

Fig.1 (continued)

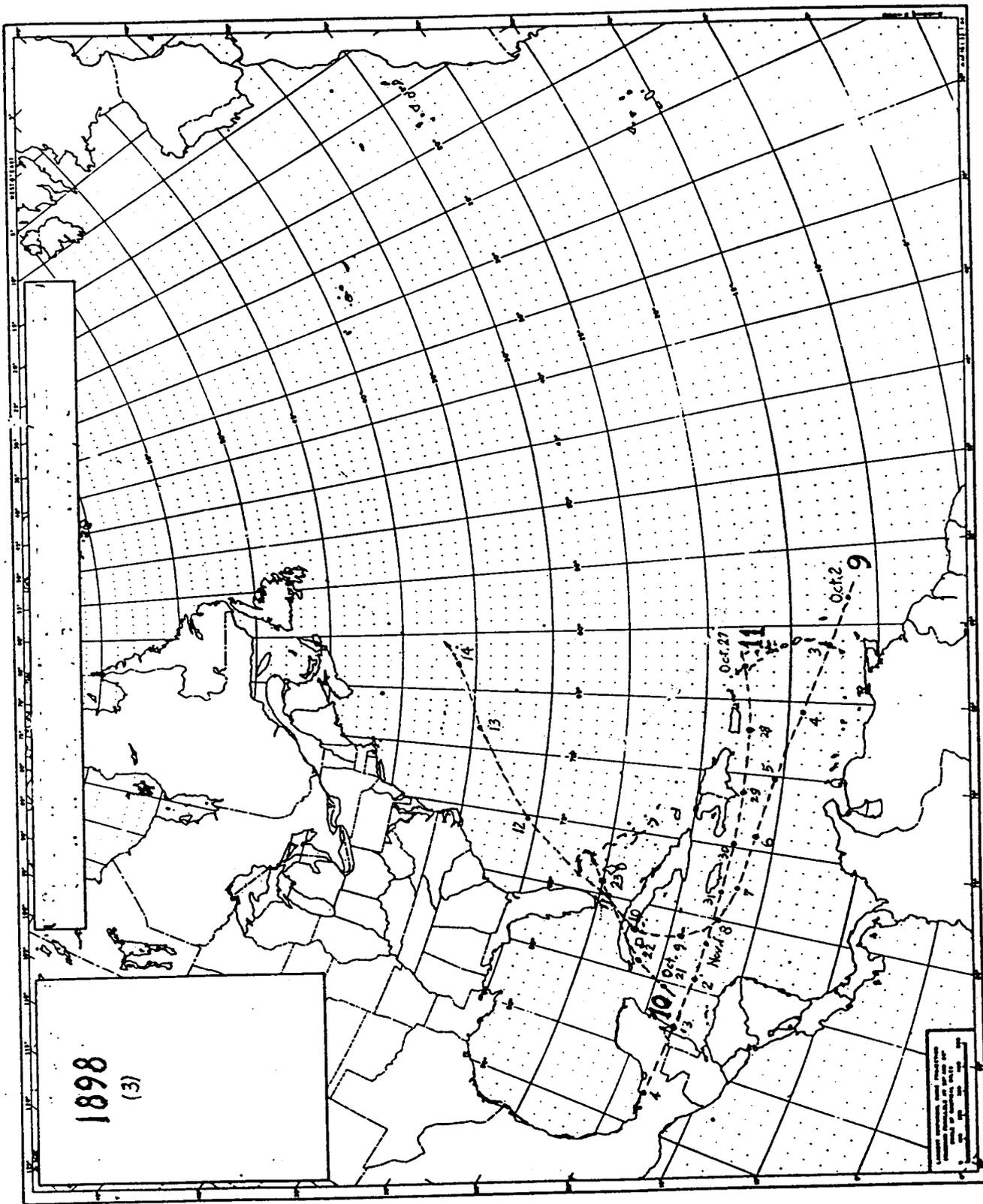


Fig.1 (continued)

storm appears to be developing in the central Gulf: Merida reports a fall in pressure of 0.15 inch in 24 hours and Key West 0.06 inch. Port Eads reports E. wind of 30 mph (The New York Times, Sept.26, 1898, p.1, col.4). Author's note: This and other weather statements published in this newspaper on subsequent days were probably issued the evening before their publication date. 2) A disturbance appears to be in the central Gulf and has caused an E. wind of 36 mph at Port Eads (The New York Times, Sept.27, 1898, p.1, col.6). 3) The storm in the West Gulf appears to be moving W. and will cause high N.E. wind on the N.W. Gulf coast today (The New York Times, Sept.28, 1898, p.1, col.2). 4) The storm in the West Gulf has increased in intensity and has caused a fall of pressure of 0.08 to 0.10 inch from New Orleans to Corpus Christi and a S. wind of 40 mph and a rainfall of 3.32 inches in 12 hours at Port Eads (The New York Times, Sept.29, 1898, p.1, col.5). 5) The storm has remained nearly stationary in the West Gulf and has caused rain in the Gulf States and Middle Mississippi Valley and gales on the coast, Port Eads reporting 36 mph from the S.E. and Pensacola the same velocity from the S.E. (The New York Times, Sept.30, 1898, p.1, col.6). 6) The storm has remained stationary in the West Gulf (The New York Times, Oct.1, 1898, p.1, col.3). 7) Maximum wind velocity at Pensacola was S.E. 39 mph on Sept.30 (Monthly Weather Review, Sept.1898). 8) Storm of Sept 21-28, 1898. Western Caribbean, Yucatan, east Texas coast. Not of much force (Tannehill 1938). 9) Storm of Sept. 27-28. Upper Texas coast. Minor (Dunn and Miller, 1960). 10) A storm was first observed at lat. 11 N., long. 80 W. on Sept. 21 and lasted 7 days; it recurved at lat. 28 N., long. 95 W. and it was last observed at lat. 30 N., long. 94 W. (Mitchell, 1924). Author's note: A track which is also included in Mitchell (1924) was found to be quite similar to the one in Neumann et al. (1993), exception made of the fact that the latter one was started on Sept.20 in lieu of on Sept.21.

Information in the above items was found to support, in general, the track for Storm 6, 1898 which is displayed in Neumann et al. (1993). Therefore, the author of this study reproduced such a track in Fig.1.

The tropical storm status which Neumann et al. (1993) gave to this storm was found to be satisfactory in the light of information contained in item 4) and in items 7) through 9).

Storm 7, 1898 (Sept.25-Oct 6), H.

The following information was found in relation to this storm: 1) The steamship "Philadelphia" arrived yesterday from La Guayra and Ponce. The vessel was about 400 miles N. of Puerto Rico when she ran into a revolving storm during which she labored and floundered around for 36 hours. The "Philadelphia" entered the storm from the S.E. steering N.W. by N. and held her course in the teeth of a gale for 20 hours. The center of the storm was reached

Tuesday afternoon (Sept.27) when the wind dropped to about 20 mph. The glass dropped to 28.84 inches. As soon as the vortex was passed, the wind shifted to S.E. blowing at a rate of 60 mph. In the storm center there was hundreds of birds which had been drawn into the vortex (The New York Times, Oct.4, 1898, p.14, col.5). 2) Reports of Sept.28 indicated the formation of a cyclonic storm near Puerto Rico and during Sept.29, the circulation of the winds and the action of the barometer showed that the disturbance has moved to a position off the northern coast of Santo Domingo. During Sept.30 the center moved N. of W. near the Old Bahama Channel, and by the morning of Oct.1, its influence had extended to the Florida coast. By the evening of Oct.1, the storm center had moved to a position about 150 miles N.E. of Jupiter. During the night of Oct. 1, the storm was deflected to a more westerly course by an intensive area of high barometer which occupied the Atlantic coast districts to the northward of its position and, by the morning of Oct.2, it had acquired hurricane strength when it was central off the coast N.E. of Jacksonville, Fl. (Monthly Weather Review, Oct, 1898). Author's note: The storm locations given for the period Sept. 28-30 appeared to be too far south. 3) A storm has developed off the Atlantic coast of Florida, Jupiter reporting a pressure of 29.02 inches and Key West a W. wind of 24 mph (The New York Times, Oct.2, 1898, p.1, col.6). Author's note: This statement was probably issued in the evening of Oct.1. The pressure reading of 29.02 inches is too low and it seems to be a typographic error. 4) The lowest barometer reading at Havana (Belen College Observatory) in association with the Oct.1-2 cyclone was 754.9 millimeters (29.72 inches) and occurred on Oct.1 (Sarasola, 1928). 5) Some observations taken at Jacksonville, Fl: Oct 2, 4 A.M., barometer 29.60 inches; 7 A.M., barometer 29.48 inches, wind N.W. 20 mph; 8 A.M., barometer 29.39 inches, wind N.W. 20 mph; 9 A.M., barometer 29.35 inches, wind N.W. 19 mph; 10 A.M., barometer 29.22 inches, wind W.N.W. 28 mph; 11 A.M., barometer 29.12 inches, wind W. 40 mph; noon, barometer 29.17 inches, wind W. 24 mph; 1 P.M., barometer 29.23 inches, wind S.W. 15 mph; 2 P.M., barometer 29.31 inches, wind S.W. 13 mph; 6 P.M., barometer 29.60 inches, wind S. 14 mph (Ho, 1989). 6) From a report by A.J. Mitchell, Weather Bureau, Jacksonville, Fl: The barometer fell rapidly during the day and night of Oct.1 and reached a minimum of 29.07 inches at 11 A.M., Oct.2. The maximum wind velocity, 60 mph, occurred about 11:10 A.M., Oct.2. The coast district from Mayport to Fernandina suffered heavily; in fact, Fernandina was nearly destroyed. Great damage was caused on the coast near and south of Everet. On the Georgia coast the wind was from the N.E. and the sea flooded level lands, destroying crops and stock and imperiling lives (Monthly Weather Review, Oct. 1898). Author's note: "Everet" is likely to refer to the town of Everett in Georgia, which is located about 10 miles to the W. of Darien. 7) A dispatch published in The Morning News (Savannah, Ga., Oct.5, 1898) and dated at Fernandina, Fl.,

Oct. 4 stated that the water during the hurricane of Sunday (Oct.2) was never known to be so high in the history of that city. It was 6 and 8 feet deep over some of the docks and a tug lying by the side of a wharf was lifted on it, and setting down smashed it. Every building at quarantine station was completely swept out of existence, and not a vestige of any was reported to remain. The damage and ruin at Amelia Beach was almost as complete (Ho, 1898). Author's note: In addition, a dispatch dated on Savannah, Oct.4 and published in The New York Times, Oct.5, 1898, p.1, col.5, stated that, according to information sent by the "H.M.C. Smith" to The Morning News, two children were drowned and many vessels were high and dry on the Beach of Fernandina, Fl. 8) From a report of H.B. Boyer, Weather Bureau observer, Savannah, Ga.: The most of the damage sustained in the vicinity of Savannah was caused by the backing up of the water caused by the S.E. hurricane winds blowing against the Gulf Stream. At Savannah, the storm winds began at 2:30 A.M. Sept.2 and continued until 11:50 P.M. of the same date, with a maximum velocity of 60 mph from the N.E. at 11:30 A.M. The greatest loss was sustained S. of Savannah and nearer the storm center. Great havoc was caused at Brunswick, where nearly every business house and warehouse in the city was damaged. At noon Oct.2 the principal residence and business thoroughfares were 4 to 8 feet under water. Nearly all docks suffered from lifting; one or two hundred thousand feet of lumber and hundreds of barrels of naval stores were washed away, and five vessels were washed ashore. Campbell island, 12 miles from Darien on the Altamaha River was swept by water and all of the inhabitants (not less than 20 and perhaps 50), except 3, were drowned. At Darien there were 31 persons drowned and one killed. The height of the tidal wave at that place was about 13 feet above mean high water mark, and 18 feet at Sapelo Lighthouse. (Monthly Weather Review, Oct. 1898). Author's note: A dispatch dated at Baxley, Ga., Oct.3, which was published by The Morning News. (Savannah, Oct.4) and reproduced in Ho (1989), added that at Brunswick, the bodies of water coming, respectively, from the point off the quarantine, the back landing opposite St. Simmons and Oglethorpe Bay across from Turtle River were drawing nearer at 11 A.M. and met at noon, and that then at least twenty blocks of business houses and residences were in 4 to 8 feet of water. 9) A dispatch dated at Blackshear, Ga., Oct.3, and published in The Morning News (Savannah, Oct.4, 1898) stated that Blackshear and vicinity had experienced the previous day (Oct.2) the most terrific storm on record. The wind began blowing in the early morning from a northeasterly direction, gradually gaining in violence, until its greatest velocity was reached between 1 and 2 P.M. From 2 to 3 P.M. there was a lull, and it seems the storm was over, but, singularly enough, shortly after 3 P.M. the wind began blowing again, and this time it came from the S. (Ho, 1989). Author's note: It is obvious that Blackshear, which is roughly 45 miles inland, was in the eye of the storm about 1 hour during the

afternoon of Oct.2. 10) Table of hourly observations taken at Savannah, Ga., showing a minimum pressure reading of 29.47 inches at 2 P.M., the maximum wind velocity having been N.E. 59 mph at noon (Ho, 1989). 11) Charleston, S.C., Oct.2. During the day the wind reached the velocity of 62 mph and the tide rose 2.5 feet above normal (The New York Times, Oct.3, 1898, p.1, col.5.). 12) The storm off the S. Atlantic coast of Florida Saturday night (Oct.1) has moved to the coast of Georgia, increasing markedly in intensity, Jacksonville reporting a barometer reading of 29.08 inches at noon Sunday (Oct.2) and Charleston an east wind of 64 mph. The storm is secondary from a disturbed condition of the Caribbean Sea which first appeared last Thursday (Sept.29) north of Santo Domingo and has been traced since that day by the cordon of stations organized in the West Indies service this summer. Hurricane signals are displayed on the Atlantic coast from Norfolk to Florida and emergency warnings of hurricane winds were sent to the S.E. portion of South Carolina and Georgia (The New York Times, Oct. 3, 1898, p.1, col.5). 13) Savannah, Ga., Oct.2. For 15 hours, from 3 A.M. to 6 P.M. tonight, Savannah has been in the grasp of a West Indian hurricane. During that time the wind blew steadily from 50 to 70 mph (The New York Times, Oct.3, 1898, p.1, col.5). 14) Brunswick, Ga., Oct.3. During the tropical hurricane of Sunday (Oct.2) a tidal wave was driven from the sea and inundated for an average of depth of 5 feet practically every business house and warehouse in this city. The docks were under water 4 feet deep. In the resident section the water was from 2 to 8 feet deep. Five vessels are ashore at Brunswick harbor. The steamers "City of Macon", "City of Augusta" and "Kansas City", from New York, and the "Essex" from Baltimore, arrived (at Brunswick), today and all felt the force of the storm to some extent. The "City of Macon" was at the height of the hurricane; the wind reached a velocity of nearly 100 mph, but the ship weathered it and sustained little damage (The New York Times, Oct.4, 1898, p.1, col.5). 15) Savannah, Ga., Oct.4. Campbell Island, 12 miles from Darien on the Altamaha River is said to be completely swept away and only 3 persons succeeded in getting off. (The New York Times, Oct.5, 1898, p.1, col.5). Author's note: Similar information was given in item 8). 16) Charleston, S.C., Oct.4. The schooner "Sarah E. Palmer", from Charlotte Harbor to Cartalet, N.J. was lost Sunday morning (Oct.2) off Stone Inlet, 7 miles S. of Charleston. The "Palmer" ran into the storm off the Bahamas and sprang a leak when 5 days out. The pumps were kept working, she lost her anchor Saturday night (Oct.1). When she was full of water Sunday morning (Oct.2) the full force of the storm struck her, and her superstructure was washed away. One boat was smashed and the other sunk. The captain and two men floated on a reefing plank, but the captain was washed away three times, finally sinking. Therefore, 2 men survived (The New York Times, Oct.5, 1898, p.1, col.5). Author's note: The storm that the "Palmer" ran into off the Bahamas, was not this one; it should

have been Storm 8, 1898. 17) A dispatch dated at Jesup, Ga., Oct.3 and published in The Morning News (Savannah, Oct.4, 1898) stated that Jesup was visited by a terrific storm which began about 8:30 A.M. Oct.2, and reached its greatest velocity about 3 P.M. and lasted until about 8 P.M. Nothing as severe was ever felt there before in the history of the place. (Ho, 1989). 18) A dispatch dated at Waycross, Ga., Oct.3 and published in The Morning News (Savannah, Oct. 4, 1898) stated that the storm did considerable damage to houses, electric wires, fences and crops in Waycross and vicinity (Ho, 1989). 19) The storm central Sunday night (Oct.2) in Southern Georgia has moved to Tennessee diminishing in intensity (The New York Times, Oct.4, 1898, p.1, col.6). Author's note: This statement was probably issued in the evening of Oct.3. 20) Maximum wind velocities were as follows: Tampa, S.W. 24 mph; Jacksonville, W. 60 mph; Savannah, N.E. 60 mph; Augusta, N.E. 36 mph; Charleston, E. 62 mph; all of the above wind velocities occurred on Oct.2. (Monthly Weather Review, Oct. 1898). 21) Storm of Sept.25-Oct.7, 1898. Atlantic, Carolina coast (Tannehill, 1938).

Author's note: The storm was felt much more severely in Georgia than in the Carolinas. 22) Storm of Oct.2, 1898. Extreme in coastal sections of Carolinas and Georgia, 179 killed in Georgia. Minimal on the N.E. Florida coast, with a few killed (Dunn and Miller, 1960). Author's note: The storm was much more severe on the Georgia coast than along the Carolina coast. Ho (1989), using an equation linking some hydrometeorological parameters, came up with an estimated central pressure of about 27.91 inches when the storm made landfall on the Georgia coast. 23) Track showing the following positions: Sept.29 (evening), lat. 20 N., long. 71 W.; Sept.30 (morning), lat. 20.5 N., long. 72.5 W.; Sept.30 (evening), lat. 21.5 N. long. 75 W.; Oct.1 (morning), lat. 25.5 N. long. 76 W.; Oct.1 (evening), lat. 27.5 N., long. 77 W.; Oct.2 (morning), lat. 30.7 N., long 80 W.; Oct 2 (evening), lat. 31.3 N., long. 82 W.; Oct.3, (morning) lat. 32 N., long. 84.7 W.; Oct.3 (evening), lat. 35 N., long. 86.5 W.; Oct.4 (morning), lat. 36.5 N., long. 86 W.; Oct.4 (evening), lat. 38.7 N. long. 85.5 W.; Oct. 5 (morning), lat. 44.5 N., long. 80 W.; Oct.5 (evening), lat. 48.5 N., long. 67 W. (Monthly Weather Review, Oct. 1898). 24) An Oct.1898 storm appeared at lat. 20 N., long. 70 W., recurved at lat. 35 N., long. 86 W. and disappeared near Newfoundland (Garriott, 1900). 25) A storm was first observed near lat. 17 N. long. 59 W. on Sept.25, 1898 and lasted 12 days; it recurved near lat. 38 N., long. 87 W. and it was last observed near lat. 50 N., long. 45 W. (Mitchell 1924). Author's note: A track for this storm, which is also included in Mitchell (1924), was found to be very similar to the one in Neumann et al (1993).

The storm track for Storm 7, 1898 in Neumann et al. (1993) could not be checked for the period Sept.25-26 owing to the lack of suitable marine data in the above items. The steamship "Philadelphia" encountered the storm about 400 miles to the N. of

Puerto Rico and passed through the center of the storm in the afternoon of Sept.27 (item 1), allowing one to estimate the storm in the vicinity of lat. 24 N., long. 67.5 W. at that time. Such a position was found to be practically along the track shown in Neumann et al. (1995), but the storm reached there roughly 24 hours earlier than in the above mentioned track. The storm very likely moved in from the southeast but the author of this study believes that there is still a slight possibility that Storm 8, 1898 and Storm 7, 1898 might be just one and that, if this were the case, the author's track for Storm 8, 1898 (Fig.1) would be erroneous over the period Sept.27-28, being the 7 A.M. Sept.27 position significantly farther to the east than in the track mentioned and having the storm to gradually turn to the southeast and south while moving at a fairly fast forward speed until reaching the vicinity of lat. 24 N., long. 67.5 W. in the afternoon of Sept.27. However, no evidence of a materialization of the above possibility was found and, consequently the author of this study decided to accept that the storm was moving in from the southeast direction when the "Philadelphia" met it in the afternoon of Sept.27 (item 1). Some modifications were then implemented along the track for storm 7, 1898 in Neumann et al. (1993). Their 7 A.M. Sept.25 position was kept unchanged, but their 7 A.M. Sept.26 position was adjusted to near 19.7 degrees N., 62.5 degrees in order to obtained a better space-time continuity with the author's 7 A.M. Sept.27 position which was estimated near 22.5 degrees N., 66.0 degrees W. on the basis of information in item 1); this position was about 200 miles to the N.W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Sept.28 position was estimated near 25.0 degrees N., 70.0 degrees W. on the basis of information in item 1) and space-time continuity. This position was about 240 miles to the N.W. of the corresponding one in Neumann et al. (1993). The author of this study estimated 7 A.M. positions for the period Sept.29-30 as follows: Sept. 29, near 26.5 degrees N., 72.5 degrees W.; Sept.30, near. 27.5 degrees N., 74.5 degrees W.; these positions suggested some gradual decrease in the storm's forward speed from Sept.28 to Sept.30. The author's 7 A.M. Oct.1 position was estimated near 29.0 degrees N., 77.3 degrees W. on the basis of information for that day contained in item 2); this position was found to be about 125 miles to the W. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Oct.2 position was based on a careful analysis of information contained in various items, particularly in item 5) and was estimated near 30.5 degrees N., 81.0 degrees W.; this position was slightly to the S.E. of the one shown in Neumann et al. (1993). The author's positions for 7 A.M. Oct.1 and 7 A.M. Oct. 2 showed some increase in the storm's forward speed from Sept. 30 to Oct.3, which probably resulted from the influence of the extensive area of high barometer mentioned in item 2). 7 A.M. positions for the period Oct.3-6 in Neumann et al. (1993) were kept unchanged. The author's track for Storm 7, 1898 is

displayed in Fig.1.

Information contained in a good number of the 25 items above was found to support the hurricane status which Neumann et al. (1993) gave to this storm. Indeed, the storm was a major hurricane as revealed by specific information included in items 8) and 22).

Storm 8, 1898 (Sept.26-28), T. S.

This storm corresponds to Storm 5, 1898 in Neumann et al. (1993).

The following information was found in relation to this storm:

- 1) On Sept.25 a storm of tropical origin appeared as a feeble disturbance over the eastern part of the Gulf of Mexico. During Sept.26 the storm moved N.E. over the Bahamas, where it developed almost hurricane violence and caused considerable damage on some of the islands of that group. Atlantic coast ports and interests were advised of the progress and character of this storm, which was not, however, severely felt on the United States coasts. Unfortunately, the Nassau (Bahamas) morning report of Sept.26 was not received (by the Weather Bureau in Washington), and warning of the storm's increasing intensity could not be given until the receipt of a special noon report from Nassau (Monthly Weather Review, Sept. 1898).
- 2) Minimum pressure at Havana (Belen College Observatory) was 755.9 millimeters (29.76 inches) in relation to the Sept.25-26, 1898 cyclone and was recorded on Sept.26 (Sarasola, 1928).
- 3) A storm appears to be developing in the Atlantic off Florida (The New York Times, Sept.27, 1898, p.1, col.6). Author's note: This statement was probably issued in the evening of Sept.26.
- 4) Santo Domingo reported a maximum wind of 15 mph from the S. on Sept.24 (Monthly Weather Review, Sept. 1898). Author's note: This relatively weak wind might or might not be related to the storm.
- 5) Storm of Sept. 20-28, 1898. Puerto Rico, Bahamas (Tannehill, 1938). Author's note: Salivia (1972) does not mention this storm as having affected Puerto Rico.
- 6) Track for this storm as follows: Sept.25 (evening), lat. 23.5 N., long. 84 W.; Sept.26 (morning), lat. 26 N., long. 79 W.; Sept.26 (evening), lat. 27 N., long. 77 W. (Monthly Weather Review, Sept.1898).
- 7) Map showing a track for the storm as follows: Sept.25 (evening) lat. 24 N., long. 84 W.. Sept.26 (morning) lat. 25.7 N., long. 79.3 W.; Sept.26 (evening), lat. 27 N., long. 76.7 W. (Garriott, 1900).
- 8) A storm was first observed at lat. 16 N., long. 60 W. on Sept. 20, 1898 and lasted 8 days; it recurved at lat. 26 N., long. 77 W. and it was last observed at lat. 28 N. long. 74 W. (Mitchell, 1924). Author's note: A storm track which is also included in Mitchell (1924) was found to be very similar to the one in Neumann et al. (1993).

Most information in the above items was found to disagree with the track in Neumann et al. (1993) prior to Sept. 27 (Storm 5, 1898 in their publication). Based on information in items 1) through 3),

6) and 7), the author of this study estimated a 7 A.M. Sept.26 position near 26.0 degrees N., long.79.0 W. as the first one along his track and, by so doing, he discarded most information in the remaining items, primarily on the basis that there is no record of the storm in Puerto Rico and that there are indications that it moved from the eastern Gulf of Mexico to the Bahamas. This position is about 200 miles to the W.N.W. of the corresponding position in Neumann et al. (1993). The author's 7 A.M. Sept.27 position was based on application of some space-time continuity, using evening positions for Sept.26 in items 6) and 7) and the 7 A.M. Sept.28 position in Neumann et al. (1993) which was kept unchanged; his 7 A.M. Sept.27 position was near 27.7 degrees N., 76.0 degrees W. and was found to be about 80 miles to the N. E. of the corresponding one in Neumann et al. (1993). The author's track for Storm 8, 1898 is displayed in Fig.1.

The tropical storm status which Neumann et al. (1993) attributed to this storm (Storm 5, 1892 in their publication) was kept unchanged. However, according to item 1), the storm developed almost hurricane violence and caused considerable damage on some of the northern Bahamas. Storm 8, 1898 probably weakened very rapidly on Sept.28 as Storm 7, 1898, a hurricane, was located some 300 miles to the E.S.E. However, the author of this study believes that there is a slight possibility that Storm 8, 1898 and Storm 7, 1898 be the same, and if this were the case, the 7 A.M. positions along the author's track for Storm 7, 1898 for Sept, 27-28 would be in error, being significantly to the west of the real ones, and the storm would have started a loop motion to the S.E. and S. at a fairly fast rate reaching the area about 400 miles N. of Puerto Rico by the afternoon of Sept.27, when a ship went through the center of Storm 7, 1898 as discussed in the author's study of this latter storm.

Storm 9, 1898 (Oct.2-14), T. S.

This storm corresponds to Storm 8, 1898 in Neumann et al. (1993).

The following information was found in relation to this storm:  
1) Oct.8-11, 1898. A cyclonic perturbation was felt in Cuba from Santiago de Cuba to Havana. Its moderate winds and torrential rains affected more intensively the provinces of Camaguey and Santa Clara when the center was N. of this province. The "Colon" felt the tempest with the intensity of a true cyclone a short distance from Cuba. (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M. Gutierrez-Lanza which is included in Sarasola (1928). 2) Rainstorm in Las Villas (Santa Clara) in Oct. 1898 (Martinez-Fortun, 1942). 3) Minimum pressure at Havana (Belen College Observatory) during the cyclone of Oct.10-11, 1898 was 754.5 millimeters (29.71 inches) and occurred on Oct.10 (Sarasola, 1928). 4) A storm which as yet shows but moderate

strength is central E. of Key West from which position it will probably move northward attended by high N.E. winds south of Jacksonville today (The New York Times, Oct. 10, 1898, p.1, col.4). Author's note: This and subsequent weather statements in The New York Times were probably issued the evening before their publication date. The position to the E. of Key West given in this item is probably in error. 5) The storm which was reported off the extreme southern coast of Florida Sunday (Oct.9) is now apparently central S. of Key West. The barometer has fallen in that region and the indications are that the center of the storm will move slowly northward causing high N.E. winds on the Florida coast. The display of signals for N.E. gales has been continued at all the Florida peninsula ports. (The New York Times, Oct. 11, 1898, p.1, col.6). 6) The South Atlantic storm has moved N.E. between the Bahamas and the Florida coast without evidence of marked strength (The New York Times, Oct.12, 1898, p.1, col.6). 7) The South Atlantic storm has moved eastward beyond the region of observation (The New York Times, Oct.13, 1898, p.1, col.5). 8) Havana, Oct.18, 1898. The latest advices received here from Trinidad in the province of Santa Clara say that great damage has been caused there by the recent storm. A great many houses were swept entirely away. Eight people are known to have been killed and many cattle drowned. (Tampa Morning Tribune, Oct.19, 1898, p.1, col.3). Author's note: Trinidad is located near the southern coast of central Cuba. 9) A heavy rain was experienced in this section Sunday and Monday (Oct.9-10). It looked as though the long delayed wet season had set in at last. But this seems not to be the case. (The Miami Metropolis, Oct.14, 1898, p.1, col.3). 10) Eugene DeBogory and his sister were sailing down from Lemon City a few days since when they were struck by a sudden squall and their boat capsized in 12 feet of water. (The Miami Metropolis, Oct.14, 1898, p.7, col.2). Author's note: Lemon City was located a few miles N. of Miami, and Mr. and Miss DeBogory were rescued by two men. 11) Storm of Oct.10-26, 1898. Caribbean Sea, western Cuba, Florida (Tannehill, 1938). 12) A storm track as follows: Oct.10 (morning), lat. 22 N., long. 83.5 W.; Oct.10 (evening), lat. 23 N., long. 82 W.; Oct.11 (morning), lat. 24.7, long. 79.7 W.; Oct.11 (evening), lat. 27 N. long. 75.5 W. (Monthly Weather Review, Oct. 1898). 13) A storm was first observed near lat. 12 N., long. 59 W. on Oct.2, 1898 and lasted for 21 days; it recurved near lat. 24 N., long 84 W. and it was last observed near lat. 69 N., long. 5 W. (Mitchell, 1924). Author's note: A track for this storm which is also shown in Mitchell (1924) and the corresponding one in Neumann et al. (1993) as for Storm 8, 1898 were found to be very similar, from their beginning to the region N.E. of Bermuda.

On the basis of information in the above items, some modifications were introduced along the track for this storm in Neumann et al. (1993), which is denoted as for Storm 8, 1898 in their publication. Their track over the eastern and central

Caribbean prior to Oct.7 could not be verified by the author of this study owing to the lack of suitable data in the above items. In fact, the author shows some skepticism about the existence of the storm as such that far to the east, but finally decided to accept that portion of the track. The 7 A.M. Oct.7 position in Neumann et al. (1993) was adjusted to the E.S.E. by about 70 miles to near 16.7 degrees N., 77.7 degrees W., in order to fit a better space-time continuity with a portion of the track prepared by the author of this study starting on Oct.8. A careful analysis of the information contained in items 1) thorough 6) and 11) and 12) allowed the author to estimate 7 A.M. positions for the period Oct.8-11 as follows: Oct.8, near 18.3 degrees N., 80.0 degrees W.; Oct.9 near 20.3 degrees N. 81.7 degrees W.; Oct.10, near 22.3 degrees N., 82.0 degrees W.; Oct.11, near 24.5 degrees N., 80.0 W. These positions were about 120 miles towards the east of the respective ones in Neumann et al. (1993), except for Oct.11 when the author's location was over 200 miles to the south of the one in the above mentioned publication. The 7 A.M. Oct.12 position in Neumann et al. (1993) was adjusted to the S.S.W. by about 100 miles to near 30.5 degrees N., 75.3 degrees W. in order to keep a better space-time continuity with the 7 A.M. positions for Oct.13-14 in Neumann et al. (1993) which were kept unchanged. The author's track for Storm 9, 1898 is displayed in Fig.1.

In spite of the fact that the "Colon" felt the storm with the intensity of a true cyclone (item 1) suggests the likelihood of hurricane winds, the tropical storm status given to this storm by Neumann et al. (1993) as for Storm 8, 1898, was retained by the author of this study.

#### Storm 10, 1898 (Oct. 21-23), T. S.

This is a new case which has been recently documented by the author of this study and which, of course, is not included in Neumann et al. (1993). Strictly speaking, however, the case is not a new one since it is included in Sarasola (1928).

Documentation of this case was based on the following information: 1) Oct.21-23, 1898. A cyclonic perturbation affected Cuba from Santa Clara to Pinar del Rio. It caused flooding. Some boats were sunk in Havana harbor and the schooner "Kate" was wrecked on the northern coast of Pinar del Rio. The "Kate" had sailed from Key West and had on board a shipment destined to the forces of General Jose Miguel Gomez at Sancti Spiritus (Sarasola, 1928). Author's note: Actually taken from the catalog of Cuban cyclones by M.Gutierrez-Lanza which is included in Sarasola (1928). 2) Havana, Oct.23. The rain storm of yesterday morning subsided towards evening and today the weather is cool and crisp. The northerly winds bring great relief and it is felt that the end of the fever season in Havana has been reached. (The New York Times, Oct.24, p.4, cols. 1 and 2). 3) Havana, Oct.27. Red Cross schooner

"Kate" which left Key West on Oct.19 with a cargo of stores and medical supplies from the Red Cross Society for the Cuban forces of Gen. José Miguel Gomez at Sancti Spiritus was wrecked Oct.22 on San Carlos reefs, Province of Pinar del Rio. The crew was saved but the cargo was lost (The New York Times, Oct.28, 1898, p.4, col.4). 4) Havana, Oct.28. The Star and Stripes floating of late over the Hotel Trocha having become somewhat damaged by the rough weather, a number of young Cuban ladies called upon Major. Gen. Butler this afternoon and asked permission to repair it. Gen. Butler readily consented, had the flag hauled down and handed it to the young ladies, who triumphantly bore it away to be mended (The New York Times, Oct.29, 1898, p.4, col.3). 5) Maximum wind at Key West was N. 31 mph and occurred on Oct.22 (Monthly Weather Review, Oct. 1898). 6) The southwestern storm was divided, one part being central this evening off the Middle Gulf coast and the other over eastern Lake Michigan. High southeasterly shifting to northwesterly winds will prevail in the eastern lake region and the winds on the South Atlantic coast and over the east Gulf are likely to become dangerously high from E. and N.E. (The New York Times, Oct.21, 1898, p.1, col.6). Author's note: This statement was issued during the evening before its publication date. 7) During today, the storm will move eastward attended by rain in New England and by rain, followed by clearing and much cooler weather in the Middle and South Atlantic States (The New York Times, Oct.22, 1898, p.1, col.6). 8) The temperature continues low in the Middle and South Atlantic States where it ranges 10 to 20 degrees (Fahrenheit) below the average for the season. Heavy frost occurred yesterday morning throughout Alabama and eastern and northern Mississippi and light frost was reported on Southwestern Mississippi and Louisiana as far south as New Orleans (The New York Times, Oct.23, 1898, p.1, col.6).

Based on a careful analysis of information in items 1) through 3) and item 5) and after having also taken into account the information in items 6) through 8), the author of this study prepared an approximate track for Storm 10, 1898. Estimated 7 A.M. positions along the author's track were as follows: Oct.21, near 19.5 degrees N., 85.3 degrees W.; Oct.22, near 21.5 degrees N., 84.0 degrees W.; Oct.23, near 25.0 degrees N., 79.0 degrees W. The track for this storm is displayed in Fig.1.

The author of this study believes that Storm 10, 1898 was a rather weak tropical storm which moved to the northeast ahead of a cold front which moved over the eastern Gulf of Mexico on Oct.21-22 as inferred from information in items 6) through 8). Weather information from Havana in item 2) showed that the front has passed that city by Oct.23, suggesting that the storm had become by then a disturbance embedded in the frontal boundary. Therefore, the storm should have rapidly lost its tropical characteristics on that date.

Storm 11, 1898 (Oct.27-Nov.4), T. S.

This storm corresponds to Storm 9, 1898 in Neumann et al. (1993).

Very little information was found about this storm: 1) Storm of Oct.26-Nov.9, 1898. Caribbean Sea, Yucatan (Tannehill, 1938). Author's note: The ending date of Nov.9 appears to be in error. 2) A storm was first observed at lat.17 N., long. 63 W. on Oct.27, 1898 and lasted 7 days; it was last observed at lat.17 N., long. 93 W. (Mitchell, 1924). Author's note: A track which is also included in Mitchell (1924) was found to be very similar to that for Storm 9, 1898 in Neumann et al. (1993).

In spite of that the author of this study showed lots of skepticism regarding the existence and evolution of this storm, he decided to accept the track shown in Neumann et al. (1898) as for Storm 9, 1898 and to reproduce it in Fig.1 as for Storm 11, 1898.

The author also decided to keep unchanged the tropical storm status given in Neumann et al. (1993).

#### Special statement.

In addition to the storm cases which were fully discussed above, two other possible cases were found for 1898. The available information for these cases was found to be insufficient to determine the true nature of the disturbances and/or to verify their tracks:

#### A) Case of Sept.9-11, 1898.

The following information was found about this possible case: 1) During Sept.9-11 a storm center moved from the central part of the Gulf of Mexico northwestward to the Louisiana coast, attended by heavy rain and high N.E. winds along the Middle Gulf coast. During Sept.12 this storm passed rapidly northward and by the morning of Sept.13 joined a low pressure area over eastern Nebraska (Monthly Weather Review, Sept., 1898). 2) Pressure is high, except for a slight depression in the West Gulf. The storm in the Gulf has moved slightly towards the W. (The New York Times, Sept.11, 1898, p.1, col.6). 3) The storm of very slight intensity in the West Gulf has moved to eastern Texas (The New York Times, Sept.13, 1898, p.1,

col.6). 4) Track for this possible case showing morning positions as follows: Sept.9, lat. 27 N., long. 88.5 W.; Sept.10, lat. 27.5 N., long. 91.3 W.; Sept.11, lat. 28.7 N., long. 93 W.; Sept.12, lat. 30.5 N., long. 93.7 W. (Monthly Weather Review, Sept, 1898). The word storm was used in connection with this case in item 1); however, no gales were mentioned in that item and the terms "slight depression" and "storm of very slight intensity" were used in items 2) and 3), respectively. Therefore, it is quite doubtful that this weather system had attained tropical storm intensity, and this is why the author of this study decided to keep this system as a possible case.

B) Case of Nov. 5-7, 1898.

The following information was found about this possible case:  
1) Special reports received yesterday afternoon indicated the presence near Trinidad of a cyclonic storm moving northwestward. Warning of the location, character and probable force of the storm was cabled to the Weather Bureau Stations in the Lesser Antilles, Trinidad, Puerto Rico, Santiago (de Cuba), Santo Domingo and Colon. Advices were also cabled to Admiral Watson, U.S. Navy, Caimanera and to the commanding officer of the U.S.Army at Ponce (The New York Times, Nov.6, 1898, p.1, col.6). 2) Yesterday's reports indicate that the storm has moved northward and is central in the vicinity of St. Kitts. (The New York Times, Nov.7, 1898, p.1, col.5). 3) A small disturbance was reported near Trinidad on Nov.6, but it apparently disappeared by the morning of Nov.7 (Monthly Weather Review, Nov. 1898). Information in the above items was not found to be sufficient to establish that this weather system attained tropical storm intensity. In fact, the term "small disturbance" used in item 2) practically disproved such intensity and, therefore, the author of this study decided to keep this one as a possible case.