ISSN 2070-2582
Key title: Newsletter (European Association for the Science of Air Pollution. Online)
Abbreviated key title: Newsletter (Eur. Assoc. Sci. Air Pollut., Online)
Parallel title: EURASAP newsletter

Articles, Letters and other Contributions
for the EURASAP Newsletter to

Prof. Zvjezdana Bencetić Klaić
Andrija Mohorovičić Geophysical Institute,
Department of Geophysics, Faculty of Science
University of Zagreb
Horvatovac bb, 10000 Zagreb, Croatia
zklaic@gfz.hr

or

Dr. Marija Zlata Božnar
MEIS storitve za okolje d.o.o.
Mali Vrh pri Šmarju 78
SI-1293 Šmarje – Sap, Slovenia
marija.zlata.boznar@meis.si

Membership forms
to
Prof. Carlos Borrego
IDAD - Instituto do Ambiente e Desenvolvimento,
Campus Universitário de Santiago,
3810-193 Aveiro, PORTUGAL,
E-mail: rosamfreire@ua.pt

ISSN 2070-2582

EURASAP

Newsletter 75
December 2012

European association for the science of air pollution

CONTENTS

Front cover: photo by Z. B. Klaić

EDITORIAL

Dear EURASAP members,

Scientific contribution presented in this issue points to the necessity of development of diagnostics needed for interpretation of results obtained by nowadays, complex models. It also proposes diagnosis based on footprints.

Additionally, in this issue you can read about the new web portal devoted to the regional modelling system for air pollution control in Slovenia, and, about a doctoral research of a young scientist, Eduardo Wilde Barbaro. We invite other young scientists preparing their PhD theses in the field of air pollution to send us short summaries on their research, and thus, inform broader community on their work. Summaries of recently defended theses are also welcomed.

I wish you all a Merry Christmas and a Happy New Year,

Zvjezdana B. Klaić

Scientist's contributions

DIAGNOSTICS WITH SCIENTIFIC AND POLICY RELEVANCE

Bernard Fisher

University of Hertfordshire and the Institute for Air Quality Management, beafisher@cantab.net

This note to the EURASAP Newsletter is to suggest that with the development of more complex models over the past 25 years (the search for the perfect model as one might call it) modellers should put more effort into developing diagnostics with which to interpret model results. Using the very valuable results from the EMEP programme, some examples of diagnostics based on footprints are proposed.

EMEP kindly send out every year the results from their annual assessment. Clearly EMEP has a political as well as a scientific purpose. It has bridged that gap very successfully. For some other regional models one still has difficulty extracting useful policy relevant results. I have found that the most useful diagnostic or metric is the 'footprint', obtained from the difference between the concentration or deposition, when all sources are included, and the concentration or deposition, when all sources, except for the specified source under consideration, are included. A footprint metric is a response function, showing how concentrations or deposition are influenced spatially by emissions from a single specified source, such as a power station. Figure 1 below provides an example showing the annual average ground-level sum of primary and secondary PM10 concentration from a power station in southern Britain.

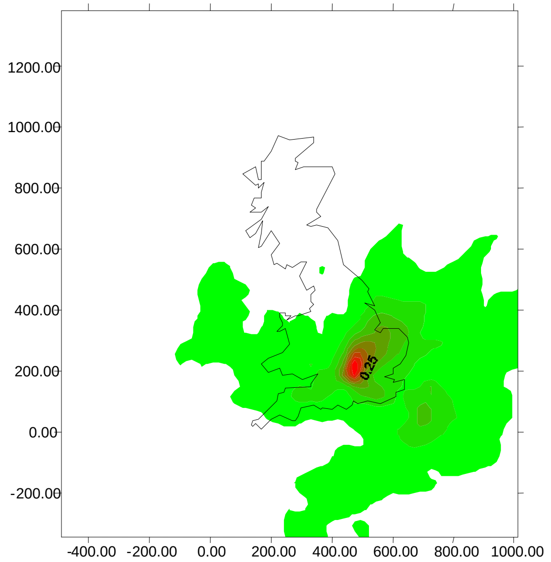


Figure 1. *PM_{10} concentrations in 2003 from power station in southern England using the CMAQ model with a 15 km grid resolution.*

The footprint metric has two purposes:

- The footprint metric is a diagnostic showing how a system that includes very complex processes, changes as a result of a change in emission at a specified position.
- It is useful for regulatory purposes as it shows how emission reductions may change the concentrations.

In principle, a reduction strategy should follow a sequential change in emissions, tracking which emission reductions are most effective.

A quantitative approach to simplifying footprints is to consider the distance dependent structure of the footprint of a single source (Fisher et al. 2011). The weighted average concentration given by the average concentration along a typical trajectory, excluding approximately any dilution arising from dispersion, is obtained by multiplying concentration by distance. This footprint metric is defined by:

$$\frac{r}{2\pi}\int_0^{2\pi} C(r,\theta)d\theta$$

where $C(r, \theta)$ is the concentration at distance r from the source in a direction θ. Taking results from the EMEP web site one can plot out the distance dependence for the footprint of the UK as a whole, comparing this with the footprint from a major single point source, such as a power station. See Figure 2 below.

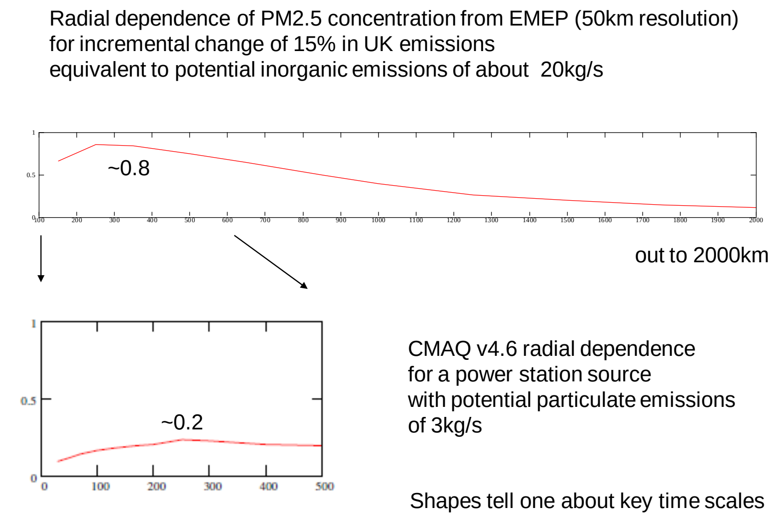


***Figure 2**. Top: Dependence of $PM_{2.5}$ concentration on distance in 2003, along a radial trajectory starting in central England, based on a 15% reduction in UK emissions, based on the EMEP model (Klein et al. 2011). Bottom: Dependence of $PM_{2.5}$ concentration on distance in 2003, along a radial trajectory, from the footprint of a stationary power station source using the CMAQ model. Notional potential source strengths for the two types of sources and maximum values of $PM_{2.5}$ concentrations (0.8 and 0.2 µg/m^3) are shown.*

One can go further using the EMEP data base of results and plot out footprints for various countries and compare these for various years as shown in Figure 3.

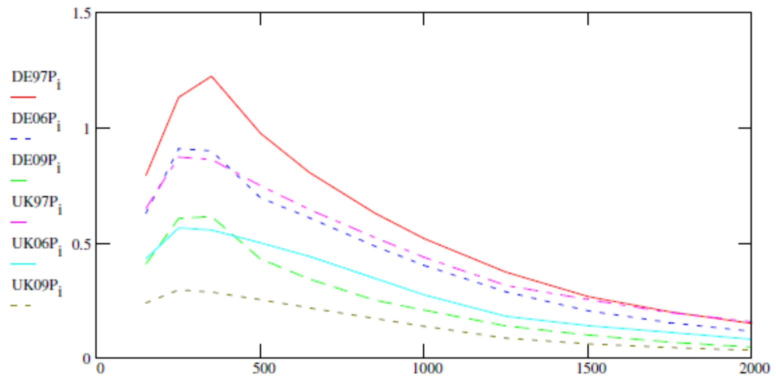


***Figure 3.** Radial footprints of annual average $PM_{2.5}$ concentration $\delta C(q,Q,\ r)$ for different years and individual countries, UK and Germany of source strength q, as a function of distance r from the centre of the country, based on the EMEP model. Q represents the source strength of all the remaining countries in Europe which together determine the composition of the ambient atmosphere into which the chosen source of strength q mixes.*

The footprints have similar shape although the source strengths q and Q are somewhat different for the UK and Germany and for the rest of Europe in 1997, 2006 and 2009. If one normalises the curves by plotting the $PM_{2.5}$ concentration relative to the $PM_{2.5}$ concentration at a distance of 150km from the nominal centre of the country one gets Figure 4.

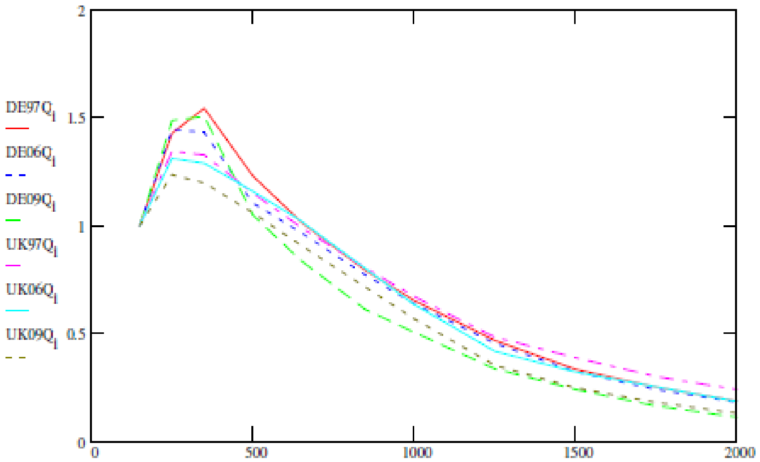


Figure 4. *Radial footprints of $PM_{2.5}$ concentration attributed to the UK and Germany for different years, from the EMEP model, scaled by the initial contribution at 150km.*

Differences in the source strengths q and Q for different countries and years appear not to be large enough to produce significant differences in the shape of radial distance dependence. This suggests that the differences are not large enough to draw any conclusions about non-linearity in the system. The shape of the radial footprint should reveal information about the time scales of the formation and removal of predominantly secondary $PM_{2.5}$ in the atmosphere.

One has been able to reduce the results of a very complex regional model down to a simple diagnostic which may help to explain aspects of the model performance. One could compare the radial dependence predicted by other regional models. Other kinds of diagnostics should be explored in connection with complex models. The use of source-receptor matrices at the very beginning of the EMEP programme is the best known example of a diagnostic which has both scientific and policy relevance. (In contrast some of the ozone metrics, SOMO35 and AOT40 *etc.* are not very helpful, being a complex combination of concentrations of ozone during episodes and other meteorological situations.)

We should be looking for more of these kinds of diagnostics in order to interpret the behaviour of complex regional models. Have any of the readers of the EURASAP Newsletter further suggestions?

References

FISHER, B.E.A., CHEMEL, C., FRANCIS, X.V., HU, R.-M., SOKHI, R.S., HAYMAN, G.D., VINCENT, K.J., DORE, A.J., BAGGALEY, M., GRIFFITHS, S., SUTTON, P. and WRIGHT, R.D., 2011. Diagnostic evaluation of complex and simple atmospheric chemical transport models by considering single source impacts in the UK. In *Air Pollution Modeling and its Application XXI* (ed. D.G. Steyn and S. Trini Castelli), pp. 427-431. Dordrecht: Springer.

KLEIN, H., GAUSS, M., NYIRI, A. and STEENSEN, B.M., 2011. *Transboundary air pollution by main pollutants (S, N, O_3) and PM: The United Kingdom*. MSC-W Data Note 1/2011. Oslo: Norwegian Meteorological Institute.

New portals

"KOoreg" PROJECT – AIR POLLUTION CONTROL IN THE REGION, PROGNOSTIC AND DIAGNOSTIC MODELING SYSTEM FOR AIR POLLUTION CONTROL IN THE REGION
http://www.kvalitetazraka.si/zasavje/index.php?lang=en

Primož Mlakar, Marija Zlata Božnar, Boštjan Grašič, Sašo Vrbinc and Darko Popović

MEIS d.o.o., Šmarska 40, SI-1291 Škofljica, Slovenia

Within a national applied research project (ARRS, no.: L1-2082 (A)), MEIS has developed a modeling system which publishes on the internet, in real time and as one-day forecast, air pollution concentrations of SO2, NO2 and PM10 emitted into the atmosphere by various sources, in the region of Zasavje.

What the portal displays

We are displaying real-time concentrations of air pollutants in intervals of 30 minutes, the history for the two previous days and pollution forecast for a day. The following companies have given their explicit consent for the use of their nominal (normal highest operating) emission values for the purpose of the project: Termoelektrarna Trbovlje, Lafarge Cement, Steklarna Hrastnik and IGM Zagorje. For JPK Zagorje we got the data from public available

source. For now, we are only displaying concentrations in the atmosphere as a result of the emissions from these sources. We use these values in the modeling system as if the facilities were operating continuously 24 hours every day all year round (unless they explicitly notify us about not operating), and so we ask users of the portal to verify whether individual facilities are actually operating. In the future, we are planning on implementing the real-time automated use of the emission values where required.

Emissions from traffic and local heating are also modeled, but these emission inventories need additional enhancement.

We have successfully developed meteorological forecasting for two days in advance in a detailed temporal and spatial resolution for Slovenia and 6 day forecasting over middle Europe.

The modeling system calculates the concentrations of air pollutants for the entire three-dimensional space above the displayed region; we are only displaying concentrations in the surface layer of the atmosphere, where regulations on ambient air quality are applicable.

We have captured an area of 20km × 20km, horizontally divided into 100 x 100 cells (each cell measures 200m x 200m). The first surface layer for which we are displaying calculated concentrations is 10m high. The concentration calculated by the modeling system is even throughout the cell, as the cell constitutes the local resolution of the system.

In collaboration with Arianet s.r.l. from Milan, forecasts for SO_2, NO_2, O_3, CO and PM10 over the whole Slovenia are displayed. These forecasts are used for the determination of pollutants transport from other regions.

Why Zasavje?

Air pollution is a pressing issue in Zasavje. The limit values of pollutant concentrations in the ambient air are frequently exceeded. Modelling pollutant concentrations in the ambient air provides certain answers regarding the causes and mechanisms of pollution, and, most importantly, it provides information on the spatial and temporal distribution of the pollution. Although measuring stations provide very accurate results, this information, especially in the conditions of complex terrain, only relates to a very small area in the immediate proximity of the measuring stations.

Highly complex orography and consequently very complex micrometeorological conditions over the small area of the municipalities of Zasavje pose a considerable scientific challenge for modeling both the meteorological conditions and the dispersion of pollutants in the atmosphere.

With this project, we wish to add a new dimension to the public general understanding of the issue of ambient air pollution.

From a scientific point of view, one of the important objectives of this project is to demonstrate the accordance (spatial and temporal) of the modeled concentrations and the measured concentrations at the locations of the numerous automatic measuring stations in Zagorje.

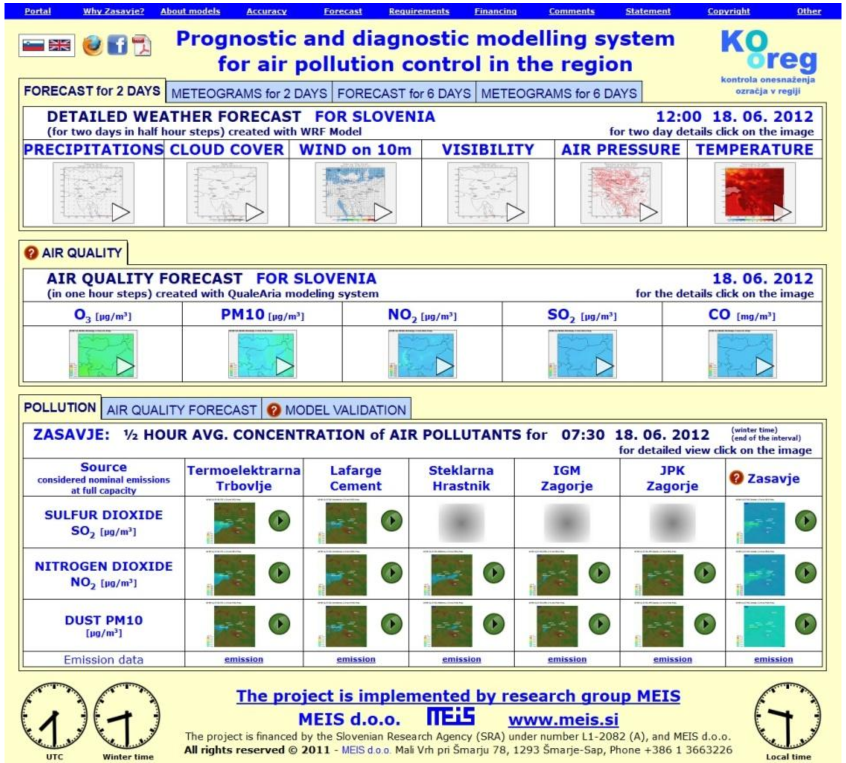
For the most accurate matching of the modeled concentrations with the measured concentrations, high-quality input data are of key importance, especially the qualitative measured meteorological data in the area discussed. For now, the meteorological forecasted data on their own are not yet a sufficient basis for modeling the air pollution spreading over such a complex

terrain as Zasavje. In order for the results of the models to match the actual measured concentrations, it is also necessary to include the measured local meteorological data using appropriate meteorological models.

About the models used

The modeling system is a mathematical tool which displays the mechanisms of the dispersion of pollutants in the ambient air. The modeling system, based on the input data regarding meteorological conditions and pollutant emissions, calculates the consequences of these emissions as concentrations in the atmosphere in the vicinity of the observed emission sources. Emission sources that have not (yet) been entered into the system, are, of course, not displayed by the modeling system (emissions from other industries, outside biomass burning and burning of waste in the countryside, etc.). But we include emission from traffic and local heating.

The modeling system, which enables these calculations for the displayed area of Zasavje, consists of multiple models and uses different input data. First, meteorological conditions are recorded for every 30 minutes in real time using the meteorological data from the automatic measuring stations in the region. As it is also essential to describe the vertical profile of the wind, temperatures and relative air humidity, the profile which is calculated using a prognostic meteorological model WRF is used as an estimate.



Measurements with the SODAR would be better, but they are, unfortunately, not available at the moment. All the data is processed by the SurfPro meteorological pre-processor and the Swift three-dimensional mass-consistent wind model.

The modeling system also processes data on terrain altitude and land use, both in the aforementioned resolution.

Data on the movement of pollutants from their sources towards the hills and valleys is then entered into this three-dimensional meteorological area, resulting in calculated pollutant concentrations, as shown in the figures. The Lagrangian numerical particle model Spray is used in this step.

The above approach, considering the current state of science in this area, provides the best results for complex terrain in operational on-line use.

Doctoral Research

ON THE ROLE OF AEROSOLS IN URBAN METEOROLOGY AND AIR QUALITY

By Eduardo Wilde Barbaro, eduardo.wildebarbaro@wur.nl

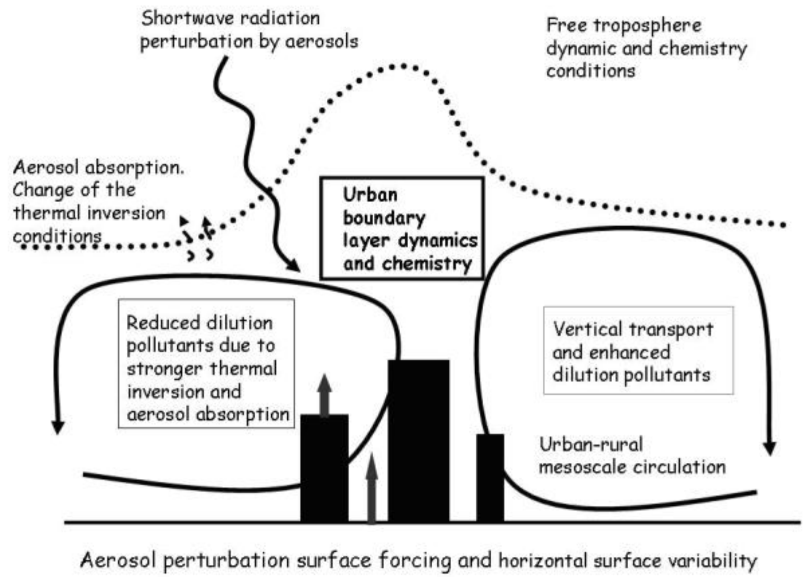
I obtained BSc (2008) and MSc (2010) degrees in Meteorology at the University of São Paulo (IAG-USP), Brazil. My BSc and MSc research were conducted at the group of Micrometeorology of the IAG-USP (www.iag.usp.br/meteo/labmicro/English). During my BSc studies, my research was focused on the characterization of the downward atmospheric longwave radiation at the surface in the city of São Paulo. My MSc thesis was based on the investigation of carbon monoxide time evolution over the city of São Paulo during the nighttime using LES model.

Since September 2010 I am a PhD student in the Meteorology and Air Quality group at Wageningen University & Research Centre(MAQ-WUR). My PhD research is about the role of aerosols in the urban meteorology and air quality. My promoters are Prof. Dr. Bert Holtslag (Meteorology and Atmospheric Climate) and Prof. Dr. Maarten Krol (Air Quality and Atmospheric Chemistry) and my supervisor is Dr. Jordi Vilà-Guerau de Arellano.

The main objective of my PhD research, is to address how the aerosols influence first the thermodynamic conditions at the inversion zone and within the boundary layer, and second the properties at the surface. Although some of the processes related to aerosols have been studied separately, a comprehensive and systematic study of the interaction of the aerosol absorbing and scattering forcing on the urban areas dynamics and the respective feedbacks has yet to be made.

The methodology is based on a combination of numerical models with different physical and chemical complexity (conceptual models, one-dimensional and large-eddy simulation, mesoscale models) and intense analysis of field observations.

Depending on the composition of the aerosols (for instance carbonaceous material and black carbon), localized heating rates near the thermal inversion, have been estimated and observed over urban areas. As a result, the thermal inversion becomes a stronger lid due to the localized heat by the aerosol absorbing radiative forcing and consequently it prevents the growth of the urban boundary layers.



Schematic representation of the main dynamic, radiation and chemical transformation processes and their interactions.

Furthermore, aerosols shield against the atmospheric irradiance that reaches the surface decrease the surface forcing and thus forming shallow boundary layers. Our preliminary working hypothesis is that both processes can compensate to a certa in extent for the enhanced boundary layer growth induced by the UHI dynamics and in turn modify the boundary layer structure.

Jobs and PhD positions

POSTDOCTORAL FELLOW: METEOROLOGICAL AND AIR QUALITY MODELLING UNIVERSITY OF BRITISH COLUMBIA / UNIVERSITY OF NORTHERN BRITISH COLUMBIA

A postdoctoral fellow is sought to use meteorological and air pollution models as part of a project to optimally design a long-term air quality monitoring network in northeast British Columbia, Canada. Northeast BC is a region that is undergoing significant and increasing oil and gas development necessitating enhancing air quality monitoring. The successful applicant will work with graduate students and Professors Douw Steyn (UBC) and Peter Jackson (UNBC) to run the Weather Research and Forecasting (WRF) meteorological model to produce a high-resolution climatology of the region to support air quality modelling using models such as the Community Multiscale Air Quality (CMAQ) model. Both models will be extensively evaluated using available observations, and then used to design an optimal air quality monitoring network for the region. The position is funded for two years, with a possible extension to a third year, and will start in early 2013. The position will involve working with industrial and other stakeholders such as the BC Ministry of Environment. The main work location can be either at UBC (in Vancouver) or UNBC (in Prince George) with up to 25% of the time spent with industrial stakeholders.

Qualifications

Education: A PhD completed within the last five years, from a recognized university in atmospheric science, atmospheric chemistry, environmental science or environmental engineering or a closely related field.

Experience: Demonstrated experience and aptitude with meteorological and air quality models such as WRF and CMAQ. Experience running these models in a linux cluster environment. Proficiency with pertinent computer languages and tools. Ability to communicate effectively in English. Relevant experience in a Canadian context will be an asset.

Application

An application consists of a cover letter explaining how your education, experience and background qualifies you for this position, as well as a curriculum vitae, a copy of your university undergraduate and graduate transcripts, and contact details for three people who have agreed to act as references and can comment on your qualifications and experience relevant to this position. Applications should be addressed to: AQ Modeller PDF Competition c/o Dr. Peter L Jackson, Environmental Science and Engineering Program, UNBC, 3333 University Way, Prince George, BC, V2N 4Z9, CANADA. Electronic applications in adobe postscript, pdf or microsoft word formats are encouraged and can be sent to Peter.Jackson@unbc.ca<mailto:Peter.Jackson@unbc.ca>. For more information contact Dr. Peter L. Jackson at +1-250-960-5985.

Applications received by January 11, 2013 will be given full consideration, but applications will be accepted and reviewed until the position is filled.

Future events

2013 INTERNATIONAL CONFERENCE ON ENVIRONMENTAL POLLUTION AND PUBLIC HEALTH (EPPH 2013)
Wuhan, China, 12-14 April 2013

More information at www.engii.org/epph2013/.

15TH INTERNATIONAL CONFERENCE ON HARMONISATION WITHIN ATMOSPHERIC DISPERSION MODELLING FOR REGULATORY PURPOSES
Madrid, Spain, 6-9 May 2013

More information at www.harmo.org/harmo15.

A conference leaflet can be downloaded from:
http://titanio.lma.fi.upm.es/harmo15/sites/default/files/HARMO15_2.pdf.

2nd INTERNATIONAL SCIENTIFIC CONFERENCE ON POLLUTION AND ENVIRONMENT-TREATMENT OF AIR, PETrA 2013
Prague, Czech Republic, 4-6 June, 2013

More information at
http://odour.cz/en/2nd_international_conference_petra_2013.php

13th INTERNATIONAL MULTIDISCIPLINARY SCIENTIFIC GEOCONFERENCE & EXPO SGEM 2013
Albena, Bulgaria, 16-22 June, 2013

More information at http://www.sgem.org/email_location/

EUROPEAN ASSOCIATION FOR THE SCIENCE OF AIR POLLUTION MEMBERSHIP FORM 2013

Please fill out the details below and return to:
Carlos Borrego
IDAD - Instituto do Ambiente e Desenvolvimento
Campus Universitário
3810-193 Aveiro (PORTUGAL)
E-mail: eurasap@idad.ua.pt

I renew my membership/ I apply for registration* as individual/corporate* member of EURASAP (* Delete whatever is not applicable).

(1)Family name...
(1)First name..
(1)Title...
(1)Organisation...
....
(1)Address..
....
....
(1)Tel...Fax...
(1) E-mail..
Internet..

(1) **Mandatory fields**

EURASAP subscription fees (please, circle what applies):
1. 40 EURO for individual members in Europe
2. 50 EURO for individual members outside Europe
3. 250 EURO for corporate members in Europe
4. 300 EURO for corporate members outside Europe
5. 15 EURO for students
6. No fee in case personal or social circumstances prevent you from paying the fee (after approval by Direction)
7. Extraordinary fee (higher than those above, after approval by Direction)
Note: The payment is only possible in **Euro**.

Payment can be done by Paypal, credit card or bank transfer. The membership forms signed should be mailed to Carlos Borrego to the address given above. **Cross your options below**. Thank you.

☐ I need the invoice receipt
  ☐ in personal name
  ☐ Institution above

Please choose your method of payment:

☐ Bank transfer
Name: BES - Banco Espírito Santo
Address: Avenida Dr. Lourenço Peixinho, 5 - 3800 Aveiro (Portugal)
IBAN: **PT50 0007 0230 00314300001 11**
BIC/ Swift: **BESCPTPL**

☐ Paypal or Credit card payment
Please visit our page: http://www.eurasap.org/Membership.html selecting what applies your situation

Please send us a message informing about your payment with the invoice number (when applicable)

It is available to download it from http://www.eurasap.org