Monitoring Ambient Air 2012

Air Quality Monitoring

Opening opportunities through new technologies and data analysis

Conference with Posters and Exhibition

Organised by the Automation and Analytical Management Group - Royal Society of Chemistry

Wednesday 12th & Thursday 13th December 2012

At The Royal Society of Chemistry,
Burlington House, Piccadilly,
London W1J 0BA

Email: conference@aamg-rsc.org
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RSC | Advancing the Chemical Sciences

Air Quality Monitoring - Opening Opportunities Through New Technologies and Data Analysis

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Wednesday 12th and Thursday 13th December 2012
at The Royal Society of Chemistry, Burlington House, London

Day 1 - Wednesday, 12th December 2012

10:00 Registration

Session 1: An Overview and Discussion on New Technologies and Methods

Chair: **Peter Woods**, National Physical Laboratory, UK

10:30 Air Quality Monitoring Technologies - An Update from the AirMonTech Project Covering their Current State and Emerging Themes
Christophe Hueglin & Ernie Weijers
ECN, Netherlands

11:00 Some Proposed Recommendations for Regulatory Urban Air Quality Monitoring Looking Ahead to 2020
Paul Quincey
National Physical Laboratory, Middlesex, UK

11:30 The Key Air Quality Metrics and Technologies, and Specific Research Needs in Relation to Future Air Quality Monitoring
Thomas Kuhlbusch
IUTA e.V. Germany

12:00 Discussion

12:30 Short Presentations by Exhibitors

13:00 Lunch - Exhibition & Posters

Session 2: Non-Regulatory Networks and Data Analysis

Chair: **Theo Hafkenscheid**, RIVM, Netherlands

14:00 UK Eutrophying and Acidifying Atmospheric Pollutants Monitoring (UKEAP): Results and Future outlook
Y S Tang
CEH, Edinburgh, UK

14:30 Chemical Climatology: A Brief History and Application to the UKEMEP Supersites
Christopher Malley
CEH, Edinburgh, UK

15:00 Novel Approaches for Extracting Added Value from Large Data Sets of Ambient Pollutant Concentrations
Richard Brown
NPL, Middlesex, UK

15:30 Tea / Coffee - Exhibition & Posters

16:00 Recent Data Analysis Developments in the Openair Software Package
David Carslaw
King's College London, London, UK

16:30 The Application of Artificial Neural Networks for Discrete Wavelength Retrievals of Atmospheric Nitrogen Dioxide from Space
James Lawrence
University of Leicester, Leicester, UK

17:00 Biomass Combustion : Tools and Research Needs to Calibrate and Assess Actions Aimed to Improve Air Quality
Gilles Aymoz & Nicolas Marchland
ADEME, Paris, France

17:30 End of Day One

Day 2 - Thursday, 13th December 2012

09:30 Tea / Coffee - Exhibition and Posters

Session 3: PM in The UK

Chair: **To be confirmed**

10:00 Launch of Defra's Air Quality Expert Group Report on $PM_{2.5}$ in the UK
Paul Monks
University of Leicester, Leicester, UK

10:30 Source Apportionment of Airbourne Particulate Matter: Estimation of the Road Traffic Exhaust and Non-Exhaust Contributions to Particle Number and Mass
Roy Harrison
University of Birmingham, Birmingham, UK

11:00 Tea / Coffee - Exhibition & Posters

Session 4: New Techniques

11:30 New Highly Resolved Chemical Speciation Measurements of PM in London
David Green
King's College London, London, UK

12:00 Measuring ppb Gas Concentrations in Air Quality Networks Using Low Cost Sensors
John Saffell
Alphasense, Essex, UK

12:30 Hemispherical Scanning Imaging DOAS: Resolving Nitrogen Dioxide in the Urban Environment
Roland Leigh
University of Leicester, Leicester, UK

13:00 Lunch - Exhibition & Posters

Session 5: Soot Measurements

Chair: **To be confirmed**

14:00 Soot Measurements in Amsterdam: Black Smoke and Black Carbon vs Elemental Carbon
Pavlos Panteliadis
GGD, Amsterdam, Netherlands

14:30 Dual-spot Aethalometer: Online Characterization of Aerosol "loading" Effect Parameter K
Luka Drinovec
Aerosol d.o.o., Ljubljana, Slovenia

15:00 The Use of a Mobile Platform to Assess the Spatial and Temporal Variability of Urban UFP and BC Concentrations
Joris Van den Bossche
VITO, Mol, Belgium

15:30 Tea / Coffee - End of Conference

ABSTRACTS

Some Proposed Recommendations for Regulatory Urban Air Quality Monitoring Looking Ahead to 2020

Paul Quincey
and members of the AirMonTech consortium

National Physical Laboratory, Teddington, Middlesex, TW11 0LW, United Kingdom

ABSTRACT

The AirMonTech project's primary roles are to assess the current and near-future state of air quality instrumentation and monitoring practice, presented in the AirMonTech database http://db-airmontech.jrc.ec.europa.eu/, and to make recommendations regarding instrumentation, monitoring practice, and necessary research in the context of future regulatory monitoring, to help with the revision of the Ambient Air Quality Directive 2008/50/EC and beyond. The emphasis is on automatic instruments for urban monitoring.

Of course, the instrumentation cannot be seen in isolation. Before forming conclusions on instrumentation, the relevant metrics need to be identified. It would be short-sighted to assume that only the metrics that currently feature in legislation will be appropriate in future, especially for particulate matter.

The choice of relevant metrics, in turn, depends on the purpose of the monitoring. It is clearthat to focus exclusively on assessing compliance with legislation misses opportunities to, at least, improve the effectiveness of the legislation in the future. Providing information to clarify health effects is the most obvious example. Valuable extra knowledge can be gained from regulatory monitoring without any significant increase in costs.

The talk will describe the context and give some provisional recommendations from the project, which are at the draft stage.

UK Eutrophying and Acidifying Atmospheric Pollutants Monitoring (UKEAP): Results and Future outlook

YS Tang[1], JN Cape[1], , [1] ID Leith[1], M Twigg, [1] M Coyle[1], J Kentisbeer[1], S Leeson[1], C Di Marco[1], E Nemitz[1], WJ Bealey[1], D Leaver[1], J Poskitt[1], S Beith[1], S. Thacker[1], I Simmons[1], N van Dijk[1], K Letho[1], C Woods, [1] D Sleep[1], MG Pereira[1], MA Sutton[1], C Conolly[2], R Yardley[2], A Collings[2], M Davies[2], D Knight[2], K Vincent[2], J Lingard[2], S Richie[2], S Telling[2], B Donovan[2], CF Braban[1]

[1] Centre for Ecology and Hydrology, NERC; [2]AEA Technology

ABSTRACT

UKEAP consists of the operation of two UK EMEP supersites for detailed process measurements and four monitoring networks measuring atmospheric acidifying and eutrophying species in the rural environment: National Ammonia Monitoring Network (NAMN): monthly ammonia concentrations in air at 85 sites, operational since 1996; Acid Gas and Aerosol Network (AGANet): monthly gas phase SO_2, HNO_3, HCl; major particulate phase inorganic anions and cations at 30 sites, operational since 1999; Precipitation Network (Precip-Net): fortnightly inorganic anion and cation concentrations in precipitation at 39 sites, operational since 1985; NO_2 diffusion tube Network (NO_2-Net): four-weekly NO_2 concentrations in air at 24 sites, operational since 1994. The UKEAP measurements underpin the capability to understand changes in rural air quality in the UK over time and contribute to validation of atmospheric models. This paper summarises the results from NAMN and AGANet since the inception of the networks and discusses potential future drivers for rural air quality in the UK and how they may be monitored.

Chemical Climatology: A Brief History and Application to the UK EMEP Supersites.

***Christopher Malley*[1,2]**, Christine F Braban[1], Mat R Heal[2], J.N.Cape[1]
[1]Centre for Ecology and Hydrology,
NERC; [2]University of Edinburgh

ABSTRACT

When Robert Angus Smith coined the term in 1872, chemical climatology was envisioned to be an entire field devoted to the observation of 'man-made climates' and assessment of their detrimental impact. The field was largely abandoned over until the late twentieth century. Recent definitions of chemical climatology have been wide ranging and encompass a wide range of data analyses on atmospheric measurements subject to specific types of data handling.

This paper presents a potentially practical definition and characterisation of chemical climatology, based on recent usage and the changing definition of climate. A broad definition is applied to allow use of multiple chemical species and novel methods. The work in this case takes climate to mean 'the conditions under which chemical impacts are possible'. The term 'conditions' being the factors resulting in an atmospheric composition leading to these chemical impacts.

The first stages in deriving a chemical climatology for Harwell and Auchencorth, the two UK EMEP Supersites are presented. These two sites routinely monitor a wide range of atmospheric species and meteorological parameters. Data from all EMEP sites are used and classified to independently group monitoring sites. For each class the average concentration profile for continuously measured pollutants can be constructed. The conditions resulting in the peak concentrations and high averages are discussed with reference to recent data from Harwell and Auchencorth.

Novel Approaches For Extracting Added Value From Large Data Sets Of Ambient Pollutant Concentrations

Richard J. C. Brown
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ABSTRACT

The quantity of data produced by modern ambient air monitoring endeavours continues to increase. This is in part because of the increasing requirements of legislation, but also because improvements in instrumentation have allowed a larger number of pollutants to be measured from one sample, often with a higher time resolution.

Faced with these very large data sets of ambient air pollutant concentrationsthere are two key challenges:

- Ensuring the quality of individual data points and the data set as a whole
- Making use of the extra data to add value to the analysis of the data set

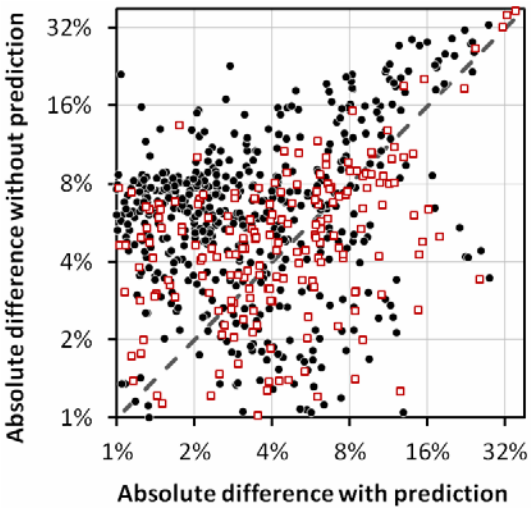

Figure1.*Comparing annual average concentrations produced with and without the use of predicted data.*

This presentation outlines some of the techniques used at theNPL to address both of these requirements. It will cover a number of techniques applied to identify potential outliers in multivariate data sets, as well as using similar techniques to provide source apportionment information.

The use of patterns observed in data to predict missing values (Figure 1) and assess the performance of co-located instrumentation is also mentioned.

The Application Of Artificial Neural Networks For Discrete Wavelength Retrievals Of Atmospheric Nitrogen Dioxide From Space

***J. Lawrence*[1],** J. Singh Anand[1], R. Leigh[1], M. Chang[2], P.S. Monks[3]
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ABSTRACT

Research at the University of Leicester is being conducted to investigate the feasibility of using a technique of discrete wavelength sunlight spectroscopy to derive concentrations of the pollutant nitrogen dioxide from a satellite platform. This technique has the potential to enable very light and compact instrumentation, and may as a result provide abundant air quality data of significant value to users and policy makers.

To perform the discrete wavelength retrieval a back propagation multi-layered perceptron artificial neural network (ANN) has been developed to retrieve atmospheric slant columns of nitrogen dioxide from simulated measurements. The ANN approach enables retrievals to be performed much faster than other retrieval methods, which is a particularly useful feature in instances where a large quantity of retrievals is required in near real time. To generate the required training data for the ANN to understand the necessary relationships a radiative transfer model SCIATRAN was run to provide millions of spectral intensities and slant column concentrations. To enable the radiative transfer simulations to realistically portray urban air quality the SCIATRAN model was fed atmospheric profile and aerosol data from modelled air quality forecasts over London to enable assimilation of the atmospheric composition of a typical urban environment.

The supercomputer at the University of Leicester (ALICE) has been utilised extensively in the network training process, and investigations into the ANN's ability to retrieve nitrogen dioxide from unseen test data of simulated concentrations will be presented.

Biomass Combustion : Tools And Research Needs To Calibrate And Assess Actions Aimed To Improve Air Quality

Marie Pouponneau*, ***Nicolas Marchand**,*** Jean-Luc Besombes***, Jean-Luc Jaffrezo****, ***Gilles Aymoz*,*** Joelle Colosio*

**Air quality department, ADEME*
*** Aix-Marseille Université, CNRS, LCE, 13331, Marseille, France*
****Université de Savoie / LCME, Le Bourget du Lac, France*
***** UJF-Grenoble 1 / CNRS, LGGE – UMR 5183 CNRS, Grenoble, France*

ABSTRACT

In France, like in others European countries, PM10, NO_2 and ozone levels are still exceeding the limit values in some places. Taking actions on household wood burning heating systems is, indisputably, an effective way to improve air quality. The role of the French Environmental and Energy Managment Agency (ADEME) on this subject is to help decision-makers to put together new and effective actions. Several research laboratories are important partners of ADEME on this topic, helping improving knowledge on the links between wood burning emissions and air quality.

This talk will give a joint vision of the question, including regulation and scientific approaches. We will present a state of art on knowledge, actions set in order to reduce wood burning impact on air quality, scientific tools used to calibrate and assess these actions and the research still needed, focusing on the following 4 main lines :

Determing the impact on air quality of emissions from biomass combustion: The presentation will show the different approaches (source apportionment, emission inventory) which bring together complementary and important information that can help calibrate actions, but also the R&D needed on those approaches. The result of the research programs “Particul’Air” and “Formes”, on the contribution of wood burning to air quality will be presented.

Developping efficient devices : The presentation will show the evolution of the performance of individual wood burning devices, through the french label « Flamme Verte ». We will also discuss about the representativeness of emission factors versus real emissions.

Assessing local actions on air quality : As far as we know, in-situ assessement of new experienced actions are necessary. The presentation will show the case of an “in-situ” study and the indicators that have been used (PM, levoglucosan, black carbon,...).

Cross impact analysis: The presentation will address the main questions asked to the research community in terms of cross impact analysis : GHG emissions and air pollutants emission, economic and societal impacts of this kind of actions.

Source Apportionment of Airborne Particulate Matter: Estimation of the Road Traffic Exhaust and Non-Exhaust Contributions to Particle Number and Mass

Roy M. Harrison
National Centre for Atmospheric Science
University of Birmingham

ABSTRACT

Road traffic continues to be a major contributor to airborne concentrations of particulate matter. The progressive uptake of particle traps for diesel vehicles is reducing the emissions of particles from the exhaust, consequently making the contribution of non-exhaust particles more evident. Non-exhaust particles arise from the abrasion of brake components (discs, drums and pads), tyres and the road surface and the resuspension of road surface dusts. Discrimination between these sources is difficult as there are no unequivocal chemical tracers. Elements most characteristic of brake wear are barium, antimony, copper and iron, although the latter has a number of other major sources. Tyre and road surface wear are more problematic, although zinc has been widely used as a tracer of tyre dust, although it is also present as a component in brake pads. Road surface dusts appear to be rich in brake dust (and current techniques are unable to discriminate direct emissions from resuspension from the road surface) but the main matrix appears to be soil-derived dust characterised by silicon, aluminium, calcium and iron, all of which have other major or minor sources in abrasion products. By use of size-discriminating chemical analysis, it is possible to distinguish brake and tyre wear from resuspended dust (which is generally coarser) and results from a number of locations will be shown. An alternative approach involves applying Positive Matrix Factorisation to multiple measurements of particle number size distributions over the range 15 nm to 10 μm. This reveals separate contributions from abrasion, resuspension and exhaust sources which can be readily quantified in terms of particle number and volume with mass inferred if densities are assumed.

Measuring ppb Gas Concentrations in Air Quality Networks

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ABSTRACT

A collision of technologies has led to affordable air quality networks: GSM, GPS, lithium-ion batteries, low power radio links and affordable massive computing capability give us access to real time urban air quality networks. Until now, affordable ppb sensors have been missing, but this has now been solved.

Amperometric electrochemical gas sensors have been the workhorse of gas detectors in mines and confined spaces for decades, but it has been assumed they can not be used to measure concentrations below 1 ppm. Projects such as MESSAGE have shown that these low cost sensors can be used below 1 ppm through the combination of improvements in sensor technology, low noise electronics and new data manipulation algorithms, giving detection limits below 5 ppb for O_3, NO, NO_2, SO_2, CO and H_2S.

We will show laboratory test results for these sensors in the 0-200 ppb concentration range and discuss error sources including temperature, humidity, zero currents and long term stability. These results will be compared with field data from the Cambridge network of 50 motes in 2010 and the latest results from the 50 mote Heathrow network which is operating now, collecting more than 50,000 readings an hour.

Hemispherical Scanning Imaging DOAS: Resolving Nitrogen Dioxide In The Urban Environment.

R.J. Leigh [1], R.R. Graves [1], J. Lawrence [1] J. Anand [1], C. Whyte[1], M. McNally [1] and P.S. Monks [2]

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[2]The Department of Chemistry, The University of Leicester, University Road, Leicester, LE1 7RH, UK

ABSTRACT

Imaging DOAS techniques have been used for nitrogen dioxide and sulphur dioxide for a number of years. This presentation describes a novel system which images concentrations of nitrogen dioxide by scanning an imaging spectrometer 360 degrees azimuthally, covering a region from 5 degrees below the horizon, to the zenith.

The instrument (CityScan) has been built at the University of Leicester (UK), on optical designs by Surrey Satellite Technologies Ltd, and incorporates an Offner relay with Schwarzchild fore-optics, in a rotating mount. The spectrometer offers high fidelity spectroscopic retrievals. The full hemispherical scanning provides complete coverage of nitrogen dioxide concentrations above approximately 5 ppbv in urban environments. Through the use of multiple instruments, the three-dimensional structure of nitrogen dioxide can be sampled and tomographically reconstructed, providing valuable information on nitrogen dioxide emissions and downwind exposure, in addition to new understanding of boundary layer dynamics through the use of nitrogen dioxide as a tracer. Furthermore, certain aerosol information can be retrieved through absolute intensity measurements in each azimuthal direction supplemented by traditional techniques of O_4 spectroscopy. Such measurements provide a new tool for boundary layer measurement and monitoring at a time when air quality implications on human health and climate are under significant scrutiny.

This presentation will describe the instrument and tomographic potential of this technique. First measurements were taken as part of the international PEGASOS campaign in Bologna, Italy. Results from these measurements will be shown, including imaging of enhanced NO_2 in the Bologna urban boundary layer during a severe thunderstorm.

Soot Measurements in Amsterdam: Black Smoke and Black Carbon vs Elemental Carbon

Pavlos Panteliadis and Dave de Jonge
Department of Air quality, Public Health Service Amsterdam, The Netherlands

ABSTRACT

Five Multiangle Absorption Photometers (MAAPs), measuring Black Carbon concentration (BC), were compared on a highway monitoring site of Amsterdam[1], in October and November 2012 showing great similarity in measured values and robustness (R^2≈0.99). Elemental Carbon (EC) analysis results[2] were also obtained for the same period and location and showed good comparability (R^2≈0.70).

Four of the previous mentioned MAAPs were then installed in various locations[3] in Amsterdam and compared with daily EC concentrations for a period of three weeks, in January 2012. The inter-comparison showed a good correlation between EC and BC and BC was found to have a factor of ~2 times of EC for all locations combined (R^2≈0.85).This correlation factor was found to be 1.3 when only low concentrations were used (R^2≈0.88 for <2 ug/m3). The correlation factors varied in regard to the location and the concentration level and a wider scattering was observed for highway monitoring sites.

Past data of EC,BC and Black Smoke (BS) were obtained for the period 2006-2011 from the GGD Amsterdam monitoring network, when available, for two out of the five monitoring sites[4]. The Black Smoke monitor, SX-200, was found to report concentrations higher by a factor of 4.5 and 5 when compared to MAAP and of 8 and 9.5 when compared to EC, depending on location. SX-200 showed a better correlation with MAAP (R^2≈0.90) than EC (R^2≈0.60).

An additional campaign for the comparison of diurnal variations of BC and EC has been planned for autumn 2012.

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[1] Ring Zuid
[2] With the use of a Thermal/Optical Carbon Analyzer (Sunset laboratory, Tigard (OR), USA)
[3] One highway (Einsteinweg), two street (van Diemenstraat and Stadhouderskade) and one urban background monitoring site (Vondelpark)
4 Vondelpark and Ring Zuid

Dual-Spot Aethalometer: Online Characterization of Aerosol »loading« Effect Parameter *k*

***Luka Drinovec*[1],** Griša Močnik[1], Jean-Eudes Petit[2,3], Jean Sciare[2], Olivier Favez[3]
Peter Zotter[4], André S.H. Prévôt[4] and Anthony D.A. Hansen[1, 5]

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[2] LSCE, Orme des Merisiers, Gif-sur-Yvette, France; [3] INERIS, France
[4] Paul Scherrer Institut, CH-5232 Villigen PSI, Switzerland
[5] Magee Scientific, 1916A M.L. King Jr. Way, Berkeley, CA 94704, USA

ABSTRACT

Filter-based measurements of aerosol optical absorption are widely used to determine Black Carbon (*BC*) concentrations in real time. Measurements at multiple wavelengths make the separation of contributions of *BC* from different combustion sources possible (Sandradewi 2008). These methods can suffer from non-linearity due to **»**loading**«** effect caused by increasing deposit on the filter (Gundel 1984, Weingartner 2003, Arnott 2005, Virkkula 2007). Static algorithms to compensate for the effect fail to capture the details and potential variability of these aerosol optical properties, and thus impact source apportionment using the data. A dual-spot Aethalometer (AE33) was developed, in which two parallel sampling channels are operated at different loading rates. An on-line compensation model ($BC_i = BC\ (1-k*ATN_i)$; for two filter sample collection spots i=1,2) similar to the off-line method (Virkkula, 2007) makes it possible to not only compensate the measurement of BC in real time but also determine the compensation parameter *k*. These analyses are performed for multiple optical wavelengths between 370 nm and 950 nm. Dual–spot compensation algorithm was evaluated during a winter measurement campaign in Klagenfurt (Austria) and during summer EMEP campaign including data from Iskrba (Slovenija), Payerne (Switzerland) and Paris (France). We obtained distinct spectral signature of *k* during winter, which corresponds to fresh soot particles. There was a small but significant difference in *k* values between diesel and wood burning sources. During summer we observed complex time course of *k*, where *k*(880 nm) changes from approximately 0.006 for fresh aerosols to near zero for aged aerosols as shown from the back trajectory analysis. We conclude that determination of $k(\lambda)$ allows for discrimination between local and aged regional air pollution.

Arnott, W. et al. (2005) Aerosol Sci. Technol. 39, 17-29;
Gundel, L.A., et al. (1984) Sci. Total Environment 36, 197-202;
Sandradewi, J. et al. (2008) Environ. Sci. Technol. 42, 3316–3323;
Virkkula, A. et al., (2007) J. Air & Waste Manage. Assoc. 57, 1214-1222;
Weingartner, E., et al. (2003) J. Aerosol Sci. 34, 1445-1463;

The Use Of A Mobile Platform To Assess The Spatial And Temporal Variability Of Urban UFP And BC Concentrations

***Joris Van den Bossche*[1,2],** Jan Peters[1], Matteo Reggente[1], Dick Botteldooren[3], Jan Theunis[1], Bernard De Baets[2]

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[2]Ghent University, Faculty of Bioscience Engineering, 9000 Ghent, Belgium
[3]Ghent University, Faculty of Engineering and Architecture, 9000 Ghent, Belgium

ABSTRACT

Mobile platforms are increasingly used to acquire air quality data at a high spatial and temporal resolution in a complex urban environment. As such, mobile measurements provide a solution for short-term studies to acquire a spatially spread data set that would not be feasible through stationary measurements. On the other hand, suitable monitoring strategies have to be developed to take into account spatio-temporal representativity.

A case study was performed in Antwerp, Belgium, from 2012-02-13 to 2012-03-08. Measurements were made on a mobile platform – the Aeroflex from VITO – which is a bike equipped with a portable UFP (P-Trak, TSI) and BC (micro-aethalometer, MicroAeth, AethLabs) monitor and a GPS. Spread over 11 days, ca 138 hours of bike measurements were made between 7 am and 13 pm along two fixed routes (ca. 2 and 5 km long) in the neighbourhood of a stationary air quality measurement station, resulting in 256 and 96 repeated runs, respectively.

Urban UFP and BC concentrations showed a high hour-by-hour and day-by-day variability. Relative differences up to a factor of 7 and 11 for UFP and BC respectively between different runs were found. Also significant differences in median levels between different streets of the same neighbourhood were found (up to a factor of 2 and 4, respectively). The high variability emphasizes that repeated runs are needed to reliably map the air quality. This extensive dataset allows to evaluate the number of runs needed to have appropriate data coverage and to provide guidelines for a systematic mobile monitoring strategy.

POSTER ABSTRACTS

PAH Monitoring In Ambient Air: Assessing The Artifacts Induced By Volatilization And Oxidants

Angelo Cecinato, ***Catia Balducci,*** Mattia Perilli, Mauro Montagnoli, Antonio Febo

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POSTER ABSTRACT

It is well known that PAHs are semi-volatile and undergo the influence of temperature; moreover, they suffer atmospheric oxidants. Thus, the concentrations formally detected in suspended particulates do not fully reflect the true burdens in air. Nevertheless, the two sources of artifacts are regularly neglected, which makes the degree of pollution induced by PAHs is underestimated. Several investigations have allowed to understand the partition of PAH congeners between gas and particulate phase at various ambient conditions, while the degree of decomposition induced by ozone and sunlight, alone or combined, has been evaluated in artificial atmospheres. Despite that, the operating conditions adopted in these studies rarely comply with those typical of standard methods for legislative purposes. Moreover, often they refer to the benzo(a)pyrene alone whilst other toxic congeners are not considered.

In the frame of the *Special Network* Program sponsored by MATTM (Italy), both sources of artifacts of airborne PAH measurements are investigated through series of in-field experiments conducted in the four year season. Two sampling lines are used operating in parallel but with different time programs to value the links between sampling time and potential losses caused by evaporation and chemical decomposition. The influence of oxidants or stripping is assessed both in relative and absolute figures, respectively by using a reference compound and exposing PAHs collected on filters to ozone or zero air. *Carcinogenic* PAHs (i.e. benz[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranth-ene, benzo[a]pyrene, indeno[1,2,3-cd]pyrene and dibenz[a,h]anthracene) are studied together with some known genotoxic congeners (chrysene, benzo[ghi]perylene) and benzo[e]pyrene.

Updating The EN 15549 Standard Method For Bap Monitoring In The Airborne Particulate: The Rationale And An Operative Approach

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POSTER ABSTRACT

PAHs belong to the list of toxic pollutants whose burdensEurope requires to be monitored in the atmosphere. Usually benzo(a)pyrene (BaP) is the sole compound measured being kept as indicative of the whole group [Council Directives1996/62/EC and 2004/107/EC]. Nonetheless, many other congeners display carcinogenic and mutagenic properties, although the relative potencies vs. BaP vary according to the test adopted to assess them. Moreover, the percent profile of PAHs depends on the source nature, condition contour in emission and in the environment, and ageing; thus, equal BaP contents can correspond to different PAH blends and toxic effects. PAHs are monitored according to the EN 15549:2004method. It prescribes 24-h sampling of PM_{10} followed by extraction (plus possible clean-up) and instrumental analysis of BaP; the methodprovides also the quality performancesrequired. Although freedom is given about the choice of sampling and instrumental analysis procedures, however it remains unclear how they comply with the European standard method for PM_{10}[EN 12341:1999]. Besides that, volatilization and artifacts induced by oxidants are in the practice neglected, although tools to evaluate or minimize them are presented.

All the above mentioned items are analyzed in a dedicated study carried out by CNR-IIA in the perspective of editing a method based on 24-h PM_{10} collection at 2.3 m^3/h, sample pooling, solvent extraction, clean-up and GC-MSD analysis including the internal standard – isotopic dilution approach. Correction factors for volatilization and decomposition calculated through in-field experiments conducted in the four year seasons are introduced. The study is applied to the seven “carcinogenic PAHs” with the aim of improving the method and assessing the whole PAH-associated toxicity.

Combined Ground and Space-Based Measurements of Air Quality during the London Olympic Games 2012

R.R. Graves [1], R.J. Leigh [1], J. Anand[1], M. McNally [1],
J. Lawrence [1] and P.S. Monks [2]

[1]Earth Observation Science Group, The Space Research Centre, The University of Leicester, University Road, Leicester, LE1 7RH, UK

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POSTER ABSTRACT

During July and August 2012 the Summer Olympic Games were held in London. During this period, unusually high levels of traffic and visitors to the city were expected, it is important to understand the effect this had on the air quality in London during this period. To this end three novel CityScan instruments were installed in London from the 20th July though to the end of September; affording the unique opportunity to monitor the spatial and vertical structure of nitrogen dioxide within the boundary layer in unprecedented detail. The deployment was included as part of the large NERC funded ClearfLo project (Clean Air for London) involving many other institutions and complementary measurement techniques.

CityScan is a Hemispherical Scanning Imaging Differential Optical Absorption Spectrometer (HSI-DOAS) which is has been optimised to measure concentrations of nitrogen dioxide. CityScan has a unique field of view which can provide full hemispherical coverage every 6 minutes. CityScan measures concentrations of nitrogen dioxide over specific lines of sight and due to the extensive field of view of the instrument this produces measurements which are representative over city-wide scales. These instruments aim to bridge the gap in spatial scales between point source measurements of air quality and satellite measurements of air quality offering additional information on emissions, transport and the chemistry of nitrogen dioxide.

CityScan measurements will be compared to other monitoring techniques to show changes in air quality caused by the Games and to give extra information on emissions, chemistry and transport of NO_2 in London.

City Guards Monitor Urban Air Quality In Antwerp, Belgium

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POSTER ABSTRACT

Mobile platforms are increasingly used to acquire air quality data at a high spatial and temporal resolution in a complex urban environment. In contrast to traditional stationary measurements, mobile platforms are able to collect spatially spread (short-term) data sets, but they are generally much more labor intensive. To address this issue, an opportunistic data collection scheme including measurements collected during the normal daily routines of volunteers can be used. In the IDEA project, such a platform has been developed integrating easily deployable air quality sensors, data aggregation and visualization on a public website (http://www.idea-project.be/).

A case study was set up to map Black Carbon (BC) in Antwerp, Belgium, with the collaboration of city guards starting from the beginning of July, 2012, and lasting for 6 months. The city guards are outdoor for a great part of their job on surveillance tours. They have been equipped with a micro-aethalometer (Micro Aeth Model AE 51, AethLabs), a lightweight sensor that allows to measure BC at a high frequency, and a GPS (Locosys Genie GT-31 GPS). Three teams of two city guards were equipped with a measurement unit. They cover together ca 3.6 km² (a quarter of the inner city).

In this case study, BC concentrations were mapped through mobile monitoring, attaining a very high spatial coverage in the selected area and with minimal effort of the volunteers. This demonstrates a promising approach to monitor urban air quality at a high spatial and temporal resolution based on opportunistic data collection.

Acknowledgement

The IDEA project (Intelligent Distributed Environmental Assessment) is a four year research programme funded by the Flemish Agency for Innovation through Science and Technology (IWT).

A Novel Tropospheric NO2 Retrieval Algorithm Optimised for the Compact Air Quality Spectrometer, CompAQS

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POSTER ABSTRACT

Despite efforts to control urban air quality in recent years NO_2 emissions from traffic and industry are still a major pollutant in many cities and have been linked to increased respiratory problems. As in-situ monitoring is limited by spatial coverage, an orbiting satellite instrument capable of measuring NO_2 concentrations in the troposphere at a sub-city resolution would provide valuable information to operational managers and policy makers. Here we present the preliminary results of a novel tropospheric NO_2 retrieval algorithm designed for use with the Compact Air Quality Spectrometer (CompAQS)- an advanced imaging DOAS spectrometer that could be used in future small satellite payloads or constellations.

As NO_2 retrieved over low polluted areas such as the Pacific Ocean is primarily stratospheric in nature, previous satellite retrievals (Richter et al, 2002) subtracted the vertical column density retrieved over such regions from their retrievals in order to estimate the tropospheric column. This retrieval operates in a similar manner; only that earthshine spectra retrieved over a low polluted region is used as a reference spectrum instead of a solar reference spectrum. This increases the signal to noise ratio inherent in the retrieval without affecting the error on the DOAS fit, while also simplifying future instrument design. The value of this retrieval technique is demonstrated using both modelled SCIATRAN spectra and L1B data retrieved by the Ozone Monitoring Instrument (OMI).

Monitoring For Airborne Nano-Oxides

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POSTER ABSTRACT

"ZIRCIMP" is a live applied R&D project, supported by the Technology Strategy Board. The 3-year project, started in October 2011, aims to demonstrate enhanced hip implant performance via sintered ceramic components containing sub-200nm grain sizes. The emerging process route involves the following steps: 1) Creation of a concentrated powder suspension that includes dispersed nano-oxide 2) Slurry atomisation to form granulates 3) Pressing of components from granulates 4) Green machining / sintering / polishing to create final components. Whilst the main project objective is to optimise process routes and final component performance, one work package focuses on an assessment of potential worker exposure to micro- and nano-particulate. This presentation will report on early analysis undertaken at a relevant area of the MEL Chemicals Ltd factory. As a producer of inorganic powders and slurries, MEL Chemicals Ltd has a focus on process steps 1) and 2) defined above. Measurements were made with Nano-ID ^{TM} Select equipment to allow chemical analysis (Inductively Coupled Plasma Spectroscopy, ICP) of dust collected in 12 size fractions according to aerodynamic diameter. This provides PSD information for the "engineered" nano-material only. Mathematical equations were subsequently applied to determine overall percentages of the total airborne engineered inorganic material likely to reach alveolar regions. The presentation will conclude by alluding to an earlier European project investigating crystalline quartz in the ceramic industry: By summarising how micron/ sub-micron quartz dust analysis was correlated to in-vitro behaviour of collected factory dusts, it is hoped to stimulate ideas for similar studies for nano-materials.

Measurement of Wood Smoke Concentrations in the UK Atmosphere

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POSTER ABSTRACT

There is much evidence that smoke from the domestic combustion of wood makes a significant contribution to $PM_{2.5}$ and PM_{10} concentrations in both urban and rural areas of Europe and North America. Currently, however, there is little information on UK concentrations of wood smoke and their contribution to PM mass. There is no universally accepted method for estimating concentrations of woodsmoke in the atmosphere and this paper describes a comparative study of a number of such methods and highlights some of the disparities in results and the potential pitfalls in their use. Both levoglucosan and fine particle potassium (after correction for contributions from sea salt and soil potassium) are widely used chemical tracers for biomass combustion, but the ratios of smoke particle mass to that of the tracer component are highly variable dependent mainly upon combustion conditions. Carbon-14 is a marker of contemporary as opposed to fossil carbon in the atmosphere and this also can be used to estimate airborne woodsmoke concentrations based upon the carbon-14 content of the elemental carbon fraction but requires both a clean separation of elemental from organic carbon (which is problematic) and knowledge of the ratio of particle mass to elemental carbon in wood smoke which is variable dependent upon combustion conditions. Use of aethalometers to estimate woodsmoke concentrations is based upon the enhanced absorption at ultraviolet wavelengths when compared to particles generated by fossil fuel (traffic) sources. The method is highly sensitive to the choice of Ångstrom coefficients which describe the wavelength dependence of light absorption by particles from traffic and biomass burning. The Delta-C method based upon differencing black carbon masses measured at infra-red and ultraviolet wavelengths has also been trialled and shown to be subject to huge problems especially at sites heavily influenced by road traffic emissions.

Low Power And Wireless Air Pollution Monitors

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POSTER ABSTRACT

The advent of electrochemical cells capable of measuring ppb levels of air pollutants has opened up the possibility of more cost effective networks of air monitors. Monitors could now be battery powered and have wireless communications, and thus be simple to install. The lower cost also means that networks of monitors could be deployed to give spatial as well as time related data. This will enable improved understanding of the causes of pollution and how to remedy them.

However, the availability of the sensors is just one link in the chain, and research has shown that the correct processing of the data is essential in obtaining reliable results. Data processing can also be used to check sensor performance and remove zero offsets.

This poster describes a monitoring system based on electrochemical cells that has the above benefits. The compact design allows simple installation of multiple monitors into critical air pollution locations, allowing direct measurement of pollution and the effects of any remedial actions.

Any new monitoring system must be field proven and this poster also shows initial test data obtained from a trial system operating in a real environment.

Monitoring Ambient PM10 In The City Of Nijmegen

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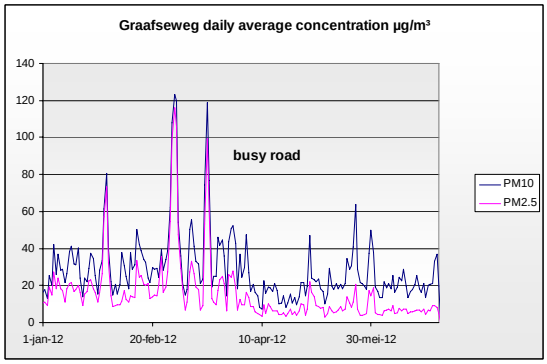
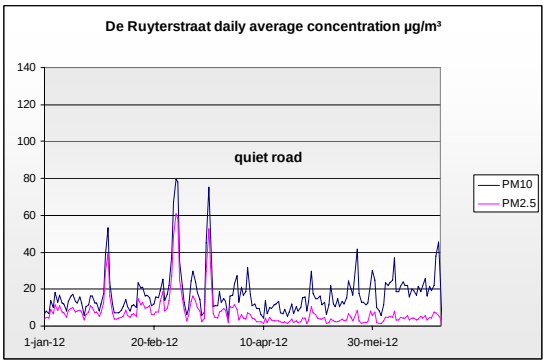
POSTER ABSTRACT

The City of Nijmegen has 165.000 inhabitants and is the 10th city in the Netherlands. Nijmegen has always been a forerunner on environmental topics, and is one of the few cities in the Netherlands with a fully automated air quality measuring network. Since January 2012 Witteveen+Bos is maintaining the continues PM10 measurement network and is analysing the data. The network is calibrated on official data from the National Institute for Public Health and the Environment (RIVM). A short overview of the operating protocol will be given. The data is measured every 10 minutes at 7 different locations in the city, and presented on the internet. Results of spatial variations of pollution within the city will be discussed. The daily results show similar patterns for all different locations. For example the overall results of location De Ruyterstraat, a quiet city road, shows lower concentrations than the busy Graafseweg, but the pattern is very much the same. This confirms that ambient PM10 concentrations are influenced by background fluctuations to a large extend (especially peaks), although local sources, like traffic add a significant portion. Sometimes background concentrations can be traced to incidents. Our conclusion is the network gives accurate concentrations and real time health information for the public. Furthermore prevailing meteorological conditions and large-scale emissions determine ambient concentrations significantly.

Different measurement locations





Long Term Trace Gas Measurements In The UK And The Role Of Meteorological Variability

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POSTER ABSTRACT

Twenty years of trace gas data from the Weybourne Atmospheric Observatory on the north Norfolk coast have been used to investigate trends in various trace gas species that affect air quality. The station receives air masses that have passed over London a few hours or a day earlier, as well as north European air masses, long range transport of aged north American air, North Sea, Atlantic and Arctic air masses and also air that has passed over the British isles before arriving at the coastal site.

The Met Office's NAME dispersion model has been run to create a database of footprints showing where the air has travelled over the previous 10 days before arriving at Weybourne. Several years of these footprints can show the frequency of different air mass types and origins (i.e. Arctic air, European air, anticyclonic Atlantic Ocean air etc..) and in combination with the trace gas measurements that were taken at the corresponding time periods, we can build up a picture of the relationship between trace gas levels and the pathways the air has taken to arrive at Weybourne and how this has changed over the years or even just between seasons. A picture of the source-receptor relationships (anthropogenic, biogenic and marine emissions representing the source) can be built up and give us an idea of how both local and long range transport can affect a remote coastal site in the UK.