Annual Report

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International Global Atmospheric Chemistry (IGAC) Project
International Program Office (IPO)

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1. Goals of the Project

The atmosphere is the integrator of the Earth system. Human emissions of pollutants and long-lived greenhouse gases into the atmosphere have caused dramatic transformations of the planet, altering air quality, climate, and nutrient flows in every ecosystem. Understanding the global atmosphere requires an international network of scientists providing intellectual leadership in areas of atmospheric chemistry that need to be addressed, promoted, and would benefit from research across disciplines and geographical boundaries. Acknowledgement of this need led to the formation of the International Global Atmospheric Chemistry (IGAC) Project in 1990.

IGAC's mission is to facilitate atmospheric chemistry research towards a sustainable world. This is achieved through IGAC's three focal activities: fostering community, building capacity, and providing leadership.

Fostering Community

IGAC is an open international community of scientists researching topics related to atmospheric chemistry (air quality, climate change, carbon and nitrogen cycles, impacts on human health and ecosystems, etc.) that is actively collaborating across geographical boundaries and disciplines in order to contribute to addressing the most pressing global change and sustainability issues through scientific research. The IGAC biennial science conference and the facilitation of numerous thematic workshops every year provides opportunities to build cooperation and disseminate scientific information across the international community.

Building Capacity

IGAC builds scientific capacity through its early career program and national and regional working groups. The IGAC early career program allows scientists to join an international network early in their career, which puts the cogs in motion to further facilitate atmospheric chemistry research at an international level for years to come. The IGAC national and regional working groups create a strong cohesive community of atmospheric scientists in emerging countries/regions that together have a sum greater than their parts and connects these scientists to the larger IGAC community to foster international collaboration.

Providing Leadership

IGAC provides intellectual leadership by identifying and fostering activities on current and future areas within atmospheric chemistry that would benefit from research across geographical boundaries and/or disciplines. IGAC's vision (Figure 1) is to link fundamental scientific research on emissions, atmospheric processes, and atmospheric composition to global change and sustainability issues such as human health, climate, and ecosystems and how individual and societal responses feed back into the core research-led foci of IGAC.

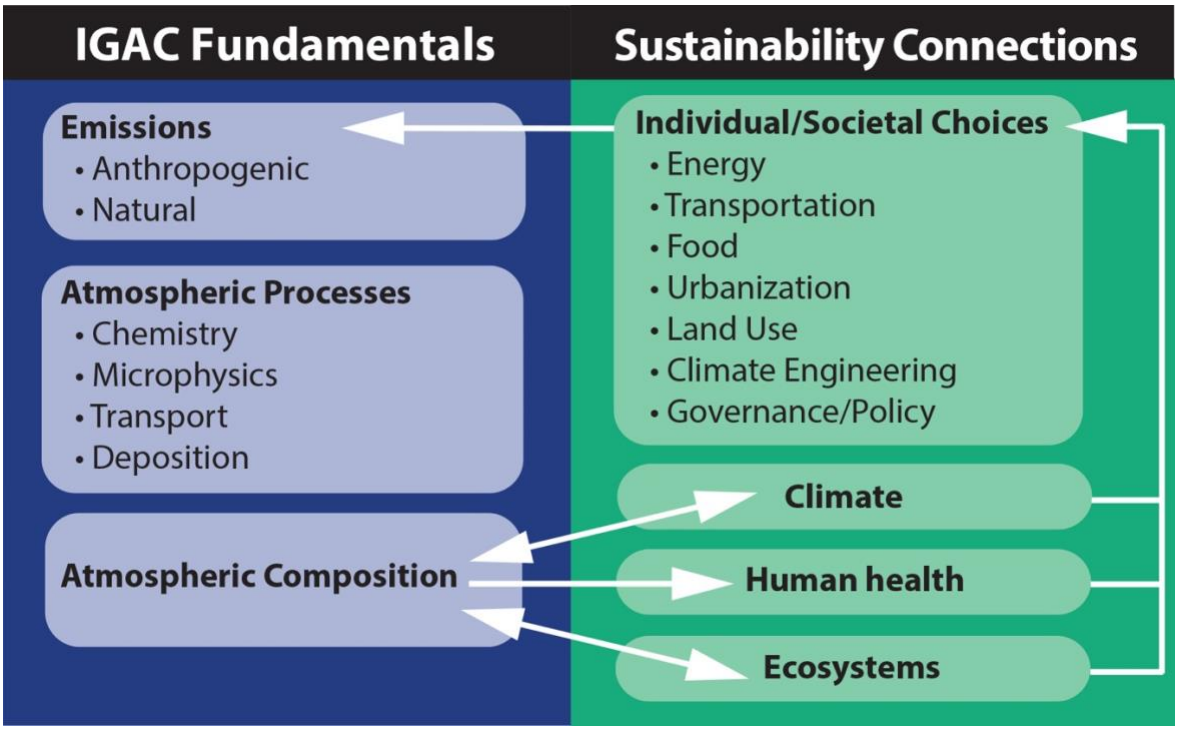

Figure 1. IGAC Vision Diagram

2. Accomplishments

Fostering Community

Every two years, IGAC's focus on fostering community is exemplified at its biennial science conference. In 2018, the joint 14th iCACGP Quadrennial Symposium and 15th IGAC Science Conference (iCACGP-IGAC 2018) was held 25-29 September in Takamatsu, Kagawa, Japan. iCACGP-IGAC 2018 was a huge success with 733 participants representing 46 different countries. The theme of the conference was "Atmospheric Chemistry: From Molecules to Global Impacts" and included five sessions: (1) Atmospheric Chemistry and People; (2) Atmospheric Chemistry and Fundamentals; (3) Atmospheric Chemistry and Ecosystems; (4) Atmospheric Chemistry and Climate/Weather; and (5) Challenging the Future. The plenary program consisted of three keynote speakers, 11 invited speakers, and 56 oral presentations. In addition to the plenary program, 580 posters were presented throughout the week. The Early Career Program was held throughout the week with the goal of encouraging networking and building collaborations. With 40% of iCACGP-IGAC 2018 participants being early career scientists, the Early Career Program events were well attended. With the help of generous sponsors (NSF, NASA, NOAA, WMO, APN, ESA, IUGG/IAMAS), 50 early career scientists were financially supported to attend iCACGP-IGAC 2018. The record number of participants at iCACGP-IGAC 2018 demonstrates IGAC's ability to truly foster an international community of atmospheric scientists.

In addition to iCACGP-IGAC 2018, IGAC sponsored or endorsed an additional six events from July 2018 – June 2019 (see Table 1 and Table 2).

Table 1. IGAC Sponsored Events July 2018 - June 2019

Event Name	Event Dates	Event Location
2018 IGAC SSC Meeting	23-24 September 2018	Takamatsu, Kagawa, Japan
2018 joint 14th iCACGP Quadrennial Symposium/15th IGAC Science Conference	25-19 September 2018	Takamatsu, Kagawa, Japan
IGAC MANGO Meeting	29-30 September 2018	Takamatsu, Kagawa, Japan
SOLAS-IGAC Workshop on Influence of Coastal Pollution on Marine Atmospheric Chemistry	27-28 November 2018	Rome, Italy
Fourth ACAM Workshop	26-28 June 2019	Bangi, Malaysia

Table 2. IGAC Endorsed Events July 2018 - June 2019

Event Name	Event Dates	Event Location
25th International Symposium on Gas Kinetics and Related Phenomena	22-26 July 2018	Lille, France
2019 ACPC Workshop	24-29 April 2019	Nanjing, China

Building Capacity

In 2018, IGAC held its second early career short course prior to its biennial conference. The IGAC Early Career Short Course, modelled after the Atmospheric Chemistry Colloquium for Emerging Senior Scientists (ACCESS) but with an international focus, is becoming a key event for fostering international networks and collaborations among the future leaders of atmospheric chemistry research. Forty early career scientists from 27 countries attended the 2018 iCACGP/IGAC Early Career Short Course 22-24 September 2018 on Shodoshima Island, Kagawa, Japan. The short course had four sessions: (1) Connecting Modeling, Observations, and Laboratory Studies; (2) The Future of Atmospheric Chemistry; (3) Science-Policy Engagement; and (4) World Café: Open discussion on global issues. In addition to the valuable knowledge gained during the short course, participants also built leadership skills by acting as ambassadors during iCACGP-IGAC 2018 in order to foster community amongst the 292 early career participants. The aim of the IGAC Early Career Short Course is to not only discuss scientific topics, but to provide skills that will help the early career scientists to be successful leaders.

In addition to the 2018 iCACGP/IGAC Early Career Short Course, IGAC also sponsored two additional early career training schools from July 2018 – June 2019 (see Table 3).

Table 3. IGAC Sponsored Early Career Events July 2018 - June 2019

Event Name	Event Dates	Event Location
2018 iCACGP/IGAC Early Career Short Course	22-24 September 2018	Shodoshima, Kagawa, Japan
School of Atmospheric Measurements in Latin America and the Caribbean: Atmospheric Particles and Reactive Gases (SAMLAC)	12-17 November 2018	San Juan, Puerto Rico
Third ACAM Training School	24-25 June 2019	Bangi, Malaysia

In addition to the early career program, IGAC builds capacity through its national and regional working groups. The goal of IGAC National/Regional Working groups is two-fold; one is to create a strong cohesive community of atmospheric scientists in a specific nation/region that together

have a sum greater than its parts, and the second is to connect the regional/national working groups to the larger IGAC community in order to foster international collaboration. IGAC currently sponsors six working groups (see Table 4).

Table 4. IGAC National/Regional Working Groups

Working Group Name	Working Group Description
African Group on Atmospheric Sciences (ANGA)	ANGA, which means "atmosphere" in Kiswahili, proposes to focus on uniting atmospheric expertise across Africa and fostering the next generation of atmospheric scientists.
Americas Working Group	Under the guiding principle of providing equal opportunity for all scientists in the Americas, the IGAC Americas Working Group aims to build a cohesive network and foster the next generation of atmospheric scientists with the ultimate goal of contributing to development of a scientific community focused on building collective knowledge in/for the Americas.
China Working Group	Chinese atmospheric chemists have been conducting frontier research for forty years in areas such as urban and regional air pollution and the climate effects and health impacts of air pollution. The IGAC China Working Group intends to more fully integrate the Chinese research experience within China and internationally.
Southern Hemisphere Working Group	The IGAC Southern Hemisphere Working Group provides a forum for scientists to discuss particular challenges in understanding the Southern Hemisphere atmosphere and to foster stronger collaborations between Southern Hemisphere research groups.
Japan National Committee	The IGAC Japan National Committee brings together Japanese scientists that have been continuously playing an important role in the development of atmospheric chemistry research, in particular, in Asia, and in the implementation of the agenda of IGAC since 1990.
Monsoon Asia and Oceania Networking Group (MANGO)	The main objective of IGAC-MANGO is to form a cohesive network of atmospheric scientists in the Asian monsoon region, facilitate collaboration between Asian and international scientists, and foster the next generation of scientists in this region.

Providing Leadership

IGAC provides intellectual leadership by fostering scientific collaborations through its activities. IGAC activities address an area of atmospheric chemistry research that requires coordination across geographical boundaries and/or disciplines, initiates new inquiry and/or fills a scientific need within the community, and addresses one or more of IGAC's focal areas. IGAC currently sponsors six activities, supports three emerging (in development) activities, and endorses two activities (see Table 5, Table 6, and Table 7). A highlight of IGAC Activities July 2018 – June 2019 was the publication of seven of the nine peer-reviewed journal articles that make up the Tropospheric Ozone Assessment Report (TOAR) in a special issue of *Elementa.*

Table 5. IGAC Sponsored Activities

Activity Name	Activity Description
air Pollution in the Arctic: Climate, Environment and Societies (PACES)	PACES aims to review existing knowledge and foster new research on the sources and fate of Arctic air pollution, its impacts on climate, health, and ecosystems, on the feedbacks between pollution and natural sources, on climate responses, and on societal perspectives, including sustainability, adaptation and economic feedbacks.
Atmospheric Composition and the Asian Monsoon (ACAM)	In order to understand the Asian Monsson system, it is necessary to build strong international collaborations to obtain the diverse expertise, resources, and access to the monsoon region for international research teams. The ACAM activity represents a critical step in building these international relationships.
Chemistry-Climate Model Initiative (CCMI)	CCMI seeks to improve our understanding of the role of chemistry-climate interactions within the Earth system in the past, present, and in future projects by providing a forum for coordinated inter-model comparisons and analysis with observations, encouraging the dissemination of innovative ideas for chemistry-climate research and building a strong and inclusive global science community.
Global Emissions Initiative (GEIA)	GEIA provides stability in a rapidly changing world, by ensuring access to emissions data, facilitating emissions analyses, and strengthening the global community of emissions stakeholders. GEIA is a trusted source of the emissions information needed to address some of society's greatest challenges.
Interdisciplinary Biomass Burning Initiative (IBBI)	The primary goal of IBBI is to instigate new interdisciplinary research that will improve the scientific understanding of the various processes associated with open biomass burning in order to make atmospheric composition prediction and air quality monitoring and forecasting better.
Tropospheric Ozone Assessment Report (TOAR)	TOAR's mission is to provide the research community with an up-to-date scientific assessment of tropospheric ozone's global distribution and trends from the surface to the tropopause, and ozone metrics for climate, human health, and crop/ecosystem productivity.

Table 6. IGAC Emerging (In Development) Activities

Activity Name	Activity Description
Analysis of eMIssions using Observations (AMIGO)	The goal of AMIGO is to organize the international scientific community around a synthesis of research using observations-based analysis techniques that aim to better quantify emissions.
Monitoring, Analysis, and Prediction of Air Quality (MAP-AQ)	The objective of MAP-AQ is to develop and implement a global air pollution monitoring, analysis, and prediction system for air quality with downscaling capability in regions of the world affected by high levels of atmospheric pollutants, in particular Asia, Latin America, and Africa.

the Cryosphere and Atmospheric Chemistry (CATCH)	The central focus of CATCH is to understand how the chemistry and composition of the interlinked cryosphere/atmosphere system will react to global change.

Table 7. IGAC Endorsed Activities

Activity Name	Activity Description
Aerosols, Clouds, Precipitation, and Climate (ACPC)	The ACPC initiative aims at a better scientific understanding of these interactions at a fundamental level. The goal is to identify, disentangle and quantify signals of impacts of aerosol perturbations on clouds, precipitation and radiation, taking into account adjustments and feedback processes, by synergistically exploiting observations and models across scales.
Deposition of Biologically Important Trace Species (DEBITS)	DEBITS aims 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.

3. Dissemination of Results

The IGAC IPO spends a significant amount of time on its communication strategy in order to better communicate IGAC activities to the international community. IGAC's communication strategy currently includes:

- IGACnews
  IGAC continues to produce the thrice yearly IGACnews that is distributed internationally to ~1,500 members of the IGAC community.
- IGAC Website
  The website highlights activities, working groups, and conferences. The website is kept up to date with recent publications, mailing announcements, and upcoming events.
- IGAC Mailing List
  Updates, reminders, and information about conferences and activities are emailed to ~1,500 subscribers via MailChimp.
- eBulletin
  IGAC also publishes a monthly eBulletin that informs the international atmospheric chemistry community about upcoming deadlines, events, and community news related to IGAC and the wider global change and sustainability community.
- Social Media
  IGAC is also found on social media outlets such as Facebook, Twitter, and LinkedIn.
- Visualizations
  IGAC continuously works with a graphic designer to create logos for its activities as well as communicate science more effectively through diagrams, figures, and graphs.
- Presentations
  The IGAC EO and members of the IGAC SSC give presentations on a regular basis about IGAC.

4. Plans for the Next Reporting Period

IGAC's priorities and activities are determined and guided by an international volunteer Scientific Steering Committee (SSC). The IGAC IPO is responsible for implementing the priorities set forth by the SSC in collaboration with volunteer scientists from the international atmospheric chemistry community. The IGAC SSC's annual meeting will take place 28-31 October 2019 in Mexico City, Mexico. The 2019 meeting will address the vision of IGAC for approximately the next decade, a review of current IGAC sponsored and endorsed activities, the relationship between IGAC and its national/regional working groups, and the plans for 2020 IGAC Early Career Short Course and the 2020 IGAC Science Conference. The outcomes of the 2019 IGAC SSC meeting will then be implement by the IGAC IPO.

5. Products

The below list of products are those that are achieved with funding from this grant or have the PI of this grant as an author. The list does not include all the products fostered by IGAC activities as most of those products are funded by other sources.

Publications

A.-H. Prieur-Richard, B. Walsh, M. Craig, **M.L. Melamed**, M'L. Colbert, M. Pathak, S. Connors, X. Bai, A. Barau, H. Bulkeley, H. Cleugh, M. Cohen, S. Colenbrander, D. Dodman, S. Dhakal, R. Dawson, J. Espey, J. Greenwalt, P. Kurian, B. Lee, L. Leonardsen, V. Masson-Delmotte, D. Munshi, A. Okem, G.C. Delgado Ramos, R. Sanchez Rodriguez, D. Roberts, C. Rosenzweig, S. Schultz, K. Seto, W. Solecki, M. van Staden, D. Ürge-Vorsatz. *Global Research and Action Agenda on Cities and Climate Change Science.* 2018.

Baumgardner, D., M. de Fatima Andrade, Z. Kilmont, J. Kuylenstierna, S.M., Carvalho, N. Borgford-Parnell, O.L. Mayol-Braceros, **M.L. Melamed**, R. Seguel, M. Andrade, C. Rudamas, G. Ruiz-Suaréz, O. Anchez-Ccoyllo, J. Ometto, M. Cazorla, L. Höglund Isaksson, P. Purohit, O.M. Cerutti, P. Medina, N. Hunueeus, J.A. Ortinez, L. Dawidowski, D. Henze, and N. Rojas, Short-lived climate pollutants: Drivers, regional emissions and measurements in *Integrated Assessment of Short-lived Climate Pollutants in Latin America and the Caribbean: Improving air quality while contributing to climate change mitigation*, 18-53, edited by Raga, G. and P. Artaxo, United Nations Environment Programme (UNEP) and Climate and Clean Air Coalition (CCAC), ISBN: 978-92-807-3549-9, 2018.

Websites

igacproject.org

Other Products

IGACnews, http://igacproject.org/IGACnews

6. Participants

Individuals Working for the Project

Dr. Megan L. Melamed works 100% time as the IGAC Executive Officer and her salary is funded by grants from NSF, NASA, and NOAA for July 2018 – June 2019.

Organizations that have been involved as partners

IGAC is sponsored by the international Commission on Atmospheric Chemistry and Global Pollution (iCACGP) and Future Earth.

Collaborators

IGAC activities are guided and, in many cases, implemented by an international Scientific Steering Committee (SSC), which acts on a volunteer basis. The current IGAC SSC members as of January 2019 are listed in Table 8.

Table 8. 2019 IGAC SSC Members

Last name	First name	Country	Affiliation
Tanimoto	Hiroshi (co-chair)	Japan	NIES
Crawford	James (co-chair)	USA	NASA
Beukes	Paul	South Africa	North-West University
Emberson	Lisa	UK	Stockholm Environment Institute/University of York
Frost	Greg	USA	NOAA
George	Christian	France	CNRS
Grutter	Michel	Mexico	UNAM
Hoelzemann	Judith	Brazil	Federal University of Rio Grande do Norte
Levelt	Pieternel	Netherlands	KMNI
Murphy	Clare	Australia	University of Wollongong
Murphy	Jennifer	Canada	University of Toronto
Naja	Manish	India	AIRES
Oanh	Kim	Thailand	Asian Institute of Technology
Salam	Abdus	Bangledesh	University of Dhaka
Zheng	Mei	China	Peking University

7. Impact

The role of the IGAC Project is to continue to foster and respond to the international atmospheric chemistry research community, and to represent the atmospheric chemistry community at an international level to the broader global change and sustainability community. Over the last 29 years, IGAC has fostered an international community of a couple thousand scientists working on topics related to atmospheric chemistry. IGAC continues to build its community by engaging with scientists from around the world, sponsoring or endorsing numerous events, and hosting an international science conference on a biennial basis. Through its early career scientists program and its national/regional working groups, IGAC is both engaging the next generation of scientists and elevating scientists and their research in underrepresented regions of the world. IGAC is also providing scientific leadership by working with its community to identify and sponsor/endorse activities that reach across geographical and

disciplinary boundaries to contribute to addressing the most pressing global change and sustainability issues through scientific research.

IGAC's second role is to represent the atmospheric chemistry research community in the broader global change and sustainability community. As a Global Research Project of Future Earth, IGAC will contribute to understanding the current state of knowledge and identifying the most pressing issues in global change and sustainability research. IGAC facilitates integrative research and synthesis efforts that leverage atmospheric chemistry research to address larger global change and sustainability issues, e.g. Tropospheric Ozone Assessment Report (TOAR). In addition, IGAC is working with international organizations, such as United Nations Environment and the World Meteorological Organizations (WMO) to involve scientists from its national/regional working groups to be lead and contributing authors on high-level reports. Through its activities, IGAC provides an invaluable service to the international atmospheric chemistry community, the wider global change and sustainability community, and to stakeholders both by advancing atmospheric chemistry research and contributing to understanding global change.