AOS & CICS Newsletter
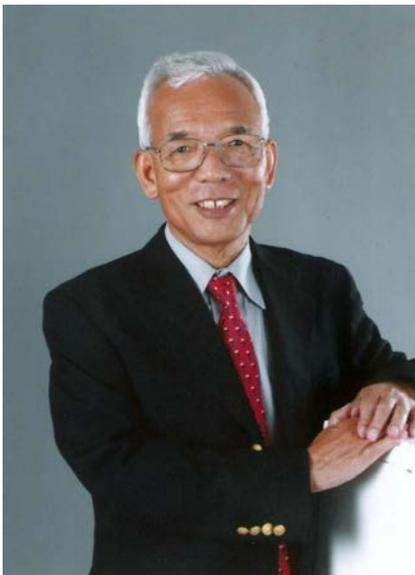
Suki Manabe Awarded the 2018 Crafoord Prize

AOS Senior Meteorologist Syukuro (Suki) Manabe has been awarded Sweden's prestigious Crafoord Prize in Geosciences "for fundamental contributions to understanding the role of atmospheric trace gases in Earth's climate system."

AOS Senior Meteorologist Syukuro (Suki) Manabe

Manabe created the first global climate model after his groundbreaking studies of atmospheric dynamics in the 1960s. In this model, he connected the processes that take place in the atmosphere and at ground level with the oceans' movements and their thermal balance. Together with Richard Wetherald of GFDL, he published several seminal global warming papers, starting with their 1967 paper which offered the first quantitative estimate of the change in surface air temperature due to increasing CO_2 in the atmosphere. It continues to be one of the most-cited papers in climate science, having been cited more than 1,550 times, and, in 1975, led to the first three-dimensional model of global warming. Using numerical modeling to predict how the Earth's surface temperatures are influenced by atmospheric conditions – Manabe's revolutionary idea – was a major breakthrough, giving researchers a powerful new tool to investigate the Earth's complex climate systems.

He shares the approximately $750,000 prize with Susan Solomon, the Lee and Geraldine Martin Professor of Environmental Studies at the Massachusetts Institute of Technology. Solomon's studies have been at the forefront of research into the ozone layer and its role in the Earth's climate system for more than 30 years. She is internationally recognized as a leader in atmospheric science, particularly for her insights in explaining the cause of the Antarctic ozone hole.

The Crafoord Prize lectures will be given on May 22 at Lund University. The prize symposium will follow the next day, and the award ceremony will be held at the Royal Swedish Academy of Sciences in Stockholm on May 24 in the presence of King Carl XVI Gustaf and Queen Silvia.

Manabe, whose work is the foundation for all modern climate research, has been widely recognized for his contributions, including his election to the U.S. National Academy of Sciences, the Academia Europaea, the Royal Society of Canada and the Japan Academy. His numerous awards and honors include the Bowie Medal (2010), the highest honor of the American Geophysical Union, the Benjamin Franklin Medal of the Franklin Institute (2015), and the BBVA Foundation Frontiers of Knowledge Award (2017). Notably, Manabe was the first recipient of the Blue Planet Prize (1992), an award established by the Asahi Glass Foundation and

Program in Atmospheric and Oceanic Sciences (AOS) & The Cooperative Institute for Climate Science (CICS)

Inside this issue:

TigerTransit/Shuttle Services Operating on Spring Schedule:
https://transportation.princeton.edu/sites/default/files/inline-files/Forrestal%20PPPL.pdf

presented to individuals or organizations worldwide in recognition of major contributions to solving global environmental problems.

The Crafoord Prize is awarded in partnership between the Royal Swedish Academy of Sciences, which selects the laureates, and the Crafoord Foundation in Lund. Chosen as a complement to the Nobel Prizes, the prize disciplines change every year from among mathematics and astronomy, geosciences, biosciences, and polyarthritis. ■

V. Balaji Selected for French Climate Initiative

CICS Scientist V. Balaji, head of the Modeling Systems Group at GFDL since 2003, has been selected as one of 18 researchers to receive funding from French President Emmanuel Macron's "Make Our Planet Great Again" initiative, which contains a series of ambitious and innovative measures to find global solutions to climate change. His newly funded project, selected from over 1800 applications and scheduled to begin in the fall of 2018, will focus on high resolution modeling of the Earth system.

V. Balaji, head of the Modeling Systems Group, GFDL/AOS

Balaji is one of 11 men and seven women from six different countries selected by France's National Centre for Scientific Research (CNRS) to address a range of climate-related issues, including agriculture and food security, ocean-atmosphere interactions, and renewable energy. The researchers have received grants of up to $1.7 million to execute three to five year

research plans at scientific institutions across France.

The unique feature of Balaji's project, Project Hermès (High-Resolution Modeling of the Earth System), according to him, is the combination of computationally challenging simulations and fast models for uncertainty exploration. His project includes creating very high-resolution simulations — at the limit of today's computing technology — of key processes in the atmosphere and oceans. These simulations are used to build and train fast approximations of the Earth system to explore questions that are currently impossible with the full model.

"Computers seem to be evolving in the direction of themselves learning what to do, instead of being told what to do," Balaji said. "It's intriguing, and we should be trying to see how we can apply this to the simulation of the Earth system. This project joins a burgeoning field of research trying out new ideas here; it is still very, very new."

In the coming months, the Institut Pierre Simon Laplace on the Jussieu campus of Paris's Sorbonne University could potentially become Balaji's home away from home, under the auspices of the Climate and Environmental Sciences Laboratory in Saclay, France's Atomic Energy Commission, the University of Versailles in St. Quentin in Yvelines and the CNRS.

"I'm very gratified by the award because of France's recognition that the problem is one of global scope, and that the solutions will indeed require global cooperation," Balaji said. "Hermès will build upon work I've done with colleagues at Princeton and GFDL for more than 20 years, and we of course will continue to collaborate for the duration of this project as well," Balaji said. ■

GFDL Winter Poster Expo

A sampling of work showcasing the breadth of research done by the broader GFDL community was on full display at the GFDL Winter 2018 Poster Expo on Wednesday, January 31. This was the fifth installment in a series of Expos whose

inaugural event took place in the summer of 2014.

Attracting many of GFDL's local partners, including Princeton University, UCAR visiting scientists, and Engility, the event aims to foster transdisciplinary interaction and possible collaboration among its attendees. It also offers presenters an intimate platform to gain confidence in talking about their research and to receive constructive feedback on their research ideas and work in progress.

Attendees discussing the research presented at the GFDL Winter Poster Expo

As in years past, over one half of the 29 posters on display were presented by AOS and CICS researchers, ranging from graduate and postdocs to early-career and more established principal investigators. There was also significant participation by GFDL's Modeling Systems Group, who presented five posters at the event.

AOS Postdoc Yongqiang Sun viewing AOS Postdoc Kun Gao's poster

Posters covered a wide range of familiar and emerging topics, among them climate sensitivity and feedbacks, hurricane prediction, fisheries, the North American Monsoon and the Indian Monsoon, anthropogenic aerosols, and GFDL's climate model workflow.

Those in attendance had many opportunities to make connections with researchers, graduate students and faculty throughout the half-day event. Jasmin John, a physical scientist at GFDL and lead organizer of the event, noted that the Smagorinsky Seminar Room was full for the duration of the event, and hopes that the winter event once again provided a platform for presenters and attendees to cross-fertilize ideas and further develop their research. Among this year's highlights was a first-time poster presentation "Experimental Methodologies Optimized for Examining Scope of Responses and Process Modeling of Early Life-stages of Marine Fishes Due to Ocean Acidification and Climate Change" by colleagues at the Northeast Fisheries Science Center (NEFSC)/Sandy Hook Lab and an animation display presented by Engility Visualization Engineer Young Cho.
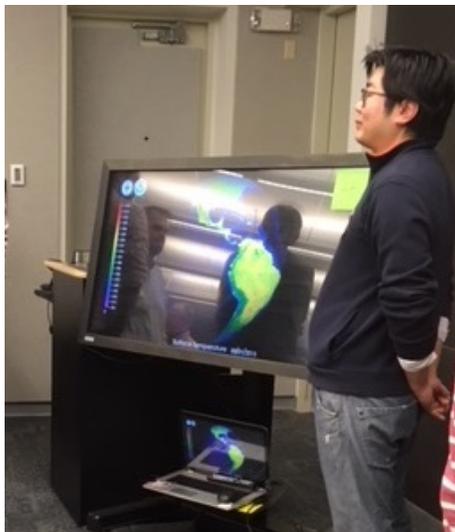
Engility Visualization Engineer Young Cho

Surpassing last year's total, approximately 60 colleagues from the local community attended the event, in addition to the 29 presenters, among them GFDL scientists, colleagues from Princeton University and Rutgers, The State University of New Jersey.

John was joined on the organizing committee by Catherine Raphael, a GFDL scientific illustrator. GFDL Director V.

Ramaswamy wrote in a February 2 email to the wider GFDL community that Jasmin "deserves tremendous credit for her sustained motivation of the event since her initiation in 2014," and that Cathy "has been a sturdy pillar of support for the Expo ever since its launch." He also acknowledged the contributions of some others who contributed to the success of the event, specifically Will Cook (UCAR), Xiao Liu (AOS), Vaishali Naik (GFDL), Jong-Yeon Park (AOS), Brandon Reichl (AOS), and Thai Truong (Engility).

According to John, feedback from the event will be used to guide the planning of future Poster Expos.

For a listing of the posters presented, please visit the Winter 2018 Poster Expo webpage on the GFDL website: < https://www.gfdl.noaa.gov/poster-expo-program-list/#posterexpolist >. ∎

AOS Program Sets Applications Record

The AOS Program received a record number of applications for the fall of 2018, with 68 students vying for a spot in the Program. This is the largest applicant pool in the Program's history.

The University's academic excellence and unrivaled access to world-class faculty members likely contributed to the rise in applications. "Our record number of applicants is a testament to the extraordinary achievements of our outstanding faculty, high-caliber students, and successful alumni," said AOS Director Stephan Fueglistaler. The AOS Program's unique ties to GFDL and its scientists, many of whom are active in the Program as faculty members, also continue to have tremendous appeal to prospective students.

Bolstered by the University's international reputation, the Program continues to attract a large number of applicants from overseas. The number of applications from international students exceeding the number of applications from U.S. citizens and permanent residents is an upward trend that can be seen across the University over recent years.

The AOS Program traditionally has an excellent balance between male and female students. That balance was reflected in this year's applicant pool, with the number of applicants almost evenly balanced between men and women.

Full funding for doctoral students in Princeton's Graduate School continues to attract exceptionally talented and outstanding candidates who also have excellent opportunities to teach and attain outside fellowships. The AOS Program benefits from the breadth of support Princeton provides, helping to attract some of the best student talent worldwide.

Applicants to the Program were notified of admission decisions in mid-February. ∎

Jane Baldwin Wins AGU Outstanding Student Presentation Award

AOS Graduate Student Jane Baldwin was awarded an Outstanding Student Presentation Award for her presentation at the American Geophysical Union's (AGU) Fall Meeting this past December in New Orleans, placing her in the top 2 to 5 percent of student presenters in the Global Environmental Change section.

Baldwin's winning presentation, "Temporal Compounding of Heat Waves in the Present and Projected Future," focused on the temporal structure of heatwaves, one less examined aspect of these extreme events. The work, conducted under her PEI-Step fellowship with STEP Director Michael Oppenheimer, the Albert G. Milbank Professor of Geosciences and International Affairs and the PEI Institute, stems from their shared interest in how the compounding of multiple extreme events influences natural disaster risk, according to Baldwin.

AOS Graduate Student Jane Baldwin

Coauthors on the paper include former Geosciences Undergraduate Jay Dessy '16, AOS Faculty Member Gabriel Vecchi, Baldwin's Ph.D. adviser and professor of Geosciences and the Princeton Environmental Institute (PEI), and Oppenheimer. Last year, Baldwin was selected as a top student paper presenter at the (AMS) Eighth Conference on Environment and Health at the 97th AMS Annual Meeting for her oral presentation on a preliminary study for the same project.

"Jane's work provides not only a unique analysis of the temporal structures of periods of extreme heat but also important insights for the policy community on how these structures could affect our ability to adapt successfully and minimize resulting damages, including illness and loss of human lives," Oppenheimer said.

Baldwin's research broadly focuses on how large-scale atmospheric dynamics influence regional climate, with an eye to climate change and policy applications. Her dissertation, examines formation of deserts, precipitation variability, and impacts of orography on climate. This work is funded through her National Science Foundation Graduate Research Fellowship.

"The core work of my dissertation is actually on how mountains influence large-scale patterns of precipitation, like monsoons and deserts-- a very different topic more focused on basic climate research than policy relevance," Baldwin said. "I guess my projects are united by all using GFDL's coupled climate models in various configurations, and making use of higher resolution atmosphere/land versions of these models which can simulate high spatial/temporal variability of temperature extremes, and tropical cyclones."

Baldwin, who plans to graduate this spring, will continue her work at Princeton with Vecchi and Oppenheimer as a postdoc next year.

The American Geophysical Union galvanizes a community of Earth and space scientists that collaboratively advances and communicates science and its power to ensure a sustainable future. With more than 24,000 attendees, the AGU Fall Meeting is the largest Earth and space science meeting in the world, bringing together leaders from academia, government, and the private sector to examine and discuss the latest research and scientific developments in Earth and space science. The Outstanding Student Paper Awards (OSPAs) are awarded to promote, recognize and reward master's and Ph.D. students for quality research in the geophysical sciences. ∎

New Forecast Product to Provide 3- to 4-Week Temperature and Precipitation Outlooks

Contributed by Maria Setzer, GFDL Communications Director

Predicting the weather beyond two weeks in advance is a daunting challenge, but a team of scientists led by CICS Scientist Nat Johnson, an AOS associate research scholar, successfully developed and transitioned a forecast tool into operations that provides guidance to NOAA Climate Prediction Center (CPC) forecasters for their operational 3-to-4 week temperature outlooks.

Successful performance of these forecasts at such long lead times requires the development of new tools that provide forecasters with information on various physical indicators that may influence the forecast. One of the key factors for success is detecting a reliable signal from the tropics. This statistical tool developed by

AOS Associate Research Scholar Nat Johnson

Johnson and his colleagues leverages information on the initial state of the tropics (specifically, the phases of the El Niño–Southern Oscillation and Madden-Julian Oscillation) and the long-term trends that influence weather, to predict temperature and precipitation over the U.S. three and four weeks later. This form of guidance was provided to forecasters during the implementation of CPC's experimental 3-to-4 week temperature and precipitation outlooks in September of 2015.

During the experimental implementation phase, the forecast tool provided skillful forecast guidance for precipitation, and even better guidance for temperature, while complementing the guidance from dynamical forecast models. The 3-to-4 week temperature outlook became fully operational in May 2017, but the precipitation outlook remains experimental.

Using one of GFDL's dynamical global climate models, Johnson is now investigating the possibility of developing a hybrid dynamical-statistical model to provide 3-to-4 week forecasts with even greater skill. This ongoing study should provide insights about North American predictability in weeks 3-to-4 while also providing a prototype for a viable hybrid dynamical/statistical forecast method. Development of this tool was a collaboration between scientists from NOAA's Geophysical Fluid Dynamics Laboratory, Princeton University, NOAA's Climate Prediction Center, Scripps Institution of Oceanography, and Penn State University. ∎

Scholars Collaborate on "Convection in Nature"

Convection occurs throughout nature: in our atmosphere and oceans, in planetary cores, in stars, and in the atmospheres of other planets. From February 8-10, 2018, experts in various types of convection converged on Main Campus to introduce their fields to one another and address key questions.

Spearheaded by Hess Fellow Nadir Jeevanjee, a former AOS postdoctoral research associate, and Daniel Lecoanet of the Princeton Center for Theoretical Science (PCTS), the Convection in Nature Workshop brought together 60 researchers from a variety of differing fields of convection to interact and tease out common threads and challenges through a series of talks and group discussions. Approximately 30 invited speakers from across the globe and 30 additional participants from the campus community attended the three-day event, held in Jadwin Hall.

L to R: Daniel Lecoanet of the Princeton Center for Theoretical Science (PCTS) and Hess Fellow Nadir Jeevanjee, a former AOS postdoc

Included among the invited speakers, a mix of senior scientists, early-career scientists, postdoctoral researchers, and graduate students, were AOS Faculty Members Leo Donner, a physical scientist at GFDL, and Sonya Legg, associate director of CICS. Donner spoke about parameterizing convection in climate models, and Legg introduced the various manifestations of convection in the ocean.

While the workshop presentations spanned multiple fields and a range of perspectives, several themes emerged across the three days of presentations. One theme was the morphology of convection, and in particular whether convection should be conceptualized in terms of continuous plumes versus isolated thermals. Other themes included the roles of rotation, phase change, and interaction with a stable layer in determining the nature and downstream effects of convection, according to Jeevanjee.

"One area of surprisingly common interest was how convection in an unstable region interacts with a stably stratified region, and how much mixing ensues," said Jeevanjee. "Such mixing is key not only to understanding stratocumulus clouds on Earth, but also to understanding how nuclear fuel in stars is mixed throughout their volumes."

The workshop also seemed to spark potential collaborations, he said, including experimental interest in studying the question of convective thermals vs. plumes, a pivotal question with regard to the atmosphere which has only recently been studied in computer simulations.

A representation of international participants covered many disciplines, including astrophysicists, planetary scientists, climate scientists, oceanographers, and geophysicists, with numerous participants spanning multiple disciplines. "We had a contingent from France, as well as speakers from Australia, Canada, Germany, and Columbia," Jeevanjee said. AOS, CICS, and GFDL were especially well represented among the participants, with approximately one third of the participants hailing from the wider AOS community.

The workshop event was conceived as an opportunity to facilitate interaction between participants who might otherwise not have the opportunity to engage in such collaborative dialogue. With this in mind, substantial breaks and opportunities for networking and unstructured discussion were built into the workshop's agenda, fostering many productive discussions. Workshop participants not only found common points of discussion, but also highlighted the challenges in addressing convection in their various disciplines, according to Lecoanet and Jeevanjee.

"The workshop illustrated the very different approaches to convection used by different communities, for example in studies of the tropical atmosphere and of the Earth's core, not just regarding terminology but in the kinds of idealizations considered of most interest," said AOS Faculty Member Isaac Held, a senior research scientist at GFDL. "I am still confused in part, but I have a clearer idea of what I am confused about."

"We brought together researchers in convection from a broad variety of fields, learned a lot from each other, and had conversations that were unlikely to happen in the usual discipline-specific conferences," Jeevanjee said. "We identified a few specific questions of interest in multiple fields, and perhaps even sparked some new research directions."

PCTS, sponsor of the event, is dedicated to exploring the frontiers of theory in the natural sciences. Its purpose is to promote interaction among theorists and seed new directions in research, especially in areas cutting across traditional disciplinary boundaries. ∎

SOCCOM Biogeochemical Float Network Reaches 100 Float Milestone

Contributed by Roberta Hotinski, Project Manager, SOCCOM, PEI

Jorge Sarmiento, Princeton's George J. Magee Professor of Geoscience and Geological Engineering, directs the Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM) project, a multi-institutional effort funded by the National Science Foundation to dramatically increase the number and variety of observations of the Southern Ocean through the world's first large-scale deployment of biogeochemical (BGC) Argo floats – robotic floats equipped with newly developed biogeochemical sensors to measure pH, nitrate, and oxygen in addition to ocean temperature and salinity. The project also receives support from NOAA, which supplies half the standard floats augmented by SOCCOM, and from

NASA, which funds the addition of bio-optical sensors to the float for estimating chlorophyll and particulate organic carbon (POC) levels.

This January, the SOCCOM project reached the milestone of 100 BGC floats operating in the Southern Ocean (see Figure), a harsh and remote region where shipboard observations have been sparse and mainly made in the austral summer. The SOCCOM floats have now collectively made nearly 5 million new observations in the Southern Ocean in all seasons and under ice, and all data are freely available in near-real time.
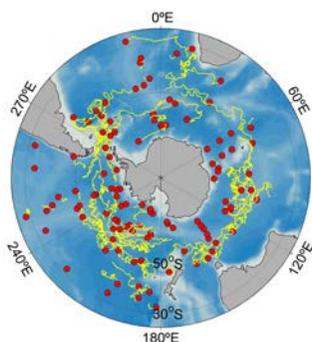
Locations and trajectories of SOCCOM floats operating as of January 30, 2018. Red dots are locations of operating floats and yellow lines indicate float trajectories since deployment. (Credit: SOCCOM)

SOCCOM adjusted biogeochemical data are providing an unparalleled view of Southern Ocean biogeochemistry. Research results include:

- Detection of a large, previously undocumented winter-time CO_2 flux from the ocean to the atmosphere that has implications for global carbon cycling
- Demonstration of no significant bias in NASA's ocean color algorithms for chlorophyll and POC for the Southern Ocean in contrast to earlier studies based on limited data sets
- Development of methods to determine Annual Net Community Production across the Southern Ocean with yearly resolution using profiling float sensors
- Assessment of biogeochemical sensor performance on SOCCOM profiling floats and demonstration of comparability of data with shipboard observations

Many of these results are highlighted in a special SOCCOM–focused virtual issue of JGR-Oceans that already contains 11 published articles, with an additional 8 in progress.

SOCCOM will continue to deploy BGC-Argo floats over the next 3 years, with a goal of roughly 200 floats operating in the Southern Ocean by 2020 that will give an even clearer picture of the distribution of pH, oxygen, and nutrients in the region. At the same time, high-resolution modeling studies are using the new data to better understand the current workings of the Southern Ocean and to compare and improve earth system models that provide a view into the future of this region in a changing climate. Results from an evolving biogeochemical state estimate (B-SOSE) are available online and a Southern Ocean Model Intercomparison effort is also underway.

SOCCOM researchers are also reaching out to the community to enable wide use of BGC-float data and promote the global use of BGC floats. SOCCOM researchers held a Town Hall at the AGU Ocean Sciences in Portland in mid-February to inform other oceanographers about their efforts and the potential of float-based observations. The group will also hold a float workshop at the University of Washington this summer to train other scientists, particularly early career researchers, in how to use and process data from these new tools. Finally, a burgeoning adopt-a-float effort is connecting SOCCOM researchers with schools around the country to inspire the next generation of ocean scientists. ■

Rebecca Asch and Daniele Bianchi Awarded 2018 Sloan Research Fellowships

Two former Sarmiento Group members are among the 126 early-career scholars awarded 2018 Sloan Fellowships, the Alfred P. Sloan Foundation announced recently.

Former AOS postdoctoral research associate Rebecca Asch, an assistant professor in the Department of Biology,

East Carolina University, and former AOS graduate student Daniele Bianchi, an assistant professor in the Department of Atmospheric Oceanic Sciences, University of California, Los Angeles (UCLA), were awarded two-year $65,000 fellowships to advance their work in the field of ocean sciences.

Former AOS Postdoc and Nereus Alum Rebecca Asch,

As a fisheries oceanographer, Asch conducts research that will advance our understanding of how climate change affects fish populations and provide knowledge for the effective management of living marine resources. More specifically, her recent research has focused principally on the phenology (the study of seasonal, biological cycles and how they are influenced by weather and climate) of fish reproduction.

Former AOS Graduate Student Daniele Bianchi

Bianchi's research focuses on interactions between climate, ocean circulation and marine life. He is particularly interested in the mechanisms that regulate marine ecosystems, and how marine organisms, from microscopic phytoplankton up to zooplankton and fish, respond to changes

in their environment, both natural and due to human activities. His research tools range from global observations to theoretical and numerical models of ocean biogeochemistry and ecology.

Awarded annually since 1955, the Sloan Research Fellowships are given to early-career scientists and scholars whose achievements and potential identify them as rising stars among the next generation of scientific leaders. This year's recipients are drawn from 53 colleges and universities across the United States and Canada.

"The Sloan Research Fellows represent the very best science has to offer," said Adam Falk, president of the Alfred P. Sloan Foundation, in a press release. "The brightest minds, tackling the hardest problems, and succeeding brilliantly — Fellows are quite literally the future of twenty-first century science."

Administered and funded by the foundation, the fellowships are awarded in eight scientific fields: chemistry, computer science, economics, mathematics, evolutionary and computational molecular biology, neuroscience, ocean sciences, and physics. To qualify, candidates must first be nominated by fellow scientists and subsequently selected by an independent panel of senior scholars.

For a complete list of winners, visit the Sloan Foundation website. ∎

AOS & CICS Research in Action

[This column is intended to focus on AOS & CICS research accomplishments and milestones, past, present, and future. In this issue, we highlight the accomplishments of AOS Postdoctoral Research Associate Dawei Li who spent three years in the AOS Program.]

Postdoctoral Research Associate Dawei Li left Princeton in late January, after three years in the AOS Program. Before joining AOS, Dawei earned his Ph.D. in Geophysical Sciences from the University of Chicago while working on the climate of a peculiar deep-time regime -- the snowball Earth. While at Princeton, Dawei collaborated with AOS Faculty Member

Rong Zhang and Tom Knutson, a GFDL meteorologist, in understanding the rapid decline of Arctic sea ice cover in recent decades.

AOS Postdoctoral Research Associate Dawei Li

The rapid change in summer Arctic sea ice could have significant large-scale climatic, ecological, and economic impacts. Understanding the mechanisms for the recent rapid decline will help to predict future changes in summer Arctic sea ice as well as its associated impacts. With this in mind, Dawei analyzed the mechanisms of low-frequency variability of summer Arctic sea ice using long control simulations from three coupled climate models. Despite different sea ice mean states, in all three models, robust features were found in the response of low-frequency summer Arctic sea ice variability to three predictors (Atlantic/Pacific oceanic heat transport into the Arctic and the Arctic Dipole). Robust Bjerknes Compensation works at low frequency, so that the northward atmospheric heat transport provides a negative feedback to summer Arctic sea ice variations. The response of Arctic sea ice thickness to the three predictors is stronger in models that have thicker climatological Arctic sea ice.

At the same time, the dramatic decline of Barents Sea winter sea ice in recent decades remains poorly understood in terms of the relative contribution of anthropogenic forcing versus internal climate variability. The CMIP5 project provides an opportunity of utilizing the most advanced climate models to address this problem. This, however, has never been done before because different CMIP5 models have very different irregular ocean

grids, and no direct output of ocean heat transport is available. Dawei took an innovative approach to make it possible to calculate ocean heat transport in each CMIP5 model, and identified a significant high anti-correlation between Barents Sea winter sea ice extent trends and trends in Atlantic heat transport across the Barents Sea Opening throughout individual CMIP5 ensemble members. Dawei was among the first to use CMIP5 models, augmented by extended control simulations, to quantify the relative contribution of external radiative forcing vs. internal variability of Atlantic heat transport to the observed Barents Sea winter sea ice decline. The new findings offer new insights into the causes of past changes and prospects for future changes of Arctic sea ice.

"The papers Dawei wrote with Tom Knutson and me are important contributions to our understanding on the role of natural variability in the observed rapid Arctic sea ice decline," Zhang said. "We expect Dawei will continue to produce important research in climate science in his future career."

Dawei accepted a postdoctoral associate position at the Department of Marine and Coastal Sciences, Rutgers University, where he will be developing and implementing an Earth system model of intermediate complexity to investigate physical, geochemical, and biological processes of our planet over geologic time. He plans to continue collaborations with scientists at GFDL on the impacts of Arctic sea ice decline on midlatitude large-scale circulations and weather. ∎

AOS & CICS News

Congratulations to **Robert Nazarian** who successfully defended his Ph.D. Thesis, "Internal Wave Scattering in Continental Slope Canyons," on December 18, 2017.

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Congratulations to **Anna FitzMaurice** who successfully defended her Ph.D. Thesis, "Parameterizing the Melting of Icebergs in Global Climate Models," on January 23, 2018.

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Princeton Energy & Climate Scholars

Application Deadline
March 23, 2018

PEI's Princeton Energy and Climate Scholars (PECS) program is seeking talented and motivated graduate students from the humanities, natural and social sciences, and engineering to foster a common intellectual exploration within the broad area of climate and energy. Guided by a faculty board, this two-year, student-governed fellowship program hosts informal student discussions, fellow-faculty dinners and group projects. A small research stipend is provided.

Applications are open through **11:55 p.m. on Friday, March 23**, and should be submitted through the online form on the PECS homepage.

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The 2018-19 Walbridge Fund Graduate Award is offering one to three grants of up to $10,000 for dissertation support. The application is open to all regular, full-time Princeton University Ph.D. candidates (who are post generals) pursuing innovative research in the areas of energy, climate change, modeling, policy, or closely related topics. (Students in DCE are not eligible to apply.)

Funds may be used for expenses such as fieldwork support, travel, conference participation, the purchase of equipment, and costs associated with data analysis and facilities use. The funds **cannot** be used for tuition support or indirect costs.

Applications are open through **11:55 p.m. Monday, April 9**, and are available through the Student Activities Funding Engine (SAFE).

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2018 PEI-STEP Fellowship Information Session

The Princeton Environmental Institute will host a lunchtime information session for Princeton graduate students interested in the 2018 PEI-STEP Fellowship program at **12:30 p.m. Friday, March 23, in Guyot Hall, Room M-171**. To attend, RSVP to Angela Petsis (link sends e-mail).

Offered in affiliation with the Woodrow Wilson School of Public and International Affairs' Program in Science, Technology, and Environmental Policy (STEP), the two-year PEI-STEP program enables participating students to explore the environmental policy dimensions of their doctoral research. PEI offers half financial support for two years (stipend and tuition) and Fellows receive a $3,500 award to support their graduate research. In addition, PEI-STEP students may apply for teaching assistantships with the Program in Environmental Studies. Students who complete the program requirements are awarded a Graduate Certificate in Science, Technology, and Environmental Policy from the Woodrow Wilson School in addition to receiving a degree from the department in which the student is enrolled.

UPcoming EVENTS

GEO, AOS, and PEI Announce a New Seminar Series Focused on Climate Research

It is our pleasure to announce a new informal seminar series focused on climate research.

The Climate Seminars are scheduled biweekly on **Mondays, 4:00-5:00 p.m., in Guyot Hall, Room 220.**

The format of the seminar presentations may vary, but common to all seminars is that we wish to foster dialogue and discussion, and that raising questions during the seminar is explicitly welcome.

We also hope that following the seminar interested parties may head to town to continue the discussions well into the evening.

The seminars will also be announced on the GEO, AOS, and PEI events pages and calendar.

Contact seminar coordinators with any questions:
Stephan Fueglistaler, Laure Resplandy and Gabe Vecchi

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Princeton Research Day

Posters • Talks • Performances • Art

Exhibitions • Digital Presentations

Thursday, May 10, 2018

Frist Campus Center

researchday.princeton.edu

#PRD18

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Geophysicists and Atmospheric Scientists Partner to Track Typhoons' Seismic footprints

An international team of researchers, assembled by Lucia Gualtieri, a postdoctoral research associate in Geosciences, and AOS Associate Research Scholar **Salvatore Pascale**, has found a new way to identify the movement and intensity of hurricanes, typhoons and other tropical cyclones by tracking the way they shake the seafloor, as recorded on seismometers on islands and near the coast. After looking at 13 years of data from the northwest Pacific Ocean, they have found statistically significant correlations between seismic data and storms. Their work was published Feb. 15 (link is external) in the journal *Earth and Planetary Science Letters*.

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Predicting Snowpack in the West before the First Flake Falls

New NOAA-Princeton research suggests that annual snowmelt in the American West can be predicted to the scale of a mountain range as early as March — some eight months before winter begins. The research has the potential to improve water-related decisions for numerous sectors, including agriculture, tourism and fire-control. First author **Sarah Kapnick '04**, a physical scientist at GFDL, started this work in 2013 as an AOS postdoc. Co-authors on the paper include **Xiaosong Yang** (GFDL), AOS Faculty Member **Gabe Vecchi**, **Tom Delworth** (GFDL), **Rich Gudgel** (GFDL), **Sergey Malyshev** (GFDL), **P.C.D. "Chris" Milly '78**, a senior scientist at the U.S. Geological Survey, **Elena Shevliakova** (GFDL/PEI), **Seth Underwood** (GFDL), and Steven Margulis (University of California, Los Angeles). The paper was published online Jan. 22 (link is external) by the *Proceedings of the National Academy of Sciences*.

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A Radical New Scheme to Prevent Catastrophic Sea-Level Rise

For the past two years, CICS Scientist **Michael Wolovick**, an AOS postdoc, has studied whether a set of targeted geo-engineering projects could hold off the worst sea-level rise for centuries, giving people time to adapt to climate change and possibly reverse it. He is exploring whether building underwater walls at the mouth of the world's most unstable glaciers—huge piles of sand and stone, stretching for miles across the seafloor—would change how those glaciers respond to the warming ocean and atmosphere, dramatically slowing or reversing their collapse.

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By 2100, Arid Cities Will Suffer from More Severe Heat Waves than Temperate Cities

Heat waves are among the deadliest and most common of environmental extremes. As the earth continues to warm due to the buildup of greenhouse gases, heat waves are expected to become more severe, particularly for cities, where concrete and a dearth of trees create what's known as the urban heat island effect. Using a global climate model, a team led by Princeton University researchers co-led by STEP groups. Among the coauthors of the paper, published in *Biogeosciences*, is former AOS Faculty Member **David Medvigy**, an associate professor of Biological Sciences at Notre Dame.

Postdoc Lei Zhao and AOS Associated Faculty Member **Michael Oppenheimer**, measured how severely heat waves interact with urban heat islands, now and in the future, in 50 American cities across three climate zones. AOS Graduate Student **Jane Baldwin** and CICS PI **Elie Bou-Zeid** (CEE) are among the paper's coauthors. The findings were published in Environmental Research Letters.

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Evaluation of Tropical Cyclone Structure Forecasts in a High-Resolution Version of the Multiscale GFDL FVGFS Model

The GFDL fvGFS model, which couples the FV3 dynamical core to a modified version of the physics from the operational Global Forecast System (GFS), is capable of tropical cyclone (TC) prediction across multiple space and time scales, from subseasonal prediction to high-resolution tropical cyclone structure and intensity forecasting. In a recent study, led by AOS Postdoc **Andrew Hazelton**, a version of fvGFS with a 2 km resolution nest covering most of the North Atlantic is evaluated for its ability to simulate TC track, intensity, and fine-scale structure. Co-authors on the paper include GFDL Physical Scientists **Lucas Harris** and **S-J Lin**.

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Sensitivity of Woody Carbon Stocks to Bark Investment Strategy in Neotropical Savannas and Forests

Fire frequencies are changing in Neotropical savannas and forests as a result of forest fragmentation and increasing drought. Such changes in fire regime and climate are hypothesized to destabilize tropical carbon storage, but there has been little consideration of the widespread variability in tree fire tolerance strategies. The results of a recent study, led by former AOS Graduate Student **Anna Trugman,** highlight that tropical vegetation dynamics depend not only on rainfall and changing fire frequencies but also on tree fire survival strategy. Further, the results of the study indicate that fire survival strategy is fundamentally important in regulating tree size demography in ecosystems exposed to fire, which increases the preservation of aboveground carbon stocks and the coexistence of different plant functional

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A New Paradigm for Diagnosing Contributions to Model Aerosol Forcing Error

Aerosol radiative forcing and its uncertainty are seen as major challenges that climate models face in reproducing observed temperature records. Climate models, such as those reporting results for the Fourth and Fifth Assessment Reports of the Intergovernmental Panel on Climate Change, exhibit a persistently large range of aerosol radiative forcing, both natural and anthropogenic. For this research, led by CICS Scientist **Alexandra Jones**, an AOS postdoc, the authors carried out a systematic evaluation of the impact of radiative errors on simulated aerosol radiative effect across the diversity of aerosol distributions resulting from the same experiment, to address a persistent ambiguity in climate sensitivity. The paper, coauthored by GFDL Research Meteorologist **Stuart Freidenreich**, **David Paynter**, a GFDL physical scientist, and GFDL Director **V. Ramaswamy**, among others, was published in *Geophysical Research Letters.*

Arrivals

Alex Haumann arrived in early January from ETH Zurich to work in the Sarmiento Group. He is being supported by a Swiss National Science Foundation (SNSF) fellowship.

Professor **Yi Huang**, a former AOS graduate student, arrived in early January for a four-month sabbatical. He is from McGill University and is working with V. Ramaswamy.

Andrew Ross arrived in early January from Penn State University to work with Charlie Stock as a postdoc.

Cesunica Ivey, a visiting assistant research associate in the Department of Chemical and Environmental Engineering at the University of California, Riverside, arrived in mid-January to work with Larry Horowitz for four months as a visiting associate research scholar. Cesunica will

begin work in July of 2018 as an assistant professor in the Department of Chemical and Environmental Engineering at the University of California, Riverside.

Departures

Andrew Shao, an AOS postdoc, left the AOS Program at the end of December. He accepted a postdoctoral fellow position at the University of Victoria where he will have a primary academic affiliation in the School of Earth and Ocean Sciences, while working with the Environment and Climate Change Canada, Canadian Centre for Climate Modelling and Analysis.

AOS Postdoc **Alon Stern's** appointment ended in mid-January.

Ángel Muñoz, an AOS postdoc, accepted an associate research scientist position at the International Research Institute for Climate and Society (IRI), Columbia University. He left the AOS Program in mid-January.

AOS Postdoc **Ping Zhai**, a member of the Sarmiento Group, left the AOS Program at the end of January.

AOS Postdoc **Dawei Li** left the AOS Program at the end of January. He accepted a postdoctoral research associate position in the Department of Marine and Coastal Sciences, Rutgers University.

Yohai Kaspi, who has been working with Isaac Held, while on sabbatical, returned to his home institution, the Weizmann Institute of Science, in mid-February.

Ben Sulman, an AOS associate research scholar, will be leaving the AOS Program at the end of February, after more than two and a half years in the Program.

Birth Announcements

Congratulations to former AOS Associate Research Scholar **Martin Jucker** and his wife, Emmanuelle, on the birth of their son, Gabriel, on January 18, 2018.