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NOTABLE SCIENTISTS

A TO Z OF Scientists in Weather & Climate

DON RITTNER

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Facts On File, Inc.

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This book is printed on acid-free paper.

To
John F. Roach
Peru Central High School
1961–65
A science teacher who made a difference!

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Introduction

The novelist Mark Twain once said, "A great, great deal has been said about the weather, but very little has been done about it." This book is about to prove that there has indeed been a great deal of discussion about the weather and that thousands of people worldwide have been doing a great deal about it! Our current knowledge of climate and weather has been built on foundations created by a wide diversity of people from around the world during the last several thousand years.

Although many readers will only think of weather in terms of the nightly weather forecaster and predictions for the next day's conditions, the study of climate and weather is a much more complicated science today and is part of applied physics. The Egyptians and the Babylonians more than 5,000 years ago attempted to connect weather conditions with astronomical events, and the Greeks developed some of the first theories as to why weather happens and how. It was ARISTOTLE (384–322 B.C.E.) who produced the definitive work of his time by amassing the current state of knowledge in his *Meteorologica,* and which became the bible of all meteorology for the next 2,000 years. Unfortunately, the work of Aristotle and others before him was not based on solid scientific experimentation, but rather on proverbs (observations and folklore) and untested theories. Exceptions in the form of Leonardo DA VINCI (1452–1519), protoscientist–engineer–futurist, were rare, and it was not until Descartes (1596–1650) established the philosophy of scientific inquiry in the 17th century that the vise of Aristotle's work was finally loosened around the collective throat of world science.

Though Descartes and his followers had the right inclinations, they were hampered by the lack of instruments to present them with the empirical data they desperately needed. A notable exception was the work of Archimedes of Syracuse, a brilliant mathematician. Among his contributions to human knowledge was his discovery of the principle of buoyancy, whose relevance to the science of meteorology is of inestimable importance because the vast majority of all precipitation is the result of buoyant forces operative in the atmosphere. The lack of having empirical data changed in the late 16th and throughout the 18th century with the invention of instruments such as the thermometer by GALILEO (1593), the barometer of Evangelista TORRICELLI (1608–1647), and the hygrometer by Jean De Luc (1773), as well as subsequent "laws" developed by Robert Boyle, Blaise Pascal, Edmund Halley, Sir Isaac NEWTON, and others. All laid the groundwork for the real scientific pursuit of weather and climate.

During the 19th century, attention was given to learning about the forces that shape the wind patterns, large and small, and produce clouds and precipitation. With the invention of the telegraph,

engineers created communications networks through which large bodies of information could be gathered and processed. Laws were formulated, tested, and modified. Yet, it was during the 20th century that the advent of flight and the use of computers rapidly transformed the study of weather and climate into a hard science. Satellite technology allowed us to "see" and track weather in action.

The study of weather and climate has taken the big picture and broken it down into more discrete units of study, be it the size of raindrops to large convection cells, and yet, by understanding these smaller pieces of the larger puzzle that is our climate, a broader understanding of how our planet works is emerging.

The Scientists

This book is a sample of the men and women who have added to the vast database of meteorological knowledge. You will learn how more than 100 people through the last 2,000 years have contributed to this body of knowledge. What you will find remarkable is the diversity of backgrounds of those who have chosen to study the pieces of the puzzle that makes up our weather past, present, and future.

There is no "typical" scientist who has contributed to the study of weather and climate. Men and women from all walks of life, age, socioeconomic backgrounds, even educational attainment have made great strides in our understanding of the weather. I have chosen this selection of biographies to demonstrate exactly that premise. There are literally thousands from which to choose; some readers may disagree with those whom I have chosen or omitted, but all should agree that this sample proves that anyone with a desire, good-headed thinking, and perseverance can contribute to the field.

The stereotype that scientists are eccentric, highbrow, or antisocial white-robed stuck-in-the-lab individuals can be finally put to rest. Throughout these pages, you will learn how a janitor formulated some of the first ideas about the ice ages or how one contributor, so torn because his religious views could not mingle with his perceptions of aiding an evolutionist, was driven to suicide. You will read how a promising actor became instead the most revered American scientist ever or about another who was killed by a soldier while he was contemplating the answer to his theory. This book even features a high school drop out who succeeded in being the first to seed rain clouds. You will learn that contributions can exist in the form of a single theory on which others expand, or they may be the invention of a single instrument. Moreover, people have made contributions by collecting and synthesizing the work of others. No matter how small or large a contribution they made to weather and climate, each nevertheless helped make the science what it is today. Like a beautiful musical symphony, each contributes an individual note that makes up the whole composition.

The Entries

I was assisted in my selections by the help of many of the living scientists featured in this book. *A to Z of Scientists in Weather and Climate* includes important weather and climate scientists whose selection is based not only on their scientific accomplishments, but also, more important, on their life histories. My purpose in mind is to demonstrate that you can make major contributions in any field regardless of your socioeconomic background, be it the son or daughter of a farmer or one of nobility. I believe I have succeeded in that endeavor.

Entries are arranged in alphabetical order by surname, with additional information provided as to birth (and death) dates, nationality, and field(s) of specialization. This is followed by an essay ranging from 750 to 2,000 words that presents the entrant's early history, educational background, positions held, prizes and awards, and major contributions to weather and climate

studies. This, of course, takes in the entire field of atmospheric science and meteorology; entries also include those who have studied the currents and depths of the oceans as well as the effects of planetary bodies on the Earth. In essence, the book is arranged in this manner:

Entry Head: Name, birth/date dates, nationality, and field of specialization.

Essay: Essays range in length from 750 to 2,000 words. Each contains basic biographical information that includes where the subject was born, parents, educational background, youth activities and interests, positions held, prizes and awards received, and so on. However, the main focus is the entrant's main contribution to weather and climate. Names in small caps within the essays provide easy reference to other people who have biographies in this book.

In addition to the main alphabetical list, you can search for entrants by scientific field, country of birth, country of major scientific activity, and year of birth. These indexes, along with a list of weather-related websites, and a glossary are found in the back of the book. A to Z of Scientists in Weather and Climate features scientists from around the world who represent many countries. Their contributions in weather and climate come from more than two dozen disciplines that range from anthropology to physics. The oldest contributor, ARISTOTLE, was born in 384 B.C.E. while the youngest contributor, Bard Anton ZAJAC, was born in 1972.

A

☒ Abbe, Cleveland

(1838–1916)
American
Astronomer, Meteorologist

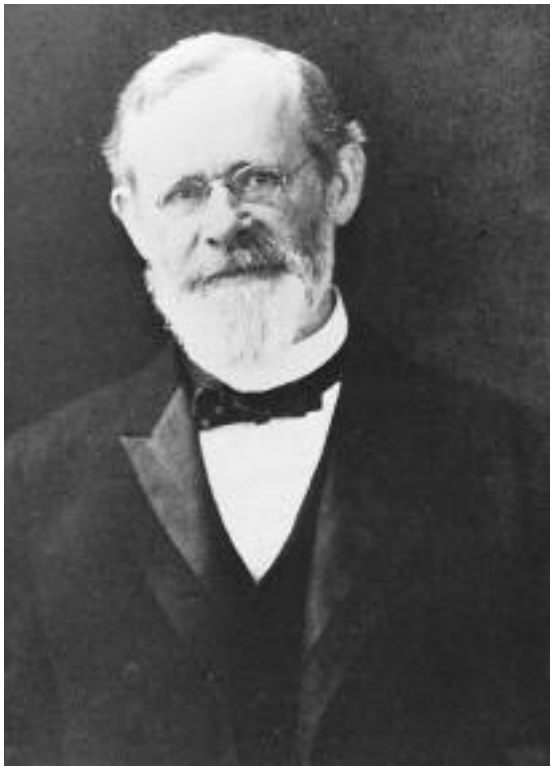
The eldest of seven children, Cleveland Abbe was born in New York City on December 3, 1838, to merchant George Waldo Abbe and his wife Charlotte Colgate. Abbe was educated at the New York Free Academy, now City College of New York, and earned a bachelor's degree in 1857 and a master's degree in 1860. He taught mathematics at Trinity Grammar School from 1857–58 and then moved on to Ann Arbor's Michigan State Agricultural College and the University of Michigan, studying astronomy under Professor Franz Brunnow and eventually teaching mathematics there.

Abbe moved to Massachusetts in 1860 and lived in Cambridge until 1864. He was not allowed to participate in the Civil War due to an eye ailment, so he worked for astronomer Benjamin A. Gould (1824–96) who assigned him to computing telegraphic longitudes for the United States Coast Survey (U.S. Coast and Geodetic Survey). Gould, the first American to receive a Ph.D. in astronomy, and Michigan's Brunnow knew each other, both having been one-time heads of the Dudley Observatory in Albany, New York, so it is possible that the job may have been arranged for Abbe between friends.

While in Cambridge, Abbe met and befriended American meteorologist, William Ferrel, at the American Ephemeris and Nautical Almanac. Ferrel later joined the Geodetic Survey, investigating the general theory of tides, and designed the first tide-predicting machine in 1882.

During the years 1865 and 1866, Abbe visited Russia and studied astronomy with Otto Struve and others at the Nicholas Central Observatory in Pulkovo, home of the largest refracting telescope in the world at that time. Struve had recently become director in 1861 after the retirement of his father, Friedrich Georg Wilhelm Struve. When Abbe returned to America in 1866, he tried to establish in New York an observatory modeled on the Pulkovo Observatory. However, the effort was not fruitful and was unable to interest anyone.

In 1868, Abbe had the opportunity to become the director of the Cincinnati, Ohio, Observatory. He expanded the scope of interests at the observatory and proposed that Cincinnati become the American center for collecting, analyzing, and publishing telegraphic weather observations from around the country and begin to forecast daily. With support from the Cincinnati Chamber of Commerce and help from the Western Union Telegraph Company, Abbe began on September 1, 1869, to publish the daily "Weather Bulletin of the Cincinnati Observatory." These telegraphic weather reports, daily weather maps,



Cleveland Abbe. Abbe was the first professional meteorologist in America and published the first telegraphic weather reports, daily weather maps, and forecasts in the country. *(Courtesy AIP Emilio Segrè Visual Archives)*

and forecasts were the first in the country. In 1870, Abbe married Frances Martha Neal. They had three sons.

The use of telegraphy in weather reports had been championed earlier by Joseph HENRY at the Smithsonian Institution, but these were generally not made available to the public. However, efforts were being generated to create a national weather service, thanks to information provided by Professor Increase A. Lapham of Milwaukee, who was providing Great Lakes weather information to Gen. Halbert E. Paine, congressman for Milwaukee. Along with the support of Gen. A. J. Myer, chief of the Army Signal Service, and the encouragement from the New York City Chamber of Commerce, the creation of a national weather service became a reality.

On February 2, 1870, a joint resolution was passed by Congress and signed into law by President U.S. Grant on the 9th:

> to provide for taking meteorological observations at the military stations in the interior of the continent and at other points in the States and Territories . . . and for giving notice on the northern (Great) Lakes and on the seacoast by magnetic telegraph and marine signals, of the approach and force of storms

The act gained little press coverage or notice. The resolution exists online at http://www.lib.noaa.gov/edocs/WeatherServiceResolution.html

The immense task was given to the U.S. Army Signal Service Corps, formed a decade earlier, and now under the direction of Gen. A. J. Myer, chief of the signal service. On November 1, 1870, at 7:35 A.M., the first meteorological reports taken in a systematic fashion were telegraphed by observers—made up of army sergeants—from 24 stations to the new Washington, D.C., based weather service, called by Myer, The Division of Telegrams and Reports for the Benefit of Commerce. This agency evolved from the "Weather Bureau," to the "National Weather Service," and now the U.S. National Weather Service.

Besides using the military, Myer turned to volunteers such as Great Lakes professor Lapham, but in 1871, he hired civilian Abbe as "Special Assistant to the Chief Signal Officer." Abbe prepared the tridaily probabilities (his word for forecasts) of storms, and eventually Abbe earned the nickname "Old Probabilities" as a result of the work. Abbe was now the first official U.S. daily forecaster and full-time civilian working for Myer for the next 10 years. His observations and analysis were extremely accurate, and he gained a reputation for being an expert forecaster, although

the new agency was not unwilling to incorporate folklore such as:

> A red sun has water in his eye.
> When the walls are more than unusually damp, rain is expected.
> Hark! I hear the asses bray, We shall have some rain today.
> The further the sight, the nearer the rain.
> Clear moon, Frost soon.
> When deer are in gray coat in October, expect a severe winter.
> Much noise made by rats and mice indicates rain.
> Anvil-shaped clouds are very likely to be followed by a gale of wind.
> If rain falls during an east wind, it will continue a full day.
> A light yellow sky at sunset presages wind. A pale yellow sky at sunset presages rain.

Much of the analysis and forecasting was on Abbe's shoulders until the signal corps could properly train observers. General Myer created the first school of meteorology, later abandoned after his death to become Fort Myer. In the early 1880s, more formal courses in meteorological instruction were designed, and Abbe taught many of the classes.

Abbe oversaw the creation and publication of the *Monthly Weather Review* in 1873 and the *Bulletin of International Simultaneous Observatories*, the latter with the cooperation of meteorologists from other countries. The corps also began to distribute forecasts, known as farmers' bulletins, to thousands of rural post offices to display in front of the post-office buildings. Twenty years later, Abbe was the editor of a much larger version of *Monthly Weather Review* that became, under his direction, one of the leading meteorological journals in the world.

Although General Myer was head of the signal corps, basic research was not a top priority for him. Yet, in 1871, when Abbe joined the corps, he initiated research projects such as the collection of lines of leveling, and by the next year Abbe figured out the altitudes of all the signal-service barometers above sea level. Abbe saw the development of a system of cautionary storm-wind signals using flags, instituted in the summer of 1871 for mariners and cities: "By means of a few flags, white, blue, and black, the probable local weather for the next day is indicated in every town and almost every telegraph and telephone station in the country, so that any one may know what to expect and prepare for." He led the research on tornadoes, humidity, atmospheric electricity, use of balloons, and thermometer exposure and created wet-bulb temperature conversion tables.

Abbe was also instrumental in developing a core research program by building a laboratory and center for research, visiting other research centers around the country, and writing complete reports about what he observed. He particularly liked the research on atmospheric electricity being directed by Henry A. Rowland at Johns Hopkins. Rowland was awarded $200 from the signal corps to help in his laboratory. Abbe also formed the Study Room, a small group of scientists at the bureau who were able to tackle individual problems such as frosts, hurricane paths, floods, and other applied problems.

By 1891, Abbe convinced Daniel C. Gilman, president of Johns Hopkins, to begin a study of meteorology and offered his private library of hundreds of books for Gilman's commitment. Under the joint auspices of Johns Hopkins, the U.S. Weather Bureau, and Maryland Agriculture College, the Maryland State Weather Service was created in May 1891. Abbe taught at Johns Hopkins in 1896, giving lectures on climatology. Abbe also helped to promote the establishment of state weather services throughout his career.

Abbe's publications, both astronomical and meteorological, total almost 300 items. He contributed to current periodicals, supplements to annual reports of the chief signal officer, and encyclopedias such as *Encyclopaedia Britannica*,