

BOOK FLYER AND ORDER FORM

AIR QUALITY MODELING

Theories, Methodologies,
Computational Techniques, and
Available Databases and Software

Volume I - Fundamentals

Editor

Paolo Zannetti

Chapter Authors

Domenico Anfossi

Peter J.H. Builtjes

Daewon W. Byun

Elisa Canepa

Joseph L. Eastman

Cecil S. Keen

Avraham Lacser

Russell Lee

Walter A. Lyons

Dennis A. Moon

Nicolas Moussiopoulos

Thomas E. Nelson

Dietmar Oettl

Steven D. Reynolds

Philip M. Roth

Roberto San Jose

Zbigniew Sorbjan

Jesse Thé

Paraskevi-Maria Turlou

Han van Dop

Akula Venkatram

Robert J. Yamartino

Paolo Zannetti

Air Quality Modeling: Theories, Methodologies, Computational Techniques, and Available Databases and Software – Volume I is the first volume of a comprehensive book series on the subject of air pollution and computer modeling of air quality phenomena. The book series is available both on CD-ROM (see [below](#)) and as a [bound textbook](#) (search for OTHP-24). The book series is published by the [EnviroComp Institute](#) and the [Air and Waste Management Association](#).

For updates, corrections, and discussion, please visit:
<http://www.envirocomp.org/aqm>

The electronic book *Air Quality Modeling: Theories, Methodologies, Computational Techniques, and Available Databases and Software – Volume I* is distributed on CD-ROM. The book takes an in-depth look at the fundamentals of air pollution modeling: from a review of air pollution meteorology, to an introduction to Gaussian plume models; from a discussion of plume rise formulations, to a review of Eulerian grid models. With individual chapters written by experts in their fields, this book gives environmental professionals a solid foundation for understanding modeling techniques using both semi-empirical formulations and well-established atmospheric science.

The electronic book is made of chapters organized as Adobe Acrobat's PDF files that can be examined using Adobe Acrobat Reader (which can be [freely downloaded](#)). The reader can use any computer platform (PC/Mac/Unix) to navigate the electronic book. Navigation is straightforward. The book is complete with hypertext links, references, website and email pointers, graphics, and information about chapter authors including curriculum vitae, biographies, and pictures. The [Table of Contents](#) of Volume I and the [order form](#) are presented below.

Copyright © 2003 EnviroComp Institute and Air & Waste Management Association. All rights reserved.



Volume I – Table of Contents¹

	Preface	xi
	About the Editor	xiii
	About the Publishers	xv
	About the Chapter Authors	xvii
1	The Problem – Air Pollution (Peter Builtjes)	1
	1 Our Natural Environment	1
	2 Air Pollution, Some Definitions	3
	3 Primary and Secondary Pollutants	4
	4 A Short History of Air Pollution Modeling	5
	5 Air Pollution Regulations	8
2	The Tool – Mathematical Modeling (Philip M. Roth and Steven D. Reynolds)	13
	1 Why Air Quality Modeling	13
	2 Modeling Categorized	14
	3 Modeling the Atmosphere	19
	4 Modeling Alternatives	20
	5 Spatial and Temporal Scales	22
	6 Spatial and Temporal Resolution	23
	7 Uncertainty: Bias, Imprecision, and Variability	24
	8 Evaluation of Model Performance	25
	9 Data Needs	27
	10 Uses of Models	29
3	<i>Emission Modeling</i>	33
4	Air Pollution Meteorology (Zbigniew Sorbjan)	37
	1 Synoptic Meteorology	38
	2 Boundary-Layer Meteorology	61
5	<i>Meteorological Modeling</i>	101
6	Plume Rise (Domenico Anfossi, Elisa Canepa, and Han van Dop)	103
	1 Introduction	108
	2 Semi-Empirical Formulations	112
	3 Advanced Plume Rise Models	131
	4 Particle Models for Plume Rise	137
	5 Special Cases	157

¹ Chapters in italics will be provided in subsequent volumes.

7	<i>Gaussian Plume Models</i>	183
7A	Introduction to Gaussian Plume Models (Akula Venkatram and Jesse Thé)	185
1	Introduction	186
2	The Point Source in the Atmospheric Boundary Layer	186
3	The Atmospheric Boundary Layer	190
4	Dispersion in the Atmospheric Boundary Layer	193
5	Building Downwash	197
6	Terrain Treatment	199
7	Modifications to the Gaussian Framework	202
8	Concluding Remarks	206
8	<i>Gaussian Puff Models</i>	209
9	<i>Special Applications of Gaussian Models</i>	211
10	Eulerian Dispersion Models (Daewon W. Byun, Avraham Lacser, Robert Yamartino, and Paolo Zannetti)	213
1	Air Quality Modeling Methods	214
2	Eulerian Formulations	218
3	Analytical Solutions for Ideal Atmospheric Conditions	232
4	Numerical Solution Methods	237
5	Numerical Algorithms for Advection	244
6	Horizontal Diffusion Algorithm	251
7	Vertical Diffusion Algorithm	258
8	Simplified Eulerian Models	268
	Appendix A	272
	Appendix B	276
	Appendix C	279
11	<i>Lagrangian Particle Models</i>	293
12	<i>Atmospheric Transformations</i>	297
13	<i>Deposition Phenomena</i>	301
14	<i>Indoor Air Pollution Modeling</i>	303
15	<i>Modeling of Adverse Effects</i>	305
16	<i>Statistical Modeling</i>	307
17	<i>Evaluation of Air Pollution Models</i>	309
18	<i>Regulatory Air Quality Models</i>	311

19	Case Studies – Air Pollution Modeling at Local, Regional, Continental, and Global Scales	313
	(Nicolas Moussiopoulos and Paraskevi-Maria Turlou)	
1	List of Case Studies	314
2	Additional Information on Case Studies Relevant to Air Pollution Modeling/Simulation	323
20	The Future of Air Pollution Modeling	325
	(Dietmar Oetl and Roberto San Jose)	
1	Processor Technology and Air Pollution Modeling	325
2	Comprehensive Modeling Systems (CMS)	330
21	Active Groups in Air Pollution Modeling	355
	(Nicolas Moussiopoulos and Paraskevi-Maria Turlou)	
1	List of Active Groups	356
2	Additional Information on Groups Working on Air Pollution Modeling Issues	360
22	Available Software	363
	(Jesse Thé and Russell Lee)	
1	Short-Range Models	366
2	Urban and Regional Photochemical Models	380
3	Long-Range Transport Models for Acid Deposition, Visibility Impairment and Complex Terrain	387
4	Emergency Release and Dense Gas Models	394
5	Meteorological Models	406
23	Available Databases	
	(Walter A. Lyons, Joseph L. Eastman, Thomas E. Nelson, Dennis A. Moon, and Cecil S. Keen)	409
1	Overview	409
2	The Challenges	411
3	Characteristics of Weather Data Sets	413
4	NCEP Gridded Data Products	414
5	Data Archival	416
6	Reanalysis Techniques	418
7	Mesoscale Prognostic Models	421
8	Future Developments	423
	Authors' Index	427
	Subject Index	429

Order Form – AQM Volume I

YES, SEND ME ____ COPY (ies) of *Air Quality Modeling: Theories, Methodologies, Computational Techniques, and Available Databases and Software – Volume I* **ON CD-ROM, READABLE IN ANY COMPUTER PLATFORM (PC/MAC/UNIX).** (See the Order Form of Volume IV for purchasing the entire AQM series of 4 volumes at a 15% discount)

I ENCLOSE A CHECK OR MONEY ORDER IN US DOLLARS (US \$109 per copy; add US \$10 per order for handling/shipping outside the US; add 9.75% in California = US \$119.63 per copy). **MAKE CHECK PAYABLE TO EnviroComp Institute.**

CHARGE MY CREDIT CARD (US \$109 per copy; add US \$10 per order for handling/shipping outside the US; add 9.75% in California = US \$119.63 per copy):

Card (circle one): **VISA MC - Card number:** _____

Extra digits: _____ (IMPORTANT: you must include the 3 or 4 extra digits or card code which are generally found near the signature strip on the back of the card)

Card Expiration Date: _____ **Total charge:** US \$ _____

Name as printed in the Card _____

Signature: _____

Deliver CD-ROM to:

Name/Organization: _____

Address: _____

Phone/Fax/E-mail: _____

Complete the order above and return by mail/fax/email to:

**EnviroComp Institute
2298 Ocaso Camino
Fremont, California 94539 (USA)**

**Fax: (1) (510) 490 – 3357
Email: zannetti@envirocomp.org
Web site: <http://www.envirocomp.org>**