Reviews

I

Handbuch der Wellen der Meere und Ozeane by Erich Bruns, VEB Deutscher Verlag der Wissenschaften, Berlin, 1955, pp. 255, 150 Figures, 99 Tables.

Waves on the sea surface has been the subject of extensive studies by scholars of various nationalities. Most of them deal with theories of the dynamical phenomena of wave-motion and water-movements and their relationships with wind. Detailed empirical studies are of relatively recent origin. A handy reference book summarising the theoretical and empirical information about sea waves in the available world-literature is a great need. The "Handbuch" under review satisfies this need admirably. The approach in this handbook is practical utility; lengthy theoretical derivations are avoided and only the results quoted. The book is intended for technical officials like ship-builders, sea-port and shore-protection engineers, sea going mariners, marine meteorologists and other civil and military officials vitally concerned with sea-waves and their consequences. An important feature of the book is that it contains many significant Soviet contributions in the fields of wave-investigation and wave-measuring techniques.

The book is divided into six parts. Part I deals with waves in general (20 pages). Nearly forty methods and apparatus employed for the determination of wave elements and wave action are described in Part II (82 pages). Part III (50 pages) contains seasonwise data of wind and wave heights over the different seas and oceans of the world. A large number of stereophotographic charts depicting the water surface contours add to the value of this Part. Results of the measurement of wave action at the coasts of the North Sea, the Mediterranean, the Atlantic Ocean and the Pacific Ocean are dealt with in Part IV (8 pages). Part V (52 pages) contains two chapters. One chapter outlines the theoretical formulae for the computation of the changes in the wave elements when the wave system enters shallow water, of wave slopes, of wave heights and wavelengths, when observational data are absent or scanty. The other chapter outlines the computation of wave action on structures with perpendicular walls, seaward sloping walls, and walls with the seaward profiles curve. Part VI (16 pages) deals with techniques for forecasting sea waves and surf. 201 references are listed at the end.

The literature is brought up to nearly 1950, although there are a few references to Soviet literature up to 1953. Therefore the handbook does not contain information on later developments like the representation of the ocean wave system as a particular realisation of a quasi-stationary gaussian process in three variables, the forecasting of ocean waves by wave spectra and statistics, etc.

The material is highly condensed as can be guessed from the number of figures (150) and tables (99) in a book of 255 pages. There are no attempts at any critical appraisal of the formulae quoted or of the apparatus described. There are about thirty listed references to literature in the English language, while the bulk of the rest are to German and Soviet literature. There is an isolated instance on page 49, where the symbols on Fig. 36 are at variance with those adopted for the equations 17 and 18 on the same page.

Dr. Ing. Erich Bruns and the ocean Hydrographic Service of the German Democratic Republic, who have apparently encouraged the author to prepare the handbook have done a great service in compiling this book.

The handbook is printed well. The numerous photographs of the sea waves and the pictures of the various apparatus described enhance the usefulness of the book. As a reference manual it is very handy and should find a place in the shelf of every official and field worker interested in the various practical aspects of sea waves.

P. R. PISHAROTY

II

Dynamics of Climate edited by Richard L. Pfeffer—Proceedings of a Conference sponsored jointly by Institute for Advanced Study, Princeton, New Jersey and Geophysics Research Directorate, Air Force Cambridge Research Centre, Air Research and Development Command, Bedford — Pergamon Press, 1960, pp. xv + 137, price 35 s net.

This book is a report of the proceedings of a conference on the application of numerical integration techniques to the problem of the general circulation held at the Institute for Advanced Study, Princeton, on 26—28 October 1955. The conference was opened by Dr. J.R. Oppenheimer and addressed by Mr. Milton Greenberg, Director, Geophysics Research Directorate at the inaugural session. The book has been dedicated to the memory of late Prof. John von Neumann. The contents of the book have been summarised on pages xi–xiii by the Editor in his preface.

The papers reported here will be found to be more mathematical and rather distinct from what one ordinarily comes across in climatological literature. All the papers, except the historical introductory ones in Section II, have been carefully edited, with the concurrence of the authors, to the essential minimum length, thus printing of practically all already printed material has been eliminated from this report.

In Section II—Numerical Methods and Related Topics—the papers presented deal with the laboratory experiments that were being carried on at the time of the conference at different centres in U.S.A. like Princeton, New Jersey, M.I.T., Chicago and California Universities, U.S. Weather Bureau etc on developing suitable models applicable to numerical integration techniques leading to an understanding of the general circulation and also to explore, 'among other things', the ultimate possibility of applying the results obtained to what has now come to be known as 'Dynamic Climatology'.

In the next Section—Other studies of the general circulation and climatic change—there is a report of the work of actual laboratory model experiments conducted at the University of Chicago. In the next paper, differential equations for the motion and conversion of energy from potential to kinetic for one of the model experiments have been presented. Here too the possibility of the use of numerical method in interpreting the observed results and evolving better design of laboratory experiments have been covered. In another paper the program mes of the General Circulation Project at the Johns Hopkins University are described which include the interesting spectrum analysis of the large scale atmospheric flow revealing the importance of both low and high wave numbers in the mechanism of the general circulation. Harry Wexler presents a paper on 'the possible causes of climatic fluctuations' and puts forward his support for the 'Volcanic theory of climatic changes'. The next paper is also devoted to the same topic wherein Sigmund Fritz maintains that if the solar constant is responsible for climatic change, onset of an ice age should be associated with a decrease in the solar constant.

In Section IV—Radiation Studies—there are two papers where models for estimating, with a high degree of accuracy, the energy exchanges due to radiation in the atmosphere have been presented.

The Editor has supplied a very valuable addition to the Report in Section V by collecting discussions which took place during the symposium from tape-recordings, notes taken down during the symposium and written communications. The technical details of the numerical methods, particularly the details of the models employed were discussed at some length. Truncation errors in these models, the most suitable map projection for the basic grid network and the type of errors to be expected from the same, onset of streakiness in the vorticity pattern etc were discussed at great length. The most debated point was regarding non-adiabatic effects and their incorporation in the numerical models. However, it was opined that for the purpose of generating climatological statistics it is not necessary to use highly sophisticated models. Workers from other groups agreed with this and added that one should not feel obligated at this point to explain all the details of the atmospheric behaviour. In the case of laboratory experiments, while it was possible to show general similarity between calculated flow pattern and the observed ones, the difference at certain points was greater, specially under the influence of localised energy supply and rotation. One of the participants remarked that in certain of the laboratory experiments either of two very different regimes, regimes as different from each other as the glacial from the inter-glacial periods in the atmosphere, can appear under the same condition of heating and rotation depending on the initial stage of the fluid. It was stated that in the laboratory one finds considerable variation in detail each time a given experiment is repeated. V.P. Starr noted that "the atmosphere seems to possess a certain 'dynamical memory' (by virtue of its non-linear behaviour) which causes it to develop in a consistent fashion from one mean state to another * * * *. As a result of such hysterisis effects, different states can be obtained under the same conditions of heating and rotation, depending on the state present immediately before the external conditions reach the critical values for transition".

While discussing the topic of non-adiabatic effects and their incorporation in numerical models, in the context of the effect of latent heat release within a cloud, Charney remarked "the problem is complicated further by the fact that radiation acts also to increase the temperature at the cloud base. It is difficult to determine, therefore, whether the net effect of radiation is a heating or a cooling of the cloud as a whole". G.S. Benton stressed that "it will probably be some time before the details of radiation and small-scale convection are understood well enough to incorporate them in numerical models". In similar connection L.D. Kaplan said that "more work has to be done in the field of turbulence in order to provide useful estimates of sensible heat flux and the evaporation from ground". Even today, five years later, some of the above questions are as alive as they were at the time of the conference. Questions such as these also focus attention to another important aspect, *viz.*, that as a result of concentrated effort in certain fields of research in meteorology as well as other scientific disciplines, it is possible that the advance achieved in certain section may be much ahead of other closely associated branches. This may result in one section becoming highly sophisticated while others remain in their primitive stage. Further, because of this very sophistication new efforts and resources may tend to be diverted towards this section to a greater extent compared with the other sections. Therefore the gap between them is widened further. This tendency towards unequal development may be mitigated to some extent if symposia of the type reported here are held frequently when workers in neighbouring fields may meet often and exchange their ideas to the benefit of each other.

It will be very much worth the while of any serious student of meteorology to carefully study this exquisitely produced booklet and find for himself to what extent the Editor has succeeded in achieving his objective, namely 'to present a somewhat unified treatment of the subject matter and to record for historical purposes, the status of thinking at the beginning of what promises to be a new and important era in the science of meteorology'.

U. K. BOSE