

Fig. 4

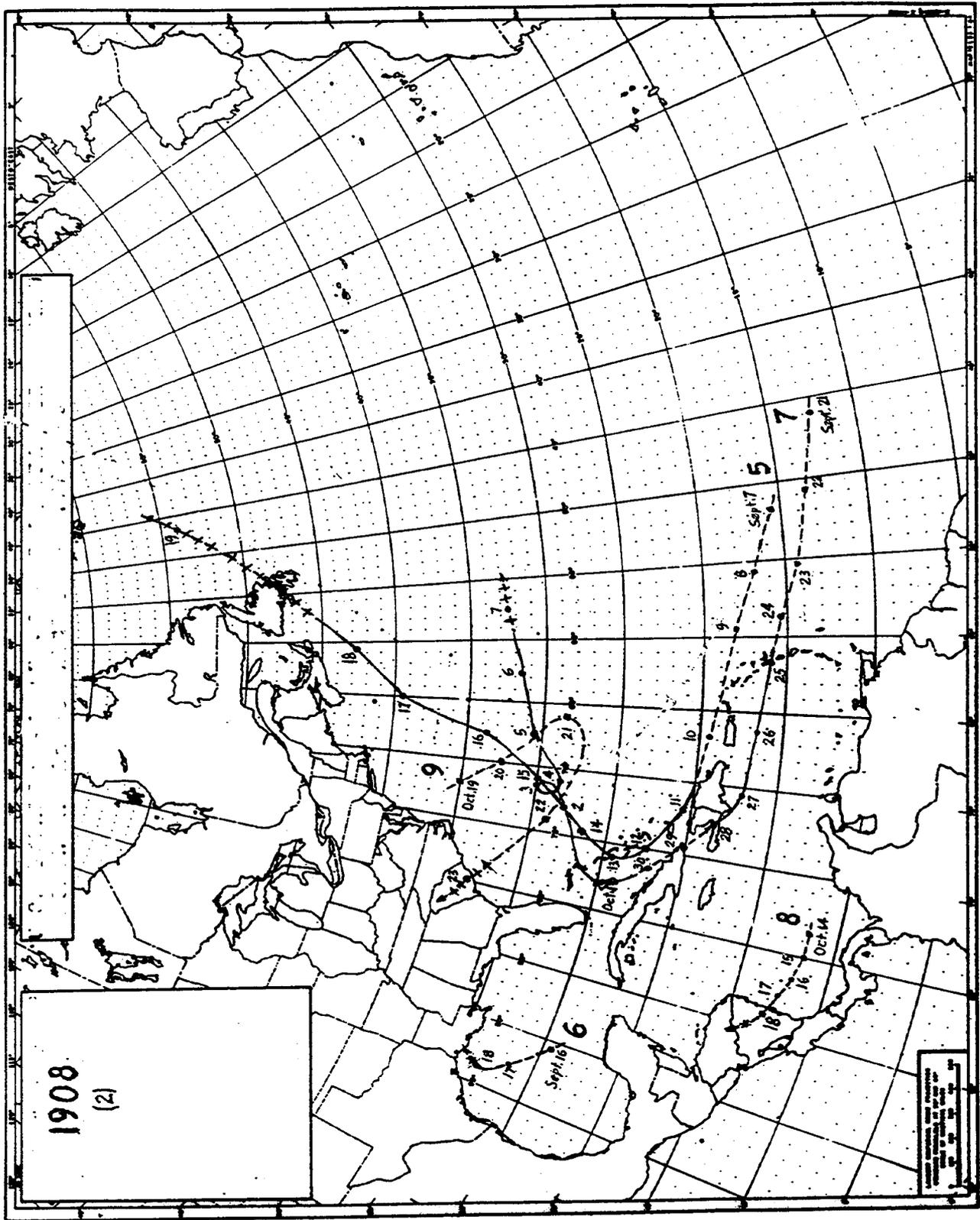


Fig. 4 continued

introduced some modifications along the track shown in Neumann et al. (1993) as for Storm 4, 1908. No modifications were introduced for the period Sept. 7-10 because either there was no information to check the positions or the available information, particularly in item 2), was found to support, in general, the 7 A.M. positions in the above publication. The 7 A.M. Sept. 11 position in Neumann et al. (1993) was adjusted by about 60 miles to the W.S.W. to near 20.5 degrees N., 72.0 degrees W. in order to fit information in items 2), 7) and 12) for that day. The 7 A.M. Sept. 12 position was adjusted to the W. by about 40 miles to near 22.5 degrees N., 75.0 degrees W. in order to allow for Long Island to be on the E. side of the center track, accounting better for the tremendous damage reported there (items 19 and 21). The 7 A.M. Sept. 13 position was kept unmodified because it was found to agree with information for that day in item 2). The 7 A.M. Sept. 14 position was, however, adjusted a short distance to the S.W. to near 26.7 degrees N., 74.5 degrees W. in order to fit better information for that day in item 2). Adjustments introduced in the 7 A.M. positions for the period Sept. 15-19 resulted in the following author's estimates: Sept. 15, near 30.0 degrees N., 71.0 degrees W.; Sept. 16, near 33.7 degrees N., 67.7 degrees W.; Sept. 17, near 39.5 degrees N., 65.0 degrees W.; Sept. 18, near 42.7 degrees N., 60.7 degrees W.; Sept. 19, near 54.0 degrees N., 46.5 degrees W. The above adjustments were made on the basis of information in item 2) for the respective days, and the differences between the author's 7 A.M. positions and the corresponding ones in Neumann et al. (1993) were found to range from about 240 miles on Sept. 19 to just a few miles on Sept. 16. The author's track for Storm 5, 1908 is displayed in Fig. 4.

Information contained in a number of the above items confirmed the hurricane status that Neumann et al. (1993) gave to this storm as for Storm 4, 1908. At least moderate hurricane intensity and the possibility of a major hurricane were suggested by information in some of the items. As in Neumann et al. (1993) for Storm 4, 1908, the author of this study denoted hurricane intensity along his track starting early on Sept. 10 and ending it late on Sept. 18 to allow for the storm to have crossed Newfoundland as an extratropical system. Prior to Sept. 10, tropical storm intensity was denoted along the author's track.

Storm 6, 1908 (Sept. 16-18), T. S.

This storm corresponds to Storm 5, 1908 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. 16, ship near 23 N., 88 W., S.W. f. 1, 29.91; Port Eads, N.E. f. 4, 29.96; ship near 27.8 N., 93 W., N.N.E. f. 5, 29.97; ship near 28 N., 87 W., E.N.E. f. 5, 29.94; center placed 24.5 N., 90.5 W. Sept. 17, Galveston, N. f. 7, pressure could not be clearly read but probably 29.83; ship near 26.7 N., 90 W., S.E. f. 6, 29.91; center 1005 millibars (29.68) placed 27.2 N., 92.8 W. Sept. 18, New Orleans, N.E. f. 5, 29.88; Galveston, N.E. f. 4, 29.79; ship near 26 N., 91 W., S.S.E. f. 4; Corpus Christi, N.W. f. 2, 29.81; center placed 27 N., 93.5 W. (too far S.). Sept. 19, New Orleans, N.E. f. 2, 29.89; Port Eads, S.E. f. 2, 29.86; Galveston, E. f. 2, 29.80; ship near 27 N., 91 W., W.S.W. f. 5, 29.88; center placed 27 N., 94 W., but center, if a closed circulation (and not an E.-W. trough existed, should have been on the central Louisiana coast (Historical Weather Maps, Sept. 1908). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) This disturbance was attained by a wind velocity of 64 mph at Galveston (Monthly Weather Review, Sept. 1908) Author's note: In a separate table the Monthly Weather Review (Sept. 1908) indicated that the maximum wind

velocity at Galveston was N.E. 62 mph on Sept. 17.

Information in the above items, particularly in item 1) was found to support, in general, the track shown in Neumann et al. (1993) as for Storm 5, 1908; however some consideration was given to the possible extension of that track to Sept. 19, resulting in a negative decision due to uncertainties about the existence of a closed cyclonic circulation on that day (item 1). Therefore, the track in Neumann et al. (1993) for Storm 2, 1908 is reproduced in Fig. 4 as for Storm 6, 1908.

The tropical storm status given to this storm in Neumann et al. (1993) was confirmed by the maximum wind velocities ranging from 62 to 64 mph at Galveston (item 2) and by the drawing of a closed isobar of 1005 millibar (29.68 inches) on the Sept. 17 morning map (item 1). Following Neumann et al. (1993) as for Storm 5, 1908, tropical storm status was denoted along the Sept. 16-17 track and the tropical depression (dissipation) stage was introduced around noon Sept. 18.

Storm 7, 1908 (Sept. 21- Oct. 7), H.

This is the same storm which Neumann et al. (1993) identify as Storm 6, 1908.

The following information was found in relation to this storm: 1) On Sept. 24 West Indian stations were advised of the presence of a cyclonic disturbance east of the Lesser Antilles in latitude about 15 N. On the following morning West Indian ports and Atlantic and Gulf shipping interests were informed that a disturbance of marked intensity near the Leeward Islands was moving in a westerly direction. During the succeeding two days the hurricane center moved on a W.N.W. course and at 6 A.M. Sept. 28 past near Port-au-Prince with a reported minimum barometric reading at that place of 29.24 inches. Continuing on a W.N.W. course the vortex of the storm advanced over or near the Great Bahama Bank by the close of the month and recurved then northward over the western Bahamas by Oct. 1, with reported minimum barometric pressure 28.68 inches at 10 A.M., and a wind exceeding 80 mph from the S. at Nassau. Assuming a N.E. course the storm then advanced over the Atlantic in the direction of Bermuda (Monthly Weather Review, Sept. 1908). Author's note: The Monthly Weather Review, Oct. 1908 added to the description above that during Oct. 3-4 severe gales were experienced on the N.E. coast of Cuba and that on Oct. 6 a disturbance that was probably a continuation of the Bahamas hurricane past near Bermuda with a reported barometric pressure of 29.22 inches. 2) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Sept. 21, center 1010 millibars (29.83) placed 11 N., 45.5 W.; no data in the vicinity; location appears to be too far S. Sept. 22, ship near 15 N., 47 W., S.S.E. f. 6; center placed 12.5 N., 50.5 W.; however, near 13.5 N., 50.5 W. seems to be a better location. Sept. 23, ship near 16 N., 54 W., E. f. 8, 29.83; ship near 17 N., 53 W., E. f. 5, 29.86, showers; ship near 14 N., 58 W., N.E. f. 5, 29.83; center placed 11.5 N., 53 W., too far S., near 14 N., 54.5 W. would probably be much better. Sept. 24, Barbados, W. f. 2, 29.87; ship near 12 N., 58 W., S. f. 5, 29.86, showers; ship near 17 N., 57 W., E. f. 7, 29.83; center placed 14 N., 56 W., but near 15.3 N., 58.3 W. appears to be a much better location. Sept. 25, Martinique, S. f. 4, 29.79; Dominica, S.W. no speed but very weak; 29.75; ship near 17 N., 61 W., E. f. 7, 29.77; center placed 13 N., 64.5 W., wrong location, between Guadeloupe and Dominica appears to be the correct one. Sept. 26, ship near 19 N., 64 W. E. f. 4, 29.80; San Juan, E. f. 5, 29.79; Santo Domingo, N.E. f. 6; Port-au-Prince, W.N.W. f. 2, 29.71; center placed 15.5 N., 68 W., but around 16.7 N., 66.3 W. appears to be a better location. Sept. 27, San Juan, S.E. f. 3, 29.86; Santo Domingo, E. f. 8; Port-au-Prince, E. f. 2, 29.69; center placed

17 N., 72.5 W., too far W., 17 N., 70.5 W. is a much better location. Sept. 28, Port-au-Prince, E. to S.E. f. 3, 29.57; Turks Is., E. f. 5, 29.86; Santo Domingo, E. f. 7; Kingston, S.W. f. 2, 29.78; Puerto Plata or ship nearby, E. f. 4, 29.77 (difficult to read); center placed 18.5 N., 73.5 W., probably a bit far W. Sept. 29, Port-au-Prince, E.S.E. to S.E. f. 2, 29.72; ship near 19.7 N., 74.7 W., W. f. 5, 29.59; center placed near 19.7 N., 74.5 W., too far W., near the eastern tip of Cuba appears to be a better location. Sept. 30, no data near the center; ship near 18.7 N., 78 W., W.N.W. f. 3, 29.65; Kingston, N.W. f. 1, 29.77; Port-au-Prince, calm, 29.75; Santo Domingo, S. f. 5; Turks Is., E. f. 3, 29.86; ship near 23.7 N, 74 W., E. f. 4, 29.83; ship near 24.7 N., 76 W., N.E. f. 3; center placed 20 N., 76.5 W., but near 22 N., 76.3 W. looks to be a better location (Historical Weather Maps, Sept. 1908). Author's note: In this item and in item 3), wind forces (f) are on Beaufort scale and pressures are in inches. 3) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 1, Jupiter, N.E. f. 6, 29.74; ship near 25 N., 76 W., E.N.E. f. 10, 29.53; ship near 25 N., 74 W., S.E. f. 6, rain; ship near 22 N., 74 W., S. f. 4, 29.86; center placed near 23.7 N., 76.5 W.; however, a short distance to the S.W. of Nassau is known to be the right location. Oct. 2, Jupiter, N. f. 4, 29.83; Turks Is., S. f. 3, 29.90; ship near 25.7 N., 75 W., N.N.W. f. 6; ship near 29.9 N., 70 W., S.E. f. 5, 29.80; ship near 25 N., 72.8 W., W.S.W. f. 9, 29.65; center placed 28 N., 73 W. Oct. 3, ship near 30.7 N., 74 W., N.E. f. 7, 29.83; ship near 32.5 N., 74 W., N.E. f. 7, 29.86; ship near 30 N., 67 W., S.E. f. 6, 29.86; ship near 27.7 N., 71 W., S.W. f. 10; center placed 30 N., 71.5 W. Oct. 4, ship near 30 N., 73 W., N. f. 8, 29.77; ship near 28 N., 73 W., N.N.W. f. 7; ship near 27 N., 67 W., S.S.W. f. 6, 29.88; ship near 28 N., 66 W., S. f. 6, pressure could not be read; ship near 34 N., 70 W., N.E. f. 7; ship near 34 N., 68 W., E.N.E. f. 7, drizzle; center placed 28.5 N., 70 W., probably a bit far E. Oct. 5, ship near 31 N., 68 W., N. f. 6, 29.18 (probably too low); ship near 31.8 N., 65.2 W., E. f. 5, 29.68; ship near 30 N., 63 W., S. f. 7, pressure could not be read; center 990 millibars (29.24) placed 29.7 N., 68.7 W., maybe too far S. and W. Oct. 6, ship near 33 N., 63.7 W., E.N.E. f. 5, barometer could not be read; ship near 34 N., 58 W., E.N.E. f. 5, S.S.W. f. 5, 29.83; ship near 27 N., 66 W., N. f. 3, 30.00; ship near 26 N., 62 W., S.W. f. 5, 29.97; center placed 31.5 N., 62.7 W. Oct. 7, center of extratropical low placed 34 N., 60 W.; however, ship near 35 N., 56 W., E. f. 8, 30.09 suggested that a better location for the center would be near 32.5 N., 57.5 W. (Historical Weather Maps, Oct. 1908). 4) Belen College Observatory, Sept. 24, 2 P.M. The cyclonic perturbation that we announced yesterday (Sept. 23) and that was approaching the Windward Islands from the Atlantic was this morning at 8 A.M. closer to the islands and at 2 P.M. has not yet passed into the Caribbean Sea. The Weather Bureau of Washington sent us this information this afternoon: "Cyclonic perturbation E. of the Windward Islands near 15 N., moving to the W." L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 25, 1908, morning edition, p.4, col.3). Author's note: The National Meteorological Observatory published in the same issued the same advisory sent by the Weather Bureau of Washington. 5) Washington, Sept. 24. There are indications of a cyclonic disturbance moving westward, east of the Leeward Islands, near latitude 15 N. (The New York Times, Sept. 25, 1908, p.13, col.7). 6) Washington, Sept. 25. The cyclonic disturbance reported Thursday (Sept. 24) east of the Lesser Antilles was central Friday afternoon S. and near the island of St. Kitts and it was moving on a W.N.W. course (The New York Times, Sept. 26, 1908, p.9, col.7). 7) Belen College Observatory, Sept. 26, 8 A.M. The cyclonic perturbation has entered in full into the Caribbean Sea and this morning at 8 A.M. its center is located to the S.S.E. of Ponce, Puerto Rico. Its forward motion is now slow and between this afternoon and tonight its influence will be felt over the eastern portion of Santo Domingo. L. Gangoiti, S.J. (Diario de la

Marina, Havana, Sept. 26, 1908, evening edition, p.4, col.1). 8) Washington, Sept. 26. The hurricane in the West Indies continues its westward course and at 4 P.M. Saturday its center was near the E. end of Santo Domingo (The New York Times, Sept. 27, 1908, p.5, col.7). 9) Washington, Sept. 27. The hurricane in the West Indies continues to move on a W.N.W. course and Sunday afternoon (Sept. 27) its center was apparently near and S. of the west of Santo Domingo (The New York Times, Sept. 28, 1908, p.14, col.7). 10) Belen College Observatory, Sept. 6, 6 P.M. The center of the cyclone should enter our island tonight near its eastern tip. During Tuesday night (Sept. 29) and all day Wednesday (Sept. 30) it will be closest to Havana. L. Gangoiti S.J. (Diario de la Marina, Havana, Sept. 29, 1908, morning edition, p.4, col.5). 11) National Meteorological Observatory, Sept. 28. The U.S. Weather Bureau announced that at 11:46 A.M. the center of the hurricane was near the eastern tip of Cuba and recurving to the N.W. It is dangerous for all shipping in the Bahamas and off the Florida coast during the next 2 or 3 days (Diario de la Marina, Havana, Sept. 29, 1908, morning edition, p.4, col.5). 12) Washington, Sept. 28. The West Indian hurricane appears to be central this evening off the east coast of Cuba, moving N.W. It will be dangerous to all vessels in Bahamian waters during the next few days (The New York Times, Sept. 29, 1908, p.16, col.7). 13) Belen College Observatory, Sept. 29, 8 A.M. The center of the tempest is now over land in the vicinity of Guantanamo; in spite of that we are far away it is affecting our atmosphere; it is moving slowly due to the resistance offered by the mountains. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 29, 1908, evening edition, p.4, col.2). 14) Washington, Sept. 29. The West Indian hurricane is still centered near the east coast of Cuba, having moved very slowly. It is apparently recurving towards the N. (The New York Times, Sept. 30, 1908, p.9, col.7). 15) Belen College Observatory, Sept. 30, 8 A.M. This morning at 8 A.M. it is observed from the observatory the cirrus arc corresponding to the hurricane with its highest point over the horizon towards the E.S.E. At 7:30 A.M. the vortex was between Gibara and Nuevitas as it was indicated in our cablegrams sent to Key West and Washington. L. Gangoiti, S.J. (Diario de la Marina, Havana, Sept. 30, 1908, evening edition, p.4, col.6). 16) National Observatory, Sept. 30, 10 A.M. The center of the perturbation is apparently over the Bahamas to the N.E. of Nuevitas, moving N.W.; therefore, there is no danger to Cuba, but there is danger to shipping to the N. (Diario de la Marina, Havana, Sept. 30, 1908, evening edition, p.4, col.6). 17) Washington, Sept. 30. The West Indian hurricane was central this afternoon near the Grand Bahama Island and continues to move W.N.W. Hurricane warnings have been issued to Florida ports (The New York Times, Oct. 1, 1908, p.4, col.7). Author's note: The position near the Grand Bahama Island proved to be in error; it probably meant Great Bahama Bank. 18) Washington. Oct. 1. The tropical storm has recurved northward off the Florida coast. At 9:40 Thursday a barometer reading of 28.82 inches and wind of 80 mph from the S. were reported at Nassau, Bahamas (The New York Times, Oct. 2, 1908, p.13, col.7). 19) Washington, Oct. 2. The West Indian hurricane will pass near and N. of Bermuda early Saturday (Oct. 3) and will reach the Banks of Newfoundland Sunday (The New York Times, Oct. 3, 1908, p.15, col.7). 20) Point-a-Pitre, Guadeloupe, Sept. 27. The gale started Thursday night (Sept. 24) and was at its height Friday morning. No great damage was done at Point-a-Pitre but the country districts suffered heavily. Many trees were uprooted, sugar factories were offroofed and the sugar cane was severely damaged. One coastal steamer was wrecked. Communications of all kinds were badly interrupted (The New York Times, Sept. 28, 1908, p.1, col.6). 21) Santiago de Cuba, Sept. 29, 9 P.M. It is raining since 2 P.M.; the cyclone appears to be moving away (Diario de la Marina, Havana, Sept. 30, 1908, morning edition, p.8, col.1). 22) Santiago de Cuba, Sept. 30, 8:35 P.M. The bad weather

continues, it has rained all day, indicating the proximity of the cyclone. The port continues closed. The "Martin Saenz" attempted to leave port but it had to return (Diario de la Marina, Havana, Oct. 1, 1908, morning edition, p.8, col.2). 23) Sept. 30- Oct. 2, 1908. Moderate cyclone affecting the province of Santiago de Cuba and the northern coast of Camaguey. Damage of some consideration was done (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). 24) Taken from The Guardian, Nassau, New Providence, Bahamas, Oct. 3, 1908: The first intelligence that another hurricane had made its appearance reached us Saturday (Sept. 26) when we were informed by cable from Washington that a storm was central near and S. of Puerto Rico, moving W.N.W. This information was confirmed by telegrams from the same source, dated on Sept. 28, Sept. 29 and Sept. 30, stating that the hurricane was central near the eastern extremity of Cuba, and finally that the hurricane was central near the Great Bahama Bank moving W.N.W. These statements were entirely borne out by the weather here on Sept. 30, which throughout the day wore an exceedingly threatening aspect... By 8 A.M. of Oct. 1 the barometer had fallen to 28.80 inches while the wind S.E. had risen to an estimated velocity of 80 mph -estimated because at 7:45 the wind-recording instruments at the Observatory were blown away. At this time squall succeeded squall with rapidly increasing velocity from the S.E., the rain falling in continuous torrents, being driven by a force that the few adventurous persons who were out found positively blinding... Although much damage was done on land, interest centered on the shipping in the harbor much of which was in sore straits... At 10 A.M. the barometer reached a minimum of 28.68 inches with wind from the S. at an estimated velocity of 60 to 80 miles an hour. At noon the barometer had risen to 29.10 inches (Monthly Weather Review, Oct. 1908). Author's note) A similar description was published in Weather Bureau (1910). 25) In reference to the work of C.L. Mitchell, we do not know why he did not place the cyclone of late Sept. 1908 among the true hurricanes. He stated that the storm was of doubtful intensity, but ships such as the "Bismark", the "Maria Cristina", the "Montevideo" and others felt the storm with great violence. The barometer at Nassau dropped to 28.68 (inches) with wind from the S. at a velocity of 60-80 mph (Sarasola, 1928). 26) The "F. Bismark", from Hamburg, arrived at 9:30 P.M. Saturday (Oct. 3). She encountered bad weather when entering the Bahama Channel Thursday night (Oct. 1). For this reason she arrived with a delay of 14 hours (Diario de la Marina, Havana, Oct. 5, 1908, evening edition, p.5, col.4). 27) At the closing time of this edition, the steamship "Montevideo" was arriving at Havana harbor from Cadiz, Spain (Diario de la Marina, Havana, Oct. 2, 1908, evening edition, p.4, col.1). Author's note: The "Montevideo" is one of the ships mentioned as having encountered the hurricane. 28) Capt. Antonio Fernandez of the "Reina Maria Cristina" stated that at 2 P.M. Oct. 1, the first signals of the hurricane were encountered, having the center of the storm to the S.W. (of the ship). The barometer was dropping rapidly and the wind was increasing from the S.E. At this time the "Reina Maria Cristina" was 70 miles from Abaco. These conditions continued until 4 P.M.. when maneuvers were taken to pass through the storm as easily as possible. The ship motion was slowed down and then the barometer continued its depression but slower. Around 6 hours the wind attained hurricane force from the S., with very heavy seas from the S. and S.W., continuing these conditions until about 10 P.M. when the hurricane began to move away from the ship. At midnight (Oct. 1-2), the wind shifted to S.W., with barometer stationary. At 16 hours (4 A.M. Oct. 2) the wind started to diminish and the heavy sea from the S. moderated. The ship was on due course around 5 A.M. and moving at full speed about 6 A.M. (Diario de la Marina, Havana, Oct. 5, 1908, evening edition, p.2, cols.3-4). 29) The steamship "La Navarre" started to encounter bad weather on Oct. 2. The ship was

coming from St. Nazaire, Santander and Coruna. At 2 A.M. (Oct. 2), the wind was blowing with hurricane force from the S. and the captain ordered to moderate the ship's motion. The wind blew from the S., the S.W. the W. and then from the N. By afternoon (Oct. 2) conditions had improved and the captain ordered to put heading to the Providence Channel. The ship passed the Abaco Light and other points as Great Isaac Light, encountering thunder, lightning and much rain (Diario de la Marina, Havana, Oct. 5, 1908, evening edition, p.2, col.5). 30) Nassau, Oct. 4. The steamer "Hesleyside", which left St. Michaels for Key West, was thrown on the reefs of Abaco Island on Oct. 1. The ship was a total loss but the crew survived (Diario de la Marina, Havana, Oct. 5, 1908, evening edition, p.10, col.5). 31) San Juan, P.R., Oct. 9. The steamer "Philadelphia", from New York, arrived here with a delay of several days. She encountered the cyclone on Monday (Oct. 5) leaving the vessel off her course near Bermuda (Diario de la Marina, Oct. 10, 1908, morning edition, p.1, col.2). 32) A storm was first observed near 12 N., 50 W. on Sept. 21, 1908 and lasted 15 days; it recurved near 25 N., 78 W. and it was last observed near 33 N., 62 W. (Mitchell, 1924). Author's note: A track for this storm in Tannehill (1938) was found to be very similar to the corresponding track which is shown in Mitchell (1924). The track in Neumann et al. (1993) as for Storm 6, 1908 was also found to be similar, in general, to the track in Mitchell (1924).

On the basis of information contained in the above items, the author of this study introduced very many modifications along the track for this storm which Neumann et al. (1993) identify as Storm 6, 1908. 7 A.M. positions as estimated by the author of this study were as follows: Sept. 21, near 12.5 degrees N., 46.0 degrees W.; Sept. 22, near 13.5 degrees N., 50.7 degrees W.; Sept. 23, near 14.3 degrees N., 55.3 degrees W.; Sept. 24, near 15.3 degrees N., 58.7 degrees W.; Sept. 25, near 16.0 degrees N., 61.7 degrees W.; Sept. 26, near 16.5 degrees N., 66.3 degrees W.; Sept. 27, near 17.0 degrees N., 70.5 degrees W.; Sept. 28, near 18.5 degrees N., 72.7 degrees W.; Sept. 29, near 20.0 degrees N., 74.5 degrees W.; Sept. 30, near 22.0 degrees N., 76.3 degrees W.; Oct. 1, near 24.7 degrees N., 78.0 degrees W.; Oct. 2, near 28.0 degrees N., 73.0 degrees W.; Oct. 3, near 30 degrees N., 71.5 degrees W.; Oct. 4, near 28.5 degrees N., 71.0 degrees W.; Oct. 5, near 30.5 degrees N., 67.5 degrees W.; Oct. 6, near 31.5 degrees N., 62.7 degrees W.; Oct. 7, near 32.5 degrees N., 57.5 degrees W. The above positions were based on daily information in items 2) and 3) but, in addition, on information in item 20) for Sept. 25, information in item 1) for Sept. 28, information in items 12) and 21) for Sept. 29; information in items 15) and 16) for Sept. 30, and information in item 24) for Oct. 1. The difference between the above 7 A.M. positions and the corresponding ones in Neumann et al. (1993) was found to range from about 240 miles on Sept. 21 to just a few miles on Sept. 24. The author's track for Storm 7, 1908 is displayed in Fig. 4.

Information contained in a number of the above items was found to support the hurricane status which Neumann et. al. (1993) gave to this storm as for Storm 6, 1908. In fact, the pressure reading of 28.68 inches taken at Nassau, outside the eye of the hurricane (items 1, 24 and 25), suggests the possibility of a central pressure below 28.50 inches and, had this been the case, major hurricane intensity. On the basis of the damages described to have occurred at Guadeloupe (item 20), the author of this study decided to introduce hurricane intensity along his track as the storm was approaching that island around midnight Sept. 25-26. Because the pressure of 29.24 inches reported to have occurred at Port-au-Prince at 6 A.M. supported minimal hurricane intensity, the author of this study decided to keep the storm as a hurricane during its travel over the Caribbean Sea until after making landfall on the southern coast of Haiti in the early morning hours and passing near Port-au-Prince about 6 A.M. that day. The storm should have quickly

become a tropical storm under the direct influence of the mountains of southern Haiti and the author decided not to reinstate hurricane intensity until the storm cleared the northern Cuban coast about midday Sept. 30. Then, hurricane intensity was maintained until early Oct. 7, when the extratropical stage was introduced. Tropical storm intensity was denoted along the author's track from Sept. 21 to around midnight Sept. 24-25, and from late in the morning of Sept. 28 to around noon Sept. 30.

Storm 8, 1908 (Oct. 14-18), H.

This storm corresponds to Storm 7, 1908 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: Oct. 14, ship near 14.7 N., 76 W., E. f. 5, 29.88; ship near 11.7 N., 81 W., N. f. 2, 29.91; ship near 10.7 N., 80 W., N. f. 2, 29.91. Oct. 15, ship near 15.7 N., 82 W., N.N.E. f. 6, 29.91; ship near 15.7 N., 77 W., E. f. 6, 29.86; Honduran station or ship near 15.7 N., 84 W., N.E. f. 3. Oct. 16, ship near 11 N., 81 W., S.S.W. f. 9 (Historical Weather Maps, Oct. 1908). Author's note: Wind forces (f) are on Beaufort scale; pressures are in inches. 2) Belen College Observatory, Oct. 24. The evening newspapers are delivering the following news: "New Orleans, Oct. 24. A brief dispatch which was received here from Bluefields, Nicaragua, indicates that a hurricane has swept the Nicaraguan coast from Point Pearl to Cape Gracias a Dios from Oct. 16 to Oct. 18. This news agrees with what we stated on Oct. 16: Today at 7 A.M. we have some indication of another revolving storm to the S.W. and quite far from Jamaica. On Oct. 19 we stated "it was at 7 A.M. this morning to the S.W. one quarter to the W. of Jamaica and somewhat nearer (than on Oct. 16)". L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct. 24, 1908, evening edition, p.4, col.4). 3) New Orleans, Oct. 24. A cable from Bluefields, Nicaragua, under date Oct. 21 says: A disastrous hurricane swept the coast of Nicaragua last Friday to Sunday (Oct. 16-18), destroying the towns of Rio Grande and Prinzapolca and doing considerable damage in the interior. Only meager advices have been brought here by schooner, but it appears that the entire coast from Pearl Cays to Cape Gracias was swept, and there was much loss of life. The fruit steamer "Dictator" is here safe and uninjured (The New York Times, Oct. 25, 1908, section C, p.3, col.6). 4) A storm was first observed near 12 N., 81 W. on Oct. 17, 1908 and lasted less than one day; it was last observed near 13 N., 84 W. (Mitchell, 1924). Author's note: A track shown in Tannehill (1938) was found to be very similar to the track included in Mitchell (1924). A second track in Neumann et al. (1993) was significantly longer and extended from Oct. 15 to Oct. 18; this track also has some similarities with the track in Mitchell (1924). On the basis of information in the above items, the author of this study introduced a number of modifications along the track in Neumann et al. (1993) as for Storm 7, 1908. The author's 7 A.M. positions were estimated as follows: Oct. 14, near 11.7 degrees N., 78.5 degrees W.; Oct. 15, near 11.7 degrees N., 80.0 degrees W.; Oct. 16, near 12.0 degrees N., 81.5 degrees W.; Oct. 17, near 12.5 degrees N., 82.7 degrees W.; Oct. 18, near 13.0 degrees N., 84.0 degrees W. It should be indicated that the author's track was started one day earlier than the track in Neumann et al. (1993). The author's track was terminated on Oct. 18 in spite of that the analysis of data on weather maps for subsequent days hinted the possibility that, as a weakening depression, this weather system could have existed for several more days and described a possible loop track over the Bay of Honduras, finally heading back towards Honduras; however, the sparsity of data prevented to ascertain that this was indeed the case. The author's track for Storm 8, 1908 is displayed in Fig. 4.

Information in items 2) and 3) allowed one to confirm the hurricane status that Neumann et al. (1993) gave to this storm as for Storm 7, 1908. Hurricane intensity was introduced along the author's track late on Oct. 16 and was maintained until the morning of Oct. 18. Then the system was allowed to rapidly weaken, and tropical storm and depression (dissipation) stages were introduced. Prior to late Oct. 16, tropical storm intensity was denoted along the author's track in spite of that the author believes that the intensity of the weather system was below that of a tropical storm over the early portion of the Oct. 14-16 period.

Storm 9, 1908 (Oct. 19-23), T. S.

This storm corresponds to Storm 8, 1908 in Neumann et al. (1993).

The following information was found in relation to this storm: 1) Data extracted from 8 A.M. (E.S.T.) Historical Weather Maps: Oct. 19, extratropical low, about 1010 millibars (29.83) placed near 35 N., 72 W. and supported by ship reports. Oct. 20, low becoming tropical; ship near 34.7 N., 68.5 W., N.E. f. 2, 29.88, temp. 72 F; ship near 33.5 N., 72 W., N.E. f. 6, 29.80, temp. 74 F; ship near 32 N., 68.7 W., S.W. f. 4, showers; ship near 32 N., 75 W., N.E. f.5, 29.88, temp. 76 F; ship near 26 N., 74 W., W. f. 2, 29.83, temp. 75 F., showers; ship near 30 N., 72 W., S. f. 2; ship near 27 N., 68.7 W., S.W. f. 3, 30.06; center near 32.5 N., 72 W., probably too far W. Oct. 21, low placed 28 N., 72 W., too far W., near 28.5 N., 66 W. appears to be a better location; ship near 30 N., 65 W., E. f. 4, 29.88, temp. 74 W., ship near 27 N., 66 W., W. f. 3, 29.94, temp.80 F; ship near 23.7 N., 66 W., N.W. f. 1, 29.83; Turks Is., N.W. f. 2, 29.99. Oct. 22, low placed 27.5 N., 75 W., but near 29 N., 74 W. would be better; ship near 30 N., 75 W., N.E. f. 4, 29.77; ship near 31 N., 72 W., E.S.E. f. 6; ship near 28.5 N., 70.3 W., S.E. f. 3, 29.94; ship near 27 N., 71 W., S.W. f. 3, 29.86; ship near 25 N., 71.7 W., S.W. f. 4, 29.88; ship near 25 N., 76.7 W., W.N.W. f. 2; ship near 29 N., 79 W., N.N.E. f. 7; ship near 33 N., 71 W., E. f. 8, 30.06; ship near 32.5 N., 78 W., N.E. speed could not be read, 29.97. Oct. 23, center N. of Charleston; Charleston, W. f. 3, 29.88, temp. 63 F; other data around the low could not be read; low losing all tropical characteristics as it was moving in a cooler environment (Historical Weather Maps, Oct. 1908). Author's note: Wind forces (f) are on Beaufort scale and pressures are in inches; temperatures in degrees Fahrenheit are sometimes indicated. 2) A storm was first observed near 26 N., 52 W. on Sept. 18 and lasted 5 days; it was last observed near 34 N., 80 W. (Mitchell, 1924). Author's note: A track shown in Tannehill (1938) was found to be similar to the one in Mitchell (1924). The track displayed in Neumann et al. (1993) as for Storm 8, 1908 was started near 28 N., 68 W, on Oct. 21 and was, therefore, shorter than the one in Mitchell (1924).

On the basis of information in item 1), the author of this study introduced some modifications along the track in Neumann et al. (1993) for Storm 8, 1908. The author's 7 A.M. positions were estimated as follows: Oct. 19, near 35.0 degrees N., 72.0 degrees W.; Oct. 20, near 32.5 degrees N., 70.0 degrees W.; Oct. 21, near 28.5 degrees N., 66.0 degrees W.; Oct. 22, near 29.0 degrees N., 74.0 degrees W. The 7 A.M. Oct. 23 position in Neumann et al. (1993) was kept unchanged. Differences between actor's positions and those in Neumann et al. (1993) were found to range from about 160 miles on Oct. 21 to about 60 miles on Oct. 22. The author's track for Storm 9, 1908 is shown in Fig. 4.

In spite of that only one wind report of force 8 was found in relation to this weather system (item 1), the author of this study decided to keep the tropical storm status that Neumann et al. (1993) gave to it as for storm 8, 1908. Storm 9, 1908 had obviously an extratropical origin

and tropicalization took place as the storm moved S.E. to lower latitudes. However, for practical purposes, the weather system was kept as a tropical storm over the entire period Oct. 19-22 and it was changed to extratropical near midnight Oct. 22-23 when approaching the South Carolina coast.

Special statement.

In addition to the nine storms that have been fully discussed above, four other weather disturbances have been identified as possible cases during 1908. These cases are presented next.

A) Case of Jun. 2-5, 1908.

Sarasola (1928) published a catalog by M. Gutierrez-Lanza in which a slight cyclone is mentioned to have occurred over extreme eastern Cuba on Jun. 3-4, causing some damage. The regular note of Jun. 4 issued by the National Observatory and published in *Diario de la Marina*, Havana, Jun. 5, 1908, morning edition, p.3, col.3, indicated a rain storm in the area of Bayamo, apparently on Jun. 3. *Diario de la Marina*, Havana, Jun. 7. 1908, morning edition, p.5, col.6, published an extensive note from the correspondent at Santiago de Cuba, dated on Jun. 3. The note indicated that on Jun. 2 the aspect of the clouds and the rain showed a perturbation. By 5:30 P.M. the dark clouds increased and the rain became heavier. Then rumors about a cyclone started to circulate. The correspondent learned later that the bishop had apparently received a telegram from the Belen College Observatory announcing the disturbance but the note was not received on time to be published in the newspapers. By 8 P.M. strong gusts accompanied by torrential rain invaded the city (Santiago de Cuba) and caused general panic. Soon the streets were flooded and some houses collapsed. The Yarayo River overflowed, causing considerable damage. Rain continued all the night of Jun. 2-3 and still continued falling as the correspondent wrote his note. When the correspondent inquired about any sensible drop in pressure, he was told that the weather was just due to a common rain storm for that time of the year. Examination of Historical Weather Maps for the early days of Jun. 1908 revealed that a weak low pressure area existed near E. Cuba and over the Bahamas, apparently moving N., but no strong winds were found, except for one of force 6 on Jun. 5. The information above was not enough to document the existence of tropical storm winds associated with this weather system and, therefore, the author of this study decided to keep it as a possible case.

B) Case of Jul. 29-30, 1908.

The Jul. 29 weather map showed a wind E. f. 5 at Port Eads with a pressure of 29.74 inches and a low placed near 28 N., 90 W. (Historical Weather Maps, Jul. 1908); by the morning of Jul. 30, the low was placed 28 N., 92 W. but observations plotted on the map suggested that the low was centered on the Louisiana coast near the 92.5 W. meridian. No winds of tropical storm force were reported, but that author believes that the pressure of 29.74 inches reported at Port Eads on Jul. 29 was low enough to merit the inclusion of this system as a possible case.

C) Case of Aug. 5, 1908.

The weather map for Aug. 5 showed a ship near 28 N., 51 W. reporting a wind S. f. 8, and a low pressure area of 1000 millibar (29.53 inches) centered near 28.5 N., 52 W. (Historical Weather Maps, Aug. 1908); a very weak circulation was drawn near 30 N., 60 W. on the Aug. 3 map and a N.N.E.- S.S.W. trough was shown near the 57 W. meridian on the map for Aug. 4. Information on the three maps above allowed one to identify an eastward moving weather system; however, such a system could not be easily identified on the map corresponding to Aug. 6, 1908. As tropical storm winds (force 8 on the Beaufort scale) were reported by a ship on Aug. 5, the author of this study believes that there is a good chance that this system had attained tropical storm status. However, the ship report could have been unreliable and this is why the author decided to be conservative and to keep this case as a possible one.

D) Case of Oct. 25-31, 1908.

A track for this case is presented in Tannehill (1938) as for Storm 6, 1908; he obviously took it from Mitchell (1924) who said that a storm was first observed near 20 N., 82 W. on Oct. 25 and lasted for 10 days and that it recurved near 23 N., 86 W. and was last observed near 60 N., 60 W. The Monthly Weather Review (Oct. 1908) also showed a track for this weather system starting in the southeastern Gulf of Mexico in the evening of Oct. 27 and ending near the N.E. extreme of Nova Scotia in the evening of Oct. 30, when it had intensified significantly, with a central pressure about 29.06 inches. The Monthly Weather Review (Oct. 1908) hinted the possibility that this could have been the same system that visited the Central American coasts some days earlier and that publication was probably following ideas expressed in cablegrams sent to Washington by the Belen College Observatory, one of which originated at 9 A.M. Oct. 26 and stated: "The ten days old perturbation is to the S.W. (of Havana), moving towards the Yucatan Channel (Diario de la Marina, Havana, Oct. 28, 1908, evening edition, p.4, col.1); however, according to the discussion of the Central American storm (Storm 8, 1908) by the author of this study, most likely this was not the case. Bulletins issued by the Belen College Observatory at 8 A.M. Oct. 27 and 8 A.M. Oct. 28 indicated that the center of the cyclonic perturbation was to the S. and near the extreme western Cuba and to the N.W. one quarter to the N. of Havana, respectively; these advices were published in Diario de la Marina, Havana, Oct. 27, 1908, evening issue, p.4, col.1 and in Diario de la Marina, Oct. 28, evening edition, p.4, col.1. The National Observatory (of Cuba) also published advisories about this weather system in the same editions, and included some information received (at Havana) from the Weather Bureau of Washington. The Monthly Weather Review (Oct. 1908) stated that the Oct. 29-30 storm was of unusual severity in New England and contained a table showing wind velocities about 55 mph to have occurred at several places in N.E. United States. Examination by the author of this study of weather maps for the mornings of Sept. 27-28 revealed that the low pressure area observed in the eastern Gulf of Mexico was rather a development of frontal wave nature, with little, if any, tropical ingredients. No closed cyclonic circulation could be drawn S. of the western tip of Cuba on the basis of available data for Oct. 27 and a cold front was clearly inferred to have extended from a low just W. of Tampa to Yucatan on Oct. 28. The front advanced eastward and was drawn over central Cuba on the morning map of Oct. 29 (Historical Weather Maps, Oct. 1908). Based on information contained on the above maps, there is only a slim probability that this weather system ever exhibited tropical characteristics. But in order to account for this very small probability, the author of this study decided to include this one as a possible case.