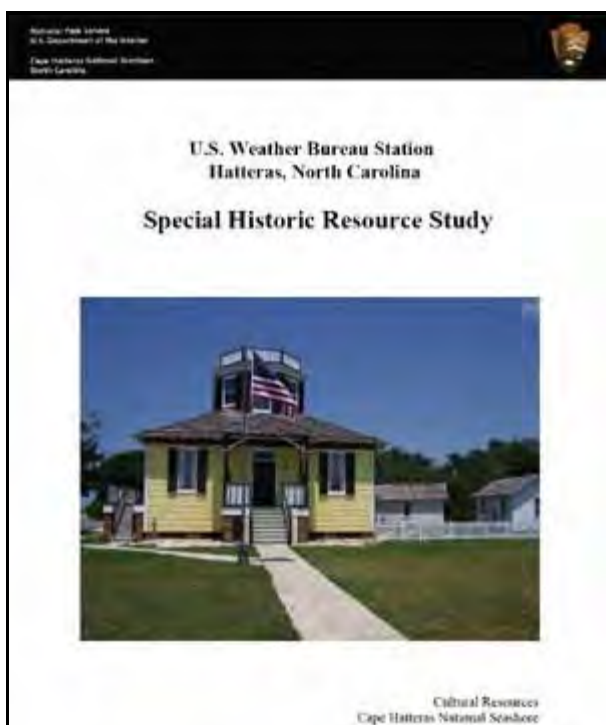


CAPE HATTERAS

Special Historic Resource Study
U.S. Weather Bureau Station



U.S. Weather Bureau Station Hatteras, North Carolina **SPECIAL HISTORIC RESOURCE STUDY**

By
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2007

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Foreward

I am pleased to make available this history of the U.S. Weather Bureau Station. Hatteras, North Carolina. The research was undertaken to help Cape Hatteras National Seashore interpret the histories of weather on the Outer Banks of North Carolina. U.S. Weather Bureau history today can still be seen on Hatteras Island. U.S. Weather Bureau stations on North Carolina's coast played an important role in early storm and hurricane tracking, providing late 19th- and early 20th-century coastal residents with their first weather warning systems.

With the help of many sources and research material from the National Archives, Outer Banks History Center, NC State Archives, Cape Hatteras National Seashore and NOAA/National Oceanic & Atmospheric Administration.

With the help of several staff from the Outer Banks Group, National Park Service, Mike Murray, Superintendent, Cape Hatteras National Seashore, Thayer Broili, Chief of Resource Management and Judy Ryan.

I hope it will prove useful to managers and interpreters at Cape Hatteras National Seashore.

Doug Stover
Historian
Cape Hatteras National Seashore

2007

Chapter One:

Introduction, History of Weather Forecasting

Weather Proverbs Since the science of meteorology was relatively undeveloped during the late 1800s, considerable emphasis was placed on folklore. Listed are the many rules of thumb and folklore which could be used by forecasters. The list was compiled from Signal Service forecasters and observers across the United States. Listed below is a selection of the weather proverbs.¹

1. A red sun has water in his eye.
2. When the walls are more than unusually damp, rain is expected.
3. Hark! I hear the asses bray, We shall have some rain today.
4. The further the sight, the nearer the rain.
5. Clear moon, Frost soon.
6. When deer are in gray coat in October, expect a severe winter.
7. Much noise made by rats and mice indicates rain.
8. Anvil-shaped clouds are very likely to be followed by a gale of wind.
9. If rain falls during an east wind, it will continue a full day.
10. A light yellow sky at sunset presages wind. A pale yellow sky at sunset presages rain.
11. Livestock wandered off into the wind.
12. Shorebirds gathered up into groups.

In the 17th and 18th centuries of the United States weather was important to the country. The early settlers to North America experienced the harshness of the weather of the New World.

Thomas Jefferson bought his first thermometer while writing the Declaration of Independence and purchased his first barometer a few days following the signing of the document. Jefferson noted that the high temperature in Philadelphia, PA on July 4, 1776 was 76 degrees. Jefferson made regular observations at Monticello from 1772-78 and participated in taking the first known simultaneous weather observations in America. George Washington also took regular observations; the last weather entry in his diary was made the day before he died.

During the mid 1800's, weather observation began to expand across the United States. By the end of 1849, 150 volunteers throughout the United States were reporting weather observations to the

¹ Hughes, P., 1970: *A Century of Weather Service*. Gordon and Breach Science Publishers, Inc., New York.

Smithsonian regularly. The telegraph was largely responsible for the advancement of meteorology during the 19th century. Daily telegraphic weather reports were reported to the Washington Evening Star.

In 1870, President Ulysses S. Grant signed a joint resolution of Congress authorizing the Secretary of War to establish a national weather service. The original weather agency operated under the War Department from 1870-1891 with headquarters in Washington, D.C., and field offices east of the Mississippi River. Within the Department of War, it was assigned to the Signal Service Corps (which was organized in 1860) under Brevet Brigadier General Albert J. Myer. General Myer gave the National Weather Service its first name: The Division of Telegrams and Reports for the Benefit of Commerce.

On November 1, 1870, at 7:35 a.m. observer-sergeants at 24 stations took the first systematized, synchronous weather observations ever taken in the U.S. were made by "observer sergeants" of the Army Signal Service.

Observations, which were transmitted by telegraph to the central office in Washington, D.C., commenced the beginning of the new division of the Signal Service. ²

The weather service work of the new organization demanded a large number of men familiar with observations, theoretic, and practical meteorology. The commissioned officers detailed to Signal Service work were required to acquire meteorological knowledge by studying the available literature and consulting with and receiving instruction from leading meteorologists. ³

Early forecasts were made for eight large districts (which covered the entire United States), three times daily and the duration of the forecasts, as well as forecast elements were determined by the forecaster. However, beginning in October 1872, predictions were made regularly for 24 hours in advance for 9 districts, and in 1874, forecasts were made for 11 districts and 4 elements, namely weather, wind, pressure, and temperature. No changes occurred until 1885 when predictions were made for 32 hours in advance, and in 1886, forecasts were made for states. In 1888, forecast were extended to 36 hours and in 1898 extended to 48 hours.

The first Signal Service weather office in Washington, D.C. also served as the central office of the country. Weather observations from across the country were compared for errors. In addition, forecasters at the office prepared maps and various weather bulletins, including forecasts, for the eastern part of the United States. In 1871, Signal Service forecasts and other weather information were posted in the Signal Service office, the post office, and at the main office of the Western Union Telegraphy Company. Maps also were posted in the principal hotels in the nation's capitol.

The first Signal Service weather office contained a printing department to print the maps and other weather information. In addition, a separate department was available to evaluate the

² Hughes, P., 1970: *A Century of Weather Service*. Gordon and Breach Science Publishers, Inc., New York.

³ Blodget, L., 1857: Climatology of the United States. J. B. Lippincott and Co. Philadelphia.

weather instruments, and another for checking weather observations. To support the various departments and functions of the office was a correspondence and clerical staff.⁴

Beginning in 1873, forecasts were distributed to thousands of rural post offices (by local Signal Service offices) for display as "Farmers' Bulletins" in front of post office buildings. This dissemination method continued until 1881 when local signal flags replaced the bulletins. The flags were large (for example, the cold-wave flag measured six-by-eight feet and was white with a black center of two feet square), and were displayed over post office buildings. By the end of 1886, display flags were available at 290 cities and towns.

The Signal Service's field stations grew in number from 24 in 1870 to 284 in 1878. Three times a day (usually 7:35 a.m., 4:35 p.m., and 11:35 p.m.), each station telegraphed an observation to Washington, D.C. These observations consisted of:

1. Temperature and its 24-hour change.
2. Relative humidity.
3. Wind velocity.
4. Pressure of the wind in pounds per square foot.
5. Barometric pressure
6. Amount of clouds.
7. State of the weather.

At Washington, D.C., forecasts were made from the telegraph reports. The forecasts subsequently were distributed back to the observers, to railroad stations and to available news media. Although the forecasts did not always prove correct, they greatly aided in planning daily life in the United States.

The Report of the Chief Signal Officer in 1877-1878 described the duties of the enlisted men at the weather offices:

...they are required to take, put in cipher, and furnish, to be telegraphed tri-daily on each day, at different fixed times, the results of observations made at those times, and embracing, in each case, the readings of the barometer, the thermometer, the wind-velocity and direction, the rain-gauge, the relative humidity, the character, quantity and movement of upper and lower clouds, and the condition of the weather. These observations are taken at such hours, at the different stations, as to provide the three simultaneous observations, taken daily at three fixed moments of physical time (7:35 a.m., 4:35 p.m., and 11 p.m. Washington mean time) throughout the whole extent of the territory of the United States... Three other observations to be taken at the local times, 7 a.m., 2 p.m., and 9 p.m., are also taken and recorded at each station. A seventh and especial observation is taken and recorded at noon on each day. If at this observation such instrumental changes are noted as to cause anxiety, the fact is to be telegraphed to the central office at Washington.

⁴ Blodget, L., 1857: Climatology of the United States. J. B. Lippincott and Co. Philadelphia.

An eighth observation is required to be taken at the exact hour of sunset at each location. This observation, embracing the appearance of the western sky, the direction of the wind, the amount of cloudiness, the readings of the barometer, thermometer, and hydrometer, and amount of rain-fall since last preceding report, is reported with the midnight report...

The average time elapsing from the time at which the readings of the instruments have been taken at the stations scattered throughout the United States, to that at which the reports based on these readings have been telegraphed to the press and to the distributing-stations, has been one hour and forty minutes.

The outfit of an inspecting officer will consist of one standard mercurial barometer, two standard thermometers, one standard compass, one jar of mercury; also the necessary blanks, stationery, barometer cisterns, clamps and screws, small screw drivers, and a tape-line.

During the early years (1870's and 1880's) of the national weather service, research studies were conducted at the central office in Washington, D.C. The first 10 years under the Signal Service with General Myer, the chief of the new agency from 1870-1880. Myer organized the agency in a effective manner. Myer stressed public service and the personnel of the weather agency knew their job was service to others. It also was becoming clear that the War Department was not enthusiastic about having oversight over the weather service. The Signal Service had been almost completely absorbed by its new mission, and should its military services ever be needed, its personnel could not be spared from their weather duties.⁵

By 1889, General Greely became convinced of the futility of attempts to reconcile opposing factions within the organization, as well as to correct admitted shortcomings within the weather service. In 1889, President Benjamin Harrison recommended transfer of the national weather service to the Department of Agriculture. Congress agreed, and on October 1, 1890, an act transferring the weather service to the Department of Agriculture was signed into law by President Benjamin Harrison.

The enlisted force of the Signal Service, excepting those hereinafter provided for shall be honorably discharged from the Army on June 30, 1891, and such portion of this entire force, including civilian employees of the Weather Bureau shall, if they so elect be transferred to the Department of Agriculture.⁶

So on July 1, 1891, the weather stations, telegraph lines, apparatus, and personnel (military people whom were honorably discharged from the War Department and were now civilians) were transferred from the Signal Corps' Division of Telegrams and Reports for the Benefit of Commerce to the Department of Agriculture's new civilian Weather Bureau.⁷

⁵ Whitnah, D.R., 1965: *A History of the United States Weather Bureau*. University of Illinois Press. Urbana.

⁶ Abbe, C., 1893: The Meteorological Work of the U. S. Signal Service, 1870 to 1891. Report of the Chicago Meteorological Congress.

⁷ Weightman, R.H., 1952: Establishment of a national weather service--Who was responsible for it? Unpublished Report. U. S. Weather Bureau.

In 1891 to 1940, The Weather Bureau became part of the Department of Agriculture had a remarkable effect on the nation's meteorological services. Between 1900 to 1910, sixty Weather Bureau Station were built throughout the US.

In 1902, Weather Bureau forecasts were sent via wireless telegraphy to ships at sea. In turn, the first wireless weather report was received from a ship at sea in 1905. Two years later, the daily exchange of weather observations with Russia and eastern Asia was inaugurated.

In 1910, the Weather Bureau began issuing weekly outlooks to aid agricultural planning. And in 1913, the first fire-weather forecast was issued. During these times, weather forecasters began using more sophisticated methods including surface weather observations; kite experiments to measure temperature, relative humidity and winds in the upper atmosphere; and later, airplane stations.

Realizing that the Weather Bureau played an important role for the aviation community, and therefore commerce, in 1940, President Franklin D. Roosevelt transferred the Weather Bureau to the Department of Commerce where it remains today. During the late 1940s, the military gave the Weather Bureau a new and valuable tool - 25 surplus radars - thus launching the network of weather surveillance radars still in use today. In 1970, the name of the Weather Bureau was changed to the National Weather Service, and the agency became a component of the Commerce Department's newly created National Oceanic and Atmospheric Administration.

Chapter Two:

Weather Forecasting on the Outer Banks



Hurricane Isabel, North Carolina, 2003, Photo: NOAA Library

The Outer Banks are a narrow chain of barrier islands stretching more than 175 miles along North Carolina's coast. Separated from the mainland by sounds up to 30 miles wide, the area is subject to severe storms and high winds. The Outer Banks of North Carolina was an important part of the national weather network.

The U.S. Weather Bureau established several weather stations and observation posts throughout North Carolina and its coast as part of a national network of weather stations. The first coastal observation station in North Carolina was in Wilmington, established in 1871. A station at Cape Hatteras followed in 1874.

Smaller Weather Bureau observation stations on the North Carolina coast were set up over the years at Wash Woods on the Currituck Outer Banks (1878); Kitty Hawk (1875), which was moved to Manteo (1904); Portsmouth Village (1876); Cape Lookout (1876) Beaufort Inlet (1878); and other communities, although some of them were temporary.⁸

⁸ Stick David, *Outer Banks of North Carolina*, Chapel Hill, Univ. of North Carolina Press, 1958

The first US Weather Bureau Station managed by the Army Signal Service's on Hatteras Island was established at the Cape Hatteras Lighthouse Keeper's Quarter in 1874; was moved to the Hatteras Life Saving Station in December 1, 1880 and later transferred to a Hatteras Village private residence on October 1, 1883, known as Styron's Building. A few years later the Weather Bureau built a structure for the station in Hatteras village for the sum of \$250.⁹



Weather Bureau Station, Hatteras, N.C. ca 1900, photo: NC State Archives

This building was a small one-story framed structure consisting of three rooms, two of the small rooms, each about 9 by 6 feet and one larger one about 14 feet square. There was also a small attic that was used for storage.

Cape Hatteras was an important location for weather forecasting where the Gulf Stream and Labrador Current meet. Cape Hatteras is a major shipping route, and shipwrecks were common along Cape Hatteras. The Weather Bureau felt that there was a need to have a main station on The North Carolina coast was important enough for the Weather Bureau to build a station in Hatteras Village.

Residents that lived on the Outer Banks received their news by boat, or through word of mouth. Residents of isolated Portsmouth and Ocracoke Islands got word of an approaching storm in sealed tubes dropped from airplanes.

⁹ Stick David, *Outer Banks of North Carolina*, Chapel Hill, University of North Carolina Press, 1958

Chapter Three:

Construction, U.S. Weather Bureau Station, Hatteras, N.C.



Hatteras Weather Bureau, ca.1900's . Photo: National Park Service

By 1901, the U.S. Weather Bureau sought much larger quarters for the station. The land selected was acquired from W.H. Rollinson for the sum of \$110.35. The property was near the main road about three-quarters of a mile from the ocean and three hundred yards from Pamlico Sound.

On July 11, 1901, Secretary James Wilson, U.S. Department of Agriculture, requested proposals for the erection a two-story Cellar Frame and Brick building for the Weather Bureau, U.S. Department of Agriculture, at Hatteras, N.C. The Chief of the Weather Bureau, U.S. Department of Agriculture, awarded contract to C.L Harding, Architect, Washington DC. To design and supervise the first official building constructed for the U.S. Department of Agriculture, US Weather Bureau Station, Hatteras, N.C.

The cost was \$5,194 to build the station and the purchase cost of the land was \$110.35. On the back of the specification was a list of other Weather Bureau Station to be constructed, Hatteras, Taloosh, Canley, Criescent, Point Reyes, Bismarck N.D.

The Official Hatteras Weather Bureau Station was commissioned and occupied on January 1, 1902.

In 1902 the weather bureau added another forty feet of land to the property already held. One inspector of the Weather Bureau upon seeing the station for the first time thought “The building is very well situated for Weather Bureau purposes”.



Hatteras Weather Bureau, ca.1900's . Photo: NC Museum of History

The design included a prefab structure that can be delivered by railroad, and steam ship to Hatteras Island. The building was to be located at the intersection know today as Kholer and Saxton Cut Street, Hatteras North Carolina.



Hatteras Weather Bureau, ca.1900's. Photo: Homer Styron, Hatteras , NC.

The original building was a wood frame structure on masonry piling. The first floor had seven rooms including a living room, dining room, kitchen, store pantry, and three bedrooms for the weather observer and family. The second floor had a large observation room/office with a ship's ladder leading to a walk on the roof. Porches extended across the front and westside.¹⁰



Hatteras Weather Bureau, ca.1925. Photo: National Archives

Other structures include two wooden storage outbuildings with gable roofs with cedar-shingled. The storage shed was 22 by 14 feet, the other was 18 by 12 feet, On-site was a cistern, and a metal signal tower for displaying weather flags, and a privy. The Weather Bureau operated there from 1902 until 1946.

¹⁰ "Brimley Collection, Box 7, Cape Hatteras, F-10, Weather Station, Hatteras, ca. 1900" NC State Archives.

Chapter Four: The Station Keepers



Hatteras Weather Bureau, ca.1902 Photo: Mason & Vera Meekins

S.L. Doshier, Observer, (pictured sitting on the porch bench)

Doshier wife Cara, standing next to the horse, with Hugh adopted child on the horse.

The Hatteras Weather Bureau Stations was manned by an observer who lived in the station with his family and a maintenance man who lived in the community; it was equipped with telegraph communication to the District Forecast Center in Washington, D.C. The observers at the Weather Bureau stations collected weather data hourly, including temperature, pressure, wind direction, wind speed, visibility, and humidity; later they also collected information by lofting helium balloons. The information was telegraphed to Weather Bureau Headquarters in Washington DC. where it was mapped and broadcast widely via telegraph. The early weather predictions were called “probabilities” and were only for 24 hours in advance. Later the preferred term was “indications.” The term “forecast” was first used in 1889, when predictions could be made 48 hours in advance.¹¹

¹¹ "Brimley Collection, Box 7, Cape Hatteras, F-10, Weather Station, Hatteras, ca. 1900" NC State Archives.

The Weather Station was responsible for the issuance of Coastal Forecasts and warnings for the area as well as the dissemination of storm warnings for Dare and Hyde counties. The station did not signal to passing vessels because the nearby Durrants Life Saving Station was equipped for that work. Information gathered by the Life Saving Station was sent to the Weather Station and in turn was telegraphed to Norfolk, Virginia.

Warnings were communicated by using weather flags on a pole outside the station. The storm warning tower forecasts provided a useful service to local residents, especially mariners and fishermen.



The U.S. Weather Bureau once used Coastal Warning Display signal flags to warn mariners of wind shifts or approaching storms ¹²

The Hatteras Weather Station was tolerated within the community, but not fully accepted. an inspector of the Bureau had to said in 1914. This station is, of course, of greatest importance in connection with the forecast work of the Bureau, but locally it appears to be of no consequence except as a means of communication with the outside world. The people are very peculiar, and have a code of ethics all their own, the principal element of which is a firm belief in their right to criticize the Weather Bureau and all connected with it, and to resent any criticism in return.

The present official is very capable and a gentlemanly man, and has done everything in his power to preserve peaceful relations. However, many refuse to be pacified, although, of course, others are friendly with Mr. Wilson and his family. Any other Weather Bureau man will have the same experience. The only use Hatteras has for the Weather Bureau is the money that it brings here.

¹² Town of Manteo, NC

The residents of Hatteras used the Weather Bureau Station for the telegraph and advance warnings about major storms. The Weather Bureau set up a system of a storm-warning flag tower. The flags represented different weather conditions. Starting around 1898, the Weather Bureau supplied its stations with towers on which to post warnings, using flags during the day and lights at night.

The life of a Observers for the Weather Station was routine is attested in a letter requesting transfer by Weather Observer S.L. Doshier in 1911, “The lonely life one is forced to lead... here and the ...continuous round of duty one must perform in keeping up the work alone, where there are none of the diverting pleasures of civilization to break the dull, soporific monotony of the situation, prove after a time to be a strain that depresses even the most optimistic nature, and a physical and an intellectual menace that even the most robust constitution and the strongest mentality can not long withstand”.¹³

Hatteras, North Carolina, Weather Bureau Station Keepers

- Albert J. Davis, Observer, Weather Bureau, Hatteras, NC.
- Weather Bureau, Hatteras, NC. July 16, 1903 to May 14, 1911.S.L. Doshier, Assistant Observer, Weather Bureau, Hatteras, NC. July 16, 1903 to May 14, 1911.
- Joseph J. Doshier, Chief, Weather Bureau, Hatteras, NC. from April 15, 1911 to May 14, 1914.
- C.E. Wilson, 1912-1914 Weather Observer
- W.L. Wyland, 1915-1917 Weather Observer
- Mark S. Howard, 1918 Weather Observer
- F.H. Ahearn 1919 Weather Observer
- Lucy Stowe, Junior Meteorologist, worked and lived in the station from 1943-1957
- Richard Dailey, Junior Meteorologist, worked and lived in the station from 1946-1952

Manteo, North Carolina, Weather Bureau Station Keepers

- Alfred H. Thiessen, Local Forecast Official, January 18, 1901- January 22, 1903
- Alfred C. Pickels, December 26, 1901 – February 3, 1903
- William T. Lathrop, February 11, 1902 – April 6, 1902
- Louis Dorman, Observer, March 11, 1902 – December 23, 1902
- Ovide St. Marie, February 13, 1902- November 14, 1902
- Alpheus W. Drinkwater, November 10, 1904 -¹⁴

¹³ Hatteras Weather Bureau Station National Register of Historic Places, February 17, 1978

¹⁴ U.S. Weather Bureau Personnel Records, National Park Service, Manteo, NC



Hatteras Weather Bureau, ca.1943. Photo: Lucy Stowe

In September of 1938, Lucy Stowe, who was born in Hatteras Village in 1925, remembers that the locals in her day heeded the Weather Bureau's warnings.

"Absolutely, they used them," says Stowe. "You could see the top of the tower from all over the village, and the fishermen definitely paid attention to them." Lucy was employed in 1943 as a Junior Weather Observer lived in the station until 1957.¹⁵

U.S Weather Bureau hired Weather Observer most all were men, but during World War II mostly women were working at the 60 Weather Bureau Station throughout the United States as observers and forecasters.

Following is a first hand account of the storm, as related by Mr. S.L. Doshier, official Observer with the Weather Bureau on Hatteras Island.

¹⁵ Interview with Lucy Stowe, NPS/Southern Oral History Project, Amy Glass, July 15, 1988

Hatteras Devastated by Hurricane

U.S. Department of Agriculture
Weather Bureau
Office of the Observer

Subject: Hurricane
Station: Hatteras, North Carolina
Date: August 21st, 1899

Chief of the Weather Bureau,
Washington, D.C.

Sir:

I have the honor to make the following report of the severe hurricane which swept over this section on the 16th, 17th and 18th instantly.

The wind began blowing a gale from the east on the morning of the 16th, varying in velocity from 35 to 50 miles an hour....During the early morning of the 17th the wind increased to a hurricane and at about 4 a.m. it was blowing at the rate of 70 miles, at 10 a.m. it had increased to 84 miles and at 1 p.m. it was blowing a velocity of 93 miles with occasional extreme velocities of 120 miles to 140 per hour. The record of wind from about 1 p.m. was lost, but it is estimated that the wind blew even with greater force from about 3 p.m. to 7 p.m. and it is believed that between these hours the wind reached a regular velocity of at least 100 miles per hour....

At about 7:30 p.m. on the 17th there was a very decided lull in the force of the wind and at 8 p.m. it had fallen out until only a gentle breeze was blowing. This lull did not last more than half hour, however, before the wind veered to east and then to south-east and began blowing at a velocity estimated from 60 to 70 miles per hour which continued until well into the morning of the 18th. During the morning of the 18th the wind veered to the south and continued to blow a gale, with heavy rain squalls, all day, decreasing somewhat in the late evening and going into southwest. This day may be said to be the end of the hurricane, although the weather continued squally on the 19th, but without any winds of very high velocity.

This hurricane was, without any question, the most severe of any storm that has ever passed over this section within the memory of any person now living, and there are people here who can remember back for a period of over 75 years. I have made careful inquiry among the old inhabitants here, and they all agree, with one accord, that no storm like this has ever visited the island....

The scene here on the 17th was wild and terrifying in the extreme. By 8 a.m. on that date the entire island was covered with water blown in from the sound, and by 11 a.m. all the land was covered to a depth of from 3 to ten feet. The tide swept over the island at a fearful rate carrying everything movable before it. There were not more than four houses on the island in which the tide did not rise to a depth of from one to four feet, and at least half of the people had to abandon their homes and property to the mercy of the wind and tide and seek the safety of their own lives with those who were fortunate enough to live on higher land.

Language is inadequate to express the conditions which prevailed all day on the 17th. The howling wind, the rushing and roaring tide and the awful sea which swept over the beach and thundered like a thousand pieces of artillery made a picture which was at once appalling and terrible and the like of which Dante's Inferno could scarcely equal.

The frightened people were grouped sometimes 40 or 50 in one house, and at times one house would have to be abandoned and they would all have to wade almost beyond their depth in order to reach another. All day this gale, tide and sea continued with a fury and persistent energy that knew no abatement, and the strain on the minds of every one was something so frightful and dejecting that it cannot be expressed.

In many houses families were huddled together in the upper portion of the building with the water several feet deep in the lower portion, not knowing what minute the house would either be blown down or swept away by the tide....

Cattle, sheep, hogs and chickens were drowned by hundreds before the very eyes of the owners, who were powerless to render any assistance on account of the rushing tide. The fright of these poor animals was terrible to see, and their cries of terror when being surrounded by the water were pitiful in the extreme.

The damage done to this place by the hurricane is, at this time difficult to estimate,...but is believed that the total loss to Hatteras alone will amount to from \$15,000 to \$20,000. The fishing business here is the principal industry from which is derived the revenue upon which the great majority live, and it may be said that this industry has for the present time been swept entirely out of existence....

A great majority of the houses on the island were badly damaged, and 5 or 6 are so badly wrecked as to be unfit for habitation and that many families are without homes, living wherever they can best find a home. The Southern Methodist church building was completely wrecked...All of the bridges and footways over the creeks and small streams were swept away.... The roadways are piled from three to ten feet high with wreckage....

The telegraph and telephone lines are both down.... It is reported that several vessels are stranded north of [Big Kinnakeet Life Saving Station]....

A large steamship foundered about one mile off Hatteras beach...and it is thought all on board were drowned....

The Diamond Shoals Light Ship which was stationed off Hatteras, broke loose from her mooring on the morning of the 17th and was carried southward by the gale....This vessel will probably prove a total loss....

The damage to the instruments and property of the Bureau here was considerable....The office building was flooded with water to the depth of about 18 inches, and the rain beat in at the roof and windows until the entire building was a mass of water....

I live about a mile from the office building and when I went home at 8 a.m. I had to wade in water which was about waist deep. I waited until about 10:30 a.m., thinking the storm would lull, but it did not do so, and at that time I started for the office.... I got about one-third of the distance and found the water about breast height, when I had to stop in a neighbor's house and rest, the strain of pushing through the water and storm having nearly exhausted my strength. I

rested there until about noon when I started again and after going a short distance further I found the water up to my shoulders.... I had to give it up again and take refuge in another neighbor's house where I had to remain until about 8 p.m. when the tide fell so that I could reach the office....

I started to the office against the advice of those who were better acquainted with the condition of the roads than I, and continued on my way until I saw that the attempt was rash and fool-hardy and that I was certain to reach low places where I would be swept off my feet and drowned.... [T]here has never been any such tide as the one here mentioned.

...The rainfall...was as heavy as I have ever seen. It fell in [a] perfect torrent and at times was so thick and in such blinding sheets that it was impossible to see across a roadway 20 feet wide.

...[E]verything went before the fury of the gale. No lives were lost at Hatteras, although many narrow escapes occurred, several families being washed out of their homes in the tide and storm. At Ocracoke and Portsmouth, 16 and 20 miles south of this station the storm is reported about the same as at Hatteras, with a corresponding damage to property. Reliable details from these places however, being lacking. A pleasure boat at Ocracoke with a party of men from Washington, N.C., was lost and a portion of the party were drowned.

There has been no communication with this place by wire or mail since the storm, and it is not known when there will be. It is therefore requested that so much of this report as may be of interest to the public be given to the Associated Press for publication in the newspaper.

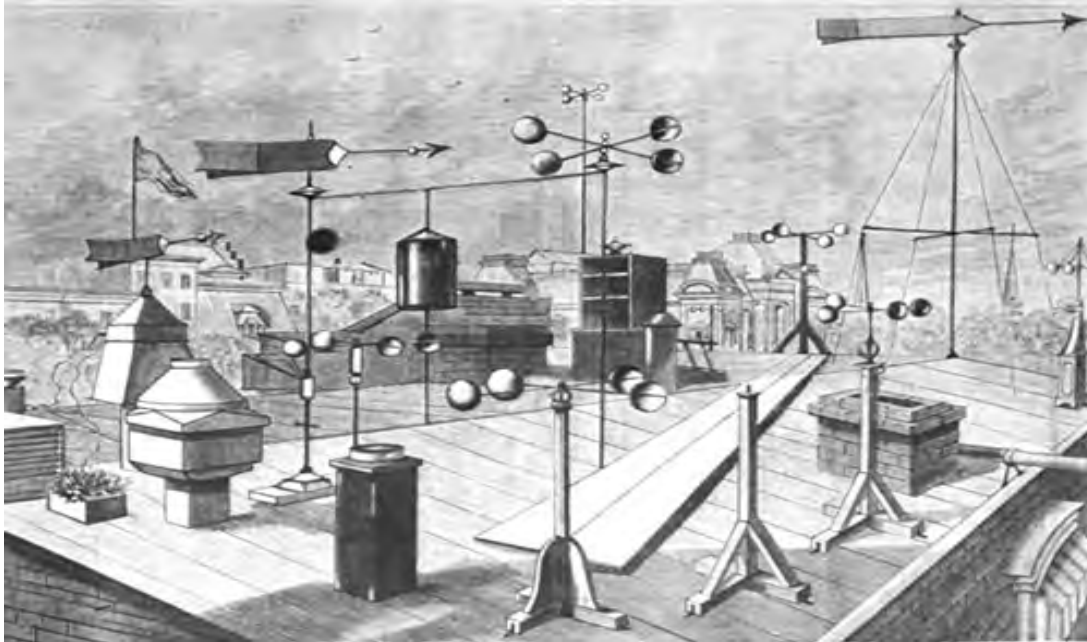
Very respectfully,

S.L. Doshier

Observer, Weather Bureau

Chapter Five:

Weather Observing Tools



Arrangement of the wind instruments on the roof of the Headquarters Building of the Meteorological Service of the United States Signal Service. In: Frank Leslie's Illustrated Newspaper, N.Y. Supplement, May 1, 1880. Call Number M/0203 U 58m.

Only within the last six centuries has the technology of weather observation been developed. The rain gauge, barometer, anemometer, hygrometer and thermometer were all invented in the years between 1400 and 1700. These instruments, improved upon through the years, remain basic observing tools of the National Weather Service and its network of cooperative observers today. However, with the advent of the telegraph system in the 1840's, the ability of meteorologists to make weather observations from weather stations throughout the U.S. and develop near real-time maps of weather systems, and then predict the future course of observed weather.

Suddenly meteorologists were able to chart the course of weather phenomena on a near continent-wide basis. Since that time communications have improved with the development of radio and telephone, new observing systems such as radar and satellites have evolved, and ever more powerful computing systems have become available to the meteorologist.

Chapter Six:

Reginald Fessenden, Pioneer Of Wireless Radio



Reginald Fessenden, Photo: N.C. State Archives

Sadly enough much of the public knows the name Marconi as the "Father of Radio." However, few know that a year earlier, on December 23, 1900, an even more prolific technologist first transmitted human speech by radio. That person was Reginald Fessenden and he did it right here on the North Carolina Outer Banks.

In 1901, Reginald Fessenden, was one of the pioneers of wireless radio. Fessenden was an inventor and he was a leader in the race to perfect wireless communication -- the forerunner of today's AM radio. Thomas Edison, called Fessenden "Fezzy" and made him his head chemist. Fessenden contributions included the radio direction finder (a type of compass), the submarine fathometer (an echo depth finder), and a turboelectric drive for battleships. Fessenden was requested to come to North Carolina under contract with the Weather Bureau, he established his base in Manteo. Professor Reginald Fessenden created the air and publicly transmitted voice and music for the first time in history. Much of Fessenden's pioneering research occurred between Hatteras and Roanoke Islands across the open waters of the sounds of North Carolina's Outer Banks.¹⁶

Fessenden's research led to numerous wireless inventions, including; the radio pager, sonar, the gyrocompass, loop antenna, radio direction finding, the television receiver, tracer bullets, the

¹⁶ "Brimley Collection, Box 7, Cape Hatteras, F-10, Weather Station, Hatteras, ca. 1900" NC State Archives.

pheroscope, turbo-electric drive to power ships, ultrasonic methods for cleaning, electrical conduit, and the fathometer to measure the depth of water beneath the keel of a ship. He brought along his wife and son and spent more than a year and a half on the Outer Banks at the turn of the century. Reginald Fessenden is credited to have been the first to transmit wireless telegraphy by tones over a 50 mile path between Buxton, NC (Cape Hatteras) and Manteo, NC (Roanoke Island) in the year 1902. Fessenden, isolated himself from the world for two years in an exceptionally remote corner of the seacoast to conduct his wireless telegraph experiments. He was working for the United States Government in the Weather Bureau during this time period. US Naval officials were brought in to observe and were duly impressed. This system made an astronomical leap in distributing Weather Bureau signals and in obtaining data for making forecasts. Fessenden sent the transmissions between two fifty foot high towers he had built. Eventually sending telegraphy across the Ocean to Europe, he was a leader in the race to perfect wireless communication which was the forerunner of today's AM radio.

Being that the area was so very remote, you were likely to know your neighbors and while Fessenden was in Manteo, he became close lifetime friends with two other entrepreneurs who were inventors as well. The Wright brothers, Orville and Wilbur, were experimenting with gliders in nearby Kill Devil Hills in preparation for their powered flight experiments. One year later, they too would become world renown.

His central interest, however, kept returning to "wireless" and its technology. He tried and tested a number of methods seeking improvement on the Marconi way of generating wireless signals, which did have its crude points. By 1899, he had demonstrated a range of 50 miles from Cobb Island to Arlington, Virginia, and impressed the U. S. Weather Bureau into signing him to a contract for the (then) large sum of \$3,000 per annum to develop wireless for weather information gathering.¹⁷

It was in that first year of the Weather Bureau work that he finally developed a method to get the frequency of an arc transmitter high enough to handle barely understandable speech. Modifying a phonograph cylinder with nearly microscopic slits, he was able to interrupt an arc at 10,000 times per second, and on December 23, 1900, transmit a barely readable voice message over a distance of one mile on Cobb Island. North Carolina

As well, he found contact radio detectors like the coherer too distorting and lacking in sensitivity for the reception of speech. He worked on a much more sensitive detector called the barrater, and fortuitously secured success in a second iteration by accidentally leaving a wire in an acid solution. The wire point in the cup of acid worked quite well. In fact, it worked well enough that Lee DeForest used it later in contravention of Fessenden's patent, resulting in a protracted legal battle between the two.

The Weather Bureau renewed his contract for two more years, and expanded the work to include extending the wireless link to Cape Hatteras, North Carolina. During this time, Fessenden set General Electric to work on producing an AC generator that would emit frequencies high enough

¹⁷ "Brimley Collection, Box 7, Cape Hatteras, F-10, Weather Station, Hatteras, ca. 1900" NC State Archives.

for use as voice-bearing wireless. The experiments were many and trying; it was only by using methods like Edison had shown in developing his light bulb that success occurred, bit by bit.

By 1902 General Electric had managed to produce a 10 kHz alternator for Fessenden. It was used to transmit telegraphy by tones over a 50 mile path between Buxton, NC (the town located at Cape Hatteras) and Manteo, N.C. Unfortunately, Fessenden got into a dispute over ownership of the ideas with Federal employees and he resigned the job in order to keep his personal inventions.

Chapter Seven:

The Wright Brothers and Weather Forecast



The Weather Bureau Office in Kitty Hawk Photo: National Park Service

A second Weather Office was set up at the Kitty Hawk Life Saving Station from January 2, 1875 to 1904. It was established for the purpose of facilitating the repair of the telegraph line connecting Cape Hatteras and Cape Henry.

At the time the Wrights were looking for a site for their experiments, Kitty Hawk consisted of a few houses, a post office, a U.S. Lifesaving station to aid shipwreck victims, and a U.S. Weather Bureau station. According to Weather Bureau records obtained by the Wrights, Kitty Hawk was the sixth-windiest station in the country in 1903. After receiving assurance from local residents that the surrounding area offered wide open flat beaches, tall sand dunes, and privacy, the brothers decided that this would be the best place to test their glider.

When the Wright Brothers received weather data from the US Weather Bureau and found Kitty Hawk had the winds they were looking for, they wrote to the weather office at Kitty Hawk. Joseph J. Doshier at the Kitty Hawk Weather Office answered the Wright Brother's letter and had a good relationship with them for three years. Orville walked to the Kitty Hawk Weather Office late in the afternoon of December 17, 1903 and sent a telegraph to his father detailing the successes of the day.¹⁸ U.S. Weather Bureau Observer, Doshier maintained a good relationship

¹⁸ Stick David, *Outer Banks of North Carolina*, Chapel Hill, University of North Carolina Press, 1958

with the Wright brothers for three years during their tests. In fact, the telegraph which alerted the world to the historic first flight came from the Weather Bureau. Orville walked to the Kitty Hawk Weather Office late in the afternoon of December 17, 1903 and sent a telegraph to his father detailing the successes of the day.

Letter from the Weather Bureau Office in Kitty Hawk, that Orville Wright wired his father to announce the successful flights of Dec. 17, 1903.¹⁹

Mr Wilbur Wright
Dayton Ohio

Dear Sir,

In reply to yours of the 3rd, I will say the beach here is about one mile wide clear of trees or high hills, and islands for nearly sixty miles south. Conditions: the wind blows mostly from the North and Northeast September and October which is nearly down this piece of land. Giving you many miles of a steady wind with a free sweep. I am sorry to say that you could not rent a house here. So you will have to bring tents. You could obtain frame.

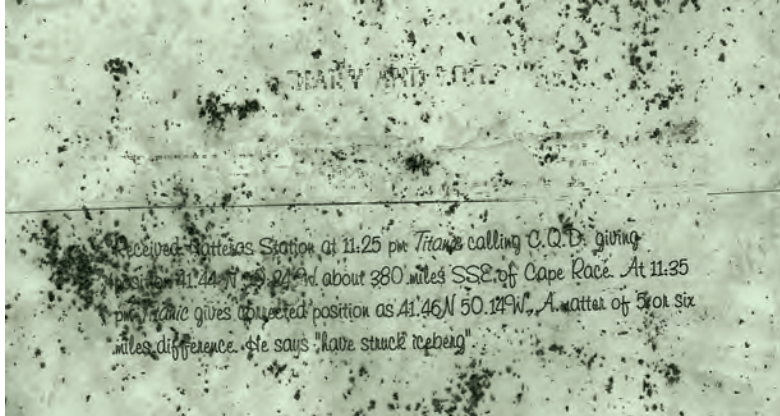
The only way to reach Kitty Hawk is from Manteo Roanoke Island N.C. in a small sailboat. From your letter I believe you would find it here like you wish. Will be pleased at any time to give you any information. Yours very respectfully

JJ. Doshier

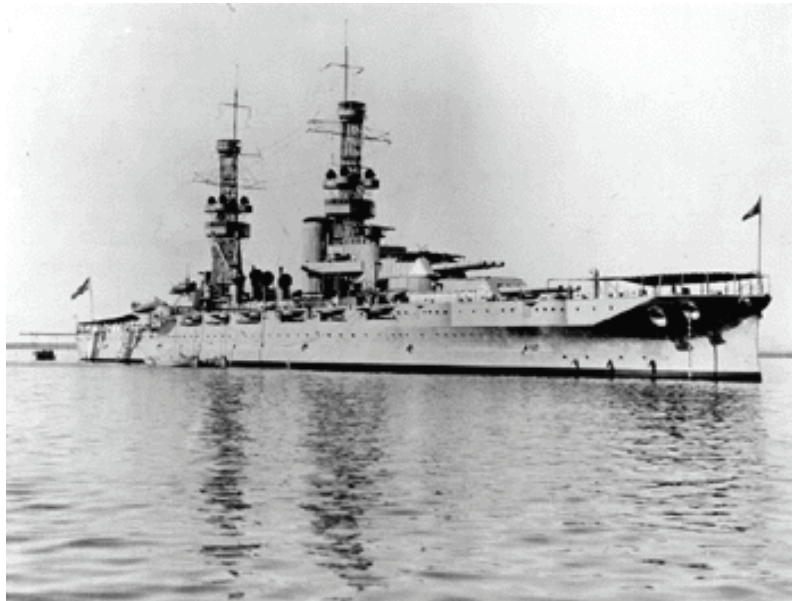
¹⁹ Letter, Library of Congress

Chapter Eight:

Historic Events at the Hatteras Weather Bureau Station



On April 14, 1912 Titanic sent a distress call in which the Hatteras Weather Bureau Station receives the distress call and records in log book National Park Service.



Arizona (Battleship No. 39), 1918, Photo: U.S. Navy

On December 1918 the USS Arizona sail from Cuba to Norfolk, Virginia and sent a wireless communication to the Hatteras Weather Bureau.²⁰

²⁰ U.S. Weather Station, Hatteras N.C. Log Report, dated 1918. National Park Service, Cape Hatteras National Seashore.

Chapter Nine:

Station is decommissioned



Hatteras Weather Bureau, ca.1950. Photo: National Park Service

In June 30, 1940 The U.S. Weather Bureau is transferred from the Department of Agriculture to the Department of Commerce. In April 1946 Hatteras Weather Bureau Station is decommissioned and the functions transferred to the another building in Hatteras Village.

The U.S. Weather Service retained the Hatteras Weather Bureau Station as living quarters for Richard B. Daily, who was in charge of local weather observations. Between 1947-1952 alterations were made to the structure, including resurfacing of the interior walls with sheetrock and the installation and upgrade of electrical, water and sewer.

In 1952, the weather bureau station and its outbuildings were turned over to the General Service Administration as excess real property, whereby the U.S. Coast Guard acquired the property and used the station as a new Hatteras Inlet Lifeboat Station and a shelter for personnel and storage in the event of storms and threatening weather.²¹

²¹ Hatteras Weather Bureau Station National Register of Historic Places, February 17, 1978



Hatteras Weather Bureau, ca.1952. Photo: National Park Service

On July 18, 1958 the U.S. Coast Guard reported the Hatteras Weather Bureau Station as excess real property. Public Law 85-540 allowed for National Park Service to acquire additional excess property to the Cape Hatteras National Recreation Area. (later renamed Cape Hatteras National Seashore) Between 1958-1964, Cape Hatteras National Seashore permitted Dr. and Mrs. Harvey W. Wells from Duke University, Department of Zoology, Durham, North Carolina to use the building for a residence and laboratory for the studies of local marine invertebrates. On July 1, 1964 a special use permit was issued to North Carolina State University in Raleigh, North Carolina to use the weather station as a biological laboratory of the North Carolina Agricultural Experiment Station between 1964-1976.²²

²² Hatteras Weather Bureau Station National Register of Historic Places, February 17, 1978



Hatteras second Weather Bureau Station, 1957. Photo: Outer Banks History Center

Hatteras second Weather Bureau Station moved from Hatteras to Buxton, NC. in 1957. The concrete weather building in Buxton was equipped with radar, computerized instrumentation and data networking. Mr. Damon Gray Sr., who lived next to the Hatteras Weather Bureau Station, was hired to continue operating the weather flag tower and light warning unit till his death in 1980.



Hatteras Weather Bureau, ca.1980. Photo: National Park Service

In 1979, several changes to the interior structure of the building were made to use the building for park staff resident. Adding and removing partition walls, laying vinyl tiles in the kitchen and bathrooms, upgrading of electrical, water and sewer services. Interior woodwork and hardware were replaced and sheet rock wall covered with Luan.



Hatteras Weather Bureau, Photo: National Park Service, 1990

In 2000, the National Park Service began with replacement of the second floor windows, and abatement of asbestos shingles and lead-base paint.



Hatteras Weather Bureau, Photo: National Park Service, 2001

Additional funding of \$442,000 was approved to continue the restoration of phase three interior restoration, starting in January 2002. The interior restoration will be to restore the interior floor plan to the 1901 period, interior painting of the original colors, wall treatments, flooring and ceiling, restored removal of modern furnishings, interior woodwork and hardware.



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Timeline of Hatteras Weather Bureau Station

There were several minor alterations and routine maintenance repairs made to the weather station after it was built.

- 1901 – Land purchased from John W. Rollinson at a cost of \$101.00
- 1902-1946 The official building was commissioned and occupied January 1, 1902
- 1911 Observer asked to be relieved of duty at the Station.
- 1946 The station was decommissioned in April 1946.
- 1952-1958 The Station was transferred to GSA and use by the U.S. Coast Guard
- 1958 – Station transferred to the National Park Service/Cape Hatteras National Seashore
- 1958-1964 Station used by a permit from Cape Hatteras NS to Zoology Dept, Duke University.
- 1964-1976 Permit to Biological Lab, NC. State University. Marine Biology
NC State spent \$17,000.00 during their eleven year stay on the building.
- 1979-1995 Used by park Staff as a Residence.
- 1995-2001 Vacant
- 2001–2005 Restoration
- July 1, 2007 Site open to the public, a partnership between Outer Banks Visitor Bureau and the National Park Service.

On September 15, 1933 Hurricane blew the storm warning tower down,

On August 30, 1999 Hurricane Dennis damage the last of the storm warning tower.

Although there is no longer a weather station on the Outer Banks In 1967, the Weather Bureau was renamed the National Weather Service. Today, NOAA's Newport/Morehead City Weather Forecast Office serves Eastern North Carolina, issuing air, water, and climate forecast. but in the mid 1980's NOAA's National Weather Service embarked on a modernization based on new technologies. The newly developed Doppler radar was the keystone of the modernization. Newport was selected as the location to serve as the base for the new Doppler radar because Hatteras was too vulnerable to destructive tropical storms and hurricanes. Today with weather radio and televised NOAA broadcast serve as the primary communication of coastal warnings to those who live and visit the Outer Banks of North Carolina.



On July 1, 2007 the National Park Service, Cape Hatteras National Seashore partnership with the Outer Banks Visitor Bureau to operate the Hatteras Weather Bureau Station as a visitor information center.

Appendix

- Plot Plan, 4-10-1956.
- U.S. Department of Agriculture Specification for the Weather Bureau Building.
- U.S. Weather Bureau Building, Hatteras, N.C. Architectural Drawings.
- U.S. Department of Agriculture, Weather Bureau, Letter to Mr. Louis Dorman, Observer, Weather Bureau, Manteo, Roanoke Island, N.C. from Chief of U.S. Weather Bureau., August 4, 1902.
- U.S. Department of Agriculture, Weather Bureau, Letter to Mr. Alfred H. Thiessen, Local Forecast Official, Manteo, N.C. from Chief of U.S. Weather Bureau., December 29, 1902.
- U.S. Department of Agriculture, Weather Bureau, Letter to The Chief of the Weather Bureau, Washington D.C. from Albert J. Davis, Observer, Weather Bureau, March 27, 1903.
- U.S. Department of Agriculture, Weather Bureau, Letter to The Chief of the Weather Bureau, Washington D.C. from Albert Davis, Observer, Weather Bureau., May 20, 1903.
- U.S. Department of Agriculture, Weather Bureau, Letter to The Chief of the Weather Bureau, Washington D.C. from Albert Davis, Observer, Weather Bureau, May 25, 1903.
- U.S. Department of Agriculture, Weather Bureau, Letter from John Rollinson., June 5, 1903.
- U.S. Department of Agriculture, Weather Bureau, Letter to the Chief of the Weather Bureau, Washington D.C. from Albert Davis, Observer, Weather Bureau., June 24, 1903.
- Hatteras N.C., Letter to the Chief of the Weather Bureau, Washington D.C. from Albert Davis, Asst. Observer, Weather Bureau and S. L. Doshier, July 16, 1903.
- Receipt, U.S. Department of Agriculture, Weather Bureau, November 27, 1904.
- Hatteras N.C., Letter to The Chief of the Weather Bureau, Washington D.C. from S.L. Doshier, Assistant Observer, Weather Bureau, April 19, 1905.
- Receipt, U.S. Department of Agriculture, Weather Bureau, January 20, 1906.
- Receipt, U.S. Department of Agriculture, Weather Bureau, February 20, 1906.
- Hatteras N.C., Letter to The Chief of the Weather Bureau, Washington D.C. from S.L. Doshier, Assistant Observer, Weather Bureau, March 22, 1906.

- Original Monthly Record of Observations of Hatteras. N.C. February, 1928.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, Hatteras, N.C.. From W.R. Gregg, Chief of Bureau, November 25, 1936.
- Hatteras N.C. Letter to Chief U.S. Weather Bureau, Washington D.C. from R.B. Dailey, Junior Meteorologist, December 7, 1936.
- U.S. Department of Agriculture, Weather Bureau, Washington, Letter to Official in Charge, Weather Bureau Office, Hatteras, N.C. From C.C. Clark, Acting, Chief of Bureau, December 11, 1936.
- Postal Telegraph, Observer 226 Hatteras, December 31, 1936.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, Hatteras, N.C. from W.R. Gregg, Chief of Bureau, February 2, 1937.
- Hatteras N.C. Letter to Chief U.S. Weather Bureau, Washington D.C. from R.B. Dailey, Junior Meteorologist, February 18, 1937.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, Hatteras, N.C. from W.R. Gregg, Chief of Bureau, July 22, 1937.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, from William Weber, Acting, Chief of Bureau., August 11, 1937.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, from William Weber, Acting, Chief of Bureau. August 17, 1937.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, from W. R. Gregg, Chief of Bureau., August 18, 1937.
- U.S. Department of Agriculture, Weather Bureau, Letter to Official in Charge, Weather Bureau Office, from E. M. Barto, Metlgst, September 28, 1937.
- Weston Union, to R.B. Dailey, from Reuben W. Banks, November 20, 1937.
- Hatteras, N.C. to: Chief U.S. Weather Bureau, Washington, D.C. Sir: _____, from R.B. Dailey, Junior Meteorologist, February 12, 1938.

- U.S. Department of Agriculture, Weather Bureau, Washington, Letter to Official in Charge, Weather Bureau Office, Hatteras, N.C., from William Weber, Chief of Division, March 4, 1938.
- U.S. Department of Agriculture, Weather Bureau, Message to Observer, Hatteras, N.C, March 10, 1938.
- Hatteras, N.C., to: Chief U.S. Weather Bureau, Washington, D.C. from R.B. Dailey, Junior Meteorologist May 21, 1940.
- U.S. Department of Agriculture, Weather Bureau, Message to Observer, Hatteras, N.C, August 31, 1940.

Bibliography

- Abbe, C., 1893: The Meteorological Work of the U. S. Signal Service, 1870 to 1891. Report of the Chicago Meteorological Congress. 53 pp.
- Blodget, L., 1857: Climatology of the United States. J. B. Lippincott and Co. Philadelphia. "Brimley Collection, Box 7, Cape Hatteras, F-10, Weather Station, Hatteras, ca. 1900" NC State Archives.
- Cline, I.M., 1945: Storms, Floods and Sunshine. Pelican Publishing Co. New Orleans, 352 pp.
- "Interesting History Attached to Weather Station at Hatteras," Coastland Times, Manteo, NC. March 12, 1961.
- Hughes, P., 1970: A Century of Weather Service. Gordon and Breach Science Publishers, Inc., New York. 212 pp.
- Stick David, Outer Banks of North Carolina, Chapel Hill, Univ of North Carolina Press, 1958
- U. S. Army, 1986: A History of Fort Myer, Department of Defense Informal Report. Fort Myer. 11 pp.
- U. S. Signal Service, 1871: The Practical Use of Meteorological Reports and Weather Maps. Government Printing Office. Washington, D.C., 76 pp.
- _____, 1882: Signal Service Notes. Government Printing Office, Washington, D.C., 850 pp.
- _____, 1883: Regulations for the Signal Office. Government Printing Office. Washington, D.C., 87 pp.
- War Dept., 1871: Report of the Secretary of War. Government Printing Office. Washington, D.C., 454 pp.
- _____, 1880: Report of the Chief Signal Officer. Government Printing Office. Washington, D.C., 570 pp.
- Weber, G.A., 1922: The Weather Bureau. D. Appleton and Company, New York. 87 pp.
- Weightman, R.H., 1952: Establishment of a National Weather Service, Unpublished Report. U. S. Weather Bureau. 25 pp.
- Whitnah, D.R., 1965: A History of the United States Weather Bureau. University of Illinois Press. Urbana. 267 pp.