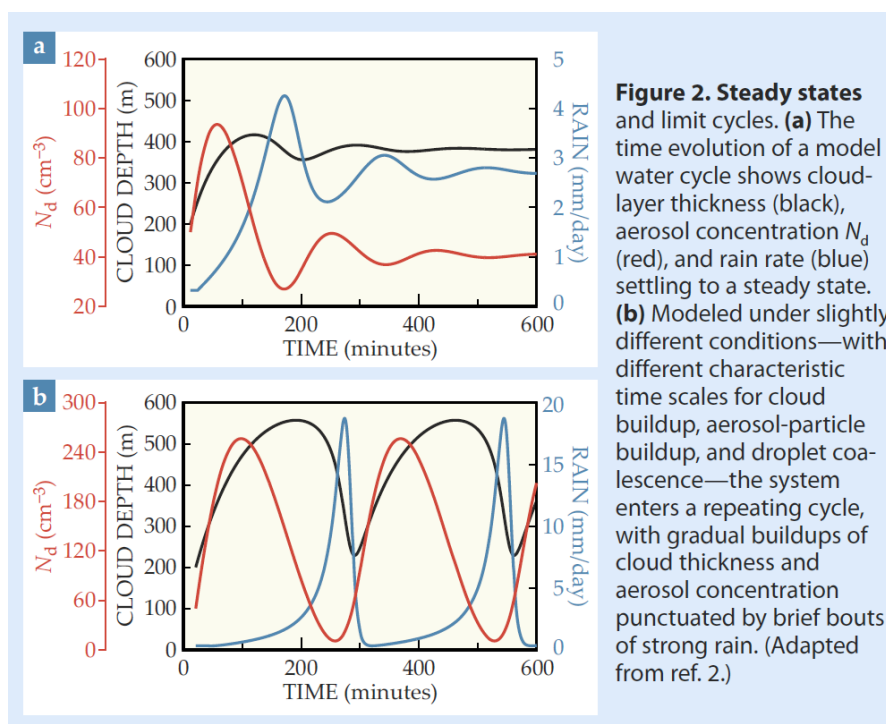


Throughout this report, please note collaboration with other IGBP and ESSP projects, IGBP National Committees, networking organisations (IAI, APN), ICSU bodies, etc., and where the work contributes to IPCC and the new ICSU *Earth System Sustainability Initiative*.

1. Key scientific highlights/findings

Aerosols, Clouds, Precipitation, & Climate (ACPC)

Ilan Korena and Graham Feingold attempted to view processes in the atmospheric as dynamic systems with preferred modes of behavior as opposed to the more Newtonian method of breaking systems down to their components. What they found is that the aerosol-cloud-precipitation system exhibits characteristics of the predator prey problem in the field of population dynamics. With the inspiration of the simple predator prey equations they were able to develop a mathematical expression composed of three equations for the aerosol-cloud-precipitation system that yielded rich dynamical outcomes. The model predicts that aerosol-rich skies should eventually settle into a steady state like that shown in the figure below. Feingold believes this model as potentially valuable complement to LES-type approaches.

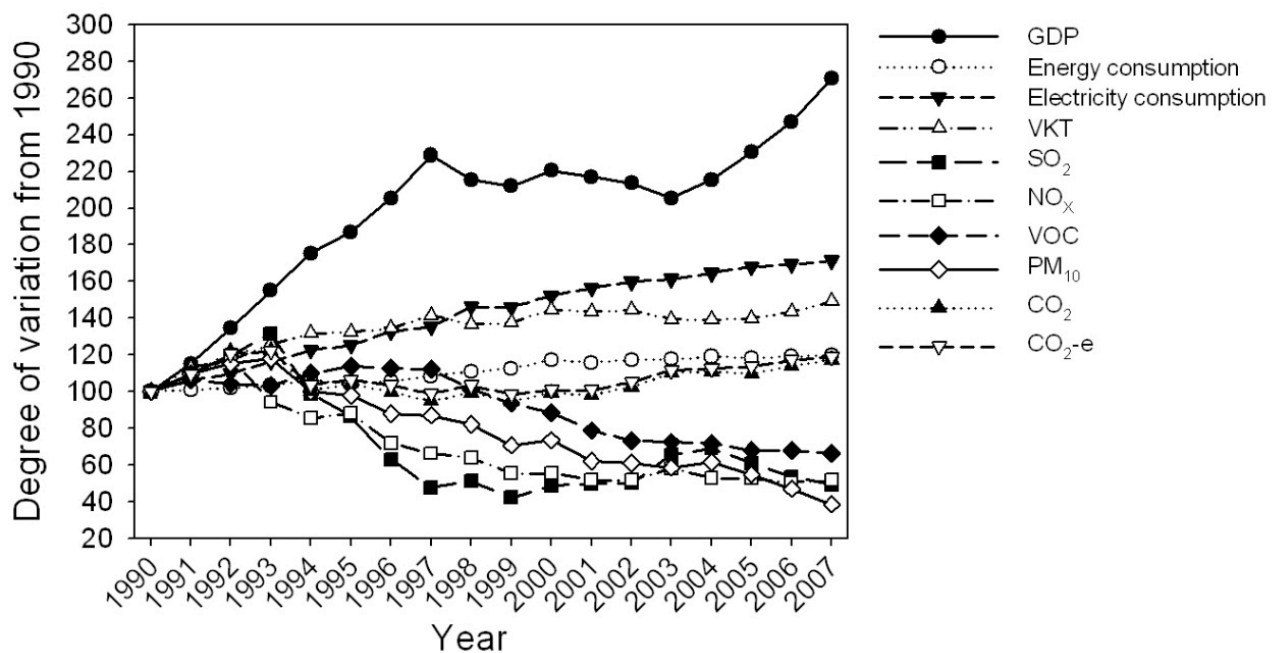


I. Koren and G. Feingold. Aerosol–cloud–precipitation system as a predator-prey problem. *PNAS* 2011 108 (30) 12227-12232; published ahead of print July 8, 2011, doi:10.1073/pnas.1101777108

A. Smart, (2011). Minimalist model captures water cycle complexities. *Physics today* 64(9) 19.

The Impact of Megacities on Air Pollution and Climate

In 1990 the Hong Kong Special Administrative Region put in place regulations that increased fuel efficiency, reduced consumption of pollutant-emitting products, and restricted emissions. While the GDP of Hong Kong has increased over 170% since 1990, it has been observed that consumption and pollutant concentrations have not increased at the same dramatic rate. A number of pollutants such as NO_x , VOC, SO_2 , and PM_{10} have either decreased or remained the same as their 1990 levels. These control measures have effectively reduced the local emission of pollutants (~50% reduction in SO_2 , NO_x , and PM_{10} and ~34% reduction in VOCs) despite the increase in VKT (~50%) and energy (~20%) and electricity consumption (~70%) over the years. The implication of these numbers is that climate and air pollution policy does not necessarily have a direct negative impact on GDP growth.

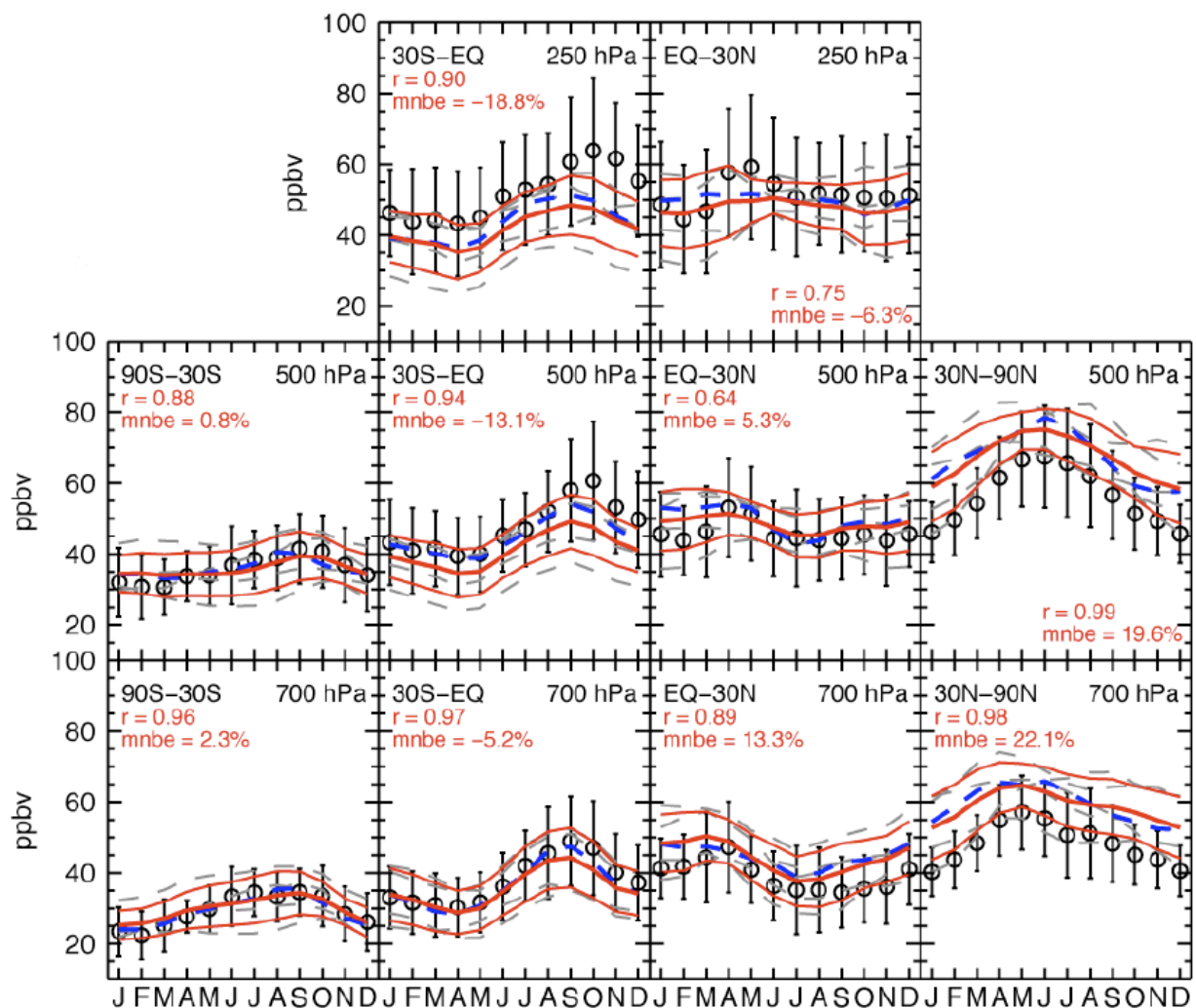


(Above) Trends of gross domestic product (GDP), energy and electricity consumption, vehicle kilometers travelled (VKT), and atmospheric emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compound (VOC), respirable suspended particulates (PM_{10}), carbon dioxide (CO_2) and carbon dioxide equivalent ($\text{CO}_2\text{-e}$) in HKSAR in 1990 – 2007 (1990 = 100). Note: Energy consumption stands for energy consumed via town gas, liquefied petroleum gas, oil and coal products, and electricity. $\text{CO}_2\text{-e}$ is a measure used to compare the emissions from various greenhouse gases (e.g. carbon dioxide, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)) based upon their global warming potential.

Trumbull K. (2007). Still holding our breath a review of air quality policy in Hong Kong 1997-2007. Civic Exchange, Hong Kong, 149pp

Atmospheric Chemistry & Climate (AC&C)

The Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP) continues to be a useful resource for modeling issues of climate sensitivity, historical climate, and climate projections. Experiments cover many short-lived species responsible for ground level pollution, particularly ozone and fine particulate matter. The ACCMIP models recent diagnostics have allowed the evolution of individual budget terms to be tracked in detail and helped understand their influence on ozone concentrations. It is necessary to understand how the ozone budget and concentrations respond to changes in emissions and climate in order to develop ozone control strategies. The ACCMIP experiments cover many short-lived species responsible for ground level pollution, particularly ozone and fine particulate matter.



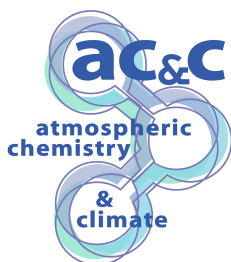
(Above) Comparison of model simulations (2000 time slice, red for multi-model mean, blue for multi-model median) against climatology of the ozone sondes in the given latitude bands. Error bars are the mean of the temporal standard deviations of the ozone sondes. Correlation coefficient and mean bias are also indicated for each region. Results are preliminary.

Kawase, H., T. Nagashima, K. Sudo, and T. Nozawa (2011). Future changes in tropospheric ozone under Representative Concentration Pathways (RCPs), *Geophys. Res. Lett.*, 38, L05801, doi:10.1029/2010GL046402.

2. Activities

List of Current Activities:

- *Atmospheric Chemistry and Climate (AC&C)*
Jointly sponsored with WCRP-SPARC



The AC&C initiative seeks to improve the representation of chemistry/climate interactions in models. Activities within AC&C are coordinated with other modeling activities such as SPARC's Chemistry-Climate Model Validation Activity (CCMVal), the Aerosol Comparisons between Observations and Models (AeroCom) project, and the Task Force on Hemispheric Transport of Air Pollution (HTAP) to assure maximum efficiency in model runs, meeting planning, and resources. There are currently four efforts occurring within AC&C.

- *Bounding the Role of Black Carbon in Climate*
Lead Authors: Tami Bond, University of Illinois, USA; Sarah Doherty, University of Washington, USA; David Fahey, NOAA, USA; Piers Forster, University of Leeds, UK

This focussed effort is to produce an assessment report that summarizes the most current knowledge on black carbon (BC) and its role in climate as well as provide a best estimate and uncertainty range for the radiative forcing by BC. The report discusses BC emissions/sources, concentrations, microphysical and optical properties, climate forcing mechanisms, reconciling different forcing estimates, and discussion of the mitigation potential for BC-rich sources. Critically, it also includes an estimate of the total forcing due to BC and co-emitted species from BC-rich sources. This effort results from a request for such an assessment by national and international groups trying to formulate policies to mitigate short-term climate warming. It is also expected to constitute a direct input to the next Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5), and has been structured to accommodate the IPCC framework. The report will be submitted in 2012 to *Journal of Geophysical Research – Atmospheres*.

- *AC&C Model Intercomparison Project (ACCMIP)*
Co-Chairs: Drew Shindell, NASA, USA and Jean-Francois Lamarque, NCAR, USA

ACCMIP is providing extensive coordinated model simulations, diagnostics, and evaluations of the effect of short-lived species on climate, in coordination with the climate model intercomparison effort (CMIP5). The main focus is on the role of tropospheric ozone and aerosols, which both have substantial climate forcing that vary widely in space and time. The first set of model runs for ACCMIP were completed this past year and the first workshop was held in April 2011 in Toulouse, France. A follow-up workshop will be held in February 2012 in Pasadena, CA USA in conjunction with an HTAP meeting. The model evaluation is expected to be completed in time to support the IPCC AR5. Visit <http://www.giss.nasa.gov/projects/accmip> for more information

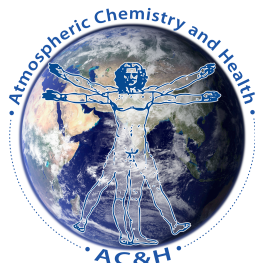
- *AC&C Hindcast*
Chair: Peter Hess, Cornell University, USA

This modeling activity seeks to test and diagnose global chemistry models using the past few decades of observations to quantify and reduce uncertainties when these models are used in climate system models to project conditions in the 21st century. Through this process, more objective measures of uncertainty in modeling atmospheric chemistry and transport and thus in projecting future composition will result. This effort focuses on atmospheric oxidants, in particular ozone and OH, but also includes aerosols.

- *AC&C Vertical Distributions*
Co-Chairs: Celine Mari, Laboratoire d'a'erologie, France and Mary Barth, NCAR USA

Previous model comparisons show there are large uncertainties in the vertical distribution of trace gases, even when the same emissions are used. This effort focuses on a model intercomparison project to better understand convection and scavenging processes that drive the vertical distribution of trace gas species. An important component of the model intercomparison will be comparisons with observations from the 2006 African Monsoon Multidisciplinary Analysis (AMMA) project. Looking forward, there is also interest in performing a model intercomparison using observations from the upcoming 2012 Southeast Asian Composition, Cloud, Climate Coupling Regional Study (SEAC4RS, <http://espo.nasa.gov/missions/seac4rs>) funded by NASA and NSF depending on the outcomes of the field campaign.

- *Atmospheric Chemistry & Health (AC&H)*
Chair: Candice Lung, Academia Sinica, Taiwan



Research on atmospheric chemistry is motivated by the possible impacts on climate, ecosystems, and human health caused by the changes of atmospheric composition. Research ranges from laboratory measurements on the formation of pollutants, field campaigns on detailed gas and aerosol composition, long term observations at background stations (trend detection), satellite observations, regional and global scale modeling, focusing on short-term periods (weeks) to multi-decadal composition change. Research on health effects of atmospheric pollutants focuses on the relationships between exposure to outdoor air pollution and a range of acute and chronic health effects. This research comprises epidemiologic studies of the effects of short- and long-term human exposure to air pollution and toxicological experiments in animals as well as in-vitro studies of tissues and cells. Epidemiologic studies generally use ground-level measurements of air pollution at a limited number of locations, either alone or as part of spatial and or temporal models, to estimate the exposure of study populations, while toxicological studies use controlled experiments to evaluate toxicity and to

understand the mechanism of air pollutants. Despite many shared issues, the atmospheric chemistry and health communities have developed research programs that, for the most part, do not explicitly acknowledge or relate to one another, and, as a result, even basic knowledge is not always widely shared. This initiative will bring together these two communities to explore the various and multi-dimensional interactions between atmospheric chemistry and human health, with IGAC leading the atmospheric chemistry research needs. AC\&H held its first workshop in October 2011 in Boston, MA USA at the Health Effects Institute (HEI). In addition, IGAC will have a session on Atmospheric Chemistry & Health at its biennial Open Science Conference in 2012 and will lead a symposium at the 2013 ISES-ISEE-ISIAQ Conference in Basel, Switzerland (<http://www.ehbasel13.org>).

- *Aerosols, Clouds, Precipitation, & Climate (ACPC)*

Jointly sponsored by iLEAPS and WCRP-GEWEX\

Co-Chairs: Graham Feingold, NOAA, USA and Meinrat O. Andrea, Max Planck Institute for Climate, Germany

ACPC

ACPC was established in 2007 to obtain a quantitative understanding of the interactions between aerosol, clouds, and precipitation and their role in the climate system. ACPC is a coordinated effort encompassing six strategic elements: 1) a focus on regimes where there are strong indications of aerosol-cloud-precipitation interactions; 2) an emphasis on statistical characterizations of aerosol-cloud-precipitation interactions; 3) the development of approaches that leverage past and ongoing activities; 4) thorough integration of modeling and observational activities; 5) a hierarchical approach to both modeling and data collection/analysis; and 6) continued development of measurement techniques (The ACPC Science Implementation Plan can be downloaded at <http://igac.jisao.washington.edu/CurrentProjects/ACPCSciPlan.pdf>). In addition, a new component of ACPC is the SAT-ACPC effort, which seeks to address specifically how satellite-based measurements can be used to improve the understanding of the role of aerosols in precipitations processes.

- *Air-Ice Chemical Interactions*

Co-Chairs: V. Faye McNeill, Columbia University, USA and Thorsten Bartels-Rausch, PSI, Switzerland



AICI was first endorsed by the IGAC SSC in 2003 in light of research demonstrating new processes observed in the polar regions at the air-ice interface. The goal of AICI was to assess the significance of these processes at local, regional, and global scales by bringing together the laboratory, field, and modeling communities. The first phase of AICI was very successful providing important information on the full range of processes and trace gases that are exchanged at the air/ice and snow/ice interface and how they related to atmospheric chemistry and climate. The first phase resulted in various publications, including a Special Issue in Atmospheric Chemistry and Physics. In June 2011, AICI held a workshop at Columbia

University, USA that brought together new insights from AICI studies over the last eight years, including work carried out at part of Ocean-Atmosphere-Sea Ice-Snowpack (OASIS), International Polar Year (IPY), and another IGAC task Halogens in the Troposphere (HitT). The past eight years of research produced new insights into cirrus ice and NO_y chemistry of the upper troposphere, air-snowpack exchange, and the role of halogen activation in the polar boundary layer. Much discussion during the workshop dealt with novel laboratory results that provide a molecular level understanding of the chemistry in snow and with the challenge to connect those to field observations by appropriate models. The challenge to develop detailed snow-chemistry models that better describe and predict air-snow interactions is considerable given that the chemistry proceeds via multiple steps, the snow is highly heterogeneous, and the number of important trace gases and radicals is numerous. The outcome of the Columbia University workshop will be a joint special issue in *Atmospheric Chemistry and Physics* and *Earth System Data* on "New Perspectives on Air-Ice Chemical Interactions".

○ *Air Pollution & Climate: A Science-Policy Dialogue*

Co-Chairs: Kathy Law, LATMOS, France and Paul Monks, University of Leicester, UK



As part of its second phase synthesis activities, the IGBP has identified several key areas which cut across research in its own core projects and which also reach out beyond IGBP with the aim of exploring future cross disciplinary research needs. The IGBP Air Pollution & Climate initiative, lead by IGAC, seeks to open a science-policy dialogue on the air pollution and climate change challenge. There is still a separation between air pollution and climate change in both the policy and scientific communities. As with many issues, there also exists a divide between the scientific and policy communities that hinders communication and understanding. The aim of the Air Pollution & Climate Initiative is to break down these divides and clarify the synergies and trade-offs of research and mitigation efforts across a spectrum of air pollution and climate change policies. The outcomes of this initiative will be an IGBP Statement on the Air Pollution and Climate Change Opportunity to be released at the Planet Under Pressure conference March 2012 and a Strategic Plan for a Multi-Disciplinary Program on Air Pollution and Climate that engages the international earth system science, social science, and policy communities to be released end of 2012.

○ *African Monsoon Multidisciplinary Analysis – Atmospheric Chemistry (AMMA-AC)*

Chair: Abdourahamane Konare, University of Cocody, Cote d'Ivoire

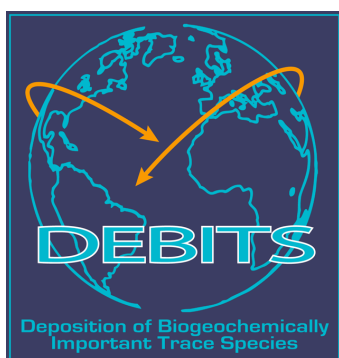


AMMA is an international project launched in 2002 to improve knowledge and understanding of the West African Monsoon, its variability, and its impact on West African nations. Now in Phase 2, 2010-2020, AMMA-AC will continue to expand the West Africa measurement network in order to provide critical information to the overall AMMA Phase 2 key research themes: 1) interactions between society, environment, and climate; 2) study of the predictability and improvement of meteorological, seasonal, and climate forecasting; and 3) continued effort to enrich knowledge of the monsoon system.

- *Biomass Burning Initiative*
Jointly sponsored by iLEAPS and WMO

Biomass burning changes the land surface drastically and leads to the release of large amounts of trace gases and aerosol particles that play important roles in atmospheric chemistry and climate. In addition, there is large uncertainty on how climate change and global change will impact the frequency, intensity, duration, and location of biomass burning in the short- and long-term making their emissions a large source of uncertainty of future atmospheric composition. Therefore biomass burning and its emissions need to be observed and modeled accurately for understanding the composition of the atmosphere and how it changes at different temporal and spatial scales. Significant gaps remain in our understanding of the contribution of deforestation and savanna, forest, agricultural waste, and peat fires to emissions. Coordinated international activities organized by IGAC, iLEAPS, and WMO (e.g. interdisciplinary laboratory measurements and field campaigns that integrate ground-based and airborne observations as well as detailed analysis of satellite data and numerical modeling results) will help better quantify the present and future impact of biomass burning emissions on the composition and chemistry of the Earth's atmosphere.

- *Deposition of Biogeochemically Important Trace Species (DEBITS)*
Jointly sponsored by WMO
Chair: Kobus Pienaar, North-West University, South Africa



Wet and dry deposition of chemical species to the earth's surface plays an essential role in controlling the concentration of gases and aerosols in the troposphere. The chemical composition of atmospheric deposition provides important information on many interacting physical and chemical mechanisms in the atmosphere such as emission sources, atmospheric dynamics and transport, atmospheric removal processes, and nutrient cycling in ecosystems. Long-term research on deposition thus provides critical information on natural and anthropogenic influences on the atmosphere and provides information on the temporal and spatial evolution of atmospheric chemistry. Phase I of DEBITS, which was initiated in 1990 under the first phase of IGAC, focused on the development of an international measurement network of stations to monitor the wet and dry deposition of biogeochemically important trace species. As a result of Phase I, DEBITS stations are of the highest data quality and assurance, following the WMO/GAW data quality objectives. In Phase II, the DEBITS science community has adopted a twofold approach to maintain the present operational structure of DEBITS and to support a new integrated approach to deposition flux measurements and impact studies. Despite the efforts of DEBITS and other research, wet and especially dry deposition, remain a large unknown in the chemical budget of the atmosphere.

- *Fundamentals of Atmospheric Chemistry*
Fundamental atmospheric chemistry research provides essential data used in all practical (laboratory, field measurements, remote sensing) and theoretical (climate modeling, pollution modeling, cloud microphysics) aspects of scientific endeavor. These studies encompass a diverse range of areas including gas-phase kinetics, heterogeneous chemistry, chamber studies, photochemistry, spectroscopic and thermodynamic chemical data, and meteorology that together, with the attendant measurement techniques, deliver the data and the constant evolution required to work in the atmospherically relevant physical and chemical regimes. The evolution of atmospheric chemistry research has resulted in more emphasis on field research and modeling than on fundamental research typically done in the laboratory. Therefore, laboratory studies for atmospheric chemistry stand at a cross-roads. In many respects they are decreasing due to shifts in funding towards large field campaigns.. Many of the pioneers and innovators of the last great paradigm shift have begun to retire and there is a risk of a shrinking community, yet the need remains the same if not more in light of challenges such as climate change, climate manipulation, and pollution-related health impacts. In response, IGAC is exploring the need for an initiative on Fundamentals of Atmospheric Chemistry that would stress the importance of continued fundamental research in atmospheric chemistry but that would explore innovative ways fundamental research could be sustained and possibly move from the laboratory bench to, for example, a component of field research.
- *Global Emissions Initiative (GEIA)*
Jointly sponsored by iLEAPS, AIMES
Co-Chairs: Greg Frost, CU/CIRES and NOAA, USA and Leonor Tarrason, NILU, Norway



For the past two decades, GEIA (formerly known as the Global Emission Inventory Activity) has provided access to various global and regional emission inventories in a consistent framework, organized workshops that bring together inventory developers and users, prepared state-of-the-science emission summaries and provided these data to international scientific projects. The joint IGAC/iLEAPS/AIMES GEIA initiative seeks to build on the success of the past two decades by expanding the breadth of GEIA's activities in order to be a forum for exchange of expertise and information that unite the scientific, regulatory, and operational emission communities. Under the new GEIA umbrella (<http://geiacenter.org>), the well-respected GEIA emission inventory portal merged with the Emissions of atmospheric Compounds & Compilation of Ancillary Data (ECCAD, <http://eccad.sedoo.fr>) portal. GEIA also includes the Community Initiative for Emissions Research and Applications (CIERA, <http://ciera-air.org>), which works to facilitate the consistent, timely, and transparent development of emissions inventories at all scales, including evaluations and analyses of emission datasets, and the inter-operational exchange and communication of emissions information. Significant advances planned for the new GEIA are the introduction of new observations from space and from a variety of Earth-based platforms, and the incorporation of other emission efforts such as operational emissions that can be used for air quality forecasting. A workshop on the new direction of GEIA will be held in June 2012 in Toulouse, France.

- *The Impacts of Megacities on Air Pollution and Climate*
Lead Author: Tong Zhu, Peking University, China

As of 2008, for the first time, the majority of the world's population is living in urban areas, many in megacities (with populations over 10 million). Megacities are not only the center of growing economies, but are also large sources of air pollutants and climate-forcing agents. Under this initiative an assessment has been written that for the first time summarizes the current knowledge around atmospheric chemistry in megacities in Africa, Asia, South America, North America, and Europe. The assessment also summarizes past and current research projects on this topic such as MEGAPOLI, CityZen, ICARTT, CalNex, MILAGRO, CareBeijing, PRIDE-PRD, and IMPACT. Finally the report will identify knowledge gaps on atmospheric chemistry in megacities. The writing of this report was a major effort of the past three years and it is now nearly complete. WMO has agreed to print and distribute the assessment to be released in 2012. In the future, IGAC plans to provide updates to this assessment every 4 to 5 years.

- *Halogens in the Troposphere (HitT)*
Jointly sponsored by SOLAS
Co-Chairs: Roland von Glasow, University of East Anglia, UK and Ulrich Platt, University of Heidelberg, Germany



The primary objective of the SOLAS/IGAC task HitT is to determine and quantify the importance of reactive halogen compounds (RHCs) in tropospheric chemistry and climate forcing. Key themes are the influence of RHC on the oxidative capacity of the atmosphere, the ozone budget, as well as in aerosol nucleation and growth. The goal of HitT is to facilitate international collaboration between laboratory, field, and model activities regarding tropospheric halogen chemistry especially in the following domains: polar regions, salt lakes, marine boundary layer (both remote and coastal), volcanoes, free troposphere, and urban areas. Since HitT was first endorsed as an IGAC Task in 2007, halogens in the troposphere has become a very active research field publishing special issues *Atmospheric Chemistry and Physics* on "Radical Chemistry over sunlit snow: interactions between HO_x and halogen chemistry at Summit, Greenland (http://www.atmos-chem-phys.org/special_issue211.html) and "The TransBrom Sonne ship campaign in the West Pacific" (http://www.atmos-chem-phys-discuss.net/special_issue150.html). HitT also works closely with the AICI IGAC Activity as well as the international multidisciplinary OASIS program. Advancements in atmospheric chemistry research on halogens in the troposphere is leading to several upcoming field campaigns such as the 2012 Tropical Ocean troposphere Exchange of Reactive Halogen Species and Oxygenated VOC (TORERO) field campaign funded by NSF and NCAR, the Surface Ocean Processes in the ANthropocene (SPORAN II) funded by the German Federal Ministry for Education and Research, and HALOPROC II funded by the German Research Foundation (DFG). Due to the exciting new research emerging from this field, IGAC will continue to jointly sponsor HitT with SOLAS in the future.

- IGAC China Working Group
Chair: Tong Zhu, Peking University China



The sheer magnitude of China's landmass coupled with its growing and economically advancing population makes it critical to understand its role in air quality and climate on both regional and global scales. Chinese atmospheric chemists have been conducting frontier research for forty years in areas such as urban and regional air pollution and the climate effects and health impacts of air pollution. IGAC intends to more fully integrate Chinese research experience by establishing its first national working group in China. The goals of the IGAC China Working Group are to:

- Encourage participation of Chinese atmospheric scientists to engage their leadership in international atmospheric chemistry research programs;
- Strengthen ties with IGAC to facilitate the implementation of IGAC related research projects and tasks in China;
- Provide advice or consultation on major research plans in atmospheric chemistry in China to promote funding support;
- Promote academic exchange on atmospheric research in China and internationally, especially with IGBP China Working Groups; and
- Provide a platform in China to facilitate the academic growth and development of young researchers in atmospheric chemistry.

Conferences and Workshops:

- ACCMIP 1st Workshop
13-15 April 2011
Toulouse, France
 - This was the first workshop for this activity, which provided summaries of the status of different model simulations. The first set of model runs were completed this past year, and the results of the data were presented at this workshop. A follow-up workshop will be held in February 2012 in Pasadena, CA, USA conjoined with a HTAP meeting.
- AICI 3rd Workshop
6-7 June 2011
New York, NY USA
 - 3rd Workshop on AICI discussed new research from AICI studies, including Ocean-Air-Sea Ice-Snow (OASIS) project, Halogens in the Troposphere (HitT) and the International Polar Year (IPY)
 - Workshop dialogue established emphasis towards understanding AICI in a changing environment and also advancing snow chemistry modelling to eventually interface with Earth System models
 - Currently in preparation are review articles to be published and featured in a joint special issue between Atmospheric Chemistry and Physics, and Earth System Science Data called "New Perspectives on Air-Ice Chemical Interactions (AICI)"

- Air Pollution & Climate: Tackling the Air Pollution and Climate Change Challenge
9-10 June 2011
Arona, Italy
 - The purpose was to discuss the development of a science-policy dialogue that addresses the Air Pollution and Climate Change Challenge.
 - 22 attendees, representing 13 countries, from all backgrounds of science-policy experience.
 - Created an arena for policy and scientific communities to come together and combine efforts towards addressing issues from an integrated perspective.

- First International Workshop on the Long-Range Transport & Impacts of African Dust on the Americas
7 October 2011
San Juan, Puerto Rico,
 - Specialists presented on topics relating to long-range transport and impacts of African dust on the Americas
 - Workshop designed to promote discussions and improve knowledge about the research of African dust, its transport and chemical reactions, as well as its impact on climate, health, and ecosystems.

- AC&H: Current Knowledge and Future Directions
12-14 October 2011
Boston, MA, USA,
 - Brought together leaders in the atmospheric chemistry, epidemiology, and toxicology communities.
 - Identified the key scientific question at the interface of atmospheric chemistry and air pollution health effects
 - Identified key area in which integrated research is needed.
 - Discussed the benefits for scientific research and environmental and health policy that would accrue from dealing air pollution and atmospheric chemistry in a more integrate way.

- Air Pollution & Climate: A Science-Policy Dialogue in Asia
7-10 November 2011
Taipei, Taiwan
 - Follow-up workshop to the first Air Pollution & Climate Initiative workshop in Arona, Italy with a focus on Asia
 - Participants also took part in a one-day symposium with Taiwanese scientist and policy makers
 - The outcome of the workshop will be a IGBP Statement on the Air Pollution and Climate Change Opportunity to be released at the Planet Under Pressure Conference in March 2012.

3. Contributions to IGBP Integration/synthesis

(List your activities (ongoing or planned) which contribute to the broader integrative aims of IGBP (interdisciplinary initiatives, joint activities with other core projects, contributions to fast track initiatives and to IGBP synthesis activities).

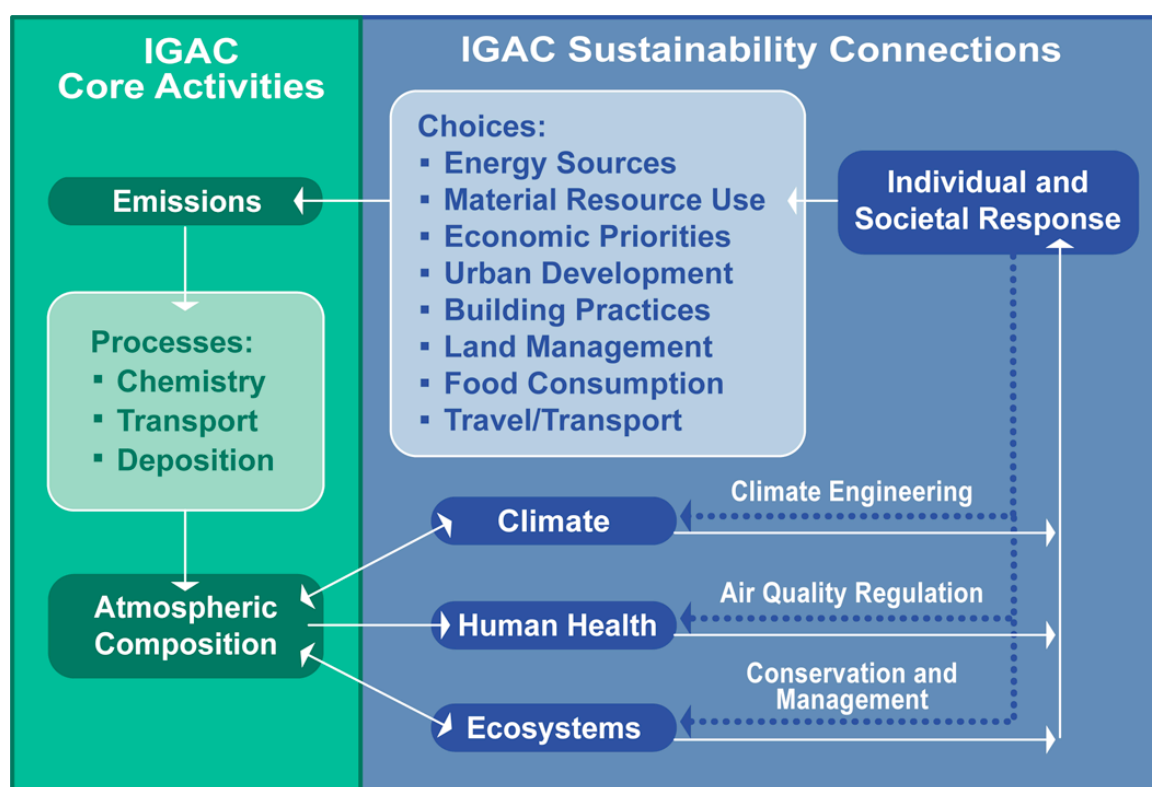
Information for: strategic development.

- Many of IGAC's research priorities are collaboration with the IGBP core projects SOLAS (surface Ocean Lower Atmosphere Study) and iLEAPS (Integrated Land Ecosystem Atmosphere Process Study), the World Climate Research Program's SPARC (Stratospheric Process and their Role in Climate) and GEWEX (Global Energy and Water Cycle Experiment) projects, and the World Meteorological Organization (WMO). Collaboration with IGBPs AIMES (Analysis Integration and Modelling of Earth Systems) project allows for scaling of local data to the regional-to-global scale and for investigating atmospheric chemistry/earth system feedbacks. Through joint workshops and research projects, IGAC, SPARC, AIMES, iLEAPS, and SOLAS have increasingly been working towards an integrated study of Earth System Sustainability Science.
- Jointly Sponsored Activities include:
 - AC&C: Atmospheric Chemistry & Climate (IGAC, SPARC)
 - ACPC: Aerosols, Clouds, Precipitation, & Climate (IGAC, iLEAPS, GEWEX)
 - AICI: Air-Ice Chemical Interactions (IGAC, SOLAS)
 - Air Pollution & Climate (IGAC, IGBP)
 - Biomass Burning Initiative (IGAC, iLEAPS, WMO)
 - DEBITS: Deposition of Biogeochemically Important Trace Species (IGAC, WMO)
 - GEIA: Global Emissions Initiative (IGAC, iLEAPS, AIMES)
 - HitT: Halogens in the Troposphere (IGAC, SOLAS)
 - The Impacts of Megacities on Air Pollution and Climate (IGAC, WMO)

4. Strategic Outlook

(a) Goals and Priorities:

As IGAC enters into its third phase, in response to the Future Earth Initiative, its mission is to coordinate and foster atmospheric chemistry research towards a sustainable world. This is achieved by integrating, synthesizing, guiding, and adding value to research undertaken by individual scientists through initiating new activities, acting as a hub of communication for the international atmospheric chemistry research community, and through building scientific capacity. More specifically, IGAC's core activities focusing on emissions, atmospheric processes, and atmospheric composition will integrate more closely with sustainability issues such as climate, human health, ecosystems, and how individual and societal responses feed back onto the core research-led activities of IGAC. IGAC believes by viewing the environment as a resource and the bases of energy and economic activities, human well-being can be sustained. This strategy has been outlined in the figure below.



(b) Workshops & activities:

Below is a list of IGAC workshops that are currently planned for 2012. IGAC is currently accepting proposals for other workshops to be held in 2012.

- ACCMIP/HTAP Workshop
30 January – 1 February 2012
Pasadena, CA USA
- Health Impacts of Air Quality and Climate in Asia
8-11 April 2012
Guangzhou, China
- IGAC/SPARC Global Chemistry-Climate Modeling and Evaluation Workshop
21-25 May 2012
Davos, Switzerland

- GEIA Workshop
11-13 June 2012
Toulouse, France
- IGAC Open Science Conference
Atmospheric Chemistry in the Anthropocene
17-21 September 2012
Beijing, China

The big event for IGAC in 2012 will be the IGAC Open Science Conference “Atmospheric Chemistry in the Anthropocene” to be held in Beijing, China at Peking University, the home institution of IGAC Co-chair Tong Zhu. It is expected that there will be wide international representation. The Scientific Program Committee is lead by IGAC SSC member Allen Goldstein, University of California at Berkeley, USA and Yuanhang Zhang, Peking University, China. The conference will also feature a Young Scientists Program, which has been an integral part of the biennial conferences since 2004. The Young Scientist Program is a special effort to create an environment where young scientists have the opportunity to display their research, meet mature scientists and fellow young scientists, and become a part of an international community of atmospheric chemists.

Atmospheric CHEMISTRY IN THE ANTHROPOCENE

www.igac2012.org 17-21 SEPTEMBER 2012 • BEIJING

Conference Sessions:

- 1. Atmospheric Chemistry in the Anthropocene**
Observations and assessments of atmospheric compositional change including emissions, trends, distributions, and losses of gases and aerosols, scientific knowledge and uncertainties, and geoengineering.
- 2. Atmospheric Chemistry and Megacities**
Emission trends and scenarios, secondary pollution formation, source apportionment, process analysis, air quality forecasting, policy implications, and evaluating connections to urban, regional, continental and global scale atmospheric chemistry.
- 3. Atmospheric Chemistry and Climate**
Greenhouse gases, stratospheric ozone, aerosols, clouds, precipitation, their interactions and feedback effects in the climate system, potential interactions of air pollution control and climate, and prospective on Earth's future.
- 4. Atmospheric Chemistry and Health**
Local to global observations, modeling, and epidemiology, connecting emissions, atmospheric chemistry, and human health impacts.
- 5. Atmospheric Chemistry and Surface-Atmosphere Exchange**
Exchange between the atmosphere and the biosphere, ocean, and cryosphere, including atmospheric chemistry near these interfaces.
- 6. Atmospheric Chemistry Fundamentals**
Chemical kinetics of gaseous and aerosol phases, chamber experiments, photochemical mechanisms, measurement technique development, gas/particle interactions, anthropogenic/biogenic interactions, and connections to observations.

Young Scientist Program:
An integral part of IGAC Open Science Conferences is the Young Scientist Program. Any currently enrolled student or scientist that graduated within the last 5 years (i.e. 2007-2012) is welcome to participate in the Young Scientist Program during the conference. A limited amount of funds are available to support young scientist participation in the conference.

Important Dates:
15 April 2012: Deadlines for abstract submission and young scientist support application
15 June 2012: Deadline for hotel reservation
30 June 2012: Deadline for early-bird registration

Host: Peking University, IGAC China Working Group

Please visit www.igac2012.org for more information

SOCIETY
社会

CHEMISTRY
化学

CLIMATE
气候

5. Contributions to international assessments

List your links and contributions to international assessments such as IPCC.
Information for: strategic development & reporting/fundraising.

- IGAC SSC or community members who are lead authors for AR5 WGI report:
 - Contributors to the IGAC/SPARC Modelling Activity (AC&C)
 - Arlene Fiore (Chapter 11 Lead Author)
 - Drew Schindell (Chapter 8 Coordinating Lead Author)
 - Veronika Eyring (Chapter 9 Lead Author)
 - Dorothy Koch (Chapter 8 Lead Author)
 - Frank Dentener (Chapter 2 Lead Author)
 - Jean-Francois Lamar (Chapter 8 Lead Author)
 - Piers Forster (Chapter 7 Lead Author)
 - Part of IGBP Air Pollution and Climate Initiative
 - Bill Collins (Chapter 8 Lead Author)
 - Jan Fuglestvedt (Chapter 8 Lead Author)
 - Current or Former IGAC SSC members
 - Maria Cristina Facchini (Chapter 1 Lead Author)
 - Yutaka Kondo (Chapter 7 Lead Author)
 - Phillip Rasch (Chapter 7 Lead Author)
 - Graham Feingold (Chapter 7 Lead Author)
 - Sandro Fuzzi (Chapter 7 Review Editor)
- The IGAC report on Bounding the Role of Black Carbon in Climate is expected to constitute a direct contribution to AR5. Metrics being reported in the publication were determined based specifically on those used in the IPCC process, and terminology was intentionally used for consistency with IPCC assessments.
- The IGAC/WMO *Impact of Megacities on Air Pollution and Climate* will itself constitute a significant international assessment report on the role Megacities play in climate change and air quality.
- IGAC activities contribute to Rio + 20, Future Earth Initiative.
- Given that the IGAC community is composed of over 3,000 scientists it is difficult to account for all links and contributions to international assessments.

Continue to Section 2

6. Communication and Outreach

List networking activities and products (websites, newsletters, outreach products) for the scientific community and beyond (policymakers, the public). Please give details where end-users have been involved in the concept and production.

Information for: outreach, networking & reporting/fundraising

- IGAC website : <http://igacproject.org>
The website has been completely redesigned and will be launched late February 2012
- The IGAC Newsletter was also completely redesigned. The new *IGACNews* is mailed to ~1,200 scientists and sent out as an electronic version to ~3,000 scientists. The most issue (October 2011 Issue No. 45) featured ACCMIP, AICI, and Air Pollution & Climate IGAC Activities.



- Updates, reminders, and information about conferences and activities e-mailed to ~3,000 subscribers via MailChimp.
- IGAC has also been working with a graphic designer to design logos for all its activities as well as communicate science more effectively through diagrams, figures, and graphs.

7. Publications

List (for the period since your last annual report to IGBP): (a) the top 10 most important publications in the peer-reviewed literature as a result of the project and (b) the total number of peer-reviewed publications attributed to the project and listed in your database

Information for: reporting/fundraising & outreach.

(a) Top 10 publications:

- Brinckmann S, Engel A, Bönisch H, Quack B, Atlas E (2011) Short-lived brominated species – observations in the source regions and the tropical tropopause layer. *Atmospheric Chemistry and Physics* 11, 22199-22245 doi: 10.5194/acpd-11-22199-2011.
- Brooks S, Moore C, Lew D, Lefer B, Huey G, Tanner D (2011) Temperature and sunlight controls of mercury oxidation and deposition atop the Greenland ice sheet. *Atmospheric Chemistry and Physics* 11, 8295-8306, doi: 10.5194/acp-11-8295-2011.
- Dibb J. E., Zeimba L. D., Luxford J, Beckman P (2010) Bromide and other ions in the snow, firn air, and atmospheric boundary layer at Summit during GSHOX. *Atmospheric Chemistry and Physics* 10, 13609-13642 doi: 10.5194/acpd-10-13609-2010
- Koren I, Feingold, G (2011) Aerosol – cloud – precipitation system as a predator – prey problem. *PNAS* 108, 12227-12232 doi: 10.1073/pnas.1101777108
- Liao J, Huey L. G., Tanner D. J., Brough N, Brooks S, Dibb J. E., Stutz J, Thomas J. L., Lefer B, Haman C, Gorham K (2011) Observations of hydroxyl and peroxy radicals and the impact of BrO at Summit, Greenland in 2007 and 2008. *Atmospheric Chemistry and Physics* 11, 8577-8591, doi: 10.5194/acp-11-8577-2011.
- Pfister, G.G., D. D. Parrish, H. Worden, L. K. Emmons, D. P. Edwards, C. Wiedinmyer, G. S. Diskin, G. Huey, S. J. Oltmans, V. Thouret, A. Weinheimer, and A. Wisthaler (2011) Characterizing summertime chemical boundary conditions for air masses entering the US West Coast. *Atmospheric Chemistry and Physics*, 11, 1769-1790, doi:10.5194/acp-11-1769-2011
- Quennehen B., A. Schwarzenboeck, J. Schmale, J. Schneider, H. Sodemann, A. Stohl, G. Ancellet, S. Crumeyrolle, and K. S. Law (2011) Physical and chemical properties of pollution aerosol particles transported from North America to Greenland as measured during the POLARCAT summer campaign *Atmospheric Chemistry and Physics*, 11, 10947-10963, doi:10.5194/acp-11-10947-2011
- Thomas, J. L., Stutz J, Lefer B, Huey L. G., Toyota, K, Dibb, J. E., von Glasow, R (2011) Modeling chemistry in and above snow at Summit, Greenland – Part 1: Model description and results. *Atmospheric Chemistry and Physics* 11, 4899-4914, doi: 10.5194/acp-11-4899-2011.
- Schmale, J. , J. Schneider, G. Ancellet, B. Quennehen, A. Stohl, H. Sodemann, J. F. Burkhart, T. Hamburger, S. R. Arnold, A. Schwarzenboeck, S. Borrmann, and K. S. Law (2011) Source identification and airborne chemical characterisation of aerosol pollution from long-range transport over Greenland during POLARCAT summer campaign 2008. *Atmospheric Chemistry and Physics*, 11, 10097-10123, doi:10.5194/acp-11-10097-2011
- Wang, Q., D. J. Jacob, J. A. Fisher, J. Mao, E. M. Leibensperger, C. C. Carouge, P. Le Sager, Y. Kondo, J. L. Jimenez, M. J. Cubison, and S. J. Doherty (2011) Sources of carbonaceous aerosols and deposited black carbon in the Arctic in winter-spring: implications for radiative forcing. *Atmospheric Chemistry and Physics*, 11, 12453-12473, doi:10.5194/acp-11-12453-2011

(b) In total, IGAC has produced 30 special issues in peer-reviewed journals. Two special issues have been published in 2011 by *Atmospheric Chemistry and Physics*. The total number of peer-reviewed publications is well in the hundreds since IGAC began in 1990.

8. Training and capacity building

List your capacity-building activities eg. Summer schools, Young Scientist Workshops, lecture series, training & education, etc.

Information for: reporting/fundraising & networking.

- IGAC co-sponsors numerous meetings, workshops, symposiums, and conferences to provide travel grants for young and developing country scientists to attend these events
- An integral part to IGACs biennial conferences is its Young Scientists Program, which creates a platform for young scientists to present their research and become connected within the larger network of international scientists. IGAC provide travel grants for young scientists to attend conferences based on both need and merit.
- IGAC sponsors National/Regional Working Groups
 - The China Working Group in China, approved April 2011, has increased the level of communication and collaboration of research between scientists in the region as well with scientists internationally.
 - More national/regional working groups are currently being explored and planned for implementation. Areas of interest include West Africa, India, Australia/New Zealand, and Latin America.

9. Project administration and management

Describe the structure of the IPO, Node/foci offices and sponsors. Note any resource concerns.

Information for: reporting/fundraising & networking.

- The International Project Office is located at the University of Washington's Joint Institute for the Study of the Atmosphere and Ocean (JISAO) in Seattle, Washington. The Seattle IPO is the primary IGAC project office, with one full time employee, Executive Officer Megan Melamed, and two part-time undergraduate student assistants.
- The IGAC IPO is funded at \$280kUSD/year from the period of July 2009-June 2012 by awards from U.S. NSF, NASA, and NOAA.
- IGBP provides ~\$35kUSD/year to cover the majority of the costs of the annual IGAC SSC meeting.
- European ACCENT Plus provides €18kEuro/year to provide IGAC travel grants for scientist to attend IGAC related meetings, workshops, symposiums, and conferences.
- Academia Sinica in Taiwan covers the cost to print and mail the IGAC Newsletter.

10. Links with the observations community

List: (a) links/activities with the observation community (e.g., meetings attended, activities, data you are providing), (b) the observation and data products you are using from e.g. ESA, NASA, etc., and (c) additional needs.

Information for: reporting/fundraising, networking and strategic development.

Observations are a key component of IGAC activities, including AC&C, ACPC, AICI, AMMA-AC, DEBITS, GEIA, HitT, and the Megacities Assessment. With over 3,000 scientists across the world, the contributions of the IGAC community to observation networks are too numerous to list here.

11. Other comments

31-01-2012

Compiled by Megan L. Melamed