J. Fluid Mech. (1974), *vol.* 64, *part* 2, *pp.* 415–416
Printed in Great Britain

REVIEW

Turbulence in the Free Atmosphere. By N. K. VINNICHENKO, N. Z. PINUS, S. M. SHMETER and G. N. SHUR. Translated from Russian, and edited by J. A. Dutton. Consultants Bureau, 1973. 262 pp. $37.50.

Perhaps the main contribution of this book is to demonstrate that an authoritative review of turbulence in the free atmosphere is now beyond any one author, or group of authors working within one discipline. Such a review would have to consist of a collection of contributions from authors of widely different backgrounds: meteorologists (dynamical and radar), fluid dynamicists (turbulence, internal waves, convection), aeronautical engineers and oceanographers (to broaden the perspective).

This book contains much that is useful and interesting, but suffers from three disadvantages.

(i) The book was completed five years ago.

(ii) The period since has been one of rapid growth in our understanding of clear-air turbulence and internal wave propagation.

(iii) The price, which left this author speechless. And a flimsy paper cover!

The contents begin with a brief survey by Dr Dutton of developments in the field since the original volume was completed. This significantly increases the value of the book, but it remains largely of historical interest and could not, I think, be considered as an essential addition to the libraries of workers in the field.

Following the survey is a rather perfunctory chapter outlining the elementary theory of turbulence. The concepts of mean flux and exchange coefficient are introduced without any indication of their limitations. Chapter 2 gives an account of methods of observation of atmospheric turbulence. There is too much space given to outdated methods, and very little to modern developments, such as the use of radar. Chapter 3 gives a useful account of the statistical analysis of time series, although it could be argued that this is standard bookwork to be referred to elsewhere. Chapter 4 is a summary of turbulence spectra obtained under various conditions and is followed by what I judge to be a rather weak chapter on atmospheric convection and thermal turbulence.

Chapter 6 discusses internal waves and mountain waves, but suffers fatally from a virtually complete omission of topics such as critical-layer absorption, wave momentum flux, upstream blocking, etc.

Chapter 7 summarizes the more 'meteorological' aspects of clear-air turbulence, e.g. frequency of occurrences as function of height, etc., correlation with Richardson number, and is followed by a chapter on turbulence in clouds, which is exclusively an account of Russian work, with no reference to any of the extensive investigations made in the United States in the past decade.

The final chapter on mesostructure of the wind field attempts to infer the spectral characteristics of the horizontal wind fields by studies of the structure

function up to scales of about 50 km. This is of interest because there are (still) very few observations in this wavelength region, and suggests that an empirical $-\frac{5}{3}$, or -2, power law for spectral density persists up to wavelengths of 20–40 km, above which the spectral density flattens out: a result not inconsistent with other (scanty) data.

While this volume remains the only one known to this reviewer specifically on the subject of turbulence in the free atmosphere, there are several conference proceedings which usefully cover the subject.

W. T. ROACH