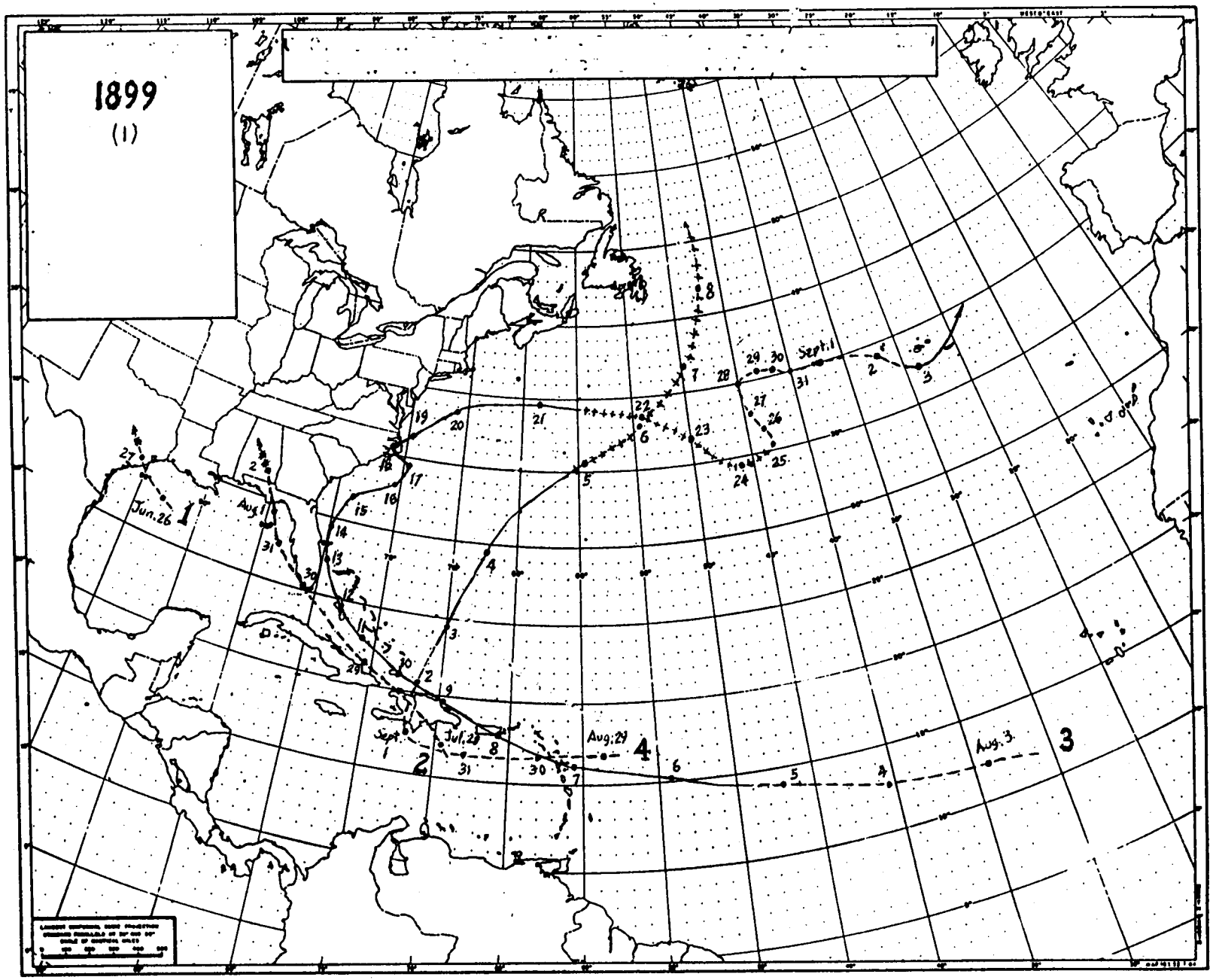

Fig. 2

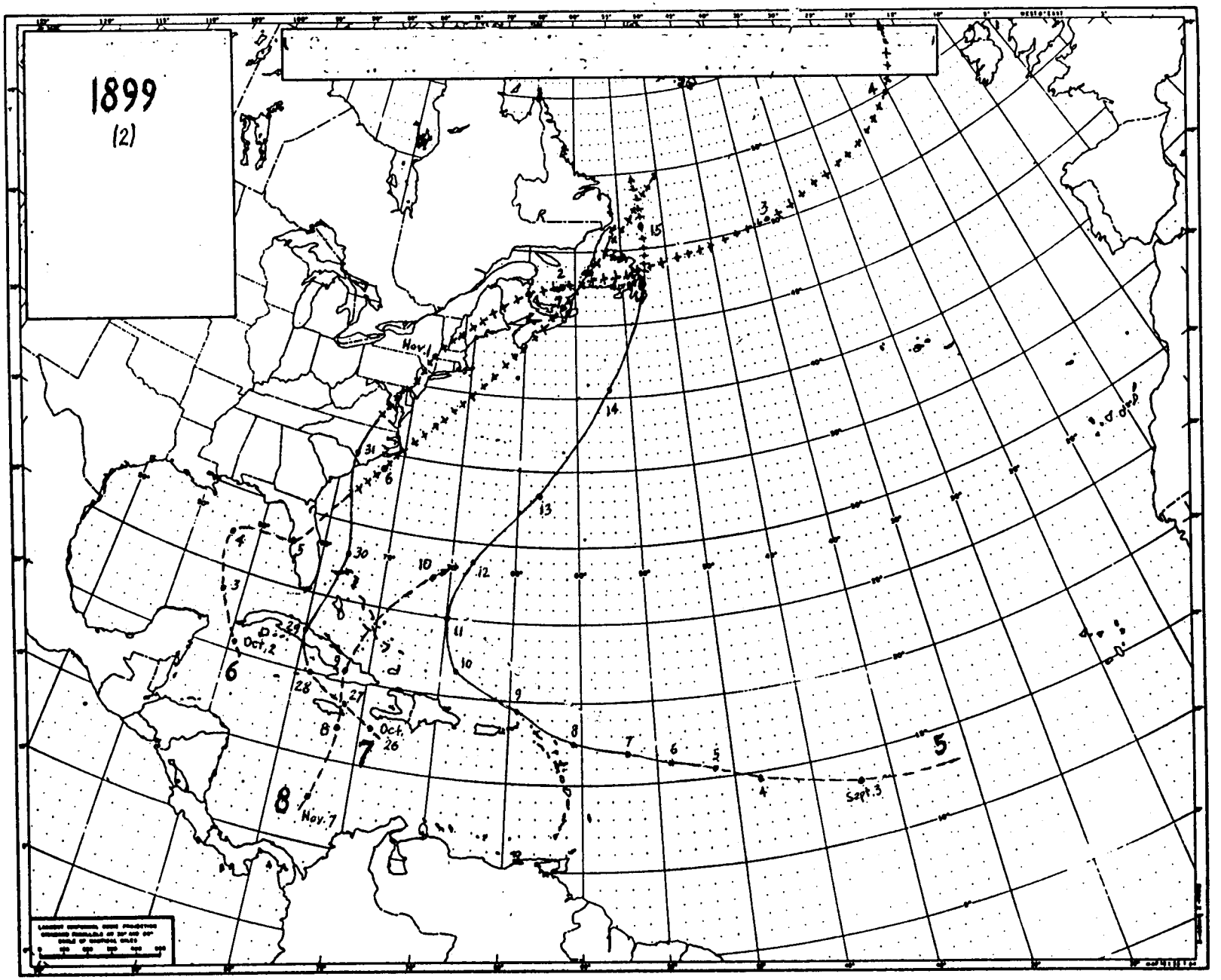

Fig. 2 (continued)

this storm (as for Storm 3, 1899) was found to be supported by the content of several of the items above, items 9) and 11) in particular. These two items were found to support hurricane intensity over the period Sept.3-4 and such intensity is indicated along the portion of the author's track which corresponds to both days. On the basis of a ship report which showed a wind of force 11, from the S. in the morning of Aug.31 (item 4), Storm 4, 1899 seems to have been approaching hurricane intensity in the eastern Caribbean Sea on that day; however, this could not be verified using information in other items and the author of this study decided to keep Storm 4, 1899 as a tropical storm while moving over the Caribbean Sea south of Hispaniola. The extratropical stage that Neumann et al. (1993) started on Sept,5 was accepted by the author of this study on the basis of information in item 10).

Storm 5, 1899 (Sept.3-15), H.

This is the same storm that Neumann et al. (1993) identify as Storm 4, 1899.

The following information was found about this storm: 1) The Barbados morning report of Sept.7 showed disturbed conditions to the northeastward of that station. A report from Barbados, timed 12:20 P.M., contained the following: Barometer irregular, unusual increase in height of sea on east coast (Monthly Weather Review, Sept.1899). 2) On Sept.7 the central office of the Weather Bureau at Washington adviced its observers in the eastern West Indies that conditions were threatening over the Lesser Antilles and to be alert to take local action if necessary. The morning of Sept.8 the approach of a severe storm from the eastward of St. Kitts was indicated and hurricane signals were ordered on that island, and advisory messages were telegraphed to all other observers in the threatened district. The center of the hurricane did not reach any of the islands of the West Indies and the winds of its west quadrant were severely felt only over the outlying Leeward Islands of the Lesser Antilles (Monthly Weather Review, Sept.1899). 3) The hurricane began (at St. Kitts) at 3:40 P.M. Sept.8 and ended at 2:25 A.M. Sept.9, lasting, therefore, ten hours and 45 minutes, during which time there was a total wind movement of 514 miles, or an average of 48 mph during the entire storm. The maximum velocity of the wind was 62 mph and occurred between 8:18 and 8:23 P.M. Sept.8. The extreme velocity was 120 mph at 5:51 P.M. The lowest reading of the barometer was 29.51 inches, occurring at 5 P.M., and the wind came from the S.W. during the entire storm. The total rainfall was 3.13 inches, the heaviest fall being during the first

two hours of the storm (Alexander, 1902). 4) About 5 A.M. Sept.8 the wind at St.Kitts, set in steadily from the N.W. and continued from that direction until 1 P.M., when it began shifting to the W. and increasing rapidly in force. From 1:45 to 3:40 P.M. the wind came from the W. with an average velocity of 36 mph. At 3:40 P.M. it shifted to the S.W. and soon reached verifying velocity. About 3:15 A.M. Sept.9, the wind began blowing from the S. and by noon it was coming steadily from that direction. Some barometer readings (at St.Kitts) were as follows: Sept.8, 7 A.M., 29.74 inches; 10 A.M., 29.68 inches; 1 P.M., 29.58 inches; 2 P.M., 29.54 inches; 3 P.M., 29.53 inches; 4 P.M., 29.52 inches; 5 P.M., 29.51 inches; 6 P.M., 29.52 inches; 7 P.M., 29.54 inches; 8 P.M., 29.62 inches; 9 P.M., 29.64 inches; 11:30 P.M., 29.69 inches; Sept.2, 2 A.M., 29.69 inches (Monthly Weather Review, Sept.1899). Author's note: According to the above publication, these data were provided by W.H. Alexander. U.S. Weather Bureau observer at St. Kitts. 5) During Thursday night (Sept.7) a tropical storm appeared E. of St. Kitts moving to the N.W. It developed hurricane proportions during Friday (Sept.8) and at 4 P.M. there was a terrific sea at St. Kitts with barometric pressure of 29.92 inches and a maximum wind of 48 mph from the S.W. (The New York Times, Sept.9, 1899, p.2, col.6). Author's note: The barometric pressure of 29.92 inches at St. Kitts is erroneous; according to information in item 4), the pressure there at 4 P.M. Sept.8 was 29.52 inches. 6) The tropical storm passed onto the ocean N. of Puerto Rico. San Juan reported a maximum velocity of 44 mph from the W. and St. Kitts the continuance of the terrific sea (The New York Times, Sept.10, 1899, p.2, col.5). Author's note: This statement was probably issued in the evening of Sept.9. 7) The hurricane which had been anticipated at St. Kitts reached that place and the wind yesterday attained a velocity of 56 mph from the S.W. At 5 P.M. it was still blowing at 54 mph from the S.W. indicating that the center was still N. of St. Kitts and that no trouble was likely in Puerto Rico (The New York Times, Sept.11, 1899, p.2, col.7). Author's note: The word "yesterday" was found to be misleading since it implies that the storm occurred at St. Kitts on Sept.10; actually the storm was felt there on Sept.8. 8) Maximum velocities were as follows: Basseterre (St. Kitts), S.W. 62 mph on Sept.8; Bridgetown (Barbados), S. 25 mph on Sept.8; San Juan, N.W. 31 mph on Sept.9 (Monthly Weather Review, Sept. 1899). Author's note: A wind velocity as high as 44 mph (from the W.) was reported to have occurred at San Juan on Sept.9 (item 6); that value is 13 mph higher than the one (31 mph) which is stated above. 9) A telegram received from the officer administering the Government of the Leeward Islands reports the occurrence on Sept.8 of a second hurricane which had caused further damage in Antigua and destroyed many houses in Barbuda and Anguilla (The Times, London, Sept.19, 1899, p.7, col.6). Author's note: In reference to the island on Anguilla, the Monthly Weather Review, Sept.1899, stated that as many as 200 houses were demolished and

that 800 people were rendered homeless. 10) Observations taken at 8 A.M. (E.S.T.) which were extracted from daily weather maps: Sept.8, Antigua, wind N. force 8; St. Kitts, wind N.W. force 4; Dominica, wind W. force 5, barometer 29.82 inches; ship near lat. 18.7 N., long. 63 W., wind N. force 5. Sept.9, San Juan, wind N.W. force 4, barometer 29.74 inches; St. Kitts, wind S. force 6, barometer 29.86 inches; ship near lat. 21 N., long. 67 W., wind N.E. force 6, barometer 29.88 inches; ship near lat. 23 N., long. 63.7 W., wind E. force 10, barometer 29.91 inches; storm center placed near lat. 19.5 N., long. 64 W. on the 8 A.M. (E.S.T.) Sept.9 weather map. Sept.10, Santo Domingo, wind S.W. force 4, barometer 29.86 inches; San Juan, wind S. force 3, barometer 29.86 inches; ship near lat. 20 N., long. 67 W., wind S.S.E. force 7, barometer 29.88 inches (obviously too high); ship near lat. 21.7 N., long. 64 W., wind S.E. force 7, barometer 29.97 inches; storm center placed near lat. 21.5 N., long. 69 W. on the 8 A.M. (E.S.T.) Sept.10 weather map. Sept.11, ship near lat. 27 N., long. 68 W., wind E. force 9; ship near lat. 27 N., long. 70 W., wind N.E. force 8; ship near lat. 23 N., long. 67.5 W., wind S.W. force 8; storm center placed near lat. 24 N., long. 69 W. on the 8 A.M. (E.S.T.) Sept.11 weather map. Sept.12, ship near lat. 29 N., long. 67.5 W., wind E.S.E. force 11; storm center placed near lat. 28.7 N., long. 68.3 W. on the 8 A.M. (E.S.T.) Sept.12 weather map (Historical Weather Maps, Sept. 1899). 11) Ship "Caracas" met the storm 400 miles N. of Puerto Rico, and experienced its fury from midnight Saturday (Sept.9-10) until Monday morning, Sept.11 (Monthly Weather Review, Sept. 1899). Author's note: The above information was sent to the U.S. Weather Bureau by W.H. Alexander, Observer, Basseterre, St. Kitts. 12) According to Capt. Heath, the "Newton", a 499 ton schooner which had sailed from Ship Island (in the Gulf of Mexico) for San Juan on Aug.15, was struck by a hurricane out of the E.N.E. at noon Sept.9 (Saturday) in lat. 22 50 N., long. 66 13 W. without little or no barometric warning. The wind blew with terrific violence as the night came on and at 11 P.M. the schooner dived into the sea. Tons of water were taken over the decks and the vessel strained and shook from stem to stern. The strain opened up many of seams forward through which the water was pouring in streams. Men worked at the pumps and labored during the night. At 6 A.M. Sunday morning (Sept.10) the vessel swung around in the way of a bucking beam sea which struck her on the starboard beam. The partially waterlogged vessel was hove down on her beam ends. All day Sunday the storm continued with unabated force. By Monday morning (Sept.11) the storm had abated somewhat but the sea was still running. The crew abandoned the schooner and was picked up by the "Fontabelle" during Wednesday night (Sept.13) and landed at St. Thomas on Sept.15 (The New York Times, Sept.25, 1899, p.1, col.5). Author's note: The Monthly Weather Review, Sept.1899 also stated that the "Isaac Newton" was waterlogged and dismasted on Sept.10, adding that the crew of the schooner, when rescued on Sept.13, were

in water waist deep and had been without food or fresh water for 3 days. In addition, the above mentioned publication stated that the crew reported the occurrence, during the hurricane, of a severe hailstorm, lasting about half an hour and producing intense cold. The hailstones were very large and fell with great force. 13) The steamship "Fontabelle" encountered the hurricane at midnight (Sept.11-12) in lat. 29 20 N., long. 68 20 W.. From 2 to 8:30 A.M. Sept.12, the wind blew at an estimated velocity of 90 mph, first from the E.S.E., then backing to E.N.E., after which, with diminished force, backed to S.W. Heavy rain from 1:30 to 4:30 A.M. Sept.12. The lowest pressure noted was 28.40 inches. The captain reports the loss of a large quantity of deck cargo and live stock, also that the storm was intensively severe and that the escape of the vessel from damage was remarkable (Monthly Weather Review, Sept.1899). Author's note: The above information was sent to the U.S. Weather Bureau by W.H. Alexander, Observer, Basseterre, St. Kitts. 14) Bermuda, Sept.13. A cyclone swept over the island last night, doing great damage to public and private property but no lives have been reported lost. The weather looked threatening early Tuesday morning (Sept.12) with a barometer falling. The storm began with rain at 2 P.M. after which there was a slight lull for a few hours with the wind S.S.E. and the barometer steadily falling. The wind suddenly backed to E. with cyclonic gusts. From 8 P.M. to midnight (Sept.12-13) it blew with hurricane force and was at its worst from 1 to 1:45 A.M. this morning. Then, after a short lull, the wind changed to S.W., when the principal damage was done, houses being blown down and others unroofed. Great cedars were uprooted, ornamental and fruit trees were destroyed and wharves were washed out into the sea (The New York Times, Sept.14, 1899, p.1, col.2). Author's note: An Associated Press dispatch, dated at Bermuda Sept.13, stated that, from what can be learned, there has been no loss of life. Such a dispatch was published in the Monthly Weather Review, Sept.1899. 15) New York, Sept.13. This information has been received here from Bermuda: A storm began at 2 P.M. yesterday (Sept.12) and continued the whole of the evening and night. Wharves were wrecked into the sea and considerable damage was also done to the military camp. Many small craft were sunk in the harbor or stranded (The Times, London, Sept.14, 1899, p.4, col.3). 16) Bermuda, Sept.14. A more detailed examination of the damage done by the hurricane shows that the breakwater of the naval yard has been severely damaged, the outer face being partially wrecked away and undermined. The damage to the Causeway previously reported was not overestimated. The Colonial Government property has suffered severely (The Times, London, Sept.15, 1899, p.4, col.1). 17) Extract of a hurricane description at Bermuda: The Weekly Report of the Weather by Walter S. Perinchief, Principal Keeper at Gibb's Hill Light Station gives: "Sept.13, 2 A.M., hurricane with barometer 27.73 inches". The hurricane seems to have reached its height between 11 and midnight (Sept.12-13) and

continued with unabated violence until a little past 2 A.M. (Sept.13). At 3 A.M. there was a lull for about half an hour during which the rain, that had fallen almost continuously for six hours, ceased and the wind shifted to N.W., rapidly growing its former strength. No abatement was noticed until about 8:30 A.M. (Sept.13), when the rain, which began again an hour or so previously, descended in white hissing sheets and lasted until 9 o'clock. Damage estimated to run into at least five figures was sustained at Her Majesty's Dockyard, Ireland Island; while Prospect Camp was described as looking "something as Alexandria after the bombardment". Many large buildings on the South Shore which withstood the hurricane of 1839, have been driven for some distance inland. The fall of the barometer was something marvelous; it seemed to go down with bounds, and when at 2:30 A.M. (Sept.13) it reached 27.99 inches one was prepared for anything from a double-barrelled cyclone to the Last Day. In speaking of this particular hurricane, A.E. Verill laments that "there is scarcely anything recorded of the changes that it wrought on the exposed cliffs, though such effects were sufficiently obvious a year later all along the southern shores". In a letter to her father, who was at Montreal at the time, Miss. Lilliam Hare Hayward wrote on Sept.15 in reference to the barometer: "I have every reason to believe that ours registered 27.45 (inches) in the middle of the hurricane at 2 A.M. (Sept.13), there was a most ominous lull then, the barometer was at its lowest and I am told that the sky at midnight was crimson. Ours, of course, is a high glass; Mr. Henry Smith and Mr. Ed. Gosling state their reading was 27.06 (inches)" (Tucker, 1982). Author's note: The most reliable of the four barometer readings given above appears to have been the one of 27.73 inches taken at Gibb's Light Station. 18) Observations taken at 8 A.M. (E.S.T.) which were extracted from weather maps: Sept. 13, ship near lat. 35 N., long. 62 W., wind N.N.E. force 6; ship near lat. 35 N., long 58 W., wind S. force 6; storm center placed near lat 34.5 N., long.61 W.on the 8 A.M. (E.S.T.) Sept.13 weather map. Sept.14, storm center placed near lat. 41 N., long. 56.5 W. on the 8 A.M. (E.S.T.) weather map. Sept.15, storm became extratropical; big low placed N. of Newfoundland (Historical Weather Maps, Sept.1899). 19) The "Lucania" arrived off Fire Island at 9:45 P.M. Saturday evening. On Thursday last (Sept.14) the "Lucania" encountered what Capt. Mc Kay and officers agree was the most violent hurricane ever met by them in the Atlantic Ocean. At noon a fresh breeze suddenly sprang up from the S.W. veering to S.S.W. and the barometer took a startling slump. The wind continued to strengthening until 3 P.M. when it assumed hurricane force, ripping up a tremendous sea. The water deluged the decks and swept 60 chairs from the promenade deck. The vessel was promptly hove to. The hurricane lasted until 6 P.M., subsiding into a heavy gale, which, however, moderated by midnight (The New York Times, Sept.18, 1899, p.3, col.1). 20) St. John's, Newfoundland, Sept.15. A violent hurricane swept this section of

Newfoundland last night. The "Corean", from Philadelphia, had a frightful passage and the "Silvia", from New York, was delayed 24 hours. Widespread destruction of fishing premises and gear is reported and it is feared that there has been much damage and probably loss of life at more distant points (The New York Times, Sept.16, 1899, p.1, col.6). 21) St. John's, Newfoundland, Sept.16. Extensive damage was done along the coast by the Thursday night (Sept.14) storm. Seven more fishermen were reported to have been drowned. Scores of schooners and other craft were demolished. The steamer "Regulus" had her coal and cargo shifted and almost sank. The steamer "Alaska", from New York to Tilt Cove, had her decks swept and her main steam pipe broken (The New York Times, Sept.17, 1899, p.1, col.6). Author's note: The number of deaths mentioned in this item was found to be larger than the 4 deaths that the Monthly Weather Review, Sept.1899 attributed to the storm in Newfoundland. 22) Storm of Sept.3-21, 1899. Atlantic (Tannehill, 1938). 23) Map showing a track for the storm along which the following morning positions were displayed: Sept.8, near lat. 18 N., long. 61.3 W.; Sept.9, near lat. 20.7 N., long. 64.3 W.; Sept.10, near lat. 23 N., long. 66.3 W.; Sept.11, near lat. 26.5 N., long. 67.3 W.; Sept.12, near lat. 29 N., long. 66.3 W.; Sept.13, near lat. 33.3 N., long. 63.7 W. (Monthly Weather Review, Sept.1899). 24) A Sept. 1899 storm appeared near lat. 17 N., long. 61 W., recurved near lat. 25 N., long. 67 W. and disappeared over midocean (Garriott, 1900). Author's note: A track for the storm is included in Garriott (1900); such a track was found to be very similar to the one shown in the Monthly Weather Review, Sept. 1899 (item 23). 25) A storm was first observed near lat. 13 N., long. 43 W. on Sept.3, 1899 and lasted 18 days; it recurved near lat. 26 N., long. 70 W. and it was last observed near lat. 60 N., long 10 E. (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) as for Storm 4, 1899.

Information in above items suggested the need for some modifications along the track of this storm which is displayed in Neumann et al. (1993). Due to the lack of suitable information in those items, their track before Sept.7 could not be checked and, therefore, the author decided to accept it. Their 7 A.M. Sept.7 position was found to be reasonable in accordance to information in item 1) and, consequently it was also accepted. On the basis of meteorological observations taken in the morning of Sept.8 (items 4 and 10) and information in item 9) which suggested that the center of the hurricane passed quite close to the N. of Barbuda and Anguilla, the 7 A.M. Sept.8 position in Neumann et al. (1899) was adjusted to the S. by about 30 miles to near 17.5 degrees N., 60.5 degrees W. Their 7 A.M. Sept.9 position was also slightly adjusted to the S.to near 19.5 degrees N., 64.5 degrees W. in order to fit better the information contained in items 4) and 10) through 12).

The author's 7 A.M. Sept.10 position was estimated near 21.7 degrees N., 68.7 degrees W., primarily on the basis of morning observations for that day (item 10) but also using information in items 11) and 12); this position was found to be about 100 miles to the S. of the corresponding one in Neumann et al. (1993). The author's 7 A.M. Sept.11 position was estimated near 25.0 degrees N., 70.0 degrees W. on the basis of morning observations for that day contained in item 10); this position was found to be about 120 miles to the S. of the one in the above mentioned publication. The author's 7 A.M. Sept.12 position was estimated near 28.7 degrees N., 68.3 degrees W. on the basis of information for that day in item 10) and the observations provided by the "Fontabelle" (item 13); this position was found to be about 100 miles to the S.W. on the one in Neumann et al. (1993). The 7 A.M. Sept.13 position in the latter publication was kept unchanged because it was found to agree very well with the passage of the eye of the storm over Bermuda about 5 hours earlier (items 14 and 17) and, in addition, the morning location given for that day in item 18) was found to be too far to the N.E. to support the time of such passage. The 7 A.M. Sept.14 position in Neumann et al. (1993) was slightly adjusted to the N.E. to near 40.5 degrees N., 57.0 degrees W. in order to fit better the information for that day in item 18) and to obtain a better space-time continuity along the storm track. Finally, the author of this study estimated a 7 A.M. Sept.15 position near 51.5 degrees N., 52.5 degrees W. on the basis of information in items 18), 20) and 21); this position was found to be about 300 miles to the N. of the corresponding one in Neumann et al. (1993). The author's track for Storm 5, 1899 is displayed in Fig.2.

The hurricane status that Neumann et al. (1993) gave to this storm as for Storm 4, 1899 was found to be supported by the content of many of the 25 items above. As for the track in Neumann et al. (1993), the author's track denotes hurricane intensity starting on Sept.6 and tropical storm status prior to that day. Transformation into an extratropical system was denoted along the author's track at about lat. 48 N., when the storm was leaving Newfoundland after having affected that island in the night of Sept.14 (items 20 and 21). The author believes that his decision of having kept the storm as a hurricane until it left Newfoundland was fully justified by the fact that the "Lucania" encountered very violent hurricane conditions in the evening of Sept.14 (item 19).

Storm 6, 1899 (Oct.2-7), T. S.

This storm corresponds to Storm 5, 1899 in Neumann et al.

(1993).

The following information was found about this storm: 1) There is evidence of a disturbance over the western part of the Caribbean Sea but its strength and future course cannot as yet be determined. Heavy rain is reported from the Florida peninsula, a rainfall of 4.94 inches being noted at Jupiter (The New York Times, Oct.3, 1899, p.3, col.6). Author's note: The location given in this weather statement, as well as in similar ones published in The New York Times, probably corresponds to the evening before their publication date. 2) A general disturbance which has been moving W. over the western portion of the Caribbean Sea during the past 2 days has passed out into the Gulf of Mexico. During yesterday the wind gradually increased along the Middle Gulf coast and on the East Florida coast, with a maximum velocity of 40 mph at Port Ead and 37 mph at Jupiter, which also reported rough seas and the highest tide in 7 years (The New York Times, Oct.4, 1899, p.3, col.6). 3) The Gulf of Mexico disturbance was apparently approaching the West Florida coast yesterday. Maximum velocities of 48 mph from the N.E. and 36 mph from the S.E. were reported from Port Eads and Jupiter, respectively. Although the storm strength at the center had not been determined, storm signals were ordered yesterday morning from New Orleans to Charleston (The New York Times, Oct.5, 1899, p.2, col.7). 4) Observations taken at 8 A.M. (E.S.T.) which were extracted from weather maps: Oct.1, ship near lat. 15 N., long. 81 W., wind N. force 2; ship near lat. 20.7 N., long.80 W., wind E. force 4; ship near the W. coast of Isle of Pines, wind N.E. force 4. Oct.2, Cienfuegos, wind N.E. force 2, barometer 29.87 inches; Havana, wind E. force 2, barometer 29.90 inches; Key West, wind N.E. force 4, barometer 29.93 inches; ship near lat. 22.8 N., long. 84.8 W., wind E.N.E. force 5; ship near lat. 25.7 N., long. 85.5 W., wind E. force 6, barometer 29.97 inches; ship near lat. 26 N., long. 83.7 W., wind E. force 6; ship near lat. 17.2 N., long 84.8 W., no wind, no pressure. Oct.3, Port Eads, wind E.N.E. force 6; Pensacola, wind N.E. force 3, barometer 30.10 inches; New Orleans, wind N.E. force 4, barometer 30.09 inches; Tampa, wind N.E. force 3, barometer 29.98 inches; ship near lat. 26.2 N., long. 87.2 W., wind E.N.E. force 10, barometer 29.80 inches; ship near lat. 28 N., long. 86 W., wind N.E. force 9; Merida, wind N.W. force 2, barometer 29.83 inches; ship near lat. 21 N., long. 86 W., wind W. force 2, barometer 30.24 inches (obviously too high); ship near lat. 21 N., long. 83 W., wind S.W. force 2, barometer 29.91 inches; storm center placed near lat. 25 N., long. 86.5 W. on the 8 A.M. (E.S.T.) Oct.3 weather map. Oct.4, Merida, wind W. force 2, barometer 29.88 inches; Havana, wind S.S.E. force 3, barometer 29.85 inches; Key West, wind S.E. force 3, barometer 29.89 inches; New Orleans, wind N.E. force 4; ship off Cape San Antonio, wind S.W. force 4, barometer 29.83 inches; ship near lat. 27.8 N., long. 86 W., wind S.S.E. force 4, barometer

29.83 inches; ship near lat. 29 N., long. 87 W., wind E.N.E. force 10; storm center placed near lat. 25.5 N., long. 88.5 W. on the 8 A.M. (E.S.T.) Oct.4 weather map (the center might have actually been some distance to the N.E. of the position shown on the map). Oct.5, Tampa, wind N.E. force 1, barometer 29.77 inches; Jacksonville, wind E. force 2, barometer 29.81 inches; Key West, wind S.W. force 3, barometer 29.86 inches; Pensacola, wind N.E. force 3, rain, barometer 29.92 inches; ship near lat. 28.7 N., long. 80 W., wind S. force 2; ship near lat. 25.7 N., long. 85 W., wind W. force 3; ship near lat. 26.7 N., long. 87 W., wind W.N.W. force 5; storm center placed just N. of Tampa on the 8 A.M. (E.S.T.) Oct.5 weather map, but wind N.E. force 1 at that station, with the lowest barometer of 29.77 inches, suggested the center to have been practically over there at map time (Historical Weather Maps, Oct.1899). 5) The Gulf storm has moved N.E. over the Florida peninsula and was central last evening near Jacksonville. Storm signals are displayed from Port Eads to Norfolk, except at Key West (The New York Times, Oct.6, 1899, p.3, col.4). 6) The Gulf storm has moved rapidly to the N.E. and is now central off the S.E. New England coast. Rain has fallen on the Atlantic coast from Florida northward, a maximum velocity of 56 mph being reported from Cape Henry and Block Island (The New York Times, Oct.7, 1899, p.2, col.5). 7) At Havana (Belen College Observatory) the lowest pressure related to the cyclone of Oct.2-6, 1899 was 755.7 millimeters (29.75 inches) and occurred on Oct.6 (Sarasola, 1928). 8) Maximum wind velocities of 37 mph from the N. and 47 mph from the N. were recorded at Boston and Woods Hole, respectively, on Oct.6 (Monthly Weather Review, Oct.1899). 9) Observations taken at 8 A.M. (E.S.T.) which were extracted from weather maps: Oct.6, Hatteras, wind S.E. force 2, barometer 29.62 inches; Wilmington, wind N. force 2, barometer 29.65 inches; Charleston, wind N.W. force 3, barometer 29.68 inches; Jacksonville, wind W.N.W. force 2, barometer 29.71 inches; Tampa, wind S.W. force 2, barometer 29.73 inches; ship near lat. 32.5 N., long. 75.5 W., wind S.S.W. force 9, barometer 29.53 inches (it might be in error because of difficulties in reading the value off the map); ship near lat. 33 N., long. 75 W., wind S.S.W. force 5, barometer 29.62 inches; frontal low off Carolina coast, with cold front passing between Jacksonville and Tampa. Oct.7, winds in the Nova Scotia area suggested center of low near lat. 47 N., long. 60.5 W. (Historical Weather Maps, Oct.1899). 10) Storm of Oct.2-9, 1899. Gulf, Florida, Atlantic. Of small force (Tannehill, 1938). 11) Map showing a track for this storm. The following positions were read off the map: Oct.3 (morning), near lat. 21.5 N., long. 81.3 W.; Oct.3 (evening). near lat. 23.5 N., long. 83 W.; Oct.4 (morning), near lat. 26 N., long. 84 W.; Oct.4 (evening), near lat. 27 N.. long. 83.7 W.; Oct.5 (morning), near lat. 28 N., long. 82.7 W.; Oct.5 (evening), near lat. 30.3 N., long. 80.3 W.; Oct.6 (morning), near lat. 35.7 N., long. 74.5 W.; Oct.6 (evening), near lat. 41 N., long. 68.7 W.;

Oct.7 (morning), near lat. 46.5 N., long, 59.5 W. (Monthly Weather Review., Oct.1899). 12) An Oct.1899 storm appeared near lat. 21 N., long. 82 W., recurved near lat. 26 N., long. 84 W. and disappeared near Newfoundland (Garriott, 1900). 13) A storm was first observed near lat. 20 N., long. 85 W. on Oct.2, 1899 and lasted 7 days; it recurved near lat. 26 N., long. 86 W. and it was last observed near lat. 52 N., long. 54 W. (Mitchell, 1924). Author's note: A track which is also shown in Mitchell (1924) was found to be quite similar to the one displayed in Neumann et al. (1993) as for Storm 5, 1899.

Information in the above items allowed the author of this study to introduce some modifications along the track for this storm which is displayed in Neumann et al. (1993). Their 7 A.M. Oct.2 position was kept unchanged because it was found to be reasonable in the light of information for that day in item 4). Information for Oct.1 in that item suggested the possibility that the storm circulation might have already existed well to the S. of central Cuba on that day, but no attempt was made to extend the track backward in time because the light northerly wind reported by a ship in the western Caribbean Sea was insufficient for documenting the existence of a closed circulation at the surface. The following 7 A.M. positions for the period Oct.3-5 were estimated by the author of this study on the basis of morning observations in item 4): Oct.3, near 23.7 N. degrees N., 86.5 degrees W.; Oct.4, near 27.3 degrees N., 87.0 degrees W.; Oct.5, near 28.0 degrees N., 82.5 degrees W. The three positions above were found to be about 40 miles to the N.N.W., about 90 miles to the N.W. and about 60 miles to the S.S.E. of the corresponding ones in Neumann et al. (1993). The following 7 A.M. positions for the period Oct.6-7 were estimated on the basis of information contained in item 9): Oct.6, near 34.0 degrees N., 76.5 degrees W.; Oct.7, near 46.3 degrees N., 61.3 degrees W. These positions were found to be about 140 miles to the S.W. and about 270 miles to the N.E. of the respective ones in Neumann et al. (1993). The author decided to terminate the track on Oct.7 on the basis that the storm was said to have been last observed near lat. 52 N., long. 54 W. (item 13), which is also near Newfoundland as indicated in item 12). The author's track for Storm 6, 1899 is shown in Fig.2.

The tropical storm status that Neumann et al. (1993) gave to this storm as for Storm 5, 1899 was supported by information contained in several of the above items. However, extratropical characteristics were observed as the storm moved towards Cape Hatteras on the morning of Oct.6 (item 9). Therefore, the author of this study decided to start denoting such characteristics on his track when the storm reached the 32 degrees N. parallel early that day.

Storm 7, 1899 (Oct.26-Nov.4), H.

This is the same storm that Neumann et al. (1993) identify as Storm 6, 1899.

The following information was found in relation to this storm: 1) Belen College Observatory, Oct.26, 6 P.M. There are some indications of an ill-defined cyclonic perturbation in the Caribbean Sea to the S.E. of this island. At Santiago de Cuba the barometer read 29.85 inches at 7:30 A.M. (Oct.26), light rain fell continuously all night; at 11 A.M. , barometer 29.84 inches, calm, cloudy, low clouds coming from the E.; at 3 P.M., barometer 29.79 inches, intermittent light rain. Heavy rain fell all morning at Holland Bay (Jamaica), where rough sea was observed. At Kingston, noon, barometer 29.80 inches, light wind from S., rain. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct.27, 1899, p.1, col.8). Author's note: L. (Lorenzo) Gangoiti, S.J. was the director of the Belen College Observatory at Havana. 2) According to information obtained from the Weather Bureau office (here), the low pressure area remains S. of Santiago de Cuba where the barometer today is somewhat lower than yesterday, but this does not mean that there are indications of a storm (Diario de la Marina, Havana, Oct.27, 1899, evening edition, p.2, col.1). 3) Belen College Observatory, Oct.27, 7 P.M. The cyclonic perturbation is better organized than yesterday; its center appears to be between Jamaica and Cuba. At Santiago de Cuba, barometer 29.80 inches, heavy and continuous rain all night, wind N.N.E., low clouds coming from the E.S.E. Holland Bay, calm sea, heavy and continuous rain, S.W. At Jamaica (probably Kingston), noon, barometer 29.75 inches, light and continuous rain, wind W. 10 mph. Tunas de Zaza, barometer 29.83 inches, wind N.E., variable and strong, high clouds coming slowly from the S., low clouds being ragged by the wind, drizzle, cumulus and nimbus clouds all over the horizon. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct.28, 1899, morning edition, p.5, col.8). 4) The most important storm of Oct.1899 advanced from the W. part of the Caribbean Sea along the east coast of the United States from Oct.28 to Oct.31. For several days preceding Oct.28 unsettled weather had prevailed over the Greater Antilles and the western Caribbean Sea and a marked barometric gradient between that region and an area of high barometer over the S.E. United States caused high N.E. winds over S. Florida, Cuba and adjacent waters, and careful watch was kept for a storm development which, at this season, these conditions favored. The evening reports of Oct.27 showed the looked-for storm development south of central Cuba and storm signals were ordered at Key West and Miami, with the

information that the center of the disturbance would probably move N,W. during the next 24 hours and cause high N.E. winds over southern Florida and western Cuba (Monthly Weather Review, Oct.1899). Author's note: Similar information was published in The New York Times, Oct.27, 1899, p.2, col.6 and in The New York Times, Oct.28, 1899, p.3, col.7. 5) Belen College Observatory, Oct. 28, 11 A.M. The cyclonic perturbation is moving W., with a tendency to recurve. At 8 A.M. today the center was located to the S.E. of Havana, between Tunas de Zaza and Cape Cruz, as inferred from the cloud bank of the hurricane which we are observing this morning (from Havana) and from the following observations: Santiago de Cuba, barometer 29.83 inches, intermittent heavy showers, wind S.E. Holland Bay (Jamaica), gusty wind from S.W., good sea condition. Cienfuegos, barometer 29.76 inches, cloudy, wind E.N.E., low clouds coming from E.N.E., cirrus arc to the S.E. Tunas de Zaza, barometer 29.76 inches, wind N.E. to E.N.E., strong gusts, cirrus shield, swell from S.E. and S. Cardenas, strong breeze, intermittent light rain, low cumulus clouds coming from E.N.E., high cumulus coming from E., cirrus arc to the S.E. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct.28, 1899, evening edition, p.2, col.1). 6) Belen College Observatory, Oct.28, 7 P.M. The motion of the cyclonic perturbation is slow this evening, with increased intensity. It continues in the area limited by Tunas de Zaza, Cape Cruz and Grand Cayman. L. Gangoiti, S.J. (Diario de la Marina, Havana, Oct.29, 1899, morning edition, p.2, col.5). 7) Belen College Observatory, Oct.29, 5 P.M. There is no danger to Havana province because the tempest has moved over Santa Clara province, passing some distance E. of Cienfuegos and turning to the N. At this time the main center is entering the Atlantic. Some of the telegrams which were sent to us by our observers are as follows: Santiago de Cuba, barometer 29.71 inches, strong S.E. wind with heavy gusts. Tunas de Zaza (evening of Oct.28), barometer 29.58 inches, moderate tempest from N.E., cloudy, rough sea from S. Cienfuegos, barometer 29.45 inches, wind N.W., heavy and continuous rain. Cardenas, barometer 29.56 inches, strong N.N.W. wind, tempest threatening, intermittent heavy showers. The direction low clouds were coming from at Havana was N.N.E. at 6 A.M. (Oct.29), N. one-quarter E. at 8 A.M. and N.W. at noon. L. Gangoiti, S.J. (Diario de la Marina, Oct.30, 1899, evening edition, p.1, col.6 and p.2, col.1). 8) Additional observations: Tunas de Zaza (Mr. Periu, observer), Oct.28, 8 P.M., barometer 29.53 inches, sometimes calm, others wind from N. and S.E., more or less strong; 10 P.M., barometer 29.50 inches, falling rapidly (this statement seems to be in error), distant lightning to S.S.W. and S.W., rough sea; midnight (Oct.28-29), barometer 29.40 inches, gusty winds from E. and E.S.E., heavy swell from S.W., very low clouds; Oct.29, 2 A.M., barometer 29.40 inches, some clearing observed to the S.; 4 A.M., barometer 29.41 inches, heavy showers returned from S.E. and S., heavy sea; 6 A.M., barometer 29.42 inches, heavy showers from the

S.W., same sea condition, small clearing to the S.W. Steamship "Cosme de Herrera", (Capt. Manuel Ginesta), at Caibarien, Oct.29, 4 A.M., barometer 29.72 inches, very strong wind, visibility very reduced by heavy rain; daybreak, wind blowing at cyclone intensity, terrible squalls, barometer 29.69 inches; after sunrise, wind appeared to be less intense out of the E.S.E. and S.E.; 8 A.M., clearing to the S., wind suddenly became calm, barometer 29.68 inches; calm conditions and very dark horizons to the S.W. and N.W. prevailed until 11:30 A.M., when strong winds started blowing from the S.W.; noon, barometer 29.67 inches. According to reports from the captain of the "Humberto Rodriguez" and several others, calm began at Sagua at 7:30 A.M. Capt. Deschamps of the steamer "Alfonso XIII" reported to have encountered strong winds from the second and third quadrants as the storm moved towards the Carolina during the afternoon of Oct.30 (Diario de la Marina, Havana, Nov.18, 1899, evening edition, p.2, cols.1 and 2). Author's note: The above information was extracted from a note signed by L. Gangoiti of the Belen College Observatory. Sagua and Caibarien are located on the northern coast of central Cuba. 9) During yesterday (Oct.29) a center of a disturbance moved N. over central Cuba and at 8 P.M. occupied a position about 150 miles E. of Key West. The lowest barometer noted in connection with the storm was 29.40 inches at 8 A.M. yesterday. It is calculated that the storm will move N.E. off the South Atlantic coast, attended today by N.E. gales from Virginia southward (The New York Times, Oct.30, 1899, p.2, col.7). 10) Sagua la Grande, Oct.29. Since yesterday (Oct.28) we are under the influence of a cyclone. Last night we had rain with intermittent strong gusts from the E. The barometer drop has been considerable from 2 A.M. (Oct.29) and now, 8 A.M., the corrected aneroid registers 752 millimeters (29.61 inches). The wind has already done some damage to banana plantations, The rain gauge recorded a rainfall of 4 inches during last night. The (Sagua) river has begun to overflow and has now reached 1.5 meters about its bed but, to the present, the flood is not alarming (Diario de la Marina, Havana, Oct.30,1899, p.2, col.3). 11) Observations taken at 8 A.M. (E.S.T.) which were extracted from weather maps: Oct.26, Camaguey, wind E. force 3, barometer 29.84 inches; Santiago de Cuba, wind E. force 2, barometer 29.80 inches; Kingston, wind N.E. force 2, barometer 29.77 inches (not clearly read off the map); Port-au-Prince, wind E. force 5, barometer 29.76 inches; Cienfuegos, wind N. force 2, barometer 29.86 inches; Havana, wind N.E. force 5, barometer 29.91 inches; ship near lat. 21 N., long. 80 W., wind E. force 10, barometer 29.97 inches (too high); ship off Cape Cruz, wind E. force 6, barometer 29.77 inches (maybe too low); ship near lat. 21 N., long. 73.7 W, wind E.N.E. force 8, barometer 29.91 inches (not clearly read off the map. Oct. 27, Santiago de Cuba, wind N.E. force 3, barometer 29.74 inches; Camaguey, wind E.N.E. force 4, barometer 29.76 inches; Cienfuegos, wind N.E. force 4, barometer 29.78 inches; Havana, wind N.E. force