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To: Kea Duckenfield, NOAA-OGP
From: Timothy Bates, IGAC Chair
Sarah Doherty, IGAC Executive Officer
Re: IGAC Interim Report (Progress for Year 2, Plans for Year 3)
Date: December 1, 2004

This past year, the International Global Atmospheric Chemistry Project has achieved its goal of moving the field of atmospheric chemistry forward through its Tasks, through focused scientific workshops, and in holding its 8th biennial International Conference. Tasks endorsed by IGAC's Scientific Steering Committee (SSC) in 2003 have made good progress in 2004 and, with one exception, appear to be on-track with meeting the goals outlined in their proposals. In addition, several new Tasks are in the pipeline for endorsement. In this past year IGAC also co-sponsored several workshops and found them to be a very cost-effective "top-down" mechanism for focusing the community on important, open science questions. Progress on each of these fronts is discussed below, along with some changes to IGAC's organizational structure.

Organizational Structure

IGAC's SSC at present is comprised of 17 members from 14 countries (see Appendix A), with three of the SSC acting as Chairs. Tim Bates (USA) is currently the lead Chair, and Sandro Fuzzi (Bologna, Italy) and Shaw Liu (China-Taipei) are Co-Chairs. Ex-officio members include representatives from the World Meteorological Organization (WMO), the Committee on Atmospheric Chemistry and Global Pollution (CACGP), WCRP's Stratospheric Processes and their Role in Climate (SPARC), IGBP's Surface Ocean Lower Atmosphere Study (SOLAS), and IGBP's Integrated Land Ecosystem-Atmospheric Process Study (iLEAPS). The SSC members help guide the scientific direction of the organization, act as representatives of IGAC, and assist in implementing IGAC activities. Under the guidelines of IGAC's parent organization, the International Geosphere Biosphere Program (IGBP), SSC members serve for 3-year terms but must rotate off after two terms.

As of January, 2005, three of the SSC members will be rotating off of the committee: Tim Bates (USA), Mary Scholes (S. Africa), and Martin Manning (USA). New members have been nominated based on their scientific expertise and with the goal of having overall geographic and gender balance on the SSC. The new members will be announced upon their official acceptance to the SSC. In January, Phil Rasch of NCAR in Boulder, Colorado will replace Tim Bates as the U.S. Chair on IGAC, and Sandro Fuzzi will take over the role of Lead Chair.

While the SSC guides IGAC science, the International Project Offices have the primary responsibility for making sure IGAC's scientific goals are implemented. In 2004, IGAC continued to operate with three International Project Offices (IPOs): in Seattle, Washington, USA (Sarah Doherty, Executive Officer); in Rome, Italy (Gian

Paolo Gobbi, Project Officer); and Taipei, Taiwan-China (Doris Chen, Project Officer). The Seattle office continues to be the central coordination and referral point for the project's activities. In addition, the Seattle office has taken over responsibility for determining the subject of, recruiting authors for, and editing articles for the *IGACtivities* Newsletter. The Taipei office will continue to print and distribute the Newsletter.

With IGAC Tasks now fully underway, more Tasks coming on board, the increasing number of workshops IGAC is co-sponsoring, and the new responsibilities for the Newsletter, it was decided that as of August, 2004 Sarah Doherty would start working full time, where previously she'd been working half time on research and half time for IGAC. In addition, while the U.S. Chair position will move from Seattle (Tim Bates) to Boulder, Colorado (Phil Rasch) in January, Sarah will remain as the IGAC Executive Officer and will continue to be based in Seattle. The original plan had been for the lead IGAC office to rotate annually or biennially through the three IPO's. However at the 2004 IGAC SSC meeting it was decided that the Seattle IGAC office would remain as the lead IGAC IPO, as the Taipei and Rome offices currently do not have the capacity to take on this role and because Sarah is interested in remaining as the Executive Officer.

The Seattle IGAC Project Office will remain at NOAA/PMEL. Tim Bates, the PI on this proposal, will continue to serve IGAC in an ex-officio role through the end of this three year proposal (April 2006).

Tasks

An update on endorsed Tasks' progress and plans was presented to the SSC at their annual meeting, September 2-3, immediately preceding IGAC's biennial conference. This progress is reported on very briefly below. In addition, one newly endorsed Task and several Tasks that we anticipate adding to IGAC in 2005 are discussed briefly. We further anticipate that workshops held in the past year will lead to the formation of additional new Tasks in 2005.

Air-Ice Chemical Interactions (AICI)

AICI was jointly endorsed by the IGAC and SOLAS SSCs in 2003. AICI has the goal of coordinating the work of field, laboratory, remote sensing and modeling groups, with the aim of understanding the importance of air-ice chemical interactions within the Earth system. This will allow assessment of the effects of a changing cryosphere on atmospheric chemistry, composition and feedbacks to climate.

In 2004, the AICI Task steering committee was formed and endorsed a number of ongoing field campaigns, including: ANTCI (Antarctic tropospheric chemistry investigation; inland Antarctica); CHABLIS (Chemistry of the Antarctic boundary layer and interaction with snow; coastal Antarctica); Summit snow chemistry (Greenland ice sheet); and OASIS (Ocean-Atmosphere-Sea Ice-Snowpack; Arctic sea ice zone). These comprise a backbone of field campaigns, and AICI's job will be to knit these elements together through workshops and common communications, and by fitting them into a theoretical and modeling framework. In the past year, the AICI team has:

- stimulated or assisted with the organization of several workshops and meetings;
- constructed and brought close to release a web page which will include links to associated programs and campaigns, to explanatory/educational science pages, and to sources of AICI data;

- successfully encouraged modelers to engage with AICI issues;
- prepared (with the Seattle IPO) the IGAC submission to the International Polar Year planning process
- liaised with the HiTT (Halogens in the Troposphere) task team, to avoid duplication (Note that the HiTT team is preparing a proposal for a separate IGAC Task).

Mega-cities: Asia

In 2004, the Mega-cities researchers continued on-going measurements in mega-cities and mega-city complexes in Japan, China, South Korea, The goals of Mega-cities are to:

- Characterize the temporal and spatial changes of aerosols, oxidants, and their precursors primarily by surface measurements near urban centers. Temporal variations include diurnal variation, variations associated with synoptic scale disturbances, and seasonal variation.
- Characterize the composition, mixing state, and physical properties of aerosols in urban air. Determine hygroscopic and radiative properties of aerosol in urban air.
- Validate emission inventories of trace gases (e.g., NO_x, SO₂, NH₃, and VOCs) through comparisons of ratios of concentrations of trace species observed in urban air.

The primary foci of the Task team in 2004 was 1) to try and ensure the disparate stations participating in the Task were making uniform, comparably measurements, and 2) to try and work out data access issues between the groups. As part of the first focus, they have been gathering data on each of the measurement suites and are close to releasing a web page with this information. Uncertainties of important aerosol measurements were assessed, including those for the Aerosol Mass Spectrometer; semi-continuous EC/OC measurements; water soluble organic carbon measurements; the CIMS-HNO₃ measurement; and black carbon measurements. In addition new instruments are being developed for BC to be used for other mega-city observations.

Many scientific results have also come out of the past years' measurements, though much data processing is still underway. At the IGAC Conference in New Zealand and elsewhere, the Mega-cities: Asia scientists presented data on aerosol and gas species' variability and on correlations between different species' variations. These data are being used for source apportionment, for understanding the source of the variations, and for comparison of different mega-cities.

The Mega-cities team took advantage of the 8th International IGAC Conference venue to a meeting and will also meet in Beijing during the IAMAS meeting in 2005. Both scientific and organizational issues were discussed. Inter-instrument comparisons of measurement techniques (specifically O₃, CO, and aerosols) are being planned for March, 2005, at Gosan, Korea. Korea, Japan, Hong-Kong groups will participate in this campaign.

Barriers to progress on the Mega-cities project include difficulties in getting some groups to release their data and difficulties in obtaining funding for continuation of measurements and for inter-instrument comparison campaigns. The IGAC SSC is attempting to assist on both of these fronts by providing letters of support for the team's work (which can be used to leverage local funding agencies) and by emphasizing with the

Mega-cities participants that open access to data is a key aspect of being included in an IGAC Task.

Intercontinental Transport and Chemical Transformation (ITCT-Lagrangian-2k4)

The goal of the Intercontinental Transport and Chemical Transformation (ITCT) Task is to understand the chemical transformation and removal processes of aerosols, oxidants and their precursors during the intercontinental transport process. The ITCT-2k4 effort is utilizing overlapping field campaigns organized and funded by several agencies, including NOAA (U.S.) through the NEAQS - ITCT 2004 program; NASA (U.S.) through the INTEX-NA program; and European agencies (a UK university consortium, funded by NERC; DLR of Germany; and CNRS of France) under the Intercontinental Transport of Pollutants (ITOP) project. Each of these programs has its own regionally focused goals and deployments, but together they provide coverage from the source regions on North America, through the transport pathways over the North Atlantic, and over the receptor regions of Europe. The IGAC Task ITCT-Lagrangian-2K4 is an organizational and analysis effort to coordinate the disparate programs into a pseudo-Lagrangian framework.

Excellent progress was made in 2004 in achieving the goals of the ITCT-2k4 Task. The aforementioned campaigns took place in June-August. Coordination of the disparate campaigns was assisted by two papers submitted by the ITCT-2k4 Task team as part of project planning. In late May and early June, the team ran through dry runs of flight-planning scenarios based on model meteorological and chemical field forecasts. During the campaign, the meteorological conditions were favorable for the ITCT study, thought pollutant concentrations were low. Through careful planning, forecasting, flight planning and platform coordination accomplished, resulting in 6 inter-aircraft comparisons in July and August.

Some early comparisons results from the campaign indicate that there were significant discrepancies between platforms (such as for HO, HO_x and VOCs), but results are still preliminary. Some side-by-side comparisons on the ground are being pursued in the post-campaign period. This will allow the team to distinguish between inter-instrument differences and discrepancies due to either sampling differences or spatial/temporal variability and imperfect co-location of platforms. Data for the in-field comparisons are being submitted to a central location so that all comparisons are "blind".

While initial meteorological and model analyses indicate that the platforms were well-coordinated for intercepting common airmasses, further data analysis is needed to see if a "Lagrangian" experiment was indeed completed for transport from the U.S. to Europe and for the U.S. to the Azores, then to Europe.

Data necessary for a full analysis are scheduled for publication on a final data archive by January 15, 2005. An ITCT-2k4 workshop will be held at the April 25-29, 2005 European Geophysical Union (EGU) meeting in Vienna, Austria. In early August, 2005 a five day workshop for larger ICARTT Study will be held at the Univ. of New Hampshire, and at the December 5-9, 2005 AGU Meeting there will be special sessions on the Summer, 2004 field campaigns and the ITCT-2k4 effort. Thus we anticipate that this Task will continue to move forward in 2005, and is likely to meet the goal of a Journal of Geophysical Research special section in late 2006.

Global HO Systematic Tests (GHOST)

The GHOST Task aims to address the problem of quantifying the global distribution of the hydroxyl radical OH, the main tropospheric cleansing agent. Because of OH's high reactivity towards many trace gases it is responsible for ridding the atmosphere of a host of reduced gases, but at the same time this extreme reactivity reduces its lifetime to less than a second. This leads to a low abundance and to extreme spatial and temporal variability. While measurement capabilities for OH have improved in recent years, localized data are not sufficient to constrain its global mean concentrations, variability and trends. Instead the approach that's been used is to measure the concentration and change in time of a trace gas that is predominantly removed from the troposphere through reaction by OH, and whose source strength is known. However, there are significant uncertainties to the existing approaches, and decreasing concentrations of one of the two key tracers currently being used (methylchloroform) will soon eliminate it as a viable proxy for OH concentrations.

The GHOST Task Team therefore proposed a study addressing alternative tracers that could be used to measure global-average OH. Possibilities include using existing natural and industrial tracers (i.e., "tracers of opportunity") or tailor-made dedicated tracers which would be released at key locations. The starting stages of the Task would be comprised of theoretical investigations, or Computer Aided Gedanken Experiments (CAGEs), of the feasibility of these tracers; assessment of the possibility of using multiple tracers; a study of the optimal release (for dedicated tracers) and sampling/measurement techniques; and an assessment of the uncertainties in retrieved OH.

Success of the GHOST Task requires the participation of multiple modeling groups and scientists with familiarity in tracer measurement techniques, as well as the careful coordination of these groups. It was hoped that the GHOST Task leaders would make progress over the past year in recruiting and organizing such a team of modelers and measurement experts. However, to date no one has taken the lead in moving the GHOST Task forward. While the group that proposed GHOST has done an excellent job of framing the problem and providing an implementation strategy, a scientist who is motivated to head up the Task execution still needs to be identified.

The IGAC SSC met with the team that proposed the GHOST Task during the September 4-9 Conference in Christchurch, New Zealand and advised them of the need for progress in order for GHOST to remain an IGAC Task. An open meeting was held during the week, where the GHOST proposal was introduced to the community studying at the atmospheric oxidation capacity. More recently, the IGAC Task team has commenced an outreach effort that includes the attendees of the open meeting, as well as other scientist who might be interested in participation. The SSC will re-assess this Task in early 2005 and determine whether sufficient progress is being made.

African Monsoon Multidisciplinary Analysis (AMMA)

Last month, the SSC granted endorsement to a new Task: the African Monsoon Multidisciplinary Analysis (AMMA), as proposed by Céline Mari of the Laboratoire d'Aerologie in Toulouse, France and Joseph Prospero of the Cooperative Institute for Marine and Atmospheric Studies at the Rosenstiel School of Marine and Atmospheric Science in Miami, Florida. The IGAC AMMA Task will be comprised of the

atmospheric chemistry component of the larger AMMA project, which is a joint endeavor of French, African, German, British, and U.S. scientists. In total, AMMA is a multidisciplinary project that aims at addressing both fundamental scientific questions related to the understanding of the West African Monsoon (WAM) variability and the impacts and practical issues related to prediction and decision-making activity.

AMMA activities were started up in 2001 and are planned to continue into 2010. However, the focus of the IGAC AMMA Task will be the Enhanced Operation Period, 2005-2007. The following four questions frame the science that will be addressed by the IGAC AMMA Task:

Question 1: What are the interactions between lightning, biomass burning, the biosphere, the ocean, human activity and growing urbanization which determine tropospheric ozone concentration over Western Africa?

Question 2: What are the interactions between dust, biomass burning, the biosphere, the ocean, human activity and growing urbanization which determine aerosol production and properties over Western Africa?

Question 3: What is the role of deep convection, the monsoon circulation and other flow patterns in the transport and processing of these emissions, and how do these emissions affect the dynamics of the WAM?

Question 4: What factors control the outflow of ozone and aerosols (and their precursors) from West Africa to the tropical Atlantic troposphere and how do they impact atmospheric processes in this region?

Deposition of Biologically Important Trace Species (DEBITS)

The DEBITS Task was proposed by Kobus Pienaar of the School of Chemistry and Biochemistry of Northwest University in South Africa. DEBITS was a highly successful activity under the first phase of IGAC, and the new proposal builds on the success and lessons of the initial activity. The scientific focus of the project is the study of the wet and dry deposition of chemical species to the earth's surface. These processes play an essential role in controlling the concentration of gases and aerosols in the troposphere and thus are key to addressing the second of IGAC's overall science questions: namely to provide a fundamental understanding of the processes that control the distributions of chemical species in the atmosphere and their impact on global change and air quality.

The new Task will take advantage of the three scientific programs established under the first phase of DEBITS: CAAP (Composition and Acidity of Asian Precipitation, 1990; 34 stations), IDAF (IGAC DEBITS Africa, 1994; 10 stations) and LBA in Amazonia (The Large Scale Biosphere Atmosphere Experiment in Amazonia, 1998; 5 stations).

The specific scientific questions of the proposed DEBITS Task are:

- What are the atmospheric removal rates via dry and wet deposition of biogeochemically important trace species on a temporal and spatial basis at regional to global scales?
- What are the key regulating processes (interactions/aerosol/cloud/ecosystem) that affect deposition?
- What are the roles of heterogeneous chemical processes in: modifying the chemical composition of the particles; partitioning between the gaseous and particulate

phases; changes of the physio-chemical properties of aerosols; and causing subsequent changes in dry versus wet deposition?

- What are the regional scale atmospheric budgets of key elements?
- How can the use of numerical models assist in quantifying relationships between emissions and depositional fluxes and provide an integrated scientific assessment of the atmospheric C, S and N cycles, specifically at the regional scale?
- How can deposition flux measurements be related to impact studies? Here there will be a special focus on the deposition of nitrogen and other key species for ecosystems and hydrology, such as phosphorous.

Final comments on the DEBITS proposal are being solicited from the SSC and we anticipate endorsement of the Task before the end of the year.

Atmospheric Brown Cloud (ABC)

A proposal to make the atmospheric chemistry component of the Asian Brown Cloud project an IGAC Task is in preparation. ABC will be a follow-on project to the 1999 Indian Ocean Project (INDOEX), where the impact of pollution on the Indian Ocean region was studied. Of particular interest is the chemical composition and radiative impact of the high concentration of aerosols that cover the region during the northeast monsoon season. The ABC project aims to resolve questions raised by the INDOEX findings through the establishment of enhanced measurement stations that will operate year-round. Shaw Liu, Achuthan Jayaraman and Makoto Koike (see Appendix A) have been working closely with V. Ramanathan and Paul Crutzen on determining the components of the IGAC Task and in preparing the proposal. We anticipate having the proposal in hand for review by mid-January, 2005.

Workshops

IGAC co-sponsored three workshops in 2004, on Organic Aerosols, Nitrogen and Halogens, and will co-sponsor a fourth in January, 2005 on the Aerosol Indirect Effect. Planning for a joint IGAC/SPARC Workshop on chemistry and climate in the mid-latitude upper-troposphere/lower stratosphere (UTLS) region is underway. This is a follow-on to the 2003 chemistry and climate workshop in Giens, France that IGAC and SPARC co-sponsored.

Highlights of the 2004 workshops are given below. We note that most participants were able to fund their own way to the meetings, and that IGAC's contribution was largely organizational. Features of these workshops that have made them successful is that they are framed around a set of focused scientific questions; a subset of participants have taken the lead in facilitating the workshop discussions on these questions; and an end-product of a white paper or other publication is a goal of the workshop. The SSC anticipates that some of these workshops will lead to new IGAC Tasks.

Organic Aerosols Workshop May 10-12, 2004; Hyytiälä, Finland (<http://www.atm.helsinki.fi/ILEAPS/organic/index.php>)

The goal of this workshop was to identify and discuss research activities that will lead to a better understanding of organic aerosols, which are one of the big unknowns in atmospheric science and for which sources, chemical composition and properties are very

poorly known. At the meeting, the participants: 1) summarized the existing knowledge on organic aerosols (OA) sources, transformations and physical and chemical properties relevant for global change issues: climate, hydrological cycle, transport of pollutants; and 2) Identified the main knowledge gaps and develop a common strategy among the three IGBP projects (IGAC, iLEAPS and SOLAS) to address them. Highlights of the meeting structure are:

- Co-sponsorship by IGAC, iLEAPS & SOLAS
- 39 attendees
- IGAC SSC members in attendance: Tim Bates, Sandro Fuzzi, & Ulrike Lohmann
- IGAC Seattle Office paid the travel expenses of two attendees
- A white paper manuscript is in preparation and should be completed in early 2005. It will be published in the *IGACtivities* Newsletter, as well as on the IGAC, iLEAPS and SOLAS web pages.

Nitrogen Workshop May 3-5, 2004 Woods Hole, Massachusetts, USA

<http://www.iniforum.org/73.0.html>

During the last few decades, the introduction of reactive nitrogen (N) into the biosphere by food and energy production has been greater than rates of N fixation in native terrestrial ecosystems, and this anthropogenic input has been steadily increasing. By far the largest uncertainty about the human domination of the N cycle on all scales is the amount of reactive N that is converted back to N₂ during the last step of denitrification. Unfortunately, we have little knowledge about how much N is denitrified, when, and in what location. To address this deficiency the INI held a 3-day workshop in the spring of 2004, comprising approximately 30 participants, to focus on quantification of N₂ production via biological denitrification. The objectives of this workshop were:

- * To evaluate the state of our knowledge of denitrification rates in a wide range of terrestrial and aquatic ecosystems
- * To compare methodologies that have been adopted by different scientific disciplines, with the expectation that collaborations across disciplines could yield methodological advances
- * To chart out the current weaknesses and the actions needed to address those weaknesses for an improved global assessment of where, when, and how much reactive N is converted to N₂ in the biosphere.

Two important considerations were superimposed over a matrix of ecosystem types and methodological approaches:

- * What are the appropriate scales over which N₂ production can and should be measured?
- * How can models be integrated with the measurements to improve mechanistic understanding of the processes and permit estimation of fluxes at larger spatial scales, longer temporal scales, and across a range of forecasted scenarios?

Highlights of the meeting structure were:

- Co-sponsorship by U.S. National Science Foundation, U.S. Environmental Protection Agency, U.S. NASA, and IGAC.
- 50 attendees
- IGAC SSC member in attendance: Mary Scholes
- IGAC-Seattle contributed \$8,000USD; IGAC-Rome supported the attendance of 3 scientists; and IGAC-Taipei supported the attendance of 2 scientists

- A white paper from the workshop can be downloaded from the web page above. In addition, the results of the workshop will be published as one or more synthesis papers in a peer reviewed journal in the next year.

Halogens Workshop May 27-28th, 2004 Heidelberg, Germany

While halogen chemistry has been recognised as an important factor influencing the composition of the stratosphere only recently, it became clear that halogens can also have a decisive influence on trace gas cycles in the troposphere. A number of scientific questions need to be addressed with respect to the role of halogen species in tropospheric chemistry and the effects of halogens on climate, the oxidation capacity of the atmosphere, and possibly other properties of the atmosphere.

The primary objectives of the meeting were to:

- * Provide a forum for exchanging information, knowledge, and expertise on the subject of halogens on the troposphere.
- * Define the priority scientific questions related to halogen chemistry in the troposphere and identify interested research groups and scientists who are currently working on these questions.
- * Identify areas where coordinated research activities in the area of halogens in the troposphere are needed and, if needed, begin framing these activities.
- * Identify links to other projects, in particular to IGAC, SOLAS, AICI, IMBER, WCRP-CliC and iLEAPS, and resolve possible overlap in research topics.
- * Identify potential Tasks that could be proposed to SOLAS, ICAC, iLEAPS, WCRP etc,

Highlights of the meeting structure were:

- Co-sponsorship by IGAC & SOLAS
- 22 attendees
- No IGAC SSC members attended, but Eric Wolff and John Burrows have been in communication with the organizers.
- The IGAC Seattle office contributed ~\$6,000USD to support workshop (~half the total cost).
- A white paper is in preparation and likely will be published in an upcoming *IGACtivities* Newsletter.

Indirect Effect Workshop January 5-7, 2005 Manchester, England

IPCC has been encouraging IGAC to run an indirect effect workshop, with the primary focus being the "direct" radiative forcing impacts of the indirect effect (i.e. the "first indirect effect", whereby cloud albedo is higher in some polluted regions). Such a meeting has been organized by Dan Murphy (NOAA Aeronomy Lab), Ulrike Lohmann (IGAC SSC), Tom Choullarton (University of Manchester), and Bruce Wielicki (NASA). A scoping document is being composed that will frame the scientific questions that will be addressed at the meeting, and several leads for generating a post-meeting white paper have been identified. The organizers are taking care to integrate the results of a meeting addressing the impact of aerosols on the hydrologic cycle that was held in Aspen, Colorado in July, 2004. They will also coordinate with planners of a joint ICSU (International Council for Science)/WMO meeting that will focus primarily on the impact of aerosol on precipitation (i.e. the "second aerosol indirect effect", where it's

hypothesized that the chance of a cloud precipitating is lower in some polluted areas because the cloud droplets are smaller). This meeting is planned for late 2005.

The 8th IGAC International Conference

IGAC held its 8th biennial International Conference September 4-9, 2004 in Christchurch, New Zealand. The latest findings in atmospheric chemistry were shared amongst the 409 attendees, coming from 38 countries. Because of the excellent meeting attendance and careful planning of the local organizing committee, conference registration fees covered the full cost of the meeting. Using generous contributions from the WMO (\$8,000USD), NASA (\$25,000USD) and NSF (\$25,000USD) and funds from the three International Project Offices we were able to support the attendance of 62 young scientists from 23 countries.

As with past IGAC conferences, talks were held in a single plenary and an emphasis was placed on poster presentations. Prizes were given for the top three posters. Participation of young scientists and their integration into the community was encouraged through a large set of "young scientist" events, including a pre-opening-ceremony gathering, a career center, and a very successful "Take a Young Scientist To Lunch" event, where young scientist could sign up with a mature scientists. A "women scientists" lunch with Dr. Susan Solomon -- the meeting's keynote speaker -- was also a huge success.

A number of science highlights emerged from the conference:

- There are increasing research activities on organic aerosols – composition, sources, radiative and cloud nucleating properties.
- Cloud-Aerosol interaction remains a very difficult issue, and appears to be a non-linear system.
- Continued advances in instrumentation have been made, improving the time resolution of measurements.
- A better understanding of the Earth System is being reached through integrating studies and by increasing pulling together individual research projects to better understand the global picture.
- The importance of the link between the gas and aerosol phases is increasingly being investigated and understood.
- Satellite measurements are taking on increasing importance for atmospheric chemistry.
- There is a growing emphasis on halogen chemistry and night-time nitrogen chemistry.
- Inter-continental transport and chemical transformation and mega-city emissions (both subjects of IGAC Tasks) are a growing concern. IGAC has moved from focusing on the regional atmosphere distant from sources to looking at large sources and their regional/global impact.

Capacity building and facilitation of multi-disciplinary & multi-national research

A priority of IGAC is to assist capacity building in under-represented countries and to facilitate multi-disciplinary and multi-national collaborations. This is being achieved through IGAC Tasks, our biennial conferences, and the composition of our SSC. In addition, in 2004 a much more concerted effort was made to communicate and collaborate with organizations whose science overlaps with IGAC's.

Sarah Doherty and Shaw Liu both attended the SPARC International Conference in August (Victoria, BC, Canada) and Sarah attended SPARC's annual Steering Committee meeting the week following. Stemming from discussions started at the Conference and SSC meeting, SPARC and IGAC will be co-sponsoring a workshop on chemistry and climate in the mid-latitude Upper Troposphere/Lower Stratosphere in 2005.

As noted earlier, IGAC has also co-sponsored workshops and jointly endorsed Tasks with the newly-formed IGBP Core Projects that are working on the atmosphere-land interface (iLEAPS) and the atmosphere-ocean interface (SOLAS). Representatives from the three organizations have also, whenever possible, attended each other's SSC meetings and conferences. The Executive Officers of the three organizations are in regular communication and are working to facilitate collaborations amongst the growing number of researchers doing work relevant to atmospheric chemistry.

Plans for 2005

1. With funding from NOAA, NASA and NSF, the Seattle IGAC Project Office will continue to be the main organizational focal point for the Project. The Office will fund the full time salary of one Executive Project Officer (Sarah Doherty) and one month of salary for secretarial assistance.
2. The IGAC SSC will hold their annual meeting in Santiago Chile in early October, 2005. SSC member Laura Gallardo-Klenner is organizing a 2-3 day symposium in connection with the meeting. The hope is that the symposium will highlight and stimulate atmospheric chemistry research in the region. Laura is working with Len Barrie of the WMO to engage participants in the GAW (Global Atmosphere Watch) Chilean stations in the symposium.
3. As noted above, workshops on the second aerosol indirect effect and on chemistry and climate in the mid-latitude UT/LS are being co-sponsored by IGAC in 2005.
4. The IGAC web page will continue to be regularly updated with announcements of IGAC tasks and meetings; links to publications from these meetings; and descriptions of IGAC Task planning and Task products.