

Fig. 2

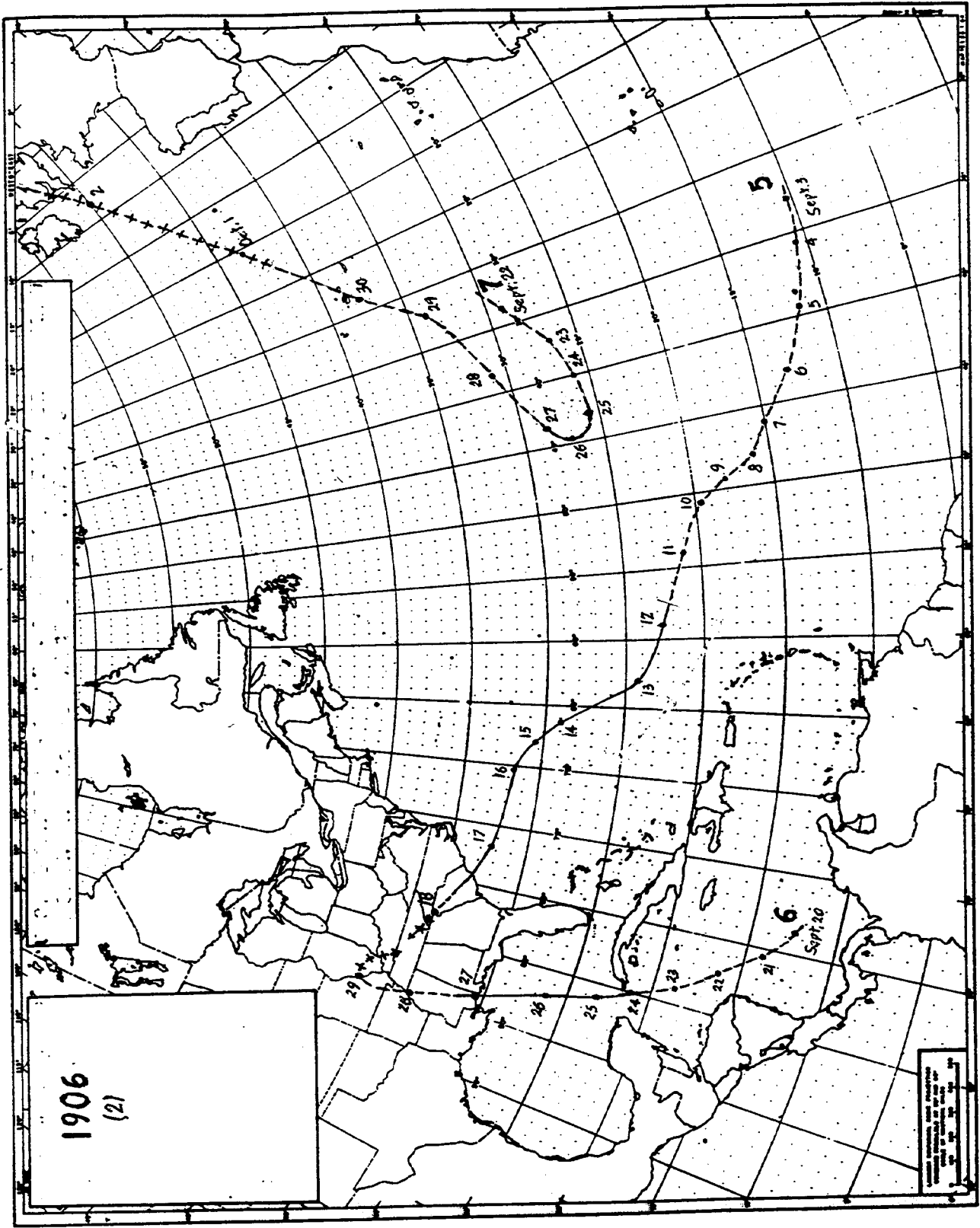


Fig. 2 continued

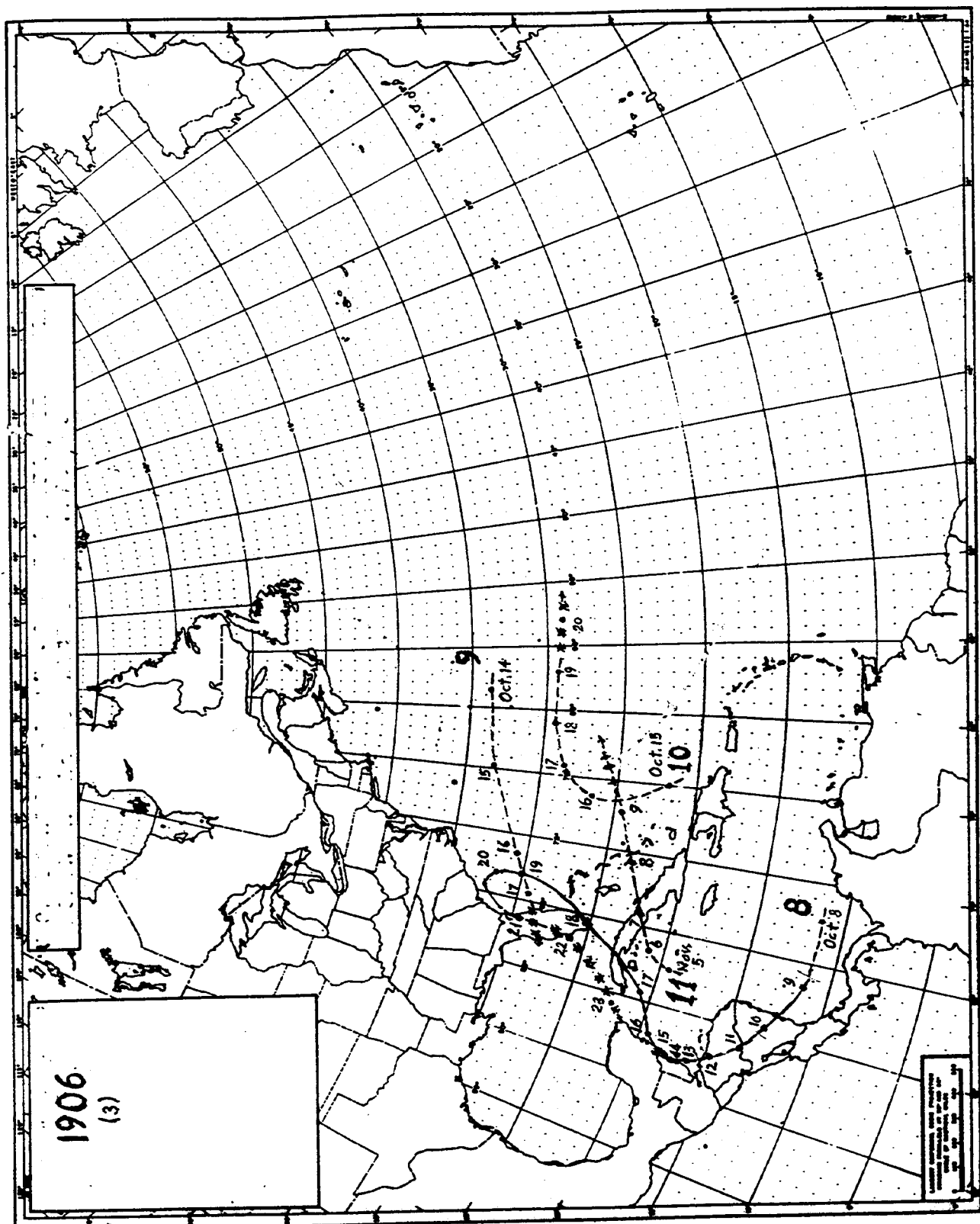


Fig. 2 continued

23, tropical storm intensity was denoted along the author's track, and tropical storm status was reinstated late on Sept. 27 when the storm had moved about 100 miles inland. The extratropical stage was introduced on Sept. 29.

Storm 7, 1906 (Sept. 22- Oct. 2), T. S.

This storm is the same one which Neumann et al. (1993) identify as Storm 6, 1906.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 22, ship near 30 N., 33 W., E.S.E. f. 9, 29.53; ship near 26 N., 32 W., W.S.W. f. 4, 29.97; center placed 29 N., 33 W. (probably too far E.). Sept. 23, ship near 29 N., 36 W., N.E. f. 6, 29.86; ship near 26 N., 37 W., S.W. f. 4, 29.35; center placed 27 N., 36.5 W. (probably a bit E.). Sept. 24, ship near 39 N., 40 W., N.E. f. 5, 30.03; ship near 24 N., 43 W., W. f. 2, 30.00; center placed 26 N., 36 W. (position seems to be wrong, around 26 N., 40 W. would be much better). Sept. 25, ship near 29 N., 43.7 W., S. f. 7 (wind direction probably wrong), 30.12; ship near 23.7 N., 47 W., N. f. 5, 29.94; ship near 22 N., 48.7 W., W. f. 2, 30.03; center placed 27 N., 46 W., (probably too far N. and W.). Sept. 26, ship near 28 N., 46.7 W., N.E. f. 5, 29.97; ship near 25 N., 41.7 W., S. to S.S.W. f. 6, 29.91; center placed 25 N., 44 W. (probably somewhat S.). Sept. 27, ship near 30 N., 43 W., E. f. 7, rain; ship near 30.7 N., 42 W., E. f. 5, 29.94; ship near 27 N., 51 W., N.E. f. 3, 30.06; ship near 26 N., 36 W., S.S.E. f. 5, pressure could not be read; center placed 28.5 N., 43.5 W. Sept. 28, ship near 30 N., 38 W., S.W. f. 7, 29.53; ship near 29 N., 44 W., N.N.W. f. 2, 29.80; ship near 35 N., 41 W., E.N.E. f. 6, showers; ship near 34 N., 41 W., E. f. 3, rain; center placed 30 N., 40.5 W. (31 N., 38.5 W. would be a much better location). Sept. 29, ship near 32.7 N., 30 W., S.S.E. f. 8, 29.65; ship near 35.7 N., 32 W., N. f. 9 (wind direction probably wrong); center placed 33.5 N., 31 W. (maybe a bit E.). Sept. 30, station in the Azores N.W. of Ponta Delgada, S.E. f. 8, 29.54; ship near 42 N., 27 W., S. f. 4, 29.86; ship near 39 N., 22 W., S.W. f. 9, 29.71; ship near 39.5 N., 20 W., S.W. f. 5, 29.97; center placed 40 N., 24 W., with a second center near 50 N., 18 W.; however, a center could be also placed to the S.W. of the station in the Azores, this center was probably the same one of previous days (Historical Weather Maps, Sept. 1906. Author's note: Wind forces (f) are on Beaufort scale and pressures are in inches. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 1, low placed 43.5 N., 18 W., maybe too far E.; it looks better near 20-21 W.; temperatures in the 60's Fahrenheit north of the low indicate system was becoming extratropical. Oct. 2, temperatures in the 50's and 60's Fahrenheit around the low; center placed 50 N., 8 W. (Historical Weather Maps, Oct. 1906). Author's note: As before, wind forces (f) are on Beaufort scale and pressures are in inches. 3) An advice which was cabled to Lloyd's, London, on Sept. 30 stated that a severe storm south of the Azores would probably move northeastward (Monthly Weather Review, Sept. 1906). 4) The meteorological conditions yesterday were of decidedly threatening character. Early in the morning a cyclonic area of considerable intensity appeared suddenly off our S.W. coasts and by 8 A.M. rain was falling in all the more southern parts of the kingdom. Later in the day the disturbance advanced steadily in a N.E. direction, the wind in the meantime increasing to a gale from the southward in the English and Bristol Channels with continuous rain over a large portion of our central and southern districts. The southerly wind was extremely mild and at 8 A.M. the shade temperature of 62 degrees (Fahrenheit) in London was about 10 degrees above average. The reports at hand last evening showed that the center of the depression had reached central England and that it was apparently moving steadily in a N.E.

direction (The Times, London, Oct. 3, 1906, p.10, cols.4-5).

No tracks for this storm were included in Mitchell (1924) and Tannehill (1938), making of the one in Neumann et al. (1993) as for Storm 6, 1906 the only one available. Primarily on the basis of information in items 1) and 2), the author of this study introduced a number of changes along such a track. The author's track was started with his estimated position near 29.0 degrees N., 33.7 degrees W. for 7 A.M. that day; this position was about 270 miles to the N. of the corresponding one in the above publication. The 7 A.M. Sept. 23 position in that publication was kept unchanged because it was found to agree with information for that day in item 1). New 7 A.M. positions for the period Sept. 24-28 as estimated by the author of this study were as follows: Sept. 24, near 26.0 degrees N., 40.0 degrees W.; Sept. 25, near 25.7 degrees N., 43.0 degrees W.; Sept. 26, near 27.0 degrees N., 44.7 degrees W.; Sept. 27, near 28.5 degrees N., 43.5 degrees W.; Sept. 28, near 31.0 degrees N., 38.5 degrees W.; differences between these positions and the corresponding ones in Neumann et al. (1993) ranged from about 240 miles on Sept. 25 to about 50 miles on Sept. 27. The 7 A.M. Sept. 29 position in the above publication was kept unmodified, but new 7 A.M. Sept. 30- Oct. 2 positions as estimated by the author of this study were as follows: Sept. 30, near 37.7 degrees N., 27.7 degrees W.; Oct. 1, near 43.3 degrees N., 20.5 degrees W.; Oct. 2, near 50.0 degrees N., 8.0 degrees W.; information for Sept. 30 in item 3) and for Oct. 2 in item 4) were also helpful in determining author's positions for those days; differences between author's positions and the corresponding ones in Neumann et al. (1993) ranged from about 200 miles on Sept. 30 to about 70 miles on Oct. 2. The author's track for Storm 7, 1906 is shown in Fig. 2.

The tropical storm status which Neumann et al. (1993) gave to this storm as for Storm 6, 1906 was found to be supported by information contained in item 1). Tropical storm intensity was denoted along the author's track over the period Sept. 22-30 and the extratropical stage was introduced on Oct. 1.

#### Storm 8, 1906 (Oct. 8-23), H.

This storm was composed from Storms 7 and 8, 1906 in Neumann et al. (1993), which showed to be just one weather system.

The following information was found about this combined storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 4, Barbados, N.E. f. 3, 29.92; ship near 12 N., 58 W. N.E. f. 4, 29.86; no closed circulation drawn. Oct. 5, Barbados, S.E. f.3, 29.92; Martinique, calm, 29.97 (probably too high); Dominica, S.E. f. 3, 29.92; St. Kitts, S.E. f. 5, 29.94; Trinidad, E. f. 2, 29.92; no closed circulation drawn. Oct. 6, Curacao, N. f. 2, 29.86, rain; no closed circulation drawn, but an incipient one could have been to the E. of Curacao. Oct. 7, Curacao, N.E. f. 3, 29.91; ship near 14 N., 76 W., N.E. f.4, 29.86; no closed circulation drawn, but one isobar showed a good cyclonic curvature over northern Colombia; Oct. 8, ship near 10 N., 78 W., N.W. f. 4, rain; probable center to the N.E. of that ship near 11.3 N., 77.3 W., but not drawn on map. Oct. 9, no data in the storm area. Oct. 10, ship near 13 N., 77 W., S. f. 6; low placed 14.5 N., 81.5 W. (too far to the N.E.). Oct. 11, no data in the storm area; center placed 16.5 N., 83.5 W. (too far to the N.E.). Oct. 12, no data in the storm area. Oct. 13, no data in the storm area; center placed 19 N., 86 W. (too far to the N.E.). Oct. 14, no data in the storm area. Oct. 15, Merida, N.E. f. 4, 29.68; center placed near Chetumal (Mexico). Oct. 16, Merida, N. f. 6, 29.66; center placed 20.5 N., 86.5 W. (probably a bit far to the N.E.). Oct. 17, Merida, calm, 29.76; center placed S.E. of Isle of Pines, which was too far E. (Historical

Weather Maps, Oct. 1906). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Belen College Observatory, Oct. 4, 7:30 P.M. There are indications of a cyclonic perturbation to the S.S.E. and not far from Barbados. Its probable course is W. and N.W. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct. 5, 1906, morning edition, p. 4, col.3). Author's note: In accordance to item 1), a closed cyclonic perturbation does not appear to have existed on that day. 3) Belen College Observatory, Oct. 5, 7 A.M. The cyclonic perturbation near Barbados last evening, which we announced in this morning's newspapers, is now to the S.W. of Bridgetown, approaching the islands of Grenada and St. Vincent on a W. one quarter to N.W. course. It showed up in the Atlantic yesterday; it will pass to the Caribbean Sea today; it is located at low latitude. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct. 5, 1906, evening edition, p.1, col.2). Author's note: According to item 1), no closed circulation apparently existed on that day. 4) Belen College Observatory, Oct. 9, 5 P.M. We did not have any news about the cyclonic perturbation to the S.S.E. of Barbados in the evening of Oct. 4 and to the S.W. of the capital of that island on Sept. 5 until the afternoon of Sunday, Oct. 7 it appeared to the S.S.E. at a distance over 400 miles (from Havana). It showed up as a depression of large area and a weak aspiration force; it remained almost stationary on Oct. 8; it has moved somewhat to the W. today, with very weak intensity and organization so far. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct. 10, 1906, morning edition, p.4, col.5). Author's note: At least for Oct. 9, the above advisory seriously underestimated the storm strength. 5) Barometric pressure at Colon, Panama, the only station in the S.E. Caribbean that sent reports by telegraph to the Weather Bureau at Washington, began to fall on Oct. 6 and continued to fall until the morning of Oct. 9 when a reading of 29.72 inches was reported (Monthly Weather Review, Oct. 1906). 6) Taken from a report made by D. W.F. Thornton, Bluefields (Nicaragua): The following are barometric readings (inches) at Bluefields: Oct. 9, 7 A.M., 29.91; noon, 29.87; 1 P.M., 29.85; 2 P.M., 29.82; 3 P.M., 29.78; 4 P.M., 29.72; 5 P.M., 29.68; 6 P.M., 29.63; 7 P.M., 29.62; 8 P.M., 29.60; 9 P.M., 29.59; 9:30 P.M., 29.57; 10 P.M., 29.60; Oct., 10, 1 A.M., 29.66; 3 A.M., 29.70; 5 A.M., 29.74; 7 A.M., 29.81. Fortunately, Bluefields was but slightly damaged, a few trees uprooted and some corrugated roofing torn off. Beginning 20 miles N. and having a width of 20-25 miles the storm swept everything before it. It traveled from E. to W. and was accompanied by a tidal wave. Some reefs that before the storm were 2-3 feet below the surface are now 4-5 feet above. Small keys have disappeared from the surface, specially two small keys (Seal Cays), one having 4 and the other 12 coconut palms, and used at a point by navigators when passing between the mainland and the Corn Islands, can be no longer seen. The tidal wave affected the coast for 80 miles, extending from 10 miles N. of Bluefields to the N. Its greatest height was 15 feet (Monthly Weather Review, Oct. 1906). 7) New Orleans, Oct. 14. A wireless message from Bluefields to The Times-Democrat tonight says that a hurricane in the neighborhood of Puerto Limon has done \$ 125,000 damage to rubber and banana crops, besides other property damage (The New York Times, Oct. 15, 1906, p.1, col.6). Author's note: Puerto Limon (Costa Rica) could have been wrongly cited, being in reality Pearl Lagoon, which is N. of Bluefields. 8) New Orleans, Oct. 15. According to wireless reports received here, a strong cyclone has caused immense damage to towns along the Central American coast. Great damage to corn crops was done at Bluefields, devastating vegetation and even changing the country topography. At Manilano damage was reduced to a 30-mile wide belt, sweeping away the banana and rubber crops and destroying all plantations (Diario de la Marina, Havana, Oct. 16, 1906, evening edition, p.1, col.1. 9) Boston, Oct. 24. The United Fruit Company steamer "Limon" has arrived here from Puerto Limon, Costa Rica, and reports that Bluefields is in ruins and that the

banana plantations have been destroyed. Capt. Porter says that Little Corn Island did not show any sign of life when the "Limon" passed and that, contrary to reports, Costa Rica appears to have escaped damage of consequence. Great Corn, although showing signs of devastation, did not appear to have suffered as much as Little Corn Island (The New York Times, Oct. 25, 1906, p.1, col.2). 10) Mobile, Al., Oct. 22. The first news of a hurricane which visited the towns of Ruatan (it should read Roatan), Tela, Utila, Colorado and El Provence on Oct. 12 was brought here last night by the steamer "Harald", which arrived with a cargo of fruit. A number of vessels were wrecked, several destroyed and buildings in each of the towns mentioned badly damaged. The damage to the owners of the fruit plantation it is stated amounts to \$ 1 million. The schooner "Southern Queen" was thrown ashore on the beach at Ruatan and went to pieces in less than one hour time, and the "Harald" suffered somewhat and will have to be docked. A great wave accompanied the storm and swept everything before it. Capt. Henrichsenn said that, when he left, the beaches were strewn with vessels of all kinds, including 3 sailing vessels. No lives were reported lost at the time of the sailing of the "Harald" (The New York Times, Oct. 23, 1906, p.5, col.3). 11) The American Consul, Jose de Olivares, at Managua, Nicaragua, under date of Oct. 26, reported that during the interval of 2 weeks, from Oct. 8-22, the entire consular district was visited by what it was probably the severest rain storm which has ever occurred in that part of the world. At Corinto, in addition to the downpour of rain, there was experienced an unusually heavy sea which badly damaged a part of the new dock in process of construction in that port. But the severest conditions and worst results in the district were reported from our consular agent in Matagalpa, in the northern mountain region of this country. In several cases, tremendous landslides, carrying away whole hillsides, occurred (Monthly Weather Review, Oct. 1906). 12) San Salvador, Oct. 19. A tempest has raged incessantly for 10 days throughout the Republic. Today the storm is abating. Guatemala and Honduras have also suffered severely. It is said that losses there will amount to many million dollars (The New York Times, Oct. 20, 1906, p.2, col.2). 13) Belen College Observatory. The cyclone which we have seen announced in Diario de la Marina this morning should be the same one which was announced to the S. and near Barbados on Oct. 12. Its effects will probably be felt at Trujillo (Honduras) today and it is likely that the cyclone is getting ready for recurvature to the N.E. over the Gulf of Honduras. L. Gangoit, S.J. (Diario de la Marina, Oct. 16, evening edition, p.4, col.1). Author's note: The cyclone referred to above was found to be unrelated to the one reported as being to the S. of Barbados on Oct. 12. 14) Belen College Observatory, Oct. 17, 11 A.M. The cyclone has come somewhat closer to us since yesterday; it is getting ready for recurvature and will probably pass over the western portion of the island (Cuba) within 40 hours. L. Gangoit, S.J. (Diario de la Marina, Havana, Oct. 17, 1906, evening edition, p.1, col.4). 15) National Meteorological Observatory. Oct. 17, 10 A.M. The vortex of the cyclone of Oct. 15 in Central America appears to be to the W.S.W. of Havana, moving towards the N. (Diario de la Marina, Oct. 17, 1906, p.1, col.4). 16) Belen College Observatory, Oct. 17, 4:30 P.M. The center of the cyclone is rapidly approaching Havana province, and will probably pass over the capital or its vicinity tonight. If a calm were observed, the wind would blow later from the opposite direction it was blowing before (Diario de la Marina, Havana, Oct. 18, 1906, supplement, p.1, col.1). 17) National Meteorological Observatory, Oct. 17, 4 P.M. The cyclone from the Caribbean Sea has recurved and it approaching; its center will passed to the W. of Havana province (Diario de la Marina, Havana, Oct. 18, 1906, supplement, p.1, col.1). 18) The observer from the Climatology and Crop Service at Nueva Gerona (Isle of Pines) reported the following: The proximity of the cyclone was noted here by daybreak Oct 17 with heavy showers, accompanied by S.E. winds

which increased during the day. Then, the wind blew from the S. and changed to the S.W. at 3:30 P.M. The change was abrupt, the wind reaching hurricane force which blew down trees and destroyed flimsy houses W. of the city. By 5 P.M. the destructive work of the hurricane had ended (Diario de la Marina, Havana, Oct. 24, 1906, morning edition, p.5, col.5-6). 19) Some pressure readings taken at Havana: Oct. 17, evening (time not specified), 748 millimeters or 29.45 inches; 9 P.M., 744 millimeters or 29.29 inches; 10 P.M., 740 millimeters or 29.13 inches; 11 P.M., 737 millimeters or 29.02 inches; 11:30 P.M., 734 millimeters or 28.90 inches; midnight (Oct. 17-18), 736 millimeters or 28.98 inches; 12:15 A.M. Oct. 18, 739 millimeters or 29.25 inches; 3 A.M., 746 millimeters or 29.37 inches; 6 A.M., 750 millimeters or 29.53 inches (Diario de la Marina, Havana, Oct. 18, 1906, supplement, p.1, col.1). 20) National Meteorological Observatory, Oct. 18. At about 10 P.M. (Oct. 17), when the anemometer started malfunctioning, the wind was 96 mph (43 meters per second. At 11:30 P.M. the vortex was some 15 miles to the E., the wind was estimated at 120 mph, and the barometer read 734.6 millimeters (approximately 28.90 inches). Shortly after that time, the wind backed to N.N.W. and started to diminish, with rising barometer. The cyclone diameter was small and its motion quite rapid (Diario de la Marina, Havana, Oct. 19, 1906, morning edition, p.4, col.4-5). 21) Belen College Observatory, Oct. 24. The minimum barometer reading occurred at 11:30 P.M. (Oct. 17) and was 733.1 millimeters (28.86 inches), after being reduced to sea level. The wind velocity around 9 P.M. was 30 meters per second (67 mph) and, between 11 P.M. and midnight (Oct. 17-18) some gusts were over 40 meters per second (90 mph). We observed at that time that the wind was backing to N.M.E. and then to N.. It was then evident that the vortex was moving E. of Havana but not very far away. The wind blew hurricane force from the N., but it gradually diminished, although there were very strong gusts from the N.N.W. direction. The rain ceased and the barometer rose with great rapidity from 11:30 P.M. on (Diario de la Marina, Havana, Oct. 25, 1906, evening edition, p.4, col.1). Author's note: The above information was taken from an article signed by S. Sarasola, S.J. The Monthly Weather Review (Oct. 1906), Martinez-Fortun (1942) and Tannehill (1938) quoted the minimum pressure at Havana as 28.86 inches and/or the vortex passage to the east of that city, which were indicated in this item. 22) Taken from Revista de Agricultura: At Batabano, the first hurricane winds blew from the S., and then from the W., indicating that the cyclone vortex passed inland just W. of that place about 9 P.M. (Oct. 17). At Jaruco, they had winds from the E. between 11 P.M. and midnight, calm and then wind from the W., indicating that the vortex left the island (Cuba) near that place. The diameter of the cyclone did not exceed 100 miles, having affected only the province of Havana and portions of Pinar del Rio and Matanzas and the Isle of Pines (Diario de la Marina, Havana, Oct. 24, 1906, evening edition, p.1, col.4). 23) At Guines, the wind blew from the E. and S., and around 10 P.M. it blew very hard from the last direction; the calm lasted 1 hour and 15 minutes without any rain or drizzle. At "Merceditas" sugar mill, to the W. of Guines, the calm lasted for two hours and the wind jumped from S.E. to N.W. It can be inferred from the above data and those from Matanzas and Jovellanos that the center passed over Melena del Sur (Diario de la Marina, Havana, Oct. 25, 1906, evening edition, p.4, col.1). Author's note: The above information was taken from the article about the storm which was signed by S. Sarasola, S.J. of the Belen College Observatory. It should be mentioned that the vortex passage over Melena del Sur is in good agreement with information in item 22). 24) New York, Oct. 18. Cable communication with Havana was interrupted at 11 o'clock last night and has not yet been restored. Shortly before the communication was broken the telegraph operator at Havana told that a great storm was raging. Soon afterward he said that the gale had become a hurricane (The



Times, London, Oct. 19, 1906, p.3, col.6). 25) New York, Oct. 19. The first news of the effects of the storm in Havana came in a dispatch to the Evening Telegram. It said that 100 persons have been killed, that the whole American fleet at Havana harbor is wrecked and that the cruiser "Brooklyn" has been torn from her moorings and thrown upon the shore. When the tempest reached its height buildings were shaking as by an earthquake (The Times, London, Oct. 20, 1906, p.5, col.4). 26) Senor Luis G. Carbonell, Chief of the Meteorological Service of Cuba, reports that in its passage over that island, the storm was of great intensity, small diameter and rapid march, and that its force extended to the W. as far as Pinar del Rio, with strong winds from the N. and N.W.; that great damage was not caused in the provinces of Matanzas and Pinar del Rio, but that in the Province of Havana there was great destruction of cane, trees and all plants in general. In the city of Havana there were some fatalities caused by the falling of houses that were in bad condition (Monthly Weather Review, Oct. 1906). 27) Oct. 17-18, 1906. An intense hurricane crossed the Island (of Cuba) E. and near Havana, causing numerous fatalities and damage to crops, cities and vessels (Sarasola, 1929). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). 28) A cyclone of great intensity crossed the province of Havana on Oct. 17, 1906 and caused damage and ruined the trees at the (Cuban) capital (Martinez-Fortun, 1942). 29) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 18. center placed 24.7 N., 80 W. (probably a bit S. and E.); difficult to read observations; Key West, N.W. f. 9, pressure could not be read. Oct. 19, ship near 31 N., 77.7 W., E. f. 9, 29.26; center placed 30 N., 78.3 W. Oct. 20, ship near 32 N., 77 W., E. f. 8, pressure could not be read; Charleston, N.N.E. speed could not be read, 29.47; Wilmington, N.E. f. 6, 29.52; center placed 31.5 N., 78 W, probably a bit S. Oct. 21, Jacksonville E. f. 4, 29.64; Tampa, W. f.3, 29.66; center between both cities. Oct. 22, Tampa, E.N.E. speed could not be read, 29.85; Key West, S.W. f. 4, 29.80; center placed 26 N., 82.3 W.. Oct. 23, ship near 22.7 N., 86.2 W., N.E. f. 5, 29.68; ship near 21.5 N., 85.5 W, no wind reported, 29.80, showers; center placed 22.5 N., 85.5 W. Oct. 24, center no longer identified (Historical Weather Maps, Oct. 1906). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 30) Some observations taken at Key West, Fl.: Oct. 17, noon, 29.67, E. 17; 4 P.M., 29.62, W. 10; 8 P.M., 29.59, N.E. 14; 10 P.M., 29.53, N.E. 23; midnight, 29.46, N.E. 27; 1 A.M. Oct.18, 29.42, N.E. 26; 2 A.M., 29.36, N.E. 29; 3 A.M., 29.30, N.E. 33; 4 A.M., 29.32, N.E. 34; 5 A.M., 29.36, N. 41; 6 A.M., 29.42, N.W. 38; 7 A.M. 29.48, N.W. 45 A.M., 29.57, N.W. 50; 9 A.M., 29.60, N.W. 38; 10 A.M., 29.62, N.W. 26; noon, 29.63, N.W. 33; 4 P.M., 29.67, N.W. 27; 8 P.M. , 29.74, N.W. 17 (Cline, 1926). Author's note: Pressures are in inches; wind speeds are in mph. 31) Taken from a report from F.E. Tartwell, assistant observer at Key West. About 3:30 A.M. Oct. 18 the wind backed to N. and by 4:30 A.M. to the N.W. The barometer fell until 3 A.M., with minimum reading 29.30 inches. The center of the storm passed very near and S.E. of the station. At Sand Key the lowest reading was about 29.25 inches, and wind velocities as high as 75 mph were recorded at that station. The highest velocity at Key West, 54 mph occurred at 7:20 A.M. Oct. 18. The Revenue cutter "Fessenden" was the only large vessel that received injuries in this port. The quarter boats of the East Coast Extension were carried out to sea and many lives, probably more than 100, were lost. Forty-five men were picked up by the steamer "Jenny" and returned to Key West; 24 were landed at Savannah, Ga., and a number were picked up by other steamers (Monthly Weather Review, Oct. 1906). Author's note: The Daily Miami Metropolis, Oct. 19, 1906, p.1, col.3 added that the survivors picked up by the "Jenny" were part of 150 men who were in waterboat N. 4 at Long Key, which was driven out to sea by the storm and went to pieces. 32) The

following extract from the log of tug "Sybil", moored at Miami, Fl. during the storm was furnished by master Dan Ross: Oct. 18, 4 A.M., N.E. gale blowing with much rain. Barometer falling rapidly. At 9:30 A.M. wind died out and the lowest barometer (28.55 inches) was noted. The calm lasted about 30 minutes, then came on a blow from the N.W., backing to W.N.W. and blowing very hard until noon, when it began to abate, and by night the gale had ceased (Monthly Weather Review, Oct. 1906). Author's note: The Daily Miami Metropolis, Oct. 19, 1906. p.1, cols.1 and 4-5, also reported that about 9 A.M. Oct. 18 the wind (at Miami) died to a calm and many thought the storm had ended and that a few minutes later the wind shifted to N.W. with renewed energy. Several barometer readings ranged from 28.78 to 28.15 inches around 10 A.M. Oct. 18, being these values the lowest ever recorded at Miami. 33) The conductor of a train that late last night (Oct. 18) reached Ft. Pierce, Fl. from Miami reported terrible destruction there by the hurricane. Fully 100 houses have been blown down and the city was in a demolished condition. The churches of the Episcopal and Methodist denominations were blown down. The jail, when the train started, was leaning and in danger of turning over, and the prisoners had been removed. Just before the wires connecting Jacksonville with the south went down, the operator at Miami reported a big storm and an unusually high tide. The last word from there said that the water was 3 feet deep in the telegraph office and that low streets were flooded (The New York Times, Oct. 19, 1906, p.1, col.1). 34) Taken from a report by H.P. Harvin, Observer, Weather Bureau, Jupiter, Fl.: A passenger steamer, the "St. Lucie", an old river packet, was swamped and 23 of the 80 people on board were lost near Elliott's Key (Monthly Weather Review, Oct. 1906) 35) Some observations taken at Jupiter, Fl.: Oct. 18, 4 A.M., 29.65, S.E. 21; 8 A.M., 29.54, E. 30; 10 A.M., 29.38, E. 51; 11 A.M., 29.28, N.E. 55; noon, 29.26, N.E. 55, 1 P.M., 29.33, N.E. 44; 2 P.M., 29.45, N. 47; 3 P.M., 29.48, N.W. 41; 4 P.M., 29.53, N. 32; 6 P.M., 29.60, N.W. 18; 8 P.M., N.W. 15 (Cline, 1926). Author's note: Pressures are in inches; wind speeds are in mph. 36) Washington, Oct. 19. The hurricane which swept from Cuba to the Bahamas now appears to be raging at full force about 200 miles out in the Atlantic, the only shore effect being tonight a falling barometer and 25 mph winds blowing on the Carolina coast (The New York Times, Oct. 20, 1906, p.2, col.2). 37) Washington, Oct. 20. The western edge of the tropical hurricane which passed N.E. from the Florida Straits Thursday night (Oct. 18) struck the South Carolina coast at 5 this afternoon. The barometer at Charleston sank to 29.16 inches, with a maximum wind velocity of 64 mph from the N. No serious damage reported (The New York Times, Oct. 21, 1906, p.9, col.4). 38) An unusual course, and one which illustrates the effect of higher latitude events on hurricane motion, was that of the hurricane of Oct. 1906. Its northeastward course in the Atlantic was blocked by high pressure on the North Atlantic coast and on Oct. 20 it turned westward, then southward across Florida where it dissipated (Tannehill, 1938). Author's note: Rather than using the words "blocked by high pressure"..., it would be much more meaningful to say: stirred by the easterly air flow associated with high pressure on the North Atlantic coast... In addition, information in item 29) suggested that the storm dissipated over the southeastern Gulf of Mexico off western Cuba and not over Florida. 39) Some maximum wind velocities associated with the storm were: Sand Key, N.W. 75 mph; Key West, N.W. 54 mph; Jupiter, N.E. 60 mph; the date was Oct. 18 for the three stations above; Wilmington, N.E. 38 mph; Charleston, N. 64 mph; Columbia, N.E. 36 mph; Augusta, N.E. 32 mph; Savannah, N. 42 mph; the date was Oct. 20 for the five stations which were just mentioned (Monthly Weather Review, Oct. 1906). 40) Storm of Oct. 18-20, 1906. S.E. coast of Florida. Major. 164 killed. Miami, barometer 28.55 inches. South Carolina. Minor, remained offshore (Dunn and Miller, 1960). Author's note: The minimum pressure of 28.55 inches at Miami was

found to be a bit high to correspond to a major hurricane; however, pressure readings ranging from 28.78 to 28.15 inches discussed in the author's note accompanying item 32) were found to partially support major hurricane intensity. 41) Map showing a track for this storm as follows: Morning of Oct. 17, near 21 N., 84 W.; evening of Oct. 21, over Cuba to the S.E. of Havana; morning of Oct. 18, near 24.5 N., 80.5 W.; morning of Oct. 19, near 32 N., 76 W.; morning of Oct. 20, near 32.5 N., 77.5 W.; evening of Oct. 20, to the S.E. of Charleston; morning of Oct. 21, between Jacksonville and Tampa; evening of Oct. 21, just E. of Tampa (Monthly Weather Review, Oct. 1906). 42) A storm was first observed near 11 N., 82 W. on Oct. 9, 1906 and was last observed near 12 N., 84 W., having lasted less than one day. A second storm was first observed near 14 N., 64 W. on Oct. 11 and lasted 11 days; it recurred near 21 N., 85 W. and it was last observed near 26 N., 82 W. (Mitchell, 1924). Author's note: Tracks for these storms in Tannehill (1938) were found to be similar to the ones in Mitchell (1924); however, the track for the first storm in Neumann et al. (1993) was started one day earlier than in Mitchell (1924). It should be mentioned that the portions of the tracks over the Caribbean Sea for the second storm in the three publications above were not supported by data in Historical Weather Maps (Oct. 1906) and were found to be in error.

On the basis of information in the above items, the author of this study modified the tracks of Storms 7 and 8 in Neumann et al. (1993) and produced a track for a single storm which was designated as Storm 8, 1906. In fact, modified portions of the tracks in the above publication were used in preparing the author's track corresponding to Storm 8, 1906. His track was started with his 7 A.M. Oct. 8 position which was estimated near 11.3 degrees N., 77.3 degrees W. on the basis of information in item 1); this position was about 120 miles to the E. on the corresponding position for Storm 7 in Neumann et al. (1993); the author's track was not extended backwards from Oct. 8 because, although information in items 2) and 3) suggested a perturbation near the Windward Islands on Oct. 4-5, the existence of a closed cyclonic circulation could not be definitively established prior to Oct. 8. The author's 7 A.M. Oct. 9 position was estimated near 11.5 degrees N., 81.5 degrees W. on the basis of space-time continuity and information regarding landfall N. of Bluefields in the night of Oct. 9 (item 6); this position was about 30 miles to the E.S.E. of the corresponding one in Neumann et al. (1993) for Storm 7, 1906. The author's 7 A.M. positions for Oct. 10-11 were primarily based on space-time continuity between landfall occurrence on the Nicaraguan coast (item 6) and the author's 7 A.M. Oct. 12 estimated position; the author's 7 A.M. Oct. 10 was near 13.0 degrees N., 84.5 degrees W. and the analogous position for Oct. 11 was near 14.0 degrees N., 86.3 degrees W. The author's 7 A.M. Oct. 12 position was estimated near 15.5 degrees N., 87.3 degrees W. on the basis of information regarding to the storm on the northern coast of Honduras and adjacent islands contained in item 10). The author's positions for the period Oct. 13-14 were primarily based on space-time continuity between the above position and the author's estimated one for 7 A.M. Oct. 15; these positions were along the coast of Belize and allowed for some deceleration from Oct. 12 to Oct. 13 and a more marked deceleration from Oct. 13 to Oct. 14; the introduction of the deceleration was justified by the fact that the storm showed to be sharply recurving to the N., and the author's positions were estimated near 16.7 degrees N., 88.0 degrees W. at 7 A.M. Oct. 13 and near 17.7 degrees N., 88.3 degrees W. at 7 A.M. Oct. 14. Primarily on the basis of information in item 1), which includes observations taken at Merida (Yucatan), the author's 7 A.M. positions for the period Oct. 15-16 were estimated as follows: Oct. 15, near 18.5 degrees N., 88.0 degrees W.; Oct. 16, near 19.5 degrees N., 87.0 degrees W. These two positions showed a turn to the N.N.E. and N.E. and the 7 A.M. Oct. 16 position was

found to be about 150 miles to the W.S.W. of the corresponding position in Neumann et al. (1993) for Storm 8, 1906. The author's 7 A.M. Oct. 17 position was estimated near 20.7 degrees N., 84.5 degrees W. and was primarily based on space-time continuity as applied backwards, using information for Nueva Gerona in item 18; this position was found to be about 200 miles to the S.S.W. on the corresponding position in Neumann et al. (1993) for Storm 8, 1906. The author's 7 A.M. Oct. 18 position was primarily based on information about the storm at Miami in item 32) and was estimated near 25.3 degrees N., 80.7 W.; this position was found to be about 60 miles to the S.W. of the corresponding one in Neumann et al. (1993) for Storm 8, 1906. Author's 7 A.M. positions for the period Oct. 19-22 were primarily based on information in item 29), but information in item 37) and space-time continuity as applied backwards also became important on Oct. 20; positions for the above mentioned period were as follows: Oct. 19, near 30.0 degrees N., 78.0 degrees W.; Oct. 20, near 31.7 degrees N., 78.3 degrees W.; Oct. 21, near 29.5 degrees N., 81.5 degrees w.; Oct. 22, near 26.0 degrees N., 82.0 degrees W.; differences between the above positions and the respective ones in Neumann et al. (1993) for Storm 8, 1906 ranged from about 80 miles on Oct. 22 to about 30 miles on Oct. 20. On the basis of information in item 29), the track for Storm 8, 1906 in Neumann et al. (1993) was extended to Oct. 23, resulting in the author's estimated position near 22.3 degrees N., 85.7 degrees W. for 7 A.M. Oct. 23. The author's track for Storm 8, 1906 is shown in Fig. 2.

The content of a number of the 42 items above was found to support the hurricane status that Neumann et al. {1993} gave to Storms 7 and 8, 1906 in their publication; therefore, the author of this study showed that status along portions of his track for Storm 8, 1906. Hurricane status was first introduced along the author's track on Oct. 9 based on information in item 6) and was kept to around noon Oct. 10, some 14 hours after the storm made landfall on the Nicaraguan coast. On the basis of the content of item 10), the author decided to reinstate hurricane intensity shortly after the storm moved off the Honduran coast on Oct. 12, and such intensity was denoted along the author's track until late Oct. 20 (item 37). Based on pressure readings ranging from 28.78 to 28.15 inches taken at Miami (item 32) and on information in item 4, the storm was a major hurricane in the southeastern Florida area. In addition, information contained in several other items strongly suggested that the storm was a major hurricane in Cuba as well. Tropical storm intensity was denoted along the author's track on Oct. 8, from about noon Oct. 10 to the morning of Oct. 12 and from late Oct. 20 to late Oct. 21. The tropical depression (dissipation) stage was introduced along the author's track on Oct. 22 and continued on Oct. 23.

#### Storm 9, 1906 (Oct. 14-17), T. S.

The following information was found about this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 13, low placed 26.5 N., 63.5 W.; however, E. and S.E. winds were reported by ships to the S. of the low; a low, if any, should have been associated with a cold front extending from 40 N., 55 W. to 33 N., 61 W., but no low could be identified along the front. Oct. 14, ship near 34 N., 64.7 W., N. f. 4, 29.74; 1005 millibar (29.68) low placed 33 N., 63.5 W. Oct. 15, ship near 34 N., 69 W., E.S.E. f. 5, 29.62, showers; ship near 33 N., 73 W., N.N.W. f. 9, 29.71; ship near 35 N., 65 W., E.S.E. f. 6, 29.91; ship near 38 N., 67 W., W. f. 7, 30.06; low placed near 32.5 N., 69.5 W. (probably a bit far to the S.E.). Oct. 16, ship near 30 N., 77.7 W., N. f. 8 or higher, pressure not clearly read but probably 29.62; ship near 33 N., 76 W., E. f. 6, 29.77; ship near 29 N., 80 W., N.W. f. 5, 29.83; ship near 28 N., 79 W., N.W. f. 3, 30.00 (too high); center placed 30 N., 76.5 W. Oct. 17, Jacksonville,

N.E. f.4, pressure could not be read, drizzle; Tampa, N.W. f. 2, pressure could not be read; ship near 28 N., 79 W., W. f. 3, 29.74; low placed 28.5 N., 81.5 W. (too far W.). Oct. 18, system could not be identified, having been absorbed by the circulation of Storm 8, 1906 (Historical Weather Maps, Oct. 1906). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Washington, Sept. 15. There is a disturbance over the Atlantic, S.E. of Hatteras (The New York Times, Oct. 16, p.9, col.6). 3) National Meteorological Observatory, Oct. 15, 3 P.M. We have received from the Weather Bureau of Washington the following advisory: "N.E. storm signals were ordered at 2:40 P.M. for Miami, Jupiter, Jacksonville, Savannah and Charleston. The perturbation off the S.E. coast of the United States will produce strong N. winds on that coast and in Florida" (Diario de la Marina, Havana, Oct. 16, 1906, morning edition, p.3, col.6). 4) National Meteorological Observatory, Oct. 17, 10 A.M. Yesterday afternoon we received the following telegram from the Weather Bureau of Washington: "At 4 P.M. weather conditions were suspicious near the central and southern Atlantic coasts and the eastern Gulf of Mexico, and strong N.E. winds are likely during the next 2 or 3 days" (Diario de la Marina, Havana, Oct. 17, 1906, evening edition, p.1, col.4). Author's note: Conditions over the eastern Gulf of Mexico were related to Storm 8, 1906 and not to this storm. 5) National Meteorological Observatory, Oct. 17, 4 P.M. We have received the following telegram from the Weather Bureau of Washington: "Northeast storm signals were placed at Apalachicola, Cedar Keys, Dunnellon, Tampa, Punta Gorda, Punta Rassa, Key West, Miami, Jupiter and Charleston due to a perturbation to the E. of the northern coast of Florida and one that appears to be approaching Cuba from the Caribbean Sea" (Diario de la Marina, Oct. 18, 1906, supplement, p.1, col.1). Author's note: The perturbation approaching western Cuba was Storm 8, 1906. 6) A storm was first observed near 30 N., 62 W. on Oct. 13, 1906 and lasted 4 days; it was last observed near 30 N., 79 W. (Mitchell, 1924). Author's note: Tracks for this storm in Tannehill (1938) and Neumann et al. (1993) were found to be similar to the corresponding one in Mitchell (1924).

On the basis of information in the above items, item 1) in particular, the author of this study introduced some modifications along the track for this storm in Neumann et al. (1993). As the weather system could not be identified as a closed circulation on Oct. 13 (item 1), the author of this study started his track with his 7 A.M. Oct. 14 position which was estimated near 33.7 degrees N., 63.5 degrees W. on the basis of information for that day in item 1); this position was found to be about 50 miles to the E. of the one in the above publication. The 7 A.M. Oct. 15 position was kept unchanged because it was found to agree with information for that day in item 1). Author's estimated positions were near 30.5 degrees N., 76.5 degrees W. for 7 A.M. Oct 16 and near 29.3 degrees N., 79.5 degrees W. for 7 A.M. Oct. 17; these positions were based on information in item 1) and in items 1) and 5), respectively, and were found to be about 120 miles to the S.W. of the 7 A.M. Oct. 16 position in Neumann et al. (1993) and about 70 miles to the E. of the one for 7 A.M. Oct. 17 in the above publication. The author's track for Storm 9, 1906 is displayed in Fig. 2.

The tropical storm status which Neumann et al. (1993) gave to this storm was supported by ship information in item 1); that status was denoted along the author's track over the period Oct. 14-16 and was changed to the tropical depression (dissipation) stage on Oct. 17 in compliance with information in item 1).

Storm 10, 1906 (Oct. 15-20), T. S.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 14, Santo Domingo, N. f. 2, 29.84; San Juan, S. f. 1, 29.83; Turks Is., N.E. f. 1, 29.85. Oct. 15, Turks Is, N.N.W. f. 4, 29.72; Santo Domingo, S. f. 3, 29.76; San Juan, S. f. 3, 29.76; center placed 22 N., 69.5 W., defined by a 1005 millibar (29.68) closed isobar. Oct. 16, Turks Is., W f. 3, 29.74; ship near 28 N., 70 W., E.S.E. f. 5, 29.68; ship near 27 N., 74 W., E. f.2, 29.86; center placed 27 N., 70.5 W. (maybe a bit to the E.). Oct. 17, ship near 28 N., 74 W., N. f. 8, 30.06; ship near 26 N., 68 W., 29.68; ship near 25 N., 69 W., W. f. 2, 29.80; center placed 27 N., 69 W. and denoted by a 1005 millibar (29.68) closed isobar (too far S.). Oct. 18, ship near 28 N., 68 W., W. f. 4, 29.74; ship near 25 N., 69 W., S.W. f. 3, 29.88; ship near 32 N., 63 W., E.N.E. f. 2, 29.94; center placed 29.3 N., 66 W., enclosed in a 1005 millibar (29.68) isobar. Oct. 19, no data around the center; center placed, still 1005 millibars (29.68), 27 N., 60 W. (probably too far E.). Oct. 20, ship near 28 N., 56 W., S. f. 2; ship near 29 N., 58 W, calm; center near that ship on the basis of the reported calm was also inferred from the curvature of the 1010 millibar (29.83) isobar. (Historical Weather Maps, Oct. 1906). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches.

Curiously, neither Mitchell (1924) nor Tannehill (1938) included tracks for this storm in their works. Therefore, the track in Neumann et al. (1993) was the only one available to the author of this study who introduced some modifications along such a track and extended it backwards from one day. The author's track was started with his 7 A.M. Oct. 15 estimated position near 21.7 degrees N., 70.0 degrees W., which was the earliest one which could be determined from information in item 1) because no closed cyclonic circulation could be inferred from the weak winds reported on Oct. 14. Author's 7 A.M. positions for the period Oct. 16-20 were estimated as follows: Oct. 16, near 26.5 degrees N., 71.3 degrees W.; Oct. 17, near 28.5 degrees N., 69.3 degrees W.; Oct. 18, near 29.3 degrees N., 66.0 degrees W.; Oct. 19, near 29.3 degrees N., 62.0 degrees W; Oct. 20; near 29.0 degrees N., 58.0 degrees W. The author's track for storm 10. 1906 is displayed in Fig. 2.

Rigorously speaking, the tropical storm status which Neumann et al. (1993) gave to this storm was suggested by only one ship report showing a force 8 wind on the Beaufort scale. But, in addition, winds of barely tropical storm intensity could be inferred to have existed E. of the center at least on Oct. 15, when a N.N.W. f. 4 (roughly 15 mph) was reported at Turks Is (item 1) as the storm center was moving towards the N.N.W. at an estimated rate of 13 mph. Therefore, tropical storm status was accepted and denoted along the author's track over the period Oct. 15-18; that status was changed to the tropical depression (dissipation) stage on Oct. 19.

It should be finally mentioned that the author of this study investigated a possible link of this storm with a gale reported to have occurred at Curacao on Oct. 13 but no evidence of a connection was found. The gale in question will be presented as a possible case for 1906.

#### Storm 11, 1906 (Nov. 5-9), H.

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Nov. 2, ship on southern Cuban coast near 80 W., E.N.E. f. 2, 29.97; ship near 16 N., 76 W., E. f. 5, 29.83. Nov. 3, ship on southern Cuban coast near 80 W., N.E. f. 2, 29.97; ship near 16 N., 76 W., S.S.E. f. 5, 29.83. Nov. 4, ship near 16 N., 74 W., E. f. 4, 29.86; ship near 13 N., 77 W., E.N.E. f. 5, 29.80. Nov. 5, ship on

the southern Cuban coast near 80 W., E.N.E. f. 2, 29.88, rain; ship near 12 N., 74 W., E.N.E. f. 5, 29.74; ship near 11 N., 81 W., N.E. f. 2, 29.83; ship near 18 N., 84 W., N.E. f. 3. Nov. 6, ship near 16 N., 74 W., S.E. f. 5, 29.74; ship near 14 N., 79 W., N. f. 3 (wind direction probably wrong), 29.83, rain; ship near 24 N., 80 W., E. f. 9, 29.88; ship near 18 N., 76 W., E.S.E. f. 3; low placed 20 N., 79 W. (too far E.). Nov. 7, ship near 25 N., 80 W., E. f. 6, 29.86; ship near 18 N., 80 W., N.W. f. 5, 29.74; ship near 17 N., 76 W., S.E. f. 4, 29.77; ship near 13 N., 79 W., W.N.W. f. 1, 29.86; center placed 17.5 N., 78.5 W. (position proved to be wrong because the storm was found to be over Cuba). Nov. 8, ship near 27 N., 76.5 W., N.N.E. f. 6, 30.03 (too high); ship near 27 N., 74 W., E.N.E. f. 3; Turks Is, S. f. 4, 29.83; ship near 20 N., 74 W., S.W. f. 3, 29.83; ship near 17 N., 77 W., calm, 29.80; ship near 19 N., 79 W., W.N.W. f. 3, 29.86; low placed 23 N., 75.5 W. Nov. 9, ship near 26.5 N., 74 W., N.E. f. 7, 29.88; ship near 23 N., 74 W., W.S.W. f. 2, 29.91; Turks Is., S.W. f. 5, 29.87; center not placed on map, but probably near 24.5 N., 72.5 W., about to be merging with a cold front. Nov. 10, no center could be easily identified along the front (Historical Weather Maps, Nov. 1906). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Belen College Observatory, Nov. 2, 4 P.M. The perturbation near Grand Cayman has acquired better organization during the last 24 hours and has moved a little to the W. It is getting ready for recurvature. L. Gangoiti, S.J. (Diario de la Marina, Havana, Nov. 3, 1906, morning edition, p.5, col.2). 3) Belen College Observatory, Nov. 3, 8 A.M. The fairly organized perturbation appears to be stationary with little force of aspiration. We expect that it will weaken under the influence of the intense anticyclone which has been present since the last day of last month as we indicated two days ago. L. Gangoiti, S.J. (Diario de la Marina, Nov. 3, 1906, evening edition, p.1, col.3). 4) Belen College Observatory, Nov. 5, 10 A.M. There is a true fight between the anticyclone and the low pressures to the S., which shows up in the barometer behavior, drizzle, sky appearance and steadiness of the currents. Today these ones appear to respond to the perturbation to the S. of this province (Havana) and about 200 miles, which is resisting to dissipate. The perturbation remains as stationary and it is not of great intensity so far. S. Sarasola, S.J. (Diario de la Marina, Havana, Nov. 5, 1906, evening edition, p.1, col.4). 5) Belen College Observatory, Nov. 5, 5 P.M. The cyclonic perturbation has gained some intensity this afternoon, and has become closer to Isle of Pines. The western provinces and perhaps Santa Clara are the most likely places to feel its influence. S. Sarasola, S.J. (Diario de la Marina, Havana, Nov. 6, 1906, morning edition, p.3, col.2). 6) National Meteorological Observatory. Observations taken at 8 A.M. Nov. 5: Pinar del Rio, barometer 756.50 millimeters (29.78 inches), moderate E. wind; Havana, barometer 757.30 millimeters (29.81 inches), fresh E. wind; Santiago de Cuba, barometer 757.43 millimeters (29.82 inches), light N. wind. The above data do not show the existence of a cyclone and the present weather is associated with the strong breeze, which is accompanied by the rains caused by the prevailing disturbance (Diario de la Marina, Havana, Nov. 6, 1906, morning edition, p.3, col. 2-3). 7) Belen College Observatory, Nov. 6, 9 A.M. The barometer drop and the circulation of the currents proved that the perturbation had gained in intensity yesterday. It is now located to the E. of Isle of Pines, between the meridians of Havana and Cienfuegos, with some increase in intensity. Here (at Havana) the wind continues getting stronger and the perturbation will be felt by the incoming ships, but we do not believe they will be in danger. A telegram was sent to Cienfuegos indicating that they should be on alert; and the Matanzas and Santa Clara provinces should be also aware of the situation. S. Sarasola, S.J. (Diario de la Marina, Havana, Nov. 6, 1906, evening edition, p.1, col.4). 8) Belen College Observatory, Nov. 6, 5 P.M. The most threatened provinces (of Cuba)

are the central ones. The tempest, with some intensity, has moved towards the S. of Cienfuegos. S. Sarasola, S.J. (Diario de la Marina, Havana, Nov. 7, 1906, morning edition, p.4, col.4). 9) Belen College Observatory, Nov. 7, 9 A.M. Meteorologists in Washington confirmed yesterday the existence of the cyclone. The first advice was given to them on Nov. 2 and yesterday afternoon we indicated to them that it was gaining in intensity and that it was heading to the Lucayas (Bahamas) through the central provinces (of Cuba). The telegraph in interrupted and we lack observations, but we believe that the cyclone is crossing central Cuba to the E. of Cienfuegos, heading for the Lucayas or their vicinity. S. Sarasola, S.J. (Diario de la Marina, Havana, Nov. 7, 1906, evening edition, p.1, col.5). 10) National Meteorological Observatory, Nov. 7, 4 P.M. Mr Beal of the "Guaibaro Colony" (to the E. and near Cienfuegos) telegraphed the following at 4:45 P.M. yesterday (Nov.6): "Barometer reduced to sea level 29.63 inches, cloudy sky, fresh N.E. wind and showers with heavy rains". Santiago de Cuba at 4 P.M. today (Nov. 7): Barometer 29.66 inches, light S.E. wind, cloudy sky. The Weather Bureau of Washington telegraphed as follows: "N.E. storm warnings have been placed at Miami and Jupiter. The perturbation which is located over central Cuba will probably move E. of N. over the Bahamas" (Diario de la Marina, Havana, Nov. 8, 1906, morning edition, p.3, col.3). 11) National Meteorological Observatory. Telegram from Cruces, 7:50 P.M. Nov. 7: "By daybreak today, the sky was cloudy, after the violent gusts from the N.E. of the night of Nov. 6 had calmed; the pressure dropped to 748 millimeters (29.45 inches). Fresh N.E. (?) wind with partly cloudy sky during the day. At 7 P.M., calm, clear and pressure continues low". From Cifuentes (via mail): The tempest of rain and strong N.E. wind continued the last 24 hours; the barometer dropped from 11 P.M. (Nov. 6) to 3 A.M. (Nov. 7) when it started to rise , with gusts abating and heavy rain ceasing at 4:45 A.M. (Nov. 7). Telegram from Santiago de Cuba, 8 A.M. Nov. 8: "Barometer 755.91 millimeters (29.76 inches), wind S.W. 20 mph, cloudy sky, 77 millimeters (3.06 inches) of rainfall in the past 24 hours (Diario de la Marina, Havana, Nov. 8, 1906, evening edition, p.4, col.1). Author's note: Cifuentes and Cruces are towns in central Cuba. 12) Jaguey Grande, via Bolondron, Nov. 7, 11 A.M. We are under the influence of a heavy rain storm. It has been raining for 4 days. Delgado, correspondent (Diario de la Marina, Havana, Nov. 8, 1906, morning edition, p.3, col.3). Author's note: Jaguey Grande is a town in the interior of Matanzas province. 13) Washington, Nov. 6. Reports received during Tuesday (Nov.6) indicate that the tropical disturbance is still central to the S.W. of Cuba with slightly increased intensity (The New York Times, Nov. 7, 1906, p.9, col.6). 14) Washington, Nov. 7. The tropical disturbance is apparently moving in the direction of the Bahama Islands but no high winds have as yet been reported, except at Havana and in the vicinity of Jupiter (The New York Times, Nov. 8, 1906, p.9, col.4). 15) Washington, Nov. 8. The tropical disturbance has passed N.E. over the eastern portion of the Bahamas without increased intensity so far as is known (The New York Times, Nov. 9, 1906, p.9, col.5). 16) From "La Democracia", a Santa Clara newspaper, issue of Nov. 7: "Since 4 days ago we have been under the influence of a wind and rain storm. From 4 P.M. yesterday (Nov. 6), gusts increased in intensity until this morning, when the weather condition is abating". From "El Comercio", a Cienfuegos newspaper, Nov. 7: "The vortex of the cyclone, which had been announced with much anticipation, passed in the morning hours over the E. (portion) of the province, it is believed that between Trinidad and Sancti-Spiritus. The barometers are rising rapidly and signs of good weather are more evident as time elapses. Some news received by cable say that considerable damage was done at Trinidad but details are lacking" (Diario de la Marina, Havana, Nov. 9, 1906, evening edition, p.4, col.3). 17) From Postal of Remedios, Nov. 7. From 12:30 P.M yesterday (Nov. 6) to midnight,



the barometer dropped 2.5 millimeters (about one tenth of an inch), and from midnight (Nov. 6-7) to 10 A.M. today it rose 0.7 millimeters (about 3 hundredths of an inch). The wind blew always from the first quadrant, and at 10 A.M. changed to the N.N.E., gusty; the height of the wind was at 1 A.M. (Nov. 7). Facundo Ramos (Diario de la Marina, Nov. 10, 1906. evening edition, p.1, col.6). Author's note: Remedios is located on the northern coast of central Cuba, just W. of Caibarien. 18) Extracted from a letter by a subscriber: Mayajigua, Nov. 9. After incessant rains for 3 or 4 days, the weather had acquired the characteristics of a true cyclone at daybreak Nov. 7. The wind fury was such that for a moment everybody believed that was going to demolish all houses, because it was horrible the view of the small flimsy houses with their beams being forced by the violence of the wind and their rooms flooded by torrents of water coming in from every place; the neighbors were asking for help as they were trying to prevent that their belongings were taken by the impetuous current... (Diario de la Marina, Havana, Nov. 13, 1906, evening edition, p.4, col.1-2). Author's note: Mayajigua is located inland over the N.E. portion of Santa Clara (Las Villas) province. 19) Extracted from Revista de Agricultura: The tempest that prevailed last week has produced N.E. gusty winds which acquired its greatest intensity in the eastern half of Santa Clara province, where the rains were also much heavier than in the two easternmost provinces and Matanzas... Some wind damage was done to trees and plants over the eastern portion of Santa Clara province and extreme E. (it should read W.) of Camaguey province... More than 20 tobacco-houses were blown down in Santa Clara province. The wind destroyed banana plantations in N.E. Santa Clara province... and vegetable crops were lost at Moron (Camaguey province). There were floodings in towns and the country side of Ciego de Avila and Sancti-Spiritus as well as at Tunas de Zaza, with some houses and bridges being destroyed... (Diario de la Marina, Nov. 14, 1906, evening edition, p.1, cols.5-6). 20) Extracted from an article by S. Sarasola, S.J., Belen College Observatory, Nov. 14. On Nov. 1 Father Gangoiti announced that "there was an intense anticyclone over the eastern U.S." and that "at the edge of that high pressure area a cyclonic perturbation was forming near Grand Cayman, which would probably cross the central provinces (of Cuba)". On Nov. 3 the depression seemed to be filling up, continuing its indecision on Nov. 4, but on Nov. 5 it deepened some and showed up a better force of aspiration some distance from Isle of Pines. By 8 A.M. Nov. 8 the dark cloud bank to the S. and S.W. of Havana had disappeared, and for a while cloudiness diminished. But by 9 A.M. the scene has changed: clouds, showers, and an ill-defined cloud bank showed up to the S.S.E., and nimbus clouds tended to converge. Frequent gusts started and frequently reached more than 22 meters per second (some 45 mph). Responding to a consult by cable from Santiago de Cuba, I replied the following at noon Nov. 6: "Cyclone of some intensity will probably move over Santa Clara province, E. of Cienfuegos, between today and tomorrow, pursuing a N.E. course. Father Gangoiti is absent. Sarasola". It is not easy to determine the track of the cyclone due to the lack of data, but we believe that we would not be far from reality if it were said that the center of the cyclonic perturbation, already organized as a cyclone of moderate energy, passed between Remedios and Ciego de Avila in the early morning of Nov. 7. Observations taken at the Jesuit school at Cienfuegos supported the above statement. At 2 A.M. Nov. 7 the barometer read 750 millimeters (29.53 inches), being the wind blowing from the N.E. with tempestuous force, and this was the minimum pressure (at Cienfuegos). The lower currents were changing more to the N. and the low clouds were coming from that direction at 6 A.M. (Nov. 7). There was no disorganization of the cyclone; on the contrary, it was gaining in organization and intensity with time (Diario de la Marina, Nov. 15. 1906, evening edition, p.4, cols.1-2). 21) Nov. 6-7, 1906. A cyclone of moderate intensity crossed the central provinces of

Cuba, causing damage of some consideration (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza, which is included in Sarasola (1928). It should be indicated that according to the nomenclature used in regard to weather systems in Cuba, the word "cyclone" normally refers to a storm of hurricane intensity. 22) A moderate cyclone caused damage and flooding in the central provinces (of Cuba) on Nov. 6-7, 1906 (Martinez-Fortun, 1942). 23) Table showing that a cyclone of weak intensity affected the Cuban provinces of Las Villas (Santa Clara) and Camaguey on Nov. 6-7, 1906 (Academia de Ciencias, 1970). 24) A storm was first observed near 16 N., 78 W. on Nov. 6, 1906 and lasted 7 days; it recurved near 18 N., 78 W. and it was last observed near 32 N., 28 W. (Mitchell, 1824). Author's note: A track in Tannehill (1938) is very similar to the corresponding one in the above publication; however, both tracks were found to be in serious error, particularly over the Caribbean Sea, Cuba, and the Atlantic to the east of the Bahamas. The track in Neumann et al. (1993) was somewhat different from the two tracks above, but it was still found to be in serious error over the Caribbean and Cuba.

On the basis of information in the above items, the author of this study introduced a number of modifications along the track for Storm 11, 1906 in Neumann et al. (1993). Although the content of items 2) and 20) suggested a perturbation in the western Caribbean Sea since early Nov., the author's track was not started until Nov. 5, when signs of intensification occurred (items 4 through 6, and 20). Based on information in these items and, to a lesser extent in item 1), the author's 7 A.M. Nov. 5 position was estimated near 19.5 degrees N., 82.5 degrees W. The time of this position was found to be 24 hours earlier than the one corresponding to the first position along the track in Neumann et al. (1993). The author's 7 A.M. Nov. 6 position was estimated near 21.0 degrees N., 81.5 degrees W., primarily on the basis of information in items 7), 8) and 20); this position was found to be about 425 miles to the N.W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Nov. 7 position was based on a detailed analysis of information for that day contained in a number of items and was estimated near 22.0 degrees N., 79.3 degrees W.; this position was found to be about 120 miles to the N. of the one in the above publication. On the basis of information in items 1) and 11), the author estimated a 7 A.M. Nov 8 position near 23.3 degrees N., 75.7 degrees W., which was found to be about 90 miles to the S. of the corresponding position in Neumann et al (1993). The author's 7 A.M. Nov.9 position was based on information for that day in item 1) and was estimated near 24.5 degrees N., 72.3 degrees W; this position was found to be about 90 miles to the S. of the corresponding one in the above publication. The author's track for Storm 11, 1906 is displayed in Fig. 2.

On the basis that the word "cyclone" was of a general use when referring to the storm over Cuba in a number of the above items which include catalogs or tables of Cuban storms (items 21 through 23), and after taking into account that normally that word is reserved in the literature of Cuban storms to those attaining hurricane intensity, the author of this study decided to upgrade to a hurricane the tropical storm status which Neumann et al. (1993) gave to Storm 11, 1993. Hurricane intensity was, therefore, introduced along the author's track late on Nov. 6 as the storm center was approaching the southern coast of central Cuba and such intensity was kept until late Nov. 7. Prior to late Nov. 6 and from around midnight Nov. 7-8 to about noon Nov. 9, tropical storm intensity was denoted along the author's track. The extratropical stage was introduced along the track for the second half of Nov. 9.

Special statement.

In addition to the eleven storms which were fully discussed above, three possible cases were found in 1906. This three cases are presented next.

A) Case of Sept. 16, 1906

This possible case was based on information published in The Times, London, Oct. 3, 1906, p.8, col.2. in regard to the schooner "Morales". The steamer "Bosefield", while on voyage from Tampico to New York, rescued 4 men, survivors of the schooner "Morales" which foundered during a hurricane on Sept. 16 while voyaging between Campeche and Tuxpan. The captain, mate and three seamen were drowned. The survivors were discovered on a raft made of 4 pieces of cedar lashed together and presented a pitiable spectacle. They have been 24 hours floating on the raft with seas sweeping over them. The weather map for Sept. 16 in Historical Weather Maps (Sept. 1906) does not show any data in the Gulf of Campeche area which could be used to verify if indeed there was a tropical storm there on the day mentioned; no sign of a storm was found for the next few days either as some coastal data were available. Under the above circumstances, the author of this study decided to keep this case as a possible one.

B) Case of Oct. 13, 1906.

This possible case was related to the wreck of the steamer "Oranje-Nassau" on the coast of Curacao in the morning of Oct. 13. In a dispatch from Willemstad, Curacao, on Oct. 13, The New York Times, Oct. 14, 1906, p.6, col.4, stated that the steamer "Oranje-Nassau" had gone ashore 3 miles E. of that place in a severe gale in the morning of Oct. 13 and that the vessel was likely to become a total wreck. Similar information was also published in The Times, London, Oct. 15, 1906, p.4, col.4, citing a dispatch from Willemstad, Oct. 14. In a dispatch from San Juan, Puerto Rico, dated on Oct. 19, The New York Times, Oct. 20, 1906, p.2, col.2, published that the "Philadelphia" had arrived there 48 hours late and said that the reason for the delay was that the ship was wrecked (it did not specified where) and met the storm upon leaving La Guayra on Monday, Oct. 15. The "Philadelphia" brought news indicating that a Dutch steamer was lost in a cyclone at a point between Curacao and La Guayra (probably the same case of the above mentioned "Oranje-Nassau") and that 20 miles of railroad connecting La Guayra from Caracas had been totally destroyed by the storm. Examination of maps in Historical Weather Maps (Oct. 1906) revealed a sort of disturbance, probably embedded in the Intertropical Convergence Zone, to the N. of the island of Trinidad, which reported a S.W. f 4 wind with heavy rain in the morning of Oct. 10; the above report was also in line with the disturbance that the Belen College Observatory had announced as "some signs of a cyclonic perturbation" to the W. of Barbados in the afternoon of Oct. 9 (Diario de la Marina, Havana, Oct. 10, 1906, morning edition, p.4, col.5). Data for Curacao as displayed on morning maps in Historical Weather Maps (Oct. 1906) were examined for the period Oct. 9-16 with the following results: a) the wind changed from E. on Oct. 9 to S. on Oct. 10, suggesting that the Intertropical Convergence Zone moved from the S. to the N. of Curacao during the 24-hour period; b) the wind, as shown on plotted morning data, was found to be from the S.W. over the period Oct. 11-15, suggesting that the Intertropical Convergence Zone remained to the N. of Curacao during those 5 days; c) the wind changed from S.W. on Oct. 15 to N. on Oct. 16, suggesting that the Intertropical Convergence Zone returned to the S. of Curacao during the 24-hour period. The strongest wind

at Curacao (as plotted on morning maps) was S.W. f. 4 on Oct. 13, accompanied by rain; a somewhat higher wind (W.S.W. f. 5) was reported by a ship near 10.7 N., 67 W. (off La Guayra) on the morning of Oct. 12. Rainfall at Curacao was 4.48 inches for the 24-hour period ending at 8 A.M. Oct. 13. It seems from the above information that the weather condition which caused the destruction of railroads in Venezuela and the wreck of the "Oranje-Nassau" in a heavy gale near Willemstad, Curacao, on Oct. 13 was an ITCZ disturbance and not a tropical storm having a closed circulation of its own. However, there was on the Oct. 13 map a ship near 13 N., 70 W. (just N.W. of Curacao) showing an E.N.E. f. 4 wind which, if it were correct, would allow for a possible cyclonic circulation to have existed, at least temporarily, on Oct. 13. This is why the author of this study decided to keep this one as a possible case.

Case of Oct. 14-15, 1906.

The morning map for Oct. 13 in Historical Weather Maps (Oct. 1906) showed a low near 24.5 N., 91.5 W., but without any data supporting the closed circulation. However, a ship near 28 N., 92 W. reporting a S.E. f. 7 wind and a pressure of 29.80 inches with rain and a N. wind f. 6 with rain at Galveston indicated a low pressure area in the Gulf of Mexico in the morning of Oct. 14; consequently, a low was placed on the map near 26.5 N., 93.5 W. By the morning of Oct. 15 the wind was N.W. f. 4 at Galveston, but no center was drawn on the corresponding weather map. No winds of tropical storm intensity were reported in connection with this low pressure area, which was not even tracked in the Monthly Weather Review (Oct. 1906). However, the author of this study believes that this low pressure area had a moderate chance of having become a tropical storm before passing inland late on Oct. 14 or on Oct. 15, and this is why he decided to keep this one as a possible case.

Two other cyclonic circulations were found over the tropical or subtropical Atlantic in Oct. 1906. One of them was first placed near 11.5 N., 55 W. on Oct. 11 (Historical Weather Maps, Oct. 1906) and announced by the Belen College Observatory as some signs of a perturbation to the S. and not very far from Barbados in the afternoon of Oct. 12 (Diario de la Marina, Havana, Oct. 13, 1906, morning edition, p.4, col.6); this system moved towards the N., just E. of the Lesser Antilles, for several days and winds at stations did not exceed force 3 on the Beaufort scale, indicating that the system remained weak. The second cyclonic circulation was placed over and to the N.E. of the Bahamas on weather maps for Oct. 25-27 (Historical Weather Maps, Oct. 1906), with just one wind report showing force 4 on the Beaufort scale. On the basis of the above information, the author of this study believes that these two circulations practically did not have any chance to have attained tropical storm intensity and, therefore, he decided not to include them as possible cases.