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IGACnews

facilitating atmospheric chemistry research towards a sustainable world

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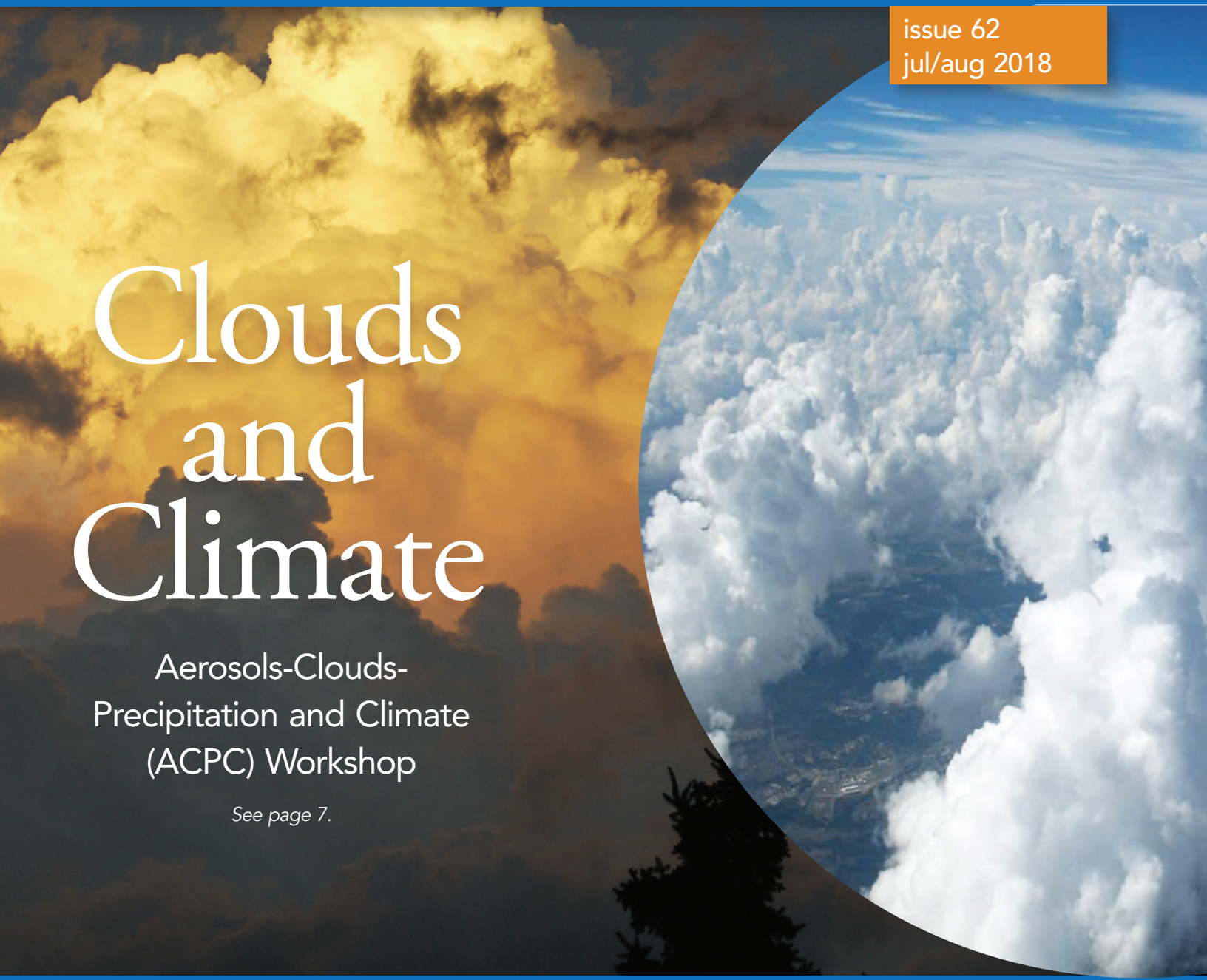

Clouds and Climate

Aerosols-Clouds-Precipitation and Climate (ACPC) Workshop

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(Left) Summertime deep convective clouds in Boulder, Colorado.
PHOTO COURTESY GRAHAM FEINGOLD.

(Right) Shallow cumulus clouds in the Houston, TX area during the GoMACCS field campaign in August 2006.
PHOTO COURTESY ROY WOODS, CIRPAS.

Editor: Megan L. Melamed
Design: Allison Gray

departments

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IGAC was formed in 1990 to address growing international concern over rapid changes observed in Earth's atmosphere. IGAC operates under the umbrella of Future Earth and is jointly sponsored by the international Commission on Atmospheric Chemistry and Global Pollution (iCACGP). The IGAC International Project Office is hosted by the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado and is sponsored by the US National Science Foundation (NSF), National Oceanic and Atmospheric Association (NOAA), and National Aeronautics and Space Administration (NASA). 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.

editor's note

27-30 August 2018, Bonn, Germany

The Future Earth Summit

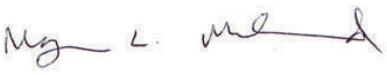
The role of IGAC is two-fold, one is to foster an international community of scientists working on topics related to atmospheric chemistry with a strong emphasis on fundamental scientific research. IGAC's second role is to represent the atmospheric chemistry research community in the broader global change and sustainability community. It is in part for this reason that IGAC is a Global Research Project of Future Earth.

IGAC co-chair Mark Lawrence and myself recently went to the 2018 Future Earth Summit in Bonn, Germany 27-30 August. Although much progress is being made in Future Earth to bring together the global change and sustainability community, it was also clear Future Earth is struggling with how to have a mission focused on accelerating transformations to global sustainability through research and innovation while continuing to maintain, and hopefully strengthen, the fundamental scientific research roots of this potentially fruitful tree.

I don't think Future Earth is alone is this juxtaposition of trying to inform societal change toward a sustainable world while also maintaining its roots in fundamental scientific research. I believe many of you probably experience this on a regular basis whether through pressure at your institute, by funding agencies, or because of your personal interests. But I personally believe that without strong roots there is a good chance the tree will blow over.

Because IGAC aims to continue expanding the capacity of the international atmospheric chemistry community to understand atmospheric composition by fostering **fundamental scientific research** on emissions and atmospheric processes, IGAC spent much of its energy stressing the importance of Future Earth having strong roots in science at the Future Earth Summit. Luckily, we were not alone in this message and hopefully we will start to see more emphasis in organizations like Future Earth to support fundamental scientific research.

Happy reading!



MEGAN L. MELAMED
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Megan Melamed received her PhD in 2006 in Environmental Engineering from the University of Colorado. She then received the National Science Foundation International Research Fellowship to work at the Universidad Nacional Autónoma de México (UNAM) in Mexico City for two years. Upon completion of the NSF Fellowship, Megan became an American Association for the Advancement of Science (AAAS) Science & Technology Policy Fellow at the U.S. Environmental Protection Agency. She has been the IGAC Executive Officer since January 2011.

14th Quadrennial Symposium iCACGP 15th Science Conference IGAC 2018 TAKAMATSU KAGAWA JAPAN

25-29 September 2018

KEYNOTE SPEAKERS

- **Hakime Akimoto**, NIES, Japan
- **Ian Galbally**, CSIRO, Australia
- **Margaret Tolbert**, University of Colorado, USA

INVITED SPEAKERS

SESSION 1: Atmospheric Chemistry and People

- **Cathy Liousse**, CNRS/University of Toulouse, France
- **Rajesh Kumar**, NCAR, USA

SESSION 2: Atmospheric Chemistry and Fundamentals

- **Luc Vereecken**, IEK, Germany
- **Nonne Prisle**, University of Oulu, Finland

SESSION 3: Atmospheric Chemistry and Ecosystems

- **Toshinobu Machida**, NIES, Japan
- **Kathryn Emmerson**, CSIRO, Australia

SESSION 4: Atmospheric Chemistry & Climate/Weather

- **Bill Collins**, University of Reading, UK

SESSION 5: Challenging the Future

- **Guy Brasseur**, MPIMET, Germany
- **Jhoon Kim**, Yonsei University, Korea
- **Kim Prather**, University of California, USA

Visit **icacgp-igac2018.org** for more information.

Submit articles to the next IGAC News

IGAC is now accepting article submissions for the next IGACnews. Workshop Summaries, Science Features, Activity News, and Editorials are all acceptable and desired. Science Features should have an approximate length of 1500 words with 1-2 images. All other submissions should be approximately 500 words and have 1-2 images. Please provide high-resolution image files. The deadline for submissions for the Nov/Dec 2018 issue of IGACnews is 16 November 2018. Send all submissions to **info@igacproject.org**.

IGAC ON SOCIAL MEDIA

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

iCACGP-IGAC 2018 Early Career Program
25 September - 29 September 2018

The joint 14th iCACGP Quadrennial Symposium/15th IGAC Science Conference (iCACGP-IGAC 2018) offers a program for Early Career Scientists aimed at fostering professional relationships and collaboration among the next generation of researchers. *All* students and scientists within three years of completing their PhD are invited to participate in the events. All events are free for early career scientists.

Early Career Scientists have the opportunity to attend the following events throughout the week of iCACGP-IGAC 2018:

1. **Special talk by Prof. Yuan Tseh Lee**
   A special talk for early career scientists entitled "Dare to be Different" by Nobel Laureate Prof. Y.T. Lee will be held on **Tuesday 25 September 2018 (12:45-13:45, plenary room**). Prof. Lee received a Nobel Prize for Chemistry in 1986 for his contributions to the dynamics of chemical elementary processes. He is currently serving as the President Emeritus and Distinguished Research Fellow at Academia Sinica, Taiwan. His talk will definitely be a source of inspiration for the younger generation of scientists. Don't miss this wonderful opportunity.

2. **Early Career Mixer**
   An Early Career Mixer is planned on Tuesday evening **25 September 2018 (19:30-21:00, Tent Square**) as a get-together for all early career scientists. This mixer will serve as an excellent opportunity for meeting and networking with other early career scientists attending iCACGP-IGAC 2018.

3. **Talks focused on a variety of career skills**
   Soft skills including such topics as time management, leadership skills, and social media are integral parts of science. You will experience some exciting talks on developing soft skills on **Wednesday 26 September 2018 (12:45-13:45, plenary room**) by some recognized leaders. These talks are intended to help early career scientists develop essential skills for their work and daily life.

4. **Excursion**
   Take advantage of the free afternoon with an excursion along with other early career scientists. An excursion to the Kompira shrine and Tamamo park has been arranged for early career scientists on **Thursday 27 September 2018 (13:30-18:00**).

5. **Lunch with established scientists**
   To provide an opportunity for early career scientists to connect with established scientists, the early career program at iCACGP-IGAC 2018 provides a lunch on **Friday 28 September 2018 (12:45-13:45, Tent Square**). This lunch will facilitate closer interactions between early career and established scientists.

6. **Early Career Presentation Awards**
   Throughout the week early career scientists' poster and oral presentations will be judged. The awards for the **early career scientists poster and oral presentations** will be given out during the closing ceremonies on Saturday.

Make the most out of iCACGP-IGAC 2018 and participate in the Early Career Program! Visit **2018 iCACGP-IGAC Early Career Program** for more information.

TOAR tropospheric ozone assessment report

Recent IGAC Fostered Publications

The assessment report is being published as a series of papers in the peer-reviewed journal, *Elementa – Science of the Anthropocene*. Papers published so far are available through a **Special Feature** of Elementa:

- Mills G, Pleijel H, Malley CS, Sinha B, Cooper OR, Schultz MG, Neufeld HS, Simpson D, Sharps K, Feng Z, Gerosa G, Harmens H, Kobayashi K, Saxena P, Paoletti E, Sinha V, Xu X, Tropospheric Ozone Assessment Report: Present-day tropospheric ozone distribution and trends relevant to vegetation. Elem Sci Anth. 2018;6(1):47. DOI: **http://doi.org/10.1525/elementa.302**

- Gaudel, A, et al. 2018. Tropospheric Ozone Assessment Report: Present-day distribution and trends of tropospheric ozone relevant to climate and global atmospheric chemistry model evaluation. Elem Sci Anth, 6: 39. DOI: **https://www.elementascience.org/articles/10.1525/elementa.291**

- Lefohn AS, Malley CS, Smith L, Wells B, Hazucha M, Simon H, Naik V, Mills G, Schultz MG, Paoletti E, De Marco A, Xu X, Zhang L, Wang T, Neufeld HS, Musselman RC, Tarasick D, Brauer M, Feng Z, Tang H, Kobayashi K, Sicard P, Solberg S, Gerosa G. Tropospheric ozone assessment report: Global ozone metrics for climate change, human health, and crop/ecosystem research. Elem Sci Anth. 2018;6(1):28. DOI: **http://doi.org/10.1525/elementa.279**

- Fleming*, Zoë. L., Ruth M. Doherty*, Erika von Schneidemesser, Christopher S. Malley, Owen R. Cooper, Joseph P. Pinto, Augustin Colette, Xiaobin Xu, David Simpson, Martin G. Schultz, Allen S. Lefohn, Samera Hamad, Raeesa Moolla, Sverre Solberg, Zhaozhong Feng (2018), Tropospheric Ozone Assessment Report: Present-day ozone distribution and trends relevant to human health, *Elem Sci Anth. 2018;6(1)*:12. DOI: **https://www.elementascience.org/article/10.1525/elementa.273/**.

- Young*, P. J., V. Naik*, A. M. Fiore, A. Gaudel, J. Guo, M. Y. Lin, J. L. Neu, D. D. Parrish, H. E. Rieder, J. L. Schnell, S. Tilmes, O. Wild, L. Zhang, J. R. Ziemke, J. Brandt, A. Delcloo, R. M. Doherty, C. Geels, M. I. Hegglin, L. Hu, U. Im, R. Kumar, A. Luhar, L. Murray, D. Plummer, J. Rodriguez, A. Saiz-Lopez, M. G. Schultz, M. T. Woodhouse and G. Zeng (2018), Tropospheric Ozone Assessment Report: Assessment of global-scale model performance for global and regional ozone distributions, variability, and trends, *Elem Sci Anth. 2018;6(1):*10. DOI: **http://doi.org/10.1525/elementa.265**

- Schultz, M. G. and 96 co-authors (2017), Tropospheric Ozone Assessment Report: Database and metrics data of global surface ozone observations, *Elem Sci. Anth, 5*, DOI: **http://doi.org/10.1525/elementa.244**

- Chang, K-L, I. Petropavlovskikh, O. R. Cooper, M. G. Schultz and T. Wang (2017), Regional trend analysis of surface ozone observations from monitoring networks in eastern North America, Europe and East Asia, *Elem Sci Anth., 5:50,*DOI: **http://doi.org/10.1525/elementa.243** IGAC

3-6 APRIL 2018
UNIVERSITY OF COLORADO, BOULDER

IGAC Endorsed

Aerosols-Clouds-Precipitation and Climate (ACPC) Workshop

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HOST INSTITUTIONS

University of Colorado Boulder

CIRES

FUNDING

IUGG

IAMAS

Colorado State University

PARTICIPANTS

Australia, China, Colombia, Germany, Israel, Japan, UK, USA

BACKGROUND

The Aerosols-Clouds-Precipitation-and-Climate (ACPC) initiative, which aims to better a scientific understanding of the interactions between aerosols, clouds, percupictation and climate, is an IGAC Endorsed Activity. IGAC was proud to help host the 2018 ACPC Workshop at the University of Colorado/CIRES.

ACPC workshop participants

The goal of the Aerosols-Clouds-Precipitation-and-Climate (ACPC; **acpcinitiative.org**) initiative is to improve the understanding of the mechanisms by which aerosol perturbations may modify clouds and precipitation, and to quantify the impact these modifications may have on climate, particularly from the process to cloud field scale. The approach combines detailed observational studies with simulations from large-eddy simulation, cloud-resolving and cloud-system resolving models. Following continued progress of activities defined and discussed in a series of previous meetings, the ACPC group gathered at the University of Colorado, Boulder, USA, 3 – 6 April 2018.

At earlier meetings, the ACPC group defined two climatically important cloud regimes to study, deep convection and marine boundary layer clouds, and formed specific sub-groups to define research objectives and roadmaps. In both cases, specific strategies were chosen aimed at detecting and attributing signatures of aerosol effects on the cloud- and precipitation properties; in both regimes, a combination of modelling and analysis of observations is used.

For the deep convective regime, the coastal region of Houston, Texas, USA was selected to potentially distinguish between deep convection influenced by aerosol emissions from the city and its surrounding industry, and others, in the vicinity, that are not. This coastal, urban

Boulder, Colorado

area experiences convection throughout the year with a significant peak in occurrence during the summertime months when onshore flow of moist air over the warm land surface enhances convective initiation and propagation. In terms of observations, a strong focus was put on the analysis of polarimetric radar data, with complementary observations of aerosol, thermodynamics and lightning. The methods already identified at the 2017 meeting have been refined in several ACPC pilot studies for application to tracking convective cells using polarimetric radar observations and identifying how processes (such as the microphysics in the updraft shafts) are affected by various drivers. A chief conclusion of the tracking pilot study is that operational weather radar observations can only poorly resolve the rapid evolution of target convective cells, strongly motivating efforts to deploy research-grade radars with adaptive scanning strategies. In accord with the objective to optimize the strategy for an observational identification of aerosol – convection interactions from rapid-scanning instruments, radar forward simulations from a regional model simulation were also performed. Chief conclusions of the forward-simulation study are that radars should optimally be located less than 30 km away from the target for microphysical retrievals, and that a network of three Doppler radars nearer than 10 km to the target would be optimal for vertical wind retrievals. Finally, four years of operational weather data were analyzed using an objective cell tracking algorithm. Results indicated the seasonality, locations, frequency and lifetime of typical isolated cells in the Houston coastal region. On the basis of these and other results, and on the basis of the ancillary observational information gathered by the ACPC group, a proposal was submitted to the U.S. Department of Energy's Atmospheric Radiation Measurement Facility (DOE ARM) shortly after the Boulder workshop to deploy instrumentation to observe the variability of convective cloud properties under varying aerosol conditions in the

Houston area. The proposed campaign includes the year-long deployment of a research-grade polarimetric radar, detailed surface-based cloud, aerosol and precipitation measurements, and regular radiosonde profiling and benefits from existing operational meteorological, air quality and lightning networks.

On the cloud-system resolving modelling side of our two-pronged model-observational approach, the investigations for deep clouds has made substantial progress. A summer-season case study of isolated convective cells developing under onshore flow conditions in the Houston region was identified using a combination of ground-based weather radar and satellite remote-sensing observations. An extensively tested case study specification and experiment design were developed, including realistic bimodal aerosol profiles representing clean versus polluted conditions in the Houston area, derived from airborne in situ measurements obtained during NASA's Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) field campaign. Six different modeling groups from Germany, England, Israel and the USA are contributing to the modelling study, thus highlighting the international collaborations facilitated by ACPC. Some emerging results about the aerosol-perturbation impact on the convection were identified across models (e.g. shifts in precipitation intensity). However, substantial differences between the models' base state and response to aerosol perturbations remain. Once fully analyzed, the results of this investigation are to be published in the peer-reviewed literature.

With regard to shallow clouds, the group decided to shift the geographical region of interest from the Southeast Pacific to the Southeast Atlantic Ocean. Recent field campaigns in this area, including Cloud-Aerosol-Radiation Interactions and Forcing (CLARIFY-2016), DOE ARM Layered Atlantic Smoke Interactions with Clouds (LASIC) and the NASA Observations of Clouds above Aerosols and their Interactions (ORACLES), provide new insights, and motivate a number of modeling studies within as well as outside the ACPC group. On the basis of science performed by several teams participating in ACPC, a few testable hypotheses have emerged. On the one hand, model research has shown that the cloud adjustments to aerosol-radiation interactions (also called the semi-direct effect) may lead to a net increase in low-cloud liquid water path (a net negative effect on the radiation budget). Due to strong solar absorption by biomass burning aerosol (BBA) in the South East Atlantic region, a combination of modelling and observations may allow researchers to investigate and test this hypothesis. On the other hand, large-eddy simulations suggest a strong microphysical impact of free tropospheric BBA mixed into the boundary layer on cloud persistence and the life cycle of liquid water path in the stratocumulus-to-cumulus transition over the South East Atlantic. These large eddy simulations disagree on the impact of entraining BBA on the transition, but differences in the model set-ups used may be important. The group now plans to coordinate studies with ongoing work for the Southeast Pacific, the former focus of the group, to identify trajectories along the cloud-system life cycle, derived from regional models, to drive reference large-eddy simulations. In combination with the field campaign measurements and satellite observations, the aim is to corroborate or falsify the described hypotheses.

Considerable insight into co-variation of aerosols, clouds and precipitation can be gleaned from satellite retrievals.

Considerable insight into co-variation of aerosols, clouds and precipitation can be gleaned from satellite retrievals. With regard to liquid-water clouds, the droplet number concentration, N_d, is a key parameter, central to the quantification of effects of aerosol perturbations on cloud properties. However, the retrieval of N_d from satellite data is prone to uncertainties, and in this regard it was a major achievement of the ACPC group to produce a comprehensive review that quantifies these uncertainties, and proposes avenues towards better measurements

A new initiative in the group interested in shallow clouds is the joint investigation of warm-rain processes from satellite data. The idea is to combine a suite of existing methodologies developed for analyzing satellite data to probe the process and its susceptibility to aerosols in an attempt to integrate different approaches of process-oriented analysis. This includes the warm rain from radar reflectivity vs. cloud optical depth-joint histogram, the probability-of-precipitation metric, and the warm-rain occurrence fraction.

A follow-up workshop is planned for 24 – 26 April 2019 at Nanjing University (China). The ACPC group welcomes interested researchers to join the activities.

19 APRIL 2018
UMBC, BALTIMORE, MARYLAND

IGAC Endorsed

AUTHORS

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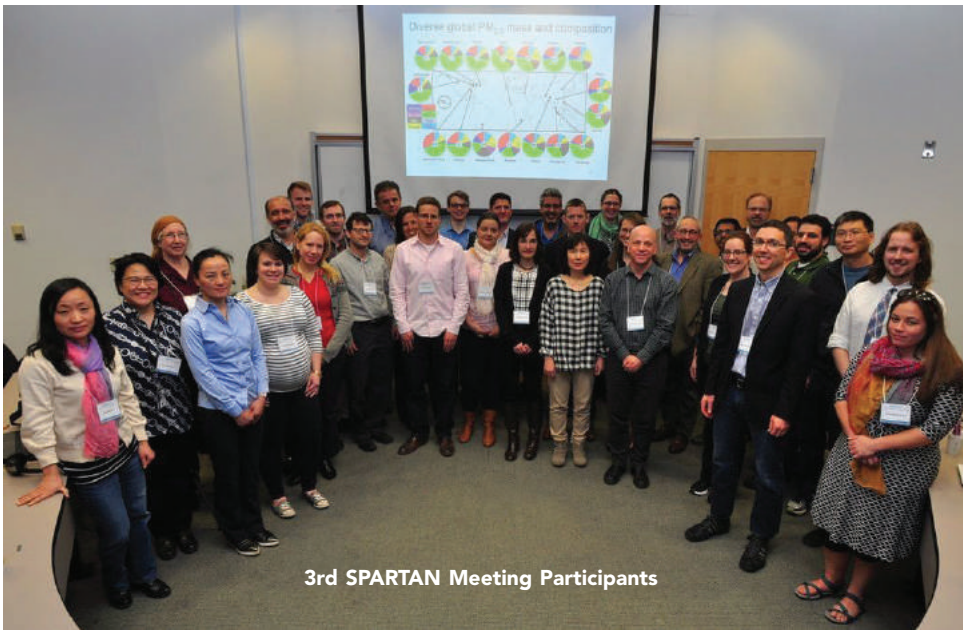
HOST INSTITUTIONS

FUNDING

BACKGROUND

The Surface PARTiculate mAtter Network (SPARTAN) is an IGAC Endorsed Activity. IGAC believes SPARTAN is providing an important contribution to research on air quality and human health by investigating the long-term relationship between columnar aerosol optical depth (AOD) from satellites and ground-level "dry" $PM_{2.5}$ composition to better understand the uncertainties and limitations of using satellite observations for global health applications.

3rd International SPARTAN Meeting



3rd SPARTAN Meeting Participants

About forty scientists recently gathered at UMBC in Baltimore, Maryland, for the 3rd Meeting of the Surface Particulate Matter Network (SPARTAN). SPARTAN is an emerging grassroots network designed to evaluate and enhance satellite-based estimates of fine particulate matter ($PM_{2.5}$).

The Meeting drew attention to the global importance of ambient $PM_{2.5}$ with serious adverse health effects, including increased mortality from chronic cardiovascular disease, respiratory disease, diabetes and lung cancer. Attention was drawn to the recent identification of outdoor $PM_{2.5}$ as the leading environmental risk factor for the Global Burden of Disease with over 4 million attributable deaths in the year 2016. The implications and uncertainties of this estimate motivated the Meeting's attention on ways to improve global estimates of $PM_{2.5}$ exposure.

The Meeting participants supported the use of satellite remote sensing of aerosol optical depth (AOD), when combined with aerosol vertical profiles from chemical transport models, as a promising solution that requires additional evaluation to support its widespread use. Outstanding questions include the accuracy and precision with which ground-level long-term $PM_{2.5}$ mass concentrations can be inferred from discontinuous AOD observations. It was noted that measurements of ground-level $PM_{2.5}$ collocated with AOD measurements in diverse settings with different PM sources are needed to evaluate model calculations of AOD to $PM_{2.5}$ relationships and, in turn, improve estimates of surface $PM_{2.5}$ from satellite AOD. Composition information is also needed, to link $PM_{2.5}$ composition to health outcomes to improve source attribution

UMBC, Maryland

to support mitigation policies, and to understand aerosol formation processes.

The Meeting highlighted the successes of SPARTAN, while also demonstrating where progress is still needed. The SPARTAN community has initiated a global-scale network of ground-level $PM_{2.5}$ monitors situated primarily in highly populated regions that routinely measures and makes publicly available, via the SPARTAN website and OpenAQ, collocated measurements of AOD, $PM_{2.5}$ mass and composition. These measurements provide, in a variety of regions around the world, the key data required to evaluate and enhance satellite-based $PM_{2.5}$ estimates used for assessing the health effects of aerosols, and are also proving useful to inform source apportionment studies.

Since the 2nd International SPARTAN Meeting in 2016, a number of new developments are occurring as highlighted in the Meeting. Instrumentation developments discussed include a cyclone inlet for a sharper $PM_{2.5}$ size cut, harmonization of filters for consistency with IMPROVE and US EPA, and a dynamic inlet on the nephelometer to identify relationships of optical measurements with particle size. Developments to analytical techniques discussed at the meeting include elemental analysis through XRF, and analysis of organics through both FTIR and through AMS. Developments to network include several recent sites, support from Bloomberg Philanthropies, and about 10 new sites planned for deployment in 2019 as part of NASA's MAIA mission.

Interest in $PM_{2.5}$ concentrations has grown rapidly across the world. The Meeting demonstrated many examples of related activities in satellite remote sensing, in instrument development, and in ground-based monitoring that offer exciting contributions to understanding these $PM_{2.5}$ concentrations. The Meeting also brought into focus some challenges for the SPARTAN community to tackle in the coming years. For example, while there have been some successes in developing SPARTAN, gaps remain in important regions. Opportunities remain to interpret SPARTAN observations to better understand aerosol processes and the implications for global estimates of $PM_{2.5}$

The meeting demonstrated the need for strategic development in global ground-based monitoring of $PM_{2.5}$. In the coming years, SPARTAN will continue its mission to evaluate and enhance satellite-based estimates of $PM_{2.5}$ through collocated measurements of AOD, $PM_{2.5}$ mass, $PM_{2.5}$ composition, and aerosol scatter.

More details of the Conference findings can be found in the presentations and other materials from the meeting, available at **spartan-network.org**.

14-16 MAY 2018
UNIVERSITY OF ALASKA FAIRBANKS, FAIRBANKS, ALASKA, USA

IGAC Sponsored

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HOST INSTITUTIONS

FUNDING

PARTICIPANTS

Canada, Finland, France, Italy, Netherlands, Russia, Switzerland, United Kingdom, United States

BACKGROUND

IGAC endorsed this workshop under the jointly sponsored IGAC/IASC PACES activity, which aims to build strong interdisciplinary and international collaborations to coordinate research efforts on Arctic air pollution.

Alaska Layered Pollution and Chemical Analysis (ALPACA) Workshop

ALPACA Workshop Participants

(UAF photo by Josh Hartman)

Forty-four researchers from nine countries recently gathered at the University of Alaska Fairbanks campus in Fairbanks, Alaska, USA, for the "ALaskan Pollution And Chemical Analysis" (ALPACA) workshop. The meeting's purpose was to identify and refine the most critical open questions regarding dark wintertime boundary-layer urban air pollution.

The workshop arose from the IGAC air Pollution in the Arctic: Climate, Environment, and Societies (PACES) activity, which aims to foster new collaborative research on Arctic air pollution at the international level. PACES recognizes that a number of Arctic urban areas and villages, Fairbanks included, have poor wintertime air quality. Addressing gaps in our understanding regarding sources and impacts of local Arctic air pollution on societies is a key focus of PACES Working Group 2 (WG2). PACES WG2 seeks to carry out observational studies guided by community concerns, investigations of local air quality in Arctic communities, and feedbacks between economic development, air pollution, and environmental change in the Arctic.

The three-day meeting began with a charge to write a whitepaper for future studies in this research area. We then reviewed similar high-latitude wintertime air quality problems, and heard concerns from local stakeholders. Next, we reviewed past work on Fairbanks air pollution problems and began work in four groups. The "Modeling/Boundary Layer" group considered model representation of processes (chemistry /

University of Alaska Fairbanks

Photo by Todd Paris

mixing), boundary layer structure, vertical mixing, coupling of chemistry and mixing. The "Oxidation" group considered sulfur and nitrogen oxidation mechanisms, oxidants, oxidation indicators (volatile organic compounds, etc.). The "Aerosol" subgroup discussed aerosol sources, gas-particle interactions, semi-volatile partitioning and chemistry, particulate pH and phase (ice/liquid). The "Health, Ecosystems, and Outreach" group discussed impacts of pollution on health, deposition of pollutants to ecosystem, impacts on ecosystem, and outreach / feedback to the community. Discussion leaders presented past ideas on these topics on the first day, and these groups met on the second day to refine open questions and design a study to address the most compelling open questions. Each of the four groups then presented summaries to the whole workshop, and we discussed plans for a future study in Fairbanks in the 2020-2021 timeframe. Other research efforts, including comparison between "twin" Arctic cities (Fairbanks and a European city) that have similar environmental conditions but different urban design and pollution were also discussed. Ideas for such a twin city approach are being explored in collaboration with other international bodies, including the WMO GAW Urban Research Meteorology and Environment (GURME) project and the Pan Eurasian Experiment (PEEX) network. The third day of the meeting involved site visits to air quality monitoring sites around Fairbanks, a tour of a coal-fired power plant, and tours of the Alaska Center for Unmanned Aircraft Systems Integration (ACUASI) research group.

These discussions highlighted the fact that intense local sources of pollution, such as fine particulate matter from home heating wood smoke, exacerbated by poor dispersion conditions, caused by strong meteorological thermal inversions combined to cause this poor air quality. It was observed that Fairbanks particulate matter differs chemically from lower latitude wintertime particles, with Fairbanks particles having more organic carbon and less inorganic nitrogen mass than the recently studied wintertime pollution in Salt Lake City, Utah, USA. These differences point to differences in both sources and chemical processing. The colder and darker conditions of Fairbanks (and other Arctic and sub-Arctic cities) likely affects this different chemical processing. An important outstanding question regarding Fairbanks pollution is that sulfate is nearly a fifth of the particulate matter, but we do not understand what oxidizes sulfur under these dark (less photochemical) conditions. Another question is how the cold conditions impact the gas-particle partitioning and growth of particulate matter. Boundary layer meteorology is also very important for trapping this pollution and isolating chemically different layers.

Meeting participants and others are continuing the goal of writing a whitepaper for a coordinated field study to address the highest impact questions and to identify critical measurements and observational strategies to address these questions. The goal of these efforts is to release the public version of the whitepaper in Fall 2018 and use it for planning a field study in Fairbanks around 2020/2021.

More details of the workshop and subsequent whitepaper will be available at the ALPACA website, **https://alpaca.community.uaf.edu/**.

The new Analysis of eMIssions usinG Observations

(AMIGO) project of IGAC

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And the participants to the April 2018 AMIGO scoping workshop.

BACKGROUND

AMIGO

Analysis of eMIssions usinG Observations

AMIGO is an emerging IGAC Sponsored Activity that aims to organize the international scientific community around a synthesis of research using observations-based analysis to better quantify emissions.

AMIGO held its first workshop recently. Below is information about the workshop.

5-6 APRIL 2018

TOULOUSE, FRANCE

IGAC Sponsored

HOST INSTITUTION

LA LABORATOIRE D'AÉROLOGIE

FUNDING

Atmosphere Monitoring Service

atmosphere.copernicus.eu

PARTICIPATING NATIONS

France, UK, The Netherlands, Spain, Italy, Czech Republic, Finland, Belgium, Canada, USA, Japan

Participants to the AMIGO scoping meeting in April 2018

1. INTRODUCTION

AN ACCURATE KNOWLEDGE of the emissions of atmospheric compounds is fundamental to many IGAC activities involving atmospheric modeling and analysis of observations. Years of extensive work to better quantify the emissions of gases and particles has led to improved determinations of the spatial distributions and temporal trends in these sources. Numerous emissions inventories have been developed at global and regional scales for specific periods and across years or even decades. For the past 25 years, the GEIA/IGAC (Global Emissions Initiative) project has coordinated these activities on surface emissions.

Many groups have analyzed inventories and obtained additional information about emissions of many species using a variety of observations and analysis techniques, including inverse models. However, comparing the findings from this array of approaches can be hampered

because the studies focus on different time periods or different regions. There has been little systematic evaluation of the results to assess their consistency and to compare the methodologies and the various observations used in each study. Similarly, relatively little attention has been given to how observations-based emissions analyses of co-emitted species can build confidence in the inventories of the individual compounds.

The goal of the new AMIGO (Analysis of eMIssions usinG Observations) project of IGAC is to organize the international scientific community around a synthesis of research using observations-based analysis techniques that aim to better quantify emissions. The synthesis will consider chemically active compounds and greenhouse gases and will evaluate the consistency of their inferred emissions. AMIGO will assess the ability of different analysis techniques to provide consistent quantification of the emissions of multiple species across a range of spatial and temporal scales. Criteria to establish the accuracy of emissions data and their uncertainties will also be defined.

2. CONTENT OF THE AMIGO ASSESSMENT

The synthesis within AMIGO will mainly consist of an assessment of publications in the past few years that report scientific and technical capabilities of observations-based emission analysis. This will include studies involving the use of different types of observations (ground-based, in-situ, and satellite) to quantify primary emissions from several source regions of the world, as well as their associated trends and variability.

Notably, there have been few inverse modeling studies on co-emitted species, as most inverse systems focus on a single species or two compounds at most. Inverse modeling aimed at improving inventories could consider co-emitted species to ensure consistency between the improved datasets.

The proposed assessment includes in particular the following topics:

- Suggested improvements in bottom-up emission inventories;
- Useful information from observations for optimizing emissions and their uncertainties;
- Successful methods for optimizing emissions, including top-down approaches;
- Analysis and evaluation of various emission datasets with emphasis on observational constraints in emission estimates;
- Suggested methods for improving emissions of co-emitted species.

The participants to AMIGO will include modelers, groups involved in the analysis of surface, aircraft and satellite observations, and scientists working on the quantification of emissions. The AMIGO project will establish links with other IGAC projects working either on modelling of the atmospheric composition (CCMI: Chemistry-Climate Model Initiative), on the development and analysis of emissions (GEIA), on fires (IBBI: Interdisciplinary Biomass Burning Initiative) and on the forecasting of air quality (MAP-AQ: Monitoring, Analysis and Prediction of Air Quality).

Links will also be established with several international organizations including the World Meteorological Organization (WMO) and the Global Atmosphere Watch (GAW), particularly with the Integrated Global Greenhouse Gas Information System (IG3IS), the LRTAP (Task Force on Hemispheric Transport of Air Pollution), and the Global Carbon Project (GCP). The Copernicus Atmosphere Monitoring Service (CAMS) in Europe will also participate in the project.

3. AMIGO SCOPING MEETING IN APRIL 2018

The first meeting to discuss the AMIGO project took place at the end of the 2016 IGAC conference in Breckenridge, USA. The IGAC scientific steering committee approved AMIGO as a new IGAC project during its last meeting in September 2017. A scoping meeting was then organized on April 5-6, 2018 in Toulouse, France. About 25 scientists from various institutions, including representatives from other IGAC activities, attended the meeting. Several participants presented relevant work related to the AMIGO topics. This was followed by small group discussions with the aim of better defining these topics and identifying the first activities of the project.

During the scoping meeting, it was decided that the AMIGO assessment should be organized as a series of papers to be published in a particular scientific journal. The papers will represent a synthesis of emissions analyses using observations, models and inversion methods. They will include recommendations for further research to characterize the methods and to increase the robustness of the analyses. It was decided that such an assessment should first focus on a few species and then will be extended to additional compounds after analyzing the interactions and synergies between them.

Toulouse, France

The availability of useful observations for the AMIGO synthesis was also discussed. It was recognized that a compilation of the data available from different measurement systems would be very useful, together with the definition of a common data format. The analysis of the trends in the concentrations and emissions of different species could bring very useful information, as well as the analysis of the ratios of different species and their trends. Moreover, the AMIGO community will provide recommendations about new measurement campaigns, especially in regions where observations are scarce or inexistent.

In addition to the synthesis assessments, innovative research activities were proposed during the meeting : (i) intercomparison studies between top-down emission estimates obtained from different models and inverse techniques, (ii) multi-model inversion experiments constrained by the same observation datasets, (iii) cross-evaluation between chemical mechanisms through box model experiments, (iv) evaluation of trends in bottom-up inventories using long-term spaceborne observations, and (v) merging of local scale emission information into global inventories. These activities, to be performed in collaboration with the CCMI/IGAC communities, will be beneficial in assessing the quality of top-down estimates and in improving our current knowledge of the emissions.

Model simulations using the results from various emission optimization studies from different numerical models could be beneficial in assessing the quality of these top-down estimation studies. Such work could be done in cooperation with the CCMI and GEIA projects of IGAC. AMIGO will help in narrowing down the uncertainties in emissions from the synthesis of model results using the top-down and bottom-up emission estimates.

4. HOW TO PARTICIPATE IN AMIGO

The AMIGO project just started and welcomes new participants and ideas. You are invited to contact the AMIGO co-chairs, Claire Granier (**claire.granier@aero.obs-mip.fr**), Ave Arellano (**afarellano@email.arizona.edu**) and Jenny Stavrakou (**jenny@aeronomie.be**).

An AMIGO side meeting will take place during the IGAC 2018 conference in Takamatsu, where details of the project will be given, and all members of the IGAC community will be able to provide input to the scope of the project and its first activities.

William Swanson

William Swanson attended the Alaska Layered Pollution and Chemical Analysis (ALPACA) Workshop 14-16 May 2018 in Fairbanks, AK, USA.

William Swanson grew up in Sewickley, Pennsylvania, USA, which is a small town outside of Pittsburgh. He earned his Bachelors in Science in Chemical Engineering at Washington University in St. Louis, Missouri, USA. Currently, William is pursuing his PhD in Environmental Chemistry at the University of Alaska, Fairbanks, USA under the guidance of William Simpson. His research is on the springtime production of reactive bromine in the Arctic troposphere, focusing on the effect of meteorology and local conditions on reactive bromine cycling.

Not very many graduate students get the opportunity to participate in a workshop that focuses on planning future field campaigns. For you, what was the most interesting thing you learned participating in the ALPACA workshop as a graduate student?

The most interesting thing I learned was the extent to which governmental organizations and research institutions collaborate. There was free and open discussion on the best way to bring materials and expertise together from many different groups to make the ALPACA campaign a success.

Your research background is on halogen oxides in the Arctic. Did attending the ALPACA workshop, which focused on dark wintertime boundary-layer urban pollution, have any impact on your future career and/or research interests?

Absolutely! I have personal experience with wintertime urban pollution while living in Fairbanks, but I was unaware of the extent to which Salt Lake City and other areas may experience similar wintertime phenomena. I also learned a lot about the potential health impacts of extreme urban pollution, and I hope to work on air pollution issues sometime in the future.

What and/or who motivated you to pursue a career in science and more specifically in atmospheric chemistry?

I have been interested in chemistry since I competed in a chemistry competition in high school, and I was fortunate enough to be able to do undergraduate research in Brent Williams' lab. There, I learned a lot about aerosol chemistry, and was left with a desire to do more explorative research. I was happy to be able to talk to him and catch up on his recent lab progress at ALPACA.

What do you think is the largest challenge in pursuing a career in science?

I think that the largest challenge in pursuing a career in science in America right now is the politicization of basic environmental science. Major scientific findings are run through a political filter by the media before being presented to the public, and this has led to an erosion of trust in the scientific community.

What do you do for fun when you're not busy pushing the limits of the knowledge of mankind doing atmospheric chemistry research?

I stay active by hiking, skiing and playing soccer and volleyball in Alaska. I also enjoy traveling to see live music, and reading science fiction and playing board games while I'm at home.

1st International Workshop "Recent findings on Particle Matter: non-exhaust emissions and chemical composition, a study case in Latin-America"

7-9 MAY 2018
UNIVERSIDAD DE LA SALLE, BOGOTÁ, COLOMBIA

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1st International workshop "Recent findings on Particle Matter: non-exhaust emissions and chemical composition, a study case in Latin-America" participants

Thirty scientists from Colombia, Mexico, Brazil, Costa Rica, Ecuador and Bolivia gathered at University of La Salle in Bogota, for the 1st International workshop "Recent findings on Particle Matter: non-exhaust emissions and chemical composition, a study case in Latin-America". The two-day workshop included presentations and working sessions organized around two topics: particle matter (PM) chemical composition on day one, and non-exhaust PM emissions on day two. The third day was open to the public and consisted in a forum discussing good practices for clean air management in Latin-America.

The workshop included the current state of research on PM chemical composition in different Latin-American cities: Bogota, Medellin, Mexico City, Quito (Ecuador), San Jose (Costa Rica) and La Paz (Bolivia). A comprehensive review on non-exhaust emissions was presented

by Fulvio Amato from the Spanish National Research Council (CSIC). The oral sessions were followed by a question-&-answer panel guided by a set of key questions, leading to extensive discussions that were a highlight of the workshop.

The oral sessions highlighted advances and limitations on PM chemical composition. Despite the lack of resources, a basic knowledge on PM_{10} and $PM_{2.5}$ chemical components has been achieved in the region. Some cases are exceptional such as Santiago (Chile) and Mexico City, the latter one, under the IMADA and MILAGRO Campaigns among others acquired substantial knowledge on PM chemical composition. It's clear that international collaboration is necessary to advance on this topic.

The workshop also shows that few cities in the region include non-exhaust emissions in their inventories. The international experience shows that wear emissions can surpass exhaust emissions and contribute with ambient PM and water runoff toxicity. Estimation of wear and resuspended emissions require extensive field campaigns and special instrumentation, limitations that need to be addressed before consolidating a non-exhaust emission inventory for the region.

The discussion in the working sessions conclude that Latin America still observe exceedances to the PM_{10} standards, even though $PM_{2.5}$ measurements are becoming available in the region. In this sense, it's important to estimate both PM_{10} and $PM_{2.5}$ chemical compositions to properly control emission sources. Most of the chemical analysis are conducted overseas, but the region is rapidly strengthening its capabilities in terms of chemical techniques, sampling and analysis protocols and training of a new generation of air quality researchers.

The workshop demonstrated the similarities in the concerns and issues for developing policies for clean air in Latin America based on science. In this sense, three levels of communication were identified: an academic level where peer-reviewed manuscripts are of interest, a public policy level where documents with specific recommendations for decision makers are preferable, and a community level where short communications in the appropriate language are desirable to engage society into environmental concerns.

The workshop concluded with the creation of a Latin-American network on particulate matter, with the purpose to share knowledge and experiences and promote a more active collaboration in the region. Given that funding sources is a major concern, searching of funding is going to be one of the priorities for the network.

Bogota, Colombia

The workshop presentations are available at **https://drive.google.com/drive/folders/1JHefW35ojjGYatvpz9j0LM_kg_pyjdpA**

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