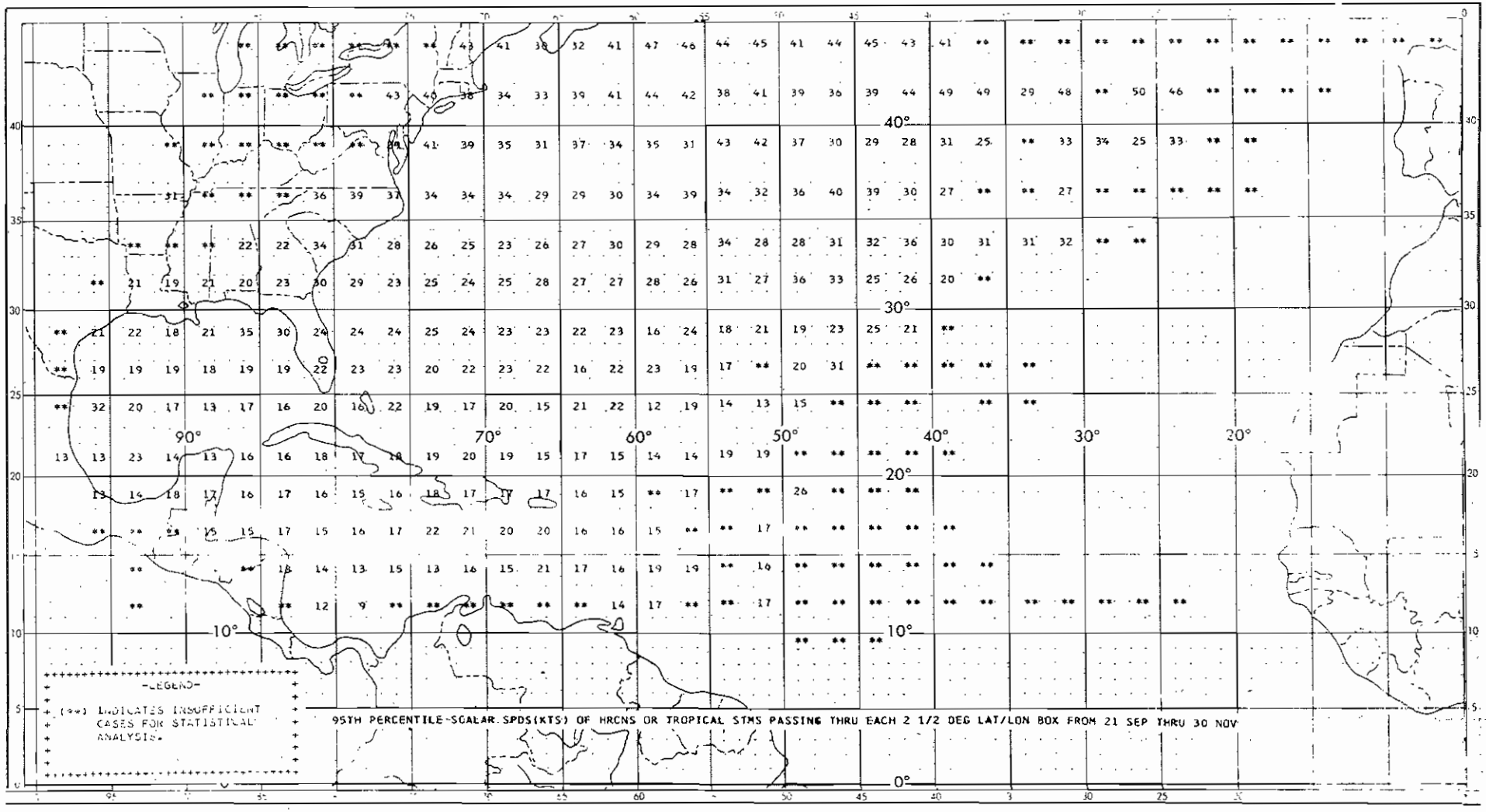

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1886-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 SEP THRU 30 NOV

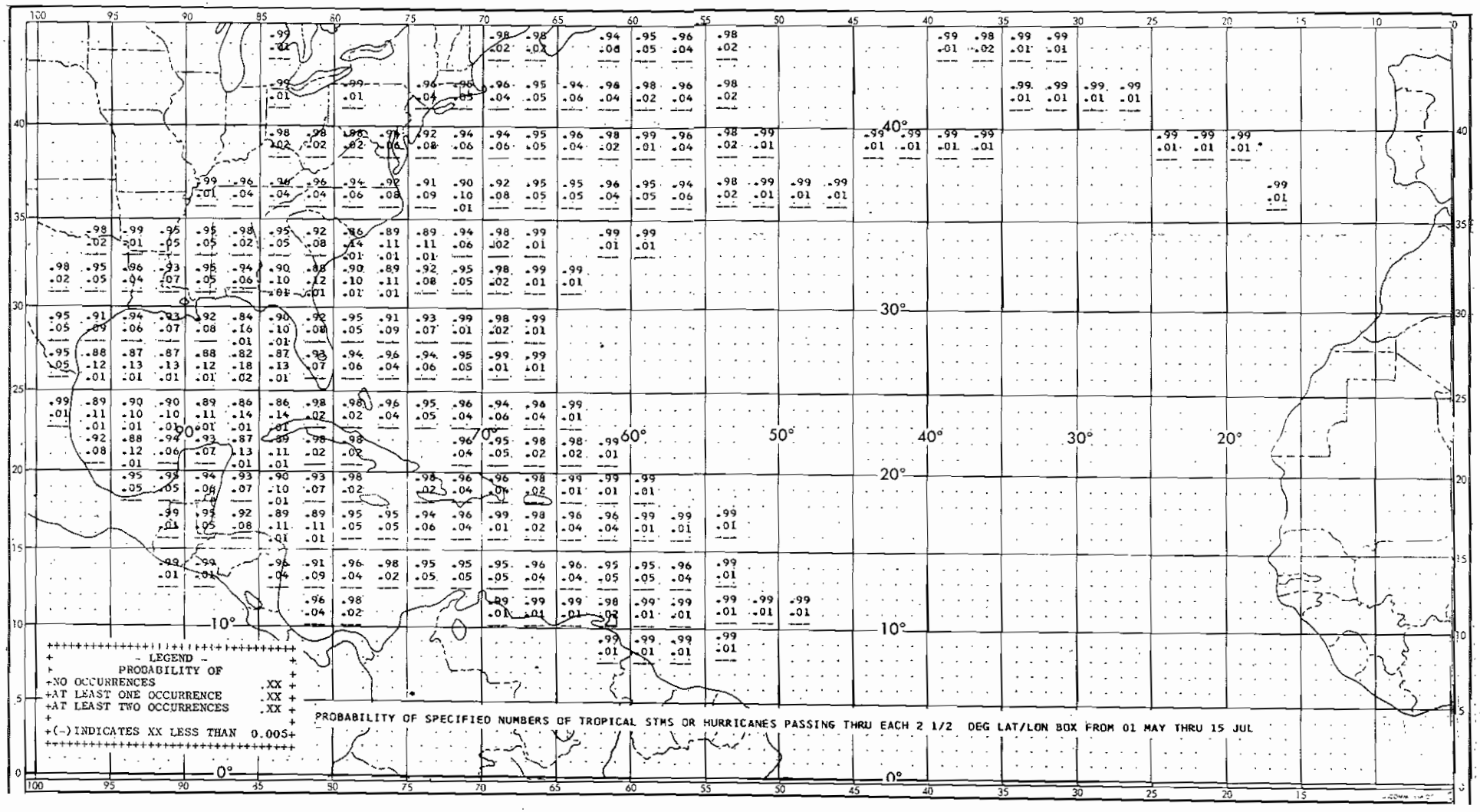

NUMBER OF TROPICAL STORMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LATITUDE-LONGITUDE BOX FROM 01 MAY THRU 30 NOV
90°
70°
60°
50°
40°
30°
20°
10°
0°

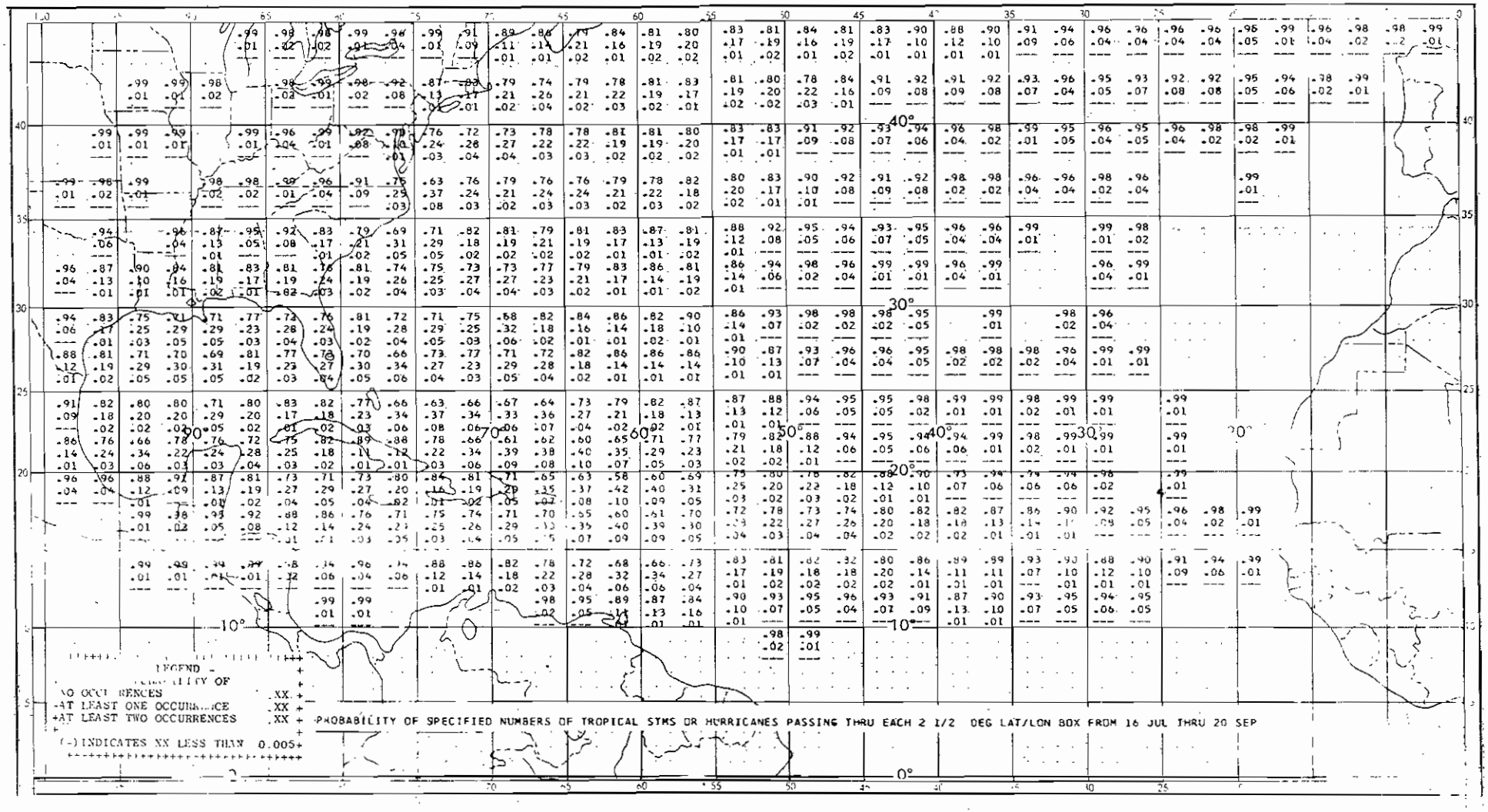

-LEGEND-
RESULTANT DIRECTION...XXX DEGS
RESULTANT SPEED..... XX KTS
MEAN SPEED..... XX KTS
PERIOD OF RECORD 1896-1968
* INDICATES INSUFFICIENT CASES
FOR STATISTICAL ANALYSIS.
RESULTANT DRCN/SPD AND MEAN SPD(KTS) OF TROPICAL STMS OR HRCNS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 MAY THRU 30 NOV

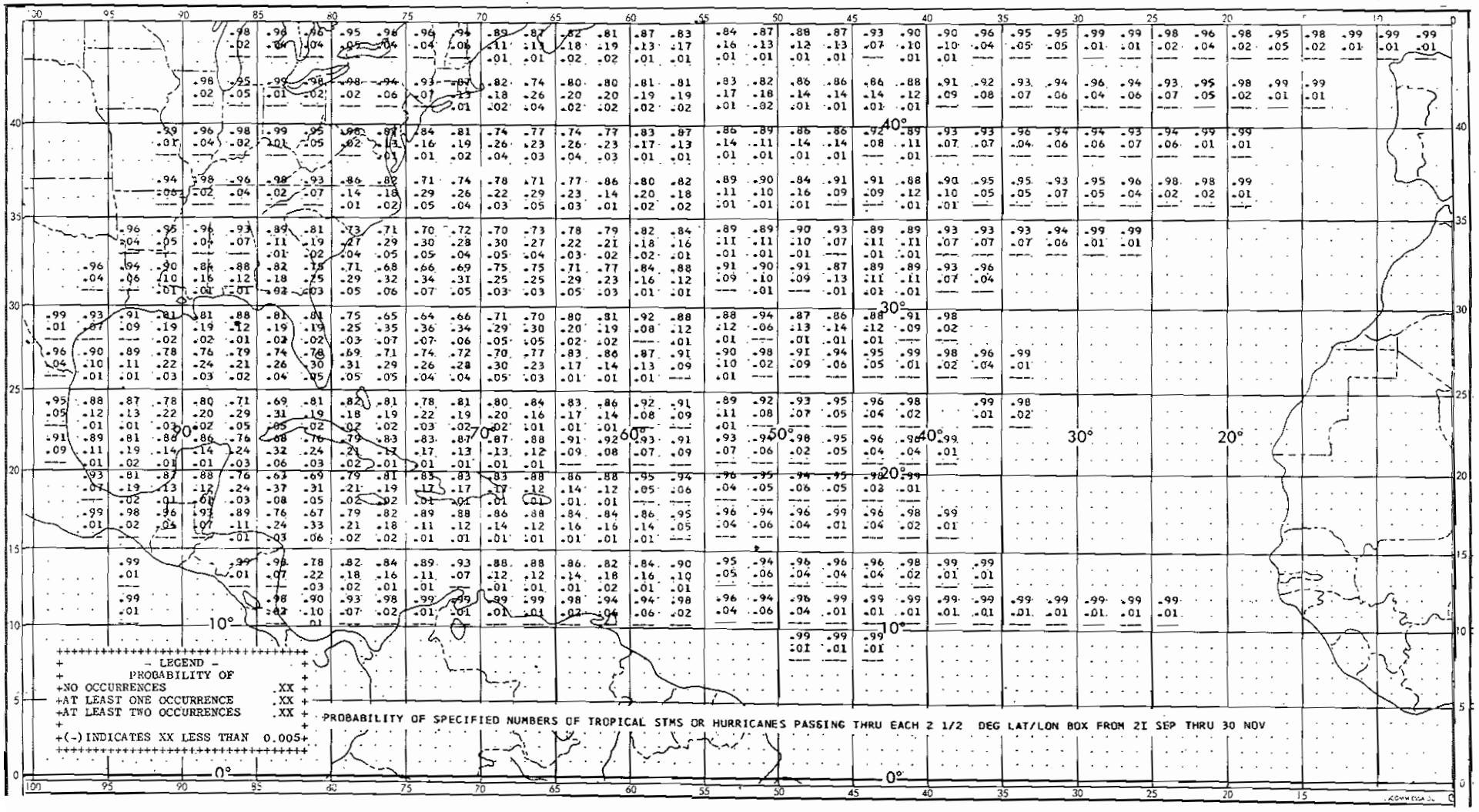

-LEGEND-
(**) INDICATES INSUFFICIENT CASES FOR STATISTICAL ANALYSIS.
95TH PERCENTILE SCALAR SPDS(KTS) OF HRCNS OR TROPICAL STMS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 MAY THRU 15 JUL
90°
70°
60°
50°
40°
30°
20°
10°
0°

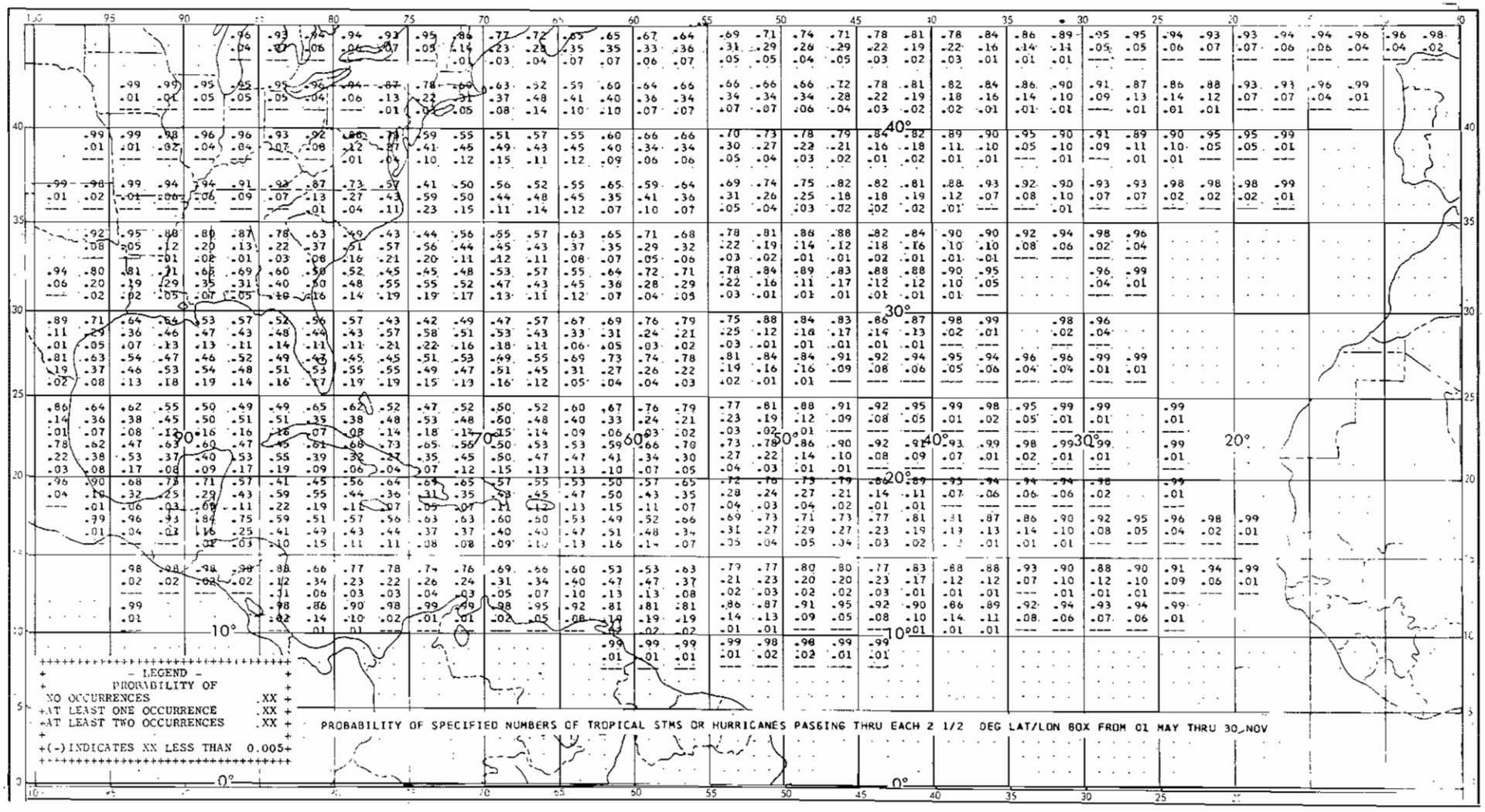

-LEGEND-
(**) INDICATES INSUFFICIENT CASES FOR STATISTICAL ANALYSIS.
95TH PERCENTILE SCALAR SPDS(KTS) OF HRCNS OR TROPICAL STMS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 16 JUL THRU 20 SEP
90°
70°
60°
50°
40°
30°
20°
10°
0°


-LEGEND-
(**) INDICATES INSUFFICIENT CASES FOR STATISTICAL ANALYSIS.
95TH PERCENTILE-SCALAR SPDS(KTS) OF HRCNS OR TROPICAL STMS PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 SEP THRU 30 NOV
90°
70°
60°
50°
40°
30°
20°
10°
0°


- LEGEND -
PROBABILITY OF
NO OCCURRENCES .XX
AT LEAST ONE OCCURRENCE .XX
AT LEAST TWO OCCURRENCES .XX
(-) INDICATES XX LESS THAN 0.005
PROBABILITY OF SPECIFIED NUMBERS OF TROPICAL STMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 MAY THRU 15 JUL


LEGEND -
PROBABILITY OF
NO OCCURRENCES .XX +
-AT LEAST ONE OCCURRENCE .XX +
+AT LEAST TWO OCCURRENCES .XX +
(-) INDICATES XX LESS THAN 0.005+
PROBABILITY OF SPECIFIED NUMBERS OF TROPICAL STMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 16 JUL THRU 20 SEP


- LEGEND -
PROBABILITY OF
+NO OCCURRENCES .XX +
+AT LEAST ONE OCCURRENCE .XX +
+AT LEAST TWO OCCURRENCES .XX +
+(-) INDICATES XX LESS THAN 0.005+
PROBABILITY OF SPECIFIED NUMBERS OF TROPICAL STMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 21 SEP THRU 30 NOV


- LEGEND -
PROBABILITY OF
NO OCCURRENCES .XX
AT LEAST ONE OCCURRENCE .XX
AT LEAST TWO OCCURRENCES .XX
(-) INDICATES XX LESS THAN 0.005
PROBABILITY OF SPECIFIED NUMBERS OF TROPICAL STMS OR HURRICANES PASSING THRU EACH 2 1/2 DEG LAT/LON BOX FROM 01 MAY THRU 30 NOV