AOS & CICS Newsletter

January 2007 Volume 1, Number 1

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

This Issue:

WELCOME

As part of our continuing effort to keep you "in the loop," we'd like to welcome you to the first edition of the AOS and CICS Newsletter, an informal, periodic newsletter intended to keep you updated on what's going on in and around the AOS Program and CICS. The newsletter is designed to provide you with information and updates that may be of interest to you, such as AOS and CICS happenings and news of research accomplishments and milestones.

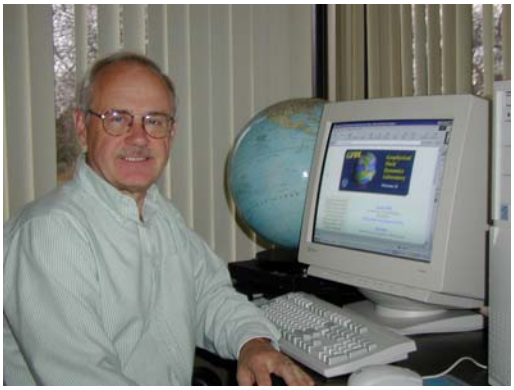
In this first edition of the AOS & CICS newsletter, we have attempted to provide you with news and information relevant to you. We encourage you to stay current by visiting the soon to be completed, newly designed AOS web site on a regular basis.

George Philander Steps Down as AOS Director; Jorge Sarmiento Steps In

After serving 16 years as Director of the Atmospheric and Oceanic Sciences Program, Knox Taylor Professor of Geosciences S. George Philander has chosen to step down as the Director of the AOS Program. As of September 2006, he is dividing his time between Princeton University and South Africa where he will participate in establishing an Earth Institute. The goal is to provide South Africa and other African nations with their own source of information concerning environmental problems such as global warming. Philander joined the Princeton faculty in 1990, after spending 19 years at GFDL. His research includes studies of interactions between the ocean and atmosphere and their role in climate fluctuations and climate changes, in the past and the present. A recognized authority in oceanic and atmospheric sciences, Philander is a member of the National Academy of Sciences and a Fellow of the American Meteorological Society, the American Geophysical Union, and the American Academy of Arts and Sciences.

His successor, Professor of Geosciences Jorge Sarmiento, reassumed the directorship on July 1, 2006 having served as the Director from 1980-1990. Sarmiento is also the current Director of the Cooperative Institute for Climate Science. In addition to directing the AOS Program, Prof. Sarmiento hopes to strengthen academic ties and communication between faculty, graduate students, and post-docs in the AOS Program, CICS, GFDL, and the rest of Princeton University.

Ants Leetmaa Retires



After serving as Director of NOAA's Geophysical Fluid Dynamics Laboratory (GFDL) since 2001, Ants Leetmaa is retiring. Dr. Leetmaa is respected among his peers for establishing the scientific foundation for moving climate prediction from statistically based to physically based techniques, thereby providing major improvements in the skill and applicability of operational climate forecasts. His leadership in providing the first-ever successful real-time El Niño and La Niña forecasts resulted in significant nationwide preparation and economic savings through improved understanding of the impacts of weather and climate regimes associated with these events. His efforts to advance the use of physically based climate forecast tools have significantly improved the quantitative skill of long-range climate predictions. His concept of an integrated or seamless suite of forecast products, across weather and climate time scales, has contributed to permanently altering the vision for climate prediction and services worldwide. At GFDL, one of his major accomplishments was to support the development of a new physical climate model and encourage its growth into a comprehensive Earth System Model. The new GFDL model is now seen as one of the best in the world and great progress has been made on adding terrestrial and marine biogeochemical processes to it.

Dr. Leetmaa holds a Ph.D in Oceanography from the Massachusetts Institute of Technology (MIT), where he worked as a research assistant until 1972. He moved to NOAA's Atlantic Oceanographic and Meteorological Laboratories, Miami, Florida in 1972 and served as a Chief Scientist on research cruises with approximately 550 days at sea, including first-hand measurements in the Pacific during the 1982-83 El Niño. He brought these talents to the National Meteorological Center (NMC), Washington DC in 1986. In 1991, he became Chief of its innovative Coupled Model Project and was responsible for development of the coupled-ocean atmosphere numerical model, which is now the foundation for physically based seasonal and interannual predictions. In 1995, he was promoted to Senior Scientist, National Centers for Environmental Prediction (NCEP, formerly NMC) and in 1997 he was appointed Director of NCEP's Climate Prediction Center (CPC). In 2001, he was named the Director of GFDL, the third in its history, following in the footsteps of Joseph Smagorinsky and Jerry Mahlman.

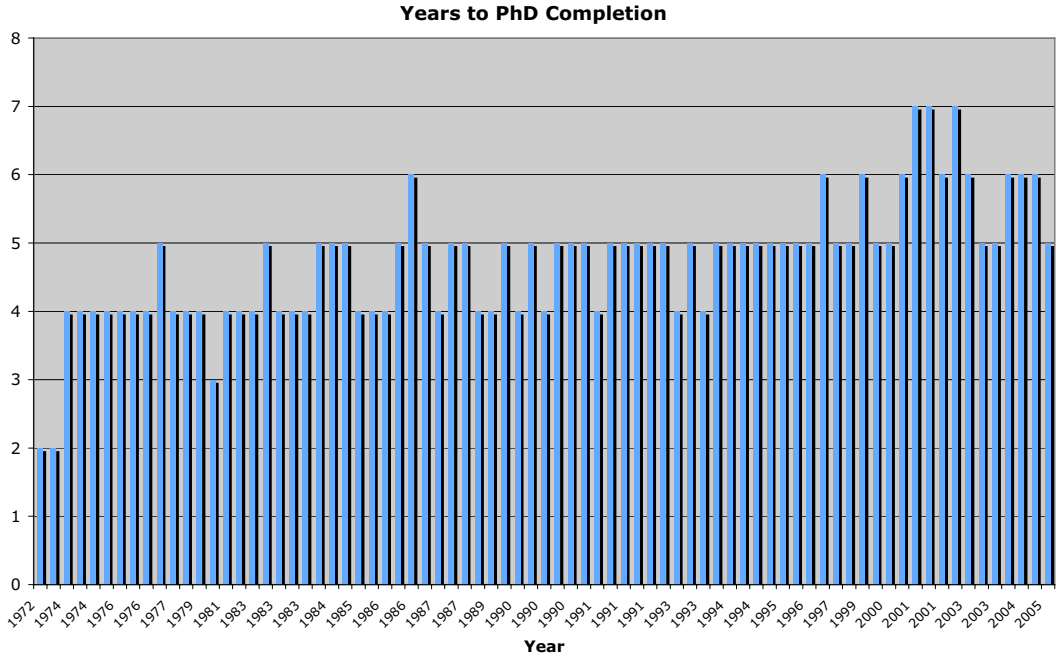
Dr. Leetmaa also has served as a member or chair of many national and international organizations and committees which address ocean observing systems, climate studies and forecasting, and development of NOAA's climate-related products.

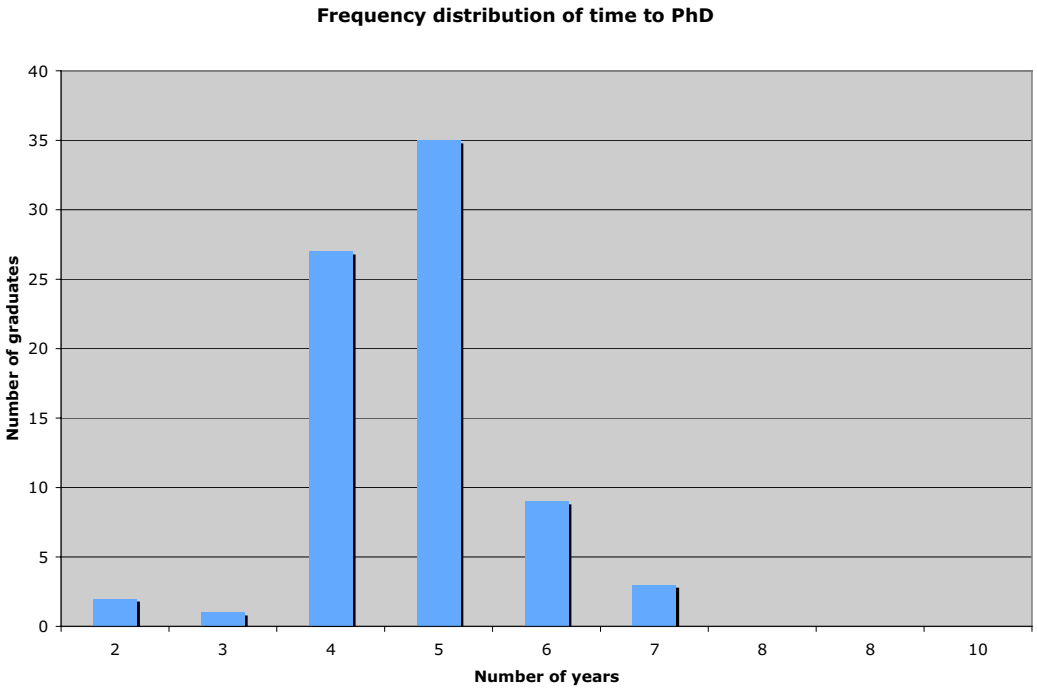
The search for a new GFDL Director to replace Leetmaa has begun.

A Meeting of Minds . . .

In his new role as Director of the AOS Program, Professor Jorge Sarmiento has recently spent time meeting with faculty, post-docs, and graduate students in an effort to encourage candid discussion about the Program. Topics included: the direction of the Program, student recruitment strategies, and student teaching assistant positions, to name a few. The meetings have not only a yielded a full menu of discussion topics, but provided forums for an informal exchange of ideas, including ways in which the Program might improve its communication and increase awareness among faculty, students, and staff. This newsletter is one response to the discussions, which revealed that many of the AOS staff are not aware of all that is happening in the AOS Program. Prof. Sarmiento will be writing a series of summaries of some of the issues that came up in the discussions.

One such issue is the rise in the average time it takes to a complete a PhD. Are you aware that there has been a lengthening of the average time to degree completion from between 4 and 5 years to close to 6 years? To illustrate this point, the figures below show the number of years it took for AOS students to complete their PhD as a function of the year they received their degree and also as a frequency distribution.





Historically, AOS has been a 4 year program and according to the Dean of the Graduate School it remains so today, *at least in name*. What needs to be considered is whether or not going beyond the 4 years is beneficial or detrimental to our program and its students. In years past, students were expected to complete their degree in 4 years, with a fifth year being granted under "exceptional" circumstances, such as to give students an opportunity to participate in the STEP Program or in teaching.

Professor Sarmiento is of the opinion that AOS would benefit by a return to the previous regime and here's why:

- The past experience of the AOS Program suggests that students (and their advisors!) will generally take longer to wrap up a project if there is no enforcement of deadlines, whether or not the project benefits from the longer time.
- It is not obvious that students benefit educationally by staying on beyond 4 or so years as contrasted with going elsewhere for a postdoctoral program.
- It is also not apparent that the longer period to degree completion has been driven in any way by a significant change in the research that students are doing in the AOS Program. One can argue that students who do field work and lab work need additional time, but this does not apply to our students. Our students are doing more GCM simulations than they used to in the past, but these tend to be reasonably efficient. Thus, an increase in time to PhD may not be justified.
- The AOS Program has limited support for graduate students. The longer students take to complete their degrees, the more difficult it is to find the support for the larger class sizes that we would all prefer to see.
- Graduate student salary levels are much lower than postdoc salary levels. Keeping graduate students on for a longer period of time can become a form of exploitation that is not fair to the student.

Story Ideas?

We'd love to hear from you! Please send your suggestions to:

jcurcio@princeton.edu

Just as we are ever evolving, we need to respond to the Program's changing needs and the needs of our students. Perhaps a four year program should mean just that, and recognize that one in name only may no longer serve our purpose.

As Director, Sarmiento hopes to build upon existing strengths of the Program and to implement changes that will be far-reaching in their impact on the future of the AOS Program. He would value your feedback and welcome your suggestions on the time to degree completion issue.

AOS/Geosciences Announces Faculty Search

The Department of Geosciences is presently seeking applications for a tenure-track faculty position in the area of **atmospheric and oceanic sciences**, including such topics as:

- analysis of climate variation and change
- interactions among the atmosphere, ocean, cryosphere, biosphere, and geosphere
- impact of human activities on the environment
- prediction of changes in Earth's climate and biogeochemical cycles

The individual selected will have their principal appointment in the Department of Geosciences and will be a member of the AOS Program. The department anticipates hiring at the assistant professor level, although candidates at a higher rank may be considered under exceptional circumstances.

The search committee is chaired by Prof. Daniel Sigman, and includes Profs. Isaac Held, V. Ramaswamy, and Jorge Sarmiento. The advertisement has been widely circulated and a large number of applications have already been received. The committee has been reviewing the applications as they come in and several candidates have already been invited to visit who will be giving Monday afternoon seminars in Geosciences, as well as a separate seminar in GFDL and interviewing with faculty and students in Guyot Hall, Sayre Hall, and at GFDL. Keep an eye out for the Geosciences and GFDL schedules of seminars this Spring term starting on February 5.

Applications are still being considered. Individuals whose research interests complement the modeling capabilities and other ongoing activities within the AOS Program and at GFDL are particularly encouraged to apply. Potential collaborators are also found in the Department of Geosciences and across the University, in particular, in the Departments of Ecology and Evolutionary Biology and Civil and Environmental Engineering. Information about several ongoing interdisciplinary research collaborations across campus and with GFDL can be found on the website of the Princeton Environmental Institute. For this and other department links, please link to: (http://geoweb.princeton.edu/geojobs.html#faculty).

Applicants should send a curriculum vitae, including a publication list, a statement of research and teaching interests, and contact information for three

references to: Search Committee, Department of Geosciences, Guyot Hall, Princeton University, Princeton, NJ 08544. The starting date is flexible, ranging up to September 2008. Evaluation of applications is ongoing; interviews of candidates began in the fall of 2006 and will continue until the position is filled.

Director's Corner

This past semester has been busy, as I have met with all the AOS and CICS students, postdocs, and faculty in order to assess where things stand, and consider what I would like to accomplish during my tenure as AOS Director. This newsletter covers some of the items that came up in those discussions, such as the increasing length of time it is taking AOS students to complete their degrees. However, when all is said and done, the most important activity of the AOS Program is to advance our understanding of atmospheric and oceanic sciences, and the most fun part of being here is to participate in and hear about exciting new research such as that of Marcelo Barreiro discussed in an accompanying article.

One such scientific advance that could have far-reaching consequences is new evidence suggesting that there does not appear to be a significant terrestrial carbon sink due to CO_2 fertilization or some other mechanism in the tropics. Most of the current generation of climate models used to estimate the effects of climate change, including those being used for the International Panel on Climate Change (IPCC) Assessment Report 4, incorporate a substantial CO_2 fertilization sink. This sink reduces the amount of mitigation required to stabilize atmospheric CO_2 concentrations to about half what it would be without CO_2. Without such a CO_2 fertilization sink, the challenge of stabilizing atmospheric CO_2 becomes much greater. The account of how the discovery came about provides a nice illustration of how AOS benefits from its close association with GFDL in particular, and NOAA in general.

The story begins in the ocean, where 67,000 individual observations of dissolved inorganic carbon and nutrient observations, many obtained by AOML and PMEL, were combined with ocean models from the NOAA Geophysical Fluid Dynamics Laboratory (GFDL) and other research groups to provide a new estimate of the geographical distribution of air-sea CO_2 fluxes. The ocean inverse results were then combined with an analogous atmospheric inversion using atmospheric CO_2 data from NOAA's Earth System Laboratory (ESRL). Combining the oceanic data with the atmospheric data in this joint inversion resulted in significant changes in the estimated terrestrial fluxes compared with previous atmospheric inversions. The largest changes occurred in the tropical and southern hemisphere regions, which are not well sampled by the atmospheric observations alone. Previous results had tended to give fluxes for this region that were not statistically different from zero. By contrast, the joint inversion finds that the tropical and southern hemisphere land regions are a source of carbon to the atmosphere, with a 77% chance that their total source exceeds 1 billion metric tons of carbon per year.

The net terrestrial flux obtained by the inversions represents the sum of emissions due to tropical deforestation and a potential natural sink from plant fertilization via increasing atmospheric CO_2 levels. The net source estimated by

In future issues, we'd like to include a column dedicated to Alumni News. Please send your news, or news of friends and colleagues, to: jcurcio@princeton.edu

the joint inversion is about the same magnitude as independent estimates of the tropical carbon source due to deforestation and land use change alone. Unless emissions due to tropical land use change have been underestimated, this result implies that the proposed tropical carbon sink CO_2 fertilization is less important a player in the global carbon cycle than previously thought.

This work is reported on in three papers authored by Dr. Andrew Jacobson and Dr. Sara Mikaloff Fletcher (in press in Global Biogeochemical Cycles). Dr. Jacobson developed the joint inversion while in the AOS Program, and has since moved to NOAA-ESRL. Dr. Mikaloff Fletcher worked on the ocean inversion and conducted an international model intercomparison project to quantify errors in the ocean inversion. She completed the work primarily at the University of California, Los Angeles and has since joined the AOS Program.

AOS Website to be Revamped

The AOS website is presently undergoing a major facelift. After its completion, the website will feature an entirely new look -- including new content, enhanced navigation, and user-friendly menu bars right on the homepage. Thanks to the collaborative efforts of Web Manager, Jonathan Sarmiento, and Committee Members, Sonya Legg, Cynthia Randles, Neven Fuckar, Yi Huang, Laura Jackson, Sara Mikaloff-Fletcher, Sandy Clark, Laura Rossi, and Anna Valerio, you can look forward to completion of the redesigned website in early 2007.

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 Marcelo Barreiro who recently returned to his homeland after 3 years with the AOS program.]*

A fond farewell to Marcelo Barreiro a former research associate in the AOS program. Marcelo is a native of Montevideo, Uruguay, where he studied physics and became interested in the dynamics of climate. His interests led him to Texas A&M to pursue a PhD in physical oceanography, with emphasis in tropical ocean-atmosphere interactions. In a time when researchers were studying the El Niño phenomenon in the Pacific, Marcelo's research focused on seasonal-to-interannual variability and predictability of tropical Atlantic sea surface temperatures and their impact on the atmospheric circulation.

Marcelo came to the AOS program in January of 2004, after completing his PhD, to work with Professor George Philander. During his three years in the Program, he extended his research activities to study the role of the tropics in past climates. Recent paleorecords have provided intriguing results of the behavior of the tropical oceans in the past. During the early Pliocene (~3 million years ago, 3 Ma) the cold tongues that straddle the eastern sides of today's equatorial oceans were absent (1). Interestingly, this was the last time CO_2 levels were the same as today, and the climate was significantly warmer. What could have maintained that tropical structure? And what are the consequences? Marcelo first studied the response of the atmosphere to the absence of cold tongues with several atmospheric models. The results suggested that these tropical conditions could have accounted for a significant portion of the warming at 3 Ma through changing the cloud albedo and the concentration of water vapor (2).

He has now turned his attention to trying to explain how such a tropical state could be maintained. Previous results with idealized ocean models showed that it is possible to reduce the equatorial cold tongues by decreasing the heat loss in high latitudes (3,4). This result can be interpreted as a response of the ocean to maintain a balanced heat budget. In the current climate, the cold tongues are the regions where the ocean gains much of the heat that is afterwards carried polewards by the circulation and that is lost in the extratropics. Thus, if the extratropical heat loss is reduced, the cold tongues are reduced in order to expose less cold water and absorb less heat.

The absence of cold tongues at 3 Ma suggests a very different state, one in which the ocean heat transport from the equator is highly reduced. But, do the results obtained with an idealized forced ocean model hold in a realistic coupled model? To answer this question Marcelo used a coupled model of intermediate complexity in which cloud albedo can be prescribed. In agreement with the simplified ocean, sensitivity experiments show that a decrease in high latitude cloud albedo not only warms the extratropical oceans, but also decreases the eastern equatorial cold tongues where no direct perturbation was applied. As expected, a reduction of the cold tongues is accompanied by a decrease in the uptake of heat in these regions (5). In the model, perturbations in the Southern Ocean were most effective in controling the extent of the Pacific cold tongue. These results suggest that a state with absent cold tongues could have existed at 3 Ma provided the ocean lost much less heat in the extratropics as compared to today. Moreover, the time scale of adjustment of the tropical Pacific to extratropical cloud changes is of the order of 100 years. Thus, this represents a novel mechanism for rapid climate change on interdecadal-to centennial time scales.

The control of high latitude heat loss on the equatorial conditions helps explain another perplexing suggestion from paleorecords. It has been discovered that during the early Pleistocene (2-1 Ma) the eastern Pacific sea surface temperature was dominated by obliquity and was nearly in phase with high-latitude rather than local solar variations (6). According to simulations, the increased extratropical shortwave radiation during periods of high obliquity decreases the oceanic heat loss, and therefore the eastern Pacific has to warm up in order to gain less heat.

At December’s end, after eight years in the U.S., Marcelo moved back to Uruguay where he has accepted an associate professor position in the Universidad de la Republica, in Montevideo. He will continue working on the role of the tropics in past climates, and how extratropical conditions can affect the state of the tropical oceans (7). He also plans to continue working on the

tropical Atlantic problem, particularly on the physical processes that could enhance predictability of sea surface temperature on seasonal-to-internannual time scales in the south Atlantic, a region where current forecasts have very limited skill. Fortunately for us, Marcelo has agreed to continue his association with the AOS Program as a Visiting Research Collaborator. His contact information is:

Instituto de Física
Facultad de Ciencias
Iguá 4225
Montevideo 11400
Uruguay

(1)Fedorov AV, Dekens PS, McCarthy M, Ravelo AC, deMenocal PB, Barreiro M, Pacanowski RC, Philander SG. 2006. The Pliocene Paradox (Mechanisms for a permanent El Nino). *Science* 312:1485-1489.
(2)Barreiro M, Philander G, Pacanowski R, Fedorov AV. 2006. Simulations of warm tropical conditions with application to middle Pliocene atmospheres. *Clim. Dyn.* 26:349-365.
(3)Boccaletti G, Pacanowski R, Philander SGH, Fedorov A. 2004. The thermal structure of the upper ocean. *J. Phys. Oceanogr.* 34:888-902.
(4)Fedorov A, Barreiro M, Boccaletti G, Pacanowski R, Philander SGH. 2006. The freshening of surface waters in high latitudes: Effects on thermohaline and wind-driven circulations. *J Phys. Oceanogr*. In press.
(5)Barreiro M, Philander SG. 2006 Response to the tropical Pacific to changes in extratropical clouds. *In preparation.*
(6)Liu Z, Herbert TD. 2004. High-latitude influence on the eastern equatorial Pacific climate in the early Pleistocene epoch. *Nature* 427:720-723.
(7)Barreiro M, Fedorov A, Pacanowski R, Philander SG. 2006. Freshening of the northern Atlantic Ocean: Impacts on the thermohaline and wind-driven circulations. *Submitted.*

AOS & CICS News

ARRIVALS AND DEPARTURES

Visiting Faculty Members
Isaac Ginis, a Professor in the Graduate School of Oceanography at the University of Rhode Island collaborated with Isaac Held and Morris Bender on hurricane modeling from August 15 to December 16, 2006.

Qiang Fu, a Professor in the Department of Atmospheric Sciences at the University of Washington collaborated with Ramaswamy on the areas of detection of climate change and the attribution of these changes, and atmospheric sub-grid parameterizations and model development from October 1, 2006 to January 31, 2007.

New Researchers
Serguei Nikonov joined AOS/GFDL on October 1, 2006 as a Senior Professional Staff Member working with V. Balaji on building a system whereby climate models and model output may be cleanly and comprehensively described for the purposes of model configurations, cataloguing, and discovery.

Brian Magi joined AOS/GFDL as a postdoctoral research associate from the University of Washington, Department of Atmospheric Sciences, on January 15, 2007. He will be working with Ramaswamy on improving the representation of southern African absorbing aerosols in the GFDL AM@ general circulation model to address the fact the modeled absorption and aerosol optical depths in southern Africa, during the months most affected by biomass burning, are not in agreement with current measurements.

Ken Takahashi joins AOS/GFDL as a visiting postdoctoral research associate from the University of Washington, Department of Atmospheric Sciences, on February 1, 2007. He has been awarded a UCAR/NOAA Climate and Global Change Fellowship. He will be working with Isaac Held on large-scale tropical climate and general circulation of the atmosphere and ocean.

Departures

After 17 years in the AOS Program working with George Mellor and Leo Oey on numerical ocean modeling, forecast systems, data assimilation, and regional and basin-scale simulation, **Tal Ezer**, a Research Oceanographer, has resigned to accept a faculty position at Old Dominion University in Virginia. Tal plans to be around Sayre Hall for the next several months before relocating to Virginia with his family sometime this summer.

After more than two years conducting research with V. Ramaswamy, Larry Horowitz, Arlene Fiore (GFDL), and Denise Mauzerall (WWS) on the cost-benefit analysis of ozone reductions from methane emission controls, **J. Jason West** has accepted a faculty position at the University of North Carolina, Chapel Hill.

IRON CHEF COMPETITION

Sayre Hall's own version of the Food Network's Iron Chef Program, where participants compete for the coveted title of "Iron Chef" by concocting theme-based dishes using a "secret ingredient" --

Sara Mikaloff-Fletcher has once again been crowned AOS Program's "Iron Chef".

Please join us on **Monday, February 26th** at high noon, in the Sayre Hall conference room, for the first official Sayre Hall Iron Chef competition for 2007, and what better theme to start 2007 with than 007!

The theme is: *"James Bond: Bold flavors with Style and Panache!"*

The secret ingredient is... what else... *Martini Flavors*. You can include any ONE OR MORE of the ingredients for a classic vodka martini, which are *vodka*, *dry vermouth*, and *olives.* (If your tastes lean toward the traditional, *gin* is an acceptable alternative ingredient.) Your entry can be in any category -- appetizer, salad, dessert, etc.

All are welcome and may the best chef triumph!

August 1, 2006

Iron Chef I: *Fluffy fusion of aromas when chocolate becomes tropical*.
Secret Ingredient: *Caramel*
Winner: **Sara Mikaloff-Fletcher**: Triple layer tropical paradise mousse cake with caramelized macadamia nuts

September 5, 2006

Iron Chef II: *Fantastical Fall Fete*.
Secret Ingredient: *Nuts*
Winner: **Eric Galbraith**: Autumn sunset cheesecake with Jersey peaches & candied pecans

December 4 , 2006

Iron Chef III: *An appetite for the Holidays: savory morsels, where levity comes in bite-sized packages.*
Secret Ingredient: *alcohol*
Winner: **Sara Mikaloff-Fletcher**: Holiday Puff Pastry Stars – one with sweet potatoes and the other with goat cheese

NUPTIALS

This has been a busy year for AOS and CICS scientists, personally as well as professionally. The following people were recently married:

Patrick Schultz to Polina Shklyanoy on September 3, 2006

Michael Hiscock to Christine Sproat on September 16, 2006

Xiaohua Lin to Weidong Wang on December 16, 2006

Congratulations to all!

AOS Program
Princeton University
Sayre Hall
300 Forrestal Road
Princeton, NJ 08544-0710

Phone:
(609) 258-6047

Fax:
(609) 258-2850

We're on the Web!
www.aos.princeton.edu

Editor: Joanne Curcio
E-mail:
jcurcio@princeton.edu