Oct. 25. 10.50 a. m. Passed out storm center. Bar. 28.28 inches. Therm. 72°. Getting wind from west, hurricane force.
No wind throughout passage through storm center.
Oct. 25. 11.30 a. m. Bar. 28.32 inches. Wind west, hurricane force.
Oct. 25. Noon. Bar. 28.40 inches. Therm. 72°. Wind west, blowing hurricane force.
Oct. 25. 4 p. m. Bar. 29.02 inches. Therm. 73°. Wind west, blowing force 11.
Oct. 25. 8 p. m. Bar. 29.36 inches. Therm. 72°. Wind north, force 10, weather and sea moderating.
Oct. 25. Midnight. Bar. 29.48 inches. Therm. 71°. Wind north, force 9, weather and sea moderating.

The following barometer readings were taken Tuesday, Nov. 22, 1921, ship lying at Mallory Docks, Tampa, Fla., seventy-fifth meridian time:
8 a. m. Therm. 74°. Bar. 30.17 inches. Tampa station sea-level 30.15.
10 a. m. Therm. 76°. Bar. 30.19 inches. Tampa pressure sea-level, 30.17.
Noon. Therm. 78°. Bar. 30.14 inches. Tampa pressure sea-level, 30.13.
2 p. m. Therm. 73°. Bar. 30.12 inches. Tampa pressure sea-level, 30.09.

Hoping this information will be of benefit to you, I remain,
Very truly, yours,

C. S. HYERS,
Master S. S. "Trujillo."
By S. STANTON,
Chief Officer.

High tides, October 25.—Tampa: The tide was 10.5 feet, the highest since 1848. Egmont and Sanibel Island: Both were practically covered by water. Fort Myers: Tide was 12 to 18 inches higher than previous records for 30 to 35 years. Punta Gorda: Tide was 7 feet above normal high tide at 3 p. m. of 25th; water was in the streets of the city. Punta Rassa: Tide was 6 feet above normal high water. Boca Grande: Tide 5 feet 4 inches above normal high tide at 7.15 a. m. Clearwater: Tide 5 feet above normal high tide, 1.30–4 p. m. St. Petersburg: Tide 8 feet 5 inches above mean low water at 2 p. m.

Maximum wind velocities, with date and direction: Key West, 25th, 48 miles SW. Jacksonville, 25th, 64 miles NE. Mayport, 25th, 54 miles SW. Tampa, 25th, 68 miles S. Tarpon Springs, Dunedin, Egmont Key, and Safety Harbor, all near the center of the storm, estimated the wind velocity as being 80 to 100 miles an hour.

Loss of life.—So far as known the loss of life was small—not exceeding five or six—due, no doubt, to the fact that shipping remained in port.

Loss of shipping.—One coast steamer, the *Vann*, plying between Jacksonville and Miami, foundered off the Jupiter coast about 10 a. m. of the 25th. The value of the vessel and cargo was about $120,000. Several schooners are reported to have capsized off the coast, but definite information is lacking.

Intrastate loss.—The citrus crop sustained a loss 800,000 to 1,000,000 boxes of fruit, approximating a monetary loss of more than $1,000,000. The loss of trees was not great; in fact, the damage from that source was slight. Truck crops adjacent to the coast were greatly damaged—a complete loss in many instances. And the loss of fertilizer and labor greatly augments the disaster, totaling, no doubt, $1,000,000 or more. Salt water flooded many acres, thereby rendering the soil unfit for cultivation in some instances; heavy rain will, however, soon remove the salt deposit, restoring the soil to normal condition.

Miscellaneous damage.—The damage to residences, docks, warehouses, buildings, bridges, and miscellaneous property, at Tampa, Tarpon Springs, St. Petersburg, Sarasota, Punta Gorda, Marco, Caxambus, and Fort Myers; in short, along the coast from a point near Cedar Keys, southward, will exceed $1,000,000, and the aggregate of losses will probably total $3,000,000. The damage on the east coast, while considerable locally, was altogether of little moment when compared with that which befell the west coast.

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THE ELECTRICAL CHARGE OF THE ATMOSPHERE AND THE HEIGHT OF THE BAROMETER.

By W. J. HUMPHREYS.

It has been suggested that many cyclones and anticyclones may be caused by changes in the electrification of the outer atmosphere, such changes, for instance, as presumably occur at the times of brilliant auroræ. It is proposed to check this suggestion by a simple calculation.

Let any considerable, more or less circular, horizontal extent of the upper air be uniformly electrified to the equivalent of a surface charge of density ρ units of electricity per square centimeter, and let the earth immediately beneath have an equal charge of opposite sign.

Now, if there is no other disturbing electrification, the force f on a unit quantity of electricity anywhere between the earth and air charges (assuming, as is approximately true, that the direction of the electric force is everywhere vertical) is given by the well-known equation

$$f = 4\pi\rho$$

of which half is from the air charge and half from the earth charge.

Hence the total electrical pull P between the air and the earth is given by the expression

$$P = 2\pi\rho^2 A \qquad (1)$$

in which A is the area of the charged surface of the earth.

From the value of f, it follows that the work w necessary to carry a unit charge through a difference of level h within the full electric field is

$$w = 4\pi\rho h,$$

or, substituting for ρ its value in terms of P and A, equation (1),

$$w = 4\pi h\sqrt{\frac{P}{2\pi A}}.$$

Hence

$$\left(\frac{w}{h}\right)^2 = 8\pi\frac{P}{A} = 8\pi p \qquad (2)$$

where p = dynes pull on each square centimeter of the electrified surface of the earth, or upper air.

But w/h = ergs work on an electrostatic unit of electricity per its centimeter change in level.

Now, the normal, vertical potential difference in the atmosphere is about one volt per centimeter. Hence, converting to electrostatic units, and substituting in (2),

$$\left(\frac{1}{300}\right)^2 = 8\pi p,$$

or

$$p = 1/2,261,947.$$

But the weight of one cubic centimeter of mercury at 0° C., and under normal gravity

$$= 13.5951 \times 980.665 \text{ dynes}$$
$$= 13,332.24 \text{ dynes}.$$

Hence p equals the weight of a column of mercury 1 square centimeter in cross section and 1/30,156,820,271 centimeter, or, say $1/(3 \times 10^9)$ millimeter, high.

That is, a local electrification of the outer atmosphere sufficient to produce a potential difference between it and the earth, having an equal charge of opposite sign, of 1 volt per centimeter difference in level would increase the height of the mercurial barometer about $1/(3 \times 10^9)$ millimeter.

If, however, the outer atmosphere were charged to this extent over all the earth, each square centimeter of it (regarded as a charged surface) would be repelled radially outward by the rest of the charge on the shell with the force F given, as is well known, by the equation

$$F = 4\pi\rho^2.$$

Hence, from (1), per square centimeter of the charged surface,

$$F = 2P.$$

That is, if the upper air is charged to the extent supposed, all around the earth, the mercurial barometer will stand *lower* by the same amount it would stand *higher* in response to an equally dense local charge, namely, in the present case, by $1/(3 \times 10^9)$ millimeter.

But, as an extreme case, let the charge be local, as first assumed, and let the potential difference with change of elevation be 30,000 volts per centimeter, a value far in excess of any observed except occasionally, perhaps, during the passage of a thunderstorm. With this extreme local electrification the barometer would be raised only about 3/10 millimeter.

Obviously, therefore, no appreciable portion of those considerable changes in atmospheric pressure, giving differences in the readings of the barometer of, say, 2 to 3 centimeters, characteristic of the passage of cyclones and anticyclones, can logically be attributed to variations in the electrification of the upper air, whether at the times of auroras or at any other time. Hence, it seems extremely improbable that either cyclones or anticyclones are ever produced by changes in the electrification of the outer atmosphere.

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PRESSURE MAPS AT THREE KILOMETERS IN JAPAN.

By S. FUJIWHARA.

[Central Meteorological Observatory, Tokyo, Japan, Sept. 19, 1921.]

NOTE.—A paper by S. Nakamura in the February, 1921, number of the *Journal of the Meteorological Society of Japan* entitled "Upper air currents and volcanic ashes from Asama" contains a reference to the practice, in Japan, of drawing maps of pressure at the 3-kilometer level. Dr. S. Fujiwhara, who devised the method, was asked if he would not kindly explain it for the benefit of those in this country who might be interested. The following interesting account of the method has been received in response to this request.—EDITOR.

Our primary object in drawing the upper isobars was to learn their forms and to get the direction and the relative intensity of the upper wind. We noticed first that the error for the pressure at any level lower than 4,000 meters that arises from the inaccurate estimation of the intermediate temperature is not serious, and also that what we want most is the general trend of the upper isobars, but not the absolute values of the pressure at the level concerned. For the general trend, the errors themselves do not produce much disturbance, but the differences, which are by no means so great, of errors for pairs of adjacent stations might come into effect. For example, suppose the errors for all stations lie within the limits of 8.5 and 11.5 mm. Then the mean error of 10 mm., being common to all, makes no disturbance in the general trend of the isobars at that level, which is actually affected by errors of ± 1.5 mm., which, for practical purposes, can be overlooked.

We began to draw upper isobars for our daily weather service in March, 1919, following the principle of Ferrel and Bigelow; by applying several artifices of our own and also that of Köppen, we arrived at an idea that the most useful isobars of the upper layers are those between 3,000 meters and 4,000 meters, so far as the vicinity of the Japanese Empire is concerned. We found by experience also that for the weather service quickness and simplicity of the process are preferable to precision.

The simplest way to draw isobars for the 3,000-meter level from the data at the earth's surface is as follows:

(1) Take the figures of pressure in millimeters of mercury, reduced to sea level and to the freezing point of water and add them to the figures of air temperature in centigrade at the same station. For example:

Reduced barometric reading	752.4 mm.
Reduced air temperature	24.1 °C.
Sum	776.5

(2) Enter the figures thus obtained into a chart and draw isopleths just as isobars. These lines are approximate isobars at the level of 3,000 meters.

By this method we get the general form and trend of the isobars at 3,000 meters, from which we can get also the idea of the direction of the wind there prevailing and also its relative intensity; because, as Sir Napier Shaw has already shown, the direction of the upper wind is nearly always tangential to the isobars at that level. From the distance separating consecutive isobars we can guess the relative intensity of the wind. We do not know, however, the absolute value of the pressure for each isobar, because the figures obtained above are only relative ones. As already has been shown by Mr. S. Takayama, we can get the approximate value of the pressure in millimeters by dividing the figures by 2.

Why do such figures give the relative values of pressure at the level of 3,000 meters? The reason is simple. We can easily see that the middle value of pressure difference corresponding to the difference of 1 mm. at mean sea-level is nearly 0.67 mm. For the range of pressure variation at mean sea-level, 730 to 780 mm., the deviation of the actual value of the pressure difference from the above mean value of 0.67 mm. is less than 0.03 mm., which is negligible for practical work. The pressure difference at 3,000 meters corresponding to a difference of 1° C. in the mean temperature of the air column from sea level to 3,000 meters is also nearly 0.67 mm., and the deviation from this value according to the temperature variation is also not great. This accidental coincidence of the pressure difference at the level of 3,000 meters due to pressure and temperature variation at the earth's surface enables us to make the above artifice.

* * * * *

Expressed mathematically,

$p_3 - P_3 = (0.67 + \alpha)\epsilon + (0.67 + \beta)\theta_m$ in which, p_3 is the current pressure at 3 kilometers, P_3 the mean pressure at that level, ϵ the difference between current and mean pressure at sea-level, θ_m the difference between current and mean average temperature of the air column, and α and β two small quantities representing variations from 0.67 mm., as a result of the range of pressure and temper-