geometrical figures for which he was granted one of the Stalin first prizes for 1942. Pontryagin, Tikhonov and several other topologists are now actively working on special war problems.

A number of topologists of the younger generation are in the ranks of the Red Army. Some of them send their scientific works to the Academy of Sciences for publication in its Reports, even from the front. Graduate students Shanin and Fomin completed their topological work while in the Red Army and came from the front to take their examinations.

Soviet topologists strive even under the most trying conditions of war not to lose their place in the international cooperation of mathematics.

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# SCIENTIFIC BOOKS

## METEOROLOGY AND CLIMATOLOGY

*Basic Principles of Weather Forecasting.* By VICTOR P. STARR. 299 pp. 125 figs. New York: Harper and Brothers. 1942.

*Workbook in Meteorology.* By ATHELSTAN F. SPILHAUS and JAMES E. MILLER. 163 pp. Figs. and maps in end pocket. New York: McGraw-Hill. 1942. $3.00.

*Climatology, General and Regional.* By THOMAS A. BLAIR. 478 pp. 101 figs. 1 fold map. New York: Prentice-Hall. 1942. $5.00.

*An Introduction to the Study of Weather and Climate.* By HAROLD B. WARD and WILLIAM E. POWERS. 112 pp. 24 figs. Evanston, Ill.: Privately printed. 1942.

*Ways of the Weather.* By W. J. HUMPHREYS. 400 pp. 75 figs. Lancaster, Pa.: The Jaques Cattell Press. 1942. $4.00.

THE publication of Espy's epoch-making "Philosophy of Storms" a century ago initiated a period of great development in meteorology in this country. Espy had recruited a corps of volunteer weather observers in the eastern part of the United States, and from the reports received from them by mail he undertook to systematize the information on size, form and rate and direction of travel of individual storms. The later development of the telegraph made it possible to get weather reports quickly and led to the conviction that the weather could be foretold. For a few years prior to the Civil War the Smithsonian Institution issued daily public weather forecasts. Official meteorological services were established in many countries during the 1870's; our own was created in the first year of that decade within the Army Signal Service. Thus meteorology in this country became an official technology and the responsibility for its welfare rested in a government agency, which presently was reorganized and became the Weather Bureau. The chief preoccupation of the bureau was with weather forecasting.

There were no trained meteorologists and unfortunately little encouragement was given to the development of adequate training facilities in the universities. New employees in the Weather Bureau were recruited at the sub-professional level and were trained through a system of apprenticeship to fill professional positions. University administrators were not willing to establish facilities for training and for research in meteorology so long as there were no professional opportunities for graduates.

With the rapid development of commercial and military aviation during the last 20 years there arose a need for weather forecasts more detailed and specialized than the Weather Bureau could provide. In 1927, with the support of the Guggenheim Fund for the Promotion of Aeronautics, an experimental airways weather service was established for the air route between Los Angeles and San Francisco. Carl-Gustaf Rossby was selected to conduct the trial. This airways weather service quickly proved that meteorology could be of inestimable service to aviation and a need for trained meteorologists soon became evident. With the support of the Guggenheim Fund, a meteorology course was instituted at the Massachusetts Institute of Technology in 1928, with Rossby in charge. Gradually, young men who had taken this course began to make themselves felt in the Army and the Navy and in civil aviation. At the same time fundamental research in meteorology was greatly stimulated and graduate work in the subject led to the conferring of the first Sc.D. degree in meteorology in this country about eight years ago. During the last five years Rossby and his students have been responsible for the establishment of departments of meteorology in three other first-rate institutions: New York University (1938), the University of Chicago (1940) and the University of California at Los Angeles (1940).

A logical by-product of the phenomenal growth of aeronautical meteorology in the last decade has been the publication of text-books. Already they occupy a five-foot shelf and they are mostly of very high quality. In the main, however, they are strongly biased by the special needs of aviation and do not even claim to treat of the whole of meteorology. For this state of affairs Rossby and his associates can not be blamed. They realize that there can be no important advance in the art of weather forecasting without

much fundamental work in the science of meteorology. They realize further that there can be no full and sound development of the science so long as any part of it remains neglected.

Nevertheless, there is no opportunity at present for them to do much to round out the development of the science. The present wartime emphasis on military aviation has brought literally thousands of Army and Navy cadets to the existing meteorology departments for training as weather forecasters. The facilities of these schools were so severely overtaxed that both the Army and Navy have found it necessary to establish new schools for training in weather forecasting.

The need for speed in training of weather forecasters for the military services has created many extremely difficult pedagogical problems. The students are not allowed time to acquire an adequate knowledge of the physics of the atmosphere; instead their training in forecasting is reduced, in so far as possible, to a series of empirical rules, and entails as much practice in the laboratory as time will permit.

"Basic Principles of Weather Forecasting" was written for use in the present accelerated training program. Mr. Starr directs the work in experimental weather forecasting in the Institute of Meteorology at the University of Chicago. He has developed special competence in making forecasts from the observations that can be obtained at a single station. Such forecasts are, of course, extremely valuable in many fields of military operation, since there are times when synoptic observations from other stations are unobtainable. The book is almost completely non-mathematical; there are scarcely a dozen equations in it and these are far from formidable. The basic principles are brought together in the first two chapters, the first of which deals with forecasting the field of motion in the atmosphere and the second with forecasting of the actual weather from the field of motion. There are only a few pages on the general atmospheric circulation. Most of the remainder of the book discusses a series of examples of weather forecasts for each of the four seasons. The author makes skilful use of carefully selected synoptic charts and charts of upper-air soundings. The book ends with a brief description of current work on extended-period forecasting. Mr. Starr is a good teacher as well as a skilful forecaster and his book profits from both of these qualities. It should be especially useful in the present emergency.

"Workbook in Meteorology" was also prepared to assist in the rapid training of students in the art of weather forecasting. Its four parts deal successively with climate (mean condition of the atmosphere), instruments and methods of observation, the elements of dynamic meteorology and the weather map. Most of the exercises are carefully prepared and are purposeful; the text is thoughtfully written and the instructions are clear and concise. Unfortunately, there are a few exercises that will be recognized even by the student as busy work. The questions that follow some of the exercises could have been much better. They are mostly of the simple true-false type (the mean position of the heat equator is [north, south] of the geographic equator) and add little to the student's understanding of the work he has been doing. Nor do they help the instructor to estimate the progress of the student. Nevertheless, this workbook should be a most useful laboratory teaching aid and there is little doubt that it will be widely adopted. "Workbook in Weather Forecasting" would be a better title.

There is one part of meteorology that has been neglected more than any other. This part is climatology. A century ago meteorology was mainly climatology, but after the possibilities of weather forecasting came to be realized, the content of meteorology became more and more restricted until to-day it consists almost entirely of "weatherology." In fact, it is no longer realized that climatology is an integral part of meteorology, coordinate with "weatherology" and of equal importance to it. Both subdivisions of meteorology use the same instruments and the same observational data. One is concerned with irregular short-time fluctuations in the state of the atmosphere, whereas the other has to do with the regularly recurrent or periodic changes in the state of the atmosphere from day to night and from winter to summer. The conditions of the atmosphere to be expected at any place over a period of time constitute its climate.

Just as meteorology ("weatherology") is given practical expression in weather forecasting, so climatology finds practical application conspicuously in the fields of agriculture, biology and geography. But climatology has not reached the stage of practical application nearly to the extent that "weatherology" has. Climatology remains largely descriptive; physical climatology is virtually unexplored in this country. Perhaps it will require pressure from the agricultural interests, like that exerted by the aviation interests to secure improved forecasts, before physical climatology will be developed to a point where it can serve practical ends.

Much of the current literature of climatology is written by the geographers. They have a very real interest in climatology because they regard climate as the key to the areal differentiation of the earth. The study of descriptive climatology has, thus, been diligently pursued and studies of the climate of particular places and regions are numerous.

There are a number of text-books on climatology written in the English language. They are largely descriptive and have more or less similar organization, giving information on temperature, rainfall, humidity, pressure and wind for various parts of the earth.

Blair's "Climatology" is such a book. It is no better, and perhaps no worse, than others that have appeared in the past. It will certainly do nothing to advance the science of climatology or to raise the level of teaching of the subject in the United States. The writing is dull and the illustrations are poorly selected and executed. The first quarter of the book deals with what is called general climatology and the remainder with the climates of the world. The book contains some modern material, but it is not adequately assimilated into the text. For example, appended to the discussion of the general circulation, which follows Ferrell quite literally, there is a brief paragraph on air masses. It may be presumed that Rossby's lucid discussion of the general circulation in the 1941 Yearbook of Agriculture (Climate and Man) was available to the author. At least it is listed in the bibliography. Yet there is no indication that he made any use of it.

The failure to deal satisfactorily with the various climatic controls, and particularly the general circulation, makes difficult the discussion of the climates of various regions. For example, when explaining the arid parts of North America he says, in part (page 173), "The southern portion of this dry-climate area, from southern California to Texas and southward into Mexico, is in the subtropical belt of high pressure, which is characteristically dry around the world. In winter, the winds are from north or northwest out of the Great Basin center of high pressure, and they decrease in humidity as they move southward to warmer latitudes. In summer the inflowing winds on the Pacific side pass over the abnormally cool water along the California and Lower California coasts, and hence are dry as they move inland over the very warm land surface." This explanation is repeated in the discussion of the factors influencing the climate of California (page 202).

As a matter of fact, the air that passes over southern California in summer is not dry; it contains three times as much moisture as in winter. Only in the Gulf and South Atlantic states is the summer air moister. Summer rainfall is deficient over southern California because a mechanism for precipitating the abundant atmospheric moisture is lacking. In "Characteristic Weather Phenomena of California" Byers has explained the peculiar rainfall régime of California clearly and simply. It can not be said that the explanation is too complicated for climatology students.

Blair says (page 12) that there are only three methods of transmitting heat: radiation, conduction and convection. The most important process for redistributing heat over the earth's surface, advection, is ignored. So is the most important process for the vertical transport of heat, mechanical turbulence. Convective turbulence is mentioned as the principal cause of high fogs in central California (page 203), but the process is nowhere explained.

"Weather and Climate" is a privately printed book of 112 pages that presumes to cover the whole field of meteorology. It fails completely. There are 10 chapters as follows: earth relations (6 pages), the atmosphere (10 pages), the heating and cooling of the earth (8 pages), atmospheric pressure and winds (6 pages), the moisture of the atmosphere (10 pages), the general circulation of the atmosphere (6 pages), the seasons (2 pages), aperiodic migratory cyclones and anticyclones (19 pages), the weather map and forecasting (9 pages) and climate (22 pages).

This statistical summary of the contents of the book does not tell the whole story of its inadequacy. Of the 6 pages in the chapter on earth relations 5 are irrelevant by any standard in a book on this subject. Three of the 6 pages on atmospheric pressure and winds are wasted on useless illustrations. The chapter on migratory cyclones and anticyclones contains a two-page half-tone reproduction of a daily weather map which is almost completely illegible and of which no use is made in the text. A footnote states, "The map . . . has been cut and made smaller so that some of the explanatory material is omitted." This is not of any importance because the part that remains can not be read. That a world survey of climate can hardly be achieved in a space of 18 pages is obvious. This book is about the equivalent of the corresponding part of a high-school text in general science. One wonders if it is being used in college classes.

The subtitle of "Ways of the Weather" is "A cultural survey of meteorology." It was published in the "Humanizing Science" series of the Jaques Cattell Press. Only Dr. Humphreys could have written this book. He has a rigorous scientific background and at the same time a rare ability to explain things simply and interestingly. His ready wit and his sprightly style are seen here at their best. Little is overlooked in the book; in fact the reader is given a bonus of material not ordinarily found in meteorology texts. Here the author is following the precedent established by his earlier work, "Physics of the Air," but there is an important difference. For example, what he then labeled "meteorological acoustics" he now calls "weather music." Where else can we get a scientific explanation of the murmur of the forest, the roar of the tornado, the howling of the wind, the clatter of hail, the rattle of sleet, the patter of rain, the detonation of meteorites, the swish of the Aurora and the song of the four-horse wagon, in non-scientific language?

Such abstruse subjects as "structure of the atmosphere," "distribution of temperature," "distribution of water vapor" and "distribution and changes of atmospheric pressure" do not readily lend themselves to

interesting presentation for the lay reader, but Dr. Humphreys has made them interesting. Still, "Ways of the Weather" is not for the lay reader alone; it is a book that every professional meteorologist should have, if for no other reason, because it presents the old and familiar substance of meteorology in a new and fresh garb.

C. W. THORNTHWAITE

# SOCIETIES AND MEETINGS

## THE ILLINOIS STATE ACADEMY OF SCIENCE

THE Illinois State Academy of Science held its thirty-sixth annual meeting on May 7 and 8, at Jacksonville, Illinois, with MacMurray College and Illinois College as hosts. Attendance, although smaller than in recent years, was larger than had been expected, with 329 persons registered.

On the morning of May 7, a general session in Jones Chapel on the Illinois College campus featured two timely addresses. The retiring academy president, F. M. Fryxell, Augustana College, spoke on "American Science in the Development of the Philippines," and Dr. Edson S. Babson, professor of geology, University of Chicago, spoke earnestly of our natural heritage, its benefits and its menace.

During the afternoon of May 7, ten sections of the academy met separately under the direction of section chairmen, in quarters provided by MacMurray College, for the reading of papers by academy members. The Agriculture Section, Dr. O. L. Whalin, University of Illinois, chairman, heard nine papers and had an attendance of nineteen persons. The Anthropology Section, Mr. Ben Nussbaum, Fairbury, chairman, heard ten papers and had an attendance of sixty-five persons. The Botany Section, Dr. K. Richard Johnson, National College of Education, chairman, heard eight papers and had an attendance of twenty-two persons. The Chemistry Section, Dr. H. W. Gould, Northern Illinois State Teachers College, chairman, heard ten papers and had an attendance of twenty. The Geography Section, Dr. L. A. Holmes, State Normal University, chairman, heard four papers by four attendants. The Geology Section, Dr. William E. Powers, Northwestern University, chairman, heard thirteen papers and had thirty-one in attendance. The Zoology Section, Dr. Herbert H. Ross, Illinois National History Survey, chairman, heard seven papers and had an attendance of twenty-six persons.

The Social Science and Psychology and Education sections, with Dr. M. R. Goodson, University of Illinois High School, and Dr. V. Dake Jolley, Wheaton College, as co-chairmen, heard four papers and had an attendance of forty-five persons. These sections also held a special noon luncheon, with Dr. Sylvanus M. Duvall, George Williams College, speaking on the subject, "Wanted, A West Point for Peace Leadership," and a morning session on May 8 to view the University of Iowa's motion picture, "The Effects of Social Climate on Behavior," and to discuss implications of this film for classroom management.

The new Collegiate Section of the Academy, which spans the gap between the Junior Academy of Science and the Senior Academy, with Miss Marjory Merrill, senior in biology, and Miss Eleanor Garvin, senior in chemistry, both of MacMurray College, as chairmen, and Dr. H. R. Wanless, University of Illinois, as coordinator, heard a program of fifteen papers presented by college students from five colleges and universities before an attendance of forty persons.

The Physics Section, Dr. O. L. Railsback, Eastern Illinois State Teachers College, chairman, in recognition of the demands made by war on physicists, asked none of its members to prepare papers but, with twenty-five persons in attendance, devoted its time to a discussion of the preparation and certification of science teachers.

The annual banquet of the academy, held on the evening of May 7, was well attended. The short program included the introduction of new officers and, as the outstanding annual highlight, the awarding by the academy of American Association for the Advancement of Science grants in aid of research to Dr. I. A. Koten, Dr. H. J. Eigenbrodt and Dr. C. L. Bieber, jointly, of North Central College, and to Dr. C. W. Bennett, of Western Illinois State Teachers College.

The banquet was followed by the annual public lecture provided by the academy. Dr. Carl T. Russell, head of the department of research and interpretation of the National Park Service, spoke on the national parks during the war and in the future, illustrating his remarks with lantern slides and with a colored motion picture film.

The morning of May 8 was devoted to tours of inspection of the State School for the Blind, State School for the Deaf and State Hospital for the Insane, all of which are located in Jacksonville. At these institutions the managing officers had arranged special demonstrations of methods and displays of equipment and facilities, by means of which the membership of the Illinois Academy might better understand both what is being done towards the rehabilitation of the blind, the deaf and the insane and also how it is being done.

Officers elected for the coming year were: