



AOS & CICS Newsletter

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AOS Welcomes Assistant Professor Stephan Fueglistaler

AOS extends a warm welcome to Geosciences Assistant Professor Stephan Fueglistaler, who joined our Program in early March.



Assistant Professor Stephan Fueglistaler

Fueglistaler most recently served as a NERC Advanced Fellow in the Department of Applied Mathematics and Theoretical Physics at the University of Cambridge, UK. Prior to embarking on a PhD program, he had been working for a software company in the early days of the internet, and he has maintained an avid interest in software engineering. His research interests in atmospheric sciences developed from cloud microphysics to the broader question of the interdependence between the general circulation, atmospheric water vapor and clouds, and their control on climate. Much of his research has focused on detailed analyses of measurements from *in-situ* and remote sensing instruments to deduce the

underlying processes and mechanisms. He hopes to complement these activities in the near future with global climate modeling, and is looking forward to interactions and stimulating discussions. “We are delighted to have Stephan join us; the breadth of his research, experience, and talents will add immeasurably to our Program,” commented AOS Director Jorge Sarmiento.

Fueglistaler holds a Ph.D. from the Institute for Atmospheric and Climate Science (IACETH) at ETH Zurich. ■

Sarmiento Awarded 2009 Roger Revelle Medal

AOS and CICS Director Jorge Sarmiento has been awarded the 2009 Roger Revelle Medal “for his groundbreaking contribution to our understanding of the global carbon cycle and its interaction with climate, especially with regard to the crucial role of the ocean in modulating and controlling this cycle.” The medal



AOS Director Jorge Sarmiento & George J. Magee Professor of Geosciences and Geological Engineering

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

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was presented at the AGU fall meeting honors banquet in San Francisco on December 16th, 2009, with an introduction by Nicolas Gruber, Professor of Environmental Physics at ETH, Zürich, Switzerland, and coauthor of Sarmiento’s *Ocean Biogeochemical Dynamics*.

Established in 1991, the Revelle Medal recognizes “outstanding accomplishments or contributions toward the understanding of the Earth’s atmospheric processes, including its dynamics, chemistry, and radiation; or the role of the atmosphere, atmosphere-ocean coupling, or atmosphere-land coupling in determining the climate, biogeochemical cycles, or other key elements of the integrated climate system.”

“In his career spanning more than 30 years, Jorge has tackled some of the most difficult problems of the Earth’s carbon cycle and its interaction with the climate system, and numerous times has provided insights that have guided research to this date,” Gruber remarked. Combining scientific curiosity, creativity and the willingness to pursue ideas that at first do not seem to work, but yield extraordinary result in the long run, has led to a highly successful scientific career, and made him one of the world’s leaders in carbon cycle research.

Through his research on the oceanic uptake of anthropogenic CO₂, Jorge has done more than, perhaps, anyone else, according to Gruber, to solve the puzzle that Revelle himself formulated together with Hans Suess in their seminal 1957 Tellus paper addressing the fate of human-induced CO₂ emissions and the role of the ocean in this. Among the first to use three-dimensional ocean carbon cycle models to conduct a detailed analysis of the processes that control the oceanic uptake of anthropogenic CO₂ from the atmosphere, Jorge also pioneered the use of such models to assess how this uptake could be affected by global climate change.

Most impressive, however, is Jorge’s breadth of research, which spans a wide range of questions at the interface between climate and the Earth’s climate cycle and the profound impact he has had on his many graduate students and post-graduate coworkers, many of whom who have gone on to distinguished scientific careers of their own. “His mentorship was elemental in helping me to develop my own scientific career,” Gruber noted. Those of us who have been mentored by him “provide an exceptional testimony to the tremendous impact he has had on biogeochemical research.”

Sarmiento’s other honors include election as a fellow of the American Geophysical Union and the American Association for the Advancement of Science. He joins an esteemed group of former Revelle Medal recipients, including AOS Senior Scientist Suki Manabe, who was awarded the medal in 1993, and Professor of Geosciences Michael Bender, who received the award in 2008. ■

AOS Program Joins Princeton in Setting Applications Record

The AOS Program has set a record for graduate students applying for admission, with 54 students vying for a spot for the fall of 2010. This number of applicants represents a 31 percent increase over last year’s record of 41. The number of female student applicants rose 69 percent and international students account for over half of the applicant pool. Since 2006, the number of applicants to the Program has more than doubled.

“We are very pleased with increase and that enthusiasm extends to the quality of the applicant pool as well, commented AOS Director Jorge Sarmiento. “The caliber of the pool was extraordinary, making the selection process all the more difficult. The increase and depth of the applicant pool is a testament to the continued strength our Program.”

In recent years, the Program expanded its outreach efforts to include a revamped website and recruiting efforts by graduate student representatives at professional meetings. For the past two years, Graduate Student Ilissa Ocko has attended the Student Career Fair at the Annual AMS Meeting’s Student Conference, the largest gathering of atmospheric science students in the country.



First year graduate student Sam Potter discusses AOS Program highlights at the 2010 conference.

At the most recent conference in January, she and first year graduate student Sam Potter joined forces in manning a table for the AOS Program. With a poster highlighting the Program, the University, and GFDL as the backdrop, they distributed promotional materials and spent several hours just talking to prospective students. “We received a lot of positive feedback from prospectives,” commented Ocko. “I had a line of people waiting to talk to me at various points during the fair,” she added.



Second year Graduate Student Ilissa Ocko at the 2009 conference

With climate change now widely recognized as the major environmental problem facing the globe, prospective students are drawn to a program that is internationally recognized for its development of models of atmospheric and oceanic circulation and climate, particularly studies related to global warming. “The success of our outreach efforts can be attributed to the fact that GFDL is a world-class modeling center that pioneered the field; the combined expertise and unmatched facilities of AOS and GFDL attract people to our Program

and may account for the rise in applications over recent years,” Sarmiento added.

The Graduate School sent acceptance letters to students in early March.

AOS joins the University in setting a record for students applying for admission. The University received 26,166 applications for the class of 2014, a 19 percent increase over last year. Over the past six years, applications to Princeton have increased by over 91 percent. ■

Ocean and Ice Modelers Converge on Forrestal Campus

In late October, AOS and CICS helped sponsor a meeting held at GFDL which brought together ocean, sea-ice and ice-shelf modelers to discuss the state of global ocean-climate modeling. According to the meeting’s organizer, CICS Scientist Alistair Adcroft, the timing for the meeting seemed apt: most of the modeling centers contributing to the next Intergovernmental Panel on Climate Change (AR5) were nearing completion of their respective model configurations, and are beginning to turn their attention forward to the development of the next generation of models. The purpose of the meeting was to discuss the latest results and progress, exchange ideas, and scope out the future directions in the field.

Meeting sessions included a broad array of topics including: coupled ocean modeling, high resolution modeling, mesoscale and sub-mesoscale parameterization, mixing and small scale parameterization, formulation and numerical methods, reference experiments and datasets. There was particular emphasis on ice-ocean interactions, with full sessions on both sea-ice and ice-shelves. Both topics are seen as important areas of future development that are essential to address societal issues related to climate change and sea-level rise.

By all accounts, the meeting was a tremendous success, providing a forum for discussions of recent results, initiatives, and future directions. Over 70 scientists from the model development community participated in the 2½ day meeting. "Not only did we learn a good deal about where the field is and is heading", said Adcroft, "but I learned a personal lesson: Laura [Rossi] and Anna [Valerio] are brilliant and indispensable; without them the meeting would not have been a success." He also wishes to thank AOS and CICS directors for some financial support for the meeting that came to the rescue in an hour of need.

Many of the presentations from the meeting are available via the CLIVAR website:

<http://www.clivar.org/organization/wgomd/ocmd/ocmd.php> ■

AOS Well Represented at Student-Run Sustainability Conference

IMAGINE a Sustainable World Conference, a student organized conference sponsored by the Princeton High Meadows Sustainability Fund, took place on February 12, 2010 in the Friend Center Convocation Room. According to AOS graduate student Ilissa Ocko, an IMAGINE committee member, the goal of conference was “to bring together a diverse group of knowledgeable people from academia, government, media, and industry in order to encourage conversation and catalyze sustainable action.”



AOS students among over 150 IMAGINE attendees

In attendance, were first year graduate students Sam Potter, Claire Radley, He Wang, and Joe Majkut, along with AOS Director of Graduate Studies Sonya Legg. The conference featured two keynote speakers. Robert Socolow, a Professor of Mechanical and Aerospace Engineering at Princeton, delivered the opening keynote. His current research interests include carbon dioxide capture from fossil fuels and storage in geological formations, nuclear power, energy efficiency in buildings, and the acceleration of deployment of advanced technologies in developing countries. The closing keynote address was given by John S. Lettow who concluded the conference by sharing how Princeton research can impact sustainability through collaborations between government, academia, and industry. Sharing his professional experiences from his start-up, Vorbeck Materials, and discussing how innovation can catalyze environmental sustainability, the conference ended on a hopeful note.



AOS Faculty Member Anand Gnanadesikan (pictured far left) moderating the Climate Change panel

Three panels “Climate Change: Behind the Buzzwords,” moderated by Anand Gnanadesikan, a faculty member in the AOS Program, “Energy: Breaking the Barriers, and Community: Going Green from the Bottom Up” addressed global climate change and the need for effective communication between stakeholders, the motivation behind the current energy movement and the implementation and use of sustainable energy, and community oriented practices and their effectiveness.

The conference, which was attended by over 150, also included a poster session which featured Princeton academic research, sustainability efforts and student environmental groups, as well as local sustainability related community and business efforts.

“The conference was tremendously successful in enabling attendees to learn more about all of the issues involved with environmental sustainability, and giving the speakers opportunities to have enlightening interactions with one another during the discussion panels,” added Ocko. “Considering the huge success of the conference, we are submitting a proposal to hold the conference again next year, but with a new theme.” ■

Photos courtesy of Andrew Hsieh

IPCC Scenarios to Include Mitigation and Adaption Strategies

Contributed by Maria Setzer, GFDL Communications Director

GFDL Scientist Ron Stouffer is coauthor on a paper published in Nature on February 11, 2010, as a "Perspectives" piece. The article describes how model-based scenarios are used in climate change research, and it explains the new multidisciplinary process for developing scenarios for the next assessment reports of the Intergovernmental Panel on Climate Change. The new process will allow for closer collaboration between impacts, adaptation, vulnerability researchers, and climate modelers. This closer collaboration will lead to better uncertainty estimates for future projections, and will reduce the time from development to implementation of future scenarios in climate models. More attention will be paid to adaptation strategies, mitigation options and potentially large feedbacks such as melting of permafrost. The climate research community is responding to society's interest in the last IPCC report, and the clear demand for information that is better suited for policy and planning purposes. Titled, "The Next Generation of Scenarios for Climate Change", the lead author is Richard H. Moss (Joint Global Change Research Institute); 17 other researchers who serve on IPCC committees and who represent other major climate research and modeling centers around the world are also coauthors on this paper.

“This work will have considerable impact on the joint research between GFDL and CICS,” noted CICS Director Jorge Sarmiento.

The pdf is available at:
<http://www.nature.com/nature/journal/v463/n7282/pdf/nature08823.pdf> ■

New Research Data Center planned at Forrestal

Plans have begun for a new University data center on the Forrestal Campus, just north of GFDL. Scheduled to open in late summer 2011, the new facility will house the Terascale Infrastructure for Groundbreaking Research in Engineering and Science Center (TIGRESS), as well as a component of the University's general administrative and academic computing systems.

With the intention of creating a well-balanced set of high-performance computer resources to meet the broad computational requirements of the University research community, TIGRESS will be a welcomed addition to the Forrestal Campus community. The site at Forrestal will enhance the center's ability to partner with GFDL, AOS, and the Princeton Plasma Physics Laboratory (PPPL).

In addition to providing improved electrical and cooling capacity, the design plans for the new facility meet the Leadership in Energy and Environmental Design (LEED) Green Building Rating System's silver rating. The center will occupy approximately 40,000 square feet and will incorporate three components: a computing area; an electrical and mechanical support area; and a small office/support area. Sited to allow for future expansion, the plans include a potential doubling of the square footage. The center is expected to support the University's program needs through at least 2017.

The relocation of TIGRESS was anticipated as part of the University's 10-year Campus Plan. ■

CICS Hot Items

Twice yearly, NOAA's cooperative institutes are asked to submit a newsworthy "Hot Item" relating to recent research or an exciting development in the field. The Hot Items page is used by OAR and NOAA senior management to learn about the research that is being funded and conducted by NOAA.

The most recent Hot Item from CICS discusses the redistribution of fisheries catch potential in the ocean under climate change. It highlights the findings of a recent study by William Cheung, the researchers from the Sea Around Us project, and CICS Researchers Jorge Sarmiento and Kelly Kearney:

Large-scale redistribution of maximum fisheries catch potential in the global ocean under climate change

Climate change is likely to affect fisheries production due to changes in ocean temperature, currents, coastal upwelling, etc. that can influence the geographic distribution of commercially important fish species. In a recent study, William Cheung and other researchers from the Sea Around Us project collaborated with scientists from Princeton University to look at potential changes in food security due to changing climate. The study used a dynamic bioclimate envelope model that links the geographic range of specific fish species to a variety of ocean parameters, such as water temperature, primary productivity levels, sea ice location, etc. They then used the output of the Geophysical Fluid Dynamics Laboratory (GFDL) CM2.1 coupled climate model and a suite of empirical primary production models to see how the distributions of different fish species might change under high- and low-emission climate scenarios. The calculation included 1,066 exploited fish and shellfish species from a wide range of taxonomic groups, ranging from krill, shrimps, anchovy and cod to tuna and sharks, that combined to produce 70% of reported global fish landings from 2000-2004. The model predicted that the global maximum catch potential in 2055 would

change very little from current levels. However, it showed an overall shift of catch potential regionally, with increases of 30-70% at high latitudes and decreases of up to 40% at low latitudes. Many of the low-latitude areas that showed decreases of catch potential coincide with socioeconomically vulnerable areas.

Background:

The challenge of predicting future response of fisheries has been approached in several ways: developing detailed local and regional individual-based and ecosystem-based models; extrapolating the present response to interannual variability to the future assuming that global warming will look like the positive phases of climate variability modes such as ENSO; or using an empirical approach like that used here. This is the first attempt of the latter approach that we know of, and while sacrificing some of the specificity of predictions for individual species, it is advantageous in that it offers a global picture of the potential response to changing climate.

Significance:

Previous studies of changing global food supply as a result of climate change have focused solely on terrestrial food supplies. Here we focused instead on marine food security, and found that regional changes in maximum fisheries catch potential may reduce access to food in vulnerable areas of the world that rely on fisheries for food and income.

The Cooperative Institute for Climate Science (CICS) at Princeton University is a NOAA Cooperative Institute sponsored by NOAA's Geophysical Fluid Dynamics Laboratory (GFDL), and conducts research in earth system processes and climate research, biogeochemistry, coastal processes, and paleoclimate. The Sea Around Us Project is a collaboration between the University of British Columbia and the Pew Environment Group, focused on analyzing the impacts of fisheries on marine ecosystems (*Sea Around Us* Project database: www.searoundus.org).

Cheung, W. W., Lam, V. W., Sarmiento, J. L., Kearney, K., Watson, R., and Pauly, D. (2010). Large-scale redistribution of maximum fisheries catch potential in the

global ocean under climate change. *Global Change Biology*, 16:24–35.

Past Hot Items can be found on the CICS website at:

<http://www.princeton.edu/cics/news-events/hot-topics/> ■

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 Postdoc Marc Salzmann, who spent two years in Leo Donner's group and has returned to Germany.]

On February 28, exactly two years and a day before the first anniversary of his arrival in the United States, former AOS postdoc Marc Salzmann has officially returned to the Land of unlimited Sausage, leaving behind his bicycle and a newly implemented stratiform cloud scheme for the GFDL AM3 general circulation model. He said "Working at GFDL has been a great experience. There is a high level of individualism and independent thinking, and yet everybody is clearly striving toward the best result for the whole. I very much enjoyed the atmosphere at GFDL. The computer support is also outstanding."



Former AOS Postdoc Marc Salzmann

In spite of a constant preoccupation with clouds, Marc has occasionally described himself as a rather cheerful person with an odd sense of humor and a fairly inter-disciplinary approach to science. "In the beginning, I would point to my background in geophysics when somebody asked me a question about the atmosphere and I did

not know the answer. More recently, I found myself more and more often pointing to my background in atmospheric physics and chemistry in response to a difficult question regarding the solid earth."

Marc is mainly known for his contribution to the chemistry part of the Weather Research and Forecast Model (WRF-Chem), and to a lesser extent also for his research on various roles of deep convection for atmospheric chemistry. At GFDL his work has focused on simulating cloud microphysics, especially cloud-ice - aerosol interactions. He is starting a position at the Max-Planck-Institute for Meteorology in Hamburg. ■

AOS & CICS News

Arrivals:

Yalin Fan arrived in January and is working with Isaac Held as an Associate Research Scholar. She comes to Princeton from the University of Rhode Island. Her research focuses on high-resolution hurricane modeling.

Vincent Saba arrived in January is working with Charles Stock, John Dunne, and Anand Gnanadesikan as a Postdoctoral Research Associate. He comes to Princeton from the Virginia Institute of Marine Science. His research focuses on modeling the synergistic effects of global warming and multidecadal climate forcing.

Fanghua Xu arrived in January and is working with Leo Oey. She comes to Princeton from Stony Brook University. Her research focuses on analyzing observational data and incorporating this data into numerical models.

Jan-Huey Chen arrived in February and is working with Isaac Held, S.J. Lin, and Morris Bender as a Postdoctoral Research Associate. She comes to Princeton from National Taiwan University. Her research focuses on high-resolution hurricane modeling.

Takeshi Doi will arrive in April to work with Gabriel Vecchi and Geoff Vallis as a Postdoctoral Research Associate. He comes to Princeton from the Japan Agency for Marine-Earth Science and Technology. His research focuses on improving the prediction skills of tropical Atlantic climate modes.

Graduate Student Defenses

Fuyu Li, under the guidance of V. Ramaswamy, successfully defended his thesis (January 2010) entitled, "*Emission, Distribution, and Transport of Mineral Dust in the Southern Hemisphere, and the Dust Deposition in Antarctica During Present-Day and the Last Glacial Maximum.*" He has accepted a postdoctoral associate position at Lawrence Berkeley National Laboratory (Berkeley Lab).

Neven Fuckar, under the guidance of Geoff Vallis, successfully defended his thesis (March 2010) entitled, "*Adaptive Scaling Model of the Main Pycnocline and the Associated Overturning Circulation.*" He has accepted a postdoctoral associate position at the University of Hawaii.

Departures

Zhibin Sun – March 2010
UMBC

Marc Salzmann – March 2010
MPI, Hamburg, Germany

Michael Hiscock – December 2009
EPA

Birth Announcements

Congratulations to former Associate Research Scholar **Mike Hiscock** and his wife Christine on the birth of their son, Andrew Michael, who was born on November 19, 2009, weighing 7 lbs. 10 oz. and measuring 21 inches long. Andrew joins big brother Benjamin, who is Mike and Christine's oldest child.

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