

Book reviews

Buoyant Convection in Geophysical Flows edited by E.J. Plate, E.E. Fedorovich, D.X. Viegas and J.C. Wyngaard (Kluwer Academic Publishers, 1998). ISBN 0-7923-5176-2. NLG 430.

The study of buoyant convection is important in applications related to geophysical flows. This book presents, in a single volume, aspects of buoyant convection in geophysical fluid mechanics, in particular in atmospheric and oceanic media. It is based on a series of invited lectures presented during the NATO Advanced Study Institute Program on Buoyant Convection in Geophysical Flows held at Pforzheim, Baden-Württemberg, Germany, from 17-27 March 1997.

The book consists of 19 chapters, which are written by some of the eminent scientists in the field and fall into four broad categories: (a) fundamentals and phenomenology of geophysical convection with a historical and conceptual overview (9 chapters), (b) convection modelling and parametrisation (4 chapters), (c) experimental studies of geophysical convection in the laboratory (2 chapters), and (d) overview of applied aspects of convection studies and convective cloud dynamics (4 chapters).

Although the title of the book is a somewhat general one, it leans heavily towards atmospheric convection, in particular the convective boundary layer (CBL); of 19 chapters, 17 are related to the atmosphere with the remaining two (both falling under Category (a)) devoted to convection in viscous and rotating fluids and in the oceans. Other topics covered under Category (a) are: a historical introduction to the CBL, convective turbulence and related eddy dynamics and kinematics, surface frictional processes, non-local mixing, radix layer (bottom fifth of the CBL), field observations of clear and cloud-capped CBLs, and lidar measurements of aerosol and water vapour. The Category (b) chapters are on large-eddy simulations, transient turbulence method, bulk models, and CBL parametrisation in atmospheric models. Wind tunnel simulations are described under Category (c), providing a good review of worldwide laboratory facilities available for convection experiments and mentioning major laboratory experiments on the CBL

being done in Australia. The Category (d) chapters are on the large-eddy simulation of turbulence and diffusion, convection in forest fires, stratocumulus-topped boundary layer, and shallow cumulus convection.

When viewed in terms of atmospheric buoyant convection, it is an excellent book providing a comprehensive account of the past and present research, and touching on new concepts in some of the topics mentioned above. However, in addition to the limited coverage of buoyant convection in oceans, there are some important atmospheric topics that have been largely left out. These include convection within the spatially growing boundary layer near coastal areas, field experiments (such as CONDORS) on turbulent diffusion within the CBL, convection over water, Monte Carlo dispersion techniques for convective mixing conditions, convection with land-surface heterogeneities, and convection in magma chambers due to compositional phase changes.

The presentation of the book is very good given the fact that it is an edited set of contributions from many authors. The editors have ensured that all contributions follow a consistent format. Except in a few cases, the quality of figures is good. I noticed very few typos. The index is moderately exhaustive and could have been organised in a better way. The reader will also find that the book is a good source of references on the topics covered.

With the book priced at NLG 430 (about AUD 315), not many may want to own a copy, but it is certainly a need-to-have item for any atmospheric sciences library. The book, with its comprehensive bibliography, would be of interest to specialist graduate students and atmospheric scientists or anyone who wants to keep abreast of developments in convective processes above the earth's surface.

Ashok Luhar

Ashok Luhar is a Senior Research Scientist in the Atmospheric Pollution Program of the CSIRO Atmospheric Research. Over the last 15 years, he has been conducting research on turbulent dispersion in the atmospheric boundary layer with a particular emphasis on the random walk and advanced analytical modelling of convective mixing.

Thermodynamics of Atmospheres and Oceans by Judith A. Curry and Peter J. Webster (Academic Press, 1999). ISBN 0-12-199570-4. \$84.

This is one of the first books to focus on the rigorous treatment of thermodynamics of the atmosphere and ocean. As a text book and a book for reference material it is excellent. There are a number of monographs on the market which fill part of the need on this subject. A number of these are presented in brilliant colour and many authors are proud of the fact that they have discussed their topic without using mathematics! Such a policy works up to a point but can leave the better students with the need for a more rigorous understanding of what are very complex processes. This book fits this need very well and is, at heart, based on the mathematical understanding of the thermodynamics of the atmosphere and the ocean. Having said this, the physical meaning and understanding of the subject matter is presented clearly and well. It is ideally suited as a class or reference text for upper undergraduate classes in atmospheric and oceanic sciences. I believe it will be a standard for many years, long after the 'softer' text books have disappeared.

For the most part the amalgamation of the atmospheric and oceanic aspects of the topic are blended together very well, and the commonality of the two is made clear. Rather than, for example, considering the atmosphere and then the ocean, the various basic concepts for the two media are treated at the same time. By way of illustration, the equations of state are treat-

ed in neighbouring sections, and the concepts of geopotential height and dynamic height (the latter referred to as dynamic 'depth' for some reason!) are treated together. This works very well and reinforces the concept of the commonality of the processes and concepts in the two media.

The text is laid out in three parts. The first presents the 'basic concepts' and lays these out in a rigorous, yet approachable, manner. The second part addresses some of the 'applications' of these concepts. There is up-to-date information given on a range of topics, including static stability, cloud characteristics, ocean surface fluxes and thermohaline processes, and some elements of the cryosphere. The last part considers 'special topics', and among these are presented useful discussions on thermodynamic feedbacks in the climate system, and planetary atmospheres.

The book is pleasingly laid out and presented (although slightly higher quality paper would not have gone amiss) and very easy to read. There are set problems included at the end of each chapter (for most of which answers are provided). These are useful for students to gauge whether they have understood the concepts presented. This book is highly recommended at the upper undergraduate level and as a reference text for practitioners.

Ian Simmonds

Ian Simmonds is a Reader in the School of Earth Sciences, at The University of Melbourne. He teaches in many aspects of meteorology, oceanography and environmental studies.