

Fig. 1

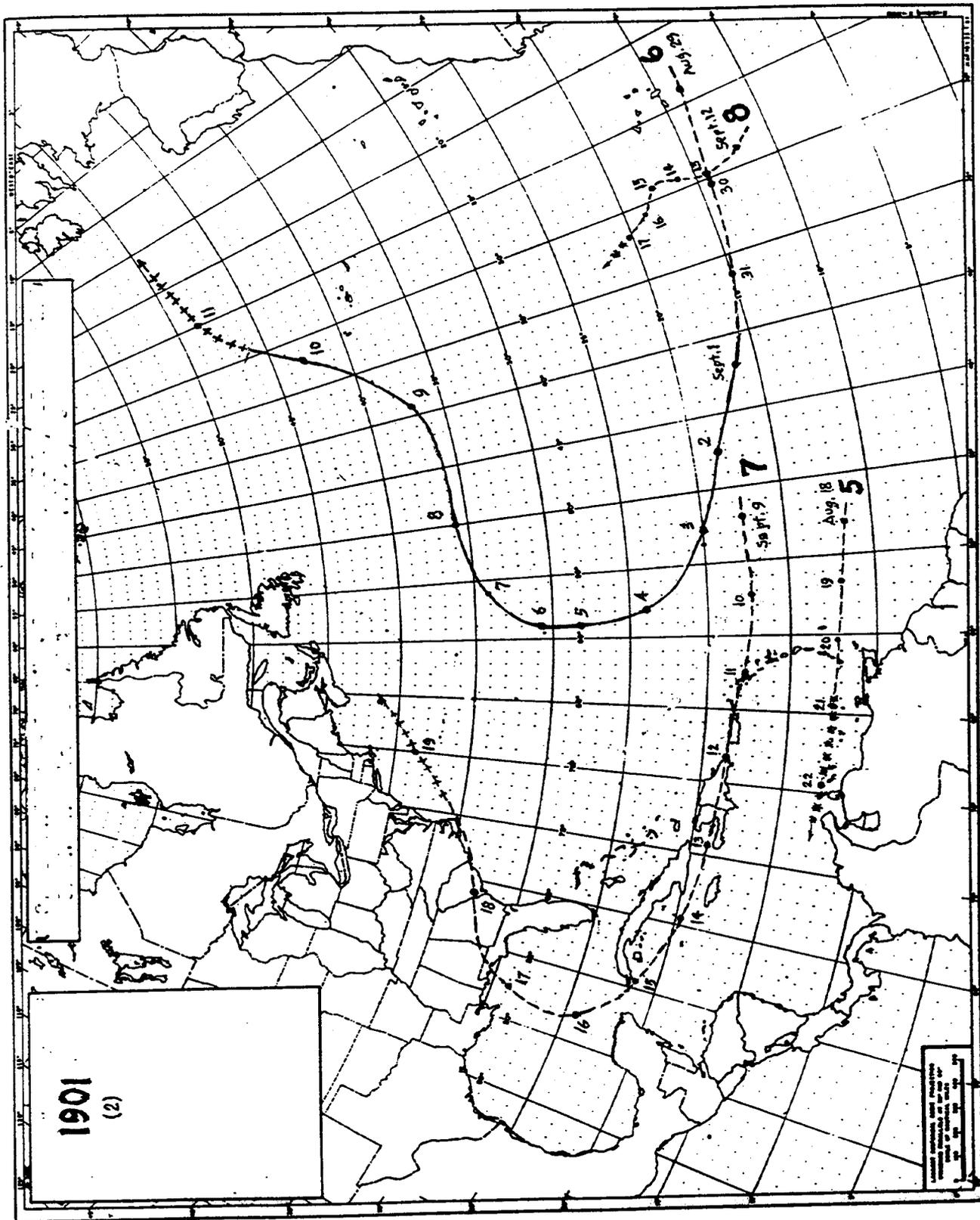


Fig. 1 (continued)

were only observed on the last day mentioned . A dissipating tropical depression stage was introduced on Aug. 21 and kept on Aug. 22. The basis for introducing dissipating conditions was that no evidence of the storm was found in the western Caribbean Sea where more abundant data (not shown) existed for Aug. 23 and subsequent days. Proximity to South America and relatively cold waters over the extreme southeastern portion of the eastern Caribbean Sea probably contributed to the storm weakening.

Storm 6, 1901 (Aug. 29- Sept. 11), H.

This is the same storm which Neumann et al. (1993) identify as Storm 5, 1901.

The following information was found in relation to this storm:

1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Aug. 29, Sao Vicente (Cape Verde Is.), N.E. f. 5, 29.80; ship near 14 N., 25 W., N.N.E. f. 6, 29.80; ship near 13 N., 26 W., W.N.W. f. 4, 29.94; ship near 7 N., 27 W., S.W. f. 4, 29.83; ship near 18 N., 25 W., N.N.E. f. 5, 29.71; center placed 15 N., 23 W. (maybe too far E.). Aug. 30, ship near 16 N., 27 W., S.S.E. f. 5, 29.77; ship near 17 N., 24 W., E.S.E. f. 5, 30.03 (too high); ship near 14 N., 25 W., S.W. f. 2, 29.88; ship near 11 N., 27 W., S.W. f.6, 29.91; center placed 14.5 N., 30.5 W. Aug. 31, no data in vicinity where the storm was likely to have been (Historical Weather Maps, Aug. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 1 and Sept. 2, no data were available near the storm. Sept. 3, ship near 18 N., 57 W., N.E. f. 4, 29.91; ship near 14 N., 50 W., S.W. f. 4, 29.97. Sept. 4, low placed near 25 N., 60 W. (probably too far N. and W.); E. and N.E. winds N. of the low; S. and S.W. winds S. of the low, reaching the Lesser Antilles. Sept. 5, ship near 29 N., 58 W., E. f. 7, 29.62 (pressure not clearly read off the map), ship near 28 N., 60 W., N. f. 8, 29.68; center placed 28.2 N., 58.8 W. Sept. 6, ship near 33 N., 60 W., N.N.E. f. 8, 29.59; ship near 27 N., 60 W., W.S.W. f. 7, 29.71; ship near 28 N., 62 W., W.N.W. f. 6, 29.83; center placed 30.5 N., 60 W. (probably too far west). Sept. 7, ship near 34 N., 50 W., S.S.E. f. 9, 29.91; ship near 37 N., 51 W., E.S.E. f. 9; ship near 37 N., 60 W., N.E. f. 6, 29.88; center placed 33.8 N., 55.8 W., pressure 995 millibars (29.38) indicated on the map. Sept. 8, ship near 36 N., 51 W., N.N.E. f. 10, 29.29; ship near 34 N., 48 W., S.S.W. f. 8, 29.26 (not clearly read off the map); ship near 36 N., 45 W., S.S.E. f. 6, 29.77; ship near 33 N., 53 W., W.N.W. f. 6, 29.91; ship near 31 N., 52 W. (position might be wrong), N.W. f. 11, 29.50; ship near 33 N., 47 W., S. f. 6, 29.65; center placed 35 N., 49 W. Sept. 9, ship near 37 N., 37 W., S. f. 2, 29.29; ship near 40 N., 40 W., E. f. 6, 29.50; ship near 35 N., 35 W., S. f. 9, ship near 33 N., 41 W., W.N.W. f. 8, 29.83; center placed 37 N., 39 W. Sept. 10, center near 43 N., 32 W. as inferred from the curvature of isobars, still ahead of a cold front associated with a low over S. Greenland. Sept. 11, frontal low placed 48 N., 25 W. (Historical Weather Maps, Sept. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 3) A storm was first observed near 14 N., 38 W. on Aug. 30, 1901 and lasted 14

days; it recurved near 32 N., 59 W. and it was last observed near 70 N., 12 W (Mitchell, 1924). Author's note: The track in Mitchell (1924) was found to be very similar to the one shown in Tannehill (1938). It was also found to be similar to that in Neumann et al. (1993), except for Sept. 10 when the latter track mentioned was found to be much farther to the west and having had the storm moving straightly to the N. and then abruptly to the N.E.

On the basis of information in items 1) and 2), some modifications were introduced along the track shown in Neumann et al. (1993 as for Storm 5, 1901. Such a track was extended backwards to the vicinity of the Cape Verde Islands as indicated by the first 7 A.M. position that the author was able to estimate near 13.7 degrees N., 24.0 degrees W. on Aug. 29. New 7 A.M. positions were estimated for the period Aug. 30- Sept. 6 as follows: Aug. 30, near 14.3 degrees N., 30.5 degrees W.; Aug. 31, near 15.0 degrees N., 36.3 degrees W.; Sept. 1, near 16.3 degrees N., 42.0 degrees W.; Sept. 2, near 18.5 degrees N., 47.5 degrees W.; Sept. 3, near 20.0 degrees N., 52.7 degrees W.; Sept. 4, near 24.0 degrees N., 58.0 degrees W.; Sept. 5, near 28.3 degrees N., 59.0 degrees W.; Sept. 6, near 30.7 degrees N., 59.0 degrees W. The differences of these positions with respect to the ones in Neumann et al. (1993) were found to range from approximately 450 miles on Aug. 30 to about 60 miles on Sept. 6. 7 A.M. positions for the period Sept. 7-9 in Neumann et al. (1993) were found to satisfy the information in item 2) for those days and, therefore, were kept unchanged; however, their 7 A.M. Sept. 10 position was adjusted by about 240 to the E. to near 43.0 degrees N., 32.0 degrees W. in order to fit information for that day in item 2). Finally, the 7 A.M. Sept. 11 position in Neumann et al. (1993) was kept unmodified. The author's track for Storm 6, 1901 is displayed in Fig. 1.

The hurricane status that Neumann et al. (1993) gave to this storm as for Storm 5, 1901 was found to be supported by pressures slightly below 29.30 inches reported by ships in spite of that the highest velocities reported were forces 10-11 on the Beaufort scale on Sept. 8 (item 2). Based on the available data it was not possible to determine the location along the track where the storm reached hurricane intensity; however, nothing was found indicating that this could not have occurred in the vicinity of the 40 degrees W. meridian as shown in Neumann et al. (1993) and, therefore, a hurricane status was denoted along the author's track starting on Sept. 1. The hurricane status was changed into the extratropical stage on Sept. 1 on the basis of information for that day shown in item 2).

Storm 7, 1901 (Sept. 9-19), T. S.

This is the same storm which Neumann et al. (1993) identify as Storm 6, 1901.

The following information was found about this storm: 1) A storm appeared near the island of St. Kitts on Sept. 11, moved thence westward over the north part of the Caribbean Sea from Sept. 12 to Sept. 15, recurved over the Gulf of Mexico and reached the middle Gulf coast by Sept. 7 and passed from that section northward off the South Atlantic coast of the U.S. While this disturbance was

lacking in the energy of a hurricane it was attained by high winds and heavy rain throughout its course (Monthly Weather Review, Sept. 1901). Author's note: Tannehill (1938) also gave a description of this storm adding that it passed inland near Pensacola. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 9, ship near 19 N., 52 W., E.N.E. f. 5, 29.91; ship near 16 N., 49 W., no wind given, 29.94. Sept. 10, St. Kitts, N.E. f. 4, 29.95; Dominica, N.W. f. 1, 29.93; San Juan, N.E. f. 4, 29.96; Barbados, W.S.W. f. 2, 29.94. Sept. 11, St. Kitts, N. f. 2, 29.86; Dominica, S. f. 4, 29.93; San Juan, N.E. f. 4, 29.95; Barbados, S.E. f. 3, 29.96. Sept. 12, San Juan, S.E. f. 8, rain, 29.84; ship near 20 N., 66 W., E. f. 9, 29.89; Santo Domingo, N.W. f. 4, 29.89; ship near 22 N., 66.8 W., E. f. 7; St. Kitts, E. f. 5, 29.98; ship near 20 N., 61.7 W., S.S.E. f. 8, 30.03; no center was drawn on the map but there was one near the N.W. coast of Puerto Rico or Mona Passage. Sept. 13, Port-au-Prince, S.E. f. 9, 29.86; ship off extreme E. of Cuba, N.E. f. 4, 29.80; Kingston, E. f. 1, 29.81; ship near 17 N., 76 W., N.E. f. 6, 29.83; Santo Domingo, S.S.E. f. 4, 29.93, rainfall in 24 hours: 5.09 inches. Sept. 14, Havana, N.E. f. 3, 29.89; Cienfuegos, N.E. f. 3, 29.82, Camaguey, E. f. 6, pressure could not be read; Kingston, S.S.E. f. 4, 29.88; center placed 20.5 N., 79 W. Sept. 15, Havana, E.S.E. f. 5, 29.85; ship near 23.8 N., 84.2 W., E. f. 8, 29.80; ship near 21 N., 86 W., W. to W.N.W. (wind force could not be read but not exceeding f. 3), 29.88; ship near 20 N., 86 W., W. f. 3, 29.80; center placed 21.5 N., 84.5 W. Sept. 16, ship near 26.7 N., 90 W., N.E. f. 5, 29.86; ship near 25 N., 84 W., S.S.E. f. 5, 29.97. Sept. 17, New Orleans, N.E. f. 3, 29.80; Pensacola, N.E. (wind force could not be read), 29.63 (pressure not clearly read off the map); ship near 26 N., 85 W., S.S.W. f. 6, 29.88; ship near 25 N., 85 W., S. f. 6; center placed 29 N., 87.5 W., 1000 millibar isobar (29.53) was drawn on map. Sept. 18, Charleston, S. (wind force could not be read), 29.77; other data difficult to read off the map; center appears to be just W. of Charleston. Sept. 19, extratropical low near 39 N., 70 W. (Historical Weather Maps, Sept. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 3) Belen College Observatory, Sept. 11, 5 P.M. It is inferred from cablegrams received this morning and afternoon that there are some indications of a cyclonic perturbation to the S.E. of St. Thomas. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 12, 1901, morning edition, p.2, col.5). 4) Belen College Observatory, Sept. 12, 11:20 A.M. A moderate tempest is being probably felt in Puerto Rico this morning. It appears to be of a weak barometric gradient and not much intensity up to the present time. Although it cannot be affirmed yet, its motion appears to be towards the W.N.W. L. Gangoiti, S.J. (Diario de Marina, Havana, Sept. 12, 1901, evening edition, p.2, col.1). 5) San Juan, P.R., Sept. 13. It is reported that half the coffee crop has been partially damaged by recent storms and that the banana crop has been seriously damaged as well. Telegraph communication with Mayaguez has been restored (The New York Times, Sept. 14, 1901, p.7, col.4). 6) This was the fourth time that a storm had visited Puerto Rico on the festivity of San Vicente (Sept. 11). The storm was of a short diameter and small violence and no casualties occurred. It passed along the northern

coast of the island between the night of Sept. 11 and the early morning hours of Sept. 12, when a wind velocity of 52 mph from the S.E. and a barometer reading of 29.57 inches were registered (Salivia, 1972). 7) Belen College Observatory, Sept. 13, 11:20 A.M. According to telegrams received, "Ciudad del Cabo" (probably Cap-Haitien on the northern coast of Haiti) had heavy showers since noon yesterday, strong gusts last night and light drizzle today. The easternmost portion of Cuba will be under the storm influence starting tonight. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 13, 1901, evening edition, p.2, col.2). 8) Belen College Observatory, Sept. 14, 10:40 A.M. Cienfuegos entered the area of low pressure late yesterday and Havana did it this morning after having an anticyclone for many days. At 6 P.M. yesterday, cumulus clouds corresponding to the hurricane bar were seen on the horizon, extending from the E.N.E. to the S.E. as observed from Havana. In our opinion the cyclonic center was between Jamaica and the S.E. of Grand Cayman 7 A.M. today, with less intensity than yesterday. L. Gangoiti, S.J. (Diario de la Marina, Sept. 14, 1901, evening edition, p.2, col.2). 9) According to the Weather Bureau the tempest is very strong and was located this morning near the southern coast of central Cuba. It will probably move towards the N.W. (Diario de la Marina, Havana, Sept. 14, 1901, evening edition, p.2, col.2). 10) Belen College Observatory, Sept. 16, 10 A.M. Direction changes of the low-level currents at Cienfuegos, Jovellanos and Havana were small Saturday (Sept. 14) indicating that the cyclonic vortex was moving at a good distance from the Cuban coast. Therefore, a message was sent to Pinar del Rio the morning of that day indicating that they would have strong winds from the N.E. to the S., as the storm passed S. and somewhat distant. At 6 A.M. yesterday (Sept. 15) the vortex was to the W.S.W. over the Yucatan Channel. At 6 A.M. this morning a cirrus arc was seen to the W. of Havana with its upper part about 40 degrees above the horizon and the vortex is now N.W. one quarter W., moving towards the Louisiana coast. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 16, 1901, evening edition, p.2, col.2). 11) Santiago (Cuba), Sept. 14. The worst cyclone in several years swept over this section last night. Two ships entered the harbor in distress but no serious damage is reported. Several lighters and small coasting schooners broke from their mooring and were driven into the mud across the bay. The small wharf at Daiquiri was completely demolished (The New York Times, Sept. 15, 1901, p.10, col.5). 12) Storm warning were displayed at Key West and Miami (The New York Times, Sept. 15, 1901, p.13, col.4). 13) Santa Clara, Sept. 17. Trinidad mayor informed of very heavy rain during all day and night yesterday, with strong gusts at times (Diario de la Marina, Havana, Sept. 17, 1901, evening edition, p.2, col.3). Author's note: The mayor's message was probably originated at Trinidad on Sept. 15. 14) Puerto Principe (Camaguey), Sept. 16. According to the mayor of Santa Cruz (del Sur), the tempest of Sept. 14 caused some damage but no casualties (Diario de la Marina, Havana, Sept. 17, 1901, evening edition, p.2, col.3). 15) Batabano, Sept. 15 (via telegraph). Strong wind and rain prevailed last night, continuing at daybreak today. The schooner "Rosalia" came ashore. The schooner "Isabelita" sank by the Horns wharf. Water in

Zanja and Progreso streets ia about a yard deep, and it is even higher at other streets (Diario de la Marina, Sept. 16, 1901, evening edition, p.2, col.3). 16) Sept. 13-16, 1901. A moderate cyclone passed south of the island of Cuba to the Yucatan Channel. Some vessels were lost, and some significant damages occurred (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza, which is included in Sarasola (1928). Martinez-Fortun (1942) mentioned this storm only as a rain storm in Las Villas (central Cuba); it is obvious that he underestimated this weather system. 17) Lowest pressure at Pensacola was 29.57 inches; it was 29.66 at Mobile (Weather Bureau, 1902). 18) Some maximum wind velocities were as follows: Pensacola, S.E. 36 mph on Sept. 16; Jacksonville, S.W. 32 mph on Sept. 17; Savannah, S.W.27 mph on Sept. 18; Augusta, N.E. 46 mph. on Sept. 18; Wilmington, S. 32 mph on Sept. 18; Hatteras, N. 43 mph on Sept. 19; Norfolk, N. 26 mph on Sept. 19; Cape Henry, N.E. 56 mph on Sept. 18 (Monthly Weather Review, Sept. 1901). 19) Storm of Sept. 17, 1901. Pensacola. Minor (Dunn and Miller, 1960). 20) Map showing a track for this storm. Positions along the track were near 19.3 N., 76.5 W. in the morning of Sept. 13; near 20.5 N., 80.5 W. in the morning of Sept. 14; near 21.5 N., 84.5 W. in the morning of Sept. 15; near 23.5 N., 87.5 W. in the morning of Sept. 16; near 27.5 N., 89 W. in the morning of Sept. 17; near Pensacola in the evening of Sept. 17; near Savannah in the morning of Sept. 18 and near Hatteras in the evening of Sept. 18 (Monthly Weather Review, Sept. 1901). 21) A storm was first observed near 18 N., 51 W. on Sept. 9, 1901 and lasted 10 days; it recurved near 27 N., 89 W. and it was last observed near 42 N., 65 W. (Mitchell, 1924). Author's note: The corresponding track in Mitchell (1924) was found to be similar to the one in Tannehill (1938) and did not differ greatly from the one in Neumann et al. (1993).

Based on information in the above items some modifications were introduced along the track in Neumann et al. (1993) which was drawn as for Storm 6, 1901 in their publication. The author of this study estimated new 7 A.M. positions for the period Sept. 9-11, primarily on the basis of information in item 2). These positions were as follows: Sept. 9, near 17.5 degrees N., 52.0 degrees W.; Sept. 10, near 17.3 degrees N., 57.3 degrees W.; Sept. 11, near 17.7 degrees N., 62.5 degrees W.; these positions ranged from about 100 to about 75 miles to the S.W. of the ones in Neumann et al. (1993). The 7 A.M. Sept. 12 position in the above mentioned publication was found to be reasonable on the basis of information in items 2) and 6) and, therefore, was kept unchanged. The author of this study estimated new 7 A.M. positions for the period Sept. 13-17 as follows: Sept. 13, near 19.0 degrees N., 74.3 degrees W.; Sept. 14, near 19.7 degrees W., 79.5 degrees W.; Sept. 15, near 21.5 degrees N., 84.5 degrees W.; Sept. 16, near 24.3 degrees N., 88.0 degrees W.; Sept. 17, near 29.0 degrees N., 87.5 degrees W. These positions were primarily based on information in item 2), although information in other items was also taken into account. For the period Sept. 13-16, these position ranged from about 90 to about 30 miles towards the S. of the respective positions in Neumann et al. (1993). However, the 7 A.M. Sept. 17 position was about 90 miles to the N.N.E. of the corresponding one in the above

publication. Positions for 7 A.M. Sept. 18 and 7 A.M. Sept. 19 in Neumann et al. (1993) were kept unmodified. The author's track for Storm 7, 1901 is shown in Fig. 1.

In spite of that "moderate cyclone" (item 16) carried an implication of hurricane intensity in the terminology used in relation to Cuban storms, the author of this study kept the tropical storm status given to this storm in Neumann et al. (1993) as for Storm 6, 1901; that decision was made on the basis of information in item 1) but, above all, on the basis that no hurricane winds or adequately pressures were reported in other items. The tropical storm status was kept over the period Sept. 9-18, but it was changed into the extratropical stage on Sept. 19.

Storm 8, 1901 (Sept. 12-17), T. S.

This storm is the same one which Neumann et al. (1993) identify as Storm 7, 1901.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 11, ship near 9 N., 30 W., S.W. f. 3, 29.88; ship near 9 N., 26 W., S. f. 2, rain. Sept. 12, ship near 13 N., 27 W., S.E. f. 7; ship near 11 N., 27 W., S.W. f. 6, rain; ship near 11 N., 30.7 W., W. f. 7, 29.88; center placed 12.5 N., 27.5 degrees W. Sept. 13, ship near 12 N., 30 W., W. f. 9, 29.80; center to the N.N.E. of that ship. Sept. 14, ship near 12 N., 29 W., W. f. 5, 29.86; ship near 18 N., 27 W., E.S.E. f. 10; Sao Vicente (Cape Verde Is.), N. f. 4, 30.10 (wrong data). Sept. 15, ship near 18 N., 27 W., E.S.E. f. 8; ship near 13.5 N., 28.7 W., W. f. 4, 29.91; center placed 15.3 N., 27.3 W. Sept. 16, ship near 19 N., 29 W., S.E. f. 8, center placed 19 N., 31 W. Sept. 17, ship near 20.8 N., 29 W., S.E. f. 6, showers; center not drawn on the map but maybe near 21 N., 31 W. Sept. 18, difficult to locate any center, rather a flow from the E. (Historical Weather Maps, Sept. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches.

The track in Neumann et al. (1993) as for Storm 7, 1901 was found to agree with many of the data in item 1) and, therefore, the author of this study decided to reproduce it in Fig. 1 as for Storm 8, 1901.

Data in item 1) were found to fully support the tropical storm status that Neumann et al. (1993) gave to this storm, and were found to suggest that the storm developed very rapidly from Sept. 11 to Sept. 12.

Storm 9, 1901 (Sept. 21- Oct. 2), T. S.

This storm corresponds to Storm 8, 1901 in Neumann et al. (1993).

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 21, ship near 14 N., 72 W., S.S.E. f. 3, 29.91; Kingston, N.E. f. 2, rain, 29.84. Sept. 22, ship near 15 N., 76 W., S.S.E. f. 5, 29.94; Kingston, N.E. f. 1, 29.86. Sept. 23, ship near 18 N., 86 W., E. to E.N.E. f. 4, 29.80. Sept. 24, no data available from the western Caribbean Sea. Sept. 25, Havana, E. f. 3, pressure could not be

read; Cienfuegos, S.E. f. 2, rain, 29.86; Key West, S.E. f. 2, 29.87; ship near 25 N., 84 W., N.N.E. f. 5, 29.83; ship near 23 N., 87 W., N.E. f. 3. Sept. 26, Havana, E. f. 4, 29.79; Key West, E.S.E. f. 4, pressure could not be read; Cienfuegos, S.E. f. 2, 29.83. Sept. 27, Havana, S.S.E. f. 5, 29.82; Key West, S. f. 4, 29.82; ship near 24 N., 83 W., S.E. f. 2, 29.83; ship near 27 N., 88 W., N.E. f. 7, 29.83. Sept. 28, extratropical low just S. of Atlanta (Historical Weather Maps, Sept. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 2) Belen College Observatory, Sept. 23, 8 A.M. In our note of 10 A.M. Sept. 17 we indicated that there was some indication that a perturbation had begun to feel its influence at Barbados. From the comparison of our yesterday's observations with those taken at other places in Cuba, the existence of a moderate cyclonic perturbation was inferred, its broad center being located about 300 miles to the S. yesterday afternoon. At present the main center of the tempest is located towards the S.W. Maybe this is the same perturbation which caused below normal barometer at Barbados on Sept. 17 and thunderstorms with heavy rains in the afternoon of that day; if this were the case it would have moved to the W. one quarter N.W. at about 10 mph. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 23, 1901, evening edition, p.2, col.3) Author's note: Data displayed on Historical Weather Maps for Sept. 17-20 (not shown) support the hypothesis that a weak weather system moved from near Barbados on Sept. 17 to the S. of Jamaica on Sept. 21, having caused a light W. wind at Curacao in the morning of Sept. 19. 3) Belen College Observatory, Sept. 25, 8 A.M. On Monday (Sept. 23) the broad center of the tempest to the S.W. remained stationary and yesterday the low clouds were running fast from S.E. one quarter E., E.S.E., and E. one quarter N.E., indicating a change in the direction of the major axis of the ellipse and a closer proximity to Havana. Low clouds at Pinar del Rio were moving rapidly from the E. yesterday morning and afternoon, and the wind (there) was blowing from the first quadrant in the afternoon. By 2 A.M. this morning, the central region (of the tempest) had moved somewhat towards the N.W., but it has not emerged into the Gulf yet. L. Gangoiti, S.J. (Diario de la Marina, Sept. 25, 1901, evening edition, p.2, col.4). Author's note: A more plausible explanation for the cloud changes at Havana and meteorological conditions at Pinar del Rio would be that the storm was never in reality to the S.W. of Havana and that the described conditions were related to the slow approximation of the storm to the Cuban coast, coming from a southerly direction, and causing an increasing influence of the storm circulation at Havana and Pinar del Rio. 4) Belen College Observatory, Sept. 27, 8 A.M. As a result of comparing observations taken at Pinar del Rio by our friend D. Eduardo Gomis yesterday morning and afternoon, it is evident that the main center of the cyclonic perturbation passed a short distance to the W. (of Pinar del Rio) in a N.W. direction and with a considerable increase in forward speed. The angular velocity of the low-level currents was very remarkable, being (there) much larger than at Havana, and the one observed here being larger than at Cienfuegos. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 27, 1901, evening edition, p.2, col.1). 5) Batabano, Sept. 27 (via telegraph). The rainy

weather continues. The aneroid barometer reads 759 millimeters (29.88 inches) and rising, and the wind blows from the S.S.E. Several streets are flooded (Diario de la Marina, evening edition, p.2, col.2). 6) Minimum pressure at Havana (Belen College Observatory) was 755.5 millimeters (29.74 inches on Sept. 26 (Sarasola, 1928). 7) Maximum wind velocity at Tampa was S. 27 mph on Sept. 27 (Monthly Weather Review, Sept. 1901). 8) Map showing a partial track for the storm as follows: Morning of Sept. 27, near 27.5 N., 84.5 W.; evening of Sept. 27, between Jacksonville and Tallahassee; morning of Sept. 28, S. of Atlanta; evening of Sept. 28, near Nashville; morning of Sept. 29. over eastern Lake Erie; evening of Sept. 29, near 46 N., 75 W.; morning of Sept. 30, near 47.5 N., 67.5 W.; evening of Sept. 30, near 47 N., 60 W. (Monthly Weather Review, Sept. 1901). 8) A storm was first observed near 12 N., 81 W. on Sept. 20, 1901 and lasted 14 days; it recurved near 23 N., 86 W. and it was last observed near 66 N, 1 W. (Mitchell, 1924). Author's note: A portion of the track in Mitchell (1924) was found to be similar to the ones in Tannehill (1938) and Neumann et al. (1993). However, the track in the latter publication was started on Sept. 21 instead of on Sept. 20.

On the basis of information in items 1) through 4) and in item 8), the author of this study introduced some modifications along the track which is displayed in Neumann et al. (1993) as for Storm 8, 1901. A possible track of the system backwards to the Lesser Antilles prior to Sept. 21 (item 2 and corresponding author's note) was not implemented due to its very weak character while moving over the eastern Caribbean Sea. New 7 A.M. positions were estimated for the period Sept. 21-28 as follows: Sept. 21, near 14.0 degrees N., 75.0 degrees W.; Sept. 22, near 15.0 degrees N., 79.0 degrees W.; Sept. 23, near degrees 16.5 N., 82.0 degrees W., Sept. 24, near 18.5 degrees N., 83.0 degrees W.; Sept. 25, near 20.0 degrees N., 83.5 degrees W.; Sept. 26, near 21.5 degrees N., 84.0 degrees W.; Sept. 27, near 25.5 degrees N., 85.0 degrees W.; Sept. 28, near 32.5 degrees N., 84 degrees W. The distance between the above positions and the corresponding ones in Neumann et al. (1993) ranged from about 350 miles on Sept. 21 to about 70 miles on Sept. 23-24. 7 A.M. positions for the period Sept. 29-30 in Neumann et al. (1993 were kept unchanged because they were not found to differ significantly from information for those days in item 8); their 7 A.M. positions for Oct. 1-2 were also kept unchanged. The author's track for Storm 9, 1901 is shown in Fig. 1.

Rigorously speaking, the tropical storm status which Neumann et al. (1993) gave to this storm as for Storm 8, 1993 could not be verified in the light of information in the above items (no wind of force 8 or higher on the Beaufort scale was found). Nevertheless, the author of this study decided to keep tropical storm intensity along the track from Sept. 21 through Sept. 27 and to change the system into the extratropical stage on Sept. 28 in accordance with information in item 1).

Storm 10, 1901 (Oct. 5-14), T. S.

This is the same storm which Neumann et al. (1993) identify as Storm 9, 1901.

The following information was found in relation to this storm:

1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 5, ship near 16 N., 56 W., E. f. 3, 29.80; Barbados. N. f. 2, 29.87; ship near 10 N., 54 W., N.W. f. 4, 29.88. Oct. 6, ship near 16 N., 55 W., E.N.E. f. 4, 29.66 (pressure too low); Barbados, N.N.E. f. 2, 29.88; ship near 13.7 N., 53.7 W., N. f. 2, 29.80; ship near 8 N., 53 W., W. f. 3, 30.00 (too high). Oct. 7, ship near 16 N., 56 W., E. f. 2, rain, 29.83; ship near 13 N., 58 W., W. f. 1; ship near 13 N., 54 W., S.W. f. 1., 29.80; ship near 15 N., 48 W., S.S.E. f. 11, 29.86. Oct. 8, ship near 23 N., 60 W., E. f. 3, rain; ship near 20 N., 64 W., N.E. f. 3, 29.77; ship near 16.5 N., 63 W., N. f. 3, 29.74; St. Kitts, N. f. 2, 29.76; Dominica, N. f. 2, 29.78; Martinique, W.S.W. f. 4, 29.80; Barbados, W.N.W. f. 2, 29.80; ship just E. of Barbados, W. f. 4, 30.00 (too high); ship near 12 N., 58 W., S.W. f. 4; ship near 12 N., 53 W., S. f. 2, rain, 29.74 (probably too low); ship near 14 N., 52 W., S. f. 3, 29.83. Oct. 9, ship near 16 N., 60 W., W. f. 6, 29.88; Dominica, E. f. 1, 29.78; Martinique, S.W. f. 4, 29.79; Barbados, S. f. 3, 29.80; St. Kitts, N.E. f. 1, 29.74; San Juan, S. f.1, 29.75; ship near 21 N., 64 W., N. f.2, 29.80; ship near 24 N., 58 W., S.E. f. 6, 29.88; Santo Domingo, N. f.2, 29.76; Port-au-Prince, W.N.W. f. 3, 29.73; ship near E. tip of Cuba, N.W. f.3, 29.80; ship near 23 N., 74 W., N.N.E. f. 5, 30.00; ship near 26 N., 70 W., N.N.E. f. 9, 30.00; Turk Is., S.E. f. 1, 29.78; ship near 23 N., 68 W., S.E. f. 2, 29.71. Oct. 10, Turk Is., W.N.W. f. 2, 29.84; ship near 26 N., 73 W., N.E. to E.N.E. f.5, pressure could not be read; ship near 21 N., 74 W., W. to W.N.W. f. 4, pressure could not be read; ship near 33 N., 69 W., E.S.E. f. 5, 30.00; ship near 22 N., 62 W., S.E. f. 4, 29.88; San Juan, S.W. f. 1, 29.85; Bermuda, E. f. 2, showers, 29.88; ship near 33 N., 66 W., S. f. 3, 29.80 (pressure too low). Oct. 11, weak frontal wave near 36 N., 66 W.; Bermuda and a ship N. of that island showed W.S.W. winds f. 2. Oct. 12, extratropical low placed 39 N., 60 W. Oct. 13, extratropical low placed 41 N., 53 W. Oct. 14, extratropical low placed 45 N., 41 W. (Historical Weather Maps, Oct. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 2) A storm was first observed near 15 N., 53 W. on Oct. 7, 1901 and lasted 7 days; it recurred near 22 N., 70 W. and it was last observed near 46 N., 40 W. (Mitchell, 1924). Author's note: The corresponding track in this publication was found to be similar to the ones in Tannehill (1938) and in Neumann et al. (1993) as for Storm 9, 1901).

Information in item 1) allowed the author of this study to introduce some modifications along the track displayed in Neumann et al. (1993) and to start such a track two days earlier, i. e. on Oct. 5. The author's estimated positions for the period Oct. 5-11 were as follows: Oct. 5, near 12.0 degrees N., 54.0 degrees W.; Oct. 6, near 13.5 degrees N., 53.3 degrees W.; Oct. 7, near 15.0 degrees N., 55.0 degrees W.; Oct. 8, near 17.5 degrees N., 58.5 degrees W.; Oct. 9, near 21.0 N., 62.3 W.; Oct. 10, near 24.5 N., 68.5 W.; Oct. 11, near 35.0 degrees N., 65.0 degrees W. As a difference with the one in Neumann et al. (1993), this track did not bring the storm center over the Leeward Islands and Puerto Rico but it kept it at a good distance to the N.E. of both places. Data in item 1) suggested that a second center, which formed near the

southern end of a front, existed near the northern coast of Hispaniola on Oct. 9 and that both centers merged on Oct. 10 and then moved northward as a wave along the frontal boundary on Oct. 11. Positions given in Neumann et. al. (1993) for the extratropical system over the period Oct. 12-14 were kept unchanged. The author's track for Storm 10, 1901 is shown in Fig. 1.

The tropical storm status given to this storm in Neumann et al. (1993) as for Storm 9, 1901 was kept unchanged on the basis of a ship reporting a wind of force 11 on the Beaufort scale well to the E. of the storm center on Oct. 7 and that the W. wind of force 6 reported by a ship well to the S. of the center on Oct. 9 implies that significantly stronger winds should have occurred over the area to the E. and N.E. on the center, where data were not available on that day. The tropical storm status was denoted along the author's track over the period Sept. 5-10 but it was changed to the extratropical stage as the system reached the 30 degrees N. parallel during the night of Oct. 10-11.

Storm 11, 1901 (Oct. 15-18), T. S.

This case has been recently revealed by the author of this study. The case appeared in previous works by Tannehill (1939) and Nitchell (1924) but it is not included in Neumann et al. (1993). In that sense, it might be considered as a new one.

Documentation of this case was based on the following information: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 15, Jupiter, N.E. f. 5, 29.93; ship near 24 N., 80 W., N. f. 4, 29.91; Camaguey, S.S.W. f. 2, 29.84; Santiago de Cuba, S.S.E. f. 4, rain, 29.87; ship near 25 N., 86 W., E. f. 5, 29.80 (probably too low); although a front was drawn on the map its validity is questionable because temperatures were in the upper 70's and lower 80's behind the front. Oct. 16, ship near 23 N., 74 W., S. f. 10, 29.88 (probably too high); Camaguey, W. f. 2, 29.90 inches; Santiago de Cuba, S.E. f. 1, 29.89; center of a low placed 24.5 N., 75.5 W. Oct. 17, ship near 27 N., 72.7 W., N. f. 5, rain, 29.88; ship near 25.7 N., 69 W., S.W. f. 8; Turk Is., S.W. f. 4, 29.96; ship near 26 N., 68 W., no wind given, 29.86; ship near 23.7 N., 65 W., S.S.E. f. 5, 30.03; center of a low placed 26 N., 70 W.; frontal wave near 39 N., 63 W., but its associated cold front did not extend into the core of the above mentioned low. Oct. 18, ship near 25 N, 64.7 W., S. f. 4, 29.7; Bermuda, N. f. 1, rain, 29.82; ship near 26.7 N., 65.7 W., W. f. 2, 30.03 (too high); ship near 30 N., 68 W., N.E. f. 5; front just to the E. of Bermuda with temperature there at 72 degrees Fahrenheit; low probably near 28 N., 65 W., embedded in the front and rapidly weakening (Historical Weather Maps, Oct. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches. 2) A storm was first observed near 24 N., 75 W. on Oct. 16 and lasted 4 days; it was last observed near 62 N., 58 W. (Mitchell, 1924). Author's note: The track shown in Mitchell et al. (1924) was found to be similar to the one in Tannehill (1938).

On the basis of information in item 1), the author of this study prepared a track for Storm 11, 1901. 7 A.M. positions along his track were estimated as follows: Oct. 15, near 22.0 degrees N.,

78.5 degrees W; Oct. 16, near 23.7 degrees N., 75.0 degrees W.; Oct. 17, near 26.5 degrees N., 69.5 degrees W.; Oct. 18, near 28.0 degrees N., 65.0 degrees W. The author's track is shown in Fig. 1.

The author of this study gave a tropical storm status to this weather system on the basis of a ship reporting a wind from the S. force 10 on Oct. 16 and a second ship reporting a wind from the S.W. force 8 on Oct. 17 (item 1). Although storm intensity probably was not reached until late Oct. 15, tropical storm status was denoted along the author's track over the period Oct. 15-17 and was changed to extratropical stage on Oct. 18. In spite of that the tracks discussed in item 2) and its corresponding author's note were found to extend to very high latitudes, the author of this study decided to terminate his track near 29 N. because, according to information for Oct 18 in item 1), he did not find a justification to extended it any farther to the north.

Storm 12, 1901 (Oct. 30- Nov. 6), T. S.

This storm corresponds to Storm 10, 1901 in Neumann et al. (1993).

The following information was found in relation to this storm:

- 1) The month (Nov.) opened with a storm of tropical origin N. of Puerto Rico. At 11:10 A.M. Nov 1, the following message was telegraphed to the Weather Bureau offices at Bermuda, New York, Philadelphia and Boston: "Severe disturbance moving N.E., east of Turk Is. will pass near Bermuda Saturday (Nov. 2)." From Nov. 2 to Nov. 5 the storm center moved N.E. over mid ocean attended by gales of great violence and there is no evidence that the storm reached the European coast. The Bermuda Colonialist, Nov. 6, 1901 verifies the accuracy of the advices furnished: "The hurricane that was predicted by the Weather Bureau for Saturday arrived on time and raged for 24 hours. All the incoming steamers were delayed. The growing crops throughout the colony suffered somewhat and the storm damage to property has been considerable" (Monthly Weather Review, Nov. 1901).
- 2) The tropical storm was still apparently central near Bermuda yesterday morning with a considerable increase in intensity and northerly gales will extend over the North Atlantic (The New York Times, Nov. 4, 1901, p.9, col.6).
- 3) Information extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 30, San Juan, S.S.E. to S. f. 2, 29.81; Santo Domingo, N. f. 2, 29.84; ship near 21 N., 67 W., N.E. f. 4, 29.86 (probably too high); St. Kitts, S.E. f. 3, 29.84. Oct. 31, Santo Domingo, N.W. f. 1, 29.72; San Juan, S. f. 2, pressure could not be read; Turk Is., N. f. 1, 29.75; St. Kitts, S. f. 4, 29.76; ship near 29 N., 60 W., S.S.W. f. 6, 29.80; ship near 24 N., 61 W., S.S.W. f. 2, 29.77; ship near 26 N., 67 W., N.E. f. 6, rain, 29.68; ship near 25 N., 68 W., N. f. 4 (or 6), 29.68 (Historical Weather Maps, Oct. 1901). Author's note: Wind forces (f) are on Beaufort scale, pressures are in inches.
- 4) Information extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Nov. 1, Bermuda, E.N.E. f. 2, 29.86; Turk Is., N.W. f. 4, 29.71; ship near 23 N., 67.7 W., W.N.W. f. 4; ship near 23 N., 65 W., S.S.W. f. 4, 29.56, ship near 26 N., 62.7 W., S. f. 2, 29.62; ship near 27.7 N., 69 W., N.E. f. 8 (or 10); , 29.62; ship near 28 N., 63 W., E.N.E. f. 7, rain. Nov. 2, a double structure was shown on

the map with centers below 1000 millibars (29.53) near 29.5 N., 60.5 W. and near 24.5 N., 65.5 W.; Bermuda, E.N.E. f. 2, rain, 29.67; ship near 24 N., 69 W., N.N.W. f. 6, 29.56; ship near 22 N., 65 W., S.W. f. 7, 29.56; ship near 28 N., 66 W., N.N.E. f. 6, rain; ship near 28 N., 67 W., N.N.E. f. 8, 29.80; ship near 27 N., 61.7 W., S.S.W. f. 5, 29.65; ship near 33 N, 63 W., N.E. f. 7; ship near 35 N., 61 W., E. f. 7, 29.86; ship near 23 N., 61 W., S.W. f. 6, 29.68; ship near 30 N., 57 W., S. f. 2, 29.62. Nov. 3, numerous ship reports around the center of a low placed 30.5 N., 60.5 W. with central pressure below 990 millibars (29.24 inches); lowest barometer reported by a ship was 29.21 with wind S. f. 8 (or 10) near 29 N., 60 W. Nov. 4, data difficult to read; center of intense low placed 37.3 N., 56.3 W. with central pressure of 975 millibars (28.79); however, no ship showing hurricane winds (f. 12) was found plotted on the map; although cold air had not reached the storm center, it was definitively entering the storm circulation causing a temperature of 64 degrees Fahrenheit at Bermuda. Nov.5, center of a low with pressure below 985 millibars (29.09) placed 38 N., 55.5 W. (maybe a bit too far to the W.S.W); inner portion of the storm gradually transforming into extratropical. Nov. 6, ship near 39 N., 52 W., N.E. f. 7, 29.50; ship near 34 N., 50 W., W.S.W. f. 9, 29.44; low embedded in front and probably located near 37 N., 50.5 W. (Historical Weather Maps, Nov. 1901). Author's note: As indicated before, wind forces (f) are on Beaufort scale and pressures are in inches. 5) A storm was first observed near 22 N., 68 W. on Oct. 31, 1901 and lasted 14 days; it was last observed near 60 N., 20 E. (Mitchell, 1924). Author's note: Portions of the corresponding track in Mitchell (1924) were found to be similar to the tracks shown in Tannehill (1938) and Neumann et al. (1993).

Primarily on the basis of information in items 3) and 4), the author of this study introduced numerous modifications along the track which is shown in Neumann et al. (1993) as for Storm 10, 1901 and extended such a track backwards in time to Oct. 30. The author's newly estimated 7 A.M positions for the period Oct. 30-Nov. 6 were as follows: Oct. 30, near 19.3 degrees N., 67.3 degrees W; Oct. 31, near 24.0 degrees N., 66.7 degrees W.; Nov. 1, near 26.7 degrees N., 65.3 degrees W; Nov. 2, near 29.5 degrees N., 63.5 W.; Nov. 3, near 31.0 degrees N., 60.3 W.; Nov. 4, near 37.0 degrees N., 56.0 degrees W.; Nov. 5, near 38.5 degrees N., 54.5 degrees W.; Nov. 6, near 37.0 degrees N., 50.5 degrees W. For the period Oct. 31- Nov. 6, differences between corresponding positions in Neumann et al. (1993) and the author's ones were found to range from about 220 miles on Nov. 4 to about 60 miles on Nov. 1 and Nov. 3. The author's track for Storm 12, 1901 is shown in Fig. 1.

The tropical storm status which was given to this storm by Neumann et al. (1993) as for Storm 10, 1901 was verified on the basis of abundant information in items 3) and 4) and found to be correct. This status was denoted along the author's track over the period Oct. 30- Nov. 5 in spite of that reported winds were below force 8 on the Beaufort scale on Oct. 30-31 (item 3); the extratropical stage was introduced on Nov. 6 when extratropical characteristics were fully acquired by the weather system (item 4). The pressure as low as 28.79 inches which was indicated on the weather map for Nov. 4 (item 4) would have normally supported full

hurricane winds in a tropical system; however, no ship reported winds of hurricane intensity on that day and all throughout the existence of the storm. Therefore, an upgrade of the storm to a hurricane was discarded.

Special statement.

In addition to the storms which were fully discussed above, one possible case was found for 1901.

A) Case of Oct. 5, 1901.

The following information was found about this possible case:
1) Oct. 4, a force 4-6, N.E. flow was found over the Cape Verde Islands. Oct. 5, ship near 18 N., 29 W., E.N.E. f. 5, 29.83; ship near 15 N., 26 W., E.S.E. f. 6; ship near 14 N., 27 W., S.S.E. f. 8, rain, 29.83. Oct. 6, a force 3-5, E. flow was found in the eastern Atlantic between 10 and 20 degrees N. and between 25 and 40 degrees W. (Historical Weather Maps, Oct. 1901). The above information suggested the existence of a well-developed tropical weather system of weak tropical storm intensity (f. 8) near 14.0 degrees N., 28.5 degrees W. in the morning of Oct. 5. However no evidence of the system was found on the previous and next days. This brought some question about how reliable the Oct. 5 data were. Therefore, this case is kept as a possible one.

A few other tropical weather systems were identified on weather maps but they were so weak that it is believed that they did not have any chance to have reached storm intensity.