

SAQN Launch meeting

Post your ideas for discussion: an opportunity that could be used, a challenge we need to address, technology that we could use...

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Indoor air quality and health

How can indoor air quality studies be optimised to include 'good' health science?

Bringing together multiple activities in particular cities. There are often multiple activities and initiatives within single cities that are not linked. Smart cities. There are likely to be opportunities for interactions and projects through linking these. (It would be good for the community outside STFC to gain an understanding of the involvement of different parts of STFC within different cities.

Looking for Holistic Solutions

The regulatory drivers for tackling NH₃ emissions currently come from the Habitat Directive, while emissions for CH₄ are covered by UNFCCC commitments. Scientific analysis of the source needs to look at both together. Solutions should also look at combined effects (e.g. it is not known how farm scale systems developed to capture CH₄ impact on NH₃ emissions). For CH₄, burning captured gas is a simple solution, but it is not clear what to do with NH₃.

Communication is critical to avoid "pollution swapping".

Combining activities in cities

Bringing together multiple activities in particular cities. There are often multiple activities and initiatives within single cities that are not linked. Smart cities. There are likely to be opportunities for interactions and projects through linking these. (It would be good for the community outside STFC to gain an understanding of the involvement of different parts of STFC within different cities.

Toxicity

Can we use this network to get group together or provide proof of concept funding to encourage more toxicity studies relevant to AQ

Standardise low cost sensors

Using Stfc capabilities and expertise to develop calibration or standardisation procedures (Or just best practice) for low cost

sensors

PM speciation

PM speciation for source apportionment and improvement of possible health impact. STFC offers several facilities that can be used for studying PM speciation, both chemical and shape.

STFC computing facilities could be used speed up source apportionment so that it could be run in real time – ANONYMOUS

more generally I think there is work to be done on particle behaviour in dynamic (thermal, chemical and physical) environments which will be affected by speciation. There is opportunity for multiscale modelling in this area.

– ANDY WILLIAMS

Upscale models

Can stfc help upscale models to make them more efficient to be able to run larger scale scenarios or run them more rapidly for sensitivity analysis

There is a specific team dedicated to understanding and improving performance for larger computations in the STFC Hartree Centre – ANONYMOUS

STFC can help with this but depends a lot from the models and the compute that there is to do. GPU acceleration can be also of interest particularly for ML models. – ANONYMOUS

Bringing together the community of researchers working on low cost sensors

To work together and coordinate in low cost and robust sensor technologies to create optimal technology. Bringing the community together

Evaluation of ammonia monitoring, ambient vs. long path vs satellite

Build on the STFC Food Network project. Evaluate the long path monitoring technique against traditional ambient monitoring and satellite data retrieval.

Allowing us to provide best policy advice on how to measure effectiveness of interventions to reduce ammonia emissions from slurry pools, fields or farm-wide levels.

Adding vertical profiling capability to existing platforms

STFC capability could support the development of vertical profilers for addition to, e.g., urban supersites and FAAM, to measure vertical concentration profiles, incl. for ammonia. These are needed to link groundbased and EO measurements, improve EO retrievals and to assess chemistry and transport models.

Sat imaging is a great way to provide benchmark calibration of spatial interpolation across stations e.g.AURN. – ANONYMOUS

Common Platform for AQ Satellite products

A one stop shop for satellite products for different gases and aerosols. Hosted at STFC facility e.g. JASMIN

This has a lot of crossover with other networks & groups. e.g. NCEO are looking at what is the best platform for their EO products – ANONYMOUS

Enabling emission/deposition (fluxes) measurements

Beyond concentrations, policy impact assessment requires understanding of emission/deposition. Looking at approaches, trade-offs, instrumentation and models needed to enable these is needed.

Technology Support for Ammonia Measurements

There are many groups developing systems for measuring NH₃. STFC could support this community with information on sensor technology. SAQN+ could support some a discussion forum and information exchange.

One stop shop access to high resolution air quality monitoring data

Bringing all conventional and sensor networks monitoring data together into a single portal/platform. E.g. DAFNI. Improving available resolution of existing monitoring networks data down to 1 minute (if possible!)

Air Quality Data Directory Tool With multidisciplinary approaches and multiple funding bodies, already air quality data is being spread beyond CEDA. The network could work to produce a method/protocol for ensuring links between air quality datasets. This is essential for realising data power, including modelling evaluation and application to health studies. – ANONYMOUS

Teaching Sessions / Summary of Interdisciplinary Challenges

Could we have a webinar series aimed at educating people on the key challenges, uncertainties from each of the disciplines

aimed at people from the other disciplines?

To raise the level of understanding of scientists across the interdisciplinary fields. (e.g. Health for Air Quality Scientists!)

Early Career Research Support

A network to help support students and post docs integrate and lead work.

Diversity of the network should be considered too. People who aren't usually members of these sorts of networks should be reached out to – ANONYMOUS

What are the issues for indoor air monitoring?

Can we just move existing instruments inside or do we need to look at new technologies

Can we also include new technologies for improving indoor air quality? – ANONYMOUS

Was this not already funded – ANONYMOUS

Miniaturisation and cost reduction needed to be able to distribute indoor monitoring packages widely c.f. BreatheLondon monitors adapter to indoor environments. – ANONYMOUS

Integrated platform for AQ database

Is it viable within have a harmonised database that combines national and local authority air quality (air quality) AQ data?

and data from vehicle measurements aligned with GPS – ANDY WILLIAMS

Coordinating open source analysis of data

From James Tate (not here on Weds): Numerous organisations are working on open-source analysis techniques to extract the most value from (expensive) air quality measurements. An activity to co-ordinate these may prove fruitful

this could be alongside a SAQN+ project to develop and disseminate structures and proposed standards for data from multiple methods onto a single platform (e.g. GPS cm resolution exhaust emission data with satellite data and vehicle based ambient measurement data etc). Currently they will be on different platforms in different formats limiting their integration – ANDY WILLIAMS

Health monitoring

From James Tate (not here on Weds): I agree with Ian Mudway that an important unknown is the link between exposure, inhaled dose and toxicity / health effects. I see exposure in association with health monitoring (breathing rate,

lung function etc) is an important strand of research but can't see how this can relate to STFC facilities and use.

Data systems to integrate (anonymised) individual movements through spatiotemporal pollutant concentrations field.
– ANONYMOUS

Can we use behaviour surveys to try to start mapping lifestyle
– ANONYMOUS

Machine learning tool to interrogate AQ-relevant publications

As mentioned by Ian Mudway the rate of publication in the air quality space is very high. This project would develop a machine learning tool with a web interface that can answer questions, or pull out evidence in a particular area, and back up answers with references to relevant research papers. This would be continually updated.

Not only research papers: planning applications for new livestock houses and changes on farms also contain potentially useful measurements. – MARTIN JUCKES

This came up on table 4 in the context of information about ammonia measurements that could be contained in impact assessment reports submitted to planning authorities. Perhaps other sources where the information is tucked away in natural language. – ANONYMOUS

Related to Machine Learning - it would be good to get networks of people who know the best way to deal with big machine learning tasks and big computational programs with JASMIN/CEDA etc. Network with people who have ideas of what they'd like to do with the TBs of data with people who know how to best use the computing facilities – ANONYMOUS

The "ammonia" problem

Understanding the sources and evaluating possible solutions

This could be expanded to studying other emissions from AD and farming waste and the impact on air quality. – ANONYMOUS

See comments on Machine learning tool to interrogate AQ-relevant publications. – ANONYMOUS

Understanding of emission sources critical. – ANONYMOUS

Technologies for affecting air quality

Does/should the scope of the network include development of technologies for improving air quality as well as monitoring of it?

Should definitely include solutions. Don't want to say there is an issue and not offer mitigation. – ANONYMOUS

Putting UK Surface air quality infrastructures on a secure funding pathway, individual sites are not large enough to bid into infrastructure funds, but deliver platforms (covers urban and rural supersizes, chambers). Making access visible and achievable

"Infrastructure" will take time to develop -- we can't put in a one-off application. SAQN+ can develop a community with clearly defined objectives, and start the process of developing relationship with the funders. – MARTIN JUCKES

USE OF EARTH OBSERVATION TECHNIQUES TO STRENGTHEN AQ MEASUREMENTS AND POLICY.

How can we more effectively use earth observation techniques to help us underpin AQ models, measurements, and policy?

Information for emission inventories is an important component
– ANONYMOUS

CLIMATE CHANGE AND AIR POLLUTION

Climate change and air pollution are closely linked, and it makes sense to address both simultaneously. The main sources of air pollutants and greenhouse gases (GHGs) are identical: combustion processes, transport, agriculture.... How can we collaborate with the climate change community, projects, policy makers, in order to leverage our efforts?

The Climate and Clean Air Coalition has been working on this at the international level, and the UK is a partner (<https://ccacoalition.org>). – MARTIN JUCKES

Nudge

How do we influence people's behaviour to make the drastic changes needed to reduce their emissions? How do we persuade people to take responsibility for their contributions, through behaviours and consumption patterns? Making explicit the link between behaviours and impacts

This would be a great opportunity to include social sciences
– ANONYMOUS

CITIZEN AND COMMUNITIES

How can we engage the citizen and communities in our work, in order to increase the public awareness, demand and support of the clean air research actions, policies, etc.? Some examples might be: citizen science, working with NGO and civil organizations working on air pollution issues, other participatory approaches, etc.

We could build a community run network of user supplied air quality measurements, similar to the UK Met Office's community run network of weather stations WOW (<https://wow.metoffice.gov.uk>). Would need to identify a suitable sensor suite. – ANONYMOUS

Leeds for example has a very active Library Service, with an emphasis on Digital Engagement. They have successfully run a lot of well-attended workshops, mainly aimed at children, but also their parents. One of them actually had an Eco theme, and explored how to make cities more liveable, but also had a session on children walking inside and outside the Library building with an rudimentary air quality sensor and looking at the data afterwards. – ANONYMOUS

Field scale, simultaneous monitoring of GHGs from different ecosystems

www.mirico.co.uk - environmentally robust open path gas analyser for CH₄, CO₂ currently, and NH₃ in Q2/3 this year. – ANONYMOUS

Multiscale real(ish) time pollution mapping

UK air pollution map derived from integrated model and monitoring data, able to zoom in from regional to local scale

In there space here for multi-scale modelling? Maybe coupling mesh scale weather predictions with more small scale CFD – ANONYMOUS

Help ODA counties in monitoring air quality (low cost sensors)

I agree! – ANONYMOUS

There could be an opportunity to incorporate a public engagement/outreach element with this, as there are a lot of cheap electronics with an educational focus. Additionally, need to make sure any hardware and software development is free/open-source. – ANONYMOUS

Internships at LIDA

Opportunity to get an intern to work on a defined project for 6 months at LIDA (Leeds Institute for Data Analytics, University of Leeds). Each project is funded by an external partner (SAQN, DEFRA, ... ?) @£20,000. Queries: Leonid Bogachev, L.V.Bogachev@leeds.ac.uk

Forecasting for local authority air quality strategy

The collective expertise in the network could collaborate to provide a "best guess" advance view of the new techniques, strategies and techniques that will be available and/or being pushed on the ground in five years time - with a focus on specific areas local authorities should begin to anticipate now, either in terms of awareness, techniques training, high level policy requirements that may need some time and consideration to implement well. Often local authorities are reactive to

advancements in air quality and there can be a lag in adoption of new best practice.

Future Platforms

We should be thinking about next generation platforms, i.e. drones, high altitudes pseudo satellites (HAPS), etc and how they will complement existing measurement networks. Porting existing sensors to new platforms will require some degree of technology pre-development.

Perhaps this could go down the route of lower cost versions leveraging the experience developing low cost sensor solutions for ground based measurement, to help poorer regions (internationally) gather high quality data. – ANDY WILLIAMS

Can we combine finer scale EO with new platforms like drones to bridge spatial resolution – ANONYMOUS

Reconstructing UK source data spatially and temporally

Combine meteorological data with ambient concentration network data, developing algorithms capable of reconstructing temporal and spatial source maps for the UK.

Is this being done in the UK Clean Air project led by UKMO & NPL .. 15 year re-analysis of air quality data? – MARTIN JUCKES

Tackling NH₃ emissions from livestock houses

NH₃ emissions from Ag activities are an issue and high on DEFRA's agenda. Livestock sheds do contribute to those emissions but there is limited (if no) understanding / inventory of those emissions and building permit regulations, as set today, do not allow much control over them. In-shed NH₃ generation can also be detrimental to animal welfare and growth (e.g. poultry). Could we imagine a project/ POC looking at measuring/ monitoring/ mapping actual NH₃ emissions from chicken/ pigs sheds across the UK and developing chemistry-based mitigation solutions? Results could support the development of new policies and regulations. It would also be an opportunity to validate new technologies (reliable NH₃ sensing, cost-effective NH₃ abatement) with the potential to take them to commercialisation.

A similar activity was launched by the STFC Food Network SFN+, so we should seek collaboration between the two network. It's very likely that there are other synergies between food / agriculture and air quality / health. – ANONYMOUS

A significant long-term measurement system at, say, 100 farms would (according to our table) need multi-million pound funding. This could deliver huge benefits, enabling a link between farm scale emissions and regional and national satellite observations. SAQN could support the work needed to create a business case. – MARTIN JUCKES

Co-develop enhancements in surface NH₃ measurements with developments in satellite NH₃ retrievals. – ANONYMOUS

Should include both indoor and outdoor ammonia levels, and the relationship between the two. Open path monitoring of outdoor NH3 emissions possible from www.mirico.co.uk in Q2/3.
– ANONYMOUS

How do we add value and connect to other ongoing activities, e.g. Clean Air, Digital Environment, Landscape Decisions SPF's to avoid duplication and meeting overload? Joint events, shared platforms, common deliverables and outputs?
