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IGAC News

Coordinating and fostering atmospheric chemistry research towards a sustainable world

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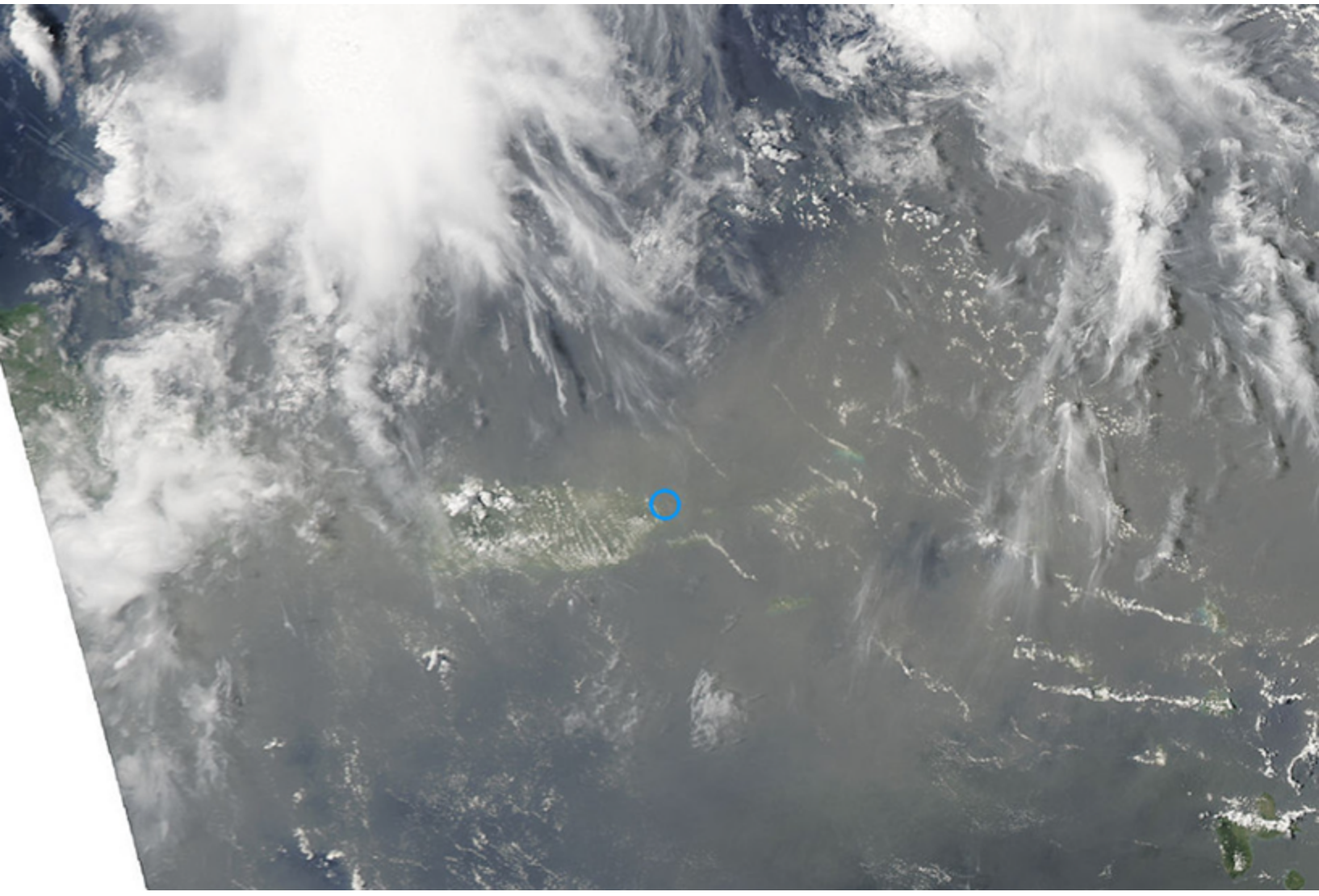

Aqua-MODIS true-color image at 250 m resolution on 3 June 2012 over the Western Atlantic Ocean/Eastern Caribbean Sea. The image shows dust transport from the Sahara Desert over the Atlantic Ocean, Caribbean Sea, and some Caribbean Islands. The blue circle marks the location of the Cape-San-Juan AERONET ground site.

Image courtesy of NASA/GSFC, http://lance.nasa.gov/imagery/rapid-response/

In Cooperation with IAMAS Commission on Atmospheric Chemistry and Global Pollution

GLOBAL CHANGE IGBP International Geosphere-Biosphere Programme

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IGAC News

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IGAC was initiated by the Commission on Atmospheric Chemistry and Global Pollution (CACGP) and is a Core Project of the International Geosphere-Biosphere Program (IGBP). The IGAC Seattle International Project Office is sponsored by the US National Science Foundation (NSF), National Oceanic and Atmospheric Association (NOAA), and National Aeronautics and Space Administration (NASA). The IGAC Taipei Project Office is funded by Academia Sinica, Taipei. The IGAC Rome Project Office is supported 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.

Future Earth: Research for Global Sustainability Initiative • *IGAC's Vision*

The IGAC Scientific Steering Committee had their annual meeting in San Juan, Puerto Rico 3-5 October 2012. One of the major outcomes of the SSC meeting was IGAC's Vision in response to the Future Earth Initiative.

In order to effectively address global change and meet economic and social goals, an evolution of earth system science is essential. Humans are at the center of the earth system both as the key forcer of change and as the recipient of its feedbacks. In recognition of this, the International Council for Science (ICSU), the International Social Science Council (ISSC), and the Belmont Forum established the Future Earth: Research for Global Sustainability Initiative that aims to deliver the environmental science-derived solutions that society needs.

The International Global Atmospheric Chemistry (IGAC) Project, a Core Project under the umbrella of the International Geosphere Biosphere Programme (IGBP) and co-sponsored by the international Commission on Atmospheric Composition and Global Pollution (iCACGP) will play a key role in responding to the challenge of the Future Earth Initiative by;

- Recognizing the linkages and benefits of both disciplinary and multi-disciplinary aspects of this challenge.
- Seeking to nurture and evolve fundamental science to address the duality of disciplinary and multi-disciplinary work.
- Underpinning scientific research on the impacts of changing atmospheric composition (e.g. climate, air quality) for evidence-based policy within a global sustainability framework.
- Acknowledging a need for national/international funding and organizational structures that accelerate the development of a multi-disciplinary approach.
- Accepting the need for IGAC to evolve within a new structure.

IGAC was formed in 1990 to address growing international concern over rapid changes observed in the Earth's atmosphere and has evolved over the decades to respond to the scientific needs of the earth system science research community. The first phase of IGAC, 1990-1999, focused on quantifying the pre- and post-industrial distributions of reactive trace species and determining the chemical, physical, and optical properties of aerosols. The first phase of IGAC culminated with the publications of Atmospheric Chemistry in a Changing World, Brasseur et al. (2003), which summarizes and integrates more than a decade of atmospheric chemistry research. In its second phase, 2000-2010, IGAC initiated and coordinated international research that greatly increased our understanding of the chemical composition of the tropo-

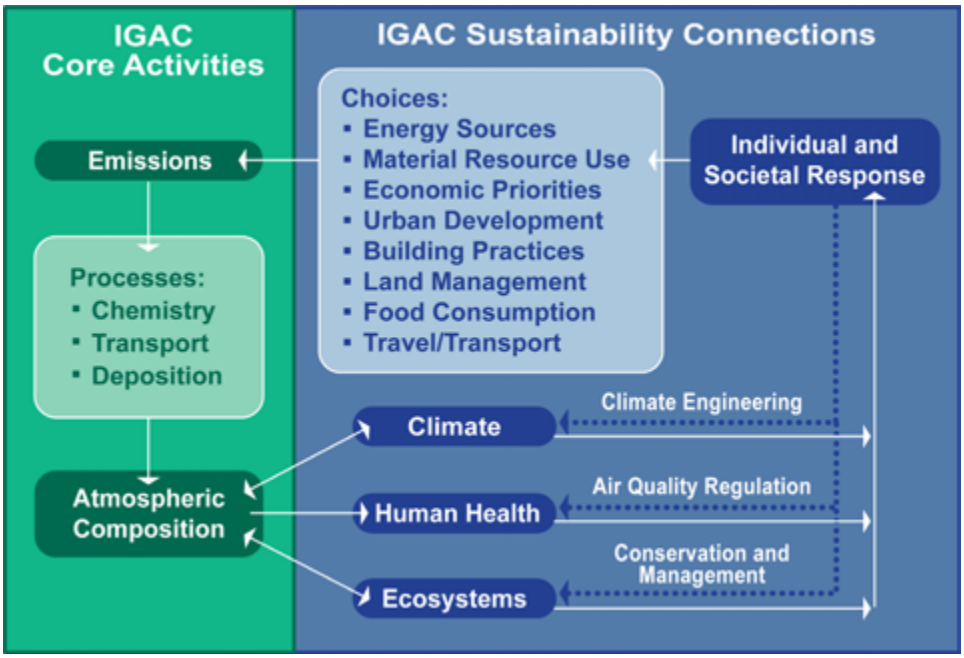


Figure 1. IGAC's role in the Future Earth Initiative is to coordinate and facilitate both fundamental research and multi-disciplinary studies on interactions between atmospheric composition and climate, human health, and ecosystems.

sphere, the fluxes of chemical species into and out of the troposphere, and the processes controlling the transport and transformation of chemical species within the troposphere.

As IGAC enters into its third phase as part of 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 (Figure 1). IGAC believes by viewing the environment as a resource and one of the bases of energy and economic activities, human well-being can be sustained.

IGAC embraces the challenge of developing a multi-disciplinary approach to address global sustainability. This is evident in IGAC's already established multi-disciplinary activities such as the Atmospheric Chemistry & Health initiative that is linking the atmospheric chemistry community and the toxicology and epidemiology communities, the IGBP Air Pollution & Climate initiative being lead by IGAC that seeks to create a science-policy dialogue in order to address air pollution and climate simultaneously, and the Atmospheric Chemistry & Climate initiative that focuses on how atmospheric composition change influences climate and vice versa. In addition, many research questions necessitate a multi-disciplinary approach within the earth system science community. Therefore IGAC has, and will continue to, collaborate with other IGBP core projects such as SOLAS (Surface Ocean Lower Atmosphere Study), iLEAPS (Integrated Land Ecosystem Atmosphere Process Study), and AIMES (Analysis Integration and Modeling of Earth Systems) projects as well with the World Climate Research Program's SPARC project (Stratospheric Processes and their Role in Climate). Through joint workshops and research projects, IGAC, SPARC, AIMES, iLEAPS, and SOLAS have increasingly been working towards an integrated study of earth system research for global sustainability.

IGAC is meeting the challenges of the Future Earth Initiative by recognizing the need to evolve in a transitioning landscape of global environmental change science. Under the strong and clear umbrella of the Future Earth initiative, the aggregate impacts of IGAC and other core projects will deliver the environmental science-derived solutions that society needs.

The IGAC SSC

Launch of the new IGAC Website

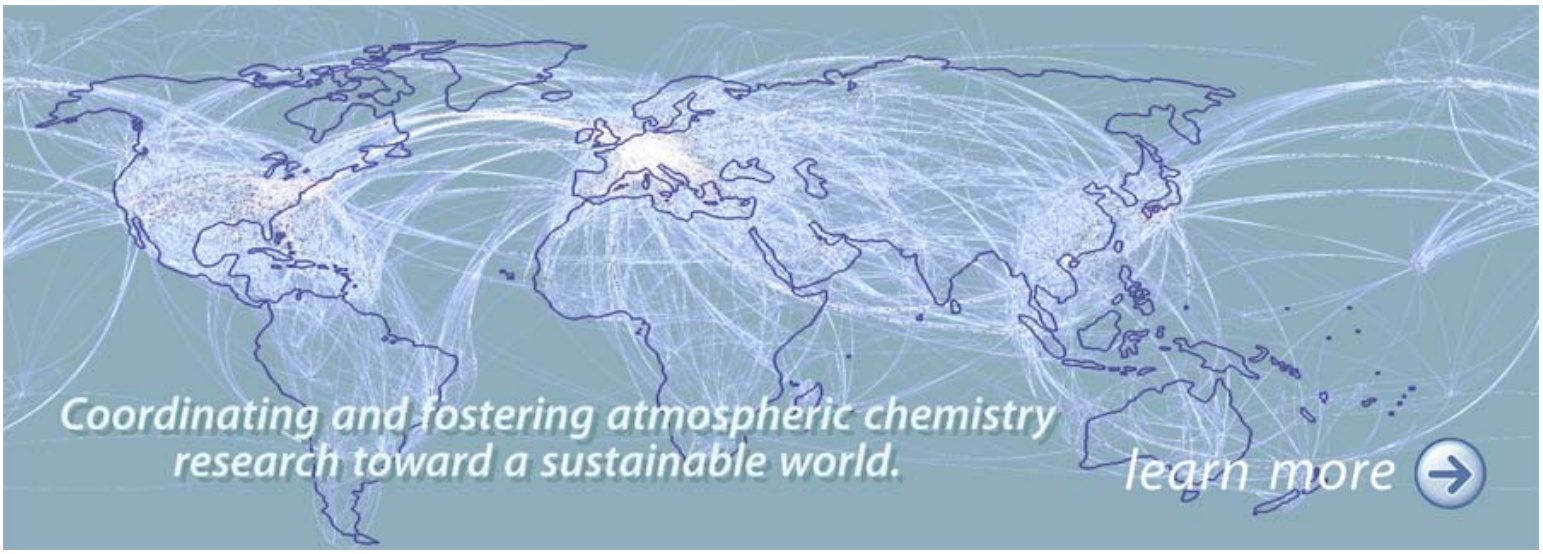
Our newly designed IGAC website launched at the end of February! We are excited to present a completely remodeled website that highlights our current activities, conferences, workshops, and IGAC related events. In order to enhance networking, we have two new special features: a listing of job openings related to atmospheric chemistry and an events calendar. It is our goal to create an interface that is more accessible for our international community. Come check us out at igacproject.org!

Submit articles to the next IGAC Newsletter

The next upcoming IGAC newsletter is now open for article submissions! Workshop Summaries, Science Features, Activity News, and Editorials are all acceptable and desired. Science Features are to be submitted at a recommended length of approximately 1500 words with 1-2 images. All other submissions must be approximately 600 words and have a maximum of 1 image. Images must be high resolution in the format of a .png file. The deadline for submissions for the July Issue of the IGAC Newsletter is 1 June 2012. Any questions concerning content or formatting may be sent to info@igacproject.org.

IGAC Events Proposal Submissions

If you are interested in receiving support for workshops related to IGAC's Activities and Vision, look no further. IGAC provides financial support and non-financial endorsements of meetings, workshops, symposiums, and conferences. Sponsored events are required to publish an event summary in the IGAC Newsletter and IGAC may request a Science Feature or Young Scientist Spotlight article related to the workshop topic. Please visit igacproject.org and go to IGAC Events to learn more about how to submit a proposal for an IGAC sponsored event. Any questions regarding proposals or to submit a proposal please write to info@igacproject.org. The deadline for proposal submissions will be twice a year with the first deadline being 1 April 2012 followed by another deadline 1 October 2012.



IGAC Welcomes four new SSC members

Jonathan Abbatt

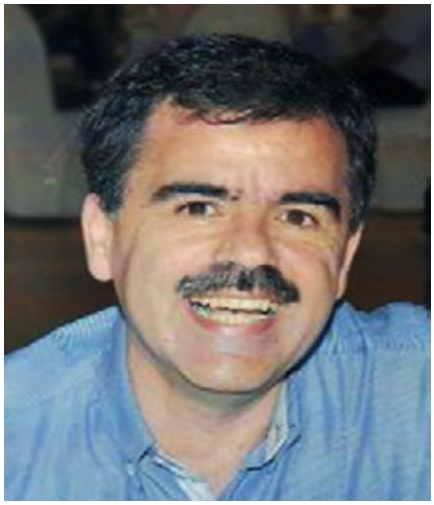
University of Toronto, Department of Chemistry, Toronto, ON, Canada

Jon Abbatt (BSc (Toronto), PhD (Harvard), Postdoc (MIT)) started as a faculty member in the Department of the Geophysical Sciences at the University of Chicago in 1992. In 2000, he returned to Canada where he is currently a professor in the Chemistry Department in the University of Toronto. He heads a research group in laboratory aerosol chemistry that has addressed issues in stratospheric ozone depletion, upper tropospheric chemistry, boundary layer processes, and both ice and liquid water cloud formation. Particular attention has been given to halogens, ice and organics in the atmosphere. Of late, he has broadened his research interests by becoming involved in a number of aerosol-related field campaigns in the Arctic and forested regions within Canada. He is a Co-Editor of Atmospheric Chemistry and Physics and Atmospheric Measurement Techniques, and was Co-Chair of the 2011 Gordon Conference on Atmospheric Chemistry.

Spyros Pandis

University of Patras, Patras, Greece
Carnegie Mellon University,
Pittsburgh, PA USA

Spyros Pandis is Professor in the Chemical Engineering Department of the University of Patras in Greece and Research Professor of Chemical Engineering and Public Policy in Carnegie Mellon University. He received his PhD from the California Institute of Technology in 1991 and joined the faculty of Carnegie Mellon University in 1993 and of the University of Patras in 2004. His research includes theoretical and experimental studies of atmospheric chemistry as it relates to urban and regional pollution and



topics related to global climate change. The research team (half of it in Greece and half of it in the US) currently investigates the formation and properties of organics aerosol, aerosol-water interactions, formation and growth of ultrafine particles and develops regional chemical transport models focusing on air quality. He is the ex-president of the American Association for Aerosol Research and one of the editors of Aerosol Science & Technology.

Chhemendra Sharma

National Physical Laboratory, Radio and Atmospheric Sciences Division, New Delhi, India

Dr. Chhemendra Sharma is a senior scientist in the Radio & Atmospheric Sciences Division of the National Physical Laboratory, New Delhi. He obtained his Ph.D. degree in chemistry from D.E.I. (Deemed University), Agra in 1989. Dr Sharma's research activities include measurements of greenhouse gases and other trace atmospheric constituents for air-quality and climate change assessments. He is involved in the development of GHG emission factors from different sources and in the preparation of emission inventories of atmospheric trace constituents at national as well as city scales. He is also engaged in the assessment of impacts of climate change and air quality on human health. He has over seventy research publications on his research

activities and edited a number of books and reports. He has also contributed in the preparation of IPCC 2006 Guidelines for preparation of National Greenhouse Gas Emission Inventories for 'Waste Sector' as a lead author.

Hiroshi Tanimoto

National Institute for Environmental Studies
Center for Global Environmental Research
Tsukuba, Ibaraki Japan

Hiroshi Tanimoto is Head of the Global Atmospheric Chemistry Section at National Institute for Environmental Studies (NIES) in Tsukuba, Japan. He also serves as a project leader for the NIES's "East Asian Environment Program". He received his PhD in Chemistry from The University of Tokyo in 2001 and was a visiting scholar at Harvard University during 2007–2008. Dr. Tanimoto has been working in the field of atmospheric composition in Asia and Oceania regions. Over the past years, his group has developed novel instruments, made field measurements at surface stations and ships, and analyzed the data with extensive use of chemistry-transport models and satellite observations to investigate atmospheric chemistry and its impacts on global change. In particular he has been studying tropospheric ozone issues and their long-term trends in East Asia, contributions from anthropogenic/biomass burning emissions, and long-range transport of ozone and its precursors. He recently extended his research to air-sea interaction/biogeochemistry, in close collaboration with chemical and biological oceanographers. He has authored or co-authored more than 70 publications in peer-reviewed scientific journals on these topics, resulting in several Young Scientist Awards. Dr. Tanimoto is active in providing international contributions. He is a co-author of Task Force on Hemispheric Transport on Air Pollution (TF HTAP) 2010 Assessment Report, an associate editor of Geochemical Journal, a planning group member/co-chair at JSPS/AvH's Japanese-German Frontiers of Science Symposium, and a co-chief scientist for gas chemistry intercomparison at the ABC-Asia campaign in 2005. He currently serves as the IGAC representative of the joint IGBP-WCRP-DIVERSITAS subcommittee of the Science Council of Japan and is a member of the committee for Japanese air quality satellite missions.

Launch of the new IGAC Mailing List

IGAC has new options for staying in touch with the community. We have recently launched a new email based mailing list that gives you control over just how much you hear from us. You can choose to receive a hard or digital copy of our newsletter, which is published three times per year. Or you can decide to keep in closer touch with the IGAC community by signing up to be notified of upcoming IGAC related conferences, workshops, and other grand gatherings!

If you are currently receiving IGAC notifications for workshop, conferences, etc., then make sure to click update subscription preferences in the lower portion of these mailings to choose your level of communication with the IGAC community.

If you have not been receiving email notifications from IGAC, then you are not signed up for our new email service and we only have a physical mailing address for you. In which case, you need to join the new email list by going to http://eepurl.com/eu3U6.

If you have any questions about our new mailing service, or IGAC in general, please contact us at info@igacproject.org.

First International Workshop on the Long-Range Transport and Impacts of African Dust on the Americas

San Juan, Puerto Rico • 6-11 October 2011

Olga L. Mayol-Bracero

Institute for Tropical Ecosystem Studies, University of Puerto Rico, Río Piedras, PR

Interest is growing in the long-range transport of mineral dust and its impact on climate, human health, and ecosystems. The largest dust sources are located in the northern hemisphere and, of these, the most intense and persistently active are those located in North Africa, which emits about half of the global total. Every year, large amounts of African dust are transported by the trade winds over vast areas of the North Atlantic to the Americas (specifically the Caribbean, southeastern USA, Central America, and South America).

In recent years, there have been a number of intensive dust field studies in West Africa (e.g. SAMUM and AMMA) but there have been no comparable studies over the Atlantic or Caribbean. Consequently, there is limited understanding of the physical, chemical, and radiative properties of the particles and how they might change during transport from Africa to the Americas. This also makes it difficult to understand the impact of dust on climate, human health, and ecosystems. This is especially true for the understudied Caribbean, a region heavily influenced by trade winds and hurricane storm tracks, which frequently transport African dust, that play a crucial role in climate by serving as an atmospheric conduit between tropical and extra-tropical regions.

To address these and other issues, the **First International Workshop on the Long Range Transport and Impacts of African Dust on the Americas** was held in San Juan, Puerto Rico, at the Intercontinental San Juan Hotel on 6-9 October 2011. The workshop provided a scientific forum for specialists on topics related to the long-range transport and impacts of mineral dust in the atmosphere, but with emphasis on African dust and its transport and impacts on the Americas.

The specific objectives were:

- To review the state of our knowledge about African dust transported to the Americas and how climate change might affect this transport.
- To bring together relevant information about long-range transported dust from research carried out in other regions.
- To identify dust-related scientific questions which need to be addressed in this area.
- To discuss how to coordinate measurements and activities in the region in order to gain a better and more coherent understanding of the impacts of African dust across the region.
- To promote collaborations among scientists in the region to focus on specific research goals.

Over 100 participants, including scientists and students, from all over the world (e.g., Mexico, Dominican Republic, Martinique, Cuba, Israel, Denmark, Germany, France, Switzerland, United Kingdom, USA, Puerto Rico) attended making it a truly international event. A total of 80 abstracts in the fields of (1) Characterization of Dust Properties, (2) Transport, Deposition, Heterogeneous Reactions, (3) Modeling, (4) Impacts on Climate and Response to Climate Change, and (5) Impact on Health were presented. The breakout working group sessions were organized around the same five theme areas. The meeting brought together some of the most recognized investigators in this field as keynote and invited speakers to present their research results and to lead discussions on research needs. The plenary speaker and co-chair of the workshop was Joseph M. Prospero, from University of Miami, Florida, USA, who starting 45 years ago pioneered research in the transport of soil dust by studying the trade winds on Barbados, where he gradually built up a first-class atmospheric chemistry station which continues in operation to this day.

The workshop featured oral and poster sessions with no parallel sessions. There was ample time for informal as well as working group discussions. Some of the workshop achievements are summarized in the following article. More information about the workshop, including presentations can be found at http://cohemis.uprm.edu/dust/.

The workshop was supported by IGAC, University of Puerto Rico-Río Piedras, University of Puerto Rico-Mayaguez, Merck, COHEMIS, NCAS, LTER, ITES, and RISE.

Improving our understanding of African dust transport using the Caribbean Basin as the receptor

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[2]Institute for Tropical Ecosystem Studies, University of Puerto Rico, Río Piedras Campus, San Juan, Puerto Rico

North Africa is the source of about half of the global mineral dust emissions [Huneeus et al., 2011]. A large fraction of these emissions are transported by the trade winds over vast areas of the North Atlantic, the Caribbean, southeastern USA, Central America, and South America [*Swap et al.,* 1992; *Prospero,* 1996; *Prospero,* 1999; *Formenti et al.,* 2001; *Prospero and Lamb,* 2003; *Reid et al.,* 2003]. There is no other ocean area that is so extensively and persistently impacted by such high concentrations of dust, a region that extends over 7000 km from the coast of Africa to the Caribbean islands and continental shores - the Caribbean Basin. In effect, the Caribbean Basin is the "receptor" site of the Saharan "source". Dust is believed to impact many aspects of climate [*Forster et al.,* 2007] and marine biogeochemical processes, most importantly through the impact of dust-Fe on marine primary productivity [*Jickells et al.,* 2005]. In order to assess the impact of dust on this region we need a better understanding of the factors that affect the transport of dust, the physical and chemical properties of the transported materials, and how these might change during transport. These questions were the focus of the **First International Workshop on the Long-Range Transport and Impacts of African Dust on the Americas,** which took place in San Juan, Puerto Rico, in October 2011. Here we present an overview of the principal conclusions.

Understanding African Dust Transport, Meteorology, and Climate

Our understanding of the large-scale aspects of dust transport to the Caribbean Basin rests largely on the long-term aerosol record accumulated at Barbados and Miami by the University of Miami research group [*Prospero,* 1999; *Prospero and Lamb,* 2003]. The studies on Barbados began in 1965 and in Miami in 1974 and they continue to this day, Figure 1. The Barbados record shows that large changes have occurred which initially seemed to be clearly linked to African climate [*Prospero and Lamb,* 2003], Figure 2. Transport dramatically increased early in the record in apparent response to drought in the early 1970s and again, and most severely, in the 1980s. Over this period trade wind dust concentrations were highly anti-correlated to Sahel rainfall, which was used as a proxy for general changes in source-region climate [*Prospero and Lamb,* 2003]. There were also suggestive relationships to major climate indices (e.g., ENSO, AMO, NAO). However, since the late 1980s, the Barbados record shows no relationship to Sahel rainfall or to climate indices. The absence of clear linkages makes it difficult to predict how dust emissions and transport might change over the coming decades. The problem is exacerbated by the inability of models [*IPCC,* 2007] to agree on rainfall trends over large areas of North Africa (including the Sahel) that are known to be major dust sources.

If we wish to predict future trends in the Caribbean Basin and their impact on the region we need a better understanding of the entire dust cycle starting with the processes that affect dust mobilization in Africa, the meteorological environment that controls transport and removal en route, and the concentration and properties of the aerosols that reach the Caribbean.

There is a continuing debate about the true nature of the most active dust sources and the importance of dust "hot spots" [*Okin et al.,* 2011] such as dry lakes, plyas, and wadiis as contrasted to larger-scale terrain characteristics and climate [*Bullard et al.,* 2011]. Of particular importance, and still highly uncertain, is the role of anthropogenic land disturbance in dust mobilization [*Mahowald et al.,* 2010]. We also lack a good understanding as to the major meteorological drivers of dust emissions: e.g., frontal systems, haboobs, mesoscale cyclonic systems, and turbulent processes. In reality, all of these processes may play a fundamental role in dust sources and the relative importance of these processes could change with season and with changing climate [*Engelstaedter et al.,* 2007; *Williams,* 2008].

However, dust can itself impact atmospheric and ocean processes to a degree that could affect weather and climate over the Basin. Of particular interest is the impact of dust on the life-cycle of tropical cyclones. There is evidence that high concentrations of dust tend to modulate the growth of cyclones [*Dunion and Velden,* 2004]. *Evan et al.* [2011] suggest that variations in dust transport over time can be negatively correlated to sea-surface-temperature changes over the tropical Atlantic. These changes, in turn, could be linked to the suggested negative correlation between Atlantic dustiness and hurricane activity.

In order to assess the impact of dust on the Caribbean Basin we need to carry out studies of aerosol properties over the region and their relationship to meteorological features ranging from synoptic scale to the cloud scale. The fundamental physico-chemical processes affecting dust particles are poorly understood. Of particular interest is the effect of atmospheric processing on particle properties dur-

ing transport. It takes about a week for dust to cross from the coast of Africa to the western Atlantic and as much as two weeks from the sources in the central Sahara to the western Caribbean. To address these issues we need intensive field campaigns over the Caribbean similar to those carried out over West Africa in AMMA [*Mari et al.,* 2011] and SAMUM [*Heintzenberg,* 2009] during the past decade. Except for the limited-scale PRIDE experiment held in Puerto Rico in 2000 [*Reid et al.,* 2003] there have been no comparable studies over the Caribbean Basin. It would be most productive to coordinate intensive field measurements over the Caribbean with similar measurements over West Africa so as to characterize the changes in aerosol properties that occur during transit.

Figure 1. The University of Miami Atmospheric Chemistry Research Station, Ragged Point, Barbados.

Dust Models

Models are essential to the development of understanding the entire dust cycle. However, dust models are in an early stage of development. A recent intercomparison of 15 models in the AEROCOM project [*Huneeus et al.,* 2010] shows large disparities in their abilities to reproduce dust concentrations and deposition. Model development is greatly hampered by the dearth of dust measurements in ocean environments. To be useful, dust models must ensure the correct description of all processes controlling dust mobilization and distribution including the evolution and persistence of the strong stratification of dust layers. These layers may themselves be influenced by the impact of dust aerosol on atmospheric heating rates. Dust-cloud interactions will influence wet deposition and the mechanisms affecting dry deposition to land and water surfaces. Early research [*Carlson and Prospero,* 1972] postulated the existence of the Saharan Air Layer (SAL) - a hot, dry layer in which the highest dust concentrations were found. While the SAL is a persistent feature over the region [*Dunion,* 2010], lidar studies on Barbados carried out by the University of Miami and the Max Plank Institute, Hamburg, show that the there is considerable variability in dust distributions [http://mplnet.gsfc.nasa.gov/cgi-bin/Mplnet/site_page_direct.cgi/allsite=Ragged_Point and http://barbados.zmaw.de/].

There are now a number of on-line dust forecast models. These predict dust emissions and transport using meteorological fields from weather forecasts. A summary of nine models can be found at the Sand and Dust Storm Warning System (SDS-WAS) web site [http://sds-was.aemet.es/forecast-products/dust-forecasts] that has links to the individual forecast products. Of these, six include the Caribbean Basin and the Americas in their coverage. Dust measurements made over the Caribbean Basin will provide data that is critically needed to test models and to improve their performance.

Dust Particle Characterization

The impact of dust particles on climate, ocean productivity, and human health will ultimately depend on the properties of individual particles. These properties will change during transit, most notably in the shift of the particle size spectrum to smaller sizes, but also because of chemical processing ("aging") during transit. The impact of these processes would be most noticeable in dust-laden air masses that mix with pollutants (e.g., European pollutants mixing with dust over the Sahara). Of particular interest is the effect on Fe solubility. At present, the assessment of the impact of dust on ocean primary productivity is limited by our lack of understanding of the properties that render Fe "bioavailable". In the absence of a specific understanding of those factors, Fe "solubility" is used as a proxy. However, there is no general agreement as to a specific protocol for determining "solubility" [*Buck et al.,* 2010]. Therefore, there is a great need for a more coordinated approach that combines laboratory, field observation, and modeling experiments to test hypotheses regarding the mechanisms of iron dissolution and to assess their relative importance in different environments [*Trapp et al.,* 2010]. The Caribbean Basin, as the receptor of African dust, is ideal for such studies because of the dominance of African dust in the region relative to other dust and pollution sources, and because of

the long historical record of dust which can serve as a context for broader studies.

Impact of Dust on Health

The concentration of African dust and other aerosols in the Caribbean Basin often exceeds the air quality standards linked to health effects. However, there has been little research on health effects in this region. Of particular interest is the possible role of dust on asthma; asthma rates are high in the region, comparable to those in urban-industrial environments. Despite the evidence of possible health impacts, there has been little research on the causative factors. Furthermore, there is very little data on aerosol properties that might help to identify linkages to health, e.g., we lack the simplest of metrics, $PM_{2.5}$ and PM_{10} concentrations.

There is a clear need to build an evidence-base for human health effects including studies at the population level and at the individual level, including vulnerable populations (i.e., the young and the aged). Scientific areas of interest include studies of: individual and population health including long versus short term health effects; acute versus chronic exposure; the conflicting findings related to the effect of African dust on asthma in the Caribbean; the effects on normal versus susceptible individuals. Other areas of interest are the mechanisms by which dust and other aerosols act to impact health and, specifically, the identification of the components in dust that have health implications: allergens, biological materials, fungal spores, metals (iron, aluminum, arsenic, lead, cadmium), endotoxins, and organics.

Unfortunately, there is a dearth of funding for studies of health effects linked to natural species such as dust because funding agencies focus on anthropogenic impacts. The community must increase the advocacy of natural impacts studies, heighten public and governmental awareness, and engage the policy community. There have been a few studies of the health impacts of mineral dust in the dust-rich environments of West Africa [*De Longueville et al.,* 2010]. Such studies might serve as a useful source of information to assess impacts in the Caribbean. Over the longer term, there should be an effort devise protocols that could be used in both regions so that the results can be compared and contrasted in a quantitative manner.

While there was considerable enthusiasm for the study of health effects of African dust in the Caribbean regional community, the obstacles to such studies include a lack of uniform approach to exposure assessment and the absence of methods to quantify African dust exposure on the "ground level" and at the individual level. There is a need to develop remote sensing techniques and models that could be used for estimating ground level exposures of populations in general.

Finally, we need to develop means of communicating risk to impacted populations and to design interventions based on the human health effects. Approaches include the issuance of air quality alerts based on real-time monitoring networks, remote sensing data, and modeling forecasts. In this context, we need to develop response plans, to educate leaders and the general public, and to use social media to heighten awareness.

Summary

In light of the long-term changes observed in the Barbados dust record, there is a clear need for long-term measurements that focus on characterizing trends in aerosol concentrations and any associated changes in critical aerosol properties. Aerosol sites should be established at various locations in the Caribbean Basin so as to better characterize the temporal and spatial variability of African dust and also of aerosols from other sources. Sampling should conform to $PM_{2.5}$ and PM_{10} protocols so that the potential for health impacts could be better assessed. Precipitation collectors should be co-located with the aerosol samplers so as to better characterize deposition rates and chemistry in relation to aerosol concentrations and properties.

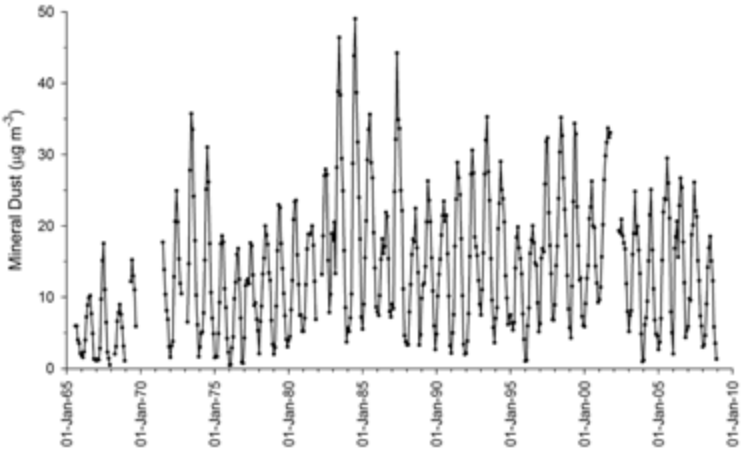

Figure 2. Monthly mean (three-month moving average) African dust concentrations measured in Trade Winds on Barbados, 1965 - 2008.

It is important to link measurements of aerosol properties over the Caribbean Basin to those in the source region, North Africa, and, furthermore, to relate these measurements to those of aerosols made over other continental regions. To this end at least two aerosol "super sites" should be established with instrumentation comparable to the super sites designed for air quality studies in the US. These sites should have extensive and remote sensing capabilities. One site should be near

the coast of Africa, possibly the SOLAS station on Sao Vincente, Cape Verde Islands, or on Tenerife, Canary Islands, where a well-developed WMO site already exists. The second site should be in the Caribbean, most logically at Ragged Point, Barbados [http://www.rsmas.miami.edu/users/barbados-dust/], a research site for over forty years which has the infrastructure to support a long-term site. The Max Plank Institute, Hamburg, also carries out cloud microphysical studies on Barbados [http://barbados.zmaw.de/].

There is a need to facilitate education and training in aerosol measurements in the region. The University of Puerto Rico – Río Piedras could serve this function based on their ongoing research activities. These include two research sites: (1) the aerosol monitoring program at Cape San Juan site located on the easternmost-end of Puerto Rico (in operation since 2004, with the support from NOAA ESRL [http://www.esrl.noaa.gov/gmd/aero/net/cpr/index.html]), and (2) the cloud forest site, Pico del Este, in El Yunque National Forest (elevation of 1051 masl), where studies on aerosol-clouds interactions are taking place.

Given the scope and complexity of the African dust phenomenon, it is clear that the full assessment of its impact on the Caribbean Basin will require a coordinated international research effort. We see the need for an organizational mechanism that would facilitate such a broad-scale integrated research program.

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Young Scientist Spotlight:

Carlos Valle

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Where are you from?

I am from Cidra, Puerto Rico.

Where did you receive your undergraduate and graduate degrees and in what subjects?

I received my undergraduate degree (BS) in Chemistry at the University of Puerto Rico, Río Piedras Campus. I am currently doing my doctoral degree in Analytical Chemistry at the same university.

Where and what is your current position?

I'm currently a third year doctoral student in analytical chemistry doing research in an atmospheric chemistry laboratory at the University of Puerto Rico, Río Piedras Campus.

What is your current area of research?

My current area of research is determining the impact long range transported African dust has on cloud properties and processes in a Caribbean tropical montane cloud forest (Pico del Este, located in El Yunque National Forest at Luquillo, Puerto Rico) as part of the **Puerto Rico African Dust and Cloud Study** (PRADACS) campaign funded by the NSF in which my thesis advisor Dr. Olga L. Mayol Bracero is the principal investigator. I seek to address the following hypothesis: The presence of long-range transported African dust produces changes in the chemical and physical properties of aerosols, clouds, and rainwater in the tropical montane cloud forest of Pico del Este.

What aspect of your research are you most excited about?

I'm always excited during field campaigns. I enjoy going to Pico del Este and being part of the clouds. It never bores me to use the cloud collectors to obtain cloud water, especially during dust events when the water turns orange. During these campaigns, I value the knowledge that I have obtained from participating collaborators. With their instruments and experiences from previous studies, I have learned so much about aerosol-cloud interactions and the sampling strategy and instruments to approach this type of study.

Who throughout your life had the greatest impact on you deciding to pursue a career in atmospheric science?

My decision to pursue a career in atmospheric science came all of the sudden to me. I am grateful of the path I've chosen to study chemistry. I had no trouble in choosing atmospheric sciences. It outweighed the other branches of environmental science. It is the area that I felt most passionate to learn and execute. Working with Dr. Rafael Arce in an atmospheric photochemistry laboratory during my undergraduate years helped me realize that I was looking forward for a more field based research rather than a purely theoretical one. And it is contradictory since I consider myself a theoretical scientist. But, atmospheric science is so multidisciplinary that I can have a dose of theory, modeling, and field work at the same time. I couldn't ask for anything better. I am blessed to be pursuing a doctoral degree with Dr. Olga L. Mayol-Bracero since my research with her keeps confirming that atmospheric chemistry is my future.

Is there a goal or dream that you are trying to accomplish as a scientist?

- Ever since I fell in love with science, I pictured myself making a discovery that would impact both the scientific and public community. I wanted to be known throughout history as

a scientist that made a remarkable contribution. As the years went by, I see that many share that same dream. I still hang on to that tightly. But, recently new goals have surfaced in my life that I wish to fulfill. I would like to be a dedicated professor. I want to be outstanding and serve as a catalyst for future scientists. Throughout my research and education skills that I will acquire through experience, I want those students to always know that science is fun and innovative and not frustrating. Whether I get recognition or not, in this lifetime I want to have the upmost personal satisfaction that I did my best. Knowledge is power and I want to share my world constructed by years of experience with others.

What do you think the ultimate goal of science is?

Personally, I don't think that there is an ultimate goal in science. You hear everywhere that science is a vehicle to solve problems, but science is infinite. Uncertainties can decrease through time and technology opens more doors, but there will always be no end to it. If there was a stop button for a scientific problem, then science would be very boring. The never-ending challenge of science is what makes us who we are… curious. Whether we reach our goal as scientists or not, we have to enjoy the process. Our findings are pillars to a horizon of possibilities. The only goal of science to me is to always promote evolution in ourselves and to our surroundings.

During the First International Workshop on the Transport and Impacts of African Dust on the America, what was the most interesting thing you learned? Who was the most interesting person you met?

I did not have a clear favorite topic in the workshop. But, there were two things I took to heart in the workshop. First, it was impressive meeting in one room different scientists around the globe that study African dust (modelers, chemists, physicists, biologists, doctors, environmental scientists, among others). The compilation of oral and poster presentations had a wide load of information worth to keep the ball rolling in this important area of atmospheric science. Second, the working groups created such a dynamic discussion that I couldn't stop learning. I wrote a substantial amount of information in my personal notebook and review it often.

The most interesting person I met in the workshop would have to be Joseph Prospero. It was inspiring seeing the scientist that has studied African dust transported over the Atlantic Ocean for over 40 years. He had a very active participation throughout the workshop and I had the honor to listen to his presentation which showed the passion he has for studies of African dust. Without his research and numerous collaborations, there would not have been a good level of comprehension of mineral dust today. That is some serious dedication!

What was it like to be part of organizing an international workshop bringing people together from Africa, Latin America, Europe, Asia, and the U.S.?

It was quite thrilling! I was grateful that Dr. Olga L Mayol-Bracero wanted me to be part of the local organizing committee. She is pro collaboration in research and I was attentive in how the workshop was being planned because I wish in the future to do one. Somehow I didn't feel overwhelmed because I was excited in meeting the participants and hearing what they had to share to us. I was also hoping that they get to love Puerto Rico and inspire themselves to promote more research in underrepresented countries.

What do you think the number one benefit is of participating in an IGAC workshop as a young scientist?

Even the greatest scientists of any given area of research have still unanswered questions. They may gather together in one place to establish new collaborations to embark on projects that may fill in those gaps. Insights will always be provided, but as we all know in the scientific world, we will never reach an absolute end to any type of scientific problem. I, as well as other young scientists today and in the future, need to be exposed to these types of workshops in order to start clearing those uncertainties. Although it will generate more questions, we contribute to a stepping stone in this area of research and leave this challenge to future generations.

When not studying dust, what do you best like to do in your free time?

I'm a down to earth kind of guy with an open mindedness to do lots of activities because I have a child's spirit. I love to play video games, be with my family and friends, go to the movies, hiking, skydiving, go to thrill rides, go to the beach, and anything else that comes to me in the moment. I don't believe in physically getting old. It is important to always keep the brain healthy and never stop practicing what one loves to do in their daily lives.

GEIA – The Global Emissions InitiAtive

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Foundations

Since 1990, GEIA (http://www.geiacenter.org/), a joint IGAC/iLEAPS/AIMES initiative of the IGBP, has served as a forum for the exchange of expertise and information on emissions. GEIA's two-fold mission is to quantify anthropogenic emissions and natural exchanges of trace gases and aerosols, and to facilitate the use of this information by the research, assessment, and policy communities.

GEIA connects and contributes to a variety of IGAC activities and scientists. Through funding from the EU, NASA, and other agencies, GEIA supports international scientific projects and provides a solid foundation for atmospheric chemistry research, by:

- Distributing emissions information. GEIA provides consistent access to global and regional emissions inventories and information about these datasets.
- **Improving emissions knowledge.** GEIA prepares state - of - the - science emissions summaries and facilitates emissions data evaluations and assessments.
- Connecting the emissions community. GEIA organizes meetings, conference sessions, and schools for inventory developers and users.

New Leadership

Gregory Frost and Leonor Tarrasón took over as GEIA co-chairs in June 2011, following the successful tenure of the previous chairs, Claire Granier and Alex Guenther. Dr. Tarrasón, Director at NILU's Urban Environment and Industry Department, is a chemical atmospheric modeler and has broad experience with the use of emissions inventories in policy and science applications. Dr. Frost, a Research Scientist at NOAA's Earth System Research Laboratory and the University of Colorado, has experience in regional air quality modeling, anthropogenic inventory development, and top-down emissions evaluation.

A new Steering Committee has been formed (Table 1) to help develop GEIA's vision for the future, broaden the GEIA community to include underrepresented regions of the globe, and find sources of long-term support of GEIA activities.

Moving Forward

In its new phase, GEIA seeks to build on the success of the past two decades and broaden its role to serve the scientific, regulatory, and operational emissions communities. GEIA aims to demonstrate the potential of improving emissions inventories through the combined use of different approaches, including bottom-up methodologies, new applications of in-situ and remote-sensing observations, and inverse modeling activities. GEIA will work to improve access to emissions information by promoting the interoperability of datasets and tools.

As a first step toward these goals, two new programs are presently being linked within GEIA: ECCAD and CIERA (see Figure 1). Their common aim is to facilitate access to emissions information. ECCAD (Emissions of chemical Compounds & Compilation of Ancillary Data, http://ether.ipsl.jussieu.fr/eccad) GEIA's new interactive emissions data portal that provides consistent access to global and regional emissions inventories and ancillary data, along with easy-to-use tools for analysis and visualization. CIERA (Community Initiative for Emissions Research & Applications, http://ciera-air.org/) is a GEIA community effort to develop interoperability in emissions datasets and tools, support evaluations of emissions inventories, and connect the emissions development and user communities. More details about ECCAD and CIERA are presented in the articles immediately following this note.

GEIA invites members of the IGAC community to join its network, attend the GEIA conferences, collaborate on upcoming GEIA programs,

and build up partnerships with GEIA to advance emissions knowledge for the future.

Opportunities

GEIA's next conference will take place in Toulouse, France, on 11-13 June 2012. This meeting is one of an ongoing series of regular conferences and sessions that GEIA organizes to unite the emissions community. Details of these meetings can be found on the GEIA website (http://www.geiacenter.org/).

Table 1. GEIA Steering Committee members, 2012-2014.

Committee Member		Affiliation
Leonor Tarrasón - Chair		NILU, Norway
Gregory Frost - Chair		NOAA & Univ Colorado, USA
Beatriz Cardenas		INE, Mexico
Hugo Denier van der Gon		TNO, The Netherlands
Claire Granier – Past Chair		CNRS & UPMC, France
Alex Guenther – Past Chair		NCAR, USA
Greet Janssens-Maenhout		JRC, Italy
Johannes Kaiser		ECMWF, UK
Terry Keating		EPA, USA
Zbigniew Klimont		IIASA, Austria
Jean-Francois Lamarque		NCAR, USA
Catherine Liousse		Laboratoire d'Aérologie, France
Paulette Middleton – Network Manager		Panorama Pathways, USA
Slobodan Nickovic		WMO, Switzerland
Toshimasa Ohara		NIES, Japan
Martin Schultz		FZ Jülich, Germany
Ute Skiba		CEH, UK
John van Aardenne		EEA, Denmark
Yuxuan Wang		Tsinghua University, China

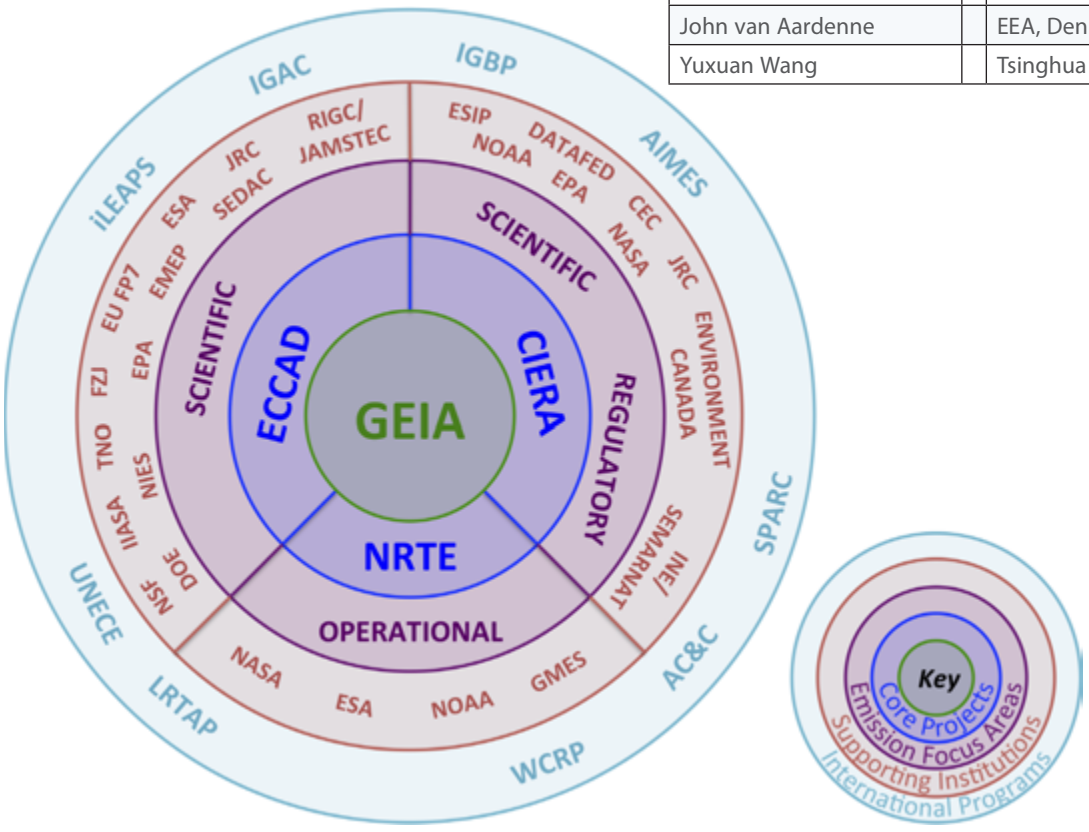

Figure 1. GEIA's community emissions efforts.

The ECCAD Database: Emissions of Atmospheric Compounds & Compilation of Ancillary Data

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1. Introduction

The analysis and modeling of atmospheric composition and its evolution requires an accurate knowledge of the spatial and temporal behavior of surface emissions. Reliable determination of these emissions at global and regional scales is furthermore necessary for the forecasting of the distribution of atmospheric compounds.

The ECCAD (Emissions of Atmospheric Compounds & Compilation of Ancillary Data) database has been developed to provide scientific and policy users with a large set of data on surface emissions of gaseous and particulate chemical species, as well as with ancillary data required to quantify and analyze surface emissions. Currently, ECCAD provides user-friendly access to global and regional emission inventories, ancillary data, and tools for the analysis and evaluation of these data.

The first step: the GEIA emissions portal

As part of the GEIA project, a first set of consistent gridded global emissions data was developed in the 1990s. At this time, GEIA aimed to provide at least one well-documented inventory for each chemical compound through the GEIA Center website http://geiacenter.org/. These original GEIA data have been used mainly for atmospheric chemistry modeling and policy issues.

In 2005, with the help of the ACCENT Network (Atmospheric Composition Change: The European Network, www.accent-network.org), a data portal was developed as part of GEIA, to provide an easy access to broader and updated sets of global and regional gridded data for anthropogenic, biomass burning, and natural emissions. Anthropogenic emissions included emissions from fossil fuel and biofuel consumption, industry and agricultural sources; biomass burning emissions covered emissions from wildfires, in forests and savannas; and natural emissions included emissions from vegetation, soils and oceans. The compounds considered in the portal were ozone precursors, greenhouse gases, aerosols and their precursors, organohalogens, and a few heavy metals.

For each inventory, the data portal provided: (1) gridded emission data files in NetCDF format, (2) total annual emission data, (3) emission maps for all the species, (4) metadata and documentation on the inventory, and (5) a visualization tool for comparing pregenerated maps.

The GEIA/ACCENT portal laid the foundations for the development of the ECCAD emission web interface.

The ECCAD database

ECCAD (http://ether.ipsl.jussieu.fr/eccad) is a sub-project of the French ETHER Data Center, which offers various products and services in the field of atmospheric chemistry. ETHER has been created and is co-directed by the French National Center for Space Studies (CNES) and the French National Institute for Earth Sciences and Astronomy (INSU). ECCAD also benefits from the support of the French Environment and Energy Management Agency (ADEME).

ECCAD aims to provide access to a large set of data, and to give detailed information on each dataset, in order to increase the visibility of each of the datasets and of the groups who developed them. Many of the datasets available within ECCAD have been developed, formatted or adapted through funding of different projects, such as MACC and MACC-II (http://gmes-atmosphere.eu), CityZen (http://cityzen-project.eu/), RETRO (http://retro.enes.org), PEGASOS (http://pegasos.iceht.forth.gr/), etc.

Structure

The ECCAD database has been structured using the relational DBMS (Database Management System) PostgreSQL. This system has optimal storage of data (no redundancy) using well structured and linked data, and has easy data management and data update. The login process is simple, and the information requested is used to gather statistics on the users.

The web interface has been developed using many different technologies (JSF, Hibernate, Mapserver, Java/Javascript/C++/C languages, etc.). The home page provides a list of available datasets and,

Table 1. List of inventories available in ECCAD.

Global inventories				
Acronym	**Categories**	**Species**	**Dates**	**Resolution**
ACCMIP	ANT, BB	All	1850-2000	0.5x0.5
MACCity	ANT	All	1980-2010	0.5x0.5
RCPs	ANT, BB	All	2000-2010	0.5x0.5
J&L / Junker &Liousse	ANT	BC/OC	1860-2003	1x1
RETRO	ANT, BB	All	1980-2000	0.5x0.5
GFED3	BB	All	1997-2009	0.5x0.5
GFED2	BB	All	1997-2005	1x1
GICC	BB	All	1900-2005	0.5x0.5
FINN	BB	All	2002-2010	0.5x0.5 (*)
GUESS-ES	BB	All	1970-2010	1x1
IS4 FIRES	BB	All	2000-2010	0.5x0.5 (*)
AMMABB (Africa)	BB	All	2000-2006	0.5x0.5 (*)
MEGANv2	NAT	NMVOCs	2000	0.5x0.5(*)
MEGANv2-CH3OH	NAT	CH3OH	2003-2009	0.5x0.5
EDGAR v3	ANT	All	1990, 1995, 2000	1x1
HYDE 1.3	ANT,BB	All	1890-1990	1x1
POET	ANT,BB,NAT	All	1990-2000	1x1
ANDRES-CO2	ANT	CO2	1751-2003	1x1
AMAP-Mercury	ANT	Hg	1995-2000	0.5x0.5
HYDE				
Acronym	**Categories**	**Species**	**Dates**	**Resolution**
TNO-MACC	ANT	All	2003-2007	0.5x0.5 (*)
EMEP	ANT	All	1980-2020	0.5x0.5
REAS	ANT	All	1980-2020	0.5x0.5

after login, allows the user to view the metadata, and to visualize, analyze and download the data. All the data have been standardized to a unique format, nomenclature and units. In order to allow a meaningful comparison of the emissions, a common unit is used for all the emissions data (kg/m^2/s), and the molar masses have been harmonized. The values of the molar masses, along with the different types of available data are listed in the "Table of Species" in the "Emissions" tab. The system can currently handle grids at 0.5° and 1° resolution, and geographical masks (regions, countries) can be applied for regional studies.

The documentation pages, which give the list of the characteristics of the different datasets and associated metadata, are created dynamically from the information stored in the ECCAD database. One option in the Table of Species allows the user to interactively sort the various inventories by category and species. A preliminary version of a module to calculate online biomass burning emissions is also available.

Data currently available

Table 1 indicates the list of inventories available in ECCAD as of February 2012. Since new inventories are added regularly, the reader is invited to look at the most recent list on the ECCAD webpage. Note that several regional inventories (indicated with '*' in Table 1) exist at a higher resolution than 0.5x0.5 degree. Links to access the original high resolution datasets are provided in the metadata.

Files format and download

After the selection of the dataset and the species of interest, the corresponding emissions or ancillary data can be downloaded from ECCAD in NetCDF format. All the files are fully CF-compliant (see www.unidata.ucar.edu for more information). The files can also be obtained in ASCII format. Further development will allow the user to download the data for more than one species at a time, and a regridder tool will enable the user to acquire data at various output grid resolutions.

All downloaded NetCDF files are interoperable, i.e. the data are compatible with many other client

interfaces and can be reused for different operations. Two protocols, WCS (Web Coverage Service) and WMS (Web Map Service), are applied on the downloaded data, which allows data to be served via the Internet through requests as geographical coverages or georeferenced maps. The NetCDF formatting and the WCS/WMS protocols used in ECCAD are the same as those used in the CIERA portal (http://ciera-air.org/), described in a companion article in this issue.

Complete metadata are also available and exportable in PDF files.

ECCAD visualization and analysis tools

Several tools are available in ECCAD for the visualization and the analysis of emissions and ancillary data. A few examples are given in this Section.

The visualization of the data can be done at the global scale, and a zoom is available, allowing the user to look at emission details. Each distribution can be compared with any other data (Figure 1, left column) and different color schemes or scales are available, allowing the user to highlight specific features in the data. In addition to visualization, different tools can be used to analyze or evaluate the data. For example the calculation of the totals emitted can be done, as shown in Figure 1 (top right). Here the totals of SO_2 for several large regions of the world are shown, together with the total calculated over the globe (given above the color bar). The temporal evolution of the studied parameter at a specific location can also be displayed, as shown on Figure 1 (bottom right): in this example, the anthropogenic methane emissions from the ACCMIP inventory from 1850 to 2000, at a location in Brazil, indicate large increases during the past decades.

The ECCAD home page provides the link to the tools and their description, as well as a detailed Users's Manual.

Future plans

In the next two years, the ECCAD team plans to provide updated and newly developed gridded emission datasets, such as several datasets of past and future anthropogenic emissions, as well as more regional emission inventories, especially for developing regions such as Africa, India, and South East Asia. New ancillary data will be included as well; for example, the new data will include data used to spatially distribute anthropogenic emissions, and data on land-use, vegetation, etc.

Currently, only data at 0.5 degree resolution in latitude/longitude or at a lower spatial resolution can be introduced into ECCAD. The team plans to modify the database in the future, in order to handle higher resolution data, at 0.1°x0.1° resolution for example. They also plan to include non-gridded emissions datasets, so that comparisons of totals for different regions and countries can be achieved.

New developments on the ECCAD web interface are planned, as well as new tools to improve analysis and comparison of emissions and ancillary data. These include a regridding tool, arithmetic expressions to combine different maps, interactive selection of scale values, and new tools for temporal profiles analysis. Comparisons of data with different scales will also be made possible. The online module to calculate biomass burning emissions will be improved, and will also be extended to anthropogenic emissions.

How to contribute

Current ECCAD users originate from more than 30 countries, and ECCAD would like to benefit from this large community of users to expand the number of datasets made available to the community. All colleagues interested in sharing their data with a large community of users are encouraged to contact the ECCAD team either directly or through the ECCAD website by clicking on the envelope tab.

The ECCAD team will work with the owners of new datasets on formatting the data, as well as the corresponding metadata, before their inclusion in ECCAD.

Another valuable way to contribute is by sending suggestions and remarks to ECCAD, or by filling in the questionnaire available on the web site. This will help ECCAD better meet users needs and expectations.

Finally, an ECCAD advisory board will be formed in 2012. This committee will help define the priorities for future developments of ECCAD, and give advice on how to provide the highest level service to the users community.

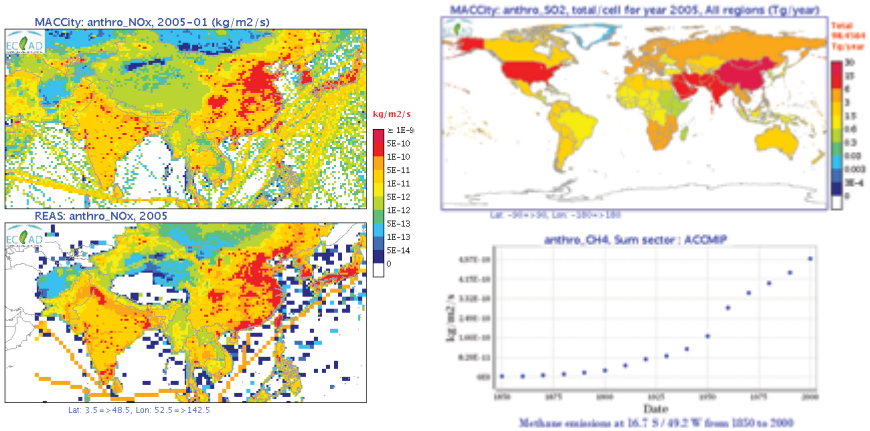

Figure 1. Example of tools available in ECCAD: Surface emissions comparison (left), total per region and at the global scale (top right), evolution of methane emissions (bottom right).

CIERA – The Community Initiative for Emissions Research and Applications

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Introduction

The Community Initiative for Emissions Research and Applications (CIERA, http://ciera-air.org/), a community project of the Global Emissions InitiAtive (GEIA, http://geiacenter.org/), aims to increase access to emissions data and facilitate improvements in emissions knowledge. CIERA's goals are to develop interoperability in emissions datasets and tools, communicate information about emissions, connect the emissions development and user communities, and support evaluations of emissions inventories. This article describes the motivations for CIERA's activities, progress in achieving the project's goals, and CIERA's future directions.

Motivations and Origins

Emissions inventories, which account for the anthropogenic and natural inputs to the atmosphere, provide critical information to modeling and observational systems for air quality and climate science and policy. Inventories that meet science and policy needs should include consistent, fully-speciated emissions estimates of air pollutants, toxics, and greenhouse gases from local to global scales over multi-decadal time periods, quantified by methods with well-understood uncertainties. However, existing emissions information generally falls short of these requirements for many reasons, including: a variety of methodologies, formats, and distribution methods; a lack of data standards; insufficiently broad access to foundational information; and difficulties in comparing and evaluating inventories [*Frost et al.,* 2012; *Granier et al.,* 2011; *Lamarque et al.,* 2010]. While progress evaluating emissions is being made through analyses combining in-situ and remote-sensing observations from field studies, monitoring networks, and satellites with forward and inverse model calculations [*HTAP,* 2010; *NRC,* 2010], the insights derived from these approaches have not been adequately incorporated into worldwide regulatory inventory development.

Recognition of these shortcomings has led GEIA to work for two decades to improve the knowledge of emissions. GEIA provides emissions data to the scientific community, connects inventory developers and users through meetings and training programs, facilitates emissions summaries and assessments, and develops supporting metadata, data, and tools. GEIA's most recent effort in this area is the development of ECCAD [http://ether.ipsl.jussieu.fr/eccad], a clearinghouse of inventories and ancillary datasets (see ECCAD companion paper in this issue). Through its work, GEIA has demonstrated that the quality and relevance of emissions data for science and policy uses will be enhanced by closer collaboration between scientists and regulators, and by integrating objective evaluations with regulatory inventory development approaches [*Frost et al.,* 2012].

It was in this spirit that GEIA organized a workshop in December 2009 in Boulder, Colorado, USA that involved a small group of experts in inventory development, atmospheric modeling, and ambient observations. This group outlined a number of common themes about the state of emissions information. They concluded that there was a need for collaborative, community-assessed approaches to emissions research that allow for consistency across temporal scales and spatial domains and for species of air quality and climate relevance.

CIERA was founded soon after this workshop by a development team (http://ciera-air.org/about) formed largely from the workshop's participants. The CIERA team recognized that the development of accurate, timely and traceable inventories requires a broad science-policy community approach that leverages existing expertise, expands data networks, adopts new information technology tools, and improves interactions among data providers and users [*Frost et al.,* 2012].

From the outset, CIERA has benefited from critical support from various organizations. The Federation of Earth Science Information Partners (ESIP) has provided the online collaboration platform for CIERA's website and linked CIERA to the latest developments in information science and technologies through its expert community and working groups. The US

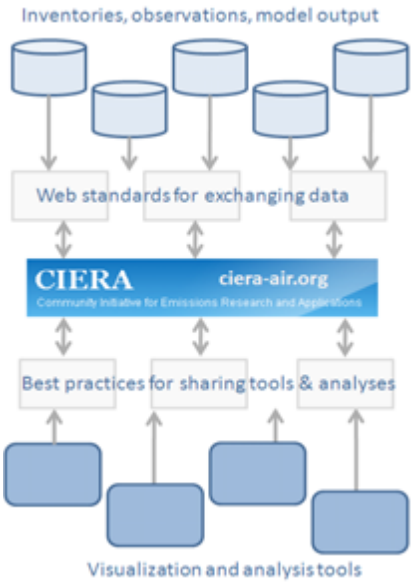

Figure 1. Conceptual model for the interoperability of datasets and tools.

Environmental Protection Agency (US EPA) initiated CIERA's web development. Ongoing CIERA support comes from NOAA, US EPA, the National Science Foundation, and other Federal agencies.

CIERA has recently become an official GEIA project (see GEIA companion paper in this issue). Several members of the CIERA development team are also directly involved with GEIA and ECCAD, and these close connections allow GEIA, ECCAD, and CIERA to function synergistically.

Goals and Progress

In this section we describe some of the progress that has been made in implementing CIERA's goals of developing interoperability in emissions datasets and tools, communicating information about emissions, connecting the emissions development and user communities, and supporting evaluations of emissions inventories.

Interoperability

To facilitate evaluations of emissions inventories, CIERA is working to make emissions data interoperable with other Earth science datasets. There is now a broad and shared pool of Earth science data distributed by multiple providers, including emission inventories at different scales from many developers, a vast array of observations from monitoring networks to satellite retrievals to measurements collected during field studies, and the outputs of many atmospheric models (Figure 1). Interoperability of these data requires standardized ways for accessing them over the web and having consistent metadata associated with each dataset. By adopting web standards, data providers can more easily share their data with a broader user base. This approach also enables a distributed network of data consumers to build and tailor tools to manipulate, visualize, and analyze these data.

CIERA's prototype tools illustrate the implementation and use of web services with the EDGAR-HTAP global inventory [*Janssens-Maenhout et al.,* 2012]. One of these tools allows the various pollutant emissions for each year to be individually downloaded from the original EDGAR-HTAP dataset (Figure 2A). Another CIERA application allows users to input filtering criteria to access a narrower subset of the EDGAR-HTAP data (Figure 2B). A tool for comparing two datasets, e.g., different years of EDGAR-HTAP data, converts user input selections into web service calls to access the specified data, carry out the specified grid comparison calculation, and map the result (Figure 2C). The comparison results can also be exported for later upload by a user's preferred tools (Figure 2D).

Similar web service approaches are being defined and used across the Earth science community, and CIERA relies heavily on connections to these other practitioners. CIERA is part of the Group on Earth Observations (GEO) Air Quality Community of Practice (http://wiki.esipfed.org/index.php/GEO_AQ_CoP), which connects an international community of air quality data providers and analysts working on standards, conventions, and tools for sharing data.

CIERA's implementation of web services to date has resulted in linking together a number of gridded emission inventories for the entire globe, North America, and Asia (http://ciera-air.org/services), including several datasets that are also available through the ECCAD portal (http://ether.ipsl.jussieu.fr/eccad). The CIERA portal also provides access to a recently released global inventory of annual SO_2 emissions from 1855-2005 [*Smith et al.,* 2011].

Communicating and Connecting

CIERA is taking advantage of information technology innovations to communicate about emissions databases, research results, and community activities. The goal is to better connect emissions data developers and users in meaningful ways that could enable the improvement of emissions knowledge.

Information on emissions is currently distributed among many types of sources. Detailed descriptions of the methodology and fundamental datasets used to produce inventories are often not available in the peer-reviewed literature and may not be broadly accessible over the long term. CIERA is building a searchable community bibliographic database of emissions literature based on existing software and social networking frameworks.

CIERA is also developing the capability to share the results of an online analysis with other users. For example, when carrying out a comparison of two datasets, a user can save the result of the analysis online, tag it with information about the datasets used and analysis performed, and save this result for later use by others who, in turn, can recreate the analysis or build upon it. This capability could assist groups working to compare or evaluate inventories and reduce duplication of effort.

CIERA's web portal also provides community blogs with information about a specific subject or event, and forums where the CIERA user community can discuss a subject of interest. CIERA users can initiate their own blogs and forums as well as contributing to existing ones, and users can advertise emissions related events, such as con-

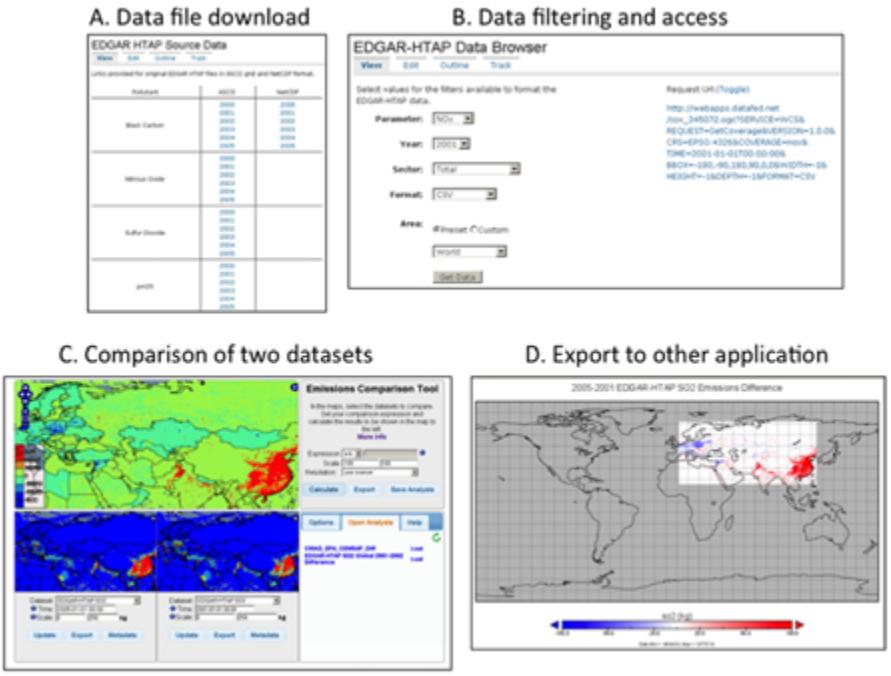

Figure 2. Examples of prototype CIERA applications based on web services applied to the EDGAR-HTAP inventory.

ferences or workshops, on the CIERA portal's event calendar.

In collaboration with GEIA, CIERA is helping to organize workshops and sponsor sessions on emissions at international scientific conferences. For example, the GEIA- and CIERA-sponsored session "Evaluating Emissions Across Spatial and Temporal Scales" was one of the largest Atmospheric Sciences sessions at the AGU 2011 Fall Meeting. CIERA and GEIA also regularly organize a Town Hall at the AGU Fall Meeting which serves as a forum for participants to learn about GEIA's projects, discuss emissions issues, request assistance with emissions information, and suggest new lines of effort in emissions research and development.

The Way Forward

The CIERA development team plans to continue building CIERA's online collaboration space with the help of the CIERA community. Additional emission inventories and analytical tools will be brought online based on community suggestions and needs. The process of connecting CIERA to observational and model data systems, such as those of DataFed [*Husar et al.,* 2008] and FZ Jülich (http://ogc-interface.icg.kfa-juelich.de:50080/), is another goal toward realizing the full potential of online emissions evaluations.

CIERA sincerely wishes to engage and help strengthen the emissions community. CIERA invites all with an interest in emissions, including developers of emissions inventories, scientists who carry out analyses of emissions data, and users of emissions information, to join in this community activity and help guide its advancement. The CIERA development team's ongoing efforts to communicate CIERA's vision and progress have been met with an overwhelmingly positive response from the Earth science and policy communities. The IGAC community has a clear need for, and broad expertise in producing, accurate and timely emissions information. We invite you to contact the CIERA development team to find out how you can contribute to CIERA.

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Workshop Summary: Air Pollution & Climate: A Science-Policy Dialogue in Asia

Taipei, Taiwan · 7 – 10 November 2011

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The International Geosphere-Biosphere Programme's (IGBP) Air Pollution & Climate Initiative had its second workshop on *Air Pollution & Climate: Creating a Science-Policy Dialogue in Asia* held in Taipei, Taiwan 8 -10 November 2011. A one-day Symposium with Taiwanese scientist and policy makers preceded the workshop. The symposium and workshop were funded by the Taiwan Environmental Protection Administration (TEPA). This workshop was a follow-up to the first Air Pollution & Climate Initiative Workshop entitled *Tackling the Air Pollution and Climate Change Challenge* held in Arona, Italy 9-10 June 2011 (workshop summary, IGACNews, vol. 45, p. 15-16).

The one-day *Symposium on Air Pollution and Climate: Creating a Science-Policy Dialogue in Asia* was held at the National Taiwan University. The Symposium consisted of participants from Taiwan's academic and policy-relevant institutions such as National Taiwan University, Academia Sinica, TEPA, amongst others. Presentations were given by participants in the workshop and covered topics on air quality and climate change ranging from *Methane Mitigation: Benefits for Air Quality, Health, Crop Yields, and Climate* by Denise Mazuerall from Princeton University, USA to *Integrating Air Quality and SLCF Reduction into Development: Observations on Tactics* by Jessica Seddon from the Indian Institute for Human Settlements, New Delhi, India. The Symposium concluded with a series of talks on regional policy perspectives from Taiwan, Asia, Africa, South America, Europe, Australia, and the United States. Presentations from the symposium are available at http://apc2011.rcec.sinica.edu.tw/program.htm.

Following the symposium a three-day workshop on *Air Pollution and Climate: Creating a Science-Policy Dialogue in Asia* was held at Academia Sinica. The workshop had 25 participants across the science-policy spectrum representing 15 different countries. The first two-days of the workshop focused on framing *The IGBP Statement on the Air Pollution and Climate Change Opportunity*. The Statement will be released during the Planet Under Pressure Conference 26-29 March 2012 in London (www.planetunderpressure2012.net) as part of the session on Tackling the Air Pollution and Climate Change Challenge: A Science-Policy Dialogue. The final day of the workshop focused on the development of an outline for a *Strategic Plan for an Interdisciplinary Programme on Air Pollution and Climate Change*. The Strategic Plan will present a framework for developing interdisciplinary programmes around five key challenges where an integrated approach to air pollution and climate is needed. The Strategic Plan will be released in Autumn 2012.

Road Map To Cleaner Fuels And Vehicles In Asia

Ritchie Anne Roño[1] and May Ajero[1]

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Asian vehicle population is on the rise. In the next 25 years, vehicles in China and India are forecast to surpass that of OECD (Organization for Economic Cooperation and Development) countries. Vehicle emission and fuel quality standards play a critical role in limiting the emissions from each vehicle and, together with other measures, in reducing the impact of continued vehicle growth on Asia's air quality.

The Clean Air Initiative for Asian Cities (CAI-Asia) is the strategic partner of the UNEP Partnership for Clean Fuels and Vehicles in the efforts to reduce vehicular air pollution through the promotion of lead-free, low sulphur fuels and cleaner vehicle standards and technologies in Asia.

Motor vehicles are responsible for as much as 75% of ambient particulate matter levels among Asian cities. The average concentration of PM_{10} in Asian cities is 90µg/m^3, exceeding the World Health Organization (WHO) air quality guideline of 20µg/m^3 by almost 400%. As PM_{10} in the ambient air increases by 10µg/m^3, the risk of early deaths in Asia goes up by 0.5% according to research done by the Health Effects Institute. Worldwide statistics from the WHO shows that particulate matter alone kills 3.1 million people annually, including 2 million from indoor air pollution. This is higher than the average number of people killed in traffic accidents annually.

Near roadside traffic emissions are also a major concern, and health studies suggest that people living within a range of up to 300 to 500 meters to a highway or major road are most highly affected by traffic emissions. Protecting public health and reducing the economic burden of treatment are compelling reasons to mandate vehicle emissions and fuel quality standards in Asia.

CAI-Asia has taken an interest in vehicle emissions and fuel quality because of the direct relationship among vehicle emissions, air quality and health in Asian cities. Through dialogues and consultations among stakeholders spearheaded by CAI-Asia, the "Road Map for Cleaner Fuels and Vehicles in Asia" was drafted. This document strongly encourages Asian countries to develop national plans with clear timelines to introduce fuel and vehicle standards so that the oil and vehicle industries can sufficiently plan for the investments needed to comply with the new standards.

Facilitated workshops with government agencies, oil companies, vehicle manufacturers, and other institutions so far have resulted in an agreed timeline for introducing Euro 4-compliant fuel and vehicles by 2016

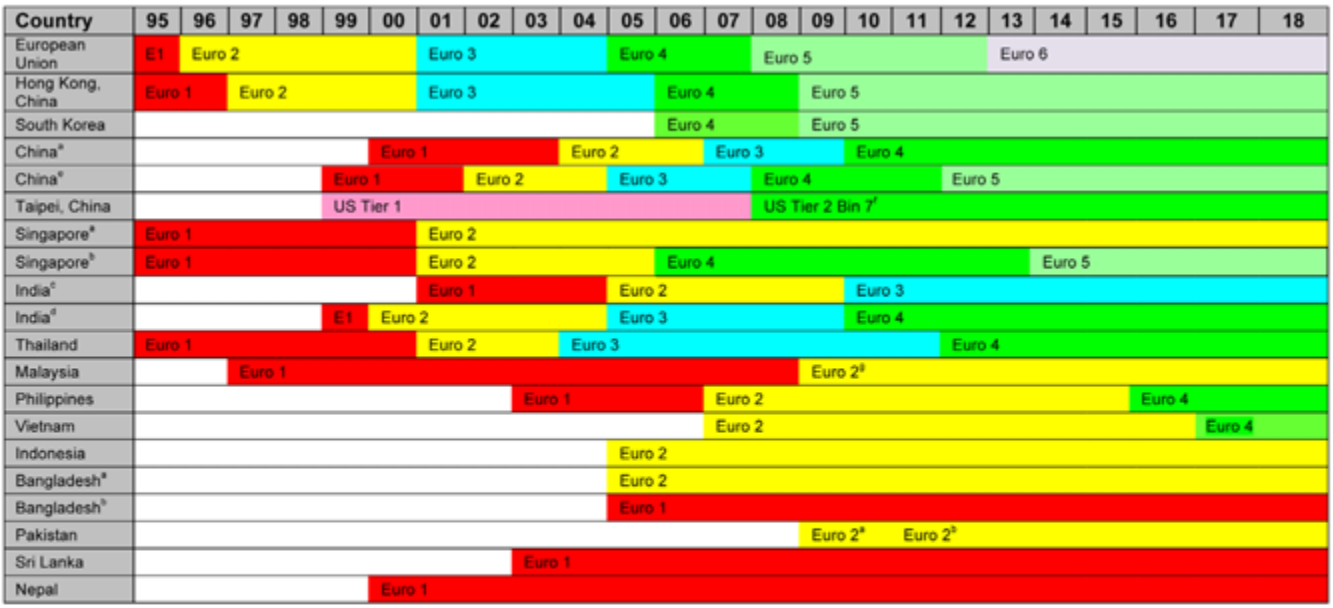

Figure 1. Emission standards for new light-duty vehicles in Asia.

Notes:
*The level of adoption vary by country but most are based on the Euro emission standards
Italics – under discussion; a – gasoline; b – diesel; c – Entire country; d – Delhi, Mumbai, Kolkata, Chennai, Hyderabad, Bangalore, Lucknow, Kanpur, Agra, Surat, Ahmedabad, Pune and Sholapur; Other cities in India are in Euro 2; e – Beijing [Euro 1 (Jan 1999); Euro 2 (Aug 2002); Euro 3 (2005); Euro 4 (1 Mar 2008); Euro 5 (2012)], Shanghai [Euro 1 (2000); Euro 2 (Mar 2003); Euro 3 (2007); Euro 4 (2010)] and Guangzhou [Euro 1 (Jan 2000); Euro 2 (Jul 2004); Euro 3 (Sep-Oct 2006); Euro 4 (2010)]; f – Equivalent to Euro 4 emissions standards; g – for gasoline vehicles only

Source: CAI-Asia. December 2011. Emission standards for new light-duty vehicles

in Philippines, and Euro 4-compliant fuel by 2016 and light-duty vehicles by 2017 in Vietnam.

South Asian countries, apart from India, have yet to develop road maps beyond their current Euro 1 and Euro 2 standards. Thirteen major metropolitan cities in India have already adopted stricter standards of Bharat Stage IV (Euro 4 equivalent) petrol and diesel and soon to be expanded to 20 cities, but there is no clear road map for nationwide introduction.

While the trend in Asia is to progressively tighten vehicle emission standards, the region has a long way to go towards harmonization. Figure 1 shows the current emission standards for new light-duty vehicles of several countries in Asia.

Sulfur in fuels deserves special attention. Vehicle emissions contribute to the buildup of sulfur aerosols over Asia known as the atmospheric brown cloud. The brown clouds are made up of smog from diesel emissions, soot and other byproducts of biomass burning which deflect sunlight, creating dimming at ground level of the Earth's surface.

However, progress in reducing sulfur levels in diesel down to 50 ppm in other Asian developing countries has been slow. China and India are phasing down to 350 ppm nationwide starting 2010, even though 50 ppm has already been mandated for Beijing (2008), Shanghai (2009) and Guangdong Province (2010). Sulfur levels in diesel in most developing countries of Southeast and South Asia remain at 500 ppm and higher except for Philippines, Thailand and Vietnam which already set in place a road map for 50ppm sulfur levels (Figure 2).

The other reason for linking these two standards is the impact of vehicle emission standards in reducing black carbon. Emissions of black carbon are the second strongest contribution to current global warming, after carbon dioxide emissions, and switching to stringent emission standards can reduce release of black carbon into the atmosphere. Experts believe that reducing black carbon offers biggest impact on immediate climate mitigation.

Standards for clean fuels and clean and efficient vehicles go hand in hand. Without strong standards in place for both CO_2 and conventional pollutants, it is unlikely that advanced vehicle technology will improve air quality or reduce greenhouse gas emissions.

At levels of 50 ppm and above, sulfur can reduce the effectiveness of advanced three-way catalysts for gasoline vehicles and clog particulate filters in diesel vehicles. The link between low sulfur and better air quality can be shown in the case of Thailand, which achieved lower roadside and ambient levels of PM_{10}, carbon monoxide and nitrogen dioxide from its fuel sulfur reduction measures.

Reducing emissions from motor vehicles in Asia requires an integrated approach which includes improving vehicle inspection and maintenance systems, transport planning and demand management,

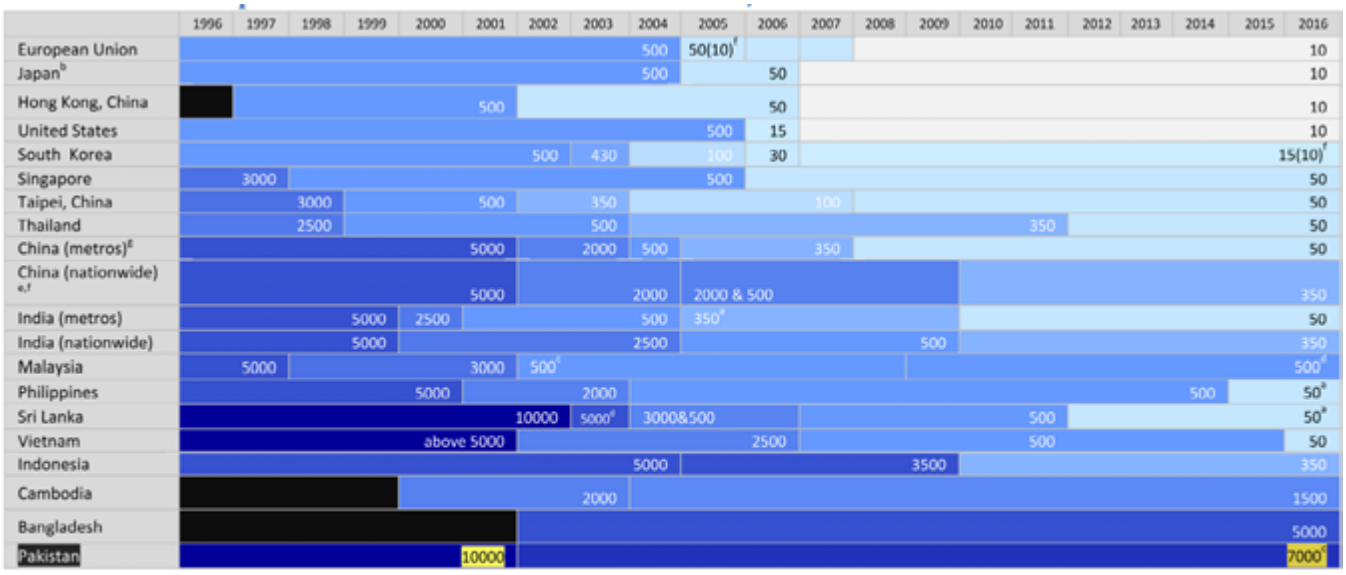

Figure 2. Current and proposed sulfur levels in diesel in Asia, EU, and USA.

Notes:
a - under consideration/ discussion; uncertain; b = nationwide supply of 50 ppm commenced in 2003 and for 10 ppm in 2005 due to voluntary goals set by the oil industry; c = marketed; d = mandatory; e = voluntary standard of 500 ppm, however formal standard remains 2000 ppm, product in the market nationwide varies 500-1000 ppm; f = various fuel quality available; g = Beijing, Guangdong, Shanghai Source: CAI-Asia. 2011. Current and Proposed Sulfur levels in Diesel in Asia, EU and USA

and promoting public transport and non-motorized transport. These parallel measures are needed; otherwise, the gains in reducing emissions from each vehicle through stricter standards could be offset by an increase in vehicle numbers and in vehicle-kilometers traveled.

To move Asia forward, national governments need to take the lead by mandating a clear and firm road map for cleaner fuels and vehicles. In consultations by CAI-Asia with governments and other stakeholders, the question on the financial and economic impacts of tighter vehicle emission standards always crops up. Experience from developed countries suggests that moving to cleaner fuels and vehicles does not adversely affect the economy and in fact benefits the economy through better public health. Country-specific analysis on the financial and economic impact could help national governments show that the cost of inaction (public health impact of air pollution) truly outweighs the cost of taking action (mandating stricter standards).

Also, growing interest in fuel economy standards provide a window of opportunity to link the vehicle emission standards with fuel economy standards. Linking these two measures requires a new approach and it has the potential to provide huge benefits to the society. In 2010, the Global Fuel Economy Initiative and CAI-Asia have conducted an in-depth survey of ASEAN auto and fuel policies, providing countries with the basis to develop a common framework for fuel economy policies and measures.

The Better Air Quality (BAQ) conferences, organized biennially by CAI-Asia, are the main platform whereby policy makers, practitioners and other stakeholders meet to network, learn and share experiences on issues relating to clean fuels and vehicles. It is the largest gathering on air quality in Asia covering transport, energy, industry and climate change.

The activities of CAI-Asia related to fuels and vehicle emissions are guided by the same underlying principles that guide all other activities of CAI-Asia. Effective policy making requires dialogue among all stakeholders and needs to be based on sound science. A transparent process can help to increase understanding and buy-in for policy decisions. Policy processes should also be predictable so that key stakeholders can prepare properly for their implementation.

About CAI-Asia

The Clean Air Initiative for Asian Cities (CAI-Asia) promotes better air quality and livable cities by translating knowledge to policies and actions that reduce air pollution and greenhouse gas emissions from transport, energy and other sectors. CAI-Asia was established as a multi-stakeholder initiative by the Asian Development Bank, World Bank and USAID in 2001, and operates since 2007 as an independent non-profit organization. CAI-Asia has offices in Manila, Beijing and Delhi, networks in eight Asian countries (China, India, Indonesia, Nepal, Pakistan, Philippines, Sri Lanka, and Vietnam) and is a UN recognized partnership of over 230 organizations in Asia and worldwide. Its flagship event, the Better Air Quality conference, brings together more than 500 practitioners, policy makers and the private sector.

For details on how you can participate in the upcoming BAQ conference in Hong Kong, visit www.baq2012.org.

To learn more about CAI-Asia projects and activities, go to www.cleanairinitiative.org.

Air Pollution & CLIMATE
a science-policy dialogue

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Where are you from?

I was born and raised in Taipei, the capital of Taiwan. My hometown is one of the major metropolitan areas in northeast Asia surrounded by lush mountains and meandering rivers.

Where did you receive your undergraduate and graduate degrees and in what subjects?

My academic background is in general chemistry and biology related to environmental health. I received my bachelor degree in Public Health, at Chung Shan Medical University, Taichung, Taiwan. After graduating from college, I pursued a PhD in Environmental Health at the National Taiwan University, Taipei, Taiwan. My doctoral dissertation focused on the health assessment of workers' exposure to 1,4-dichlorobenzene.

Where and what is your current position?

My current position is a Post-doctoral Research Fellow at Taiwan's Research Center for Environmental Changes at Academia Sinica.

What is your current area of research?

My current research area concentrates on the interaction between urban air pollution and vehicle emissions. I am investigating traffic driven aerosol pollution, such as black carbon, particulate matters, and total PAHs. Organic aerosols are important pollution components that may play key roles in regional air pollution, climate change, and atmospheric chemistry, especially in metropolitan areas. My preliminary outcome suggests that policies like electronic toll stations significantly reduce the soot concentration. This scientific evidence might encourage our government to make more efforts.

What got you involved in this area of research?

It began with a NSC grant on a highway vehicle emission project. My research indicates that certain policies mitigate aerosol emission concentrations along highways. I have experience in using Gas Chromatography-Mass Spectrometers to analyze organic aerosols and in using Liquid Chromatography-Mass Spectrometers to analyze persistent organic compounds in the water to assess the associated risk in the environment and in human biological indicators. Organic aerosols are an important influence on human health and climate change. Climate change is a big issue, and I would like to contribute some efforts to the community. I am eager to apply these technologies to have a more robust monitor method on urban aerosol pollutants. Focus on the detection of aerosol species of urban cities and evaluating the various influences of control programs to induce the atmospheric pollution situation are my future direction.

Is there an element or aspect of your research you believe to be particularly important?

Yes, traffic emission definitely is. A metropolitan area consists of several satellite cities, daily cross-commuting takes place every day. People spend time traveling between work and home; they produce and are exposed to air pollutions while commuting. Traffic induced organic aerosols are one of the major pollutants threatening human health. Thus, my ambition is to find out what the major organic components from traffic emissions are, as well as their potential roles in climate change and human health. I do believe with proper policy making, we can control the traffic driven aerosol pollution concentration.

How did you become a member of the IGAC community and do you think as a young scientist IGAC workshops and conferences will aid your career as a scientist?

My supervisor, Dr. Candice Lung, encouraged me to join the IGAC community when I attended the symposium and workshop *Air Pollution & Climate: A Science-Policy Dialogue in Asia* in November 2011 in Taipei, Taiwan. I met many friends from all over the world. I was touched by their enthusiasm

in scientific research. I learned a lot from the participants and the conference. For me, as a young scientist, getting insights on air pollution sources, their fate, effects, and control and reduction on cities and other areas helped me understand atmospheric chemistry better than before. This greatly broadens my viewpoint. I also hope I can extend my connections for potential collaboration.

What was the highlight for you of the Air Pollution & Climate: A Science-Policy Dialogue in Asia workshop?

I would say, "control of air pollutants that lead to warming of the atmosphere is necessary to meet climate targets". I was impressed with the idea of controlling the emission of soot and achieving a win-win benefit and cost savings. The preliminary conclusion we got is that by reducing the emission of soot appears to be beneficial for health and climate. Reductions from diesel engines appear to be especially beneficial for urban air quality, especially in Asia.

What motivated you to pursue a career in science?

In college, I had an opportunity to study about exposure assessment. Investigating the fluoride concentration in tea and using the concentration and daily drink amount to assess the exposure risk was my topic. As I was pursuing an advanced degree, my interest in identifying and evaluating environmental health problems grew bigger.

What are challenges of being a woman scientist in Asia?

I feel blessed. This is not an issue in Taiwan. Women scientists have relatively equal opportunities. However, to balance between work and family is never easy for a woman. Other than this, to be aspired by ordinary things and turn these inspirations into a new research direction would be a major challenge.

What do you do for fun when your not conducting research at Academia Sinica?

Reading is my major hobby. I enjoy many kinds of categories. For example, arts and photography, crafts, hobbies and home, cookbooks, comics and graphic novels, health and life, biographies and memoirs, and travel. I think reading increases my viewpoint of the world. I am also very fascinated with handicrafts; I like to DIY.

The Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP) 2nd Workshop · Pasadena, CA USA

30 January – 1 February 2012

Jean-François Lamarque[1] and Drew Shindell[2]

[1]National Center for Atmospheric Research, Atmospheric Chemistry Division, Boulder, CO USA

[2]NASA, Goddard Institute for Space Studies, New York, NY, USA

The 2nd Atmospheric Chemistry and Climate Model Intercomparison Project (ACCMIP) Workshop was held in Pasadena, Jan. 30-Feb 1 2012. The goal of the workshop was to assess progress on ACCMIP analysis efforts as they progress, to plan together with satellite observational teams the model evaluations that can be completed during the next few months, and to present the ACCMIP activity more fully to those who were new to ACCMIP (such as attendees of the HTAP workshop held jointly with ACCMIP). The overall attendance was from modeling groups representing Canada (CCC), France (Meteo-France), Japan (MIROC), Norway (CICERO), United Kingdom (MetOffice, University of York) and USA (GFDL, LLNL, NASA-GISS, NASA-Goddard and NCAR) and from additional analysis groups from Italy (JRC), United Kingdom (Cambridge University and U. of Edinburgh) and USA (EPA, NOAA, UC Irvine and University of Maryland).

The agenda was organized around the following research topics:

- Tropospheric ozone budget and trends
- Ozone radiative forcing
- Aerosol direct and indirect forcings
- Methane: historical and future trends, present-day interannual variability
- Black carbon in ice-cores
- Nitrogen and sulfate deposition
- Model evaluation (troposphere and stratosphere)
- Climate penalty (on air quality)
- Health impacts of air quality changes

The focus on the presentations was the ongoing analysis of the existing simulations available at the BADC, identification of shortcomings in available data and requests for additional data. In addition, much discussion went into refining the specific goals of each paper (with the list above being the papers presently planned) and determining the availability of data and needs for model evaluation. The leads for each analysis and the observational data to be included in each analysis have now been agreed upon for all the topics above. It was decided the target submission of July 2012 (in order for the papers to be usable in the AR5) would apply to the first eight papers listed above, while the "Health impacts of air quality changes" and a newly developed analysis of "Agricultural impacts of surface ozone changes" could be completed later if necessary as these are more relevant to the Impact Working Group II of the IPCC (which has a later deadline).

Additional simulations to target key uncertainties in our current understanding were defined; in particular, priority was set on performing sensitivity experiments, based on the 2000 time slice, on methane and lightning, with an intention to also have the methane sensitivity experiment performed for 2100 conditions. A simulation covering the 2001-2010 period that would be driven by observed sea-surface temperatures was also suggested as a way to help evaluate the model simulated interannual variability and facilitate understanding of differences with respect to the many satellite observations available during this period. Presentations from several satellite teams, largely those based at JPL, highlighted the many available global datasets that could be used for model evaluation of the 2000s decade. Initial work in this direction has already led to the inclusion of satellite datasets covering ozone and carbon monoxide into the ACCMIP BADC archive, and the ACCMIP group concluded that further such collaboration between the global modelers and global satellite data teams would be beneficial to both, and that following on existing activities such as the NASA obs4mips program could help achieve substantial progress in bringing in more observational data for evaluations.

On the technical side, the group highlighted the need for analysis leads to put blank tables on the ACCMIP wiki for the information they need and for groups to then fill those in. All agreed this would be much easier now, while the setup is still fresh in our minds, than later on. All presentations are available on the password-protected portion of the ACCMIP web site (http://www.giss.nasa.gov/projects/accmip/).

The meeting was jointly sponsored by IGAC (AC&C), the US EPA, and the NASA JPL Center for Climate Sciences.

Task Force on Hemispheric Transport of Air Pollution · Pasadena, CA USA

1 – 3 February 2012

Terry Keating[1] and Frank Dentener[2]

[1]U.S. Environmental Protection Agency, Office of Air and Radiation, Washington, D.C.

[2]European Commission, Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy

The 8th annual meeting of the Task Force on Hemispheric Transport of Air Pollution (TF HTAP) under the Convention on Long-range Transboundary Air Pollution (LRTAP Convention) was held in Pasadena, 1-3 February 2012. The meeting was held in conjunction with the 2nd ACCMIP meeting and was hosted by the U.S. EPA, IGAC (AC&C), and the NASA JPL Center for Climate Sciences. The meeting was attended by more than 80 scientists from 20 countries.

The TF HTAP was created in 2004 to organize cooperative scientific efforts to improve our understanding of the intercontinental transport of air pollutants across the Northern Hemisphere. In 2010, the TF HTAP completed an extensive assessment report based on their first phase of work (see http://www.htap.org/activities/2010_Final_Report.htm). The 2010 report demonstrates the significance of the intercontinental transport of air pollution in terms of the achievement of air quality objectives and impacts on public health, ecosystem damage, and radiative forcing. However, relying primarily on global scale analyses, the picture of intercontinental transport is painted with a relatively broad brush.

The objective of the Pasadena meeting was to elaborate the work plan for the TF HTAP for the 2012–2015 period, building on the previous work and the general framework for future work developed at the TF HTAP's 2011 meeting. The focus remains on distinguishing between regional and extra-regional influences on air pollution and its various impacts and characterizing the potential benefits of broad international cooperation to decrease air pollution emissions. In the new phase of work, greater emphasis is being placed on refining the picture of intercontinental transport by nesting regional analyses within global analyses, improving the spatial and temporal resolution of our estimates of source apportionment, source-receptor relationships, model uncertainty, and air pollution impacts.

The future work has been organized around six themes:

1. **Emissions Inventories and Projections,** focused on compiling global emission data mosaics for 2006-2010, incorporating several available and widely-accepted regional emissions inventories, and on developing future emission scenarios for 2030.
2. **Source/Receptor and Source Apportionment Experiments,** focused on a prioritized list of global and regional emission sensitivity studies for the 2006-2010 period, as well as a parallel methods intercomparison study. Simulations for these experiments are expected to begin in the second half of 2012.
3. **Model-Observation Evaluation and Process Diagnosis Studies,** focused on case studies for the 2006-2010 period organized around specific regions or types of observational data.
4. **Impacts on Health, Ecosystems, and Climate,** which will work to improve the methodologies and resolution of previous impact assessments building on the work of the Global Burden of Disease Study, the LRTAP Working Group on Effects, the UNEP Atmospheric Brown Cloud assessments, the Arctic Monitoring and Assessment Program and other relevant efforts.
5. **Impacts of Climate Change on Pollution,** which will draw insights from ongoing work under the IGAC Atmospheric Chemistry & Climate Initiative and other efforts.
6. **Extending the Distributed Data Network and Analysis Tools,** focused on connecting TF HTAP's data repositories to other relevant data centers in an emerging information network coordinated with the Group on Earth Observation's Air Quality Community of Practice.

Further details about the planned work and all of the presentations from the meeting are available on the TF HTAP's website (http://www.htap.org/). The TF HTAP's meetings and activities are open to all interested experts. To subscribe to the TF HTAP mailing list, please visit http://www.htap.org/general/participate.cfm.

The 1st Inaugural Workshop of the Equatorial Africa Deposition Network (EADN)

Imperial Hotel, Kisumu-Kenya

5 – 9 December 2011

Eric Odada

Department of Geology, University of Nairobi, Nairobi, Kenya (eodada@uonbi.ac.ke)

The Equatorial Africa Deposition Network (EADN) held an Inaugural workshop on the 5th - 9th December 2011 at Imperial Hotel, Kisumu, Kenya. The workshop was organized by The African Collaborative Center for Earth System Sciences (ACCESS), United Nations Environment Programme (UNEP) and United Nations University – Institute for Water Environment and Health (UNU - INWEH). The participants were drawn from Canada, Democratic Republic of Congo, France, Ghana, Côte d'Ivoire, Kenya, Malawi, Mozambique, Nigeria, Republic of South Africa, Senegal, Tanzania, Uganda, United Kingdom and United States of America. These participants were representatives of international, national and research institutions involved in air quality data analysis and monitoring such as IGAC where the DEBITS (Deposition of Biogeochemically Important Trace Species) program is ongoing in the West African region. The program seeks to facilitate the production of high quality data on atmospheric deposition of nutrients and other contaminants that are necessary in making decisions regarding restoration actions on the equatorial lakes, enhancement of human health and conservation of the environment. It is in this regard that the focus of the EADN is to assess the trans-boundary transport of nutrients in the aquatic ecosystems within the region. The key objective is to measure the sources, distribution and deposition rates of nitrogen and phosphorus in the waterways.

The African continent is endowed with vast water resources comprising major river basins, large lakes, wetlands and groundwater, the continent faces challenges in water quality and quantity associated with eutrophication linked to sediment, nutrient and microbial loading. Other factors such as high evaporation rates, clearing of forests in water catchment areas and climate change and variability further threaten the ecosystem services provided by these resources. The motivation behind this project is the need to answer the following questions:

1. Can Africa's food and water systems support one billion people today and higher number in future without seriously compromising the functionality of ecosystems and their services?;
2. What is the condition of the lake water and food systems within basins that explains the current and future constraints to development?;
3. What kinds of interventions within lake basins seem most promising to enable sustainable development?; and
4. What kind of monitoring procedures need to be put in place to provide quality data that informs policy?

The aim of this workshop was to review current understanding of atmospheric transport/deposition of soil and the nutrient effects on the African Great Lakes; To share capacities, methodologies and approaches applicable for EADN implementation; To review the project, the implementation plan, the budget, and management mechanisms for effective execution; and to identify steps for Year 1 work plan and long term sustainability of the network function and impact. Within the region the potential importance of the atmosphere as a nutrient source to aquatic ecosystems has received increasing attention. The stakeholders shared some of their ongoing and past research activities that helped evaluate the capacities, methodologies and approaches. Among the Great Lakes, Lake Victoria, Lake Tanganyika and Lake Malawi featured prominently whereas the West African Lagos Lagoon and the atmospheric dust circulation over Côte d'Ivoire and Senegal presented some interesting work. Lakes Victoria, Tanganyika and Malawi represent the Great African Lakes where research on P and N loading show that the contributions from atmospheric deposition is much higher than that from the rivers. This loading has been linked to changes in land cover, land use and biomass burning that shows the growing indirect human impact on our natural resources. It was noted that there are yearly variations in the wet and dry phases of atmospheric nutrient depositions that need to be monitored in the long-term in order to understand what cumulative effects are to be expected [*Bootsma et al.,* 1999; *LVEMP,* 2001; 2002; 2003; *Langenberg et al.,* 2003]. Other

human activities that have resulted in increased atmospheric deposition can be noted from Nigeria, where sawdust burning and vehicular traffic from industrial the industrial city of Lagos has had significant contributions to the phosphorus loading in soils and sediments with slight seasonal variations [*Abayomi et al.,* 2011; *Oluseyi et al.,* 2011].

Simulation results from models generated for West Africa have identified Saharan dust sources that have had climate change implications inducing a thermal profile of cooling in the mid troposphere and warming in the Saharan air layer. This impact on the climate has resulted in reducing surface temperatures and decrease in precipitation over the West and Central African region according to the findings from [*Toure and Konare,* 2011; *Grant et. al.,* 2008].

The focus on phosphorus and nitrogen loading in the aquatic ecosystems proved to be a good starting point for the project as regionally these results exists from ongoing and new research projects. A unique concern from the colleagues based in DRC was the volcanic dust deposition in the aquatic ecosystems. This has not been given much attention in the region due to the lack of active volcanoes. This is a challenge in creating the regional network and trying to understand the unique needs of the individual stakeholders.

The workshop was a stepping-stone on evaluating the strengths, weaknesses and feasibility of this project in an attempt to respond to some of the questions mentioned above. From the workshop it was noted that there is data, potential sites and capacity to generate regionally accepted data, methodologies and atmospheric models, which would be useful in tracing the nutrient pathways in the water bodies. Partnership with the IGAC DEBITS program that is ongoing proved to be useful to the project as co-learning can be achieved in aspects of quality assurance and quality control. The partners expressed their satisfaction and optimism that the project is able to and will achieve its objectives within the project time frame.

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Equatorial Africa Deposition Network Workshop Message

EADN Participants

Kisumu, Kenya

We the scientists from the following countries of Burundi, Canada, Democratic Republic of Congo, France, Ghana, Cote d'Ivoire, Kenya, Malawi, Mozambique, Nigeria, Republic of South Africa, Senegal, Uganda, United Kingdom and United States of America met in Kisumu Kenya from 5th - 9th December 2011 to discuss issues relating to atmospheric deposition in Africa. The meeting was convened under the auspices of ACCESS, University of Nairobi; UNU-INWEH with funding of GEF through UNEP the GEF implementing agency. Having considered the state of Equatorial African Lakes and other major water bodies and rivers do hereby inform our governments and the global scientific communities that the science knowledge so far gathered over the last thirty years on the aquatic health of the lakes show that the land use policies and agricultural practices of the African countries have significantly contributed to the eutrophication and led to many losses of socio-economic benefits. The weight of the scientific evidence available to us now shows that biomass burning in the equatorial Africa has increased the atmospheric loading and subsequent deposition of phosphorus and nitrogen in the lakes. Secondly, poor agricultural practices and land management has substantially added the amount of phosphorus the plant limiting growth nutrient, in the lakes. A third contributing activity is the dumping of sewage wastes into the rivers and lakes due to lack of sustainable waste treatment facilities in the urban and rural centers and communities. The fourth contributing activity is untreated effluent discharge by industries that, by virtue of the availability of water, tend to be located along river courses and along lakeshores. For example in Nigeria, in Lagos lagoon and the Odoiyaa laro and Ibeshe rivers, Lake Victoria, River Congo have been impacted by the dumping of sanitary and industrial wastes and emissions.

Atmospheric deposition in Equatorial Africa is 10 times more than the global average and has contributed to the eutrophication of Lake Victoria and threatens Lake Malawi. The continued degradation of these waterways threatens the livelihoods of 250 million Africans. We urge the governments of Equatorial African states to take appropriate actions to stop widespread biomass burning, effect sustainable land management and improve sanitary and industrial waste treatments in order to reduce the inflow of nutrients phosphorus and nitrogen as well as other pollutants.

We further appeal for the continued support for knowledge development by scientists in the Equatorial Africa in order to restore and manage these life-giving waters.

Signed:

EADN Participants,

Kisumu, Kenya

9th December 2011

SOURCE: ACCESS,
University of Nairobi; UNU-INWEH with funding of GEF through UNEP

Program Update

Sergey Victorov, St. Petersburg State University, St, Petersburg Russia
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Faculty of Geography and Geoecology of St. Petersburg State University in Russia is launching a new ambitious project called the "Observatory of Ecological Safety" lead by Professor Vladislav Donchenko. The project's main objective is the synergetic integration of educational process and innovative activities in the area of on-line monitoring of the land, atmosphere, marine and coastal environments. The Observatory includes five modules:

1. **Lidar module:** Study of atmosphere, aerosols and air pollution.
2. **Screening of Ecotoxins Module:** Development of methods for screening of new and less-studied chemical compounds and biological contaminants in water bodies based on new approaches.
3. **Bioelectronic Module:** Development of bioelectronic systems of ecological diagnostics and monitoring of the environment.
4. **Geoinformatics Module:** Development of geoinformation systems of situational modelling for ecological safety
5. **Ecological-Mathematical Module:** Mathematical modelling, development of software in support of dynamical monitoring of the state of the environment in research networks

The Lidar Module is the most relevant to the IGAC community and will consist of: (a) Mobile lidar complex based on vehicle; (b) Lidar complex located in a tower on the roof of faculty building, and (c) Centre for data collection, storage and analysis. The multiwave mobile lidar complex includes shortwave differential absorption lidar for detection of gaseous substances in atmosphere, doppler heterodyne lidar for wind speed and direction, and aerosol lidar for measurements of atmospheric aerosol parameters. The multiwave lidar complex in the tower includes doppler heterodyne lidar for wind speed and direction and aerosol lidar for measurements of atmospheric aerosol parameters. Although the Lidar Module is the only atmospheric chemistry related Module, Modules 4 and 5 could be used for in-depth analysis of the lidar data and the lidar data could be integrated with data provided in Modules 2 and 3.

Our current plans are to establish lidar sites/stations, develop a set of research-educational programs, and become a member of the European Aerosol Research Lidar Network (EARLINET).

We are open for international cooperation.

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IGAC Calendar

March 2012

Air Quality Conference
19-23 March · Athens, Greece
http://www.airqualityconference.org/

Planet Under Pressure Conference
26-29 March · London, UK
http://www.planetunderpressure2012.net/

April 2012

Health Impacts of Air Quality and Climate in Asia
8-11 April · Guangzhou, China
http://www.sysueeswxm.org/workshop/

European Geophysical Union (EGU) General Assembly
22-27 April · Vienna, Austria
http://meetings.copernicus.org/egu2012/

Developing Asian Megacities towards a Sustainable World
25-27 April
Zhangjiakie, Hunan Province, China

May 2012

SOLAS Open Science Conference
7-10 May · Cle Elum, WA USA
www.solas-int.org/osc2012

IGAC/SPARC Global Chemistry-Climate Modeling and Evaluation Workshop
21-25 May · Davos, Switzerland
http://projects.pmodwrc.ch/ccval/

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Questions?

Please contact us at
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Calendar

Visit igacproject.org for updates to the calendar.

June 2012

GEIA Workshop
11-13 June · Toulouse, France
www.geiacenter.org

ESA Atmospheric Science Conference
18-22 June · Bruge, Belgium
http://www.congrex.nl/atmos2012/

June 2012

Gordon Research Conference: Biogenic Hydrocarbons and the Atmosphere
24-29 June · Bates College
Lewiston, ME USA
http://www.grc.org/programs.aspx?year=2012&program=biogenic

September 2012

IGAC Open Science Conference Atmospheric Chemistry in the Anthropocene
17-21 September · Beijing, China
www.igac2012.org

3rd International Conference on Earth System Modelling
17-21 September · Hamburg, Germany
http://www.meetings.copernicus.org/3icesm/

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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:
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