the Mediterranean in April and on the ocean in July and August, 1905.

The results obtained have confirmed our expectations and the object of the present note is to describe the method employed.

The following is the principle on which rest the launchings of sounding balloons—a principle due to Professor Hergesell:

Two india rubber balloons, unequally inflated, carry the recording instrument and a float; at an elevation fixed, with sufficient approximation in advance, one of the balloons bursts and the entire system falls until the float and the débris of the balloon have reached the surface of the sea. The second balloon carrying the instrument then hangs above the water at an elevation of about 50 meters and serves as a guide to the vessel which has constantly followed the balloon.

In case it is desired to limit the ascension to an elevation absolutely fixed, the balloon is automatically freed by means of disengaging gear operated by an electromagnet, which is actuated by a dry battery, the circuit of which is closed by the pen of the barograph when it indicates the elevation selected.

The use of either of the methods described results in giving, only for the period of the ascension, with the aid of a register, the elevation, temperature, and humidity. But these data do not suffice to give a complete knowledge of the condition of the atmosphere. To complete them it is necessary to study at different periods in the ascent the direction and velocity of the air currents. To this end the vessel follows as exactly as possible the direction taken by the balloons, while two observers on board take at fixed intervals the azimuths and angular elevation of the system. The route and the speed of the vessel being known, a simple geometrical construction enables one to trace the horizontal projection of the trajectory followed by the balloons, a projection which determines for each moment the direction and force of the air currents.

But the application of this method requires that the balloons be constantly visible from the moment of departure until the moment of their fall into the water. In the frequent case where the second balloon becomes invisible after the bursting of the first, and especially in the lower layers of the atmosphere, Ensign Sauerwein has devised a very simple method for finding the point of descent.

The course of the ship being traced in distance and direction, on any scale, upon a chart, the point of descent, if the condition of the atmosphere has not changed, is measurable from the point of departure by reference to the horizontal projection of the point of bursting, calculated according to the vertical speed of the system. It is sufficient, therefore, as soon as the balloon is lost to view, to sail to the point thus determined.

If the investigation is limited to the direction and velocity of the air currents, it is sufficient, according to the method of Professor Hergesell, to launch an india rubber pilot balloon, the trajectory of which is determined, similarly, by sighting, the elevation being deduced from the vertical velocity, which is a function of the ascensional force, following a formula established by preliminary experiment.

By means of this method there have been made on board the yacht *Princesse Alice* 26 ascensions, eight in the Mediterranean and eighteen in the region in and north of the trades. The maximum elevation attained was 14,000 meters above the Atlantic; and several balloons have exceeded 12,000 meters. The results of these ascensions and of the kite ascensions made in 1904–5 will form the subject of a publication by Professor Hergesell.

WEATHER BUREAU CIPHER CODES.

By Prof. E. B. Garriott.

The first cipher code used by our Government weather service for the telegraphic transmission of meteorological observations consisted of lines of figures that indicated the readings of the various instruments, and denoted, by series of numbers, the names of stations of observation, the direction and force of the wind, state of the weather, and the kind and amount of clouds. Twenty figures were employed to send the morning, and ten figures to send each afternoon and night observation, the figures for clouds, relative humidity, and rainfall being omitted in the afternoon and night reports. A calm and an absence of upper or lower clouds was indicated by the word "naught", and the word "blank" was used to indicate that upper or lower clouds were hidden, the words in each case being entered in the places assigned to the figures that ordinarily represented these elements.

In 1871 a cipher code[1] was adopted by means of which a full report was transmitted in ten words. By this system one word was used for the name of the station, and one each to encipher the height of the barometer, air temperature, relative humidity, wind velocity, rainfall, and day of the month and time of the observation, one for the direction of the wind and the state of the weather, and one for the kind, amount, and direction of movement of the upper, and lower, clouds, respectively. The code also contained words for reporting river stages.

During the succeeding seventeen years various changes were made in the code, the most important of which provided for a separate set of barometer words for the three daily reports, the words for the morning, afternoon, and night reports beginning with M, E, and N, respectively. During the entire period, however, the code words were arbitrarily selected and an expeditious deciphering of the data required that a large number of words, and their equivalents, should be memorized.

The code used since 1887 was devised by Gen. A. W. Greely, and by its use an average of six words is required to transmit a report of a meteorological observation. The code is known as a "key" code, and has for a base the consonants b, d, f, g, m, n, r, s, t, representing 10, 20, 30, 40, 50, 60, 70, 80, and 90, respectively, and the vowels a, e, i, o, and u or y, representing 2, 4, 6, 8, and 0, respectively. The consonants b to s are also used to indicate the eight directions of the wind beginning with b for north, d for northeast, etc., and the vowels also indicate the condition of the weather, a indicating fair, e cloudy, i rain, o snow, and u or y clear. Each syllable of the words of this code represents by the first consonant and the following vowel one or more meteorological elements. The meaning of a word depends upon its place in the message. Thus the first code word after the name of the station gives the pressure and temperature. The word "seldom", for instance, when written as the first code word of a message, indicates the height of the barometer and the temperature of the air; the first consonant with the first vowel, s and e, represent 84 for the barometer; the second consonant with the vowel following in the second syllable, d and o, represent 28, for the temperature. The height of the barometer, to the nearest whole inch, is, as a rule, apparent from the readings on the last map or at surrounding stations of observation. In another position in the message the first syllable of the word would indicate the direction of the wind and the state of the weather, e. g., s indicating northwest, and e cloudy, and the second syllable would indicate the reading of the maximum thermometer, 28, as shown by the letters d and o.

Adaptations of this code have been employed in transmitting reports of the Weather Bureau River and Flood Service, in telegraphing weather reports for the Climate and Crop Service, and in cabling reports from the West Indies, Europe, and some islands of the Atlantic. The latest adaptation provides for a transmission to Washington of reports received by wireless telegraph from vessels at sea, and furnishes in four or five words the position, in degrees of latitude and longitude, of a

[1] Modelled after the cipher code printed in 1869 for use by the Cincinnati observatory.—Ed.

reporting vessel, and the essential data of a meteorological observation.

The particular advantage of the code is found in the rapidity with which it can be deciphered, and in the economical conduct of the great amount of Weather Bureau telegraphic business that its use permits. The first code required twenty words, the second ten words, and the present one six words for a report of a meteorological observation. In the beginning telegraphic rates were 6 to 9 cents a word for each circuit, they are now 2¼ to 4 cents a word. By the present cipher system and telegraphic rates the two daily reports now telegraphed cost less than one-half the amount that would be required to conduct the same service under the original system. Improvements in the cipher codes and reductions in telegraphic tolls have for years saved the Government more than $100,000 annually in the cost of the reports used in its weather forecast and storm warning service.

RECENT PAPERS BEARING ON METEOROLOGY.

C. FITZHUGH TALMAN, Acting Librarian.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——

Scientific American Supplement. New York. Vol. 60.
- **Smith, N. F.** Note on filling a barometer tube. P. 24936.
- **Wixon, Howard W.** Principles of soaring flight. P. 24904.

Transactions of the Canadian Institute. Toronto. Vol. 8.
- **Tully, Kivas.** Fluctuations of Lake Ontario. [Precipitation, 1854–1903.]

Sunset. San Francisco. Vol. 15. Oct., 1905.
- **McAdie, Alexander [G.].** The Los Angeles rain-making. Pp. 575–577.

Aeronautical Journal. London. Vol. 9. Oct., 1905.
- **Reid, Walter F.** Balloon varnishes and their defects. Pp. 64–68.
- **Walker, William George.** Vertical screw aerial machine, with special notes on the lifting propellers. Pp. 57–64.
- **Wenham, F. H.** Some remarks on aerial flight. Pp. 56–57.

Nature. London. Vol. 73.
- **S., W. N.** Astronomy and meteorology in Australia. P. 8. Nov. 2, 1905.

Symons's Meteorological Magazine. London. Vol. 40. Oct., 1905.
- **Bonacina, L. C. W.** Summary of the results of British thunderstorm committee (1888–89). Pp. 158–160.
- **Curtis, R. H.** On the use of Beaufort's scale. Pp. 156–158 (continued from p. 140).
- —— Nile floods and atmospheric pressure. [Abstract of paper by H. G. Lyons. Proc. roy. soc., vol. A 76, p. 66–86]. Pp. 164–165.

L'Aérophile. Paris. 13 année.
- **Goupil, A.** Equilibre d'un cerf-volant de 1m² de surface, s'étant tenu à une position très voisine de la verticale du lieu de retenue. Oct., 1905. Pp. 226–227.

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- **Goutereau, Ch.** Distribution des pluies sur les plaines maritimes. Sept., 1905. Pp. 206–209.
- **Lumen, Ch.** Note sur deux orages. Sept., 1905. Pp. 202–206.
- **Moureaux, Th.** Trombe du 28 août 1905 à Saint-Maur et à Champigny (Seine). Sept., 1905. Pp. 201–202.
- —— Distribution des gouttes de différentes grosseurs dans les chutes de pluie. Sept., 1905. P. 215.
- —— Les plus basses températures observées dans l'atmosphère. Sept., 1905. P. 216.
- —— Observations météorologiques faites pendant l'éclipse de soleil du 30 août 1905. Oct., 1905. Pp. 218–230.
- —— Température dans les cyclones et les anticyclones. [Abstract of paper by H. H. Clayton in Beiträge zur Physik der freien Atmosphäre.] Sept., 1905. Pp. 212–214.

Archives des Sciences Physiques et Naturelles. Genève. 4 Période. Tome 20. Oct., 1905.
- **Brückner, Ed.** Sur le bilan du cycle de l'eau sur la terre. Pp. 427–430.
- **Dufour, Henri.** Résultats actinométriques observés au dessus de Lausanne pendant l'éclipse partielle du 30 août. Pp. 434–435.
- **Gautier, R.** Résumé météorologique de l'année 1904 pour Genève et le grand Saint Bernard. Pp. 386–411.
- **Gockel, A.** Observations sur l'électricité atmosphérique pendant l'éclipse totale de soleil du 30 août 1905. Pp. 433–434.
- **Pictet, Raoul.** Phénomène de convection du gaz apparu accidentellement dans ses expériences de Berlin. Pp. 432–433.
- **Saussure, Renéde.** Projet de bureau météorologique central européen. Pp. 414–418.

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- **L., V. D.** Froid dans la haute atmosphère. Oct. 1, 1905. Pp. 374–375.
- **Lagrange, E.** Cyclone de Sedan du 9 août 1905. Oct. 16, 1905. Pp. 384–390.
- **Lancaster, A. [Ed.].** Éclipse totale de soleil du 30 août 1905. [Continued.] Oct. 1, Oct. 16, Nov. 1, 1905. Pp. 355–368, 379–384, 403–419.
- —— Mouvements généraux de l'atmosphère en hiver. [Pressure distribution in the northern hemisphere. Abstract of paper by P. Garrigou-Lagrange, Compt. rend. ac. sc., Par., July 24, 1905.] Oct. 16, 1905. Pp. 397–400.
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- **Bigourdan, G.** Résumé des observations de l'éclipse totale de soleil du 29–30 août 1905 faites à Sfax (Tunisie) Oct. 2. Pp. 541–546.
- **Brunhes, Bernard and Baldit, Albert.** Sur la dissymétrie de la déperdition électrique en pays de montagne; rôles comparés de l'altitude et du relief. Oct. 30. Pp. 693–695.
- **Janssen, J.** Sur la creation d'une association internationale pour les études solaires. Oct 9. Pp. 572–573.
- **Rotch, A. Lawrence, and Teisserenc de Bort, Leon.** Sur les preuves directes de l'existence du contre-alizé. Oct. 9. Pp. 605–608.

Éclairage Électrique. Tome 44.
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- **Villedeuil, Ch. de.** Existence du contre-alizé au sud des Açores. Oct. 14. P. 319.
- —— Concours international de prévision du temps. [Liege, Sept., 1905.] Oct. 21. P. 327.

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- **Bracke, A.** Arc-en-ciel sextuple. P. 167.
- **Quignon, G.** Éclipse de soleil du 30 août. Pp. 192–196.
- **Roy, Felix de.** Une ascension scientifique. Pp. 161–166.
- **Touchet, Emile,** Photographie des éclairs. [Reprinted from Bull. soc. astrom. de France.]. Pp. 168–187.

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- **Nell, Chr. A. C.** De Halo's. Pp. 82–87. Continued from p. 72.

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- **Hambruch, Paul.** Eisverhältnisse auf der Unterelbe. Pp. 435–454.

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- **Janezic, E.** Beobachtung einer Wolkenrolle. Pp. 413–414.
- **Johansson, Osk. V.** E. Cederström über die Anemometerprüfungsmethoden. Pp. 418–420.
- **Linsbauer, K.** Lichtklima in seiner Bedeutung für die Pflanzenphysiologie nach Wiesner. Pp. 420–423.
- **Meinardus, W.** Ueber die Windverhältnisse an der Winterstation des "Gauss". Pp. 424–427.
- **Meinardus, Wilhelm.** Ueber Schwankungen der nordatlantischen Zirkulation und damit zusammenhängende Erscheinungen. Pp. 398–412.
- **Osthoff, H.** Formen der Cirruswolken. Pp. 385–398.
- **Schlein, Anton.** Wiener Hochfahrt vom 2 August und vom 6 September 1905. Pp. 427–430.
- —— Meteorologische Beobachtungen 1904 zu Moose Factory an der Hudsonbai. P. 431.
- —— Resultate der meteorologischen Beobachtungen zu Weihaiwei in den Jahren 1899–1904, inkl. P. 423–424.
- —— Resultate meteorologischer Beobachtungen in den Kapstadt und am Tafelberge in Jahre 1903. P. 416.
- —— Ueber die Schwankungen des Kohlensäures-gehaltes der Luft in Kew während der Jahre 1898–1901. Pp. 414–415.
- —— Ueber einige zusammenhängende Beobachtungsreihen des Betrages der elektrischen Zerstreuung in freier Luft von Dr. C. Coleridge-Farr. [Abstract from Nature, May, 1905, p. 94.] Pp. 416–417.
- —— Eredia über die Inversion der Temperatur zwischen Rocca di Papa und Monte Cavo. 1893–1899. Pp. 430–431.