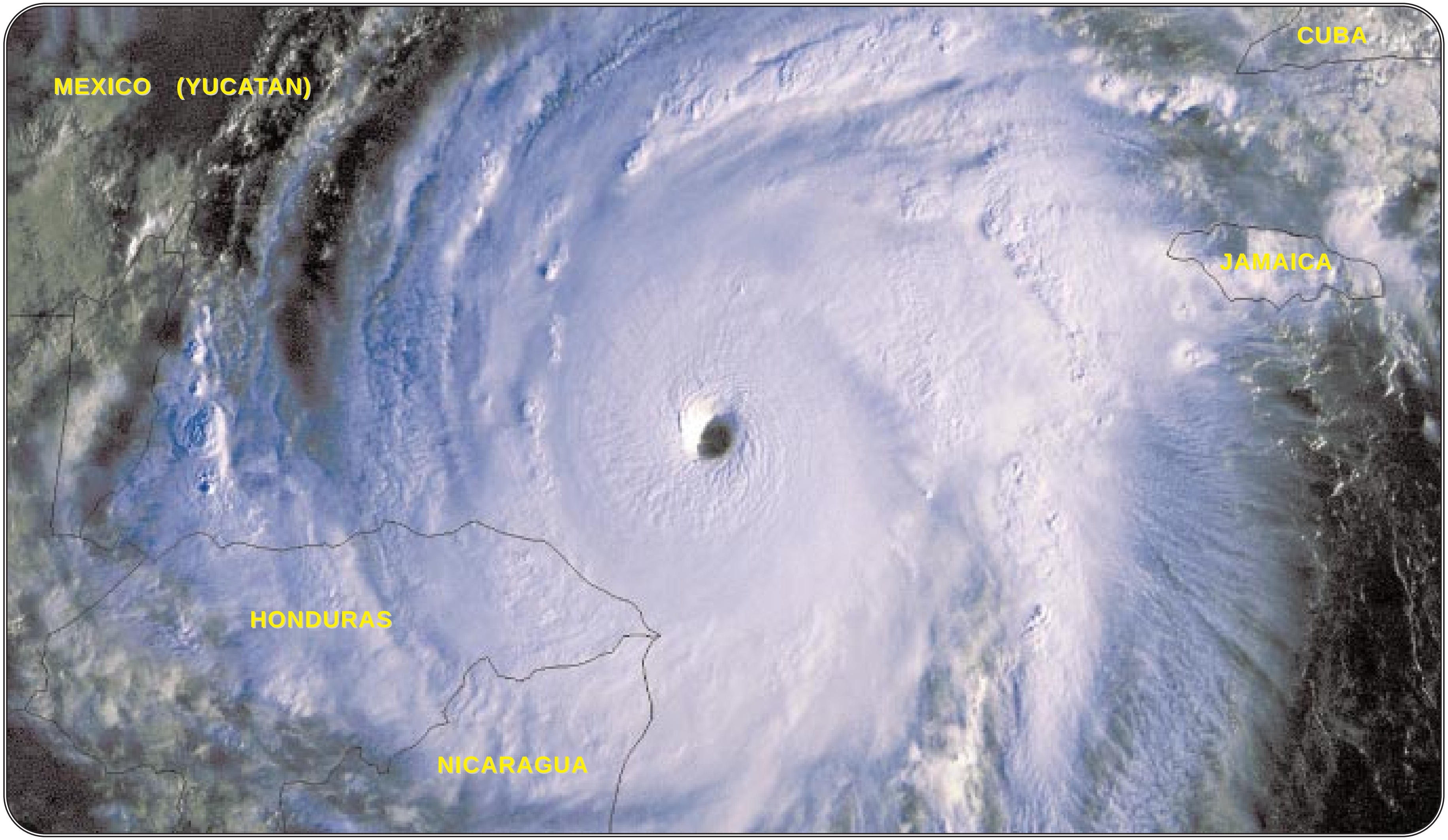
HISTORICAL CLIMATOLOGY SERIES 6-2

Tropical Cyclones of the North Atlantic Ocean, 1871 - 1998



U.S. DEPARTMENT OF COMMERCE - National Oceanic and Atmospheric Administration
National Weather Service-National Environmental Satellite, Data, and Information Service

Cover illustration - Eye-catching NOAA weather satellite image (GOES-8, visible sector) of Hurricane Mitch approaching the Honduran coastline, 1245 UTC (8:45 A.M. Eastern Daylight Time) 26 October 1998, moving towards the west-northwest at 5 knots. The "eye" of the hurricane is located in the Caribbean Sea approximately 100 nautical miles north-northeast of the border between Honduras and Nicaragua. At this time, near the eye, the maximum sustained 1-minute winds were estimated at 170 mph. Several hours later, near 1900 UTC, aircraft reconnaissance estimated the maximum 1-minute winds at 180 mph with gusts of at least 225 mph and recorded the lowest pressure of 905 millibars (26.73 inches of mercury). This makes Mitch a category 5 on the Saffir/Simpson hurricane scale. Mitch gradually turned toward the southwest and weakened to a category 2 hurricane as it made landfall along the Honduran coast. Mitch brought intense tropical rainfall over the mountains of Central America; particularly Honduras and Nicaragua. The resulting flash floods and mudslides caused tremendous property damage and a great loss of life. It is estimated that greater than 9,000 people perished in Mitch.

(Image courtesy of NOAA's Operational Significant Event Imagery Team of the Satellite Services Division)

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TROPICAL CYCLONES OF THE NORTH ATLANTIC OCEAN, 1871-1998

ERRATA and ADDENDA, 30 JANUARY 2000

1. Page 22, eighth line from top of left-hand column: The 5-year period is given as 1950 to 1954. While this is correct as of the 1998 cutoff date of this publication, readers are advised that this record was exceeded for the 5-year period 1995-1999 when 41 hurricanes were observed over the Atlantic basin.

2. Page 26, near center of right-hand column: The two dates should be 1893 and 1998 rather than 1898 and 1998.

3. Page 172, 1999 Atlantic track map provided for attachment in Appendix A.

HISTORICAL CLIMATOLOGY SERIES 6-2

TROPICAL CYCLONES OF THE NORTH ATLANTIC OCEAN, 1871 - 1998

Charles J. Neumann
Science Applications International Corporation

Brian R. Jarvinen & Colin J. McAdie
Tropical Prediction Center/National Hurricane Center

Gregory R. Hammer
National Climatic Data Center

Asheville, NC
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Contents

Tropical Cyclones of the North Atlantic Ocean, 1871-1998

1. INTRODUCTION

Over the 128-year period, 1871 through 1998, a total of 1,062 tropical cyclones (tropical storms and hurricanes) of various intensities have been documented 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 seven to eight 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 seven in the world; others in the Northern Hemisphere are the eastern North Pacific, the western North Pacific (typhoons) and the northern Indian Ocean (cyclones). The Southern Hemisphere basins are the southwestern Indian Ocean, the Australia/southeastern Indian Ocean and the Australia/SW Pacific. 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 traverse from one basin to an adjacent basin within a given hemisphere. In the Northern Hemisphere, 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 destructive potential of hurricanes, associated interest has always been great. Numerous publications, technical and non-technical, describe tropical cyclone climate on various scales. Studies by Crutcher and Quayle (21) and by Neumann (72) contain charts describing tropical cyclone frequency and motion characteristics over the various global basins. Gray (37, 38) presents an instructive and more theoretical treatment of global tropical cyclone climatology, including a discussion of the conditions associated with tropical cyclone development. Many studies on individual basins or even portions of basins such as for Florida alone (9) can be found in most meteorological libraries.

Tropical cyclone climatologies are based upon long-term records of tropical cyclone occurrence; on average, about 83 occur annually over the globe (21, 72). Today, computers perform much of the previously tedious analyses. Figure 1, for example, would have been very difficult to prepare without the aid of computer graphics. Other examples of the utility of computers in tropical cyclone climatology are given by Hope and Neumann (50, 51) and by Neumann and Hill(71a).

Tropical cyclones have always been of concern to shipping and, through mariner reports, are reasonably well documented over remote oceanic areas, even in the 19th century and earlier. Ludlum (59) for example, presents a history of Atlantic tropical cyclones dating back to the time of the Columbus explorations.

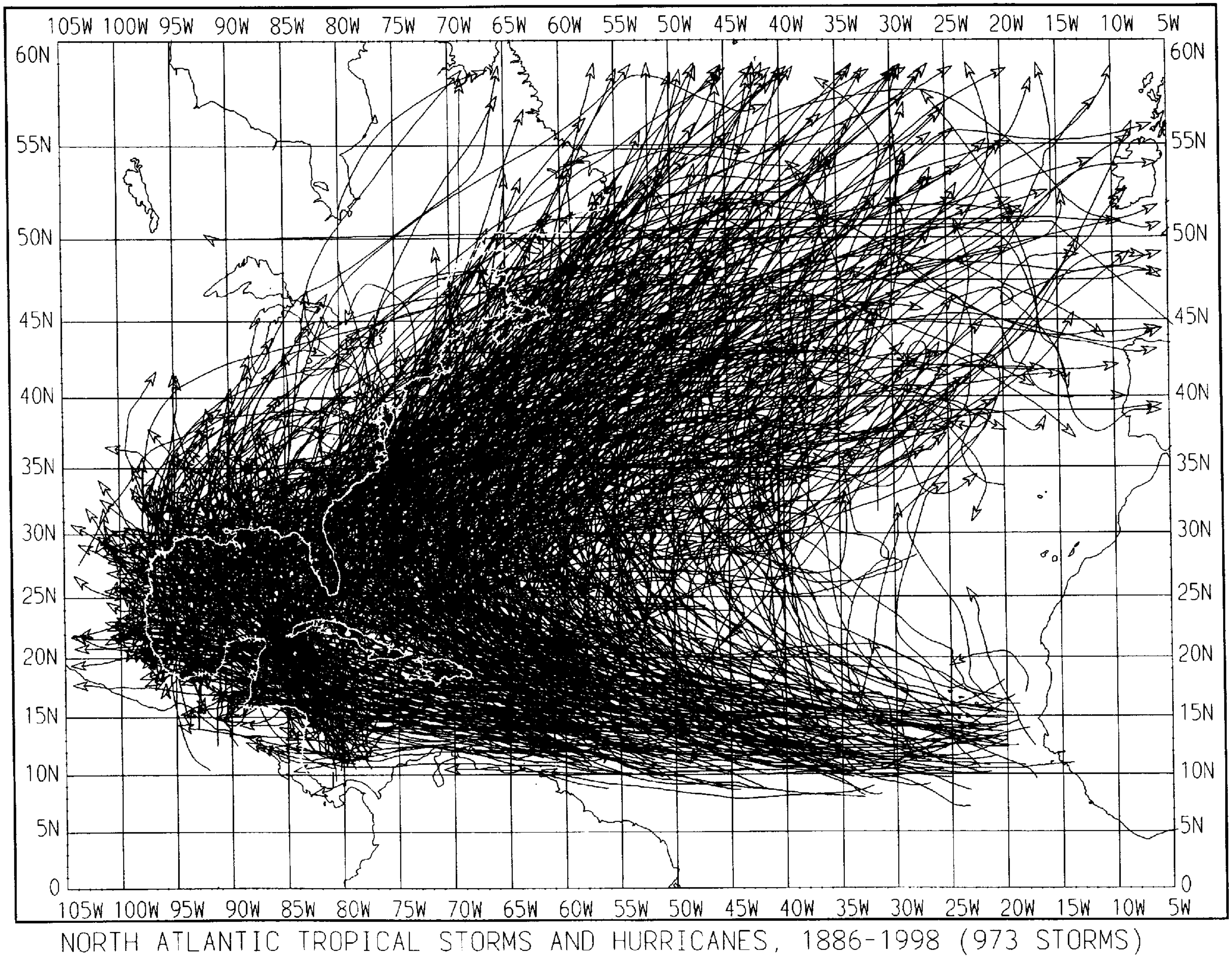


Figure 1. Computer plot showing the tracks of the 973 known North Atlantic tropical cyclones reaching at least tropical storm (see Table 1) intensity over the 113-year period, 1886-1998.

Collation and dissemination of global tropical cyclone data is the responsibility of the National Climatic Data Center (NCDC), Asheville, NC. Data are obtained in an agreed upon format from World Meteorological Organization (WMO) designated Regional Specialized Meteorological Centers (RSMC), and other global meteorological services. In the United States, the former National Hurricane Center (NHC), now known as the Tropical Prediction Center/National Hurricane Center (TPC/NHC) and collocated with Florida International University in Miami, Florida, serves as an RSMC, with responsibility for both the North Atlantic and eastern North Pacific basins.

For the Atlantic basin, tropical cyclone tracks have been published at irregular intervals. U.S. Weather Bureau Technical Paper 36 (25) provided tracks and associated statistics for years 1886 to 1958. Six years later, Cry, in Technical Paper 55 (26), extended the tracks backwards through 1871, forward through 1963 and extended the statistical analysis. For a number of years, that publication was the standard reference for Atlantic tropical cyclone activity. It provided the original nucleus for this and earlier revisions which extend the tracks through the 1998 season. Since 1978, revisions have been issued approximately every three to five years.

2. SCOPE

Together with related statistical summaries, this study presents annual tropical cyclone tracks, 1871-1998. A detailed analysis of the tracks was not attempted. This is a departure from Cry (26) who included a considerable amount of track analysis and interpretation. The omission was prompted by the desire to keep the size of the book from becoming excessive.

As an alternative source of more detailed data, readers are referred to other publications that deal specifically with the analysis of Atlantic tropical cyclones. These include NOAA publications prepared for the Federal Flood Insurance Program and the U.S. Army Corps of Engineers (48, 69, 74) and studies to satisfy the needs of the Tropical Prediction Center/National Hurricane Center (44, 47, 49, 54, 79a). The National Climatic Data Center has also been active in tropical cyclone studies to satisfy the needs of the U.S. Navy (21, 22, 23, 24). Finally, the official (TPC/NHC) Internet web site <http://www.nhc.noaa.gov> also contains a large amount of information on current and historical tropical cyclone activity. Information contained therein can be used to update this text until such time as additional editions are issued. Also available on the TPC/NHC web site are the digitized tracks of all Atlantic tropical cyclones since 1886. Charts presented in Chart series A and B are based on these data.

Despite the availability of numerous studies dealing with the climatology of tropical cyclones, the TPC/NHC in Miami annually receives hundreds of requests for tropical cyclone related information from both official and non-official sources. One of the goals of this publication is to provide readily available, correct, and consistent answers to some of these queries. A knowledge of climatology is important in the forecast process and this publication also provides Hurricane Specialists at the TPC/NHC with a reliable source of reference material on Atlantic tropical cyclones.

3. CHARACTERISTICS OF TROPICAL CYCLONES

It is beyond the scope of this study to discuss details of tropical cyclone characteristics and structure. A few 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), Simpson and Riehl (92) and Pielke and Pielke (77b) are devoted entirely to that topic. Certain specialized topics, such as the state-of-the-art in forecasting of tropical cyclone motion and intensity 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 counterclockwise in the Northern Hemisphere or clockwise in the Southern Hemisphere, is called a cyclone. The term "tropical cyclone" refers to such a circulation that 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 radially inward toward the center of tropical cyclones with sustained speeds often exceeding 100 knots near the center. Occasionally, sustained winds exceeding 140 knots, with still higher 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 such as Hurricane Andrew, 1992, in south Florida, coastal inundation from storm surge has been 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 being much less than over the area surrounding the storm circulation (8, 29). The eye (note the distinct eye of Hurricane Mitch on the cover illustration) provides a convenient visual and physical entity that can be tracked with the aid of aircraft, satellite 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 small-scale oscillatory motions of the storm center, which can deviate some 5 to 30 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 traversed the Gulf of Mexico (118). Satellite evidence of similar eye motions of Hurricane Belle (1976) is given by Lawrence and Mayfield (57). The storm tracks in Chart Series A and B should therefore be considered as the average path of the larger scale storm circulation rather than a 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 weather systems, pass through stages of genesis, intensification, maturity, and decay or modification. Satellite imagery has confirmed that some North Atlantic tropical cyclones classically develop from tropical waves that regularly move westward 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 researchers, one of the earliest being Riehl (81a). Later, Carlson (16) presented case histories, while Shapiro (85) discussed theoretical aspects of the transformation of certain waves into tropical cyclones. In other basins, atmospheric conditions which initiate tropical cyclones may be quite different.

During the 1967 Atlantic hurricane season, Simpson, et al. (88) initiated an annual "census" of African disturbances (2), and other features associated with tropical cyclone genesis. A more recent continuation of this annual census (77) include long-term averages of these data where it can be noted that, May through November, an average of 61 waves move off the African coast.

Weather satellites have also confirmed that some tropical cyclones may develop in connection with old polar troughs or upper-level cold low-pressure areas that have initial "cold-core" circulations as opposed to the "warm-core" circulations of tropical cyclones. Beginning in the late 1960's, these latter systems were designated as "subtropical cyclones" during the period in which they exhibited 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 publication is to discuss tropical systems, 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 a 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 whether sustained winds are,

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

respectively, <34 knots, 34 to <64 knots or ≥64 knots. More complete definitions are given in Table 1. Tropical cyclones are not named unless they reach at least tropical storm strength and these weaker systems are mostly excluded from discussion in this text.

The term, "sustained wind," as used in the United States, refers to the near-surface (10-meter) wind averaged over 1-minute. Shorter period gusts or lulls in the wind, perhaps only a few seconds duration, can be much higher or lower than the sustained wind. In other countries, the averaging period defining a sustained wind can be higher than 1-minute.

The wind criteria separating the various stages of tropical cyclones are rather rigidly defined, but the ability to measure the winds with the precision implied by the definitions seldom exists. The maximum wind speed must often be inferred by indirect evidence such as storm surge, damage, or pressure. In practice, a maximum sustained wind is assigned by the responsible analyst after considering all available evidence. These realistic restrictions should be considered before making decisions based on limited intensity information 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. This indicates that modification of the tropical circulation has started by movement of the system into a non-tropical environment. The transformation is a gradual process: 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 becomes 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 (number 4, 1938), described in physical terms by Pierce (78) and in narrative form by Allen (5), is a good example of a storm that was technically classified as extratropical, but that still maintained hurricane-like characteristics.

There are no wind speed criteria associated with the term extratropical and such systems may indeed have hurricane force winds. Usually, when storms move out of the tropics, 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 predominate.

4.3 Subtropical Cyclones

Until the late 1960's, the terms tropical (warm core) and extratropical (cold-core), as described in sections 4.1 and 4.2, were exclusively used to categorize a cyclone. 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 often led to some storms being unnamed. Ferguson (33), Simpson (90) and Spiegler (94) give additional information on this topic.

By 1968, availability of continuous satellite imagery and other observational evidence confirmed the existence of an intermediate class of storm with both tropical (warm-core) and extratropical (cold-core) characteristics. The Monthly Weather Review's annual review for the 1970 and 1971 hurricane seasons (110,111) call attention to this nomenclature problem. By 1972, however, the term "subtropical" was adopted as official terminology and the annual summary article for that season 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 official tracks for the 1968-1971 seasons and to identify subtropical portions of the tropical cyclones for those years. The re-evaluation included the addition of the storms suggested earlier by Spiegler (93).

Table 1. Classification criteria for tropical, subtropical and extratropical cyclones.

STAGE OF DEVELOPMENT	YEARS USED	CRITERIA
Tropical cyclone	1871-1885	A warm-core, non-frontal low pressure system of synoptic scale that develops over tropical or subtropical waters and has a definite organized surface circulation.
Tropical depression (development)	1951-1998	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	1886-1998	A 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	1886-1998	A tropical cyclone in which the maximum sustained surface wind (1-min mean) is at least 64 kt (74 mph, 33 m/s).
Tropical depression (dissipation)	1899-1998	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	1899-1998	A tropical cyclone that has been modified by interaction with a nontropical environment. There is no wind speed criteria and maximum winds may exceed hurricane force.
Subtropical depression	1968-1998	A low pressure system that develops over subtropical waters initially having a non-tropical circulation but in which some elements of tropical cyclone cloud structure are present. Surface winds are below 34 kt (39 mph, 18 m/s).
Subtropical storm	1968-1998	Same definition as subtropical depression except that wind is at least 34 kt (39 mph, 18 m/s). Also, winds may exceed hurricane force.

A subtropical cyclone is defined as a low pressure system that develops over tropical waters and has an initial 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 on wind speed, two classes of subtropical cyclones are recognized: subtropical depressions and subtropical storms. The former have maximum sustained winds < 34 knots while the latter have maximum winds exceeding that speed. More complete definitions are given in Table 1. There is no upper wind limit associated with subtropical storms as there is with tropical storms. Experience has shown that when and if surface winds in subtropical storms reach at least 64 knots, the system typically takes on sufficient tropical characteristics to be designated a hurricane (see, for example, storm 3, 1972). In rare cases, such systems do attain hurricane force winds without associated tropical conditions. In this case, the term "subtropical" is retained. An example of such an occurrence is storm 6, 1968, having had hurricane force winds September 20 and 21.

4.4 Summary of Classification Criteria

A summary of the various storm classification criteria and years over which each is applicable are given in Table 1. For 1886-1898, the data are too fragmented, and the assigned track intensity is assumed to be the known maximum attained by the system at some point along the track. Storm 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 through 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 knowledge on these early storms. Indeed, portions of many of these tracks were well documented if they were associated with disasters either ashore or at sea. For example, the hurricane of August, 1873 (number 2) which destroyed over 1,200 vessels, and the hurricane of August, 1893 (number 6) which inundated the islands off the coast of Georgia and South Carolina, resulting in large loss of life and property, are described by Garriott (35) and others. Persons seeking specific information on these, and on other hurricane events occurring in later years, should consult the references given in section 11.

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 55 (26). Although the main purpose of this and of previous editions of this text was to update the track charts, some of these original charts have been modified based on additional information that has come to the attention of the authors.[2] Specific details on these modifications are given later in this section. The present revision extends the track charts through the 1998 season and includes one additional change to the landfall intensity of storm 6 of 1899 (Table 6).

5.1 Data Sources 1871-1963

This section, with references updated, is quoted directly from Cry's original study (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) more recently attempted to document many of the early storms. Ludlum (59) has also 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 text. U. S. Weather Bureau Technical Paper 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

[2] Detailed studies are currently underway to obtain better documentation of earlier storms. Future editions of this text will include the results of these efforts.

details of specific storms, have been published in the Review throughout the years. Summaries of each tropical cyclone season 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 been used: Alexander (4); Bonnelly (10); Bowie (12); Contreras Arias (20); Deutsche Seewarte (27); Elwar (31); Fischer (34); Gray (36); Hall (42); Newnham (73); Salivia (83); Sarasola (84); Tannehill (97); and Vines (119). Comprehensive texts by various authors (8, 29, 77b, 92) contain complete discussions of various aspects of tropical cyclones, including a continuation of Tannehill's chronology in Dunn and Miller (29)."

5.2 Additional Data Sources 1871-1963

In connection with its research and operational commitments, the Tropical Prediction Center/National Hurricane Center maintains and continuously updates computer files of Atlantic tropical cyclone tracks back to the year 1886. An early climatological forecast technique, HURRAN (HURRicane ANalogs)(49), for example, was based on these data. Initially, the computer files were developed from data presented in Technical Paper 36 (25). However, they have been continually updated over the years and currently contain storm positions, sustained wind speeds, and surface pressures (when available) beginning in 1886. As mentioned in footnote 2, these data are currently being reviewed. Some of the more significant changes that 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 official observations.

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

Fernández-Partagás (76).

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 (45a).

5) The status of storm 3, 1903, was downgraded to tropical storm before it entered the Gulf of Mexico. This was done to be consistent with studies by the National Weather Service Hydrometeorological Branch and, as implied in the September 1903 Monthly Weather Review.

6) The track of storm number 1, 1876, was made to pass through Washington, DC to agree with the Monthly Weather Review for 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, 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 provided by the Netherlands Antilles Meteorological Service.

10) In accordance with information 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 Guadaloupe.

12) Unpublished information on file at the TPC/NHC suggested that minor changes be made to some of the original Cry (26) tracks for the years 1932, 1933, 1960 and 1961. Also minor changes were made to the tracks for years 1966, 1971 and 1975.

13) Reference Sugg (96) and others, the landfall intensity of storm 6, 1899, was increased from category 1 to category 3 (see Table 6).

Additional minor differences still exist between the official computer files and Cry's (26) tracks. For example, detailed records 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 small changes are hardly discernable in the scale used on Chart series A and the original charts prepared for Cry's original paper were still used.

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 unpublished notes on hurricanes in Jamaica, W.I. (62).

5.3 Data Sources 1964-1998

The principal data source in the preparation of the charts for the additional 35 years, 1964 through 1998, were the annual summary reports of Atlantic tropical activity prepared by the TPC/NHC. The primary medium for the dissemination of these reports is the Monthly Weather Review (110, 111, 112). In addition, summary articles tailored to specific user groups appear annually in the popular weather magazine Weatherwise (60, 79b) and, in the Mariner's Weather Log (9a). Annual summary articles, dealing with the genesis of Atlantic tropical cyclones, also appear in the Monthly Weather Review (77, 88). Finally, annual summaries, describing other aspects of each hurricane season, such as tabulated storm positions (best-track), aircraft reconnaissance and satellite storm positions, and forecast verifications (52, 61) were issued by the Tropical Prediction Center/National Hurricane Center for years 1974-1992.

The annual tropical cyclone track charts that appear in individual issues of the Monthly Weather Review for the period subsequent to 1963 were prepared in the same general format used in Technical Paper 55 (26). The maps, beginning with the 1968 season, include the subtropical stages (if any) of the storm tracks. The 1970 map includes the unnamed storms discussed by Spiegler (93).

Determination of the storm tracks for the years following 1963 was obviously less burdensome than for the earlier years; the only complicating factor being the need to deal with the concept of subtropical cyclones beginning in 1968. The decision to include these latter storms was based on climatological considerations. In earlier years, subtropical systems were not formally recognized as separate entities and, in most cases, they were designated as tropical systems. Consequently, failure to include these systems would produce a discontinuity in the climatological tabulations beginning in 1968.

6. ACCURACY OF TRACKS AND INTENSITY CLASSIFICATIONS

Tropical cyclones often traverse thousands of miles, but spend most of their lives over, and derive their energy from, oceanic sources. Before the era of aircraft reconnaissance and weather satellites (see Figure 2), the detection of these storms was dependent on chance encounters with shipping or populated land areas. Over the Atlantic basin, the intersection of mean tropical cyclone tracks with shipping lanes and populated islands makes it unlikely that major storms would have gone completely undetected even well back into the 19th century. However, even with the knowledge of a storm's presence, it is difficult, without additional observational platforms, to specify the exact location and the exact intensity. It is likely, too, that some weaker, short duration early storms were not detected at all.

After the introduction of continuous weather satellite surveillance in the mid-1960's (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 intensity can be determined with 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 1998 Atlantic hurricane seasons were prepared with the benefit of satellite imagery (as well as aircraft reconnaissance and other conventional data), the track accuracy should be near optimum, considering the scale of the maps and the scale of the 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, certain milestones in track accuracy. The subject is treated is some detail by Cry (26), and much of the following is quoted directly or indirectly from his account.

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 Yucatan. The amount and quality of marine weather data 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 a corresponding period exceeded 64,000. Since the early 1960's the number has increased less rapidly, because of changes in the characteristics of the shipping industry and the availability of satellite observations over oceanic areas.

Technological advances since World War II have resulted in more precise tropical cyclone detection, positioning, intensity determination and prediction. 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 a hurricane was found to be feasible in 1943 (87), and U. S. Air Force and Navy[3] aircraft have made routine flights into tropical cyclones since 1944. Before the operational availability of satellite data in the mid-1960's, these flights proved to be especially important in the early detection of storms.

Currently, tropical cyclones are primarily detected and tracked by satellite, although supplemental aircraft data are needed to obtain 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 that are used primarily for research but that are also

[3]U.S. Navy hurricane reconnaissance was discontinued after the 1974 season.

important for operational needs of the TPC/NHC.

Recently, the NOAA aircraft fleet has been augmented with a jet aircraft. New Global Positioning System (GPS) aircraft released dropsondes[4] provide vastly improved data quality and quantity over earlier aircraft dropsondes. These data feed into complex numerical models that can predict tropical cyclone motion with greatly improved accuracy (57a, 87).

A significant milestone occurred during the 1977 hurricane season when a complex system known as the Aircraft Satellite Data Link (ASDL) system enabled aircraft measurements taken inside a storm at 60-second intervals to be received, computer plotted and delivered to the forecaster within a few minutes. It is significant to contrast this with an earlier statement concerning the receipt of ship observations months after the observation was taken. 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 when storms were approaching land. An extensive network of powerful coastal Doppler radars is now in operation. Radar is particularly useful in detecting sudden changes in the direction and intensity of tropical cyclones 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 was the development of weather satellites, now the standard observational tool for the viewing of tropical cyclones on a global scale. By reviewing thousands of satellite cloud signatures, Dvorak (30), Hebert and Poteat (45) and others were able to systematically estimate the location and intensity of a tropical cyclone. The resulting "Dvorak system" is now used throughout the world. Satellites also provide the means of obtaining direct or indirect measurements of many other environmental quantities (1, 13, 41, 53).

The first research pictures of a tropical cyclone were transmitted by the polar orbiting TIROS-1 satellite in 1960. By 1966 the first completely operational weather Satellite, ESSA-1, was placed in orbit. The ESSA series were also polar orbiting satellites and provided views of tropical cyclones once per day. By the late 1960's geostationary satellites allowed continuous daylight viewing 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 these data have also improved. Two such systems, known by the acronyms McIDAS and VDUC (see section 12) (87) are gradually being consolidated into the completely automated AWIPS system (see Figure 2).

Marine meteorological data buoys are widely positioned at strategic locations. These floating platforms transmit observations of wind, pressure, waves, ocean and air temperatures in and around tropical cyclones and other weather systems.

The 128 years from 1871 through 1998 cover the complete period of the development of meteorology and organized weather services. In general, the quality

[4] Dropsondes (sometimes referred to as dropwindsondes) are devices released from aircraft which transmit atmospheric measurements back to the aircraft as they descend to the surface.

and quantity of tropical cyclone data are consistent with the technical advances depicted in Figure 2. Better processing, understanding and application of these data are leading to continuously improving tropical cyclone motion forecasts (57a, 87). There is every reason to expect continued improvement.

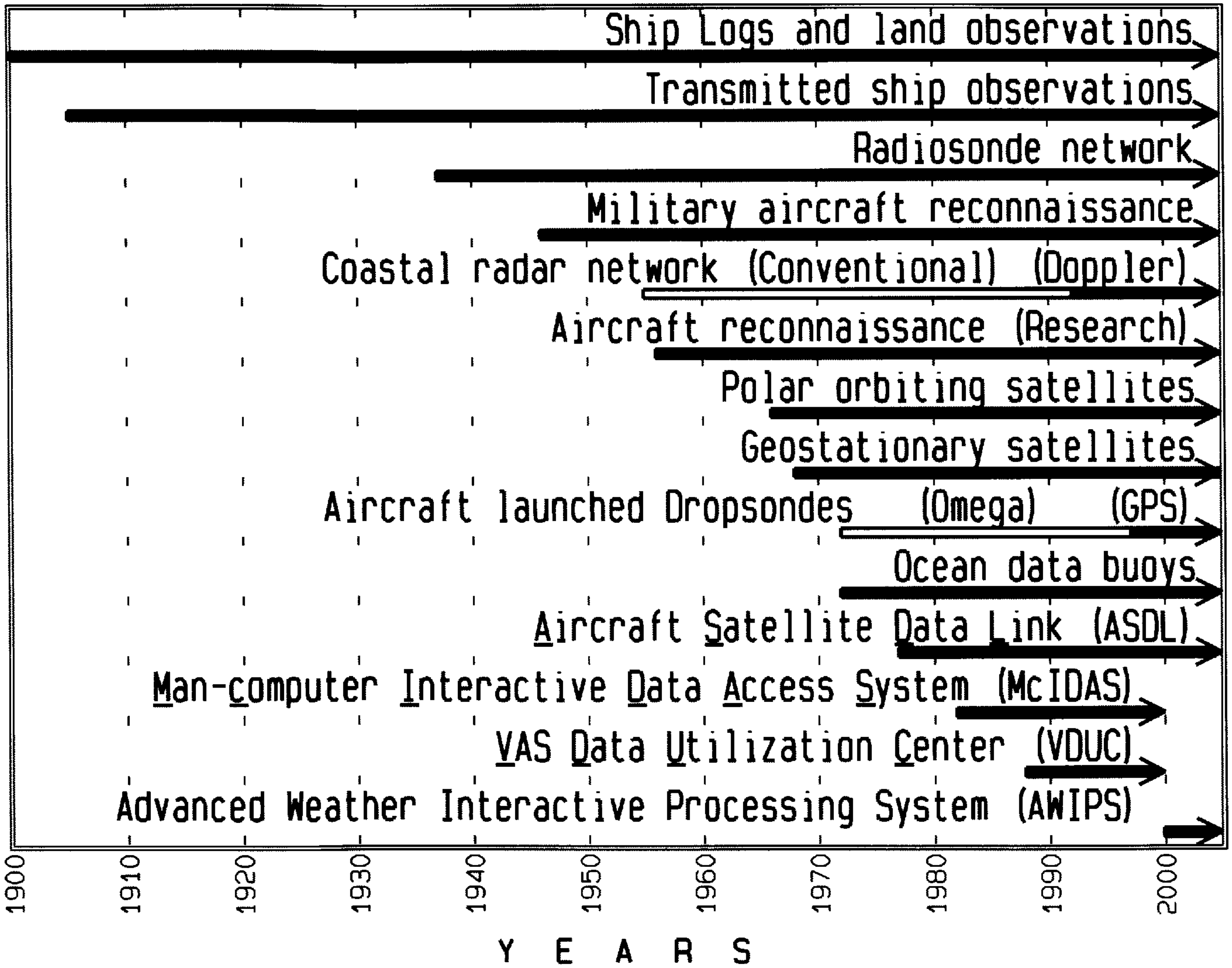


Figure 2. Some milestones in tropical cyclone observing, data processing and communication systems since 1900.

In the early years, the observations simply did not exist or were very uncertain. Not knowing where a storm was located nor the properties of the atmosphere in which the storm was embedded and how this was changing with time made forecasting tropical cyclone movement and associated intensity extremely uncertain. Today, a widespread network of land stations, ships, aircraft, radar, satellites, data buoys, etc., along with 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 1998 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 evaluations 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, throughout their existence, the position and intensity of each significant tropical cyclone in the North Atlantic. Unfortunately, the quality of some of the data prevented full attainment of this goal; many positions and intensities, particularly for the earlier years, are estimates, representing compromise to significant difference in the references.

Delineation of intensity changes was found to be unrewarding before year 1899, at which time daily synoptic charts for the entire area became available. Consequently, no indications of intensity have been made for 1871 through 1885. A simple classification of "tropical storm" or "hurricane" was used 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. Revisions to the Cry (26) paper added an additional breed of storm beginning in 1968: subtropical cyclones (see section 4.3). 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 hurricane," "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 they did have tropical characteristics.

Table 2. Number of recorded Atlantic tropical cyclones (excluding tropical depressions and including subtropical cyclones) that reached at least tropical storm intensity in specified month, 1871-1998. 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
1935								3	1	2			6
1936						3	2	6	4	1			16
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

7.2 Chart Series B

Another series of charts (Series B) provides storm groupings according to selected intra-seasonal periods. A similar series presented by Cry (26) has always been useful for both operational and research purposes. Except for recent years, Series A charts were manually prepared. However, Chart Series B was

Table 2 (cont.) Number of recorded Atlantic tropical cyclones (excluding tropical depressions and including subtropical cyclones) that reached at least tropical storm intensity in specified month, 1871-1998. Refer to Table 4 for summaries of these data.

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
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
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
1970					1		1	3	3	2			10
1971							1	4	6	1	1		13
1972					1	1		2	2		1		7
1973							2	2	2	2			8
1974						1	1	4	4	1			11
1975						1	1	2	3	1		1	9
1976					1		1	5	2	1			10
1977								1	3	2			6
1978	1						1	4	3	3			12
1979						1	2	3	2	1			9
1980								3	5	1	2		11
1981					1	1		2	5	1	2		12
1982						2		1	2	1			6
1983								2	2				4
1984								4	6	1	1	1	13
1985							2	3	3	2	1		11
1986						2		1	2		1		6
1987								3	3	1			7
1988								3	7	1	1		12
1989						1	2	4	2	1	1		11
1990							2	6	2	4			14
1991							1	1	3	3			8
1992				1				1	4	1			7
1993						1		4	3				8
1994							1	2	2		2		7
1995						1	4	7	3	4			19
1996						1	2	4	2	3	1		13
1997						1	4		1	2			8
1998							1	4	6	2	1		14
1999													
2000													
2001													
2002													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

Table 3. Number of tropical cyclones listed in Table 2 that eventually became hurricanes. Refer to Table 4 for summaries of these data. Before 1886, data are currently too fragmented to make a distinction between tropical storms and hurricanes (see footnote 2).

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

Table 3 (continued)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
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								1	3				4
1994								1			2		3
1995						1	1	4	3	2			11
1996							2	3	2	1	1		9
1997							2		1				3
1998								3	4	2	1		10
1999													
2000													
2001													
2002													
YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL

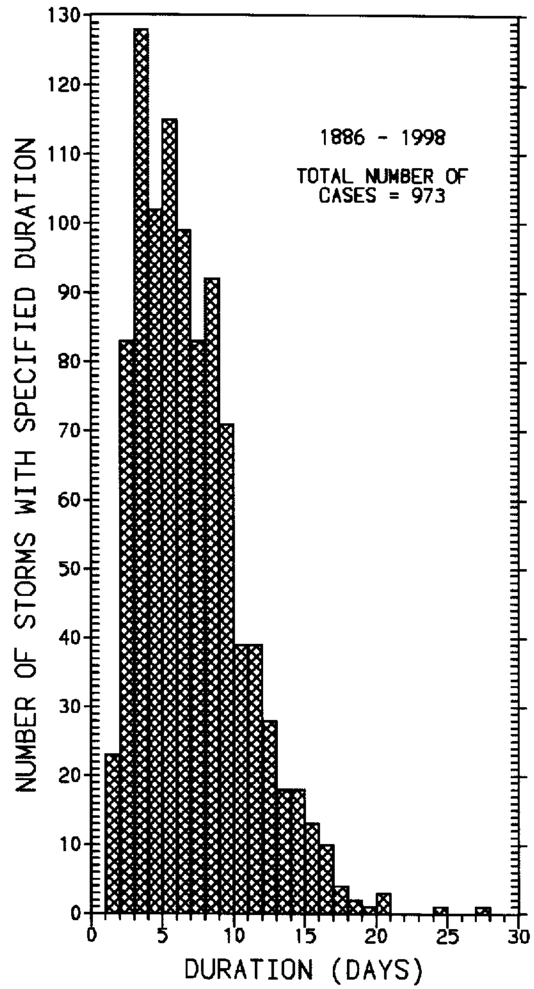


Figure 3. Distribution of observed duration (number of days), including depression stage and excluding extratropical stage, of Atlantic tropical cyclones, 1886-1998. Average and standard deviation are 7.5 and 3.7 days, respectively.

computer produced.

A Mercator projection, true at 22.5°N latitude was used in Chart Series B. In a manner similar to that employed in previous editions, the tracks are presented without regard to identification other than they are assigned to the period in which they first reached tropical storm intensity. Additional labels would clutter the chart and detract from their main purpose: the identification of spatial and temporal shifts in tropical cyclone occurrence. A tabulation by intensity and discussion of decadal-scale changes appear in Hebert and McAdie (44).

Series B charts are presented for months May through December and for 10- (or 11-) day periods, June through November. Figure 1, illustrating the entire storm sample can also be considered as part of Series B. This rendition of the entire 973 storm sample serves to illustrate the bounds of the North Atlantic tropical cyclone basin. The relative frequency of storms in any given area can be roughly identified by the track density.

The tracks were drawn by means of a computer interpolation routine suggested by Akima (3). Storm positions, at 6-hourly intervals are specified in a computer file. With these 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 or sudden changes in direction.

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 1998. Since the hurricane stage was not identified before 1886, no hurricane entries appear in Table 3 for 1871-1885. Grouping in these tables is based on the initial date (UTC) of tropical storm intensity or the detection of the storm; the tropical depression stage (if any) was not included. For example, a storm reaching tropical storm strength on August 31, reaching hurricane strength on September 5 and dissipating on September 20, would be counted as an August storm in both tables. No entries would be made for September.

Based on all Atlantic tropical cyclone tracks from 1886 through 1998, the duration of a tropical cyclone, including the depression stage (if recorded) was 7 to 8 days, but as shown in Figure 3, may vary from less than 2 to as many as 28 full days (i.e., a storm which begins at 0600 UTC on one day and ends 0600 UTC on the next would be assigned a duration of 1 day rather than 2). The smoothed modal (most frequently occurring duration) is 4-6 days. The ability to detect tropical cyclones 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, often before reaching full maturity. Storm number 3, 1946 is a good example.

Including the depression and tropical storm stages and excluding the extratropical stage, hurricanes of long duration include Ginger, occurring September 6 to October 3, 1971 and Inga, occurring September 20 to October 15, 1969 (UTC). Both storms meandered slowly around the western and central Atlantic for much of their existence. Other long-duration storms include those that form in the eastern Atlantic, travel westward, recurve near or over the United States East Coast and then move northeastward across the open Atlantic.

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

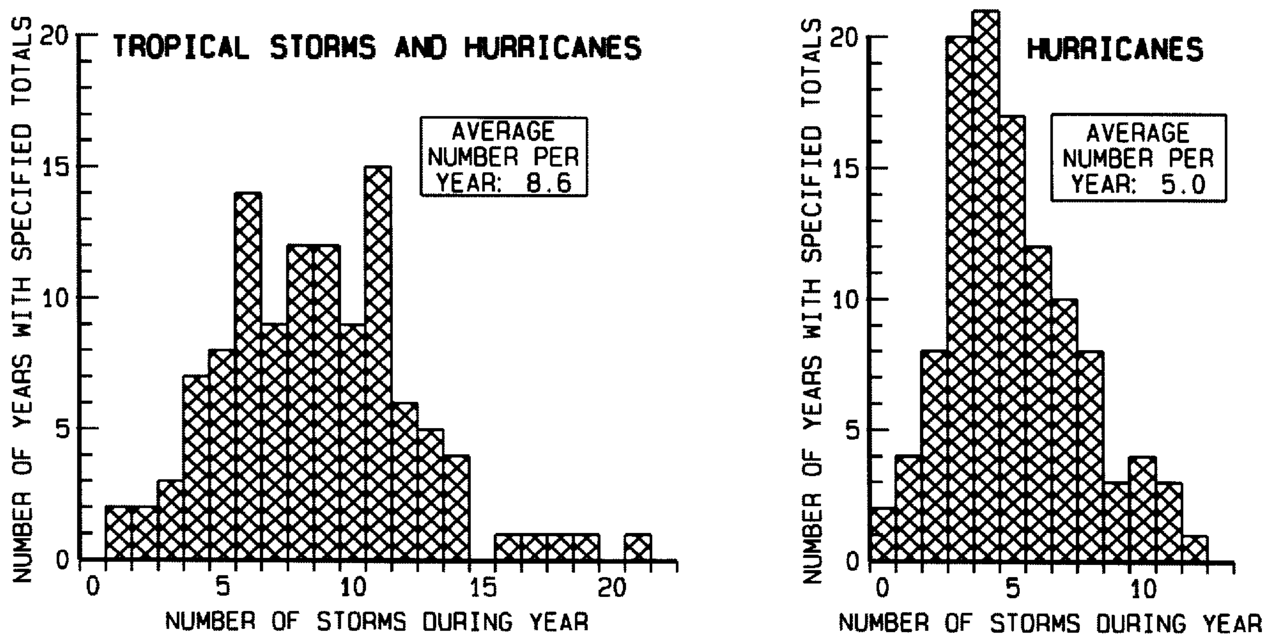


Figure 4. Distribution of annual number of tropical cyclones with maximum winds reaching at least 34 knots (left) and 64 knots (right), 1886-1998. Data derived from Tables 2 and 3.

Of further note are consecutive years having the thus-far observed maximum number of hurricanes. The following are found in the annual totals given in Table 3:

- the 1995-1996 seasons (2 consecutive years) observed 20 hurricanes;
- the 1949-1951 seasons (3 consecutive years) observed 26 hurricanes;
- the 1995-1998 seasons (4 consecutive years) observed 33 hurricanes;
- the 1950-1954 seasons (5 consecutive years) observed 39 hurricanes.

The area of the Atlantic basin observing the maximum number of hurricanes is near 29.0N, 75.5W (approximately 325 nmi east of the central Florida east coast). Recorded hurricanes have passed near this location 56 times over the 113-year period, 1886 through 1998. This is equivalent to about 50 storms per 100 years.

One may question the adequacy of these data. Before the aircraft reconnaissance era, it is considered likely that short-duration and, perhaps even some longer-duration over-water storms were either undetected or were misclassified in regard to location and intensity. After the mid-1940's, when aircraft reconnaissance began, it is unlikely, except in the distant eastern Atlantic, that even weak, short duration storms went undetected. After the introduction of operational weather satellites in the mid-1960's, even the more remote areas were viewable.

In addition to observational deficiencies, it is known that large-scale atmospheric conditions such as El Niño or other variations in sea-surface temperatures can influence tropical cyclone frequency and intensity. Some of these factors are discussed in Goldenburg and Shapiro (35a), Gray (39), Gray et al. (40a), Shapiro (86) and Wendland (120).

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

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
1886 - 1998													
TROPICAL STORMS & HURRICANES	1	1	1	1	14	60	80	238	325	200	46	6	973
AVERAGE OVER PERIOD	*	*	*	*	0.1	0.5	0.7	2.1	2.9	1.8	0.4	0.1	8.6
HURRICANES ONLY	0	0	1	0	3	24	40	163	206	102	25	3	567
AVERAGE OVER PERIOD	0.0	0.0	*	0.0	*	0.2	0.4	1.4	1.8	0.9	0.2	*	5.0
1910 - 1930													
TROPICAL STORMS & 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 - 1998													
TROPICAL STORMS & HURRICANES	1	1	0	1	8	30	50	143	188	93	25	4	544
AVERAGE OVER PERIOD	*	*	0.0	*	0.1	0.5	0.9	2.6	3.4	1.7	0.5	0.1	9.9
HURRICANES ONLY	0	0	0	0	2	11	22	90	122	57	15	2	321
AVERAGE OVER PERIOD	0.0	0.0	0.0	0.0	*	0.2	0.4	1.6	2.2	1.0	0.3	*	5.8
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR

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

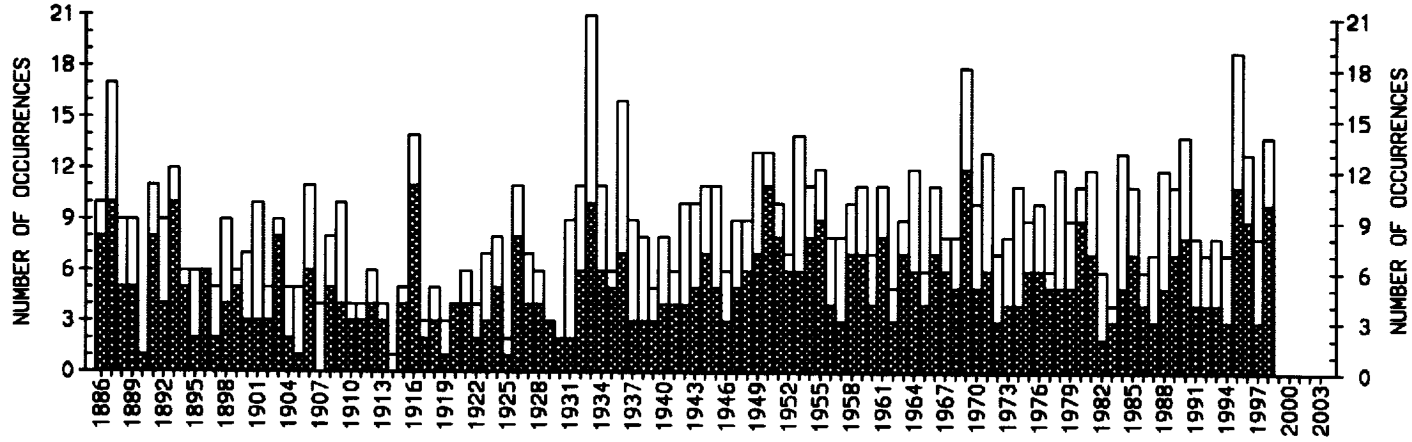


Figure 5. Annual distribution of the 973 tropical cyclones reaching at least tropical storm strength (upper bar) and the 567 reaching hurricane strength (shaded lower bar), 1886-1998. The average number per year is 8.6 and 5.0, respectively.

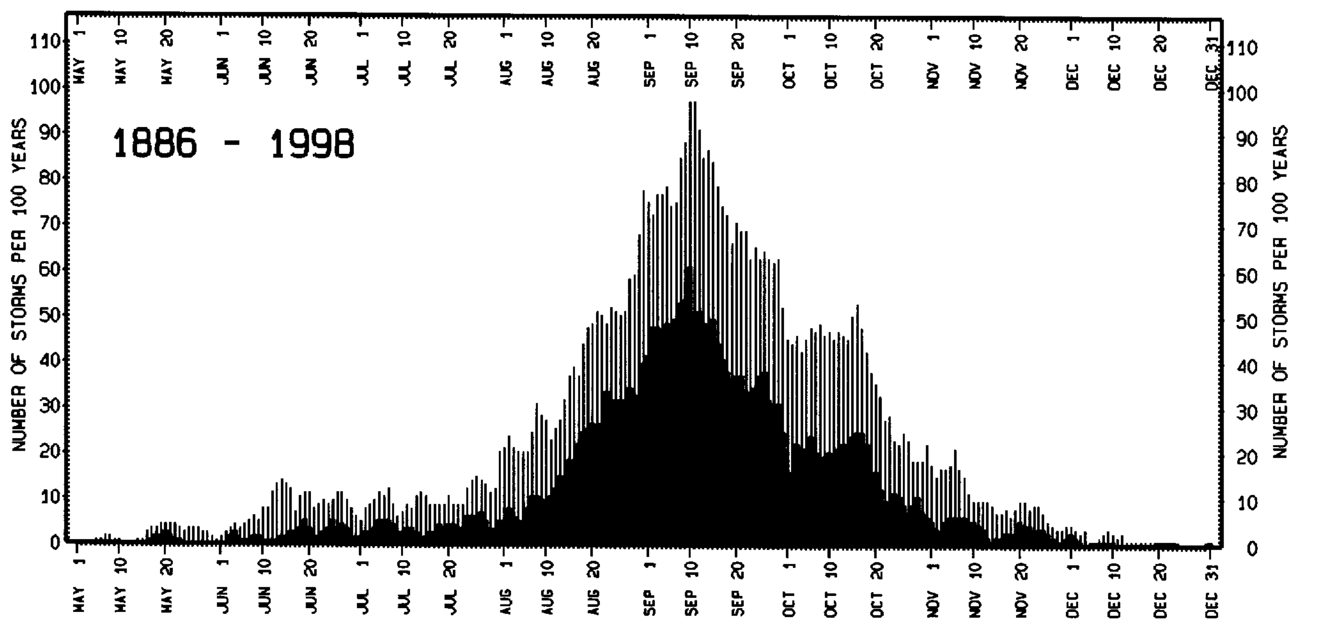


Figure 6. Intra-seasonal variations in the 100-year expectancy of tropical cyclone occurrence. Lower bar is for hurricanes while upper bar is for hurricanes and tropical storms combined. Summary based on 113-year period, 1886-1998.

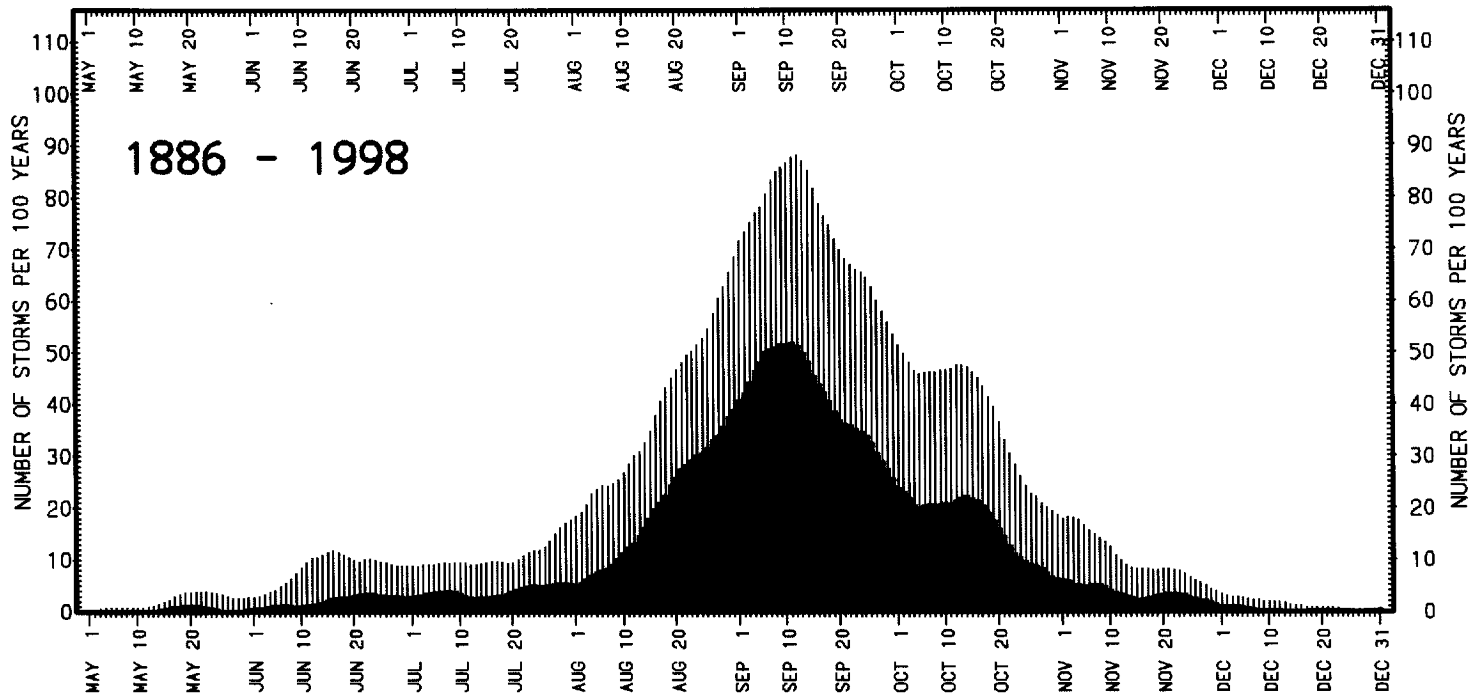


Figure 7. Same as Figure 6 except smoothed by 9-day moving average.

Long-term upward or downward trends in the frequency of tropical cyclones, if not accounted for, make the average frequency a function of the period of record. To illustrate, data from Tables 2 and 3 have been averaged over three periods: 1886-1998, 1910-1930 and 1944-1998. The first period begins with the year when observational tools were limited; the second period shows a minimum in frequency with an average of only about five storms per year; and the last period, 1944-1998 begins with the introduction of aircraft reconnaissance. The averages for the three periods appear in Table 4 and the substantial differences in the monthly and annual frequencies can be noted. The period 1944 through 1998 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, Figure 6 is similar to one presented by Cry

Figure 8. Intra-seasonal variation 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, 1886-1998.

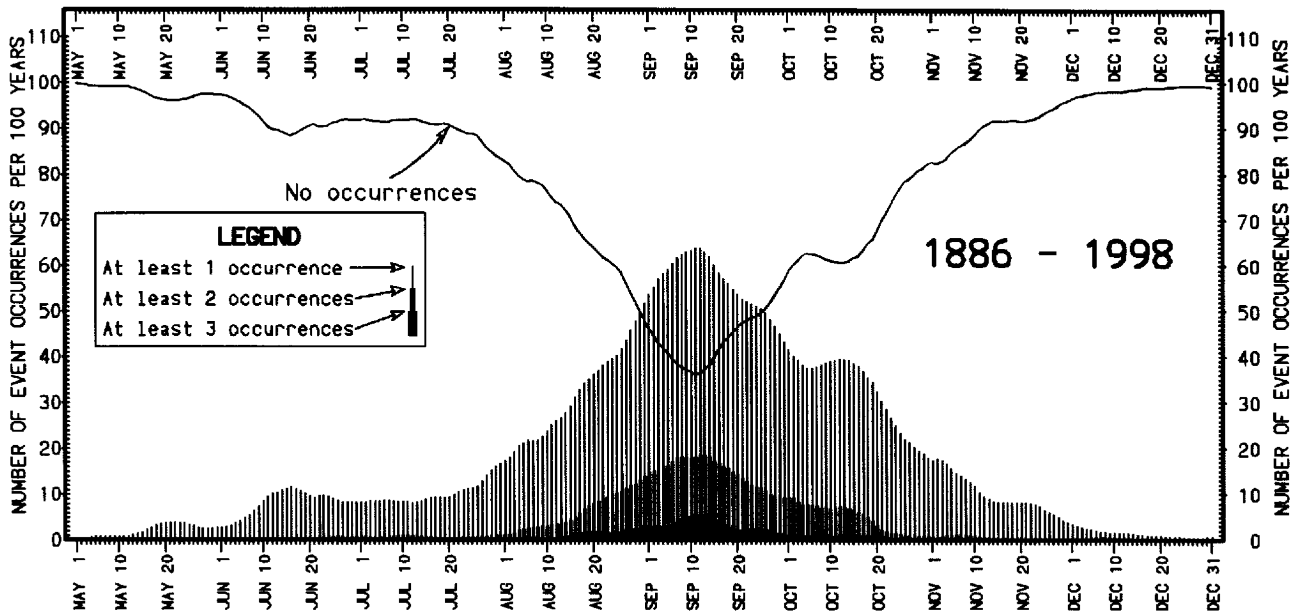
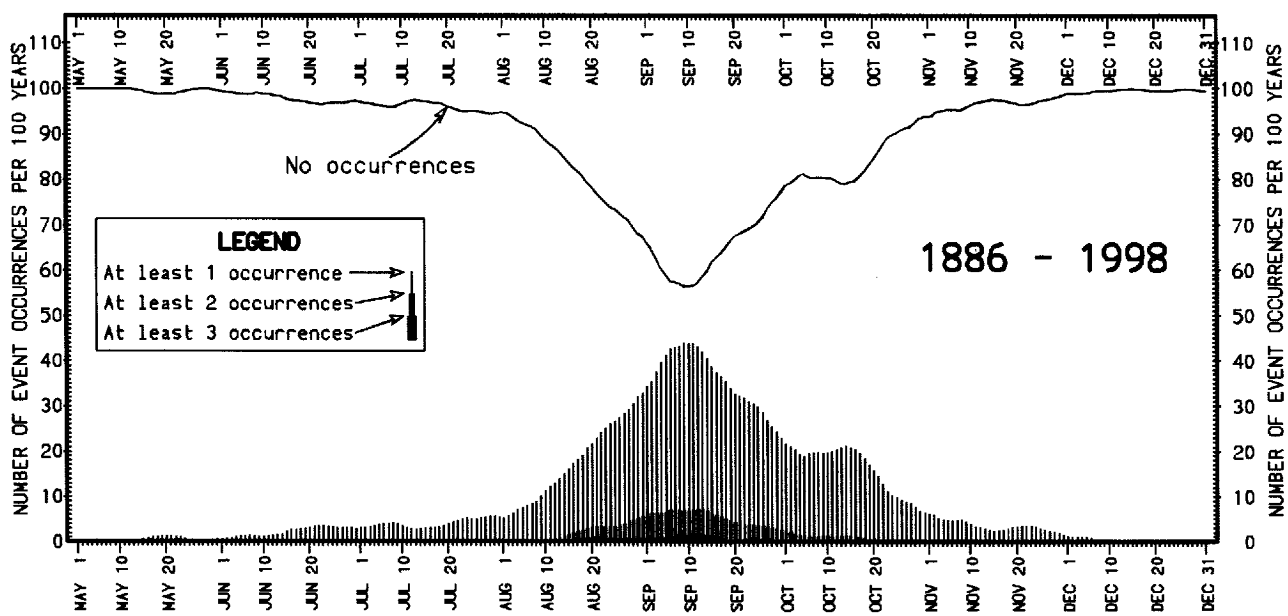


Figure 9
Same as Figure 8 except for hurricanes.



(26). Figure 7 uses the same data as Figure 6 except that it has 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.

Referring to Figure 7, the seasonal fluctuations in tropical cyclone frequency include, in chronological order, a slight maximum around mid-June, followed by a slight decline 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 unit of measurement 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 totals. Thus, the occurrence of three storms on a given date for a single year would yield the same average as a single storm on the same date for each of three years. This counting methodology needs to be considered when making interpretations of these data.

The latter topic is specifically addressed in Figures 8 and 9 where it can be noted that multiple storm occurrences on single days are reasonably common during the peak of the hurricane season. Figure 8 shows that, except for the period from about August 30 to September 25, there is a greater chance of <u>not</u> observing a tropical cyclone on any given day than there is of observing at least one tropical cyclone over the North Atlantic basin.

The maximum multiple occurrence event depicted on these figures is the "at least three" category. The maximum number of simultaneous occurrences on a single day over the North Atlantic is four although such an event is quite rare, being observed in but 9 of the 113 years, 1886-1998. The longest daily span of a 4-storm event occurred in 1893 when four tropical storms or hurricanes were in existence August 15-25. The most recent occurrence of such an event was in 1998 when four tropical cyclones (GEORGES, IVAN, JEANNE and KARL), were occurring simultaneously, September 24-28. Also, during the very active 1995 season, there were four storms present August 29-September 1 (HUMBERTO, IRIS, KAREN, and LUIS).

Insofar as hurricanes alone are concerned, there were only two years (1898 and 1998) when 4 hurricanes existed simultaneously. The 1998 hurricanes were GEORGES, IVAN, JEANNE and KARL and the dates were September 25 and 26.

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

There are no well-defined statistical relationships between the beginning and ending dates; that is, the seasons that began early or late did not necessarily end early or late. However, as might be expected, there is somewhat of a statistical relationship between starting date and the number of storms such that seasons that begin early tend to have more storms than those that begin late. The low linear correlation coefficient (-0.35) 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 Dunn (28) or Dunn and Miller (29) for discussions.

These seasonal shifts become quite apparent after a review of Chart Series B. 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 the number of storms. By late July, the frequency gradually increases, and the centroid of formation shifts still farther eastward. By late August, tropical cyclones form over a broad area that extends eastward to near the Cape Verde Islands off Africa. The period from about August 20 to September 15 encompasses the maximum of the "Cape Verde" type storms, so-named because they can traverse the entire Atlantic and are often a threat to the Caribbean Islands and the United States.

After mid-September, the frequency begins to decline and the genesis area shifts westward. By early October, the area is generally confined to longitudes west of 60°W, and the area of maximum occurrence returns to the western Caribbean. In November, the frequency of tropical cyclones further declines.

Many additional features relating 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

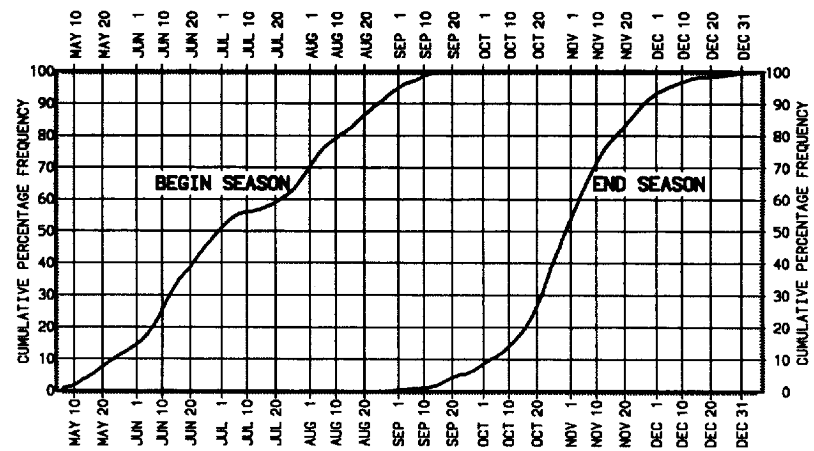


Figure 10. Cumulative percentage frequency distribution of beginning and ending dates of Atlantic tropical cyclone season, 1886 through 1998. (Dates are of first and last recorded position with at least tropical storm strength.) Data have been smoothed using a 9-day moving average.

Figures 6 and 7, depicting the daily frequencies. As discussed in section 2, readers wishing to perform a computer analysis of the storm tracks can download the basic data from the Tropical Prediction Center/National Hurricane Center Internet Web site at <http://www.nhc.noaa.gov>.

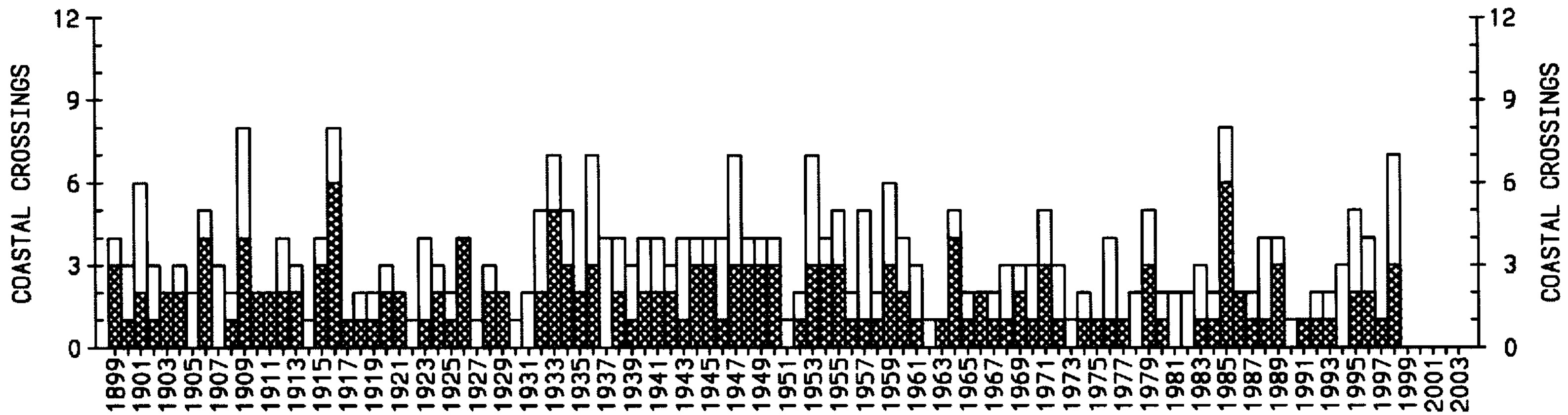


Figure 11. Annual distribution of the 325 tropical storms and hurricanes (upper open bars) and the 170 hurricanes alone (shaded lower bars) that have crossed or passed immediately adjacent to the U.S. coastline (Texas to Maine) over the 100-year period, 1899-1998. The average number of these events is 3.2 and 1.7, respectively. Chart displays one coastal crossing per storm even through multiple crossings may have occurred.

8.4 Tropical Cyclones Affecting the U.S.

Of the 863 tropical cyclones that have been recorded over the Atlantic tropical cyclone basin, 1899-1998, a total of 325 or about 38% have crossed or passed immediately adjacent to the United States coastline, Texas to Maine. Figure 11 shows the year-to-year distribution of these 325 storms. It is interesting to note that there has been at least one coastal crossing for each of these years.

Locations of the coastal crossings referred to in Figure 11 can be found on the appropriate yearly map in Chart series A. In regard to these coastal crossings, the weather is usually very asymmetrical about the point of landfall. Looking in the direction of storm motion, the "heaviest" weather is normally to the storm's right side where rotational winds and translational (forward) motion are complementary; thus, for a hurricane moving into the Florida peninsula from the east, strongest winds and storm surge would normally be on the right (north) side; for a storm moving into the Florida west coast from the Gulf, maximum wind and storm surge would be expected south of the landfall point.

Other meteorological conditions and terrain features also contribute to wind, wind gusts, weather and storm surge asymmetries such that it is difficult to speculate on the extent and nature of storm damage at a particular site given only the storm track and storm classification. Also building codes vary from location to location. Accordingly, persons desiring to know the specific effect or potential effect of past or future storms on a given site should seek further meteorological or engineering advice.

8.5 Coastal Variation of Tropical Cyclone Threat

Many factors relate to the geographical variation of coastal tropical cyclone frequency and intensity from Texas to Maine. Since maximum possible intensity of hurricanes depends on a continuous supply of warm and very moist air near the surface, a marine environment with warm sea-surface temperatures is an important factor. Thus, in general, storms hitting the cooler northeast coast are apt to be less frequent and less intense than those hitting the south or the southeast coast. Another factor is the location and orientation of the coastline in relation to mean storm tracks. Storms located in the Gulf of Mexico are almost certain to make landfall whereas those off the U.S. East Coast may recurve and remain at sea.

Tropical cyclone variation along the United States Gulf and East Coasts is depicted in Figure 12. At 57 coastal locations, approximately fifty miles apart, counts were made of the number of tropical cyclones whose centers passed within 75 nautical miles from the sampling point (1886-1998). These 57 locations are shown by the black dots along the coast. The count was stratified by the following thresholds: 34 knots (all tropical storms and hurricanes), 64 knots (hurricanes) and 100 knots (major hurricanes).

The upper left inset of Figure 12 shows the results of the above counting procedure. The number of tropical cyclones counted in the process (normalized to number of storms per 100 years) is shown by the vertical axis on both the left and the right side of the inset. The first point on the left side of the chart is for south Texas (Port Isabel) while that on the extreme right is for northeastern Maine. A few well-known locations (not necessarily at the same locations as the 57 sampling points) are listed across the chart top.

Looking at the upper line in the inset, note that, in general, there is a gradual but irregular increase in the frequency of weaker tropical cyclones (tropical storms) from South Texas, around Florida to Cape Hatteras④ with a rapid decline in frequency thereafter. Superimposed on this larger-scale pattern, local maxima can be noted near Galveston①, the Mississippi Delta area②, Southern Florida③, and the southeastern Massachusetts/Nantucket area⑤.

Insofar as hurricanes are concerned (middle line), two rather distinct maxima occur: over southern Florida③ and near Cape Hatteras④. Finally, the lowermost line (major hurricanes) shows that the maximum is over Southern Florida③ and the Keys, with local maxima near the Mississippi Delta②, and again, the Cape Hatteras④ area.

Figure 12 does not specifically address tropical cyclones that cross the coast, although there is a reasonably good correlation between coastal crossings and the frequencies shown on the figure. One notable exception occurs in the north Florida/south Georgia coastal area where the number of tropical cyclones crossing the coast from the Atlantic is rather small. However, Figure 12 suggests a relatively high frequency of tropical cyclone events in that area. Most of this high frequency is caused by tropical storms that approached from a southwesterly direction from the Gulf and were weakened by their passage over the Florida Peninsula. The number of major hurricanes affecting the north Florida/south Georgia area are observed to be quite low and this is consistent with Figure 12.

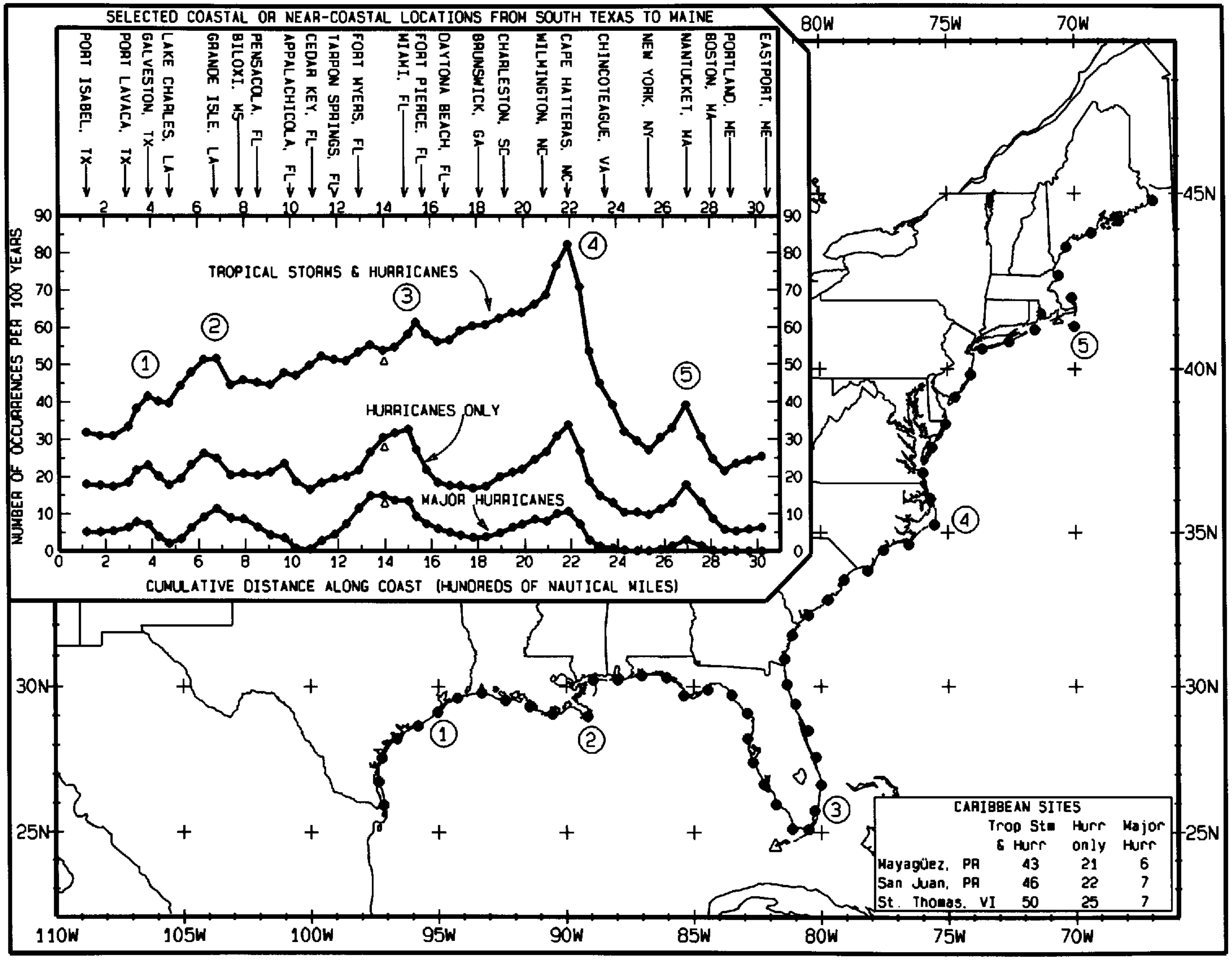


Figure 12. Variation of tropical cyclone frequency and intensity along the United States coastline, south Texas to Maine. For three different intensity categories, inset chart gives the frequency of tropical cyclones passing near selected coastal points shown by small dark circles on map (small triangles give data for and location of Key West, FL). Comparable data for a few Caribbean sites are given in the lower right corner of map. An explanation of this figure can be found beginning with the second paragraph of section 8.5, page 29.

8.6 Hurricane Damage Potential

The previous sections (8.4 and 8.5) dealt with all tropical cyclones, regardless of intensity. This section concerns only hurricanes; that is, storms having sustained winds near the center of at least 64 knots. Figure 11 shows that, of the 325 coastal crossings, 1899-1998, 170 or slightly over one-half were classified as hurricanes. Depending upon the section of coastline under consideration, this average can vary from 40 to 60%.

The amount of damage caused by hurricanes is highly variable and depends on a number of factors. Obviously, more intense storms can be expected to yield more damage. However, there are numerous other factors which need be considered such as wind gusts, storm size, the speed of translational motion (affecting rainfall and fresh-water flooding), storm surge (affected by offshore water depth and coastal configuration), astronomical tide, terrain features, local building codes, distance from coast, etc.

In 1972, the National Weather Service accepted a hurricane damage scale devised by Herbert Saffir, and later expanded upon by Robert Simpson. The Saffir-Simpson (82, 104) scale, as it has come to be known, relates the strength of hurricane-force winds and associated storm surge with potential damage. The scale is now widely used in public awareness programs and by the news media. It gives the public and disaster preparedness officials a good estimate of what can be expected from various levels of intensity.

In 1975, Hebert and Taylor (45a) carefully analyzed all hurricanes that had affected the United States, beginning with the 1900 season, and classified

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 and 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 structural 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 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 waters 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, 1899-1998

Storm number	Year	Month	Coastal States affected and category	Highest category U.S.	Storm name
2	1899	Aug	NC3	3	------
6	1899	Oct	SC3, NC3	3	------
1	1900	Sep	TX(N)4	4	------
3	1901	Jul	NC1	1	------
4	1901	Aug	LA2, MS2	2	------
3	1903	Sep	FL(SE)2, FL(NW)1	2	------
4	1903	Sep	NJ1, NY1, CT1	1	------
2	1904	Sep	SC1	1	------
2	1906	Jun	FL(SE)1	1	------
4	1906	Sep	SC3, NC3	3	------
5	1906	Sep	MS3, AL3	3	------
8	1906	Oct	FL(SE)2	2	------
2	1908	Jul	NC1	1	------
3	1909	Jul	TX(N)3	3	------
5	1909	Aug	TX(S)2	2	------
7	1909	Sep	LA4	4	------
9	1909	Oct	FL(SE)3 (Keys)	3	------
2	1910	Sep	TX(S)2	2	------
4	1910	Oct	FL(SW)3	3	------
1	1911	Aug	FL(NW)1, AL1	1	------
2	1911	Aug	GA2, SC2	2	------
3	1912	Sep	AL1	1	------
5	1912	Oct	TX(S)1	1	------
1	1913	Jun	TX(S)1	1	------
2	1913	Sep	NC1	1	------
2	1915	Aug	TX(N)4	4	------
4	1915	Sep	FL(NW)1	1	------
5	1915	Sep	LA4	4	------
1	1916	Jul	MS3, AL3	3	------
2	1916	Jul	MA1	1	------
3	1916	Jul	SC1	1	------
4	1916	Aug	TX(S)3	3	------
13	1916	Oct	AL2, FL(NW)2	2	------
14	1916	Nov	FL(SW)1 (Keys)	1	------
3	1917	Sep	FL(NW)3	3	------
1	1918	Aug	LA3	3	------
2	1919	Sep	FL(SW)4, TX(S)4	4	------
2	1920	Sep	LA2	2	------
3	1920	Sep	NC1	1	------
1	1921	Jun	TX(C)2	2	------
6	1921	Oct	FL(SW)3 (Keys), FL(NE)2	3	------
3	1923	Oct	LA1	1	------
4	1924	Sep	FL(NW)1	1	------
7	1924	Oct	FL(SW)1	1	------
2	1925	Nov/Dec	FL(SW)1	1	------
1	1926	Jul	FL(NE)2	2	------
3	1926	Aug	LA3	3	------
6	1926	Sep	FL(SE)4, FL(SW)3, FL(NW)3, AL3	4	------
1	1928	Aug	FL(SE)2	2	------
4	1928	Sep	FL(SE)4, FL(NE)2, GA1, SC1	4	------
1	1929	Jun	TX(C)1	1	------
2	1929	Sep	FL(SE)3, FL(NW)2	3	------
2	1932	Aug	TX(N)4	4	------
3	1932	Sep	AL1	1	------
5	1933	Jul/Aug	TX(S)2, FL(SE)1	2	------
8	1933	Aug	NC2, VA2	2	------
11	1933	Sep	TX(S)3	3	------
12	1933	Sep	FL(SE)3	3	------
13	1933	Sep	NC3	3	------
2	1934	Jun	LA3	3	------
3	1934	Jul	TX(S)2	2	------
2	1935	Sep	FL(SW)5 (Keys), FL(NW)2	5	------
6	1935	Nov	FL(SE)2	2	------
3	1936	Jun	TX(S)1	1	------
5	1936	Jul	FL(NW)3	3	------
13	1936	Sep	NC2	2	------
2	1938	Aug	LA1	1	------
4	1938	Sep	NY3*, CT3*, RI3*, MA3*	3*	------
2	1939	Aug	FL(SE)1, FL(NW)1	1	------
2	1940	Aug	TX(N)2, LA2	2	------
3	1940	Aug	GA2, SC2	2	------
2	1941	Sep	TX(N)3	3	------
5	1941	Oct	FL(SE)2, FL(SW)2, FL(NW)2	2	------
1	1942	Aug	TX(N)1	1	------
2	1942	Aug	TX(C)3	3	------
1	1943	Jul	TX(N)2	2	------
3	1944	Aug	NC1	1	------
7	1944	Sep	NC3, VA3, NY3*, CT3*, RI3*, MA2*	3*	------
11	1944	Oct	FL(SW)3, FL(NE)2	3	------
1	1945	Jun	FL(NW)1	1	------
5	1945	Aug	TX(C)2	2	------

Notes: Storm numbers in column 1 correspond to those given in Chart Series A. Legend for State abbreviation is given in Table 7. Texas and Florida have been further subdivided geographically (see text for details). Hurricane names were not formally assigned before 1950. Data for years 1900-1992 were derived from Jarrell et al. (54). Asterisk (*) indicates that the hurricane was moving in excess of 30 mph. Listing includes only those hurricanes affecting coastal counties.

Table 6. (continued) Chronological listing of, and states affected by, all category 1 through 5 hurricanes, 1899-1998

Storm number	Year	Month	Coastal States affected and category	Highest category U.S.	Storm name
9	1945	Sep	FL(SE)3	3	------
5	1946	Oct	FL(SW)1	1	------
3	1947	Aug	TX(N)1	1	------
4	1947	Sep	FL(SE)4, LA3, MS3, FL(SW)2	4	------
8	1947	Oct	GA2, SC2, FL(SE)1	2	------
5	1948	Sep	LA1	1	------
7	1948	Sep	FL(SW)3, FL(SE)2	2	------
8	1948	Oct	FL(SE)2	2	------
1	1949	Aug	NC1	1	------
2	1949	Aug	FL(SE)3	3	------
10	1949	Oct	TX(N)2	2	------
2	1950	Aug	AL1	1	BAKER
5	1950	Sep	FL(NW)3	3	EASY
11	1950	Oct	FL(SE)3	3	KING
2	1952	Aug	SC1	1	ABLE
2	1953	Aug	NC1	1	BARBARA
4	1953	Sep	ME1*	1*	CAROL
8	1953	Sep	FL(NW)1	1	FLORENCE
3	1954	Aug	NY3*, CT3*, RI3*, NC2*	3*	CAROL
5	1954	Sep	MA3*, ME1*	3*	EDNA
9	1954	Oct	SC4, NC4*, MD2*	4*	HAZEL
2	1955	Aug	NC3, VA1	3	CONNIE
3	1955	Aug	NC1	1	DIANE
9	1955	Sep	NC3	3	IONE
7	1956	Sep	LA2, FL(NW)1	2	FLOSSY
2	1957	Jun	TX(N)4, LA4	4	AUDREY
4	1959	Jul	SC1	1	CINDY
5	1959	Jul	TX(N)1	1	DEBRA
8	1959	Sep	SC3	3	GRACIE
5	1960	Sep	FL(SW)4 (Keys), NC3*, NY3*, FL(NE)2, CT2*, RI2*, NH1*, ME1*	4	DONNA
6	1960	Sep	MS1	1	ETHEL
3	1961	Sep	TX(C)4	4	CARLA
4	1963	Sep	TX(N)1	1	CINDY
5	1964	Aug	FL(SE)2	2	CLEO
6	1964	Sep	FL(NE)2	2	DORA
10	1964	Oct	LA3	3	HILDA
11	1964	Oct	FL(SW)2, FL(SE)2	2	ISBELL
3	1965	Sep	FL(SE)3, LA3	3	BETSY
1	1966	Jun	FL(NW)2	2	ALMA
9	1966	Oct	FL(SW)1 (Keys)	1	INEZ
2	1967	Sep	TX(S)3	3	BEULAH
8	1968	Oct	FL(NW)2, FL(NE)1	2	GLADYS
3	1969	Aug	LA5, MS5	5	CAMILLE
7	1969	Sep	ME1*	1*	GERDA
3	1970	Aug	TX(S)3	3	CELIA
6	1971	Sep	LA2	2	EDITH
7	1971	Sep	TX(C)1	1	FERN
8	1971	Sep	NC1	1	GINGER
2	1972	Jun	FL(NW)1, NY1, CT1	1	AGNES
6	1974	Sep	LA3	3	CARMEN
5	1975	Sep	FL(NW)3	3	ELOISE
3	1976	Aug	NY1	1	BELLE
2	1977	Sep	LA1	1	BABE
2	1979	Jul	LA1	1	BOB
4	1979	Sep	FL(SE)2, FL(NE)2, GA2, SC2	2	DAVID
6	1979	Sep	AL3, MS3	3	FREDERIC
1	1980	Aug	TX(S)3	3	ALLEN
1	1983	Aug	TX(N)3	3	ALICIA
5	1984	Sep	NC3	3	DIANA
2	1985	Jul	SC1	1	BOB
4	1985	Aug	LA1	1	DANNY
5	1985	Sep	AL3, MS3, FL(NW)3	3	ELENA
7	1985	Sep	NC3, NY3*, CT2*, NH2*, ME1*	3	GLORIA
10	1985	Oct	LA1	1	JUAN
11	1985	Nov	FL(NW)2	2	KATE
2	1986	Jun	TX(N)1	1	BONNIE
3	1986	Aug	NC1, VA1	1	CHARLEY
7	1987	Oct	FL(SW)1 (Keys)	1	FLOYD
7	1988	Sep	LA1	1	FLORENCE
3	1989	Aug	TX(N)1	1	CHANTAL
8	1989	Sep	SC4	4	HUGO
10	1989	Oct	TX(N)1	1	JERRY
2	1991	Aug	RI2, MA2, NY2, CT2	2	BOB
2	1992	Aug	FL(SE)4, FL(SW)3, LA3	4	ANDREW
5	1993	Aug	NC3	3	EMILY
5	1995	Aug	FL(SE)1, FL(NW)2	2	ERIN
15	1995	Oct	FL(NW)3	3	OPAL
2	1996	Jul	NC2	2	BERTHA
6	1996	Sep	NC3	3	FRAN
5	1997	Jul	LA1, AL1	1	DANNY
2	1998	Aug	NC2	2	BONNIE
5	1998	Sep	FL(NW)1	1	EARL
7	1998	Sep	FL(SW)2 (Keys), MS2	2	GEORGES

Same notes as on previous page.

Table 7. Number of hurricanes(direct hits) affecting the U.S. and individual States 1899-1998, according to the Saffir-Simpson scale.

	Category Number						Major Hurricanes
	1	2	3	4	5	All	(≥3)
U.S. (Texas to Maine)	60	39	48	15	2	164	65
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)	9	5	8	3	1	26	12
Mississippi (MI)	1	2	5	0	1	9	6
Alabama (AL)	5	1	5	0	0	11	5
Florida (FL)	18	17	17	6	1	59	24
(Northwest)	10	8	7	0	0	25	7
(Northeast)	1	7	0	0	0	8	0
(Southwest)	6	4	6	2	1	19	9
(Southeast)	5	10	7	4	0	26	11
Georgia (GA)	1	4	0	0	0	5	0
South Carolina (SC)	6	5	2	2	0	15	4
North Carolina (NC)	10	6	11	1*	0	28	12
Virginia (VA)	2	1	1*	0	0	4	1*
Maryland (MD)	0	1*	0	0	0	1*	0
Delaware (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 are summarized from Table 6.

them according to the Saffir-Simpson hurricane scale as given in Table 5. To be consistent with the breakdown given in Table 1, the analysis was extended back an additional year (to 1899) and was extended to later years (with some modifications) by Jarrell et al. (54).

Ideally, a Saffir-Simpson scale assignment would be made in terms of observed damage with consideration being given to local building codes. However, the amount of damage in some historical storms was not always known, nor was the wind or the building code. Accordingly, the original authors based their damage scale estimates on central pressure. Central pressure is a quantity more often retrievable from historical records, much more so than the wind. Furthermore, pressure is considered a more conservative quantity than wind and, in the inverse sense, is well-correlated with wind speed.

Currently, winds or wind estimates are generally available when hurricanes make landfall. Accordingly, a decision was made after the 1995 season by TPC/NHC officials to base future Saffir-Simpson scale assignments on the wind.

The Saffir-Simpson scale assignments on historical storms are given in Table 6. 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 on whether the area was located to the right (stronger) or left (weaker) portion of the storm when viewed towards the direction of motion. The authors point out a certain degree 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 upon, for example, 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 geographically. In Florida, the north-south dividing line is roughly from Cape Canaveral to Tarpon Springs. In Texas, south is roughly from the Mexico border 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 if it affected more than one section; thus, 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 individual state is used. The total 164 is six storms less than the 170 count given in Figure 11. The difference is because the original authors of the study determined that six of the hurricanes included in Figure 11 (No. 1, 1899; No. 2, 1902; No. 3, 1904; No. 10, 1926; No. 6, 1934; and No. 8, 1958) either weakened to below hurricane strength immediately upon reaching the coast or passed far enough offshore that hurricane force winds affected only coastal waters and did not produce significant onshore damage. Some storms, however, do produce hurricane force winds over land even though the cyclone center remains offshore. Two examples are storm 1, 1949 and storm 5, 1993 (Emily).

Thus, over the 100-year period 1899 through 1998, a total of 164 category 1 through 5 hurricanes have crossed the U.S. coastline at one or more points. This is equivalent to an average of five hurricanes every three years. Since some hurricanes affect or threaten more than one coastal segment, hurricane warnings average closer to two per year over some coastal segments of the United States. Economic aspects of these warnings are discussed by Sugg (95) and by Neumann (71); societal aspects are discussed by Pielke (77a).

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As mentioned earlier, a comprehensive reanalysis of all available data, published and unpublished,

relating to Atlantic tropical cyclones is underway. It is anticipated that, primarily for the early years, this will result in modification of some tropical cyclone tracks and intensities. Reanalysis may also result in the addition or deletion of entire storms. The next edition of the publication will include these findings.

10. LIST OF ACRONYMS AND ABBREVIATIONS

While every effort was made to avoid use of acronyms or abbreviation, this was not possible in some instances Listed here, along with a brief comment, are those used in the text.

ASDL Aircraft Satellite Data Link - (see Figure 2) Method of transmitting aircraft weather observations directly to forecasters.

AWIPS Advanced Weather Information Processing System (see Figure 2) (Recently installed National Weather Service integrated display platform).

ESSA Environmental Sciences Service Administration - (The predecessor of NOAA).

GOES Geostationary Operational Environmental Satellite - (stationed above a fixed point, high picture frequency, important for hurricane tracking).

GPS Global Positioning System - A method of precise navigation using satellites - (see Figure 2)

kt knots - (nautical miles per hour). Multiply knots by 1.152 to obtain miles per hour.

McIDAS Man-computer Interactive Data Access System - (see Figure 2).

m/s Meters per second - Multiply m/s by 1.94 to obtain knots.

mph miles per hour - Multiply mph by 0.868 to obtain knots.

NOAA National Oceanographic and Atmospheric Administration - (Parent agency of TPC/NHC).

NCDC National Climatic Data Center, Asheville, NC (a branch of NOAA)

RSMC Regional Specialized Meteorological Center (An agency designated by WMO as a major forecasting Center).

TPC/NHC Tropical Prediction Center/National Hurricane Center - (formerly the National Hurricane Center).

UTC Universal Time Coordinated - Global time system, (formerly Greenwich Mean Time or "Zebra" time).

WMO World Meteorological Organization - (an agency of the United Nations).

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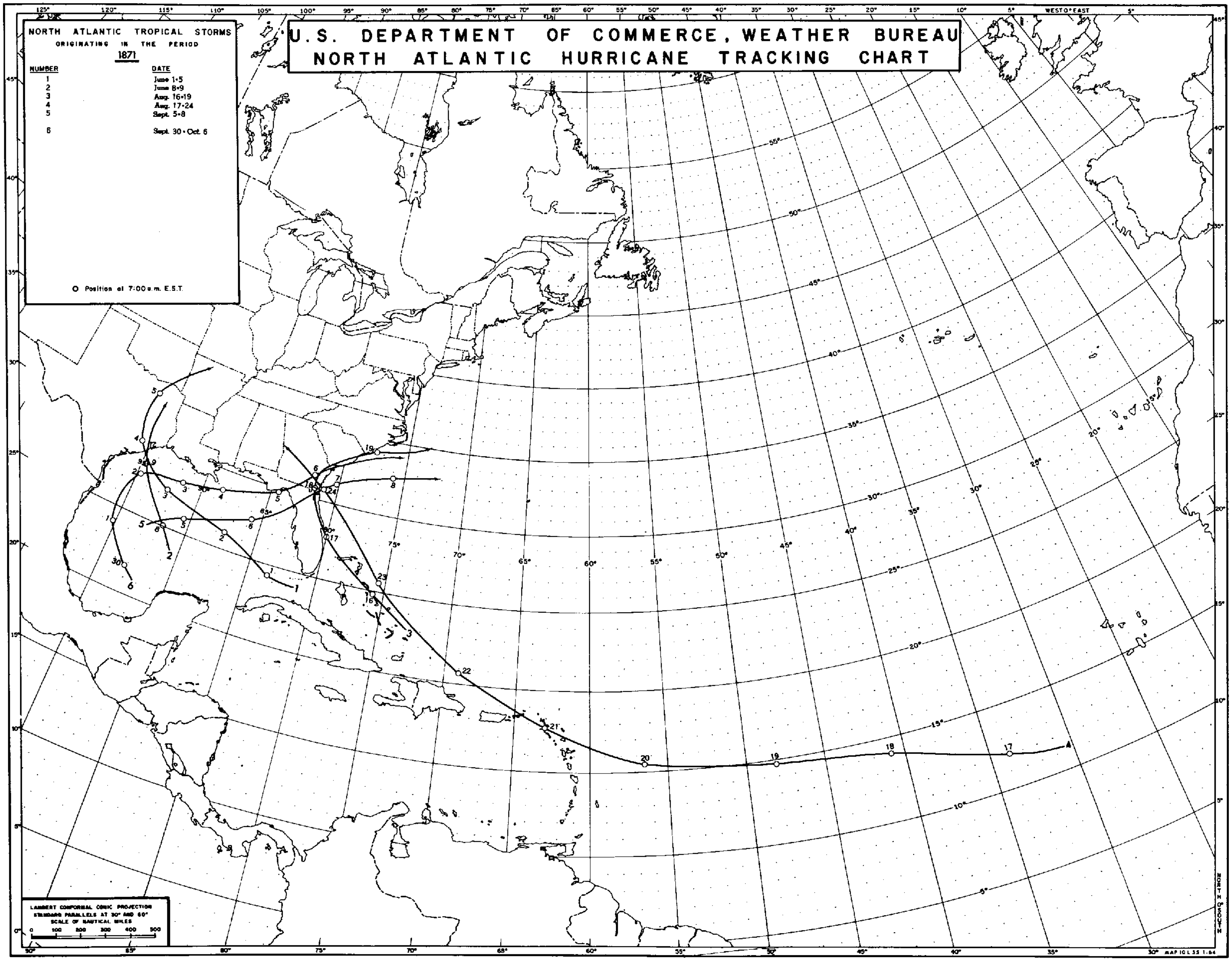
APPENDIX A

TRACKS OF NORTH ATLANTIC TROPICAL CYCLONES BY YEARS, 1871-1998
(CHART SERIES A)

YEARS	INFORMATION INCLUDED ON CHART (See Table 1 for definition of various stages)
1871-1885	Tracks only, no intensity indicated.
1886-1898	Track type shown indicates maximum intensity believed to have been attained at some point along track.
1899-1950	Tropical depression (dissipation stage only), tropical storm, hurricane or extratropical storm.
1951-1967	Tropical depression, tropical storm or hurricane.
1968-1998	Tropical depression, tropical storm, hurricane, subtropical depression, subtropical storm and extratropical storm.

Note: Following the 1998 map, a set of blank pages have been provided for displaying later charts. These are normally published in the Monthly Weather Review.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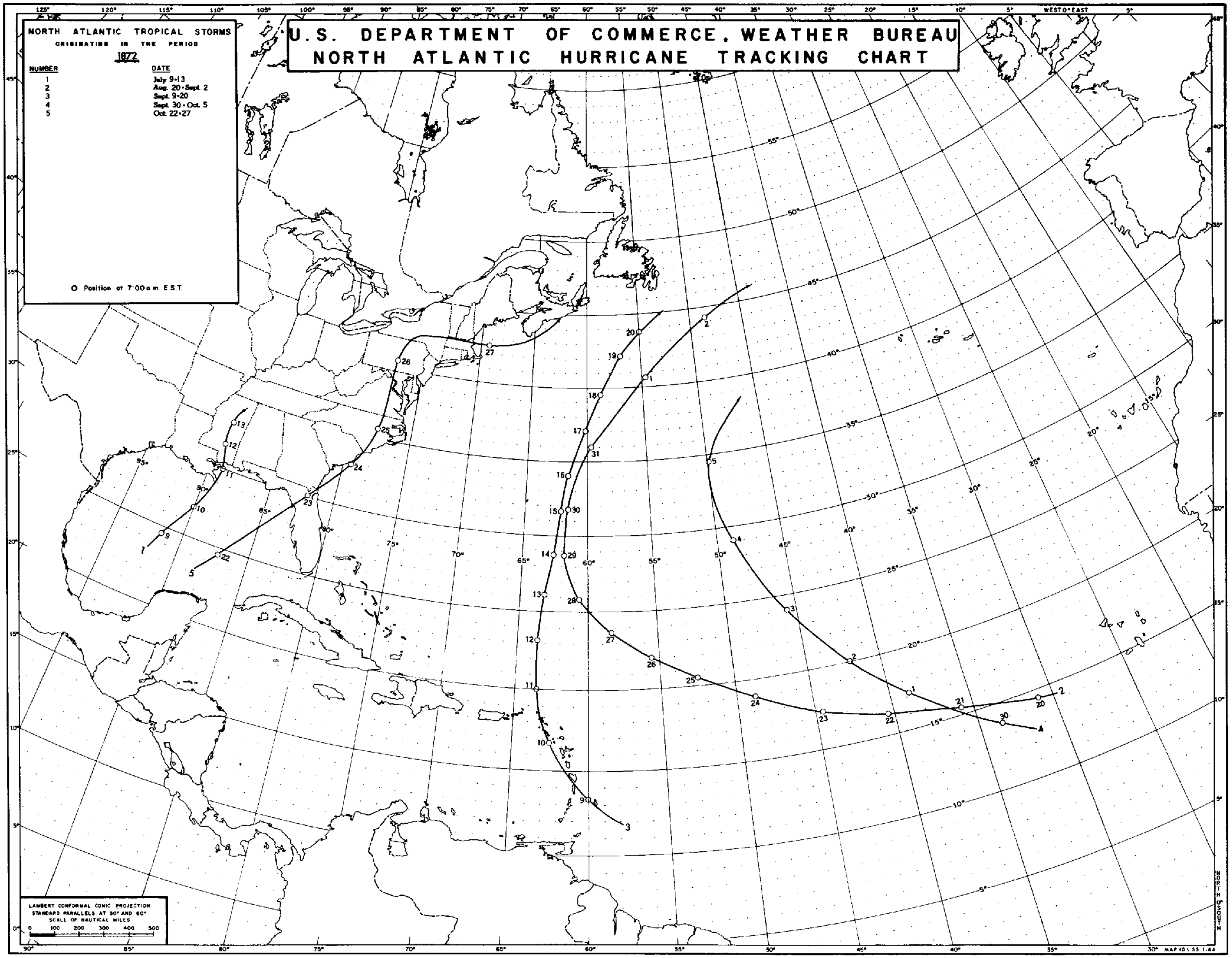
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1871
NUMBER
DATE
1 June 1-5
2 June 8-9
3 Aug. 16-19
4 Aug. 17-24
5 Sept. 5-8
6 Sept. 30 - Oct. 6
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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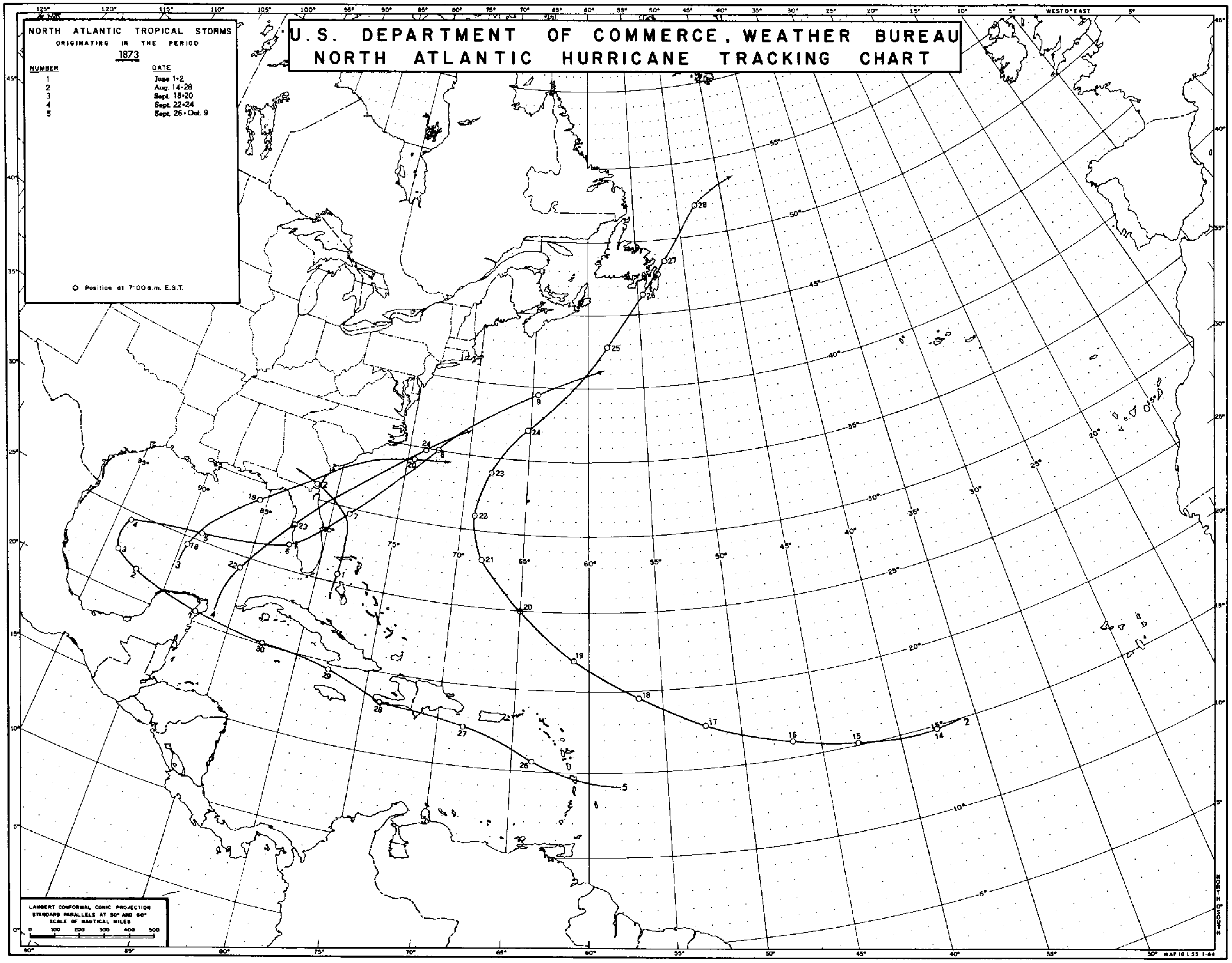
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1872
NUMBER
DATE
1 July 9-13
2 Aug. 20-Sept. 2
3 Sept. 9-20
4 Sept. 30-Oct. 5
5 Oct. 22-27
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES



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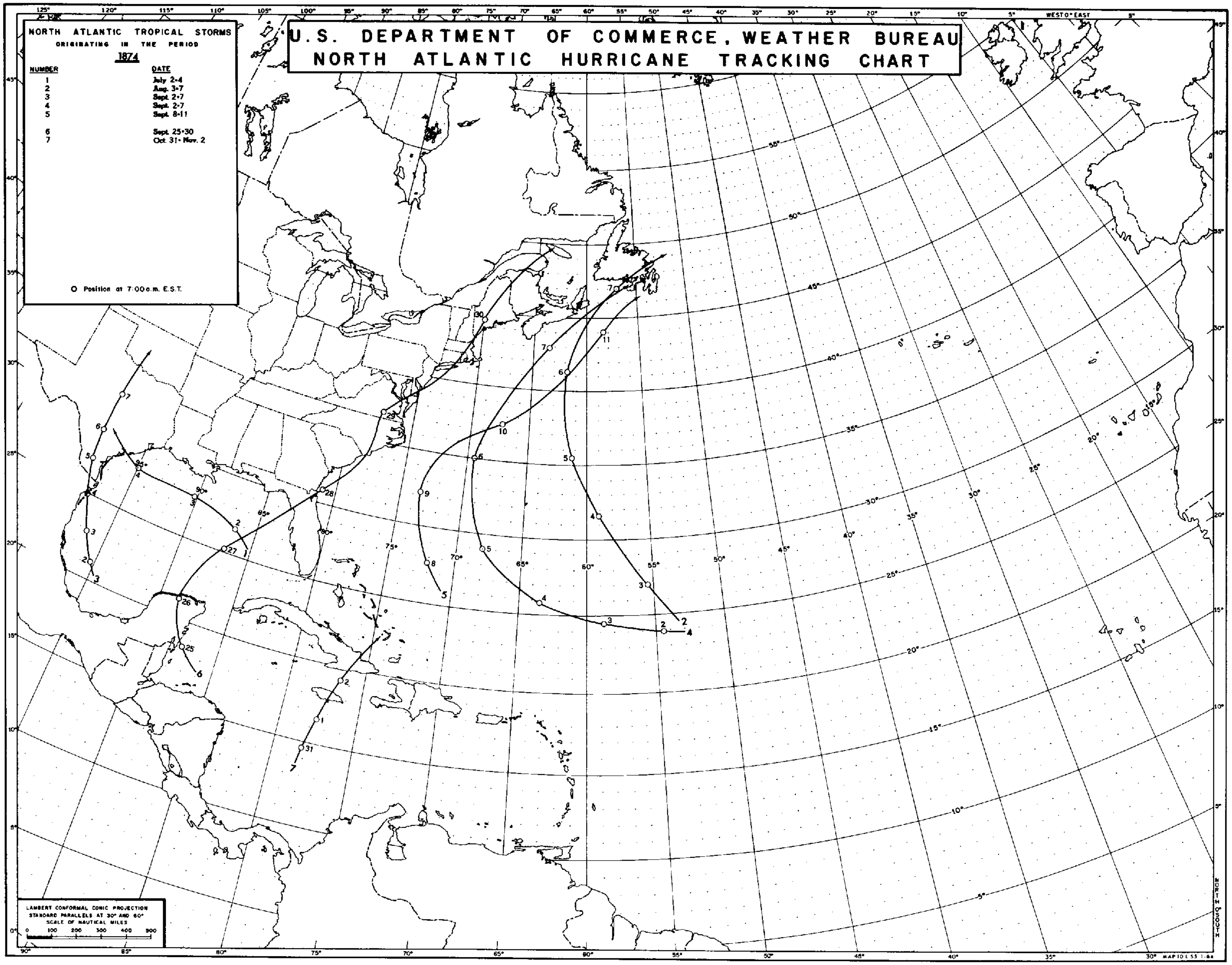
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1873
NUMBER
DATE
1
June 1-2
2
Aug. 14-28
3
Sept. 18-20
4
Sept. 22-24
5
Sept. 26 - Oct. 9
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL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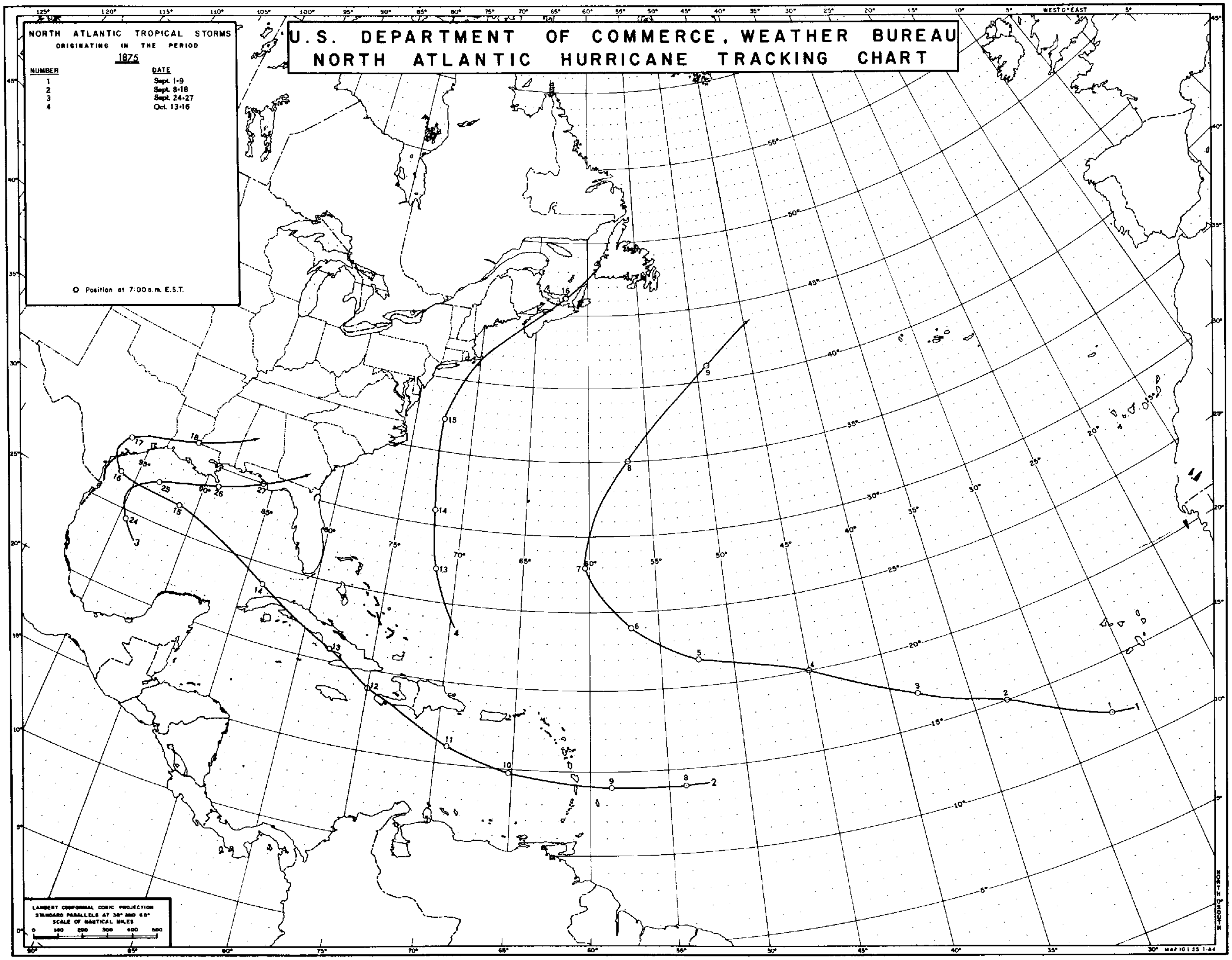
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1874
NUMBER DATE
1 July 2-4
2 Aug. 3-7
3 Sept. 2-7
4 Sept. 2-7
5 Sept. 8-11
6 Sept. 25-30
7 Oct. 31- Nov. 2
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND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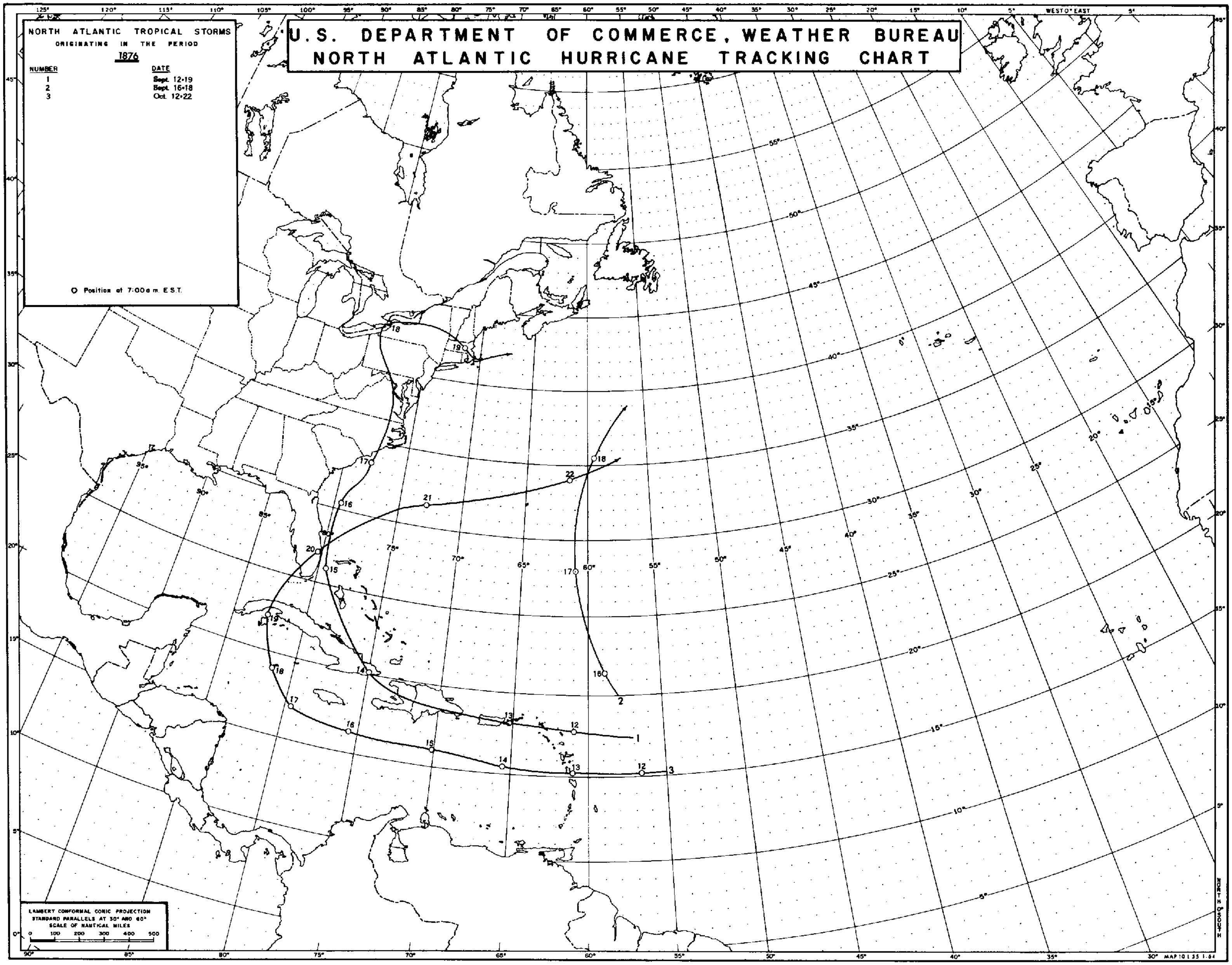
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1875
NUMBER
DATE
1 Sept. 1-9
2 Sept. 8-18
3 Sept. 24-27
4 Oct. 13-16
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES



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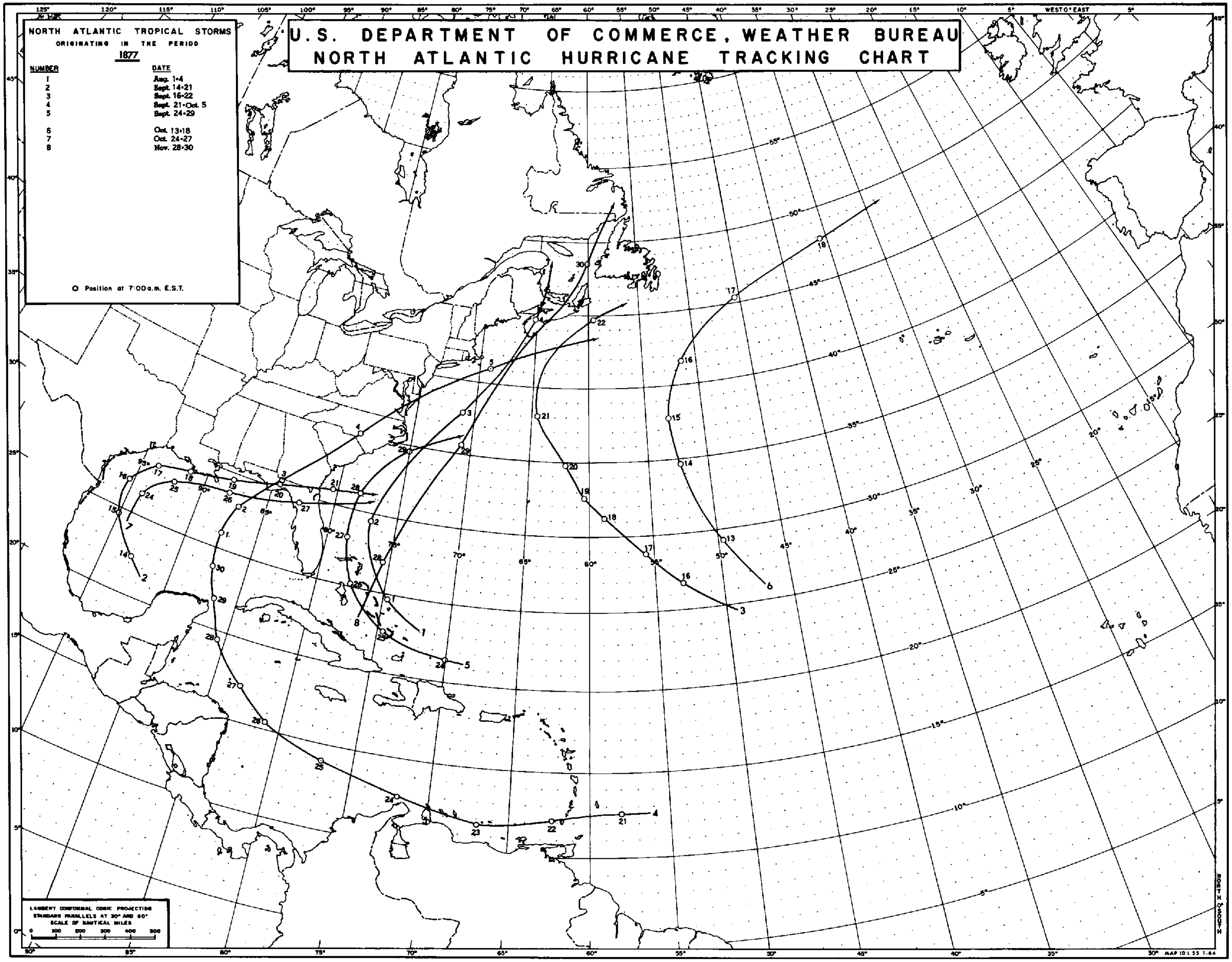
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1876
NUMBER
1
2
3
DATE
Sept. 12-19
Sept. 16-18
Oct. 12-22
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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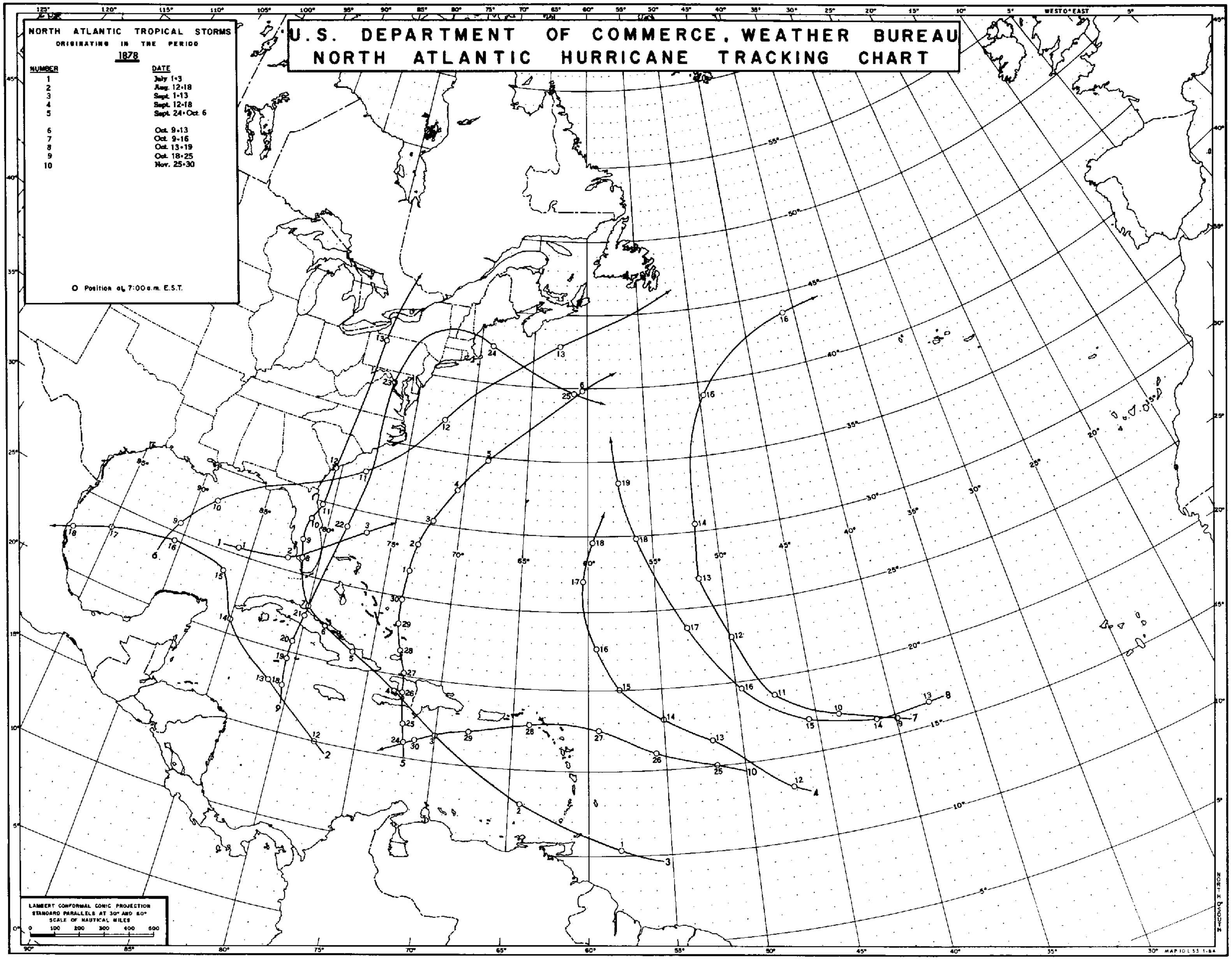
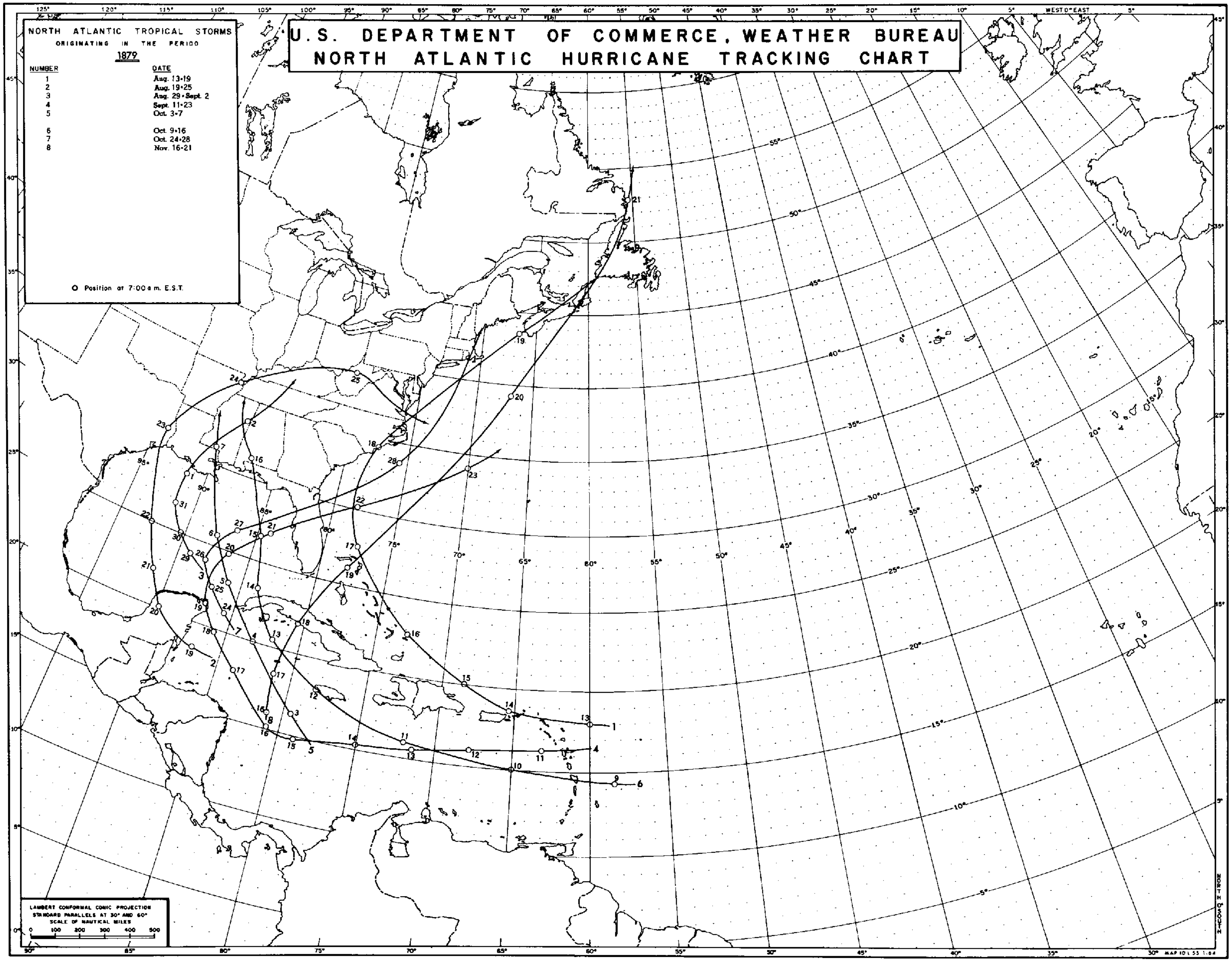
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1877
NUMBER
DATE
1 Aug. 1-4
2 Sept. 14-21
3 Sept. 16-22
4 Sept. 21-Oct. 5
5 Sept. 24-29
6 Oct. 13-18
7 Oct. 24-27
8 Nov. 28-30
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS 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
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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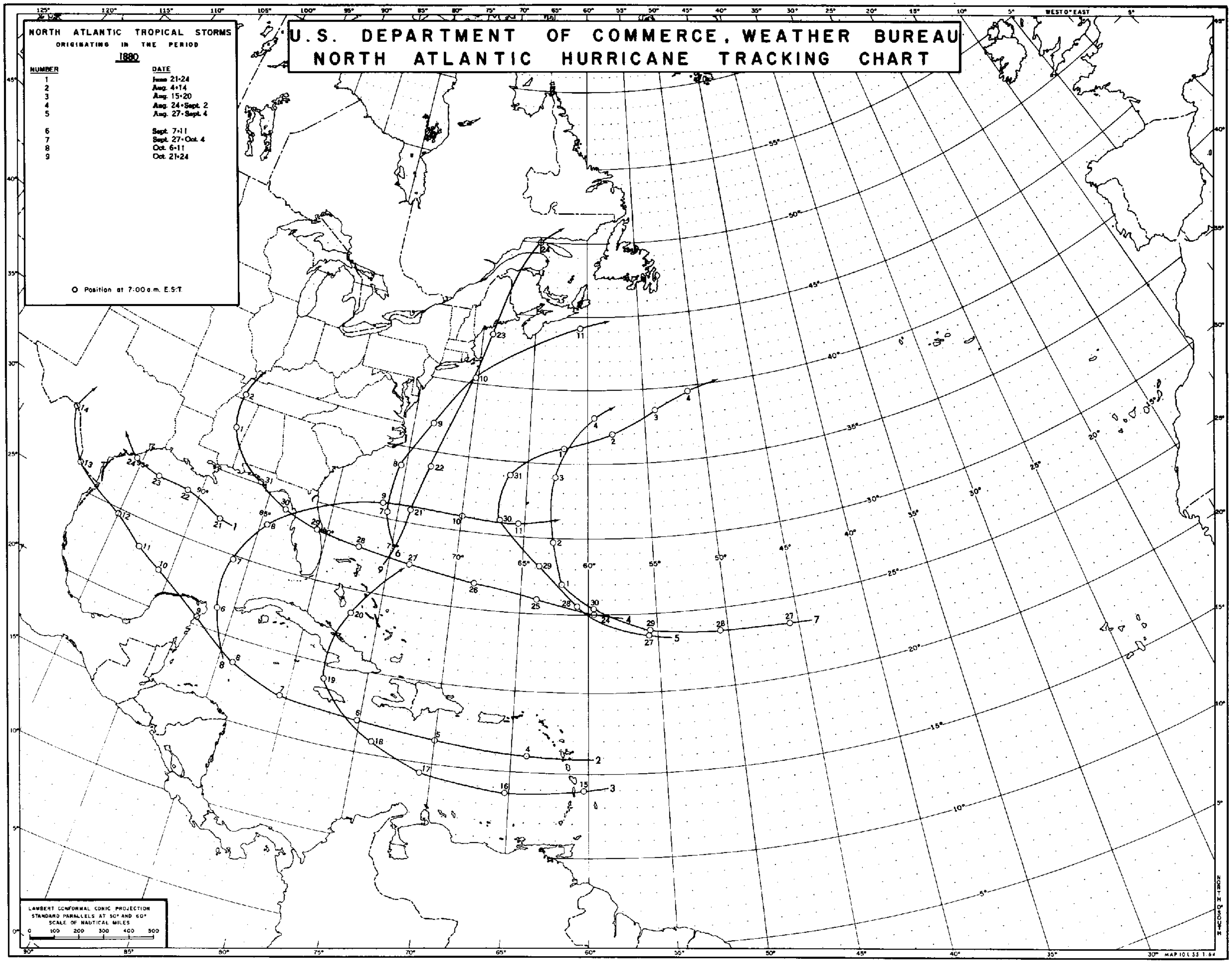
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1879
NUMBER DATE
1 Aug. 13-19
2 Aug. 19-25
3 Aug. 29 - Sept. 2
4 Sept. 11-23
5 Oct. 3-7
6 Oct. 9-16
7 Oct. 24-28
8 Nov. 16-21
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES



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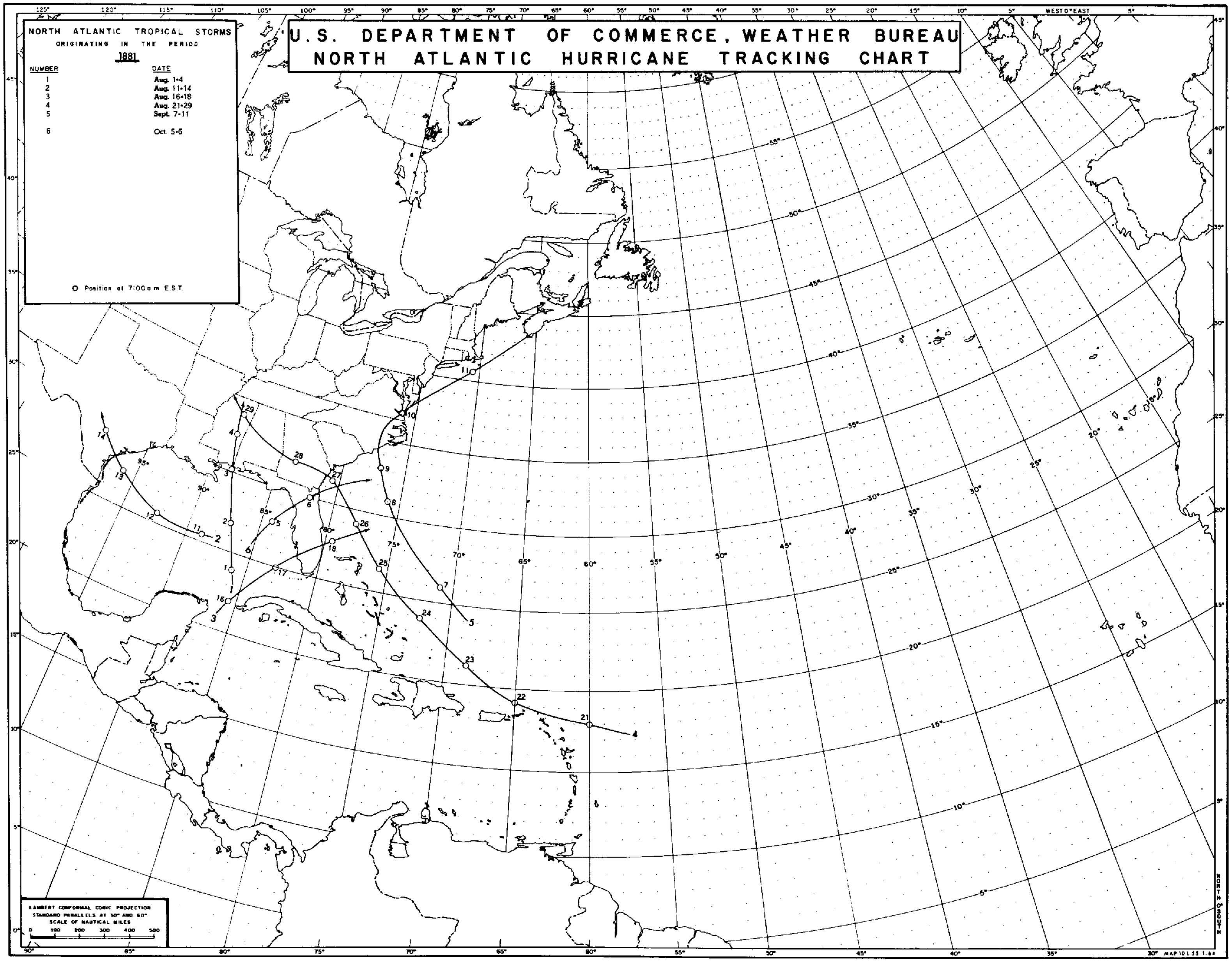
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1880
NUMBER DATE
1 June 21-24
2 Aug. 4-14
3 Aug. 15-20
4 Aug. 24-Sept. 2
5 Aug. 27-Sept. 4
6 Sept. 7-11
7 Sept. 27-Oct. 4
8 Oct. 6-11
9 Oct. 21-24
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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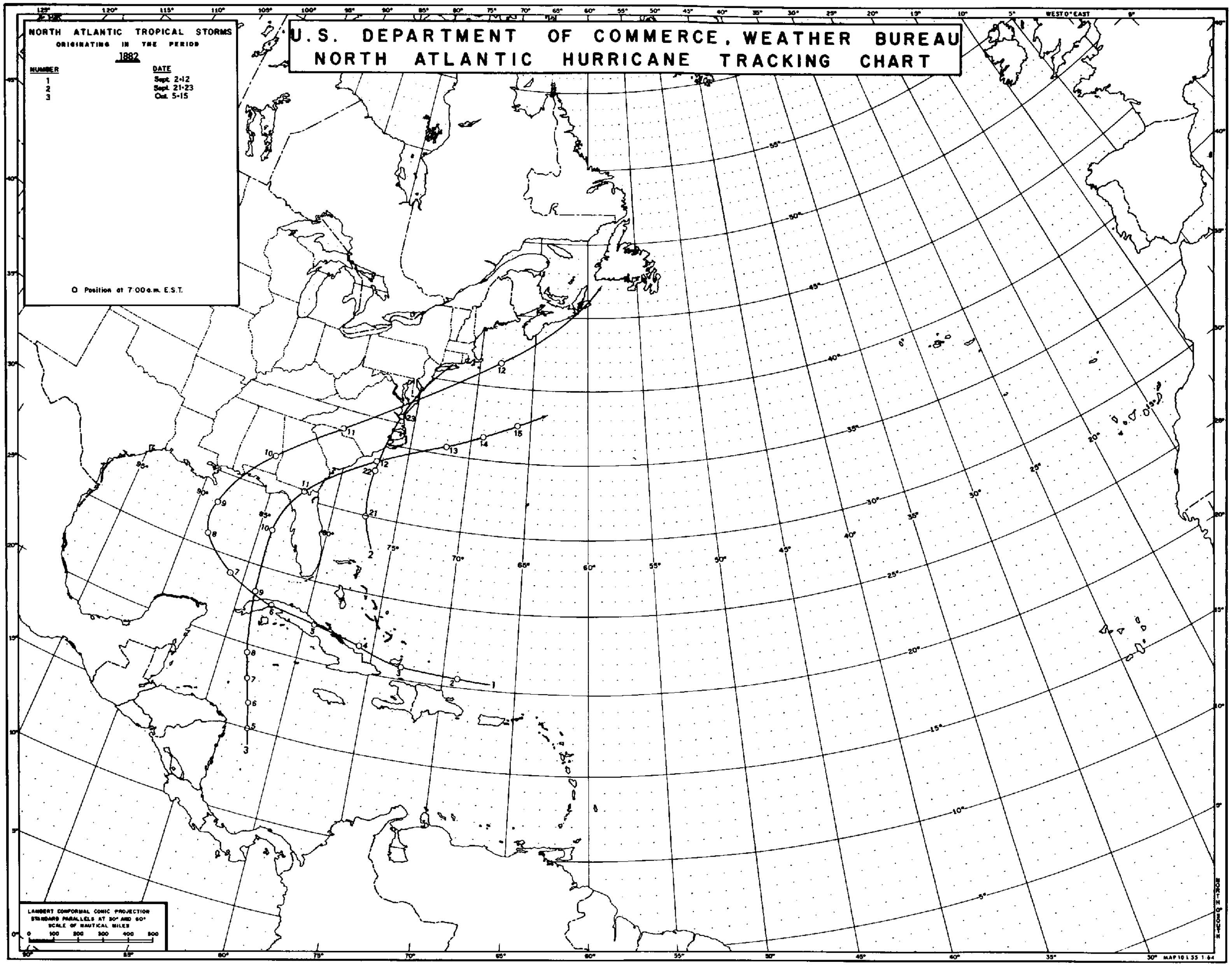
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1881
NUMBER DATE
1 Aug. 1-4
2 Aug. 11-14
3 Aug. 16-18
4 Aug. 21-29
5 Sept. 7-11
6 Oct. 5-6
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES



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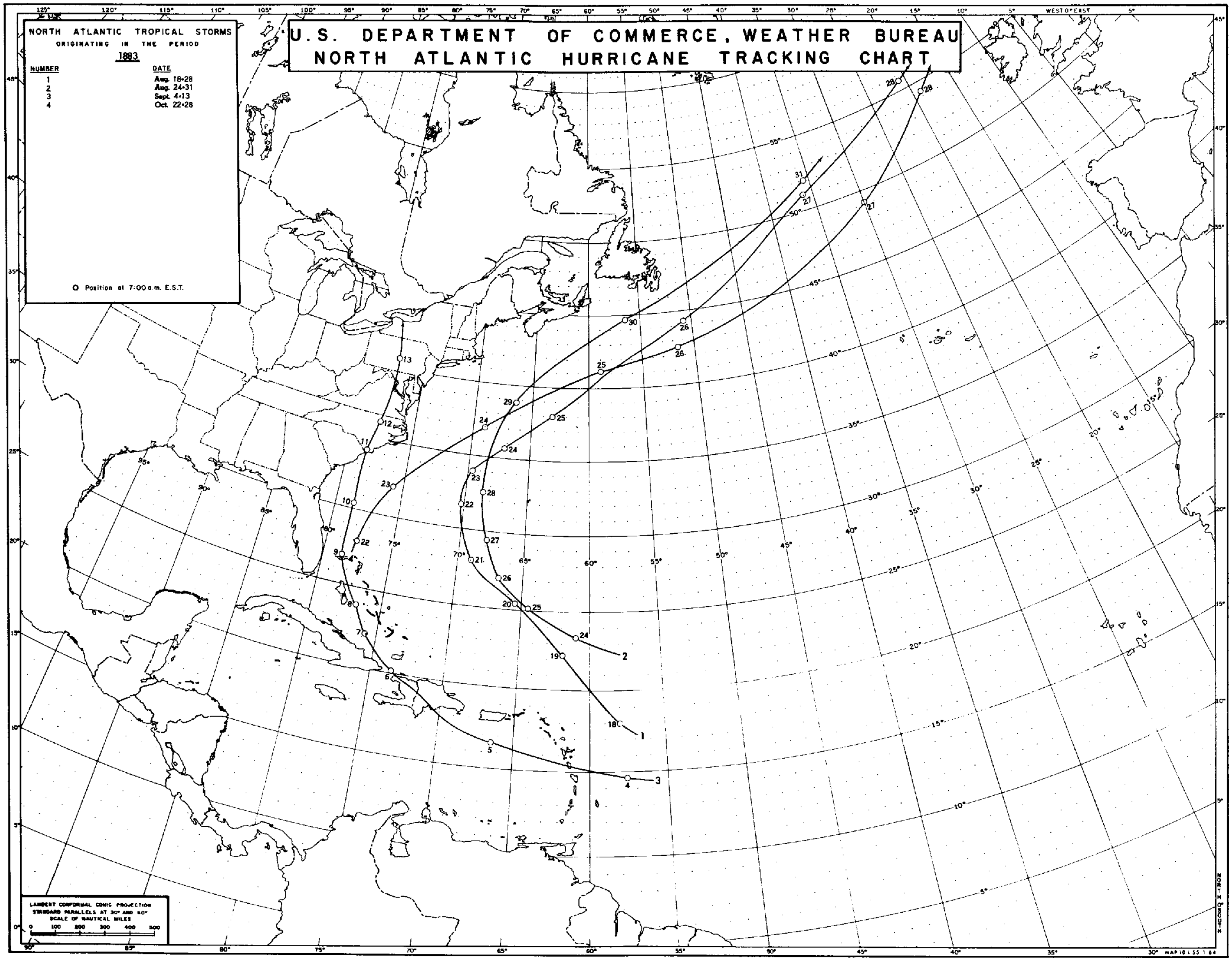
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1882
NUMBER
DATE
1 Sept. 2-12
2 Sept. 21-23
3 Oct. 5-15
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500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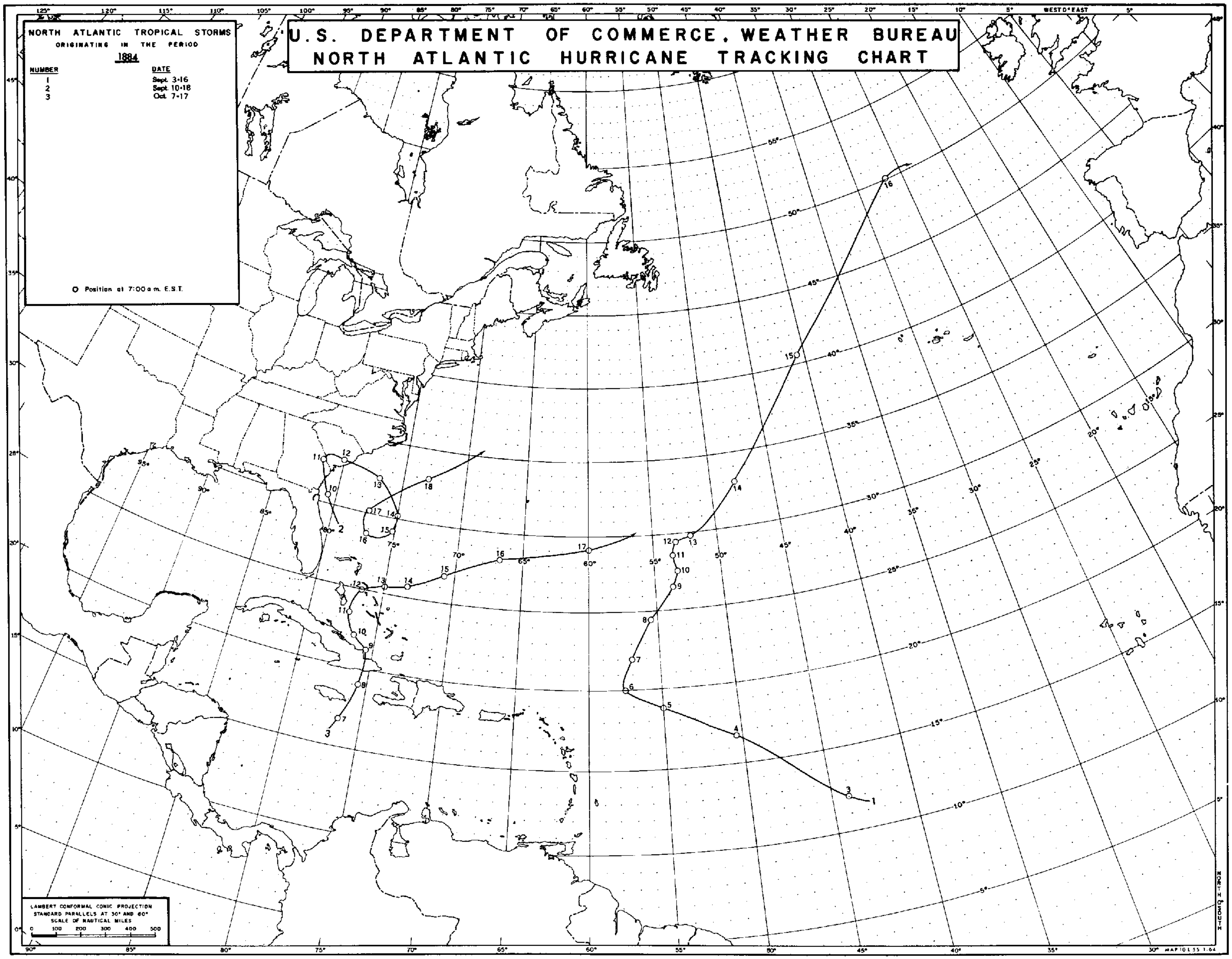
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1883
NUMBER
DATE
1 Aug. 18-28
2 Aug. 24-31
3 Sept. 4-13
4 Oct. 22-28
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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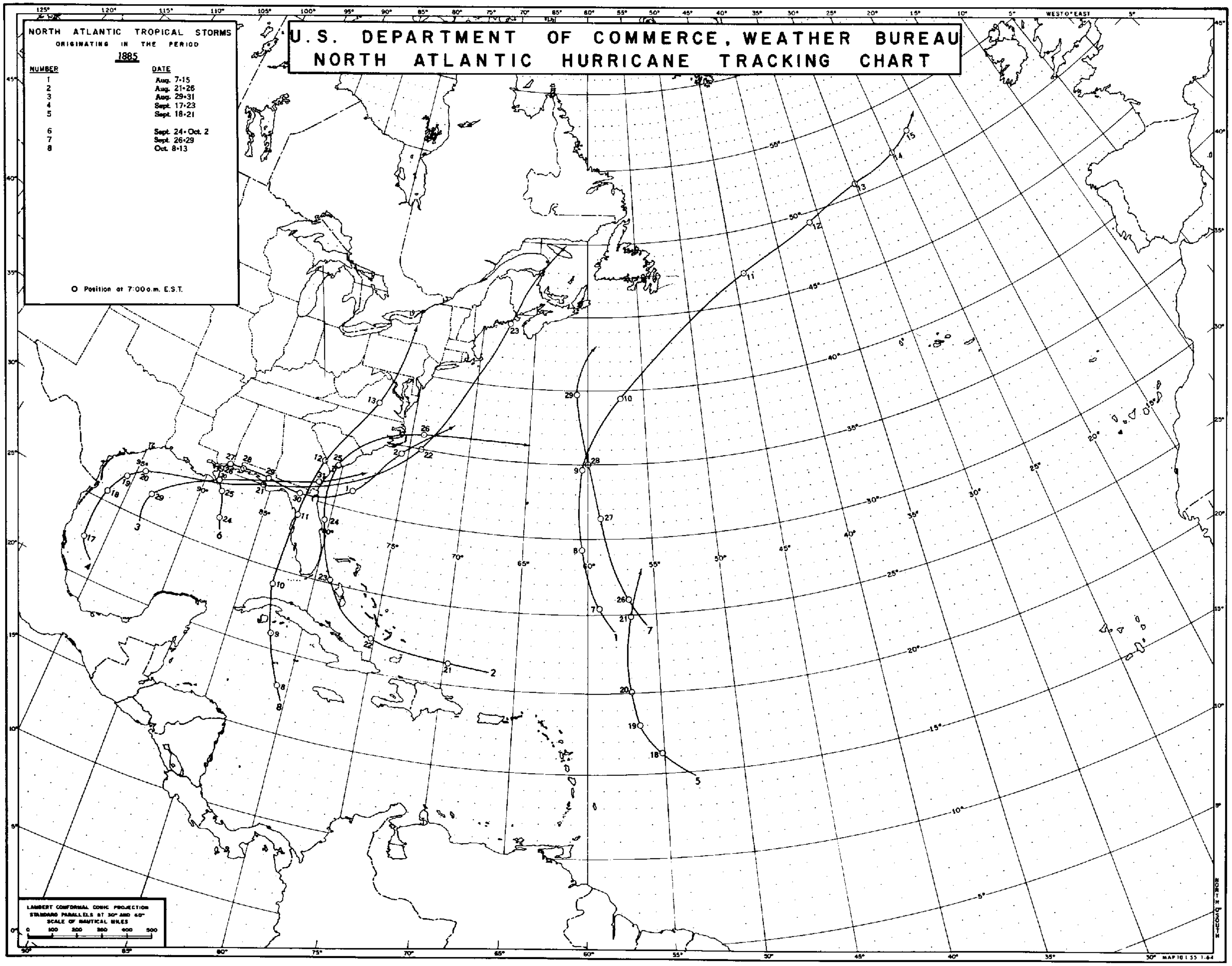
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1884
NUMBER DATE
1 Sept. 3-16
2 Sept. 10-18
3 Oct. 7-17
○ Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500



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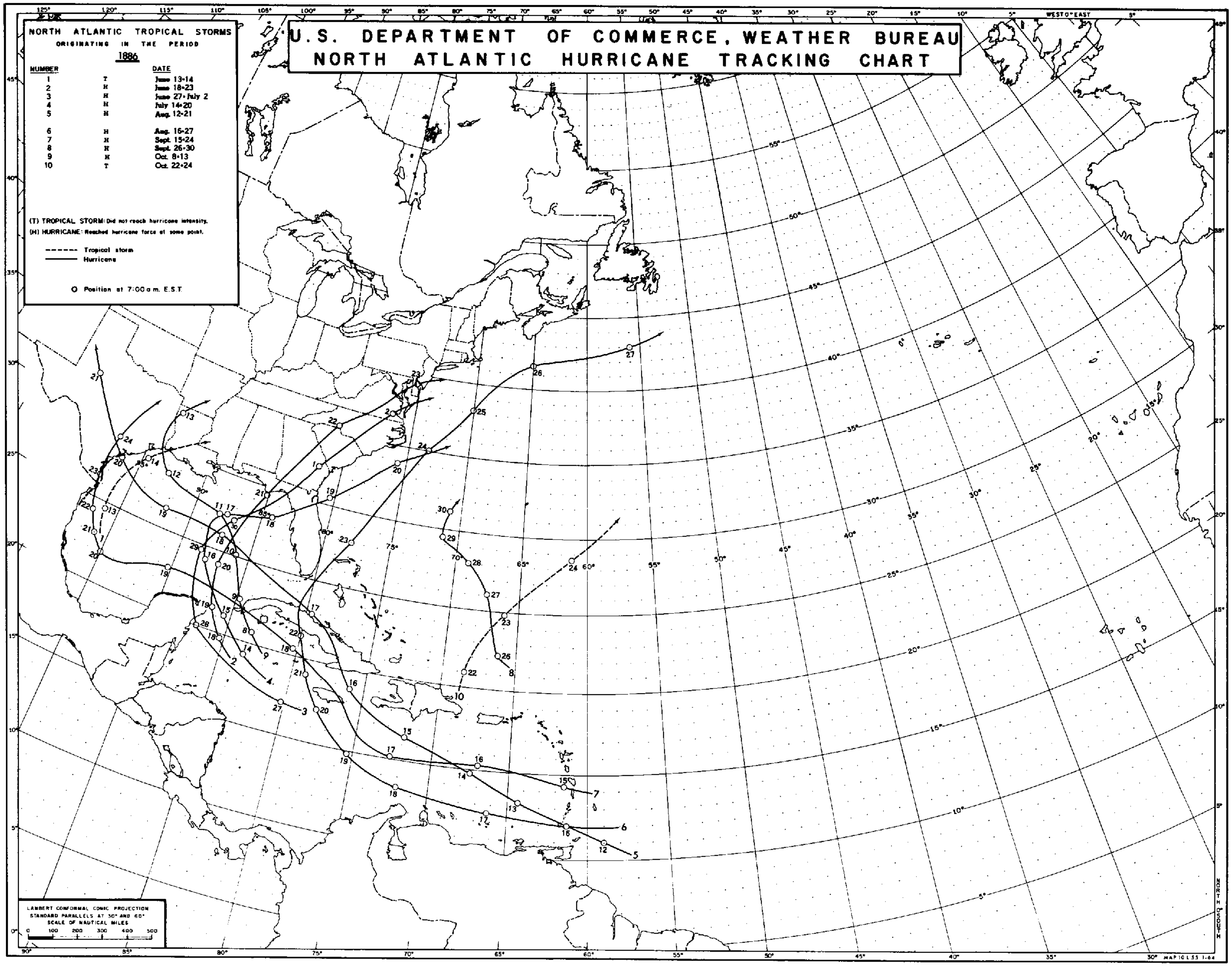
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1885
NUMBER
DATE
1 Aug. 7-15
2 Aug. 21-26
3 Aug. 29-31
4 Sept. 17-23
5 Sept. 18-21
6 Sept. 24-Oct. 2
7 Sept. 26-29
8 Oct. 8-13
O Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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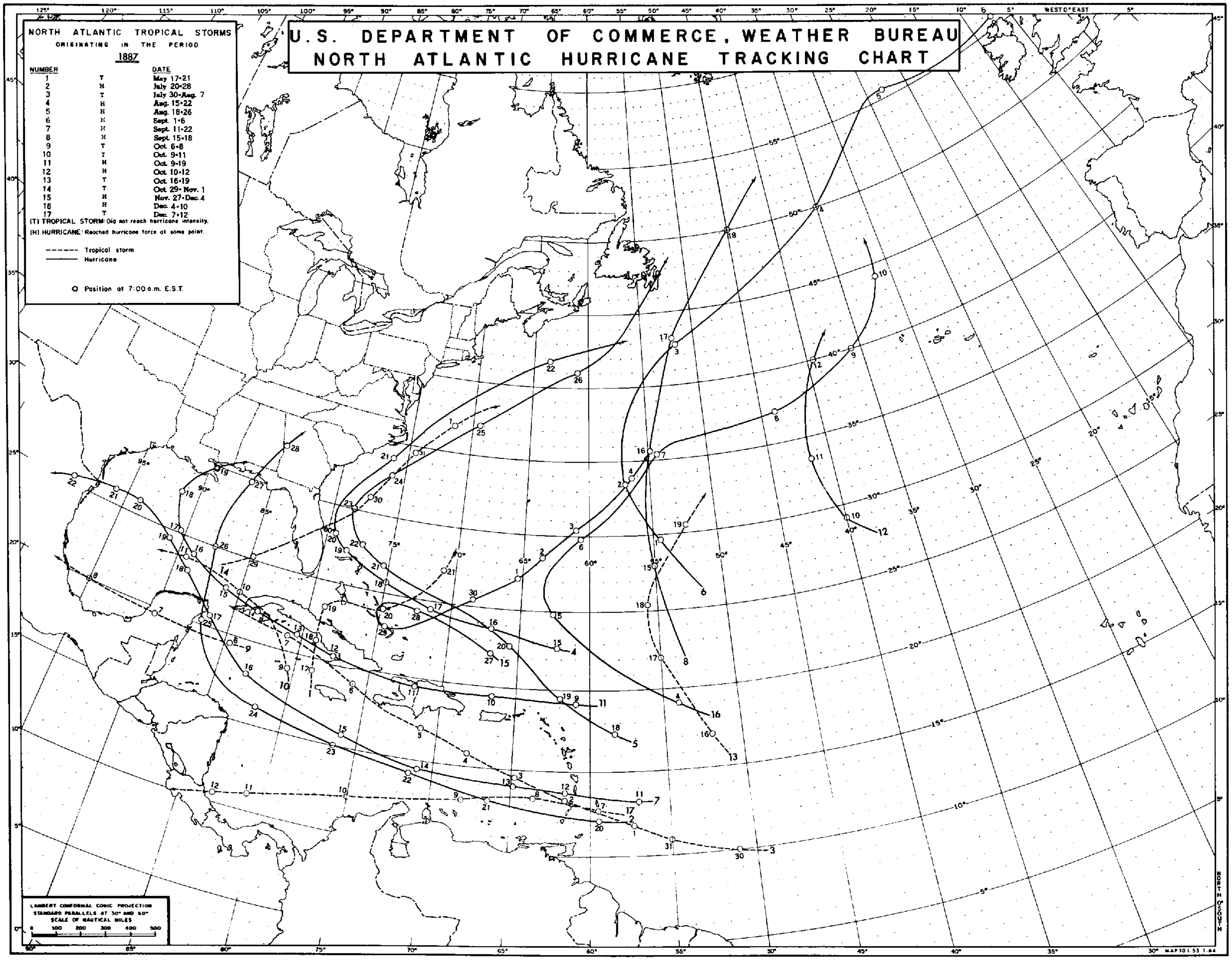
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1886
NUMBER DATE
1 T June 13-14
2 H June 18-23
3 H June 27-July 2
4 H July 14-20
5 H Aug. 12-21
6 H Aug. 16-27
7 H Sept. 15-24
8 H Sept. 26-30
9 H Oct. 8-13
10 T Oct. 22-24
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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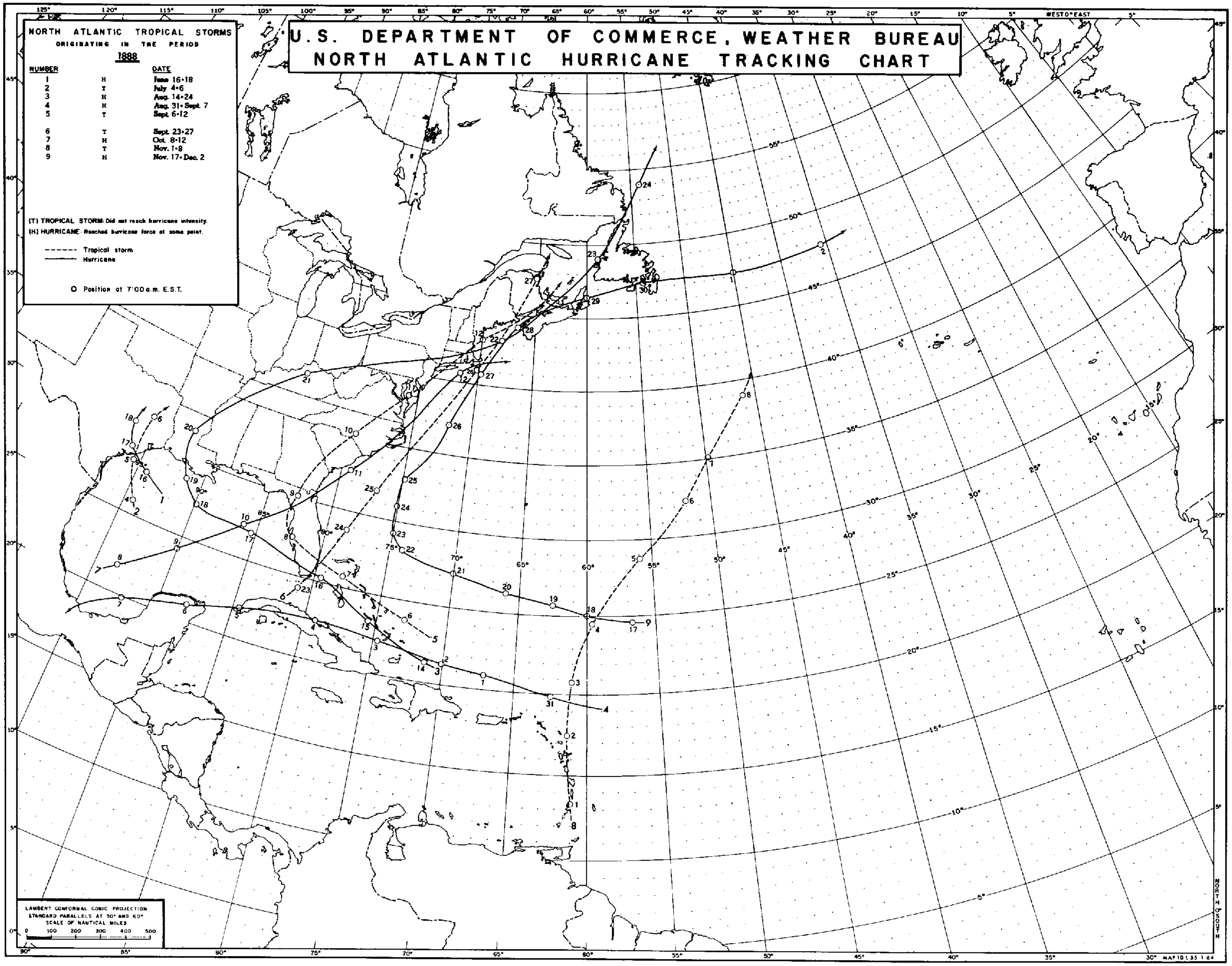
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1887
NUMBER DATE
1 T May 17-21
2 H July 20-28
3 T July 30-Aug. 7
4 H Aug. 15-22
5 H Aug. 18-26
6 H Sept. 1-6
7 H Sept. 11-22
8 H Sept. 15-18
9 T Oct. 6-8
10 T Oct. 9-11
11 H Oct. 9-19
12 H Oct. 10-12
13 T Oct. 16-19
14 T Oct. 29-Nov. 1
15 H Nov. 27-Dec. 4
16 H Dec. 4-10
17 T Dec. 7-12
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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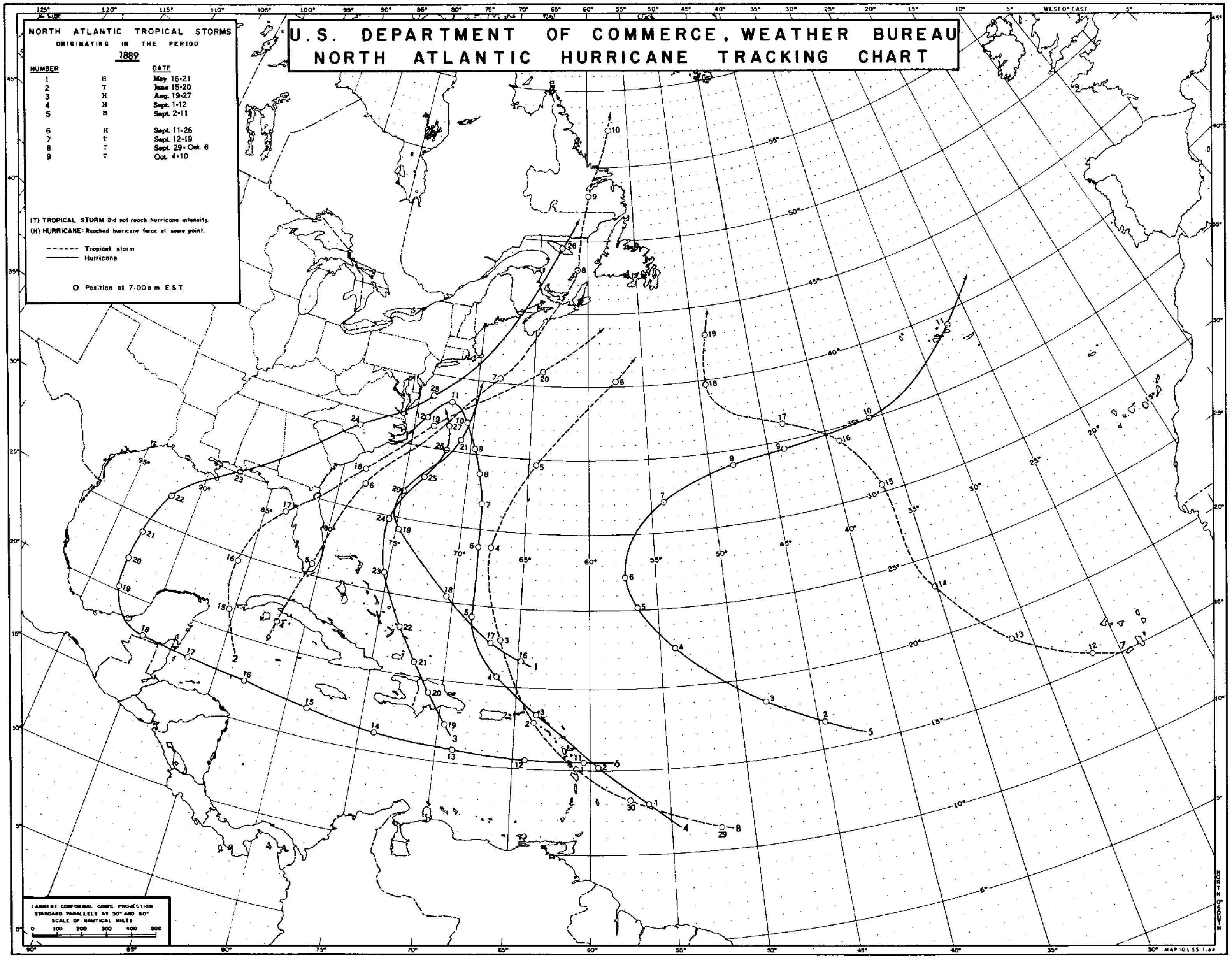
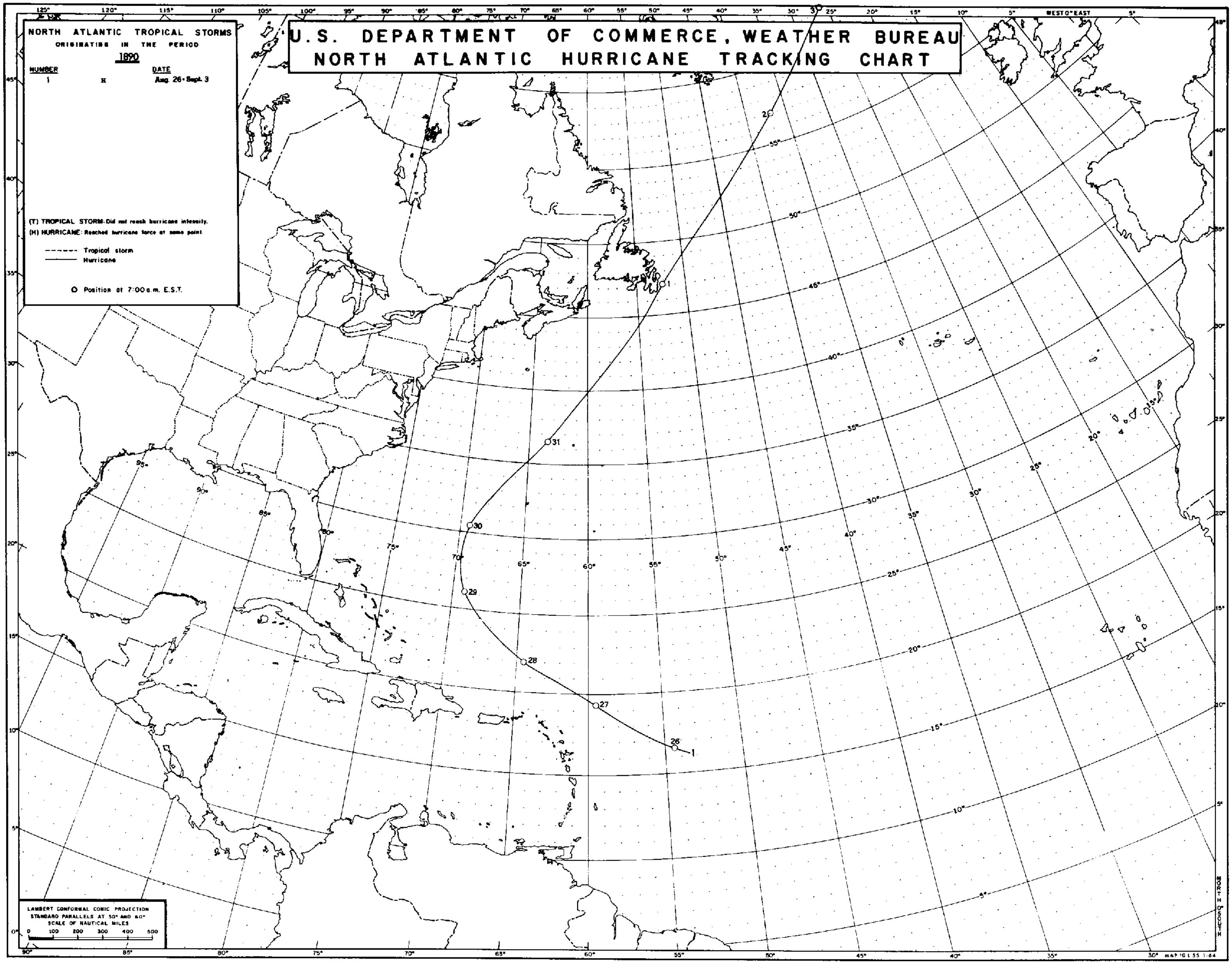
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1888
NUMBER DATE
1 H June 16-18
2 T July 4-6
3 H Aug. 14-24
4 H Aug. 31-Sept. 7
5 T Sept. 6-12
6 T Sept. 23-27
7 H Oct. 8-12
8 T Nov. 1-8
9 H Nov. 17-Dec. 2
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
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
1889
NUMBER
DATE
1 H May 16-21
2 T June 15-20
3 H Aug. 19-27
4 H Sept. 1-12
5 H Sept. 2-11
6 H Sept. 11-26
7 T Sept. 12-19
8 T Sept. 29 - Oct. 6
9 T Oct. 4-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES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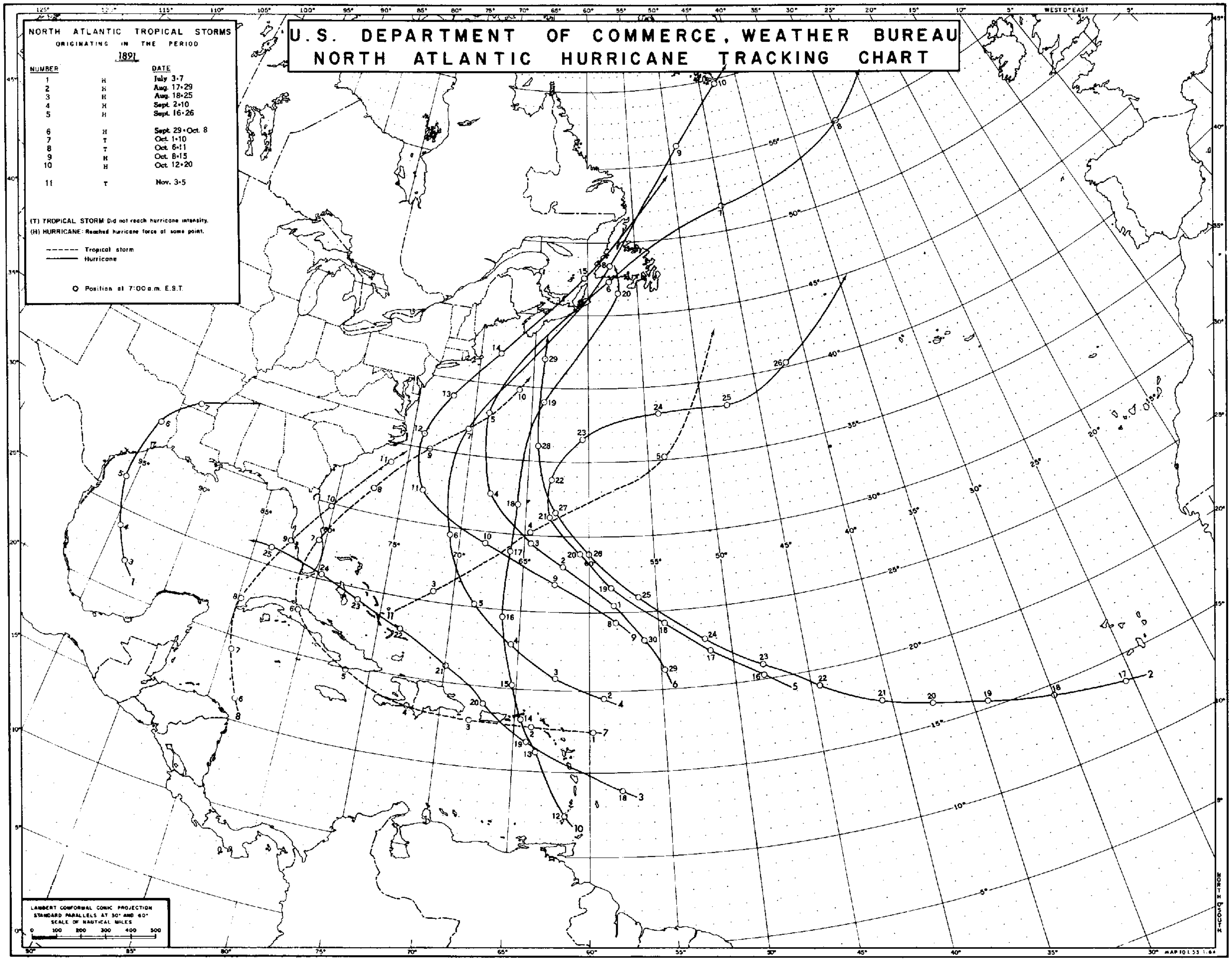
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1890
NUMBER
DATE
1
H
Aug. 26 - Sept. 3
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm
Hurricane
Position at 7:00 a.m. E.S.T.
26
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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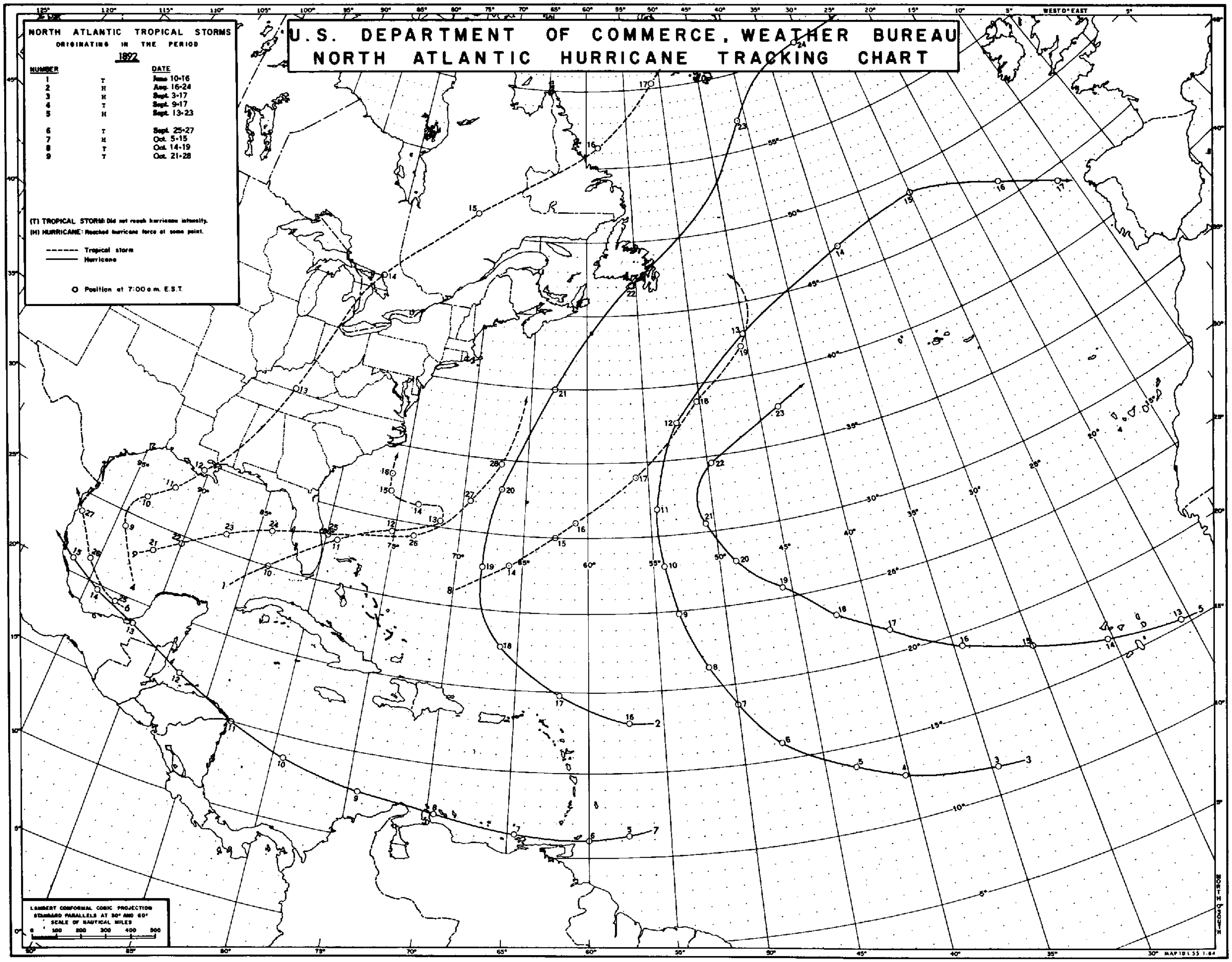
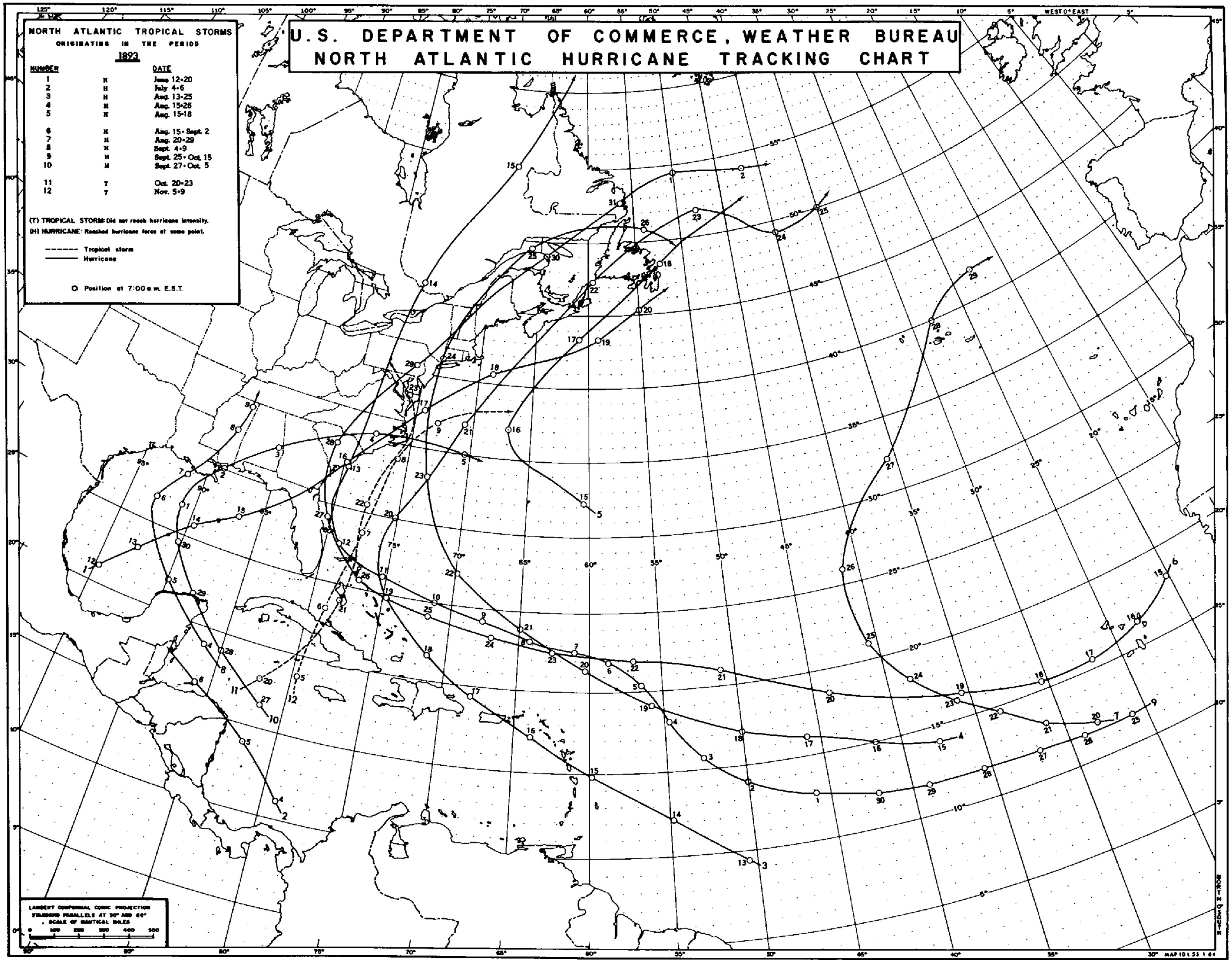
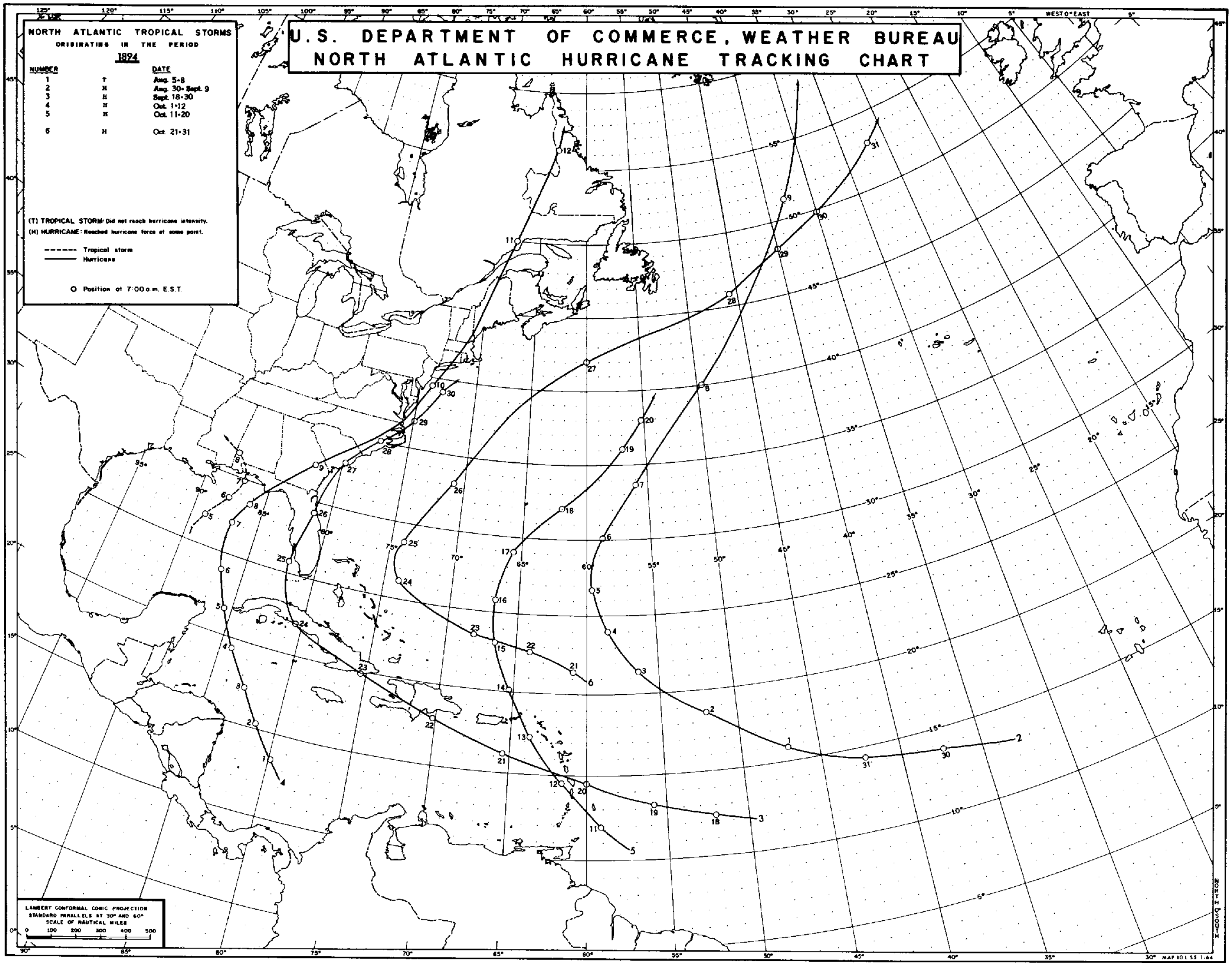
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1891
NUMBER
DATE
1 H July 3-7
2 H Aug. 17-29
3 H Aug. 18-25
4 H Sept. 2-10
5 H Sept. 16-26
6 H Sept. 29-Oct. 8
7 T Oct. 1-10
8 T Oct. 6-11
9 H Oct. 8-15
10 H Oct. 12-20
11 T Nov. 3-5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: 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

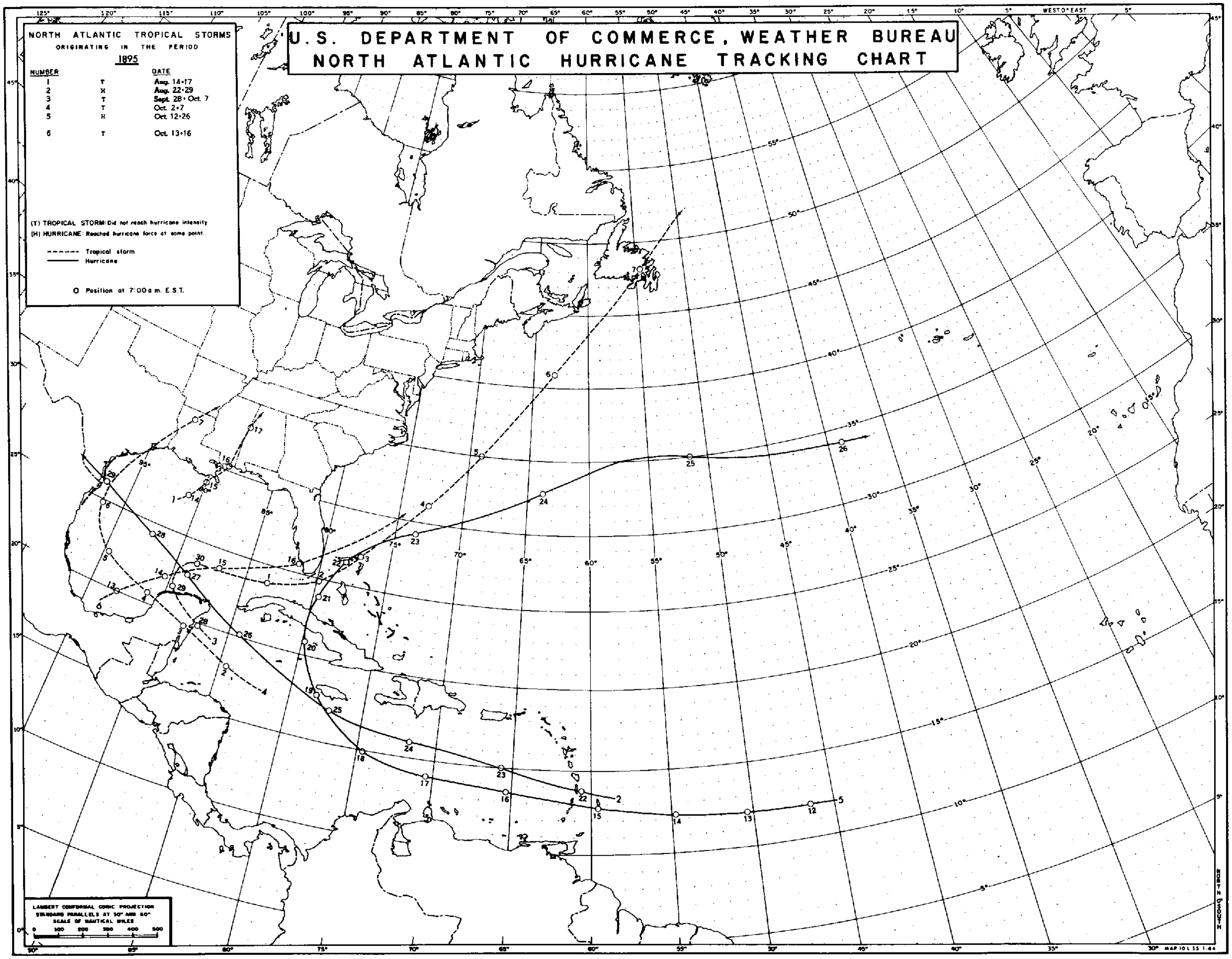

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1892
NUMBER
DATE
1 T June 10-16
2 H Aug. 16-24
3 H Sept. 3-17
4 T Sept. 9-17
5 H Sept. 13-23
6 T Sept. 25-27
7 H Oct. 5-15
8 T Oct. 14-19
9 T Oct. 21-28
(T) TROPICAL 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES



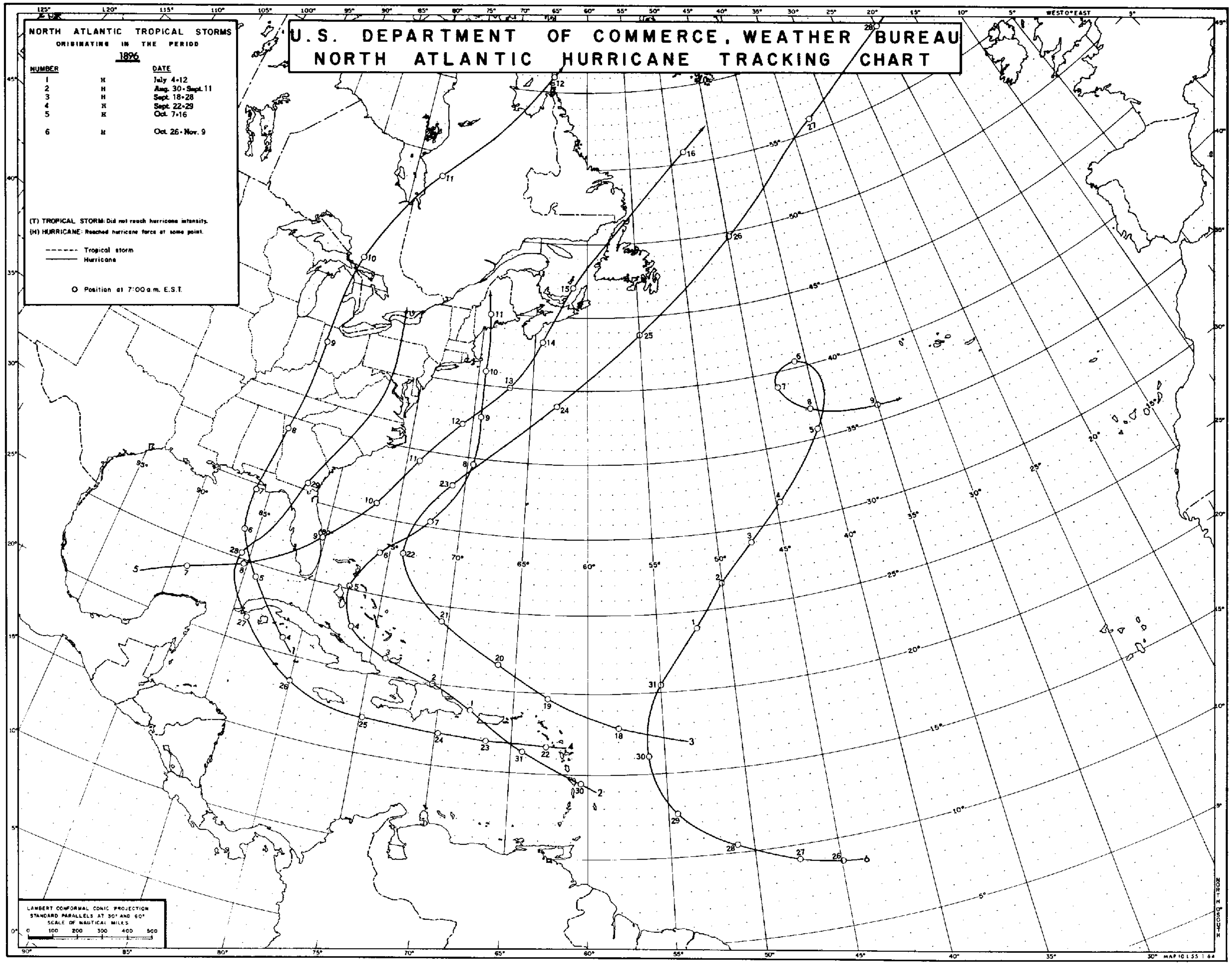
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1893
NUMBER
DATE
1 H June 12-20
2 H July 4-6
3 H Aug. 13-25
4 H Aug. 15-26
5 H Aug. 15-18
6 H Aug. 15 - Sept. 2
7 H Aug. 20-29
8 H Sept. 4-9
9 H Sept. 25 - Oct.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

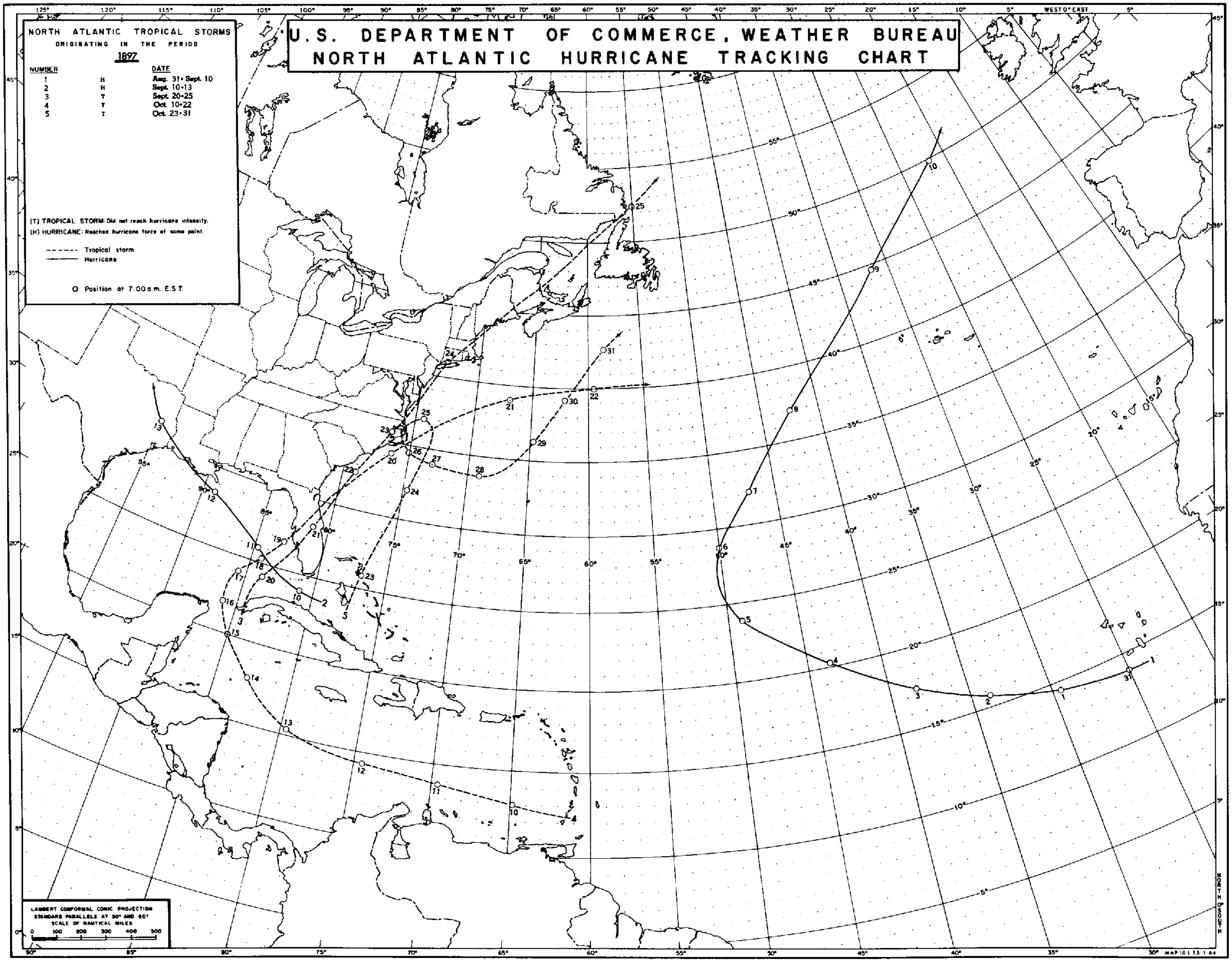


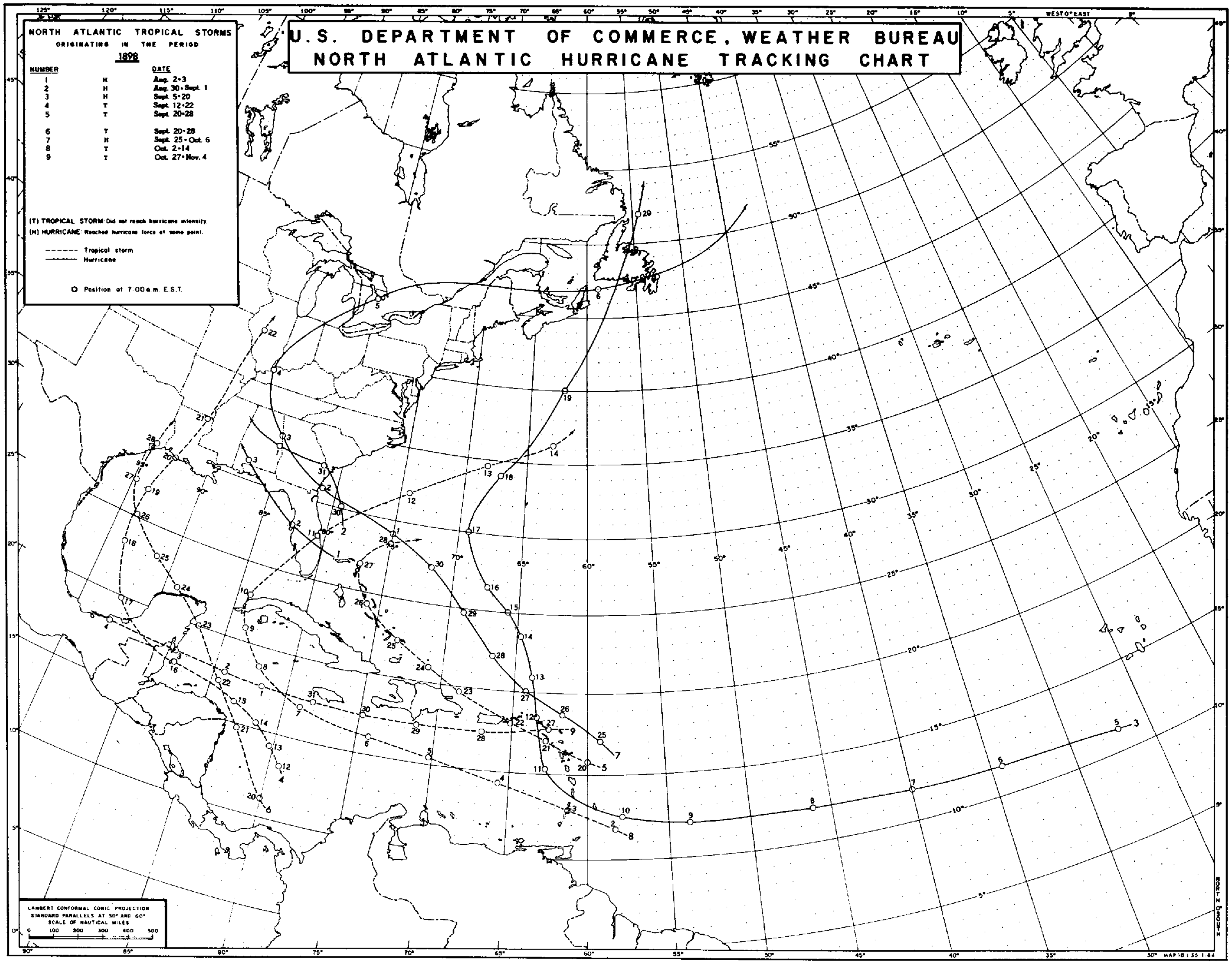
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1894
NUMBER DATE
1 T Aug. 5-8
2 H Aug. 30- Sept. 9
3 H Sept. 18-30
4 H Oct. 1-12
5 H Oct. 11-20
6 H Oct. 21-31
(T) TROPICAL STORM: Did not reach hurricane intensity.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

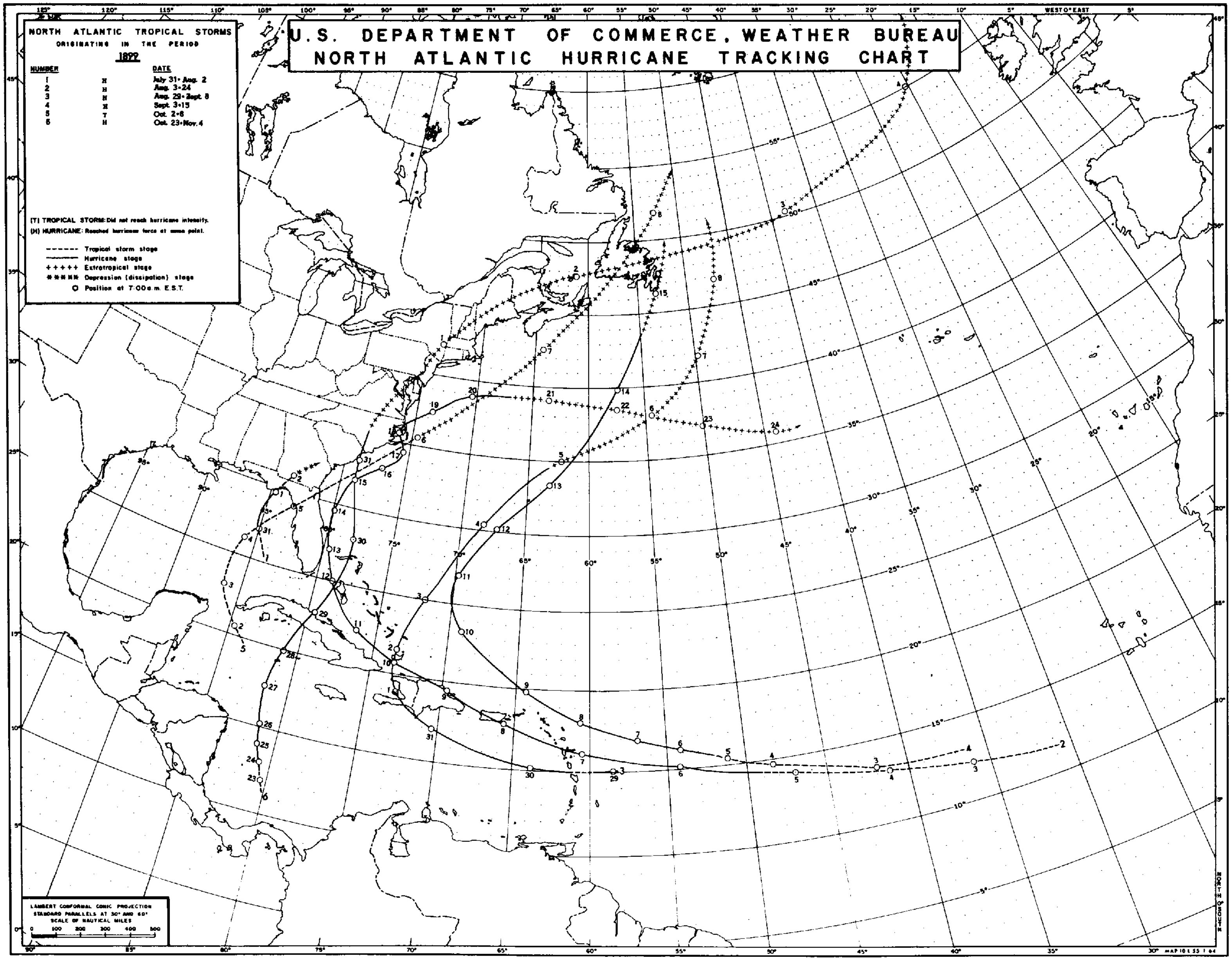


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1895
NUMBER DATE
1 T Aug. 14-17
2 H Aug. 22-29
3 T Sept. 28 - Oct. 7
4 T Oct. 2-7
5 H Oct. 12-26
6 T Oct. 13-16
(T) TROPICAL STORM: Did not reach hurricane intensity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

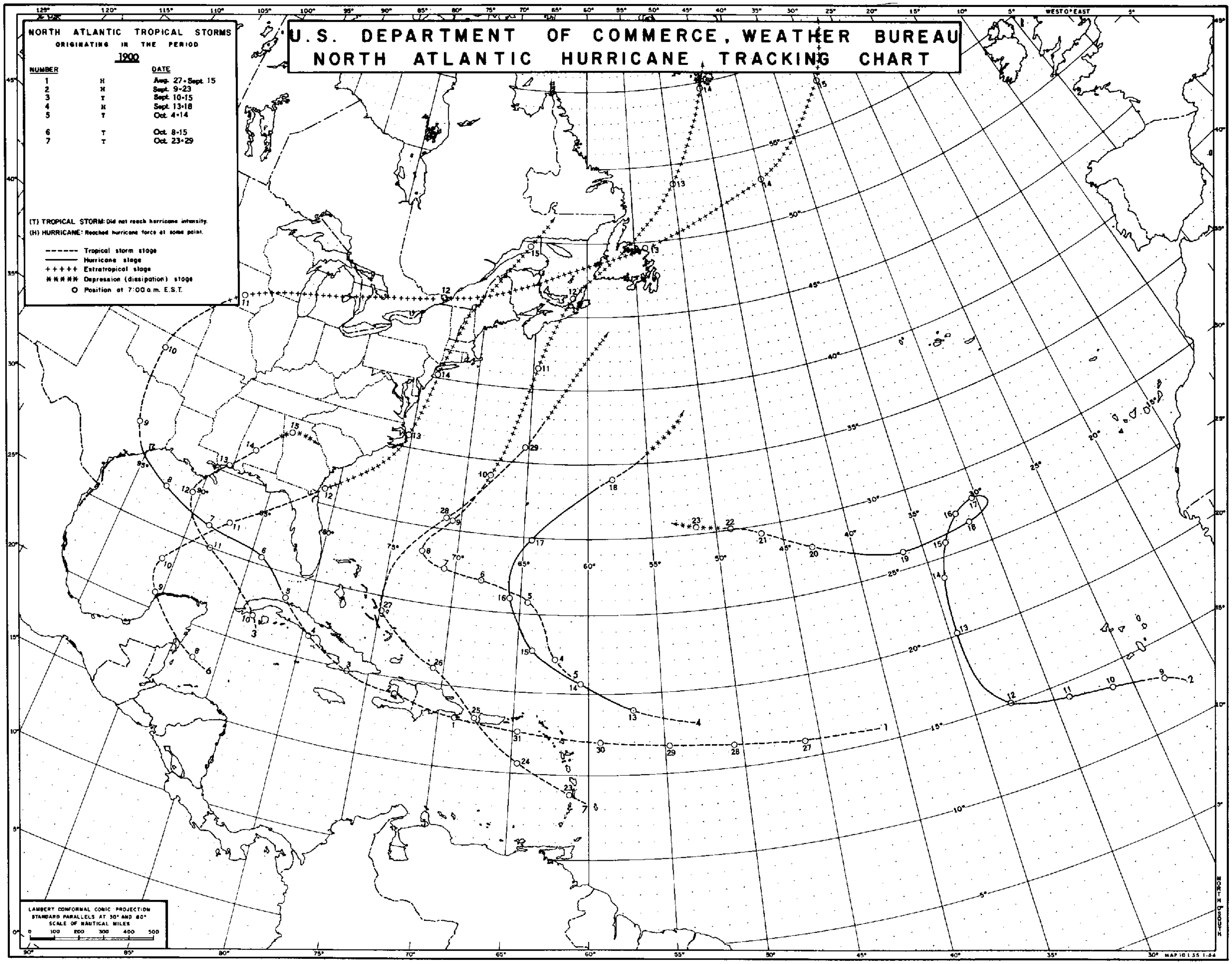

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1896
NUMBER DATE
1 H July 4-12
2 H Aug. 30-Sept. 11
3 H Sept. 18-28
4 H Sept. 22-29
5 H Oct. 7-16
6 H Oct. 26-Nov. 9
(T) TROPICAL STORM: Did not reach hurricane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

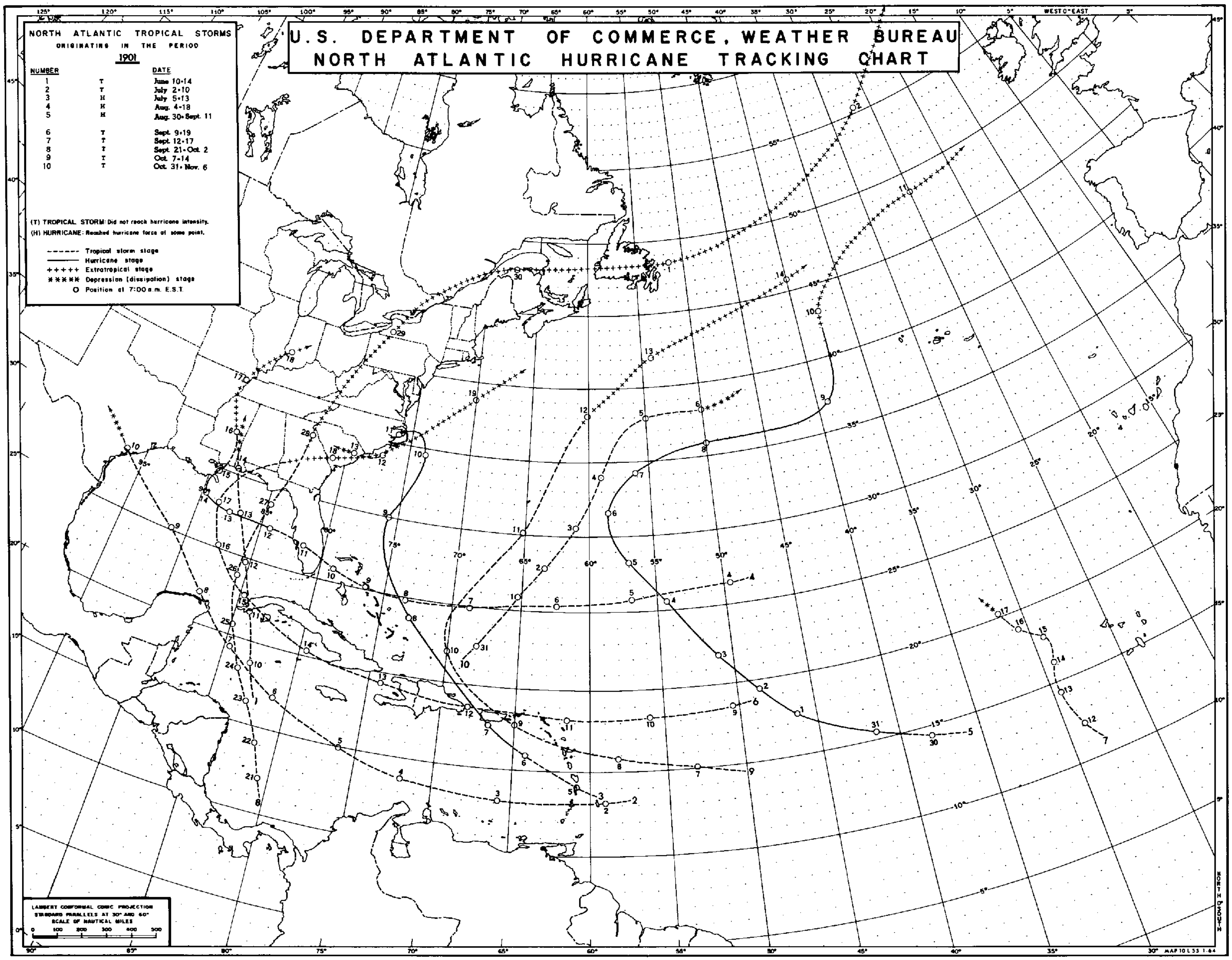

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1897
NUMBER
DATE
1 H Aug. 31 - Sept. 10
2 H Sept. 10-13
3 T Sept. 20-25
4 T Oct. 10-22
5 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H)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

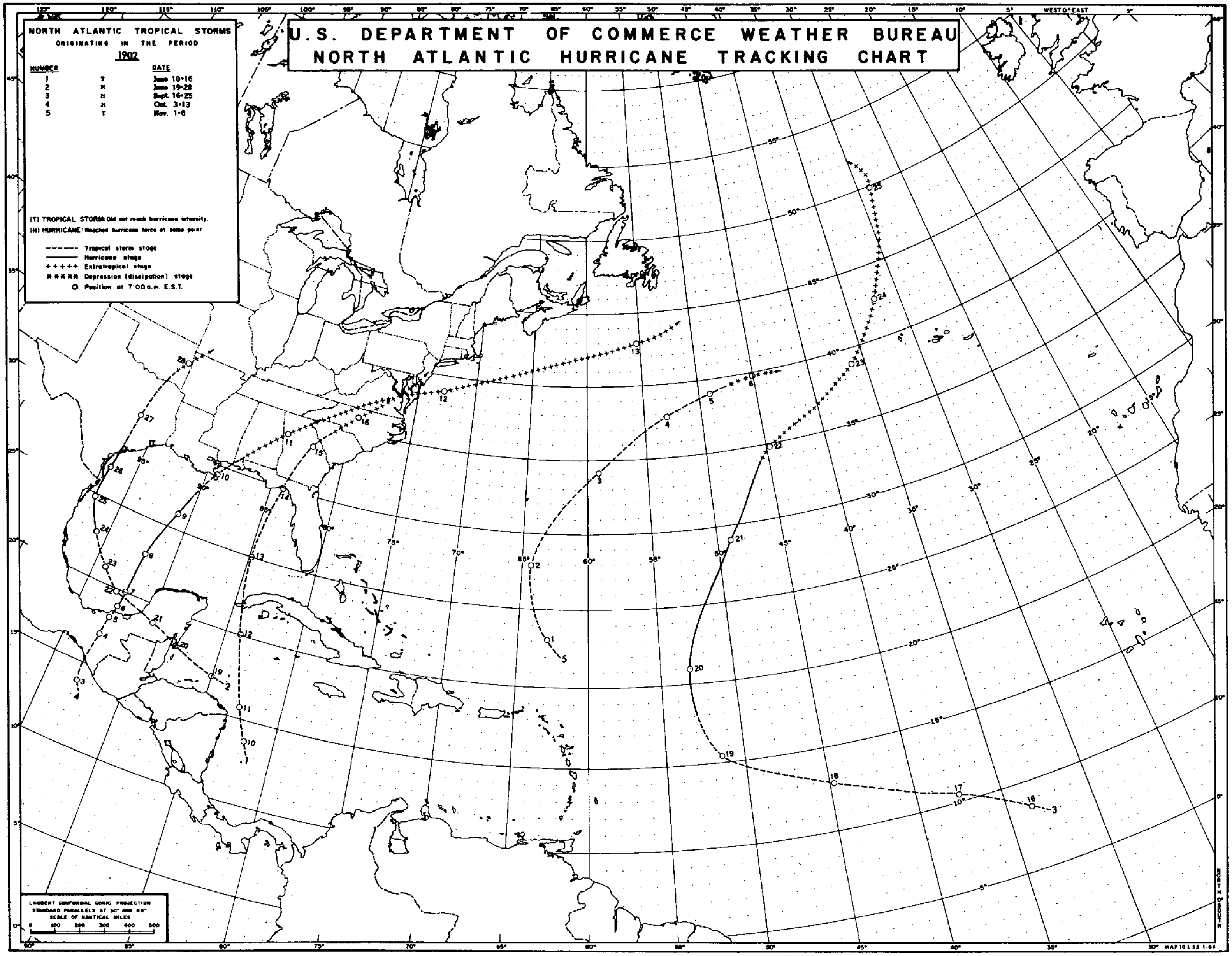


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1899
NUMBER
DATE
1 H July 31-Aug. 2
2 H Aug. 3-24
3 H Aug. 29-Sept. 8
4 H Sept. 3-15
5 T Oct. 2-8
6 H Oct. 23-Nov. 4
(T) TROPICAL STORM: Did not reach hurricane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

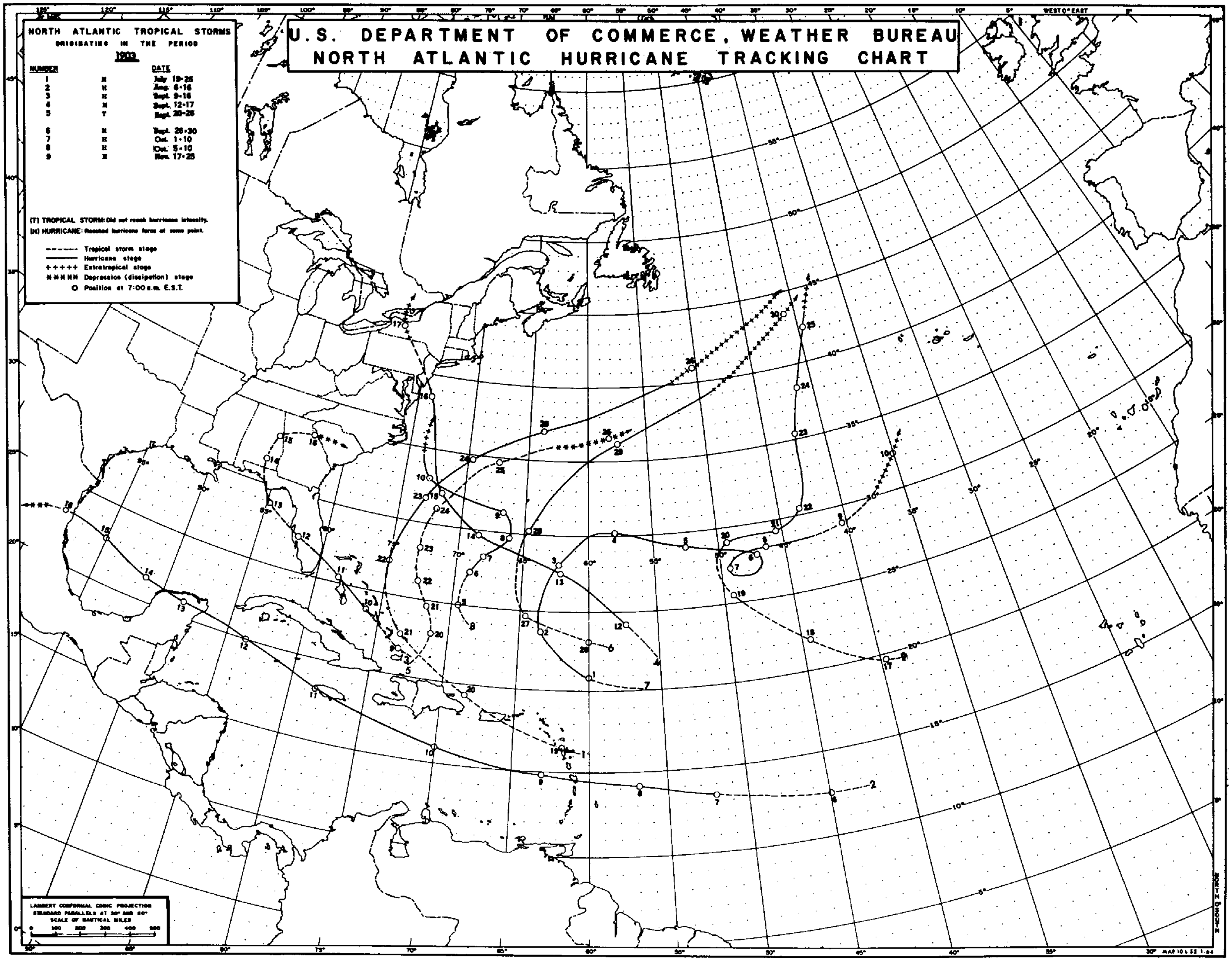

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1900
NUMBER DATE
1 H Aug. 27-Sept. 15
2 H Sept. 9-23
3 T Sept. 10-15
4 H Sept. 13-18
5 T Oct. 4-14
6 T Oct. 8-15
7 T Oct. 23-29
(T) TROPICAL STORM: Did not reach 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
0 100 200 300 400 500

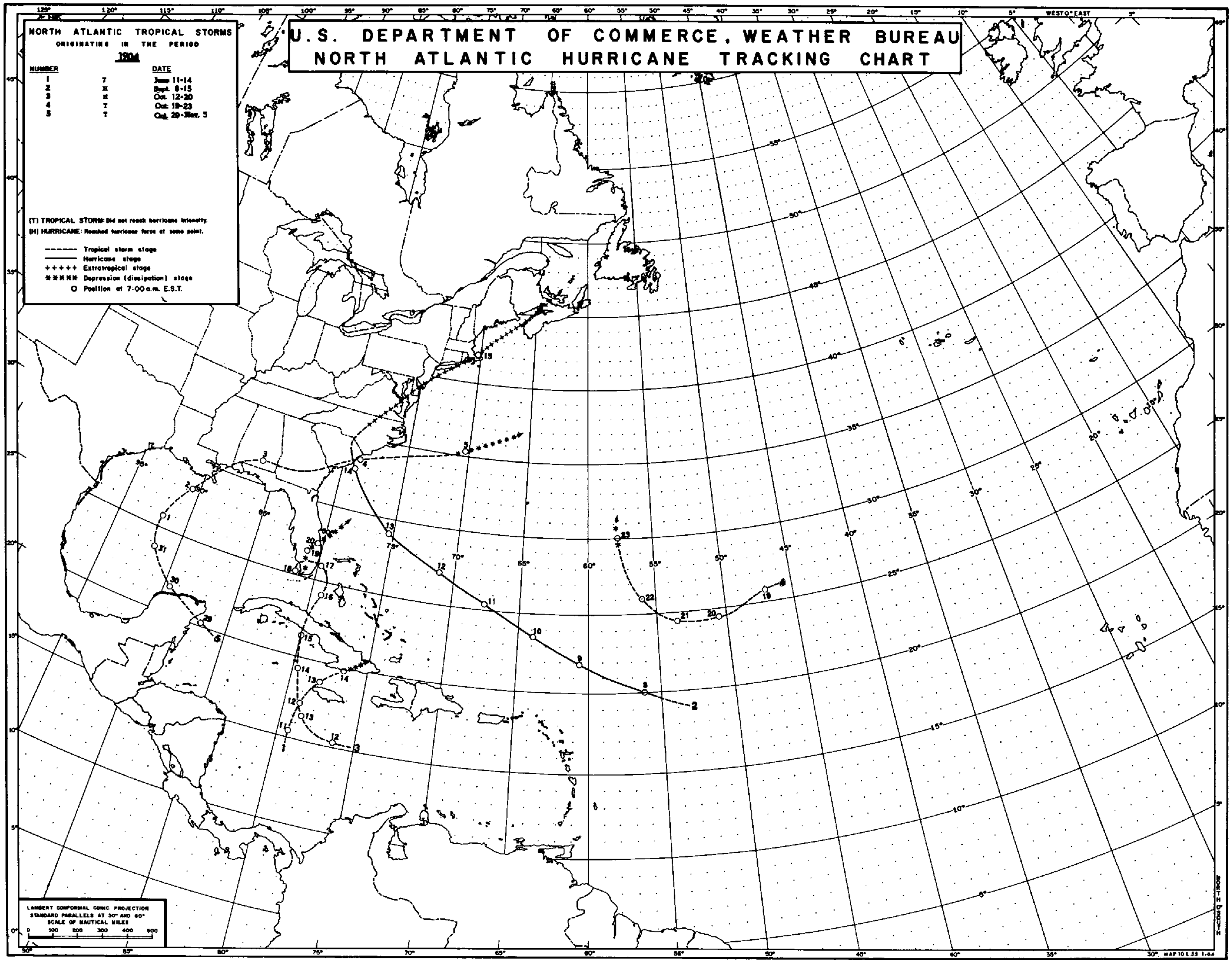


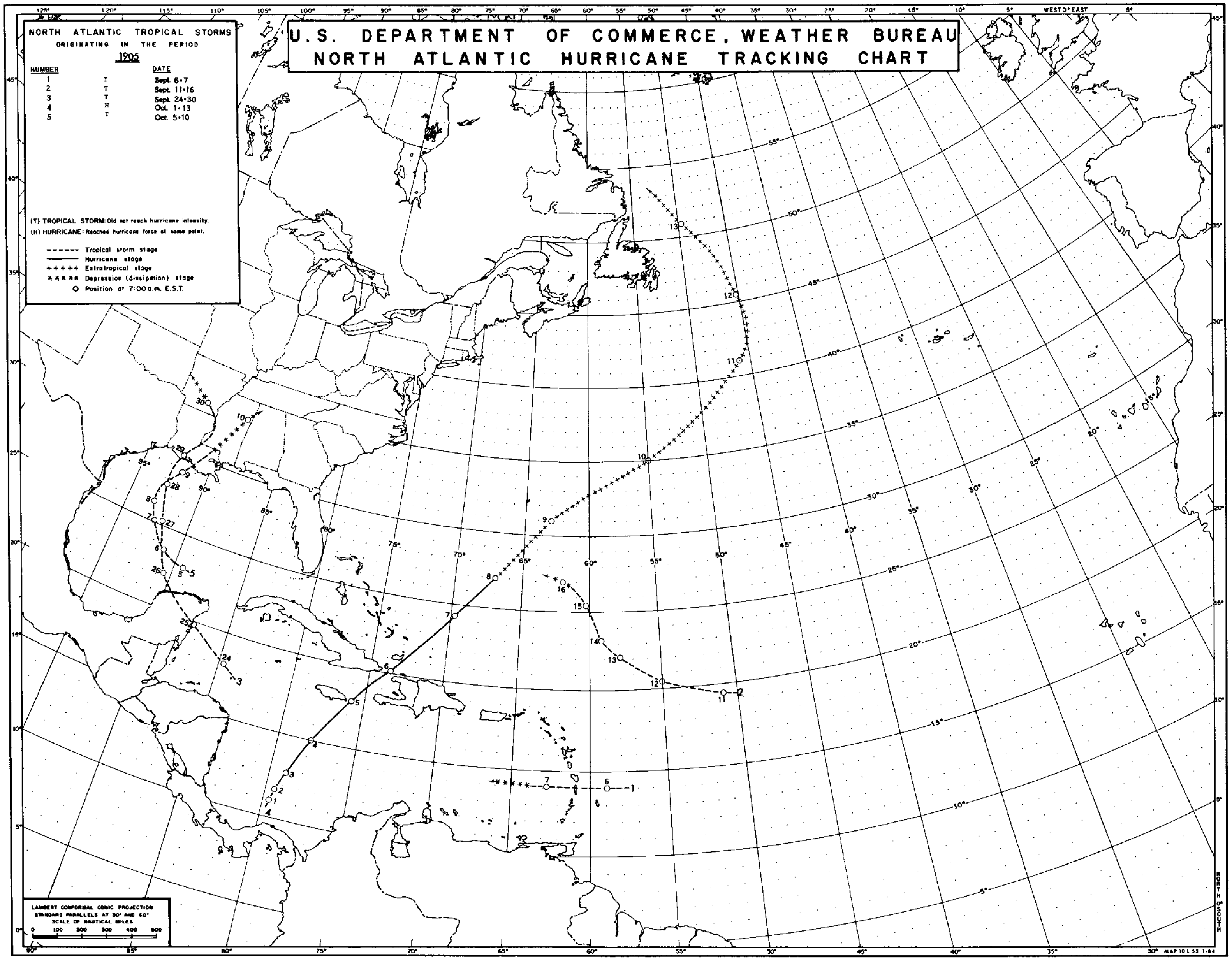
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1901
NUMBER
DATE
1 T June 10-14
2 T July 2-10
3 H July 5-13
4 H Aug. 4-18
5 H Aug. 30-Sept. 11
6 T Sept. 9-19
7 T Sept. 12-17
8 T Sept. 21-Oct. 2
9 T Oct. 7-14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

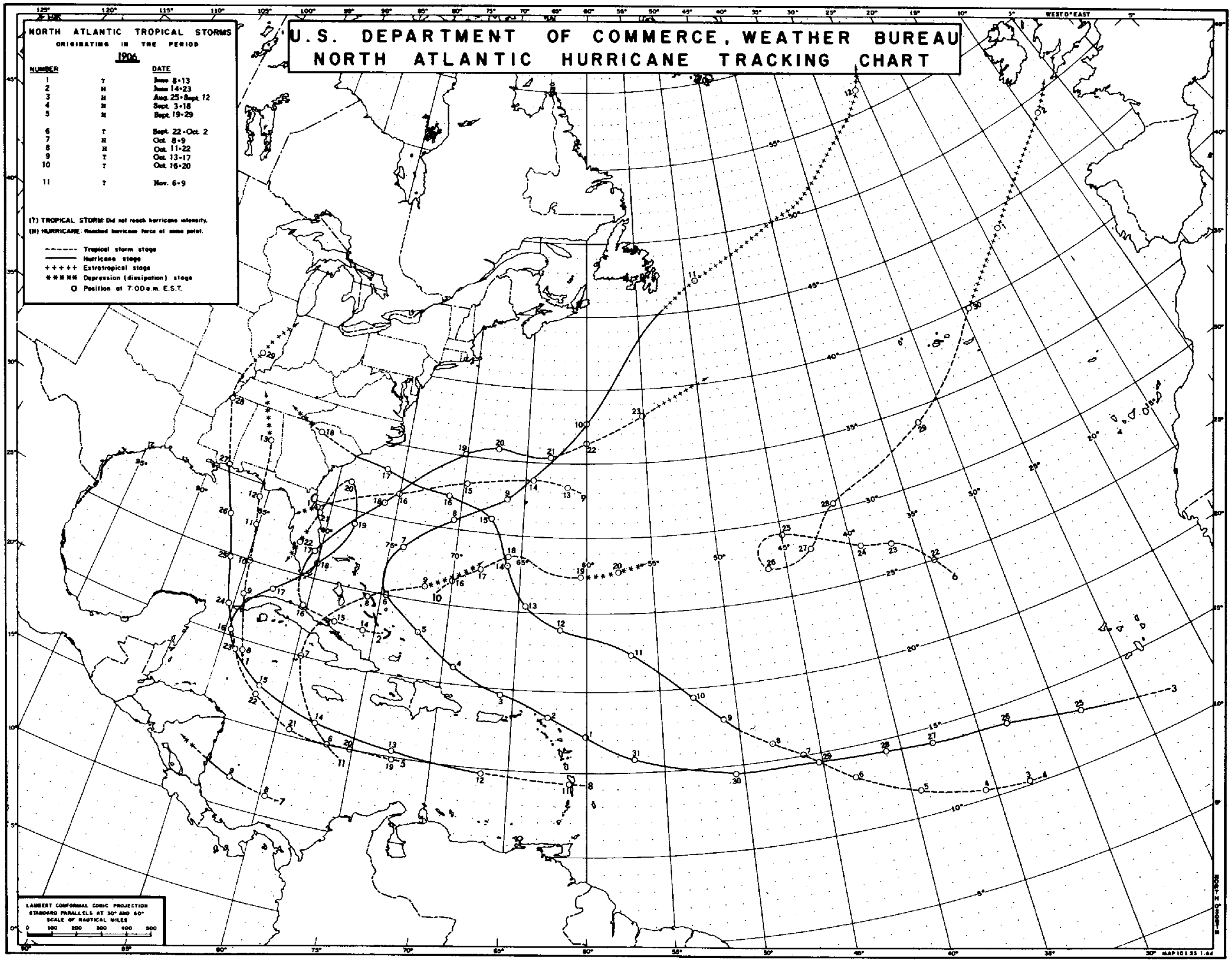


U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1902
NUMBER DATE
1 T June 10-16
2 H June 19-28
3 H Sept. 16-25
4 H Oct. 3-13
5 T Nov. 1-6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached 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
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

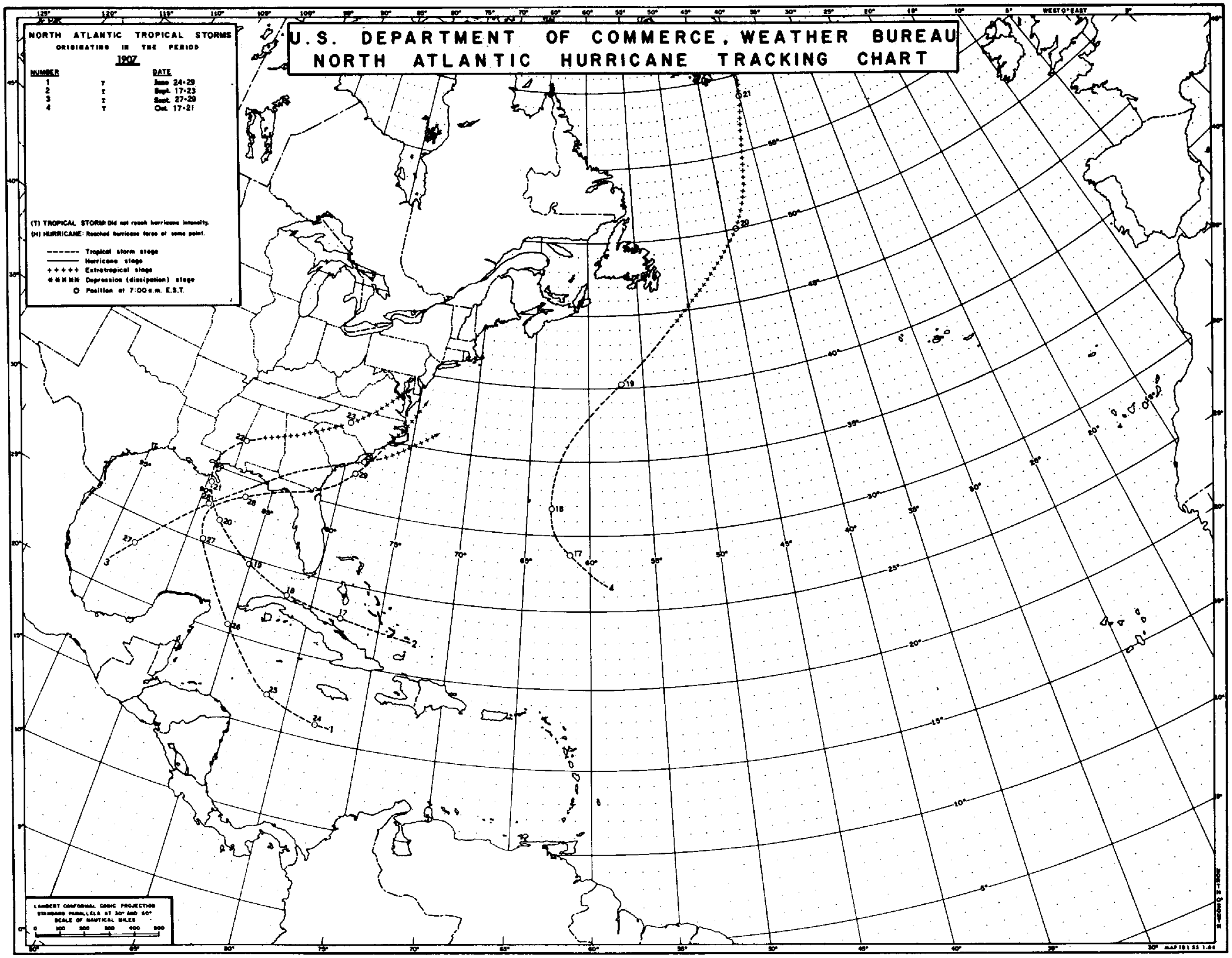

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1903
NUMBER DATE
1 H July 19-25
2 H Aug. 6-16
3 H Sept. 9-16
4 H Sept. 12-17
5 T Sept. 20-25
6 H Sept. 25-30
7 H Oct. 1-10
8 H Oct. 5-10
9 H Nov. 17-25
(T) TROPICAL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

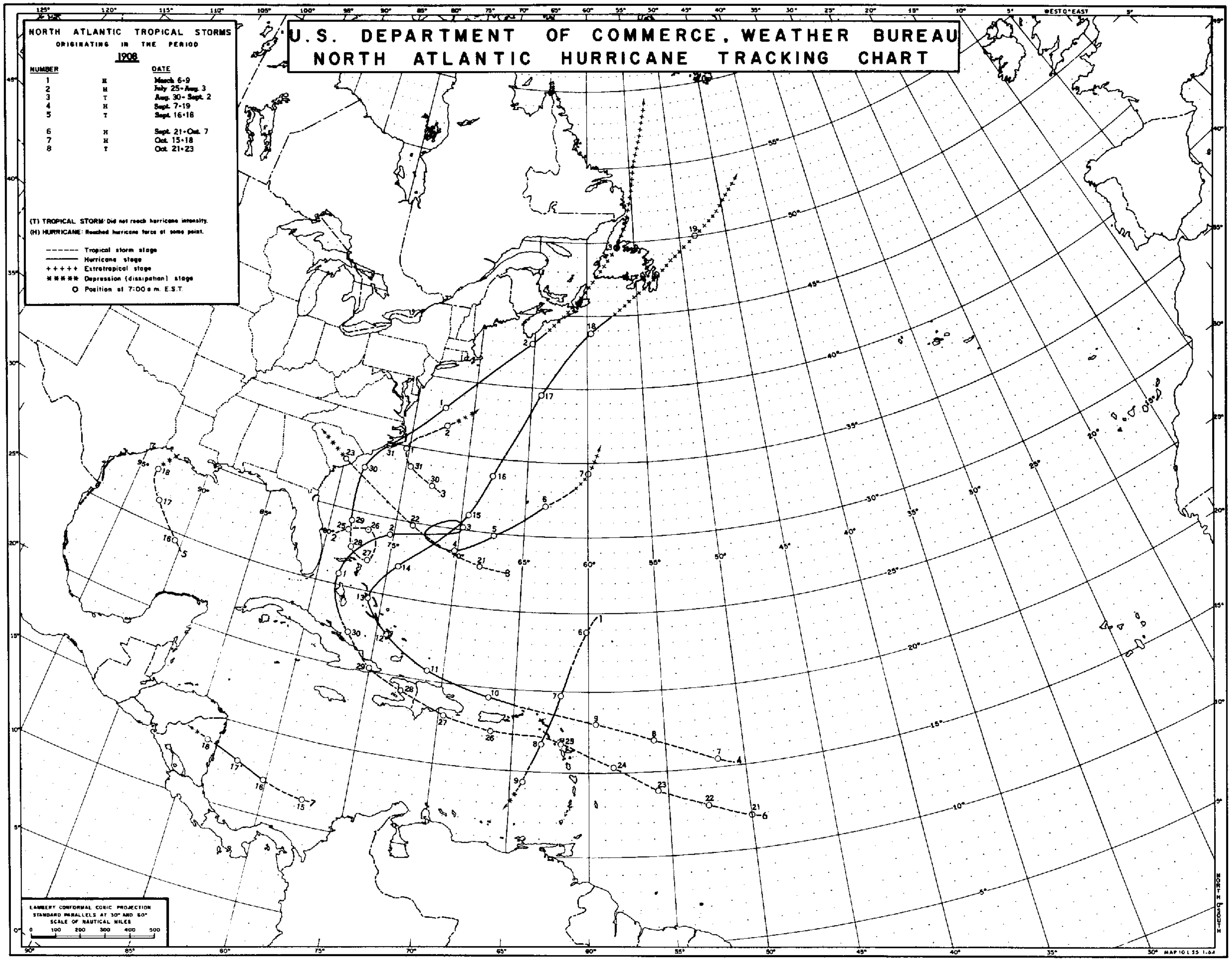

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1904
NUMBER DATE
1 T June 11-14
2 H Sept. 8-15
3 H Oct. 12-20
4 T Oct. 19-23
5 T Oct. 29-Nov. 5
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: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

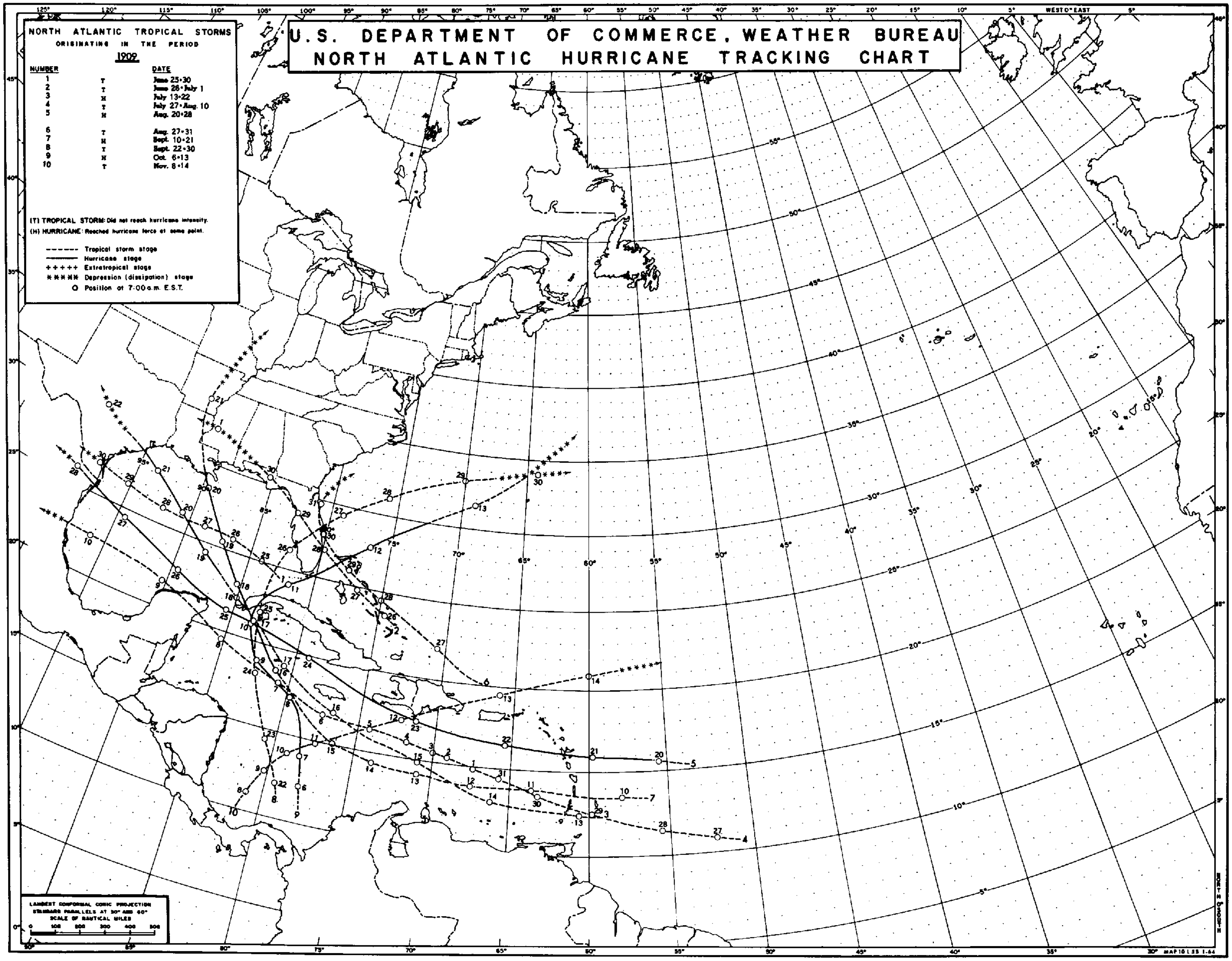

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1905
NUMBER
DATE
1 T Sept. 6-7
2 T Sept. 11-16
3 T Sept. 24-30
4 H Oct. 1-13
5 T Oct. 5-10
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: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



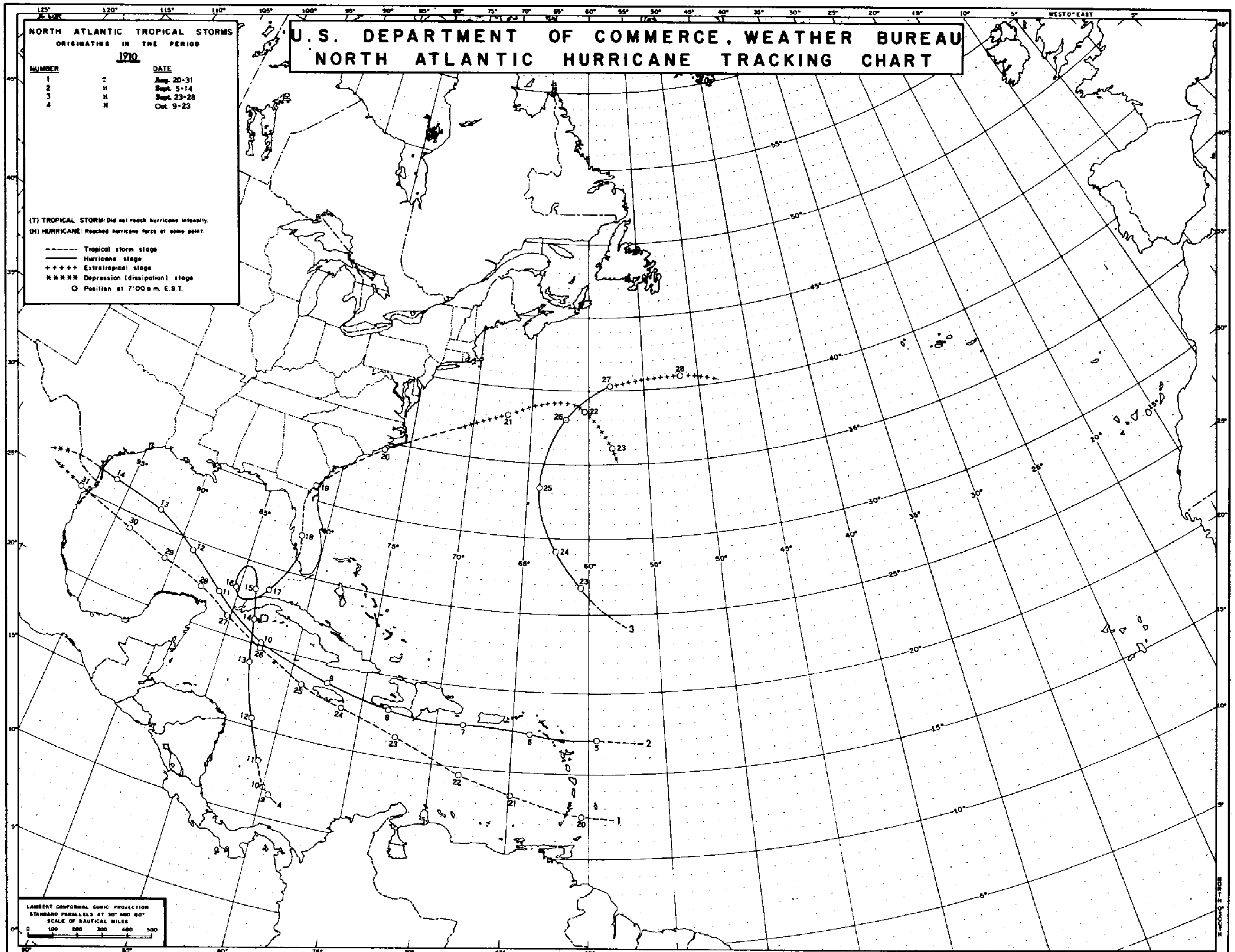
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1906
NUMBER DATE
1 T June 8-13
2 H June 14-23
3 H Aug. 25-Sept. 12
4 H Sept. 3-18
5 H Sept. 19-29
6 T Sept. 22-Oct. 2
7 H Oct. 8-9
8 H Oct. 11-22
9 T Oct. 13-17
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

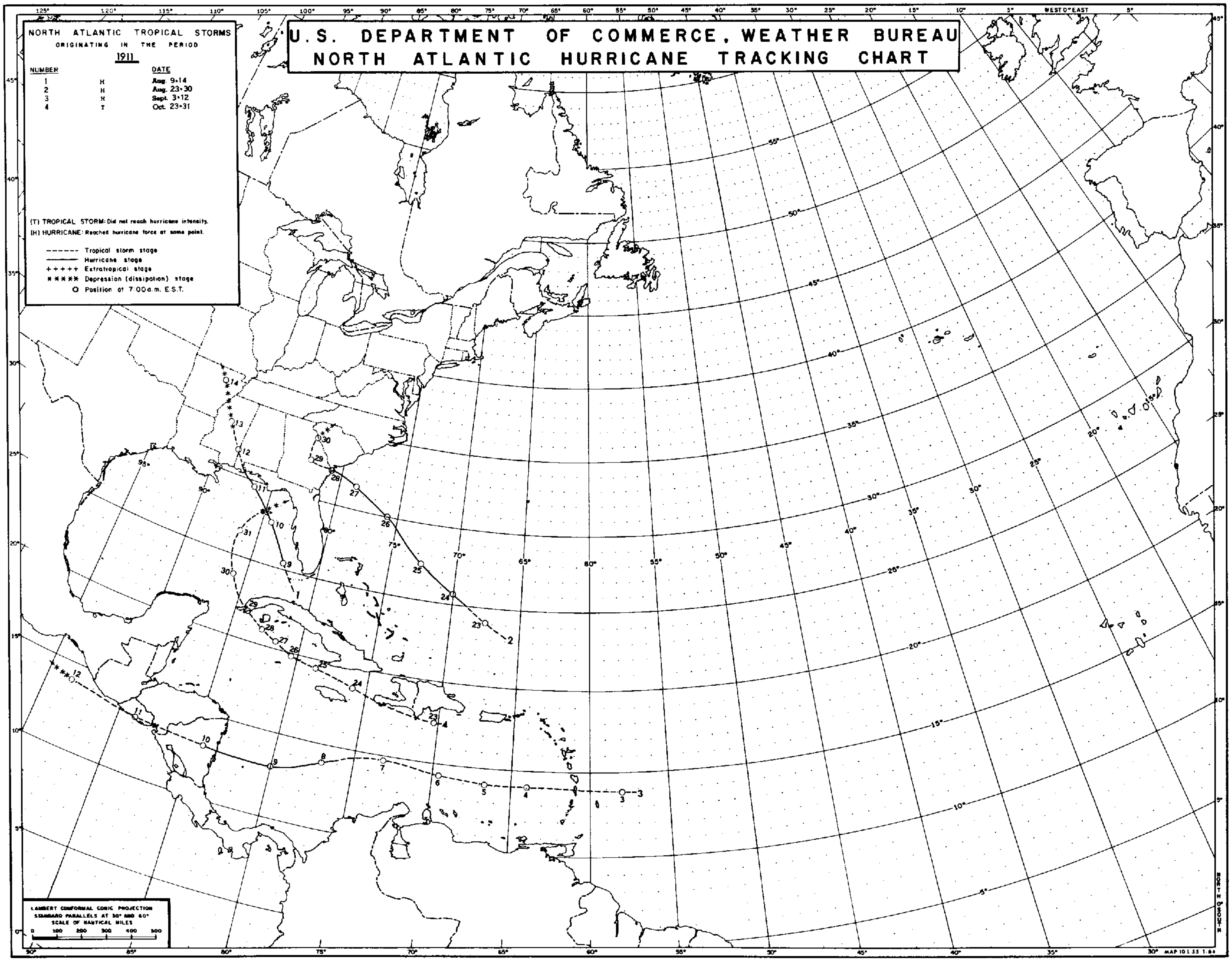

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1908
NUMBER DATE
1 H March 6-9
2 H July 25-Aug. 3
3 T Aug. 30-Sept. 2
4 H Sept. 7-19
5 T Sept. 16-18
6 H Sept. 21-Oct. 7
7 H Oct. 15-18
8 T Oct. 21-23
(T) TROPICAL 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

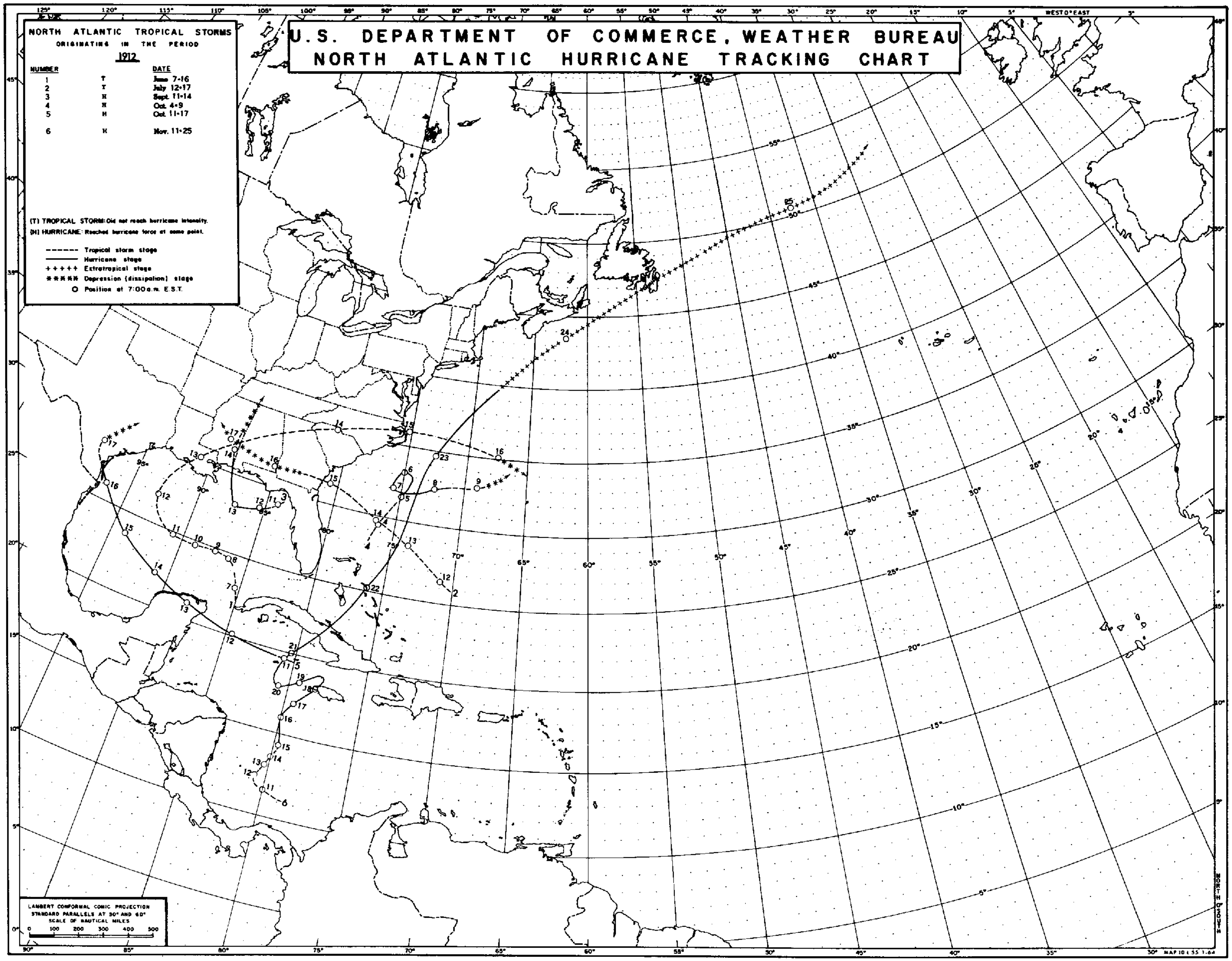


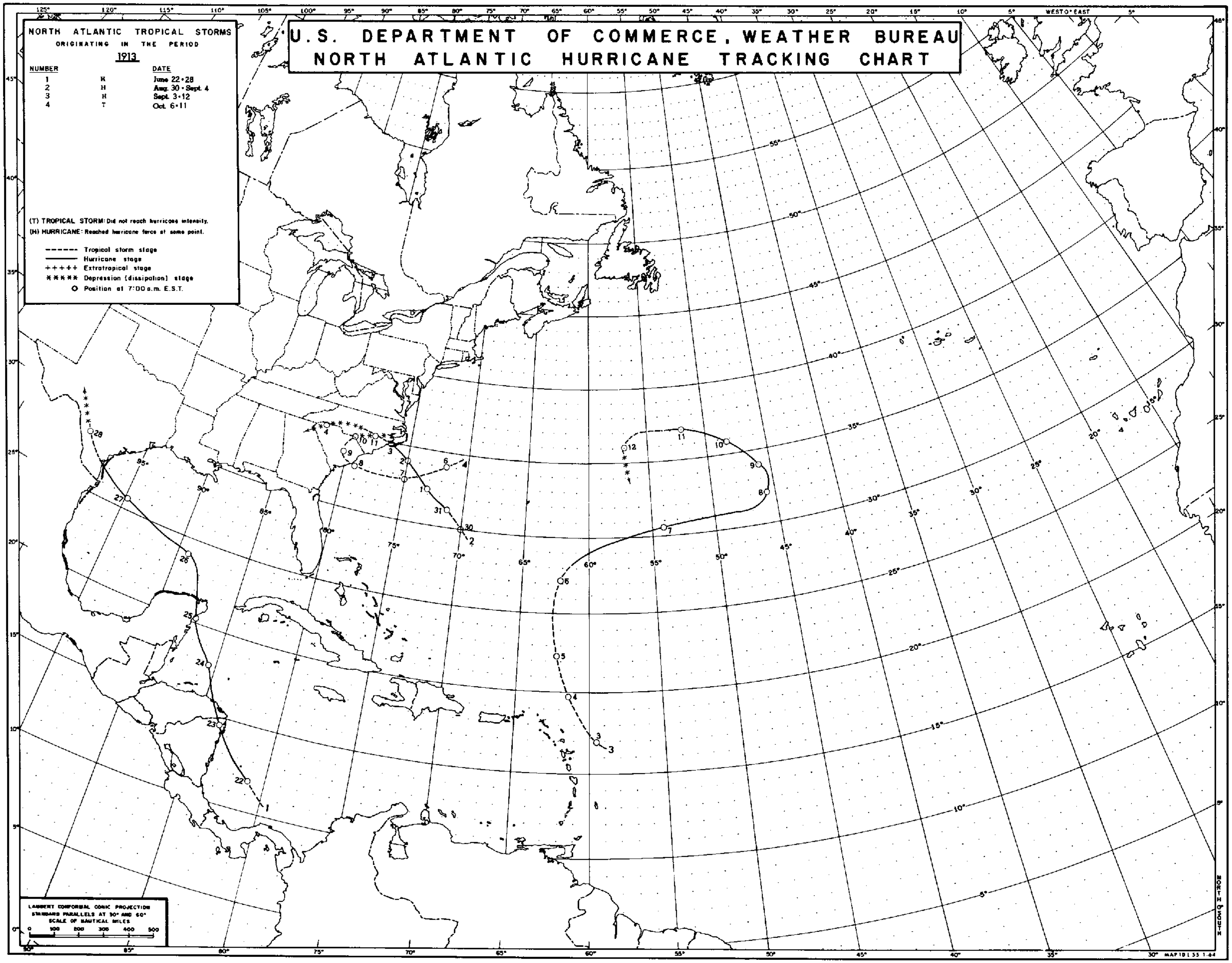
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1909
NUMBER
DATE
1 T June 25-30
2 T June 26-July 1
3 H July 13-22
4 T July 27-Aug. 10
5 H Aug. 20-28
6 T Aug. 27-31
7 H Sept. 10-21
8 T Sept. 22-30
9 H Oct. 6-13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

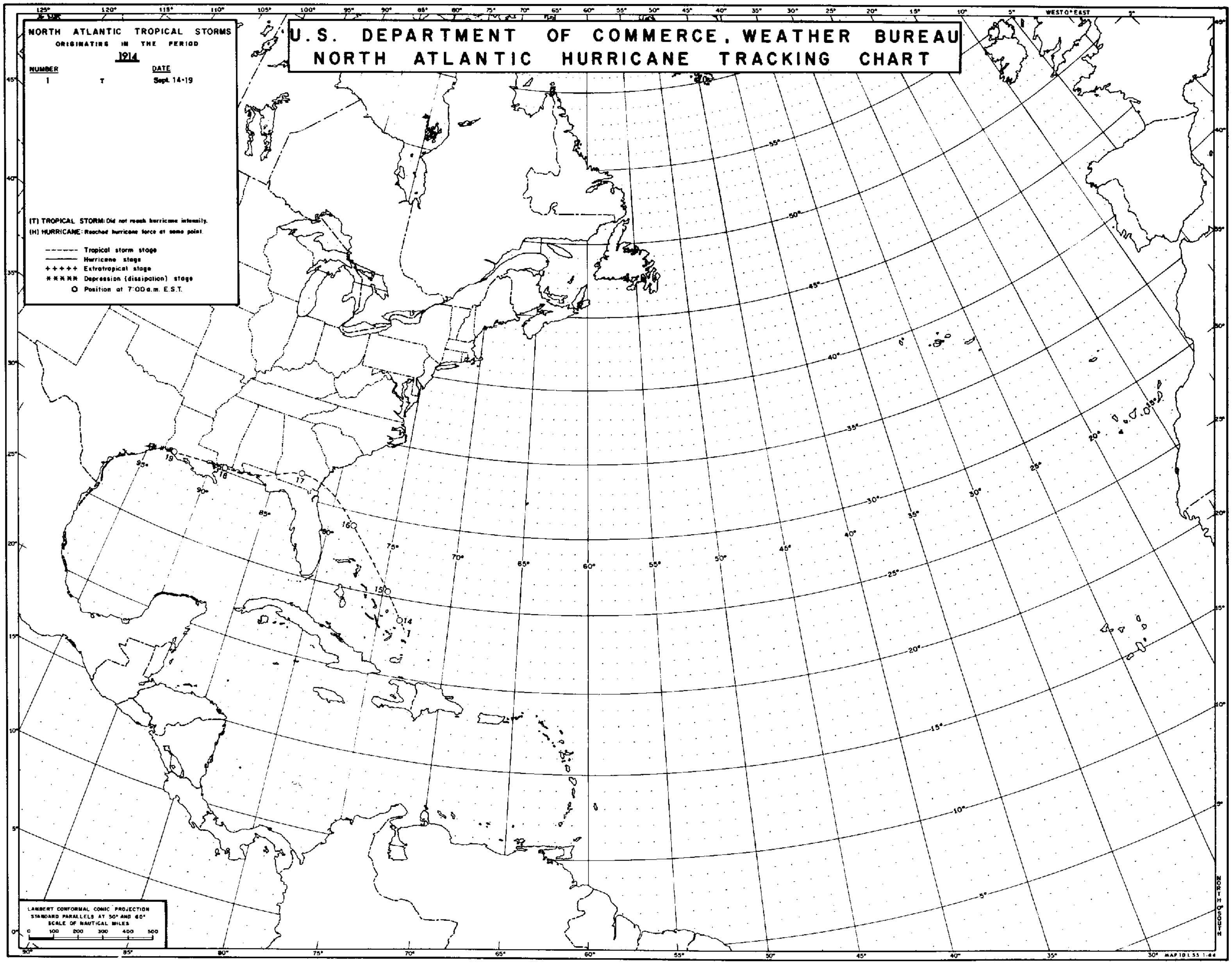


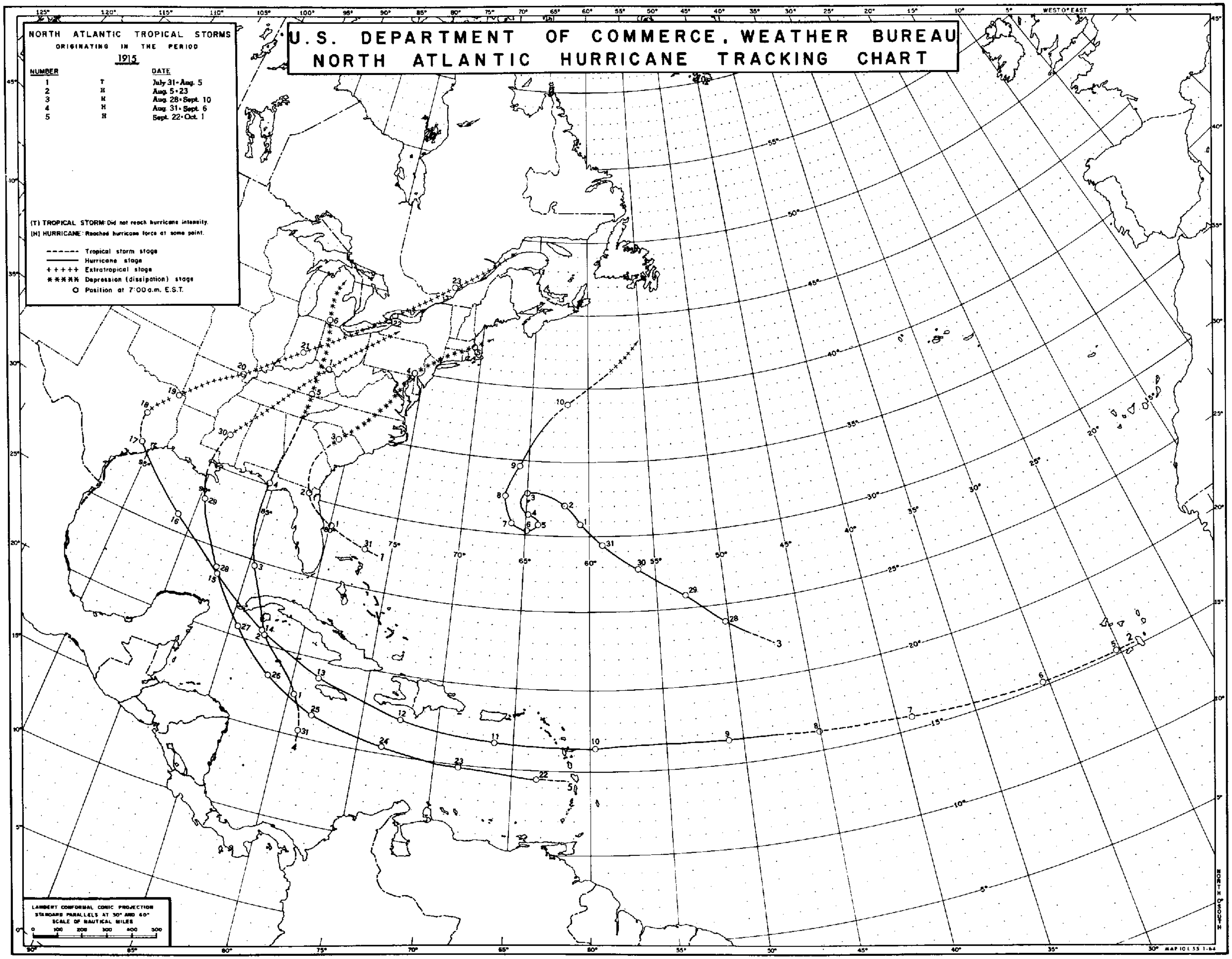
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1910
NUMBER DATE
1 T Aug. 20-31
2 H Sept. 5-14
3 H Sept. 23-28
4 H Oct. 9-23
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane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

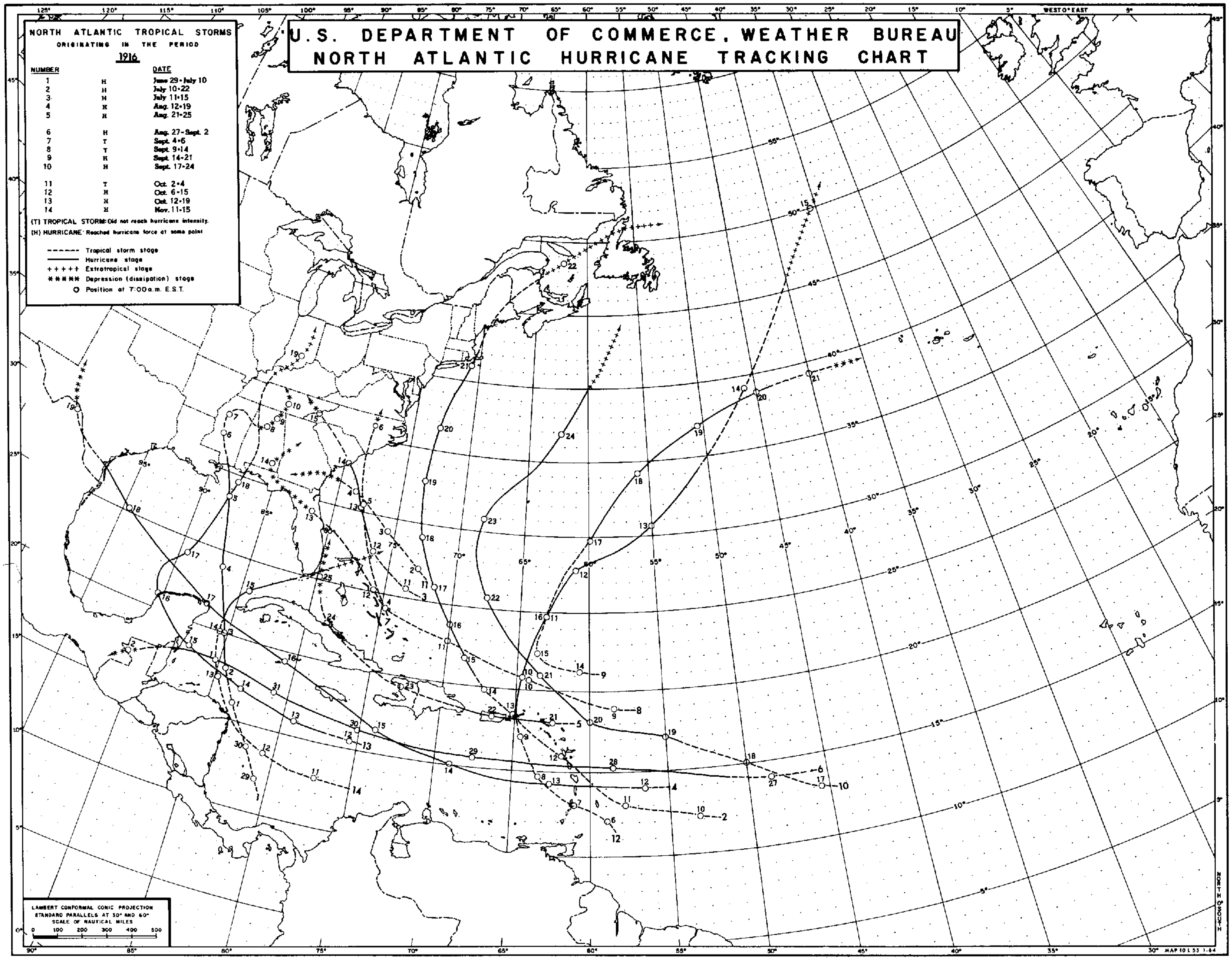

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1911
NUMBER DATE
1 H Aug. 9-14
2 H Aug. 23-30
3 H Sept. 3-12
4 T Oct. 23-31
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane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

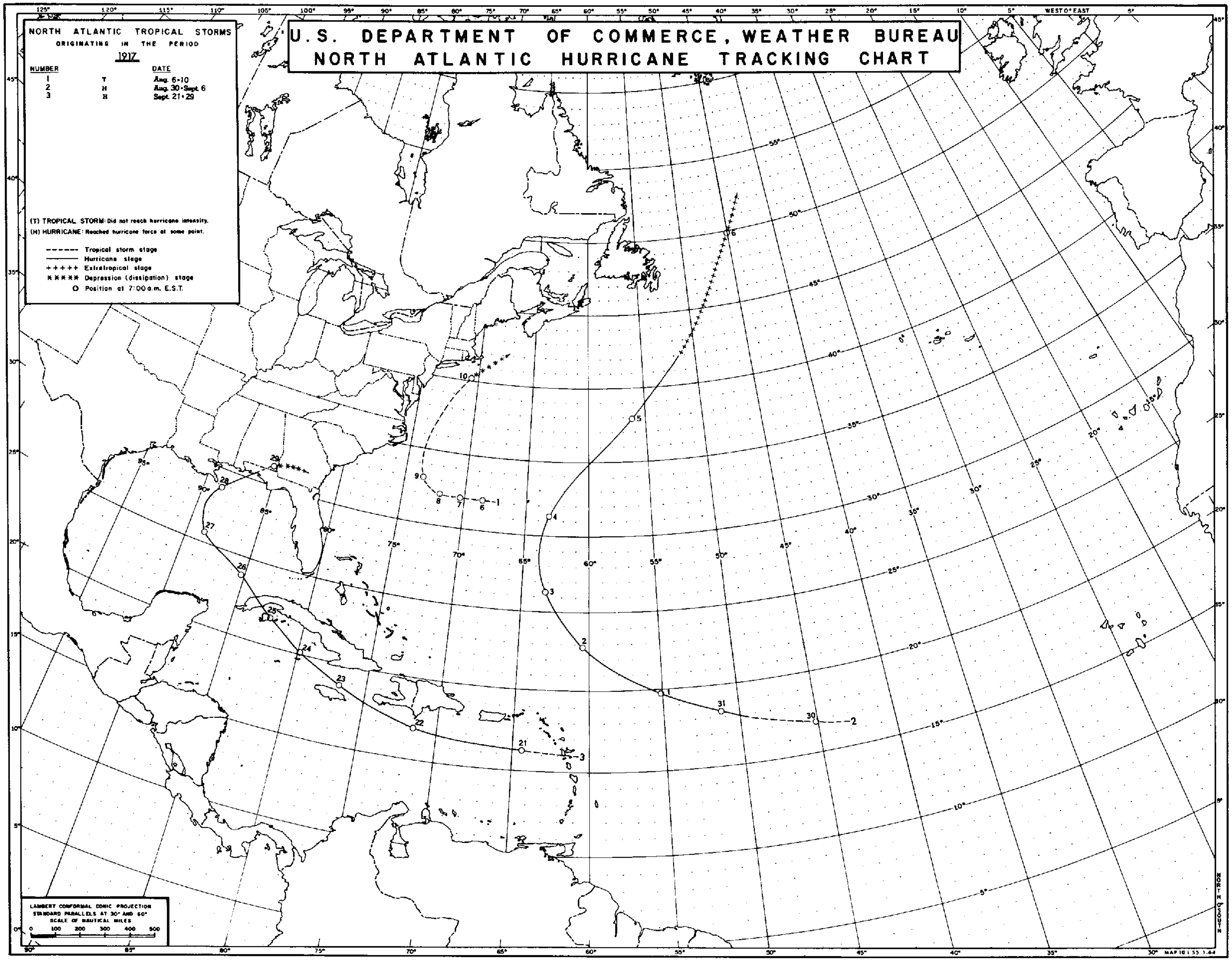

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1912
NUMBER
DATE
1 T June 7-16
2 T July 12-17
3 H Sept. 11-14
4 H Oct. 4-9
5 H Oct. 11-17
6 H Nov. 11-25
(T) TROPICAL STORM: Did not reach hurricane intensity.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

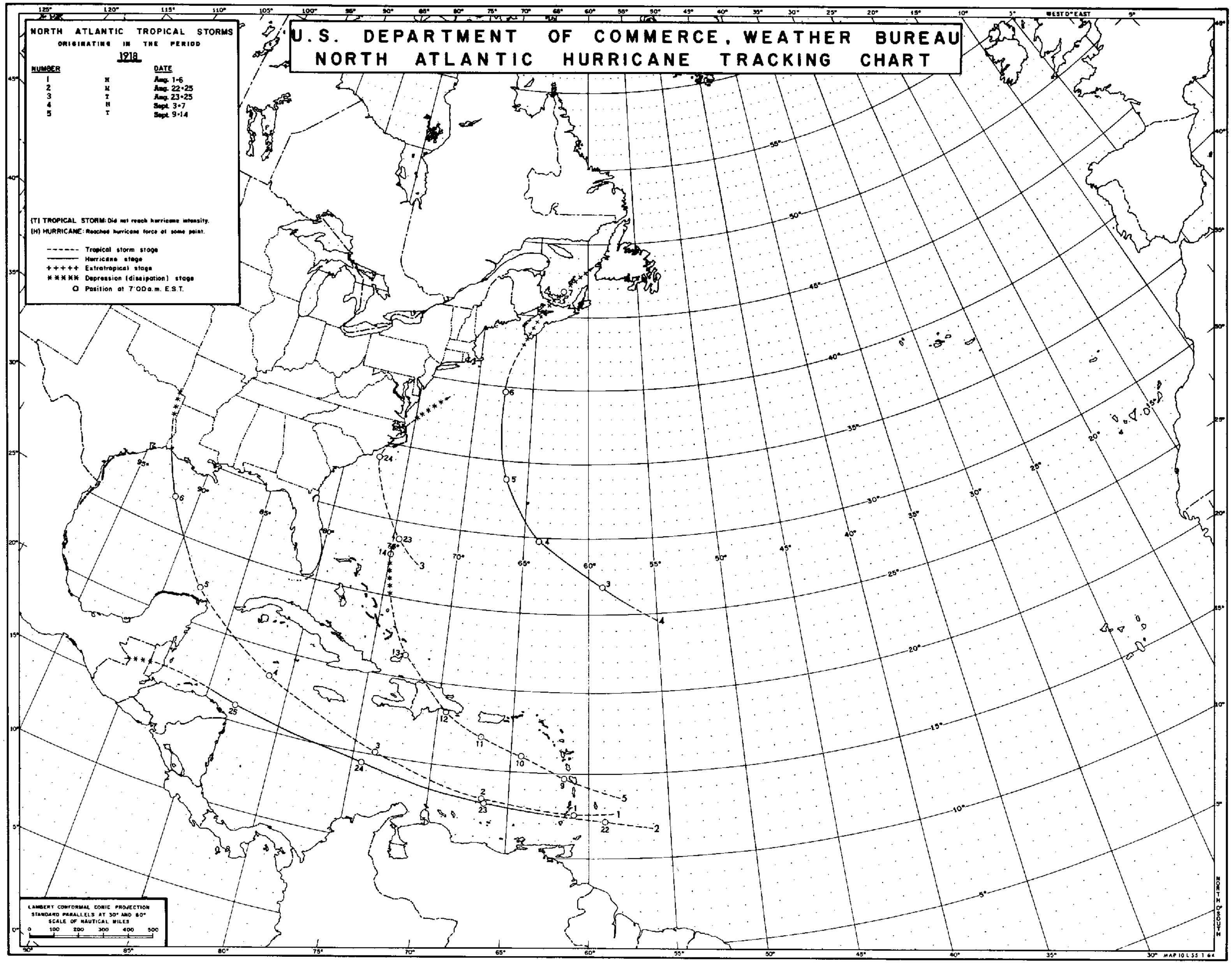

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1913
NUMBER
DATE
1 H June 22-28
2 H Aug. 30 - Sept. 4
3 H Sept. 3-12
4 T Oct. 6-11
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached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

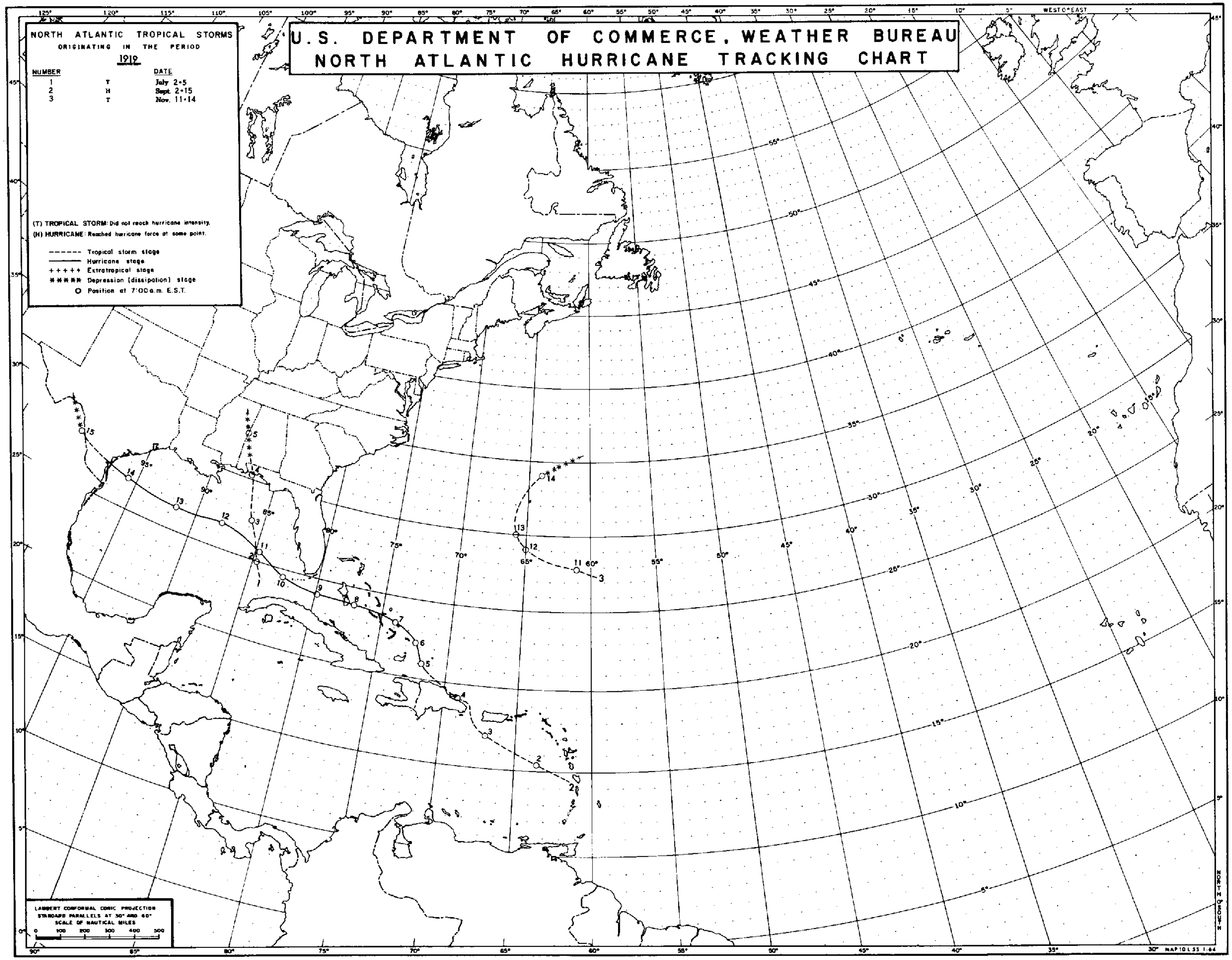

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1914
NUMBER
DATE
1
T
Sept. 14-19
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage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

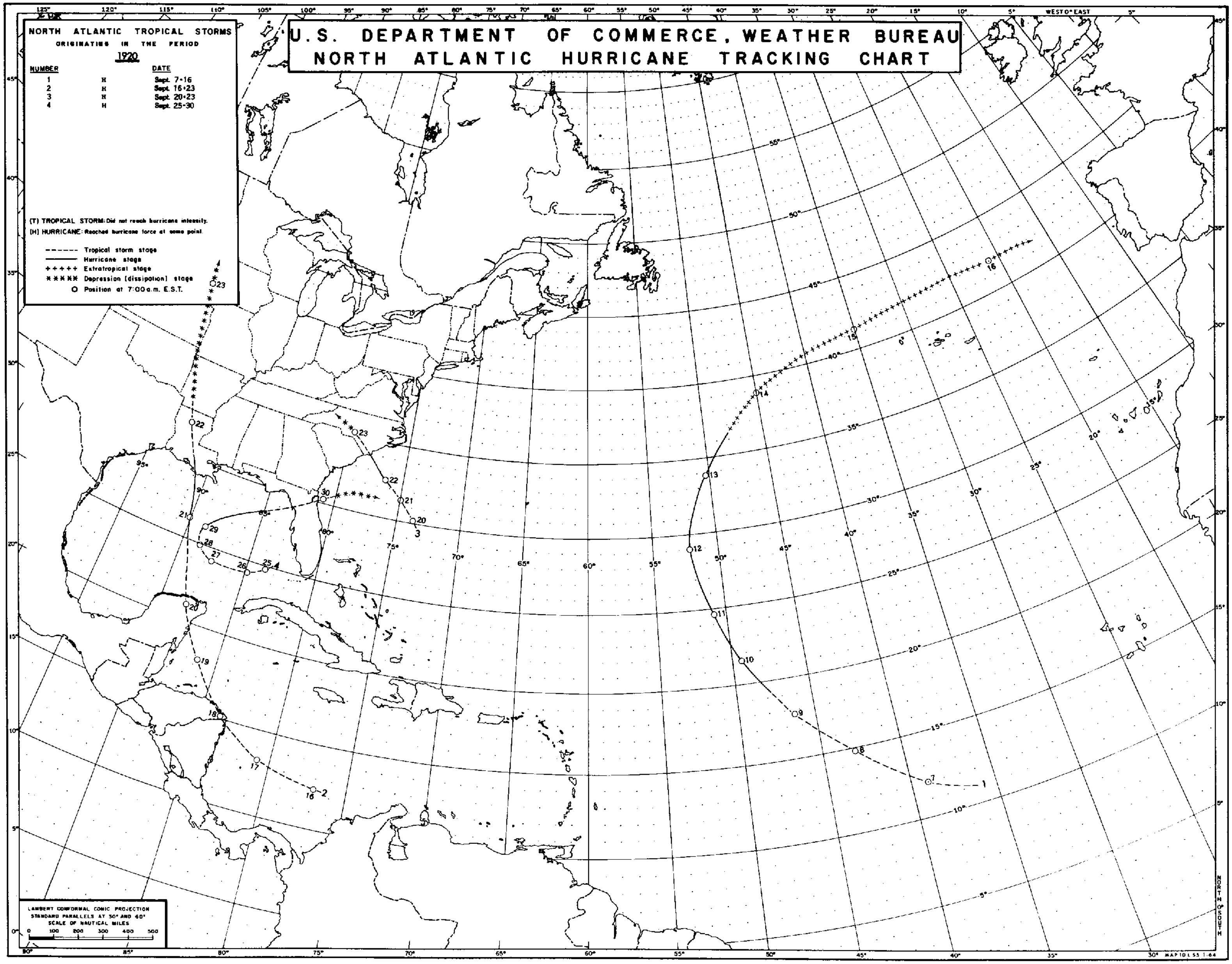

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1915
NUMBER DATE
1 T July 31 - Aug. 5
2 H Aug. 5 - 23
3 H Aug. 28 - Sept. 10
4 H Aug. 31 - Sept. 6
5 H Sept. 22 - Oct. 1
(T) TROPICAL STORM: Did not reach hurricane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

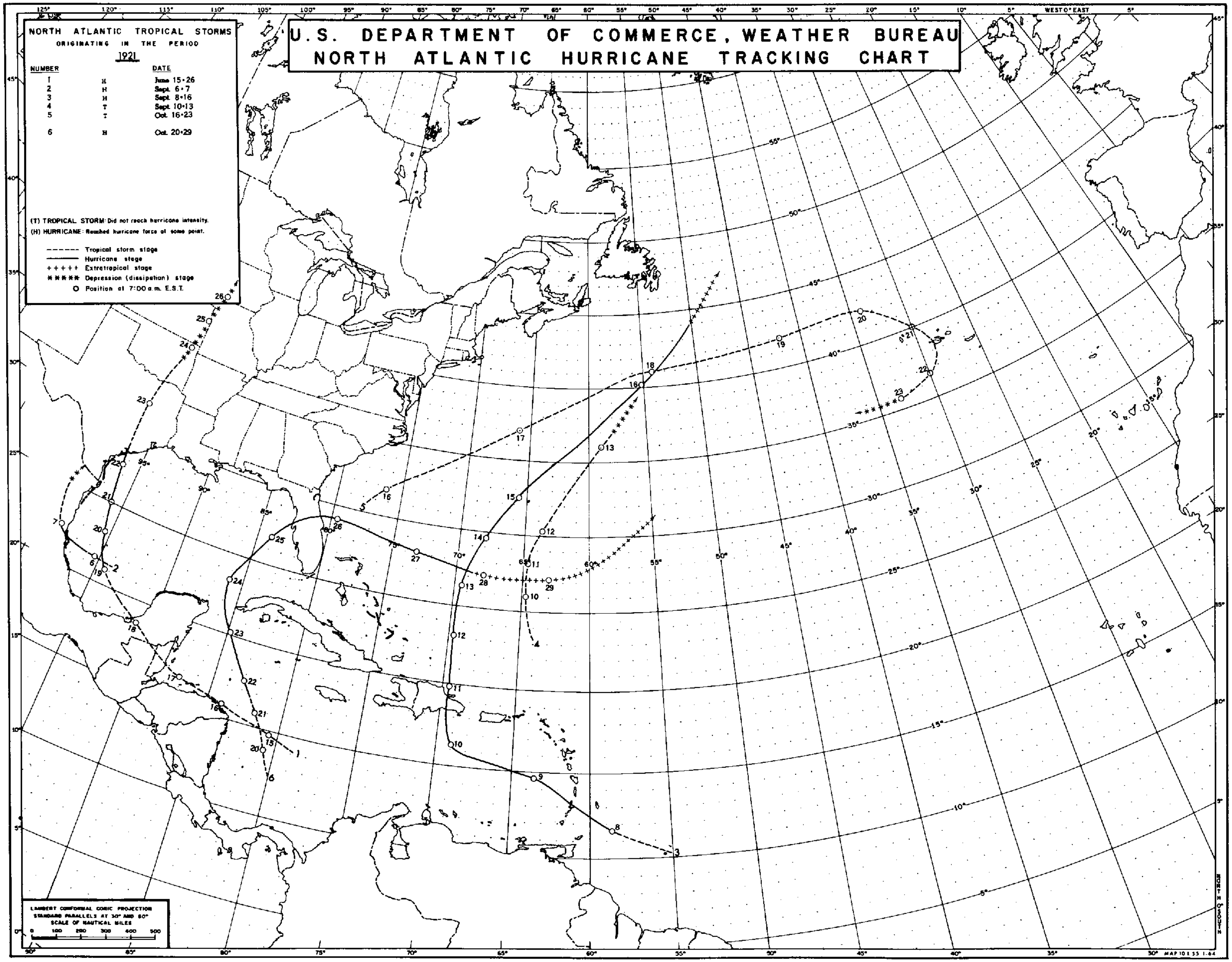

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1916
NUMBER DATE
1 H June 29 - July 10
2 H July 10-22
3 H July 11-15
4 H Aug. 12-19
5 H Aug. 21-25
6 H Aug. 27 - Sept. 2
7 T Sept. 4-6
8 T Sept. 9-14
9 H Sept.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


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
0 100 200 300 400 500

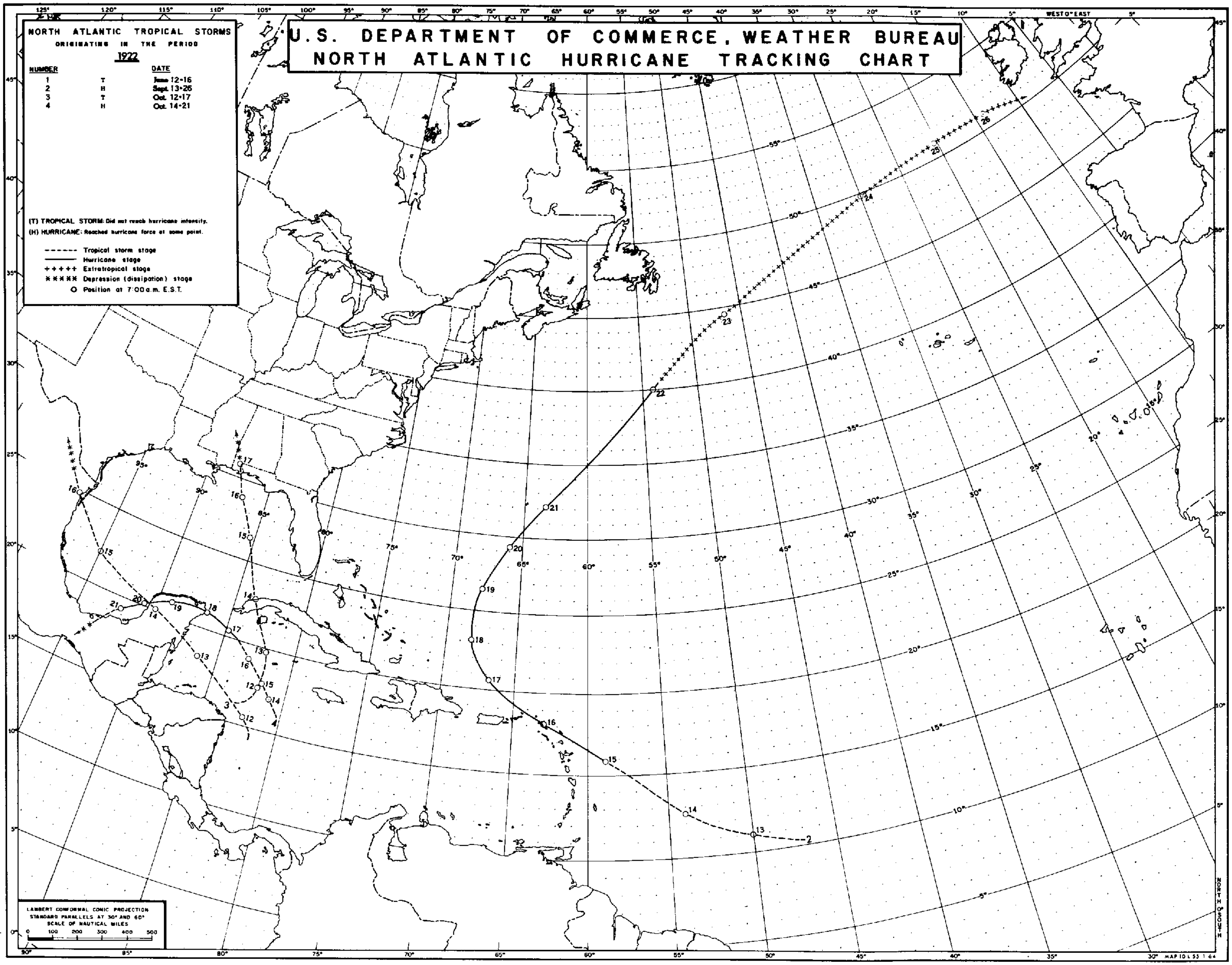

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1918
NUMBER DATE
1 H Aug. 1-6
2 H Aug. 22-25
3 T Aug. 23-25
4 H Sept. 3-7
5 T Sept. 9-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached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

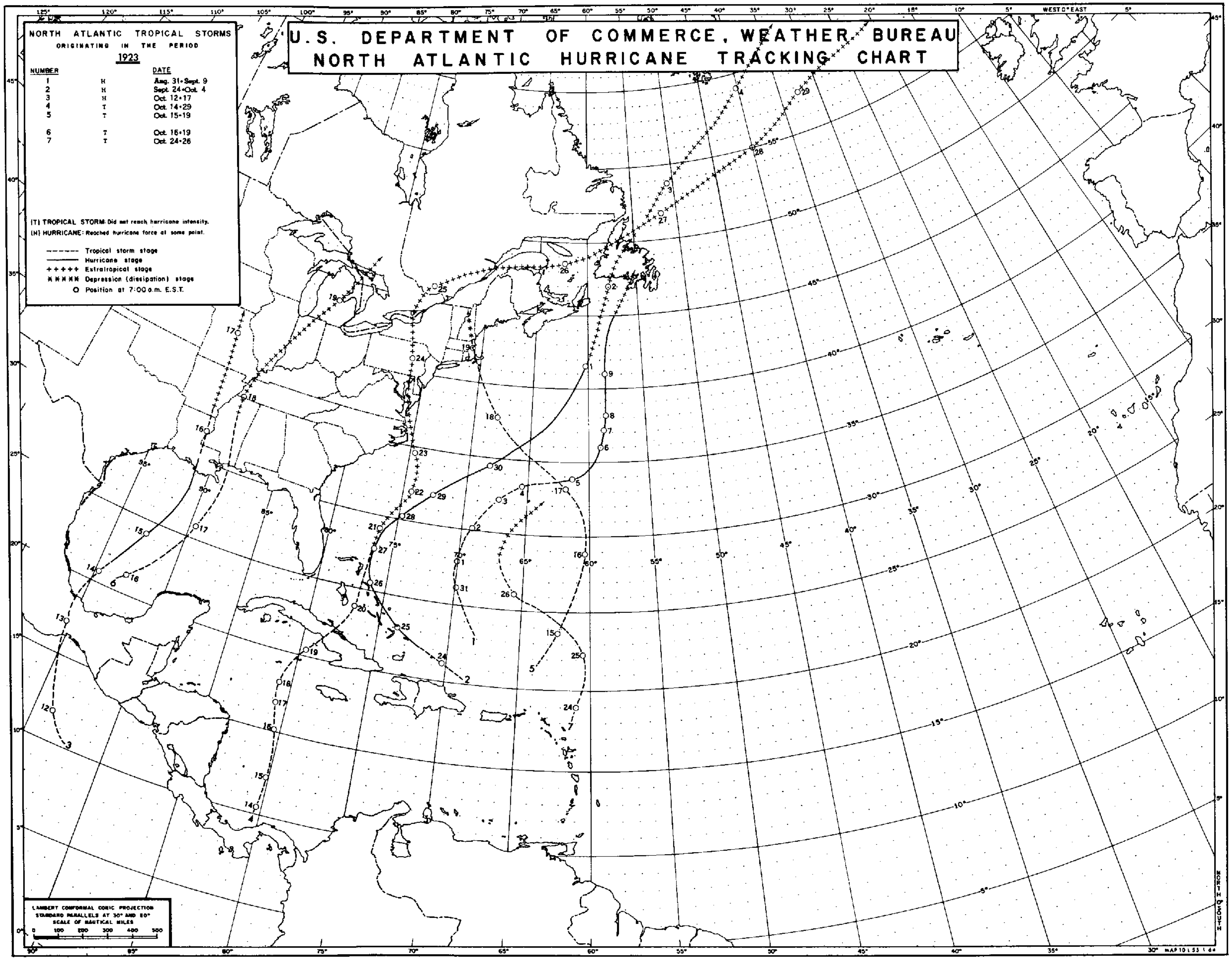

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1919
NUMBER DATE
1 T July 2-5
2 H Sept. 2-15
3 T Nov. 11-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some 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

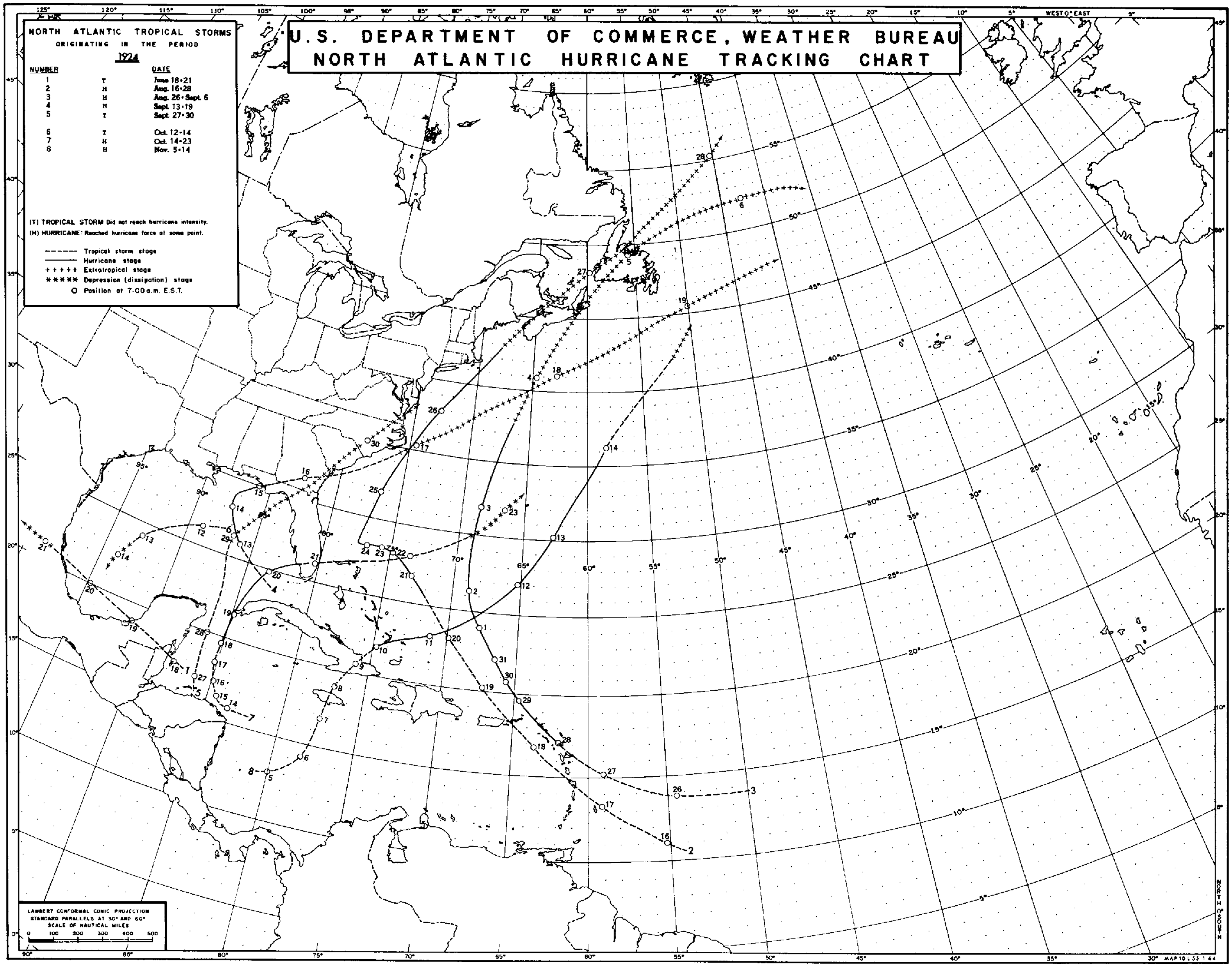

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1920
NUMBER DATE
1 H Sept. 7-16
2 H Sept. 16-23
3 H Sept. 20-23
4 H Sept. 25-30
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane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

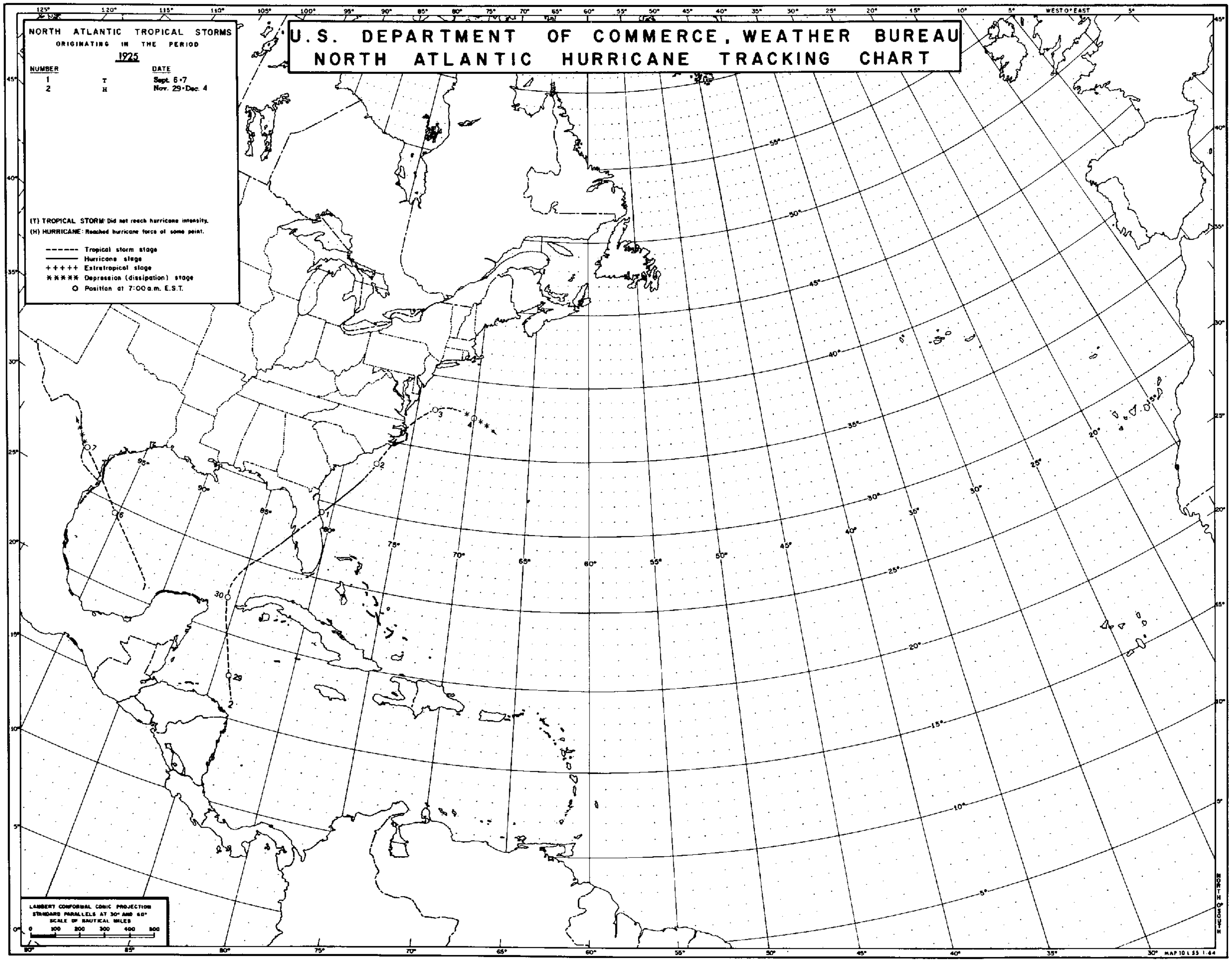


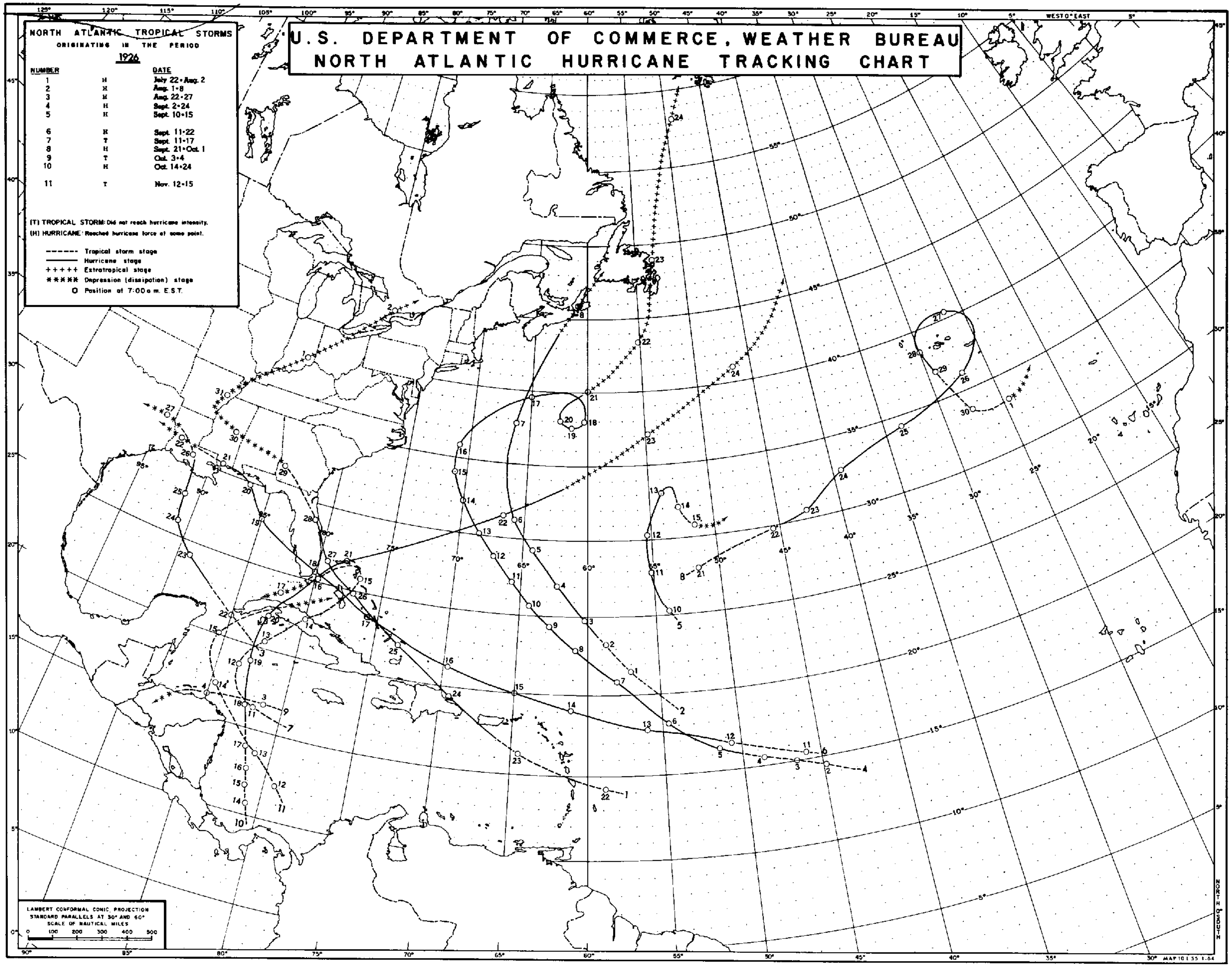
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1921
NUMBER
DATE
1 H June 15-26
2 H Sept. 6-7
3 H Sept. 8-16
4 T Sept. 10-13
5 T Oct. 16-23
6 H Oct. 20-29
(T) TROPICAL STORM: Did not reach hurricane intensity.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

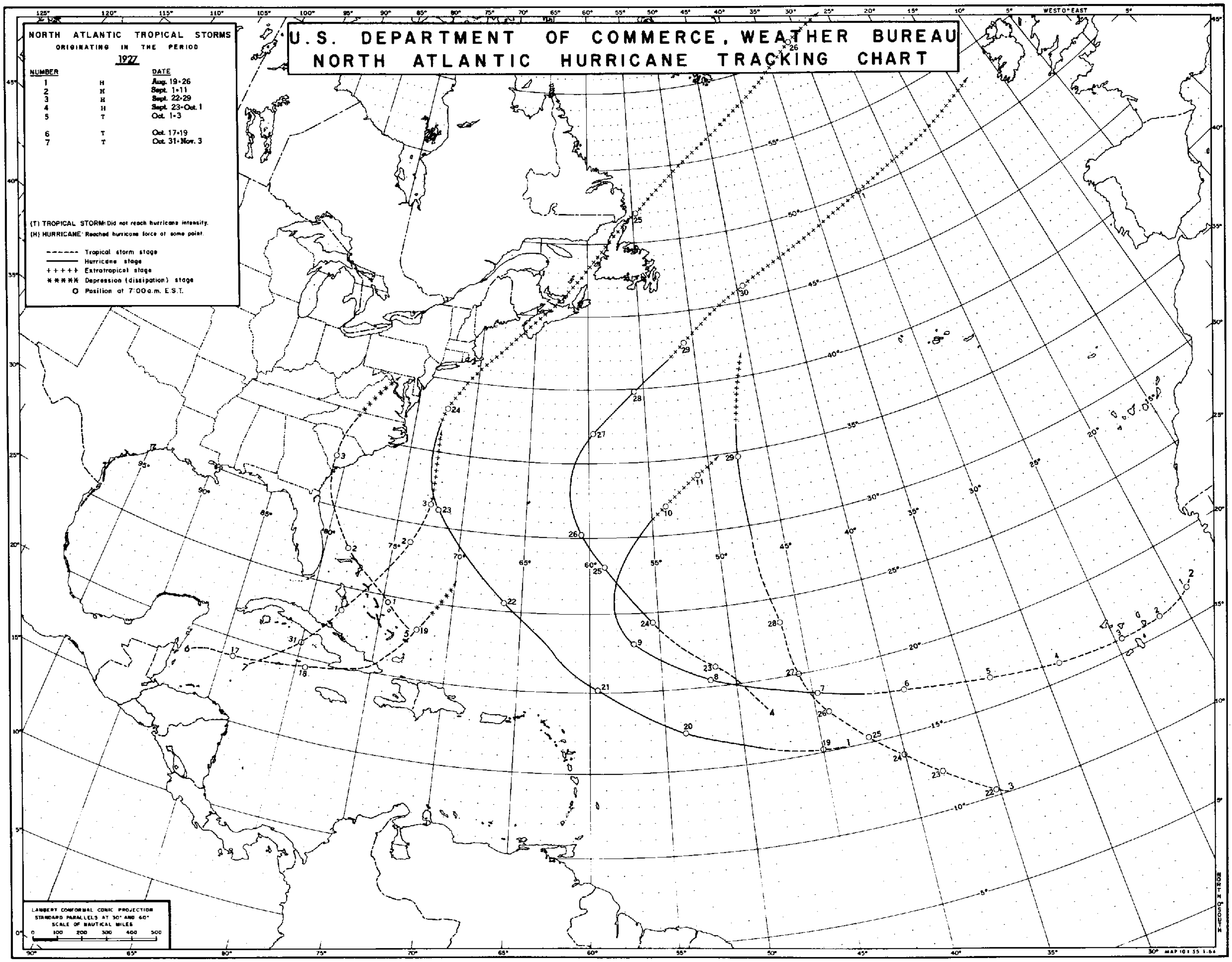

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1922
NUMBER DATE
1 T June 12-16
2 H Sept. 13-26
3 T Oct. 12-17
4 H Oct. 14-21
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane 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
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
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

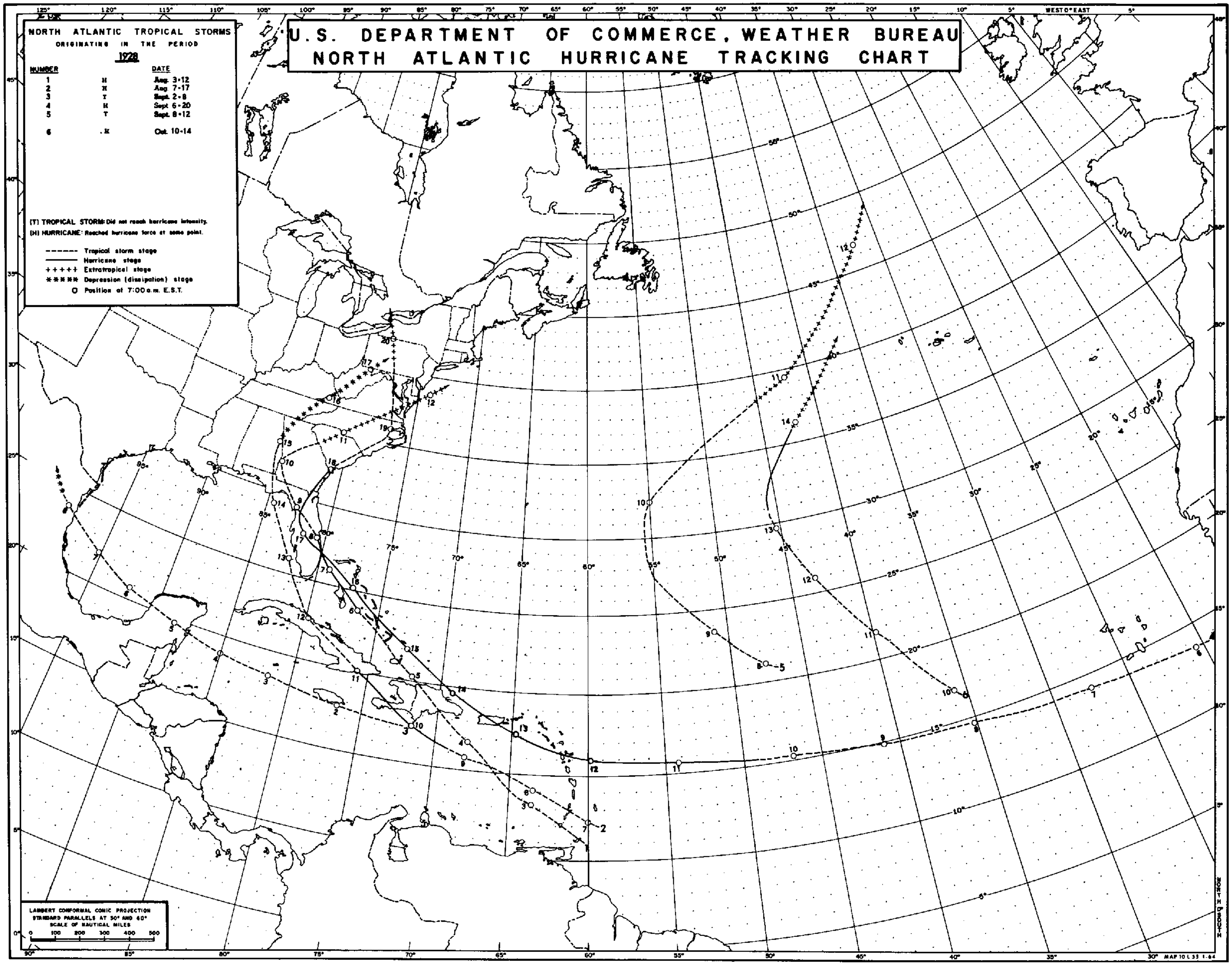

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1924
NUMBER DATE
1 T June 18-21
2 H Aug. 16-28
3 H Aug. 26-Sept. 6
4 H Sept. 13-19
5 T Sept. 27-30
6 T Oct. 12-14
7 H Oct. 14-23
8 H Nov. 5-14
(T) TROPICAL STORM: 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

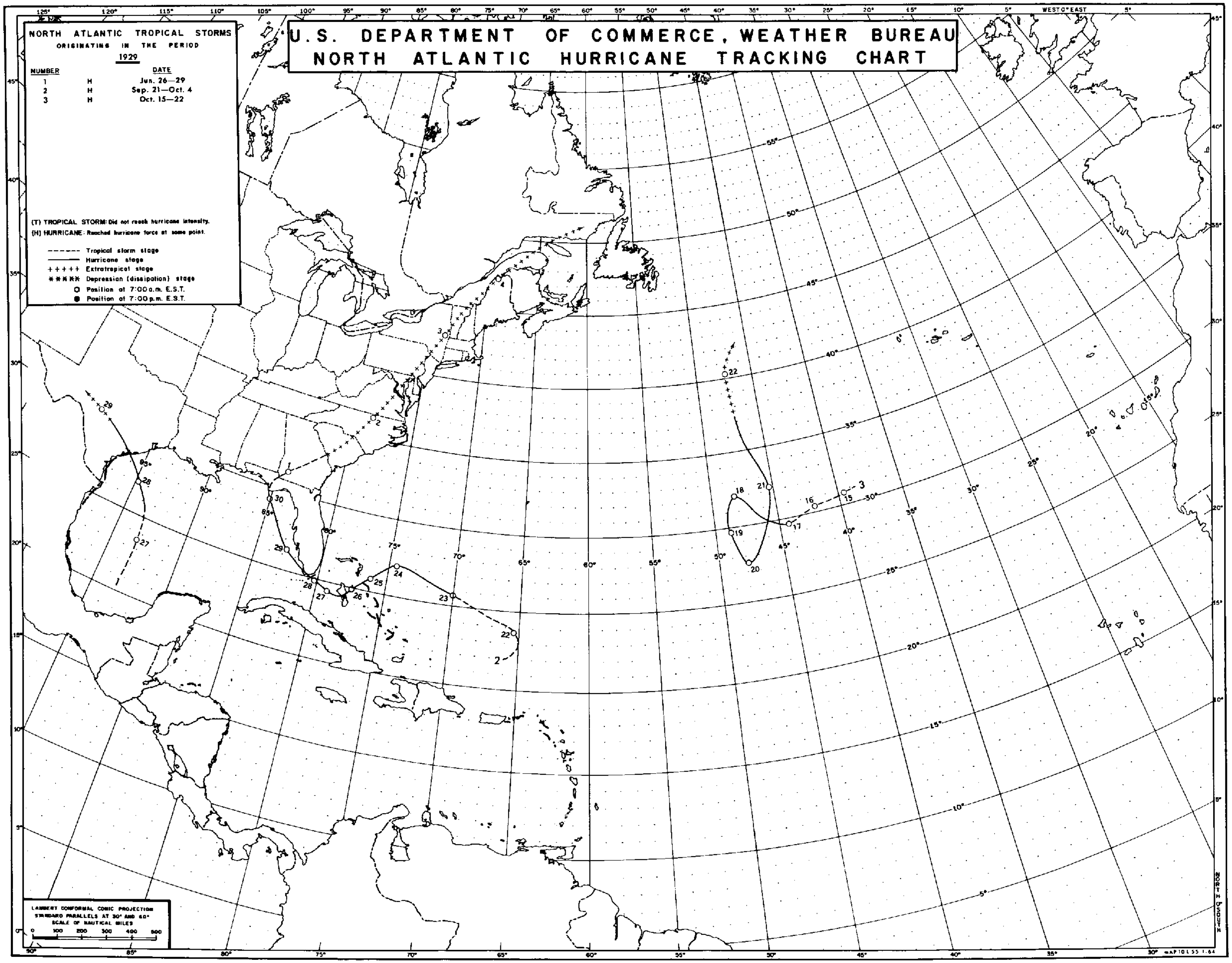

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1925
NUMBER
DATE
1 T Sept. 6-7
2 H Nov. 29-Dec. 4
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical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

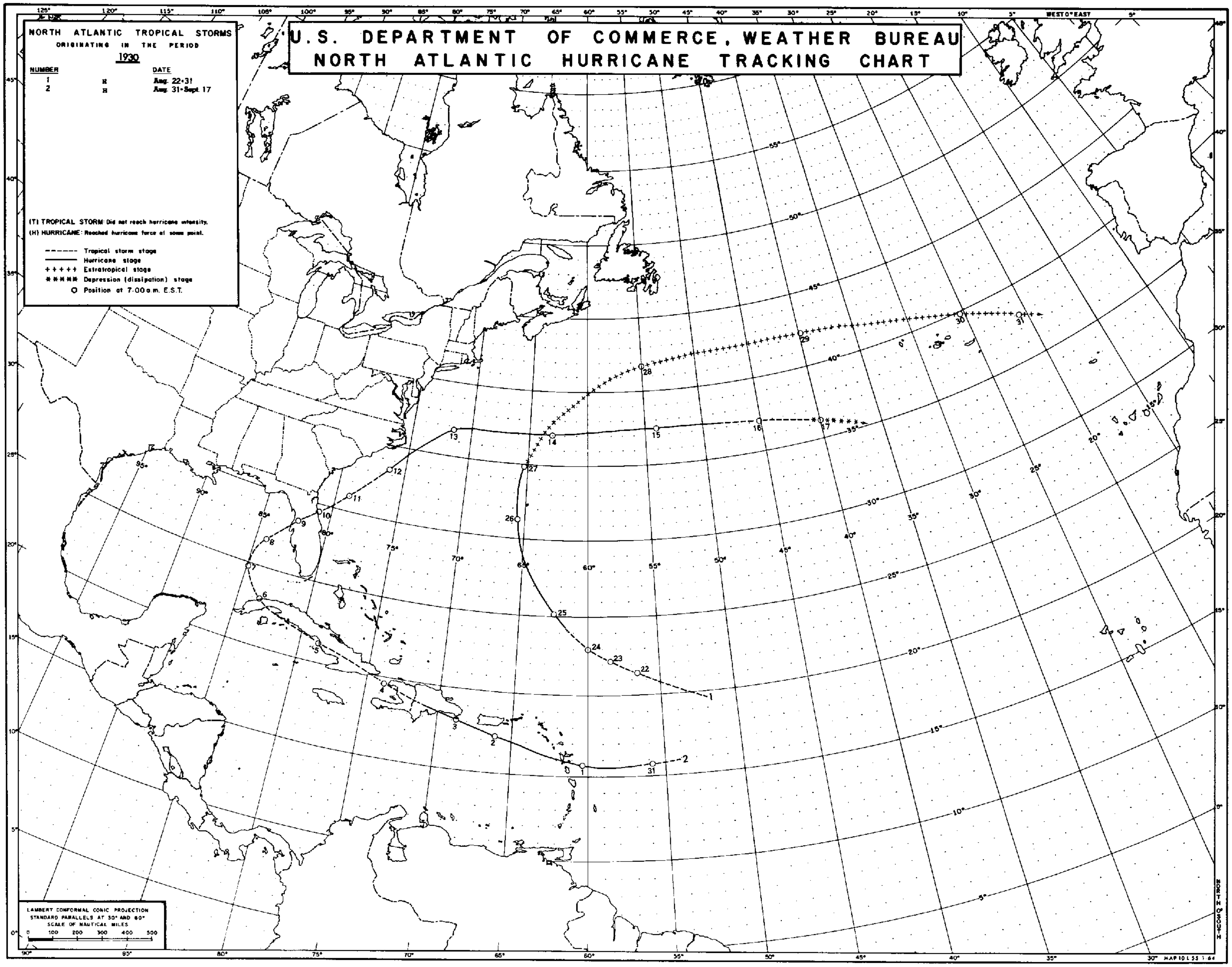

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1926
NUMBER
DATE
1 H July 22 - Aug. 2
2 H Aug. 1 - 8
3 H Aug. 22 - 27
4 H Sept. 2 - 24
5 H Sept. 10 - 15
6 H Sept. 11 - 22
7 T Sept. 11 - 17
8 H Sept. 21 - Oct.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

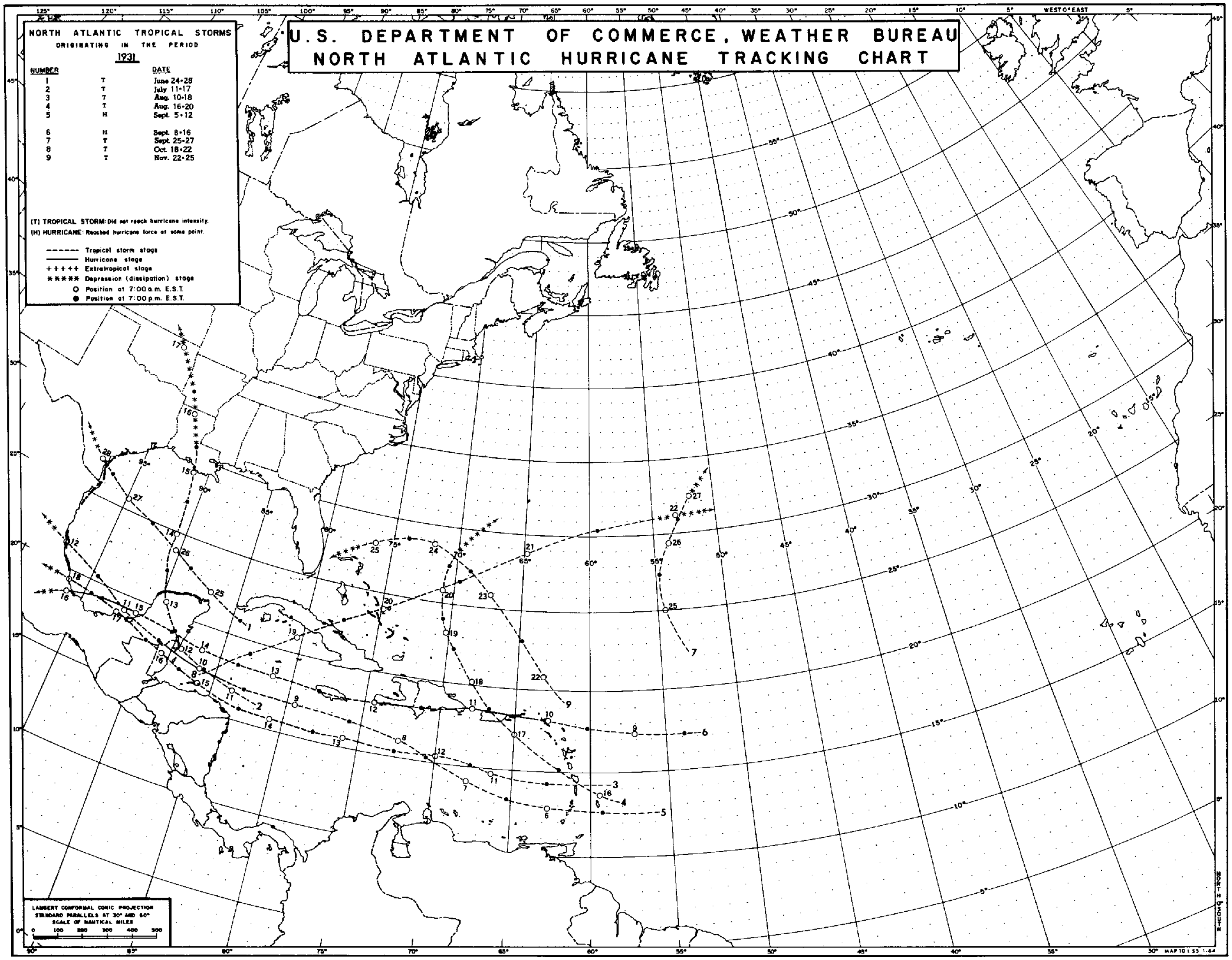


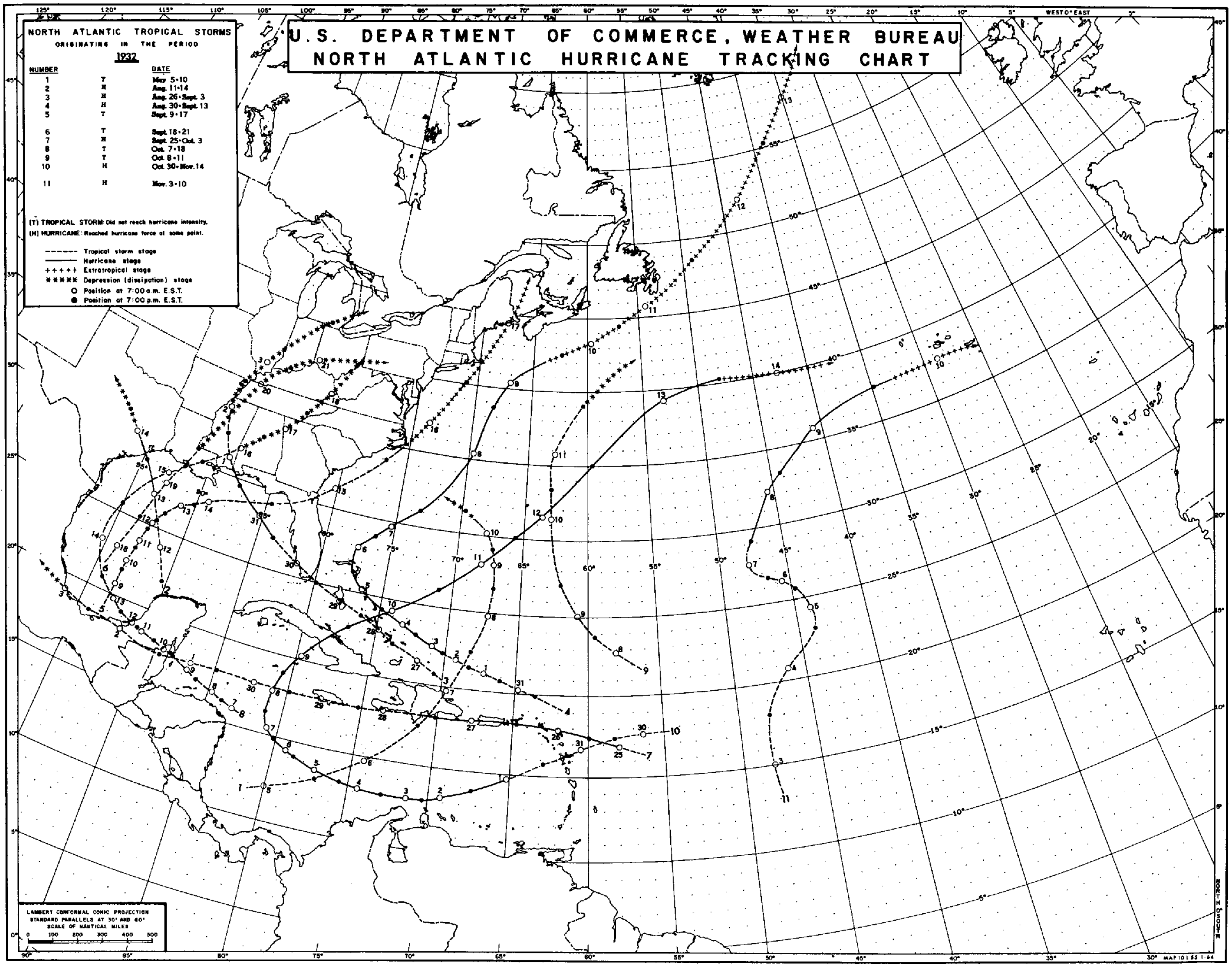
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1927
NUMBER DATE
1 H Aug. 19-26
2 H Sept. 1-11
3 H Sept. 22-29
4 H Sept. 23-Oct. 1
5 T Oct. 1-3
6 T Oct. 17-19
7 T Oct. 31-Nov. 3
(T) TROPICAL STORM: Did not reach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

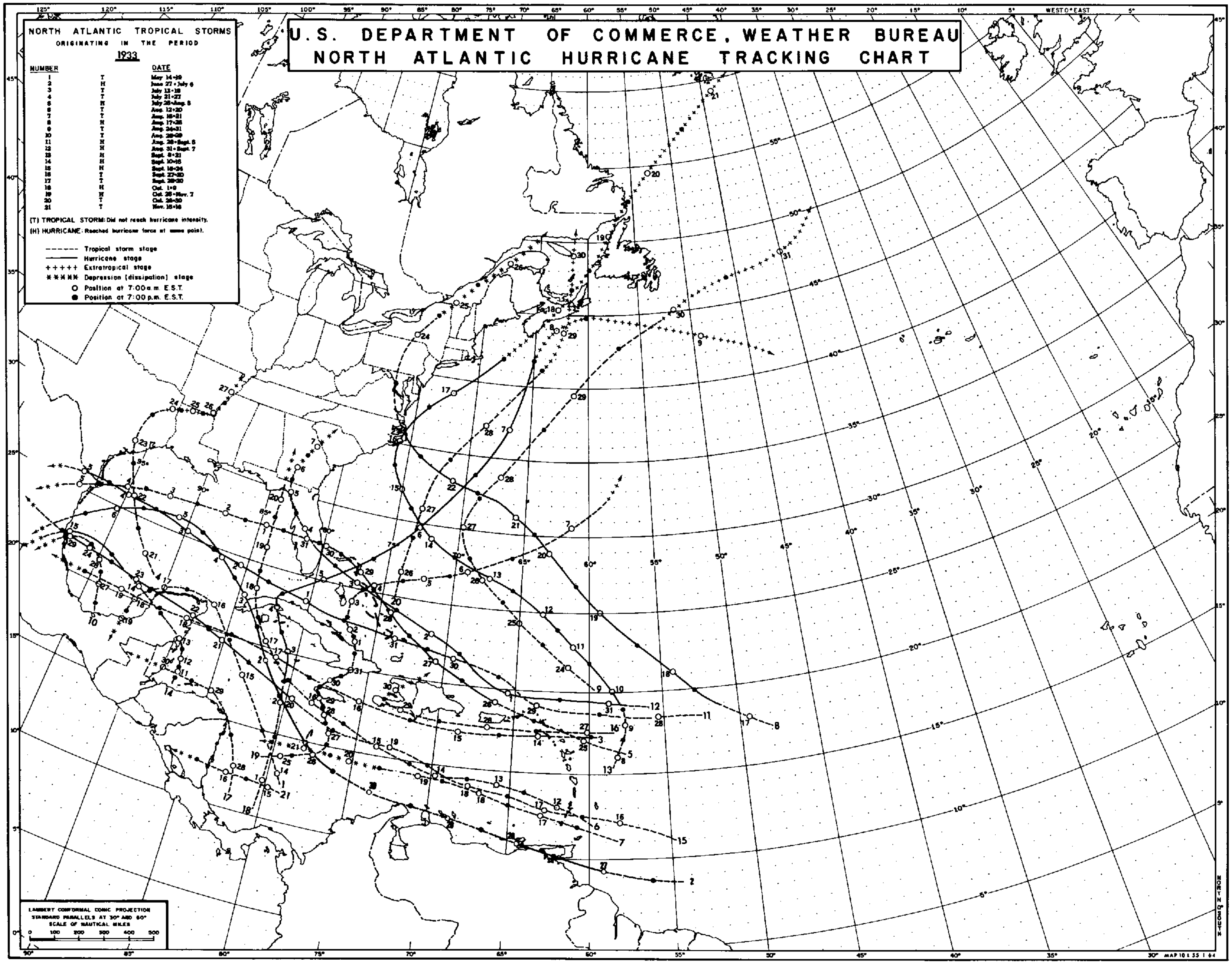

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1928
NUMBER
DATE
1 H Aug. 3-12
2 H Aug. 7-17
3 T Sept. 2-8
4 H Sept 6-20
5 T Sept. 8-12
6 H Oct. 10-14
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) 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
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

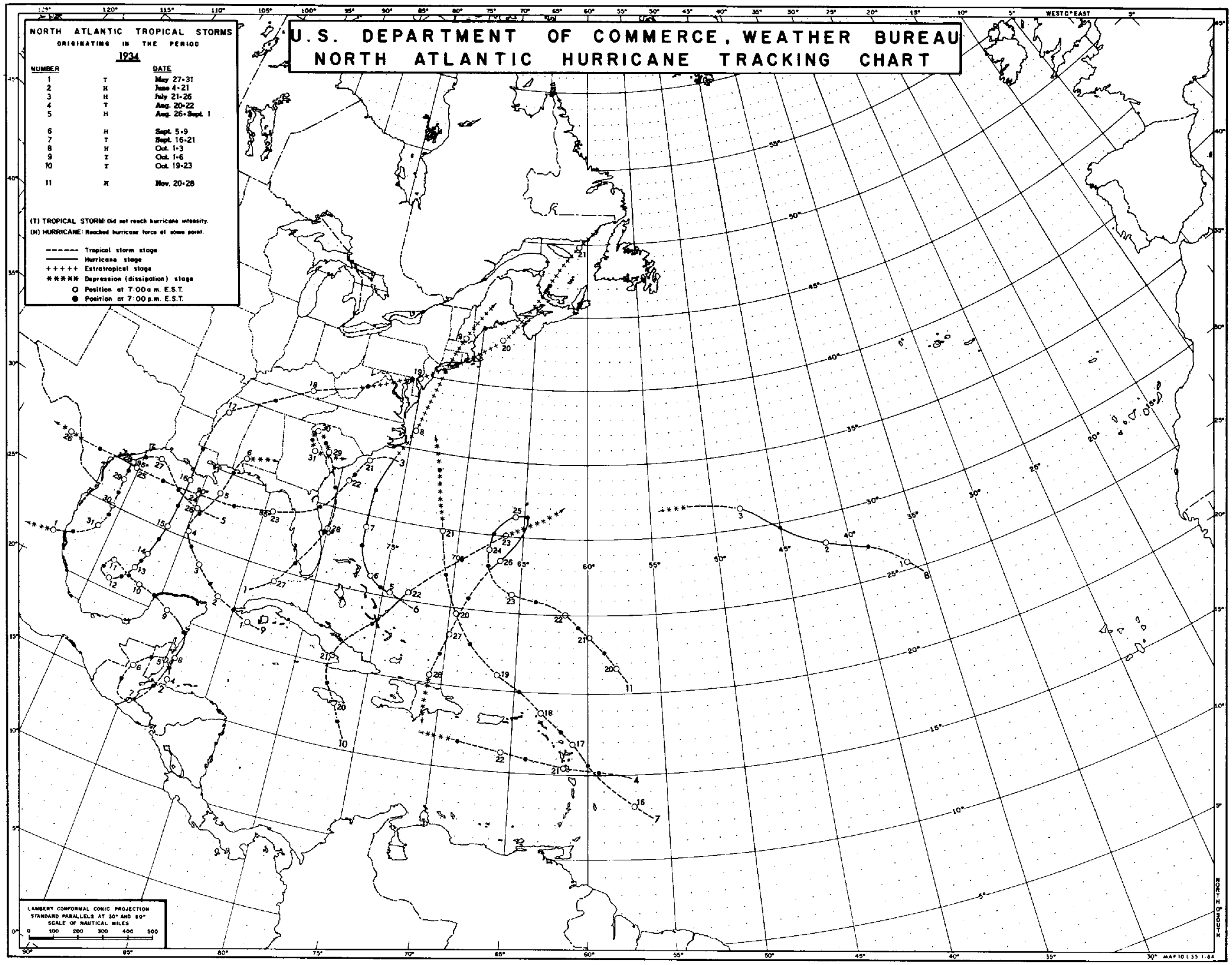

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1929
NUMBER
DATE
1 H Jun. 26—29
2 H Sep. 21—Oct. 4
3 H Oct. 15—22
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force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

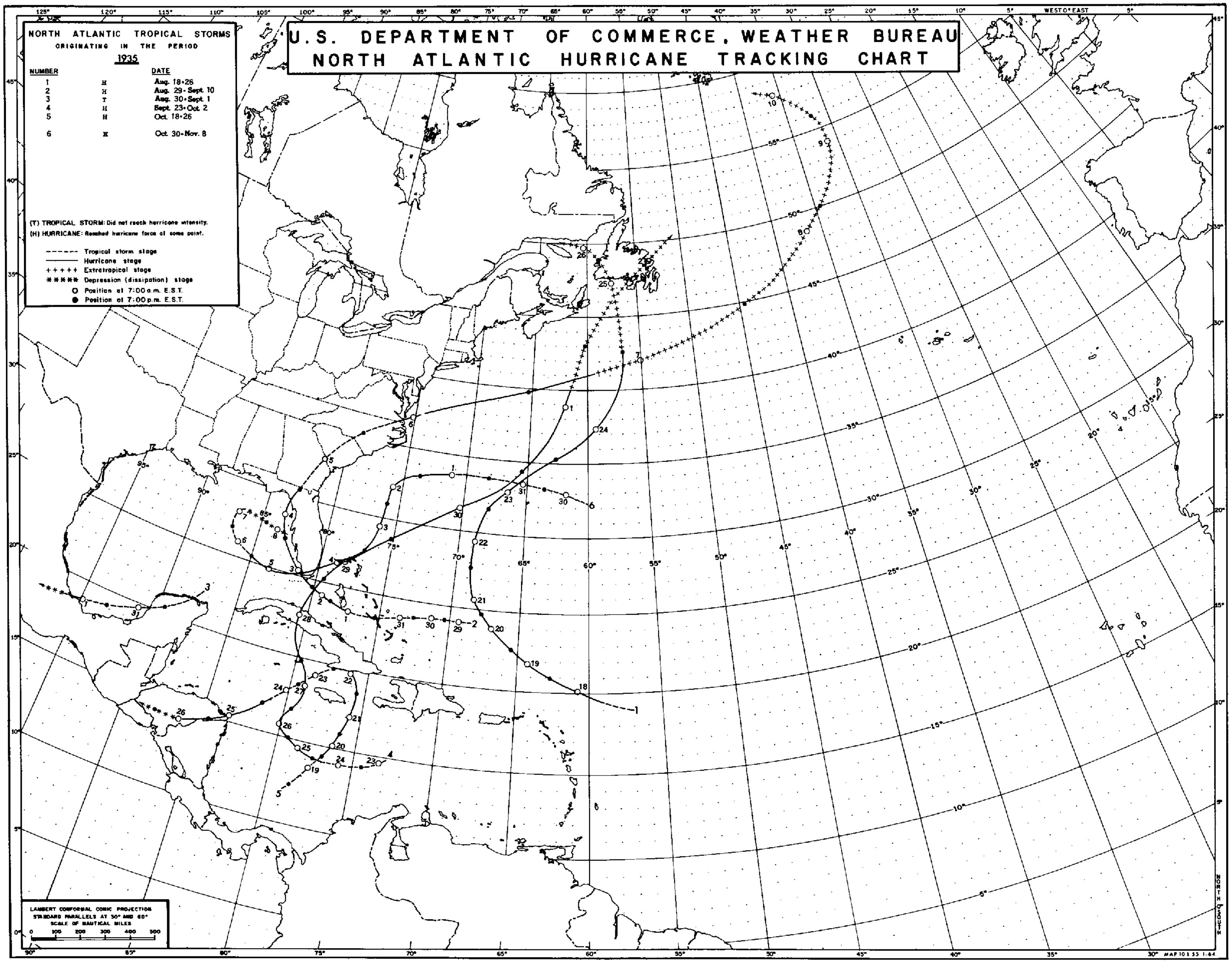

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1931
NUMBER DATE
1 T June 24-28
2 T July 11-17
3 T Aug. 10-18
4 T Aug. 16-20
5 H Sept. 5-12
6 H Sept. 8-16
7 T Sept. 25-27
8 T Oct. 18-22
9 T Nov. 22-25
(T) TROPICAL 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
0 100 200 300 400 500

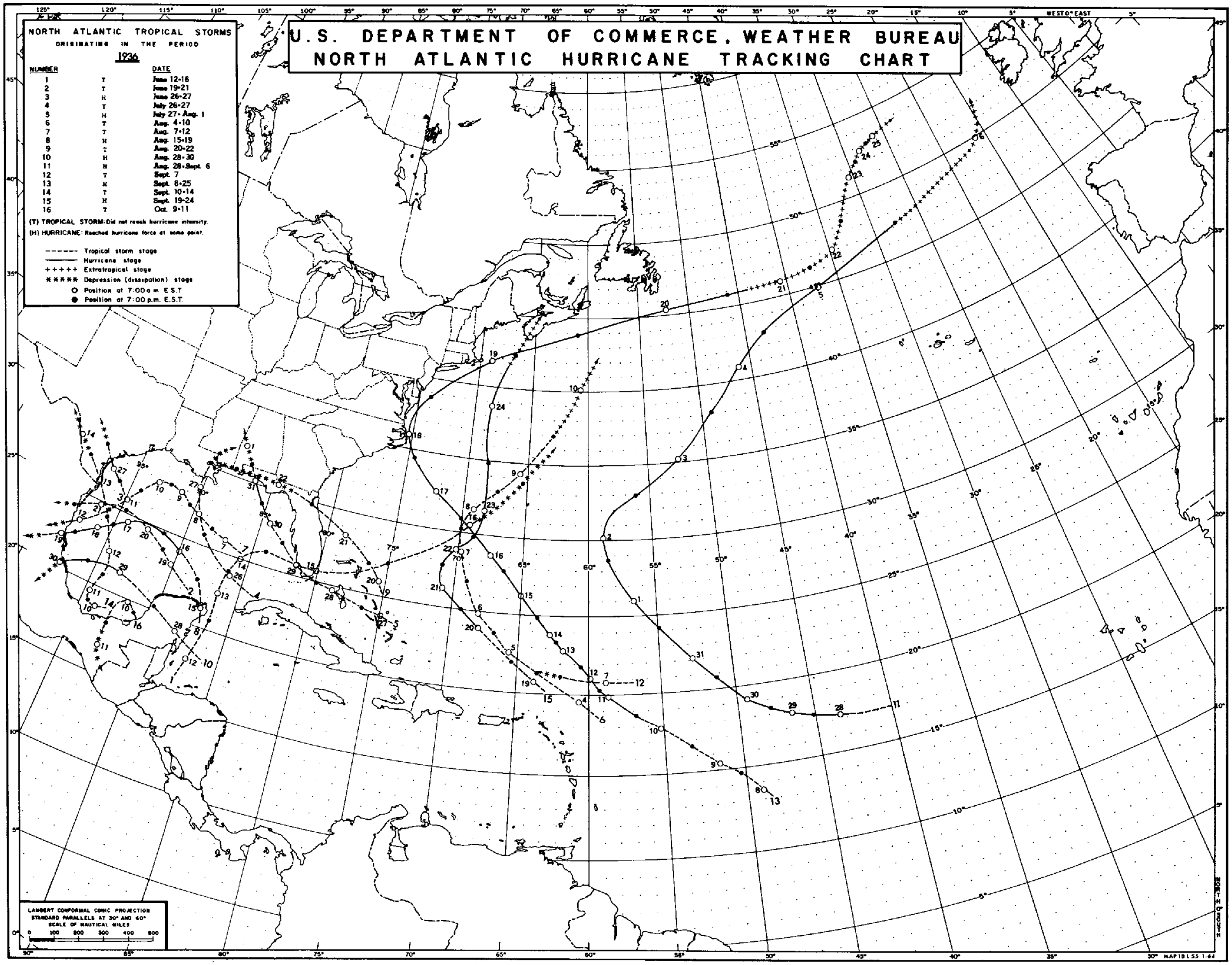

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1932
NUMBER DATE
1 T May 5-10
2 H Aug. 11-14
3 H Aug. 26-Sept. 3
4 H Aug. 30-Sept. 13
5 T Sept. 9-17
6 T Sept. 18-21
7 H Sept. 25-Oct. 3
8 T Oct. 7-18
9 T Oct.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

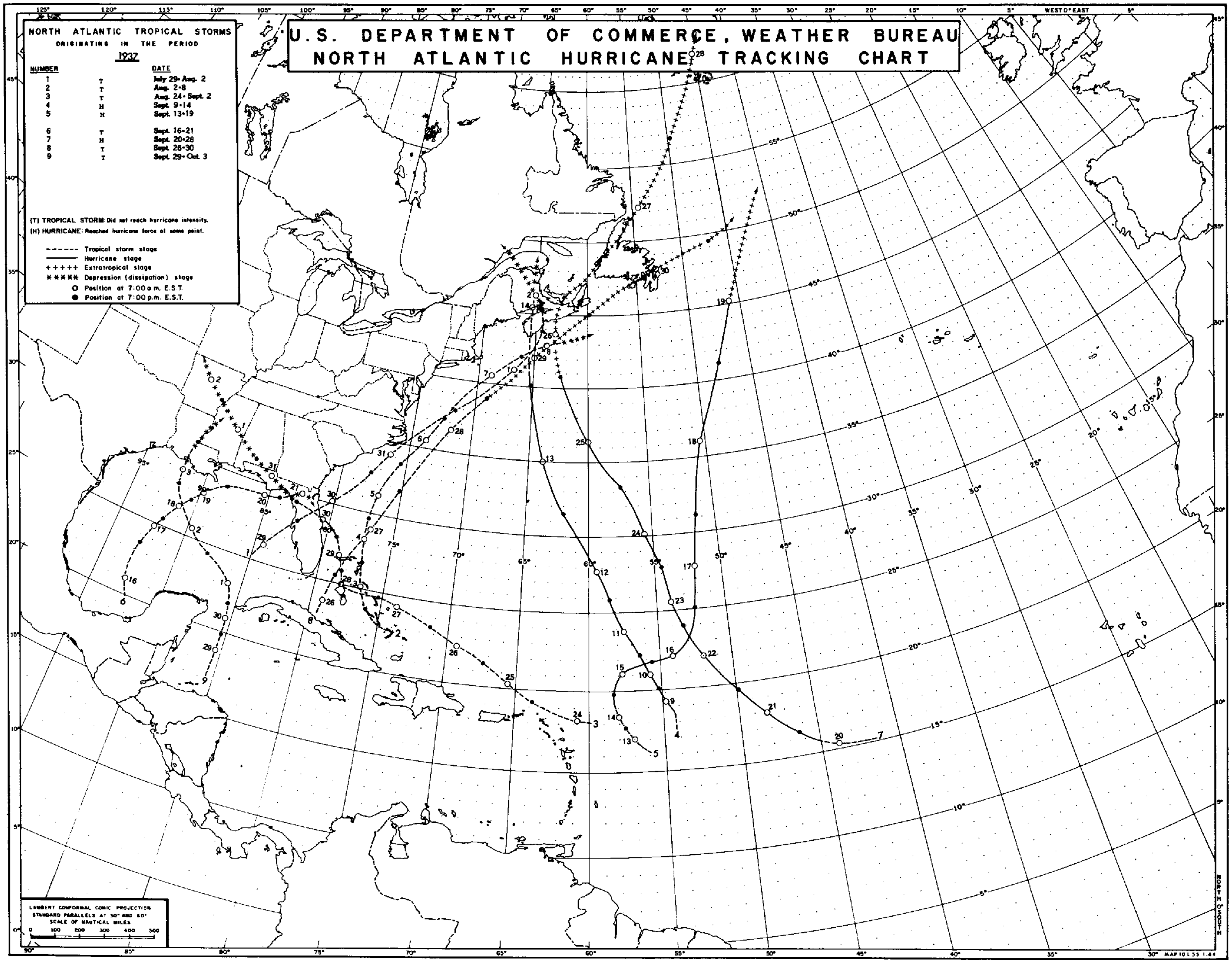

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1933
NUMBER
DATE
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: Reached hurricane force at some point.
Tropical storm stage
Hurricane stage
Extratropical stage
Depression (dissipation) stage
Position at 7:00 a.m. E.S.T.
Position at 7:00 p.m. E.S.T.

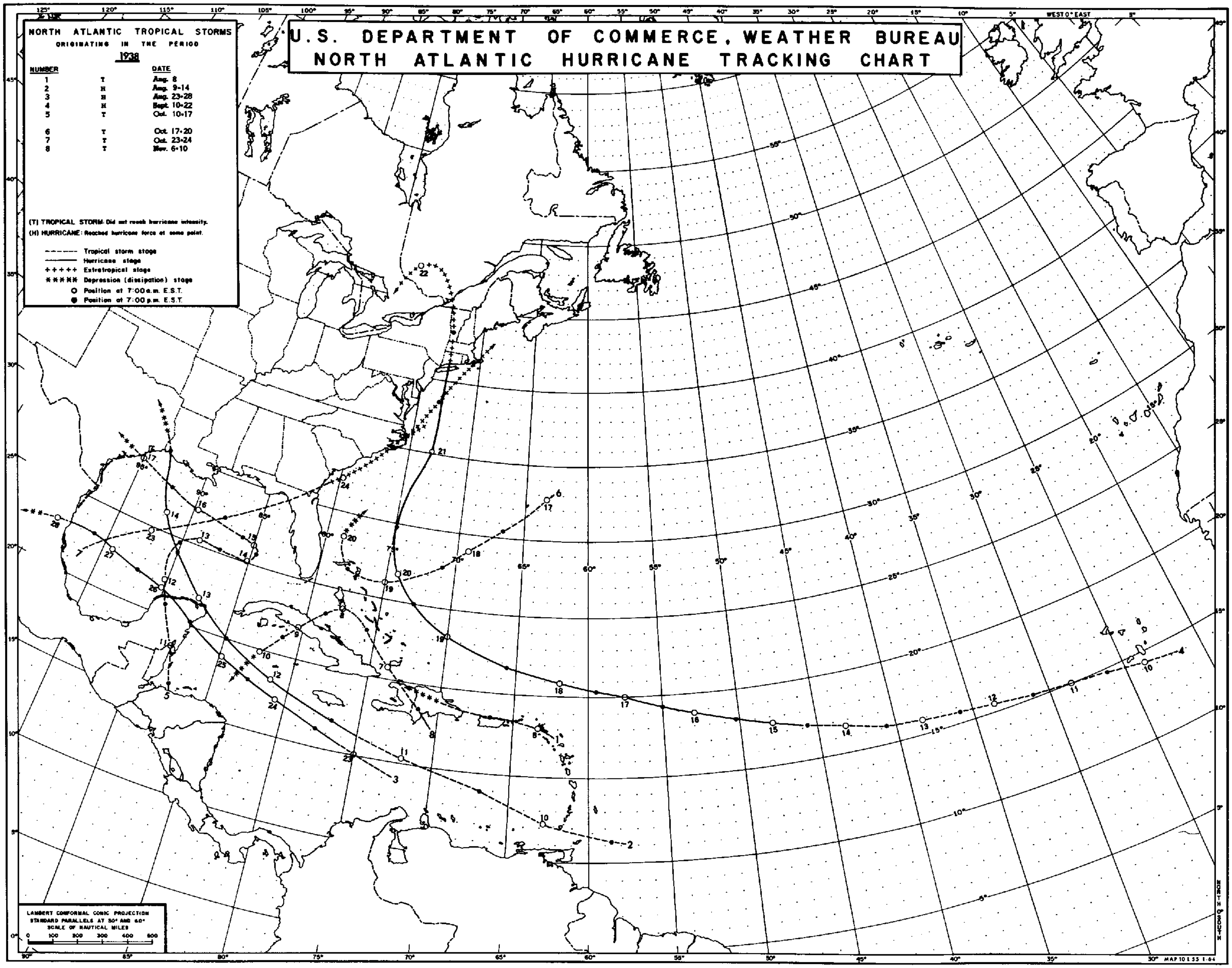


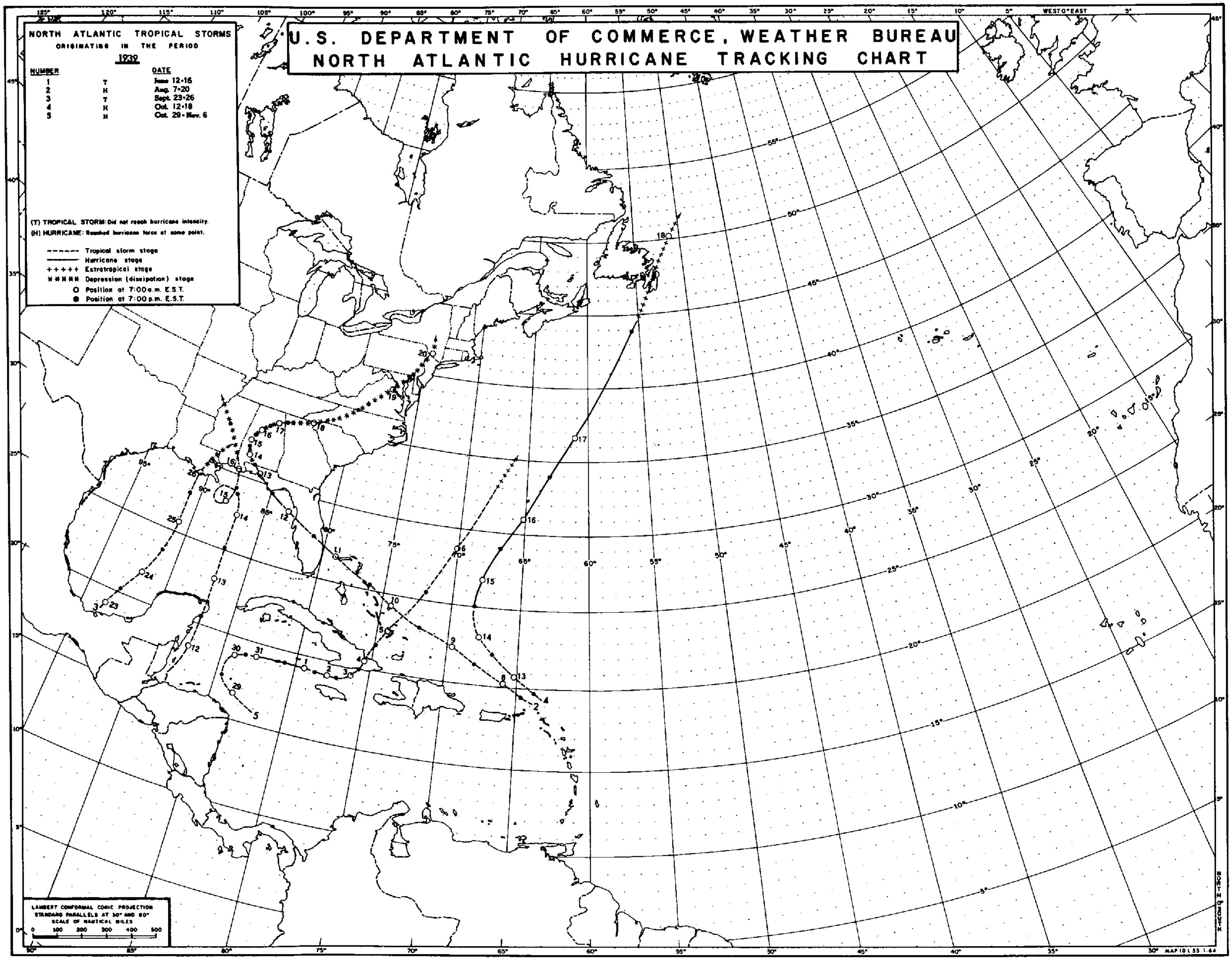
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1934
NUMBER DATE
1 T May 27-31
2 H June 4-21
3 H July 21-26
4 T Aug. 20-22
5 H Aug. 26-Sept. 1
6 H Sept. 5-9
7 T Sept. 16-21
8 H Oct. 1-3
9 T Oct. 1-6
10 T Oct.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

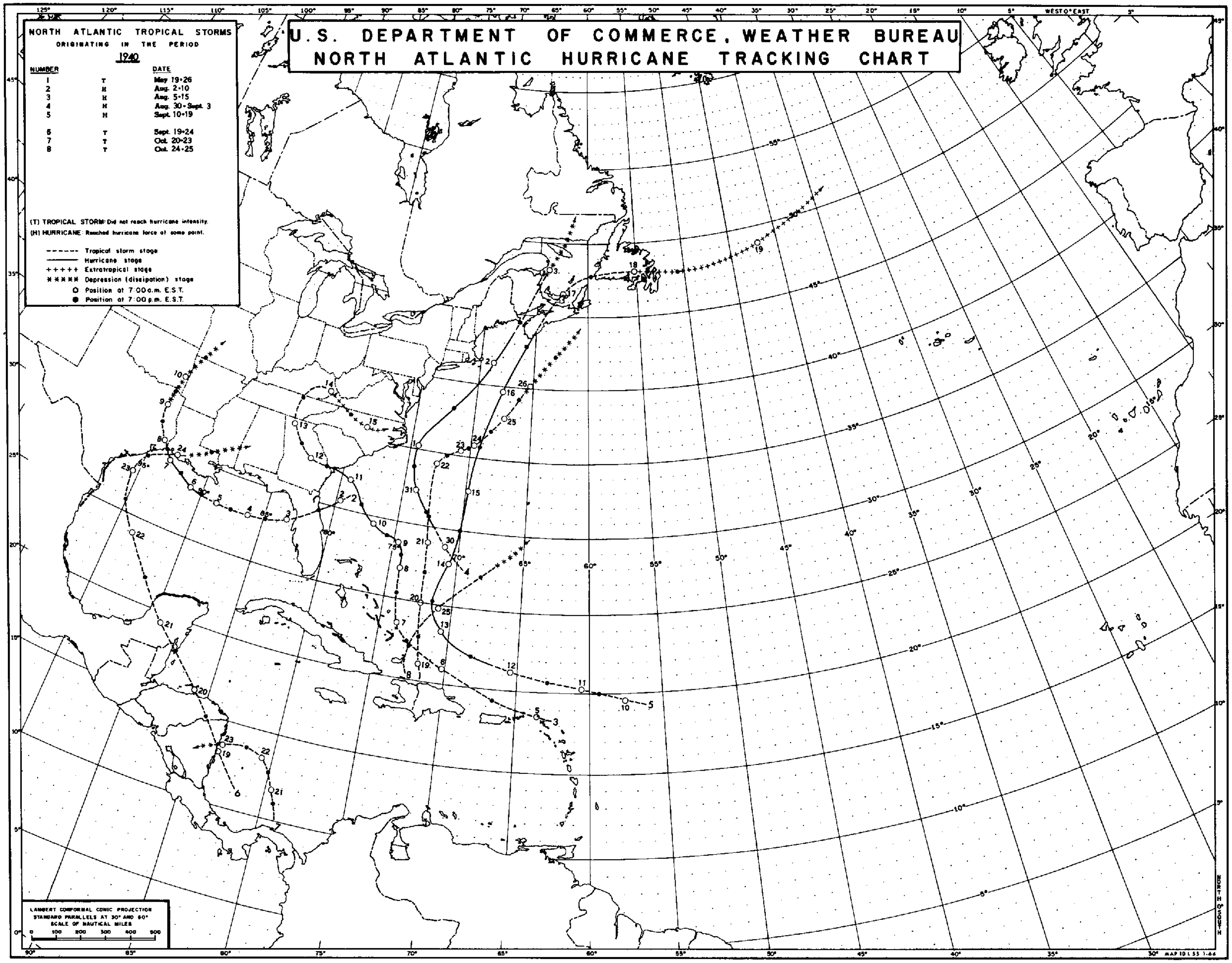

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1936
NUMBER DATE
1 T June 12-16
2 T June 19-21
3 H June 26-27
4 T July 26-27
5 H July 27- Aug. 1
6 T Aug. 4-10
7 T Aug. 7-12
8 H Aug. 15-19
9 T Aug. 20-22
10 H 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
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

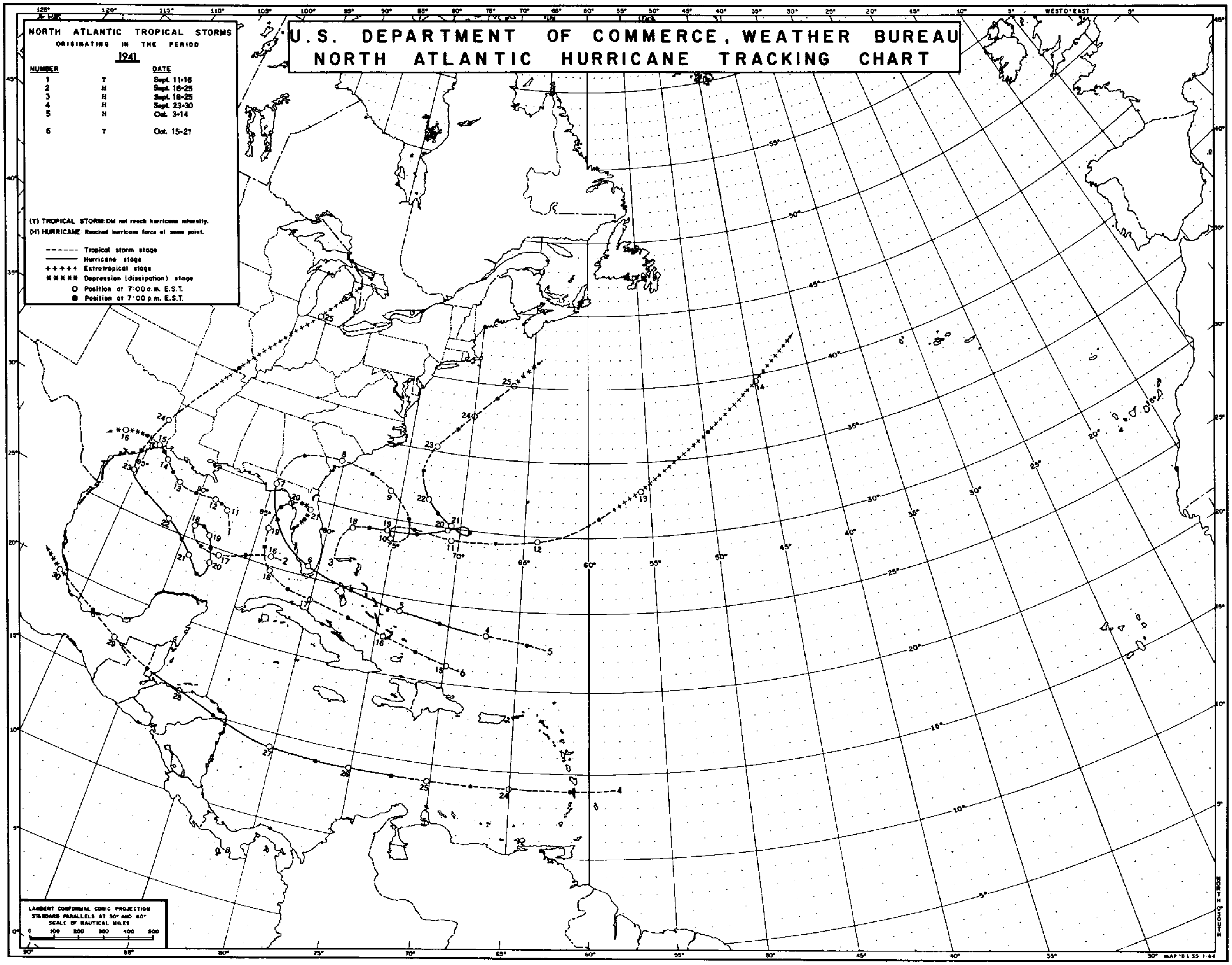

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1937
NUMBER
DATE
1 T July 29-Aug. 2
2 T Aug. 2-8
3 T Aug. 24-Sept. 2
4 H Sept. 9-14
5 H Sept. 13-19
6 T Sept. 16-21
7 H Sept. 20-28
8 T Sept. 26-30
9 T Sept. 29-Oct.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

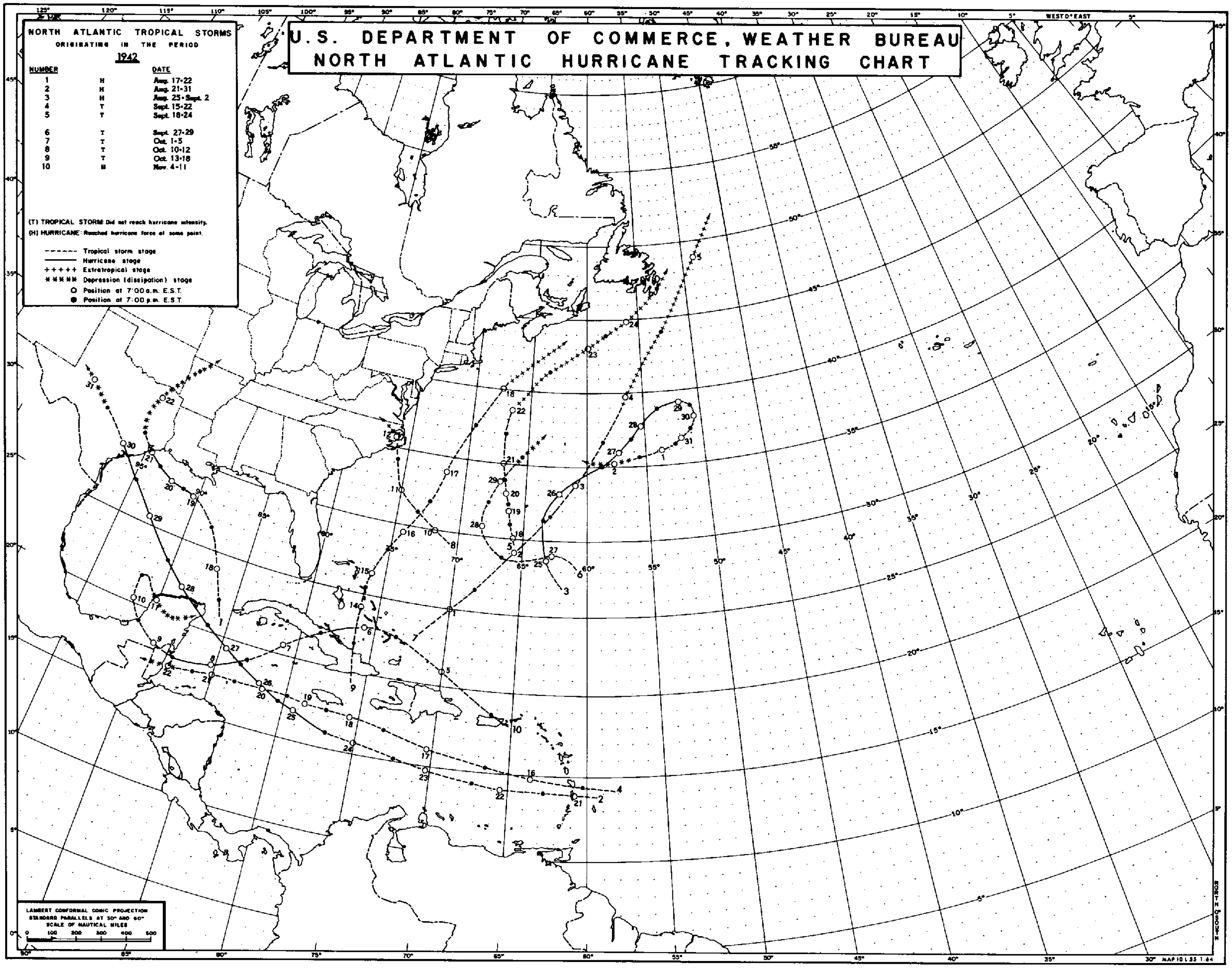

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1938
NUMBER
DATE
1 T Aug. 8
2 H Aug. 9-14
3 H Aug. 23-28
4 H Sept. 10-22
5 T Oct. 10-17
6 T Oct. 17-20
7 T Oct. 23-24
8 T Nov. 6-10
(T) TROPICAL STORM: Did not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

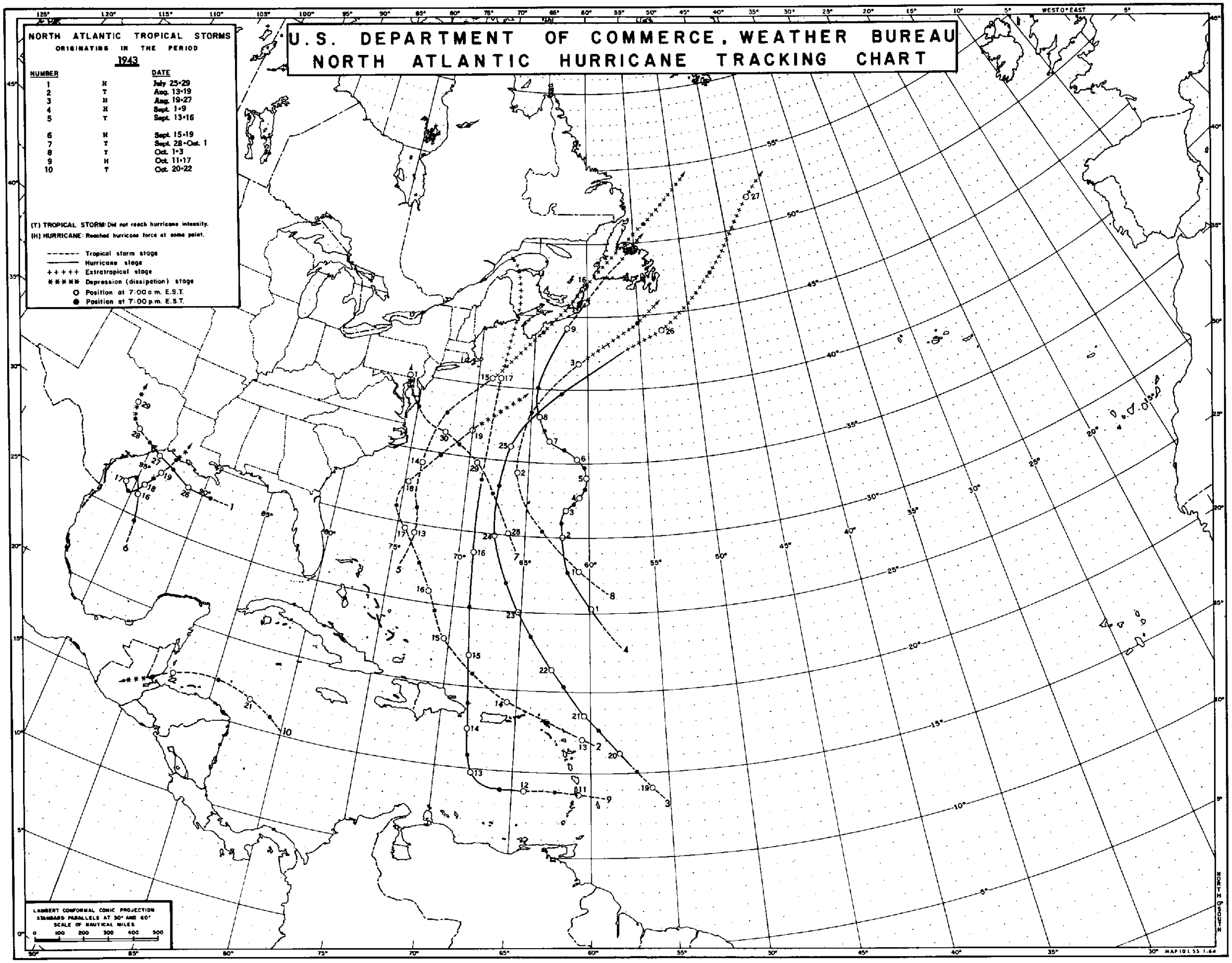


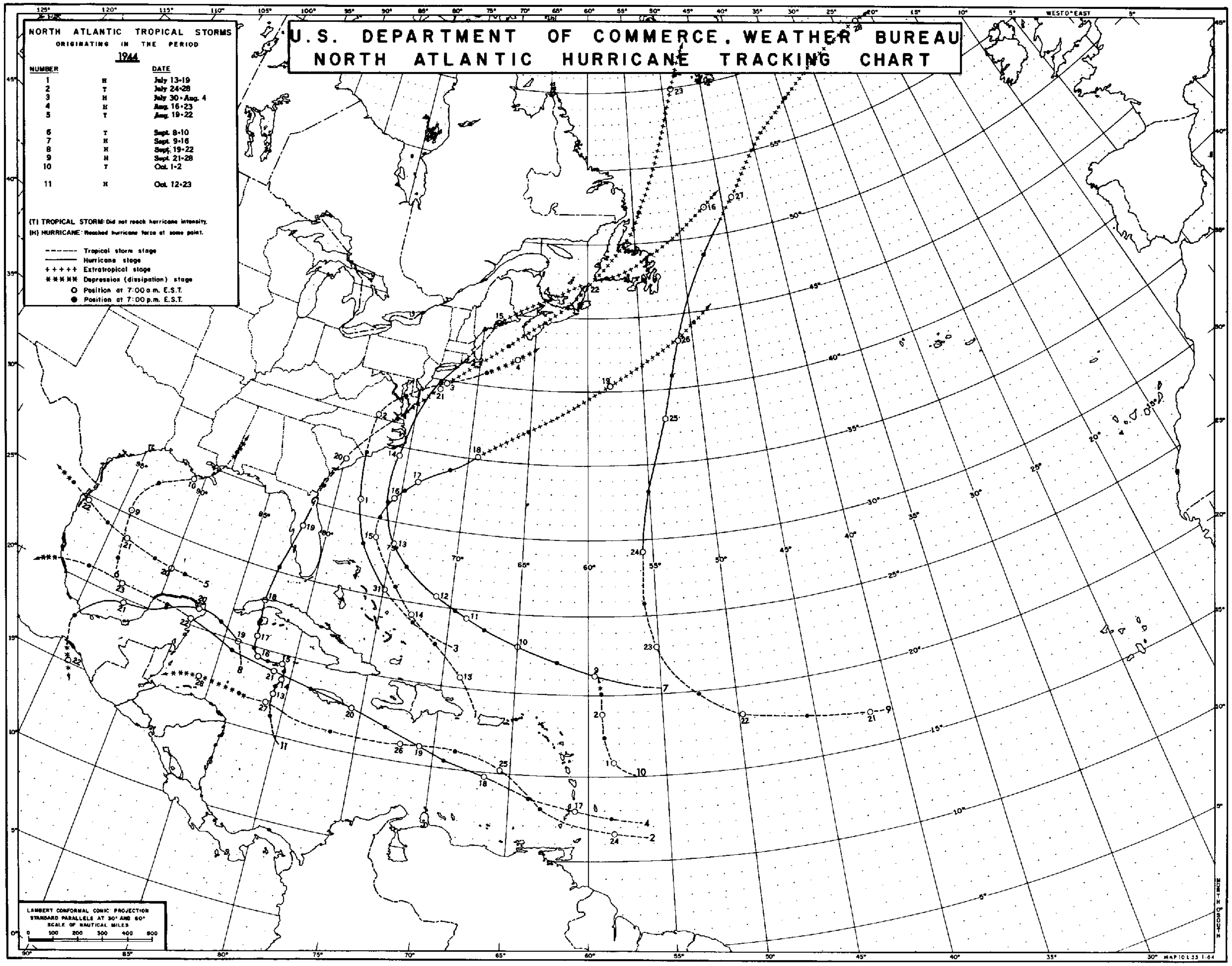
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1939
NUMBER
DATE
1 T June 12-16
2 H Aug. 7-20
3 T Sept. 23-26
4 H Oct. 12-18
5 H Oct. 29-Nov. 6
(T) TROPICAL STORM: Did not reach hurricane intensity.
(H) HURRICANE: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

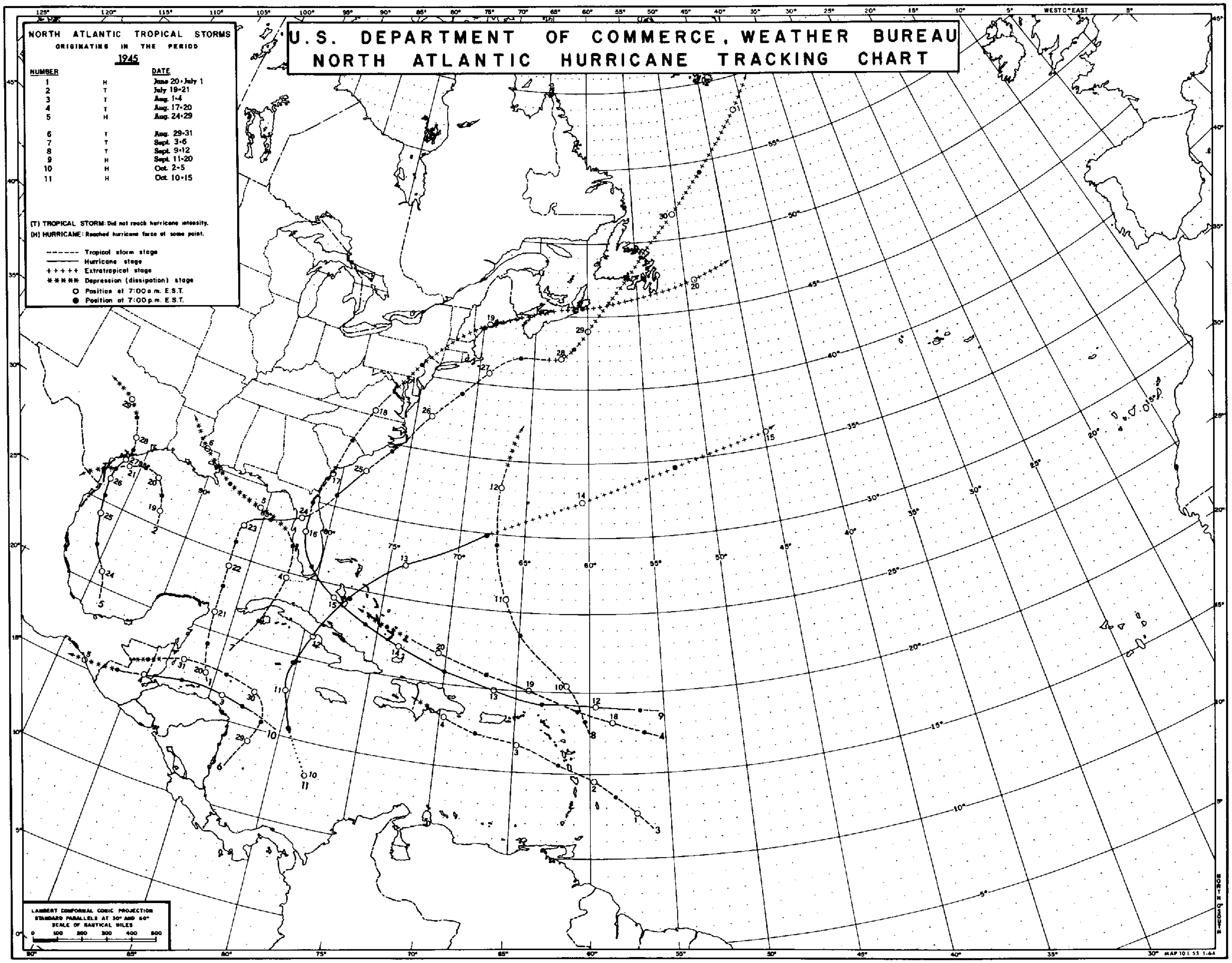

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1940
NUMBER DATE
1 T May 19-26
2 H Aug. 2-10
3 H Aug. 5-15
4 H Aug. 30-Sept. 3
5 H Sept. 10-19
6 T Sept. 19-24
7 T Oct. 20-23
8 T Oct. 24-25
(T) TROPICAL STORM: 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
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

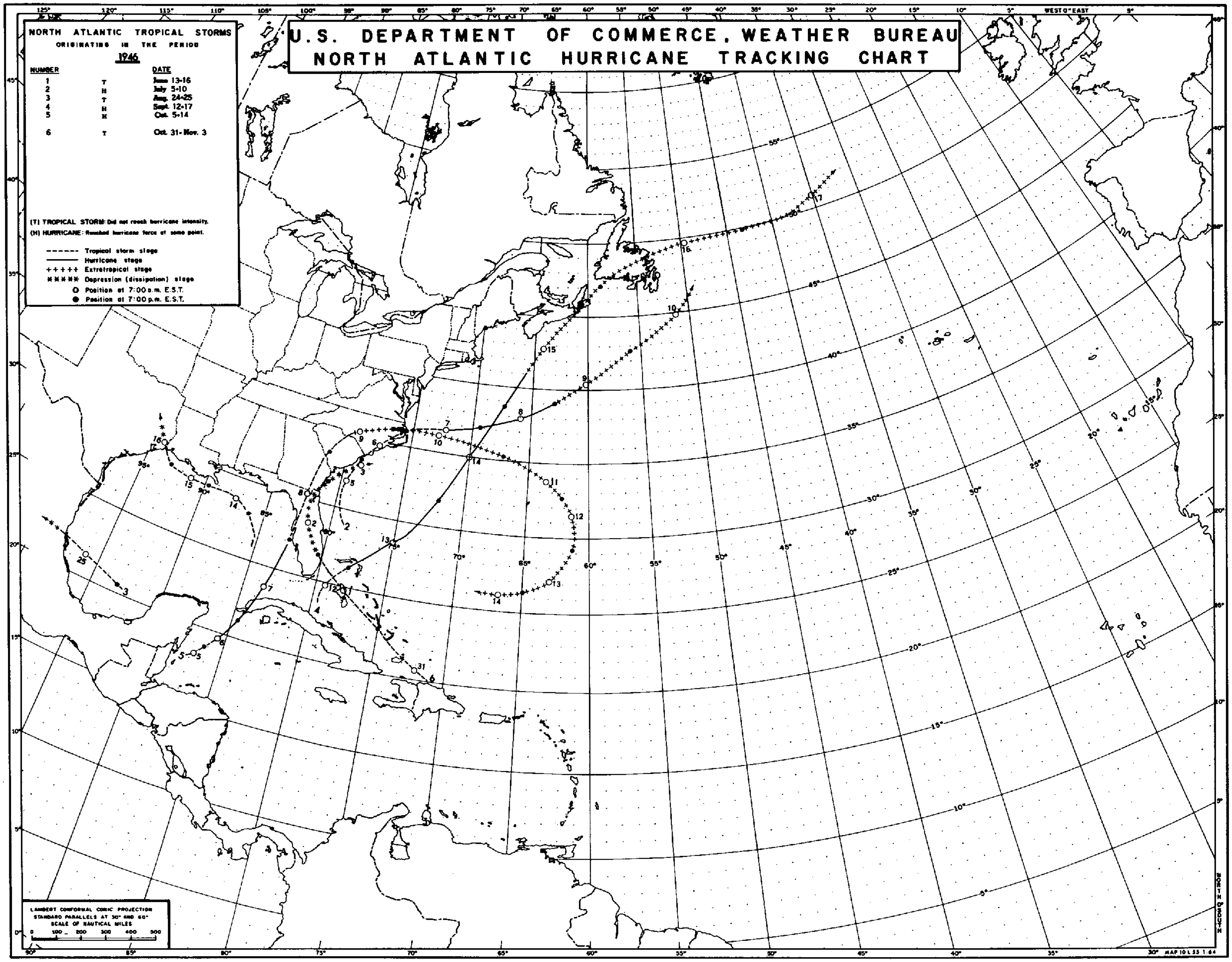

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1941
NUMBER DATE
1 T Sept. 11-16
2 H Sept. 16-25
3 H Sept. 18-25
4 H Sept. 23-30
5 H Oct. 3-14
6 T Oct. 15-21
(T) TROPICAL STORM: Did not reach hurricane intensity.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

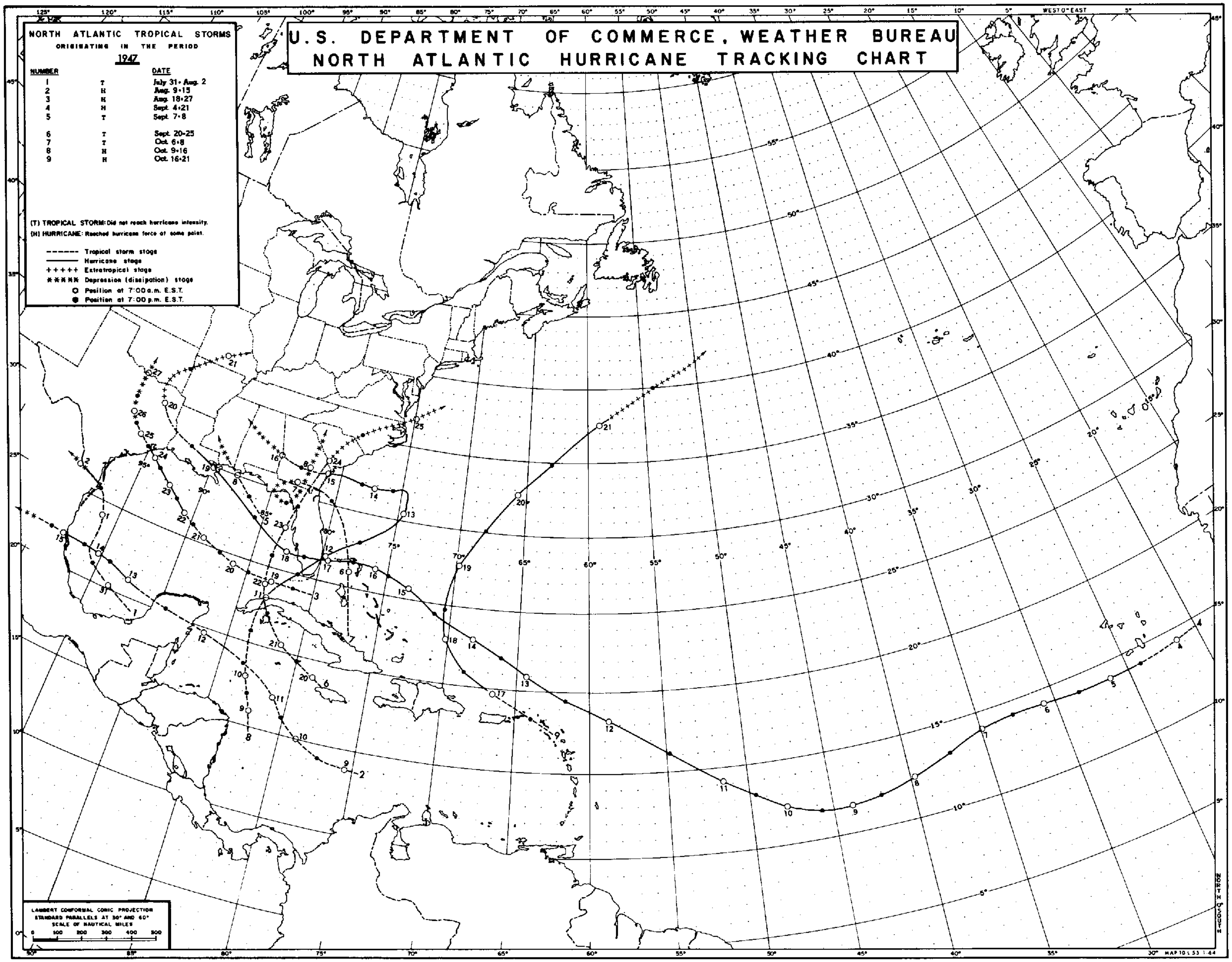

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1942
NUMBER DATE
1 H Aug. 17-22
2 H Aug. 21-31
3 H Aug. 25-Sept. 2
4 T Sept. 15-22
5 T Sept. 18-24
6 T Sept. 27-29
7 T Oct. 1-5
8 T Oct. 10-12
9 T Oct. 13-18
10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

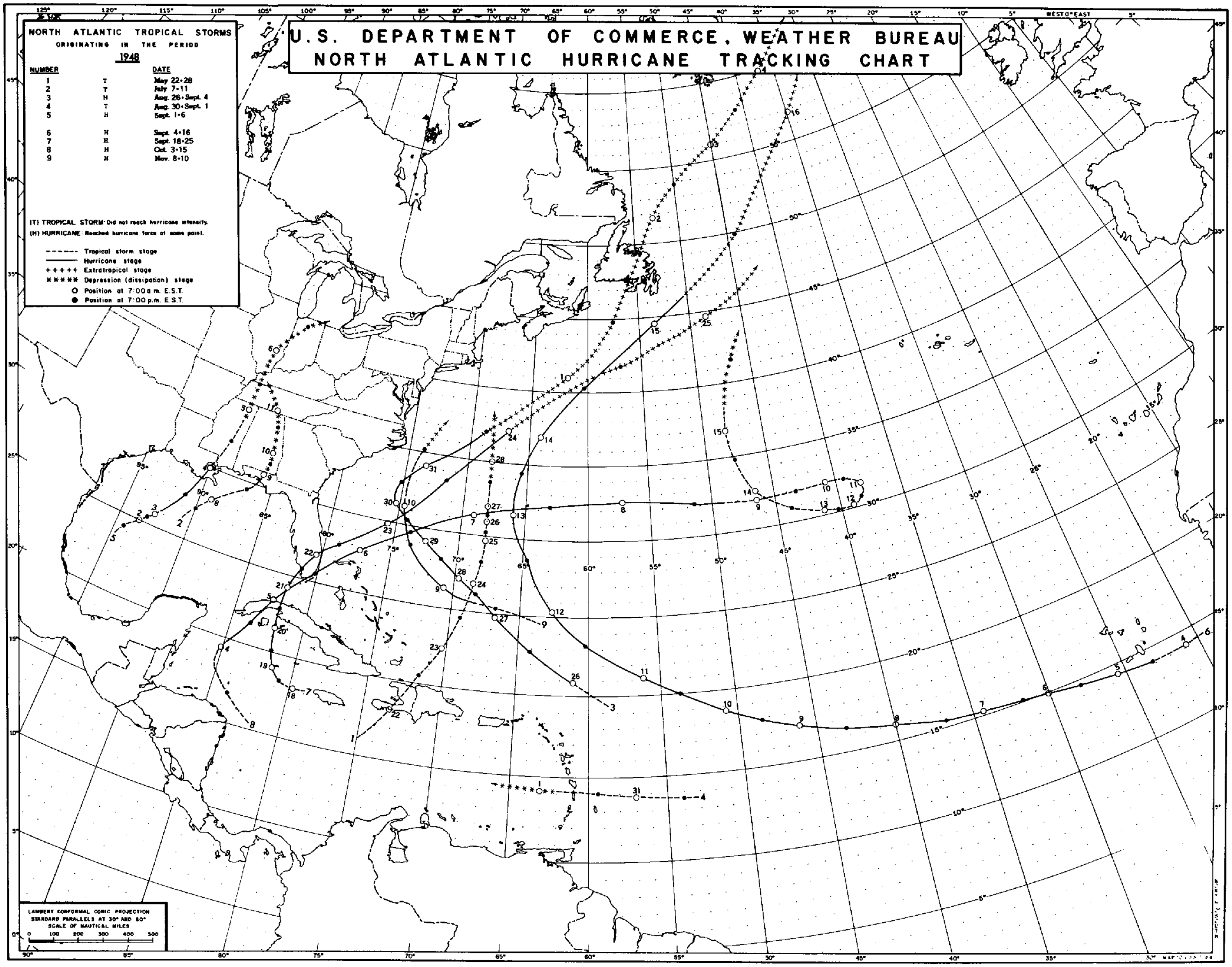

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1943
NUMBER
DATE
1 H July 25-29
2 T Aug. 13-19
3 H Aug. 19-27
4 H Sept. 1-9
5 T Sept. 13-16
6 H Sept. 15-19
7 T Sept. 28-Oct. 1
8 T Oct. 1-3
9 H Oct. 11-17
10 T 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

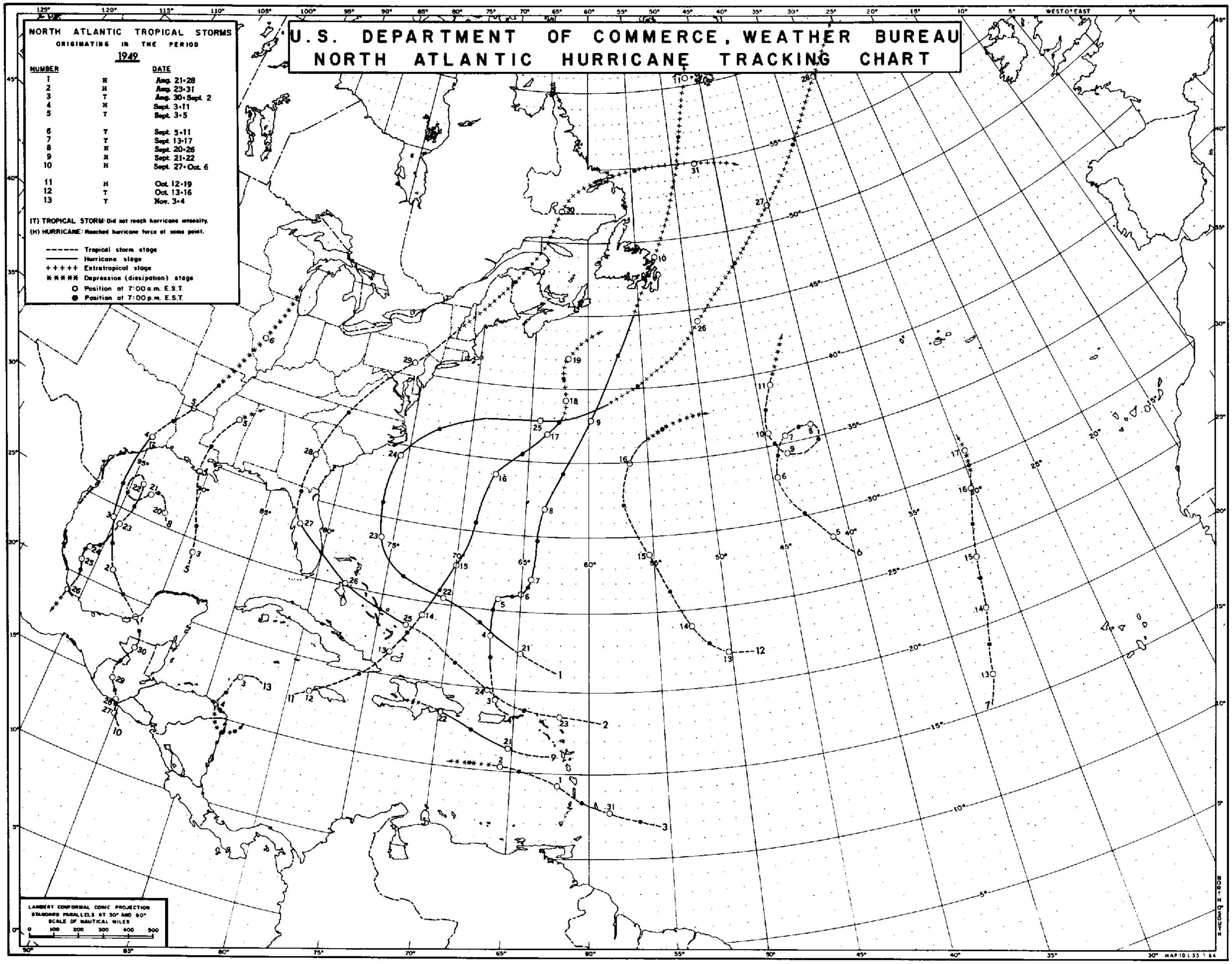

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1945
NUMBER
DATE
1 H June 20-July 1
2 T July 19-21
3 T Aug. 1-4
4 T Aug. 17-20
5 H Aug. 24-29
6 T Aug. 29-31
7 T Sept. 3-6
8 T Sept. 9-12
9 H Sept. 11-20
10 H Oct.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


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


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


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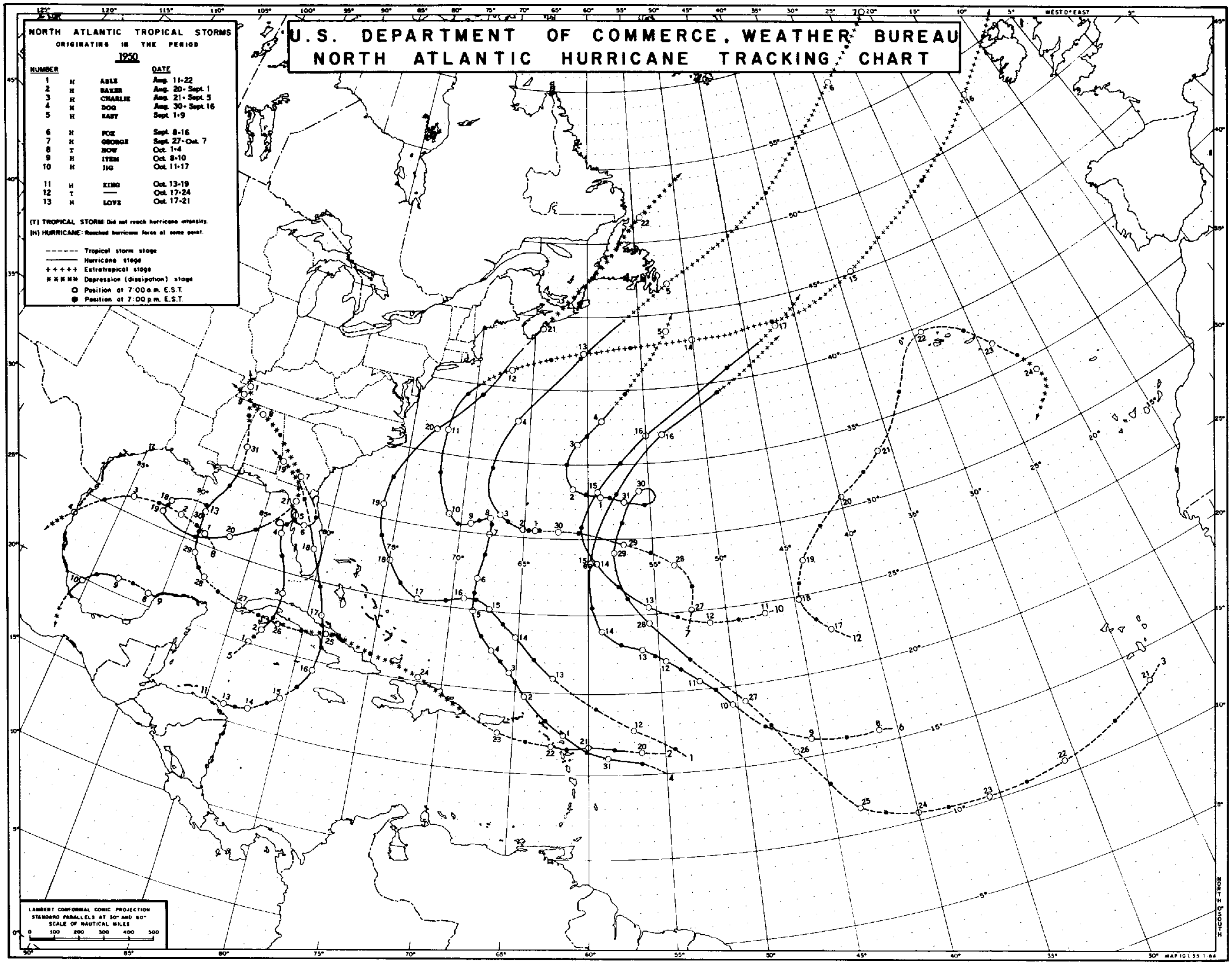
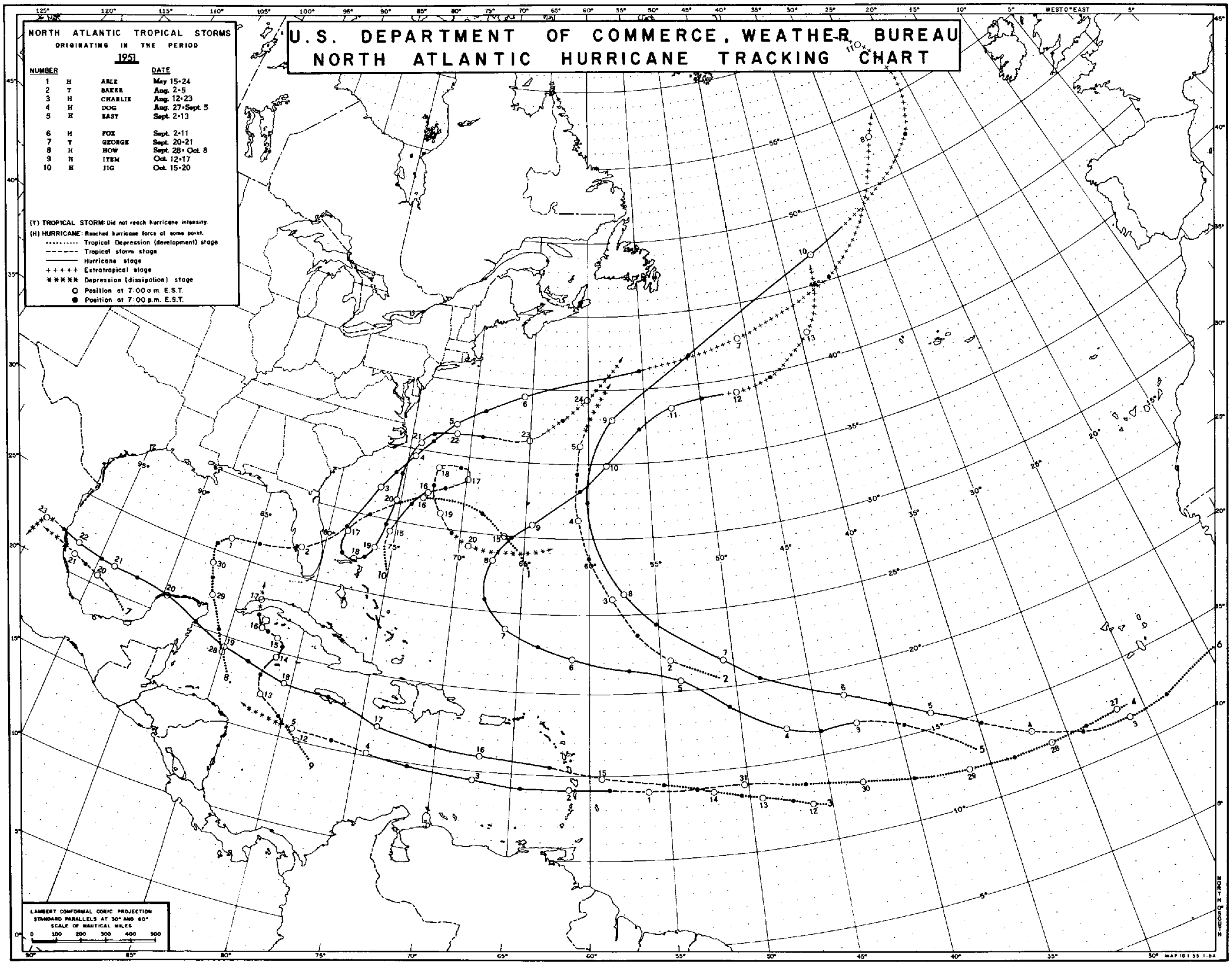
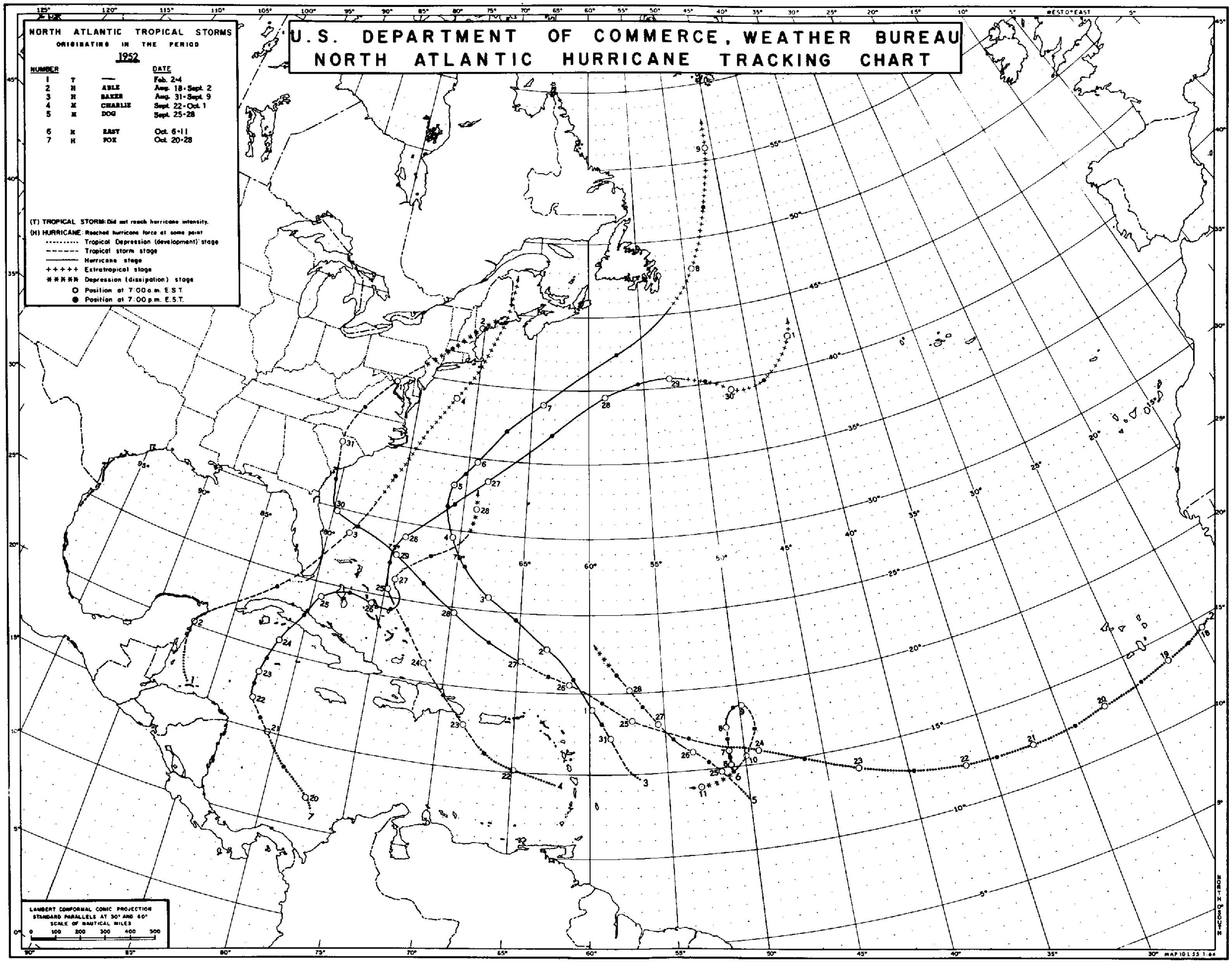
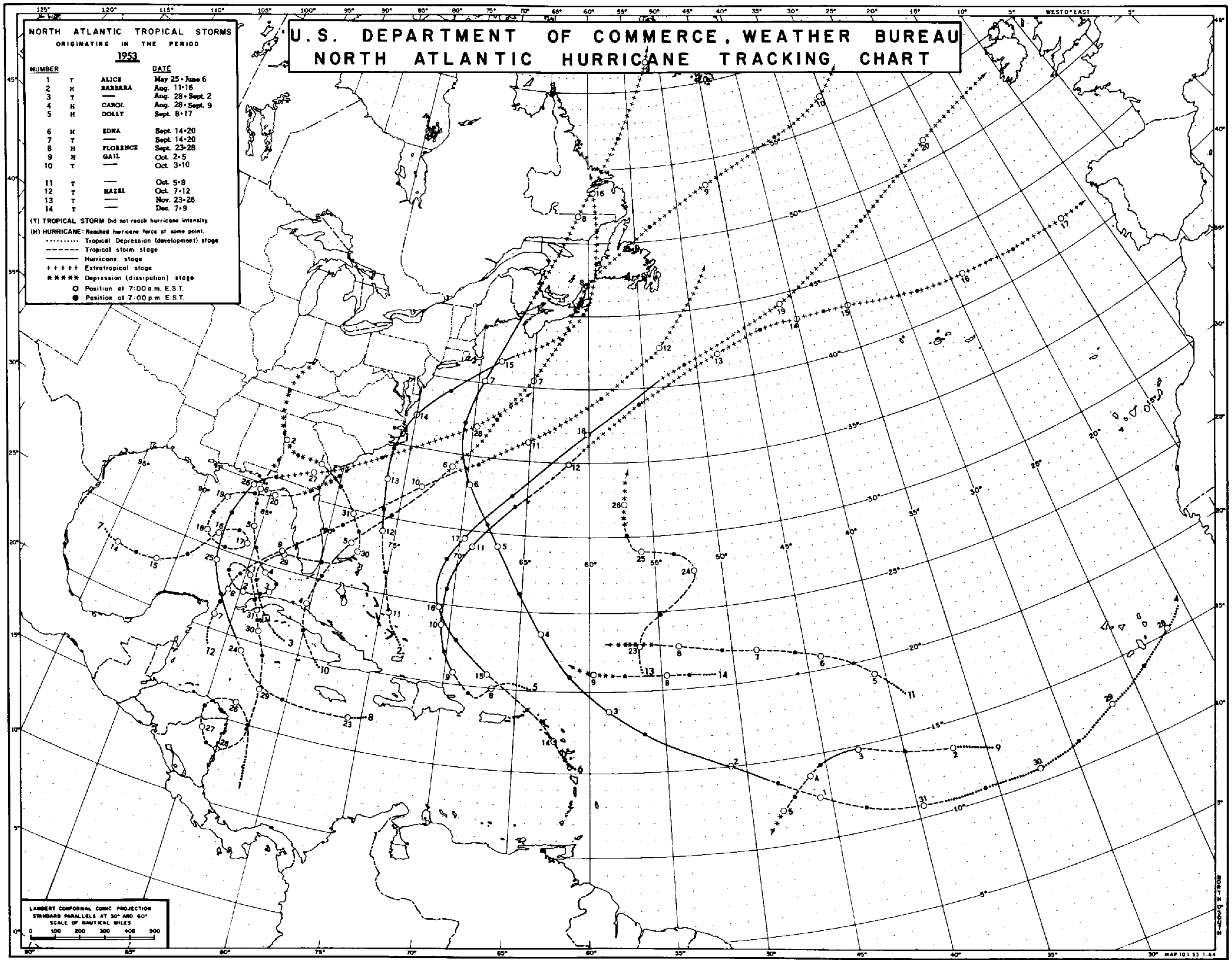
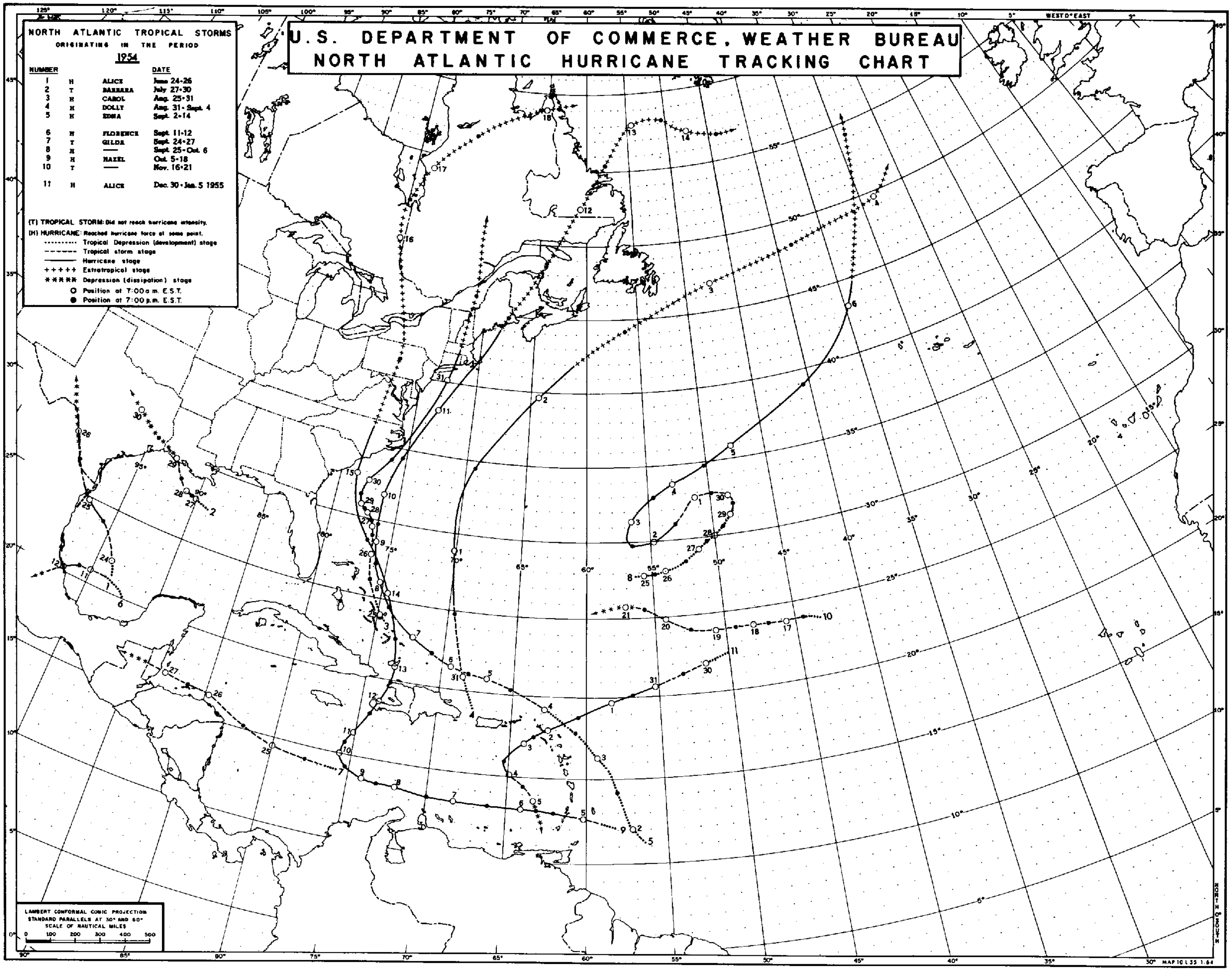

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1950
NUMBER DATE
1 H ABLE Aug. 11-22
2 H BAKER Aug. 20 - Sept. 1
3 H CHARLIE Aug. 21 - Sept. 5
4 H DOG Aug. 30 - Sept. 16
5 H EASY Sept. 1-9
6 H FOX Sept. 8-16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

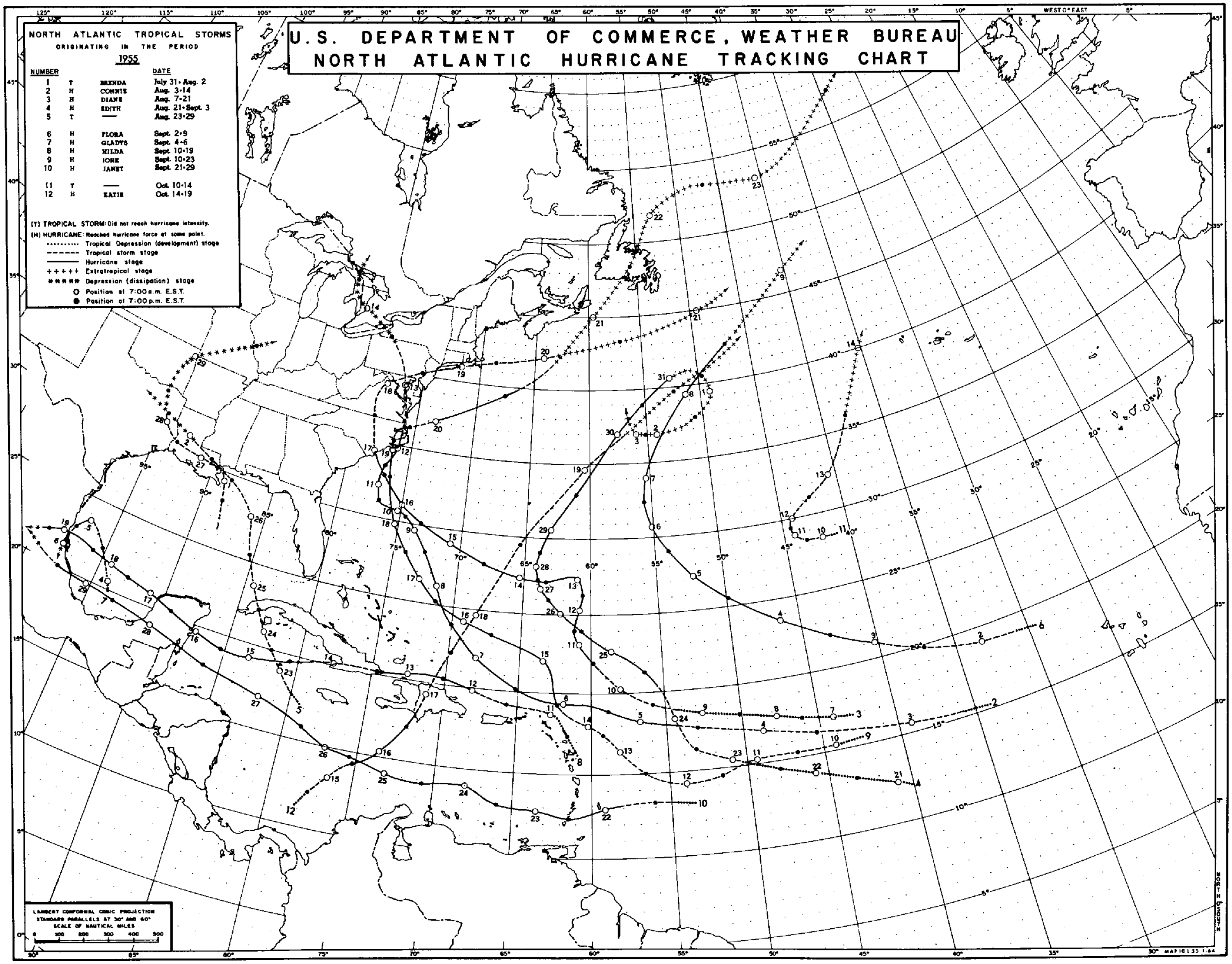


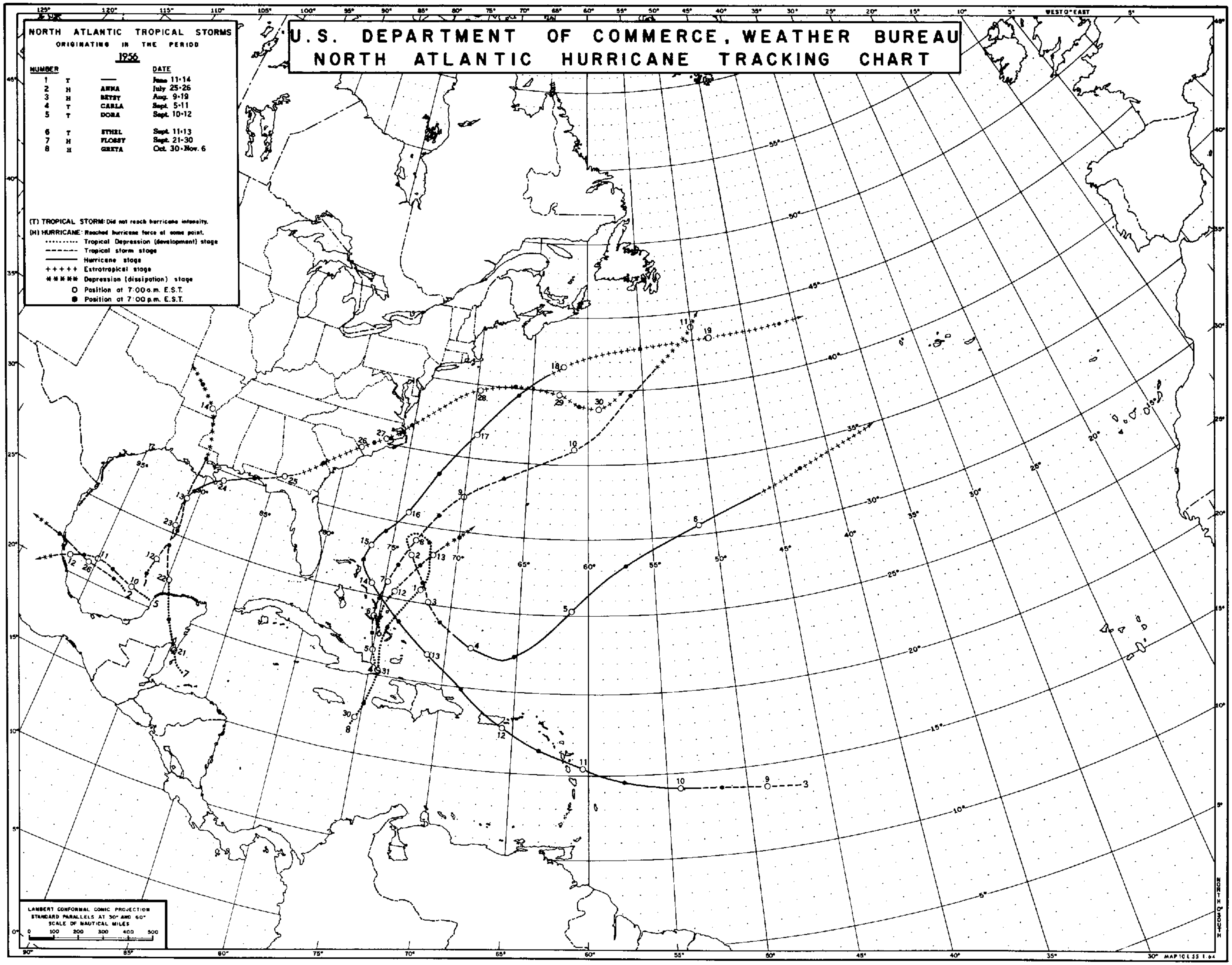
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1952
NUMBER DATE
1 T — Feb. 2-4
2 H ABLE Aug. 18-Sept. 2
3 H BAKER Aug. 31-Sept. 9
4 H CHARLIE Sept. 22-Oct. 1
5 H DOG Sept. 25-28
6 H EASY Oct. 6-11
7 H FOX Oct. 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

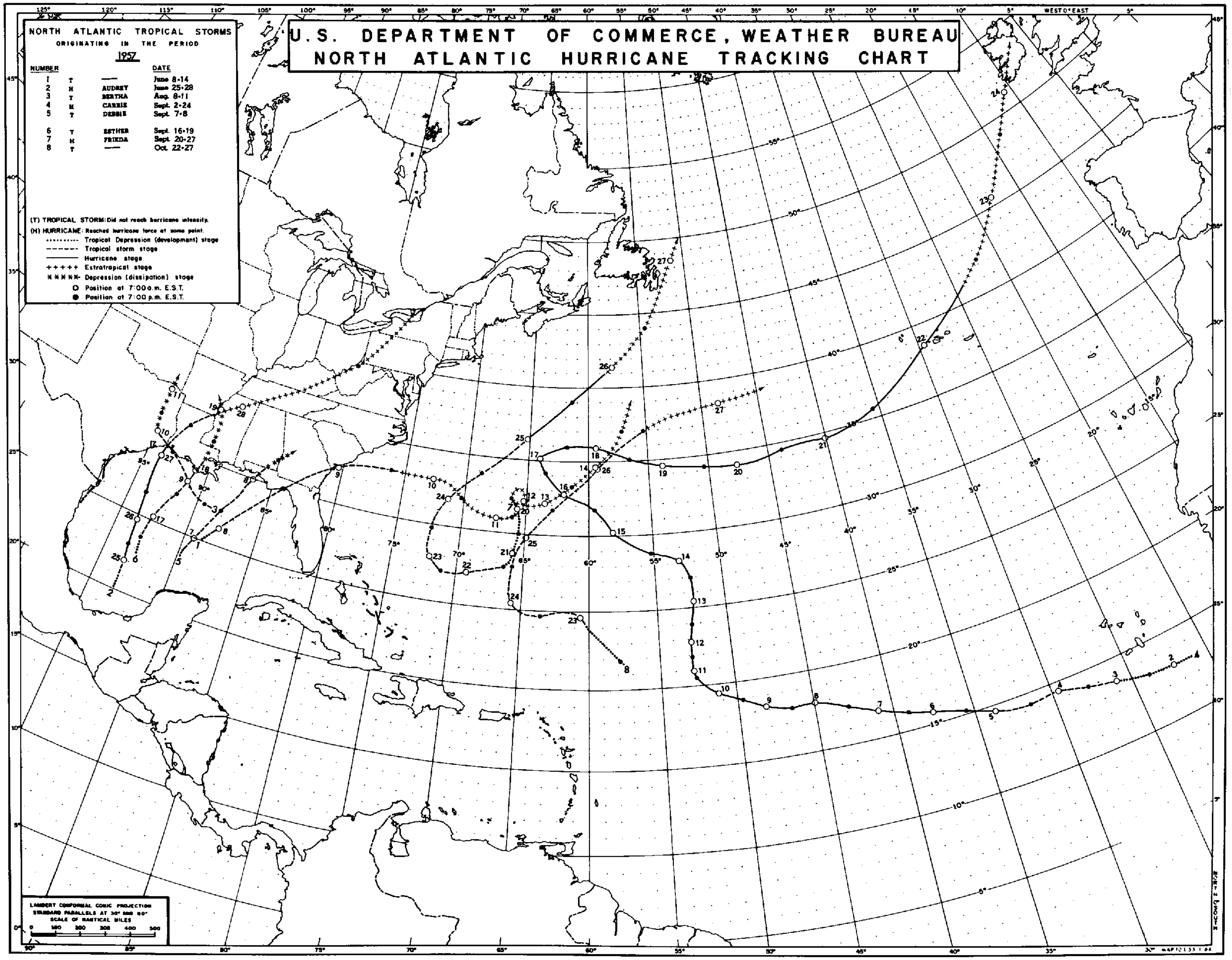

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1953
NUMBER DATE
1 T ALICE May 25 - June 6
2 H BARBARA Aug. 11-16
3 T — Aug. 28 - Sept. 2
4 H CAROL Aug. 28 - Sept. 9
5 H DOLLY Sept. 8-17
6 H EDNA Sept. 14-20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

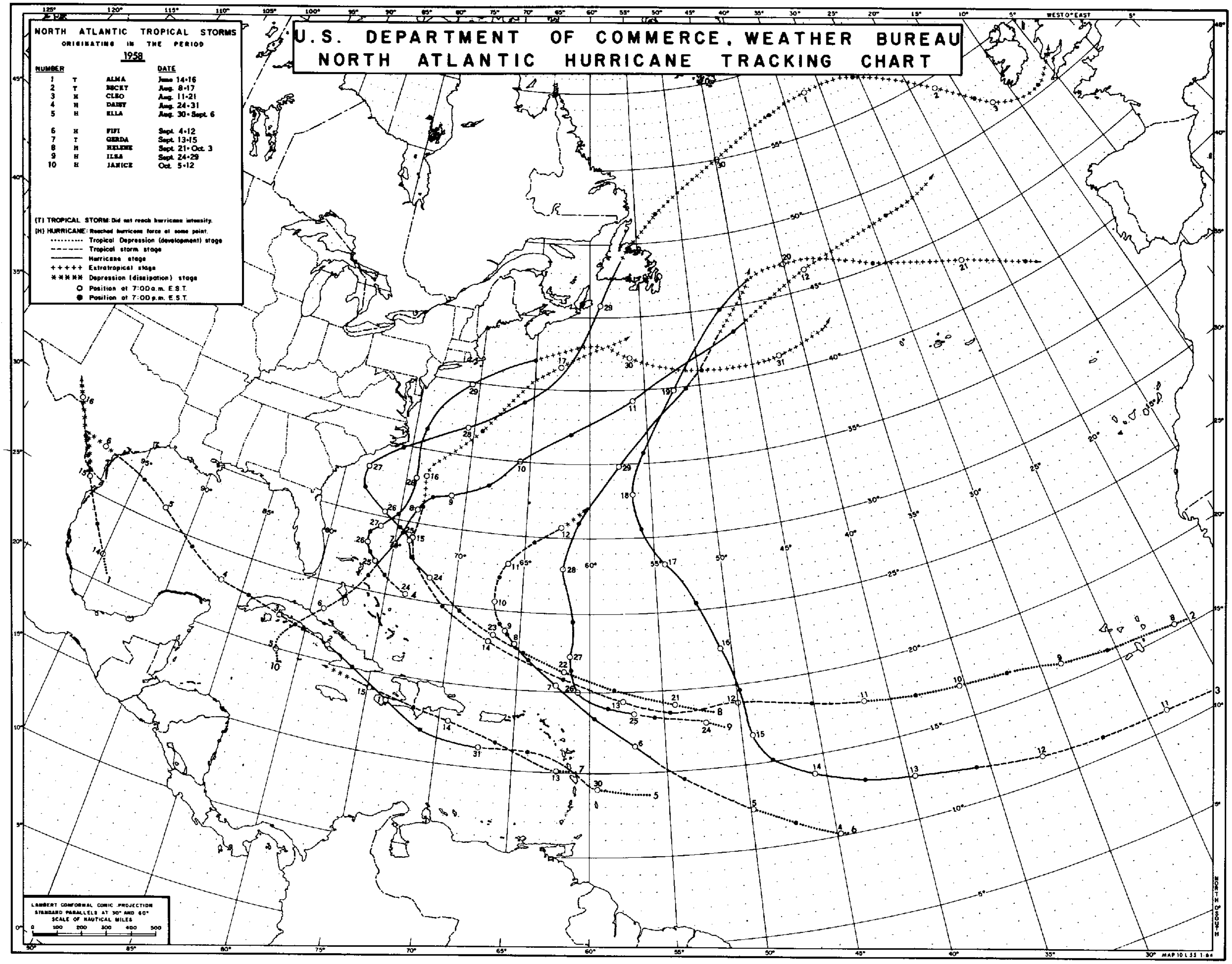


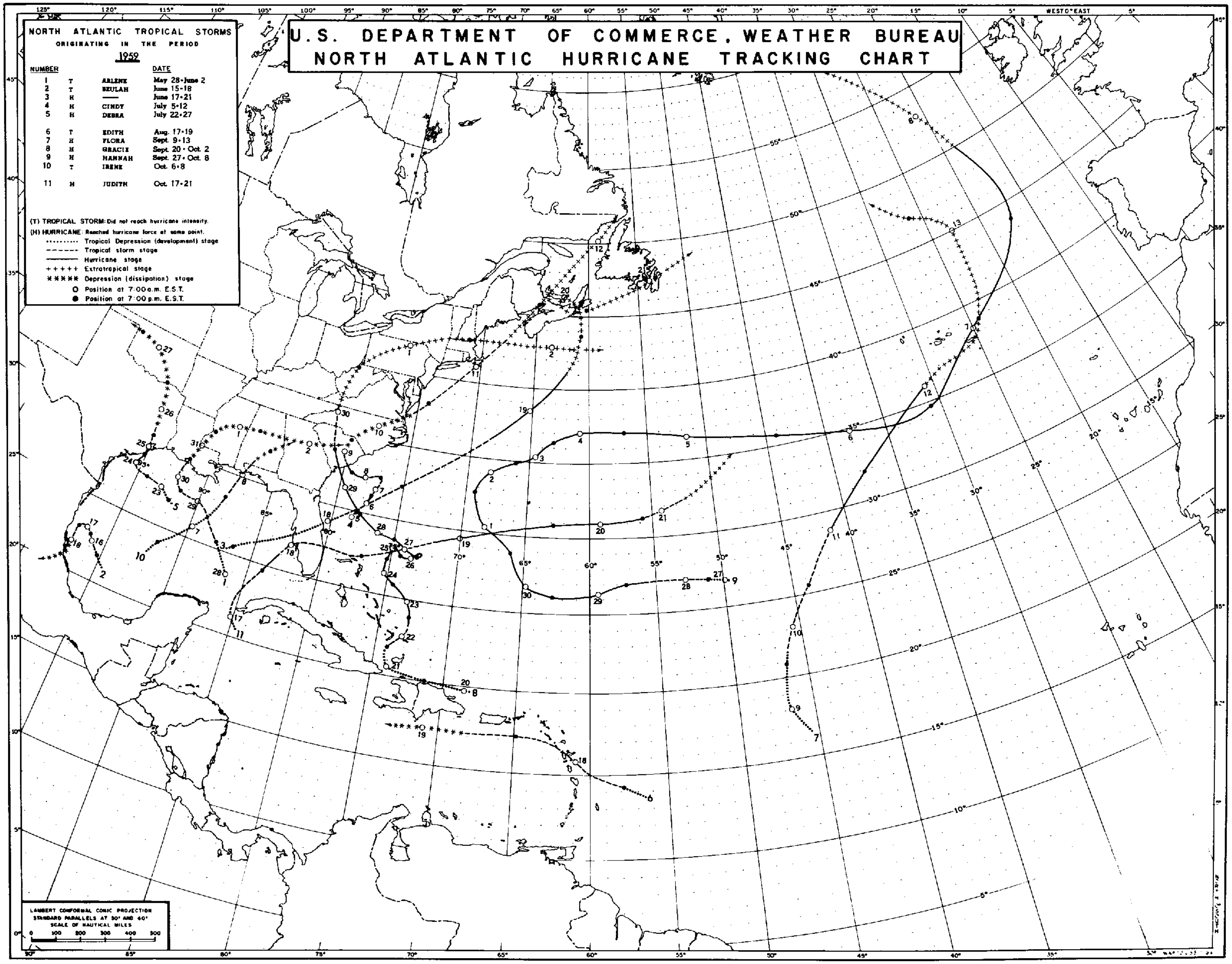
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1954
NUMBER DATE
1 H ALICE June 24-26
2 T BARBARA July 27-30
3 H CAROL Aug. 25-31
4 H DOLLY Aug. 31 - Sept. 4
5 H EDNA Sept. 2-14
6 H FLORENCE Sept. 11-12
7 T GILDA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


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.

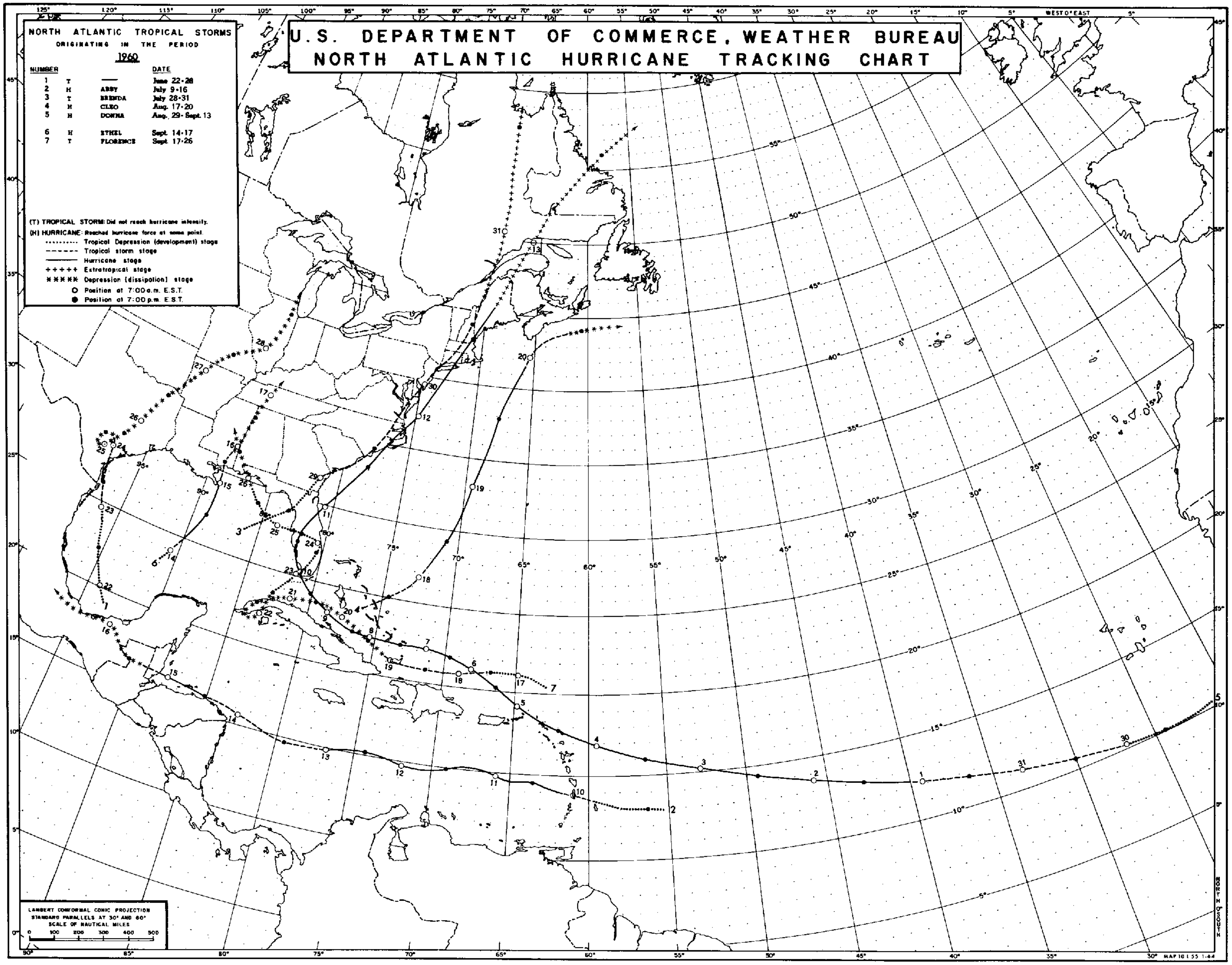

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1956
NUMBER DATE
1 T — June 11-14
2 H ANNA July 25-26
3 H BETSY Aug. 9-19
4 T CARLA Sept. 5-11
5 T DORA Sept. 10-12
6 T ETHEL Sept. 11-13
7 H FLOSSY Sept. 21-30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


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

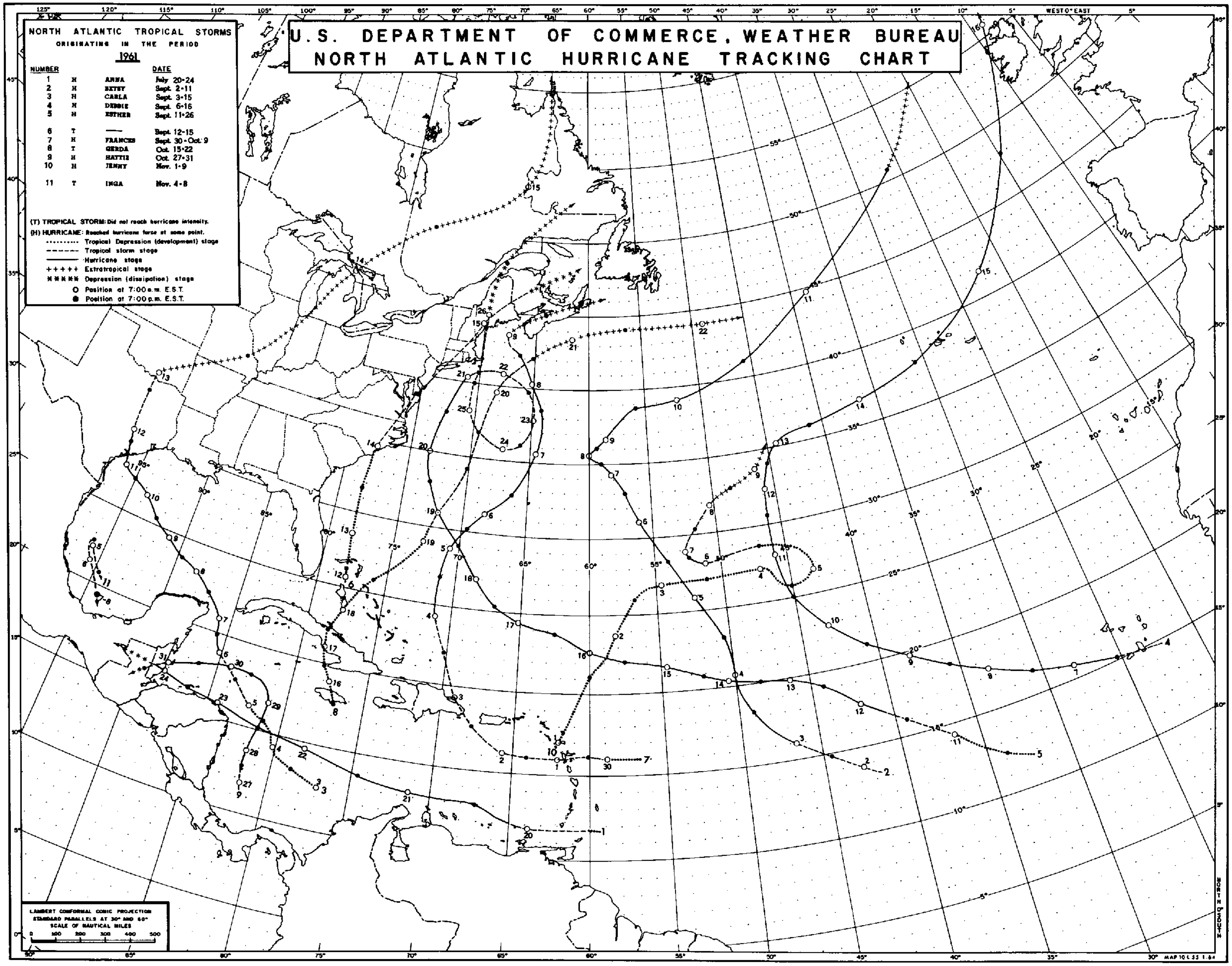

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1958
NUMBER
DATE
1 T ALMA June 14-16
2 T BECKY Aug. 8-17
3 H CLEO Aug. 11-21
4 H DAISY Aug. 24-31
5 H ELLA Aug. 30-Sept. 6
6 H FIFI Sept. 4-12
7 T GERDA Sept. 13-15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



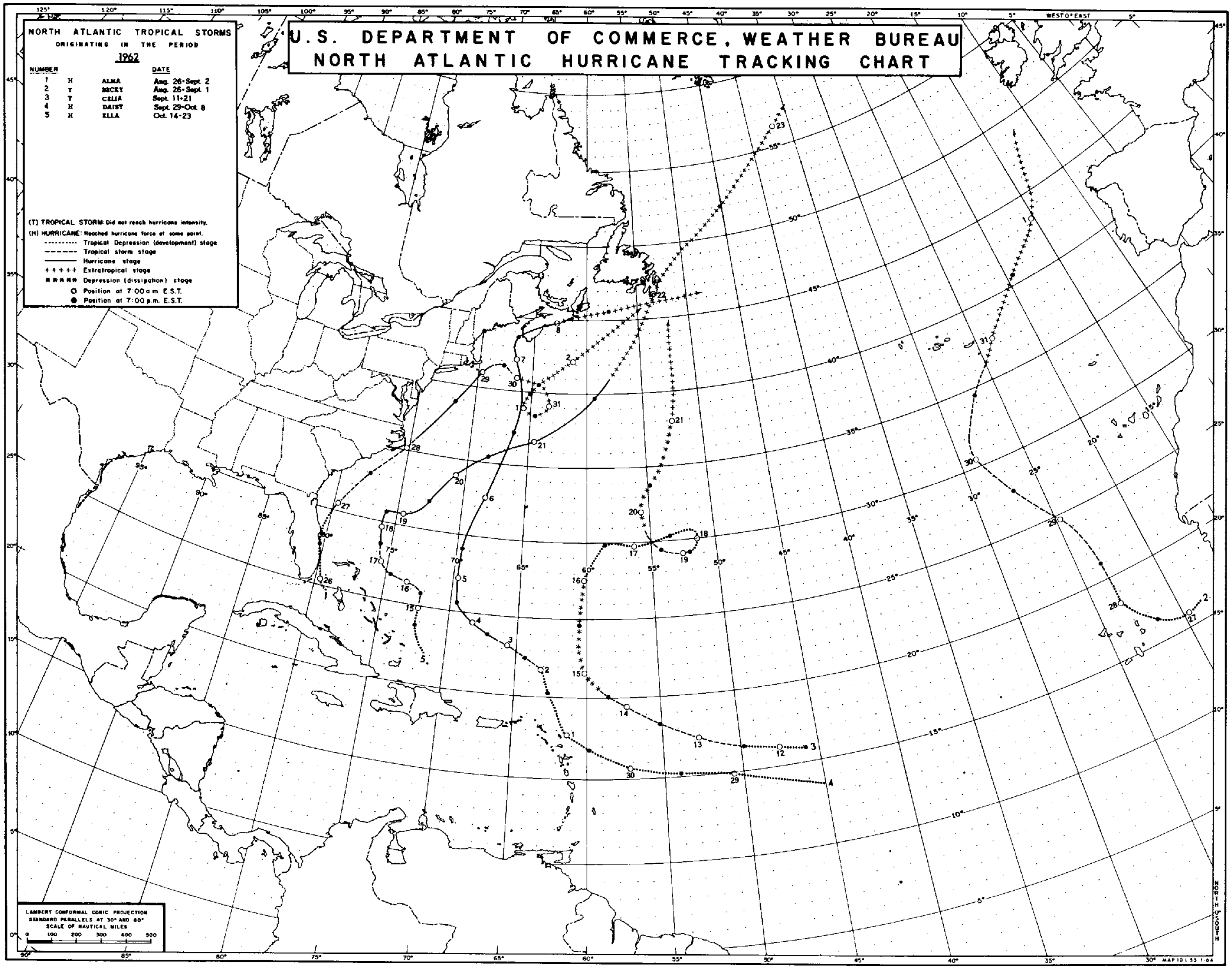
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1959
NUMBER DATE
1 T ARLENE May 28-June 2
2 T BEULAH June 15-18
3 H —— June 17-21
4 H CINDY July 5-12
5 H DEBRA July 22-27
6 T EDITH Aug. 17-19
7 H FLORA Sept.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

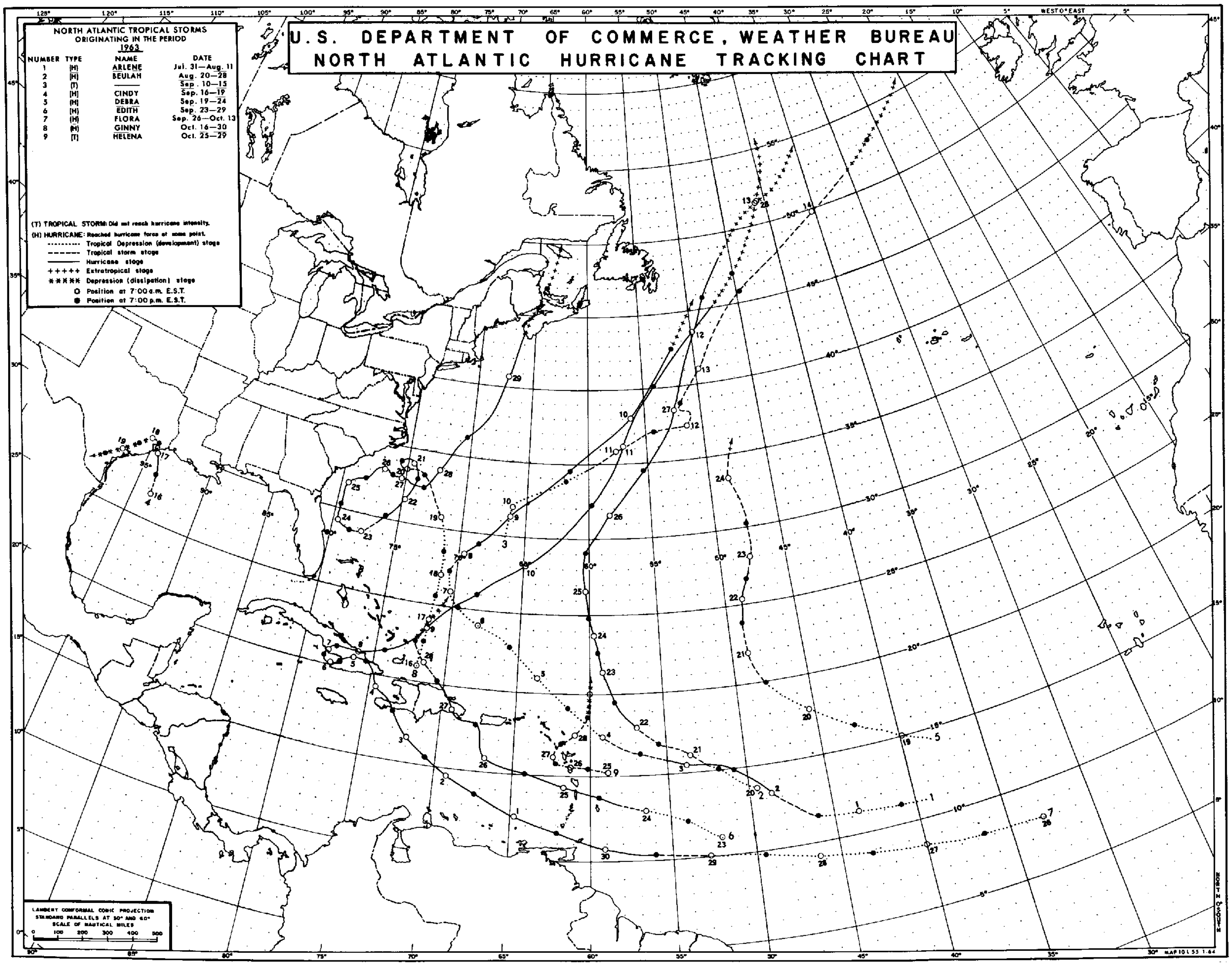


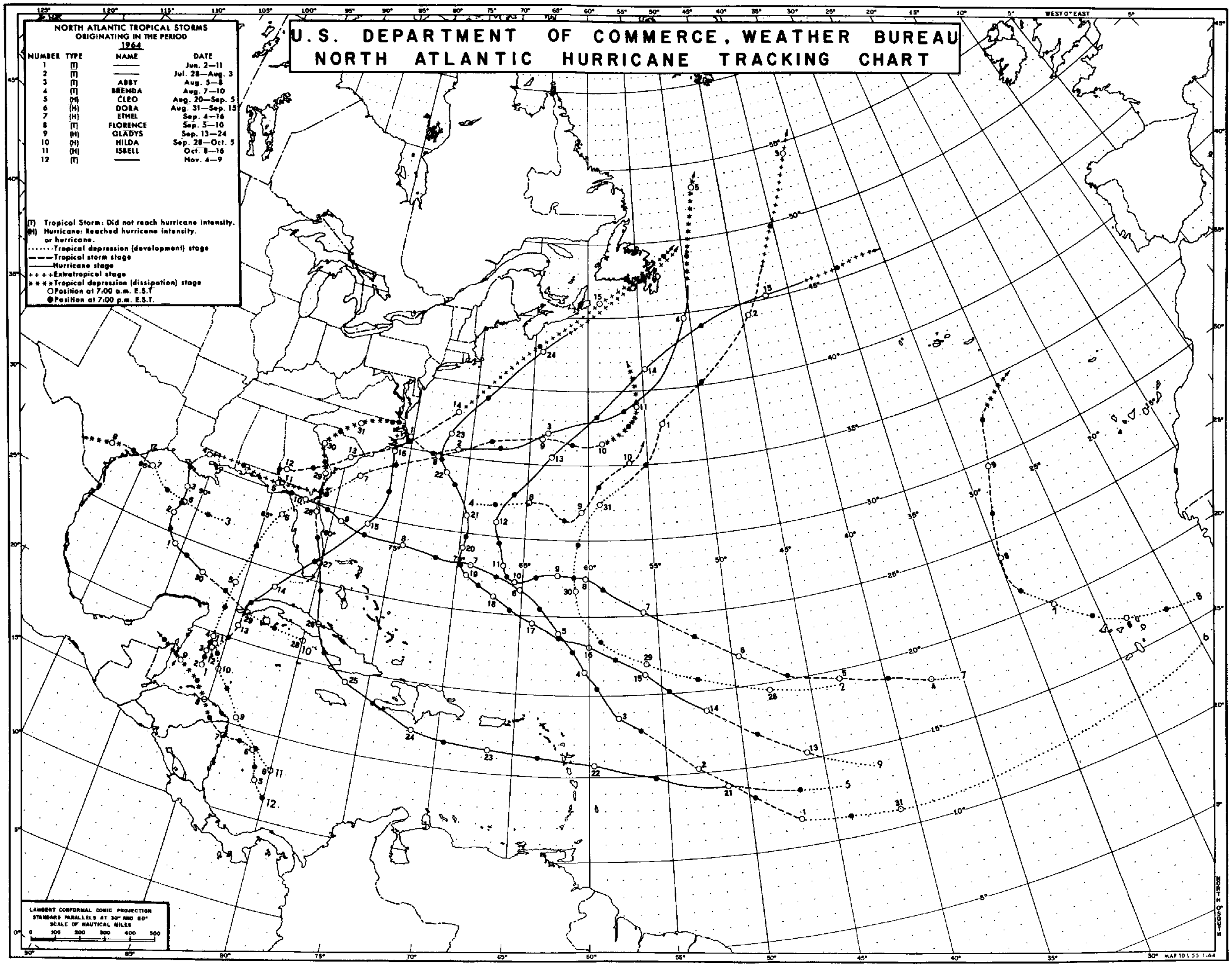
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1960
NUMBER DATE
1 T — June 22-28
2 H ABBY July 9-16
3 T BRENDA July 28-31
4 H CLEO Aug. 17-20
5 H DONNA Aug. 29-Sept. 13
6 H ETHEL Sept. 14-17
7 T FLORENCE Sept.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

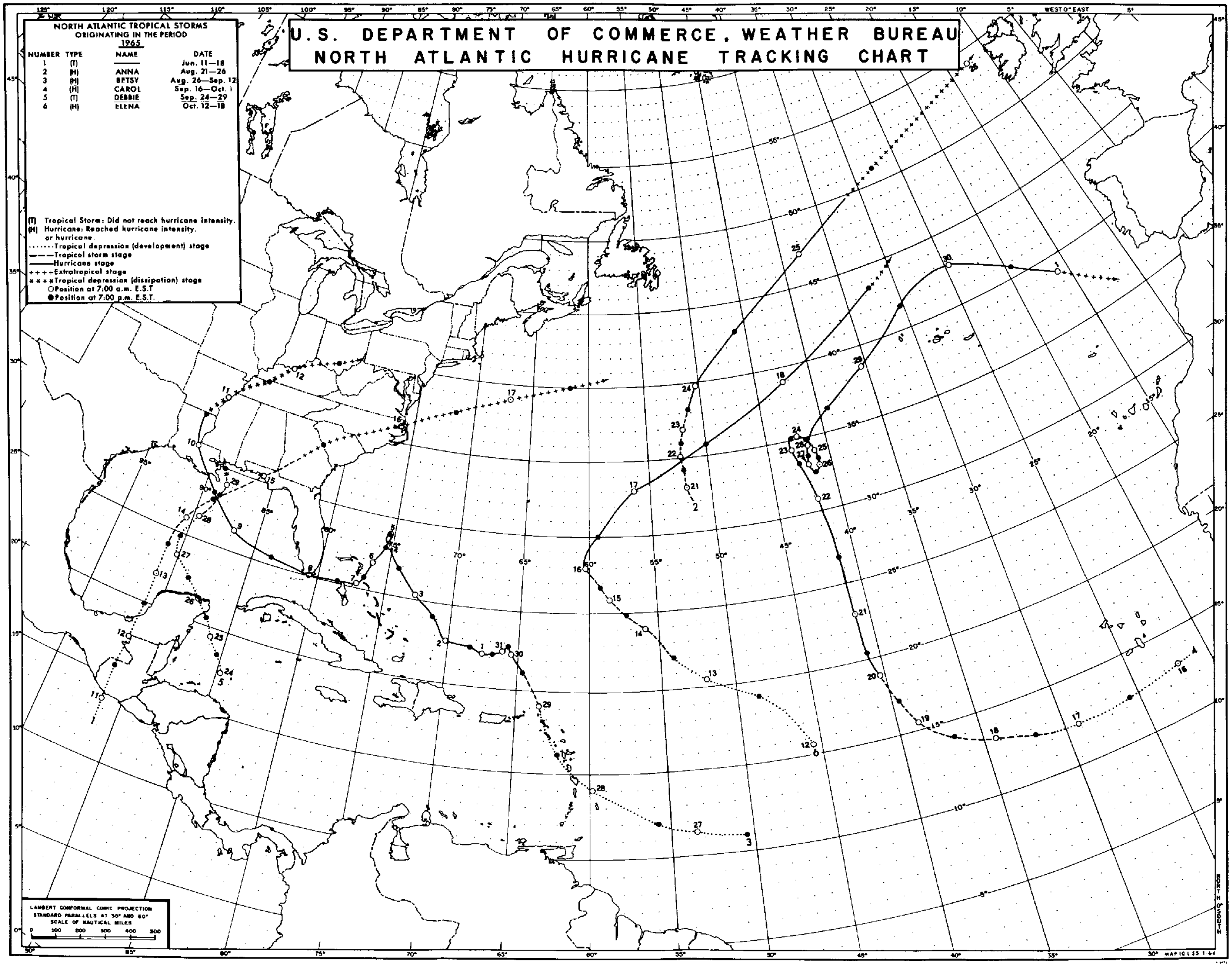


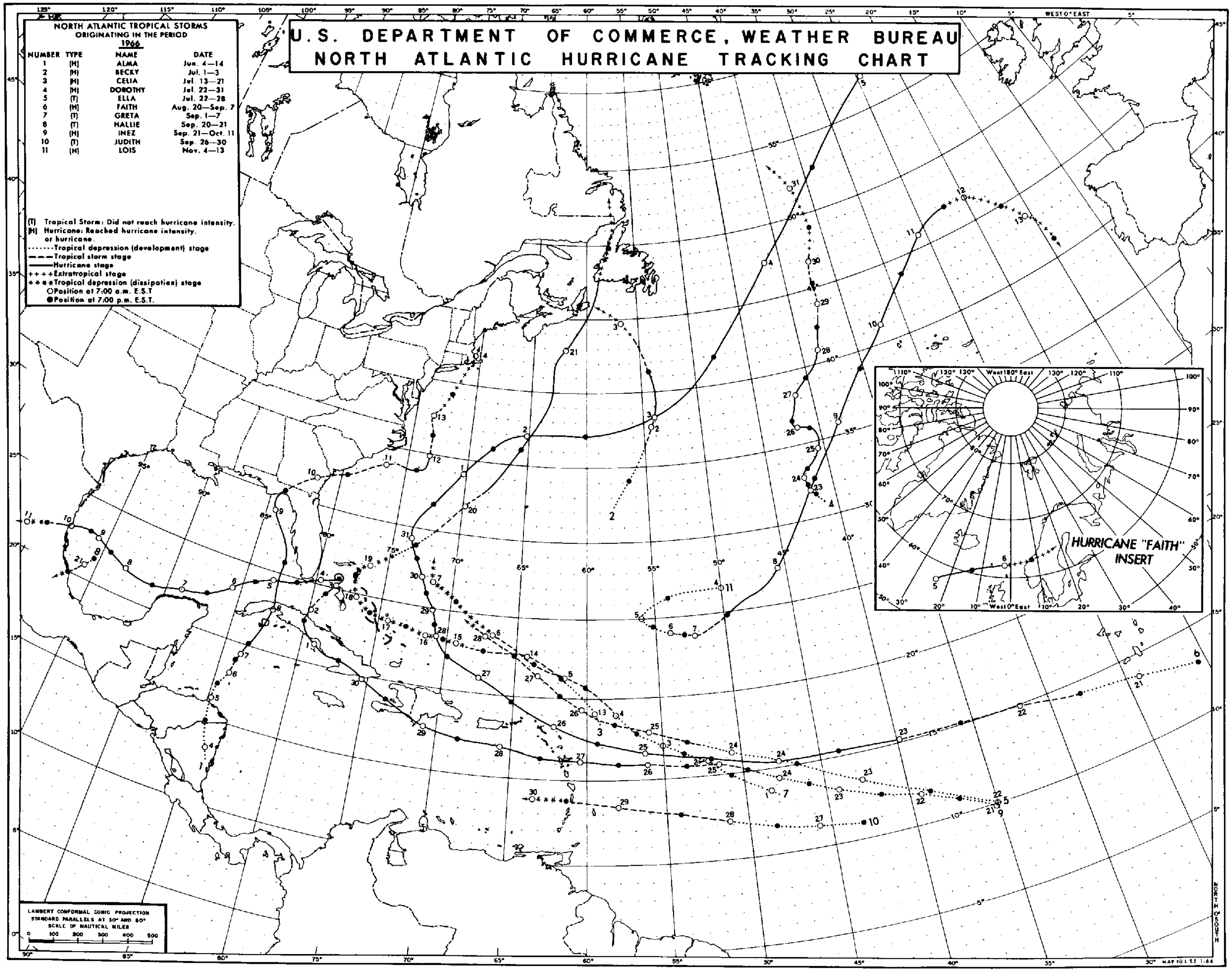
U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1961
NUMBER DATE
1 H ANNA July 20-24
2 H BETSY Sept. 2-11
3 H CARLA Sept. 3-15
4 H DEBBIE Sept. 6-16
5 H ESTHER Sept. 11-26
6 T —— Sept. 12-15
7 H FRANCES Sept.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

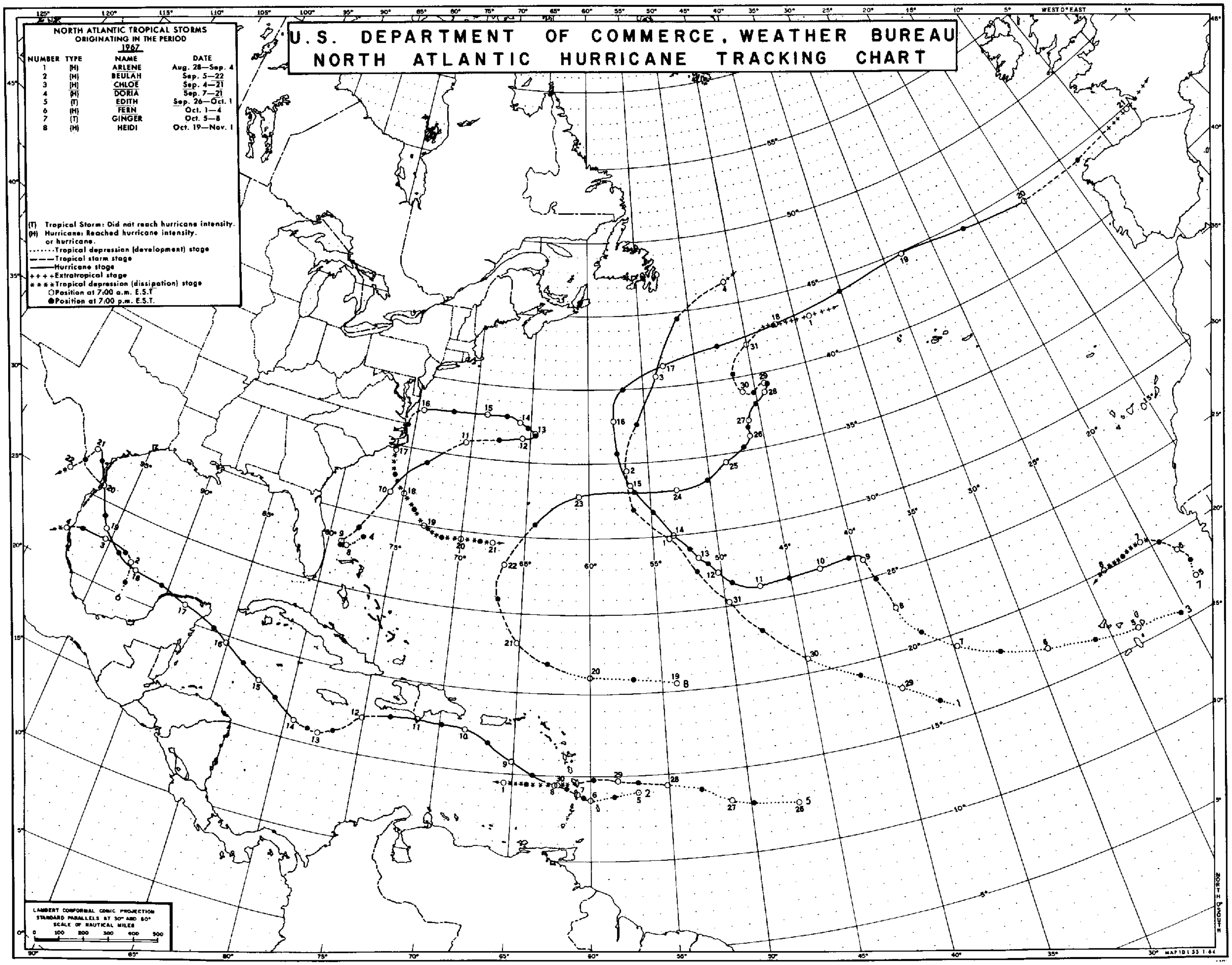

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1963
NUMBER TYPE NAME DATE
1 (H) ARLENE Jul. 31—Aug. 11
2 (H) BEULAH Aug. 20—28
3 (T) ——— Sep. 10—15
4 (H) CINDY Sep. 16—19
5 (H) DEBRA Sep. 19—24
6 (H) EDITH Sep. 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
0 100 200 300 400 500
WEST 0° EAST

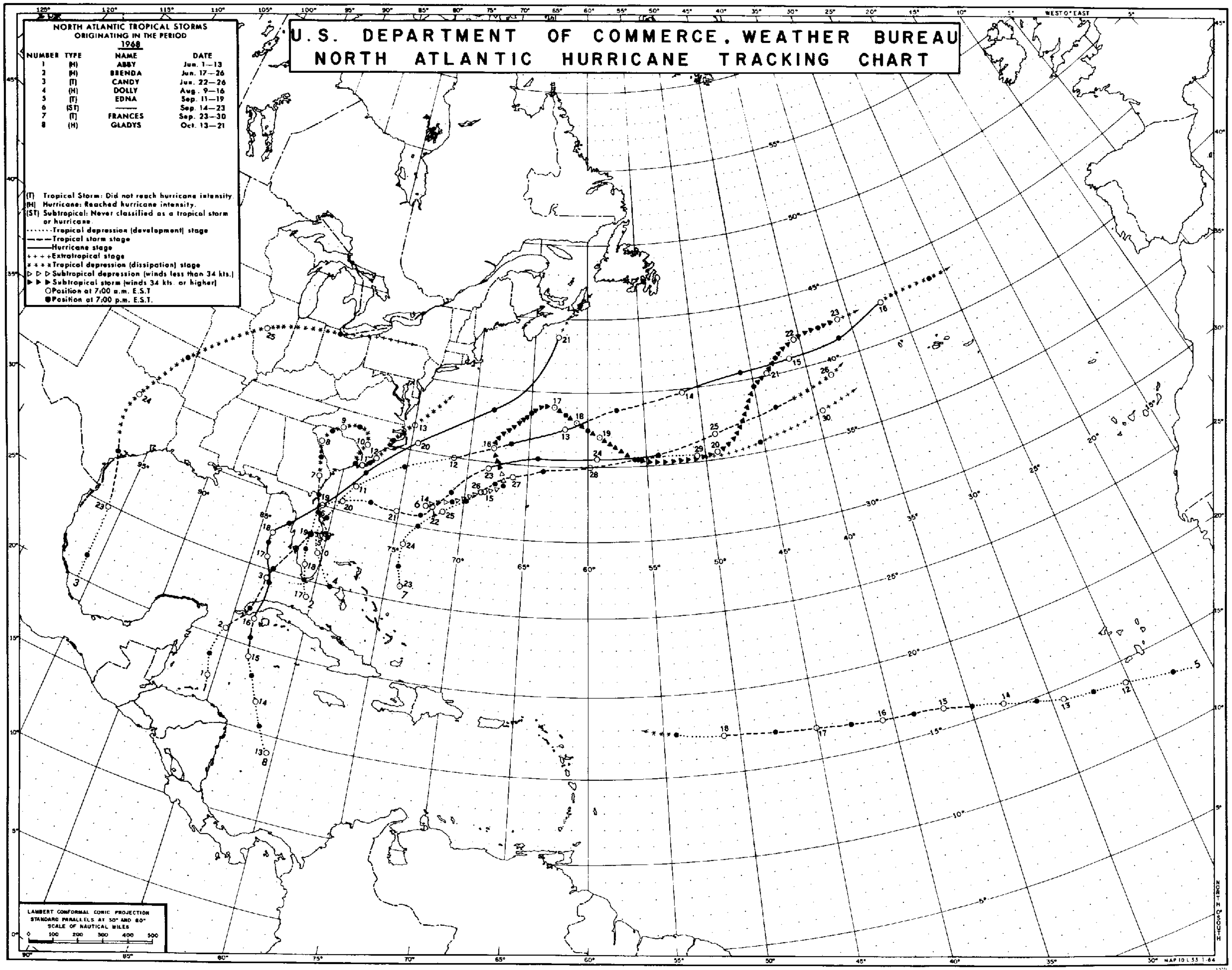

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1964
NUMBER TYPE NAME DATE
1 (T) —— Jun. 2—11
2 (T) —— Jul. 28—Aug. 3
3 (T) ABBY Aug. 5—8
4 (T) BRENDA Aug. 7—10
5 (H) CLEO Aug. 20—Sep. 5
6 (H) DORA Aug. 31—Sep. 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

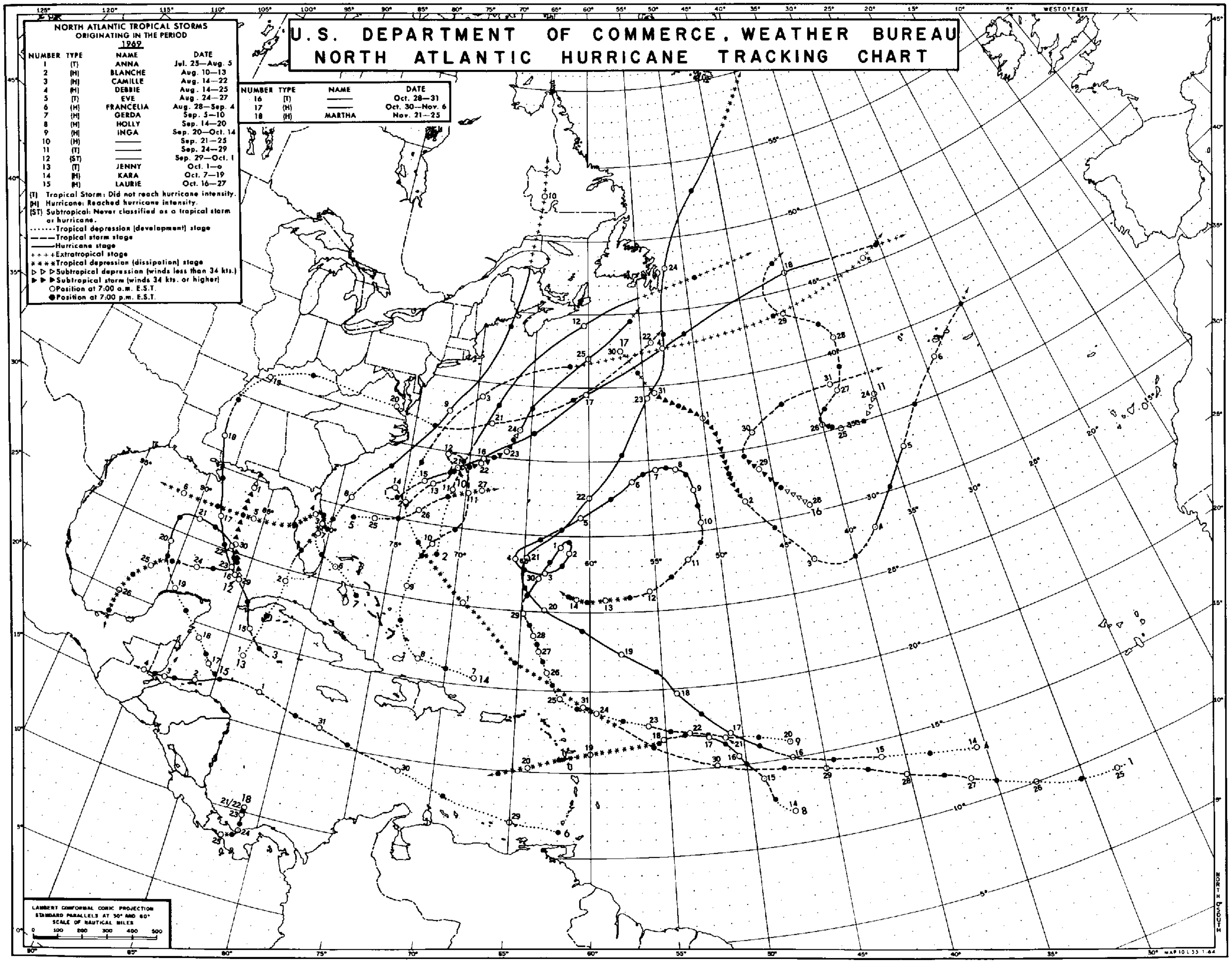

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1965
NUMBER TYPE NAME DATE
1 (T) —— Jun. 11—18
2 (H) ANNA Aug. 21—26
3 (H) BETSY Aug. 26—Sep. 12
4 (H) CAROL Sep. 16—Oct. 1
5 (T) DEBBIE Sep. 24—29
6 (H) ELENA 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

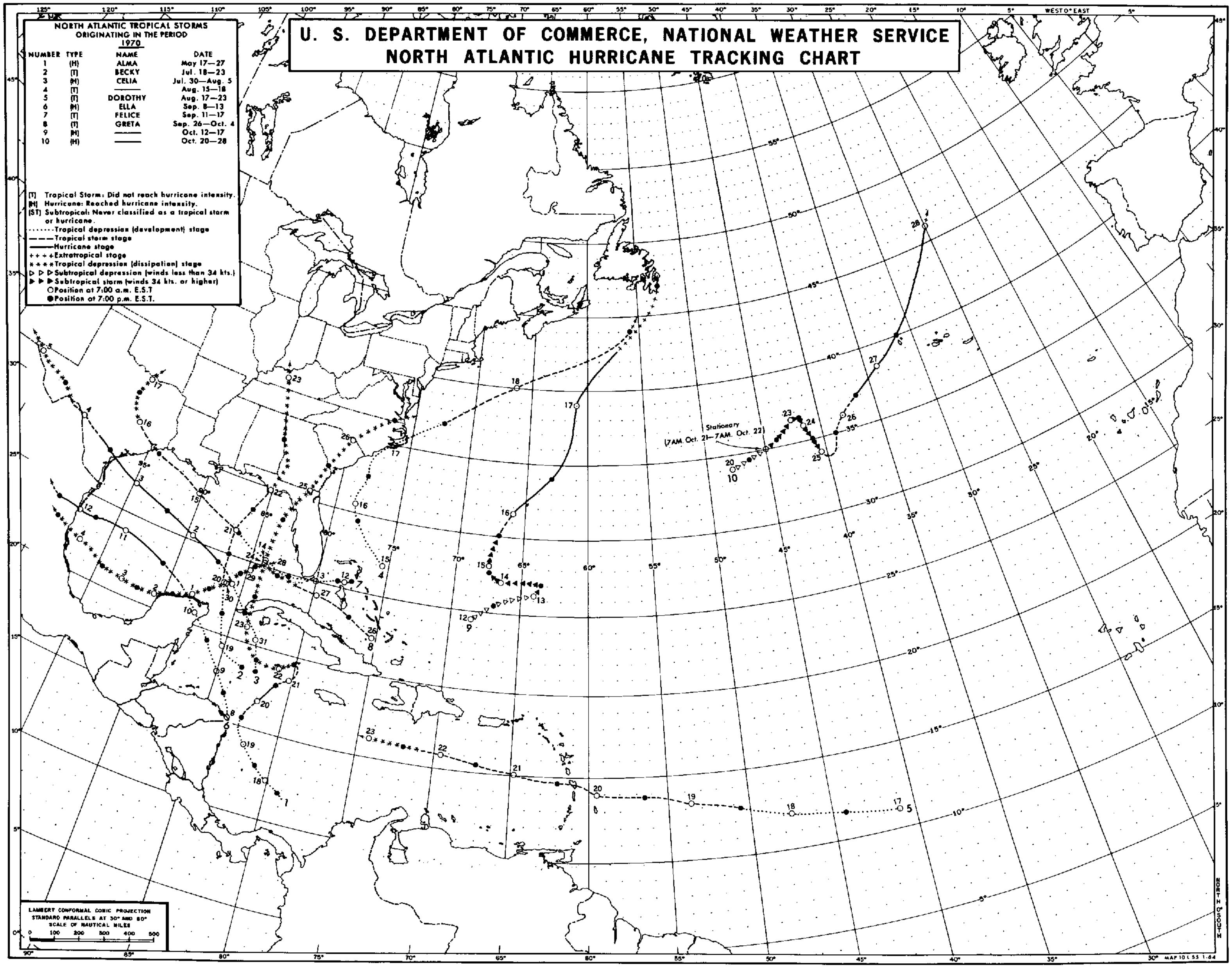


U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1966
NUMBER TYPE NAME DATE
1 (H) ALMA Jun. 4—14
2 (H) BECKY Jul. 1—3
3 (H) CELIA Jul. 13—21
4 (H) DOROTHY Jul. 22—31
5 (T) ELLA Jul. 22—28
6 (H) FAITH Aug. 20—Sep. 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

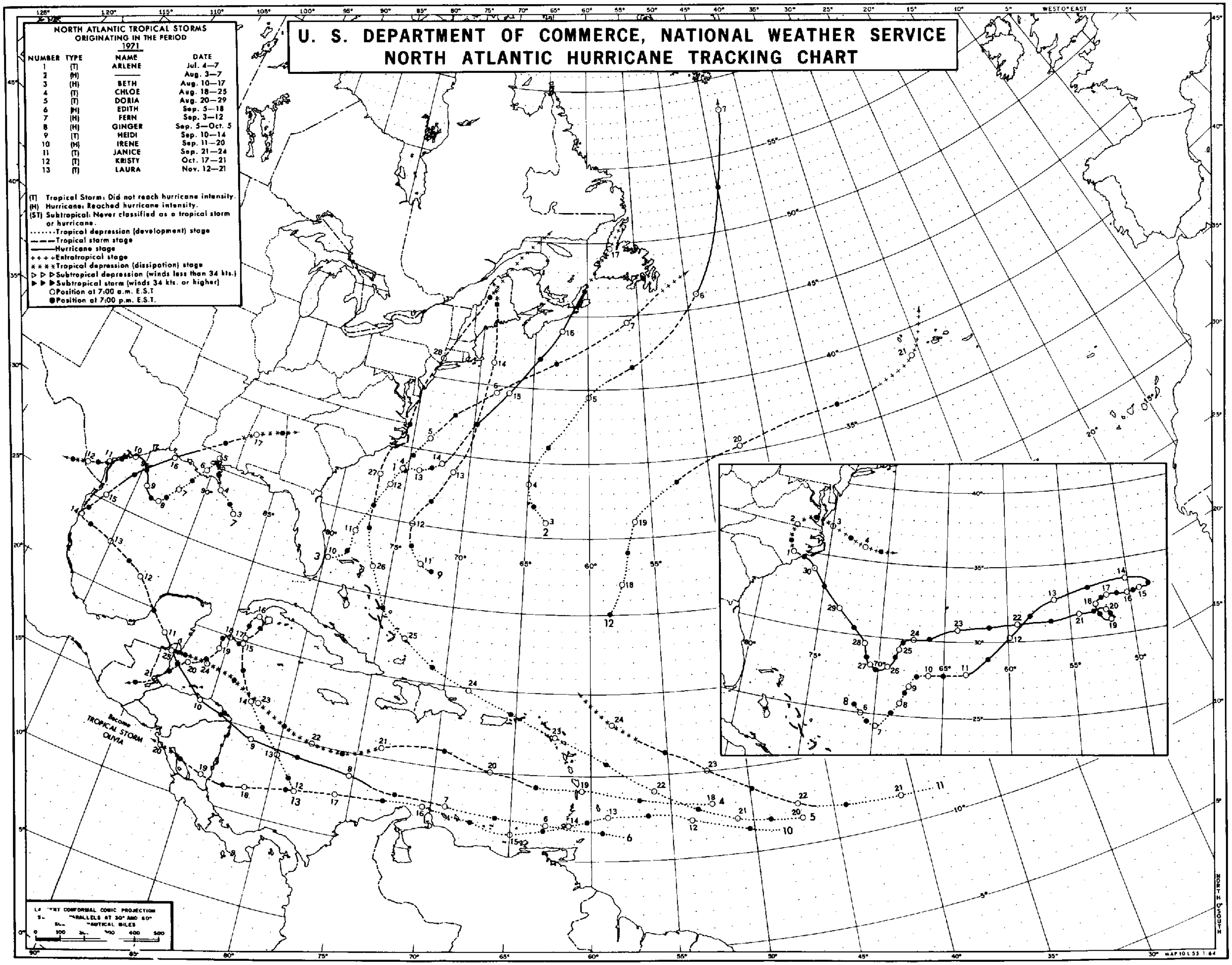

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1967
NUMBER TYPE NAME DATE
1 (H) ARLENE Aug. 28—Sep. 4
2 (H) BEULAH Sep. 5—22
3 (H) CHLOE Sep. 4—21
4 (H) DORIA Sep. 7—21
5 (T) EDITH Sep. 26—Oct. 1
6 (H) FERN 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
0 100 200 300 400 500

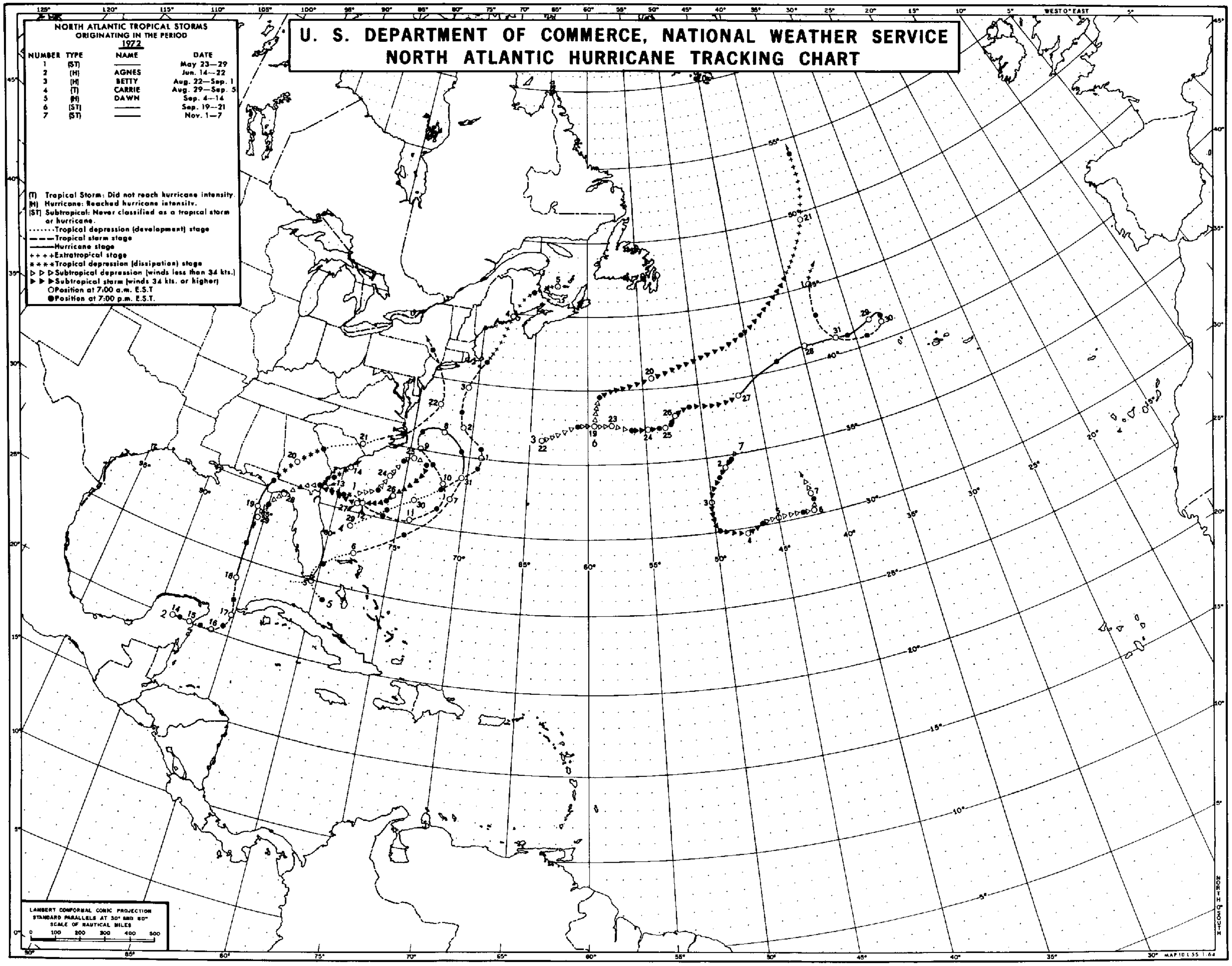

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1968
NUMBER TYPE NAME DATE
1 (H) ABBY Jun. 1—13
2 (H) BRENDA Jun. 17—26
3 (T) CANDY Jun. 22—26
4 (H) DOLLY Aug. 9—16
5 (T) EDNA Sep. 11—19
6 (ST) ——— Sep. 14—23
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

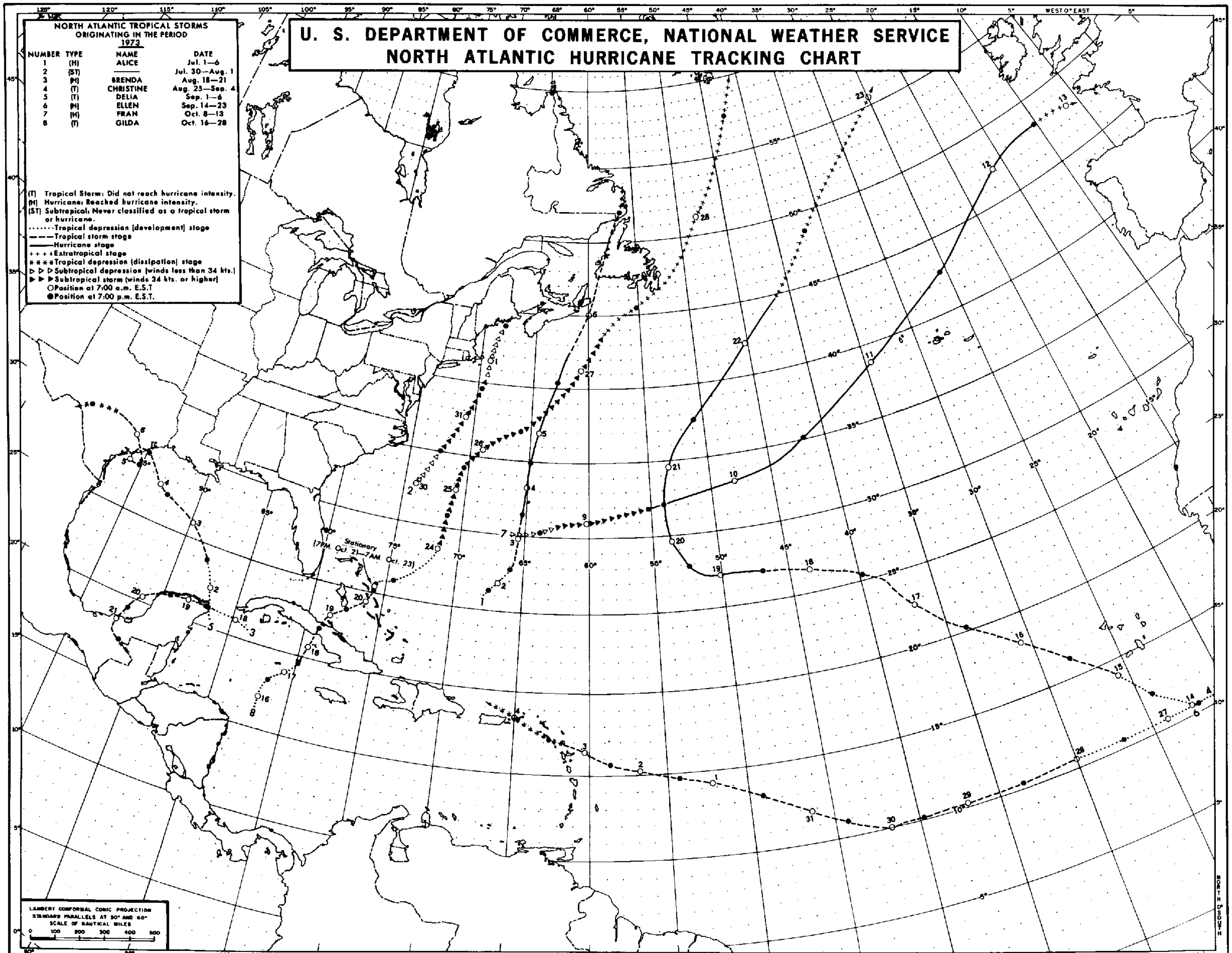

U.S. DEPARTMENT OF COMMERCE, WEATHER BUREAU
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1969
NUMBER TYPE NAME DATE
1 (T) ANNA Jul. 25—Aug. 5
2 (H) BLANCHE Aug. 10—13
3 (H) CAMILLE Aug. 14—22
4 (H) DEBBIE Aug. 14—25
5 (T) EVE Aug. 24—27
6 (H) FRANCELIA 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—o
14 (H) KARA Oct. 7—19
15 (H) LAURIE Oct. 16—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.
NUMBER TYPE NAME DATE
16 (T) —— Oct. 28—31
17 (H) —— Oct. 30—Nov. 6
18 (H) MARTHA Nov. 21—25
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

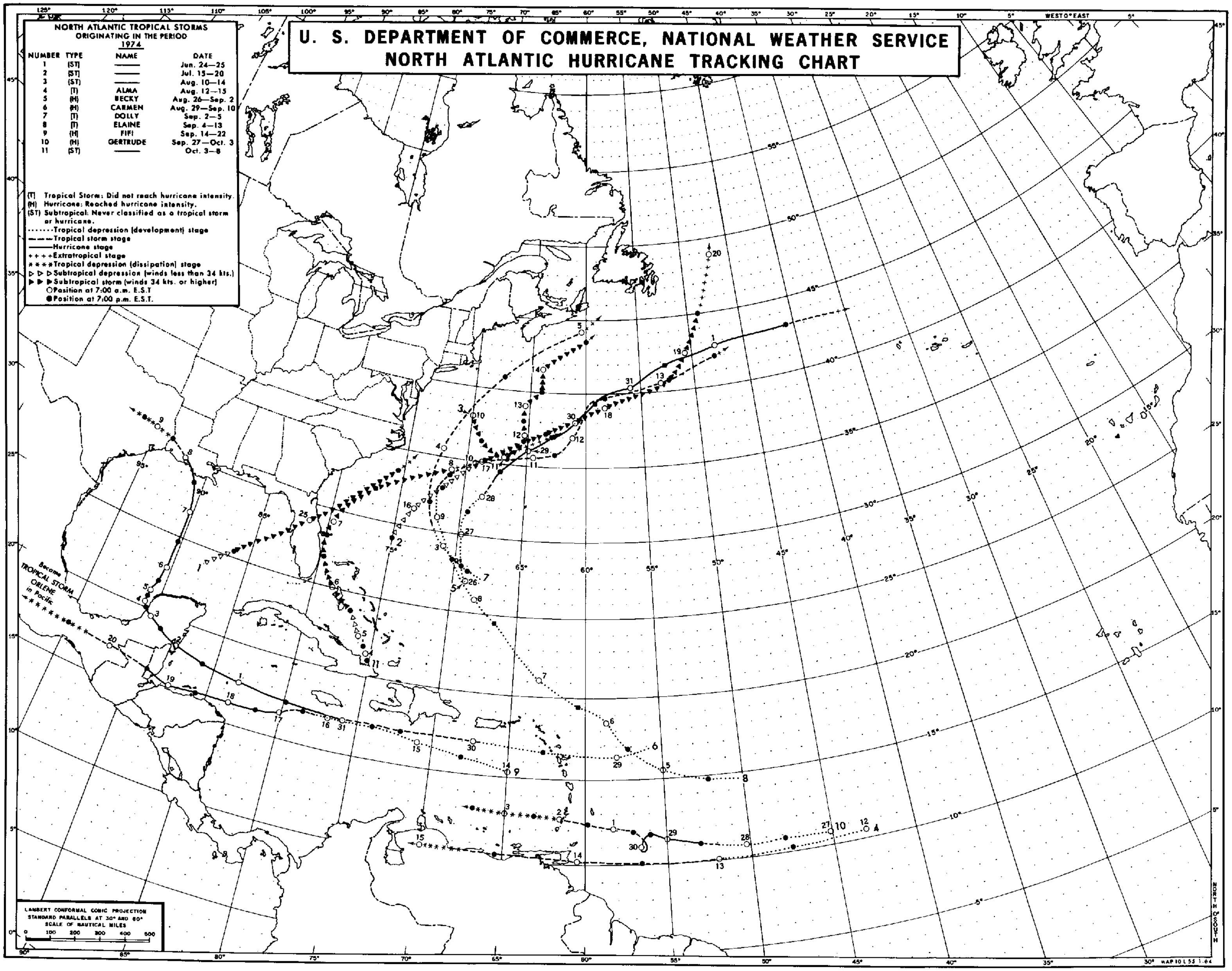


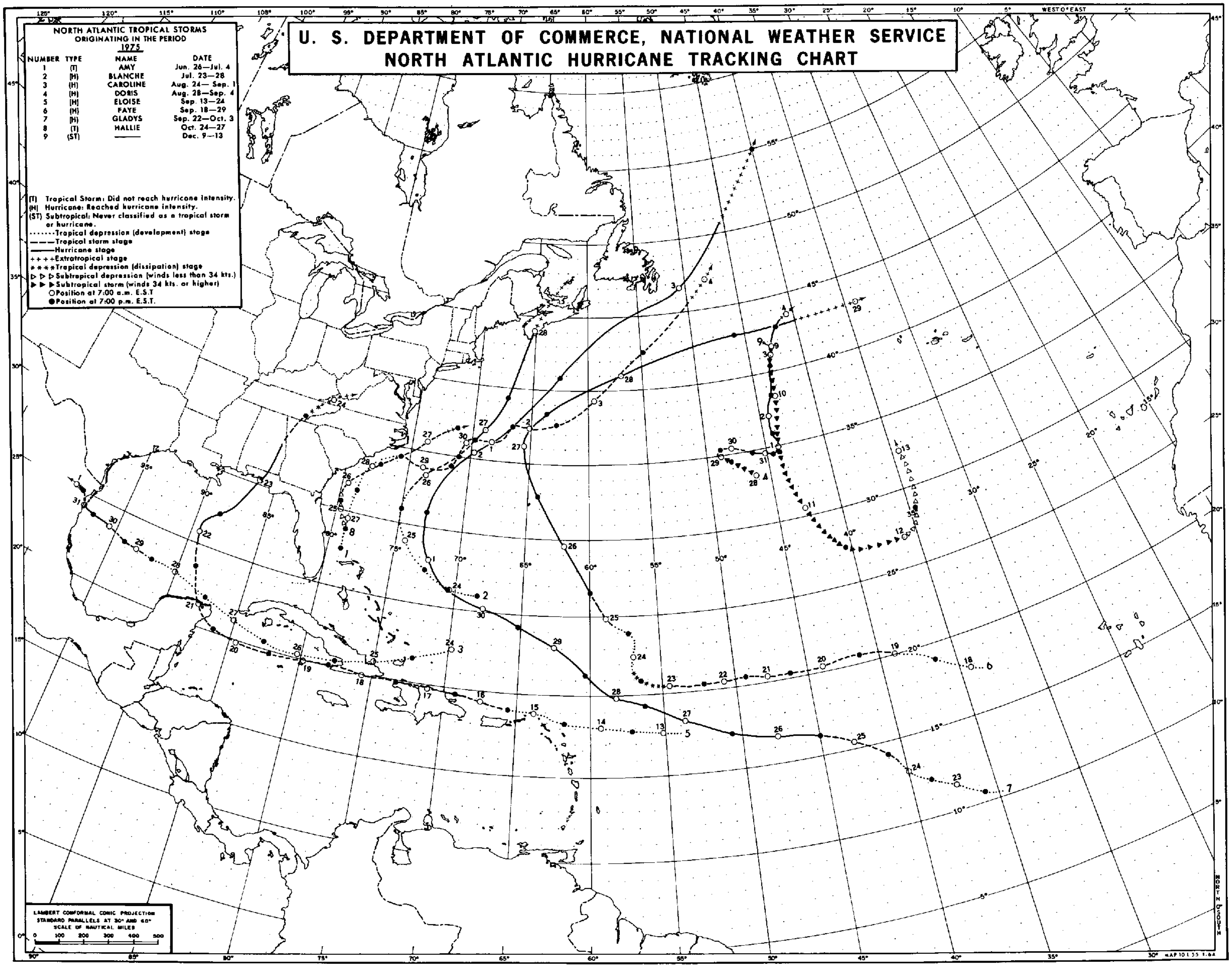
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS ORIGINATING IN THE PERIOD 1970
NUMBER TYPE NAME DATE
1 (H) ALMA May 17—27
2 (T) BECKY Jul. 18—23
3 (H) CELIA Jul. 30—Aug. 5
4 (T) —— Aug. 15—18
5 (T) DOROTHY Aug. 17—23
6 (H) 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

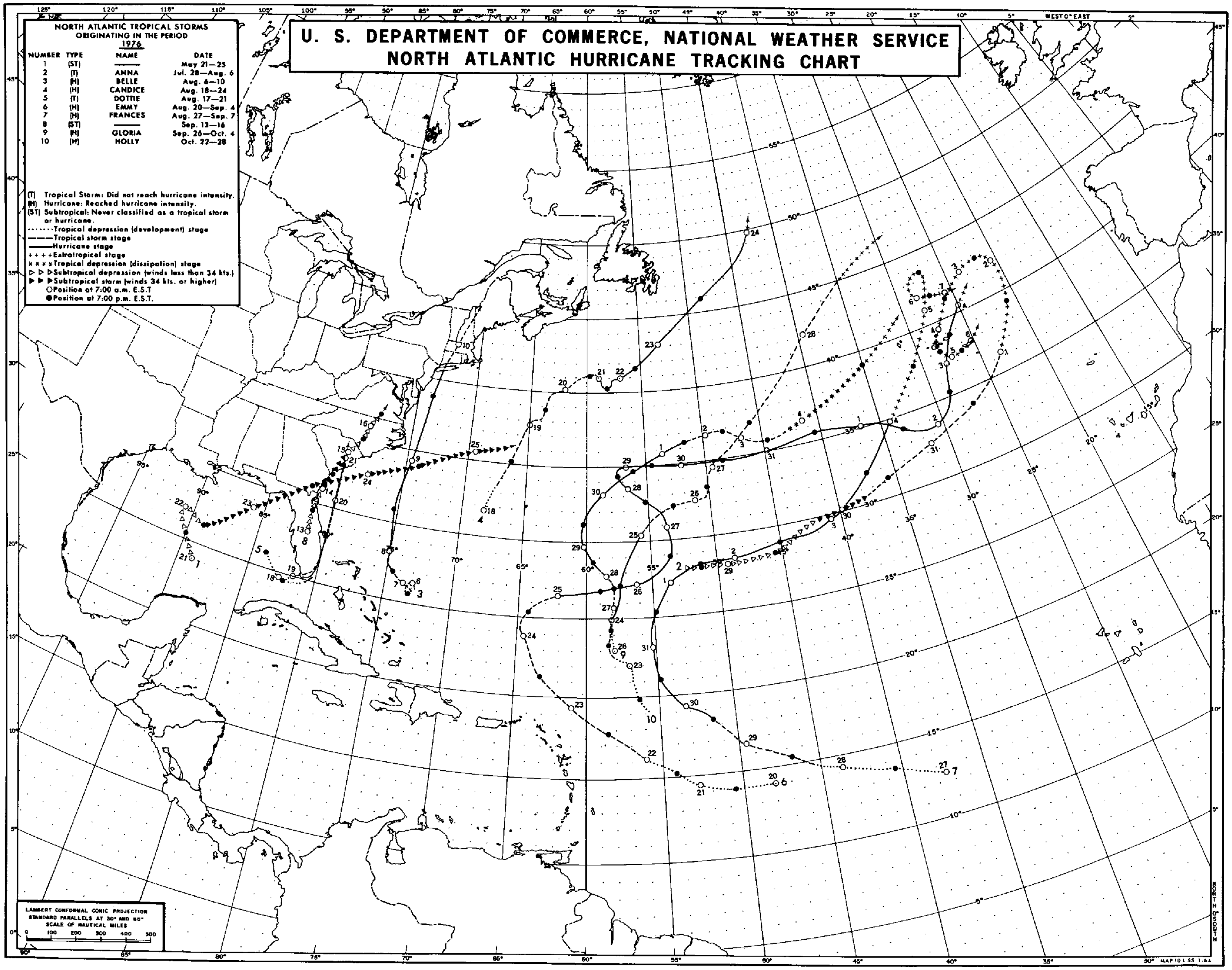

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1971
NUMBER TYPE NAME DATE
1 (T) ARLENE Jul. 4—7
2 (H) ——— Aug. 3—7
3 (H) BETH Aug. 10—17
4 (T) CHLOE Aug. 18—25
5 (T) DORIA Aug. 20—29
6 (H) EDITH Sep. 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.
Become TROPICAL STORM OLIVIA

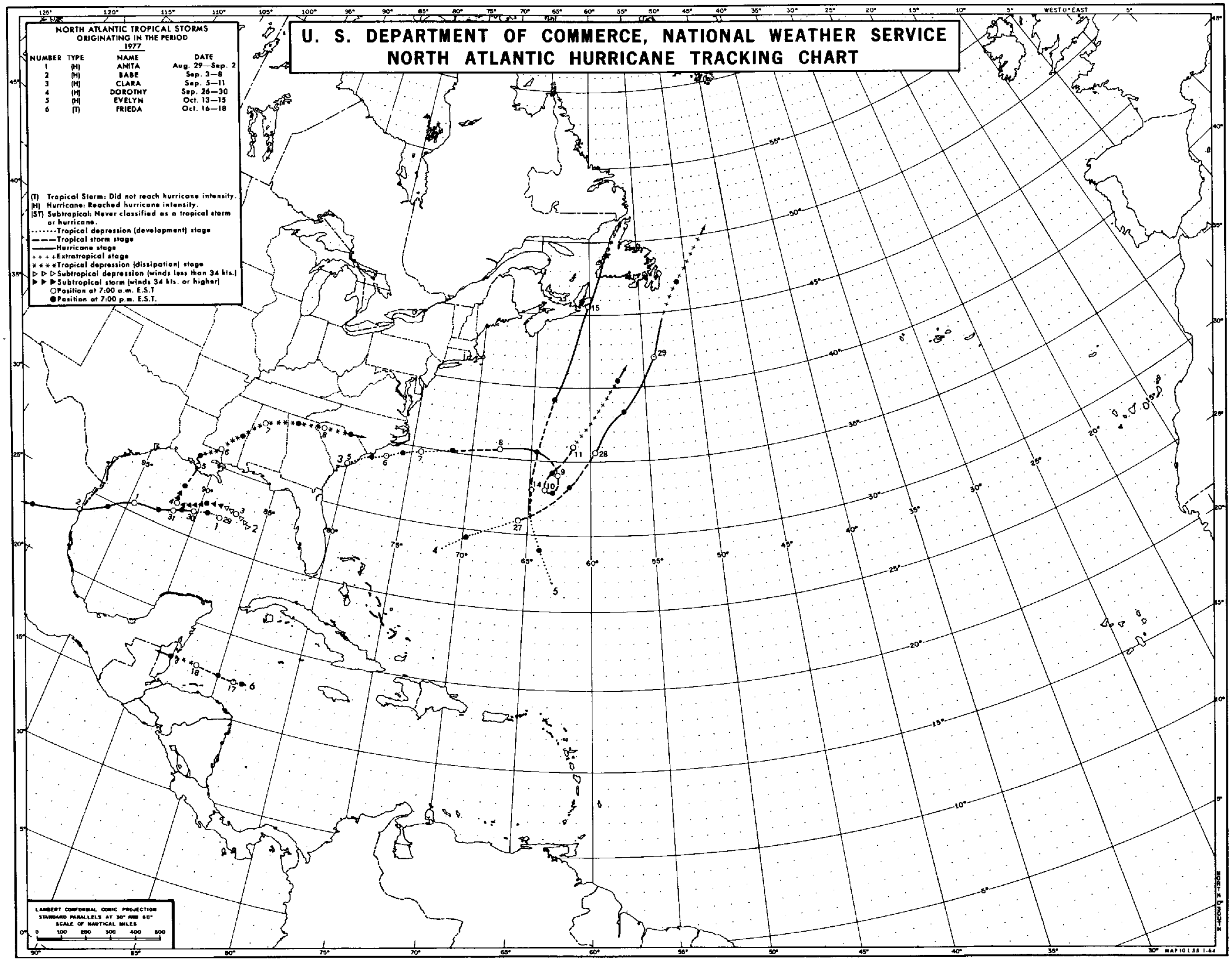

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1972
NUMBER TYPE NAME DATE
1 (ST) —— May 23—29
2 (H) AGNES Jun. 14—22
3 (H) BETTY Aug. 22—Sep. 1
4 (T) CARRIE Aug. 29—Sep. 5
5 (H) DAWN Sep. 4—14
6 (ST) —— 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
0 100 200 300 400 500

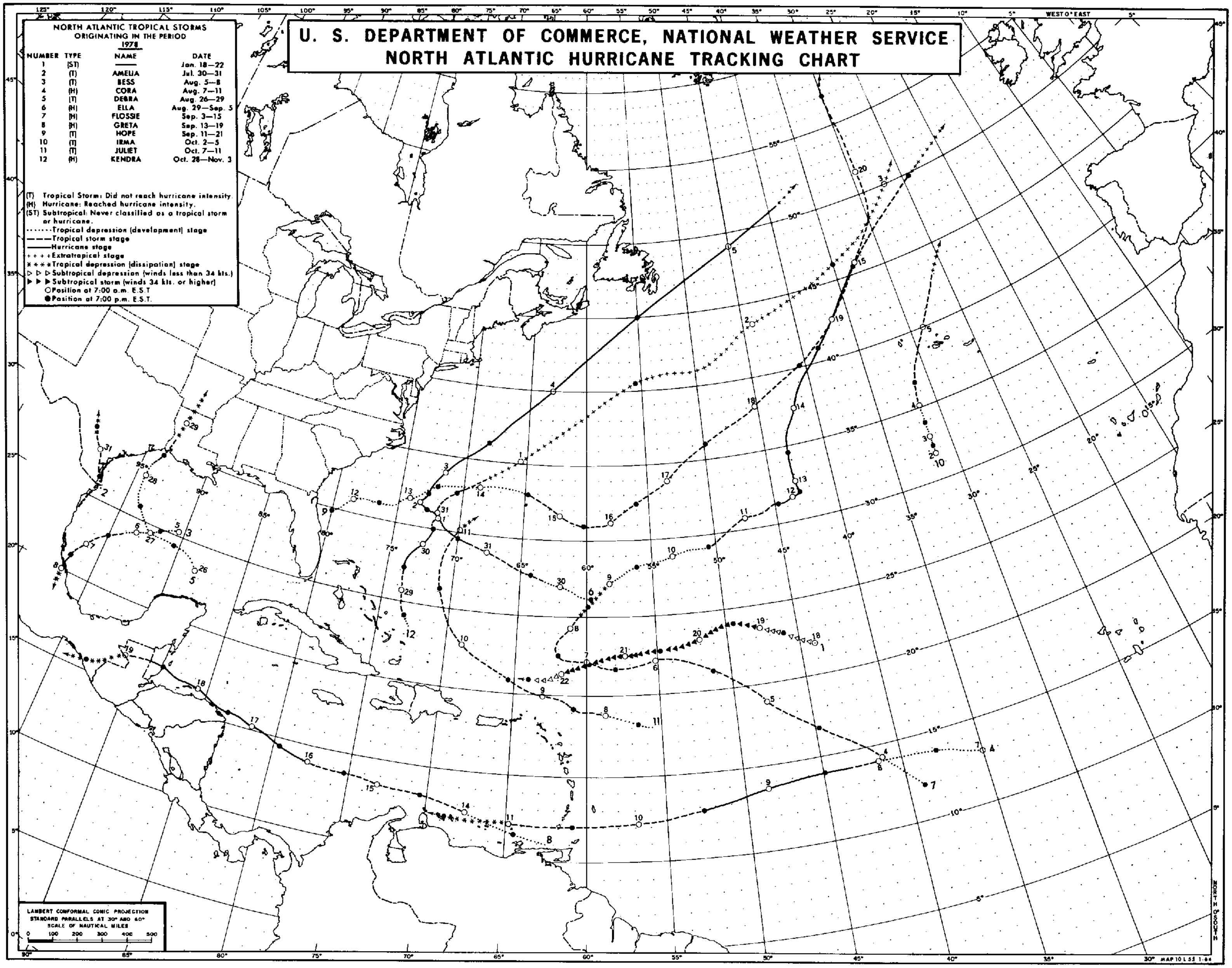

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1973
NUMBER TYPE NAME DATE
1 (H) ALICE Jul. 1—6
2 (ST) —— Jul. 30—Aug. 1
3 (H) BRENDA Aug. 18—21
4 (T) CHRISTINE Aug. 25—Sep. 4
5 (T) DELIA Sep. 1—6
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 (7PM Oct. 21—7AM Oct. 23)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

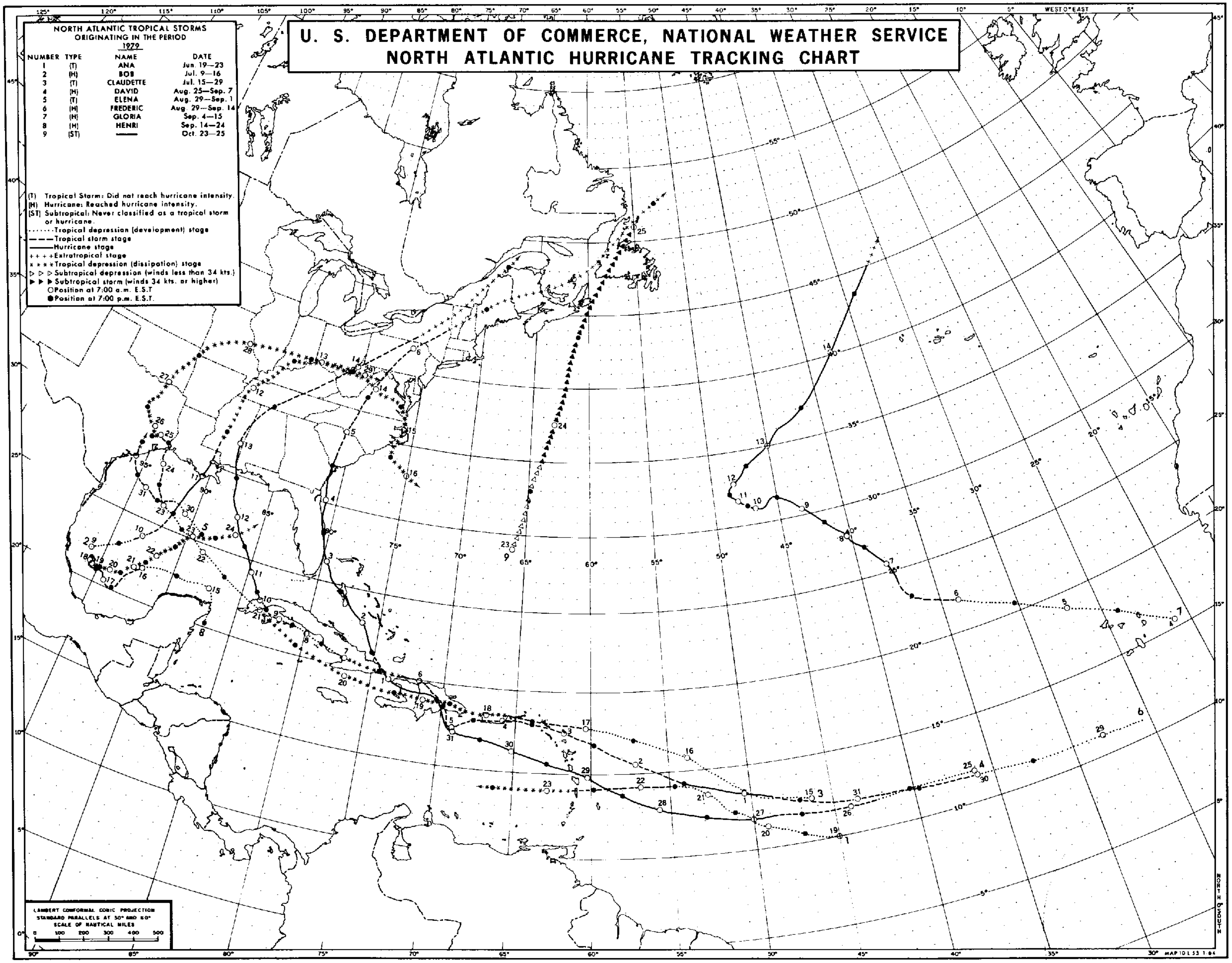

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1974
NUMBER TYPE NAME DATE
1 (ST) —— Jun. 24—25
2 (ST) —— Jul. 15—20
3 (ST) —— Aug. 10—14
4 (T) ALMA Aug. 12—15
5 (H) BECKY Aug. 26—Sep. 2
6 (H) CARMEN 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
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
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

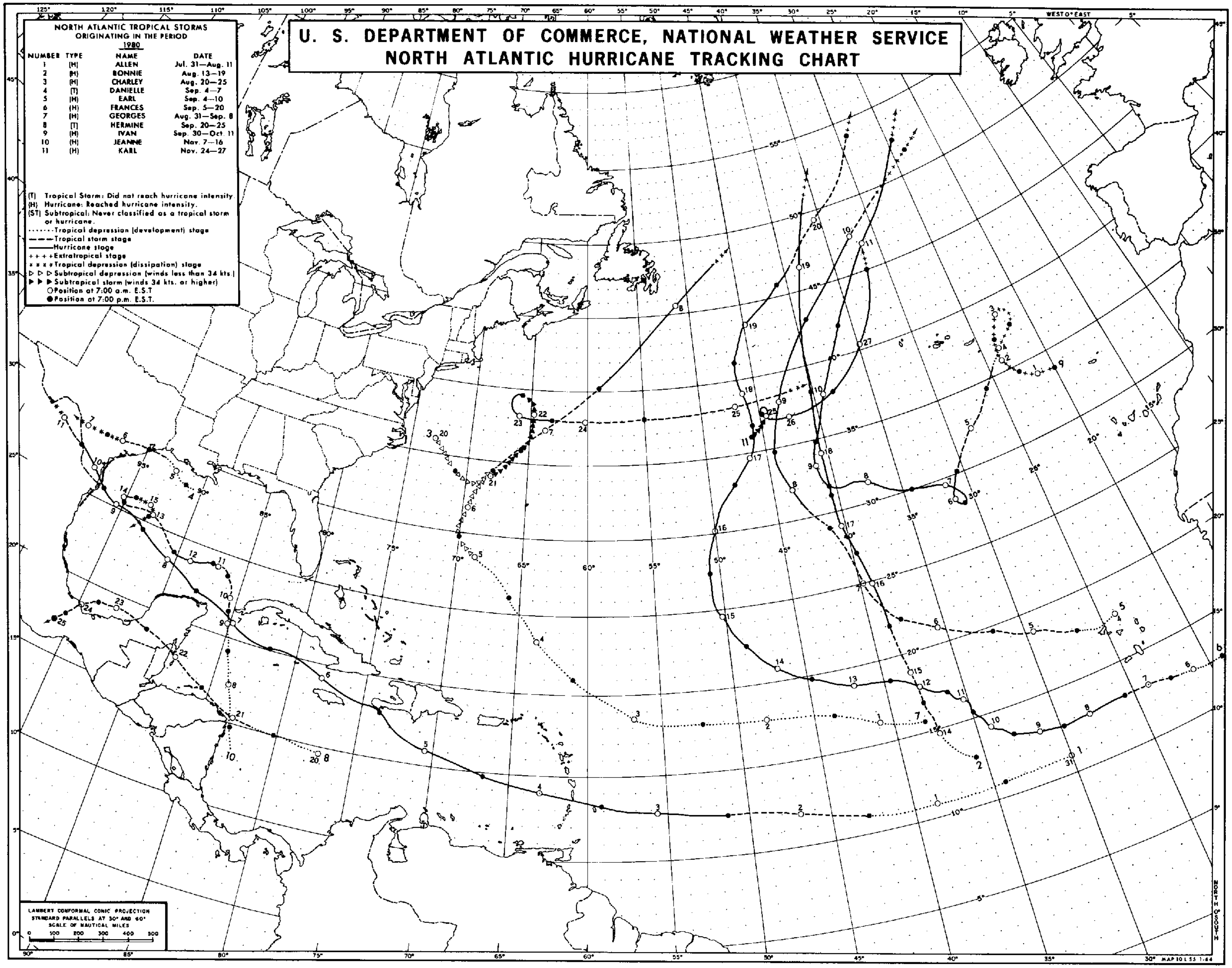

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1976
NUMBER TYPE NAME DATE
1 (ST) —— May 21—25
2 (T) ANNA Jul. 28—Aug. 6
3 (H) BELLE Aug. 6—10
4 (H) CANDICE Aug. 18—24
5 (T) DOTTIE Aug. 17—21
6 (H) 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

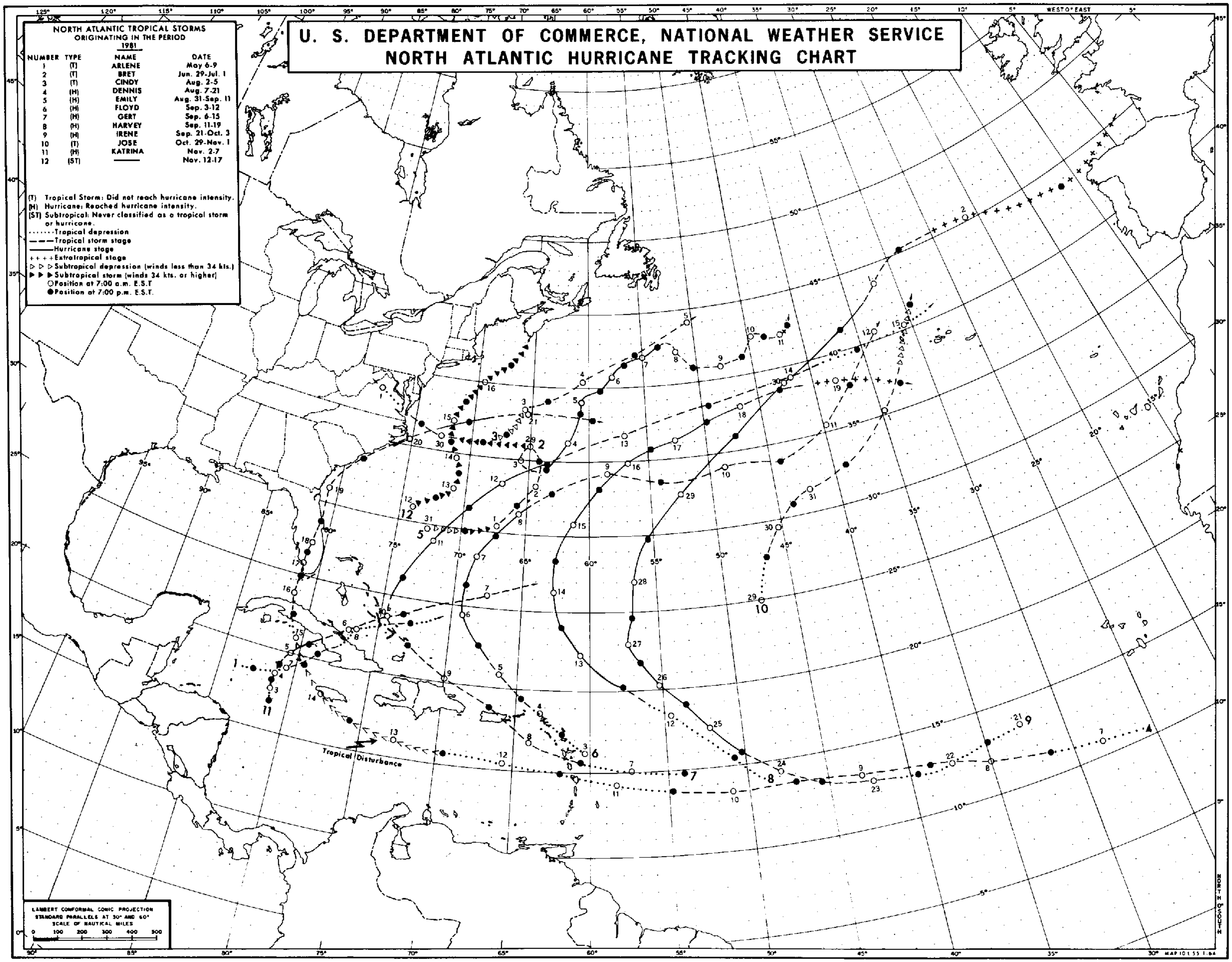

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1977
NUMBER TYPE NAME DATE
1 (H) ANITA Aug. 29—Sep. 2
2 (H) BABE Sep. 3—8
3 (H) CLARA Sep. 5—11
4 (H) DOROTHY Sep. 26—30
5 (H) EVELYN Oct. 13—15
6 (T) 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
SCALE OF NAUTICAL MILES

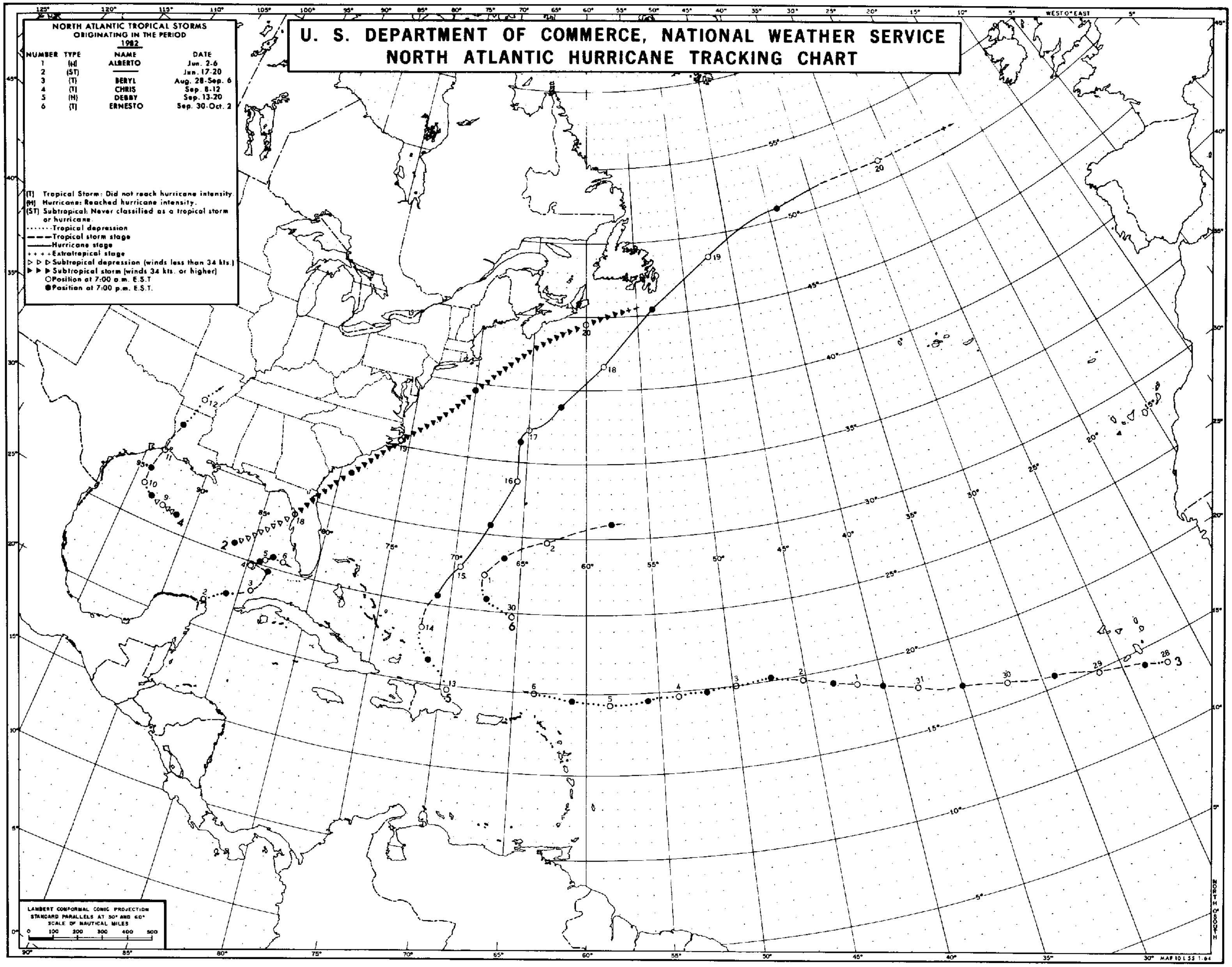

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1978
NUMBER TYPE NAME DATE
1 (ST) —— Jan. 18—22
2 (T) AMELIA Jul. 30—31
3 (T) BESS Aug. 5—8
4 (H) CORA Aug. 7—11
5 (T) DEBRA Aug. 26—29
6 (H) ELLA Aug. 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
0 100 200 300 400 500

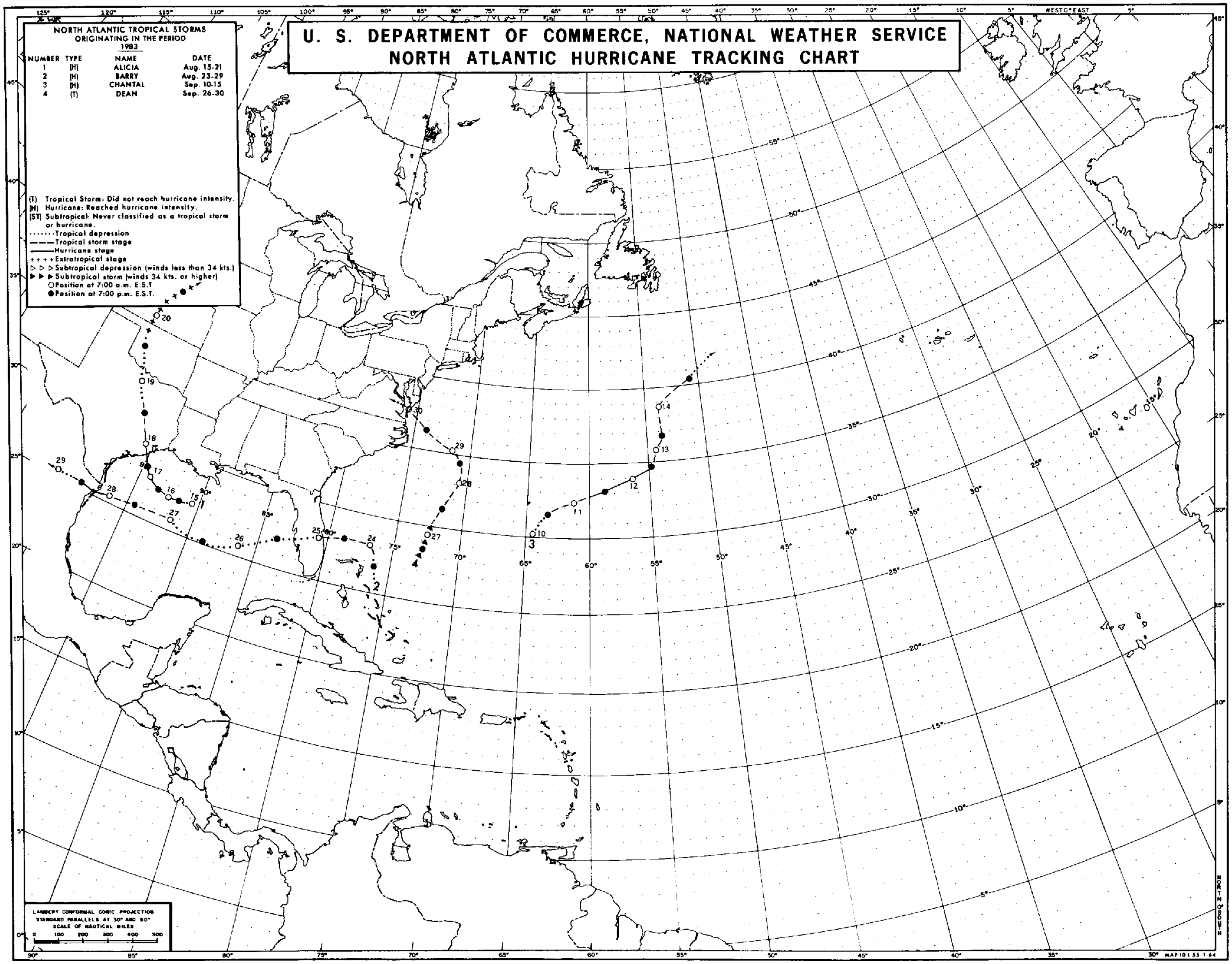


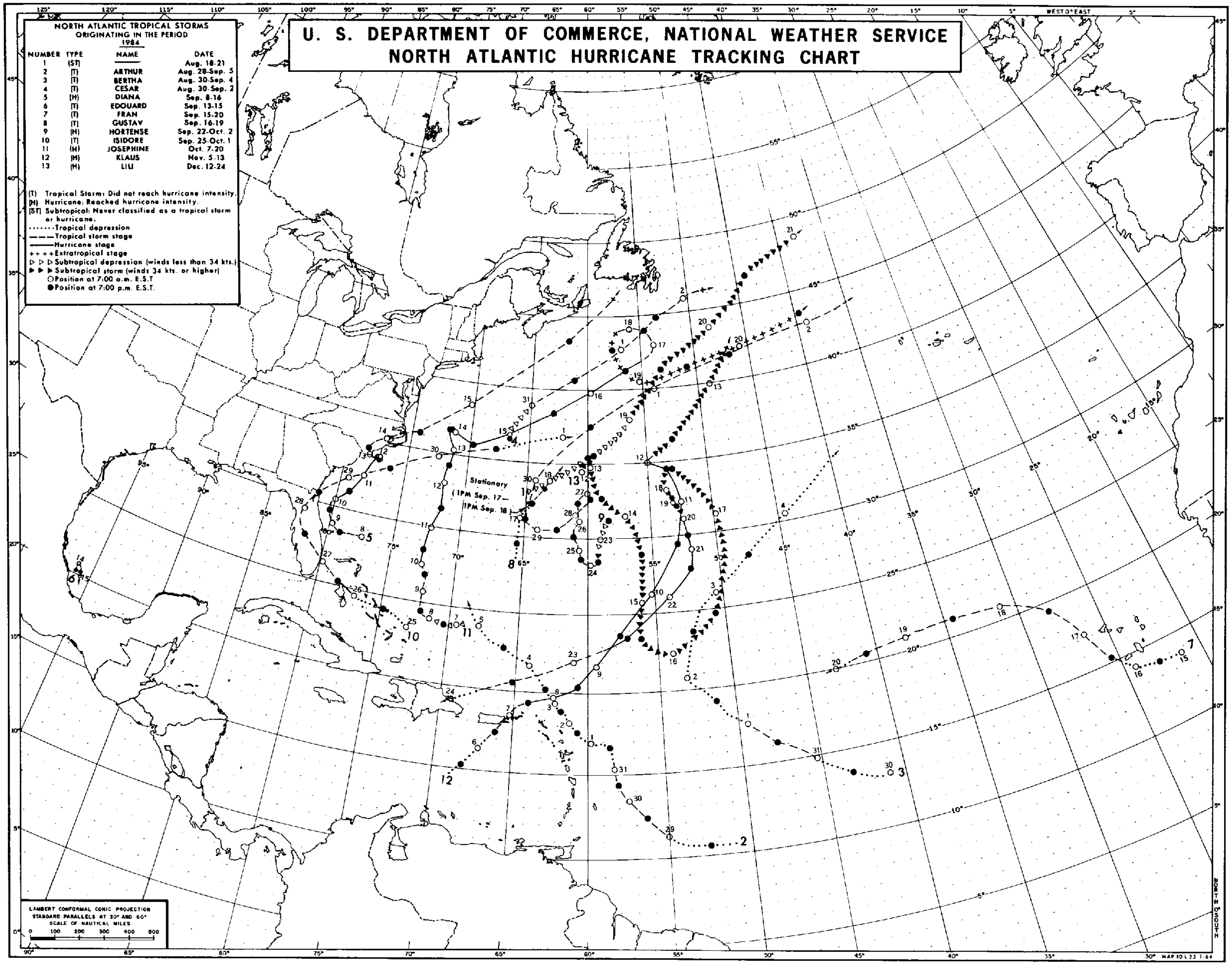
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1979
NUMBER TYPE NAME DATE
1 (T) ANA Jun. 19—23
2 (H) BOB Jul. 9—16
3 (T) CLAUDETTE Jul. 15—29
4 (H) DAVID Aug. 25—Sep. 7
5 (T) ELENA Aug. 29—Sep. 1
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

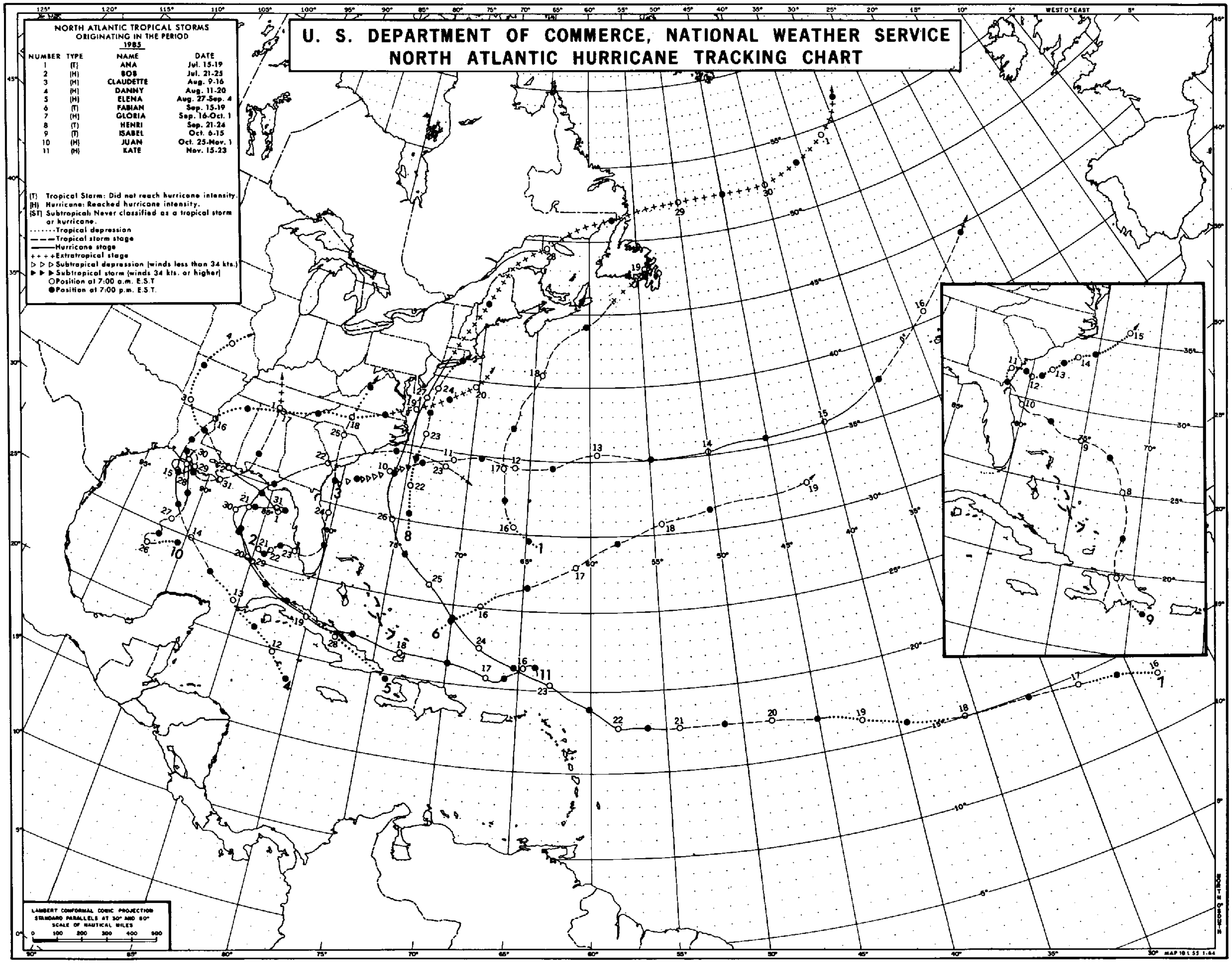

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1980
NUMBER TYPE NAME DATE
1 (H) ALLEN Jul. 31—Aug. 11
2 (H) BONNIE Aug. 13—19
3 (H) CHARLEY Aug. 20—25
4 (T) DANIELLE Sep. 4—7
5 (H) EARL Sep. 4—10
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

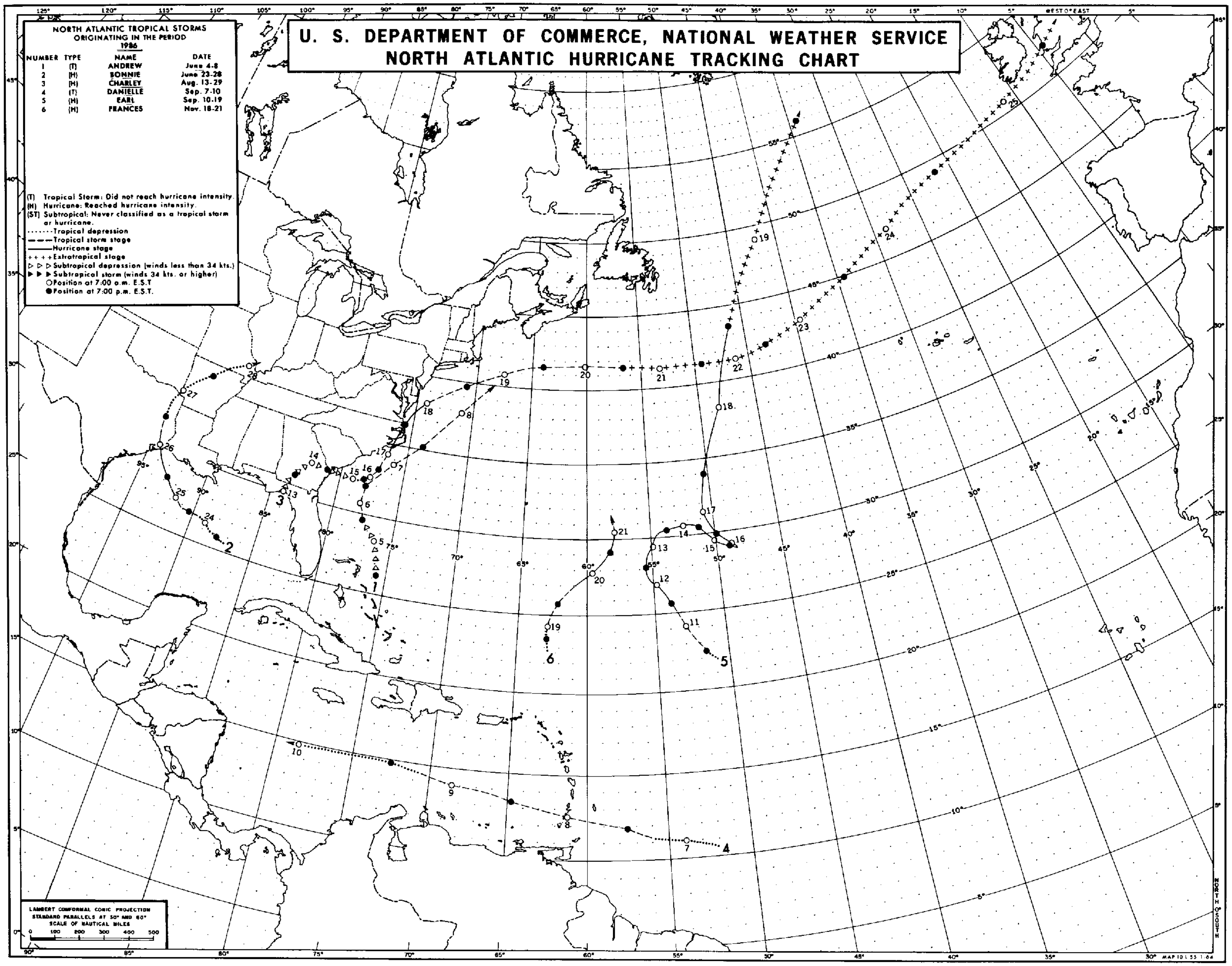

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1981
NUMBER TYPE NAME DATE
1 (T) ARLENE May 6-9
2 (T) BRET Jun. 29-Jul. 1
3 (T) CINDY Aug. 2-5
4 (H) DENNIS Aug. 7-21
5 (H) EMILY Aug. 31-Sep. 11
6 (H) 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


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
0 100 200 300 400 500
WEST | EAST

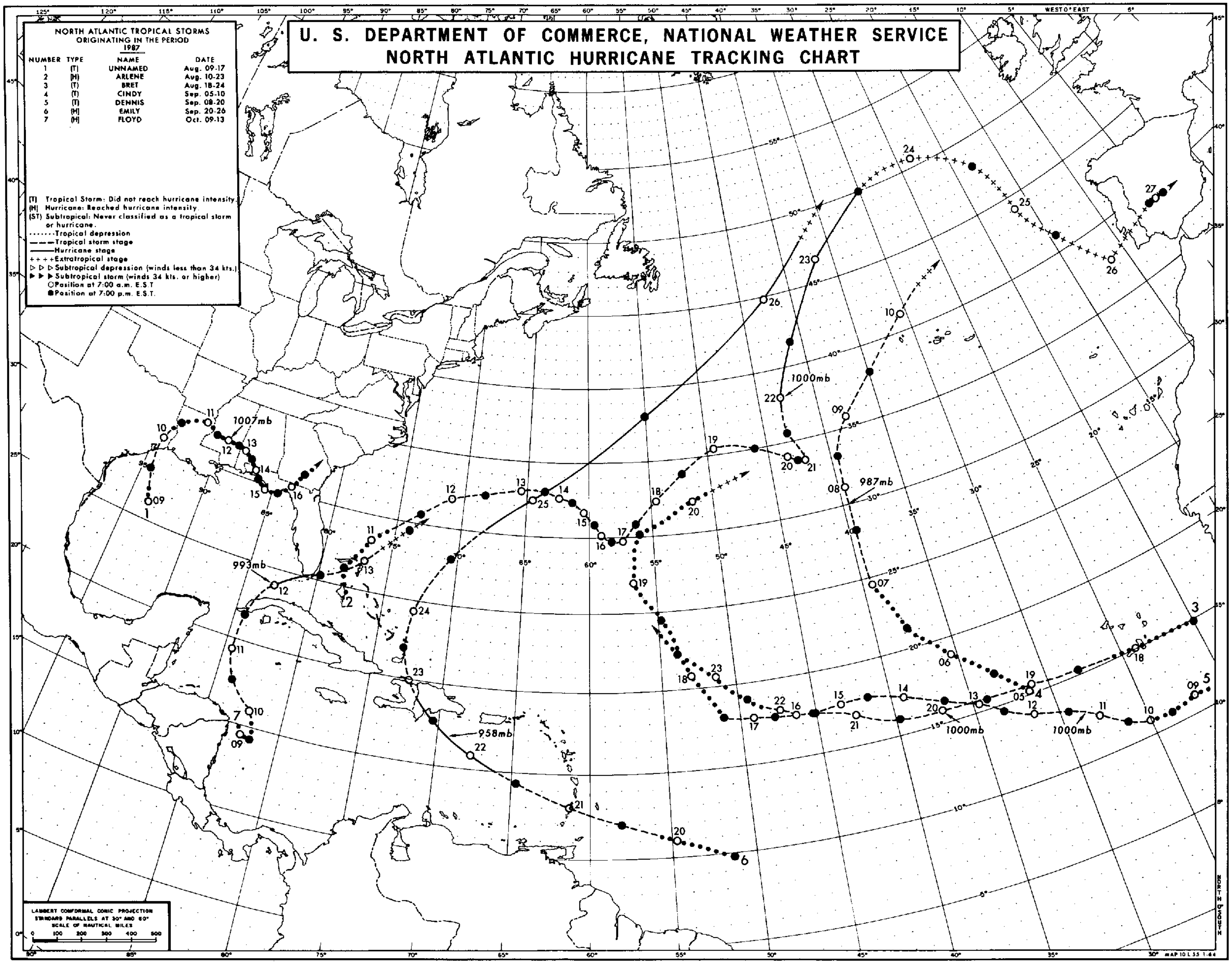

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1983
NUMBER TYPE NAME DATE
1 (H) ALICIA Aug. 15-21
2 (H) BARRY Aug. 23-29
3 (H) CHANTAL Sep. 10-15
4 (T) DEAN Sep. 26-30
(T) Tropical Storm: Did not 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
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
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)
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

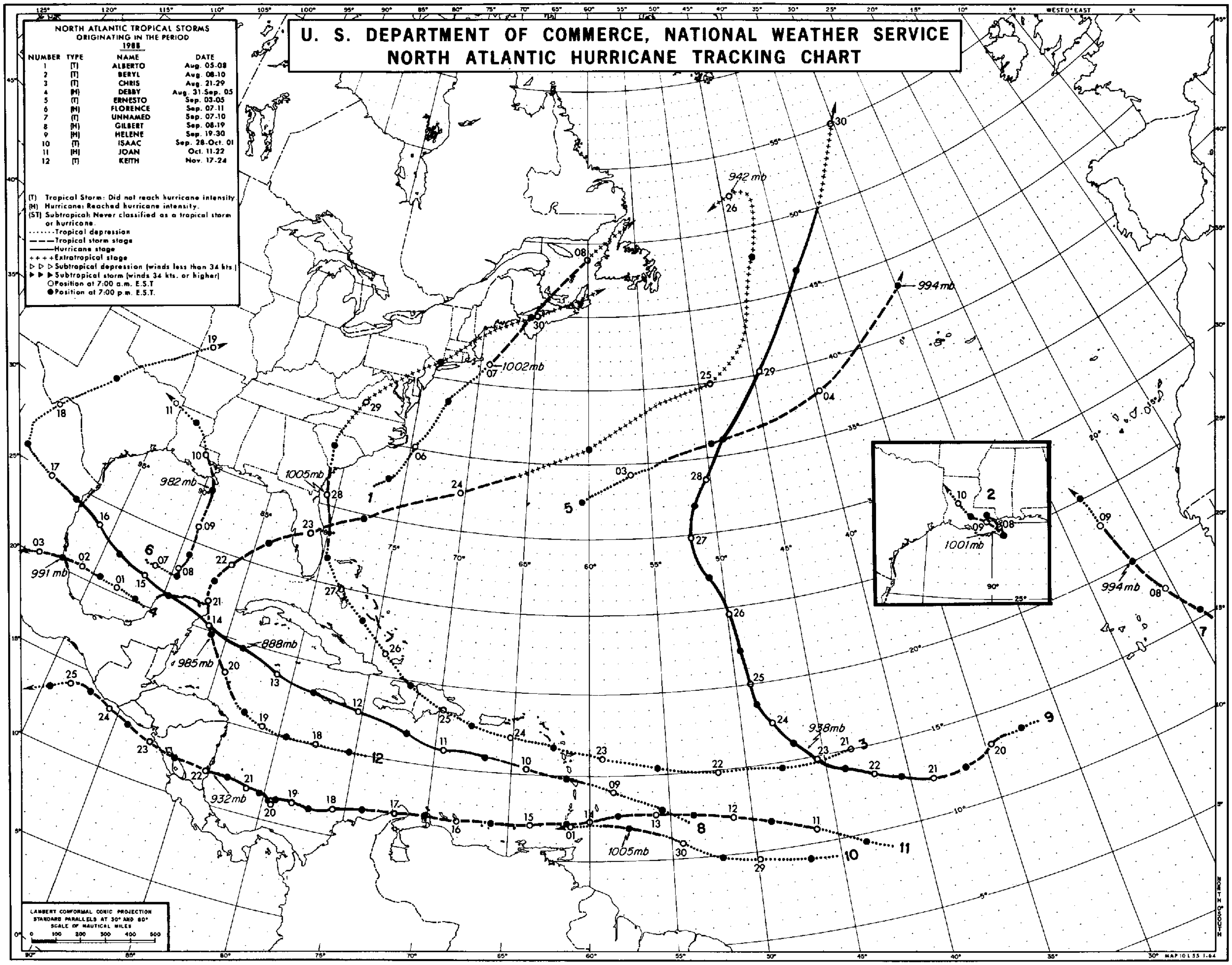

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1985
NUMBER TYPE NAME DATE
1 (T) ANA Jul. 15-19
2 (H) BOB Jul. 21-25
3 (H) CLAUDETTE Aug. 9-16
4 (H) DANNY Aug. 11-20
5 (H) ELENA Aug. 27-Sep. 4
6 (T) 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



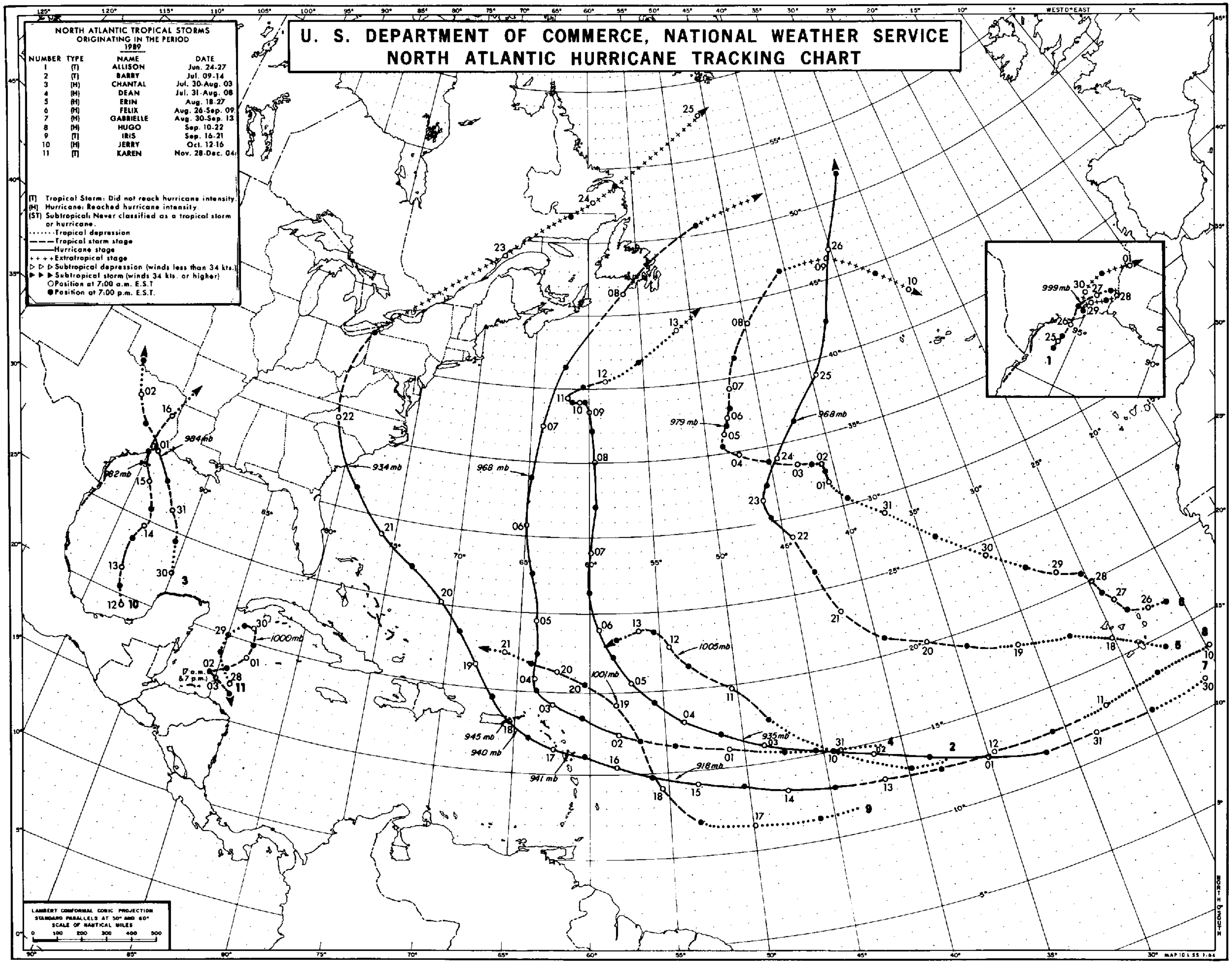
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1986
NUMBER TYPE NAME DATE
1 (T) ANDREW June 4-8
2 (H) BONNIE June 23-28
3 (H) CHARLEY Aug. 13-29
4 (T) DANIELLE Sep. 7-10
5 (H) EARL Sep. 10-19
6 (H) 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
0 100 200 300 400 500

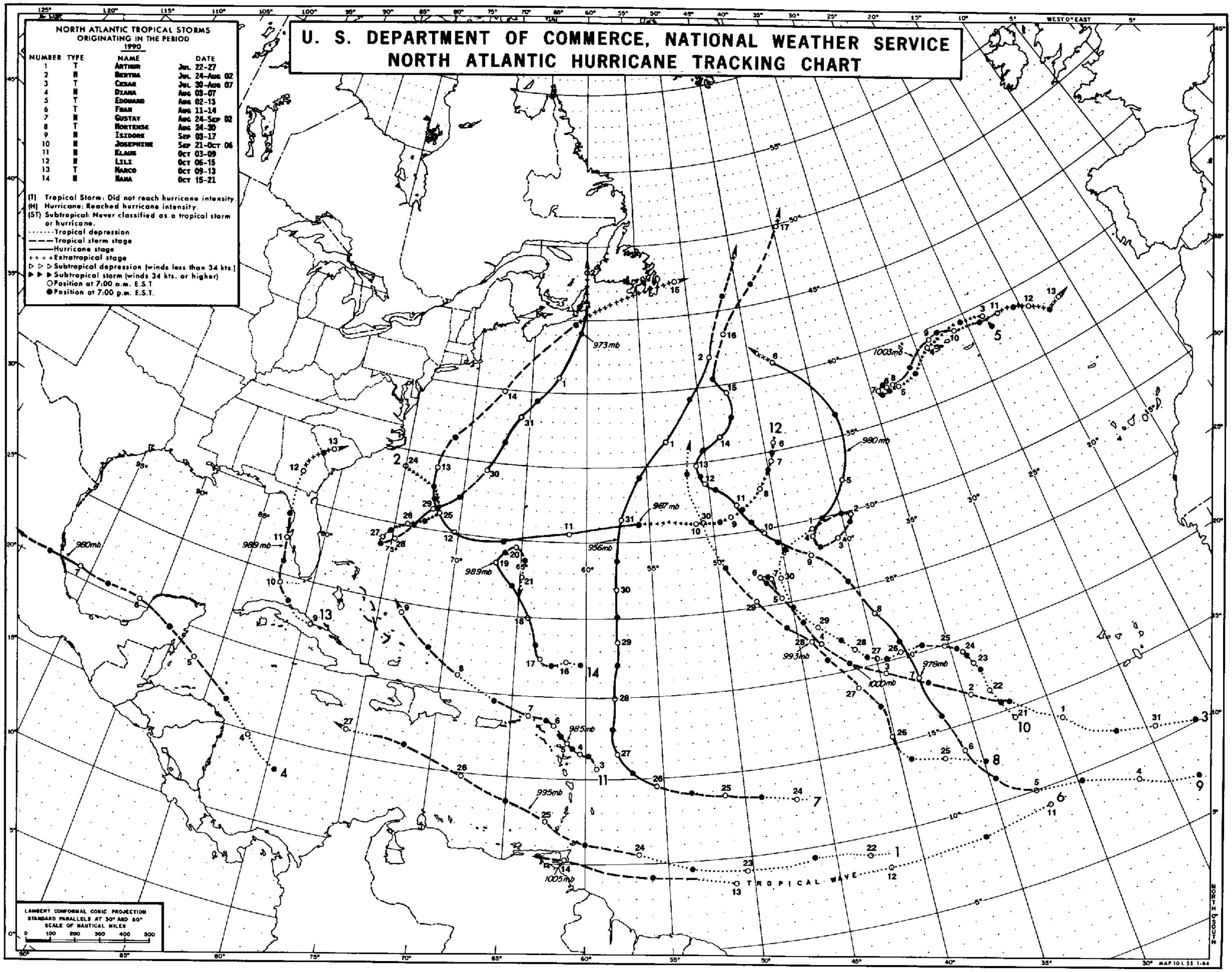


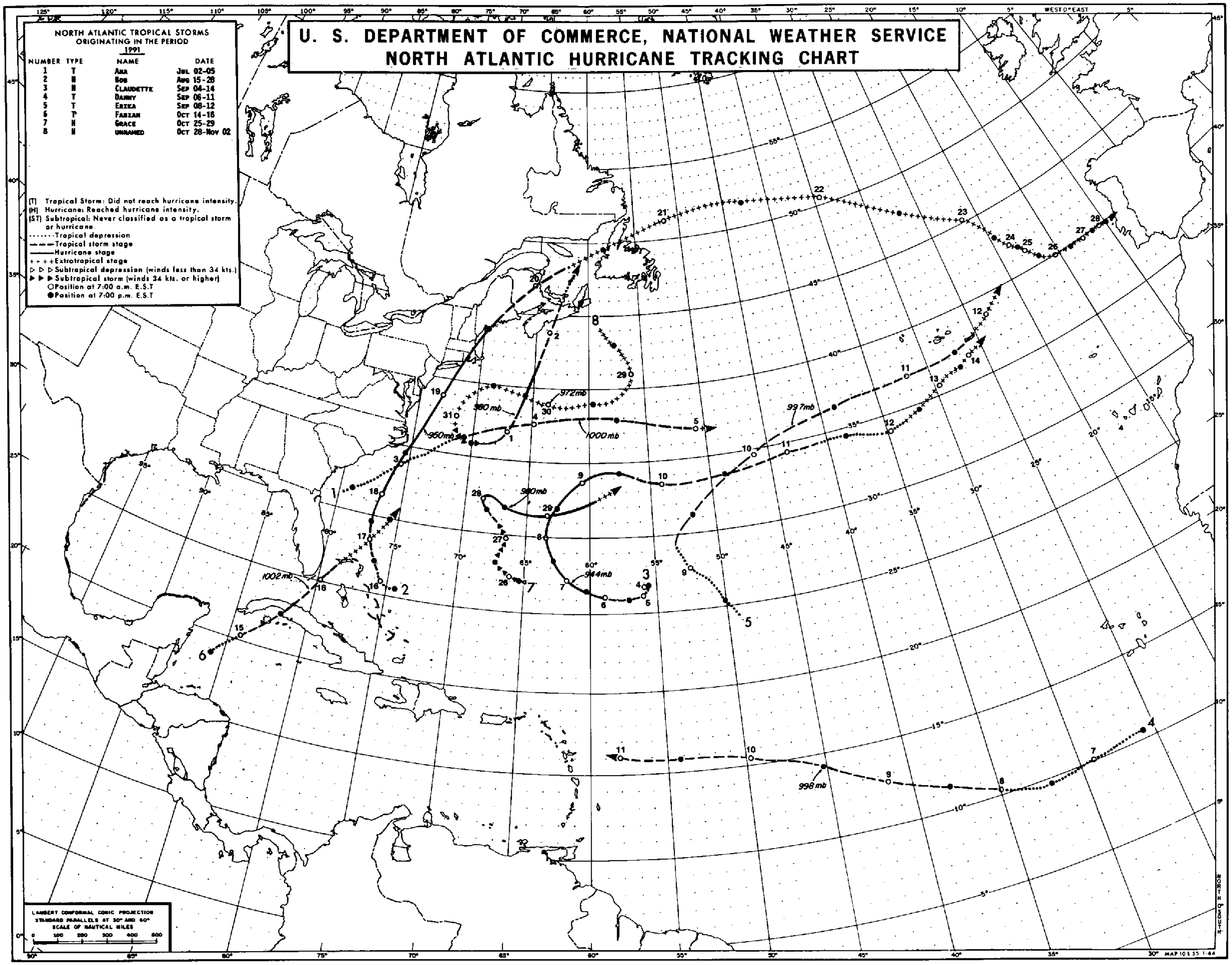
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1987
NUMBER TYPE NAME DATE
1 (T) UNNAMED Aug. 09-17
2 (H) ARLENE Aug. 10-23
3 (T) BRET Aug. 18-24
4 (T) CINDY Sep. 05-10
5 (T) DENNIS Sep. 08-20
6 (H) 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
LAMBERT CONFORMAL CONIC PROJECTION

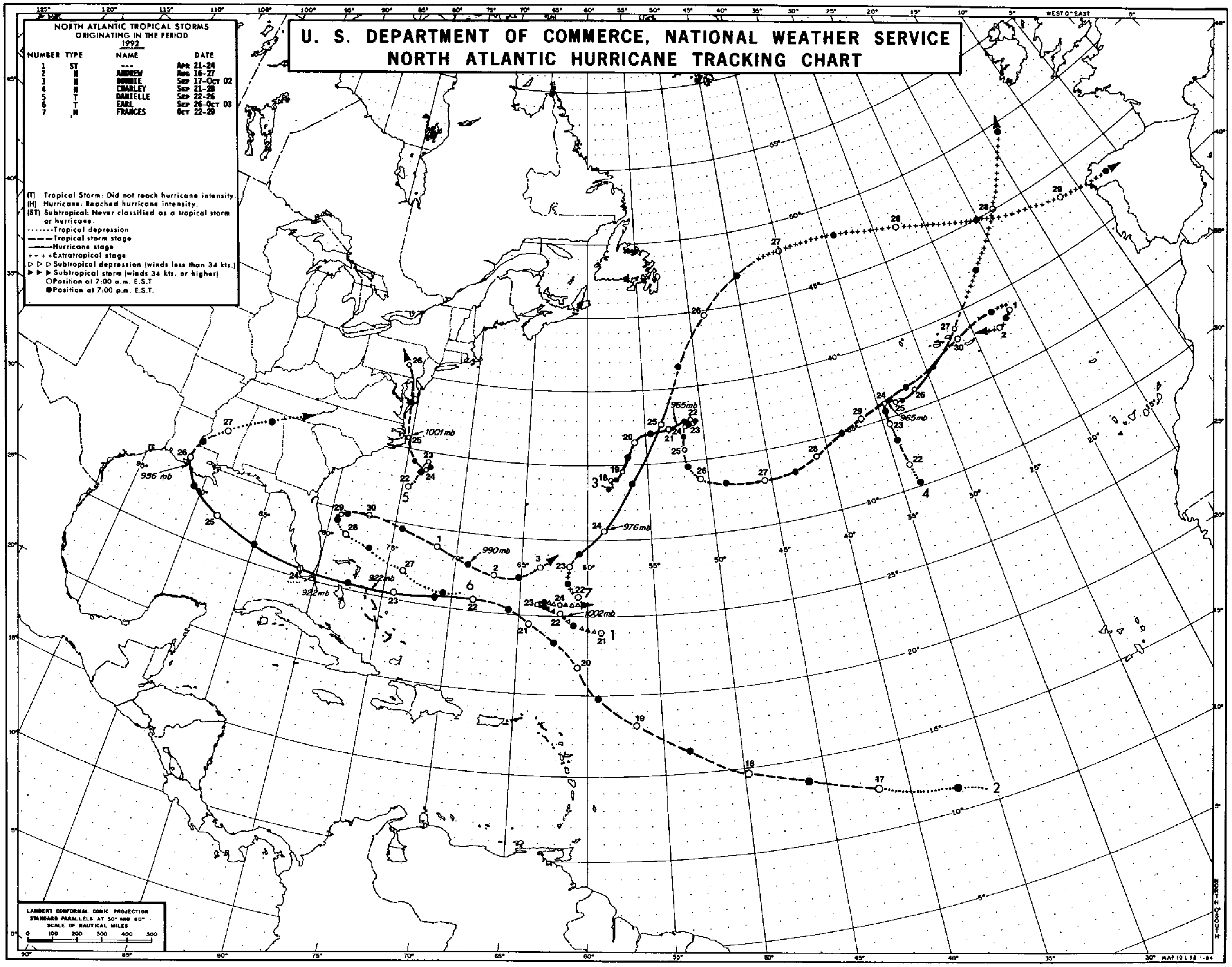


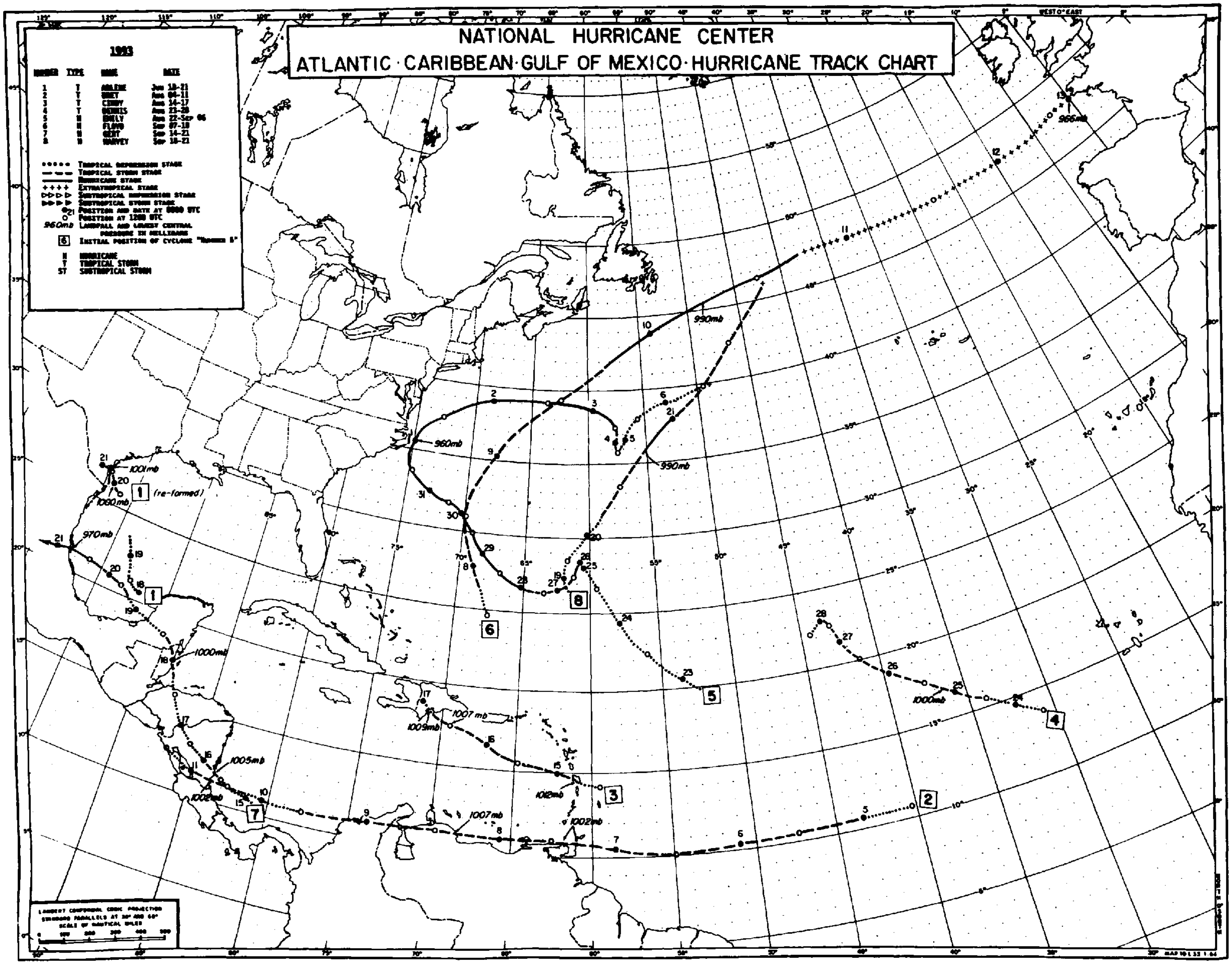
U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1988
NUMBER TYPE NAME DATE
1 (T) ALBERTO Aug. 05-08
2 (T) BERYL Aug. 08-10
3 (T) CHRIS Aug. 21-29
4 (H) DEBBY Aug. 31-Sep. 05
5 (T) ERNESTO Sep. 03-05
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
1002mb
1005mb
982 mb
991 mb
888mb
985mb
932mb
938mb
1005mb
994mb
1001mb
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
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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

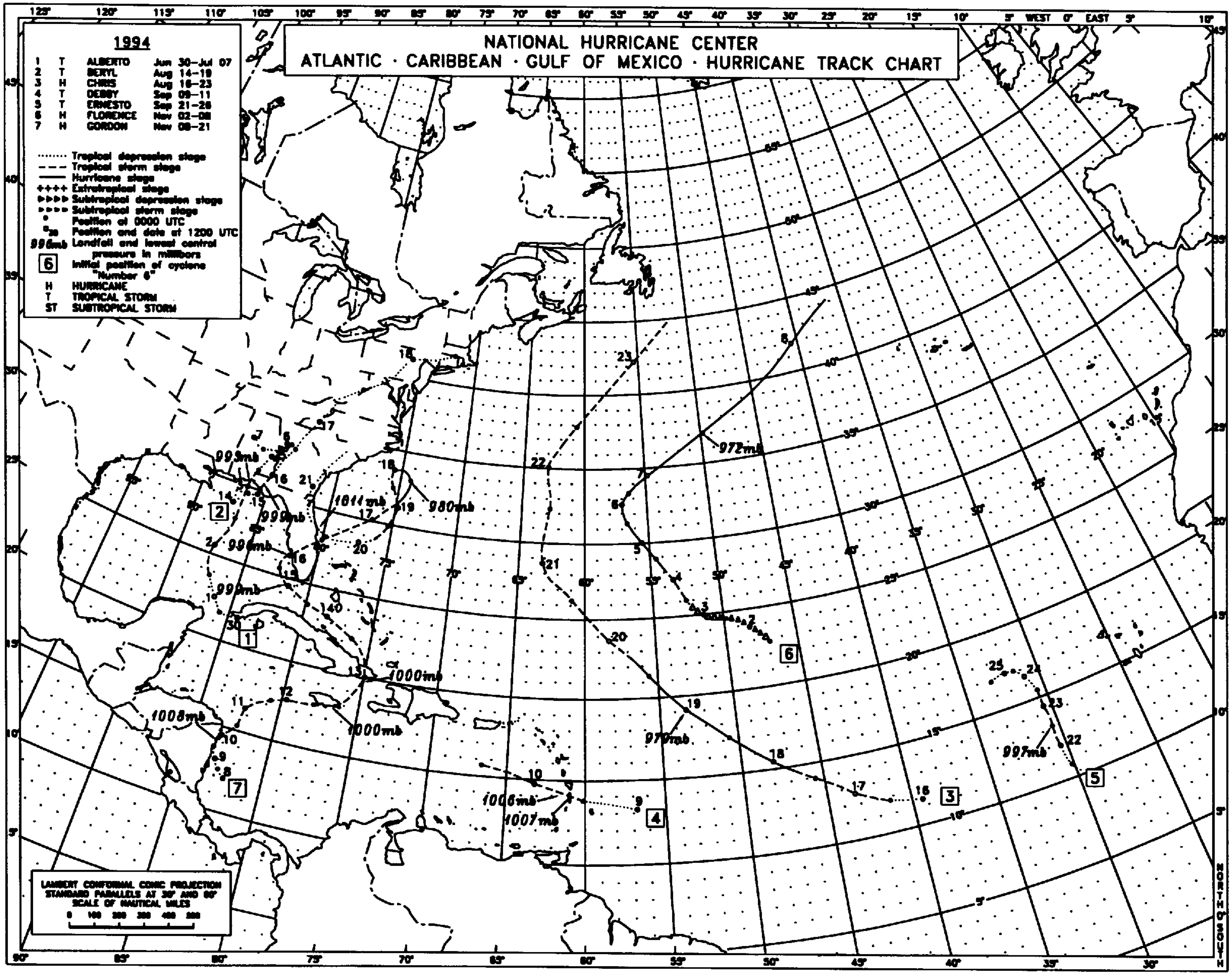

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1990
NUMBER TYPE NAME DATE
1 T ARTHUR JUL 22-27
2 H BERTHA JUL 24-AUG 02
3 T CESAR JUL 30-AUG 07
4 H DIANA AUG 03-07
5 T EDOUARD AUG 02-13
6 T FRAN AUG 11-14
7 H GUSTAV AUG 24-SEP 02
8 T HORTENSE 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 MARCO 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.
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
TROPICAL WAVE


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 06-11
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
1002 mb
950 mb
980 mb
972 mb
1000 mb
960 mb
944 mb
997 mb
998 mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

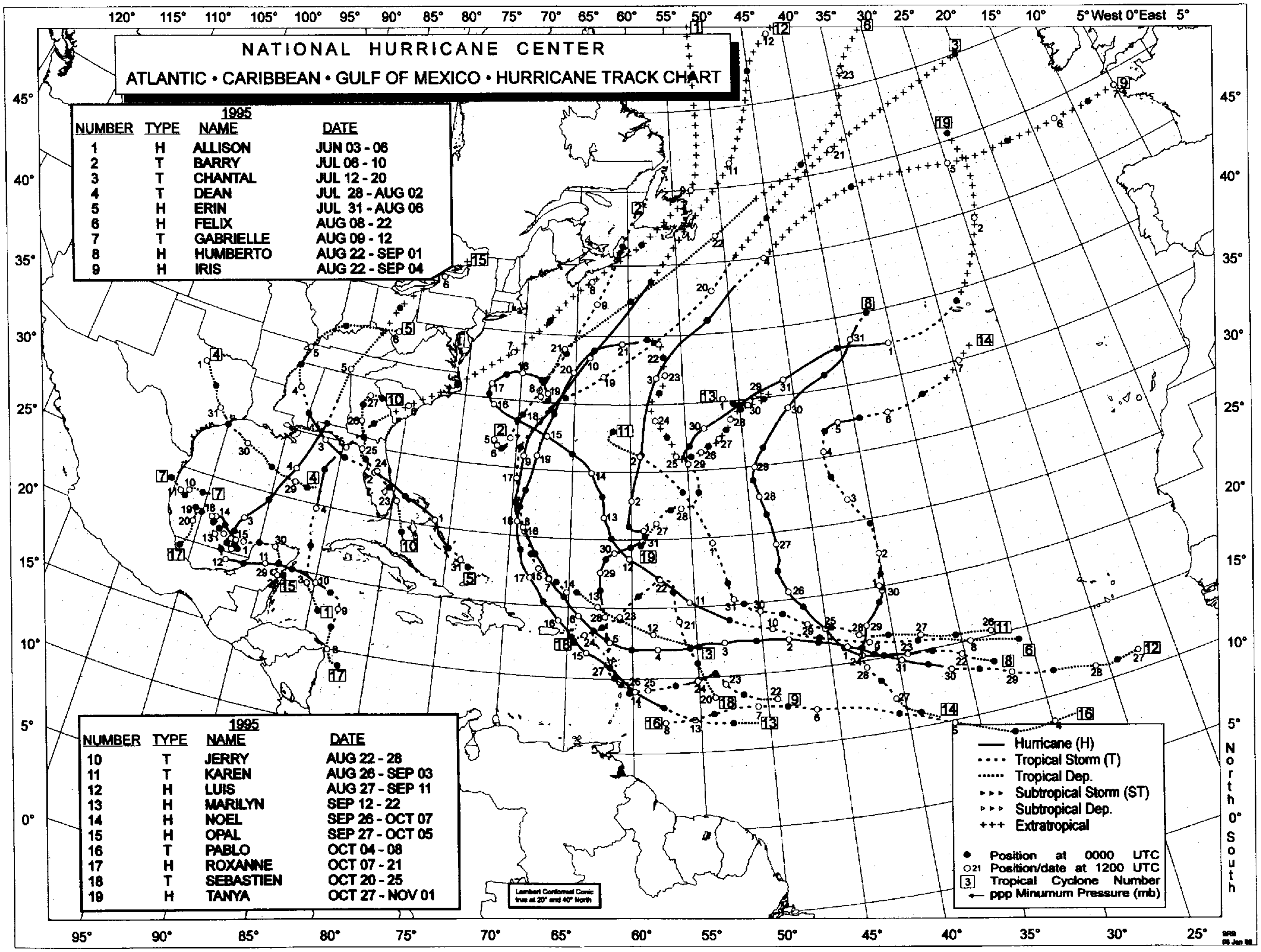

U. S. DEPARTMENT OF COMMERCE, NATIONAL WEATHER SERVICE
NORTH ATLANTIC HURRICANE TRACKING CHART
NORTH ATLANTIC TROPICAL STORMS
ORIGINATING IN THE PERIOD
1992
NUMBER TYPE NAME DATE
1 ST --- Apr 21-24
2 H ANDREW Aug 16-27
3 H BONNIE Sep 17-Oct 02
4 H CHARLEY Sep 21-28
5 T DANIELLE Sep 22-26
6 T EARL Sep 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
1001 mb
965 mb
976 mb
990 mb
1002 mb
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES

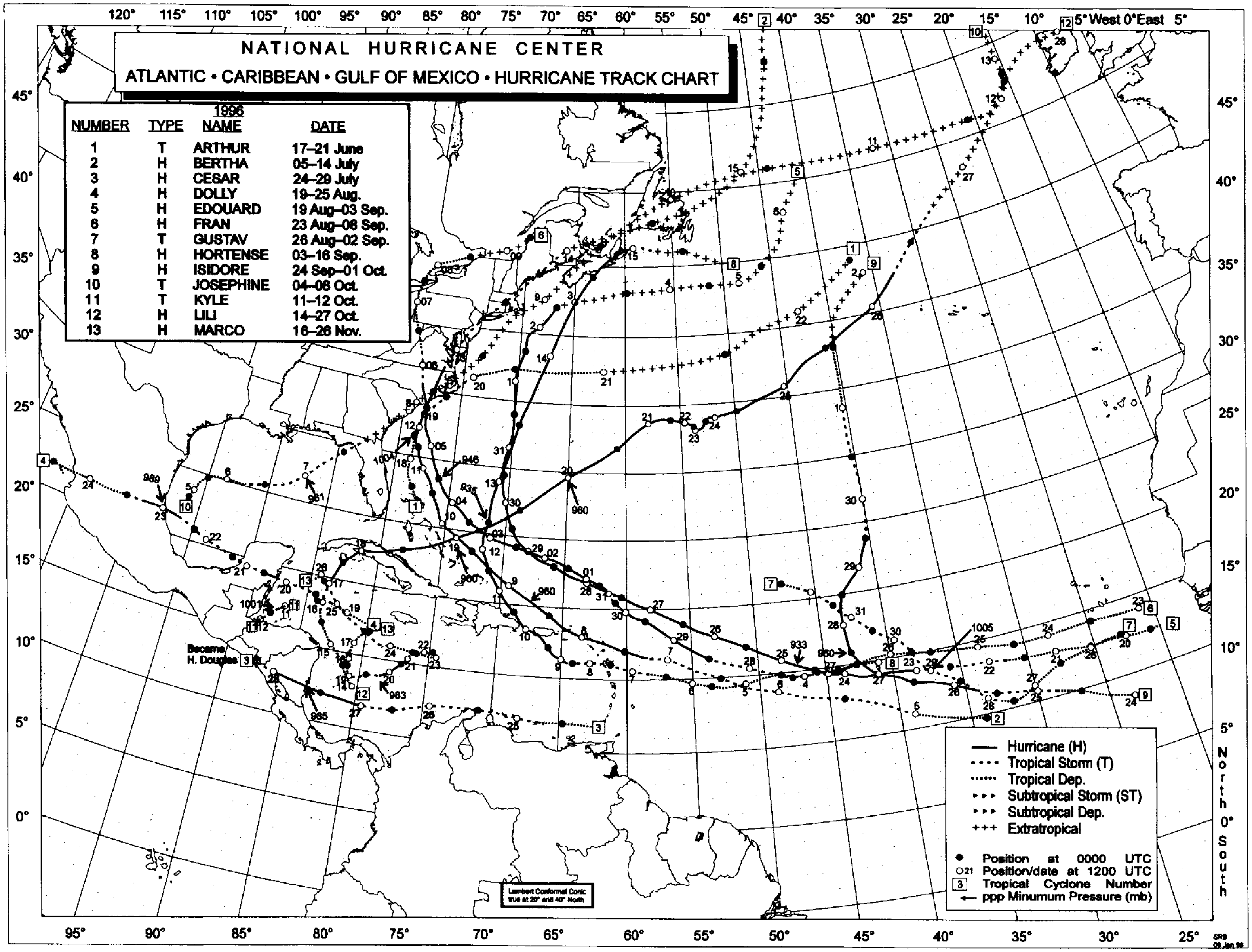


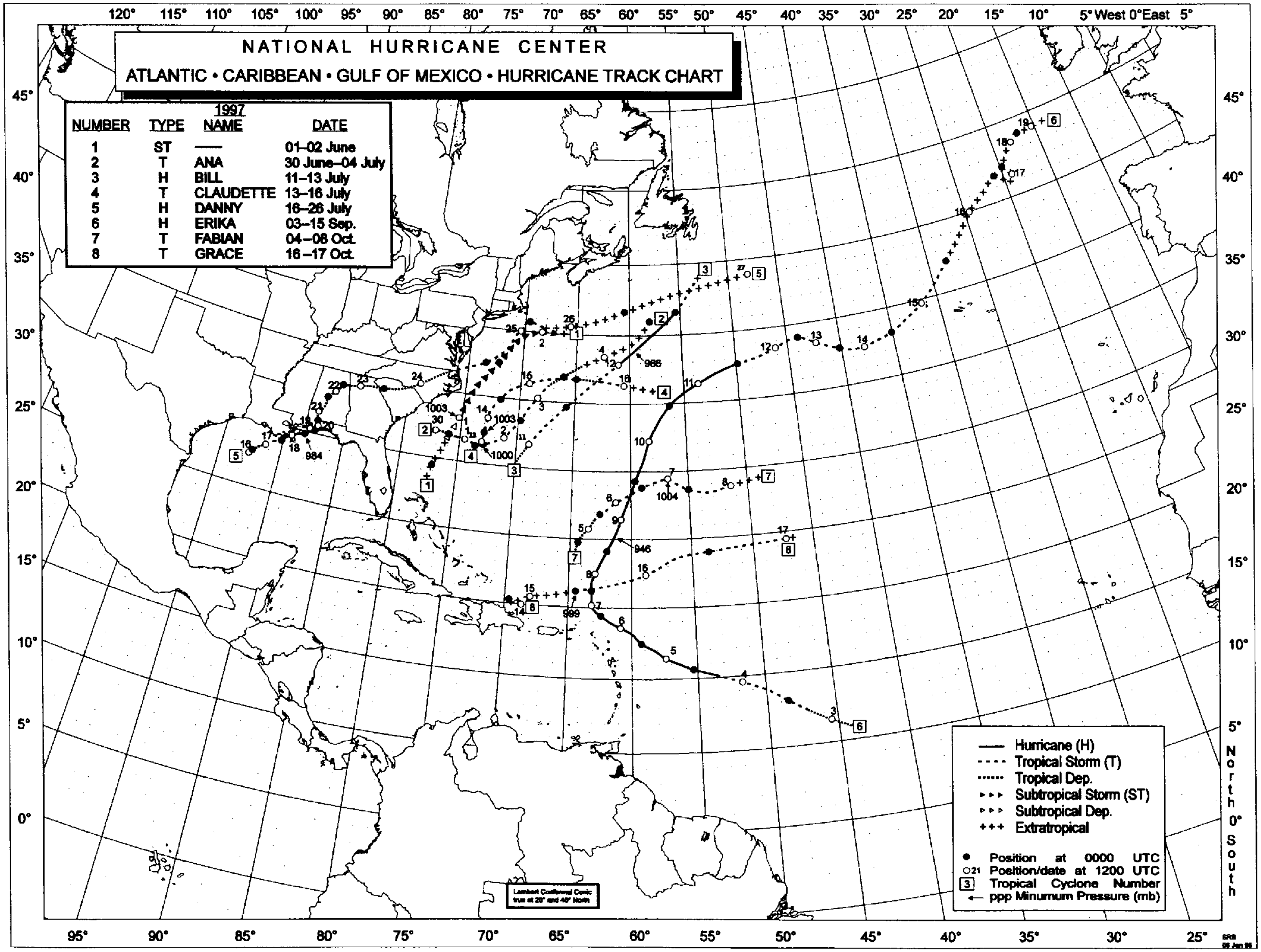
NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1993
TYPE
POSITION AT 1200 UTC
H
T
ST
TROPICAL STORM
960mb
1001mb
1000mb
(re-formed)
970mb
990mb
966mb
1007 mb
1009mb
1005mb
1002mb
1012mb

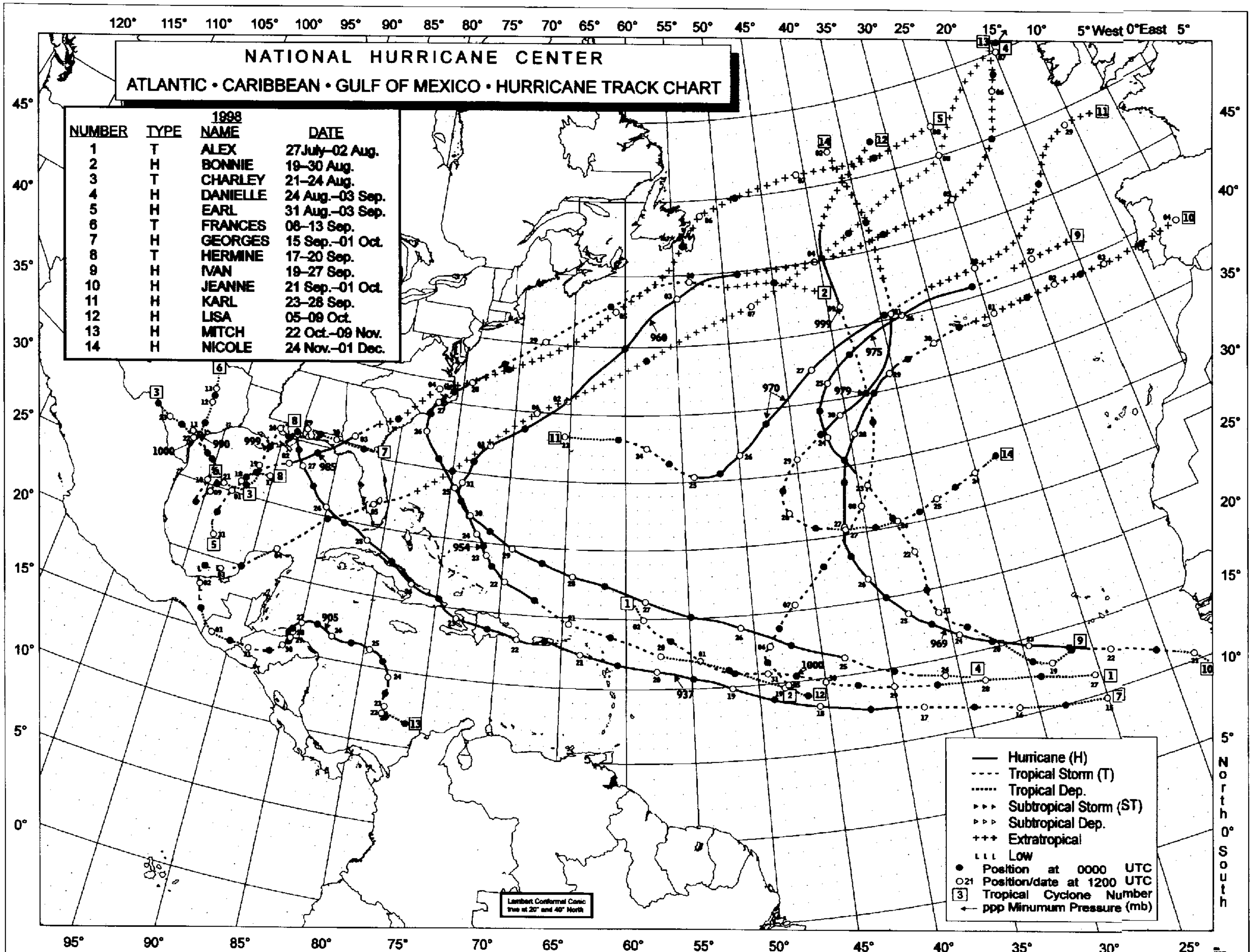


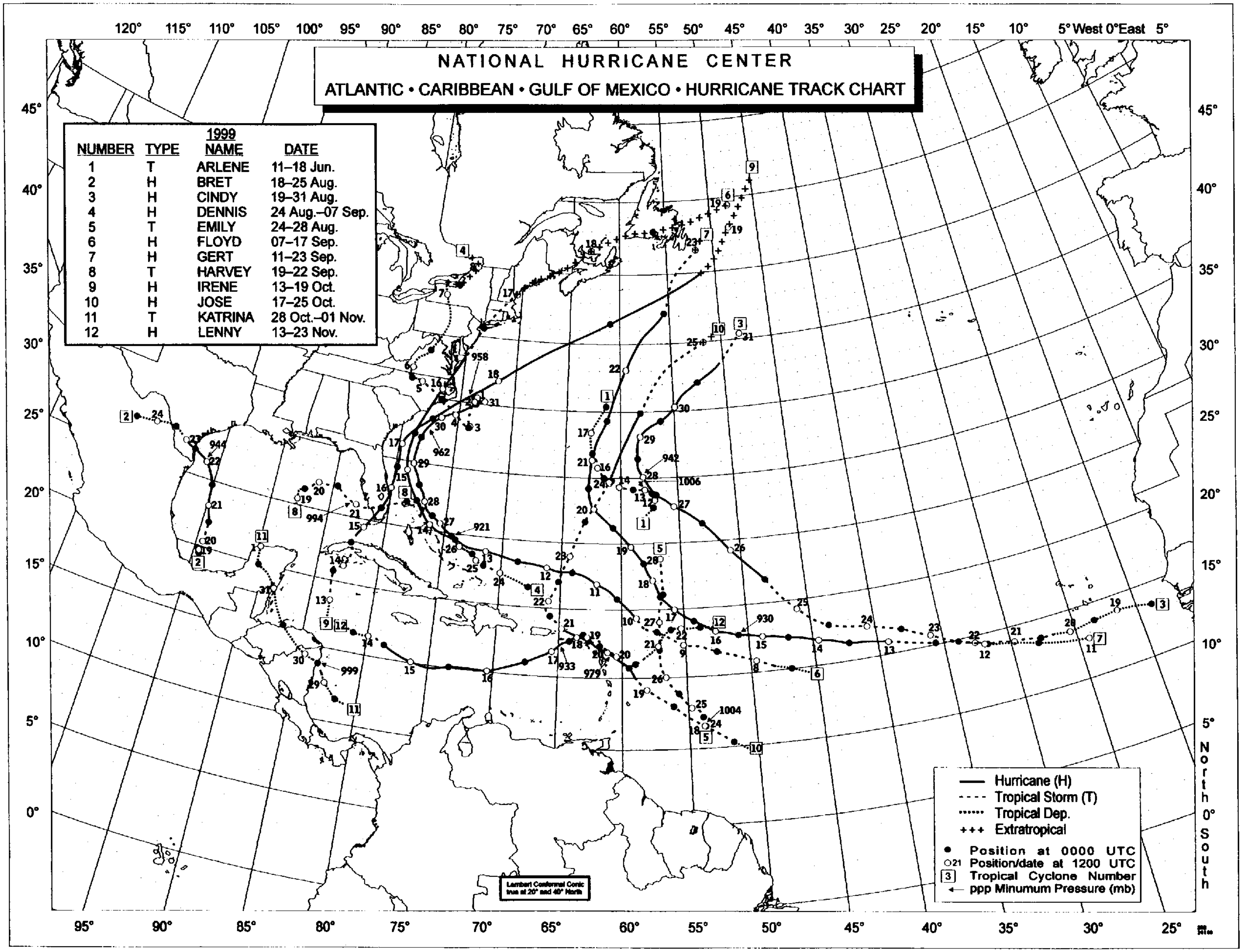
NATIONAL HURRICANE CENTER
ATLANTIC · CARIBBEAN · GULF OF MEXICO · HURRICANE TRACK CHART
1994
1 T ALBERTO Jun 30–Jul 07
2 T BERYL Aug 14–19
3 H CHRIS Aug 16–23
4 T DEBBY Sep 09–11
5 T ERNESTO Sep 21–26
6 H FLORENCE Nov 02–08
7 H GORDON Nov 08–21
Tropical depression stage
Tropical storm stage
Hurricane 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
LAMBERT CONFORMAL CONIC PROJECTION
STANDARD PARALLELS AT 30° AND 60°
SCALE OF NAUTICAL MILES
972mb
980mb
1011mb
999mb
996mb
1000mb
1008mb
979mb
997mb
1006mb
1007mb


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 (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 Minumum Pressure (mb)
North
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.
Subtropical Storm (ST)
Subtropical Dep.
Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
ppp Minumum Pressure (mb)
Lambert Conformal Conic true at 20° and 40° North
5° West 0° East 5°
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 Minumum Pressure (mb)
North
0°
South


NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1998
NUMBER TYPE NAME DATE
1 T ALEX 27July–02 Aug.
2 H BONNIE 19–30 Aug.
3 T CHARLEY 21–24 Aug.
4 H DANIELLE 24 Aug.–03 Sep.
5 H EARL 31 Aug.–03 Sep.
6 T FRANCES 08–13 Sep.
7 H GEORGES 15 Sep.–01 Oct.
8 T HERMINE 17–20 Sep.
9 H IVAN 19–27 Sep.
10 H JEANNE 21 Sep.–01 Oct.
11 H KARL 23–28 Sep.
12 H LISA 05–09 Oct.
13 H MITCH 22 Oct.–09 Nov.
14 H NICOLE 24 Nov.–01 Dec.
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Subtropical Storm (ST)
Subtropical Dep.
Extratropical
Low
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
ppp Minumum Pressure (mb)
Lambert Conformal Conic true at 20° and 40° North
North
South



NATIONAL HURRICANE CENTER
ATLANTIC • CARIBBEAN • GULF OF MEXICO • HURRICANE TRACK CHART
1999
NUMBER TYPE NAME DATE
1 T ARLENE 11–18 Jun.
2 H BRET 18–25 Aug.
3 H CINDY 19–31 Aug.
4 H DENNIS 24 Aug.–07 Sep.
5 T EMILY 24–28 Aug.
6 H FLOYD 07–17 Sep.
7 H GERT 11–23 Sep.
8 T HARVEY 19–22 Sep.
9 H IRENE 13–19 Oct.
10 H JOSE 17–25 Oct.
11 T KATRINA 28 Oct.–01 Nov.
12 H LENNY 13–23 Nov.
Hurricane (H)
Tropical Storm (T)
Tropical Dep.
Extratropical
Position at 0000 UTC
Position/date at 1200 UTC
Tropical Cyclone Number
ppp Minumum Pressure (mb)
Lambert Conformal Conic true at 20° and 40° North
North
South
5° West 0° East

ATTACH 2000 TRACK CHART

ATTACH 2001 TRACK CHART

ATTACH 2002 TRACK CHART

ATTACH 2003 TRACK CHART

ATTACH 2004 TRACK CHART

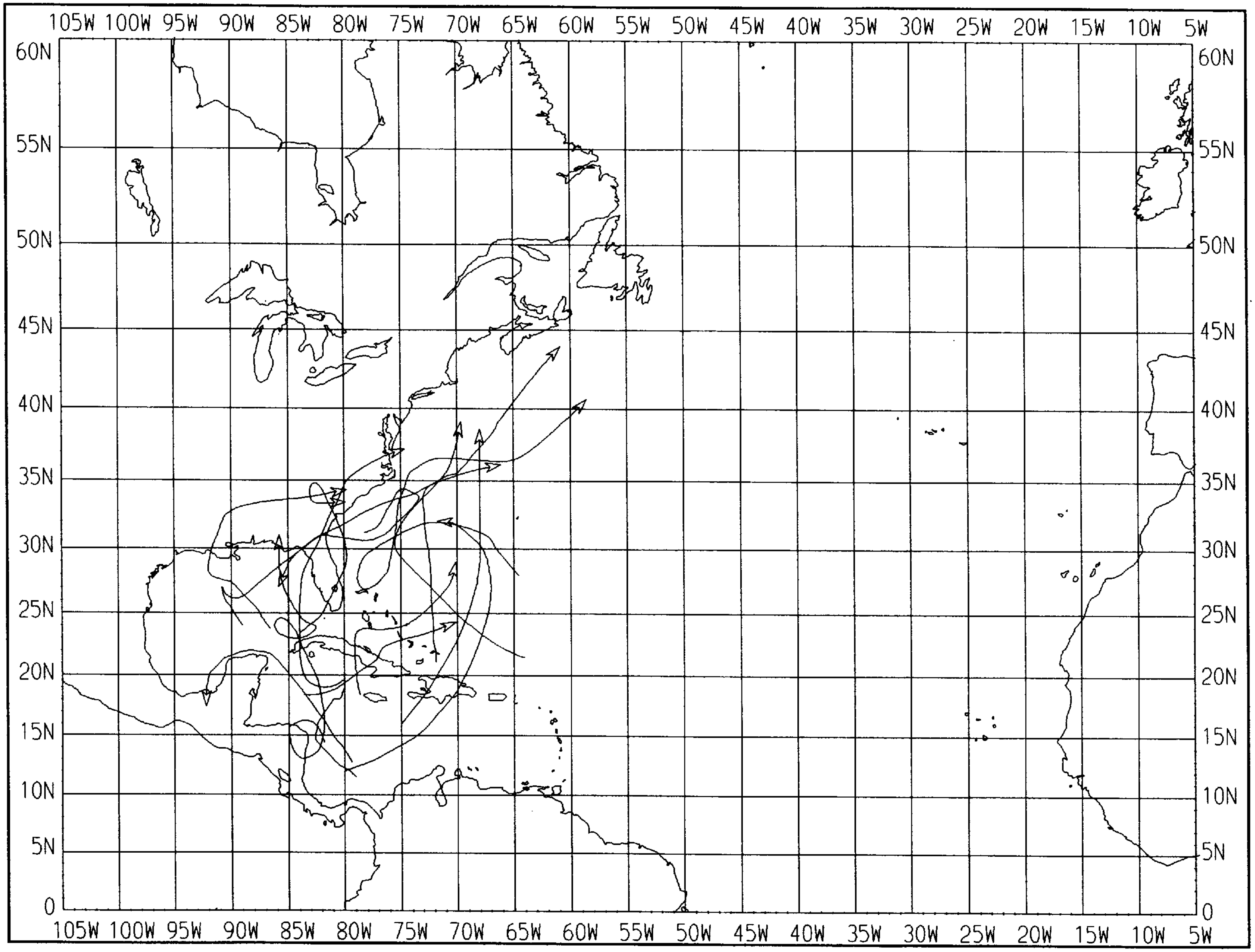
ATTACH 2005 TRACK CHART

ATTACH 2006 TRACK CHART

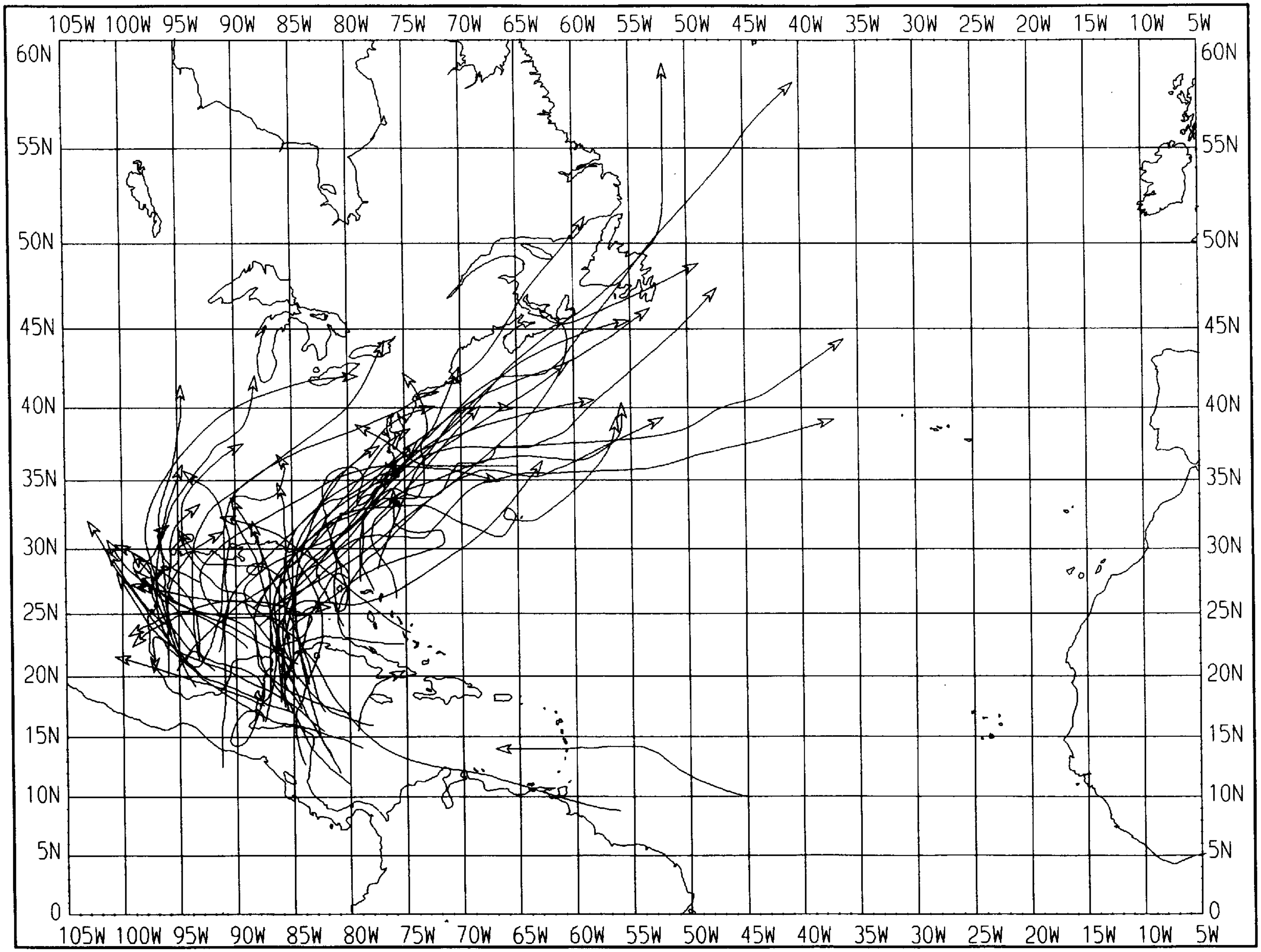
APPENDIX B

TRACKS OF NORTH ATLANTIC TROPICAL CYCLONES BY INTRA-SEASONAL PERIODS, 1886-1998 (CHART SERIES B)

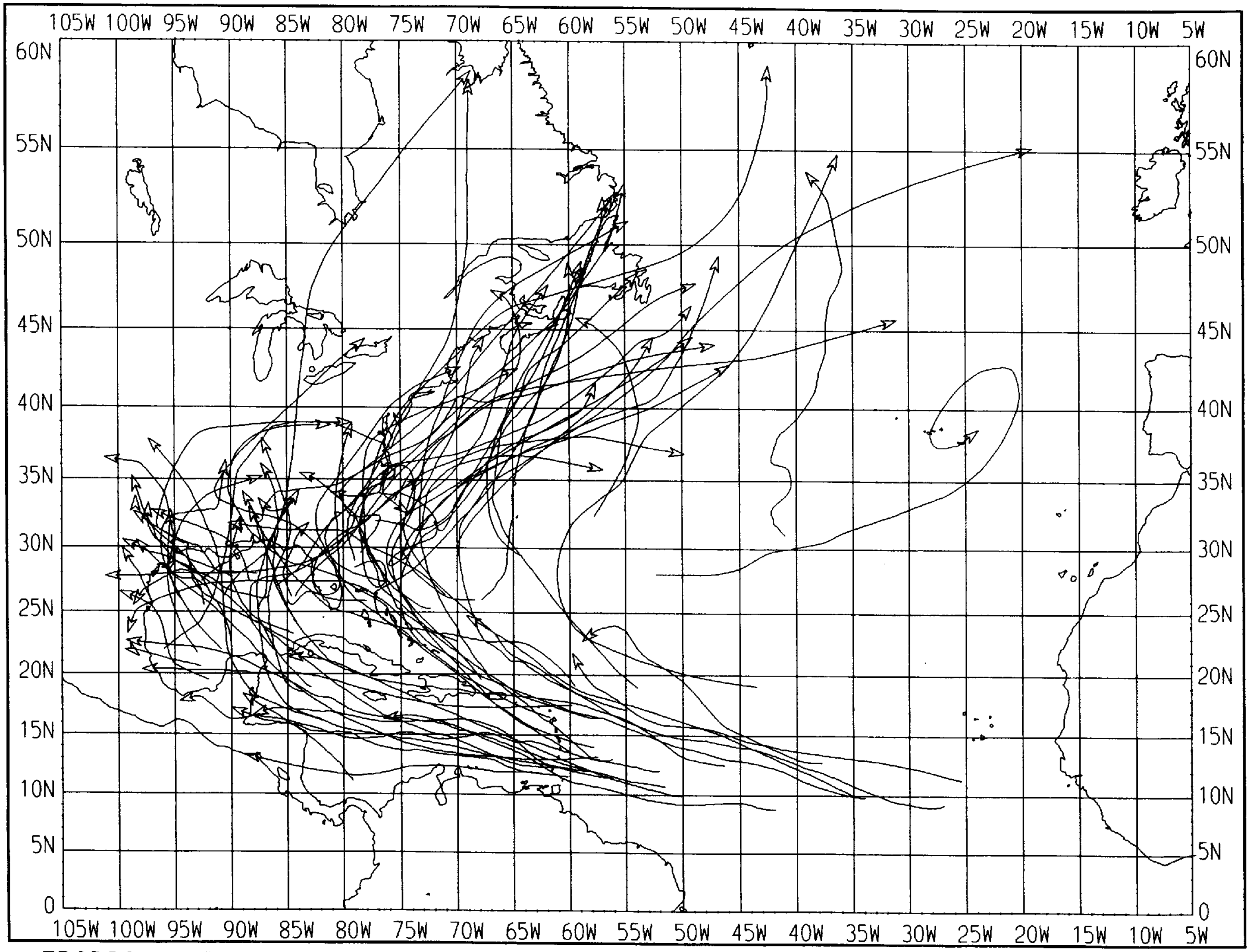
Tracks of North Atlantic Tropical Cyclones by months, May through December and by 10- (or 11-) day periods, June 1 through November 30.



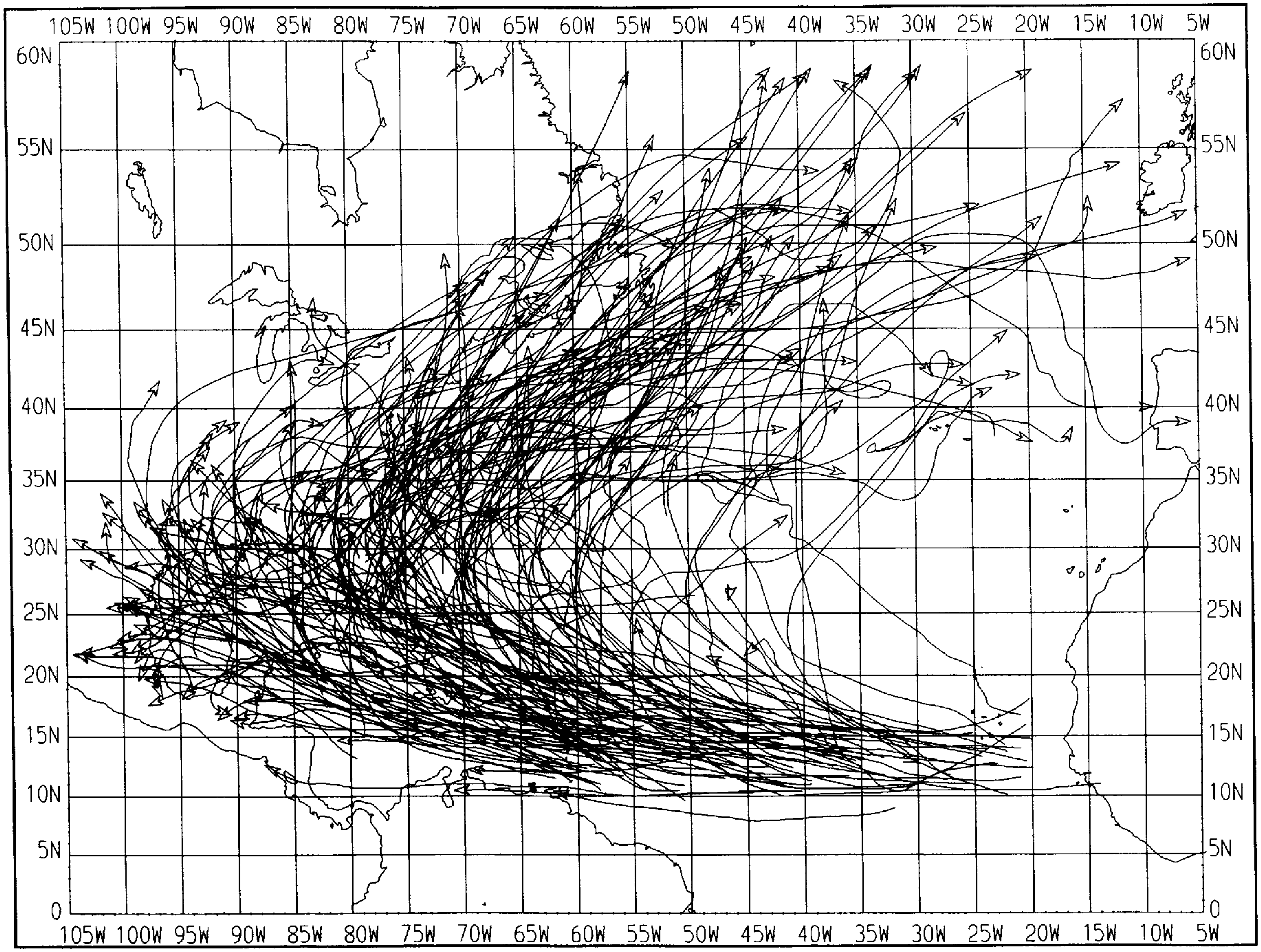
TROPICAL STORMS AND HURRICANES BEGINNING IN MAY, 1886-1998 (14 STORMS)



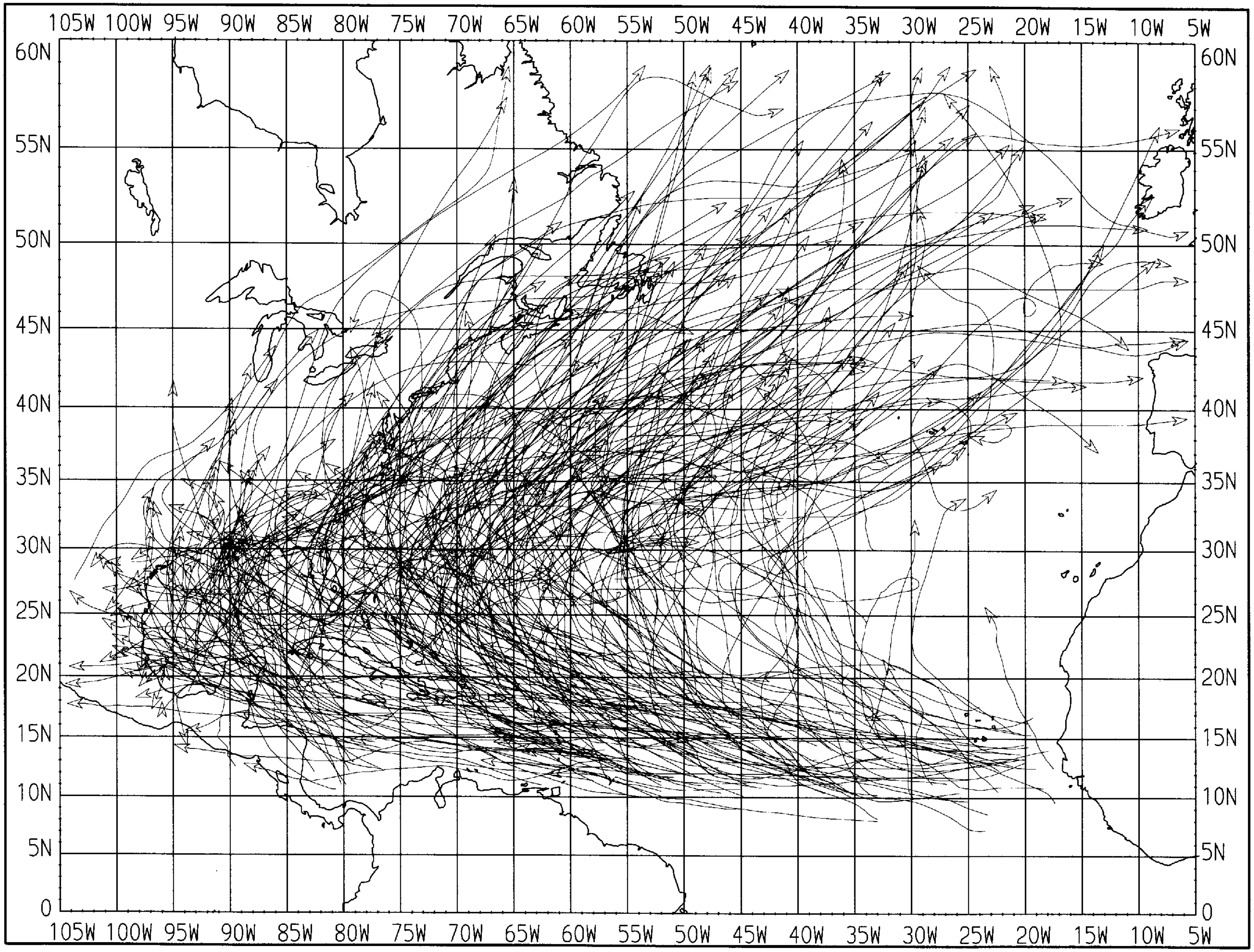
TROPICAL STORMS AND HURRICANES BEGINNING IN JUNE, 1886-1998 (60 STORMS)



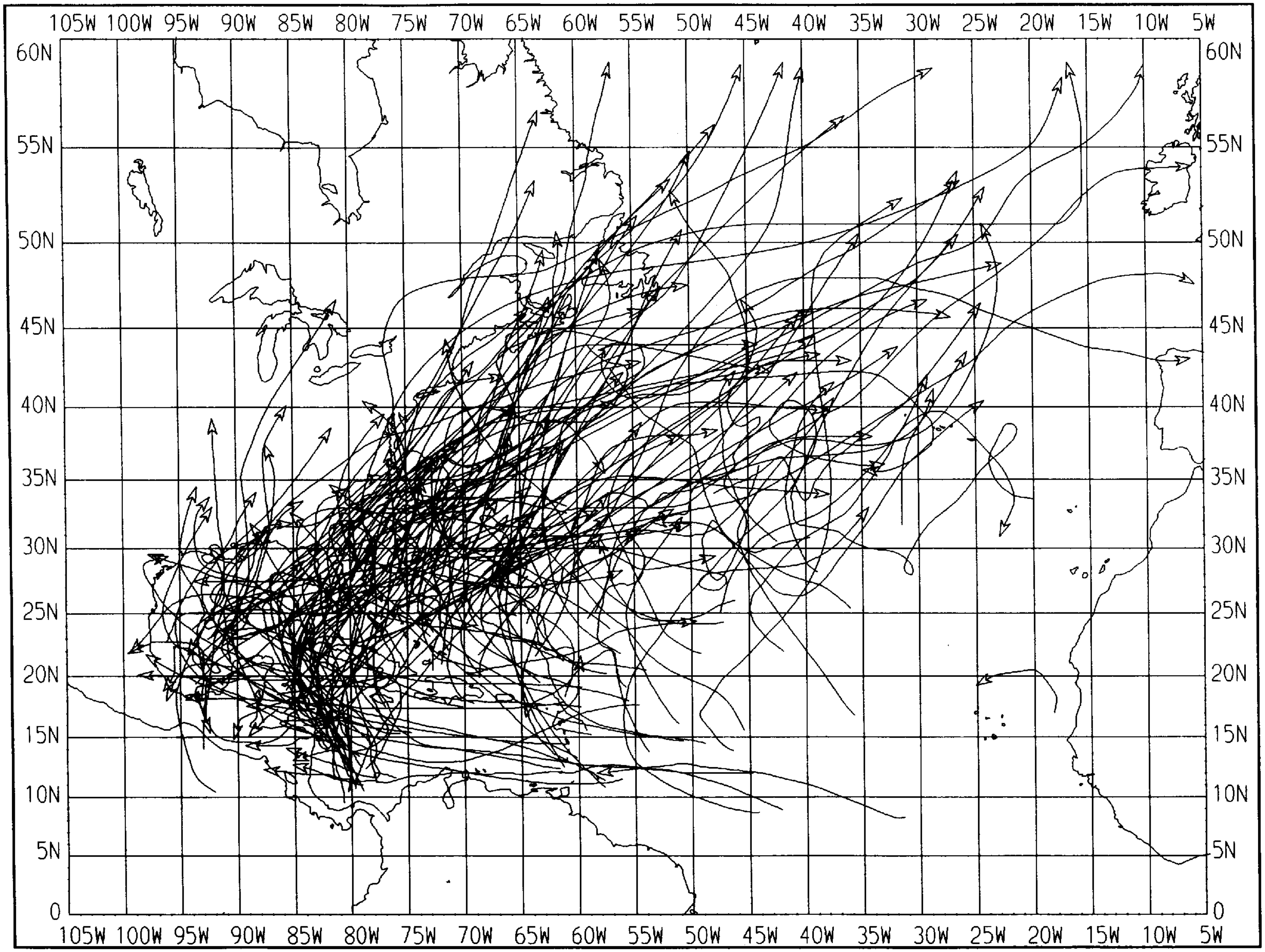
TROPICAL STORMS AND HURRICANES BEGINNING IN JULY, 1886-1998 (80 STORMS)



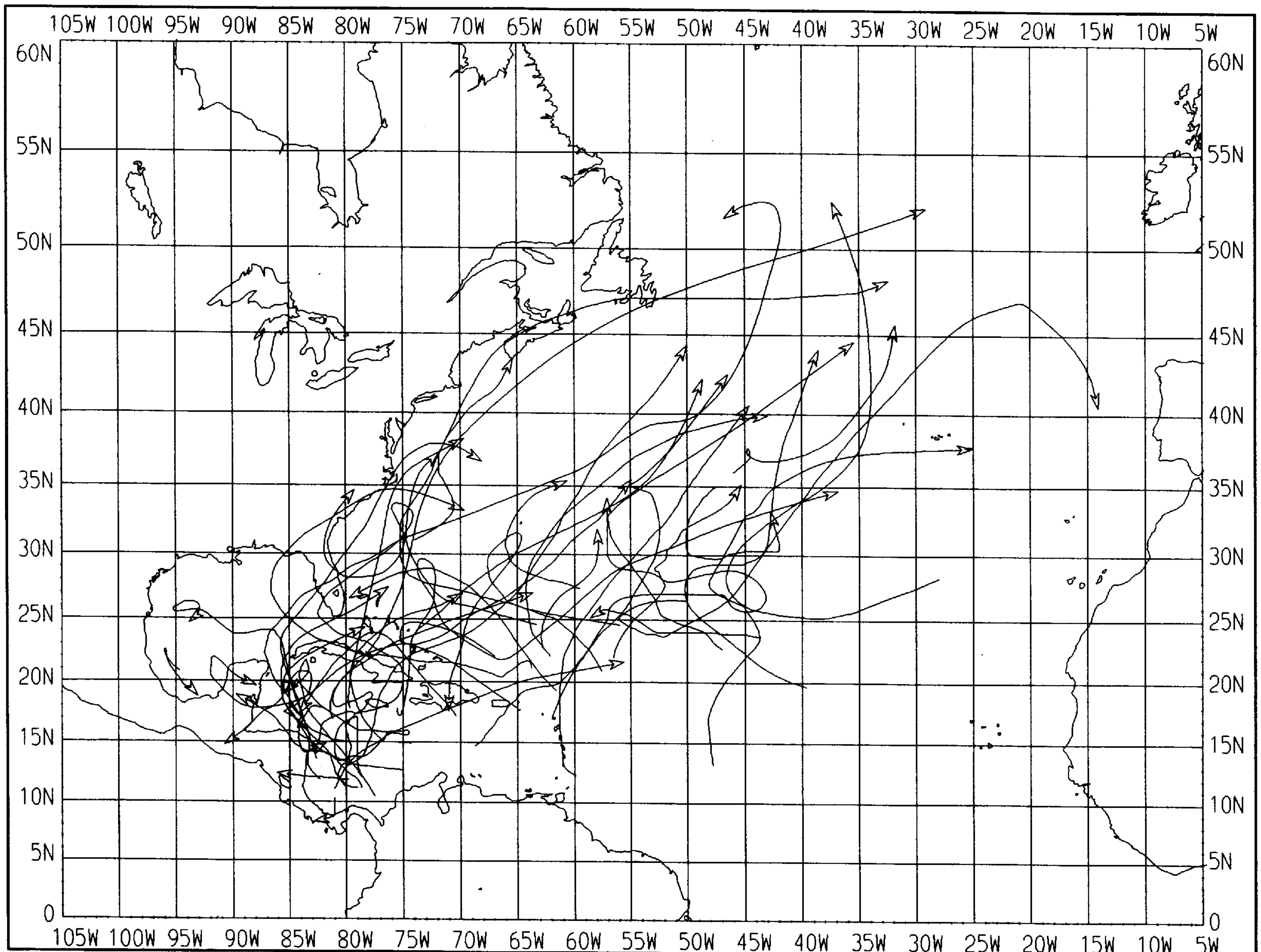
TROPICAL STORMS AND HURRICANES BEGINNING IN AUGUST, 1886-1998 (238 STORMS)



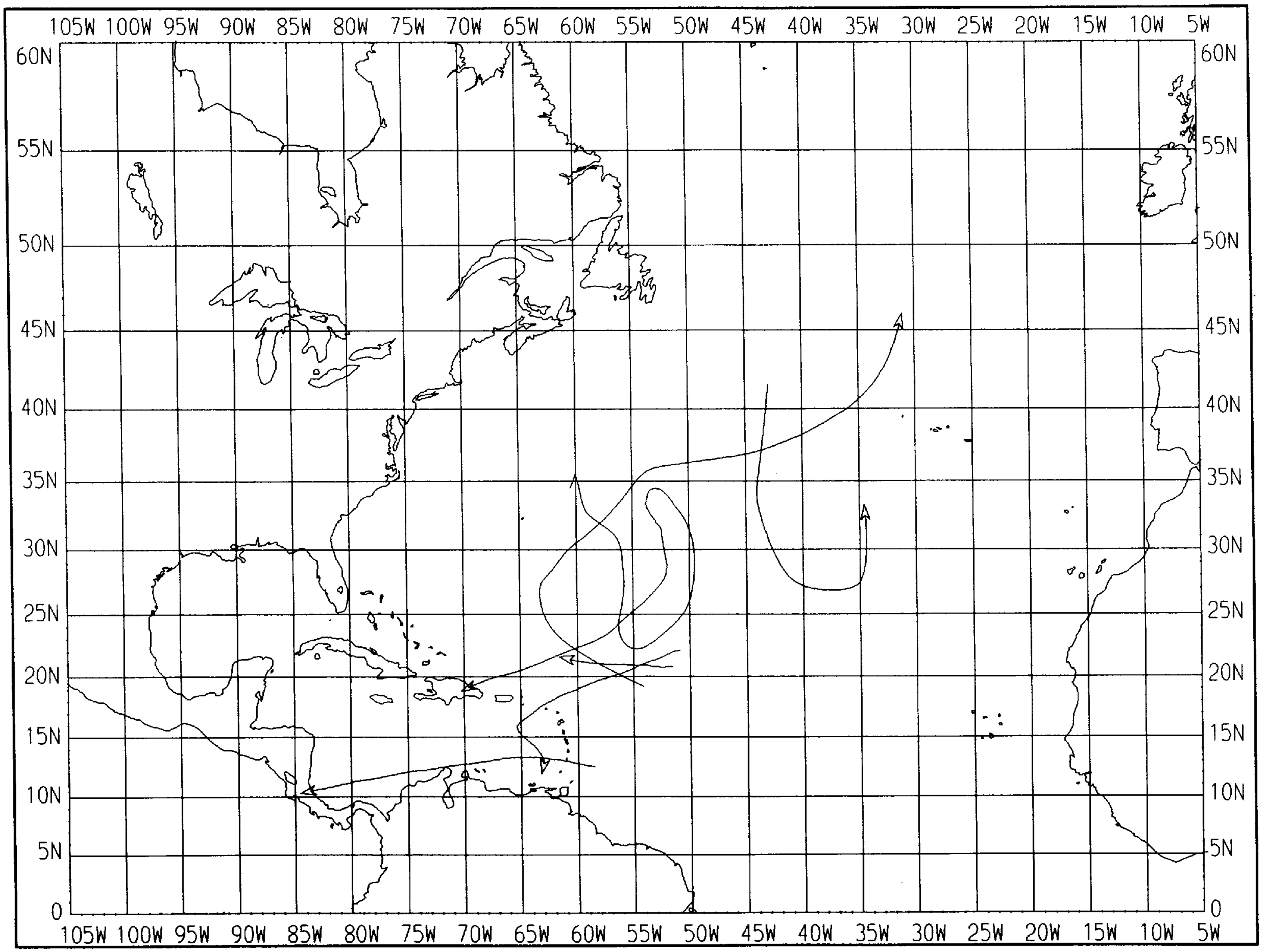
TROPICAL STORMS AND HURRICANES BEGINNING IN SEPTEMBER, 1886-1998 (325 STORMS)



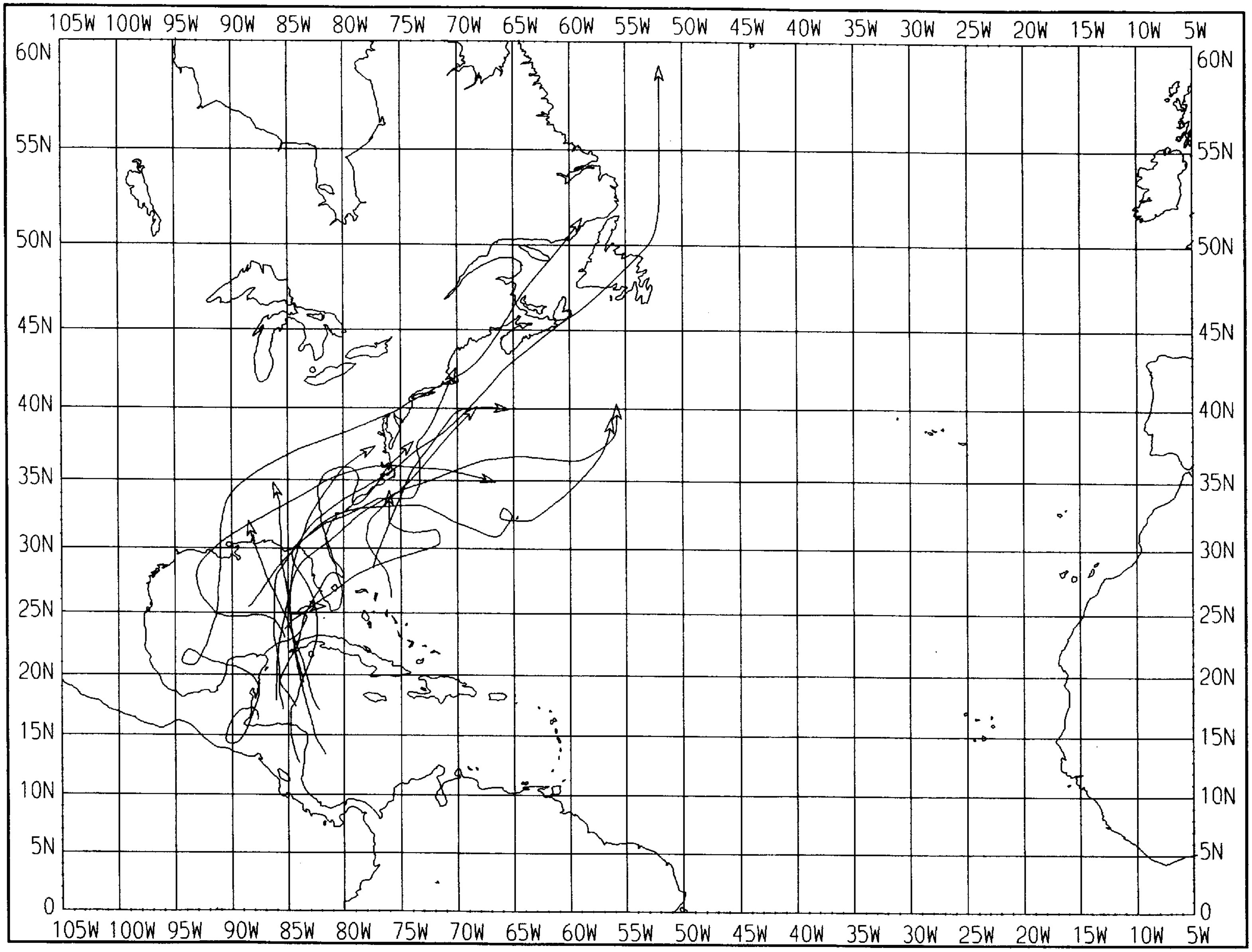
TROPICAL STORMS AND HURRICANES BEGINNING IN OCTOBER, 1886-1998 (200 STORMS)



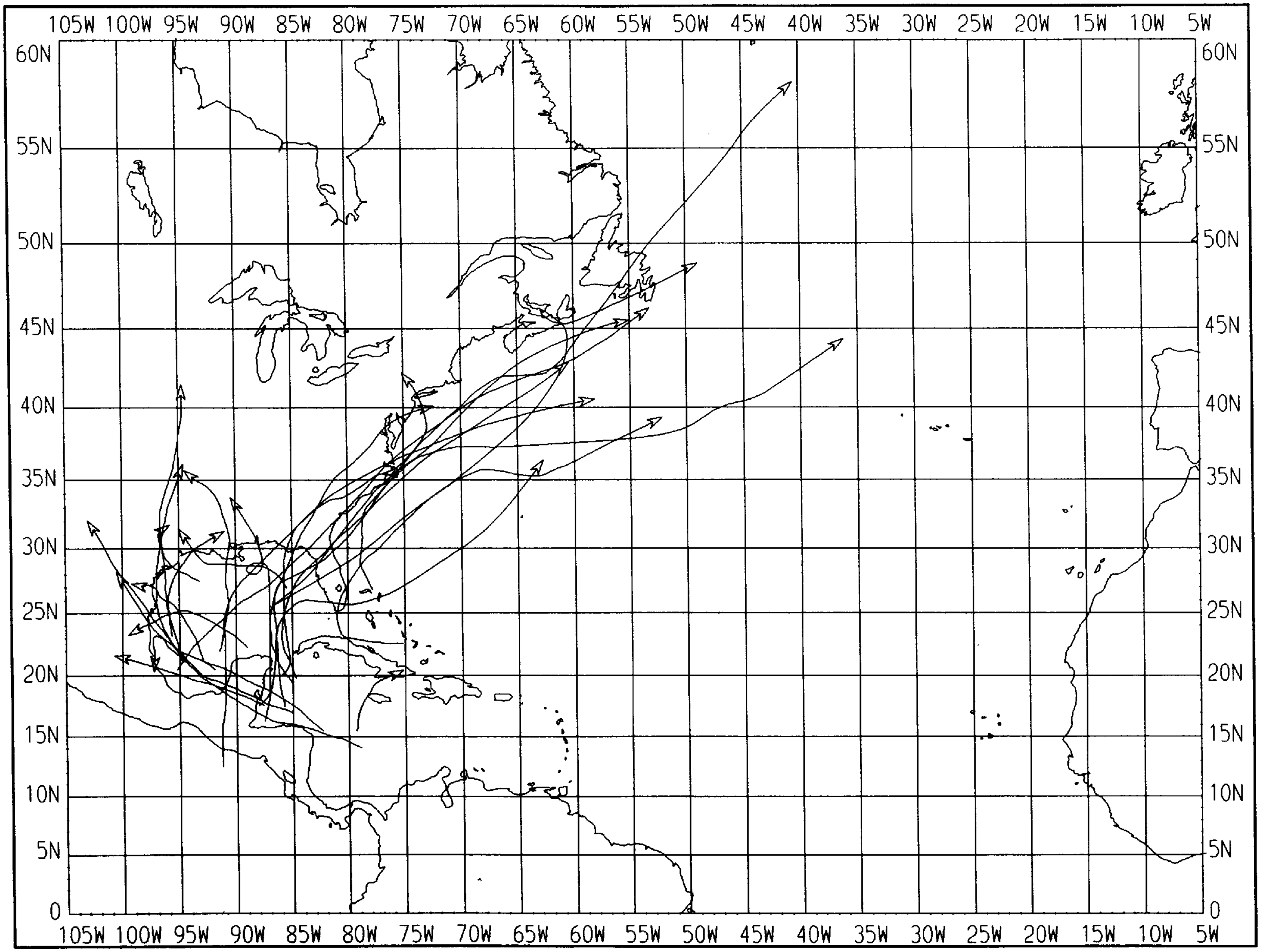
TROPICAL STORMS AND HURRICANES BEGINNING IN NOVEMBER, 1886-1998 (46 STORMS)



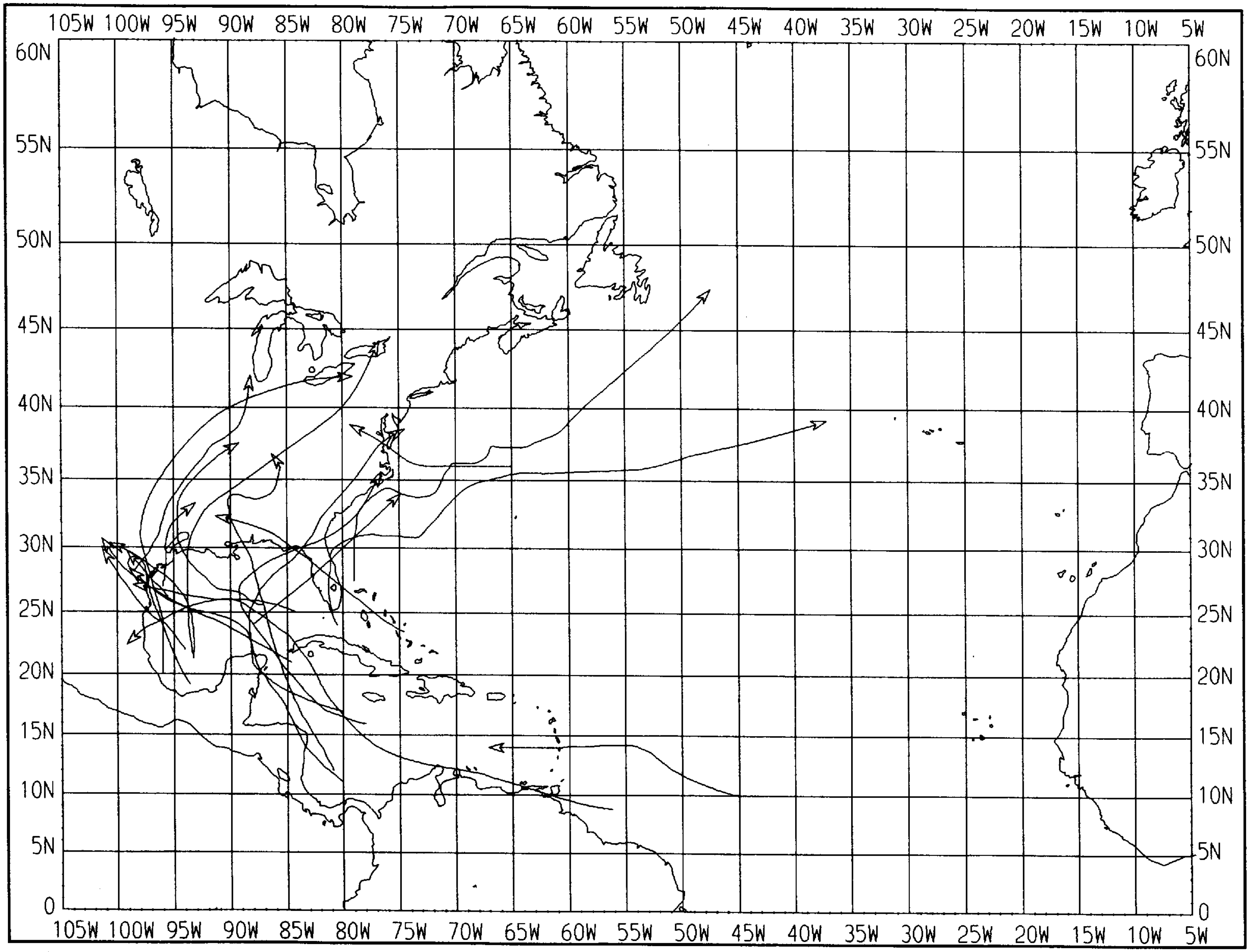
TROPICAL STORMS AND HURRICANES BEGINNING IN DECEMBER, 1886-1998 (6 STORMS)



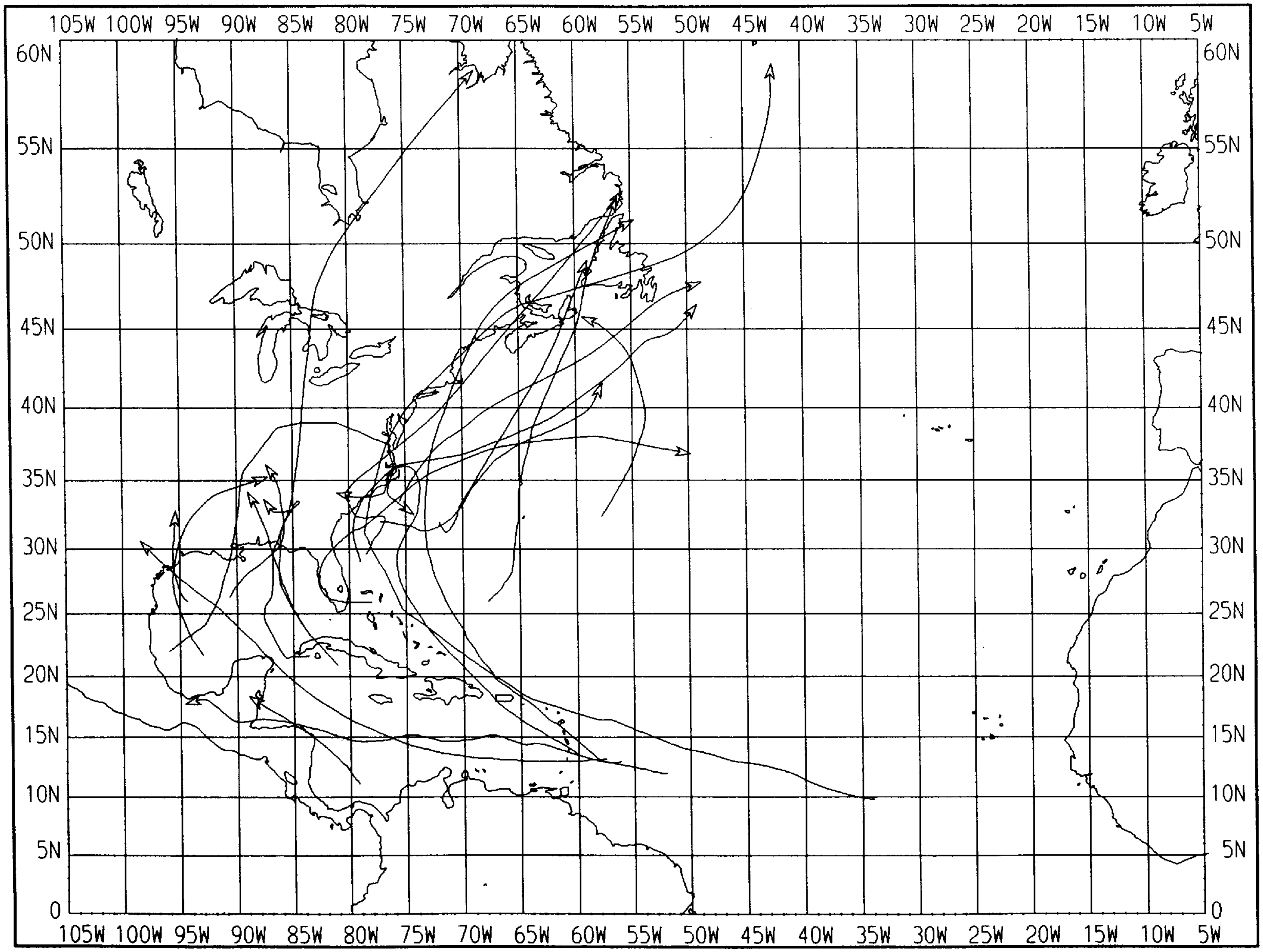
TROPICAL STORMS AND HURRICANES BEGINNING JUNE 1-10, 1886-1998 (14 STORMS)



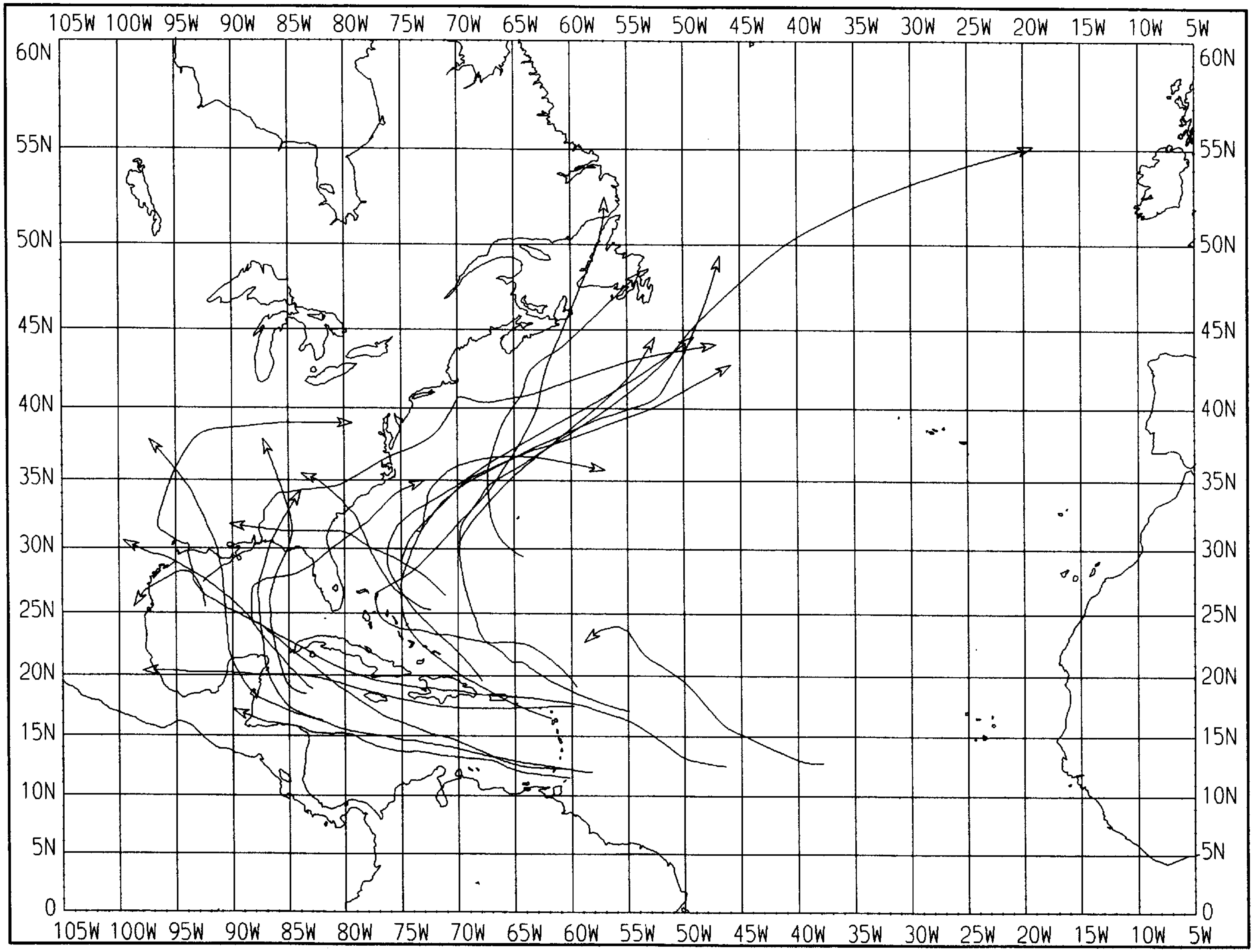
TROPICAL STORMS AND HURRICANES BEGINNING JUNE 11-20, 1886-1998 (25 STORMS)



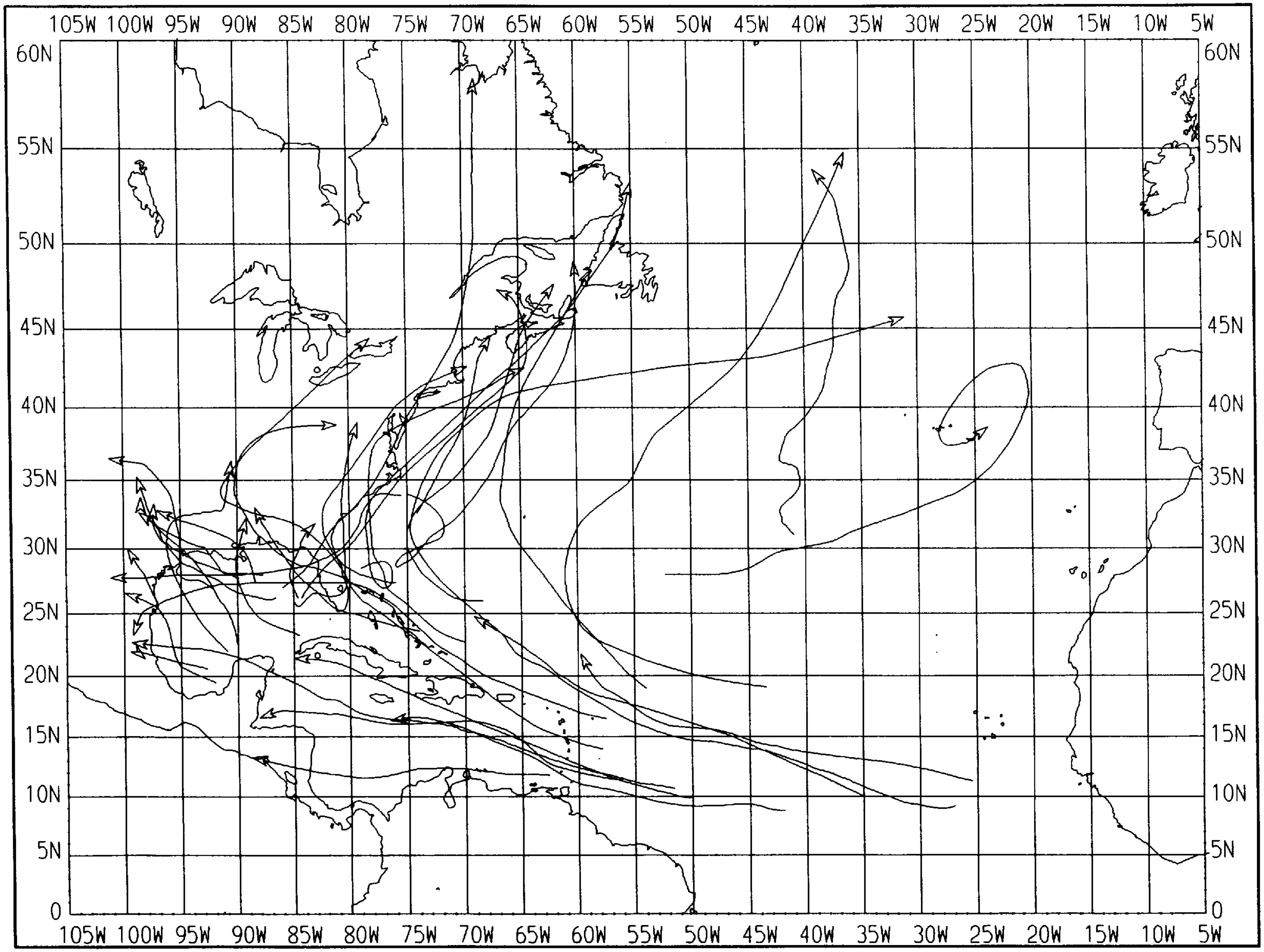
TROPICAL STORMS AND HURRICANES BEGINNING JUNE 21-30, 1886-1998 (21 STORMS)



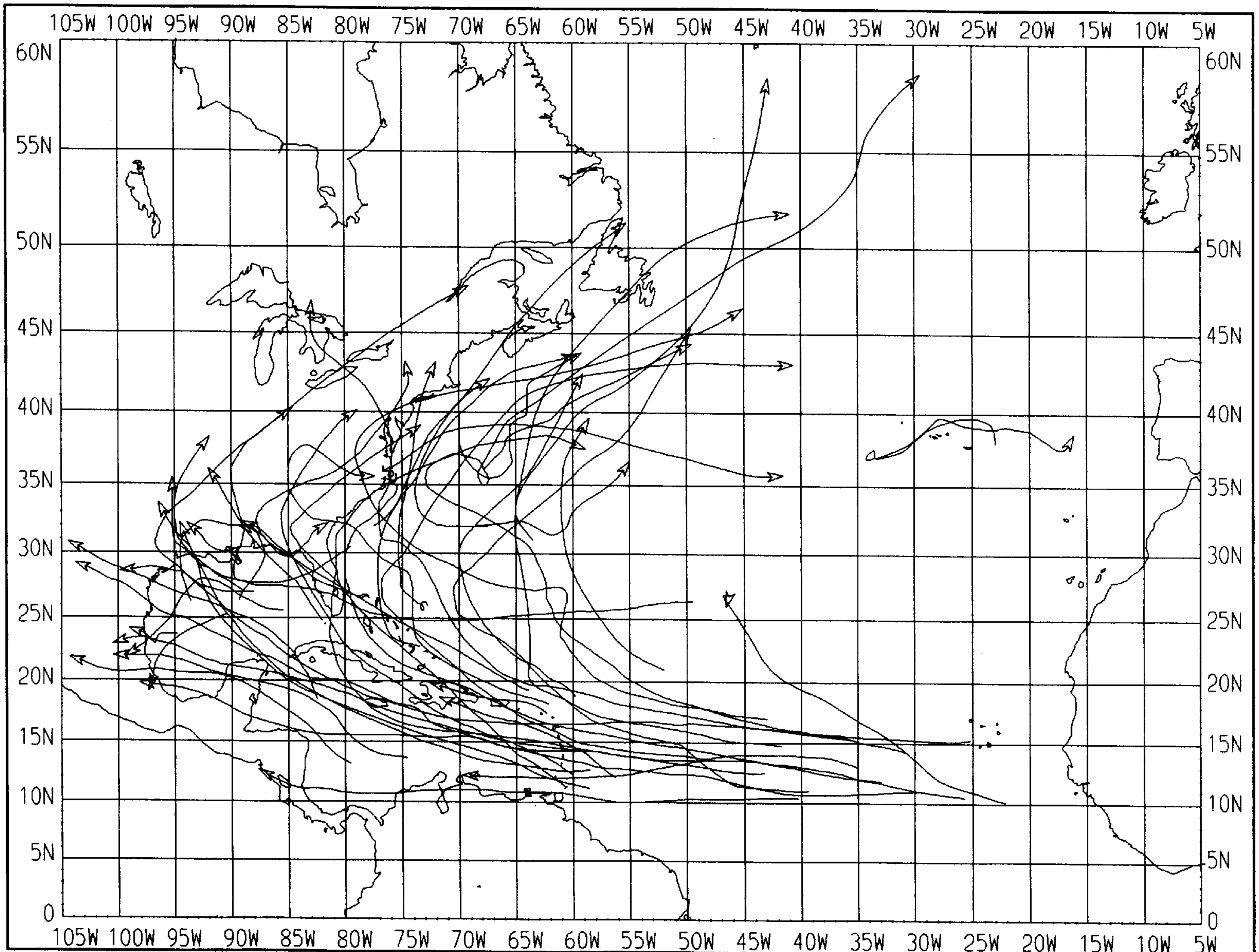
TROPICAL STORMS AND HURRICANES BEGINNING JULY 1-10, 1886-1998 (21 STORMS)



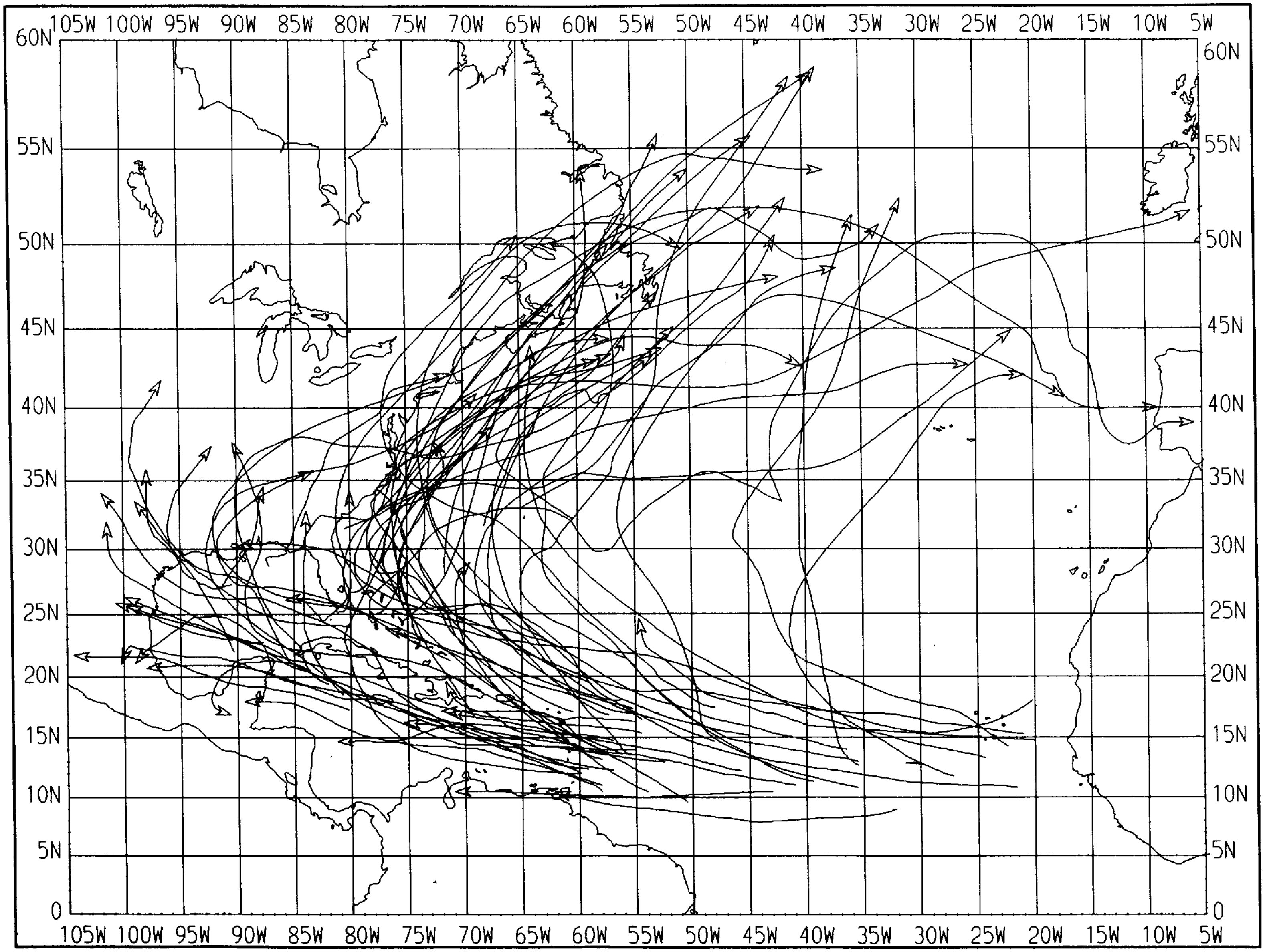
TROPICAL STORMS AND HURRICANES BEGINNING JULY 11-20, 1886-1998 (21 STORMS)



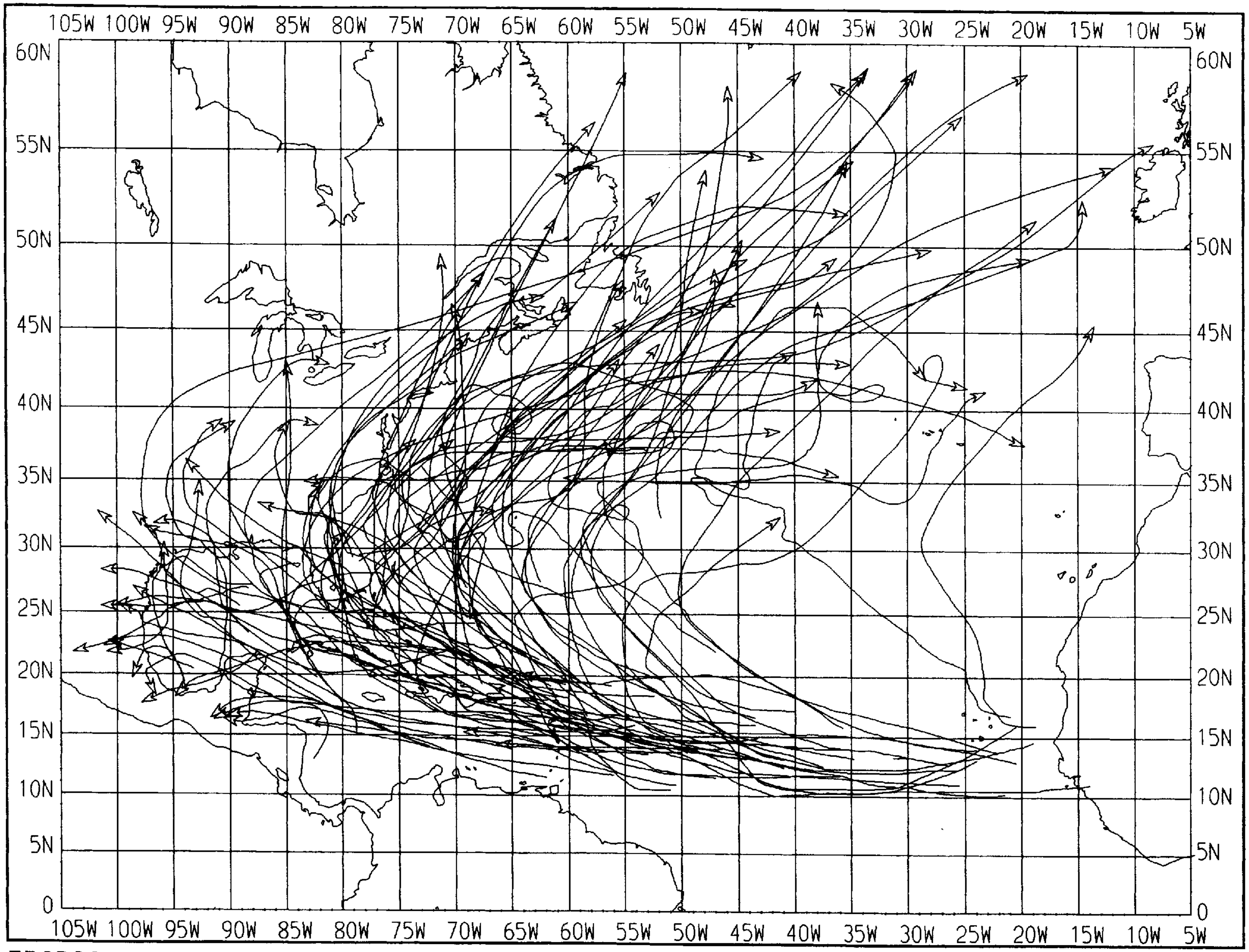
TROPICAL STORMS AND HURRICANES BEGINNING JULY 21-31, 1886-1998 (38 STORMS)



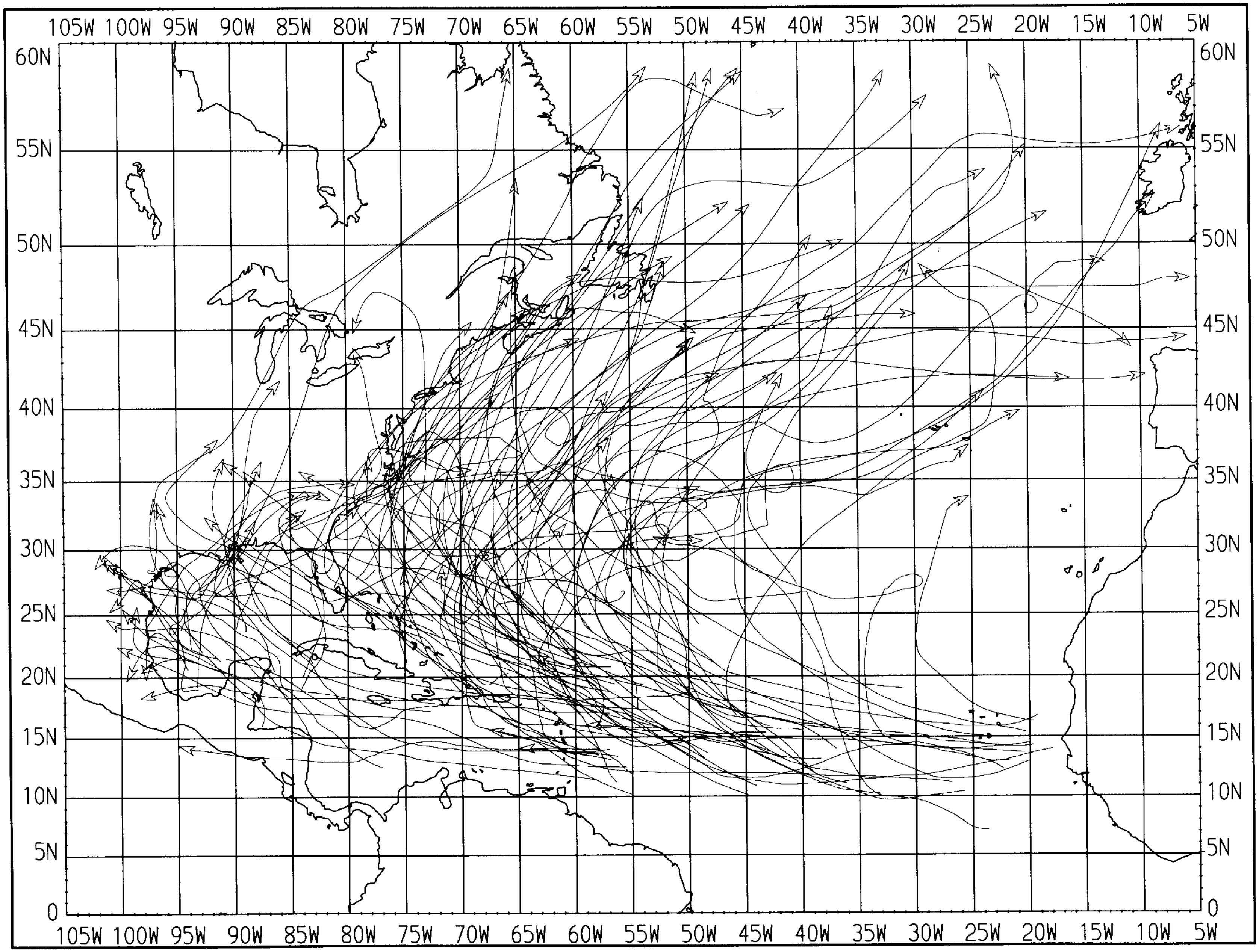
TROPICAL STORMS AND HURRICANES BEGINNING AUGUST 1-10, 1886-1998 (49 STORMS)



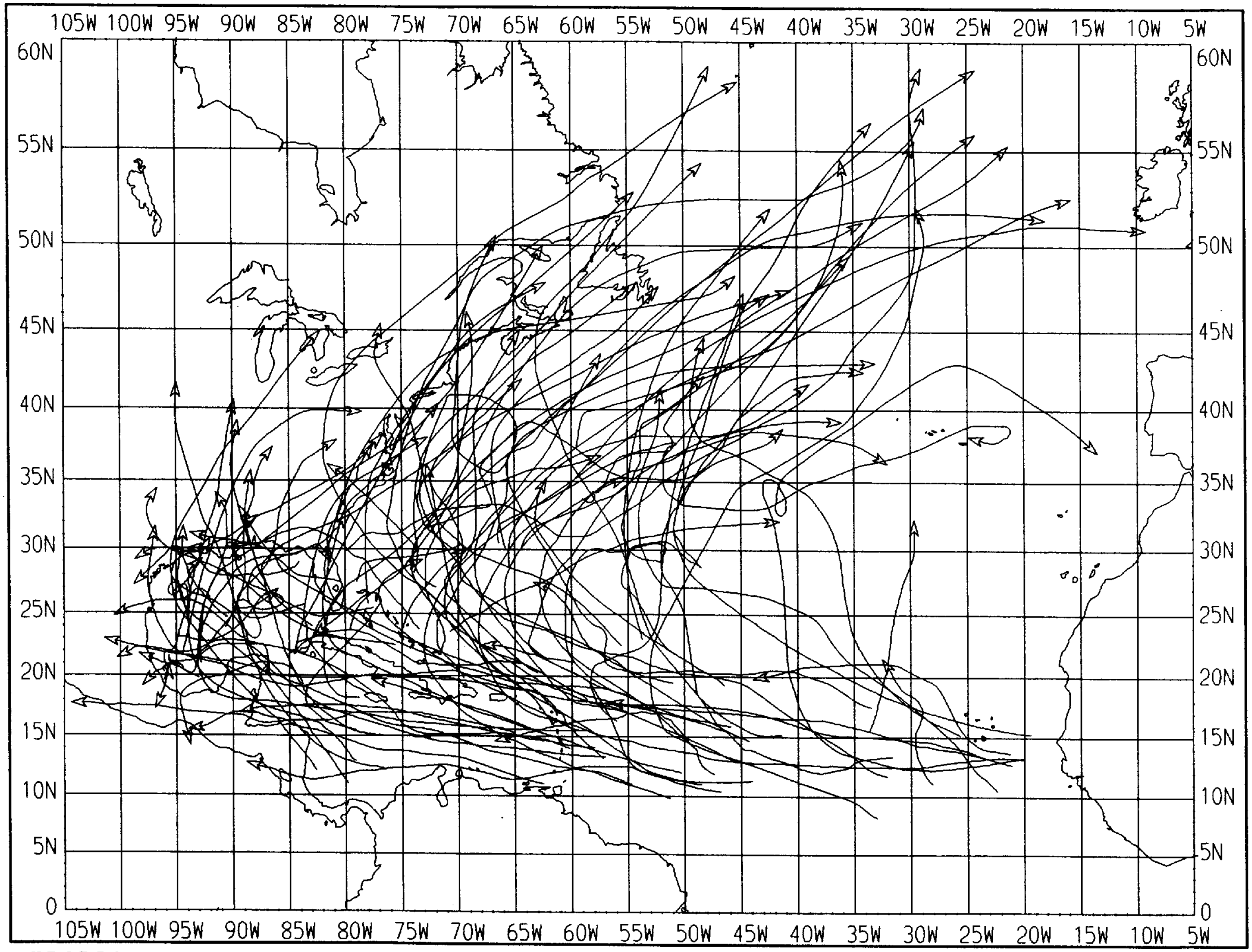
TROPICAL STORMS AND HURRICANES BEGINNING AUGUST 11-20, 1886-1998 (73 STORMS)



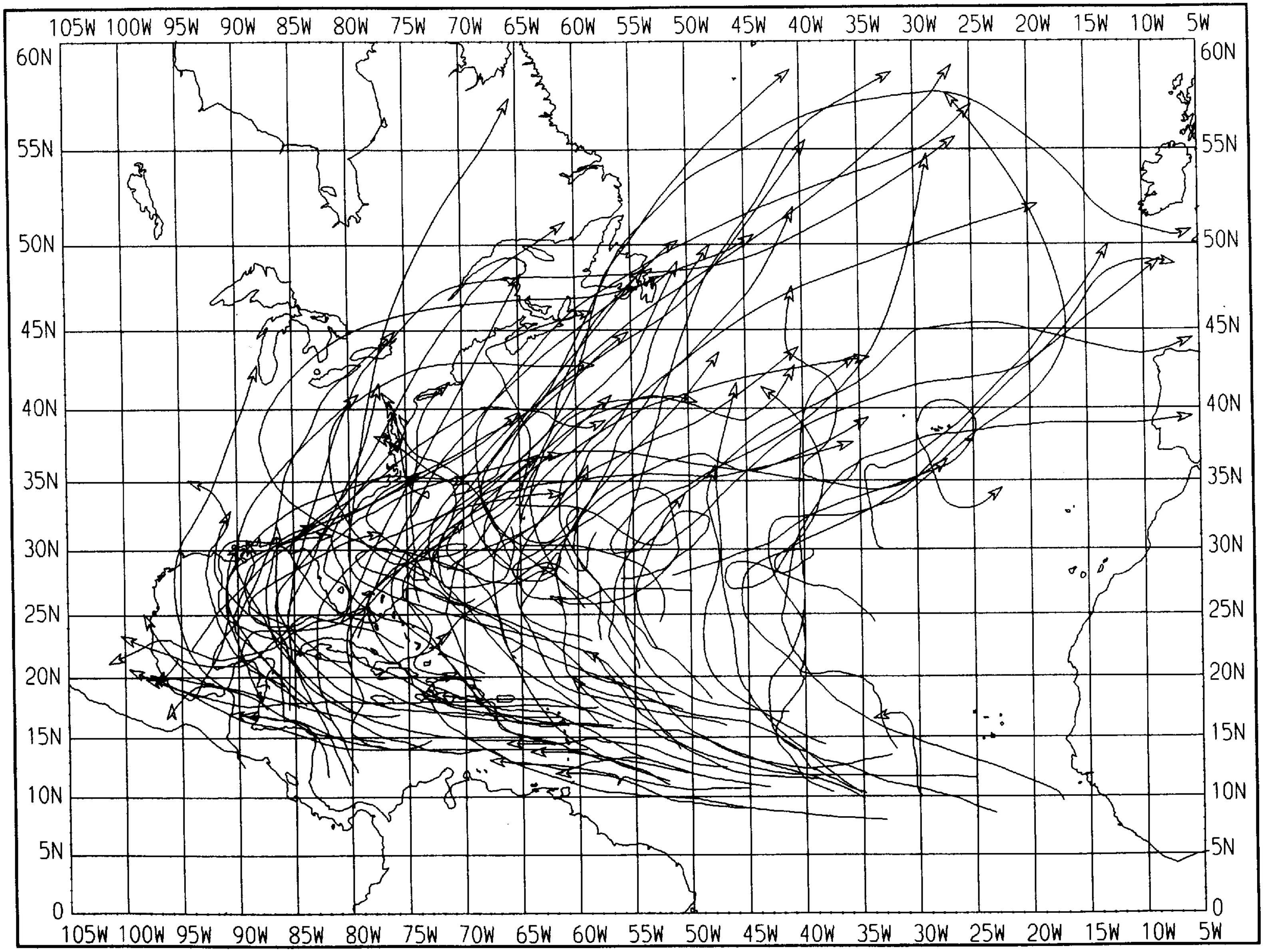
TROPICAL STORMS AND HURRICANES BEGINNING AUGUST 21-31, 1886-1998 (116 STORMS)



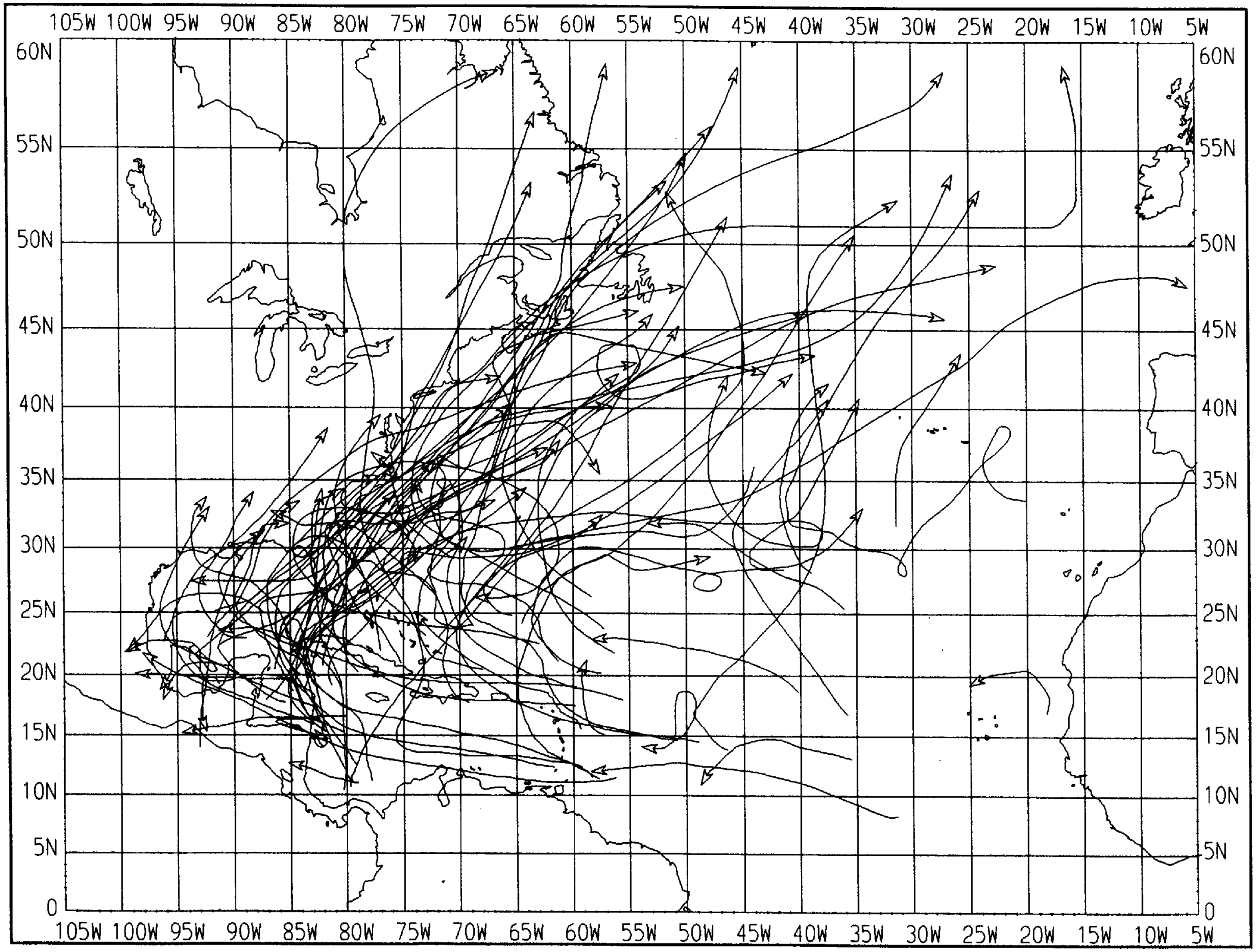
TROPICAL STORMS AND HURRICANES BEGINNING SEPT. 1-10, 1886-1998 (127 STORMS)



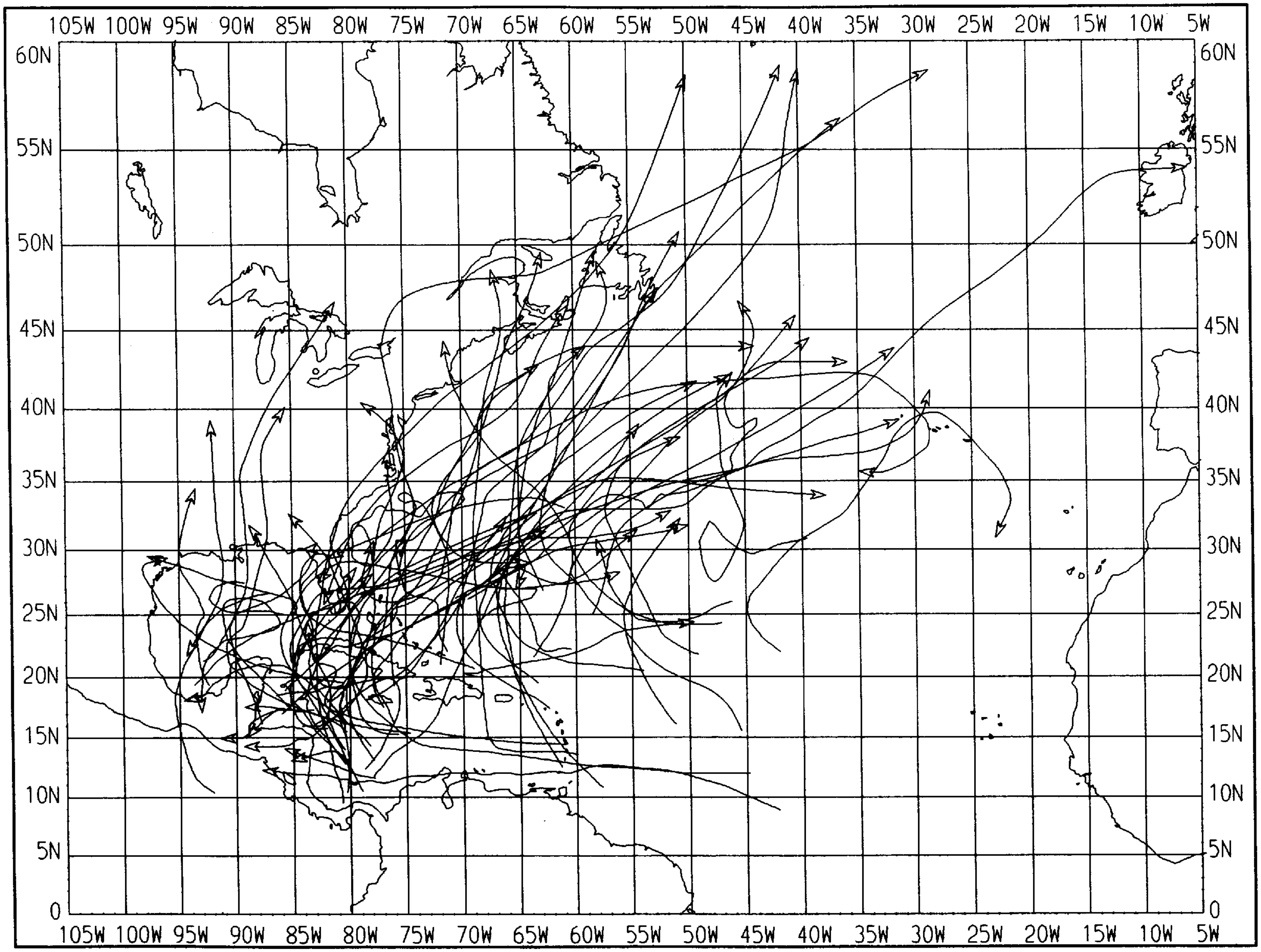
TROPICAL STORMS AND HURRICANES BEGINNING SEPT. 11-20, 1886-1998 (106 STORMS)



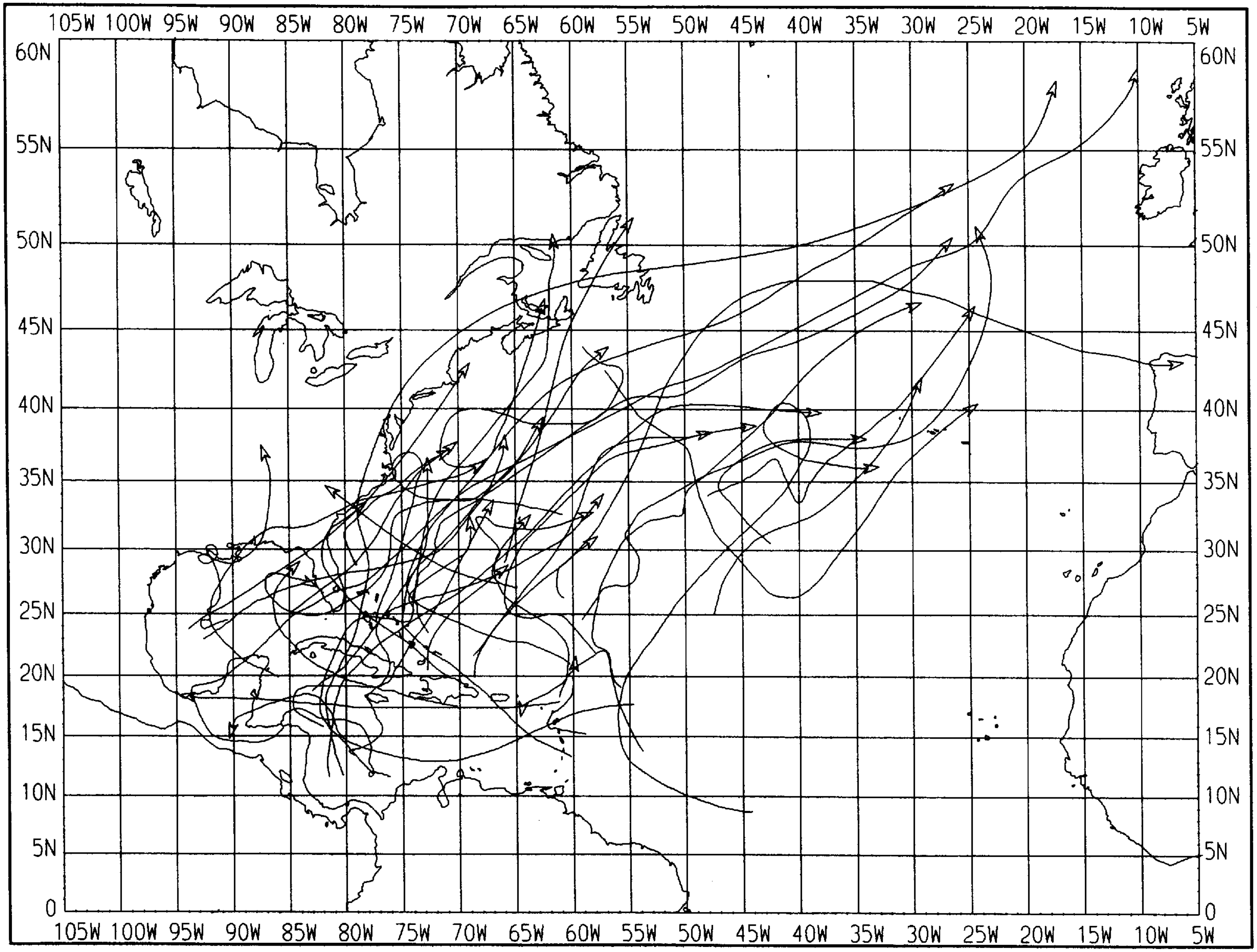
TROPICAL STORMS AND HURRICANES BEGINNING SEPT. 21-30, 1886-1998 (92 STORMS)



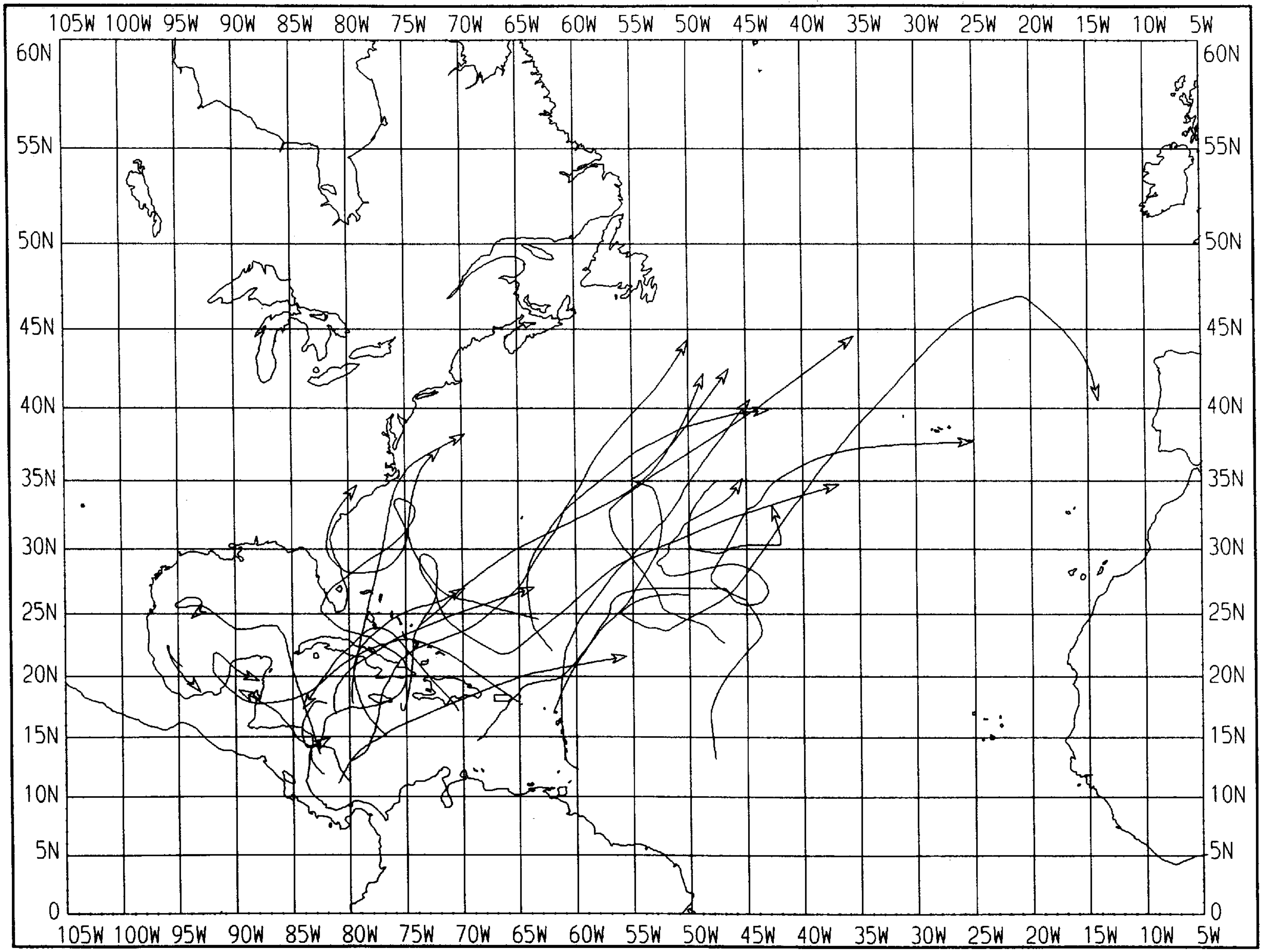
TROPICAL STORMS AND HURRICANES BEGINNING OCTOBER 1-10, 1886-1998 (85 STORMS)



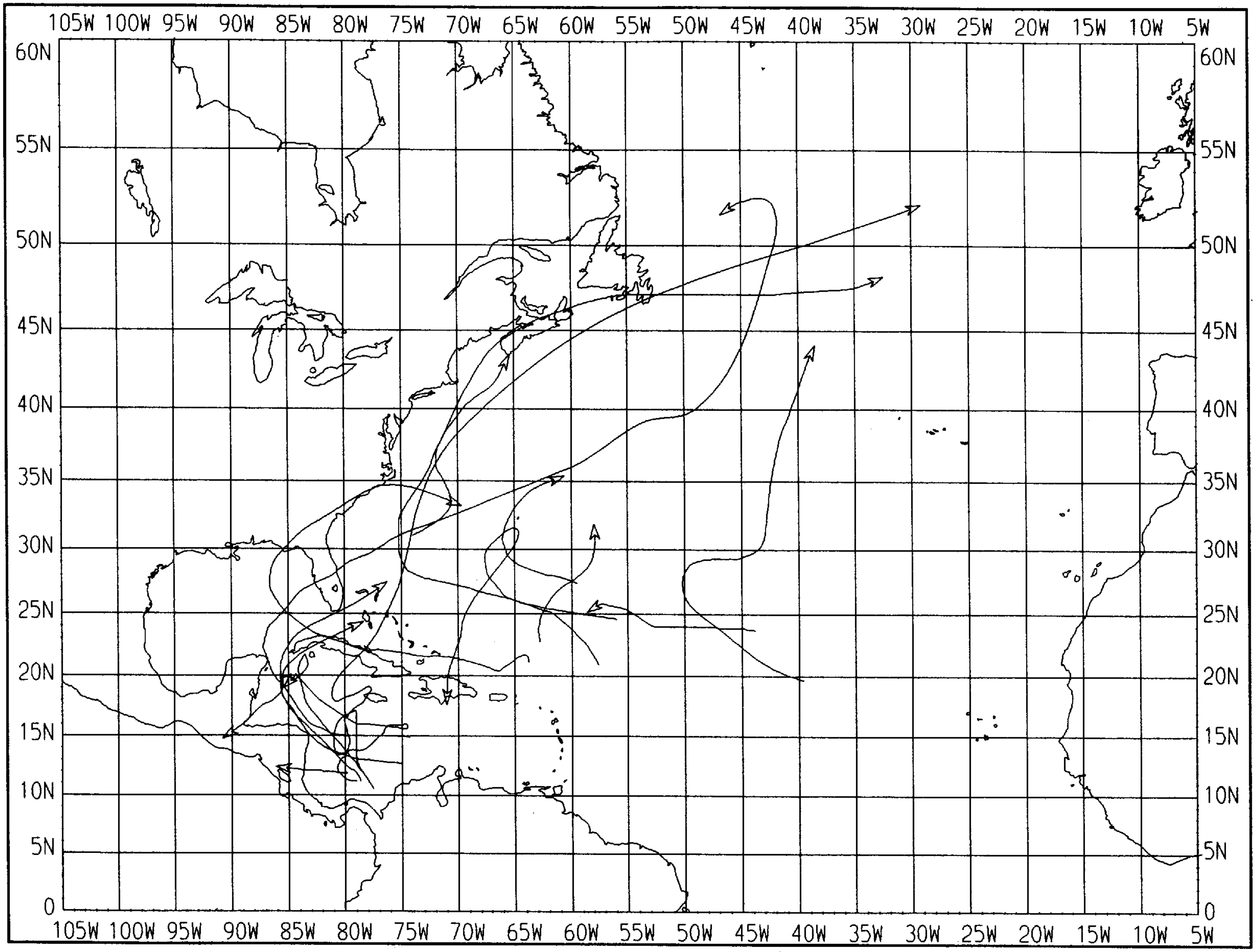
TROPICAL STORMS AND HURRICANES BEGINNING OCTOBER 11-20, 1886-1998 (73 STORMS)



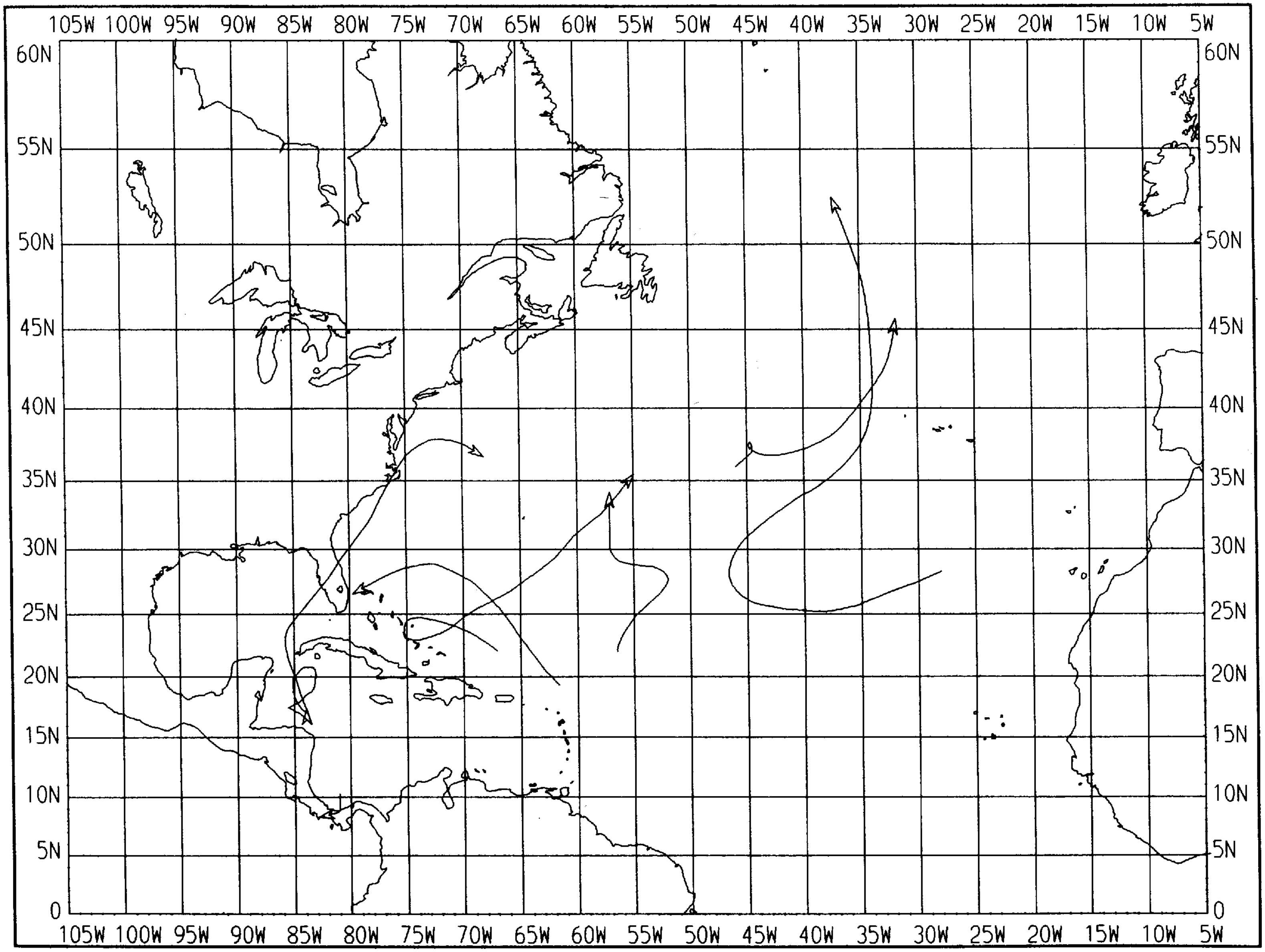
TROPICAL STORMS AND HURRICANES BEGINNING OCTOBER 21-31, 1886-1998 (42 STORMS)



TROPICAL STORMS AND HURRICANES BEGINNING NOV. 1-10, 1886-1998 (23 STORMS)



TROPICAL STORMS AND HURRICANES BEGINNING NOV. 11-20, 1886-1998 (15 STORMS)



TROPICAL STORMS AND HURRICANES BEGINNING NOV. 21-30, 1886-1998 (8 STORMS)