

Mathematical Modelling  
of Turbulent Diffusion  
in the Environment

C. J. HARRIS

# Mathematical Modelling of Turbulent Diffusion in the Environment

*Proceedings of the Conference on  
Mathematical Modelling of Turbulent  
Diffusion in the Environment held at  
Liverpool University, September 12–13th,  
1978, organised by the Institute of  
Mathematics and its Applications*

Edited by  
C. J. HARRIS

*Department of Engineering Science  
and St. Edmund Hall, Oxford University,  
Oxford, England*

1979



**ACADEMIC PRESS**

London New York Toronto Sydney San Francisco

*A Subsidiary of Harcourt Brace Jovanovich, Publishers*

## CONTENTS

### CHAPTER ONE. MATHEMATICAL MODELLING TECHNIQUES FOR TURBULENT DIFFUSION

- 1.1 The basic structure of clouds of diffusing contaminant by P. C. Chatwin and P. J. Sullivan 3
- 1.2 Concentration fluctuations in atmospheric diffusion by J. R. Thomas 33
- 1.3 Continuous plumes - their structure and prediction by A. G. Robins and J. E. Fackrell 55
- 1.4 The application of renormalised perturbation theory in turbulence and related problems by R. Phythian 115

### CHAPTER TWO. AIR POLLUTION AND ATMOSPHERIC DIFFUSION

- 2.1 Mathematical models of dispersion of air pollution around buildings and hills by J. C. R. Hunt, R. E. Britter and J. S. Puttock 145
- 2.2 The application of field-experimental data to the parametrisation of the dispersion of plumes from ground level and elevated sources by F. B. Smith and R. M. Blackall 201
- 2.3 Use of the diffusion approximation to model atmospheric dispersion over short and long distances by B. E. A. Fisher 237
- 2.4 Statistics of the concentration fluctuations in short range atmospheric diffusion by C. D. Jones 277

### CHAPTER THREE. MIXING PROCESSES IN ESTUARIES AND COASTAL WATERS

- 3.1 Mathematical modelling of circulation and mixing in estuaries by T. J. Smith and K. R. Dyer 301
- 3.2 Calculation of shear-dispersion coefficients by R. Smith 343

3.3	A simple model for the dispersion of radioactive wastes dumped on the sea bed by P. A. Gurbutt and J. G. Shepherd	363
3.4	Turbulence and cooling water discharges from power stations by J. F. Macqueen	379
CHAPTER FOUR. WATER POLLUTION MODELLING AND CONTROL		
4.1	Modelling the dispersion of pollutants from marine outfalls by R. E. Lewis	441
4.2	River quality models near effluent outfalls by C. J. Harris	459
	SUBJECT INDEX	497