



AOS & CICS Newsletter

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Gnanadesikan Moving On After 15 Years



GFDL Oceanographer & AOS Lecturer
Anand Gnanadesikan

After 15 years at Princeton, GFDL Oceanographer and AOS Faculty Member Anand Gnanadesikan has accepted a tenured associate professor position at the Earth and Planetary Sciences Department at Johns Hopkins University. He will begin his appointment in January, 2011.

Gnanadesikan's research interests focus on understanding the mechanisms that drive the large-scale physical circulation of the ocean and the impact of changes in this circulation for climate, ocean chemistry, and ecosystems. Using general circulation models of the ocean and atmosphere and examining how these simulate not only the physical climate, but quantities such as radiocarbon, oxygen, and nutrients, has led him to look at how human activities might perturb the carbon cycle. Over the years, he has been very involved in the development of new models at GFDL, including ocean-only models, coupled ocean atmosphere models, and models of biogeochemical cycling.

"During my time here, I've had a chance to interact with biological, physical and chemical oceanographers, atmospheric dynamicists and chemists, terrestrial ecologists and mechanical engineers. Princeton is an outstanding place to get a broad view of how our planet works."

"Anand is tireless in his dedication to discovery. He's passionate about the development of climate models and their continuous evolution," AOS Director Jorge Sarmiento said. "Not only is he a dedicated scientist, he is an esteemed colleague and mentor to his students. He will be sorely missed."

Regarding continuing collaborations at GFDL and Princeton, Gnanadesikan said, "I also anticipate continuing the collaborations I've been fortunate enough to build here in the past fifteen years, and hope to be able to build new bridges to the paleoclimate and observational communities. I look forward to our continuing to learn about the planet together!"

Outside of work, he is extensively involved in outreach through programs such as Science Olympiad, the largest national team science competition for secondary schools, and through working with museums to help bring up-to-date science into exhibitions.

Gnanadesikan earned his undergraduate degree in Physics from Princeton University and his Ph.D. in Oceanography from the Joint Program in Oceanography at MIT/Woods Hole Oceanographic Institution. ■

TigerTransit/Shuttle Services Operating on Summer Schedule:
<http://www.princeton.edu/transportation/ForrestalSummer10.pdf>

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

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Oey's Research Featured in Times of Trenton Interview

AOS Researcher Leo Oey was featured June 14 in The Times of Trenton in an interview addressing the BP oil spill.

The article discussed the overlap between Oey's work in ocean modeling and the estimated distribution of oil from the spill. Using the Princeton Ocean Model (POM),

co-developed by Oey, George Mellor, and Alan Blumberg in the early eighties, Oey and his research team entered thousands of simulated particles at the coordinates of the spill site and had the computers crunch out the data of how those particles are likely to move and spread over time.



AOS Researcher Leo Oey

“What we did was to release (simulated) particles at the spill site and we track that in time for weeks, for months [*sic*],” Oey told the Times. “And we throw in many particles and then we do some statistical analysis to average them and get a sense of where those particles might go.”

“There's a big assumption, of course: We assume that the oil will also follow the particles' movements. They generally do, but not exactly,” Oey said in the article. He cautioned that long range ocean modeling isn't specifically equipped to predict the movement of an oil spill, because the models don't calculate in the properties specific to oil. Instead, modeling focuses on historical data of current locations and shifts, as well as wind patterns that affect ocean currents.

In discussing the Loop Current, a high-speed stream that pulses north into the Gulf of Mexico and travels in a clockwise pattern toward Florida, Oey told the Times that the POM estimates that, at most, 10 percent or so of the surface particles that originate at the spill site could get caught up in the main Loop Current and Gulf Stream. He added, however, that this figure is a worst-case scenario.

He also noted that despite the model's sophistication, the forecasting done thus far via the POM has focused on what happens at or near the surface; it doesn't take into account the oil plume at depth. In response, Oey and his team are beginning to examine simulated particles at 800 meters below the surface.

The article in its entirety can be found at: http://www.nj.com/mercer/index.ssf/2010/06/gulf_view_not_a_pretty_picture.html ■

Jerry D. Mahlman Lobby is Dedicated

On Tuesday, May 4th, 2010 the newly renovated GFDL lobby was named the “Jerry D. Mahlman Lobby,” in honor of Jerry Mahlman, former director of GFDL and lecturer with rank of professor in the AOS Program. The dedication ceremony was attended by Jerry's and Janet's daughter, Julie, and the many friends and colleagues who had the pleasure of working with Jerry throughout the years.



Jerry and Janet Mahlman's daughter, Julie, at the May 4th lobby dedication

Mahlman's NOAA career began on the day the agency was created, October 3, 1970 when he joined Joseph Smagorinsky and Syukuro (Suki) Manabe in their pioneering efforts to develop atmospheric circulation models at GFDL. During his three decades at GFDL, Mahlman was a pioneer in stratospheric dynamics and chemistry as well as numerical modeling. He added significantly to the understanding of how climate works and spent much of his career modeling how Earth's atmosphere responds to the steady buildup of greenhouse gases.

Under Mahlman's tenure as director, GFDL continued to recruit highly talented scientists and provide an intellectually stimulating environment for them, a tradition begun by Smagorinsky, the lab's first director. “I am proud that we are able to attract, nurture and retain these young scientists,” Mahlman said just prior to his retirement from GFDL in 2000. Today, some ten years later, this legacy of support for younger scientists at GFDL remains one of the key elements to the lab's continued success.



Jerry Mahlman, former director of GFDL and lecturer with rank of professor in the AOS Program

From 2000-2009, Mahlman was a senior research associate at the National Center for Atmospheric Research. In recent years, he has been centrally involved in the communication of climate change science to a wide variety of audiences, and assists in guiding the international policy deliberation process through the interpretation of climate science.

During the span of his illustrious career, Mahlman published over 100 scientific papers. Among his many awards, he received the U.S. Department of Commerce Gold Medal in 1986, the American Geophysical Union First Annual Jule G. Charney Lecturer Award in 1993, the Presidential Distinguished Rank Award in 1994, and the highest honor given by the American Meteorological Society, the Carl-Gustaf Rossby Research Medal, in 1994.

Mahlman received his undergraduate degree from Chadron State College in 1962 and earned his Ph.D. from Colorado State University in 1967. ■

SEAS-AOS-GFDL Workshop held on Main Campus

A Student-Postdoc workshop on Fluid Dynamics & the Global Environment was held at the Friend Center on Friday, May 21st, with some 35 people in attendance. The workshop, organized by the School of Engineering and Applied Sciences Program, the Atmospheric and Oceanic Sciences Program, and GFDL, focused on

environmental fluid dynamics. Workshop sessions ran from 9 a.m. to approximately 3 p.m. and covered such topics as: "Weather and Climate Simulations," "Turbulence, Instabilities, and Fundamentals," and "Flows and Fluxes in Complex Geometries." "As GFDL and the AOS program move towards thinking about smaller spatial scales and coupling with biological systems, we are finding the engineering community moving up to the scales which we care about," AOS Faculty Member and GFDL Oceanographer Anand Gnanadesikan said.

Among the speakers were AOS and CICS Researchers Rym Msadek, Joseph Kidston, Mehmet Ilicak, and Jaime Palter. During the "Weather and Climate Simulations" session, Msadek presented predictability results based on GFDL coupled model simulations and discussed the challenge of providing reliable climate predictions considering the lack of consensus pertaining to the mechanism of decadal climate variations. Kidston explored the question of whether an increase in the eddy length scale can cause a poleward shift of the jet streams during the "Turbulence, Instabilities, and Fundamentals" session. He presented an experiment with a barotropic model in which an increase in the length scale of a mid-latitude perturbation results in a poleward shift in the acceleration of the zonal flow. Initial investigations indicate that this behavior is also valuable in both observational data and the output of comprehensive general circulation models (GCMs).

Ilicak kicked off the "Flow and Fluxes in Complex Domains" session with a presentation on the challenges in resolving the overflows in GCMs. Noting the different processes that affect the amount of mixing in the overflows, such as shear instabilities and topographic features, he described how idealized and realistic overflow simulations are performed with different vertical mixing parameterizations. Ilicak also introduced a new approach to parameterize topographic features. Entitled "Fronts in the oceans: Barrier, blenders, and biogeochemical gateways," Palter's talk, also part of the "Flow and Fluxes in Complex Domains" session, examined some of the work on exchange across ocean fronts and attempted to reconcile two opposing views on fronts: that they can be physical barriers to exchange and that they are critical gateways of biogeochemical property exchange.

Commenting on the workshop, Palter said, "The Fluid Dynamics & the Global Environment Student-Postdoc meeting gave AOS and GFDL postdocs and students a unique opportunity to interact with students and postdocs in Princeton's engineering departments. It is unusual to be at a workshop in which research ranges from the sub-millimeter scale of surface-tension driven flows through flexible membranes to the global scale of climate modeling." ■

Conference "Empowers" Women in Science

In late May, AOS Lecturer and Research Oceanographer Sonya Legg and CICS Researchers Stephanie Downes, Rym Msadek, and Jaime Palter participated in the Pattullo Conference sponsored by MPOWIR (Mentoring Physical Oceanography Women to Increase Retention.). The conference, named for June Pattullo, the first woman to receive a Ph.D. in physical oceanography, is the centerpiece of the MPOWIR program which provides mentoring to physical oceanographers from late graduate school through their early careers and aims to reduce the barriers to career development for all junior scientists in the field, with a particular focus on improving the retention of junior women.

In addition to research talks, professional development sessions, and round-table discussions, the program is unique in that it not only brings junior women and senior scientists together to share experiences, advice, and concerns, but it raises awareness of issues confronting junior women among the senior scientist community. "The Pattullo conference was an excellent opportunity to network with junior and senior scientists in the field of physical oceanography, showcase the work we do at Princeton and GFDL, and discuss issues that women confront throughout their career in science. Spending three days in Charleston, South Carolina to learn more about each scientist's work in her sub-specialty of physical oceanography, as well as discussing some of the 'soft-skills' required in scientific endeavors, was time well spent, and great fun too," said Palter.

The professional development sessions covered issues such as: strategies for funding, proposal writing, negotiations, and balancing work and family. The agenda also included time for one-on-one interaction between junior and senior scientists as well as unstructured time for informal networking. "The Pattullo Conference was a great way to meet a large number of the female students and postdocs working in physical oceanography today. We had a lot of intense discussions, but also some fun kayaking in the alligator-filled river. I wish this sort of opportunity to talk and learn about all the aspects of a scientific career had been around when I was a postdoc 15 years ago," Legg added.

The Pattullo Conference was held May 23-26, 2010 in Charleston, South Carolina. In addition to the conference, MPOWIR's efforts include a website, [mentor groups](#), [a blog](#), forums at major meetings, and the NASA MPOWIR Speaker Series. To learn more about MPOWIR, please visit: <http://www.mpowir.org/>. ■

Rossi and Slater Honored at Service Recognition Luncheon

AOS Department Manager Laura Rossi and Senior Earth System Modeler Rick Slater were honored for their dedication during the annual Service Recognition Luncheon on March 24th in Jadwin Gymnasium. Rossi and Slater were honored for their 25 years of service to the University.

Rossi joined the AOS Program in 1995, after ten and a half years as Budget Officer/Grants Manager in the Chemistry Department. Under the broad direction of the Director, she plans, oversees and directs the administrative and financial affairs of the Program and the Cooperative Institute for Climate Science (CICS). With the Director, she executes policy and strategic direction for the operation of AOS and CICS and participates in the short and long-term planning for the operations and activities. She is responsible for ensuring that the faculty, students and staff have the necessary assistance to carry out their

academic, research and administrative duties.

During his twenty-five year tenure, Slater has been affiliated only with the AOS Program. He works on model and code development for ocean and ocean-atmosphere general circulation models, particularly as it pertains to the carbon cycle. He also provides support for scientists and model analysis.

AOS Director Jorge Sarmiento commended both Rossi and Slater, for their “invaluable contributions to the Program over the years. Laura and Rick are committed to excellence and our Program has long been the beneficiary of that commitment. Their dedication to AOS and the University extends way beyond their years of service.”

To commemorate their years of service, they were each presented with a certificate of recognition and received a chair bearing an engraved University seal. Rossi and Slater were two of the 342 University staff members with a collective 6,550 years of service recognized at the luncheon. ■

GFDLEA Annual 5K Race

On Tuesday, May 11th, 30 racers turned out to participate in the GFDLEA Annual 5K charity event benefiting Doctors without



1st Place Winner, AOS Postdoctoral Research Associate Rym Msadek

Borders, a humanitarian relief organization that provides lifesaving medical care around the world. The handicapped event attracted a record number of walkers and runners from both GFDL and AOS and raised over one thousand dollars for the cause.



Post-race cookout was a welcomed break.

The winners of the 5K event were female walker Karen Dreboty, male walker Jim Byrne, female runner Rym Msadek, and male runner Keith Dixon. Race Organizer Rich Gudgel expressed thanks to the judges Yanluan Lin, Tony Gordon, Ron Stouffer, Aparna Radhakrishnan, and Tom Knutson “without whom the race would not be possible.” A “courtyard” cookout immediately followed the race and was enjoyed by all. ■

AOS & CICS Research in Action

New Study Presents a Simple Mixing Scheme Alternative

Among research oceanographers, there is considerable interest in how topography interacts with stratified flows to produce internal waves and turbulence. With this in mind, a fruitful collaboration between AOS Lecturer and CICS Researcher Sonya Legg and Jody Klymak at the University of Victoria, has resulted in a simple alternative to previous approaches that parameterize the turbulence using a universally large viscosity or use mixing schemes that rely on Richardson-number criteria. The alternative is presented in a new study published in the April edition of *Ocean Modelling*.

Klymak and Legg present a simple mixing scheme for models that resolve breaking internal waves based on the overturning scale of these breaking waves. The scheme enhances mixing and viscosity in the presence of breaking waves by assuming that the overturning scale is equivalent to the Ozmidov scale, which in turn is a function of the dissipation and buoyancy stratification. The eddy viscosity and diffusivity can then be calculated from the estimated dissipation using the widely-used Osborn relation to yield a simple parameterization of the viscosity and diffusivity, in terms of the diagnosed overturning scales and the stratification.

The researchers expect that this scheme will be most useful for parameterizing mixing in strong flows over topography, with particular application to internal tide generation and reflection problems. It may also be useful for mean-flows over rough topography such as might occur in the Antarctic circumpolar current.

During their investigation, this method was compared to previous schemes for flow over topography to show that, when eddy diffusivity and viscosity are assumed to be proportional, it dissipates the correct amount of energy, and that the dissipation reported by the mixing scheme is consistent with energy losses in the model. A significant advantage of this scheme, according to the researchers, is that it has no tunable parameters, apart from the turbulent Prandtl number and flux coefficient.

While the scheme is promising, Legg cautions that the mixing scheme does have its limitations. “The major limitation of our new mixing scheme is that the largest mixing events should be driven by breaking waves rather than unresolved shear instabilities,” she noted. “The scheme is most useful in process study simulations which resolve the largest scales of the wave breaking, but not the much smaller dissipation scales.”

As a next step, the researchers intend to use this new scheme in simulations exploring mixing generated by the breaking of low mode internal waves on reflection from steep topography. ■

Four Years Well Spent

After completing a Ph.D. in Oceanography at the Southampton Oceanography Centre, UK, Riccardo Farneti joined the AOS Program in 2006 to work with Geoff Vallis. Together, they developed an intermediate complexity coupled model to study decadal and longer climate variability and other fundamental problems



Former AOS Associate Research Scholar
Riccardo Farneti

in climate dynamics. "Working with Riccardo was always a pleasure, and he accomplished a great deal of science while he was here," remarked CICS Associate Director Geoff Vallis. "Not only was he hardworking and bright, but he had a positive attitude and a ready smile that kept things in perspective."

Later, Riccardo joined the Climate Group at GFDL to work with the fine-resolution GFDL Coupled Model CM2.4; he then focused on the Southern Ocean climate variability and change. "Riccardo made some very important contributions while working with us in the Climate Group at GFDL," noted Tom Delworth, group leader of GFDL's climate change, variability and prediction group. "In particular, his work using a high resolution global coupled model has provided important perspectives on the role of small scale processes in the response of the climate system to changing radiative forcing. In addition, Riccardo was an excellent colleague to work with, and we look forward to ongoing collaborations."

"We spent four wonderful years in Princeton and working at GFDL/AOS was a great experience. The coexistence of so many experts in different fields, and the possibility to do both fundamental and state-of-the-art climate modeling makes

this place unique," Farneti added.

Farneti is now a Research Scientist in the Earth System Physics Section of the International Centre for Theoretical Physics in Trieste, Italy. ■

AOS & CICS News

Congratulations to Graduate Student **Amanda O'Rourke** who was selected to participate as a fellow in the 2010 Geophysical Fluid Dynamics Program on "Swirling and Swimming in Turbulence" in the Woods Hole Oceanographic Institution (WHOI). She will be one of a small group of competitively selected graduate-student fellows to participate in



the 10-week program this summer which commences with two weeks of Principal Lectures delivered by Glenn Flierl (MIT), Antonello Provenzale

(CNR Italy) and Jean-Luc Thifeault (U. Wisconsin). Lectures by staff and visitors on a wide range of GFD and related topics will follow daily.

The GFD Program promotes an exchange of ideas among researchers in the many distinct fields that share a common interest in the nonlinear dynamics of fluid flows in oceanography, meteorology, geophysics, astrophysics, applied mathematics, engineering and physics. Over its fifty one year history, the Program has produced numerous alumni, many whom are prominent scientists at universities worldwide. The program will run from June 21 to August 27, 2010.

Researchers Sweep Outstanding Young Scientist Competition at IWMO-2010

Congratulations to AOS Researchers **Eda Chang, Fanghua Xu, and Ayumi Fujisaki** who placed first, second, and third in the Outstanding Young Scientist Competition at the International Workshop on Modeling of the Ocean (IWMO) Workshop in Norfolk Virginia on May 24th.

Chang's presentation "Why Can Wind

Delay the Shedding of Loop Current Eddies?" earned first place recognition, Xu's "The Origin of the Along-Shelf Pressure Gradient in the Middle Atlantic Bight," secured second place, and Fujisaki was awarded third place for her presentation entitled, "Formation of Ice Bands by Wind."

"I know that all three of them worked very, very hard on preparing for this competition; I am extremely proud of them," said colleague and Research Oceanographer Leo Oey.

The competition was open to first author presenters who are graduate students or postdocs not more than two years past their graduation. Entrants were judged on their research quality and presentation.

Welcome AOS Graduate Students

The AOS Program extends a warm welcome to incoming graduate students: **Kityan Choi** and **Wenyu Zhao**.

Visiting Research Collaborators

The AOS Program would like to acknowledge the following people who were recently appointed as Visiting Research Collaborators, a new category of appointments which recognizes the sterling efforts of GFDL staff members in helping to advise graduate students:

Arlene Fiore, Gabe Vecchi, Mike Winton, Paul Ginoux, and Chip Levy

Arrivals

Hung-Fu Lu arrived in April to work with Leo Oey as a Visiting Associate Professional Specialist. His research focuses on modeling the circulation in the South China Sea using the Princeton Ocean Model.

Massimo Bollasina arrived in May and is working with Yi Ming and V. Ramaswamy as a Postdoctoral Research Associate. His

research focuses on understanding aerosol-induced regional circulation and hydroclimate changes.

Lucas Harris arrived in May and is working with Isaac Held, S.J. Lin and Morris Bender as a Postdoctoral Research Associate. His research focuses on the development of the regional-global two-way nesting capability within the High-Resolution Atmosphere Model (HiRam).

Meiyun Lin arrived in June and is working with Arlene Fiore and Larry Horowitz as a Postdoctoral Research Associate. Her research focuses on multi-scale interactions between climate and air quality.

Patrick Lynett arrived in June and is collaborating with S.J. Lin. He is a visiting faculty member from TAMU. His research focuses on the nonlinear and coupled interactions between wind, sea waves, ocean, and storm surge during hurricanes.

K. Allison Smith arrived in July to work with Jorge Sarmiento as a Postdoctoral Research Associate. Her research focuses on the oceanography and ecology of suboxic regions in the ocean.

Yohsuke Yamashita will be arriving in August to work with John Austin and Leo Donner as a Visiting Postdoctoral Research Associate. His research focuses on the effects of QBO on tropical and extratropical stratosphere, dynamical and chemical analyses of lower stratospheric ozone variation associated with the solar cycle, and the effects on the troposphere.

Maarten Buijsman will be arriving in September to work with Sonya Legg as a Postdoctoral Research Associate. His research focuses on the numerical investigation of non-linear internal wave generation and breaking in straits, in connection with a field program in the Luzon Straits.

Thomas Frölicher will be arriving in September to work with Jorge Sarmiento as a Postdoctoral Research Fellow. His research focuses on the variability of the coupled carbon cycle-climate system and numerical modeling with coupled atmosphere-ocean-biogeochemistry Earth System Models.

Jingqiu Mao will be arriving in September to work with Larry Horowitz as a Postdoctoral Research Associate. His

research focuses on the sensitivity of isoprene emission changes to future climate and air quality.

Visiting Student **Thomas Flannaghan** will be arriving in September from Cambridge to work with Stephan Fueglistaler. His research focuses on Kelvin waves in the tropical tropopause layer.

Visiting Student **Miguel Gomez-Escolar Viejo** will be arriving in September from Complutense University, Madrid (Dept. Fisica de la Tierra II) to work with Stephan Fueglistaler. He will be studying the time series of temperature measurements in the tropical tropopause layer.

Caroline Muller will be arriving in October to work with Isaac Held as a Postdoctoral Research Associate. Her research focuses on a sensitivity study of tropical convection using a cloud resolving model.

Visiting Student **Maria Rugenstein** will be arriving in October from ETH, Zurich to work with Isaac Held. Her research focuses on questions related to the ocean's uptake of heat in global warming simulations.

Departures

Riccardo Farneti – April 2010
Earth System Physics Section of the International Centre for Theoretical Physics in Trieste, Italy

Dilip Ganguly – June 2010
Pacific Northwest National Laboratory (PNNL), Richland, WA

Ayumi Fujisaki – July 2010
NOAA/Great Lakes Environmental Research Laboratory, Ann Arbor, MI

Joseph Kidston – July 2010
University of New South Wales, Australia

Young-Gyu Park – August 2010
Returns to the Korean Ocean Research & Development Institute (KORDI)

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