J. Fluid Mech. (1974), *vol.* 64, *part* 3, *pp.* 623–624
Printed in Great Britain

REVIEW

Workshop on Micrometeorology. Edited by DUANE A. HAUGEN. American Meteorological Society, 1973. 392 pp. $30.00.

This book is a collection of papers on the atmospheric boundary layer, presented at a five-day 'workshop' held by the American Meteorological Society in August 1972. The titles and authors are as follows.

On the mechanics of atmospheric turbulence, N. E. Busch.

Turbulent transfer in the atmospheric surface layer, J. A. Businger.

On surface layer turbulence, J. C. Wyngaard.

Tower micrometeorology, H. A. Panofsky.

Similarity laws and scale relations in planetary boundary layers, H. Tennekes.

Numerical modelling of the planetary boundary layer, M. A. Estoque.

Three-dimensional numerical modelling of the planetary boundary layer, J. W. Deardorff.

Construction of a dynamic model of the production of atmospheric turbulence and the dispersal of atmospheric pollutants, C. duP. Donaldson.

There is a great deal of overlap, especially as regards the theoretical and observational aspects of the 'surface-stress' layer, but there are differences of emphasis.

It was interesting to see Businger's brief summing-up on von Kármán's constant; although he is associated with strong claims for a value lower than the long-standing 0·4, he accepts that the matter is by no means settled. Also it seemed to be taken for granted in Businger's discussion that the transfer relations for any material property may be identified with those for water vapour, an assumption which is not obviously justified in density-stratified flow.

The important data obtained by Wyngaard and his colleagues in Kansas allow him to go further than hitherto with the properties of certain of the third moments of the turbulent fluctuations: those representing the vertical fluxes of turbulent energy, temperature variance, stress and heat flux. In relation to the 'closure' problem, which is the principal concern of the final paper in the series, it appears that the Kansas data on these third moments do not support consistent gradient-transfer relations.

For the still relatively unexplored region above the surface-stress layer the available data are usefully summarized in Panofsky's short article. However, the major attention is to theory and 'modelling' and is given in the following three articles. Although dealing in a thought-provoking way with the fundamental search for similarity and scaling relations, it is only in the last few pages of Tennekes' article that the important problem of the evolutionary character of the real boundary layer is introduced. Estoque draws largely on his own well-known two-dimensional numerical solutions for atmospheric flow, including time-dependent and inhomogeneous boundary-layer situations, and refers

briefly to inclusion of two-dimensional inhomogeneity. There is however little advance in physical reality as regards the turbulent transfer relations. Deardorff's numerical modelling goes much further in including three-dimensional properties and in introducing second-moment equations before closure assumptions are made. Some impressive detail emerges in the predicted patterns of eddy fluctuations, but at the cost of a digital computer requirement which few will be able to consider.

The search for closure assumptions more acceptable than the traditional gradient-transfer relations for the fluxes of momentum, heat and water vapour is the central theme of Donaldson's article. Use of equations for these and other second moments of the fluctuations was introduced a considerable time ago in Russian work, but Donaldson now takes this up on different lines. Unknown terms in these equations are 'modelled' in terms of second moments by using a characteristic velocity scale (the square root of the turbulent energy) and a whole hierarchy of interrelated scalar lengths. The aim is to show that common or consistent values for these scales lead to satisfactory predictions of various phenomena (free jet, free shear layer, boundary layer). Some progress appears to have been made but much remains to be clarified before a satisfactory development can truly be claimed.

The general theme of the workshop was supposed to be to "provide an introduction to the various subjects that could be used by the non-specialist". However, much of the material is concerned with incomplete advances which are still debatable and require careful study. Inclusion of these features will be welcome enough to the specialist in atmospheric turbulence, but is unlikely to be immediately helpful to the non-specialist.

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