EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE
Directorate C. Climate, Energy and Transport
Sustainable Transport Unit

Ispra (Italy), 19 th September 2021

Workshop: Mitigation and forestalling of Secondary Aerosol formation. *The role of vehicle emissions*.

22-23 -24 September 2021

https://ec.europa.eu/jrc/en/event/workshop/workshop-secondary-aerosol-formation

Session 1 – 22nd September - Emissions and secondary aerosol (SA) formation (experimental evidences), atmospheric processes.
Session 2 – 23rd September - Instrumentation (on-line & coupled instruments) for the analysis and characterization of primary and secondary aerosol (PA & SA); study of the aging of aerosol in smog chamber and/ or aerosol Flow tube.
Session 3 – 24th September - Source apportionment and modelling of SOA (Secondary Organic Aerosol) and/or SIA (Secondary Organic Aerosol) at urban and regional scales.

The purpose of this workshop would be to reach, together with the lecturers and participants, science based recommendations to assess policies for preventing secondary aerosol (SA) formation.

The workshop will be open, on-line and free of charge for participants (students, researchers, policy makers, etc).

For any further information please don't hesitate to contact us at JRC-C04-SEC@ec.europa.eu

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Mitigation and forestalling of Secondary Aerosol formation.

The role of vehicle emissions.

22 -23 -24 September 2021

Day 1 – Wednesday, 22nd September 2021

- Emissions and SA formation (experimental evidences), atmospheric processes.

Webex link for participants will be provided after registration

https://ec.europa.eu/jrc/en/event/workshop/workshop-secondary-aerosol-formation

The deadline for registration is 20.09.2021

Time (CET)	Title	Speaker
10:45 11:00	**Welcome coffee for speakers** **Opening of the workshop to participants**	**DG - JRC & DG – ENV** (Ispra Italy and Brussels)
11:30	**Road transport – Past, current, and future emissions factors – Application to France**	**Jean-Marc ANDRE** Citepa – France
12:00	**Issues with condensable organics in European PM2.5 emissions; key messages and follow-up from an expert workshop organised by EMEP MSC-W**	**David Simpson** Norwegian Meteorological Institute
12:30	**Lunch break**	
13:30	**The Synergistic Role of Sulphuric Acid, Bases, and Oxidized Organics Governing New-Particle Formation in Beijing**	**Federico Bianchi** University of Helsinki - Finland
14:00	**Recent developments on SVOC/IVOC as "condensable species" emissions leading to SOA formation**	**Bertrand BESSAGNET** European Commission, Joint Research Centre (JRC), Ispra, Italy
14:30	**Road vehicles as a source of national and urban ammonia emissions**	**David Carslaw** Department of Chemistry, University of York, UK
15:00	**Coffee break**	
15:15	***Round table - discussion & conclusions of the 1st session***	All speakers & Participants Moderator - DG ENV
16:00	**End of the 1st session**	

Abstracts
Session 1

Road transport – Past, current, and future emissions factors – Application to France

Jean-Marc ANDRE
Citepa/France

Abstract

Since early 70s, road transport emission standards have been implemented in Europe to try to tackle emissions. They were first applied to gasoline passengers' cars, and in 90s "Euro norms" appeared. These last allowed to reduce more or less rapidly emissions of primary particulate matters and also to reduced emissions of pollutants which contribute to secondary aerosol (NOx, VOCs, SOx, etc.). All these emissions standards are linked to technologies such as catalyst or PM filters. Fuel specifications have also changed over the years (Sulphur and lead content for example). Today, after the "diesel gate", which accelerated the change of the normative driving cycle, state of art seems showing emissions factors are now in a good way to reduce emissions.

The electrification of the fleet will cancel many exhaust emissions (precursors of secondary particulates) but particle matter from abrasion has to be now better known to be better controlled. Wear PM content are not the same than combustion PM (more heavy metal such as Copper -in brakes- and Zinc -in tyres).

The application of these emission factors to the French case will be shown.

Short CV

Jean-Marc ANDRE is a senior expert who has been working in climate change and atmospheric pollution for more than twenty-two years. Jean-Marc has a PhD in climate and physico-chemistry of the atmosphere with a speciality in experimental optical characteristics of aerosols. Jean-Marc was involved during five years as a researcher in the European project Artemis which aimed to improved transports emission factors. Jean-Marc developed a new light vehicles cold start model, and he also studied the impact of different parameters on emission factors (driving cycles, vehicles sample).

Jean-Marc works in GHG and pollutants emissions inventory compilation, specializing in transport, in particular road transport, since more than fourteen years. Jean-Marc has also an extensive experience in capacity building, as well as experience in projections and mitigation in the transport sector. After heading a technical unit dedicated to transport for 10 years, Jean-Marc now heads a department dealing with air pollution, mobility and the offer to non-state actors.

Issues with condensable organics in European PM2.5 emissions; key messages and follow-up from an expert workshop organised by EMEP MSC-W

David Simpson & participants of MSC-W workshop on condensable organics

Norwegian Meteorological Institute

Abstract

European emission reduction strategies depend strongly upon national reporting estimates as submitted to the European Monitoring and Evaluation Programme (EMEP). There are however significant differences in the way in which countries report such emissions. Some countries include "condensable" organics in their emissions, while others exclude such organics. This difference is important since inclusion of organics can sometimes increase reported PM2.5 emissions by factors of 3 or sometimes more. For some source sectors, even the national emission experts are unsure as to the degree to which condensables are included.

These differences lead to severe problems in the modelling of organic aerosol and hence PM2.5, and to imbalances in the policies recommended for emission reductions.

In March 2020 EMEP MSC-W organised an expert workshop (funded by the Nordic Council of Ministers, NMR) to discuss these issues in detail. Experts from the fields of emission inventory development, emissions measurements, atmospheric modelling, and policy agreed to a number of key messages, and outlined steps that could be taken to improve the consistency of PM2.5 reporting in Europe (see Simpson et al., https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf).

This talk will outline some of the main points from these discussions and the resulting report, as well as discuss the changes and efforts which have taken place within the EMEP system.

Short CV

David Simpson (Norwegian Meteorological Institute, Oslo and Chalmers Univ. Techn., Gothenburg) has worked with air pollution modelling since 1982. His main work has focused on developing *EMEP MSC-W's 3D Eulerian model systems as support for the Air Convention (see www.emep.int). Special interests include biosphere-atmosphere exchange, ozone pollution, and both primary and secondary organic aerosol, always with a strong focus on model evaluation. He is a member of the board of the Swedish strategic research initiative on Modelling the Regional and Global Earth System (MERGE), and member of the Scientific Advisory group (SAG) on Reactive Gases, Global Atmosphere Watch (GAW) Programme of the World Meteorological Organisation (WMO).*

In a series of papers and EMEP reports (in cooperation with TNO, NL), he has drawn

attention to the issues with condensable organics in European PM inventories, and their implications for modelling results and policy assessment. In March 2020 he organised a workshop, funded by the Nordic Council of Ministers, entitled "How should condensables be included in PM emission inventories reported to EMEP/CLRTAP?". This workshop, and the resulting report (see below), attracted a lot of attention and has already resulted in changed procedures for PM inventories and modelling in the EMEP system, and is the basis for ongoing work within the EMEP system,

Report: (https://emep.int/publ/reports/2020/emep_mscw_technical_report_4_2020.pdf)

Publications: https://publons.com/researcher/2876522/david-simpson/

The Synergistic Role of Sulphuric Acid, Bases, and Oxidized Organics Governing New-Particle Formation in Beijing

Federico Bianchi

University of Helsinki / Finland

Abstract

Intense and frequent new particle formation (NPF) events have been observed in polluted urban environments, yet the dominant mechanisms are still under debate. To understand the key species and governing processes of NPF in polluted urban environments, we conducted comprehensive measurements in downtown Beijing during January–March, 2018. We performed detailed analyses on sulfuric acid cluster composition and budget, as well as the chemical and physical properties of oxidized organic molecules (OOMs). Our results demonstrate that the fast clustering of sulfuric acid (H_2SO_4) and base molecules triggered the NPF events, and OOMs further helped grow the newly formed particles toward climate- and health-relevant sizes. This synergistic role of H_2SO_4, base species, and OOMs in NPF is likely representative of polluted urban environments where abundant H_2SO_4 and base species usually co-exist, and OOMs are with moderately low volatility when produced under high NOx concentrations.

Short CV

Federico Bianchi, born in Bergamo, Italy, in 1984, graduated in chemistry from University of Milan. He received his Ph.D. in atmospheric chemistry from the Eidgenössische Technische Hochschule (ETH) Zürich (2014). In 2017, he received the Arne Richter Award for Outstanding Early Career Scientists given by the European Geosciences Union. After being awarded with an ERC Starting Grant in 2019, he was appointed as Associate Professor on atmosphere and cryosphere interactions at the University of Helsinki.

His research interests are the formation of new particles in extreme environments, from pristine free troposphere to polluted megacities. Currently, his group is focusing on understanding preindustrial atmosphere and the influence of biogenic highly oxygenated organic molecules on aerosol formation.

Recent developments on SVOC/IVOC as "condensable species" emissions leading to SOA formation

Bertrand BESSAGNET - European Commission, Joint Research Centre (JRC), Ispra, Italy

Florian COUVIDAT - INERIS, National Institute for Industrial Environment and Risks, Parc Technologique ALATA, F-60550 Verneuil-en-Halatte, France

Abstract

Condensable PM (CPM) is a branch of condensable particles under the temperature of the exhaust gas outlet (Feng, Li, and Cui, 2018). CPM is gaseous at the pre-discharge flue temperature, but it immediately enters the particulate state after releasing into the atmosphere. CPM is formed by the "vaporization–condensation" mechanism (Bessagnet and Allemand, 2020). This mechanism includes two types of particle formation processes: "homogeneous nucleation" and "heterogeneous condensation". CPM belongs to PM2.5, and it is harmful to the environment and human body. CPM test methods can be divided into two categories: impinger cooling method and dilution cooling method. In many activity sectors, analyses of CPM composition reveals that CPM is dominated by inorganic components due to the presence of sulphur in the fuel. The organic components mainly consist of alkanes, esters, and other complex organic compounds (*e.g.* PAHs) on a large range of volatility. The inorganic components of CPM may contribute significantly to the water-soluble ions in the atmospheric PM2.5. The concept of "condensables" is of major importance to understand the role of carbonaceous species from the emissions (High temperature and low dilution) to the ambient conditions (cooler temperature and high dilution). A specific action has been jointly organized to define new and common practices to handle condensables in emissions for modelling activities (Simpson et al., 2020).

Primary Organic Aerosols (POA) have been traditionally assumed to be non-volatile and unreactive in atmospheric aerosol models. Although these assumptions are still used by the great majority of chemical transport models, it has been shown that in many cases, such assumptions are not correct (Donahue, Robinson, and Pandis, 2009). Most measurements of ambient Organic Aerosol concentrations displayed significant negative (particle evaporation after collection on the filter) and/or positive artefacts/biases (vapour adsorption on the filter), providing strong hints about the semi-volatile nature of organic aerosols (Turpin, Saxena, and Andrews, 2000). These emissions strongly affect the formation of Secondary Organic Aerosol (SOA) and is still an important burning issues in the modelling community particularly for the residential wood burning and road traffic sectors (Couvidat, Vivanco, and Bessagnet, 2018; Lanzafame et al., 2021).

Bessagnet, B., and N. Allemand, Review on Black Carbon (BC) and Polycyclic Aromatic Hydrocarbons (PAHs) Emission Reductions Induced by PM Emission Abatement Techniques, Informal document, Citepa - TFTEI Techno-Scientific Secretariat - UNECE, Paris, France, December 18, 2020.

Couvidat, F., M.G. Vivanco, and B. Bessagnet, 'Simulating Secondary Organic Aerosol from Anthropogenic and Biogenic Precursors: Comparison to Outdoor Chamber Experiments, Effect of Oligomerization on SOA Formation and Reactive Uptake of Aldehydes', Atmospheric Chemistry and Physics, Vol. 18, No. 21, 2018, pp. 15743–15766.

Donahue, N.M., A.L. Robinson, and S.N. Pandis, 'Atmospheric Organic Particulate Matter: From Smoke to Secondary Organic Aerosol', Atmospheric Environment, Vol. 43, No. 1, January 2009, pp. 94–106.

Feng, Y., Y. Li, and L. Cui, 'Critical Review of Condensable Particulate Matter', Fuel, Vol. 224, July 2018, pp. 801–813.
Lanzafame, G.M., D. Srivastava, O. Favez, B.A.M. Bandowe, P. Shahpoury, G. Lammel, N. Bonnaire, et al., 'One-Year Measurements of Secondary Organic Aerosol (SOA) Markers in the Paris Region (France): Concentrations, Gas/Particle Partitioning and SOA Source Apportionment', Science of The Total Environment, Vol. 757, February 2021, p. 143921.
Simpson, D., H. Fagerli, A. Colette, H.D. van der Gon, C. Dore, M. Hallquist, H.C. Hansson, et al., How Should Condensables Be Included in PM Emission Inventories Reported to EMEP/CLRTAP? Report of the Expert Workshop on Condensable Organics Organised by MSC-W, Gothenburg, 17-19th March 2020, EMEP Technical Report MSC-W 4/2020, Norwegian Meteorological Institute, December 2020.
Turpin, B.J., P. Saxena, and E. Andrews, 'Measuring and Simulating Particulate Organics in the Atmosphere: Problems and Prospects', Atmospheric Environment, Vol. 34, No. 18, January 2000, pp. 2983–3013.

Short CV

Bertrand Bessagnet (Prof.-Dr.) joined the European Commission - Joint Research Centre in 2021 as Project Officer - Air Policy Analyst. Formerly he worked in Citepa (France) as head of the Atmospheric Pollution, Mobility and TerrItories (POMI) department. Between 2001 and 2018, Bertrand Bessagnet was successively R&D Engineer, Unit Manager and scientific affairs manager at the National Institute for Industrial Environment and Risks (INERIS), which he joined in 2001 after completing his PhD in the field of chemistry and physics of the atmosphere in 2000 at the University Paul Sabatier (Toulouse). In 2015, he obtained his HDR in Atmospheric Sciences from Pierre et Marie Curie University (Paris) and is affiliated to Sorbonne University. He is also an Engineer (MSc) in Chemical Engineering from the Polytechnic Institute of Toulouse (DEA and Engineering Diploma obtained in 1997). Its main skills are: air quality management, air pollution exposure, modeling, pollutant emissions, climate change, meteorology. Bertrand Bessagnet has contributed at the national level to the development of the CHIMERE chemistry transport model, in close collaboration with the National Center for Scientific Research (CNRS). He participated in the management of the air quality platform PREV'AIR, the official national air quality forecasting system in France (www.prevair.org). Bertrand Bessagnet spent one year in Hangzhou (China) to develop air quality modelling services and has a long term cooperation with Chinese institutions in Beijing. He is author and co-authors of more than 130 peer-reviewed publications on air quality management (h-factor 38 from web-of-sciences).

Road vehicles as a source of national and urban ammonia emissions

David Carslaw and Naomi Farren

Department of Chemistry, University of York, UK

Abstract

There is an increasing interest in emissions of ammonia (NH_3) because it is an important precursor emission for secondary aerosol formation and is associated with many other adverse environmental impacts. Ammonia is also highly challenging to measure and control. While emissions of NH_3 are dominated by agricultural emissions across Europe, road vehicles also represent a potentially important source. Unlike agricultural emissions of NH_3, vehicular emissions are co-emitted with NO_x and other combustion-related pollutants which potentially provides a more effective route to secondary aerosol formation. There have, however, been relatively few real-world measurements of transport NH_3 and urban and national emission totals are uncertain. In part, the lack of NH_3 measurements from vehicles reflects the current absence of specific legislated limits for light duty vehicles, which have existed for decades for pollutants such as NO_x and carbon monoxide.

We have measured over 230,000 passenger car emissions using a vehicle emission remote sensing technique to quantify emissions of NH_3 and NO_x in the UK to provide more robust estimates of total urban and national emissions. The technique is unobtrusive and does not interfere with the vehicle being measured. These measurements have been made at over 30 locations across the UK under a wide range of driving and environmental conditions. A major benefit of the measurements is that they capture the influence of factors such as the effect of different vehicle manufacturers and technologies, the influence of cold start emissions and any deterioration of emissions due to increasing mileage or ageing.

The main finding of this work shows that current total national transport NH_3 emissions estimated by the UK National Atmospheric Emissions Inventory (NAEI) are over a factor of two lower than that estimated through the new emissions measurements. The verification does however show excellent agreement with total fuel used at a UK national scale, supporting the conclusion of a NH_3 underestimate in the NAEI. Furthermore, we find that urban emissions of NH_3 from road vehicles are considerably underestimated compared with the NAEI by over a factor of ten.

Short CV

Dr Carslaw has a joint position with the Department of Chemistry at the University of York where he is a Reader in Air Pollution and Ricardo Energy & Environment where he is a

Technical Director. David has 30 years of experience in urban air pollution science and has a specific focus on the measurement and impacts of road vehicle emissions. He has led many vehicle emission remote sensing campaigns across the UK, which has led to many new insights of importance to urban air pollution. Dr Carslaw also leads the openair project that makes available open-source data analysis tools for the analysis of air pollution data. The openair package is used extensively worldwide by academia and the private sector and has been downloaded over 300,000 times. David has published his work widely in academic journals and is advisor to several governmental bodies including the UK Air Quality Expert Group (AQEG).

Day 2 – Thursday, 23rd September 2021

- Instrumentation for analysis and characterization of PA, SA (on-line & coupled instruments) and study of the aging of aerosol in smog chamber and/ or aerosol Flow tube.

Webex link for participants will be provided after registration

Time (CET)	Title	Speaker
11:00	**Field Studies of Road Traffic Emissions and Estimates of Secondary Pollutant Formation**	**Roy M Harrison** University of Birmingham, United Kingdom
11:30	**Towards realistic engine emissions and oxidation chemistry in smog chambers**	**James Allan** The University of Manchester, UK
12:00	**Secondary emissions formed by diesel and gasoline Euro5 passenger vehicles emissions**	**Kostenidou Evangelia,** Aix-Marseille Université, UMR 7673 CNRS, LCE, Marseille, France
13:30	**In situ measurements of emissions and evolutions of particles from road traffic**	**Boris Vansevenant** EASE, University Gustave Eiffel, Bron, 69500, France
14:00	**Oxidative Properties of Secondary Organic Aerosol as a Potential Particle Toxicity Metric**	**M. Kalberer,** University of Basel, Department of Environmental Sciences, Switzerland
14:30	**Atmospheric nanoparticles in urban environment**	**T.Petäjä,** Institute for Atmospheric and Earth System Research (INAR) / Physics, Faculty of Science, University of Helsinki / Finland.
15:00	**Coffee break**	
15:15	***Round table - discussion & conclusions of the 2nd session***	All speakers & Participants Moderator - DG ENV
16:00	**End of the 2nd session.**	

Abstracts
Session 2

Field Studies of Road Traffic Emissions and Estimates of Secondary Pollutant Formation

Roy M Harrison and David C S Beddows

University of Birmingham, United Kingdom

Abstract

A detailed analysis of primary pollutant emissions from road traffic in European cities and of secondary particulate pollutant concentrations derived from field measurements is reported. This includes long-term temporal trends in emissions and airborne concentrations of both precursor gases and secondary aerosol constituents. The road traffic source strength of both NOx and SO_2 is evaluated from field data using both roadside and urban background sites. The effects of emissions reductions during the Covid lockdowns are evaluated with correction for the effects of weather, and the influence upon concentrations of secondary particulate pollutants estimated. Trends in concentrations of secondary organic aerosol precursors are evaluated alongside estimates of secondary organic aerosol concentrations. Urban emissions of both gases and particles influence the concentrations of nanoparticles arising from secondary new particle formation processes. An analysis of the effects of additional precursors and an enhanced condensation sink is presented.

Short CV

Roy Harrison is Queen Elizabeth II Birmingham Centenary Professor of Environmental Health at the University of Birmingham, UK, and also Distinguished Adjunct Professor at King Abdulaziz University, Saudi Arabia. His research interests are in air pollution, especially airborne particulate matter. These extend from emissions, through atmospheric transformations to personal exposure and effects upon human health. Recent research has focussed especially on China (Beijing). India (Delhi) and the United Kingdom. He has also been heavily engaged at the science/policy interface as a member of several government technical advisory groups for the Department of Health and the Department for Environment, Food and Rural Affairs (Defra) in the U.K. including past membership of Defra's Science Advisory Council. He was a contributor to the World Health Organization Global Air Quality Guidelines and the Guidelines for Quality of Indoor Air. He was appointed an Officer of the Order of the British Empire (OBE) in the 2004 New Year Honours List and elected a Fellow of the Royal Society in 2017. He is author of over 600 papers in the peer-reviewed literature, and is listed by Web of Science as a Highly Cited Researcher with an H-index of 92.

Towards realistic engine emissions and oxidation chemistry in smog chambers

James Allan, Jamie Whitehead, M. Rami Alfarra, Gordon McFiggans

The University of Manchester, UK

Abstract

The ideal chamber experiments that inform models of SOA formation should use both emissions and oxidation chemistry that are representative of the real atmosphere. In addition to emissions during stable running of vehicular engines, emissions during transient conditions and cold starts may present a different emissions profile that may have a disproportionate effect on atmospheric chemistry. Furthermore, VOC emissions from combustion are often accompanied with NO_x (especially diesel engines), which can also participate in the reaction chemistry. In particular, NO molecules which will suppress ozone and peroxy radical concentrations. While oxidation can be stimulated under these conditions through the addition of supplementary VOCs, chemical sources of radicals and/or the use of shorter wavelength UV light, these throw the representativity of the experiment into question.

Here we present the results from the COM-PART series of experiments, where emissions from a light duty diesel engine dynamometer rig (equivalent to EURO 4) were introduced into the Manchester Aerosol Chamber. By injecting whole emissions (both particle and gas phase) into the chamber for short periods, discrete engine conditions can be captured with a variable dilution ratio. The collapsible bag configuration means that a large amount of aerosol, generated over a short period of time, can then be sampled onto a filter for subsequent detailed offline analysis, thus allowing the study of non-steady-state conditions in a manner not possible with conventional dilution tunnels. The Manchester Aerosol Chamber was also used to subject the emissions to realistic atmospheric chemistry conditions, using simulated solar radiation rather than hard UV to initiate oxidation. However, it was found difficult to initiate SOA-forming chemistry on the emissions without injecting further reagents, due to the NO emitted from the engine. This raises the question how the 'ideal' atmospheric chemistry simulation of vehicular emissions should be performed.

Short CV

James Allan received his PhD in 2004 from the University of Manchester Institute for Science and Technology (UMIST). Since then he has worked at the University of Manchester and the UK National Centre for Atmospheric Science (NCAS), where he currently has the role of Reader, specialising the in the in situ measurement of aerosols, in the atmosphere and the laboratory. Much of his work has focused on the development and application of the Aerodyne Aerosol Mass Spectrometer (AMS), including the development of the methodologies for quantitative interpretation of the mass spectra (Allan et al., 2003; 2004). This instrument has underpinned many important insights in aerosol composition in the last two decades, in particular the quantitative study of the organic aerosol fraction. He has contributed to a number of landmark papers highlighting the important role of secondary

organic aerosols globally, such as Jimenez et al. (2009). He has also published a number of other important papers, including the Allan et al. (2010) paper that is widely regarded as establishing the importance of cooking aerosols in urban atmospheres, and the Robinson et al. (2012) paper first identifying an AMS marker for isoprene SOA. He continues to be active in AMS and Aerosol Chemical Speciation Monitor (ACSM) measurements and is a member of the EU COST action COLOSSAL. In addition to atmospheric aerosol studies, he is also active in the measurement of emissions from combustion sources, such as wood burning, cooking and heating stoves, internal combustion engines and jet engines.

James Allan is a member of the Air Quality Expert Group (AQEG) at the Department of the Environment, Food and Rural Affairs (DEFRA) of the UK Government and has contributed to 11 official reports. He is a senior editor for aerosols at the leading journal Atmospheric Chemistry and Physics. He has contributed to 177 peer reviewed publications (10 as first author, 5 review papers), 2 book chapters and 2 magazine articles, with a Publons H-index of 57 and an average 88 citations per article. Awards include: 2018 Web of Science Cross-Field Highly Cited Researcher (Clarivate Analytics); 2013 Smoluchowski Award (Gesellschaft für Aerosolforschung); 2012, 2013 and 2018 Editor's Citation for Excellence in Refereeing (J. Geophys. Res.-Atmos); 2012 Peter Salamon Young scientist award (Telluride Science Research Centre); 2005 Atmospheric Chemistry Colloquium for Emerging Senior Scientists (ACCESS, Gordon Research Conferences).

https://www.research.manchester.ac.uk/portal/James.Allan.html

In situ measurements of emissions and evolutions of particles from road traffic

Boris Vansevenant[1,2,3]; Corinne Ferronato[3]; Véronique Cerezo[1]; Yao Liu[1]

[1]EASE, University Gustave Eiffel, Bron, 69500, France

[2]French Agency for Ecological Transition, ADEME, 49000, Angers

[3]IRCELYON, University Claude Bernard Lyon 1, Villeurbanne, 69100, France

Abstract

Experimentally quantifying SOA from road traffic presents challenges due to uncertainties on the quantification methodology of precursors (VOCs, IVOCs, SVOCs) (Lu et al., 2018), as well as uncertainties on the physicochemical and photochemical evolution processes (Chen et al., 2019). Most experiments are performed under controlled laboratory conditions, allowing the study of specific motorizations and aftertreatment technologies, as well as evolutions in the presence of specific oxidants. However, there is a lack of studies under more representative conditions (Chen et al., 2019), with a diversified vehicle fleet in real driving conditions, and evolutions in ambient air (Kaltsonoudis et al., 2019). This impacts the model estimation of SOA formation (Sartelet et al., 2018; Zhao et al., 2018).

A study was conducted *in situ* on the emissions and evolutions of particles and precursors from road traffic in an urban area (Bron, Fance). The experiments took place in winter (February-March) and in summer (July), next to a two-way street with a tramway line. Instrumentation was placed at a distance of about 4 meters of the first traffic lane. Emissions of particles, precursors and NOx were characterized during the morning rush hour. Meteorological and traffic conditions were monitored during measurements. Simultaneously, the sampled air (traffic emissions in urban background) was injected during 1 hour into a 4-m^3 ageing chamber with Teflon walls. Injections was performed using an ejector with dilution ratio 1.5. After injection, the chamber was placed either in the dark or under sunlight. Evolutions of particles and precursors were monitored during 6 hours.

Preliminary results present significative differences between laboratory and *in situ* emission factors of particles and precursors, showing the impacts of the fleet composition, driving conditions and sampling methodology. Particle evolutions in the chamber also show specific *in situ* behaviors, in the presence of external sources and between winter and summer conditions. This experimental protocol shows novelty, in part due to measurements of particles and precursors with an actual, diversified and characterized vehicle fleet in real driving conditions. Also, *in situ* chamber evolutions with ambient air represent a small minority of chamber experiments, due to technical difficulties transport chambers and instrumentation. They do however have a significant scientific interest (Kaltsonoudis et al., 2019).

Short CV

Boris Vansevenant is a PhD student at the EASE laboratory of the University Gustave Eiffel

(France). His thesis is supervised by Yao Liu and Veronique Cerezo (Univ. Gustave Eiffel), as well as Corinne Ferronato from the research institute on catalysis of Lyon (IRCELYON). His work focuses on emissions and physicochemical evolutions of particles and particle precursors from road traffic. His experimental work is based on the comparison of emissions and evolutions in both laboratory and in situ conditions.

SECONDARY EMISSIONS Formed by DIESEL AND GASOLINE EURO 5 PASSENGER VEHICLES emissions

Kostenidou Evangelia[1], Marques Baptiste[1], Temime-Roussel Brice[1], Michel André2, Liu Yao[2], Vansevenant Boris[2], Patrick Tassel[2] and D'Anna, Barbara[1]

[1]Aix-Marseille Université, UMR 7673 CNRS, LCE, Marseille, France

[2] AME-EASE, Univ Gustave Eiffel, IFSTTAR, Univ Lyon, Lyon, France

Abstract

Vehicle emissions is an important source of air pollution in most of the urban areas in Europe. The air quality constantly deteriorates as the number of vehicles in cities increases leading to an increased morbidity and mortality rates among the urban population. In the past, it has been assumed that vehicles-derived PM emissions were predominantly primary. However, several recent studies showed that secondary aerosol that it is produced by chemical reactions followed by condensation, constitutes a much larger fraction.

In this study we investigated the potential of secondary organic aerosol (SOA) formation upon oxidation of one diesel and two gasoline Euro 5 passenger vehicles emissions. Moreover, we investigated the chemical speciation of the SOA produced by photo-oxidation of one of the EURO 5 gasoline vehicle emissions during cold urban, hot urban and motorway Artemis cycles. The experiments were conducted in an 8 m^3 Teflon environmental chamber at 50% RH and ~25° C. Both atmospheric and higher levels (1.4-9.6x10^{10} molecules cm^{-1} s^{-1}) of OH radicals were produced by HONO or H_2O_2 photolysis under UV radiation. A proton-transfer-reaction time-of-flight mass spectrometer (PTR-ToF-MS) and the newly developed technique of the chemical analysis of aerosol on-line (CHARON) coupled with a PTR-ToF-MS were used for the gas and particle phase measurements correspondingly. This is the first time that CHARON inlet was applied for the identification of the secondary organic aerosol (SOA) produced form vehicle emissions. NO_x and O_3 were monitored by common analyzers. In addition, an Aerodyne High-Resolution Time-of-Flight Aerosol Mass Spectrometer (HR-ToF-AMS) and a Scanning Mobility Particle Sizer (SMPS) characterized the particulate phase.

Short CV

I am a chemical engineering with a PhD in atmospheric chemistry (2010) from University of Patras, Greece. I have 10 years of research experience in ICE-HT and University of Patras (Greece), at the University of Southern California (US) and at the University of Aix-Marseille (France). Recently I was selected as an assistant Professor in the Department of Environmental Engineering in Democritus University in Thrace, (Greece) where I'm going to teach several classes related to the atmospheric chemistry starting in October 2021.

During my career I have been focused on the physicochemical properties of the atmospheric

aerosol and the measurements of the gas phase. I have studied both anthropogenic and biogenic aerosol sources during field measurements, in environmental chambers, at chassis dynamometers infrastructures (IFSTTAR) and in indoor environments. I am particularly experienced in online mass spectrometer techniques such as Q-AMS, HR-ToF-MS, PTR-MS, PTR-ToF-MS and CHARON.

I have 28 peer-reviewed research articles published in international journals, with 730 citations resulting in an h-index of 17. 7 more manuscripts are in preparation. I took part in numerous international conferences (over 70 participations) and I have 5 invited talks. I have participated in 10 international projects and I have written 5 research proposals. I am an active reviewer in 11 journals and guest editor of the journals "Atmosphere" and "Sustainability".

Oxidative Properties of Secondary Organic Aerosol as a Potential Particle Toxicity Metric

M. Kalberer, Zhihui Zhang, Steven Campbell, Kate Wolfer, Battist Utinger, Alexandre Barth, Julian Resch, Benjamin Gfeller, Nicilas Bukowiecki

University of Basel, Department of Environmental Sciences, Switzerland

Abstract

Organic material is the main component in atmospheric aerosol and is strongly affecting the particle effects on climate but also on human health. Due to the highly complex and poorly known composition and sources of the organic material in aerosols there is only limited understanding of their effects. Total particle mass is currently the main particle property regulated but it is likely that specific components in the particles are causing their negative health effects rather than the total mass. To devise more targeted air pollution mitigation measures, it will be essential to identify the most toxic particle components and sources.

Components in aerosol particles with oxidising properties (OP) are potentially a key factor causing the severe health effects of atmospheric particles. The vast majority of oxidising components in particles is highly reactive and thus only very short-lived, requiring novel online instruments for a meaningful and reliable quantification. In addition, atmospheric conditions are often highly variable in time, requiring high time resolution instrumentation.

Over the last years we developed a novel online instrument to quantify OP in particles with a time resolution of a few minutes. Results will be discussed characterising the concentration levels and diurnal variability of particle OP from recent field experiments at highly polluted locations in Europe (London and Po Valley) demonstrating a strong influence of atmospheric photochemical processes on particle OP and from laboratory studies where we investigate fundamental aspects of OP formation.

Short CV

After undergraduate and graduate studies in Environmental Sciences and Atmospheric Chemistry at ETH Zurich and the University of Bern, Switzerland, Markus Kalberer did postdoc work at Caltech and ETH Zurich before moving to the University of Cambridge, UK, where he was Professor of Atmospheric Sciences from 2008 to 2020. He is now at the Department of Environmental Sciences at the University of Basel in Switzerland.

Markus Kalberer has over 20 years experience in atmospheric field and laboratory experiments using a wide variety of analytical techniques. His research interests and experience are in the field of analysis and reactivity of atmospheric aerosols with an emphasis on secondary organic aerosol particles and on the development of new analytical instrumentation and methods, mainly based on mass spectrometry and optical spectroscopy. His work includes method developments to characterise a range of chemical-physical and toxicity-specific particle properties. He developed a novel online chemical analysis instrument to quantify reactive oxygen species in aerosols (ROS), which are thought to be a key factor to explain air pollution particle toxicity but which are challenging to

quantify due to their fast decomposition before analysis with conventional techniques. He also developed a new cell culture – aerosol particle deposition chamber, which allows depositing of particles onto lung cell cultures directly out of a continuous airflow, which allows assessing the toxicity of aerosol particles without changing their physical and chemical properties.

Atmospheric nanoparticles in urban environment

Petäjä, T.

Institute for Atmospheric and Earth System Research (INAR) / Physics, Faculty of Science, University of Helsinki / Finland

Abstract

Atmospheric nanoparticles are abundant in urban environments and their concentration varies dramatically within the city. The sources of nanoparticles include regional secondary formation and (delayed) primary emissions from vehicular traffic. Regional new particle formation is a frequent process occurring both in rural and urban environments (Kerminen et al. 2018; Chu et al. 2019). A recent study in Helsinki, Finland, indicated that the relative contribution from secondary sources dominated during daytime and the traffic sources during night time in the urban background. The two sources were equally important in the street canyon (Okuljar et al. 2021). The nanoparticles will grow in size during their lifetime and accumulating condensable vapors from the anthropogenic and biogenic sources in the urban environment. The recent studies underline the importance of monitoring aerosol number concentrations particularly in the sizes below 10 nm in diameter in order to understand the processes governing urban air quality and aerosol-health impacts.

References:

Chu et al. (2019) (2019) Atmospheric new particle formation in China, Atmos. Chem. Phys. 19, 115-138.

Kerminen et al. (2018) Atmospheric new particle formation and growth: review of field observations, Environ. Res. Lett. 13, 103003.

Okuljar et al. (2021) Measurement report: The influence of traffic and new particle formation on the size distribution of 1–800 nm particles in Helsinki: a street canyon and an urban background station comparison, Atmos. Chem. Phys. Discuss., doi.org/10.5194/acp-2020-1282.

Short CV

Prof. Tuukka Petäjä, University of Helsinki, Finland. Over 20 years of research experience related to atmospheric sciences. He leads the experimental aerosol group. He has published over 465 peer reviewed articles (10 in Science, 9 in Nature), total citations 23200, h-factor of 72. He is a highly cited scientist. His research interests include 1) aerosol-cloud interactions, 2) development of mass spectrometric methods for atmospheric aerosols and trace gases, 3) measurement techniques for aerosol particles, 4) comprehensive and long-term atmospheric observations.

Tuukka Petäjä leads ACTRIS-Finland consortium and ACTRIS calibration facility for sub-10 nm aerosol particles.

Day 3 – **Friday, 24th September 2021**

- Source apportionment and modelling of SOA and/or SIA at urban and regional scales.

Webex link for participants will be provided after registration

Time (CET)	Title	Speaker
11:00	**Secondary organic aerosol (SOA) composition, formation and evolution in Indo-Gangetic plain**	**S. N. Tripathi** Department of Civil Engineering; Indian Institute of Technology - Kanpur
11:30	**Dominant role of meteorology in the near-surface ozone enhancements over Europe during the COVID-19 lockdown in early spring 2020**	**Carlos Ordóñez,** Departamento de Física de la Tierra y Astrofísica, Facultad de Ciencias Físicas, Universidad Complutense de Madrid (UCM), Madrid, Spain
12:00	**Source-allocation methods in regional and urban models - main differences and recommended uses**	**Leonor Tarrason,** NILU, Norway.
12:30	**Lunch break**	
13:30	**The contribution of vehicle emissions to secondary aerosol concentrations across Europe? Results from the recent Clean Air Outlook**	**Jens Borken-Kleefeld,** Energy, Climate, and Environment (ECE) Program; IIASA
14:00	**Influence of traffic on particle concentrations in cities**	**Karine Sartelet** **CEREA, Ecole des Ponts, France**
14:30	**From the lab to the field, measuring and quantifying vehicle impacts to primary and secondary aerosol using aerosol mass spectrometry**	**P.F. DeCarlo,** Department of Environmental Health and Engineering Johns Hopkins University Baltimore, MD USA 21218
15:00	**Coffee break**	
15:15	***Round table - discussion & conclusions of the3rd session***	All speakers & Participants Moderator - DG ENV
16:00	**Conclusions and follow up. End of the workshop.**	

Abstracts
Session 3

Secondary organic aerosol (SOA) composition, formation and evolution in Indo-Gangetic plain

S. N. Tripathi

Department of Civil Engineering; Indian Institute of Technology Kanpur

Abstract

Particulate organic matter produced by gas to particle conversion process is referred to as secondary organic aerosol (SOA). Our understanding of SOA formation pathways, especially those involving heterogeneous chemistry, SOA composition, and the contribution of SOA to total particle concentration are all uncertain. To understand the aqueous phase OA chemistry, carbonaceous species (OC and EC) were measured in foggy and non-foggy days by Kaul et al. (2011) during winter 2010 in Kanpur. Enhanced SOA production was observed during fog episodes likely due to aqueous phase chemistry in fog droplets. Further, SOA concentrations on foggy days exceeded those on clear days at all times of day with foggy day SOA peak observed in the evening vs clear day peak in the afternoon. In addition to SOA production, it was found that fog episodes can also play an important role in cleaning the atmosphere by of carbonaceous aerosols including water-soluble organic carbon (WSOC) and elemental carbon (EC).

The combined effects of OA loading and aqueous fog processing on the evolution of OA was studied in Chakraborty et al. (2016) by characterizing the non-refractory PM_1 measured in real-time during foggy and non-foggy days in Kanpur during the winter of 2014-15. It was observed that fog episodes reduced the magnitude of the negative impact of OA loading on O/C ratio (OA loading and O/C ratio are anti-correlated, as higher OA loading allows gas to particle partitioning of relatively less oxidized organics) by 60% via aqueous processing. In addition, the effect of aqueous-phase processes on the formation pathway of OA, its composition and oxidative properties during different phases of a fog episode was studied during winter 2015-16 in Kanpur (Mandaria et al., 2019). Activating fog period was found to be heavily polluted while fog period was least polluted suggesting wet scavenging of aerosols facilitated during fog episodes. OA formation pathways differed during different fog phases including functionalization in activating fog period while oligomerization during dissipating fog period.

A multi-site chemical characterization and source apportionment of fine particulate matter study using real-time measurement for the first time in Delhi-NCR region during later winter of 2018 by Lalchandani et al. (2021a). OA was found to be the dominant PM component at all sites (44%), consisting mainly of SOA (over 50%) at all sites. Further, a similarity of PM chemical composition and diurnal variability suggested similar sources affecting PM pollution in the Delhi-NCR region. Further, the chemical composition and key sources of $PM_{2.5}$ during the commonly observed haze episodes in the post-monsoon season in Delhi were studied by Lalchandani et al. (2021b). Four haze periods with high $PM_{2.5}$ concentrations and distinct chemical composition were identified during all of which organic fraction dominated but with varying contribution (~(50-70)% of $PM_{2.5}$). Biomass burning SOA was found to be the dominant OA fraction during all the haze events. In addition, rapid night time oxidation of BBOA was linked to enhanced SOA and secondary

inorganic aerosol (SIA). SOA was also found to be the main driver for the variation in the oxidative potential (OP) of $PM_{2.5}$ in the first ever real-time measurement of $PM_{2.5}$ OP by Puthussery et al., (2020).

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3. Lalchandani, V., V. Verma, S.N. Tripathi et al., 2021, Real-time characterization and source apportionment of fine particulate matter in the Delhi megacity area during late winter, Science of the Total Environment, 770, 145324, DOI: 10.1016/j.scitotenv.2021.145324.
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6. Puthussery, J. V., Singh, A., Rai, P., Bhattu, D., Kumar, V., Vats, P., Furger, M., Rastogi, N., Slowik, J. G., Ganguly, D., Prevot, A. S. H., Tripathi, S. N., & Verma, V. (2020). Real-Time Measurements of PM2.5 Oxidative Potential Using a Dithiothreitol Assay in Delhi, India. Environmental Science & Technology Letters, 7(7), 504–510. https://doi.org/10.1021/ACS.ESTLETT.0C00342

Short CV

Dr. SachchidaNand Tripathi is a Higher Administrative Grade (Senior) Professor of Civil Engineering at IIT Kanpur. He also holds Arjun Dev Joneja Chair in Civil Engineering. He is the recipient of Shanti Swarup Bhatnagar Award (highest in science and technology given by Government of India) and the J C Bose National Fellowship. He is an elected fellow of the Indian National Science Academy, Indian National Academy of Engineering and National Academy of Sciences of India and recipient of the Distinguished Alumnus award of Banaras Hindu University. He was a Senior Fellow at NASA Goddard Space Flight Centre. Professor Tripathi is also on the editorial board of Environmental Science and Technology Letters, Journal of Aerosol Science and Environmental Science: Atmospheres. Dr. SachchidaNand Tripathi has made impactful contribution to address challenges of Air Pollution and Climate Change. Prof Tripathi has built ground-breaking innovative approaches for indigenously built low-cost sensor-based network technologies for nation-wide urban air quality monitoring and Real Time Source Apportionment. His work on Taj Mahal discolouration led to policy interventions in Agra city. His pioneering work in aerosol-induced cloud invigoration effect (AIvE) and synergy of coupling between urban land use, land cover and Cloud Condensation Nuclei-induced AIvE has contributed significantly in future urban planning to avoid flash floods. He is also the lead Coordinator of the National Knowledge Network, formed under the National Clean Air Mission and an expert member of the Steering Committee, NCAP, MoEFCC and Member, Executive Council, Climate Change Program, Department of Science and Technology.

Dominant role of meteorology in the near-surface ozone enhancements over Europe during the COVID-19 lockdown in early spring 2020

Carlos Ordóñez[1], José M. Garrido-Pérez[1,2], Ricardo García-Herrera[1,2]

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[2] Instituto de Geociencias (IGEO, CSIC-UCM), Madrid, Spain

On the 11th of March of 2020 the World Health Organization (WHO) declared the coronavirus (COVID-19) outbreak a global pandemic. European governments took social distancing measures to reduce further spread and avoid the collapse of healthcare systems. Most of the continent was under lockdown from mid-March to late April, causing unprecedented falls in industrial activity and vehicle use, two of the main sources of air pollution.

We have investigated the effect of the lockdown on 1-h daily maximum nitrogen dioxide (NO_2) and maximum daily 8-h running average ozone (MDA8 O_3) observations from ~1300 background sites of the European Environment Agency's air quality database (AirBase) during 15 March – 30 April 2020. NO_2 concentrations decreased considerably with respect to the same period in 2015–2019 because of the emission reductions. On the other hand, MDA8 O_3 decreased in southwestern Europe and increased elsewhere, with enhancements of ~10–22% at urban background sites in northwestern and central Europe.

We found that atmospheric conditions were anomalously stable, dry, warm, and sunny over large parts of the continent during 15 March – 30 April 2020, potentially explaining the high O_3 concentrations. To quantify the effect of the meteorology, we built generalized additive models fed by reanalysis meteorological data and estimated the expected O_3 concentrations during that period in the absence of a lockdown. The results indicate that the positive O_3 anomalies in northwestern and central Europe can mostly be attributed to elevated temperatures, low atmospheric humidity and high solar radiation.

While our analyses show a dominant role of the meteorology, we will discuss other factors such as changes in chemical regimes that may yield regional ozone enhancements under strict emission controls.

Short CV

During my PhD at Paul Scherrer Institute (PSI), Switzerland, from April 2002 to March 2006, I developed statistical models and used different observational datasets to understand the trends in near-surface ozone in central Europe during the 1990s and early 2000s. I also

participated in three field experiments to measure ozone and precursors for the Swiss YOGAM project and the EU-funded FORMAT project.

In May 2006 I joined CNRS-Laboratoire d'Aérologie, France, where I used regular aircraft observations for the evaluation of global model simulations and coordinated some model evaluation activities within the framework of the EU GEMS project. This work contributed to building the capacity for the global forecasting and data assimilation system of atmospheric composition that is now running fully operationally in the Copernicus Atmospheric Service (CAMS).

From 2008 to 2016 I worked as an atmospheric modeller for different institutions: British Met Office, Spanish National Research Council (CSIC) and National Center for Atmospheric Research (NCAR) in the US. At Met Office I implemented a chemistry scheme and other parameterizations to develop a new regional air quality forecasting capability for the United Kingdom. While working for CSIC and NCAR I implemented the emissions and photochemical breakdown of very short-lived (VSL) halogenated substances in a global climate model to investigate the impact of these species on tropospheric chemistry.

Since 2016 I joined Universidad Complutense de Madrid (UCM), first as a Research Fellow and now as Associate Professor. I conduct research on different topics, with a focus on the role of the atmospheric circulation and the regional meteorology on air pollution.

Source-allocation methods in regional and urban models - main differences and recommended uses

Leonor Tarrason,

NILU, Norway.

Influence of traffic on particle concentrations in cities

Karine Sartelet[1], Youngseob Kim[1], Lya Lugon[1], Yelva Roustan[1], Thibaud Sarica[1], Baptiste Marques[2], Barbara D'Anna[2]

[1] CEREA, Ecole des Ponts, France ; [2]**Aix Marseille Univ, CNRS, LCE, Marseille, France**

Abstract

High nitrogen dioxide (NO_2) and particle concentrations are observed in cities. For particles, concentrations of organic aerosols and black carbon (BC) are higher in streets than in the urban background. In cities, populations are mostly exposed to the pollutant concentrations in the streets. They are then exposed to high concentrations of organic aerosols, BC and NO_2, which may strongly affect human health. Understanding the origins of those high concentrations is essential to limit them as much as possible, and reduce their health impacts. Here modelling of pollutants including primary and secondary aerosol is used, coupling the regional-scale model Polair3D and the street-scale model MUNICH. Gas-phase chemistry and the formation of secondary organic/inorganic aerosols are considered at both scales. At the regional scale, organic aerosols are mostly from biogenic origin, organic aerosols from anthropogenic origin dominate at the city scale, with a large contribution of intermediate and semi volatile organic compounds (IVOC/SVOC). The formation of secondary aerosols affects not only the regional-scale but also the street-scale concentrations. For example, emissions of ammoniac by vehicles may contribute by up to 26% of inorganic concentrations in the street of Paris. The high BC concentrations observed in streets cannot be explained by exhaust traffic emissions alone, but non-exhaust emissions, such as tyre-wear emissions, may need to be revisited. For organic concentrations, different assumptions related to the speciation of volatile organic compounds (VOC) and IVOC/SVOC from exhaust emissions, non-exhaust and asphalt-related emissions are investigated. Taking into account primary and secondary aerosol at regional and local scales, we show that the impact of realistic and ambitious tendencies of vehicle fleet renewal over 10-years and mobility (home-office practice) do strongly impact regional and street concentrations, but more ambitious reductions of pollutant emissions are still needed to respect air-quality guidelines.

Short CV

Karine Sartelet is a director of research at Ecole des Ponts/CEREA in France. She teaches air pollution to undergraduate students at Ecole des Ponts. She is a member of several scientific and advisory committees in France. She did her PhD in the field of atmospheric dynamics at the Department of Applied Mathematics and Theoretical Physics of Cambridge University (UK). She spent two years in the Central Research Institute of Electric Power Industry in Japan where she studied the dominant aerosol processes during high-pollution episodes over Greater Tokyo, and she participated to the Model Inter-Comparison Study – Asia phase II.

For the past 15 years, her research has focused on improving the understanding of

atmospheric processes that govern air quality and developing numerical models that represent these processes as comprehensively and accurately as possible. She has devoted herself to understand the most uncertain processes influencing air quality to improve their representations in models, with a specific interest in the physico-chemical processes related to aerosol formation at regional and local scales. She has published 72 articles in peer-reviewed journals. She participated to the training book written for the World Meteorological Agency on best practices for air quality monitoring and forecasting. She co-developed several aerosol models: Modal Aerosol Model (MAM), SIze Resolved Aerosol Model (SIREAM), SSH-aerosol, which is included in different types of air-quality models (chemistry-transport, street-network and computational fluid dynamic models). She participated between 2015 and 2018 to a study led by the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) on the influence of traffic on particle concentrations.

The contribution of vehicle emissions to secondary aerosol concentrations across Europe - Results from the recent Clean Air Outlook

Jens Borken-Kleefeld, Gregor Kiesewetter, Zig Klimont

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Abstract

There is no safe minimum level avoiding health impacts from fine particulate matter. In fact, more than 300'000 premature deaths can be attributed to current PM2.5 exposure across Europe. This number is expected to decline by some 25% until 2030, when current legislation and control technologies have taken effect. However, further reductions in exposure and consequent health impacts require new measures; therefore, it is useful to explore options to reduce precursor emissions wherever possible.

This talk provides an outlook

- how large-scale PM2.5 exposure might develop until the year 2030 and beyond,
- how much secondary particles contribute to the exposure, and
- what the contribution from road vehicle emissions is.

Short CV

Jens Borken-Kleefeld is a Senior Researcher in the IIASA Energy, Climate, and Environment Program. He works on the impact assessment of traffic and is an expert in remote sensing of vehicle emissions. He is a member of the European expert group on transport emission modeling (ERMES).

https://iiasa.ac.at/web/ece/Jens_Borken-Kleefeld.html

From the lab to the field, measuring and quantifying vehicle impacts to primary and secondary aerosol using aerosol mass spectrometry

P.F. DeCarlo Associate Professor
Department of Environmental Health and Engineering
Johns Hopkins University

Abstract

Air pollution is a global issue impacting over 90% of the worlds population. Our need for transportation contributes to the overall burden of air pollution, especially in urban area, and necessitates the study of emissions and subsequent chemical processing of those emissions in both controlled (laboratory) and ambient (real-world) settings. For controlled studies, focusing on emissions and estimates of secondary particulate matter (PM) production as a function of different technologies and control devices provides insight into the expected relative concetrations of primary and secondary particulate matter from vehicle emissions. These experiments are laborious, and typically do not include a large sample size representative of real-world vehicle fleets, nor are they able to truly simulate the complexity of the ambient atmosphere. Nevertheless, these experiments provide important insight into post emission processing of pollutants. Ambient measurements utilize the information and insights gained from laboratory studies to measure the contribution of primary emissions and secondary chemical processing to particulate matter in urban environments. Ultimately, the differences in fleet composition, level of regulatory standards in place, seasonality, and driving patterns determines the relative impact of vehicle emissions on air quality in a specific location. Comparisons and contrast between cities in Europe, the US, and Asia provide clear examples of how differences in fleet, driving patterns, and regulations can influence vehicle related air quality impacts in real-world environments.

Short CV (250-300 words)

Dr. Peter DeCarlo is an Associate Professor at Johns Hopkins University in Environmental Health and Engineering and an adjunct member of the Center for Excellence in Environmental Toxicology (CEET) at the University of Pennsylvania. Dr. DeCarlo has a Ph.D. in Atmospheric Science from the University of Colorado, and a BS in Biochemistry from the University of Notre Dame. He uses state-of-the-art instrumentation to measure the chemical composition of particulates and gases in in the air we breathe to better understand the intersection between energy use, air quality, health, and climate impacts of human emissions. He has made air quality and climate related measurements from mobile and stationary sites all over the world to better understand primary pollutant emissions, sources characterization, and subsequent chemical reactions of pollutants in the atmosphere forming secondary aerosol. Dr. DeCarlo is active in the intersection of science and policy and was an AAAS Science Policy Fellow at the US EPA in the office of the Science Advisor working on issues related to air pollution and health and public sharing of environmental data. Dr. DeCarlo has served as a representative to the University Corporation for Atmospheric Research (UCAR), as an advisory board member for PA Physicians for Social Responsibility, and the Thirdhand Smoke Research Consortium, and has served on the Education

Committee for the American Association for Aerosol Research. Funding for his research comes from the National Science Foundation, US EPA, NIH, Sloan Foundation, Electric Power Research Institute, Camille and Henry Dreyfus Foundation, the Department of Transportation, and Bloomberg Philanthropies. Dr. DeCarlo has co-authored over 100 peer reviewed publication and has been identified as a highly cited researcher by Clarivate Analytics.