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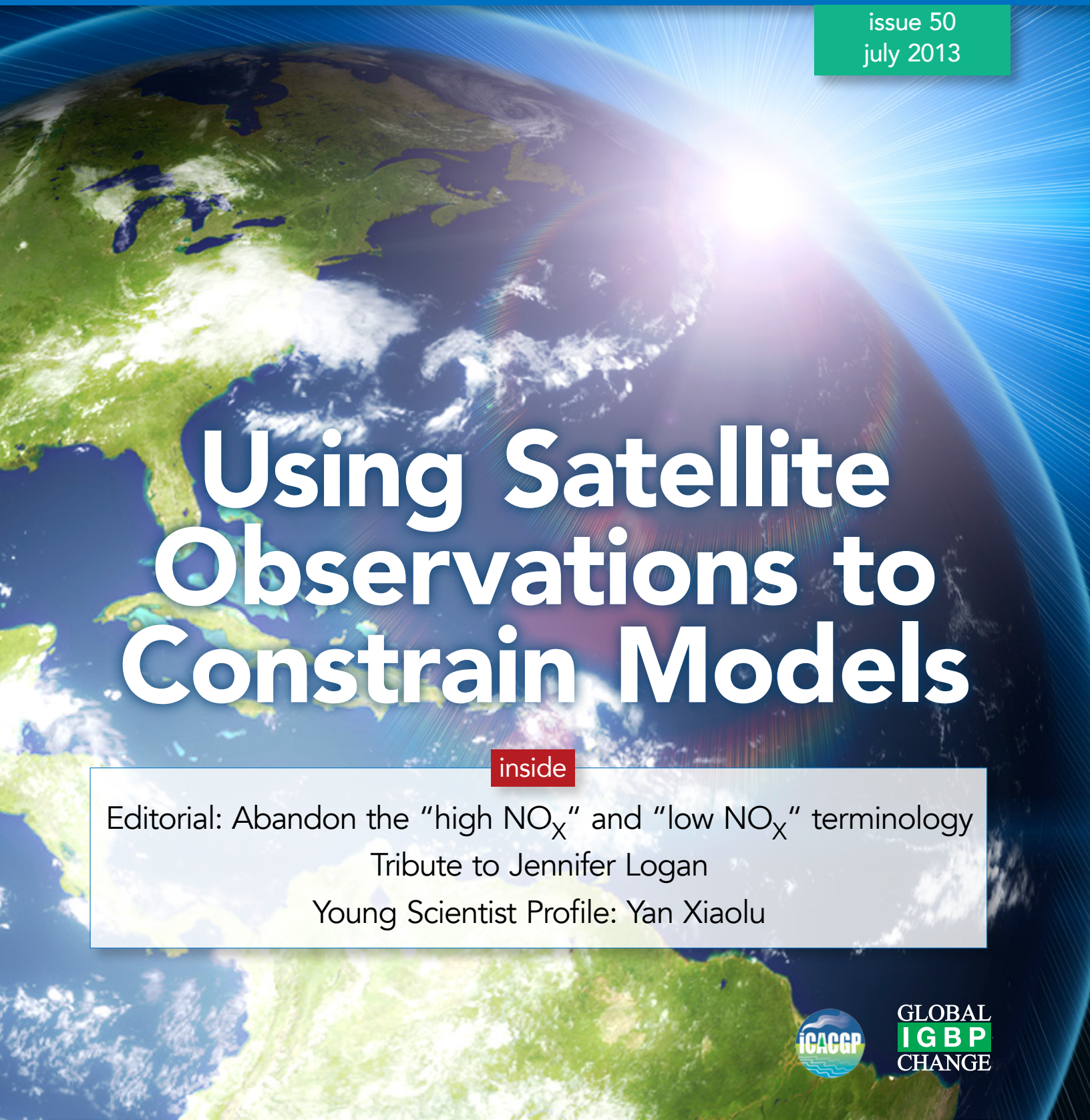
IGACnews

coordinating and fostering atmospheric chemistry research towards a sustainable world

issue 50
july 2013



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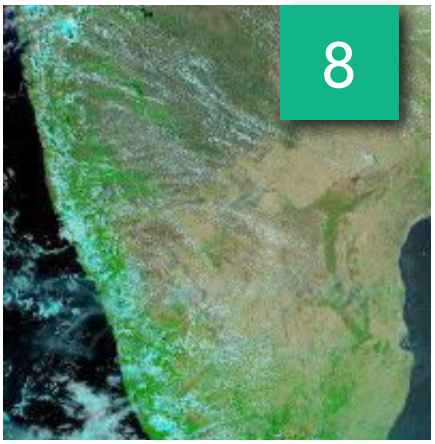

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IGAC was formed in 1990 to address growing international concern over rapid changes observed in Earth's atmosphere. IGAC operates under the umbrella of the International Geosphere Biosphere Programme (IGBP) and is jointly sponsored by the international Commission on Atmospheric Chemistry and Global Pollution (iCACGP). The IGAC International Project Office is hosted by the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado and is sponsored by the US National Science Foundation (NSF), National Oceanic and Atmospheric Association (NOAA), and National Aeronautics and Space Administration (NASA). The IGAC European Project Office is hosted by the Italian National Research Council and by the European Commission Network of Excellence (ACCENT Plus). Any opinions, findings, and conclusions or recommendations expressed in this newsletter are those of the individual author(s) and do not necessarily reflect the views of the responsible funding agencies.

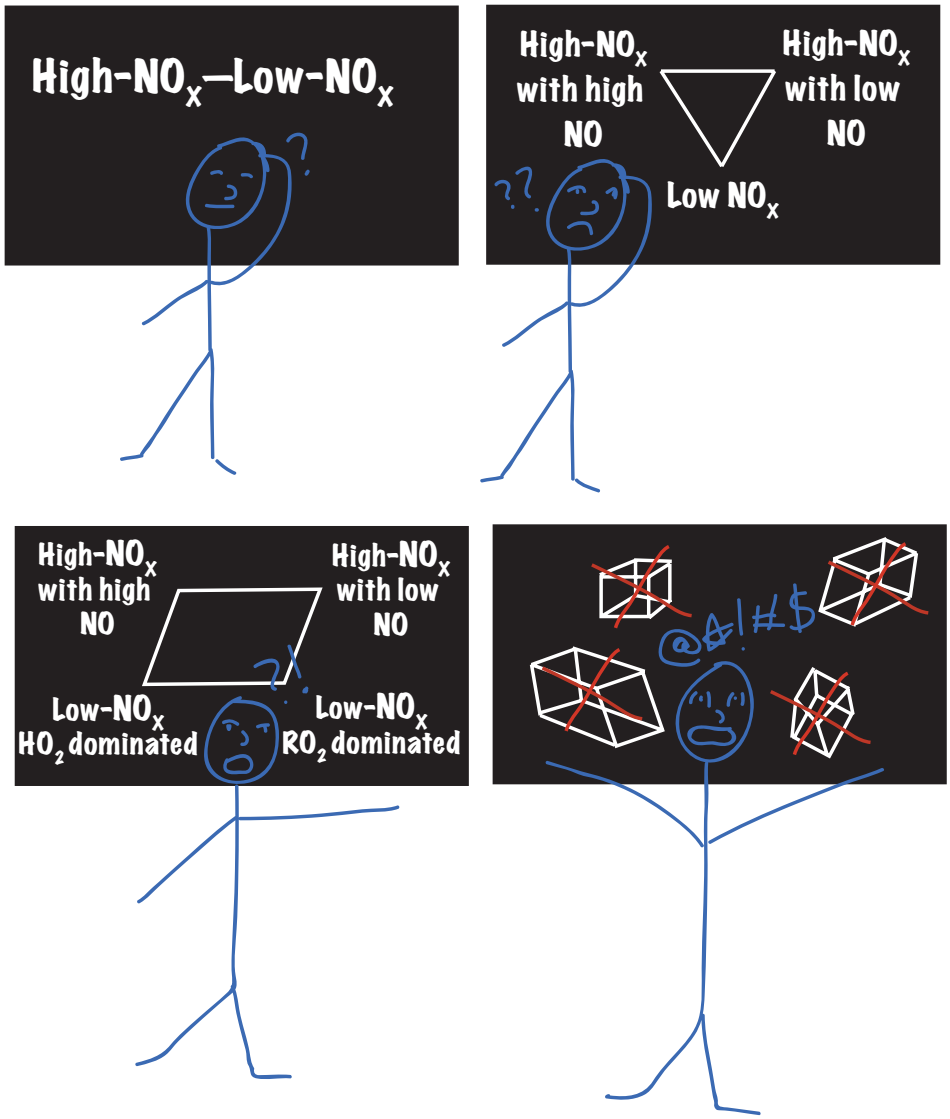
Let's abandon the "high NO_X" and "low NO_X" terminology

Paul O. Wennberg, California Institute of Technology, Pasadena, CA USA (wennberg@gps.caltech.edu)

"High-NO_X" and "low-NO_X" are used ubiquitously in the atmospheric chemistry community as shorthand terms meant to describe the end-member photochemical conditions that span from "urban"/"anthropogenically-impacted" to "remote"/"pristine". They do not, however, have precise or accepted definitions. Following a rather heated discussion at the 2012 Atmospheric Chemistry Mechanisms conference in Davis California, I was tasked with suggesting appropriate definitions. I've come to the opinion that these terms cause more confusion than they do insight and we should abandon them entirely.

Within the air quality community, "high-NO_X" is often used to describe environments that are "NO_X-saturated" with respect to production of oxidants, in particular ozone (O_3). In such environments – where NO_X concentrations are measured in 10s of ppb or more – the production rate of O_3 is either independent of or decreases with additional NO_X . This dependence results from the titration of the O_3 by NO and by a slowing of the rate of oxidation of volatile organic chemicals (VOC) by OH. (The reduction in OH results from loss in its reaction with NO_2).

Within the community interested in the atmospheric photochemical oxidation of organic molecules, the term "high-NO_X " has generally been used to refer to conditions where the fate of peroxy radicals formed from the OH-initiated oxidation of any number of hydrocarbons is exclusively reaction with NO. Such NO dominant peroxy radical chemistry occurs in the atmosphere (and many laboratory studies) when NO concentrations are typically greater than 2×1010



molecules cm-3 (>~1 ppb at 1 atm), e.g. more than an order of magnitude lower than the "NO_X-saturated" conditions described above. Even here, however, the term is used rather loosely and often is just shorthand for laboratory (e.g. chamber) experiments with initially large concentrations of NO (100's of ppb). Even with these extreme NO levels, the "high- NO_X" terminology can be confusing. Consider an atmospheric chamber experiment probing the OH oxidation of an alkane that begins with 100 ppb of NO and 200 ppb of the alkane. As the photochemistry proceeds, reaction of NO with both the organic peroxy radicals and any O_3 produced in the system rapidly converts the NO to NO_2. NO_X(the sum of NO and NO_2) may decrease only slowly as organic nitrates, PAN-type compounds, and HNO_3 are formed. Even with very high initial concentrations of NO (and always elevated NO_X), the chemistry may transition over the course of a single experiment to NO-starved conditions where the peroxy radicals react with HO_2 (and other peroxy radicals) producing organic hydroperoxides (and alcohols) – compounds that, as described below, are generally considered "low-NO_X" products. As another example of the ambiguity, consider the formation of secondary organic aerosol (SOA) from isoprene in "high-NO_X" environments. The SOA forms as a result of the oxidation of a third generation isoprene oxidation product, MPAN by OH radicals. The lifetime of MPAN, and thus the amount formed that can be oxidized to produce SOA is, however, controlled by the ratio of NO_2/NO. Thus SOA formation may be efficient in a NO_2-rich "high-NO_X" environment (high ozone and low photolysis rates – e.g. a warm but cloudy day in Atlanta) while almost no isoprene SOA will form in a NO-rich "high-NO_X" environment (low ozone, high photolysis – e.g. a tropical coastal city). Clearly, the "high-NO_X" terminology is insufficient to describe the richness of the "urban impacted" chemistry.

Beyond the simple tautological definition, "low-NO_X" also does not define a single chemical regime. As for its obvious meaning, even here there is little agreement.

Beyond the simple tautological definition, "low-NO_X" also does not define a single chemical regime. As for its obvious meaning, even here there is little agreement. At the 2012 Atmospheric Chemistry Mechanisms conference, for example, a participant tongue-in-cheek suggested that "low-NO_X" conditions could be defined as when the NO concentration was too small to be measured with a commercial chemiluminescence NO_X sensor. Analytical challenges aside, the relationship between a "pristine" atmosphere and a "low-NO_X" one is certainly not unique: laboratory experiments characterized as "low-NO_X" may or may not be relevant to pristine conditions found in the atmosphere.

The diversity of 'low-NO_X' chemical regimes result from the diversity of the chemistry. When NO is absent, peroxy radicals react with other peroxy radicals (including HO_2) or can undergo unimolecular processes such as isomerization, photolysis, or heterogeneous uptake. The fraction of the peroxy radicals that follow each pathway varies by system and depends on environmental conditions. In a laboratory "low-NO_X" environment, the peroxy radical chemistry may be dominated by self-reactions while in the atmosphere what may be thought of as the same chemistry (e.g. oxidation of an alkene by OH in the absence of NO), may proceed entirely via reaction with HO_2 to form hydroperoxides and none of the alcohols and aldehydes produced in the laboratory experiment.

One possible solution to the terminological confusion might be to add additional end-members to our vocabulary (e.g. "HO_2-dominated", "isomerization-dominated", etc.). But given the richness of the NO free chemistry, such a solution is not likely to produce any efficiency beyond that of simply describing the chemical state.

In summary, rather than helping to clarify and systematize, the "low-NO_X" / "high-NO_X" terminology we employ as shorthand to describe the photochemical conditions in the lab and in the field leads as often to confusion and muddled thinking. These photochemical conditions encompass a topology that is not a line between two unique end members but rather a continuum of photochemical states of which only a small fraction can be found in the atmosphere. In reporting both laboratory and field studies, rather than characterize the conditions as either low or high NO_X, let us provide a description of the fate the peroxy radicals (along with the necessary estimate of the uncertainty). In this way, the comparability among laboratory studies and between them and the field will be made more explicit and transparent.

updates

Future Earth Updates

>>Professor **Frans Berkhout** of King's College London has been appointed interim director of Future Earth to lead the implementation of the new initiative.

http://www.icsu.org/news-centre/news/top-news/professor-frans-berkhout-named-interim-director-of-future-earth

>>Former IGBP vice chair **Mark Stafford Smith** has been appointed inaugural chair of the eighteen-member Future Earth Science Committee.

http://www.icsu.org/news-centre/news/future-earth-inaugural-science-committee-announced-csiro2019s-mark-stafford-smith-to-be-first-chair

>>Future Earth has a new blog featuring editorial content, videos and other digital content of interest to the global change community, the development community and the broader general public.

www.futureearth.info

GEIA has a new website

GEIA, a jointly sponsored IGAC, iLEAPS and AIMES activity, has launched a new website, **geiacenter.org**. The new site will be providing frequent updates on development and use of emissions information and upcoming emission-related events. It also serves as an interactive forum for registered GEIA network members to share their work, collaborate with other emissions specialists, and discuss emission challenges and approaches to addressing them.

IBBI introduces its website

The IGAC activity co-sponsored with iLEAPS and the WMO now has a website hosted by the Max Planck University, **mpic.de/en/projects/ibbi**. Summaries of past workshops and sessions are hosted here, as well as information on future events. Visit to register for the IBBI mailing list.

CCMI welcomes a new co-chair

The CCMI steering committee held its most recent workshop this May in Boulder, CO. In recognition of the ongoing efforts and devotion of **Michaela Hegglin**, there was a decision to add a third co-chair. We welcome Dr. Hegglin from the University of Reading as the newest co-chair of CCMI, joining Veronika Eyring of DLR and Jean-Francois Lamarque of NCAR.

IGAC India Working Group Organizing Committee Announced

The formation of the IGAC India Working Group is being led by an organizing committee of emerging atmospheric scientists in India. The members of the Organizing Committee are:

- **Dr. Sachin S. Gunthe** (Chair), Indian Institute of Technology Madras
- **Dr. Anoop Mahajan**, Indian Institute of Tropical Meteorology
- **Dr. Ramya S. Raman**, Indian Institute of Science Education and Research Bhopal
- **Dr. Lokesh Kumar Sahu**, Physical Research Laboratory
- **Dr. Vinayak Sinha**, Indian Institute of Science Education and Research Mohali
- **Dr. Shubha Verma**, Indian Institute of Technology Kharagpur

IGAC Now on Social Media

IGAC is now on Twitter and Facebook in an effort to further advance international scientific cooperation and serve as a resource to the public. Please join us to stay apprised of the most current news on conferences, workshops and publications. And let us hear from you on how to improve the international conversation, @IGACProject.

IGAC/iLEAPS/WMO Interdisciplinary Biomass Burning Initiative (IBBI) Workshop

12 April 2013 • Vienna, Austria

Melita Keywood, CSIRO Marine and Atmospheric Research, Australia (melita.keywood@csiro.au)
Johannes Kaiser, ECMWF, UK; KCL, UK; MPIC, Germany (j.kaiser@ecmwf.int)

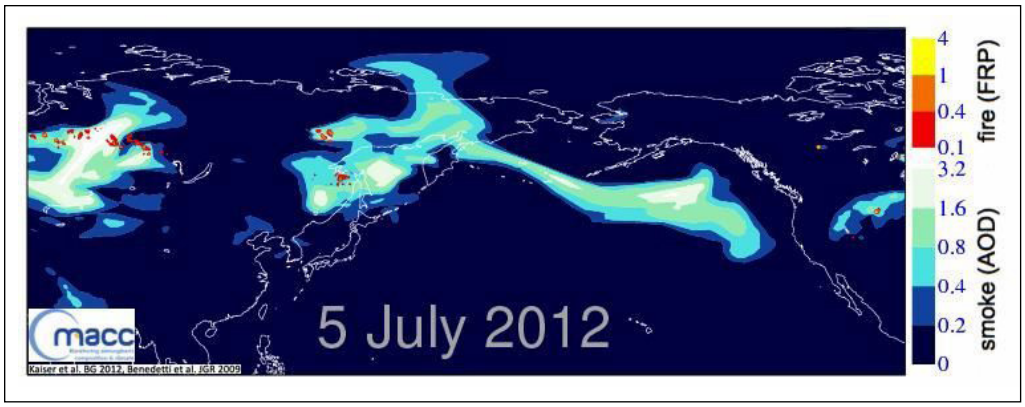


Figure 1. Fire activity and smoke plumes in Siberia on 5 July 2012 (from http://www.gmes-atmosphere.eu/about/project_structure/input_data/d_fire/more_highlights/).

Biomass burning (BB) changes the land surface and emits large quantities of trace gases and aerosol to the atmosphere that influence atmospheric chemistry, radiative processes and cloud formation. Under a warming climate, it is likely that fire frequency and severity will increase. Under the IGBP-IGAC umbrella a series of international and interdisciplinary research campaigns on BB in tropical, subtropical and boreal biomes conducted during the 1990s formed the basis of our understanding of role of emissions from fires on global atmospheric chemistry. However, the large-scale international and global collaborative effort has been replaced by numerous smaller-scale projects and campaigns in recent times. The aim of the IGAC\iLEAPS\WMO Interdisciplinary Biomass Burning Initiative (IBBI) is to coordinate and facilitate research on all aspects of biomass burning in order to better quantify the impact of biomass burning (including feedbacks) on the Earth System.

The second in a series of IBBI workshops was held in Vienna during EGU. The report from the first IBBI Workshop held in Geneva in July 2012 was presented in IGAC Newsletter Issue 47 (http://www.igacproject.org/sites/all/themes/bluemasters/images/WorkshopSummaries/Issue_47_Aug_2012_BBI_WSS.pdf) and the third workshop is planned for 23-25 April 2014 at the Schloss Ringwood in Germany.

The Vienna workshop was attended by 34 participants from 14 countries. The aim of the workshop was to define the activities of the IBBI by developing the structure of a paper on new directions in biomass burning research. The paper will be finalised at the 2014 Workshop where the Scientific Steering Committee for the Initiative will also be elected.

Five dominant themes emerged from the Vienna workshop discussions. The first was around fire products. In particular the evaluation of fire products and their uncertainties is an important issue. Researchers and operational institutions increasingly use the relatively new fire radiative power (FRP) satellite observations (Figure 1). So, how can we quantify and reduce the uncertainties associated with an FRP-based description of fires and fire emissions? Also, how can FRP be linked to burnt area? In addition, other products are required including vegetation types and fire ecology.

The second theme was around fire models and fires within models, which are complex due to the scale hierarchy of models (from process such as fire spread to fires in global

climate/earth system simulator) and the range of different end-users. There is not a one-size-fits all system available (and nor is one likely to be), however there is clearly a large and diverse effort going into developing these ranges of models. How can the international community direct this effort in such a way that different disciplines benefit from others experience and knowledge?

The third theme was around the observations of fires and atmospheric composition. The aging of smoke may be a factor in the under prediction of AOD in climate models relative to satellite AOD observations. Observational programs that target smoke aging may provide insights into whether a change in aerosol size or chemical composition may contribute to this under prediction if such processes are not adequately captured in these models. Emission factors continue to be a significant source of uncertainty as these vary in space and time but are fundamental to understanding the impact of fires on atmospheric composition and atmospheric chemistry.

The role of BB on influencing air quality was the fourth theme of interest. In the first instance how well do we understand the contribution of biomass burning to regional air quality and atmospheric composition and can we separate the BB contribution from other sources. Again the issue of scales is important, in particular high temporal resolution and complex chemical transport mechanisms are required for air quality modeling with small fires most likely being important. However can we capture these?

One of the most complex and uncertain areas of science of biomass burning (and the fifth theme discussed) is the link between fires and climate change and fire climate feedbacks. Fires have been part of the earth system for a very long time, so how can we learn from paleo records to improve our understanding of these feedbacks?

An issue that crossed all of these themes was around the human dimension. In particular, humans play a significant role in fires, either deliberately or accidentally. How do we include human activities in our models? To do so will require understanding of physical processes (ignition, suppression, land use), and economic and social policy and will require the inclusion of social scientists in the IBBI.

Finally, ideas for fostering future collaborations were discussed including the new directions paper, establishment of a web-based information portal (with links to relevant sites concerning data, models and upcoming activities). We also discussed establishing a Global Fire Alert web page and potential sources of funding to support IBBI activities.

If you would like to participate in the production of the new directions paper or any IBBI activity please join the IBBI mailing list at http://lists.mpic.de/mailman/listinfo/ibbi or visit the IBBI website at http://www.mpic.de/en/projects/ibbi.html for more information and updates.

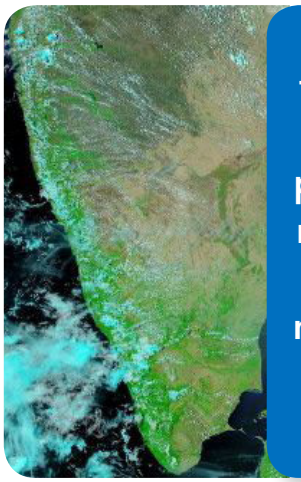
IGAC/iLEAPS/SPARC/ICIMOD Atmospheric Composition and the Asian Summer Monsoon (ACAM) Workshop

9-12 June, 2013 • Kathmandu, Nepal

Laura Pan, National Center for Atmospheric Research, USA (liwen@ucar.edu)
Arnico Panday, International Center for Integrated Mountain Development, Nepal (apanday@icimod.org)
Jim Crawford, NASA Langley Research Center, USA (james.h.crawford@nasa.gov)

One hundred twenty scientists representing 17 countries recently gathered in Kathmandu, Nepal for the Workshop on Atmospheric Composition and the Asian Summer Monsoon (ACAM). As a weather pattern, the Asian monsoon impacts the lives of more than a billion people. With rapid population and economic growth of the regional countries in the recent decade, it becomes a pressing concern that the monsoon convection coupled to surface emissions is playing a significant role in the region's air quality. The uplift of pollutants also enhances aerosol–cloud interactions that may change the behavior of the monsoon. The chemical transport effect of the monsoon system is seen from satellites as an effective transport path for pollutants to enter the stratosphere. The monsoon system is therefore relevant to scales and processes bridging regional air quality, climate change, and global chemistry-climate interaction. Accurate representation of this system in global chemistry-climate models is critical to predicting how this evolving region may contribute to future change. To characterize and quantify the impact of the system,

integrated study is essential, including observations (in situ and remote sensing) from the surface through the troposphere and stratosphere as well as modeling from regional to global scales. To be successful in this pursuit, it is necessary to build strong international collaborations to obtain the diverse expertise, resources, and access to the monsoon region for international research teams. The ACAM workshop represents a small but critical step in building these international relationships.



As a weather pattern, the Asian monsoon impacts the lives of more than a billion people. With rapid population and economic growth of the regional countries in the recent decade, it becomes a pressing concern that the monsoon convection coupled to surface emissions is playing a significant role in the region's air quality.

Recognizing the importance of this problem, the 3.5 day workshop was co-sponsored by four international organizations (IGAC, SPARC, iLEAPS, ICIMOD) and the US National Science Foundation. The workshop began by overviews of dynamics and predictability of the Asian monsoon system (Dr. M. Rajeevan, Ministry of Earth Sciences, India), chemical impact of the Asian summer monsoon anticyclone in the upper troposphere and lower stratosphere (Dr. Bill Randel, National Center for Atmospheric Research, USA), and a historical perspective on southern Asian pollution outflow (Dr. Mark Lawrence, Institute for Advanced Sustainability Studies, Germany). The main body of the workshop consisted of oral and poster sessions organized around four themes:

1. Emissions and Air Quality in the Asian Monsoon Region
2. Aerosols, Clouds, and the Asian Monsoon
3. Asian Monsoon Convection and Chemistry
4. UTLS Response to Asian Monsoon

The meeting culminated with a summary session focused on how to continue the community building effort initiated by the workshop. Representatives of IGAC, SPARC, and iLEAPS outlined perspectives and advice from their respective organizations. This was followed by a final open floor discussion that proved to be the highlight of the workshop. Participants from a broad spectrum of experience including graduate students, young faculty, and senior scientists, spoke up to express what follow-up activities they would like to see. A clear consensus emerged in favor of forming an ACAM initiative or working group to continue with community building activities. Suggested activities included convening a regular ACAM workshop on an annual or bi-annual interval, organizing data sharing, modeling training sessions, summer schools for Asian monsoon regional countries, young scientist forums, and coordinated participation of local researchers in future international community field campaigns. Each of these suggestions were noted by the workshop organizing committee and will be addressed in an in-depth workshop report. A much more detailed summary of the workshop will be posted on the ACAM website (http://www.acd.ucar.edu/utls/2013/), together with the invited talks. Interested researchers may also join the ACAM mailing list to become involved with this group (subscription from the above link).

IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) 2013 Science Workshop

14-16 May 2013 • Boulder, Colorado, USA

Veronika Eyring, DLR, Germany; **Jean-Francois Lamarque**, NCAR, USA; **Irene Cionni**, ENEA, Italy; **Bryan Duncan**, NASA, USA; **Arlene Fiore**, LDEO/Columbia University, UK; **Andrew Gettelman**, NCAR, USA; **Michaela Hegglin**, University of Reading, UK; **Peter Hess**, Cornell University, USA; **Tatsuya Nagashima**, NIES, Japan; **Tom Ryerson**, NOAA, USA; **Ted Shepherd**, University of Reading, UK; **Drew Shindell**, NASA, USA; **Darryn Waugh**, JHU, USA; **Paul Young**, Lancaster University, UK

Approximately 130 participants attended the IGAC/SPARC Chemistry-Climate Model Initiative (CCMI, http://www.pa.op.dlr.de/CCMI/) 2013 Science Workshop that was held in Boulder, CO, USA at the Center Green Campus of the National Center for Atmospheric Research (NCAR) from 14-16 May 2013, followed by a Scientific Steering Committee Meeting on the morning of 17 May 2013. Workshop participants' expertise ranged from global chemistry and climate model developers and users, to in-situ and satellite observational experts, with interests in both tropospheric and stratospheric chemistry and climate. Science topics discussed included key observations needed for model evaluation, critical topics in tropospheric and stratospheric chemistry and dynamics as well as stratosphere-troposphere coupling. Examples of process-oriented evaluation of CCMs were presented and discussed.

There were three days of scientific talks and discussions, focusing on upcoming simulations and model inter-comparison analysis. The recorded videos and presentations from the workshop are available from the workshop website at http://ccmi.ucar.edu/. Three breakout groups were held, targeting specific topics around (1) the CCMI data request and diagnostic tool, (2) tropospheric chemistry, and (3) CCMI support for the upcoming WMO/UNEP Scientific Assessment of Ozone Depletion. In addition, there were extensive discussions of upcoming multi-model analysis under CCMI. Twenty two different global chemistry-

climate models are currently part of the first round of CCMI simulations and representatives from each of the modeling groups presented an update on the status and plans. The CCMI Phase 1 (CCMI-1) simulations (Eyring et al., 2013) are carried out in part in support of the WMO/UNEP Scientific Assessment of Ozone Depletion: 2014, and will also form an ensemble for a first comprehensive inter-comparison of a transient chemistry-climate hindcasts of the late 20th and early 21st century spanning both the troposphere and stratosphere. Hindcast simulations will constrain the models and facilitate detailed comparisons between models and observations, as well as process-oriented model evaluation. These simulations feed into evaluation for assessing future chemistry-climate projections. Hindcast and future scenarios in support of the Ozone Assessment are due to be done by the fall of 2013. Model groups are producing output that will be uploaded to the British Atmospheric Data Center (BADC), and distributed to the community for analysis.

A CCMI SSC meeting was held following the main workshop. The SSC revisited the timeline and action items that were discussed throughout the meeting and identified individuals to move things forward. It was decided to hold the next CCMI workshop with a focus on the analysis of hindcast simulations in Lancaster, UK, from 20-22 May 2014.

To help the overall coordination of CCMI, it was agreed that the CCMI SSC would elect a new co-chair through a formal process. The SSC meeting was followed by a nomination and voting period open to all CCMI SSC members. Michaela Hegglin (University of Reading, UK) was elected as new co-chair of the CCMI starting immediately, with Veronika Eyring (DLR, Germany) stepping down as co-chair of CCMI at the end of 2013 when she takes over from Ron Stouffer (GFDL, USA) as Chair of the CMIP Panel.

The workshop was held under the auspices of the International Global Atmospheric Chemistry (IGAC) Project, WCRP's (World Climate Research Programme) SPARC (Stratospheric Processes and their Role in Climate) project, and NCAR. We would like to thank NCAR and the local organizing committee (Andrew Gettelman and Christy Edwards) for hosting the workshop.

A more detailed summary of the workshop will be published in the SPARC newsletter and on the CCMI website.

References:

Eyring, V., Lamarque, J.-F., Hess, P., Arfeuille, F., Bowman, K., Chipperfield, M.P., Duncan, B., Fiore, F., Gettelman, A., Giorgetta, M.A., Granier, C., Hegglin, H., Kinnison, D., Kunze, M., Langematz, U., Luo, B., Martin, R., Matthes, K., Newman, P.A., Peter, T., Robock, A., Ryerson, T., Saiz-Lopez, A., Salawitch, R., Schultz, M., Shepherd, T.G., Shindell, D., Stähelin, J., Tegtmeier, S., Thomason, L., Tilmes, S., Vernier, J.-P., Waugh, D.W. and Young, P.J., 2013. Overview of IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) Community Simulations in Support of Upcoming Ozone and Climate Assessments. SPARC Newsletter, 40: 48-66.

Changing Chemistry in Changing Climate (C4): Monsoon Workshop

1-3 May 2013 • Indian Institute of Tropical Meteorology (IITM), Pune

Gufran Beig, Indian Institute of Tropical Meteorology (IITM), India (beig@tropmet.res.in)
John P. Burrows, University of Bremen, Germany (burrows@iup.physik.uni-bremen.de)
Manish Naja, Aryabhatta Research Institute of Observational Sciences (ARIES), India (manish@aries.res.in)

The Changing Chemistry in Changing Climate (C4): Monsoon Workshop took place 1-3 May 2013 and was initiated as one of the new regional activities of iCACGP (international Commission on Atmospheric Chemistry and Global Pollution). It was sponsored by IGBP (International Geosphere Biosphere Programme), IGAC (International Global Atmospheric Chemistry Project), IITM (Indian Institute of Tropical Meteorology), MoES (Indian Ministry of Earth Sciences), WCRP (World Climate Research Programme), SPARC (Stratospheric and tropospheric Processes and their Role in Climate), WMO-GURME (Global atmosphere watch Urban Research Meteorology and Environment), and MAIRS (Monsoon Asia Integrated Regional Study).

The workshop attracted much interest from scientists, young researchers and students from all over the world. In total the number of registered participants attending the workshop was 211. The majority of the participants were from the region, representing 19 different states in India with a further 40 from China, Germany, Ivory Coast, Kenya, Malaysia, Nepal, Nigeria, Pakistan, Switzerland, United Kingdom, and USA. A total of 147 abstracts were selected for oral and poster presentations and 21 invited talks were delivered by eminent sceintists from around the world. The workshop addressed the following scientific themes: air quality, transport and transformation of pollution, tropospheric chemistry, and their feedback in a changing climate. The oral and poster presentations described in the four theme foci of the meeting addressed the past, current and future needs of research in the field of atmospheric chemistry, aerosols, Asian monsoon, air quality and its health impacts, and their feedback in a

changing climate.

The opening ceremony was combined with the official inauguration of SAFAR-Pune (System of Air Quality Forecasting and Research for Indian Metro cities), which is an operational service delivering air quality and weather information for the host metropolitan region of Pune. The opening ceremony was led Dr. Shailesh Nayak, secretary to Govt. of India, MoES; Professor John P. Burrows, President, iCACGP; and Dr. Liisa Jalkanen, Chief, WMO, who gave the inaugural speeches. Professor B. N. Goswami, Director IITM, delivered the welcome address. This was followed by talks from Dr. Gufran Beig and Dr. Manish Naja, the heads of the local organising committee and conveners of C4: Monsoon, who provided the background to the conference and the introduction, respectively.

As part of the workshop, a panel discussion on "Black Carbon and Climate Paradox in Asia" was held. The recent rapid economic development in South Asia has been coupled with increasing air quality issues and carbon emissions. In a lively debate concerns were expressed as to whether the role of South Asian black carbon in climate change is exaggerated. It was pointed out that knowledge about organic carbon and other forms of carboneous aerosols are also important to improve our understanding and impacts of air quality and climate change. Currently these topics are not given as much prominence as black carbon. Overall it was concluded that there is an urgent need to develop accurate emission inventories for BC, OC in aerosol, ozone, and the relevant precursor trace gases, coupled with representative and systematic measurements of their concentrations and surface fluxes for the land surface types, ocean, and glaciers in the South Asian region. Measurements of both carbon dioxide and methane surface fluxes and concentrations were also recommended. Campaigns addressing poorly understood aspects of our understanding of the transport and transformation of emissions were also recommended.

The recent rapid economic development in South Asia has been coupled with increasing air quality issues and carbon emissions. In a lively debate concerns were expressed as to whether the role of South Asian black carbon in climate change is exaggerated.

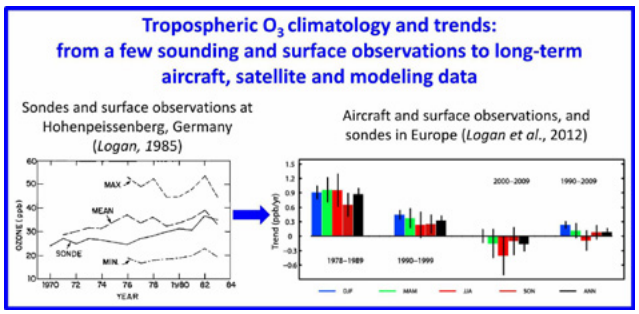
This workshop, intended to be the first of a continuing series addressing the changes in air quality, atmospheric chemistry, health, and ecosystem services during this phase of the anthropocene brought together key researchers and stakeholders. It provided a unique overview of current capabilities and understanding, and defined the needs for research for the next decade and beyond in the South Asian region. The workshop ended with a rapporteur's session, describing the achievements of the workshop and an award ceremony for the best oral presentation (2) and best posters (8). More details are provided on the web site: http://www.tropmet.res.in/c4/

Jennifer Logan

After a career spanning 40 years in atmospheric sciences, Jennifer Logan retired last month. With this note, students and colleagues of Jennifer would like to express their gratitude for her pioneering and inspiring work over the years.

Jennifer received her B.S. in Chemistry from University of Edinburgh in 1971, and her PhD in Physical Chemistry from the Massachusetts Institute of Technology in 1975. She then moved to Harvard's Centre for Earth and Planetary Physics for a postdoc in atmospheric chemistry. At Harvard, she developed a strong research program that made exceptional contributions to the understanding of the trends and variability of ozone and CO, and to the impacts of pollution and biomass burning on atmospheric composition. Her internationally recognized impact on atmospheric science is reflected by her involvement in more than 10 science assessments for the WMO and IPCC, over 100 articles in leading journals, and membership of a range of advisory and steering committees for NASA, NRC, WMO, NCAR and NSF among others. She was elected a Fellow of the American Geophysical Union in 2001, and a Fellow of the American Association for the Advancement of Science in 1997.

Jennifer's early work was invaluable in developing our understanding of the chemistry of tropospheric ozone, NOx, and OH. Logan et al. (1981) presented the most comprehensive treatment of the chemistry of tropospheric OH of that time. In a similarly comprehensive study in Logan (1983), she examined the global atmospheric budget of reactive nitrogen. This analysis exploited the expansion of in-situ observations of tropospheric composition in the early 1980s, and, in combination with concurrent advances in models and emissions estimates, produced a detailed nitrogen budget that compared remarkably well with later analyses derived from global 3-D chemical transport models (CTMs). Subsequently, Logan (1985) drew on surface and ozonesonde observations, and produced the first comprehensive review of the characteristics of global distribution of tropospheric ozone. The analyses of seasonal, latitudinal, and urban-rural differences of tropospheric ozone guided the development and evaluation of the first-generation global CTMs that included detailed descriptions of the O_3-NO_X-VOC chemistry in the troposphere. This study also addressed the influence of anthropogenic emissions on tropospheric ozone, and laid the foundation for her later investigations of ozone trends in Logan (1994), which served as the starting point for more detailed analyses of tropospheric ozone trends. A significant outcome of this early work was her contribution to the 1991 NRC report *Rethinking the Ozone Problem in Urban and Regional Air Pollution*, which had a crucial impact on the development of more effective NO_X emission regulations for ozone control. Her early career contributions from the 1980s are still valid today, and have proved fundamental in current understanding of tropospheric chemistry.



Synopsis of Jennifer Logan's research work on tropospheric O_3 climatology and trends, from the 1980s to the 2010s.

As a co-leader of the Harvard Atmospheric Modeling Group, Jennifer's keen scientific insights were invaluable in steering the development of the GEOS-Chem global CTM, now used by almost 70 research groups internationally. Her rigorous standards helped guide the model's application in interpreting a range of in-situ and remote-sensing observations. In this context, Jennifer also provided valuable leadership in the rapidly emerging field of space-based observation of tropospheric composition. She was an original member of the science team for the Tropospheric Emission Spectrometer (TES), which was launched on the Aura spacecraft. TES provided the first global continuous observation of tropospheric ozone, and Jennifer played a key role in integrating these data with other measurements to better understand the mechanisms controlling the seasonal and interannual variations of ozone and CO. In one novel application of the satellite data, Jennifer and her colleagues used the observed CO tape recorder pattern observed by the Microwave Limb Sounder (MLS) to derive a vertical velocity profile in the upper troposphere and lower stratosphere (UTLS) to evaluate the NASA GEOS assimilated meteorological products in the UTLS.

Jennifer's contributions to our understanding of the impacts of biomass burning on atmospheric chemistry have also been significant. A major milestone was a comprehensive dataset

on global emissions from combustion of solid biofuels and agricultural waste (Yevich and Logan, 2003). Other results led to a realization that forest fires in North America and Siberia provide a major perturbation to the atmospheric composition of the northern hemisphere. Jennifer was also keenly interested in the impacts of a changing climate on fires in North America. Her work showed that wildfires in the western United States are likely to increase in spatial extent in the warmer, drier atmosphere of 2050s, with significant consequences for air quality (Spracklen et al., 2009; Yue et al., 2013). Other work focused on the mechanisms controlling the injection heights of pollution from fires, which provided the first characterization of plume heights over North America (Val Martin et al., 2010).

Throughout her career, Jennifer has dedicated herself to the education and training of graduate students and postdocs. She pushed us to think hard about our scientific efforts, to understand what we are doing and why it matters, and to get it right. At weekly group meetings, Jennifer's insights and frank opinions always sharpened the discussion. Her approach is scrupulously honest and rigorous. If observations could not be reconciled with model results, she said so, and forced us to dig deep into our analyses for the answers. She taught us to value not just attention to detail, but also creativity, and the quest to look for unexpected connections between atmospheric phenomena.

Her mentoring has also provided strong support to women in science and her legacy lives on in the work of numerous female scientists who were fortunate to encounter her early in their careers. Two commonly expressed barriers to succeeding as a woman in science are a lack of female role models and a sense of isolation. Jennifer's natural willingness to share her experiences with the younger women helped alleviate any sense of isolation and provided a sense of how life could be as a female scientist and a mom. Furthermore, her outstanding research and international reputation demonstrated that it was indeed possible for women to excel as scientists, and to engage fully in scientific discourse at all levels.

Through her candor and diligence, Jennifer has set a terrific example, whether at Harvard, at the AGU fall meeting, or the wider world. She says what she thinks, and she thinks very well. For example, in 2011, Jennifer fearlessly spoke out against proposed budget cuts to Environment Canada, a government agency responsible for meteorological services and environmental science. Jennifer's comments had great weight, especially given her knowledge of the value of long-term ozone measurements in Canada. In the fallout from this dispute, Jennifer stood her ground when challenged by Canadian government officials.

Jennifer has left a lasting legacy in the field of atmospheric chemistry through her scientific contributions, her role in training the many students and postdocs who have passed through Harvard, and her principled approach. We are grateful for her contributions and wish her well.

Sincerely,
A. Fiore (Columbia University), **D. Jones** (University of Toronto, CAN), **J. Liu** (Harvard University), **L.J. Mickley** (Harvard University), **S. Sillman** (Michigan University), **D. Spracklen** (Leeds University, UK), **P. Suntharalingam** (University of East Anglia, UK), **Y. Terao** (National Institute for Environmental Studies, Japan), **V. Thouret** (Laboratoire d'Aérologie, CNRS), **M. Val Martin** (Colorado State University), **J. S. Wang** (NASA Goddard), **Y. Wang** (Georgia Tech), **X. Yue** (Yale University), among many students, postdocs and colleagues.

References

Logan, J.A., et al., Tropospheric chemistry: A global perspective, J. Geophys. Res. 86, 7210-7255, 1981.

Logan, J. A., Nitrogen oxides in the troposphere: Global and regional budgets, J. Geophys. Res. 88, 10785-10807, 1983.

Logan J. A., Tropospheric ozone: seasonal behavior, trends and anthropogenic influence. J. Geophys. Res., 90, 10,463-10,482, 1985.

Logan, J. A., Trends in the vertical distribution of ozone: An analysis of ozonesonde data, J. Geophys. Res., 99, 25553-25585, 1994.

Logan, J.A., et al., Changes in ozone over Europe: analysis of ozone measurements from sondes, regular aircraft (MOZAIC) and alpine surface sites, J. Geophys. Res., 117, D09301, doi:10.1029/2011JD016952, 2012.

Spracklen, D. V., et al., Impacts of climate change from 2000 to 2050 on wildfire activity and carbonaceous aerosol concentrations in the western United States, J. Geophys. Res., 114, D20301, doi:10.1029/2008JD010966, 2009.

Val Martin, et al., Smoke injection heights from fires in North America: Analysis of five years of satellite observations, Atmos. Chem. Phys., 10, 1491-1510, 2010.

Yevich, R. and J. A. Logan, An assesment of biofuel use and burning of agricultural waste in the developing world, Global Biogeochem. Cycles, 17, (4), 1095, doi:10.1029/2002GB001952, 2003.

Yue, X., et al., Ensemble projections of wildfire activity and carbonaceous aerosol concentrations over the western United States in the mid-21st century, Atmos. Environ., in press, 2013.

Using satellite observations and models to understand processes in the composition-climate system

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A major recent advance that has tremendously influenced atmospheric chemistry research and Earth system science in general is the availability of an unprecedented amount of information that has been generated from a range of Earth-observing satellite missions. For the first time, scientists are able to have a continuous global view of the atmosphere, the oceans, the biosphere, and other integral parts of the Earth system. The challenge of using this wealth of observational data is significant, as scientists have to continuously follow the latest advances in satellite products, and also to simultaneously think of ways of using these datasets creatively to perform in-depth analyses.

Another major advance that has occurred almost simultaneously is the further development of models that simulate the environment, and especially the coupling of models that represent different components of the Earth system. During especially the last decade, a large body of work that compared satellite information with different model results has been produced. Specifically, atmospheric chemistry has largely benefited from studies that evaluated the global distribution of gases and aerosols in the atmosphere. But how can we go beyond individual constituent comparisons and evaluate underlying processes that determine the concentrations of such species.

Scientists from the NASA Goddard Institute for Space Studies (GISS), the University of Cambridge, and the Jet Propulsion Laboratory (JPL) attempted to take that direction by looking at the global correlation of ozone and

carbon monoxide (CO) in the troposphere (Voulgarakis et al., 2011). Past research had extensively examined this relationship with models and observations (e.g. Chin et al., 1994, Parrish et al., 1998), but only for specific locations, since there was no global view of those species in the pre-satellite era. The general idea was that such a test can "diagnose whether a model is giving a successful simulation of ozone for the right reasons" (Chin et al., 1994). The ozone-CO correlation is a reflection of the underlying chemistry, or of other important processes such as stratosphere-troposphere exchange, and therefore can help us "scratch below the surface". Since satellite information for the troposphere has become available, modelled ozone or CO have been evaluated against observations, but only individually. Zhang et al. (2006) first provided some preliminary results using the two variables in combination, but only with a month's data. Voulgarakis et al. (2011) used multi-year, simultaneous and collocated measurements from the Tropospheric Emission Spectrometer (TES), as well as two global composition-climate models to constrain the ozone-CO relationship and to evaluate processes in the two models.

The NASA Goddard Institute for Space Studies (GISS) model and the UK Chemistry and Aerosols (UKCA) model are both widely used climate models that have recently been coupled with atmospheric chemistry and aerosols. Global ozone-CO correlation maps were constructed using daily data from TES observations and from simulations with the nudged versions of the two models. In the observations, positive and strong correlations were found in tropical biomass burning regions, the northern Atlantic, and northern Pacific (Fig. 1a, top panel). Especially in the latter, the correlations are particularly strong and ubiquitous, surprisingly extending over regions that are not known as ozone producing (e.g. the central northern Pacific). By comparing the global ozone-CO correlation maps with those derived from the models (Fig. 1a, lower panels), it is obvious that one of the models (GISS) captures the correlation very well, while the other (UKCA) performs less successfully in the majority of regions. What is even more interesting is that both models capture the ozone and CO levels and distribution fairly well (see Fig. 1b for ozone), even though they disagree strongly on the correlation. This suggests that the underlying processes are fairly different in the two models and triggers further investigation.

One strength of modeling approaches is that they can involve sensitivity analysis to attempt to explain the importance of individual processes, e.g. what is it that makes ozone-CO correlations well captured (or not) over certain

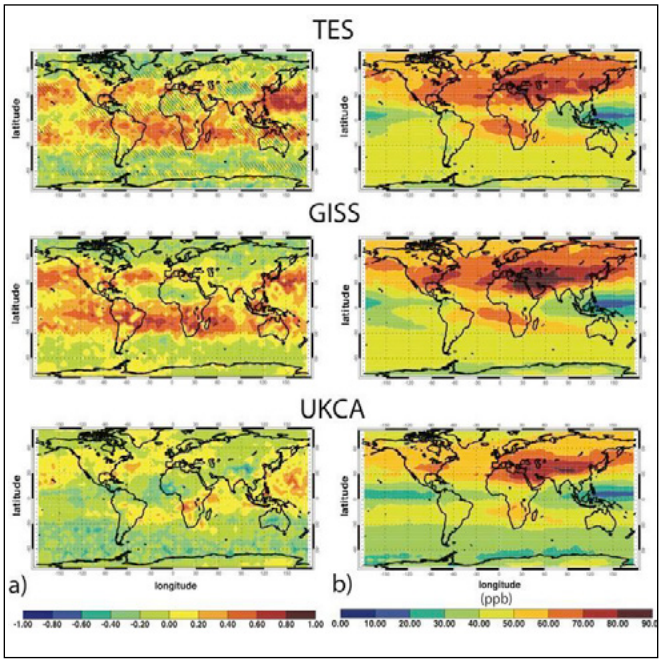

Figure 1. a) Correlation coefficient of daily mean 2005–08 middle/lower free tropospheric ozone and CO concentrations for TES, GISS and UKCA in July–August. We used data from 7 TES pressure levels between 800 and 400 hPa. TES sampling and operators have been applied to the model output. Also, the observational error has been taken into account for the model correlations, following Eq. (3) of Zhang et al. (2006). The data have been smoothed by averaging on a 4°-5 degree grid; b) Mean 2005–08 middle/lower free tropospheric ozone concentrations for July–August.

regions by different models. For example, one can scale or remove different emissions that affect both ozone and CO chemistry and examine whether the relationships will remain the same or change. Such analysis was performed by Voulgarakis et al. (2011), but did not reveal a dominant role of emissions in driving the ozone-CO correlation differences. Since then, the models have evolved significantly, and the above analysis has provided valuable insight into the processes represented in them. A follow-up study that is currently underway aims to explore the role of atmospheric dynamics in shaping the ozone-CO correlation maps. The different representation of atmospheric transport, possibly due to the different re-analyses used for driving the nudging in the models is the most likely cause of discrepancies.

In the future, to solidify the findings of this study, it is also essential to investigate how global ozone-CO correlations are captured in models other than GISS and the UKCA. Furthermore, it will be interesting to examine how this relationship changes under drastically different conditions, e.g. in a pre-industrial or future atmosphere. Both of

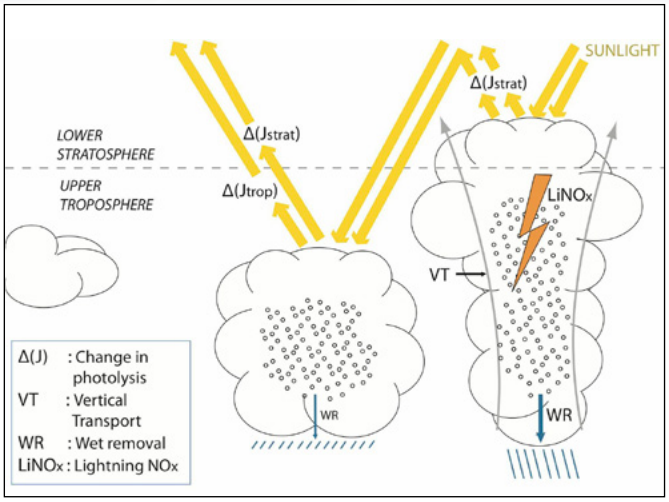

Figure 2. Cloud-related processes that can affect UT/LS composition. The processes depicted are a) changes in photolysis rates in the troposphere and stratosphere due to cloud backscattering, b) vertical transport associated with clouds (the current schematic emphasizes on convection, but other processes, e.g. frontal uplift, are also of relevance), c) wet removal of constituents absorbed in cloud droplets, and d) production of NOx from lightning, which affects ozone. The schematic shows two examples of clouds with different vertical extents, the one extending into the stratosphere.

the above could be achieved within a multi-model framework such as the IGAC/SPARC Chemistry-Climate Model Initiative (CCMI), which will involve a range of composition-climate models simulating both the observational period and past/future atmospheres.

Looking at the Voulgarakis et al. (2011) study from a larger perspective, one realizes that extending its scope goes beyond the boundaries of tropospheric oxidation research. There is a wide range of variables in the composition-climate system that are being modelled nowadays by CCMs, but also measured by satellites on global scales. Performing such a global correlation analysis for different components of the system can reveal important large-scale processes and/or improve their representation in models. Such directions are currently explored in research performed at NASA GISS and at Imperial College London. Additionally, as part of CCMI, there is a plan to analyse upper troposphere/lower stratosphere (UT/LS) cloud-constituent correlations in order to understand how different models simulate such relationships, in comparison with satellite observations.

Clouds can be linked to UT/LS composition (e.g. ozone, water vapour, aerosols) in a variety of ways, e.g. through influences on photolysis of gases, vertical transport of emissions, wet removal, and emissions of lightning NO_X (Fig. 2). These are all processes that are represented in models, but several of them are fairly uncertain and/or not well tested on large scales. In general, clouds remain a large unknown in current composition-climate modelling, and satellite information has not been used much in the past for the evaluation of their role in influencing chemistry (e.g. Liu et al., 2006; Voulgarakis et al., 2009). Hopefully our planned analysis will shed some light on such interactions. Furthermore, as Earth system science moves towards more integrated approaches, we expect that using models in conjunction with satellite observations, and examining different interacting components of the system simultaneously will become more common practice in the future.

References:

Voulgarakis, A., Telford, P. J., Aghedo, A. M., Braesicke, P., Faluvegi, G., Abraham, N. L., Bowman, K. W., Pyle, J. A., and Shindell, D. T.: Global multi-year O3-CO correlation patterns from models and TES satellite observations, Atmos. Chem. Phys., 11, 5819-5838, doi:10.5194/acp-11-5819-2011, 2011.

Chin, M., Jacob, D. J., Munger, J. W., Parrish, D. D., and Doddridge, B. G.: Relationship of ozone and carbon monoxide over North America, J. Geophys. Res., 99(D7), 14565–14573, 1994.

Parrish, D. D., Trainer, M., Holloway, J. S., Yee, J. E., Warshawasky, M. S., and Fehsenfeld, F. C.: Relationships between ozone and carbon monoxide at surface sites in the North Atlantic region, J. Geophys. Res., 103(D11), 13357–13376, 1998.

Zhang, L., Jacob, D. J., Bowman, K. W., Logan, J. A., Turquety, S., Hudman, R. C., Li, Q., Beer, R., Worden, H. M., Rinsland, C. P., Kulawik, S. S., Lampel, M. C., Shephard, M. W., Fisher, B. M., Eldering, A., and Avery, M. A.: Ozone-CO correlations determined by the TES satellite instrument in continental outflow regions, Geophys. Res. Lett., 33, L18804, doi:10.1029/2006GL026399, 2006.

Liu, H., Crawford, J. H., Pierce, R. B., Norris, P., Platnick, S. E., Chen, G., Logan, J. A., Yantosca, R. M., Evans, M. J., Kittaka, C., Feng, Y., and Tie, X.: Radiative effect of clouds on tropospheric chemistry in a global three-dimensional chemical transport model, J. Geophys. Res., 111, D20 303, doi:10.1029/2005JD006403, 2006.

Voulgarakis, A., Wild, O., Savage, N. H., Carver, G. D., and Pyle, J. A.: Clouds, photolysis and regional tropospheric ozone budgets, Atmos. Chem. Phys., 9, 8235-8246, doi:10.5194/acp-9-8235-2009, 2009.

Yan Xiaolu

2013 IGAC Young Scientist Travel Grant Awardee
Workshop on Atmospheric Composition and the Asian Summer Monsoon (ACAM)

Yan Xiaolu, originally from Suqian, Jiangsu, P. R. China, received her undergraduate degree in Physics from Yangzhou University. She proceeded to complete a graduate degree in Environmental Sciences from the Chinese Academy of Meteorological Sciences, and is currently a PhD student in Meteorology at the University of Chinese Academy of Sciences. Here she is researching the observation and study of water vapor and ozone in the upper troposphere and lower stratosphere (UT-LS) over the Tibetan Plateau (TP) and its adjacent regions. Xialou is working on the correction of Vaisala RS92 radiosonde water vapor measurements, with the goal of getting more accurate water vapor data in TP. Additionally she works on the validation of MLS water vapor and ozone products from the upper troposphere to the upper stratosphere through comparisons with balloon-borne Cryogenic Frost point Hygrometer (CFH) and Electrochemical Concentration Cell (ECC) sonde measurements. Her next goal is to work on the detailed structure of the UT-LS in TP.

How has the evolution of your early career affected your perceptions of the field?

My college courses helped me to better understand the mechanism of the radiosonde. A lot of my work was about the in situ observations of water vapor and ozone by the balloon-borne CFH and ECC during my Masters. The campaign in the Tibetan Plateau made me know more about the vertical distribution of water vapor and ozone. I can understand more about the quality control of the measurements when I do the experiment. The intercomparison between CFH and RS92 water vapor measurements work that I have done is based on this. This also helps me do the validation of MLS products.

What components of your research do you find most beneficial for you and for the atmospheric chemistry community?

Atmospheric water vapor and ozone play a critical role in the Earth's radiation budget and atmospheric chemistry processes. TP is the most characteristic region in global middle and low latitudes. But the water vapor and ozone

data in TP, especially in UT-LS altitude region, are very rare. I think the most beneficial component is I get the water vapor and ozone sonde data in TP. Then I analyze the data, combining with satellite data and models.

The TP serves the role of "the world water tower". There is an "ozone valley" in TP during the boreal summer. The TP provides an effective pathway for pollution to enter the global stratosphere. My research can provide more accurate sonde and validation satellite data to analyze the dynamic and chemical process in TP. It also can help to research the interaction between water vapor and ozone in UT-LS altitude region.

How do you want your career to progress and where do you think you can ultimately have the greatest impact?

I think collaboration and communication with others are the two most important ways that I can make progress. I want to participate in more workshops and discuss the opinions and issues with others by email. Since I'm a PhD student, I will have much time to visit or go on research as a postdoctoral. I'd like to seek an opportunity to continue my work in CMA or abroad after receiving my PhD degree.

In what ways will your research change the world around us?

My research can get accurate and high vertical resolutions data in TP. So we can know more about the detailed structure of the upper troposphere and lower stratosphere in TP and get the influence of dynamic transport and chemical process in TP on stratosphere-troposphere exchange and global climate.

The most important thing I learned is about the contributions of different chemical source regions to the upper troposphere, the processes which determine stratospheric water vapor, the way they analyze the data, and the issues that the participants proposed during the workshop.

What was the most important thing you learned from the Workshop on Atmospheric Composition and the Asian Summer Monsoon in Kathmandu and to what extent do you address this in your research?

The most important thing I learned is about the contributions of different chemical source regions to the upper troposphere, the processes which determine stratospheric water vapor, the way they analyze the data, and the issues that the participants proposed during the workshop. At present, I can think of three kinds of approaches to address in my research. First, I want to collaborate with some others who research the model, then I will combine the backward trajectory model and synoptic process to analyze the trajectory of water vapor and ozone in Tibet. Second, I'm going to research the detailed structure in TP in UT-LS altitude region. Then we can know more about the transport mechanism of water vapor and ozone in this area. Third, I want to research the interaction between water vapor and ozone in UT-LS altitude region so we can understand more about the feedback between them.

TF HTAP's 9th Annual Meeting

TF HTAP co-chairs:
Terry Keating, US Enivronmental Protection Agency, USA (Keating.Terry@epa.gov)
Frank Dentener, European Commission - Joint Research Centre, Italy (frank.dentener@jrc.ec.europa.eu)

The Task Force on Hemispheric Transport Air Pollution (TF HTAP) is an international cooperative scientific effort to improve the understanding of the intercontinental transport of air pollution across the Northern Hemisphere. The TF HTAP was organized under the auspices of the Convention on Long Range Transboundary Air Pollution in 2005. The TF HTAP's work programme for 2012-2016 addresses six themes: 1) development of emissions inventories and projections; 2) global and regional modeling of source-receptor relationships; 3) model to observation comparison and process evaluation; 4) assessment of impacts on health, ecosystems, and climate; 5) assessment of climate change on air pollution; and 6) development of a data network and analysis tools.

TF HTAP's ninth annual meeting was held from 20 to 22 March 2013 in Geneva, Switzerland, at the World Meteorological Organization's headquarters, in conjunction with the Global Atmospheric Watch (GAW) Programme 2013 Conference. More than 70 experts attended the meeting in person and approximately 40 experts participated remotely via web conferencing.

Together, experts from approximately 24 countries participated. Presentation materials are available at www.htap.org.

Jointly with GAW and Group on Earth Observations, the first day of the meeting explored the status of efforts to improve the interoperability of data management systems relevant to atmospheric science and policy. This discussion highlighted the work of the GEO Air Quality Community of Practice, the status of the WMO's Information System (WIS), and the development of a network of data archives and web-based user interfaces under Theme 6 of TF HTAP's work programme. A leading example of the capabilities being developed is the FZ Juelich JOIN tool which allows users to visualize data from the HTAP modeling archive and compare results to a number of observational data sets served from other locations (see http://join.iek.fz-juelich.de/htap).

The second and third day of the meeting focused on the design of the planned multi-model experiments for 2006 through 2010 and related analyses under Theme 2 (global and regional modeling) and 3 (model to observation evaluation). As a result of the discussion, TF HTAP decided to limit the future modeling experiments to 2008 through 2010, dropping simulations for 2006 and 2007. The participants also discussed whether emission perturbation experiments should focus on the response to changes in individual pollutants or to the changes in emissions from individual sectors. Participants expressed interest in both methods so both options were left available for further consideration. Candidate global models were identified for producing boundary conditions for regional models once new global emissions data sets are available starting in July.

With global modeling experiments expected to get underway this summer, a technical workshop is tentatively scheduled for San Francisco in

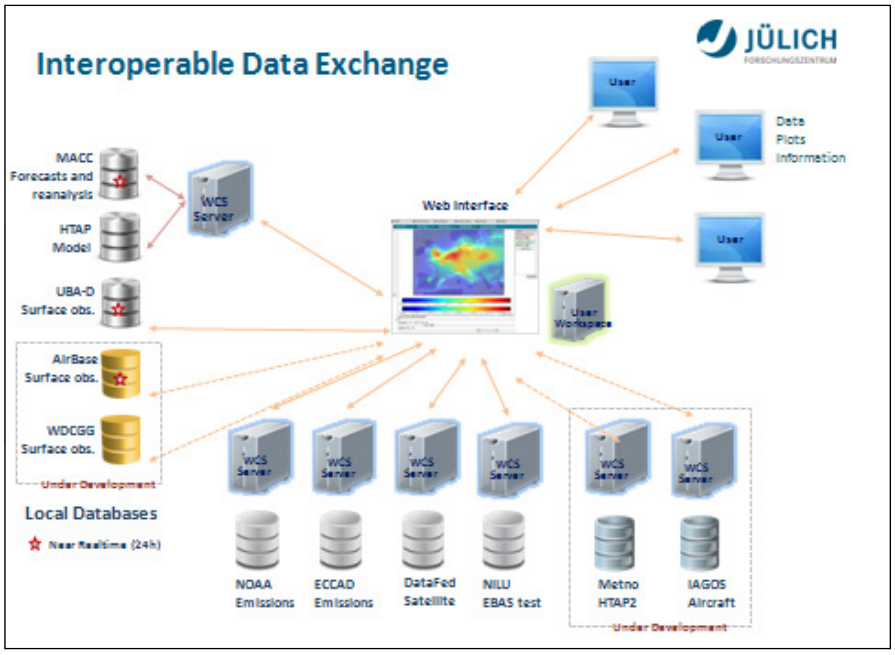

Figure 1. FZ Juelich's JOIN tool for visualization and analysis of distributed modeling and observational data, presented by Olaf Stein and Martin Schultz at the TF HTAP-WMO/ GAW joint workshop, 20 March 2013, Geneva.

The first Sino-European School on Atmospheric Chemistry (SESAC)

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The first Sino-European School on Atmospheric Chemistry (SESAC) took place in Taicang (near Shanghai) from May 17th to 28th. The school brought together 56 PhD students and postdocs mainly from Europe and China but also from many other countries from all over the world working in atmospheric chemistry. The main emphasis of SESAC was building a common awareness between the new generations of scientists in Atmospheric Chemistry and promoting collaboration between them. The event was organized by the above authors and sponsored by the French embassy in China, the Chinese NSF, the Sino-German Science Centre (joint DFG and CNSF), the region Rhone-Alpes, the Fudan University and its Tyndall Centre, and the CNRS.

Lectures were given by eminent scientists in the field. A.R Ravishankara addressed the topics of atmospheric photochemistry and that of Science and Policy Interlinkages: connections between climate change, ozone depletion, and air quality. M. Pilling described homogeneous gas phase chemistry and its modeling via the Master Chemical Mechanism. H. Herrmann and D.J. Donaldson presented lectures on aqueous and heterogeneous atmospheric processes and M.R. Hoffmann addressed the reactions at the air-water Interface in the troposphere. In his presentation, P. Wiesen described the atmospheric structure and atmospheric simulation chambers: past, present and future. J. Kleffmann and T. Wang presented lectures on nitrogen oxide species while M. Shao talked about VOCs study to understand air pollution complex. T. Wallington addressed the topic of the future automotive fuels and vehicle emissions while S. Zhang talked about the thermal chemical conversion of biomass wastes to bio-oils.

A number of lectures, reflecting current hot topics, were dedicated to the atmospheric aerosol, dust and PAHs chemistry, optics, characterization, measurements, observation. Key contributors were X. Yang, G. Evans, R. Zhang, A. Wiedensohler, S. Nizkorodov, Y. Rudich, S. Borrmann, V. Grassian, Th. Hoffmann, P. Laj, and E. Villenave. C. Law, M. Beekmann and B. Vogel gave a series of talks on long-range transport of pollution, large scale modelling and on the atmospheric turbulence. A few sessions were dedicated to air pollution in China. Lectures were given by Y. Zhang, T. Zhu, X. Wang, and L. Zhou.

Accordingly, the students attending SESAC received an intensive training on the most important aspects of tropospheric chemistry and its linkage with climate change and policy making, building a common sense on the urgent matter to be addressed by the upcoming generation of scientists.

Overall, SESAC was a big success as intensive exchanges took place between the students and the lecturers, reflecting constructive exchanges with high potentiality for long-term exchanges – one of the main objectives of the school. Clearly, such events have the potential to help tailor the future of this scientific field.

Conference on Future Challenges of Chemical Mechanism Development for Earth System Models

29-30 May 2013 • Royal York Hotel, York, UK

Alexander T. Archibald, National Centre for Atmospheric Science–Climate, University of Cambridge, UK (ata27@cam.ac.uk)
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Chemical mechanisms play a central role in atmospheric chemistry. At its most basic, a chemical mechanism is responsible for providing a framework to convert reactants into products via elementary steps. Simple? Not quite. Unraveling the complexity of atmospheric chemistry is still a grand challenge (something everyone in IGAC knows!). Since the realization of the large-scale societal impacts of the L.A. smogs in the 1960s and the Antarctic ozone hole, the last half century has seen a quantum leap in our understanding of the chemistry of the atmosphere. However, we are still far from possessing a complete evidence base. As the chemical mechanism acts as a lynchpin for evaluating our understanding, there is a necessity that chemical mechanisms be responsively developed as our understanding evolves. Given the central importance of chemical mechanisms – and the move towards state-of-the-science chemistry being included as a core component of Earth System models – a workshop was recently held dedicated to discussing how far we have progressed chemical mechanism development in the past and what are the likely challenges in the future. The workshop was organized as part of a series of meetings aimed at addressing the challenges involved with incorporating atmospheric chemistry into Earth System models through a recently funded UK Natural Environment Research Council (NERC) network Atmospheric Chemistry In The Earth System (ACITES), led by Prof. Mathew Evans (University of York).

The ACITES workshop on chemical mechanisms was held at the end of May 2013 in York, UK, and was attended by 15 delegates coming from the USA, France and the UK. A wide range of themes were covered including:

- Historical perspectives in mechanism development.
- Policy requirements.
- Outlook for evaluated kinetic databases.
- Explicit mechanisms and the challenges of working with these
- Challenges in evaluating chemical mechanisms in complex models.
- Challenges in automatic mechanism generation and reduction.

One of the greatest challenges identified during the discussions was the issue of funding mechanism development and the potential loss of expertise following a lack of continued funding. One widely used detailed benchmark mechanism, the UK Master Chemical Mechanism (MCM, http://mcm.leeds.ac.uk/MCM) was focused on in particular. The MCM development team outlined a 5 year strategic plan for its development, aiming to put the extensive community of MCM users at the heart of the process of mechanism development.

From Mighty Oaks - Start "big" to go "small"

The need for detailed, well evaluated, benchmark mechanisms like the MCM was made very clear at the workshop. Not only do they act as chemical libraries, they are essential in providing the crucial link between the fundamental laboratory/theoretical studies and developing smaller mechanisms suitable for applications in a wide range of policy and scientific activities where chemical detail is needed, such as Earth system modeling. The protocols used to construct these mechanisms were identified as key to ensuring integrity and continuity. Making the details of the protocol rules transparent and easily available to users was highlighted as a step in the right direction to enhance community engagement. A conclusion of the workshop was that there is a need for the establishment of new metrics to evaluate mechanisms against, a task that the involvement of the wider atmospheric chemistry community will greatly help to achieve.

Conference on Air Quality and Climate Change Policies: Separate or Joint Challenges?

21 May 2013 • Brussels, Belgium

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Air pollution and climate change are often treated as separate problems. In the EU, two very different regulatory frameworks have been developed and politically the challenges are addressed by separate departments. However, air pollution and climate change are inexorably linked with regard to their causes, effects and mitigation options. In addition, a joint approach is estimated to be economically cheaper and more sustainable. This conference has shown that the usefulness of integration is widely accepted within the European Union and that it is time to specifically think about the next steps. The degree of integration within the two policy areas, however, needs to be evaluated carefully in order to prevent delays in action or other inefficiencies. Nevertheless, a first no regret and immediately applicable step is to evaluate consequences for air quality when implementing climate change mitigation options and vice versa to make use of co-benefits and to avoid trade-offs. Concrete examples are listed in the section "next steps".

The need for Integration

The following main needs for integrating air quality and climate change policies were identified:

- Climate change and air pollution are two of the most challenging global environmental problems. There is an international consensus to limit global warming to 2°C to keep climate impacts manageable. By 2050 the single most important global environmental cause of premature death is projected to be air pollution.
- Air pollution and climate change are linked via the simultaneous emission of greenhouses gases and air pollutants from the same sources and the resulting approaches for a joint mitigation. Examples for these "multi-effect-sources" are motorized vehicles or coal-fired power plants. Co-control of emissions is one of the strongest arguments for integration of policies.
- Many air pollutants have warming or cooling effects on climate. Conversely, climate change has the potential to aggravate air pollution e.g., through altered weather patterns.

Potential

Simultaneous action against the emission of air pollutants and greenhouse gases results in several co-benefits:

- The socio-economic co-benefits to air quality are significant - on average about € 35 per ton CO2 avoided. For Europe specifically, if climate mitigation policies to achieve the 2°C climate target are implemented, it is estimated that 10 billion Euro could be saved annually within the air pollution control sector. Furthermore, 23,000 premature deaths yearly due to fine particulate matter (PM2.5) and ozone could be avoided through 2030.
- Systemic changes (e.g., the 'Energiewende' in Germany) have many 'side benefits' especially through multi-pollutant measures of energy efficiency that even go beyond the air quality or climate ones, which includes significant cost savings.

Challenge

Even though the need and potential of integrating the two policy areas are evident, an actual implementation requires careful consideration due to a variety of challenges:

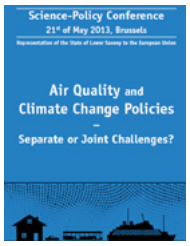
- Not only synergies but also trade-offs exist for the various measures available for climate change and air quality mitigation, thorough evaluation of these aspects is necessary.
- Points to be aware of when thinking about integration include that impacts and benefits occur at different temporal and spatial scales, that there are different perceptions of relevance, and that the uncertainties are different for air quality and climate change.
- Integration will be useful up to a certain extent. However, full integration might prevent fast progress in either policy sector under

specific circumstances. In addition, the inclusion of other sectors, such as agriculture, energy or transport, need to be carefully taken into account.

Next Steps

A key result from this conference is that the need for policy integration is widely accepted, but that the actual degree of integration is yet to be elaborated. Several concrete solutions and next steps were identified and the challenge ahead is their implementation. The following options were discussed:

- Good starting points to make use of co-benefits are e.g., retrofits to current vehicle fleets including ships, and regulation of emissions from stoves, biomass burning and non-road mobile machinery. In addition, stressing energy efficiency is highly relevant. Incentives to encourage action are needed. Those however, need to be flexible as the optimal solution is different depending on the location.
- Across all scales of implementation, evaluating the impacts for climate change when mitigating air pollution and vice versa will easily prevent trade-offs and foster measures that lead to co-benefits.
- A prerequisite for efficient joint action are specific targets with respect to air and climate policy in the EU. Source policies need to be considered, specifically agriculture, non-road mobile machinery, and domestic solid fuel combustion. New and more ambitious emission ceilings for air pollution in general but also including methane and PM2.5 (NEC) for 2020/2025 are relevant within this context. For climate change, adopting binding targets before 2015 for renewable energy sources, GHG emissions, and energy efficiency will help streamlining both policy areas.
- At the European level the framework that facilitates integrated implementation at regional, national and local scales needs to be designed. Cities are often lacking the power to prevent actions that cause trade-offs. Tools that allow evaluating measures for air quality, climate change and energy efficiency simultaneously need to be developed. In addition, the spending of limited funds for mitigation needs to be balanced between the more expensive, systemic change options with longer term gains and the more easily implementable 'end of tailpipe' measures.
- For the evaluation of effective integration gaps in the monitoring and data management across Europe need to be filled. Also, appropriate evaluation metrics will need to be developed.



More detailed background information and podcasts are available at: http://climpol.iass-potsdam.de, http://www.russfrei-fuers-klima.de/international/events/workshop-air-quality- and-climate-change-policies-seperate-or-joint-challenges-21-5-2013-1/

On the importance of having the right data to support Air Quality and Climate Change integration

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A number of initiatives in the science and policy arenas are looking at different aspect of the air quality and climate change issues and their inter-linkages, such as the Climate and Clean Air Coalition, the Air Pollution & Climate Initiative (IGBP/IGAC), the ClimPol Project (IASS), and various other research (e.g., European FP7 projects ECLIPSE and PEGASOS) and policy initiatives from the local to regional scale. These initiatives attest to both the scientific and political relevance of the topic. From a scientific perspective, emissions of greenhouse gases and air pollutants come from the same sources, and each has a relevant effect on the other. A number of 'air pollutants' also affect climate forcing, directly and indirectly, and on different spatial scales. Climate change is projected to have a number of influences on future air quality, from changes in emissions to alteration of weather patterns. From a policy perspective, the simultaneous emission of greenhouse gases and air pollutants means possible co-benefits and avoided trade-offs for mitigation options, as well as significant potential for cost savings. Integral for informed decision-making is a way to understand the different roles of the greenhouse gases and air pollutants, and their environmental effects. It is rather essential that a correct relationship between air pollutant and greenhouse gas emissions and their combined effect on the environment can be made and this is where metrics are crucial.

We would like therefore to bring your attention to a session at the 2013 AGU Fall Meeting on 'Linking Air Quality and Climate Change Metrics' (A038). With this session we hope to explore a variety of aspects related to metrics available for air quality and/or climate, especially any new developments or revisions within the field of metrics. The information from this session will hopefully raise awareness of the different types of metrics that are currently being used, the science behind them, and the applicability and limits of such metrics to decision-making. Building on previous work, a series of workshops are also being planned or are underway on the topic of metrics within the framework of air quality and climate change. The information presented at the AGU session would also be communicated back to the initiatives working on the topic, with an aim to foster communication among the sectors for which such metrics are relevant. Working on this topic? Please think about submitting an abstract to the AGU session. Interested to know more? Please contact the authors.

Pan American Advanced Studies Institute (PASI) on Atmospheric Processes of Latin America and the Caribbean: Observations, Analysis, and Impacts

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The 2013 Pan American Advanced Studies Institute (PASI) on Atmospheric Processes of Latin American and the Caribbean: Observations, Analysis, and Impacts was held at the Almirante Padilla Naval Academy in Cartagena, Colombia from May 27 – June 7, 2013. This two-week short course was designed to provide early career scientists with an introduction to the most significant atmospheric and ocean processes of the Intra Americas Seas (IAS) region. The short course included lectures, computer labs, and group research projects. Thirty-five early career participants gathered from twelve countries to listen and interact with nine lecturers from across the Americas.

This course was focused on improving the regional knowledge, capabilities, and communication between atmospheric scientists in the United States and their counterparts in the Americas. The short-course had the following objectives:

- Contribute to the broader knowledge of atmospheric processes of the Americas through lectures, open discussions, and dissemination of electronic learning modules.
- Promote the use of and access to freely available model, observational, and visualization tools for use within the international geoscience community.
- Promote the development of early career scientists through the interaction with a diverse collection of internationally recognized lecturers.
- Facilitate international collaborations through group and individual discussions and planning.

The topic of African dust transport, and how the Caribbean serves as a receptor for these aerosols was recognized as a key component of the Caribbean weather and climate system. Lecture and computer labs that were specifically related to African dust in the Caribbean provided both theoretical and hands on experience with model output as well as in-situ and satellite data. A sub-set of the participants worked collaboratively on a research project that utilized data and analysis tools that were presented during the short course to investigate a June 2012 Saharan Air Layer (SAL) event.

The short course was also intended as a way of introducing researchers to the Continuously Operating Caribbean Observational Network (COCONet). COCONet is a regional network of Global Navigation Satellite System (GNSS) instruments and surface meteorology stations that will provide continuous total column precipitable water vapor, surface pressure, temperature, relative humidity, horizontal winds,sand precipitation measurements across the Caribbean and Latin America. It is a multidisciplinary project that will form the backbone for a broad range of geoscience and atmospheric investigations (Braun, et al., 2012). Its utility in tracking the dry air masses that are associated with SAL events was demonstrated within the group research project.

Based on preliminary feedback from the PASI participants, the course was successful in introducing early career scientists to many of the important elements of the regional atmospheric system as well as fostering an environment of international cooperation and open data.

The National Science Foundation was the primary sponsor of the event (grant OISE-1242281). Additional support was provided by NOAA, Colombian Navy, the Colombian Geological Survey, the Colombian General Maritime Directorate (DIMAR), the World Meteorological Organization, the University Corporation for Atmospheric Research (UCAR), UNAVCO, and the COCONet project.

References:

Braun, J. J., G. Mattioli, E. Calais, D. Carlson, M. Jackson, R. Kursinski, M. Miller, R. Pandya, 2012: Multi-disciplinary natural hazards research initiative begins across Caribbean basin, EOS. Transactions of the American Geophysical Union, Vol 93, No 9, doi:10.1029/2012EO090001.

Photo courtesy of Gete Bond, UCAR/JOSS.

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calendar

July

DACA-13
8–12 July 2013
Davos, Switzerland

Health, Agriculture, and Water Risks Associated with Air Quality and Climate in Asia
9–12 July 2013
Boulder, CO, US

Gordon Research Conference
July 28–2 August 2013
West Dover, VT, US

August

Colombian Conference and International Meeting on Air Quality and Public Health
13–16 August 2013
Bogota, Colombia

iLEAPS: Communicating Science to Society: Coping with climate extremes for resilient ecological-societal systems
21–24 August 2013
Seoul, Korea

Goldschmidt2013
25–30 August 2013
Florence, Italy

33rd NATO/SPS International Technical Meeting (ITM) on Air Pollution Modeling and Its Applications
26–30 August 2013
Miami, FL, US

September

IGAC SSC Meeting
September 30–4 October 2013
Kruger Park, South Africa

October

Capacity Building Workshop on Modeling of Regional Climate and Air Quality for West Africa
7–11 October 2013
Abidjan, Cote d'Ivoire

Stratospheric Sulfur and Its Role in Climate (SSiRC)
28–30 October 2013
Atlanta, Georgia, US

November

IGBP/ IGAC Air Pollution & Climate Initiative Workshop
5–7 November 2013
Boulder, CO, US

January, 2014

SPARC General Assembly
12–17 January 2014
Queenstown, New Zealand

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