

contain weighing, drying and preparation rooms and facilities for cleaning and storing seed stocks of various kinds. For the fruit farm near Zumbra Heights in the Lake Minnetonka district, \$9,000 was appropriated for the purchase of additional land and \$13,-

500 for an office building and laboratory. Nearly all the investigations in fruit crop breeding are conducted at this farm, and the laboratory will provide much-needed facilities and greatly expedite the making of records and the interpretation of results.

DISCUSSION

CYCLONE AND ANTI-CYCLONE

IN some recent letters, published¹ and personal, Sir Napier Shaw suggests that we might with profit employ the terms "*air-sink*" and "*air dump*" for cyclone and anticyclone. Both of the last-named have done honorable service, and it will be long before they are eradicated from conventional usage in all treatises on airgraphics. But even as we are eliminating the almost unpronounceable word meteorology, so we may gradually dispense with terms that have outlived their usefulness. Cyclone came to us from Piddington, with the Greek *κυκλος* or coil of a snake, and anti-cyclone from Francis Galton, as the opposite of an uprising, rotary wind structure. It would now seem that we have unconsciously overstressed the importance of the circulatory air flow in a depression or cyclone; and so neglected the scooping-out or removal of air on the one hand and the heaping-up or cumulative effect on the other, which is so aptly pictured as a *dump*. This overstressing of the "low" as shown by the surface air flow and a positive insistence upon the fundamental physical relation that air flow is initiated by pressure, and pressure only, has resulted in missing a most important factor in the formation of areas of high and low pressure.

To quote Sir Napier Shaw:

So pressure-gradient comes to be the mere index of the response of an air current to the centrifugal force of the earth's rotation aided or counteracted by any local curvature of the air's path.

Here then we come to a new point of view, as explaining the origin, also maintenance, of highs and lows, and this is of importance in forecasting the weather, and an understanding of the daily maps. Cyclone and anticyclone are really created and maintained by the winds of the straight isobars that lie between them. To quote further from Sir Napier

The high and the low are mere incidents of the relative motion of the air currents of different directions. In the northern hemisphere wherever the passing currents keep the English rule of the road, with opposing traffic on the right, high pressure (and generally fine weather) between them is the inevitable consequence; but wherever the atmosphere adopts the continental rule of keeping

the opposing traffic on the left, there a "low" between them is equally inevitable.

This fundamental law in forecasting we have recognized for some years at Blue Hill Observatory, and may be expressed briefly as, "An air flow from northwest, north or northeast, in advance of a flow of warm, moist air from south or southwest, is less likely to give precipitation and form a depression than when the southerly air flow is in advance of a dry, cold flow from the north." In keeping with the new point of view, we should perhaps mark storm paths, not from the loci of minimum pressure but from the points of wind conflict.

Much more could be said concerning an automatic balance between wind velocity and gradient under the influence of the earth's rotation; but it must suffice for the present to call attention to this shifting of attention from pressure minima to air-flow effects as the really important dynamical agents.

Sir Napier has also calculated the energy of the horizontal motion of a 100 meter layer of air, in thickness, with pressure interval of 2 kilobars as approximately 26,000 kilowatt-hours, varying with height and latitude.

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THE UNCERTAINTY PRINCIPLE

IN his note on "The Uncertainty Principle and Free Will" published in *SCIENCE* for August 14 (p. 172), Professor A. H. Compton seems to overlook the important distinction between a thing which is *indeterminable* and one which is *indeterminate*. No one can predict with accuracy and certainty what the weather will be to-morrow, to say nothing of predicting what it will be a week or a month hence. But I think no scientific man would claim that because the weather is indeterminable it is indeterminate—that the weather to-morrow will not depend, inevitably, on conditions which exist to-day.

It may be an "even chance" whether the photon of which Professor Compton writes will enter one or the other of two photoelectric cells, but it is illogical to suppose, for that reason, that the conduct of the photon is not determined by complex conditions of such a character that prediction is impossible. The fact that so minute an event may produce tremendous

¹ *Nature*, June 27, 1931, "Potential Temperature and the Stratosphere"; August 8, 1931, "The Energy of Horizontal Atmospheric Motion."