



AOS & CICS Newsletter

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Isaac Held Honored at Modeling the Earth's Climate Symposium

A symposium in celebration of AOS Faculty Member Isaac Held's seminal contributions to advancing our understanding of the Earth's climate and to graduate and postdoctoral education was held in the Frick Chemistry Lab/Taylor Auditorium from October 29-31, 2018, with over 200 people in attendance.



AOS Faculty Member Isaac Held, flanked by some of his current and former students

The three-day symposium featured acclaimed researchers from around the globe, many of whom were mentored by Held as graduate students and postdoctoral researchers, and friends and colleagues from academia and government presenting on topics that address Held's core interests, which lie at the interface of atmospheric and climate dynamics.

Following opening remarks by Former AOS Graduate Student David Neelin (UCLA), a lead member of the symposium organization committee that also included Former AOS Graduate Students Gang Chen (UCLA), Sarah Kang (UNIST,

Korea) and Tapio Schneider (Caltech), among others, AOS Director Stephan Fueglistaler thanked Held for his inspiration, motivation, and his many years of dedication, support, and guidance to the AOS Program. With the intention of keeping the reminiscing to a minimum in favor of scientific exchange, Fueglistaler simply said, "I think it's fair to say we wouldn't be where we are without you, so to keep it short – thank you."

GFDL Director V. Ramaswamy then addressed the packed auditorium, briefly highlighting Held's career and his contributions to the global scientific community. A key aspect of his influence in the field, he said, was Held's "creative synthesis, based on physical principles, to form the 'big picture' in atmospheric and climate sciences." Ramaswamy went on to say that years and decades of new research directions were inspired by his thinking, and he expressed his appreciation for Held's decades of service and his "forty years of sustained creative contributions."

"You are going to hear many more tales of Isaac's exploits, daring ones which have shifted the future," Ramaswamy said, addressing the audience. "All I'll end with is this," he said, addressing Isaac, "that the whole community – not just GFDL, not just Princeton – the whole scientific community really stands in appreciation of your outstanding – not only contributions, but also thinking and clarity of vision."

A series of invited talks followed over the course of the three days, showcasing the breadth of Held's research and its far-reaching influence on the field of climate dynamics over the last four decades. The presentations and ensuing discussions focused on five research topics that bring to mind the approaches Held championed over his illustrious career: theory of the atmospheric circulation, teleconnections, dynamical insights on climate change, geophysical turbulence, and tropical

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

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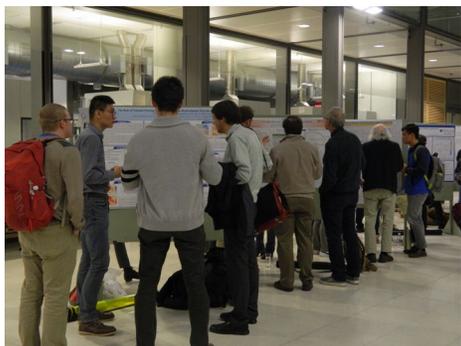
dynamics. Held's influence in the field and on a generation of students, postdocs, and colleagues was evident from the number of scientific talks given in his honor and the sheer number of people who returned to Princeton for the celebratory event.



AOS Faculty Member Isaac Held speaking at the reception held in his honor on October 29, 2018

Beyond recognizing Held and his lasting contributions, a reception and dinner held on Monday evening at the Princeton Hyatt was also an opportunity to catch up with old friends, students, and colleagues and to toast the man whose trailblazing inspired so many throughout his distinguished career, before heading into another day-long research exchange on the 30th.

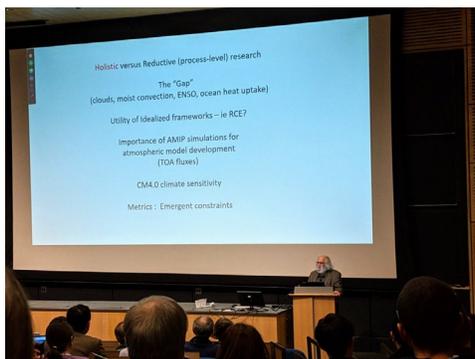
Toasts were given by AOS Senior Meteorologist Suki Manabe, Held's graduate advisor; former AOS Graduate Student Max Suarez (NASA, retired), Held's officemate in the early years; Sir Brian Hoskins, an AOS postdoc alumnus and professor at Imperial College London/emeritus professor of Meteorology at the University of Reading; former AOS Postdoc Tim Merlis, a professor at McGill University; and former AOS Graduate Student Dennis Hartmann, a professor at the University of Washington, all of whom are friends and colleagues of Held.



Poster session attracted many Heldfest attendees

A one-minute "madness" pre-poster session on the second day of the symposium sparked the interest of many in attendance and drew a cadre of individuals, ranging from senior scientists to students, to a sampling of research on display during the poster session and reception that followed. Among the poster presenters were AOS Graduate Student Jenny Chang, and former AOS Graduate Students Nick Lutsko (MIT), Zhaoyi Shen (Caltech), and Wenyu Zhou (Scripps, UC San Diego), with posters spanning a wide range of topics in the climate dynamics field.

On the final day of the symposium, Held gave a talk and led a discussion on the tension between climate dynamics and model development, noting that he may have exhausted what inspiration he could give on this topic and "it's time for others to move on in different directions." He thanked everyone for coming and challenged them "to take the next step," stressing the importance of finding new ways of looking at our climate models and understanding the climate at a holistic level.



AOS Faculty Member Isaac Held presenting closing remarks on Heldfest's final day

A leader in the field of climate dynamics for four decades, Held has made fundamental and original contributions to the study of the dynamics of Earth's climate, ranging from theory of the atmospheric circulation, planetary wave dynamics, climate sensitivities, and geophysical turbulence to leadership in the developing the current generation of climate models. His advocacy and practice of hierarchical modeling, spanning the gap between theories and computationally intensive simulations, and using insights from theoretical atmospheric dynamics to understand the forces maintaining the current climate and at work under climate change have inspired many across the

fields of atmospheric dynamics and climate dynamics.

Held is a member of the National Academy of Sciences, a Fellow of the AGU and the American Meteorological Society (AMS), and has received numerous distinctions throughout his career, including the Rossby Medal from AMS, their highest award for atmospheric science, and the BBVA Foundation Frontiers of Knowledge Award in Climate Change.

Organized by AOS alumni in coordination with the AOS Program and GFDL, the symposium was presented with generous support from the National Science Foundation (NSF) and the AOS Program.

CICS Summer Interns Engage in Climate Science Research

The lazy days of summer were anything but for the seven CICS summer interns who participated in a program designed to broaden participation in climate science. Now entering its fourth year, the Cooperative Institute for Climate Science (CICS) Research Internship Program offers promising scholars from diverse backgrounds the opportunity to conduct cutting-edge scientific research alongside a GFDL/AOS host.



2018 CICS Summer Interns: (L to R) Ioana Bociu, Nicholas Ordonez, Annika Barth, Kalen Fisher, MonTre' D. Hudson, Robin Sehler, Bobby Garza

In collaboration with GFDL, CICS recruited both undergraduate and graduate students for 8-10 week paid research internships in atmospheric, oceanic, and Earth system science. The 2018 cohort

hailed from universities from around the country, representing varied academic interests and experiences. They participated in a broad array of projects, under the mentorship of their host, spanning the range of research conducted at GFDL, including seasonal climate forecasts and commerce; computer experiments on sea-ice behavior using particles; diagnosing ocean models with particle methods; bit-for-bit reproducibility among compilers, using ensemble-based climate models; physiological effects of CO₂ on fish; analysis of ocean carbon in CM4 simulations; and predictions of extreme precipitation from landfalling tropical cyclones using the fvGFS model. Projects were solicited from GFDL/AOS staff by the CICS Research Internship Committee.

The ensuing collaborations not only provided professional experience in a world-renowned laboratory, but also an opportunity for robust conversations amongst the hosts, interns, scientists, and graduate students. This is particularly important for emerging scholars who may not have had access to similar research experiences and facilities elsewhere. Throughout the summer, project hosts familiarized the interns as to how climate science research is designed and conducted, and through various lab and social events, including bi-weekly lunches in the GFDL courtyard, tutorials, cookouts, a Q&A about graduate school, and GFDL's summer picnic, the 2018 interns got a taste of University life on the Forrester Campus and the breadth of research going on at GFDL.



Several of the CICS summer interns and their hosts at lunch in the GFDL courtyard; Latoyia Kirton (AOS) in the right foreground

CICS intern Robin Sehler, who holds a B.S. in Geology from California State University, Northridge and a M.S. in Environmental Science from California

State University, Los Angeles, worked with GFDL Deputy Division Leader and Research Physical Scientist Sarah Kapnick'04, a former AOS postdoc, on a project that employs financial market data to understand the economic importance of NOAA forecasts.

"I love my mentor's dynamic approach to science, and I am inspired by her leadership," Sehler wrote in a special edition of the NOAA EEO/Diversity Program Office Newsletter. At the start of her project, Kapnick lent her a book about the graphic visualization of scientific research, she said, reigniting her passion for art and sparking her enthusiasm about "the opportunity to creatively present data and disseminate it clearly."

"I also enjoy the interdisciplinary nature of this project," Sehler said, "which involves collaboration with an economist from the University of Arizona and with the director of the Climate Prediction Center."

The internship was part of a larger research goal in collaboration with University of Arizona, the NOAA Climate Prediction Center, and the NOAA Office of the Chief Economist to combine climate outlooks with financial data to provide a valuation methodology for seasonal predictions, according to Kapnick.

Sehler recently relocated to Princeton and plans on applying to the Department of Civil and Environmental Engineering's (CEE) graduate program, hoping to join Professor Amilcare Porporato's research group.

Bobby Garza, a CICS intern working towards a B.A. in computer science at Southwestern University, worked with GFDL hosts Thomas Robinson and Jessica Liptak on a project determining whether compiler and optimization choice impacted climate stability. Learning the ins and outs of analyzing climate data, including processing data from netCDF files and plotting time series and global maps of model output variable, Garza said he felt "integrated into the team" he worked with at GFDL.

He assisted with analysis of ensemble-based climate model runs to ensure bit-for-bit reproducibility among ensemble members, noting the many iterations of technology that people or groups use to run these simulations. "Making sure that the

simulations between different tech generations produce the same answers," he said, "is important for future research and scalability."

Garza said his internship experiences have led him to consider a career at a federal agency such as NOAA or NASA, once he completes his education.

"The program would not exist without our volunteer mentors and hosts who share a strong commitment to broadening participation in our field," said CICS Associate Director Sonya Legg. "They see the value in fostering the future of diverse, scientific talent in the climate-related sciences."

In addition to Kapnick, Robinson and Liptak, hosts included Alistair Adcroft (AOS), Steve Griffies (AOS), Anders Damsgaard (AOS), Olga Sergienko (AOS), John Dunne (GFDL), and Heather Archambault (GFDL).

During the final weeks of their internships, the 2018 cohort presented the results of the climate science work they had engaged in since their internships began earlier in the summer to the GFDL/AOS/CICS community.



CICS Intern Nicholas Ordonez giving his final presentation in the Smagorinsky Seminar Room

The CICS summer interns included Annika Barth, Ioana Bociu, Kalen Fisher, Bobby Garza, MonTre' D. Hudson, Nicholas Ordonez, and Robin Sehler.

The research internship selection committee comprises GFDL Deputy Director Whit Anderson, John Dunne, a GFDL research oceanographer, and AOS Faculty Members Sonya Legg and Yi Ming. The contributions of Tom Robinson (Engility), who organized tutorials, Latoyia Kirton (GFDL), who organized the

onboarding, orientation, and lunches, and Fabien Paulot (AOS), who organized the intern seminars, are gratefully acknowledged by the committee. The graduate school information session was led by AOS Faculty Members Sonya Legg, Leo Donner, and Steve Garner.

The program will continue again next year under the Cooperative Institute for Modeling the Earth System (CIMES), a new institute enabling Princeton and GFDL to continue collaborative work begun under CICS 15 years ago and a long-standing cooperative agreement between the University and GFDL that has been in place since 1967. ■

Rong Zhang Elected AMS Fellow

AOS Faculty Member Rong Zhang was elected a Fellow of the American Meteorological Society (AMS) for 2019. A GFDL oceanographer and head of the Ocean and Cryosphere division, Zhang has been affiliated with the AOS Program and GFDL since 2002.



AOS Faculty Member Rong Zhang, a GFDL oceanographer and head of the Ocean and Cryosphere division

Zhang is recognized for her work on the mechanisms of Atlantic multidecadal variability and the impact of Atlantic Meridional Overturning Circulation (AMOC) on global and regional climate change and variability. Her research has provided important insights about the role of AMOC in many regional phenomena having enormous socioeconomic implications, such as Gulf Stream

separation, Intertropical Convergence Zone shifts, Sahel monsoon rainfall, Atlantic hurricane activity, and Arctic sea ice extent. She currently serves as an editor of the *Journal of Climate* and has served in leadership roles for the U. S. AMOC Science Team.

Zhang is a current member of GFDL's Science Board, which provides long-term strategic thinking for GFDL's leadership (the Director's office and the Research Council) and a forum to grapple with scientific, technical, and policy trends that cut across the Lab's scientific research themes and areas.

Zhang teaches AOS 573: Physical Oceanography, next offered in spring 2020. She holds a Ph.D. in Climate Physics and Chemistry from MIT. She earned her M.A. in Physics from Boston University and B.E. in Electronic Engineering from Tsinghua University.

AMS Fellows are selected for their "outstanding contributions to the atmospheric or related oceanic or hydrologic sciences or their applications during a substantial period of years." Fellows are chosen from academic, government, and private sectors, and they retain the recognition for life. Zhang will be recognized at the AMS Annual Meeting, the world's largest yearly gathering for the weather, water, and climate community, in January 2019 in the company of other AMS Fellows. ■

Thomas Delworth Elected Fellow of AGU

**Contributed by Maria Setzer, GFDL
Communications Director**

AOS Faculty Member Thomas Delworth was elected a Fellow of the American Geophysical Union (AGU), the world's largest Earth and space science society, for 2018. A senior scientist at GFDL, Delworth's research has advanced the scientific frontiers on the role of the ocean in our climate system, especially climate variability, change, and predictability on time scales from seasonal to centennial. He is also widely recognized as a leading expert on the Atlantic Meridional

Overturning Circulation (AMOC) and climate.



AOS Faculty Member Tom Delworth, a GFDL senior scientist

Delworth's research collaborations have addressed wide-ranging issues associated with the role of the ocean, including drought, flooding, tropical cyclone activity, warming temperatures, winter storms, and other extremes. The breadth of his research is reflected in nearly 150 published papers in peer-reviewed journals, and his Hirsh Index of 55 attests to its significant impact. His expertise has been recognized and sought internationally. He presently chairs or serves on science advisory boards for the U.S. Department of Energy, as well as major scientific institutions in the U.K. and South Korea. He has served in numerous leadership roles for the U.S. CLIVAR program and for the National Academies National Research Council. Delworth, leader of GFDL's Seasonal-to-Decadal Variability and Predictability division, has been at the lab since 1984. He has been a lecturer in the lab's collaborative graduate program in atmospheric and oceanic sciences since 2008.

Delworth holds a Ph.D. in Atmospheric Science and a M.S. in Meteorology from the University of Wisconsin, Madison. He earned his B.A. in Integrated Sciences at Northwestern University.

Fellows are elected each year for their visionary leadership and scientific excellence. AGU Fellows are recognized for expanding our understanding of the Earth and space sciences, and for their scientific eminence in these fields. Only 0.1% of AGU membership receives this recognition in any given year. The class of 2018 Fellows will be honored on December 12, 2018, at AGU's Fall Meeting in Washington, D.C. ■

Shiv Priyam Raghuraman Named PEI Energy and Climate Scholar

AOS Graduate Student Shiv Priyam Raghuraman is among the ten Ph.D. candidates selected by the Princeton Environmental Institute as the most recent members of the Princeton Energy and Climate Scholars Program (PECS).



AOS Graduate Student Shiv Priyam Raghuraman

Founded in 2008, PECS provides an interdisciplinary platform for Ph.D. candidates working on any aspect of energy and climate research to interact, collaborate, exchange ideas, and gain firsthand understanding of research outside their own discipline. The group is student-led, though a core group of faculty provides supervision and sponsorship.

The new scholars join 11 other graduate students who are entering their second year of the two-year program, which also funds members' research and professional development, among them AOS Graduate Students Michelle Frazer, Aaron Match, and Sarah Schlunegger. The newly selected students will contribute a wide range of climate- and energy-related expertise to the existing group of PECS scholars. Current PECS students now represent 11 different departments across the University.

Raghuraman, who is a third-year graduate student, aims to understand the causes of

energy imbalances in the atmosphere and how these imbalances impact the climate. His research focuses on the radiative forcing of the most important greenhouse gas — water vapor — which has a strong positive feedback on the climate system. He is advised by AOS Faculty Member V. “Ram” Ramaswamy, director of GFDL.

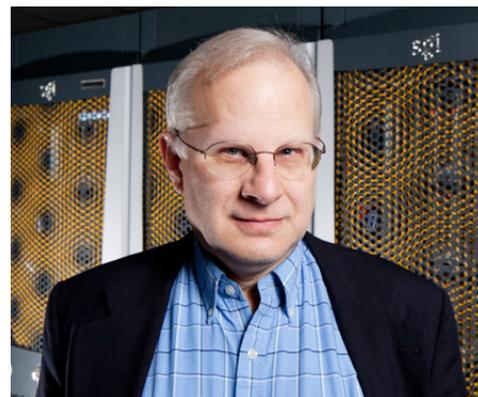
PECS aims to enhance the research experience of its members by encouraging them to transcend the boundaries of their fields and by fostering a sense of common intellectual adventure. Drawing from a broad range of disciplines, PECS students and members of the Faculty Board have a unique opportunity to thoughtfully approach the multifaceted energy challenges of the 21st century. The selection process is undertaken jointly by the Faculty Board and members of the student committee.

Raghuraman joins an outstanding group of AOS PECS alumni, including Jane Baldwin (2014-2016), Spencer Hill (2012-2013), Joe Majkut (2011-2013), Geeta Persad (2011-2013), Ilissa Ocko (2010-2011), and Ian Lloyd (2009-2011). ■

Leo Donner's Contributions to Atmospheric Science Recognized by AMS

AOS Faculty Member Leo Donner, a physical scientist in GFDL's Atmospheric Physics division, has been elected a 2019 Fellow of the American Meteorological Society (AMS), the nation's premier scientific and professional organization promoting and disseminating information about the atmospheric, oceanic, and hydrologic sciences.

Donner is widely recognized for his novel work on cloud and convective processes in the atmospheric general circulation. His research has yielded important insights about interactions between processes on the scales of clouds and convective systems and large-scale atmospheric flows.



AOS Faculty Member Leo Donner, a GFDL physical scientist

Donner has been with GFDL since 1991, and he has been a lecturer in Geosciences and AOS since 1993. He currently serves as chair of the Community Earth System Model Advisory Board and also serves on the Directorate Advisory Committee for Earth and Biological Sciences at Pacific Northwest National Laboratory. He previously served as chair of the Board of Trustees of the University Corporation for Atmospheric Research. He has served on advisory panels for NASA, Brookhaven National Laboratory, and the World Climate Research Programme. Donner is also a past editor of *Journal of Climate*. His contributions to atmospheric science have been recognized with numerous awards from the Department of Commerce, NASA, and the University of Michigan Alumni Society.

Donner teaches AOS 547: Atmospheric Thermodynamics and Convection, next offered in spring 2019. He earned his B.S. in atmospheric sciences from the University of Michigan, Ann Arbor and a M.S. and Ph.D. in Geophysical Sciences from the University of Chicago.

AMS Fellows are selected for their “outstanding contributions to the atmospheric or related oceanic or hydrologic sciences or their applications during a substantial period of years.” Fellows retain the honor for life and represent all facets of the academic, government, and private sectors. Donner, along with other awardees, will be recognized at the 99th AMS Annual Meeting in January 2019 in Phoenix. ■

Building Community at the Annual AOS Program Retreat

Perhaps the best way to encourage community building between people within academia is to spend the day away from campus and the demands of the classroom and lab.

To mark the start of the 2018-2019 academic year, the AOS Program held its seventh annual retreat on Tuesday, September 11, 2018 at Mountain Lakes House in Princeton. The event, which has become a fixture on the Program's calendar, drew 35 members of the AOS community, among them students, postdocs, research staff, and faculty. The event also served as an informal forum for the Program to welcome Graduate Students Allison Hogikyan and Lingwei (Liv) Meng, the newest members of the AOS community.



AOS faculty, postdocs, and students underneath the Mountain Lake House canopy

With the grounds of the 90-acre nature preserve as its backdrop, the event fostered scientific and social interaction through scientific dialogue and team-building activities. The activities were designed to bring participants together in constructive ways, with opportunities to relax together over coffee breaks and meals. Organized into teams, the participants competed in spirited outdoor activities designed to foster cooperation and teamwork.

Following breakfast, organizers split the participants into four groups and had them take turns conducting two experiments. The first experiment involved gathering a few observations, such as wind speed and

atmospheric conditions, in order to estimate how quickly a container of hot water placed under a fan would cool off. Groups were judged based on how closely they could estimate the final temperature of the water, given the initial temperature. In the second experiment, participants were presented with the challenge of building a hot air balloon using provided materials, including lightweight trash bags, plastic straws, cotton balls, string, and lighter fluid, to act as a fuel source. According to AOS Graduate Student Elizabeth Yankovsky, a member of the organizational committee, one of the groups was very successful, with their constructed balloon taking off and soaring above the trees.



Retreat team members constructing their hot air balloon

“It turned out to be a relatively challenging experiment, since the basket of the balloon could only weigh a few grams in order for it to be able to take off,” Yankovsky said.

In the afternoon, teams competed in a rousing game of trivia, dubbed “The AOS Second Years and the Graduate Work Committee,” and inspired by the stress-inducing general exam taken in graduate students’ second year of study. Teams answered a variety of trivia and logic questions as they watched the “Second Years” carry out a daring plan to avoid taking the generals.

“Since the retreat has been going on for a number of years, we wanted to introduce fresh ideas while staying true to the aim of enhancing interaction within AOS,” said AOS Graduate Student Xin Rong Chua, a co-organizer of the event.

Following trivia, teams were faced with the creative challenge of creating an entertaining, yet scientifically-accurate, performance depicting a climate event, aptly named “So you think you can

climate.” In the winning team's narrative, a charismatic entrepreneur claims to have found a magical climate cactus from an exoplanet that is capable of sequestering large amounts of carbon, but is unable to provide a convincing scientific explanation. Through gripping twists and turns, it was eventually revealed that the entire scheme had been a hoax, and “there is no magic cactus” that will do the job of reversing greenhouse gas emissions. The exercise not only induced laughter, but also exposed the creativity and hidden talents of many in the AOS community.

The day's festivities closed with a game of AOS-themed Chameleon, a board game where every member of the team knows a secret word except for the chosen “chameleon,” whose challenge is to blend in and not be found out. As in past years with Apples to Apples, customizing the game added to the fun and friendly competition.

The credit for the success of the 2018 retreat goes to an organizational committee comprised of graduate students and faculty members and staff who oversaw the planning and implementation of the retreat, including scientific and social activities. In addition to Chua and Yankovsky, committee members included AOS Graduate Administrator Anna Valerio and Faculty Members Stephan Fueglistaler and Steve Garner, who served on the committee every year since the inaugural event in 2012.

“I think the event was a success,” said Yankovsky. “All the groups made good attempts at the experiments, had quite a few laughs during the “So you think you can climate” game, and new members of AOS got a chance to meet students and faculty.” ■

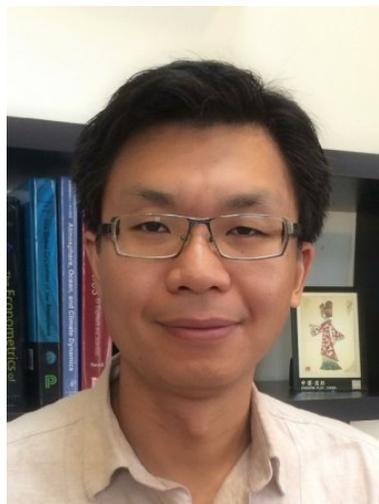
Yi Ming to receive AGU Ascent Award

Contributed by Maria Setzer, GFDL Communications Director

AOS Faculty Member Yi Ming, head of GFDL's Atmospheric Physics and Climate Group, has been honored with AGU's Ascent Award for Atmospheric Sciences this year. The Atmospheric Sciences Ascent Award rewards exceptional mid-career scientists in the atmospheric and

climate sciences. Honorees are recognized for demonstrating excellence in research and leadership in his or her field.

Yi Ming is an expert in atmospheric physics and modeling, and his research has led to new insights into the mechanisms by which aerosols force changes in atmospheric circulation and climate. He is being recognized for “innovations and major advances in the understanding of the role of aerosols in radiative forcing, atmospheric dynamics and climate change from the global to regional scales.”



AOS Faculty Member Yi Ming, head of GFDL's Atmospheric Physics and Climate Group

Ming co-teaches AOS 527: Atmospheric Radiative Transfer each fall with GFDL Director V. Ramaswamy. He holds a Ph.D. in Civil and Environmental Engineering from Princeton along with a certificate in science and environmental policy from the Woodrow Wilson School. He has a B.E. in chemical engineering and a second in environmental engineering, both earned at Tsinghua University in Beijing, China, in 1998.

AGU award recipients are selected for their innovative research, important contributions to promoting better understanding of their scientific fields, and meritorious work and service to their communities. They will be formally recognized at the 2018 AGU Fall Meeting.



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Spencer Clark Awarded Arnold Guyot Teaching Prize

AOS Graduate Student Spencer Clark, an AI (Assistant in Instruction) in ENV/GEO 367, is the recipient of the 2018 Arnold Guyot Graduate Student Teaching Prize. The prize is awarded for excellence in instruction, contribution to curriculum, and overall contribution to the teaching mission of the Department. The award was announced at the Annual Geosciences Picnic on Friday, September 21 and comes with an honorary certificate and a monetary prize. Clark joins fellow award recipients Danielle Schlesinger and Rachel Harris (Geosciences).



Back row: Laurel Goodell, Bess Ward and previous winners Danielle Santiago Ramos and Akshay K. Mehra standing with Spencer Clark (AOS). Seated: Danielle Schmitt, Laure Resplandy, Danielle Schlesinger, and Rachel Harris

“Spencer was the perfect AI, always available for students, advising their modeling projects on mitigation strategies, while also helping to build the computer labs components from the ground up,” said AOS Faculty Member Laure Resplandy. “The class was a success!”

Clark is a fifth-year graduate student whose interests lie at the intersection of tropical atmospheric dynamics, idealized general circulation models, and Python. He is currently investigating the extent to which monsoon low pressure systems can be simulated in an idealized moist general circulation model (GCM), and has studied the role of water vapor in the ITCZ response to hemispherically asymmetric perturbations. In the past, Clark has worked on simulating the climate impacts of aerosols released from forest fires and investigated the varied future projections of

lightning flash density by different lightning parameterizations.

Clark is only the second AOS student to receive the prize. Robert Nazarian, an assistant professor of Physics, Fairfield University, won the award in 2015. Clark is advised by AOS Faculty Member Yi Ming. ■

Summer QUEST to Deepen Teacher's Content Knowledge in Science

On the Princeton campus this summer, teachers from surrounding New Jersey school districts gathered at Guyot Hall to take part in “Climate and the Ocean,” a QUEST summer institute sponsored by the Cooperative Institute for Climate Science (CICS) in partnership with Princeton's Program in Teacher Preparation. The week-long institute, whose formal name is Questioning Underlies Effective Science Teaching, was held from July 9-13, 2018.

Initiated 30 years ago, the summer professional development program was designed to deepen teachers' content knowledge in science through self-directed investigation and hands-on laboratory experiments. The institute is led by content experts Steve Carson, a middle school teacher and former GFDL researcher who has been leading Quest institutes for the past 20 years, and Danielle Schmitt, manager of the Geosciences undergraduate lab.



Under the guidance of Quest Instructor Steve Carson, Quest participants get “hands-on” in a Guyot Hall laboratory.

By diving deep into experiments throughout the week, the teachers gained a better understanding of the important role

the ocean plays in our climate and weather patterns, and of the content in relation to their pedagogical practices. They also learned about the work of University researchers and how to translate the science for their classrooms in line with the Next Generation Science Standards (NGSS), recently adopted in New Jersey.

Feedback following the institute indicated that confidence levels of participants increased substantially after attending, according to Anne Catena, director of professional development initiatives in Princeton's Program in Teacher Education.

"Quest has provided me with an arsenal of information and more important, the reasons that support the science," said one of the participating teachers. "Quest does a really great job of deepening teacher's content knowledge through the use of understandable demonstrations... and treats teachers as professionals," commented another.

"Allowing teachers to pursue their own love of learning in topics relevant to the classroom and the world, and giving them valuable content information was cited as a major strength of the program," Catena said. The participating teachers, she said, viewed their discussions with experts in the field as a major strength of QUEST and considered the experience to be a beneficial one.



Danielle Schmitt, manager of the Geosciences Undergraduate lab, co-facilitating QUEST Climate & Ocean unit

These discussions were followed by wider collegial conversations about pedagogy and instructing inquiry-based science, which adopts an investigative approach to teaching and learning. The teachers also engaged in practices of science, including analyzing and engaging in argument from evidence, and planned NGSS-aligned lessons.

As a group, the participating teachers instruct approximately 890 students per year throughout the state, among them historically underserved student populations, according to Catena. The institute's broader goal was to provide the resources, knowledge, and confidence these teachers need to generate new and engaging standards-based science lessons and to implement them in their classrooms. Thanks to QUEST, the nearly 900 New Jersey students instructed by the institute's participating teachers will reap the benefits of enriched science instruction this academic year, led by teachers who bring a renewed enthusiasm to their teaching.

The 2018 institute drew 11 teachers of grades 3-8 from five New Jersey school districts: Hillsborough Township, Montgomery Township, North Hanover Township, Somerset Hills, and West Windsor-Plainsboro.

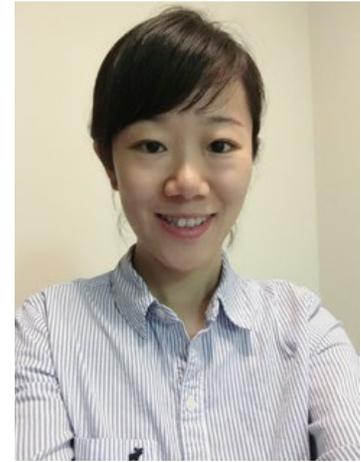
The QUEST program will continue next year with a summer institute on extreme weather and problems of relevance to society, including impacts on marine ecosystems, drought, and air quality, under the sponsorship of the Cooperative Institute for Modeling the Earth System (CIMES).

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 Associate Research Scholar Bing Pu who spent three years in the AOS Program.]

Associate Research Scholar Bing Pu will leave Princeton in late December, after three years in the AOS program. Before joining AOS, Bing earned her Ph.D. in Atmospheric Science from Cornell University and worked as a postdoctoral researcher at the University of Texas at Austin. Her previous work mainly focused on regional climate change and vegetation-climate interactions. While at Princeton, Bing worked at GFDL with Paul Ginoux on understanding climatic factors controlling dust variability over the U.S. and other major dust source regions using high-resolution satellite products and GFDL climate models.

Dust is one of the most abundant aerosols by mass in the atmosphere. It absorbs and scatters both shortwave and longwave radiation and thus affects local energy budget and regional climate.



*AOS Associate Research Scholar
Bing Pu*

Severe dust storms also have far-reaching socioeconomic impacts, affecting public transportation and health. Climate models projected rising drought risks over the southwestern and central U.S. in the late 21st century due to increasing greenhouse gases. The projected drier regions largely co-locate with the major dust sources in the U.S. However, whether dust activity will increase in these drying regions in the future is not clear due to large uncertainties in dust modeling.

Using satellite observation and multi-model output, Bing developed a regression model to identify key factors controlling dust variations in the present day and projected future variation of dust. It is projected that under the Representative Concentration Pathways 8.5 scenario, dust activity will increase in the southern Great Plains from spring to fall in the late half of the 21st century, largely due to reduced precipitation, enhanced land surface bareness, and increased surface wind speed. However, over the northern Great Plains, less dusty days are expected in spring due to increased precipitation and reduced bareness. This work was published in *Scientific Reports* in June 2017. The article was picked up by 15 news outlets and featured on NOAA Climate.gov.

Dust is lifted to the atmosphere from the dry and bare surface, when surface wind velocities are greater than a threshold of wind erosion. Globally constant values of wind threshold are widely used in climate

models. Bing is now working on developing a time-varying two-dimensional threshold of wind erosion map based on high-resolution satellite products. It is found that with the newly-developed threshold of wind erosion, both the magnitude, seasonal cycle, and distribution of dust optical depth in major dust source regions, e.g., North Africa and the Middle East, are improved in the GFDL AM4.0 model.

“Bing’s research on mineral dust was instrumental to better understand the controlling factors of dust variability,” said Paul Ginoux, a GFDL physical scientist. “She did it by developing a statistical model based on satellite data of dust load and surface properties. Armed with this tool, she was able to detect the origin of biases in dust properties simulated with climate models, and to provide better short and long-term prediction.”

“In view of the importance of properly constraining dust emission, she developed the first high-resolution global inventory of the threshold of wind erosion,” Ginoux added. “I expect her work to provide major improvement in dust modeling as it did with GFDL’s latest climate model AM4.0-LM4.0.”

Bing accepted an assistant professor position at the Department of Geography and Atmospheric Science, University of Kansas, where she will continue working on dust variability and dust-climate interactions in collaboration with GFDL scientists. ■

AOS & CICS News

Congratulations to **Zhaoyi Shen** who successfully defended her Ph.D. thesis, “The Influence of Aerosols on Large-Scale Circulation and Regional Climate,” on August 13, 2018.

[Global Race to Create Better Climate Change Simulations: A Q&A with V. Balaji](#)

In an interview with the *Hindustan Times*, **V. Balaji**, head, Modeling System Group, AOS/GFDL, talks about climate science, modeling systems, and his views on how the Anthropocene age is unfolding.

[Climate Warming to Boost Major Hurricanes in Active Atlantic Seasons](#)

New research that looks at the devastating 2017 Atlantic hurricane season projects that if similar weather conditions occur in the future, it’s likely that the number of major hurricanes (category 3 and higher) would increase by two in a similar active year at the end of century.

This increase would be driven by predicted climate warming, according to the research appearing in [Science](#).

The finding was reported by a team of researchers led by **Hiroyuki Murakami** (UCAR), who conducted the research while an associate research scholar with the AOS Program. AOS Faculty Member **Tom Delworth**, a GFDL senior scientist, and **Rich Gudgel** (GFDL) are among the study’s coauthors.

[Read more](#)

[Climate Change may Cause More Hurricanes to Rapidly Intensify](#)

A recent [study](#) published in the *Journal of Climate* and led by former AOS Postdoc **Kieran Bhatia** (BP Sunbury, Greater London), who conducted the research while at Princeton, shows that we have a lot to worry about when it comes to changing hurricanes as the planet warms. The new research says that as the climate continues to warm, storms will do it faster and more often, and in some extreme cases, grow so powerful that they might arguably be labeled “Category 6.” AOS Faculty Member **Gabe Vecchi** (GEO & PEI), former AOS Associate Research Scholar **Hiroyuki Murakami** (UCAR), and **Seth Underwood** (GFDL) are among the paper’s co-authors.

[Read more](#) (Kieran Bhatia and Gabe Vecchi quoted in *Washington Post* piece ...)

[Read more](#) (Gabe Vecchi quoted in *New York Times* article ...)

Alumni News

AMS announced the 2019 Awards and Honors Recipients. Congratulations to the following AOS Alumni who are among the winners:

The Julie G. Charney Medal

Former AOS Graduate Student **J. David Neelin** (UCLA) for fundamental contributions to understanding tropical climate dynamics and the impact of anthropogenic forcing on precipitation, drying, circulation, and extremes

The Nicholas P. Fofonoff Award -- Early Career

Former AOS Postdoctoral Research Associate **Malte Jansen** (University of Chicago) for deep theoretical insight into geophysical turbulence and its implications for ocean circulation, climate, and paleoclimate



Princeton University Python Community Kickoff Event

Python enthusiasts from all levels are invited to the **PrincetonPy** group kickoff event on **Wednesday, November 14th from 4:00-5:30 pm in 347 Lewis Science Library**. The event will incorporate introductions and discussion on topics of interest to the group. It will be followed by a talk on **Python Debugging and Testing** by Alexey Lavrov, graduate student in Electrical Engineering. **RSVP:** <https://goo.gl/forms/WQRHZTHKvNRzpsXqI>

If you have any interest in leading a PrincetonPy talk, and/or if you want to be added to the listserv, please email Research Computing events: rcinfo@princeton.edu.



GFDL 2019 Winter Poster Expo

GFDL will be holding its sixth Poster Expo on **Jan 30, 2019 from 1-4pm**.

Please mark your calendars and consider submitting a poster!

Poster presentations on research topics relevant to the broader GFDL community, as well as topics related to diversity, equity, and inclusion are welcome.

Logistics and registration information will be sent in the coming weeks. Please note that due to space limitations, posters are limited to 28.



Save the Date for Princeton Research Day!

Posters • Talks • Performances • Art Exhibitions • Digital Presentations

Thursday, May 9, 2019

Frist Campus Center

researchday.princeton.edu
#PRD19

Arrivals

The AOS Program extends a warm welcome to its newest members -- Graduate Students **Allison Hogikyan** (advised by Laure Resplandy and Stephan Fueglistaler) and **Lingwei (Liv) Meng** (advised by Steve Garner).

Gaurav Govardhan arrived in mid-October from the Indian Institute of Science. He is working with V. Ramaswamy as a postdoc.

Xiaoqiong (Sage) Li will be arriving in early November to work with Yi Ming and Stephan Fueglistaler as a postdoc. She comes to Princeton from Lamont-Doherty.

Yitian Qian, a visiting student research collaborator, will arrive in early November, from Nanjing University of Science and Technology, to work with Hiroyuki Murakami and Tom Delworth for one year.

Jilong Chen is scheduled to arrive in early November to work with Steve Garner as a visiting student research collaborator through the end of March. He comes to Princeton from the Chinese University of Hong Kong.

Yuanyu Xie is scheduled to arrive in mid-November from the Tsinghua University to work with Meiyun Lin as a postdoc.

Xianan Jiang, a researcher at UCLA's Joint Institute for Regional Earth System Science and Engineering (JIFRESSE), will be arriving in early December to work with Ming Zhao for one year as a visiting research scholar.

Departures

Effective September 1, 2018, AOS Research Oceanographer **Keith Rodgers** took a one-year leave of absence to work as a senior research fellow at the IBS Center for Climate Physics, or ICCP, at Pusan National University in South Korea.

AOS Associate Research Scholar **Jong-Yeon Park** took a 3-month leave of absence, effective October 1, 2018, to teach a course in Oceanography at Chonbuk National University, South Korea, in the Department of Earth and Environmental Sciences.

Effective November 5, 2018, **V. Balaji**, head, Modeling System Group, AOS/GFDL, took a 6-month leave of absence to participate in French President Emmanuel Macron's climate science program. Balaji's project, known as Project Hermès (High-Resolution Modeling of the Earth System), includes creating very high-resolution simulations — at the limit of today's computing technology — of key processes in the atmosphere and oceans.

AOS Postdoctoral Research Associate **Alexandra Jones** accepted a position as a clinical assistant professor at the University of Maryland, effective December 10, 2018.

She will be working with the FIRE (First Year Innovation & Research Experience) program, out of the Provost's Office, and will have an affiliation with the Department of Atmospheric and Oceanic Science.

Bing Pu, an associate research scholar, will be leaving the Program in late December. She accepted a position as an assistant professor in the Department of Geography and Atmospheric Science at the University of Kansas.

Birth Announcements

Congratulations to AOS Postdoctoral Research Associate **Xiaoqin Yan** and her husband, Mengfan, on the birth of their daughter, Anne Li, on August 7, 2018.

Congratulations to AOS Postdoctoral Research Associate **Kun Gao** and his wife, Shuwen, on the birth of their son, Daniel, on September 21, 2018.

Congratulations to AOS Associate Research Scholar **Salvatore Pascale** and **Lucia Gualtieri** (Geosciences) on the birth of their son, Leonardo, on October 14, 2018.

Congratulations to AOS Postdoctoral Research Associate **Yujin Zeng** and his wife, Xinxia, on the birth of their daughter, Shelly, on November 1, 2018.

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