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ART. XI.—*Historical Notes on the Systems of Weather Telegraphy, and especially their Development in the United States*; by CLEVELAND ABBE, A.M.

THE recent establishment in our own country of a national System of Weather Reports and the general interest in this enterprise, has induced me to accede to the request of the Editor of this Journal, and to offer the following notes relating to the development of the idea of storm warnings.

It was evidently possible to study with advantage, the progress of atmospheric changes only when the telegraph lines had become widely extended over the earth's surface. It was through the public press—the daily newspaper—that it first became possible to watch the hourly progress of storms, under one's own eye, and to confirm the general laws independently deduced from the closet studies of the professional meteorologist. The first mention that I find of the systematic daily use of these daily press reports, is given by Kämtz, in his "Repertorium," wherein it appears that already in 1835, he began to collate the weather reports published in the *Vossische Zeitung* of Berlin. In the subsequent history of Weather Telegraphy in Europe, I first find a suggestion by John Bell, made in 1848, at the Swansea meeting of the British Association for the Advancement of Science, that in London it was already possible to receive weather reports with only a few hours' delay, from most parts of Great Britain and Europe, and that this information ought to be utilized for the study and prediction of storms. The general press reports seem to have continued to be in

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Europe the only source of information regarding the impending weather, until Le Verrier first began to publish the *Bulletin International*. Already in 1854 he had urged the importance of systematic telegraphic weather reports, and in 1855 the Emperor Napoleon sanctioned the beginning of the undertaking: the stations from which reports were received during the first two years were confined mainly to France, but the network of stations was extended to foreign countries in 1857. In 1858 all the important cities of Europe were included, and on the 1st of January of this year began the publication of the "*Bulletin International*,"—previous to this the telegraphic reports had been distributed gratuitously, but only to the observers and others immediately engaged in the work. With September, 1863, began the publication in the *Bulletin* of the chart and the isobaric curves for Europe. During the previous six years Le Verrier had met with insurmountable obstacles to the systematic utilization of the weather reports, by disseminating predictions of storms, &c.,—but occasional warnings had been issued, and the practicability and importance of the matter had been faithfully urged by him. In this year (1863) stimulated probably by the success of Fitzroy in England, the obstacles were partly removed, and the French system of daily probabilities of weather was inaugurated. In 1865 the coöperation of the French marine was obtained, and with this year begins the series of quarterly volumes of the "*Atlas Généraux des Mouvements de l'Atmosphère*." To the preface of this volume we must refer for the fullest detail of Le Verrier's undertakings.

The storm warnings issued since 1860 by Buys Ballot in the Netherlands, and those of Fitzroy (died, May, 1865), and Babington in England (Feb., 1861, to Dec., 1865), followed upon the growing success of the French system; and the recent extension of these to India and Russia, as well as the system now being organized in Australia, need but to be mentioned. The present English system in charge of the "*Meteorological Committee*," is in some respects very different from that established by Fitzroy: it began its publication of weather intelligence in December, 1867.

While thus practical meteorology has made brilliant progress in Europe, we cannot forget that the original impulse to this success was given by the labors of our own countrymen. Franklin* is said to have been the first who strictly defined and published the general law that the storms of our Southern States move off to the northeastward over the Middle and

* Earlier than Franklin must have been Lewis Evans, who, according to Hon. T. Pownall, M. P., published in 1749 at Philadelphia, the brief statement of this general law. (See Blodgett's *Climatology*, p. 379).

Eastern States, preceded by northeastern wind and rain, and these latter followed necessarily by low barometer and westerly winds, with clearing up weather. In this we recognize the original of the generalizations of President Jefferson and Dr. Mitchell, as published in their writings, and something a step in advance of the propositions of Lavoisier, for the study and prediction of storms. (See *Atlas Généraux*, 1865, p. 13).

To Sir Wm. Reid and W. C. Redfield, (this *Journal*, 1831) is due a clear analysis of the elements of storms and the deduction of the more general laws followed by them. To the generalizations of these authors relative to the ocean storms of the Western Atlantic, Espy (*Philosophy of Storms*, 1841, and *Reports*, 1854), and Loomis (on the Storms of 1836, 1842, &c.) added others referring to the storms of our interior, and to the origin of atmospheric disturbances. To Ferrel (the *Motions of Fluids and Solids*, 1856 and 1860) we owe the most complete mathematical investigations into the general and the special movements of the atmosphere.*

However frequently the idea may have been suggested of utilizing our knowledge by the employment of the electric telegraph, it is to Professor Henry and his assistants in the Smithsonian Institution that the credit is due of having first actually realized this suggestion.†

The practical utilization of the results of scientific study is well known to have been in general greatly furthered by the labors of this noble Institution, and from the very beginning Professor Henry has successfully advocated the feasibility of telegraphic storm warnings. The agitation of this subject in the United States during the years 1830–1855, may be safely presumed to have stimulated the subsequent action of the European meteorologists. It will be interesting to trace the gradual realization of the earlier suggestions of Redfield and Loomis, in the following extracts from the annual Smithsonian Reports of the respective years.

* Meteorological studies were actively carried on by the Joint Committee of the American Phil. Soc. and of the Franklin Institute, from 1834 to 1838, Professor Espy being chairman, and were furthered by the Franklin Kite Club in the latter year.

† See *Vienna Acad. Sitzungsberichte*.

The first published suggestion that I have found is by the lamented Redfield; this *Journal*, Sept. 1846.

"In the Atlantic ports, the approach of a gale may be made known by means of the electric telegraph, which probably will soon extend from Maine to the Mississippi, &c."

The next notice and very nearly in the wording of the above, is in the Report to Prof. Henry, by Prof. Loomis. *Smithsonian Report*. 1847.

"When the magnetic telegraph is extended from New York to New Orleans and St. Louis, it may be made subservient to the protection of our commerce, even in the present imperfect state of our knowledge of storms, &c."

See also the "*Rural New Yorker*" of the following year; also the "*Boston Courier*" and the "*Philadelphia Evening City Item*," for 1848 and 1849.

1847. "The extended lines of telegraph will furnish a ready means of warning the more northern and eastern observers to be on the watch for the first appearance of an advancing storm."

1848. "As a part of the system of meteorology, it is proposed to employ, as far as our funds will permit, the magnetic telegraph in the investigation of atmospherical phenomena. . . . The advantage to agriculture and commerce to be derived from a knowledge of the approach of a storm by means of the telegraph, has been frequently referred to of late in the public journals; and this we think is a subject deserving the attention of the Government."

1849. "Successful applications have been made to the presidents of a number of telegraph lines to allow us at a certain period of the day the use of the wires for the transmission of meteorological intelligence as soon as they [certain instruments, &c.] are completed, the transmission of observations will commence."

[It was contemplated to constitute the telegraph operators the observers].

1850. "This map [an outline wall map] is intended to be used for presenting the successive phases of the sky over the whole country at different points of time, as far as reported."

1851. "Since the date of the last report the system particularly intended to investigate the nature of American storms immediately under the care of the Institution, has been continued and improved."

The system of weather reports thus inaugurated continued in regular operation until 1861, when the disturbed condition of the country rendered impossible its further continuance. Meanwhile however the study of these daily morning reports had led to such a knowledge of the progress of our storms, that in the Report for 1857, Prof. Henry writes:

1857. "We are indebted to the National Telegraph Line for a series of observations from New Orleans to New York and as far westward as Cincinnati, which have been published in the *Evening Star* of this city. We hope in the course of another year to make such an arrangement with the telegraph lines as to be able to give warnings on the eastern coast of the approach of storms, since the investigations which have been made at the Institution fully indicate the fact that as a general rule the storms of our latitude pursue a definite course."

It would seem therefore that nothing but the disturbances of the late war prevented our having had ten years ago a valuable system of practical storm warnings. Even before peace had been proclaimed, Professor Henry sought to revive the systematic daily weather reports, and in August, 1864, at the meeting of the North American Telegraph Association (see their published

Report of Proceedings), a paper was presented by Professor Baird, on behalf of the Smithsonian Institution, requesting the privilege of the use of the telegraph lines, and more especially in order to enable Professor Henry "to resume and extend the Weather Bulletin, and to give warning of important atmospheric changes to our seaboard." In response to this communication it was resolved, "That this Association recommend to pass free of charge, . . . brief meteorological reports, . . . for the use and benefit of the Institution."

On the communication of this generous response, preparations were at once made for the laborious undertaking, and the inauguration of the enterprise was fixed for the year 1865. In January of that year however occurred the disastrous fire which so seriously embarrassed the labors of the Smithsonian Institution for several following years: it became necessary to indefinitely postpone this meteorological work, which indeed had through its whole history been carried on with most limited financial means, and was quite dependent upon the liberal coöperation of the different telegraph companies.

It will thus be seen that without material aid from the Government, but through the enlightened policy of the telegraph companies, and with the assistance of the munificent bequest of James Smithson, "for the increase and diffusion of knowledge," the Smithsonian Institution, first in the world, organized a comprehensive system of telegraphic meteorology, and has thus given first to Europe and Asia, and now to the United States, that most beneficent national application of modern science, the Storm Warnings.

Having been absent from the United States in 1864-66, it so happened that I was not acquainted with the more recent plans of the Secretary of the Smithsonian as above detailed, but rather supposed that its costliness would always prevent the resumption by that Institution of this national work. In May, 1868, on taking charge of the Cincinnati Observatory, I urged in my Inaugural Report, that the practical utilization of the sciences there cultivated should be our constant care, and the desirability of storm warnings was specially indicated. This latter subject was in the same year brought by myself before the Cincinnati Chamber of Commerce, and that body at once decided to authorize me to establish a system of Reports and Predictions, at its own expense and for its special benefit.

"The Weather Bulletin of the Cincinnati Observatory" began September 1st, 1869, the previous summer having been fully occupied with preparations for this duty as well as with the labors incident to the "eclipse expedition" of the Observatory.*

* Accompanied by seven amateur assistants, I occupied the site of old Fort Dakotah, (now Sioux Falls City), Dakotah Territory. A very complete series of

Beginning with ten stations, the number was gradually increased to thirty, from most of which the experienced correspondents of the Smithsonian Institution sent me their morning observations. The dispatches being in a condensed form, allowed me to receive the fullest details, i. e. barometer; dry and wet thermometer; direction and force of wind; weather and rain-fall; kind, amount, direction and velocity of motion of the upper and the lower clouds; and remarks. The Bulletin was published in printed form at first, and subsequently by the "Rogers Manifold Bulletin Process," appearing daily (Sundays excepted), at noon. To it was appended a brief forecast of the weather that would probably be experienced at Cincinnati during the next twenty-four hours.

This was, I believe, the first systematic attempt in the United States to make the weather reports practically useful to our commercial communities. At the expiration of the first three months' trial, and while negotiations were pending with the Western Union Telegraph Company, for its permanent continuance, I, in order to prevent a break in the series, for six months maintained the Bulletin myself, receiving the dispatches gratuitously from the telegraph employées, and publishing the reports daily, including Sundays, in the newspapers of Cincinnati. The reports indeed ceased to include barometric readings, but the number of stations was much increased, and the value of the Bulletin to the general public very frequently acknowledged. In February, 1870, Mr. Armstrong, the enterprising manager of the W. U. Tel. Office in Cincinnati, undertook the daily publication (by the Rogers Manifold Map Process) of a Weather Map for the United States, and this added very much to the value of and interest in the reports. Copies of this map were regularly sent to the telegraph offices in Chicago and New York and elsewhere, everywhere meeting with favor. In May, 1870, the publication of both Bulletin and Map was undertaken by Mr. Armstrong, and continued to be issued by him until in December, when the entire service was relinquished, in view of the daily publications of the Army Signal Office.

I had undertaken this laborious work, in the confident hope that by it a local interest would be excited in the Observatory, which might possibly lead to its being better supported by the friends of science in Cincinnati: and equally had I hoped and expected thus to contribute towards the establishment

observations was secured. but the subsequent year was incessantly occupied with very imperative labors on the Weather Bulletin and a subsequent absence from Cincinnati, so that I have as yet been utterly unable to even attempt the reduction and publication of our observations. By means of a very fine six-inch achromatic and favored by a remarkably clear atmosphere, interesting and novel observations were made upon the corona, of which a brief notice was at once communicated to the editor of the *Astronomische Nachrichten*.

of a more extended and ultimately of a national system, such as those that had long been known in Europe. To this end I, in August, 1869, in behalf of the Cincinnati Chamber of Commerce, had proposed to the Board of Trade of Chicago a general plan of coöperation by which both organizations would share in the advantages expected to result from the Weather Bulletin. That body, however, through a special committee, preferred not to engage in such an enterprise, although sensible of its feasibility, unless the Dearborn Observatory should give it the weight of its authority and name; but the other duties of Professor Safford seemed to forbid this, and I was forced to forego the advantage of such coöperation. An editorial in the Chicago Evening Journal of August 13-17, served, however, to call attention to the Cincinnati enterprise.

In November, 1869, occurred at Richmond the annual meeting of the National Board of Trade. Several of the Cincinnati delegates (and especially Mr. John A. Gano, President of the Cincinnati Chamber of Commerce) had been the hearty supporters of my Weather Bulletin, and were desirous of bringing the subject to the attention of that body. Their action was, however, anticipated by that of the Hon. C. D. Holton of Milwaukee, who presented a memorial, drawn up by the Hon. I. A. Lapham. This distinguished observer, to whom I had for some time been indebted for my daily weather report from Milwaukee, was perhaps more sanguine than myself of the prospect of immediate aid from Congress, and heartily labored to impress the importance and feasibility of storm warnings upon the attention of that body. By him was drawn up the memorial presented to Congress, Dec. 14, 1869, by Hon. H. C. Paine, and the subsequent papers printed as Miscellaneous Document 10, (41st Congress). This latter paper, as well as the chart of the storm of March, 1859, published by Professor Lapham in the Chicago Bureau, served to very generally arouse public attention. The necessity for action was heartily endorsed by prominent Boards of Trade and Commerce and by eminent scientific authorities. To Mr. Paine is due the suggestion that the conduct of the service be entrusted to the War Department, and it is interesting to notice that independently of and coincident with the labors of Professor Lapham, "papers and maps in reference to the same subject were prepared in the War Department."

Congress as well as the country seemed ready for this measure, and by unanimous consent the following joint resolution was promptly passed, receiving the President's signature on the 9th February, 1870:

"Be it resolved, &c., That the Secretary of War be, and he hereby is, authorized and required 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 of the United States, and for giving notice on the northern Lakes and on the sea coast by magnetic telegraph and marine signals, of the approach and force of storms."

By a general order of March 15th, Brevet Brig. Gen. Albert J. Myer, the Chief Signal Officer of the army, was charged with the duty of the execution of the preceding law, and has therefore organized in connection with the Army Signal Office, the "Division of Telegrams and Reports for the Benefit of Commerce."

Washington, May 1, 1871.