

---

# Air Pollution XV

---

**WIT***PRESS*

WIT Press publishes leading books in Science and Technology.  
Visit our website for the current list of titles.  
[www.witpress.com](http://www.witpress.com)

**WIT***eLibrary*

Home of the Transactions of the Wessex Institute.  
Papers presented at Air Pollution XV are archived in the WIT eLibrary in volume 101 of  
WIT Transactions on Ecology and the Environment (ISSN 1743-3541).  
The WIT eLibrary provides the international scientific community with immediate and  
permanent access to individual papers presented at WIT conferences.  
<http://library.witpress.com>

FIFTEENTH INTERNATIONAL CONFERENCE ON MODELLING,  
MONITORING AND MANAGEMENT OF AIR POLLUTION

**AIR POLLUTION XV**

**CONFERENCE CHAIRMEN**

**C. A. Borrego**

*University of Aveiro, Portugal*

**C. A. Brebbia**

*Wessex Institute of Technology, UK*

**INTERNATIONAL SCIENTIFIC ADVISORY COMMITTEE**

M. Assael

J. Baldasano

D. M. Elsom

G. Ibarra-Berastegi

W. Kaminski

J. G. Kretzschmar

J. W. S. Longhurst

G. Passerini

F. Patania

V. Popov

E. Richardson

R. San Jose

K. Sawicka-Kapusta

E. Tiezzi

C. Trozzi

K. Yamamoto

**ORGANISED BY**

*Wessex Institute of Technology, UK*

**SPONSORED BY**

*WIT Transactions on Ecology and the Environment*

# WIT Transactions on Ecology and the Environment

## Transactions Editor

Carlos Brebbia  
Wessex Institute of Technology  
Ashurst Lodge, Ashurst  
Southampton SO40 7AA, UK  
Email: carlos@wessex.ac.uk

---

## Editorial Board

---

**Y N Abousleiman**  
University of Oklahoma  
USA

**D Almorza Gomar**  
University of Cadiz  
Spain

**M Andretta**  
Montecatini  
Italy

**J G Bartzis**  
Institute of Nuclear Technology  
Greece

**J Boarder**  
Cartref Consulting Systems  
UK

**H Boileau**  
ESIGEC  
France

**A H-D Cheng**  
University of Mississippi  
USA

**A Cieslak**  
Technical University of Lodz  
Poland

**M da Conceicao Cunha**  
University of Coimbra  
Portugal

**A B de Almeida**  
Instituto Superior Tecnico  
Portugal

**C Dowlen**  
South Bank University  
UK

**J P du Plessis**  
University of Stellenbosch  
South Africa

**D Elms**  
University of Canterbury  
New Zealand

**A Aldama**  
IMTA  
Mexico

**A M Amer**  
Cairo University  
Egypt

**J M Baldasano**  
Universitat Politecnica de Catalunya  
Spain

**A Bejan**  
Duke University  
USA

**B Bobee**  
Institut National de la Recherche Scientifique  
Canada

**C A Borrego**  
University of Aveiro  
Portugal

**C-L Chiu**  
University of Pittsburgh  
USA

**W Czyczula**  
Krakow University of Technology  
Poland

**M Davis**  
Temple University  
USA

**K Dorow**  
Pacific Northwest National Laboratory  
USA

**R Duffell**  
University of Hertfordshire  
UK

**A Ebel**  
University of Cologne  
Germany

**D M Elsom**  
Oxford Brookes University  
UK

- J W Everett**  
Rowan University  
USA
- D M Fraser**  
University of Cape Town  
South Africa
- N Georgantzis**  
Universitat Jaume I  
Spain
- K G Goulias**  
Pennsylvania State University  
USA
- C Hanke**  
Danish Technical University  
Denmark
- S Heslop**  
University of Bristol  
UK
- W F Huebner**  
Southwest Research Institute  
USA
- D Kaliampakos**  
National Technical University of Athens  
Greece
- H Kawashima**  
The University of Tokyo  
Japan
- D Kirkland**  
Nicholas Grimshaw & Partners Ltd  
UK
- J G Kretzschmar**  
VITO  
Belgium
- A Lebedev**  
Moscow State University  
Russia
- K-C Lin**  
University of New Brunswick  
Canada
- T Lyons**  
Murdoch University  
Australia
- N Marchettini**  
University of Siena  
Italy
- J F Martin-Duque**  
Universidad Complutense  
Spain
- C A Mitchell**  
The University of Sydney  
Australia
- R Olsen**  
Camp Dresser & McKee Inc.  
USA
- R A Falconer**  
Cardiff University  
UK
- G Gambolati**  
Universita di Padova  
Italy
- F Gomez**  
Universidad Politecnica de Valencia  
Spain
- W E Grant**  
Texas A & M University  
USA
- A H Hendrickx**  
Free University of Brussels  
Belgium
- I Hideaki**  
Nagoya University  
Japan
- W Hutchinson**  
Edith Cowan University  
Australia
- K L Katsifarakis**  
Aristotle University of Thessaloniki  
Greece
- B A Kazimee**  
Washington State University  
USA
- D Koga**  
Saga University  
Japan
- B S Larsen**  
Technical University of Denmark  
Denmark
- D Lewis**  
Mississippi State University  
USA
- J W S Longhurst**  
University of the West of England  
UK
- Ü Mander**  
University of Tartu  
Estonia
- J D M Marsh**  
Griffith University  
Australia
- K McManis**  
University of New Orleans  
USA
- M B Neace**  
Mercer University  
USA
- R O'Neill**  
Oak Ridge National Laboratory  
USA

**K Onishi**  
Ibaraki University  
Japan

**G Passerini**  
Universita delle Marche  
Italy

**M F Platzer**  
Naval Postgraduate School  
USA

**H Power**  
University of Nottingham  
UK

**Y A Pykh**  
Russian Academy of Sciences  
Russia

**A C Rodrigues**  
Universidade Nova de Lisboa  
Portugal

**J L Rubio**  
Centro de Investigaciones sobre Desertificacion  
Spain

**R San Jose**  
Technical University of Madrid  
Spain

**H Sozer**  
Illinois Institute of Technology  
USA

**E Tiezzi**  
University of Siena  
Italy

**S G Tushinski**  
Moscow State University  
Russia

**R van Duin**  
Delft University of Technology  
Netherlands

**Y Villacampa Esteve**  
Universidad de Alicante  
Spain

**J Park**  
Seoul National University  
Korea

**B C Patten**  
University of Georgia  
USA

**V Popov**  
Wessex Institute of Technology  
UK

**M R I Purvis**  
University of Portsmouth  
UK

**A D Rey**  
McGill University  
Canada

**R Rosset**  
Laboratoire d'Aerologie  
France

**S G Saad**  
American University in Cairo  
Egypt

**J J Sharp**  
Memorial University of Newfoundland  
Canada

**I V Stangeeva**  
St Petersburg University  
Russia

**T Tirabassi**  
Institute FISBAT-CNR  
Italy

**J-L Uso**  
Universitat Jaume I  
Spain

**A Viguri**  
Universitat Jaume I  
Spain

**G Walters**  
University of Exeter  
UK



---

# Air Pollution XV

---

**Editors**

**C. A. Borrego**

*University of Aveiro, Portugal*

**C. A. Brebbia**

*Wessex Institute of Technology, UK*

**WIT**PRESS Southampton, Boston



**Editors****C. A. Borrego***University of Aveiro, Portugal***C. A. Brebbia***Wessex Institute of Technology, UK*

Published by

**WIT Press**

Ashurst Lodge, Ashurst, Southampton, SO40 7AA, UK

Tel: 44 (0) 238 029 3223; Fax: 44 (0) 238 029 2853

E-Mail: [witpress@witpress.com](mailto:witpress@witpress.com)<http://www.witpress.com>

For USA, Canada and Mexico

**WIT Press**

25 Bridge Street, Billerica, MA 01821, USA

Tel: 978 667 5841; Fax: 978 667 7582

E-Mail: [infousa@witpress.com](mailto:infousa@witpress.com)<http://www.witpress.com>

British Library Cataloguing-in-Publication Data

A Catalogue record for this book is available  
from the British Library

ISBN: 978-1-84564-067-5

ISSN: (print) 1746-448X

ISSN: (on-line) 1734-3541

*The texts of the papers in this volume were set  
individually by the authors or under their supervision.  
Only minor corrections to the text may have been carried  
out by the publisher.*

No responsibility is assumed by the Publisher, the Editors and Authors for any injury and/or damage to persons or property as a matter of products liability, negligence or otherwise, or from any use or operation of any methods, products, instructions or ideas contained in the material herein.

© WIT Press 2007

Printed in Great Britain by Athenaeum Press Ltd.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the Publisher.

## Preface

This volume contains most of the contributions presented at the Fifteenth International Conference on Modelling, Monitoring, and Management of Air Pollution. This International Scientific Meeting began its course in Monterrey, Mexico in 1993 and has been successfully reconvened since.

Air pollution nowadays represents one of the most challenging issues that humankind is facing. On the one hand, with the growth of the economies of emerging countries leading to an increase in the demand for more energy, the prevention of air deterioration by means of controlling atmospheric emission has become an urgent task. On the other hand, the mitigation strategies for traditional, but persistent air pollution problems, such as particulate and photochemical pollution, soil eutrophication and acidification remain important issues.

Science has, in this process, a crucial role to play in the prediction, understanding and mitigation of atmospheric pollution phenomena. Furthermore, the development of analysis tools is making it possible to accomplish air quality assessment using modelling techniques that can be applied on a global scale, providing technical support to policy-makers. Air quality networks continue to be enhanced, offering monitoring and forecasting operations in real time

The need for awareness of the population in the process of implementing policies is fundamental towards the success of legislative efforts. The accessibility of the population to education and scientific knowledge is important to help promote a better understanding of the policies adopted.

This book includes the latest developments in air pollution modeling, air quality management, urban air management, transport emissions, emission inventory, comparison of model and experimental results, monitoring and laboratory studies, global and regional studies, aerosols and particles, climate change and air pollution, atmospheric chemistry, indoor pollution, environmental health effects and remote sensing.

The Editors would like to thank the contribution of the Authors, and acknowledge the assistance of the members of the International Scientific Advisory Committee who helped to organise the conference and to review the submitted papers.

The Editors  
Algarve, Portugal, 2007



# Contents

## Introduction

Fifty years air pollution research and policy in the EU <i>J. G. Kretzschmar</i> .....	3
---	---

## Section 1: Air pollution in Portugal

Air pollution and child respiratory diseases: the Viseu case study, Portugal <i>C. Borrego, M. Lopes, J. Valente, J. Santos, T. Nunes, H. Martins, A. I. Miranda &amp; N. Neuparth</i> .....	15
--	----

Application of TAPM to predict photochemical air pollution over Portugal <i>C. Ribeiro, C. Borrego &amp; M. Coutinho</i> .....	25
--	----

Evaluating ozone spatial distribution in Portugal using passive samplers <i>J. Monjardino, S. Mesquita, H. Tente, F. Ferreira, P. Gomes &amp; N. Franco</i> .....	35
--	----

Composition and source apportionment of atmospheric aerosols in Portugal during the 2003 summer intense forest fire period <i>C. A. Pio, C. A. Alves, T. Oliveira, J. Afonso, A. Caseiro, H. Puxbaum, A. Kasper-Giebl, S. Preunkfert, M. Legrand &amp; A. Gelencsér</i> .....	45
---	----

Influence of traffic on the elemental composition of PM <sub>10</sub> and PM <sub>2.5</sub> in Oporto region <i>K. Slezakova, M. A. Reis, M. C. Pereira &amp; M. C. Alvim-Ferraz</i> .....	59
--	----

## Section 2: Air pollution modelling

Modelling of carbon monoxide dispersion along roads with the use of the finite element method <i>W. Kamiński, M. Kucharski, E. Tomczak &amp; J. Petera</i> .....	71
--	----

Air velocity and pollutant profiles in Krakow <i>E. Tomczak, W. Kamiński, K. Kamiński &amp; J. Petera</i> .....	79
Optimizing the prediction models of the air quality state in cities <i>J. Skrzypski, E. Jach-Szakiel &amp; W. Kaminski</i> .....	89
Evaluation of industrial sources' contribution to PM10 concentrations over a coastal area <i>A. Tanzarella, C. Mangia, I. Schipa, M. Cervino &amp; M. Milanese</i> .....	99
A neural network based model to forecast hourly ozone levels in rural areas in the Basque Country <i>E. Agirre, A. Anta, L. J. R. Barrón &amp; M. Albizu</i> .....	109
Satellite imagery used in constructing emission maps for air quality modelling in the Dubai-Sharjah (UAE) region <i>D. S. Zachary &amp; B. Farooq</i> .....	119
A distributed computing solution for CALPUFF <i>K.-H. Yau &amp; J. Thé</i> .....	129

### **Section 3: Air quality management**

Local scale vehicles pollution study in the absence of sufficient data: the case of the city of Thessaloniki <i>M. J. Assael, M. Delaki &amp; K. Kakosimos</i> .....	137
Barriers and opportunities to successful local air quality management consultation in England <i>N. S. Leksmono, F. Burnet, P. Dorfman, D. C. Gibbs, J. W. S. Longhurst &amp; E. L. C. Weitkamp</i> .....	147
Www.airqualitynow.eu, a common website and air quality indices to compare cities across Europe <i>S. vd. Elshout, K. Leger, H. Heich, N. Hodges &amp; F. Nussio</i> .....	157
Air quality management in Auckland, New Zealand <i>J. K. Symons, N. S. Leksmono, E. T. Hayes, T. J. Chatterton &amp; J. W. S. Longhurst</i> .....	169
Simplified reading of one-year air pollution: ranking of chemical and physical variables <i>M. C. Mura</i> .....	181

SO<sub>x</sub> emission reduction in the ceramic industry: BAT and beyond  
*D. Huybrechts, E. Meynaerts & K. Vrancken*..... 191

Pollutants site ratio as appointment of highway, industrial and  
farming sources  
*L. Bontempi, M. L. Ruello & G. Fava*..... 201

#### **Section 4: Emission studies**

Decreasing greenhouse effect in agriculture using biodiesel – when green  
may be enough  
*F. Coppola, M. Bravi, R. Ridolfi & E. Tiezzi*..... 213

Trends and sources identification of non-methane hydrocarbons (NMHC)  
concentration in rural areas in France  
*S. Sauvage, H. Plaisance, N. Locoge, P. Coddeville & J. C. Galloo*..... 223

Emission inventory for an urban area: construction and use  
*E. Brizio, G. Genon & S. Caon*..... 233

Computing mobile emissions for the Montreal area  
*Y. Noriega, M. Florian & G. Morneau*..... 243

Renewable energy impact in reducing greenhouse gas emissions  
at local scale: the case study of South Tuscany geothermal fields  
*S. Bosco, R. M. Pulselli & S. Bastianoni*..... 253

Wood processing as a source of terpene emissions compared to  
natural sources  
*K. M. Granström*..... 263

Measuring fugitive emission in the printing sector as a verification of  
the solvent management plan according to the EU Solvent Directive  
*J. Van Deun, R. De Fré, I. Bilsen, R. Baert & M. Blondeel*..... 273

Chemical processes effect on ambient air quality: modelling and  
primary/secondary pollutants monitoring study  
*M. S. Al-Salem, A. Al-Haddad & A. Rehman Khan*..... 281

Air quality in vicinity of a government school in Kuwait  
*E. Al-Bassam, V. Popov & A. Khan*..... 291

Mapping anthropogenic B(a)P releases in the Great Lakes Basin  
*Y.-F. Li, C. Yang, D. Li & S. Michajluk*..... 301

Traffic pollutant emissions in Barreiro city <i>R. Cerdeira, C. Louro, L. Coelho, J. Garcia, C. Gouveia, P. J. Coelho &amp; T. Bertrand</i> .....	311
Source apportionment of VOC in 3 French sites by CMB and PMF models and critical analysis <i>F. Troussier, N. Locoge &amp; J. C. Galloo</i> .....	321
Simulation of fuel consumption and emissions in typical traffic circumstances in Belgium <i>L. Pelkmans, T. Denys, E. Verhaeven, G. Spleesters, S. Kumra &amp; A. Schaerf</i> .....	331
Modelling vehicles kinematics and parking processes relevance on pollutant emissions in the city of Florence <i>E. Negrenti, S. Carrese, B. Beltran, A. Parenti, F. Giovannini &amp; V. Lapolla</i> .....	341
 <b>Section 5: Monitoring and laboratory studies</b>	
Biological monitoring – the useful method for estimation of air and environment quality <i>K. Sawicka-Kapusta, M. Zakrzewska &amp; G. Bydłoń</i> .....	353
Ambient air quality monitoring in southern Kuwait <i>A. A. Ramadan, A. Khan &amp; S. Al-Hajraf</i> .....	363
Characterization of BTEX sources in a medium-size city by concentration statistical analysis and GIS technique <i>S. Capasso, M. Monaco, P. Iovino, S. Salvestrini &amp; M. Vigliotti</i> .....	373
Potentialities of Vis-NIR spectroradiometry for mapping traffic emissions in urban environments <i>R. Salzano, R. Salvatori, M. Angelone &amp; R. Casacchia</i> .....	381
A pilot investigation into the potential of mineral magnetic measurements as a proxy for urban roadside particulate pollution <i>C. A. Booth, C. M. Winspear, M. A. Fullen, A. T. Worsley, A. L. Power &amp; V. J. Holden</i> .....	391
Trends in ozone levels and identification of visible injuries on agricultural crops in areas in the Metropolitan Zone of Mexico Valley <i>J. Cerón, J. Ramírez, B. Cárdenas, V. Gutiérrez, S. Blanco, R. Cerón, J. Guerra, R. Ramos &amp; A. Retama</i> .....	401

A method for the characterisation of ambient dust: geochemical analyses of directional sticky pad dust samples <i>H. Datson &amp; M. Fowler</i> .....	413
NO <sub>x</sub> adsorbent formulation research by uniform design <i>Y. L. Wang, J. Li, H. Ji &amp; Y.-Q. Jin</i> .....	429
Effects of process changes on concentrations of individual malodorous sulphur compounds in ambient air near a Kraft pulp plant in Thunder Bay, Ontario, Canada <i>L. J. J. Catalan, V. Liang, C. Walton &amp; C. Q. Jia</i> .....	437
Odour studies and health risk assessment: two complementary approaches in response to residents' complaints <i>G. Deiber, J. Boudaud &amp; L. Pourtier</i> .....	449
Atmospheric volatile organic compounds in a Portuguese mountain region <i>M. Evtuygina, T. Nunes, C. Alves &amp; M. C. Marques</i> .....	455

## **Section 6: Aerosols and particles**

PM and NO <sub>2</sub> at urban sites with different traffic exposure: curb site measurements in Flemish cities <i>M. Van Poppel, E. De Dekker, L. Int Panis, N. Bleux, M. Spruyt &amp; P. Berghmans</i> .....	467
Human exposure against particles: the indoor-outdoor problem <i>U. Franck, T. Tuch, M. Manjarrez, A. Wiedensohler &amp; O. Herbarth</i> .....	477
Size distribution of commuters' exposure to airborne particulate matter in buses in the UK <i>W. W. Song &amp; M. R. Ashmore</i> .....	487
A comparison between aerosols modelled and measured by AERONET network emitted by vegetation fires over Iberian Peninsula <i>A. M. Ramos, S. Freitas, K. Longo, F. C. Conde, J. Corte-Real, A. M. Silva, A. L. Fazenda, F. S. Recuero &amp; D. S. Moreira</i> .....	497
Generation of monodisperse aerosols through condensation nuclei control <i>H. M. Kadlimatti, S. Gangamma &amp; S. K. Varghese</i> .....	505
Assessment of particle pollution in an industrial area in Kuwait <i>H. Tang, M. Al-Sudairawi, S. Mathkory, M. Al-Mutairi, A. Ali &amp; M. Behabhani</i> .....	513

Identification of particulate matter and vitreous fibres in the atmosphere of a megacity <i>P. Avino, C. Fanizza &amp; M. Manigrasso</i> .....	523
---	-----

## **Section 7: Climate change and air pollution**

Global climate change – the technology challenge <i>F. T. Princiotta</i> .....	533
---	-----

CDM project approval and evaluation criteria: comparative study of Morocco and South Africa <i>G. Nhamo</i> .....	553
--	-----

First investigations on gas-phase mercury in two Italian cities <i>P. Avino, M. Manigrasso, C. Fanizza, C. Vernale, R Schirò, L. Giuliani, R. Acerboni, V. Annoscia, C. Giannico &amp; F. Perri</i> .....	563
--	-----

## **Section 8: Indoor pollution**

Indoor air quality in Portugal: technical, institutional and policy challenges in the implementation of the directive on the energy performance of buildings (work in progress) <i>A. R. de Oliveira, A. T. Perez &amp; A. Morais</i> .....	571
--	-----

Identification and evaluation of the volatile organic compounds in working environment areas at a material recycling facility <i>M. S. Elmegrahi, G. Karani &amp; K. Morris</i> .....	579
--	-----

Gas phase photocatalytic oxidation of VOC using TiO <sub>2</sub> -containing paint: influence of NO and relative humidity <i>Th. Maggos, P. Leva, J. G. Bartzis, Ch. Vasilakos &amp; D. Kotzias</i> .....	585
--	-----

<b>Author Index</b> .....	595
---------------------------	-----