

# Preface

The possibility that emissions of chemicals to the atmosphere might cause depletion of ozone in the stratosphere has been recognised since the early 1970s. It was only, however, in the mid-1980s that observations by the British Antarctic Survey showed massive depletion of the ozone column in the austral spring. Since that time there has been a great deal of international activity to quantify better the global distribution of ozone, to monitor and understand loss processes and to devise numerical models capable of predicting future changes in stratospheric ozone and its distribution. These provide an excellent example of atmospheric science in action; the work has involved the three major areas of atmospheric chemistry, *i.e.* laboratory studies which determine the reaction pathways and rate coefficients, field measurements, which define composition and time trends, and numerical modelling which helps to confirm our understanding and provides a predictive capability of future trends. This has been a considerable success for science but much remains to be done. Defining and predicting changes in ozone is, however, in many senses only the beginning of the story. As every secondary school pupil should know, stratospheric ozone serves a crucial role in reducing the intensities of ultraviolet radiation reaching the Earth's surface and therefore protects us and other living organisms from an unpleasant fate. It therefore naturally follows that from our improved understanding of changes in stratospheric ozone, we need to move on and both measure and predict changes in potentially harmful UV-B radiation at the Earth's surface and to examine the effects of such changes on the environment, including living organisms.

This volume of *Issues* charts this research from the changing distribution of atmospheric ozone, to changes in UV-B radiation, and consequent effects on photochemistry and biological systems in the aquatic and terrestrial environments. The first chapter, by John Pyle of the University of Cambridge, summarises current knowledge of stratospheric chemistry relevant to ozone, together with measurements of ozone distribution in the atmosphere. It examines links between climate change and ozone distributions and gives a somewhat pessimistic outlook on the ability of current models to predict trends in ozone concentrations. The second chapter, by Ann Webb of UMIST, examines the processes responsible for the attenuation of UV radiation, the means of measurement of UV-B and current knowledge of trends in UV-B intensities within the atmosphere. The tremendous natural variability in UV-B radiation is pointed out, and clearly

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much remains to be done if we are to predict future trends with confidence.

Chapter 3, by Robert Whitehead of the University of North Carolina and Steve de Mora of the IAEA Marine Laboratory in Monaco, deals with UV photochemistry in the marine environment. This is a highly active research area in itself. It appears that light in the near ultraviolet and short visible wavelengths in the solar spectrum is primarily responsible for most marine photochemical reactions. This observation coupled with known changes in stratospheric ozone has spurred interest in the potential effects of increased UV-B on marine photobiological and photochemical processes. The subsequent chapter by Patrick Neale of the Smithsonian Environmental Research Center and David Kieber of the State University of New York extends this analysis examining the wavelength dependence of photochemical and photobiological processes and showing the development of biological weighting functions which better define the effects of UV-B exposure.

In the subsequent chapter, Jelte Rozema of the Free University of Amsterdam considers the terrestrial environment, examining how enhanced solar UV-B at the Earth's surface may reduce growth of some plants. Results are presented which indicate that greenhouse studies may lead to an overestimation of the effects of increased UV-B, with native plant species in their natural ecosystems showing relatively smaller effects. There are various feedbacks on such processes, such as the decomposition of plant litter and changes to the structure of the vegetation canopy via plant secondary metabolites acting as UV-B receptors. In the final chapter, Brian Diffey of Newcastle General Hospital considers the effects of increased UV-B on skin cancer in human populations. Based on current prediction, incidences of skin cancer will peak around the mid-part of the century with an additional incidence of around 7 per 100 000 population, implying 4200 additional cases of skin cancer per year in the United Kingdom alone.

All of the authors highlight the extreme complexity of this field of science and stress the areas in which knowledge is currently highly incomplete. There are many interactions and feedbacks in the systems that they describe which make prediction of future trends extremely difficult. We have been very fortunate in attracting a number of the leading workers in this field to contribute to this volume of *Issues*. We commend it to our readers as an up-to-date and authoritative summary of the state of the science. It will be of especial value to environmental scientists, policy makers and students seeking knowledge on this subject, which has yet to be assimilated in textbooks in any appreciable way.

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