

HISTORY OF WEATHER OBSERVATIONS
Bowling Green, Kentucky
1849—1948

July 2005

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NOAA's National Climatic Data Center, Asheville, North Carolina.**

ACKNOWLEDGEMENTS

There are many people who contributed to this study of the weather observations in Bowling Green but none as important as the observers themselves. They were all volunteers who gave part of their life several times each day to record the weather. Their collective accumulation of data forms a valuable asset for climatological research.

The initiation of the College Heights Weather Station at Western Kentucky University was a momentous event. It has provided weather observation experience to scores of students and gave rise to the extensive meteorology and climatology coursework now offered in the Department of Geography and Geology.

Special recognition goes to those who preserved this long record of Bowling Green's climate. Primary among them were Willard Cockrill who preserved the observation equipment used in the College Heights Weather Station and Michael Trapasso who continued that tradition. They also preserved the observer's records that were produced by that equipment.

The descendants of Alonzo and Lillie Causey, who were observers in Bowling Green for forty-four years, provided photographs of them for this study. Special thanks are due to Robert Causey and Ken Causey who found and shared the photographs and the personal stories about them.

The staff at the Kentucky Library and the Kentucky Climate Center provided unflagging assistance in this project.

To you who are reading this, thanks for your interest in preserving the history of weather observations.

CONTENTS

Acknowledgements	ii
List of Illustrations	iv
Introduction	1
The Location	2
Goal of the Study	3
Location of Observations	4
1849—1853	6
1878—1901	7
1901—1943	8
1943—1944	9
1945— Present	10
Instrumentation	
Thermometer	11
Barometer	13
Rain Gauge	16
Shelter	18
Wind Instruments	19
Triple Register	20
The Observers	
The Smithsonian Years 1849—1853	23
The Signal Service Years 1878—1892	24
The Weather Bureau Years 1892—1948	26
The Observations	
The Army and Navy Departments' Years	39
The Smithsonian Years	40
The Signal Service Years	40
The Weather Bureau Years	42
The Digital Record	42
Other Bowling Green Area Observations	
Bowling Green State Police	44
Bowling Green Water Treatment Plant	44
College Heights Weather Station	44
Matlock	48
Smiths Grove	49

Appendices	
Appendix 1, Reichelderfer Letter	51
Appendix 2, College Heights Weather Instruments	52
Appendix 3, Matlock's History Form	55
Appendix 4, Methodology	56
Bibliography	57

ILLUSTRATIONS

Figures

1.	First Weather Observations from Bowling Green	1
2.	Map of Bowling Green Observer Sites	4
3.	Historic District of Bowling Green 1877	5
4.	Younglove's Drug Store 1870	6
5.	Younglove's Home	7
6.	Crump's Home in 1894 and 1984	7
7.	The Causey Home	8
8.	Tycos Maximum-Minimum Thermometer	12
9.	Thermograph	13
10.	Timby Barometer	14
11.	Green Barometer	14
12.	College Heights Weather Station Barometer	15
13.	Barograph	16
14.	Ombrometer	16
15.	Standard Rain Gage	17
16.	Standard Shelter	18
17.	Anemometer	19
18.	Triple Register	20
19.	Total Mile Run Dial	21
20.	Sunshine Recorder	21
21.	John E. Younglove	23
22.	Ogden College 1894	25
23.	Col Malcolm H. Crump	26
24.	Mary Underwood Crump	28
25.	Alonzo M. Causey	30
26.	Weather and Forecast Flags	31
27.	Lillie and Lon Causey 1908	33
28.	Lillie Causey	34
29.	College Heights Weather Station History Form 530-1	36
30.	Dr. Judson R. Griffin	36
31.	Willis O. Whitt	37
32.	Bowling Green Airport Station History Form 530-1	38
33.	College Heights Weather Station	44
34.	Earliest Extant College Heights Weather Record in 1932	45
35.	Current and Former College Heights Observations Sites	46
36.	Willard Cockrill	47
37.	Dr. L. Michael Trapasso	48
38.	Smiths Grove Station History Form 530-1	49
39.	Smiths Grove Airport in 1944	50

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Kentucky State Climatologist Emeritus

It may seem peculiar that Bowling Green's first weather observations (Figure 1) were recorded on a form printed by the Navy Department in Washington, D.C.

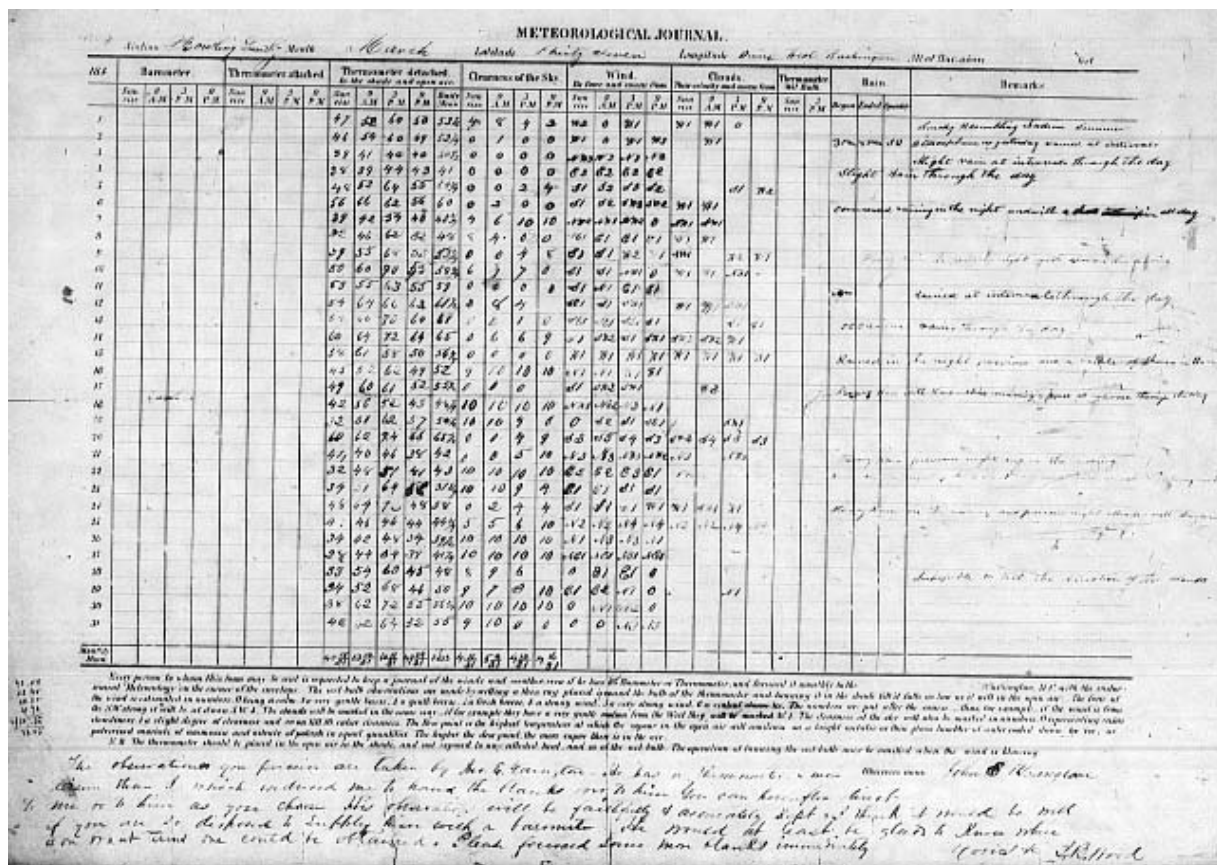


Figure 1. First Weather Observations from Bowling Green, March 1849
Source: National Climatic Data Center

Even more peculiar, the form wasn't sent to the Navy Department. Note that there is a blank space near the end of the first line of printed instructions at the bottom of the form. The words "Navy Department" were excised from those instructions. The form was sent to the Smithsonian Institution instead of the Navy Department¹.

Also peculiar is that the Smithsonian apparently was not expecting to receive it. At the bottom of that first form, there was an introduction of the observer, John E. Younglove, written by a Mr. L. B. Wood², who was making the introduction. The introduction written at the bottom reads:

The observations you perceive are taken by Mr. Jno. E. Younglove. He has a thermometer & more time than I which induced me to hand the blanks over to him. You can hereafter write to me or him as you choose. His observations will be faithfully & accurately kept. I think it would be nice if you are so disposed to supply him with a barometer. He would at least be glad to know where & on what terms one could be obtained. Please forward some more blanks immediately.

The Smithsonian Institution must have welcomed this submission. Their archives record that they sent a Green's Thermometer with cast iron brackets to Younglove in 1851.

Bowling Green's participation in our Nation's climate network began with an unsolicited volunteer observer forwarding observations that he had recorded on a borrowed form sent to an organization he had not previously contacted. From that beginning, participation continued in the Smithsonian Institution's national climate network. We now look back over the past one hundred fifty-six years of observational history to that beginning.

The Location

The early settlement in south-central Kentucky benefited from the river traffic from the Ohio, Green, and Barren Rivers to Bowling Green. Subsequent construction of the Louisville and Nashville Railroad through the City accelerated its development as a transportation hub. Among the residents were some who held a strong interest in weather and climate.

The Observers

The early observers were conscientious, reliable, and well educated people. They had an interest in and a curiosity about the weather that did not waver over years of observation.

¹ A 10 July 1899 letter from Williams, Chief of the Weather Bureau, confirms that the Smithsonian received that first report.

² There was an attorney in Bowling Green by that name

Because of those attributes, the climate record that they produced was useful both to them then and to us now.

Their Instrumentation. The first observer used his own instruments to measure the weather elements. All the observers who followed sought to upgrade their measurement capability and, in some cases, the network provided instruments for that purpose. Little detail is known about the exposure of the instruments in the earliest years. Nevertheless, the observers were well aware of the need for proper exposure to assure the most accurate results and one expects that they would have made a good site selection.

Their Locations. The early locations of the observations were either downtown or on the “hill” on which Western Kentucky University is situated. All were within about a mile of each other. The move to the airport in 1944 was a move of about two and half miles from both downtown and the hill. That made a significant difference in environment and had an impact on the climate record that followed.

Their Climate Record. The importance of the climate observations was evidenced by the early publication of the data. There was a section in the 1894 publication of Picturesque Bowling Green, Warren County, Kentucky titled, “Why Home Seekers Should Come to Warren County.” Twelve reasons were given. The first two on the list were about climate and were made possible because of the extensive climate record that had accumulated by then.

1. Because of splendid climate. Average annual temperature 56 degrees. Winter, 29. Spring, 58. Summer, 75. Autumn, 56
2. Because of its generous rainfall. Annual amount, 47 inches. Winter, 12. Spring, 13. Summer, 12. Autumn, 10.

Goal of the Study

The goal of this study was to document the primary weather observational history of Bowling Green that recorded such an important block of knowledge of early Kentucky climate. The climatic data and information from the observations made there are readily available for the entire period of record. They may be accessed through the National Climatic Data Center at Asheville, North Carolina; the Midwestern Regional Climate Center at Champaign, Illinois; and the Kentucky Climate Center at Western Kentucky University in Bowling Green, Kentucky. The State Climatologist for Kentucky at the latter can provide advise on the acquisition of or access to them. The challenge of this study was to identify Bowling Green’s role in the development of a federal weather observational program and where it fit in the route that followed from the Army and Navy surgeons, through the Smithsonian Institution Observers, the Signal Service Observer Sergeants, the Weather Bureau meteorologists, to the National Weather Service observational network of today.

LOCATION OF OBSERVATIONS

Bowling Green, Kentucky was established on the Barren River in 1798 with the construction of a courthouse and a jail. The first building lot was sold the following year. The current map of the downtown area of the City with the locations of the observation sites is shown in Figure 2.

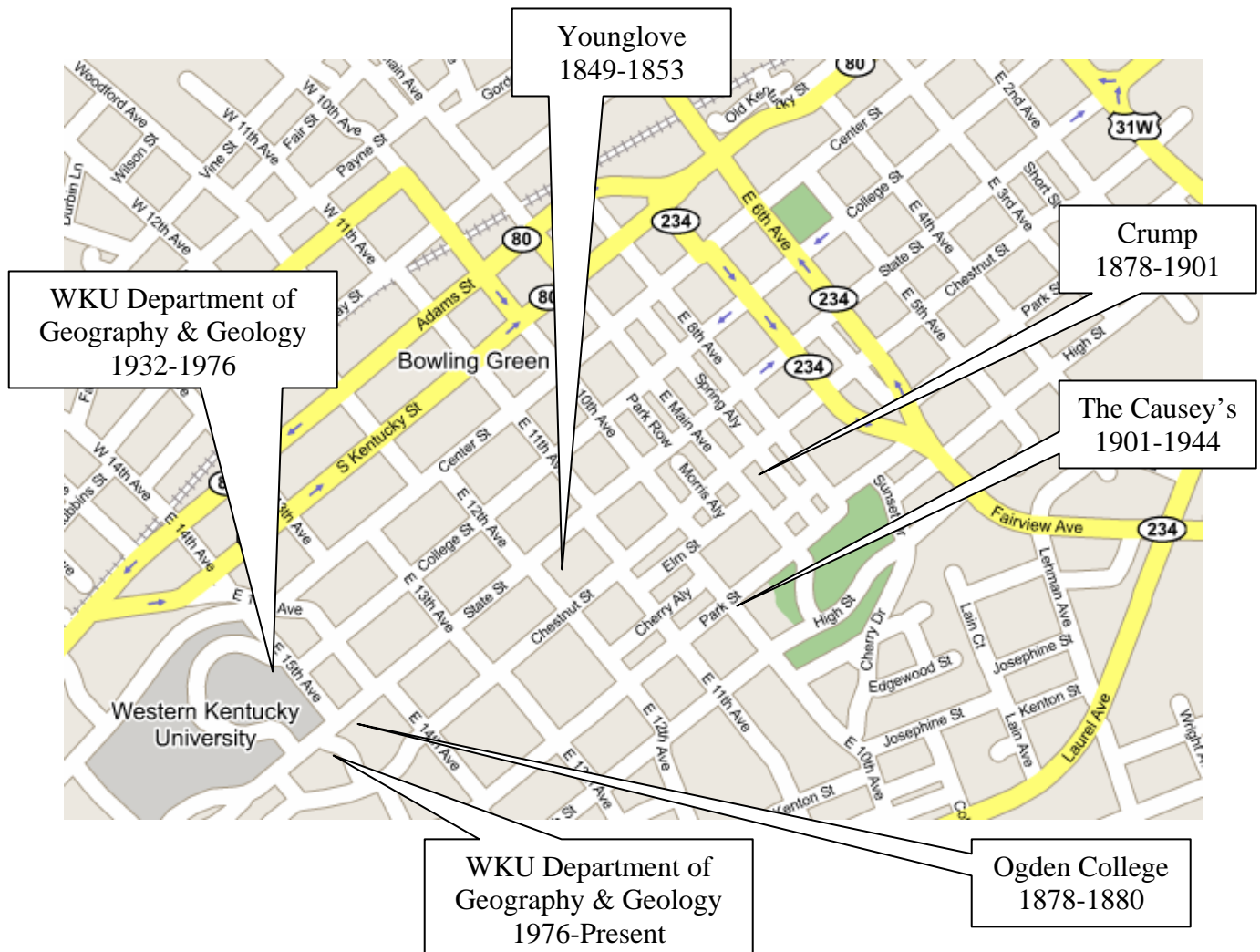


Figure 2. Bowling Green, Kentucky
Source: Author using a Google Base Map

Some of the earliest observations sites shown above used the old street addresses. Figure 3 is one of the old maps of the downtown area. It uses the old street names. All the street names used in this study are the current names.

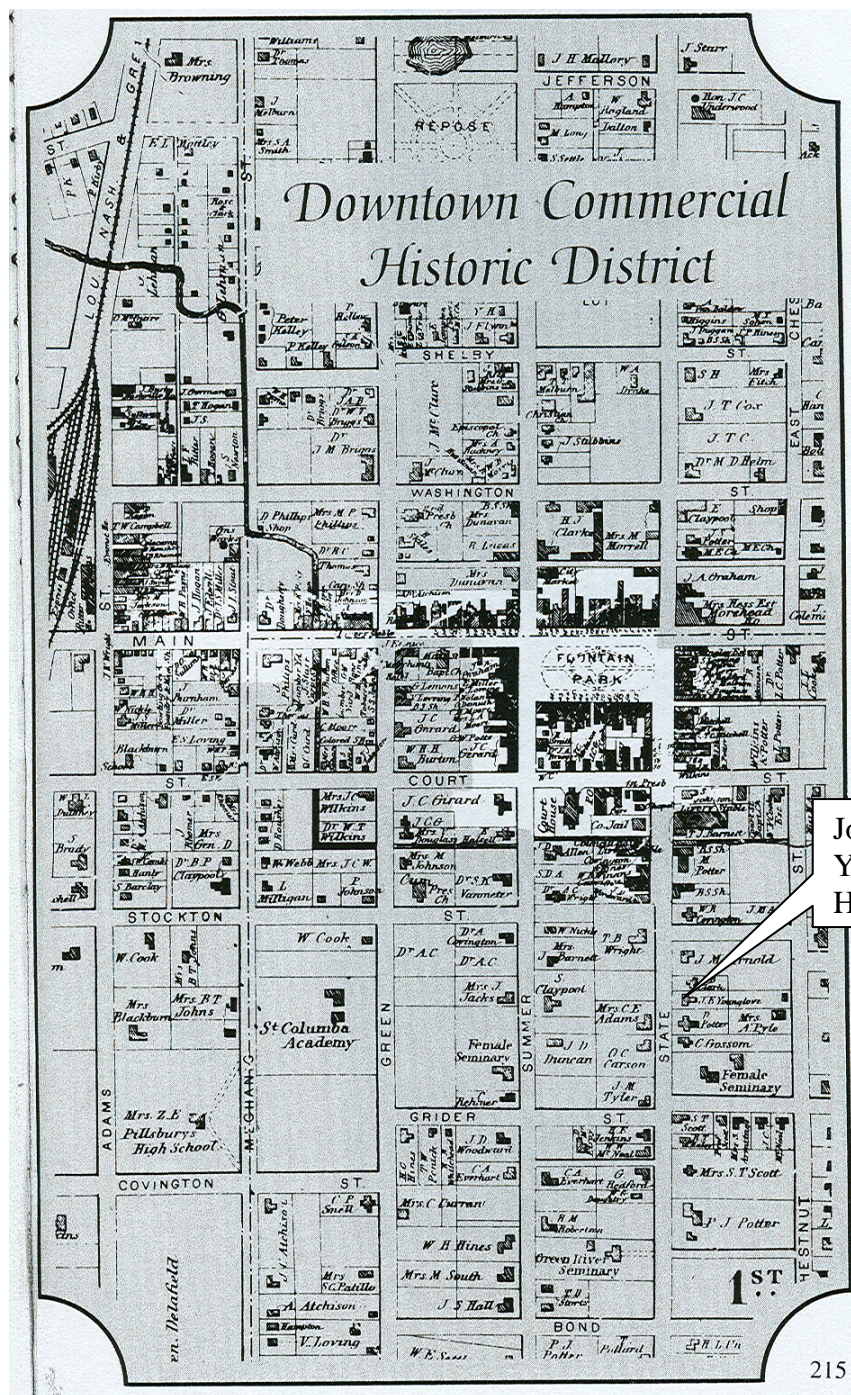


Figure 3. Historic District, 1877
Source: Kentucky Library, Western Kentucky University

1849—1853

John E. Younglove's Drug Store (Figure 4) was located at the corner of Main and State Streets on the square in Bowling Green. As a corner building with other buildings contiguous with it, it seems an unlikely location for his weather observations.



Figure 4. Younglove's Drug Store, 1870

Source: Kentucky Library, Western Kentucky University

On the inside cover of Mr. Younglove's Meteorological Record, he wrote the location as 37° N and $86^{\circ} 22' 46''$ W. He added the longitude as $9^{\circ} 19' 58''$ W from Washington³. The altitude by his accounting was 500 feet MSL.

It seems certain that Younglove's observations were taken at his home (Figure 5). The location of his home was stated in the 1886 City Directory as being on State Street between Walnut and Poplar Streets. The location was noted on the back of the photograph shown in Figure 4 as being next to 1110 State Street.

³ Measuring longitude from the Capitol in Washington rather than from Greenwich was in vogue during that period.



Figure 5. John E. Younglove's Home
Source: Kentucky Library, Western Kentucky University

1878—1901

There is a gap in the official record of about 25 years. The observations resumed in 1878 by Malcolm M. Crump who made them at his home (Figure 6).

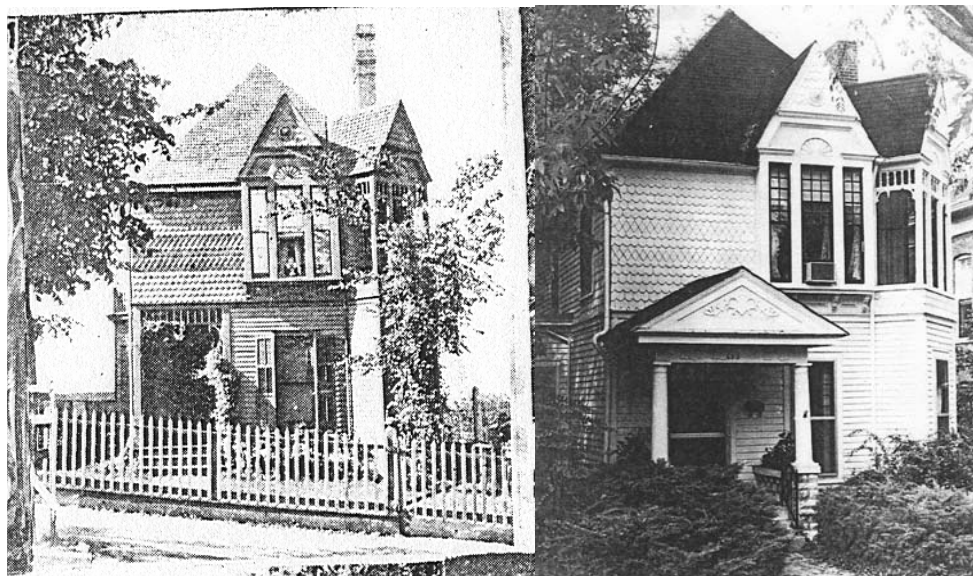


Figure 6. Malcolm H. Crump's Home, in 1894 on left, in 1984 on right
Source: Picturesque Bowling Green on left, Landmark Association on right

According to the Weather Bureau's Form 530, Col Crump's site was at 37° 00' N and 86° 27' W at an elevation of 500 feet. However, his first submission in March 1878 listed 37° N and 9° 30' W (of Washington) at an elevation of 799.47 feet above MSL and his address was at Ogden College where he taught. Those entries remained through May. Even though the precision of the entries gave the appearance of being accurate, that elevation was much too high regardless of where the observations were made in Bowling Green.

The June through August 1878 data are missing. Beginning in September and continuing until November 1880, the elevations were variously and inconsistently listed. They included values of 580 feet MSL, 600 nearly, 650, 670, 700, and between 600 and 700. It may be that this group of elevations was associated with the Ogden College location. If so, that would be about 600 feet MSL. Although Col Crump had a degree in Civil Engineering and taught surveying, it is clear that the elevations that he reported in this group were not reliable.

In September 1882, the elevations began to be reported with a different set of values that were reported variously at 498 or 500 feet MSL. It may be that this group was associated with his home. These values seem to be reliable.

He had similar inconsistencies in the longitude. He reported it as between 9° and 10° W in September 1878, as 86 1/2 ° in February 1879, and as between 85° and 86° in May 1880.

1901—1943

The observations taken between 1901 and 1943 were at the home of Alonzo and Lillie Causey at 702 Tenth Street. The shelter was located in the side yard as seen in Figure 7.



Figure 7. The Causey Home in 2005
Source: Author

The Western Union Telegraph and Cable Company that he managed was located at 433 Park Row but, so far as is known, no observations were taken there.

The observation location was 37° 00' N and 86° 27' W at 500 feet MSL, the same geographic grid that was listed for Col Crump, but not the same street address. The elevation seems to be correct.

1943—1944

The official observation site was moved to the campus of Western Kentucky State Teachers College in November 1943 where observations were being made in the Department of Geography and Geology.⁴ The observations were taken on the roof of Cherry Hall that is located near the top of a significant 656-foot hill, known locally as “The Hill.” The elevation of the observations on the roof was 687 feet MSL. The location was 36° 59' 15" N and 86° 27' 07" W.

On 27 October 1958, the Weather Bureau in a separate Form 530-1, assigned a distinct station index number 150914-2 to this station and called it Bowling Green College.⁵ The College Heights weather station, as it was and is called locally, would have been the proper name for it. The College Heights weather station began observation on 1 March 1932 and had an unbroken daily record from then to now.

There is a Transmittal Slip in the station file dated 21 July 1967 from ESSA WBSC/KY to the Director of the NWRC⁶ that questioned this site’s data because of the distance, elevation, and exposure changes that occurred from the move.

While working on a substation summary for Bowling Green, Kentucky, we discovered some rooftop data that could not be used (11/1/43-12/7/44, see attached, amended copy of WB Form 530-1).

We believe that these data should not be used in the computation of record means for the Bulletin W 1961-1970.

It must be noted that the Signal Service, from 1871 to about 1892, chose rooftops as the preferred location for their observation sites. Indeed, the higher the building the better. Those sites were inherited by the Weather Bureau and were still being used at the time the comments above were made. The College Heights site was neither unique nor uncommon. Nevertheless, the College Heights observations have been made on the rooftops since 1932 and comprise a useful dataset in its own right.

⁴ It has since been renamed Western Kentucky University

⁵ There was not a college by that name, the Weather Bureau in Louisville made a mistake in naming the station.

⁶ ESSA was a predecessor of NOAA, the WBSC was the Weather Bureau State Climatologist, and the NWRC was the National Weather Records Center—a predecessor of the National Climatic Data Center

1945—Present

In January 1945, the Weather Bureau moved their official station to 36° 48' N and 86° 21' W with an elevation of 536 feet, the new site for observations at the airport in Bowling Green. The name of the official station changed from “Bowling Green College” to “WBO⁷, Bowling Green.” The observations have continued there to the date of this study.

⁷ Weather Bureau Office

INSTRUMENTATION

Thermometer

In the January 1876 page of John E. Younglove's Meteorological Record is this note about his thermometer.

The thermometer that I have used for these observations from 1870 to the present time Feb 16th 1876 is an ordinary 12 inch mercury thermometer. Have compared it with a U.S. Signal Service thermometer of Col M. H. Crump when they were above 90 when mine was one degree the highest and when several points between freezing and 20 degrees below zero mine was from one to two degrees lower. On Feb 5th 1886, mine was 21 below zero and U.S. Signal service was 20 degrees below zero. John E. Younglove

The Green's thermometer that the Smithsonian Institution had provided him in 1851 had apparently been replaced.

Col. Crump was the first observer from Bowling Green to submit observations to the Signal Service. He did so in March 1878. He was very interested in the instruments and made several comments about them and their makers. Waltz's Climatological Report of June 1907 reported that the station had been equipped with Weather Bureau standard maximum and minimum thermometers and rain gage after July 1896. The thermometers were in a standard shelter four feet above ground level and had a good exposure over sod twenty-five feet from the nearest high object. In the March 1878 report, the thermometer used by Col Crump was identified as a "Towes." In April 1880, a Green thermometer #4359 was placed into use.

A Rutherford maximum thermometer and a Green minimum thermometer were first used by Col Crump in July 1883. The Rutherford was one of the first maximum-minimum thermometers and was invented by Daniel Rutherford many years before⁸. In April 1889, Col Crump's maximum thermometer was reported as broken. However, there was no break in reporting maximum temperature. Perhaps he had a spare.

Instructions for reporting temperature at Bowling Green were included in the 5 December 1900 letter from W. B. Hersey to Col Crump.

Replying to your favor of the 4th, I wish to say that we do not want any temperature recorded except the maximum and minimum. As the instruments are self-registering, it is only necessary to read them once each day and the best time is after 4 p.m.

⁸ The maximum-minimum thermometer invented by James Six was in use in 1780 several years before Rutherford's

The maximum thermometer #9181 was reported by Hersey on 15 September 1903 as having been broken. It was replaced by # 9214. In October 1923, the maximum thermometer # 20075 was replaced by #24665 and the minimum thermometer # 13561 was replaced by #15407.

In an inspection report of 29 July 1936, the Changes in Equipment were indicated but without the dates of replacement.

Maximum	Minimum	Thermometer Support
17488	16802	5401
27950	17210	3817
		17283
		15543
		16763
		16048
		18265

On 10 October 1940, the minimum thermometer was replaced with #24816. In 1941, the thermometers agreed within 0.5° during an inspection.

From 1 January 1943 through 7 December 1944, the College Heights Weather Station at Western Kentucky University used the maximum and minimum thermometer shown in Figure 8.

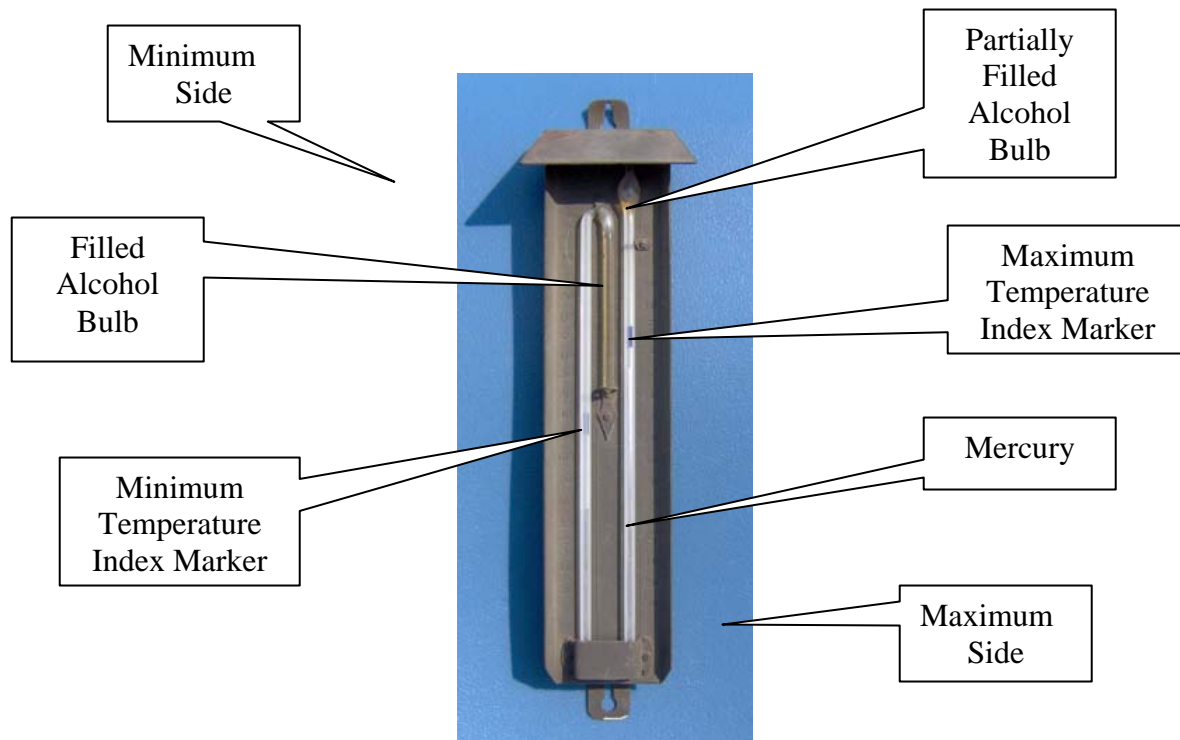


Figure 8. Tycos Maximum-Minimum Thermometer, Used from 1930 to 1965
Source: Author

It was one that followed the design of James Six's invention in 1782. It had two bulbs, one filled with alcohol and one partially filled with alcohol. Mercury filled the space in the U-shaped portion not occupied by alcohol in the U-shaped portion of the glass tube. As the temperature rose, the alcohol stored in the filled bulb expanded and forced the mercury away from the bulb, pushing the metal index with it. When the temperature fell, the alcohol contracted and the mercury forced the index toward the bulb but left the index in place at the highest temperature point on the right side (maximum side). When the temperature rose again, the index marker on the left side (minimum side) was left in place at the lowest temperature point when the mercury moved away from the bulb.

During the 1943—1944 period, a thermograph (Figure 9) was used. It was made by Taylor and was in use from 1930 through 1965.



Figure 9. Thermograph Used by College Heights Weather Station 1930 –1965
Source: Author

Barometer

Col Crump reported in March 1878 that the maker of his barometer was “Timby” although he later called it “Timby’s Patent.” The Timby (Figure 10) was a stick barometer made in the 1860s in Worchester, Massachusetts and patented on 3 November 1857.



Figure 10. Timby Barometer, circa 1860

Source: <http://www.barometershop.net/images/b26.jpg> (last visited 3 June 2005)

Col Crump wished for a barometer like that in Figure 11.

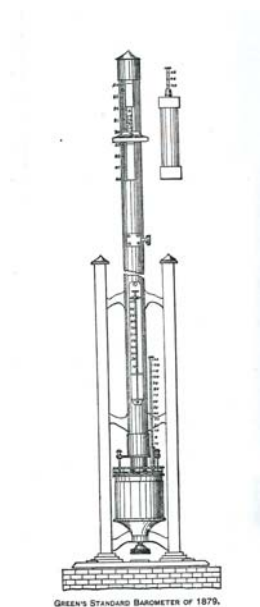


Figure 11. Green Standard Barometer in 1879

Source: National Archives and Records Administration, College Park MD

He wrote about that wish.

I have made an effort to get Green's Barometer from State Geological Survey—haven't succeeded as yet, hope soon to.

He was successful and, in September 1879, he listed his barometer as a Green #1397. But the success didn't prove to be such. In May 1880, the barometer was not recorded because he commented that he had "but little faith in instrument."

He first reported the elevation of the barometer to be at 799.47 feet above mean sea level (MSL). That elevation, like the previously discussed site elevation, was a gross error. The instrument elevations listings of 500 feet in September remained at that about level until the end of the Crump period in 1900.

During the 1943 to 1944 period, a mercury barometer (Figure 12) was used. That barometer originally acquired from the U.S. Army is still used by the College Heights Weather Station.



Figure 12. Mercury Barometer, College Heights Weather Station, 1943 to Present
Source: Author

In addition, there was a barograph (Figure 13) made by Entral Scientific of Chicago that had been in use beginning in 1925.

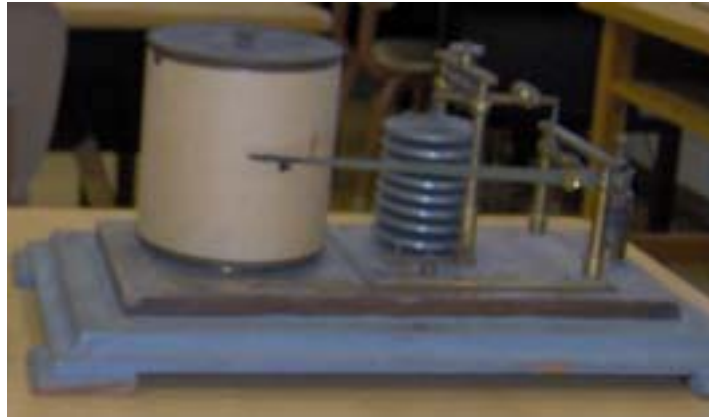


Figure 13. Entral Scientific Barograph, used by College Heights Weather Station, 1925-1965
Source: Author

Rain Gauge

There was no rain gauge in the first report to the Signal Service in March 1878. In November, Col. Crump had a suggestion to the Chief Signal Officer of the Army to remedy that situation.

Should like much to have Rain Gauge. Could you not let me have an old one to be returned whenever observations cease to be taken.

In March 1880, he recorded rainfall using a “Signal Service” rain gauge mounted at zero feet above the ground. It may have been like the one shown in Figure 13.

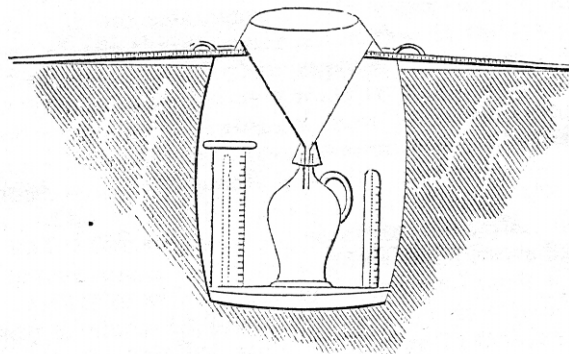


Figure 14. Ombrometer Recommended by the Smithsonian Institution
Source: Smithsonian Tenth Annual Report, 1856

The Substation History Form 530-1 dated 8 January 1954, indicated that there was a rain gage between 1 March 1880 and 30 November 1900. A Hersey letter of 15 November 1899 discusses the rain gages used by Col Crump. Questions arose about gages #2386 and #320. It was stated that #320 had been declared unserviceable ten years before. That would have been in 1889. There was a question about whether the funnel shaped receiver and the overflow container were the same size. The inference was that Col Crump may have been using the a rain gage like that in Figure 14 instead of the Weather Bureau cylindrical above ground gage.

Instructions for reporting precipitation information at Bowling Green were included in a 5 December 1900 letter from W. B. Hersey to Col Crump.

The time of beginning and ending of rain or snow should be recorded as near as possible in the proper columns.

In 1906, the rain gage was 50 feet from the nearest object. In 1923, the rain gage #1900 was replaced by #7670 and was reported to have good exposure. In 1938, the 8-inch rain gage was located 30 feet from the nearest building. It was moved on 10 October 1940 because of a growing young tree.

During the period 1 January 1943 through 7 December 1944, a standard rain gage was used. The rain gage used at the College Heights Weather Station from 1928 through 1965 is shown in Figure 15 . It was located twenty feet from the nearest object on the roof.



Figure 15. Standard 8 Inch Rain Gage, College Heights Weather Station, used 1928 to 1965
Source: Author

The Western Kentucky State Teachers College site also had a tipping bucket rain gage. In December 1944 and thereafter, the precipitation amount was totaled at 7 a.m. for the previous twenty-four hours.

Shelter

A standard shelter provided by the Weather Bureau was used after 1 March 1880 until 1943. On 10 March 1906, the shelter was facing north, standing four feet over sod and was 20 feet from any object. In October 1938, a new shelter was ordered. In 1940, the shelter was reported as being practically new. It faced north and the bottom was four feet above ground. In 1943, the shelter was located in a yard with the bottom of the shelter being four feet above ground.

During the period 1 January 1943 through 7 December 1944, a cotton region shelter mounted on the roof of Cherry Hall was used to house instruments. The cotton region shelter with instruments and the anemometer on top of the Environmental Science and Technology Building are shown in Figure 16. That same type shelter continued in use after the station moved to the airport.

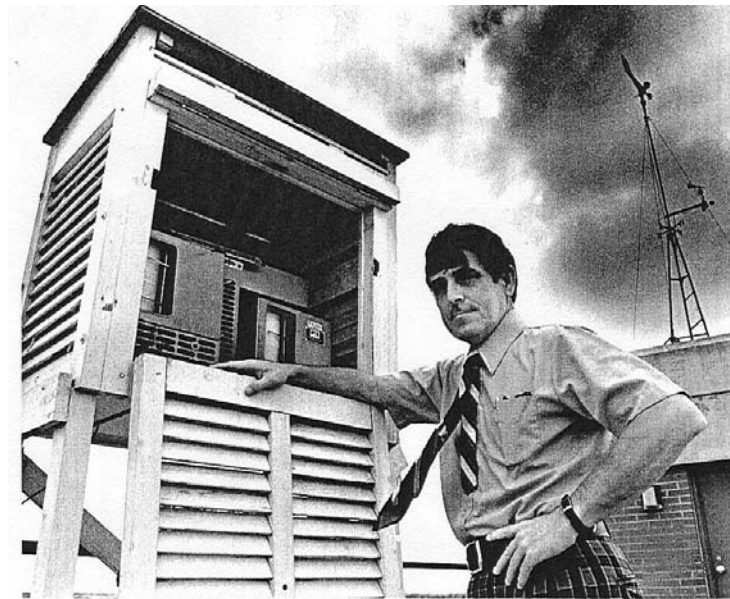


Figure 16. Shelter with Weather Instruments and Glen Conner
Source: The Talisman, 1979

Wind Instruments

A note on the record in September 1853 said that he had noted the wind direction by use of a weathercock.

Instructions for reporting wind information at Bowling Green were included in the 5 December 1900 letter from W. B. Hersey to Col Crump.

In regard to the direction of the wind you should simply use your own judgment as to the prevailing direction for the day but the direction should be noted on form 1009 only once and that the prevailing direction for the day,

The anemometer tower can be seen in the upper right of the photograph in Figure 16 mounted on the roof of the Environmental Science and Technology Building. The earliest one used at the College Heights Weather Station (Figure 17) was used during the time that the station was the official Weather Bureau Station.



Figure 17. Anemometer Used at the College Heights Weather Station with Miles Run Dial
Source: Author

Triple Register

One of the primary instruments of the Weather Bureau was the Triple Register (Figure 18).

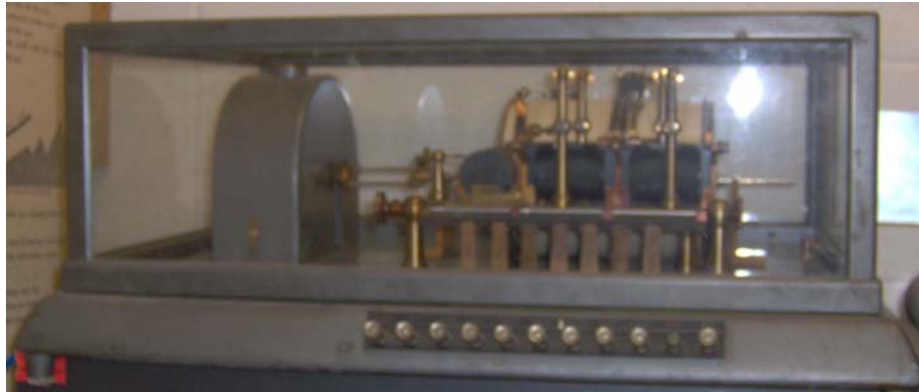


Figure 18. Triple Register, College Heights Weather Station Museum
Source: Author

The Triple Register was an electrical device that recorded the direction and velocity of the wind each minute, the amount of rainfall as it fell, and the accumulated hours and minutes of sunshine. The information was recorded by pens on graph paper wrapped around a drum that rotated once per week. The working parts of the Triple Register were made of brass and the unit was covered by a glass case to protect the device from dust. It was quite an impressive part of the meteorologist's equipment.

Wind was measured in two ways. A wind vane that was mounted on the roof determined the wind direction. It swiveled toward the direction from which the wind came. It can be seen in Figures 16. Also mounted on the roof were the anemometer cups (Figure 17). The wind rotated those cups that in turn rotated the shaft to which they were attached. Each time the shaft rotated 500 times, one mile was added to the "total miles run." That total was displayed on a dial (Figure 19). That is to say, the dial displayed the total number of miles of air that had passed since the anemometer dial was reset. Both the wind direction and the wind speed were electrically connected to the triple register where they were registered on the Triple Register's graph. The difference between the miles run dial and its earlier reading could be divided by the elapsed hours to determine the average wind speed for the period.



Figure 19. Total Miles Run Dial
Source: Author

A tipping bucket rain gage was mounted on the roof. A funnel directed rainfall into a small “bucket” on one end of a seesaw like device. The seesaw tipped when the bucket filled with one hundredths of an inch of rain. The tipping emptied that bucket and placed the bucket at the other end of the seesaw under the funnel to be filled next. Each time the buckets tipped, an electrical signal marked another 0.01” of rain on the triple register.

The triple register also recorded sunshine. The sensor was a glass tube with a large bulb at either end (Figure 20). It was normally located on the roof. One end was clear, the other coated with lampblack. The tube was partially filled with mercury. In the middle of the tube were two wires. When exposed to sunshine, the lampblack would absorb solar radiation causing the mercury to expand and cover the ends of the two wires. The electrical circuit between the two wires would be completed. That connection would be recorded on the triple register until cooling (as the sunshine ended) caused the mercury to contract and uncover the two wire ends thus breaking the connection.



Figure 20. Sunshine Recorder, College Heights Weather Station Museum
Source: Author

See Appendix 2 for additional photographs of instruments from the College Heights Weather Station.

The move to the airport retained the same types of equipment as had been used at the College Heights site. There were thermometers, maximum and minimum thermometers (first installed about July 1938), a Cotton Region shelter, a Standard 8 inch rain gage, a barometer (first installed there on 7 December 1936), psychrometer, and an anemometer mounted at a height of 78 feet above ground level.

THE OBSERVERS

The Smithsonian Years 1849—1853

John E. Younglove

John E. Younglove (Figure 21) began observations in March 1849 in Bowling Green. His are the earliest known observations from the area.

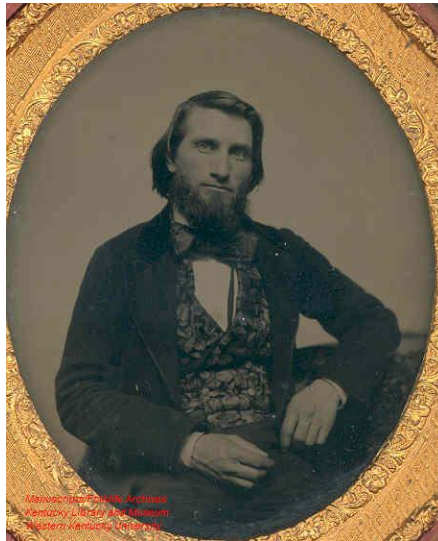


Figure 21. John E. Younglove

Source: Younglove Collection, Western Kentucky University, Kentucky Library

He was born in Johnstown, New York on 14 September 1826. He came to Bowling Green in 1836. He was a druggist and, according to Rodes, he had the Post Office and the Stage Coach Offices in his store for twenty years.

He was a successful businessman even though the Civil War brought considerable losses to his business. Both Union and Confederate armies occupied Bowling Green at one time or another. Gildersleeve states that Younglove was a Union sympathizer. However, both armies appropriated drugs and other items from his apothecary without payment. They caused other damage as well according to Baird. A group of Union soldiers tried to fill their canteens with what they thought was syrup. When they discovered that it was varnish, they vented their disappointment by emptying the barrel onto his floor. After the war, his business continued to grow. The 1870 census valued his real estate holdings at \$16,000 and his personal estate at \$9,000.

The 1886 City Directory of Bowling Green listed his home as being on State Street between Walnut and Poplar Streets where he lived with his wife Esther Virginia (Jennie). She was the daughter of Andrew Ray, the Governor of Indiana. The 1900 and 1910 censuses listed him as widowed and living at 900 State Street with a servant.

John E. Younglove had many interests. In 1889, he sent a water sample from the 175 foot well on the Public Square in Bowling Green to the Kentucky Geological Survey. The weakly saline and chalybeate water was judged safe. He was also a collector of Indian artifacts. One letter in the Younglove collection at the Kentucky Library at Western Kentucky University offered arrowheads for sale at \$5.00 per 100 from a collection of over 1,700 arrowheads that he had accumulated over a thirty-year period.

He was Chairman of “Relief of the Sufferers Occasioned by the Hurricane in the Vicinity of Cave City,” a humanitarian effort that provided money for the victims of a violent storm. That storm occurred about 4 a.m. on 17 January 1870 and caused great damage. The term hurricane referred only to the force of the wind, not to the origin of the wind. During those years, the wind force was estimated subjectively from a Smithsonian scale using words as force descriptors; very light breeze, gentle breeze, fresh breeze, strong wind, high wind, gale, strong gale, violent gale, hurricane, and most violent hurricane. The Smithsonian Institution provided a list of speeds in miles per hour that were associated with each force descriptor. The wind force for the descriptor “Hurricane” was between 80 and 99 mph.

Younglove was a historian too. There is a 26 page manuscript of his narrative descriptions of weather and other natural events in Bowling Green from 1808 to 1909. The early accounts were from the memory of other citizens.

Younglove turned over the reporting of observations to F. C. Herrick. The reason that change is not known.

F. C. Herrick

In August 1852, the observation form was signed by F. C. Herrick, “for J. E. Younglove.” The 1860 census lists F.C. Herrick as a 34 year old clerk who was born in New York as was Younglove. Perhaps he was a clerk in Younglove’s drugstore.

The last extant report by Herrick was in October 1853. The entire month was complete with no indication of any expected change in status.

The Signal Service Years 1878—1892

The Signal Service’s approach to weather observations was focused on providing that information to the public. To accomplish that objective, they were very proactive. They began preparing and distributing forecasts less than a year after their establishment in 1871. They extended that service beyond the Signal Service in each state by enlisting individuals to assist in their distribution. Part of that augmentation came in the form of Voluntary Observers. The first

Substation History Form 530-1 was prepared for Bowling Green by the State Climatologist for Kentucky in 1954. The significance of the Signal Service beginnings is evident in the omission of the previous observers except as afterthoughts in the additional remarks made at the bottom of the form. Col Crump was the first Signal Service observer and therefore received first mention.

Col Malcolm H. Crump, 1878—1898

Col Malcolm Hart Crump was the first Volunteer Observer in Bowling Green for the Signal Service. The 1900 census listed him as 49 years old born in October 1850 in Culpepper County, Virginia. He was then living at 633 Main Street in Bowling Green.

He graduated from the Virginia Military Institute with a degree in science and engineering, came to Hopkinsville, Kentucky in 1875, and taught in a military school there. He relocated to Bowling Green in 1877 to become Chair of Science at Ogden College (Figure 22).

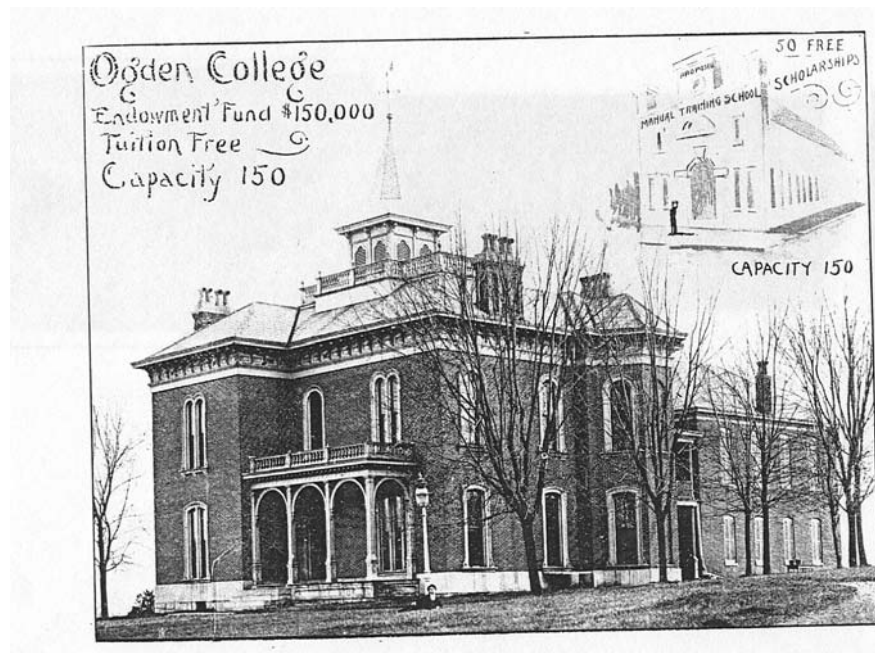


Figure 22. Ogden College, 1894
Source: Picturesque Bowling Green

Col Crump taught there until about 1905. The current Dean of Ogden College of Science and Engineering at Western Kentucky University can trace his heritage back to him. One must believe that heritage influenced the creation of the College Heights Weather Station that has operated for 73 years within Ogden College.

At some point, Col Crump owned about 3,000 acres of land in Edmonson County that was the Kentucky Rock Asphalt Company's asphalt mine. He was known as "one of the South's best

posted geologists” according to his obituary. The 1886 City Directory listed his occupation as a Geologist working from his home.

According to a Chamber of Commerce publication, he presented a geological essay to the XV Club⁹ of Bowling Green on 21 May 1904. He stated that the “first land to poke its nose above the great seas was about Lexington Ky. and Nashville, Tenn., and those lands were islands, our own county and adjacent being many hundreds of feet under the sea.” That was an interesting way of describing the Lexington and Nashville geologic domes.

The 1910 census listed his profession as Civil Engineer. Road building was a logical extension of the asphalt business and he had been trained for that at VMI. In addition, he had taught a School of Engineering Course at Ogden College in 1881 that included surveying, construction of roads, canals, and tunnels.

Governor S. B. Buckner of Kentucky appointed him as Inspector General of the Army on his staff. The appointment was made on 23 June 1888 and gave him the rank of Colonel. Thereafter, he was always known as Col Crump (Figure 23).



Figure 23. Colonel Malcom Hart Crump
Source: Picturesque Bowling Green, 1894

The Weather Bureau Years 1892—1943

When the Weather Bureau replaced the Signal Service, Col Crump continued to report. The Local Forecast Official from Louisville gave Col. Crump an additional task on 16 January 1896 when he wrote to Professor Willis L. Moore, Chief of Weather Bureau.

⁹ He was a charter member of the XV Club when it formed in 1879

I have the honor to report that owing to the inability of Mr. C. A. Matlock, displayman at Matlock, Ky., to attend to the work of distributing forecasts by mail from his station, the centre has been changed from that place to Bowling Green, Ky., where the work will be in the charge of Col M. H. Crump, the present voluntary observer there. It is thought that this change will be very beneficial, as Bowling Green is a much larger place than Matlock and possesses better mail facilities. Post Offices formerly supplied with forecasts from the old centre will in future receive them from the new one, and it is expected that many additional place will be added to the list. Matlock¹⁰ will hereafter receive the information by mail and the telegrams will be transferred to Bowling Green.

Col Crump had previously received an explanation of the displayman's responsibilities in a 19 December 1895 letter send to him by the Weather Bureau in Louisville.

The plan is simply to distribute by mail to such post offices as can be reached upon the same day the forecast which will be telegraphed from this office. The displayman will be supplied with addressed cards bearing the government frank, and also with logotypes and pad for use in printing the forecasts. By this means, a very large number of cards can be stamped in a few moments. Each postmaster to whom the information is sent, is supplied with a bulletin board to which the cards are attached. If a business firm acts as distributing agent, it is permissible for it to sign the cards in its official capacity a displayman. But the character of the business cannot be stated. This method of distributing weather information met with gratifying success in this and other states and many thousands of post offices are receiving it in the manner described. If you succeed in interesting someone there, I will take steps to have forecast telegrams transferred to him and the logotype outfit now at Matlock sent there.

Mary Underwood Crump 1898—1899

Mary Underwood Crump was the wife of Col. Crump. According to the 16 August 1898 letter from the Louisville Local Forecast Official George E. Hunt, her appointment began on 1 April 1898. He stated that she was a native of Kentucky and that she would be the Corn and Wheat Region Observer at Bowling Green during her husband's absence while he served in the Army during the Spanish-American War. Col Crump was a Staff Officer in the Third Kentucky Infantry Regiment during the expedition to Cuba.

¹⁰ Matlock still exists as a place name about six miles south of Bowling Green. It got its name from C. A. Matlock who was a voluntary observer there in 1893. The Station History form for Matlock is in Appendix 3.

Mary Underwood Crump (Figure 24) continued to make the observations until her husband resumed the work as the observer after he returned from his military duties.



Figure 24. Mary Underwood Crump

Source: Western Kentucky University Photograph Collections, Kentucky Library

Col. Malcolm H. Crump, 1899—1900

Col Crump replaced his wife as the Corn and Wheat Region Observer in Bowling Green on 22 April 1899 according to a letter from H. B. Hersey, the Weather Bureau Local Forecast Official in Louisville.

Col Crump's service as an observer soon took an unexpected turn. On 7 November 1900, his October submission was returned by Hersey as being unacceptable.

Col M. K. Crump
Bowling Green, Ky

Dear Sir,

I enclose herewith copy of your monthly record for Oct. and want to bring to your attention to your failure to comply with the instructions in regard to the preparation of same and to its lack of legibility.

I have repeatedly requested you in the most courteous and proper way to prepare this form in accordance with the instructions furnished by this Bureau and these requests have as often been entirely ignored. I fail to see why you persist in doing the work in this way after it has been fully explained to you how it was desired.

The lack of legibility and the frequency of apparent errors on the work are also very discouraging and unless you can provide for the proper performance of this work, I shall be compelled to secure some one who is willing to take charge of the instruments and conform to our methods of keeping a record of the weather at your point.

It is with great that I am compelled to take a position in this matter but I see no alternative in view of the that (sic) repeated solicitation on my part appears to be of no avail to you. Kindly return the enclosed report to this office when you have noted the corrections thereon.

Very Truly Yours
H. B. Hersey
L. F. C. and Section Director

On 26 November 1900, Mr. Hersey notified Col. Crump that he would no longer be the Observer at Bowling Green.

Col. M. H. Crump
Bowling Green, Ky.

Dear Sir

As your time seems to be fully demanded to give the weather work the necessary attention at all times, I will have to request that you turn over the instruments and outfit to Mr. A. M. Causey who will take charge of the work for me in your city.

In this connection, I wish to thank you for your past service and to express to you my highest regard.

Any favors that you can show to Mr. Causey in the way of starting him in the work, will be surely appreciated.

I am, very truly yours,
H. B. Hersey
L.F.O. and Section Director

Alonzo Morehead Causey 1901—1903

The Signal Service had established the telegraph as the means for acquiring or disseminating weather data and forecasts about thirty years earlier. It was logical that, when the weather observer opening in Bowling Green occurred, the telegraph officer would be considered as the replacement. The 1905 City Directory listed the Western Union Telegraph and Cable Company office as being located at 433 Park Row in Bowling Green. Its manager was A. M. Causey (Figure 25).



Figure 25. Alonzo M. Causey

Source: Bowling Green Daily News, 7 November 1967

Alonzo M. Causey was a native of Warren County, born on 5 October 1870. He took a telegraphy course at the Bowling Green Business College. He graduated in 1894 and became an employee of the Postal Telegraph-Cable Company in Bowling Green. When the Spanish-American War began, he volunteered and, as he said, “commanded the high position as a Private” in the Third Kentucky Infantry. He landed at Matanzas, Cuba with his unit. He returned to his old job after the war but later transferred to manage the Western Union office, a position he held for fifty years.

The earliest record of Alonzo M. Causey’s involvement with weather was a responding letter he received on 9 May 1899 from H. B. Hersey who was the Forecast Official and Section Director of the Weather Bureau’s Climate and Crop Service of Kentucky. It acknowledged Causey’s offer to use his flagstaff for the display of weather forecast flags. The staff was 90 feet high and was located in “the prominent part of town” according to the Hersey letter that requested a set of weather flags for Col Crump, who was still the observer at that time.

The forecast flags were to be displayed prominently so that citizens could see what weather conditions were forecast for that location. The use of the flags began shortly after the Weather Bureau took over from the Signal Service. Two versions of the flags were used. One displayed the precipitation forecast, the other temperature.

Square flags (Figure 26) gave the precipitation forecasts; white for fair, blue for rain or snow, and half white—half blue for showers. A pennant gave the temperature forecast by its position on the staff; warmer if above the precipitation flag, colder if below, and no change if it wasn't displayed. A square white flag with a small black square in its center forecast a cold wave.¹¹

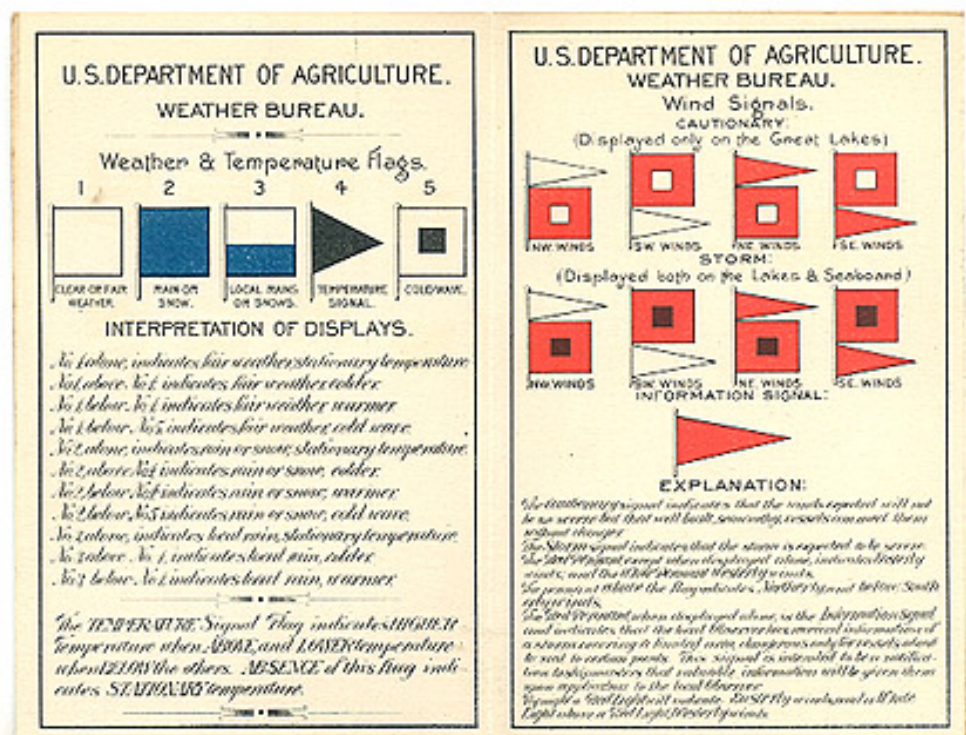


Figure 26. Weather and Temperature Forecast Flags
Source: World's Columbian Exposition Souvenir, 1893

In Hersey's 5 December 1900 letter to Causey, he referred to the display of flags that represented the day's forecast.

I am sorry to say that the Department does not furnish ropes for hoisting flags. According to their rules the forecast is only sent to

¹¹ Bowling Green did not display the wind signal flags shown in Figure that were displayed on the Great Lakes

places where the local interest is sufficient to provide for the display of flags and the Department to furnish only the flags. In some places the flags are displayed on public buildings on flag staffs furnished by the authorities, in other places prominent merchants sometimes furnish the flag staff so as to have them displayed over their buildings and in some towns the City Council made an appropriation of about \$200.00 for putting up a very fine flag staff and furnished the halyards for hoisting the flags. I hope that you may be able to make some arrangement so as to display the flags but do not think that you ought to provide the rope at your own expense.

One criticism of the forecast flags use was that, when the wind wasn't strong enough, people could not distinguish them. In 1904, J. Warren Smith, the Columbus, Ohio Section Director advocated their discontinuance because "The money spent on flags could be better spent in other means of distribution." Apparently that was the prevailing view within the Weather Bureau because the use of the flags eventually ceased.

One such alternative to the flags was suggested in a responding letter from Hersey to Causey on 21 April 1903. It confirmed that there was no allowance for payment of messengers to deliver forecasts. He suggested that he might benefit from providing this service even without pay.

I suppose that your messenger as he went out delivering messages could, without extra trouble, leave forecasts at a few centrally located places. I suppose four or five cards would cover Bowling Green very well.

It would be of considerable value to the people of Bowling Green and you would receive credit for the distribution. If you wish, you could have a rubber stamp to mark the cards, "Distributed by Western Union Telegraph Office" or "Distributed by A. M. Causey, Manager Western Union, which would be something of an advertisement for your office.

Whether Causey accepted this proposal is not known but it appears to have been an attractive offer.

Alonzo M. Causey recorded his first observations in 1 January 1901. The 1910 census lists Alonzo M. Causey as a 35 year-old telegraph officer. He was living at 702 Tenth Street with his wife Lillie G. who was then 29 years old, and sons Robert G. age 7 and Kenneth 6. His observations were from December 1901 until April 1903.

Alonzo M. Causey 1901-1903

Both Alonzo M. Causey (Lon), and his wife Lillie (Figure 27) were observers.



Figure 27. Lillie, Observer 1903—1944, and Lon Causey, Observer 1901—1903

Source: Photograph from 1908 Provided by Grandson Robert Causey

Lon Causey was frequent writer of letters. The Kentucky Library at Western Kentucky University has several of them. Among them was his 1966 letter to Charles de Gaulle, who then was the President of the French Republic. Causey protested De Gaulle's order for NATO troops to leave France, a change in the French attitude toward the United States that offended Causey. He received a response that had President de Gaulle's speech attached. He frequently wrote letters to the editors of the Bowling Green and Louisville newspapers. The subject of the letters to the editors of newspapers varied but most of them were expressed his opinion about topical, but not necessarily local, issues of the time.

On 16 September 1963, he wrote about the Spanish-American War, a war that he described as the longest (four years and two months) in United States history. He said that only three veterans of that war were still alive in Warren County and that he was one of them. He recorded his unit as Company B, 3rd Kentucky Volunteer Infantry. In 1970, he was elected President of the Kentucky Spanish-American War Veterans at age 99 years.

He was active in getting the historical marker that stands in front of the County Court House honoring both the Union and Confederate soldiers who received the Medals of Honor.

He was physically active as well, still playing tennis at age 75. He broke his hip from a fall while shoveling snow at age 95. On his 100th birthday, the Governor commissioned him as a Kentucky Colonel, the City declared a Lon Causey day, and he received a card from President Nixon.

He died at age 101 still calling 702 East 10th Street in Bowling Green his home, the home he had lived in for so many years.

Lillian G. Causey 1903—1944

Lillian Coombs Glenn Causey (Figure 28) was the wife of Alonzo M. Causey and replaced him as Bowling Green's weather observer in 1903.



Figure 28. Lillian Coombs Glenn Causey, Bowling Green Weather Observer 1903 to 1944
Source: Ken Causey, Her Great-grandson

She began this work when Hersey recommended on 20 March 1903 that she become a Corn and Wheat Observer. She appeared on his list of sixteen observers within Kentucky. It is interesting that there were five women among those sixteen: Lillie G. Causey of Bowling Green, Lida L.

Whyland of Eubank, Mary C. McKee of Mt. Sterling, Anna Lee Atkins of Williamsburg, and Laura May Carter of Williamstown. Hersey notified the Weather Bureau that she had been employed in that capacity in April 1903. That change in observer did not appear in the published data in *Climate and Crops: Kentucky Section* until October 1904. In that issue, she was listed as Mrs. L. G. Causey. The reason for that confusion was that she had submitted her first observations using the name “L. G. Causey.” For the next 41 years, she signed as Lillie G. Causey.

The United States entered World War II in December 1941. The value of weather observations to the enemy suddenly became apparent to all. The Chief of the Weather Bureau, F. W. Reichelderfer, in February 1942 directed the Cooperative Observers to limit publication of weather data as a means of assuring that that information would not fall into unfriendly hands (Appendix 1). Cooperative Observers were permitted to give out local temperature and precipitation data of all kinds over the telephone or in person to local inquiries. They were prohibited from providing information to anyone outside their hometowns except to the Weather Bureau or another government agency. In April, Lillie Causey received a letter from J. L. Kendall of the Weather Bureau in Louisville that confirmed the prohibitions.

Please don't send state of weather and wind direction in your daily telegram. We are strictly forbidden by the military authorities to telegraph or publish anything about wind or state of weather.

Lillie Causey continued to be Bowling Green's observer through January 1944. After more than forty-one years, her devoted and dedicated service ended. During the previous year, Bowling Green's direct involvement in the war increased when the Army moved one of their pilot training programs to the local airport. The weather observation responsibility was given to Western Kentucky State Teachers College.

Lillie Causey died on 26 October 1950 in Bowling Green.

Judson Roy Griffin. 1943—1944

The College Heights Weather Station within the Department of Geography and Geology at Western Kentucky State Teachers College replaced Lillie Causey. It had been recording the weather for over twelve years before it was given the responsibility of officially reporting Bowling Green's weather to the Weather Bureau. According to the Substation History Form 530-1 (Figure 29), the observer was Judson R. Griffin.

WB Form 530-1

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
SUBSTATION HISTORY

Office preparing form CO, Washington, D. C.

Station Bowling Green College County Warren State Kentucky Index No. 15-0914-2 Date prepared 10/27/58

(Current name)

Location	Latitude	Longitude	Sec. Twp. Rng.	Elevation m	Direction and distance from		Station known as	Description of exposure
					Post Office	Prev. Location		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1st	36 59	86 27		687	0.8 mi. WSW		Bowling Green #3	On roof of Cherry Hall, Teachers College.
2nd	37 00	86 26		505	0.5 mi. E	2.3 NNE	Bowling Green Water Works	Located at City Water Works.
3rd	36 59	86 27		556	0.8 mi. WSW	1.7 WSW	Bowling Green College	Rolling, on College Campus
4th								
5th								
6th								

(Con't)	Instruments used	Record			Observers and Dates	Remarks
		Original located	Where published	Dates 1st and last observations		
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1st	RRnG# SRG, Mx M	College	Unknown	1/1934-5/1/43	Judson R. Griffin	#Tipping Bucket.
2nd	RRnG	NWRC	HPD	5/22/53-3/22/56	City of Bowling Green	%
3rd	RRnG	NWRC	HPD CD	3/23/56-5/15/57	Western State Teachers College	
4th						
5th						
6th						

% For previous History of RRnG 5/11/45-5/21/53, see Form 500-1 for WBAS Bowling Green.

WB Form 530-1

Figure 29 . College Heights Weather Station Form 530-1
Source: National Climatic Data Center

Dr. Griffin was first mentioned in the 1932 Yearbook. The other faculty members in the Department of Geography and Geology were George E. Wood and Sarah Ella Jefferies. The 1934 Yearbook listed him as a PhD, the first within the Department. Dr. Griffin (Figure 30) was a Geologist who later became the Head of the Department.



Figure 30. Judson Roy Griffin, Department Head, Geography and Geology
Source: The Talisman, 1945

World War II had come to campus in March 1943 according to the recollections of Dr. L. K. Causey. The Army Air Corps opened a flight training school at the Bowling Green Airport to train single seat aircraft pilots. These aviation cadets also attended classes at Western Kentucky State Teachers College in geography, mathematics, physics, history, and English. Clearly, the College Heights Weather Station had an important role to play in that training.

The first extant observations that were sent to the Weather Bureau from the College Heights Weather Station were dated November 1943. The forms from November 1943 through June 1944 were signed by Oliver Whitt (Figure 31). Whitt was a student¹² at that time whose address as 410 15th Street.



Figure 31. Willis Oliver Whitt, College Heights Weather Observer 1943-1944
Source: The Talisman, 1945

From July through November 1944, the observation forms were signed by John E. Frank. He was a student during 1943 and 1944. In November 1943, his address was 1536 State Street.

To better support the flight training and to provide twenty-four hour weather observations, the Weather Bureau moved the official station from the College Heights Weather Station to the Bowling Green Airport effective on 8 December 1944.

Bowling Green CAA Airport 1944—Present

The Weather Bureau provided observers at the new location at the airport. The Weather Bureau Form 530 (Figure 32) shows their heritage as having passed from Lillie Causey, through Judson Griffin, to the Weather Bureau at the airport.

¹² Whitt received a B.S. degree in Industrial Arts in 1947

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU

SUBSTATION HISTORY

Office preparing form WBO, Louisville, Ky.

Station Bowling Green CAA AP County Tarren State Kentucky Index No. 1509092 Date prepared 1/8/54

Location	Latitude	Longitude	Sec. Twp. Rng.	Elevation msl	Direction and distance from Post Office	Station known as	Description of exposure
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1st	37° 00'	86° 27'		500	Unknown	Bowling Green	Located near residence.
2nd	37° 00'	86° 27'		500	"	"	Located at residence.
3rd	37° 00'	86° 27'		500	1.0 Mi. W P.O.	"	Located at Western Ky. State Teachers College
4th	36° 58'	86° 26'		534	2.6 Mi. SSE P.O.	Bowling Green WBAP	Located at Municipal Airport
5th	36° 58'	86° 26'		534	2.6 Mi. SSE P.O.	"	"
6th	36° 58'	86° 26'		534	2.6 Mi. SSE P.O.	Bowling Green CAA AP	"

(Con't)	Instruments used	Record			Observers and Dates	Remarks
		Original located	Where published	Dates 1st and last observations		
(a)	(i)	(j)	(k)	(l)	(m)	(n)
1st	SS, Mx, Mn, SRG	Louisville	CD	3-1-1880 11-30-1900	3-1-1880 M.H. Crump 11-30-1900	Fragmentary records kept in 1879.
	SS, Mx, Mn, SRG	"	CD	12-1-1900 10-31-1943	12-1-1900 A.M. Causey 3/31-1903; L.G. Causey 10-31-1943	4-1-1903 4-1-1944
3rd	CRS, Mx, Mn, SRG	"	CD	4-1-1944 12-7-1944 12-8-1944	Students at college 12-7-1944 12-8-1944	4-1-1944
4th	CRS, Mx, Mn, SRG	"	CD	Date	U.S.W.B. 6-1-1953	
5th	RRNG, CRS, Mx, Mn, SRG	Charts at Dep. Lou.	HB, CU	5-11-1945 6-1-1953	" 5-11-1945 6-1-1953	Same station, RRNG added 5/11/1945
6th	CRS, Mx, Mn, SRG	Louisville	CD	Date	CAA Date	Same location, WB station closed, RRNG removed.

Records indicate 2 other stations located in Bowling Green area at various times in the past.
 Additional records: Smithsonian Institute: Mar.-Dec.1849, Jan.1851-Dec.1852, Aug., Oct., Dec.1853, Oct.1855.
 Smithsonian Institute Coop or Surgeon General Coop: Mar.1878-Feb.1884, May 1886-Aug.1890, Mar.-Dec.1891
 Corn and Wheat Monthly Reports: 1877-1902.
 Special Rainfall: Jan.-Dec.1888.

WB Form 530-1

Figure 32. Weather Bureau Form 530, Bowling Green Airport

Source: National Climatic Data Center

Observations have continued at the airport since that move. The aviation training of the Army Air Corps cadets ended with the end of the War.

On 1 June 1953, the Weather Bureau closed their operation at the airport and the Civil Aviation Administration. (CAA) assumed the weather observation duties.

The major change occurred on 6 February 1996 when the Automated Surface Observations System was commissioned. The data it generates continue to add to the records begun by Younglove in 1849 and is a continuation of that observational lineage.

THE OBSERVATIONS

The Bowling Green's earliest records were entered daily on the Navy Department's Meteorological Journal forms. Those forms contained temperature, sky conditions, clouds, wind, and weather beginning in March 1849. In April, the observer mentioned that he had not received new forms from the Smithsonian Institution and that he would use something else until they were received. It appears that he waited to begin using the new ones until all the old ones had been used. The Smithsonian Institution forms weren't used until September 1853. Wastefulness wasn't an admired trait in those days and the continued use of outdated forms were common throughout the nineteenth century.

The Army and Navy Departments Years

The Navy established a network in 1834 to record the weather on board ships and at navy yards. The initial instructions were to the senior surgeon at each of those places.

... keep or prepare a journal of the changes in temperature and weather, as indicated by the thermometer and barometer...The journal is to contain also, notes of gales, storms and hurricanes, with their direction, time of commencement and termination; and a brief statement of the effects, immediate and remote, supposed to be produced by any of the important changes, on the health of the officers and men.

Those motivations and objectives were similar to those of the Army who began their network in 1814. In both the Army and the Navy, the task of observation was given to the surgeons. The primary purpose was to identify relationships between climate and disease and the surgeons were a logical group to make that determination. They were scientists who were trained to be observe, to collect and analyze information, and to assess influences and effects.

By the time the Navy began their network, the Army Surgeon General's network was well established at Posts throughout the country.

Attached to the December 1851 observation form from Younglove was a clipping from a newspaper. It contained daily data for that month that had been submitted to the Courier Journal newspaper in Louisville. The origin of the data was not shown on the clipping but was not from Bowling Green. Rather, it contained data from Eliza Young's observations in Springdale, Kentucky. He may have included the clipping of her data as a comparison to his.

The last extant report to be submitted F. C. Herrick on a Navy Department form was in December 1852. The January through August 1853 data forms are missing.

The Smithsonian Years

The Smithsonian Institution Climate Network

The Smithsonian Institution's focus was for a dense network of observations stations like that proposed by Thomas Jefferson in 1797¹³ that would have placed observation equipment in each Virginia County.¹⁴ The Smithsonian Network under the leadership of Joseph Henry grew rapidly. In two years, it had over 150 observers¹⁵ providing monthly report containing daily data. By 1860, there were over 500 stations reporting.¹⁶ It grew rapidly because Henry obtained a list of people who were already observing weather from Professor James H. Coffin at Lafayette College in Pennsylvania.¹⁷ He had been collecting weather reports from a large number of those observers. The Smithsonian prepared circulars and sent them to those on Professor Coffin's list to solicit them to become members for their new network.¹⁸ As an observer of weather, it seems likely that Younglove or Herrick would have received one of those invitations. In any case, they submitted reports to the Smithsonian Institution that at that time was working for the Department of Agriculture. The Smithsonian Institution's Register of Meteorological Observations form had spaces for forty-eight entries on each day. Herrick wasn't equipped nor was he required to make all those observational entries.

Herrick submitted the first Smithsonian Institution Form in September 1853. The observer Herrick began recording the winds on this new form. His note at the bottom said that he had noted the wind direction by a weathercock.

The Signal Service Years

The first observations from Bowling Green made for the Signal Service were submitted in March 1878 by Col Crump. He acknowledged some uncertainty about that first effort.

Enclosed please find a very meager & ill prepared report--this is the first attempt-hense crude- as our instruments. Having only old form of Bar-Timby's Patent reading to 10ths only and com. ther. If

¹³ Ralph H. Brown. 1940. The First Century of Meteorological Data in America. Monthly Weather Review, vol. 68, No. 5. 131

¹⁴ Notes by the Editor. 1895. Monthly Weather Review. 457

¹⁵ Patrick A. Hughes. 1970. Century of Weather Service, A History of the Birth and Growth of the National Weather Service 1870-1970. Gordon and Breach, Science Publishers, Inc., New York. 5

¹⁶ Donald R. Whitnah. 1961. A History of the United States Weather Bureau. University of Illinois Press, Urbana. 12

¹⁷ Frank Rives. 1998. Joseph Henry, Father of the Weather Service. The Joseph Henry Papers Project, History Division, Smithsonian Institution.

¹⁸ 1848 Smithsonian Institution Annual Report. Mis. No. 48. Smithsonian Institution Archives, Washington, D.C/.

you conclude to accept this report & should offer any suggestions I should be pleased to hear them & will endeavor to follow them

June and July 1878 are missing. Col. Crump reported that he had been absent. He promised that “they would be sent regularly hereafter.”

The Signal Service Form beginning in May 1882 had columns for only the maximum and minimum temperature, no longer allowing for the three times per day observations to be recorded. Col Crump recorded the minimum daily temperature only. He didn’t begin to submit maximum temperatures until 20 April 1883, apparently when he first obtained his Rutherford maximum-minimum thermometer.

He recorded some interesting weather during his period of service. For example, January 1884 he recorded as the coldest month ever known. “Ice from 5" to 7". Ground covered with snow during the entire month except last 4 days. Thermometers in many parts city ranged from - 12 (degrees) to -28 (degrees).”

He, like other Signal Service observers, was receiving requests for information. In September 1882, he asked for an explanation of the methods of obtaining frost indications. He stated that the County Horticultural Society was anxious to know.

In December 1888, notations on the forms that he submitted indicated that someone at the Signal Service was reviewing and, in some cases, correcting his observations. There were several examples. In March 1880, he entered only the hundredths and omitted the inches in the barometer readings. In May 1880, he entered the precipitation amounts in the snowfall column. All three of these entry errors persisted and were still being made in 1889.

Concurrent but separate from Col Crump’s observations, were the ones contained in The Meteorological Record of John E. Younglove. That was a journal manuscript that had temperature entries from 1870 through 1886. Those entries contained only two observations per day. Beginning with 1 January 1886, he made three temperature entries per day in his journal. In addition, he noted the occurrence of precipitation but not the amounts. His journal data extended through 1890. This document is held in the Kentucky Library at Western Kentucky University

Younglove’s precipitation diary contained daily precipitation amounts from 1 January 1883 through 31 December 1892. It is part of The Younglove Papers held in the Kentucky Library at Western Kentucky University. It includes photographs, correspondence, and notes.

The Younglove Collection also contains journal entries that describe events in Bowling Green from 1808 forward through 1909. Some of these entries were commentaries from “old people” that he was preserving as history of the area. Professor Willard Cockrill, who was in charge of the College Heights Weather Station in the Department of Geography and Geology at Western Kentucky University for many years, had those comments typed and filed in the station.

The Younglove Collection contains a detailed account of the cholera outbreak of 1854 in Bowling Green. He notes that the night of the contagion was warm and sultry, described as suffocating by some of those gathered in a tent. The thought that climate or weather caused disease was of serious interest to the scientists of his day.

The Weather Bureau Years

John E. Younglove used the Weather Bureau Form 1005 to report temperature at sunrise, 2 p.m. and 9 p.m. and daily precipitation amounts beginning 1 March 1893. He added the maximum and minimum temperatures, the amount of daily precipitation, winds, and sky conditions in September 1895.

Col. Crump's Forms 1005 began on 1 January 1896 and ended on 31 December 1900. He recorded only maximum and minimum temperatures, amount of daily precipitation, winds, and sky conditions. Those forms continued in use through Alonzo and Lillie Causey.

In January 1941, Lillie G. Causey first used the Weather Bureau Form 1009. The information being reported remained the same but the monthly summary was expanded considerably. The new version included dates of extreme events and the number of days that crossed some threshold. For example, days above 90°, days below 32°, days with greater than 0.25 inch of precipitation, and other such information were included. Subsequently, the College Heights Weather Station and the Bowling Green Airport both used the WB Form 1009. The CAA-WBO¹⁹ continued the form after June 1948.

The Weather Bureau published a compilation of Bowling Green data in their Climatological Report, Kentucky Section in June 1907. The maximum, minimum, and mean temperature 1886—1906 and the precipitation monthly totals and maximum daily precipitation amounts 1886—1906 were presented in tabular form. There were many missing values in the tables before the Weather Bureau years. The reason for the omission of observations from the Navy Department, Smithsonian Institution, and Signal Service during earlier years was not given.

The Substation History Kentucky published in 1956 also omitted any mention of Pre-Weather Bureau observations. The reason for the oversight is not apparent but it could not have been accidental. Everyone in Bowling Green must have known John E. Younglove for example.

The Digital Record

The National Climatic Data Center in 1948 began digitizing the data from weather observations. To facilitate that effort, index numbers were assigned to each station. Those numbers should be used when searching the digital record for weather observational data. In the Bowling Green area, there are eight index numbers that may have digital data for some period of

¹⁹ Civil Aviation Administration-Weather Bureau Office

time and for some weather elements. The two index numbers for the sites whose history was discussed above are:

150909	Bowling Green Warren County Airport	The site and its
predecessors		
150914	Bowling Green College	The College
Heights site		

In addition, there are other sites that were assigned index numbers by the National Climatic Data Center in the immediate area. Bowling Green 150904 data began about 1924, Matlock 155184 data were from 1893—1895, and Smiths Grove from 1937—1944. The other sites are more recent, from the post—1948 period.

150904	Bowling Green Water Treatment Plant
150906	Bowling Green State Police
150907	Bowling Green Substation
155184	Matlock
157486	Smiths Grove

OTHER BOWLING GREEN AREA OBSERVATIONS

Bowling Green State Police

There is a precipitation station located at the State Police office on Nashville Road in Bowling Green. It is at 36° 57' N and 86° 29' W at an elevation of 570 feet MSL. It has operated since 1 February 1981. Its station index number is 150907

Bowling Green Water Treatment Plant

The Bowling Green Water Treatment Plant provided precipitation and river stage data for a relatively long period. It continues to do so at 37° 00' N and 86° 26' W at an elevation of 481 feet MSL.

College Heights Weather Station

The current College Heights Weather Station (Figure 31) is located within the Department of Geography and Geology at Western Kentucky University.²⁰ The University was founded on 21 March 1906 but the first classes began on 22 January 1907. Mr. R. P. Green taught geography during that first year. Thus the current geography program is as old as the University itself. Dr. Judson Roy Griffin, a graduate of the University of Illinois, was added to the faculty in 1932. He was a geologist by training but also taught geography courses.



Figure 33. College Heights Weather Station 2005

Source: Author

²⁰ In the beginning, it was named Western Kentucky State Normal School

An accompanying note says that January and February 1932 data are missing, but the extant files of daily observations began on 1 March 1932 (Figure 34).

Dept. of Geog. & Geol., W. K. S. T. C.
COLLEGE HEIGHTS STATION
WEATHER REPORT
Special to The Park City Daily News

Bowling Green, 3/1/32
Mo. Day Yr.

TEMPERATURE

Maximum Last 24 Hours 45 Degrees
Minimum Last 24 Hours 41 Degrees
Mean Last 24 Hours 43 Degrees
Departure from Year Ago 150 above Degrees
Departure from Normal 9 Above Degrees

PRECIPITATION

Last 24 Hours 0.0 Inches
Month To date 0.0 Inches
Departure from Year Ago 0.33 Below Inches
Departure from Normal 5.11 Below Inches
Year To date 13.61 Inches
Departure from Normal 0.11 Below Inches

METEOROLOGICAL DATA—7 A. M.

Barometer 29.45 Inches
Temperature 47.5 Degrees
Dew Point 31 Degrees
Relative Humidity 34 %

AERONAUTICAL CONDITIONS—7 A. M.

Cloud Level 3750 Feet
Visibility 1 Miles
Wind Direction East
Wind Velocity Light Breeze
Outlook Foggy with probable increasing cloudiness and rain by night
BARREN RIVER AT KY-TENN. PWPT.
Height 6.6 Feet
Change -0.5 Feet
State Falling Slowly For Past Several Days

Figure 34. Earliest College Heights Weather Station Observations, March 1932
Source: College Heights Weather Station Files, Western Kentucky University

Note that this form was made to be sent to the Park City Daily News in Bowling Green. There were instruments that measured temperature, precipitation, atmospheric pressure, dew point, relative humidity, cloud height, wind direction, comparisons to the previous year, comparisons to normal, the outlook, and the height of water in Barren River. To make this report, the station must have had a full complement of observational equipment. Two years later, there is a record

that they were equipped with a standard rain gage, a recording rain gage, and a tipping bucket rain gage as well as maximum and minimum thermometers. To make the outlook, there must have been forecast experienced personnel. It was quite a start for this University endeavor.

The Weather Bureau's Substation History Form 530-1 dated 27 October 1958 (Figure 26) records the observer as Judson R. Griffin and that his beginning was in 1934. It seems likely that he was the director of the College Heights Weather Station as early as two years before. Dr. Griffin taught Geology and was the Head of the Geography and Geology Department until his death in 1950.

At first, the College Heights observations were taken on the roof of Cherry Hall, seen in the background in Figure 32. The observations were moved to the roof of Science and Technology Building in 1976 (the foreground in Figure 35) and remained until now.

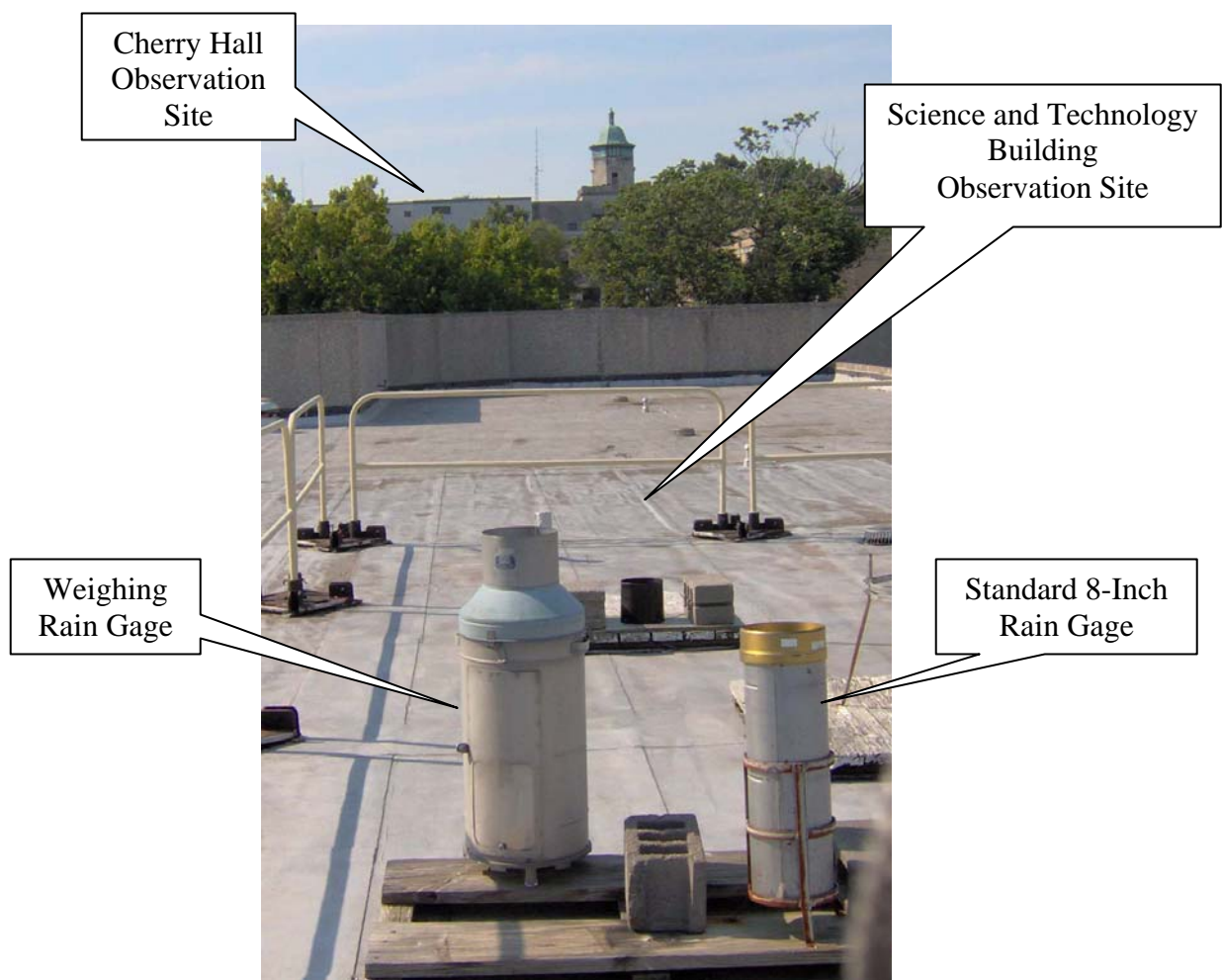


Figure 35. Current and Former College Heights Weather Observation Site
Source: Author

The individual with the longest reign as Director of the College Heights Weather Station, was W. Willard Cockrill (Figure 36) who joined the Department in 1947. He had previously been a high school teacher and the Cooperative Observer in Scottsville, Kentucky. He came to the Department in 1947 to teach meteorology, among other subjects. He had been a meteorologist with the Army Air Corps during World War II.



Figure 36. Willard Cockrill and the College Heights Weather Station's Pyroheliometer
Source: The Talisman, 1979

He was the Director of the College Heights Weather Station from his arrival in the Department until his retirement in 1978. Many of his meteorology students gained hands on experience by taking observations in the Station.

One of Willard Cockrill's legacies was the collection of meteorological instruments that had been used in the College Heights Weather Station. He retained the old instruments as they were replaced. The accumulation of them represents not only the history of weather observations at the College Heights Weather Station but also forms a museum of weather instruments that were in general use in the United States over the past 75 years. A few instruments from the Station are shown in Appendix 2.

Dr. L. Michael Trapasso (Figure 37), the Director of the College Heights Weather Station since 1980, continued that collection. He also maintained the files of the College Heights Weather Station that has records of daily observations since 1932 and continues to assure that daily observations are made and recorded. He teaches meteorology and climatology and supervises the work of student observers who continue a tradition of student involvement that began almost three quarters of a century ago.



Figure 37. Dr. L. Michael Trapasso, Director College Heights Weather Station
Source: Author

Ogden College of Science and Engineering and its Department of Geography and Geology have changed during their long history. Unchanged is the emphasis they have placed on weather observations and meteorology as integral to the University's mission.

Matlock

The USGS benchmark at Matlock is at 36° 48' 58" N and 86° 27' 58" at an elevation of 626 feet MSL. It is about twelve miles south of Bowling Green near the intersection of KY 240 and KY 622. The site at Matlock has a short but important contribution to Bowling Green's weather observation history. The observer was C. A. Matlock whose store and post office provided the community's name. He began observations on 1 January 1893.

A letter from the Weather Bureau in Louisville on 16 January 1896 to the Chief of the Weather Bureau gave an insight to Matlock's responsibilities.

Sir

I have the honor to report that owing to the inability of Mr. C. A. Matlock, displayman at Matlock, Ky., to attend to the work of distributing forecast by mail from his station, the centre has been changed from that place to Bowling Green, Ky., where the work will be in the charge of Col. M.H. Crump, the present voluntary observer there. It is thought that this change will be very beneficial as Bowling Green is a much larger place than Matlock and possesses better mail facilities. Post Offices formerly supplied with forecasts from the old centre will in future receive them from the new one and it is expected that many additional places will be added to the list. Matlock will hereafter receive the information by mail and the telegrams will be transferred to Bowling Green.

Smiths Grove

A Weather Bureau Form 530, Substation History, (Figure 38) recounted the Smiths Grove connection with the climate record of Bowling Green. Note that weather observations were taken by R. W. Richardson there beginning on 1 May 1937.

UNITED STATES DEPARTMENT OF COMMERCE WEATHER BUREAU SUBSTATION HISTORY							
Station <u>Smiths Grove</u>		County <u>Farrar</u>		State <u>Kentucky</u>		Office preparing form <u>WFO-Louisville, Ky.</u>	
(Current name)				Index No. <u>57486-2</u>		Date prepared <u>3/12/1953</u>	
Loca- tion	Latitude	Longitude	Sec. Twp. Rng.	Elevation (m)	Direction and distance from Post Office	Station known as	Description of exposure
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1st	37° 03'	86° 13'		607	Unknown	Smiths Grove	Unknown
2nd	37° 03'	86° 13'		607	Unknown	Smiths Grove	Unknown
3rd							
4th							
5th							
6th							

(Con't)	Instruments used	Record			Observers and Dates	Remarks
		Original located	Where published	Dates 1st and last observations		
(a)	(i)	(j)	(k)	(l)	(m)	(n)
1st	GRG, CRS, Mr. Ma	Louisville	CD	5-1-1937 5-31-1939	R. W. Richardson 5-1-1937 5-31-1939	
2nd	SRG, CRS, Mr. Ma, A EG, BW, F&F	Louisville	CD	6-1-1939 12-7-1944	U.S. Weather Bureau 12-7-1944	Attny Station
3rd						
4th						
5th						
6th						

Figure 38. Smiths Grove Substation History Form 530
Source: National Climatic Data Center

A barometer was installed on 7 December 1936 and maximum, minimum thermometers were added in July 1938. In 1939, it was designated as an Airways Station and became a Weather Bureau station about February 1944.

Smiths Grove had been a Civil Aviation Administration (CAA) Landing Field since 1 October 1933. Barnstormers used the field for flying demonstrations during the late 1930s.

Weather and flying merged on 29 July 1943 when a DC-3 flown by American Airlines and enroute to Smiths Grove encountered turbulence associated with a thunderstorm. It hit some trees and crashed near Trammel in Allen County killing the four crew members and sixteen of twenty passengers.



Figure 39. Smiths Grove, Kentucky Airport, 10 June 1944
Source: WB Form, 4007, National Climatic Data Center

The Smiths Grove Airport as it was in 1944 is shown in Figure 39. The CAA Watch House is on the left and the wind instruments are on the tower. The view is toward the northeast.

REICHELDERFER LETTER

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
WASHINGTON

February 27, 1942

To Cooperative Observers:

WEATHER INFORMATION IN WAR

Weather wisdom has helped to win many battles and some wars. Conversely, adverse weather where unexpected has sometime been disastrous. The United States, with one of the world's most efficient weather observing systems, controls a vast amount of weather information. It is the responsibility of all concerned to make sure that this information is not allowed to fall into unfriendly hands for use against the United States.

To accomplish this, the Weather Bureau and the Office of Censorship have called upon the nation's press and radio broadcasting stations to help control publication and broadcast of weather observations and reports. The intent of this control is to withhold information that might be valuable to our enemies, but to give out whatever is safe and necessary for ourselves. The regulations may change from time to time; and if air or naval attacks actually threaten our cities, all such information may, of course, be silenced completely. For the present, warnings of blizzards, cold waves, floods, and other dangerous weather conditions will continue to be distributed by press and radio except that in coastal areas broadcasts of such warnings are subject to the approval of military authorities. The following information may be printed in newspapers published in the town where the observations were made, even though these newspapers may circulate in neighboring cities and towns.

(a) Local data for a single day, consisting of maximum and minimum and hourly temperatures, and precipitation in any amount, and comparisons of these data with normals and extreme records.

(b) Local data for two or more days of the kind mentioned in (a), with averages or summaries.

(c) Local papers may also publish tables with limited data for a small list of other cities, but only when secured through a press association or from a regular Weather Bureau Office.

Cooperative observers are authorized to give out local temperatures and precipitation (rain or snow) data of all kinds over the telephone or in person or by letter, to local inquirers, *but they may not telephone, telegraph or radio any weather information to places outside their home towns or furnish it to others for this purpose unless the recipient is a Weather Bureau office or other Government agency authorized by the Weather Bureau to receive the information.*

Wind direction, wind velocity, condition of the sky, visibility, barometer readings, or weather data other than listed in (a) and (b) above, should not be given out by cooperative observers for publication locally or elsewhere, and no weather information should be furnished for radio broadcast.

To join cheerfully in this effort to regulate the distribution of weather data is a patriotic service to which we can all contribute. The assistance of all our cooperative observers will be appreciated. This letter may be shown to local newspapers.

Sincerely Yours,



Chief of Bureau.

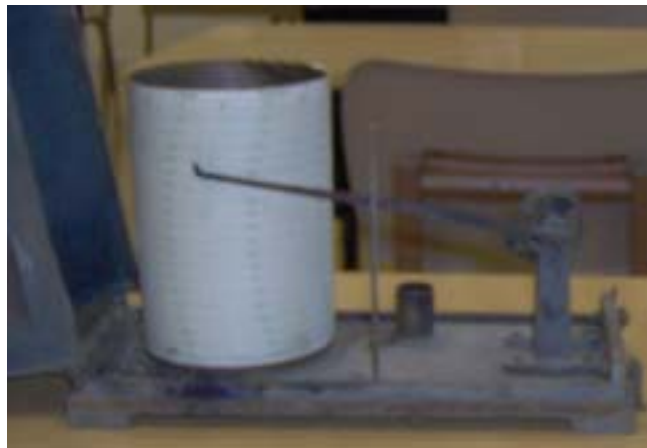
APPENDIX 2

COLLEGE HEIGHTS WEATHER INSTRUMENTS



Anemometer, College Heights Weather Station, 2005

Source: Author



Thermograph, College Heights Weather Station, Used 1930-1965

Source: Author



Pyroheliometer, College Heights Weather Station, 2005



Sunshine Recorder, College Heights Weather Station, 2005



Home Weather Station Donated to the College Heights Instrument Collection

APPENDIX 3

MATLOCK

WB Form 530-1

UNITED STATES DEPARTMENT OF COMMERCE
WEATHER BUREAU
SUBSTATION HISTORY

Office preparing form WFO Louisville, Kentucky KY

Station Matlock (Current name) County Warren State Kentucky Index No. 15-5124-02 Date prepared 3/13/1953

Location	Latitude	Longitude	Sec. Twp. Rng.	Elevation msl	Direction and distance from Post Office	Station known as	Description of exposure
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
1st	36° 50'	86° 29'	—	Unknown	Unknown	Matlock	Unknown
2nd							
3rd							
4th							
5th							
6th							

(Con't)	Instruments used	Record			Observers and Dates (m)	Remarks (n)
		Original located	Where published	Dates 1st and last observations		
(a)	(f)	(j)	(k)	(l)	(m)	(n)
1st	SRG, SS, DT	Louisville, KY	CD	1-1-1893 8-31-1895	G.A. Matlock	
2nd						
3rd						
4th						
5th						
6th						

WB Form 530-1

Source: Kentucky Climate Center

APPENDIX 4

METHODOLOGY

The primary sources of information for this study were the Bowling Green observers' daily weather records themselves. Copies of their monthly reports and the data digitized from those reports were available from the National Climatic Data Center in Asheville, North Carolina; the Midwestern Regional Climate Center in Champaign, Illinois; or the Kentucky Climate Center at Western Kentucky University in Bowling Green, Kentucky. These monthly reports can be considered original sources because they were written by the observers and not altered by subsequent readers.

There were a variety of secondary sources that held information about Bowling Green, its history, and its people. The author visited and collected information from the holdings of the National Climatic Data Center at Asheville, North Carolina; the Public Library in Bowling Green, Kentucky; the Kentucky Historical Society Library, and Kentucky State Library and Archives in Frankfort, Kentucky; the Smithsonian Institution Archives in Washington, D.C.; the National Archives and Records Administration in College Park, Maryland; the Kentucky Library at Western Kentucky University in Bowling Green, Kentucky; and the files of the College Heights Weather Station and the Kentucky Climate Center at Western Kentucky University in Bowling Green, Kentucky. Invaluable assistance and documentation were given by Dr. L. Michael Trapasso, the Director of the College Heights Weather Station and by Dr. Stuart Foster, the State Climatologist for Kentucky.

The tertiary sources were reference materials that are available on-line. Among those were the metadata and station histories prepared by the Office of the State Climatologist of Kentucky, the Midwestern Regional Climate Center, and the National Climatic Data Center. Two genealogical research sources, Ancestry.com and Genealogy.com were used to provide some of the personal information about the observers. For location analysis, the interactive maps available from TopoZone.com were used.

There was an attempt to glean information from all these sources that would allow a glimpse into the lives of the observers, the location of the observation site, and the historical environment that produced the climatic history of Bowling Green. Maps, drawings, and photographs were included when appropriate to illustrate the information. The faculty and staff of the Kentucky Library at Western Kentucky University were most helpful, especially Pat Hodges in the manuscript division. The research advice received from Connie Mills was particularly enlightening.

Throughout the research for and preparation of this study, the objective was to produce a document that future climatological 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.

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