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## 1. INTRODUCTION

National Weather Service's Cooperative Observers and their predecessors are mostly anonymous except for their names and addresses. Who were those people? The history of their station is detailed from its inception and we know its latitude, longitude, elevation, equipment, types of observation, times of observation, inspections, repairs, and other details. Each change of the station's location, observation, and equipment is recorded with the date it occurred. Great emphasis is placed on the accuracy of the equipment, its exposure, and its reliability. Photographs are now being added and GPS locations are being measured. But, we still know little about the observers beyond their names.

There are computer programs that can determine whether the data set is accurate enough to be usable. Sometimes, the data are "adjusted" for "errors" identified by the programs to produce a more accurate record of weather. At other times, models are used to develop data sets deemed to be more useful than the observed data. Because we often use these adjusted or modeled data instead of the observer's reported data, there is an impression that the observer who saw and recorded the observations was somehow inadequate for the job. This paper identifies some of the Nineteenth Century observers and describes their occupations than infer reliability.

### 1.1 Background

In a project directed by the Midwestern Regional Climate Center, the Kentucky Climate Center digitized daily weather observations in Kentucky for the period extending backward from 1896 to 1825. These digitized data include the daily temperatures, precipitation amounts, and snowfall. During this work, it was necessary to collect metadata. One could not help but notice the seemingly frequent notation that an observer

observers to learn more about the persons who observed the weather.

## 2. METADATA SOURCES

Prior to the first publication of the monthly Climatological Data in mid 1896, climate observational data were filed in their original handwritten form. Most of these monthly forms containing daily data are stored in the National Archives. The forms have the observer's name and Post Office address, his or her title if there was one, but little else. Neither the observer nor the equipment was described in enough detail to make a judgment about the reliability of the entries. Construction of metadata for the early stations is needed.

### 2.1 National Archives Observer Forms

Decades ago, the original observer forms that reside in the National Archives were microfilmed. A complete set of these rolls of microfilm is kept at the National Climatic Data Center. The microfilm and the paper copies for Kentucky are in the Kentucky Climate Center. In addition, there are images of the original observer forms available on-line from the National Climatic Data Center.

### 2.2 United States Census Forms

The data collected during each decadal census contained the name of the head of each household. Beginning in 1850, the census form required entry of the profession, occupation, or trade of each individual enumerated. In states that have indexed the census, finding an individual is easy. In non-indexed states, the process is laborious.

### 2.3 Substation History Form 530

For many years, the National Weather Service maintained a summary of each station's history on their Form 530. These forms originally existed for only a few stations prior to the 1890s. The State Climatologist for Kentucky produced Forms 530 for all Kentucky stations in the entire record of observations in Kentucky. These forms reside in the Kentucky Climate Center and copies were provided to the National Climatic Data Center. They were the first attempt at metadata within the state for the early years.

## 3. METADATA DEVELOPMENT

Derivation of metadata for the early stations used in this study began with the original Observer

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\*Corresponding author address: Glen Conner, Kentucky State Climatologist Emeritus, Department of Geography and Geology, Western Kentucky University, Bowling Green, KY 42101; e-mail: glen.conner@wku.edu was a medical doctor. Research began to learn more about the occupations of the other

Forms. The handwriting of the original observations and the faded quality of some of the observer records before they were imaged presented problems. When the observer had used pencil, the lack of contrast made reading more difficult. Different styles of cursive writing of the period added to the interpretation time before metadata entry.

### **3.1. Choice of Study Year and States**

A list of Observers in the Smithsonian Climate Network during the period of 1854-1859 was available with their locations (U.S. Patent Office, 1864) and the 1860 U.S. Census contained the occupations of the members of each household. Therefore, these two documents became the primary sources for this study.

### **3.2 Station Location**

The information on the Observer forms includes the name, the Post Office, the latitude and longitude, and the elevation. The geographical location was often estimated by the observer and should not be accepted without verification by other means. The Post Office was located using the U.S. Geological Survey's locator web site to identify its current county ([http://geonames.usgs.gov/pls/gnis/web\\_query.gnis\\_web\\_query\\_form](http://geonames.usgs.gov/pls/gnis/web_query.gnis_web_query_form)). The county's identity was necessary to locate the individual observer in the 1860 Census except where the current county did not yet exist in 1860. In those cases, maps of the applicable states showing the counties as they then existed were consulted. (<http://www.genealogyinc.com/maps/uscf.htm>)

Three states were selected for study. Kentucky, a state since 1792, was selected because preliminary work had already been completed; Pennsylvania, one of the original thirteen states, because of its link through Lafayette College to the earliest Smithsonian climate observation efforts; and California, because of its relatively early stage of development after its admission in 1850.

### **3.3. Biographical Data**

The 1860 census listed each individual's occupation, the value of their real estate, and the value of their personal property. Using a search engine and the name of the observer, several biographical sketches were discovered. Two online genealogical subscriptions (Ancestry.com and Genealogy.com) provided significant historical information for several individuals. In some cases, the comments on the reverse side of the Smithsonian Meteorological Observation Form contained helpful information.

### **3.4 Observer Qualifications**

The U.S. Army developed the first climate network in 1814 (U.S. Army, 1855) and used the surgeons at Army Posts as their observers (Smart, 1894). The Smithsonian Institute began its climate network in 1847 (Smithsonian Institution, 1848) using many of the observers who had already been reporting climate observations to Professor James Coffin of Lafayette College in Pennsylvania (Rives, 1997). The Smithsonian developed their climate network and solicited observers who were both experienced and equipped. In later years the Army's Signal Service required trained observers (Signal Service, 1887), as did the Weather Bureau (Moore, 1899). The Nineteenth Century observers were not novices.

## **4. RESULTS**

This study showed that it is possible for metadata to be constructed from a variety of sources to present a satisfyingly complete description of the early observers. The new identity of each observer goes far beyond just a name, a place, and a date. It is important to know that these early observers were not weather hobbyists, climate enthusiasts, or bored frontiers people. They were already accomplished individuals before they became climate observers. Knowledge of these people's personal characteristics heightens our confidence in the accuracy and reliability of their observational data. That confidence may allow their data to be used to extend the observational data back into a period when the climatic effects of urbanization were not yet dominating the record.

## **5. DISCUSSION**

### **5.1 Kentucky's Observers 1859**

The ten Kentuckians who were observers for the Smithsonian Institute were not the backwoodsmen one might have expected. One observer was John Swain the observer at Ballardsville, Kentucky. He was a Medical Doctor. Another observer was Thomas Miles of Bardstown, Kentucky. His occupation was listed as a Notary Public. At Danville, Kentucky, the observer was Ormond Beatty. He was a Professor of Mathematics and Natural Philosophy at Centre College. In 1868, he became President of the College that today is recognized as one of the best of the small colleges. Mr. E. N. Woodward was the only urban observer of the period in Kentucky. He was a Druggist whose business was located at the corner of 2nd and Chestnut Streets in Louisville, Kentucky. In Millerstown, Kentucky the observer was another Medical Doctor, Dr. George Savage.

Across the Ohio River from Cincinnati, the Newport Barracks in Kentucky had been an observation site since July 1825. This U.S. Army

Post, like many others, was required by the U.S. Army's Surgeon General to observe the weather each day. Specifically, the Post Surgeon was required to make the observations. The latest in a series of Surgeons was doing the observations in the 1860s.

Nicholasville, Kentucky had another educator as its observer. He was Joseph McDowell Mathews who was the President of the Jessamine Female Institute, a college operated by the Methodists. He was difficult to find in the census because he had not come to Kentucky until after the 1860 census and had left before the 1870 census. He was located on the 1860 and 1870 census in Ohio at a college there.

An observation site called Ohio River operated for a short period. It was located about 25 miles upstream from Newport, Kentucky. The observer was M. G. Williams who was a minister. At Pine Grove, Kentucky, another Medical Doctor was observing the weather. He was an 1815 graduate of Transylvania University in Lexington, practiced medicine in Winchester, and operated a farm and a livestock breeding operation.

Eliza I. Young compiled one of the best records of the period from her home in Springdale, Kentucky. Following the formality of that day, she always wrote her name on the observation forms as Mrs. Lawrence Young. The census reveals that she was the wife of a farmer of some worth.

## **5.2 Pennsylvania's Observers 1859**

The large number (thirty-four) of Smithsonian Observers in Pennsylvania may simply reflect the greater population. But as well, it may be attributable to the earlier data collection effort at Lafayette College for the Smithsonian Institution. The professionals formed a significant portion of the Pennsylvania group. Within that group were three medical doctors: Dr. J. R. Hoffer of Mount Joy, Dr. Alexander M. Speer of Pittsburgh, and Dr. Paul Swift of West Haverford. There were four professors: M. Jacobs of Gettysburg, Charles S. James, Professor of Mathematics in Lewisburg, William D. Smith of Canonsburg, and W. C. Wilson Professor of Astronomy in Carlisle. Four were teachers: Samuel Alsop of Westtown, P. Friel of Shamokin, J. C. Harvey of Nazareth, and T. F. Thickstun of Meadville. Three were ministers: Rev. James A. Heckerman a German Reformed minister in Bedford, Rev. J. Grier Ralston the principal of a Female Seminary in Norristown, and William D. Smith, D.D., a minister and professor in Canonsburg. There was one lawyer, John H. Baird of Tarentum and there was one civil engineer, Samuel Brugger of Fleming.

The remaining ten included two merchants, Samuel Brown from Bedford and Franklin W. Cook of Benderville. There were three farmers: Edward Kohler of North Whitehall, John H. Smedley of Chromedale, and James E. Tracy of East Smithfield. There were six tradesmen: John Eggert, a watchmaker from Berwick; W. O. Hickok, a book binder from Harrisburg; George R. Houghton, a boat fitter from Easton; Mahlon Moore, a cabinet maker from Morrisville; Samuel Scott, a carpenter from Worthington; and one laborer, Thomas Meehan of Germantown.

The census described the occupation of two of the observers as gentlemen. These well to do men apparently no longer worked. One was William Heyser of Chambersburg. He may have been a druggist because his son living in his home was one. George Mowry of Somerset was the other gentleman.

Three observers could not be positively identified in the census data and therefore their occupations could not be determined. They were James Barrett of Linden, W. R. Boyer of Altoona, and S. Ebert of Germantown.

## **5.3 California's Observers 1859**

California had ten Smithsonian Observers in 1859. Of those ten, there were seven professionals; four doctors, one professor, and two attorneys. W. O. Ayres was a 42 year old San Francisco physician born in Connecticut. In Marysville, the observer was an attorney, W. C. Belcher. Wesley K. Boucher was a lawyer in a gold mining area of Calaveras County. In Monterey, Dr. Colbert A. Canfield was a physician and surgeon. Oliver S. Frambes was a professor in Santa Clara. Robert Gordon, from Ireland, was a grocer in Auburn. S. A. Gould was the observer in Santa Clara but his occupation is unknown. The observer in Downieville was Dr. T. R. Kibbe. Another physician, Dr. Thomas M. Logan from Sacramento was the observer there. In Crescent City, Robert B. Randall was a painter by trade. The tenth California observer was James Slaven who was observing at Union Rancho according to the Smithsonian record. Neither the identity of his occupation nor the county in which Union Rancho was located could be determined.

## **6. CONCLUSIONS**

The occupations of 49 of the 54 observers in California, Kentucky, and Pennsylvania were identified. Of those 49, 22% were doctors, 22% were professors or teachers, and 10% were other professionals (lawyers, engineers or druggists). To this 54% cadre of professionals could be added other trusted members of the communities such as notary public, farmers, ministers, merchants, tradesmen, and the gentlemen. These people were not average

individuals chosen by chance. Rather, they were selected and recruited because of their reliability.

This paper presents the observers of 1859 as educated and responsible individuals. Their backgrounds and occupations engender trust in their competence and reliability in observing and in reporting their observations. The individual making the observation is equally as important as the equipment being used. The tradition of finitely detailing the quality of the latter while ignoring the quality of the former is illogical. Biographical sketches of observers should be a standard feature of all metadata files. Where such information for early observers is not available, research should be initiated to provide it. The methods used in this paper can facilitate that provision.

One final example of the need for these metadata is offered. The list of observers published by the Smithsonian Institute has this entry: "Cleveland Abbe, 1859, Lansing, Michigan." The 1860 Census of Michigan identifies a Cleveland Abbe living in Washtenaw County. On Roll 563 Book 1, Page 530 of that census, he is identified as a white male, 23 years old, with \$500 in personal property, who was born in New York. He was living in the Ann Arbor household of 45 year-old James R. Boire whose occupation was Professor of Greek Language and Literature. Cleveland Abbe's occupation is listed as "Tutor Michigan University." Confidence in the reliability of the observations taken at Lansing, Michigan in 1859 increases when we know that the observer there would later become one of the most famous meteorologists in our history.

Anonymity of Nineteenth Century weather observers should be replaced with metadata that strengthens our confidence in data reliability.

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