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Tropical Cyclones of the North Atlantic Ocean

Tracks and Frequencies of Hurricanes and Tropical Storms, 1871–1963

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PREFACE

Scope.—This paper seeks to consolidate records of the occurrences and paths of tropical cyclones of storm and hurricane force in the North Atlantic region, and to provide information on the frequencies and seasonal distributions of these relatively rare, but important, disturbances.

Tropical cyclones are significant features of the climate of much of the eastern and southern United States as well as of most other areas bordering the western edge of the Atlantic, the Caribbean, and Gulf of Mexico. The destructive features of a single fully-developed hurricane—extremely strong winds, torrential rainfall, and high tides and waves—may pose a threat to life and property over an area of more than 30,000 square miles, and to more than 30 million people. Tremendous amounts of property damage have resulted from tropical cyclone activity—ranging upward to near $1 billion during the passage of a single hurricane. More than 12,000 persons have lost their lives in hurricanes in the United States since 1900, and almost 6,900 deaths were attributed to a hurricane in the Caribbean as recently as 1963.

All activities in the regions subject to periodic tropical cyclones—business, commerce, industry, agriculture—can benefit from more complete information concerning their occurrence. The primary purpose of this paper is to provide this information in a convenient form.

U.S. Weather Bureau *Technical Paper* No. 36 [9] provided the starting point for the present study. The general outline of that work has been maintained, but additional material has been utilized to extend information on tropical cyclones backward to include the years 1871 through 1885 and forward to include the years 1959 through 1963. New material also provided the basis for slight modifications of a number of the tropical cyclone paths shown in [9]. New text, tables, figures, and charts have been prepared, and a short discussion of possible trends in tropical cyclone frequencies has been included. The decadal (10-day, 10-yr.) maps of *Technical Paper* No. 36 have not been included in this paper. Consequently, *Technical Paper* No. 36 remains the only source of this type of data.

Acknowledgments.—The interest, encouragement, and advice of Dr. H. E. Landsberg, Director of Climatology, H. C. S. Thom, W. H. Haggard, A. I. Cooperman, and W. C. Palmer are appreciated. Thanks are due C. F. Kambic for his assistance in the collection and assembly of data. The support of the National Hurricane Research Laboratory, Dr. R. C. Gentry, Director, is gratefully acknowledged.

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1. TROPICAL CYCLONES

Any closed atmospheric circulation in the Northern Hemisphere in which the winds move counterclockwise around a center of pressure lower than the surrounding area is called a cyclone. A tropical cyclone is a circulation developing over tropical oceanic regions where temperature and moisture conditions are almost uniform over large areas.

The terms "cyclone" or "tropical cyclone" signify nothing as to the intensity of associated winds or weather. Cyclones of the middle latitudes, deriving energy primarily from the contrasts of temperature and moisture in the air masses present within the circulation, may range from weak, barely discernible whirls to massive, intense vortices of immense power often covering an area well over 1,000 miles in diameter. Tropical cyclones, with energy derived primarily from the latent heat of condensation of water vapor, are generally smaller in areal extent, ranging from 60 to 600 miles in diameter at maturity, and only rarely exceed 1,000 miles in diameter. The speed of the maximum winds near the center of the storm has been estimated at more than 200 m.p.h. (175 kt.) in well-developed hurricanes. Torrential rainfall over a considerable area is a common feature of tropical cyclones of all intensities. Tides produced by an intense hurricane in coastal areas may reach levels of 10 to 25 feet above normal.

The distributions of winds, pressure, and temperature tend to be circularly symmetric in tropical cyclones because of the development of these storms in regions of nearly constant air mass properties. Another unique feature is the central "eye." The pattern of winds does not converge to a single point, but becomes tangent to the eye boundary at a radius of some 5 to 10 miles or more from the exact storm center. In the eye there is little wind or rain; the sky may become clear in some cases; temperatures at the surface are usually a few degrees higher, and the moisture content of the air lower, than in the encircling region of strong winds.

The exact processes and mechanisms for tropical cyclone formation are not yet completely known. Detailed physical and dynamical descriptions of the formation, structure, and movement are beyond the scope of this work. Recent discussions of present hypotheses are given by Riehl [34] and Yanai [59].

2. CLASSIFICATIONS OF TROPICAL CYCLONES

Various methods for identification of the different stages of tropical cyclones have evolved over the years in the several regions of the world subject to these storms. All atmospheric circulations have a "life cycle" of development, intensification, maturity, and decay or modification. Technical criteria have been formulated to identify these various stages.

The strength of the maximum winds is also used extensively to classify tropical cyclones. Although universal agreement in terms has not been attained, most classifications are similar, with only moderate differences in threshold values for various intensities. The strongest stage, with sustained surface wind speeds of 74 m.p.h. (64 kt.) or more, is called *hurricane* in the North Atlantic region, including the Caribbean Sea and the Gulf of Mexico, in the eastern North Pacific, and in the western South Pacific. Cyclones of comparable intensity are called *typhoons* in the western North Pacific, and simply *cyclones* in the Bay of Bengal, the Arabian Sea, and the southern Indian Ocean. Local names for tropical cyclones of hurricane force include *baguio* in the Philippine Islands.

Tropical cyclones with sustained winds in the range 39 to 73 m.p.h. (34 to 63 kt.) are called *tropical storms* in the North Atlantic region; circulations with maximum sustained winds up to 38 m.p.h. (33 kt.) are *tropical depressions*. These categories are also used in the North Pacific tropical cyclone regions.

Riehl [33], Dunn [11], Dunn and Miller [13], and U.S. Weather Bureau [52] discuss the life cycle and classifications of tropical cyclones.

Most previous compilations of North Atlantic tropical cyclone tracks have shown storms of all intensities in the same manner, or indicated only that each storm did or did not reach hurricane force at some point. This was done in most cases by showing the tracks of those designated as hurricanes by solid lines and the tracks of tropical storms by dashed lines. In general, no indications of the geographical locations of the various stages of the life cycle—where the cyclone was weak, well-developed, decaying, or being modified by the intrusion of air from source regions outside the Tropics—were given.

Such a summary of tracks without some estimation of intensity along each path, when any data are available from which inferences of intensity can be drawn, is lacking in an important aspect of the overall description of the storms, because a hurricane normally does not retain winds of hurricane force throughout its existence. Intensity estimates have been made in this paper. The criteria for the different stages and the periods used are given in table 1. A combination of life cycle and intensity criteria, these stages conform to the thresholds and terminology in current use in the North Atlantic region.

The development and dissipation of tropical cyclones are dependent on location and the interaction of the storms with the surrounding environment. For example, tropical cyclones remaining at low latitudes may progress in intensity from tropical depression to tropical storm, to hurricane, then back to tropical storm as they begin to lose intensity, and then to tropical depression (dissipation). Those cyclones moving northward out of the Tropics may follow these same

TABLE 1.—*Terms used to describe intensity stages of tropical cyclones*

Stage of development	Criteria and period used
Tropical depression (development).	The weak stage of a tropical cyclone with a definite closed surface circulation, one or more closed surface isobars, and highest sustained wind speed less than 34 kt. (39 m.p.h.) (1951–1963 only).
Tropical storm	A tropical cyclone with closed isobars and highest sustained wind speeds of 34 to 63 kt. (39–73 m.p.h.) inclusive (1899–1963).
Hurricane	A tropical cyclone with highest sustained wind speeds 64 kt. (74 m.p.h.) or higher (1899–1963).
Extratropical	Tropical cyclone modified by interaction with non-tropical air mass, and extratropical weather systems. Winds may remain above hurricane force in some cases (1899–1963).
Depression (dissipation)	Criteria similar to development stage, but occurring during the decay of the circulation (1899–1963).

stages, or may be modified by the intrusion of polar air into the circulation as they move into the higher temperate latitudes. Some tropical cyclones are absorbed into existing extratropical cyclones.

In warm tropical ocean areas evaporation rates are very high and enormous quantities of water vapor are stored in the atmosphere. Upon condensation and precipitation of this water vapor, latent heat is converted to sensible heat and kinetic energy in the form of winds. Portions of the tropical oceans thus serve as vast reservoirs of energy for the development and maintenance of tropical cyclones. These storms may be a major factor in maintaining the atmospheric heat and moisture balances between the Tropics and middle latitudes. They possibly provide a kind of "safety valve" that limits the continued buildup of heat and energy in tropical regions [21].

The movement of a tropical cyclone over land or into regions of cooler sea surface temperatures removes this primary source of energy, and the intensity of the circulation decreases, in the absence of outside factors. Increased surface roughness over land is an additional factor in the dissipation of energy. Miller [25], investigating conditions in hurricane Donna of 1960 over Florida, concluded that the removal of the oceanic heat source was the primary cause of that storm's loss of intensity.

Maintenance of the energy of tropical cyclones also requires a mechanism for the transport of air away from the storm center at high levels in the atmosphere. Circulation patterns at upper levels sometimes change in ways that damp this outflow by bringing broad areas of subsidence or convergence over the cyclone, thus effectively "putting a lid" over it [52, p. 63].

The extratropical stages of the cyclone tracks in this paper indicate that modification of the tropical circulations had started by virtue of movement of the cyclones into regions where contrasts in the thermal properties of the atmosphere were present. In this situation, the size of the circulation usually expands, the speed of the maximum winds decreases, and the tropical symmetry of the distributions of winds, rainfall, and temperatures around the center of the cyclone is destroyed. While these features characteristic of extratropical cyclones develop, some tropical features—a small area of intense winds near the center, remnants of an eye, and extremely heavy rainfall—may be retained for a considerable period of time. In some cases, reintensification of the circulation may begin as a result of the presence of mechanisms conducive to extratropical cyclone development strong enough to offset the dissipative effects of the removal of the tropical energy source and, over land, the increase of surface roughness and frictional dissipation.

Rigid rules for the location of exact places or times of complete modification cannot be stated. The physical processes involved are complex, act continuously, and vary markedly from case to case.

Papers discussing tropical cyclone modification include Sawyer and Ilett [38], Pierce [30], Richter and DiLoreto [32], and Ross and Blum [35].

3. SOURCES AND QUALITY OF DATA

The history of hurricanes extends back to the early voyages of discovery in the late fifteenth century. These early records are fragmentary and incomplete. One of the earliest compilations of hurricane tracks (1804–1853) was prepared by Redfield [31]. Millas [24] has recently attempted to document many of the early storms. Ludlum [23] has also recently prepared a hurricane chronology extending through 1870.

Information from many sources has been used to define the tracks of the tropical cyclones presented in this paper. U.S. Weather Bureau *Technical Paper* No. 36 [9] provided the nucleus. The primary continuing reference, the *Monthly Weather Review* [53], first appeared in June 1872 and has been published without interruption to the present, although changes in format, emphasis, and contents have been numerous. Monthly reports of North Atlantic tropical cyclone activity and tracks have been included in most volumes, and since 1922, annual summary articles have also appeared in most years. Numerous papers, discussing various aspects of tropical cyclones or complete details of specific storms, have been published in the *Review* through the years. Summaries of each tropical cyclone season since 1950 have also been included in

Climatological Data National Summary [48], and details of hurricanes affecting the United States are given there and in appropriate monthly issues of *Climatological Data* for individual States [49].

The first comprehensive climatological analyses of the early series of Signal Service synoptic weather maps were made between 1874 and 1889 by Professor Elias Loomis of Yale. Of his many papers [22], one was devoted to North Atlantic tropical cyclone activity during the years 1871 through 1880.

Several summaries containing "complete" series of tropical cyclone tracks and information on various storm features, have been published periodically since the turn of this century. In preparing this paper we have relied heavily on the works of Garriott [17], which contain tracks for the years 1878–1900; Fassig [15], 1876–1911; Mitchell [26, 27], 1887–1932; Cline [4], 1900–1924; and Tannehill [41], 1901–1955. Additional unpublished chronologies of tropical cyclone tracks have been available, including the charts and notes of Tingley [45] for 1871–1930; charts probably prepared by Mitchell [28] 1898–1920; and track charts centered on the Gulf of Mexico prepared at the U.S. Weather Bureau Office, New Orleans, La. [55], 1875–1956.

In addition to these primary sources containing relatively long series of tracks, the following less extensive sources have also been used: Alexander [1]; Bonnelly [2]; Bowie [3]; Contreras-Arias [6]; Deutsche Seewarte [10]; Elwar [14]; Fischer [16]; Gray-Norton [18]; Hall [20]; Newnham [29]; Salivia [36]; Sarasola [37]; Tannehill [39]; and Viñes-Finley [57]. The recent comprehensive book by Dunn and Miller [13] contains complete discussions of various aspects of tropical cyclones, including a continuation of Tannehill's chronology.

Some expected problems were encountered in the selection of tracks to show accurately the paths followed by each tropical cyclone. With several usually similiar but sometimes widely discrepant versions of the track of a given storm available in most cases, two basic problems devolved: (a) to select the "best" track, considering all the information in the references; and (b) to indicate, if possible, the intensity of the tropical cyclone at all points along its path.

Data for a precise determination of the location and intensity of atmospheric disturbances were scarce, widely scattered, of generally poor quality, and sometimes conflicting for many years following the establishment of the National Weather Service in 1870. Reports from United States land stations were relayed to central forecasting offices by telegraph, but observations from ships were not received until the vessels returned to port, sometimes months later. Although such late reports were of no immediate value for forecasting, they were used extensively for the construction of tracks of all major storms occurring over the oceans. These tracks appeared in the International Meteorology sections of the *Monthly Weather Review* for several years. The files of marine observations also served as a basic source for the work of Garriott, Fassig, Mitchell, and other authors mentioned above.

The first operational radio weather report from a ship underway was received December 3, 1905; the first message reporting a hurricane was sent August 26, 1909 by the *SS Cartago* from the southern Gulf of Mexico near the coast of Yucatan. The amount and quality of marine weather data have increased gradually during the succeeding years. During the June-November tropical cyclone season of 1935, more than 21,000 observations were received from the tropical portions of the Atlantic. By 1959 the number of observations from ships during the corresponding period exceeded 64,000.

Technological advances since World War II have resulted in more precise tropical cyclone position and intensity estimates. Improved radiosonde and rawinsonde equipment has provided additional knowledge of factors affecting tropical cyclone motion and intensity. The use of aircraft to obtain data inside hurricanes was found to be feasible in 1943 [40]. U.S. Air Force and Navy planes have been making routine reconnaissance of North Atlantic tropical cyclones since 1944. These flights have proved especially important for earlier detection and more accurate estimates of location and intensity.

The U.S. Weather Bureau Research Flight Facility operates several aircraft equipped with special instrumentation for the collection of detailed data primarily useful in research and also assists in tropical cyclone tracking.

The wartime development of storm-tracking radar and subsequent improvements in its range and accuracy have further increased observational capabilities. An extensive network of powerful coastal radars is now in operation; reconnaissance and research aircraft all have good radar equipment; and numerous ships also carry this valuable storm-tracking tool.

Meteorological satellites have provided a new and promising method for surveillence of the vast ocean areas of the world. They have been particularly useful in locating and tracking tropical cyclones in areas where conventional data are not available.

The source material reflects, of course, the varying number and quality of observations on which it is based. The 93 years covered span almost the complete period of the development of meteorology and organized weather services. The period begins in an era when observations were simple and relatively rare, before the details of the nature and characteristics of atmospheric disturbances were understood. Today a widespread network of land stations, ships, aircraft, and satellites using complex and sophisticated instrumentation is available for the collection of data. Well-developed theoretical and empirical methods are used to evaluate the observations. Improvements in the tracking of tropical cyclones and the determination of their intensity have accrued with each new development.

4. NORTH ATLANTIC TROPICAL CYCLONE TRACKS

Several steps were necessary to obtain the final North Atlantic tropical cyclone tracks. First, all cyclones considered to be of tropical origin in the reference material were listed on an annual basis, together with all information available concerning their intensity. Second, all versions of the track of each storm were plotted on charts. Comparisons of these differing interpretations, and evaluations of information from all sources, including daily synoptic charts [46, 50, 51, 54, 56] as well as the published and manuscript summaries, were made, and the track configuration for each storm most consistent with all the data was selected. These positions and intensities were then plotted on the annual charts of Series A, beginning on page 36.

The objective was to depict accurately and completely the position and intensity of each significant tropical cyclone in the North Atlantic region throughout its existence. Unfortunately, the quality of data prevented the full attainment of this goal. It should be emphasized that many positions and intensities, particularly for the earlier years, are estimates, and represent compromises in some cases between significant differences in the references.

Delineation of intensity stages was found to be unrewarding prior to the period when daily synoptic charts for the entire area were available. Consequently, no indications of intensity have been made for the years 1871–1885; a simple classification as tropical storm or hurricane was made for the years 1886–1898; tracks showing intensity were prepared from 1899 onward. The tropical depression (development) stage was included only for the 1951–1963 period.

TABLE 2.—*Observed frequencies of North Atlantic tropical cyclone occurrences. (Grouping corresponds to periods of chart series B.)*

Periods	Years			Total
	1871–1880	1881–1890	1891–1900	
June–July	7	9	6	22
August	14	17	19	50
September	26	22	25	73
October	15	15	25	55
Nov.–May	3	7	2	12
Total	65	70	77	212

Periods	Years							Total
	1901–1910	1911–1920	1921–1930	1931–1940	1941–1950	1951–1960	1961–1963	
June 1–15	5	1	2	3	1	4	0	16
June 16–30	4	2	2	4	1	4	0	17
July 1–15	3	4	0	2	3	2	0	14
July 16–31	3	1	1	6	5	5	2	23
Aug. 1–10	2	4	3	9	2	6	0	26
Aug. 11–20	2	1	2	9	9	6	1	30
Aug. 21–31	4	9	5	14	12	11	2	57
Sept. 1–10	8	8	10	12	14	14	4	70
Sept. 11–20	8	6	4	8	14	11	5	56
Sept. 21–30	8	3	6	8	7	11	4	47
Oct. 1–10	9	4	3	7	12	9	0	44
Oct. 11–20	7	2	13	6	12	5	3	48
Oct. 21–31	3	1	2	7	1	2	2	18
Nov. 1–15	3	3	2	3	3	0	2	16
Nov. 16–May 31	2	0	1	6	1	8	0	18
Total	71	49	56	104	97	98	25	500

The seasonal patterns and shifts in the tracks of tropical cyclones in the North Atlantic are illustrated in chart Series B, beginning on page 129. This series has been divided into two periods—1871 through 1900 and 1901 through 1963. The tracks are shown as simple lines without indications of intensity. No "mean" tracks were prepared. Bowie [3] wrote in 1922: "A single track to represent an average [tropical cyclone] track is of no particular value."

Inspection of these charts verifies this statement. The endless variety of tracks is a result of the positions and intensities of other atmospheric circulations (cyclones and anticyclones) over a large portion of the hemisphere, and is a reflection of the continual changes in pattern of the general circulation during periods when tropical cyclones are in existence [52].

The seasonal periods are indicated on each chart, and a summary of frequencies is given in table 2.

5. NORTH ATLANTIC TROPICAL CYCLONE FEATURES

FORMATION

Most North Atlantic tropical cyclones develop over remote sections of the ocean where there are no organized networks of weather observatories, and ocean traffic is light. During the early stages of storm development, the circulation usually covers a relatively small area in a larger region of disturbed weather. Consequently, the probability of identifying with certainty the exact initial point of development is low. Tracks of most tropical cyclones in our source material begin at the point where some evidence of an organized circulation was first observed by ships or aircraft. Circulations of slight to moderate intensity may exist for several days before they can be conclusively identified and tracked, particularly in the area east of the Lesser Antilles, but also in other regions as well. This factor was more serious during the earlier portions of the record. All information available, including synoptic charts, has been used to portray origins as accurately as possible.

Figures 1 through 5 show the observed points of origin or of detection for the 500 tropical cyclones which occurred in the North Atlantic region during the years 1901–1963. Table 3 is a summary of points of origin in various areas of the ocean.

Analyses of wind constancy and the frequency of precipitation, important features in determining the position of the intertropical convergence zone, are also shown on figures 1 through 5. These analyses have been adapted from a study [47] conducted by the U.S. Naval Oceanographic Office. Data were extracted from the marine climatological records covering the period from 1854 to 1959.

TABLE 3.—*North Atlantic tropical cyclone origins by areas, 1901–1963*

Period	East of 50° W.	50°–60° W.	60°–70° W.	70°–80° W.	80°–90° W.	90°–100° W.	Total
Origins South of 20° N.							
June–July	1	12	2	4	12	3	34
August	24	37	7	4	3	2	77
September	36	31	11	11	13	6	108
October	3	8	5	21	24	3	64
Nov.–May	2	0	3	8	7	0	20
Total	66	88	28	48	59	14	303
Percent	21.8	29.0	9.2	15.9	19.5	4.6	--------
Origins North of 20° N.							
June–July	0	0	1	10	14	11	36
August	2	2	9	11	10	2	36
September	4	13	11	14	9	14	65
October	7	5	9	15	6	4	46
Nov.–May	1	6	3	1	2	1	14
Total	14	26	33	51	41	32	197
Percent	7.1	13.2	16.8	25.9	20.8	16.2	--------
All Origins							
All Months	80	114	61	99	100	46	500
Percent	16.0	22.8	12.2	19.8	20.0	9.2	--------

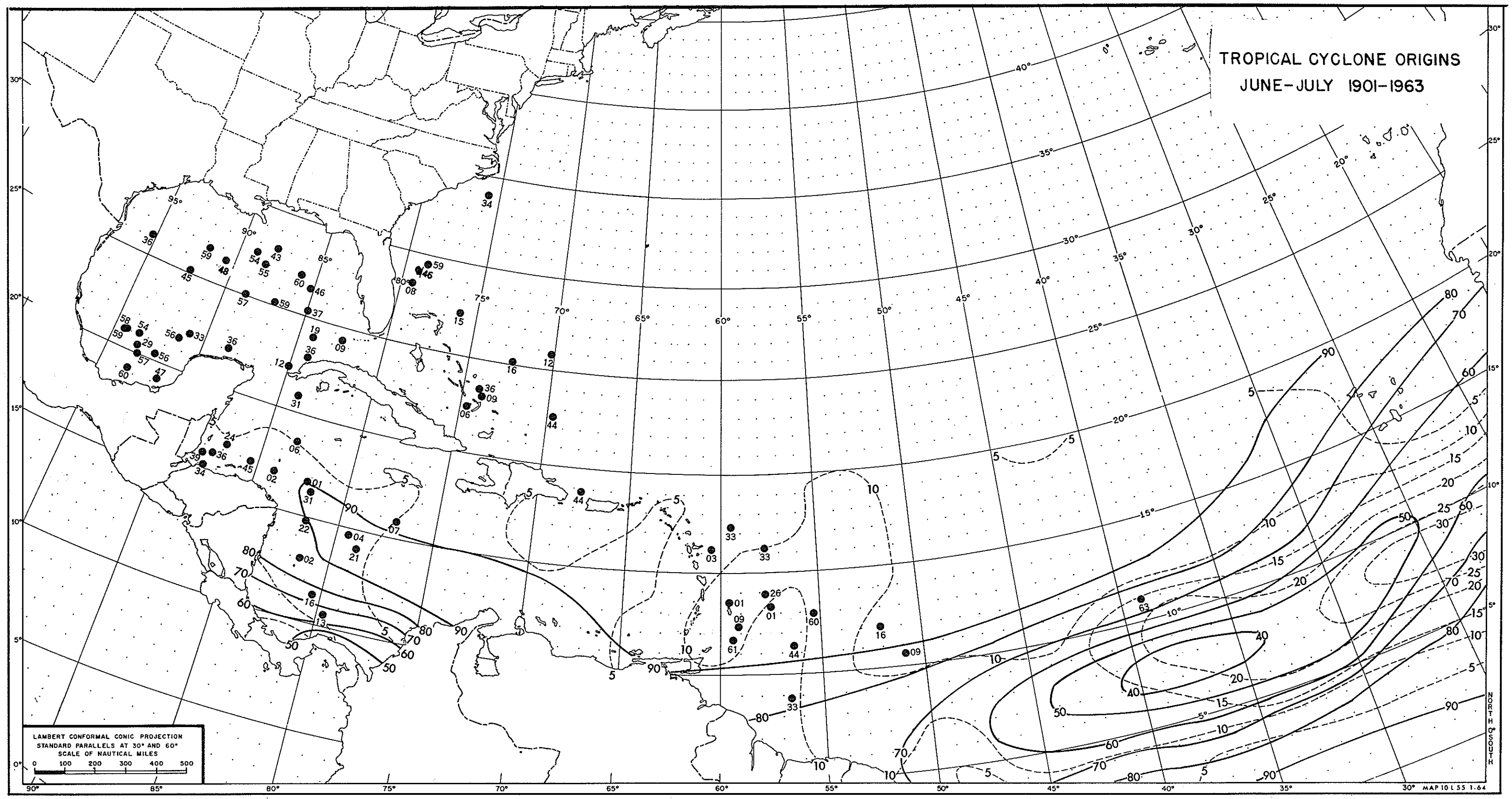

FIGURE 1.—Points of tropical cyclone origin or detection, June and July 1901–1963. Year of occurrence indicated by two digits (01=1901, 63=1963). Solid isopleths are percentage ratio of resultant mean wind vector and mean scalar wind. Dashed isopleths are percentage frequency of precipitation. Adapted from [48]. (Analyses are for July data.)

Wind constancy is defined as $q=100\times V_r/V_s$, where V_r is the magnitude of the resultant mean wind vector and V_s is the scalar mean wind speed. If the wind always blew from one direction, $V_r=V_s$ and $q=100$. High constancy values are characteristic of the trade wind region and minimum constancy is a feature of the convergence zone. Precipitation frequency data for ocean areas are in terms of the percentage of the total number of observations reporting precipitation.

Seasonal shifts in areas of tropical cyclogenesis have been discussed by Colón [5], Cry and Haggard [8], and Haggard [19]. Developments in June and July have been primarily in the southwestern portions of the North Atlantic region. The primary area of genesis

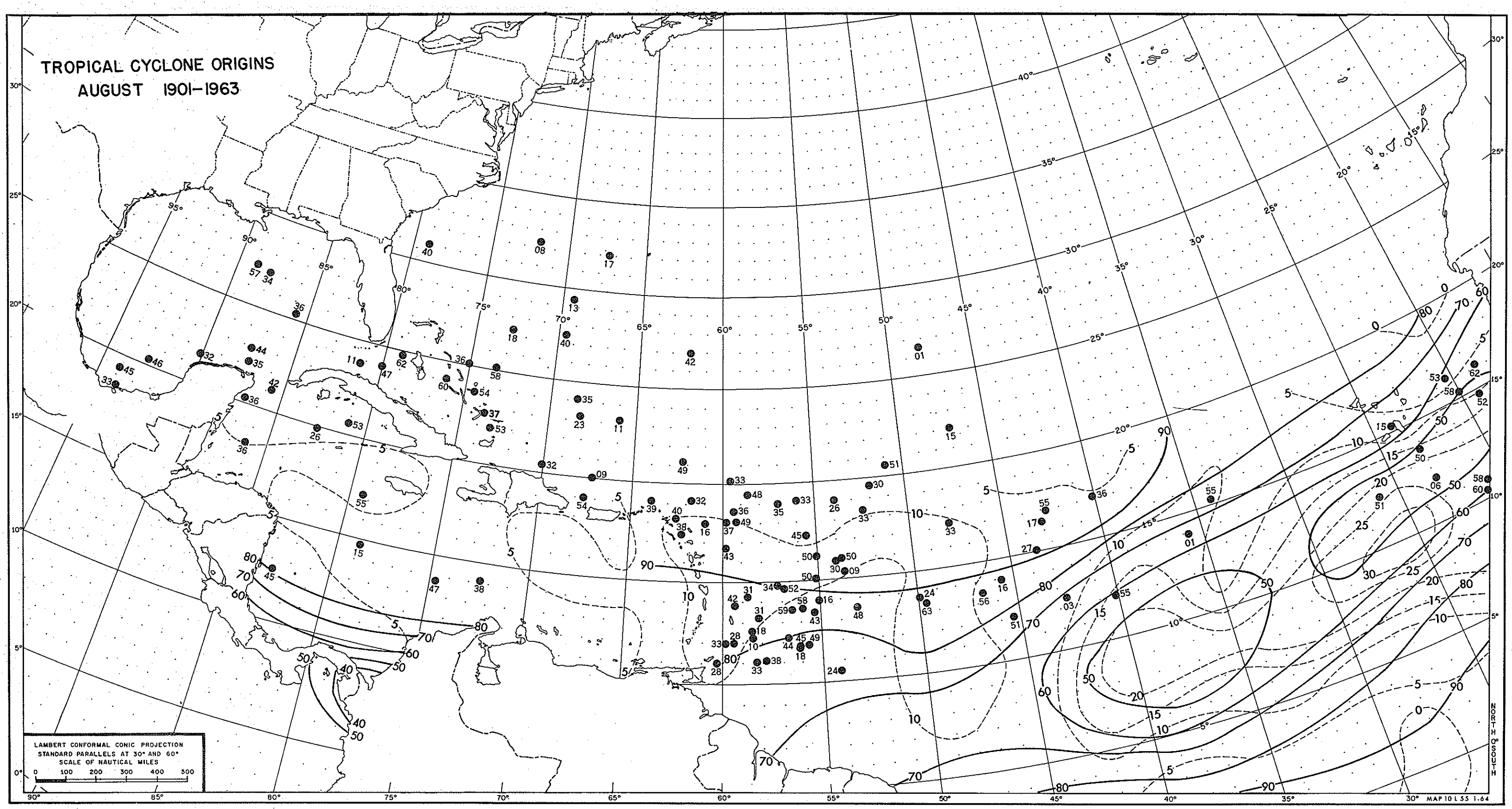

FIGURE 2.—Points of tropical cyclone origin or detection, August 1901–1963.

during August has been east of the Lesser Antilles between 10° and 20° N. Some recent cases have been traced eastward to near Africa. September tropical cyclone developments extend throughout the area south of 30° N., with favored regions between 50° W. and the Lesser Antilles, in the southwestern Gulf of Mexico and the western Caribbean, near the Bahamas, and near the Cape Verde Islands.

The primary area of tropical cyclone development during October shifts to the western sections of the Caribbean, with slight concentrations east of the Bahamas and east of the Lesser Antilles. Off-season (November–May) origins are most frequent over the western Caribbean, and scattered across the region between 20°N. and 30°N. from 50°W. to 65°W., northeast of the West Indies.

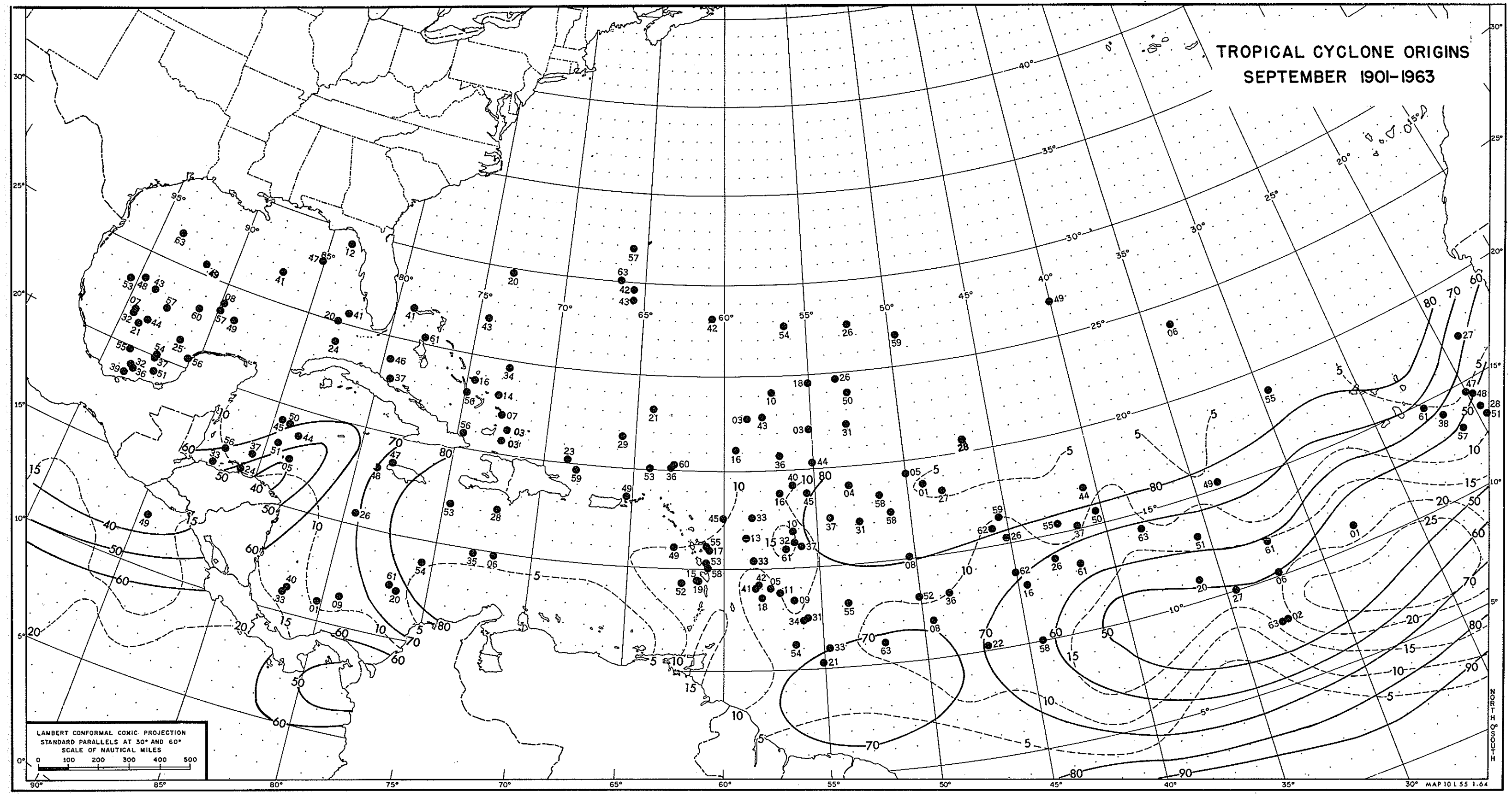

FIGURE 3.—Points of tropical cyclone origin or detection, September 1901–1963.

Overall, 22.8 percent of all North Atlantic tropical cyclones (1901–1963) have been initially tracked between 50°W. and 60°W.; 19.8 percent between 70°W. and 80°W.; and 20.0 percent between 80°W. and 90°W. The region between 60°W. and 70°W., with 12.2 percent has a relative minimum of tropical cyclogenesis, because of the small number of developments over the eastern half of the Caribbean (only 6 cases in the Sea east of 70°W. during 63 years). This feature was first noted by Mitchell before 1924, and served as the impetus for his classic work [26]. Dunn and Miller [13, p. 39] indicated this may be due to significant divergence or spreading out of the easterly surface wind patterns as they are diverted into the semi-permanent low pressure over the Amazon Basin.

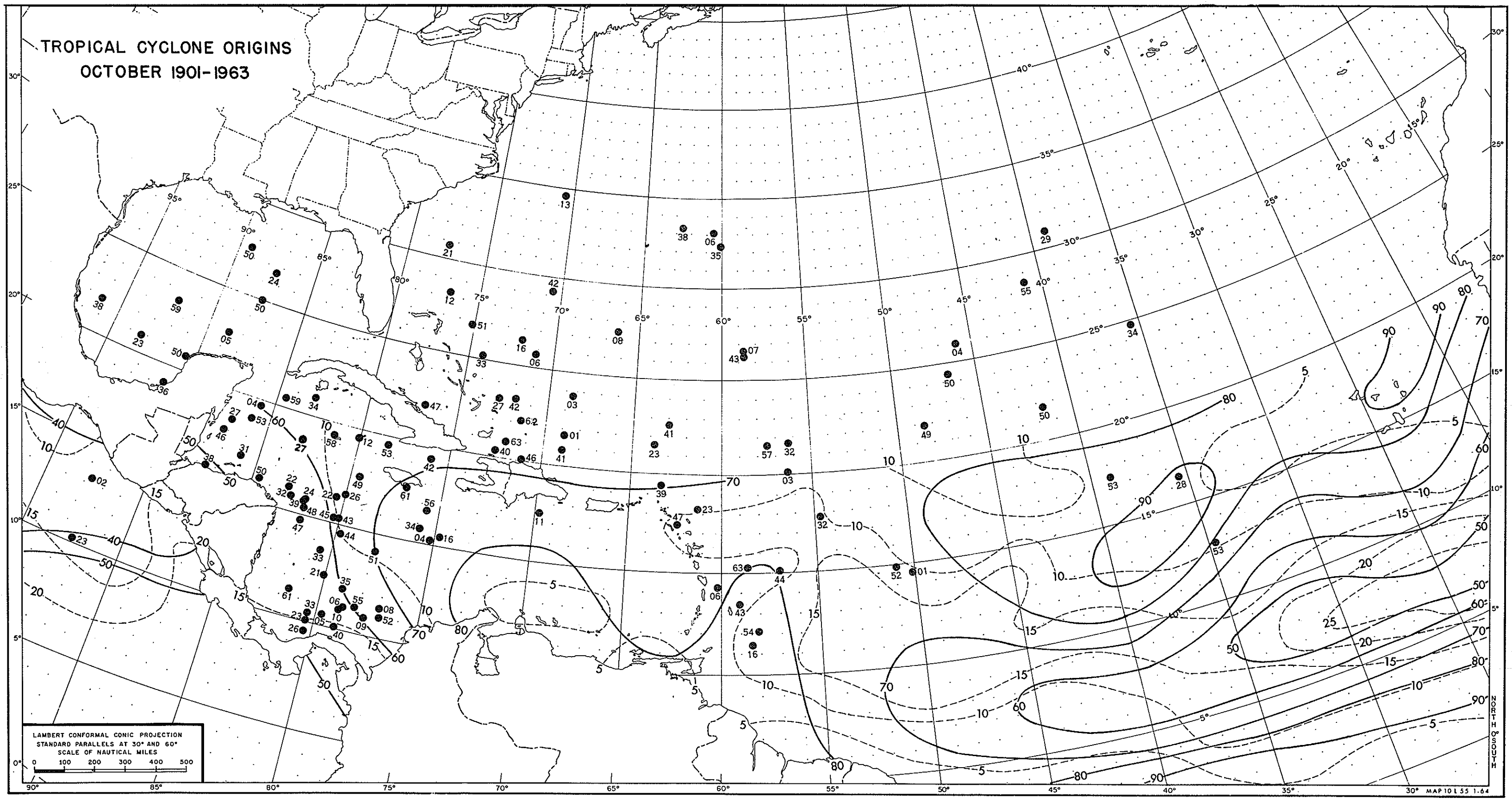

Figure 4.—Points of tropical cyclone origin or detection, October 1901–1963.

Inspection of the areas of tropical cyclone development and the analyses of the intertropical convergence zone indicates clearly that most tropical cyclones have been initially detected north of the mean position of the ITC in the trade wind region where wind constancy is quite high (>80 percent). The most notable exceptions are in the western Caribbean region during September and October.

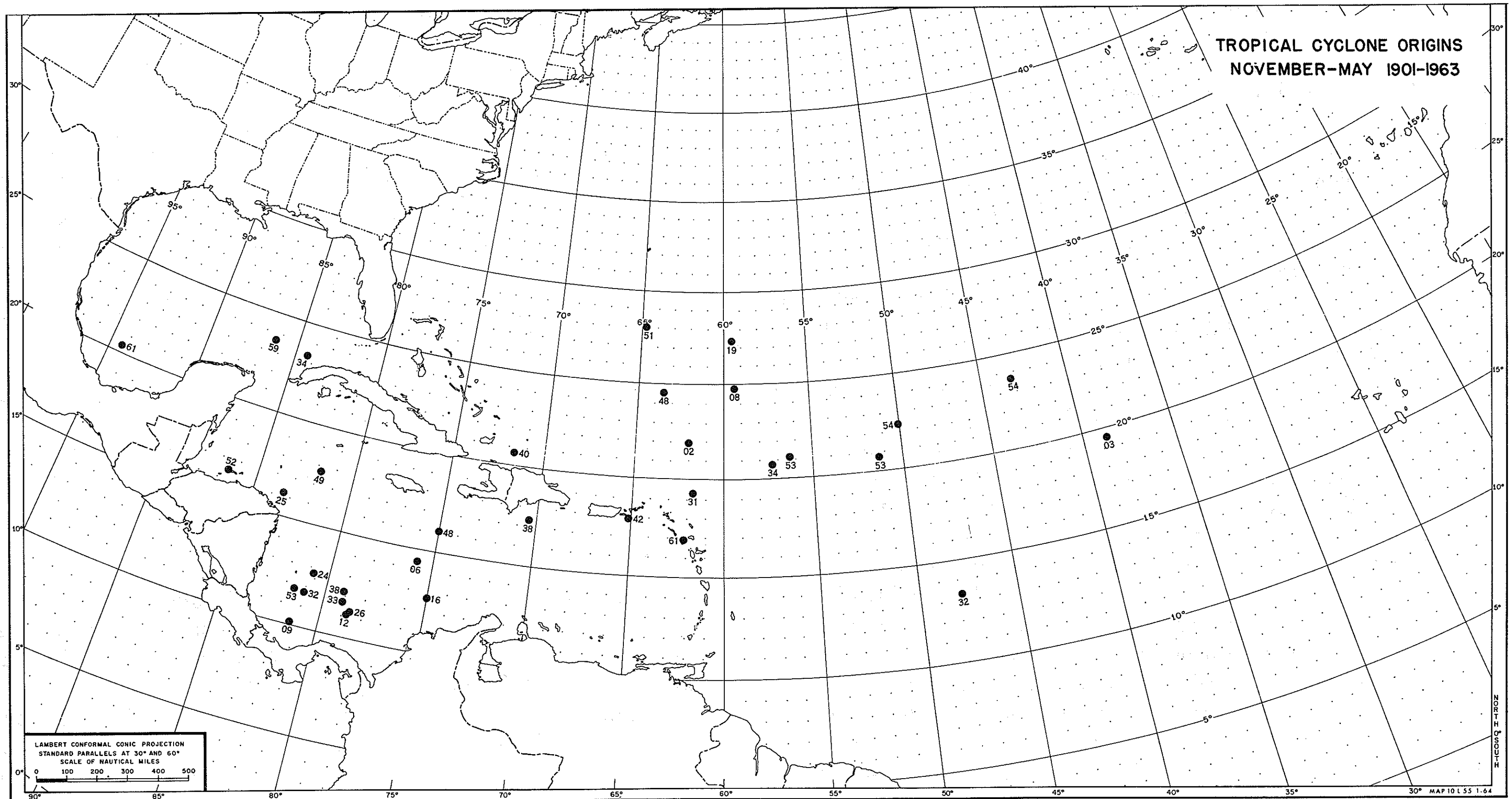

FIGURE 5.—Points of tropical cyclone origin or detection, November–May 1901–1963.

HURRICANE INTENSITY

Figures 6 through 10 show best estimates of the locations where tropical cyclones first attained hurricane intensity, with sustained winds estimated or measured at 74 m.p.h. or higher, during the years 1901 through 1963. Table 4 gives a summary of these locations grouped by several areas of the North Atlantic. Dunn, in a 1956 study [12], indicated that the location of initial hurricane intensity might be identified with a greater degree of accuracy, and also might have a more consistent definition, than the points of initial tropical cyclone development or detection.

Some 290 tropical cyclones reached hurricane force in the North Atlantic region during the years 1901 through 1963. This was about 58 percent of the total number. The patterns of location of initial hurricane intensity are quite similar to those of initial tropical cyclone detection, with expected shifts to the north and west reflecting movement of the cyclones during their tropical storm stages. About 60 percent of North Atlantic tropical cyclones were detected south of 20°N.; but only 45 percent of those which finally reached hurricane intensity attained that force south of 20°N.

During June and July hurricane intensity points have been confined to extreme eastern and western sections of the Caribbean, the western and northern portions of the Gulf of Mexico, and to a region off the United States eastern coast from the Carolinas southward.

In August the area of most frequent initial hurricane intensity extends from the south-central North Atlantic along a broad band north of the West Indies to near the Bahamas, and throughout the Gulf of Mexico. Eight storms reached hurricane force over the eastern two-thirds of the Caribbean, none in the western third.

The pattern for September is similar to August, with the exceptions of several storms (17) that attained hurricane force over the central Atlantic north of 23°N. and a shift to more frequent cases in the western half of the Caribbean (13), compared to 5 in the eastern half.

The initial hurricane intensity pattern for October shifts, along with the tropical cyclone distribution, into the western Caribbean, with 23 of 50 storms reaching hurricane intensity in October located over the Sea west of 75°W. During the off-season months, hurricane intensity points are widely scattered, mainly between 20°N. and 30°N., from the eastern Gulf of Mexico to the central Atlantic.

Overall figures show 60 percent of hurricanes reached that intensity between 50°W. and 80°W., with 78 cases south of 20°N. and 96 north of that latitude. The relative minimum of tropical cyclones originating over the eastern Caribbean is reflected in a minimum of hurricane points (16) between 70°W. and 80°W., south of 20°N., although this longitude band had the greatest overall frequency (63).

TABLE 4.—*North Atlantic hurricane development by areas, 1901–1963. Storm counted in period when hurricane force was reached*

Period	East of 50°W.	50°–60°W.	60°–70°W.	70°–80°W.	80°–90°W.	90°–100°W.	Total
Development South of 20°N.							
June–July	0	0	6	0	3	0	9
August	8	15	7	3	0	0	33
September	18	20	7	5	6	0	56
October	1	1	5	7	15	1	30
Nov.–May	0	0	1	1	0	0	2
Total	27	36	26	16	24	1	130
Percent	20.8	27.7	20.0	12.3	18.5	0.7	--------
Development North of 20°N.							
June–July	0	0	2	7	5	9	23
August	1	4	8	13	6	8	40
September	5	10	10	14	8	9	56
October	3	3	5	9	3	4	27
Nov.–May	1	3	4	4	2	0	14
Total	10	20	29	47	24	30	160
Percent	6.2	12.5	18.1	29.4	15.0	18.8	--------
All Developments							
All Months	37	56	55	63	48	31	290
Percent	12.8	19.3	19.0	21.7	16.6	10.7	--------

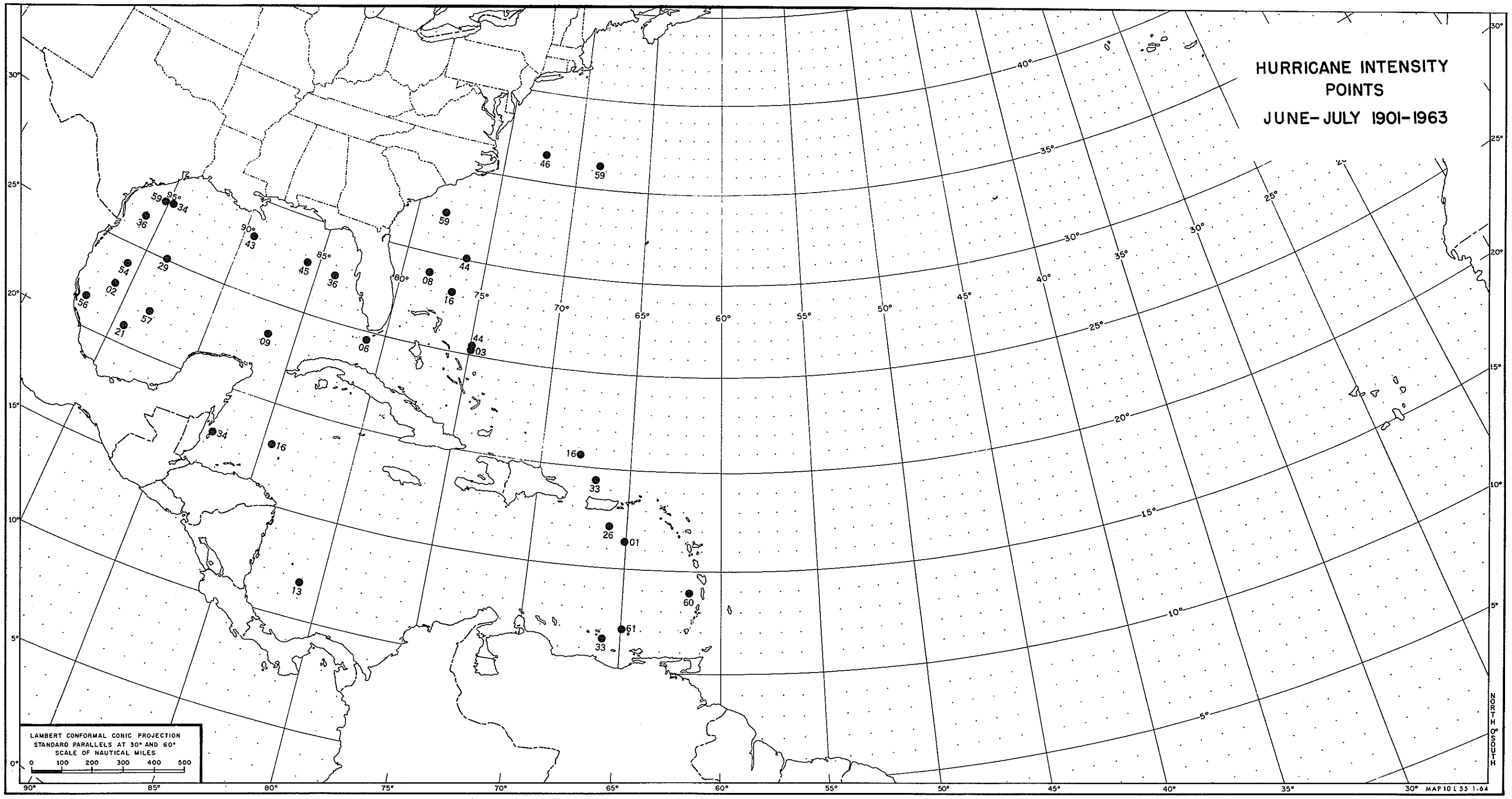

FIGURE 6.—Points of initial hurricane intensity, June and July 1901–1963. Year of occurrence indicated by two digits (01=1901, 63=1963.)

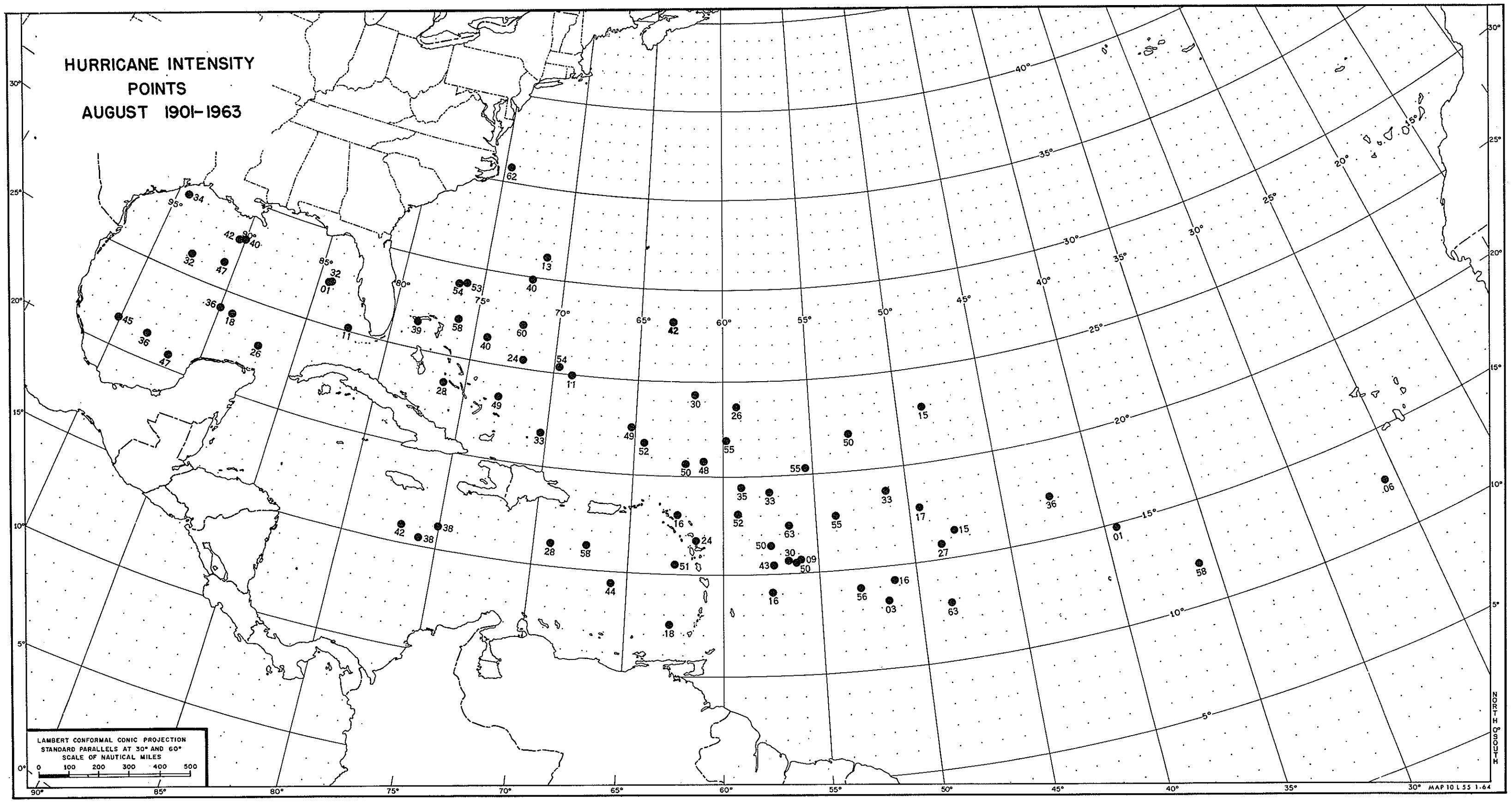

FIGURE 7.—Points of initial hurricane intensity, August 1901–1963.

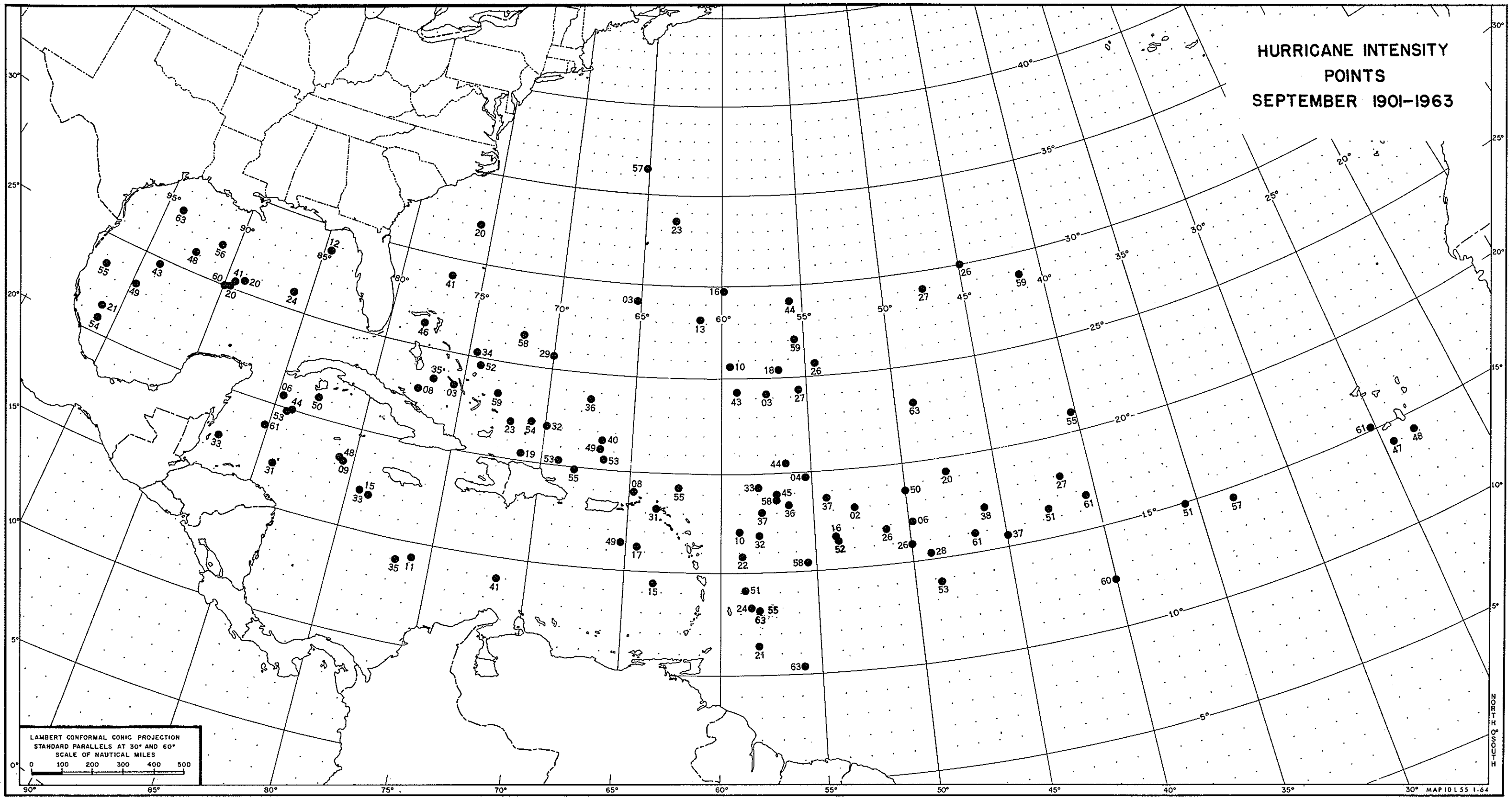

FIGURE 8.—Points of initial hurricane intensity, September 1901–1963.

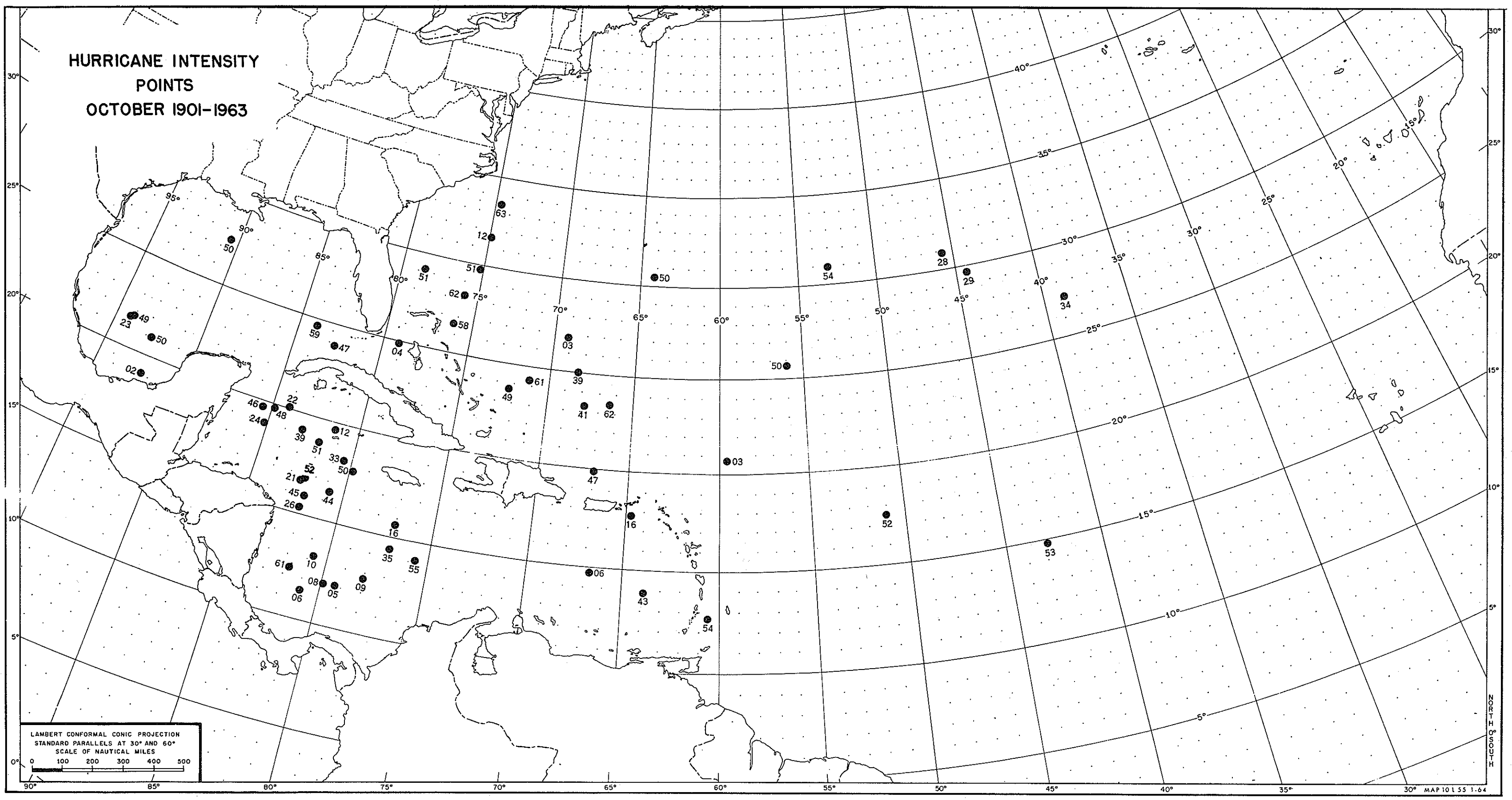

Figure 9.—Points of initial hurricane intensity, October 1901–1963.

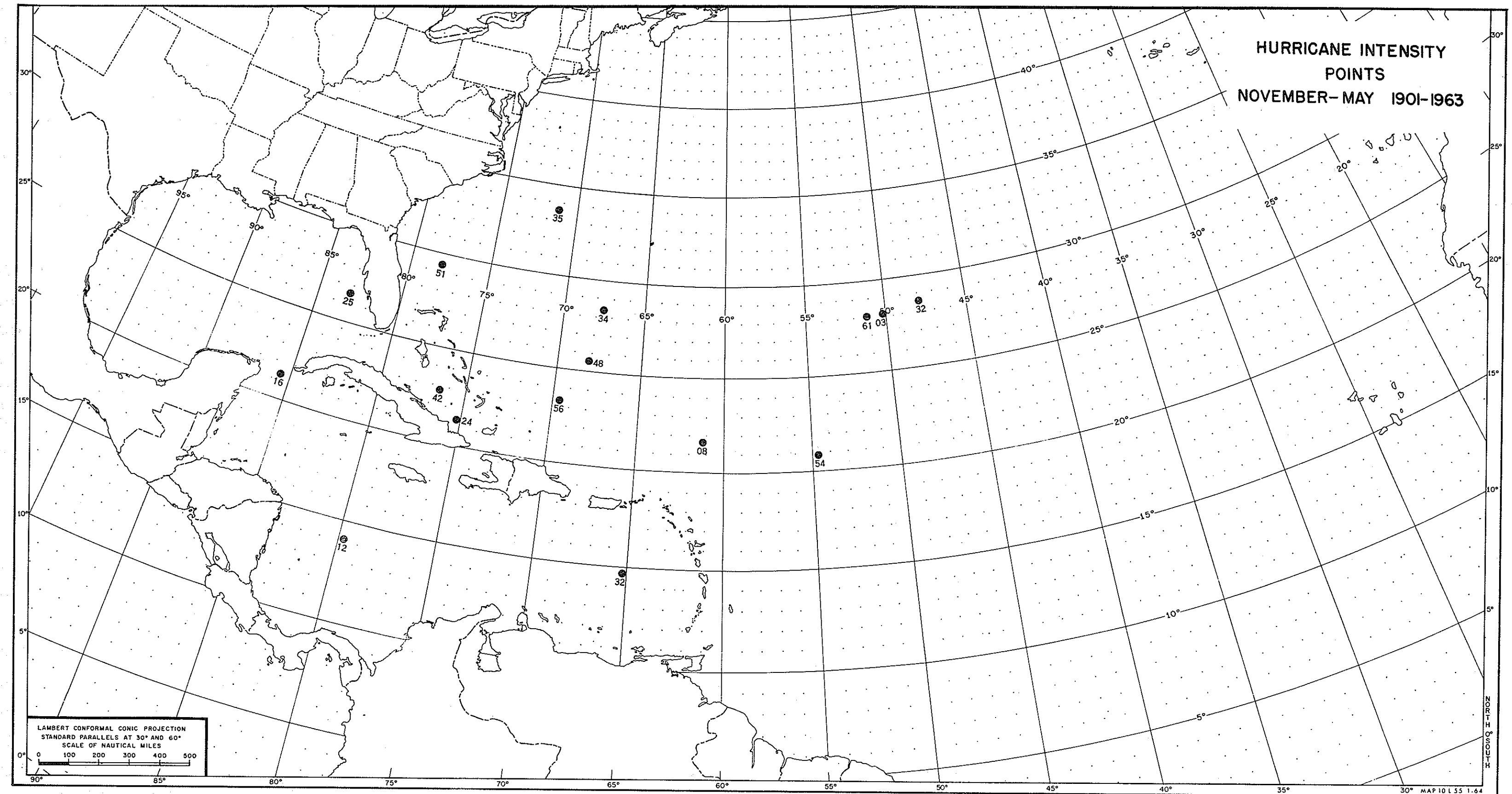

FIGURE 10.—Points of initial hurricane intensity, November–May 1901–1963.

RECURVATURES AND ERRATIC MOVEMENTS

The path of each tropical cyclone is determined by the dynamic physical forces that control the distribution of winds in the troposphere from the surface to above 50,000 feet over an area several hundred miles in diameter surrounding the storm. These local steering winds are, in turn, influenced by the patterns of the large-scale general circulation over a major portion of the hemisphere [33; 52, pp. 43–48]. The general movement of air over most of the Tropics is from the east; in higher latitudes it is usually from the west. Consequently, a large percentage of tropical cyclones move initially toward the west, with some tendency to drift slightly northward as a result of the latitudinal gradient of the Coriolis force. However, as they continue to drift toward higher latitudes, they come under the influence of westerly winds and *recurve* in response to this change in the general flow patterns. Recurvature is most simply defined as the change in the longitudinal component of motion. Several types of recurvature may be distinguished [7, p. 6], but the most frequent by far is a clockwise change in the direction of movement from a westward to an eastward component. The *point of recurvature* is the most westerly location of the cyclone center. These are shown on figures 11 through 15.

Early-season recurvatures have been confined to the area between 25°N. and 35°N. from the western Gulf of Mexico and Texas eastward to the extreme western Atlantic. The principal concentration in August has been off the southeastern coast of the United States between 75°W. and 78°W. In this month the latitudinal limits extend from near 26°N. to 40°N. Only two storms recurved within the Gulf of Mexico; other cyclones in that area passed inland north of 30°N. before completing the change in direction of movement.

September has been the period with the maximum areal extent of the recurvature zone. A few recurvatures occurred south of 20°N. although the majority were still located between 25°N. and 35°N. There have been no regional concentrations as in August, although the overall frequency of 106 was more than twice as great as August's 46. The Gulf of Mexico has had a proportionate share of September recurvatures.

In October all recurvatures have been south of 35°N. While marked concentrations have been absent, the most frequent areas of recurvature have been near Bermuda and over the northwestern Caribbean. Recurvatures in other months have been scattered.

When tropical cyclones move into the area between the two major wind regimes where organized steering currents are not present, the storm center often moves quite erratically. Reductions in forward speed usually occur, and the storm may "drift" over a relatively small area for a considerable time. Paths of some storms have also been blocked by movement toward regions of higher pressure. Complete loops in several tracks have occurred under these conditions. These are shown on figures 11 through 15. Paths of 37 tropical cyclones, of the 500 tracked during 1901–1963, contained single loops, and four had two loops. Clockwise (20) and counterclockwise (21) loops were almost equally frequent; of the double cases, three were counterclockwise, only one was clockwise.

The location of the counterclockwise group was primarily in the western part of the region: 11 cases west of 80°W. and 16 west of 70°W. The seasonal distribution included 3 in May, 5 in June, 5 in September, 7 in October, and 1 in November. The maximum decadal frequency was 8 during 1951–1960, followed by 4 during 1901–1910. The clockwise group has been more widely scattered: 3 in the Gulf of Mexico; a majority over the region from the United States east coast to near 45°W.; and 1 over the south-central Atlantic. The seasonal distribution was 1 in July, 4 in August, 9 in September, 5 in October, and 1 in November. Of the 20 cases, 17 have occurred since 1934, with 8 during 1941–1950 and 4 during 1961–1963.

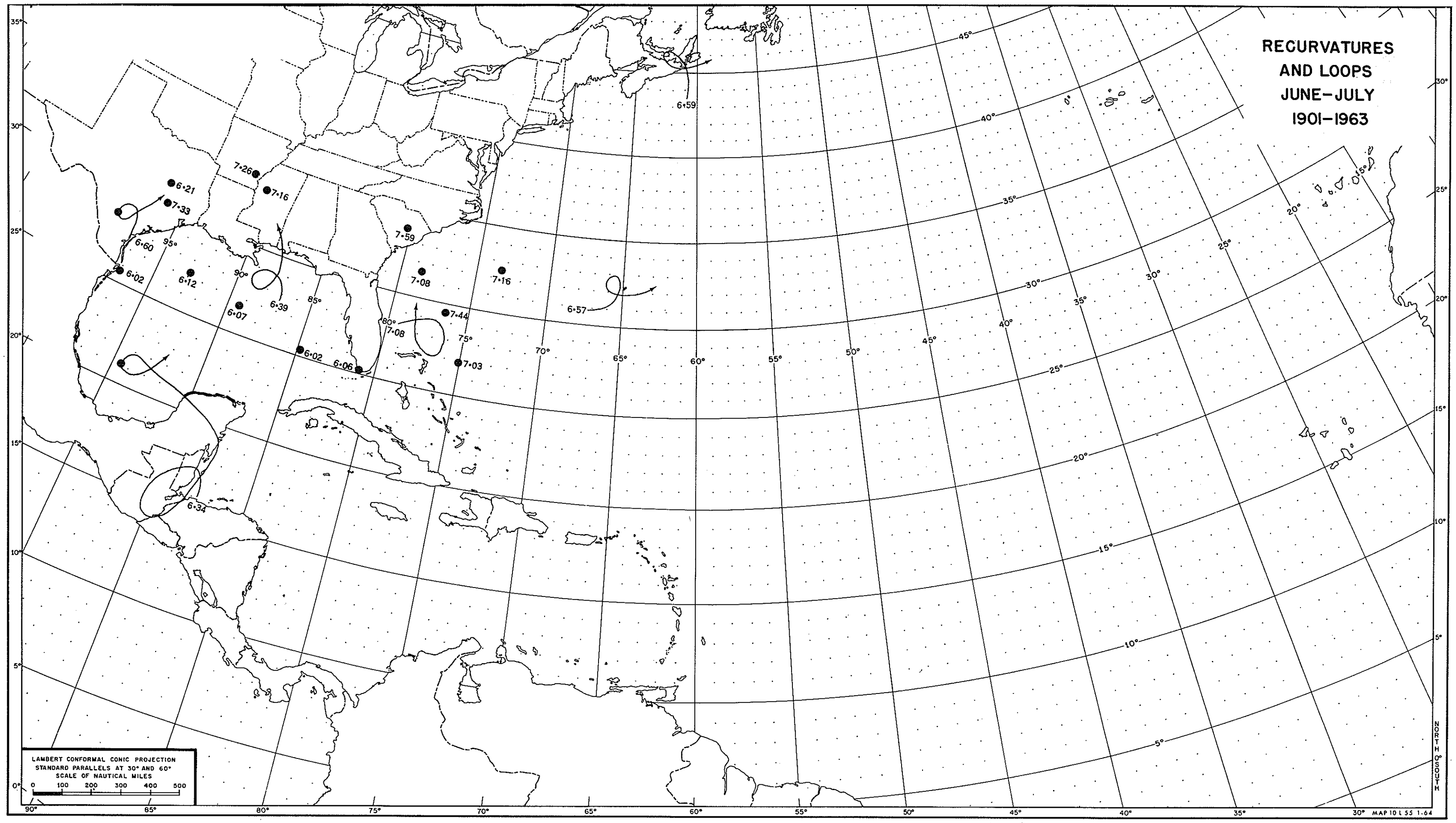

FIGURE 11.—Points of recurvature and locations of loops in tropical cyclone tracks, June and July 1901–1963. Month and year of occurrence indicated by digits (6=June, 7=July, 01=1901, 63=1963).

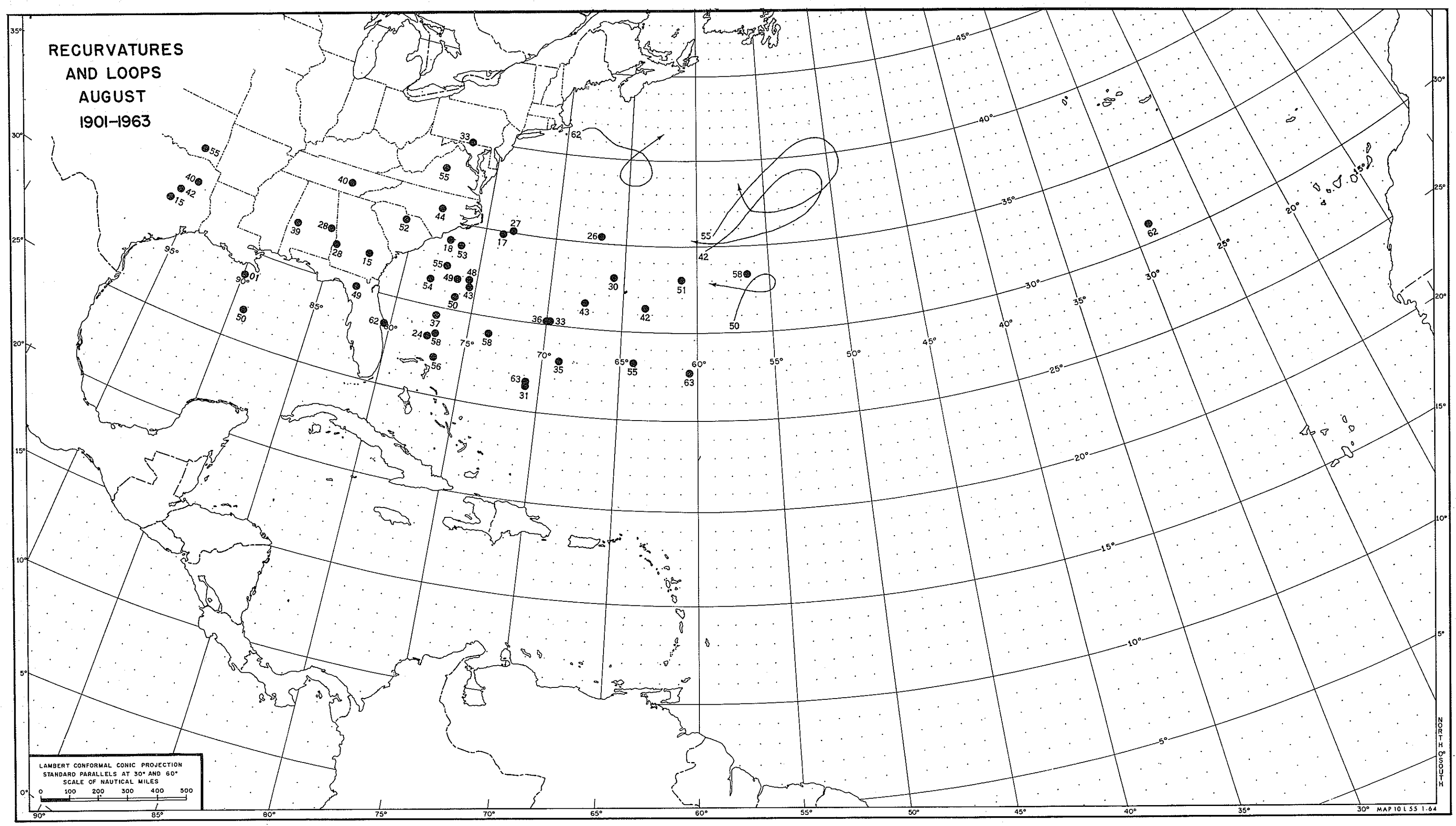

Figure 12.—Points of recurvature and location of loops in tracks, August 1901–1963. Year of occurrence indicated by digits (01=1901, 63=1963).

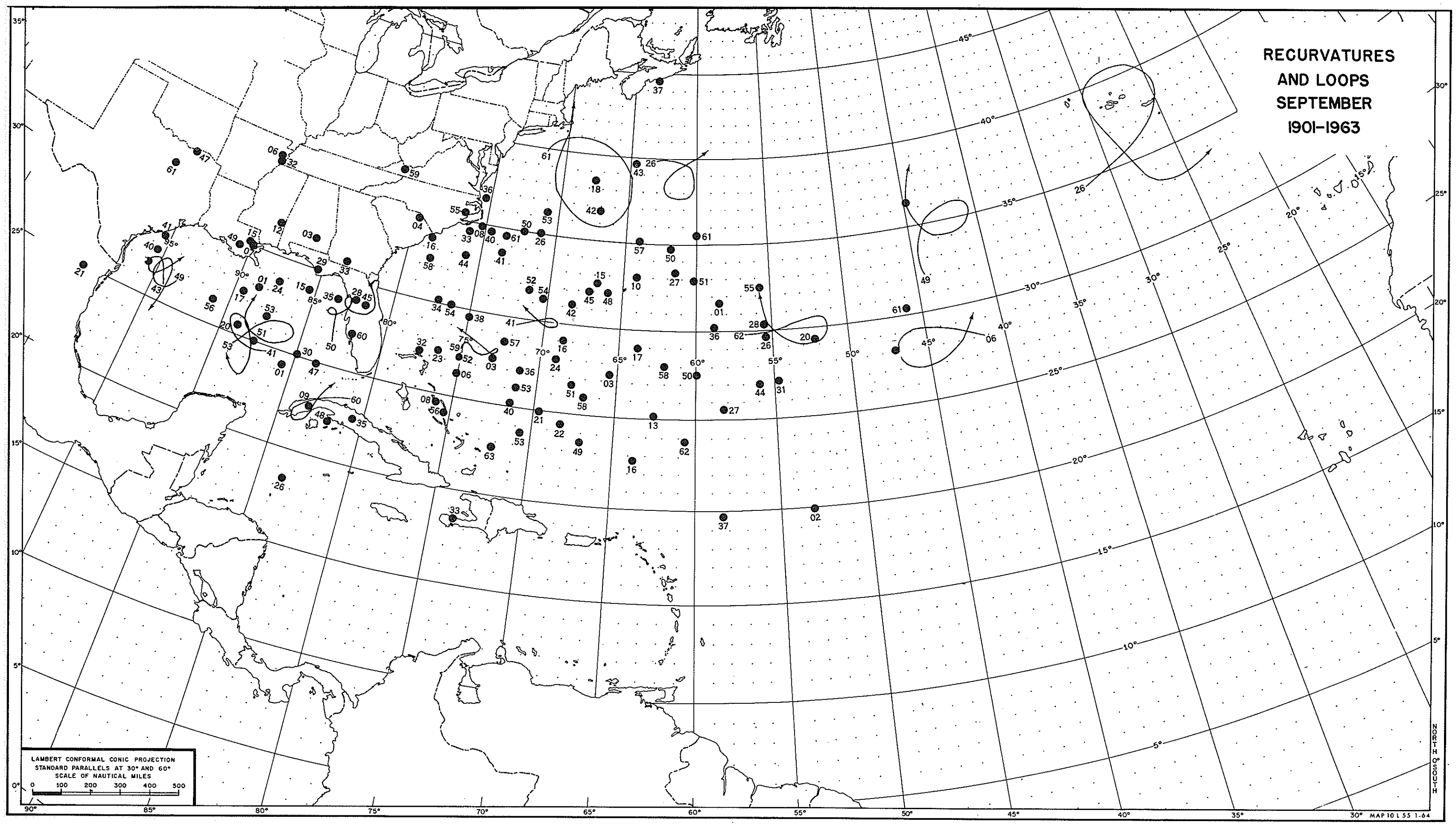

FIGURE 13.—Points of recurvature and locations of loops in tracks, September 1901–1963.

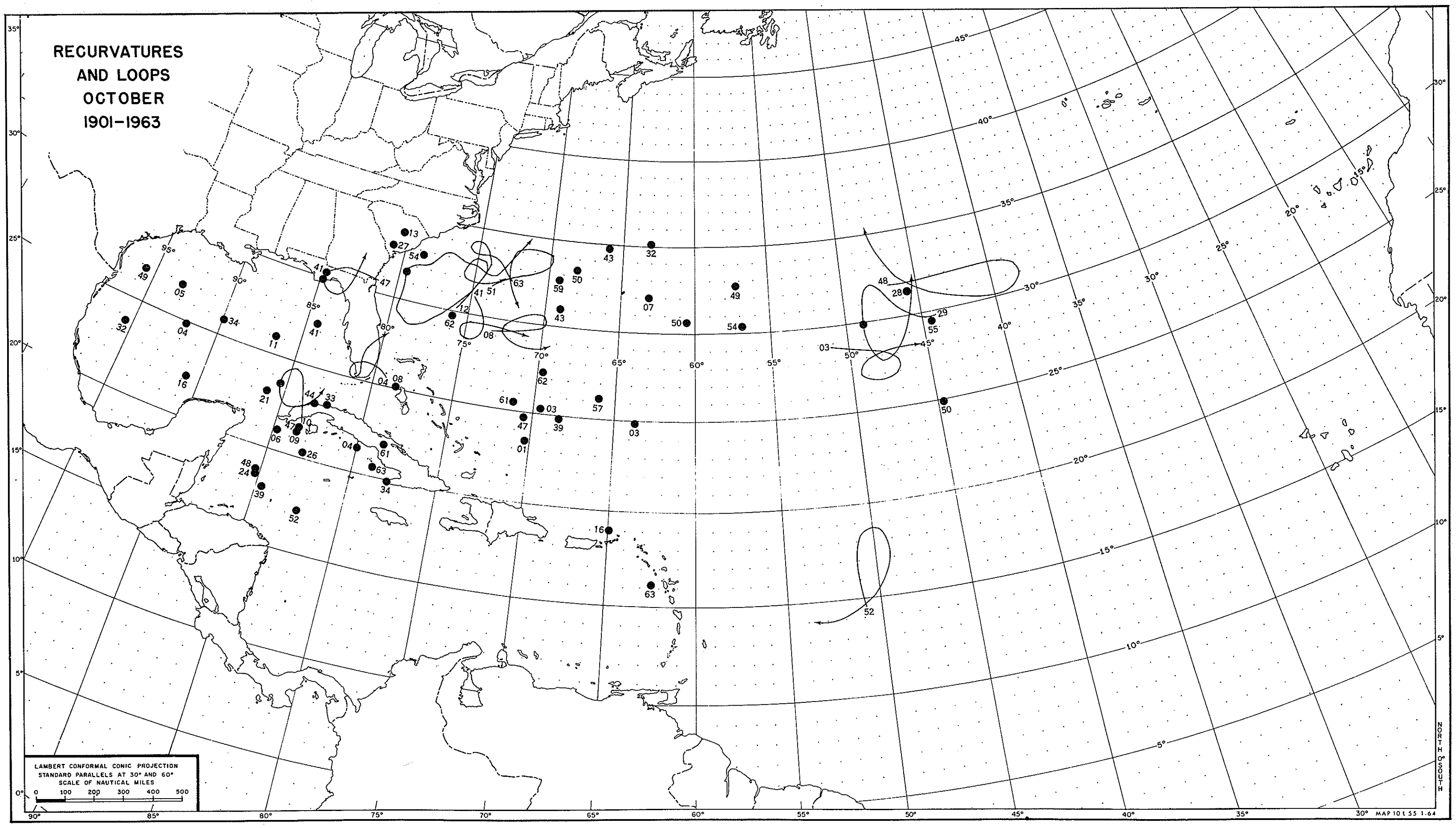

Figure 14.—Points of recurvature and location of loops in tracks, October 1901–1963.

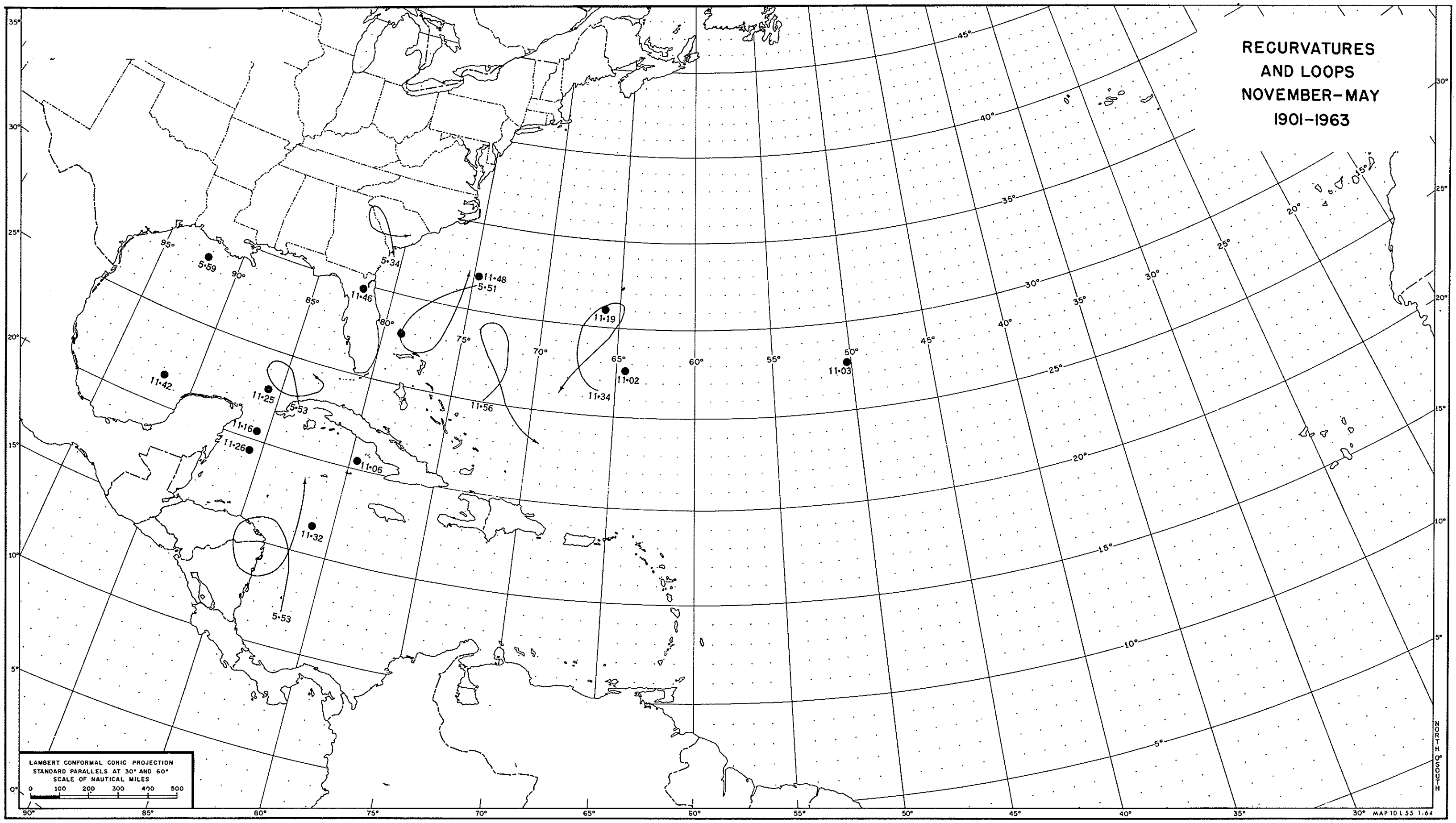

FIGURE 15.—Points of recurvature and locations of loops in tracks, November through May 1901–1963. Month and year of occurrence indicated by digits (11= November, 5= May, 01= 1901, 63= 1963).

Table 5.—*Monthly and annual frequencies of North Atlantic tropical cyclones and hurricanes, 1871–1963*

TROPICAL CYCLONES

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1871						2		2	2				6
1872							1	1	2	1			5
1873						1		1	3				5
1874							1	1	4	1			7
1875									3	1			4
						3	2	5	14	3			27
1876									2	1			3
1877								1	4	2	1		8
1878							1	1	3	4	1		10
1879								3	1	3	1		8
1880						1		4	2	2			9
						1	1	9	12	12	3		38
1881								4	1	1			6
1882									2	1			3
1883								2	1	1			4
1884									2	1			3
1885								3	4	1			8
								9	10	5			24
1871–1885						4	3	23	36	20	3		89
1886						3	1	2	2	2			10
1887					1		2	2	3	6	1	2	17
1888						1	1	2	2	1	2		9
1889					1	1		1	5	1			9
1890								1					1
					2	5	4	8	12	10	3	2	46
1891							1	2	3	4	1		11
1892						1		1	4	3			9
1893						1	1	5	3	1	1		12
1894								2	1	3			6
1895								2	1	3			6
						2	2	12	12	14	2		44
1896							1	1	2	2			6
1897								1	2	2			5
1898								2	5	2			9
1899							1	2	1	2			6
1900								1	3	3			7
							2	7	13	11			33
1886–1900					2	7	8	27	37	35	5	2	123
1901						1	2	2	3	2			10
1902						2			1	1	1		5
1903							1	1	4	2	1		9
1904						1			1	3			5
1905									3	2			5
						4	3	3	12	10	2		34
1906						2		1	3	4	1		11
1907						1			2	1			4
1908			1				1	1	3	2			8
1909						2	2	2	2	1	1		10
1910								1	2	1			4
			1			5	3	5	12	9	2		37
1911								2	1	1			4
1912						1	1		1	2	1		6
1913						1		1	1	1			4
1914									1				1
1915							1	3	1				5
						2	2	6	5	4	1		20
1916						1	2	3	4	3	1		14
1917								2	1				3
1918								3	2				5
1919							1		1		1		3
1920									4				4
						1	3	8	12	3	2		29
1921						1			3	2			6
1922						1			1	2			4
1923								1	1	5			7
1924						1		2	2	2	1		8
1925									1		1		2
						3		3	8	11	2		27
1926							1	2	5	2	1		11
1927								1	3	3			7
1928								2	3	1			6
1929						1			1	1			3
1930								2					2
						1	1	7	12	7	1		29
1931						1	1	2	3	1	1		9
1932					1			3	3	3	1		11
1933					1	1	3	7	5	3	1		21
1934					1	1	1	2	2	3	1		11
1935								3	1	2			6
					3	3	5	17	14	12	4		58
1936						3	2	6	4	1			16
1937							1	2	6				9
1938								3	1	3	1		8
1939						1		1	1	2			5
1940					1			3	2	2			8
					1	4	3	15	14	8	1		46
1941									4	2			6
1942								3	3	3	1		10
1943							1	2	4	3			10
1944							3	2	4	2			11
1945						1	1	4	3	1			10
						1	5	11	18	11	1		47
1946						1	1	1	1	2			6
1947							1	2	3	3			9
1948					1		1	2	3	1	1		9
1949								3	7	2	1		13
1950								4	3	6			13
					1	1	3	12	17	14	2		50
1951					1			3	4	2			10
1952		1						2	2	2			7
1953					1			3	4	4	1	1	14
1954						1	1	2	4	1	1	1	11
1955							1	4	5	2			12
		1			2	1	2	14	19	11	2	2	54
1956						1	1	1	4	1			8
1957						2		1	4	1			8
1958						1		4	4	1			10
1959					1	2	2	1	3	2			11
1960						1	2	2	2				7
					1	7	5	9	17	5			44
1961							1		6	2	2		11
1962								2	2	1			5
1963							1	1	5	2			9
							2	3	13	5	2		25
1901–1963		1	1		8	33	37	113	173	110	22	2	500

HURRICANES

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1871													
1872													
1873													
1874													
1875													
1876													
1877													
1878													
1879													
1880													
1881													
1882													
1883													
1884													
1885													
1871–1885													
1886						2	1	2	2	1			8
1887							1	2	3	2	1	1	10
1888						1		2		1	1		5
1889					1			1	3				5
1890								1					1
					1	3	2	8	8	4	2	1	29
1891							1	2	3	2			8
1892								1	2	1			4
1893						1	1	5	3				10
1894								1	1	3			5
1895								1		1			2
						1	2	10	9	7			29
1896							1	1	2	2			6
1897								1	1				2
1898								2	2				4
1899							1	2	1	1			5
1900								1	2				3
							2	7	8	3			20
1886–1900					1	4	6	25	25	14	2	1	78
1901							1	2					3
1902						1			1	1			3
1903							1	1	3	2	1		8
1904									1	1			2
1905										1			1
						1	2	3	5	5	1		17
1906						1		1	2	2			6
1907													0
1908			1				1		2	1			5
1909							1	1	1	1			4
1910									2	1			3
			1			1	2	2	7	5			18
1911								2	1				3
1912									1	2	1		4
1913						1		1	1				3
1914													0
1915								3	1				4
						1		6	4	2	1		14
1916						1	2	3	2	2	1		11
1917								1	1				2
1918								2	1				3
1919									1				1
1920									4				4
						1	2	6	9	2	1		21
1921						1			2	1			4
1922									1	1			2
1923								1	1	1			3
1924								2	1	1	1		5
1925											1		1
						1		3	5	4	2		15
1926							1	2	4	1			8
1927								1	3				4
1928								2	1	1			4
1929						1			1	1			3
1930								2					2
						1	1	7	9	3			21
1931									2				2
1932								3	1	1	1		6
1933						1	1	3	3	1			9
1934						1	1	1	1	1	1		6
1935								2	1	2			5
						2	2	9	8	5	2		28
1936						1	1	3	2				7
1937									3				3
1938								2	1				3
1939								1		2			3
1940								3	1				4
						1	1	9	7	2			20
1941									3	1			4
1942								3			1		4
1943							1	1	2	1			5
1944							2	1	3	1			7
1945						1		1	1	1			4
						1	3	6	9	4	1		24
1946							1		1	1			3
1947								2	1	2			5
1948								1	3	1	1		6
1949								2	4	1			7
1950								4	3	4			11
							1	9	12	9	1		32
1951					1			2	3	2			8
1952								2	2	2			6
1953								2	3	1			6
1954						1		2	3	1		1	8
1955								3	5	1			9
					1	1		11	16	7		1	37
1956							1	1	1	1			4
1957						1			2				3
1958								3	3	1			7
1959						1	2		3	1			7
1960							1	2	1				4
						2	4	6	10	3			25
1961							1		5	1	1		8
1962								1	1	1			3
1963							1	1	4	1			7
							2	2	10	3	1		18
1901–1963			1		1	13	20	79	111	54	10	1	290

6. FREQUENCIES OF NORTH ATLANTIC TROPICAL CYCLONES

MONTHLY AND ANNUAL FREQUENCIES

The left half of table 5 shows the number of tropical cyclones beginning in the North Atlantic region during each month from 1871 through 1963. The right half of the table lists, since 1886, the number that reached hurricane intensity. Five-year subtotals have been listed to facilitate rapid summarization of any portion of the record. The previously discussed limitations of data prompted the division of the table into the three periods shown. The inadequacies of the data in the earlier years also prompted the decision to confine much of the following discussion to the period after 1900.

Figure 16 is a graphic summary of the annual frequency of tropical cyclones and of hurricanes for the years 1871–1963 and 1886–1963,

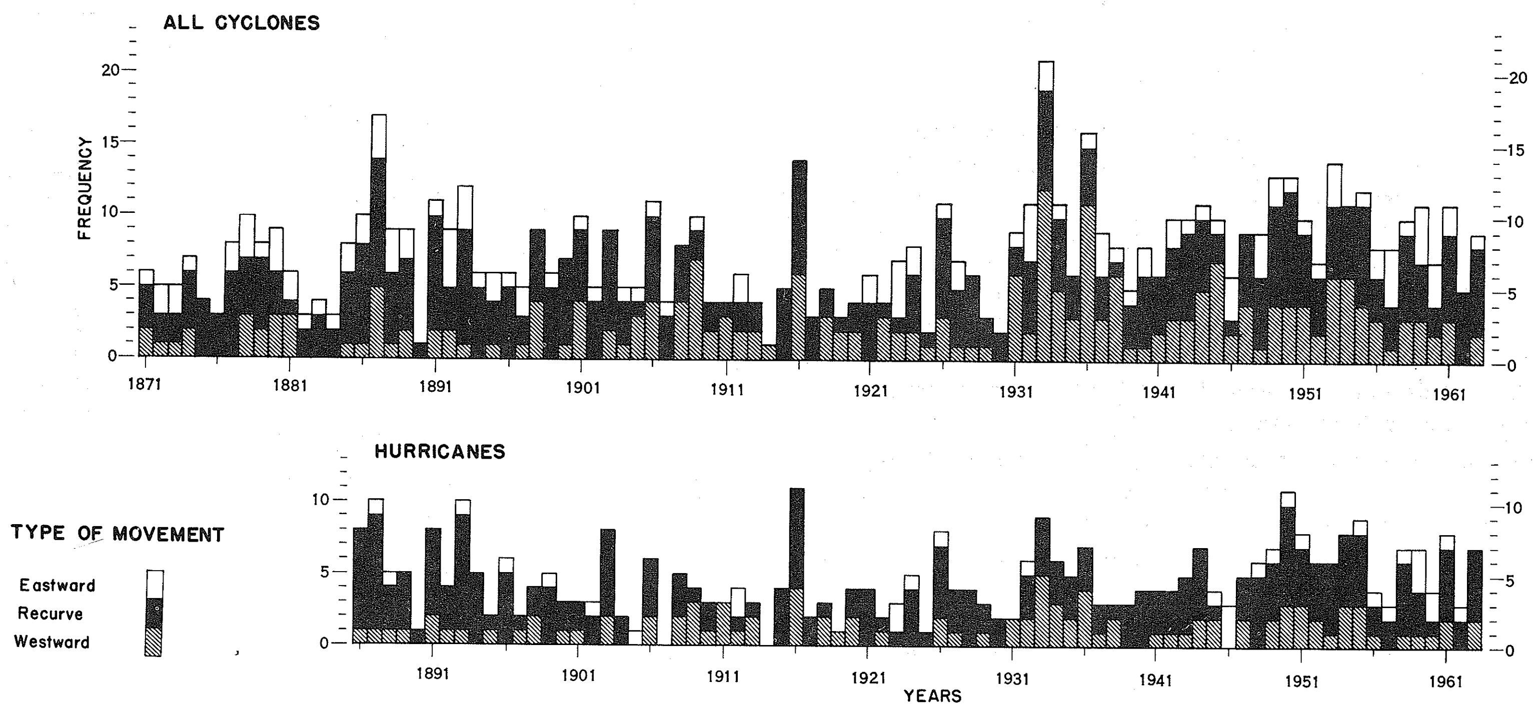

FIGURE 16.—Total annual frequency of North Atlantic tropical cyclones, 1871–1963, and of North Atlantic hurricanes, 1886–1963. General type of movement is indicated by varous shadings.

TABLE 6.—*North Atlantic tropical cyclones, generalized movement characteristics, 1871–1963*

	All Tropical Cyclones										
	WESTWARD (Always in Easterlies)			RECURVED			EASTWARD (Always in Westerlies)			TOTAL	
	Number	Percent	Annual Mean	Number	Percent	Annual Mean	Number	Percent	Annual Mean	Number	Annual Mean
1871–1885	18	20.2	1.2	49	55.1	3.3	22	24.7	1.5	89	6.0
1886–1900	21	17.1	1.4	77	62.6	5.1	25	20.3	1.7	123	8.2
1901–1963	186	37.2	3.0	241	48.2	3.8	73	14.6	1.2	500	8.0
	Tropical Cyclones of Hurricane Intensity										
	WESTWARD (Always in Easterlies)			RECURVED			EASTWARD (Always in Westerlies)			TOTAL	
	Number	Percent	Annual Mean	Number	Percent	Annual Mean	Number	Percent	Annual Mean	Number	Annual Mean
1886–1900	13	16.7	0.9	60	76.9	4.0	5	6.4	0.3	78	5.2
1901–1963	86	29.7	1.4	176	60.7	2.8	28	9.6	0.4	290	4.6

respectively. The storms have been grouped according to general movement characteristics. Hatched sections indicate the number of cyclones that remained under the influence of the general easterly circulation of the lower latitudes throughout their existence—these proceed on a *westward* track. The shaded sections indicate the cyclones that *recurved*—these pass from the influence of easterly to westerly circulation patterns. The unshaded sections indicate frequencies of tropical cyclones that remained under the influence of westerly circulation patterns throughout their existence—these proceed on an *eastward* track.

Table 6 is a summary of the numbers of tropical cyclones in each of the movement categories during the three periods. Almost half of the tropical cyclones and over 60 percent of the hurricanes occurring during 1901–1963 recurved. Figure 17 shows frequency distributions of the annual number of westward-moving, recurving, and eastward-moving tropical cyclones, and figure 18 gives the frequency per year. In tables 7–9 are tabulated observed frequencies and probabilities of occurrence by months.

TABLE 7.—*Observed frequency of North Atlantic tropical cyclone occurrences*

	All Tropical Cyclones, 1871–1900						
Number of Storms	June	July	Aug.	Sept.	Oct.	Nov.	Dec.–May
0	22	20	4	1	3	23	27
1	6	9	11	6	12	6	3
2	1	1	10	10	7	1	1
3	1	0	2	7	5	0	0
4	0	0	2	4	2	0	0
5	0	0	1	2	0	0	0
6	0	0	0	0	1	0	0
	All Tropical Cyclones, 1901–1963						
Number of Storms	June	July	Aug.	Sept.	Oct.	Nov.	Dec.–May
0	37	36	14	1	10	42	51
1	20	19	13	17	17	20	12
2	5	6	19	10	22	1	0
3	1	2	11	15	10	0	0
4	0	0	4	13	2	0	0
5	0	0	0	4	1	0	0
6	0	0	1	2	1	0	0
7	0	0	1	1.	0	0	0

TABLE 8.—*Observed frequency of North Atlantic hurricane occurrences*

Number of Storms	June	July	Aug.	Sept.	Oct.	Nov.	Dec.-May
Hurricanes, 1886–1900							
0	12	9	0	3	6	13	13
1	2	6	8	3	5	2	2
2	1	0	6	5	3	0	0
3	0	0	0	4	1	0	0
4	0	0	0	0	0	0	0
5	0	0	1	0	0	0	0
Hurricanes, 1901–1963							
0	50	46	21	8	21	53	60
1	13	14	16	26	32	10	3
2	0	3	16	10	9	0	0
3	0	0	9	13	0	0	0
4	0	0	1	4	1	0	0
5	0	0	0	2	0	0	0

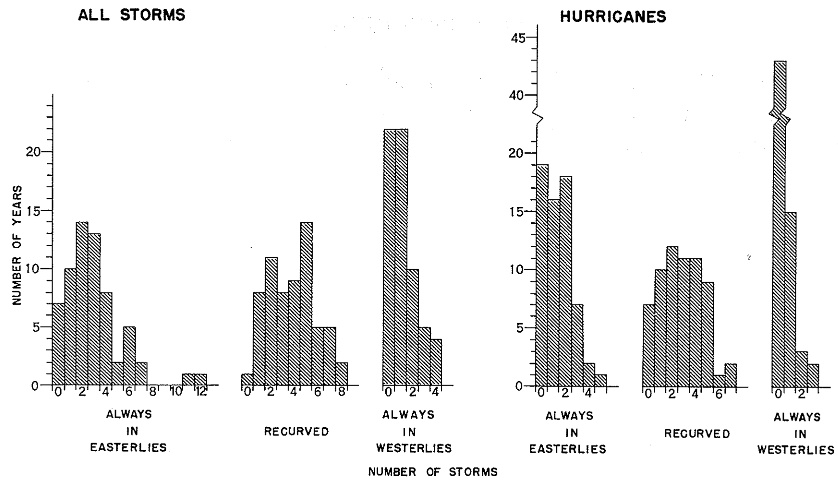

FIGURE 17.—Distribution of annual frequencies of North Atlantic tropical cyclones and hurricanes, grouped according to general type of movement, 1901–1963.

TABLE 9.—*Observed probability of occurrence of North Atlantic tropical cyclones 1901–1963*

	June	July	Aug.	Sept.	Oct.	Nov.	Other Months
All Tropical Cyclones							
At least 1	0.41	0.43	0.78	0.98	0.84	0.33	0.19
2 or more	0.09	0.13	0.57	0.71	0.57	0.02	0
3 or more	0.02	0.03	0.27	0.56	0.22	0	0
4 or more	0	0	0.10	0.32	0.06	0	0
Hurricanes							
At least 1	0.21	0.27	0.67	0.87	0.67	0.16	0.05
2 or more	0	0.05	0.41	0.46	0.16	0	0
3 or more	0	0	0.16	0.30	0.02	0	0
4 or more	0	0	0.02	0.10	0.02	0	0

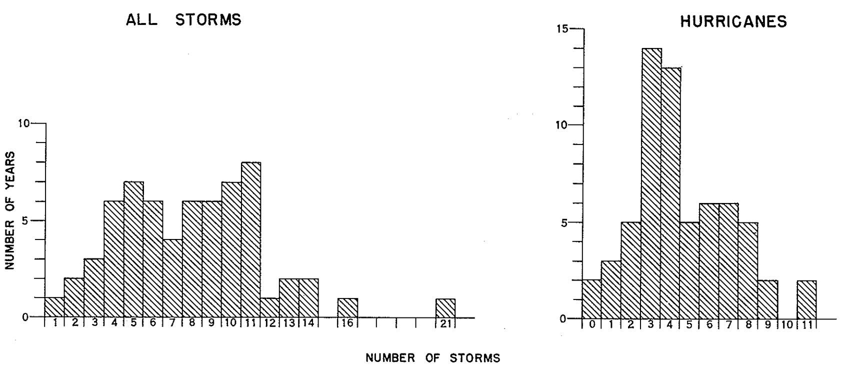

FIGURE 18.—Total annual frequency distributions of North Atlantic tropical cyclones and hurricanes, 1901–1963.

DAILY FREQUENCY

Figure 19 illustrates the incidence of tropical cyclones in the North Atlantic region on a daily basis for the six months that comprise the principal season. The period of record is again 1901–1963. The upper part of this figure is a summary of the total number of tropical cyclones occurring on each day. Individual counts were made of each storm track. If two or more tropical cyclones were in existence on any single day, each was counted. The total number of days that tropical cyclones were indicated to

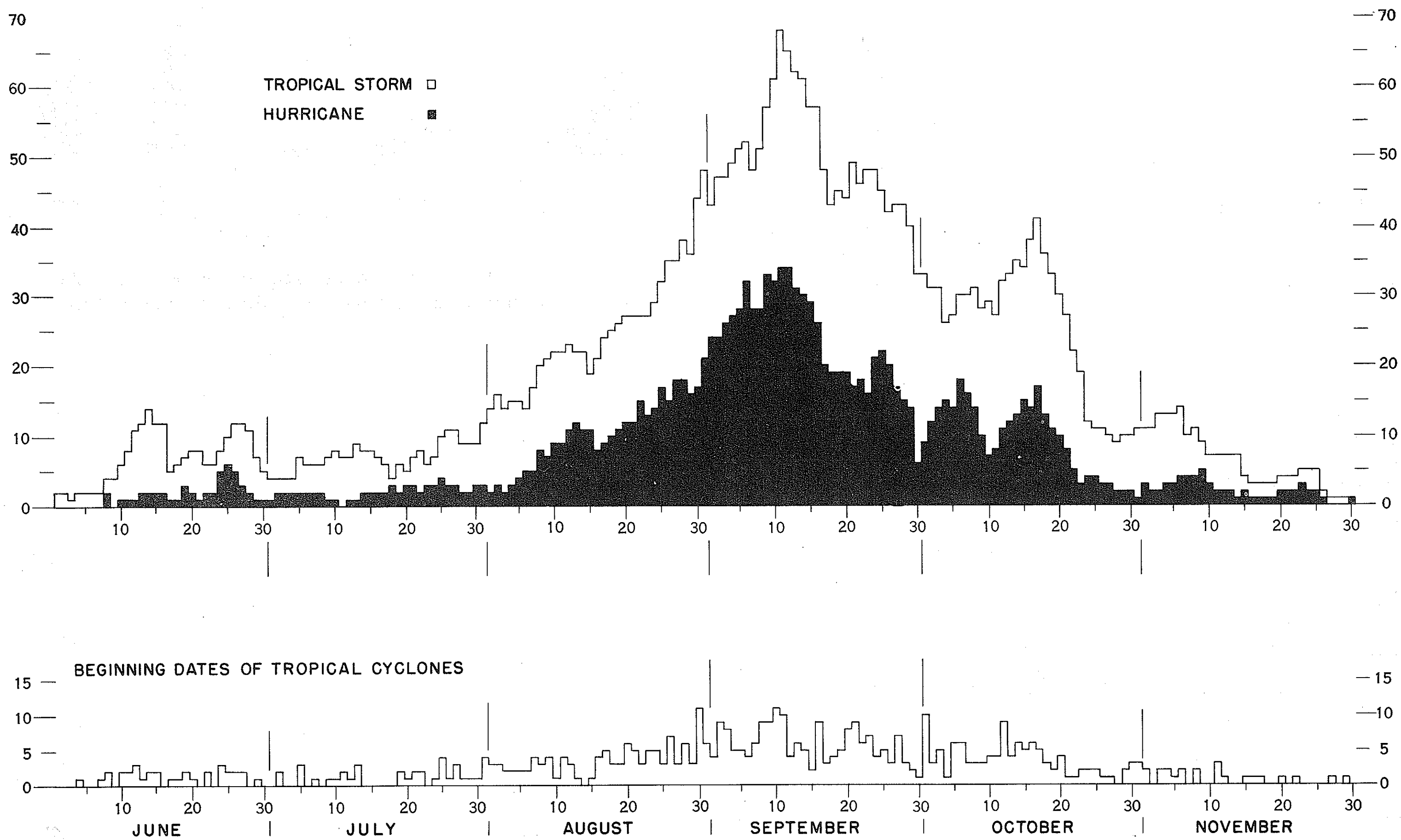

FIGURE 19.—Total number of North Atlantic tropical cyclones in existence on each date between June 1 and November 30 during the years 1901–1963. Dates of origin or detection of tropical cyclones are shown in the bottom graph. Frequency of cyclones of hurricane force is indicated by shading.

be of hurricane intensity on the track charts is shown by the black shading. The lower portion of the figure gives a summary of the dates of origin or detection for the tropical cyclones occurring during 1901–1963.

Cry and Haggard [8] included a similiar figure for the years 1901–1960 and figures showing the contributions to the overall activity curve by those tropical cyclones originating in six geographical regions of the North Atlantic. On the basis of daily numbers of tropical cyclones, June and July are prelude to the principal tropical cyclone season. A steady increase in activity persists during August and early September. The peak of activity has been centered in the second week of September. A secondary maximum occurred in mid-October, produced by tropical cyclones that form over the western Caribbean during that period.

TROPICAL CYCLONES AFFECTING THE UNITED STATES

The incidence of tropical cyclone effects in various sections of the eastern and southern United States is shown in figure 20. The lower graph represents the annual frequency of these storms with hurricane (solid shading), tropical storm (hatching), and tropical depression (clear) intensity (measured by the strength of the sustained winds) at the time they passed inland over the continental United States. The intensities have been estimated from all available information.

The count of tropical cyclone centers which have entered specific land areas (shown in the six upper graphs by the square shape of the appropriate symbol) does not completely reflect the occurrence of tropical cyclone effects in each area. Those tropical cyclones responsible for high winds, heavy rains, and/or high tides in any indicated region, that moved inland in other areas or passed a short distance offshore without the center moving inland, are shown by the circular symbols on the graphs.

The intensity of each cyclone, measured by the strength of the sustained winds, is indicated on all the graphs by solid shading when all or a portion of the area was affected by winds of 74 m.p.h. or higher; by hatched shading when all or a portion of the area was affected by winds of 39 through 73 m.p.h., and by no shading when the area was affected by a hurricane or tropical storm that did not move directly over it or that had diminished in strength so that winds in the area were less than 39 m.p.h.

These frequencies do not include the many non-developing tropical depressions, easterly waves, and other minor perturbations responsible for many of the periods of disturbed weather over the southern States during the warmer seasons.

Periods of relatively high or low tropical cyclone activity in the several areas may be noted. The frequencies of tropical cyclones have not been shown to vary systematically in such a way that has predictive value. It will be demonstrated in the next section that no statistically significant trends exist in the total frequencies of tropical cyclones or hurricanes affecting the United States.

The regions of maximum tropical cyclone activity have been Florida, Texas, the middle Gulf coast, and the Carolinas. Hurricanes were quite frequent in Florida in the 1940's, and in Texas in the 1930's and 1940's. From 1951 through 1959 only two marginal hurricanes passed over Florida. The Carolinas, in contrast, experienced widespread effects of hurricanes primarily during the 1950's. The largest number of hurricanes in a 2-year period, for any area, 6, occurred there in 1954 and 1955.

The middle Gulf Coast region, a favored area for hurricanes during the early years of this century, has had relatively few severe tropical cyclones during the past 20 years. The middle Atlantic States have been exposed to hurricane effects mainly from storms moving parallel to the coast at varying distances offshore and from storms that move inland to the south. Only two hurricanes—one in 1903, another in 1923—made initial contact with the coastline in that region.

The northeastern States were only rarely and moderately subject to hurricanes between 1901 and 1938. Sections of the region have been severely affected several times since the massive hurricane of 1938, notably in 1944, twice in 1954, and in 1960. These five severe hurricanes all made landfall over southern New England, and the effects of intense winds, torrential rainfall, and high storm surges were felt in large sections of this highly developed urban area.

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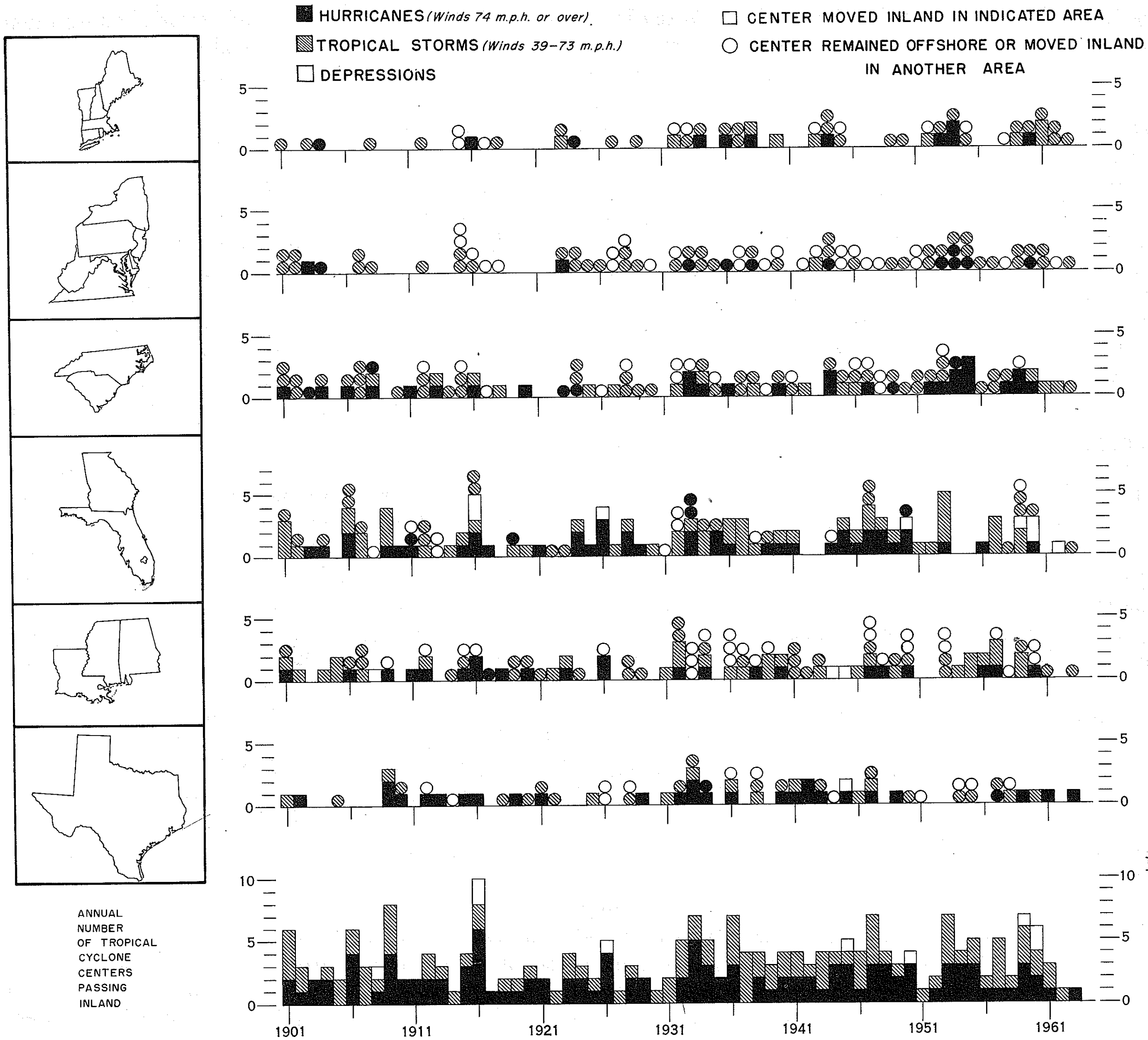

Figure 20.—Annual frequency of tropical cyclones moving inland over the United States or passing close enough offshore to affect significantly various sections of the coast with storm or hurricane winds, heavy rainfall, or high storm tides, 1901–1963.

TRENDS IN NORTH ATLANTIC TROPICAL CYCLONE FREQUENCIES

The summaries in the previous sections contain information on several aspects of tropical cyclones in the North Atlantic region. The important question of trends in tropical cyclone frequencies, however, has not been considered. To examine this problem briefly, the methods developed by H. C. S. Thom [42, 43, 44] have been applied to four 1901–1963 annual frequency series: (a) all tropical cyclones; (b) all hurricanes; (c) those tropical cyclones, and (d) those hurricanes affecting the United States.

Two assumptions are necessary: (1) tropical cyclones have been sufficiently uncommon that they may be considered rare events; and (2) conditions for possible cyclogenesis exist during a relatively long period of the year. If these conditions exist some tendency toward correlation between successive cyclones within each season would be present.

Riehl [34, p. 1001] emphasized the rarity of tropical cyclone development relative to the total possible if all incipient areas of disturbed weather over the tropical oceans did become organized circulations. Cry and Haggard [8, p. 349] noted repetitive patterns of cyclogenesis in several areas during some seasons indicative of persistence of factors favorable for tropical cyclone development over a period of several weeks. These observations tend to support the necessary assumptions.

Thom's analyses [44] showed correlation in frequencies led to a Pascal or negative binomial distribution; consideration of the partial series of cyclones affecting the United States led to reduced correlation, and the use of the Poisson distribution. The methods for fitting these distributions to climatological data were discussed in [42]. The interested reader is referred to these papers for details.

The results of the calculations include (a) regression equations for trend, (b) analyses of variance to test trend significance, (c) an indication (r^2) of the amount of variability explained by linear trend, (d) calculated probabilities and frequencies, (e) methods for removal of the effects of linear trend, if present, including adjustments to obtain more valid probability estimates.

The F-tests for trend for the series of tropical cyclones and hurricanes affecting the United States were not significant. Similar

TABLE 10.—*Analysis of variance, North Atlantic tropical cyclones, 1901–1963*

	Sum of squares	Degrees of freedom	Variance
Regression	17. 1661	1	17. 1661
Residuals	88. 8885	61	1. 4572
Total	106, 0546	62	1. 7106

$r^2=17.1661/106.0546=0.1619$
$y=4.7404+0.0287t$
$F=17.1661/1.4572=11.78$

TABLE 11.—*Analysis of variance, North Atlantic hurricanes, 1901–1963*

	Sum of squares	Degrees of freedom	Variance
Regression	17. 0495	1	17. 0495
Residuals	60. 1872	61	0. 9867
Total	77. 2367	62	1. 2458

$r^2=17.0495/77.2367=0.2207$
$y=3.4364+0.0286t$
$F=17.0495/0.9867=17.28$

tests for the complete series of tropical cyclones and hurricanes were significant, and indicated an upward linear trend totaling about 1.8 storms for both series over the 63-year period. When compared to the year-to-year differences in frequency this increase is small: linear trend accounts for 16 percent of the total variability for the tropical cyclone series and 22 percent for the hurricane series. These results are shown in tables 10 and 11.

Factors that might contribute to increased total frequencies of tropical cyclones over the entire North Atlantic region, while the frequencies of tropical cyclones affecting the United States remained relatively stable may include: (a) warmer sea-surface temperatures over the tropical Atlantic, resulting in shifts of the major regions of cyclogenesis to central and eastern sections of the ocean and recurvature of these cyclones before they reached the United States; or (b) gradual improvement in tropical cyclone detection through additional observations.

A complete analysis of these possible explanations has not been attempted here. Willett [58] and Dunn and Miller [13, pp. 55–57] have discussed possible long-term changes in temperature that might influence the general circulation patterns and, consequently, the areas of cyclogenesis and the paths of tropical cyclones. The wide-ranging data-collection networks gradually developed during the past few decades have permitted the detection of a number of short-lived tropical cyclones in relatively remote and untraveled sections of the ocean. Several storms of this type might easily have gone undetected during earlier years.

TABLE 12.—*Poisson distribution of tropical cyclones reaching United States coast, 1901–1963*

No. storms per year (x)	Calculated probability function (f_c)	Observed occurrence (g_o)	Calculated frequency (g_c)	Probability annual frequency $\geq x$ $(1-F_c)$
0	0.0282	0	1.78	1.0000
1	.1005	8	6.33	.9718
2	.1790	14	11.30	.8713
3	.2135	12	13.45	.6923
4	.1906	13	12.01	.4788
5	.1361	6	8.57	.2882
6	.0810	3	5.10	.1521
7	.0413	5	2.60	.0711
8	.0184	1	1.16	.0298
9	.0073	0	.46	.0114
10	.0026	1	.16	.0041

$\bar{x}=3.57$ $s^2=3.93$
Adequacy of Poisson: $P(\chi^2_{62}>68.2)>0.20$
Goodness of Fit: $P(\chi^2_4>1.69)>0.70$

TABLE 13.—*Poisson distribution of hurricanes reaching United States coast, 1901–1963*

No. storms per year (x)	Calculated probability function (f_c)	Observed occurrence (g_o)	Calculated frequency (g_c)	Probability annual frequency $\geq x$ $(1-F_c)$
0	0.1557	10	9.81	1.0000
1	.2896	14	18.24	.8843
2	.2693	22	16.97	.5547
3	.1670	12	10.52	.2854
4	.0776	3	4.89	.1184
5	.0289	1	1.82	.0408
6	.0090	1	.57	.0119

$\bar{x}=1.86$ $s^2=1.64$
Adequacy of Poisson: $P(\chi^2_{62}>54.8)>0.70$
Goodness of Fit: $P(\chi^2_4>3.18)>0.50$

TABLE 14.—*Negative binomial distribution for complete series of tropical cyclones, 1901–1963 (not adjusted for trend).*

No. storms per year (x)	Calculated probability function (f_c)	Observed occurrence (g_o)	Calculated frequency (g_c)	Probability annual frequency $\geq x$ $(1-F_c)$
0	0.0027	0	0.17	1.0000
1	.0121	1	.76	.9973
2	.0300	2	1.89	.9852
3	.0540	3	3.40	.9552
4	.0787	6	4.96	.9012
5	.0984	7	6.20	.8225
6	.1097	6	6.91	.7241
7	.1114	4	7.02	.6144
8	.1050	6	6.61	.5030
9	.0929	6	5.85	.3980
10	.0780	7	4.91	.3051
11	.0625	8	3.94	.2271
12	.0482	1	3.04	.1646
13	.0359	2	2.26	.1164
14	.0259	2	1.63	.0805
15	.0182	0	1.15	.0546
16	.0125	1	.78	.0364
17	.0084	0	.53	.0239
18	.0055	0	.34	.0155
19	.0035	0	.22	.0100
20	.0022	0	.14	.0065
21	.0014	1	.09	.0043

$\bar{x}=7.94$ $s^2=13.87$ $p^*=0.7469$
$k^*=10.63$ $C=29.54$
Adequacy of Poisson: $P(\chi^2_{62}>108.33)<0.001$
Goodness of Fit: $P(\chi^2_6>2.80)>0.80$

TABLE 15.—*Negative binomial distribution for complete series of hurricanes, 1901–1963 (not adjusted for trend).*

No. storms per year (x)	Calculated probability function (f_c)	Observed occurrence (g_o)	Calculated frequency (g_c)	Probability annual frequency $\geq x$ $(1-F_c)$
0	0.0190	2	1.20	1.0000
1	.0654	3	4.12	.9810
2	.1207	5	7.60	.9156
3	.1587	14	10.00	.7949
4	.1664	13	10.48	.6362
5	.1480	5	9.32	.4698
6	.1159	6	7.30	.3218
7	.0820	6	5.17	.2059
8	.0533	5	3.36	.1239
9	.0323	2	2.03	.0706
10	.0184	0	1.16	.0308
11	.0100	2	.63	.0199

$\bar{x}=4.60$ $s^2=6.15$ $p^*=0.3359$
$k^*=13.69$ $C=62.42$
Adequacy of Poisson: $P(\chi^2_{62}>82.79)<0.05$
Goodness of Fit: $P(\chi_4^2>1.14)>0.80$

TABLE 16.—*Distribution of North Atlantic tropical cyclones, 1901–1963 adjusted for trend to 1963*

No. Storms per year (x)	Probability function		Calculated frequency		Probability annual frequency $\geq x$	
	Negative binomial (f_{nb})	Poisson (f_p)	Negative binomial (g_{cnb})	Poisson (g_{cp})	Negative binomial ($1-F_{nb}$)	Poisson ($1-f_p$)
0	0.0003	0.000036	0.02	0.002	1.0000	1.0000
1	.0021	.0004	.13	.03	.9997	.999964
2	.0071	.0019	.45	.12	.9976	.9996
3	.0170	.0064	1.07	.40	.9905	.9977
4	.0320	.0164	2.02	1.03	.9735	.9913
5	.0506	.0336	3.19	2.12	.9415	.9749
6	.0697	.0573	4.39	3.61	.8909	.9413
7	.0862	.0838	5.43	5.28	.8212	.8840
8	.0972	.1071	6.12	6.75	.7350	.8002
9	.1014	.1217	6.39	7.67	.6378	.6931
10	.0991	.1245	6.24	7.84	.5364	.5714
11	.0913	.1158	5.75	7.30	.4373	.4469
12	.0801	.0987	5.05	6.22	.3460	.3311
13	.0671	.0777	4.23	4.90	.2659	.2324
14	.0540	.0568	3.40	3.58	.1988	.1547
15	.0419	.0387	2.63	2.44	.1448	.0979
16	.0314	.0248	1.98	1.56	.1029	.0592
17	.0229	.0149	1.44	.94	.0715	.0344
18	.0162	.0085	1.02	.54	.0486	.0195
19	.0112	.0046	.71	.29	.0324	.0110
20	.0076	.0023	.48	.14	.0212	.0064
21	.0050	.0011	.32	.07	.0136	.0041

$\bar{x}_a=10.23$ $s_a^2=11.62$ $p_a=0.5974$ $k_a=17.12$

TABLE 17.—*Distribution of North Atlantic hurricanes, 1901–1963 adjusted for trend to 1963*

No. storms per year (x)	Probability function		Calculated frequency		Probability annual frequency $\geq x$	
	Negative binomial (f_{nb})	Poisson (f_p)	Negative binomial (g_{cnb})	Poisson (g_{cp})	($1-F_{nb}$)	($1-F_p$)
0	0.0020	0.0017	0.13	0.11	1.0000	1.0000
1	.0123	.0109	.77	.69	.9980	.9983
2	.0374	.0348	2.36	2.19	.9857	.9874
3	.0764	.0738	4.81	4.65	.9483	.9526
4	.1181	.1176	7.44	7.41	.8719	.8788
5	.1473	.1498	9.28	9.44	.7537	.7612
6	.1545	.1590	9.73	10.02	.6065	.6114
7	.1400	.1447	8.82	9.12	.4520	.4524
8	.1120	.1152	7.06	7.26	.3120	.3077
9	.0803	.0816	5.05	5.14	.2000	.1925
10	.0523	.0520	3.29	3.28	.1197	.1105
11	.0312	.0301	1.97	1.90	.0674	.0589

$\bar{x}_a=6.37$ $s_a^2=4.789$ $p_a=0.0569$ $k_a=112.0$

The probability functions were next fitted: the Poisson distribution for tropical cyclones and hurricanes reaching the United States coasts (tables 12 and 13) and the negative binomial distribution for the complete series of tropical cyclones and hurricanes (tables 14 and 15). The calculated probabilities are the f_c-columns of the four tables corresponding to the frequencies, x. The number of years (g_o) with x observed cyclones in the 63-year record are shown in the third column of each table. The expected or calculated frequencies ($g_c=f_c\times 63$) are shown in the fourth column. Comparison of the observed and calculated frequencies is a measure of the goodness of the fit. These comparisons have also been made statistically and are shown below each table together with the means and variances of the distribution. The last column ($1-F_c$) of the tables is the probability that the annual frequency will equal or exceed x.

Because the data of tables 14 and 15 contain a trend the fitting, while indicated to be good, was not strictly valid. Adjustments for the removal of the effects of the linear trend and the calculation of probability estimates outlined by Thom [44], were carried out. For comparison, both the Poisson and the negative binomial distribution were fitted. The results are shown in tables 16 and 17. These adjusted distributions have frequencies and probabilities higher than those of the original series, more accurately represent the occurrence of tropical cyclones during recent years, and are preferable to the original estimates.

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58. H. C. Willett, "A Study of Tropical Cyclones Along the Atlantic and Gulf Coasts of the United States," *Inter-Regional Insurance Report*, New York, 1955, 63 pp.
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CHART SERIES A

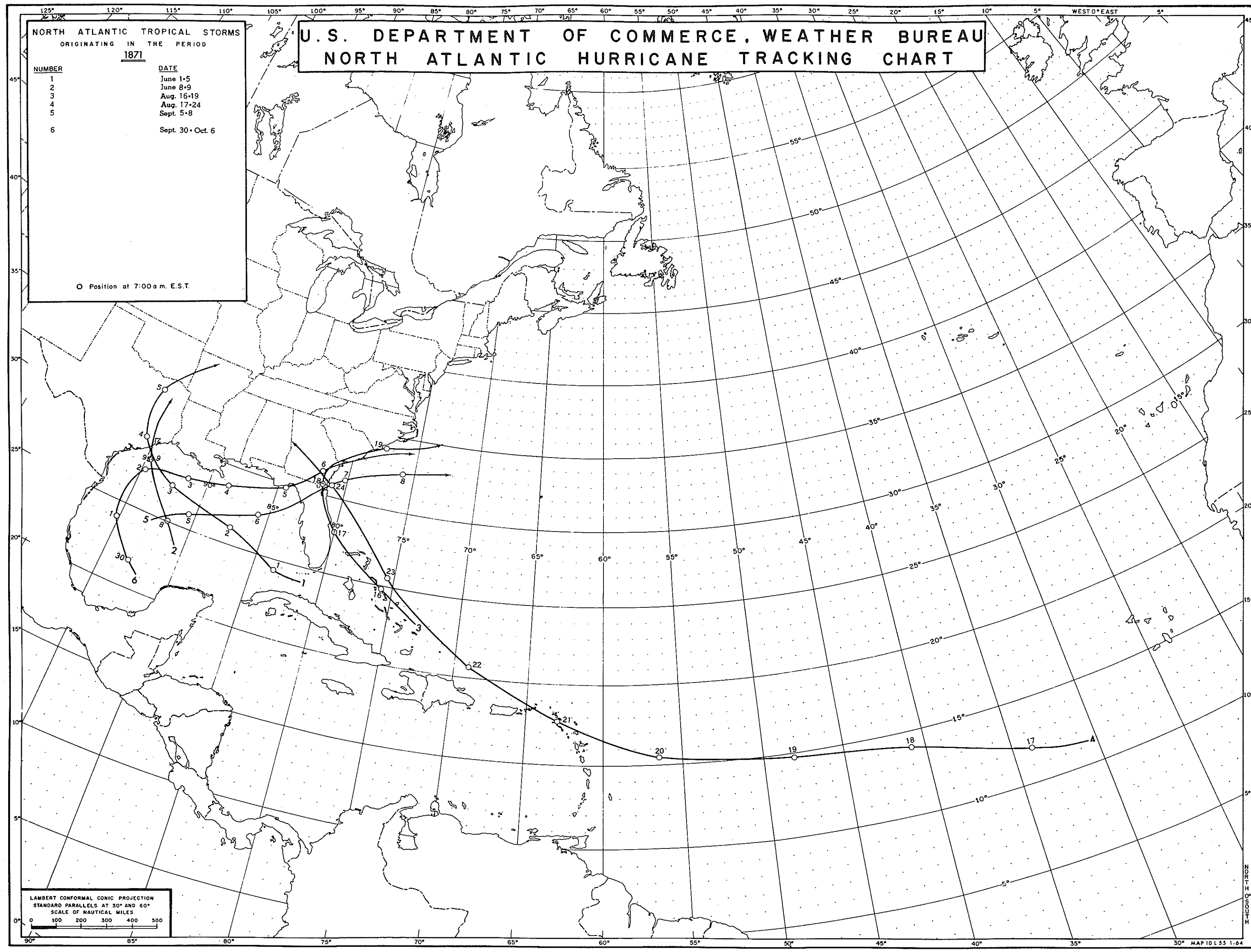
Tracks of North Atlantic Tropical Cyclones
By Years, 1871–1963

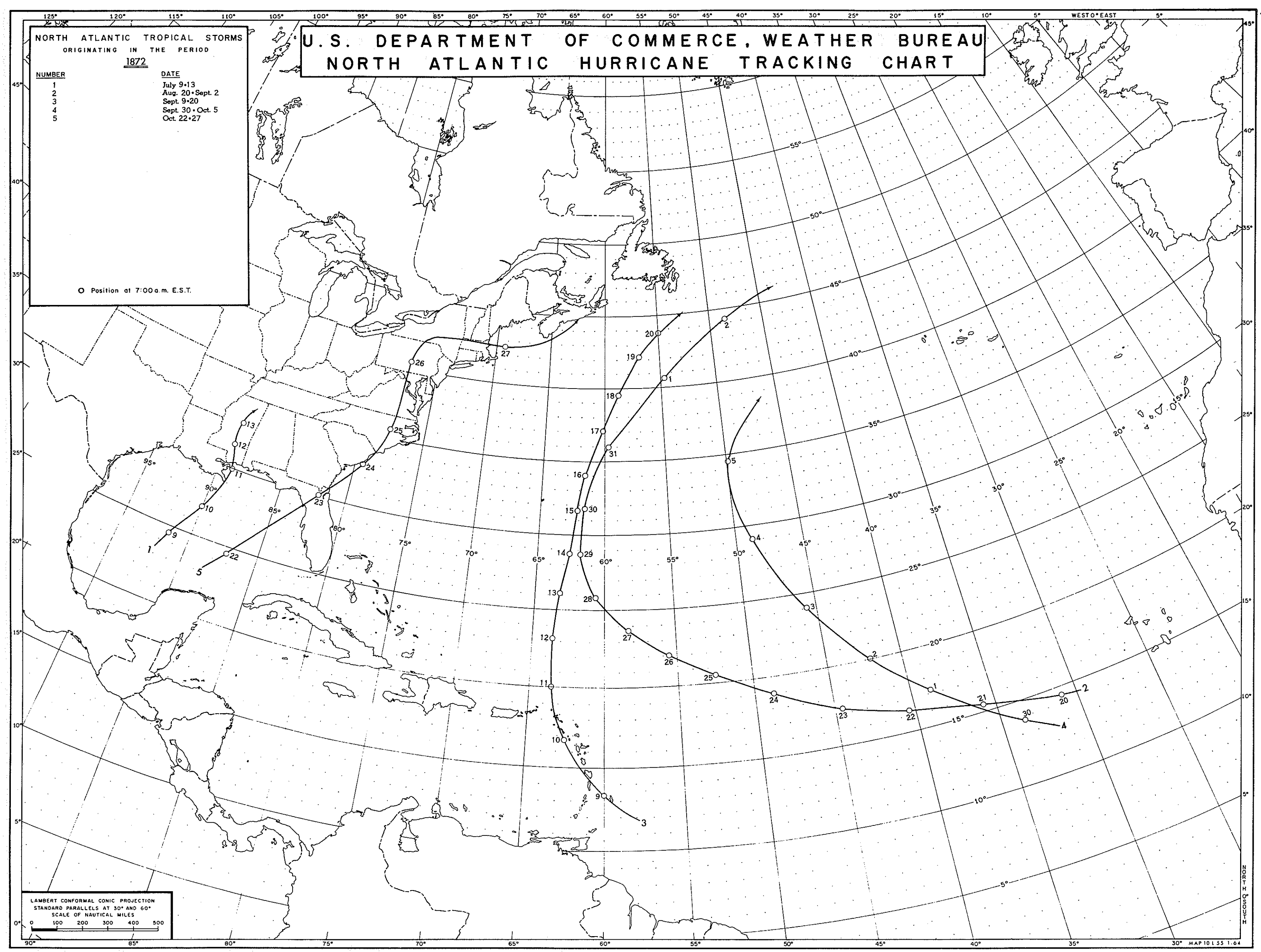
Pages 36–128

CHART SERIES B

Tracks of North Atlantic Tropical Cyclones
By Months and Other Calendar Periods

Pages 129–148


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1871
NUMBER
DATE
1 June 1-5
2 June 8-9
3 Aug. 16-19
4 Aug. 17-24
5 Sept. 5-8
6 Sept. 30-Oct. 6
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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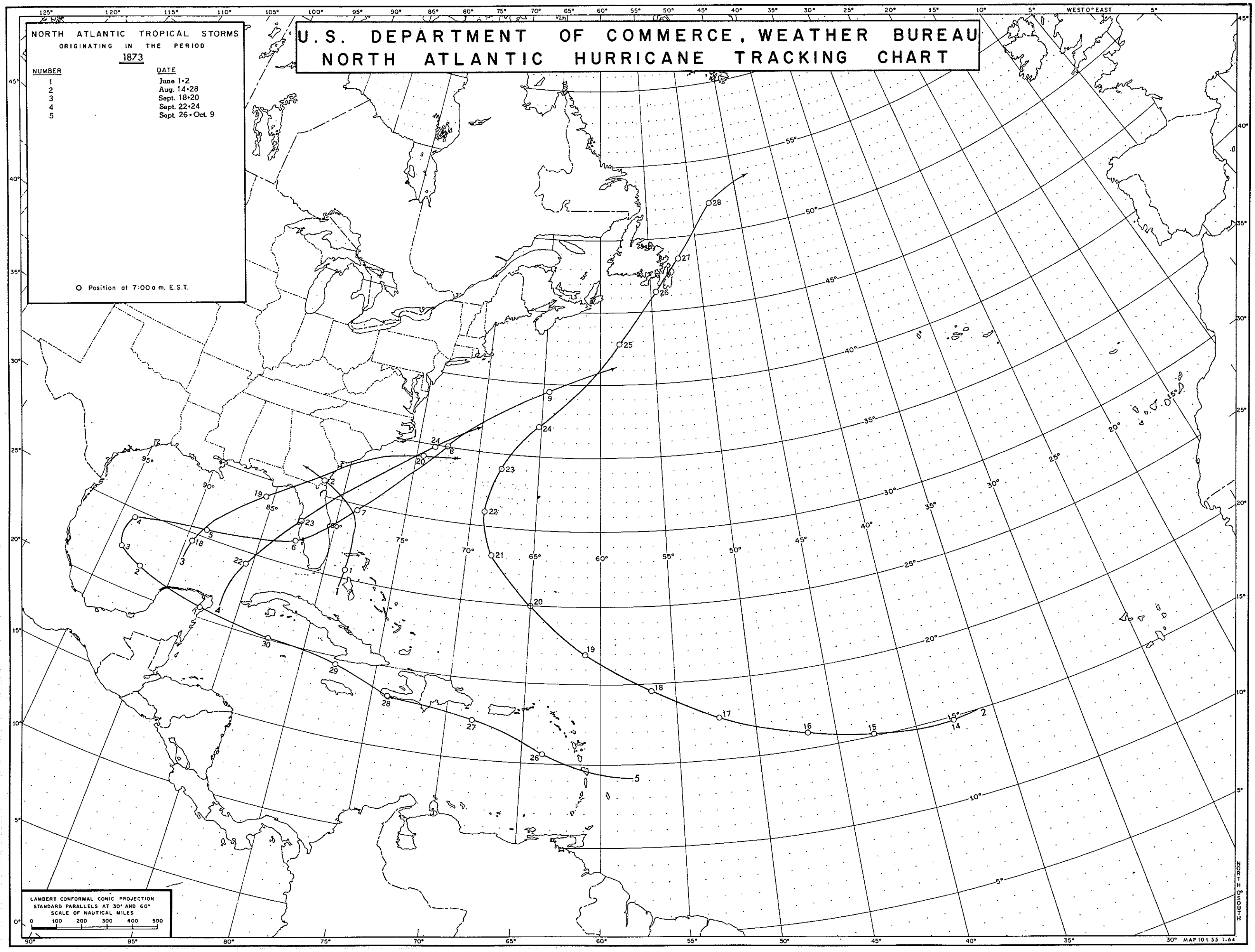
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1872
NUMBER DATE
1 July 9-13
2 Aug. 20-Sept. 2
3 Sept. 9-20
4 Sept. 30-Oct. 5
5 Oct. 22-27
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



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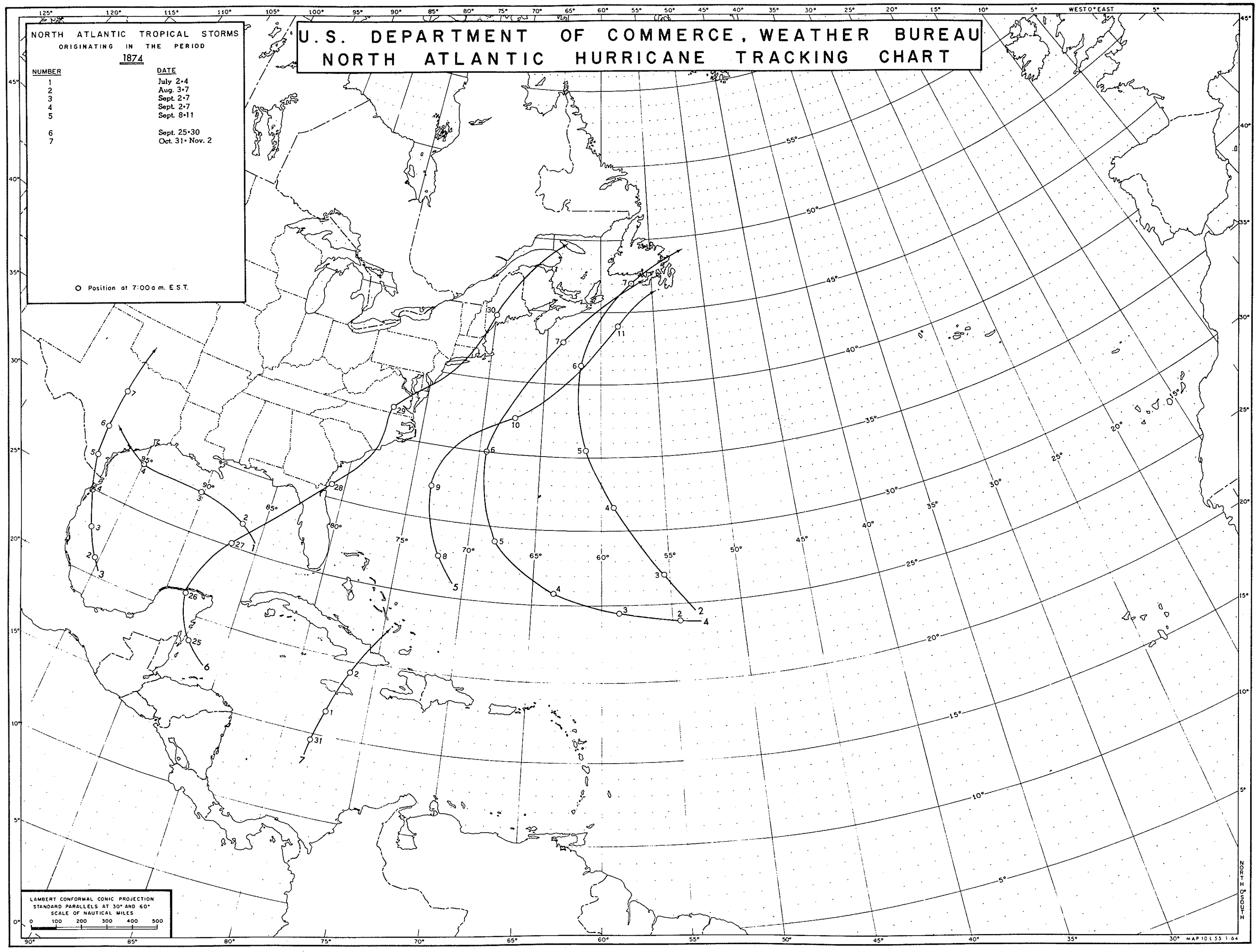
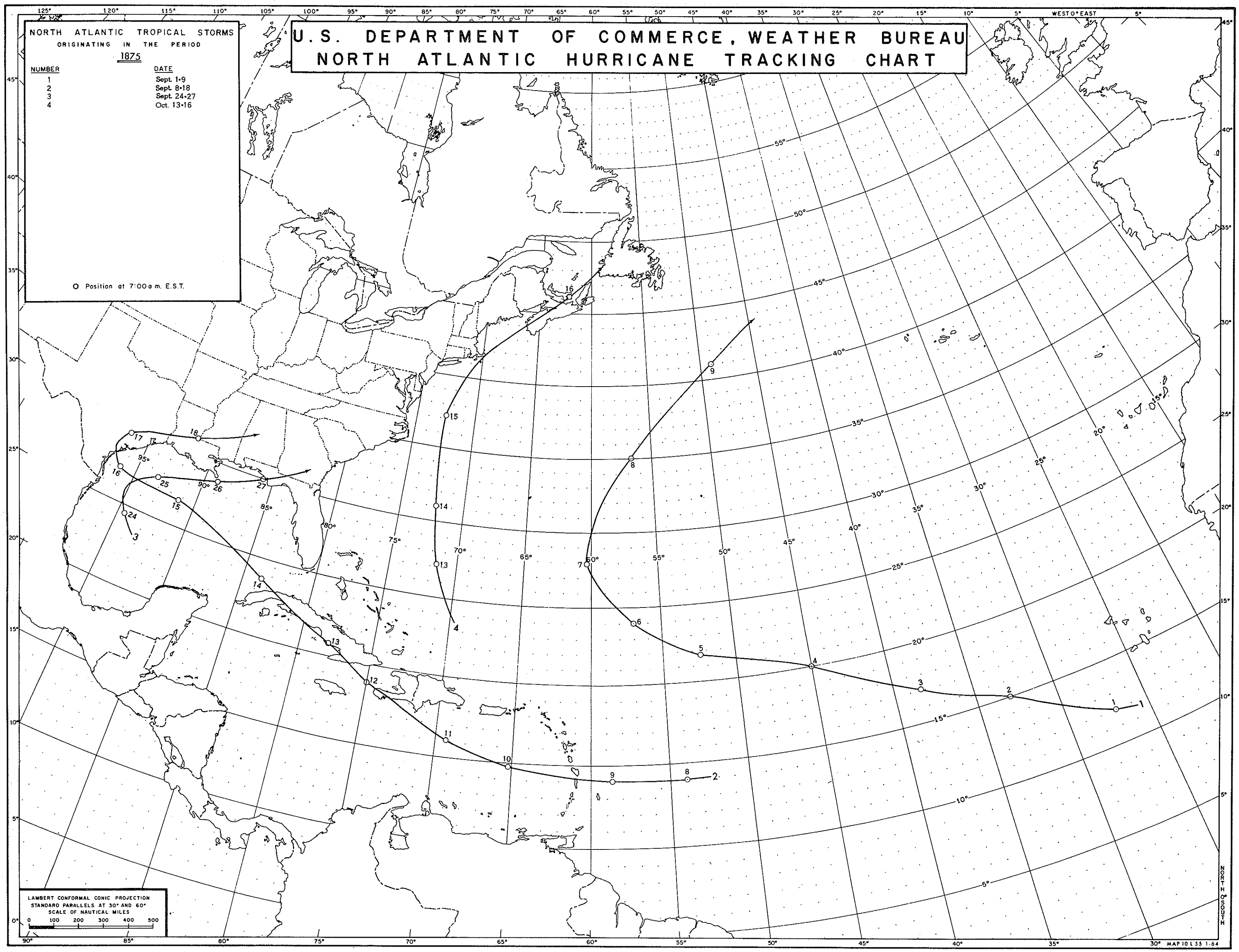
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1873
NUMBER
DATE
1 June 1-2
2 Aug. 14-28
3 Sept. 18-20
4 Sept. 22-24
5 Sept. 26-Oct. 9
○ Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1874
NUMBER DATE
1 July 2-4
2 Aug. 3-7
3 Sept. 2-7
4 Sept. 2-7
5 Sept. 8-11
6 Sept. 25-30
7 Oct. 31- Nov. 2
○ Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH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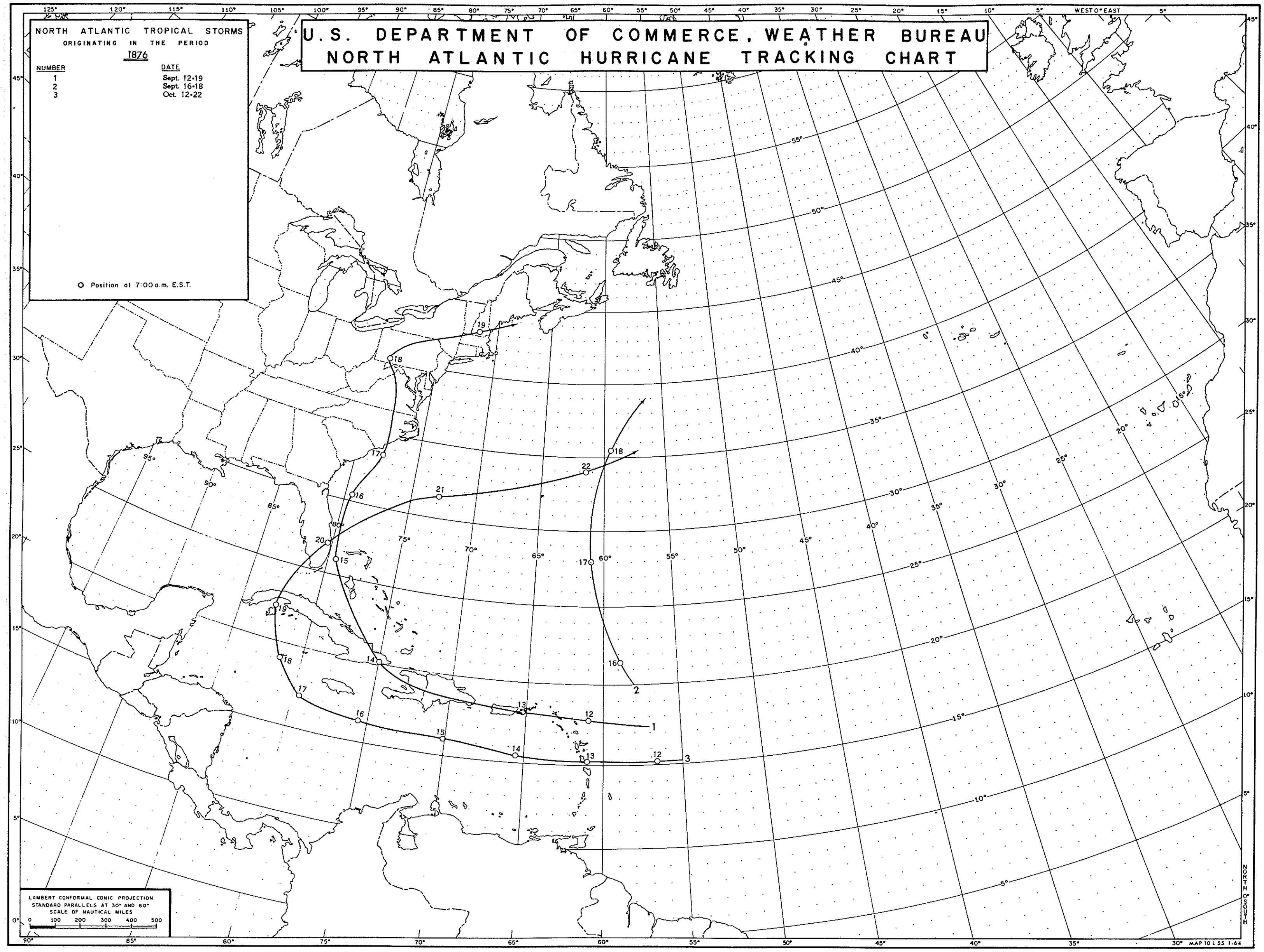
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1875
NUMBER
DATE
1 Sept. 1-9
2 Sept. 8-18
3 Sept. 24-27
4 Oct. 13-16
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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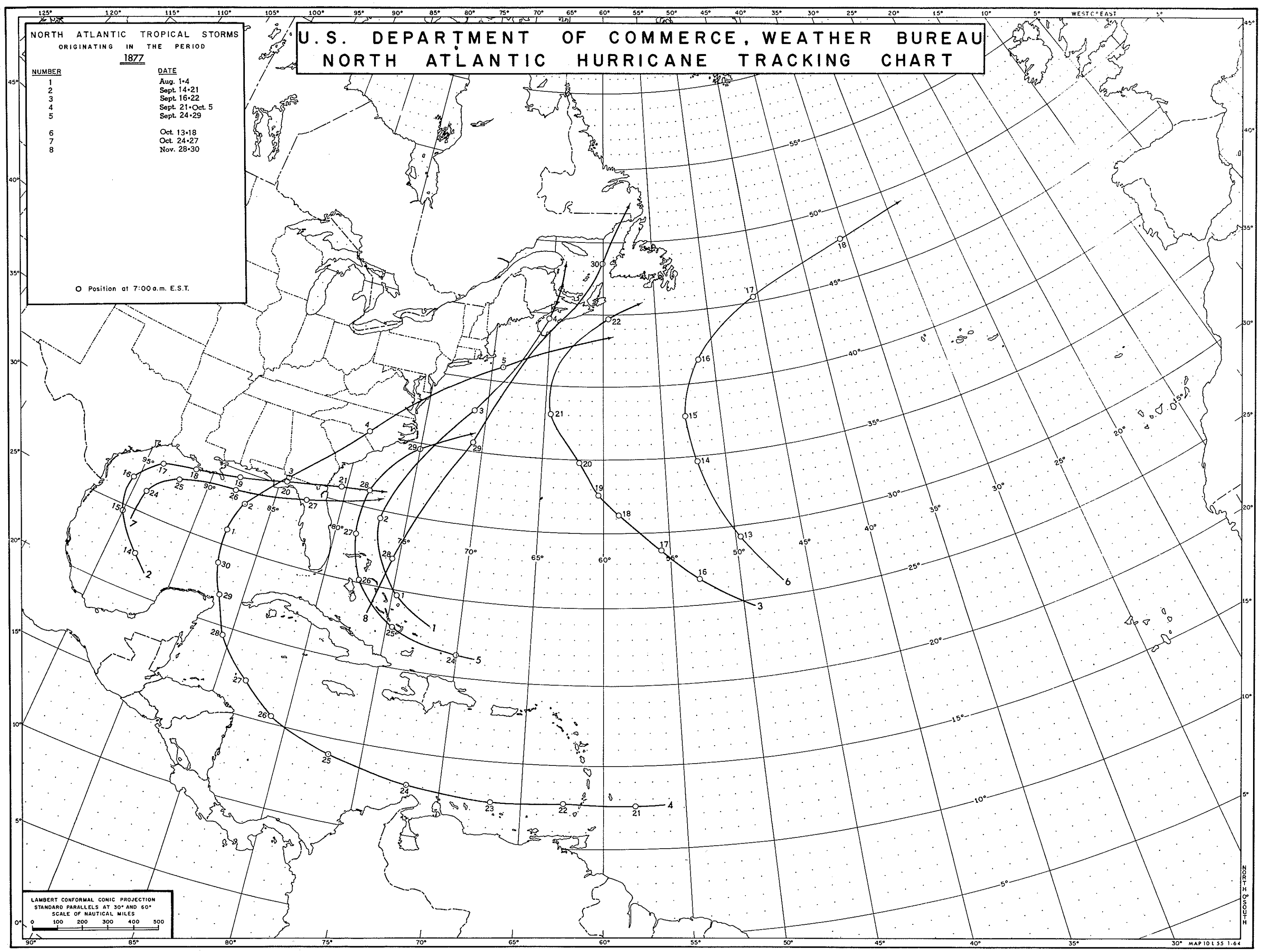
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1876
NUMBER DATE
1 Sept. 12-19
2 Sept. 16-18
3 Oct. 12-22
○ Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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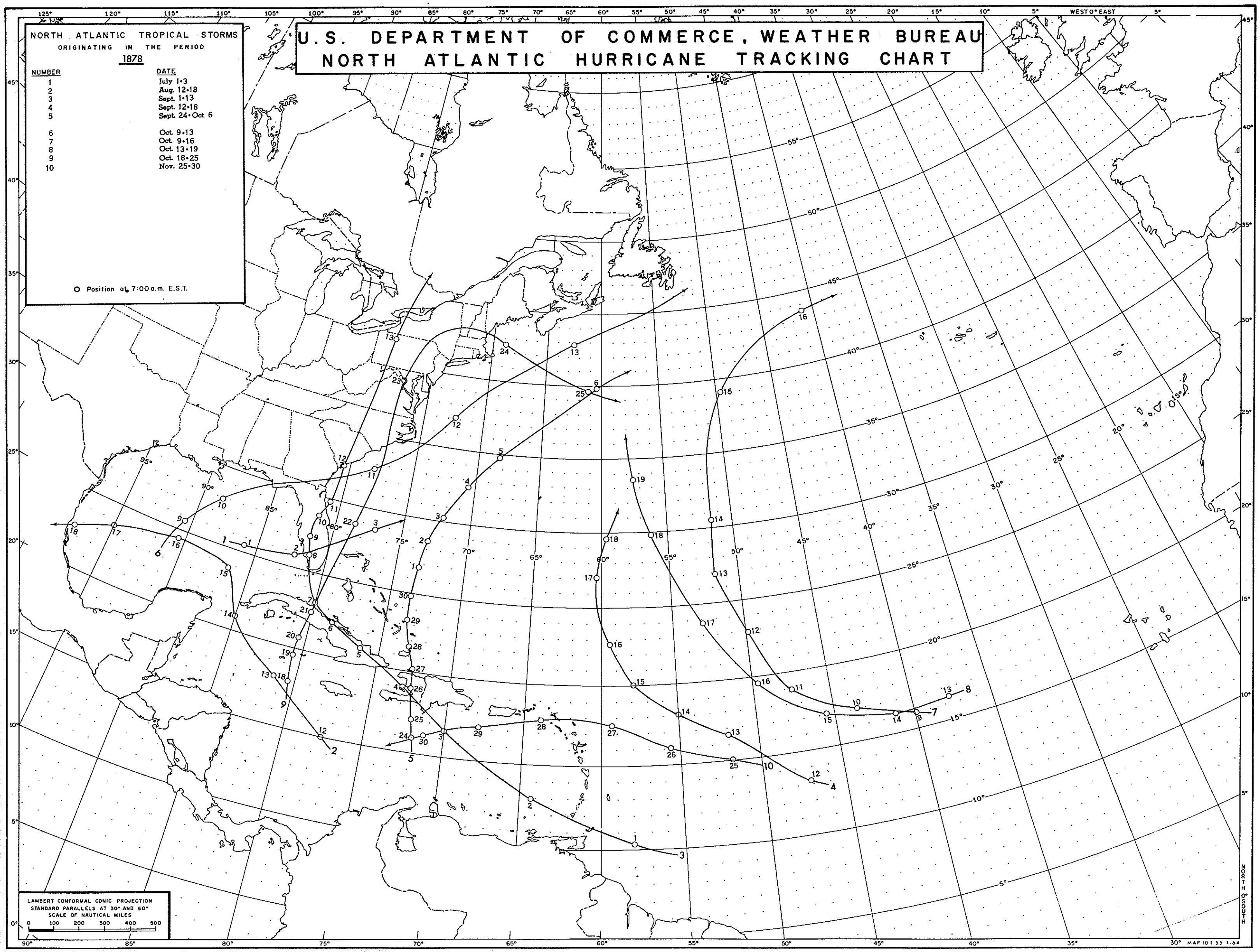
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1877
NUMBER DATE
1 Aug. 1-4
2 Sept. 14-21
3 Sept. 16-22
4 Sept. 21-Oct. 5
5 Sept. 24-29
6 Oct. 13-18
7 Oct. 24-27
8 Nov. 28-30
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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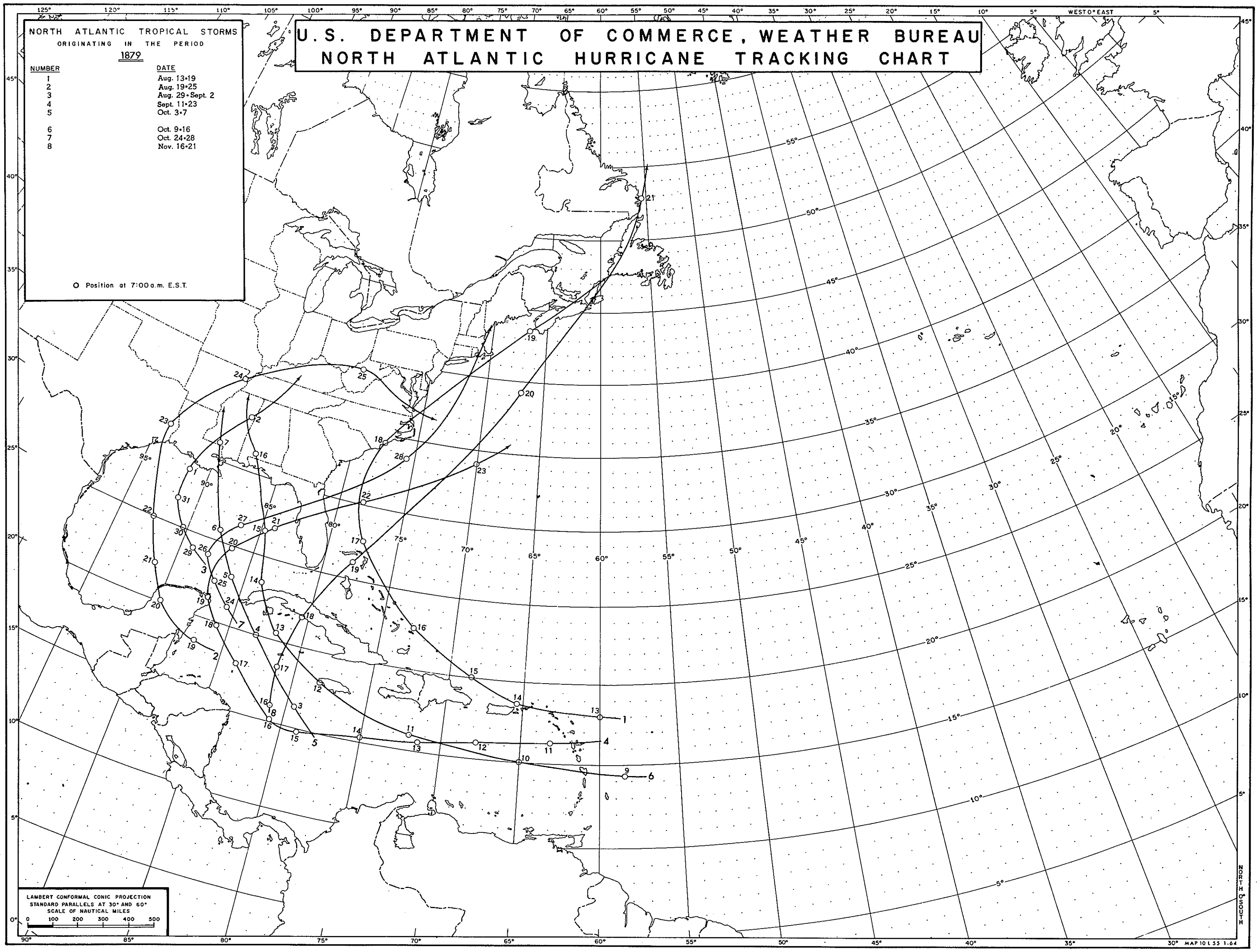
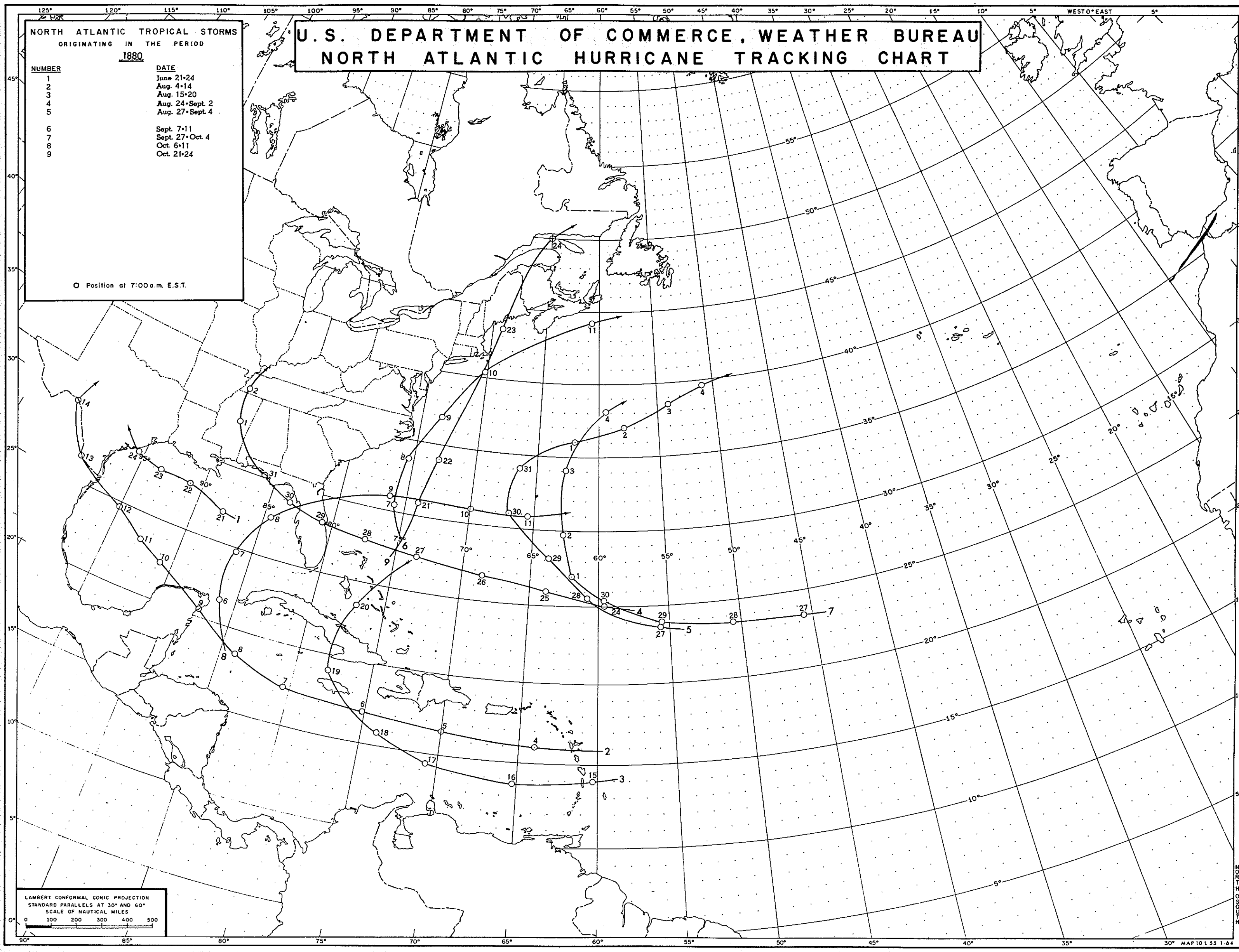
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1878
NUMBER
DATE
1 July 1-3
2 Aug. 12-18
3 Sept. 1-13
4 Sept. 12-18
5 Sept. 24-Oct. 6
6 Oct. 9-13
7 Oct. 9-16
8 Oct. 13-19
9 Oct. 18-25
10 Nov. 25-30
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1879
NUMBER DATE
1 Aug. 13•19
2 Aug. 19•25
3 Aug. 29 • Sept. 2
4 Sept. 11•23
5 Oct. 3•7
6 Oct. 9•16
7 Oct. 24•28
8 Nov. 16•21
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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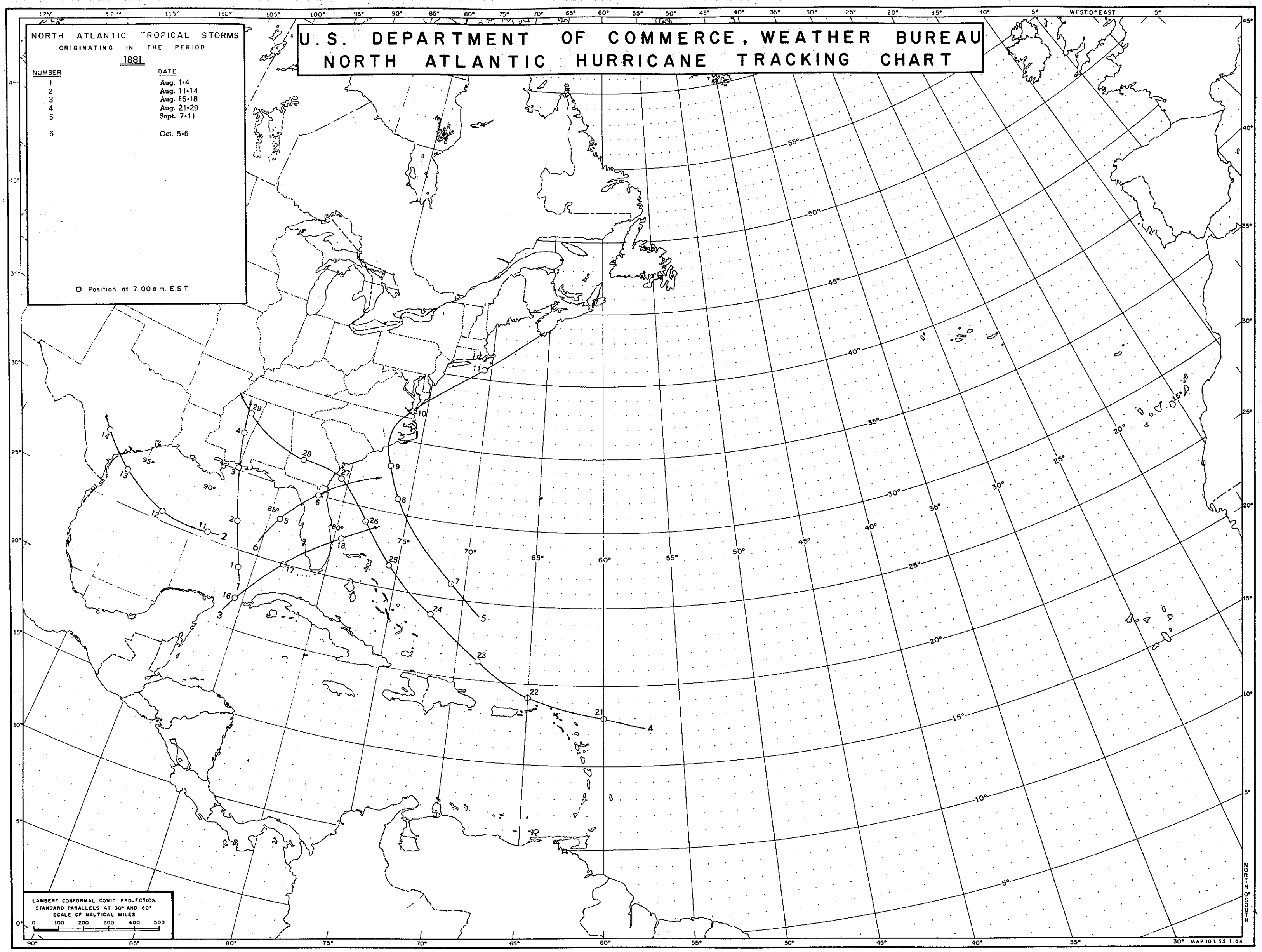
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1880
NUMBER
DATE
1 June 21-24
2 Aug. 4-14
3 Aug. 15-20
4 Aug. 24-Sept. 2
5 Aug. 27-Sept. 4
6 Sept. 7-11
7 Sept. 27-Oct. 4
8 Oct. 6-11
9 Oct. 21-24
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH
SOUTH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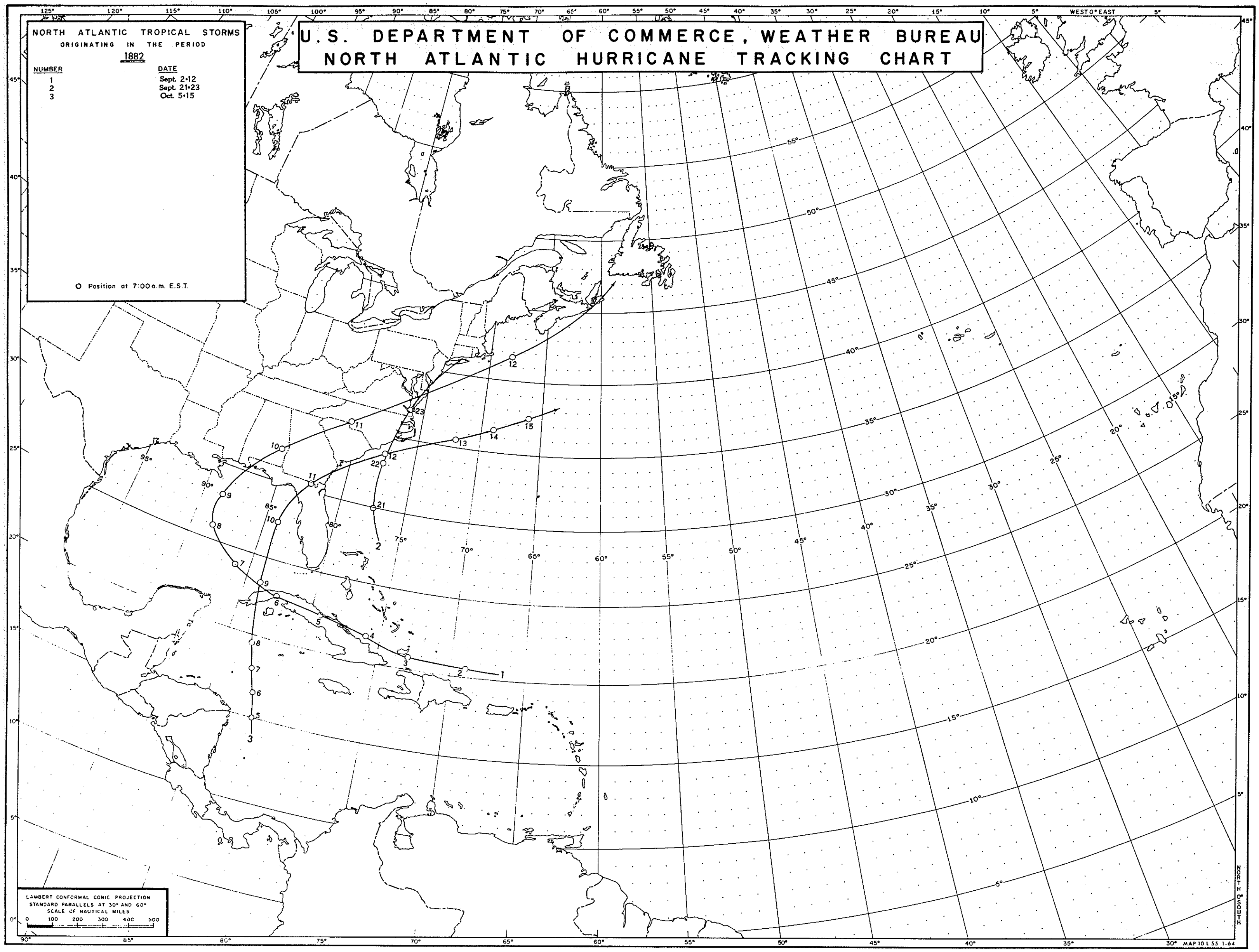
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1881
NUMBER
DATE
1 Aug. 1-4
2 Aug. 11-14
3 Aug. 16-18
4 Aug. 21-29
5 Sept. 7-11
6 Oct. 5-6
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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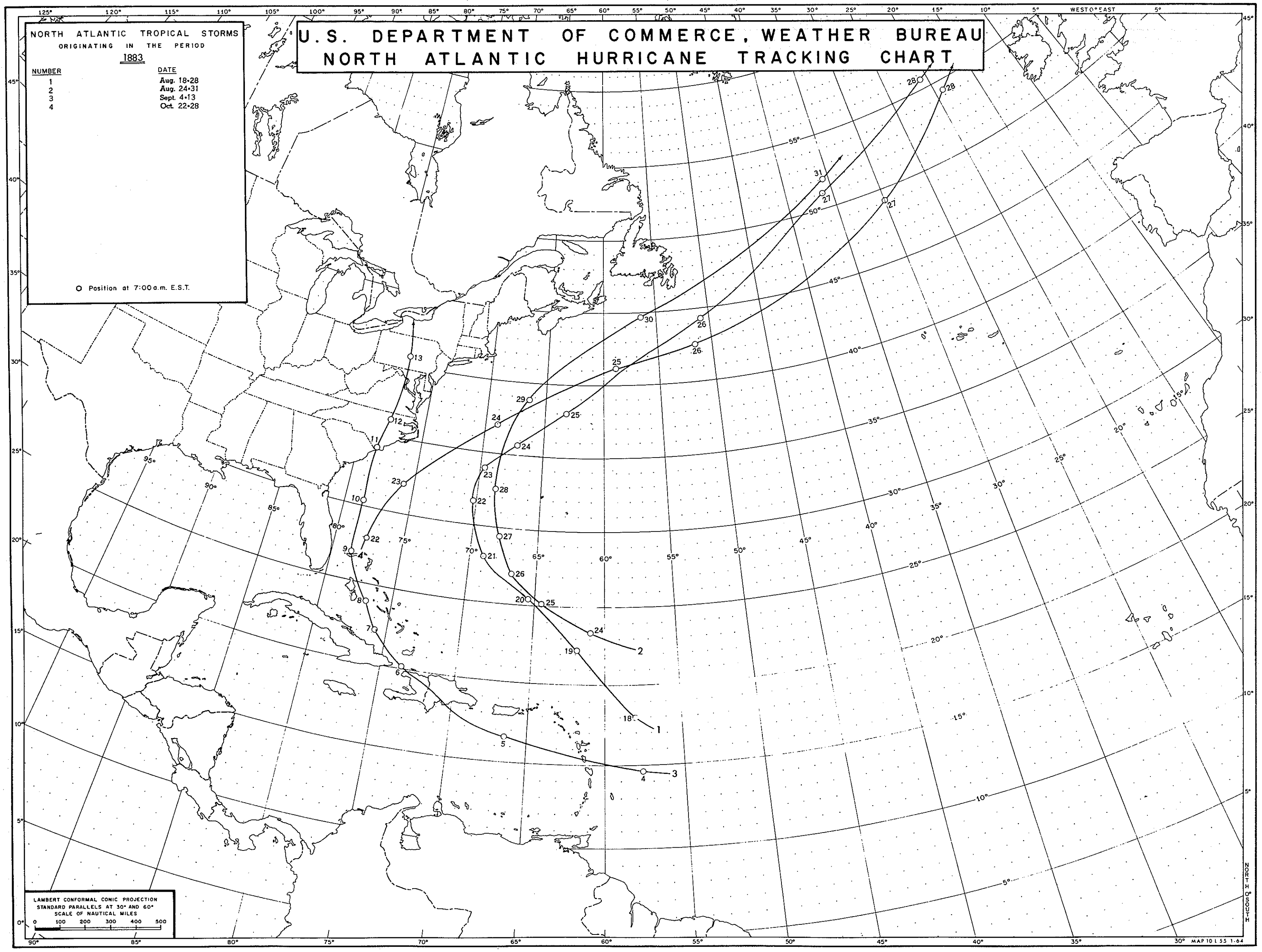
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1882
NUMBER DATE
1 Sept. 2-12
2 Sept. 21-23
3 Oct. 5-15
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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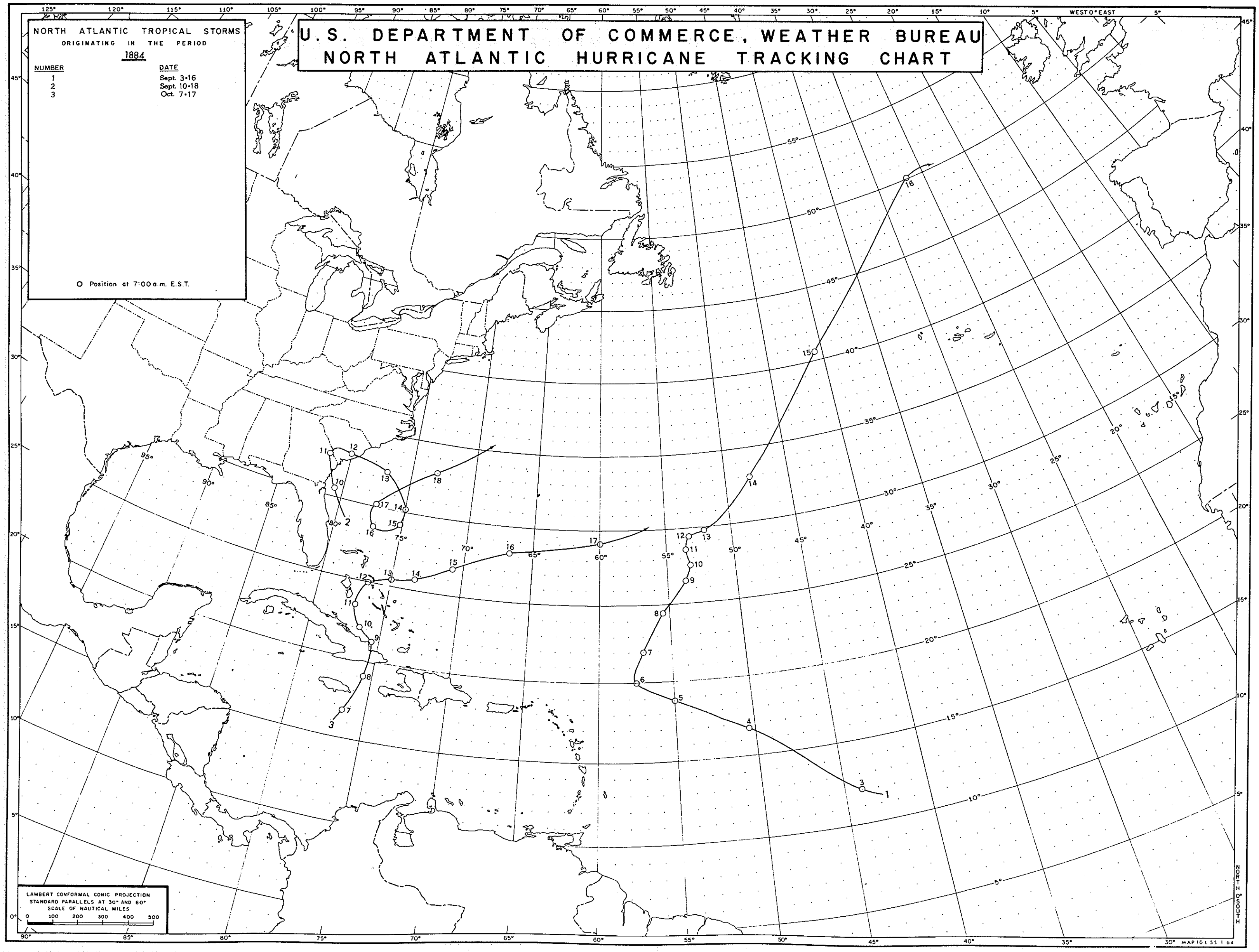
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1883
NUMBER
DATE
1 Aug. 18-28
2 Aug. 24-31
3 Sept. 4-13
4 Oct. 22-28
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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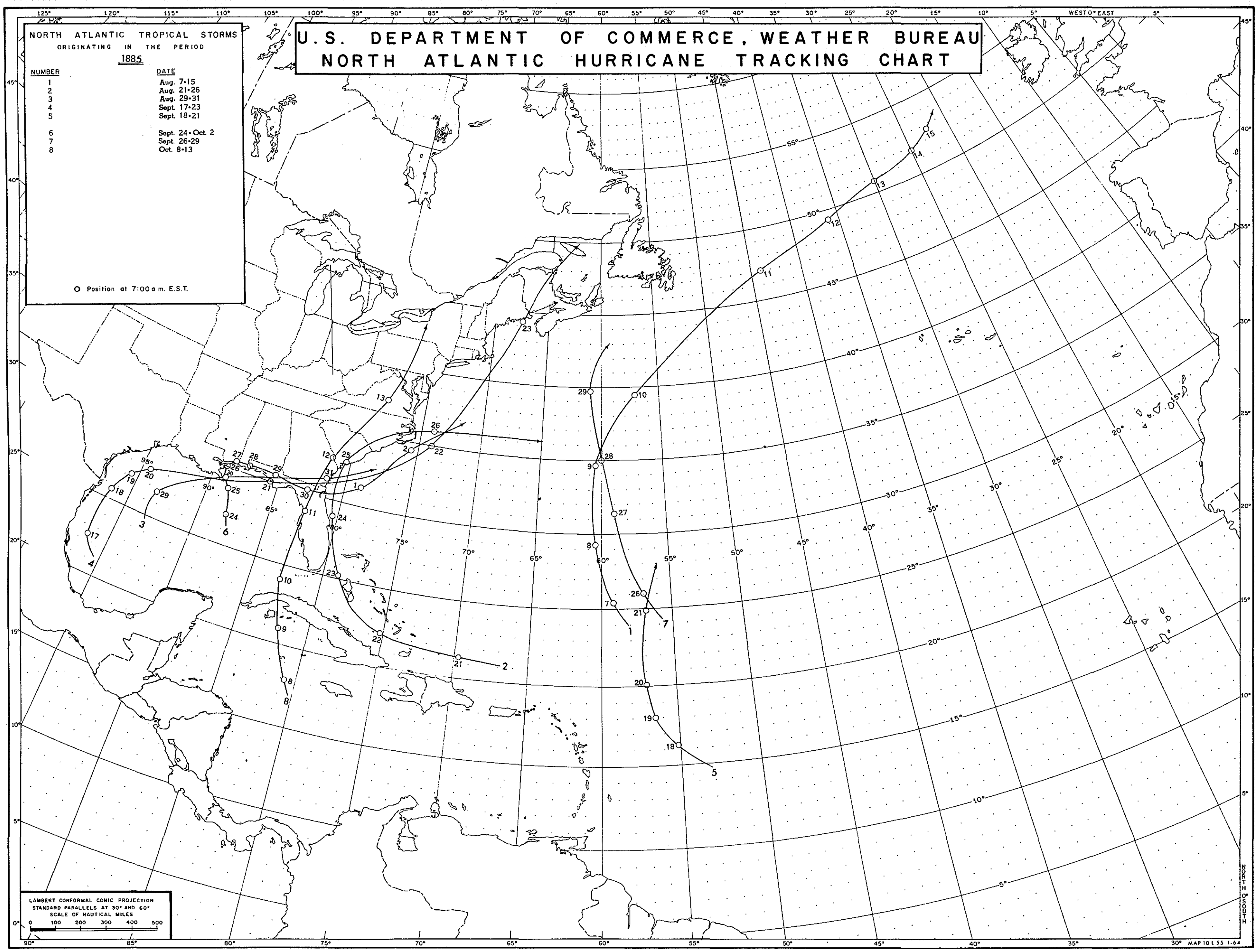
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1884
NUMBER DATE
1 Sept. 3-16
2 Sept. 10-18
3 Oct. 7-17
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH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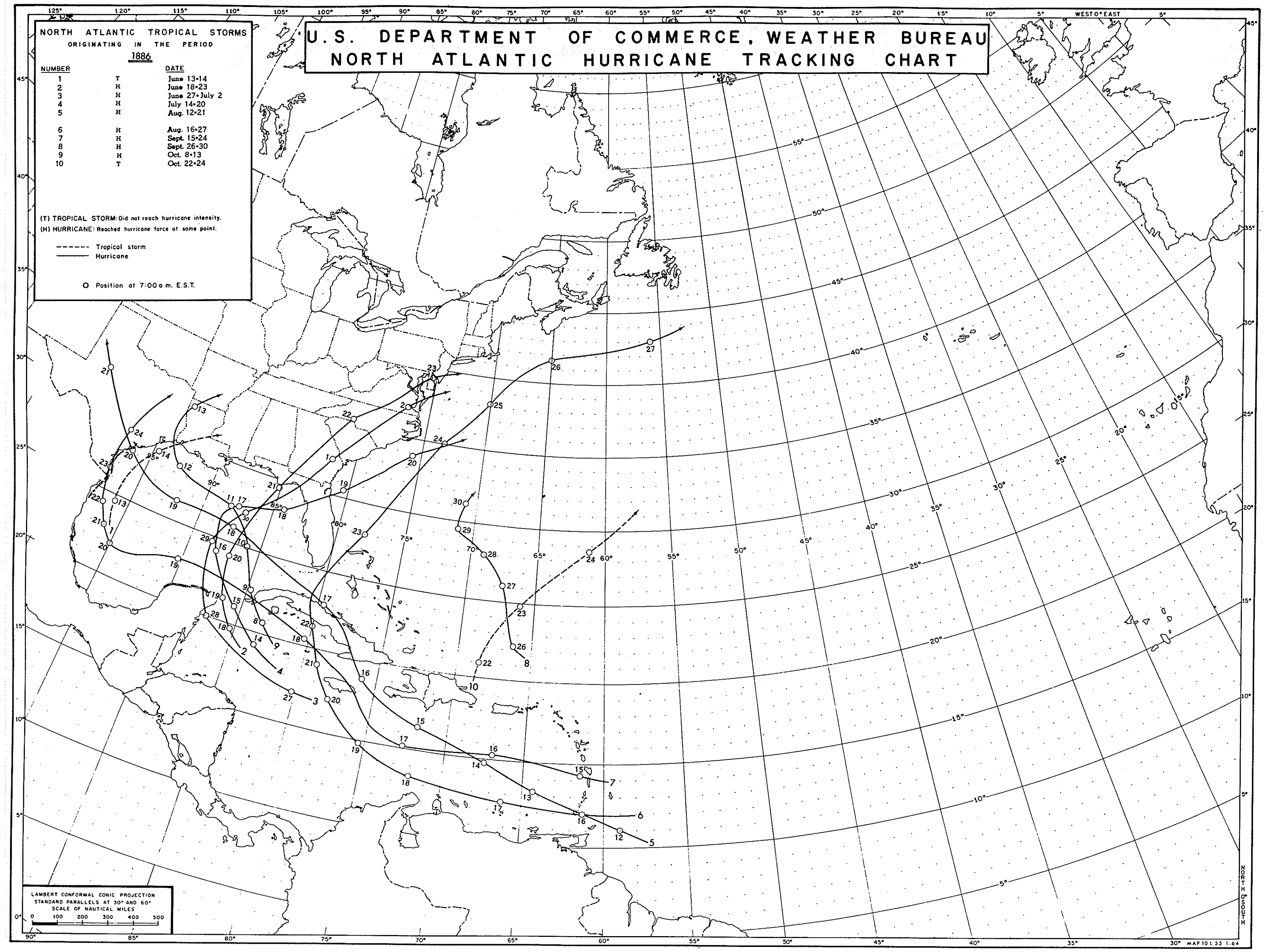
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1885
NUMBER
DATE
1 Aug. 7-15
2 Aug. 21-26
3 Aug. 29-31
4 Sept. 17-23
5 Sept. 18-21
6 Sept. 24-Oct. 2
7 Sept. 26-29
8 Oct. 8-13
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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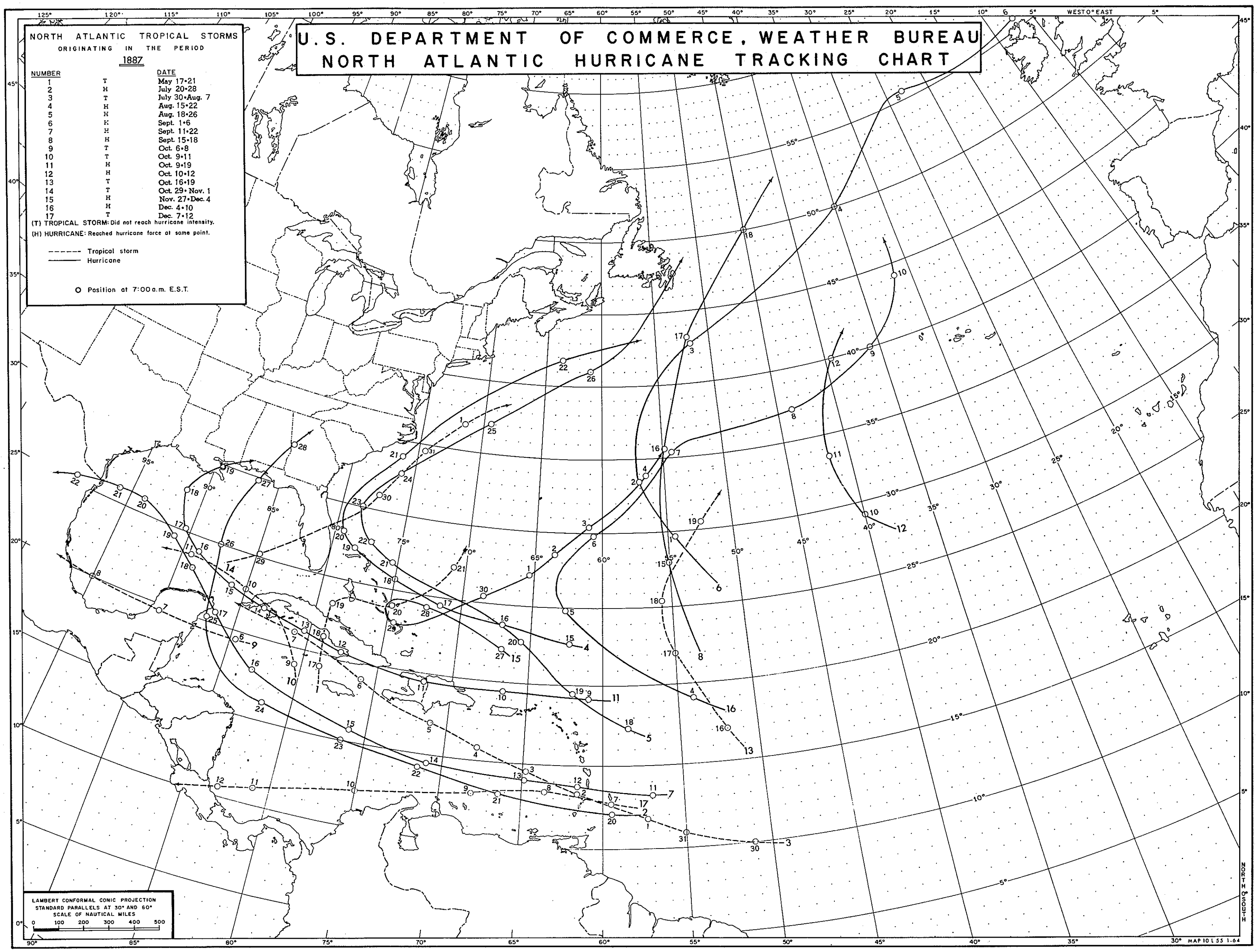
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1886
NUMBER DATE
1 T June 13-14
2 H June 18-23
3 H June 27-July 2
4 H July 14-20
5 H Aug. 12-21
6 H Aug. 16-27
7 H Sept. 15-24
8 H Sept. 26-30
9 H Oct. 8-13
10 T Oct. 22-24
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH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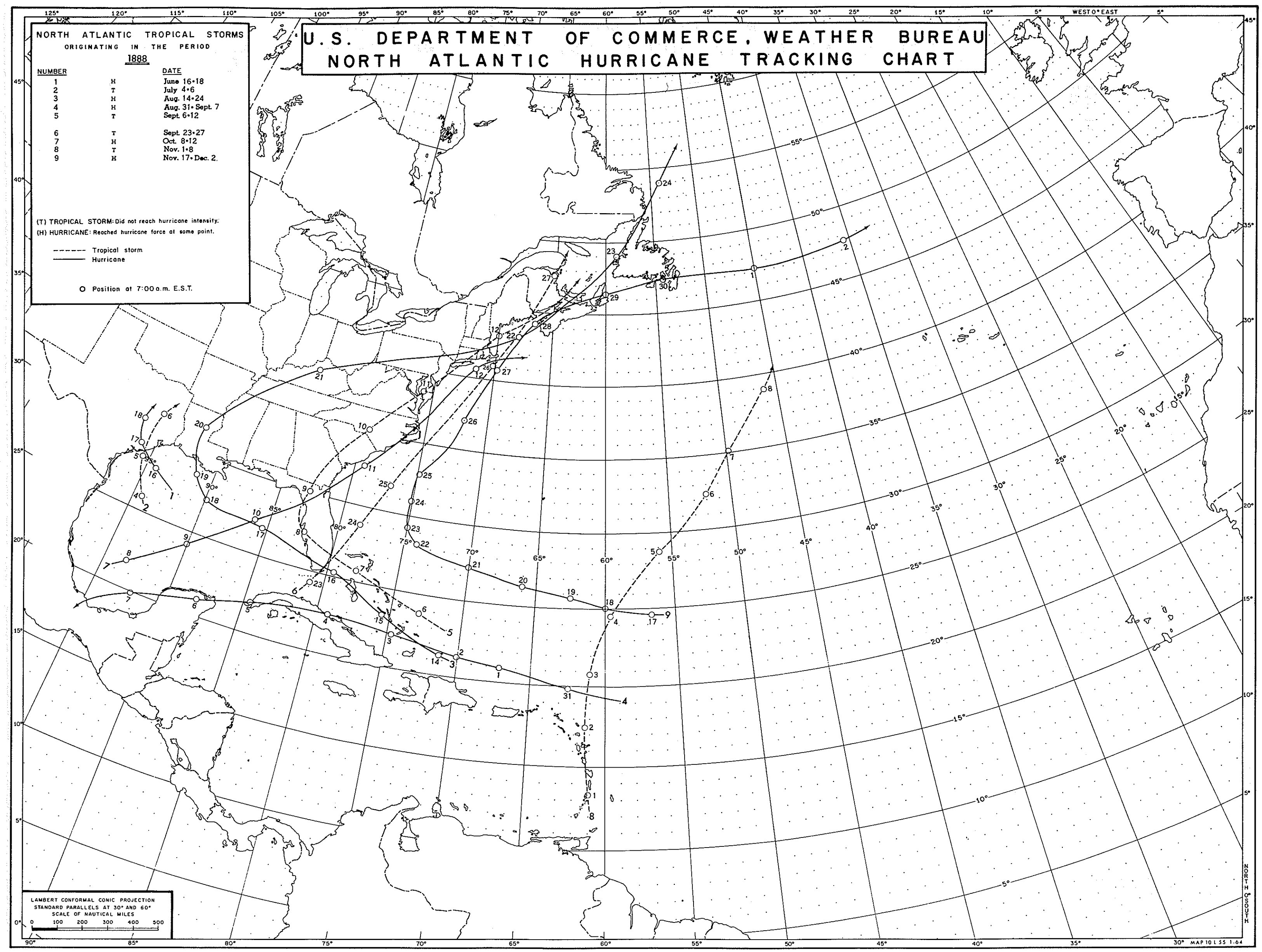
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1887
NUMBER
DATE
1 T May 17•21
2 H July 20•28
3 T July 30•Aug. 7
4 H Aug. 15•22
5 H Aug. 18•26
6 H Sept. 1•6
7 H Sept. 11•22
8 H Sept. 15•18
9 T Oct. 6•8
10 T Oct. 9•11
11 H Oct. 9•19
12 H Oct. 10•12
13 T Oct. 16•19
14 T Oct. 29• Nov. 1
15 H Nov. 27•Dec. 4
16 H Dec. 4•10
17 T Dec. 7•12
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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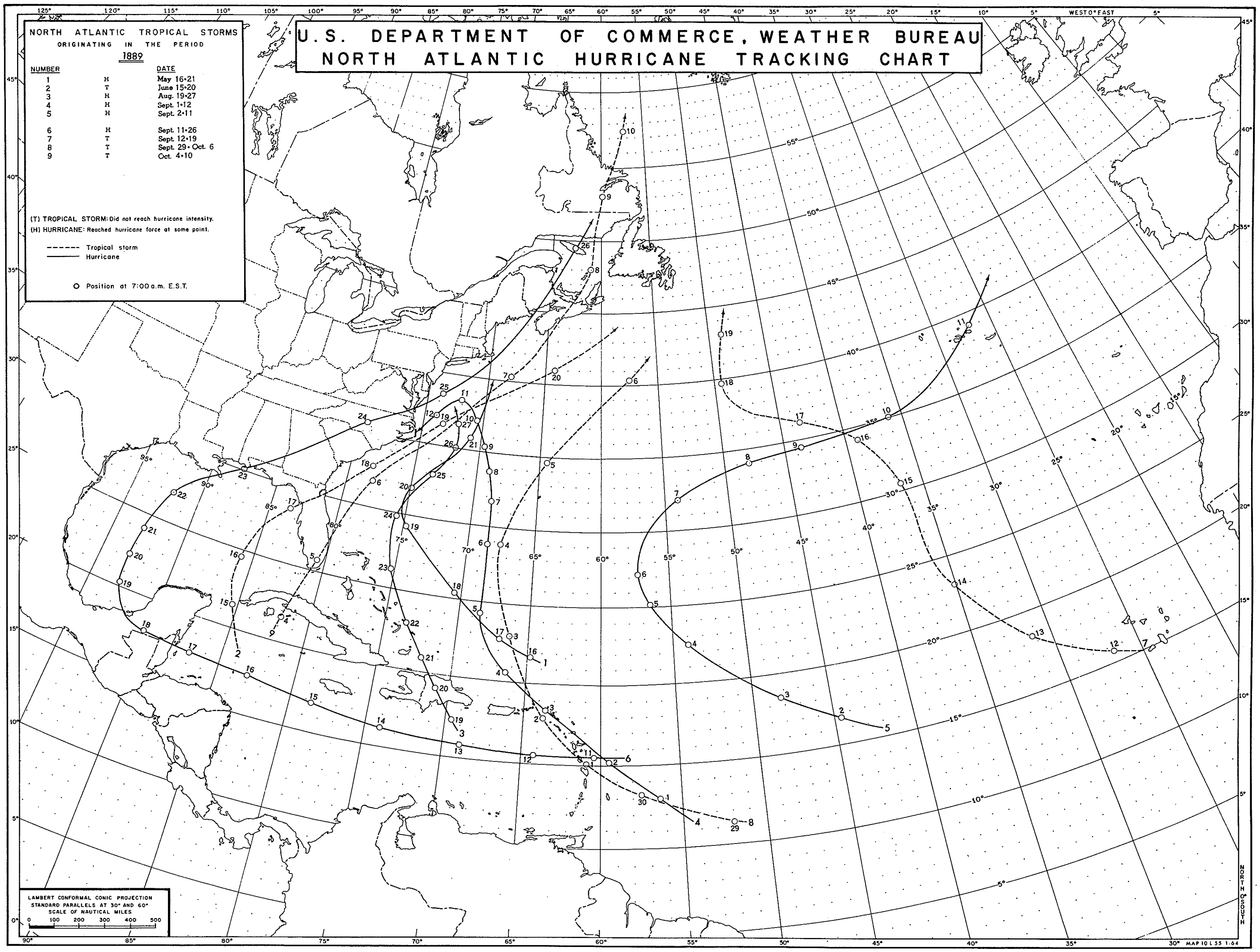
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1888
NUMBER DATE
1 H June 16-18
2 T July 4-6
3 H Aug. 14-24
4 H Aug. 31- Sept. 7
5 T Sept. 6-12
6 T Sept. 23-27
7 H Oct. 8-12
8 T Nov. 1-8
9 H Nov. 17- Dec. 2.
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64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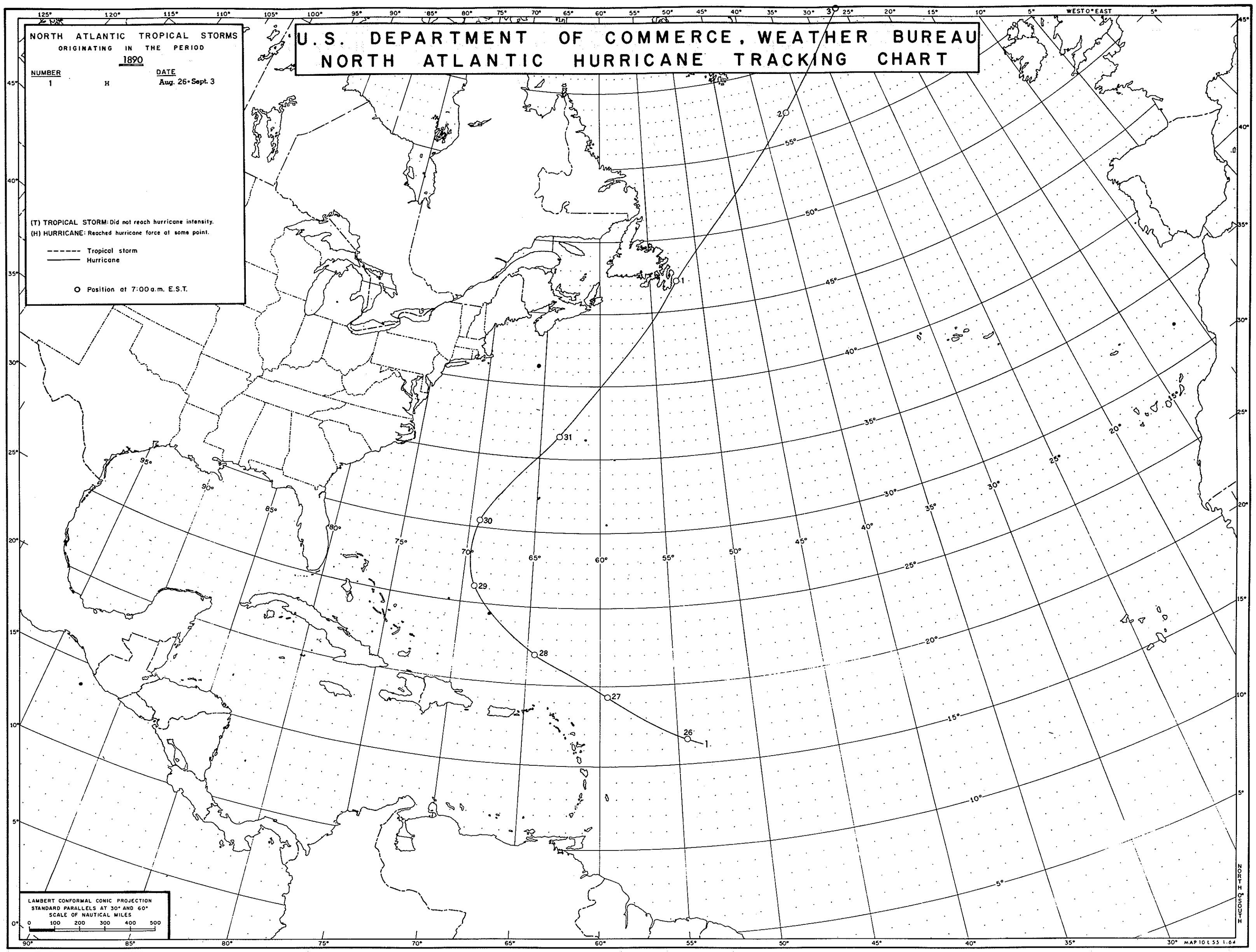
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1889
NUMBER DATE
1 H May 16-21
2 T June 15-20
3 H Aug. 19-27
4 H Sept. 1-12
5 H Sept. 2-11
6 H Sept. 11-26
7 T Sept. 12-19
8 T Sept. 29 - Oct. 6
9 T Oct. 4-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



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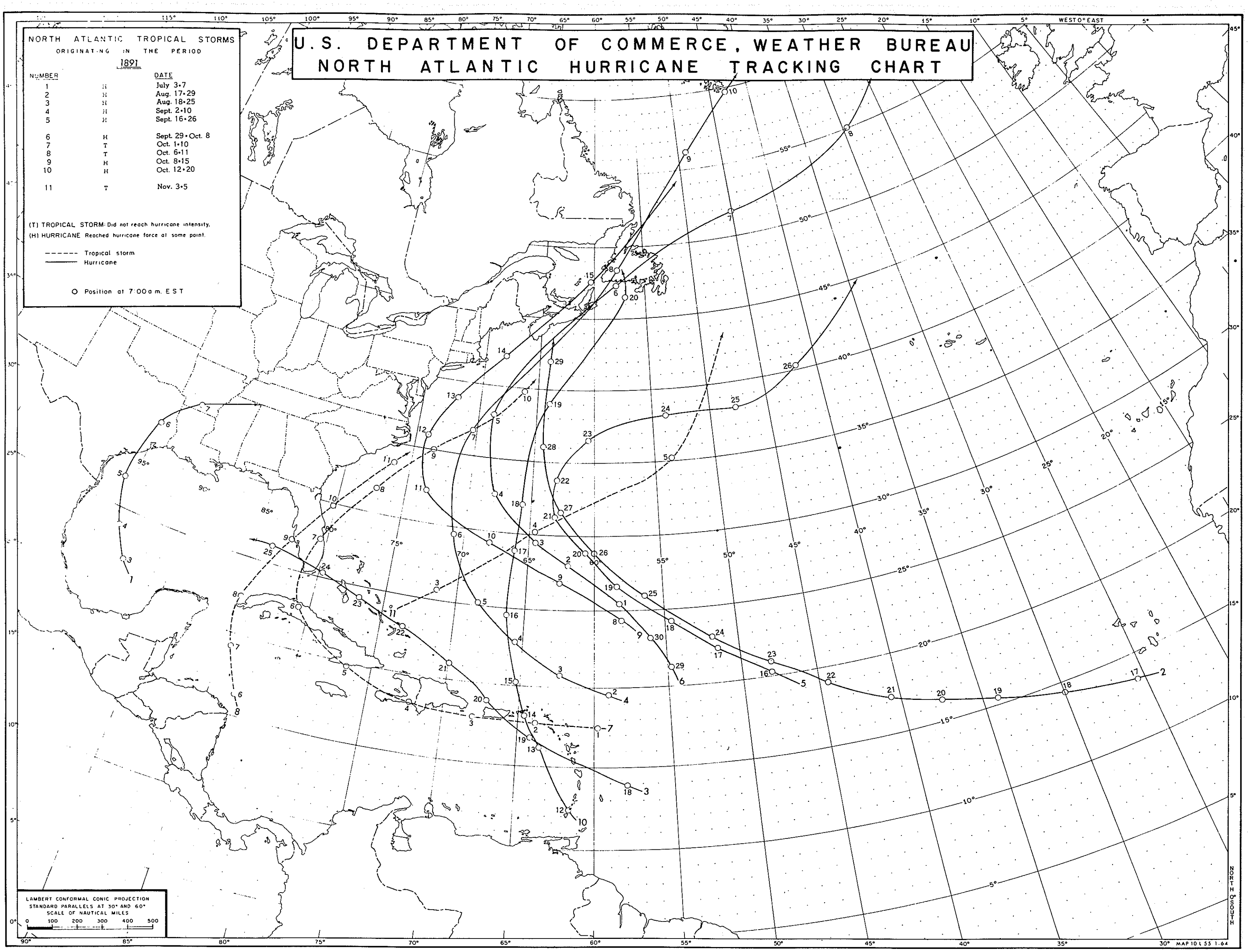
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1890
NUMBER
1
H
DATE
Aug. 26-Sept. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
26
27
28
29
30
31
1
2
3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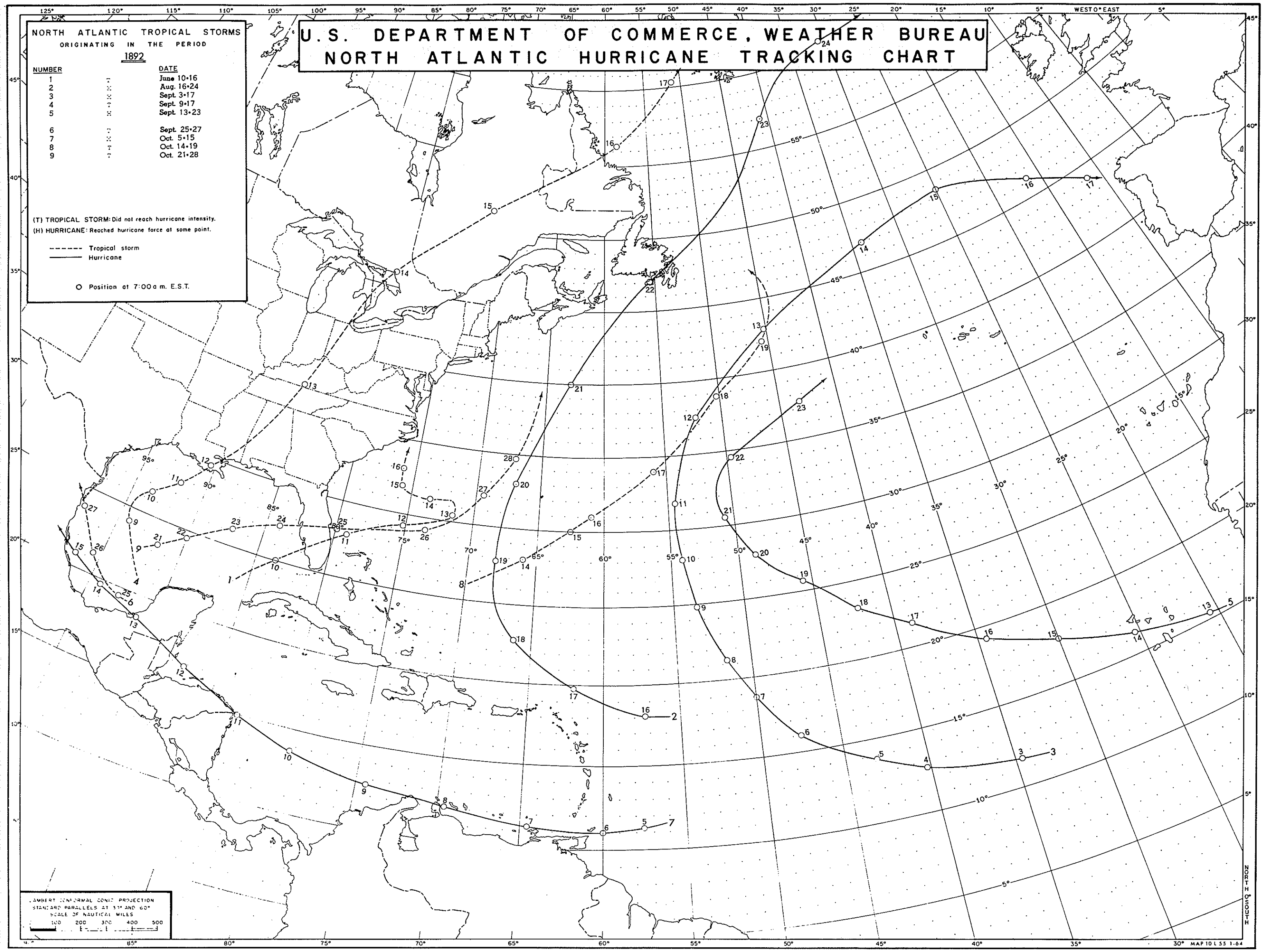
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1891
NUMBER DATE
1 H July 3-7
2 H Aug. 17-29
3 H Aug. 18-25
4 H Sept. 2-10
5 H Sept. 16-26
6 H Sept. 29-Oct. 8
7 T Oct. 1-10
8 T Oct. 6-11
9 H Oct. 8-15
10 H Oct. 12-20
11 T Nov. 3-5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. EST
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L.S.S. 1-64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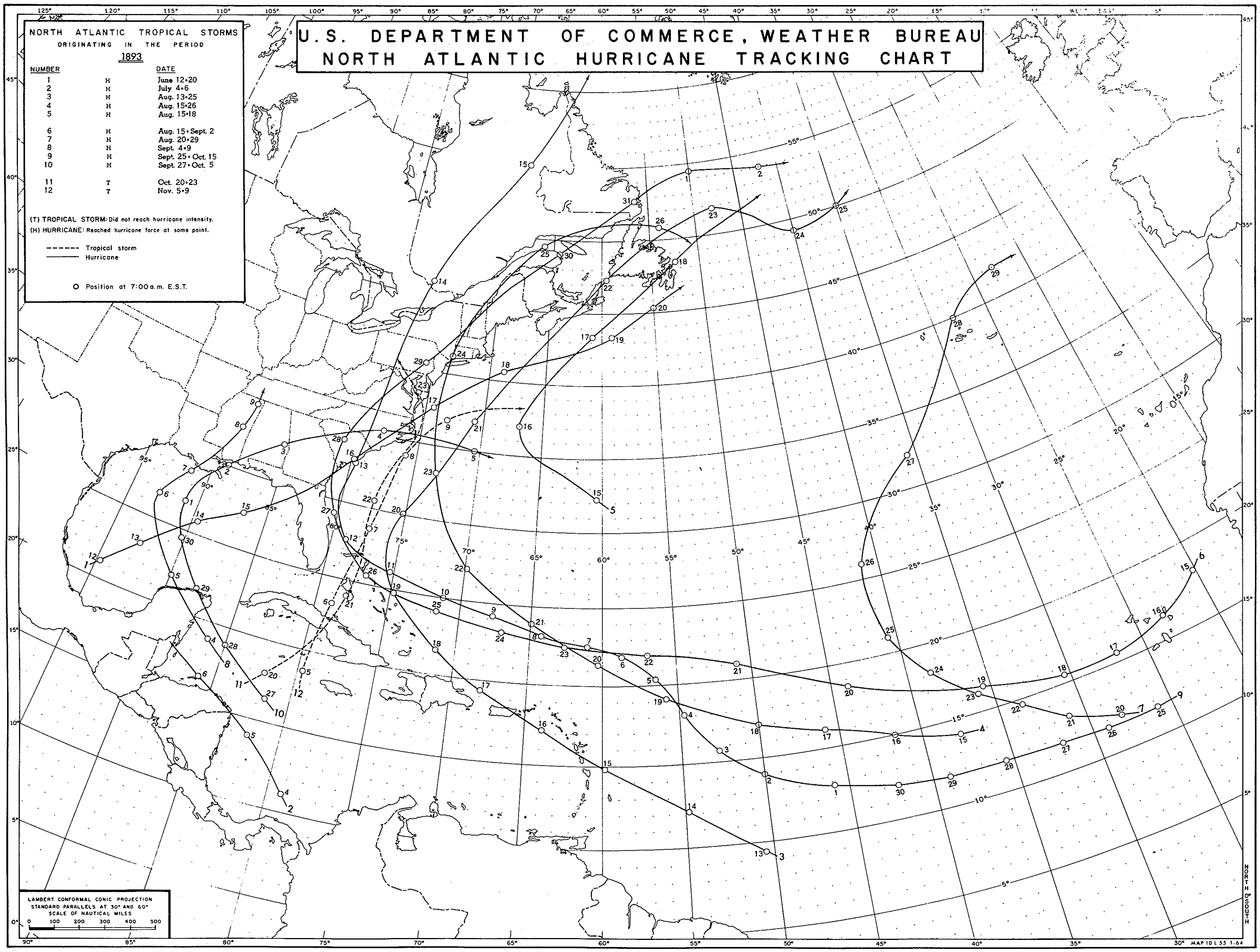
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1892
NUMBER
DATE
1 T June 10-16
2 H Aug. 16-24
3 H Sept. 3-17
4 T Sept. 9-17
5 H Sept. 13-23
6 T Sept. 25-27
7 H Oct. 5-15
8 T Oct. 14-19
9 T Oct. 21-28
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 33° AND 60°
SCALE OF NAUTICAL MILES
100 200 300 400 500
MAP 10 L 55 1-64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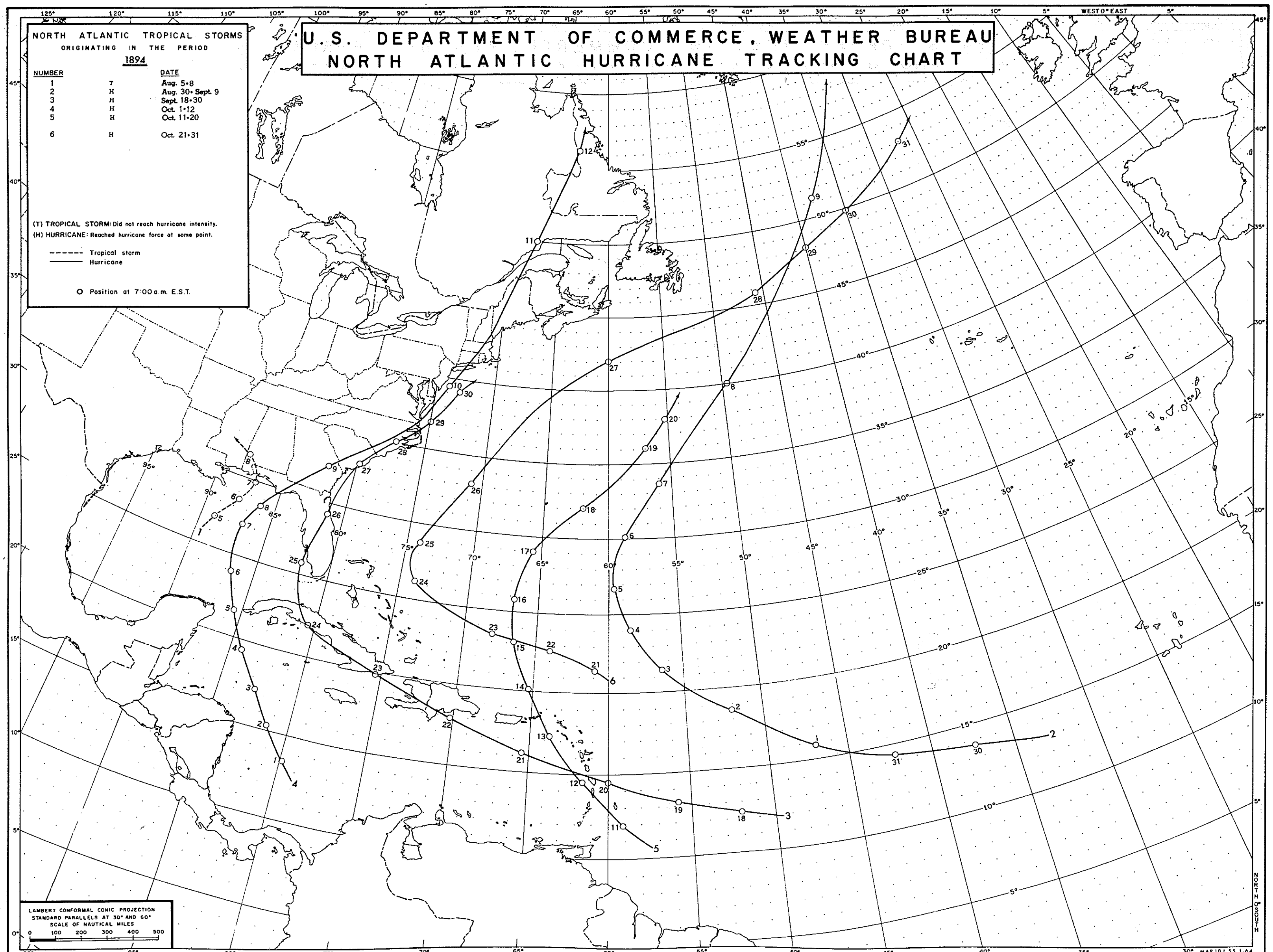
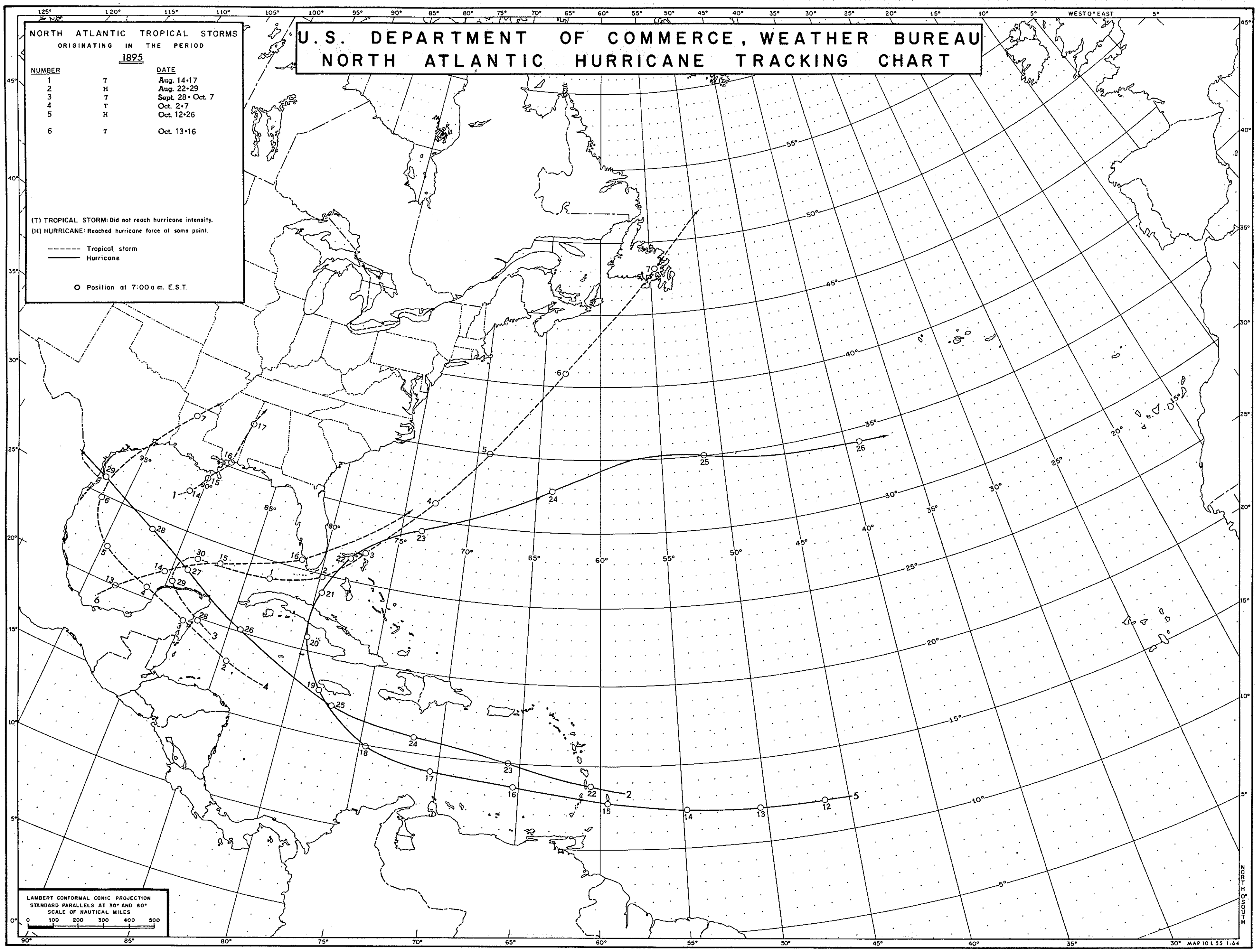
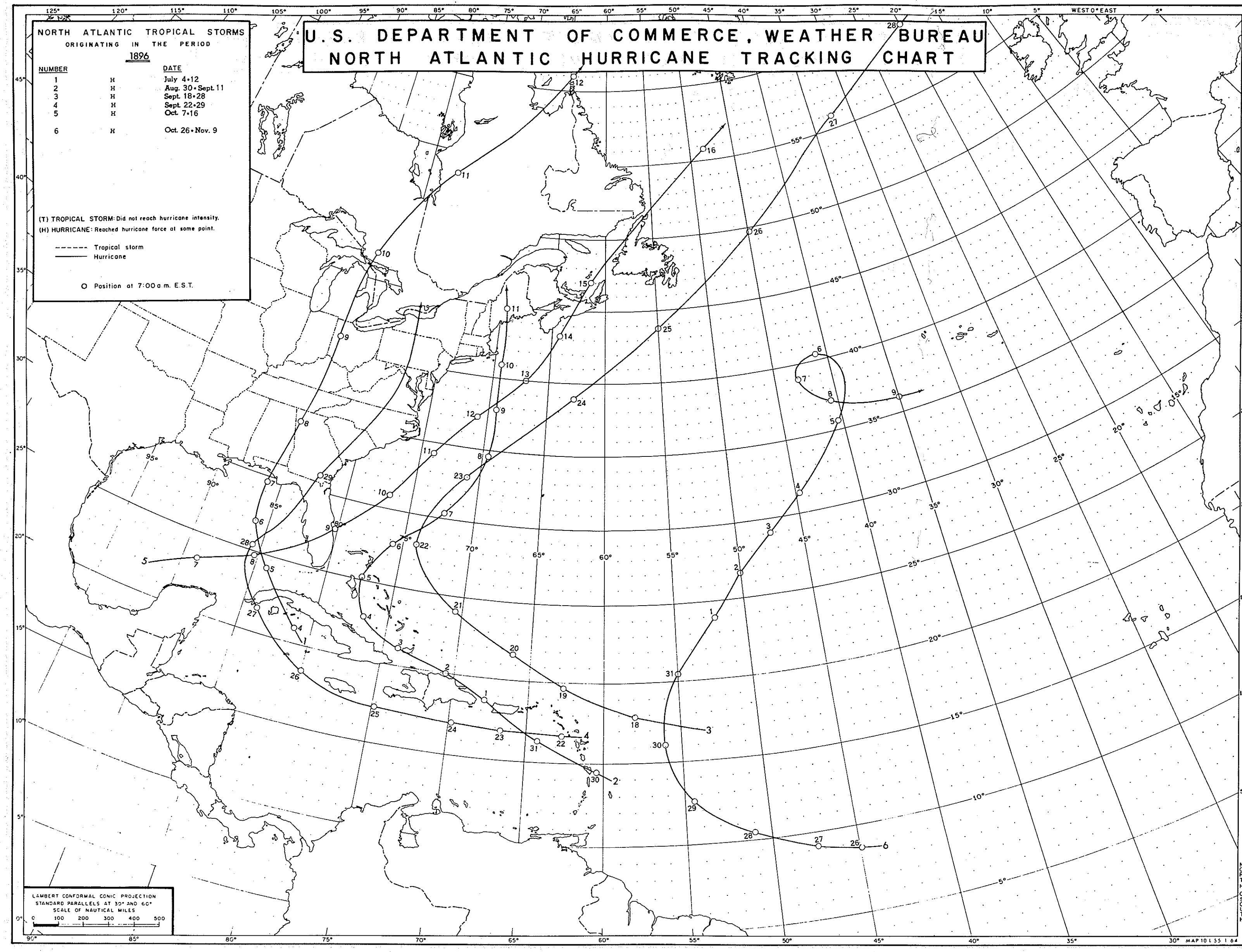
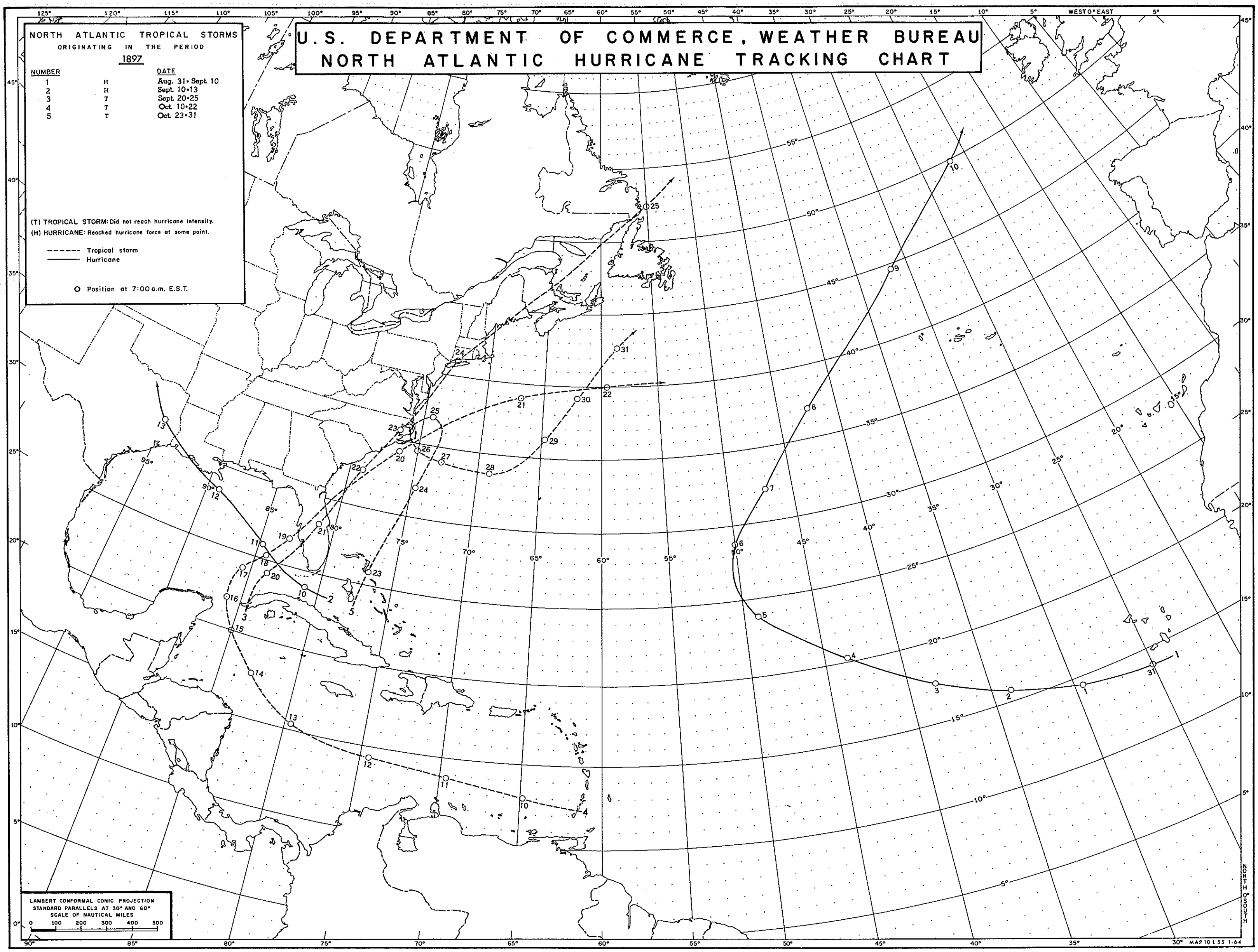
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1893
NUMBER DATE
1 H June 12-20
2 H July 4-6
3 H Aug. 13-25
4 H Aug. 15-26
5 H Aug. 15-18
6 H Aug. 15-Sept. 2
7 H Aug. 20-29
8 H Sept. 4-9
9 H Sept. 25-Oct. 15
10 H Sept. 27-Oct. 5
11 T Oct. 20-23
12 T Nov. 5-9
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 35 1-64

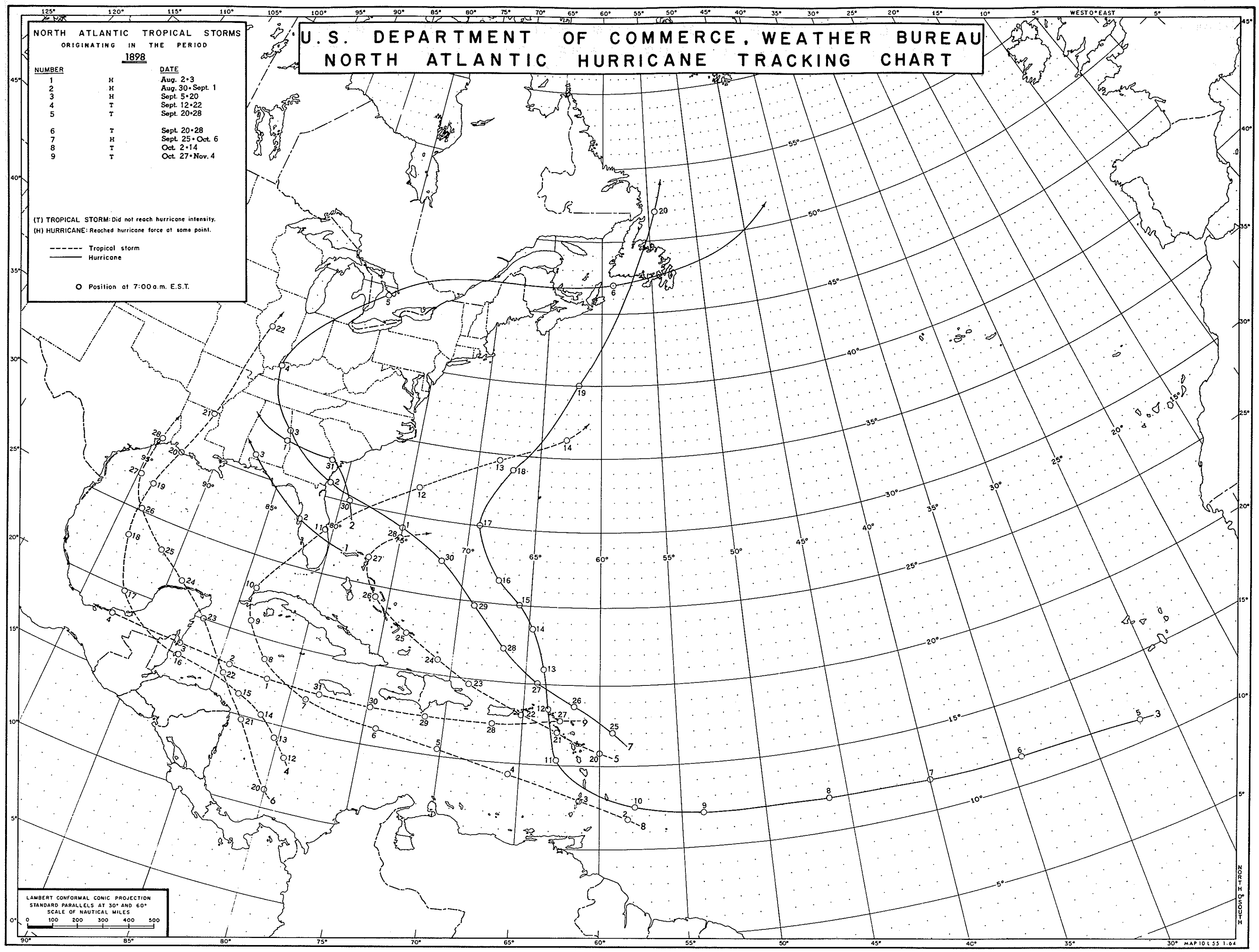

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1894
NUMBER DATE
1 T Aug. 5-8
2 H Aug. 30- Sept. 9
3 H Sept. 18-30
4 H Oct. 1-12
5 H Oct. 11-20
6 H Oct. 21-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH
SOUTH

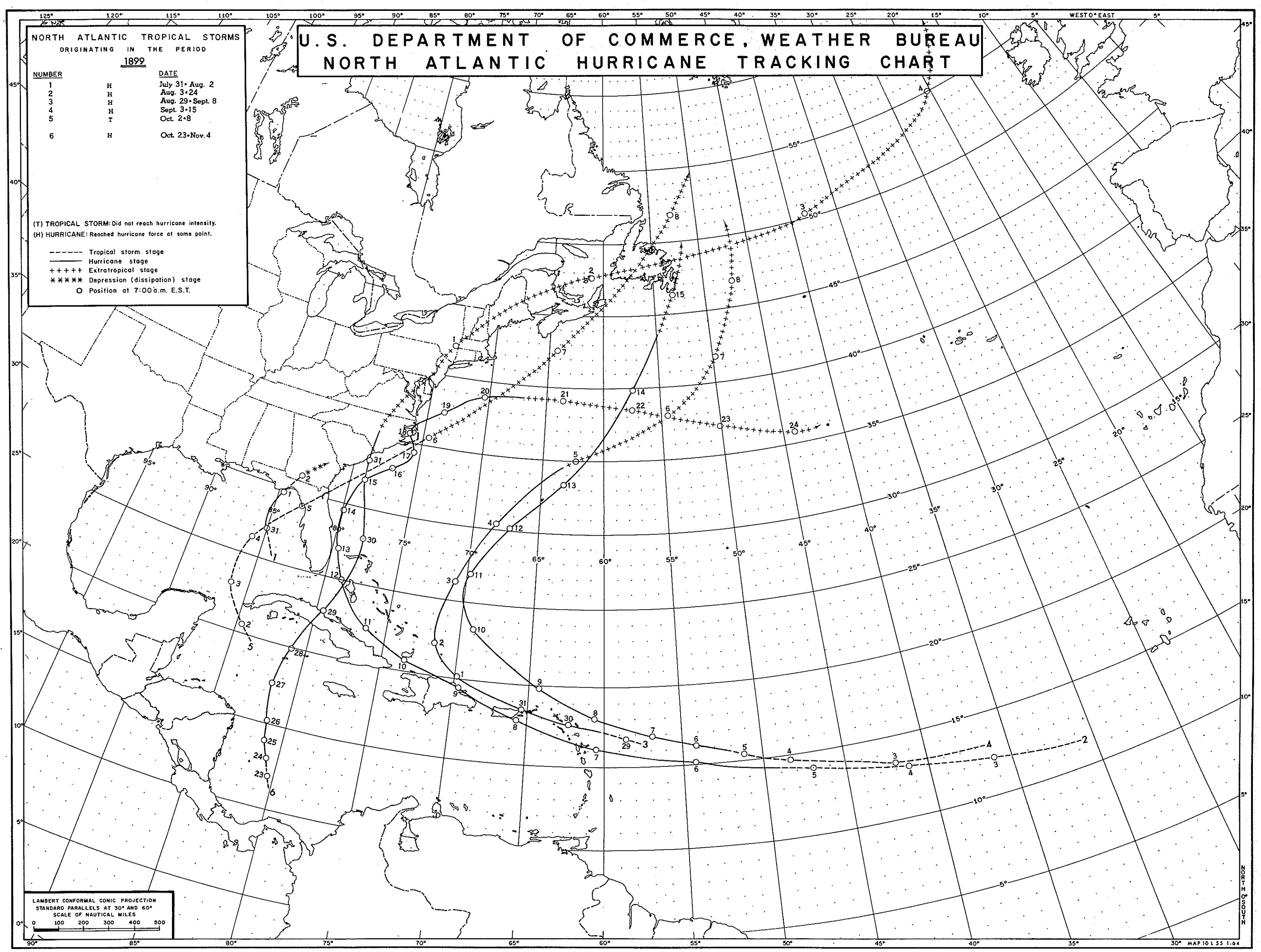


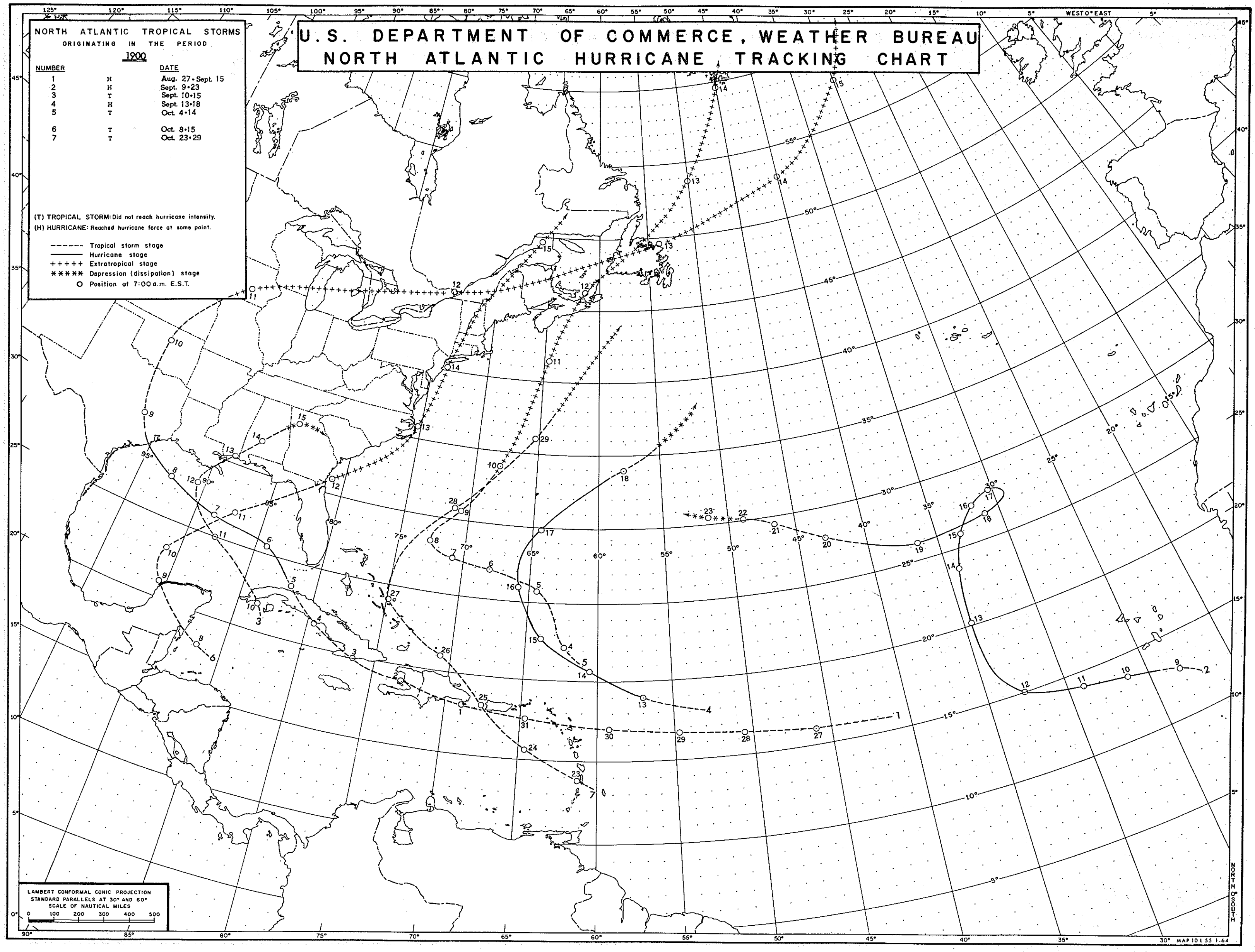
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1895
NUMBER
DATE
1 T Aug. 14-17
2 H Aug. 22-29
3 T Sept. 28 - Oct. 7
4 T Oct. 2-7
5 H Oct. 12-26
6 T Oct. 13-16
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0 EAST
NORTH 0 SOUTH
MAP 10 L 55 1-64

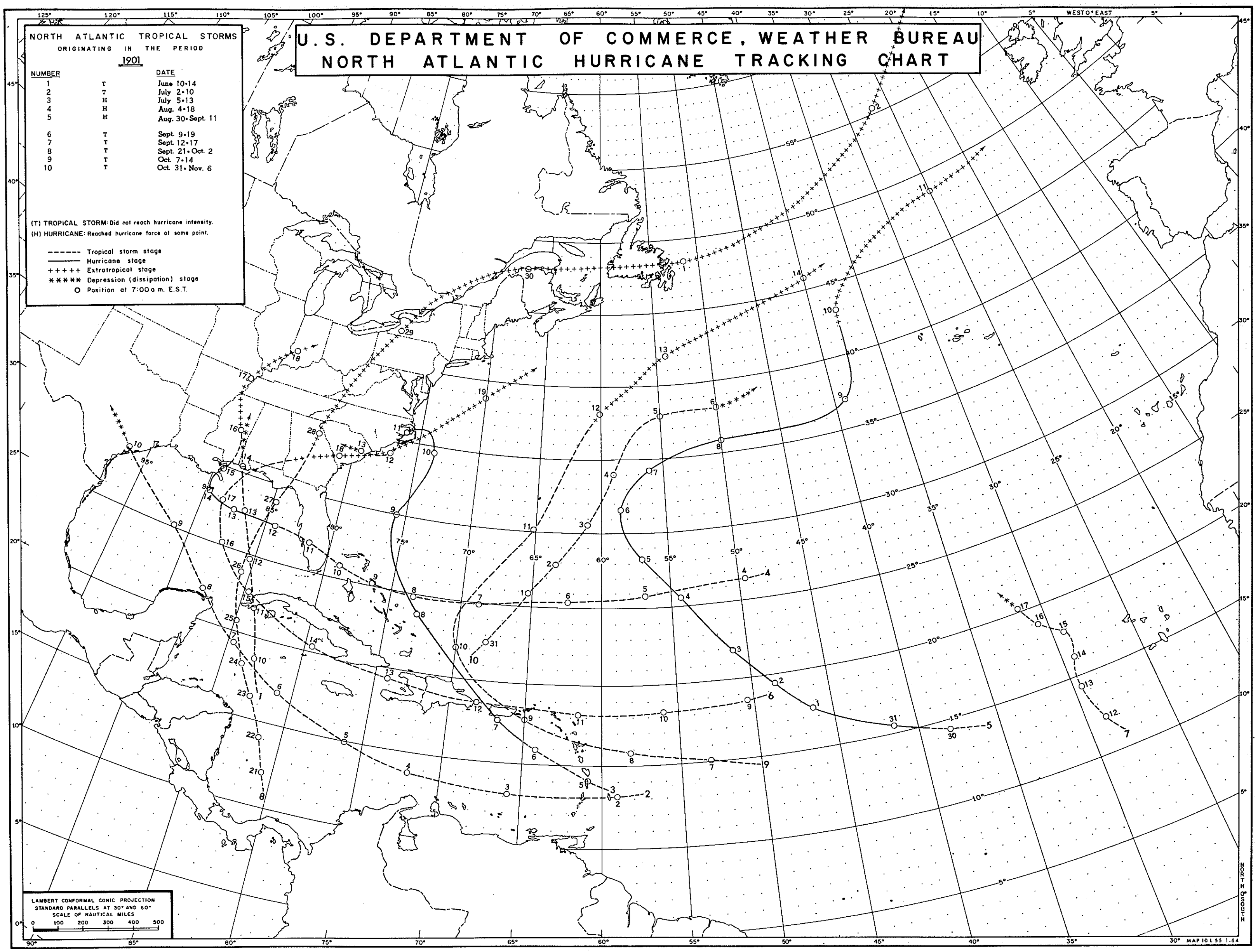

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1896
NUMBER DATE
1 H July 4-12
2 H Aug. 30-Sept. 11
3 H Sept. 18-28
4 H Sept. 22-29
5 H Oct. 7-16
6 H Oct. 26-Nov. 9
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH

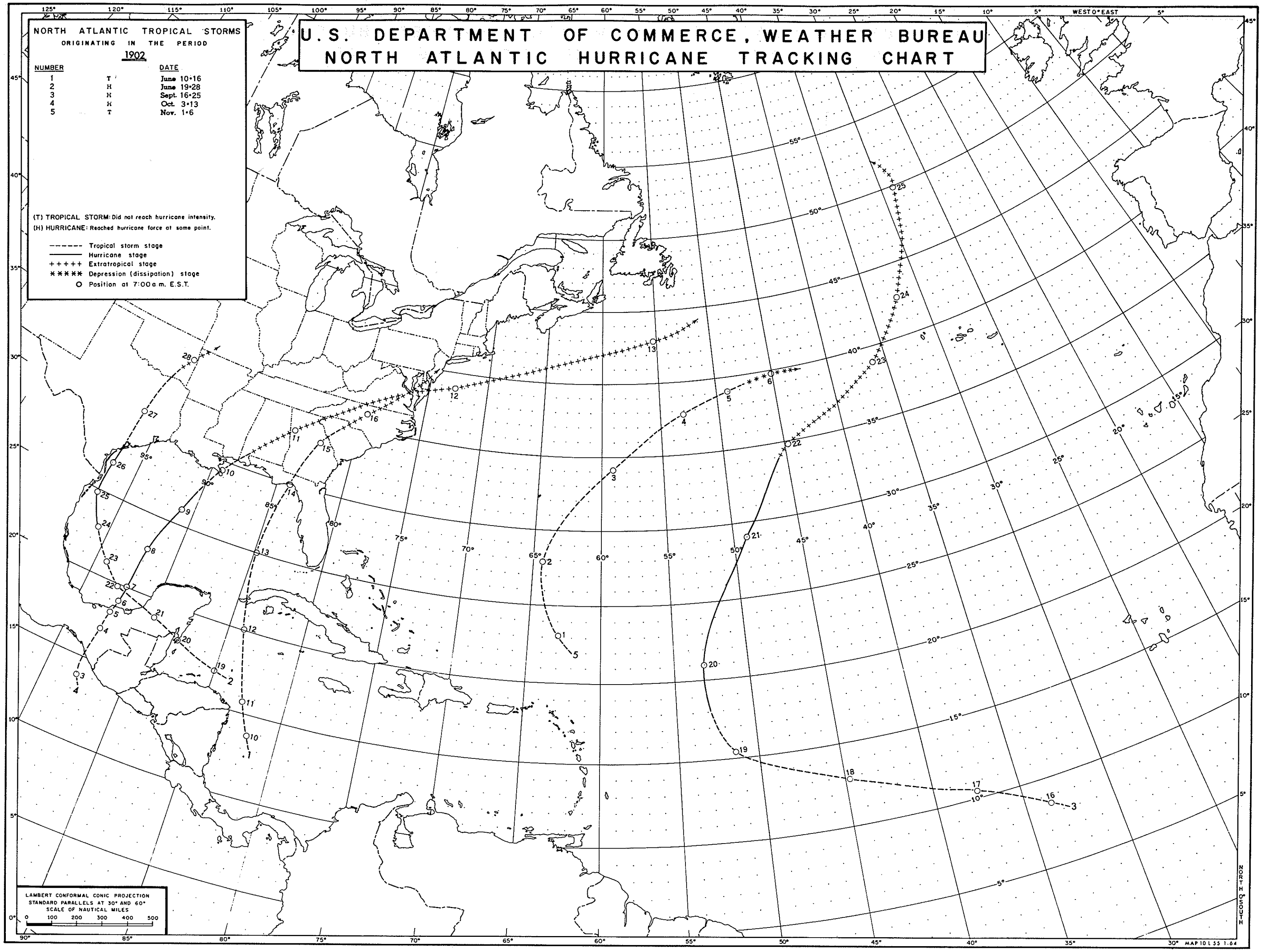

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1897
NUMBER
DATE
1 H Aug. 31 - Sept. 10
2 H Sept. 10-13
3 T Sept. 20-25
4 T Oct. 10-22
5 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1898
NUMBER DATE
1 H Aug. 2-3
2 H Aug. 30-Sept. 1
3 H Sept. 5-20
4 T Sept. 12-22
5 T Sept. 20-28
6 T Sept. 20-28
7 H Sept. 25-Oct. 6
8 T Oct. 2-14
9 T Oct. 27-Nov. 4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

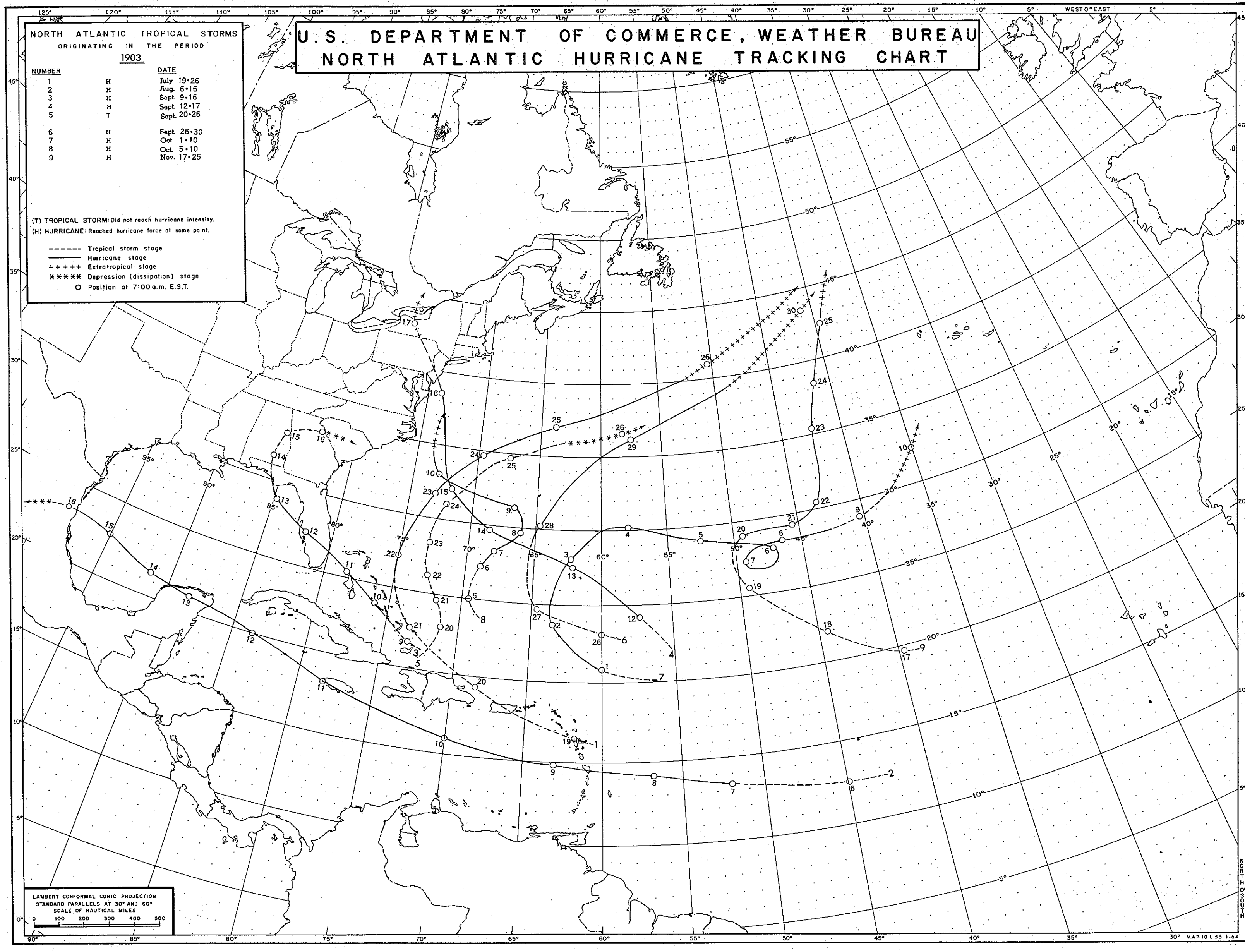

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1899
NUMBER
DATE
1 H July 31 • Aug. 2
2 H Aug. 3 • 24
3 H Aug. 29 • Sept. 8
4 H Sept. 3 • 15
5 T Oct. 2 • 8
6 H Oct. 23 • Nov. 4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64

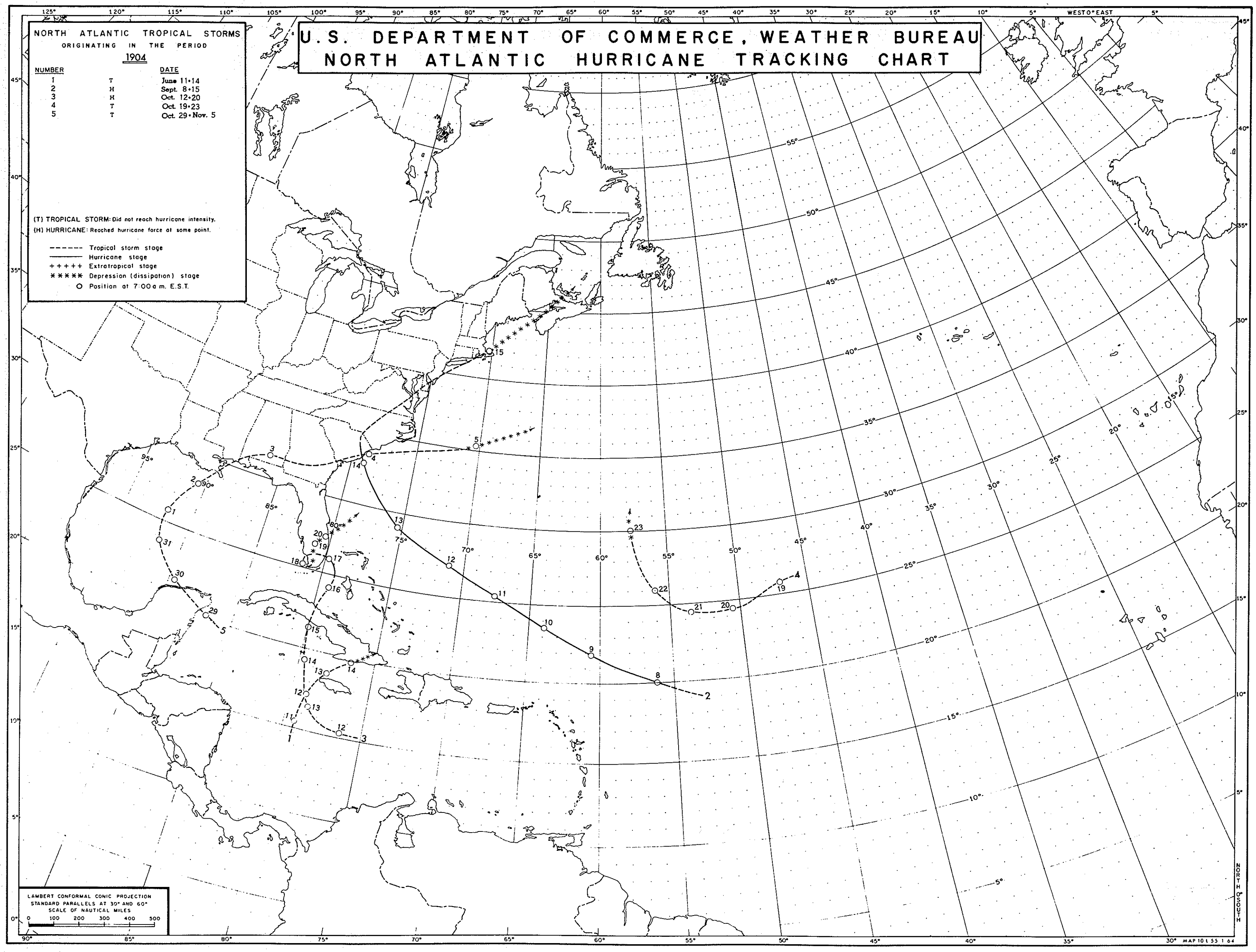

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1900
NUMBER
DATE
1 H Aug. 27-Sept. 15
2 H Sept. 9-23
3 T Sept. 10-15
4 H Sept. 13-18
5 T Oct. 4-14
6 T Oct. 8-15
7 T Oct. 23-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1901
NUMBER
DATE
1 T June 10-14
2 T July 2-10
3 H July 5-13
4 H Aug. 4-18
5 H Aug. 30-Sept. 11
6 T Sept. 9-19
7 T Sept. 12-17
8 T Sept. 21-Oct. 2
9 T Oct. 7-14
10 T Oct. 31-Nov. 6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH
MAP 10 L 55 1-64

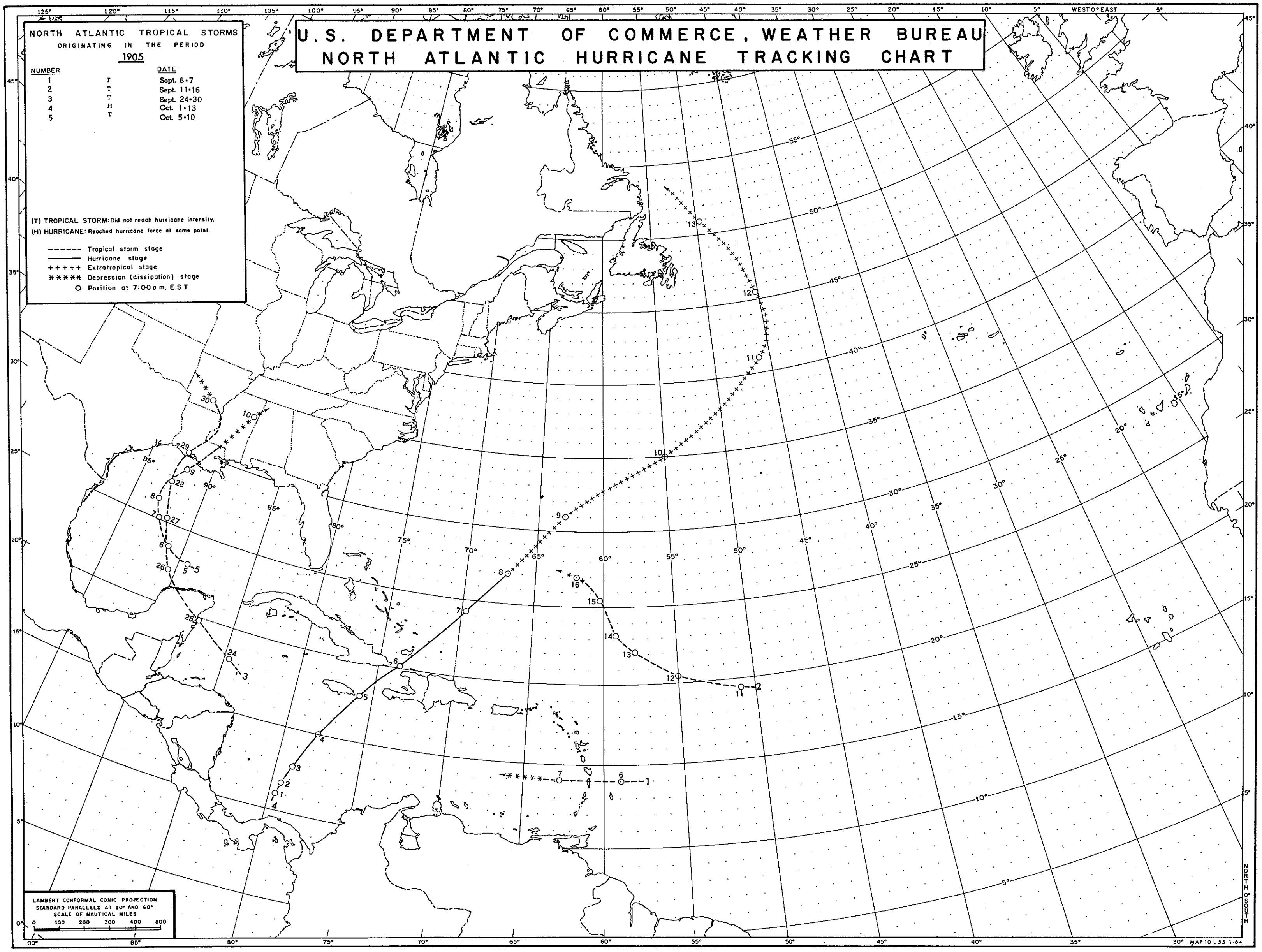


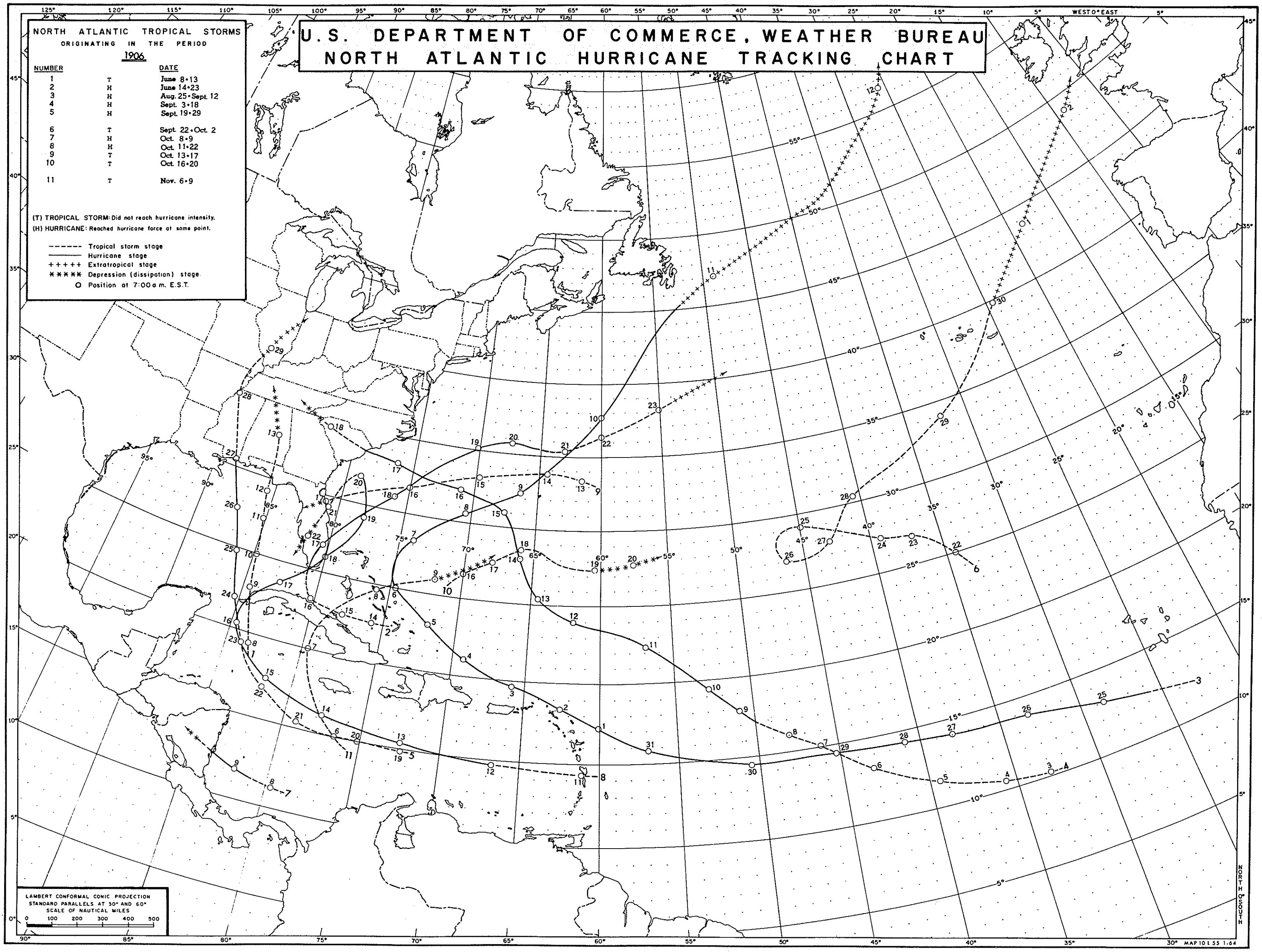
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1902
NUMBER DATE
1 T June 10-16
2 H June 19-28
3 H Sept. 16-25
4 H Oct. 3-13
5 T Nov. 1-6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
——— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1903
NUMBER DATE
1 H July 19•26
2 H Aug. 6•16
3 H Sept. 9•16
4 H Sept. 12•17
5 T Sept. 20•26
6 H Sept. 26•30
7 H Oct. 1•10
8 H Oct. 5•10
9 H Nov. 17•25
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH SOUTH
WEST EAST

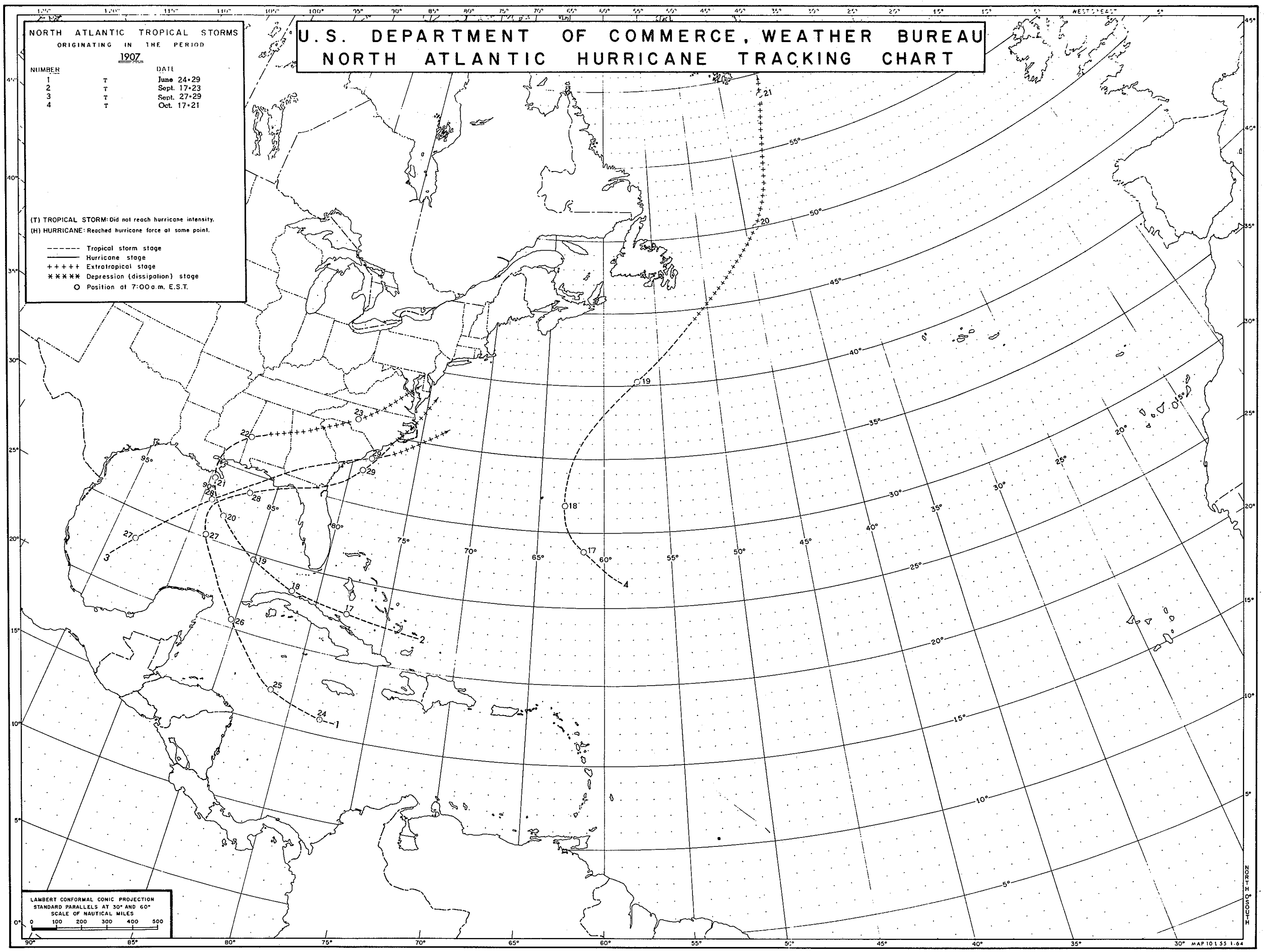


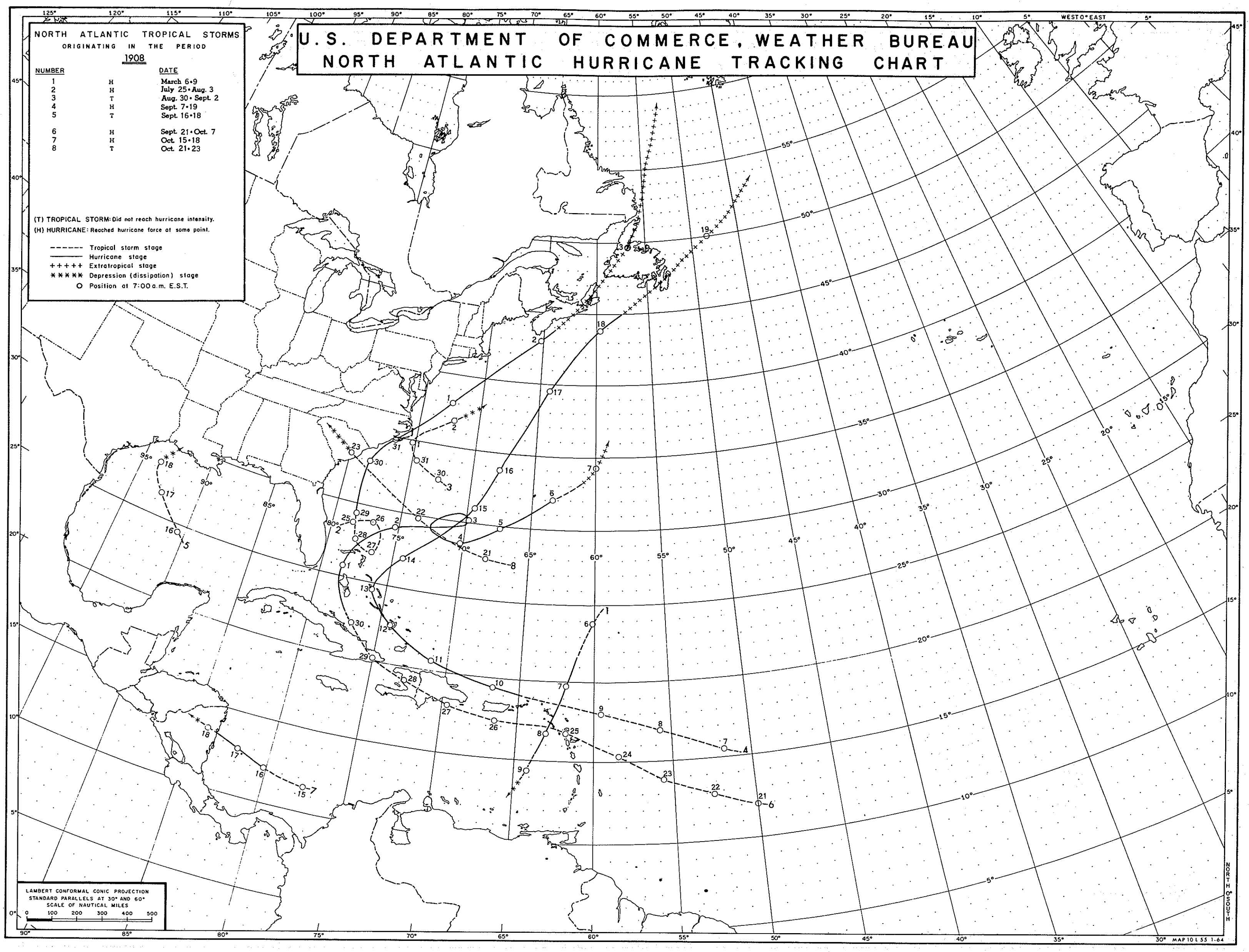
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1904
NUMBER DATE
1 T June 11-14
2 H Sept. 8-15
3 H Oct. 12-20
4 T Oct. 19-23
5 T Oct. 29-Nov. 5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1905
NUMBER
DATE
1 T Sept. 6-7
2 T Sept. 11-16
3 T Sept. 24-30
4 H Oct. 1-13
5 T Oct. 5-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

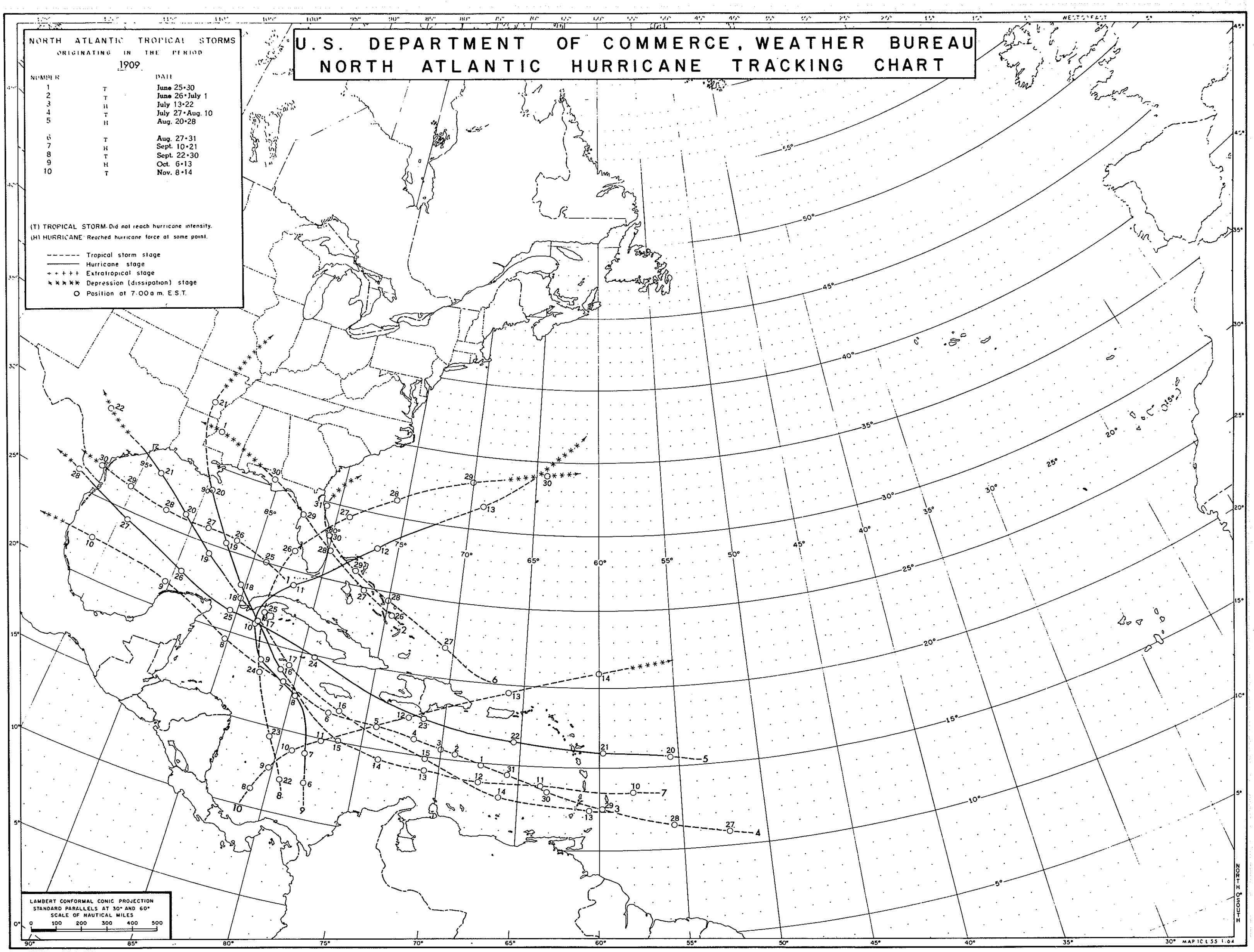


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1906
NUMBER DATE
1 T June 8-13
2 H June 14-23
3 H Aug. 25-Sept. 12
4 H Sept. 3-18
5 H Sept. 19-29
6 T Sept. 22-Oct. 2
7 H Oct. 8-9
8 H Oct. 11-22
9 T Oct. 13-17
10 T Oct. 16-20
11 T Nov. 6-9
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

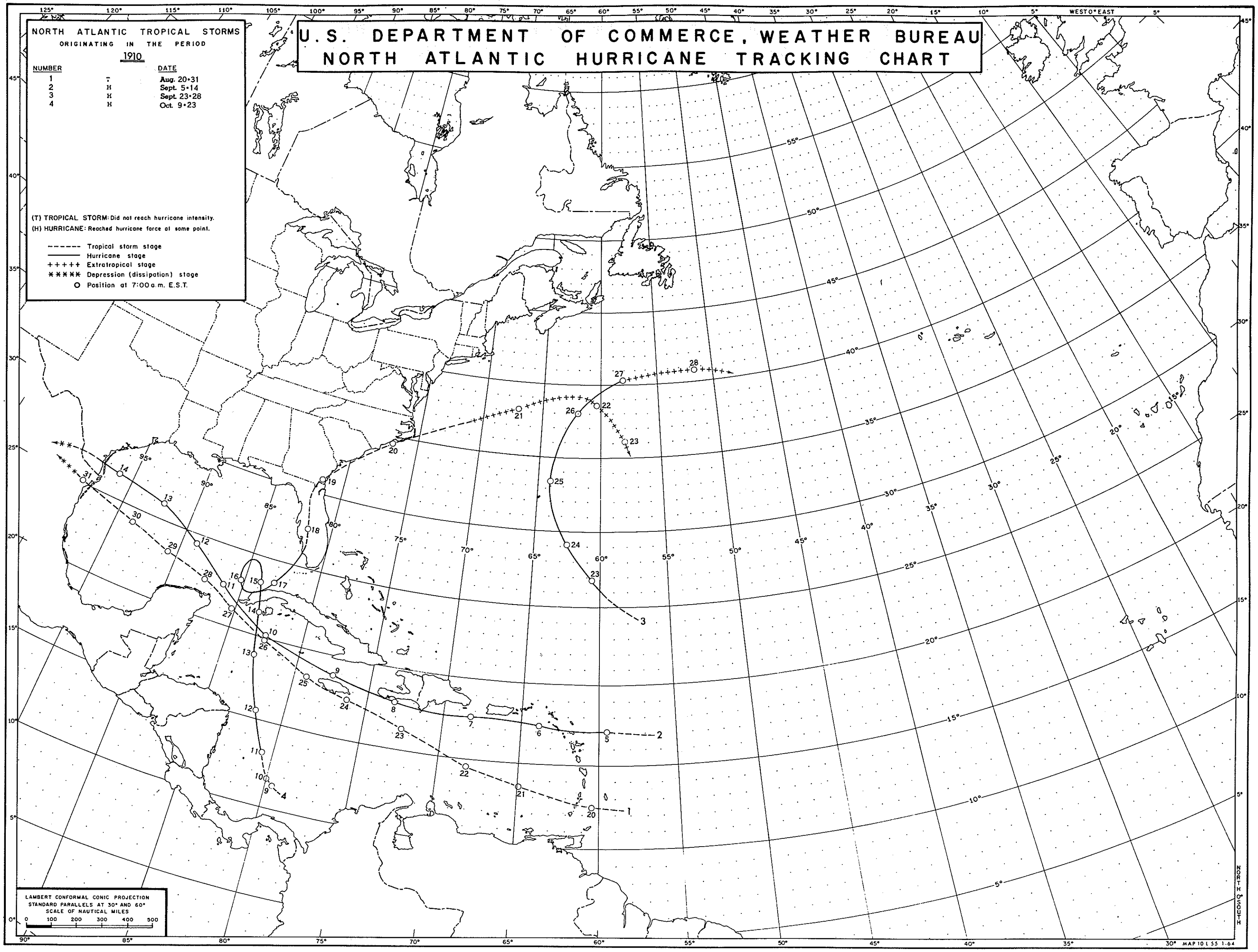

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1907
NUMBER DATE
1 T June 24-29
2 T Sept. 17-23
3 T Sept. 27-29
4 T Oct. 17-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

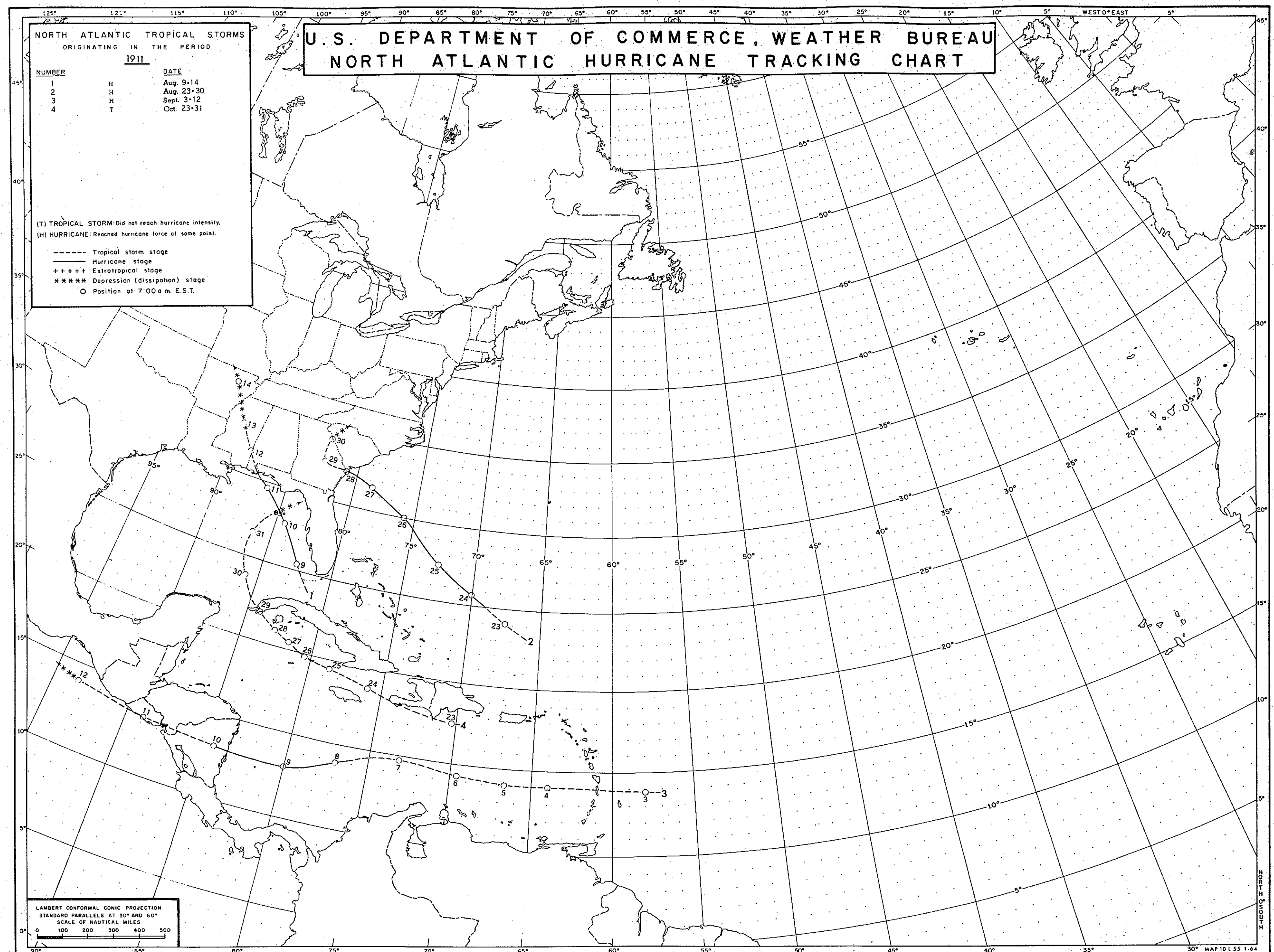


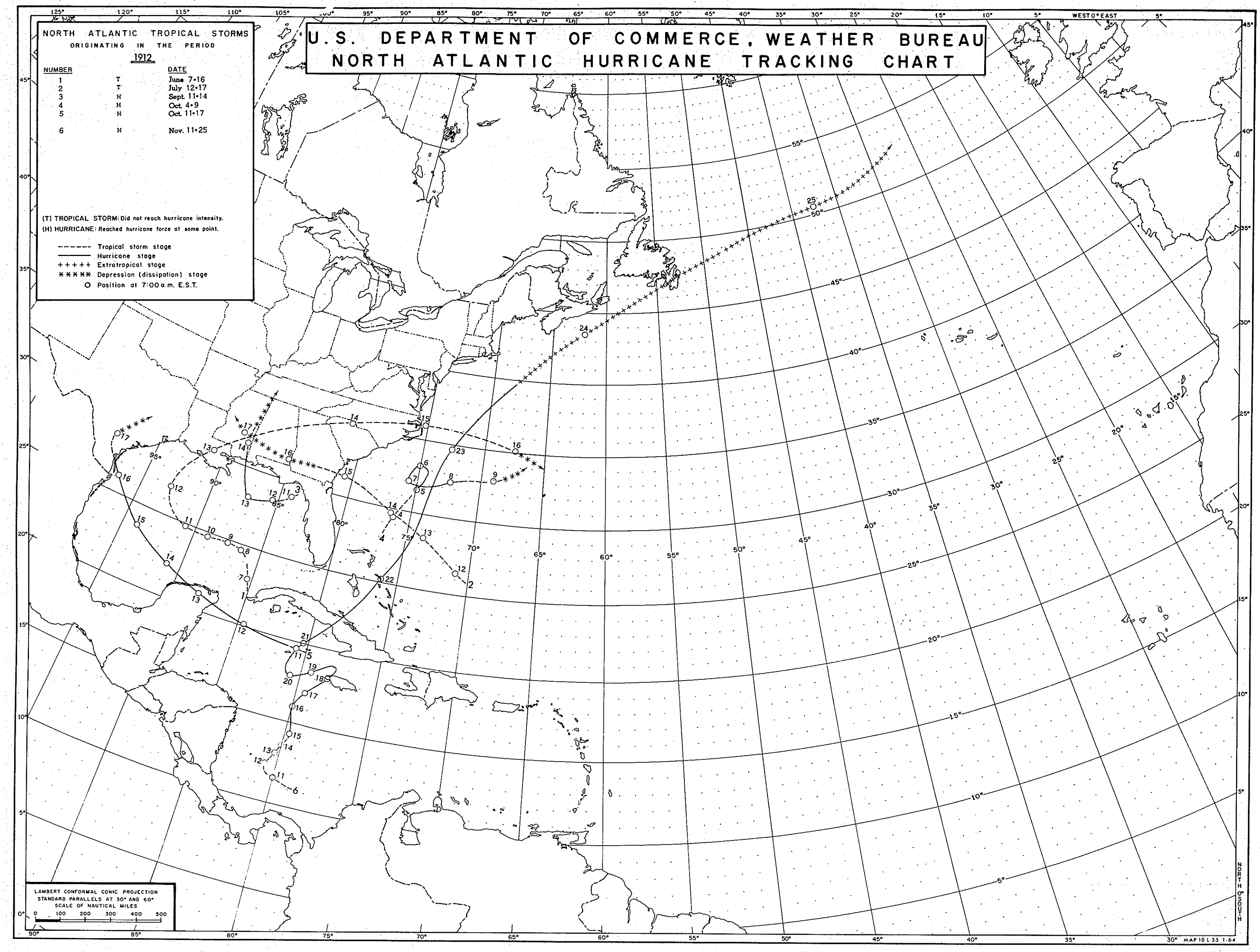
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1908
NUMBER
DATE
1 H March 6-9
2 H July 25-Aug. 3
3 T Aug. 30-Sept. 2
4 H Sept. 7-19
5 T Sept. 16-18
6 H Sept. 21-Oct. 7
7 H Oct. 15-18
8 T Oct. 21-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH

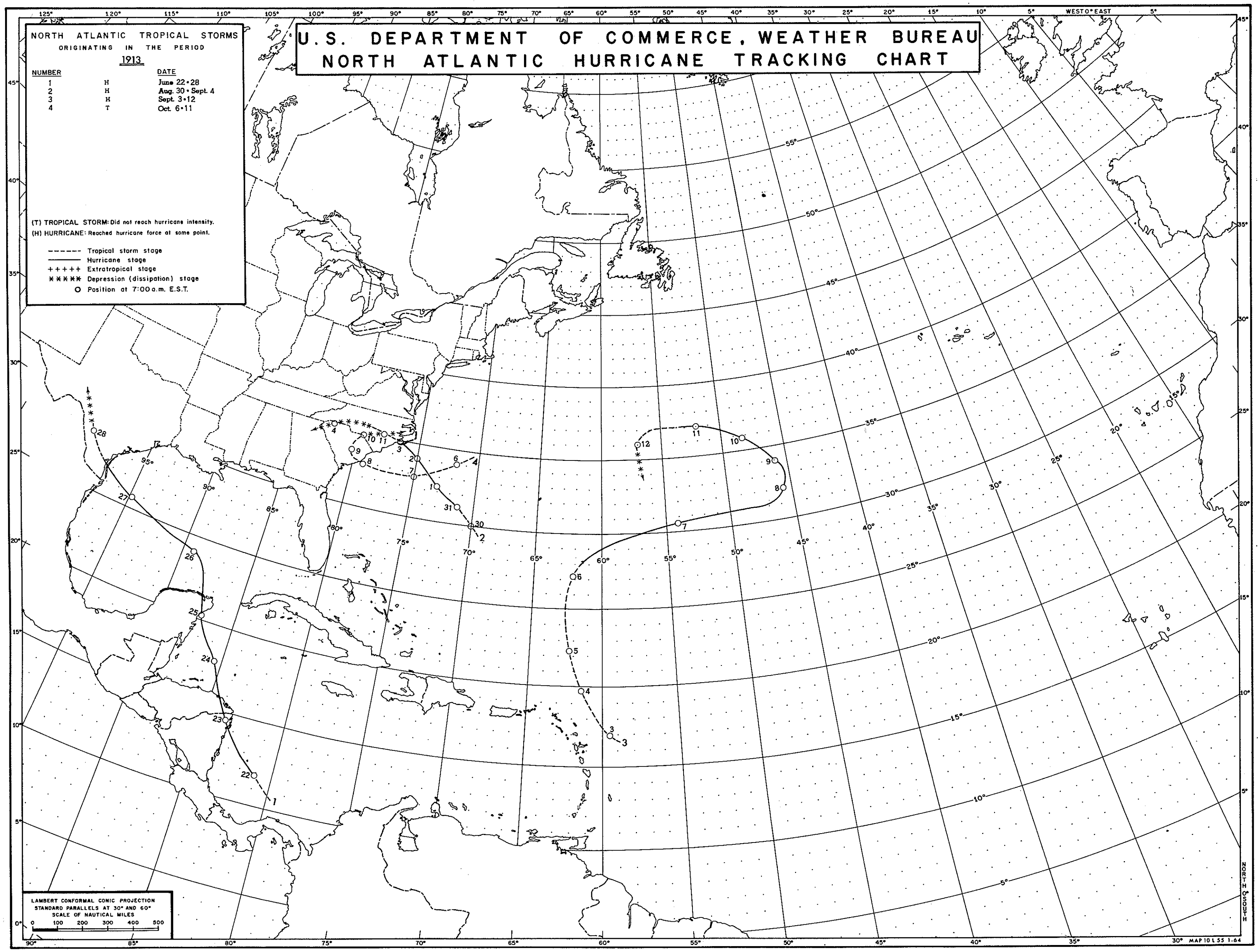


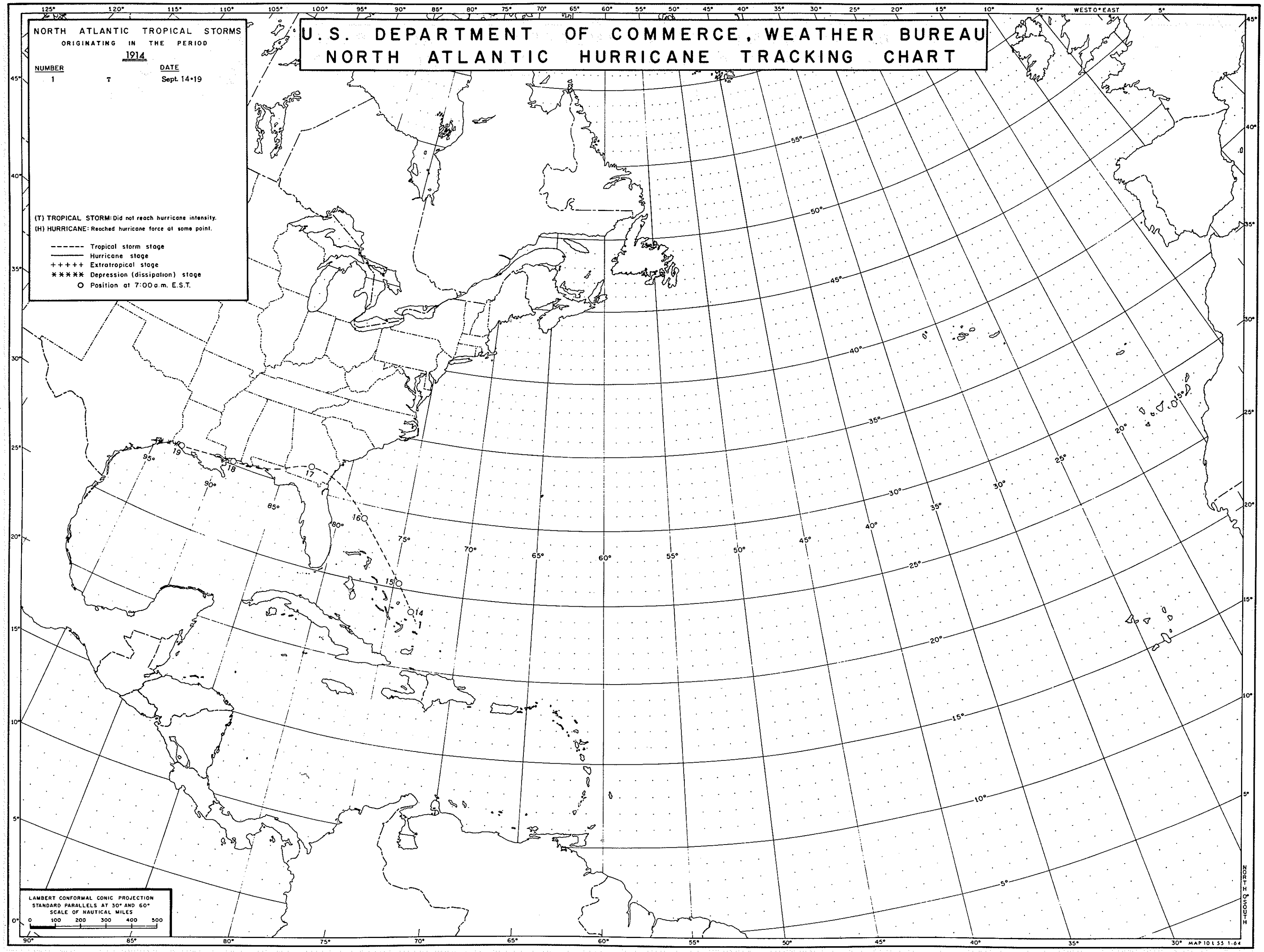
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1909
NUMBER
DATE
1 T June 25•30
2 T June 26•July 1
3 H July 13•22
4 T July 27•Aug. 10
5 H Aug. 20•28
6 T Aug. 27•31
7 H Sept. 10•21
8 T Sept. 22•30
9 H Oct. 6•13
10 T Nov. 8•14
(T) TROPICAL STORM. Did not reach hurricane intensity.
(H) HURRICANE. Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

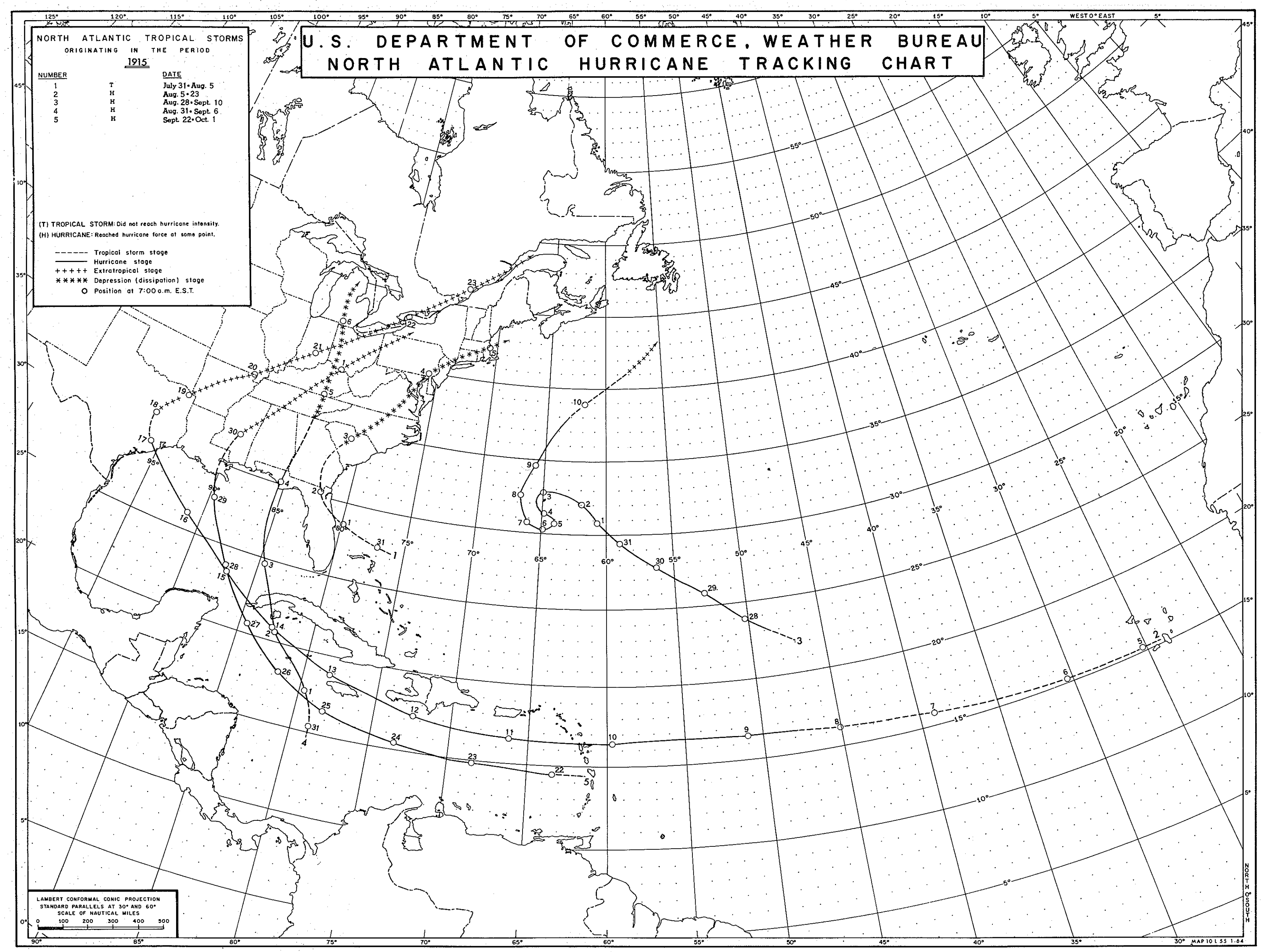

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1910
NUMBER DATE
1 T Aug. 20-31
2 H Sept. 5-14
3 H Sept. 23-28
4 H Oct. 9-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

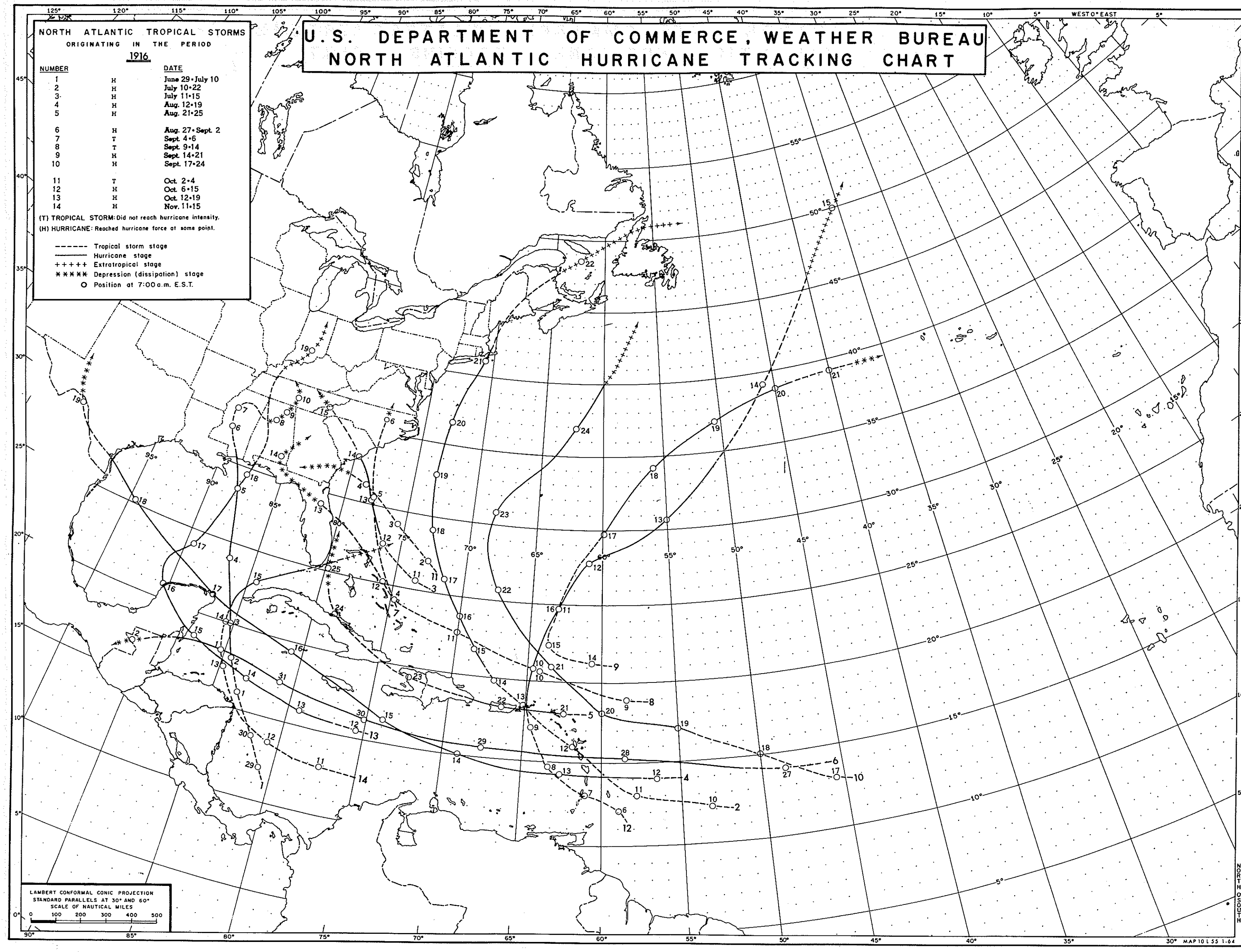

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1911
NUMBER
DATE
1 H Aug. 9-14
2 H Aug. 23-30
3 H Sept. 3-12
4 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1912
NUMBER DATE
1 T June 7-16
2 T July 12-17
3 H Sept. 11-14
4 H Oct. 4-9
5 H Oct. 11-17
6 H Nov. 11-25
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
MAP 10 L 55 1.64

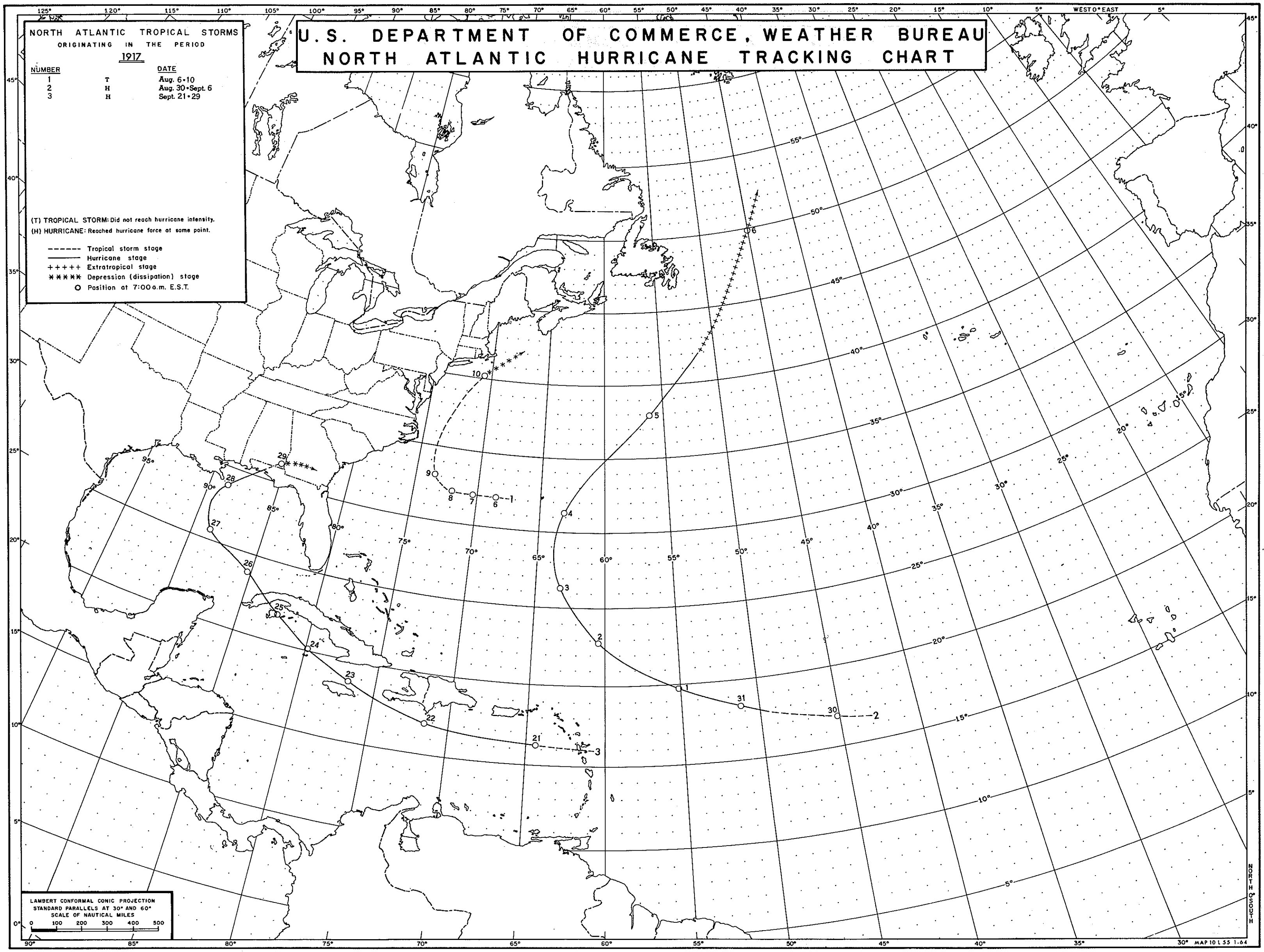

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1913
NUMBER
DATE
1 H June 22-28
2 H Aug. 30 - Sept. 4
3 H Sept. 3-12
4 T Oct. 6-11
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
MAP 10 L 55 1-64

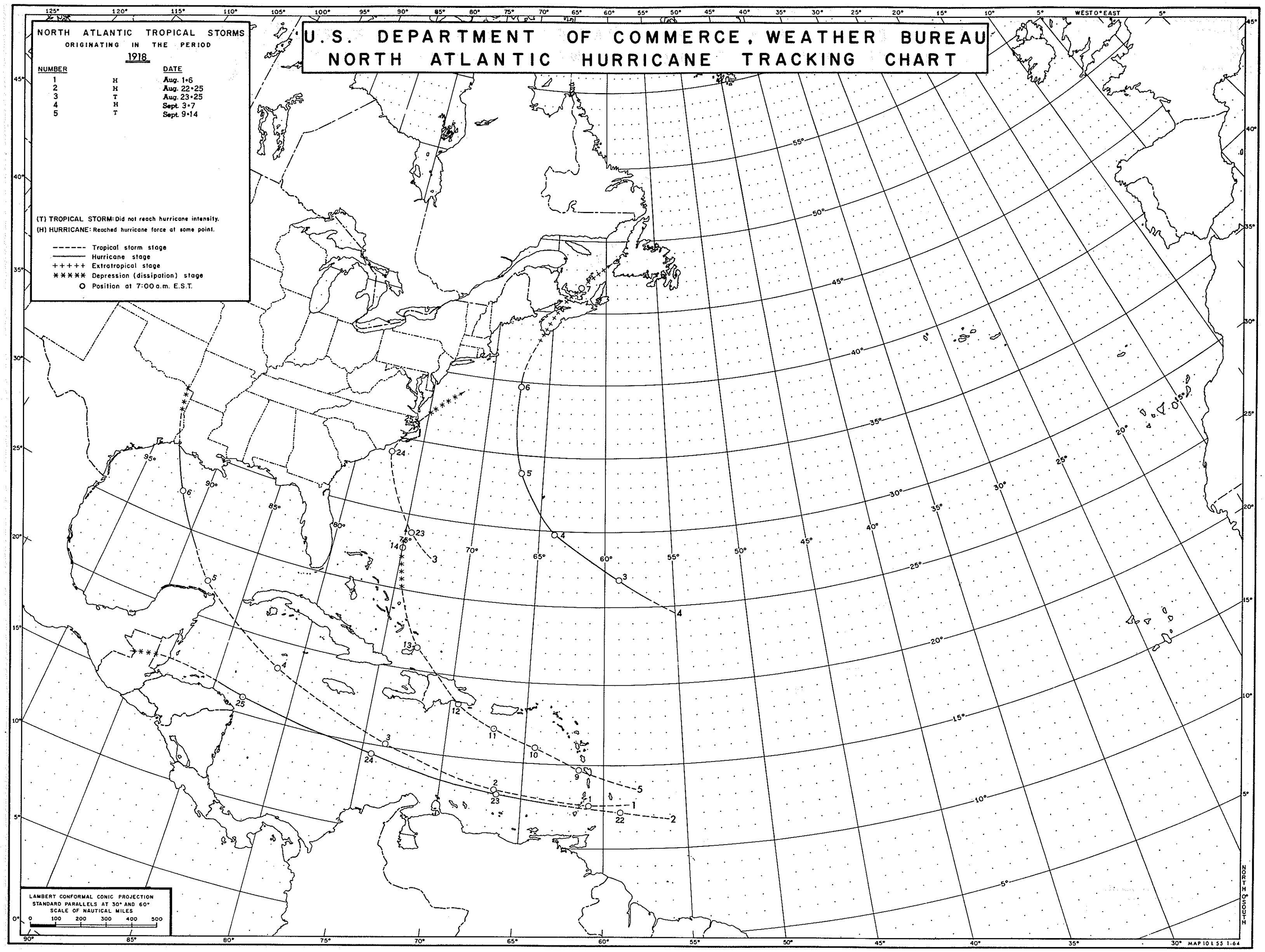

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1914
NUMBER
DATE
1
T
Sept. 14-19
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0
100
200
300
400
500
14
15
16
17
18
19
1

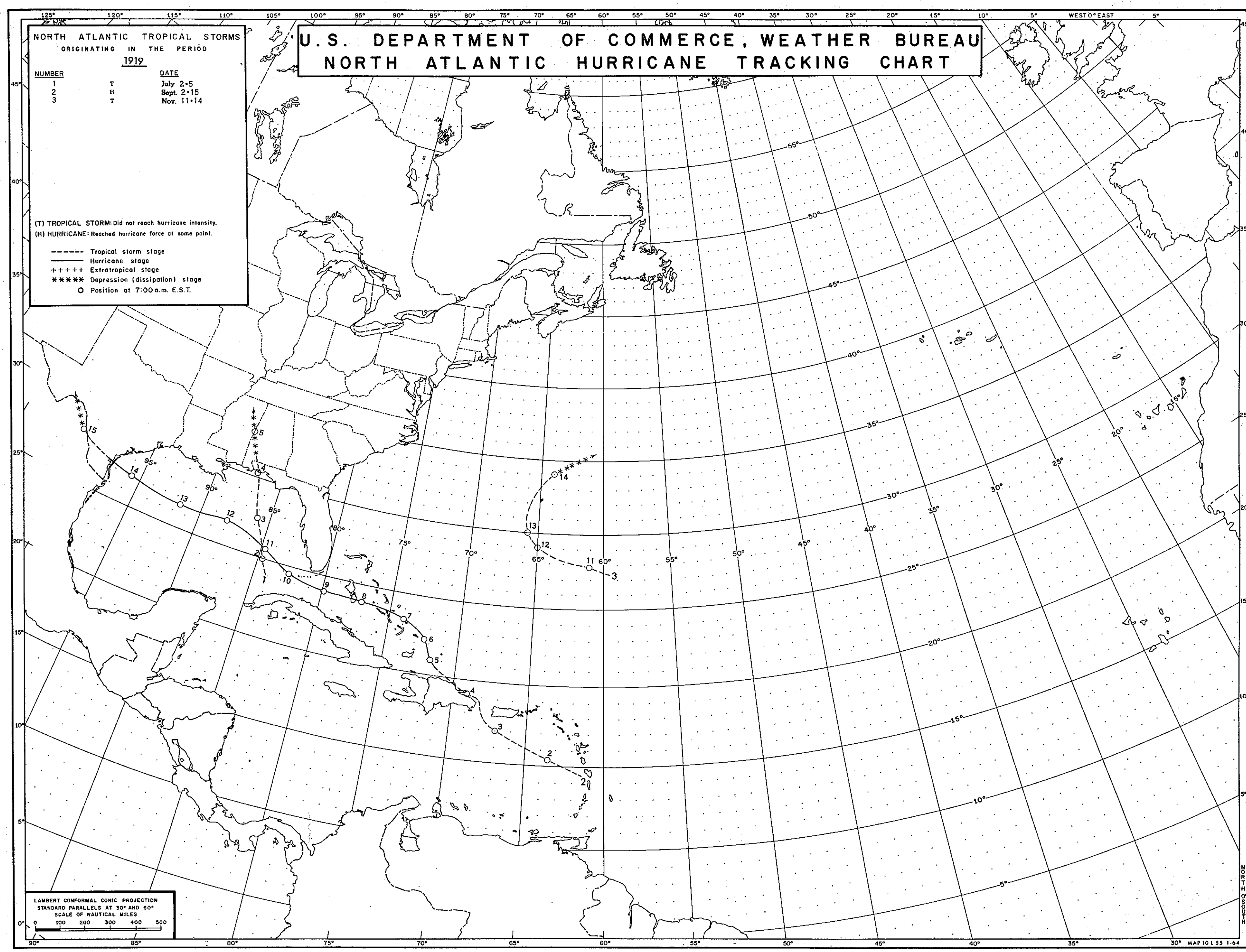

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1915
NUMBER
DATE
1 T July 31 • Aug. 5
2 H Aug. 5 • 23
3 H Aug. 28 • Sept. 10
4 H Aug. 31 • Sept. 6
5 H Sept. 22 • Oct. 1
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

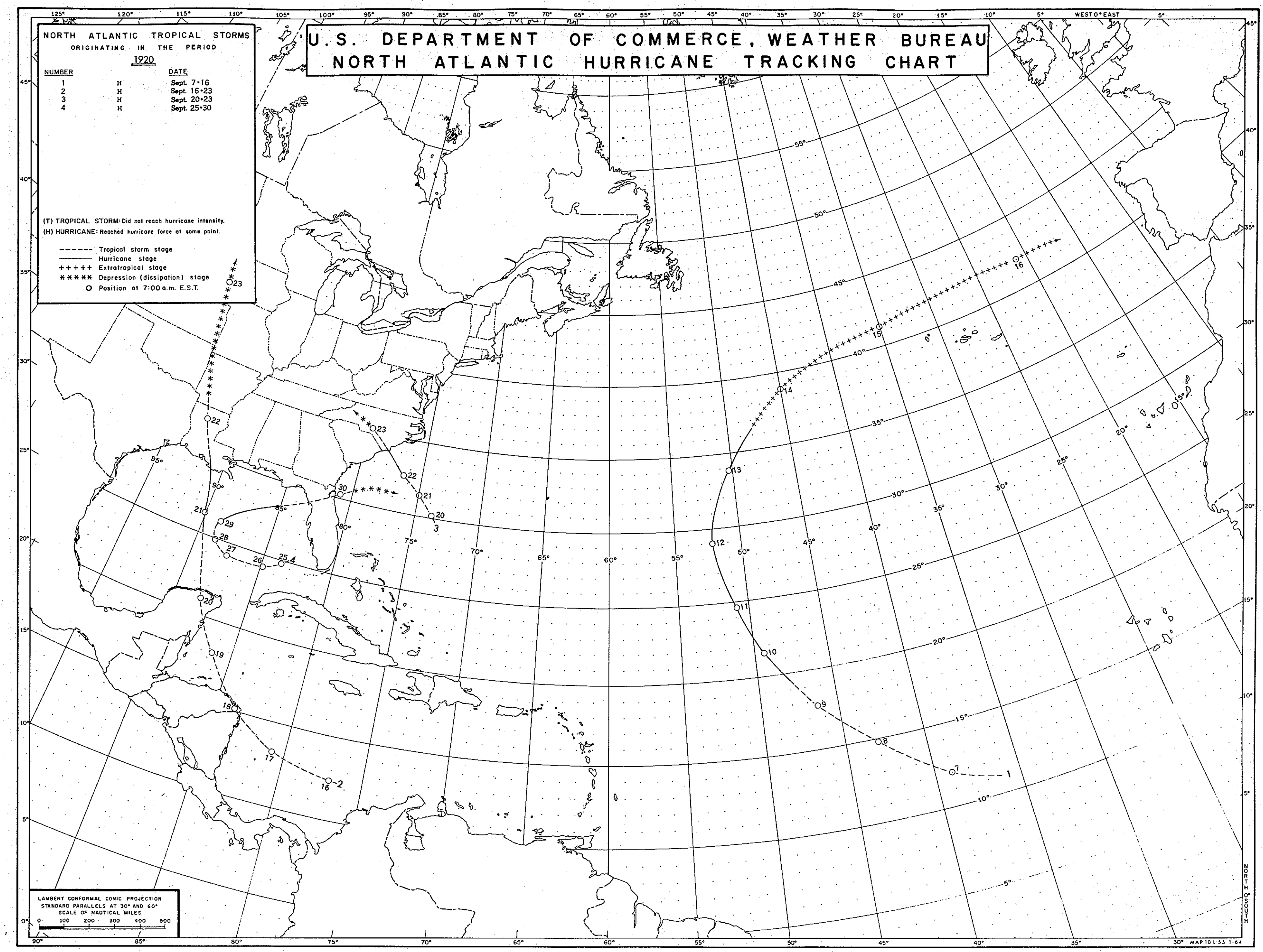


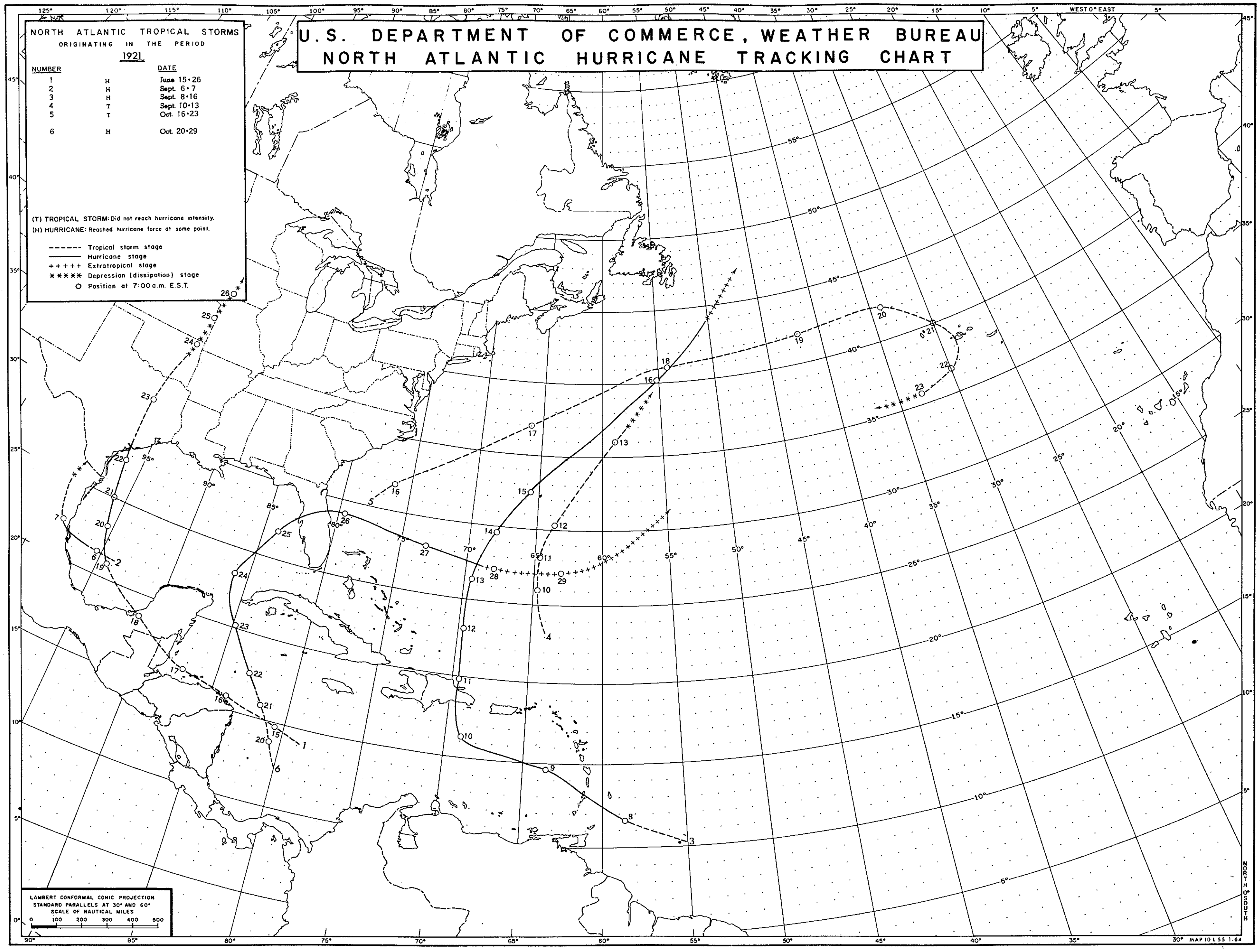
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1916
NUMBER DATE
1 H June 29-July 10
2 H July 10-22
3 H July 11-15
4 H Aug. 12-19
5 H Aug. 21-25
6 H Aug. 27-Sept. 2
7 T Sept. 4-6
8 T Sept. 9-14
9 H Sept. 14-21
10 H Sept. 17-24
11 T Oct. 2-4
12 H Oct. 6-15
13 H Oct. 12-19
14 H Nov. 11-15
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1917
NUMBER
DATE
1 T Aug. 6-10
2 H Aug. 30-Sept. 6
3 H Sept. 21-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

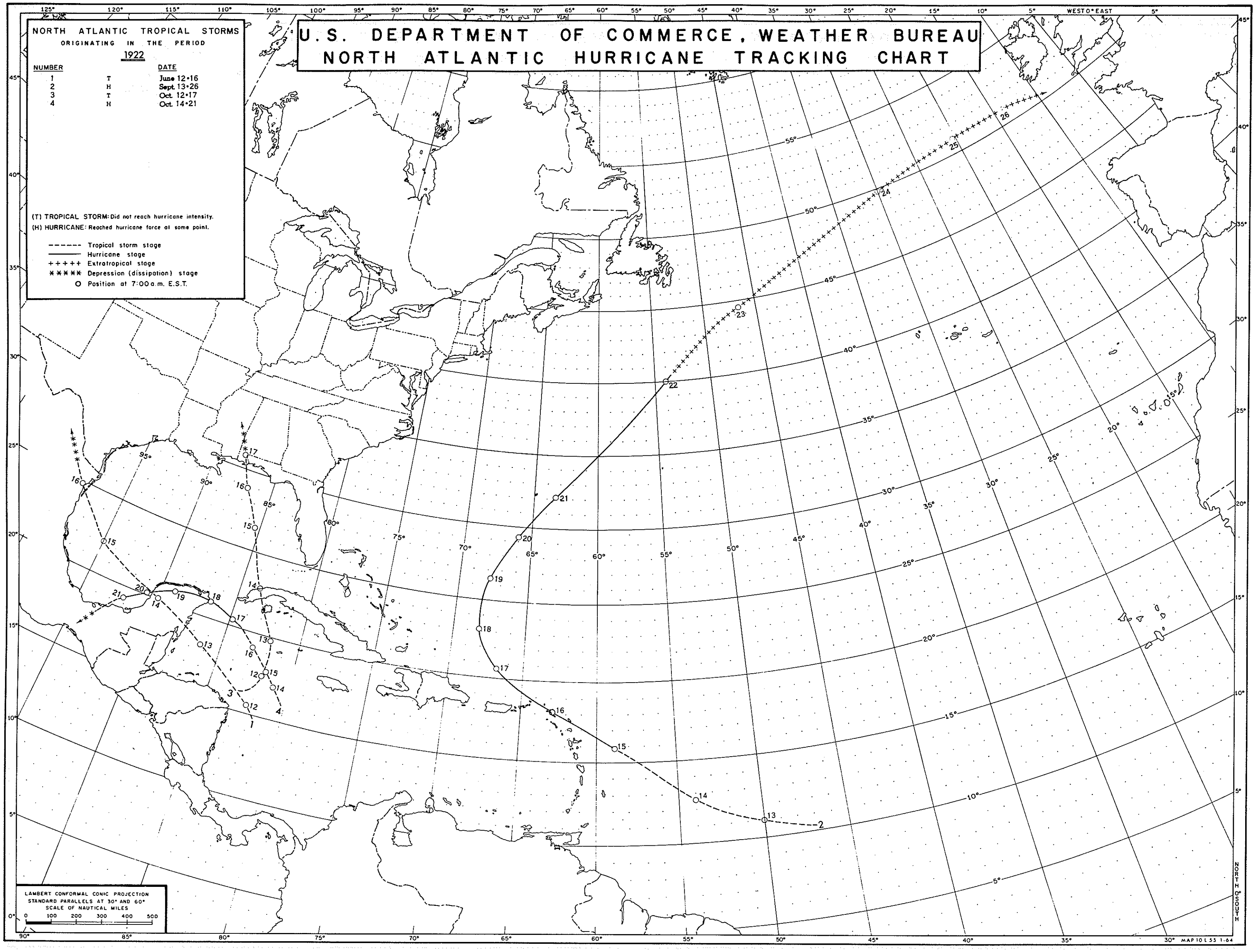

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1918
NUMBER
DATE
1 H Aug. 1-6
2 H Aug. 22-25
3 T Aug. 23-25
4 H Sept. 3-7
5 T Sept. 9-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH

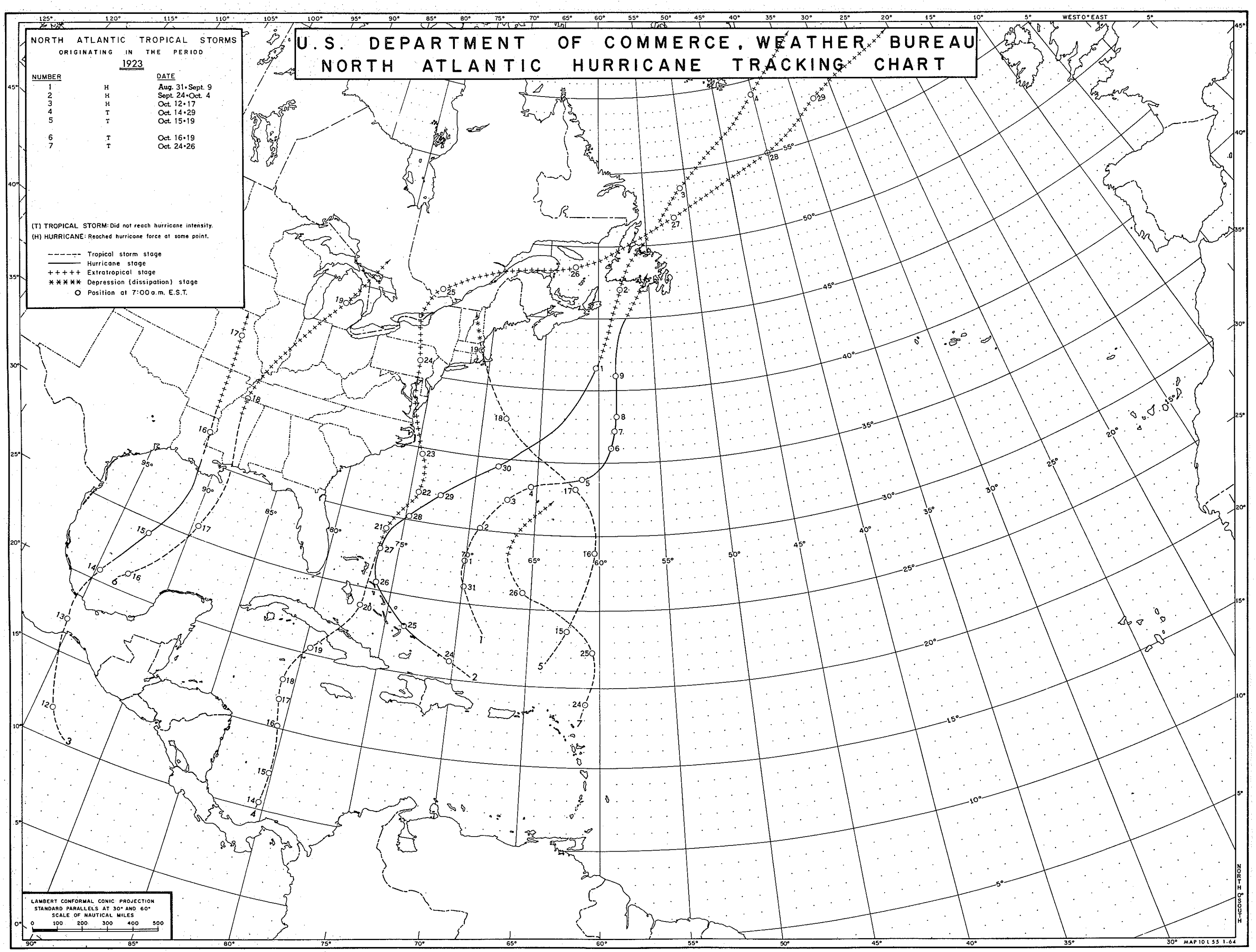

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1919
NUMBER
DATE
1 T July 2-5
2 H Sept. 2-15
3 T Nov. 11-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 1015S 1-64

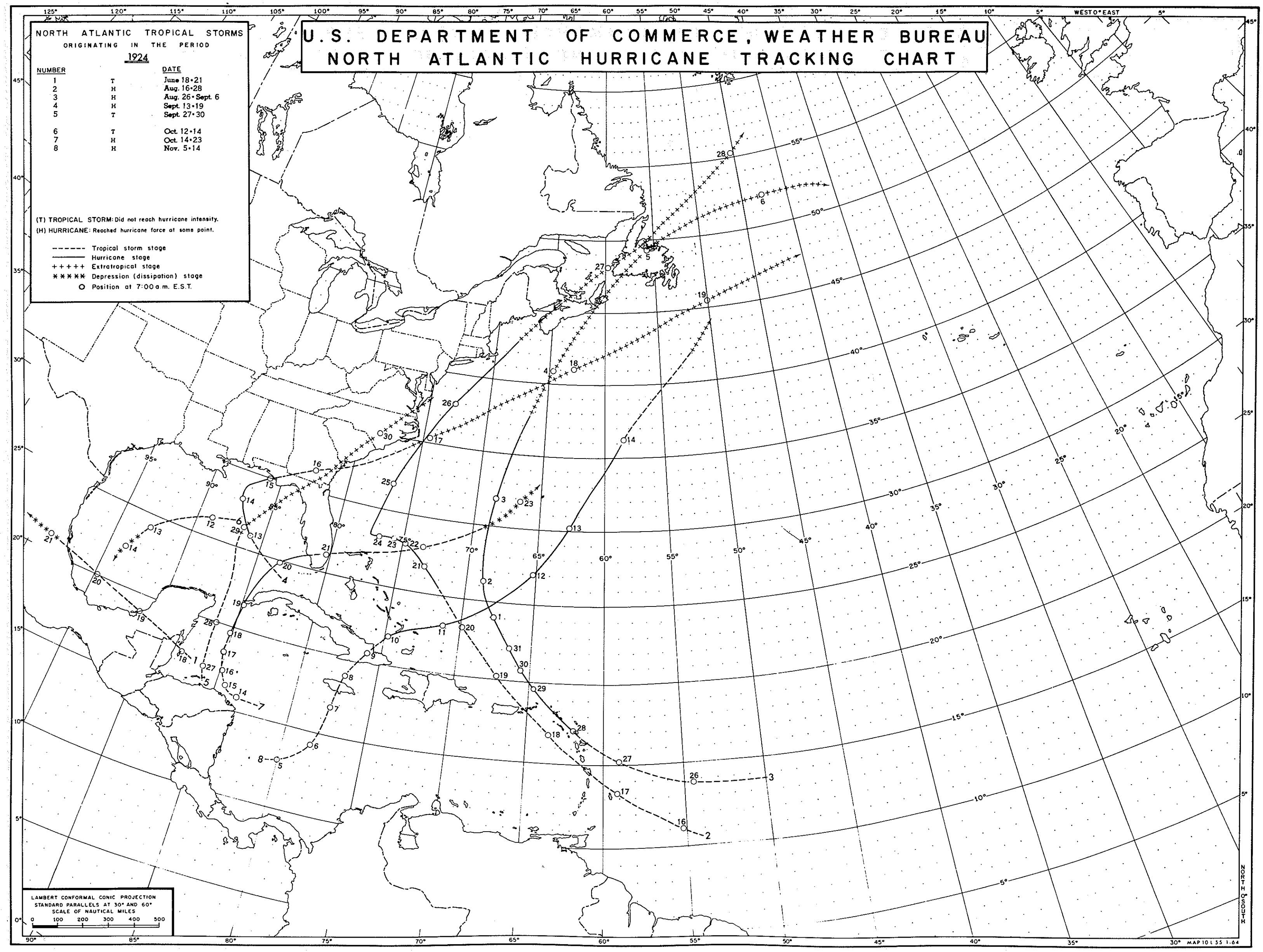

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1920
NUMBER DATE
1 H Sept. 7-16
2 H Sept. 16-23
3 H Sept. 20-23
4 H Sept. 25-30
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH 0° SOUTH
WEST 0° EAST

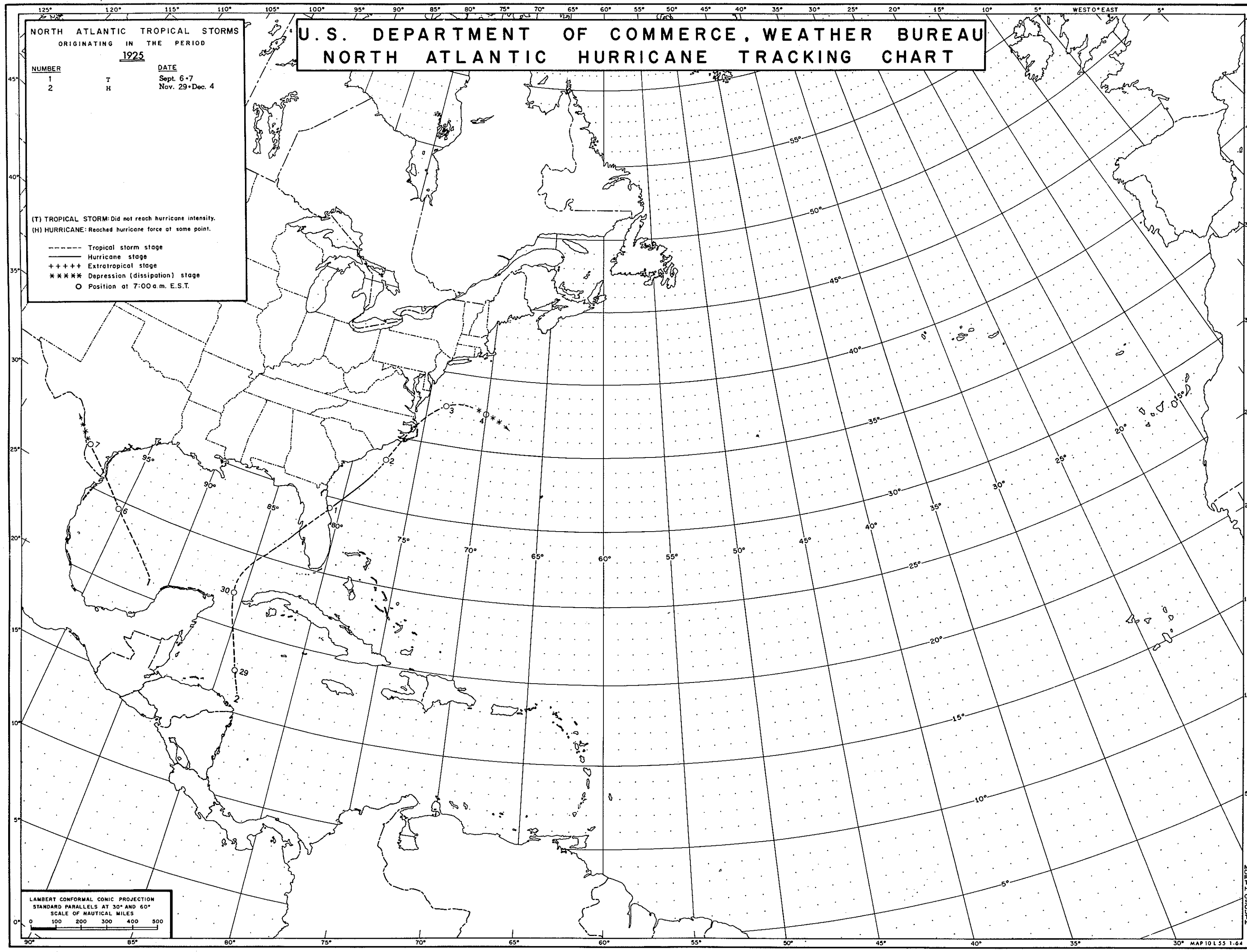


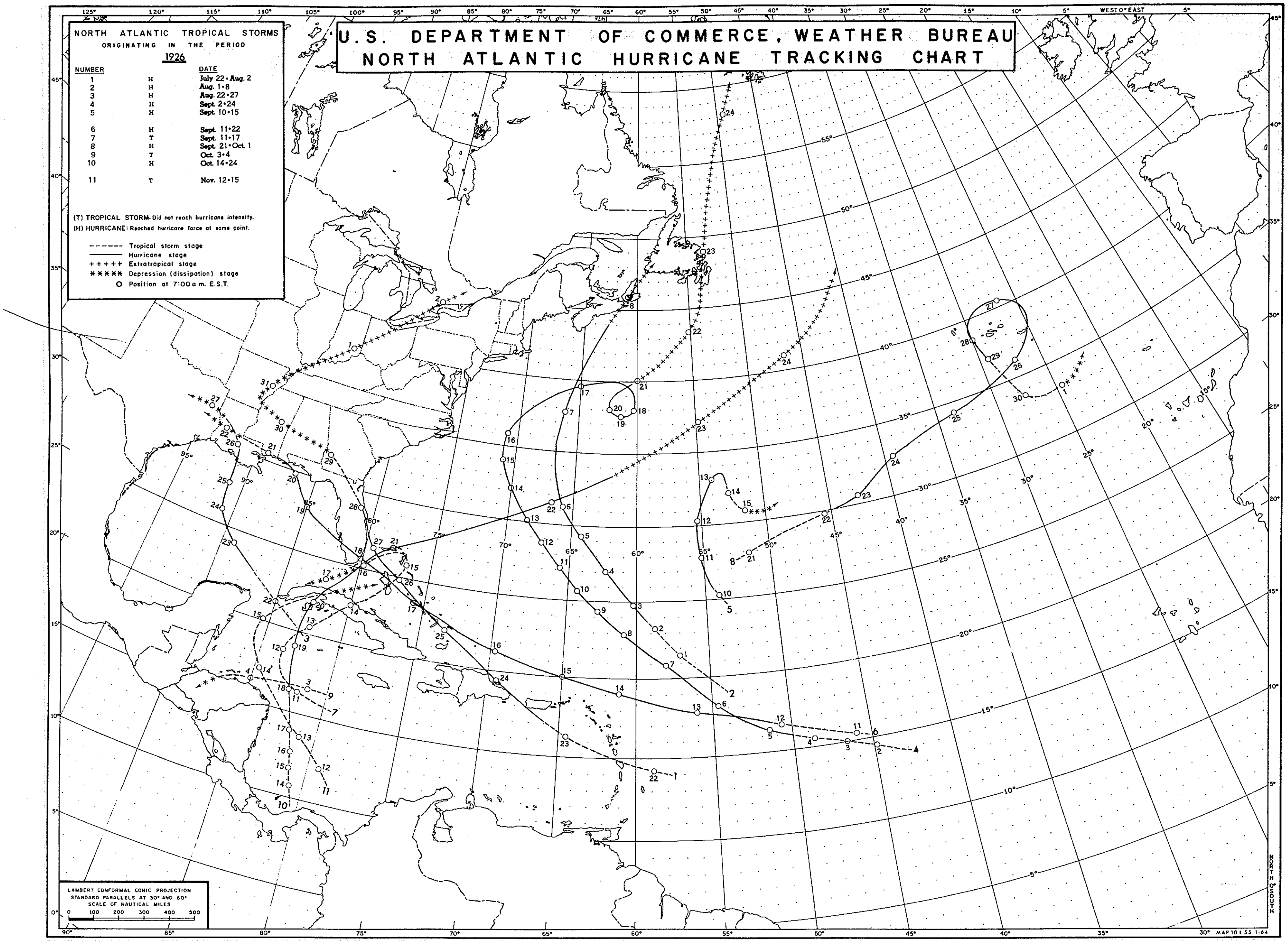
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1921
NUMBER DATE
1 H June 15-26
2 H Sept. 6-7
3 H Sept. 8-16
4 T Sept. 10-13
5 T Oct. 16-23
6 H Oct. 20-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
——— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

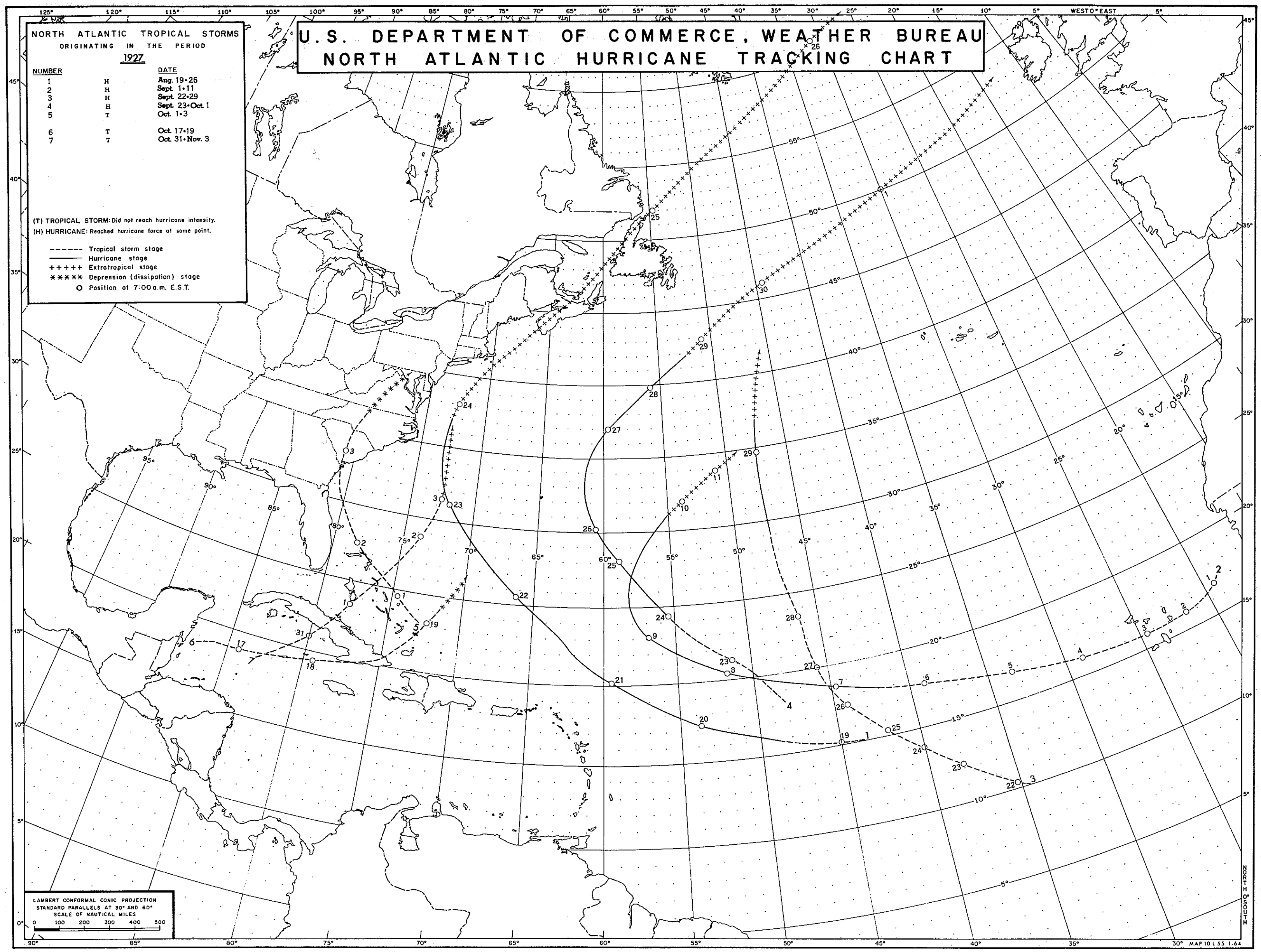

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1922
NUMBER
DATE
1 T June 12-16
2 H Sept. 13-26
3 T Oct. 12-17
4 H Oct. 14-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 35 1-64

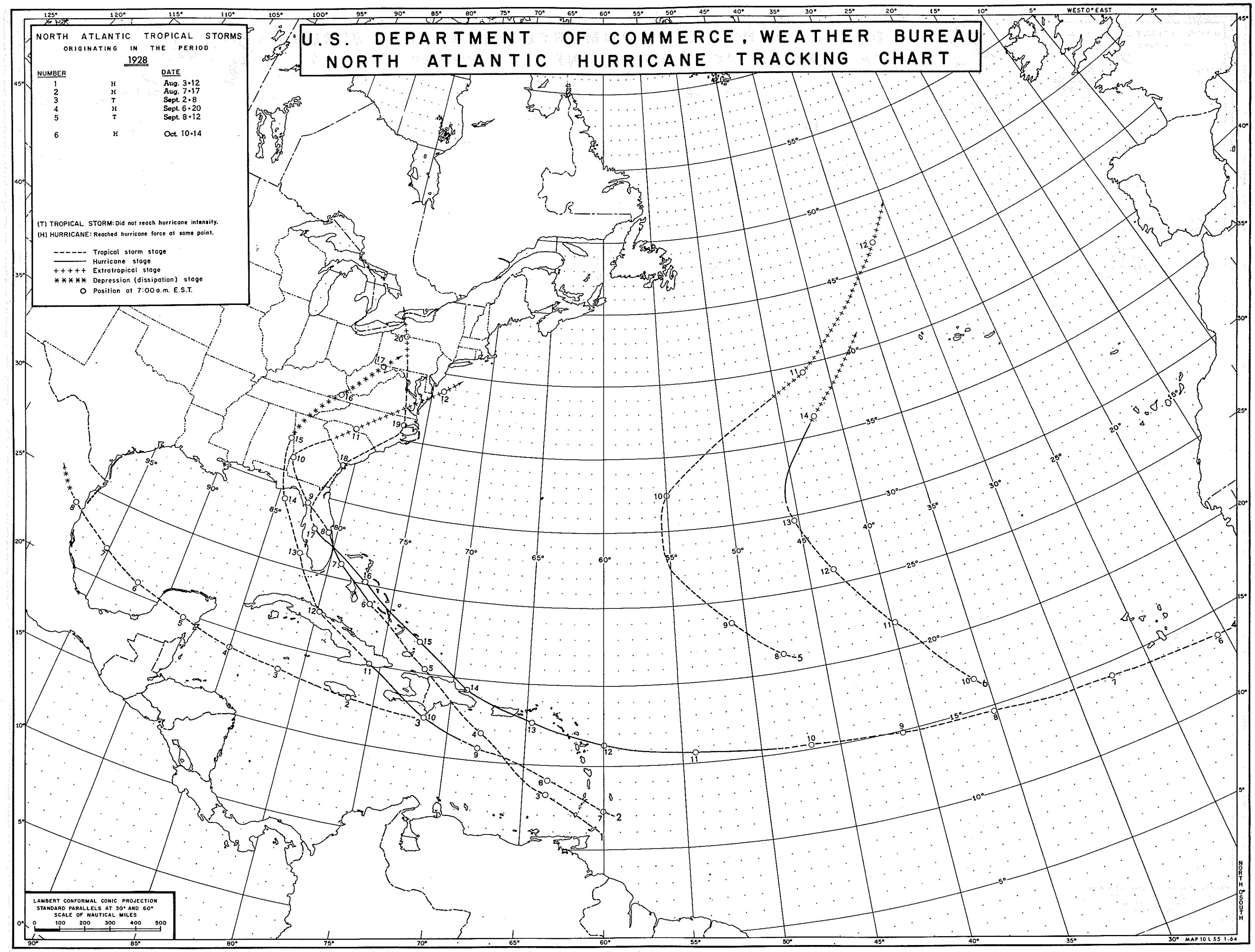

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1923
NUMBER DATE
1 H Aug. 31-Sept. 9
2 H Sept. 24-Oct. 4
3 H Oct. 12-17
4 T Oct. 14-29
5 T Oct. 15-19
6 T Oct. 16-19
7 T Oct. 24-26
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

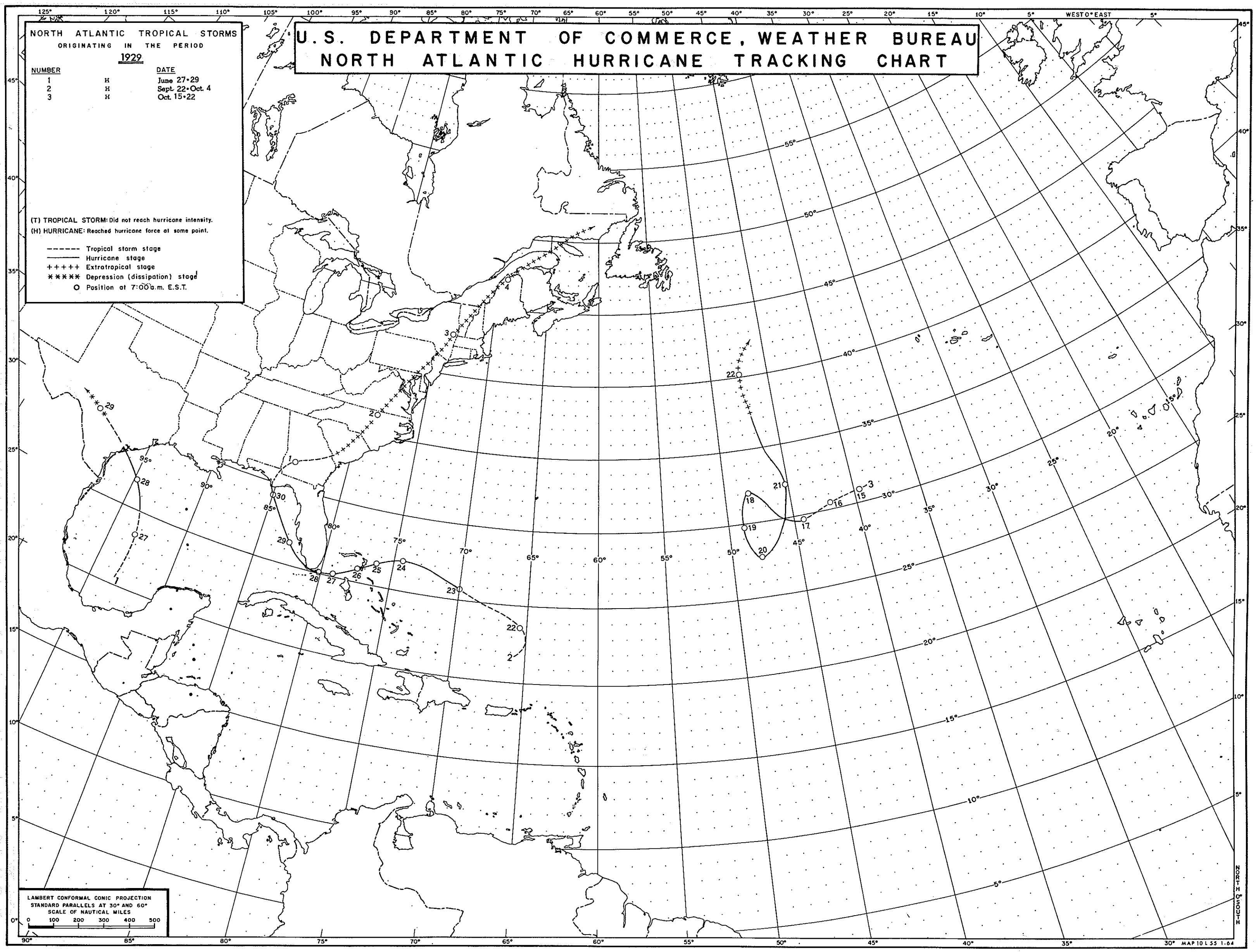

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1924
NUMBER
DATE
1 T June 18-21
2 H Aug. 16-28
3 H Aug. 26-Sept. 6
4 H Sept. 13-19
5 T Sept. 27-30
6 T Oct. 12-14
7 H Oct. 14-23
8 H Nov. 5-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 35 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1925
NUMBER
DATE
1 T Sept. 6-7
2 H Nov. 29-Dec. 4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

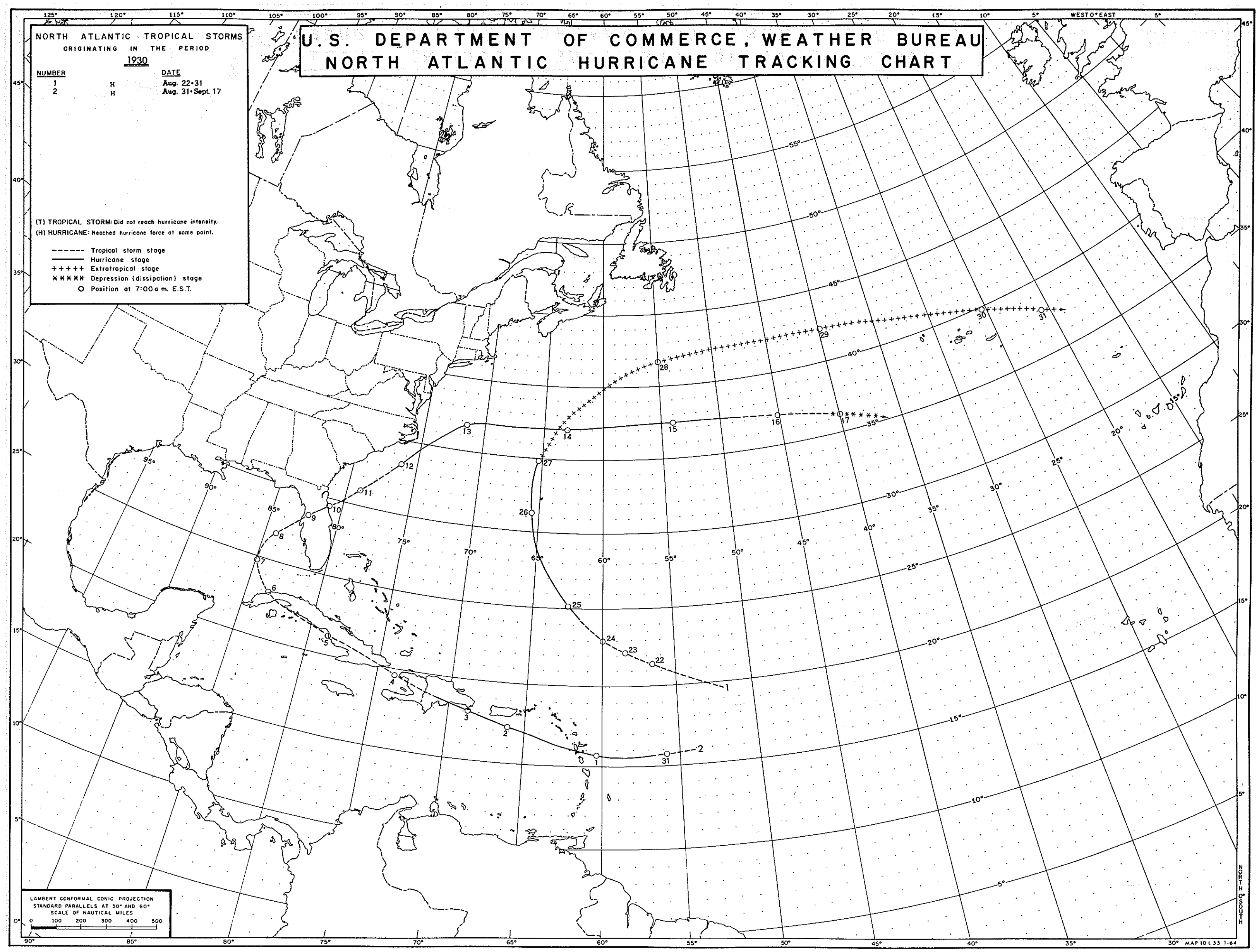

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1926
NUMBER
DATE
1 H July 22 - Aug. 2
2 H Aug. 1 - 8
3 H Aug. 22 - 27
4 H Sept. 2 - 24
5 H Sept. 10 - 15
6 H Sept. 11 - 22
7 T Sept. 11 - 17
8 H Sept. 21 - Oct. 1
9 T Oct. 3 - 4
10 H Oct. 14 - 24
11 T Nov. 12 - 15
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64

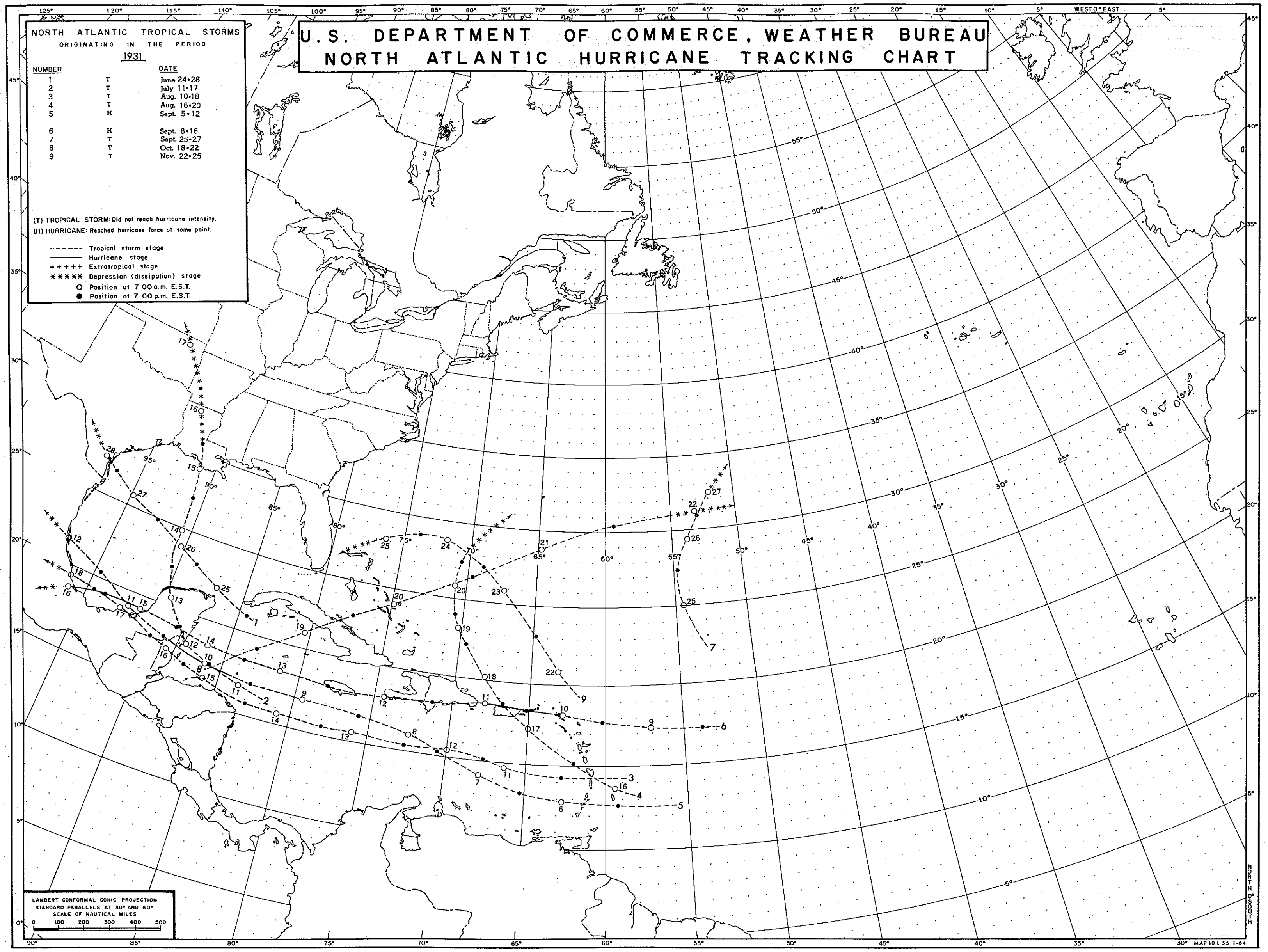

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1927
NUMBER DATE
1 H Aug. 19-26
2 H Sept. 1-11
3 H Sept. 22-29
4 H Sept. 23-Oct. 1
5 T Oct. 1-3
6 T Oct. 17-19
7 T Oct. 31-Nov. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 35 1-64

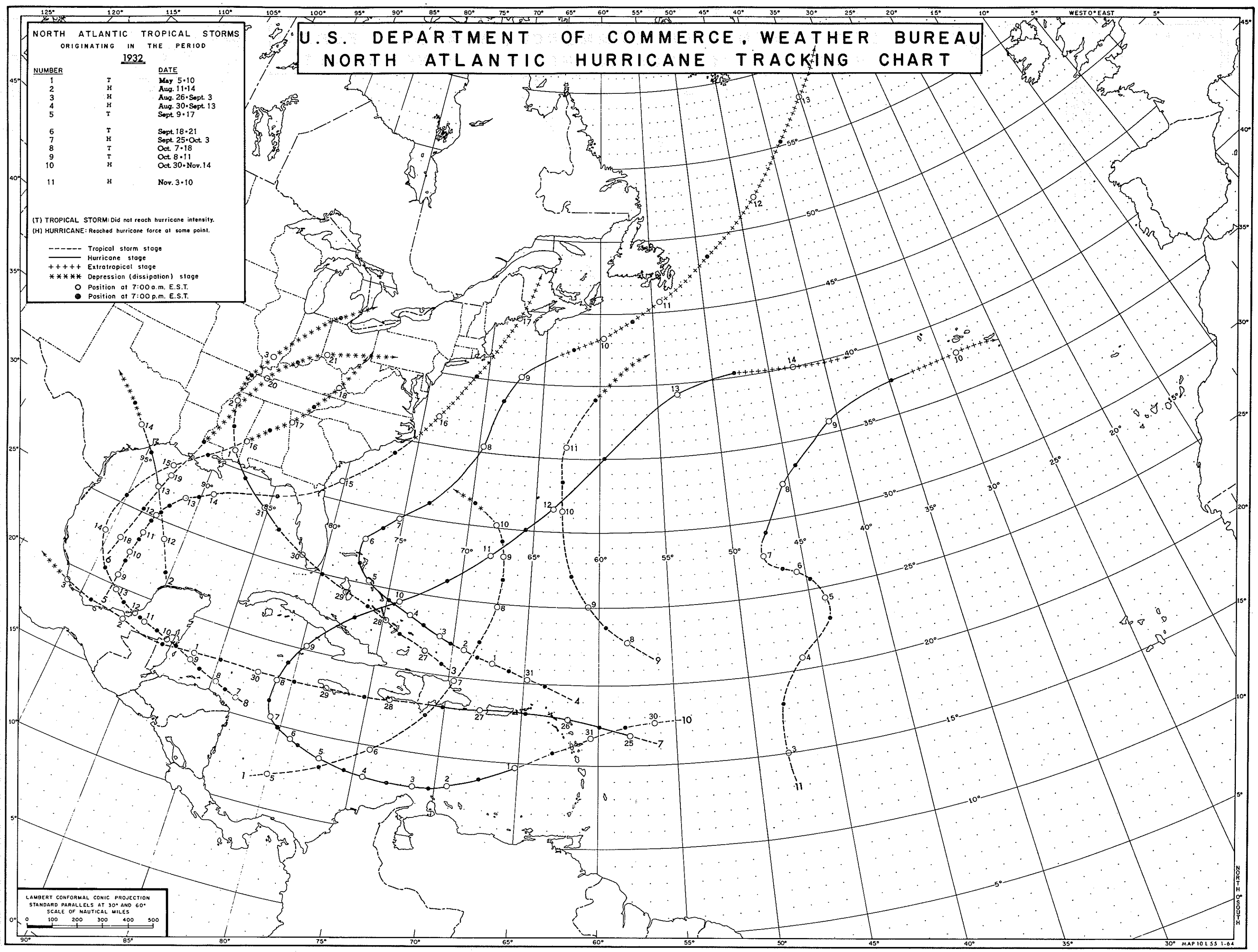

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1928
NUMBER
DATE
1 H Aug. 3-12
2 H Aug. 7-17
3 T Sept. 2-8
4 H Sept. 6-20
5 T Sept. 8-12
6 H Oct. 10-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

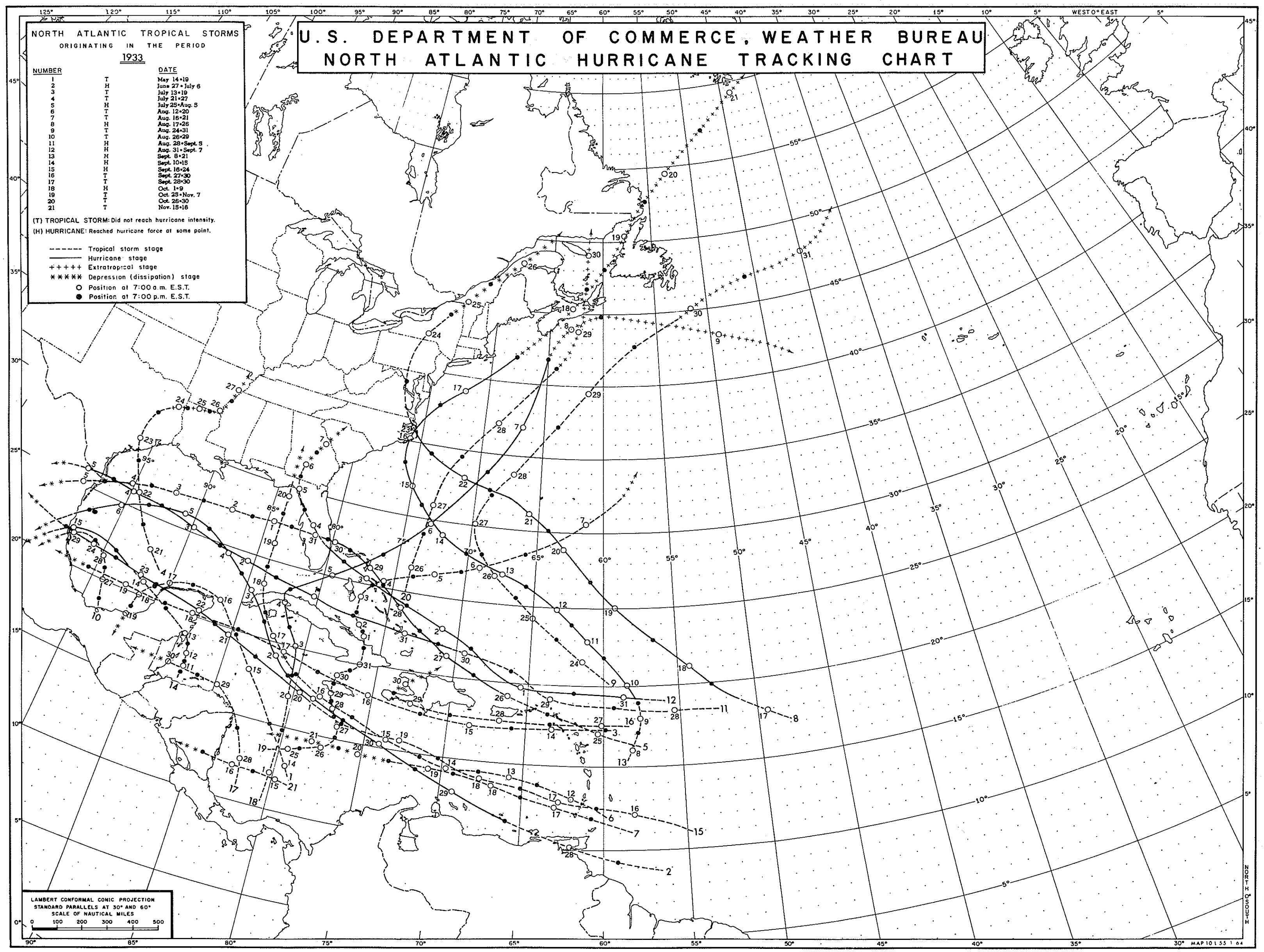


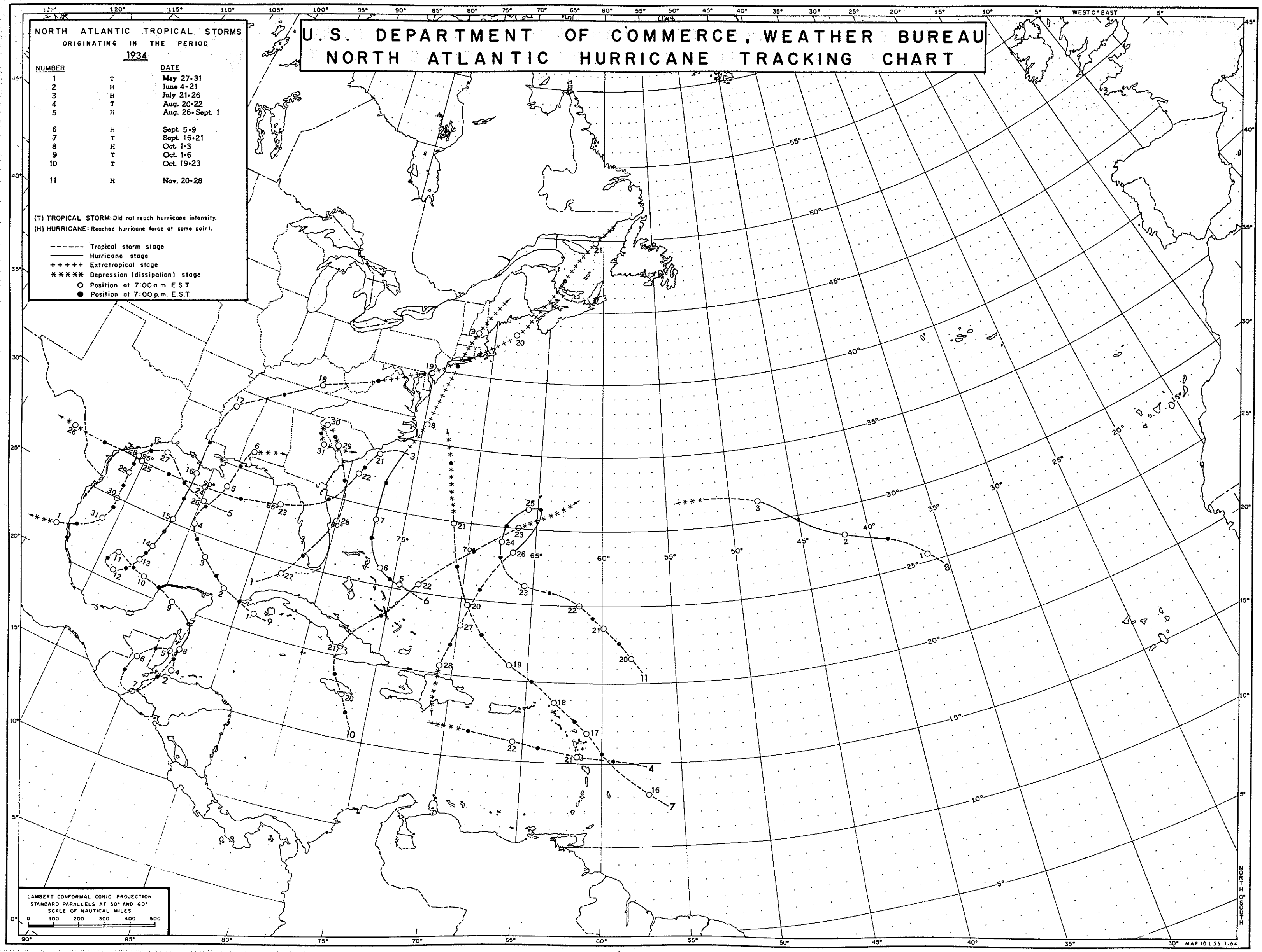
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1929
NUMBER DATE
1 H June 27-29
2 H Sept. 22-Oct. 4
3 H Oct. 15-22
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1930
NUMBER
DATE
1 H Aug. 22-31
2 H Aug. 31-Sept. 17
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

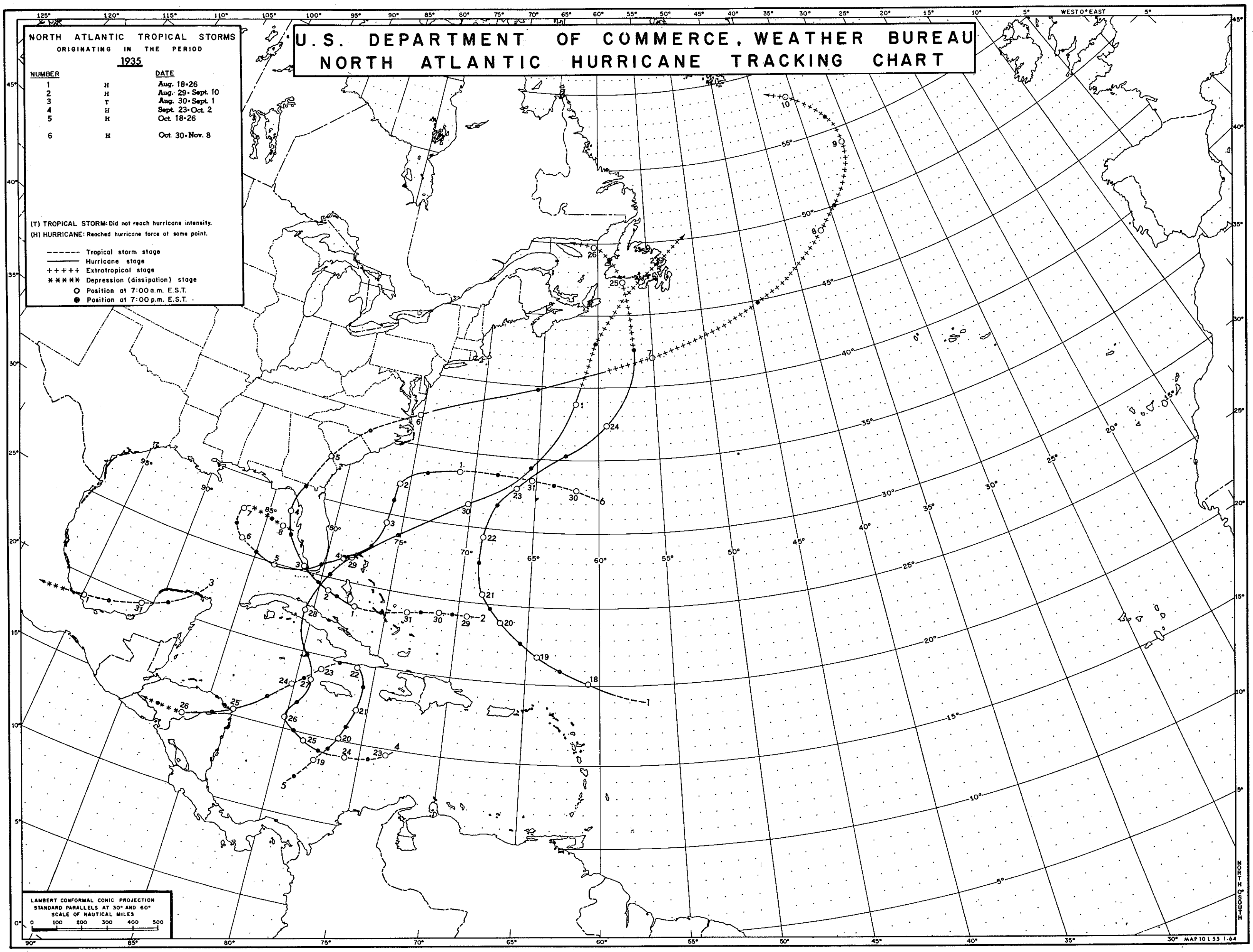

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1931
NUMBER DATE
1 T June 24-28
2 T July 11-17
3 T Aug. 10-18
4 T Aug. 16-20
5 H Sept. 5-12
6 H Sept. 8-16
7 T Sept. 25-27
8 T Oct. 18-22
9 T Nov. 22-25
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

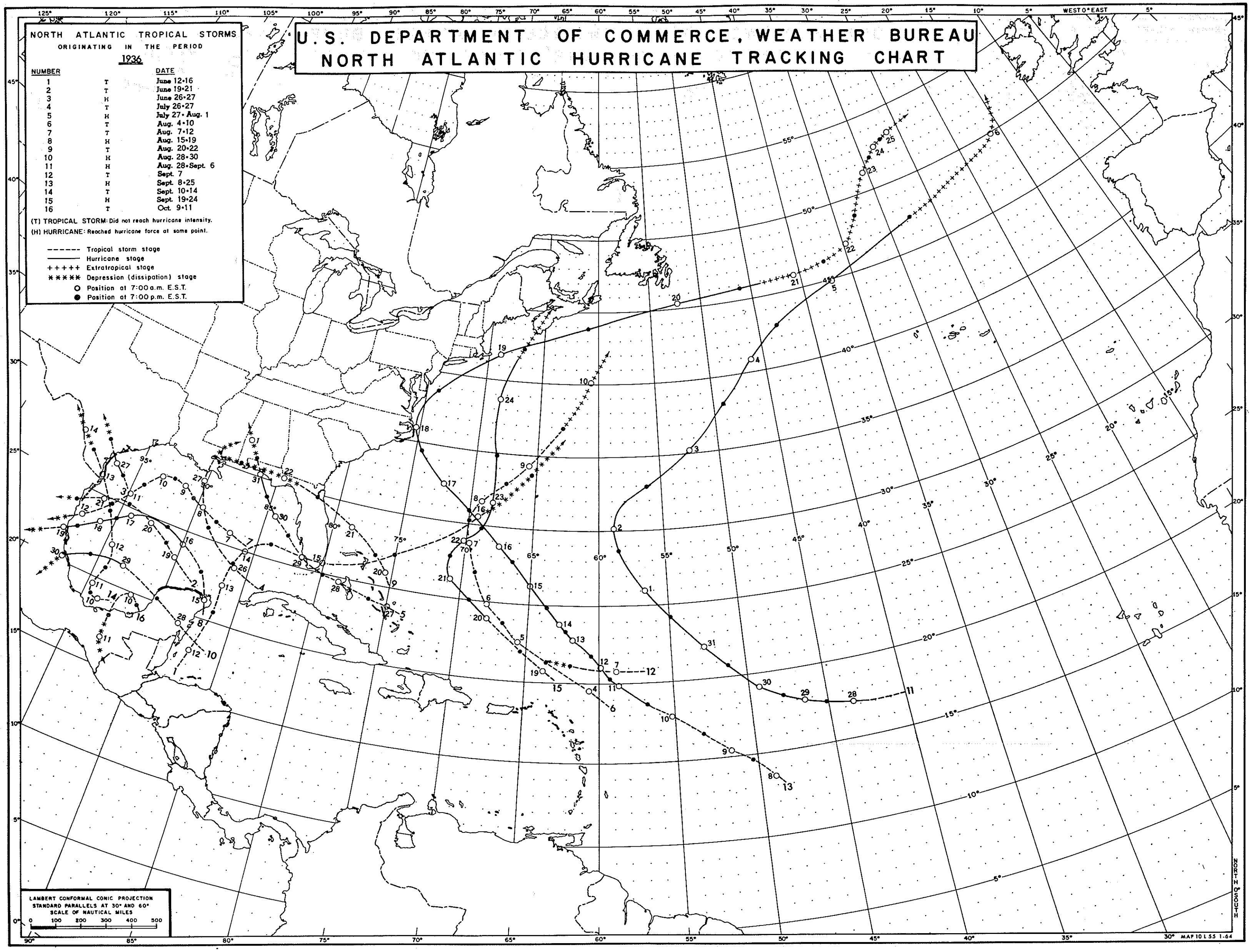

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1932
NUMBER DATE
1 T May 5-10
2 H Aug. 11-14
3 H Aug. 26-Sept. 3
4 H Aug. 30-Sept. 13
5 T Sept. 9-17
6 T Sept. 18-21
7 H Sept. 25-Oct. 3
8 T Oct. 7-18
9 T Oct. 8-11
10 H Oct. 30-Nov. 14
11 H Nov. 3-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L.S.S. 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1933
NUMBER DATE
1 T May 14-19
2 H June 27 - July 6
3 T July 13-19
4 T July 21-27
5 H July 25-Aug. 5
6 T Aug. 12-20
7 T Aug. 16-21
8 H Aug. 17-26
9 T Aug. 24-31
10 T Aug. 26-29
11 H Aug. 28-Sept. 5
12 H Aug. 31-Sept. 7
13 H Sept. 8-21
14 H Sept. 10-15
15 H Sept. 16-24
16 T Sept. 27-30
17 T Sept. 28-30
18 H Oct. 1-9
19 T Oct. 25-Nov. 7
20 T Oct. 26-30
21 T Nov. 15-16
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

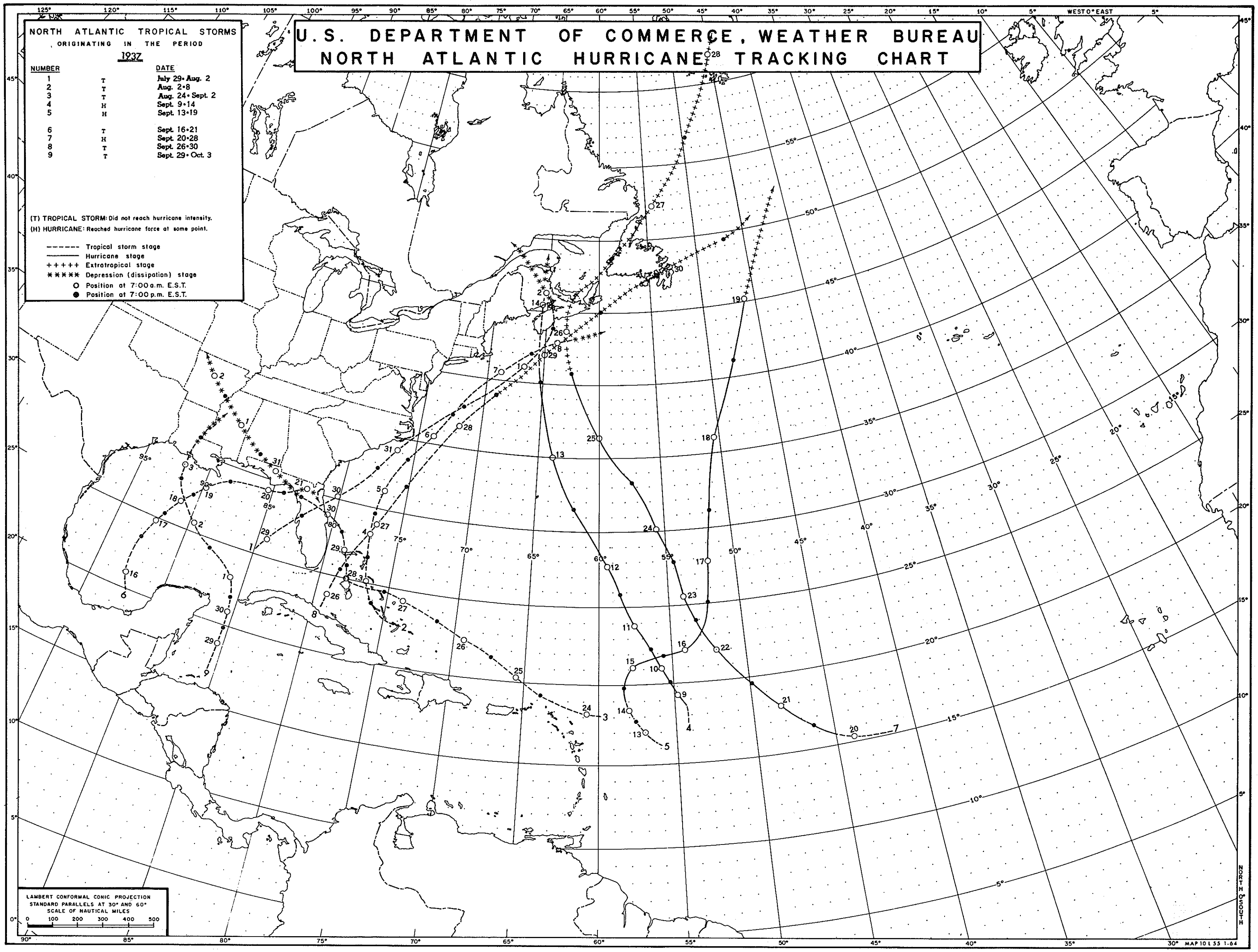


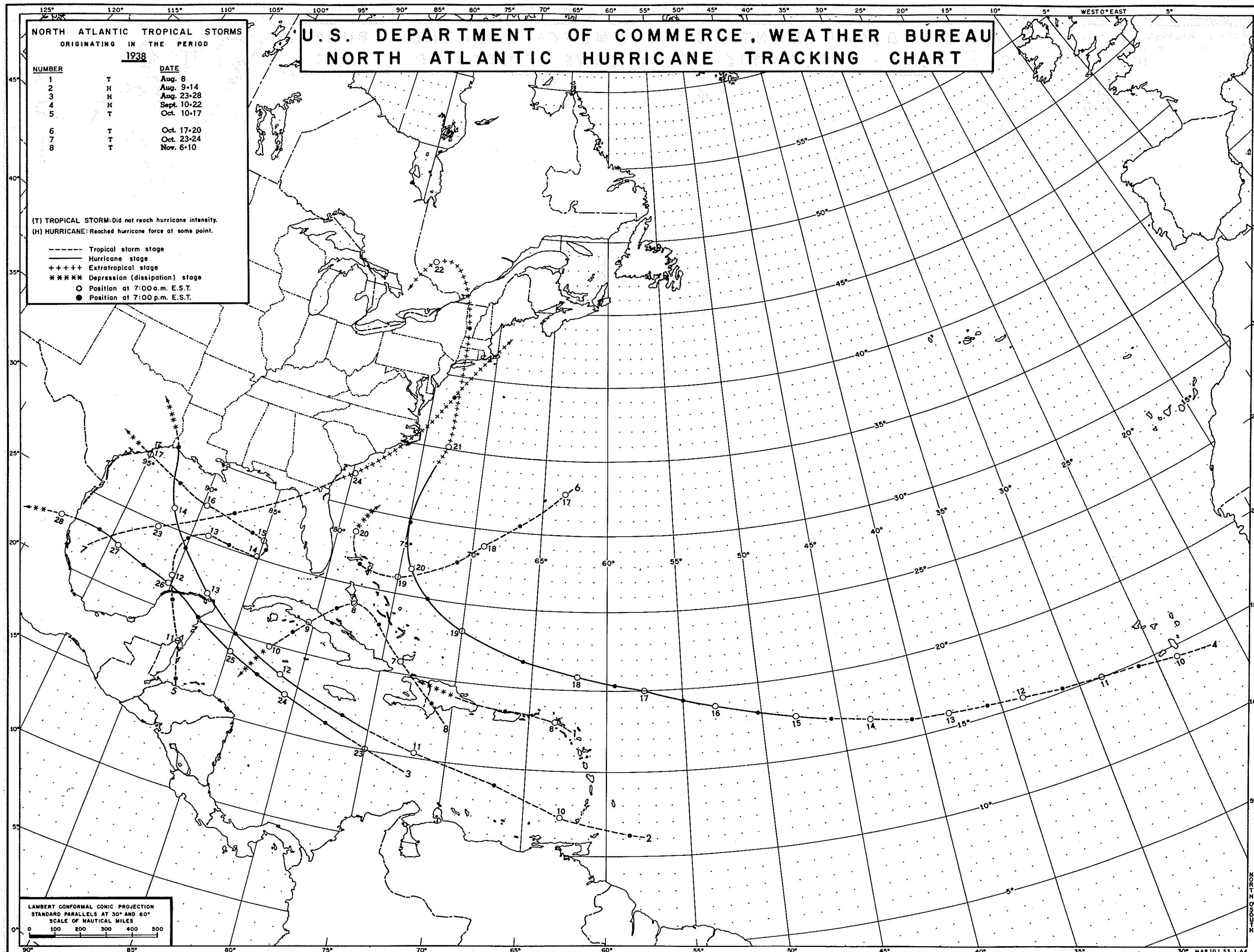
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1934
NUMBER DATE
1 T May 27-31
2 H June 4-21
3 H July 21-26
4 T Aug. 20-22
5 H Aug. 26-Sept. 1
6 H Sept. 5-9
7 T Sept. 16-21
8 H Oct. 1-3
9 T Oct. 1-6
10 T Oct. 19-23
11 H Nov. 20-28
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST O EAST
NORTH O SOUTH
MAP 10 L 55 1-64

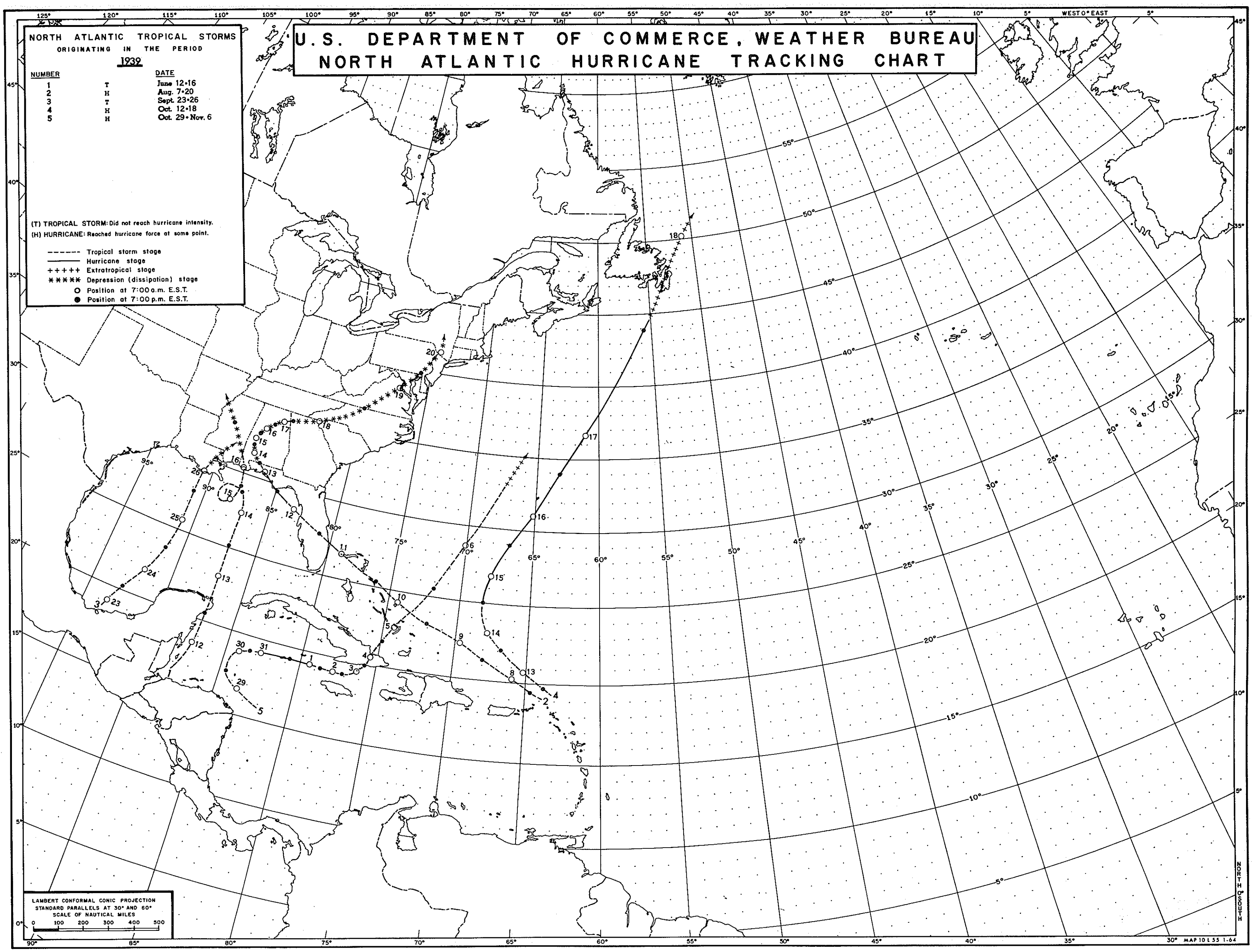

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD
1935
NUMBER DATE
1 H Aug. 18-26
2 H Aug. 29-Sept. 10
3 T Aug. 30-Sept. 1
4 H Sept. 23-Oct. 2
5 H Oct. 18-26
6 H Oct. 30-Nov. 8
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



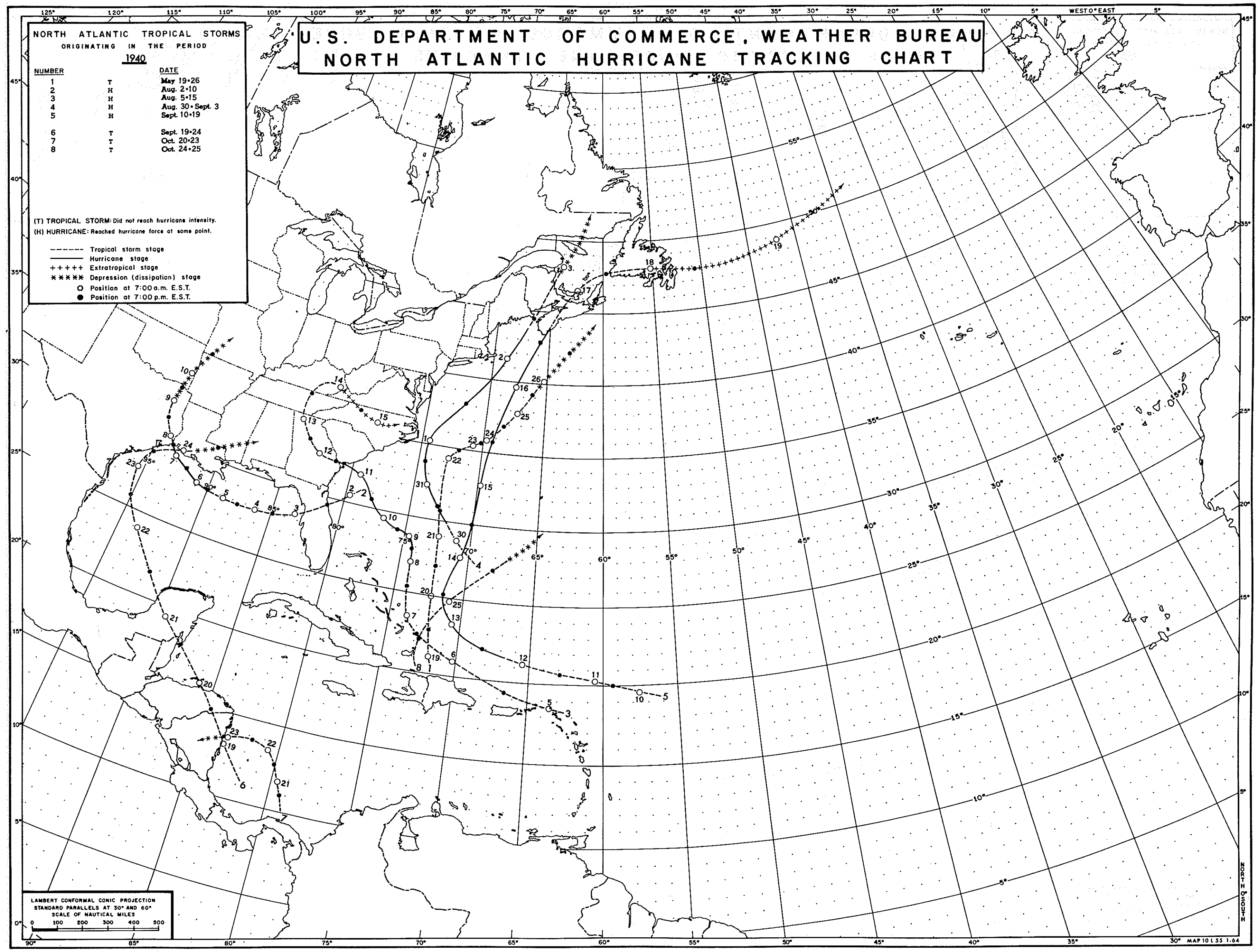
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1936
NUMBER DATE
1 T June 12-16
2 T June 19-21
3 H June 26-27
4 T July 26-27
5 H July 27 - Aug. 1
6 T Aug. 4-10
7 T Aug. 7-12
8 H Aug. 15-19
9 T Aug. 20-22
10 H Aug. 28-30
11 H Aug. 28-Sept. 6
12 T Sept. 7
13 H Sept. 8-25
14 T Sept. 10-14
15 H Sept. 19-24
16 T Oct. 9-11
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
○ Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

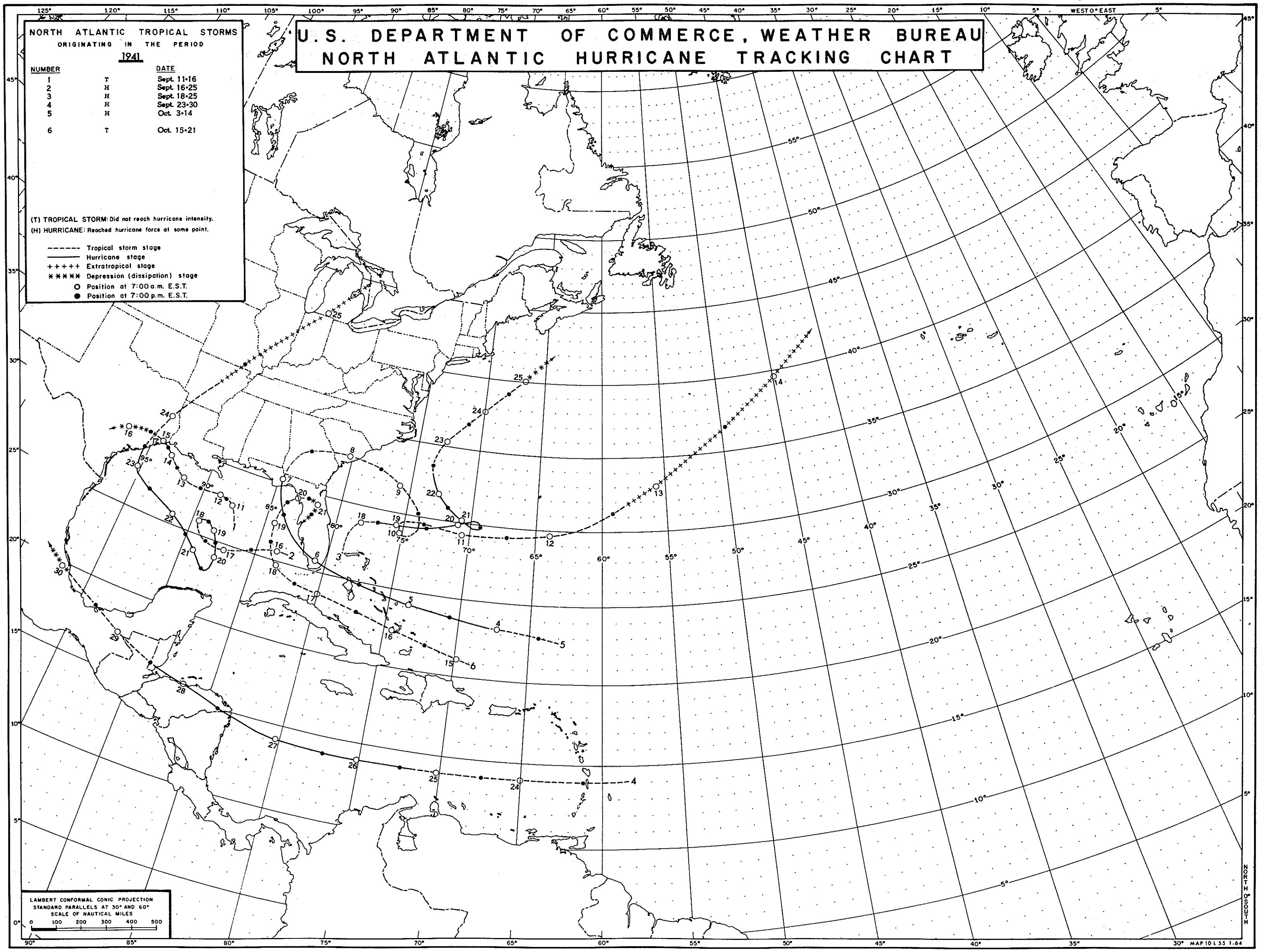

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1937
NUMBER DATE
1 T July 29-Aug. 2
2 T Aug. 2-8
3 T Aug. 24-Sept. 2
4 H Sept. 9-14
5 H Sept. 13-19
6 T Sept. 16-21
7 H Sept. 20-28
8 T Sept. 26-30
9 T Sept. 29-Oct. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

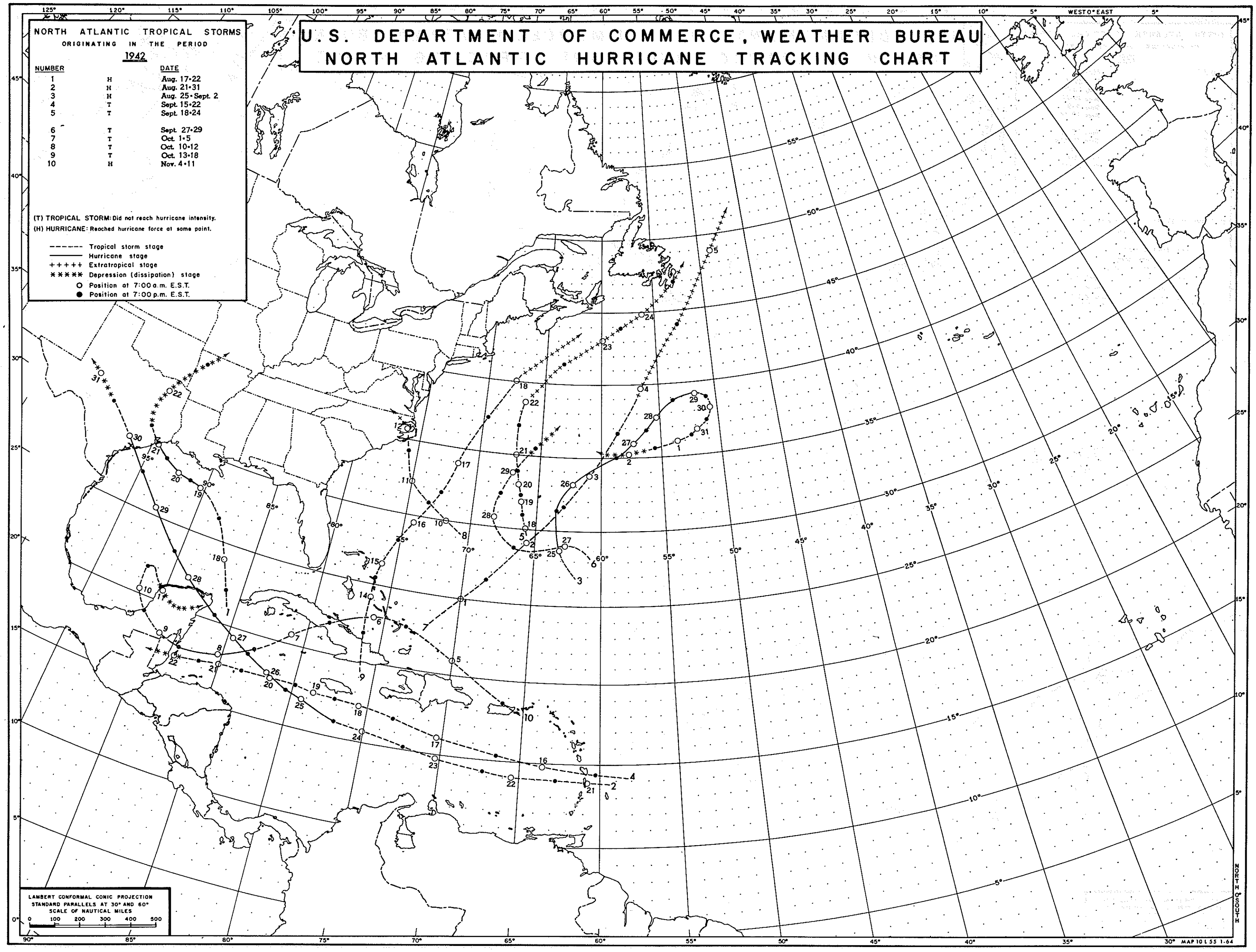

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1938
NUMBER DATE
1 T Aug. 8
2 H Aug. 9-14
3 H Aug. 23-28
4 H Sept. 10-22
5 T Oct. 10-17
6 T Oct. 17-20
7 T Oct. 23-24
8 T Nov. 6-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
○ Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH & SOUTH
MAP 10 L 55 1-64

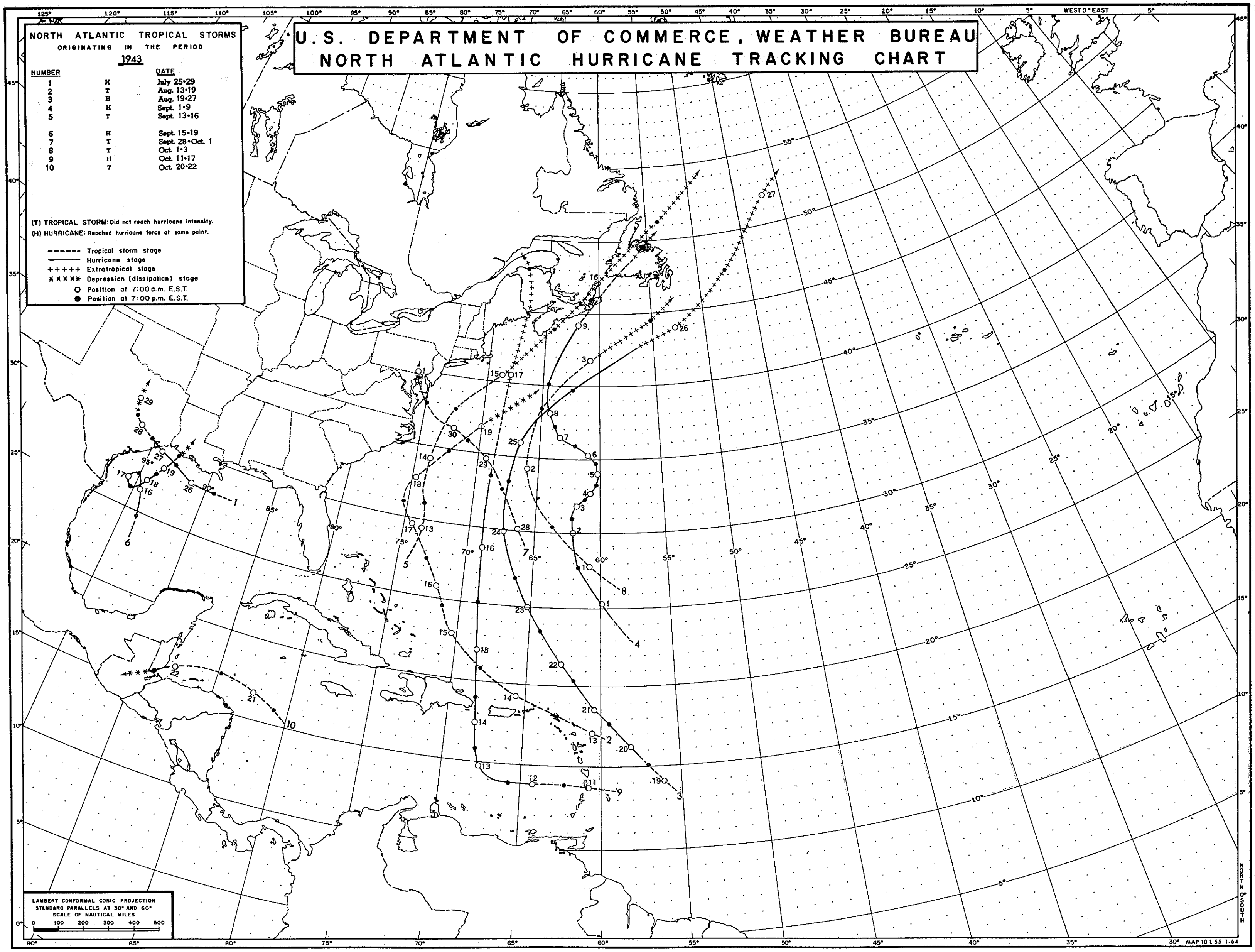


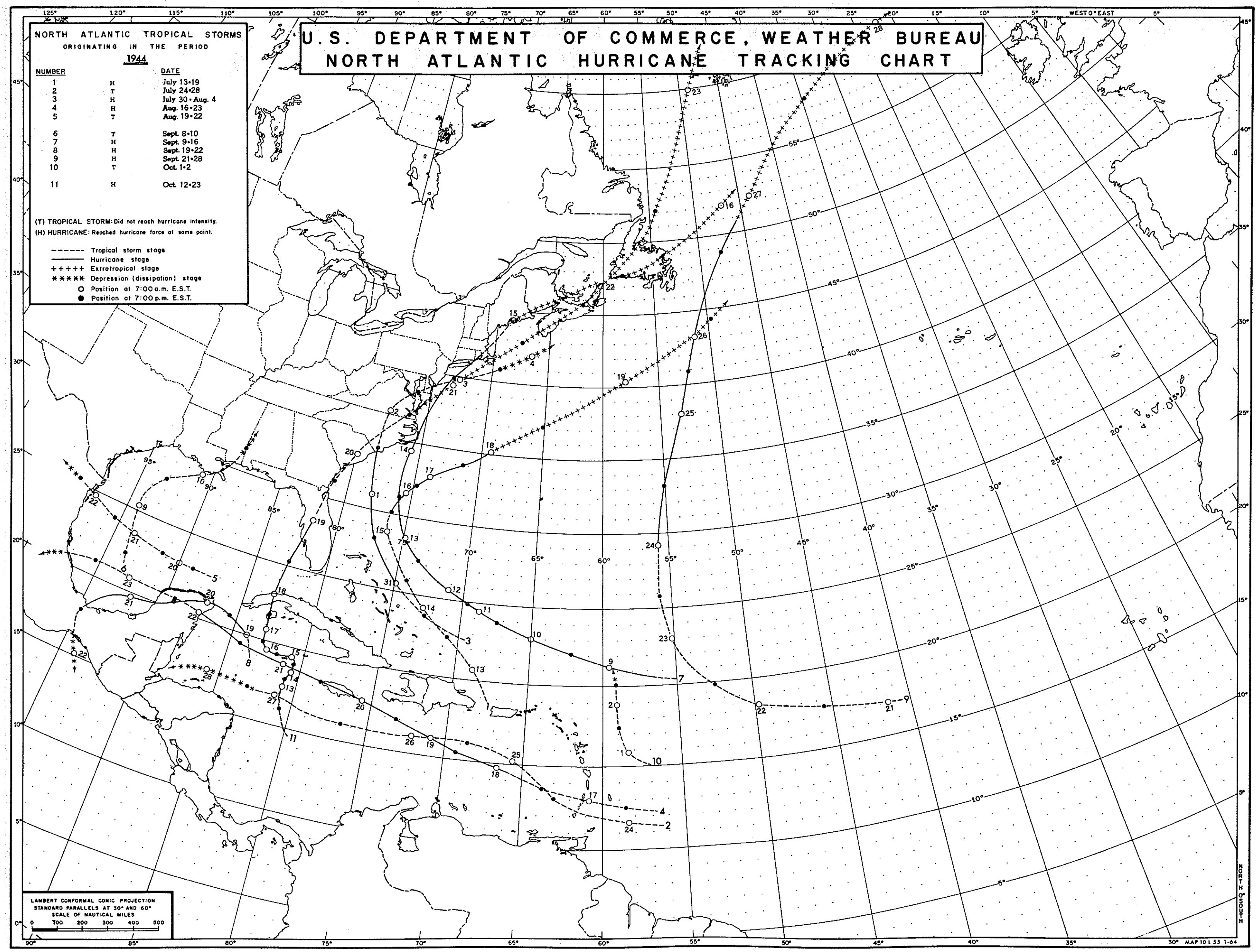
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1939
NUMBER
DATE
1 T June 12-16
2 H Aug. 7-20
3 T Sept. 23-26
4 H Oct. 12-18
5 H Oct. 29-Nov. 6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

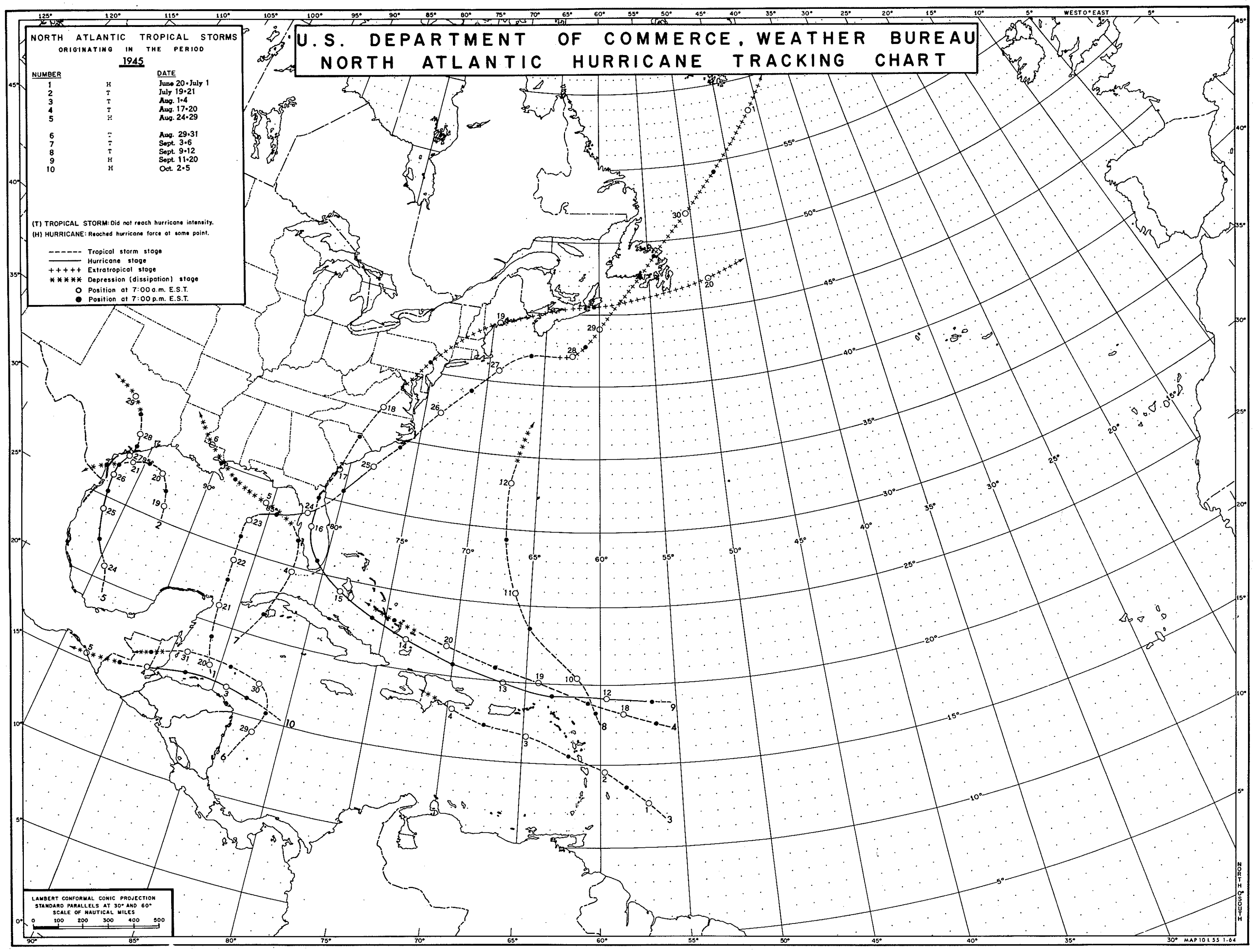

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1940
NUMBER DATE
1 T May 19-26
2 H Aug. 2-10
3 H Aug. 5-15
4 H Aug. 30-Sept. 3
5 H Sept. 10-19
6 T Sept. 19-24
7 T Oct. 20-23
8 T Oct. 24-25
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1941
NUMBER DATE
1 T Sept. 11-16
2 H Sept. 16-25
3 H Sept. 18-25
4 H Sept. 23-30
5 H Oct. 3-14
6 T Oct. 15-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

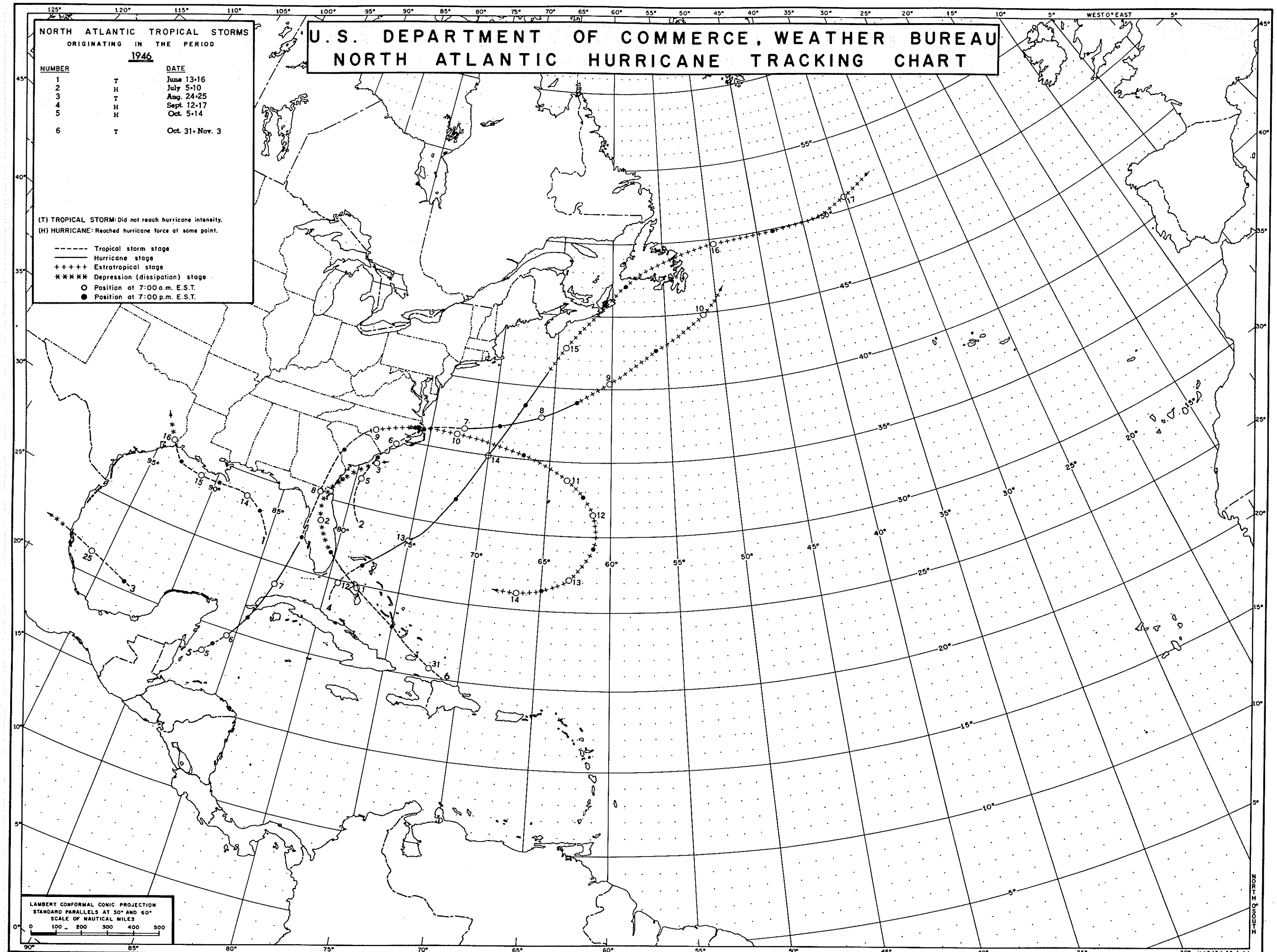

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1942
NUMBER DATE
1 H Aug. 17-22
2 H Aug. 21-31
3 H Aug. 25-Sept. 2
4 T Sept. 15-22
5 T Sept. 18-24
6 T Sept. 27-29
7 T Oct. 1-5
8 T Oct. 10-12
9 T Oct. 13-18
10 H Nov. 4-11
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

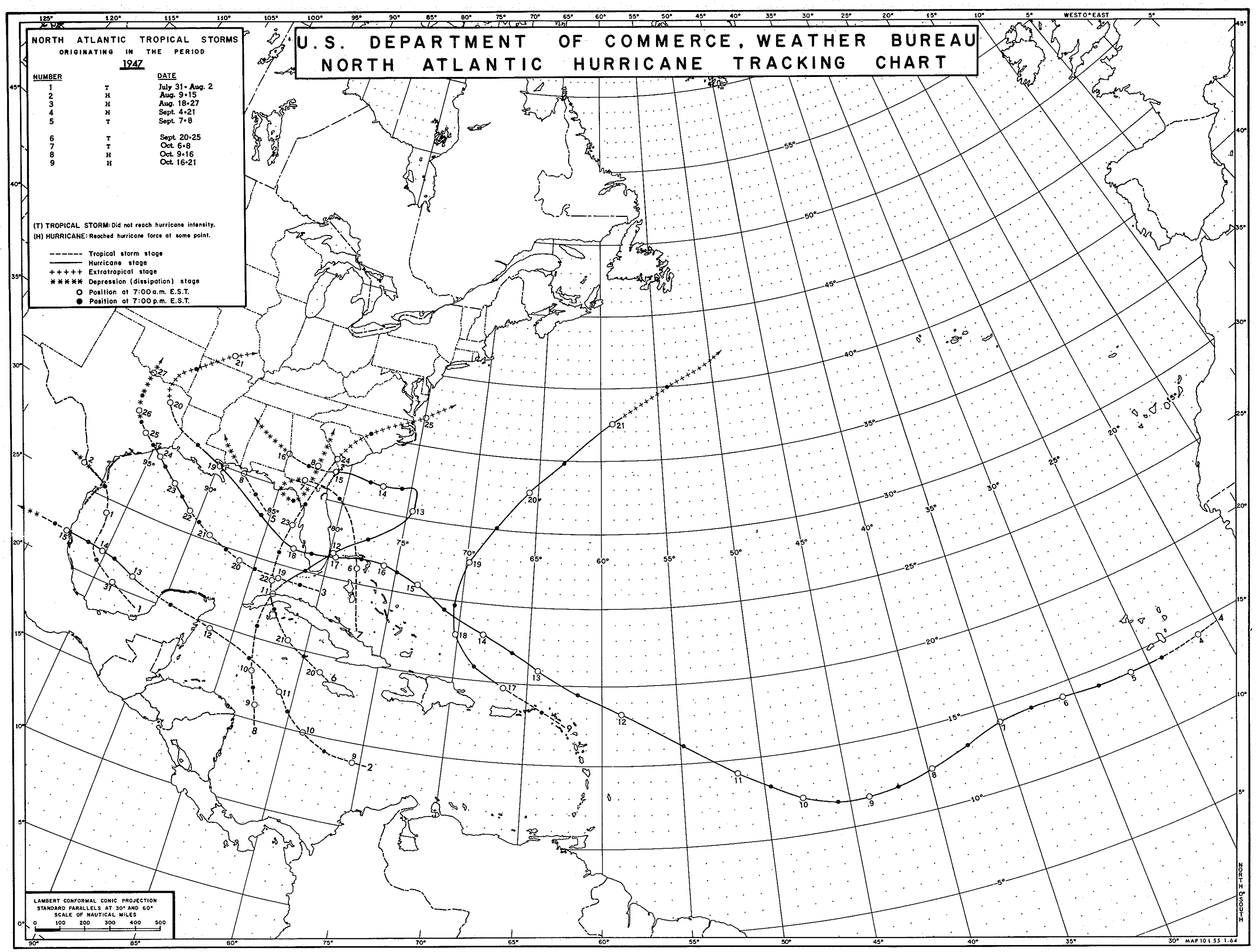

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1943
NUMBER DATE
1 H July 25-29
2 T Aug. 13-19
3 H Aug. 19-27
4 H Sept. 1-9
5 T Sept. 13-16
6 H Sept. 15-19
7 T Sept. 28-Oct. 1
8 T Oct. 1-3
9 H Oct. 11-17
10 T Oct. 20-22
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

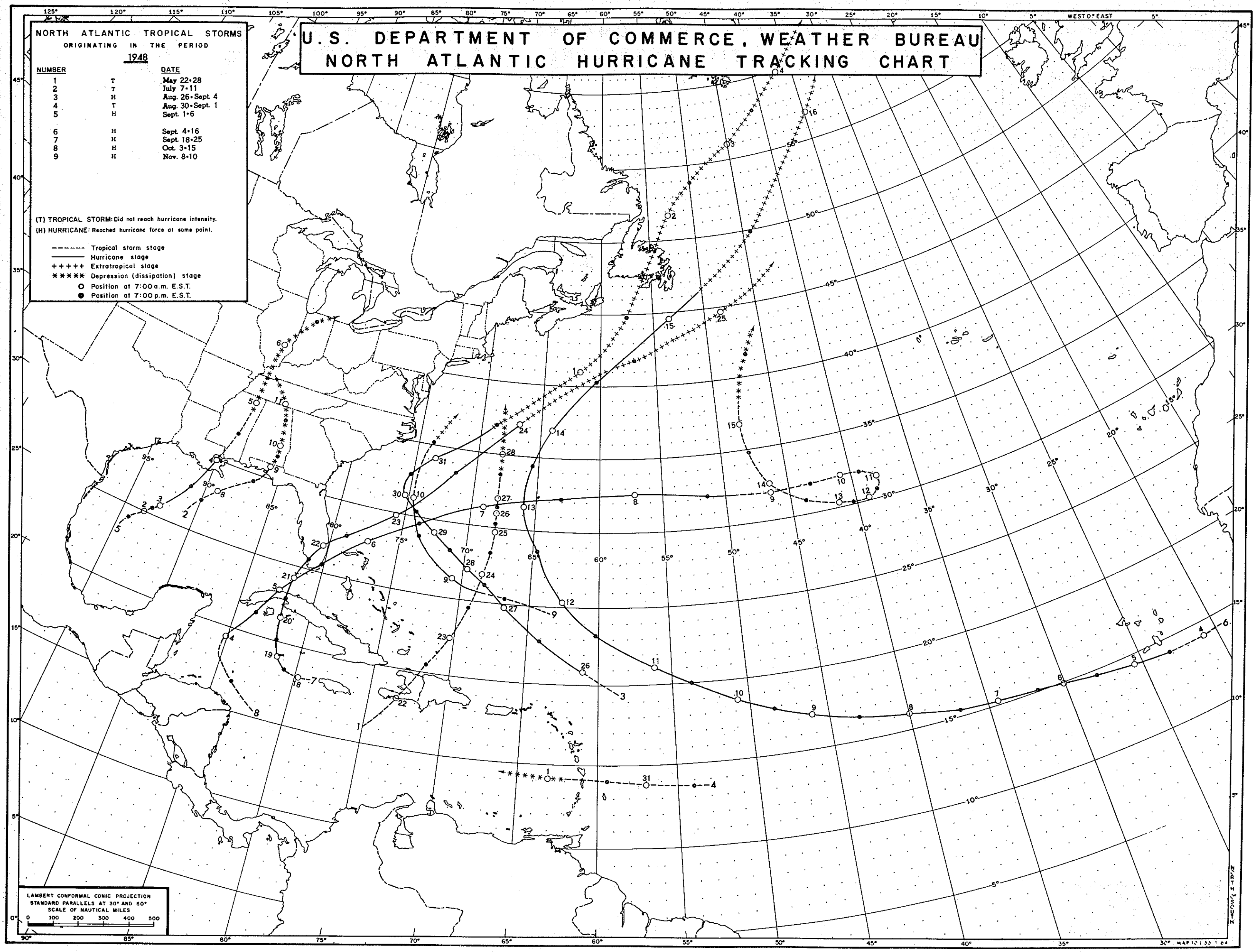

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1944
NUMBER DATE
1 H July 13-19
2 T July 24-28
3 H July 30 - Aug. 4
4 H Aug. 16-23
5 T Aug. 19-22
6 T Sept. 8-10
7 H Sept. 9-16
8 H Sept. 19-22
9 H Sept. 21-28
10 T Oct. 1-2
11 H Oct. 12-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
○ Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
MAP 10 L 55 1-64



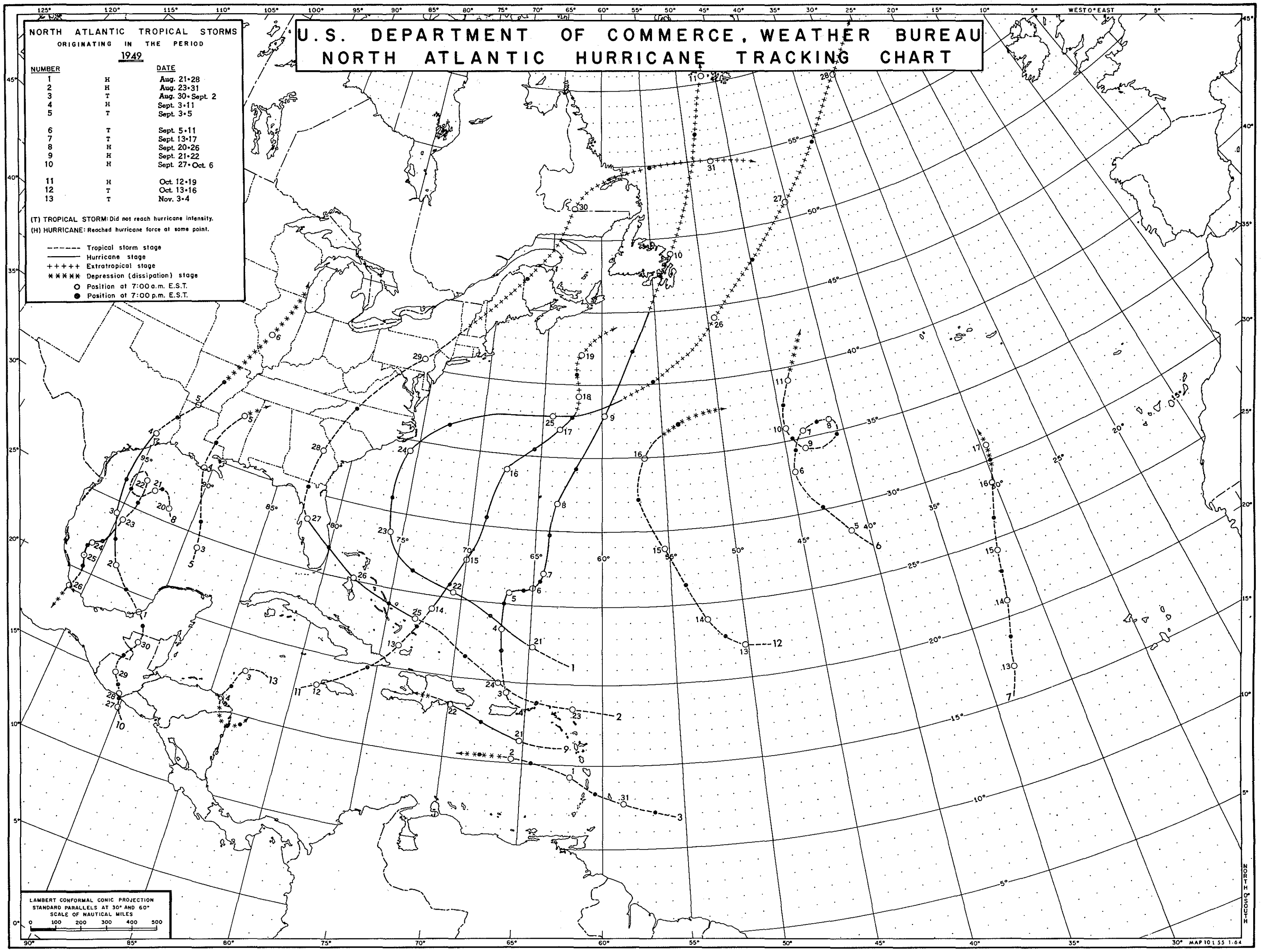
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1945
NUMBER
DATE
1 H June 20-July 1
2 T July 19-21
3 T Aug. 1-4
4 T Aug. 17-20
5 H Aug. 24-29
6 T Aug. 29-31
7 T Sept. 3-6
8 T Sept. 9-12
9 H Sept. 11-20
10 H Oct. 2-5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1946
NUMBER
DATE
1 T June 13-16
2 H July 5-10
3 T Aug. 24-25
4 H Sept. 12-17
5 H Oct. 5-14
6 T Oct. 31-Nov. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH

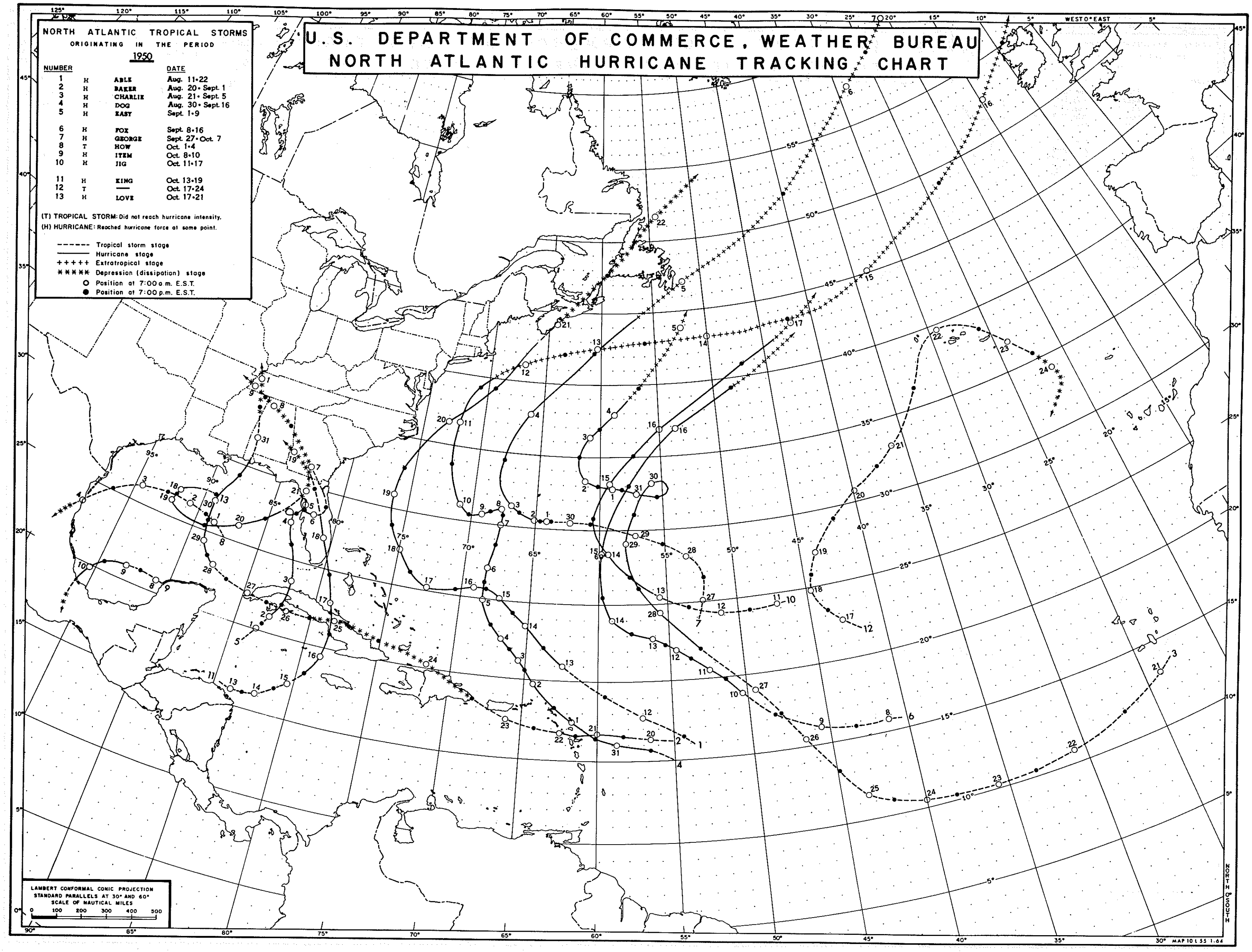

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1947
NUMBER
DATE
1 T July 31 • Aug. 2
2 H Aug. 9 • 15
3 H Aug. 18 • 27
4 H Sept. 4 • 21
5 T Sept. 7 • 8
6 T Sept. 20 • 25
7 T Oct. 6 • 8
8 H Oct. 9 • 16
9 H Oct. 16 • 21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

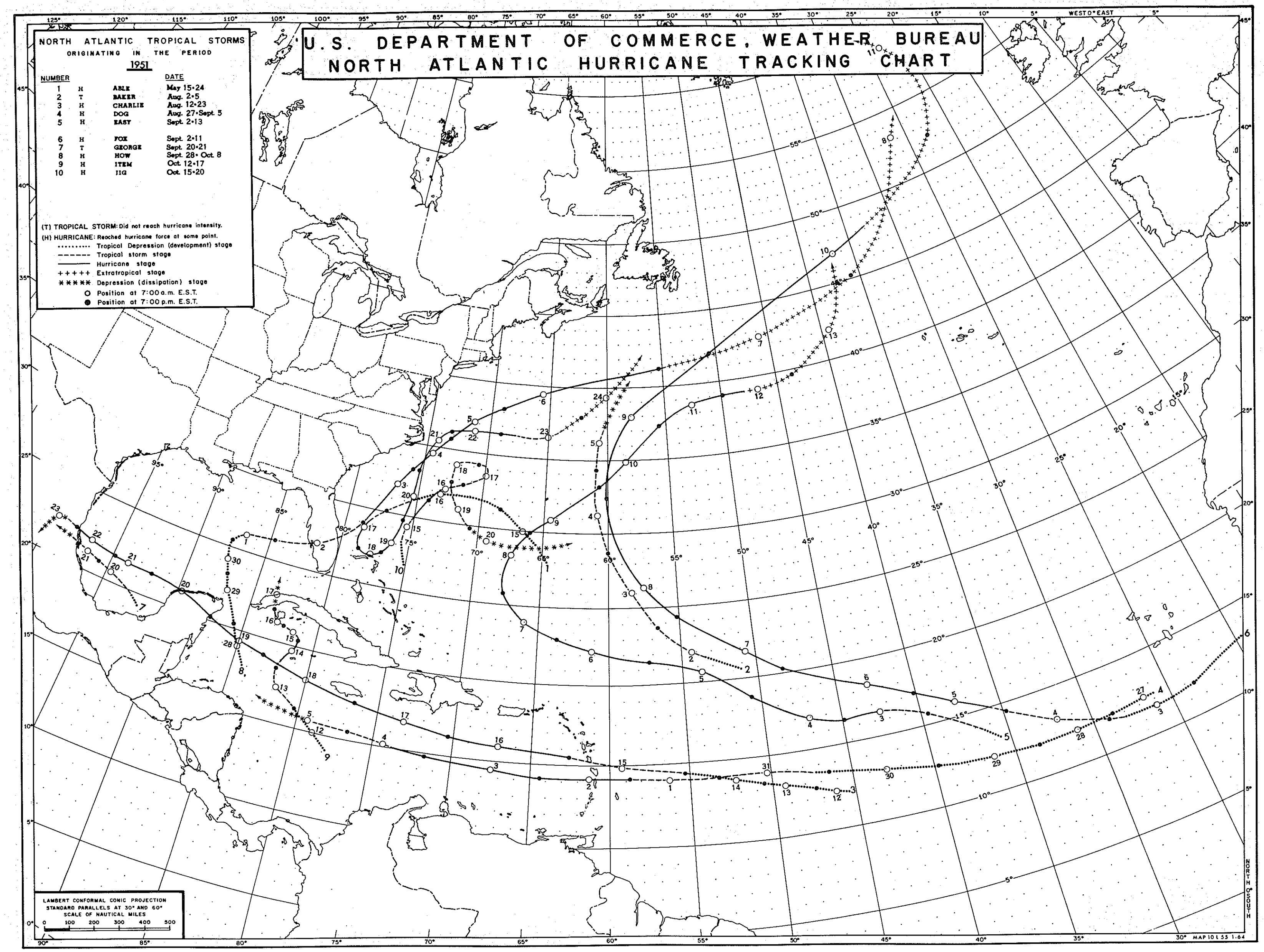


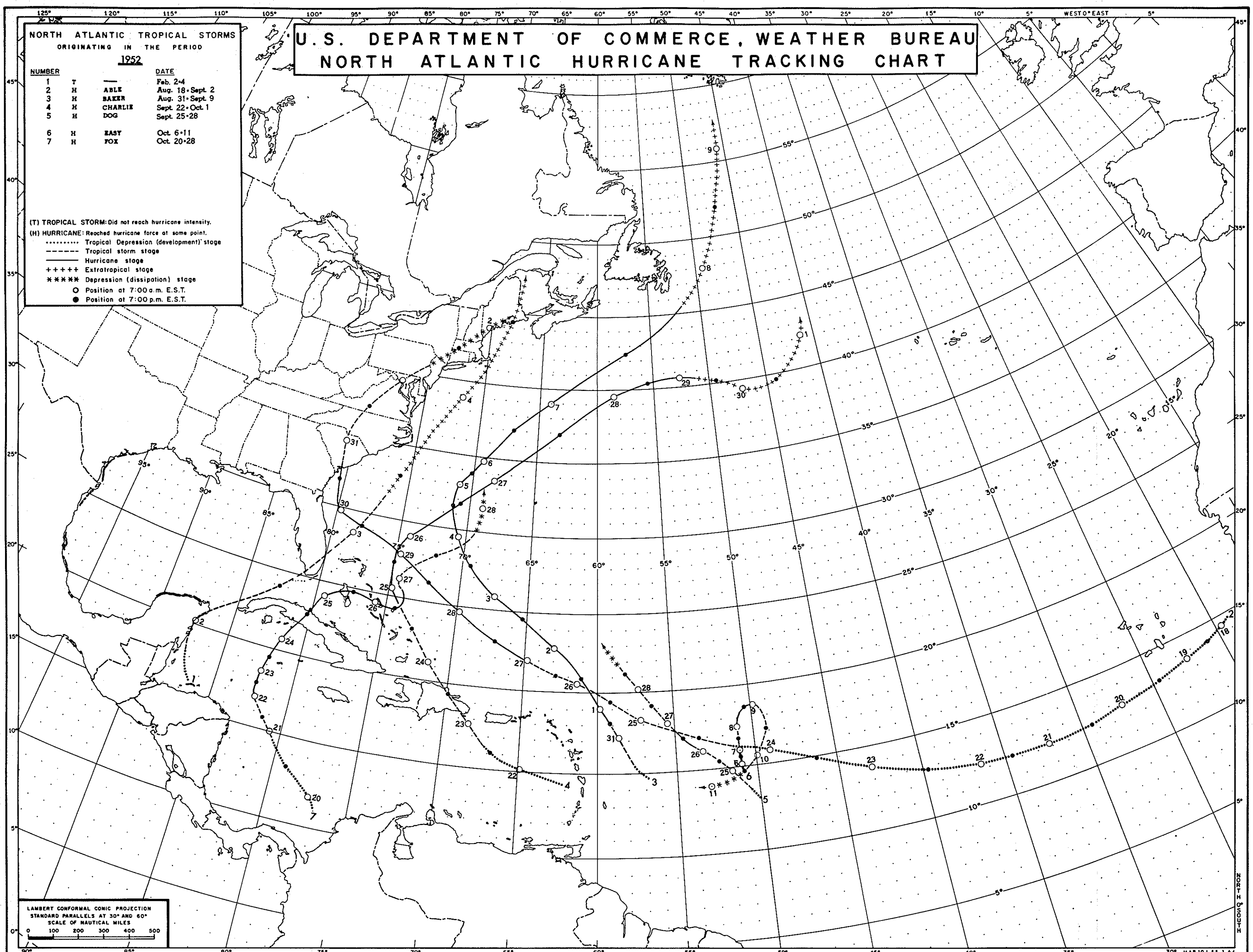
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1948
NUMBER DATE
1 T May 22-28
2 T July 7-11
3 H Aug. 26-Sept. 4
4 T Aug. 30-Sept. 1
5 H Sept. 1-6
6 H Sept. 4-16
7 H Sept. 18-25
8 H Oct. 3-15
9 H Nov. 8-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
O Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

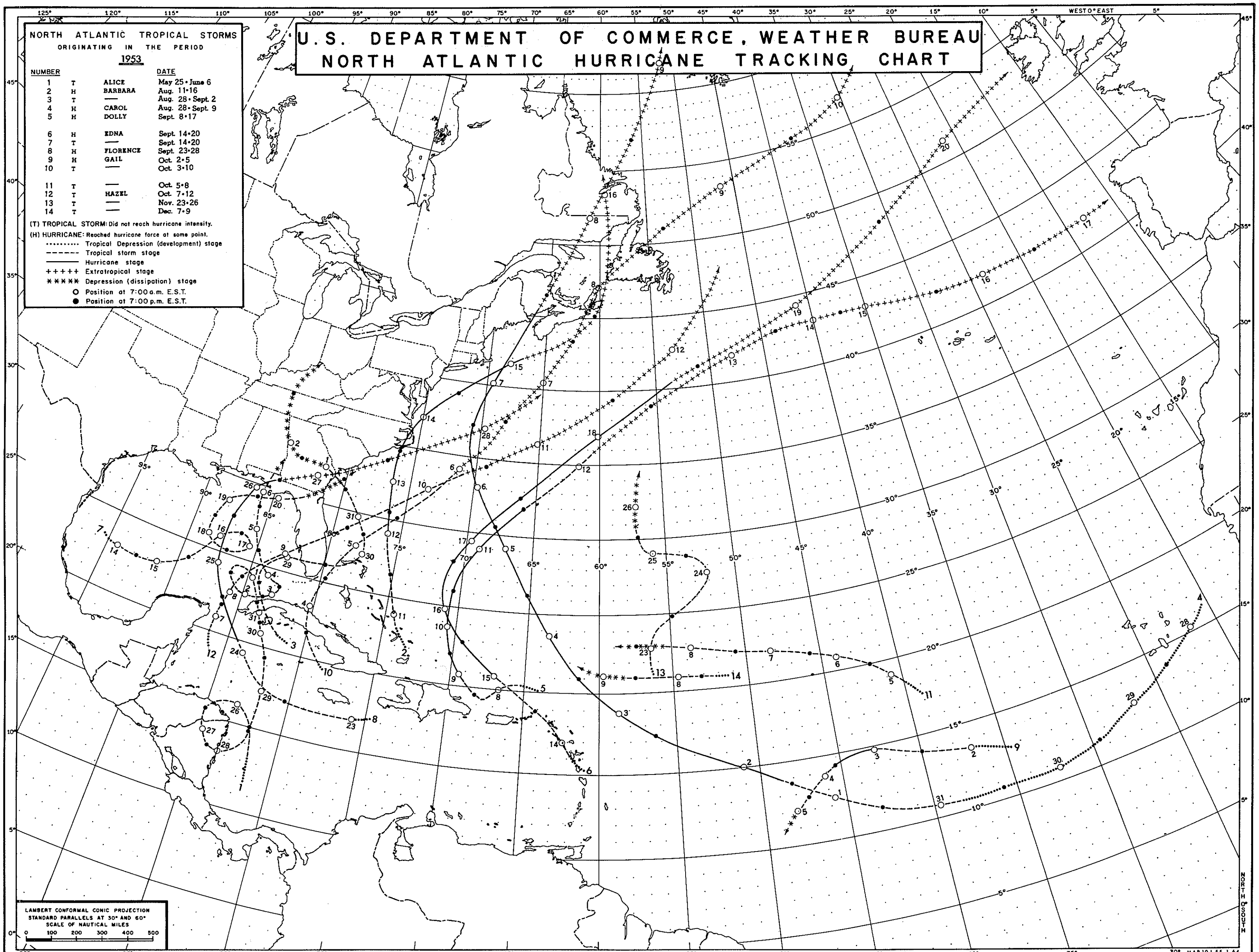


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1949
NUMBER DATE
1 H Aug. 21-28
2 H Aug. 23-31
3 T Aug. 30-Sept. 2
4 H Sept. 3-11
5 T Sept. 3-5
6 T Sept. 5-11
7 T Sept. 13-17
8 H Sept. 20-26
9 H Sept. 21-22
10 H Sept. 27-Oct. 6
11 H Oct. 12-19
12 T Oct. 13-16
13 T Nov. 3-4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH SOUTH
MAP 10 L 55 1-64

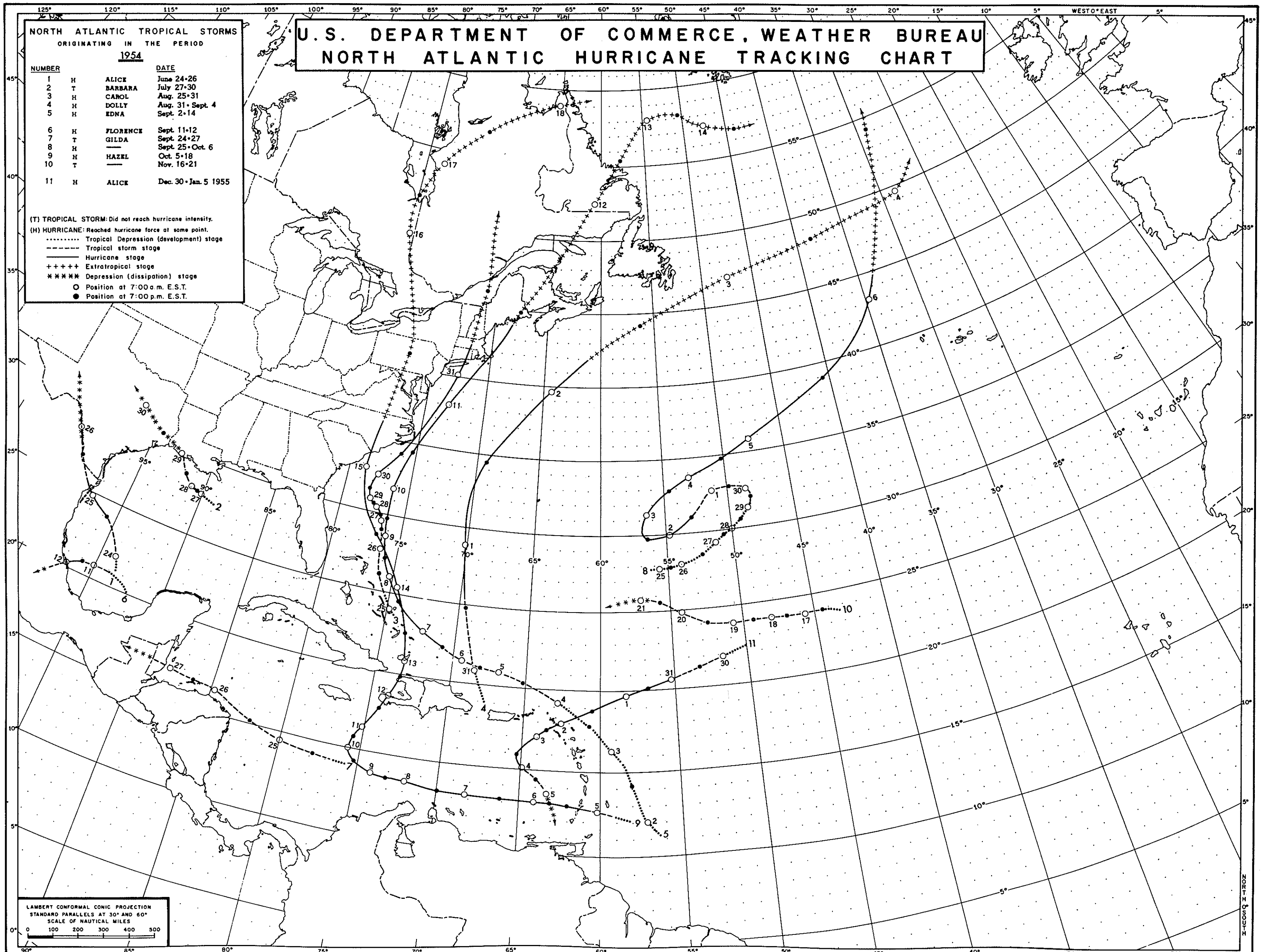

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1950
NUMBER
DATE
1 H ABLE Aug. 11-22
2 H BAKER Aug. 20-Sept. 1
3 H CHARLIE Aug. 21-Sept. 5
4 H DOG Aug. 30-Sept. 16
5 H EASY Sept. 1-9
6 H FOX Sept. 8-16
7 H GEORGE Sept. 27-Oct. 7
8 T HOW Oct. 1-4
9 H ITEM Oct. 8-10
10 H JIG Oct. 11-17
11 H KING Oct. 13-19
12 T —— Oct. 17-24
13 H LOVE Oct. 17-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
MAP 10 L 55 1.64

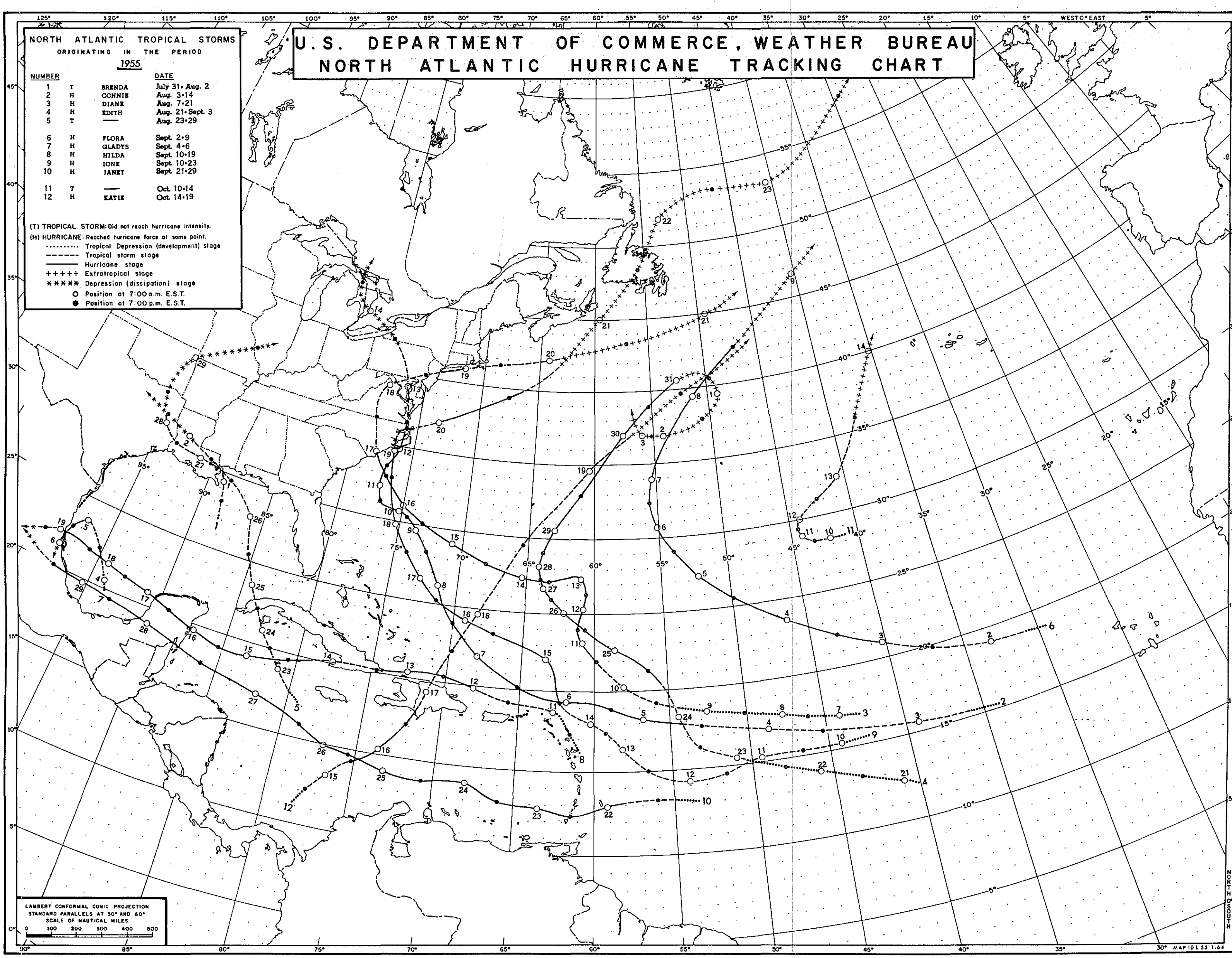

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1951
NUMBER DATE
1 H ABLE May 15-24
2 T BAKER Aug. 2-5
3 H CHARLIE Aug. 12-23
4 H DOG Aug. 27-Sept. 5
5 H EASY Sept. 2-13
6 H FOX Sept. 2-11
7 T GEORGE Sept. 20-21
8 H HOW Sept. 28- Oct. 8
9 H ITEM Oct. 12-17
10 H JIG Oct. 15-20
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 33 1-64

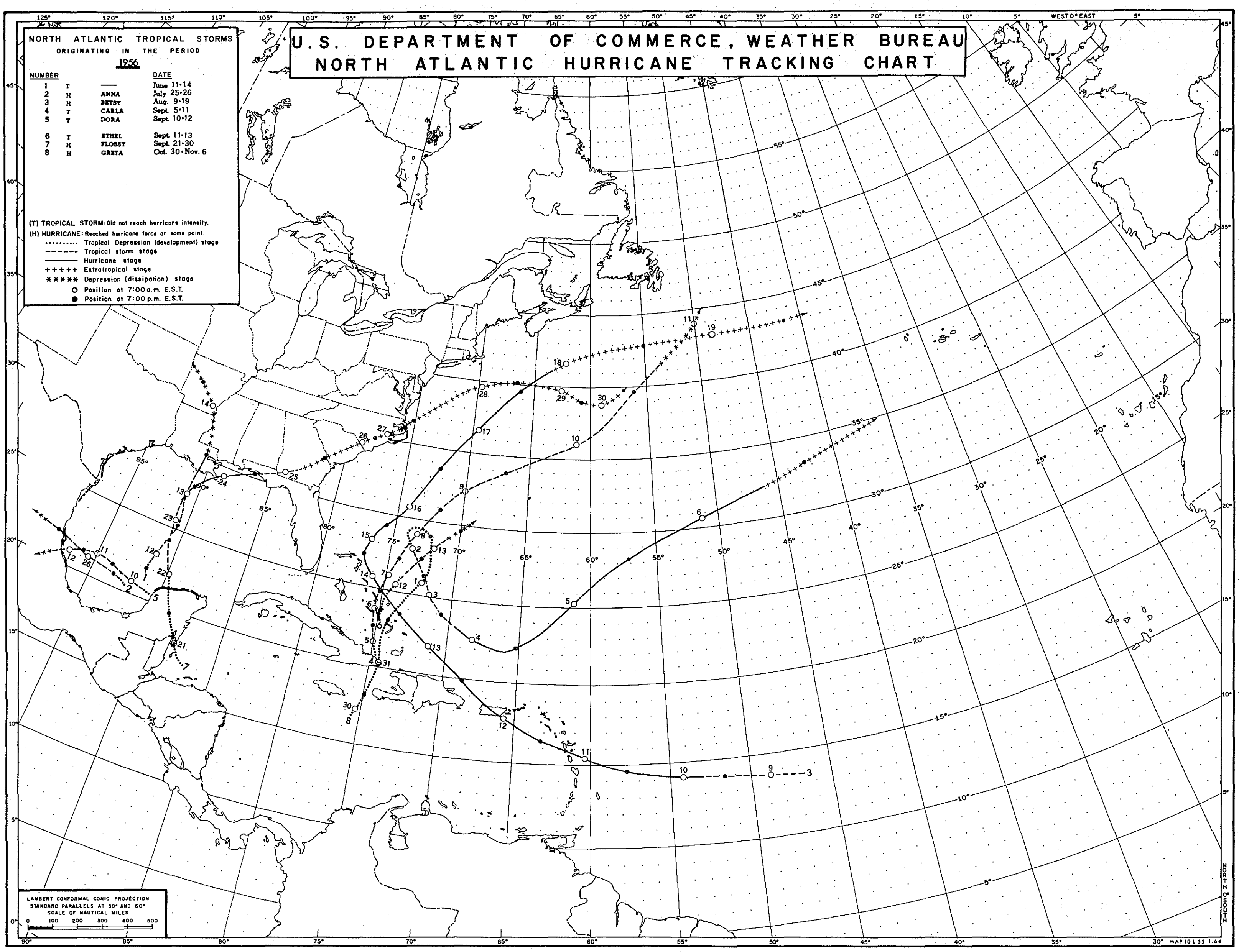

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1952
NUMBER DATE
1 T — Feb. 2-4
2 H ABLE Aug. 18-Sept. 2
3 H BAKER Aug. 31-Sept. 9
4 H CHARLIE Sept. 22-Oct. 1
5 H DOG Sept. 25-28
6 H EASY Oct. 6-11
7 H FOX Oct. 20-28
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 53 1-64



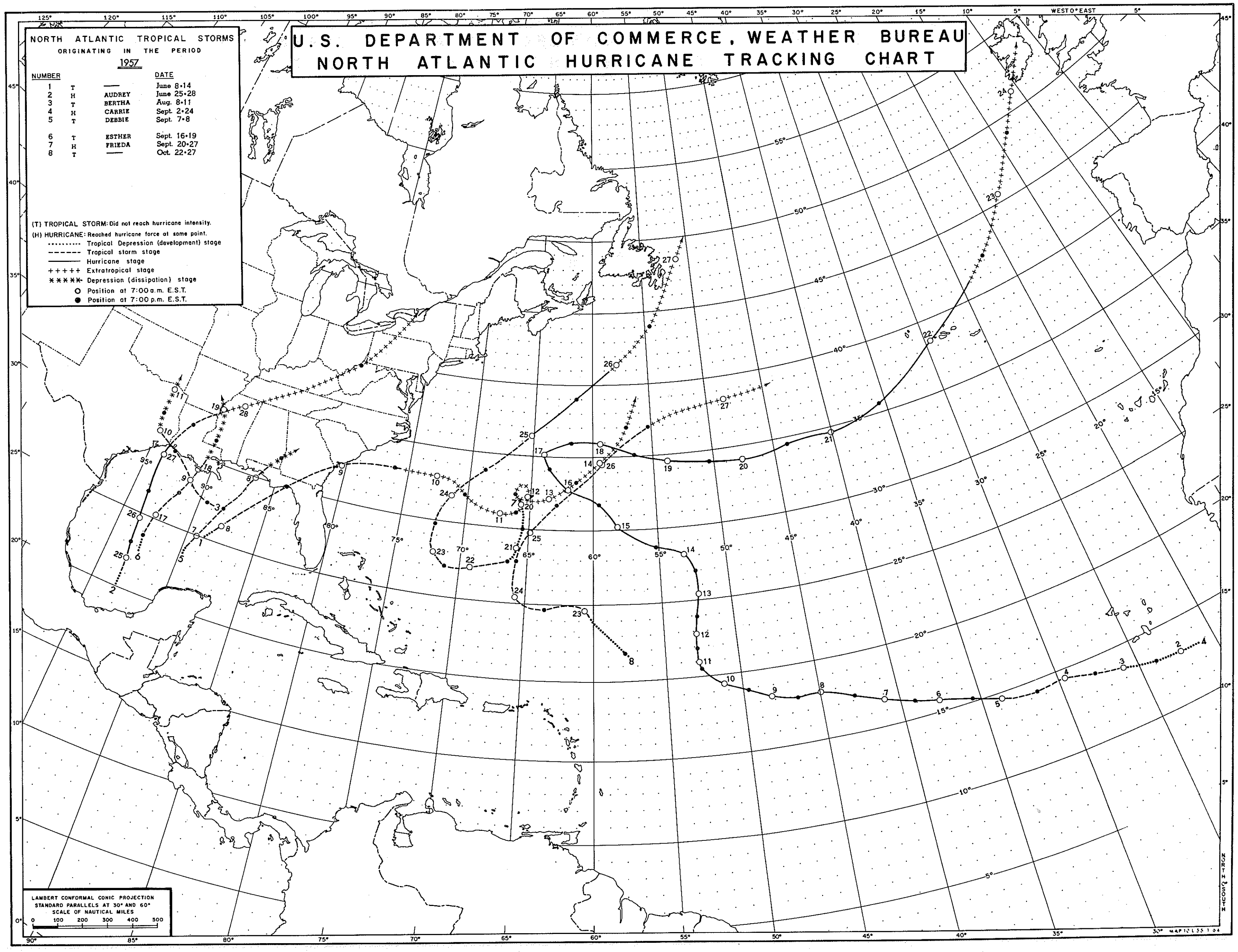
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1953
NUMBER DATE
1 T ALICE May 25 • June 6
2 H BARBARA Aug. 11•16
3 T — Aug. 28 • Sept. 2
4 H CAROL Aug. 28 • Sept. 9
5 H DOLLY Sept. 8•17
6 H EDNA Sept. 14•20
7 T — Sept. 14•20
8 H FLORENCE Sept. 23•28
9 H GAIL Oct. 2•5
10 T — Oct. 3•10
11 T — Oct. 5•8
12 T HAZEL Oct. 7•12
13 T — Nov. 23•26
14 T — Dec. 7•9
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0 EAST
NORTH
SOUTH
MAP 10 L 55 1-64

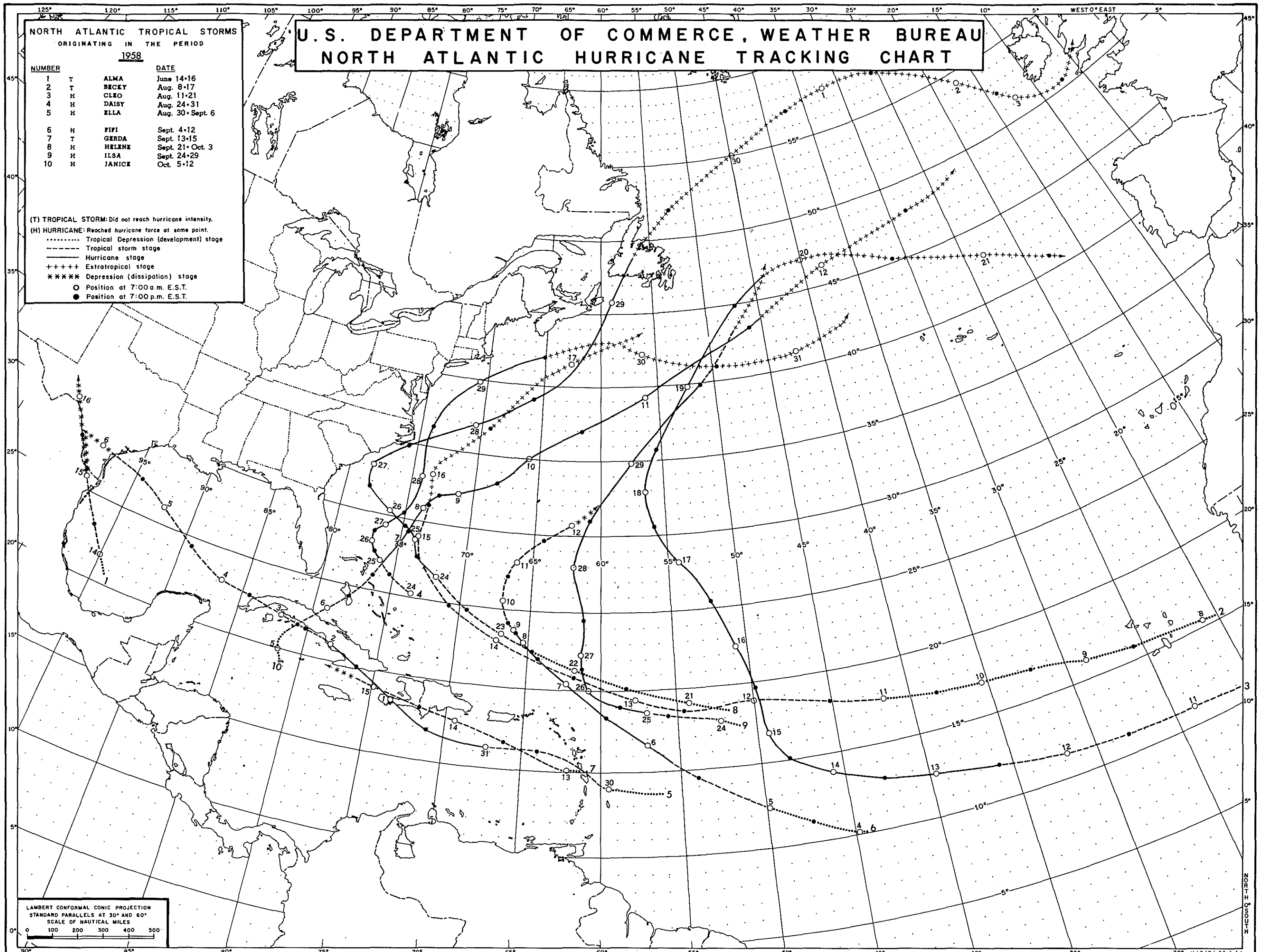

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1954
NUMBER DATE
1 H ALICE June 24-26
2 T BARBARA July 27-30
3 H CAROL Aug. 25-31
4 H DOLLY Aug. 31 - Sept. 4
5 H EDNA Sept. 2-14
6 H FLORENCE Sept. 11-12
7 T GILDA Sept. 24-27
8 H —— Sept. 25 - Oct. 6
9 H HAZEL Oct. 5-18
10 T —— Nov. 16-21
11 H ALICE Dec. 30 - Jan. 5 1955
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-84

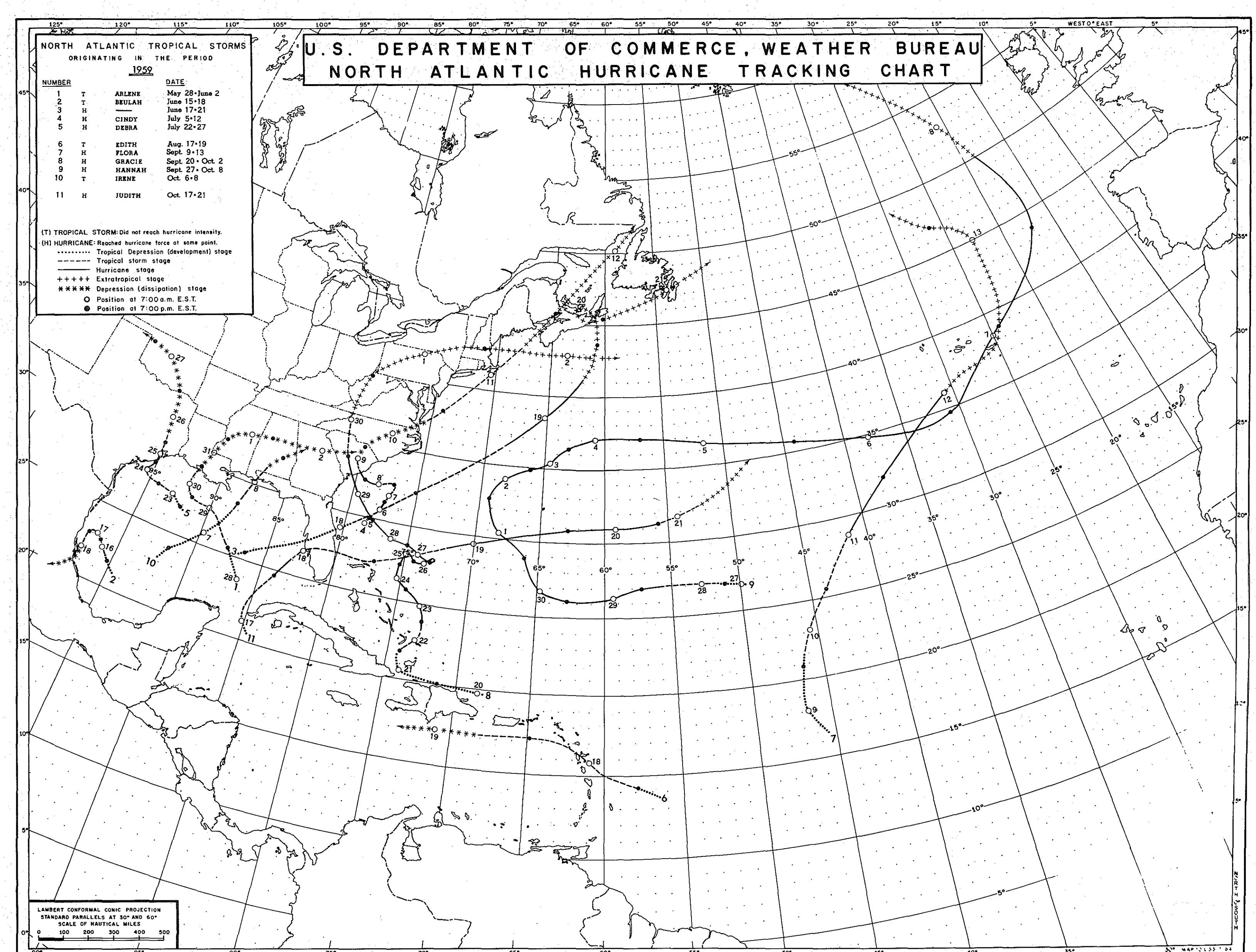

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1955
NUMBER
DATE
1 T BRENDA July 31 - Aug. 2
2 H CONNIE Aug. 3-14
3 H DIANE Aug. 7-21
4 H EDITH Aug. 21 - Sept. 3
5 T —— Aug. 23-29
6 H FLORA Sept. 2-9
7 H GLADYS Sept. 4-6
8 H HILDA Sept. 10-19
9 H IONE Sept. 10-23
10 H JANET Sept. 21-29
11 T —— Oct. 10-14
12 H KATIE Oct. 14-19
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
.... Tropical Depression (development) stage
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
○ Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64

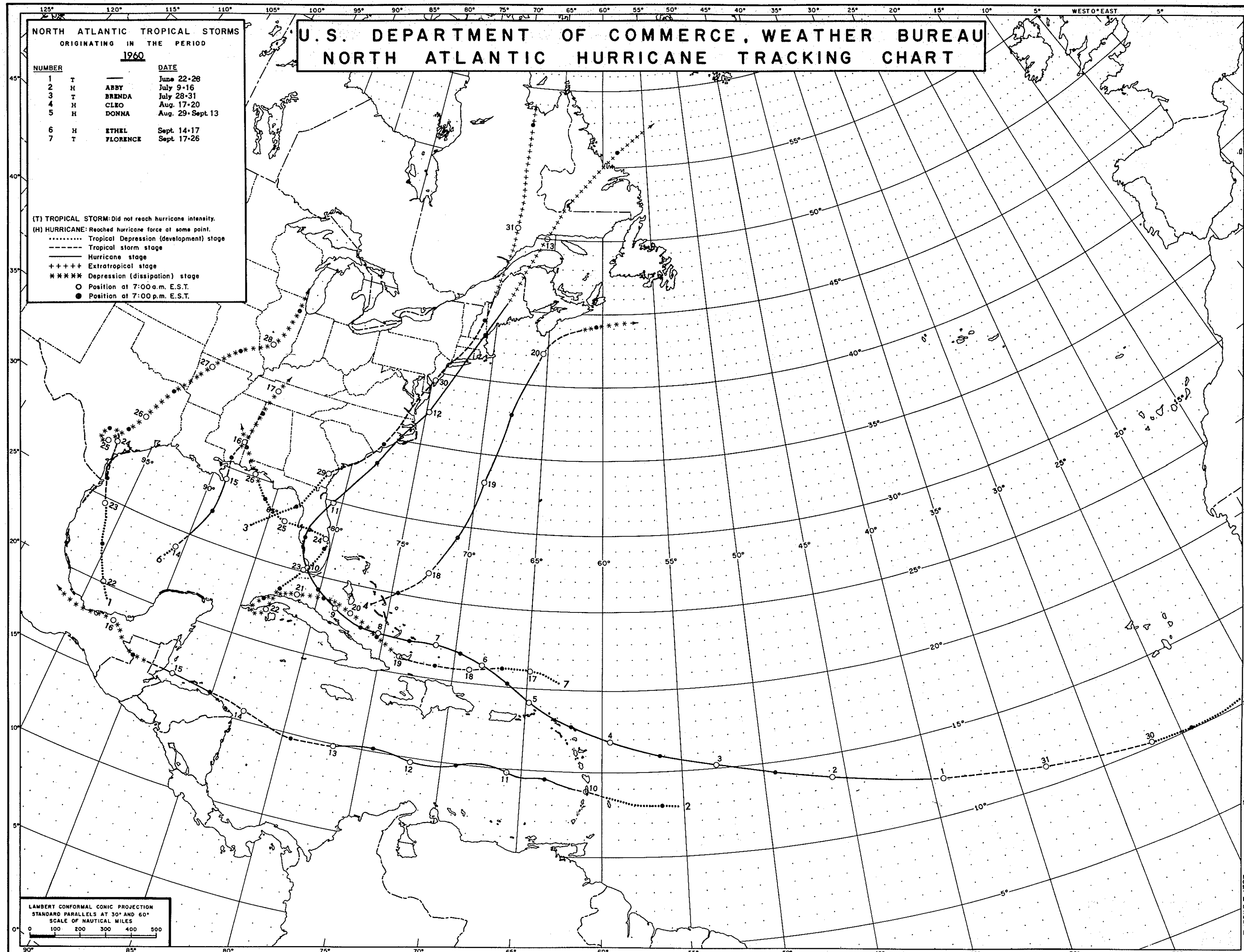


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1956
NUMBER DATE
1 T — June 11-14
2 H ANNA July 25-26
3 H BETSY Aug. 9-19
4 T CARLA Sept. 5-11
5 T DORA Sept. 10-12
6 T ETHEL Sept. 11-13
7 H FLOSSY Sept. 21-30
8 H GRETA Oct. 30-Nov. 6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
.... Tropical Depression (development) stage
------ Tropical storm stage
—— Hurricane stage
+++++ Extratropical stage
✱✱✱✱✱ Depression (dissipation) stage
○ Position at 7:00 a.m. E.S.T.
● Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

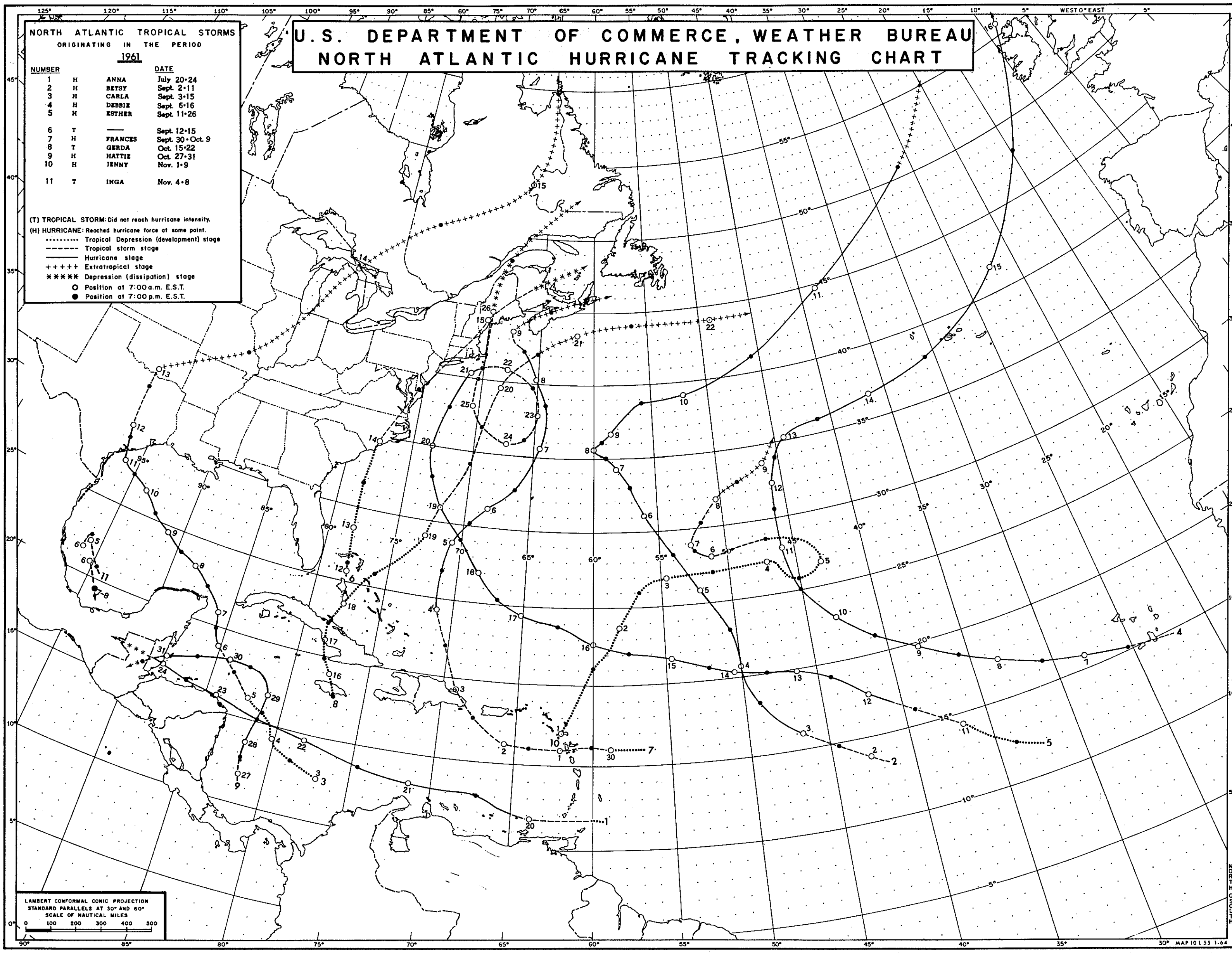

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1957
NUMBER DATE
1 T — June 8-14
2 H AUDREY June 25-28
3 T BERTHA Aug. 8-11
4 H CARRIE Sept. 2-24
5 T DEBBIE Sept. 7-8
6 T ESTHER Sept. 16-19
7 H FRIEDA Sept. 20-27
8 T — Oct. 22-27
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

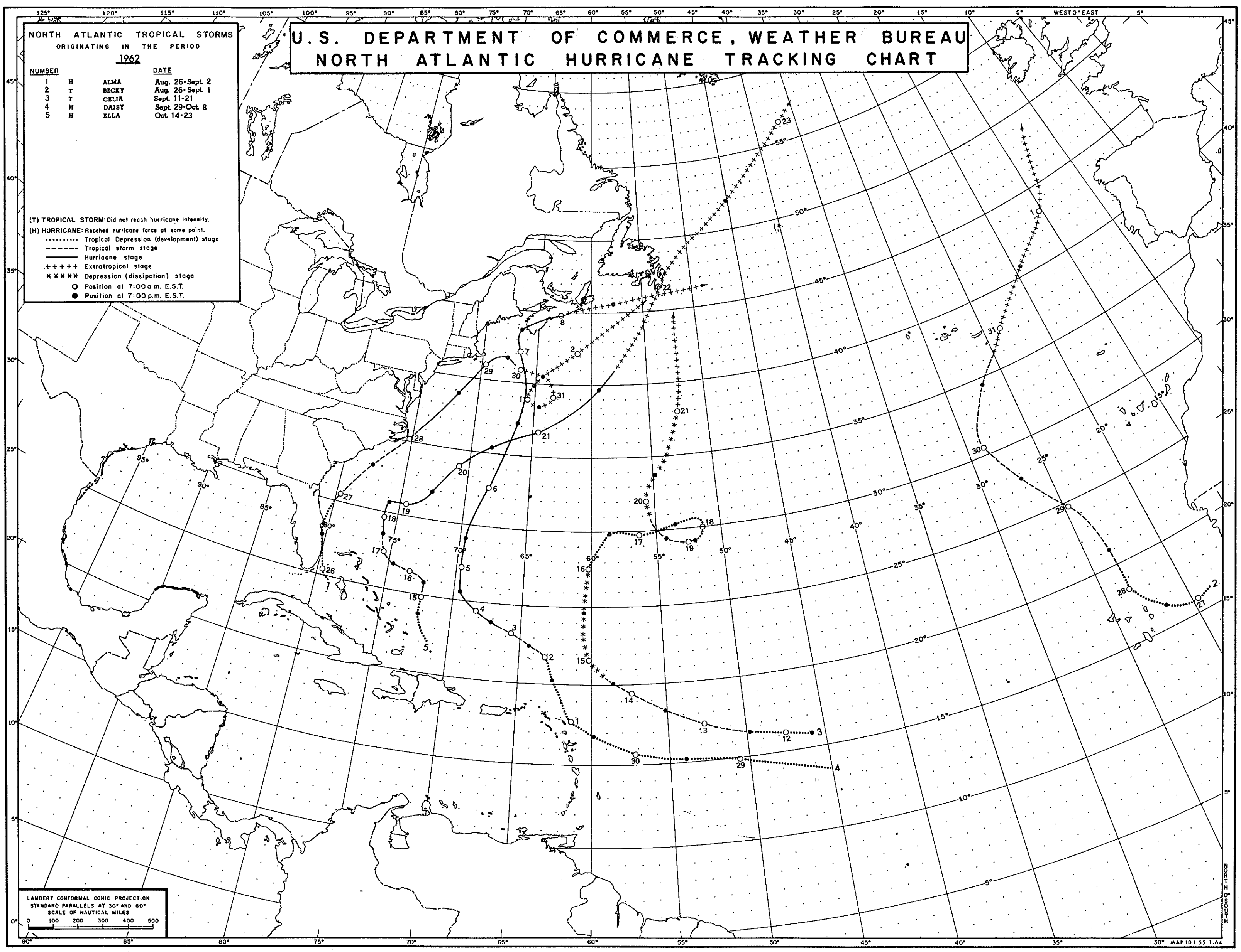

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1958
NUMBER
DATE
1 T ALMA June 14-16
2 T BECKY Aug. 8-17
3 H CLEO Aug. 11-21
4 H DAISY Aug. 24-31
5 H ELLA Aug. 30 - Sept. 6
6 H FIFI Sept. 4-12
7 T GERDA Sept. 13-15
8 H HELENE Sept. 21 - Oct. 3
9 H ILSA Sept. 24-29
10 H JANICE Oct. 5-12
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
WEST 0° EAST
NORTH 0° SOUTH


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1959
NUMBER DATE
1 T ARLENE May 28-June 2
2 T BEULAH June 15-18
3 H —— June 17-21
4 H CINDY July 5-12
5 H DEBRA July 22-27
6 T EDITH Aug. 17-19
7 H FLORA Sept. 9-13
8 H GRACIE Sept. 20 - Oct. 2
9 H HANNAH Sept. 27 - Oct. 8
10 T IRENE Oct. 6-8
11 H JUDITH Oct. 17-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

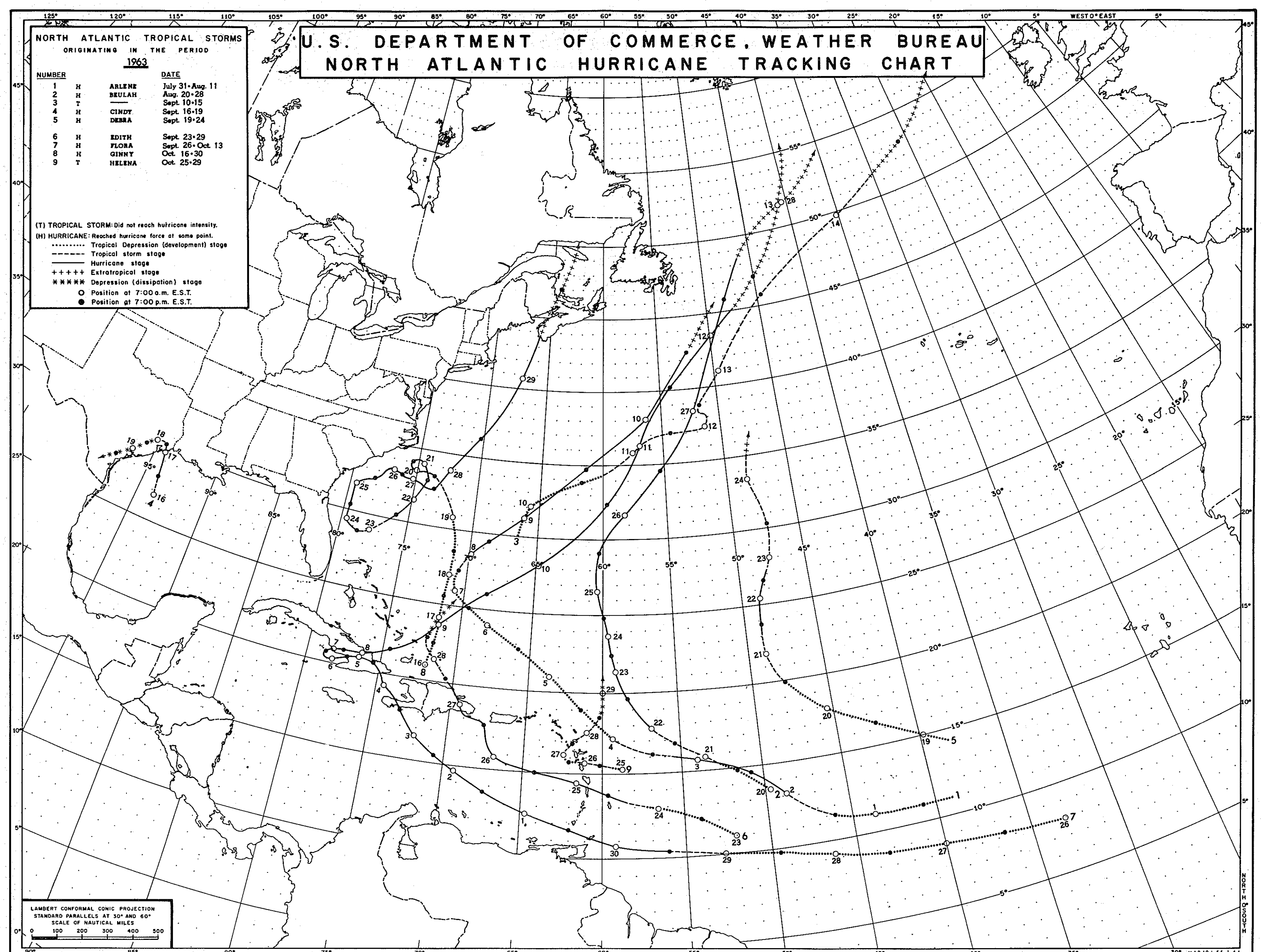


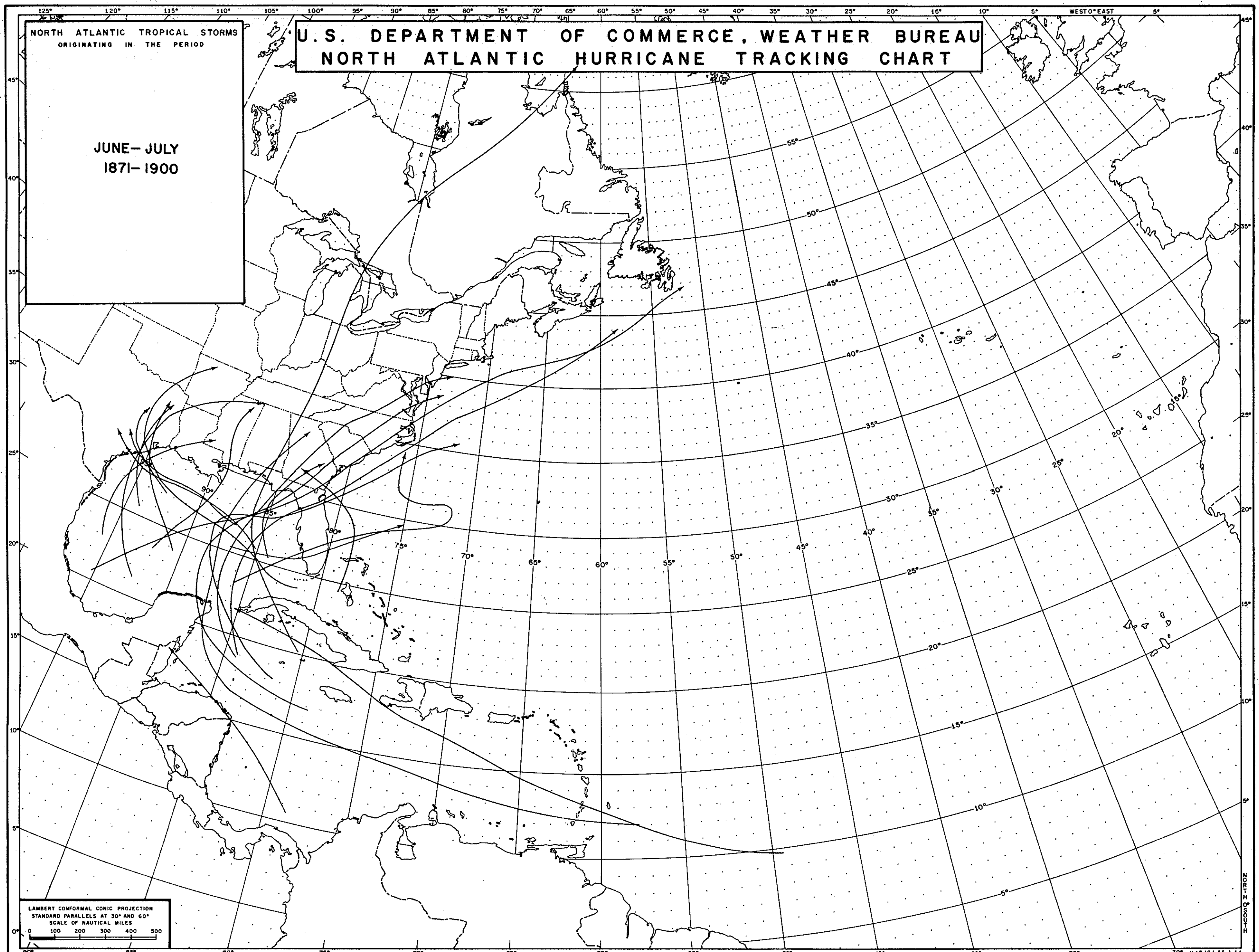
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1960
NUMBER DATE
1 T —— June 22-28
2 H ABBY July 9-16
3 T BRENDA July 28-31
4 H CLEO Aug. 17-20
5 H DONNA Aug. 29-Sept. 13
6 H ETHEL Sept. 14-17
7 T FLORENCE Sept. 17-26
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

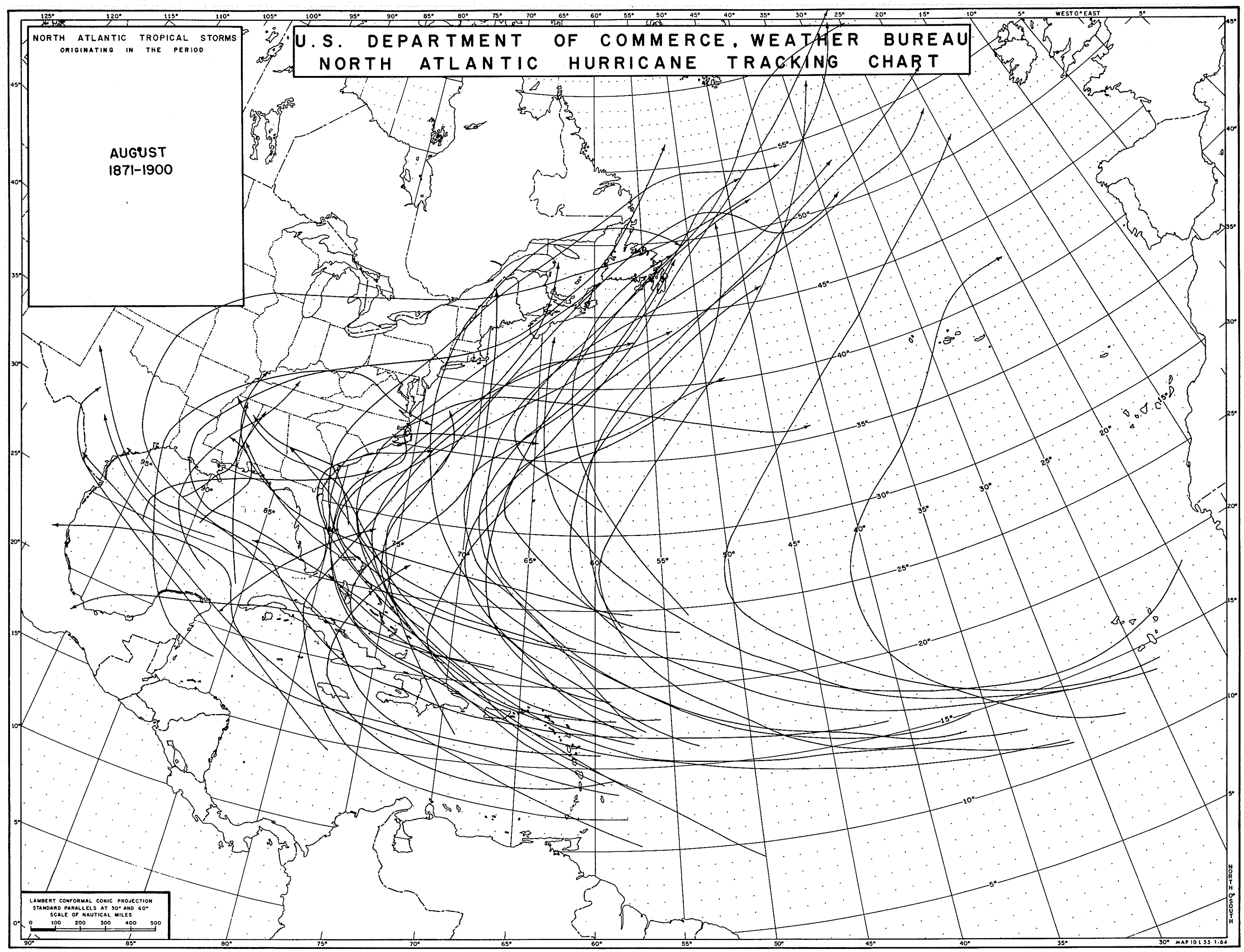

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1961
NUMBER
DATE
1 H ANNA July 20-24
2 H BETSY Sept. 2-11
3 H CARLA Sept. 3-15
4 H DEBBIE Sept. 6-16
5 H ESTHER Sept. 11-26
6 T —— Sept. 12-15
7 H FRANCES Sept. 30-Oct. 9
8 T GERDA Oct. 15-22
9 H HATTIE Oct. 27-31
10 H JENNY Nov. 1-9
11 T INGA Nov. 4-8
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64

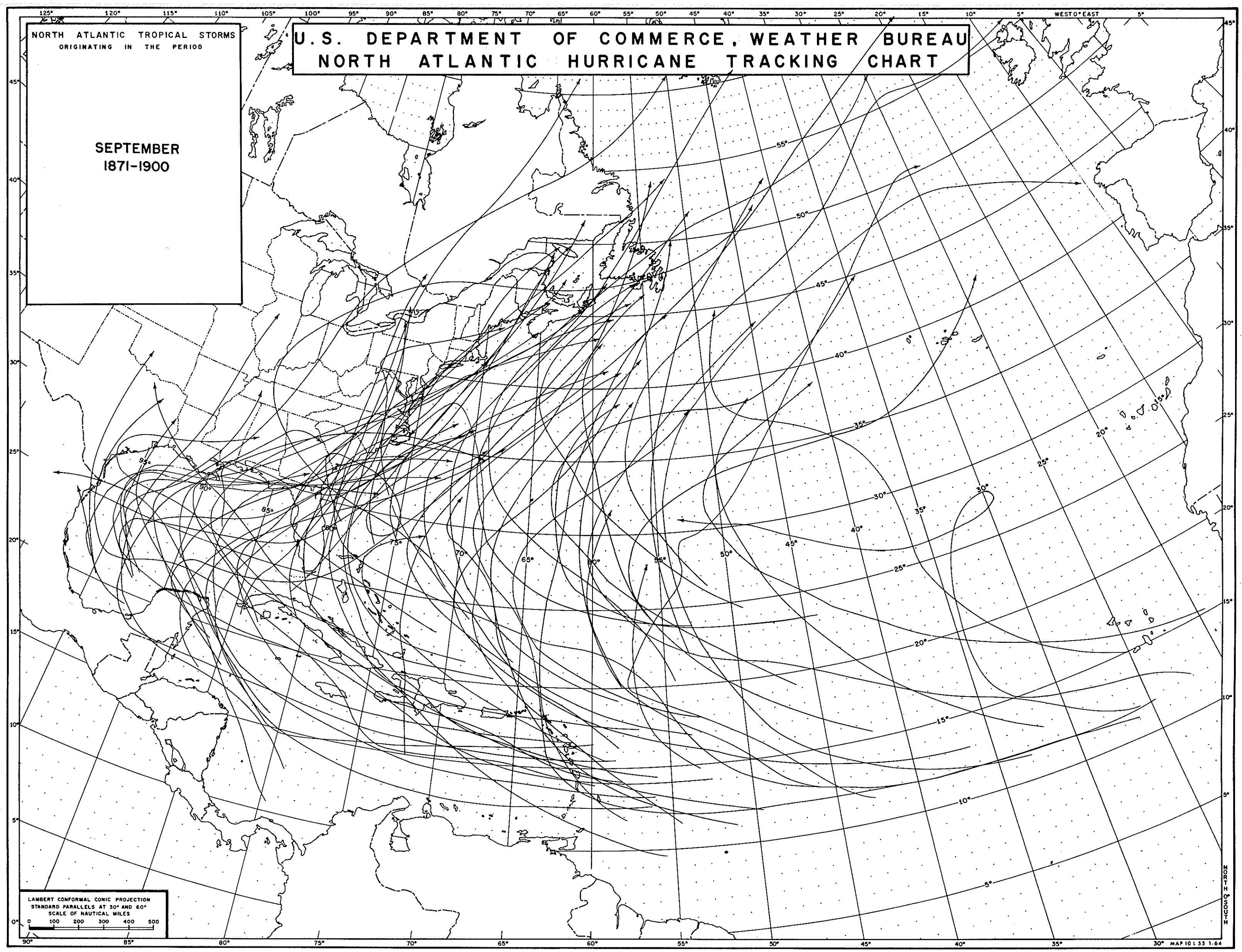


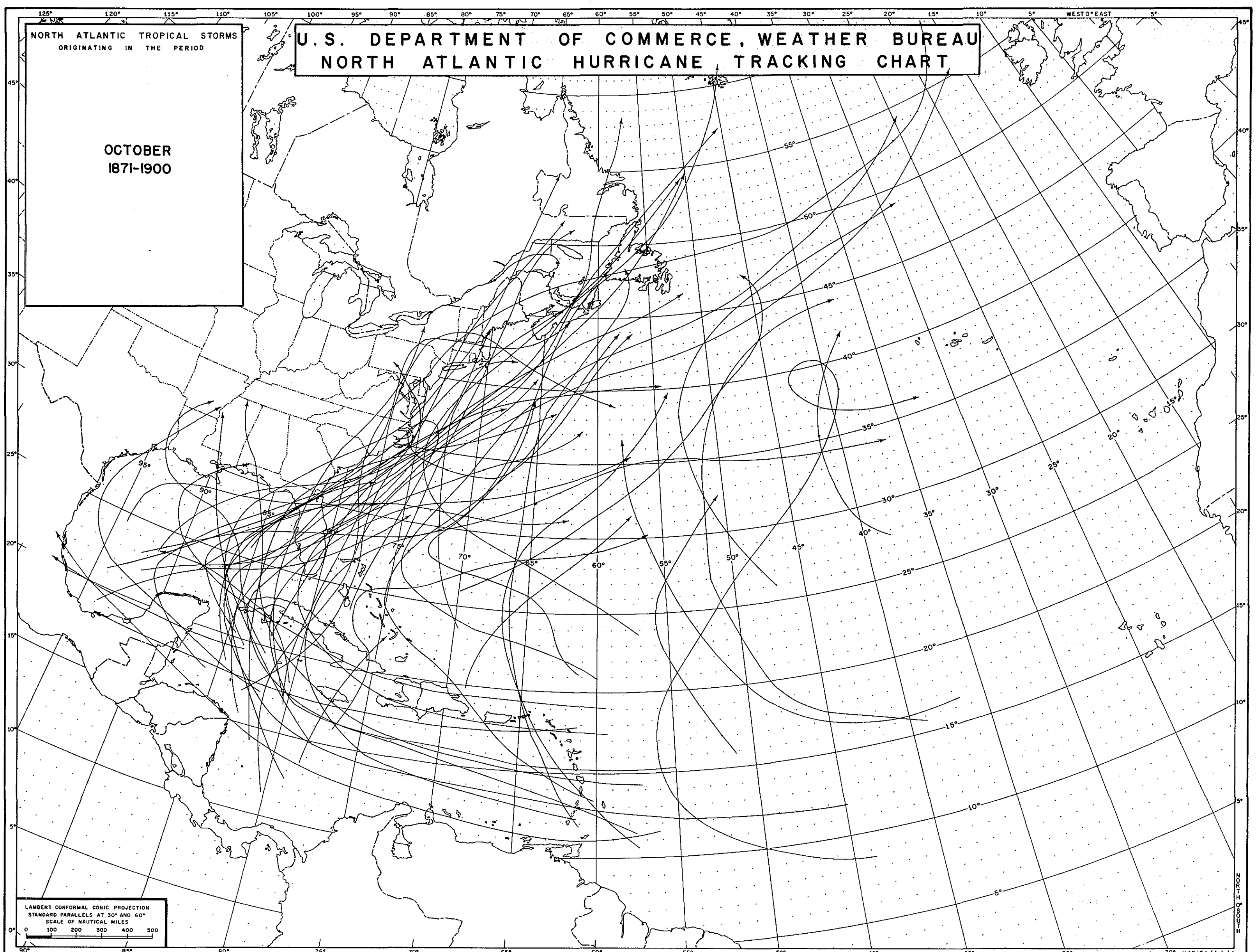
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1962
NUMBER
DATE
1 H ALMA Aug. 26-Sept. 2
2 T BECKY Aug. 26-Sept. 1
3 T CELIA Sept. 11-21
4 H DAISY Sept. 29-Oct. 8
5 H ELLA Oct. 14-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

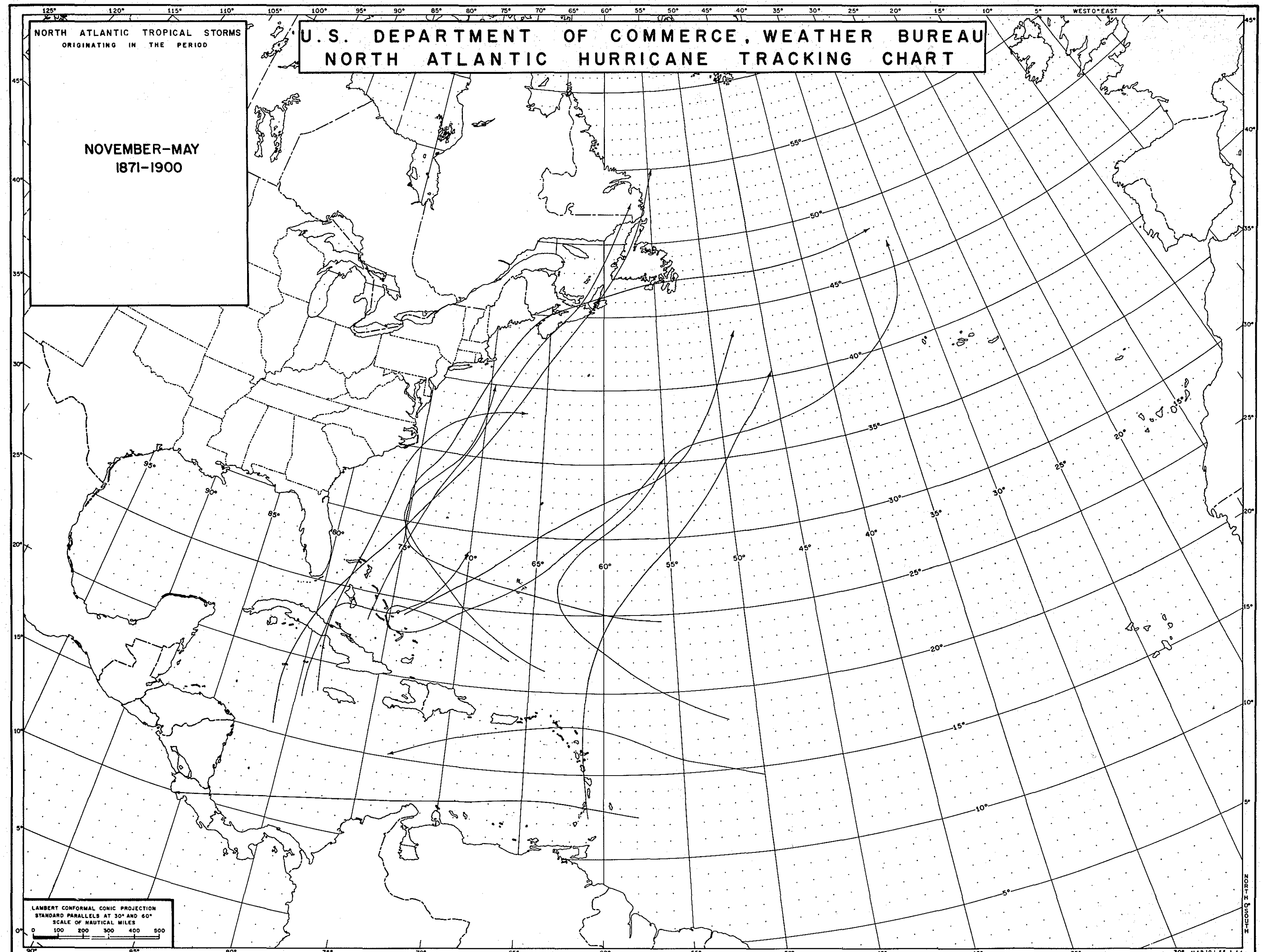

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1963
NUMBER
DATE
1 H ARLENE July 31-Aug. 11
2 H BEULAH Aug. 20-28
3 T —— Sept. 10-15
4 H CINDY Sept. 16-19
5 H DEBRA Sept. 19-24
6 H EDITH Sept. 23-29
7 H FLORA Sept. 26-Oct. 13
8 H GINNY Oct. 16-30
9 T HELENA Oct. 25-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical Depression (development) stage
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
***** Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH 0° SOUTH
WEST 0° EAST
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
JUNE– JULY
1871– 1900
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

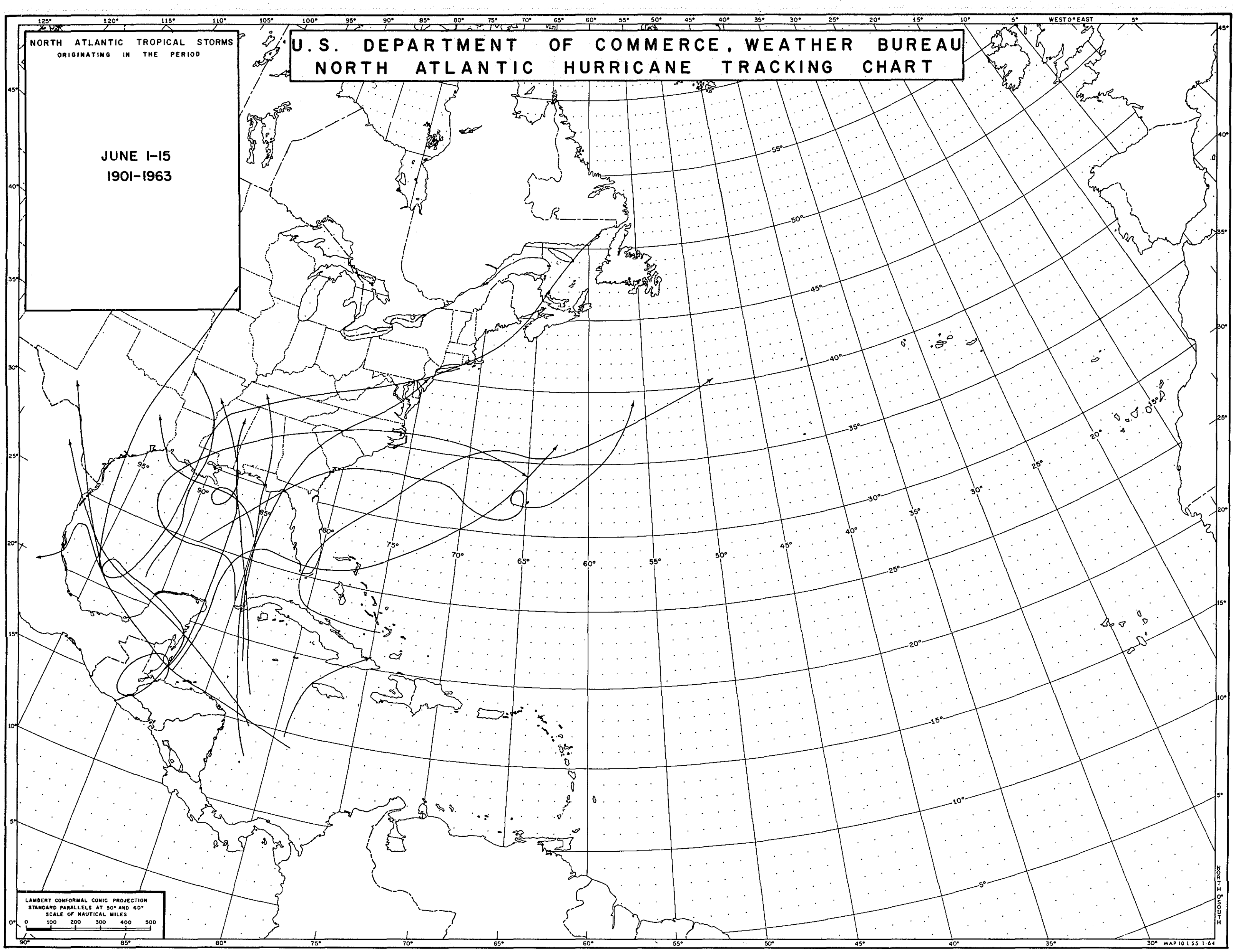

NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
AUGUST
1871-1900
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L.S.S. 1-64

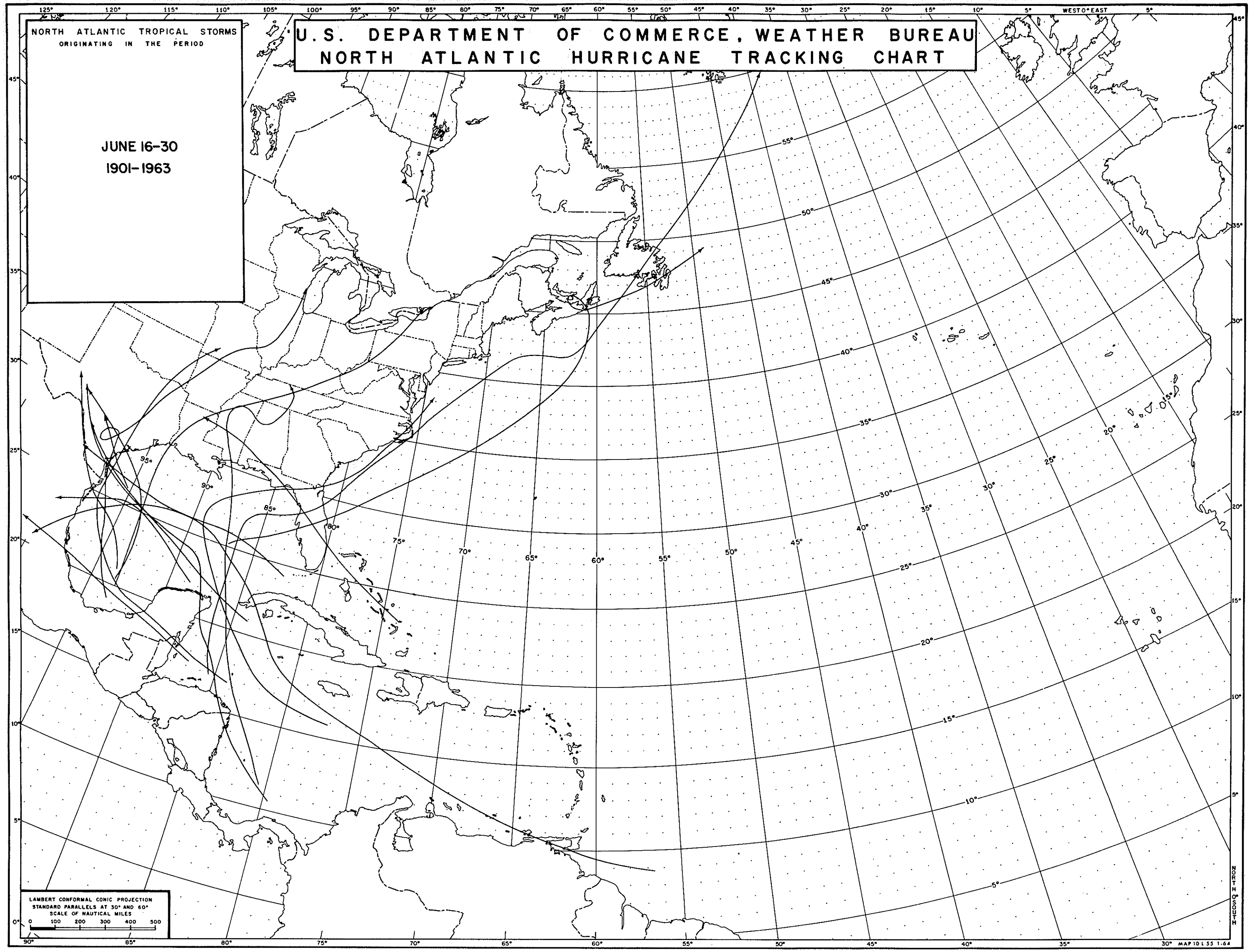

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD
SEPTEMBER
1871-1900
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 1013 55 1-64


NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
OCTOBER
1871-1900
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 LSS 1-64

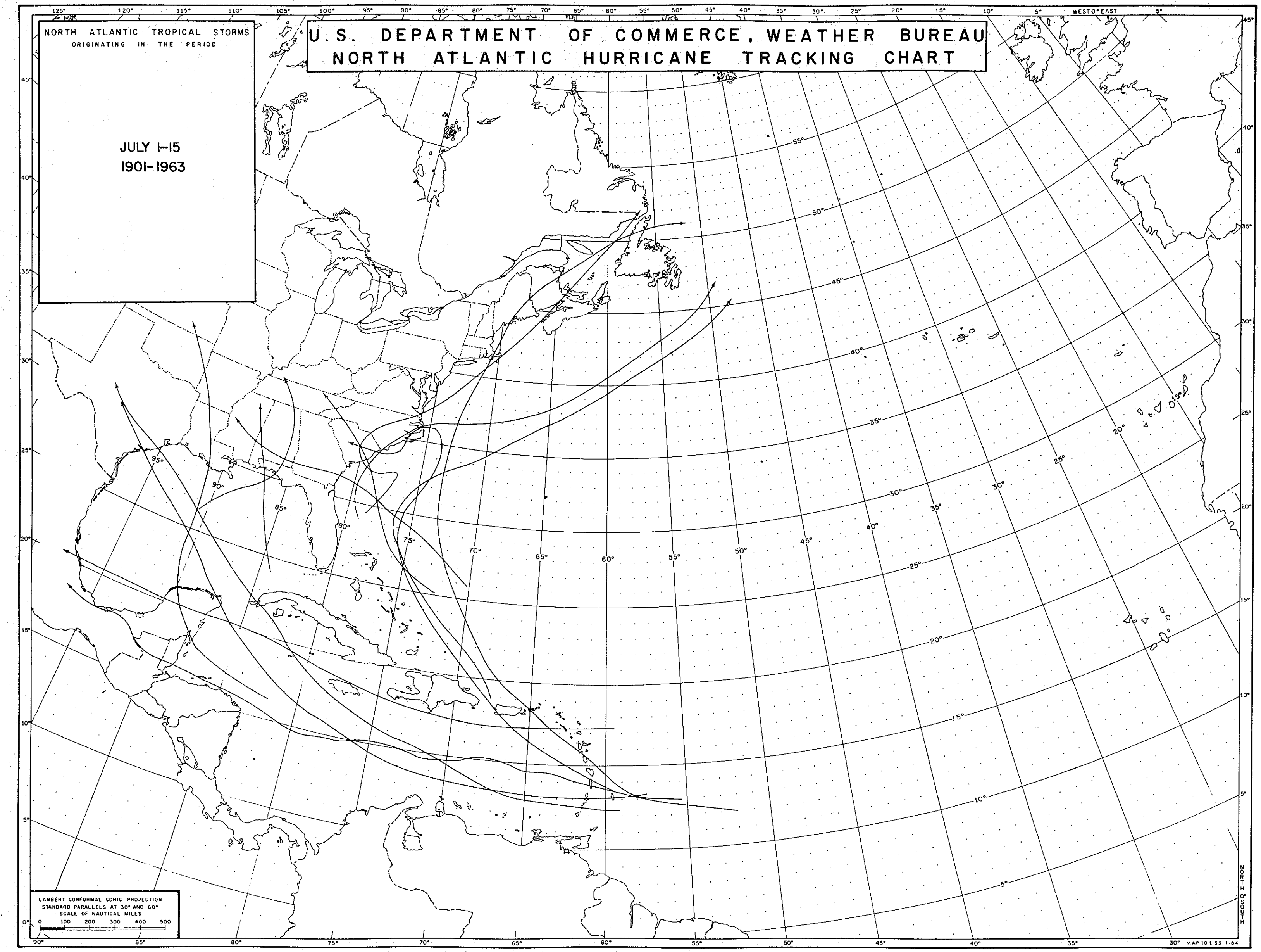


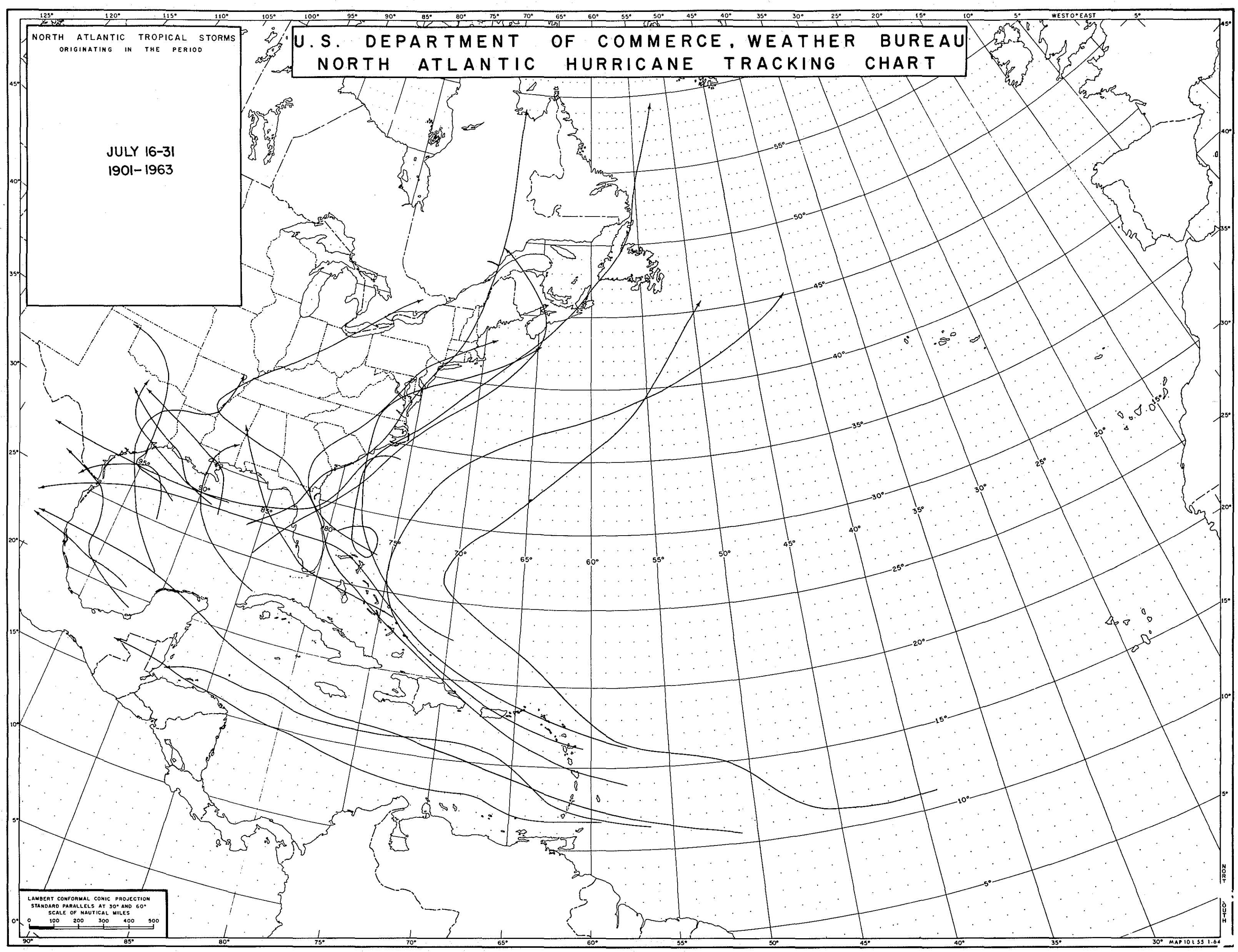
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD
NOVEMBER-MAY
1871-1900
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
JUNE 1-15
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

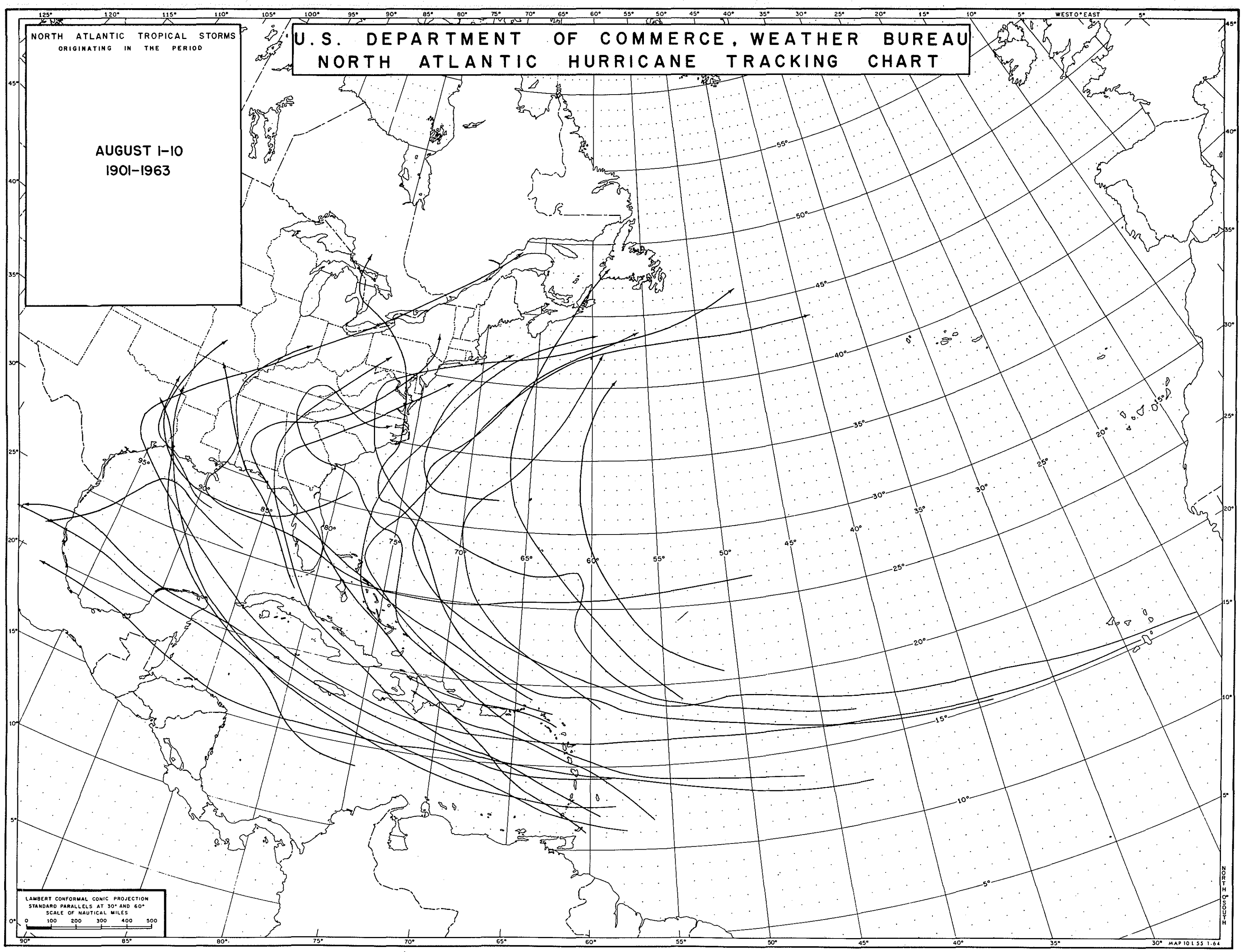


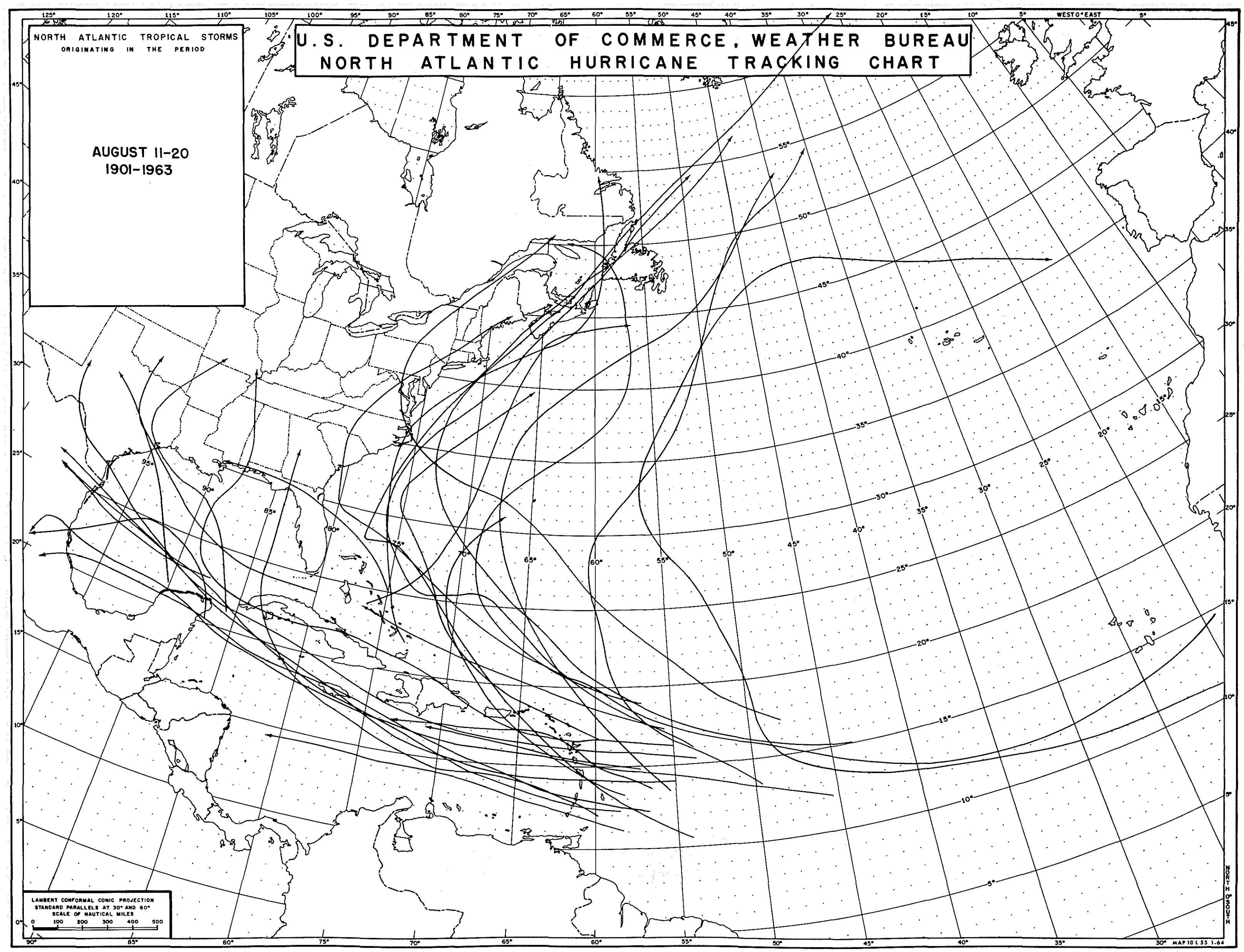
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD
JUNE 16-30
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

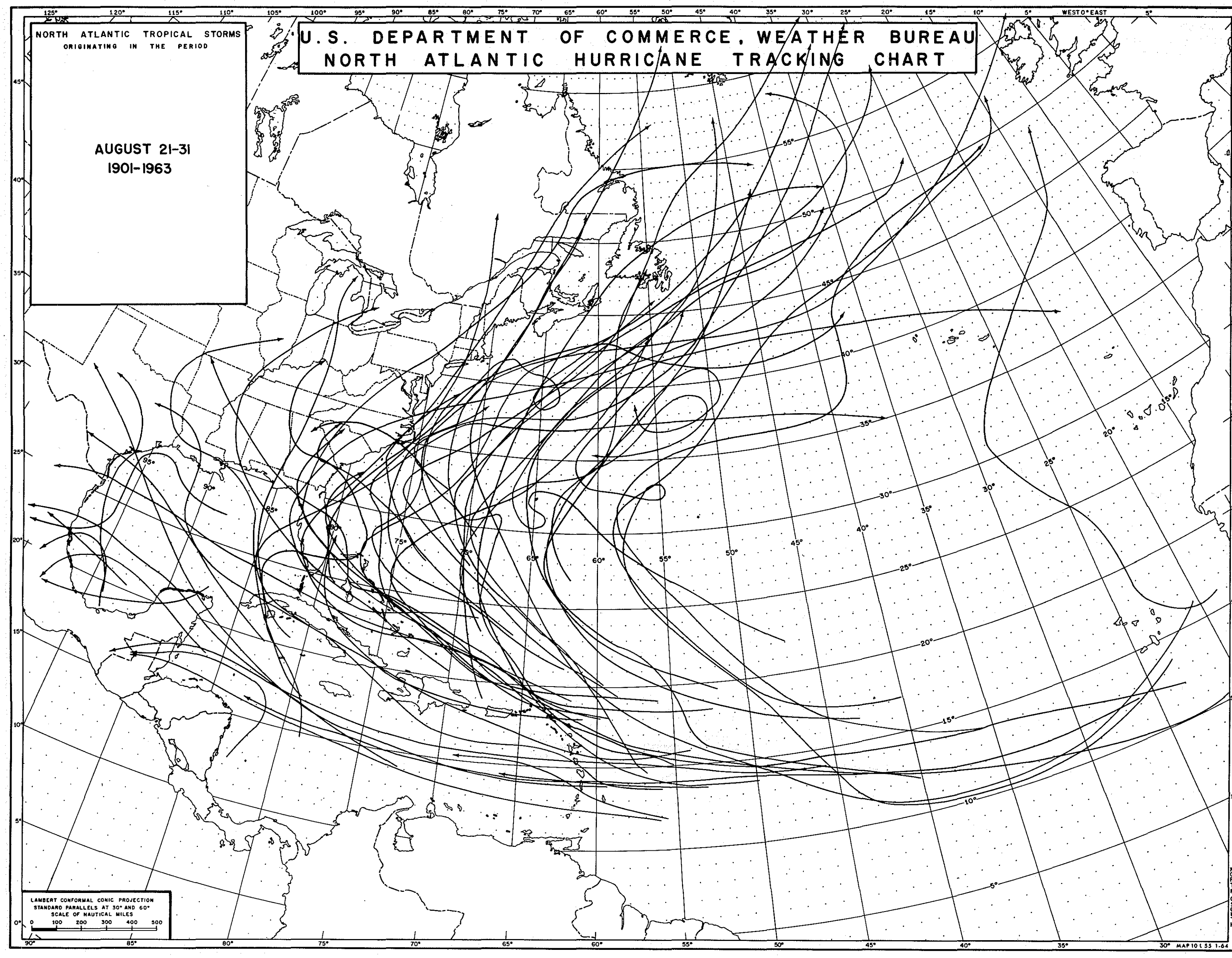

NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
JULY 1-15
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64



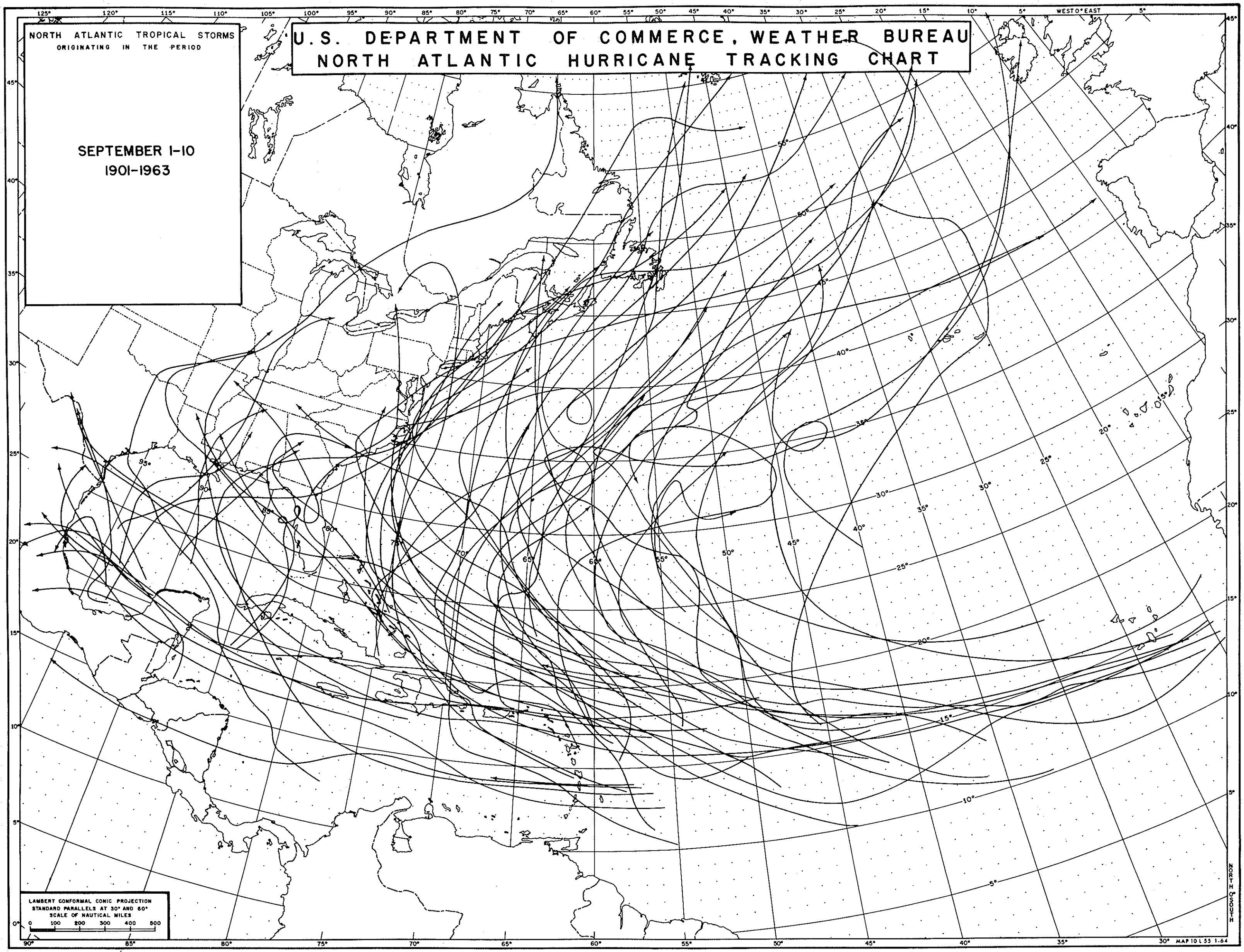
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
JULY 16-31
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

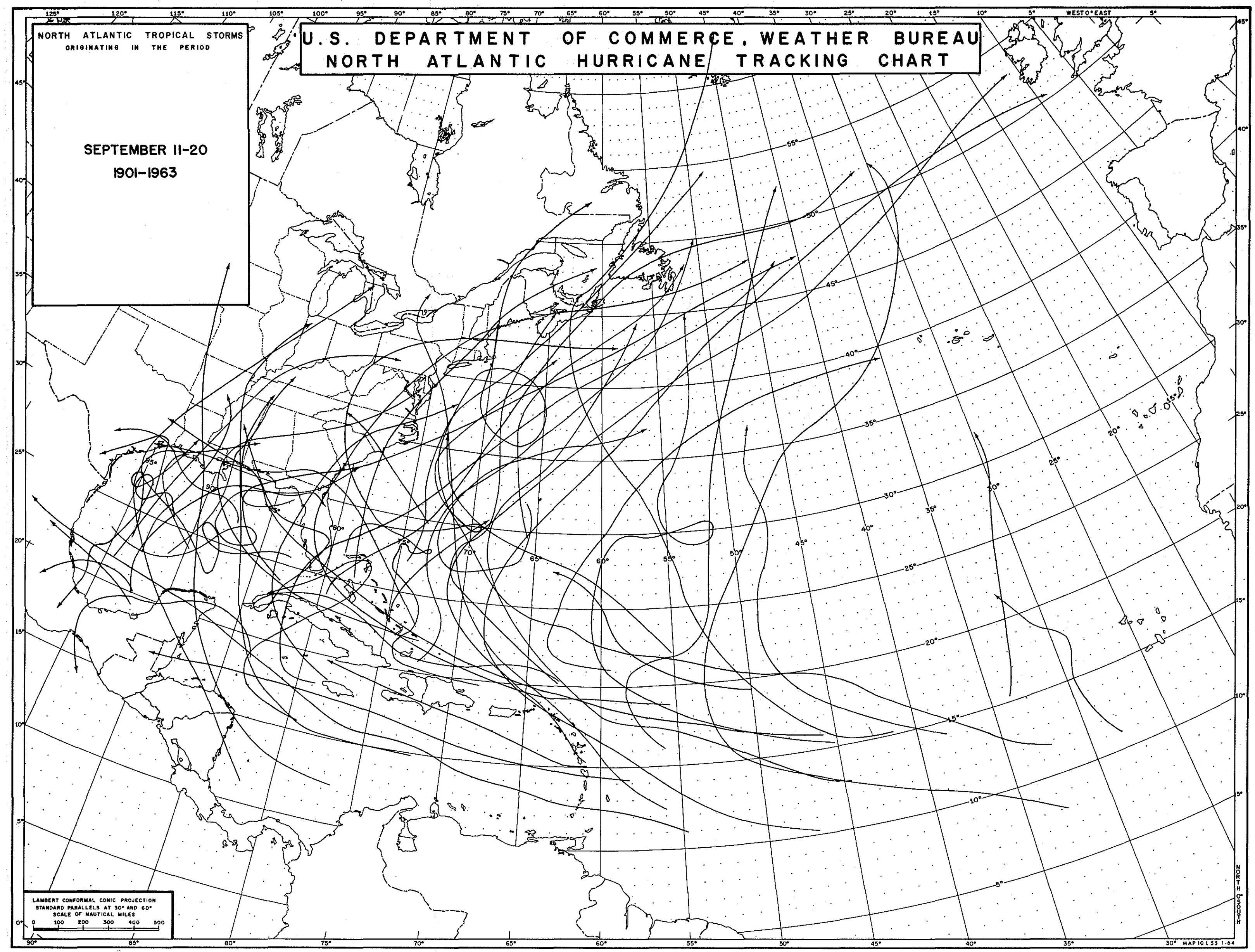

NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
AUGUST 1-10
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

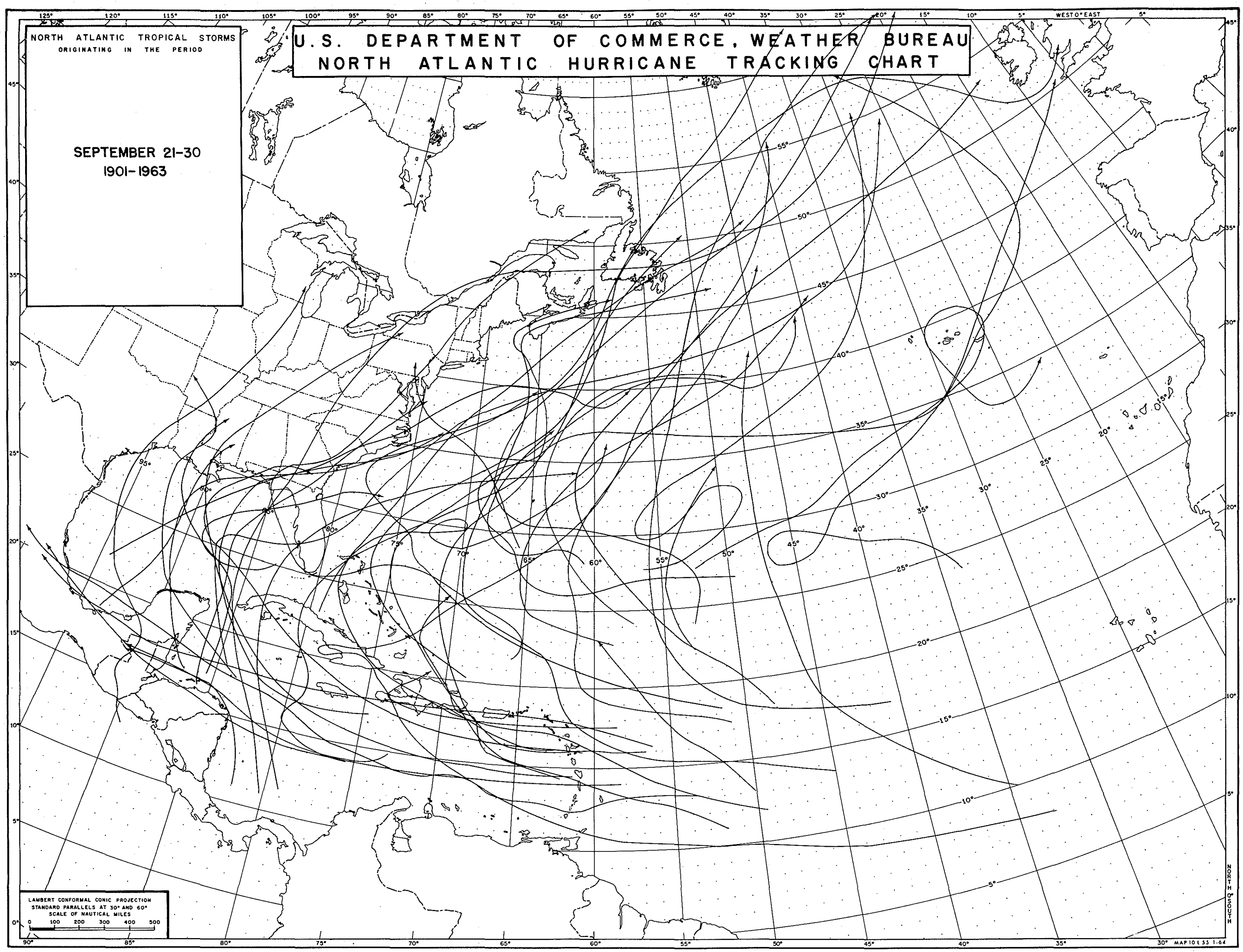

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
AUGUST 11-20
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

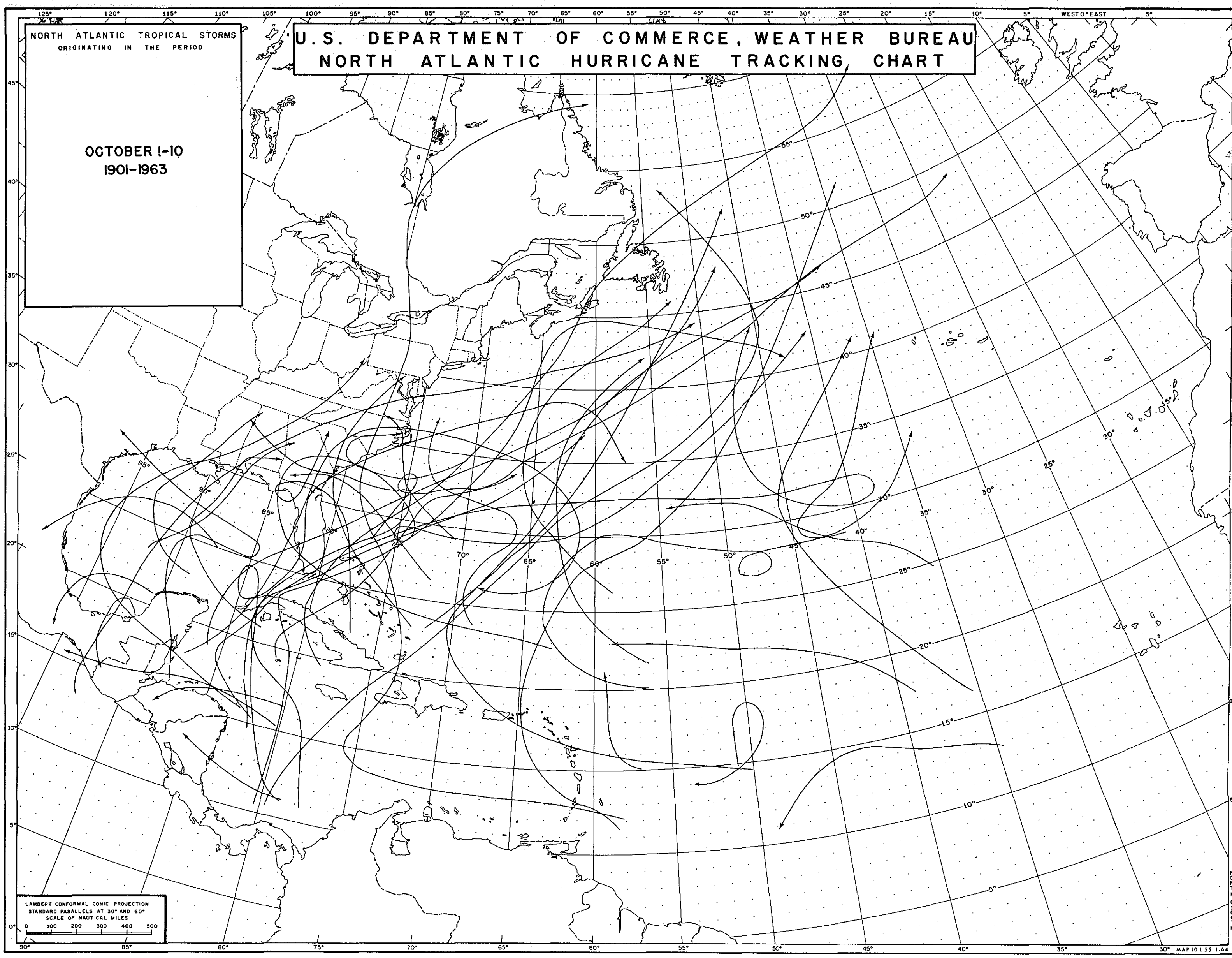


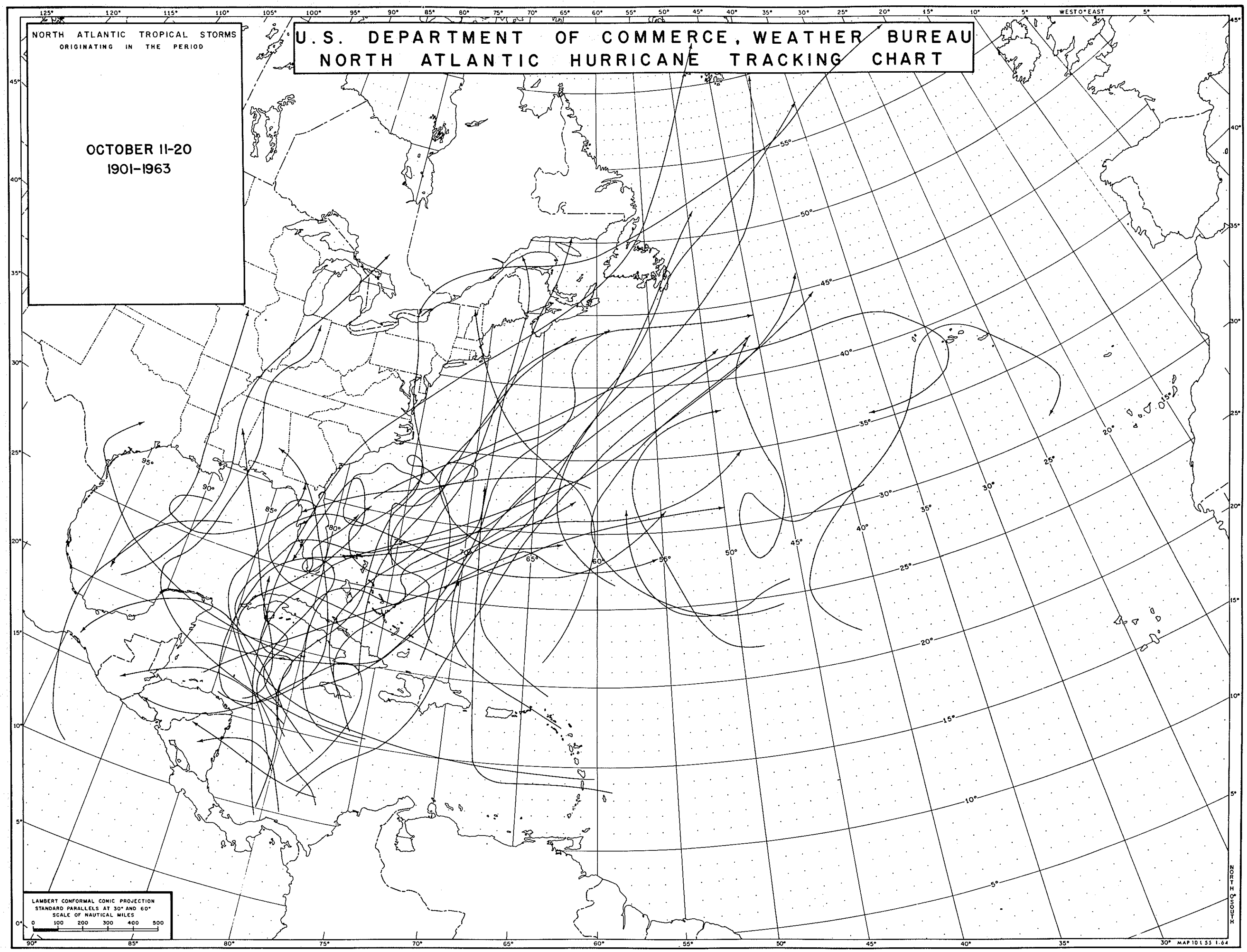
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
AUGUST 21-31
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

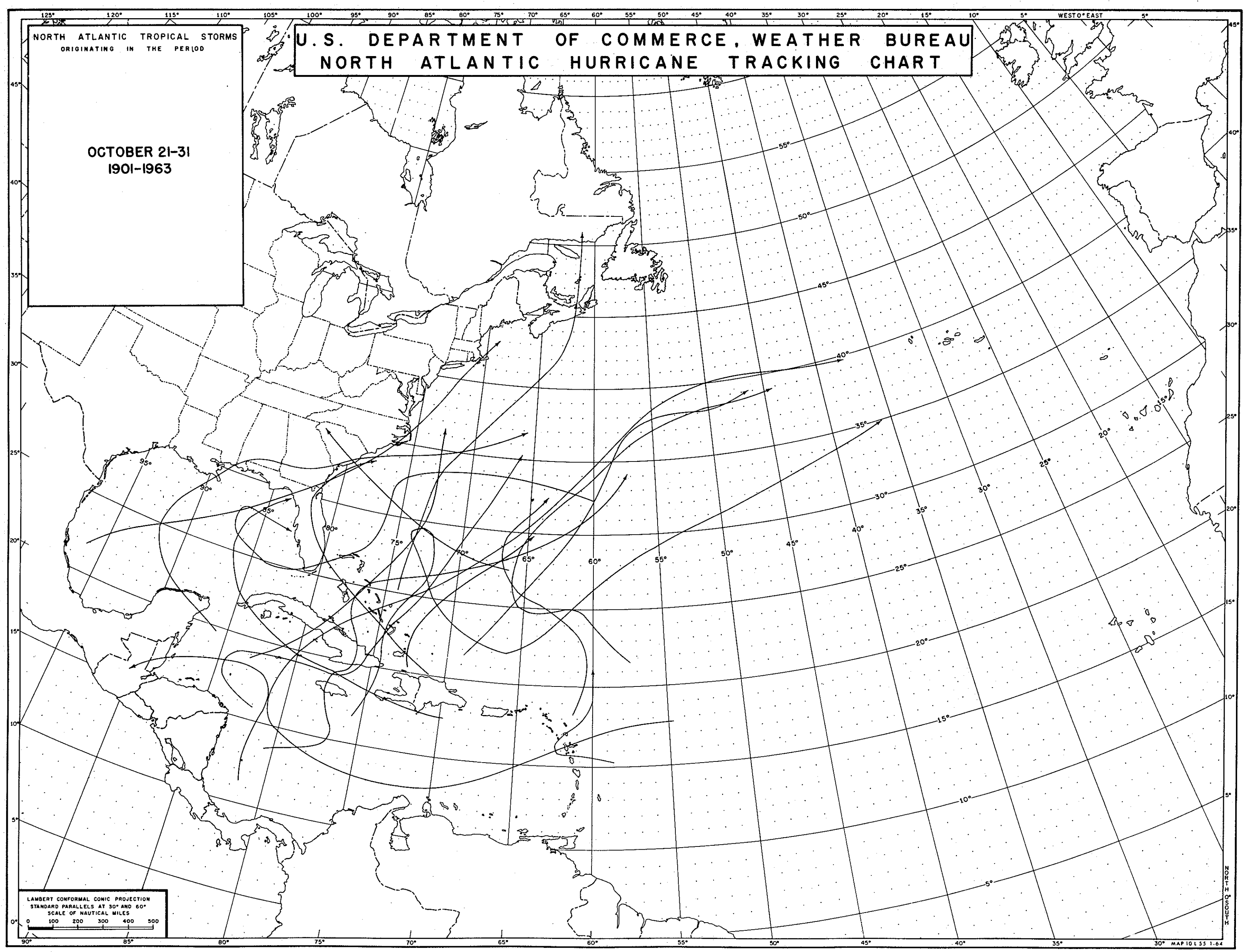

NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
SEPTEMBER 1-10
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64

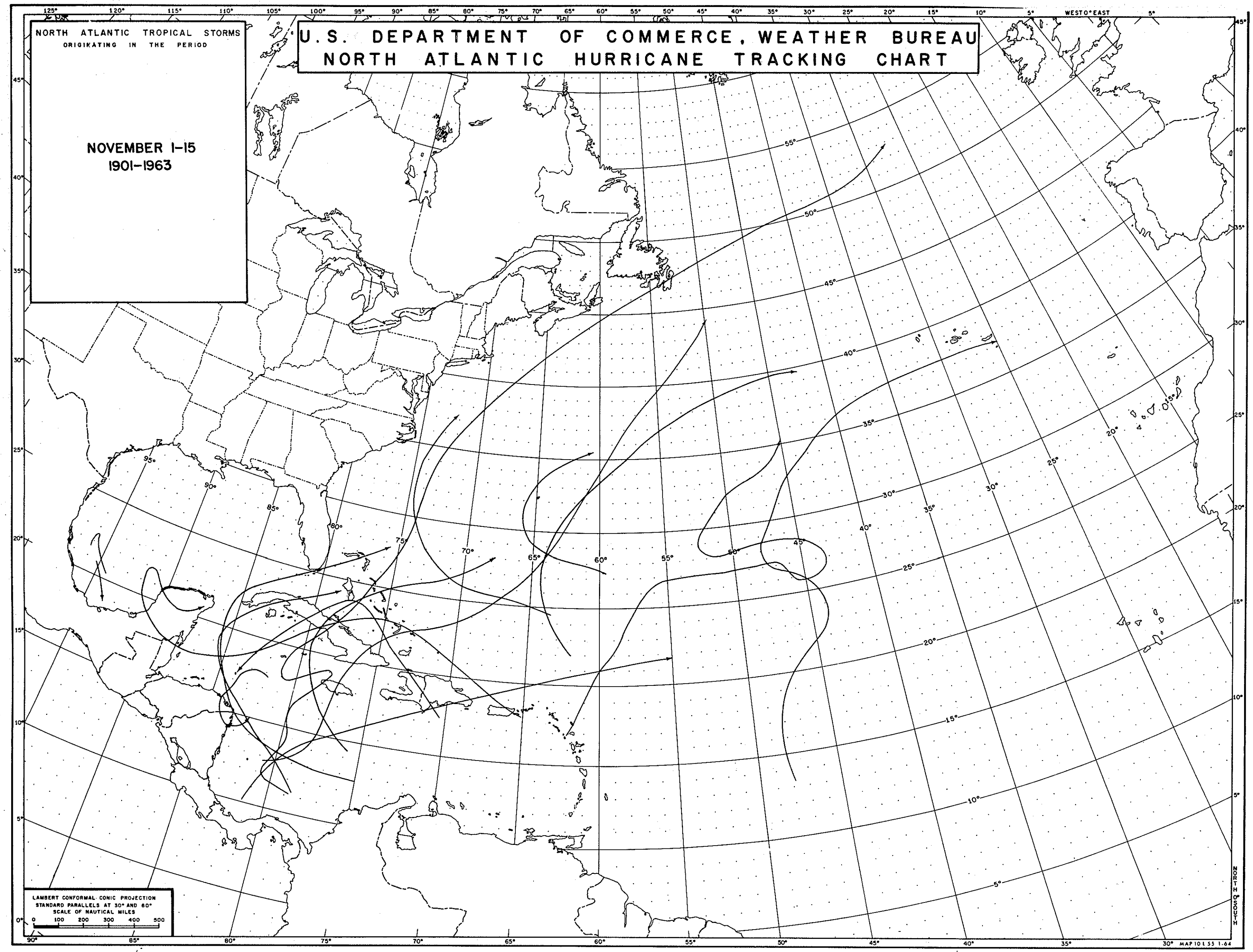

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
SEPTEMBER 11-20
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST 0° EAST
NORTH 0° SOUTH
MAP 10 L 55 1-64


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
SEPTEMBER 21-30
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

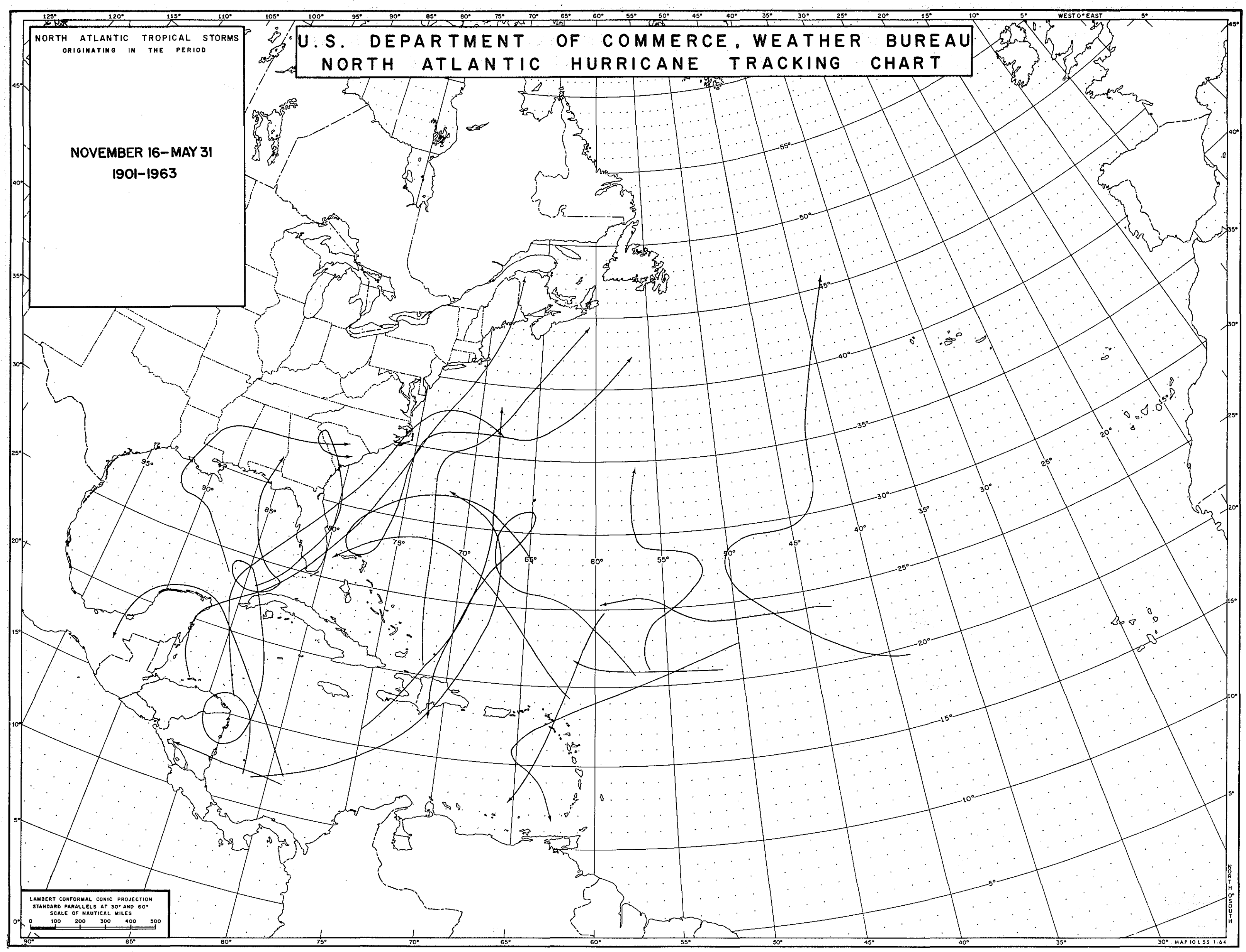

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
OCTOBER 1-10
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10155 1-64


NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD
OCTOBER 11-20
1901-1963
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
OCTOBER 21-31
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
MAP 10 L 55 1-64



U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
NOVEMBER 1-15
1901-1963
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



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