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The Weather Forecast Center in 1888

National Meteorological Center

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The Weather Service in 1888 was in the hands of the United States Signal Service. To its offices in Washington came a British traveler, Ralph Abercromby, a meteorologist and former Army officer with keen powers of observation and a flair for writing.

This is how the Weather Service appeared to him more than 80 years ago, as he described it in his book, "Seas and Skies in Many Latitudes":

Our primary object in visiting Washington was to inspect the United States Signal Office, which organises and controls the weather-forecasting system of the Union. General Hazen, the chief signal officer, received us courteously, and, besides giving us all the information in his power, introduced us to the leading heads of departments. Much interest attaches to this office,—by far the largest weather bureau in the world, and the one that devotes its chief energies to the problem of weather changes from day to day, rather than to those questions of climate which occupy the leading place in almost all other similar organisations.

We were introduced first to Professor T. C. Mendenhall, who not only presides over the department that verifies and issues all instruments sent out by the office, but also over the laboratory, where new instruments and new methods of observation can be investigated; afterwards to Mr. Cleveland Abbé, one of the professors of theoretical meteorology, who had just completed a bibliography of meteorological publications which contains no less than 50,000 entries; and lastly to one of the most remarkable men in the United States—Professor William Ferrel.

More than sixty years ago, he, as a young man in a store out among the backwoods of Missouri, found a copy of Newton's *Principia* among a pile of old books. This he mastered, and then sent—which was then no easy matter—for Bowditch's translation of Laplace's *Mécanique Céleste*. This he also mastered so thoroughly that he eventually found employment in the Nautical Almanack Office at Washington; and more than twenty-five years ago he published a new theory of the influence of the earth's rotation on the atmosphere. This theory, after much discussion, has now been adopted in almost every country except England, and has earned for him among his countrymen the title of the "Newton of Meteorology."

We found the professor—a large, elderly, gray-haired man, with a broad-topped head, big eyes, a thoughtful face, and the unmistakable look of an American—busily engaged over the proofs of a new book in a dingy unfurnished room, where there was scarcely room for two chairs and a table. His deafness made conversation difficult; but it was delightful to listen to the simplicity and earnestness of a man who was pleased, because the only English meteorologist who had taken the new theory up, had so thoroughly appreciated the principles involved, as to detect what the professor himself felt to be a weak point in one of the applications of his system.

I also met Mr. Finley, who has made tornadoes the subject of special study for many years. For some reason or other the United States are exceptionally devastated by these destructive whirlwinds; and within its limited sphere of 200 or 300 yards across, the tornado is more disastrous than the hurricane, and is the most terrific manifestation of nature in the whole range of atmospheric phenomena. Some photographs, not only of the tornado clouds themselves, but also of the destruction wrought by them, were most interesting. The conical spout which forms the body of the whirlwind seemed sometimes to hang down from the clouds, and sway about like an elephant's trunk, and it seemed difficult to realise that so small a whirlwind could lift wooden buildings right up into the air, and even unroof and wreck a substantially built structure of brick.

In another building the instrument room of the office has been located. Here there was a large assortment of barographs and thermographs, with instruments for recording automatically the

direction and velocity of the wind, and also delicate electrometers for measuring the tension of electricity in the air. But the most interesting sight of all was the indications room, where the forecasts of weather are prepared. No one, who only reads in a newspaper a short, clear statement of the probable weather, can have any idea of the enormous amount of labour and organisation which the preparation of that brief sentence has involved.

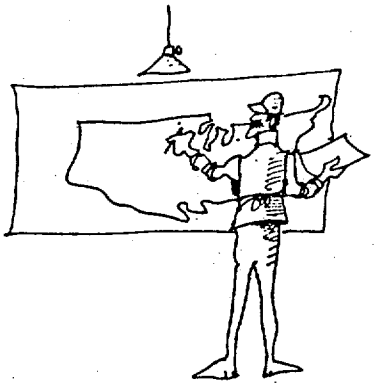
Three times a day, seventy-five men in all parts of the Union simultaneously read their barometers and thermometers, besides noting the direction and force of the wind, with the appearance of the sky and motion of the clouds.

As often, six other men are waiting in a small room in the Signal Office to receive their reports.

Number one reads out the figures for each station as they arrive through the telegraphic wire.

Number two writes the numbers down with a cyclostyle copying apparatus, so that a few copies of the original records can be reproduced and preserved.

Number three has a much more difficult task. He has before him a large outline map of the United States, and as the observations are read out for each station, he writes them down in the proper place on the map. For instance, suppose he heard called out—New York, 30.0 inches, 79°, S.W. 30, he would mark the barometric height of 30.0 inches in one coloured ink, the temperature of 79° in another colour. An arrow flying from south-west with a little 30 beside it, to denote the number of miles an hour the wind was blowing, all as near as possible where New York would be on the map. This he does for every station, and then waits for a bit to perform some other work, which we shall describe presently. This is far the most important chart; but to get all the possible use out of it, no less than six subsidiary charts have to be constructed, which requires the labour of three more men.



Number four has two blank maps of the United States on his desk before him; but instead of writing down on them what the barometer actually is at each place, he marks on one map how much the mercury has risen or fallen in the last eight hours, and on the other the amount of change in the last twenty-four hours. From these he draws, as it were, a picture of how changes of pressure are travelling across the country, or of the formation of new storms. He also draws on these two charts lines of what are called equal barometric departure, and abnormal variation; but these represent a refinement of detail that we need not explain here.

Number five has also two maps before him, and draws on them lines of equal changes of temperature, exactly as number four has done for pressure. By means of his charts it becomes easy to trace the progress of what are called hot or cold waves across the Union.

Number six likewise prepares two maps; on one he marks at every station

the kind of cloud, and the direction of its motion—which may be very different from that of the wind on the surface of the ground—and sometimes the colour of the sunset. On the other he notes the temperature of the dew point, and some deductions from that, which enable him to chart out the position of damp or dry areas of country.

Two hours have elapsed from the moment at which all the observations were taken till they have all reached Washington, and been tabulated and charted as just described; and now the indications officer makes his appearance. It is not everybody who is competent to be an indications officer of the United States Signal Office. Such a man must not only have shown some aptitude for the work, but have gone through a severe course of training for two years, in learning the theory and practice of all branches of meteorology, and in travelling about the country so as to know the local peculiarities of the wind and weather at every station.

The work of preparing forecasts three times a day, at such hours as one and nine in the morning, and two o'clock in the afternoon, is so severe that four men have to take it successively, a month at a time; and each man spends the three months he is off in visiting the different stations, and in doing other less exhausting work in the office.

But let us return to the indications room as the officer enters and finds the six charts more or less ready for his inspection. He first goes to the chart on which number three has written down the readings of the barometer and thermometer, and draws with his own hand lines, called isobars, through all places where the barometer was at the same height, say 30.0 inches, 30.1 inches, and so on; and also another set of lines with a red pencil through all places where temperature is the same, say 60°, 70°, and so on; and then he walks round the room and looks at the five other charts which are all ready for his inspection.

He is then ready to issue his indications—but why, and how? All forecasting depends principally on the lines we have called "isobars." These map out to a trained eye not only the whereabouts of good or bad weather, but also indicate the future course of wind or rain or thunderstorm. The map which the indications officer drew himself is the primary source of his forecast; the other five charts are only refined and elaborate adjuncts to assist in the formation of his judgment. No calculation is possible; everything depends on the skill and experience of the forecaster.

Some men make up their minds quicker than others; and some seem to form their judgment more by instinct, others by study. The difference between the best and worst is, however, about 13 percent; that is to say, that if the most skillful got 93 percent of success, the least skillful would obtain 80 percent of success. Lieutenant Woodruff of the United States Army was the indications officer at the time of our visit, and on looking over the verification of his forecasts for one month at one particular place, we found that he had achieved the exceptionally high figure of 93 percent of success.

As soon as the indications officer is ready he dictates his forecast to clerk number three, who sets it up with logotypes, that is with whole words in a block instead of single letters. For instance, *"Tennessee"* would be in a single block, and many other common words, such as *and, the,* etc. We might be surprised at a man setting up types to dictation, but a forecaster does not speak his carefully-considered sentences at the same rate as an orator like Mr. Gladstone, who perorates at the rate of 120 words a minute.

And now, some two hours and twenty minutes after the observations were taken, the indications are ready to be telegraphed to every city in the Union, and the officer is probably glad to retire to rest, as he will have to turn out again in the middle of the night. . . .

They told us in the Signal Office that the work of even the privates was so hard that it took all of a good man to stand the strain, and we have no doubt that such must be the case. Holidays are short, for the departmental chiefs only get about twenty days' leave in the year, and one could see the look of hard work on all. We left the office with the conviction that we were saying good-bye to a body of men who were not only striving to do their prescribed work, but, with characteristic American earnestness, were trying to excel, and to carry their several branches beyond the present limits of knowledge.