SCIENTIFIC BOOKS

METEOROLOGY

Meteorology, Theoretical and Applied. By E. WENDELL HEWSON and RICHMOND W. LONGLEY. 468 pp. 194 figs. New York: John Wiley & Sons, Inc. 1944. $4.75.

Weather Around the World. By IVAN RAY TANNEHILL. 200 pp. 55 figs. Princeton: Princeton University Press. 1943. $2.50.

Fogs, Clouds and Aviation. By W. J. HUMPHREYS. 200 pp. 93 figs. Baltimore: The Willams & Wilkins Company. 1943. $3.00.

An Introduction to Weather and Climate. By GLENN T. TREWARTHA. 545 pp. 196 figs. 7 plates. New York: McGraw-Hill Book Company, Inc. 1943.

Methods in Climatology. By VICTOR CONRAD. 228 pp. 46 figs. Cambridge: Harvard University Press. 1944. $4.00.

A BY-PRODUCT of the growth of aviation immediately prior to and during World War II has been a vast expansion of meteorology. Research and instruction have been vigorously prosecuted and great progress in both lines has been made. Now, for the time being, the scope of meteorology has been established and its content crystallized. Meteorology is a science which partakes at one time of physics and of geography. Depending on the point of view and the emphasis, the field of meteorology breaks down into several subdivisions. Dynamic meteorology, dealing with forces and motions in the atmosphere, is exclusively physics. Physical meteorology also is largely physics, but, in so far as it deals with geographical distributions of the physical qualities of the atmosphere, it is geography. Synoptic meteorology refers back to dynamic and physical meteorology for its materials but is largely geographic in method. Various special applications of meteorology have resulted in further subdivision of the field. Thus, for example, we have aeronautical meteorology, marine meteorology, agricultural meteorology, hydrometeorology and medical meteorology. The place of climatology in the hierarchy of meteorological science is vague and ill-defined. The meteorologists with a background in physics regard it as "statistical meteorology" dealing with mean values of the meteorological elements. Those with a geographical background, on the other hand, think of it as being concerned with a synthesis of the atmospheric factors that give character or individuality to geographic regions.

The large number of text-books that have appeared in the last few years fit readily into the established framework: novelty and innovation have become rare. "Meteorology—Theoretical and Applied" follows the established pattern. The first part, called "Theoretical Meteorology," contains material that is usually classed as dynamic meteorology and follows the outline of Haurwitz' excellent book of that name, chapter by chapter. The second part, called "Applied Meteorology," gives the student the material usually associated with synoptic meteorology.

Three chapters scattered through the book are innovations. At the end of Part I there is a chapter on statistical analysis of meteorological data. Toward the end of Part II there is a brief chapter on climatology and the last chapter is entitled "Meteorology Applied to Various Human Activities." The treatment of these new subjects is necessarily superficial; furthermore, they are not properly integrated into the main text. For example, the climatology chapter is introduced because of the "importance of climatology to the meteorologist." Yet the authors accept the prevalent view that "the statistical facts presented by the climatologist are not vital to the forecaster."

As a matter of fact, weather forecasts are unintelligible except when referred to the expected conditions of the time and place, which are the climate. Otherwise how can we get any meaning out of the following forecasts for the District of Columbia? January 5, 1945—Clear and not quite so warm; to-morrow fair and warmer. July 2, 1945—Considerable cloudiness and not so warm; to-morrow fair with moderate temperature. The forecaster has no fixed standard but one that changes with the seasons. In discussing the possibilities of weather forecasting, Joseph Henry, in 1855, stated the objective to be "to trace to their source, various perturbing influences which produce the variations from the mean, and thus arrive, at least, at an approximate explanation of the meteorological phenomena which are constantly presented to us."[1]

During the war many popular books have been written on a great variety of subjects to assist the men in the armed forces to understand unfamiliar things in distant places. "Weather Around the World" and "Fogs, Clouds and Aviation" have this objective. "Weather Around the World" is a Baedeker's Guide to weather and climate for travelers. It is simply written, but at the same time it answers most of the questions about the weather that would probably arise in the mind of the non-meteorologist. Especially interesting are the descriptions of weather to be expected on actual ocean voyages.

[1] Joseph Henry, "Meteorology in its Connection with Agriculture." In Report of the Commissioner of Patents for the year 1855, p. 358, Washington [D. C.] (34th Cong., 1st Sess., H. Ex. Doc. 12.)

This little book should be very useful to travelers long after the war is over.

"Fogs, Clouds and Aviation" is a reprinting in book form of a delightful lecture entitled "Fogs and Clouds" delivered by Dr. Humphreys at the Franklin Institute and printed in the journal of that institution in 1922. Nearly 100 well-chosen photographs of cloud forms are reproduced; almost twice as many as in the original publication. The text, however, is only slightly changed. Brief biographical sketches of John Aitken and Luke Howard have been introduced, and here and there new material has been added; for example, a description of the "helm bar" of the Lake District of northern England. However, extremely little has been inserted to justify the addition of the word "aviation" to the title. We are told that the "cirrus is a valuable one-way screen," that cumuli are "convenient hide-and-seek places for the aviator," and that "the aviator should keep either above or below a layer of billow clouds, since in their midst the air is likely to be quite bumpy." Even so, the book is a valuable one for the aviator, just as it is for any other non-meteorologist, since it describes and explains fogs and clouds.

"An Introduction to Weather and Climate" is already well established as a standard text through the first edition which appeared in 1937. It was written from the geographical point of view by a geographer, whose university course is called climatography. Although the book deals with descriptive and regional aspects of climate, it does not stop with mere description; it goes far in the explanation of regional climates. The first edition contains 373 pages; the new edition 545. The author has utilized material made available by recent advances in meteorology and has rewritten and expanded the original text in the light of classroom experience. A new chapter dealing with the origin and modification of air masses, atmospheric fronts and the air-mass characteristics of some of the continents has been added. The first edition of this book was good; the new edition is better.

"Methods in Climatology" was written, according to the author, for students of geography. He explains that "climatology and climatography appear as parts of geography, because they are essentially necessary to describe the suface of the earth and its changes." He maintains that in the climatological studies of the geographers, "geographical methods are kept in the forefront, and specifically climatological methods are not so much used." He holds that the "too-schematical descriptions" characteristic of climatography can be avoided by adapting various "methods of mathematical statistics and theory of probability" to the analysis of the data. The first part of the book deals with statistical methods. The second part is concerned with the variations of the elements in the course of time at one fixed place. The third part presents the comparison of the elements which are observed synchronously at different places, and arrives at their geographical distribution. The last section of the book gives suggestions for the arrangement of a more or less complete climatography.

The climatological elements listed by the author include, (1) radiation of sun and sky, (2) temperature of the air and of the surface of the earth, (3) wind direction and velocity, (4) humidity and evaporation, (5) cloudiness and sunshine, (6) precipitation, (7) snow cover and (8) air pressures. The elements may be classified as (1) primitive elements, which are directly observed or estimated, such as temperature, precipitation and cloudiness, (2) combined elements, such as continentality and equivalent temperature, and (3) derived elements, such as the duration of the frost period and the growing season.

The author's first concern is with the comparability of the data. He warns that instrumentation and exposure vary from one country to another; for example, rain-gage funnels range in area from 20 square inches to 78 square inches (50 square inches in the United States) and the elevation of the rim of the receiver above the ground varies from 12 inches to 59 inches (34 inches in the United States). He quite properly insists that the climatologist "should be aware of these inequalities and discontinuities."

The author next presents four chapters on statistical methods. Although this material may be found in any text on statistics, it is appropriate here because of the examples from climatology. In parts 2 and 3 we have the real substance of the book: here various statistical procedures are applied to the serial and spatial data of climatology.

"Methods in Climatology"[1] is a useful book. Nevertheless, it is disappointing. Workers in the United States badly need a handbook on methods, yet this book, although written in English and published in this country, is clearly for European students. The author confesses that it is developed from lecture notes and student theses from the University of Vienna. Most of the citations are to his own works published in German. This results in a curious incongruity. He says that "everyone with high-school training should be able to understand" the mathematical procedures which he presents. Yet, repeatedly, "for lack of space" he does not complete the develop-

[1] This book was reviewed in SCIENCE for March 16, 1945, by Dr. R. G. Stone. This review presents a different point of view.

ment of a theme but refers the student to a German reference. Not only does he overestimate the language training of our high-school graduates but their training in mathematics as well.

The author has not taken the trouble to become acquainted with the American literature. He refers to the *Monthly Weather Review* scarcely a half dozen times, yet for many years it was a primary source of material on climatological methodology. By way of contrast, we may cite the work of Geiger,[2] one of his former colleagues, who obtained 60 out of a total of 82 references to frost from the *Monthly Weather Review*. Apparently the author has not examined the few citations to American literature that he has included. For example, he says (p. 95) that he could not find a proper definition of killing frost in the available literature and quotes a definition given to him by a colleague. The quoted definition is a paraphrase of one by W. G. Reed in "Frost and the Growing Season," a part of the Atlas of American Agriculture, to which the reader is referred. Only in one other place, in a footnote in the conclusion of the book, does he cite the Climatic Section of the Atlas of American Agriculture. Here he calls it a "monumental work" and promises the reader "a rich source of different methods of representation," but he cites the work incorrectly and does not mention J. B. Kincer, the author of the principal parts.

No book for use in this country dealing with the application of statistics to climatology should fail to make use of the innumerable articles that have appeared in the *Monthly Weather Review* during the last 30 years.[3] Perhaps Professor Conrad intends to issue a second edition of his book. If so, it is hoped that he will become acquainted with our literature and consider the needs of our students during its preparation.

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THE CHEMICAL FORMULARY

The Chemical Formulary. Vol. VII. By H. Bennett, editor-in-chief. xxxii + 474 pp. Brooklyn, N. Y.: Chemical Publishing Company, Inc. 1945. $6.00.

This is the seventh volume of the series, and as in previous volumes the editor-in-chief has had the assistance of an editorial board of about fifty assistant editors in industrial and educational organizations. A footnote to the preface states that all the formulae in volumes I to VII are different except for a few typical cases used in the introduction to illustrate directions and advice for new users of the volumes.

The fields covered in the present volume include adhesives, beverages, cosmetics, emulsions, foods, inks, lubricants, materials of construction, metals and alloys, paints and varnishes, pyrotechnics and explosives, rubber, plastics, detergents, textiles, etc.

The directory of sources of chemicals and supplies in the present volume now numbers 606 sources. This will prove of value to users of the volume, since many of the substances mentioned in formulae throughout the book are trademarked or copyrighted "trade names" and could not be secured on the open market either by reason of their compound nature or secret composition. The editor feels justified in including such substances, since without them many ideas and processes offered in formulae of specialty producers would have been automatically eliminated.

A large number of the formulae and compositions presented in the present volume are taken from the patent literature. In most cases the original patent number is given so that users of these formulations may refer to the original sources. Those who are familiar with the use or application of such formulae will recognize the generally limited usefulness of such patented disclosures.

Tables of weights and measures, a list of foreign sources of chemicals and an index of nearly 2,000 entries complete the present volume. Previous volumes have been widely reviewed in technical and trade publications such as *American Dyestuff's Reporter, Electrochemical Society Bulletin, Modern Plastics, Rubber Age,* etc., and have received favorable comment. The present volume is a timely addition to the series and will doubtless find wide acceptance among chemists and technologists throughout the industry.

Volume VI has been reviewed in Science, and previous volumes have been widely reviewed in technical and trade publications and have received favorable comment.

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BOOKS RECEIVED

Proceedings of the American Philosophical Society. Pp. 542. The American Philosophical Society. 75¢. 1945.

Universidad de Antioquia, Numeros 71–72. Pp. 584. Colombia.

[2] Rudolf Geiger, Das Klima der bodennahen Luftschicht. Die Wissenschaft. Vol. 78, Braunschweig, Vieweg, 1927.

[3] A single volume of the *Monthly Weather Review* (v. 44, 1916) contains the following articles: C. F. Marvin, "Elementary Notes on Least Squares, the Theory of Statistics and Correlation, for Meteorology and Agriculture. Vol. 44, Oct., 1916, pp. 551–569; William Gardner Reed, "Weather Insurance," Vol. 44, Oct., 1916, pp. 575–580, and "The Probable Growing Season," Vol. 44, Sept., 1916, pp. 509–512; William G. Reed and Howard R. Tolley, "Weather as a Business Risk in Farming," Vol. 44, June, 1916, pp. 354–355; W. J. Spillman, H. R. Tolley and W. G. Reed, "The Average Internal Curve and its Application to Meteorological Phenomena," Vol. 44, Apr., 1916, pp. 197–200; Howard Ross Tolley, "Frequency Curves of Climatic Phenomena," Vol. 44, Nov., 1916, pp. 634–642.