METEOROLOGY IN THE PHYSICAL LABORATORY.

It is well known that for many years the Editor has endeavored to stimulate the study of dynamic meteorology as a combination of laboratory methods with analytical mechanics. A man familiar with hydrodynamics and thermodynamics should be able to make their application to the atmosphere a most interesting subject, and eventually build up a school of mathematical physics applied to meteorology that will be as important to the university as it will be to the advancement of the science.

The following article, by Brunhes, illustrates the class of work to be done in such a laboratory; and many similar examples of careful experimentation could be adduced. At the Peoria convention the Editor sketched out the plan of a work entitled "A handbook of laboratory work leading up to research in meteorology", in which, by a well graded series of experiments, the student proceeds, step by step, until he has explored the prominent feature of atmospheric phenomena, comparing his measurements with his theories until he has obtained a clear idea of the processes that are going on in nature.—*C. A.*

ACTION OF A HORIZONTAL AIR CURRENT UPON A VERTICAL WHIRLWIND.

By BERNHARD BRUNHES.

[Translated by Chester L. Mills from the Comptes Rendus of the Academy of Sciences, Paris, April 29, 1907. Vol. CXLIV, p. 900.]

I have been conducting an experimental research as to the mechanical action exerted by a horizontal air current upon a whirlwind with a vertical axis susceptible of lateral displacement. I have recognized that the phenomenon follows the following law:

A horizontal current exerts on a movable vertical whirlwind that has a sinistrorsal rotation, a horizontal force perpendicular to the current and directed to the left; the force is directed toward the right of the current if the motion of the whirlwind is dextrorsal.

1. I have had recourse to the apparatus of Weyher for the production of a vertical whirling column of air. A vertical box 140 centimeters high and 50 centimeters on a side has three vertical wooden sides, the fourth being of glass before which the observer places himself. At the top is fixt a revolving drum which may be rotated in either direction at will by a small motor. The vertical whirling column is rendered visible by a white smoke of ammonium chlor-hydrate, produced by placing on the floor of the box an evaporating dish full of [hydrochloric] acid in the middle of a vessel of ammonia.

Against a given point of the vertical column of smoke is directed a jet of air generated by an electric fan and carried to the center of the box by a horizontal bent glass tube, which is terminated by a branch, *A*, perpendicular to the glass front of the box and ending a few centimeters from the axis. With a sinistrorsal (counterclockwise) whirling column, the observer standing before the glass front sees the column deviate to his left at the height of the tube *A;* and, continuing to inflect itself and to oscillate, it maintains itself at the right of the tube *A*, if the jet of air is strong enough.

2. A second tube, *B*, exactly in the line of the prolongation of *A*, opens opposite the orifice of *A*, conducting the air which escapes from it from the rear to the front. A stopcock allows the air from the fan to enter by either *A* or *B*, as desired. When the direction of the whirling column is sinistrorsal, the revolving column is deflected to the left if the air enters by *A*, but to the right if the air enters by *B*. With a dextrorsal rotation of the whirling column, the result is reversed, altho it is proper to remark that a column of smoke with dextrorsal rotation is produced and maintained less easily than one with sinistrorsal rotation.

The interior diameter of the tubes *A* and *B* being 8 millimeters, and the speed of the drum one thousand revolutions per minute, for a current of air 30 meters per second, blowing upon the vertical column 65 centimeters from the bottom, there is produced a mean displacement of 15 to 25 millimeters when we pass from tube *A* to tube *B*.

3. I endeavored to check these results by manometric measurements, with a pressure receiver (*prise de pression*) which made it possible to explore the hydrodynamic field of the whirling column and its neighborhood. This pressure receiver is the end of a small horizontal tube, *T*, bent vertically, and capable of being displaced in two directions, forward and backward, and from right to left. The glass tube is connected by a rubber tube to a water manometer with an inclined arm, giving about 1 centimeter displacement for a variation in pressure of 1 millimeter of water.

On moving the tube *T* a minimum of pressure is found to correspond to the case where the vertical arm of the small tube is in the axis of the whirling column. If a horizontal jet of air is directed from *A* or *B* on the vertical arm of the tube *T*, being careful always to blow a little below the opening, so as not to exert, by means of the jet, a direct influence on the free end, it is observed that the manometer rises a little whether one blows from the front or from the back. Again, to find the minimum of pressure it is necessary to push in or draw out the tube *T* so that its extremity will be a little to the left of its initial position (8 to 10 millimeters) if one blows from front to back thru *A*, and when the whirling column is sinistrorsal; but, on the contrary, to the right if one blows from back to front thru *B*.

When the exploring tube *T* is placed in a position such that its extremity is 8 millimeters to the left of the position of minimum pressure without the air jet, there is clearly an increase in pressure (from 0.3 to 0.5 millimeters) when the stopcock is manipulated so as to substitute the rear jet for the one in front. The reverse is the case (with the sinistrorsal whirling column in every case) if the end of the exploring tube is placed 8 to 10 millimeters to the right of the initial position of minimum pressure.

CHARACTERISTICS OF THE INTERTROPICAL ATMOSPHERIC CIRCULATION.[1]

[Translated by Chester L. Mills from the Comptes Rendus of the Academy of Sciences, Paris, April 8, 1907.]

Last year we presented to the academy the results obtained during the first two cruises of the *Otaria*. Since that time the discussion of the observations on the second voyage, of 1906, has been brought to a conclusion, which enables us to state with precision some of the characteristics of the circulation of the air in the intertropical region of the Atlantic.

The north to east trade winds ordinarily extend to an altitude of only several hundred meters. In this stratum the decrease in temperature is very rapid, as one may judge from the following figures which result from ascensions of kites and sounding balloons:

Decrease in temperature per 100 meters of ascent.

Position.	0 to 200	200 to 400	400 to 600	600 to 800	800 to 1000	1000 to 1100	1100 to 1200	1200 to 1400	Method.
	°C.	°C.	°C.	°C.	°C.	°C.	°C.	°C.	
To the north of parallel 25° N.	1.3	1.0	0.6	0.35	0.4	0.1	0.8	.....	Kites.
To the south of parallel 25° N.	+1.8	+0.9	+0.3	—0.75	—0.5	0.0	—1.0	+0.7	Kites.

Six sounding balloons (mean latitude 30° N.) gave a diminution of 1.8° C. for the first 500 meters, with the minimum rate of diminution of temperature at about 1250 meters.

Six sounding balloons at the equator (mean latitude 1° N.)

[1] Note by Messrs. L. Teisserenc de Bort and A. L. Rotch, presented by M. Mascart.