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Editors

全球气候变化中的紫外线辐射

观测、模拟及其对生态系统的影响

UV Radiation in Global Climate Change

Measurements, Modeling and Effects on Ecosystems

TSINGHUA UNIVERSITY PRESS

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内 容 简 介

大量研究指出紫外线（UV）辐射对生物有机体有害，并且危害人类健康。对地表UV-B辐射强度增加的研究极大地促进了地基和空基相关观测项目的发展；人们还需要进一步对UV辐射的观测、建模和影响进行深入研究。本书各章描述了过去30年来世界范围内与UV辐射相关的研究工作，涉及的领域有：① UV辐射的当前与预测水平及其对生态系统、人类健康、经济与社会的影响；② UV辐射观测仪器的最新发展，地基和空基观测仪器定标进展情况以及观测方法，建模与有关应用；③ 全球气候变化对紫外线辐射的影响。

对于涉及全球气候变化、气象学、气候学、环境科学、生物学和农林科学的大专院校高年级本科生、研究生和教师，本书是一本很有价值的参考书。相关领域的科学家、决策者和普通公众亦能受益于此书。

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Preface

Over the past three decades, the scientific community has realized the urgency of obtaining a better understanding of the interaction between the earth's atmosphere/biosphere and the sun's radiant energy. Most of the research has focused on the radiant energy balances in the solar and infrared regions of the spectrum, and the way these energy flows affect the climate. During this same time frame, in a related arena, a smaller group of dedicated individuals has concentrated on the role of ultraviolet (UV) radiation as it affects the overall welfare of the planet. Although comprising only a small fraction of the radiation balance that may play a role in global climate change over the next centuries, UV radiation has the capacity to cause direct and more immediate harm to virtually all living organisms and especially to human health. Cumulative high doses of UV radiation are considered a major causal factor in the development of skin cancer and cataracts. Ultraviolet radiation can weaken the human immune system, and can also affect crop production and ocean bio-productivity.

Concerns about the increased levels of UV-B radiation reaching the earth's surface have led to the development of ground- and space-based measurement programs to provide long-term records of its levels. Accurate long-term measurements are difficult to obtain, especially when limited to the bandwidth regions that contain the most harmful solar photons. A core of concerned scientists from across the globe realizes that much work is needed in quantifying the harmful radiation levels and defining their adverse effects. In assessing the effects of UV-B radiation, it is important to realize the complexity of the interactions of living organisms that cause adverse responses with radiant energy directly, as well as in combination with other climate stressors, such as drought, increased temperatures, and CO_2.

This book addresses work that has been conducted throughout the world over the past three decades, such as: (1) current efforts for establishing a climatology of UV radiation; (2) modeling the UV component and its impact on ecosystems, human health, and related economic and social implications; (3) new developments in

UV instrumentation, advances in calibration (ground-based and satellite-based) measurement methods; and (4) the effects of global climate change on UV radiation. All chapters, including the review chapters, have been solicited from renowned scientists in their research fields of UV radiation, meteorology, the environment, and ecosystems. They have presented their work based on research at the global scale, taking into consideration possible future developments. Many new techniques and methods developed from space-ground measurements, mathematical modeling, and remote sensing have recently become available, yet have not previously been presented. This book will be a useful source of reference for undergraduate and graduate students who are involved in the study of global change, environmental science, meteorology, climatology, biology, and agricultural and forest sciences. It will also benefit scientists in related research fields, as well as professors, policy makers, and the general public.

As editors of this book, we wish to express our great appreciation for the contributions of many individuals. We are indebted to the over 50 authors and co-authors within the scientific community who have shared their expertise and contributed much time and effort in the preparation of the book chapters. We also wish to give credit to the numerous funding sources promoting the scientific research performed, and thus the valuable findings shared by the authors. We express our appreciation to the many reviewers and expert scientists who took the time to offer valuable comments and suggestions for the improvement of the book chapters. We acknowledge the management and editorial assistance of Laurie Richards and the technical support of Jonathan Straube of the Natural Resource Ecology Laboratory, Colorado State University and Tsinghua University Press and Springer-Verlag. We especially want to express our appreciation for the support of the Cooperative State Research, Education and Extension Service (CSREES) of the U.S. Department of Agriculture, and the USDA UV-B Monitoring and Research Program at Colorado State University. The efforts of many individuals including Drs. John Moore, John Davis, Steve Liu, Ni-Bin Chang, Mr. George Janson, and Ms. Rita Deike are appreciated.

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