HISTORY OF WEATHER OBSERVATIONS
Charleston, South Carolina
1738-2005

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CONTENTS

ACKNOWLEDGEMENTS

I would like to thank Dr. Cary Mock for his help in the compilation of this report. The history of weather observing in Charleston, South Carolina, is long and, in some cases, hidden in the shadows of time. Dr. Mock and his students at the University of South Carolina have worked diligently to shine a bit of light on this rich history. Also, the continuing work of the various historical societies and museums in Charleston is acknowledged for without them this type of historical research would be fruitless. A special thanks to Amy Quesenbery at the Charleston County Public Library for her assistance.

The author would also like to thank Glen Conner and Gary Grice for their advice and direction as it concerned the formulation of this report and its contents. And a special thanks to Joe Elms and the staff of the Climate Database Modernization Program at the National Climatic Data Center for their support and assistance.

LIST OF ILLUSTRATIONS

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INTRODUCTION

Executive Summary

Weather observations in the Charleston, South Carolina, area may have begun as early as 1670 when the area was settled. From the beginning the community sought to discover the linkage between diseases that affected Charleston and the weather. Dr. John Lining began the faithful recording of observations from his home on Broad Street in 1738, a practice that lasted until 1753. His partner, Dr. Lionel Chalmers, continued to take observations through 1759. Here the actual observers and locations become a bit confusing but the South Carolina Gazette newspaper published observations from 1759-1761, followed by Gabriel Manigault from 1784-1789. Then a series of medical personal from the Board of Health began an 80 year stretch of weather observing that lasted from 1791 until 1871. The U.S. Army Signal Service established an observing site on Broad Street in 1871, continuing to 1892 when the U.S. Weather Bureau assumed the responsibilities. In 1897 the downtown observational program moved to the Customs House, a program that continues to this day. The Weather Bureau established an observing site at the airport in late 1931 and this location remains open today.

A number of plantation owners and others recorded diaries in which they made references to the weather from 1784 until 1864. The U.S. Army Medical Service recorded observations at Fort Moultrie, located across the harbor from downtown Charleston, from 1821 through 1860.

Limited weather observations were also taken at other locations in the Charleston area including Castle Pinckney, 1833-1835; Citadel, 1830-1832; Fort Sumter, 1860-1861; and Fort Johnson, 1821.

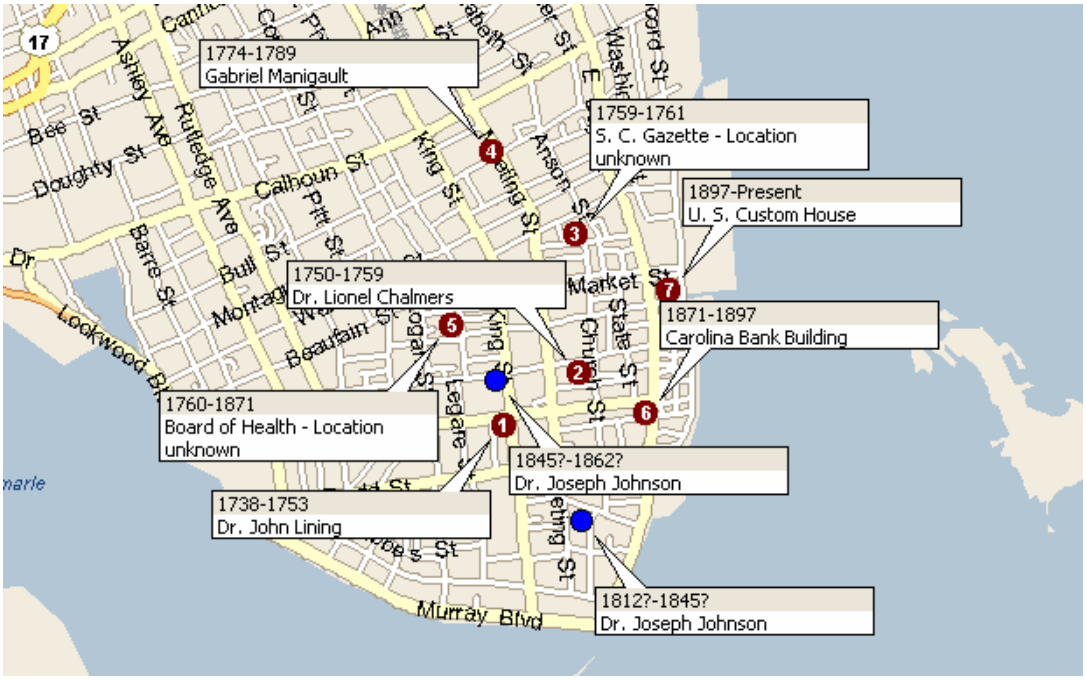
Goal of Study

The goal of this study is to document the primary weather observational path at Charleston, South Carolina. Throughout the research for and preparation of this study, the goal was to produce a document that future studies can use to evaluate the validity of the data that were collected here, judge the trustworthiness of the observers who collected them, and determine the climatological significance of the whatever variability may be discerned.

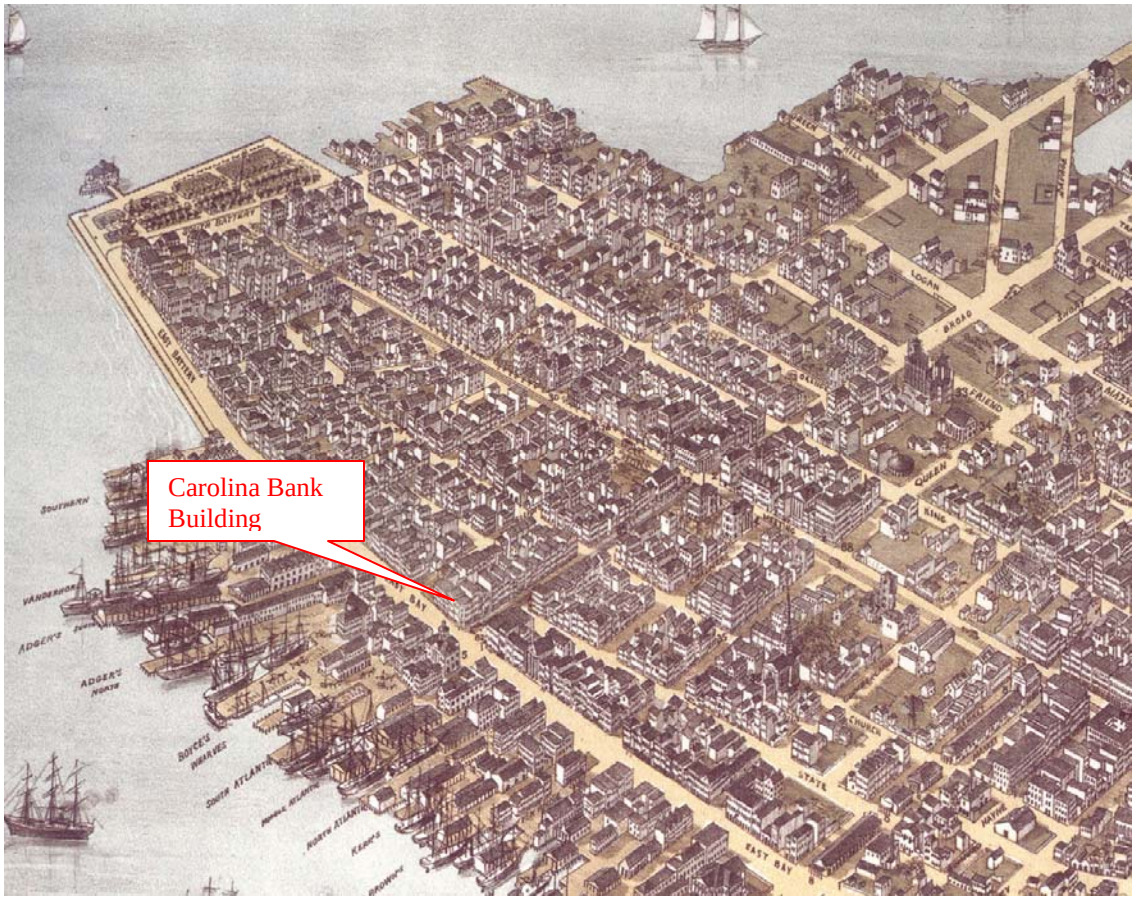
LOCATION OF OBSERVATIONS

Location maps

Map 1. The location of weather observing sites in the Charleston, South Carolina, vicinity, 1738-2005.



Map 2. The location of downtown weather observing sites at Charleston, South Carolina, 1738- 2005.



Map 3. A view of downtown Charleston, South Carolina, 1872. View is looking southwest. The Carolina Bank Building was located on the southwest corner of East Bay and Broad Streets.

Chronology of locations and elevations

The following lists the chronology of weather station locations at Charleston, South Carolina, during the period 1738-2005: (The latitude and longitude entries, when listed to seconds, were derived using U. S. Geological Survey maps as presented on Topozone.com.)

Area Locations

1784 – 1864

- Various locations in and around Charleston, see Table 1
- Various military locations including Castle Pinckney, Citadel, Fort Sumter, and Fort Johnson

1821 – 1860 – Elevation approximately 5 feet - 32° 45’ 32” N, 79° 51’ 28” W

- Fort Moultrie, U. S. Army Surgeons

City Locations

1738 – 1753 – Elevation approximately 10 feet - 32° 46’ 36” N, 79° 55’ 59” W

- 106 Broad Street, residence, John Lining, M.D., observer

January 1750 – December 1759 – Elevation approximately 10 feet - 32° 46’ 42” N, 79° 55’ 52” W

- Chalmers Alley (Street), residence, Lionel Chalmers, M.D., observer

1759 – December 1761– Elevation approximately 15 feet

- Location unknown

January 1774 – December 1789 – Elevation approximately 10 feet - 32° 47’ 07” N, 79° 56’ 00” W

- Corner of Meeting and George Streets, residence, Gabriel Manigault, observer

January 1791 – 1870? – Elevation unknown

- Location unknown, Medical Society and Board of Health members, observers

January 1871 – January 1897 – Elevation 11 feet – 32° 46’ 35” N, 79° 55’ 38” W

- No. 1 Broad Street, Carolina Bank Building

February 1897 – 2005 – Elevation 9 feet – 32° 46’ 50” N, 79° 55’ 36” W

- 200 East Bay Street, U. S. Custom House

Airport Locations

December 1931 – July 1941 – Elevation 44 feet – 32° 53’ 51” N, 80° 02’ 17” W

- Administration Building

July 1941 – December 1942 – Elevation 43 feet – 32° 54’ N, 80° 02’ W

- Weather Bureau Building adjacent to Administration Building

December 1942 – August 1949 – Elevation 41 feet – 32° 54’ N, 80° 02’ W

- Weather Bureau Building

August 1949 – June 1982 – Elevation 41 feet – 32° 54’ N, 80° 02’ W

- New Administration Building

June 1982 – 2005 – Elevation 40 feet - 32° 53’ 58” N, 80° 02’ 27” W (ASOS)

- Center of airfield

OBSERVERS AND INSTRUMENTATION

Area Locations:

1784–1864:

A number of local land owners and others recorded information about the weather in their personal dairies. See Table 1. The quality and frequency of the observations varies from observer to observer and from year to year. Dr. Mock considers the Daniel Webb observations to be the best of these early diarists.

Observer	Period of Diary	Location	Comments
Charles Drayton	1784-1820	Drayton Plantation	General information
Daniel Cannon Webb	1817-1850	Charleston	Good description
Charles Heyward	1835-1862	Charleston	Warm season only
Thomas Walter Peyre	1830s-1840s	Peyre Plantation	Extreme events
John Berkeley Grimball	1832-1862	Pinebury Plantation	Extreme events
Major Edward Manigault	1863-1864	Folly Island	Good information

Table 1. A summary of diaries that contain references to the weather as recorded from 1784 until 1864 in the Charleston, South Carolina, area.
Source: From information compiled by Dr. Cary J. Mock, University of South Carolina.

Limited weather observations were taken at other locations in the Charleston area including Castle Pinckney, 1833-1835; Citadel, 1830-1832; Fort Sumter, 1860-1861; and Fort Johnson, 1821.

1821-1860:

The U. S. Army Medical Service began taking weather observations at Fort Moultrie in 1821. Fort Moultrie was located on Sullivans Island at the entrance to Charleston Harbor some two miles southeast of downtown Charleston. See Map 1. Observations were taken through 1860. Figure 1 shows Fort Moultrie in April 1861 after exchanging fire with the Federal forces holding Fort Sumter. The exact placement of the weather instruments within the fort is not known. Information as to the instruments in use is not available.

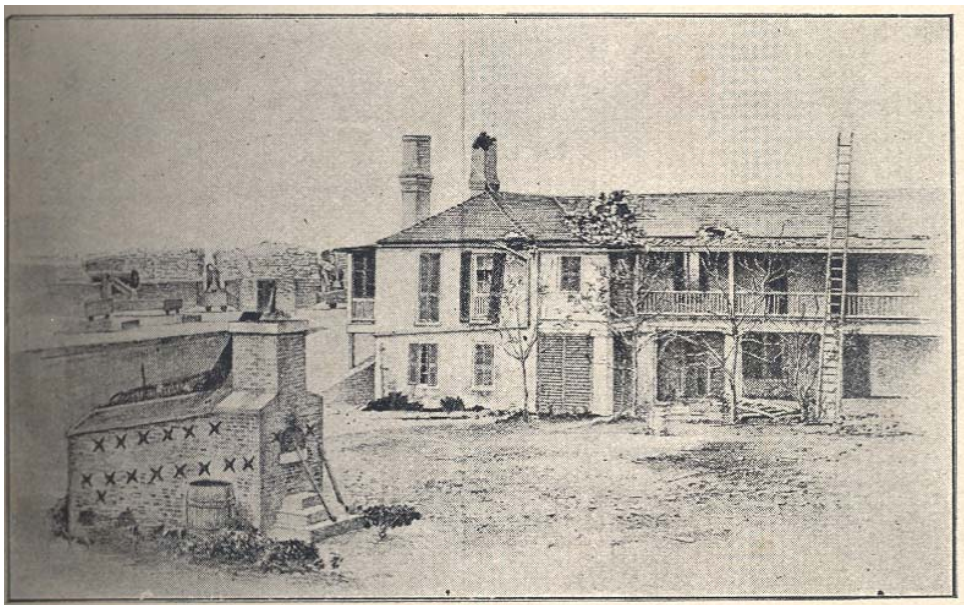


Figure 1. Parade of Fort Moultrie, showing southwestern portion of barracks, 16 April 1861.
Source: ***The Confederate Soldier in the Civil War***

City Locations:

1738-1753:

Dr. John Lining immigrated to Charleston, South Carolina, in 1730 arriving in town a 22-year old medical doctor. It became apparent to him that the weather had some relationship to the many epidemics of yellow fever that affected Charleston. He began recording the weather in 1738, a practice that he continued through February 1753. These observations were made from his home at 106 Broad Street (Figure 2) on the northwest corner of Broad and King Streets.

Figure 2. The home of Dr. John Lining, located at 106 Broad Street, Charleston, South Carolina, circa 2000. House faces south.
Source: Charleston County Public Library

Dr. John Lining made careful note of his instruments and their location in a letter written to the Royal Society in January 1741 and as published in the "Philosophical Transactions of the Royal Society, XLII (1742-43). To quote from Aldredge's *Weather Observers and Observations at Charleston, South Carolina, 1670-1871*, (page 32):

> Instrument location - "These instruments are conveniently placed on the outside of a NE window in a large square box, about 3 feet broad, 6 feet high and 1 ½ feet deep, which is so constructed that neither the sun nor rain can have access to the instruments and it at the same time sufficiently perflated to show the temperature of the air, have a great number of large holes, regularly placed & passing obliquely upwards, in both sides and in the front, with weather boards placed over each range of holes so as to hang over them obliquely downwards, and has likewise a large window in the front, which is open from morning to bed time. The shutters of the windows are in many places perforated obliquely upwards, that the air may have a free circulation thru the box when the window is shut in the night."
>
> "I made 3 observations by these instruments, of the weather every day, viz in the morning and at bed time at the same hours in which I weigh myself [6:30 to 7:30am and 10:00 to 10:30pm], and the other at 3 pm."
>
> Thermometer - "The thermometer is Fahrenheits: the other thermometer is made by Thos Heath in London and is divided into 90 equal parts, 65 is the freezing point, and 45 temperate; I suspect it to be the same with Hawksby's, and have call'd it so in the Tables."

Barometer - “The Barometer is a common portable one, the diameter of its bore is about 1/5 of an inch.”

Rain gage - “The depth of the rain is in inches and decimals.”

Other instruments - “The Hygroscope is a whip cord, prepared after the same manner as that of the Society’s in Edinburgh: the difference twixt its greatest & least length, by their manner of preparation, I found to be 5 inches, for which made an Index 5 Inches long and divided it into 100 equal parts, the first of which is the Hygroscopes greatest length.”

1750-1759:

Dr. Lionel Chalmers, an associate of Dr. Lining, began recording observations in January 1750, a practice that he continued until December 1759. These observations were taken from his home on Chalmers Alley (Street). No information has been found on the instruments in use.

1759-1761:

The *South Carolina Gazette* published weather reports from 1759 through December 1761 but no precise location was given. Observations consisted of temperature, pressure, wind direction, and weather recorded three times per day at 6am, 2pm and 9pm.

Thermometer – The readings were simply listed as “The temperature of the shaded air, by Fahrenheit’s thermometer” in the November 1759 edition of the paper.

Barometer – The barometer was listed as being “suspended about fifteen feet above the level of high-water”.

1784-1789:

Gabriel Manigault, a merchant in Charleston, recorded observations from January 1784 until December 1789. His residence was at the corner of Meeting and George Streets, or 279 Meeting Street. He observed the sunrise and daytime temperatures and in the later years he began including pressure, wind direction, and weather. No information has been found on the instruments in use.

1791-1870

In January 1791, Dr. Robert Wilson, one the founders of the Medical Society of South Carolina, began to record weather observations. Under the auspices of the Medical Society, and later the Charleston Board of Health (beginning in 1816), observations would continue until approximately 1870. Though the names of the observers and their home addresses are generally known, the precise site for the taking of weather observations is not known. Table 2 presents the Medical Society and Board of Health observers and their home addresses.

Observer	Period of Observations	Home Address
Dr. Robert Wilson	Jan 1791 – Dec 1812	NW corner Broad & Logan
Dr. Joseph Johnson	1812? – 1845?	Church St, south of Water St
	1845? – 1862?	King St, north of Broad St
Richard Hrabowski	Jan 1816 – Dec 1819?	Broad Street?
James A. Miller	Jan 1824 – Dec 1830?	10 Magazine Street
John Skottowe Bellinger	Late 1820s – early 1830s?	37 St. Phillip Street
A. G. Howard	1830's	Corner Broad & State Strs
John Ryan	Late 1830s – Dec 1843?	70 King Street
Dr. John L. Dawson, Sr.	Jan 1843 – Jul 1859	80 Church Street
Dr. George S Plezer	Aug 1859 – Dec 1867?	371 King Street
Dr. Robert Lebby	?	49 Beaufain Street

Table 2. The names of weather observers, dates of their observations, and their home address for Charleston, South Carolina, 1791-1870.
Source: From information compiled by Dr. Cary J. Mock, University of South Carolina.

It might be speculated that the observations were taken at the Board of Health offices but information as to exact location of the offices is quite limited. In December 2005, Amy Quesenbery with the South Carolina Room, Charleston County Public Library, conducted a through search for references to the location of the Board of Health. Only a few tantalizing clues were found. In 1816, Mr. Hrabowski, the Board's clerk, was located on the second floor of the Cannonboro Exchange. The Health Office was at 27 Broad Street in 1840. In 1856, the Board of Health office was located on the upper floor of the City Hall which was located on the northeast corner of Broad and Meetings Streets. And finally, in 1870, the location seemed to be the Mazychk Street Hospital.

Another mystery is whether Dr. Joseph Johnson recorded concurrent weather observations with the Board of Health observers beginning in 1812 to perhaps 1862. Dr. Johnson used instruments belonging to the Medical Society. Dr. Johnson and Dr. Dawson were found to be Smithsonian Institution observers from 1856-1861. Their names appear together on the original observational forms for this time period.

Mr. Howard, Dr. Pelzer, and Dr. Lebby are shown to have been the City Registrar, a position created in 1842. The Registrar's office was at the City Hospital on Magazine Street in 1869. Earlier locations are unknown. Mr. Ryan was listed as a City

Inspector. Aldredge (page 106) notes: "Since the office hours were such that the office would be closed at the time that some of the observations were taken, it is possible that they were taken at the homes of the observers. Whether or not these offices had assistants is unknown, but it is highly probable that they did and these might have taken the observations. Until June 1828, the observations were made at 9 AM, 12 noon, and 3 PM: then for June and July 1828 there were five daily observations, 2 AM, 8 AM, 2 PM, 6 PM and 10 PM. The 2 AM and 6 PM observations were soon dropped and the others continued until September 16, 1832 when the observers were changed and the hours of observations become 7 AM, 2 and 9 PM."

Dr. Cary Mock's analysis of the observational data indicates a possible location change (or instrument change) in January 1839; on 21 January 1849; and in July 1857.

During the period 1791 to 1812 the observations were taken by Dr. Robert Wilson. He recorded observations at 8am, 3pm, and 10pm. He used a Fahrenheit thermometer suspended in an open passage about ten feet from the earth. The meteorological observations are further described as being taken "by an instrument, containing a thermometer, barometer, and hygrometer, constructed by Dolland, and suspended in a corner of an open passage, leading to the stair case, in the house of Doctor Robert Wilson, near the western extremity of Broad Street." (Aldredge, page 69).

Little is known about these instruments; however, some interesting information is available concerning the rain gage in use. In 1794 the Medical Society purchased three tin vessels to use as rain gages. These vessels were 18 inches deep, one foot in diameter and graduated on the opposite sides internally, into inches and tenths of inches. Unfortunately, no information is available as to the exposure of these gages.

Dr. Joseph Johnson's observations, 1812-1862, were taken with care and accuracy but for the most part have been lost to antiquity. It is recorded that he used a rain gage graded in inches, quarters of inches, and tenths of quarters of inches.

Little information is available about the instruments in use by the Board of Health, the City Inspector, or the City Register. A note on the May 1830 observational form mentions that the thermometer was hung out of doors in the shade.

1871-1897:

On 5 January 1871 the weather observing program in Charleston was assumed by the U.S. Army Signal Service being located in the Carolina Bank Building at No.1 Broad Street on the southwest corner of Broad and East Bay Streets. The offices were located on the third floor. See Figure 3. The U.S. Department of Agriculture's Weather Bureau began observing at this same location on 1 January 1892. Mr. J. N. Jesonofsky was the last Signal Service observer and the first Weather Bureau observer.

Figure 3. Broad Street in Charleston, South Carolina, circa 1880. The Carolina Bank Building, which housed the Weather Bureau Offices on the third floor is the last building on the right side of the street. View is looking east.
Source: Courtesy of South Caroliniana Library, University of South Carolina, Columbia.

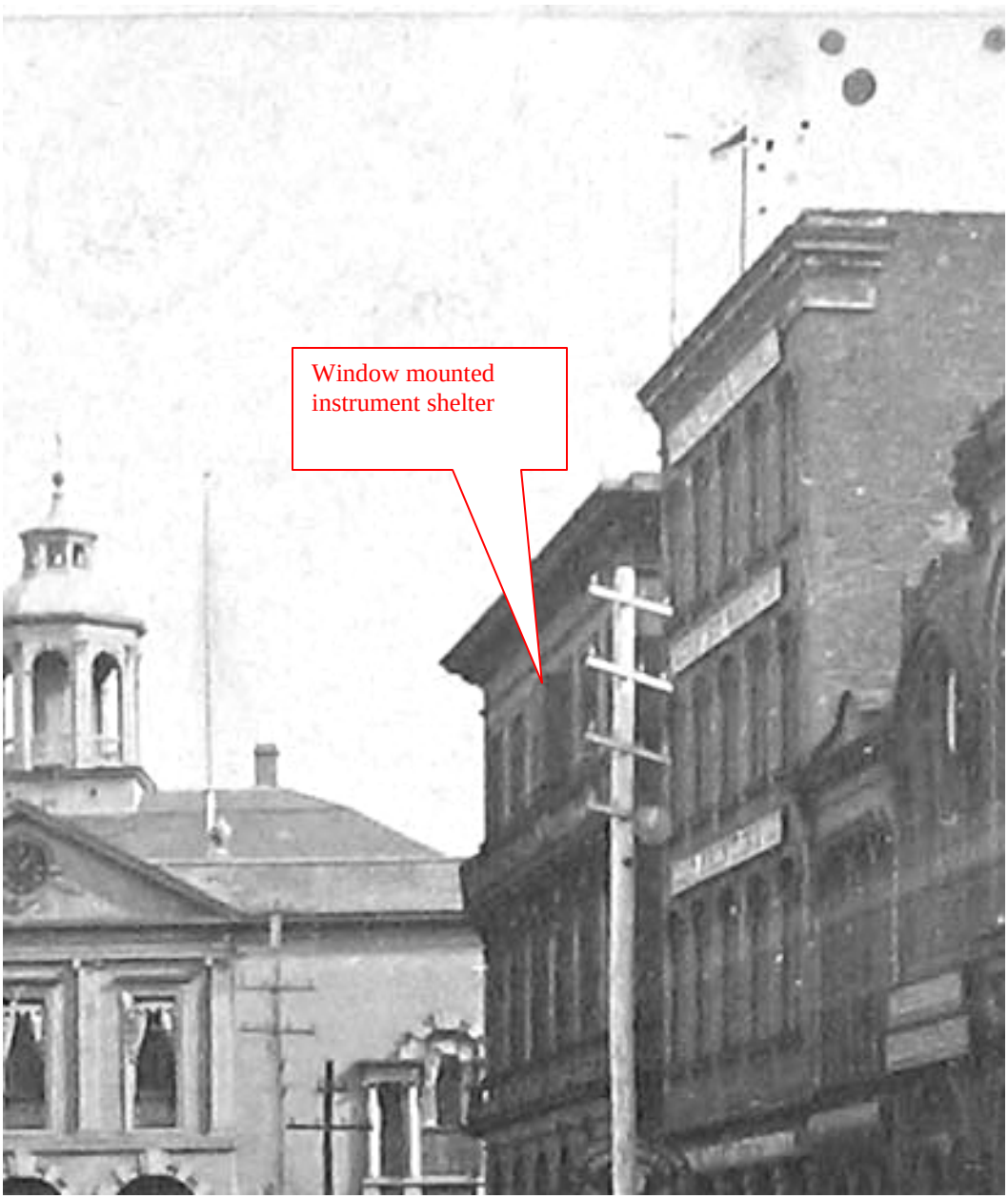


Figure 4. Close up of the window mounted instrument shelter at the Weather Bureau office in Charleston, South Carolina, circa 1880. Shelter is mounted on the north side of the building.
Source: Courtesy of South Caroliniana Library, University of South Carolina, Columbia.

The 1871 "Report of the Signal Chief" lists the wind vane, anemometer, and rain gage as being well exposed, the instrument shelter as being of the usual model, and well constructed. The station was supplied with a complete set of standard instruments and they were to be found in good condition.

Thermometer - For the period 1871 through 1885 the instrument shelter was mounted in a north window some 40 feet above the ground. See Figure 4. In January 1886 the thermometer was housed in a "standard" shelter on the roof of the building some 60 feet above the ground and eight and a half feet above the roof. In December 1892, the shelter was listed as being a "Hazen, lattice, roof".

Barometer – The barometer was located 52.7 feet above sea level.

Rain gage - The tipping-bucket rain gage was on the roof of the Bank Building. From 1871 until 8 April 1881 the gage top was 57 feet above the ground and five feet above the roof. The gage was then lowered to 53 feet above the ground and one and a half feet above the roof. Then changed to 55 feet on 1 September 1886 when the height above the roof increased to three and a half feet.

Wind instruments – The wind instruments were mounted on the roof some 72 feet above the ground. See Figures 3 and 4.

1897-2005:

On 1 February 1897 the location of the observing program was moved to the U. S. Custom House at 200 East Bay Street. This was a move of 1,500 feet north. The Weather Bureau offices were located on the second floor, southwest corner. The observing program continues to this day, however, the human observers were replaced with automated instruments in 1957.

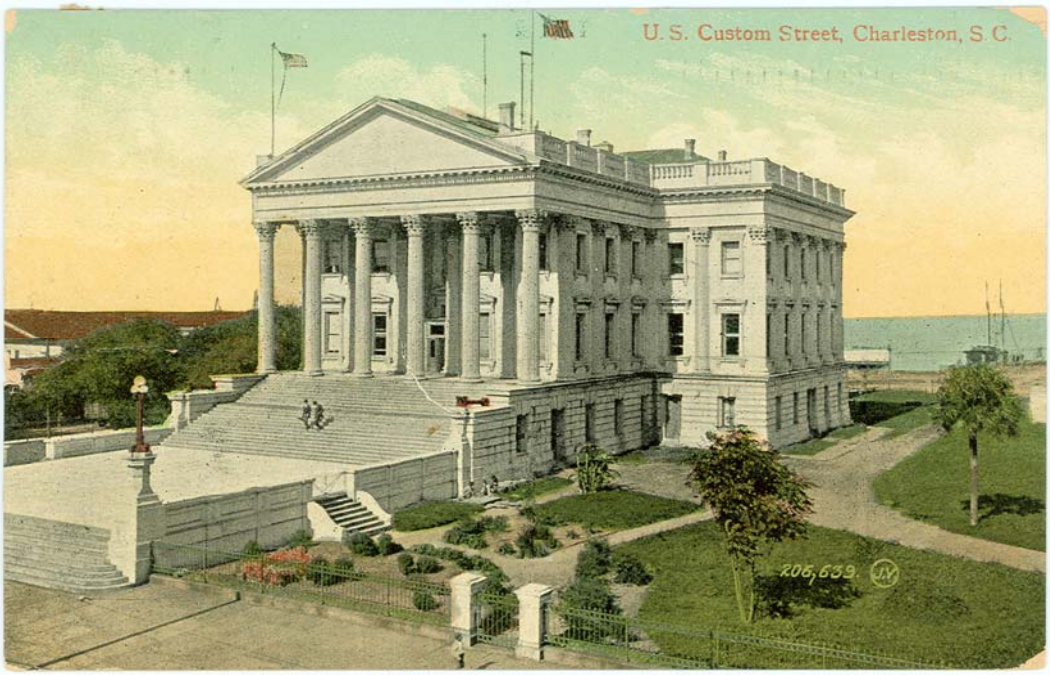


Figure 5. The Custom House at 200 East Bay Street in Charleston, South Carolina, circa 1900. View is looking northeast. Notice the harbor and the small trees. Source: Courtesy of South Caroliniana Library, University of South Carolina, Columbia.

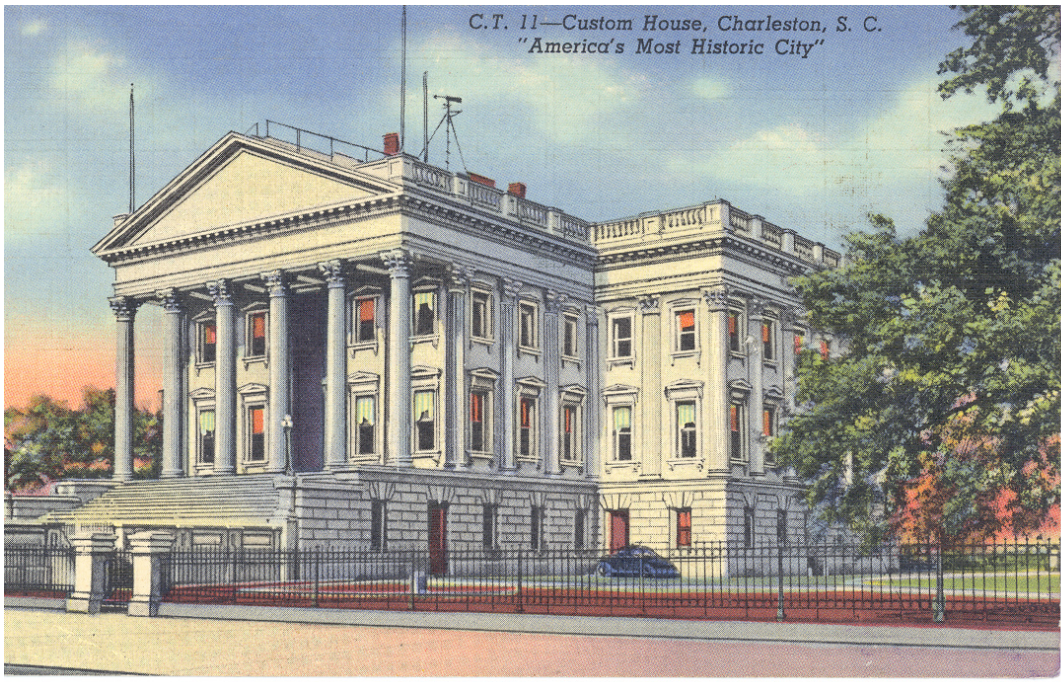


Figure 6. The United States Custom House in Charleston, South Carolina, circa 1950. View is looking northeast. Notice that trees are now fully grown. Source: Author's personal collection of post cards.

Thermometer - The instrument shelter was located on northeast lawn until 1949 when it was moved to the south lawn. Figure 7 shows the location of the instruments on the grounds of the Custom House, circa 1940. The thermometers were at 11 feet above the ground. On 19 July 1949 the thermometers were lowered to six feet above the ground when they were placed in a new hip-roofed shelter. The Chief, Weather Bureau Field Inspection Section stated in a 1 March 1949 memo that "Mr. Lockwood is still trying to get authority to move the instrument shelter, and when it is moved to the new location, it will be in an excellent exposure. However, it will still be within about a block or two of the water's edge and the temperatures will still be far from representative."

Barometer – The mercurial barometer, serial number 400, was located 48.45 feet above sea level. Barometer was decommissioned in April 1965 and was not replaced.

Rain gage – At the time of the move to the Custom House in 1897 the tipping-bucket rain gage was located on the roof, 76 feet above the ground. The gage was moved to the south lawn on 10 June 1932 changing the top of the gage to three feet above the ground.

Wind instruments - The wind instruments were mounted on the roof at a height of 92 feet above the ground as clearly shown in Figures 5 and 6. The anemometer was 19 feet above the roof and the vane 21 feet above the roof. Wind exposure was considered excellent.

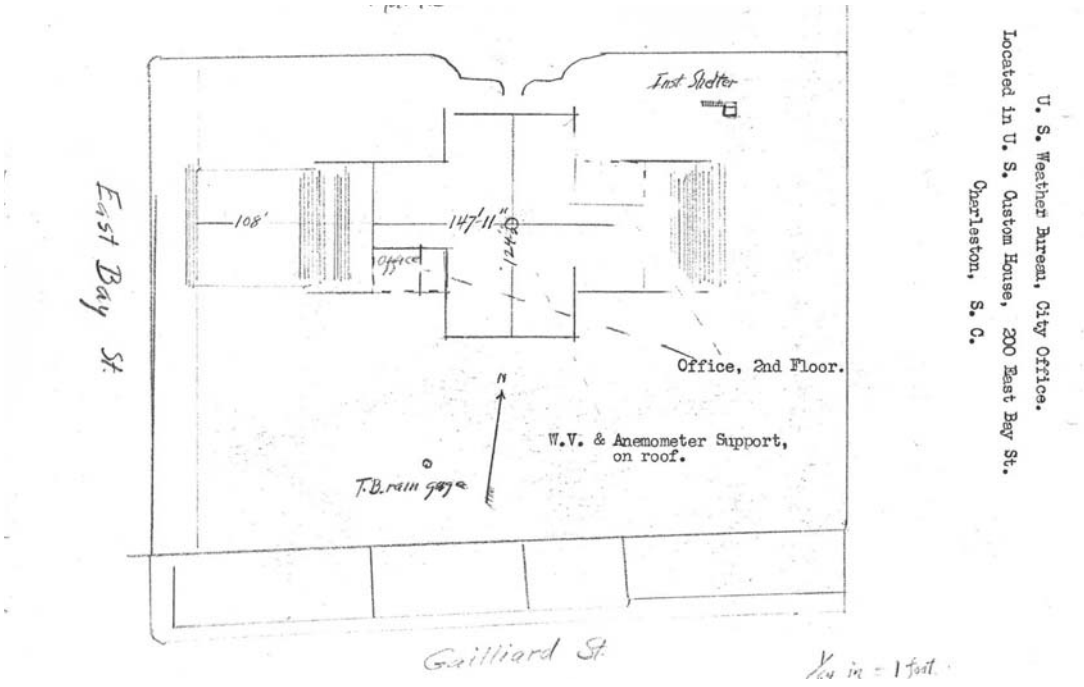


Figure 7. The location of the Weather Bureau office, circa 1940, in the U. S. Custom House in Charleston, South Carolina.
Source: Official station history files at the National Climatic Data Center.

Charleston Airport

1931-1941:

On 28 December 1931 an observing program was established at the new Charleston airport some ten miles northwest of the downtown locations. The Weather Bureau was located in an Annex to the Administration Building. Figure 8 shows the Administration building and the instruments as they appeared in May 1941. The offices were located on the first floor, see Figure 8, location 1. The Bureau remained in this location until 29 July 1941.

Figure 8. The Administration Building at the Charleston, South Carolina, airport on 24 May 1941. View looking southeast.
Source: Official station history archives, National Climatic Data Center.

Thermometer – On 25 May 1935 the maximum and minimum thermometers were installed in a Cotton Region Shelter at a height of four feet above the ground. The shelter was located over sod. See Figure 8, location 4.

Barometer - The mercurial barometer, serial number 816, was located 48.03 feet above sea level.

Rain gage – The standard eight-inch rain gage was located at a height of three feet above the ground. See Figure 8, location 5 to the far right side of the photograph.

Wind equipment – The wind instruments were located on the roof of the building with the three-cup anemometer cups at 37 feet above the ground and 16 feet above the roof. The three foot vane was at 39 feet above the ground and 17 feet above the roof. See Figure 8.

1941-1942:

On 29 July 1941 the Weather Bureau moved to its own building adjacent to the Administration Building. They remained at this location until 17 December 1942

Thermometer – The maximum and minimum thermometers were located five feet above the ground.

Barometer – The mercurial barometer, serial number 816, was located 48.12 feet above sea level.

Rain gage – The standard eight-inch rain gage was located so the top of the gage was three feet above the ground.

Wind equipment – The wind instruments were located on the roof so that the anemometer cups were 38 feet above the ground and the vane 41 feet above the ground.

1942-1949:

The U. S. Army literally moved the Weather Bureau Building 900 feet southeast on 17 December 1942. The observational program remained in this location until 11 August 1949. Figure 9 shows the relationship of this new location to the previous location. Figures 10 and 11 show the location of the building and the instruments as of 1943 and 1946.

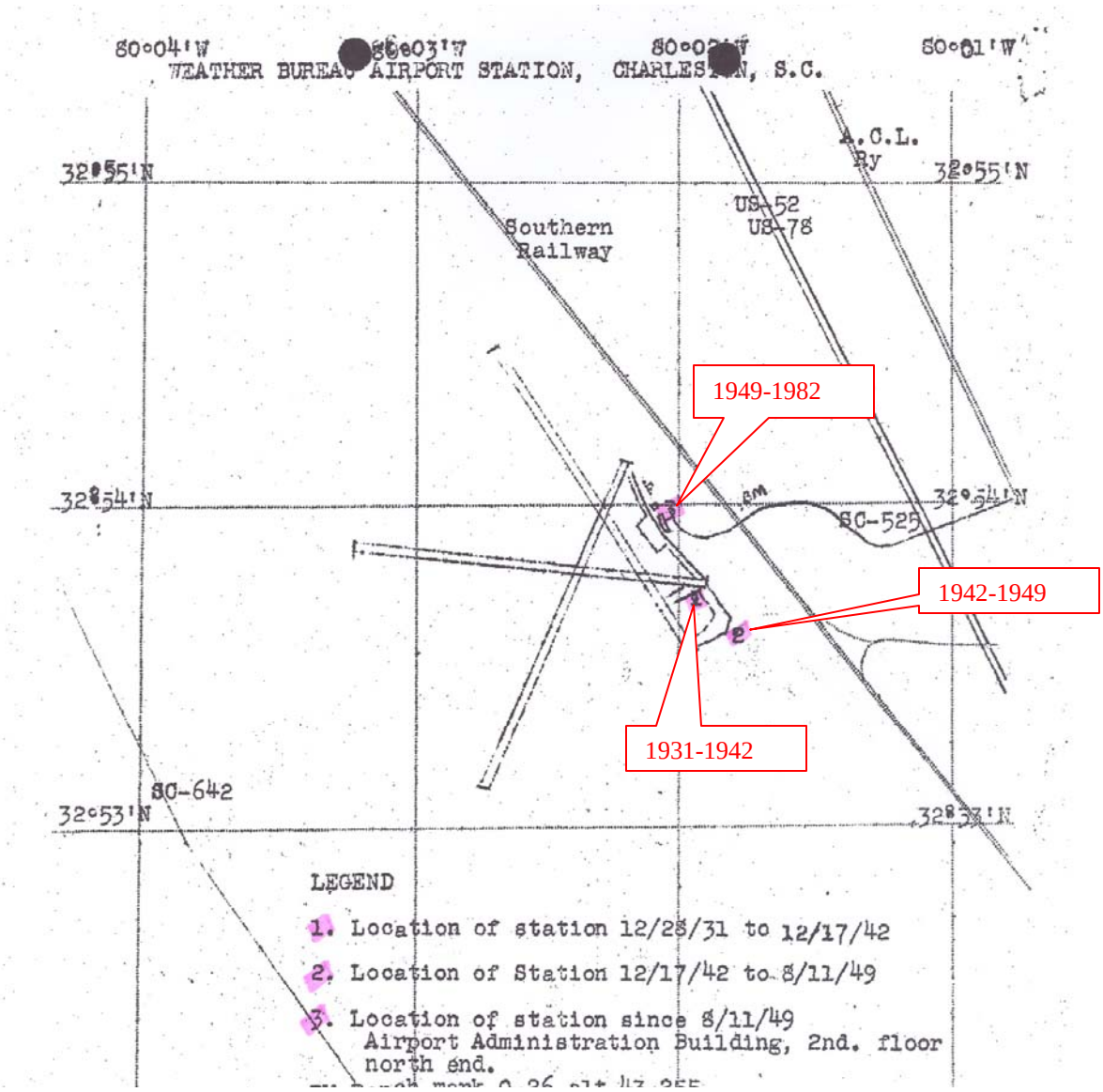


Figure 9. The relative locations of the weather observing sites, 1931-1982, at the Charleston, South Carolina, airport. Drawing was prepared in December 1951. Source: Official station history files, National Climatic Data Center

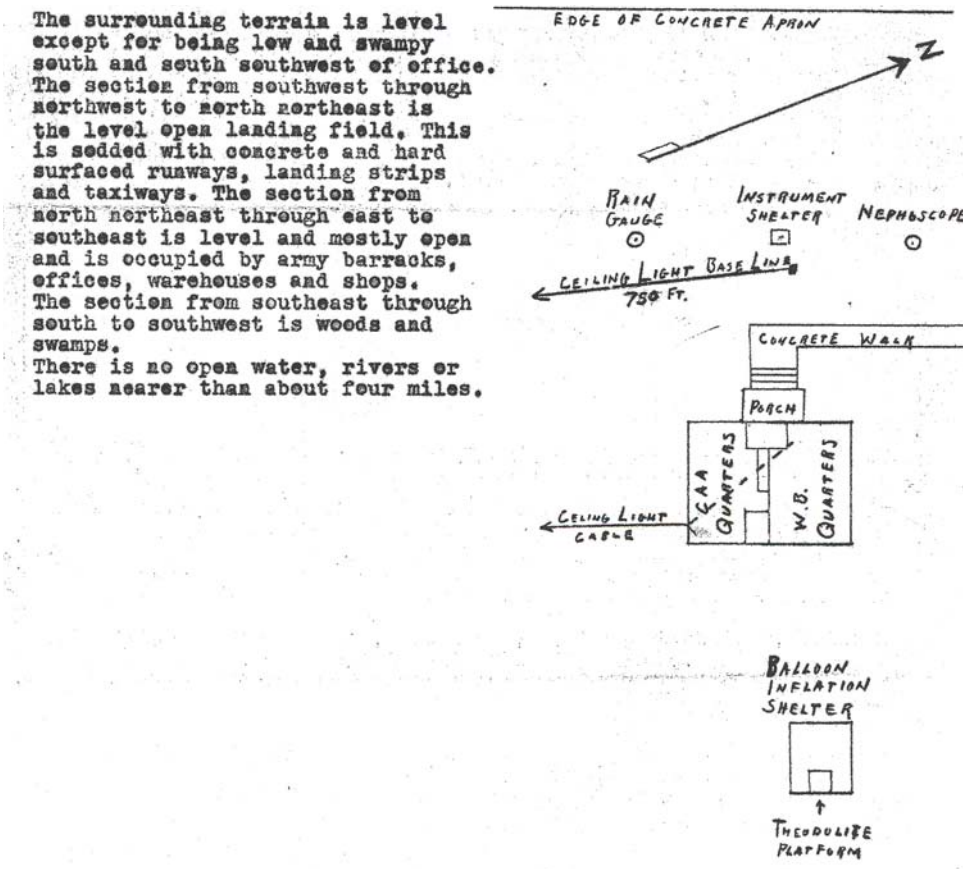


Figure 10. The location of weather instruments at the Charleston, South Carolina, airport as of 25 June 1943.
Source: Official station history files, National Climatic Data Center.

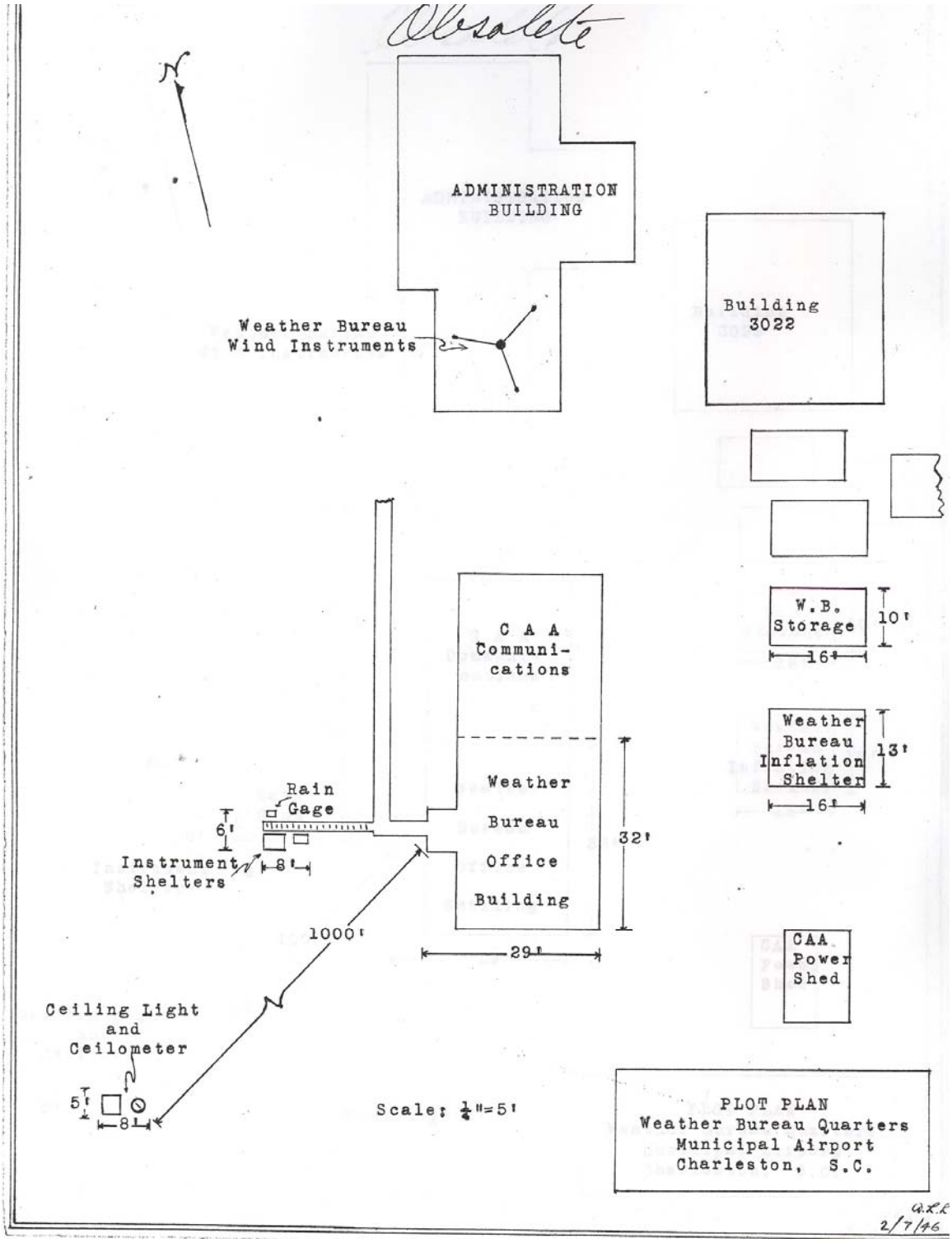


Figure 11. Plot plan for the Weather Bureau quarters at the Municipal Airport, Charleston, South Carolina, 7 February 1946.
Source: Official station history files, National Climatic Data Center

Thermometer – The maximum and minimum thermometers were at a height of four and a half feet above the ground. The shelter was approximately 30 feet west northwest of the building. See Figures 10 and 11.

Barometer – The mercurial barometer, serial number 816, was located 45.63 feet above sea level.

Rain gage - The standard eight-inch rain gage was located so that the top was three feet above the ground. The gage was approximately 35 feet west of the building. See Figures 10 and 11.

Wind equipment – The wind equipment were located on the roof of the building at 38 feet above the ground. The three-cup anemometer was 14 feet above the roof and the vane 17 feet above the roof. On 2 January 1945 the instruments were moved back to the roof of the Administration Building returning the height to 38 feet. See Figure 11.

1949-1982:

The Weather Bureau office moved once again on 11 August 1949 to a location in the new Administration Building. The offices were located on the second floor of the building. This location was 2,600 feet northwest of the previous location. Figure 9 shows the relationship of this new location to the previous locations.

Figure 12. The Charleston, South Carolina airport new Administration Building on 22 August 1949. The instrument shelter and the rain gage are shown in the foreground. Wind instruments were on the roof of the Tower. The Weather Bureau office was at the top of the stairs.
Source: Official station history files, National Climatic Data Center.

Figure 13. A close up view of the Cotton Region Shelter, Charleston, South Carolina Municipal Airport, August 1949.
Source: Official station history files, National Climatic Data Center

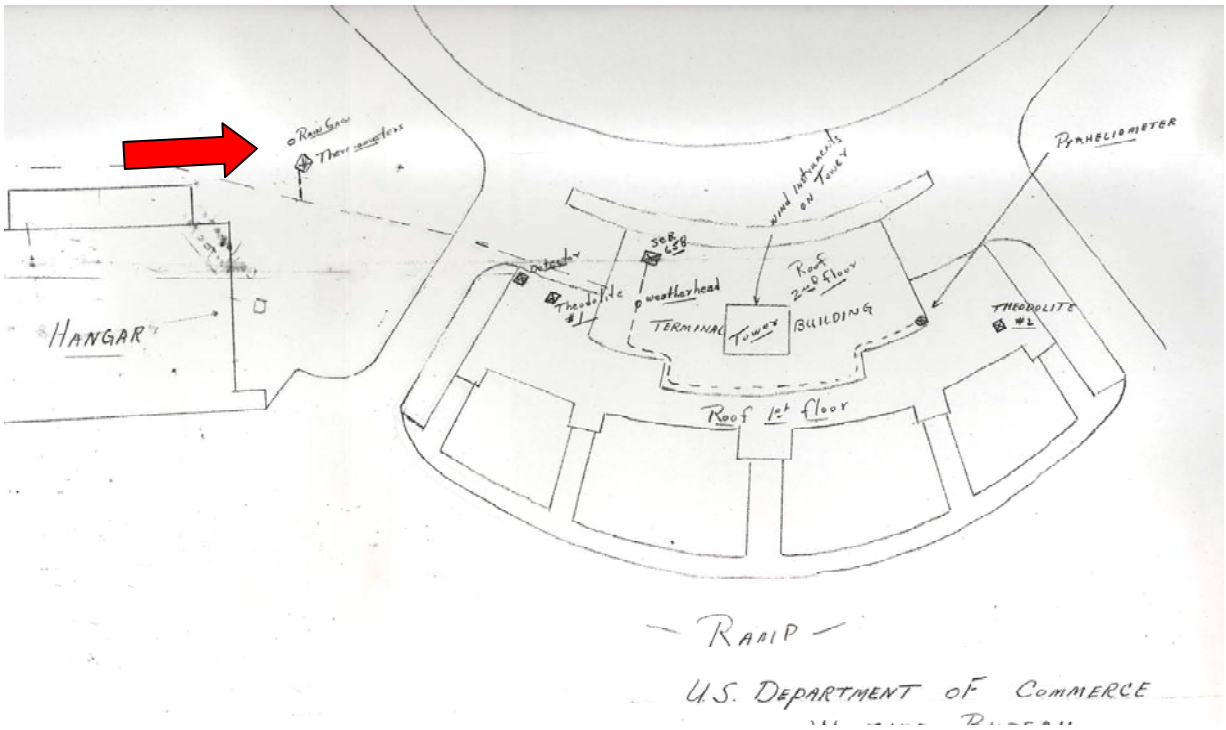


Figure 14. The location of the weather instruments at the Charleston, South Carolina, airport, circa 1950. The red arrow indicates the location of the rain gage and thermometers. Top of diagram is northeast.
Source: Official station history files, National Climatic Data Center

Thermometer – The maximum and minimum thermometers were housed in a Cotton Region Shelter located in a grassy area in front of the Administration Building. See Figures 12 and 13. The thermometers were five feet above the ground. On 21 March 1950 the shelter was moved to a new location some 65 feet southeast of the hanger. See Figure 12. On 1 June 1960 the shelter was moved to the "evaporation station" which was 450 feet northeast of the Administration Building. A hygrothermometer was placed in service 1 October 1948 at an unknown site. On 1 June 1960 an HO60 instrument was installed at a field site being four feet above the ground. Presumably this location was near the F420C wind instrument. See Figure 16.

Barometer – The mercurial barometer, serial number 816, was located 58.81 feet above sea level. A new barometer, serial number 1142, was installed on 3 April 1965.

Rain gage – The standard eight-inch gage was located so that the top was three feet above the ground. The gage was moved to a location 60 feet southeast of hanger on 21 March 1950. See Figure 14. A weighing rain gage was installed at this same location on 1 February 1954 so as to have the top of the gage four feet above the ground. The eight-inch gage was

moved on 31 December 1959 to the "evaporation station". The weighting rain gage was moved to the "evaporation station" on 12 March 1959 and relocated again in August 1976 to the roof of the Administration Building some 18 feet above the ground.

Wind equipment – The wind instruments were located on the tower roof 73 feet above the ground. On 4 January 1952 the height changed to 77 feet above the ground. On 6 October 1958 the wind equipment was moved to center of field location and the height changed to 20 feet above the ground. This location was 2,000 feet west of Administration Building. See Figure 16.

1982-1995:

On 7 June 1982 the National Weather Service moved into a new building, a move of one-quarter mile south of previous location. See Figure 16. The instruments were moved to a new "instrument plot" near the building. This location was flat and grass covered.

Thermometer – The maximum and minimum thermometers were located in the instrument plot at a height of five feet above the ground. The move was made on 26 May 1982. Also on 26 May 1982 the HO60 hygrothermometer was moved to the same instrument plot being located some 45 feet southwest of the instrument shelter. It was located six feet above the ground. On 5 June 1985 a HO83 hygrothermometer replaced the older HO60 in the same location and height.

Barometer – The barometer, serial number 1-73, was 46.995 feet above mean sea level effective 7 June 1982.

Rain gage – The eight-inch gage was located in the instrument plot some 16 feet south of the instrument shelter. The top of the gage was five feet above the ground. The weighing rain gage was also at the instrument plot some 12 feet south of the instrument shelter. The top of the weighing gage was five feet above the ground. The tipping-bucket gage was four feet south of the eight-inch gage and was placed so that the top was four feet above the ground. The eight-inch gage and the weighing gage were moved effective 26 May 1982 while the tipping bucket gage was moved 1 June 1982.

Wind equipment – The wind instruments were not moved from their center of field location, remaining at 20 feet above the ground. See Figure 16.

1995-2005:

On 1 October 1995 the Automated Surface Observing System (ASOS) instruments were commissioned. The instruments were located at a center field location. The ASOS wind mast height was 33 feet above the ground. See Figures 15 and 16.

Figure 15. The Automated Surface Observing System at Charleston, South Carolina International Airport, circa 2000. View is looking north.
Source: National Climatic Data Center web site.

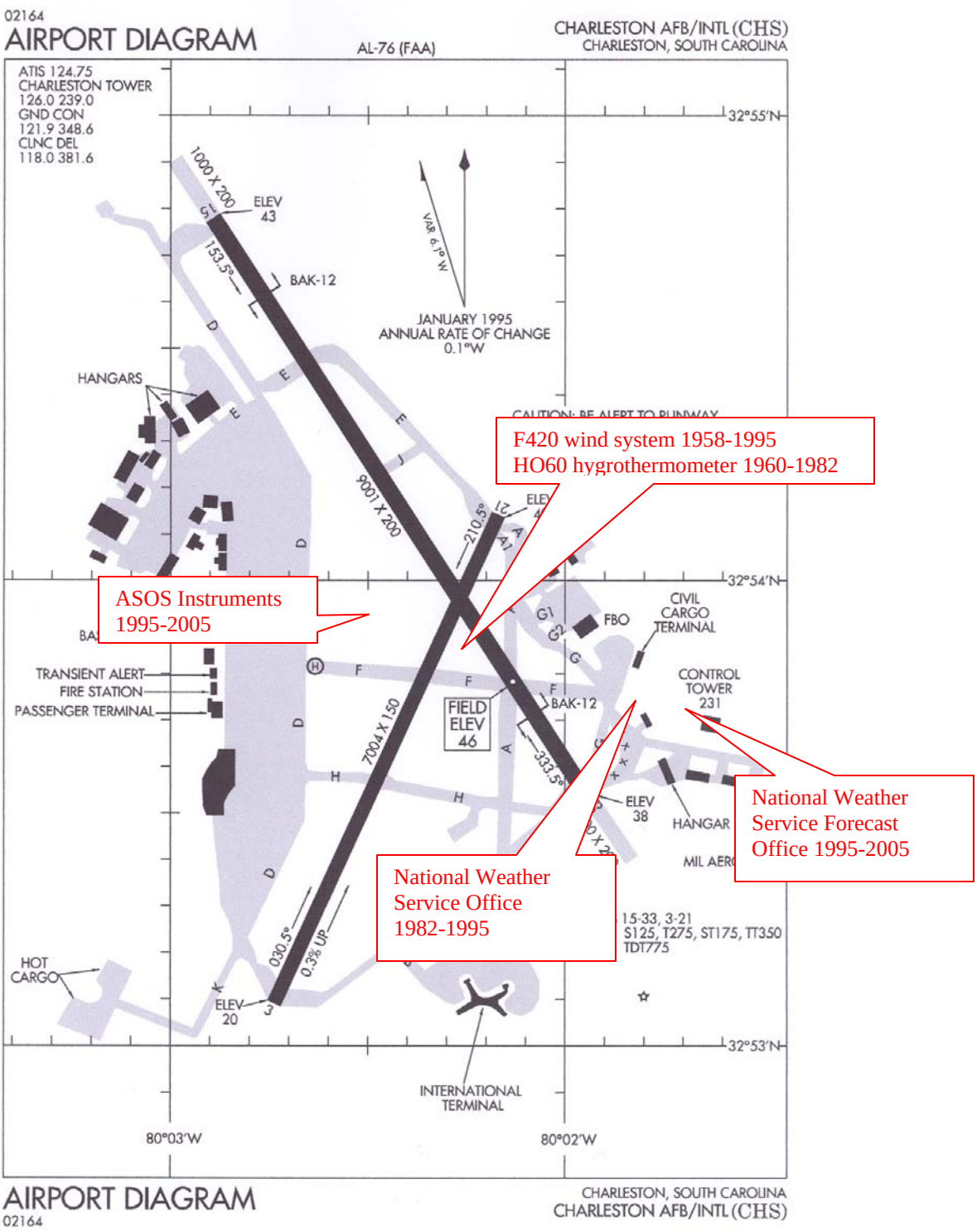


Figure 16. Charleston, South Carolina, airport diagram, circa 1995. The location of the National Weather Service buildings, wind instruments, and ASOS instruments are indicated.

APPENDICES

Appendix 1 – Observer Stories

Drayton Hall Plantation and Dr. Charles Drayton –

The following was extracted from the Drayton Hall Plantation web site at www.draytonhall.org. John Drayton built the estate in 1738 and it remains to this day as an American treasure.

> "Drayton Hall was begun in 1738 and was completed after four years of construction by European and African American craftsmen. Today, its Georgian-Palladian architecture represents the oldest surviving example of its kind in the American South. Still without running water, electric lighting, or central heating, the preservation of the house extends to its guests a sense of timelessness and continuity. Its mere existence proves its strength against the tests of time and change, disuse and nature.
>
> Drayton Hall is the only plantation house on the Ashley River to survive the Revolutionary and Civil Wars intact. After seven generations, two great wars, and numerous hurricanes and earthquakes, the main house of this National Historic Landmark remains in nearly original condition. The entire site serves as an eloquent testimony to America's heritage."
>
> "Over the years John Drayton became a man of great wealth, distinguished by his public offices, which included several judgeships as well as membership in the Royal Council to the governor from 1754 until the outbreak of the Revolution. For the next 230 years six generations of John's descendants owned Drayton Hall, and while several gained world esteem, many others made the private, unheralded decisions that maintained and preserved the great house. John Drayton married four times and had seven children who survived infancy. When he was fifty-nine, he took as his fourth wife seventeen-year-old Rebecca Perry, who bore him three children in the four years of their marriage. According to family tradition, John left Drayton Hall to Rebecca. She made an arrangement with her husband's eldest surviving son, **Dr. Charles Drayton**, who assumed ownership of Drayton Hall in 1784. In return, Rebecca removed some of the furniture and the silver. Only twenty at the time of her husband's death, Rebecca moved back into town, never remarried, and lived until she was eighty. Upon her death some of the original Drayton furniture along with the town house was sold to provide for her six surviving personal slaves, whom she had brought with her from Drayton Hall."
>
> "John Drayton's eldest son, William Henry Drayton (1742-1779), was the most prominent member of the family in any national sense. Shortly before the meeting

of the first Continental Congress in 1774, he published a pamphlet, signed "Freeman," which outlined a course of action for the Congress and included a bill of rights. He served in the 1778 Congress and died the same year as his father. Drayton Hall passed to William's younger brother, **Charles** (1743-1820), who studied at the University of Edinburgh to become a physician, a profession practiced by a number of his descendants. He was perhaps the most interesting of the Draytons as far as the property is concerned, for he kept a diary from 1779 until his death and he counted horticulture among his diverse hobbies. He often met to exchange advice and specimens with André Michaux, a well-known botanist who introduced many exotic plants to this country. **Dr. Drayton** also corresponded with Thomas Jefferson, who sent him varieties of upland rice and olive trees (which failed to grow). Under **Dr. Drayton's** care, the gardens, which were situated on the river side of the house near the orangerie built by John Drayton, must have resembled an experimental station where new plants were tested for their introduction to the New World.

Figure 17. A portrait of Dr. Charles Drayton (1743-1820), circa 1800.
Source: Gibbes Museum of Art (www.draytonhall.org)

Dr. Drayton's son (1785-1844) and grandson (1814-1852) were also named Charles and also trained as physicians, although both seem to have spent their

time managing their extensive property. His great-grandson, also Charles (1847-1915), who was thirteen at the outbreak of the Civil War, ran away to join the Confederate forces and served as a courier in the army. Family tradition credits young Charles's uncle, Dr. John Drayton, with saving the house from destruction by posting the property with yellow flags signaling a smallpox hospital, although another explanation credits its salvation to a cousin, Percival Drayton, who was a commodore in the Union blockading squadron that was headquartered at Hilton Head Island and presumably exercised his influence to save a relative's property.

In truth, no one knows for certain why Drayton Hall escaped the fate of the other plantation houses along the Ashley River, but the fact that the house survived both Reconstruction and the twentieth century can be credited to the Charles who ran away to join the army and to his son and daughter, Charles (1887-1941) and Charlotta (1884-1969). The mining of phosphate, which was used for fertilizer, redeemed the postwar family fortunes. The Draytons moved into a handsome Eastlake Victorian house on the Battery, and Drayton Hall became a country retreat, one that suffered neither frugal disrepair nor profligate modernization. The Draytons did install a rose garden and enlarged the pond on the road side of the house, alterations that moderate the classical severity of the grounds with a certain romantic asymmetry, but for the most part the changes they introduced were made to maintain the house. The last Drayton in residence, Miss Charlotta, who came out "to camp" in the house for a few weeks each spring, was adamant about the preservation of what was now considered an architectural treasure. (Miss Charlotta was a quiet southern lady, who always had a dog, including the favored Nipper, a terrier whose height Miss Charlotta recorded on the children's growth chart on a first-floor door jamb.) Upon her death her nephews, Charles and Francis, decided that the best way to preserve the house was to arrange for its transmission to the National Trust for Historic Preservation."

Gabriel Manigault –

The following was extracted from The Buildings of Charleston by Jonathan H. Poston; Historic Charleston Foundation, concerning the fate of the original Gabriel Manigault home on Meeting Street.

"Three houses dated between 1782 and 1805 had been built on this site, but they were torn down after Standard Oil (Company of New Jersey) acquired the property in 1929. Considerable public outrage ensued over this demolition."

"Using brick, as well as elements such as columns, balusters, and window surrounds saved from the concurrent demolition of the Gabriel Manigault House at 279 Meeting Street, (Albert) Simons designed the service station on the Colonial Revival style. Some found the station charming, but most did not. The demolition of the original structures and the construction of this service station inspired the city council to enact America's first historic zoning ordinance in 1931

and to create the nation's first historic district and Board of Architectural Review."

Report of the Chief Signal Officer – Charleston, South Carolina

The following was extracted from the U. S. Army *1871 Report of the Chief Signal Officer*. The report tells of the duties and hardships encountered by these early weather pioneers.

> "The station was established by Sergeant J. E. Evans, and reports commenced on the morning of January 5, 1871, and have been continued regularly since that time, with the exception of the midnight reports from March 4 to May 24, during which time the telegraph office closed at 10 p.m., and the reports were necessarily held over until next morning. Full reports are received from all other stations, and six daily bulletins are issued and posted in prominent places. The daily papers publish a portion of the afternoon and midnight reports, and the probabilities regularly. A large weather map is hung in the rooms of the Chamber of Commerce, and the symbols changed each morning."
>
> "The station is supplied with a complete set of standard instruments, and all are reported to be in good condition. An assistant was sent from this office June 12, 1871, as the work was too great for one man to perform satisfactorily. Reports have been made regularly and properly, and the conduct of the observer has received the commendation of the meteorological committee of the chamber of commerce. Both observer and assistant have been attacked with yellow fever, and were unable for a few days to perform their duties, but they are now so far recovered as to dispense with the services of the citizen who made the reports during their illness."
>
> "The station has not been visited by an inspecting officer, owing to the prevalence of fever, and the only information had is derived from the reports of the observer and of the chairman of the meteorological committee."
>
> "The rent paid for office is $10 per month."

Stresses of occupying new space –

The following was extracted from a letter written on 1 March 1949 by the Chief, Weather Bureau Field Inspection Section to the Regional Office. This letter was found in the official station history files at the National Climatic Data Center. It seems to relay the sense of frustration that sometimes comes with the building and occupying of new space.

> "I made a trip to the airport and inspected the new building which is almost completed, and if work continues at the present rate, we will be able to move in

less than 90 days. [Note: the move did not actually take place until some five months later, in August 1949] However, a political squabble is now brewing over the construction of this building. The present mayor had nothing to do with the planning of the building since it had been planned and authorized by preceding mayors, including the present Senator Maybank. The present mayor says that it is too large an undertaking for a city the size of Charleston, and I anticipate that we will have difficulties in negotiating a lease – although the original agreement between the Government and the city of Charleston clearly defines the conditions under which the Government agencies will occupy space. We have very adequate quarters as far as the amount of space is concerned, but it is very poorly planned and stresses the need for more aggressiveness on the part of the Regional Office in future planning for new construction. The inflation room is quite adequate except that a baggage loading platform has been built adjacent to the entrance. This platform has a protruding roof which will make it difficult to maneuver balloons out the door and into the clear since on the other side of the doorway is a building wall extending out for some distance. The windbreaks for the theodolite are the smallest that I have ever seen, and will not give adequate space for moving about while following balloons. The prime windbreak is located too close to the superstructures, i.e., the part extending above the level of the theodolite which is located on the roof of a one-story wing. I pointed out to Mr. Ulsh where I thought this windbreak should have been located, and stated that the blue prints called for the erection on that very spot and that he did not know until too late that the contractor had not followed the specifications. Although the quarters are adequate as far as space is concerned, it is not as usable as it could be if it were more properly planned. The office for the OIC is of glass on two sides and the walls are only slightly above head-level, so that it is impossible to have confidential discussions between the OIC and members of the staff or when Regional Office representatives are visiting the station. Since the greatest need for a private office for the OIC is for such confidential conferences, it is recommended that in the future we approve only offices which are entirely private. The so-called executive type office is all right for a supervisor who has only to sit in his office and look out at the work going on in the main room, but our officials spend most of their time in the main work room and it is only when privacy is needed that they will be in the private office. I understand that the new building cost about one-half million dollars, and since the present mayor had nothing to do with authorizing this building he is going to be difficult to deal with when lease time comes; however, the most that we can be required to pay is a pro rata cost of furnishing services. As a rough estimate, I would say that the cost of maintenance will be about $1500 per month for water, heat, janitor service, etc. The three airlines are going to pay $300 per month each, which will leave a balance of $600 to be made up between the airport restaurant and the Government. The airport restaurant, considering the elaborate quarters they have, should pay about $1000 a month, but due to the small amount of customers which can be expected, I doubt whether they can pay $300 a month, which will leave $300 between the CAA and the Weather Bureau, and I make a rough estimate that

we will be requested to pay about one-third of this or $100 per month plus cost of electricity."

Appendix 2 - Methodology

The primary sources of information for this study were the Charleston observers' daily weather records themselves. Copies of these reports were available from the National Climatic Data Center's on-line system called WSSRD. These reports were considered the primary sources because they were written by the original observers and not altered by subsequent readers.

All these sources were gleaned to obtain a glimpse of the lives of the observers, the location of the observation site, and the historical environment that produced the climatic history of Charleston, South Carolina. Maps, drawings, and photographs were included when appropriate to illustrate the information.

The street maps were generated using Microsoft's Streets and Trips software. Elevations, latitude, and longitude were determined from the United States Geological Survey maps available on Topozone.com.

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