AOS & CICS Newsletter

Spring/Summer 2018 Volume 12, Number 2

CIMES: Princeton-NOAA Climate Institute Awarded $40 Million

A new institute enabling Princeton and GFDL to continue collaborative work begun under the Cooperative Institute for Climate Science (CICS), founded in 2003 with funding from NOAA, has been awarded up to $40 million over five years to continue its groundbreaking research in Earth system science. The Cooperative Institute for Modeling the Earth System (CIMES) aims to understand and predict the Earth's climate system across timescales from days to decades, and on local to global scales, with particular focus on extreme weather events and problems of relevance to society.

L to R: V. "Ram" Ramaswamy, director of GFDL; AOS Faculty Member Sonya Legg, an AOS senior research oceanographer; Whit Anderson, deputy director of GFDL; AOS Faculty Member Gabriel Vecchi, professor of geosciences and the Princeton Environmental Institute; Jorge Sarmiento, Princeton's George J. Magee Professor of Geoscience and Geological Engineering; and Craig McLean, assistant administrator for Oceanic and Atmospheric Research at NOAA.
(Photo by Denise Applewhite, Office of Communications)

Under the leadership of Jorge Sarmiento, Princeton's George J. Magee Professor of Geosciences and Geological Engineering, the institute will combine GFDL's expertise in numerical climate modeling with Princeton's scientists and engineers as well as public policy experts who are world-renowned for shaping the national and international response to Earth system change.

"This decision enables us to continue groundbreaking research that Princeton University and GFDL have been doing for the past 50 years on the Earth system," said Sarmiento. "Through this collaboration, the University contributes academic expertise that advances the study of a broad Earth system model that incorporates biogeochemistry to improve our understanding of the Earth and its future."

AOS Faculty Member Gabriel Vecchi, professor of geosciences and the Princeton Environmental Institute (PEI), has been named the institute's deputy director, and AOS Senior Research Oceanographer Sonya Legg, an AOS faculty member, will serve as associate director.

CIMES will conduct research in three major areas, directly aligning with the scientific research at GFDL: Earth system modeling; seamless prediction across time and space scales; and Earth system science: analysis and applications.

CIMES research will involve graduate students and postdoctoral researchers at both institutions, providing exceptional opportunities to train the next generation of leaders in Earth system sciences through the AOS Program's graduate and postdoctoral programs. The institute will also broaden the participation of underrepresented groups in Earth system science through summer internships, visiting faculty exchange fellowships and research collaborations with a diverse range of institutions, bridging the gap

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

Inside this issue:

TigerTransit/Shuttle Services Operating on Summer Schedule (Regular Service): https://transportation.princeton.edu/sites/default/files/Forrestal%20PPPL.pdf

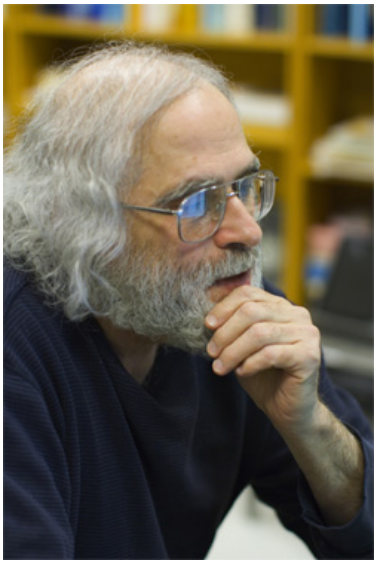
between NOAA-GFDL and the University and the wider academic community.

NOAA currently supports 16 Cooperative Institutes that promote research, education, training and outreach relevant to its mission and promotes the involvement of students and postdoctoral researchers in NOAA-funded research.

NOAA selected CIMES for funding after an open, competitive evaluation process with the potential to renew for another five years based on successful performance. ■

Understanding and Modeling the Earth's Climate: A Symposium in Honor of Isaac Held

Friends and colleagues of AOS Faculty Member Isaac Held, a GFDL senior research scientist, will convene a symposium in his honor from October 29-31, 2018. The symposium will be held in the Frick Chemistry Lab/Taylor Auditorium on Princeton's Main Campus.



AOS Faculty Member Isaac Held, a GFDL senior research scientist

The symposium will foster cross-disciplinary scientific exchange at the interface of atmospheric and climate dynamics, celebrating Held's seminal contributions in advancing our understanding of the Earth's climate, according to symposium organizers. A set of invited talks will provide the broad context for panel discussions and a poster session that will address Held's core interests which include atmospheric general circulation, teleconnections, dynamical insights on climate change, geophysical turbulence, and tropical dynamics. The symposium will honor his scientific contributions in these areas as well as his contributions to graduate and postdoctoral education, providing forward-looking perspectives and new directions in the areas to which Held has contributed significantly. It will also provide an opportunity to bring graduate students, early career scientists, and established researchers/educators from across these areas together, fostering further dialogue.

The symposium will be a coming together of acclaimed researchers from around the globe, including former Ph.D. students and postdoctoral researchers, many of whom were mentored by Held, as well as colleagues and friends from government and academia who have worked with and been influenced by Held over the course of his career. A celebratory dinner following the symposium's first day will be held at the Hyatt Regency in Princeton.

"The symposium should be a scientifically exhilarating experience for everyone and will form a well-deserved tribute to Isaac from his colleagues and friends – a wonderful occasion to celebrate his pioneering accomplishments of remarkable scope and far-reaching significance," said V. Ramaswamy, director of GFDL.

A leader in the field of climate dynamics for over three 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 is presented with support from the National Science Foundation (NSF) and the AOS Program.

The symposium is free, but registration is required and limited to 200 attendees. A full list of speakers for the symposium, along with registration details, can be found at: <http://splash.princeton.edu/heldfest/>. ■

6th Annual AOS Program Workshop Planned for August

Building on the success of the first five workshops, the AOS Program is hosting "Natural Variability in the Pacific"— the sixth annual workshop hosted by the Program with the generous support of a share of AOS Faculty Member Isaac Held's BBVA Foundation Frontiers of Knowledge Award. The workshop will be held from August 15-17, 2018 at GFDL.

The yearly summer workshop is aimed at members of the AOS community, in particular AOS graduate students, to foster dialogue surrounding topics in climate science and its related disciplines, outside of the Program's formal curriculum, and discussion between the graduate students and invited speakers on emerging research areas. This summer's workshop will broadly focus on the El Niño–Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO) phenomena, and how they may change in our future climate. A specific emphasis will be placed on developing a clear, physical picture of the fundamental mechanisms underlying these oscillations and projections. A secondary objective of the workshop is to raise awareness about the current state of research and gain insight into effective

communication and public engagement on climate change and climate projections.

"We hope that this year's theme appeals to everyone in the AOS community, as ENSO is a coupled phenomenon with far-reaching impacts, said Jane Smyth, an AOS graduate student and member of the workshop organizing committee. "By the end of the workshop we should be familiar with some simple models for ENSO and their shortcomings, as well as the most pressing questions in this field."

Confirmed invited speakers for the three-day event include: Pedro DiNezio, University of Texas at Austin; Eli Tziperman, Harvard University; and Shang-Pie Xie, University of California, San Diego, according to Smyth and co-organizers Michelle Frazer and Justin Ng, AOS graduate students. DiNezio's research investigates the role of tropical oceans on Earth's climate, with a focus on El Niño and La Niña – recurrent patterns of warming and cooling of the tropical Pacific Ocean. Tziperman's research interests include large-scale climate and ocean dynamics, including El Nino, thermohaline circulation, abrupt climate change, glacial cycles and equable climates; and advanced methods of ocean data assimilation. Carrying out both diagnostic and modeling studies, using observations and numerical models of the ocean, atmosphere, and their coupled system, Xie's research centers on ocean-atmosphere interactions and their role in climate formation, variability, and change.

The structure of this summer's workshop is similar to past workshops with only slight variations in format. It will feature plenary lectures open to the GFDL/AOS community, blackboard-style lectures and tutorials on specific aspects of ENSO or PDO, and group discussions, attended only by graduate students and postdocs. There will also be a panel discussion, moderated by the workshop committee, with both invited speakers and GFDL/AOS scientists serving as panelists. Beyond the scheduled sessions, there will be ample opportunities for casual interaction among the speakers and AOS students, postdocs, and faculty.

"We are excited to have three leading scientists to join us this year," Ng said. "By introducing new elements to the workshop including a panel discussion, we hope that everyone will find it interactive and rewarding."

The organizing committee will be finalizing the workshop agenda and logistical details in the coming weeks. Questions related to the workshop may be directed to committee members. ■

GFDL Scientists in Leadership Roles for IPCC AR6

Contributed by Maria Setzer, GFDL Communications Director

Production of the Sixth Assessment report of the The Intergovernmental Panel on Climate Change (IPCC) has been launched, and two GFDL scientists have been selected as Lead Authors, while GFDL's director has been named a Review Editor, for Working Group I. John Dunne will be a Lead Author for Chapter 4, "Future Global Climate: scenario-based projections and near-term information". Vaishali Naik will be a Lead Author for Chapter 6, "Short-lived Climate Forcers", and V. "Ram" Ramaswamy, an AOS faculty member, will be a Review Editor for Chapter 7, "The Earth's energy budget, climate feedbacks, and climate sensitivity". The first meeting of Working Group I authors will be in June 2018; the Assessment report is expected to be released in April 2021.

Two other GFDL scientists are serving in leadership roles for IPCC special reports. Elena Shevliakova, a PEI visiting research scholar, is serving as a Convening Lead Author for Chapter 2, "Land-Climate Interactions", of the IPCC Special Report on Climate Change and Land which covers climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Robert Hallberg, an AOS faculty member, is a Lead Author of Chapter 5, "Changing Ocean, Marine Ecosystems, and Dependent Communities" of the Special Report on the Ocean and Cryosphere in a Changing Climate. Both special reports are due to be finalized in September 2019.

The IPCC is a scientific body set up by the World Meteorological Organization and the United Nations. It was established to provide the decision-makers and others interested in climate change with an objective source of information about climate change. Its role is to assess on a comprehensive, objective, open and transparent basis the latest scientific, technical and socio-economic literature produced worldwide relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. ■

SOCCOM Held 4th Annual Meeting on Main Campus

The Southern Ocean Carbon Climate Observations and Modeling (SOCCOM) program held its fourth annual meeting from June 11-13, 2018 at the Princeton Center for Theoretical Science in Jadwin Hall, bringing its cross-disciplinary experts from across the United States to discuss the progress of the past year and plan for the future of the NSF-sponsored initiative.

Launched in 2014, SOCCOM aims to increase the understanding of the Southern Ocean and the role it plays in climate change and biogeochemistry through a combination of innovative, float-based observations and a high-resolution modeling program. Led by Director Jorge Sarmiento, Princeton's George J. Magee Professor of Geosciences and Geological Engineering, SOCCOM draws on the strengths of co-investigators at 13 institutions around the U.S., including GFDL.

This year's meeting was an opportunity to celebrate the remarkable progress the initiative has made over its first four years. The SOCCOM project now has 111 biogeochemical floats operating in the Southern Ocean, each equipped with sensors to measure oxygen, nitrate, pH, and bio-optical properties from the surface of the ocean down to 2000 m depth. The floats have made over 3.5 million new measurements in the Southern Ocean, many in regions and at times never previously sampled, including under sea-ice, and are now the dominant source of recent biogeochemical measurements in the region. All data are made freely available to the public in near-real time both via the SOCCOM website (https://soccom.princeton.edu) and the Argo data system.

SOCCOM Director Jorge Sarmiento (front row) listens to a presentation by SOCCOM Modeling Lead Joellen Russell (University of Arizona), a former AOS associate research scholar.

In addition to the observational effort, the SOCCOM project also has a modeling team (spearheaded by former AOS Associate Research Scholar Joellen Russell (University of Arizona)) that has developed metrics for comparing Southern Ocean simulations, developed methods to enable the quantification of the carbon system from standard biogeochemical floats and as a proxy in coupled climate models with simplified or no biogeochemical modules, and is leading a Southern Ocean Modeling Intercomparison Project (SOMIP - the first such regional intercomparison approved by the World Climate Research Programme), in addition to carrying out model simulations to help forecast impacts of climate change on the region.

AOS researchers play key roles in the program and presented a variety of results at the meeting. In the science sessions, AOS Researchers Alex Haumann, Seth Bushinsky, Lionel Arteaga, Haidi Chen and former AOS Associate Research Scholar Alison Gray (University of Washington) discussed new initiatives to study carbon, oxygen, and heat fluxes in the Southern Ocean using float-based observations and high-resolution earth system models. AOS Faculty Member Steve Griffies and Ben Bronselaer, an AOS visiting postdoctoral research associate, presented modeling studies of future physical changes to Antarctic ocean waters and their impacts.

There were also presentations on educational and outreach initiatives carried out by SOCCOM's Broader Impacts team. A highlight was Research Oceanographer Bob Key's report on the project's Adopt-A-Float program, which creates a powerful opportunity for elementary- and secondary-aged students at 22 schools to engage directly with world-class scientists. Students learn about SOCCOM research by naming and tracking floats and following the scientists' blogs for each deployment cruise. Key is continuing to recruit classrooms and has a goal of having students engaged in all 50 states.

SOCCOM will continue to deploy BGC-Argo floats over the next two years to achieve their goal of approximately 200 floats operating in the Southern Ocean by 2020. The float data are providing an unparalleled view of Southern Ocean biogeochemistry, including variability of pH and carbonate saturation in the system, net community production, carbon export, air-sea fluxes of biogeochemical parameters and bloom dynamics.

"SOCCOM's high-resolution modeling studies are using the new data to better understand the Southern Ocean and its inner workings, painting a clearer picture of what a changing climate means for the future of this until now largely under-explored region," said Sarmiento. ■

June Symposium Highlighted Significant Contributions of Former GFDL Director, Ants Leetmaa

Contributed by Maria Setzer, GFDL Communications Director

In late June the GFDL community honored the life and career of Ants Leetmaa with a memorial symposium, held at Princeton University. Dr. Leetmaa served as director of GFDL from 2001 to 2007. He spent his career at NOAA, including 4 years as director of NOAA's National Weather Service Climate Prediction Center before he came to GFDL. His contributions to climate variability and predictability research, and forecast applications, substantially advanced how we understand and predict natural climate variability, and the role of oceans in the climate system.

The symposium, on June 20, brought together former colleagues of Dr. Leetmaa's from around the country and covered many facets of his life. Speakers and panelists at the symposium reminisced about his career, leadership, and scientific vision. Colleagues offered insights about ways in which he contributed to GFDL, NOAA, and climate science in general. Every presenter added unique personal anecdotes that, taken together, offered a full portrait of Dr. Leetmaa as a scientist, a leader, a colleague, and as a person.

GFDL Director V. Ramaswamy delivers remarks at the Ants Leetmaa Memorial Symposium

Several presenters spoke of Dr. Leetmaa's visionary leadership, his willingness to challenge the status quo, and how instrumental his influence was on early career scientists. Scientific presentations underscored this impact. He took particular interest in recruiting and mentoring young scientists and for many, he was very influential at a critical juncture in their career. He could be very direct and his tough questions often inspired a new way of thinking about a problem, even driving their research for years. It was clear from listening to the speakers how he shaped the culture and quality of science during his tenure at GFDL.

Speakers included scientists from NASA's Jet Propulsion Laboratory, Lamont-Doherty Earth Observatory, George Mason University, University of Miami, University of Kiel (Germany), Princeton University, GFDL, and other NOAA labs – all former colleagues of Dr. Leetmaa's. Many of them attested to his passion for and versatility in science, as well as his rich personal life. He loved art, and spending time with family and friends was an important priority for him. Following the symposium, about 50 participants gathered for a more informal continuation

of the celebration of Dr. Leetmaa's life and career over dinner. ■

AOS/CICS Researchers Inspire Next Generation of Female Scientists

On May 21, 2018, successful, enthusiastic scientists, engineers, and students converged on Princeton's main campus at the University's Frick Chemistry Laboratory, to show more than 700 seventh-to-tenth-grade girls that science is for them too. AOS/CICS researchers were among the more than 50 volunteer exhibitors from the Princeton Plasma Physics Laboratory (PPPL) and the University at the Young Women's Conference (YWC) in Science, Technology, Engineering and Mathematics (STEM) which aims to change the way that science is perceived, focusing specifically on women in science.

L to R: AOS Graduate Student Elizabeth Yankovsky, AOS Graduate Student Yi Zhang, AOS Graduate Student Xin Rong Chua, & AOS Associate Research Scholar Pu Lin

For 18 years, PPPL has organized the YWC with the hope of changing statistics which show a comparatively small percentage of women entering STEM fields, particularly in engineering and physics. Women make up half of the total U.S. college-educated workforce, but only 29% of the science and engineering workforce, according to the National Science Board. Numbers from New Jersey show out of approximately 327,000 STEM jobs in the state, only 25% percent are filled by women, according to the New Jersey Department of Labor & Workforce Development American Community Survey. This year's conference was the largest gathering to date, with hundreds of girls on the waitlist.

Girls from schools throughout New Jersey and a few from surrounding states participated in the conference and some 37 hands-on activities, including interactive demonstrations by Lockheed Martin Advanced Technology Laboratories, the Liberty Science Center, the NOAA National Marine Fisheries Service, and several groups from Princeton University, including AOS and CICS. Xin Rong Chua (AOS), Sonya Legg (AOS/CICS), Pu Lin (AOS/CICS), Elizabeth Yankovsky (AOS), and Yi Zhang (AOS) showed visitors at their exhibit how acidification changes the buffer capacity of the ocean through a demonstration in which the girls blew bubbles through a straw into water that either had lemon juice or baking soda added, exploring the relationship between CO_2 and ocean acidification. They also led students through a hands-on experiment demonstrating how both temperature and salinity determine the density of seawater based on the behavior of the meltwater from dyed ice cubes.


L to R: AOS Graduate Student Yi Zhang & AOS Graduate Student Elizabeth Yankovsky

"I volunteered at the Young Women's Conference with the intention of encouraging middle and high school students to pursue a career in science," said Yankovsky, an AOS graduate student. "In particular, I wanted to emphasize to young women that a research career is more accessible than societal stereotypes may lead them to believe." Yankovsky was surprised by the level of enthusiasm and knowledge that the participants had. One student, she said, was eager to discuss a geoengineering project she had worked on and showed an impressive understanding of climate science. "Many of the girls I spoke with are already planning for a future in science," she added.

The event not only provided a launching pad to develop and continue their early interest in STEM, but also introduced them to women scientists and the wide breadth of careers available to them in STEM fields. In her keynote address at Richardson Auditorium, Celeste Nelson, a professor in Princeton's departments of Chemical & Biological Engineering and Molecular Biology and principal investigator of the Tissues Morphodynamics Laboratory, discussed her unforeseen path to becoming a scientist and encouraged girls in attendance to find mentors who will inspire them.

For those fortunate enough to attend this year's YWC and actively participate in the demonstrations led by accessible, visible role models, inspiration was never further than their fingertips.

"I realized there is no lack of motivation to pursue science/engineering careers among young women, Yankovsky said, but rather a need for mentoring and helping such students navigate their education and careers." ■

Reichl Invited to Speak at NOAA Science Days


CICS Scientist Brandon Reichl, an AOS Associate Research Scholar

On May 15, 2018, CICS Scientist Brandon Reichl, an AOS associate research scholar, joined experts from across NOAA at the spring installment of NOAA Science Days to speak on "Advancing NOAA Science through Public and Private Partnerships." Reichl was selected to speak because of his collaborative work through the Carbon Mitigation Initiative (CMI), leading to better understanding of surface wave properties and potential changes with future climate. An opportunity for scientists across NOAA and their research partners to engage on a common theme, the event was held at NOAA headquarters in Silver Spring, Maryland and webcast live.

In his talk "Making Waves in Climate Models: Benefits of Ocean Surface Wave Simulation," Reichl spoke about simulating ocean surface waves in climate models, highlighting Princeton's CMI/British Petroleum partnership, an 18-year collaboration with the goal of finding solutions to the carbon and climate problem. Specifically, he addressed two important benefits that stem from simulating ocean waves in a climate model. First, is the ability to understand how surface waves may change due to changing atmospheric conditions under climate change, according to Reichl. Second, is the ability to improve coupled climate simulations by accounting for the effect of ocean waves on physical processes in the model.

"I was thrilled to have the opportunity to participate in this installment of the Science Days program," said Reichl. "It was a great experience to summarize my efforts working with CMI for a diverse audience."

"I also enjoyed meeting the other participants and learning about their projects," Reichl said. "The presentations highlighted many synergistic collaborations between the public and private sector that are an important component of NOAA's success."

Reichl's presentation was one of eight given, highlighting the innovative and forward-thinking research that has high relevance to NOAA's mission and advances its services. The event drew over 200 people from across NOAA, between the in-person event and the webinar. ■

Researchers and Environmentalists Join Forces at 2018 Ocean Fun Days

With 130 miles of ocean beaches and 1,792 miles of tidal shoreline, New Jersey, nicknamed the Garden State, could have just as easily been called the Coastal State. Despite the designation and undeterred by the previous day's inclement weather and early-morning gray skies, a group of AOS and GFDL researchers joined over 35 exhibitors on Sunday, May 20th to commemorate the 15th anniversary of Ocean Fun Days at the New Jersey Sea Grant Consortium (NJSGC) on Sandy Hook. Hundreds of visitors eager to learn more about our coastal environment descended on NJSGC's parade grounds late morning to join in the celebration of the 15th annual event, which typically draws thousands to the Jersey Shore over the course of two days.

L to R: AOS Associate Research Scholar Salvatore Pascale, AOS Postdoc Feiyu Lu, and GFDL Physical Scientist Jasmin John

CICS Associate Director Sonya Legg, an AOS faculty member, CICS Researcher Salvatore Pascale, an AOS associate research scholar, GFDL Physical Scientist Jasmin John, CICS Researcher Feiyu Lu, an AOS postdoc, and Legg's daughter, Amelia, who persuaded her school's Ocean Science bowl team to attend, were among the exhibitors, comprised of fellow scientists and environmentalists from around the garden state united to promote ocean awareness and coastal stewardship. The AOS contingent led hands-on experiments demonstrating iceberg melting and ocean acidification for reasonably-large crowds, according to Legg. As the day grew warmer, the crowds grew larger along with a renewed sense of enthusiasm for scientific inquiry.

"The most exciting part about this outreach event was watching the kids' faces light up when they blew the straw and saw water changing color, an entertaining way to explain the ocean acidification," said Salvatore Pascale, an AOS associate research scholar. "This event was able to generate a sense of curiosity and excitement about science in the kids, and at the same time they were able to have fun and learn something new."


AOS Associate Research Scholar Salvatore Pascale

Cultivating scientific curiosity in children and families who visit the interactive demonstrations can be equally rewarding for AOS/GFDL researchers who spend much of their time within the scientific community. Communicating science outside of the academic environment can help them to see the bigger picture and improve their communications skills in a field that has become increasingly collaborative.

"Talking to the public, especially kids and teenagers, is a great way to improve communication skills as well as to realize how the general public perceives our research field and what they consider important," said Feiyu Lu, an AOS postdoc. "The outreach experiences have always been the most helpful to my teaching and presentation skills, among all my professional and scientific activities; the Ocean Fun Day event is no exception." The various table-top activities also help the children think outside of their daily reality and hopefully spark their continued interest in the science of the state's shoreline.

In addition to eco-friendly activities such as seining, coast-themed crafts, an energy-saving scavenger hunt, youth fishing

clinics, face painting, and marine-life touch tanks and games, several new activities were offered to mark the anniversary, including an interactive *Rip Current vs. Sharks* trivia game and participatory paddleboarding/kayaking demos. Parts of the NOAA Fisheries Service James J. Howard Lab were open to the public.

Ocean Fun Days is presented by founding sponsor New Jersey Natural Gas, in partnership with New Jersey Sea Grant Consortium, Asbury Park Press, New Jersey Department of Environmental Protection, New Jersey Division of Parks and Forestry, National Park Service and the National Oceanic and Atmospheric Administration. ■

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 Andrew Hazelton who spent two years in the AOS Program.]

Postdoctoral Research Associate Andrew (Andy) Hazelton left Princeton in June 2018, after spending two years in the AOS program. He earned a Ph.D. in 2016 from Florida State University, conducting research on the inner-core structure of tropical cyclones, specifically small-scale updrafts called convective bursts.

AOS Postdoctoral Research Associate Andrew Hazelton

While at Princeton, Andy worked at GFDL with S-J Lin and Lucas Harris on analysis of tropical cyclones in high-resolution simulations using the fvGFS model (FV3 dynamical core with GFS physics). Tropical cyclones are multifaceted hazards to coastal communities, and the ability to provide accurate forecasts of TC track, intensity, and structure is critical for providing warnings. Andy's research specifically focused on using radar observations from aircraft flying through hurricanes to validate the structure of fvGFS hurricane forecasts, to provide insights into the model's ability to predict details of TC eyewall structure. This work was summarized in a paper titled "Evaluation of Tropical Cyclone Structure Forecasts in a High-Resolution Version of the Multiscale GFDL fvGFS Model" published in the journal *Weather and Forecasting* in April 2018. This paper was also highlighted as a "paper of note" in the April 2018 edition of the *Bulletin of the American Meteorological Society*.

Andy also worked on a project analyzing a large set of hurricane forecasts from the very active 2017 Atlantic Hurricane Season. This set of forecasts included multiple high-impact cases such as Hurricanes Harvey, Irma, and Maria. In particular, fvGFS correctly predicted that Harvey would go from a weak, disorganized storm into a consolidated, stronger system capable of rapidly intensifying. In addition, the model showed comparable track and intensity skill to current state-of-the-art hurricane models despite being experimental. A paper on this work is in review in *Weather and Forecasting*, and further improvements to the model based on these results are being tested on the plethora of cases from 2017.

"Andy has been extraordinary in his ability to apply new datatypes for the validation of the simulated-predicted hurricane structures from GFDL models," said S-J Lin, a GFDL physical scientist. "These models include the GFDL HiRAM and the FV3-GFS at resolution ranging from a few kilometers to 25 kilometers. It has often led to discovery of model defects. The team then revisited the model algorithms and/or configurations to address the problems he discovered. This is how progress is made!"

Andy recently accepted an assistant scientist position at the University of Miami Cooperative Institute for Marine and Atmospheric Studies (CIMAS), working at NOAA's Hurricane Research Division. He will continue to aid in the development and evaluation of an FV3-based hurricane model (which will be a collaborative effort between HRD, GFDL, and other NOAA labs). This model will also be used to perform basic research on the evolution of the hurricane inner core. ■

AOS & CICS News

Congratulations to **Jane Baldwin** who successfully defended her Ph.D. Thesis, "Orographic Controls on Asian Hydroclimate, and an Examination of Heat Wave Temporal Compounding," on May 15, 2018.

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AGU's Outstanding Reviewers of 2017

Congratulations to former AOS postdoc **Laura Jackson** (Met Office), former AOS student **Sarah Kang** (Ulsan National Institute of Science and Technology), AOS faculty member and CICS associate director **Sonya Legg**, former AOS student **Geeta Persad** (Carnegie Institution for Science), former AOS student **Anna Trugman** (University of Utah) and former AOS postdoc **Karin van der Wiel** (Royal Netherlands Meteorological Institute), who are among the outstanding reviewers of 2017 selected by the AGU editors.

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Congratulations to AOS Postdoctoral Research Fellow **Alex Haumann**, a member of the Sarmiento Group, for being awarded the Prix de Quervain 2018 from the Swiss Committee on Polar and High-Altitude Research for his Ph.D. thesis, "Southern Ocean response to recent changes in surface freshwater fluxes." The award ceremony took place during the POLAR2018 conference in Davos, Switzerland in June.

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AOS Research Oceanographer **Keith Rodgers** is now co-chair, along with Clara Deser at NCAR, of the US CLIVAR Working Group on Large "Initial-Condition" Earth System Model Ensembles (LEs). The working group was formed in March 2018 with the intent of spearheading a dedicated effort across the national and international climate communities to

advance progress on identifying anthropogenic influences on weather and climate amidst the "noise" of internal variability. <https://usclivar.org/working-groups/large-ensemble-working-group>.

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Ocean's Heat Cycle Shows that Atmospheric Carbon may be Headed Elsewhere

A recent study in the journal *Nature Geosciences*, led by AOS Faculty Member **Laure Resplandy**, assistant professor of geosciences and the Princeton Environmental Institute, and coauthored by AOS Research Oceanographer **Keith Rodgers**, among others, examined the global carbon cycle and suggests that scientists may have misgauged how carbon is distributed around the world, particularly between the northern and southern hemispheres. The results could change projections of how, when and where the currently massive levels of atmospheric carbon will result in environmental changes such as ocean acidification.

Read more

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Icy Interactions: Exploring the Interactions between Ice Sheets and Other Earth System Components

Complex interactions between ice sheets and other components of the Earth system determine how ice sheets contribute to sea level rise.

Motivated by the urgent need to better understand the contributions to future sea level rise from the Antarctic and Greenland ice sheets, a recent article, coauthored by AOS Research Glaciologist **Olga Sergienko** and published in *Reviews of Geophysics*, explores the interactions between ice sheets and other Earth system components, and the feedback loops caused by these interactions. Here, the authors give an overview of scientific research in this area.

Read more

Alumni News

Congratulations to former AOS Postdoc **Lucas Harris**, a GFDL physical scientist, who was awarded an honorable mention under the WCRP/WWRP International Prize for Model Development 2017. The Committee, consisting of representatives from WCRP, WWRP and WGNE, was greatly impressed by Harris's strong profile and the high quality of his contribution to weather and climate model development.

WCRP and WWRP established the Prize in recognition of the essential role model development plays in weather and climate science. It is awarded annually for an outstanding contribution to model development by an early- to mid-career researcher.

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AOS Alumnus **Anna Trugman** (University of Utah) was awarded a two-year independent National Institute of Food and Agriculture Postdoctoral Fellowship. The goal of her research project is to disentangle the effects of water limitation and CO_2 fertilization on forest productivity and understand how variability in environmental conditions modulates forest response to drought. She will use a combined approach integrating USDA-curated Forest Inventory and Analysis (FIA) datasets across the U.S, a tractable tree model, and larger scale ecosystem models to (i) identify regions of future drought vulnerability, (ii) reduce uncertainties in projections of U.S. forest productivity, and (iii) inform potential management strategies to adapt to drought.

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Former AOS postdocs **Jaime Palter** (University of Rhode Island**)** and **Gregory de Souza** (ETH Zurich**)** recently coauthored a paper on an unusual mode of supply of the micronutrient iron to the North Atlantic subtropical gyre -- through Gulf Stream rings. Their paper, published in *Nature Geoscience*, combines analyses of seawater iron concentrations with satellite observations of sea-surface height to show that these cold-core rings are a quantitatively important source of iron to the gyre, providing a more nuanced view than the current paradigm of dust-dominated iron supply. The paper can be found at: <http://dx.doi.org/10.1038/s41561-018-0162-0>.

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Former AOS Postdoc **Sujong Jeong** is the lead author of a paper, published recently in *Science Advances*, that finds a 13.4% decrease in carbon residence times (50% CI = 9.2 – 17.6%) for North Slope tundra since the 1970's. Reduced soil carbon residence times, with Arctic greening and shrubification, are further evidence for the 'borealization' of Arctic tundra. Former AOS Associate Research Scholar **Colm Sweeney** (CIRES, University of Colorado, Boulder) and former AOS Faculty Member **David Medvigy** (Notre Dame) are among the study's coauthors.

<http://advances.sciencemag.org/content/4/7/eaao1167>

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GFDL Summer Blood Drive

Monday August 6th, 2018

11am – 2pm
GFDL Parking Lot

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Summer Intern Presentations

beginning July 24

Check the GFDL website Events and Seminars page for dates and times:
<https://www.gfdl.noaa.gov/events/>

Natural Variabilty in the Pacific Workshop
(AOS Program Workshop)

August 15-17, 2018

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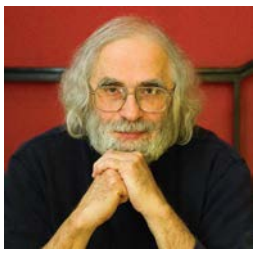
Understanding and Modeling the Earth's Climate: A Symposium in Honor of Isaac Held



October 29-31, 2018

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Arrivals

We would like to welcome the 2018 CICS summer interns:

Annika Barth (American University), hosted by John Dunne;
Ioana Bociu (Florida State University), hosted by John Dunne;
Kalen Fisher (Howard University) hosted by Heather Archambault;
Bobby Garza (Southwestern University), hosted by Thomas Robinson and Jess Liptak;
MonTre' D. Hudson (University of Tennessee), hosted by Anders Damsgaard, Alistair Adcroft and Olga Sergienko;
Nicholas Ordonez (Stevens Institute of Technology), hosted by Alistair Adcroft and Steve Griffies;
Robin Sehler (California State University, Los Angeles), hosted by Sarah Kapnick.

PEI Summer Undergraduates working with the Sarmiento Group:

Sam Bartusek (Princeton), who is working with Alex Haumann; **Udit Basu** (Princeton), who is working with Seth Bushinsky; **Lilly Quach** (Princeton), who is working with Lionel Arteaga; and **Vydhourie Thiyageswaran** (Princeton), who is working with Fernando Gonzalez Taboada.

Gan Zhang arrived at the end of March from the University of Illinois. He is working with Tom Knutson as a postdoc.

Randye Rutberg, an assistant professor at Hunter College, arrived in early June to work with Lori Sentman for the summer months.

Kai-Yuan Cheng, who arrived in early June, comes to Princeton from the University of Wisconsin, Madison. He is working with SJ Lin and Lucas Harris as a postdoc.

Kisei Tanaka arrived in mid-June from the University of Maine. He is working with Jorge Sarmiento and Charlie Stock as a Nereus postdoc.

Monika Sikand, an assistant professor at Bronx Community College, arrived in early July to work with V. Ramaswamy and Stephan Fueglistaler for the summer months.

Allison Hogikyan, an incoming graduate student, will arrive in early August from the University of Michigan to work with Stephan Fueglistaler.

Dasol Kim will arrive in early August through the end of January to work with Tom Delworth as a visiting student research collaborator. He comes to Princeton from Seoul National University.

Lingwei Ming, an incoming graduate student, will arrive in early September from Nanjing University. She will be advised by Steve Garner.

Yong-Fei Zhang will arrive in mid-September, from the University of Washington, to work with Mitch Bushuk, Mike Winton, and Alistair Adcroft as a postdoc.

Graeme MacGilchrist is scheduled to arrive in mid-September to work with Jorge Sarmiento and Steve Griffies as a postdoc. He comes to Princeton from University College, Oxford.

Welcome Back!

We welcome back **Gabriel Lau**, a former faculty member and GFDL scientist, who arrived in late-June to work with his AOS/GFDL colleagues through the end of August.

Pablo Zurita-Gotor, a returning faculty member from the Universidad Complutense de Madrid, arrived in early July. Pablo is working with Isaac Held and Stephan Fueglistaler throughout the summer.

Departures

AOS Postdoc **Michael Wolovick** left the program at the end of March. He accepted a research fellow position at the Climate Foundation effective June 25th.

Hiroyuki Murakami, an AOS associate research scholar, began his UCAR affiliation effective mid-June; he continues to have an office at GFDL.

Andrew Hazelton, an AOS postdoc, accepted an assistant scientist position at the University of Miami - CIMAS, working in NOAA's Hurricane Research Division (HRD). He began his new position on June 18th.

AOS Postdoc **Kieran Bhatia** left the Program at the end of June. He accepted a position as a climate science program lead at BP in Sunbury, London.

Nathaniel Tarshish, an AOS research specialist, left the Program in mid-July. He will be pursuing his graduate studies at University of Berkeley.

AOS Alum **Rob Nazarian**, a lecturer in Geosciences, left the University in mid-July. He accepted a position as an assistant professor of Physics at Fairfield University.

AOS Postdoctoral Research Associate **Anders Damsgaard** accepted a position as an academic technician at the Danish Environmental Protection Agency. He will be leaving the Program at the end of July.

Honghai Zhang, an AOS postdoc, accepted a postdoctoral research position at Lamont-Doherty Earth Observatory, Columbia University. He will be leaving the Program at the end of July.

AOS Postdoc **Nathaniel Chaney** accepted a position as an assistant professor in the department of Civil and Environmental Engineering at Duke University. He will be leaving the Program at the end of July.

Lakshmi Krishnamurthy, an AOS climate prediction specialist, will be leaving the AOS Program at the end of July after more than two years in the Program.

Jie He, an AOS postdoc working with Gabe Vecchi and Stephan Fueglistaler, will be leaving the Program at the end of July. He accepted a position as an assistant professor at Georgia Tech**.**

Birth Announcements

Congratulations to AOS Alumnus **Neven Fučkar** and his wife, Paula Stella, on the birth of their son, Adrian Felix, on March 30, 2018.

Congratulations to AOS Research Scholar **Meiyun Lin** and her husband, Zhiguo, on the birth of their son, Luke, on June 25, 2018.

Congratulations to AOS Climate Prediction Specialist **Lakshmi Krishnamurthy** and her husband, Venkata Ramakrishna, on the birth of their daughter, Nayananvitha, on June 27, 2018.

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