waves with the pressure waves the numerical signs have been reversed throughout the temperature computation.

Diurnal wave.—These temperature waves have been constructed without using the surface temperatures, and this implies that the temperatures in the several strata are chiefly concerned in generating the pressure waves that are observed at the respective elevations. Of course some additional influence must be expected to work in from the adjacent strata not here reckoned in the integration, and therefore the results here discussed do not exhaust the entire scope of the available sources of inquiry. A close approximation to a parallelism between the pressure and the temperature systems is certainly indicated. In January, February, and March the diurnal curves of temperature and pressure are in close agreement as to amplitude and phase, and reversing the sign of ΔT, we obtain the relation,

$$-4^\circ \Delta T \propto +0.010\ \Delta B, \text{ or } -1^\circ F + \propto 0.0025 \text{ inch.}$$

With the approach to summer the curve of temperature increases in amplitude more rapidly than the pressure curve, and the phase of maximum and of minimum in July and August is about three or four hours earlier, 4 a. m. for temperature and 7 a. m. for pressure, or 3:30 p. m. for temperature and 7:30 p. m. for pressure. The semidiurnal temperature waves are, however, smaller than would be expected and possibly I have not obtained exactly the correct temperature curves to resolve into components in these two months. We have an approximate relation,

$$-12^\circ \Delta T \propto +0.017\ \Delta B, \text{ or } -1^\circ F \propto +0.0014 \text{ inch.}$$

It follows that in summer the influence of one degree of temperature to change the pressure is about one-half as much as it is in the winter. This implies a series of complex functions which it is not possible to discuss in this place.

Semidiurnal wave.—The most important fact brought out by this computation is that a true semidiurnal wave of temperature is developed in the lower strata whose phase for the maximum ordinate persists steadily throughout the year at 8 a. m. and 8 p. m., with the minimum at 2 a. m. and 2 p. m., except that in summer the minimum occurs about one hour earlier. Generally the temperature maxima precede the pressure maxima by about two hours, implying that the semidiurnal pressure wave follows the temperature wave at an interval of two hours throughout the year. In winter the amplitudes have nearly the following relation,

$$-3^\circ \Delta T \propto +0.018\ \Delta B, \text{ or } -1^\circ F \propto +0.0030 \text{ inch,}$$

while in summer the relation is follows,

$$-2^\circ \Delta T \propto +0.015\ \Delta B, \text{ or } -1^\circ F \propto +0.0075 \text{ inch.}$$

Hence, the temperature wave in summer is two and one-half times as effective in producing the pressure wave as it is in the winter. In considering the dynamic relations of these waves, it is necessary to bear in mind that the entire system is moving from east to west in the atmosphere, or from right to left in the diagram, and the relative position in the semidiurnal, as in the diurnal waves, is that the temperature waves precede the pressure waves. If a physical process is concerned, as the vertical movement of convectional currents with expanding heads, or the downward flow of cool air along the sides of the warm diurnal cone, then this time-lag of two hours represents the interval connecting the temperature cause with the pressure effect. It is, however, quite clear that the diurnal pressure waves have their origin in a temperature wave, rather than in a forced dynamic wave as suggested by Lord Kelvin.

Tridiurnal wave.—We shall divide the year into two portions for discussing the tridiurnal wave: first, October to March, and, second, April to September. In the winter period it is seen that a fair agreement exists in the phases of the maxima of the temperature and the pressure waves, and that, with the system of coordinates here employed, they are in approximately direct synchronism. In the summer months, on the other hand, although the correspondence between the two sets of curves is much less satisfactory, there is suggested a synchronism of the inverse type, such that the phases of the temperature and pressure are opposite to one another. It will hardly be safe to lay down more definite conclusions regarding these tridiurnal curves, because we should not only require to have for discussion very perfect original curves in the atmosphere, but also it would be necessary to integrate throughout the entire range in altitude—that is, through the strata of the atmosphere affected by the diurnal disturbance—instead of limiting our summation to three selected curves.

A further discussion of these curves in connection with the vapor tension, the electric potential gradient, the coefficient of dissipation, and the phenomena of atmospheric electricity generally will be found in the next paper of this series, while their relations to the diurnal variation of the earth's magnetic field will be taken up in a still later paper.

RECENT PAPERS BEARING ON METEOROLOGY.

By H. H. KIMBALL, Librarian and Climatologist.

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 ——

Science. New York. New Series. Vol. 21.
- **Rotch, A. Lawrence.** The St. Petersburg conference on the exploration of the atmosphere. Pp. 461–465.
- **Barus, Carl.** Radiation associated with X-rays. Pp. 551–566.
- **Chester, C. M.** The total solar eclipse of August 29–30, 1905. Pp. 635–637.

Scientific American. New York. Vol. 92.
- L. Some weather observations. P. 262.

Scientific American Supplement. New York. Vol. 59.
- **Poynting, J H.** Radiation pressure. P. 24435.
- —— Rain: its cause. Pp. 24474–24475.
- —— The Piesmic barometer. P. 24482.
- —— The structure of the atom. P. 24498.

Nature. London. Vol. 71.
- **Bryan, G. H.** Progress in aerial navigation. Pp. 463–465.
- —— [Kite ascents made on the yacht of the Prince of Monaco in the Mediterranean and North Atlantic Ocean in the summer of 1904.] [Note on work of H. Hergesell.] P. 467.
- —— Effect of autumnal rainfall upon wheat crops. Pp. 470–471.
- **Rotch, A. Lawrence.** Inversions of temperature and humidity in anticyclones. Pp. 510–511.

Geographical Journal. London. Vol. 25.
- **Scott, Robert F.** Results of the National Antarctic Expedition. [Climate.] Pp. 353–373.

Symons's Meteorological Magazine. London. Vol. 40.
- —— The rainfall of the six months, September, 1904–February, 1905. Pp. 21–25.
- **Dansey, R. P.** The glacial snow of Ben Nevis. Pp. 29–32.
- **Harvey, C. Wigan.** A quarter of a century's rainfall at Throcking, Herts. P. 32.
- **Burtt, Theodore.** Meteorological observations in Pemba during 1903 and 1904. Pp. 34–35.

Knowledge. London. New Series. Vol. 2.
- **Ingram, Beresford.** "Ad Infinitum." The structure of the atom. Pp. 74–75.
- **MacDowall, Alex. B.** Forecasting seasons. P. 80.

Science Abstracts. London. Vol. 8.
- **Ros[enhain], W.** Manufacture of thermometer glass at Jena. [Abstract of report of E. Grieshammer.] P. 162.
- **B[aynes], R. E.** Formula for gaseous diffusion. [Abstract of article of P. Langevin.] P. 163.
- **Ros[enhain], W.** Thermometer glass and the annealing thermometers. [Abstract of article of G. Müller.] P. 176.

Scottish Geographical Magazine. Edinburgh. Vol. 21.
- **Brown, Rudmose.** Argentine Antarctic station. Pp. 207–210.

Journal of Geography. New York. Vol. 4.
- **Kirchwey, Clara B.** Laboratory work in physical geography in secondary schools. [Atmosphere.] Pp. 122–130.

Astrophysical Journal. Chicago. Vol. 21.
Schuster, Arthur. The temperature of the solar atmosphere. Pp. 258–260.
Poynting, J. H. Radiation pressure. Pp. 393–406.
London, Edinburgh, and Dublin Philosophical Magazine. 6th Series. Vol. 9.
Cook, S. R. Escape of gases from atmospheres. Pp. 508–510.
Stoney, G. Johnstone. Escape of gases from atmospheres. [Dr. G. Johnstone Stoney's reply to article of S R. Cook.] Pp. 510–513.
Wood, Alexander. Spontaneous ionization of air in closed vessels and its causes. Pp. 550–576.
Bulletin of the American Geographical Society. New York. Vol. 37.
Ward, R. DeC. Meteorology in the Antarctic. [Note on address of Charles Royds.] Pp. 105–106.
W[ard], R. DeC. The rainiest district in Europe. [Abstract of article of Kassner.] Pp. 162–163.
W[ard], R. DeC. Mean temperatures of high southern latitudes. [Abstract of article of Hann.] P. 167.
W[ard], R. DeC. The cyclonic element in climatological summaries. [Summary of paper of R. DeC. Ward.] P. 169.
Engineering News. New York. Vol. 53.
Kimball, Herbert Harvey. Evaporation observations in the United States. Pp. 353–355.
Popular Science Monthly. New York. Vol. 66.
Brown, Ernest W. Sunspots and weather. Pp. 505–514.
Annuaire de la Société Météorologique de France. Paris. 53 année.
Marchand, E. Les lueurs crépusculaires et les phénomènes connexes observés en 1902–1903. Pp. 40–45.
Annales de Geographie. Paris. 14 année.
Zimmermann, Maurice. L'oeuvre scientifique de l'expédition de la "Belgica". [Note] Pp. 170–176.
Comptes Rendus de l'Académie des Sciences. Paris. Tome 140.
Forel, F. A. Le cercle de Bishop de la montagne Pelée de la Martinique. Pp. 694–696.
Hansky, A. Sur la photographie de la couronne solaire au sommet du mont Blanc. Pp. 768–771.
Janssen, J. Sur la photographie de la couronne solaire au sommet du mont Blanc. P. 771.
Fonvielle, W. de. L'influence des éclipses sur le mouvement de l'atmosphère. Pp. 901–902.
Archives des Sciences Physiques et Naturelles. Genève. 4 Période. Tome 19.
Forel, F. A. Le cercle de Bishop de la montagne Pelée 1902–1904. Pp. 229–258.
Le Temps qu'il Fait. Mons. 2me année.
Bracke, A. Les gelées d'avril. Pp. 42–47.
Ciel et Terre. Bruxelles. 26me année.
—— L'insolation Suisse. [Note on work of H. Dufour.] p. 24.
L., V. D. La faible pluvosité relative des côtes basses. Pp. 42–44.
Fooz, G. de. La température dans le tunnel du Simplon. [Extract from article of G. de Footz.] Pp. 44–46.
—— Ascensions de cerfs-volants au-dessus de la mer. Pp. 47–49.
—— L'état des glaces dans les mers Arctiques pendant l'hiver 1903–1904. Pp. 49–50.
Bulletin de la Société Belge d'Astronomie. Bruxelles. 10me année.
Spée, —. La grande tache solaire de janvier-février, 1905. Pp. 57–62.
Spée, E. L'activité solaire en février, 1905. Pp. 69–71.
V., J. Anomalies dans la direction du vent au Ben Nevis. Pp. XV–XVIII.
Gaea. Leipziz. 140 Jahrgang.
—— Die Entstehung des Hagels. Pp. 220–225.
—— Die Aufspeicherung der Sonnenwärme in verschiedenen Flüssigkeiten. Pp. 225–232.
—— Die Abbildung von Gewässern in Wolkendecken. [Note on work of Erk.] Pp. 248–249.
Petermanns Mitteilungen. Gotha. 51 Band.
Nansen, Fridtjof. Die Ursachen der Meeresströmungen. Pp. 1–4.
Das Wetter. Berlin. 22 Jahrgang.
Arendt, Th. Gewitter und Hagelgefahr. Pp. 49–55.
Sprung, A. Ueber die automatische Aufzeichnung der Regen-Intensität. Pp. 56–58.
Sieberg, August. Erdbeben und Witterung. Pp. 58–65.
Assmann, Julius. Die Niederschlagsverhältnisse in Zentral-Europa in der ersten November-Dekade 1904. Pp. 68–70.
Annalen de Physik. Leipzig. 4 folge. Bd. 16.
Frank, Albert. Versuche zur Ermittelung des Luftwiderstandes, dessen Abhängigkeit von der Geschwindigkeit und der Gestalt der Körper. Pp. 464–489.
Illustrirte Aeronautische Mitteilungen. Strassburg. 9 Jahrgang.
Ritter, Friedrich. Winddruck auf unrunde und vertiefte Flächen. Pp. 73–84.
K. Die Drachenstation der Deutschen Seewarte. Pp. 89–91.
Rosenthal, Elmar. Ueber den vertikalen Temperaturgradienten in Zyklonen. Pp. 117–121.
Zölss, B. Electricitätszerstreuung in Kremsmünster (1903–1904). Pp. 129–132.
Boltzmann, A. Luftelektrische Beobachtungen auf dem Meere. Pp. 132–133.
Physikalische Zeitschrift. Leipzig. 4 Folge. Band 16.
Battelli, A. and Maccarrone, F. Sind radioactive Emanationen elektrisch. Pp. 161–163.
Das Weltall. Leipzig. 5 Jahrgang.
Schmidt, A. Die Gesetze der Lichtbrechung, angewendet auf die Physik der Sonne. Pp. 215–220.
Annalen der Hydrographie und Maritimen Meteorologie. Berlin. 33 Jahrgang.
Barth, Paul. Das Wetter auf dem Nordatlantischen Ozean vom 25 September bis zum 13 Oktober 1903. Pp. 97–112.
Frühling, J. Der Nordsturm an der ostdeutschen Küste vom 13 und 14. Januar 1905. Pp. 113–116.
Heyne, —. Die Witterung zu Tsingtau im September, Oktober und November 1904 nebst einer Zusammenstellung für Herbst 1904. (Bericht der Kaiserlichen Meteorologisch-astronomischen Station zu Tsingtau.) Pp. 116–120.
Meteorologische Zeitschrift. Wien. Band 22.
Gockel, A. Ueber den Ionengehalt der Atmosphäre und dessen Zusammenhang mit Luftdruckänderungen. Pp. 97–102.
Jaufmann, J. Ueber Radioaktivität von atmosphärischen Niederschlägen und Grundwässern. Pp. 102–113.
Topolansky, M. Einige Resultate der 20 jährigen Registrierungen des Regenfalles in Wien. Pp. 113–119.
Hann, J. Zum Klima der äquatorialen Westküste Afrikas. Pp. 120–127.
Siegel, —. Regenwind-Rosen für Curityba, Paraná. Pp. 127–128.
Baer, —. Merkwürdige Refraktionserscheinungen. Pp. 128–129.
—— Meteorologische Beobachtungen an der Küste von Chile im Jahre 1903. Pp. 129–130.
Krebs, W. Ungewohnlich starke Szintillation am Sonnenrande. P. 130.
Friesenhof, —. Doppelte Cirri. Pp. 130–131.
H[ann], J. Ueber die Dauer des Regenfalles in Japan. pp. 131–132.
Blumhof, Franz. Eigentümliche Lichterscheinung. P. 132.
Ms. Wolkenbildungen bei Gewitterstürmen aus der Vogelperspektive. Pp. 132–133.
Birkeland, J. Täglicher Gang des Barometers in Norwegen. Pp. 133–134.
Kassner, K. Einige Wolkenbeobachtungen auf der Reise. Pp. 134–136.
H[ann], J. Zum Klima der Italienischen Eriträ. P. 136.
—— Einige Resultate der meteorologischen Beobachtungen auf der Zugspitze im Jahre 1904. P. 137.
Krebs, Wilhelm. Staubfall-Wolken. P. 137.
Sassenfeld, M. Zur täglichen Periode der Bewölkung. Pp. 137–138.
—— Neuere Beobachtungsresultate von Papeiti auf Tahiti. Pp. 138–139.
Sapper, Karl and List, Karl. Elecktrische Erscheinungen bei den Vulkanausbrüchen in Mittelamerika. Pp. 139–140.
Hann, J. Meteorologische Beobachtungen in Mozambique. P. 140.
Hemel en Dampkring. Amsterdam. 2 Jahrgang.
Monné, A. J. Neerslag in het Koninkrijk der Nederlanden. Pp. 162–166.
Nell, Chr. A. C. De weervoorspelling met behule van locale waarnemingen. Pp. 167–171.
S. Nog eens de telegrafische verbieding met Ijsland en de weervoorspellingen. Pp. 171–173.

RECENT ADDITIONS TO THE WEATHER BUREAU LIBRARY.

By H. H. KIMBALL, Librarian.

The following titles have been selected from among the books recently received, as representing those most likely to be useful to Weather Bureau officials in their meteorological work and studies. Most of them can be loaned for a limited time to officials and employees who make application for them.

Buitenzorg. Botanical Institute of the State of Buitenzorg.
Observations météorologiques. Année 1901. Institut Botanique de l'État de Buitenzorg. n. p.
Canada. Meteorological Service.
General meteorological register for the year 1904. n. p.
Dubinskij, V[ladimir Christianovic].
Magnetic storm, October 31 to November 1, 1903, according to observations made at the Constantin Observatory in Pavlosk. (Bull. imp. acad. sc., St. Petersb. T. XX, No. 2.) Pp. 67–76. [Russian text.]
Fassig, Oliver L.
Climate of the Bahama Islands. (Reprint from "The Bahama Islands," edited by George Burbank Shattuck.) Pp. 111–125.
Exploration of the upper atmosphere at Nassau, New Providence, by means of kites. (Reprint from "The Bahama Islands," edited by George Burbank Shattuck.) Pp. 129–143.
Magnetic observations in the Bahama Islands. (Reprint from "The