



AOS & CICS Newsletter

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Carter Sets Sail on Southern Ocean

“Bracing, exhausting, terrifying, exhilarating, annoying... the Southern Ocean has a unique flavor of hospitality that can be any or all of these things, depending on how tired you are and what exactly you are trying to do.” – Brendan Carter

On March 20th, 2014, AOS Associate Research Scholar Brendan Carter, and Professor Lynne Talley (Scripps Institution of Oceanography), along with 27 fellow scientists from around the globe, embarked on a 45-day journey from Hobart, Tasmania to Papeete, Tahiti for the first deployment of bio-Argo floats far south of New Zealand. The ship carried the first set of fully-equipped Southern Ocean biogeochemical profiling floats, measuring oxygen, nitrate, fluorescence and backscatter, and -- the newest addition -- pH. The field campaign is part of the US Repeat Hydrography, P16S, 2014 under the auspices of GO-SHIP and sponsored by the US Climate Variability and Predictability Program (CLIVAR).



R/V Nathaniel B. Palmer (Photo courtesy of Nick Huynh, UC, Santa Barbara)

As chief scientists on the icebreaker R/V Nathaniel B. Palmer, Chief Scientist Talley and Co-chief Carter played a lead role in what promises to be a major new

observational initiative that will give the scientific community unprecedented year-round coverage of biogeochemistry in the Southern Ocean, the least observed and least understood region of the world’s oceans. “We are looking for the chemical and physical imprints of global change,” Carter said. One main goal is to observe the Southern Ocean’s important uptake of excess heat and CO₂, and directly measure the ocean warming and acidification resulting from mankind’s emissions.

Oceanographic cruises are not new to Carter who worked at sea as a chemistry technician while working on his doctoral dissertation. In his role as co-chief scientist, however, he took on the added responsibility of making sure that “great science gets done, the data gets collected and reported, and everything goes smoothly...” By all accounts, he and his cruisemates accomplished what they set out to do, despite the challenging conditions of the Southern Ocean.

“The waves are always big in the Southern Ocean in my experience—even in calm weather—but I’ve lost count of the number of low pressure systems that have passed overheard on their eastward march in the prevailing winds,” Carter wrote in a blog post while at sea. “Each day, I’ve gotten up to see a weather report laden with the tightly spiraling isobars indicating high winds and the big red blotches suggesting large waves. Somewhere in the middle of it is a forlorn set of dots indicating where we’ll be....”

Measuring the Southern Ocean, despite the unique challenges the chronically under-sampled region presents, is important. A modeling study by Carter’s advisor, AOS Director Jorge Sarmiento, underscores the

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

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TigerTransit/Shuttle Services
Operating Schedule:
<<http://www.princeton.edu/transportation/troutes/ForrestalSummer2014.pdf>>.



Rough Seas of the Southern Ocean (Photo courtesy of Nick Huynh, UC, Santa Barbara)

importance of the region for global ecosystems. It found that if you prevented nutrients from upwelling in the Southern Ocean, then the biological productivity of the rest of the world (i.e. the ocean outside of the Southern Ocean) would decrease by 75%. The Southern Ocean is also an important piece of Earth's changing climate. About 70% of the ocean heat uptake (of which the ocean accounts for 93% of the planetary total) and about half of the uptake of the carbon emitted by mankind (of which the ocean absorbs about 25%) happen in the Southern Ocean.

According to Talley and Carter, the stations that the researchers occupied along 150°W are repeats of two earlier transects. This set of stations was occupied in 1991 as part of that decades' global observing program WOCE, and then again in 2005 as part of the international repeat hydrography program, now called GO-SHIP, which crisscrosses all of the oceans. They analyzed about 19 different properties in the water collected from the rosette water sampler, and collected vertical profiles of conductivity, temperature, oxygen (2 sensors), and pressure (on the CTD), velocity from a Lowered Acoustic Doppler Current Profiler (LADCP), transmittance, fluorescence, and temperature microstructure from a new program ("chi-pod") for U.S. GO-SHIP. The goal was to observe changes over the decades in the ocean's heat, salt, nutrient, oxygen, and carbon content.

The biogeochemical Argo floats deployed and calibrated on this cruise will also allow Carter and others to continue to monitor the Southern Ocean between the once-a-decade expeditions. "These floats are revolutionary and the Southern Ocean promises to hold many keys to understanding the science behind all of this as well as understanding the impact of climate change," Sarmiento said.

Notwithstanding the rough conditions and being pummeled by an endless series of low pressure systems, at the cruise's end on May 5th in Tahiti, Talley, Carter, and their fellow scientists deployed 12 profiling biogeochemical floats –profiling every 10 days to 2000 m depth, deployed 30 surface drifters, made daily biogeochemical observations for NASA ocean color satellite cal/val, and completed 90 stations with physical and chemical measurements from surface to bottom. They sampled or deployed instruments for approximately 18 different principal investigators, supported by NSF funding, NOAA and NASA.



Rosette CTD Package (Photo courtesy of Steve Howell, University of Hawaii)

"Expeditions like this one are a critical component of modern oceanographic research," Carter said. "The data retrieved is mined directly and used to refine and test our climate models; the boats serve as platforms for calibrating and prototyping new measurement techniques; and the research environments on the expeditions train, inspire, and support new generations of oceanographic researchers. Personally, I arrived back on land exhausted by the work and overflowing with news ideas for research directions and ways to improve our capacity to do great climate research with finite resources." ■

Lab Review Gives GFDL Opportunity to Shine

Contributed by Maria Setzer, GFDL Communications Director

A collective sigh of relief could be heard, as GFDL scientists and many of their CICS colleagues successfully concluded a lab review on May 22, 2014. The comprehensive review of GFDL's research garnered very favorable feedback from a

panel of experts who came from institutions such as NASA, Pacific Northwest National Laboratory, and Scripps Institution of Oceanography, to evaluate the quality and relevance of research conducted at GFDL.

GFDL scientists, and CICS and UCAR collaborators, presented an overview of ongoing research efforts and accomplishments since the last review in 2009, and the eight members of the expert review panel offered feedback. A preliminary assessment was generally very positive, including the review team's observation, "GFDL's cooperative arrangement with Princeton University (CICS) appears to be a great success, perhaps one of the best examples of a government-university partnership in the United States."

Over the course of two and a half days, presentations were categorized into three themes: Modeling the Earth System; Climate Variability and Change: Understanding and Prediction; and Chemistry, Carbon, Ecosystems, and Climate. The first theme, "Modeling the Earth System," showcased recent progress toward enhancing model resolution and representing key climate processes. New modeling capabilities were featured, including GFDL's high-resolution trunk model with advanced aerosol/cloud physics; the formulation of two-way nesting and stretched grid dynamical cores; and the incorporation of ice sheet dynamics into fully coupled models. CICS scientists Alistair Adcroft and Olga Sergienko were among the presenters in this session.

The second theme, "Climate Variability and Change: Understanding and Prediction," featured research projects that used observational analyses and model experimentation to develop a predictive understanding of the global climate system, on time scales from seasonal to centennial. Trends in surface and atmospheric temperatures, large-scale tropical climate change, ENSO, hurricane activity, drought, ocean circulation, snow cover, and sea ice changes were among the topics covered. This theme included a presentation by CICS postdoctoral researcher Sarah Kapnick.

The third theme, "Chemistry, Carbon, Ecosystems, and Climate," focused on chemical and ecological processes that influence, or are influenced by, climate.

Presentations underscored the breadth of GFDL research in this area. This session highlighted studies that harness advances in earth system modeling and climate understanding to gain new insights into interactions between climate and chemical/ecological systems. For example, recent findings that help explain how climate-sensitive patterns of aerosol production, transport and removal profoundly impact regional air quality, were presented. Other talks showed how projected changes in ocean temperature, stratification, and acidity will impact ocean ecosystems and the marine resources they support. CICS scientists Jingqiu Mao and Elena Shevliakova presented their work in this session.

The first and second themes concluded with poster sessions featuring related work. In total, twenty-three posters covered topics such as ice microphysics, the impact of soil moisture-atmosphere interactions on climate variability, and spectral bin microphysics within GFDL's cloud-resolving models. CICS postdoctoral researchers Pu Lin, Xi Chen, Nir Benmoshe, Kara Sulia, Liping Zhang, and Malte Jansen all presented posters highlighting their research.

CICS participated in the lab review in several other ways. A group of graduate students met with members of the review panel to discuss their experiences in the graduate program. In a closed session, CICS Director, Jorge Sarmiento, and Associate Director, Sonya Legg, discussed the cooperative institute in detail with the review panel. CICS climate modeler, Sergey Malyshev, was part of a small group of scientists who shared their insights informally during another meeting with the review panel.

The lab review was video-streamed live for remote viewers. About 60 people watched the review remotely. Many were at NOAA headquarters, and quite a few were at Princeton University and other academic institutions around the world.

Scientific reviews are conducted every four years for each laboratory in NOAA's Office of Oceanic and Atmospheric Research. These reviews help to strategically position laboratories in their planning of future science and are intended to ensure that the research is linked to the NOAA's strategic plan, and remains

relevant to the agency's research mission and priorities. ■

Frölicher Recipient of 2014 CMI Best Paper Award

During an evening reception at the Carbon Mitigation Initiative (CMI) 13th Annual Meeting on April 15th, Ellen Williams, chief scientist at BP, awarded the 2014 CMI Best Paper Award to Thomas Frölicher, an AOS collaborator and former postdoctoral research fellow in the AOS Program who is currently an ETH researcher. Sarah Batterman, a postdoctoral research associate in Ecology and Evolutionary Biology (EEB), was also a recipient of the 2014 Award.



L to R: Thomas Frölicher, recipient of 2014 CMI Best Paper Award for Postdoctoral Research Fellows; Ellen Williams, chief scientist at BP; and Sarah Batterman, also a recipient of the 2014 CMI Best Paper Award for Postdoctoral Research Fellows (Photo: Frank Wojciechowski)

Frölicher's paper "Continued global warming after CO₂ stoppage," published in *Nature Climate Change* in January of 2014, was selected for its original contributions using new model calculations to show that even if carbon dioxide emissions come to a sudden halt, the Earth's atmosphere could continue to warm for hundreds of years.

The research is selected based on its contribution to one of CMI's core areas of research: climate science, carbon capture and sequestration, renewable energy, efficient energy use, or carbon policy. According to the CMI website, "the spirit of the program is to recognize and reward CMI-funded work." Papers are judged for their quality and impact on the carbon mitigation community.

"This award represents a well-deserved acknowledgement of the high caliber of Thomas's research, not only in the carbon mitigation community but in the scientific community as a whole," AOS Director Jorge Sarmiento said. "He has made and will continue to make significant and sustained contributions in the research literature."

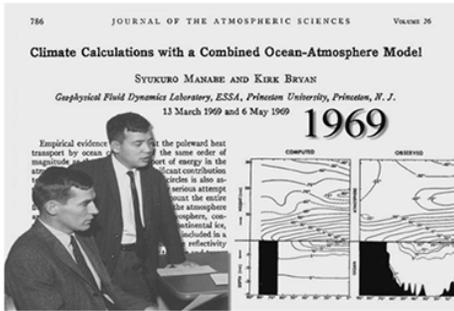
"It is a great honor to have won the award and I am very grateful to CMI for affording me this much-appreciated recognition," Frölicher said.

The two-day meeting brought together more than 90 participants to discuss CMI's most recent initiatives in the areas of low carbon energy and carbon storage, and policy. Attendees from the CMI community included Princeton faculty and students, colleagues from BP, GFDL, Harvard's Energy Technology Innovation Policy Program (ETIP), Rutgers Energy Institute, the U.S. Department of Energy, and Resources for the Future.

Formed in 2000 and led by Co-Directors Stephen Pacala and Robert Socolow, CMI aims to lead the way to a compelling and sustainable solution of the carbon and climate change problem. The group includes over 70 researchers who have published over 700 peer-reviewed articles. For additional information about CMI's current research, visit their website <http://cmi.princeton.edu>. ■

SSTs Immortalized on 2014 Global Forever Stamp

If you asked AOS Senior Scientists Syukuro (Suki) Manabe and Kirk Bryan back in 1969, how their first-ever coupled atmosphere-ocean general circulation model (GCM) might be remembered some forty years later, it is doubtful that the answer would have been 'immortalized on a postage stamp.' Yet that is exactly what happened on Earth Day 2014.



L to R: Senior Scientists Kirk Bryan and Suki Manabe, (Photo courtesy of: GFDL)

An image derived from a modern day descendent of the first NOAA-GFDL couple climate model used to study climate took its place in history, as a 2014 Forever® international rate stamp, at a first-day-of-issue dedication ceremony on April 22, 2014 in the U.S. Department of Energy Forrestal Plaza in Washington, D.C.

The Global: Sea Surface Temperatures Forever Stamp image – one frame in a 1,460-frame (or four-year) animation created from the output of a state-of-the-art computer model of Earth’s climate by a team of researchers at GFDL, many of whom had worked with Manabe and Bryan over the years – is based on a snapshot from a single July day. It shows the Earth and North America at the center and parts of South America, Asia and Europe just visible on the edges, surrounded by vivid bands of color throughout the oceans. According to GFDL Research Meteorologist Keith Dixon, though the model spans the full three-dimensional atmosphere and the global ocean to depths of more than three miles, the image focuses on ocean surface temperatures. Yet, about a million individual model-simulated SST values were used to make the vibrant image.



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Art Director/Designer: William J. Gicker

To understand climate trends, both past and future, researchers must first grasp the pattern of seas surface temperatures. Delworth notes that sea surface

temperatures are important to model because they influence weather around the planet, sometimes for months and even years. The world-class climate model uses general conditions in tandem with the laws of physics to mimic the climate’s behavior.

The global climate model used to produce the stamp’s image is far more sophisticated than the first GCM of Manabe and Bryan’s day, according to Dixon. Major advances in climate modeling result in a more physically realistic simulation of processes taking place in the three-dimensional atmosphere, ocean, and land. The creation of the world’s first GCM, however, remains a noteworthy accomplishment. A 2006 article, appearing in the journal *Nature*, titled “Milestones in Scientific Computing” cited the original climate model of Manabe and Bryan, who published their original findings in 1969, among the breakthroughs that have had a profound effect on our lives.

“It is hard to believe that our old work would evolve into such a beautiful stamp,” Manabe said.

The design of the 2014 Global Forever Stamp was done as collaboration between the U.S. Postal Service, GFDL, NOAA’s Earth System Research Laboratory, and NOAA’s Science On a Sphere. For detailed information about how the stamp’s artwork was created, see: <http://www.gfdl.noaa.gov/2014-forever-international-stamp>. ■

Scientists Captivate Audience at World Science Festival

Contributed by Maria Setzer, GFDL Communications Director

In a tent packed with curious children and their parents and grandparents, CICS postdoctoral researcher Sarah Kapnick captivated the audience at the World Science Festival in New York City recently. NOAA’s Science On a Sphere (SOS) was a feature attraction at the festival, and Sarah used animations on the interactive sphere to explain the role of sea surface temperature in climate, and to talk about how hurricanes are studied on a variety of time scales. She answered dozens of questions from an audience eager to learn from an expert. Sarah’s talk even

inspired one young member of the audience to ask how he could pursue a career at NOAA when he grows up!



GFDL’s John Krasting gave a “tour” across time scales of weather and climate at the World Science Festival in NYC.

GFDL climate scientist John Krasting also volunteered to participate, and the crowds were equally large and inquisitive for his talk. John enthralled the crowd with a “tour” across time scales of weather and climate. He used current weather and recent weather events to explain some of the drivers of climate, and to talk about projections of climate change from GFDL’s CM3 climate model. On June 1, when John gave his talk, approximately 175,000 people attended the World Science Festival.



NOAA’s Science On a Sphere installation at the World Science Festival

Held annually in New York City, the festival ran from May 28th through June 1st this year. Nearly 2,000 people visited SOS over the course of the five-day event. The theme for NOAA’s exhibit, including the SOS installation in a tent, was, “Eye of the Storm, The Science of Weather”. The World Science Festival is a production of the Science Festival Foundation, a non-profit organization headquartered in New York City. The Foundation’s mission is to

"cultivate a general public informed by science, inspired by its wonder, convinced of its value, and prepared to engage with its implications for the future." ■

Jucker 2014 Art of Science Finalist

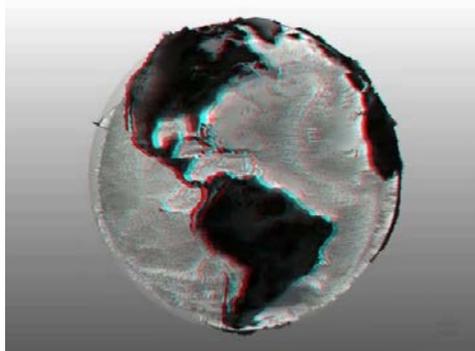


AOS Associate Research Scholar Martin Jucker

For the second straight year, AOS Associate Research Scholar Martin Jucker has emerged from the 2014 Art of Science Competition as a finalist – only this year for his video entry *Fly Me*. Jucker took first prize in last year's competition for his winning visualization, of wind circling the earth, *East-West, West-East*.

The Art of Science exhibition explores the interplay between science and art and consists of images produced during the course of scientific inquiry that have aesthetic merit. For the first time in the exhibition's seven year history, a video competition was added to the traditional still image competition. Awards were announced at the exhibit's opening reception on May 8th in the Friend Center Atrium.

Drawing ooohs and aahs from visitors to the exhibit, Jucker's *Fly Me* video appeared to be a three-dimensional crowd favorite. He describes his video entry as "Flight over Earth's solid surface (without water and atmosphere) on a latitude-longitude grid of 1/6 degree resolution (~11 miles at the equator). This is a typical grid size for high-resolution climate models. But of course, vertical topography is highly exaggerated. This movie is best seen with blue-red 3D glasses!"



Fly Me, Martin Jucker (AOS)

An expert in computer animations, Jucker is the author of a newly published paper that describes the visualization package he developed and used for his images and movies. Jucker developed a freely available software package for ParaView — an open-source software package that is one of the most popular programs for visualizing scientific data — to create computer models that look like the Earth's actual atmosphere. The software package calculates the true spatial dimensions and curvature of Earth's atmosphere.

The paper was published on June 3 in the Journal of Open Research Software. Jucker's software, the package, known as "pv_atmos," is free and available for download at: https://github.com/mjucker/pv_atmos.

Seven Students Accept Offers of Admission

In a year with a record number of applications to the AOS Program - 63 in all - seven graduate students accepted offers of admission to the Program for the 2014-2015 academic year. This number of acceptances matches the last previous highs in AY 2011-2012 and AY 1979-1980, respectively.

As in recent years, the male-female ratio of the admitted students is nearly evenly split. Four are international students and three are from the U.S. The students hail from Cedarville University, Cornell University, Imperial College, National Taiwan University, the National University of Singapore, and the University of Illinois.

"We continue to attract talented students from across the country and around the

globe who possess a vast intellectual curiosity," AOS Director Jorge Sarmiento said. "I look forward to welcoming this exceedingly accomplished group in September."

As in past years, Sarmiento noted that the admissions process was both rigorous and thorough. "I am immensely grateful to our faculty who work tirelessly throughout this process, in particular Isaac Held, our Director of Graduate Studies, and Graduate Work Committee Members Stephan Fueglistaler and Larry Horowitz," Sarmiento said.

A new student orientation is being planned for the early fall. ■

2nd Annual AOS Program Workshop Planned for Fall 2014

The "Ice in the Climate System" workshop is scheduled for September 3rd through September 5th, 2014 and will be held at Sayre Hall and GFDL on the Forrestal Campus. According to Graduate Students Junyi Chai, Anna FitzMaurice, Jeffrey Strong, and Hannah Zanoski, members of the Workshop Planning Committee, the workshop will focus on the role of the cryosphere in climate science as understood through observations and models across varying spatial and temporal scales.

Invited speakers Kyle Armour (MIT-- Modeling/Sea Ice/Current Climate Variability), Natalya Gomez (NYU -- Theory/Ice Sheets/Paleoclimate), and Valentina Radic (UBC -- Observations/Glaciers/Future Climate Change) are confirmed for the three-day event. The workshop will follow a similar format as last fall's event with each speaker presenting a tutorial and accompanying seminar on their specific focus in the cryosphere and in time, participating in small group discussion sessions with AOS students and postdocs, and presenting a plenary lecture on his or her current research to the AOS/GFDL community.

Throughout the summer months, the Planning Committee will be finalizing the agenda and planning the logistical details.

Any questions relating to the Workshop may be directed to the Committee. ■

AOS/GFDL Scientists Lend their Expertise to Ocean Fun Days 2014

Scientific inquiry and fun went hand-in-hand at the eleventh annual celebration of Ocean Fun Days at the Jersey Shore. Seven Scientists from AOS and GFDL spent the weekend of May 17th and 18th alongside of children and families as part of the yearly event. Sponsored by the New Jersey Sea Grant Consortium (NJS GC) in coordination with the state Department of Environmental Protection, Ocean Fun Days, an annual environmental public education event, provided interactive activities designed to promote the wise use of New Jersey's marine and coastal resources.



L to R: Sonya Legg, Anna FitzMaurice, Hannah Zanolowski, and Ivy Frenger (AOS)

With a record number of exhibitors, the 2014 family-friendly event was held at two locations: Island Beach State Park and Sandy Hook. Shaped by storms and tides, Island Beach State Park is a narrow barrier island stretching for 10 miles between the ocean and Barnegat Bay. It is one of New Jersey's last significant remnants of a barrier island ecosystem and is one of the few remaining undeveloped barrier beaches on the north Atlantic coast. The historic Fort Hancock section of Sandy Hook is home to NJS GC headquarters.

Activities at both locations included seining (net fishing), coastal crafts, an energy-saving scavenger hunt, youth fishing clinics, face painting, touch tanks, a student science fair competition, and the NJS GC's fiddler crab races. A clamming the bay demonstration was also held at

Island Beach State Park. The Sandy Hook location also included guided tours of many of Sandy Hook's historic sites and an open house at the NOAA/James J. Howard Marine Sciences Laboratory.



L to R: Todd Mooring (AOS) and Philip Pika (ETH Zurich)

Among the educational displays and exhibits designed to "celebrate the wonders of the Jersey Shore," was an exhibit manned by AOS and GFDL scientists demonstrating how temperature and salinity drive ocean currents and another demonstrating oceanic acidification commonly referred to as "the other CO₂ problem." According to AOS Faculty Member Sonya Legg, who led the AOS/GFDL outreach effort, "the kids enjoyed stirring together salty and fresh water, lifting the lock to release gravity currents, and blowing bubbles into a glass of water to make it acidic."

"It was a lot of fun interacting with the kids and watching their faces light up when they saw some of the results of the demonstrations," AOS Graduate Student Hannah Zanolowski said. "Most were too young to understand the concepts, but they were still delighted to be able to blow bubbles into the cups with pH indicator or stir the dye and remove the barriers in the density tank. Others were totally disgusted and fascinated when they found out that chalk is made up of the shells of microscopic Dead Sea creatures, leading to all sorts of hilarious shocked and amazed expressions."

Are You New to GFDL/AOS?

"GFDL Orientation Session for New Arrivals" on Wednesday, July 2nd from 1:30 pm to 5:15 pm in the Smagorinsky Room. RSVP: <thai.truong@noaa.gov>



GFDL Oceanographer Marian Westley

"We tried to make the demonstrations as hands on as possible for them, and I think that tactile experience will be a great aid to their memory when they eventually do learn about these things in school," Zanolowski added.

The children, mostly school-aged, were not the only ones who enjoyed the two-day event; the scientists enjoyed fielding questions not only from the kids, but also from inquisitive adults. "Often the reactions of the adults were much the same as their kids', and I think many of them learned quite a bit as well. It goes to show that learning occurs at all ages, and even though many of these events are designed with children in mind, we are reaching out to adults as well," said Zanolowski.

Legg noted that the researchers also enjoyed meeting people from other institutions, particularly the New Jersey Sea Grant Consortium who organized the event.

In addition to Legg and Zanolowski, other scientists who volunteered at the event include: Anna Fitz Maurice (AOS), Ivy Frenger (AOS), Todd Mooring (AOS), Philip Pika (AOS intern/ETH Zurich), and Marian Westley (GFDL).

The New Jersey Sea Grant Consortium is an affiliation of colleges, universities and other groups dedicated to advancing knowledge and stewardship of New Jersey's marine and coastal environment. NJS GC meets its mission through its innovative research, education and outreach programs. Sponsoring partners of Ocean Fun Days 2014 include founding sponsor New Jersey Natural Gas, the Asbury Park Press, NOAA, and the DEP's Division of Parks and Forestry. ■

GFDLEA Annual 5K Race

Sunny skies and pleasant temperatures greeted 30 racers, on Tuesday, May 6th, who turned out to participate in the GFDLEA Annual 5K charity event benefiting Doctors without Borders, a humanitarian relief organization that provides lifesaving medical care around the world. The event, which has become somewhat of a tradition on the Forrestal Campus, attracted walkers and runners from both GFDL and AOS and raised vital funds and awareness for the cause.

The winners of the 5K event were female walker Cindy Kandell, male walker Kirk Bryan, female runner Hannah Zanowski, and male runner Gabe Vecchi.



L to R: Kirk Bryan and Cindy Kandell (AOS)

The event preceded this year's first GFDLEA Lunchtime Cookout, organized by the GFDLEA Executive Board.



L to R: Rich Gudgel (GFDL) and Hannah Zanowski (AOS)



L to R: Maja and Dad Gabe Vecchi (GFDL/AOS)

Thank you to Rich Gudgel, who organized the 5K; timer Tim Marchok; judges John Dunne, Tom Knutson, Zhi Liang, Tim Marchok, Vaishali Naik, and Laura Rossi; photographer Will Cooke; and Keith Dixon, who designed the event's logo years ago and arranged the participant gift. They, along with GFDLEA Executive Board, provided a fun-filled day for all. ■

AOS & CICS Research in Action

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

Associate Research Scholar Martin Jucker will be leaving the AOS Program in September in the direction of Manhattan, to join the Courant Institute at New York University. Martin will be working with former AOS graduate student Ed Gerber on the dynamic and radiative effects of water vapor in the stratosphere.

Martin arrived in Princeton in April 2011, after receiving his Ph.D. in plasma physics at the Swiss Federal Institute of Technology of Lausanne, Switzerland. Concentrating on stratospheric dynamics, Martin's work at AOS allowed him to derive a simple yet powerful stratospheric setup for idealized atmospheric models. He studied the seasonal cycle of the tropical tropopause layer temperature, the occurrence of sudden stratospheric warmings, and, more generally, stratosphere-troposphere interactions.



Associate Research Scholar Martin Jucker

In addition to the purely scientific activity, Martin developed software for three-dimensional visualization. Besides creating unique pictures and movies for his talks and posters, he won Princeton University's 2013 Art of Science competition with one of the pictures resulting from this software applied to his science.

"Martin elevated climate visualizations to stratospheric heights," said AOS Faculty Member Stephan Fueglistaler who collaborates with Jucker.

"Working at AOS was extremely stimulating as there is a great diversity of subjects being investigated - any question one might have, there's a specialist to ask," Jucker said. "But also besides purely scientific activity, Princeton University's tradition in political science can be felt at AOS; there is a lot of consciousness of the responsibility towards the public that comes with conducting research, the importance of communicating science correctly, and the intricate relations between science and politics." ■

AOS & CICS News

Outreach Opportunity

Climate Voices -- Science Speakers Network was launched in the spring as a new initiative of the University Corporation for Atmospheric Research (UCAR) and the United Nations Foundation. The goal is to bring scientists and their local communities together for real dialogue on climate science that speaks to citizens' current and future well-being and responsibility as members of a community and democracy.

If you are interested in volunteering for this network, please go to <http://climatevoices.org/> and create a profile.

GFDL Poster Expo Wednesday, July 16th

GFDL is hosting a Poster Expo on Wednesday, July 16 from 10am-1pm. The Expo is an opportunity for GFDL/AOS/CICS scientists to share their research with colleagues and current summer interns being hosted by GFDL/AOS/CICS.

New Paper Explores an Observing System Simulation for Southern Ocean Carbon Dioxide Uptake

Graduate Student **Joe Majkut** is the lead author of a new study that reviews current estimates of the CO₂ uptake in the Southern Ocean and projections of its response to climate change. The authors show, via an observational system simulation experiment, that float-based sampling provides a significant opportunity for measuring the mean fluxes and monitoring the mean uptake over decadal scales. AOS Associate Research Oceanographer **Brendan Carter**, AOS Collaborator **Thomas Frölicher** (ETH Zurich), **Carolina Dufour**, an AOS postdoctoral research associate, and AOS Research Scholar **Keith Rodgers** are coauthors on the study along with AOS Director **Jorge Sarmiento**. The paper, "An Observing System Simulation for Southern Ocean Carbon Dioxide Uptake" was published on June 2 in the Royal Society journal Philosophical Transactions of the Royal Society A and can be found [here](#).

Silicon dissolved in seawater is a vital nutrient for siliceous organisms, such as the diatoms that play an important role in naturally sequestering carbon within the ocean. A recent study, led by AOS Postdoctoral Research Fellow **Greg de Souza**, combines recent, novel observations of the stable isotope composition of silicon dissolved in seawater with a model simulation of the ocean's silicon cycle. The authors demonstrate that the observed silicon isotope distribution in the ocean reflects the importance of the Southern Ocean, the

circumpolar ocean surrounding Antarctica, for the cycling of silicon in the sea.

Access the study here:

<http://www.sciencedirect.com/science/article/pii/S0012821X14002805>.

Recent Study Provides a New Estimate for Eddy Scale

AOS Graduate Student **Junyi Chai** is the lead author of a recent study that provides a new estimate for eddy scale. The results of this study fill in the gap between studies that assume the Rossby deformation radius is a good estimate for the eddy scale and studies that assume an inverse energy cascade is relevant. Former AOS Faculty Member **Geoff Vallis** (University of Exeter) coauthors the study. The study can be found [here](#).

Black carbon (BC) is an air pollutant that affects climate change, air quality, and human health. A recent study, led by AOS Graduate Student **Zhaoyi Shen**, evaluates the transpacific transport of BC during HIPPO-3. The authors find that biomass burning from Southeast Asia is the major source of BC over the North Pacific during the March mission of HIPPO-3, while more than 90% of BC comes from anthropogenic sources in East Asia during the April mission. The paper, "Analysis of Transpacific Transport of Black Carbon during HIPPO-3: Implications for Black Carbon Aging," was recently published in Atmospheric Chemistry and Physics and can be found [here](#).

Congratulations to AOS Graduate Students **Jane Baldwin** and **Nicholas Lutsko** who have been awarded NSF Graduate Fellowships.

Xin Rong Chua, an incoming AOS graduate student, was awarded Singapore's National Research Foundation (NRF) Ph.D. Scholarship for four years.

AOS Alumna Featured in Nature

Former AOS Graduate Student **Tracey Holloway** was featured in *Nature* in April discussing her plans to turn a network for female researchers into a non-profit organization.

Perseverance and Support Play Key Roles in Women's Success in Stem

Women from across Princeton University's science and engineering departments -- including the AOS Program -- gathered to discuss and find solutions to the challenges that female scientists face during the March 29 Women in STEM symposium. The event included a keynote address by Emily Carter, Princeton's Gerhard R. Andlinger Professor in Energy and the Environment, as well as a panel discussion with women in various stages of their scientific careers, from undergraduate students to administrators. [full story](#)

Congratulations to our GFDL Colleagues who were elected to the 2014 GFDLEA Board:

President: Lucas Harris
Vice President: Dan Gall
Treasurer: Seth Underwood
Secretary: Marian Westley
Membership: Kenneth Nock
Board Members: Robbie Toggweiler, Dan Schwarzkopf, Erker Baysal, and Dave Skahn

AOS and GFDL Scientists Reach Out to Girls at Young Women's Conference in Science

AOS and GFDL scientists were among 25 scientists from fields ranging from astrophysics to oceanography to biogeochemistry to robotics who participated in the Young Women's Conference in Science, Technology, Engineering and Mathematics on Friday, March 21st in the Frick Chemistry Laboratory.

An annual event launched in 2001, the conference introduces middle-school and high-school aged girls (in 7th through 10th grades) to women scientists and engineers and the wide breadth of careers available to them in these fields. **Ivy Frenger** (AOS),

Sonya Legg (AOS), Todd Mooring (AOS), Allison Smith (AOS), Desiree Tommasi (GFDL), Marian Westley (GFDL), and Hannah Zanowski (AOS) spent the day with the girls in a variety of formats including, small-group presentations and hands-on demonstrations and activities. Almost 400 young women from 46 schools in New Jersey, New York and Pennsylvania attended the event.

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Arrivals

Hiroyuki Murakami arrived in early April from the International Pacific Research Center (IPRC) at the University of Hawaii. Hiroyuki will be working with Gabe Vecchi as an associate research scholar.

Philip Pika arrived in early April from ETH Zurich. Philip will be joining the Sarmiento Group as an intern.

Yohan Ruprich-Robert arrived in early May from the Centre de Recherche et de Formation Avancee en Calcul Scientifique (CERFACS), France. Yohan will be working with Tom Delworth and Rym Msadek as a postdoctoral research associate.

2014 summer undergraduates:

Jonathan Lin who will be working with Keith Rodgers; **Paul Yi** who will also be working with Keith; **Michelle Tan** who will be working with Rebecca Asch and Hannah Zanowski, and **Bridget Zakrzewski** who will be working with Ivy Frenger; **Emily Chen** who will be working with Adele Morrison and Carolina Dufour.

Summer interns with AOS appointments working over at GFDL: **Marjahn Finlayson**, an undergraduate from Wesleyan University, who will be working with Gabe Vecchi; **Alejandra Sanchez-Franks**, a graduate student from Stony Brook who will be working with Rong Zhang; and **Nathan Serota '14**, who will be working with Elena Shevliakova and Larry Horowitz.

Sarah Schlunegger, one of our incoming graduate students, arrived in early June to work with the Sarmiento Group this summer.

Wei Zhang is arriving in early July from Nanjing University of Information Science

& Technology, where he is a lecturer, to work with Gabe Vecchi.

Welcome Back!

Claudie Beaulieu, a former associate research scholar, returned for a few weeks in June to work with the Sarmiento Group.

Geoff Vallis, a returning faculty member from the University of Exeter and former CICS Associate Director, visited in June and will be dropping by periodically throughout the summer.

Pablo Zurita-Gotor, a returning faculty member from Spain, arrived in early June. Pablo will be working with Geoff Vallis and Isaac Held.

Gabriel Lau, a former faculty member and GFDL scientist of 35 years, arrived in mid-June to work with his AOS/GFDL colleagues for the summer months.

Departures

In late March, Senior Research Specialist **Xiaohua Lin**, who worked with Bob Key for the most of the last decade on the development of the CARINA, PACIFICA, and GLODAPv2 data products, left Princeton to welcome an addition to her family. In the early years, Xiaohua also worked with Leo Oey running models.

Senior Research Assistant **Thomas Flannaghan** returned to the United Kingdom at the end of May. His research focuses on understanding and explaining various aspects of Kelvin wave propagation in the tropical tropopause layer. He is also interested in the response to convective heating in dry GCMs, and the modelling and behavior of equatorial waves in these systems. Thomas will continue to work with Stephan Fueglistaler through the month of August.

Associate Research Scholar **Allison Smith** has accepted a Moore/Sloan Data Science Postdoctoral Fellowship in the eScience Institute at the University of Washington. She will be leaving Princeton in early July. A member of the Sarmiento Group, Allison is interested in the function and distribution of organisms in physically and chemically complex marine ecosystems. She examines how small-scale processes influence large-scale patterns using a combination of laboratory measurements, field

observations, and biophysical and biogeochemical models.

Birth Announcements

Congratulations to former Senior Research Specialist **Xiaohua Lin** and her husband, Weidong, on the birth of their daughter, Ziheng, on May 25, 2014.

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