The History of the Atmospheric Sciences in Iowa

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The development of the atmospheric sciences in Iowa began in a very simple manner, with the entry of the earliest meteorological and climatological observations into logs, journals, and private correspondence and the recording of weather proverbs and lore. These simple environmental records provide virtually all our historical meteorological knowledge until the U.S. Army forts began their systematic, but often short-term (in number of years) daily record of weather in 1819.

Not until 1838 did a private Iowa citizen, the renowned professor Theodore S. Farvin, begin a continuing daily record of weather observations at Muscatine. His was the first climatological gift of service by an Iowan to Iowa, which was later to be duplicated by thousands of Iowans in the years to follow. His 35 years of creative climatological endeavor set the stage for the creation of the Iowa Weather Service in 1875 by another equally brilliant Iowa professor, Gustavus Hinrichs. The Iowa Weather Service, the first state weather service created west of the Mississippi River and now the oldest continuing state weather service in our nation, is also celebrating its centennial in 1975. The Iowa Weather Service functioned alone until it joined with the federal National Weather Service in 1890, to rapidly advance the agricultural climatology and meteorology for our nation—and later joined with Iowa State University and other higher institutions from whence scores of now famous atmospheric scientists have spread around the world.

PRE-INSTRUMENTAL RECORD

Written references to Iowa climate were few prior to 1819. One of the earlier inferences about Iowa’s climate in the fur trading era prior to instrumental record was presented by the second director of the Iowa Weather Service, J. R. Sage (1907), in an article in the Cedar Rapids Republican mentioning that “early records of Jesuits and fur traders from Canada among the Sioux Indians indicate that the winters then were about as they are now.”

During this same era, Benjamin Franklin, George Washington and Thomas Jefferson were among those recording or advancing the meteorological knowledge of this nation. Thomas Jefferson, who daily recorded the weather for 40 years (1776-1816) in his Garden Diary, instructed Lewis and Clark prior to their famous expedition to the west coast to record the environmental information along their route, which included western Iowa.

From their log we find the earliest known mention of an Iowa tornado entered on June 29, 1804, as they toiled up the Missouri River past the present boundaries of southwestern Iowa. The entry:

On the S.S. passed much falling timber apparently the ravages of a Dreadful haricam [tornado] which had passed obliquely across the river from N.W. to S.E. about twelve months since, many trees were broken off near the ground the trunks of which were sound and four feet in diameter.

EARLY IOWA WEATHER RECORDS

The first systematic daily weather observations in the midwest included Fort Calhoun near Council Bluffs, Iowa, along with Fort Snelling, Minnesota, both begun in October, 1819. The Army Register (1830) described the action thus:

In 1819 under the direction of the then Secretary of War, a system of meteorological operation was commenced and zealously prosecuted by the late Surgeon-General [Lowell]; but as the instruments provided never exceeded a thermometer and a rain-gauge, the observations, including those upon the course of the winds and other states of weather have necessarily had a limited range.

Army post records by location and dates of weather data in and near Iowa (Sage, 1890) used to determine our early climate include:

Council Bluffs, Ia. 1819-1826 and occasionally through 1843
Fort Snelling, Minn. 1819-1855
Prairie du Chien, Wis. 1822-1825, 1829-1845
Fort Armstrong (Rock Island, Ill.) 1824-1835
Fort Des Moines, Ia. 1843-1846
Fort Atkinson, Wis. 1844-1846
Fort Dodge, Ia. 1851-1853

According to Blodget (1857) at “Engineer Cantonment” located three miles southeast of the point called “Council Bluff,” daily temperature readings were begun on October 22, 1819, and taken thrice daily, at 7 a.m., 2 p.m., and 9 p.m. The average of the three daily readings compares with the present method within about one degree.

The hospital surgeons kept the records because of the initial order issued May 2, 1814, by Surgeon-General Dr. James Tilton that in each case “He shall keep a diary of weather.”

In 1817, Josiah Meigs, Commissioner-General of the Land Office, began a system of observation at land offices. The Patent Office also gathered some data, and in 1849, Professor Joseph Henry of the Smithsonian Institution established an extensive network by supplying instruments to telegraph companies. The appearance of telegraph in 1845 made meteorology a practical science. Iowans from some 20 or more localities contributed climatological data to the Smithsonian network. James P. Espy, who served as the first governmental

1 Former state climatologist of Iowa. Present address: TF 2 JSC-NASA, Houston, Texas 77058.
meteorologist from 1842 to 1857, aided the Smithsonian Institution in the creation of this, the most extensive network to date in the nation, until its deterioration during the Civil War.

During this same era, New York operated our nation's first state weather service, with some 30 weather observers, from 1825 to 1850. Similar but smaller programs were begun in Pennsylvania in 1837 and Massachusetts and Ohio in 1849, but those were of relatively short duration (U.S.D.A. Weather Bureau, 1894a).

To the Honorable Theodore Sutton Parvin (1807-1901) we may confer the title of Father of Iowa Climatology. He arrived in Iowa on July 4, 1838, according to Josiah P. Walton (1899), to serve as the private secretary to the newly appointed governor of the Iowa territory, Robert Lucas. Mr. Parvin's weather records began on December 1, 1838, at Muscatine, where he continued them until his move to Iowa City in October, 1860. He continued his daily record until April, 1874, at Iowa City, in addition to his professional duties at The University of Iowa. J. P. Walton, one of his weather observer successors, typically continued the record from 1863 to past the date of his article in 1899. Professor Parvin read his thermometer three times daily, reported cloudy, clear and partly cloudy days, reported precipitation measurements and in 1850 purchased a barometer.

Professor Parvin is also remembered for having selected the books for Iowa's first library, and for founding the Iowa Masonic Library, located at Muscatine in 1844, but later in Cedar Rapids.

Following Parvin's lead at Muscatine, other weather sites were begun in Iowa during the 1840's and 50's. The U.S. Patent Office and the Smithsonian Institution (1864) listed early Iowa weather sites with beginning dates or tenure if short as follows (county in parentheses): Bellevue (Jackson), 1850; Border Plains (Webster), 1856-59; Burlington (Des Moines), 1859; Camanche (Clinton), 1856-58; Clinton (Clinton), 1856; Davenport (Scott), 1859; Dubuque (Dubuque), 1851; Fairfield (Jefferson), 1855; Fayette Village (Fayette), 1859; Forestville (Delaware), 1859; Fort Madison (Lee), 1848; Franklin (Buchanan), 1856-59; Iowa City (Johnson), 1856; Keokuk (Lee), 1854; Lyons City (Clinton), 1859; Maquoketa (Jackson), 1857; Mt. Vernon (Linn), 1855-57; Muscatine (Muscatine), 1838; Pella (Marion), 1854-56; Poulbney (Delaware), 1854-58; Quasuqueton (Buchanan), 1857-59; and Rossville (Allamakee), 1857-59. In addition to this listing, additional records were available from Monticello, 1854-1906; Hopkinton, 1852-1895; Farmersburg, 1845; and Sioux City, 1857. During the 1860's the Smithsonian Institution also acquired data beginning in 1861 from Independence, Iowa Falls, Logan, Algona and Mt. Vernon, in 1863 from Mt. Pleasant and Iowa Falls, in 1864 from Orono, in 1865 from Clarinda and in 1869 from Sac City, Ames and Newton.

Since 1873 the climatological site density was deemed sufficient to determine the Iowa climate in terms of measured temperature and precipitation. State snowfall values begin in 1892.

The bill officially creating the National Weather Service was signed on February 9, 1870, by U. S. Grant. The bill had been introduced in 1869 by Congressman H. E. Blaine (Wis.), a friend of the scholarly Smithsonian observer Increase A. Lapham, to provide for an agency to predict storms and issue coastal warnings. In 1873 a river stage and flood warning service was begun by the U.S. Army Signal Corps Weather Service.

IOWA WEATHER SERVICE

At about this time Iowa's own Professor Gustavus Hinrichs had conceived the need for an Iowa Weather Service, which he established on October 1, 1875, with sixty observers, a revival of the state weather service and the largest of its kind in the nation thus created to date.

The colorful and versatile creator of the Iowa Weather Service, Gustavus D. Hinrichs (1836-1923) was born and educated in Denmark. He arrived in the United States in 1861. His first position came as head of the newly created department of Modern Languages at The University of Iowa. In 1863 Dr. Hinrichs became professor of philosophy, chemistry and physical sciences. In 1871 he became professor of physical sciences and director of the laboratory, until his strong will and forceful opinions created dissention that led to his departure from the University of Iowa staff in 1886.

Professor Hinrichs was a "brilliant and gifted educator who pioneered in many fields." According to the Iowa City Press-Citizen (1953) he was the second college professor in the United States to establish a physical laboratory for students in which they could experiment, and it was during his tenure that The University of Iowa was recognized as having one of the four leading science laboratories in North America. In his lifetime he wrote some 300 publications including 25 books.

When the medical faculty was chosen in 1870, he was one of the original eight members and served as professor of chemistry. The University of Iowa medical historian observed that "in 1872, 290 out of 400 students in the university were registered in his courses. The champions of the classical curriculum grew envious and with the accession of President Thatcher, the scientific course was relegated to a secondary position." His interests ranged across the entire scientific gamut, for his works extended across chemistry, toxicology, astronomy, physics, meteorology, and geology. It was from this meteorological base that he began his own weather observations in Iowa City in 1873 and proceeded to become the father of the Iowa Weather Service.

Almost immediately he established the Central Weather Observatory, first on campus, but later in 1876 in his own home, which was designed to house both his family and Hinrichs' observatory. The formal organization came in August, 1875, when Professor Hinrichs issued his call to "friends of scientific work . . . to secure as complete a history of the weather of Iowa as possible in order to furnish material for an exhaustive study of the climate of our state. On the first day of October, 1875, actual and regular observations were begun at sixty stations, distributed over all parts of Iowa, though closest together in the more densely populated parts of the state." Dr. Hinrichs described his corps of volunteer observers as largely physicians, but coming from many walks of life, willing to provide without compensation thrice daily observations (8 a.m., noon and 8 p.m.). Professor Hinrichs spent his own money and time to create and operate the service. Within a few months after the establishment of the Iowa
Weather Service, the observers bore their own share of the operating expense, for weather was important to them. The observers reported promptly to the Central Weather Observatory in Iowa City no less than three times monthly. Professor Hinrichs issued the reports about Iowa weather between the fourth and seventh of each succeeding month to the Iowa newspapers, "long in advance of the monthly reports issued in Washington, and [which] at the same time, are naturally much more complete so far as our State is concerned" (Iowa Weather Report, 1876).³

Without official recognition or support, the Iowa weather data, so carefully analyzed by Professor Hinrichs, accumulated at the Central Observatory. However, John R. Shaffer, Secretary of the Iowa State Agricultural Society, requested of the Board of Directors of the Society that the 1875-76 annual report of the Iowa Weather Service be published as an appendix to the State Agricultural Report for the year 1876. The 1877 Annual Iowa Weather Service report was likewise appended to the State Agricultural Report for that year. In the 1877 report Dr. Hinrichs commented upon the considerable expenditure of his own labor and money which he said would be imprudent for him to continue even if possible.

In 1878 the sought-after state support was extended by the 17th General Assembly in the establishment of the Iowa Weather Service with the Central Observatory in Iowa City; Professor Gustavus Hinrichs was named its first director. The act, signed on March 15, 1878, by Governor John H. Gear, also provided "one thousand dollars annually, or so much thereof as may be necessary, for the purpose of meeting the actual expenses in carrying out the provisions of this measure, but no part of said sum shall be used in payment of salaries to any officer or officers, except for clerk hire and only upon the order of the said Director" (Iowa General Assembly: Acts 17:38-39, 1878). The act also specified that the director's duties included the establishment of "volunteer weather stations throughout the state and to supervise the same." Thus the tradition of free weather observations for the state was perpetuated with that act. Dr. Hinrichs also served as the state director without salary throughout his tenure, which lasted until 1889. Because of the diversity of Professor Hinrichs' interests and abilities, the Iowa Weather Service printed earthquake data, magnetic observations and astronomical phenomena in addition to weather data. Professor Hinrichs also observed maximum solar radiation, sunspot numbers and ozone at Iowa City.

National Weather Service

With the establishment in 1870 of the National Weather Service as an arm of the U.S. Army Signal Corps came an emerging nationalized service. The federal service began weather forecasts and observations in 1871 at Keokuk (July 15) and at Davenport (May 24). On July 10, 1873, Dubuque began operation, and on September 30, 1874, Burlington began taking observations for the U.S. Army Signal Corps Weather Service. On August 1, 1878, the Des Moines station was established, and on July 1, 1889, the establishment of a federal station at Sioux City brought the number of Signal Corps weather offices to six. The Signal Corps began utilizing the Smithsonian observers and enlarged their network of weather observers in addition to creating a network of storm reporters. In time, conflict between the state and federal services arose, with Gustavus Hinrichs declaring that the federal service was enticing the state observers away from his network (also without payment for observers), and that the federal weather forecasts were inaccurate. His differences surfaced more often in his later years while he served as the Iowa Weather Service Director.

Professor Hinrichs described the service and some of his problems in the Fifth Biennial Report (1887):

The Iowa Weather Service has been in continuous operation for over twelve years. ... When starting this service, there was nothing of the kind in the United States. We had to plan and invent methods. After a few years of work, six other states organized after our plans, mainly through the influence of public spirited men of science, such as my former student and assistant, Professor Francis E. Nipher of Washington University, St. Louis (Mo.). The national weather bureau remained for years, indifferent, if not hostile, to this work of climatological study.

Gustavus Hinrichs narrated further that he had differences with the Signal Corps, that he had made great personal sacrifices in relinquishing his remunerative program in chemistry and toxicology to produce the Iowa Weather Service with all its hard work, no vacation, and reduced living space as records overflowed the observatory annex into his own home.

The U.S.D.A. Weather Bureau International Congress (1894b) noted the creation of the Iowa and other state weather services thus:

The Iowa Weather Service ... was a revival of state weather services as had existed before in New York and Pennsylvania and had been attempted in Massachusetts and Ohio. After the creation of the U.S. Signal Corps Weather Service several state weather services came into existence following Iowa's Weather Service.

The State-Federal Weather Service

On April 25, 1890, Governor Boies approved an act by the Twenty-Third Assembly to create the Iowa Weather and Crop Service, to cooperate with the National Weather Service, under the direction of the directors of the State Agricultural Society. The Central Station was relocated in Des Moines and the new director, J. R. Sage, was commissioned by Governor Boies on June 3, 1890. George M. Chappel, M.D., was detailed at the same date as the assistant director by General Greely, Chief of the U.S. Army Signal Corps office. Sgt. Chappel had previously arrived from Omaha to direct the Signal Corps weather station in Des Moines on August 5, 1888, and soon relieved Sgt. P. Connor, who later became well known as the official weather man in Kansas City, Missouri.

At the creation of the joint state-federal weather service for Iowa, thirty other states joined in similar cooperation. Only Iowa has continuously maintained that cooperative arrangement to 1975.

Dr. Chappel was listed in the U.S.D.A. Bulletin 7 (1893) as the elected second vice president of the permanent officers of the American Association of State Weather Services held in Washington, D.C., on August 15 and 16, 1892.
Iowa's first crop reporting service was begun by Sgt. Chappel beginning in April, 1889, prior to the official federal-state cooperation.

J. R. Sage served as director of the Iowa Weather Service until December 31, 1907, resigning then due to ill health; Dr. Chappel officially became Iowa's third director of the Weather Service on January 1, 1908, and fittingly the second director of the combined Weather and Crop Service which he had begun nearly 19 years earlier.

In 1889 the initial preliminary cooperation began under the direction of the U.S. Signal Corps observer George M. Chappel of the Des Moines Signal Corps station and an aide of Secretary J. R. Shaffer of the State Agricultural Society. Voluntary observers in nearly every county began collecting weather and crop reports from all parts of the state, the substance of which was embodied in weekly bulletins published and circulated during the crop season for the benefit of producers and consumers. The Twenty-Third General Assembly passed an act establishing the Iowa Weather and Crop Service, the scope and purpose of which are set forth in chapter 29, session laws 1890.

During the Sage era the federal cooperator changed from the U.S. Army Signal Corps to the U.S. Department of Agriculture on July 1, 1891, in response to a bill signed by President Benjamin Harrison on October 1, 1890. Some policies were immediately changed, which included deleting the tornado forecasting service operated by Jno. P. Finley, U.S. Army Signal Corps. The prohibition was imposed against tornado forecasting, a stance which continued until nearly 1950.

In 1895 the total number of weather observers was 104 and weather-crop observers 78. About 900 crop correspondents provided information. In that same year weekly weather and crop bulletins were mailed to some 1,600 locations including newspapers from April 1 through October 1. During 1895 some 29,000 copies of the Monthly Review of Weather were printed. The service continued to grow. In 1895 forecasts were telegraphed to 112 locations and distributed therefrom by mail to about 1,000 post offices in Iowa. In 1902 mention is made in the Annual Report of the Iowa Crop Service that about 7,000 farmers were now receiving daily weather forecasts by Rural Free Delivery. By 1906 "about 95,000 patrons of rural telephone lines were receiving forecasts before noon of each working day. This service appears to be highly appreciated by the general public in towns and in the country districts" (Iowa Weather and Crop Service, 1906).

Regarding weather forecast by telephone, the Fort Madison Democrat observed (1906) that of the total 222,325 instruments in Iowa according to the first census of telephones in Iowa, 104,524 were rural (farmer's) instruments. It proceeds further that:

During the past few years the Government Weather Service has arranged for the telephone distribution of forecasts, and a large percentage of these farmers now receive by telephone every morning the forecast of weather for the coming thirty-six hours. This, in fact, has been one strong incentive for the installation of telephones in the homes of farmers of the state.

In 1910 the State-Federal Weather Service, now under the directorate of George Chappel, reported a weather forecast distribution to 177,711 homes daily; 171,389 by telephone, 4,189 by R.F.D., 142 by telegraph and 1,993 by ordinary mail service.

In 1912 specialized frost warnings were issued by arrangement with the Iowa State Horticultural Department during the fruit blossoming season to all orchardists who were prepared to use heaters in case of injurious temperatures. This cooperation was continued each year through at least 1915. In 1916 Dr. Chappel traveled to the New York weather office to interview their first assistant, Charles Dana Reed, for the position of first assistant and meteorologist. When C. D. Reed arrived during late 1916, he increased the staff to six persons. Other employees included Edward McGann and Carl Hadley, assistants; Ruby Sage, stenographer; and Joseph Franford, messenger.

On April 1, 1918, C. D. Reed became the section director and the fourth director of the Iowa Weather Service. In the quarter century of service following he was to become one of the best known persons in Iowa while achieving considerable stature and reputation as an excellent scientist—although not as versatile as the famous "boat-rocking" Gustavus Hinrichs. Under Reed's direction the State-Federal Weather Service began several agriculturally related research and service programs that accelerated Iowa's progress.

The Iowa Weather and Crop Service Annual Report (1919) described Reed's first major adjustment in the consolidation of the state and federal crop reports into one Iowa report under his direction. Mr. Frank S. Pinney, U.S.D.A., became the agricultural statistician for Iowa. In the following year (1920) the staff totaled eight: four supplied by the U.S. Weather Bureau, two supplied by the U.S. Bureau of Crop Estimates and two by Iowa for the Iowa Weather and Crop Division, which was increased to four in 1921.

In 1921 C. D. Reed began the corn phenology program, later to become world famous, for the numerous studies of this relatively unique data base continued into the mid-1950's. The operational weather service continued to expand through the creation of a special Highway Weather Service in 1919 by the Weather Bureau in Charles City, which was adopted during part of 1920 in other Iowa Weather Bureau offices. During this same period frost warnings were issued to concerned orchardmen at fruit blossom time.

Early in June, 1922, radio telephone distribution of weather forecasts based on the 1 a.m. observations were begun by the Electrical Engineering Department, Iowa State College, Ames, at 9:30 a.m. and 12:40 p.m. Forecasts were also broadcast that same year from WEAB (Fort Dodge), WKAA (Cedar Rapids) and WEAF (Sioux City).

On July 1, 1923, at the creation of the State Department of Agriculture, the Iowa Weather Service became a bureau in that department.

C. D. Reed was responsible for the computation of the Iowa weather temperature and precipitation as a state-wide value back through 1873. He also computed divisional averages, available since 1890, in the same nine divisions as are presently in use. He described his careful evaluations and use of data with such necessary corrections in the Monthly Weather Review, June, 1925.

Reed continued to publish, primarily in agricultural meteorology. His article, "Weather and Corn Maturity in Iowa," in the Monthly Weather Review (1927) was often referred to in subsequent studies by others.

In 1928 C. D. Reed began the corn moisture testing program that continued until the mid-1950's. In the same year
he began routinely issuing climatological data for the same nine districts used for the crop reporting service. The year 1928 was noteworthy for a total of 45 tornadoes—such a complete account was available because of the excellent storm climatology program which emphasized hail and tornado research.

On October 1, 1929, the Weather Bureau moved to new quarters at the U.S. Court House. Nowhere else in Iowa was there such a structure of design and equipment meriting the term meteorological observatory.

Following the earlier Depression years, considerable climatological data were assembled by workers federally hired for public works programs.

In 1937 the Iowa Weather and Crop Bureau ended as one agency, as it was split on July 1, 1937, into the Iowa Weather Division and the Division of Agricultural Statistics, both reporting to the Iowa Department of Agriculture, respectively through C. D. Reed and Leslie M. Carl, senior statistician. In 1943 the Division of Agricultural Statistics was moved from the U.S. Court House to the Old Colony Building. On December 2, 1944, C. D. Reed worked his last day for the Weather Bureau; his retirement was effective on February 28, 1945, just 46 years to the day after his Weather Bureau career began at Vicksburg, Mississippi. His 28 years in Des Moines had set the meteorological stage for the emergence of a new era in Iowa—that of a growing center of agricultural climatology.

Reed's influence was such that he was considered for the post of President, Iowa State College, Ames, Iowa, being one of 15 persons listed in the Des Moines Sunday Register on December 12, 1926. Reputedly in the 1930's he was likewise considered for the position of Chief of the U.S. Weather Bureau. He was listed in America's Who's Who and in American Men of Science, and held the post of Vice President General of the Sons of the American Revolution.

In 1945 C. D. Reed became a research professor at Iowa State College, where he had previously received his B.Agr. (1894) and M.S. (1896) degrees. He died on October 26, 1945, at the age of 70, ranking with Gustavus Hinrichs as Iowa's most illustrious sons in the meteorological field. He had published extensively, but undoubtedly short of Hinrichs' hundreds of publications.

IOWA METEOROLOGICAL EDUCATION AND RESEARCH ERA

In the 1940's Iowa moved into the academic area of meteorology and climatology to support the need for World War II meteorologists as provided by various Iowa colleges and universities. Iowa State College joined with the Iowa State-Federal Weather Service to advance the state's atmospheric sciences in 1944. In addition to C. D. Reed on the Iowa State College staff, H. C. S. Thom, the newly appointed Iowa Section Director for the State-Federal Weather Service, actively participated in developing the Iowa State College graduate program for agricultural climatologists. The first of the graduates, the now world renowned Dr. Gerald L. Barger, graduated in June, 1948, followed shortly thereafter by the equally famous Professor Robert H. Shaw (now at Iowa State University). Other illustrious early graduates include Paul Waggoner, Wayne Decker and Robert Dale, from among the many agricultural climatologists originating from Iowa State University.

During the past decade Iowa State University has expanded to include a most diversified and talented meteorology staff to specialize now, in addition to agricultural climatology, in various aspects of meteorology.

Atmospheric science in Iowa would be incomplete without a passing note regarding the contribution by Dr. James Van Allen for his pioneering work at The University of Iowa in satellite development and his discovery of the Van Allen radiation belts surrounding the earth.

Applied climatology in recent years continued the impetus in this area provided by C. D. Reed. C. E. Lamoureux, director of the State-Federal Service for 22 years, provided a classical hail study that continues to serve as a valuable source. Under his direction C. Robert Elford, Iowa's first state climatologist, continued to publish applied climatological studies and served as collaborator at Iowa State University (1955-59). He was followed in the same capacity by Paul Waite, who served Iowa for 15 years with publications about agricultural, applied and storm climatology.

Perhaps one of the more spectacular contributions to Iowa's atmospheric sciences was the discovery, by Newton Weller, and testing for many years of a tornado detection method using ordinary television. The "Weller method" was publicized throughout the nation after its first successful public test in the well known Orange City tornado of September 22, 1968 (see Popular Mechanics, March, 1969; Successful Farming, May, 1969; TV Guide, August 9, 1969, and December 11, 1971; and the Des Moines Sunday Register, September 29, 1968). The method was evaluated by Gale Biggs (Iowa State University) and Paul Waite and the successful usage of the "Weller method" was reported in Weatherwise (1970). And, even though as of 1974 Weller had realized no remuneration for his invention, he did set off a substantial amount of national research in the area of electromagnetic sensing of tornadoes, including that by Scouten, Stephenson and Stanford at Iowa State University.

Finally, let it be noted that the history of Iowa's environmental past is continuing to unfold thanks to studies by such scientists as Robert Ruhe (I.S.U.) (Iowa's Quaternary landscape) and Roger Landers (I.S.U.) (inquiry into the past by study of tree rings). Scores and perhaps hundreds of other paleoscientists are patiently assembling the historical and paleoclimatology of Iowa to remind us that once dust storms laid down much of southern Iowa's topsoil, while glaciers lay over much of north and central Iowa. The recovery of Iowa's vegetation from times past tells us of the gradual warm-up after the last glaciers left Iowa some 13 or 14 thousand years ago. The clues are there and the careful, tedious work of Iowa's scientists is regularly adding knowledge to Iowa's history of atmospheric sciences, while other scientists are making history today.

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