AOS & CICS Newsletter

Spring/Summer 2016 Volume 10, Number 2

Tropical Dynamics – 4th Annual AOS Program Workshop

Join AOS graduate students and postdocs from Wednesday July 13 through Friday July 15, 2016 for "Tropical Dynamics" – the fourth annual AOS Program Workshop hosted by the Program with the generous support of AOS Faculty Member Isaac Held's BBVA Foundation award.

The workshop will bring together leading experts of observations, modeling, and theories to present recent insights and future directions on a wide range of atmospheric dynamics in the tropics, from small cumulus convection to large-scale weather and climate. Confirmed invited speakers for the three-day event include: Brian Mapes, University of Miami; Courtney Schumacher, Texas A&M University; and Allison Wing, Columbia University.

Working with postdocs, students, and collaborators, Mapes maintains a 3-pronged effort that builds from local scales, through quantitative analysis and abstraction, up toward global scales. Schumacher's research focuses on a wide array of atmospheric convective processes in the tropics, from small cumulus to large mesoscale convective systems. She counts among her interests the environmental factors that affect precipitation production and convective organization. Wing's broad interests include atmospheric dynamics and climate, with specific interests in tropical meteorology, tropical convection, and tropical cyclones.

According to AOS Graduate Students Xin Rong Chua, Spencer Clark, Aaron Match, and Zhaoyi Shen, members of the workshop planning committee, the workshop is structured so that each speaker will present a plenary lecture to the GFDL community, lead two tutorial sessions on a specific aspect of tropical dynamics, and lead three hands-on sessions with graduate students and postdocs. The agenda also includes opening and closing discussions related to the history and future of the field respectively. Open to the entire AOS/GFDL community, the public seminars will be held in GFDL's Smagorinsky Room on each day of the workshop.

"The workshop aims to provide an opportunity for AOS students to gain more understanding in tropical dynamics and interact with leading scientists outside of the University," said Shen. "This year the topic was purposely chosen because most students have some exposure to tropical dynamics, while none of them have expertise in this field. We hope such a topic will make the three-day workshop interactive and engaging."

As in past years, the workshop will offer numerous opportunities for casual interaction among the speakers and AOS students, researchers, and faculty. Building on the success of the first three AOS Program workshops, the student organizers hope to foster and strengthen existing interactions between the various communities. ■

AOS Annual Retreat

September 13, 2016

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

Inside this issue:

TigerTransit/Shuttle Services Operating on Summer Schedule: http://www.princeton.edu/transportation/ttroutes/ForrestalS16.pdf

Bring Your Young Scientist to Work Day 2016

On Thursday, April 28, 2016 the GFDL Employee's Association (GFDLEA) hosted "Bring Your Young Scientist to Work Day" at GFDL, a day of discovery and exploration at a premier NOAA research laboratory. Twenty-two children of employees, their friends, and relatives attended the event designed to help spark interest in the field of climate science by exposing them to the scientists and lab employees who carry out important work and research in their community.

Bring Your Scientist Work Day Participants (Credit: Will Cooke)

Age appropriate talks covered a wide range of topics including: air pollution and climate; hurricanes and climate; ocean acidification; the climate of Mars; climate modeling; and AMOC and the future of world climate. Among the speakers were: Kirsten Findell (GFDL), Yi Ming (AOS/GFDL), Hannah Zanowski (AOS), John Dunne (GFDL), Tim Marchok (GFDL), Todd Mooring (AOS), Desiree Tommasi (AOS), Whit Anderson (GFDL), Andrew Shao (AOS), Shannon Rees (Engility), and Tom Delworth (AOS/GFDL).

AOS Graduate Student Hannah Zanowski talked about her personal experience "amongst the bergs," aboard the German Research Icebreaker *Polarstern*, and led a hands-on activity based on the behavior of the meltwater from dyed ice cubes to demonstrate how both temperature and salinity determine the density of seawater. Desiree Tommasi, an AOS associate research scholar, conducted "The Phytoplankton Race," an interactive activity that explored buoyancy, the role of phytoplankton in ecosystems, how phytoplankton acquire energy, and the adaptations they have to remain close to the surface to acquire energy from sunlight.

"The children were divided in different groups (all marine animals directly or indirectly dependent on phytoplankton for food) and then were tasked with building a phytoplankton that would neither float at the surface, where nutrients are low, nor sink to the bottom, away from sunlight," Tommasi explained. "The phytoplankton were then raced against one another in a tall aquarium and the slowest sinking phytoplankton won the race."

Shannon Rees, a programming scientist in GFDL's Weather and Climate Dynamics Group, explored the science behind clouds with her "Clouds in a Jar" experiment, an apparent crowd favorite, according to GFDLEA President Rich Gudgel.

In addition to the talks and interactive activities, the children explored the Lab and its technology, including the computing facility, on a walking tour led by GFDL scientists, enjoyed a courtyard cookout, and earned "Certificates of Attendance" which were presented to them by GFDL Deputy Director Whit Anderson, all the while acquiring awareness of GFDL's mission and career opportunities in the STEM fields – science, technology, engineering and math.

"I was thrilled with the experience that the kids were treated to at "Bring Your Young Scientist to Work Day" here at GFDL," said GFDL Research Physical Scientist Kirsten Findell, who had the duo role of presenter and parent. "There was a wonderful mix of presentation topics and presentation styles. The hands-on activities got the kids out of their seats to test out some scientific principles in fun ways. The tour of the computer room gave them a glimpse of computing robots in action, and they enjoyed a wonderful lunch in the courtyard."

"I think it's great that my kids got an introduction to so many different possible careers and fields of study, and most importantly," she added, "I think they learned a thing or two while they were here! Many thanks to all who gave of their time -- it was quite a gift for these lucky kids." ■

Q&A with AOS Graduate Student Jane Baldwin

The Andlinger Center for Energy and the Environment (ACEE) recently released its latest Energy Technology Distillate, a report titled, "Fusion Energy via Magnetic Confinement." AOS Graduate Student **Jane Baldwin** is one of 10 members of the Princeton Energy and Climate Scholars (PECS) who researched, synthesized, and wrote, along with their faculty mentor Robert Socolow, the Distillate, the third Energy Technology Distillate from ACEE designed to provide succinct yet substantive information to policymakers, educators, students, and other citizens. Jane was also one of four students on a panel who spoke about the Distillate at the Andlinger Center for Energy and the Environment Celebration and Symposium on May 20, 2016.

andlinger center
for energy+the environment


AOS Graduate Student Jane Baldwin

In this Q&A, Baldwin discusses her involvement leading up to the Distillate's release:

How is it that a group of Ph.D. students with a range of expertise from biogeochemistry, climate modeling, ecology, electrical engineering, psychology, to public policy came to write a report related to nuclear fusion?

About every year or so PECS does a project, but what the project constitutes is quite open-ended. Past projects have included a trip to exchange with

universities in India and attending a sustainable development conference in Rio. When I joined PECS in June of 2014, the group was interested in learning more about US national labs, and the role they play in the overall energy research enterprise. When it became clear that traveling to a large number of U.S. national labs was logistically difficult, we started talking more about the largest national lab close to Princeton, the Princeton Plasma Physics Laboratory, and prospects for fusion energy more generally. Rob Socolow, the main faculty sponsor of PECS, happens to also be in charge of the Andlinger Center's distillates effort. He suggested that working towards a distillate on fusion could be a useful way to focus our learning. Additionally, Socolow felt that having a group of graduate students not in the fusion field approach the topic with fresh eyes might be useful in producing an objective analysis, especially given the fraught environment regarding funding for fusion and which type of fusion reactor model to pursue. All the PECS students were intrigued to learn more about this low-carbon and low-nuclear waste, seemingly endless but technologically very difficult energy supply. So we said yes we'd work towards a distillate, and started right away organizing and researching...

What was the most challenging aspect of the process?

Getting up to speed on fusion, a topic outside of our respective research fields, was of course challenging, and is probably best represented by the many, many drafts we had to go through as we learned. Fortunately, Egemen Koleman and Rob Goldston, both fusion scientists at Princeton, were very helpful in making sure we understood the technical details and relayed them accurately.

In the case of the economics section, which I was in charge of, the biggest challenge was picking apart the assumptions that went into estimates of future fusion power plant costs and fusion's potential energy market share. Given that fusion energy does not exist yet, any related economic estimates are somewhat speculative. However, with significant effort, we were able to wade through the uncertainty and draw some key conclusions.

Finally, keeping the project going was difficult -- all of the grad students involved (including myself) had to prioritize our dissertation research first, and so sometimes the momentum would drop and it looked like the distillate would never become a reality. I'm very proud of us for persevering to a finished product, and Rob Socolow and the student distillate leaders Cleo Chou and Janam Jhaveri definitely deserve some credit for that.

What was the most rewarding?

Getting to work closely with all the other grad students in the project and Rob Socolow was definitely the most rewarding part of the project. Each student brought a different skill set to the table, creating a very creative dialogue. Rob also kept pushing for further rigor, which was at times frustrating but in the end very valuable. Forging relationships with all these diversely interested and intelligent individuals has been a highlight of my Princeton experience to date, and I don't think would have occurred without the intensive work we had to put in together on this project.

Also rewarding was going through the extensive review process for the distillate. The distillate was reviewed by 10 different experts in total, a much more extensive review process than for a typical peer-reviewed paper. As a young scientist who hasn't yet gone through the review process many times, this gave me great hands-on experience in negotiating between reviewers with different viewpoints, and defending our (the authors') choices when necessary.

Has working on the report changed the way you view nuclear fusion as a global energy source?

Yes. When embarking on this project, I was convinced that fusion was a great solution to cleaning up our energy mix and ultimately dealing with global warming, and assumed it must just be held back by lack of funding. After working on this project, I am not a pessimist regarding fusion's potential, but my views have definitely become more nuanced. It is important to consider the energy system holistically when trying to quantify fusion's potential. For example, in the economics section we demonstrate that fusion may not be that valuable if carbon capture and sequestration becomes available, or there's no price on carbon. Additionally, technological uncertainty is still quite significant -- fusion plants being successful is contingent on numerous technologies that are still waiting to be tested in ITER (the internationally funded tokamak in the south of France) and other fusion test facilities. Nonetheless, working fusion energy is a unique energy supply, and despite these uncertainties significant research into fusion, and funding for that research, should certainly continue.

Has your involvement with PECS and the Distillate, in particular, made a difference in how you approach your own research?

I'm still a little too close to the project to say -- I expect ideas for more interdisciplinary collaborations will branch off from my involvement in PECS and the students I got to know in it for years to come. In terms of methodology, working with Rob Socolow has empowered me to try to quantify things that others assume or just explain qualitatively; many of our meetings were spent attempting back of the envelope calculations to test our understanding of economic quantities relevant to fusion, which I previously did not think could be quantified. I also now appreciate the costs and benefits of entering a new area of research (really, entire field!) from the ground up. I'm sure that experience will direct my future research choices, informing when I dive deeper into a prior area of research or pursue something new.

The executive summary and full report can be found at the following link: http://acee.princeton.edu/distillates/distillates/fusion-energy-via-magnetic-confinement/

Princeton Energy & Climate Scholars

Advised by AOS Faculty Member Gabriel Vecchi, Jane Baldwin's core research employs a combination of dynamical climate models and earth observations to elucidate the ties between global and regional climate, and move towards useful predictions of climate change. A recipient of the National Science Foundation graduate research fellowship, her current work explores the influences of orography on regional climate, with a particular focus on the deserts across interior Asia. ■

Fall Model Hierarchies Workshop Announced

Because Earth system science often deals with complex systems spanning multiple disciplines, these systems are best described by an impressive range of models built with contributions from specialists of many backgrounds. An upcoming workshop will address the key challenge of how to make the hierarchy of models more effective, so that climate scientists may readily isolate observed behavior of a complex model in a simpler one, and represent findings from idealized models in General Circulation Models (GCMs).

The "Modeling Hierarchies Workshop" will be held in McDonnell Hall on Main Campus from November 2 – 4, 2016. The meeting will be held in conjunction with the 20th Session of the World Climate Research Programme Working Group on Coupled Modeling (WGCM-20), which runs from October 31 – November 2, 2016.

According to CICS Scientist V. Balaji, head of the Modeling System Group at GFDL and Princeton University, the workshop will be organized into several sessions, based on aspects of the Earth system to which different model "species" can be applied, with the hope of demonstrating how robust and uncertain features from comprehensive model simulations can be interpreted through simpler or more idealized models and experiments. The session themes include: tropical convection and radiative-convective equilibrium; mid-latitude dynamics and storm tracks; stratosphere-troposphere coupling; ocean dynamics; ENSO and other couple modes of variability; climate sensitivity and feedbacks; and biospheres and the carbon cycle: from Gaia to full ecosystems.

The workshop will feature AOS Faculty Member Isaac Held and Tim Palmer (University of Oxford) giving a talk on "Debating model hierarchies," and seven additional invited speakers including, Bjorn Stevens (Max Planck Institute), Masaki Satoh (Tokyo University), Michela Biasutti (Columbia University), Alan Plumb (Massachusetts Institute of Technology), Amy Clement (University of Miami), Mick Follows (Massachusetts Institute of Technology), and Marika Holland (NCAR).

In addition to fostering communication and collaboration between relevant communities, an anticipated outcome of the workshop is a paper intended for a broad audience around the theme of model hierarchies, to which all workshop participants will be encouraged to contribute. Carolina Dufour, an AOS associate research scholar, AOS Director Stephan Fueglistaler, and AOS Faculty Member Isaac Held, a GFDL senior research scientist, join Balaji on the workshop organizing committee.

"We are all very excited by the high level of interest this workshop call has generated and are looking forward to it," said Balaji. "There should be fodder here for some very interesting debates, scientific and philosophical: Can you simulate something without understanding it? Can you understand something without being able to simulate it? Such questions are fundamental to the very nature of modeling as a basis of scientific method, alongside theory and observation."

The event is being sponsored the World Climate Research Programme under the auspices of the WCRP Grand Challenge on Clouds, Circulation, and Climate Sensitivity and the Working Group on Coupled Models, with the facilities provided by Princeton University and technical support provided by the Institut Pierre Simon Laplace (IPSL). ■

Inspiring Young Women at PPPL's Young Women's Conference

Researcher and Professor in the NYU Department of Chemical and Biomolecular Engineering Jin Kim Montclare told seventh- to tenth-grade girls from throughout New Jersey, as well as Pennsylvania and Maryland, attending the 15th annual Young Women's Conference in Science, Technology, Engineering, and Mathematics (STEM) at the Princeton Plasma Physics Laboratory (PPPL) to "tune down the people who tell you you can't do it and tune up the people who are supportive."

In a keynote speech to 575 girls on March 18, 2016, Montclare discussed how her early interest in nature as a child became a successful career in a cutting-edge research field. She said she was helped and encouraged by several mentors along the way, but also had to ignore people who told her she wasn't good enough. As women who forge their way in a field where women are often underrepresented, AOS Graduate Student Hannah Zanowski and AOS colleagues Rebecca Asch, Alison Gray, Natasha Henschke, Anna Trugman, and Ping Zhai subscribe to a similar philosophy. They were among the approximately 80 people who staffed the more than 30 exhibits at the conference, held at the University's Frick Chemistry Laboratory.

CICS/AOS interactive displays included "Taste and Sea," in which the participants learned about the different processes that affect ocean salinity in a fun game that involves tasting and ranking water with different salinities; "The Ocean's Acid Test," an experiment exploring ocean acidification by demonstrating the relationship between CO_2 and ocean acidification; and "Ice, Ice Baby," a hands-on display 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 Hannah Zanowski and AOS colleagues

"I was blown away by how engaged and enthusiastic all the girls were at the PPPL Young Women's Conference," said Henschke, an AOS postdoctoral research associate. "It was really nice to see an event tailored towards educating and empowering young women, and I think events like these show that there is great promise for the next generation of scientists."

Celebrating its 15th anniversary this year, the event attracted a record number of participants as a means of cultivating girls' interest in STEM subjects and career paths through a myriad of hands-on activities, demonstrations, and talks by female scientists. While the percentage of women in science and engineering careers has increased in past decades, women still constitute less than 30 percent of all science and engineering occupations, according to a report by the National Science Foundation.

The 16th annual Young Women's Conference in STEM is scheduled for Thursday, March 23, 2017. ■

AOS to Welcome Four Students in the Fall

The AOS Program will welcome the newest members of its community in September of 2016. The new students - three domestic and one international - were selected from a talented and highly qualified applicant pool through a rigorous selection process.

"The new students bring impressive academic achievements to our University and broad intellectual interests to our AOS community," said AOS Director Stephan Fueglistaler. "I am grateful to our faculty for their untiring dedication to the admissions process."

Given the Program's worldwide reputation, the Program continues to attract students from across the globe with over 75% of the applicant pool comprised of international students. These applicants represent twelve countries, with the largest representation from China. This upward trend in international applicants can be seen across the University over the past five years. Among the total applicants, 40 percent were women and 60 percent were men.

"The Program's outstanding faculty and its ties with GFDL continue to contribute to the strength and reputation of the Program, and we continue to attract talented students from across the United States and around the world," Fueglistaler said. The new students hail from Yale University, Peking University, St. Joseph's University, and the University of Minnesota.

While enrolled in the Program, AOS graduate students continue to garner accolades for their work, and receive prestigious fellowships from the NSF, NASA, and other federal agencies, which fund and support the high caliber of education provided at the University. The students also benefit from the research capabilities of GFDL and from the many GFDL scientists who are active in the AOS Program as lecturers.

As the Program prepares to welcome a new cohort of students, it bids farewell, over the coming months, to members of one of the largest class of graduates the Program has seen in its history. "Each of these students has made a unique contribution to their field through their research and has enriched the intellectual vitality of our Program," Fueglistaler said. "They have earned a place in the Program's rich academic heritage."

For the incoming students, a new student orientation is being planned for the early fall. ■

PECS: A Program Worth Emulating

Imitation may indeed be the sincerest form of flattery for the Princeton Energy and Climate Scholars (PECS) group whose goal is to encourage communication and scholarly exchange among doctoral candidates and faculty working on a broad range of energy and climate change related questions. Over the course of the 2015-2016 academic year, thirteen talented and engaged Princeton Day School (PDS) high school students eagerly followed in the footsteps of their PECS counterparts in a program with a similar aim.

These two outwardly disparate groups met in the evening, in the PDS Library, on seven occasions for informal dinner and research discussions addressing the energy challenges of the 21st century. "The topics were chosen to progress in a somewhat systematic way from explaining the problem of climate change/global warming from climate modeling and geological perspectives, the impacts of this change (sea level rise, heat waves, etc.), and different policy and clean energy options which might provide a solution," said AOS Graduate Student Jane Baldwin, a member of PECS.

L to R: Levi Golston (CEE), Wei Peng (WWS-STEP) and Jane Baldwin (AOS)

According to Baldwin, the collaboration originated when Liz Cutler, an English teacher and sustainability coordinator at PDS, approached their group about creating "a mirror" of the PECS group at her school, composed of high school students who would be selected to take part in the collaboration based on their academics, interest in the environment, enthusiasm, leadership, and cooperative skills. After agreeing to join the collaboration, Baldwin agreed to be the point person for the PECS community and ensured the meetings were attended by three graduate students so that doctoral students and high schoolers could break off into small groups for discussion.

Each discussion began with a thirty to sixty minute presentation by a graduate student or a pair of students on a climate change-related topic followed by details related to their research. An open discussion between the graduate students and the high schoolers, a few of whom were on the fence about environment/energy related studies in their future, ensued for the remaining hour.

Joining Baldwin as discussions leaders were PECS students from a broad range of disciplines: Civil and Environmental Engineering (CEE), Electrical Engineering (ELE), Geosciences (GEO), Mechanical and Aerospace Engineering (MAE), and the Woodrow Wilson School (WWS). The Ph.D. students, according to Baldwin, were quite impressed by the PDS students' questions and enjoyed the opportunity to hone their general audience science communication skills. More importantly, the collaboration seems to have had a significant impact on the PDS students. "At least a few who were not considering environment/energy related studies said

they now intended to study those topics in college and pursue related careers," Baldwin said. "I am very grateful to have had this opportunity to encourage tomorrow's environmental leaders, and I am glad that the collaboration will be continuing next year."

Beyond the promise of the program going forward next year, it is also worth noting that this year's PDS Energy and Climate Scholars had the opportunity to visit GFDL in early March and to hear presentations by GFDL Scientists Tim Marchok, Vince Saba, an AOS visiting research collaborator, and AOS Research Glaciologist Olga Sergienko, and to tour the Lab.

Since its beginnings in 2008, PECS has been aiming 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. The Energy and Climate Scholars program at PDS hopes to emulate that success in the years ahead. ■

Ocean Fun Days 2016

An overcast, rainy day could not dampen the energy surrounding the opening day of the thirteenth annual celebration of Ocean Fun Days at the Jersey Shore. It did, however, prompt CICS Associate Director Sonya Legg to go it alone the first day of event and spare the sizable group of volunteers scheduled to work with her from having to navigate the wet roads. The free, two-day event, whose goal is to promote the wise use of New Jersey's marine and coastal resources, was held on Saturday, May 21st at Island Beach State Park and May 22nd at the New Jersey Sea Grant Consortium (NJSGC) on Sandy Hook.

More hospitable weather on the second half of the weekend brought out many families and four additional volunteers from the AOS Program, GFDL, and Engility to lend their expertise and hands at the yearly, education-oriented event, sponsored by the NJSGC in coordination with the state Department of Environmental Protection. Jasmin John (GFDL), Todd Mooring (AOS), Tom Robinson (Engility), Honghai Zhang (AOS), and Legg's eldest daughter, Amelia, oversaw the experiments which included "ocean acidification in a cup," "iceberg melting," and "taste the difference between the bay and the ocean." They joined marine scientists, fellow scientists and researchers, and environmentalists from around the state in offering learning and hands-on activities focused on our marine and coastal environment.

"Our table was pretty consistently busy, indicating a high level of interest among children and parents in what we had to say," said Mooring, an AOS graduate student. "It was not hard to convince people to do (or watch, as appropriate) our experiments, and the kids made some pretty funny faces in response to the taste of the salt water. I enjoyed sharing my enthusiasm for atmospheric and oceanic sciences with the families at Ocean Fun Days."

L to R: AOS Postdoc Honghai Zhang, AOS Graduate Student Todd Mooring and CICS Associate Director Sonya Legg

"I really enjoyed the interaction with the public to communicate the ocean sciences that I do," Zhang, an AOS postdoctoral research associate, added. "Meanwhile, it's also a challenge -- in the very beginning -- to explain the science with "nonscientific" language that the public, particularly kids, normally use. It's rewarding at the end when people were inspired by and learned something from the experiments that we did."

With a record number of exhibitors, the event also offered eco-tours of the island, a host of hands-on activities, educational displays, a variety of classes, and exhibits that celebrate the natural wonders of the Jersey Shore. Eco-friendly activities included coastal crafts, fiddler crab races, workshops, using seins to net fish and other aquatic life, an energy scavenger hunt, games and prizes, youth fishing clinics, Beachcombing 101, face painting, and sea-creature touch tanks and exhibits. In addition to all the booths and exhibits, the NJSGC headquarters location, in the historic Fort Hancock section of Sandy Hook, also included guided tours of many of Sandy Hook's historic sites and an open house at the NOAA/James J. Howard Science Laboratory.

According to the Marine Defenders Project, New Jersey's coastline stretches 127 miles from Sandy Hook in the north to Cape May in the south. While the coast is home to more than fifty towns and cities, the waters just offshore are teeming with a wide variety of marine life. Island Beach State Park protects the longest stretch of undeveloped barrier island remaining in New Jersey, according to the Department of Environmental Protection. The park encompasses about 3,000 acres of sandy beaches, dunes, dense maritime forests, freshwater wetlands, and tidal marshes, and makes for a perfect outdoor classroom.

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, and the National Oceanic and Atmospheric Administration. ■

In Pictures:

Over 100 colleagues of Ron Stouffer, a retired senior research climatologist and group head of the Climate and Ecosystems Group at GFDL, came together at a symposium in his honor on June 6, 2016 at GFDL. The event served as a platform to celebrate Stouffer's 38-year career at GFDL.


Symposium attendees gather in front of GFDL (Credit: John Dunne)

L to R: Jerry Meehl (NCAR), Ron Stouffer, John Mitchell (Hadley Centre, UK) and Suki Manabe (AOS) (Credit: Ron Stouffer)

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 Adele Morrison who spent two and a half years in the AOS Program.]

After two and a half years as a postdoc in the AOS Program, Adele Morrison will be departing Princeton in August. Working with Jorge Sarmiento and Stephen Griffies, Adele studied the role of the Southern Ocean in the climate system.

AOS Postdoctoral Research Associate Adele Morrison

Adele's research focuses on the large-scale dynamics of the Southern Ocean and in particular the role of eddies in driving and modifying the transport of mass, heat, and carbon. While at Princeton, Adele studied how eddies and changing ocean circulation impact heat and carbon uptake in the Southern Ocean. Adele also led a project in collaboration with Scripps and LANL using particle tracking to investigate the three-dimensional structure of Southern Ocean upwelling pathways in climate models.

"Adele has been a terrific asset to our group," said Sarmiento. "She has contributed great scientific curiosity, insights and efforts to a number of projects and has extended our understanding of the Southern Ocean and its role in global climate. She will be missed!"

During her time in Princeton, Adele was also able to take advantage of the opportunity to go to Antarctica on a five week research cruise from Chile. Adele joined a team of researchers from Caltech and Scripps to retrieve gliders and take CTD observations for the ChinStrAP (Changes in Stratification at the Antarctic Peninsula) project.

"It has been an extremely rewarding experience for me to work in the AOS Program," Morrison said. "I am especially grateful for the opportunities to apply for my own grants, supervise students and collaborate with so many great scientists. My time at Princeton will be invaluable for a future research career."

Adele is setting off on a round-the-world adventure for the next year with her partner, Morgan, and eight month old son, Griffin. She plans to return to the Australian National University after one year of travel to continue her research on Southern Ocean dynamics. ■

AOS & CICS News

Congratulations to **Geeta Persad** who successfully defended her Ph.D. Thesis "Climate Implications of the Heterogeneity of Anthropogenic Aerosol Forcing" on May 9, 2016.

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Congratulations to **Junyi Chai** who successfully defended his Ph.D. Thesis "Understanding Geostrophic Turbulence in a Hierarchy of Models" on June 21, 2016.

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Congratulations to AOS Graduate Student **Aaron Match** who has been awarded a NSF Fellowship.

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Congratulations to AOS Graduate Student **Michelle Frazer** who has been awarded a PEI-STEP Fellowship.

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Congratulations to AOS Graduate Student **Spencer Clark** who has been awarded a NDSEG Fellowship.

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Congratulations to AOS Graduate Student **Anna Trugman** who has been awarded a 2016 Walbridge Fund Graduate Award.

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Congratulations to AOS Graduate Student **Spencer Hill** who was selected for the Caltech Foster and Coco Stanback Postdoctoral Fellowship. He will begin the position in the fall and will focus on using idealized models to improve theories of monsoons.

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Anthropogenic Mediterranean Warming Essential Driver for Present and Future Sahel Rainfall

A new paper led by AOS Postdoctoral Research Associate **Jongyeon Park** emphasizes the role of the Mediterranean Sea as the most critical pathway of the greenhouse gas impact on West African monsoon rainfall in recent and future warming periods. The study was published recently in *Nature Climate Change*.

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Climate Impacts on Sea Turtle Breeding Phenology in Greece and Associated Foraging Habitats in the Wider Mediterranean Region

Sea turtles are vulnerable to climate change impacts in both their terrestrial (nesting beach) and oceanic habitats. Through a combination of close examination of past and current data and their projections of future climate conditions, the authors of a new study suggest that loggerhead populations will be threatened both at sea and at the nesting beaches if climate continues to warm in the Mediterranean region. The study, published in the journal *PLOS ONE*, was coauthored by **Vincent Saba**, an AOS visiting research collaborator.

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Comment on "The Atlantic Multidecadal Oscillation without a Role for Ocean Circulation"

A Comment on "The Atlantic Multidecadal Oscillation without a role for ocean circulation" was published June 24 in *Science*. AOS Faculty Member **Rong Zhang** is the lead author of the Comment, which disputes the claims of Clement *et al*. (Reports, 16 October 2015, p. 320) regarding the role of ocean dynamics in the Atlantic Multidecadal Oscillation (AMO). AOS Faculty Member **Tom Delworth** is among the Comment's coauthors.

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New Research Examines the North Atlantic Oscillation and its Influence on Global Weather

A recent study led by AOS Faculty Member **Tom Delworth** examines how a natural atmospheric force -- the North Atlantic Oscillation (NAO) -- may be changing currents in the North Atlantic. The study suggests that variations in the NAO can drive multidecadal climate variability over the Northern Hemisphere, including rapid sea ice loss and multidecadal changes in Atlantic tropical storm activity. AOS Faculty Member **Gabriel Vecchi**, **Liping Zhang**, an AOS associate research scholar, and AOS Faculty Member **Rong Zhang** are among the coauthors. The paper was published in *Nature Geoscience*. GFDL Research Highlights

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PEI Awards $840,000 for Research and Teaching in Water and the Environment

A newly launched initiative recognizes the vital role that water plays in virtually all aspects of the environmental sciences ... Southern Ocean observations and modeling (**Sarmiento Group**) is one of seven original research projects which will become the nucleus of a new and Grand Challenges cooperative focused on environmental issues associated with physical, chemical, and biological aspects of oceans and freshwater systems.

http://www.princeton.edu/pei/news/archive/?id=16853

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New Study Underscores Value of Combining Studies for Regional Analyses of Sea Turtle Biology with Large Spatial and Temporal Scales

A new study coauthored by **Vince Saba**, an AOS visiting research collaborator, underscores the value of combining studies for regional analyses of sea turtle biology with large spatial and temporal scales. The lack of a spatial effect or spatio-temporal interaction and the very strong temporal effect reveal that growth rates in West Atlantic hawksbills (long-lived, major consumers in coral reef habitats that move over broad geographic areas -- hundreds to thousands of kilometers) are driven by region-wide forces. The close association of annual growth rates with the Multivariate El Niño Southern Oscillation Index (MEI) and Caribbean SST indicates that the decline in hawksbill growth rates since 1997 is probably an indirect response to increasing temperatures and climate. The study was published recently in *Ecosphere*.

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Knox Taylor Professor of Geosciences George Philander Awarded Honorary Doctor of Marine Science Degree

In early spring, the University of Florida (UF) awarded Knox Taylor Professor of Geosciences **George Philander**, an AOS faculty member, an Honorary Doctor of Marine Science degree. He accepted his award at the University's commencement ceremony held at the USF Sun Dome on Sat. May 7, 2016.

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University Services has launched a **Summer at Princeton University** website: www.princeton.edu/summer. The site hosts information on various campus support services, summer hours, and events on and around campus that may be useful for graduate and undergraduate students who are staying at Princeton this summer.

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Alumni News

Former AOS Graduate Student Ilissa Seroko (Ocko) wins NASA FameLab USA Final Competition

Congratulations go out to a former graduate student of the AOS Program, **Ilissa Seroka (Ocko)**, who recently won the NASA FameLab USA Final competition. (Her presentation can be found at 46:00 ...) FameLab is something like an "American Idol" for early career scientists. Started in the UK in 2005 and sponsored by NASA in the U.S., the communications competition is designed to engage and entertain by breaking down science, technology, and engineering concepts into three minute presentations (with no slides, only a hand-held prop). She represented the U.S. at the Cheltenham Science Festival in June to compete for the international title.

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Ocean Currents Push Phytoplankton and Pollution Around the Globe Faster than Thought

A study co-authored by **James Watson** (Stockholm University), a former AOS postdoctoral researcher, found that ocean currents can carry objects to almost any place on the globe in less than a decade, faster than previously thought. While good for microorganisms such as phytoplankton that are essential to the marine food web, it also means that plastic debris, radioactive particles and virtually any kind of litter can quickly become a problem in areas far from where they originated. The study published recently in the journal *Nature Communications* is led by Bror Jönsson, a Geosciences associate research scholar.

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Arrivals

Andrew Shao arrived in April from the University of Washington. He is working with Bob Hallberg as a postdoctoral research associate.

Kun Gao, a postdoctoral research associate, began working with S.J. Lin, Lucas Harris, and Jan-Huey Chen in early May. Kun comes to Princeton from the University of Rhode Island.

Jong-Yeon Park arrived in early May and comes to Princeton from the Max Planck Institute for Meteorology. He is working with John Dunne as a postdoctoral research associate.

Xiaoqin Yan arrived in late May from George Mason University. Xiaoqin is working with Rong Zhang and Tom Knuston as a postdoctoral research associate.

2016 CICS Summer Interns:
Alyssa Stansfield, from Rutgers University, hosted by Xiaosong Yang; **Keira Barakat Norford**, from Franklin and Marshall College, hosted by John Dunne; **Maryam Abdi-Oskouei**, from University of Iowa, hosted by Vaishali Naik; **Maria Pulido-Velosa** from Florida International University, hosted by John Krasting; **Leonardo Rodriguez Gutierrez**, from University of Illinois, hosted by Sonya Legg; **Alice Nadeau**, from University of Minnesota, hosted by Jasmin John and John Dunne; **Claire Miles**, from Stanford University, hosted by Liwei Jia; **Aria Alexander**, from Princeton University, hosted by Gabriel Vecchi; **Miguel Moravec**, from Vanderbilt University, hosted by Seth Underwood.

2016 PEI Summer Undergraduates working with the Sarmiento Group:
James Stadler (Haverford) who is working with Adele Morrison; **Keo Chan** (Princeton) who is working with Rebecca Asch; **Charles Copeland** (Princeton) who is working with Alison Gray and Carolina Dufour; **Erin McCabe** (Princeton) who is working with Keith Rodgers, Alison Gray and Ping Zhai; and **Kate Begland** (Princeton) who is working with Alison Gray and Carolina Dufour.

Andrew Hazelton arrived in mid-June to work with S.J. Lin, Lucas Harris, and Jan-Huey Chen as a postdoctoral research associate. He comes to Princeton from Florida State University.

Sina Khani will be working remotely (University of Chicago) with Alistair Adcroft and former AOS Visiting Postdoctoral Research Associate Malte Jansen, an assistant professor at the University of Chicago, as a postdoctoral research associate. He comes to Princeton from the École Polytechnique Fédérale de Lausanne (EPFL).

Nathaniel Tarshish will arrive in mid-July, from Brown University, to work with Jorge Sarmiento and Carolina Dufour as a research specialist.

Catherine (Kit) Chandler will be joining the AOS Program in mid-July as our new business manager. She comes to us from the Office of the Dean of the Graduate School here at Princeton.

Nadir Jeevanjee will arrive in early August from the University of California, Berkeley. He will be working with Leo Donner as a postdoctoral research associate.

Welcome Back!

Pablo Zurita-Gotor, a returning faculty member from the Universidad Complutense de Madrid, arrived in late June. Pablo will be working with Isaac Held throughout the summer.

Gabriel Lau, a former faculty member and GFDL Scientist of 35 years, will arrive in early August to work with his AOS/GFDL colleagues through mid-September.

Departures

Adrien Deroubaix, an AOS postdoctoral research associate, returned to his former lab, Le Laboratoire de Météorologie Dynamique (LMD)/École Polytechnique, in early June.

At the end of June, **Wei Zhang**, an AOS visiting associate research scholar, will be heading to the University of Iowa to work with Gabriele Villarini, a former CEE lecturer and research associate. Wei will continue his collaboration with AOS Faculty Member Gabriel Vecchi.

Henri Drake, a research specialist in the Sarmiento Group, has accepted an offer of admission to the MIT/WHOI Joint Program in Oceanography. He will be leaving the AOS Program at the end of July.

Jingyi Li, an AOS postdoctoral research associate, will be returning to China in mid-August.

AOS Postdoctoral Research Associate **Adele Morrison**, a member of the Sarmiento Group, will be leaving the Program at the end of August.

AOS Associate Research Scholar **Tra Dinh**, a member of the Fueglistaler Group, will be working remotely from California for the summer months. She has accepted a faculty position at the University of Auckland, New Zealand.

Birth Announcements

Congratulations to AOS Climate Prediction Specialist **Lakshmi Krishnamurthy** and her husband, Venkata, on their birth of their son, Jaishnav, on April 16, 2016.

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