Reviews

I

Oceanographic Atlas of the Polar Seas, Part II, Arctic, H.O. Publ. 705, Washington, D.C., U. S. Hydrographic Office, 1958, 12½ × 16 inches; 143 pages, 132 figures; $ 5·00

The Oceanographic Atlas of the Polar Seas, Part II, Arctic, was released for distribution in August 1959. It completes the first oceanographic atlas in a series, which will ultimately cover all ocean areas. Part I, covering the antarctic region, was published in 1957 and is now in its second printing.

Previous to this compilation no atlas provided such comprehensive coverage of all elements of the marine environment of the arctic regions; although there are a number of excellent publications prepared by various countries, which cover selected areas of the Arctic, or treat special topics only, such as ice, of the entire area.

The preface introduces Part II with a recapitulation of arctic explorations by the United States, beginning with the expeditions of Griffin, DeHaven and Kane, into the Davis Strait-Baffin Bay area together with some passages of the Canadian Arctic Archipelago while searching for the ill-fated Franklin Expedition in the mid-nineteenth century. The scientific achievements of the search expeditions and of later United States expeditions to the Arctic were primarily of a geographical nature, but included some information on natural history subjects. Only in recent years has the emphasis been placed on the study of the environment. Since World War II sustained efforts by the United States and other nations in oceanographic and meteorological research have added materially to our knowledge of the arctic environment.

Charted information is presented in the atlas on a monthly or seasonal basis depending on the distribution and the manner of variation of the particular environmental element. Charts in the atlas were prepared during 1957 and early 1958 from all data then available. The atlas is divided into seven sections, and there is a bibliography of 125 major reference sources.

In the section on tides and currents data are presented on charts showing tidal types; co-tidal lines; tide range; general surface circulation; surface currents of parts of the Arctic Ocean and adjacent waters; major drifts of vessels and ice islands; circulation of Atlantic water in the Arctic Ocean and adjacent seas; and the dynamic topography of the Greenland-Norwegian Sea. Physical properties, such as temperature, salinity, density, water color, and transparency, as well as selected vertical sections are shown on other charts.

The section on ice occupies a good portion of the book and ice charts constitute about one-third of the figures. Presentations include concentration of ice and extremes of ice conditions; variability of lead width and concentration; comparison of ice conditions in 1955 and 1956; comparison of the polar pack boundaries along the Alaskan and Canadian coasts for the years 1953 to 1956; comparison of ice pack boundaries in Baffin Bay and Davis Strait for 1953 to 1956; freeze-up and break-up dates; and probability of superstructure icing. Special treatment is given to the period of ice formation. On account of the marked changes of ice conditions during the spring, summer, and fall seasons, they are presented in biweekly charts for selected areas where observations are sufficiently numerous to allow this.

The wind, sea, and swell section gives surface wind roses and shows the state of sea, swell, accumulated heights and periods for surface waves, the directional distribution of periods, and sea heights for selected coastal stations.

Bathymetry, bottom sediments, earthquake epicentres, volcanoes, structural trends, major rock types, gravity, gravity anomalies, variation of the magnetic compass, range of disturbance in total magnetic intensity during a low sunspot year, and a chart of the auroral zone make up the graphic presentation of marine geology.

Charts showing intensity of fouling, distribution of marine algae and seagrasses, deep scattering layer, and distribution of marine mammals, are included in the marine biology section. The last section of the atlas is devoted to the distribution of oceanographic stations and bathythermograph observations.

Reliability diagrams are included for some elements. The bibliography and charts of oceanographic observations give in detail the principal sources of the data from which the atlas was prepared.

A polar projection chart (equidistant azimuthal) that extends to at least 65°N is used as the base for the areal analyses shown in the atlas. With the exception of the ice distribution this polar base chart seems to be suitable for all presentations. For the ice section the base chart could have been extended to provide a complete coverage of ice conditions to the southern most winter extent of ice in the Bering Sea and along the east coast of Canada.

A few large scale charts on a Mercator projection are employed to present more detail. Cross-sections and histograms supplement the basic analyses of the physical properties and ice sections respectively.

For most publications the physical make-up is of little real importance other than for advertising and selling purposes; atlases, however, are in a different category in this regard, because their accuracy and utility depend to a considerable degree on their physical characteristics.

This publication is of a convenient size for desk and shipboard use, and is definitely an improvement over most previous Hydrographic Office atlases, which were extremely large and unwieldy. It is printed on high rag content nonabsorbent paper that should be serviceable for marine use. Multicolor printing is used, which allows the presentation of related parameters on one chart. The lithography in general is good. The atlas is permanently bound, but the paper cover is not in keeping with the otherwise high quality.

The price should put this publication within reach of everyone interested in polar areas. For the student it can answer almost every conceivable general question he may have on arctic marine environment; for the research worker it should serve as a basic reference book he could ill afford to overlook.

It is unfortunate that this atlas was not available prior to the I.G.Y. The charts it contains would have been very helpful in the development of the plans for various scientific endeavours. The two charts of oceanography stations are probably the best compilation available at present; they might well serve as a polar supplement to T. Wayland Vaughan's notable publication "International Aspects of Oceanography".

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*The opinions or assertations contained in this article are the author's and are not to be construed as being officially endorsed by the USAF or Department of Defence.

II

Recent Advances in Atmospheric Electricity : Edited by L. G. Smith. Published by Pergamon Press, London, 1958, pp. xv + 631, price £ 6 net.

The volume, entitled 'Recent Advances in Atmospheric Electricity' contains the proceedings of the Second Conference on Atmospheric Electricity, sponsored by the Geophysics Research Directorate of the Air Force Cambridge Research Centre and held at Portsmouth, New Hampshire on 20—23 May 1958. At this conference, there were as many as 92 participants who include most of the leading figures in atmospheric electricity at the present time—physicists, chemists, meteorologists, electrical and radio engineers—from different countries. They discussed the various aspects of the current experimental and theoretical investigations into the problems of natural electrical phenomena in the lower atmosphere. Altogether there were 58 papers (including 14 short contributions) which were presented and these papers are now published with a resume of the discussions which followed the presentation of each paper. (It is also noticed that a large number of the investigations reported in the papers presented were sponsored by grants given through European Office of Air Research Development Committee, U.S.A.)

In this report the contributions have been classed under three broad divisions—(*i*) Fair Weather Electricity (23 papers), (*ii*) Thunderstorm Electricity (19 papers), and (*iii*) The Lightning Discharge (16 papers).

In the division on "Fair Weather Electricity", papers dealing with problems of atmospheric electricity, ionization, conductivity, electric potential gradient etc in the free atmosphere near the surface over land and oceans as well as high up in the atmosphere have been grouped. As water-tight compartmentation is not possible (in these cases), a certain amount of intermixing is perhaps inevitable, for instance in the paper by E. T. Pierce the critical discussions on the expressions for the current surge during the return stroke of a lightning flash and allied problems could very well have gone under the division "The Lightning Discharge".

To show the representativeness of the contributors in this division one could quote names at random such as P. J. Nolan, Rita C. Sagalyn, L. W. Pollak and A. L. Metnieks, G. A. Faucher, H.W. Kasemir and L. H. Ruhnke, M. Kawano, R. Mühleisen, R.H.D. Barklie and others. There is a group of papers on measurements of fair weather electrical potential gradient, conductivity and other atmospheric measurements at places distributed widely over the Northern Hemisphere by J. F. Clark, S. P. Venkiteshwaran, Hatakeyama *et al.* and J. H. Kraakevik. H. Israël in his paper deals with atmospheric electrical agitation and Hans Dolezalek discusses atmospheric electric synoptic investigations. Koenigsfeld presents a paper on the observations on atmospheric potential gradient on the ground and at upper levels and their relation with artificial radio-activity. At the end of the division there are five short contributions which include atmospheric artificial radio-activity by H. Israël and D. L. Harris and Rita Sagalyn's observed variation of the ratio of negative to positive conductivity in polluted areas.

In the division on "Thunderstorm Electricity" there are many valuable contributions most of which are descriptive giving the results of elaborate observations. In the first paper Byers and Fitzgerald report on their aircraft observations of convective cloud electrification and discuss the important results emerging therefrom. Other papers report measurements of thunderstorm electric field from multiple ground stations, corona point discharge, electrical structure of nimbostratus clouds, experiment to determine initial precedence of organised electrification and precipitation in thunderstorms and some other detailed studies of cumulus and cumulonimbus clouds. L. G. Smith reports his study of

electric field variations following lightning discharges at various distances which have been found to agree generally with Tamura's theory which attributes the variations with distance of the field recovery curve to the non-uniform conductivity of the atmosphere. Another paper contains study of the potential difference between two pieces of ice in contact as a function of temperature, temperature-difference and contamination of difference and another paper reports some studies of charge generation during rain in natural supercooled clouds but no definite conclusions have been arrived at. In this division also there are short contributions by J. A. Chalmers, J. E. Maund and J. W. Milner, T. W. Wormell and C. J. Adkins, J. C. Williams, V. J. Schaefer and R. Reiter.

In the division on "The Lightning Discharge" there are twelve papers and four short contributions. The first paper is by David Atlas on 10 cm-radar lightning echoes and atmospherics in vertical cross-section, where he concludes that the most frequent sferics, suggestive of stepped-leaders, emanate from the ice crystal region, and that ionization propagates upwards thus accounting for the lightning echoes. He suggests a discharge process, in accord with the process proposed by Malan and Schonland for the F-type field change, starting from the positive crystal region which is initiated by stepped-leaders and followed by slow neutralization of charge by upward movement to the negative space charge in the clear air above.

In the second paper pertaining to terrestrial and cosmical lightning discharges, C.E.R. Bruce has criticized the recombination theories of the leader discharge and also Schonland's recent theory of the same and has advocated his own glow-to-arc transition theory. He has totally by-passed Loeb's calculations of the current and fields down the axis of a streamer in a lightning discharge in relation to the tip-velocity and his concept of an expanding streamer channel to account for the breadth of the stepped-leaders. Also he does not mention Khastgir's (*Phys. Rev.*, May 15, 1957) finding that the pilot streamer current prior to the step-flash is of the order of 320 amp which comes out from Loeb's streamer mechanism formula and which is consistent with the observed electrostatic field-changes during the leader process. Although the corona concept of Bruce has been supported by E.T. Pierce, the glow-to-arc transition has not been explained from fundamental physical considerations. It is unfortunate that the discussion on leader discharge has been one-sided. The next paper by E.L. Hill has dealt with free electrons in the lower atmosphere. In the succeeding paper on lightning discharge channel characteristics and related atmospherics, M. M. Newman has shown how lightning discharge channel phenomena can be reproduced in laboratory experiments. He has also given a feasible model of a simple equivalent circuit discharge channel. The paper by N. Kitagawa and M. Kobayashi describes the field-changes due to lightning flashes as recorded simultaneously by an electrostatic fluxmeter and an amplifier-oscillograph of Watson-Watt and Appleton type. The records have shown that the dart leader also develops fast intermittent discharge processes similar to the initial stepped-leader. The paper also gives the time-variation of the illumination of the whole sky as recorded by Photo-multiplier and a C.R.O. The records have indicated scores of luminous discharge processes of small scale and of short duration throughout the cloud flash and the periods between and after the strokes of the flash to the ground. The analysis of the daylight photographs of lightning paths and simultaneous oscillographic records in the paper by H. Norinder and E. Knudsen is of great value. It has been shown that the combined photographic and oscillographic method enables one to find if all the multiple strokes follow in the same or in different directions. Equally important is the next paper by H. Norinder, E. Knudsen and B. Vollmer on multiple strokes in lightning channels. Their experimental method enabled a detailed study of the various features of the multiple strokes. A new type of atmospheric, discovered by H. L. Jones and P. Hess is

discussed in the paper by H. L. Jones. The paper describes how the sferic-radar system can be used for the tracking and identification of severe thunderstorm cells. D. J. Malan describes how simultaneous recordings have been made of the electrostatic field-changes and radiations at different frequencies of nearby discharges. A. Kimpara has presented in his paper the results of an extensive series of observations of wave-forms and the direction of arrival of atmospherics at several observatories. In the paper by C.G. Stergis and J.W. Doyle, a sferic system for detecting the direction of arrival of electromagnetic radiations from near lightning discharges has been described. The nature of a cloud discharge inferred from its electromagnetic effects is described in a paper by H. Ishikawa and A. Kimpara.

The short contributions are summarised as follows—

1. R.E. Holzer : The author gives an approximate quantitative explanation of the observations on World Thunderstorm Activity and extremely Low-frequency Sferics.

2. M. I. Large and T.W. Wormell : The authors have discussed fluctuations in the vertical electric field in the frequency range from 1 cycle/sec to 500 cycles/sec.

3. William L. Taylor and L. Jerome Lange : The authors have given some characteristics of VLF propagation using atmospheric waveforms.

4. H. W. Curtis : The basic theory of whistler generation and propagation has been outlined in the short paper.

In the closing remarks by P. H. Wyckoff, Chief, Aerophysics Laboratory of the Geophysics Directorate, ARDC, tributes have been paid to the pioneer workers on Atmospheric Electricity in the early days before the World War II when electronics was almost unknown and emphasis has been laid on Holzer's prediction that in the very near future the relation will be much closer between the astronomer and the atmospheric electrician.

The proceedings of the Second Conference on Atmospheric Electricity published in this volume and made available to all the scientists interested in this field will provide a wealth of up-to-date information and specialised knowledge which will stimulate further research on the subject.

The present volume has been ably edited by Dr. L. G. Smith of the Geophysics Research Directorate, AFCRC, Bedford. Finally the Pergamon Press is to be complimented on the excellent publication of the volume.

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