



AOS & CICS Newsletter

Spring 2008

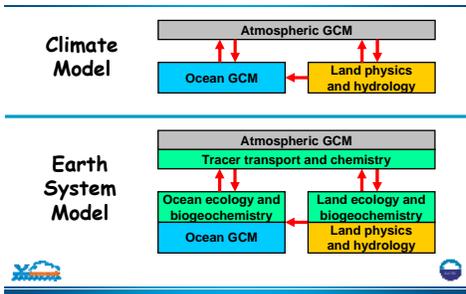
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New Frontiers: Earth System Modeling at GFDL

CICS and GFDL scientists are working side by side to advance our understanding of how the Earth's biogeochemical cycles, including human actions, interact with the climate system. Together, they have made great strides in developing and applying predictive models of climate - the physics backbone of the ESM. Ranked among the world's best, GFDL's climate models have been successful in representing the observed dynamics of El Niño and drying in the African Sahel, and providing good seasonal predictive skill, however, current models simplify biogeochemical processes, such as the carbon cycle - making future predictions less certain. Earth System Models will allow GFDL and Princeton scientists to make better predictions of climate responses to greenhouse gas emissions and land use changes.

Like GFDL's climate models, the earth system models are based on coupled atmosphere-ocean models with representations of land and sea ice dynamics. These models employ a set of mathematical equations and physical parameterizations to study weather, climate, and potential changes, both natural and anthropogenic. The atmospheric component of the model includes representations of atmospheric circulation, cloud physics, aerosols, and precipitation. The land component simulates exchanges of water through evapotranspiration to the atmosphere, and runoff through the rivers to the ocean. The oceanic component includes features such as realistic fresh-water fluxes, currents, sea ice dynamics, and a state-of-the-art representation of ocean mixing.

What is an Earth System Model?



Under the leadership of John Dunne and Ronald Stouffer (GFDL), GFDL's efforts are now focused on adding interactive global carbon cycling and associated chemical and ecological tracers, which determine plant biomass and productivity. Elena Shevliakova, Sergey Malyshev (both supported by CICS) and Stephan Pacala (Princeton University) are leading development of the new land model, which captures vegetation dynamics and variations of land surface characteristics due to natural and anthropogenic disturbances, including agriculture and forestry. George Hurtt and his colleagues at the University of New Hampshire, with CICS support, constructed scenarios of land use changes for the period 1700-2000, which are used as a forcing for the ESM historical experiments. Stephan Gerber and Lars Hedin (Princeton University, also supported by CICS) are leading the implementation of a new model to track the fate of nitrogen in terrestrial systems including adaptive nitrogen fixation, and carbon-nutrient feedbacks manifested in down-regulation of plant photosynthesis.

In parallel to land model development efforts, John Dunne has developed a new model of oceanic ecosystems and biogeochemical cycles. This state-of-the-art model, which is based on partner research carried out originally by Jorge Sarmiento's group, tracks a suite of tracers including three phytoplankton groups, animal and bacteria biomass,

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

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dissolved organic matter, and dissolved inorganic species for carbon, nitrogen, iron, calcium carbonate, and oxygen cycling. Model tuning of river inputs, ocean acidification, calcium carbonate cycling, and sediment processes is ongoing.

Building upon their success of the integration of climate and carbon cycle models, CICS and GFDL scientists plan to fully integrate nitrogen cycling into the atmosphere, land, river, and coastal components and apply this model to study problems of global and regional environmental change. This new ESM aims to link climate and biosphere dynamics with atmospheric chemistry to address multifaceted environmental challenges. Their vision of global modeling is an integrated ESM, projecting not only climate variability on seasonal to

centennial timescales, but also biogeochemical and ecosystem cycling and biospheric feedbacks on the climate system. These collaborative efforts are certain to keep Princeton and GFDL at the forefront of cutting-edge climate science for the 21st century and beyond.

Earth Science Women's Network has AOS Roots

The first meeting of the leadership board of the Earth Science Women's Network (ESWN) was held at Sayre Hall in March 2008. ESWN is a peer-mentoring network of women in the Earth Sciences, most in the early stages of their careers. Members work in nine countries, with the largest representation from U.S. institutions, including universities, government agencies, and research organizations. Arlene Fiore (GFDL) and AOS alumna Tracey Holloway (University of Wisconsin) are founding members of ESWN. Two current board members, Galen McKinley and Agatha De Boer, were recently post-docs in the AOS program.

ESWN informally took shape in 2002, at the Washington, DC meeting of the American Geophysical Union (AGU) when, together with two colleagues, Arlene Fiore organized a reception to conclude a special session of the meeting. What began as a friendly gathering and an exchange of emails between friends and collaborators has evolved into a community building, networking opportunity for young career scientists around the globe.

At this first meeting, board members began planning a NOAA-funded workshop to be held in December, on leadership training for advancement within scientific organizations. The meeting also allowed members to discuss the direction of the organization, organizational infra-structure, near- and long-term goals and strategies for achieving these goals, as well as the value provided by ESWN to the earth science community.

Leaders from other programs that support women in science provided valuable

advice to ESWN board members during the meeting, including representatives from the National Science Foundation ADVANCE program, Mentoring Physical Oceanography Women to Increase Retention (MPOWIR), and the Committee On the Advancement of Women in Chemistry (COACH).



From left to right: ESWN board members Kim Pependorf, Tracey Holloway, Christine Wiedinmyer, Allison Steiner, Arlene Fiore, Meredith Hastings, Galen McKinley.

Missing from the photo are ESWN board members Erika Marin-Spiotta, Amanda Staudt, and Agatha De Boer.

With the aim of lessening the isolation of women scientists, sharing strategies for balancing family and work, and exchanging resources for research and career development, the ESWN has grown from an informal peer network of six female scientists to over 600. Formed, in part, as a response to gender specific barriers faced by female scientists in historically male-dominated fields, ESWN addresses equity in hiring and advancement, and the broader issues of work/family balance. Though the Network, women scientists have found jobs, established research collaborations, and built a community that extends well beyond their affiliations, both in the U.S. and abroad.

Through their NCAR-sponsored listserv, ESWN has established connections for peer-mentoring and scientific collaboration, sharing job announcements, discussing professional life, finding roommates for meetings, and organizing get-togethers at conferences. ESWN, a clearinghouse of sorts, serves as a central access point to connect women across all facets of the earth sciences. Membership is free and has grown exponentially over the years through personal connections and "word of mouth." For more information about ESWN's mission and membership, visit their website at: (<http://www.sage.wisc.edu/eswn/>) or contact Arlene Fiore at GFDL. Outcomes of the discussions at the ESWN board

meeting, and the group's future plans, will be posted on the ESWN web site shortly.

Ramaswamy Named AGU Fellow

V. (Ram) Ramaswamy, Acting Director, Geophysical Fluid Dynamics Laboratory and AOS lecturer with rank of professor, was recently named a Fellow of the American Geophysical Union (AGU). His election to the rank of AGU Fellow was recognized on May 29th at an Honors Ceremony in Ft. Lauderdale, Florida.



V. (Ram) Ramaswamy, Acting Director, GFDL & AOS Lecturer with rank of professor

Ram joins the ranks of AOS colleagues Michael Bender, Kirk Bryan, Isaac Held, Hiram (Chip) Levy, Syukuro (Suki) Manabe, George Mellor, George Philander, and Jorge Sarmiento in becoming an AGU fellow. He is the only AGU Fellow from NOAA named this year, and he is the fourth current GFDL scientist to be awarded this honor, joining Held, Levy, and Robbie Toggweiler.

Since arriving at Princeton in 1985 as a Visiting Scientist in the AOS Program and during more than 20 years as a research scientist at GFDL, Ram has come to be considered one of the leaders in climate modeling in the world. In addition to responsibilities as Acting Director, Ram is head of GFDL's Atmospheric Physics and Chemistry Group and is on the faculty of Geosciences and the AOS Program, with rank of Professor. Ram's career has been devoted to improving our understanding of atmospheric radiation and incorporating this understanding in climate models. His published research includes over 125 papers on climate in refereed journals. Since 1992, he has been a Lead Author or Coordinating Lead

Author for each of the assessment reports for the Intergovernmental Panel for Climate Change. He has also had a leading role in the Climate Change Science program, and is currently serving as the Vice-Chair of the World Climate Research Program.

Each year AGU selects no more than one-tenth of one percent of its membership to be named as Fellows. Election as an AGU Fellow serves as acknowledgement of the scientist's eminence in the Earth (or space) sciences over a sustained period, with significant impact on his or her field. ■

Lecture Series: Inside the IPCC Science, Policy and Politics

Since late February, major contributors to the Intergovernmental Panel on Climate Change (IPCC), including CICS and GFDL scientists, have participated in a spring lecture series, entitled "Inside the Intergovernmental Panel on Climate Change: Science, Policy and Politics." The series aimed to advance the discussion surrounding the latest scientific findings gathered in the 4th Assessment Report and the unique process of coordinated scientific effort that defines the IPCC.

Isaac Held, Professor of Geosciences and Atmospheric and Oceanic Sciences, and Geophysical Fluid Dynamics Laboratory (GFDL) Senior Research Scientist, opened the series on February 26th with his talk, entitled "The scientific basis for projections of climate change (In a nutshell): History, status, unsolved problems." He provided an overview of the state of climate science and modeling at the same time highlighting current challenges, particularly the problem of parameterizing sub-grid scales features such as clouds. Held was a lead author of the chapter on Regional Climate Projections in the 2007 IPCC Assessment Report.

The following week on March 6th, V. (Ram) Ramaswamy, Acting Director and Senior Scientist, GFDL and Lecturer with

rank of Professor in Geosciences and Atmospheric and Oceanic Sciences (AOS), presented a talk on "Evolution of climate science in the IPCC assessments: Understanding the 20th century climate change." Ramaswamy provided a history of the Intergovernmental Panel on Climate Change and the role of Princeton and GFDL in climate research and assessment efforts. Ramaswamy was Coordinating Lead Author of the chapter on Changes in Atmospheric Constituents and in Radiative Forcing and Author of the Summary for Policymakers and the Technical Summary of the IPCC 4th Assessment Report. He has been a Lead Author or Coordinating Lead Author for each IPCC assessment report, since 1992.

"From science to assessment: Overview of the IPCC AR4 Working Group 1 Report," the third talk in the series, was given by Ron Stouffer, senior research meteorologist in the Climate Dynamics Group, GFDL and contributor to all four IPCC Working Group 1 Reports since 1990. Stouffer addressed how the IPCC arrives at consensus in the face of uncertainty, particularly when it comes to predicting future climate change. Also noteworthy, he was an author of the Summary for Policy Makers in both 2001 and 2007.

Albert G. Milbank Professor of Geosciences and International Affairs, Michael Oppenheimer, was the speaker on Tuesday, April 1st. Entitled "Ice Sheets and Sea Level Rise: How should IPCC handle deep uncertainty?," his talk continued the broad conversation surrounding climate science and the role of the IPCC process in shaping the global dialogue. Oppenheimer was a Lead Author of the chapter on "Assessing Key Vulnerabilities and the Risk from Climate Change" and Author of the "Summary for Policymakers" and "Technical Summary" of the IPCC 4th Assessment Report. He also contributed to the Working Group II Report "Impacts, Adaptation, and Vulnerability".

The series completed its program with climate luminaries Jae Edmonds and Gary Yohe. Jae Edmonds, a senior staff scientist and technical leader of economic programs at the Pacific Northwest National Laboratory's (PNNL) Joint Global Change Research Institute and the principal investigator for the Global Energy Technology Strategy Program,

focused his April 22nd talk on "Emissions Mitigation and Climate Stabilization." Themes included the feasibility of climate stabilization, fundamental change to the global energy system, and applying a price to carbon emissions. He has served as a lead author for all three major assessments of the IPCC and numerous interim assessment reports. Lessons from the Climate Wars: The Future of the IPCC was the final talk in the series and took place on Wednesday, May 7th. Gary Yohe, a Woodhouse/Sysco Professor of economics and Director of the John E. Andrus Public Affairs Center at Wesleyan University spoke about adaptation and the potential damage of global climate change. Yohe is a senior member and coordinating lead author of the IPCC.

The "Inside the Intergovernmental Panel on Climate Change: Science, Policy and Politics" lecture series was co-sponsored by the Princeton Environmental Institute (PEI), Princeton's Woodrow Wilson School of Public and International Affairs (WWS) and the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory (GFDL). ■

Isodoro Orlanski's Argentine Ties

Isodoro Orlanski, a lecturer with rank of Professor in the AOS Program, recently spent six weeks as a guest of the University of Buenos Aires (UBA) teaching a class and conducting collaborative research with Dr. Silvina Solman from CIMA/UBA (Centro de Investigaciones para el Mar y la Atmosfera), an institution Orlanski founded in the late eighties at the request of the Argentine government. Since that time, CIMA has served as a *port-of-call* for AOS alumni visiting Argentina, including C. Mechoso, Z. Garaffo, M. Barreiro, R. Matano, H. Figueroa, to name only a few. Through the years, AOS Faculty have also visited CIMA, including K. Miyakoda, A. Levy, V. Ramaswamy, and G. Philander. Today, the center, under the direction of Dr. Mario Nuñez, is dedicated to researching and modeling the atmosphere and oceans and plays a unique role in South America by training scientists from neighboring countries in atmospheric and ocean modeling. A high point of Orlanski's

visit was when more than twenty students signed up for “The elements of the Coupled Climate Model,” a graduate level course offered through the Department of Atmospheric and Ocean Sciences and taught by Orlanski. The course enrollment was noteworthy to those in the department because graduate level courses typically only attract a handful of students.

Orlanski’s present research on the precipitation of the subtropical regions of South America is of particular significance to those in the region. Nowhere was that interest more evident than in an invitation from Alberto Arizu, an agronomist and owner of the Luigi Bosca winery which produces about 9 million liters of wine a year, to speak at his winery. Speaking to an audience of vintners, researchers from the agronomy school of the local university, and others from research institutes of the wine making industry, Orlanski discussed the possible impact of climate change in Argentina, the fifth largest wine producer in the world. According to Orlanski, although it is tempting to speculate that the increasingly higher alcohol levels of wines from places like Australia, California, and Argentina are the result of a warming climate, it is difficult to prove. Other factors come into play such as how long the grape hangs on the vine. One thing is clear, however, climate and wine are intricately linked. For Orlanski, a wine aficionado of sorts, this particular talk at the foot hills of the impressive Andes mountain chain, in the province of Mendoza, was a trip highlight. ■

Transportation Update

On behalf of our research staff and students, Jorge Sarmiento, Director of the AOS Program and Laura Rossi, AOS Program Manager, have been working with Paul Breitman, General Manager for University Services, to resolve the transportation issue that go hand-in-hand with being located 3 miles from Main Campus. With input from Sarmiento and Rossi, Breitman will be submitting a proposal to the Provost and University Executive Vice President, Mark Burstein, to request “on call” shuttle service to and from the Forrestal Campus. If approved, the service would begin in September of

2008. In the interim, the Geosciences van is on loan to AOS until the transportation issue can be resolved. Graduate Student, Yves Plancherel, will continue to don his chauffeur’s cap for the common good of fellow “*Forrestallians*.”

In related news, campus parking decals for lot 25 have recently been distributed to GFDL Faculty for use during the time when they are teaching classes. This not only shortens the trek to Guyot, but demonstrates that the transportation concerns of our faculty are being addressed. ■

Director’s Corner



Having recently completed the CICS recompetition process for the continuation of the cooperative agreement between Princeton University and NOAA, it has occurred to me that some of you may not be all that familiar with the history of CICS and the cooperative agreement that steers its course. I’d thought I’d share with you a brief history of CICS and tell you how we benefit from such an agreement.

CICS was created as an outgrowth of over 40 years of successful collaboration between the University and GFDL. In 1968, the affiliation between Princeton and GFDL began with GFDL’s relocation to the Forrestal Campus, thanks, in part, to AOS Faculty Emeritus, George Mellor, then a professor of mechanical engineering, who suggested that Princeton might be just the university setting that GFDL was looking for to broaden its scope of its activities. Twelve months after the initial conversation between Mellor and Joseph Smagorinsky, GFDL’s founder, a memorandum of understanding was signed. The relocation of GFDL from Pennsylvania Avenue, in Washington to Princeton brought with it Senior Scientists Kirk Bryan, Syukuro (Suki) Manabe, and Kikuro Miyakoda who were appointed visiting lecturers with rank of professor. They taught graduate students and interacted with

other faculty members in geophysics, engineering, and statistics through the interdepartmental AOS Program. All four continue their scientific endeavors working side-by-side with present-day faculty, researchers, postdocs, and graduate students, a true testament to the success of the collaboration some 40 years later.

In 2003, recognizing the thriving partnership between the University and GFDL and the outstanding research program, NOAA designated Princeton as a Joint Institute which provided an easy mechanism through which NOAA and GFDL would be able to fund various projects at the University. Today, CICS continues to provide a strong framework for more readily transferring research funds from NOAA to Princeton, a significant benefit to the University and the AOS Program. Simply put, the CICS cooperative agreement simplifies NOAA’s funding of Princeton’s research.

The new cooperative agreement will cover a five year period between July 1, 2008 and June 30, 2013 and follows the submission of a 77-page “recompetition” proposal which outlined the capabilities of CICS in Earth system modeling, with a particular emphasis on climate applications for decadal or longer timescales. Spearheaded by CICS Associate Director, Geoff Vallis, the CICS proposal demonstrated exceptional capabilities to provide research in three areas: Earth system modeling and analysis, data assimilation, and Earth system model applications, while directly addressing both NOAA’s mission needs and strategic plans for the 21st century. Throughout the proposal process, Geoff enlisted the scientific expertise of CICS Research Oceanographers, Alistair Adcroft and Sonya Legg, Associate Research Scholars, Elena Shevliakova, Sara Mikaloff-Fletcher and Eric Galbraith, and software architect, Venkatramani Balaji as well as the administrative expertise of Laura Rossi, AOS Program Manager. I would like to thank Geoff and “his team” for stepping up to the challenge in my absence, while I was on sabbatical in Europe. I am pleased to report that the competitive renewal of CICS has been awarded and will pave the way for five more years of innovative, scientific research. ■

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 ACCESS Climate Modeling Workshop, Cape Town, South Africa.]

ACCESS, the Africa Centre for Climate and Earth System Science, is an institute established in Cape Town to address some of the gaps in current climate science. It was founded through the efforts of George Philander, Professor, Geosciences, who stepped down as AOS Director to devote his attention to this undertaking. ACCESS has many goals: to address climate questions of particular significance to Africa; to train a generation of young scientists in the skills necessary to answer questions of great social relevance to the region; to promote scientific literacy in resource-poor nations to enable them to ask the right questions about the consequences of climate change and adaptation pathways; to encourage collaboration between African scientists and climate scientists from resource-rich countries. Princeton University has listed Africa among its millennial grand challenges and is poised to play a key role in this effort.



Partial Group Shot, ACCESS Workshop, Cape Town

During March 2008, ACCESS conducted its first workshop on climate and Earth system science in the beautiful setting of the University of Cape Town. This workshop, focused on the ocean, ran for two weeks, March 10-20, 2008, and had as its centerpiece, the NOAA/GFDL Modular Ocean Model (MOM4). Students from South Africa as well as elsewhere on the continent received training in the theory of the ocean circulation. They then learned to apply theory to idealized and comprehensive models of the ocean. The hands-on workshop allowed groups of

students to design modeling experiments using MOM4 and run them on the supercomputer provided by the South African Centre for High-Performance Computing in Cape Town. Instructors included V. Balaji (CICS); Marcelo Barreiro, formerly of AOS, now at the Instituto de Física, Universidad de la República in Montevideo, Uruguay; Matt Harrison, Oceanographer at NOAA/GFDL; and George Philander.

This is anticipated to be one in a series of regular workshops taught by scientists from Princeton and elsewhere at ACCESS. Future workshops will address questions in geochemistry, modeling of the atmospheric circulation, and in climate system modeling, including the use of the complete GFDL Earth system model CM2.

References:

<http://www.gfdl.noaa.gov/~vb/talks/access-za.pdf>

<http://picasaweb.google.com/hildatp/Workshop2008> ■

AOS & CICS News

Congratulations to the Newly Elected GFDLEA Board Members

President: Bill Hurlin

Vice President: Fanrong Zeng

Secretary: Kenny Nock

Treasurer: Robbie Toggweiler

Board Members (2nd year): Jeff Flick, Jasmin John

Board Members (1st year): Niki Zadeh, Colin Morgan

Director of Entertainment: Marian Westley

On Tuesday, May 6th, the GFDLEA and the Ombuds program sponsored the third **GFDL 5K Run/Walk**. The focus of this year's pledge drive was once again Mercy Corps' effort in Darfur. Thanks to everyone who donated; **\$1,665.50** was collected!



GFDL 5K Run/Walk for Mercy Corps

First place awards were presented to walkers Bonnie Samuels and Tony Gordon and runners Kristen Findell and Laurent White. Participants in this handicapped event crossed the finish line just in time for the first GFDLEA Spring Cookout. All participants received the OFFICIAL GFDLEA 5k Fun Run tee shirt designed by GFDL's very own Keith Dixon. Many thanks to Jasmin John who organized the cookout and Rich Gudgel who helped kickoff cookout season with the GFDL 5k Run/Walk.



GFDLEA Spring Cookout

GFDLEA's next cookout is scheduled for Tuesday, June 10 (raindate: Thursday, June 12). The fee is \$5 for GFDLEA members and \$6 for non-members. A sign up sheet is located outside of Room 165 (Jeff Flick's office). Payment is due by Monday, June 9th and may be given to Jeff, Fanrong Zeng (Rm. 365) or Niki Zedah (Rm. 134B).

Arrivals:

Zhibin Sun arrived on March 1st, 2008 and began working with Leo Oey to help develop and improve high-resolution ocean models, including MPI's and data assimilation methodologies, conduct process and data assimilation experiments with these models, and analyze the large set of model results in conjunction with observational data. He completed his Ph.D at the Joint Center for Earth Systems Technology (JCET), University of

Maryland, Baltimore County and held a postdoctoral position there for six months prior to joining AOS.

Eun Young Kwon joined us on April 7th, 2008 and is working with Jorge Sarmiento and Anand Gnanadesikan on offline transport calculations for biogeochemical processes. She completed her Ph.D at the University of California, Irvine.

Marc Salzmann arrived on March 1st, 2008 and is working with Leo Donner on cloud microphysics and feedbacks in the GFDL general circulation model. He completed his Ph.D at the Max Planck Institute for Chemistry.

David Paynter arrived on June 1, 2008 to work with V. Ramaswamy on the water vapor continuum. He completed his Ph.D at the University of Reading.

SAYRE HALL'S 8th & 9th IRON CHEF COMPETITIONS

Fat Tuesday enthusiasts came together on February 5th for Sayre Hall's Iron **Chef VIII**. Reigning Iron Chef Champion, **Jennifer Simeon**, passed the winning torch to **Stephanie Henson** for her ultravelvet carnival chocolate cake with Valentine accents (*Britain-Creole style*).

Laura Rossi came in a close second for her millegoglie (pastry puff) with grappa cream and strawberries. These triple-layer bites of pastry and cream filling topped with fresh strawberry slices, were served with homemade grappa — a true *carnevale* tradition that is sure to chase away the winter chill!

Iron Chef IX was held on Monday, May 5th ... Cinco de Mayo. Sara Mikaloff Fletcher came in first place wowing her colleagues with her eye-catching black bean and mango salad with grilled gingerlime shrimp in avocado cups. Always a strong contender, Anna Valerio placed second with her sweet potato black bean burritos.

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