

**The Role of 19<sup>th</sup> Century Communication Technology in the Emergence of Meteorology**

*Research Project: General overview of the history, as a broad basis for a thesis*

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The study of meteorology came late to the party.

Mathematics, chemistry, physics, and medicine flourished in the age of the Enlightenment, buoyed by scientific academies and societies, developed under the guidelines of the scientific method, and embraced by a population that was becoming increasingly literate. For meteorology, however, there is a vast gulf of relative inactivity between Aristotle's studies (and frequently incorrect conclusions) on the subject in the 4<sup>th</sup> century BCE, and the rise of the scientific method in the 17<sup>th</sup> century ACE. Even then, though the 17<sup>th</sup> and 18<sup>th</sup> centuries brought about the introduction of the barometer and thermometer, and thus the meteorological scientific observations to which Aristotle was opposed, meteorology was still hamstrung by a profound inability to share relevant weather data in any kind of timely fashion.

*Those scattered few who did track air temperature and pressure... not only lacked a standardised language but they also had no outlet, no forum to share their research. Rooted in one place, able to see perhaps ten or twenty miles to the horizon, they had a flavour of their own weather, but no conception of what was going on beyond their little scientific fiefdoms. Of fronts, cyclones, cumulus clouds, lapse rates or radiation flows, they knew nothing.<sup>1</sup>*

Not only did this hinder the ability of early weather scientists to share data, it also prevented them from dispersing weather information to the general public in any kind of way that would be helpful in daily life. The notion of impacting – or improving – everyday existence with weather forecasts was, at the time, a mere pipe dream.

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<sup>1</sup> Peter Moore, *The Weather Experiment*, first section "The Weather Experiment."

The 19<sup>th</sup> century saw a whirlwind of evolution and advancement in communication technology. Newspapers shifted their focus from partisanship to (theoretically) unbiased objectivity, broadening readership substantially. Phonography made permanent and easily accessible sounds which were previously available only in performance halls, parlors, and memory. Telephony enabled real-time vocal interaction across long distances. Photography enabled people to capture permanent, realistic representations of themselves and the world around them. And telegraphy, the great eliminator of transportation as the primary factor in communication, introduced the world to near-instantaneous information exchange from far-flung locations. Not only had technology expanded, but so too did humanity's perception of the world around them, in both time and space. As communication sped up, the world shrank.

With the reduction in the importance of space, and the increased importance of time in communication, the ripple effects were felt across commerce, politics, newsgathering... and science.

Meteorology, to this point limited in its ability to coordinate weather observations, communicate findings, and otherwise coherently advance the science, found a whole new lease on life with the introduction of telegraphy.

*During the early and mid-1800s, weather observation networks began to grow and expand across the United States. Although the most basic meteorological instruments had existed for over 100 years, it was the telegraph that was largely responsible for the advancement of operational meteorology during the 19<sup>th</sup> century. With the advent of the telegraph, weather observations from distant*

*points could be “rapidly” collected, plotted and analyzed at one location.<sup>2</sup>*

The networks to which they refer are the volunteers, organized and provided instrumentation by the Smithsonian Institution, and supported by telegraph companies across the United States. The Smithsonian used this data to create the first weather maps. Of Prof. Joseph Henry, the first secretary of the Smithsonian and the organizer of the volunteer weather observation network, meteorologist Cleveland Abbe wrote in 1897:

*There is scarcely a branch of practical or applied science that he was not able to advance; among these telegraphy and meteorology, with their applications to the benefit of mankind, stand pre-eminent... [By 1848], the telegraph companies, recognizing and acknowledging their indebtedness to him for his discoveries and inventions in electrical matters, granted him freely those daily weather dispatches that he asked for and which enabled him to be the first to demonstrate systematically the truth that Redfield, Espy and Loomis had long maintained; i.e., that through the telegraph, although then in its infancy, we had the power to predict the coming storms.<sup>3</sup>*

Abbe helped establish the National Weather Bureau in 1870, serving as the first chief meteorologist and setting a high standard for scientific research within the organization. Integral to this research were the daily observations from around the country, reported via telegraph and then dispatched to newspapers in cities from coast to coast. The reports had been published by

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<sup>2</sup> National Weather Service, “History of the National Weather Service.”

<sup>3</sup> Cleveland Abbe, “The Origins of the Weather Bureau,” 182.

newspapers for decades, to that point, but the science had not yet advanced to forecasting before Abbe entered the field. Abbe continued, recalling his childhood in the 1850s:

*In those days the New York evening papers printed a daily weather bulletin, furnished by the enterprise of the telegraph companies, which gave the temperature, wind and weather for some early morning hour at a large number of stations scattered over the whole country. Had these items been displayed graphically upon a map of the country, it would have been possible to practice daily forecasting for New York; but as this was not done by the newspapers, the readers probably picked out only a few interesting temperatures as items of news, and never realized how nearly they had in their grasp the power of predicting the weather... If those telegrams had contained the reading of the barometer in addition to the other items, and if [publisher] Merriam had charted them, as Espy and Henry were then doing, he would undoubtedly have been able to add also the prediction of storm winds and rain.*

While newspapers played their role in publishing collected weather data, scientific journals had entered the publishing fray. *Scientific American*, established in the United States in 1845, began as a weekly paper, focusing largely on inventions and happenings at the patent office, before evolving into a journal of popular science. *Nature*, established in England in 1869, initially focused on scientific innovations, eventually growing to include peer-reviewed research, explanatory and scientific journalism, and current affairs. Both journals, still in publication in the 21<sup>st</sup> century, provided a platform for scientific discussion amongst a myriad of disciplines,

including the emerging atmospheric sciences. Innovations, discoveries, and theories were reported and debated, shared amongst scientists and laypeople, alike.

Among the many advances in communication technology that caught the interest of the publishers, scientists, and readers who followed science journals in the 19<sup>th</sup> century, photography emerged as a key player in numerous aspects of meteorology. In particular, the studies of lightning, cloud formation, and tornadoes benefited immensely from the existence of a permanent visual record, capturing aspects of each phenomenon that had proved incredibly difficult to analyze with the naked eye.

But first, photography had to be taken seriously in its own rite. Hugh Stannus, Fellow of the Royal Institute of Architects and member of the Royal Photographic Society of Great Britain, noted in 1894:

*It is not so very long since photography occupied a very subordinate position in the world alike of science and of art. Scientific men looked on photography as a mere art, artists regarded it as a mere science... A large proportion of the most important contributions to photographic knowledge were not made by scientific workers, or by men who worked in scientific methods. They were obtained by practical men, seeking for results, often indeed seeking for them successfully by methods which could not have commended themselves to men better equipped with scientific knowledge. Of course, this was the consequence of the fact that photographic science was early associated with photographic practice, and the same remark hold good of other sciences, electricity for instance, in*

*which theory and application to practical use advance with equal steps; but I think it applies more to photography than any other.*<sup>4</sup>

In the early days of photography, there was no “point and shoot and send it to the lab for processing” option for photographers. The capturing of images required careful measurements of a variety of tetchy chemicals, handled and administered in environments that may not have been the most ideal. Mixing chemicals, setting shots, and handling photographic plates in dedicated studios inside of buildings was challenging enough, but scientific photography – namely, that which related to meteorology – was rarely accomplished indoors. Successfully capturing a picture was equal parts art and science, and those who were not inclined toward both had a difficult time adjusting.

As such, it took a while for photography to gain a foothold in the sciences. Once the initial barrier was overcome, Stannus declared, photography advanced not only science, itself, but also the public perception of science as a worthy venture:

*There is not a single branch of science in which photography is not largely used. There are many whose progress is now absolutely dependent on the power of the camera to observe more accurately, more independently, more minutely, more rapidly, more permanently, than the human eye... The meteorologist has been enabled by its [the camera's] aid to study the form and nature of clouds, the shape and character of the lightning flash... whenever the observer of natural phenomena requires to make an accurate*

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<sup>4</sup> Hugh Stannus, “The Scientific Applications of Photography,” 891.

*record of his observations, photography supplies the means. It also supplies the means of showing a roomful of spectators what could otherwise be seen by but a single observer at one time, and had thus rendered to the popularization of science no less a service than it has led to its advancement.*

*Scientific American* picked up on Stannus' declaration, later that year, referring to it as "an interesting account of the services of the camera in scientific research," but notably not endorsing the view:

*It is generally admitted that the camera in recording scientific observations often serves to verify results with a thoroughness which no other test can. The English writer goes so far as to say that photography, in association with the telescope and spectroscope, has placed modern astronomy on an entirely new basis. The meteorologist by aid of the camera has been able to study the form and nature of clouds, and the shape and character of the lightning flash... It further claimed that whenever the observer of natural phenomena finds it necessary to make an accurate record of his observations, the camera is indispensable.<sup>5</sup>*

Nevertheless, journal articles throughout the latter 19<sup>th</sup> and early 20<sup>th</sup> centuries bear out Stannus' observation. Numerous pieces delved deeply into the analysis of lightning photography,

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<sup>5</sup> *Scientific American*, "Value of Photography in Scientific Research," 395.

like a piece from the journal *Science* in 1888, which went into extensive detail about more than a half dozen types of lightning, based on analysis of crowd sourced photographic images from around the world. Following this analysis, there was a request for more photographs:

*The Council of the Royal Meteorological Society are desirous of obtaining more photographs of flashes of lightning, as they believe that a great deal of research on this subject can only be pursued by means of the camera, and would esteem it a great favor if any one would give them any assistance in this matter, either by sending them copies of any photographs of flashes of lightning that may have already been taken, or by endeavoring to procure them, or to interest others in so doing.*<sup>6</sup>

And a *Scientific American* article from 1918, looking back on several decades of lightning photography, noted, regarding the Royal Meteorological Society of England sending out their requests for photographs:

*About sixty photographs were secured, and an examination of them made possible the first accurate classification of the forms of lightning. In 1889 Mr. Marriott, assistant secretary of the society, published a set of rules for photographing lightning. The same year Weber, in Germany, and Hoffert, in England, independently devised a method of analyzing a compound lightning flash, viz., by the use*

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<sup>6</sup> A.F.N., "Photographs of Lightning-Flashes," 12.

*of a camera revolved slowly in a horizontal plane. This was an immense improvement upon the non-photographic methods – entailing the use of various forms of the revolving disk – which had led earlier investigators... to conclude that many lightning flashes are multiple, and had enabled them to form a rough idea of the intervals between the successive discharges along an identical path which gives such lightning a flickering appearance. Moreover, in 1889, A.W. Clayden, in England, cleared up the mystery of “black flashes” in lightning photographs by his discovery of the “Clayden effect.”*

By sourcing out to seasoned photographers around the world, and requiring adherence to a set standard of taking said photographs (a la the scientific method), meteorologists were able to utilize photography in order to secure viable, scientific data in the analysis of lightning. Photography proved itself indispensable in meteorological observation.

The early 20<sup>th</sup> century saw further advancements in atmospheric science, revolutionized by the incorporation of mathematics in forecasting, radar and satellite observations, and computer analysis. And progressing alongside these developments were radio, television, internet, and the ever-evolving art and science of photography, further aiding scientific observation and analysis, and playing their part in continuing communication technology’s intricate dance with the growth of meteorology.

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