Space Science

The Ionosphere. Proceedings of the International Conference held at London, July 1962. A. C. Strickland, Ed. Institute of Physics and the Physical Society, London, 1963 (order from Chapman and Hall, London). x + 528 pp. Illus. £5 5s.

Strickland and his collaborators are to be congratulated for the excellent format of this volume and for the speed with which it was published.

The book is divided into four sections: Ionospheric Constitution and Ionizing Radiations, Geomagnetism and the Ionosphere, Irregularities and Drifts in the Ionosphere, and the Mathematics of Wave Propagation through the Ionosphere. Three papers that give preliminary results from the first Anglo-American satellite, Ariel, are also included. Each section is preceded by a generally well-written introductory chapter in which the chairman of that section reviews the topics covered, and each is closed by a summary of the papers presented.

Broad features of the structure of the ionosphere are discussed in a paper that opens the section on the constitution of the ionosphere and ionizing radiations. Another paper in this section proposes a new model atmosphere, characterized by a high O to N_2 ratio, which is then used to obtain a model for the E and F1 layers. Electron density measurements are used by one author to determine the neutral scale height at the F2 peak, and by another to deduce ion temperatures above the F2 peak. Diurnal variations in electron density at the magnetic equator are reported. One of two papers on solar x-ray emission reports results from a series of rocket measurements; the other compares theoretical predictions with recent measurements. A single paper deals with the D region; this imbalance is characteristic of all sections. Rounding out the first section are papers on the effects of solar eclipses and flares on the ionosphere and on the geomagnetic anomaly of the F layer.

Interactions between the geomagnetic field and the ionosphere are treated in some 20 papers in the section on geomagnetism and the ionosphere. The papers deal generally with geomagnetic deformation of the ionosphere layers, under both quiet and disturbed conditions. Various processes of deformation are analyzed, but no clear statement of the relative significance of the processes is made. Three interesting papers deal with the correlation of ionosphere behavior at geomagnetic conjugate points; another paper presents data on the effects of nuclear detonations on the ionosphere.

In the section on irregularities and movements of the ionosphere a large number of observations of those phenomena in the F region are reported. A substantial body of data from backscatter measurements and from scintillation of radio star and satellite radiations is presented. That only a limited number of conclusions can be drawn from these many observations is recognized in the summary paper; some of the theories employed to explain the experimental data are also discussed.

The section on the mathematics of wave propagation contains articles on such topics as the reflection of waves from various model ionospheres, one of which uses an energy-dependent electron-ion collision frequency; very low frequency propagation; impedance of an antenna immersed in the ionosphere; treatment of the wave equation in dipolar coordinates; and the usual earth-ionosphere waveguide problems. Unfortunately only one paper treats the ionosphere as a plasma. The comparative neglect of the latter approach is unjustified in view of the increasing importance of plasma methods in treating problems on the interaction between electromagnetic waves and the ionosphere.

The three papers in which preliminary results from the Ariel satellite are presented close the book. The first of these papers presents solar x-ray spectra observed during solar flares. Others report the results of plasma probe experiments that show a surprising diurnal electron temperature variation; direct measurements of ion spectra, including the identification of He^+; and an electron density measurement that shows a significant new ledge of ionization near 800 kilometers. All of these data are very preliminary, and it seems likely that further analysis will alter some of the initial interpretations of the results.

The more than 70 papers in the volume contain a great deal of valuable material that will be useful to ionosphere scientists.

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Aerophotogeodetic Surveying

A Course in Higher Geodesy. Spheroidal geodesy and fundamentals of gravimetry and practical astronomy. P. S. Zakatov. Translated from the Russian. Published for the National Science Foundation by the Israel Program for Scientific Translations, Jerusalem, ed. 2, 1962 (order from the Office of Technical Services, Washington, D.C.). x + 390 pp. Illus. Paper, $4.

"This textbook is intended for fourth- and fifth-year university students specializing in aerophotogeodetic surveying," says the author in the preface to this excellent book. In one sense the prefix, "aerophoto," is somewhat misleading, for aerial photography and photogrammetry are never mentioned. Nevertheless, since the shape and dimensions of the Earth are basic to all maps and since, in modern practice, all maps, save those at the largest scale, rest ultimately on aerial photographs, geodetic surveying and aerial photography are both foundations of precise cartography and must be considered together; thus, the phrase "aerophotogeodetic surveying" is a logical marriage.

The volume is a comprehensive treatment of the fundamentals necessary for the geodetic portion of such work. The author begins with definitions of the parameters of the Earth's ellipsoid; he then proceeds logically to the relations between them and develops, with all necessary rigor, the familiar formulas for the solution of spherical and spheroidal triangles and the calculation of geodetic latitudes, longitudes, and azimuths. A chapter is devoted to the derivation of basic formulas that pertain to the transverse mercator projection, called the Gaussian; the author then discusses astrogravimetric leveling.

More than half the book is devoted to a lucid discussion of deflection of the vertical, the principles behind gravimetric methods of determining it, and astronomical methods of observation. This is no manual of instrumentation or field operations; instead, it is a clear and uncluttered development of basic theory, a derivation of formulas used, a discussion of accuracies attained by making certain reasonable approximations, and an outline of the steps required in data reduction, with a few illustrative examples of calculations. It should be required reading for anyone engaged in these aspects of physical geodesy.