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TROPICAL CYCLONES OF THE NORTH ATLANTIC OCEAN, 1871 - 1992

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1. INTRODUCTION

Over the 122-year period 1871 through 1992, a total of 993 tropical cyclones (tropical storms and hurricanes) of various intensities have been recorded over the North Atlantic area. The formation of these storms, and possible intensification into mature hurricanes, takes place over warm tropical and subtropical waters. Eventual dissipation or modification, averaging 7 to 8 days later, typically occurs over the colder waters of the North Atlantic, or when the storms move over land and away from the sustaining marine environment.

The geographical areas influenced by tropical cyclones are often referred to as tropical cyclone basins. Figure 1 shows the areal extent of the Atlantic tropical cyclone basin; it includes much of the North Atlantic Ocean, the Caribbean Sea, the Gulf of Mexico, and a substantial portion of the adjacent coastal area. The Atlantic tropical cyclone basin is but one of six in the world; others in the Northern Hemisphere are the western North Pacific (typhoons), the eastern North Pacific and the northern Indian Ocean. The Southern Hemisphere basins are the southern Indian Ocean and the southwest Pacific-Australian area. Two large tropical ocean areas are virtually devoid of tropical cyclone occurrence—the South Atlantic and the eastern portion of the South Pacific. On rare occasions, tropical cyclones have been known to traverse from one tropical cyclone basin to an adjacent basin within a given hemisphere (Northern or Southern). An example would be North Atlantic Hurricane Fifi (1974) which moved westward across Central America as a weak system and then became Tropical Storm Orlene over the eastern North Pacific.

Because of the potential destructive power of tropical cyclones, associated interest has always been great. Numerous publications are available which describe tropical cyclone activity over the various basins. A comprehensive study by Crutcher and Quayle (24) contains charts and diagrams showing storm frequency and motion characteristics over the six basins. Gray (37, 38) presents an instructive and more theoretical treatment of global tropical cyclone climatology, including a discussion of the meteorological conditions associated with tropical cyclone development. Numerous studies on the climatology of individual basins have been published and can be found in most meteorological libraries.

Tropical cyclone climatologies are based upon analyses of many years of individual tropical cyclones; on average, 82 occur annually over the globe (24). Today, computers perform much of the previously tedious analyses. Figure 1, for example, would have been extremely difficult to produce without the aid of a computer plotting device. Other examples of the utility of computers in tropical cyclone climatology are given by Hope and Neumann (50, 51), and Neumann and Hill (71).

Tropical cyclones have always been of concern to shipping and, because of reports from mariners, are reasonably well documented over remote oceanic areas, even in the 19th century or earlier. Ludlum (59), for example, presents a history of Atlantic tropical

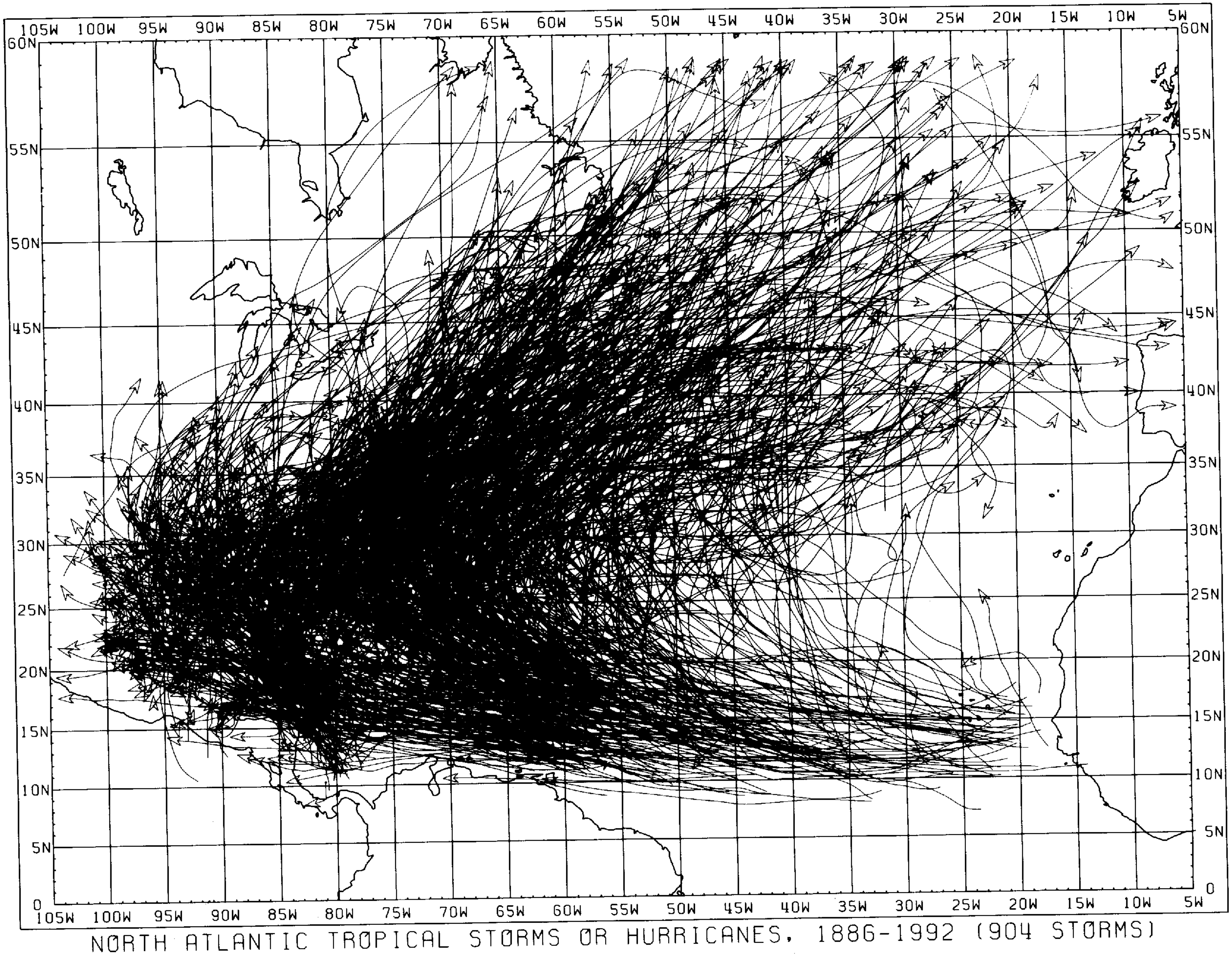

Figure 1. Computer plot showing the tracks of the 904 known tropical cyclones reaching tropical storm intensity (see section 4.1) over the 107-year period 1886 through 1992.

cyclones dating to the time of the Columbus explorations.

The collation and dissemination of global tropical cyclone data is the responsibility of the National Climatic Data Center. Data are obtained in an agreed upon format from World Meteorological Organization (WMO) designated Regional Specialized Meteorological Centres (RSMC), and other meteorological services. In the United States, the National Hurricane Center serves as a RSMC, with responsibility for both the North Atlantic and eastern North Pacific basins. The principal source of annual summary articles describing tropical cyclone activity within these two basins is the Monthly Weather Review (110, 111, 112).

For the Atlantic basin, tropical cyclone tracks have been published at irregular intervals. U.S. Weather Bureau Technical Paper Number 36 (25) provided tracks and certain statistical summaries for 1886 through 1958. Five years later, Cry, in Weather Bureau Technical Paper Number 55 (26), extended the tracks backward through 1871 and forward through 1963, and extended the statistical analysis. For a number of years, that paper was the standard reference for Atlantic tropical cyclone activity. It provided the nucleus for this and earlier revisions which extend the tracks through the 1992 season.

2. SCOPE

This study presents North Atlantic tropical cyclone tracks and some basic statistical summaries. A detailed analysis of the tracks was not attempted. This is a departure from Cry (26) who includes a considerable amount of track analysis and interpretation. The omission of some of the material kept the size of the revision from becoming excessive. Several other recent publications also deal specifically with the analysis of Atlantic tropical cyclone tracks. Those include NOAA publications prepared for the Federal Flood Insurance Program and the U.S. Army Corps of Engineers (48, 73, 74), and studies to satisfy the needs of the National Hurricane Center (47, 49, 54). The National Climatic Data Center also has been active in work on tropical cyclone activity in order to satisfy the operational needs of the U.S. Navy (21, 22, 23, 24).

Despite the availability of studies dealing with the climatology of tropical cyclones, many of the hundreds of requests for information received annually by the National Climatic Data Center and the National Hurricane Center require additional work tailored to specific user requirements. The availability of storm tracks for the complete 122-year period 1871-1992 should satisfy many of those requests.

Because this study will be used primarily as a reference volume, users will probably limit reading of textual material to sections pertinent to their particular query. For this reason, a certain amount of redundancy among sections was necessary.

3. CHARACTERISTICS OF TROPICAL CYCLONES

It is beyond the scope of this study to discuss details of tropical cyclone characteristics. Some comments are necessary, however, for proper interpretation of the material presented. The reader is referred to Miller (65) or Anthes (8) for further information. Texts by Riehl (81) and Palmen and Newton (75) devote chapters to tropical cyclones, and texts by Dunn and Miller (29) and Simpson and Riehl (92) are devoted entirely to tropical cyclones. Certain specialized topics, such as the state-of-the-art forecasting of tropical cyclones, are discussed by Simpson (91), the American Meteorological Society (6, 7), and Sheets (87). Information on the initial deepening of tropical cyclones can be found in Hebert (46).

Any closed circulation, in which the winds rotate counter-clockwise in the Northern Hemisphere or clockwise in the Southern Hemisphere, is called a cyclone. The term "tropical cyclone" refers to such a circulation which develops over tropical waters. Landsberg (55) pointed out that these storms may be a major factor in maintaining the atmospheric heat and moisture balance between the tropics and the poleward latitudes; they may be thought of as providing a kind of "safety-valve" that limits the continued buildup of heat and energy in tropical regions.

Cyclones which form outside the tropics (extratropical cyclones) have structure, energetics, and appearance (when viewed from weather satellites or radar) that are different from tropical cyclones. They derive their energy primarily from large-scale horizontal contrasts of temperature and moisture and are typically associated with cold and warm fronts. Tropical cyclones, with their energy derived from the latent heat of condensation of water vapor, are generally smaller in extent than extratropical cyclones and typically range from 100 to 600 nautical miles in diameter at maturity. Winds normally increase toward the center of a tropical cyclone with sustained speeds often exceeding 100 knots near the center. Occasionally, sustained winds exceeding 150 knots, with still higher speed gusts, may occur in well-developed systems. Apart from the wind, other destructive features of tropical cyclones include torrential rains over a large area, and coastal storm tides of 10 to 25 feet above normal in extreme cases. Indeed, with some exceptions, coastal inundation from the storm surge is primarily responsible for deaths and damages from these storms in the United States.

A unique feature of tropical cyclones is the central "eye", about which the winds rotate counter-clockwise in the Northern Hemisphere (clockwise in the Southern Hemisphere) and whose diameter averages some 10 to 30 miles across. This central region of the storm is typically associated with light winds, minimum cloud cover and minimum sea-level pressure; the latter, in more intense hurricanes, is much less than the peripheral surface pressure (8, 29). The eye provides a convenient visual and physical entity that can be tracked with the aid of aircraft, satellites or radar.

The tropical cyclone tracks presented here are technically referred to as "best-tracks." They represent the best estimate of the smoothed path of the eye as it moves across the earth's surface. Smoothing is necessary to remove the small-scale oscillatory motions of the storm center, which can deviate considerably (5 to 20 nautical miles) from a mean path. These smaller scale motions are transitory and are not representative of the more conservative motion of the entire storm envelope. Radar verification of eye oscillations was obtained as Hurricane Carla (1961) traversed the Gulf of Mexico (118). Satellite evidence of similar motions of the eye of Hurricane Belle (1976) is given by Lawrence and Mayfield (57). The storm tracks in Chart Series A and B should be considered as the average path of the larger scale storm circulation system and not necessarily the precise location of the eye at any given time.

4. CLASSIFICATIONS OF ATLANTIC TROPICAL CYCLONES

In the course of their life cycle, tropical cyclones, like other atmospheric circulation systems, pass through stages of development, intensification, maturity, and decay or modification. Satellite imagery has confirmed that some North Atlantic tropical cyclones classically develop from tropical waves which regularly move off the coast of Africa near 15°N latitude. The relationship between these waves and Atlantic tropical cyclones has been studied by a number of authors. Carlson (16), for example, presents case histories, while Shapiro (85) discusses theoretical aspects of the transformation of certain waves into tropical cyclones. Beginning with the 1967 Atlantic hurricane season, Simpson, et al. (88) initiated a formal annual "census" of African disturbances, intertropical convergence zone disturbances (2), and other features upon which Atlantic tropical cyclones are known to develop. Recent continuations of this annual census (9) include long-term averages of these data.

Weather satellites have also confirmed that some tropical cyclones may develop in connection with old polar troughs or upper-level cold low-pressure areas and have initial "cold-core" circulations as opposed to the "warm-core" circulations of tropical cyclones. In recent years, these latter systems have been designated as subtropical cyclones during the period they exhibit cold-core characteristics. The subject is discussed by Hebert (43). Finally, many tropical cyclones, after moving out of the tropical environment, may lose their tropical characteristics and become extratropical. While the primary purpose of this paper is to discuss tropical cyclones, it is necessary, for continuity, to discuss subtropical and extratropical cyclones as well.

4.1 Tropical Cyclones

Tropical cyclones are technically defined (104) as warm-core, nonfrontal, low pressure synoptic-scale[1] systems that develop over tropical or subtropical waters and have definite organized surface circulation. Further classification depends upon the wind speed near the center of the system. The terms tropical depression, tropical storm, or hurricane are assigned depending upon whether the sustained surface winds near the center of the system are, respectively, <34 knots, 34 to 63 knots inclusive, or ≥64 knots. More complete definitions are given in Table 1. Tropical cyclones are not named unless they reach at least tropical storm strength. The material presented herein concerns only the storms that met this requirement.

[1] Synoptic-scale refers to large-scale weather systems as distinguished from local systems, such as thunderstorms.

The term "sustained wind" refers here to the wind averaged over one minute. Shorter period gusts (or lulls) in the wind may be considerably higher (or lower) than the sustained wind. Dunn and Miller (29, page 65), illustrate gustiness. The wind criteria defining the various stages of tropical cyclones are rather rigidly defined, but the opportunity to measure the wind with a precision implied by the definitions seldom exists. The maximum wind speed often must be inferred from indirect evidence, and a wind speed is subjectively assigned by the responsible analyst after considering all available information. These operational constraints should be considered before making decisions based on intensity criteria given in Chart Series A and elsewhere.

4.2 Extratropical Cyclones

During the final stages of their life cycle, tropical cyclones are often classified as extratropical. The extratropical stages of the cyclone tracks shown in this study indicate that modification of the tropical circulation was started by movement of the cyclone into a nontropical environment. In this situation, the size of the circulation usually expands, the speed of the maximum wind decreases, and the distribution of winds, rainfall, and temperatures around the center of the cyclone become increasingly asymmetric. While these characteristic features develop, some tropical features, such as a small area of strong, often hurricane-force, winds near the center, the remnants of an eye, and extremely heavy rainfall, may be retained for a considerable time. The 1938 New England storm (storm number 4), described in physical terms by Pierce (78) and in narrative form by Allen (5), is a good example of a storm which was technically classified as extratropical, but which still maintained hurricane-like characteristics.

There are no wind speed criteria associated with the term extratropical. Usually, wind speeds near the center of a storm gradually subside. In some cases, however, reintensification of the system may occur when mechanisms conducive to extratropical development offset the loss of the tropical energy source. If over land, these mechanisms may offset the dissipative effects of the increase in surface friction (64).

4.3 Subtropical Cyclones

Until the late 1960's, the terms tropical and extratropical, as described in sections 4.1 and 4.2, were used to categorize the life cycle of hurricanes. Although it was often suspected that a given storm was "hybrid" in that it exhibited both tropical and extratropical characteristics, the lack of sufficient observational evidence or official sanction precluded the use of other terminology. The problem occasionally led to some storms being unnamed. Spiegler (94) and Ferguson (33) give further background information related to this problem.

By 1968, the availability of continuous daylight satellite imagery and other observational evidence confirmed the existence of an intermediate class of storms with both tropical (warm-core) and extratropical (cold-core) characteristics. The Monthly Weather Review's annual summary articles (111), which describe the 1970 and 1971 hurricane seasons, call attention to this type of storm and the lack of suitable descriptive terminology. Additional studies by Simpson (90) and Spiegler (94) focus attention on the nomenclature problem.

Beginning in 1972, the term subtropical was adopted as official terminology, and the annual summary article appearing in the Monthly Weather Review for that year includes the tracks of the subtropical stages, if any, of tropical systems. Satellite imagery and other observational evidence enabled Hebert and Poteat (45) to re-examine the official Atlantic tracks for the 1968, 1969, 1970, and 1971 seasons and to identify subtropical portions of the cyclones for those years. The re-evaluation included the addition of the storms suggested by Spiegler (93).

Table 1. Classification criteria for Tropical, Subtropical and Extratropical Cyclones, 1899-1992. Wind speeds are given in nautical miles per hour (kt), statute miles per hour (mph) and meters per second (m/s).

Stage of development	Years used	Criteria
Tropical depression (development)	1951-1992	The formative stages of a tropical cyclone in which the maximum sustained (1-min mean) surface wind is < 34 kt (< 39 mph, < 18 m/s).
Tropical storm	1899-1992	A warm core tropical cyclone in which the maximum sustained surface wind (1-min mean) ranges from 34 to < 64 kt (39 to < 74 mph, 18 to < 33 m/s).
Hurricane	1899-1992	A warm core tropical cyclone in which the maximum sustained surface wind (1-min mean) is at least 64 kts (74 mph, 33 m/s).
Tropical depression (dissipation)	1899-1992	The decaying stages of a tropical cyclone in which the maximum sustained surface wind (1-min mean) has dropped to below 34 kt (39 mph, 18 m/s).
Extratropical cyclone	1899-1992	Tropical cyclones modified by interaction with nontropical environment. There is no wind speed criteria and maximum winds may exceed hurricane force.
Subtropical depression	1968-1992	A subtropical cyclone in which the maximum sustained surface wind (1-min mean) is below 34 kt (39 mph, 18 m/s).
Subtropical storm	1968-1992	A subtropical cyclone in which the maximum sustained surface wind (1-min mean) is at least 34 kt (39 mph, 18 m/s).

A subtropical cyclone is defined (104) as a low pressure system that develops over tropical waters that initially has a non-tropical circulation but in which some elements of tropical cyclone cloud structure are present. Many of these eventually develop into purely tropical (warm-core) systems, but others remain as subtropical. On rare occasions, such as storm 8 of 1973, subtropical systems have evolved from tropical systems.

Depending upon wind speed, two classes of subtropical cyclones are recognized -- subtropical depressions and subtropical storms. The former have maximum sustained winds of <34 knots, and the latter, ≥34 knots. More complete definitions are given in Table 1. There is no upper wind speed limit associated with subtropical storms as there is with tropical storms. However, experience has shown that when and if surface winds in subtropical storms do reach or exceed 64 knots, the system typically takes on sufficient tropical characteristics to be formally designated as a hurricane (see, for example, storm 3, 1972). In rare cases, such systems do associate themselves with hurricane force winds without attaining sufficient tropical characteristics. In this case, the term subtropical storm is retained. An example of such an occurrence is storm 6, 1968, which had hurricane force winds on September 20 and 21. Since this storm would probably, in earlier years, have been designated as a hurricane, it is tabulated as such in summary tables and figures.

4.4 Summary of Classification Criteria

A summary of the various storm classification criteria and the years over which each is applicable are given in Table 1. The criteria are valid only for the years beginning with 1899. For 1886 through 1898, available data are too fragmented, and the tracks are presented as being entirely tropical storms or hurricanes, depending upon the maximum intensity apparently attained by the storm at some point along its track. Storm number 7, 1898, for example, was known to be a hurricane (18) when it moved into Georgia on October 2. However, the hurricane designation does not necessarily apply elsewhere along the track. For still earlier years, 1871 though 1885, the data are even more uncertain, and it was impossible to indicate other than a tropical cyclone of unknown intensity.

The lack of specific intensity documentation before 1899 should not be interpreted as a complete lack of information on these early storms. Indeed, portions of many of these tracks were well documented if they were associated with disasters in populated areas or with shipping. For example, the hurricane of August 1873, which destroyed 1,223 vessels, and the hurricane of August 1893, (storm number 6), which inundated the islands off the coasts of Georgia and South Carolina, resulting in large losses of life and property, are described by Garriott (35) and others. Persons seeking specific information on these, and on storms occurring in later years, should consult the references given in section 10.

5. DATA SOURCES

For the period 1871 through 1963, the primary reference for the storm tracks and associated intensity criteria was U.S. Weather Bureau Technical Paper Number 55 (26). Although the main purpose of previous revisions was to update the track charts, a few of the original tracks were modified based on additional information available to the National Hurricane Center. Specific details on these modifications are given later in this section. Considering the widespread use of the above cited paper over the many years since its publication, the requirement for only a few changes attests to the care that went into its preparation. The present revision extends the track charts through 1992, and includes only one other minor revision to the track charts. This change extends the hurricane force winds for the second tropical cyclone of 1932 somewhat inland, following landfall near Galveston, Texas.

5.1 Data Sources 1871-1963

This section, with references updated, is quoted directly from Cry's original work, Technical Paper number 55 (26).

"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 (80). Millas (63) has recently attempted to document many of the early storms. Ludlum (59) 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 Number 36 (25) provided the nucleus. The primary continuing reference, the Monthly Weather Review (110, 111, 112), first appeared in June 1872 and has been published without interruption to the present, although changes in format, emphasis, and content have been numerous. Monthly reports on 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 throughout the years. Summaries of each tropical cyclone season from 1950-1980 are found in Climatological Data National Summary (108). More recently, tropical cyclone summaries have appeared in Storm Data (105); details of hurricanes affecting the United States are given there and in the appropriate monthly issues of Climatological Data for individual States (109).

"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 (58), 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 the century. In preparing this paper, we have relied heavily on the works of Garriott (35), which contain tracks for the years 1878-1900; Fassig (32), 1876-1911; Mitchell (66, 67), 1887-1932; Cline (19), 1900-1924 and Tannehill (98), 1901-1955. Additional unpublished chronologies of tropical cyclone tracks have been available, including the charts and notes of Tingley (100) for 1871-1930; charts probably prepared by Mitchell (68) 1898-1920; and track charts centered on the Gulf of Mexico prepared at the U.S. Weather Bureau Office, New Orleans, Louisiana (114), 1875-1956.

"In addition to these primary sources containing relatively long series of tracks, the following less extensive sources have also been used: Alexander (4); Bonnelly (10); Bowie (12); Contreras Arias (20); Deutsche Seewarte (27); Elwar (31); Fischer (34); Gray (36); Hall (42); Newnham (72); Salivia (83); Sarasola (84); Tannehill (97); and Vines (119). The comprehensive book by Dunn and Miller (29) contains complete discussions of various aspects of tropical cyclones, including a continuation of Tannehill's chronology."

5.2 Additional Data Sources 1871-1963

In connection with its research and operational commitments, the National Hurricane Center (NHC) maintains and continuously updates detailed computer files of Atlantic tropical cyclone tracks back to 1886. An analog forecast technique HURRAN (49) (HURRicane ANalogs), for example, is based on those data. Initially, the computer files were developed from data presented in Technical Paper Number 36 (25). However, they have been gradually updated over the years and currently contain storm positions, sustained wind speeds, and surface pressures (when available) beginning in 1886. Some of the more significant changes which have been made to the Cry (26) tracks are:

1) The track of storm 2, 1929, was adjusted to pass over Andros Island in accordance with the findings of Sugg, et al. (96).

2) The 7 p.m. EST, November 4 position of storm number 6, 1935, was moved southwestward along the original track to agree with surface observations on file at the National Weather Service Forecast Office, Miami.

3) An additional storm was added for the year 1945 (storm number 11) in accordance with a study by Fernandez-Partagas (77).

4) The hurricane stages of storm number 2, 1904, storm number 4, 1928, and storm number 11, 1944 were extended farther northward to agree with a study by Hebert and Taylor (44).

5) The status of storm number 3, 1903, was downgraded to tropical storm before the storm entered the Gulf of Mexico, to agree with studies by the National Weather Services Hydrometeorological Branch and as implied in the Monthly Weather Review for September 1903.

6) The track of storm number 1, 1876, was made to pass through Washington, DC to agree with material appearing in the Monthly Weather Review September 1876.

7) To be consistent with current operational practice, the hurricane stage of storm number 4, 1938, was extended northward.

8) In accordance with published and unpublished data on file at the NHC, the tracks and intensities of storms number 2 and 19 of 1933, and storm number 3, 1951, were modified.

9) The track of storm number 4, 1877, was moved southward in accordance with data supplied by the Netherlands Antilles Meteorological Service.

10) In accordance with information contained in the Monthly Weather Review (110) and Historical Weather Maps (117), the track of storm 3, 1899, was moved south of Puerto Rico into the Caribbean Sea.

11) In accordance with documentation cited by Tannehill (98), the track of storm number 4, 1928 (the famous "San Felipe" storm) was made to pass over the island of Guadeloupe.

12) Other, minor changes were made to the Cry (26) tracks for the years 1932, 1933, 1960, 1961 and 1966 in accordance with information on file at the National Hurricane Center (69). Also, minor changes were made to charts for the years 1971 and 1975.

Minor differences still exist between the NHC computer file and Cry's (26) tracks. For example, detailed records on file at the NHC indicate that the exact 7 a.m. September 18 position of storm number 6, 1926, was 25.6°N, 80.3°W, rather than 25.8°N, 80.1°W. However, such a small change is hardly discernible on the scale of the maps reported in Chart Series A. For such minor discrepancies, when the shift in track was less than 24 nautical miles, the original maps were used as they appeared in Cry's paper.

Additional data sources for the period through 1963 include: U.S. Navy Annual Tropical Cyclone Reports (106, 107); Bowden (11); Carney and Hardy (17); Carter (18); Cambriaso (15); Purvis (79); U.S. Army Air Force (101); U.S. Army Corps of Engineers (102, 103); and various notes on hurricanes in Jamaica, W.I. (62).

5.3 Data Sources 1964-1992

The principal source in the preparation of the charts for the additional 29 years, 1964 through 1992, were the annual summary reports of Atlantic tropical cyclone activity prepared by staff members of the NHC. The primary medium for the dissemination of these annual reports is the Monthly Weather Review (110, 111, 112). In addition, summary articles are tailored to specific user groups and appear annually in the Mariners Weather Log (56) and in the popular weather magazine Weatherwise (60). Annual summary articles, dealing with the genesis of Atlantic tropical cyclones, also appear in the Monthly Weather Review (9, 88). Finally, annual summaries, describing other aspects of each hurricane season, such as tabulated storm positions (best-track), reconnaissance and satellite storm positions, and forecast verifications are prepared (52, 61) by staff members at the National Hurricane Center.

The annual tropical cyclone track charts that appear in individual issues of the Monthly Weather Review for the period 1964 through 1992 were re-drafted in the same general format used in Technical Paper 55 (26). The maps, beginning with the 1968 season, include the subtropical stages of the storm tracks as determined by Hebert and Poteat (45). The 1970 map also includes the unnamed storms discussed by Speigler (93).

Determination of the storm tracks for the years following 1963 was obviously less burdensome than for the earlier years; the only complicating factor was the need to deal with the concept of subtropical cyclones. The decision to include the latter storms was based on climatological considerations. In earlier years, subtropical systems were not formally recognized and, in most cases, they were designated as tropical systems. Consequently, failure to include these systems could alter the tropical cyclone climatology for the years following the introduction of the subtropical concept.

6. ACCURACY OF TRACKS AND INTENSITY CLASSIFICATIONS

Although tropical cyclones may traverse thousands of miles, they spend most of their lives over, and indirectly derive their energy from, oceanic areas. Before the era of aircraft reconnaissance and weather satellites, the detection of such storms was dependent upon chance encounters with shipping or populated areas. Over the Atlantic basin, the intersection of mean tropical cyclone tracks with shipping lanes and populated island areas makes it unlikely that major storms would have gone completely undetected, even well back in the 19th century. However, even with the knowledge of a storm's presence, it is difficult, without additional observational tools, to specify the exact location of a storm center and its intensity. There is a chance, too, that weaker, short duration storms could have gone completely undetected.

After the introduction of continuous weather satellite surveillance (see Figure 2), as augmented by aircraft reconnaissance when storms are near critical areas, there is a high probability that the location of the storm center and the maximum winds can be determined to a reasonable degree of accuracy. The role of satellite and aircraft data in tropical cyclone prediction is discussed by Gray et al. (40) and by Sheets (87). Since all of the storm tracks and intensity classifications for the 1964 through 1992 Atlantic hurricane seasons were prepared with the benefit of satellite imagery (as well as aircraft reconnaissance and other data), the track accuracy should be near optimum, considering the scale of the maps and the scale of motion depicted.

Agencies responsible for determining earlier storm tracks and intensities did not have the benefit of satellite data and, before 1944, of aircraft reconnaissance. Consequently, the over-water portions of these earlier tracks are subject to considerable uncertainties. There were, however, some historical observational milestones in track accuracy. The subject is treated in some detail by Cry (26), and much of the following material is quoted directly or indirectly.

For many years following the establishment of the U.S. Government Weather Service in 1870, data for a precise determination of the location and intensity of tropical cyclones were scarce, widely scattered, of generally poor quality, and sometimes conflicting. Reports from United States land stations were relayed to central forecast 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 purposes, they were used extensively for the construction of tracks of all major storms occurring over the oceans. These tracks appeared in the International Meteorology Section of the Monthly Weather Review for several years. The files of marine observations also served as a basic source for the work of Garriott (35); Fassig (32); Mitchell (66, 67, 68) and others.

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 the ships during the corresponding period exceeded 64,000. Since the early 1960s, the number has increased less rapidly, because of changes in the characteristics of the shipping industry.

Technological advances since World War II have resulted in more precise tropical cyclone detection, positioning, and intensity determination. Many of these advances, together with earlier noteworthy events, are depicted in Figure 2. Improved radiosonde and rawinsonde equipment for measuring weather conditions above the earth's surface have 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 (87), and U.S. Air Force and Navy[2] aircraft have made routine reconnaissance of tropical cyclones since 1944. Before the operational availability of satellite data around the mid-1960s, these flights proved to be especially important in the early detection of storms.

Currently, tropical cyclones are usually detected by satellite, although supplemental aircraft data are needed for more precise environmental data in and around the storm area (40). In addition to military aircraft reconnaissance, the National Oceanic and Atmospheric Administration (NOAA) operates several aircraft with sophisticated instrumentation for the collection of detailed data which is used primarily for

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[2] Navy hurricane reconnaissance was discontinued after the 1974 season.

research but is also useful for operational tropical cyclone tracking.

A significant milestone occurred during the 1977 hurricane season when a complex communications system known as the Aircraft Satellite Data Link (ASDL) system enabled aircraft measurements taken inside a storm at 60-second intervals to be received and plotted by a National Hurricane Center computer within a few seconds. It is significant to contrast this with an earlier statement concerning the receipt of ship observations months late. Thus, the temporal gap between the taking of a weather observation and receipt of the message by the ultimate user appears to be closed.

The World War II development of storm-tracking radar and subsequent improvements in range and accuracy further increased observational capabilities. An extensive network of powerful coastal radars is now in operation. Radar is particularly useful in detecting sudden changes in the direction of tropical cyclone motion when these storms are within 250 miles of the radar site. This permits "last minute" adjustments in community preparedness efforts as these storms move ashore.

An important product of the NASA space program is the development of weather satellites, now the standard observational tool for the detection and monitoring of tropical cyclones on a worldwide scale. A classic example of a satellite view of a hurricane is given by the cover illustration. By reviewing thousands of such pictures, Dvorak (30) and Hebert and Poteat (45) were able to specify systematic procedures to estimate the location of the center and the intensity of the storm. Satellites also provide the means of obtaining direct or indirect measurements of other environmental quantities, such as wind, temperature, moisture, and rainfall around the storm (1, 13, 41, 53). Although the first pictures of a tropical cyclone were transmitted by the polar orbiting TIROS-I satellite in 1960, it was not until 1966 that the first completely operational weather satellite, ESSA-I, was placed in orbit. The ESSA series were also polar orbiting satellites and provided views of tropical cyclones once per day. By the late 1960s, geostationary satellites allowed continuous daytime surveillance and, in 1974, the nighttime viewing gap was closed with the launch of the first Geostationary Operational Environmental Satellite (GOES). Systems for viewing, processing, and analyzing satellite data have also improved. Two such systems, known by the acronymns McIDAS and VDUC (see Figure 2), are discussed by Sheets (87).

In recent years, marine meteorological data buoys have been developed and deployed. These floating data platforms, anchored at strategic locations, transmit observations of wind, pressure, waves, ocean and air temperatures in and around tropical cyclones and other weather systems.

The quality of the charts and figures presented in this report reflects the variation in amount and quality of observational data. In early years, the observations simply did not exist, and the tracks were extrapolated from fragmentary information. Other than a gradual increase in quality of the observational material over the years, there is no way to determine the reliability of a particular storm track. However, those tracks that crossed populated areas can be expected to be reasonably accurate, even back into the previous century. Thom (99) and Cry (26) cite statistical evidence that, compared with the storms that remained at sea, most tropical cyclones that crossed the United States coastline were probably detected.

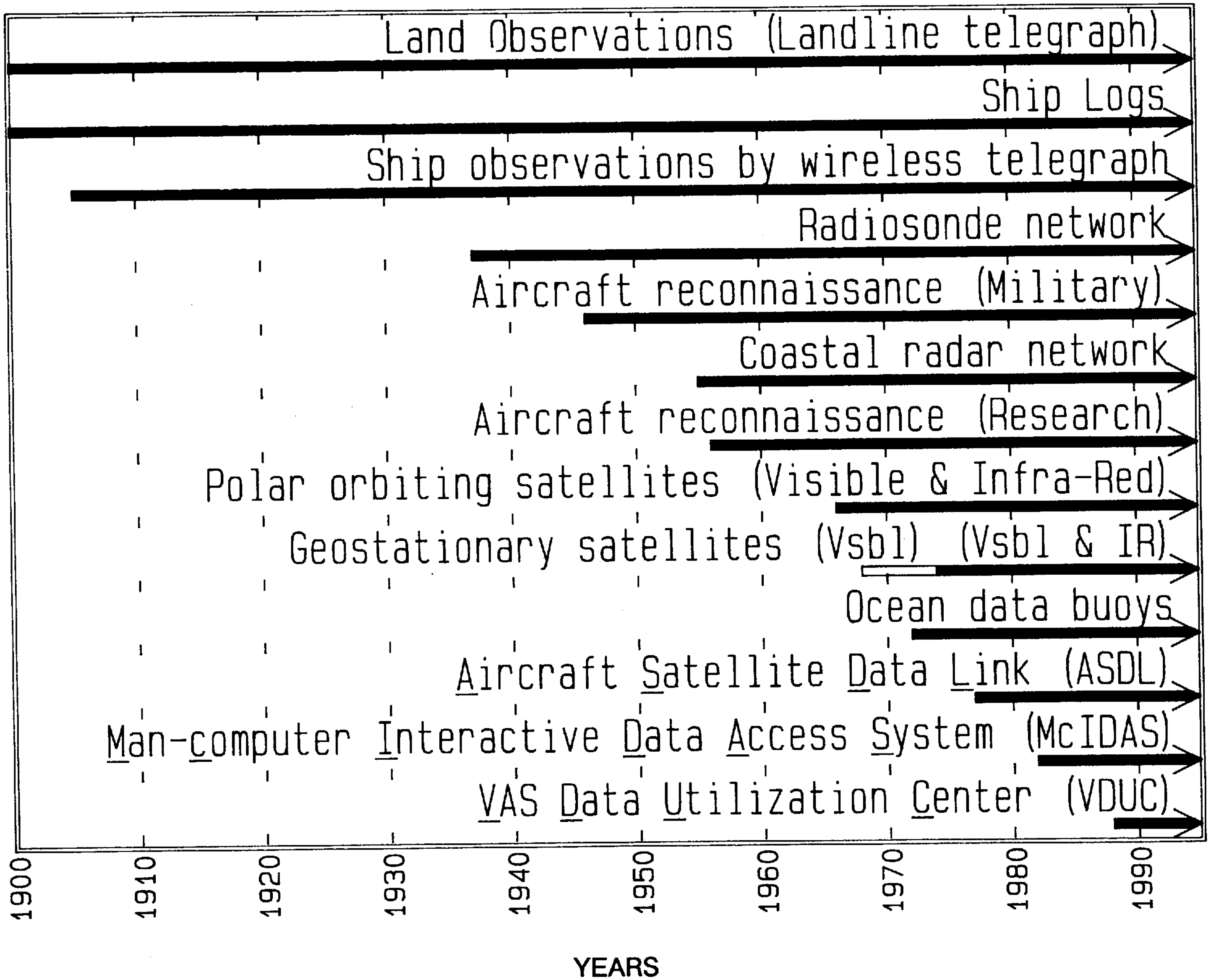


Figure 2. Technical advances in systems for observing tropical cyclones, 1900 through 1992.

The 122 years from 1871 through 1992 cover 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, radar, satellites, and data buoys, using complex and sophisticated instrumentation and communication, is available for the detection, tracking, and understanding of tropical cyclones.

7. NORTH ATLANTIC TROPICAL CYCLONE TRACKS

7.1 Chart Series A

The tracks of all recorded Atlantic tropical cyclones for each year from 1871 through 1992 are presented in Chart Series A (appendix A). For the period before 1964, several steps were used by Cry (26) to obtain the final tracks. First, all cyclones considered to be of tropical origin in any given year were listed together with all relevant intensity data. Second, all versions of each storm track were plotted on charts. Comparisons of these differing interpretations and evaluation of information from all sources, including daily synoptic charts (101, 113, 115, 116, 117), were made, and the track configuration for each storm most consistent with all the data was selected. These positions and intensities were plotted on the annual charts of Series A.

The objective was to depict accurately and completely the position and intensity of each significant tropical cyclone in the North Atlantic basin throughout its existence. Unfortunately, the quality of the data prevented full attainment of this goal; many positions and intensities, particularly for the earlier years, are estimates, representing compromise to significant differences in the references.

Delineation of intensity stages was found to be unrewarding before the period when daily synoptic charts for the entire area were available; consequently, no indications of intensity have been made for 1871 through 1885. A simple classification of "tropical storm" or "hurricane" was made for the years 1886 through 1898, and tracks showing intensity were prepared from 1899 onward. The tropical depression (development) stage was included starting in 1951. Finally, an additional breed of storms, subtropical, was added starting in 1968. Intensity and classification criteria are given in Table 1.

Before 1950, there was no formal nomenclature for the identification of cyclones. Noteworthy storms were informally designated by such descriptive terms as "Yankee hurricane," "New England hurricane," "Labor Day storm," "Galveston storm," etc. Official naming of Atlantic tropical cyclones began in 1950. Initially, the 1950 vintage phonetic alphabet (ABLE, BAKER, CHARLIE, etc.) was used. However, for the 1953 season, the practice of using women's names, first used in the western Pacific during World War II, was introduced. This convention continued until 1979 when both men's and women's names were used alternately. In Chart

Series A, certain storms lack names, even after the formal naming of tropical cyclones began. Some of these remained subtropical. Others, originally thought to be nontropical, were added after post-analysis indicated that they did have tropical characteristics.

Table 2. Number of recorded Atlantic tropical cyclones (excluding depressions and, after 1967, including subtropical cyclones) which reached at least tropical storm intensity in specified month, 1871-1992. (Refer to table 4 for summaries of these data.)

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
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
1881								4	1	1			6
1882									2	1			3
1883								2	1	1			4
1884									2	1			3
1885								3	4	1			8
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
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
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
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
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
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
1916						1	2	3	4	3	1		14
1917								2	1				3
1918								3	2				5
1919							1		1		1		3
1920									4				4
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
1926							2	1	5	2	1		11
1927								1	3	3			7
1928								2	3	1			6
1929						1			1	1			3
1930								2					2
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

7.2 Chart Series B

Another series of charts (Series B) provides groupings of storms according to selected intraseasonal periods. A similar series presented by Cry (26) has always been useful for both operational and research purposes. The charts of Series A were manually prepared. However, Chart Series B was computer-drawn

Table 2. Number of recorded Atlantic tropical cyclones (excluding depressions and, after 1967, including subtropical cyclones) which reached at least tropical storm intensity in specified month, 1871-1992. (Refer to table 4 for summaries of these data.) - Continued

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1935								3	1	2			6
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
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	2			11
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
1951					1			3	3	3			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
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
1961							1		6	2	2		11
1962								2	1	2			5
1963								2	5	2			9
1964						1	1	3	5	1	1		12
1965						1		2	2	1			6
1966						1	4	1	4		1		11
1967								1	4	3			8
1968						3		1	3	1			8
1969							1	5	6	5	1		18
1970					1		1	3	3	2			10
1971							1	4	6	1	1		13
1972					1	1		2	2		1		7
1973							2	2	2	2			8
1974						1	1	4	4	1			11
1975						1	1	2	3	1		1	9
1976					1		1	5	2	1			10
1977								1	3	2			6
1978	1						1	4	3	3			12
1979						1	2	3	2	1			9
1980								3	5	1	2		11
1981					1	1		2	5	1	2		12
1982						2		1	2	1			6
1983								2	2				4
1984								4	6	1	1	1	13
1985							2	3	3	2	1		11
1986						2		1	2		1		6
1987								3	3	1			7
1988								3	7	1	1		12
1989						1	2	4	2	1	1		11
1990							2	6	2	4			14
1991							1	1	3	3			8
1992				1				1	4	1			7
1993													
1994													
1995													
1996													
1997													

YEAR JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC TOTAL

Table 3. Number of storms listed in Table 2 which eventually became hurricanes. (Refer to Table 4 for summaries of these data.)

Note: For many of the storms occurring before the year 1886, there is insufficient information for determining if and when hurricane intensity was reached; see Table 2 and Section 4.4.

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													
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
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
1896							1	1	2	2			6
1897								1	1				2
1898								2	2				4
1899							1	2	1	1			5
1900								1	2				3
1901							1	2					3
1902						1			1	1			3
1903							1	1	3	2	1		8
1904									1	1			2
1905										1			1
1906						1		1	2	2			6
1907													0
1908			1				1		2	1			5
1909							1	1	1	1			4
1910									2	1			3
1911								2	1				3
1912									1	2	1		4
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1913						1		1	1				3
1914													0
1915								3	1				4
1916						1	2	3	2	2	1		11
1917								1	1				2
1918								2	1				3
1919									1				1
1920									4				4
1921						1			2	1			4
1922									1	1			2
1923								1	1	1			3
1924								2	1	1	1		5
1925											1		1
1926							2	1	4	1			8
1927								1	3				4
1928								2	1	1			4
1929						1			1	1			3
1930								2					2
1931									2				2
1932								3	1	1	1		6
1933						1	1	3	3	2			10
1934						1	1	1	1	1	1		6
1935								2	1	2			5
1936						1	1	3	2				7
1937									3				3
1938								2	1				3
1939								1		2			3
1940								3	1				4
1941									3	1			4
1942								3			1		4
1943							1	1	2	1			5
1944							2	1	3	1			7
1945						1		1	1	2			5
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
1951					1			2	2	3			8
1952								2	2	2			6
1953								2	3	1			6
1954						1		2	3	1		1	8
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

Table 3. Number of storms listed in Table 2 which eventually became hurricanes. (Refer to Table 4 for summaries of these data.) - Continued

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1955								3	5	1			9
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
1961							1		5	1	1		8
1962								1		2			3
1963								2	4	1			7
1964								1	4	1			6
1965								2	1	1			4
1966						1	3	1	1		1		7
1967								1	3	2			6
1968						2		1	1	1			5
1969								4	4	3	1		12
1970					1			1	1	2			5
1971								2	4				6
1972						1		1	1				3
1973							1	1	1	1			4
1974								2	2				4
1975							1	2	3				6
1976								4	1	1			6
1977								1	3	1			5
1978								2	2	1			5
1979							1	2	2				5
1980								3	3	1	2		9
1981								1	5		1		7
1982						1			1				2
1983								2	1				3
1984									2	1	1	1	5
1985							1	3	1	1	1		7
1986						1		1	1		1		4
1987								1	1	1			3
1988									4	1			5
1989							1	4	1	1			7
1990							1	2	2	3			8
1991								1	1	2			4
1992								1	2	1			4
1993													
1994													
1995													
1996													
1997													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

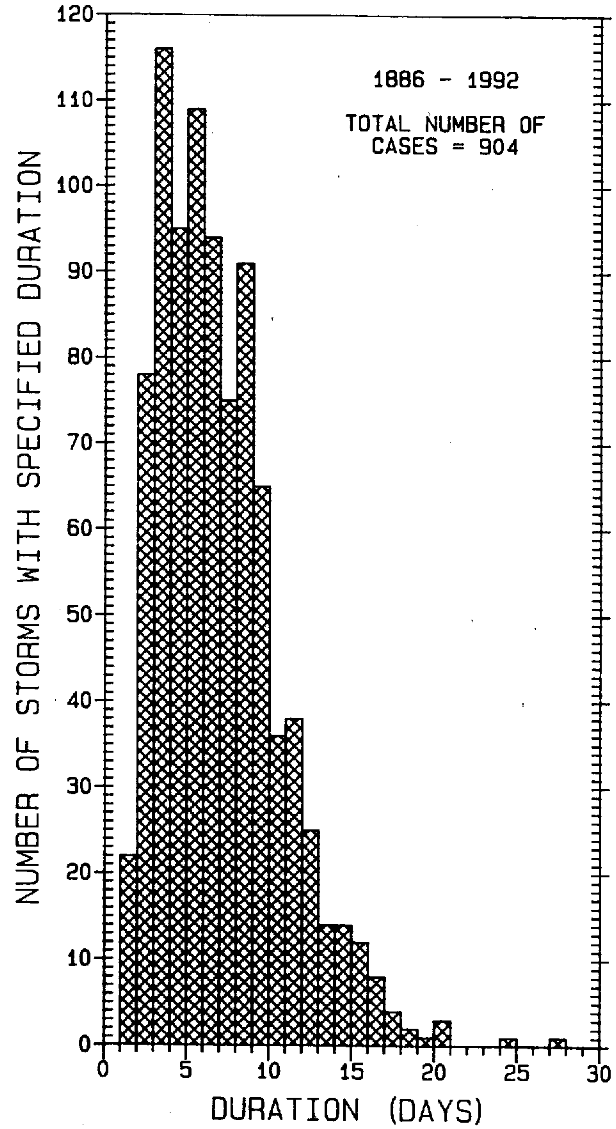


Figure 3. Distribution of observed duration (number of days, including depression stage and excluding extratropical stage) of Atlantic tropical cyclones, 1886-1992. Average and standard deviation are 7.5 and 3.7 days respectively.

with NOAA computer-graphics facilities. Computer methods also allow the use of any map projection. For a number of reasons, most relating to convenience, a Mercator projection, true at 22.5°N latitude, was used in Chart Series B. In a manner similar to that employed by Cry, the storm tracks are presented without regard to identification other than that they reached tropical storm strength sometime during the specified time period. Additional labeling would clutter the charts and detract from their main purpose, which is the identification of spatial and temporal shifts in tropical cyclone occurrence.

The first chart of Series B was introduced on page 2 as Figure 1. This rendition of the entire 904 storm sample serves to illustrate the bounds of the North Atlantic tropical cyclone basin. The relative frequency of storms in any given area also can be roughly identified by the track density. Other charts in Series B are presented for May through December and for 10- (or 11-) day periods, June 1 through November 30.

The tracks were drawn by means of a computer interpolation routine suggested by Akima (3). Storm positions, at 6-hourly intervals, are specified on a computer file. With these positions as anchor points, a reasonably faithful rendition of the hand-drawn tracks depicted on Chart Series A can be expected. In a few cases, however, the 6-hourly positions are insufficient to define tight loops and sudden changes in direction.

The charts in Series B were prepared with the same convention used in the preparation of Tables 2, 3, and 4. That is, storms were assigned to the month in which they initially reached tropical storm status (see Table 1). Also specified in the legend of each chart is the total number of storms included in the period.

8. FREQUENCY OF NORTH ATLANTIC TROPICAL CYCLONES

8.1 Monthly and Annual Frequencies

Tables 2 and 3 present monthly and annual frequencies of recorded Atlantic basin tropical cyclones and hurricanes for each year 1871 through 1992. Since the hurricane stage was not identified before 1886, no hurricane entries appear in Table 3 for 1871-1885. The frequencies for some months and years differ slightly from those given in a similar table by Cry (26). The differences result from minor revisions to some of the tracks (section 6). Computer specification of storm positions at 6-hourly intervals, rather than at 12-hourly intervals as used by Cry, also may have shifted one or two storms to earlier or later months. Grouping in this table is based on the initial date of tropical storm intensity or the detection of the storm; the tropical depression stage was not included. For example, a storm reaching tropical storm strength on August 31, reaching hurricane strength on September 5, and finally dissipating on September 20, would be assigned as a hurricane beginning in August. No entries would be made for September.

Based on all Atlantic tropical cyclone tracks from 1886 through 1992, the duration of a tropical cyclone, including the depression stage (if recorded), averages about 7 to 8 days, but as shown in Figure 3, may vary from less than 2 to as many as 30 days. The smoothed modal (most frequently occurring) duration is 4-6 days. The ability to detect tropical cyclones earlier has improved in recent years such that the distribution shown in Figure 3 is somewhat biased toward lower values. Very brief storms typically form in the Gulf of Mexico and dissipate over adjacent land areas before reaching maturity. Storm number 3, 1946, is a good example. Hurricanes of extreme duration include Ginger, September 5 to October 3, 1971 and Inga, September 20 to October 14, 1969. Both storms meandered slowly around the western and central Atlantic for much of their existence. Other long-duration storms include those which form in the eastern Atlantic, travel westward, recurve just before reaching the United States and then move northeastward across the open Atlantic.

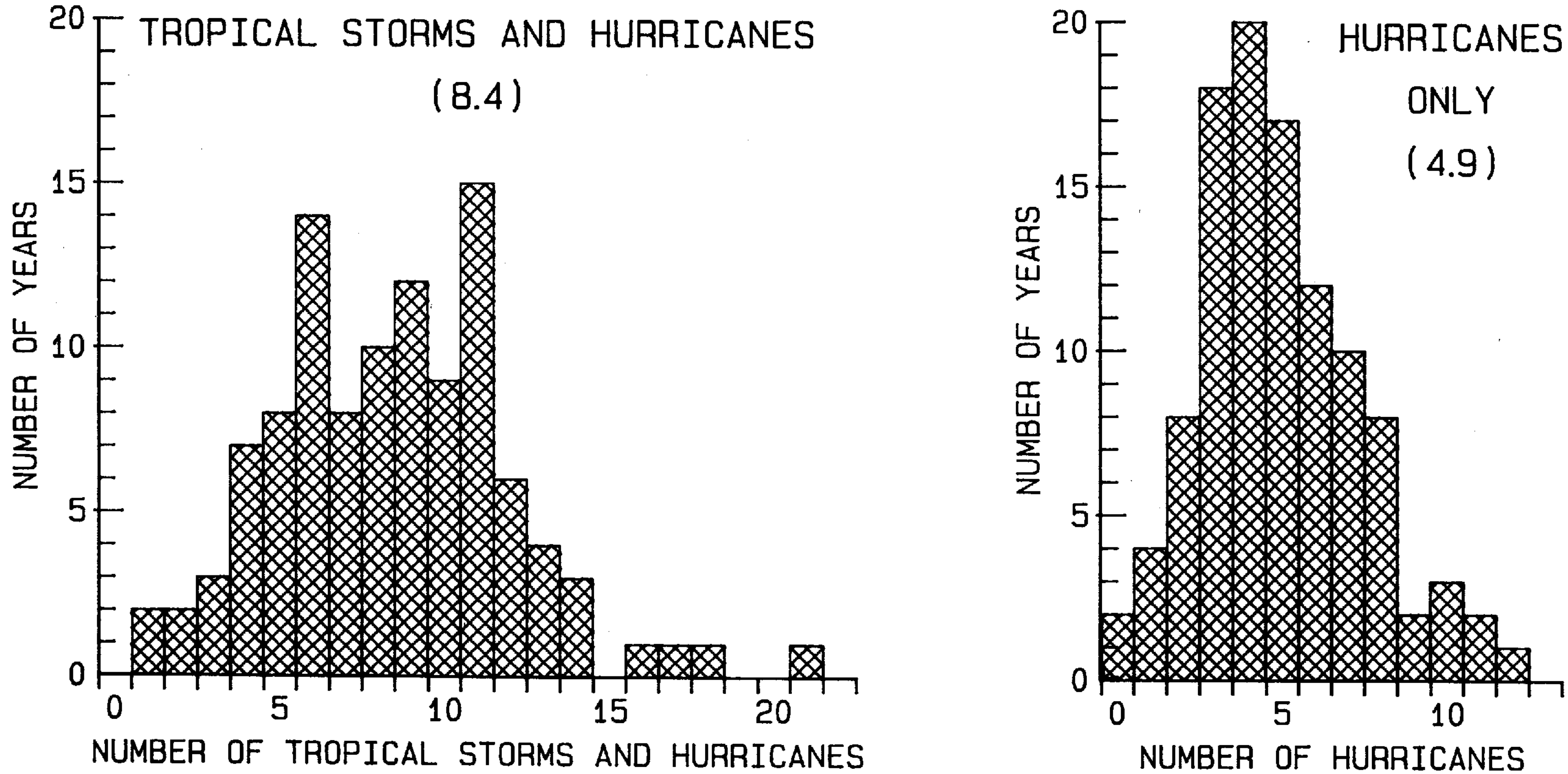


Figure 4. Distribution of annual number of tropical cyclones reaching at least tropical storm strength (left) and hurricane strength (right), 1886 through 1992. The average number of such storms is 8.4 and 4.9, respectively (see Table 4).

The number of storms occurring in any given year varies widely. Insofar as storms reaching at least tropical storm strength are concerned, there were two years, 1890 and 1914, that observed but one storm while 21 tropical storms or hurricanes occurred in 1933. There were no storms that reached hurricane strength in both 1907 and 1914 while 12 hurricanes occurred in 1969. Frequency distributions are given in Figures 4 and 5.

One may question the adequacy of these data. After the middle 1940's, when aircraft reconnaissance began, it is unlikely that even weak, short-duration storms have been undetected. This was not always the case: some small, weak tropical storms may have gone undocumented in the earlier years, and storms that were detected could have been mis-classified as to intensity.

In addition to observational problems, there is a strong possibility that other natural trends exist in the frequency of tropical cyclones. The possible effect of large-scale anomalies in sea-surface temperature for example, is discussed by Wendland (120) while Gray (39) and Shapiro (86) discuss the effect of large-scale atmospheric events on tropical cyclone frequency.

Upward or downward trends in the frequency of tropical cyclones, if not accounted for, make the

Table 4. Total and average number of tropical cyclones (excluding depressions and including subtropical systems) beginning in each month.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1886 – 1992													
TROPICAL STORMS AND HURRICANES	1	1	1	1	14	56	68	217	308	189	42	6	904
AVERAGE OVER PERIOD	*	*	*	*	0.1	0.5	0.6	2.0	2.9	1.8	0.4	0.1	8.4
HURRICANES ONLY	0	0	1	0	3	23	35	151	193	97	21	3	527
AVERAGE OVER PERIOD	0.0	0.0	*	0.0	*	0.2	0.3	1.4	1.8	0.9	0.2	*	4.9
1910 – 1930													
TROPICAL STORMS AND HURRICANES	0	0	0	0	0	7	7	24	39	26	6	0	109
AVERAGE OVER PERIOD	0.0	0.0	0.0	0.0	0.0	0.3	0.3	1.1	1.9	1.2	0.3	0.0	5.2
HURRICANES ONLY	0	0	0	0	0	4	4	21	29	12	4	0	74
AVERAGE OVER PERIOD	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.0	1.4	0.6	0.2	0.0	3.5
1944 – 1992													
TROPICAL STORMS AND HURRICANES	1	1	0	1	8	26	38	122	171	82	21	4	475
AVERAGE OVER PERIOD	*	*	0.0	*	0.2	0.5	0.8	2.5	3.5	1.7	0.4	0.1	9.7
HURRICANES ONLY	0	0	0	0	2	10	17	78	109	52	11	2	281
AVERAGE OVER PERIOD	0.0	0.0	0.0	0.0	*	0.2	0.3	1.6	2.2	1.1	0.2	*	5.7
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL

Note: Data are summarized from Tables 2 and 3. Asterisk(*) indicates less than 0.05 storms.

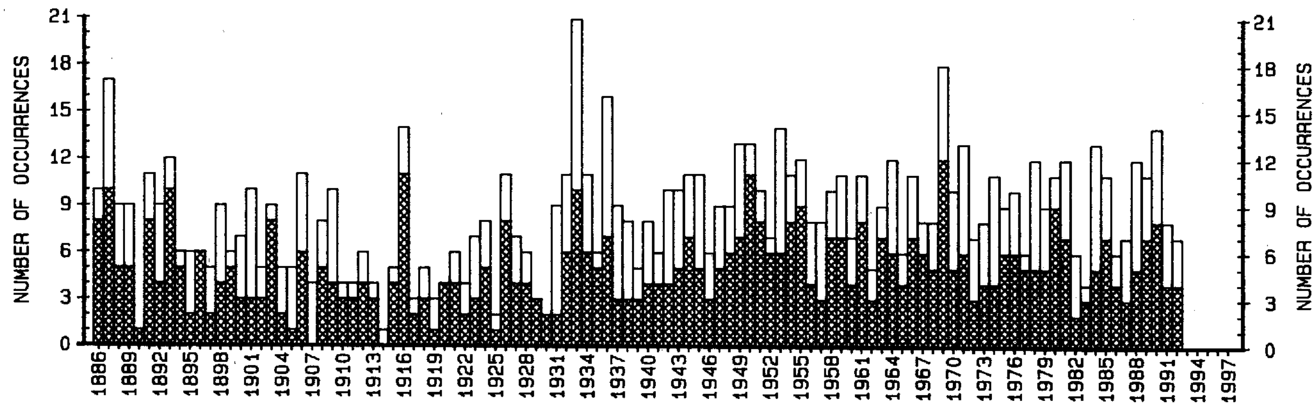


Figure 5. Annual distribution of the 904 Atlantic tropical cyclones reaching at least tropical storm strength (open bar) and the 527 reaching hurricane strength (solid bar), 1886 through 1992. The average number of such storms is 8.4 and 4.9, respectively (see Table 4).

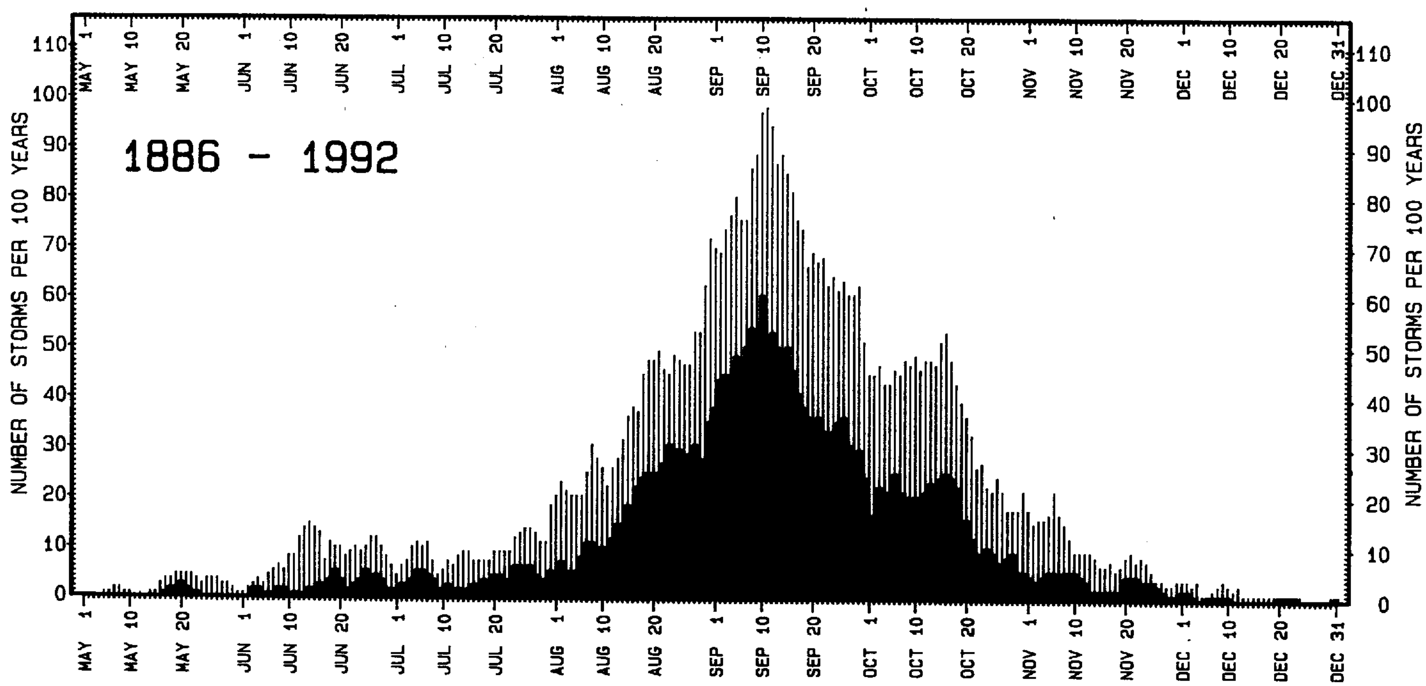


Figure 6. Intra-seasonal variations in the 100-year frequency of tropical cyclone occurrences. Lower bar is for hurricanes and upper bar is for hurricanes and tropical storms combined. Summary is based on period of record, 1886-1992.

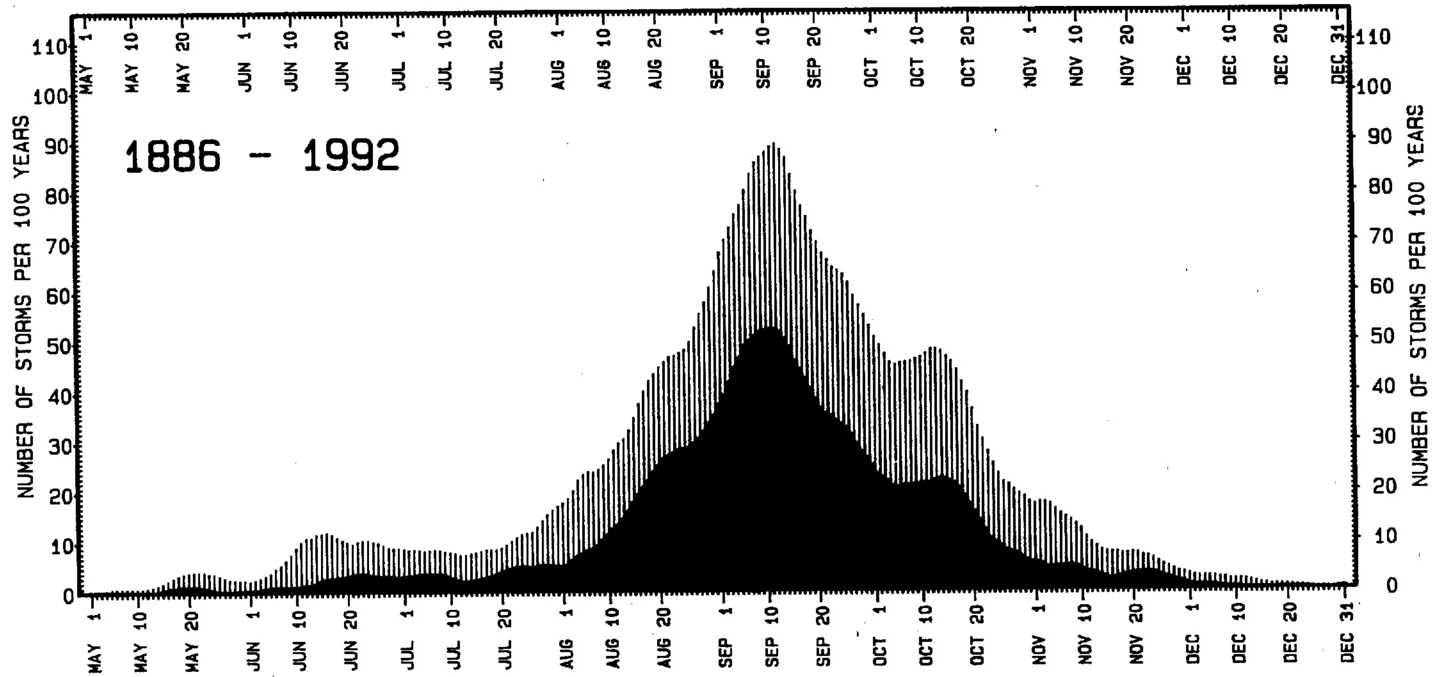


Figure 7.Same as Fig. 6 except data smoothed by 9-day moving average.

average frequency a function of the period of record included in the summary. To illustrate, data from Tables 2 and 3 have been averaged over three periods: 1886 through 1992; 1910 through 1930; and 1944 through 1992. The first period begins with the year when it was possible to distinguish between tropical storms and hurricanes; the period 1910 through 1930 was a minimum in frequency with an average of only about five storms per year; and the last period begins with the introduction of organized aircraft weather reconnaissance. The averages for the three periods appear in Table 4 and substantial difference in the monthly and annual frequencies can be noted. The period 1944 through 1992 probably best represents Atlantic tropical cyclone frequencies as they currently exist.

8.2 Daily Frequencies

Figures 6 and 7 illustrate the incidence of tropical cyclones over the North Atlantic basin on a daily basis for the 8-month period that covers the principal season. Except for the longer period of record, the figure is similar to one presented by Cry (26). In addition, however, the frequencies have been smoothed using a 9-day moving average. These smoothed frequencies eliminate much of the "noise" inherent in the raw data, yet preserve the larger scale seasonal cycles.

The seasonal fluctuations in tropical cyclone frequency include, in chronological order, a slight maximum around mid-June, followed by a slight decline

Figure 8.

Intra-seasonal variations in the 100-year frequency of specified tropical cyclone events. Summary is for hurricanes and tropical storms combined and is based on the period of record, 1886-1992.

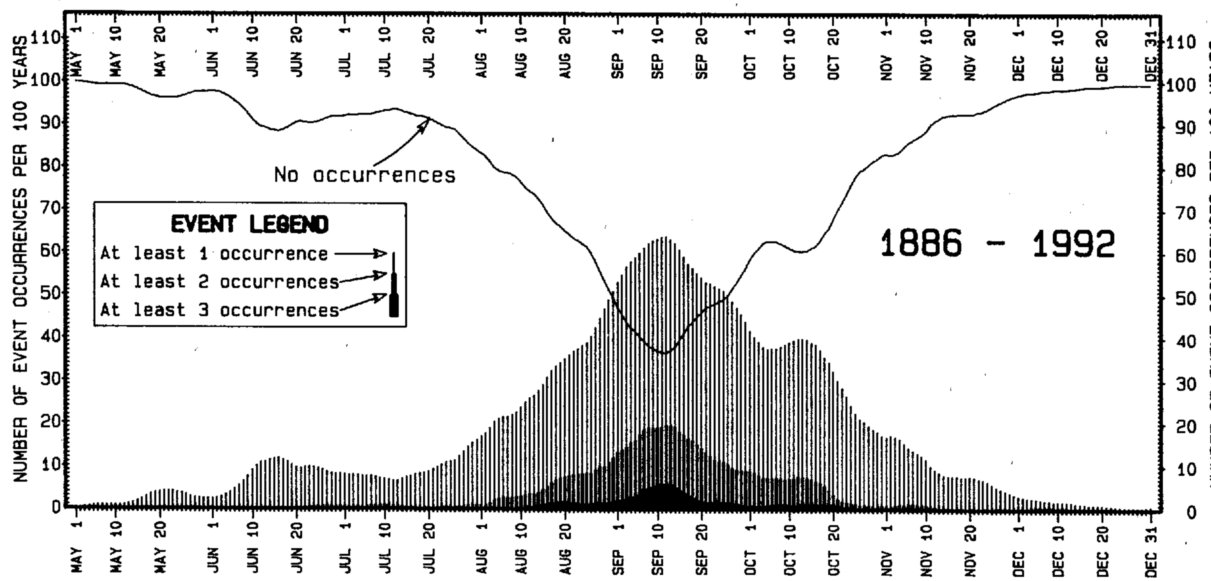
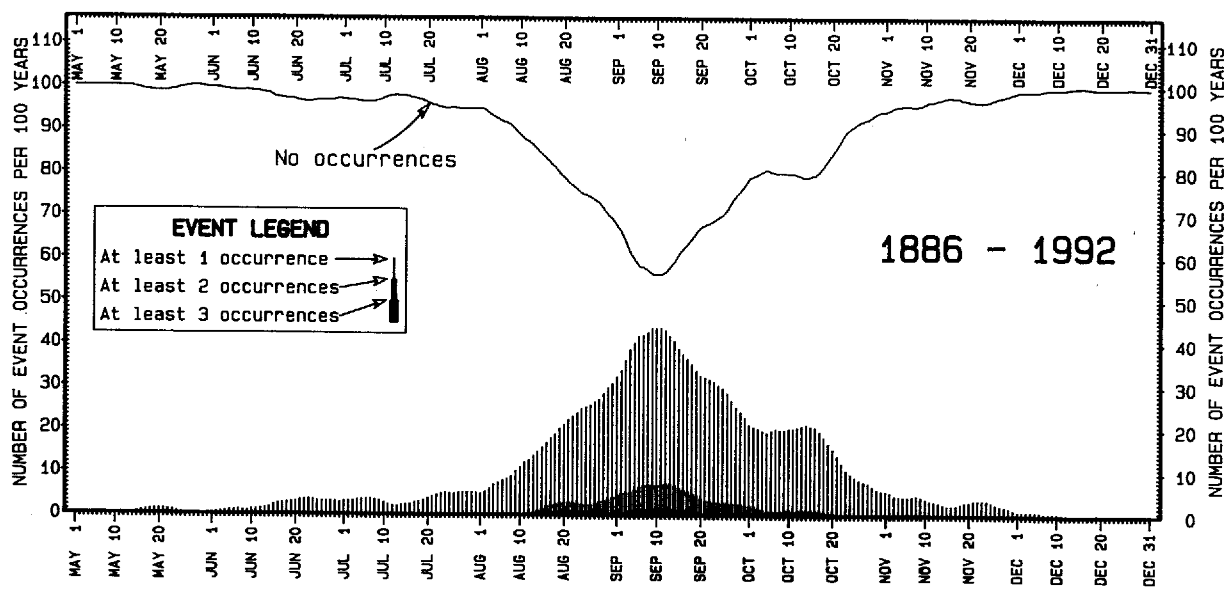


Figure 9.

Same as Figure 8 except for hurricanes alone.



until mid-July, and a gradual increase in frequency until just before mid-September. A somewhat irregular decline in frequency occurs thereafter, interrupted by a slight increase in mid-October.

It can be noted in Figures 6 and 7, that the storm frequency on any given day is specified in units of, "Number of storms per 100 years". This notation is convenient for comparing Atlantic storm frequencies with similarly normalized charts for other basins having dissimilar periods of record. In preparing these figures, multiple storm occurrences on single days were included in the overall total. Thus, for example, the occurrence of 4 storms in a single year and no storms on that date for the 3 subsequent years would yield the same average frequency as 1 storm per year on that date for 4 consecutive years. It is not proper, therefore, to use Figures 6 and 7 for estimating discrete storm occurrence or non-occurrence on given dates.

This latter topic is specifically addressed in Figures 8 and 9. In Figure 8, for example, it can be noted that, except for the period from the end of August through the end of September, there is a greater chance of not observing a tropical cyclone on any given day than there is of observing at least one storm. Figures 8 and 9 show that multiple storm occurrences on single days are reasonably common during the peak of the season.

The maximum multiple occurrence event depicted on these figures is the "at least three" category. The maximum number of simultaneous occurrences recorded over the North Atlantic is four. Such an event is quite rare, however, being observed in but 7 of the 101 years, the longest span being in the year 1893 when 4 tropical storms or hurricanes were present for practically the entire period August 15 to 25. The most recent occurrence of such an event was in the year 1971 when 4 tropical cyclones (EDITH, FERN, GINGER and HEIDI) were in existence on September 12. A fifth tropical cyclone (IRENE) was also in existence on that date but was still in the tropical depression stage.

The "official" Atlantic hurricane season extends from June 1 through November 30. However, the season occasionally begins or ends outside of these "limits". Figure 10 provides a cumulative percentage frequency distribution (14) of the beginning and ending dates of the Atlantic tropical cyclone season. Although there are a few instances when the first storm of the season began earlier than May 1 (see Table 2), these preseason events were not included in Figure 10. The figure shows that the median (50% cumulative percentage frequency) beginning date is July 2 while the median ending data is October 29.

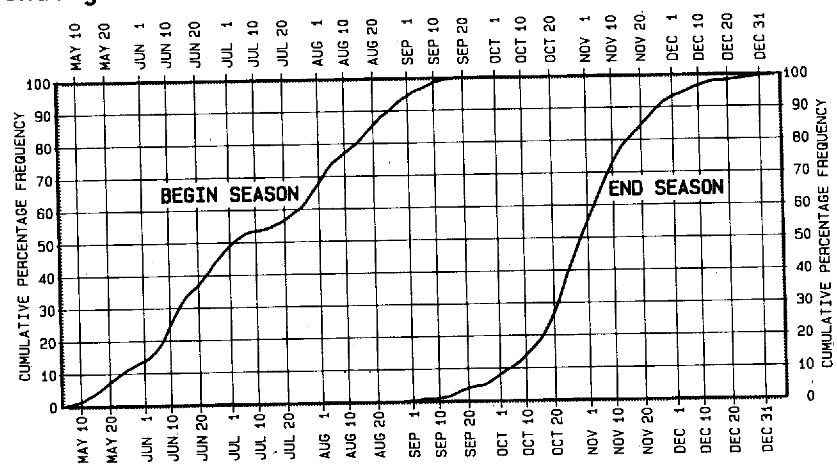


Figure 10. Cumulative percentage frequency distribution of beginning and ending dates of Atlantic tropical cyclone season, 1886 through 1992. (Dates are of first and last recorded position with at least tropical storm strength.) Data have been smoothed using a 9-day moving average.

There are no well-defined statistical relationships between the beginning or ending dates;

that is, seasons which began early did not necessarily end early or seasons which began late did not necessarily end late. However, as might be expected, there is a statistical relationship between starting date and the number of storms for a given year such that seasons which start early tend to have more storms. However, the low linear correlation coefficient (-0.37) indicates that there are many exceptions to this rule.

8.3 Areas of Formation

Seasonal shifts in the principal areas of tropical cyclone formation over the Atlantic basin have been recognized for many decades, and the reader is referred to standard references such as Crutcher and Quayle (24), Dunn (28), or Dunn and Miller (29) for quantitative and qualitative discussions. Chart Series B presents a convenient means of identifying the temporal and spatial variations of these patterns. Early season tropical cyclones are almost exclusively confined to the western Caribbean and the Gulf of Mexico. However, by the end of June or early July, the area of formation gradually shifts eastward, with a slight decline in overall frequency of storms. By late July, the frequency gradually increases, and the area of formation shifts still farther eastward. By late August, tropical cyclones form over a broad area which extends eastward to near the Cape Verde Islands. The period from about August 20 through about September 15 encompasses the maximum of the "Cape Verde" type storms, many of which traverse the entire Atlantic Ocean. After mid-September, the frequency begins to decline and the formative area retreats westward. By early October, the area is generally confined to longitudes west of 60°, and the area of maximum occurrence returns to the western Caribbean. In November, the frequency of tropical cyclone occurrence further declines.

Many additional features pertaining to temporal and spatial variations in storm frequency can be identified by careful analysis of Chart Series B. It often is helpful to consider these charts in conjunction with Figures 6 and 7, which depict the daily frequencies.

8.4 Tropical Cyclones Affecting the United States

Of the 794 tropical cyclones that have been recorded over the Atlantic tropical cyclone basin, 1899-1992, a total of 303 or about 38% have crossed or passed immediately adjacent to the United States mainland. Figure 11 shows the year-to-year distribution of these 303 storms. In a NOAA study for the Federal Emergency Management Agency (FEMA), Ho, et al. (48) analyzed these and earlier tropical cyclones that affected the United States. Figure 12, adapted from their study, shows the spatial variability of tropical storm and hurricane incidence along a smoothed and elongated United States coastline that extends from Texas to Maine for the period 1871-1984. The additional years, 1985 through 1992, do not significantly alter this pattern.

Certain factors should be considered before making inferences from Figure 12. First, the chart includes all storms, ranging from weak tropical storms to the most intense hurricanes. Second, the frequencies represent long-term averages. For shorter (10 or 20-year) periods, considerable deviation has occurred and will continue to occur in the future (47, 87). For example, from 1951 through 1960, many more major hurricanes struck the East Coast of the United States than affected the Gulf of Mexico coast. Figure 12 does not address these short-period variations.

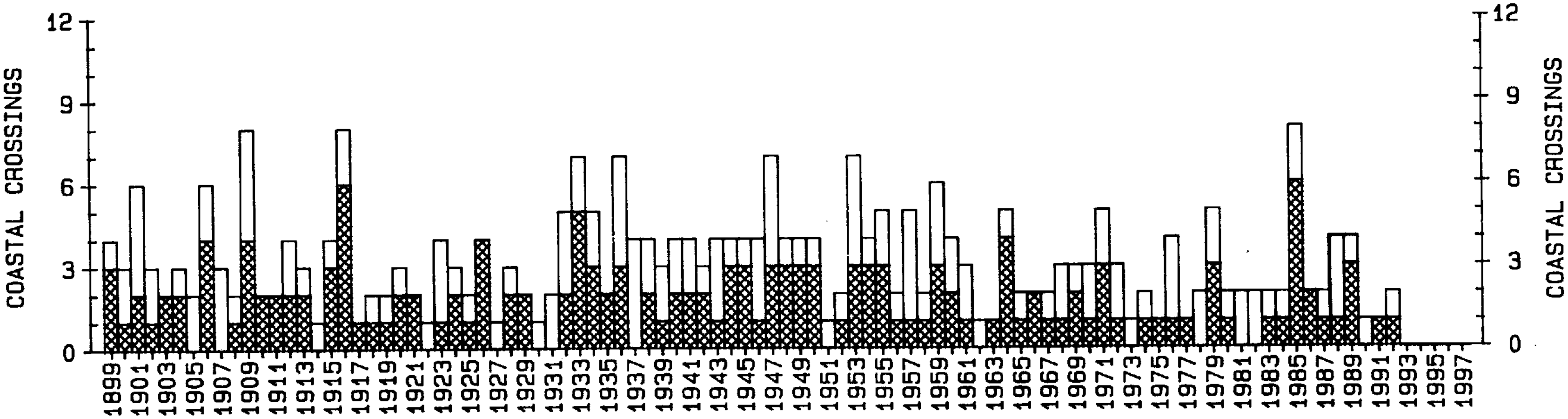


Figure 11. Annual distribution of the 303 Atlantic tropical storms and hurricanes (open bars) and the 161 hurricanes (solid bars) that have crossed or passed immediately adjacent to the United States coastline (Texas to Maine), 1899 through 1992. The average annual number of such events is 3.2 and 1.7 respectively. Graph displays one crossing per storm even though multiple crossings may have occurred.

Another factor to be considered pertains to proper interpretation of the term "per 10 nautical miles of coastline." In the Miami area, about 2 storms per 100 years per 10 nautical miles of coast are indicated. This should not be interpreted to mean that the Miami area expects only 2 storms per century. Storms that strike along the coast in other 10 nautical mile segments, both south and north of Miami, would also affect the area. Indeed, the damage swath from a major hurricane can cover more than 100 miles of coastline. For further details on proper interpretation of Figure 12, the reader is referred to the original paper which contains much additional information, including a chart that gives the ratio of hurricanes to tropical storms along the entire coastline, and a chart that can be used to estimate the return periods of hurricanes of various intensities (based upon central pressure) for the entire coast.

Another factor to be considered before making deductions on hurricane or storm damage relative to any given storm track is that the pattern of wind, rainfall, storm surge, and associated damage are rarely symmetrical about the storm track. Wind and storm surge are typically higher in the right semicircle of a storm (as viewed toward the direction of motion) where the storm's motion and wind are complementary. Thus, when the hurricane on the cover photograph crossed the Florida east coast on a westward heading, higher winds and storm surge occurred northward from the center where the counter-clockwise rotating winds and the hurricane's forward speed of motion are both working in the same direction. On the other hand, a storm moving into the Tampa, FL, area from the southwest generally would bring stronger winds and higher tides southward from the Tampa area.

Other meteorological and geographical factors also contribute to wind asymmetries such that it is difficult to speculate on the extent and nature of storm damage at a particular site given only the track and intensity of a tropical cyclone. Also, wind gusts, which may substantially exceed sustained wind speeds, must be considered in assessing damage potential.

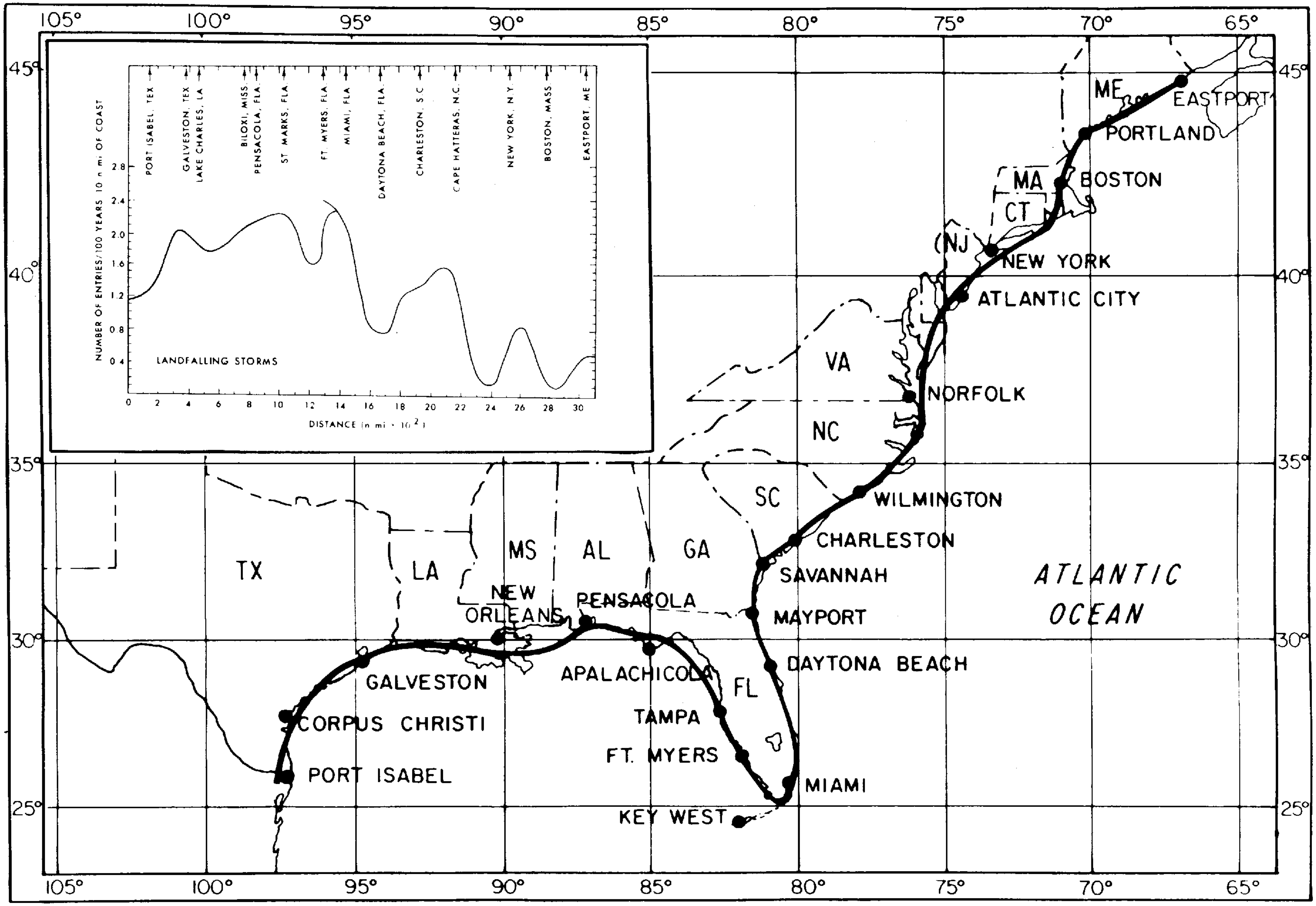


Figure 12. Smoothed frequency of landfalling tropical storms and hurricanes (1871-1984) for the Gulf and East Coasts of the United States. Discontinuity near Miami represents Florida Keys. (Adapted from Ho, et al. (48)

Accordingly, persons needing the specific effect of a historical storm on a given site should seek further meteorological advice. Instrumental documentation of specific weather elements, however, even when storms cross coastlines, is meager. Much must be inferred from immediate post-storm surveys of damage from wind and storm surge.

8.5 Hurricanes Affecting the United States

Figure 12, discussed in section 8.4, gives the combined frequency of both hurricanes and tropical storms. Depending on the area of landfall, approximately 40 to 60 percent of these storms were classified as hurricanes. The observed (or potential) damage from these hurricanes ranged from minimal to catastrophic, depending not only on the intensity of the storm, but upon such factors as size of the storm, coastal configuration, astronomical tides, terrain features, urbanization, and industrialization. To relate hurricane intensity to damage potential, the National Hurricane Center has adopted the Saffir/Simpson (82, 104) Hurricane Scale. This descriptive scale, over a range of categories 1 through 5, is shown in Table 5.

Figure 11 shows that 161 hurricanes and 141 tropical storms have crossed or passed immediately offshore to the United States over the 94-year period 1899-1992. Jarrell et al. (54) carefully analyzed all hurricanes affecting the United States between 1900 and 1990 and classified them according to the Saffir/Simpson damage potential scale. Their listing, with some minor modifications, has been extended backward through 1899 and forward through 1992 and appears in Table 6.

The scale numbers assigned by Jarrell et al. were based primarily upon the central pressure at the time

Table 5. The Saffir/Simpson (82, 104) Hurricane Scale.

Scale No. 1—Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. And/or: storm surge 4 to 5 feet above normal. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.

Scale No. 2—Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage; some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. And/or: storm surge 6 to 8 feet above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hours before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying island areas required.

Scale No. 3—Winds of 111 to 130 miles per hour. Foliage torn from trees; large trees blown down. Practically all poorly constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. And/or: storm surge 9 to 12 feet above normal. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Flat terrain 5 feet or less above sea level flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of shoreline possibly required.

Scale No. 4—Winds of 131 to 155 miles per hour. Shrubs and trees blown down; all signs down. Extensive damage to roofing materials, windows and doors. Complete failure of roofs on many small residences. Complete destruction of mobile homes. And/or: storm surge 13 to 18 feet above normal. Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required, and of single-story residences on low ground within 2 miles of shore.

Scale No. 5—Winds greater than 155 miles per hour. Shrubs and trees blown down; considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction of mobile homes. And/or: storm surge greater than 18 feet above normal. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Massive evacuation of residential areas on low ground within 5 to 10 miles of shore possibly required.

Table 6. Chronological listing of, and states affected by, all category 1 through 5 hurricanes which have hit the United States, 1899-1992.

Storm number	Year	Month	States affected and category by States	Highest category U.S.	Storm name
2	1899	Aug	NC 3	3	....
6	1899	Oct	SC, NC 1	1	....
1	1900	Sep	TX 4N	4	....
3	1901	Jul	NC 1	1	....
4	1901	Aug	LA, MS 2	2	....
3	1903	Sep	FL 2SE, 1NW	2	....
4	1903	Sep	NJ, NY, CT 1	1	....
2	1904	Sep	SC 1	1	....
2	1906	Jun	FL 1SE	1	....
4	1906	Sep	SC, NC 3	3	....
5	1906	Sep	MS, AL 3	3	....
8	1906	Oct	FL 2SE	2	....
2	1908	Jul	NC 1	1	....
3	1909	Jul	TX 3N	3	....
5	1909	Aug	TX 2S	2	....
7	1909	Sep	LA 4	4	....
9	1909	Oct	FL 3SE (Keys)	3	....
2	1910	Sep	TX 2S	2	....
4	1910	Oct	FL 3SW	3	....
1	1911	Aug	FL 1NW; AL 1	1	....
2	1911	Aug	GA, SC 2	2	....
3	1912	Sep	AL 1	1	....
5	1912	Oct	TX 1S	1	....
1	1913	Jun	TX 1S	1	....
2	1913	Sep	NC 1	1	....
2	1915	Aug	TX 4N	4	....
4	1915	Sep	FL 1NW	1	....
5	1915	Sep	LA 4	4	....
1	1916	Jul	MS,AL3	3	....
2	1916	Jul	MA 1	1	....
3	1916	Jul	SC 1	1	....
4	1916	Aug	TX 3S	3	....
13	1916	Oct	AL 2; FL 2NW	2	....
14	1916	Nov	FL 1SW (Keys)	1	....
3	1917	Sep	FL 3NW	3	....
1	1918	Aug	LA 3	3	....
2	1919	Sep	FL 4SW (Keys); TX 4S	4	....
2	1920	Sep	LA 2	2	....
3	1920	Sep	NC 1	1	....
1	1921	Jun	TX 2C	2	....
6	1921	Oct	FL 3SW, 2NE	3	....
3	1923	Oct	LA 1	1	....
4	1924	Sep	FL 1NW	1	....
7	1924	Oct	FL 1SW	1	....
2	1925	Nov	FL 1SW	1	....
1	1926	Jul	FL 2NE	2	....
3	1926	Aug	LA 3	3	....
6	1926	Sep	FL 4SE, 3SW, 3NW; AL 3	4	....
1	1928	Aug	FL 2SE	2	....
4	1928	Sep	FL4SE, 2NE; GA, SC 1	4	....
1	1929	Jun	TX 1C	1	....
2	1929	Sep	FL 3SE, 2NW	3	....
2	1932	Aug	TX 4N	4	....
3	1932	Sep	AL 1	1	....
5	1933	Jul/Aug	FL 1SE; TX 2S	2	....
8	1933	Aug	NC, VA 2	2	....
11	1933	Sep	TX 3S	3	....
12	1933	Sep	FL 3SE	3	....
13	1933	Sep	NC 3	3	....
2	1934	Jun	LA 3	3	....
3	1934	Jul	TX 2S	2	....
2	1935	Sep	FL 5SW (Keys), 2NW	5	....
6	1935	Nov	FL 2SE	2	....
3	1936	Jun	TX 1S	1	....
5	1936	Jul	FL 3NW	3	....
13	1936	Sep	NC 2	2	....
2	1938	Aug	LA 1	1	....
4	1938	Sep	NY, CT, RI, MA 3*	3*	....
2	1939	Aug	FL 1SE, 1NW	1	....
2	1940	Aug	TX 2N; LA 2	2	....
3	1940	Aug	GA, SC 2	2	....
2	1941	Sep	TX 3N	3	....
5	1941	Oct	FL 2SE, 2SW, 2NW	2	....
1	1942	Aug	TX 1N	1	....
2	1942	Aug	TX 3C	3	....
1	1943	Jul	TX 2N	2	....
3	1944	Aug	NC 1	1	....

Table 6. Chronological listing of, and states affected by, all category 1 through 5 hurricanes which have hit the United States, 1899-1992. - Continued

Storm number	Year	Month	States affected and category by States	Highest category U.S.	Storm name
7	1944	Sep	NC,VA,NY,CT,RI 3*; MA 2*	3*	----
11	1944	Oct	FL 3SW,2NE	3	----
1	1945	Jun	FL 1NW	1	----
5	1945	Aug	TX 2C	2	----
9	1945	Sep	FL 3SE	3	----
5	1946	Oct	FL 1SW	1	----
3	1947	Aug	TX 1N	1	----
4	1947	Sep	FL 4SE,2SW; LA,MS 3	4	----
8	1947	Oct	FL 1SE; GA,SC 2	2	----
5	1948	Sep	LA 1	1	----
7	1948	Sep	FL 3SW,2SE	3	----
8	1948	Oct	FL 2SE	2	----
1	1949	Aug	NC 1	1	----
2	1949	Aug	FL 3SE	3	----
10	1949	Oct	TX 2N	2	----
2	1950	Aug	AL 1	1	BAKER
5	1950	Sep	FL 3NW	3	EASY
11	1950	Oct	FL 3SE	3	KING
2	1952	Aug	SC 1	1	ABLE
2	1953	Aug	NC 1	1	BARBARA
4	1953	Sep	ME 1*	1*	CAROL
8	1953	Sep	FL 1NW	1	FLORENCE
3	1954	Aug	NC 2; NY,CT,RI 3*	3*	CAROL
5	1954	Sep	MA 3*; ME 1*	3*	EDNA
9	1954	Oct	SC,NC 4*; MD 2*	4*	HAZEL
2	1955	Aug	NC 3; VA 1	3	CONNIE
3	1955	Aug	NC 1	1	DIANE
9	1955	Sep	NC 3	3	IONE
7	1956	Sep	LA 2; FL 1NW	2	FLOSSY
2	1957	Jun	TX 4N; LA 4	4	AUDREY
4	1959	Jul	SC 1	1	CINDY
5	1959	Jul	TX 1N	1	DEBRA
8	1959	Sep	SC 3	3	GRACIE
5	1960	Sep	FL 4SW (Keys), 2NE; NC, NY 3*; CT,RI 2*, MA, NH,ME 1*	4	DONNA
6	1960	Sep	MS 1	1	ETHEL
3	1961	Sep	TX 4C	4	CARLA
4	1963	Sep	TX 1N	1	CINDY
5	1964	Aug	FL 2SE	2	CLEO
6	1964	Sep	FL 2NE	2	DORA
10	1964	Oct	LA 3	3	HILDA
11	1964	Oct	FL 2SW,2SE	2	ISBELL
3	1965	Sep	FL 3SE; LA 3	3	BETSY
1	1966	Jun	FL 2NW	2	ALMA
9	1966	Oct	FL 1SW (Keys)	1	INEZ
2	1967	Sep	TX 3S	3	BEULAH
8	1968	Oct	FL 2NW,1NE	2	GLADYS
3	1969	Aug	LA,MS 5	5	CAMILLE
7	1969	Sep	ME 1*	1*	GERDA
3	1970	Aug	TX 3S	3	CELIA
6	1971	Sep	LA 2	2	EDITH
7	1971	Sep	TX 1C	1	FERN
8	1971	Sep	NC 1	1	GINGER
2	1972	Jun	FL 1NW; NY,CT 1	1	AGNES
6	1974	Sep	LA 3	3	CARMEN
5	1975	Sep	FL 3NW	3	ELOISE
3	1976	Aug	NY 1	1	BELLE
2	1977	Sep	LA 1	1	BABE
2	1979	Jul	LA 1	1	BOB
4	1979	Sep	FL 2SE,2NE; GA 2; SC 2	2	DAVID
6	1979	Sep	AL,MS 3	3	FREDERIC
1	1980	Aug	TX 3S	3	ALLEN
1	1983	Aug	TX 3N	3	ALICIA
5	1984	Sep	NC 3	3	DIANA
2	1985	Jul	SC 1	1	BOB
4	1985	Aug	LA 1	1	DANNY
5	1985	Sep	AL,MS 3; FL 3NW	3	ELENA
7	1985	Sep	NC 3; NY 3*; CT,NH 2*; ME 1*	3	GLORIA
10	1985	Oct	LA 1	1	JUAN
11	1985	Nov	FL 2NW	2	KATE
2	1986	Jun	TX 1N	1	BONNIE
3	1986	Aug	NC,VA 1	1	CHARLEY
7	1987	Oct	FL 1SW	1	FLOYD
6	1988	Sep	LA 1	1	FLORENCE
3	1989	Aug	TX 1N	1	CHANTAL
8	1989	Sep	SC 4	4	HUGO
10	1989	Oct	TX 1N	1	JERRY
2	1991	Aug	RI,MA,NY,CT 2	2	BOB
2	1992	Aug	FL 4SE,3SW; LA 3	4	ANDREW

Notes: Storm numbers in column 1 correspond to storms identified by number in chart series A. Legend for state abbreviations is given in Table 7. Formal storm names as specified in column 6 were not assigned before 1950. Data for the years 1900 through 1990 have been derived from Jarrell et al. (54). Asterisk (*) indicates that the hurricane was moving in excess of 30 miles per hour. Listing includes only those hurricanes which affected coastal counties.

Table 7. Number of hurricanes (direct hits) affecting the U.S. and individual states, 1899-1992, according to Saffir/Simpson hurricane scale

Area	Category Number					Major Hurricanes	
	1	2	3	4	5	All	(≥ 3)
U.S. (Texas to Maine)	59	34	45	15	2	155	62
Texas (TX)	12	9	9	6	0	36	15
(North)	7	3	3	4	0	17	7
(Central)	2	2	1	1	0	6	2
(South)	3	4	5	1	0	13	6
Louisiana (LA)	8	5	8	3	1	25	12
Mississippi (MI)	1	1	5	0	1	8	6
Alabama (AL)	4	1	5	0	0	10	5
Florida (FL)	17	15	16	6	1	55	23
(Northwest)	9	7	6	0	0	22	6
(Northeast)	1	7	0	0	0	8	0
(Southwest)	6	3	6	2	1	18	9
(Southeast)	4	10	7	4	0	25	11
Georgia (GA)	1	4	0	0	0	5	0
South Carolina (SC)	7	4	2	2	0	15	4
North Carolina (NC)	11	3	9	1*	0	24	9
Virginia (VA)	2	1	1*	0	0	4	1*
Maryland (MD)	0	1*	0	0	0	1*	0
Deleware (DE)	0	0	0	0	0	0	0
New Jersey (NJ)	1*	0	0	0	0	1*	0
New York (NY)	3	1*	5*	0	0	9	5*
Connecticut (CT)	2	3*	3*	0	0	8	3*
Rhode Island (RI)	0	2*	3*	0	0	5*	3*
Massachusetts (MA)	2	2*	2*	0	0	6	2*
New Hampshire (NH)	1*	1*	0	0	0	2*	0
Maine (ME)	5*	0	0	0	0	5*	0

Notes: Asterisk (*) indicates that all hurricanes in this category were moving in excess of 30 mph. Data summarized from Table 6.

of storm landfall. Certain hurricanes (indicated by an asterisk in Table 6), because of their rapid forward speed, could have produced greater or lesser damage than implied by the scale number depending upon whether the area was located to the right (stronger) or left (weaker) portion of the storm, as viewed toward the direction of motion. The authors point out a certain amount of subjectivity inherent in this type of classification, particularly with hurricanes during earlier years and with those moving inland in sparsely settled areas. Consequently, some hurricanes near the borderline between two scale numbers might be classified one way or the other, depending on various considerations such as coastal inundation.

The data presented in Table 6 are summarized by state in Table 7. Because of their long coastlines, Florida and Texas are further subdivided. In Florida, the north-south dividing line is roughly from Cape Canaveral to Tarpon Springs. In Texas, south is roughly Brownsville to Corpus Christi, central is from north of Corpus Christi to Matagorda Bay, and north is from Matagorda Bay to the Louisiana border. Entries in Table 7 may be made for the same hurricane more than once, and sectional totals cannot be summed to get national totals. The initial line of Table 7 is an actual count of the number of hurricanes that have affected the United States, where only the highest Saffir/Simpson category in any state has been used. The total (155) is somewhat less than that given (161) in Figure 11. The difference is because Jarrell et al. (54) determined that 6 of the hurricanes included in Figure 11 (No. 1, 1899; No. 2, 1902; No. 3, 1904; No. 10, 1926; No. 6, 1934; No. 8, 1958) either weakened to below hurricane strength immediately upon reaching the coast or passed somewhat offshore with hurricane force winds affecting only coastal waters. However, some storms (for example, storm number 1, 1949) did produce hurricane force winds over land even though the storm center remained well offshore.

Thus, over the 94-year period 1899 through 1992, a total of 155 category 1 through 5 hurricanes crossed the United States coastline at one or more points. This is equivalent to an average of 5 hurricanes every 3 years. Since some hurricanes affect or threaten more than one coastal segment, hurricane warnings average closer to 2 per year over some coastal segments of the

United States. The economic aspects of these warnings are discussed by Sugg (95) and Neumann (70).

Table 7 further shows that 62 major hurricanes (category 3 or higher) have affected the United States between 1899 and 1992. Thus, major hurricanes, capable of causing damage in the billions of dollars and killing hundreds of people, have crossed the United States coastline about twice every 3 years.

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APPENDIX A

Chart Series A

Tracks of North Atlantic Tropical Cyclones By Years, 1871-1992

1871-1885 Tracks only, no intensity

1886-1898 Maximum intensity (tropical storm or hurricane) only

1899-1950 Tropical depression (dissipation stage only), tropical storm, hurricane or extratropical storm

1951-1967 Tropical depression, tropical storm, hurricane or extratropical storm

1968-1992 Tropical depression, tropical storm, hurricane, extratropical storm, subtropical depression, subtropical storm

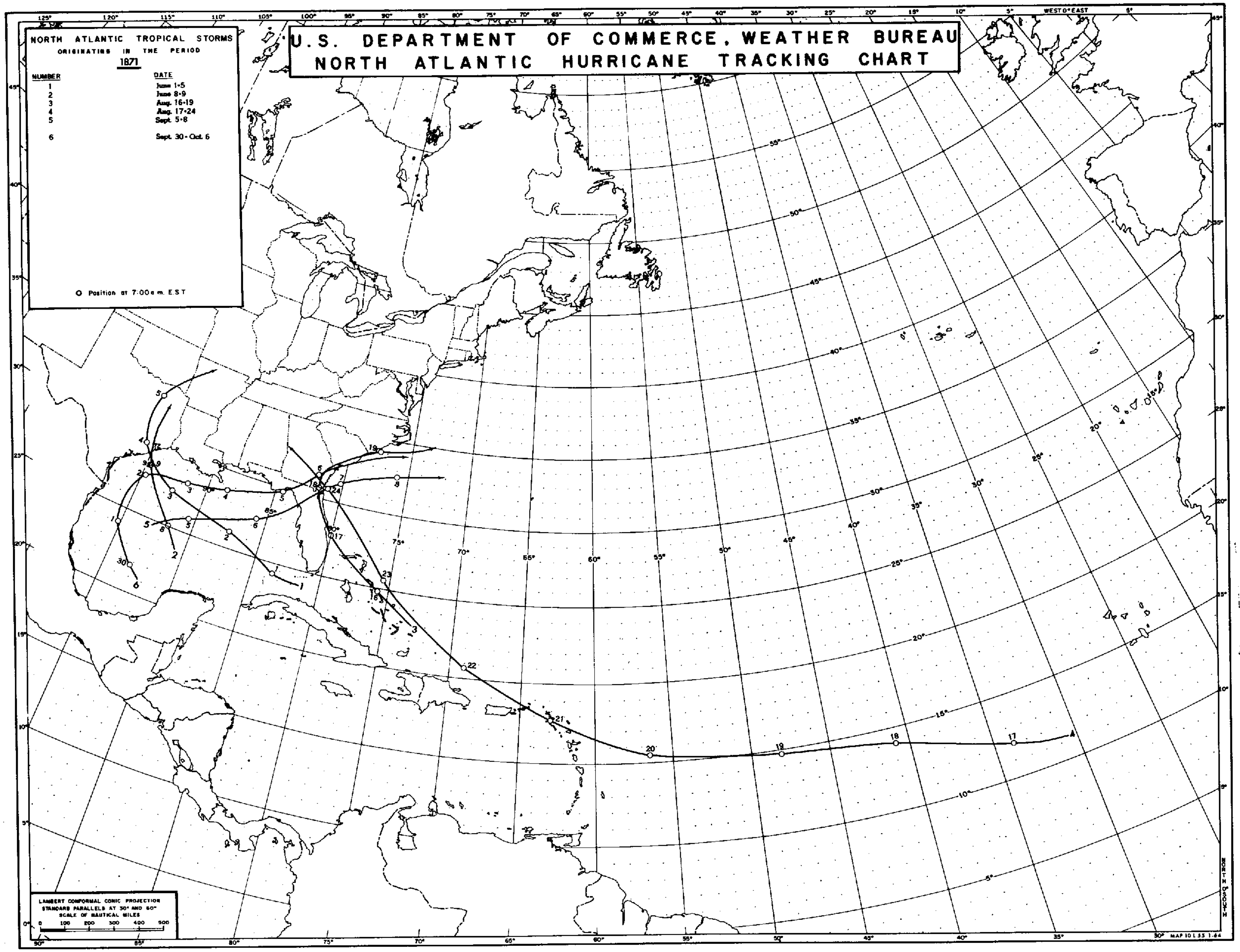
(See Table 1 for definitions of various stages)

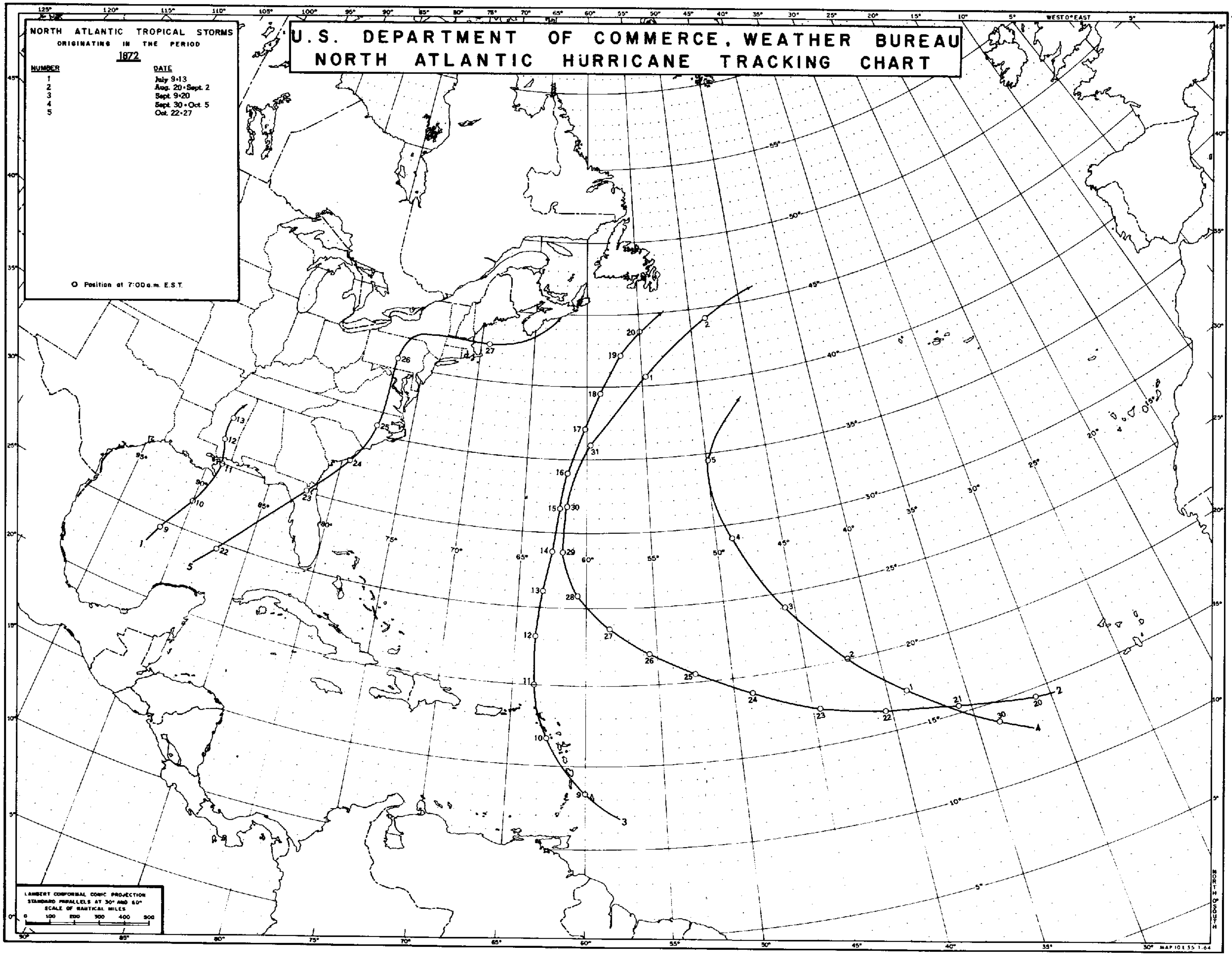
Note: Six blank pages have been provided for attaching track charts for the years 1993 through 1998. These charts are normally published in the *Monthly Weather Review* (112).

APPENDIX B

Chart Series B

Tracks of North Atlantic Tropical Cyclones by months, May through December, and by 10- (or 11-) day periods, June 1 through November 30, 1886 through 1992.


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
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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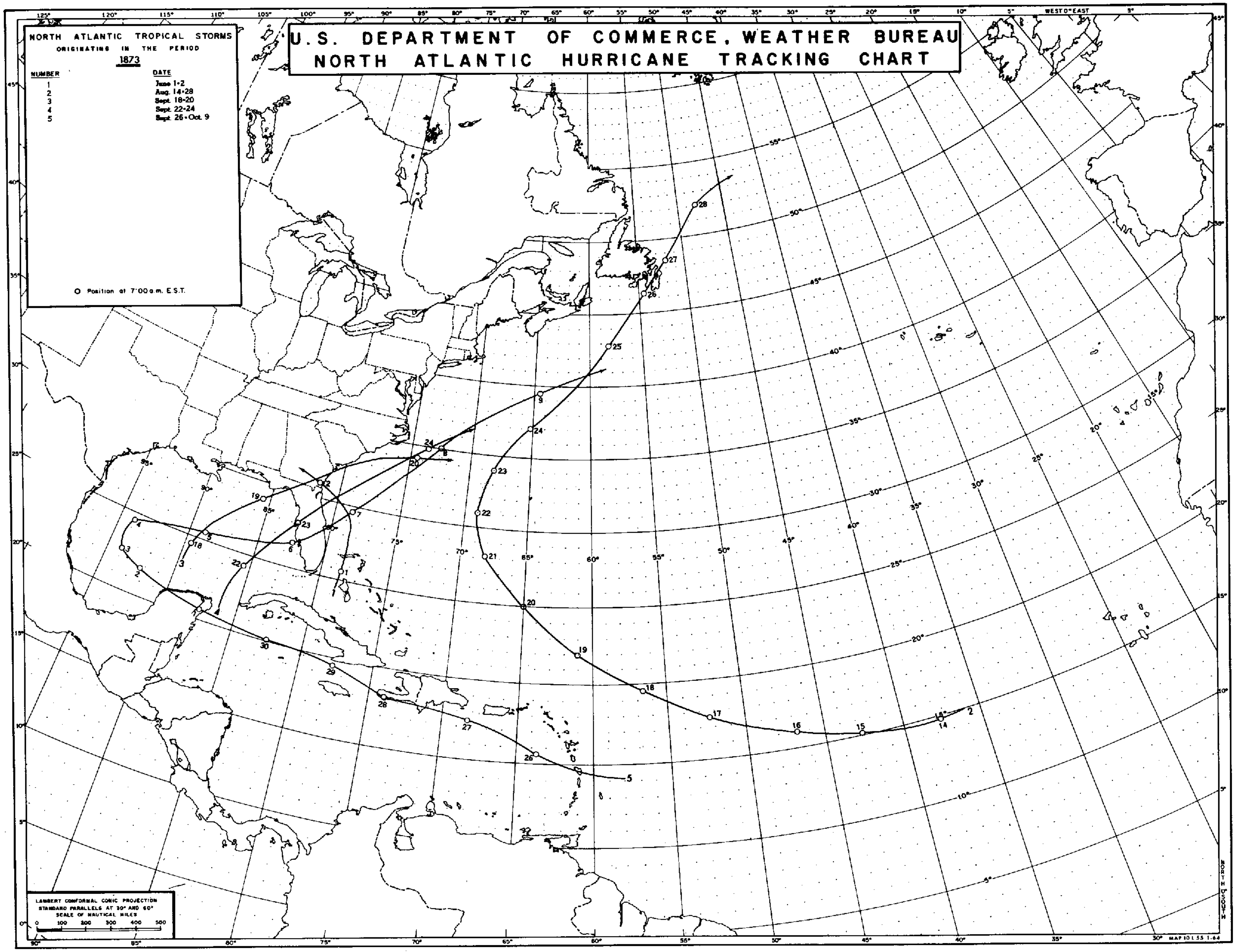
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1872
NUMBER
DATE
1 July 9-13
2 Aug. 20-Sept. 2
3 Sept. 9-20
4 Sept. 30-Oct. 5
5 Oct. 22-27
Position at 7:00a.m. E.S.T.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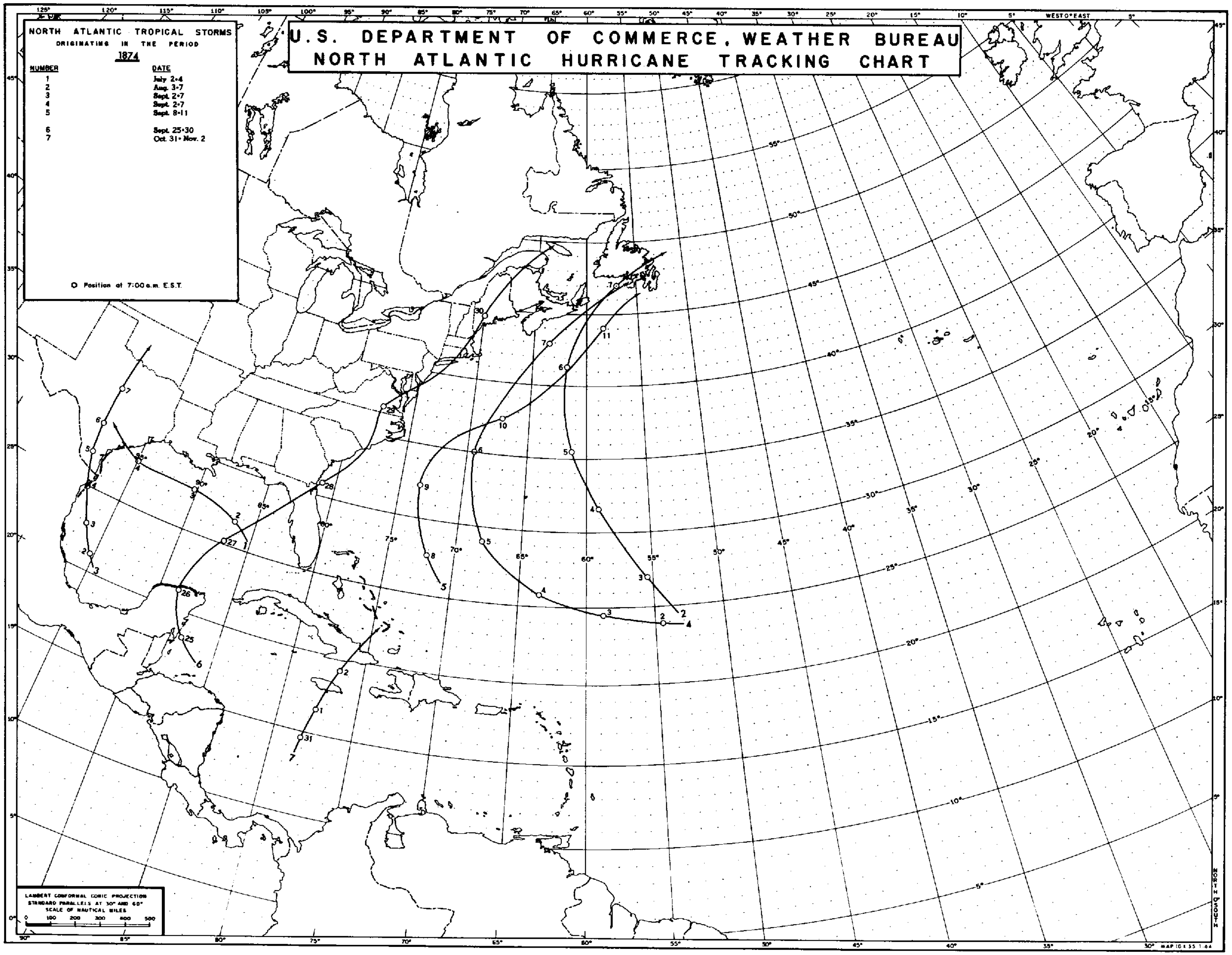
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1873
NUMBER
DATE
1 June 1-2
2 Aug. 14-28
3 Sept. 18-20
4 Sept. 22-24
5 Sept. 26-Oct. 9
○ Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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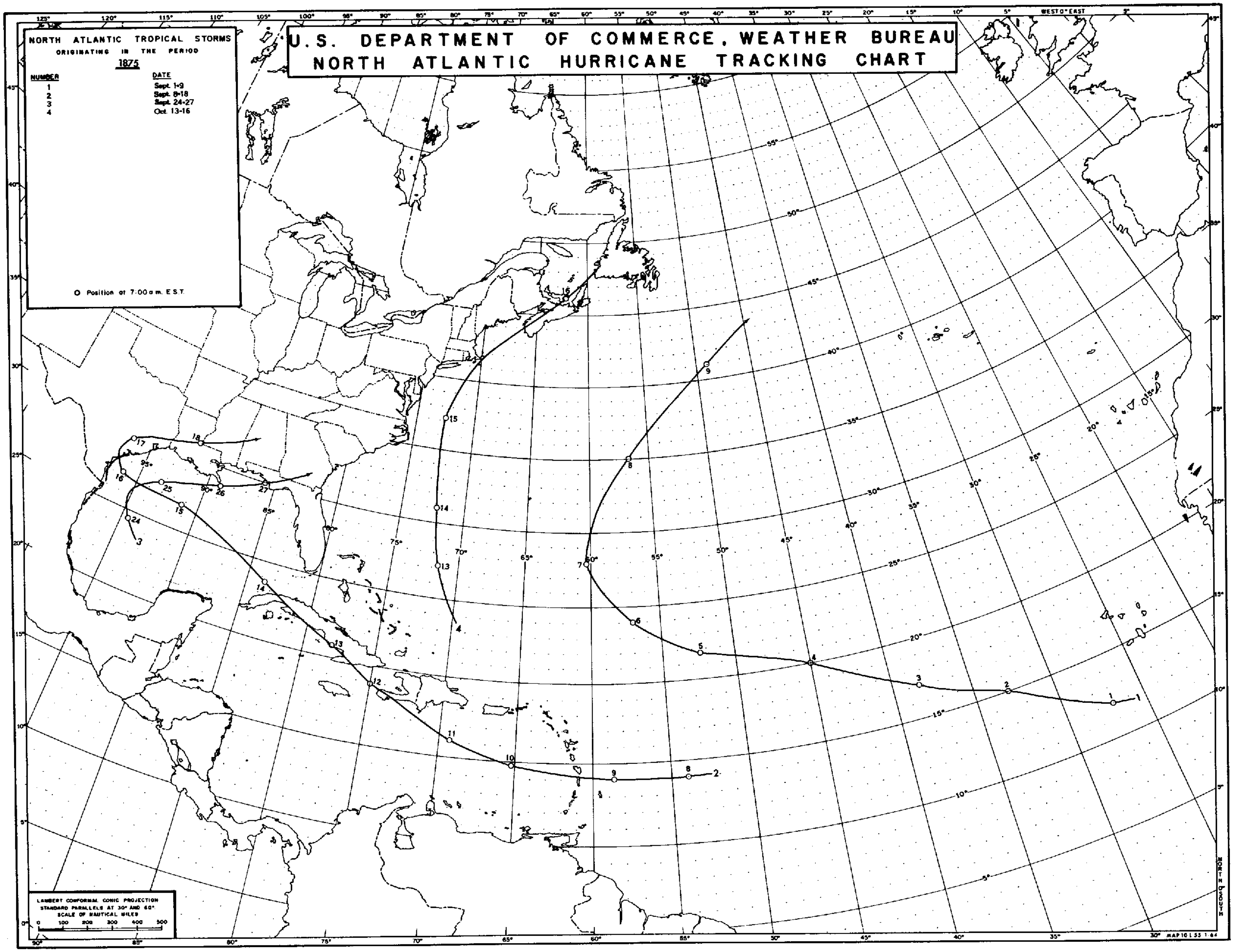
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1874
NUMBER
DATE
1 July 2-4
2 Aug. 3-7
3 Sept. 2-7
4 Sept. 2-7
5 Sept. 8-11
6 Sept. 25-30
7 Oct. 31 - Nov. 2
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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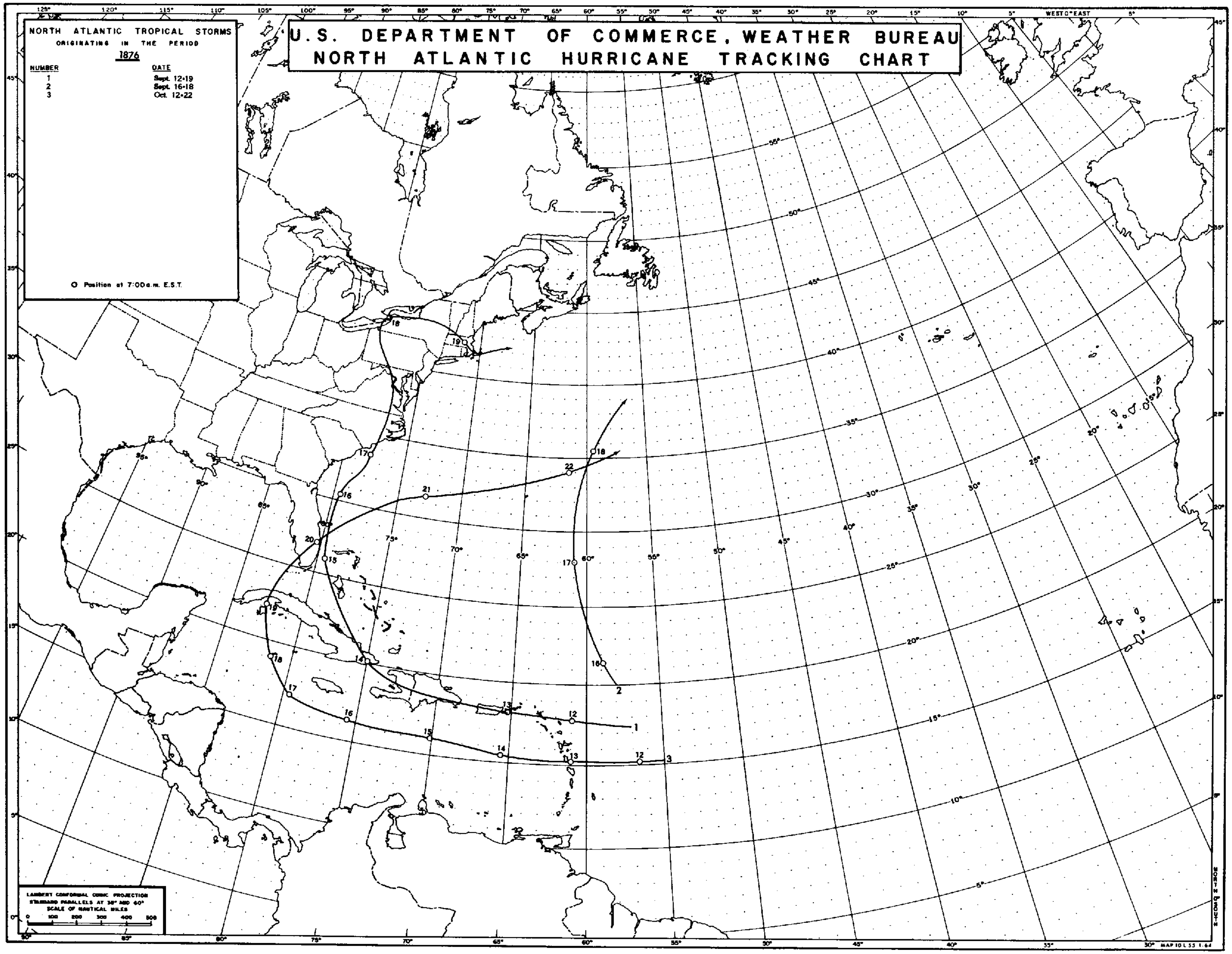
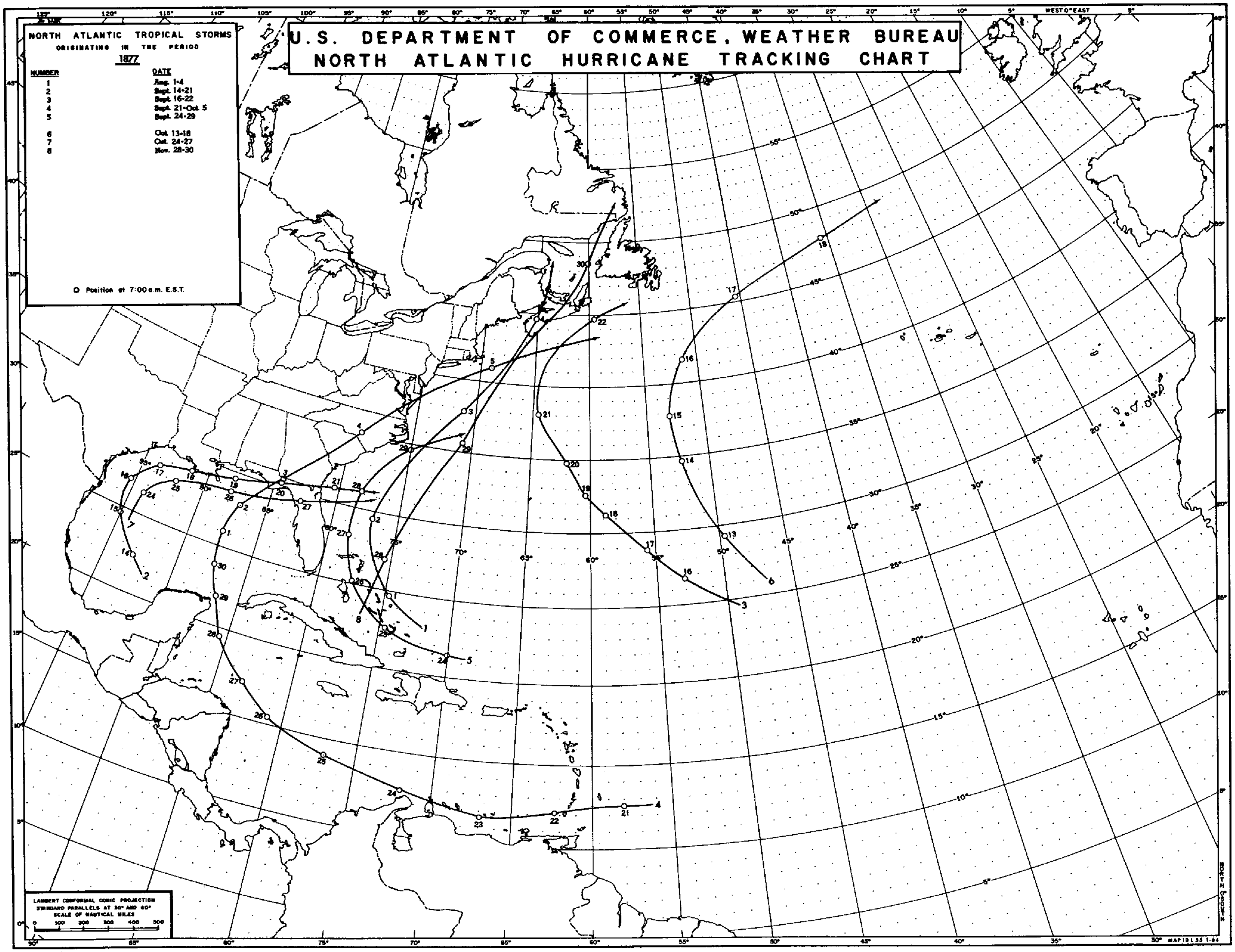
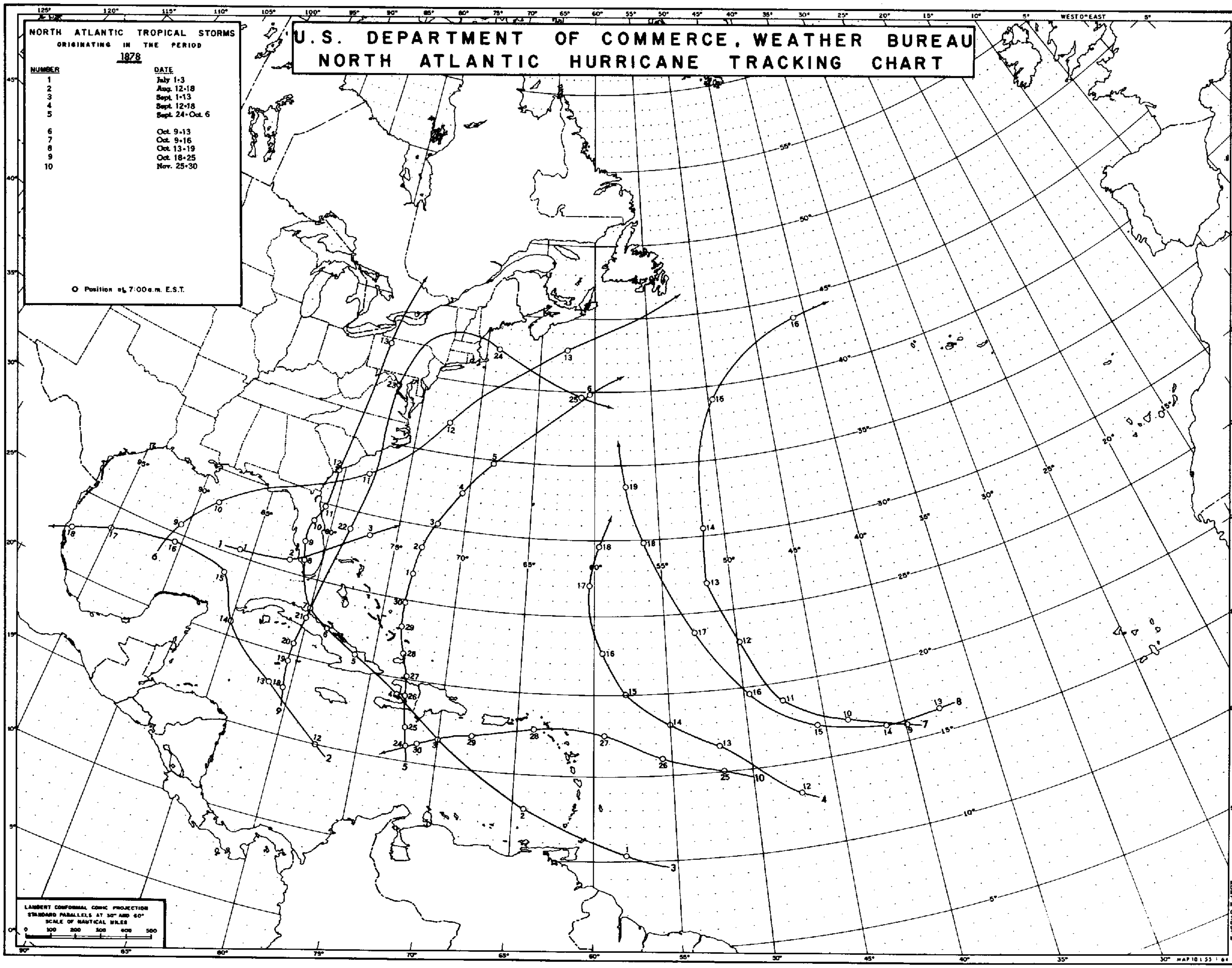
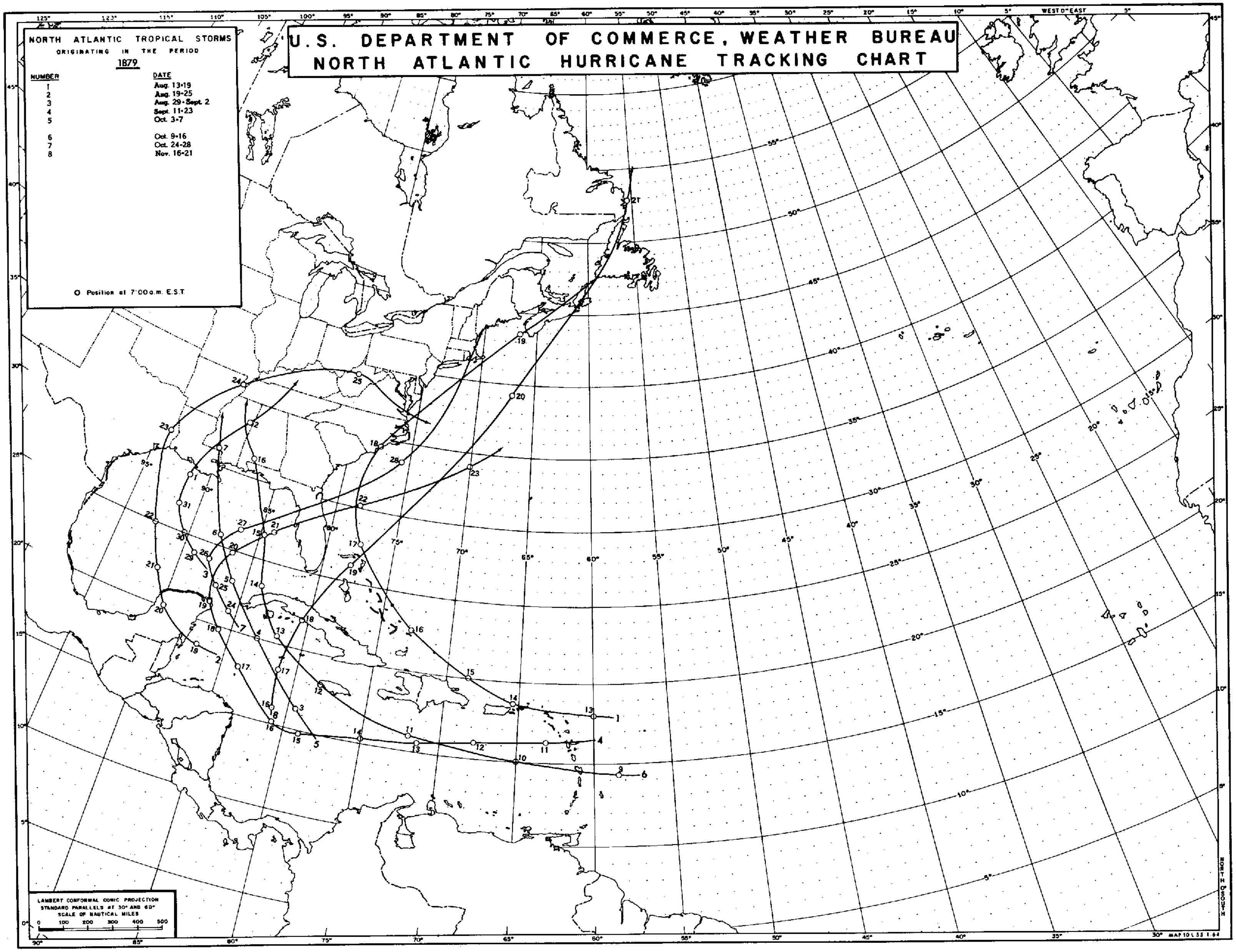
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1875
NUMBER
1
2
3
4
DATE
Sept. 1-9
Sept. 8-18
Sept. 24-27
Oct. 13-16
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

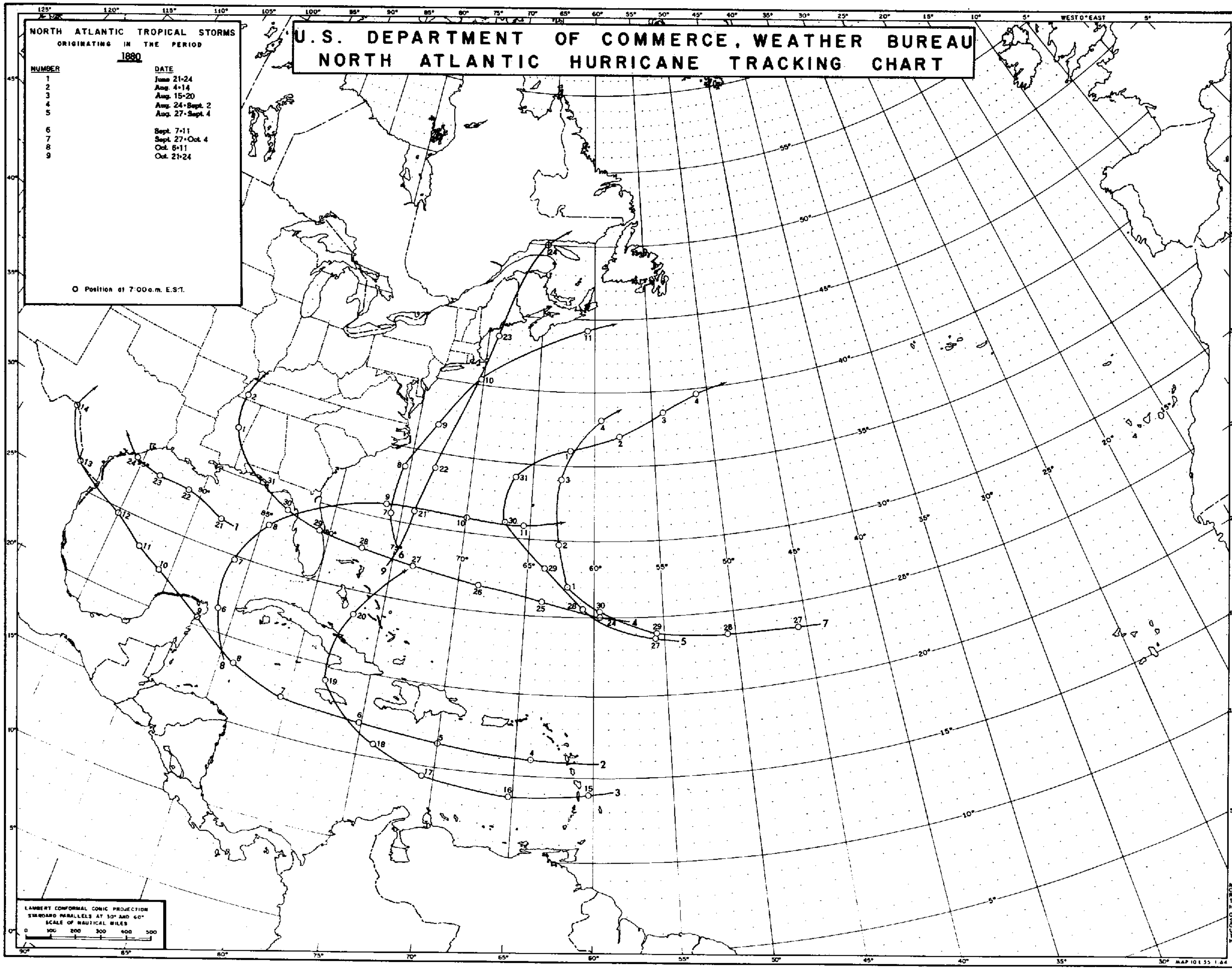

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1876
NUMBER
DATE
1
Sept. 12-19
2
Sept. 16-18
3
Oct. 12-22
Position at 7:00 a.m. E.S.T.
SCALE OF NAUTICAL MILES
0
100
200
300
400
500

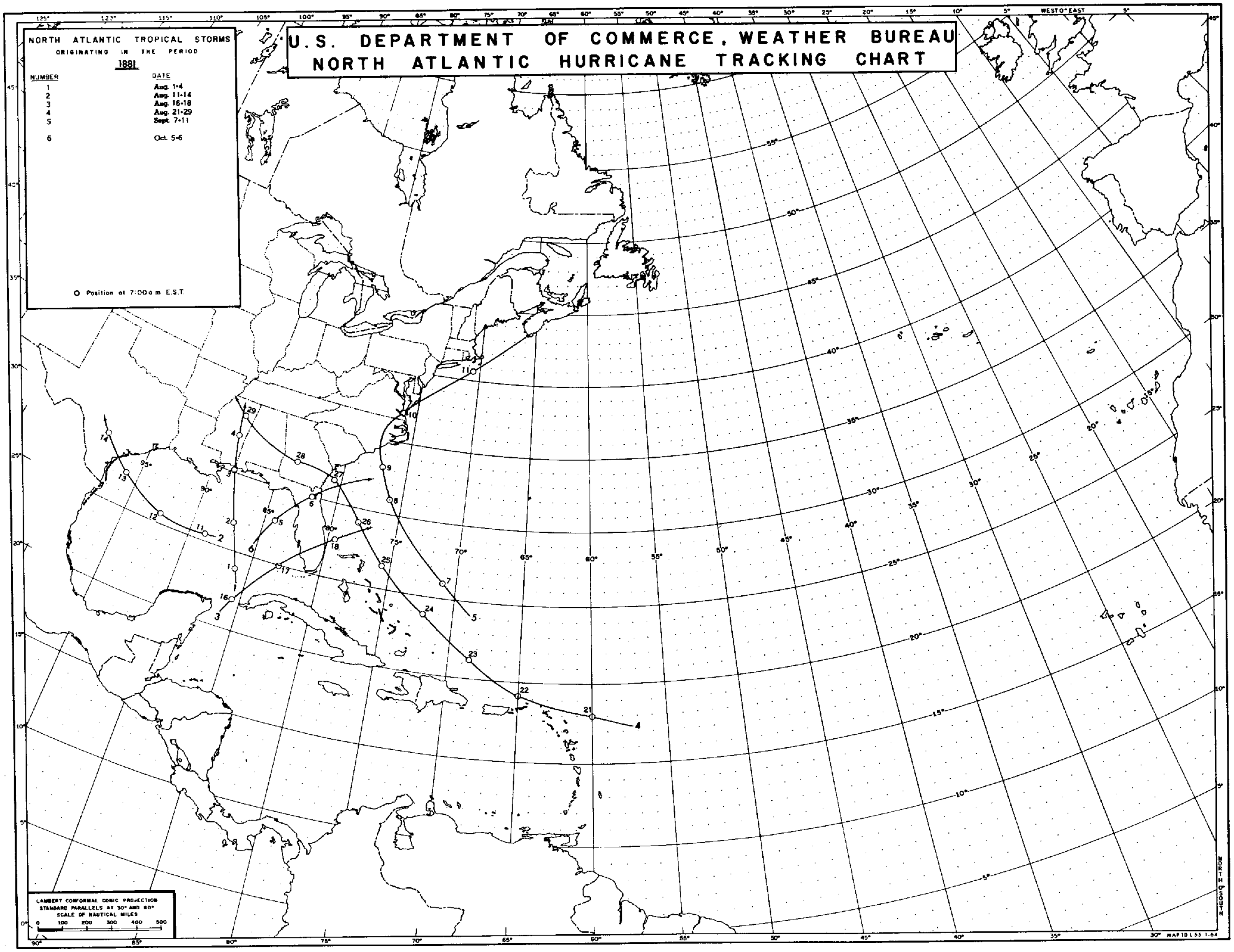

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1877
NUMBER DATE
1 Aug. 1-4
2 Sept. 14-21
3 Sept. 16-22
4 Sept. 21-Oct. 5
5 Sept. 24-29
6 Oct. 13-18
7 Oct. 24-27
8 Nov. 28-30
O Position at 7:00 a.m. E.S.T.

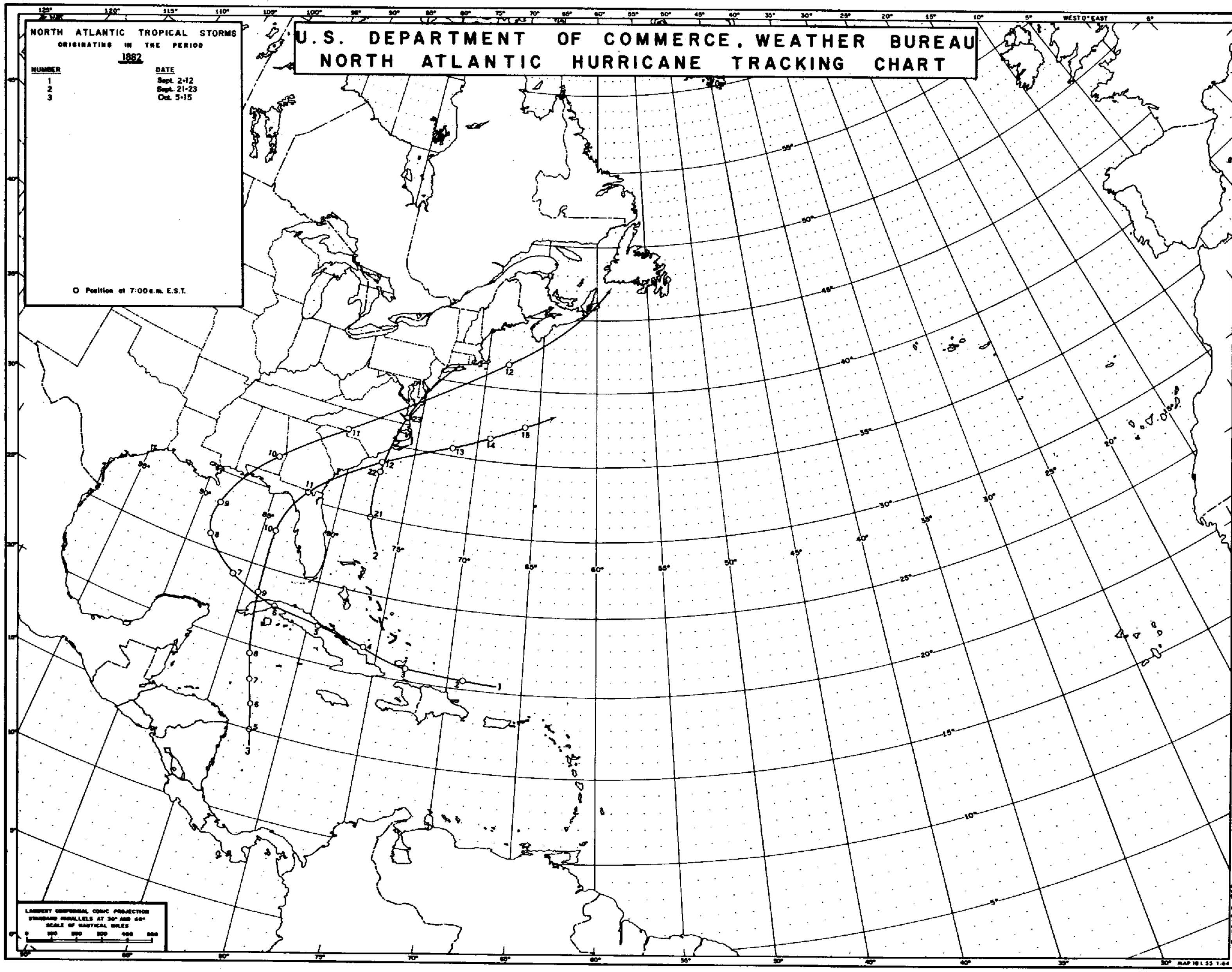


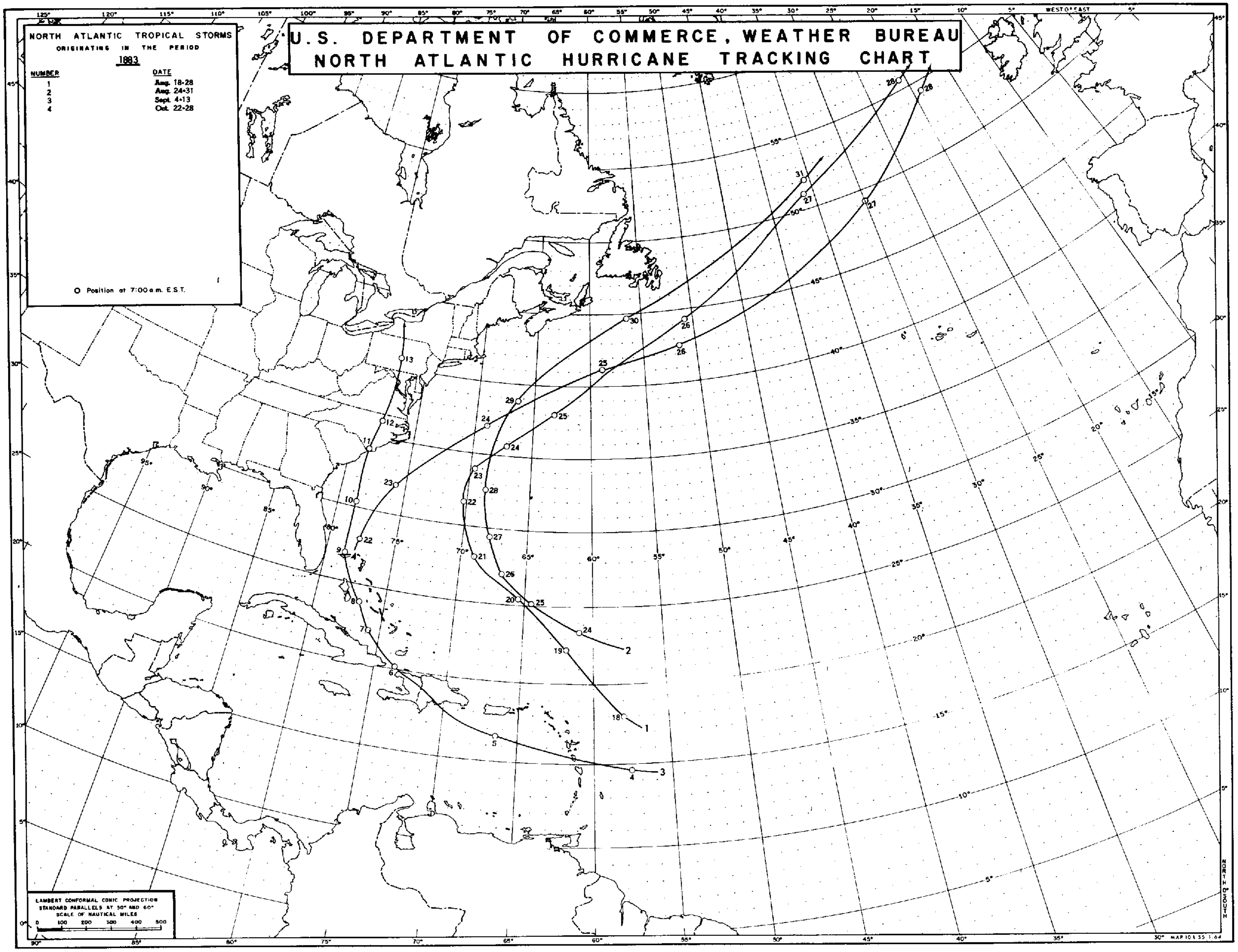
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1878
NUMBER DATE
1 July 1-3
2 Aug. 12-18
3 Sept. 1-13
4 Sept. 12-18
5 Sept. 24-Oct. 6
6 Oct. 9-13
7 Oct. 9-16
8 Oct. 13-19
9 Oct. 18-25
10 Nov. 25-30
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

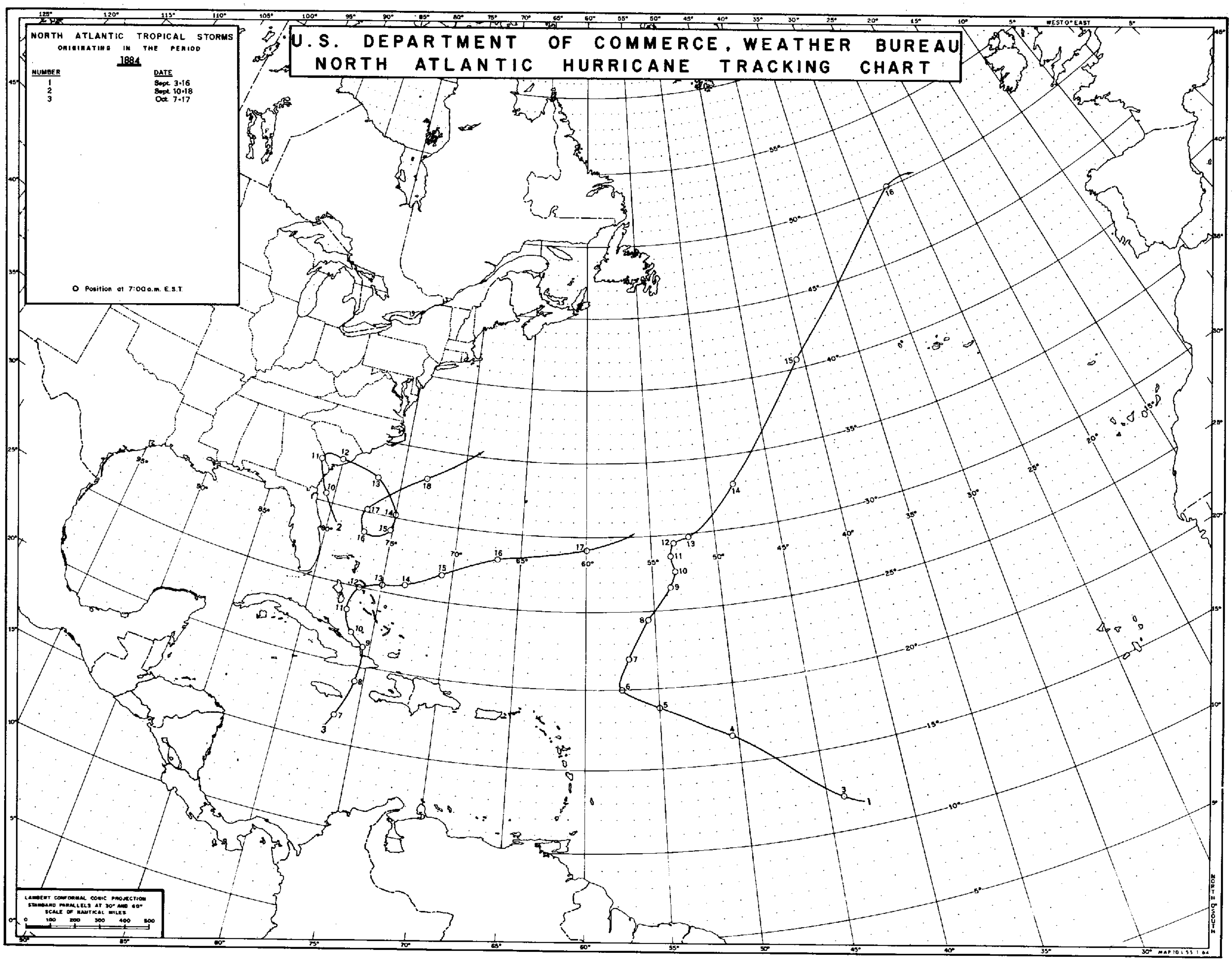

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1879
NUMBER DATE
1 Aug. 13-19
2 Aug. 19-25
3 Aug. 29 - Sept. 2
4 Sept. 11-23
5 Oct. 3-7
6 Oct. 9-16
7 Oct. 24-28
8 Nov. 16-21
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

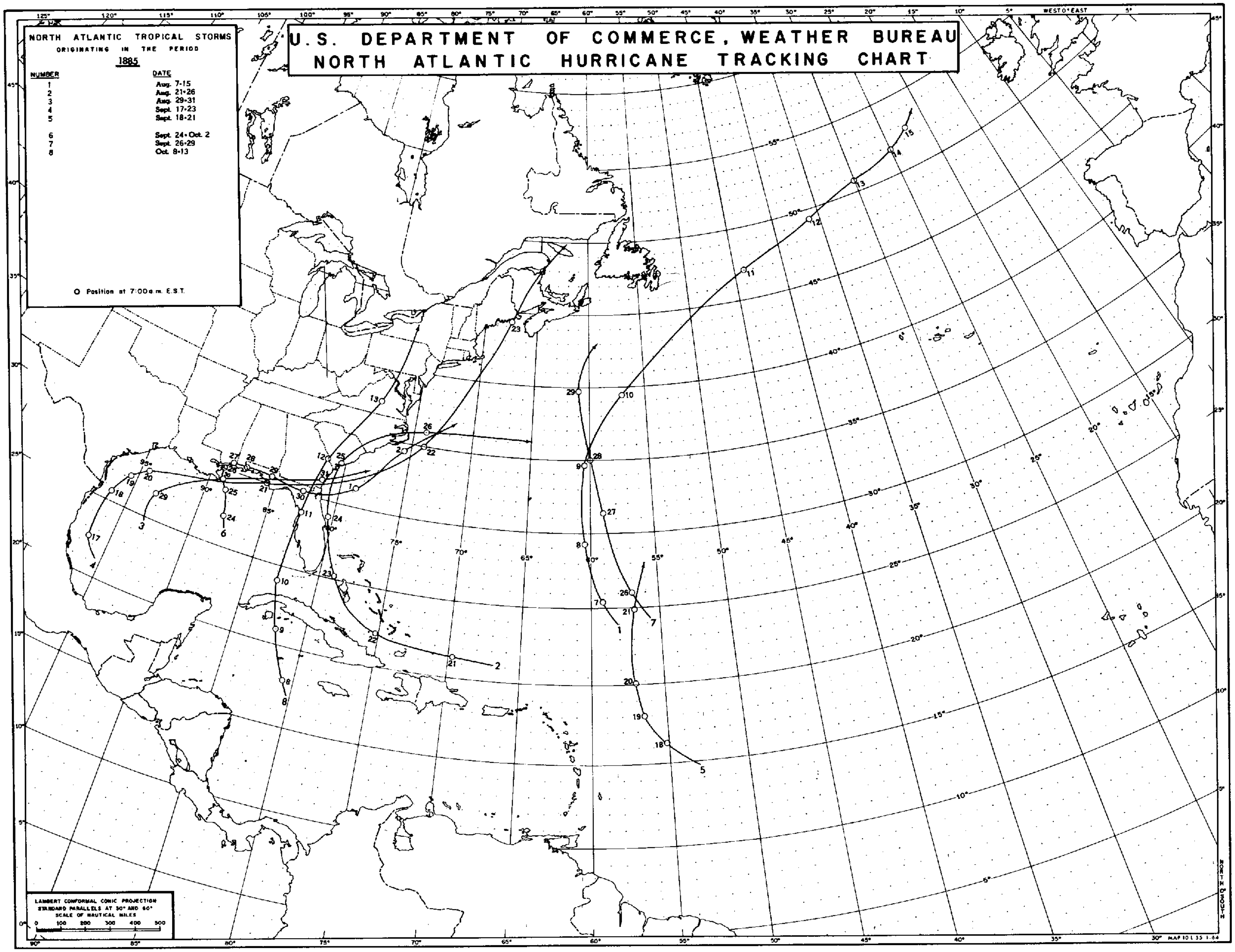

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1880
NUMBER DATE
1 June 21-24
2 Aug. 4-14
3 Aug. 15-20
4 Aug. 24-Sept. 2
5 Aug. 27-Sept. 4
6 Sept. 7-11
7 Sept. 27-Oct. 4
8 Oct. 6-11
9 Oct. 21-24
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
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

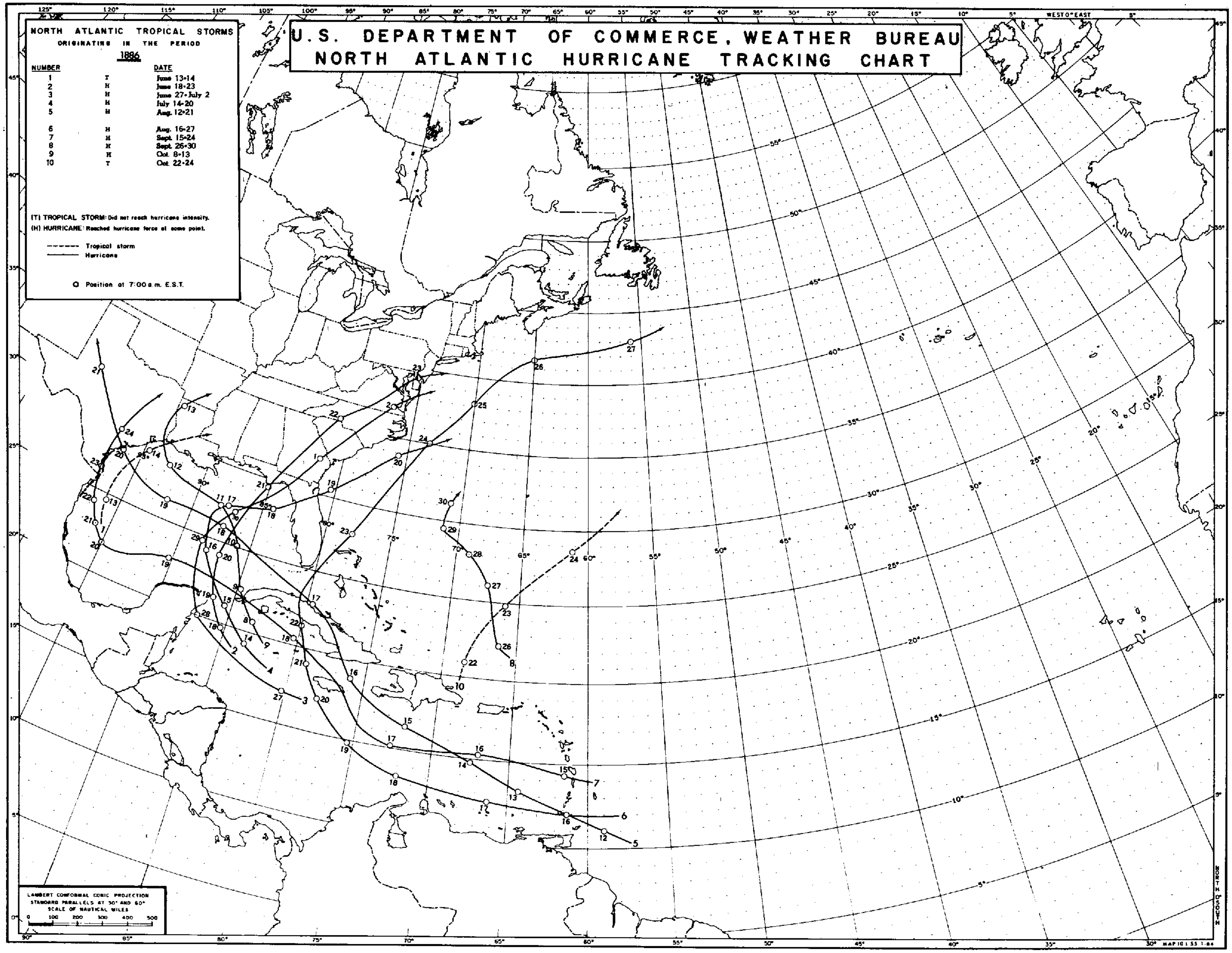

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1882
NUMBER DATE
1 Sept. 2-12
2 Sept. 21-23
3 Oct. 5-15
O Position at 7:00 a.m. E.S.T.

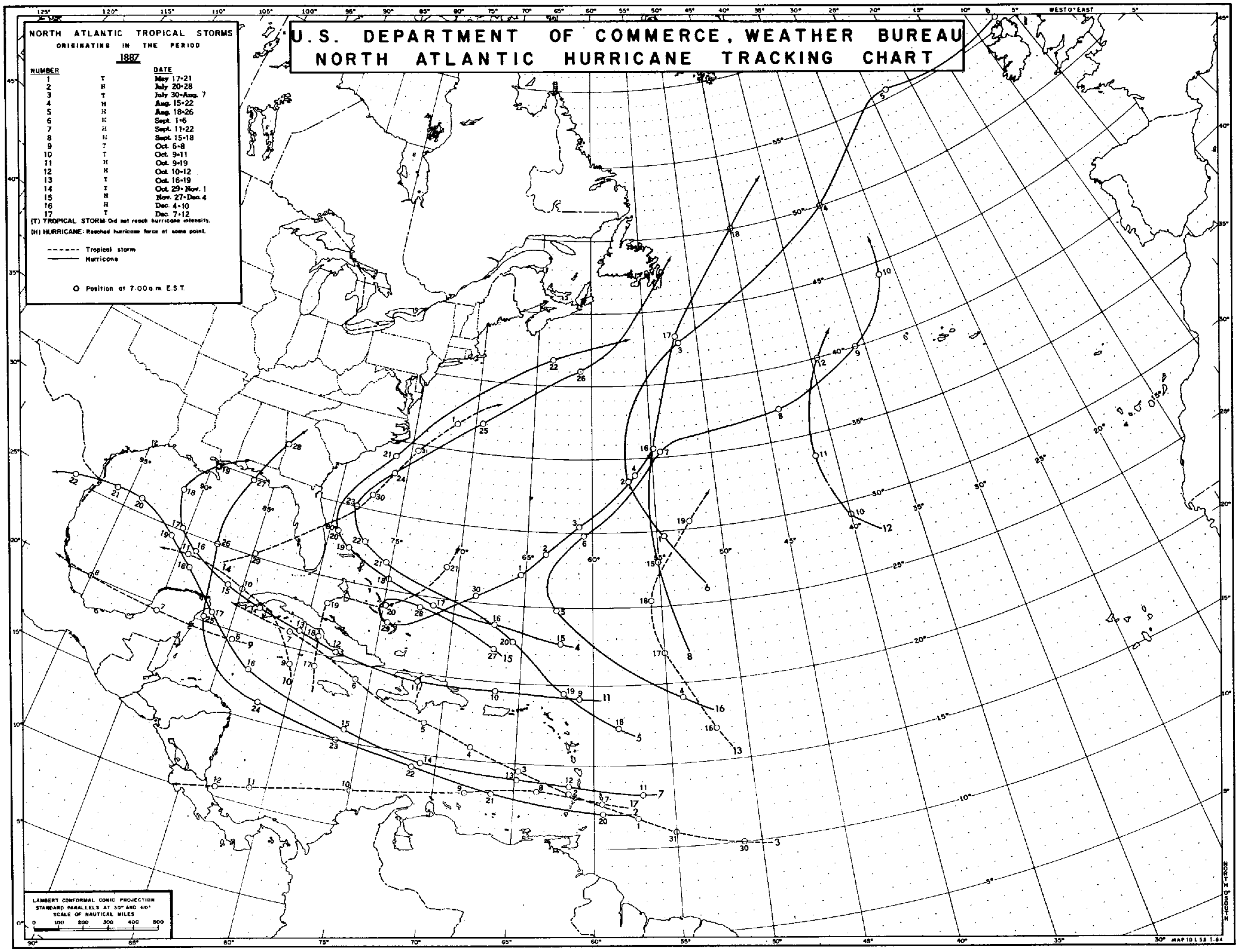

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1883
NUMBER
DATE
1 Aug. 18-28
2 Aug. 24-31
3 Sept. 4-13
4 Oct. 22-28
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

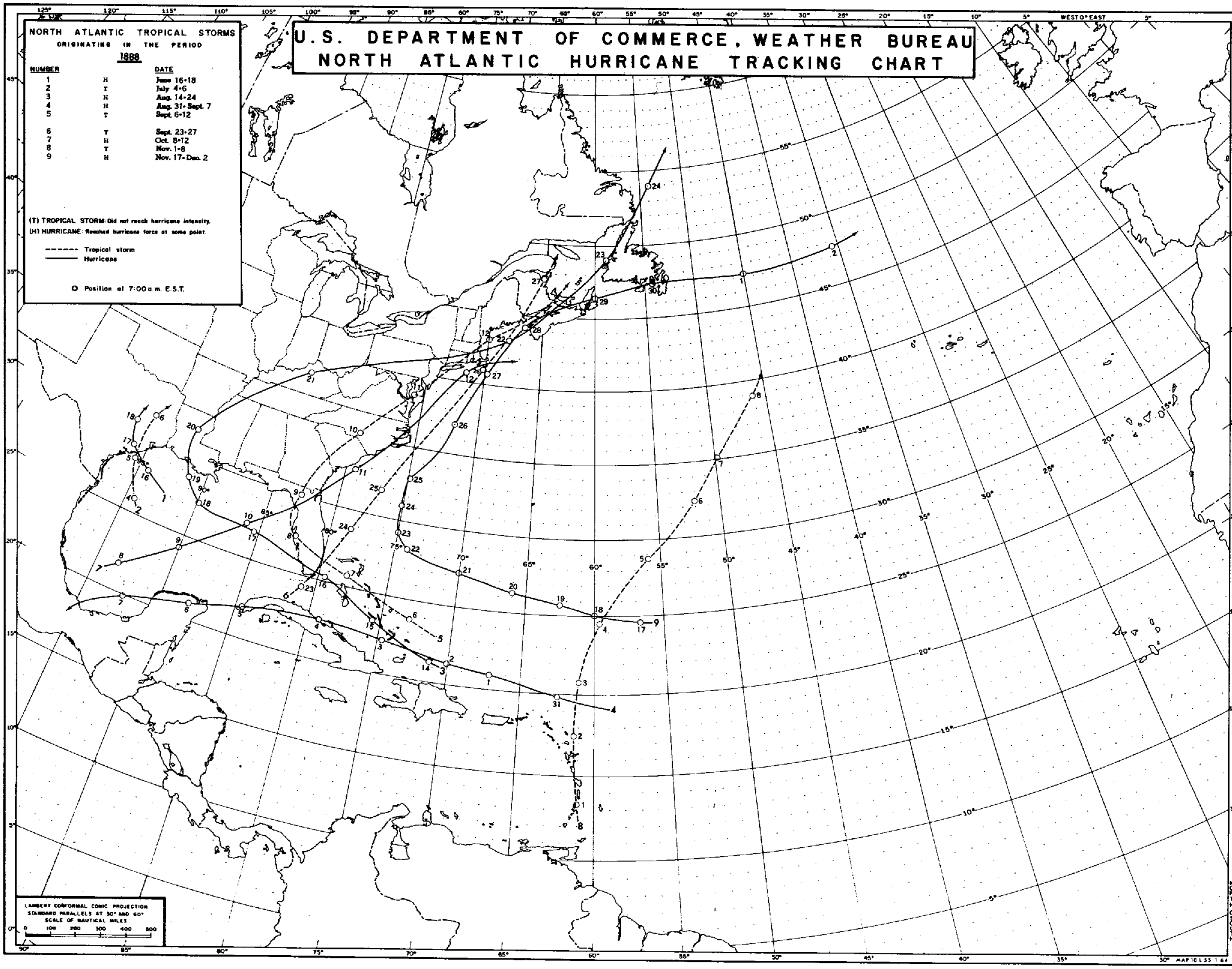

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1884
NUMBER
DATE
1
Sept. 3-16
2
Sept. 10-18
3
Oct. 7-17
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

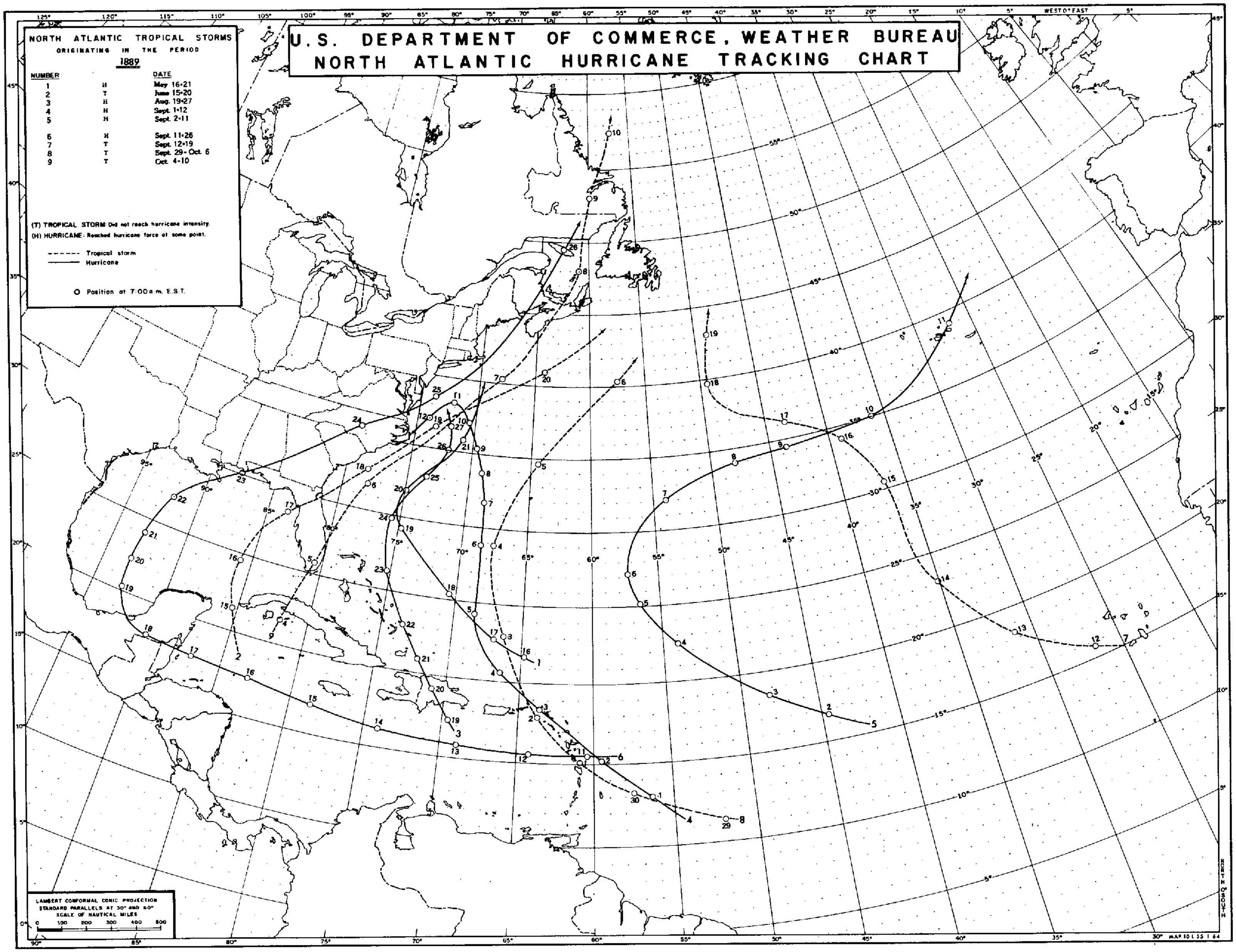


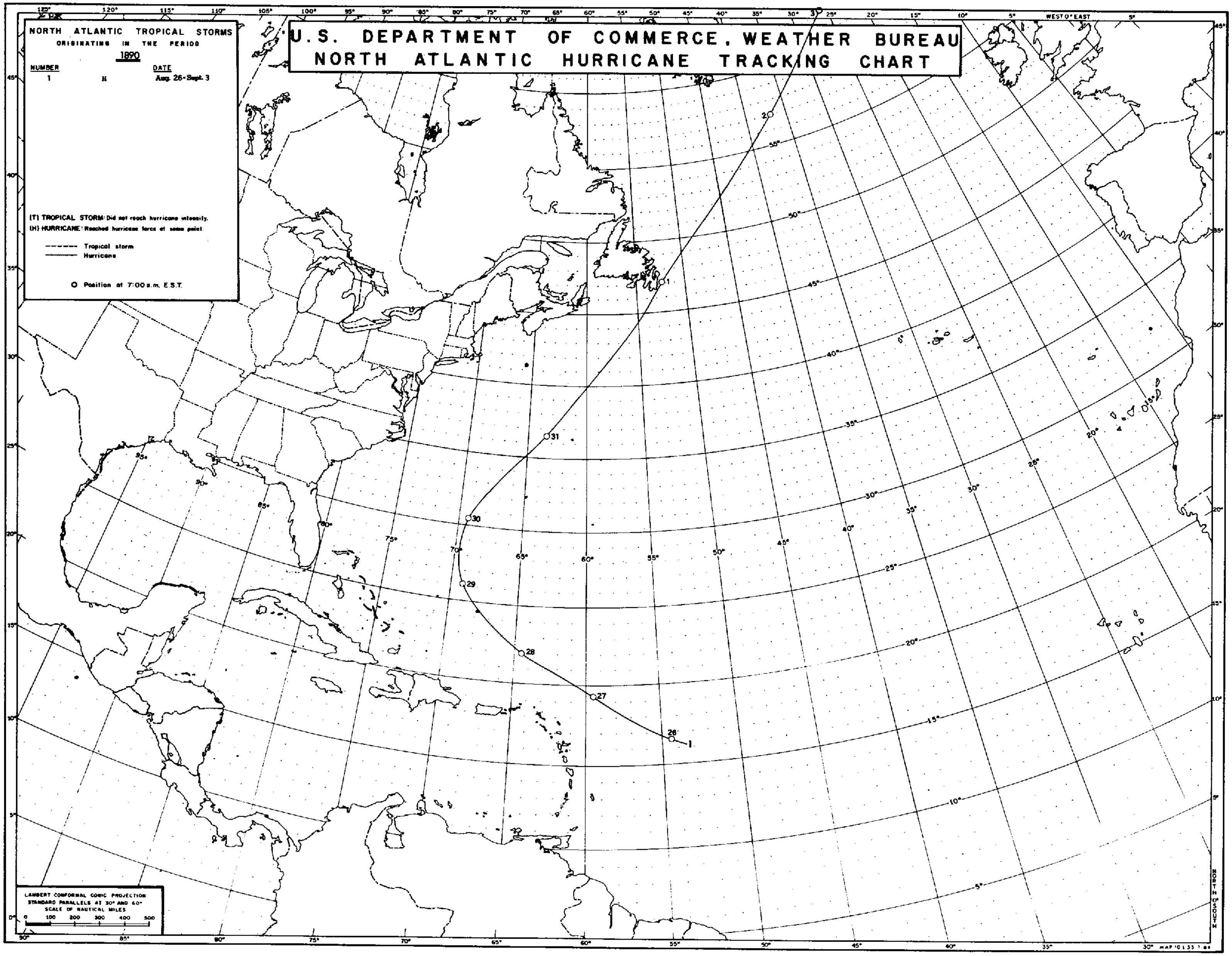
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1885
NUMBER
DATE
1 Aug. 7-15
2 Aug. 21-26
3 Aug. 29-31
4 Sept. 17-23
5 Sept. 18-21
6 Sept. 24-Oct. 2
7 Sept. 26-29
8 Oct. 8-13
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

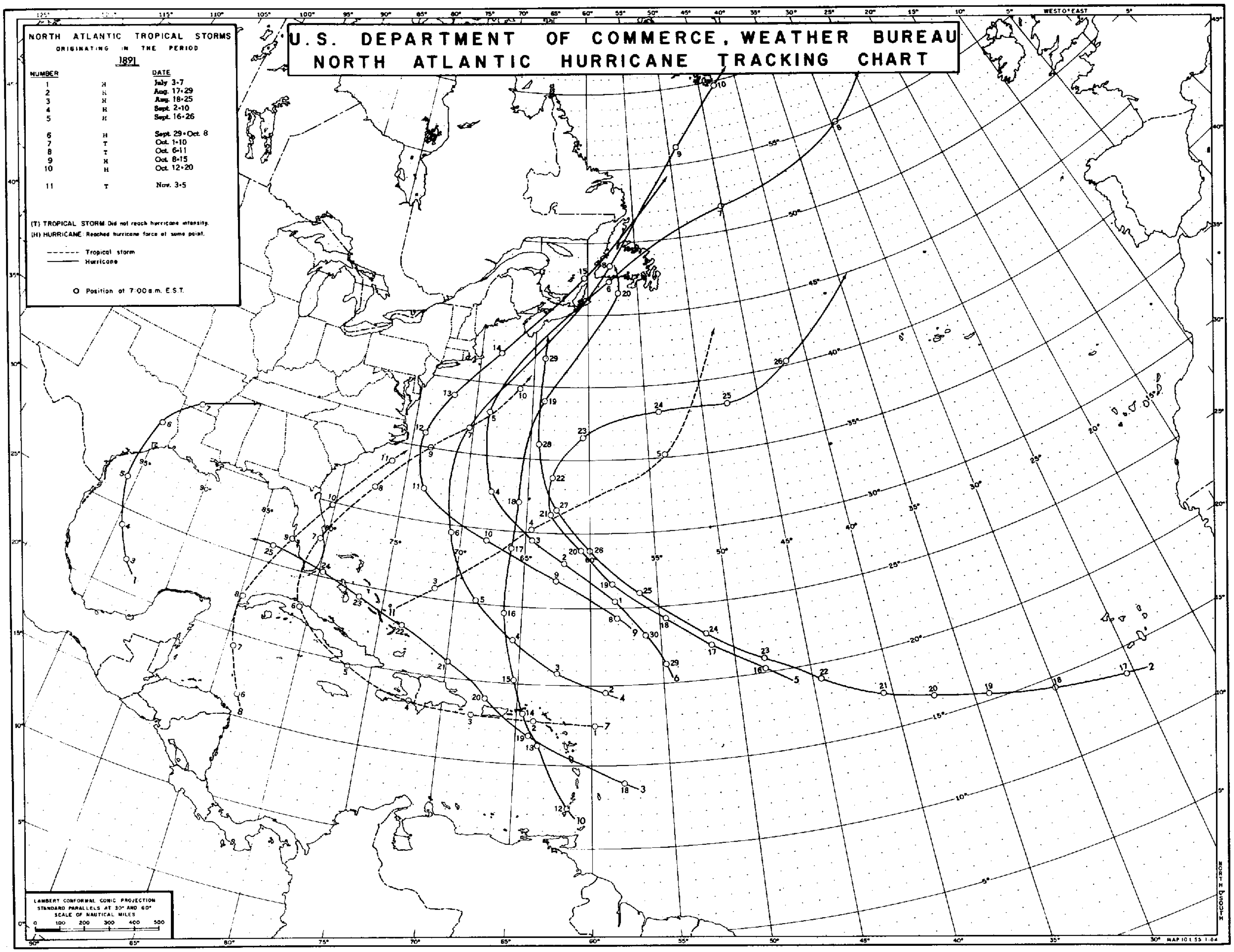

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1886
NUMBER
DATE
1 T June 13-14
2 H June 18-23
3 H June 27-July 2
4 H July 14-20
5 H Aug. 12-21
6 H Aug. 16-27
7 H Sept. 15-24
8 H Sept. 26-30
9 H Oct. 8-13
10 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

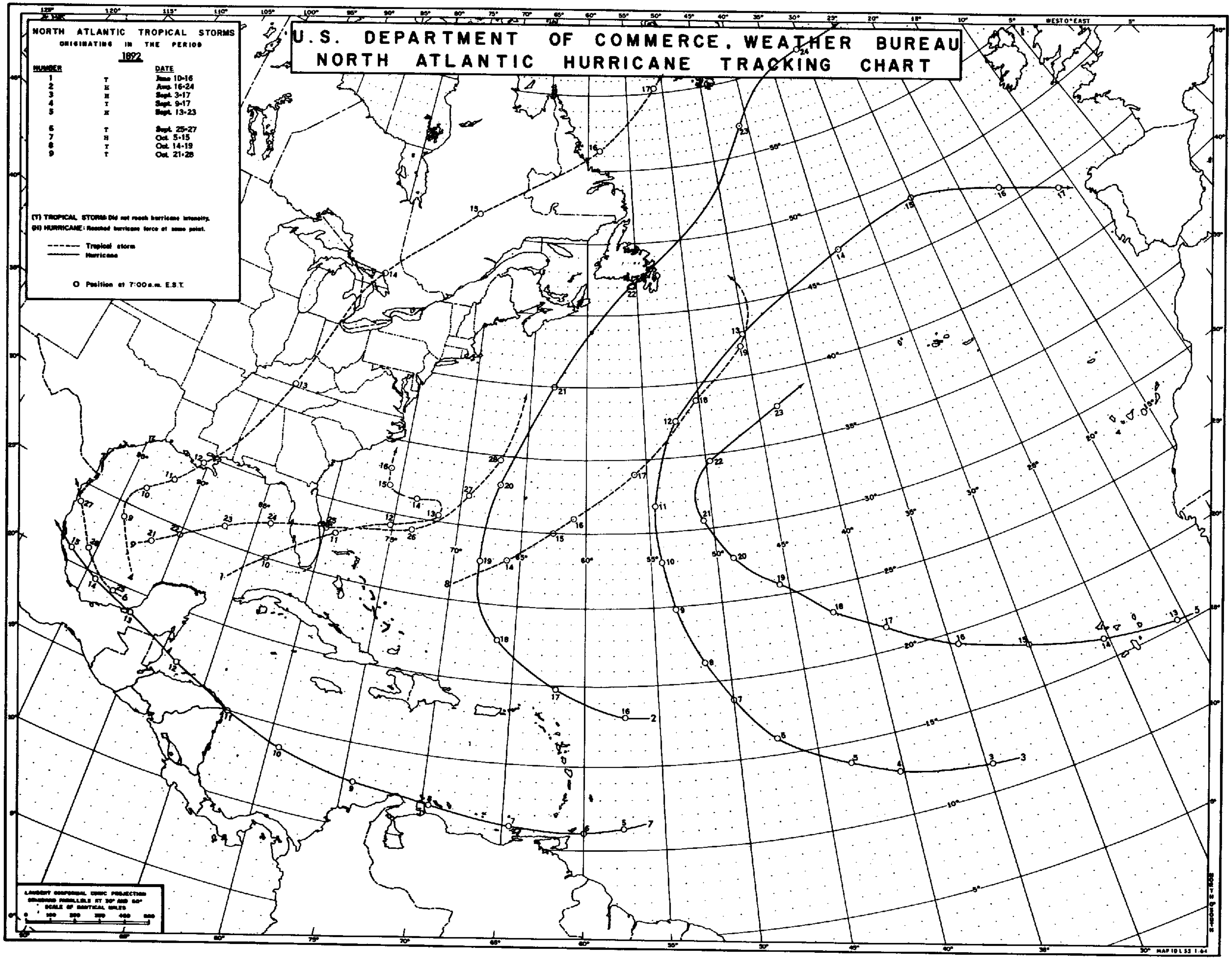

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1887
NUMBER DATE
1 T May 17-21
2 H July 20-28
3 T July 30-Aug. 7
4 H Aug. 15-22
5 H Aug. 18-26
6 H Sept. 1-6
7 H Sept. 11-22
8 H Sept. 15-18
9 T Oct. 6-8
10 T Oct. 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

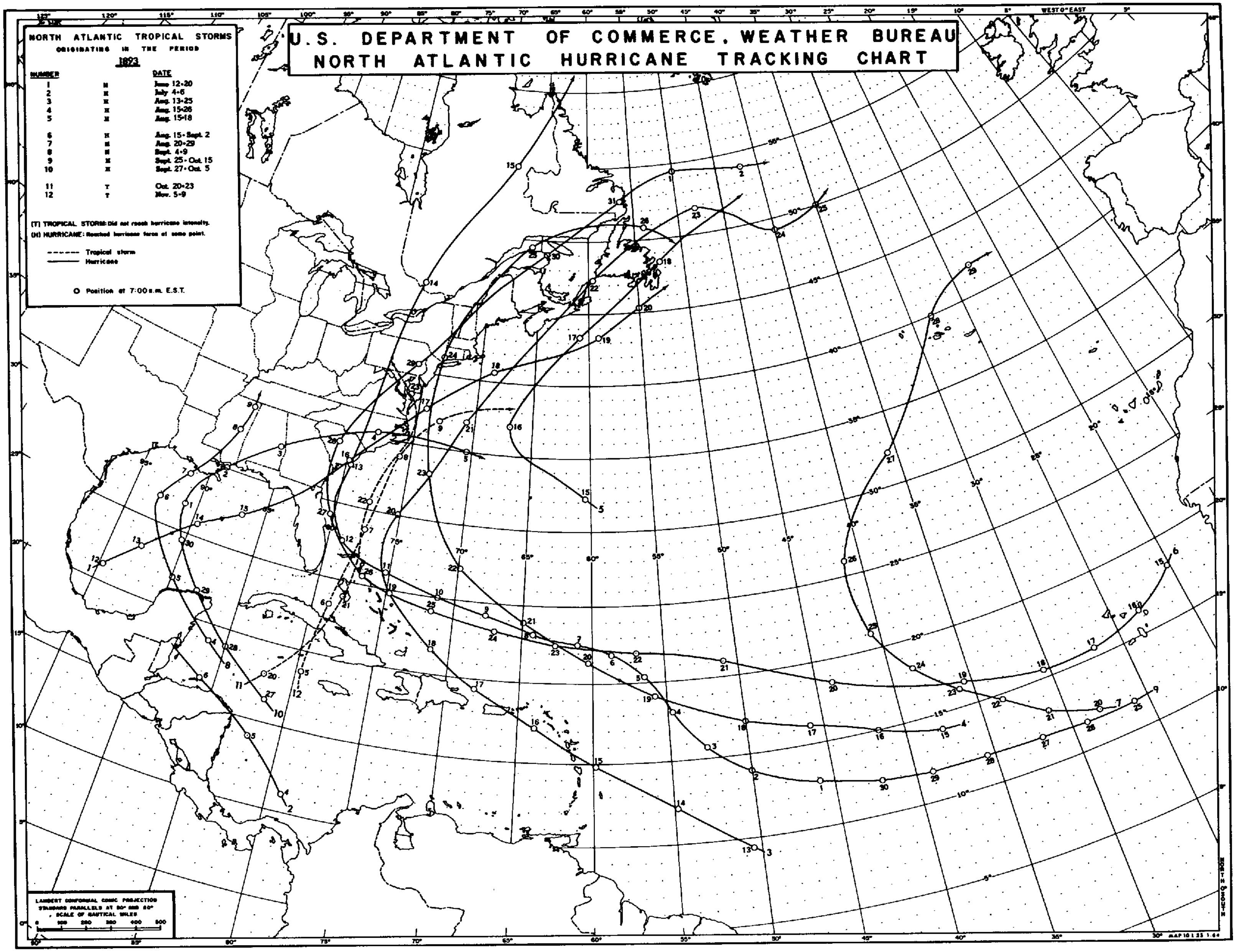

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1888
NUMBER DATE
1 H June 16-18
2 T July 4-6
3 H Aug. 14-24
4 H Aug. 31- Sept. 7
5 T Sept. 6-12
6 T Sept. 23-27
7 H Oct. 8-12
8 T Nov. 1-8
9 H Nov. 17- Dec. 2
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.

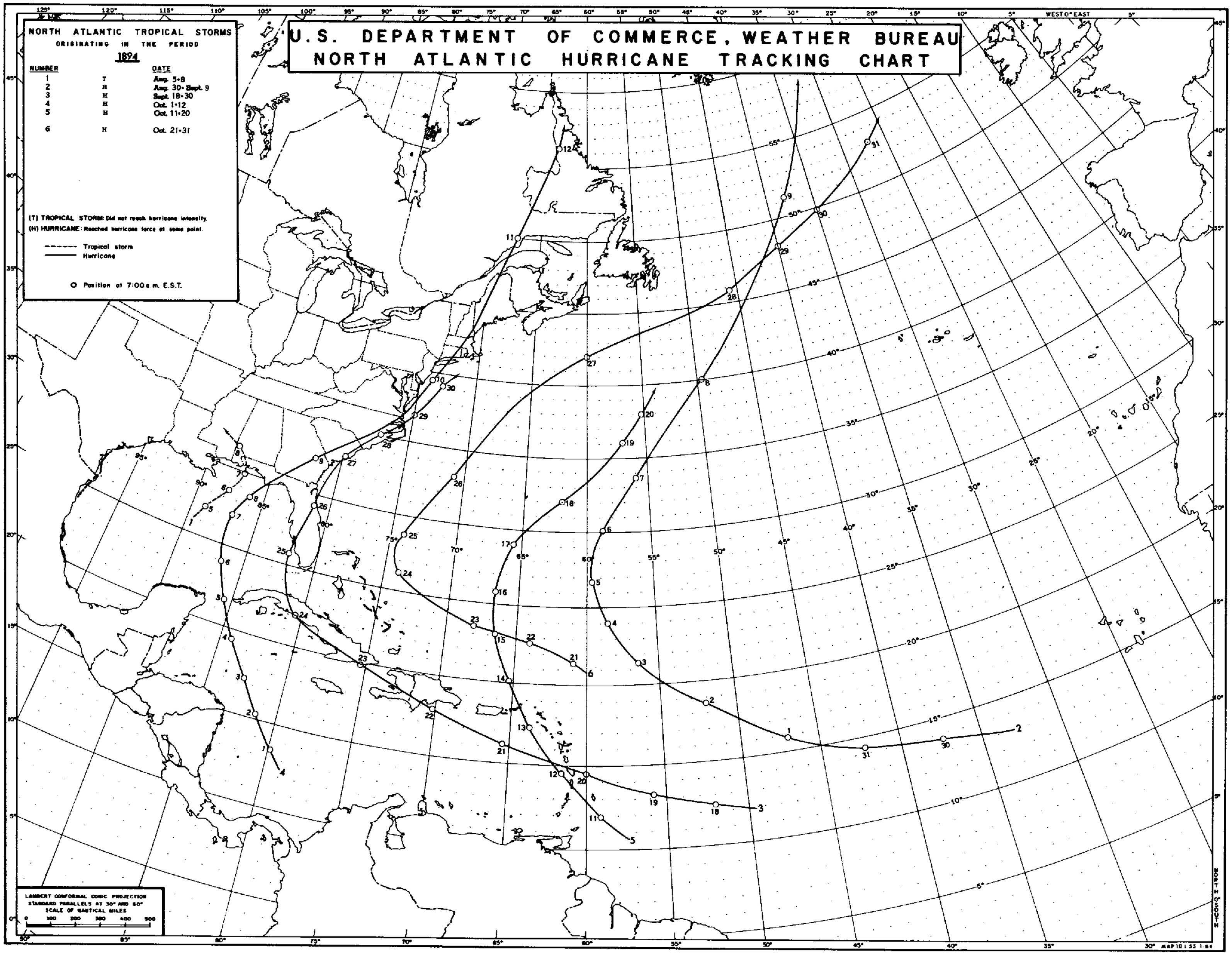

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1889
NUMBER DATE
1 H May 16-21
2 T June 15-20
3 H Aug. 19-27
4 H Sept. 1-12
5 H Sept. 2-11
6 H Sept. 11-26
7 T Sept. 12-19
8 T Sept. 29- Oct. 6
9 T Oct. 4-10
(T) 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.

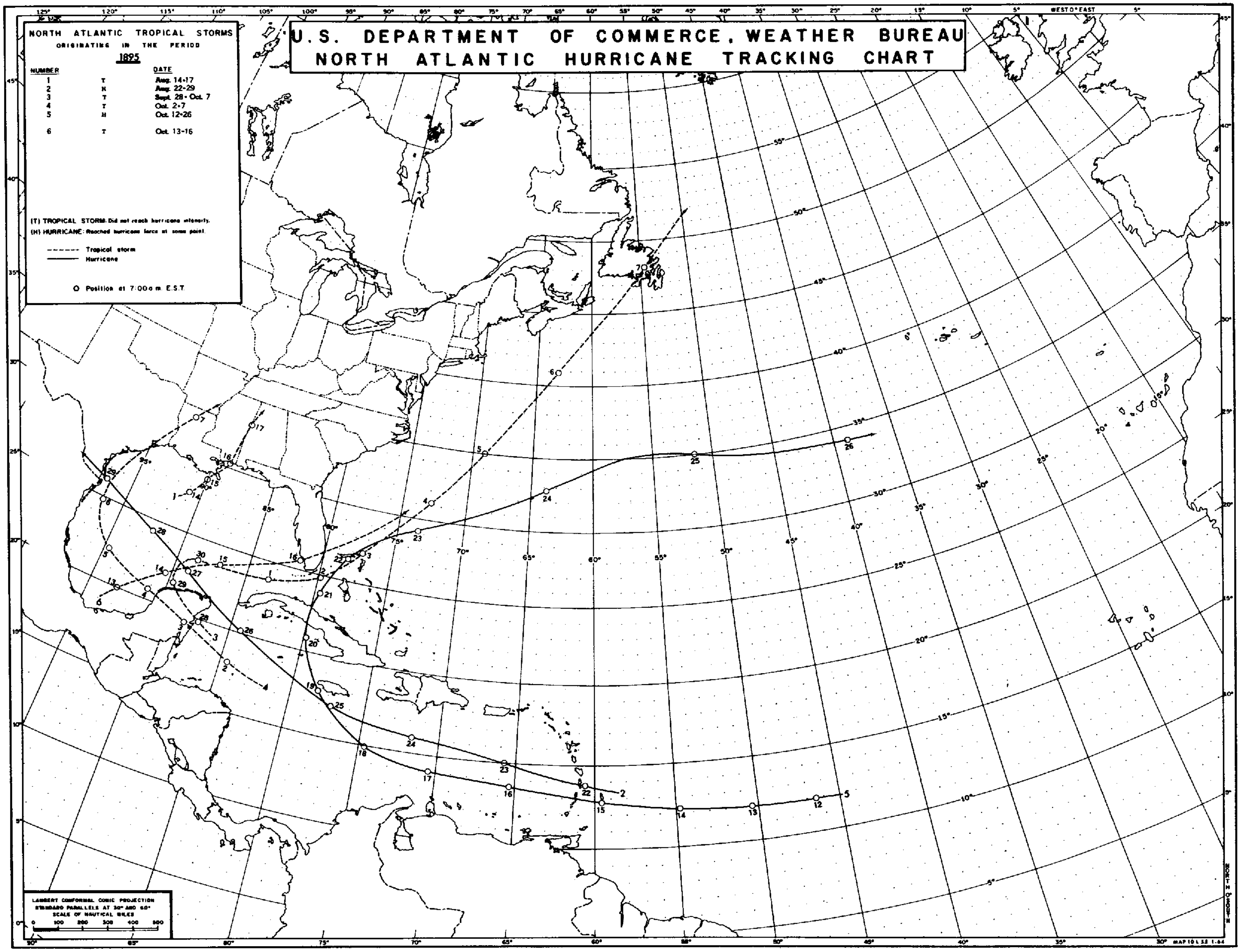

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1890
NUMBER
DATE
1
H
Aug. 26-Sept. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
26
27
28
29
30
31
1
2
3
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

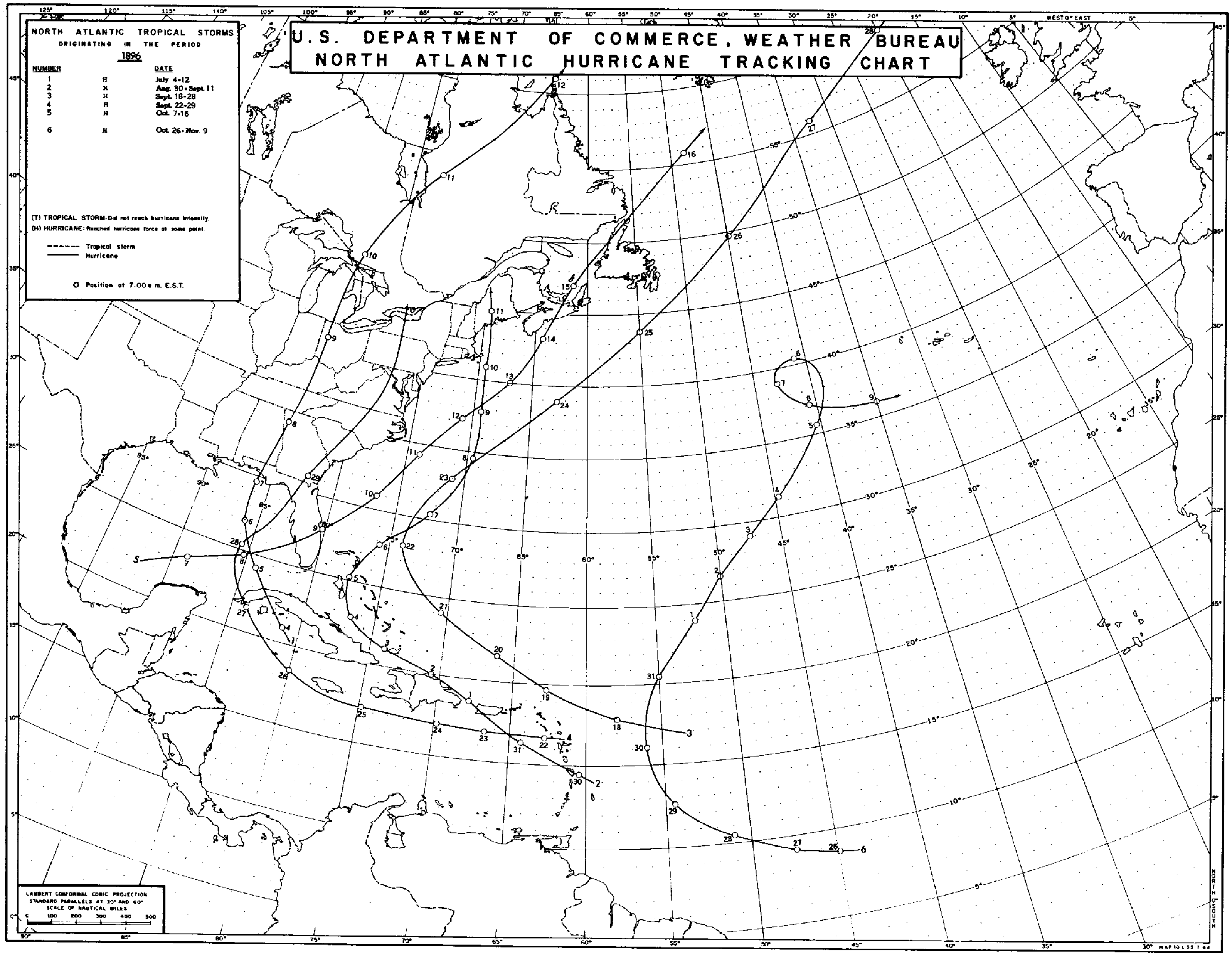

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1891
NUMBER
DATE
1 H July 3-7
2 H Aug. 17-29
3 H Aug. 18-25
4 H Sept. 2-10
5 H Sept. 16-26
6 H Sept. 29-Oct. 8
7 T Oct. 1-10
8 T Oct. 6-11
9 H Oct. 8-15
10 H Oct. 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. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

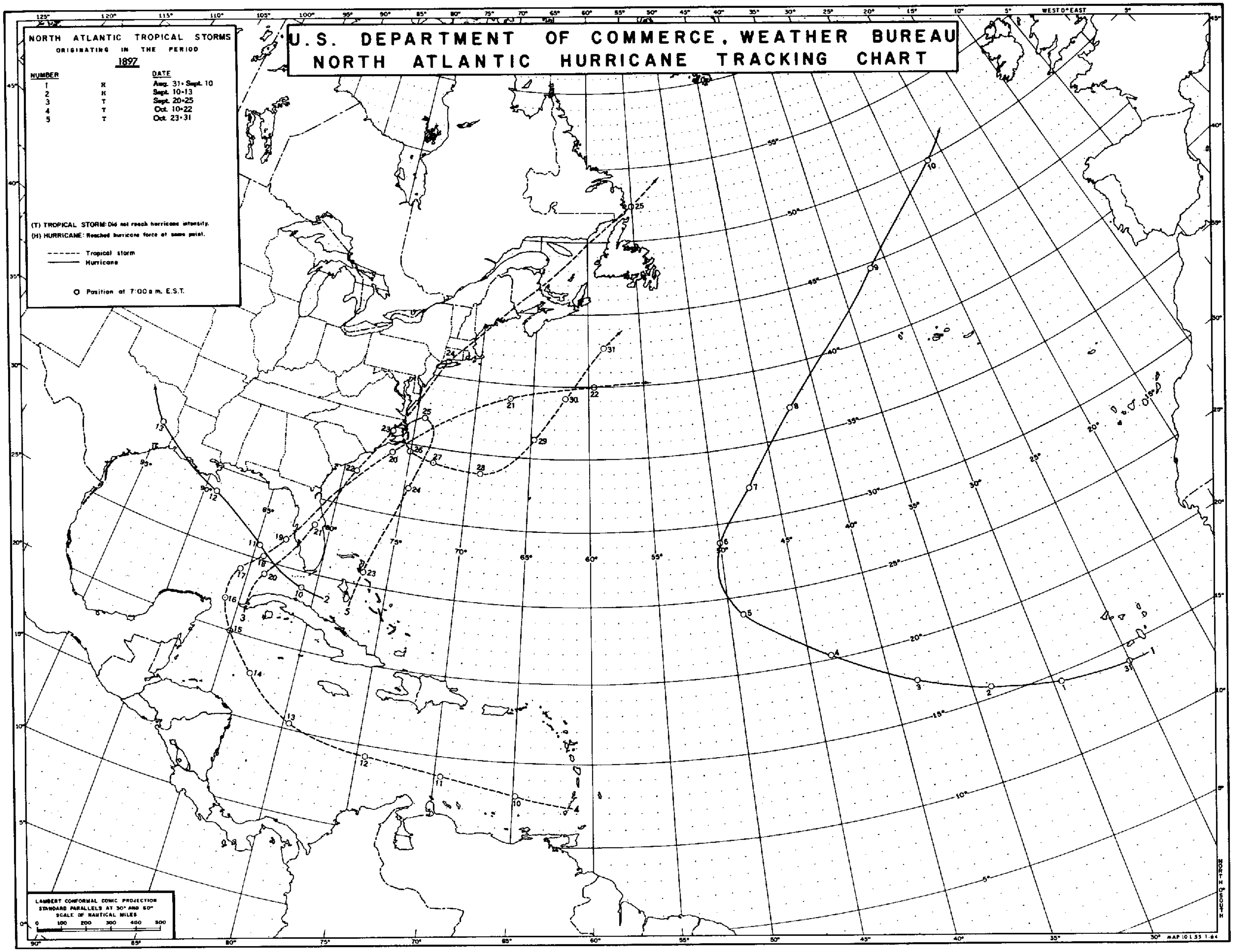

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1892
NUMBER
DATE
1 T June 10-16
2 H Aug. 16-24
3 H Sept. 3-17
4 T Sept. 9-17
5 H Sept. 13-23
6 T Sept. 25-27
7 H Oct. 5-15
8 T Oct. 14-19
9 T Oct. 21-28
(T) TROPICAL 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.

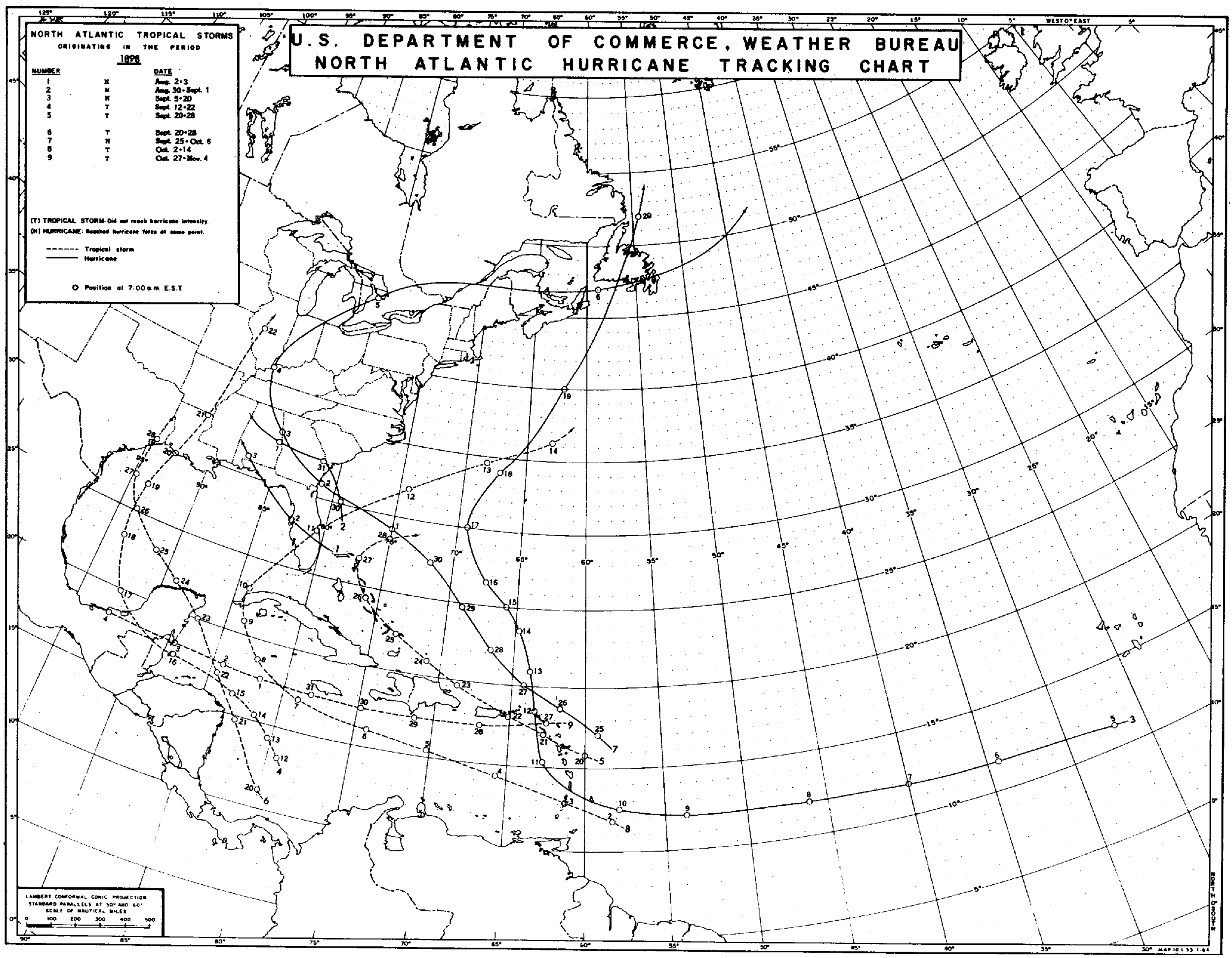

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1893
NUMBER DATE
1 H June 12-20
2 H July 4-6
3 H Aug. 13-25
4 H Aug. 15-26
5 H Aug. 15-18
6 H Aug. 15-Sept. 2
7 H Aug. 20-29
8 H Sept. 4-9
9 H Sept. 25-Oct. 15
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

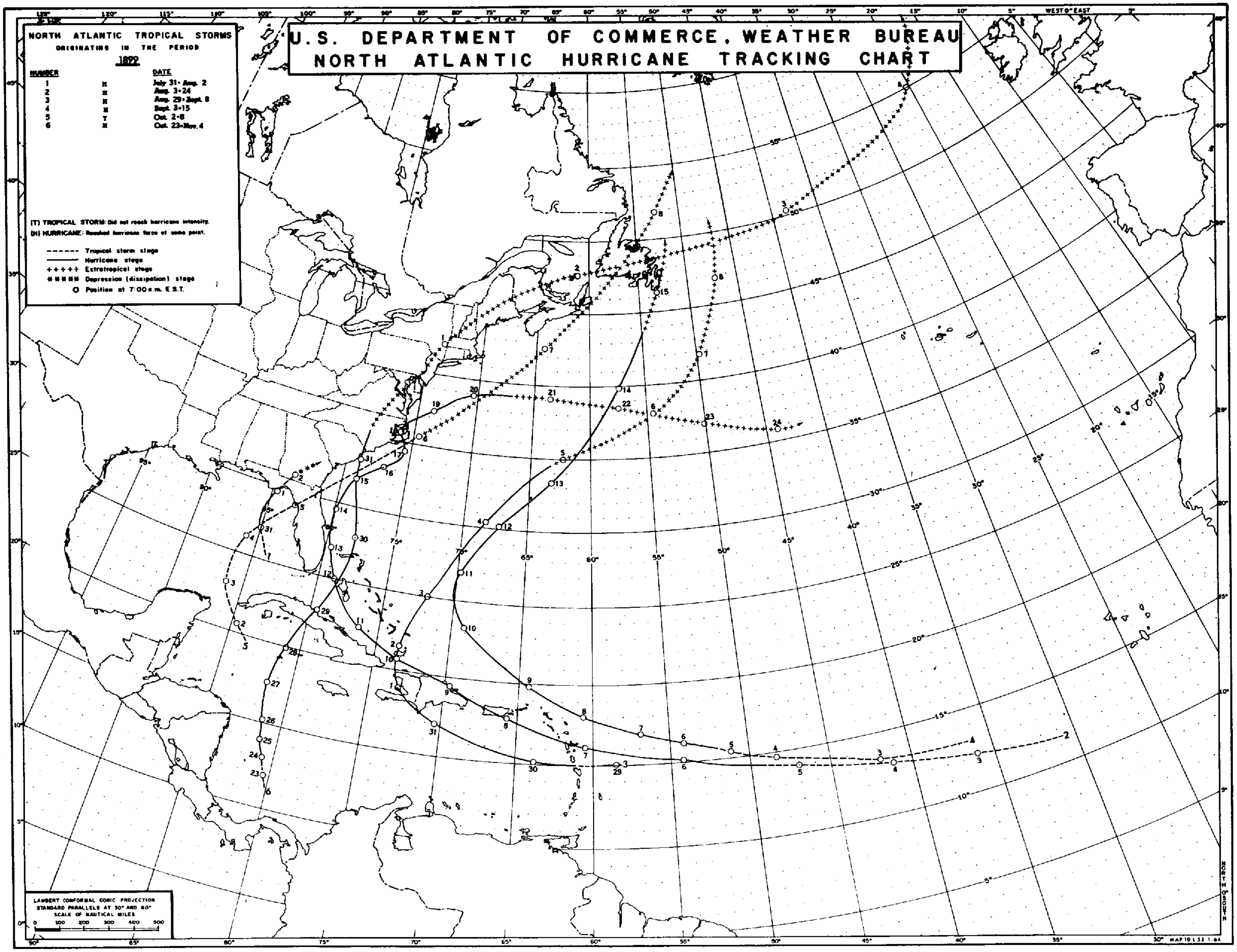

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1894
NUMBER
DATE
1 T Aug. 5-8
2 H Aug. 30-Sept. 9
3 H Sept. 18-30
4 H Oct. 1-12
5 H Oct. 11-20
6 H Oct. 21-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(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

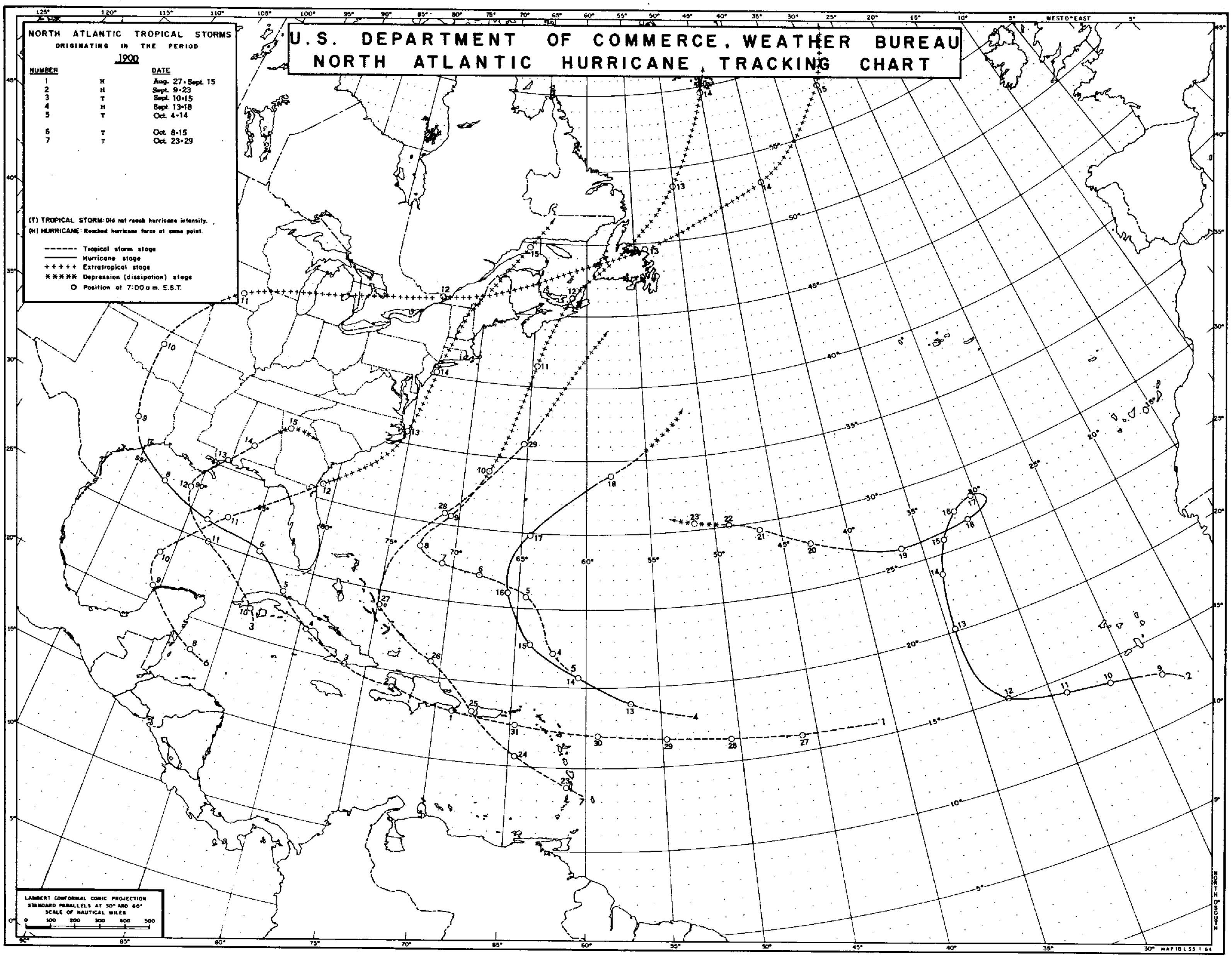

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1895
NUMBER DATE
1 T Aug. 14-17
2 H Aug. 22-29
3 T Sept. 28 - Oct. 7
4 T Oct. 2-7
5 H Oct. 12-26
6 T Oct. 13-16
(T) TROPICAL STORM: Did not reach hurricane intensity.
(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

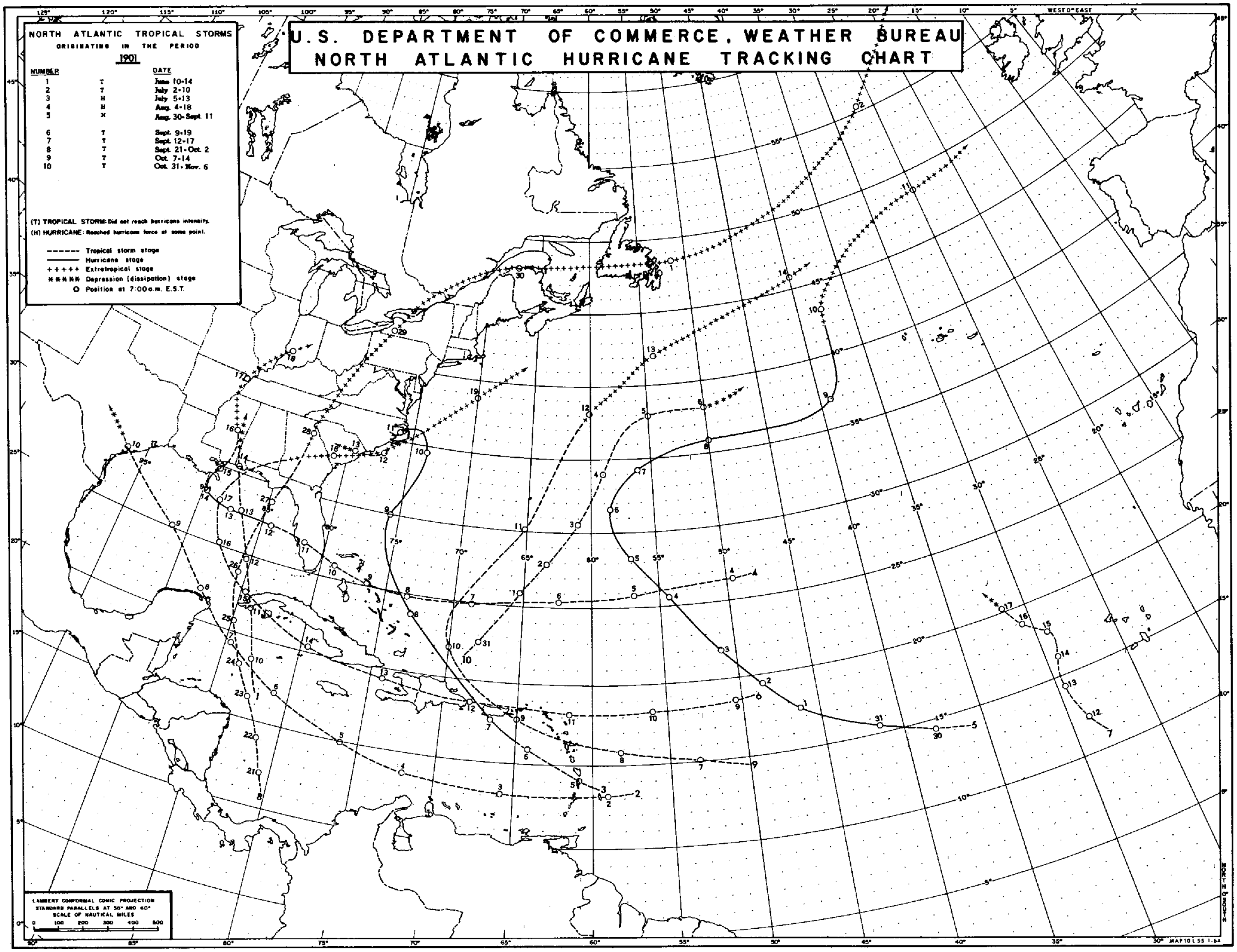

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1896
NUMBER
DATE
1 H July 4-12
2 H Aug. 30-Sept. 11
3 H Sept. 18-28
4 H Sept. 22-29
5 H Oct. 7-16
6 H Oct. 26-Nov. 9
(T) TROPICAL STORM: Did not reach hurricane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

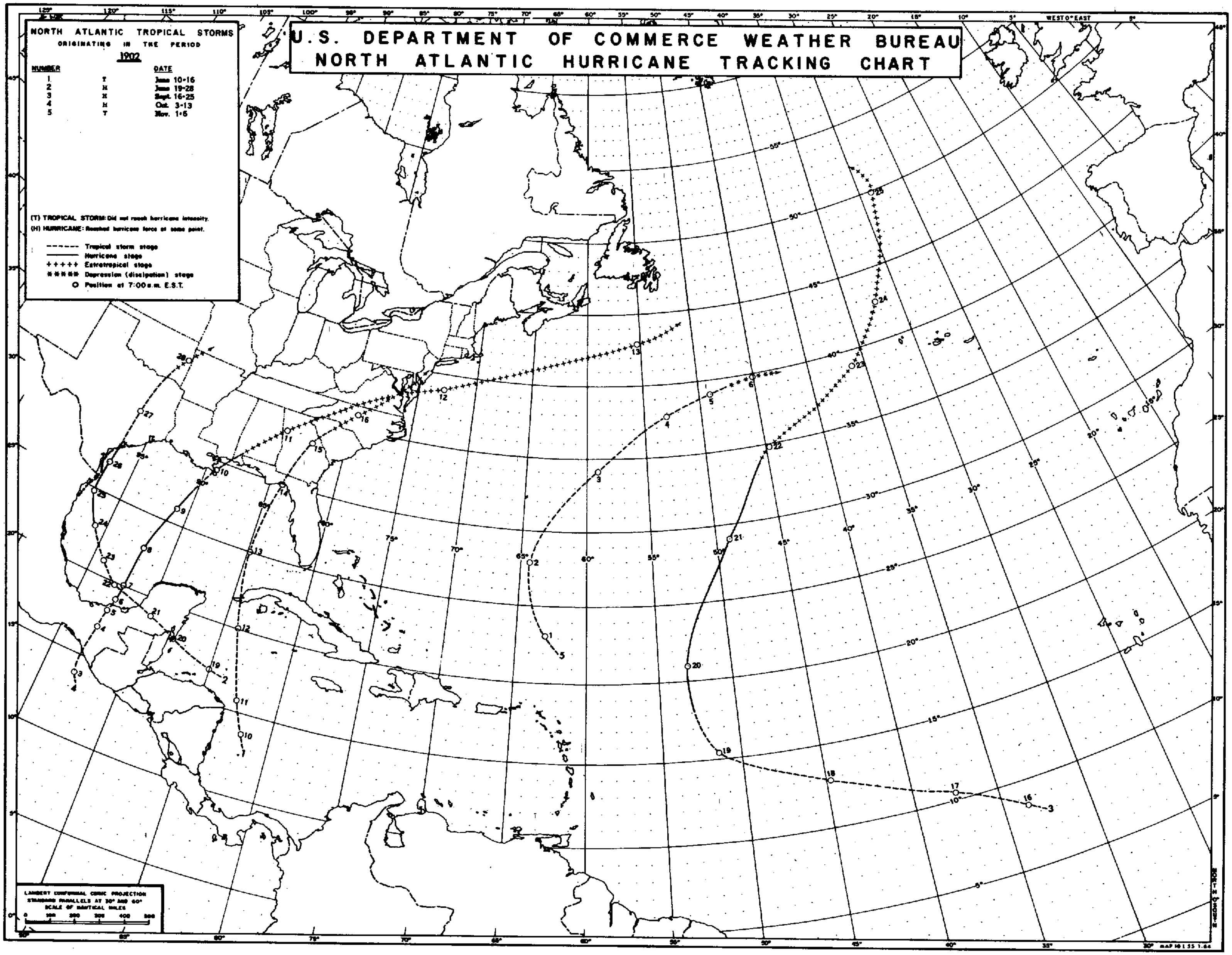

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1897
NUMBER
DATE
1 H Aug. 31 - Sept. 10
2 H Sept. 10-13
3 T Sept. 20-25
4 T Oct. 10-22
5 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) 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

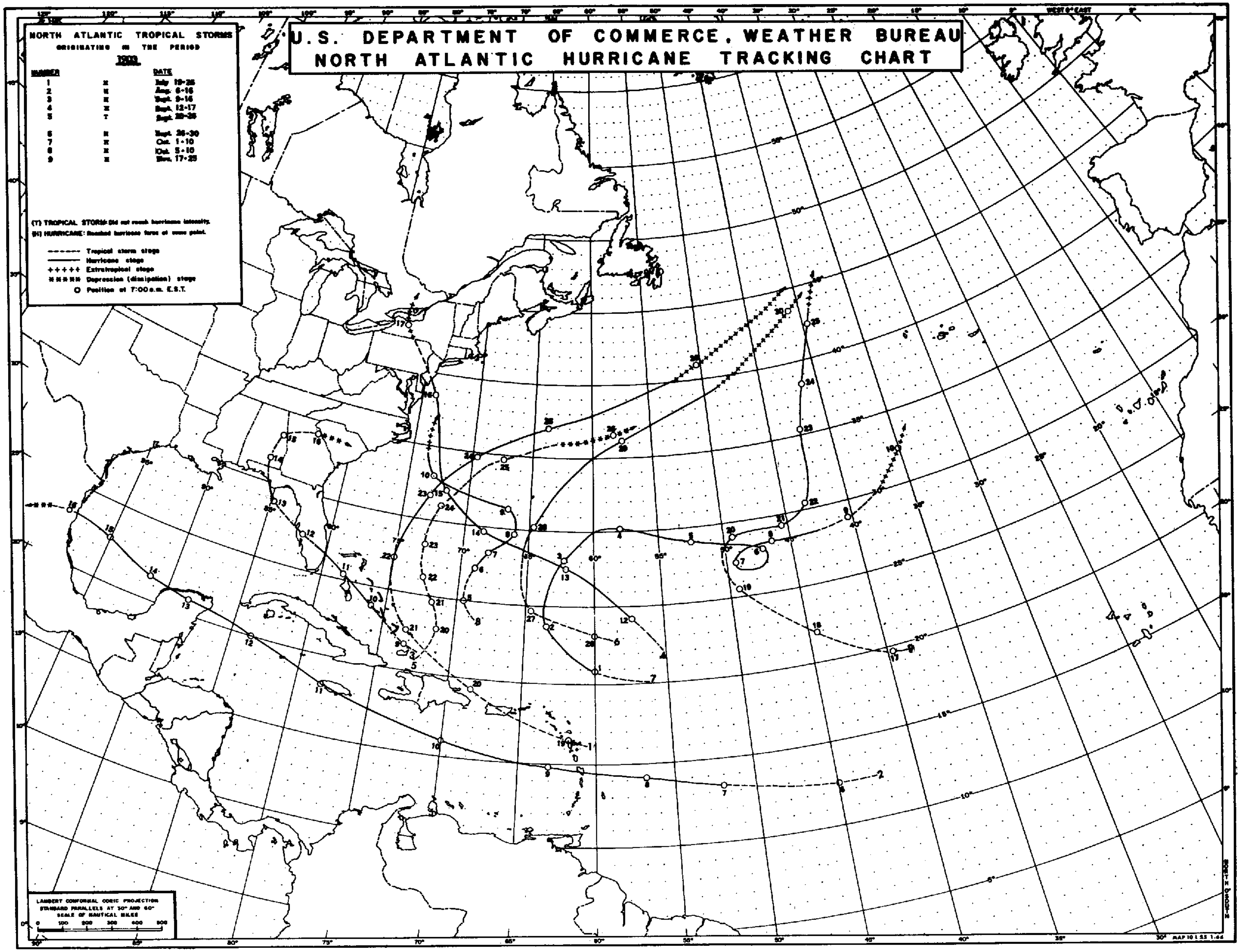

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1898
NUMBER
DATE
1 H Aug. 2-3
2 H Aug. 30-Sept. 1
3 H Sept. 5-20
4 T Sept. 12-22
5 T Sept. 20-28
6 T Sept. 20-28
7 H Sept. 25-Oct. 6
8 T Oct. 2-14
9 T Oct. 27-Nov.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

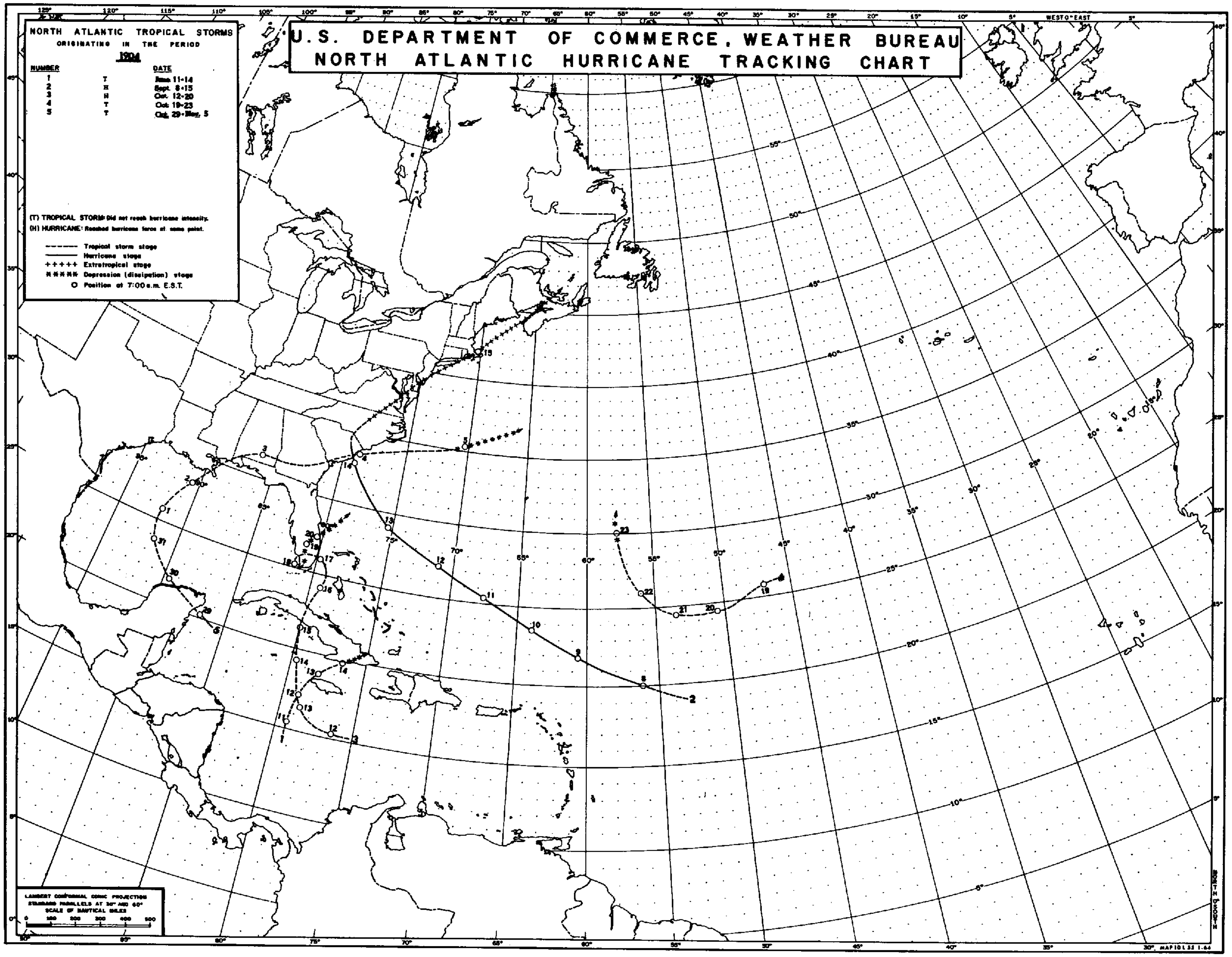

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1899
NUMBER
DATE
1 H July 31 - Aug. 2
2 H Aug. 3-24
3 H Aug. 29 - Sept. 8
4 H Sept. 3-15
5 T Oct. 2-6
6 H Oct. 23-Nov. 4
(T) TROPICAL STORM: Did not reach hurricane 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

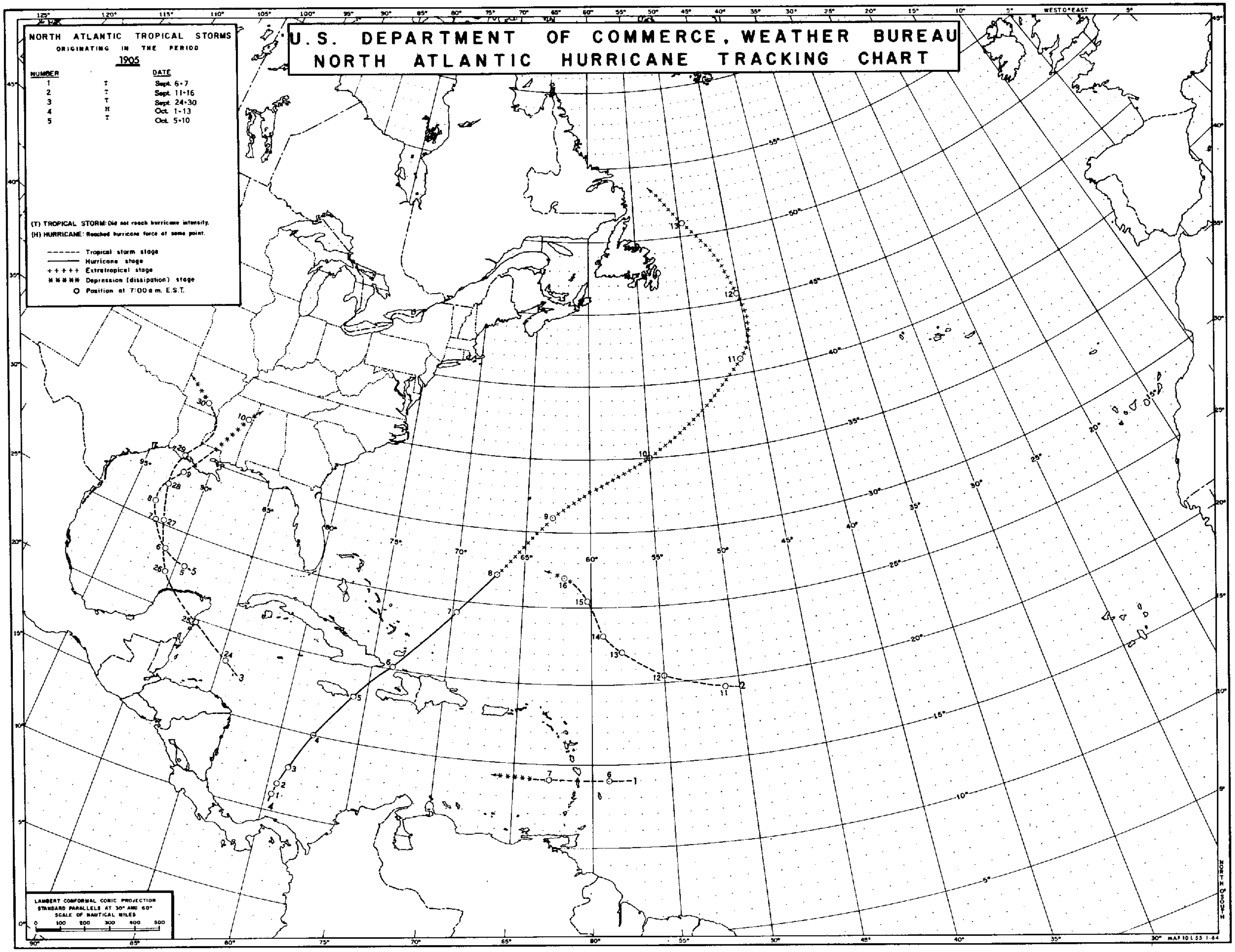

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1900
NUMBER
DATE
1 H Aug. 27 - Sept. 15
2 H Sept. 9 - 23
3 T Sept. 10 - 15
4 H Sept. 13 - 18
5 T Oct. 4 - 14
6 T Oct. 8 - 15
7 T Oct. 23 - 29
(T) TROPICAL STORM: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

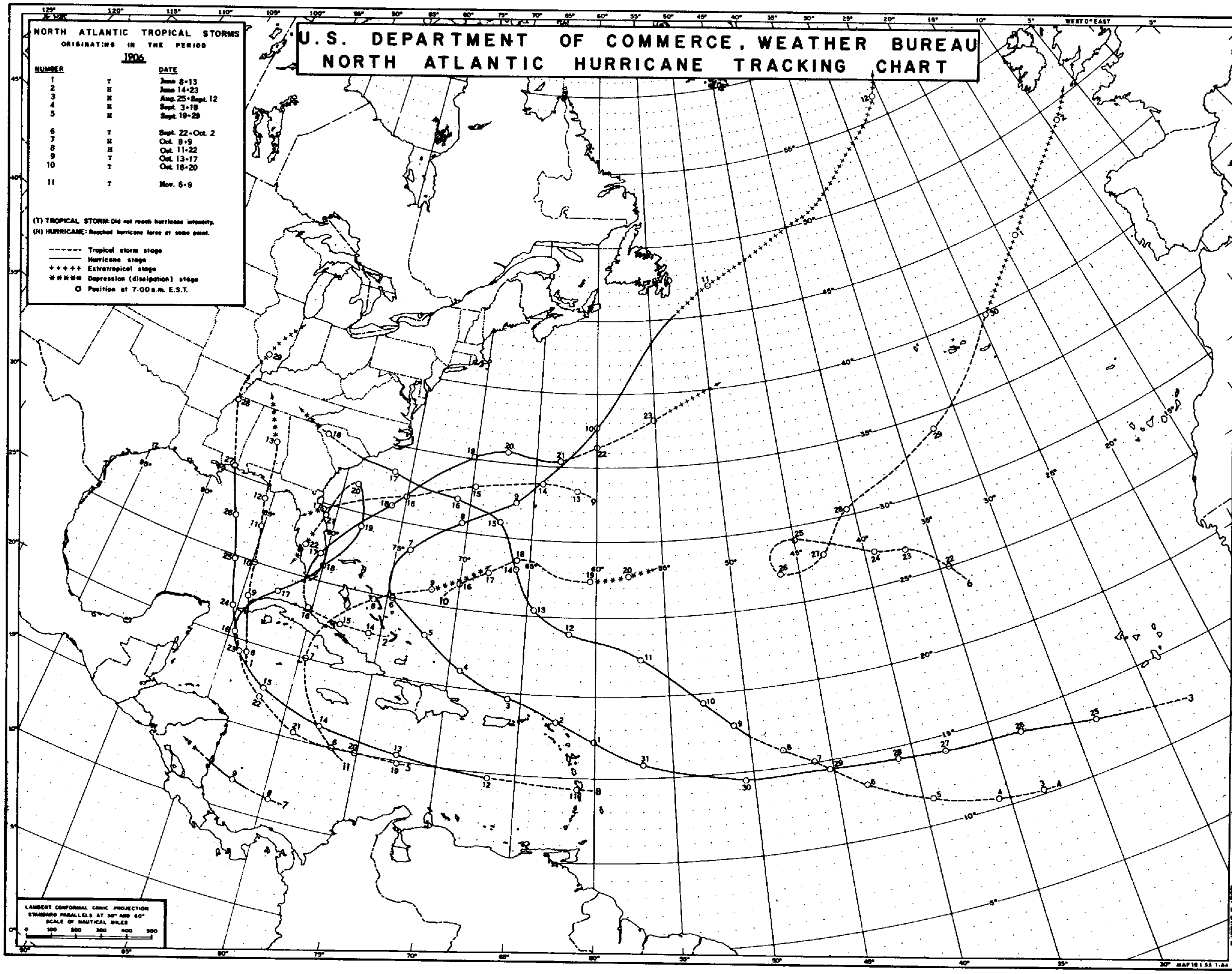

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1901
NUMBER
DATE
1 T June 10-14
2 T July 2-10
3 H July 5-13
4 H Aug. 4-18
5 H Aug. 30-Sept. 11
6 T Sept. 9-19
7 T Sept. 12-17
8 T Sept. 21-Oct. 2
9 T Oct. 7-14
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.


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
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION

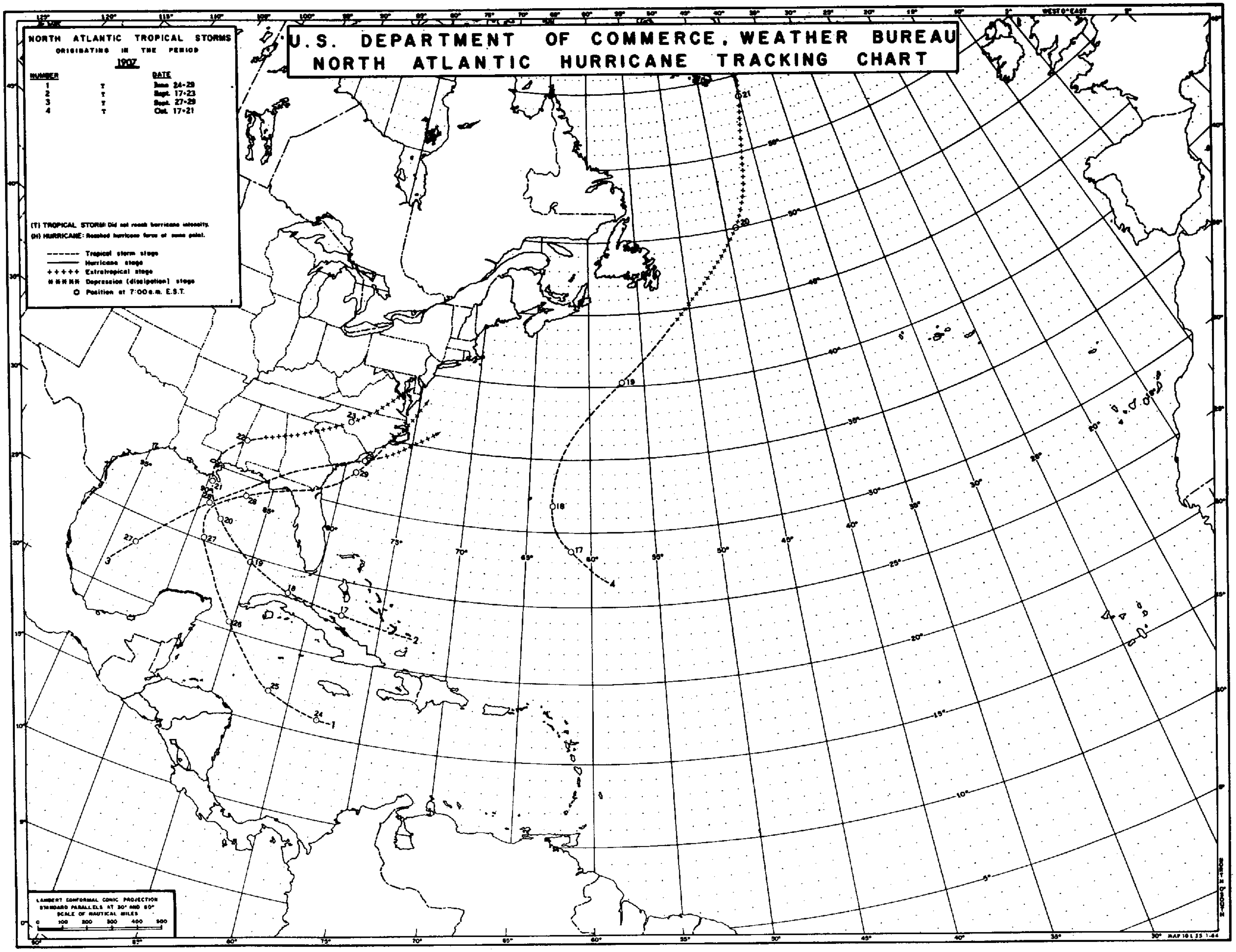

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
NUMBER
DATE
1 H July 19-25
2 H Aug. 6-16
3 H Sept. 9-16
4 H Sept. 12-17
5 T
6 H Sept. 26-30
7 H Oct. 1-10
8 H Oct. 5-10
9 H Nov. 17-25
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.

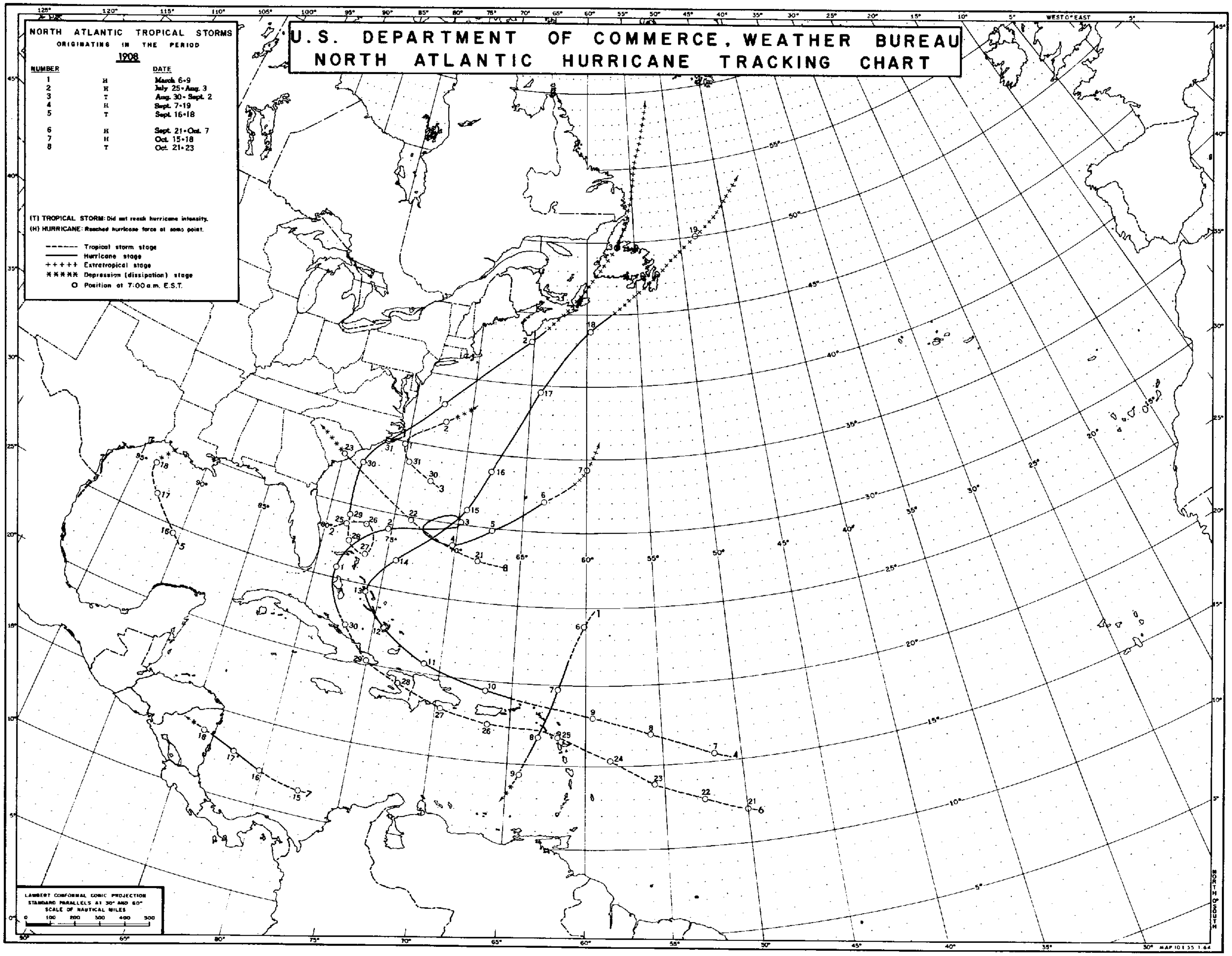

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1904
NUMBER
DATE
1 T June 11-14
2 H Sept. 8-15
3 H Oct. 12-20
4 T Oct. 19-23
5 T Oct. 29-Nov. 5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: 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

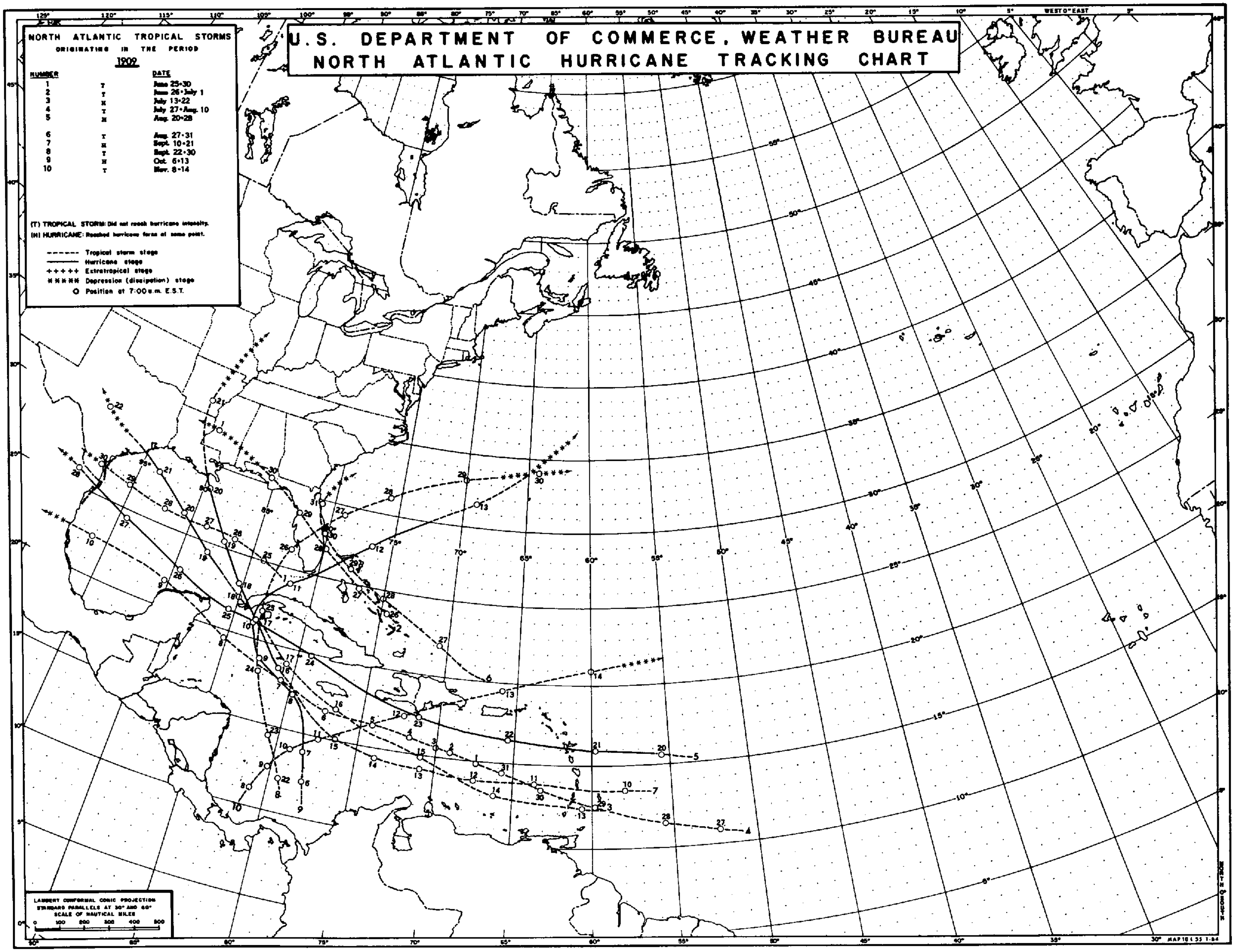

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1905
NUMBER
DATE
1 T Sept. 6-7
2 T Sept. 11-16
3 T Sept. 24-30
4 H Oct. 1-13
5 T Oct. 5-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: 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

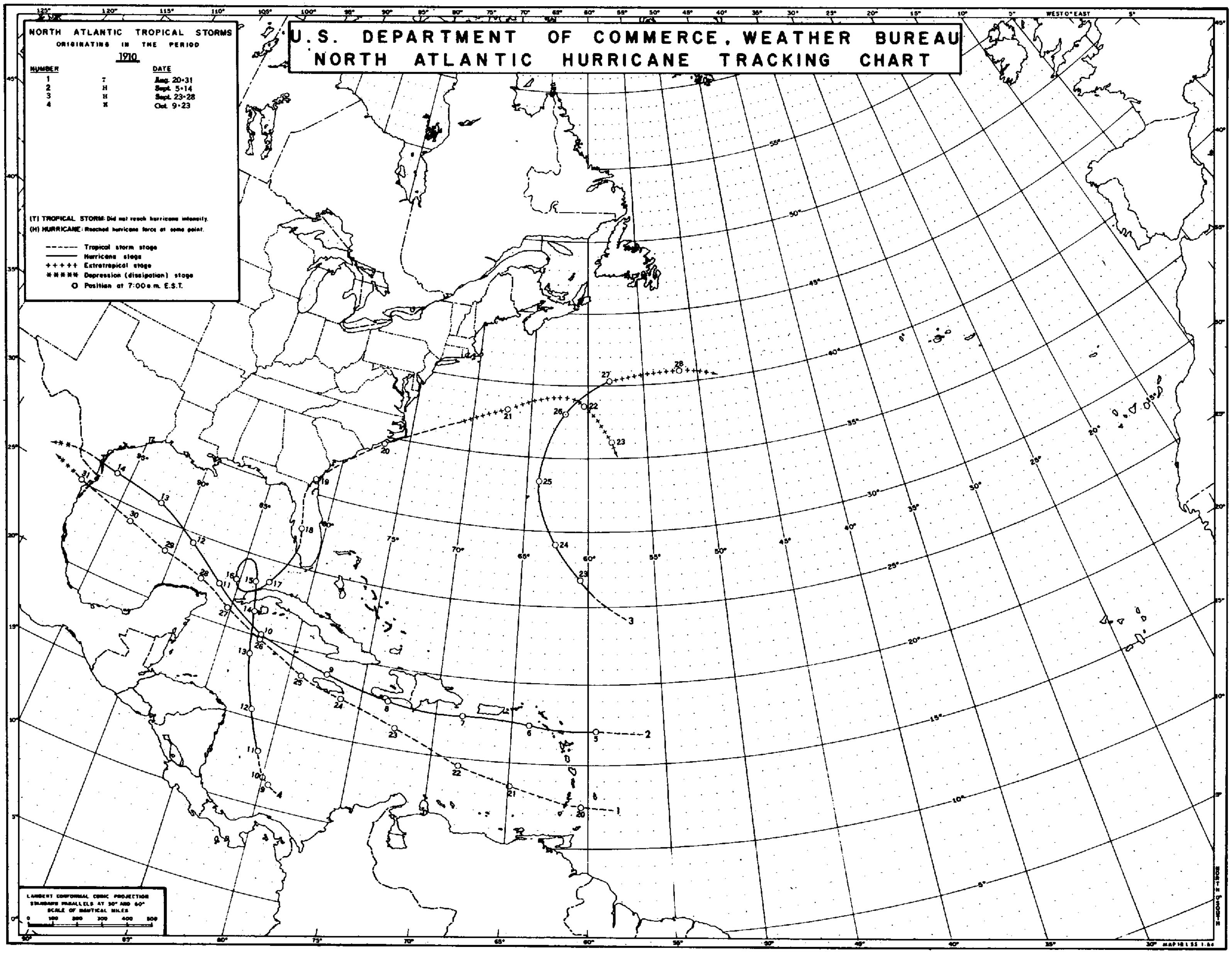


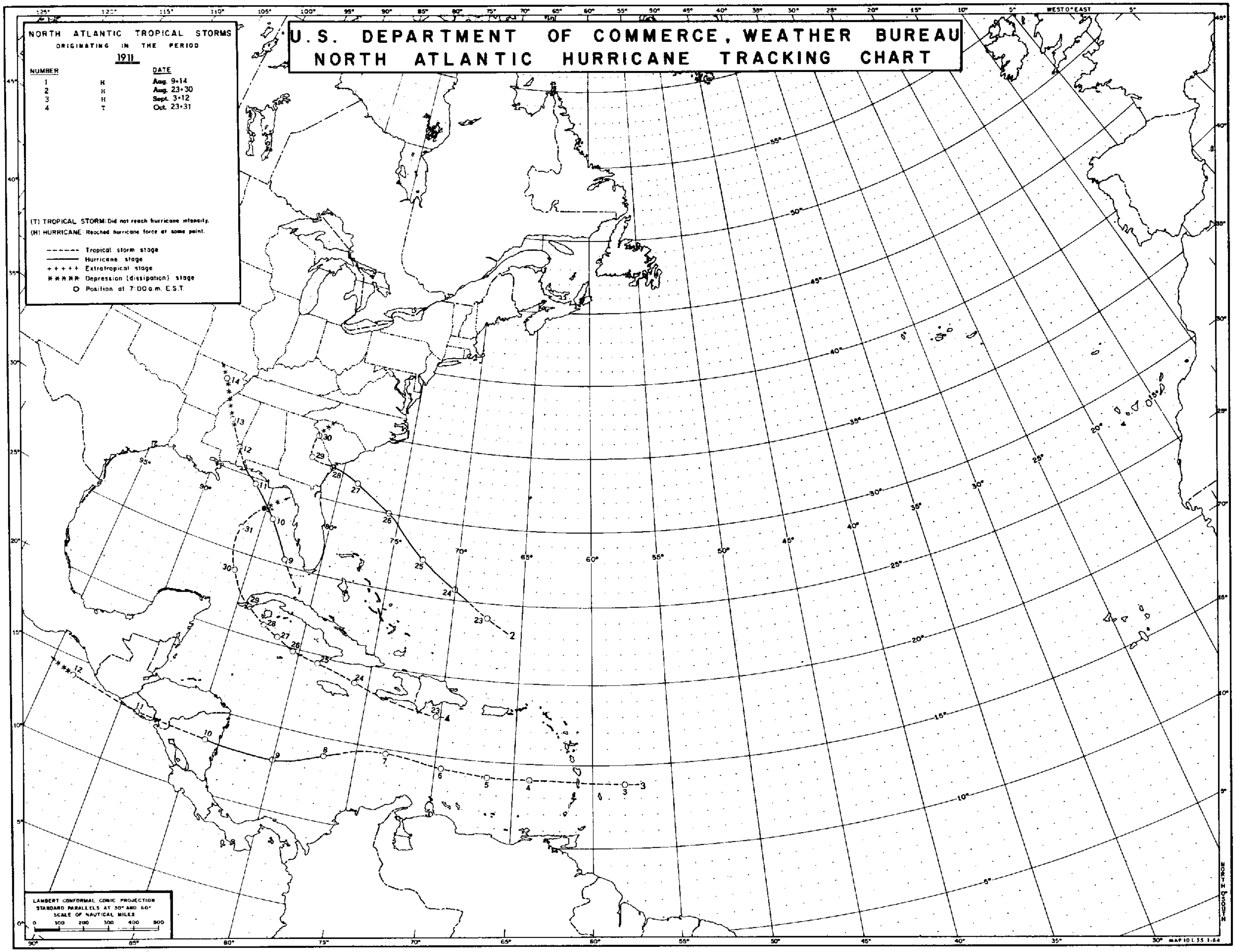
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1906
NUMBER DATE
1 T June 8-13
2 H June 14-23
3 H Aug. 25-Sept. 12
4 H Sept. 3-18
5 H Sept. 19-29
6 T Sept. 22-Oct. 2
7 H Oct. 8-9
8 H Oct. 11-22
9 T Oct. 13-17
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
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

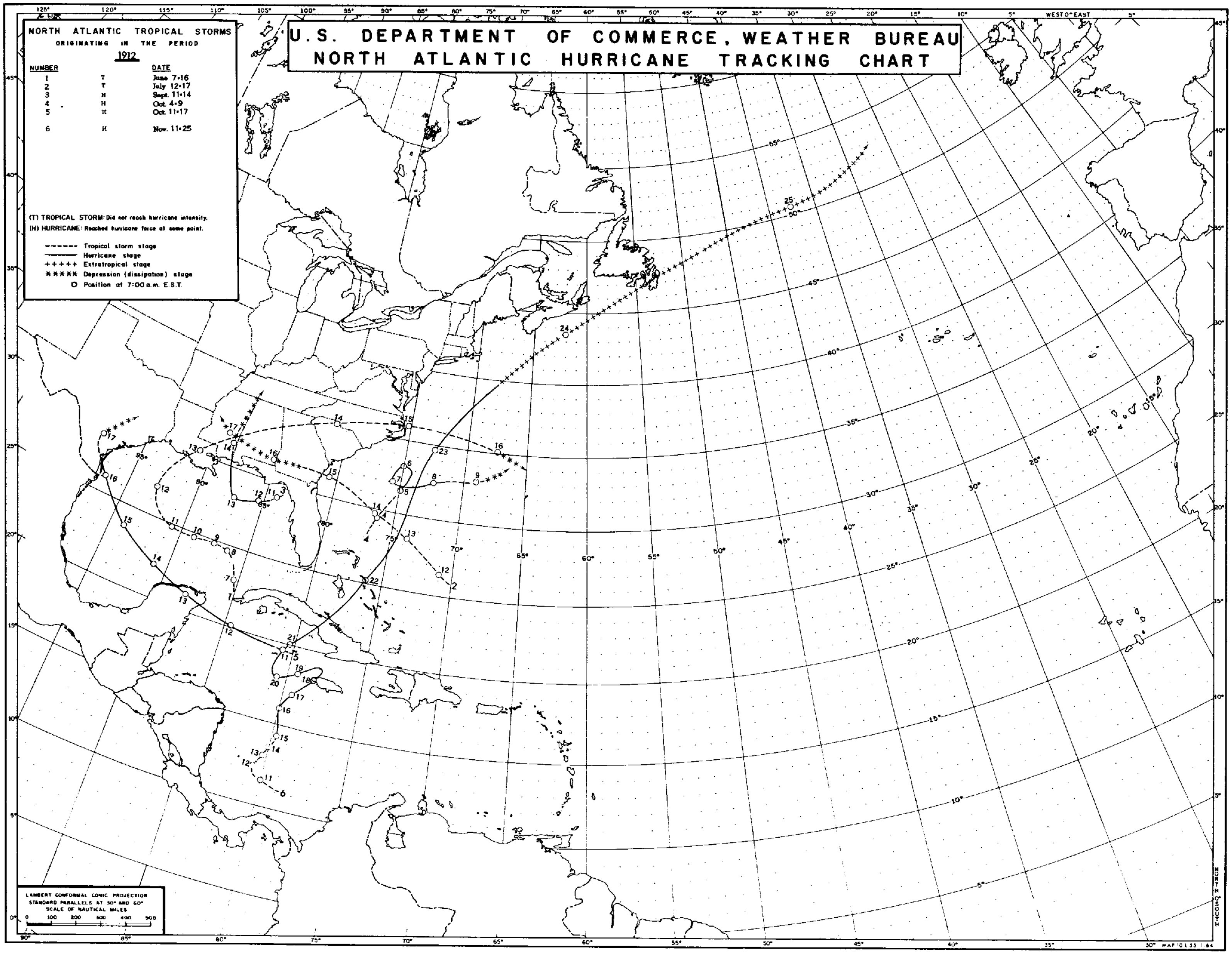

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1907
NUMBER DATE
1 T June 24-29
2 T Sept. 17-23
3 T Sept. 27-29
4 T Oct. 17-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane 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

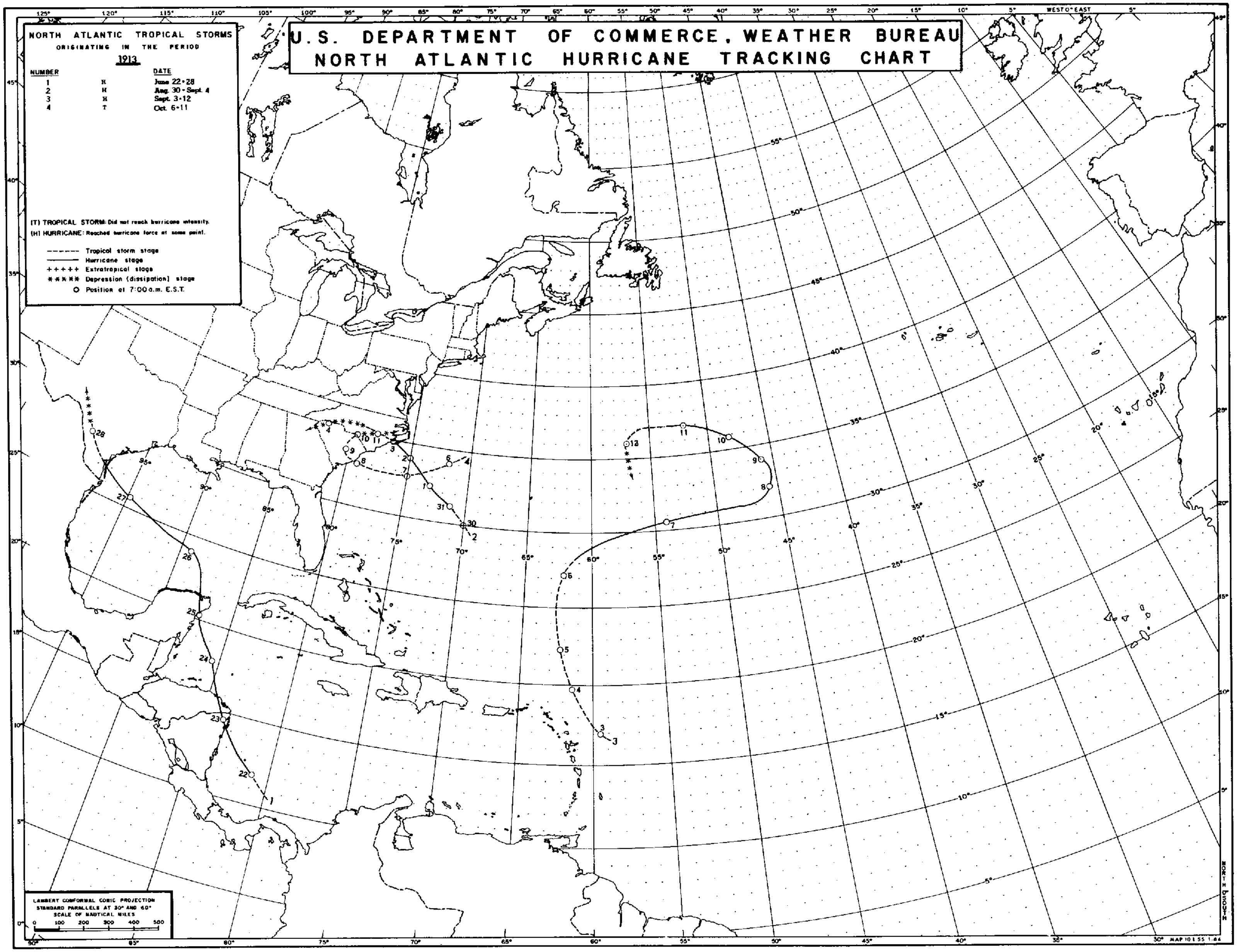

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1908
NUMBER DATE
1 H March 6-9
2 H July 25-Aug. 3
3 T Aug. 30-Sept. 2
4 H Sept. 7-19
5 T Sept. 16-18
6 H Sept. 21-Oct. 7
7 H Oct. 15-18
8 T Oct. 21-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
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

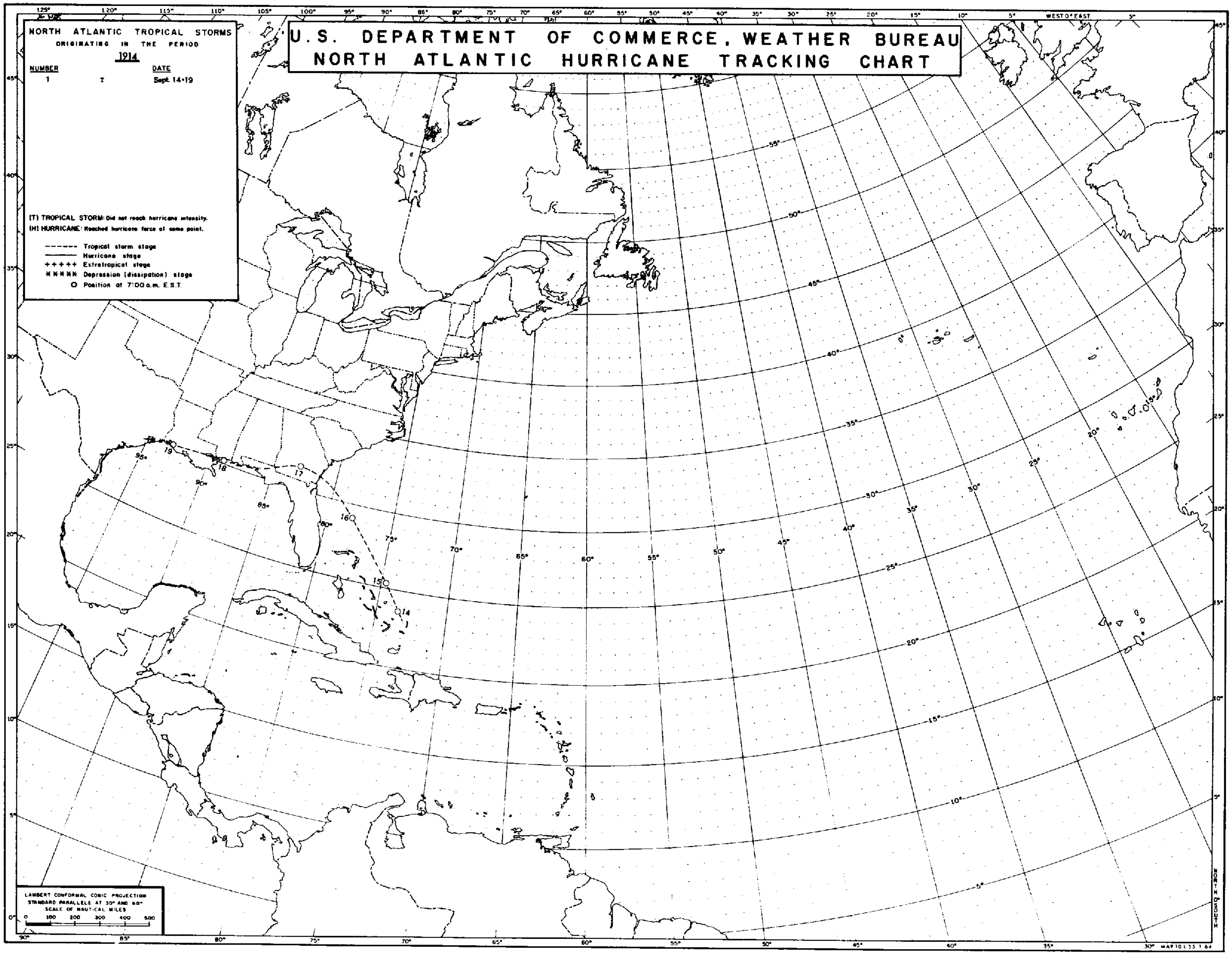

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1909
NUMBER DATE
1 T June 25-30
2 T June 26-July 1
3 H July 13-22
4 T July 27-Aug. 10
5 H Aug. 20-28
6 T Aug. 27-31
7 H Sept. 10-21
8 T Sept. 22-30
9 H Oct. 6-13
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


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.

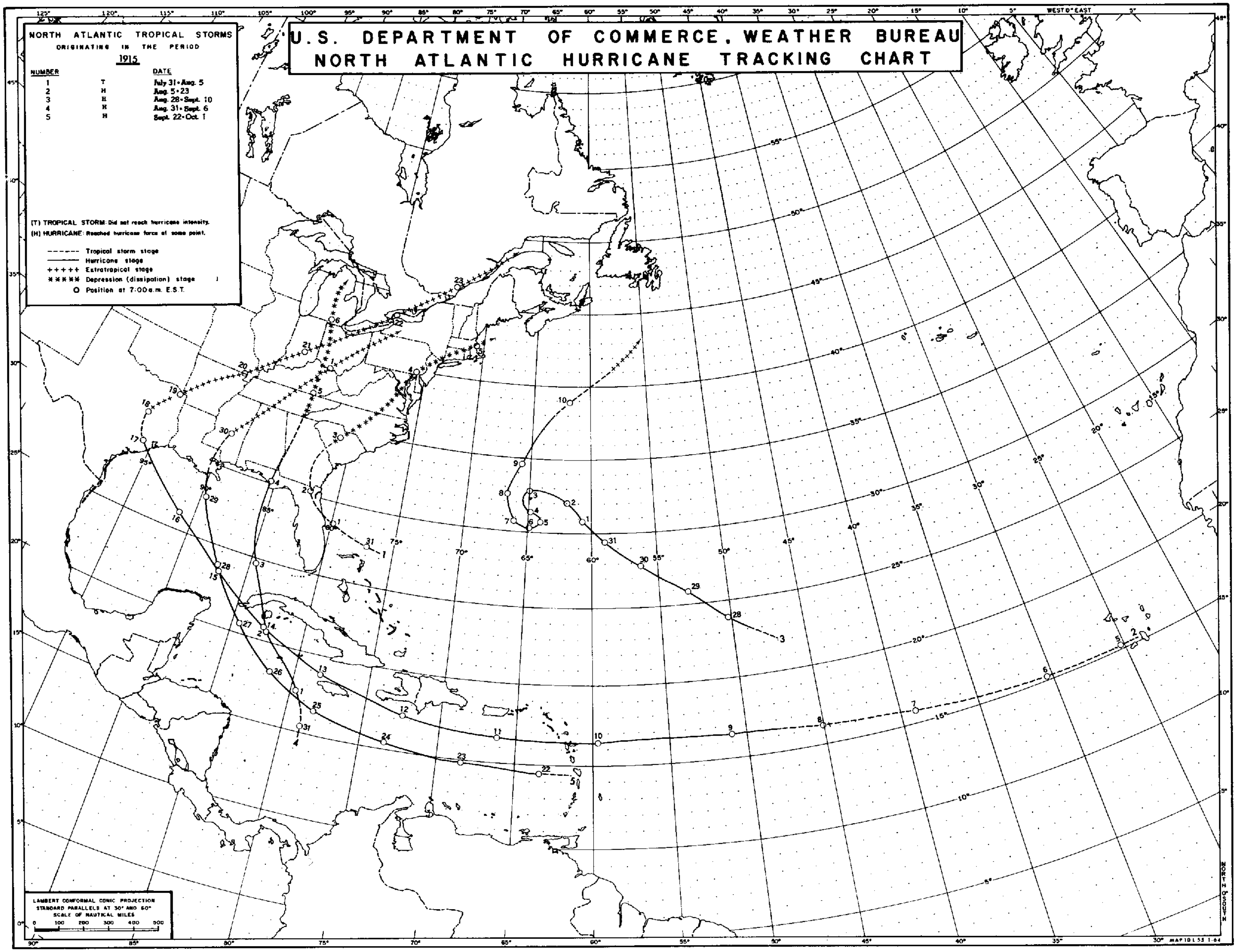

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1911
NUMBER DATE
1 H Aug. 9-14
2 H Aug. 23-30
3 H Sept. 3-12
4 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane 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

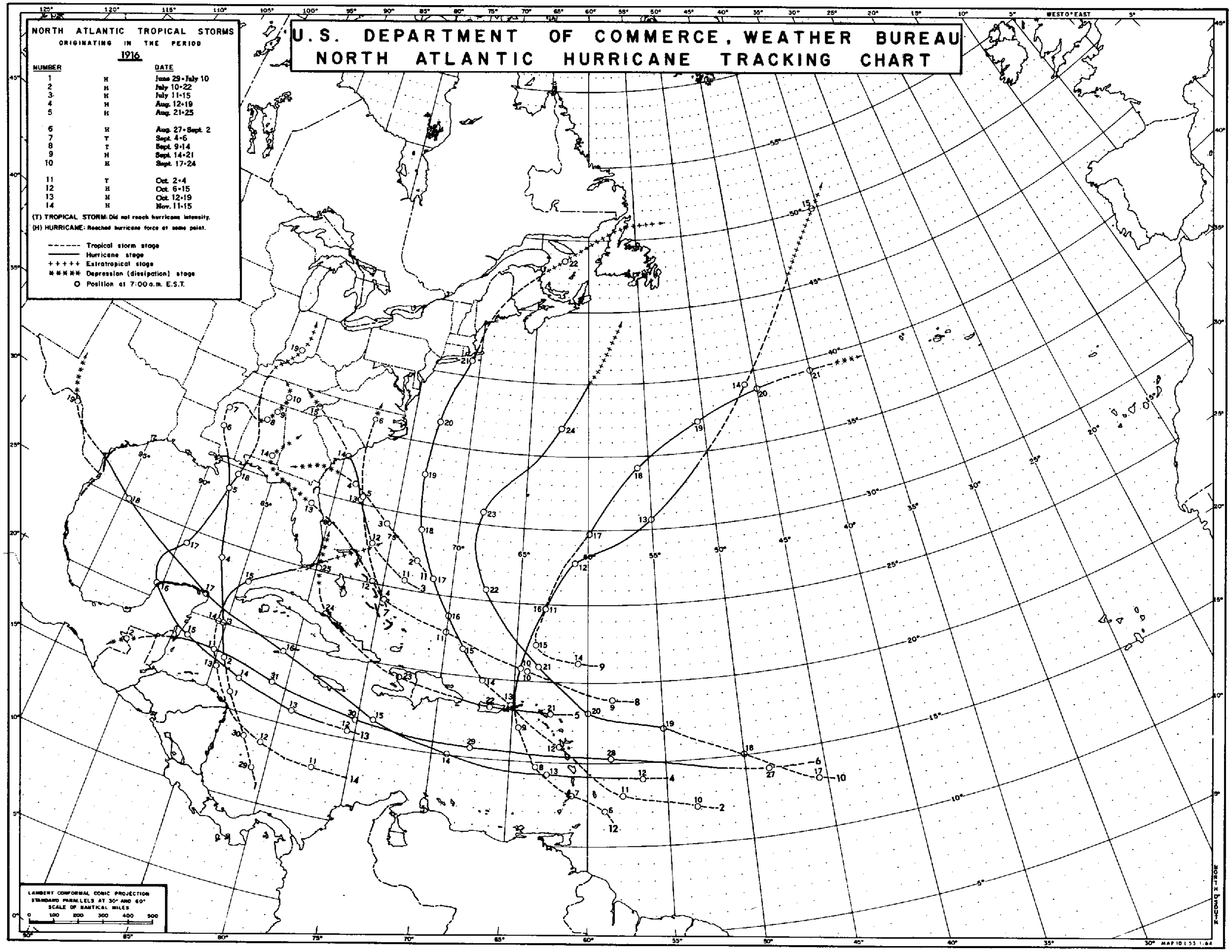

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1912
NUMBER
DATE
1 T June 7-16
2 T July 12-17
3 H Sept. 11-14
4 H Oct. 4-9
5 H Oct. 11-17
6 H Nov. 11-25
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
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
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
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

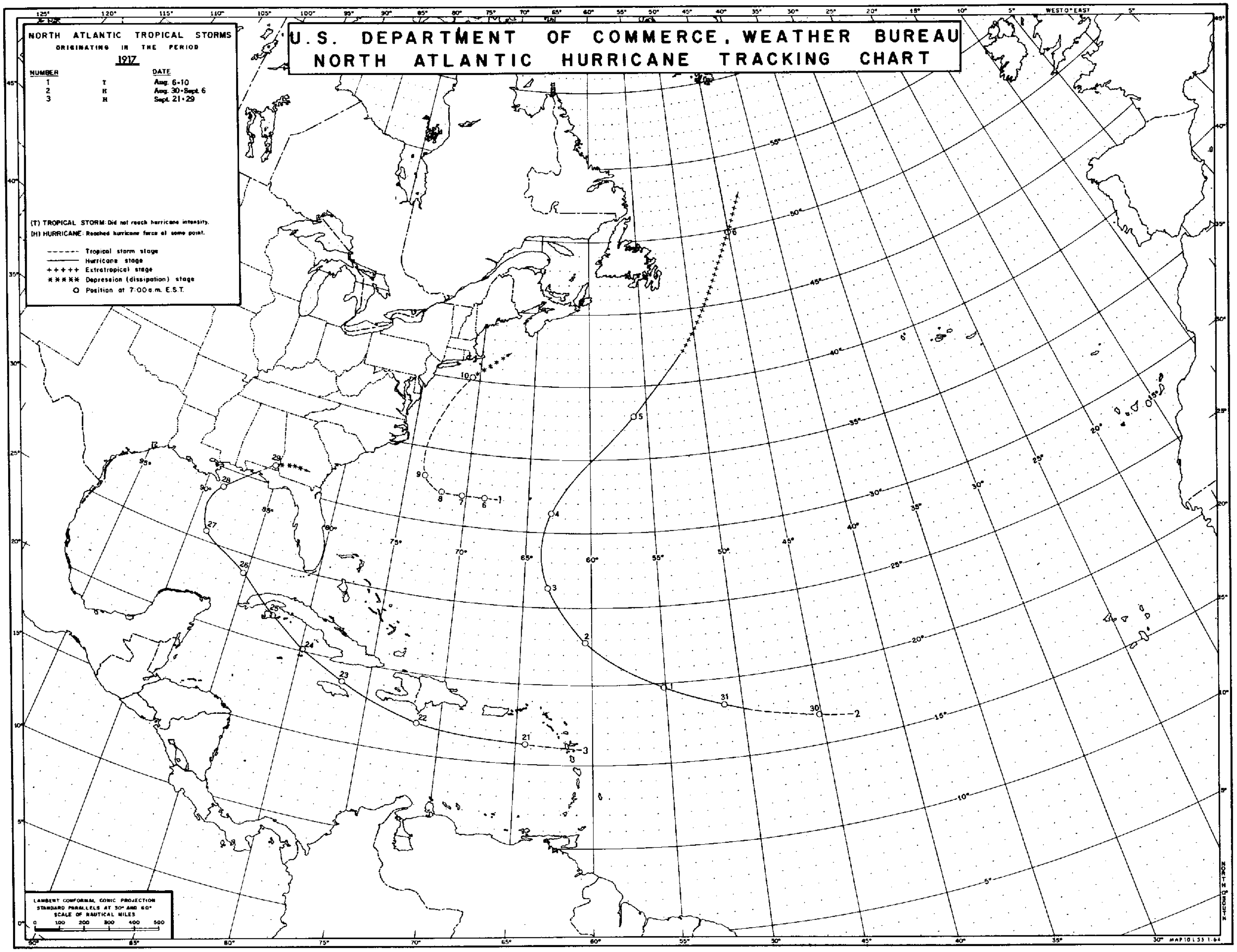


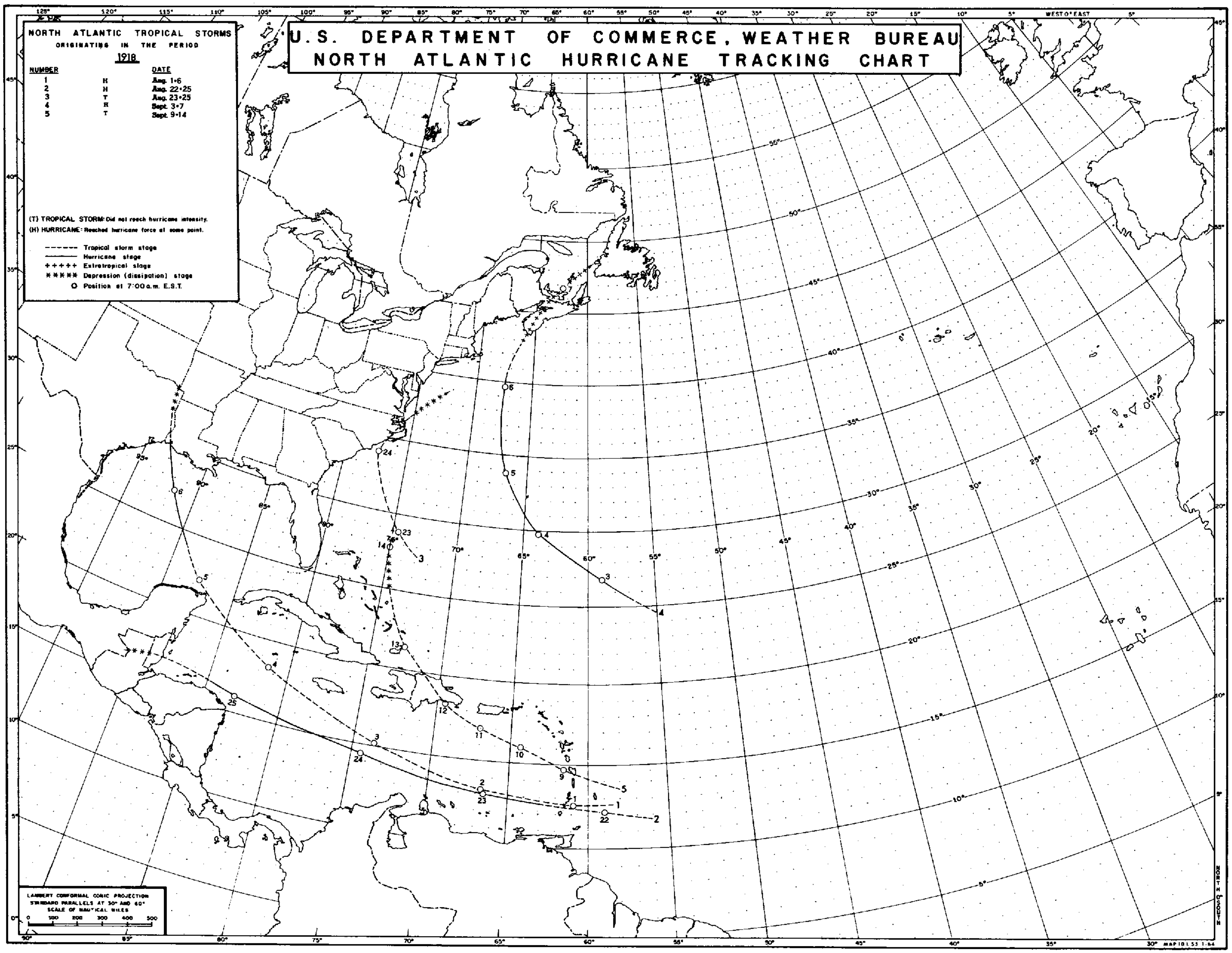
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1914
NUMBER
DATE
1
T
Sept. 14-19
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
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

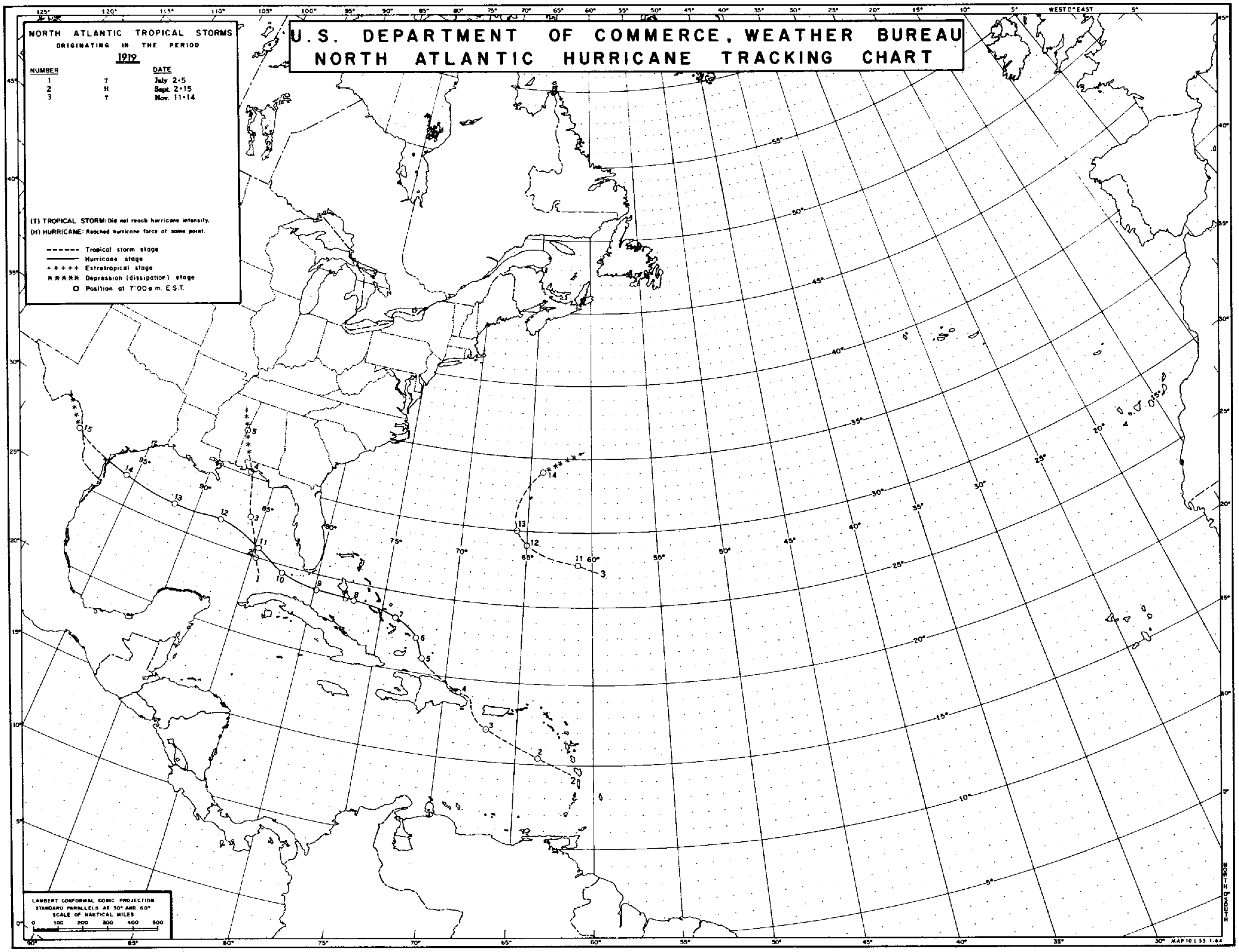

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1915
NUMBER DATE
1 T July 31-Aug. 5
2 H Aug. 5-23
3 H Aug. 28-Sept. 10
4 H Aug. 31-Sept. 6
5 H Sept. 22-Oct. 1
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
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

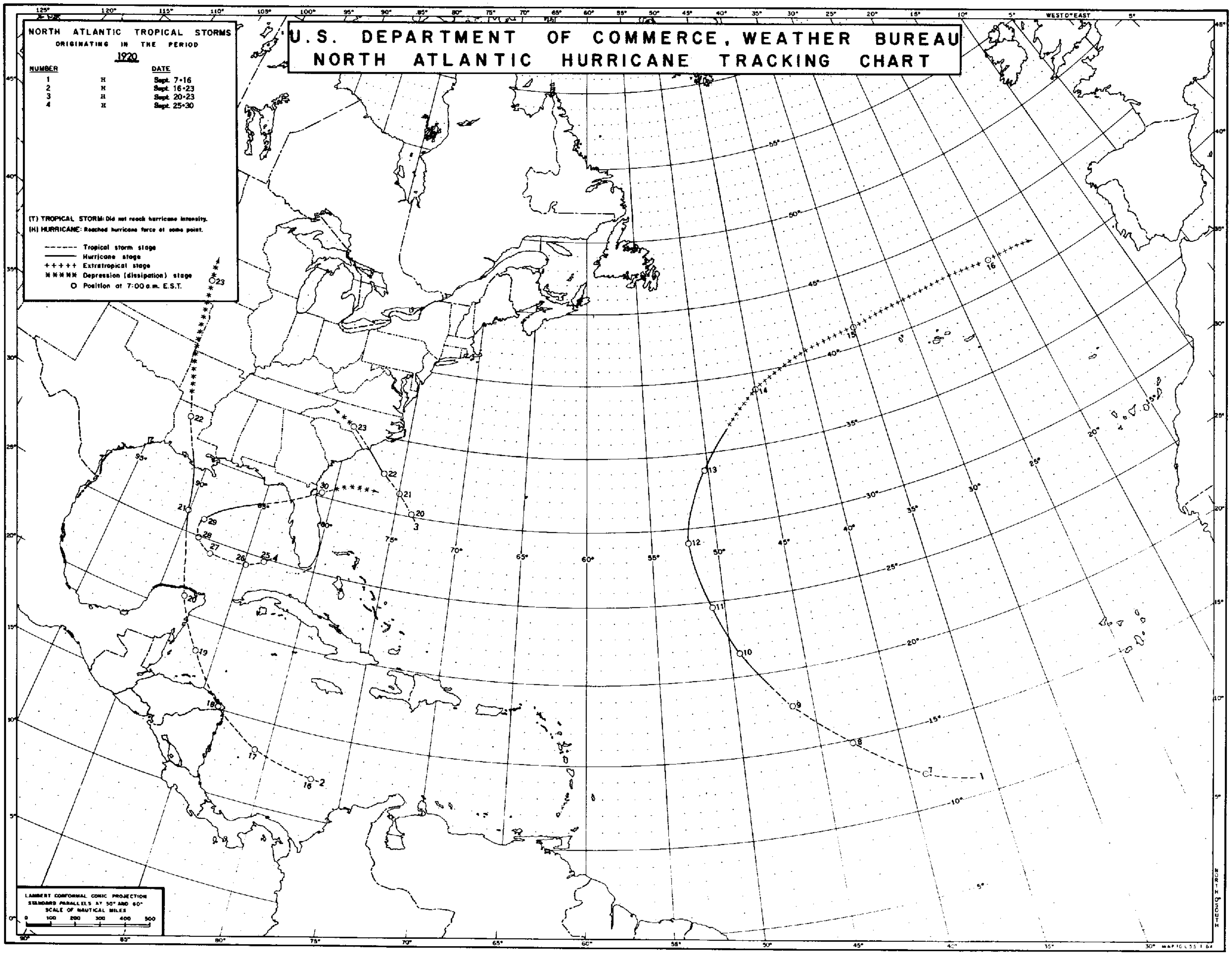


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1916
NUMBER DATE
1 H June 29 - July 10
2 H July 10-22
3 H July 11-15
4 H Aug. 12-19
5 H Aug. 21-25
6 H Aug. 27 - Sept. 2
7 T Sept. 4-6
8 T Sept. 9-14
9 H Sept. 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
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

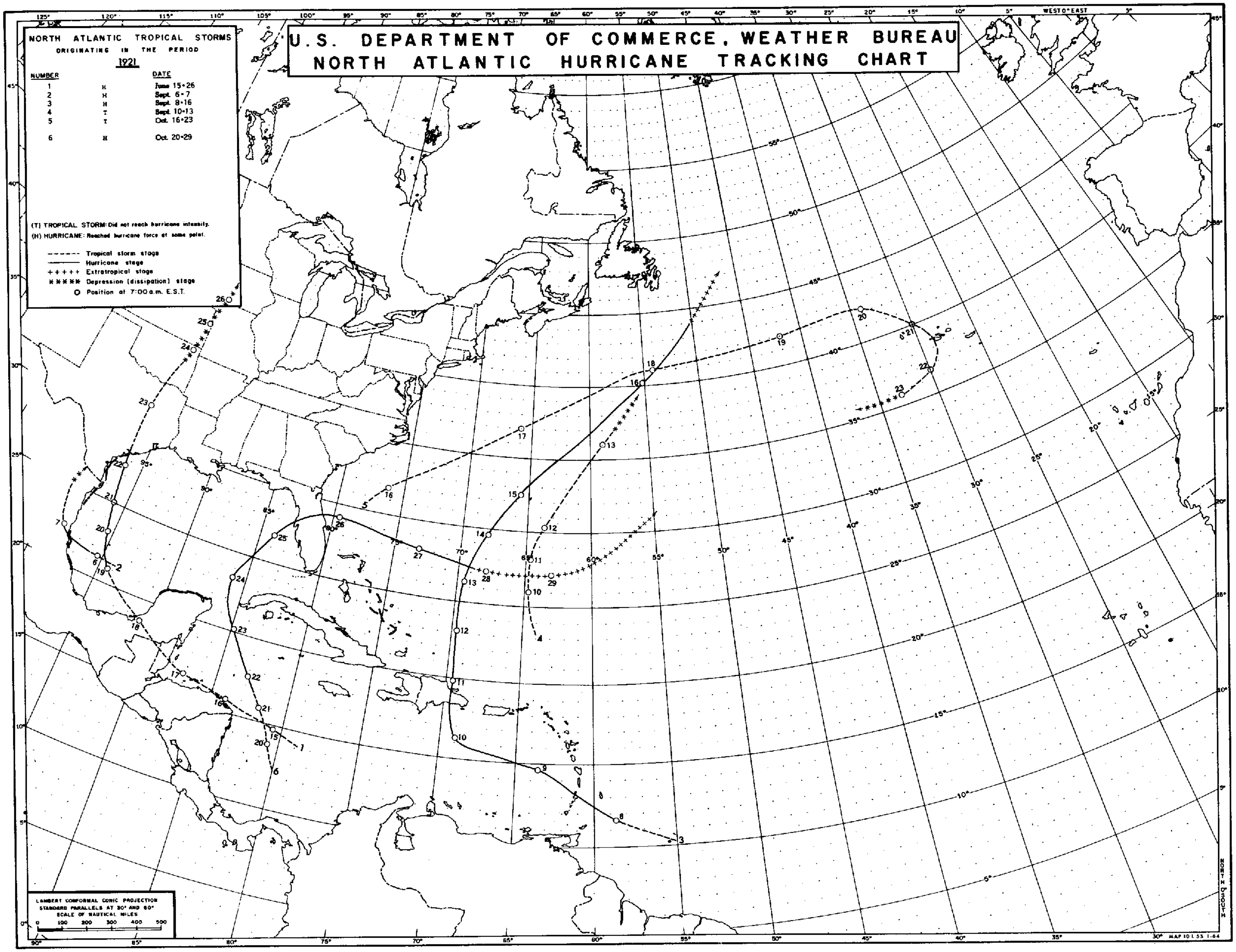

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1917
NUMBER DATE
1 T Aug. 6-10
2 H Aug. 30-Sept. 6
3 H Sept. 21-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force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

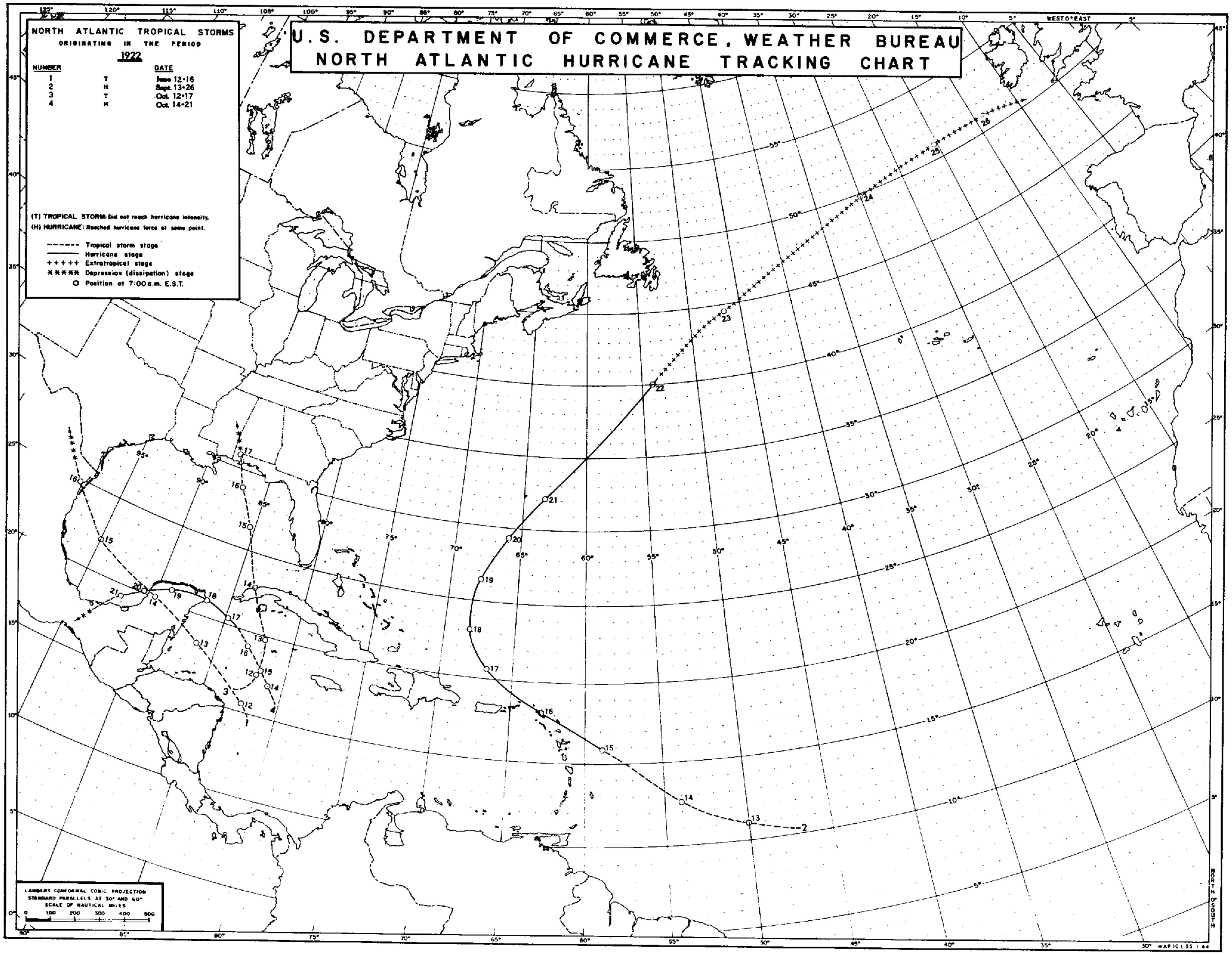

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1918
NUMBER
DATE
1 H Aug. 1-6
2 H Aug. 22-25
3 T Aug. 23-25
4 H Sept. 3-7
5 T Sept. 9-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
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
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
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

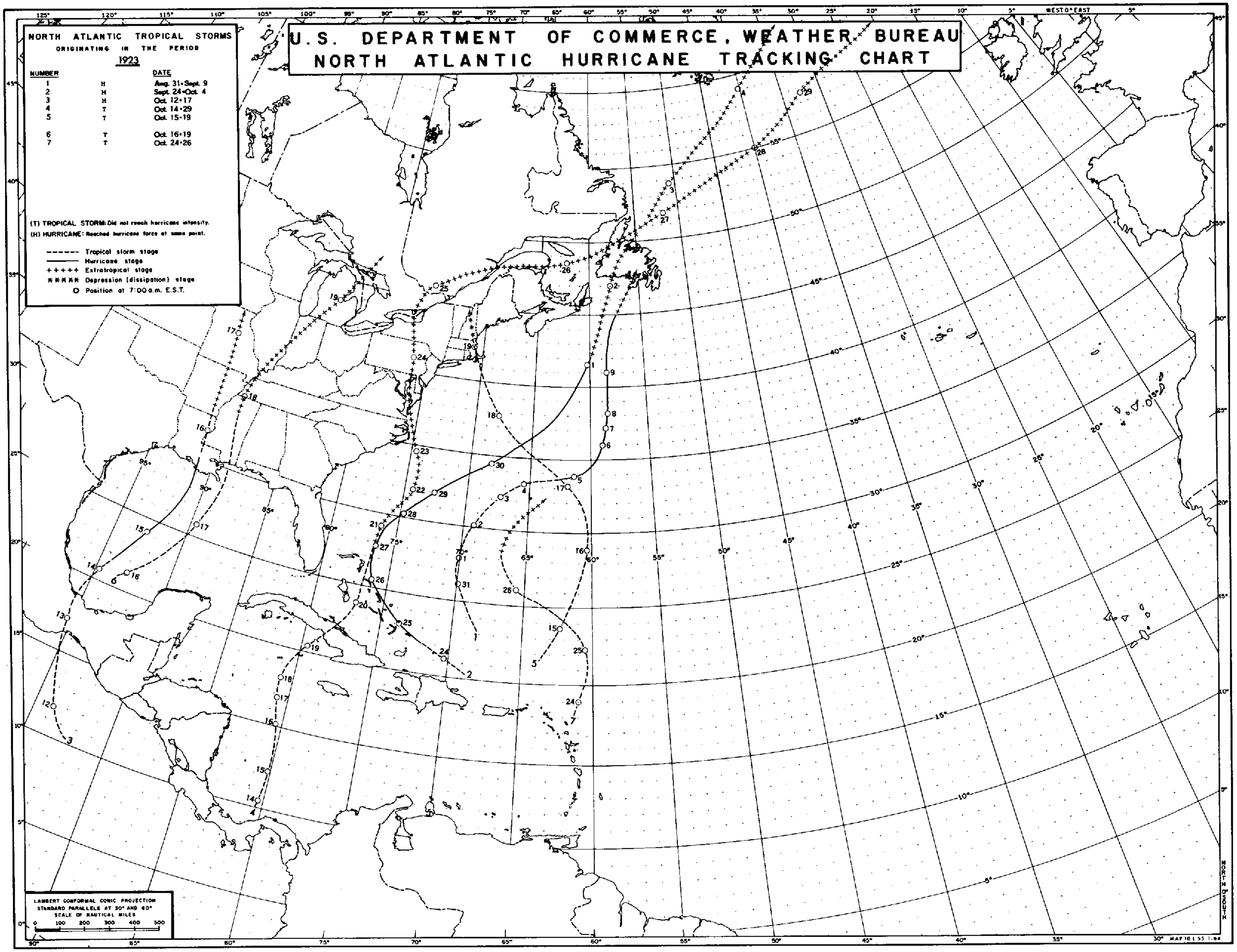


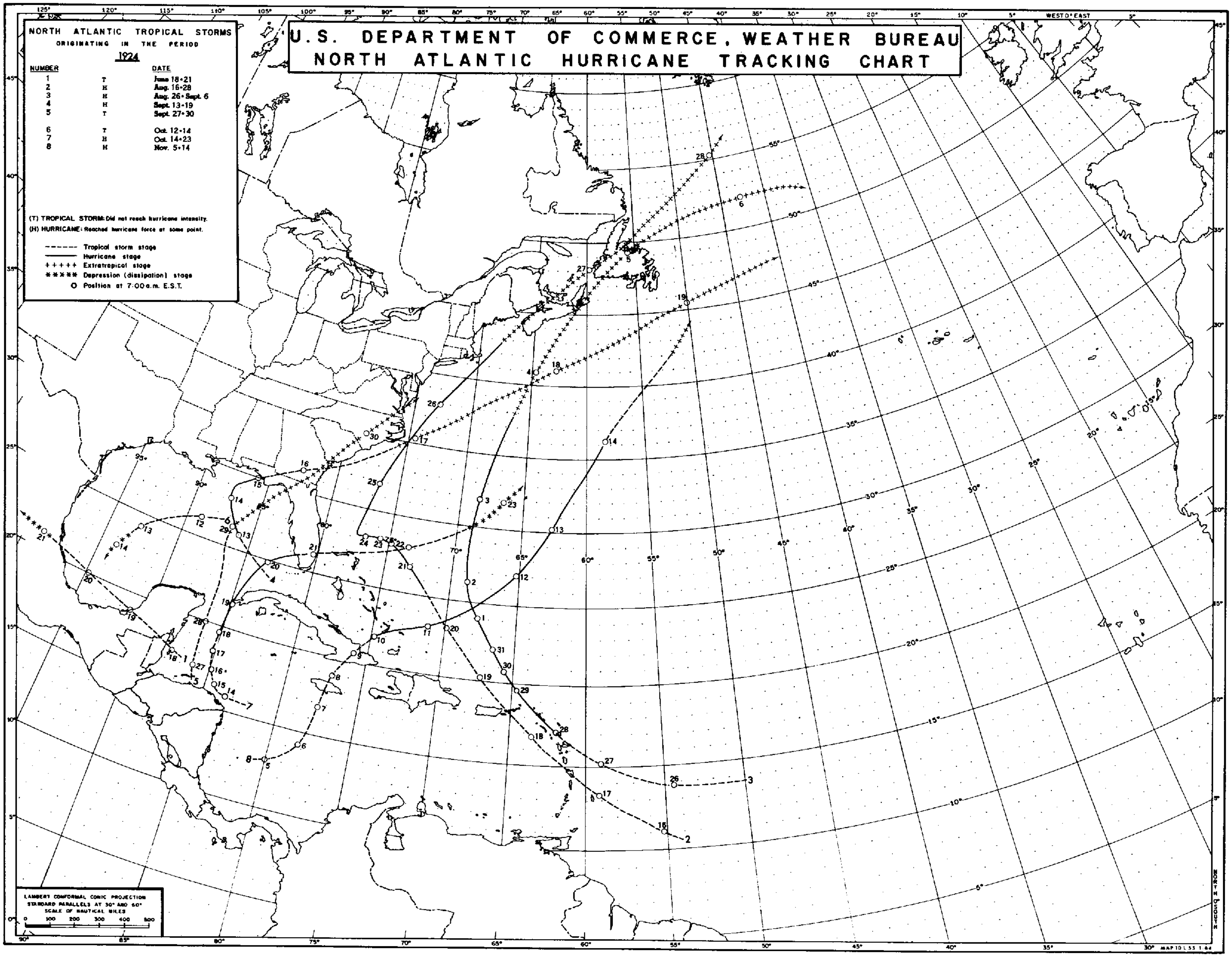
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1920
NUMBER DATE
1 H Sept. 7-16
2 H Sept. 16-23
3 H Sept. 20-23
4 H Sept. 25-30
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane 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

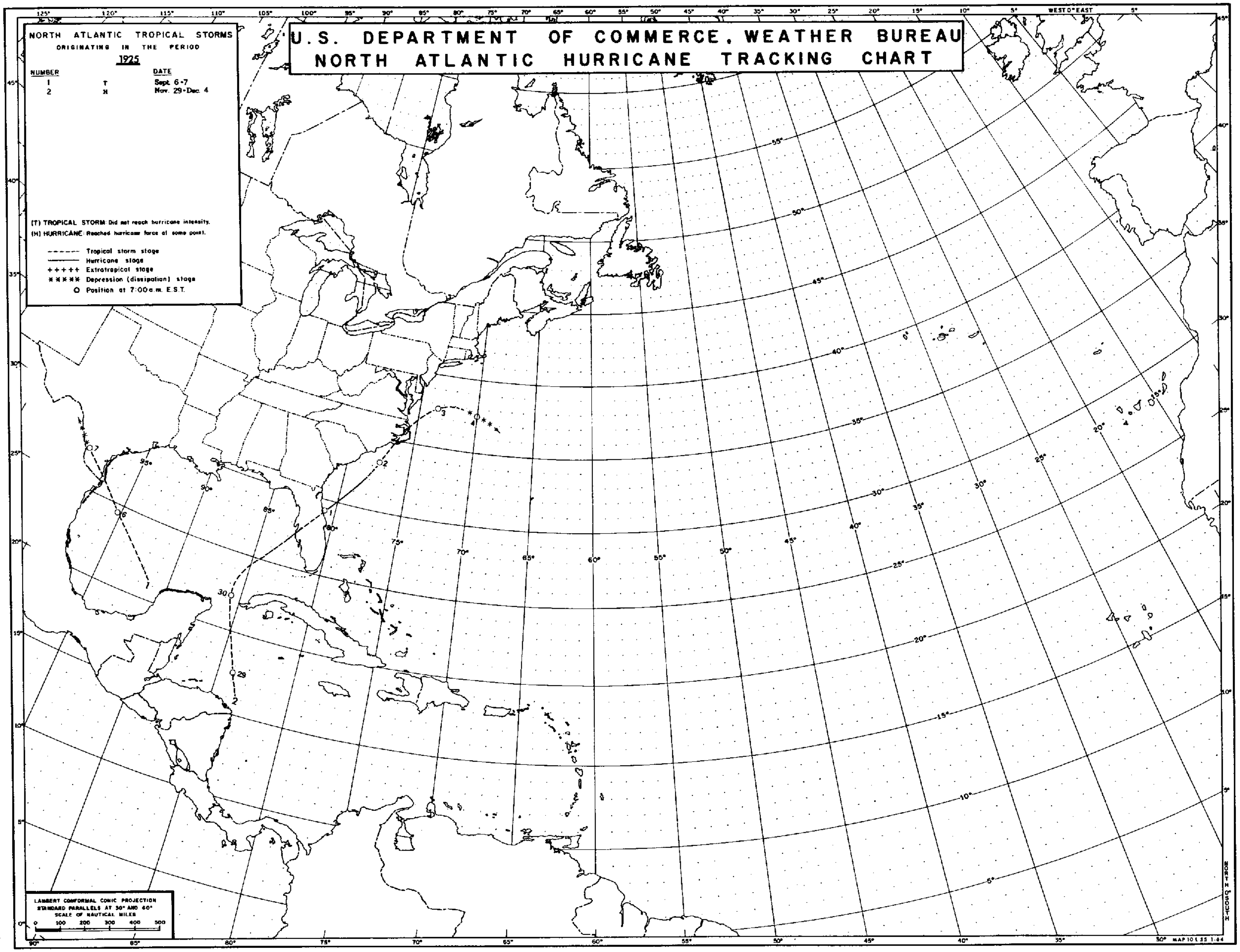

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1921
NUMBER
DATE
1 H June 15-26
2 H Sept. 6-7
3 H Sept. 8-16
4 T Sept. 10-13
5 T Oct. 16-23
6 H Oct. 20-29
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
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

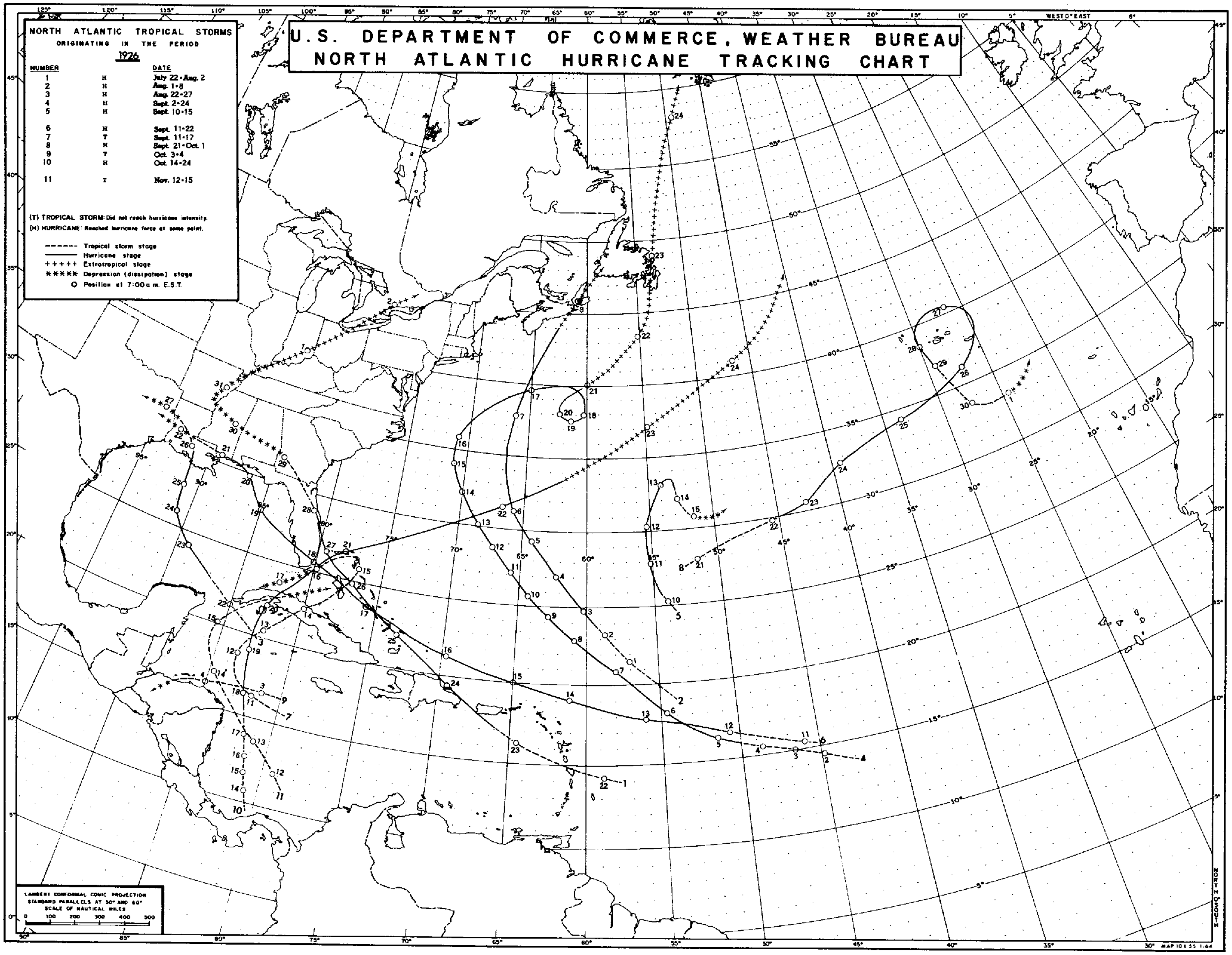


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1922
NUMBER DATE
1 T June 12-16
2 H Sept. 13-26
3 T Oct. 12-17
4 H Oct. 14-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane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

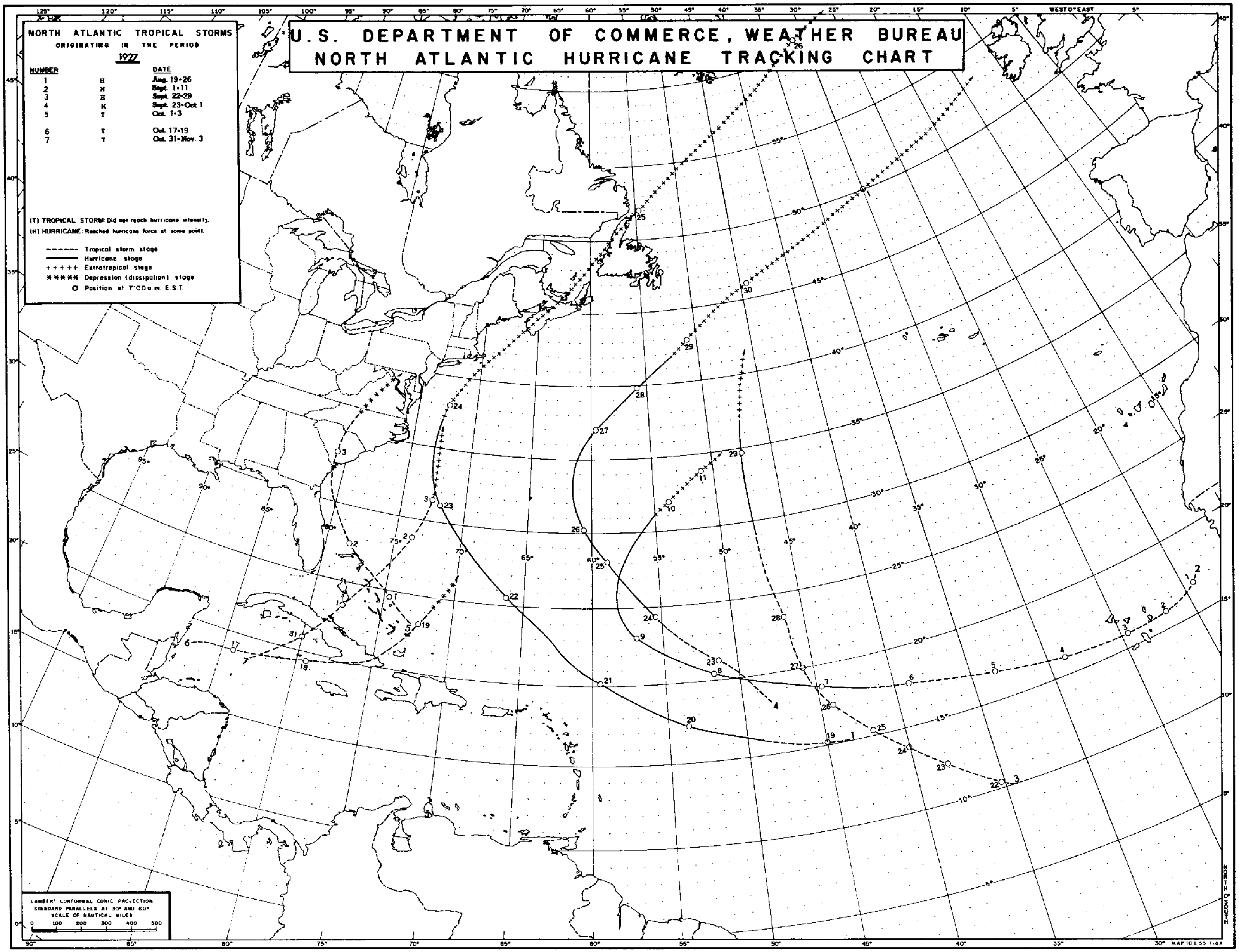

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1923
NUMBER DATE
1 H Aug. 31-Sept. 9
2 H Sept. 24-Oct. 4
3 H Oct. 12-17
4 T Oct. 14-29
5 T Oct. 15-19
6 T Oct. 16-19
7 T Oct. 24-26
(T) TROPICAL STORM: Did not 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

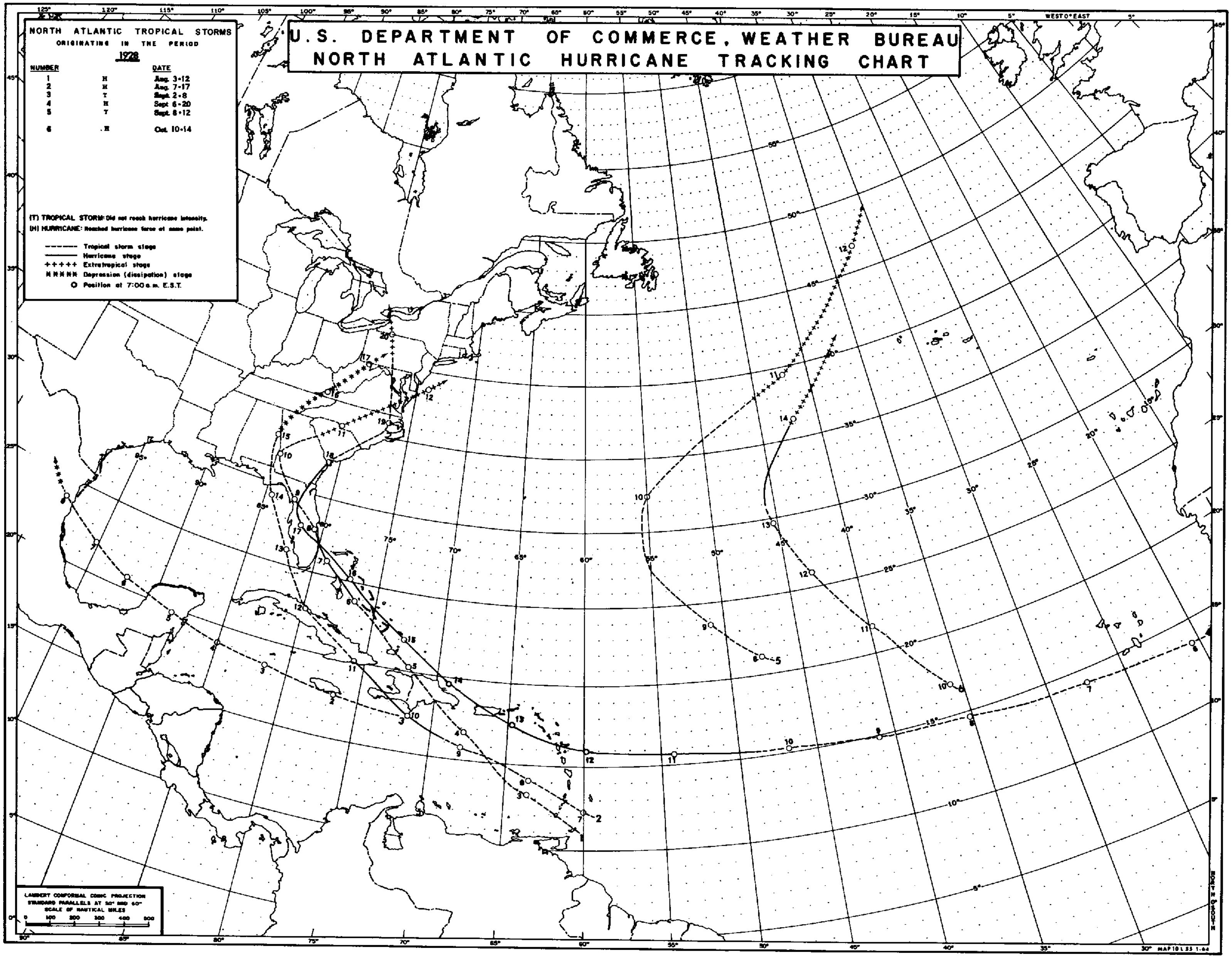

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1924
NUMBER
DATE
1 T June 18-21
2 H Aug. 16-28
3 H Aug. 26-Sept. 6
4 H Sept. 13-19
5 T Sept. 27-30
6 T Oct. 12-14
7 H Oct. 14-23
8 H Nov. 5-14
(T) TROPICAL STORM: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

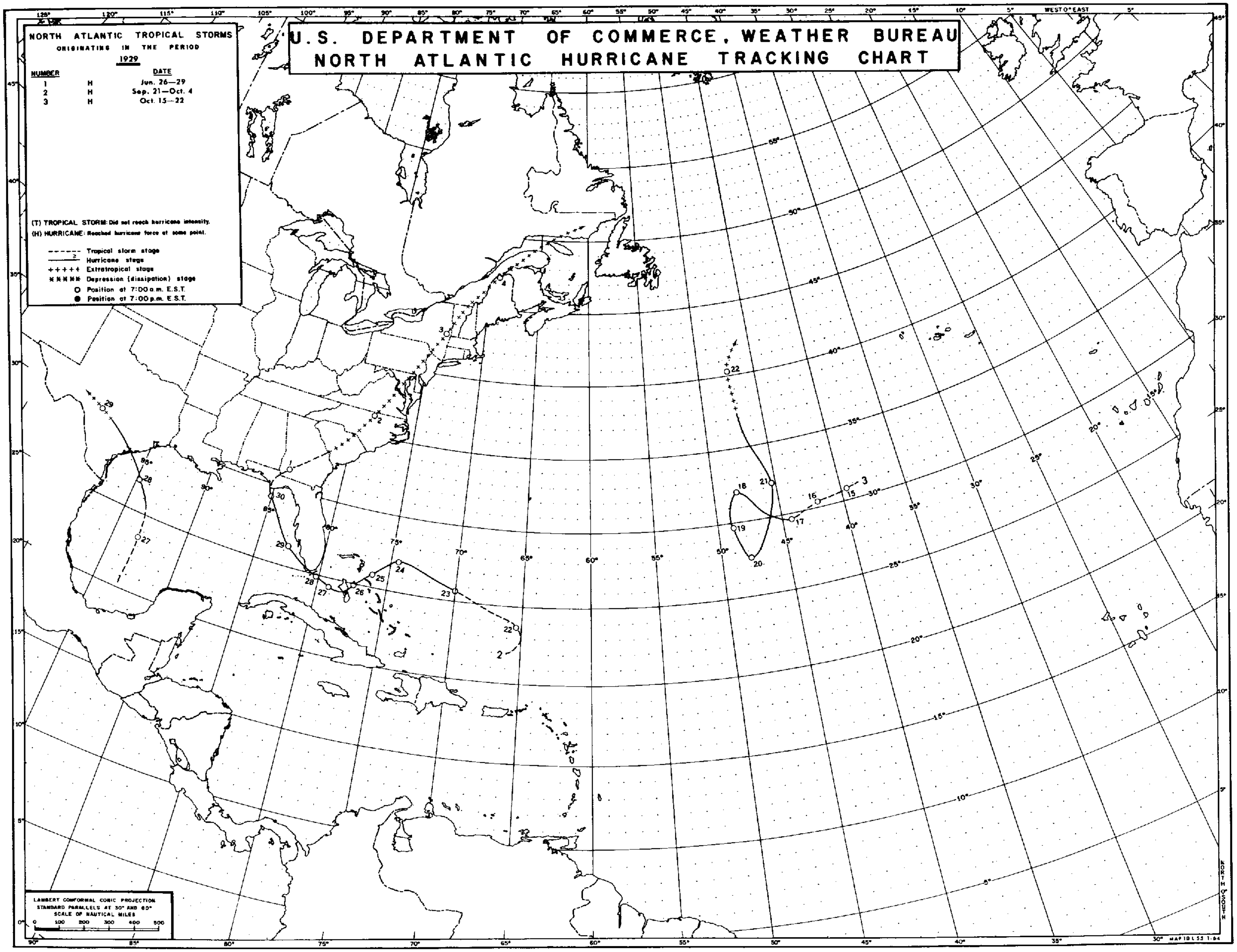

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1925
NUMBER DATE
1 T Sept. 6-7
2 H Nov. 29-Dec. 4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
+++++ Extratropical stage
Depression (dissipation) stage
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 101.35 1-44

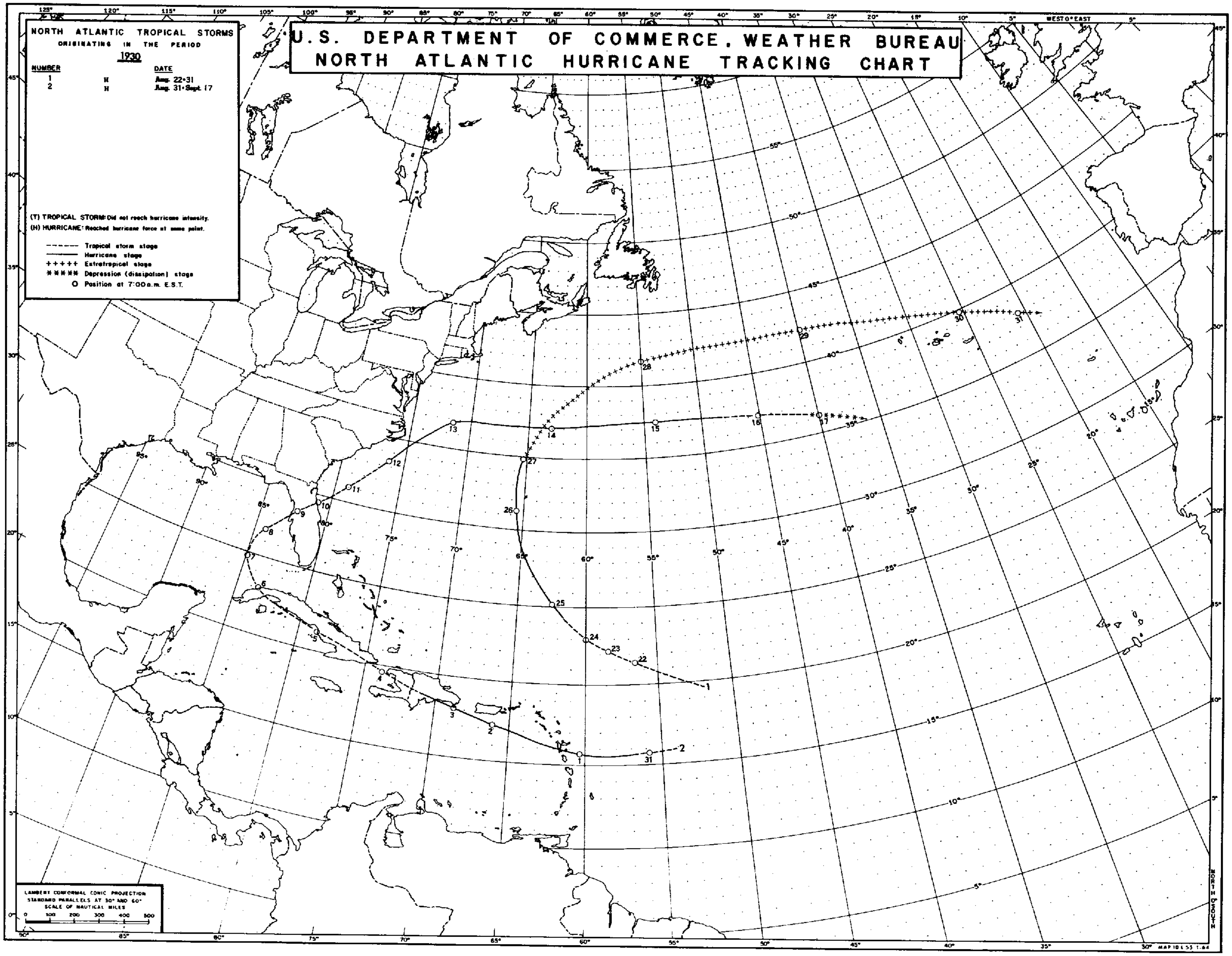


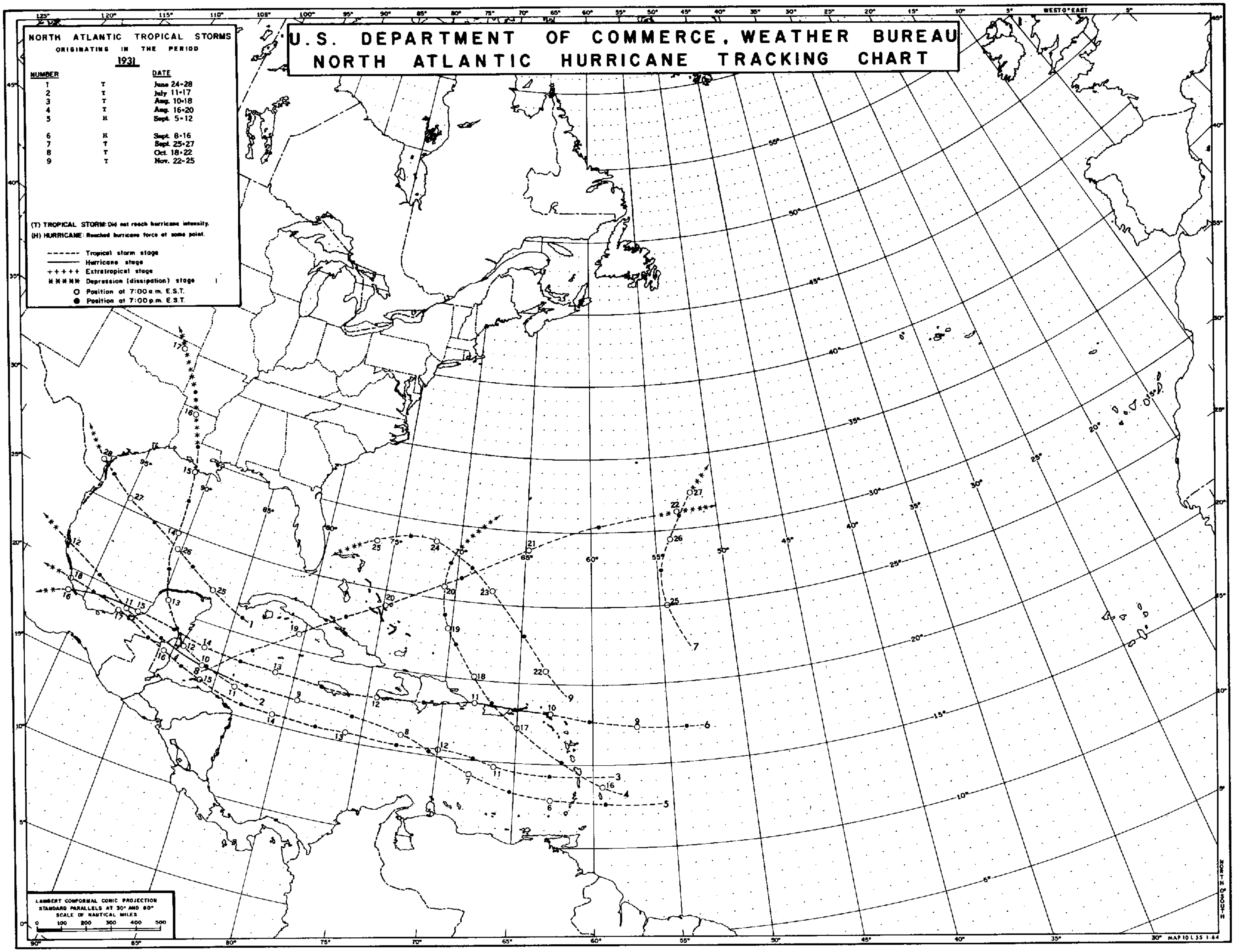
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1926
NUMBER DATE
1 H July 22 - Aug. 2
2 H Aug. 1-8
3 H Aug. 22-27
4 H Sept. 2-24
5 H Sept. 10-15
6 H Sept. 11-22
7 T Sept. 11-17
8 H Sept. 21-Oct. 1
9 T Oct. 3-4
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

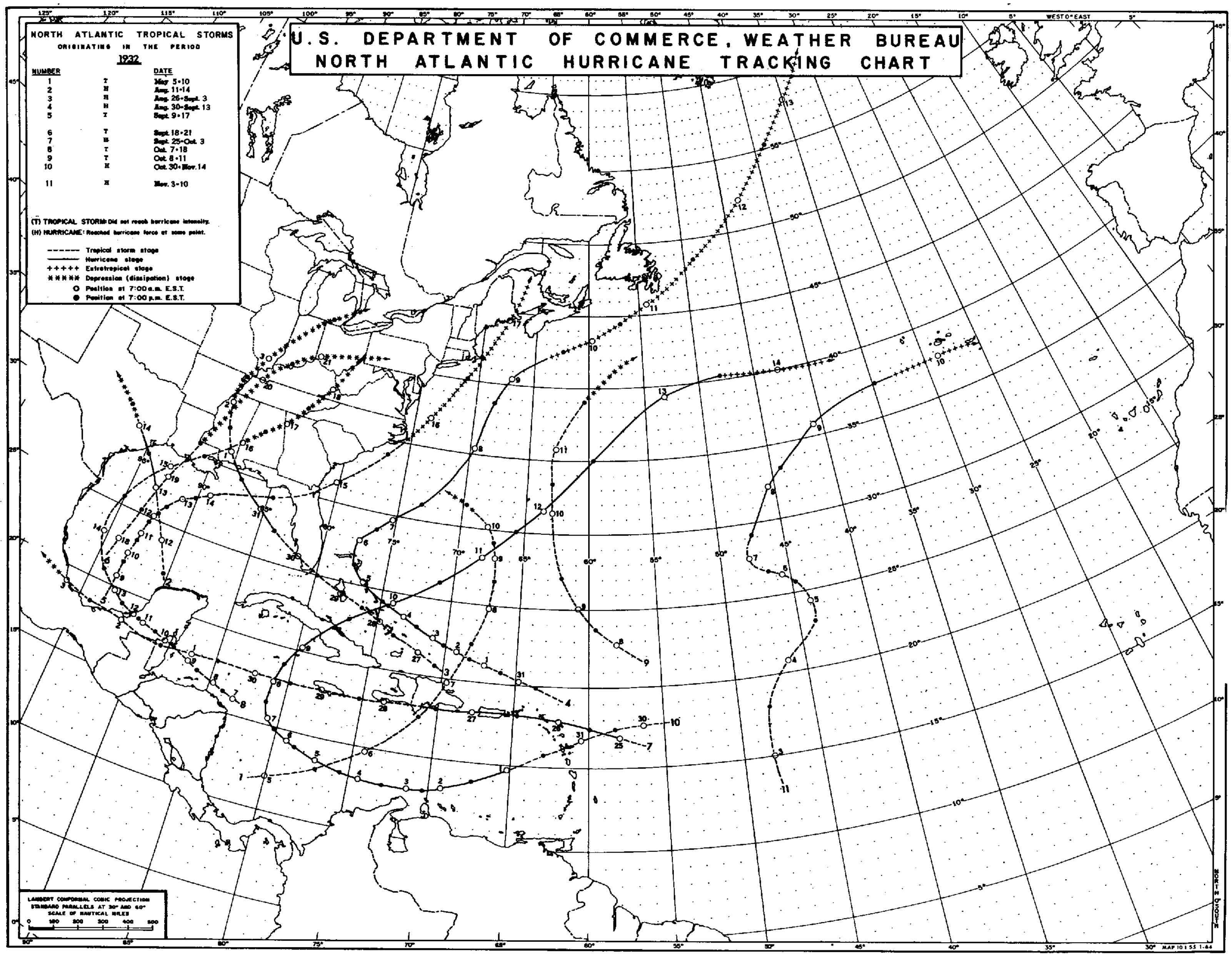

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1927
NUMBER DATE
1 H Aug. 19-26
2 H Sept. 1-11
3 H Sept. 22-29
4 H Sept. 23-Oct. 1
5 T Oct. 1-3
6 T Oct. 17-19
7 T Oct. 31-Nov. 3
(T) TROPICAL STORM: Did not reach 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

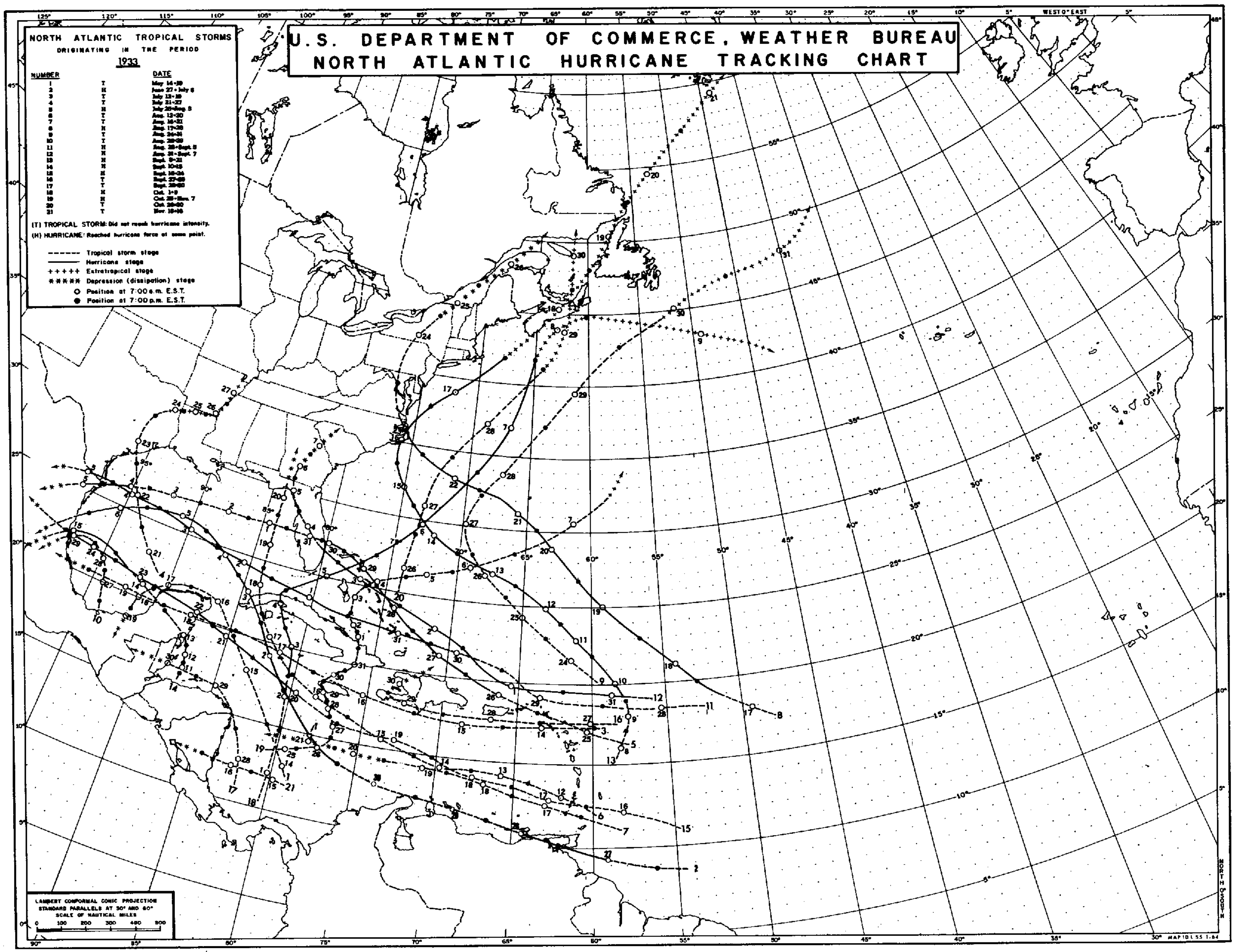

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1928
NUMBER DATE
1 H Aug. 3-12
2 H Aug. 7-17
3 T Sept. 2-8
4 H Sept 6-20
5 T Sept. 8-12
6 H Oct. 10-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION

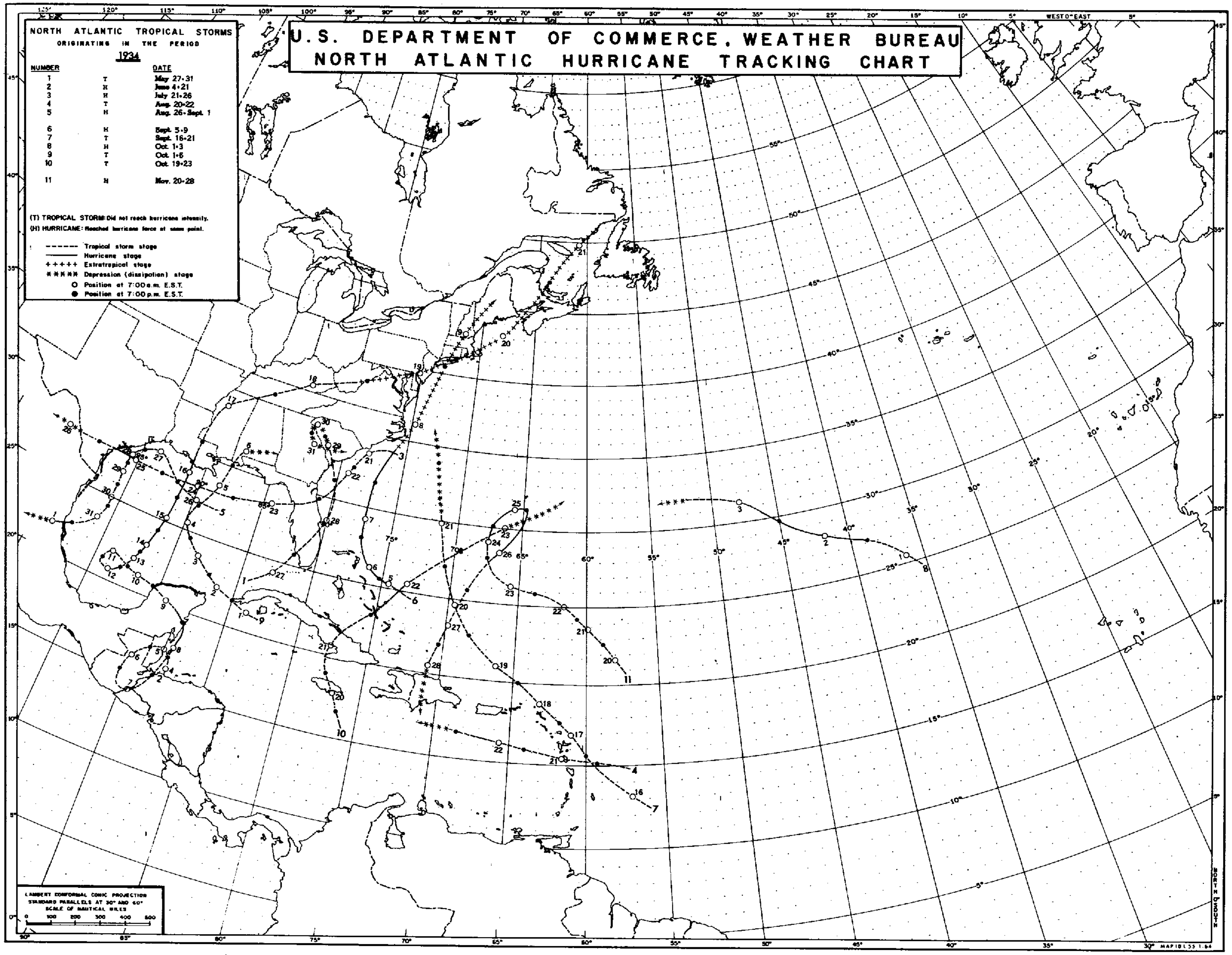

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1929
NUMBER
DATE
1 H Jun. 26—29
2 H Sep. 21—Oct. 4
3 H Oct. 15—22
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
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

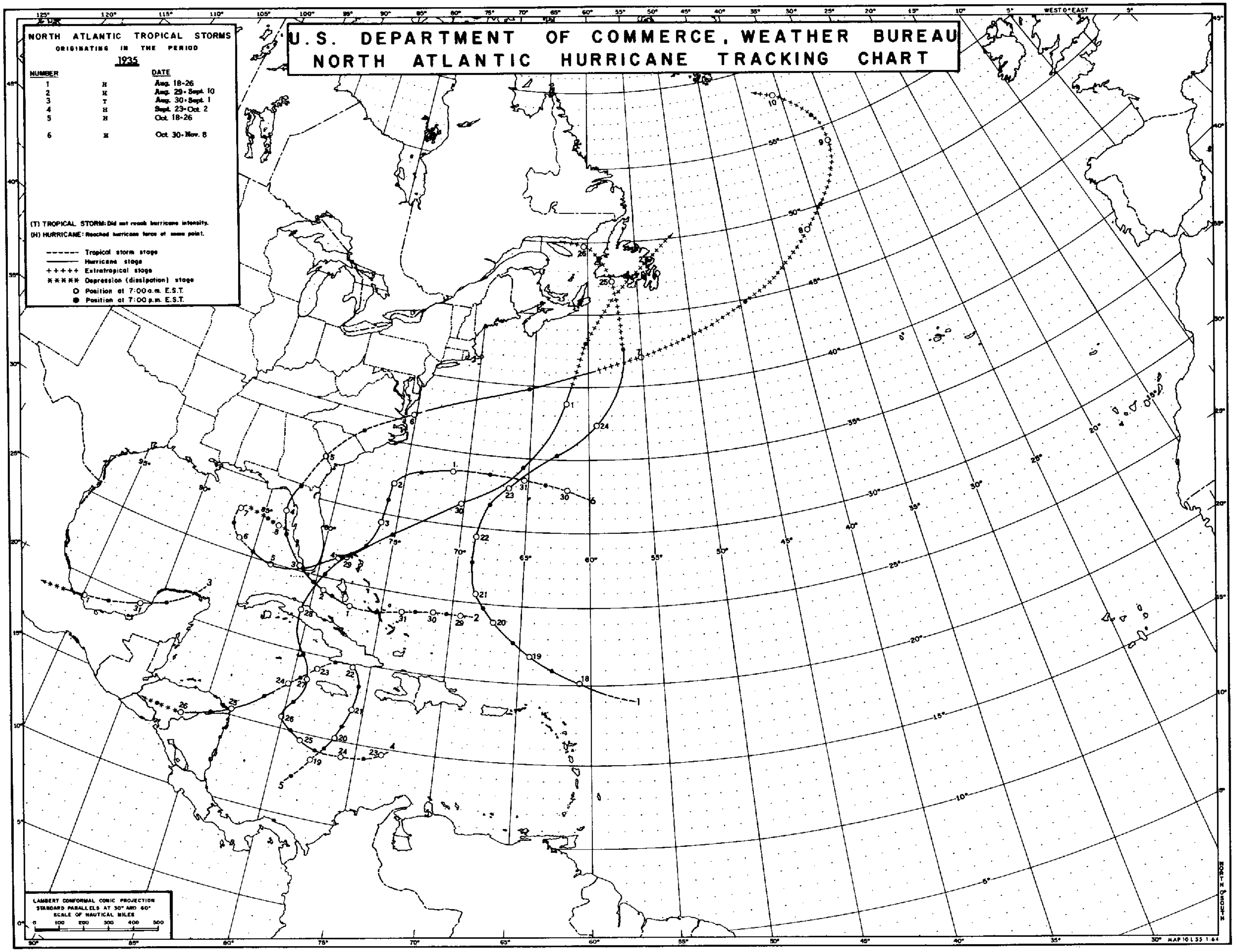

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1930
NUMBER
DATE
1 H Aug. 22-31
2 H Aug. 31-Sept. 17
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
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

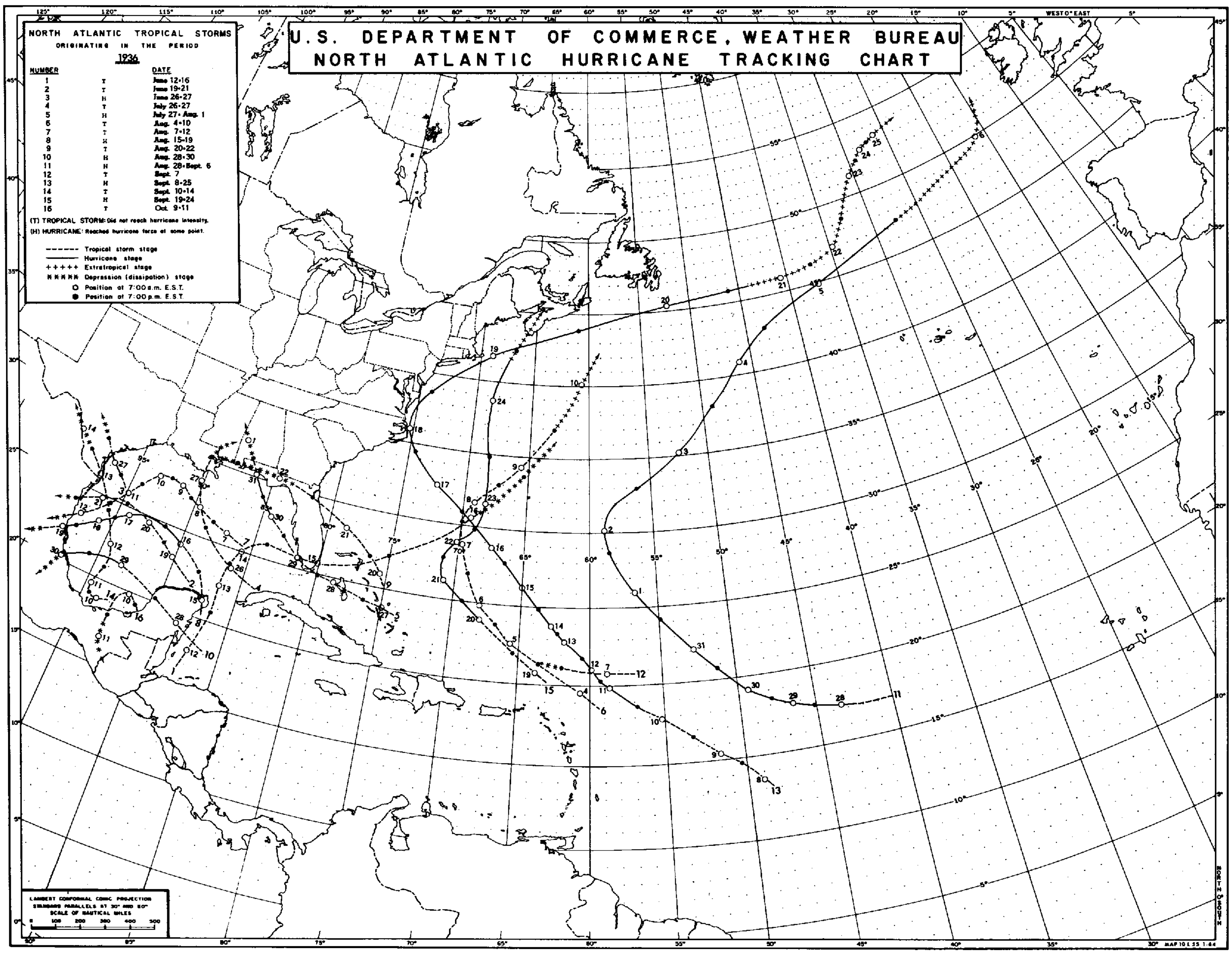

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1931
NUMBER DATE
1 T June 24-28
2 T July 11-17
3 T Aug. 10-18
4 T Aug. 16-20
5 H Sept. 5-12
6 H Sept. 8-16
7 T Sept. 25-27
8 T Oct. 18-22
9 T Nov. 22-25
(T) TROPICAL 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

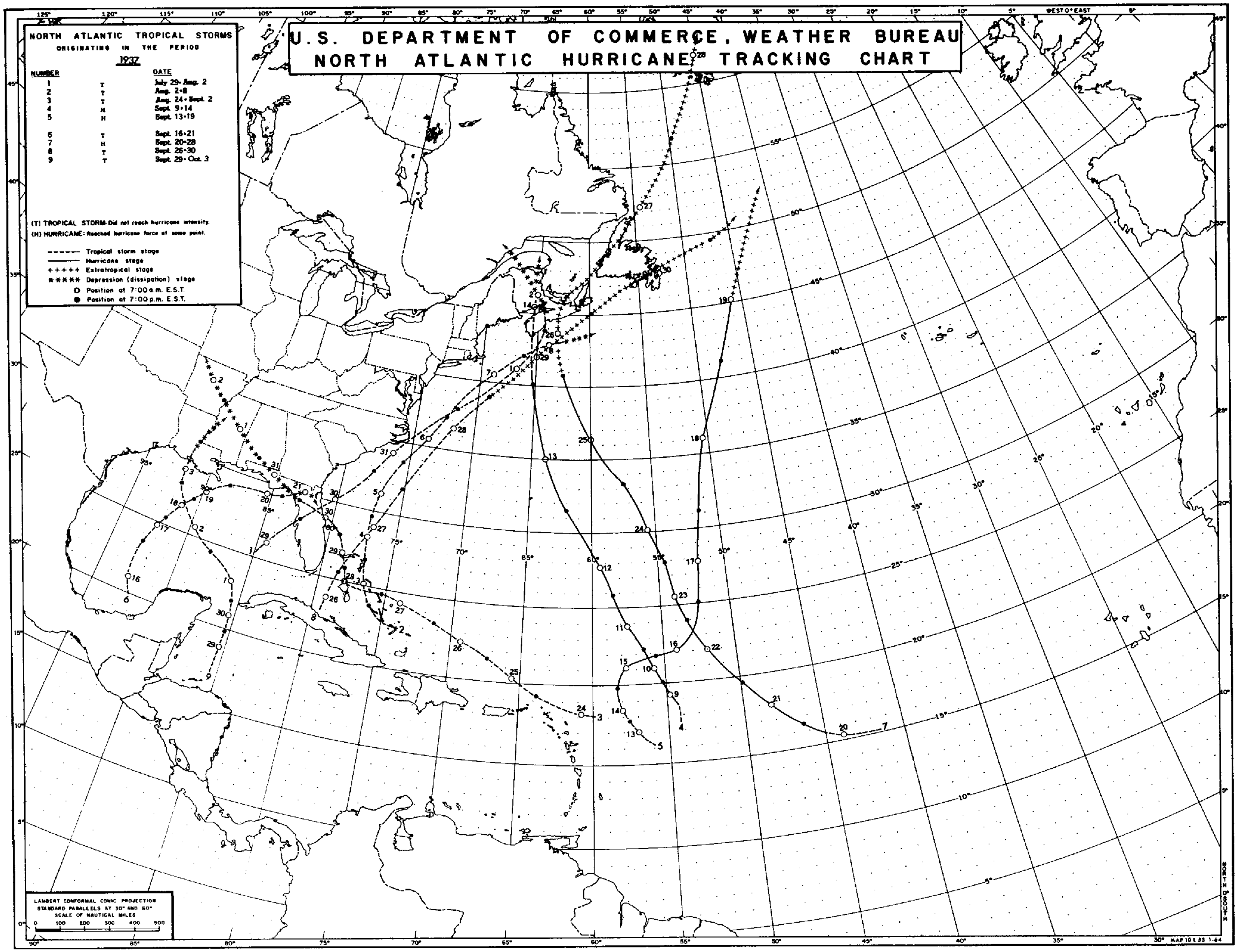

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1932
NUMBER DATE
1 T May 5-10
2 H Aug. 11-14
3 H Aug. 26-Sept. 3
4 H Aug. 30-Sept. 13
5 T Sept. 9-17
6 T Sept. 18-21
7 H Sept. 25-Oct. 3
8 T Oct. 7-18
9 T Oct. 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


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1933
NUMBER
DATE
(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

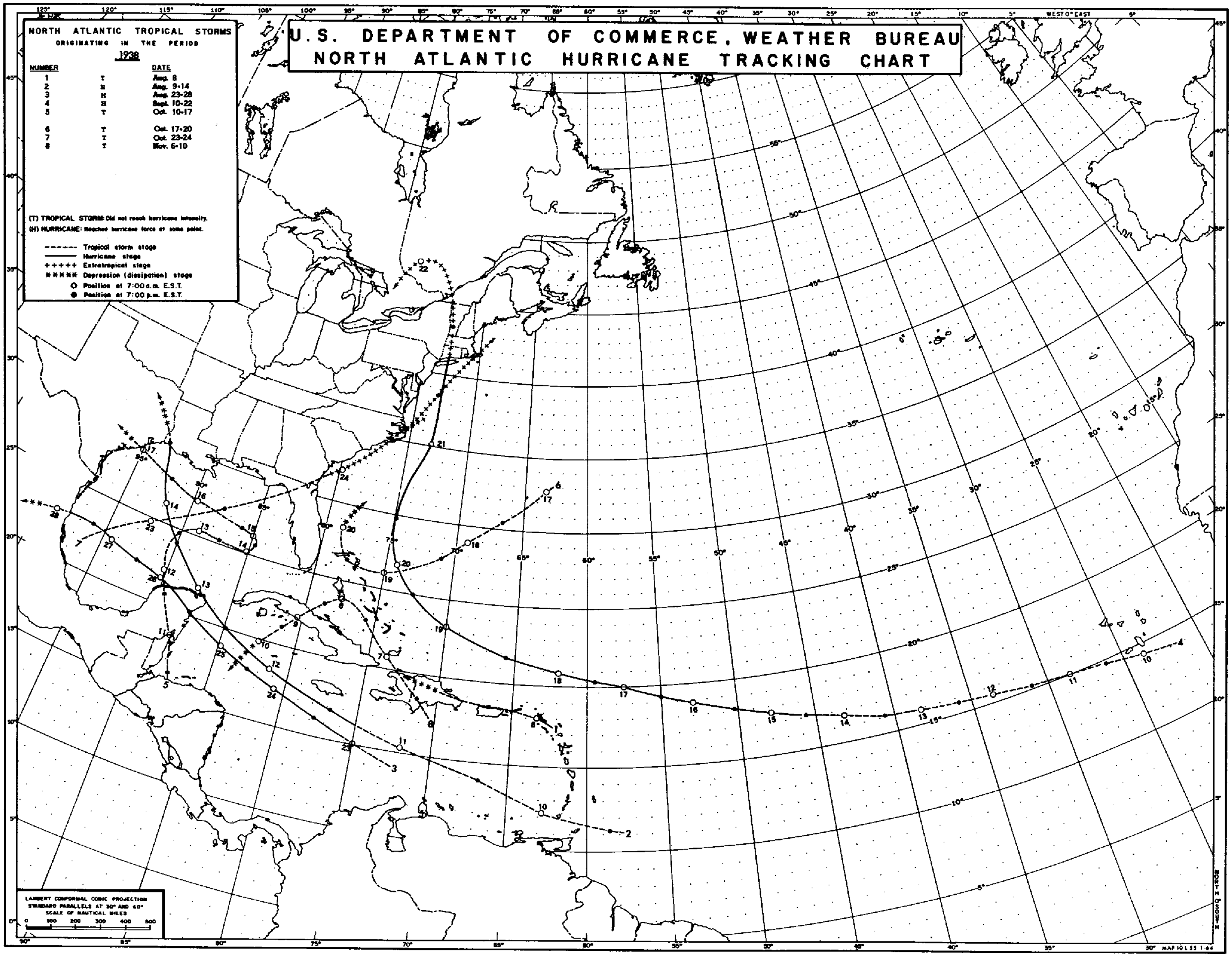

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1934
NUMBER
DATE
1 T May 27-31
2 H June 4-21
3 H July 21-26
4 T Aug. 20-22
5 H Aug. 26-Sept. 1
6 H Sept. 5-9
7 T Sept. 16-21
8 H Oct. 1-3
9 T Oct. 1-6
10 T Oct. 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

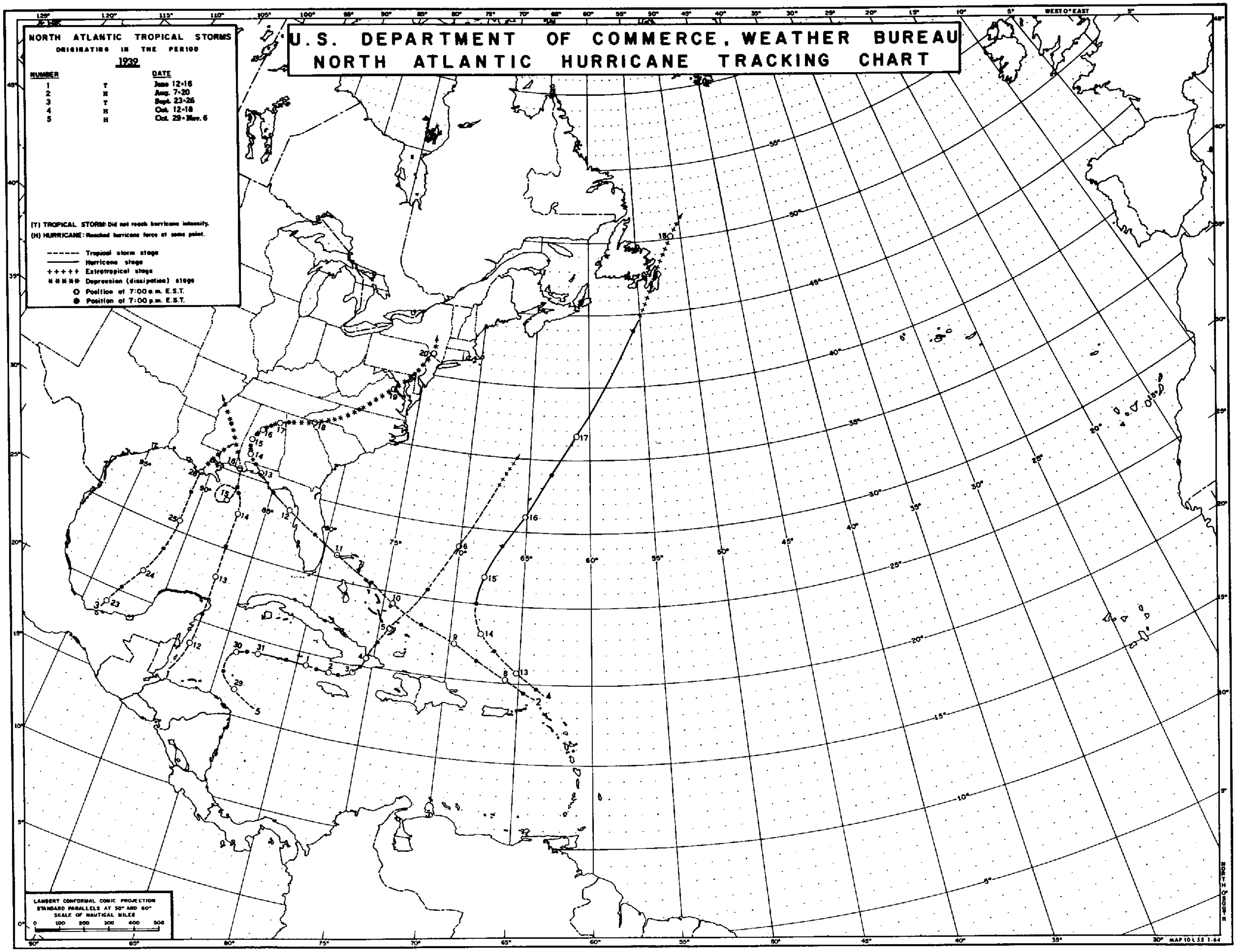

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1935
NUMBER
DATE
1 H Aug. 18-26
2 H Aug. 29-Sept. 10
3 T Aug. 30-Sept. 1
4 H Sept. 23-Oct. 2
5 H Oct. 18-26
6 H Oct. 30-Nov. 8
(T) TROPICAL STORM: Did not reach 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

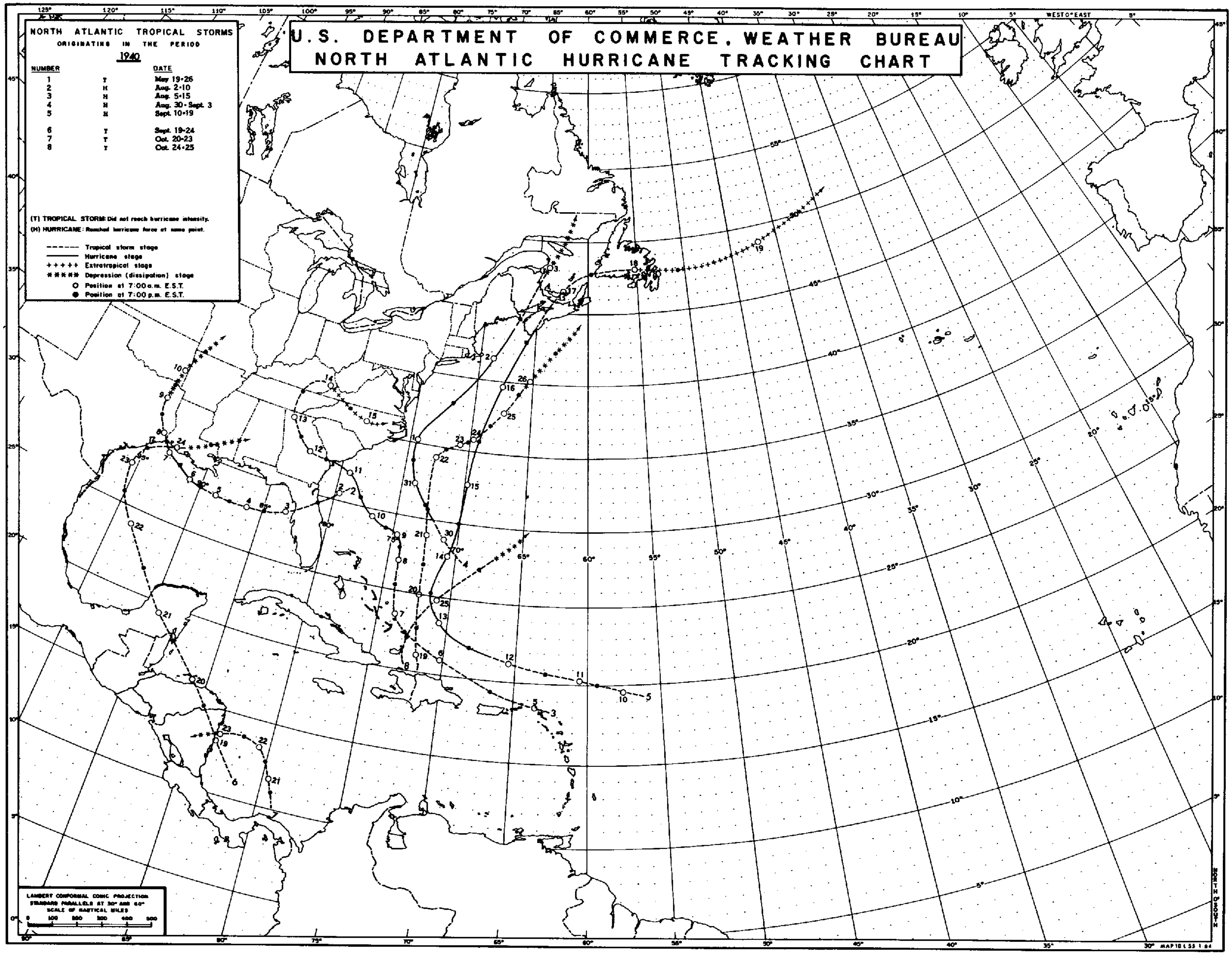

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1936
NUMBER DATE
1 T June 12-16
2 T June 19-21
3 H June 26-27
4 T July 26-27
5 H July 27-Aug. 1
6 T Aug. 4-10
7 T Aug. 7-12
8 H Aug. 15-19
9 T Aug. 20-22
10 H Aug. 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

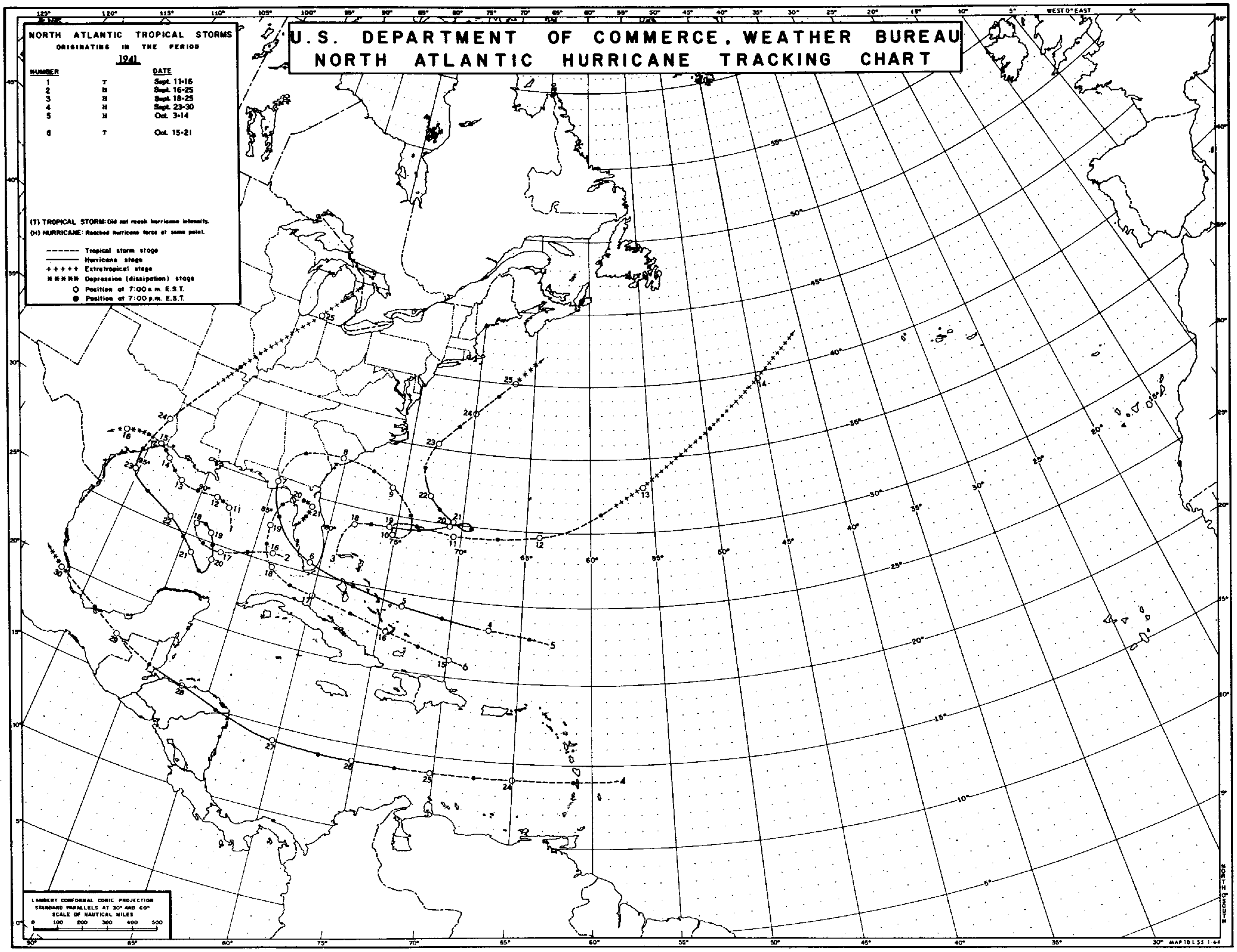


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1937
NUMBER DATE
1 T July 29- Aug. 2
2 T Aug. 2-8
3 T Aug. 24 - Sept. 2
4 H Sept. 9-14
5 H Sept. 13-19
6 T Sept. 16-21
7 H Sept. 20-28
8 T Sept. 26-30
9 T Sept. 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

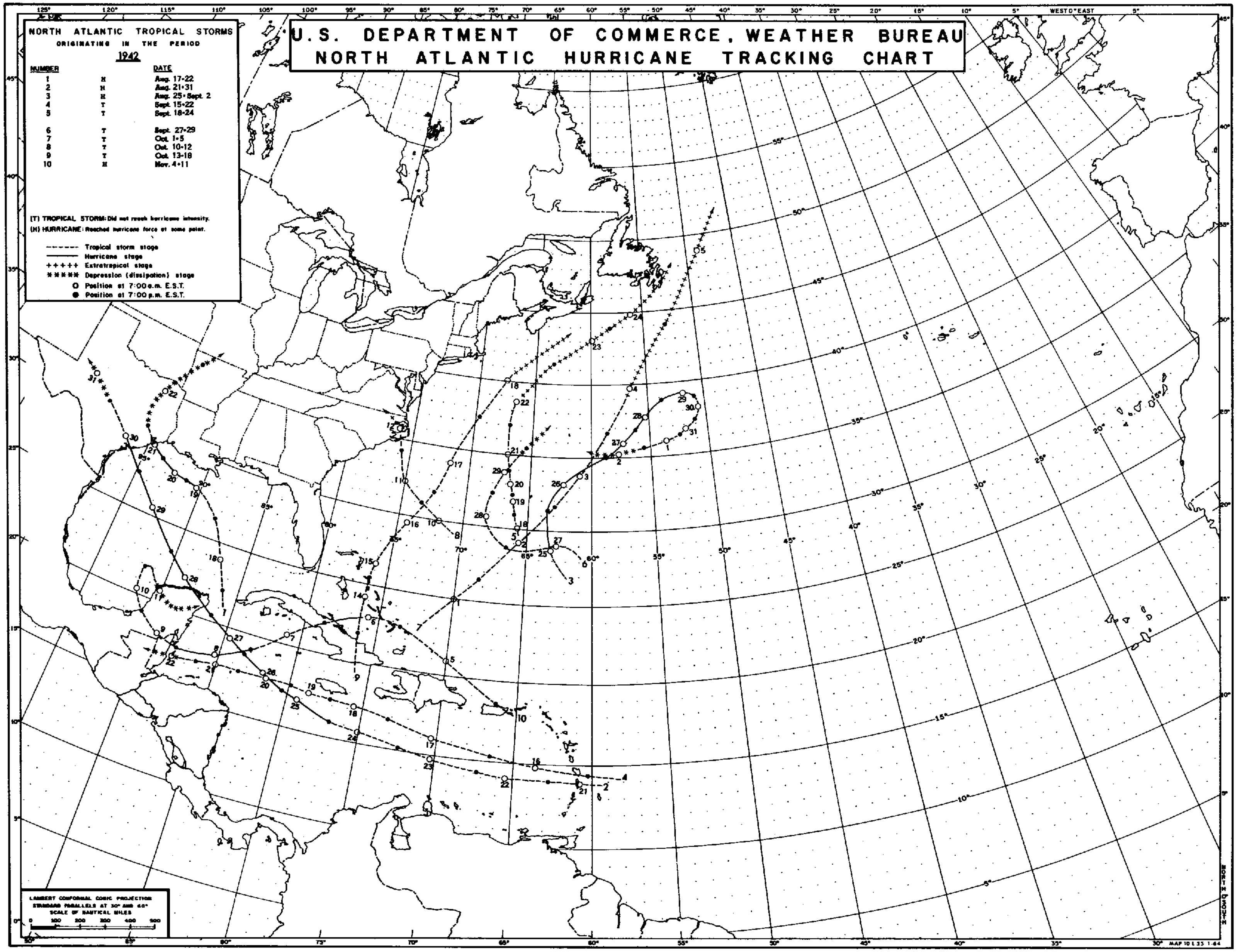

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1938
NUMBER DATE
1 T Aug. 8
2 H Aug. 9-14
3 H Aug. 23-28
4 H Sept. 10-22
5 T Oct. 10-17
6 T Oct. 17-20
7 T Oct. 23-24
8 T Nov. 6-10
(T) TROPICAL STORM: Did not 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

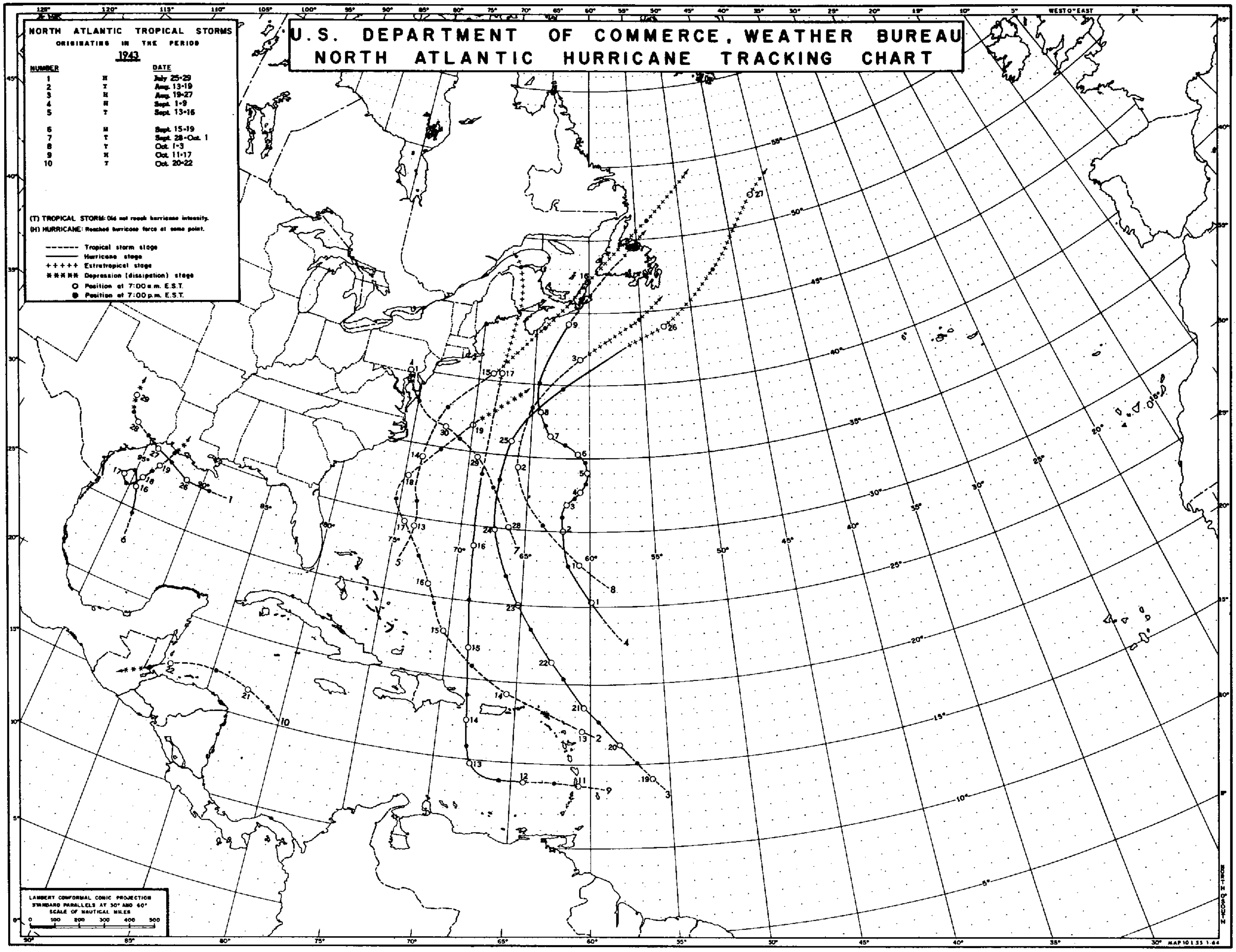

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1939
NUMBER
DATE
1 T June 12-16
2 H Aug. 7-20
3 T Sept. 23-26
4 H Oct. 12-18
5 H Oct. 29-Nov. 6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: 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

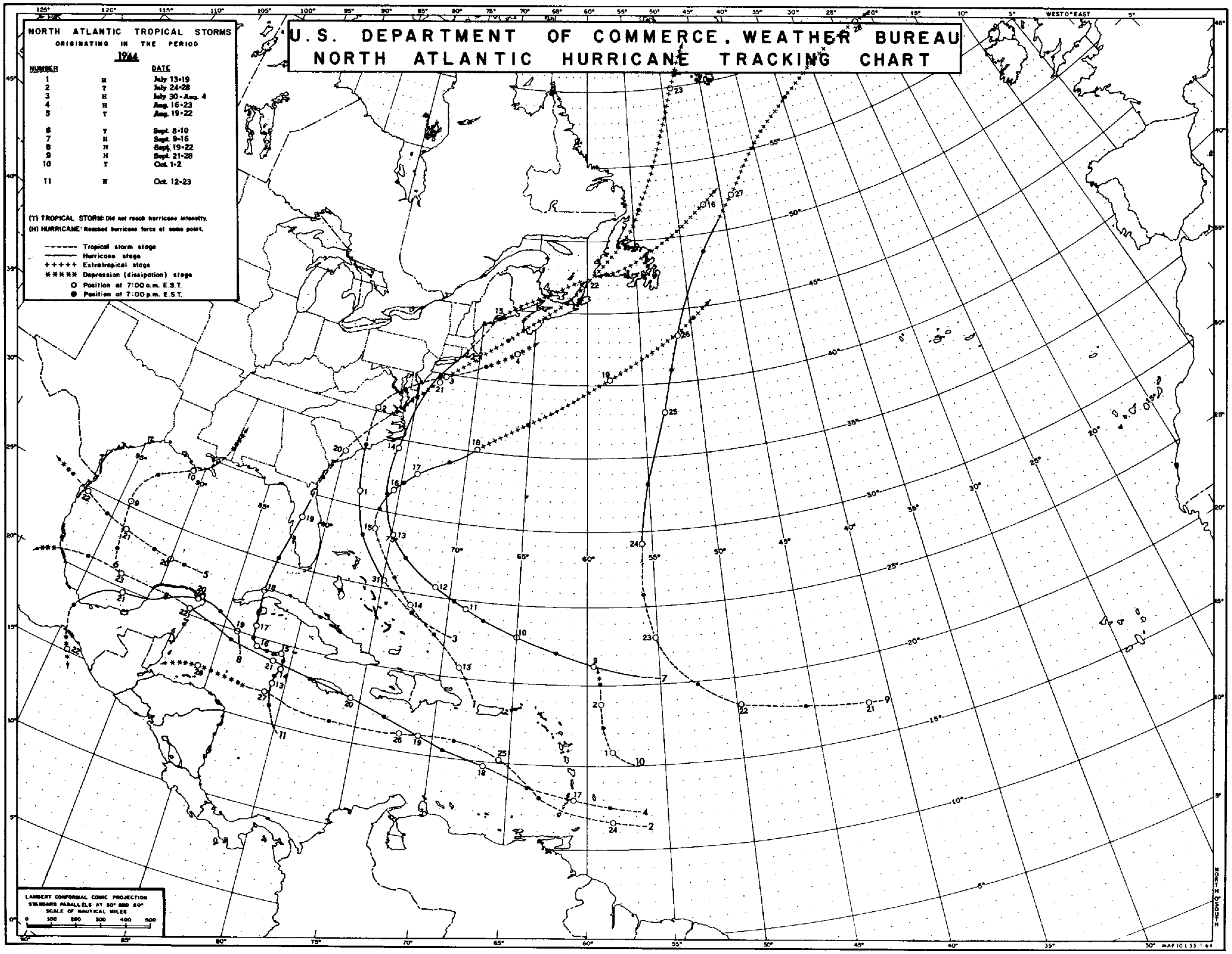

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1940
NUMBER DATE
1 T May 19-26
2 H Aug. 2-10
3 H Aug. 5-15
4 H Aug. 30 - Sept. 3
5 H Sept. 10-19
6 T Sept. 19-24
7 T Oct. 20-23
8 T Oct. 24-25
(T) TROPICAL STORM: 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



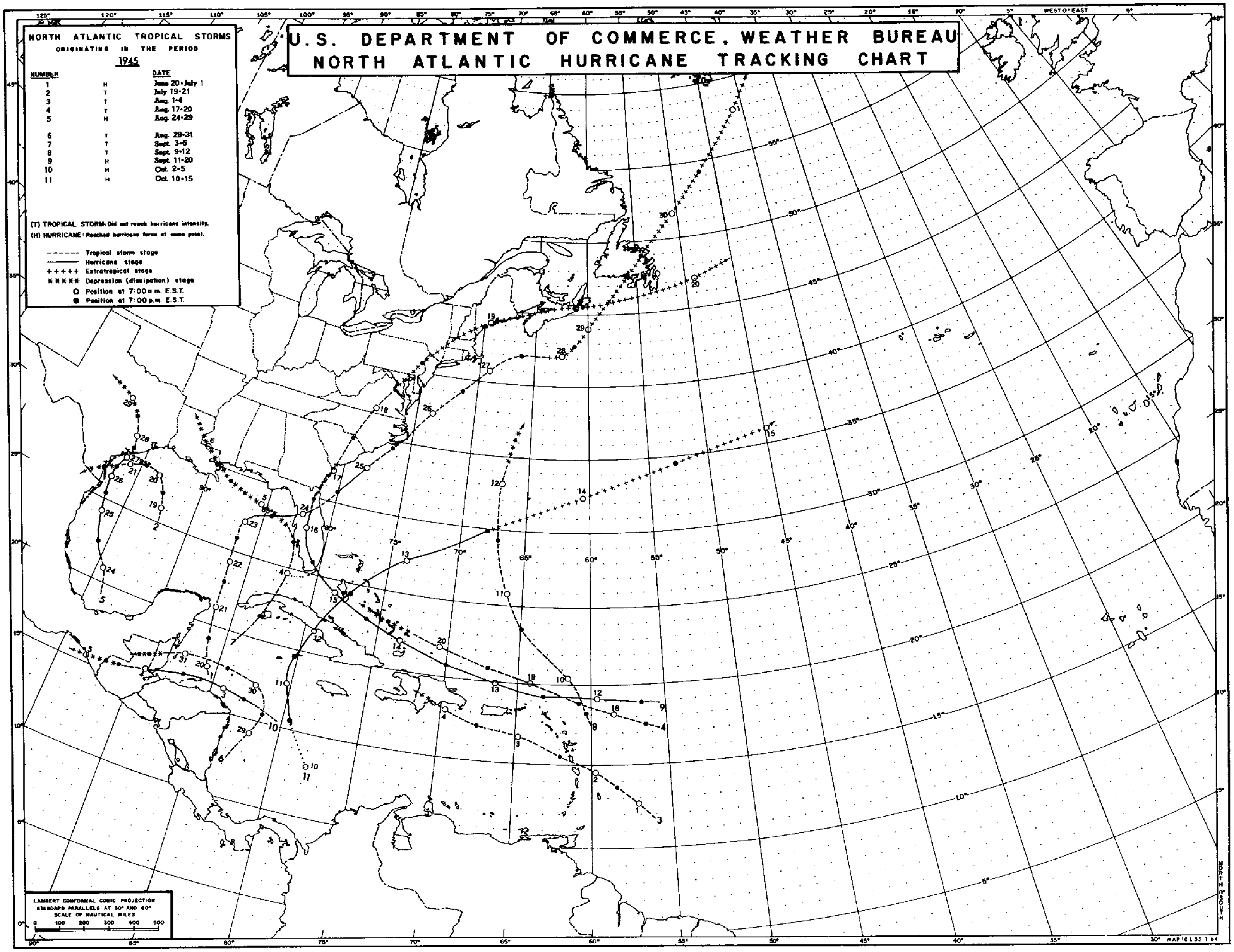
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1941
NUMBER DATE
1 T Sept. 11-16
2 H Sept. 16-25
3 H Sept. 18-25
4 H Sept. 23-30
5 H Oct. 3-14
6 T Oct. 15-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(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

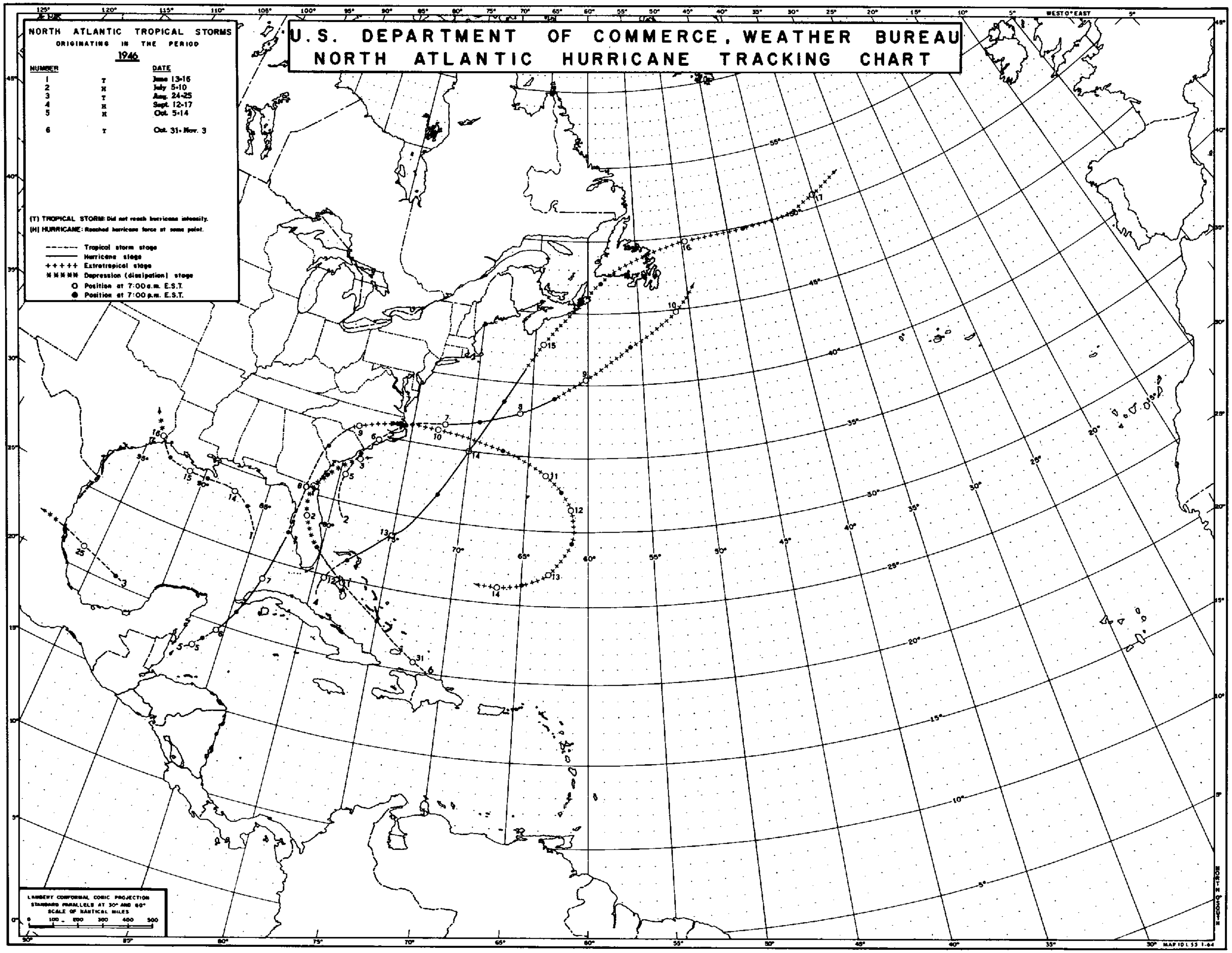

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1942
NUMBER
DATE
1 H Aug. 17-22
2 H Aug. 21-31
3 H Aug. 25-Sept. 2
4 T Sept. 15-22
5 T Sept. 18-24
6 T Sept. 27-29
7 T Oct. 1-5
8 T Oct. 10-12
9 T Oct. 13-18
10 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

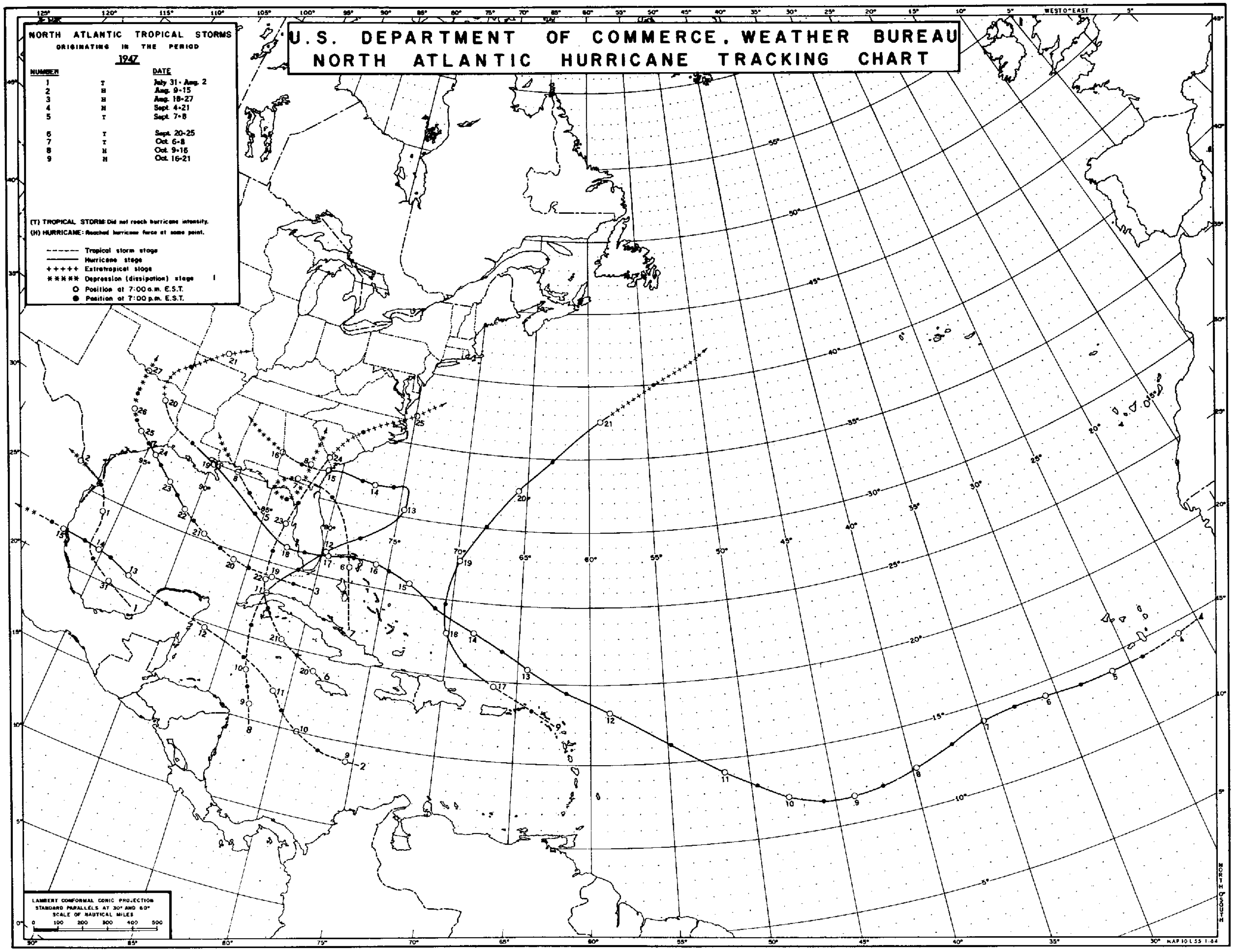


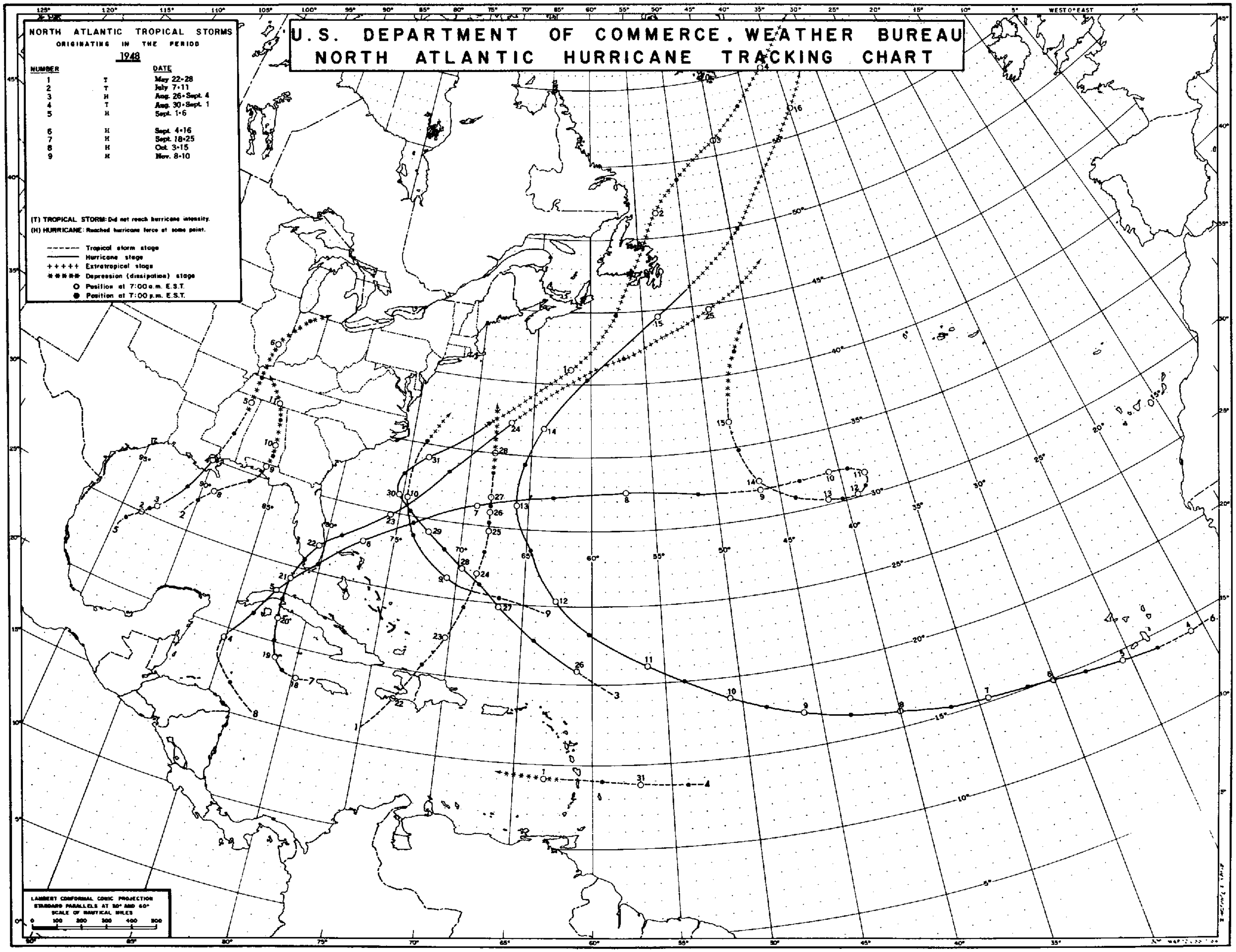
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1944
NUMBER
DATE
1 H July 13-19
2 T July 24-28
3 H July 30 - Aug. 4
4 H Aug. 16-23
5 T Aug. 19-22
6 T Sept. 8-10
7 H Sept. 9-16
8 H Sept. 19-22
9 H Sept. 21-28
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

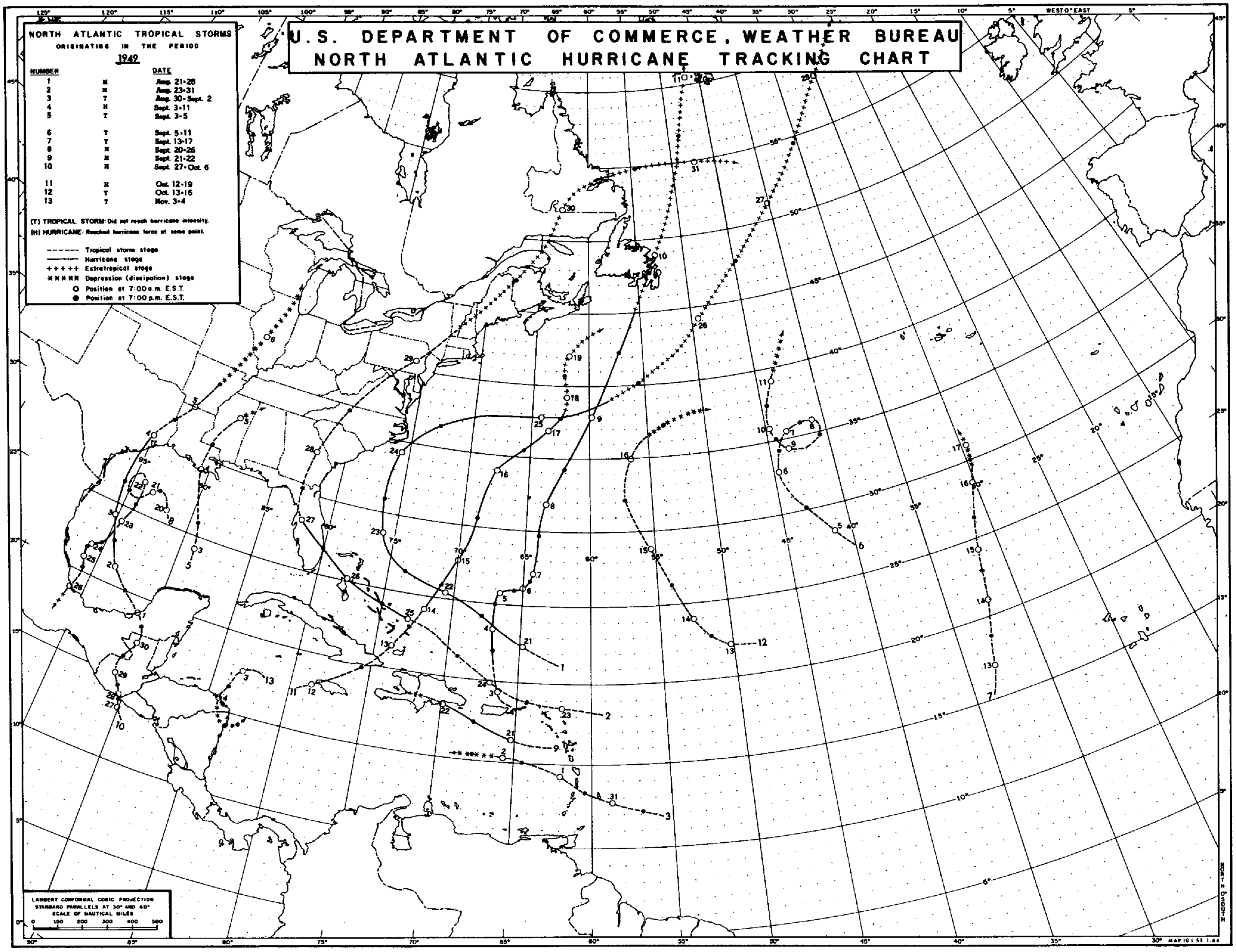

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1945
NUMBER DATE
1 H June 20 - July 1
2 T July 19-21
3 T Aug. 1-4
4 T Aug. 17-20
5 H Aug. 24-29
6 T Aug. 29-31
7 T Sept. 3-6
8 T Sept. 9-12
9 H Sept. 11-20
10 H Oct. 2-5
11 H Oct. 10-15
(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.
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

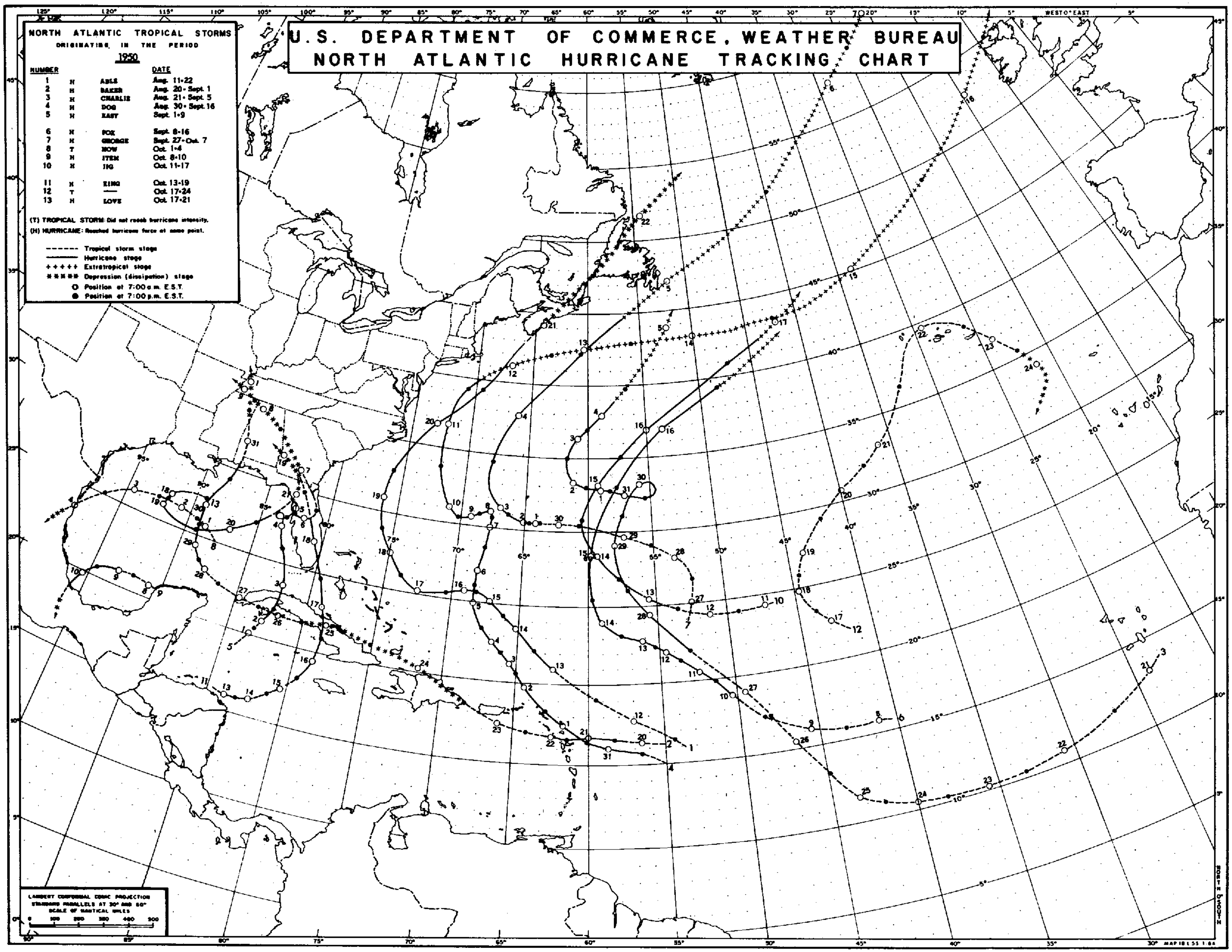


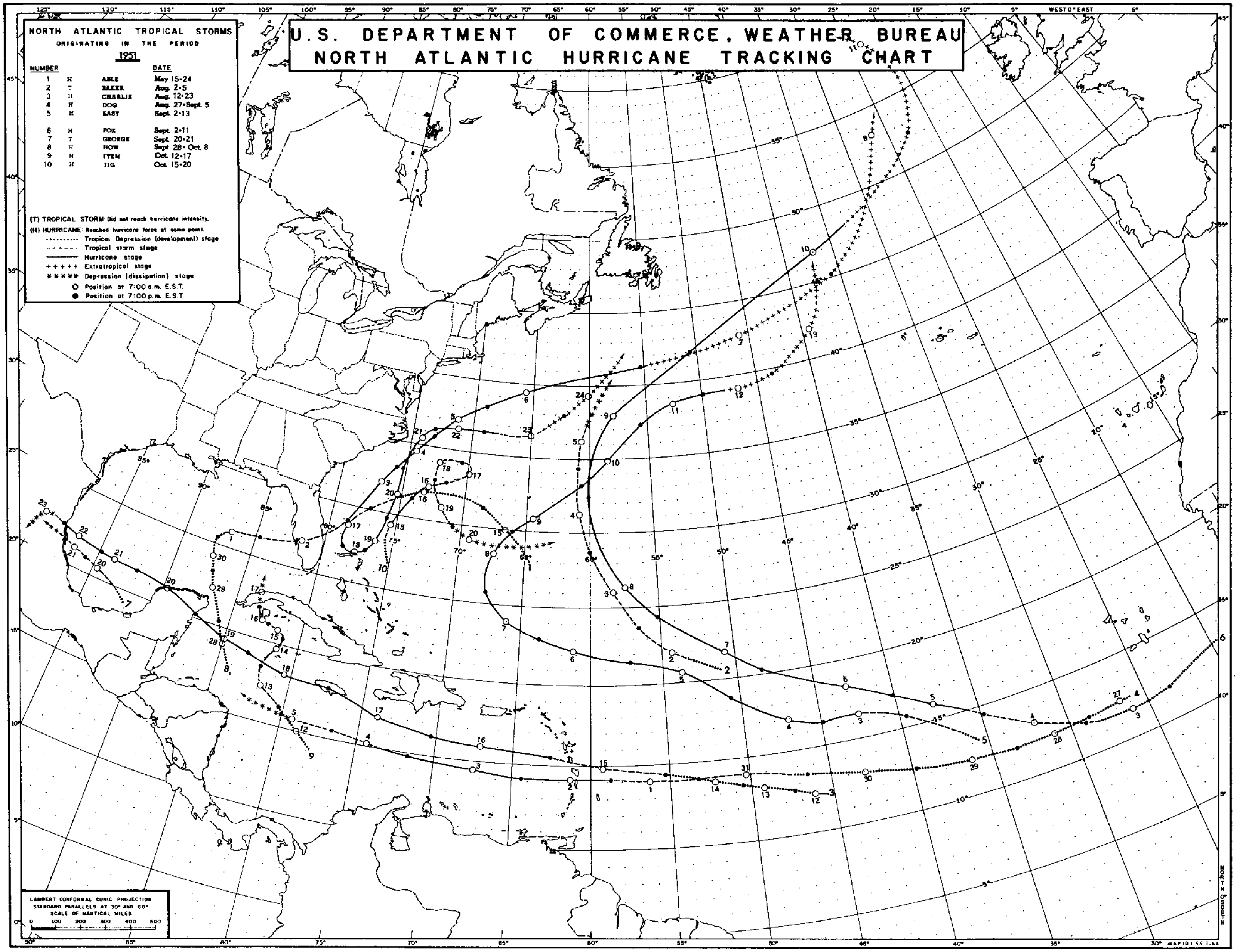
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1946
NUMBER DATE
1 T June 13-16
2 H July 5-10
3 T Aug. 24-25
4 H Sept. 12-17
5 H Oct. 5-14
6 T Oct. 31- Nov. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(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.


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

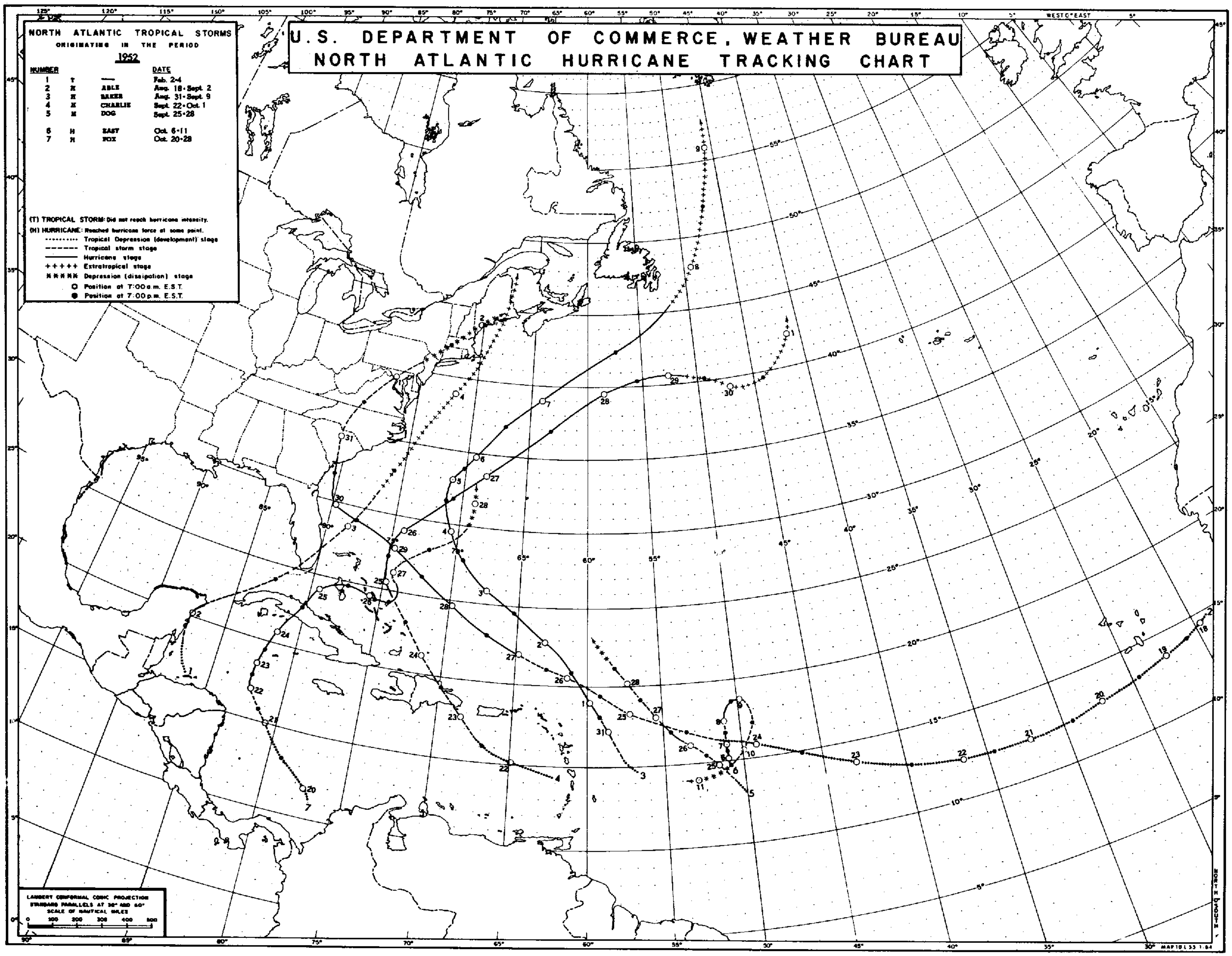

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1948
NUMBER DATE
1 T May 22-28
2 T July 7-11
3 H Aug. 26-Sept. 4
4 T Aug. 30-Sept. 1
5 H Sept. 1-6
6 H Sept. 4-16
7 H Sept. 18-25
8 H Oct. 3-15
9 H Nov. 8-10
(T) 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
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

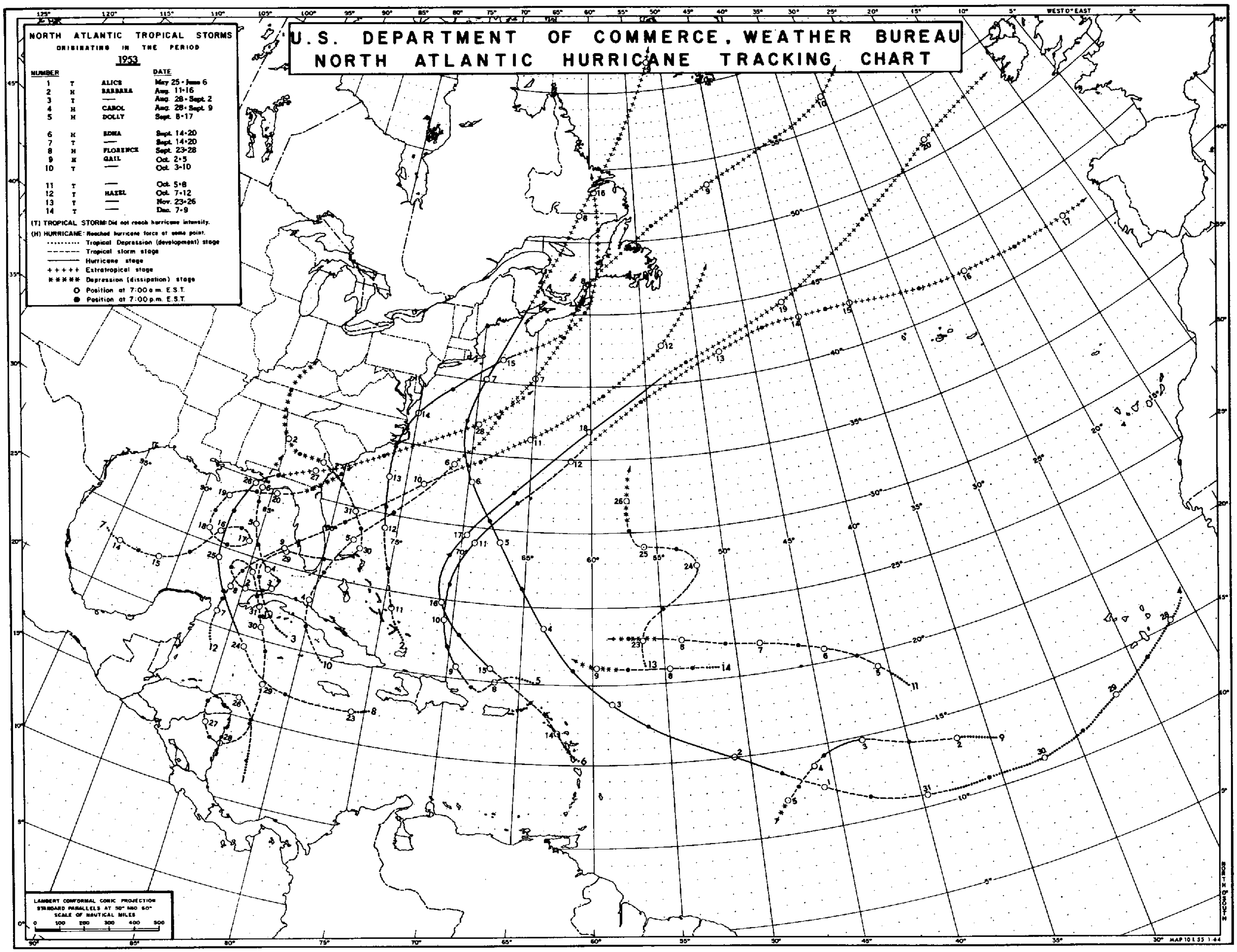

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1949
NUMBER DATE
1 H Aug. 21-28
2 H Aug. 23-31
3 T Aug. 30-Sept. 2
4 H Sept. 3-11
5 T Sept. 3-5
6 T Sept. 5-11
7 T Sept. 13-17
8 H Sept. 20-26
9 H Sept. 21-22
10 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.

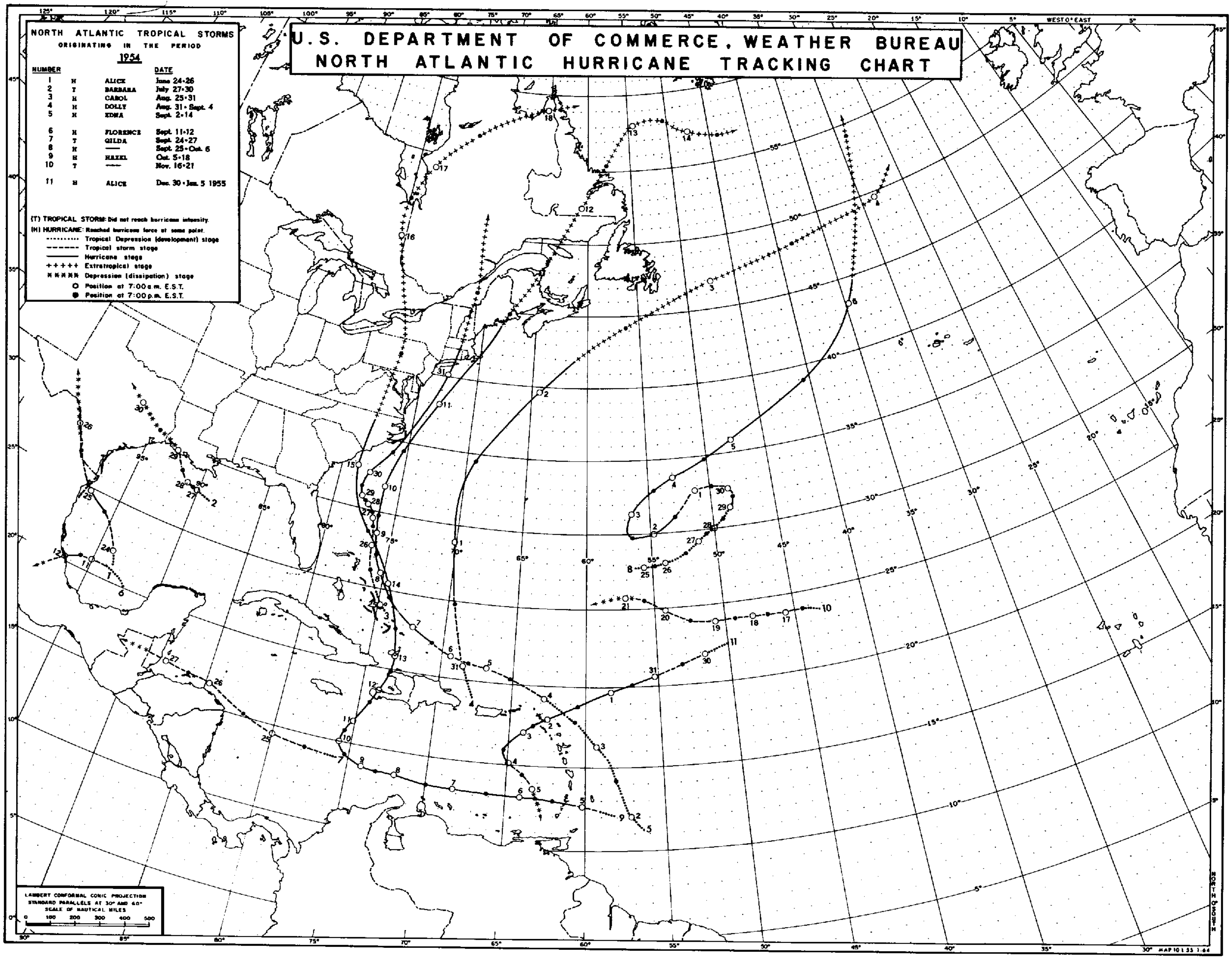

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1950
NUMBER DATE
1 H ABLE Aug. 11-22
2 H BAKER Aug. 20 - Sept. 1
3 H CHARLIE Aug. 21 - Sept. 5
4 H DOG Aug. 30 - Sept. 16
5 H EASY Sept. 1-9
6 H FOX Sept. 8-16
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
(H) HURRICANE
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.

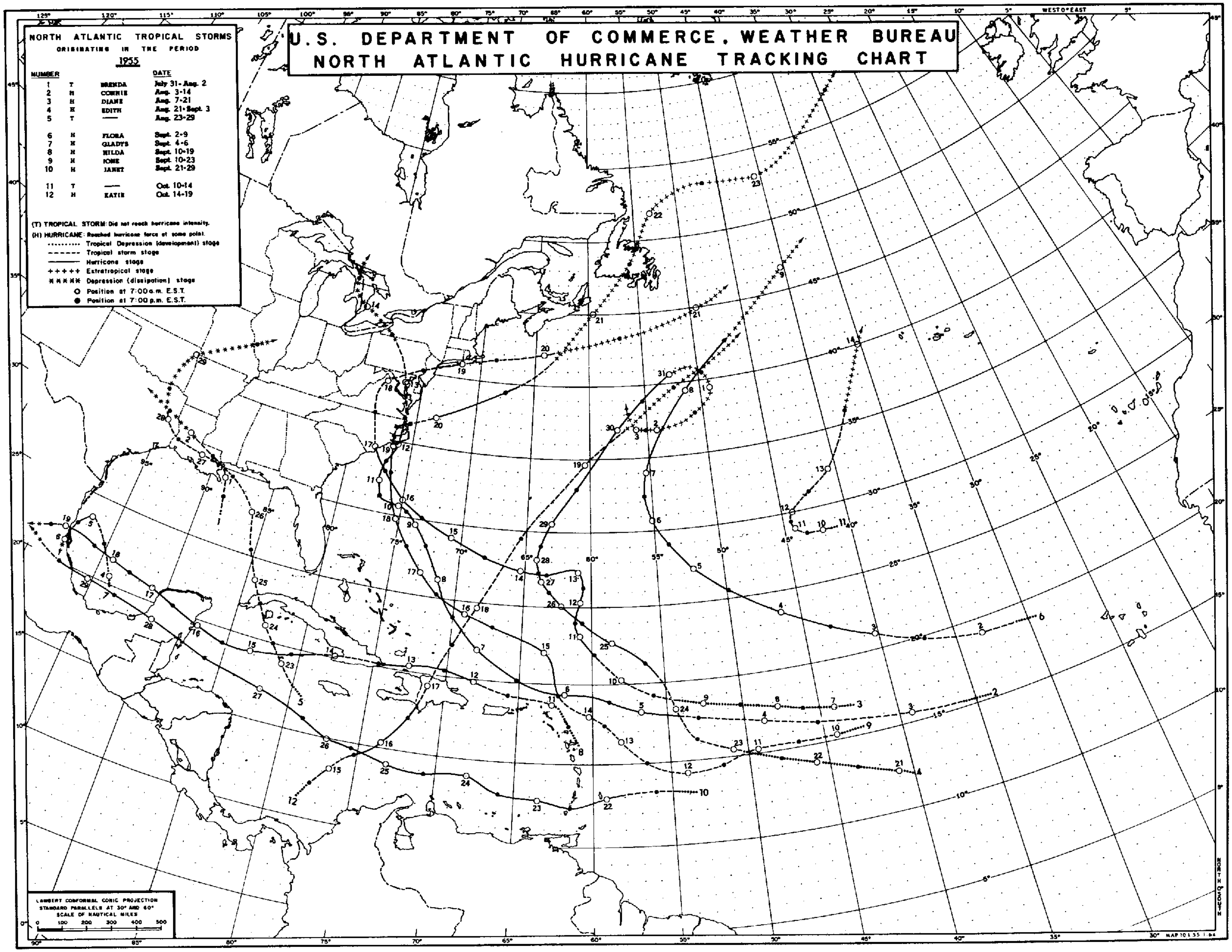


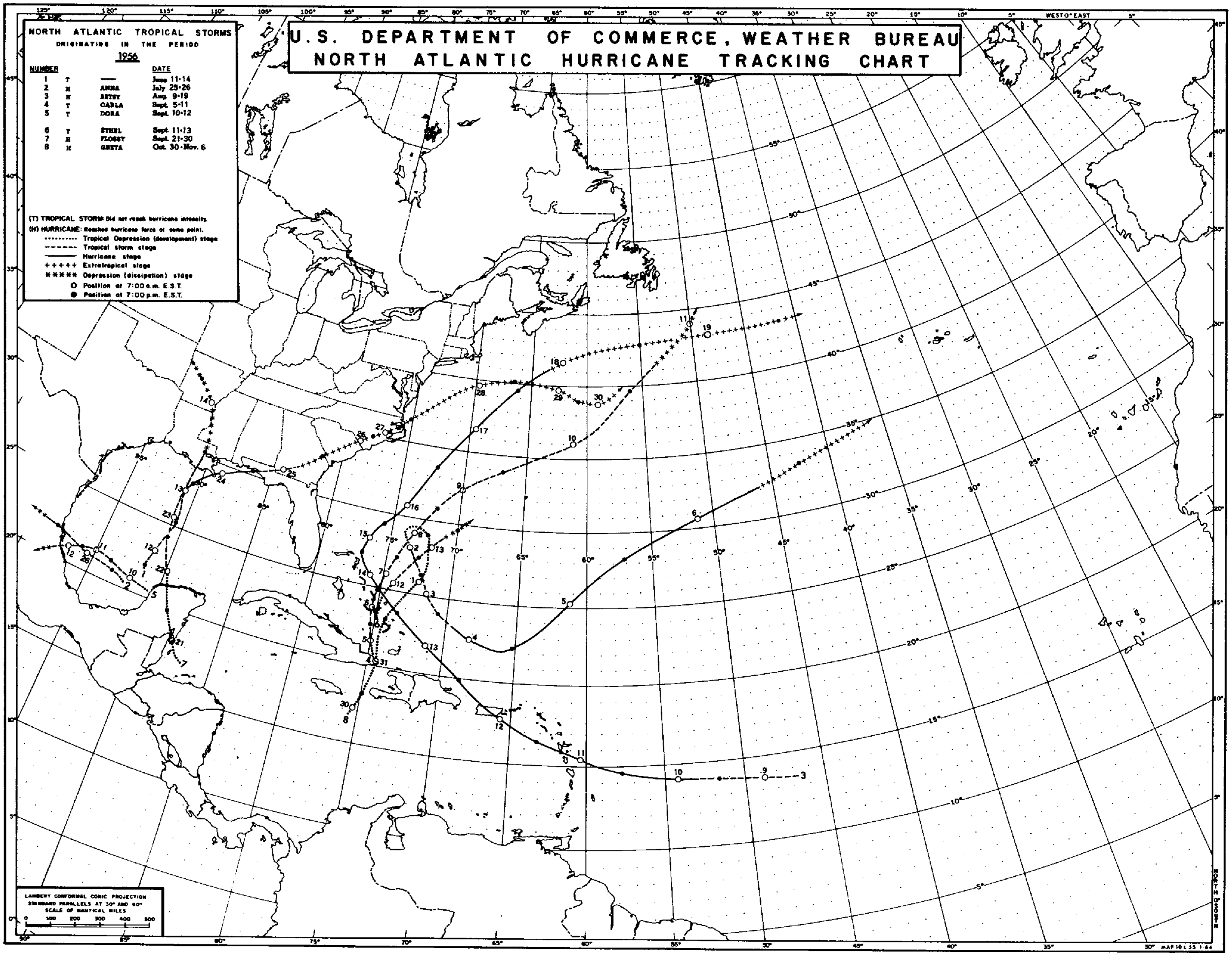
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1951
NUMBER DATE
1 H ABLE May 15-24
2 T BAKER Aug. 2-5
3 H CHARLIE Aug. 12-23
4 H DOG Aug. 27-Sept. 5
5 H EASY Sept. 2-13
6 H FOX Sept. 2-11
7 T GEORGE Sept. 20-21
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


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.

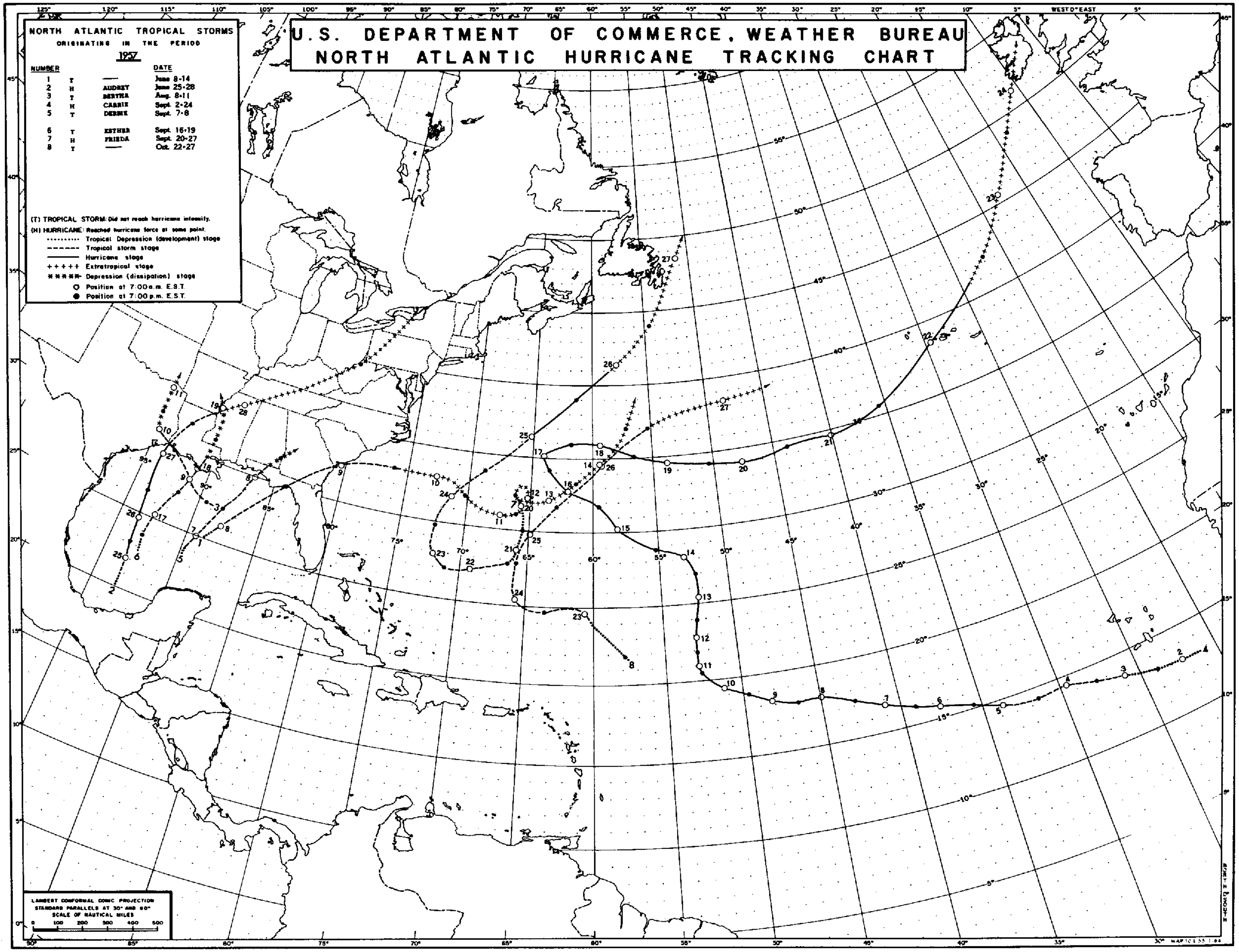

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1953
NUMBER DATE
1 T ALICE May 25 - June 6
2 H BARBARA Aug. 11-16
3 T — Aug. 28 - Sept. 2
4 H CAROL Aug. 28 - Sept. 9
5 H DOLLY Sept. 8-17
6 H EDNA Sept. 14-20
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

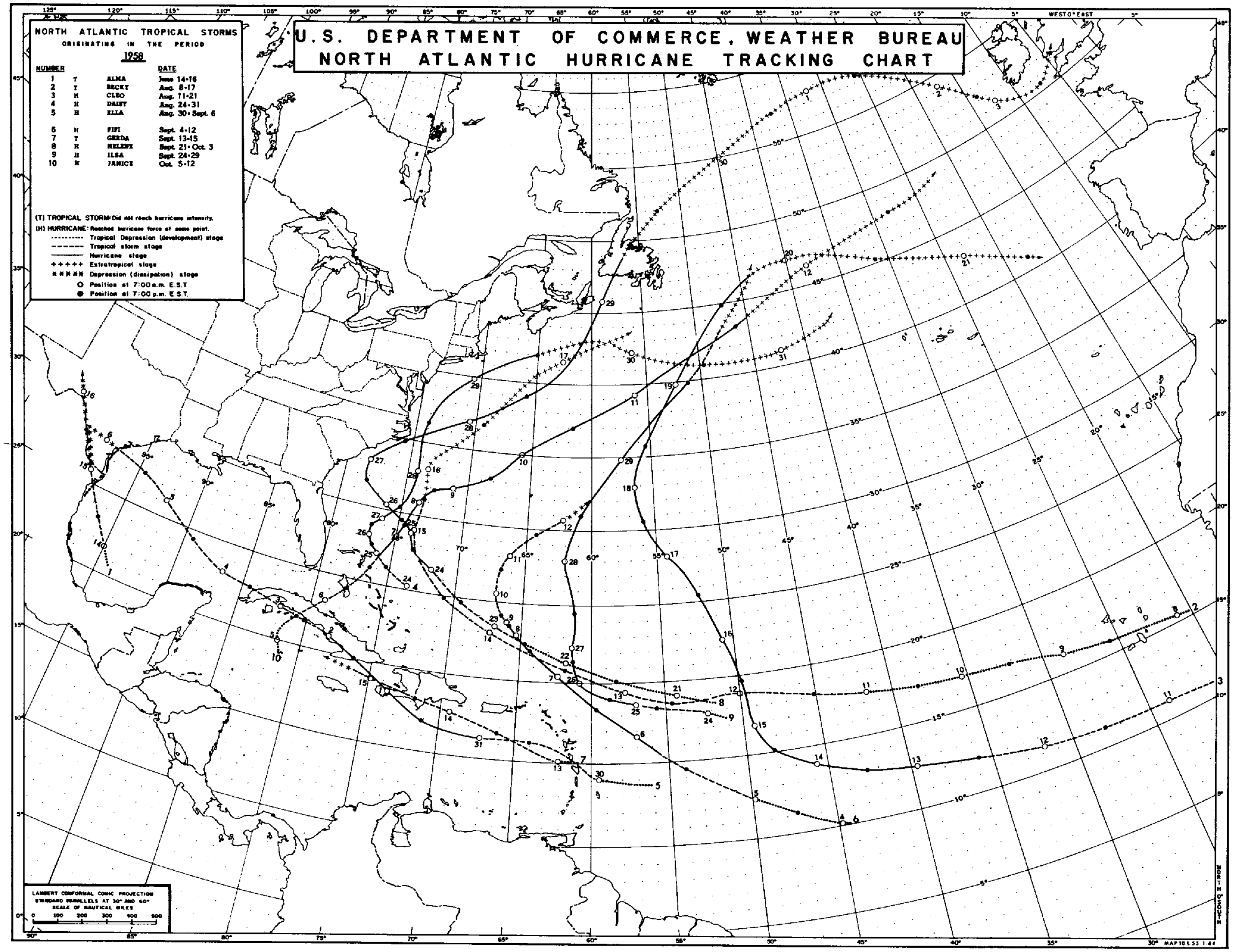

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1954
NUMBER DATE
1 H ALICE June 24-26
2 T BARBARA July 27-30
3 H CAROL Aug. 25-31
4 H DOLLY Aug. 31 - Sept. 4
5 H EDNA Sept. 2-14
6 H FLORENCE Sept. 11-12
7 T GILDA 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.


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

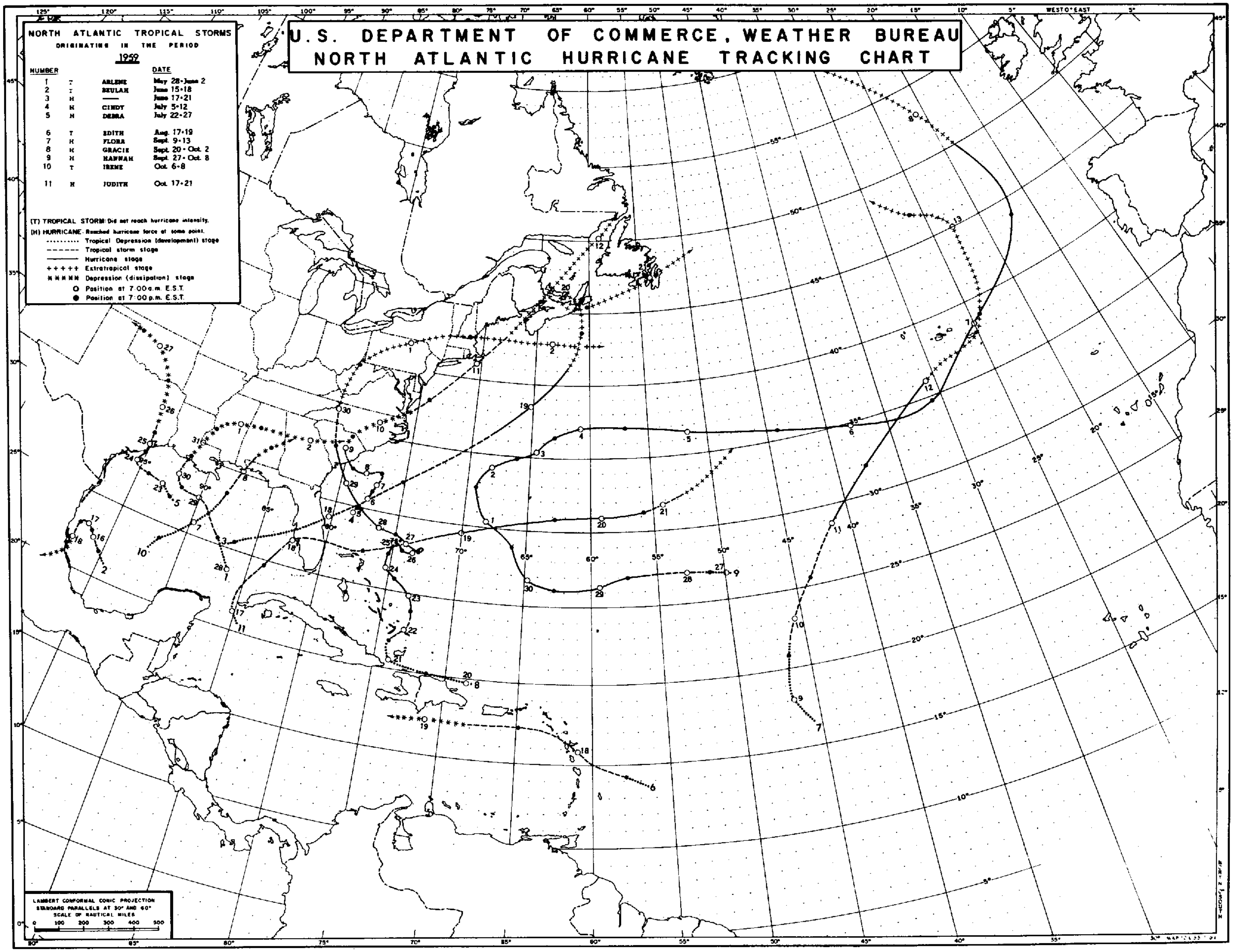


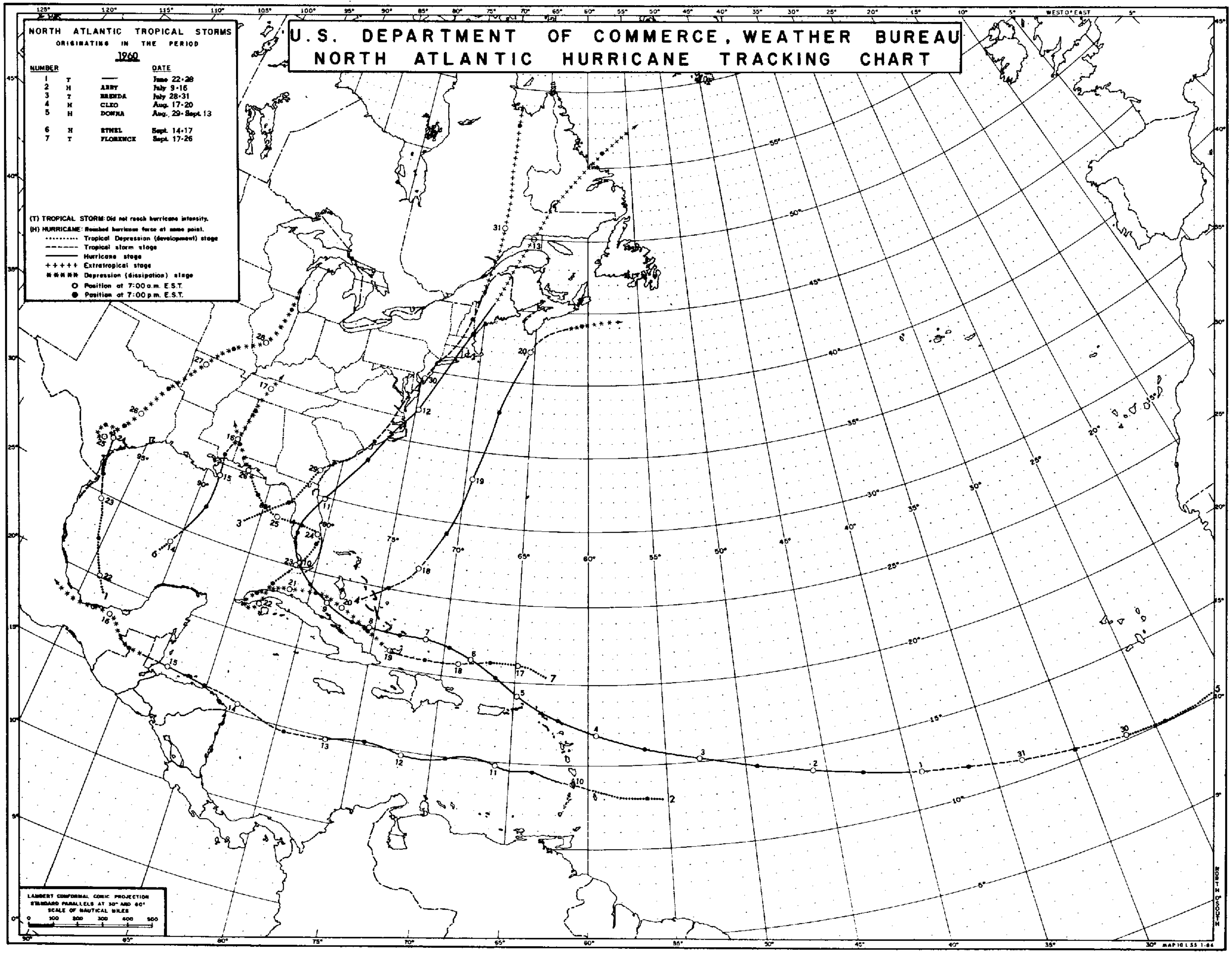
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1956
NUMBER DATE
1 T —— June 11-14
2 H ANNA July 25-26
3 H BETSY Aug. 9-19
4 T CARLA Sept. 5-11
5 T DORA Sept. 10-12
6 T ETHEL Sept. 11-13
7 H FLOSSY Sept. 21-30
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.

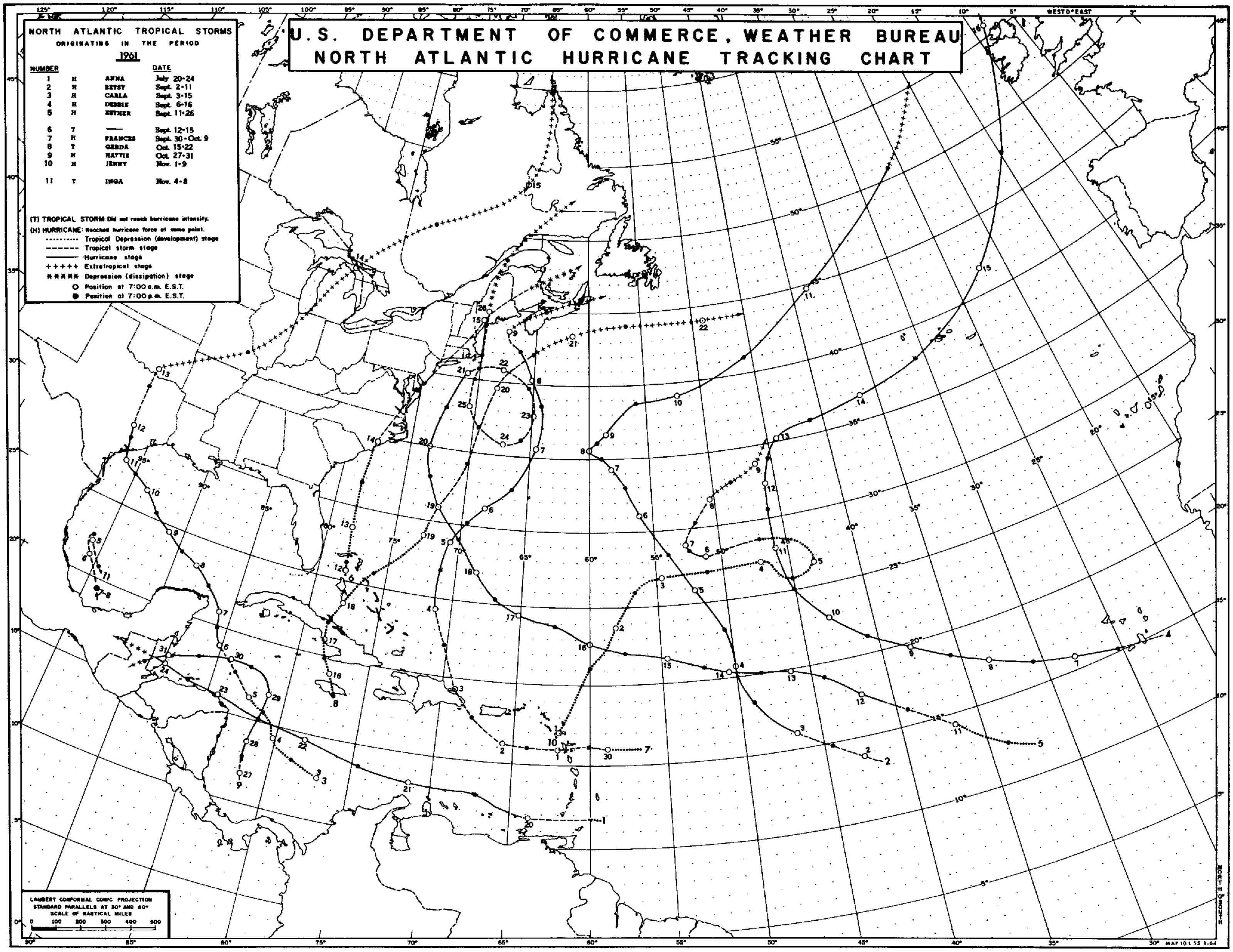

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1957
NUMBER
DATE
1 T — June 8-14
2 H AUDREY June 25-28
3 T BERTHA Aug. 8-11
4 H CARRIE Sept. 2-24
5 T DEBBIE Sept. 7-8
6 T ESTHER Sept. 16-19
7 H FRIEDA Sept. 20-27
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
WEST 0° EAST



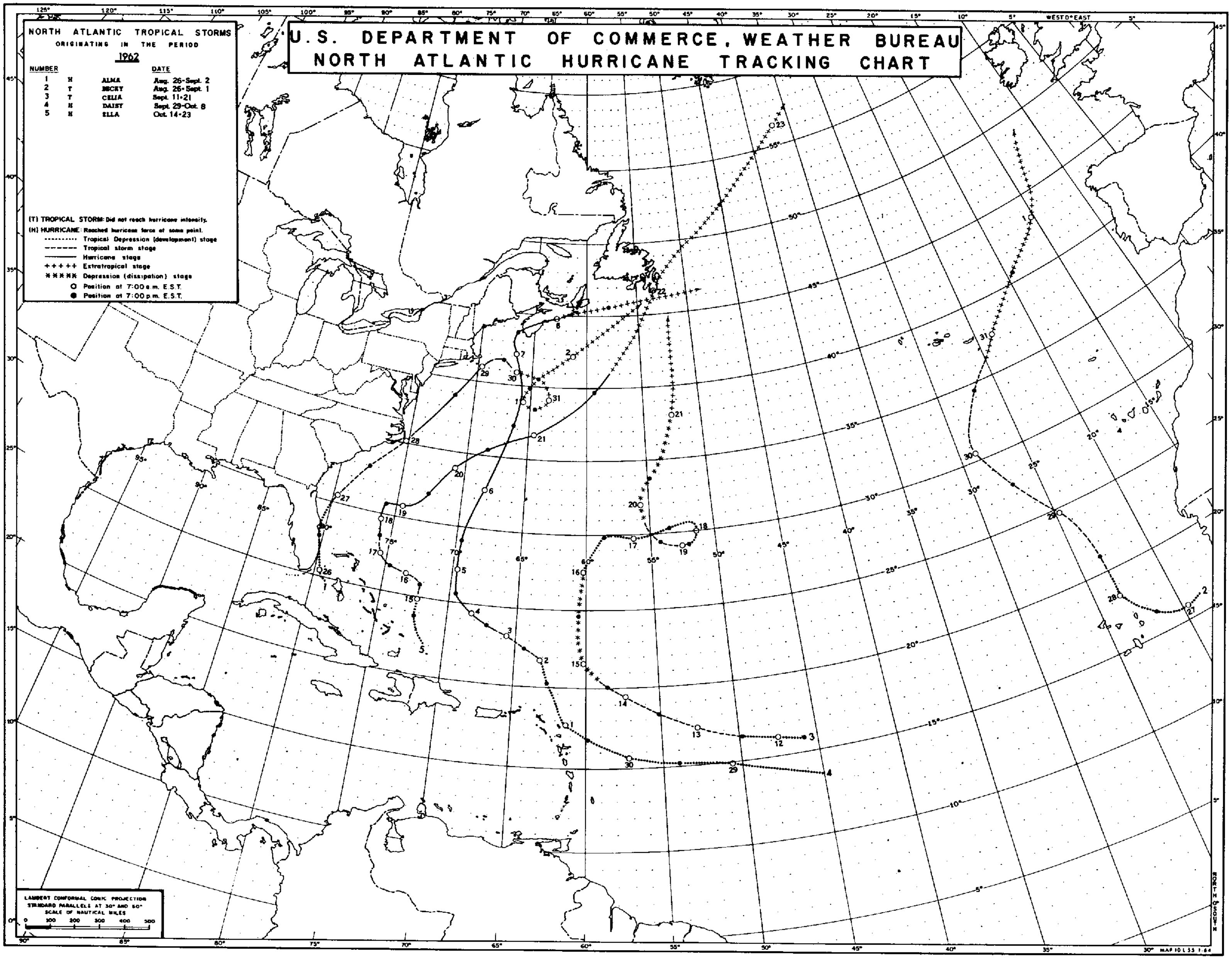
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1958
NUMBER DATE
1 T ALMA June 14-16
2 T BECKY Aug. 8-17
3 H CLEO Aug. 11-21
4 H DAISY Aug. 24-31
5 H ELLA Aug. 30-Sept. 6
6 H FIFI Sept. 4-12
7 T GERDA Sept. 13-15
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

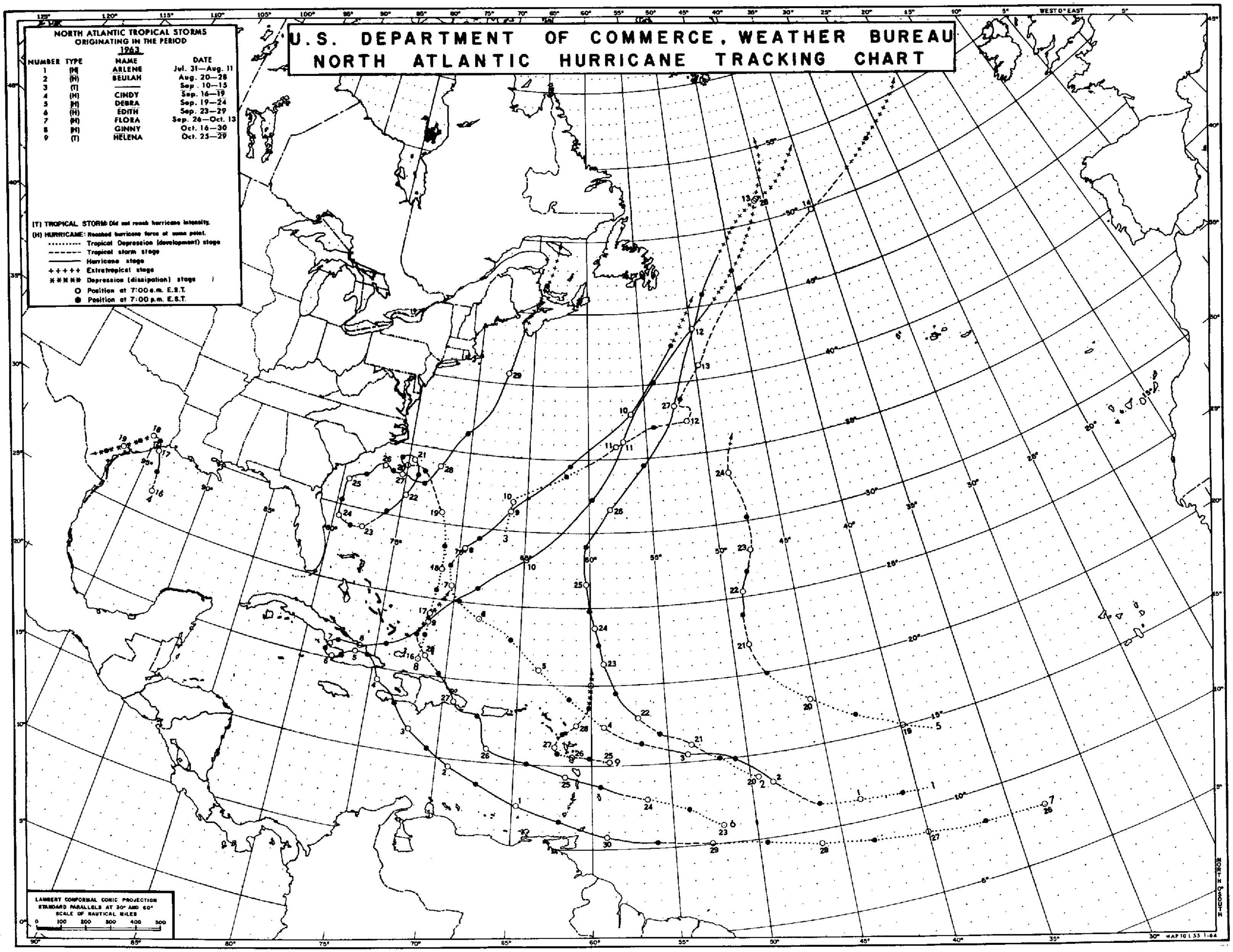

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1959
NUMBER
DATE
1 T ARLENE May 28-June 2
2 T BEULAH June 15-18
3 H —— June 17-21
4 H CINDY July 5-12
5 H DEBRA July 22-27
6 T EDITH Aug. 17-19
7 H FLORA Sept. 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

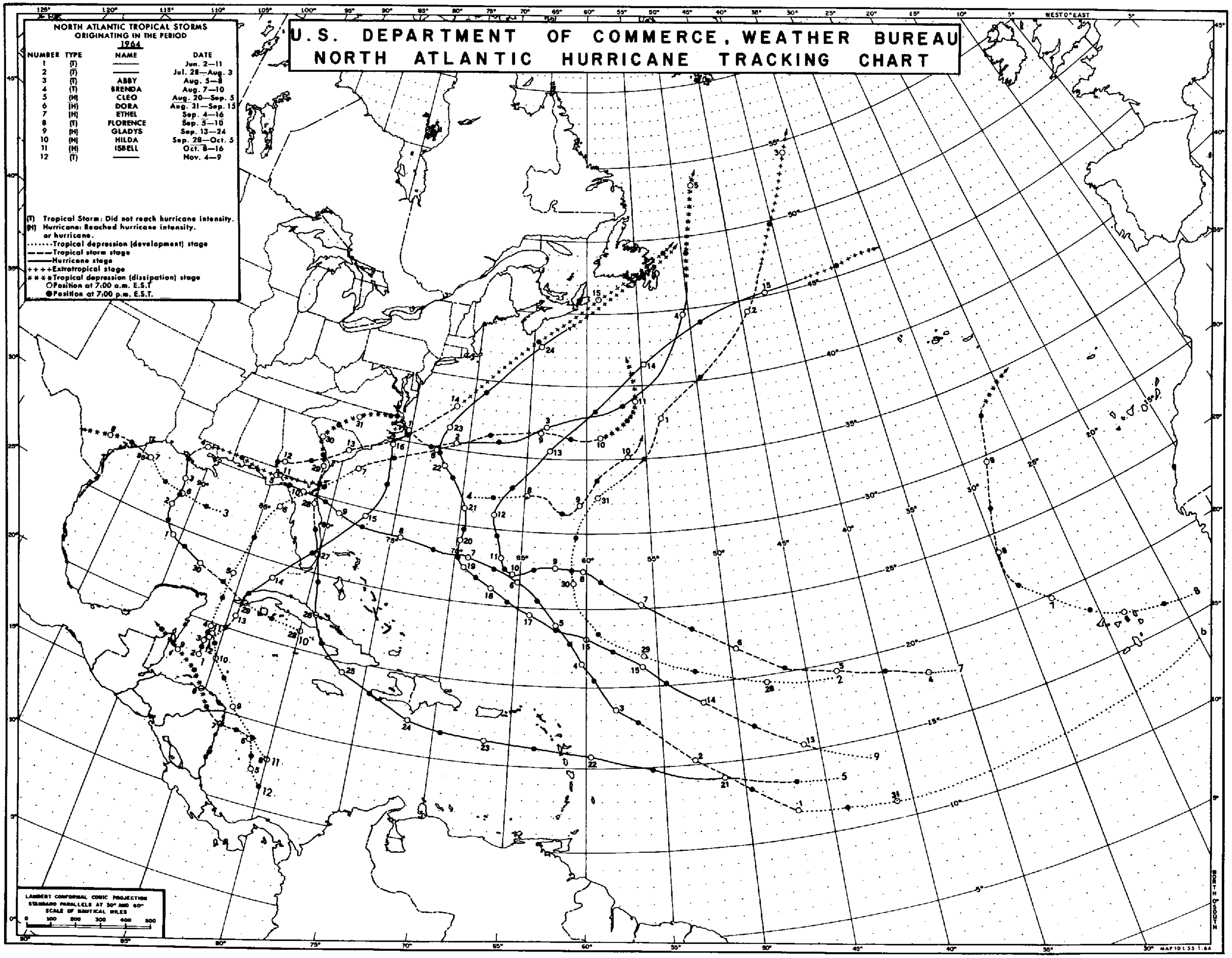

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1960
NUMBER
DATE
1 T — June 22-28
2 H ABBY July 9-16
3 T BRENDA July 28-31
4 H CLEO Aug. 17-20
5 H DONNA Aug. 29-Sept. 13
6 H ETHEL Sept. 14-17
7 T FLORENCE Sept. 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

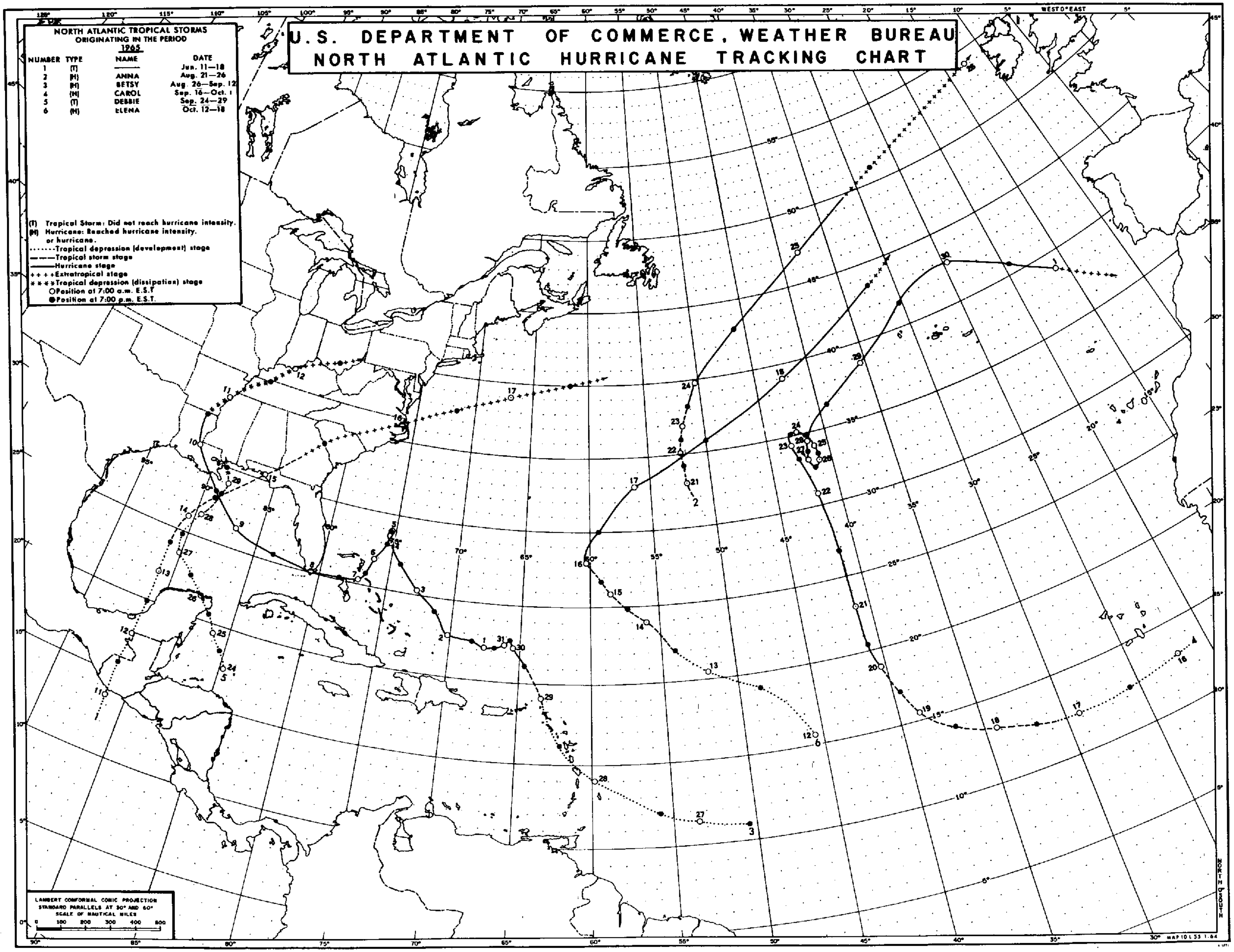


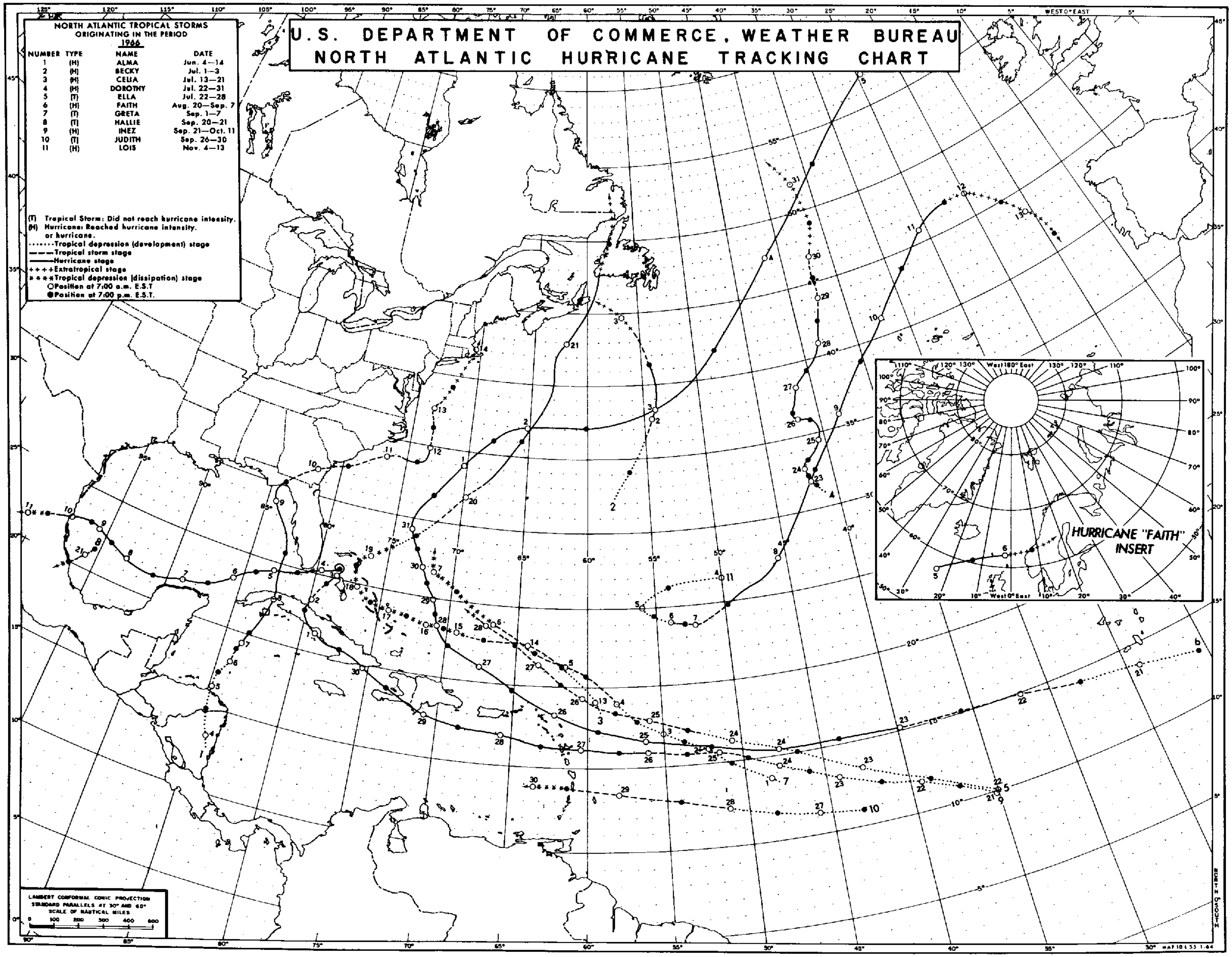
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1961
NUMBER DATE
1 H ANNA July 20-24
2 H BETSY Sept. 2-11
3 H CARLA Sept. 3-15
4 H DEBBIE Sept. 6-16
5 H ESTHER Sept. 11-26
6 T —— Sept. 12-15
7 H FRANCES Sept. 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


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
WEST O EAST

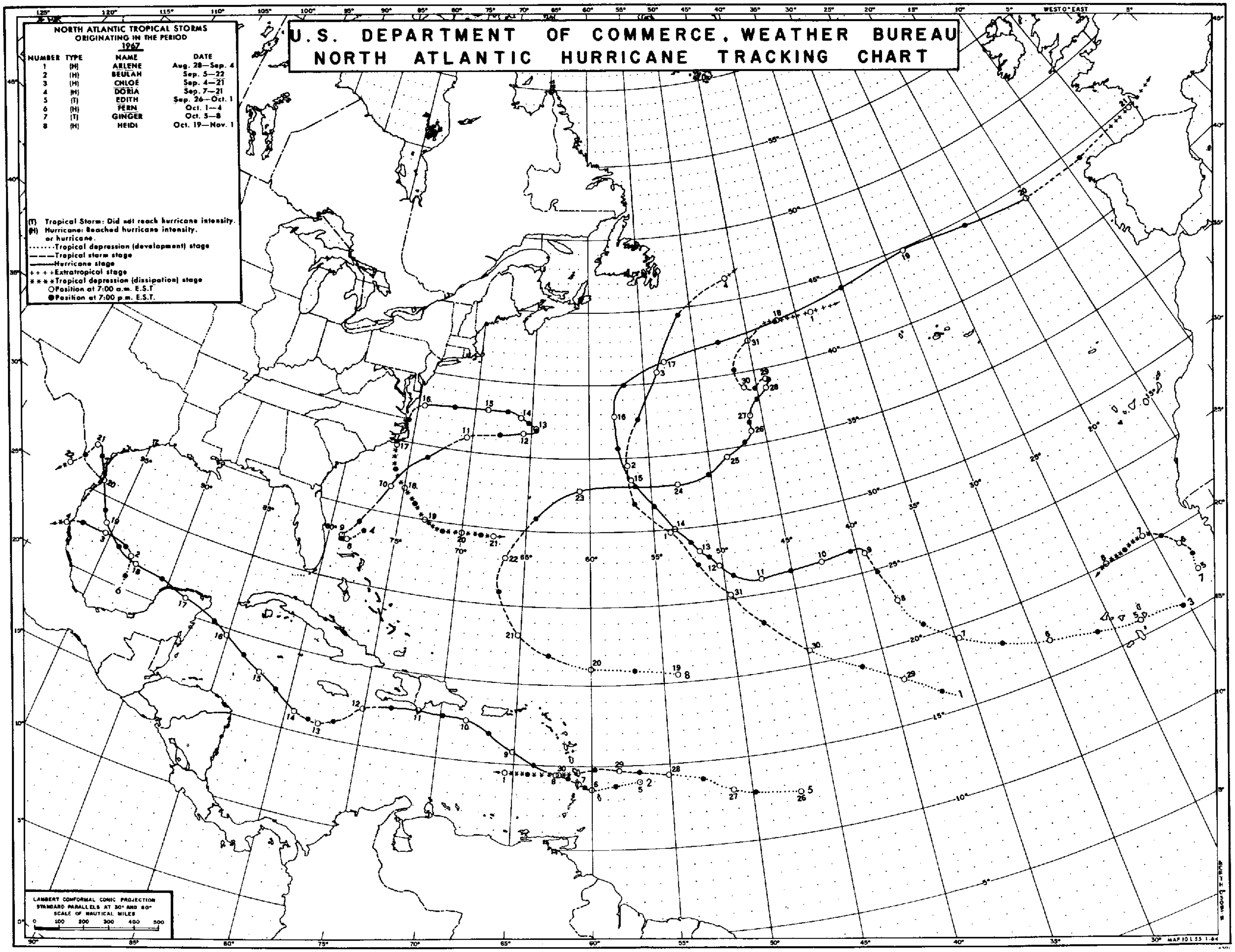

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1963
NUMBER TYPE NAME DATE
1 (H) ARLENE Jul. 31—Aug. 11
2 (H) BEULAH Aug. 20—28
3 (T) ——— Sep. 10—15
4 (H) CINDY Sep. 16—19
5 (H) DEBRA Sep. 19—24
6 (H) EDITH Sep. 23—29
7 (H) FLORA Sep. 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

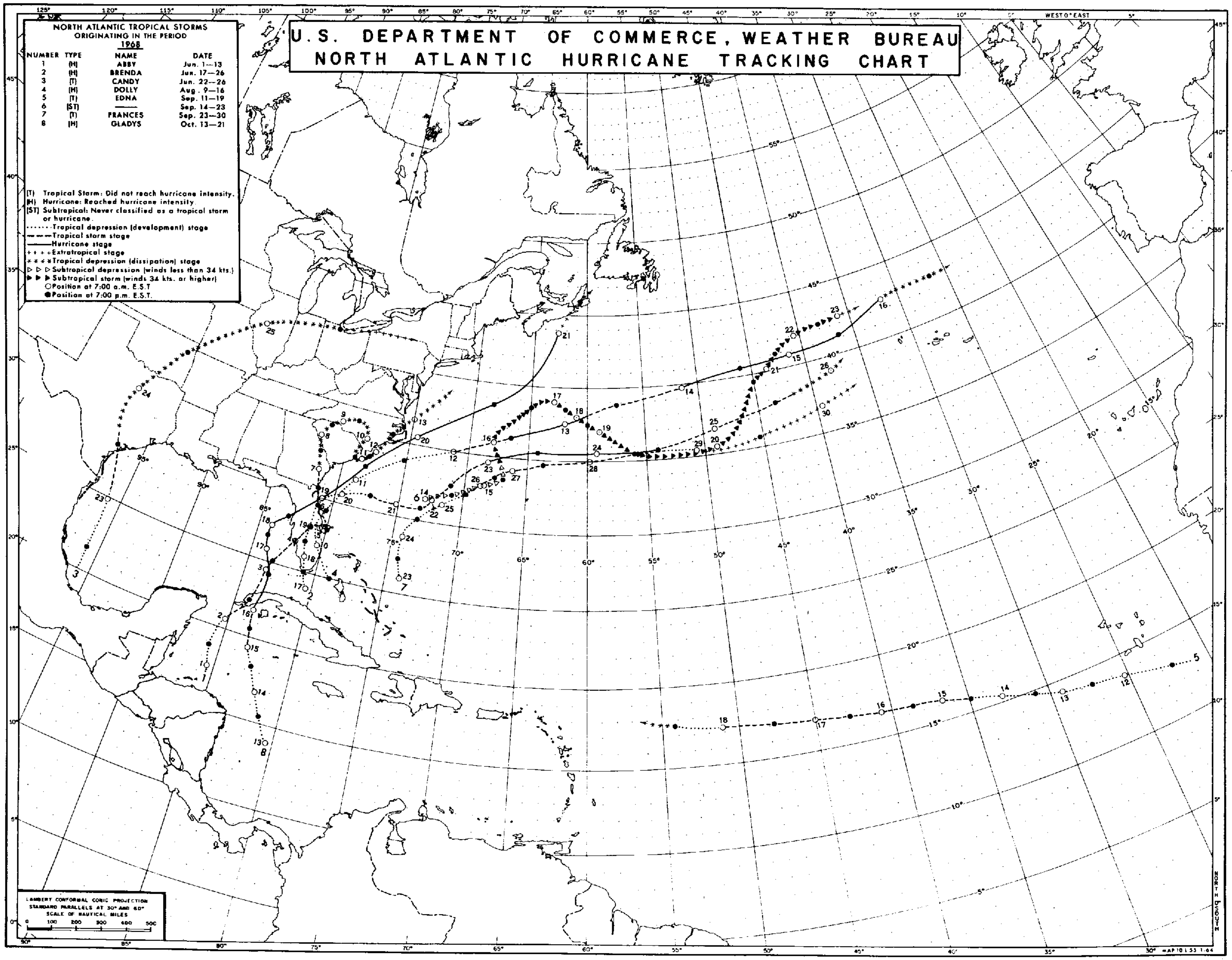

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1964
NUMBER TYPE NAME DATE
1 (T) —— Jun. 2—11
2 (T) —— Jul. 28—Aug. 3
3 (T) ABBY Aug. 5—8
4 (T) BRENDA Aug. 7—10
5 (H) CLEO Aug. 20—Sep. 5
6 (H) DORA Aug. 31—Sep. 15
7 (H) ETHEL Sep. 4—16
8 (T) FLORENCE Sep. 5—10
9 (H) GLADYS Sep. 13—24
10 (H) HILDA Sep. 28—Oct. 5
11 (H) ISBELL Oct. 8—16
12 (T) —— Nov. 4—9
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.

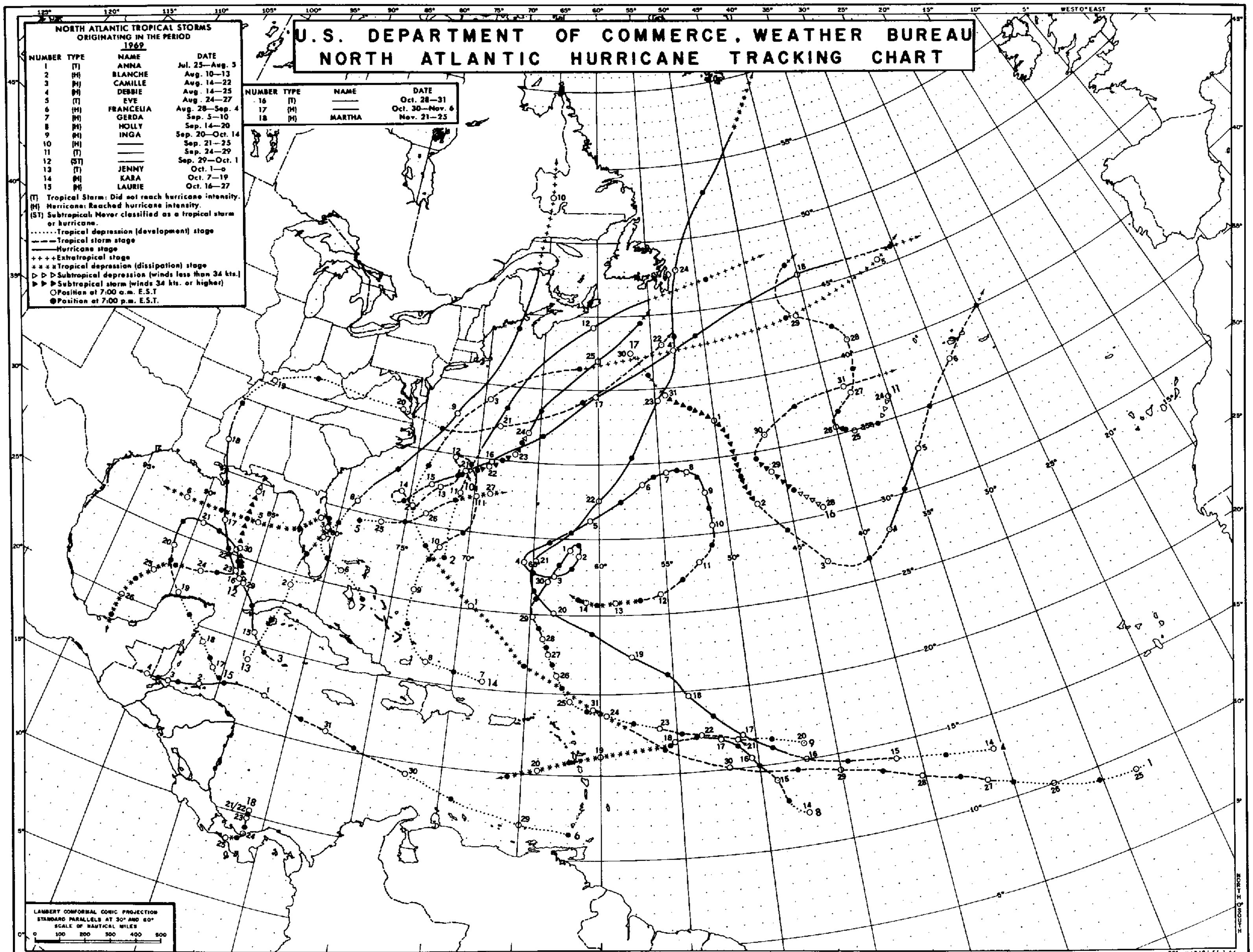

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD 1965
NUMBER TYPE NAME DATE
1 (T) —— Jun. 11—18
2 (H) ANNA Aug. 21—26
3 (H) BETSY Aug. 26—Sep. 12
4 (H) CAROL Sep. 16—Oct. 1
5 (T) DEBBIE Sep. 24—29
6 (H) ELENA Oct. 12—18
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity. or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical 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

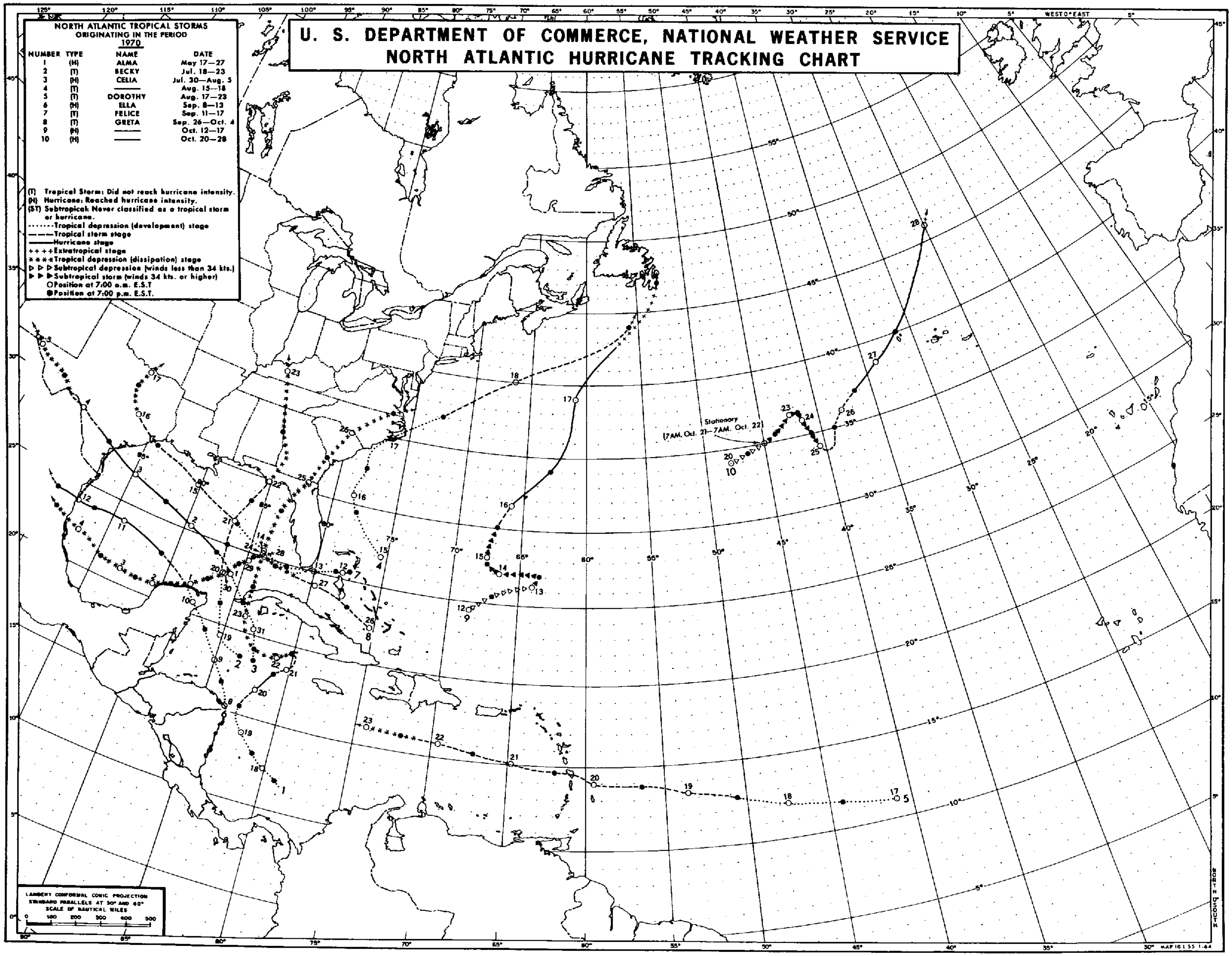


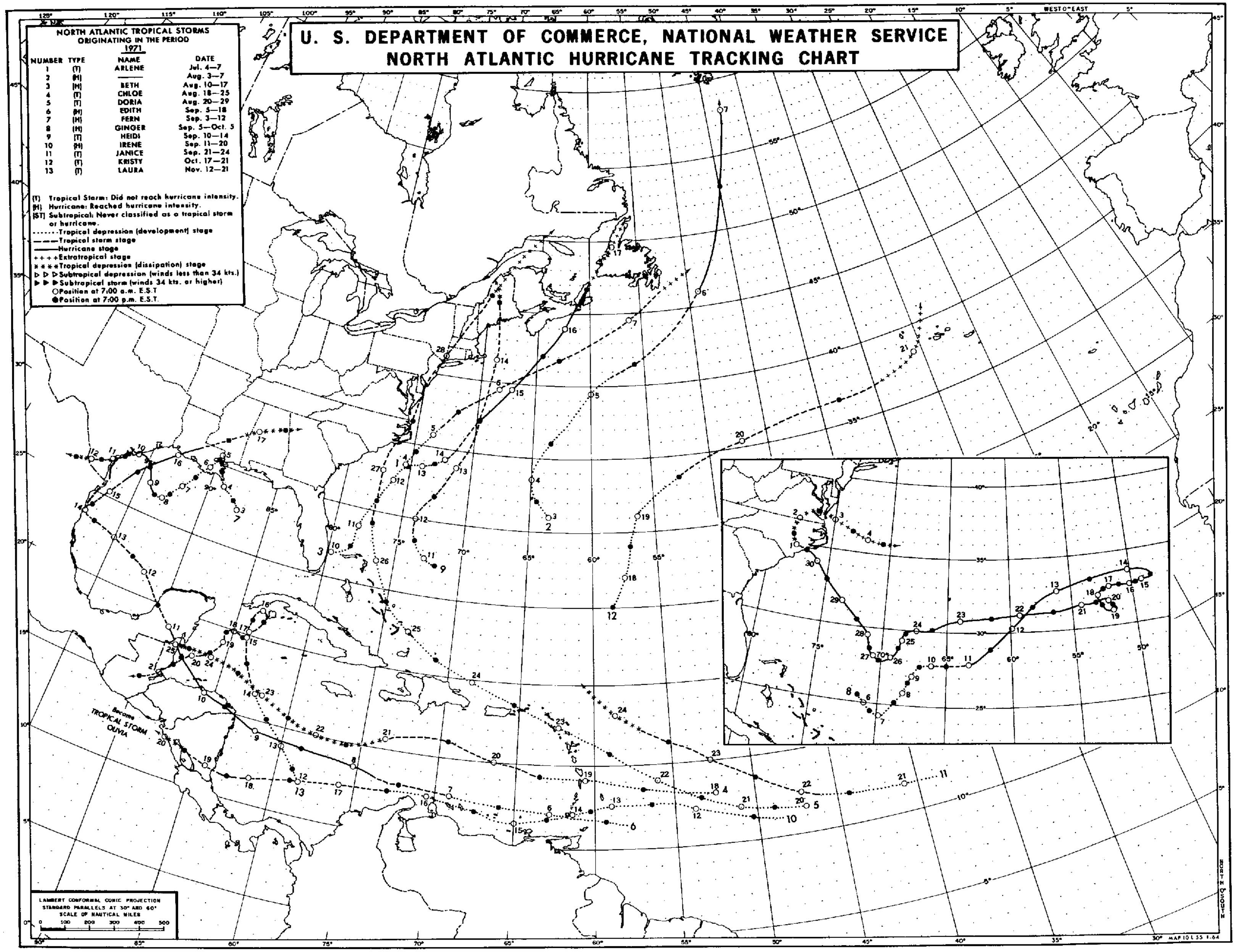
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1966
NUMBER TYPE NAME DATE
1 (H) ALMA Jun. 4—14
2 (H) BECKY Jul. 1—3
3 (H) CELIA Jul. 13—21
4 (H) DOROTHY Jul. 22—31
5 (T) ELLA Jul. 22—28
6 (H) FAITH Aug. 20—Sep. 7
7 (T) GRETA Sep. 1—7
8 (T) HALLIE Sep. 20—21
9 (H) INEZ Sep. 21—Oct. 11
10 (T) JUDITH Sep. 26—30
11 (H) LOIS Nov. 4—13
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
or hurricane.
·······Tropical depression (development) stage
— — —Tropical storm stage
———Hurricane stage
+ + + +Extratropical stage
* * * *Tropical depression (dissipation) stage
○Position at 7:00 a.m. E.S.T
●Position at 7:00 p.m. E.S.T.
HURRICANE "FAITH" INSERT
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

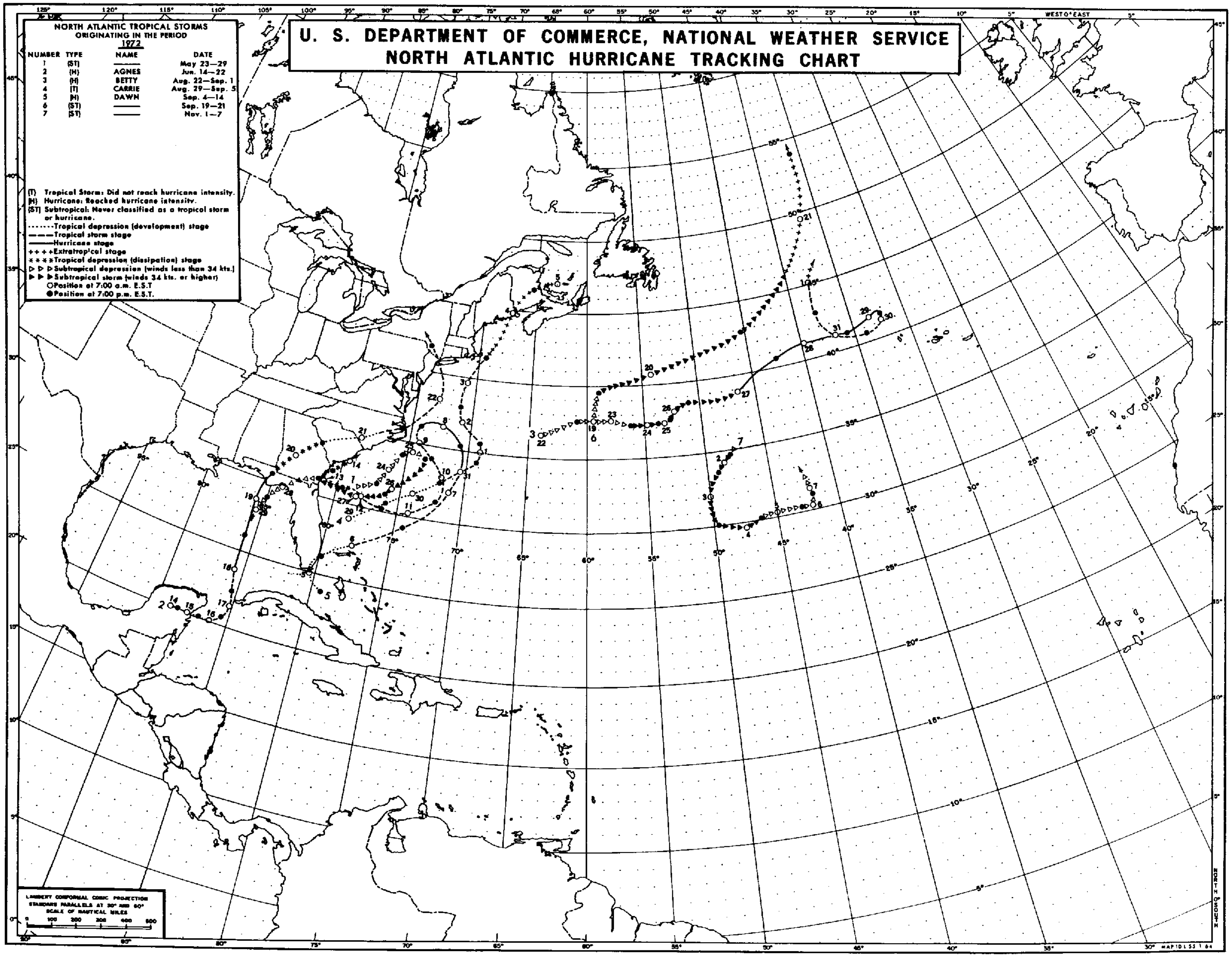

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1967
NUMBER TYPE NAME DATE
1 (H) ARLENE Aug. 28—Sep. 4
2 (H) BEULAH Sep. 5—22
3 (H) CHLOE Sep. 4—21
4 (H) DORIA Sep. 7—21
5 (T) EDITH Sep. 26—Oct. 1
6 (H) FERN Oct. 1—4
7 (T) GINGER Oct. 5—8
8 (H) HEIDI Oct. 19—Nov. 1
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical 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

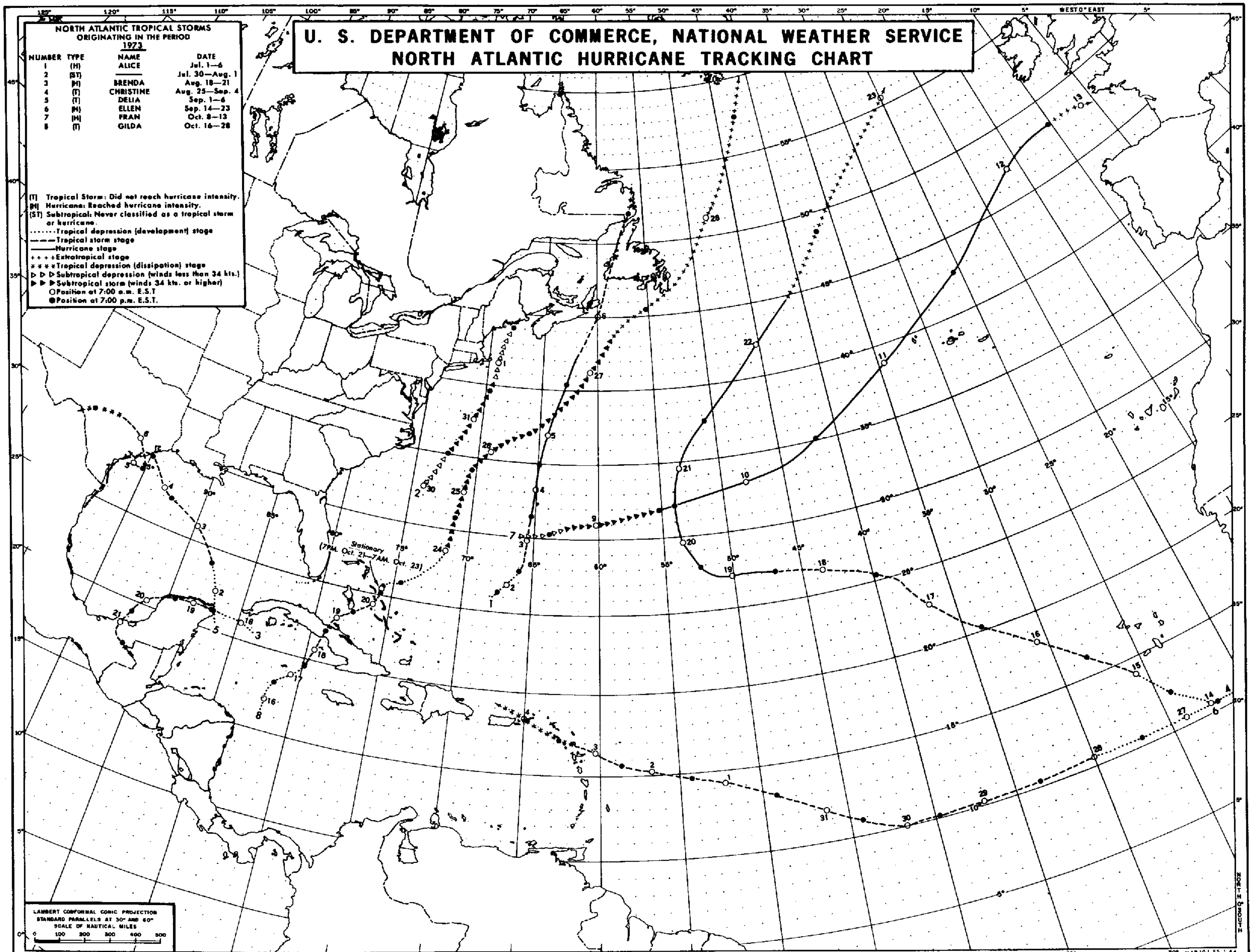

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1968
NUMBER TYPE NAME DATE
1 (H) ABBY Jun. 1—13
2 (H) BRENDA Jun. 17—26
3 (T) CANDY Jun. 22—26
4 (H) DOLLY Aug. 9—16
5 (T) EDNA Sep. 11—19
6 (ST) —— Sep. 14—23
7 (T) FRANCES Sep. 23—30
8 (H) GLADYS Oct. 13—21
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

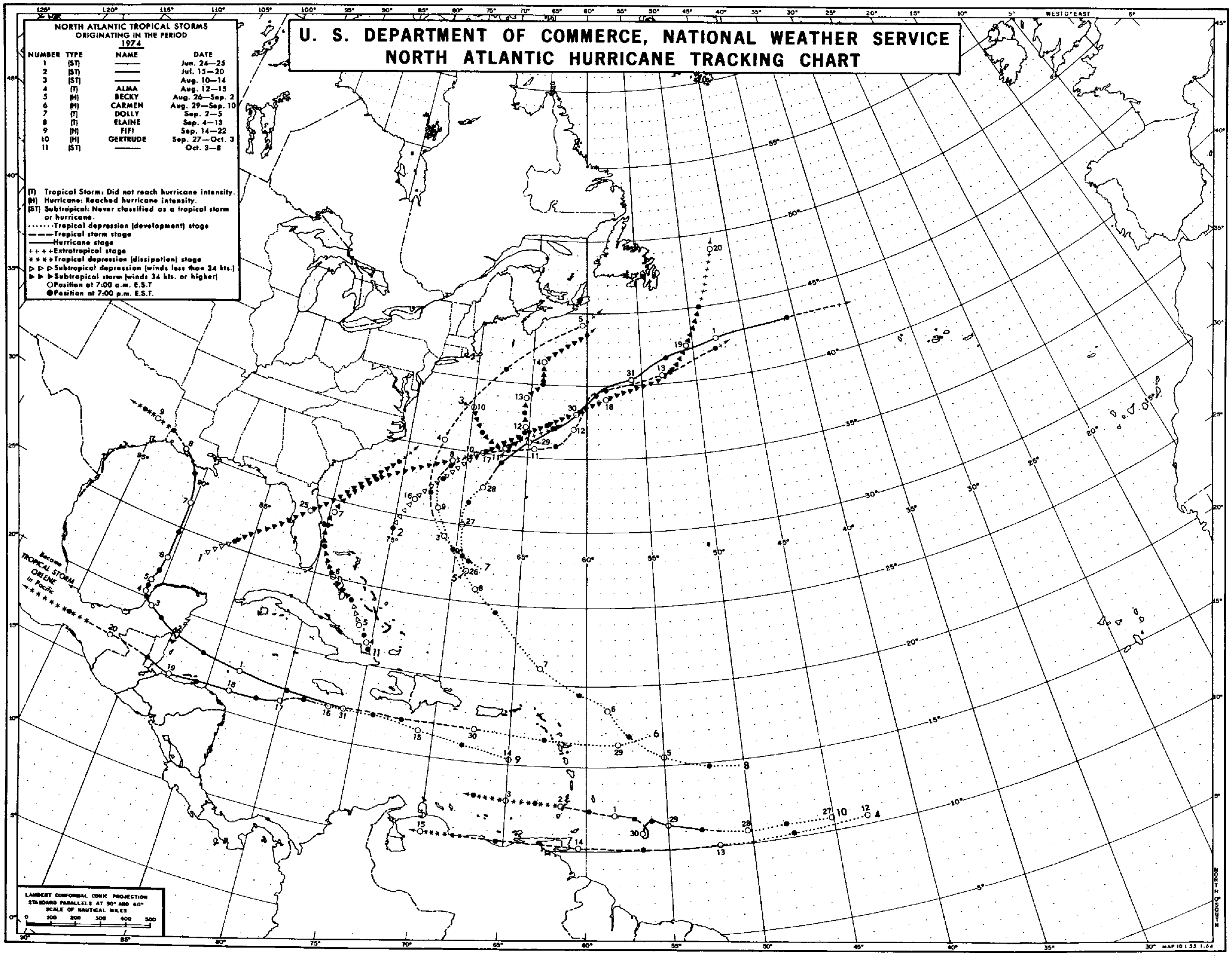

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1969
NUMBER TYPE NAME DATE
1 (T) ANNA Jul. 25—Aug. 5
2 (H) BLANCHE Aug. 10—13
3 (H) CAMILLE Aug. 14—22
4 (H) DEBBIE Aug. 14—25
5 (T) EVE Aug. 24—27
6 (H) FRANCELIA Aug. 28—Sep. 4
7 (H) GERDA Sep. 5—10
8 (H) HOLLY Sep. 14—20
9 (H) INGA Sep. 20—Oct. 14
10 (H) Sep. 21—25
11 (T) Sep. 24—29
12 (ST) Sep. 29—Oct. 1
13 (T) JENNY Oct. 1—6
14 (H) KARA Oct. 7—19
15 (H) LAURIE Oct. 16—27
16 (T) Oct. 28—31
17 (H) Oct. 30—Nov. 6
18 (H) MARTHA Nov. 21—25
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

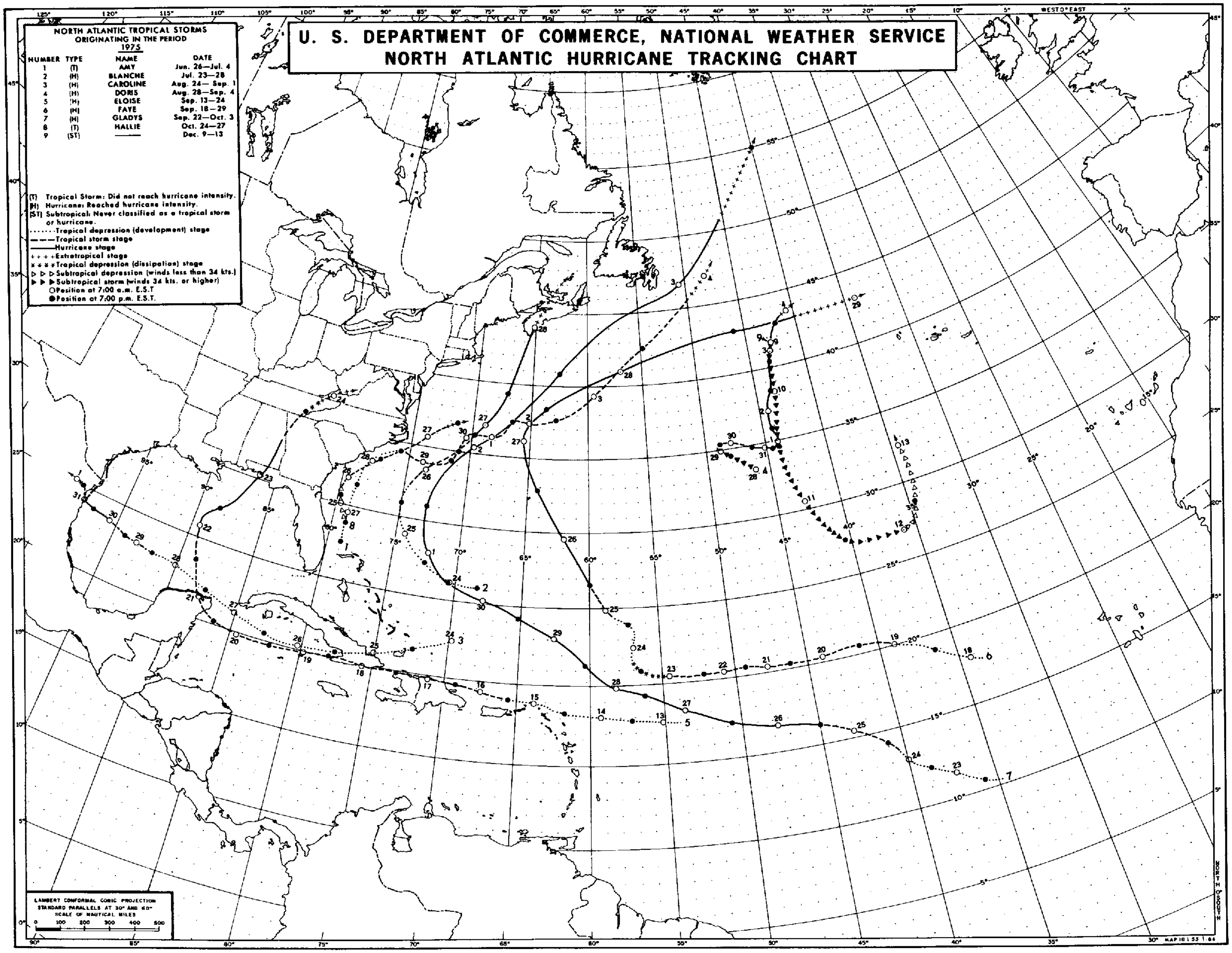

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1970
NUMBER TYPE NAME DATE
1 (H) ALMA May 17—27
2 (T) BECKY Jul. 18—23
3 (H) CELIA Jul. 30—Aug. 5
4 (T) —— Aug. 15—18
5 (T) DOROTHY Aug. 17—23
6 (H) ELLA Sep. 8—13
7 (T) FELICE Sep. 11—17
8 (T) GRETA Sep. 26—Oct. 4
9 (H) —— Oct. 12—17
10 (H) —— Oct. 20—28
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Stationary (7AM. Oct. 21—7AM. Oct. 22)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

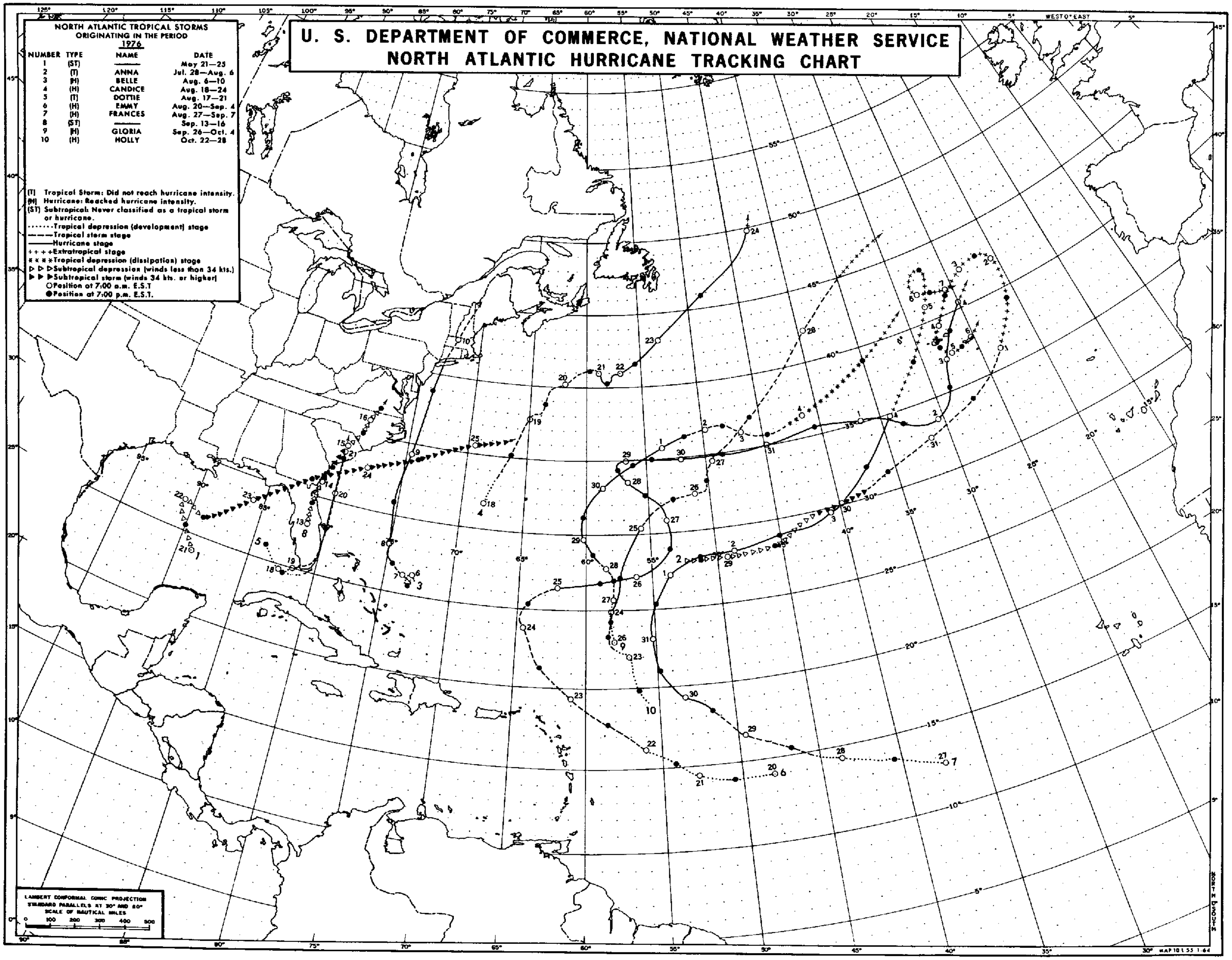

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1971
NUMBER TYPE NAME DATE
1 (T) ARLENE Jul. 4—7
2 (H) ——— Aug. 3—7
3 (H) BETH Aug. 10—17
4 (T) CHLOE Aug. 18—25
5 (T) DORIA Aug. 20—29
6 (H) EDITH Sep. 5—18
7 (H) FERN Sep. 3—12
8 (H) GINGER Sep. 5—Oct. 5
9 (T) HEIDI Sep. 10—14
10 (H) IRENE Sep. 11—20
11 (T) JANICE Sep. 21—24
12 (T) KRISTY Oct. 17—21
13 (T) LAURA Nov. 12—21
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Became TROPICAL STORM OLIVIA
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

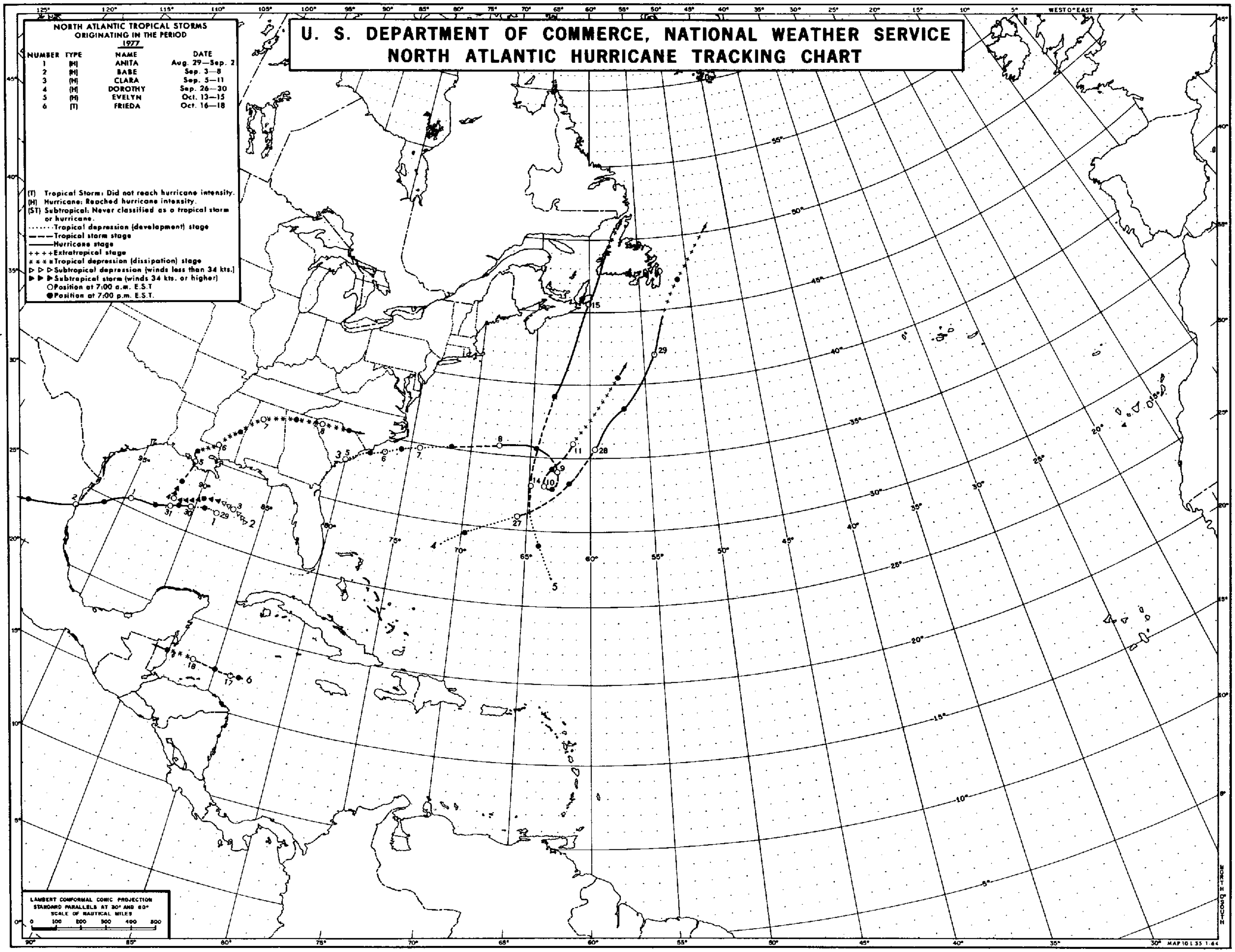

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1972
NUMBER TYPE NAME DATE
1 (ST) ——— May 23—29
2 (H) AGNES Jun. 14—22
3 (H) BETTY Aug. 22—Sep. 1
4 (T) CARRIE Aug. 29—Sep. 5
5 (H) DAWN Sep. 4—14
6 (ST) ——— Sep. 19—21
7 (ST) ——— Nov. 1—7
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.

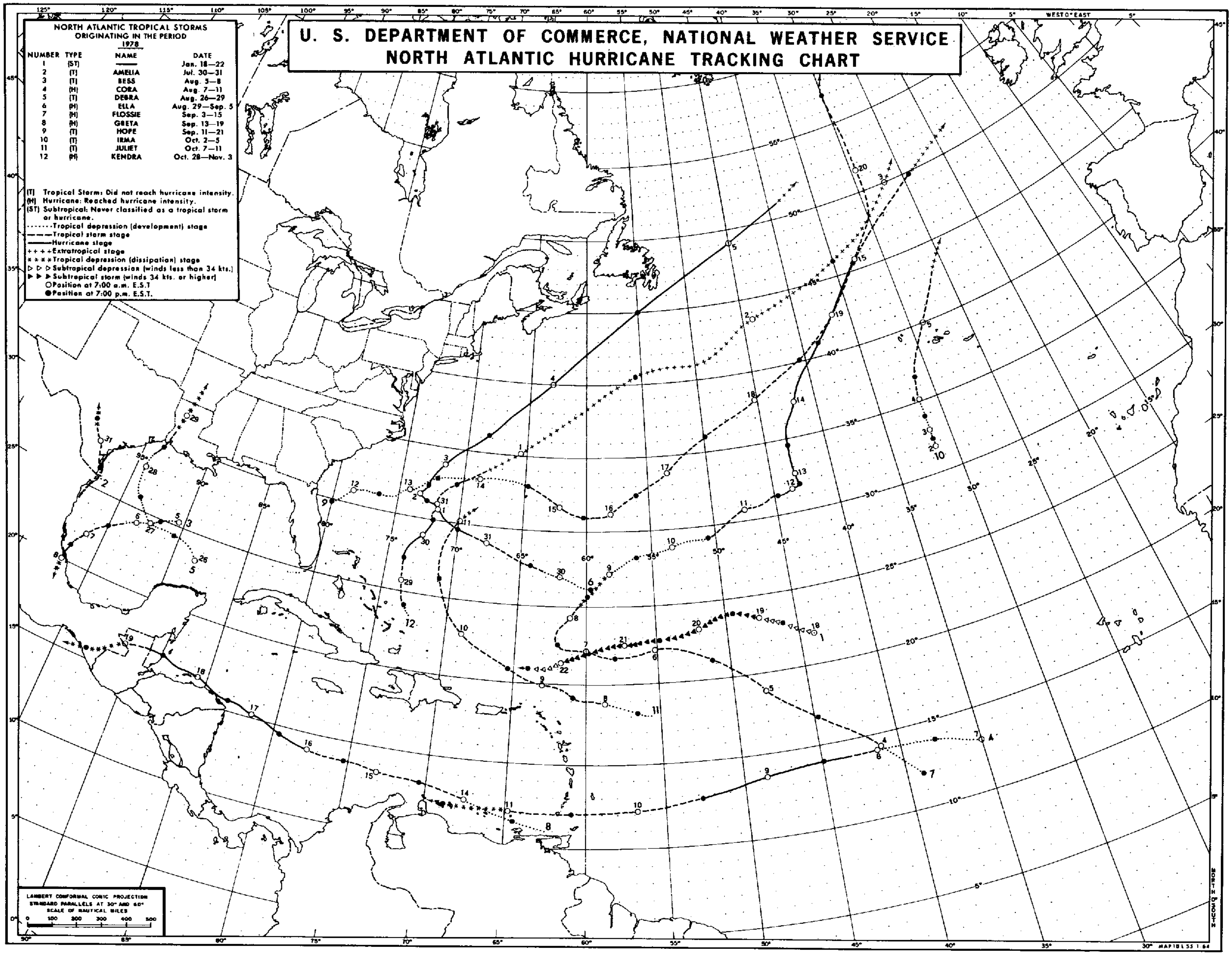

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1973
NUMBER TYPE NAME DATE
1 (H) ALICE Jul. 1—6
2 (ST) —— Jul. 30—Aug. 1
3 (H) BRENDA Aug. 18—21
4 (T) CHRISTINE Aug. 25—Sep. 4
5 (T) DELIA Sep. 1—6
6 (H) ELLEN Sep. 14—23
7 (H) FRAN Oct. 8—13
8 (T) GILDA Oct. 16—28
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Stationary (7P.M. Oct. 21—7A.M. Oct. 23)
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, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1974
NUMBER TYPE NAME DATE
1 (ST) —— Jun. 24—25
2 (ST) —— Jul. 15—20
3 (ST) —— Aug. 10—14
4 (T) ALMA Aug. 12—15
5 (H) BECKY Aug. 26—Sep. 2
6 (H) CARMEN Aug. 29—Sep. 10
7 (T) DOLLY Sep. 2—5
8 (T) ELAINE Sep. 4—13
9 (H) FIFI Sep. 14—22
10 (H) GERTRUDE Sep. 27—Oct. 3
11 (ST) —— Oct. 3—8
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Became TROPICAL STORM ORLENE in Pacific
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

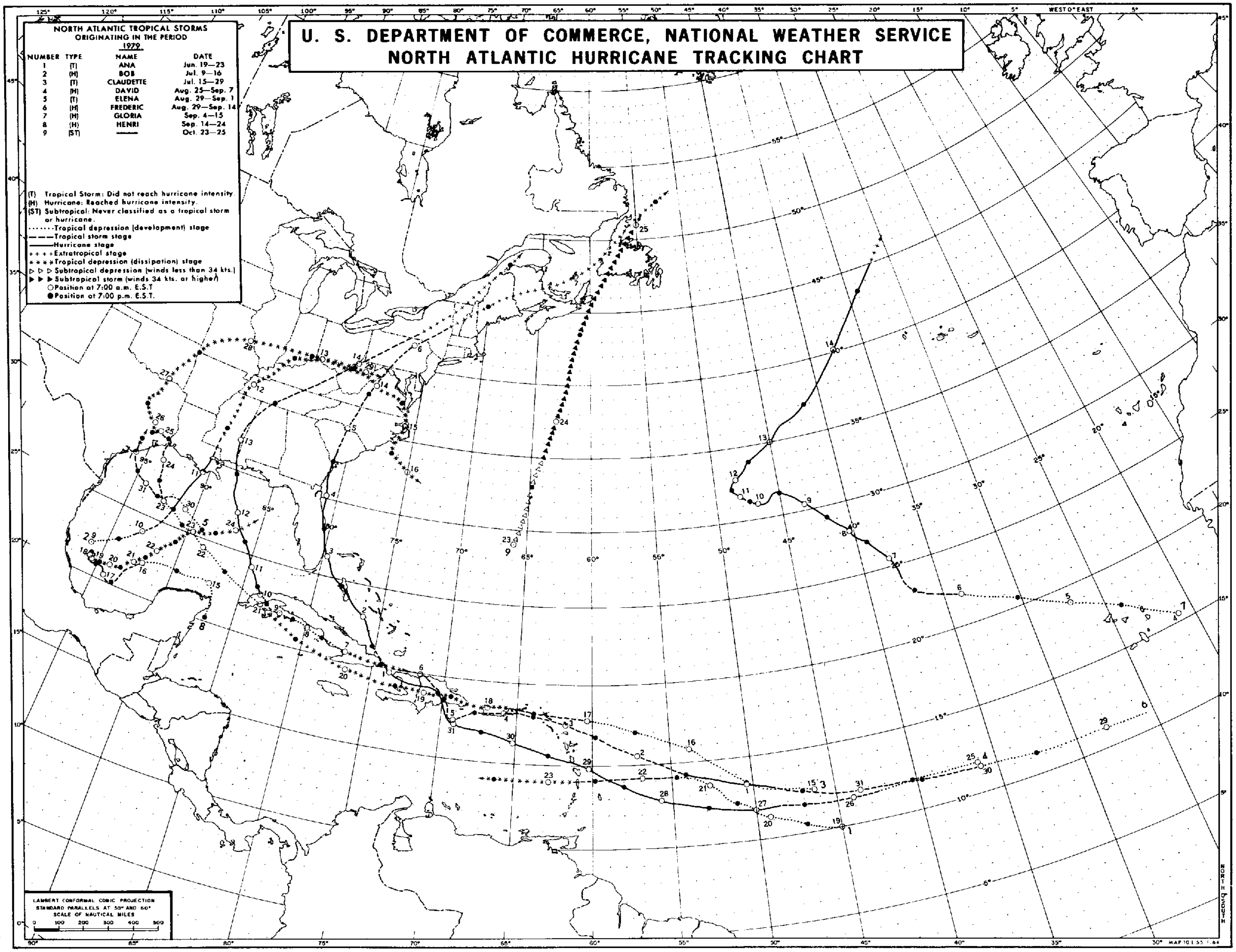

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1975
NUMBER TYPE NAME DATE
1 (T) AMY Jun. 26—Jul. 4
2 (H) BLANCHE Jul. 23—28
3 (H) CAROLINE Aug. 24— Sep. 1
4 (H) DORIS Aug. 28—Sep. 4
5 (H) ELOISE Sep. 13—24
6 (H) FAYE Sep. 18—29
7 (H) GLADYS Sep. 22—Oct. 3
8 (T) HALLIE Oct. 24—27
9 (ST) —— Dec. 9—13
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

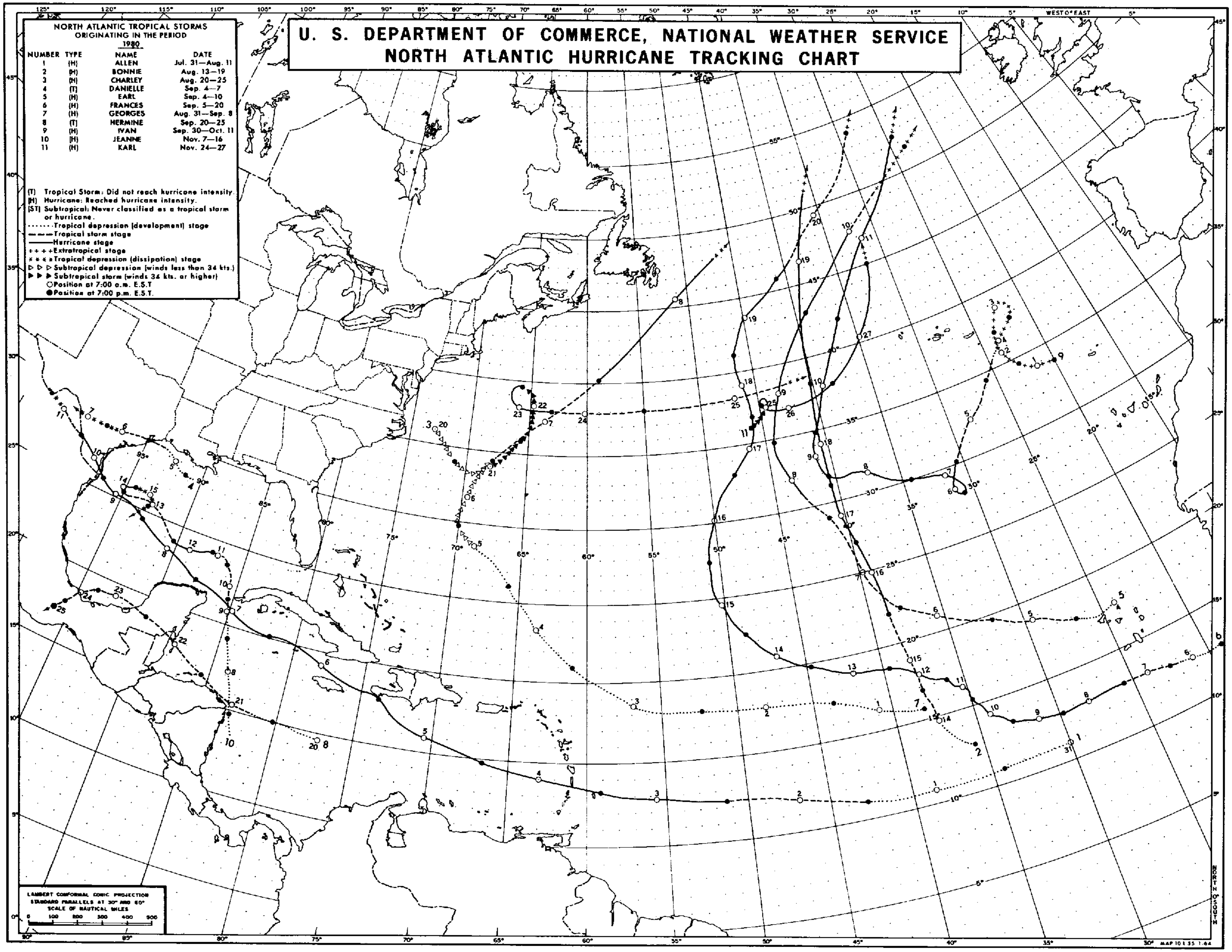

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1976
NUMBER TYPE NAME DATE
1 (ST) —— May 21—25
2 (T) ANNA Jul. 28—Aug. 6
3 (H) BELLE Aug. 6—10
4 (H) CANDICE Aug. 18—24
5 (T) DOTTIE Aug. 17—21
6 (H) EMMY Aug. 20—Sep. 4
7 (H) FRANCES Aug. 27—Sep. 7
8 (ST) —— Sep. 13—16
9 (H) GLORIA Sep. 26—Oct. 4
10 (H) HOLLY Oct. 22—28
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.

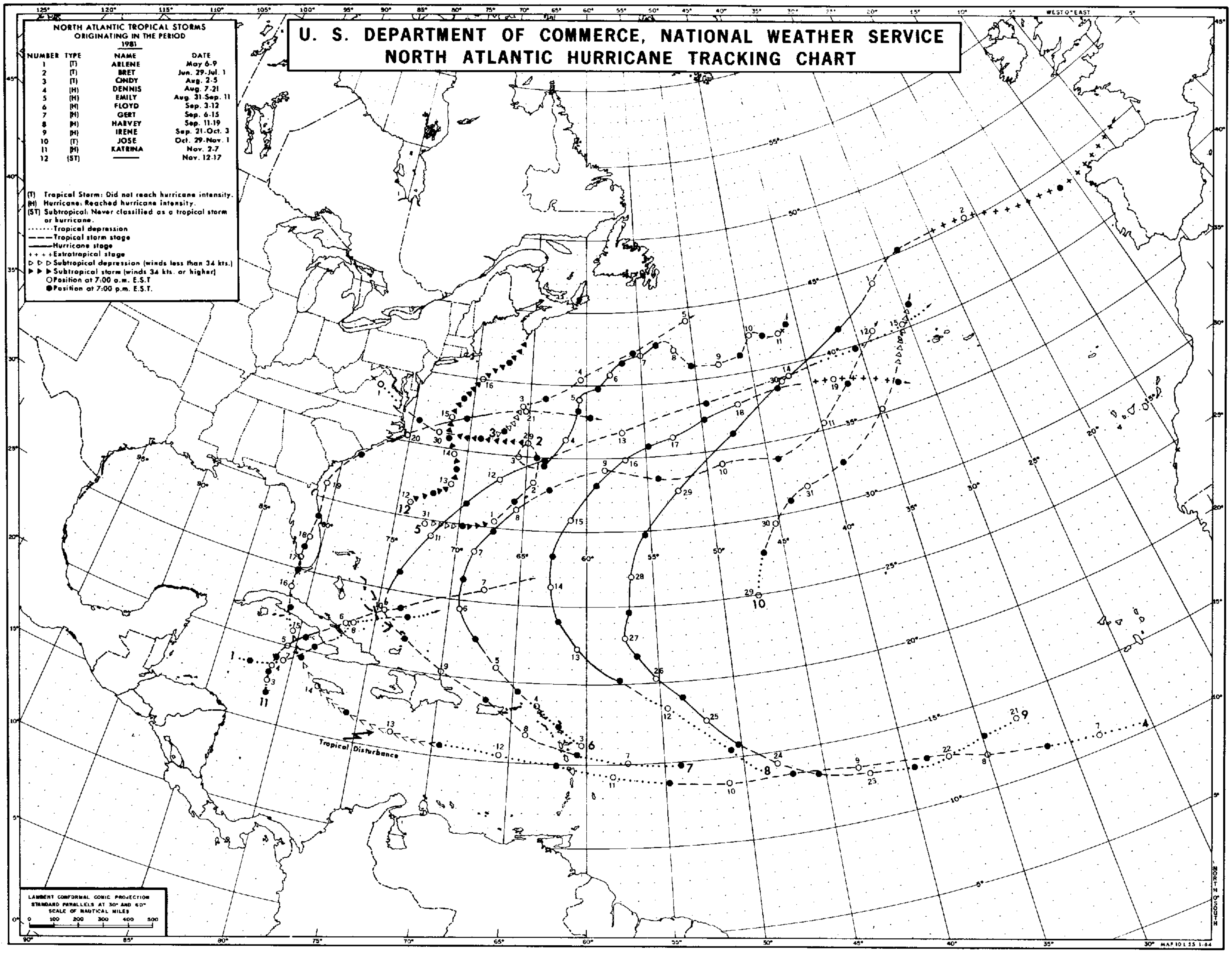

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1977
NUMBER TYPE NAME DATE
1 (H) ANITA Aug. 29—Sep. 2
2 (H) BABE Sep. 3—8
3 (H) CLARA Sep. 5—11
4 (H) DOROTHY Sep. 26—30
5 (H) EVELYN Oct. 13—15
6 (T) FRIEDA Oct. 16—18
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

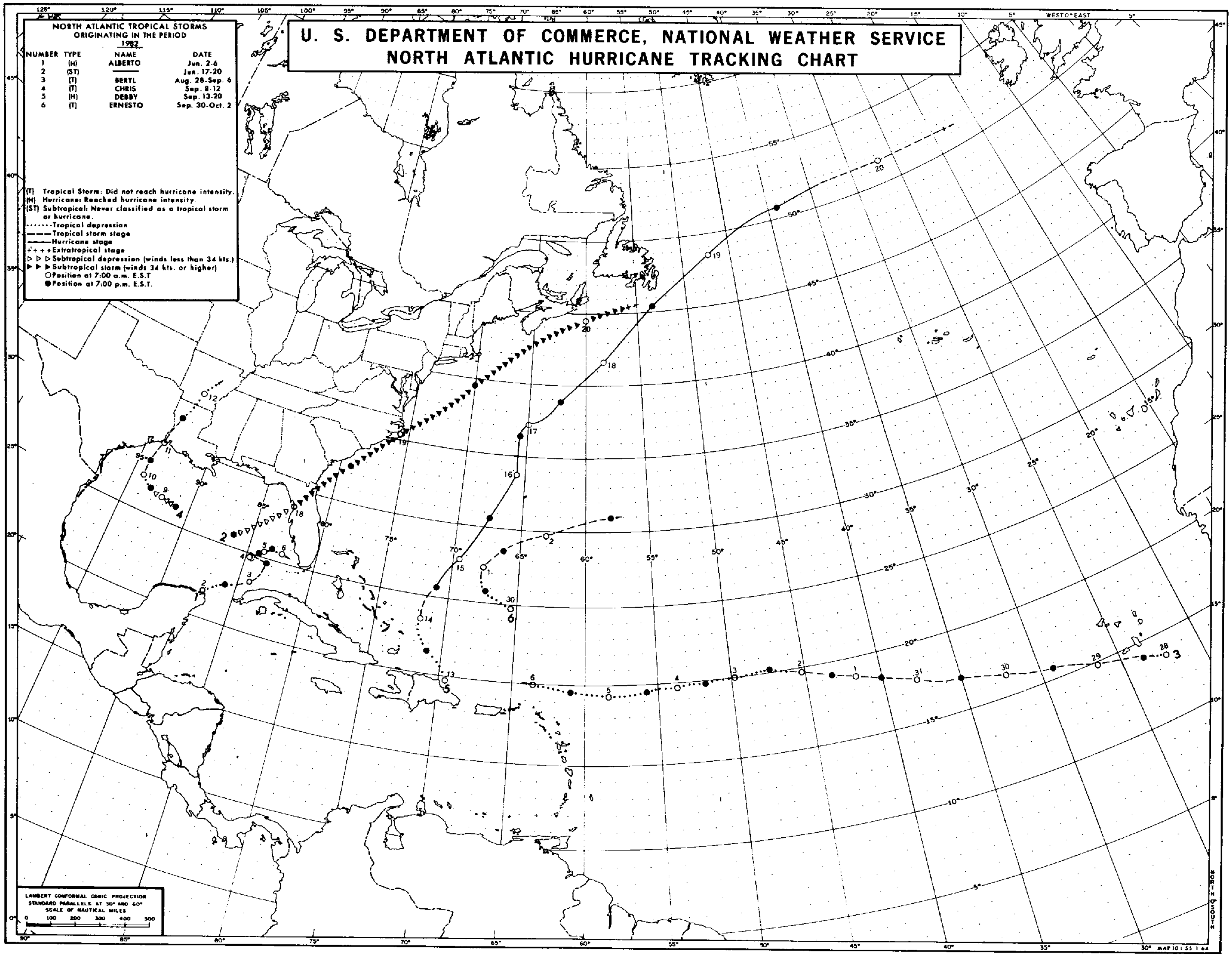


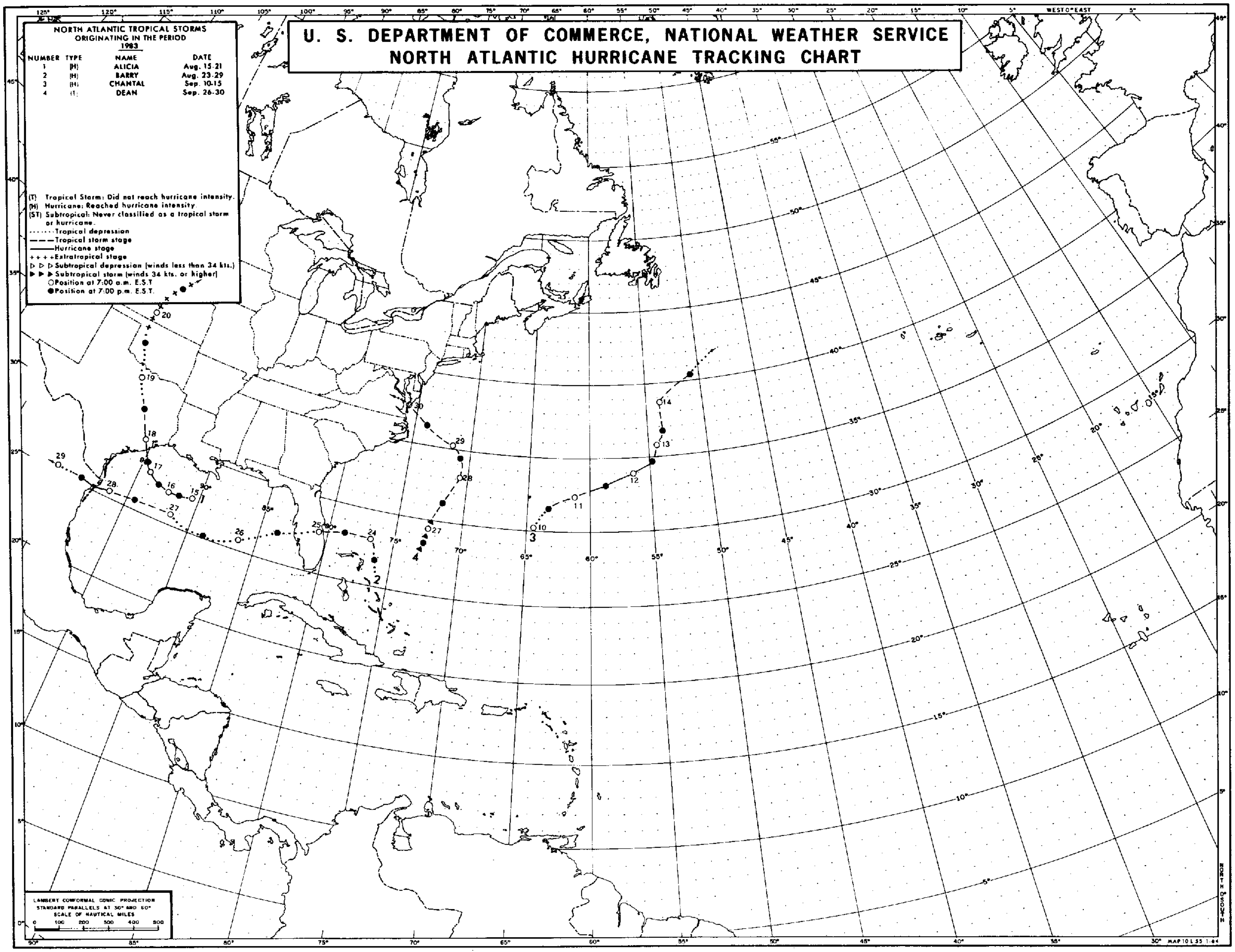
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1978
NUMBER TYPE NAME DATE
1 (ST) —— Jan. 18—22
2 (T) AMELIA Jul. 30—31
3 (T) BESS Aug. 5—8
4 (H) CORA Aug. 7—11
5 (T) DEBRA Aug. 26—29
6 (H) ELLA Aug. 29—Sep. 5
7 (H) FLOSSIE Sep. 3—15
8 (H) GRETA Sep. 13—19
9 (T) HOPE Sep. 11—21
10 (T) IRMA Oct. 2—5
11 (T) JULIET Oct. 7—11
12 (H) KENDRA Oct. 28—Nov. 3
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

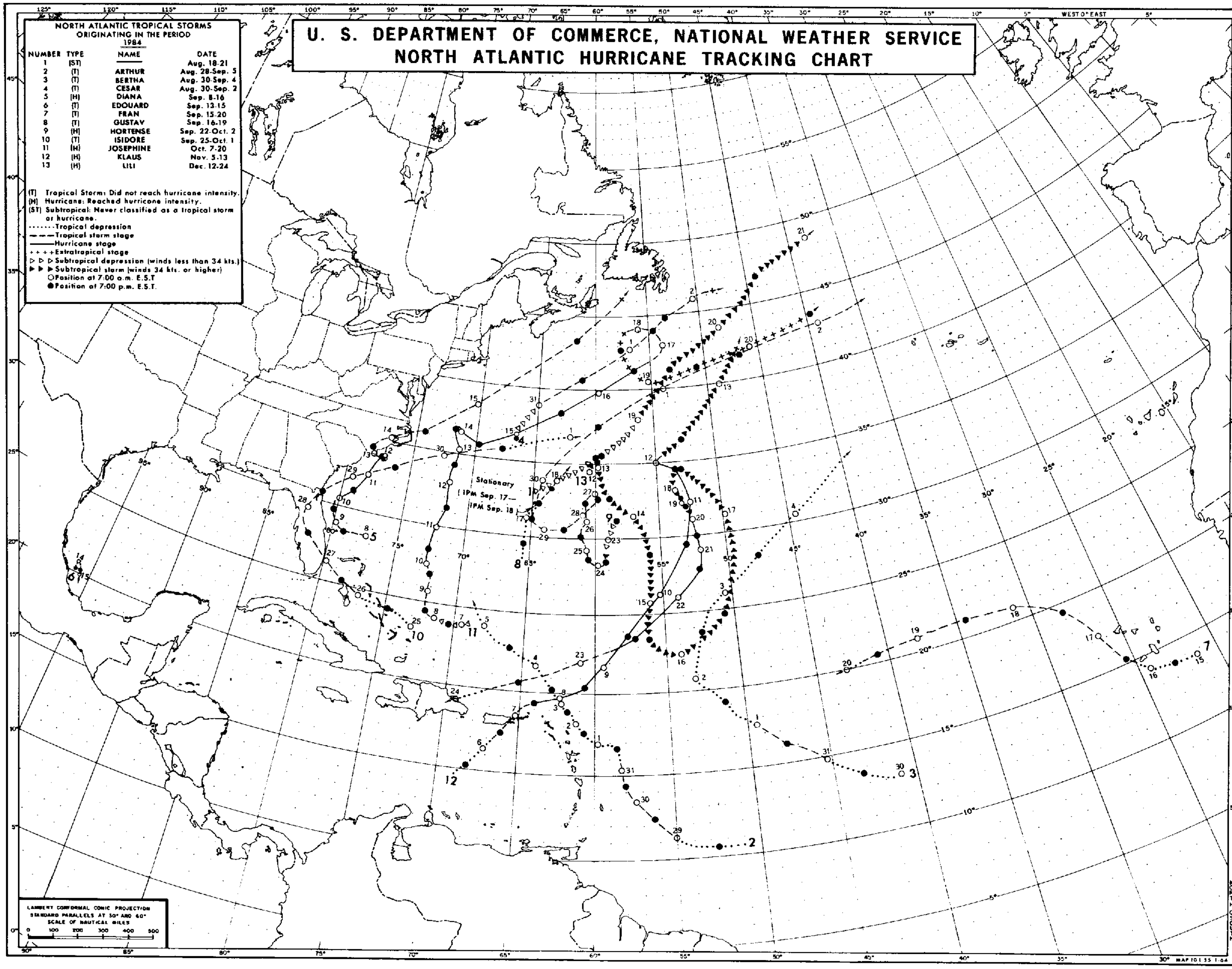

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1979
NUMBER TYPE NAME DATE
1 (T) ANA Jun. 19—23
2 (H) BOB Jul. 9—16
3 (T) CLAUDETTE Jul. 15—29
4 (H) DAVID Aug. 25—Sep. 7
5 (T) ELENA Aug. 29—Sep. 1
6 (H) FREDERIC Aug. 29—Sep. 14
7 (H) GLORIA Sep. 4—15
8 (H) HENRI Sep. 14—24
9 (ST) —— Oct. 23—25
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

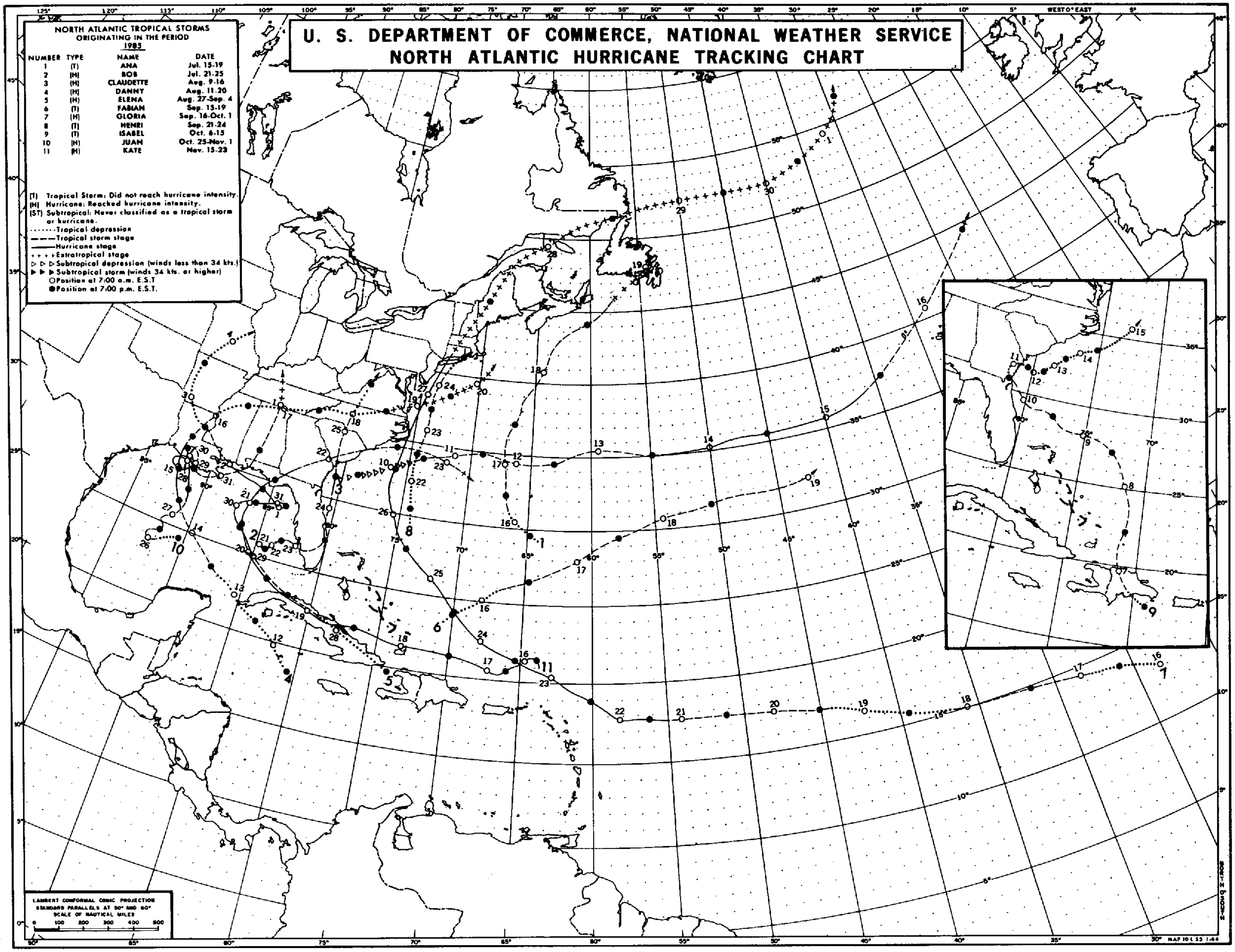

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1980
NUMBER TYPE NAME DATE
1 (H) ALLEN Jul. 31—Aug. 11
2 (H) BONNIE Aug. 13—19
3 (H) CHARLEY Aug. 20—25
4 (T) DANIELLE Sep. 4—7
5 (H) EARL Sep. 4—10
6 (H) FRANCES Sep. 5—20
7 (H) GEORGES Aug. 31—Sep. 8
8 (T) HERMINE Sep. 20—25
9 (H) IVAN Sep. 30—Oct. 11
10 (H) JEANNE Nov. 7—16
11 (H) KARL Nov. 24—27
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression (development) stage
Tropical storm stage
Hurricane stage
Extratropical stage
Tropical depression (dissipation) stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1981
NUMBER TYPE NAME DATE
1 (T) ARLENE May 6-9
2 (T) BRET Jun. 29-Jul. 1
3 (T) CINDY Aug. 2-5
4 (H) DENNIS Aug. 7-21
5 (H) EMILY Aug. 31-Sep. 11
6 (H) FLOYD Sep. 3-12
7 (H) GERT Sep. 6-15
8 (H) HARVEY Sep. 11-19
9 (H) IRENE Sep. 21-Oct. 3
10 (T) JOSE Oct. 29-Nov. 1
11 (H) KATRINA Nov. 2-7
12 (ST) —— Nov. 12-17
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Tropical Disturbance
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
NORTH 0° SOUTH

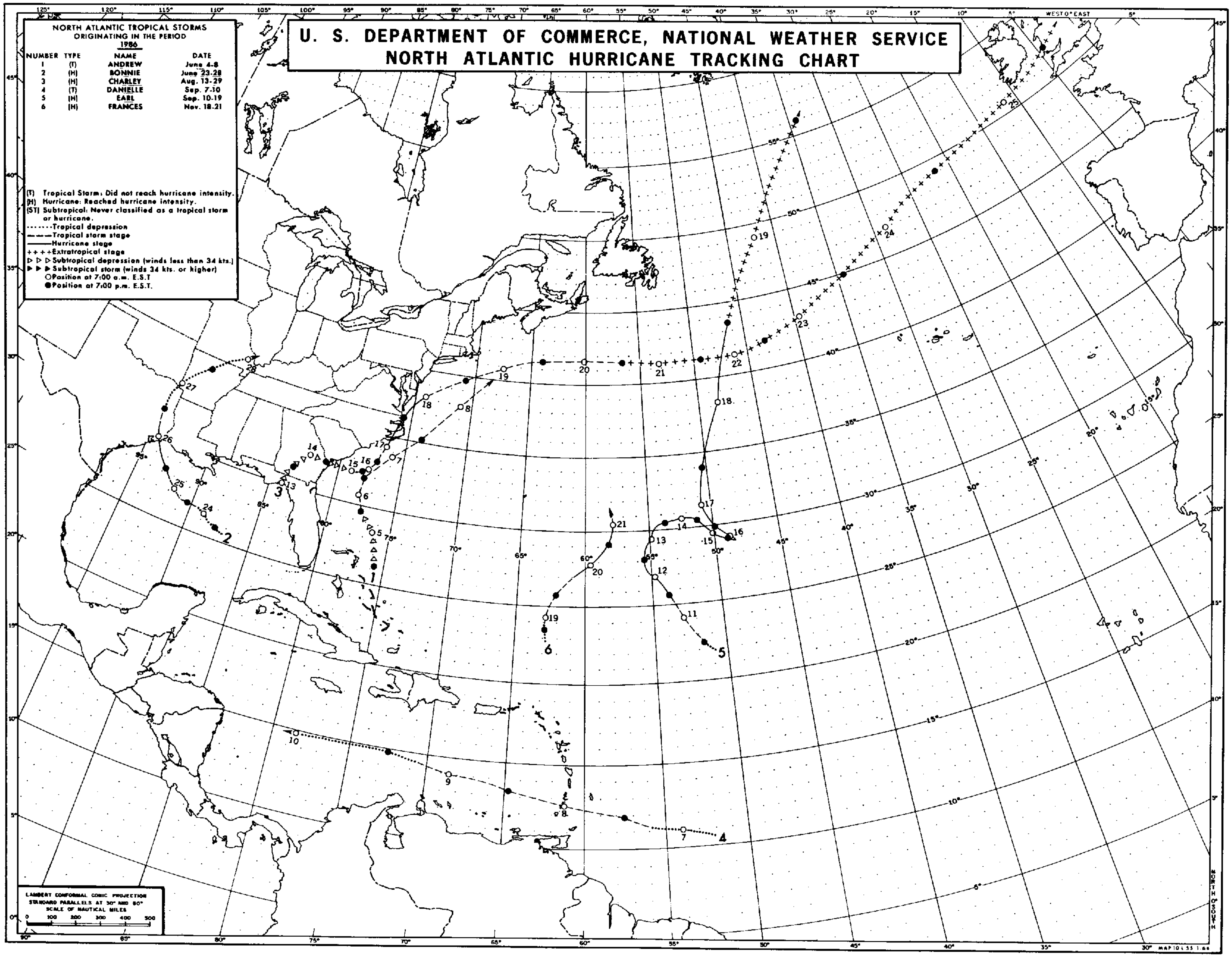

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1982
NUMBER TYPE NAME DATE
1 (H) ALBERTO Jun. 2-6
2 (ST) —— Jun. 17-20
3 (T) BERYL Aug. 28-Sep. 6
4 (T) CHRIS Sep. 8-12
5 (H) DEBBY Sep. 13-20
6 (T) ERNESTO Sep. 30-Oct. 2
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

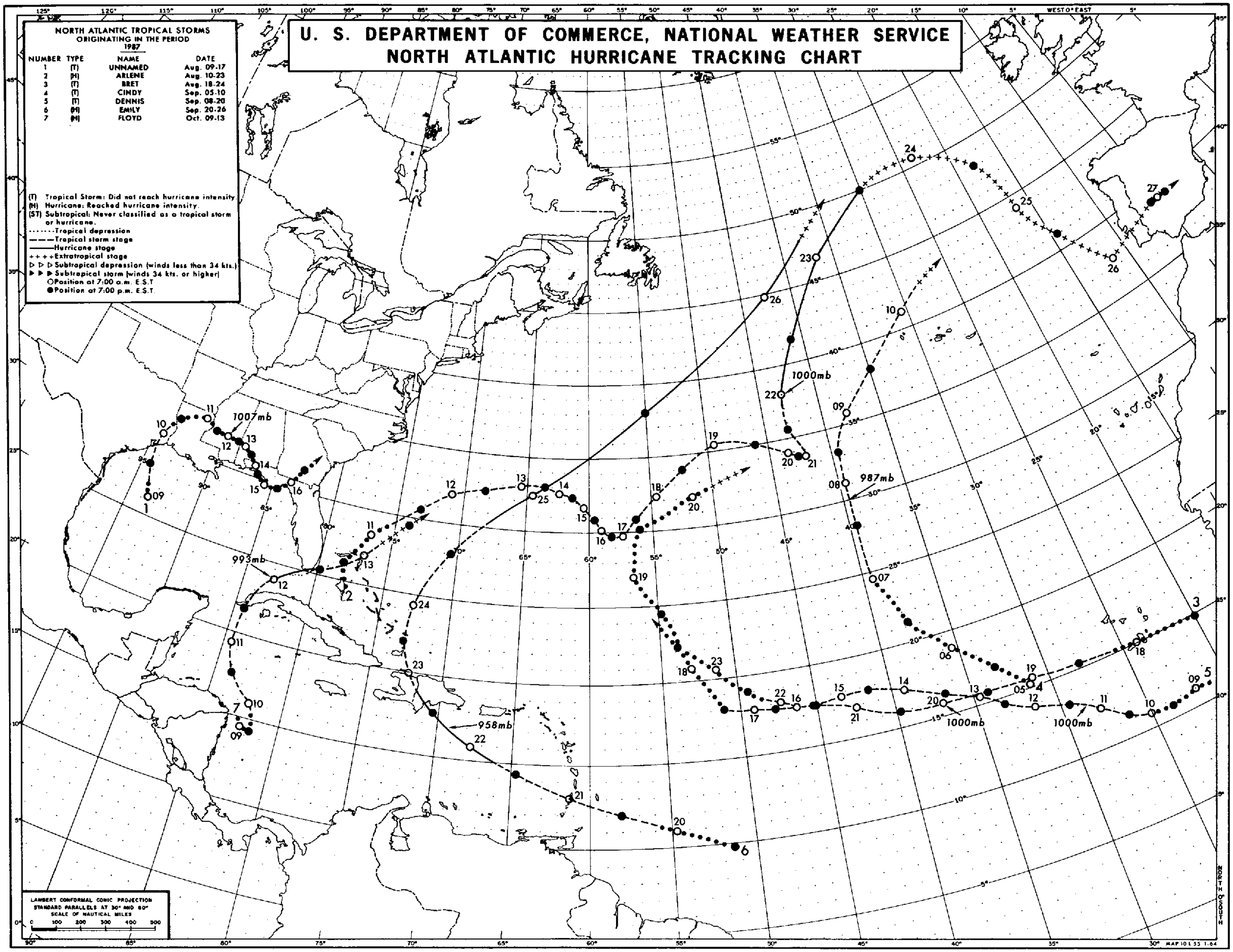

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1983
NUMBER TYPE NAME DATE
1 (H) ALICIA Aug. 15-21
2 (H) BARRY Aug. 23-29
3 (H) CHANTAL Sep. 10-15
4 (T) DEAN Sep. 26-30
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
SCALE OF NAUTICAL MILES

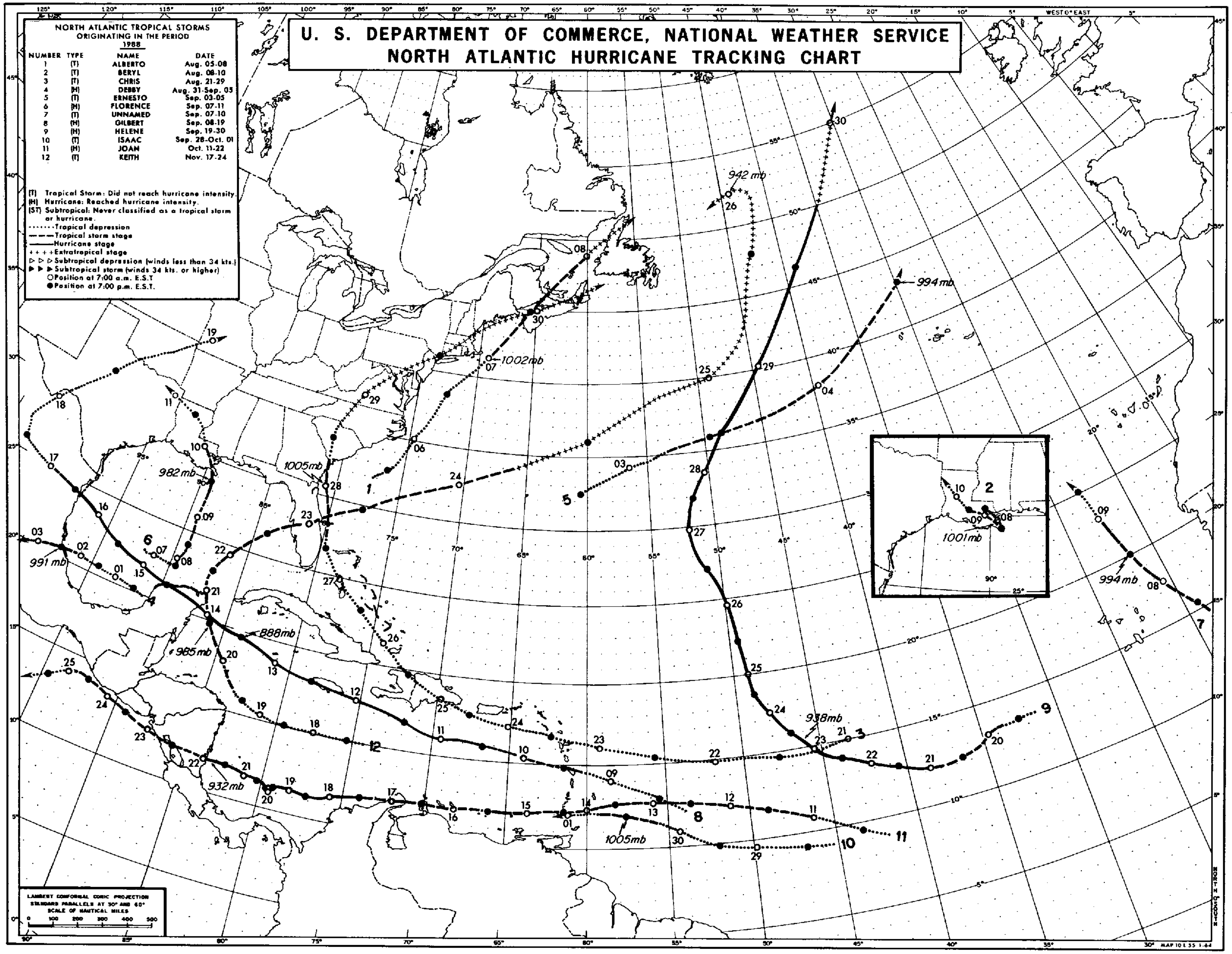

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1984
NUMBER TYPE NAME DATE
1 (ST) —— Aug. 18-21
2 (T) ARTHUR Aug. 28-Sep. 5
3 (T) BERTHA Aug. 30-Sep. 4
4 (T) CESAR Aug. 30-Sep. 2
5 (H) DIANA Sep. 8-16
6 (T) EDOUARD Sep. 13-15
7 (T) FRAN Sep. 15-20
8 (T) GUSTAV Sep. 16-19
9 (H) HORTENSE Sep. 22-Oct. 2
10 (T) ISIDORE Sep. 25-Oct. 1
11 (H) JOSEPHINE Oct. 7-20
12 (H) KLAUS Nov. 5-13
13 (H) LILI Dec. 12-24
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
Stationary
(1PM Sep. 17—
1PM Sep. 18)

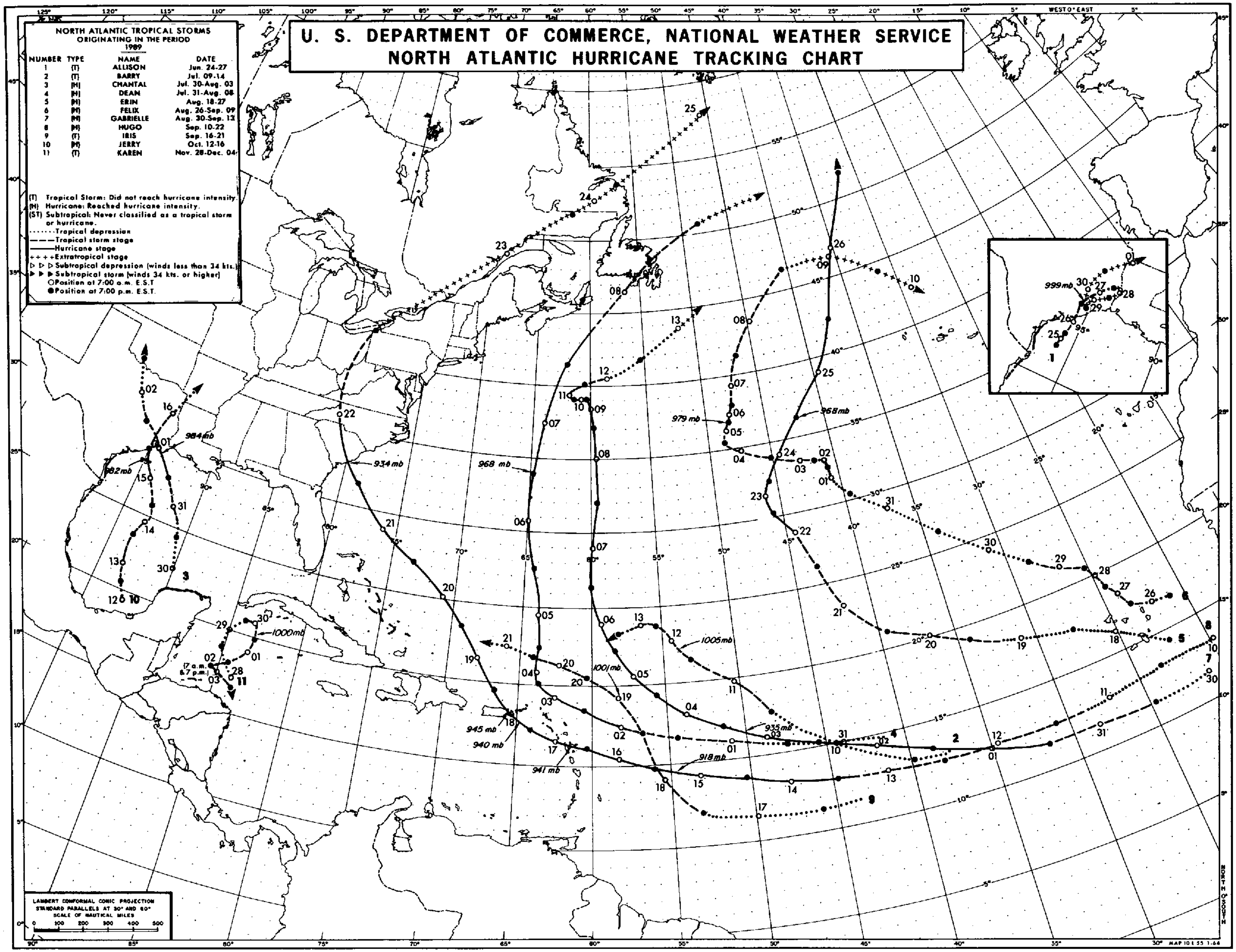


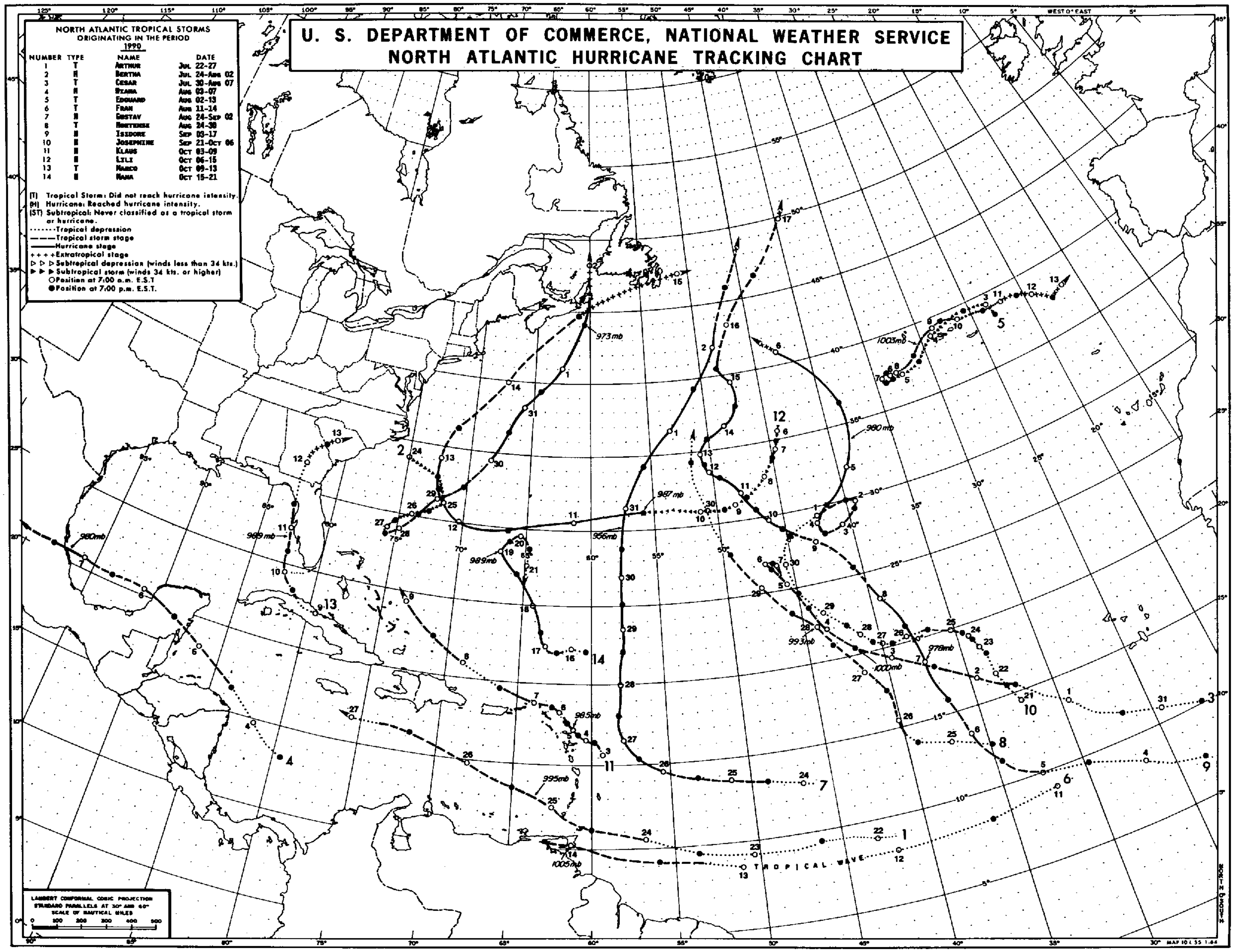
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1985
NUMBER TYPE NAME DATE
1 (T) ANA Jul. 15-19
2 (H) BOB Jul. 21-25
3 (H) CLAUDETTE Aug. 9-16
4 (H) DANNY Aug. 11-20
5 (H) ELENA Aug. 27-Sep. 4
6 (T) FABIAN Sep. 15-19
7 (H) GLORIA Sep. 16-Oct. 1
8 (T) HENRI Sep. 21-24
9 (T) ISABEL Oct. 6-15
10 (H) JUAN Oct. 25-Nov. 1
11 (H) KATE Nov. 15-23
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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

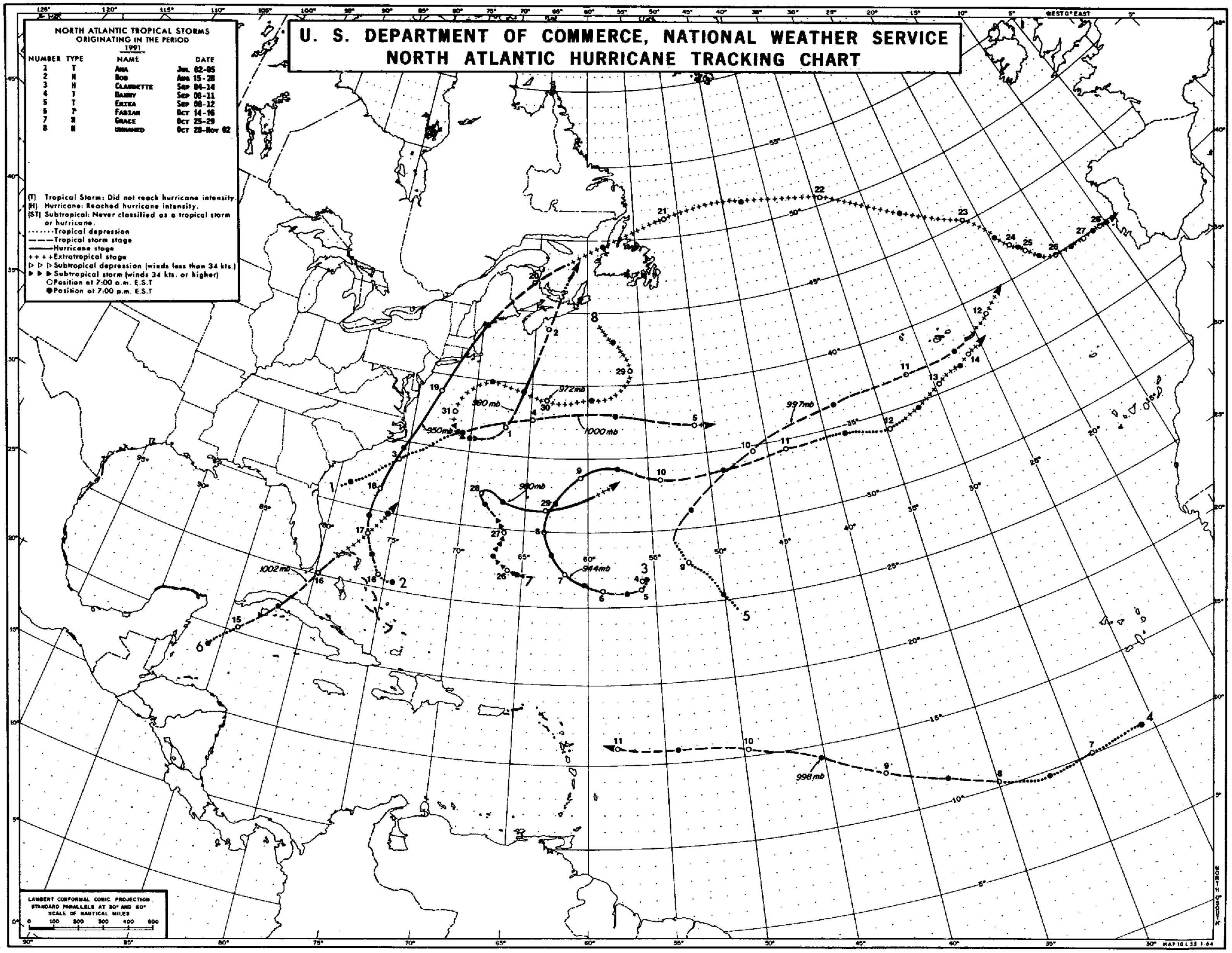

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1986
NUMBER TYPE NAME DATE
1 (T) ANDREW June 4-8
2 (H) BONNIE June 23-28
3 (H) CHARLEY Aug. 13-29
4 (T) DANIELLE Sep. 7-10
5 (H) EARL Sep. 10-19
6 (H) FRANCES Nov. 18-21
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
+ + + + Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
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, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1987
NUMBER TYPE NAME DATE
1 (T) UNNAMED Aug. 09-17
2 (H) ARLENE Aug. 10-23
3 (T) BRET Aug. 18-24
4 (T) CINDY Sep. 05-10
5 (T) DENNIS Sep. 08-20
6 (H) EMILY Sep. 20-26
7 (H) FLOYD Oct. 09-13
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
1007mb
993mb
958mb
1000mb
987mb
1000mb
1000mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

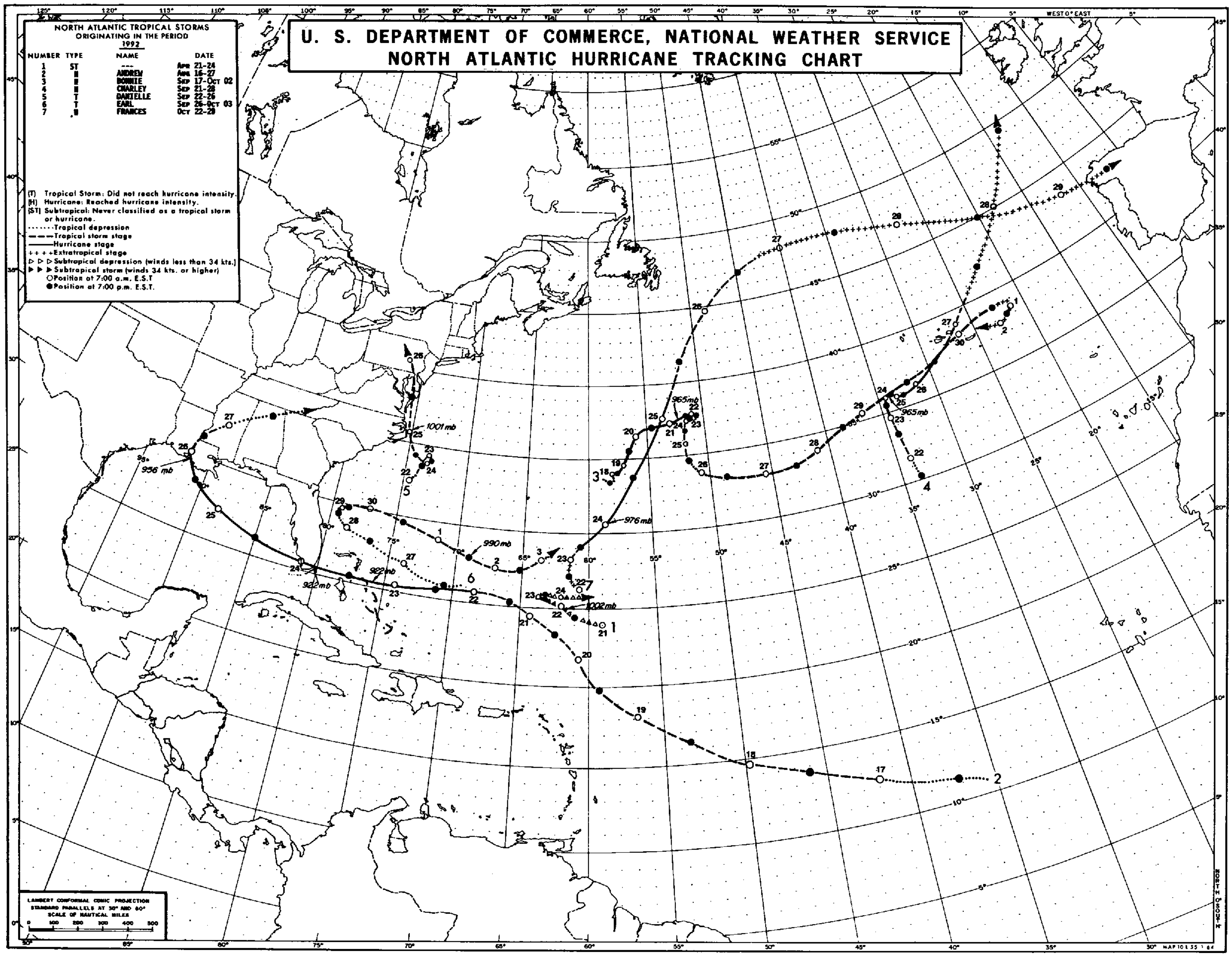

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1988
NUMBER TYPE NAME DATE
1 (T) ALBERTO Aug. 05-08
2 (T) BERYL Aug. 08-10
3 (T) CHRIS Aug. 21-29
4 (H) DEBBY Aug. 31-Sep. 05
5 (T) ERNESTO Sep. 03-05
6 (H) FLORENCE Sep. 07-11
7 (T) UNNAMED Sep. 07-10
8 (H) GILBERT Sep. 08-19
9 (H) HELENE Sep. 19-30
10 (T) ISAAC Sep. 28-Oct. 01
11 (H) JOAN Oct. 11-22
12 (T) KEITH Nov. 17-24
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
942 mb
994 mb
1002 mb
1005 mb
982 mb
991 mb
985 mb
888 mb
938 mb
932 mb
1001 mb

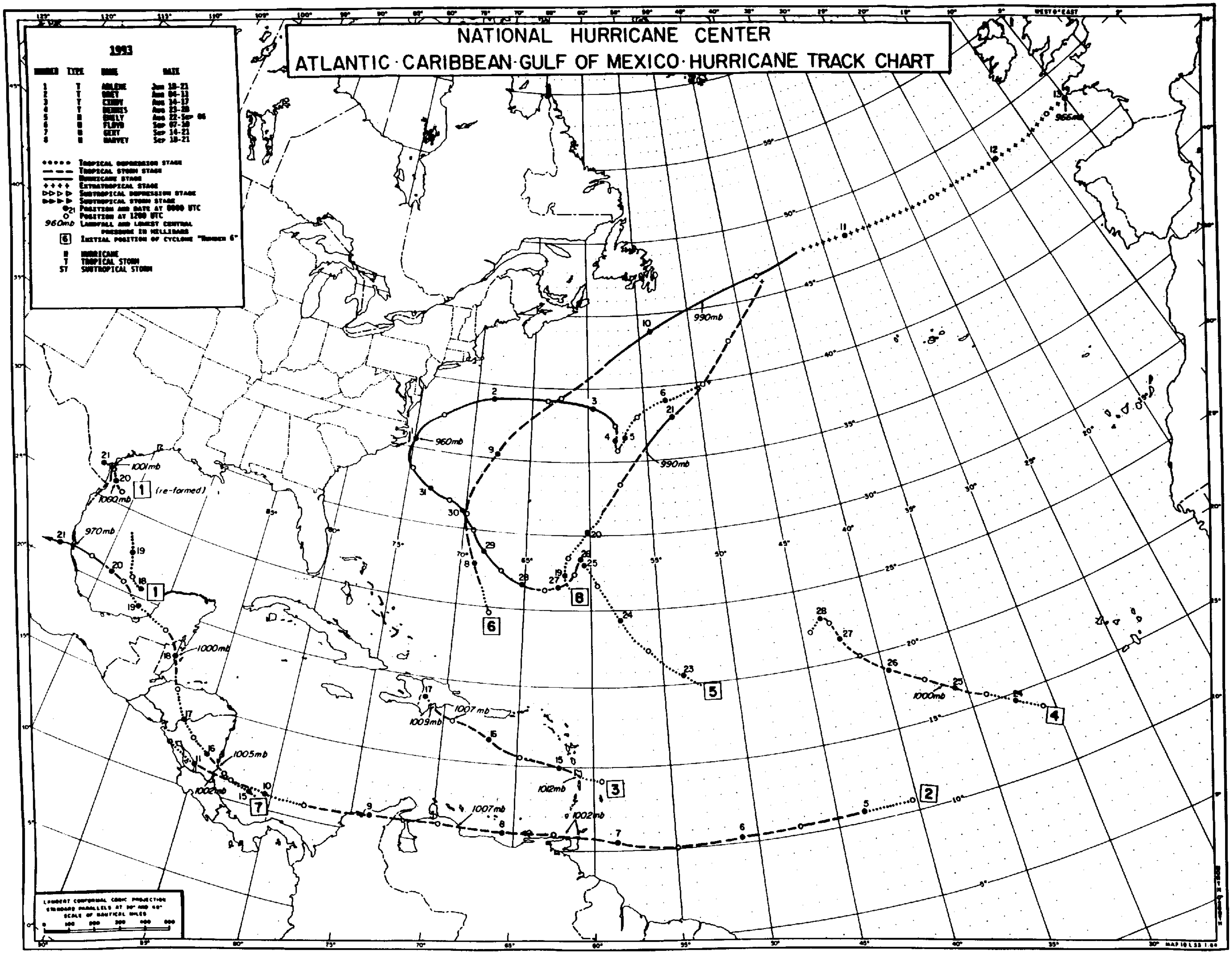

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1989
NUMBER TYPE NAME DATE
1 (T) ALLISON Jun. 24-27
2 (T) BARRY Jul. 09-14
3 (H) CHANTAL Jul. 30-Aug. 03
4 (H) DEAN Jul. 31-Aug. 08
5 (H) ERIN Aug. 18-27
6 (H) FELIX Aug. 26-Sep. 09
7 (H) GABRIELLE Aug. 30-Sep. 13
8 (H) HUGO Sep. 10-22
9 (T) IRIS Sep. 16-21
10 (H) JERRY Oct. 12-16
11 (T) KAREN Nov. 28-Dec. 04
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
934 mb
968 mb
979 mb
968mb
984mb
982mb
1000mb
1001mb
1005mb
935mb
945 mb
940 mb
941 mb
918mb
999mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

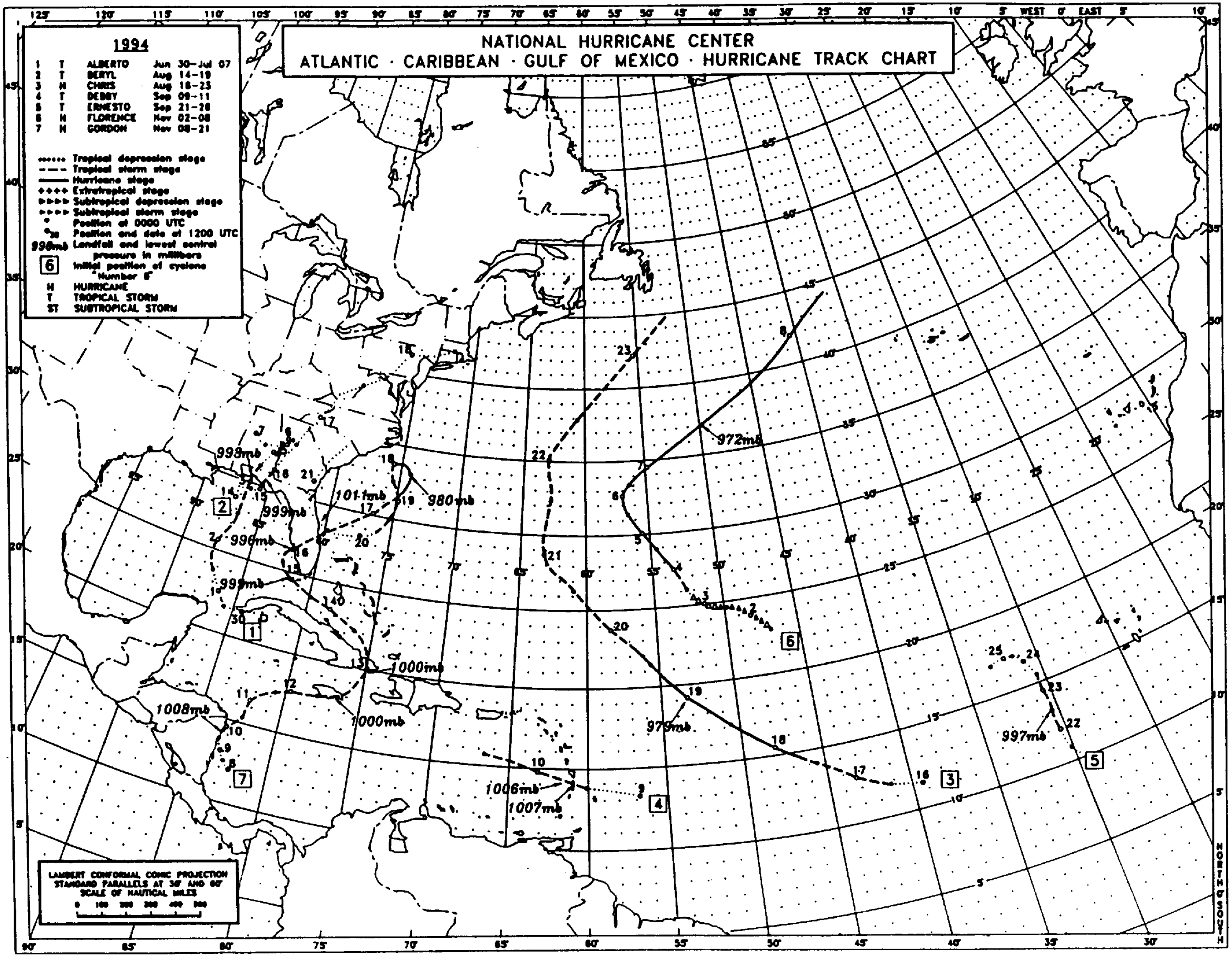

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1990
NUMBER TYPE NAME DATE
1 T ARTHUR JUL 22-27
2 H BERTHA JUL 24-AUG 02
3 T CESAR JUL 30-AUG 07
4 H AUG 03-07
5 T EDOUARD AUG 02-13
6 T FRAN AUG 11-14
7 H GUSTAV AUG 24-SEP 02
8 T AUG 24-30
9 H ISIDORE SEP 03-17
10 H JOSEPHINE SEP 21-OCT 06
11 H KLAUS OCT 03-09
12 H LILI OCT 06-15
13 T OCT 09-13
14 H NANA OCT 15-21
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
973mb
980mb
987mb
956mb
989mb
985mb
995mb
1005mb
1003mb
978mb
1000mb
993mb
TROPICAL WAVE
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

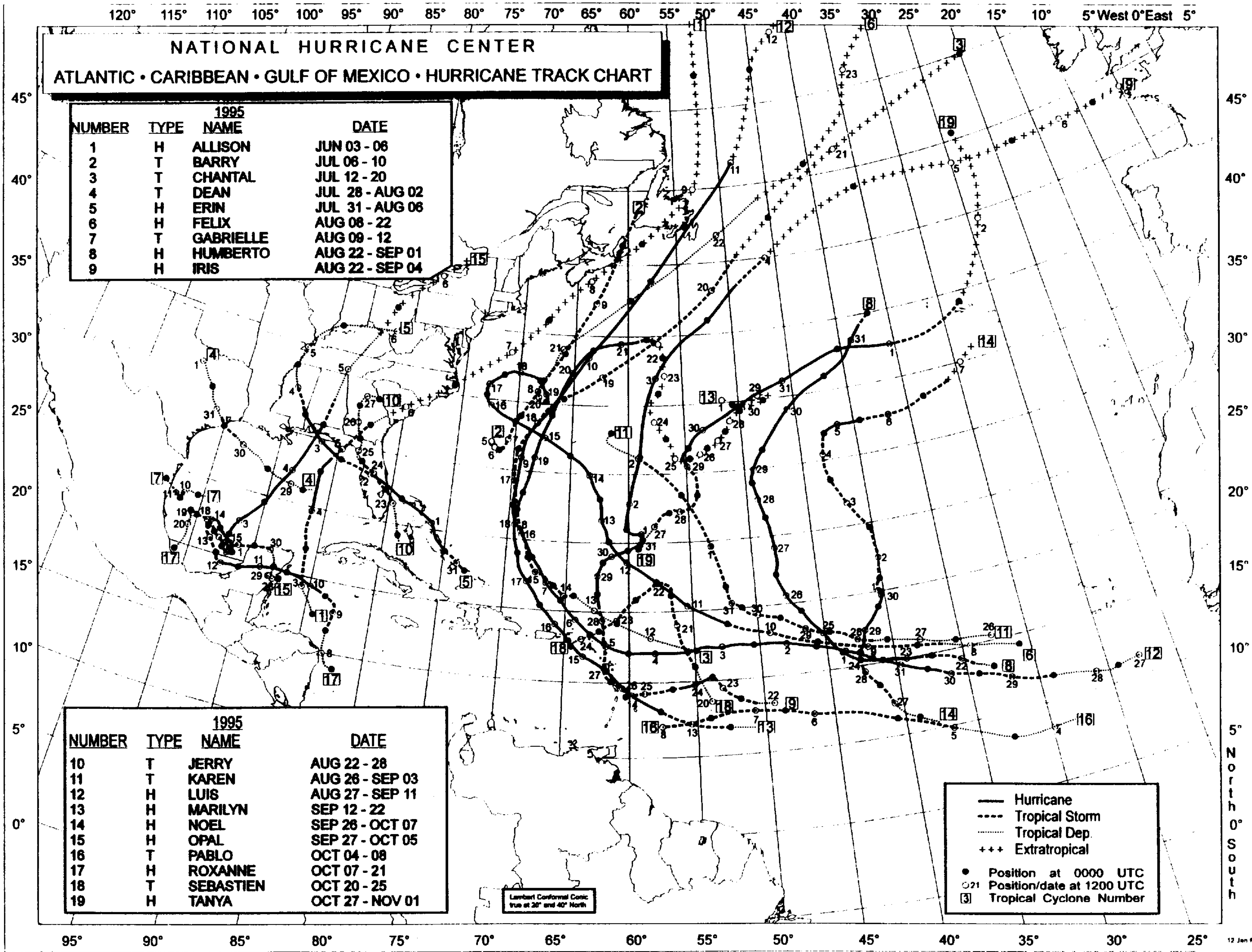


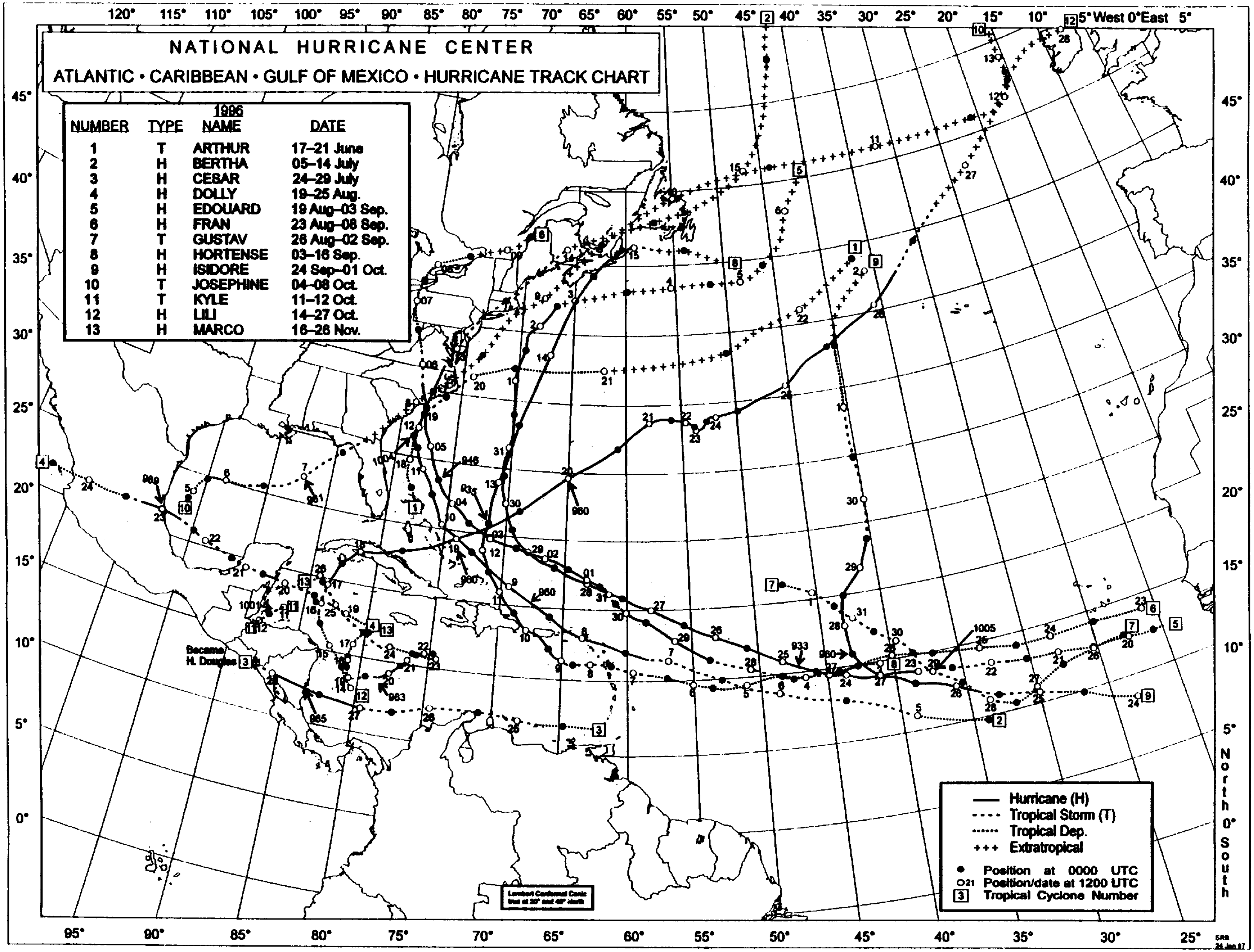
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD 1991
NUMBER TYPE NAME DATE
1 T Ana Jul 02-05
2 H Bob Aug 15-28
3 H Claudette Sep 04-14
4 T Danny Sep 08-11
5 T Erika Sep 08-12
6 T Fabian Oct 14-16
7 H Grace Oct 25-29
8 H Unnamed Oct 28-Nov 02
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T
972mb
980mb
950mb
1000mb
997mb
980mb
944mb
1002mb
998mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

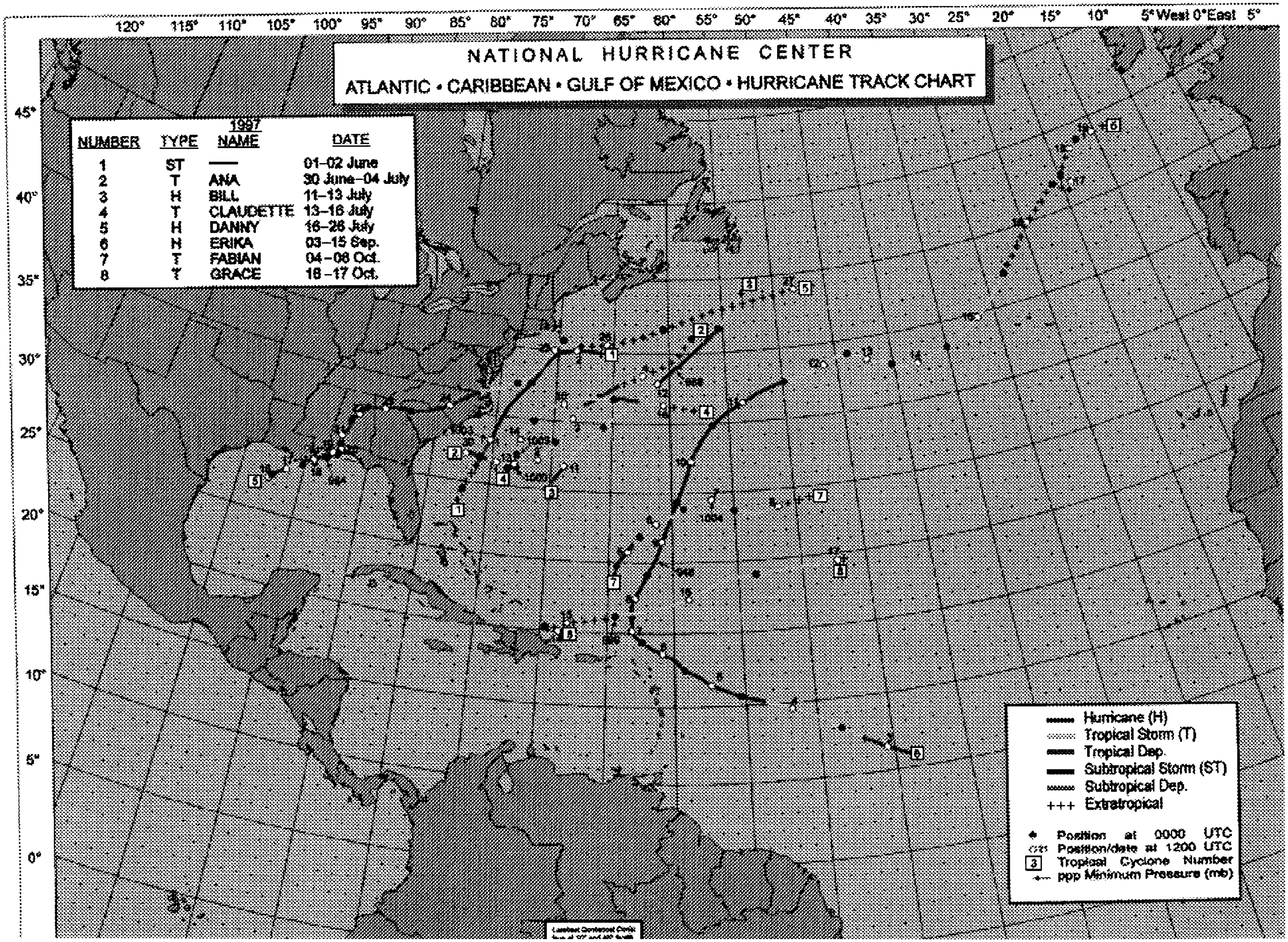

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1992
NUMBER TYPE NAME DATE
1 ST --- APR 21-24
2 H ANDREW AUG 16-27
3 H BONNIE SEP 17-OCT 02
4 H CHARLEY SEP 21-28
5 T DANIELLE SEP 22-26
6 T EARL SEP 26-OCT 03
7 H FRANCES OCT 22-29
(T) Tropical Storm: Did not reach hurricane intensity.
(H) Hurricane: Reached hurricane intensity.
(ST) Subtropical: Never classified as a tropical storm or hurricane.
Tropical depression
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression (winds less than 34 kts.)
Subtropical storm (winds 34 kts. or higher)
Position at 7:00 a.m. E.S.T
Position at 7:00 p.m. E.S.T.
956 mb
922 mb
922mb
1001mb
990mb
976mb
965mb
965mb
1002mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES


NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1993
NUMBER TYPE NAME DATE
1 T ARLENE Jun 18-21
2 T BRET Aug 04-11
3 T CINDY Aug 14-17
4 T DENNIS Aug 23-28
5 H EMILY Aug 22-Sep 06
6 H FLOYD Sep 07-10
7 H GERT Sep 14-21
8 H HARVEY Sep 18-21
TROPICAL DEPRESSION STAGE
TROPICAL STORM STAGE
HURRICANE STAGE
EXTRATROPICAL STAGE
SUBTROPICAL DEPRESSION STAGE
SUBTROPICAL STORM STAGE
POSITION AND DATE AT 0000 UTC
POSITION AT 1200 UTC
960mb LANDFALL AND LOWEST CENTRAL PRESSURE IN MILLIBARS
INITIAL POSITION OF CYCLONE "NUMBER 6"
H HURRICANE
T TROPICAL STORM
ST SUBTROPICAL STORM
960mb
990mb
990mb
965mb
1001mb
1000mb
(re-formed)
970mb
1000mb
1007mb
1009mb
1005mb
1002mb
1012mb
1007mb
1002mb
1000mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

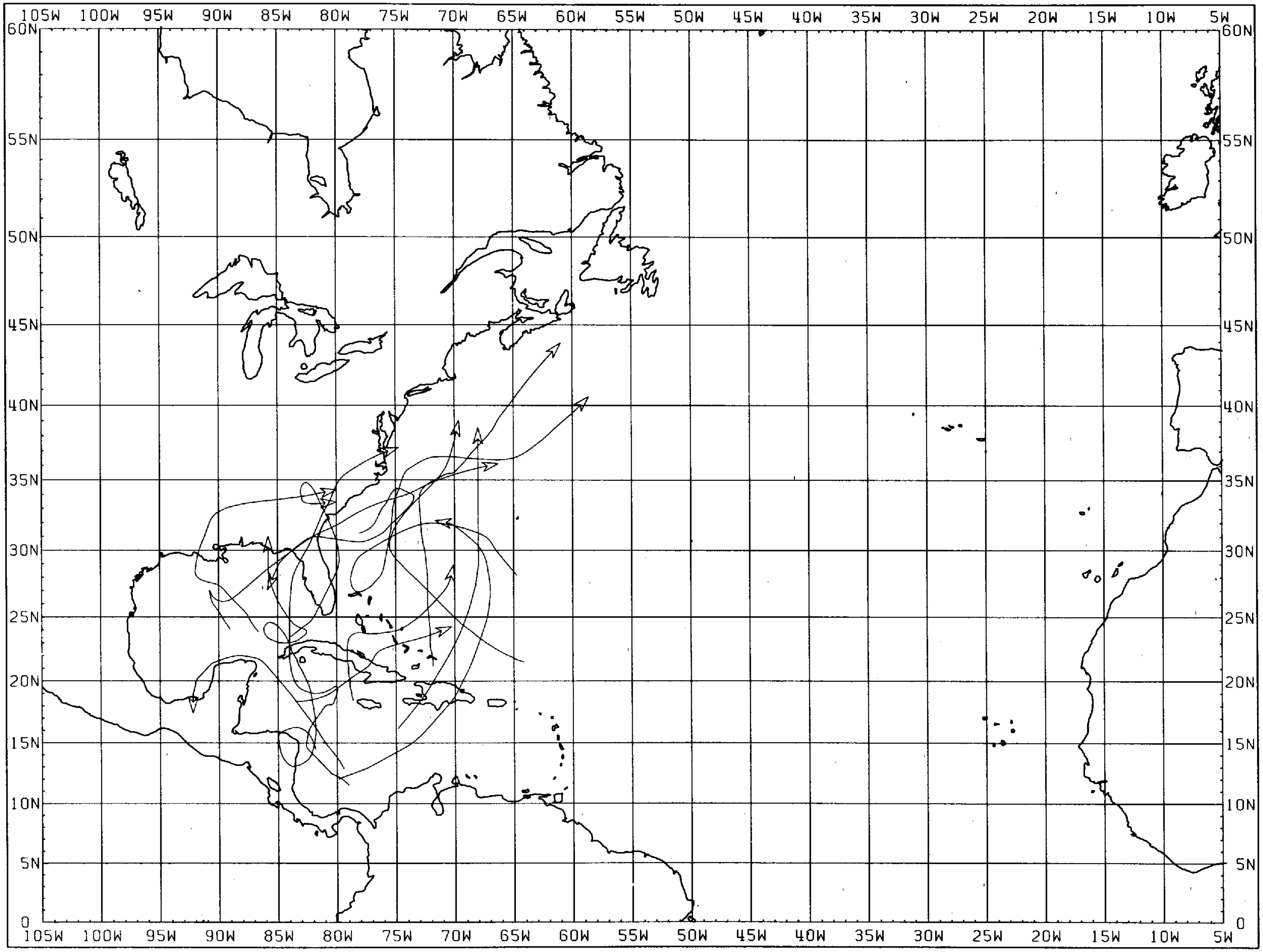

NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1994
1 T ALBERTO Jun 30–Jul 07
2 T BERYL Aug 14–19
3 H CHRIS Aug 16–23
4 T DEBBY Sep 09–11
5 T ERNESTO Sep 21–26
6 H FLORENCE Nov 02–08
7 H GORDON Nov 08–21
Tropical depression stage
Tropical storm stage
Hurricane stage
Extratropical stage
Subtropical depression stage
Subtropical storm stage
Position at 0000 UTC
Position and date at 1200 UTC
996mb Landfall and lowest central pressure in millibars
6 Initial position of cyclone "Number 6"
H HURRICANE
T TROPICAL STORM
ST SUBTROPICAL STORM
972mb
980mb
979mb
997mb
1000mb
1008mb
1006mb
1007mb
993mb
999mb
996mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500
WEST
EAST
NORTH
SOUTH


NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1995
NUMBER TYPE NAME DATE
1 H ALLISON JUN 03 - 06
2 T BARRY JUL 06 - 10
3 T CHANTAL JUL 12 - 20
4 T DEAN JUL 28 - AUG 02
5 H ERIN JUL 31 - AUG 06
6 H FELIX AUG 08 - 22
7 T GABRIELLE AUG 09 - 12
8 H HUMBERTO AUG 22 - SEP 01
9 H IRIS AUG 22 - SEP 04
1995
NUMBER TYPE NAME DATE
10 T JERRY AUG 22 - 28
11 T KAREN AUG 26 - SEP 03
12 H LUIS AUG 27 - SEP 11
13 H MARILYN SEP 12 - 22
14 H NOEL SEP 26 - OCT 07
15 H OPAL SEP 27 - OCT 05
16 T PABLO OCT 04 - 08
17 H ROXANNE OCT 07 - 21
18 T SEBASTIEN OCT 20 - 25
19 H TANYA OCT 27 - NOV 01
Hurricane
Tropical Storm
Tropical Dep.
Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
North 0° South
5° West 0° East 5°

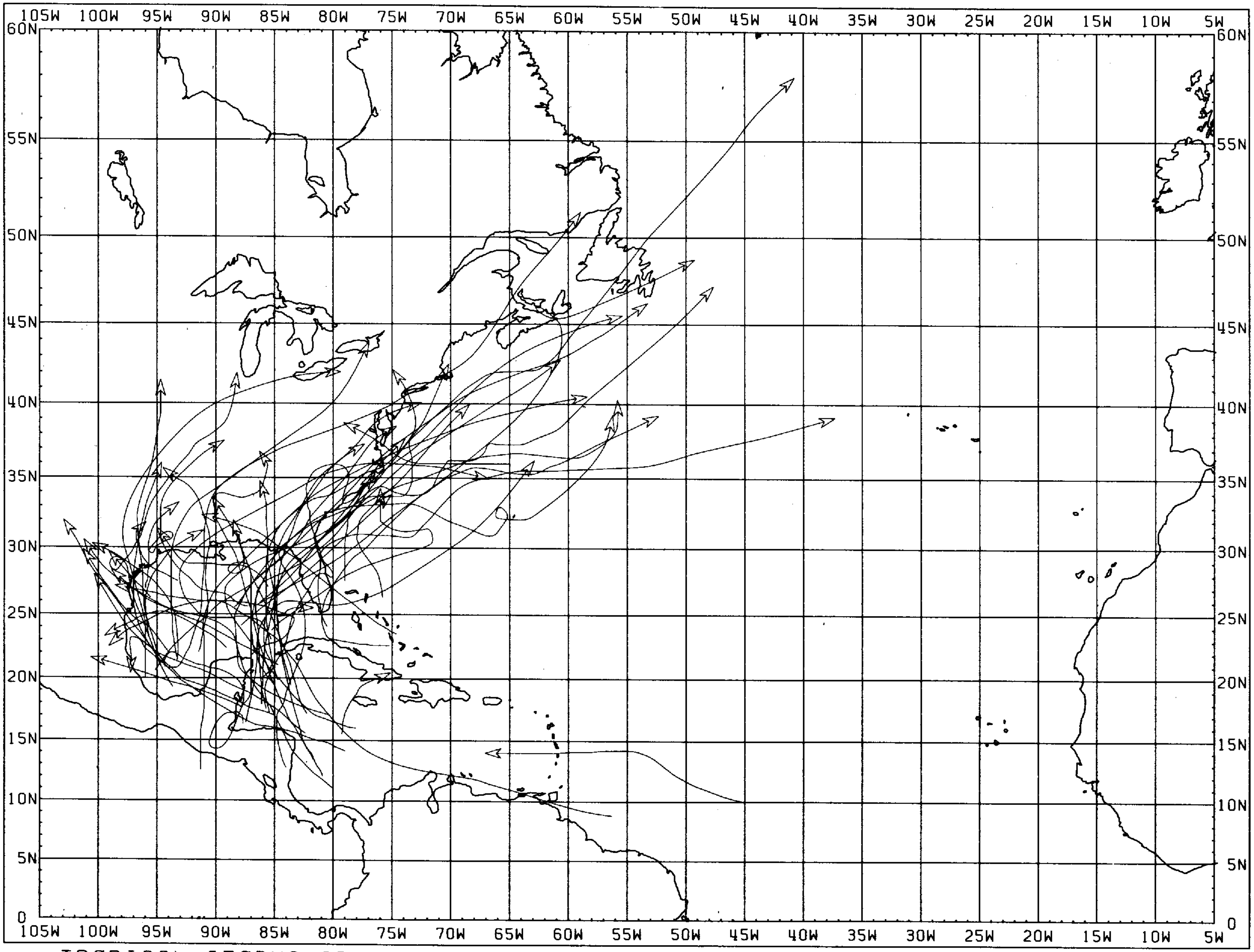

NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1996
NUMBER TYPE NAME DATE
1 T ARTHUR 17–21 June
2 H BERTHA 05–14 July
3 H CESAR 24–29 July
4 H DOLLY 19–25 Aug.
5 H EDOUARD 19 Aug–03 Sep.
6 H FRAN 23 Aug–08 Sep.
7 T GUSTAV 26 Aug–02 Sep.
8 H HORTENSE 03–16 Sep.
9 H ISIDORE 24 Sep–01 Oct.
10 T JOSEPHINE 04–08 Oct.
11 T KYLE 11–12 Oct.
12 H LILI 14–27 Oct.
13 H MARCO 16–26 Nov.
Became H. Douglas
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
West 0° East
North 0° South


NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1997
NUMBER TYPE NAME DATE
1 ST — 01-02 June
2 T ANA 30 June-04 July
3 H BILL 11-13 July
4 T CLAUDETTE 13-16 July
5 H DANNY 16-26 July
6 H ERIKA 03-15 Sep.
7 T FABIAN 04-08 Oct.
8 T GRACE 16-17 Oct.
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Subtropical Storm (ST)
Subtropical Dep.
+++ Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
ppp Minimum Pressure (mb)

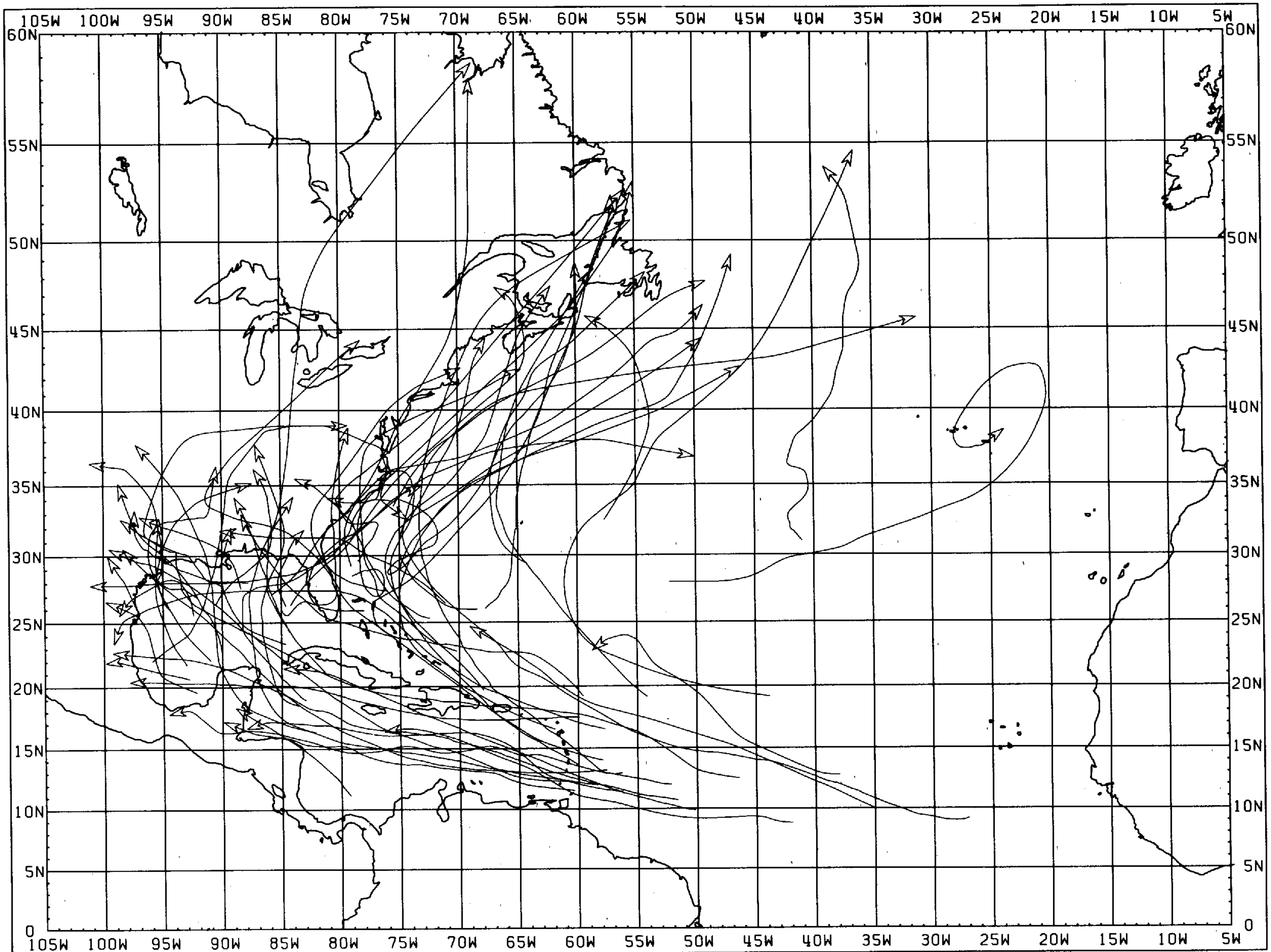
ATTACH 1998 CHART HERE



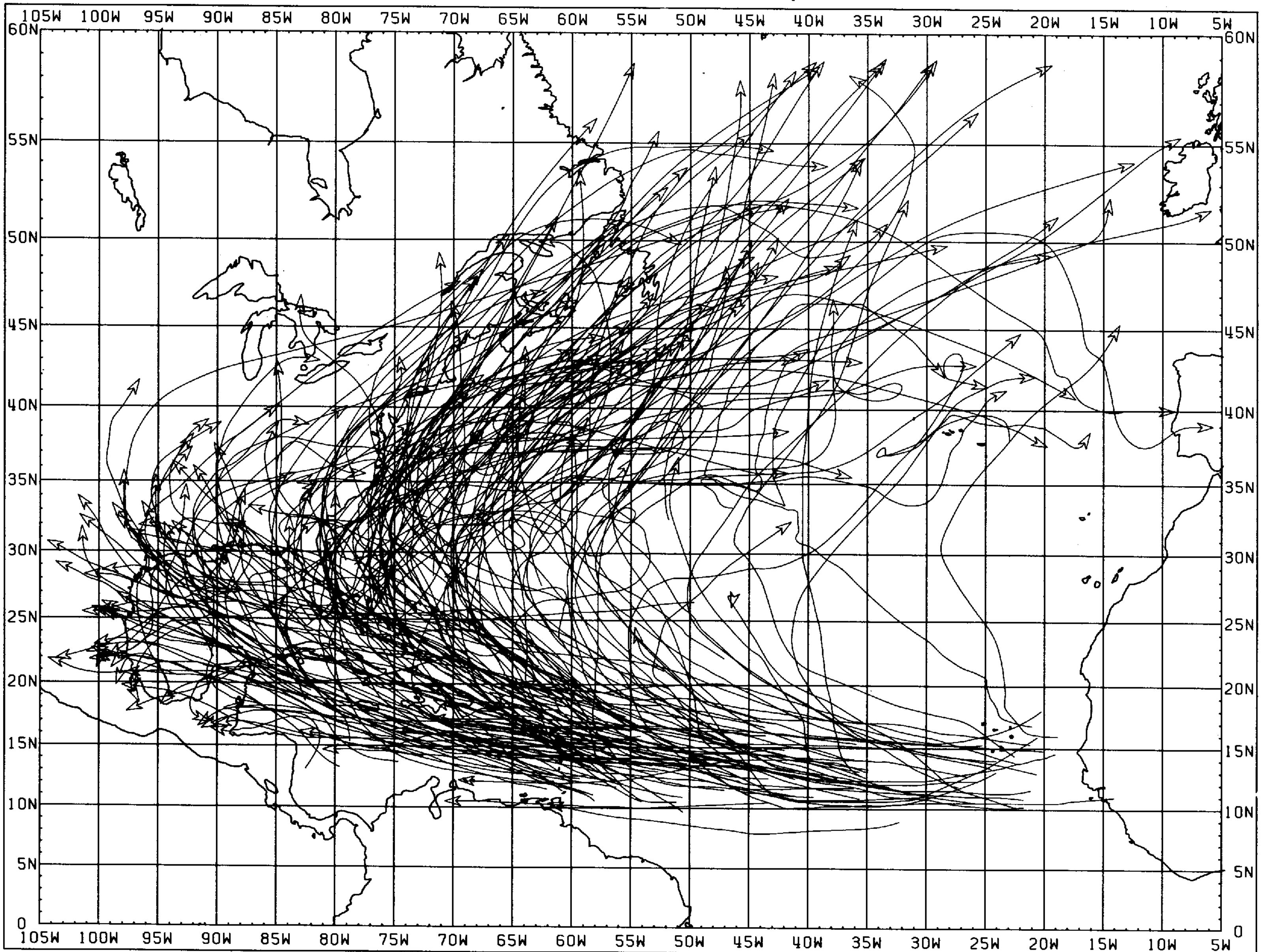
TROPICAL STORMS OR HURRICANES BEGINNING IN MAY, 1886-1992 (14 STORMS)



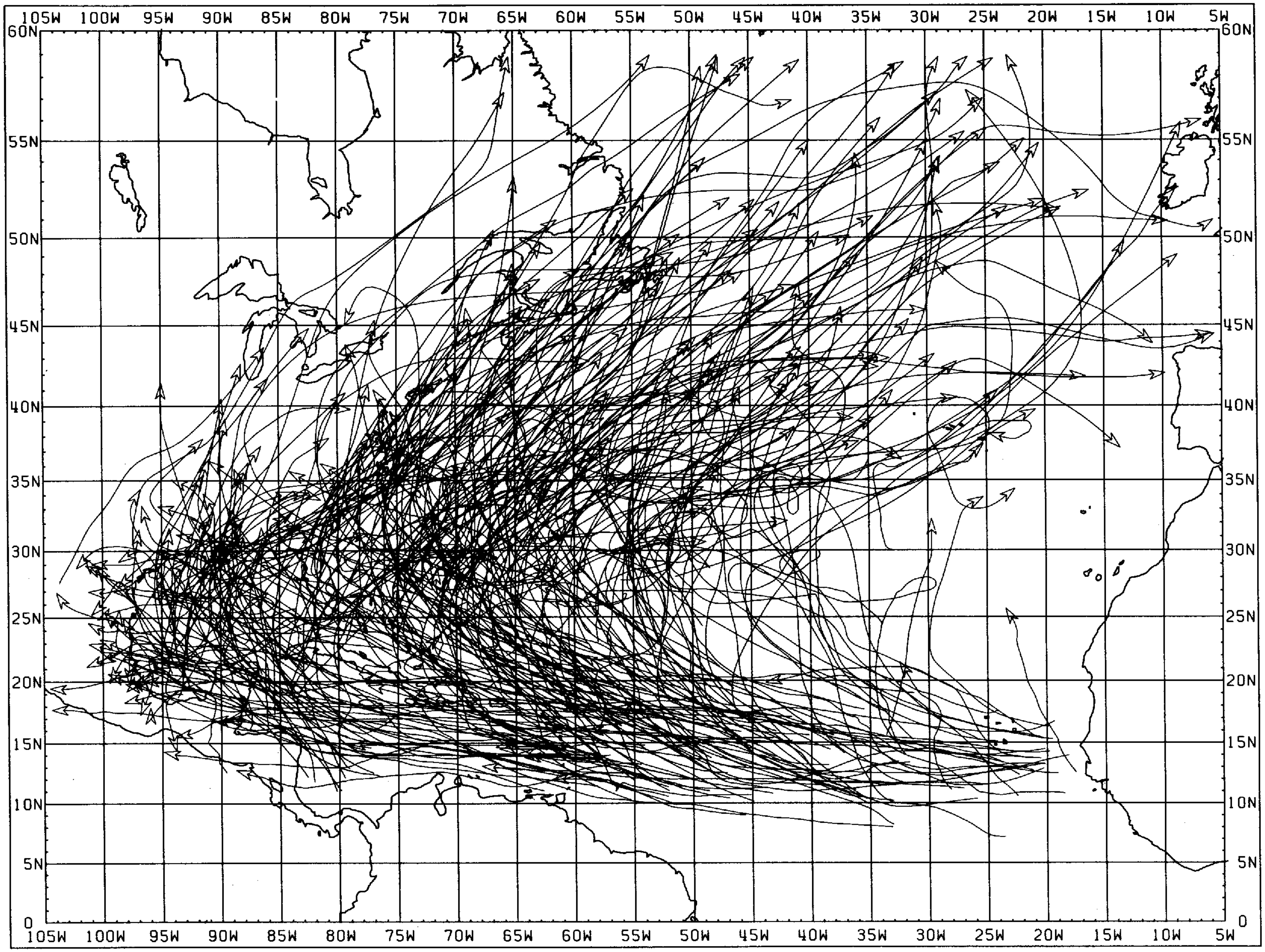
TROPICAL STORMS OR HURRICANES BEGINNING IN JUNE, 1886-1992 (56 STORMS)



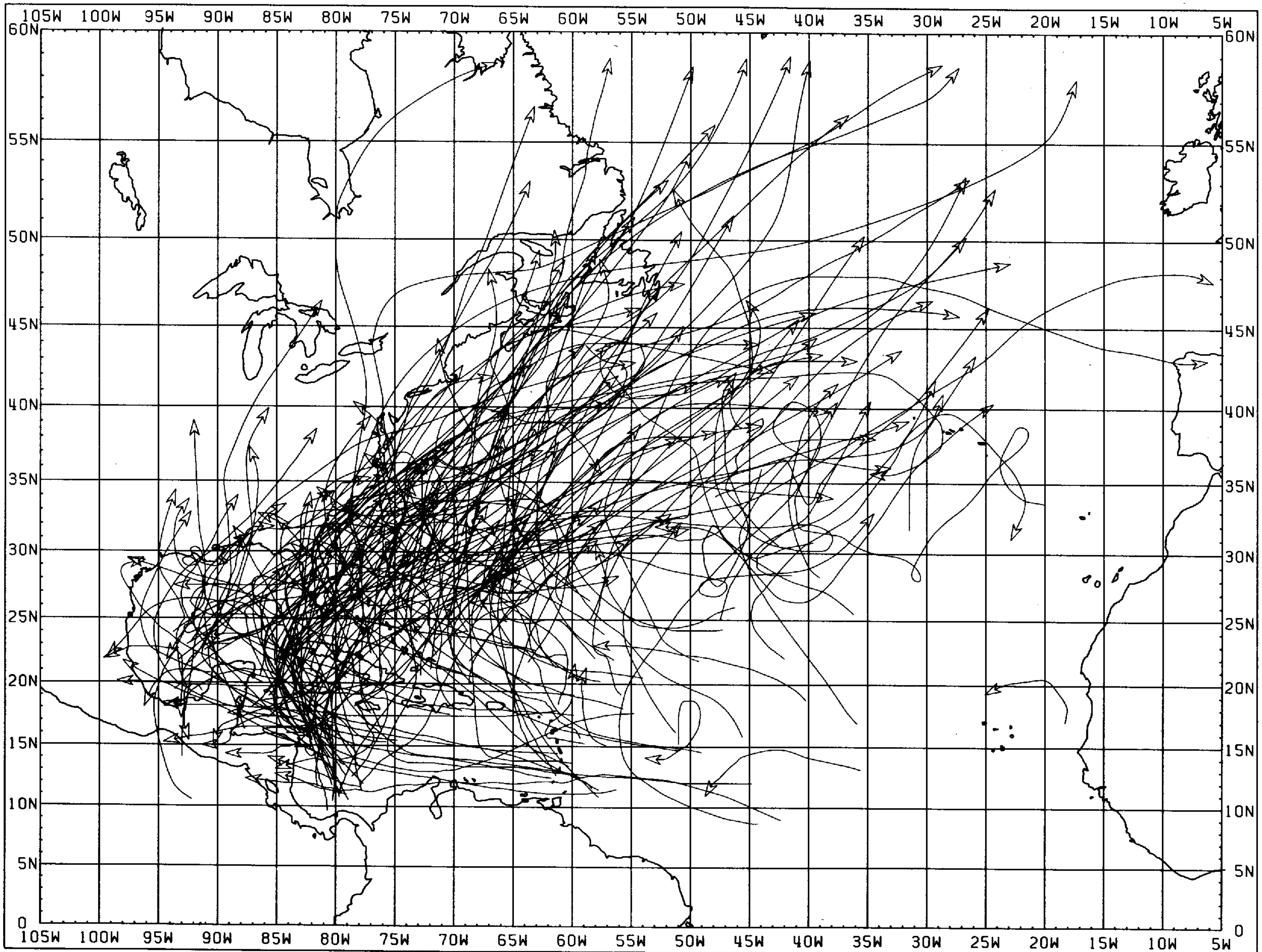
TROPICAL STORMS OR HURRICANES BEGINNING IN JULY, 1886-1992 (68 STORMS)



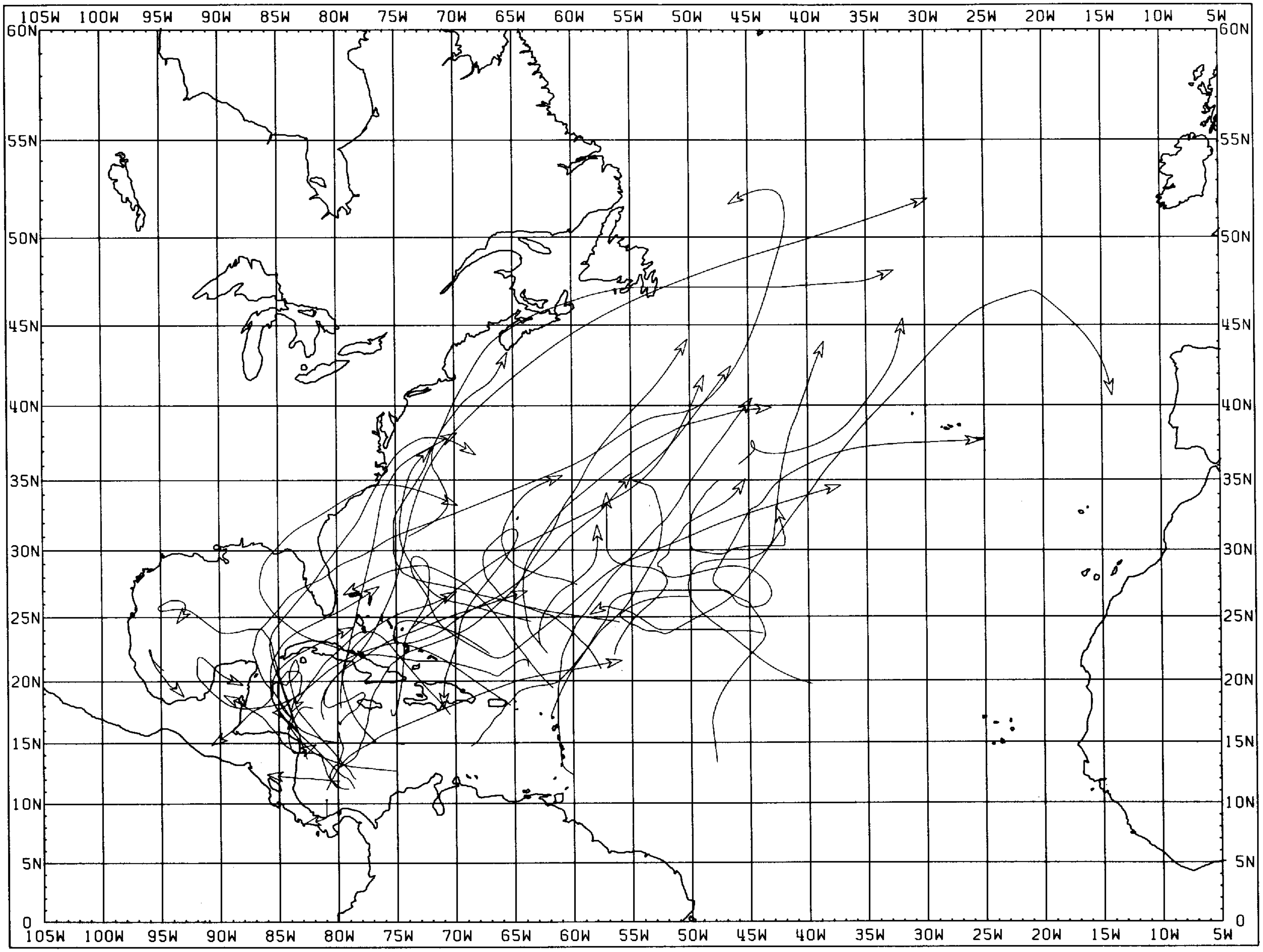
TROPICAL STORMS OR HURRICANES BEGINNING IN AUGUST, 1886-1992 (217 STORMS)



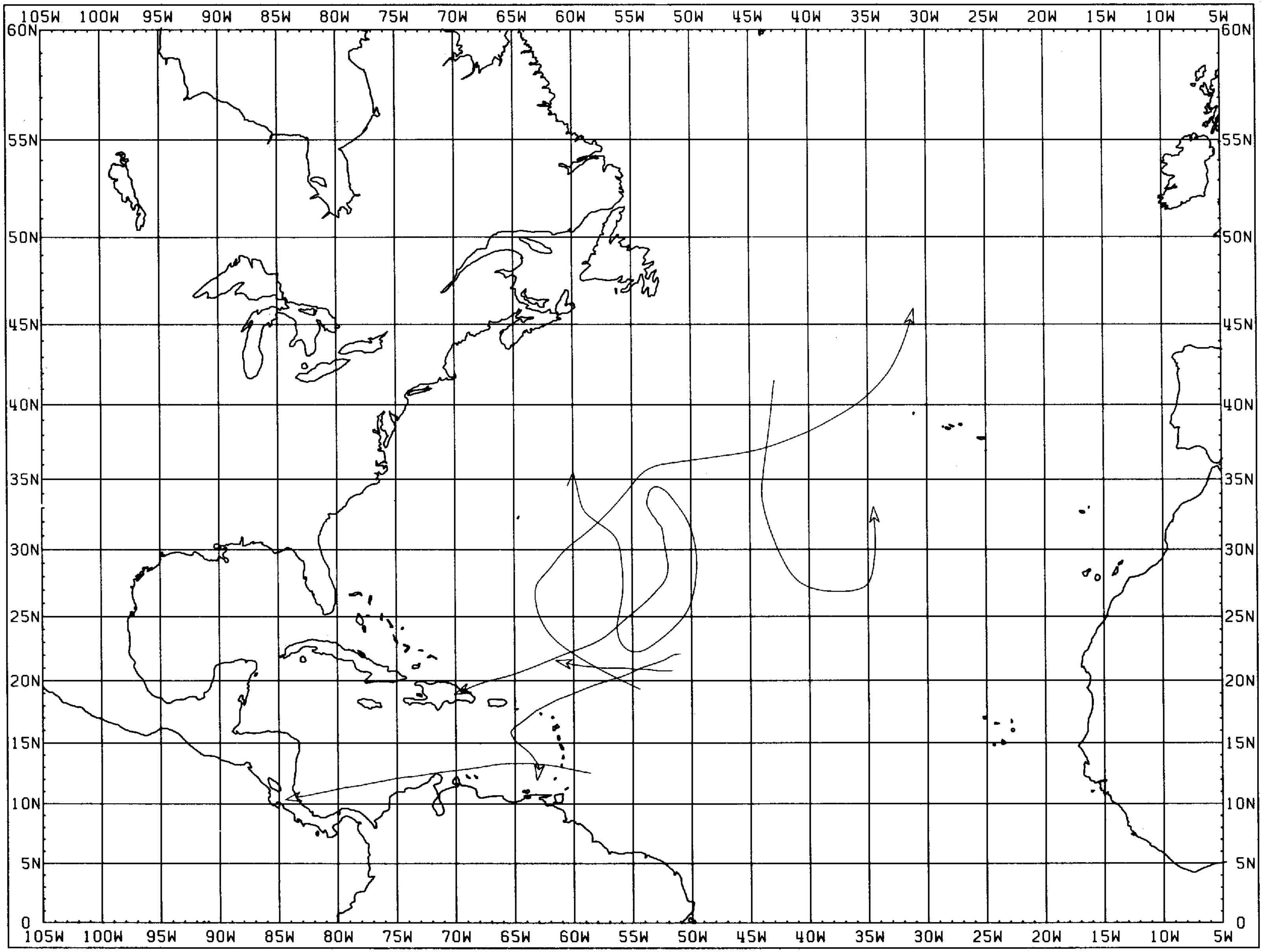
TROPICAL STORMS OR HURRICANES BEGINNING IN SEPTEMBER, 1886-1992 (308 STORMS)



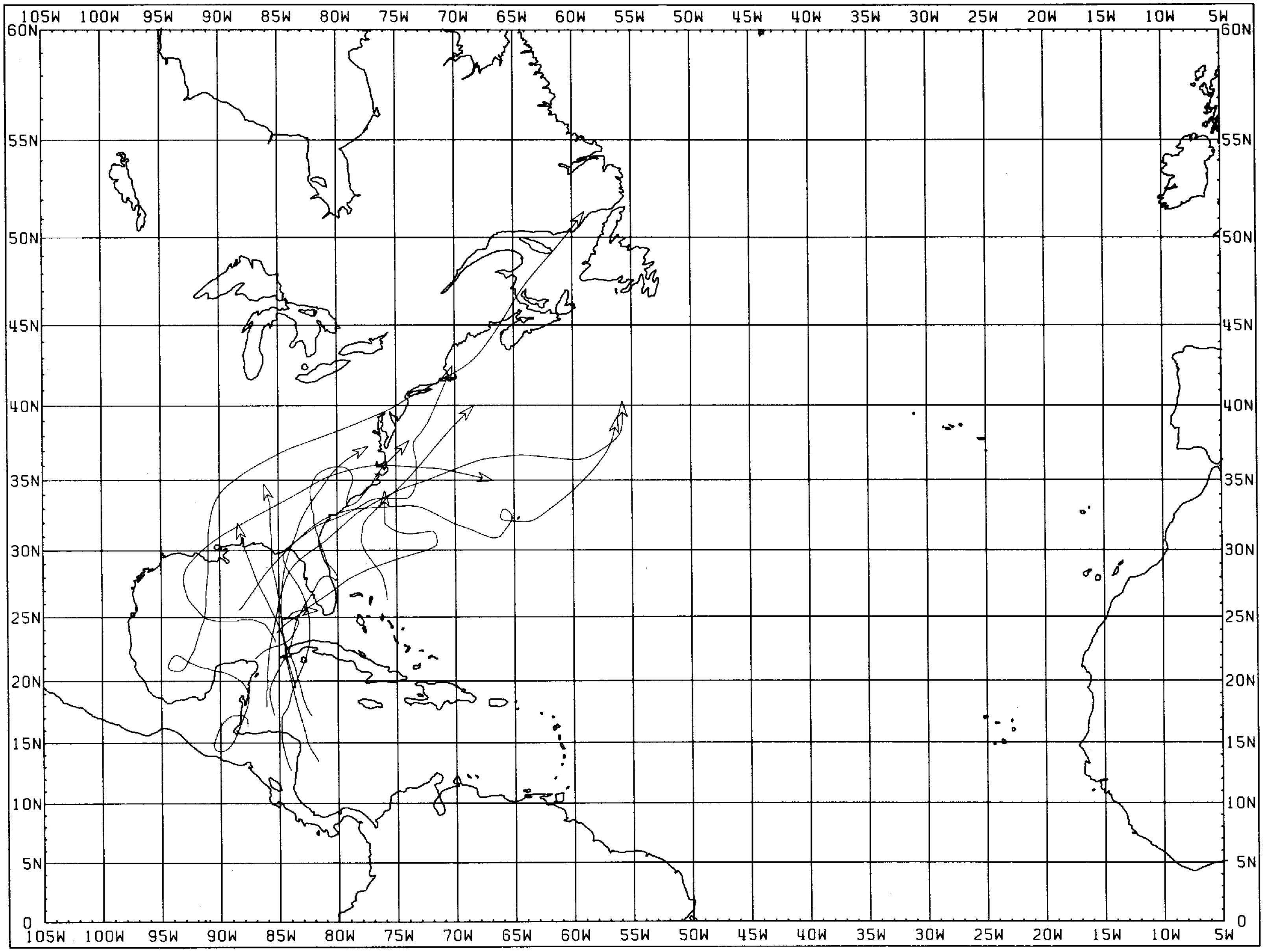
TROPICAL STORMS OR HURRICANES BEGINNING IN OCTOBER, 1886-1992 (189 STORMS)



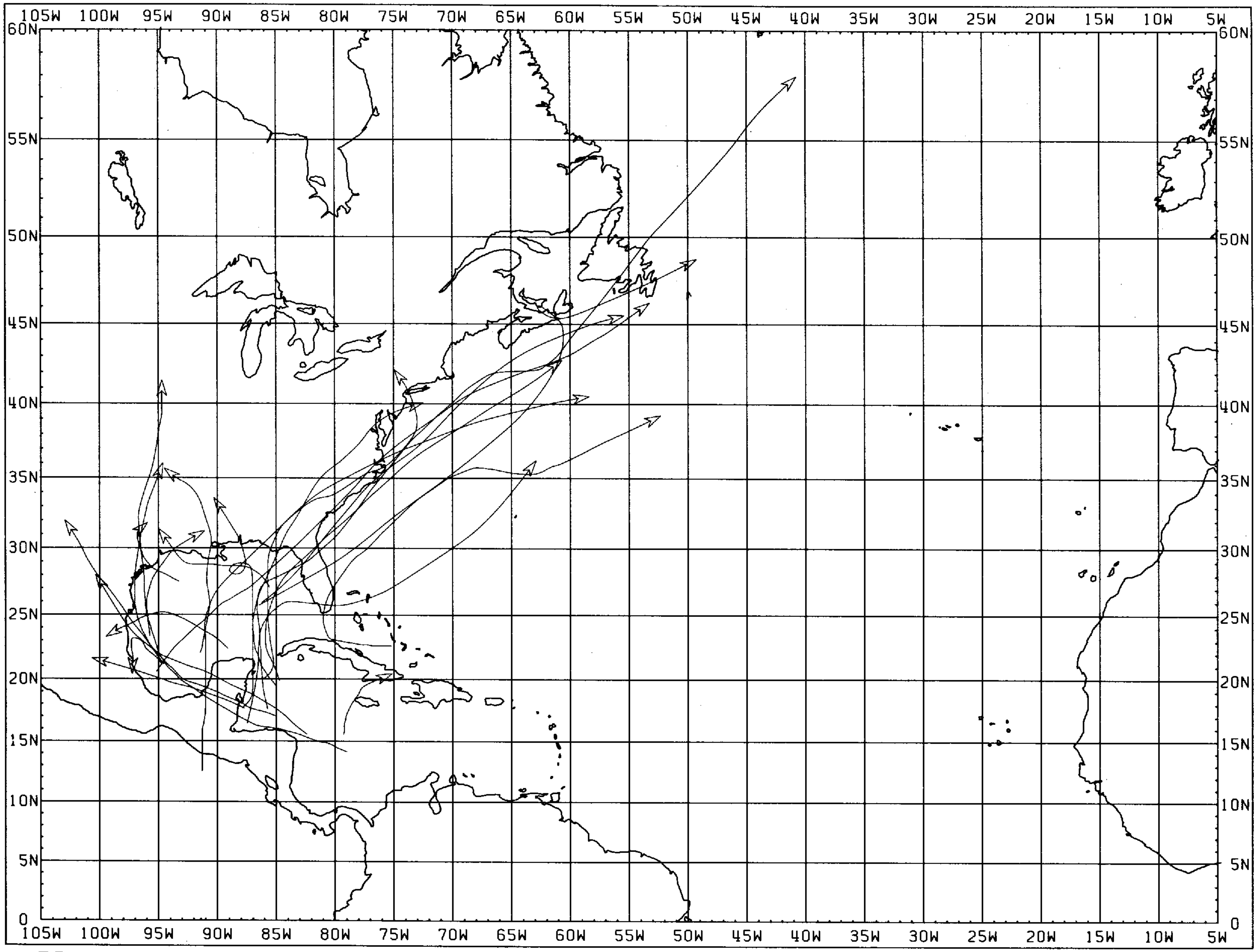
TROPICAL STORMS OR HURRICANES BEGINNING IN NOVEMBER, 1886-1992 (42 STORMS)



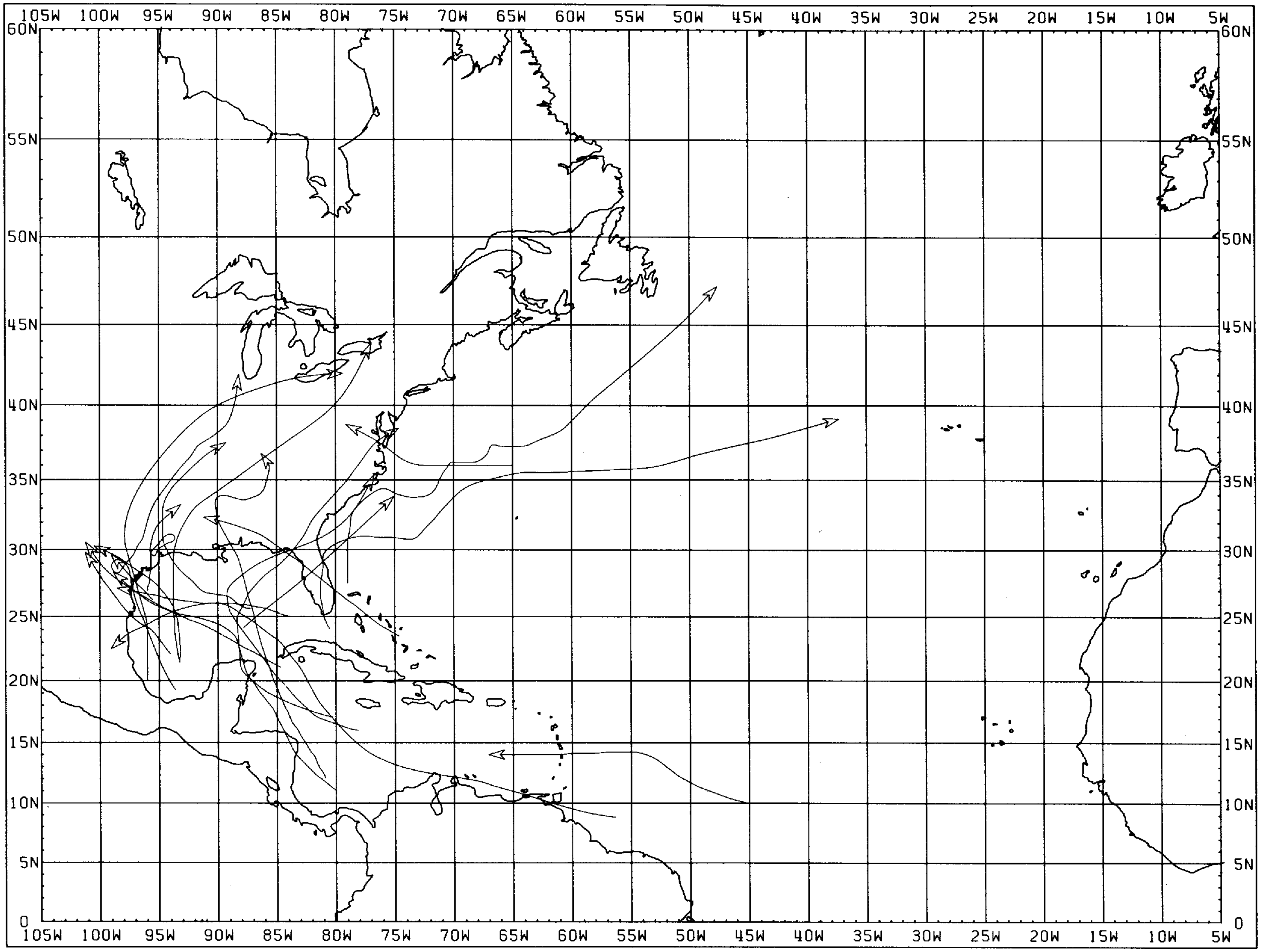
TROPICAL STORMS OR HURRICANES BEGINNING IN DECEMBER, 1886-1992 (6 STORMS)



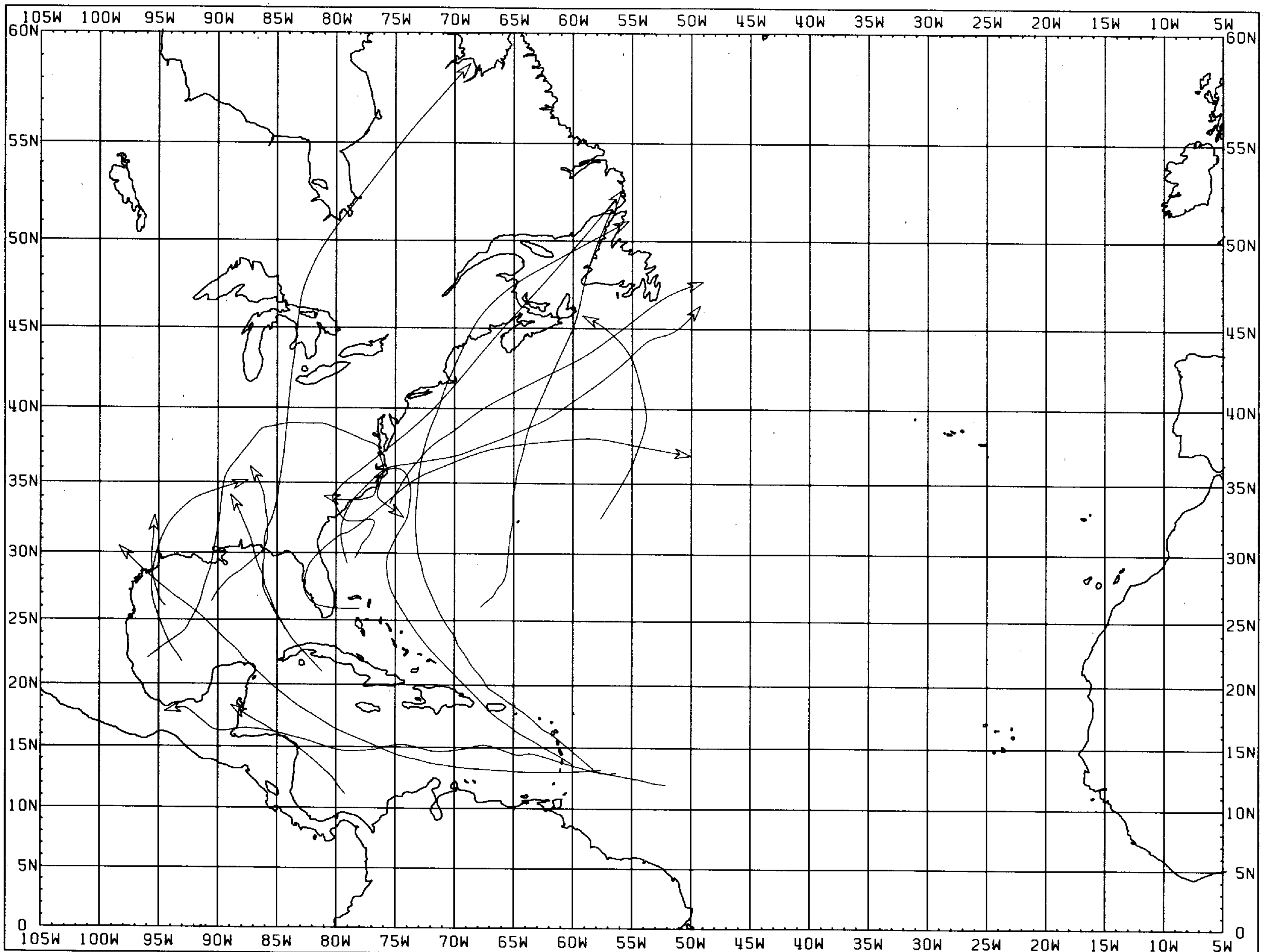
TROPICAL STORMS OR HURRICANES BEGINNING JUNE 1-10, 1886-1992 (12 STORMS)



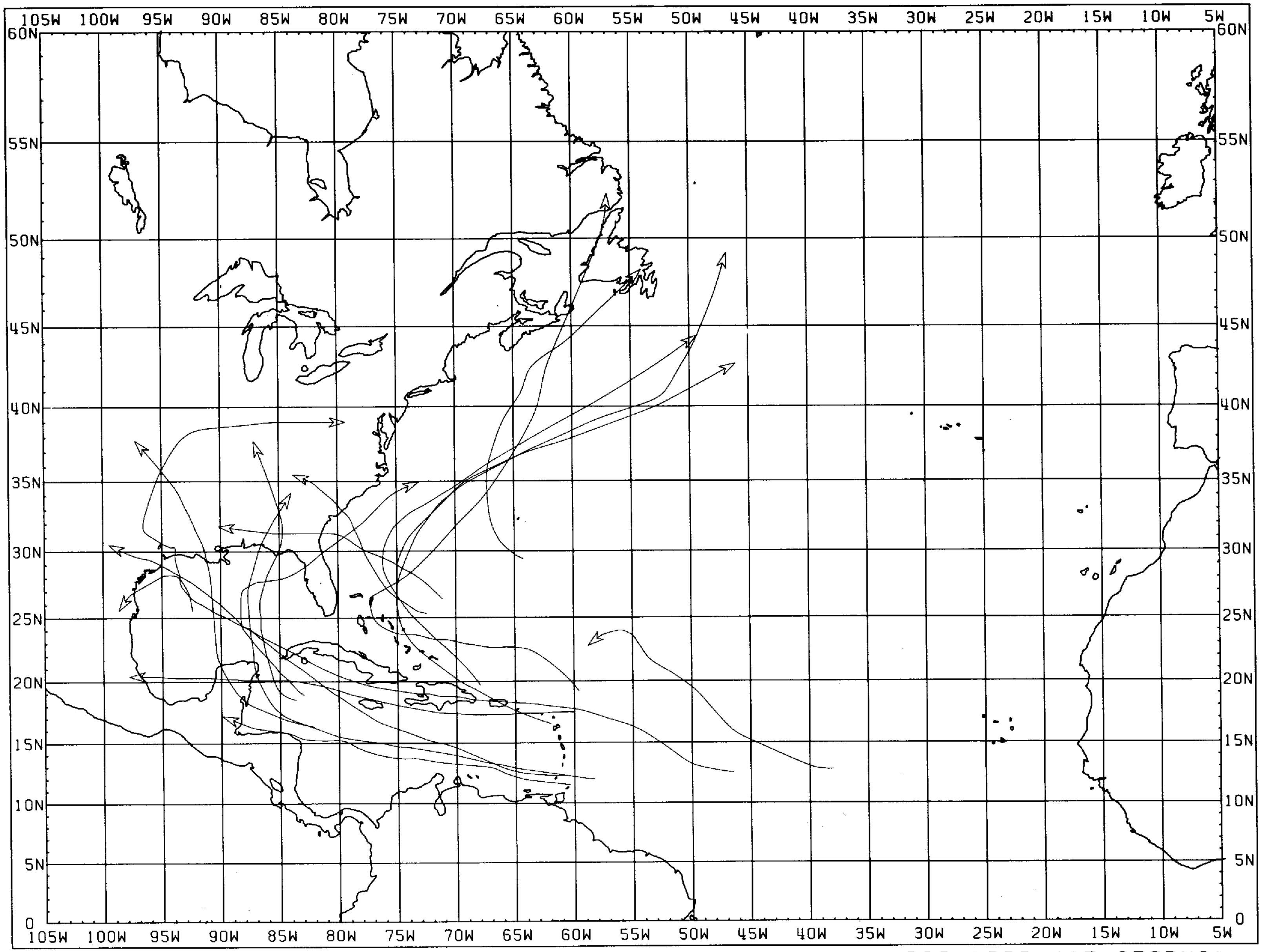
TRØPICAL STØRMS ØR HURRICANES BEGINNING JUNE 11-20, 1886-1992 (23 STØRMS)



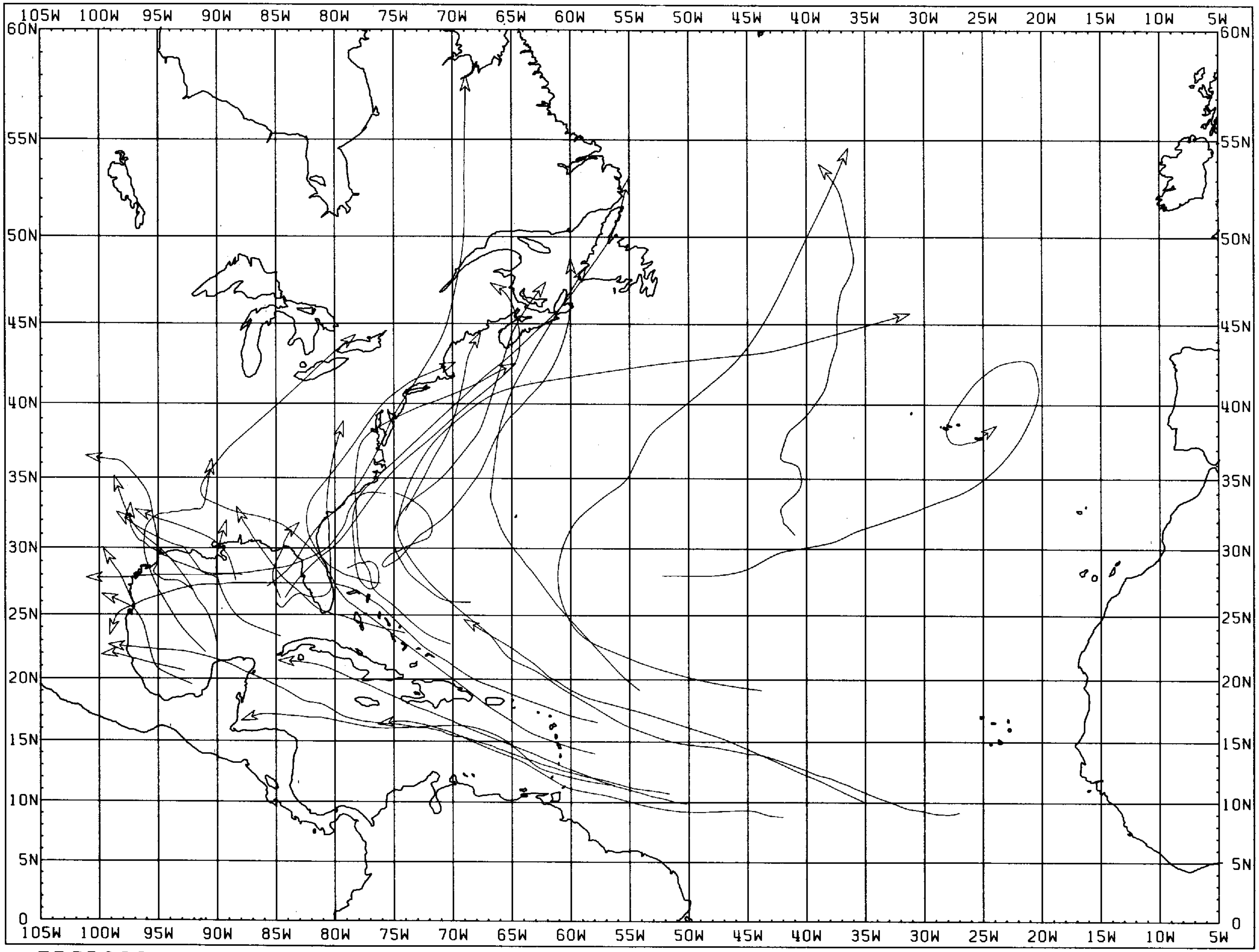
TRØPICAL STØRMS ØR HURRICANES BEGINNING JUNE 21-30, 1886-1992 (21 STØRMS)



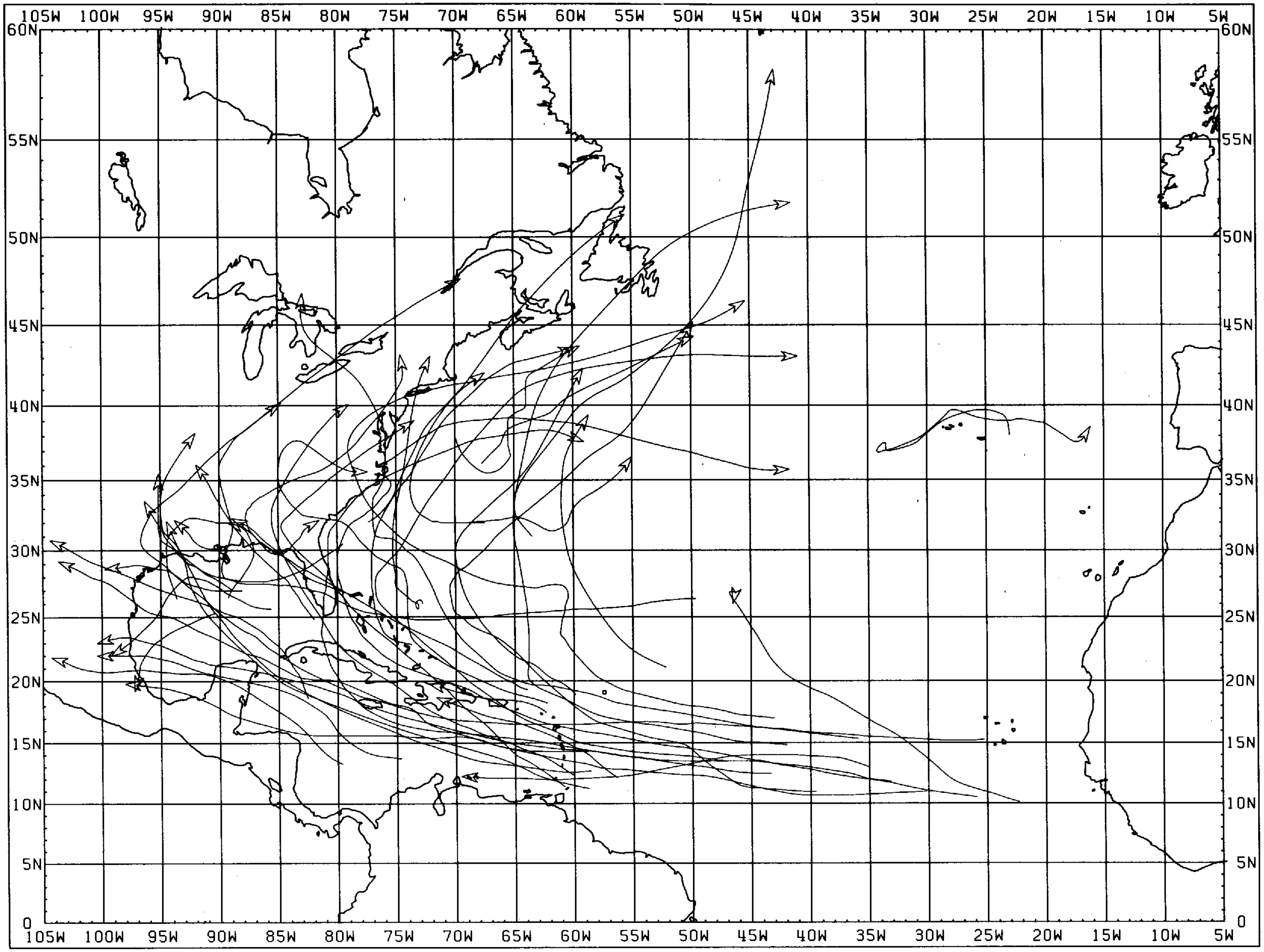
TROPICAL STORMS OR HURRICANES BEGINNING JULY 1-10, 1886-1992 (17 STORMS)



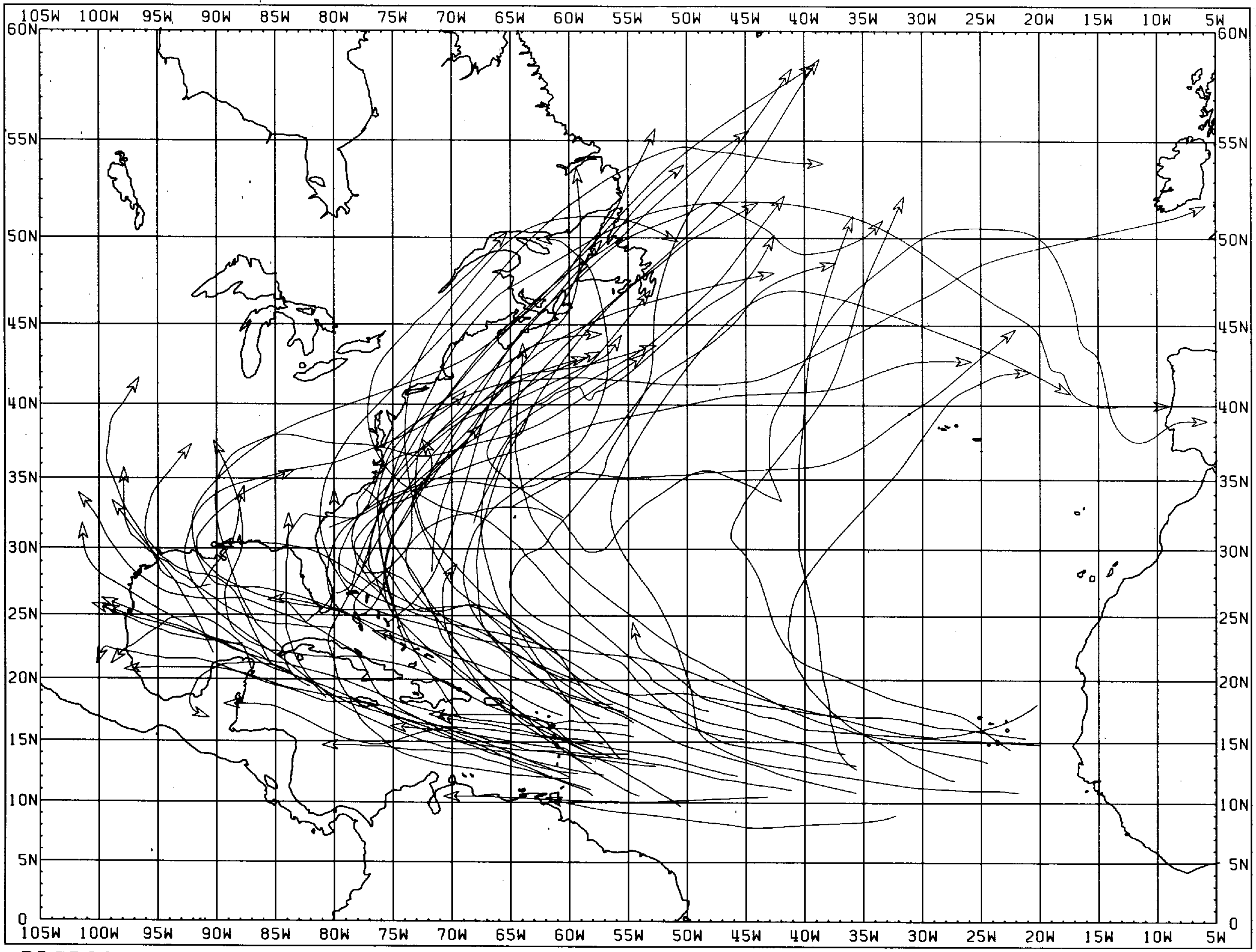
TROPICAL STORMS OR HURRICANES BEGINNING JULY 11-20, 1886-1992 (17 STORMS)



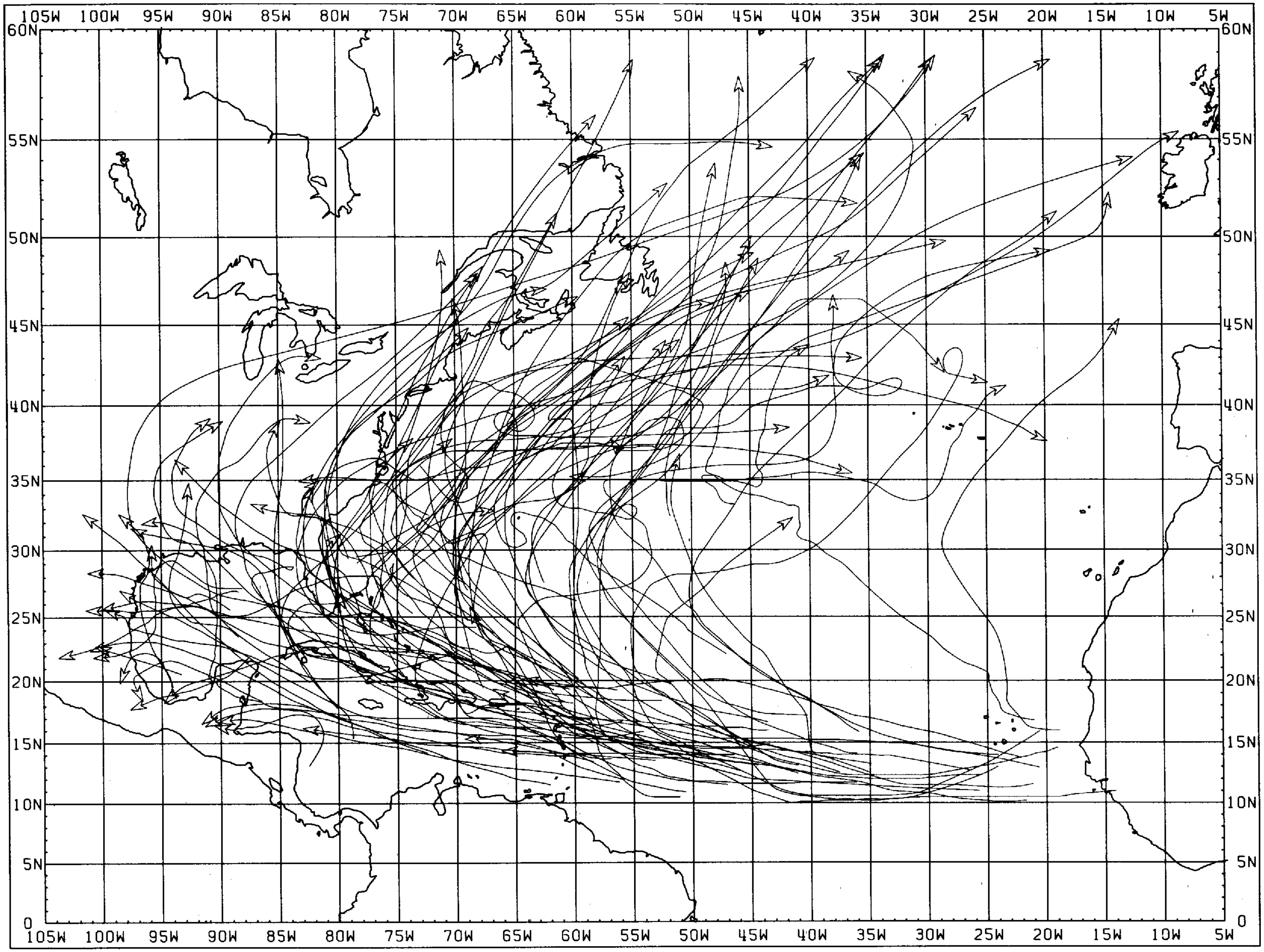
TROPICAL STORMS OR HURRICANES BEGINNING JULY 21-31, 1886-1992 (34 STORMS)



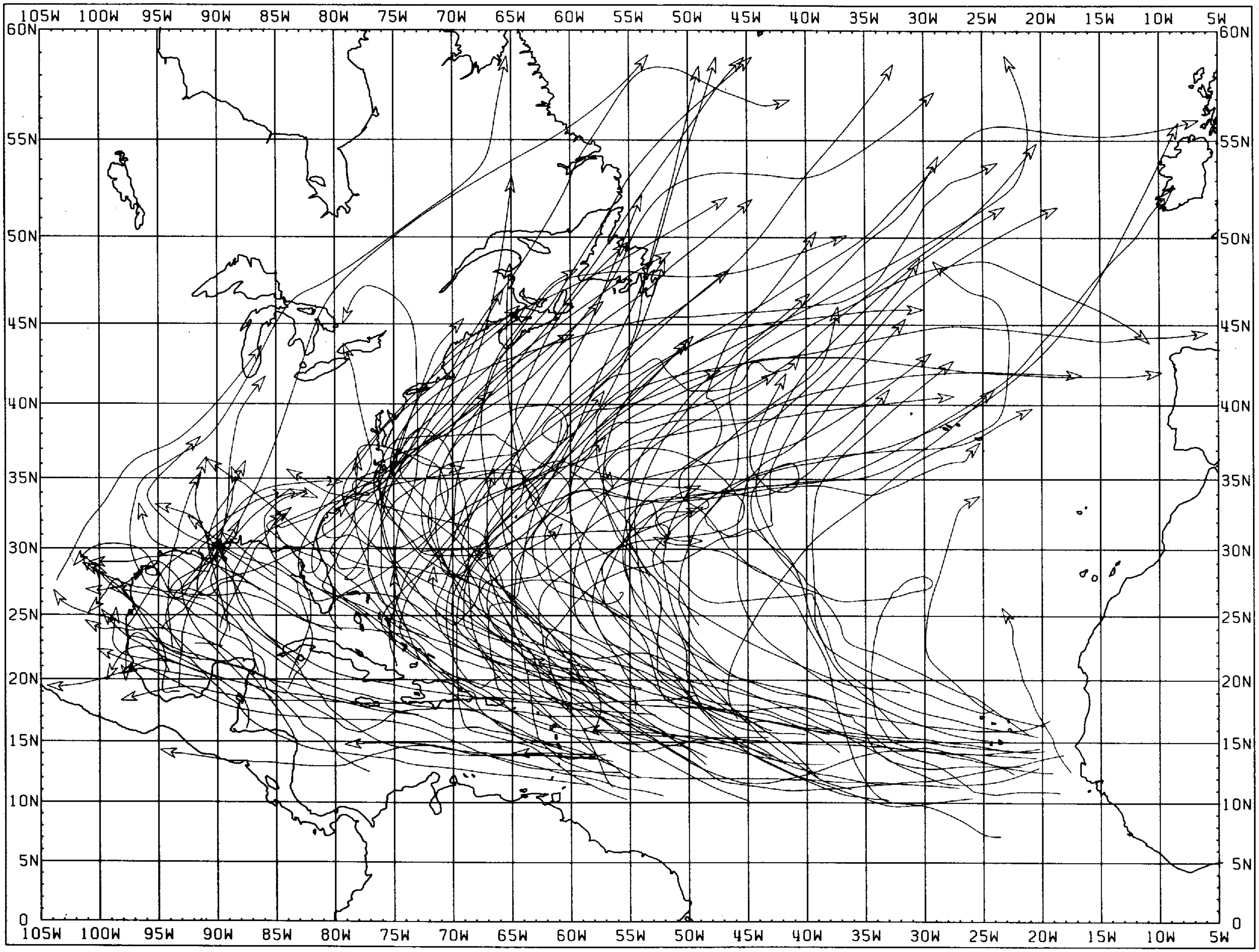
TROPICAL STORMS OR HURRICANES BEGINNING AUGUST 1-10, 1886-1992 (46 STORMS)



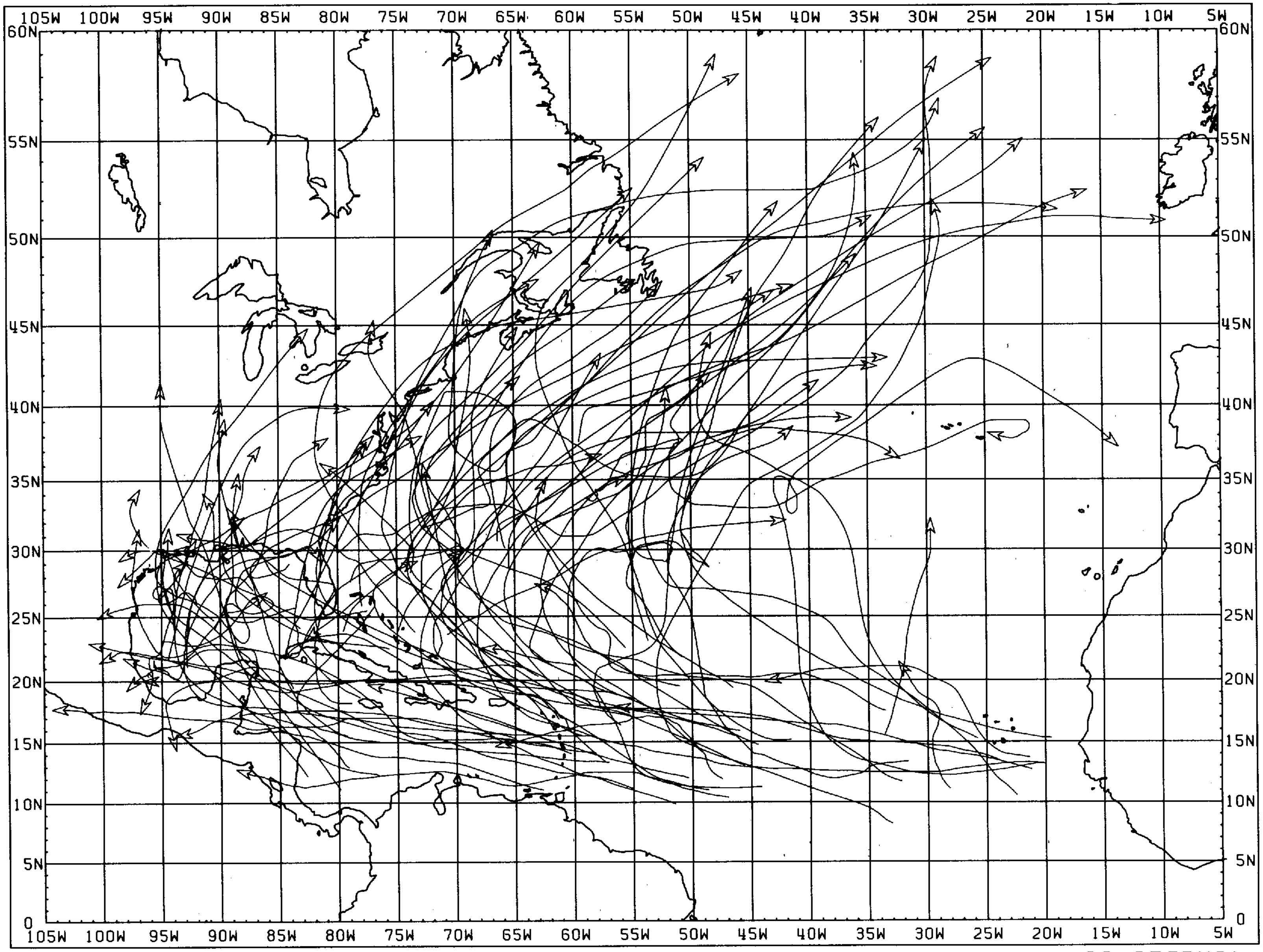
TROPICAL STORMS OR HURRICANES BEGINNING AUGUST 11-20, 1886-1992 (68 STORMS)



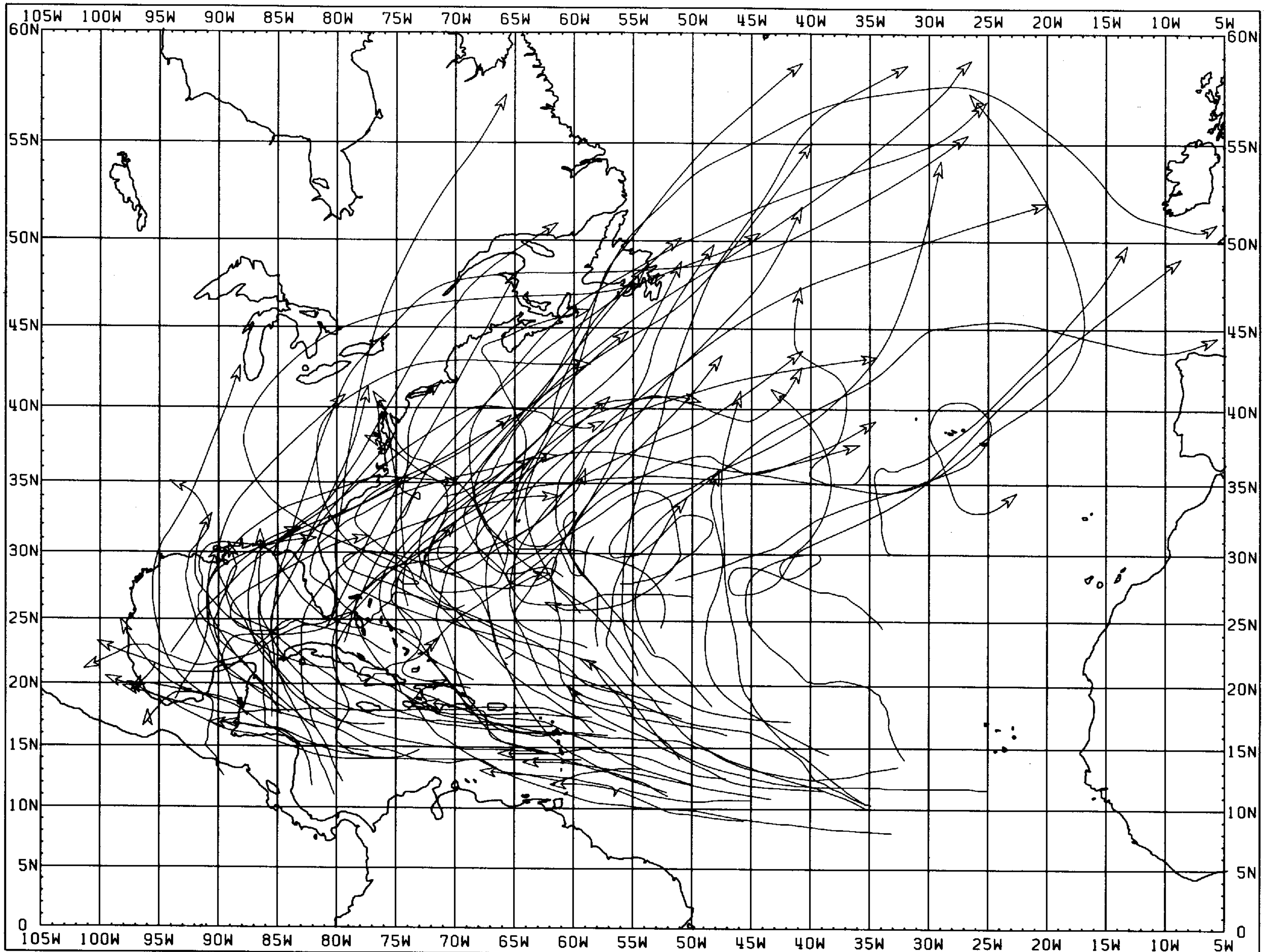
TRØPICAL STØRMS ØR HURRICANES BEGINNING AUGUST 21-31, 1886-1992 (103 STØRMS)



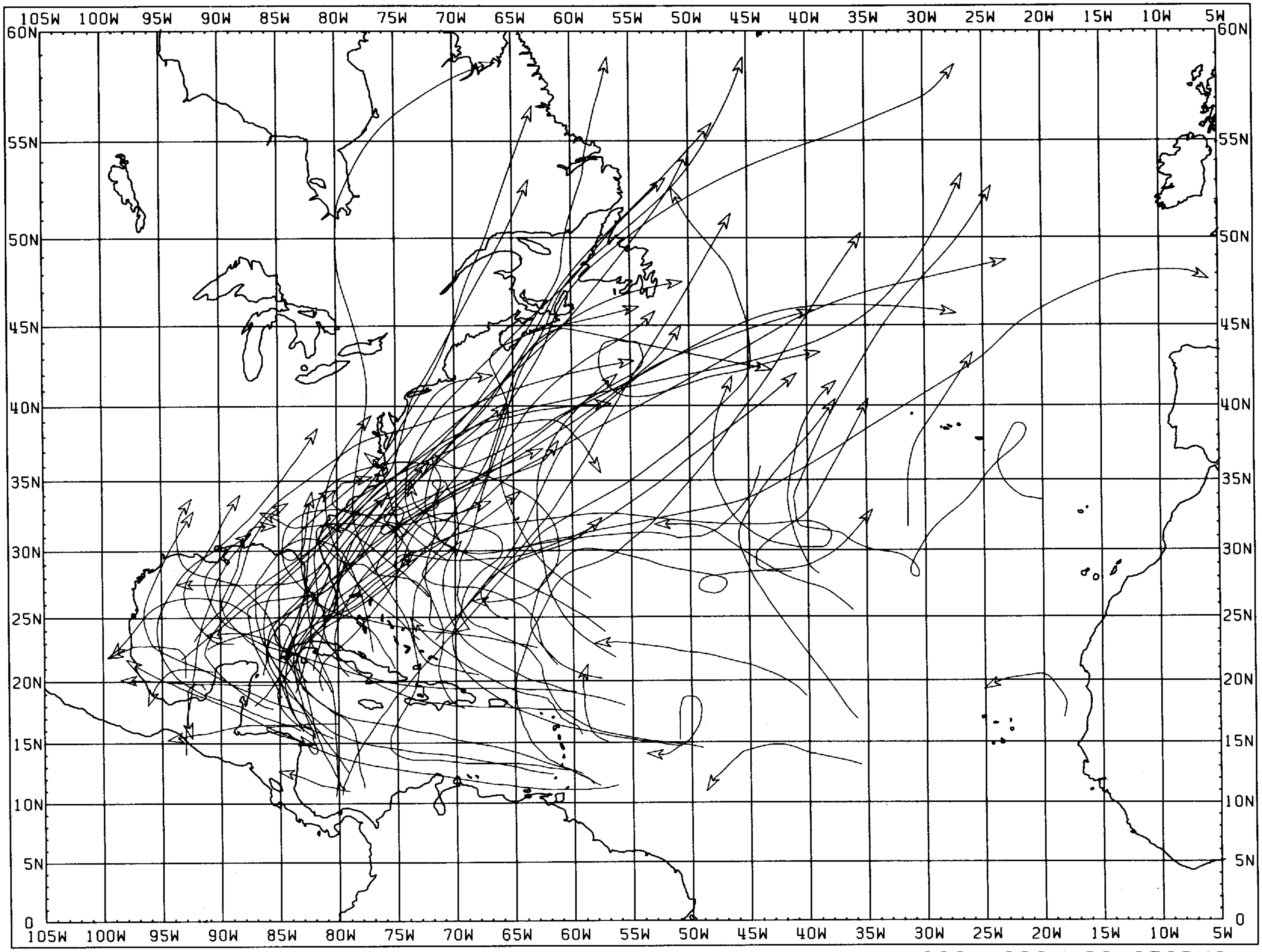
TROPICAL STORMS OR HURRICANES BEGINNING SEPT. 1-10, 1886-1992 (122 STORMS)



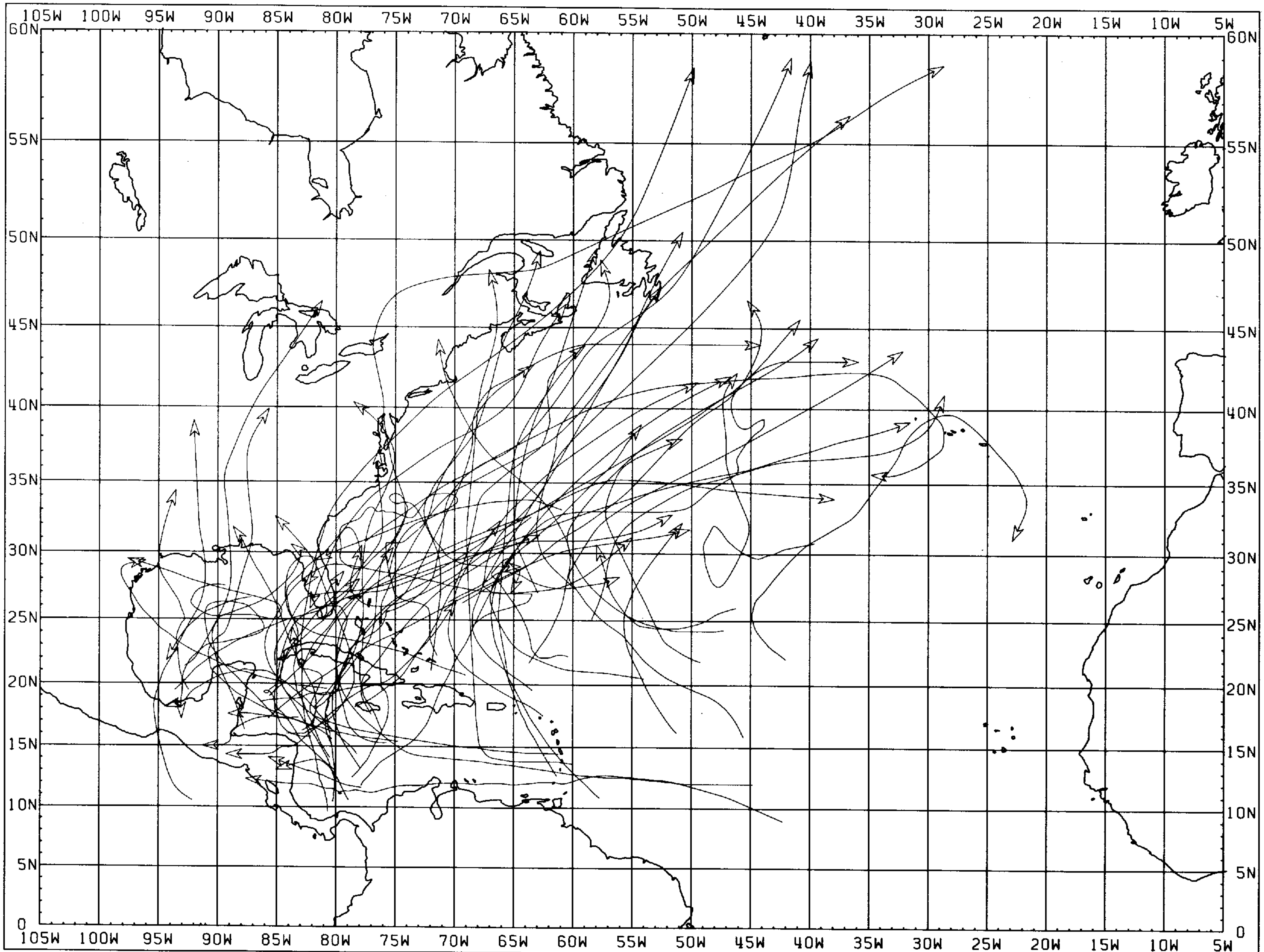
TROPICAL STORMS OR HURRICANES BEGINNING SEPT. 11-20, 1886-1992 (100 STORMS)



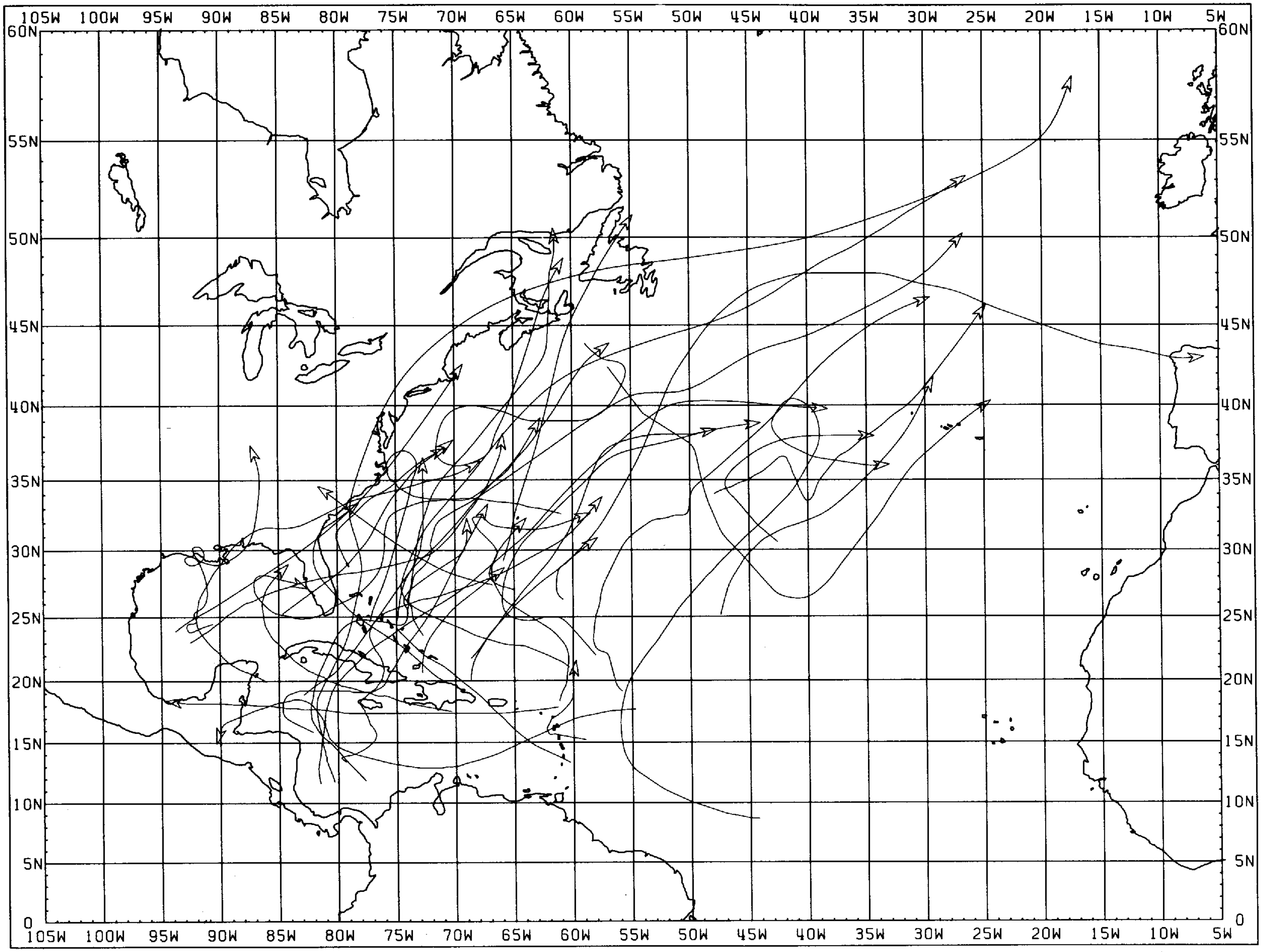
TROPICAL STORMS OR HURRICANES BEGINNING SEPT. 21-30, 1886-1992 (86 STORMS)



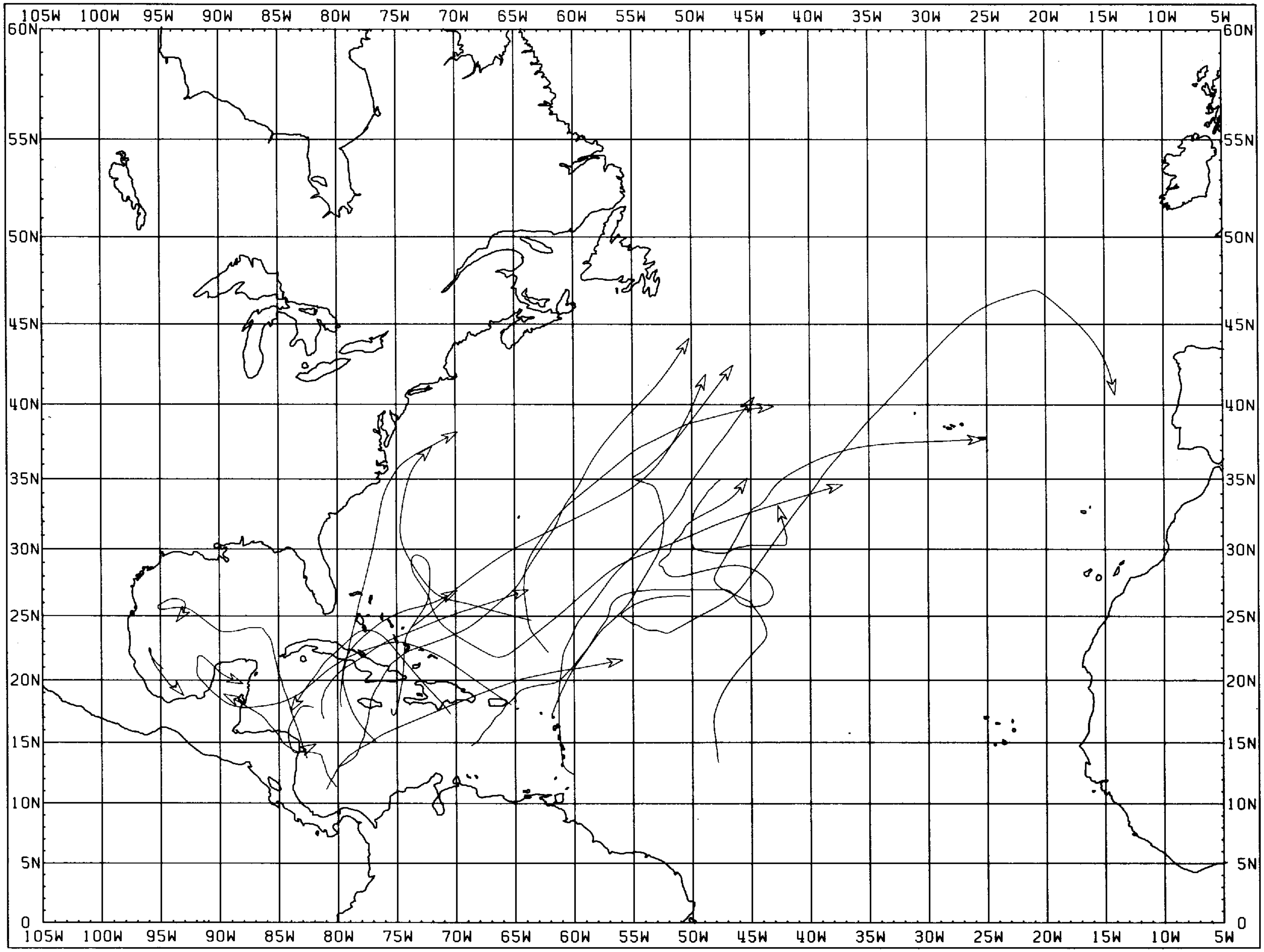
TROPICAL STORMS OR HURRICANES BEGINNING OCTOBER 1-10, 1886-1992 (80 STORMS)



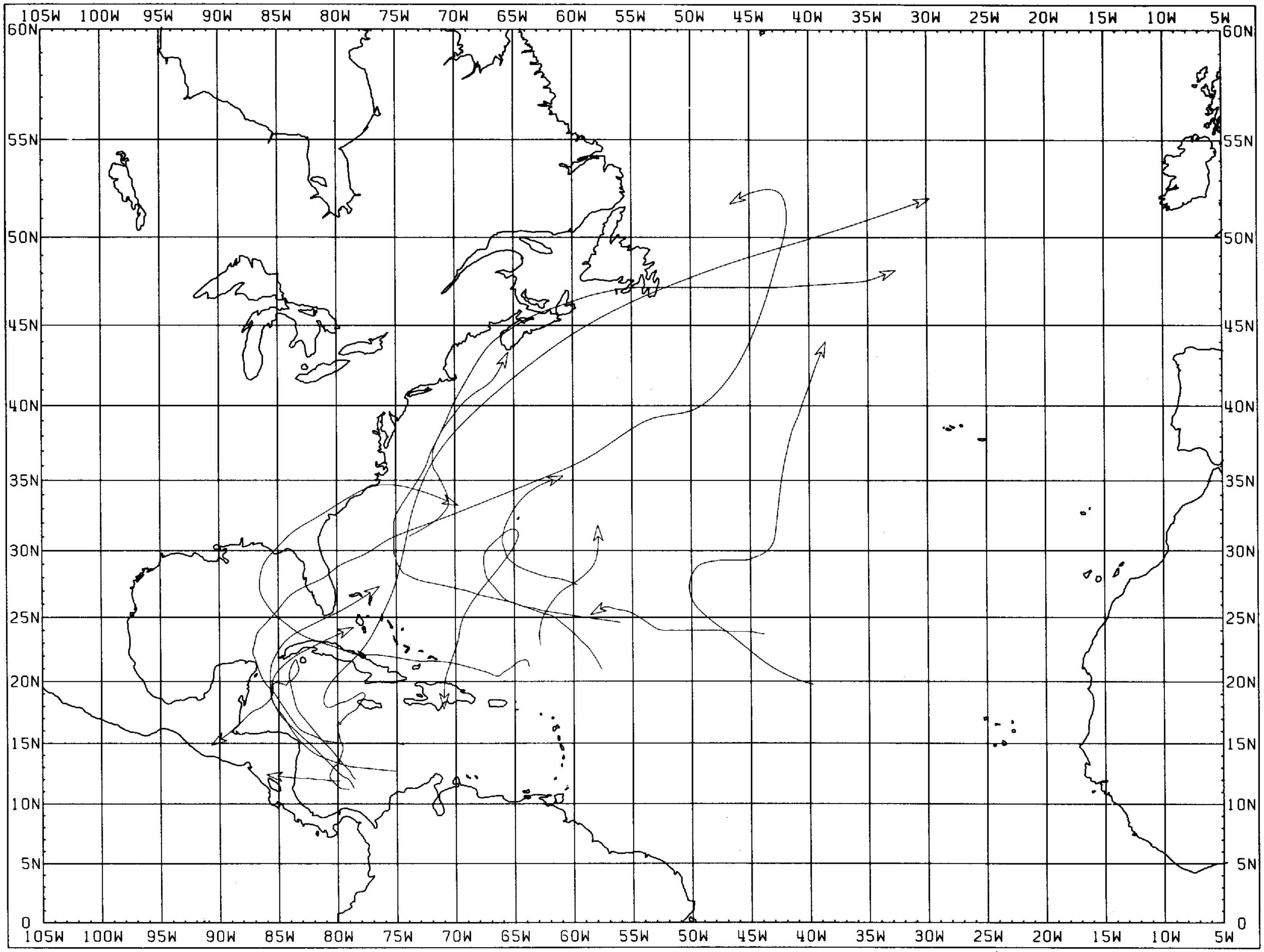
TROPICAL STORMS OR HURRICANES BEGINNING OCTOBER 11-20, 1886-1992 (70 STORMS)



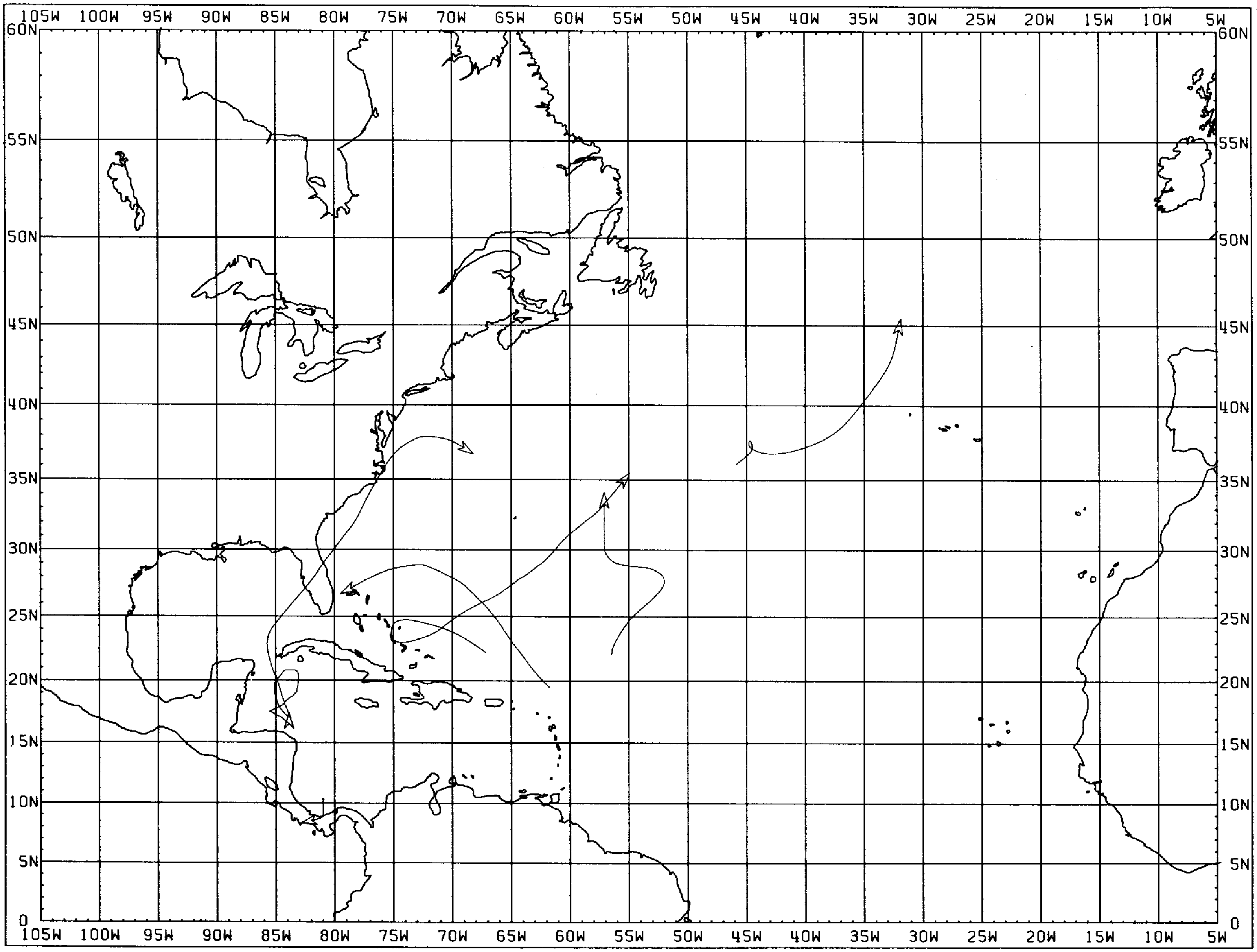
TROPICAL STORMS OR HURRICANES BEGINNING OCTOBER 21-31, 1886-1992 (39 STORMS)



TROPICAL STORMS OR HURRICANES BEGINNING NOV. 1-10, 1886-1992 (21 STORMS)



TROPICAL STORMS OR HURRICANES BEGINNING NOV. 11-20, 1886-1992 (14 STORMS)



TROPICAL STORMS OR HURRICANES BEGINNING NOV. 21-30, 1886-1992 (7 STORMS)