necessary, and there is also a sharp bend in the curve at this point. The lower part of the curve seems to be very definitely determined, and below 50° C. there is unanimous agreement among the various investigators.

Calorimetric investigations are frequently conducted at room temperatures and the results exprest in terms of the "calorie at 20° C.". For this reason the values in the last column of Table 3 are given. They are computed from the values in the preceding column by means of the factor $\frac{4.1846}{4.1783}$, obtained from the variation curve of Barnes. The 15-degree calorie may be taken as equal to the mean calorie.

If the finally accepted value for the Clark cell at 15° C. is not 1.433 volts, then a new calculation of the above values from the data in the original papers will be in order. But until this point is definitely settled, these values are the best available for all those who have occasion to use the heat of evaporation of water, either by itself or as a correction factor in other investigations.

INTERESTING OLD METEOROLOGICAL LITERATURE.

The Meteorological Library of the Johns Hopkins University desires to secure as complete a set as possible of the early publications of our various State weather service organizations. Before the present systematic uniformity was introduced by Professor Moore these State publications were of various sizes, shapes, and styles; and many of them were personal matters by our local observers, encouraged by General Greely and Professors Harrington and Moore as leading up to State organizations. Any one who has either whole sets or odd numbers of these old monthly sheets that he will present to the abovementioned meteorological library should mail them to Dr. Nicholas Murray, Librarian, Baltimore, Md.

The pioneers in these personal enterprises were (1) Kerkam and Hunt, at New Orleans, La., 1891 and 1892; (2) Moore, at Milwaukee, Wis., 1892; (3) Hunt, at Omaha, Nebr., 1893–94; (4) Beals, at Minneapolis, Minn.; (5) Hunt, at Atlanta, Ga., 1894–95; and the publications for these years would be of great historical interest. Besides these publications by Signal Service men personally, we may also note those of an official character by the State weather services established about 1885 and subsequently.

FIRE AT MOUNT WEATHER.

About 4 a. m. on the morning of Wednesday, October 23, 1907, fire was discovered in the administration building at Mount Weather. Altho it had already gained much headway, the occupants escaped with little difficulty, except one who sustained severe injuries by jumping from a window. It was useless to try to check the flames and there was time to save no Government property and scarcely any private belongings. The building was totally destroyed, causing a loss of about $25,000 to the Government on building, furnishings, instruments, etc., and about $6,500 to the occupants.

All books and records in the building were destroyed, including the only copies of the regular meteorological records from the first of the month, and some records of special investigations which had not been copied or worked up for publication, and which are therefore completely and irreparably lost. The loss in the way of instruments is far less serious; for the exposed thermometers, thermograph, and gages, tho near the building, were unharmed; and the equipment for upper air research and the valuable instruments for investigations in terrestrial magnetism and solar radiation were in distant buildings and therefore unaffected.

Altho several of the men were compelled to borrow clothing from their more fortunate comrades and from neighbors, yet the daily work of kite flying and observations was immediately resumed on the day of the fire, and has suffered no interruption. A meteorological observatory has been temporarily installed in the power house, and telegraphic communication with Bluemont and Washington was speedily restored.

ICE COLUMNS IN GRAVELLY SOIL.

We have lately learned that a very important article on this subject was published a few years ago, in the Japanese language, and we shall endeavor to obtain a translation or abstract thereof. Meantime those interested in the subject will perhaps be glad to add the following title to the bibliography of the subject.

Report of investigation of ice columns by Prof. M. Goto, Higher Normal School, Tokyo, Japan, and Prof. O. Inagaki, Higher Agricultural School, Morioka, Japan. In the "Toyo Gakugei Zasshi" (Oriental Science Monthly), Vol. 16, 1900, Nos. 211, 212, and 213; 38 pages; 12 experiments.

This memoir contains:

Chapter I. Introduction.
II. Facts known to previous investigators.
III. Facts made known by our investigations.
i. Reasons why ice columns grow upward.
ii. Upward pressure of the growing ice columns.
iii. The morphology of the ice columns.
a. Forms of ice columns.
b. Density of ice columns.
c. Specific gravity of ice columns.
d. Limit of growth of ice columns.
e. Damage done by these ice columns.
f. Relations of soils and the growth of ice columns.

PLEASE ANSWER THESE QUERIES PROMPTLY.

The Editor has been asked to what extent he can diminish the size of the MONTHLY WEATHER REVIEW, and how he can improve its value to its readers. Considered as a meteorological journal it must necessarily contain a wide range of material. It is consulted by teachers, engineers, climatologists, and special students of a variety of topics, and the Editor wishes to submit to these the question what can be done to remove unnecessary material and improve the general value of the publication.

Will not each reader, whether domestic or foreign, kindly consider the following questions as addrest to him personally, and reply by return mail to the Editor?

(*A*) Are the following features of so much interest to you as to be worth publishing, either for your own personal use or in the general interest of meteorology?

1. The chapter on forecasts and warnings.
2. The section on rivers and floods.
3. The special articles, notes and extracts.
   a. Popular.
   b. Educational.
   c. Technical.
   d. Bibliographical.
   e. Seismological.
4. The chapter on "The weather of the month".
5. The climatological summary.
6. Table I. Climatological data.
7. Table II. Climatological record.
8. Table III. Wind resultants.
9. Table IV. Excessive precipitation.
10. Table V. Canadian data.
11. Table VI. Heights of rivers.
12. Honolulu data.
13. Jamaica rainfall.
14. Chart I. Hydrographs for seven principal rivers.
15. Chart II. Paths of areas of high pressure.
16. Chart III. Paths of areas of low pressure.
17. Chart IV. Total precipitation.
18. Chart V. Daytime cloudiness.
19. Chart VI. Isobars and isotherms at sea level and resultant surface winds.
20. Chart VII. Total depth of snowfall.
21. Chart VIII. Amount of snow on ground.

(*B*) If you get the equivalent of the tables, or so much of them as are interesting or useful to you, in the monthly section reports, or the Annual Report of the Chief of Bureau, in form more serviceable to you, please so state.

(*C*) Is there any feature or subject not yet introduced into the REVIEW that you wish us to take up?

(*D*) Is your copy of the REVIEW destroyed, preserved for future use, or deposited in some library?

STUDIES ON THE VORTICES IN THE ATMOSPHERE OF THE EARTH.

By Prof. FRANK H. BIGELOW.

I.—THE APPLICATION OF THE THEORY OF VORTEX MOTION TO THE FUNNEL-SHAPED WATERSPOUT AT COTTAGE CITY, AUGUST 19, 1896.

INTRODUCTORY REMARKS.

The purpose of the series of papers on the thermodynamics of the atmosphere, which appeared in the MONTHLY WEATHER REVIEW during the year 1906, was to indicate the distribution of the masses of air of different temperatures in the neighborhood of the axes of cyclones, anticyclones, and a typical waterspout, and to develop the formulas which are useful in discussing the energy contained in them, available in the restoration to a thermal equilibrium under the action of gravity. When a sheet of relatively cold air overlies a sheet of relatively warm air there will be an interchange of position, and in changing places there will be a development of certain stream lines which it is important to understand as fully as possible. Such a distribution of stratified air is an efficient cause of the formation of the vortices popularly called the tornado, the waterspout, and the hurricane. There are two types of such vortices prevailing in the earth's atmosphere, each of which is represented in the Cottage City waterspout of August 19, 1896.[1] The first type is seen in the second appearance, as on Chamberlain's photograph, 2d A, and the second type is found in the third appearance, as on Chamberlain's photograph, 3d A. It will be shown that the St. Louis tornado, May 27, 1896, and the De Witte typhoon, August 1–3, 1901, belong to the first, or dumb-bell, type, while many small funnel-shaped tornadoes belong to the second type. These typical examples will be fully worked out, and the velocities, radial (u), tangential (v), and vertical (w), computed, together with the various relations connecting them together. When two masses of air of different temperatures lie side by side the stream lines which are generated in the thermal flow are of a very different type from those of the preceding cases, in so far as the cyclone represents a pure vortex motion of any type. The general vortices in the earth's atmosphere or other atmospheres belong to still other classes. These vortices were summarized on pages 512, 513, of the International Cloud Report,[2] and in the MONTHLY WEATHER REVIEW, January, 1904;[3] but in this present series of papers an attempt will be made to find the constants and the velocities existing in these specific examples. The final step in the solution of this class of problems will consist in correlating the observed temperature and pressure conditions with these computed velocities. It will be important to develop the computations in detail, so that meteorologists may be able to discuss the circulations of the air as practical examples of the interchange of energy in the atmosphere. The knowledge already attained regarding the temperatures in the earth's atmosphere justifies us in making an effort to advance these fundamental problems in dynamical meteorology. It seems to me quite probable that the best way to determine the physical constants belonging to the sun's atmosphere, i. e., the specific heats and the temperature gradients, will be by utilizing the visible surface velocities of the solar vortex, which is a function of the same.

[1] See Monthly Weather Review for July, 1906, p. 307–315, and plates.

[2] Report of the Chief of the Weather Bureau, 1898–99, Vol. II. Hereafter this is referred to as "Cloud Report," or merely "C. R."

[3] Vol. XXXII, p. 15–20.

THE FORMULAS OF VORTEX MOTION.

The subject of vortex motion applicable to the earth's atmosphere may be conveniently referred to in the following works:

1. Basset's Treatise on Hydrodynamics, Vol. II, pp. 34–94, 1888.
2. Lamb's Hydrodynamics, pp. 222–265, 1895.
3. Wien's Lehrbuch der Hydrodynamik, pp. 54–83, 1900.
4. Bigelow's Summary of Formulas, Cloud Report, pp. 508–513, 1898.

Since the notation differs in these treatises the following table of equivalents is added:

TABLE 1.—*Equivalent systems of notation.*

Functions.	Basset.	Lamb.	Wien.	Bigelow.
Total differential	∂	∂	d	d
Partial differential	d	d	∂	∂
Differential increment	δ	δ	δ	δ
Finite difference	Δ	Δ	Δ	Δ
Rectangular coordinates	y, z, x	y, z, x	x, y, z	x, y, z
Cylindrical coordinates	ϖ, θ, z	ϖ, ϑ, x	ρ, ϑ, z	ϖ, ϕ, z
Polar coordinates	r, θ, ϕ	r, θ, ω	r, ϑ, Θ	r, θ, λ
Rectangular velocity	v, w, u	v, w, u	u, v, w	u, v, w
Cylindrical velocity	v, w, u	v, w, u	r, ϖ, η, w	u_1, v_1, w_1
Polar velocity	V, W, U	v, w, u	.....	u_2, v_2, w_2
Angular velocity	η, ζ, ξ	η, ζ, ξ	ξ, η, ζ	$\omega_1, \omega_2, \omega_3$
Current function	Right hand. $+\psi$	Right hand. $-\psi$	Left hand. $+\psi$	Right hand. $+\psi$
Velocity potential	$+\phi$	$-\phi$	$+\phi$	$+\phi$
Static potential	$+V$	$+V$	$-V$	$+V$
Vortical coordinates	M, N, L	G, H, F	U, V, W	F, G, H
Kinetic energy	T	T	L	T
Potential energy	V	V	F	U
Density	ρ	ρ	s	ρ
Viscosity coefficient	$\nu = \frac{\mu}{\rho}$	μ	k^2	μ

Bigelow and Wien take the z-axis as the axis of rotation in cylindrical coordinates, while Basset and Lamb use the x-axis. Wien has left-hand rotation and the others right-hand.

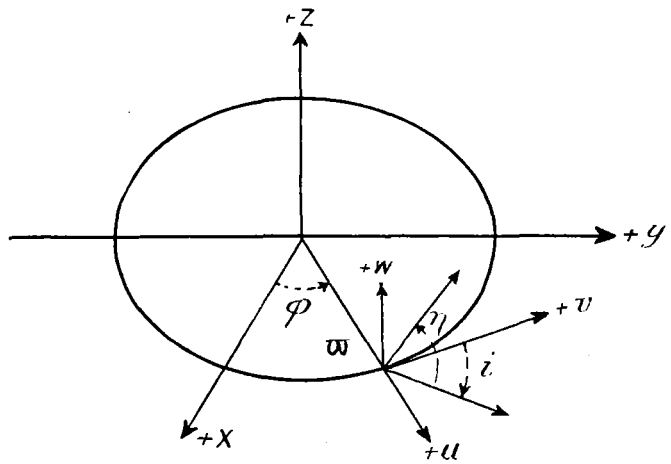

FIG. 1.—Rectangular coordinates of any point are x, y, z. Cylindrical coordinates of the same point are ϖ, ϕ, z. Velocities at that point (ϖ, ϕ) are u, v, w. Angles at that point (ϖ, ϕ) are i, η.