

Book reviews

Atmospheric Chemistry and Physics: From Air Pollution to Climate Change by J.H. Seinfeld and S.N. Pandis (John Wiley & Sons, 1997). ISBN 0-471-17816-0. £55.00.

I congratulate John Seinfeld and Spyros Pandis on their excellent book. This book brings the same excitement and intellectual interest to the study of atmospheric chemistry as *Air Chemistry and Radioactivity* by the late Christian Junge, and *The Photochemistry of Air Pollution* by P.A. Leighton did many years ago, and only a handful of books in between.

The book presents a detailed study of urban, regional and global atmospheric chemistry, covering gas phase and aerosol processes and the interaction of these with climate. There are chapters and sections on the underlying physical, chemical and mathematical techniques necessary for addressing the main themes, with a solid introduction to meteorology (particularly boundary layer meteorology and cloud physics), aerosol physics and chemistry and numerical modelling techniques appropriate to graduate study. The book is written in a clear, insightful style and during the 1326 pages, only on a handful of occasions did I have to stop to re-read a sentence or think about a figure because it was unclear. The book distills and interprets the scientific literature in these fields up to the mid 1990s.

Every reader likes different sections of a book. The highlights for me in terms of the clarity and freshness of presentation were:

- The chemistry of the troposphere, including the relative roles of VOC (Volatile Organic Compounds) and NO_x in ozone formation, particularly the basis in radical chemistry for determining how ozone formation is non-linearly affected by the concentrations of its precursors;
- the role of ozone as a source of new radicals in the troposphere;
- the introduction to the chemistry of the aqueous phase and the gas-aqueous phase distribution including the oxidation of SO_2 ;
- the dynamics of single aerosol particles, particularly the inclusion of the Brownian motion section;
- the introduction to cloud physics;
- atmospheric diffusion theories; and
- radiative effects of atmospheric aerosols.

The exercises presented in the book are very good and mirror many of the original contributions to atmospheric chemistry and aerosol science of the last three

decades. Any graduate student or researcher who has worked through this book and the exercises is as close to the cutting edge of these areas as can be taught; the remaining task for them is to discover new knowledge! The reader is expected to have a knowledge of differential equations. For those who want to test their advanced mathematical skills, there is a section on the use of adjoint methods and Green's function for calculating the sensitivities of chemical reaction mechanisms, and a problem on lifetimes and eigenstates of the OH/CO/CH₄ system. The inclusion of these advanced problems enhances the usefulness of the book for students who wish to obtain a thorough understanding of the field.

The piece of information from the book that is most likely to be of use in trivia quizzes is the following: what is the mass of fine aerosol generated from charbroiling a kilogram of regular meat? The answer is 40 grams. In Los Angeles, more than six tons of organic aerosol is emitted into the atmosphere from cooking meat each day.

With any book it is possible to identify details where one would present material differently to the authors. Examples here are as follows:

- p. 243, the concept of reaction of chain length could be better explained as its use recurs in the book;
- p. 342, the use of ΔH_A for enthalpy change when H_A is used as the Henry's law coefficient could be confusing;
- p. 298, the section on temperature effects on photochemical smog, while short, does not provide the reader with perspective on the relative importance of the different processes;
- p. 862, some fluid dynamicists who have struggled with the theoretical and experimental value of von Karman's constant may wince at its nameless introduction 'where k (≈ 0.4) is just a dimensionless proportionality factor'. On the same page the length L is more correctly the Obukhov length (proposed by A.M. Obukhov in 1946) rather than the Monin-Obukhov length, as this length scale is used in Monin-Obukhov similarity theory.

The boundaries of the book can be defined by the fact that it only briefly covers both the external sources of atmospheric constituents (in the biosphere, oceans, geosphere and human activities) and the composition of past atmospheres, and does not cover either the ionosphere or the composition of other planetary atmospheres. This means that the discussion of the long-lived atmospheric constituents, including the long-lived greenhouse gases, is brief. A significant omission, in my mind, is of recent studies of the global distribution, sea-

sonal cycles and trends of atmospheric oxygen. These potentially hold a wealth of information and are sufficiently exciting to merit discussion.

I recommend the book for all libraries holding collections in these areas, and to graduate students and researchers who want to purchase an authoritative and comprehensive book on these subjects.

Ian Galbally

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Tropical Climatology: An Introduction to the Climates of the Low Latitudes, 2nd edition by Glenn R. McGregor and Simon Nieuwolt (Wiley, 1998). ISBN 0-471-96611-8. \$65.00.

This book is intended for undergraduate students in geography and environmental science, and is a comprehensive overview of most aspects of tropical meteorology. The preface states the aim is 'to provide a geographical viewpoint on the physical processes in the tropical atmosphere, to offer explanations of how a location's climate is a product of these processes, and to highlight the implications of tropical atmospheric behaviour for those living in the tropics'. The book is up-to-date, so that in addition to traditional tropical meteorology and climatology, it includes discussions of the 40 to 50-day oscillation, the ENSO phenomenon, and an entire chapter on climate change.

I would consider the book, however, to be of only limited interest to readers of the *Australian Meteorological Magazine*. Consistent with the above stated aims, the emphasis throughout is on physical understanding. To give accurate and easily understandable explanations of physical mechanisms to a non-technical audience is a difficult task, one in which the cur-

rent book fails admirably. The early chapters include a long one on the physical laws, essentially the primitive equations, but explained physically, without equations. The discussion is confusing, difficult to follow, and in some cases incorrect. (For example on page 14, we are told that sinking air in the subtropical anticyclones dries through the process of evaporation. On page 16 we are told a fall of surface pressure is brought about by atmospheric mass being transferred upwards.) Another long chapter on radiation has similar faults, as does one on the general circulation of the tropics, which doesn't mention the three tropical heat sources, nor the fundamental role of latent heat release in large-scale tropical dynamics.

Despite these faults, the remaining chapters are quite good, with good literature overviews, appropriate figures and up-to-date references. These chapters are on 'Tropical Temperatures', 'Non-seasonal Variations', 'Seasonal Variations' (predominantly a monsoon chapter), 'Tropical Disturbances', 'Water in the Tropical Atmosphere', 'Tropical Precipitation', 'Tropical Climates', 'Tropical Climates and Agriculture' and 'Climate Change'.

To me, however, this book fails to convey the excitement of tropical meteorology, with its exotic history of monsoon currents, trade winds and typhoons; the elegantly simple physical phenomena such as the rainfall gradients from upwind to lee side of most tropical islands; temperature being essentially a function of altitude; the Gill model of the large-scale structure; and wet and warm western oceans contrasting with the subsident and cool eastern oceans. Tropical meteorology without excitement is not tropical meteorology; thus I could not recommend the book to a technically inclined audience such as the readers of the current journal. However there are very few books that I know of attempting to overview the field for undergraduates. Given the comprehensiveness and up-to-date nature of the book, it should be a useful source of reference for the intended audience: undergraduates in the non-physical sciences.

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