J. Fluid Mech. (1991), *vol.* 224, *pp.* 660–661
Printed in Great Britain

REVIEWS

An Introduction to Boundary Layer Meteorology. By R. B. STULL. Kluwer Academic, 1988. 666 pp. $99 or £64.

Although entitled an Introduction, this book by Stull is quite comprehensive and includes extensive reference to current research in boundary-layer meteorology. The book has been written for graduate students in meteorology but would also be useful to anyone working in meteorology or associated disciplines.

The author has three goals, all of which are achieved. First, to produce a *text book* including fundamental concepts, necessary mathematics, and adequate physical interpretation based on actual field data. The text book also includes worked examples and student exercises. I found many of these to be novel and instructive, particularly those based on real data. Second, the author has provided a *reference book* for the boundary-layer meteorologist. Third, the last part of the book is a *literature review* containing useful summaries of past and current research.

In addressing all three goals the author has a daunting task, and the outcome is a large and variable book. When judged on each of these goals separately I found the book satisfactory but preferred other books. However, when judged in its entirety the book does shine as being a significant contribution to the literature in the field.

Chapter 1 is a good, well-referenced, descriptive account of boundary-layer characteristics, although I found the author's frequent use of short-hand labels distracting. Taylor's hypothesis is made unduly complicated and I doubt the correctness of the estimate provided for its applicability. The necessary mathematical tools for analysing stochastic problems are provided in chapters 2 and 8.

Chapters 3 and 4 develop and manipulate the governing equations. The derivation of the turbulence equations is always a tedious activity but the author has wisely outlined and highlighted the general methodology. The author retains the reader's interest by frequent reference to real data. This also provides an early indication for the graduate student of the uncertainty to be expected from field data. The following chapter provides a more descriptive interpretation of the turbulent kinetic energy and the use of scaling to form dimensionless variables. Only a few pages address the concept of stability, and I found these unconvincing. After initially stressing the importance of non-local parameters the author then uses two local variables, the Richardson flux and gradient numbers, to produce statements regarding stability. The framework for turbulence closure techniques in chapter 6 is accompanied by examples up to second order. No attention is given to the modelling assumptions themselves. A 'transilient' theory is introduced as a non-local closure. The link between this theory and the equations of motion appears tenuous. A treatment of relevant boundary conditions is given in chapter 7.

Chapter 9 extends earlier scaling arguments to the more general use of dimensional analysis (here called similarity theory) as a correlating device. A chapter on measurement and simulation techniques (chapter 10) is a refreshing contribution to a textbook. Here the reader gets a little closer to the reality of boundary-layer meteorology and how field research is conducted, both by individuals and large multi-laboratory groups. Only brief mention is made of large-eddy simulation techniques and there is even less on laboratory simulation.

The final four chapters address the convective mixed layer, the stable boundary layer, boundary-layer clouds and geographic effects, making much use of extensive recent references. These provide useful summaries of current understanding and indicate topics that are attracting research interest.

The author faced a difficult task in trying to achieve three goals. There is sometimes a lack of balance and looseness of argument but these criticisms are greatly outweighed by many novel features such as the persistent use of real data for demonstration.

The book is an impressive work and will be of value to many students, researchers, and operational meteorologists.

REX BRITTER

Viscous and Compressible Fluid Dynamics. By M. E. O'NEILL and F. CHORLTON. Ellis Horwood, 1989. 395 pp. £49.95.

This is the second of a two-volume work by the present authors. As its title implies it is a complementary sequel to *Ideal and Incompressible Fluid Dynamics* previously reviewed in this Journal (vol. 182, 1987, p. 565). The first part is devoted to laminar viscous flow, the second to the flow of an inviscid compressible gas. There is a preliminary chapter on vector and tensor methods which are used, in particular, in the second chapter where the equations of motion are discussed. The motivation here is inadequate, with no discussion, for example, of the general deformation of a fluid element. The Newtonian fluid is introduced more or less by definition through the linear dependence of stress upon rate-of-strain. There follow chapters on exact solutions, low and high Reynolds number flows which, unexceptionally, contain standard material. But, disappointingly, although the chapter on high Reynolds number flows begins with a qualitative description of flow separation, this is in no way pursued quantitatively. As a consequence the control which the boundary layer exerts on bluff-body flows is inadequately emphasized. The remaining part of the book is devoted to inviscid, compressible flow. The equations, together with simple examples, are established in chapter 6, with an analysis of shocks based on the Rankine–Hugoniot relations in the following chapter. The penultimate chapter is devoted to the method of characteristics for partial differential equations; this is exploited in the final chapter devoted to a discussion of various supersonic flow problems. Taken together the two volumes by these authors could provide a useful introduction to theoretical fluid mechanics at the undergraduate level.

N. RILEY