AirMonTech

Air Pollution Monitoring Technologies
for Urban Areas

AirMonTech Newsletter

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Welcome to the 3rd AirMonTech Newsletter

Dear members of the air quality monitoring and modeling community, we are now in the final year of AirMonTech. Since the Barcelona workshop in April 2012, the Consortium made a lot of progress. Much energy has been invested in the roadmap for future research and monitoring and the recommendations are near completion. Another product, the AirMonTech database, ready since September 2012, offers you a flexible portal to all the information for all stakeholders. We strongly believe that these are the right ingredients to open up the road to a new and refocused monitoring strategy in Europe.

The Consortium was very pleased to give an update of her work at the 3rd AirMonTech workshop in Duisburg (4 and 5 March). Similar to the first workshop in London 2010 and the second in Barcelona 2012 more than 100 participants attended the workshop. In this Newsletter the most important outcomes of the workshop have been summarized. I hope it will encourage you to participate in the widening AirMonTech network, and in particular to have a look in the AirMonTech database.
If you have comments of any kind please contact us via the website www.airmontech.eu. If you wish to join us at our final conference on 16 May in Brussels (in conjunction with the EFCA workshop), you can register at the same site.

Thomas Kuhlbusch (project coordinator)

Announcement

Final AirMonTech Conference 'Current and Future Urban Air Quality Monitoring' Brussels, Belgium

May 16th 2013
The AirMonTech project is approaching its final step. During the 3rd and last AirMonTech workshop in Duisburg, Germany all relevant information, the database and the research road map developed by the AirMonTech consortium together with all stakeholders were presented and discussed. The final conference and session in Brussels will now summarize the findings and recommendations.
It will present the research roadmap developed by AirMonTech enabling improved and extended

Urban Air Quality Monitoring in 2020 e.g. linking the air quality monitoring with health effect monitoring. The presentations will give details and put the concept also into the larger perspective of the European Air Quality Strategy.

The conference is organized in conjuction with the 4th EFCA UFP symposium (May 16 and 17). To register to the AMT conference, which is free of charge, see http://www.airmontech.eu. A separate registration is needed for the entire EFCA symposium. See http://ufp.efca.net for registration.

AirMonTech database is online!

**All the information gathered within the AirMonTech project is now available in its database!
The web address is http://db-airmontech.jrc.ec.europa.eu/**

Please keep in mind that the AirMonTech-Project is still on-going and that new information is added to the database continuously. Check again later if information you are looking for is missing. If you are aware of relevant documents not included in the database yet, please send us your suggestions by
e-mail: info@airmontech.eu

The 3rd AMT workshop Duisburg, March 2013

The third AirMonTech workshop was hosted by the IUTA (project coordinator) in Duisburg. The conference was held in conjunction with COST Action TD1105 EuNetAir. 106 Participants mostly from the EU, but also from non-EU counties joined the workshop. The venue was comfortable and the presentations vivid and of high quality. Five AMT sessions were scheduled addressing the most important themes. Appealing session and presentation titles were introduced by the host, leading to a coherent assessment of the topics and fruitful discussions after the presentations and sessions as well as during the breaks. The conference diner was held close to the new harbour in a Spanish restaurant. While cold outside the social event provided for warm food and good networking.

1st Session - Monitoring

The session was devoted to an in-depth discussion of the current status and new developments and trends for monitoring technologies.
L. Emmenegger showed the recent progress in the use of MIR lasers for gas analysis and in particular the speciation of different isotopologues. Significant progress was already achieved concerning improved sensitivity. High priority is currently given to the miniaturisation of the devices which up to now are still quite bulky and expensive.
A. Petzold led through the quite confusing diversity of terminologies and methods for the characterisation of soot. Several optical methods offer easy to perform and highly time resolved measurements and also the possibility to gather additional information about different soot sources (e.g. multi wavelength measurements). However, site and season specific scaling with the currently developed reference method is essential to get harmonised and comparable results. R. Jones discussed the possibilities and limitations of low
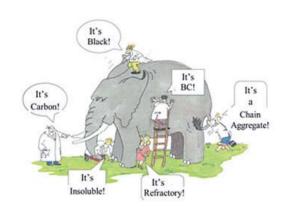
cost sensors. The still observable drawbacks concerning specificity and in some cases also sensitivity of the sensors might be at least partly compensated by their low cost and thus by the possibility to operate a large number of sites. With suitable calibration concepts better information on spatial distribution can be expected than with few conventional measurement sites.
C. Hüglin illustrated the fundamental importance of reference methods and traceable calibrations for high quality measurements. Lacking certified reference materials for calibrations, an important and pressing issue is to consequently link continuous measurements of PM and soot with the conventional reference methods in order to ensure consistent and comparable data. U. Quass presented current trends in the development of improved measurements techniques which are clearly directed towards improved performance, higher time resolution, miniaturisation and multi component detectors. This trend includes also metrics like PAH, carbonaceous particles, metals and ROS, thus parameters which until now have to be measured mainly with time-consuming manual methods. A. Bartonova presented the

At the workshop: Petzolds analogy for Black Carbon

concept and goals of the recently started Citi-Sense project which is aimed at empowering citizens to contribute and participate in environmental governance and to influence priorities and associated decision making. Possible deliverables of the project will be web interfaces, mobile apps etc. providing warnings and advice for the public as well as detailed information about exposure. This may also sharpen the awareness of the public of environmental issues and promote necessary behaviour changes.

Discussions

After the presentations and at the end of the session were frequently dedicated to carbonaceous matter. L. Emmenegger hinted on T. Kuhlbusch question the possibility to measure the 12C13C ratio with MIR laser technology. One order of magnitude away yet. A. Petzold showed an illustrative slide on the many ways black/elemental carbon could be seen as the elephant analogy. It was stated that optical black carbon measurements would comply for political purposes. X. Querol stressed the importance of health effects and linked to the most suspicious organic shell. Furthermore participants were asked to submit results from instrument comparison campaigns to the AMT team.

2nd Session – Modelling

J. Duyzer explained the advantages of data assimilation, improving modelling by incorporating experimental data. He gave a demonstration of real-time air quality modelling in Rotterdam (URBIS). The performance improves by using linear interpolation and Kalman filtering. An adverse effects on the modelling emerges from incomplete emission data and bad monitoring stations. In his presentation H. Jakobs focussed on the chemical transport in EURAD for the exposure assessment. Since 2001 EURAD delivers forecasts of air quality and also applies data assimilation. It successfully provided exposure data for a cohort study to investigate the temporal patterns of changes in inflammatory markers.

Forecasts of annual NO_2 and PM_{10} compared well with the real values. The model estimates annual and seasonal averages, as well as exposure data by calculating frequency distributions of PM_{10}, $PM_{2.5}$ and PM_1 per year.
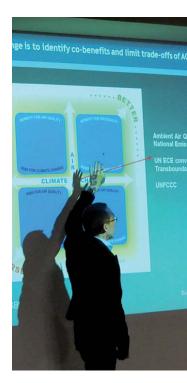
K. Eleftheriadis introduced a policy tool for the reduction of PM in air (ACEPT-AIR). It allows policy makers to evaluate the effects of existing and new control measures applied on emissions sources. The tool contains a database of PM concentrations, source apportionment studies results and emission inventories. Further development in the near future. Y. Roustan discussed the contribution to the "Air 2030 project": a simulation of the air quality by two CTMs (Polyphemus and Chimere). The impact of traffic measures and biomass combustion was estimated for three French cities. Large decrease of NO_2 was calculated in the case of traffic emissions reductions (ranging from -39% to 45%). Less biomass combustion was particularly favourable for obtaining lower PM2.5 levels (-22% to -55%).

Discussions

After the presentations and at the end of the session were frequently focused on how to improve the modelling result, the essential role of the quality of emission data and the uncertainty. HG. Muecke asked if the AMT results will be included in a reporting system like INSPIRE?
T. Kuhlbusch replied that it was not the purpose of AMT. G Aymoz stated that basically everything can be modelled, the question is how well we are able to model whatever it is that we are modelling.
D. de Jonge indicated

that in the Netherlands models usually under-estimate the measured concentrations. M. Lutz wondered if models will be
a better tool when we are close to the limit values (in 5 to 10 years). J. Stedman answered that models will improve in the future. Compliance does not represent exposure, as indicated by L. Tarrason. S. Galmarini added that the Commission will not come up with a statement saying that models must be used. The Commission can only provide a recommendation but will not make it mandatory, because they say that some MS can apply models but other MS cannot.

3rd Session - Regulation

P. Bruckmann zoomed in on the Air Quality current regulations for PM and future needs. A fair balance of coherent European source related, national (NEC, exposure reductions) and local/regional measures (limit values) was proposed as well as simplification of the limit values by removing redundancies. Urban supersites are permanently needed to explore health adverse processes. Other recommendations were to approach WHO guidelines more stepwise, regulate the deposition of heavy metal and monitor EC(TC) as better tracer for combustions sources. V. Foltescu addressed the ways to make climate change and air quality as a common goal.
The impact of policy on air quality (ETC/ACM 2012) was shown. In 2020 $PM_{2.5}$ in Europe would come down about 40% if both all global planned climate and AQ measures became effective. He stressed the need for PM composition measurements largely missing in AirBase. M. Lutz showed the success of abatement strategies in Berlin.
Low Emission Zones in place since a couple of years showed solid reduction percentages in NOx, PM_{10} (5-10%) and total traffic related carbon (50%). Traffic reference sites were used. Representative hot spot and urban background station pairs are essential for source and impact analysis. Impact

analysis of traffic management measures needs more extensive site-specific monitoring. Cheap samplers and sensors allows for better coverage. Advanced hotspot sites are necessary for source apportionment. It would be good to have the same indicators used in Air Quality and Climate/Eosystems assessments.
B. Resch had a refreshing presentation on the network data assimilation combining different sources of Air Quality data information. The data pathway leads through stages: Sensor, O&M data Structure, Sensor Fusion, Processing Model, real-time GIS analysis and Visualisation. The theme people as sensors was promoted, leading towards concepts like Citizen Science and Crowd Sourcing. As an example the intensity of use of mobile phones in Rome around the WC football final in South Africa was presented showing the potential power of collective sensing. Standardization enables a wide variety of monitoring applications. Sensor systems not only view and analyse the world, but can also influence it in real time.

Discussions

It was stated that NO_2 persist as a problem, while PM/UFP came down in concentration levels. Comments added that the distribution of sites should reflect the distribution of population living close to the roads. The use of speed limits appeared questionable. Contrasting results show rising emissions as speed decreases. This remark was weakened as it was observed that speed emissions characteristics are well predicted in case of smooth traffic velocity situations. With respect to the concept of the use of people as sensor it was noted that it could bias the results towards traffic characteristic exposure. SOS was seen as a standard data format methodology.

4th Session - Health

It's (almost) all about health was the slightly provoking title of the fourth session. T. Kuhlbusch predicted the urban monitoring design in 2020: a combination of high-quality fixed and mobile monitoring, supplemented by low cost small sensors, satellite observations, and the use of an improved modeling. Other issues he raised were the value and aims of routine health monitoring (linking air quality data to health?) and a list of possibly important topics to be incorporated in Horizon 2020.
In her talk Klea Katsouyanni further specified "supply and demand": how can routine health monitoring serve epidemiology? Next to a more intensified interaction between decision makers and health researchers, she stated that the assessment of the personal exposure with high temporal and spatial resolution should be the target. Fixed site measurements at urban super-sites complemented with mobile measurement

units could be of value here. Also using smart-phone technology and sensors to record individual location and exposure, can provide input to generate appropriate models for predicting exposure.

J. Cyrys also predicted the future epidemiological approach starting with the various pros and cons of today's regulatory monitoring. He also compared the Land Use Regression (LUR) and dispersion modeling approach as applied in epidemiology. In his conclusions, he advocated both, the study of how other sources affect the exposure, and the implementation of more health-relevant constituents and properties next to the regulated pollutants. In her talk B. Hoffmann asked herself if we really need alternative metrics to PM mass concentration. Possible candidates are size and number as well as particle surface area. However, in these cases the epidemiological evidence is rather scarce and thus not very convincing. In her conclusions she advised Black Carbon for a better estimation and regulation of exposure to primary combustion emissions, more spatially resolved measurements of UFP. She considers the oxidative potential as an interesting new candidate.

G. Hoek introduced the concept of "Exposome" that came up recently. It can be defined as "the representation of all environmental exposures (including those from diet, lifestyle, and endogenous sources) from conception onwards, as a quantity of critical interest to disease etiology" Current epidemiology suffers from a number of asserted weaknesses. With Exposome one analyses traces of exposure occurrence in terms of pattern of gene methylation and expression, proteins or metabolites. Indeed, evidence of specific exposure for radiation, smoking, benzene, diet change were discovered. This work is part of Exposomics, an FP7 multi-center study. Clearly, more experimental work is needed here to demonstrate the concept's utility.

Discussions

S. Chicherin wondered if black carbon really has been identified as a cause of health effects? M. Krzyzanowski explained that evidence was already presented by B. Hoffman, the REVIHAAP conclusion was that black carbon is of interest; it has not been confirmed toxic. The methodology needs multipollutant component analysis to help with the Exposome concept. B. Hoffman added, black carbon may be similar to NO_2, in that it may be a surrogate while not necessarily toxic itself, however, this is enough, to make it usefully regulated. X. Querol stated: limit values are hard to set for combustion product proxies (possible examples being NO_2 and black carbon), because different fuels behave very differently. T. Kuhlbusch stated that looking at groupings of stressors may reveal interplay between them; looking at "omics" may miss this. M. Lutz intervened that regulated

parameters need to be kept simple – e. g. AOT40 is a nightmare to explain to non-specialists. Keep to simple regulation and simple monitoring if at all possible. U. Pfeffer liked to know, would it be better for health monitoring purposes to have 2 sites measuring daily, or 4 sites measuring alternate days? K. Katsouyanni knew, it is best to have a daily site with supplementary spatial information.

5th Session – New Horizons

S. Galmarini reported about the FAIRMODE Network, guiding on the use of models and the background behind the models (benchmarking, combined use of monitoring and modeling, emission inventories, source apportionment). Unfortunately modeling is not mandatory, so MS do not gain further expertise in a possible combined use of monitoring and modeling. L Tarrason message was: the world needs real time data NOW. Forecasting of AQ is an important tool in short term planning (eg avoid concentration peaks by reducing traffic). But do we model and monitor the same thing? Revisit the networks and classifications of sites. K. Torseth presented EMEP. The EMEP future is lying in aerosols and ozone, SLCF (link to climate), nitrogen and carbon cycle, mercury and POPs, HTAP and the creation of supersites. M. Krzyzanowski told that according to the Global Burden of Diseases report Europe and Asia are under serious threat by air pollution. He explained the conclusions of the REVIHAAP project, concluding that health relevance is confirmed and enhanced by recent studies. P. Quincey explained the AirMonTech Research Roadmap. The focus of the AirMonTech project is on monitoring technologies for urban areas, leading to the AirMonTech database http://db-airmontech.jrc.ec.europa.eu/. The project will also produce recommendations, and a roadmap to guide future research in this area. This part of the project must consider a much broader range of information than just monitoring technologies, for example monitoring network aims and designs, health effects, and modelling.

The presentation described the goals considered to be achievable by around 2020, such as a well-justified set of metrics (not necessarily the same as those now), measured by improved instrumen-

tation, with processes to evaluate new metrics and instruments on a continual basis; making it explicit that national monitoring networks have aims beyond compliance monitoring, such as source apportionment, abatement assessment, and scientific understanding; better integration of air pollution evaluation tools, such as network monitoring, remote monitoring, emissions inventories, and modelling; and above all, integration of ongoing air pollution and health effects studies. The introduction of designated "super-sites", or better, Areas for Research and Monitoring of Air Quality (ARMAQs) in urban background and traffic-dominated locations is seen as a key element of this. A research roadmap is outlined in terms of calls that might be included in the Horizon 2020 program. A major theme in this is the eventual integration of developments in monitoring instruments, modelling and health effect evaluation. It is proposed for FP8 to have a data phase (2013-2016), followed by an integration phase (2017-2020).

Discussions

H.G. Muecke: according to Tarrasons presentation only 7% of the population will be exposed in 2020 to NO_2 concentrations above the limit value (source EEA assessment). Have the correct sites been chosen for this assessment? Is population exposed to urban background concentrations or to traffic site concentrations? He plead for careful handling and interpretation of data, and more consistency within the EU. When doing certain assessments the definition of the station type has to be mentioned. X. Querol reported about the BREATH project and a cohort study of pregnant women where 30-60% higher values than expected from traditional assessments were measured for traffic air pollutants like BC. He is wondering how exposure is accumulating during commuting. M. Lutz explains the possibilities to combine noise mapping with air pollution modeling. He further pleas for taking NOW (in 2013) the chance to change legislation in the near future and make our voice heard by policy makers to pave the road for the future. M. Krzyzanowski said, there is not sufficient evidence for health effects of BC. He

is asking the AIRMONTECH consortium to have monitoring, modeling and exposure assessment in one row at the same level in the research roadmap that AIRMONTECH is proposing. The use of Land Use Regression Modelling should be further explored. K. Eleftheriadis was asking the community not to miss the opportunity to define and standardize the measurements for EC and EBC We should not make the same mistake as it was done with PM measurements (problems with methods, filters, humidity, etc). P. Quincey explains/answers that the CEN working group is standardizing first the mass-based EC method and will then look at further possibilities.
M. Krzyzanowski: the current NO_2 limit value is based on indoor (cooking) assessments, as no outdoor data were available. L. Tarrason was asking to arrange for supersites in urban and traffic sites. How could those supersites be integrated? It should be part of health related monitoring, research platform and become an integrated design.

6th Session – COST Action EuNetAir

Environmental Case Studies from Mediterranean, Central and Eastern Europe were presented in the afternoon. M. Penza gave an overview on the plans for the COST action concerning the European Network on new sensing technologies for air-pollution control and environmental sustainability. A. Borowiak showed QA/QC programmes by the AQUILA network. Various other presentations gave interesting status reports on air quality programmes executed in the East, Mid and South parts of Europe.

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