METEOROLOGICAL MONOGRAPHS

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2. Preface or foreword. A preface may be contributed by the sponsors of the investigation, or by some other interested group or individual. The preface should indicate the origin of the study and should present other facts of general interest which emphasize its importance and significance.

3. Table of contents. Chapter, section, and subsection headings should all be listed in the table of contents.

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ATMOSPHERIC RADIATION TABLES

by

Walter M. Elsasser

with

Margaret F. Culbertson

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PREFACE

In 1942, the author published a monograph entitled "Heat Transfer by Infrared Radiation in the Atmosphere," which was rather favorably received by the meteorological public. The war terminated this particular work, and during it and thereafter the author became engaged in other scientific pursuits not directly related to atmospheric radiation. In the meantime, a vast literature has grown up around the subject, dealing with laboratory experiments as well as theoretical analysis, not to speak of the applications to the atmosphere itself. From the fall of 1950 until 1954, the author, while at the University of Utah, was engaged in a project sponsored by the Air Force Cambridge Research Center whose aim it was in part to extend the methods used earlier for water vapor so that they were applicable to carbon dioxide and ozone. Very extensive new laboratory data on all three optically active atmospheric gases have become known in the last seven or eight years. This finally suggested a new edition of the earlier monograph, and the task was begun in the summer of 1957 at the Scripps Institution of Oceanography, again under the sponsorship of the Air Force Cambridge Research Center.

The present monograph is a second edition of the earlier one in the limited sense that the methods used to determine radiative fluxes in the atmosphere have been retained with only very minor changes. Approximations much more refined but also much more cumbersome to handle than the linear techniques of the 1942 work have been omitted. Instead, radiation tables have been calculated on the basis of the available data, practically all of them fairly new, for the 15-μ CO_2 band, the combined 9.6-μ and 9.0-μ ozone bands, the 6.3-μ water-vapor band, the rotational water-vapor band, and finally for the overall water-vapor spectrum. The only difference, in principle, from the earlier treatment lies in the use of a linear pressure reduction throughout, in place of the former square-root reduction. In the text, the review of the basic theory of band structure and band absorption has been somewhat enlarged. On the other hand, Part III of the earlier monograph which dealt mainly with radiation measurements in the atmosphere itself has been omitted, partly because the new tables are based on laboratory data, but largely because the literature on the subject has swollen to such dimensions that it would be impossible to do justice to it within the confines of this monograph.

Owing to many other obligations, the author has been unable to keep up in detail with the proliferating literature on atmospheric radiation. A purely formal bibliography based on a search of the abstracting literature seemed out of place in a work of this limited character. We have therefore restricted the bibliography to papers that are actually quoted in the text. It is possible, though not too probable, that an occasional paper which has a direct bearing on our work might have been overlooked, and the author apologizes in advance for such omissions.

Another restriction of the present monograph concerns the fact that we give only tables and no nomograms (charts). This is based on the view that a work like the present by its very nature addresses itself not so much to the practical forecaster as to the scientific investigator of the atmosphere. The latter will almost invariably spend some time and effort on the subject of radiative transfer if he becomes engaged in it at all. Given the very numerous graphical or numerical schemes that may be used for this purpose, depending on individual tastes, we felt it to be preferable to leave the construction of nomographs to the investigators concerned. With modern methods of reproduction, this is a relatively simple and cheap task that can be performed quite rapidly.

The very extensive computational work, including the involved two-dimensional smoothing of the radiation tables, was done by Miss Margaret Culbertson, M.A. Without her consistent accurate performance, this monograph could not have been written.

We are greatly indebted to the Thermal Radiation Laboratory of the Air Force Cambridge Research Center for their financial support, and in particular to Drs. John N. Howard, J. I. King, and P. R. Gast for their personal encouragement. This assistance and encouragement has been invaluable in completing the work.

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SCRIPPS INSTITUTION OF OCEANOGRAPHY
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