

Preface

This book attempts to bring together the methods, models and formulae used for estimating air pollutant concentrations in urban areas. It is aimed at giving the air pollution engineer, the town planner, the urbanist, the technically minded urban administrator and other scientists who are approaching this problem for the first time a few hints as to the usefulness of the available methods. For students and research workers in the more narrow field of urban area air pollution calculations, it presents a bibliography of the subject which is as complete as is possible nowadays (up to 1 January 1977 in general, and an additional coverage of about a dozen of the most important journals and meetings up to August 1979). More essential to the research worker is perhaps the fact that it focusses on the many uncertainties and undecided questions and indicates possible areas needing further research. I consider that a senior scientist's main duty is to point out the problems to be solved and to show where an effort or a well-guided thesis might result in a significant advance in knowledge. I have indicated the topics which have been thoroughly investigated and the subjects in which progress is limited by natural processes by including numerous references prior to 1970; I hope therefore that newcomers to urban air pollution modelling will avoid wasting their efforts on unrewarding and unproductive research.

The treatment is non-mathematical; it endeavours to expose the rational physical principles which form the basis of each method and subsequently to provide as much detail as possible concerning practical accomplishments. The treatment dwells more on the validation of a method than on the elegance or the details of the mathematical solution: this is the engineer's point of view. A method must be selected with regard only to its usefulness; any other aspect such as intellectual challenge, mathematical beauty or even fascinating theoretical reasoning must be disregarded. The basic philosophy of this book

may be expressed by just one sentence: the emphasis is on how good (or how bad) different urban air pollution calculation schemes, logical, methodological, conceptual or otherwise, are as indicated by the available experiments and not on their claims.

The book is designed for three categories of readers.

(1) For the non-specialist who requires a general view of what has been accomplished in the field of air pollution calculations, no particular knowledge of air pollution, atmospheric sciences or meteorology is assumed. General considerations are developed at the beginning or the end of the sections.

(2) For the air pollution specialist, chapter 2 provides the main systematisation. As researchers developing a model need resolving power in terms of time, space, the span allowed for obtaining the results, the available input data, etc., tables 2.1 and 2.2 are included in order to lead automatically to the section(s) that will supply the answers.

The validation of a method has always been performed by comparing computed values with observed data and by bearing in mind that most observed data are far from perfect. Without notable rejections or recommendations, I have tried to present clearly the numerical evidence, so that critical readers may judge for themselves.

(3) The final category is the specialist who wishes to check the solution of only one problem. From general scientific experience, I think this type of textbook usage is more frequent than cover-to-cover reading. Hopefully the systematic treatment of the subject, together with the contents list, will help these readers to find the required information easily. For these specialists a complete (as possible) review of available reports and publications was included. For their convenience, the symbols are repeatedly explained, in order to avoid the extremely frustrating search through hundreds of pages for the meaning of a letter in an equation. Most symbols are explained several times close to their textual use (that is, in equations, in diagrams or elsewhere). To avoid the use of symbols other than Latin and a few Greek letters, a multiplicity of subscripts and superscripts are common throughout the book (for example, those used for coordinates and concentrations). Also a few letters such as k , n , p , r , s and others are used with various meanings in different sections but only when it might be reasonably expected that no confusion will ensue. It is hoped that this system which avoids the use of, the search for and the memorising of a considerable number of multi-indexed or other exotic symbols will be acceptable to readers.

An enormous amount of literature has already been published on the subject of this book, which is limited to urban models. Therefore, almost all basic information regarding urban micrometeorology, the flow and turbulence in the urban boundary layer, the chemistry of the urban air, emission inventories, point-source modelling, multiple-point-source modelling, etc., has been omitted because (a) excellent books are already available in these

fields, (b) knowledge of the basic concepts and achievements in these fields was assumed and (c) even a superficial treatment of these topics would have resulted in an immense and expensive volume.

For 20 years, the author has worked with the Institut National de Recherche Chimique Appliquée (IRCHA), Vert-le-Petit, France, first as a senior research engineer and since 1967 as the Department Head of Air Pollution. Without the many industrial air pollution surveys and urban air management tasks accomplished during this period, the experience and the engineering outlook necessary for writing this book would never have been achieved. Therefore my thanks are due to the management of the IRCHA for their encouragement and for allowing the use of the IRCHA library in order to write this book.

Particular thanks are due to Dr Kenneth Calder, Dr Ralph Larsen, Professor P. D. Tyson and Dr Whelpdale for reading parts of the manuscript and for providing valuable advice.

I also wish to thank all my colleagues and the scientists, engineers and research workers who sent reports and reprints of their work. It would be impossible to mention them all individually as almost all the authors quoted in the references (about 1000) gave their help in this way. My thanks are also due to a number of institutes, laboratories and agencies who were most liberal in providing information and especially to the United States Environmental Protection Agency, Research Triangle Park, North Carolina. Without this generous international cooperation this book could never have been completed.

I also wish to express my gratitude to the World Meteorological Organisation, Geneva, Switzerland, and to Dr R. C. Koch from the Geomet Corporation, Gaithersburg, Maryland, for permission to use excerpts from their publications with slight modifications; the references in the respective sections specify exactly where these passages are used.

Finally, I would like to quote a few sentences of Professor Rudolf Geiger's Preface to his classical book *Climate Near the Ground*. His remarks and feelings are so accurate and pertinent that nobody could express it better:

'During my work . . . it became clear to me why, in spite of the ever-swelling flood of published papers, the number of usable textbooks is increasing much more slowly. In drafting almost every chapter, I could feel the spirit of a cherished colleague, at home or abroad, looking over my shoulder, and it seemed to me that he was more fitted to write this chapter than I was. Then came the feeling of suffocation under the weight of good new literature, and the anxiety that the first chapter would be out of date before the last one could be finished.'