The Archivist and Weather Records

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National Weather Records Center

MAN'S recorded interest in weather and climate dates back 6,000 years. About 4000 B.C. the Babylonians inscribed weather proverbs on their clay tablets. From that time until about 1600 A.D. crude observations were taken over the known world, nearly all without the aid of instruments. The results for the most part were inaccurate, but after the thermometer and barometer came into use in the early seventeenth century, meteorology began to develop as an accurate science.

The earliest known weather observations in the American Colonies were kept—without the aid of instruments—by the Rev. John Campanius at Swedes Fort, near the site of Wilmington, Del. (1644-45). Dr. John Lining of Charleston, S. C., using the first Fahrenheit thermometer in the Colonies, took systematic weather observations with instruments, 1738-50, under the sponsorship of the local medical society. The contributions of such men prompted the first systematic American program of climatological observation.

As a result of the surge of scientific inquiry in the second half of the eighteenth century, interest in the atmospheric environment was universal among the well educated. Thomas Jefferson kept a log of his observations, and he knew the necessity for simultaneous observations. Jefferson's lifelong interest in climatological work found only limited response in his own era. It was not until about a century after he published his first climatological notes that a firm framework emerged for a survey.

Although interested persons had kept private weather records for various lengths of time in several localities, no organized system of meteorological observation was developed until early in the

* Paper read on Oct. 2, 1962, at the 26th annual meeting of the Society of American Archivists, in Rochester, N. Y., as a part of a session on special records collections over which Edith M. Fox presided. Mr. Collier became a member of the staff of the National Weather Records Center, Asheville, N. C., upon its establishment in 1952; in 1955 he was appointed Supervising Archivist. During World War II he had been an observer for the Army Air Force Weather Service in the United States, Europe, and Africa. After the war and before his appointment to the National Weather Records Center he was successively a weather observer at Washington National Airport and a member of the staff of the Office of Climatology of the Weather Bureau.

nineteenth century, when agencies of the Federal Government interested themselves. Army post surgeons were required to "keep a diary of the weather" by an order of May 2, 1814, and specific climatological objectives were outlined in an 1817 order of the Surgeon General. Weather records were collected later in the nineteenth century by the General Land Office, the Smithsonian Institution, the Patent Office, and the Signal Corps of the Army.

An act of Congress of October 1, 1890,[1] established the Weather Bureau, under the Department of Agriculture, and farsightedly included among the specific duties of its Chief "the taking of such meteorological observations as may be necessary to establish and record the climatic conditions in the United States." This act provided the administrative framework of the weather service with the legal and official status it so desperately needed. On June 30, 1940, the Weather Bureau was transferred from the Department of Agriculture to the Department of Commerce. The Bureau was transferred because of the importance of its functions to the Nation's commerce, especially to air transportation.

When the civilian Weather Bureau began its work, over 2,000 stations were recording daily amounts of precipitation and maximum and minimum temperatures, and 180 were observing atmospheric pressure, wind, clouds, and sunshine duration. The public need for an agency to record and interpret the climates of different parts of the United States was recognized in the mid-1890's by establishment of the Climate and Crop Weather Division of the Weather Bureau. Industrial and agricultural developments of the twentieth century have put further emphasis on the importance of climatological information—the data and interpretations useful for crop-planning, housing, marketing, shipping, aviation, air conditioning, flood control, manufacturing, insuring against risk, and other fields of agriculture and commerce. The present Office of Climatology is the direct descendant of the Climate and Crop Weather Division.

The National Weather Records Center, although physically located at Asheville, N. C., is a branch of the Office of Climatology. The Center (NWRC) furthers the interests of the national weather service and of the specialized weather services of the Department of Defense. The armed forces use the NWRC as a common facility but maintain there units of their own. The NWRC is the final repository for weather records of the U. S. Government. It is responsible primarily for the assembly, quality control, mechanical and electronic processing and analysis, publication, and

[1] 26 Stat. 653.

safekeeping of U. S. climatic records, of increasingly numerous conventional weather records from around the world, and of observations from meteorological satellites. The weather records are of all types, from the weather journals kept in the eighteenth century to the supervised daily entries now made at more than 12,000 observing stations in the United States.

The original materials kept in the NWRC number more than 50 million documents, and annual accessions of documents exceed 2½ million. Not included in these figures are reference aids such as punched cards, special summaries, and tabulations. With few exceptions, the original records contain meteorological data exclusively. The holdings are essentially one record group consisting of more than 150 series. The records span the period from 1735 to the present and are, of course, increasingly adequate for the later part of the period. They make up the world's greatest centralized climatological archive and are the core of the Asheville operation.

The centralization of almost all past U. S. weather records in a single archive has come about only within the past ten years. This centralization of records, with the necessary electronic computers and other high-speed data-processing equipment and with a staff of specialists from many disciplines, has enabled the NWRC to satisfy a service demand that a generation ago would have staggered the imagination of the wildest dreamer.

Need for the centralization of Government activities in the collection and processing of climatological records became acute during World War II. The first attempt to centralize activities occurred in 1945 at New Orleans, where a joint Navy, Army Air Force, and Weather Bureau punchcard library was established. This operation centralized and coordinated most of the three services' climatological project work, using punchcard techniques. It also served in a small way as a focal point of collection of basic weather records. The need for a central depository for all weather records, however, remained unsatisfied and became more urgent. With the finding of more suitable space in Asheville, it was possible to establish the National Weather Records Center there.

The records that had been collected by the Smithsonian Institution, the Surgeon General's office, and other Federal agencies before 1871 had been transferred to the Army Signal Service during the 1870's. These records, together with those created by the Signal Service, were in turn transferred to the Weather Bureau of the Department of Agriculture, when it was established in 1891. Most

of these records were in manuscript; self-recording instruments had not been used until the 1870's, and for many years thereafter they were used only at principal stations. These and many later records were eventually transferred to the National Archives. Most of the manuscript weather records created by Federal agencies before July 1, 1891, were microfilmed by the National Archives, with the concurrence of the Weather Bureau; and the originals were disposed of. A copy of the microfilm (562 rolls), furnished to the Weather Bureau, was deposited in the microfilm library at the NWRC.

After acquiring the space in Asheville, the Bureau began in earnest the job of centralizing U. S. weather records. There were two concentrations in Washington, the less active in the National Archives, the more active in the Weather Bureau. Records were frequently sent back and forth between the two agencies. A third formidable accumulation was at the New Orleans tabulation unit. Each military or naval weather service also held records from its station networks, which had been greatly expanded during World War II. In addition each of some 200 major Weather Bureau offices and stations had records of its own and often had records "inherited" from a nearby station that had been closed. A section director functioned in practically every State, and his office also had records.

Most of the weather records in the National Archives were needed by the NWRC for studies based on long-term observational data or for other technical investigations. With the Archivist's consent, these records were permanently withdrawn from the National Archives by the Weather Bureau and were transferred to Asheville in 1952. The National Archives retained all official correspondence; the organizational, administrative, and fiscal records of the Weather Bureau and predecessor agencies; and a small amount of observational records and personal papers that though historically valuable are not often needed by technical investigators.

An avalanche of records descended upon a harried staff at Asheville. NWRC's master plan was orderly enough, but frequently records that came from different places at different times had to be put together in series. Furthermore, "priority requests" inevitably arrived just before, or simultaneously with, the arrival of each vanload of records! Slowly but surely, however, we achieved a degree of control that enabled us to advance on all fronts in an orderly fashion.

After weather observations have served their immediate opera-

tional uses in weather intelligence and forecasting, the records are subjected to three major processes. First, they are checked and edited, both to assure the quality of the observational program and to avoid gross errors in the climatological record. Second, selected data are summarized and prepared for publication in current monthly and annual bulletins. Third, the records are organized, indexed, and stored for further reference, which includes long-term climatic studies and research analyses.

Before 1948 these three processes were conducted in a loosely organized manner at several hundred stations. When Weather Records Processing Centers were established in 1948, the previously diffuse processing of climatological data was drawn together, standardized, and streamlined. The observational records from more than 12,000 observing points then flowed directly to the Weather Records Processing Centers. Upon completion of the current processing, usually within 90 days, the records were transferred to the NWRC. All Weather Bureau processing functions have now been consolidated at the NWRC and almost all of the records are available to us within 30 days of their creation.

In the NWRC archives there are frequently as many as 75 inquiries at one time in various stages of consideration—and the archival activity is but one of many NWRC functions! In order to fulfill our mission with any degree of acceptability, the arrangement of the records had to be simple and uniform—an order that would facilitate the handling of the greatest number of reference requests quickly and easily. For purposes of identification, storage, and reference we consider most of our records to be in one of three general categories: surface, autographic, or upper air.

Surface records include all manuscript records ranging from once-daily recordings of precipitation and/or maximum and minimum temperature on a monthly form to the most detailed observations recorded at major airport stations.

Autographic records are produced by self-recording instruments. These too are mainly "surface" records, but are stored separately from manuscripts.

Upper air records document American meteorologists' probes into the atmosphere above the ground, from the first experimental kites in 1898 to the present radiosonde. Twice-daily ascents to heights of 85,000 to 90,000 feet are now routine at many stations. Rockets are also now in use at a few locations to probe the atmosphere to heights up to 250,000 feet.

The various series within each of these three general categories are kept separately. The filing order is simple: alphabetically by State, within State by station, and thereunder in chronological order

for each station. For filing or reference purposes no distinction is made among identical series created by the three major weather services (Weather Bureau, Navy, and Air Force).

Before World War II similar records from several stations were frequently combined in permanent bindings. The order was fixed; there was no flexibility. A research project using records for one station involved withdrawing from the files records for many other stations, some of which were frequently needed by someone else at the same time. Times have changed, as have reference requirements. The more active records have been removed from their bindings and completely rearranged in the order just mentioned. They will not be bound again.

Although most contacts with the NWRC are by mail, many are by telephone to determine the availability of the desired data for a station or group of stations and the period for which the data are available. In-house requests are very frequent. Central locator files enable us to give most of these answers within seconds. Three types of files are used:

1. Records from the several hundred principal stations are indexed on 5″×8″ cards, which are put into a 17,000-card-capacity Diebold rotary file. From these cards alone we can determine, for any station, the period of record for each series; the present latitude, longitude, and elevation; and dates of changes in the status of the station. Detailed station history files (a folder per station) are nearby if more detailed information is needed.

2. Records from the more than 15,000 substations now in operation or in operation at some time since 1891 are indexed separately. The indexes are kept by State in post binders.

3. The third type of locator, the dossier, is used only for some special project records, deposits from other than the agencies principally served, and collections not yet indexed. Some accumulations will never need detailed indexing.

Weather records come in many sizes, but filing them in series has not generally presented serious problems. It has, however, necessitated the use of some oversize shelving. During the first years of our existence, eight-foot uprights were used exclusively. Some of our storage areas will permit only this height, but we are installing shelving to 12 feet where the ceiling height will permit.

The use of a greater-than-usual number of box sizes has also been necessary and these boxes have been made to order. Despite their higher cost, metal-edged boxes are often the most suitable for active records. The use of post binders has so far been our

solution for storing some of the active serially numbered upper air records. This does not of course preclude the use of low cost record-center cartons for a considerable volume of the records.

Surface manuscript and some upper air records have a particularly high reference rate during the first few years, especially for use in litigation or in connection with insurance claims. These records are filed, when received and indexed, in a temporary staging area for the calendar year, where they are available for quick reference. At the end of the calendar year they are, except for a quick check to verify completeness and proper order, ready for microfilming, if scheduled, and for subsequent transfer to permanent storage.

Even at the present rate of growth of 2½ million documents a year, our holdings will double in 20 years. This takes into consideration present conventional observations only. The present TIROS series of meteorological satellites, although experimental, has resulted in an impressive record output. The NIMBUS spacecraft, soon to succeed the TIROS series, will be primarily a research and development satellite; the Weather Bureau will make operational use of the data in weather analysis and forecasting. This and other meteorological satellites will create records at phenomenal rates. We are hastening to get our house in order.

What are we doing about this records explosion? Providing more compact storage for the original documents is always a good place to begin, and we are doing this with good results. Because of limited space in Asheville, some records have been transferred to the Federal Records Center at East Point, Ga. What about outright disposal? The present retention periods for most of the records vary from 5 to 30 years with the stipulation that they be microfilmed before disposal. Microfilming is a matter of dollars and cents. With the proper storage facilities, records can be stored for many, many years before the cost of storage will equal the cost of microfilming. Less than 10 percent of the manuscript records (all of which are in the 30-year category) are yet 30 years old. Records made by self-recording instruments become virtually impossible to use when reduced to conventional microfilm. Statutes of limitation do not apply to this type of technical record. Disposal cannot necessarily be on a chronological basis. Space-age research has resulted in a high reference rate on some series that had not been active in years. We are faced with many unknown factors.

We have a very high regard for microfilm. We have an active microfilming program with a staff of 12 and a microfilm library of 62,500 reels. The more active series that lend themselves readily

to conventional microfilming are microfilmed routinely on a calendar-year basis. We have used both 16mm. and 35mm. microfilm for years. The primary objective from a service point of view is to enable us to provide, at low cost, duplicate microfilm of the records to researchers. Security against loss or destruction of the originals is equally considered, and a copy of some of our currently microfilmed records is sent elsewhere for reference and security. Some microfilm is stored underground.

Conventional roll microfilm has its limitations. It is impossible to organize data on roll film in a manner adequate for their use in varied types of technical investigations. One method of unitizing roll microfilm is to cut the film into short strips and to insert these strips into clear plastic jackets, using a semiautomatic jacket loader. The film in the jackets is easy to view, and paper enlargements can be prepared quickly by means of a recently developed film-jacket printer. The operational development of this new method is underway.

An automatic document-feeding 70mm. microfilm camera that places several small images across a 70mm. film, resulting in a film negative similar to a Microcard, has been built. This camera has been named MIMIC (multiple image microcopy camera). Testing of this camera is now also being done at Asheville.

All aspects of the filming effort are being accelerated. Reduction of punched cards to microfilm as a medium for machine processing has been made practical by the development of a Film Optical Sensing Device for Input to Computers (FOSDIC). By this method 13,000 card images can be placed on a 100-foot roll of 16mm. film at a rate of 420 cards per minute. Some of the punched cards have been transferred to magnetic tape for very compact storage and use by electronic computers.

In a service organization such as ours duplication of records is of primary importance. During the fiscal year ending June 30, 1962, the NWRC furnished 768,300 feet of duplicate microfilm and 343,000 hard copies (principally photocopies, Ozalid and Xerox copies, and enlargements from microfilm) in answer to requests. Reference services approached 300,000. Certification of copies of records for use in litigation exceeded 8,000. Had it not been for the availability and distribution of 548,000 back issues of climatological publications, which contained all the information some inquirers needed, we would have been hopelessly swamped.

Most of the weather records created under Federal authority have miraculously survived. Some very valuable early records,

however, have been lost to posterity as a result of fire, floods, earthquakes, and neglect. And our knowledge of weather conditions in the United States before the establishment of an effective Federal weather service is very limited. We believe that fairly homogeneous climatological values can be developed for climatologically homogeneous regions by using records kept by private individuals, some from the Colonial period. The prime requisite for such a venture is a bibliography of meteorological observations—as complete as possible. A recent bibliography of early weather observations in the United States[2] listed 80 such records. About an equal number have been deposited in the NWRC from various sources, including Harvard and Johns Hopkins Universities and interested citizens. In a number of cases we have arranged to borrow valuable records for microfilming; in others we have obtained a microfilm copy.

We must vigorously collect, meticulously identify, and carefully preserve, in usable form, the records that will assist the climatological historian in unraveling the climatic mysteries of the past and provide guidance to programs of the future. The operational advantages of the centralization of this body of scientific observation has been demonstrated for a decade. The safety of this national—this *world*—asset is of great concern. Most of the records are, at present, irreplaceable. Duplicate storage of a film copy of every significant record would greatly decrease the present vulnerability of the collection. Acceleration of microfilming and disposal of many of the originals would conserve space and money.

The global aspects of this unique collection of scientific data have become increasingly apparent with the accessioning of the data from meteorological satellites. Very little is yet known about the space environment. Our work has just begun.

[2] U. S. Department of Commerce, Weather Bureau, *An Annotated Bibliography of Meteorological Observations in the United States, 1715-1818* (*Key to Meteorological Records Documentation* no. 5.11; Washington, 1958).

Alas, what boots it with incessant care
To tend the homely slighted archives trade
And strictly meditate men's written views!
Were it not better to computers use,
To sport with punchèd-cards in vacuum shade
Or see magnetic tapes in tangled hair?

—J. MILTON