Atmospheric pressure. Instruments for measurement; barometers; aneroid, mercurial self-registering; thermometric-hypsometry; diurnal and annual variation of atmospheric pressure.

Variation of pressure with altitude. Laplace's formula; applications; reduction of pressure to sea level; calculation of altitudes by means of barometric observations.

Wind. Measurement of direction and of velocity of wind; weather vanes; velocity anemometers; pressure anemometers.

Diurnal variation of velocity and of direction of wind. Variation of wind with altitude; general relation between the wind and pressure; gradients; theory of atmospheric movements; relation of wind to temperature; influence of rotation of earth; deviation of wind on gradient.

General circulation of the atmosphere. Regular winds; trades, antitrades; distribution of wind and pressure at the surface of the globe; seasonal winds; monsoons; diurnal winds; land and sea breezes, mountain and valley breezes.

Atmospheric vapor. Evaporation; measure of evaporation; diurnal and annual variations of evaporation; general laws of evaporation.

Atmospheric humidity. Elastic force of water vapor; relative humidity; instruments of measurement; hygrometers; chemical; condensation; self-registering; psychrometer.

Diurnal and annual variations of humidity. Variation of humidity with height; distribution of humidity at surface of earth; condensation of water vapor, various modes of condensation in the ascending currents of air; dryness in the descending currents; production of the foehn.

Properties and constitution of clouds and fogs. Cloudiness; measure of cloudiness; heliograph; annual and diurnal variations of cloudiness; general distribution of cloudiness at the surface of the earth; study of movements of clouds; classification of clouds; average altitude of different forms of clouds.

Optical phenomena of the atmosphere. Rainbows; halos; coronas.

Dew and Frost. Formation of dew; measurement of dew; practical importance of these phenomena; frost; hoar frost; glazed frost.

Rain, snow, hail. Measurement of rain; rain gages, their installation.

Theory of the formation of rain. Rains of various origins; rains due to convection; cyclonic rains; rains due to orography; influence of topographical conditions, of forests.

General distribution of rains at the surface of the globe. Rainy regions; desert regions; detailed study of rain in the different regions; rainfall system; distribution of rain throughout the seasons; intensity of heavy showers.

Snow. Constitution and density of snow; effect of snow; limits of perpetual snow.

Natural utilization of meteoric waters. Percolation; surface flow; water consumed by evaporation and by vegetation; supply of underground waters, of springs, and of rivers; drainage system of water; risings and floods, their prevision.

The law of storms. Depressions of temperate latitudes and cyclones of tropical regions, their constitution; distribution of wind about centers of low pressure.

Influence of barometric depression on the weather. Local winds produced by the passage of depressions; mistral, sirocco, foehn, bora, etc.

Laws of movements and of frequency of barometric depressions and of cyclones; their velocity, their average paths. Various causes of the circulatory movement; causes which tend to modify their velocity, their paths, or their intensity.

Anticyclones, their origin. Influence of anticyclones on the weather.

Thunderstorms. Atmospheric electricity, lightning, flash of lightning, thunder; frequency of hourly, seasonal, and geographical distribution of thunderstorms; origin of thunderstorms, thunderstorms of heat, and cyclonic thunderstorms; hail, formation of hail; means proposed for defense against hail.

Whirlwinds and waterspouts, their effects, their origin, and their relations to thunderstorms; heat storms.

Forecasting. Short range system of forecasting; organization of forecast service; general principles of forecasting.

Forecasting by isolated observers. Utilization of observations and of local signs; prevision of frost in spring time.

Discussion of attempts to forecast at long range.

Cosmical influences. Periodicity of sunspots, discussion of relations they present to meteorological phenomena. Discussion of influences attributed to the moon; reddish sunset; other influences attributed to cosmical causes.

Problem of variability of climates. Can man influence climate? Effect of deforestation, of reforestation.

Attempts to produce rain.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

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 ——.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 29.

Bayard, F. C. English Climatology, 1881-1900. Pp. 1-21.

—— The Bora in the Adriatic. P. 21.

Bellamy, C. V. The Rainfall of Dominica. Pp. 23-28.

Bellamy, C. V. Notes on the Climate of Cyprus. Pp. 29-44.

Clayton, H. Helm. The Eclipse Cyclone of 1900. Pp. 47-52.

—— St. Elmo's Fire. [Note on letters from J. Fellows and Charles Dibdin.] Pp. 55-56.

—— Rainfall of the Hawaiian Islands. [Note on pamphlet by C. J. Lyons.] Pp. 56-57.

Terrestrial Magnetism. Baltimore. Vol. 7.

Bauer, L. A. Results of International Magnetic Observations made during the Total Solar Eclipse of May 18, 1901, including results obtained during previous Total Solar Eclipses. Pp. 155-192.

Pegram, Geo. B. Elster's and Geitel's researches on the Radio-Activity and the Conductivity of the Air. Pp. 202-204.

Symons's Meteorological Magazine. London. Vol. 38.

Stupart, R. F. The Canadian Climate. Pp. 1-4.

—— Temperature of Air and Rivers. [Note on paper by W. Andson.] Pp. 4-6.

Proceedings of the Royal Society. London. Vol. 71.

Chree, C. Preliminary Note on the Relationships between Sunspots and Terrestrial Magnetism. Pp. 221-224.

Taylor, J. E. Characteristics of Electric Earth-current Disturbances, and their Origin. Pp. 225-227.

Evershed, J. Solar Eclipse of 1900, May 28. General Discussion of Spectroscopic Results. Pp. 228-229.

Science. London. N. S. Vol. 17.

Ward, R. DeC. Scientific Investigations by Weather Bureau men. Pp. 353-354.

Ward, R. DeC. Cycles of Precipitation in the United States. [Note on article by L. H. Murdoch.] P. 354.

Astrophysical Journal. Chicago. Vol. 17.

Langley, S. P. The "Solar Constant" and related problems. Pp. 89-99.

Bigelow, Frank H. Reply to E. von Oppolzer's remarks on Bigelow's "Eclipse Meteorology." Pp. 161-163.

Journal of Geography. Chicago. Vol. 2.

—— How the Weather Fixes Train Loads. Pp. 45-46.

Journal of the Franklin Institute. Philadelphia. Vol. 165.

Auria, Luigi d'. Relation between the Mean Speed of Stellar Motion and the Velocity of Wave Propagation in a Universal Gaseous Medium Bearing upon the Nature of the Ether. Pp. 207-211.

Engineering News. New York. Vol. 48.

Clarke, Ernest Wilder. Storm flows from city areas, and their calculation. Pp. 386-388.

Nature. London. Vol. 67.

Lockyer, William J. S. Solar prominences and terrestrial magnetism. Pp. 377-379.

Marriott, Wm. Fall of Coloured Dust on February 22-23. Pp. 391.

B., G. H. The Fata Morgana of the Straits of Messina. Pp. 393-394.

Lockyer, William J. S. Indian Rainfall. Pp. 394-395.

Chree, Charles. Magnetic Work in New Zealand. Pp. 418-419.

Geographical Journal. London. Vol. 21.

—— Circulation of the Atmosphere in the Tropical and Equatorial Regions. [Note on statement by Professor Hildebrandsson.] Pp. 298-301.

London, Edinburgh, and Dublin Philosophical Magazine. London. 6th Series. Vol. 5.

Wilderman, Meyer. Theory of the Connexion between the Energy of Electrical Waves or of Light introduced into a System and Chemical Energy, Heat Energy, Mechanical Energy, etc., of the same. Pp. 208-226.

Makower, Walter. On a Determination of the Ratio of the Specific Heats at Constant Pressure and at Constant Volume for Air and Steam. Pp. 226-238.

Schuster, Arthur. The influence of Radiation on the Transmission of Heat. Pp. 243-257.

Thomson, J. J. On the Charge of Electricity carried by a Gaseous Ion. Pp. 346-355.

Journal de Physique. Paris. 4me séries. Tome 2.

Baillaud, J. L'influence des atmosphères d'azote et d'hydrogène sur les spectres d'arcs du fer, du zinc, du magnesium, et de l'étain, comparée avec celle d'une atmosphère d'ammoniaque. [Note on article by Royal A. Porer.] Pp. 128-129.

Gradenwitz, A. Comparaison des thermomètres à platine et à hydrogène. [Note on article by B. Meilink.] Pp. 137-138.

Annales de Chimie et de Physique. Paris. 7me série. Tome 28.
Coppet, L. C. de. Étude expérimentale de la propagation de la chaleur par convection dans un cylindre d'eau à axe verticale chauffé ou refroidi par sa surface latérale. Application à la détermination de la température du maximum de densité de l'eau et des solutions aqueuses. Pp. 145–213.
Langevin, P. L'ionisation des gaz. Pp. 289–384.
Annuaire de la Société Météorologique de France. Paris. 51me année.
David, P. Comparaison des températures prises sous abri en plein air et dans un abri annexé à un édifice, au sommet du Puy-de-Dôme. Pp. 1–3.
Maillet, Ed. Résumé des observations météorologiques et hydrométriques de 1891 à 1900. P. 3–11.
L'Aérophile. Paris. 11me année.
De Rue. Expériences d'aviation. Pp. 36–40.
Comptes Rendus de l'Académie des Sciences. Paris. Tome 136.
Mascart, E. La tempête du 2 mars 1903. Pp. 529–530.
Ciel et Terre. Bruxelles. 23me année.
—— La station franco-scandinave pour l'étude des couches élevées de l'atmosphère. Pp. 587–591.
L., V. D. Une pluie extraordinaire. [Note on article by G. Hellmann.] Pp. 608–610.
Lagrange, E. Le temps et les télégraphiques. [Note.] Pp. 610–611.
Ciel et Terre. Bruxelles. 24me année.
Chauveau, A. B. Historique des théories relatives à l'origine de l'électricité atmosphérique. Pp. 1–15.
—— Pluie de boue. P. 20.
—— Variations périodiques et marche des glaciers. Pp. 22–24.
Das Wetter. Berlin. 20 Jahrgang.
Frenbe, —. Ein landwirtschaftlicher Wetterdienst. Pp. 25–31.
Assmann, Richard. Ueber die Ausführbarkeit von Drachen-auf stiegen auf Binnenseen und deren Vorteile. Pp. 31–41.
Schwenck, O. Interessante Raucherscheinung. Pp. 44–45.
Assmann, R[ichard]. Aus dem Aëronautischen Observatorium. Pp. 46–48.
Petermann's Mittheilungen. Gotha. Band 48.
Isachsen, Gunnar. Kurze Uebersicht über die Arbeiten der zweiten norwegischen Polarfahrt. P. 269.
Petermann's Mittheilungen. Gotha. Band 49.
Reger, Joseph. Regenkarte von Europa. Pp. 11–13.
Annalen der Physik. Leipzig. 4te Folge. Band 10.
Walter, B. Ueber die Entstehungsweise des Blitzes. Pp. 393–407.
Schmidt, A. Der Energieinhalt einer unendlich hohen Luftsäule bei konstantem Werte von g. und T. Pp. 449–452.
Physikalische Zeitschrift. Leipzig. 4 Jahrgang.
McLennan, J. C. Induzierte Radioaktivität, die in Luft am Fusse eines Wasserfalles erregt wird. Pp. 295–298.
Illustrirte Aeronautische Mittheilungen. Strassburg. 7 Jahrgang.
Süring, R. Die Arbeiten des Berliner aëronautischen Observatoriums im Jahre 1902. Pp. 86–91.
Mittheilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Berlin. Band 15.
—— Resultate der Regenmessungen und Erdbeben-Beobachtungen in Deutsch-Neu-Guinea in den Jahren 1900 und 1901. Pp. 243–249.
Hemel en Dampkring. Amsterdam. Maart 1903.
—— Zodiakaallicht. Pp. 69–70.
Mars, S. De Weerverwachtingen van het Kon. Nederlandsch Meteorologisch Instituut te de Bilt en van de filiaal Inrichting te Amsterdam en de Weervoorspellingen van Jules Capré. Pp. 73–81.
Boletim da Sociedade de Geographia de Lisboa. Lisboa. Dezembro 1902.
Berthoud, Paul. Meteorologia de Lourenco Marques. Pp. 186–194.
Meteorologische Zeitschrift. Wien. Band 19.
Liznar, J. Ueber die Aenderungen des Grundwasserstandes nach den vom Prälaten Gregor Mendel in den Jahren 1865–1880 in Brünn ausgeführten Messungen. Pp. 537–543.
Maurer, H. Das Klima von Deutsch-Ostafrika. Pp. 543–548.
Stolberg, A. Verhalten der Rheintemperaturen in den Jahren 1895–1900. Pp. 548–551.
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Exner, F. M. Versuch einer Berechnung der Luftdruckänderungen von einem Tage zum nächsten. P. 560.
—— Resultate der meteorologischen Beobachtungen zu Carmen (Patagonien) im Jahre 1900. Pp. 560–561.
—— Meteorologische Beobachtungen auf der Insel Martinique im Jahre 1899. P. 561.
—— Temperatur der Lena bei Golowskaja. Pp. 561–562.
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—— Giuseppe Zettwuch über die blaue Farbe des Himmels. Pp. 564–565.
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—— Auffallende Abenddämmerung. Pp. 566.
—— Shaw, —. "La lune mange les nuages." Pp. 566–570.
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—— Ueber die Beziehung des Luftdruckes an Stationen der Ostseite des Atlantischen Oceans. Pp. 574–575.
—— Partielle Regenmessung. Pp. 575–576.
—— Sonnenfinsterniss-Meteorologie. Pp. 576–577.
—— Die Anticyklone von Sibirien. P. 577.
—— Duffek, —. Bemerkungen zur Frage über Vorgänge bei Gewittern. Pp. 577–578.
—— Die effektive Temperatur der Sonne. Pp. 578–580.
Rörig, A. Waldungen und Hagelfälle. Pp. 580–581.
—— Magnetische Beobachtungen in Aegypten 1893–1901. P. 581.
—— Meteorologische Beobachtungen in Kete-Kratyi, Togo. Pp. 581–583.
Mouromtzoff, P. v. Merkwürdige Hagelform. P. 583.
Meteorologische Zeitschrift. Wien. Band 20.
Hann, J. Die meteorologischen Verhältnisse auf der Bjelasnica (2067 m.) in Bosnien. Pp. 1–19.
Hann, J. Arthur Schuster über Methoden der Forschung in der Meteorologie. Pp. 19–30.
Liznar, J. Die Feuchtigkeits-Korrektion in der barometrischen Höhenformel. Pp. 30–33.
Rudel, K. Natürliche Psychrometer. Pp. 33–35.
Czermak, P. Ein NW-Föhn in Graz. Pp. 35–37.
Hann, J. Klima von Timbuktu. Pp. 37–40.
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Sapper, C. Regenmessungen in Cabo Gracias à Dios, Nicaragua. Pp. 41–42.
Exner, F. Der grüne Strahl der untergehenden Sonne. P. 42.
Hegyfoky, J. Starker Gewitterregen. P. 42.
Wolter, A. Provisorische Sonnenflecken-Relativzahlen für das IV. Quartal 1902. P. 42.

IV. THE MECHANISM OF COUNTERCURRENTS OF DIFFERENT TEMPERATURES IN CYCLONES AND ANTICYCLONES.[1]

By Prof. FRANK H. BIGELOW, dated March 27, 1903.

THE WEATHER BUREAU CLOUD OBSERVATIONS.

The report on the international cloud observations of May 1, 1896, to July 1, 1897, Report of the Chief of the Weather Bureau, 1898–99, Vol. II, contained an outline description of a theory of the structure of cyclones and anticyclones, which was thought to be indicated as the probable interpretation of the motions of the air in cyclones and anticyclones. It was evident that a more complete insight into the mechanism of this type of motion in a fluid under atmospheric conditions would be afforded by the construction of systems of isobars on at least three planes having different elevations. For this purpose the sea level, the 3500-foot level, and the 10,000-foot level were selected, and suitable reduction tables have been made as described in the report on the barometry of the United States, Canada, and the West Indies, Report of the Chief of the Weather Bureau, 1900–1901, Vol. II. Since December 1, 1902, we have received daily reduced pressures on these planes from the regular stations of the United States and Canada, and the corresponding charts have been drawn with care by Mr. George Hunt of the Forecast Division. A definitive treatment of the problem evidently requires charts of the isotherms on the same planes, but it will not be necessary to wait for the completion of our discussion of the temperatures, because we have already obtained the approximate gradients needed in a preliminary study of this question. It is proposed to summarize the present status of the research, previous to working out an analytic treatment of the mechanism of tornadoes, cyclones, hurricanes, and the general circulation, from the data now in possession of the Weather Bureau.

THE GENERAL CIRCULATION.

The circulation of the atmosphere has been analyzed by meteorologists into (1) the general cold center cyclone, which covers a hemisphere of the earth from the pole to the equator, and (2) the local warm center cyclones and the anticyclones,

[1] No. I was published in the Monthly Weather Review for December, 1902, and Nos. II and III in that for January, 1903.