## SCIENTIFIC BOOKS

*Annals of the Astronomical Observatory of Harvard College,* Edward C. Pickering, Director. Vol. LVIII., Part III. Observations and Investigations made at the Blue Hill Meteorological Observatory, Massachusetts, U. S. A., in the Year 1905, Under the Direction of A. LAWRENCE ROTCH. With Summaries of Observations for the Lustrum and for the Twenty Years, a Discussion of them, Memoirs on the Meteorology of Total Solar Eclipses and on the Eclipse Shadow-Bands, and a Bibliography. 4to. Cambridge, 1908. Pp. 147–228. Pls. I.–II.

The same. Vol. LXVIII., Part I. Exploration of the Air with Ballons-sondes at St. Louis, and with Kites at Blue Hill. By H. HELM CLAYTON and S. P. FERGUSSON.

The work of the Blue Hill Observatory, whether it be the routine observations or the original investigations carried on by members of the staff, has always been of the highest grade of accuracy, interest and importance. The publications which have dealt with this work, both those in the regular series of the *Annals of the Harvard College Observatory,* and those which have appeared in various scientific journals, make up a list which includes some of the very best contributions to meteorology. Without Professor Rotch's generous and whole-souled support of the Blue Hill Observatory, and without the steady, careful and devoted work of himself and of his assistants, American meteorology would not occupy the important position in the world of science which it does occupy to-day. This statement can be made with perfect truth, and without in any way whatever disparaging the excellent work which has been, and is being, carried on by the United States Weather Bureau.

To review, adequately, the two volumes now before us is wholly out of the question in a journal in which meteorology necessarily has to occupy a subordinate position. We can only note the most important matters presented in these publications.

1. The first number of the *Annals* contains the 1905 observations, both surface and upper air, together with summaries of the observations at the ground during the preceding lustrum and the twenty years. As Professor Rotch points out in his introduction, there is probably nowhere else in the United States so homogeneous a series of observations, due to unchanged exposure of the instruments and methods of reading them. This, alone, gives these records considerable importance. The principal climatic features of the twenty-year period are, therefore, at this time appropriately indicated by Mr. A. L. Wells. Mr. H. H. Clayton gives an interesting summary of "The Meteorology of Total Solar Eclipses, including the Eclipse of 1905." Eclipse meteorology may almost be termed a meteorological curiosity, for total solar eclipses are infrequent, and their effects are not far-reaching, long-lived, or important. *Practically,* eclipse meteorology is therefore unimportant. *Theoretically,* however, there is much of interest in the subject. Mr. Clayton's paper gains much in general usefulness because of his bibliographic notes. His summary of results brings out the fall of temperature during total solar eclipses, with the notable fact that, in the free air and over the ocean, the time of minimum temperature occurs almost at the time of totality, while over the land surfaces the minimum temperature usually lags fifteen to twenty minutes after totality. A low vapor tension about the time of totality; a diminished wind velocity; an outflow of the "eclipse wind," and a maximum of pressure, all indicate a descent of air, are all phenomena connected with anticyclones. The author is firmly of the belief "that a cold-air cyclone is generated by the fall of temperature during an eclipse, and that the phenomena . . . are all results of this cyclone." The final paper in the first volume is one on "Eclipse Shadow-Bands," by Professor A. L. Rotch. In this the author gives the results which he has collected during many years, especially those obtained during the eclipse of August 30, 1905. "The inference from all the data collected is that the shadow-bands are produced by the diminishing crescent of light penetrating air strata differing in their thermal and hygrothermic conditions, and therefore in their refracting power."

2. More general scientific interest will probably attach to the second volume, which deals

with the results and methods of the pioneer work in *ballon sonde* meteorology, carried out by Professor Rotch in the United States with the financial cooperation of the Louisiana Purchase Exposition, and, later, of the Smithsonian Institution. Most men of science in this country probably already have a general idea of the importance of this investigation, and those who are able to keep up with meteorological literature know how widely this work has been discussed, and with what a warm welcome the results have been received abroad. If we mistake not, SCIENCE has contained several notices of this work. Mr. S. P. Fergusson contributes the first portion of the volume, on the "Apparatus and Methods," in which a brief account is given of the historical development of this kind of investigation. (It may be recalled that on March 21, 1893, MM. Hermite and Bésancon first employed a special instrument, recording time, pressure and temperature, which was sent up with a *ballon-sonde* in Europe.) "The Method of Reducing the Data" is discussed by Mr. H. H. Clayton. Then come a series of tables in which the records are given *in extenso*. "A Discussion of the Temperature and Wind," also by Mr. Clayton, follows. Particular interest attaches to the vertical temperature gradients, a subject which has been much discussed of late years, and which has important theoretical bearings. It appears that for all seasons the rate of decrease of temperature with increase of altitude above 2 km. increases up to about 8 km., then diminishes, and that there is an inversion in the gradient above 13–14 km., the well-known "isothermal stratum," whose existence was first established in Europe. Mr. Clayton contributes an interesting fact to the discussion concerning the cause of this isothermal layer. He suspects that a diminution in the northerly currents is characteristic of the region above 10 km., and that this may in part explain the phenomenon. The most frequent gradients in the lower air (0–1 km.) are the adiabatic gradients of dry air (0.9°–1.1° C.) and of saturated air (0.5°–0.6° C.). Inversions of temperature also show a maximum frequency in the lower stratum. Between 1,000 and 7,000 meters the prevailing gradients are the adiabatic gradients of saturated air. The adiabatic gradients for dry air diminish rapidly from the ground up to 2 km., and are rarely observed between 2 and 4 km. Above 4 km. they increase in frequency and reach a decided maximum between 8 and 9 km.; then decrease again in frequency to almost zero between 11 and 15 km. The upper parts of the two zones of maximum frequency of the adiabatic gradients of dry air are regions of maximum cloud frequency, the one zone being characterized by a prevalence of cumulus clouds, and the other by a prevalence of cirrus clouds. Cold waves, the author believes, are inclined strata of descending air, felt first at the earth's surface, and successively later at greater altitudes. The following statement is of special interest (pp. 81–82):

> At each successive rise of 2 km., the position of the area of cold in the anticyclone, and the position of the area of warmth in the cyclone, shifts northward in a semicircular course around the centers of the anticyclones and cyclones, until at 10 km. the area of cold is in the northern portion of the anticyclone, and the area of warmth is in the northeastern portion of the cyclone.

Our notice is already unduly long. We can but mention a final paper, by Mr. Clayton, on "The Distribution of the Meteorological Elements around Cyclones and Anticyclones up to 3 Kilometers at Blue Hill," an important contribution to a discussion to which our author has already devoted much time during recent years.

It is a pleasure to call the attention of the readers of SCIENCE to these valuable memoirs. Although the interest in meteorology is not as active or as widespread in this country as it should be, we feel sure that we are expressing the sentiments of a large number of our fellow-workers in science when we congratulate Professor Rotch, and his colleagues, most heartily, on their latest achievements in the field of meteorological research.

R. DEC. WARD

*Bulletin of the American Museum of Natural History.* Twenty-fourth Volume.

This large volume is only slightly less