Water in the Atmosphere

Clouds and Storms. The Behavior and Effect of Water in the Atmosphere. F. H. LUDLAM. Pennsylvania State University Press, University Park, 1980. xviii, 406 pp., illus., + plates. $57.50.

Prior to the end of World War II cloud physics was a sluggish enterprise remote from the mainstream of meteorological research. A few investigators were exploring the subject, and indeed in 1933 Tor Bergeron had laid the ground for what was to come with his analysis of the processes by which precipitation is formed and his conclusion that the nucleation of ice crystals in supercooled clouds of liquid drops was the only way in which significant rainfall or snow is initiated. With the discovery by Vincent Schaefer in 1946 that introducing Dry Ice into a supercooled cloud results in formation of ice crystals that grow rapidly and fall out as precipitation, the subject received a great stimulus. Motivated by the possibility of economically valuable increases in rainfall and dissipation of fog, basic research into the processes by which cloud drops grow and develop into raindrops or snowflakes was greatly expanded, in addition to widespread operational cloud-seeding activities. The structure of thunderstorms was already the subject of a large research project, and the possibility of preventing destructive winds, crop-damaging hail, and fire-initiating lightning stimulated continuing investigation of the dynamics of severe local storms.

In addition to its role in fog, precipitating clouds, and thunderstorms, water enters the physics of the atmosphere in other ways. Thus water vapor is a principal absorber in the transfer of radiation through the atmosphere, and the presence or absence of clouds is a major factor in controlling the amount of solar radiation absorbed in the atmosphere and at the earth's surface, as well as the amount of terrestrial radiation emitted to space. Latent heat of condensation and evaporation plays a major role in the exchange of energy between earth and atmosphere and between low and high latitudes. The motions of the atmosphere on all scales are influenced by the effects of water vapor and its changes in phase. Optical and electrical phenomena in the atmosphere are almost entirely the consequence of the presence of water.

These manifold aspects of the role of water are the subject of *Clouds and Storms*. The subtitle of the book is the more appropriate indication of its nature, for in it is brought together a compendium of the influences of water in its various phases on the energy budget, the motions, and the visual phenomena of the atmosphere.

The first part of the book presents conventional background material, though the presentation is in some places quite unconventional. It is in the last three chapters, entitled "Cumulus convection," "Cumulonimbus convection," and "Large-scale slope convection," that Ludlam deals with topics on which he himself has done research. While many of the results of his own work that are given here have been published in journals, some of them appear for the first time and some are presented in more detail than in the journal papers. Also, the presentation of his work in relation to that of others in a coherent, organized fashion adds to its interest.

The special value of the book lies in the synthesis it provides. Ludlam was unusually well suited to carry out this type of synthesis. A keen observer of cloud and storm development, he participated in several projects measuring various aspects of them and was responsible for much of the clarification of the structure of thunderstorms that has taken place. The book was written while he was suffering from a progressive illness that claimed his life in June 1977, and as a consequence it does not include late developments (the latest of the hundreds of references are dated 1974). It is doubtful, however, that the insights Ludlam provides into the relationship between physical theories and observed phenomena would have been improved if these developments had been available to him.

MORRIS NEIBURGER
1510 Oak Creek Drive,
Palo Alto, California 94304

"A wave cloud with a smooth texture and regular outlines in the lee of the Matterhorn (which reaches nearly 4.5 km). Later the flow over and near the Matterhorn and neighboring mountains became unsteady, and the associated clouds more extensive and irregular." [From *Clouds and Storms*; photograph by G. J. Jefferson]

Complex Carbohydrates

The Biochemistry of Glycoproteins and Proteoglycans. WILLIAM J. LENNARZ, Ed. Plenum, New York, 1980. xiv, 382 pp., illus. $35.

The past ten years have witnessed notable advances in our understanding of the metabolism and function of complex carbohydrates. The synthesis and processing of oligosaccharide residues in glycoproteins and the observation of cell surface carbohydrate-recognition proteins are just two examples of such advances. Complex carbohydrate biochemistry has caught the attention of a broad spectrum of investigators, since these recent studies offer new insights into subjects as diverse as the processing of intracellular proteins and the social behavior of cells. *The Biochemistry of*