

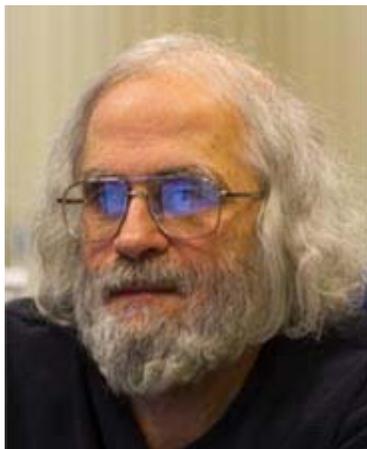


# AOS & CICS Newsletter

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## Held Earns International Honor



AOS Faculty Member Isaac Held

AOS Faculty Member and NOAA/GFDL Senior Research Scientist Isaac Held has been awarded the prestigious BBVA Foundation Frontiers of Knowledge Award in Climate Change “for his fundamental and pioneering contributions to our understanding of the structure of atmospheric circulation systems and the role of water vapor – the most important greenhouse gas – in climate change.” The BBVA Foundation runs the annual Frontiers of Knowledge and Culture Awards in order to recognize and encourage world-class research and artistic creation and advances in a series of basic, natural, social and technological sciences, prizing contributions of broad impact for their originality and theoretical significance.

“It is an honor to be nominated for an award of this kind, let alone to be chosen to receive it. I have been fortunate to have worked at GFDL and with a series of exceptional Princeton University students and post-docs. It is difficult for me to envision making as much progress on the

problems on which I have worked in another environment,” said Held.

Held, in opinion of the award jury, has charted new pathways across the climate change landscape. One focus of his research is the essential role of water, its movement in the atmosphere, and the investigation into how water vapor influences the greenhouse effect. “The amount of water in the atmosphere is what makes some zones wetter than others. Trying to understand how water moves in the atmosphere and how climate change may alter those patterns in the future is one of the things I have focused on in my research,” remarked Held after hearing of the award.

Many of the processes that dictate the existence of different climate zones and predict how they will change due to the alteration of the world’s climate, have been unearthed through Held’s research. Specifically, his work sheds light on why tropical zones will become wetter as subtropical zones get gradually dryer, a trend derived from available data.

As the temperature rises, the quantity of water vapor in the atmosphere rises as well, and this gas, in turn will drive further warming. Held predicts that if CO<sub>2</sub> emissions are not curtailed, temperatures in the Mediterranean will rise by 3° in the next century while rainfall levels will drop by between 10% and 15%.

The chairman of the jury, Bjorn Stevens, announced the name of the new laureate on January 11<sup>th</sup>, 2012 in the Marqués de Salamanca Palace, Madrid headquarters of the BBVA Foundation, where he was accompanied by Juan José Damborenea, Assistant Vice-President of Scientific and Technical Areas at the Spanish National Research Council (CSIC), the Rafael Pardo, Director of the BBVA Foundation. Held will accept the award, which

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

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comprises 400,000 euros, a diploma, and a commemorative piece of artwork, at a ceremony in Madrid, Spain in June.

The BBVA Foundation established the Frontiers of Knowledge Awards in 2008 to recognize the authors of outstanding contributions and significant advances in a broad range of scientific and technological areas characteristic of our times. The quality of the nominations received and the stature of the jury members and laureates in their first three editions have placed them among the world’s foremost award families. Held’s Frontiers of Knowledge

Award comes in their fourth edition. He joins a prestigious array of former Frontiers of Knowledge Award recipients in the climate change category, including British economist Nicholas Stern, German physicist and mathematician Klaus Hasselmann, and Wallace Broecker of Columbia University. ■

## Student-run Symposium in the Geosciences Brings Students Together

The first all student-run Research Symposium in the Geosciences at Princeton University was held on Friday, November 11<sup>th</sup> in Lewis Library, with more than 100 people in attendance, including graduate students, faculty, post-doctoral researchers, and undergraduates. This full day event was organized exclusively by the graduate students of the Department of Geosciences.

Fifty presenters from Princeton and surrounding universities, including Rutgers, Columbia/LDEO, NYU, and the University of Pennsylvania, convened on Main Campus for a day of science and camaraderie. Graduate student research was showcased in a series of oral talks and poster presentations. According to the event's organizing committee, in addition to increasing graduate student visibility within and across the local research community, the intent of the symposium was "to advance student appreciation and understanding beyond their specific area of research by encouraging a more holistic view of the geosciences through presentations from graduate students in any branch of Earth Science: atmospheric science, Earth history, geochemistry, geology, geophysics, oceanography, orography, paleoclimate, paleontology, and seismology."

Andrew Babbin, co-organizer of the event, said, "The symposium was quite a success in allowing students throughout the many fields within the geosciences - from microbiology to paleoclimate to atmospheric dynamics - to interact on both scientific and social levels. In fact, students

from some of the other participating universities are eager to host the event next year in an effort to continue the push to build a local student geosciences community."

The symposium was divided into four oral sessions and two poster sessions as follows: Modern Environmental Biogeochemistry, Geology, Geomorphology, Geophysics, Geochemistry, and Geochronology, Insights into the Biology and Geochemistry of Earth's Past, and Earth Systems Modeling: Past, Present, and Future. Among the many presenters were Geosciences Graduate Student Kelly Kearney (a member of the Sarmiento group) and AOS Graduate Students Spencer Hill, Ilissa Oeko, and Amanda O'Rourke.



AOS Graduate Student Amanda O'Rourke presents her poster on "The interaction of the subtropical and eddy-driven jets in an idealized model."

"The symposium facilitated a dynamic interaction amongst participants studying various aspects of the Earth system. By providing students from several universities the opportunity to interact, the symposium was instrumental in fostering academic and professional development," Oeko said.

First Year Graduate Student Spencer Hill said, "The symposium was a great opportunity to meet non-AOS geosciences students. Additionally, my talk directly led to a new research collaboration with Prof. George Philander (who was in attendance), Marcelo Barreiro, and others on the potential role of aerosol-driven cloud albedo changes to drive observed changes in the paleoclimate record. So it was overall a really positive experience."

"I am so pleased to see our graduate students taking advantages of opportunities such as this one to present their research

and to network with their peers in the scientific community," AOS Director Jorge Sarmiento said. "The symposium was a wonderful opportunity for them to learn about research being carried out in related disciplines, in addition to their own." ■

## Landmark Study Examines Day-to-Day Climate Variations

Day-to-day weather has grown increasingly erratic and extreme, with significant fluctuations in sunshine and rainfall affecting more than a third of the planet, according to a recent study by Assistant Professor David Medvigy and AOS Postdoctoral Associate Claudie Beaulieu. Published in the *Journal of Climate*, the study, one of the first to focus on daily climate variations, found that exceedingly sunny or cloudy days have become increasingly common since the early 1980s as have swings from thunderstorms to dry days since the late 1990s. The researchers noted that these variations could have consequences for ecosystem stability, pest and disease control, and the agriculture and solar energy industries.

Historically, climate variations have been observed on a monthly basis. Using satellite records from 1984-2007, Medvigy and Beaulieu looked at daily changes on a global scale; this attention on day-to-day variability is what makes this study so significant. These daily fluctuations hold implications for natural and manmade systems, most notably solar energy production and terrestrial plant photosynthesis, according to the authors.

"Their results not only provide new information on daily climate variations, but they also open the door to further research

**GFDL Blood Drive**

**Monday, Feb. 13, 2012**

**11 am - 2 pm**

on the possible connection between these day-to-day fluctuations and rising carbon dioxide concentrations in the atmosphere, remarked AOS Director Jorge Sarmiento.

In addition to these fluctuations having the potential to alter how the atmosphere distributes heat and rainfall, they could inhibit the ability of plants to remove carbon dioxide from the atmosphere thereby leading to higher levels of the greenhouse gas.

“The implications of changes in variability could be substantial, and I think putting a number on it is going to require a little more work,” Medvigy said. Although he acknowledges that direct ties between weather variability and increased carbon dioxide concentrations in the atmosphere were not examined in this study, he noted that it wouldn’t come as a surprise to him if they are connected in some way. “As next steps, we have two major projects planned. First, we want to figure out what is driving these increases in atmospheric variability, and to determine whether we can expect these increases to continue in the future. Second, we want to assess how the strong changes that have occurred over the past few decades in the tropics may have impacted tropical forest carbon budgets.”

The study was published online Oct. 14 by the *Journal of Climate*, and was funded by grants from the Princeton Carbon Mitigation Initiative and the Fonds Québécois de la Recherche sur la Nature et les Technologies. ■

## AOS Work is Recognized at Open Science Conference

**Contributed by Maria Setzer, GFDL Communications Director**

AOS Postdoctoral Research Associate Massimo Bollasina and AOS Graduate Student Ilissa Ocko were honored for "outstanding presentations" at the World Climate Research Program's first-ever Open Science Conference held in Denver, in late October. The recipients were selected by a team of evaluators and a panel of judges who reviewed

presentations made by students and early career scientists. Nearly 2,000 participants came from 86 countries to attend the Conference.

Massimo studies aerosol-driven changes in regional hydroclimate and atmospheric circulation -- especially over South Asia. His presentation, “Anthropogenic aerosols and the weakening of the South Asian summer monsoon”, was based on a paper published in *Science* earlier in 2011. Massimo and his coauthors provide



*AOS Postdoctoral Research Associate  
Massimo Bollasina*

compelling evidence of the prominent role of aerosols in shaping regional climate change over South Asia. Using GFDL’s CM3 climate model, the observed drying trend of the South Asian summer monsoon is shown to be of anthropogenic origin, and attributed to increased aerosols rather than human-influenced greenhouse gas emissions. This work also demonstrated that the decrease in the monsoon rainfall can be explained as an outcome of a slowdown of the tropical meridional circulation, driven by the need to counteract the aerosol-forced energy imbalance between the northern and southern hemispheres.

Ilissa was recognized for her presentation examining changes in air temperature, precipitation, soil moisture, and ice volume, which are attributed to the presence of sulfate and black carbon. She sought to evaluate how contrasting differences among the main anthropogenic aerosol species have affected 20<sup>th</sup> century climate change, using GFDL’s CM2.1 climate model. Her results showed that black carbon and sulfate have opposing global-mean effects on all variables except precipitation. Both aerosols reduce global-

mean rainfall rates. Ilissa plans to continue this work by investigating the policy and



*AOS Graduate Student Ilissa Ocko*

climate implications of mitigating sulfate and/or black carbon emissions. Future climate change mitigation strategies may involve reducing emissions of all aerosols, with an emphasis on warming agents. Since the climate responds to sulfate and black carbon in opposing ways, there are tradeoffs in reducing cooling and warming aerosol emissions simultaneously. She hopes to explore the policy implications of the consequential climatic tradeoffs. ■

## High Performance Computing Research Center Opens



*The University’s High-Performance Computing Research Center located on Forrestal Campus  
(Photo by Christopher Lilja)*

AOS faculty, researchers and students may soon benefit from the robust computing resources that are now centralized across

the street from Sayre Hall on Princeton's Forrestal Campus. The 47,000-square-foot building is the new home to powerful research computers that can tackle difficult calculations and large data sets, for example the computers are allowing Princeton scientists to explore the feasibility of carbon dioxide storage, among others.

This centralized approach provides broad access to all researchers who wish to use these high-performance computers and also enables interaction between researchers from different disciplines. About 70 percent of the computing power at the new center is to be dedicated to high-performance research computing. Part of Princeton's existing TIGRESS (Terascale Infrastructure for Groundbreaking Research in Science and Engineering) High Performance Computing Center and Visualization Laboratory, five high-performance research computers will provide computing speed of about 110 teraflops, or 10 percent of the capability -- as measured in "FLOPS," or floating point operations per second -- of a national computing center.

"The HPCRC will allow my research group to address complex scientific problems related to Earth's atmosphere and vegetation. Using these resources, we are simulating how deforestation of the Amazon is affecting weather and climate, how forests in the U.S. respond to climate variability and change, and the effects of insect disturbances on the terrestrial carbon cycle," Assistant Professor David Medvigy noted.

"We have used these resources to develop predictive models for the timing of the springtime green-up of temperate forests, and to quantify implications of forest seasonality on the terrestrial carbon cycle," in related work with CICS Researcher Su-Jong Jeong, Medvigy added.

"The new facility is quite impressive; the University's commitment to energy efficiency and sustainability is evident at every turn," AOS Director Jorge Sarmiento remarked. According to Edward T. Borer Jr., manager of Princeton University's energy plant, the building's many energy-savings features include an air conditioning system that can be switched off and giant louvers on the south that can be opened to let in cold air from the outside, cooling towers that enable chillers to be turned off

when the outside temperature is near freezing, and a gas-powered second backup generator that has a co-generation feature that harnesses waste heat as energy to chill the water. This natural gas generator will be switched on when electricity prices are high which will not only lower costs, but lower Princeton's carbon footprint as well.

In addition to these sustainability measures, the facility's planners developed the site with future expansion in mind, allowing for the existing building to be doubled in size when the time comes.

Researchers who are interested in using the high-performance computers make requests through the Research Computing <<http://www.princeton.edu/researchcomputing/>> website. Proposal requirements for prospective users are outlined on the site, along with information on available resources and services. ■

## Summer School for Atmospheric Modeling at GFDL, July 16-20, 2012

This summer, Geophysical Fluid Dynamics Laboratory will host a course to introduce users to the GFDL AM3 atmospheric model, from July 16th to 20th. The Summer School on Atmospheric Modeling will take students through the steps involved in configuring, running, and analyzing results from GFDL's climate model running on parallel supercomputers and attached to large-scale data archives. The course will also provide an overview of the atmospheric model's scientific formulation.

The course is aimed principally at advanced graduate students, post-docs and research staff. General background in climate science is required. Knowledge of climate modeling or High Performance Computing is helpful, but not necessary. Approximately 25 students will be accepted for this course.

The deadline for applications is March 16, 2012. Please see the summer school web site for more information, and to apply: <<http://data1.gfdl.noaa.gov/summer-school/>>. ■

## Alumni News

Former AOS Research Scholar Stephanie Henson has been awarded the European Geosciences Union Arne Richter Award for Outstanding Young Scientists. The award will be presented during the 2012 General Assembly of the Union in Vienna, Austria in April. As a testament to the high caliber of Stephanie's work, she has also been invited to present a Medal Lecture at the General Assembly, which is typically well attended, particularly by younger scientists.

Stephanie's research has largely addressed questions of variability in marine ecosystems by using remote sensing.



*Former AOS Research Scholar Stephanie Henson*

Although remote sensing gives only information about the first few meters of the ocean, Stephanie has used it to delve into deeper biogeochemical truths. She has explored nutrient dynamics, bloom timing, phytoplankton dominance, and export production.

Stephanie's scientific leadership is evident. "Since completing her Ph.D. only six years ago, she has become an outstanding young scientist working at the leading edge of marine biogeochemical research. She has led international groups of fellow researchers, is an enthusiastic teacher and a lead-supervisor of doctoral students, and a sea-going scientist," her nomination for the prize noted. "Stephanie is producing results that cut to the heart of our understanding of how, and when, anthropogenic effects will perturb the Earth system."

This comes as no surprise to AOS Director Jorge Sarmiento. "Stephanie has always had a clear vision for the direction of her

research and the remarkable ability to tackle complex research questions,” he remarked. “She has an exceptional talent for getting her research out into the literature.”

In a recent paper, she applied her expertise with remote sensing techniques to define when the effects of climate change may be separated from background variability. In addition to dealing with topics of critical contemporary importance, her work successfully challenged the conclusions of earlier, high-profile research. “She is a highly independent scientist which is essential to successful scientific inquiry,” Sarmiento added.

Stephanie is currently a NERC research fellow in the Ocean Biogeochemistry and Ecosystems division of the National Oceanography Centre, Southampton. ■

## 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 former Postdoctoral Research Associate Stephanie Downes who spent over two and a half years in Jorge Sarmiento’s group.]

In November, Stephanie Downes left the AOS program to join the Geophysical Fluid Dynamics group at the Australian National University in Canberra, Australia, as a Research Fellow. Stephanie is a physical oceanographer who joined the AOS program as a postdoctoral research associate in early 2009. She previously worked with several climate models investigating Southern Ocean circulation and water mass formation, and continued her model-based research in Princeton using GFDL’s coarse and high resolution models.

In Jorge Sarmiento’s group at AOS, Stephanie worked with several AOS and GFDL scientists on two major projects. The first was to use GFDL’s models and assimilated solutions to determine the exchange rates of water masses carrying carbon, heat and nutrients in and out of the



Former AOS Research Fellow Stephanie Downes along with her husband Greg and son James

Southern Ocean, and how these changed under extreme wind stress forcing. The two resulting publications concluded that coarse resolution models differ greatly in their representation with ocean-ice heat and freshwater fluxes around the Antarctic continent and their Indian and Pacific Ocean deep circulation. When the strong Southern Ocean westerlies were increased, Downes et al. showed that the underlying Antarctic Circumpolar Current flow and associated water mass formation was restructured and increased slightly. Stephanie is currently expanding these results by linking water mass formation with El Niño and the Southern annular Mode, to demonstrate variability in formation rates across the Southern Ocean is not uniform around the circumpolar belt.

Since May 2011, Stephanie has been working closely with AOS Research Oceanographer Bob Key and other U.S. scientists to describe the abyssal South Pacific circulation using hydrographic data from the past 40 years. The circulation is driven by the physical processes of hydrothermal vents, the strong Antarctic Circumpolar Current, eddy mixing and the Ross Gyre - all of which can be traced via Helium-3 data and stratification measures. This work (recently submitted to the Journal of Physical Oceanography) highlights the need for observations along the South Pacific major ocean ridges.

“Stephanie just finished over two years as the ‘post-doctoral physical oceanographer’ for our research group. She was also my next door neighbor in Sayre Hall. I very quickly came to appreciate not only her scientific skills, but also her very pleasant personality. Collaborating with her on an interesting research project was a most rewarding experience. We already miss Stephanie, but wish her, Greg and James a

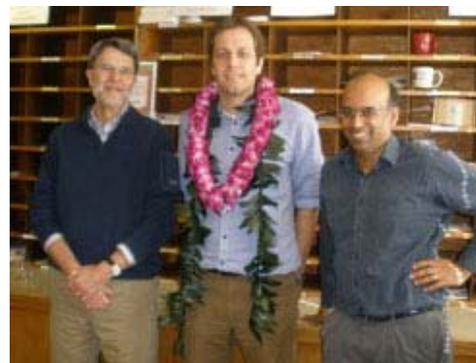
successful adventure back in Australia,” Key said.

Stephanie will continue working with AOS and GFDL scientists in her new post, and thoroughly enjoyed her time at Princeton University. ■

## AOS & CICS News

Former AOS Associate Research Scholar **Sara Mikaloff-Fletcher** is now an Associate Editor for *Global Biogeochemical Cycles*.

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AOS Director Jorge Sarmiento, Graduate Student Yves Plancherel, and Associate Professor Anand Gnanadesikan, Johns Hopkins University, at defense celebration for Yves

Congratulation to GEO grad student **Yves Plancherel** who successfully defended his thesis titled, "A Study of the Ocean's Water Masses Using Data and Models" on December 13th. Yves has accepted a postdoctoral position at the University of Oxford.

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Congratulations to **Daniele Bianchi** who successfully defended his thesis titled, "Processes Controlling the Distribution of Biogeochemical Tracers in the Ocean" on October 27th. Daniele accepted a postdoctoral position in the Earth and Planetary Science Department at McGill University.

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Congratulation to **Ying Li** who successfully defended her thesis titled, "Dynamical Mechanisms for the Teleconnection between ENSO and NAO

in Late Winter" on October 26th. Ying has taken a postdoctoral position at Colorado State University.

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## Beaulieu lends expert commentary to climate change discussion

On December 11th, AOS Postdoctoral Research Associate **Claudie Beaulieu** was interviewed on Canada's national public broadcaster Radio-Canada "Les années lumières" weekly scientific radio show. Commentator Yanick Villedieu interviewed Beaulieu based on her and Professor David Medvigy's recent report on erratic climate change recently published in the *Journal of Climate*.

Listen online at: < [http://www.radio-canada.ca/emissions/les\\_annees\\_lumiere/2011-2012/chronique.asp?idChronique=190645&autoPlay=#>](http://www.radio-canada.ca/emissions/les_annees_lumiere/2011-2012/chronique.asp?idChronique=190645&autoPlay=#>).

(Claudie's commentary begins 13:00 minutes into the interview. Note: Interview is in French.)

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The January 2012 edition of *Physics Today* features an article on Congressional Science Fellows, including former AOS Graduate Student and current Congressional Science Fellow **Ian Lloyd**.

The article can be found here:

<[http://www.physicstoday.org/resource/1/phtoad/v65/i1/p24\\_s1](http://www.physicstoday.org/resource/1/phtoad/v65/i1/p24_s1)>.

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## Staff Recognition

AOS Department Assistant/Graduate Administrator **Anna Valerio** and AOS Grants Manger **Cindy Kandell** will be honored for their years of dedicated service to Princeton University at a luncheon on Thursday, March 29<sup>th</sup>, 2012. Anna will be honored for 20 years of service and Cindy for 25.

## Arrivals

Postdoctoral Research Associate **Sarah Kapnick** arrived in October from UCLA. Sarah, a Princeton undergraduate alum, will be working with Tom Delworth.

Nereus Fellow **Ryan Rykaczewski** joined Jorge Sarmiento's group in November after working with John Dunne at GFDL.

**Xin Liu**, an associate professor at the Institute of Coastal Zone Research for Sustainable Development, Chinese Academy of Science, arrived in January for a 6 month visit to collaborate with Leo Oey.

**David Brayshaw**, a NERC Research Fellow in the Department of Meteorology, University of Reading, will arrive in February for approximately 5 months to collaborate with Geoff Vallis. David's wife, **Sarah Keeley**, a Scientist and Educational Officer at the European Centre for Medium-Range Weather Forecasts, will visit sporadically during this time to collaborate with Geoff Vallis and Mike Winton.

**Chia-Ying Tu**, a researcher at the Research Center of Environmental Changes, Academia Sinica, Taiwan, will arrive in February for one year to collaborate with Isaac Held and S. J. Lin.

## Departures

**Stephanie Downes** – November 2011  
Research Fellow  
Research School of Earth Sciences,  
Australian National University

**Cheryl Logan** – December 2011  
Assistant Professor, Marine Physiology  
California State University Monterey Bay

**Lucas Harris** – January 2012  
Physical Scientist, GFDL

## Birth Announcements

Congratulations to **Caroline Muller** on the birth of her daughter, Margot, on November 9<sup>th</sup>.

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