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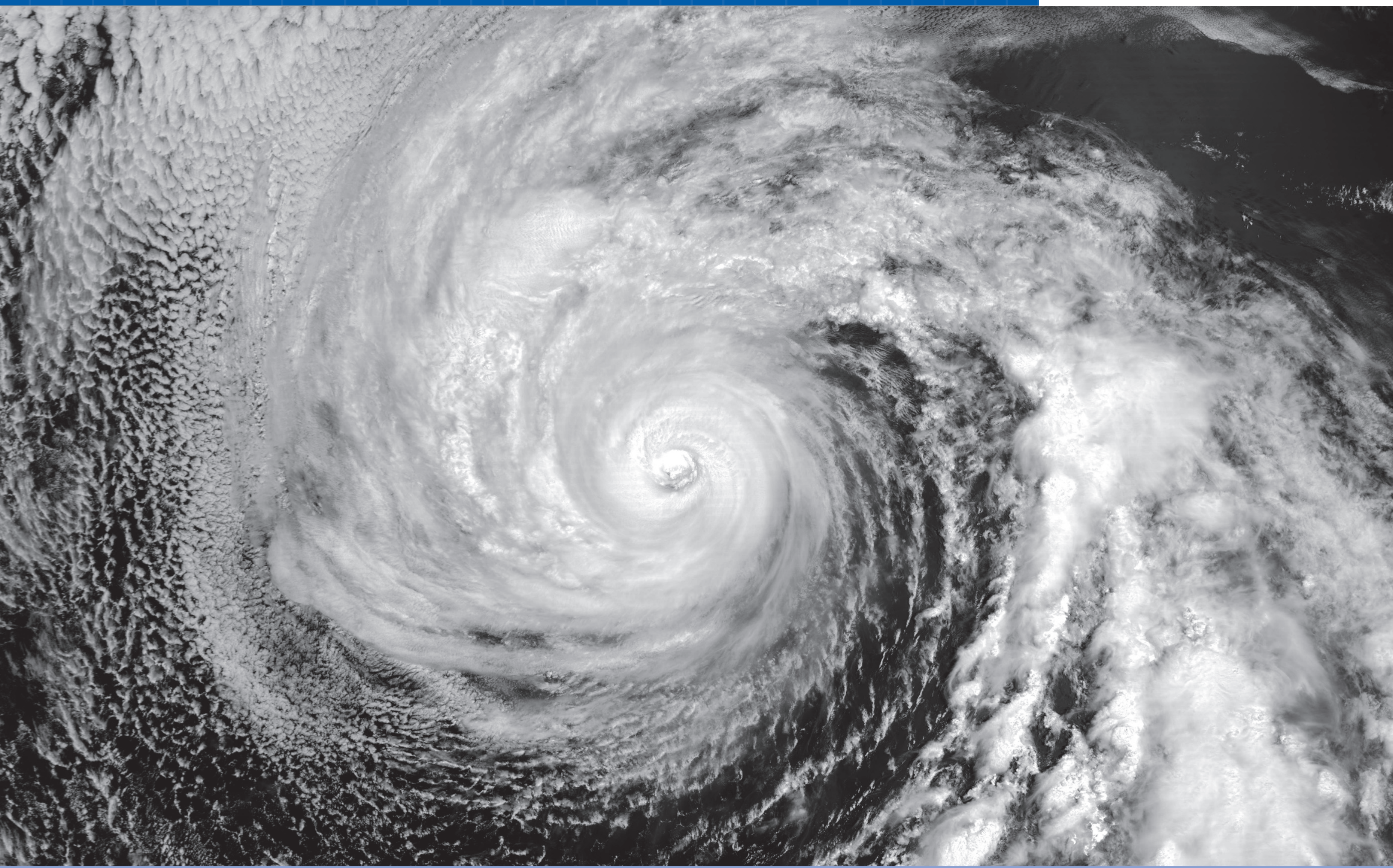

FEATURE ARTICLE

Climate Models: The Future May Be Ours to See

Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

Issue 15

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Front cover image: Hurricane Fausto hit the eastern Pacific Ocean in August of 2002.

Photo by: NASA/Visible Earth

Bruce Gilbert

Letter from the Director

Kim Martineau

Seismologist Won-Young Kim leads a discussion on campus about Haiti's earthquake.

Nick Frearson

An LC-130 plane (seen on the left) at the Antarctic

Bruce Gilbert

Visitors inspect a specimen at the 2008 Open House.

Dear Friends,

As we await spring's arrival, it is clear that 2010 promises to be a year of change and progress at the Observatory.

Although the meltdown of the global financial institutions has been a negative for us (especially with regard to our endowment), new funding from the federal stimulus program has been a great help. In addition to receiving numerous new research grants, the Observatory has secured two highly competitive federal infrastructure grants. One, from the National Institute of Standards and Technology, provides $1.35 million in matching grants for the construction of an Ultra Clean Lab to be housed within the Gary C. Comer Geochemistry Building. An $8 million grant from the National Science Foundation will fund the renovation of the top floor of the Core Lab, allowing us to construct much-needed new laboratories for researchers in the Division of Biology and Paleo Environment. As is often the case, the Observatory must provide matching at various levels for a number of these grants, which will be a financial challenge for my office. Nevertheless, these new resources will ensure Lamont-Doherty's continued health and growth at a critical time in our development.

A large grant from the National Science Foundation will support important growth here in the area of polar research. Marine geophysicist Robin Bell and her team received a $6 million instrumentation award that will revolutionize efforts to map the Antarctic ice sheet. Operation IcePod will be run in cooperation with New York's Air National Guard fleet of LC-130 planes. Our scientists will outfit one of these planes with ice-penetrating radar, infrared cameras, and scanning lasers. The resulting data will provide new insights into ice cap characteristics as the climate warms. Such knowledge is critical if we hope to predict sea-level rise.

The prevalence of natural disasters—and the huge social toll they inflict—has weighed heavily on all of our minds since devastating earthquakes struck Haiti and Chile. Geodynamics experts here were interviewed at length by the media, providing a great deal of context to concerned listeners. Unfortunately, natural hazards span all the earth science disciplines. This issue's feature article discusses ongoing efforts by Lamont-Doherty scientists to use computer models to analyze the complex forces in the tropics responsible for oscillating weather patterns that elicit wide-scale flooding in some parts of the world and crippling droughts in others. We hope continued breakthroughs in basic research will lead to better prediction of hazard risks on the ground.

To that end, we are in the process of making key new research appointments in paleo and biological oceanography, atmospheric sciences, geodesy, geodynamics, and terrestrial ecology. And in July, the Observatory will initiate its Lamont Research Professor appointments, a culmination of years of efforts to provide enhanced benefits and security to our research staff, ensuring the long-term quality and stability of the Observatory.

In closing, I remind everyone of our forthcoming Spring Public Lecture series, again boasting a terrific lineup of speakers and topics (details inside), and thank you for your friendship and continued interest in the Observatory's scientific and educational activities.

Sincerely,

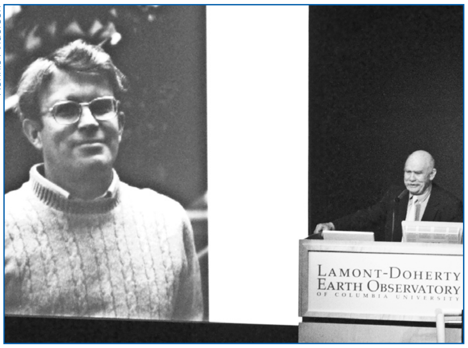
G. Michael Purdy

Celebrating the Scientific Achievements of Bill Ryan

In October, the Lamont-Doherty community celebrated Bill Ryan's superb record of scientific accomplishment. Ryan, considered to be one of the world's foremost marine geologists, has spent a career investigating a broad range of geologic processes, including those of the mid-ocean ridge, the continental margins, and, in particular, those responsible for shaping the geology of the Mediterranean.

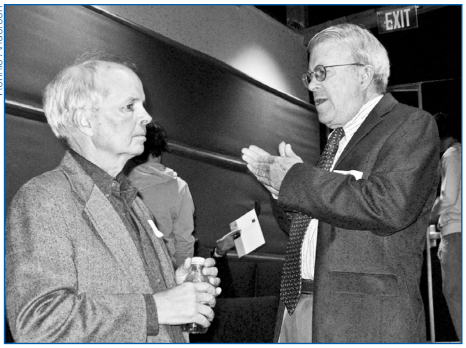
Colleagues and former students from around the world converged upon the Observatory for a day of commemorative lectures and toasts. Below, scientist William Ruddiman (PhD '69, Columbia University) and Ryan's good friend, offers a brief depiction of both the day's events and of the man himself.

Ronnie Anderson



Walter Pitman pays tribute to his colleague.

Ronnie Anderson



Bill Ruddiman and Bill Ryan speak during a break.

Some scientists are great scientists, and some are wonderful human beings, but few are both. The celebration held at Lamont-Doherty on October 23 showed that Bill Ryan is both—to a rare and remarkable degree.

Several colleagues gave afternoon talks in Ryan's honor. The talks cited some of his enormously important contributions: uncovering evidence for the isolation and drying out of the Mediterranean Sea nearly 5 million years ago; adapting SeaMARC technologies for imaging sea-floor relief in unprecedented resolution (leading to the true discovery of the *Titanic*); and advancing the "Noah's Flood" hypothesis with Walter Pitman that a rise in global sea levels flooded a previously isolated Black Sea between 8,000 and 7,000 years ago, possibly the inspiration for biblical and prebiblical references to an ancient flood.

Two speakers noted that Ryan can slip into a "zone of his own"—not responding to friendly hellos from passers-by, or appearing uncommunicative with fellow graduate students. The reason for this seemingly off-putting behavior later became clear—Ryan had (still has) a unique ability to focus on the scientific problem he is working on, and so screens out all (ALL!) outside "noise." In a moment of charming candor at the end of the afternoon talks, Ryan acknowledged his history of going into this zone, not just at work but also at home, where Judy has put up with it too!

I was amazed by how many graduate students and colleagues stood up and fondly toasted Ryan at a later dinner. The students included current leaders in the geosciences I had remembered simply as Lamont students but now realize were members of Ryan's personal family. Most of the toasts were fond and glowing, and even the "roasts" were lightly browned, with the speakers' fondness for their subject showing through.

SAVE THE DATE
Public Lectures 2010

For information, call 845-365-8998
or e-mail events@LDEO.columbia.edu

SUNDAY, MARCH 28, 2010, 3:00 P.M.
"Detecting and Measuring Landslides with Seismology"
Göran Ekström, PhD, Professor, Department of Earth and Environmental Sciences, Columbia University

SUNDAY, APRIL 11, 2010, 3:00 P.M.
"Currents, Conveyors, and Climate Change"
Jerry McManus, PhD, Professor, Department of Earth and Environmental Sciences, Columbia University
(Sponsored by the Alumni Association)

SUNDAY, APRIL 18, 2010, 3:00 P.M.
"Dust in the Wind: Dust, Stardust, and Earth's Climate System"
Gisela Winckler, PhD, Doherty Research Scientist, LDEO, Columbia University

SUNDAY, APRIL 25, 2010, 3:00 P.M.*
"Rockland County's Water Resources"
Paul Heisig, Hydrologist, US Geological Survey
Martin Stute, PhD, Adjunct Senior Research Scientist, LDEO; Professor and Co-Chair, Department of Environmental Science, Barnard College
Stuart Braman, PhD, Adjunct Associate Research Scientist, LDEO, Columbia University
Brad Lyon, PhD, Research Scientist, IRI, Columbia University
Steven Chillrud, PhD, Doherty Senior Research Scientist, LDEO, Columbia University
Meredith Golden, CIESIN, Columbia University

***Note, this will be a two-hour presentation**

Light reception to follow lectures

The Haitian Earthquake in Context

The earthquake that struck Haiti's densely populated capital, Port-au-Prince, took place along a fault whose existence was not unknown to seismologists. In the days following the disaster, experts at Lamont-Doherty spoke to numerous media outlets in an attempt to explain the science behind the social tragedy.

This particular fault—termed a strike-slip fault—is composed of two plates on each side of a fault line that move past one another in opposite directions. The Haitian earthquake's relative shallowness—it occurred roughly nine miles below Earth's surface—exacerbated its deadly impact. The resulting collapse of poorly constructed edifices caused thousands of deaths and led to the wide-scale destruction of the country's infrastructure.

"The hard lesson is that construction, urbanization, land reform—all the things we do in terms of development—need to take resiliency into account," seismologist Arthur Lerner-Lam of Lamont-Doherty tells *Newsweek.*

"There are hot spots around the world where poverty and natural-hazard risk are going to continue to produce these high-level disasters with high casualties, but we know where those hot spots are. So there's a lot more we can do before the fact to mitigate the human suffering," explains Lerner-Lam. Lerner-Lam has been appointed to a United Nations task force that will deliver an authoritative analysis of January's quake and advise the Haitian government on ways to anticipate future events.

FURTHER READING

Below is a selection of interviews in which Lamont-Doherty experts elaborate further on the scientific processes that caused the quake.

MyFoxNY.com, *January 20, 2010*
Seismologist Bill Menke of Lamont-Doherty Earth Observatory is interviewed by *Good Day New York* about the earthquakes in Haiti.
http://www.myfoxny.com/dpp/good_day_ny/seismologist-bill-menke-100120

CNN *American Morning,* *January 19, 2010*
Earthquake in Haiti Like Katrina, Only Worse
By Lamont-Doherty scientist John Mutter
http://amfix.blogs.cnn.com/2010/01/18/opinion-earthquake-in-haiti-like-katrina-only-worse/

CBS News, *January 16, 2010*
Seismologist Points to Regions Prone to Mega-Quakes
Lamont-Doherty seismologist Arthur Lerner-Lam explains on *The Early Show Saturday Edition* that Hispaniola is by no means the only hotspot for killer quakes.
http://www.cbsnews.com/stories/2010/01/16/earlyshow/saturday/main6104011.shtml?tag=cbsnewsTwoColUpperPromoArea

The Journal News,
January 16, 2010
Scientists: Haiti Vulnerable for More Quakes
The seismology division at LDEO hosts an informal discussion about the devastating January 12 earthquake in Haiti.
http://www.lohud.com/apps/ pbcs.dll/article?AID= 20101160331

Kim Martineau

Seismologist Bill Menke discusses Haiti's fault line.

Metro International,
January 15, 2010
Abject Poverty Made Forecasts Useless in Haiti
"The question is not whether they are aware of it, but if they can do anything about it," says Arthur Lerner-Lam, a seismologist at Columbia University. "And that's the sad thing: They simply are too poor to do much about it."
http://www.metro.us/us/article/2010/01/15/05/1748-82/index.xml

MSNBC, *January 15, 2010*
Earthquake Threat Lurks for US, Too
"The very largest earthquakes all occur on subduction zones," said seismologist Geoffrey Abers at the Lamont-Doherty Earth Observatory of Columbia University.
http://www.msnbc.msn.com/id/34883176/ns/technology_and_science-science//

National Geographic, *January 15, 2010*
Haiti Earthquake, Deforestation Heighten Landslide Risk
"Anywhere you have strong motion and steep terrain, you have extremely high risk of slope failure and landslides, and they can be extremely large," said Colin Stark, a geophysicist at Lamont-Doherty Earth Observatory in New York.
http://news.nationalgeographic.com/news/2010/01/100114-haiti-earthquake-landslides/

ABC News, *January 14, 2010*
Haiti Earthquake: Why So Much Damage?
"Buildings—designed to withstand gravity—have to be built to withstand lateral motion," explains Art Lerner-Lam, head of the seismology division at Columbia University's Lamont-Doherty Earth Observatory in Palisades NY.
http://abcnews.go.com/Technology/HaitiEarthquake/haiti-shallow-earthquake-magnified-damage-californias-san-andreas/story?id=9562379&page=2

NPR *All Things Considered/Morning Edition,*
January 13, 2010
Haitian Quake Not a Surprise to Geologists
Interview with Geoffrey Abers of Lamont-Doherty
http://www.npr.org/templates/story/story.php?storyId=122532156

WNYC *The Leonard Lopate Show,*
January 13, 2010
What Caused the Earthquake in Haiti?
A discussion with Leonardo Seeber, seismologist at Columbia University's Lamont-Doherty Earth Observatory, regarding the estimated 7.0 magnitude earthquake that struck Haiti, the worst in more than 200 years
http://www.wnyc.org/shows/lopate/episodes/2010/01/13/segments/148062

MSNBC-TV, *January 13, 2010*
Haiti Quake: What Happened?
Columbia University's Art Lerner-Lam speaks about Haiti's geography, and why it's made past natural disasters worse.
http://www.msnbc.msn.com/id/31510813/ns/msnbc_tv-the_dylan_ratigan_show#34847891

Newsweek, *January 13, 2010*
Scientists Warned of Coming Quake
Interview with Lamont-Doherty scientist Arthur Lerner-Lam on what should have been done to prepare
http://www.newsweek.com/id/230776

The Year in CO_2

By Ken Kostel

The end of the year is a time for reflection. We look back and take stock of what we've accomplished. Science, it appears, is no different.

Amidst holiday plans and the annual American Geophysical Union conference comes the year-end issue of *Discover* magazine, with its list of the top 100 science stories of the past 12 months. This year, the magazine included a place at number 85 for recent work led by Department of Earth and Environmental Sciences assistant professor and Lamont-Doherty geochemist Bärbel Hönisch that laid out a record of atmospheric carbon dioxide concentration for the past 2 million years.

"I was pretty flattered," Hönisch says. "So many other stories could have been in there."

The list, explains *Discover*'s Executive Editor Corey Powell, represents the fruit of a "brain dump" by the magazine's staff and some 20 additional writers. Throughout the year, the editors meet to discuss selections, discarding many top-notch studies in order to present what they hope represents the full scope of a year's worth of scientific achievement.

"It's painful and a bit arbitrary," Powell says. "Some things are obviously big stories. Even with 100, we have to do an amazing amount of winnowing. Still, the fundamentally transformative science tends to rise to the top."

The citation in *Discover* describes Hönisch and her co-authors' application of a technique developed by Lamont-Doherty's Gary Hemming that measures the ratio of boron isotopes preserved in fossilized shells of planktic foraminifers. Using this ratio, scientists can determine the pH of the water in which the shells formed. Hönisch and her team employed this technique to derive the pH of ocean surface water in the eastern Atlantic over the past 2.1 million years, allowing them to estimate atmospheric CO_2 levels and produce the longest and most detailed record of carbon dioxide in Earth's atmosphere to date. That record showed carbon dioxide varied relatively little and rarely exceeded 300 parts per million—much less than today's level of 387 ppm.

Important as this finding is, "it was only one sentence in the final paper," Hönisch says.

The actual aim of their work was to examine changes in atmospheric carbon dioxide during a period known as the mid-Pleistocene transition, when Earth's climate system suddenly switched from producing a relatively mild ice age every 40,000 years, to the present-day pattern in which more intense cold periods occur every 100,000 years. One thought was that a gradual drop in carbon dioxide could have brought about the change, but Hönisch et al. could not find such a decline.

Now, Hönisch is looking back nearly 5 million years, to a time when Earth's climate was warmer. Scientists suspect carbon dioxide concentrations, similar to today's levels, were to blame.

While it's true that natural processes accounted for high CO_2 concentrations in Earth's history, "we have to ask whether we want similar CO_2 and climate changes to occur as a result of human action," Hönisch says.

Alan Orling

Bärbel Hönisch at work in her lab

> "'I was pretty flattered,' Hönisch says. 'So many other stories could have been in there.'"

Ronnie Anderson

2009 Lamont Service Award

Analyst/buyer Bonnie Deutsch was this year's recipient of the award, which recognizes a member of the administrative or support staff who willingly goes "above and beyond" the call of duty.

Climate Models: The Future May Be Ours to See

A Peek into the Future with Climate Models

By Mohi Kumar

Some Earth scientists travel the globe, drilling cores, analyzing sediments, installing seismic networks to monitor earthquakes, testing the air around volcanoes to track emitted gases, and surveying forests to estimate the amount of carbon stored and released in regional canopies. They do all this under the guiding principle that the past and present hold insight into what may happen in the future.

NASA/Visible Earth

The Intertropical Convergence Zone, which circles the earth near the equator, is where the trade winds of the Northern and Southern Hemisphere meet.

But other scientists fulfill the same function without extended travel and specialized equipment. They are climate modelers. Armed with computers, they take data from satellites, from air or ocean surveys, from projections of future carbon dioxide levels—even from idealized imaginary conditions—and push the collected information through a series of complex computer functions.

Some models are as simple as a few lines of computer code; some contain thousands upon thousands of lines filled with differential equations, if-then clauses, multiple variables, and feedback loops, and are not for the mathematically disinclined.

Regardless of complexity, models serve a common purpose: prediction. "Climate models are imaginary but realistic versions of the real climate system," says Adam Sobel, an associate professor at the Lamont-Doherty Earth Observatory. "If the model makes things happen like what happens in nature, then we can use the models to turn factors on and off to see if they still reproduce nature." Through the results of such analysis, scientists gain insight into why past climate events occurred and they can generate scenarios of future climate changes.

Computer modeling may seem esoteric, but humans encounter such models all the time. "Climate models are similar to the computer models that are used to forecast weather on a day-to-day basis," explains Richard Seager, a senior scientist and climate modeler at Lamont-Doherty. Users of weather forecasts seek to know whether this week's forecast will bring rain or clear skies now that spring has started. Users of climate forecasts are on a similar mission—but they are looking for future trends, such as whether decades into the future, spring rains will persist for shorter periods of time. This is particularly important given the conclusions of the 2007 U.N. Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC AR4),

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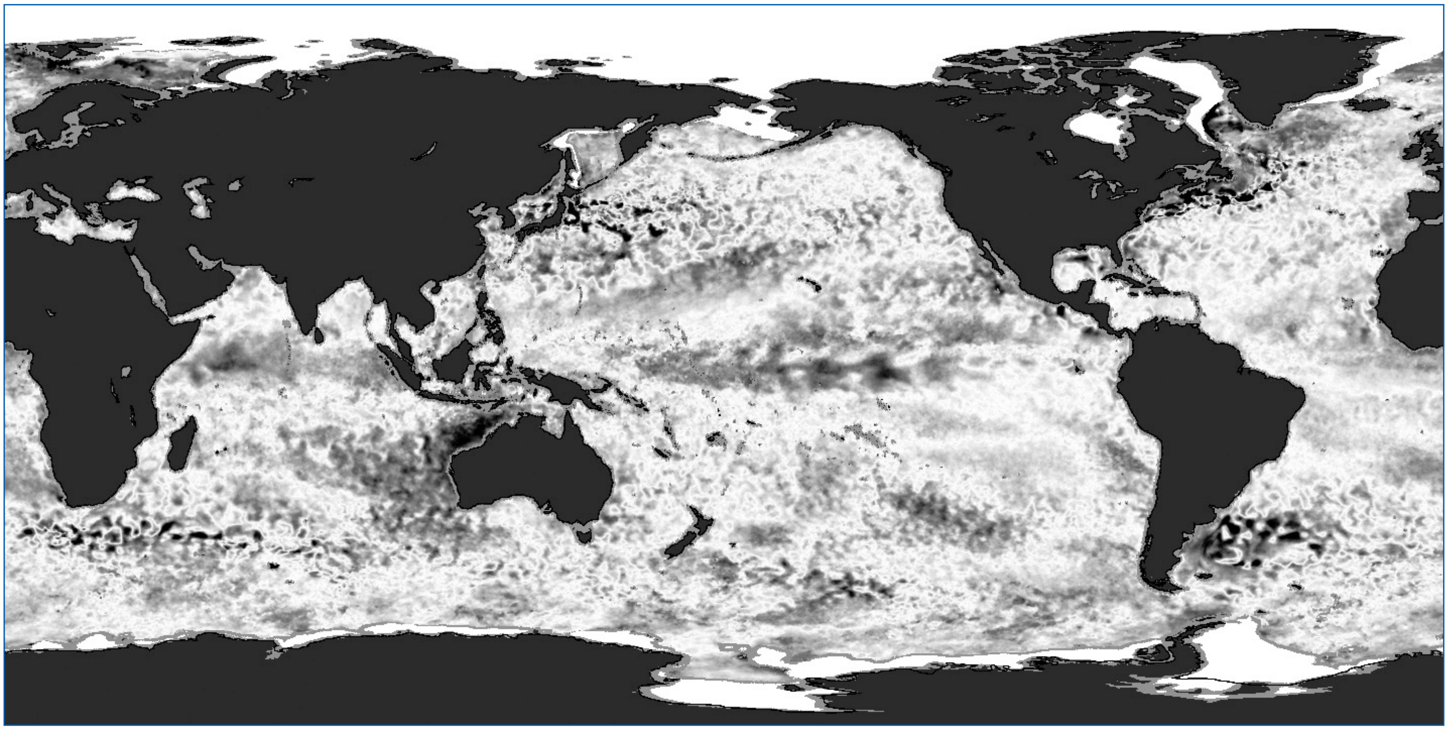

NASA/Visible Earth

A La Niña—an occurrence of unusually cold water temperatures along the equator in the Pacific Ocean—is shown in progress. Here the dark area along the equatorial Pacific indicates colder waters in the process of moving eastward.

> "Scientists at Lamont-Doherty agree that being able to predict atmospheric patterns over the Pacific is a key part of predicting climate."

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which states that "continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century."

But what exactly are those changes? Sobel, Seager, and other scientists in Lamont-Doherty's Climate Modeling and Diagnostic Group are at the forefront of this investigation.

UNDERSTANDING THE OCEANIC SEESAW

Earth's atmosphere is a chaotic and dynamic system, making it difficult to reliably predict patterns that govern climate. One source of this chaos can be found in the humid masses of air that evaporate from the oceans and churn the atmosphere in the tropics. And at more than 12,000 miles across, the Pacific Ocean is the mother of all storm generators. Thus, scientists at Lamont-Doherty agree that being able to predict atmospheric patterns over the Pacific is a key part of predicting climate.

Winds in the tropics generally blow from east to west. Over the vast expanse of the Pacific Ocean, these winds are strong enough that warm surface waters in the eastern Pacific are pushed west, where they pool. This concentration of warm water creates its own weather, inducing high humidity and generating storms in Asia. By contrast, the land around the eastern tropical Pacific, stripped of its warm waters, remains cooler and dryer.

But about every four years, the trade winds falter and sometimes even switch direction. Warm waters no longer head west; they linger, generating storms in the normally more arid climates of the U.S. desert southwest, Mexico, and western South America. This anomalous warm wet period, dubbed El Niño—"the boy" in Spanish, named for its coincidental arrival with the Christmas season—persists for nine months or more. During these times, the western Pacific becomes cooler and drier.

Time periods termed La Niña—"the girl"—occur when El Niño conditions are reversed, when strong winds in the Pacific push warm waters even further west. This amplification of normal conditions leads to unusually cool waters across a broad expanse of the equatorial Pacific.

Despite the relative infrequency of El Niño and La Niña events, their effects have profound impacts on society, says Dake Chen, a senior research scientist at Lamont-Doherty. “El Niño is implicated in catastrophic flooding in coastal Peru and Ecuador, and drought in Indonesia, New Guinea, and Australia. Huge forest fires in 1997–1998 on the Indonesian island of Borneo spread a thick cloud of smoke over Southeast Asia, crippling air travel between Singapore, Malaysia, and Indonesia.” La Niña events, such as the one that happened in 2008, are known to bring severe flooding to Australia, Indonesia, and the Philippines.

The seesaw effect between El Niño and La Niña conditions is called ENSO, the El Niño-Southern Oscillation. “There is no doubt that ENSO is the largest and most influential short-term climate change on Earth,” says Chen, explaining that climate models run with older data to simulate past events show that ENSO behavior for the past century helped cause past climate events like droughts and flooding. In fact, evidence from records such as tree rings, whose thinner rings denote drier seasons, imply that El Niño has been a prominent feature of Earth’s climate for at least the past 130,000 years. “The paleoclimate record also indicates that El Niño behavior is quite sensitive to climatological conditions, so it is possible that El Niño would behave differently in our greenhouse future,” Chen adds.

Just how different? That’s up in the air, says Chen. “Long range projections given by present climate models are still far from conclusive. Fortunately, thanks to the extensive observational and modeling efforts in the tropics, we are much better at making seasonal forecasts of El Niño.”

Chen, along with Lamont-Doherty’s Mark Cane, Alexey Kaplan, and the International Research Institute for Climate and Society’s Steven Zebiak, regularly forecast anomalies in sea surface temperature over the Pacific. Developed by Zebiak and Cane in the mid-1980s, their original model was the first physics-based ocean-atmosphere coupled model ever employed to study and predict short-term climate changes. Improvements to this model have been continuous, and its current generation, called LDEO5, forecasts ENSO conditions up to 12 months in advance.

“Our forecast for this year’s El Niño is a bit weaker than the actual event seems to be,” Cane explains. Nonetheless, the model “is one of the best, if not the best, in the ENSO forecasting business,” says Chen.

> “The major role played by the tropical atmosphere makes both weather and climate prediction heavily dependent upon exactly those aspects of the atmosphere’s behavior that scientists least understand.”

Such short-term forecasts allow scientists to readily see if their predictions have borne fruit. “To get confidence in models, you simulate the future over shorter timescales where you can check them,” says Cane. “So if a model can predict El Niño reliably over that timescale, it’s doing something right, and you feel a little bit better about applying it to a longer-term problem.”

THE TROUBLE WITH THE TROPICS

When ENSO fluctuations are modeled over many months, short-term fluctuations—what we refer to as weather—tend to average out, affording researchers the ability to predict longer-term tropical climate with some confidence. Yet modeling the tropics on a day-to-day basis is hindered by a lack of knowledge of the fundamental physics that controls the tropical atmosphere. “In middle and high latitudes, elegant models can cast the behavior of the atmosphere in simple terms on a day-to-day basis,” Sobel explains. “But in the tropics we haven’t had such theories,” he says. “Wind, precipitation, and other factors aren’t totally able to be forecasted.”

The reason for this inability lies in the crucial role of moist convection at the tropics’ hotter temperatures. Warm temperatures cause more water to be evaporated from the surface, increasing humidity. This humidity condenses to form clouds, releasing latent heat, spurring convection, increasing turbulence, and ultimately influencing global atmospheric circulation. The major role played by the tropical atmosphere makes both weather and climate prediction heavily dependent upon exactly those aspects of the atmosphere’s behavior that scientists least understand.

To learn more, some scientists who model the tropics begin with the most complex forms of models available: global climate models. Global climate models split the surface of the globe into a finely meshed grid. For each of these tens of thousands of grid spaces, a set of interconnected equations is advanced to determine how fluid and air will behave given hypothetical projections of future gas concentrations or solar energy output. As the models cycle through simulated days, weeks, months, years, decades, and centuries, they spit out daily values of future temperatures, atmospheric pressures, precipitation levels, wind speeds, and other parameters, not only at each grid box but at each of several dozens of separate layers of the atmosphere above each grid and in the ocean below each grid—terabytes upon terabytes of raw information for climate modelers to later sift through and find trends.

The best way to determine whether models are on the right track is to attempt to simulate and understand present climate conditions, says Sobel. Sobel and colleague Suzana Camargo, a climate analyst and associate research scientist at Lamont-Doherty, take vast amounts of data from satellites, weather balloons, and other observational datasets and use statistical tests to see how current and past El Niño events influence tropical cyclone activity, including the development of hurricanes in the Atlantic. This type of data analysis reveals key information about current climate patterns. For example, during El Niño events, Camargo and Sobel found that hurricanes tend to be suppressed in the Atlantic and enhanced in the Pacific.

“Hurricane formation is always a random event, but their likelihood depends on several factors, and El Niño events shift all those factors around. We’re trying to untangle what’s important in different places,” Sobel explains.

HURRICANES AND MONSOONS

ENSO clearly adds complexity to researchers’ attempts to understand global climate change. But what if modelers were to ignore complexity

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and simply consider a simple picture of global warming? In such a picture, surface temperatures in IPCC models would rise by about 2 to 6 degrees centigrade in the 21st century.

Hurricanes form over warm water. If the oceans warm en masse, then a logical assumption is that warmer sea surface temperatures will generate more hurricanes globally. But it is not actually that simple. "What may really matter is how warm sea surface temperatures are relative to other places," Sobel explains. With simple models, combined with theory and data analysis, he and Camargo are investigating whether hurricane frequency will increase given warmer temperatures. Preliminary results say no—"if the whole climate warms, the intensity of hurricanes may potentially increase, but models are suggesting that the frequency of hurricanes may actually decrease," Sobel says.

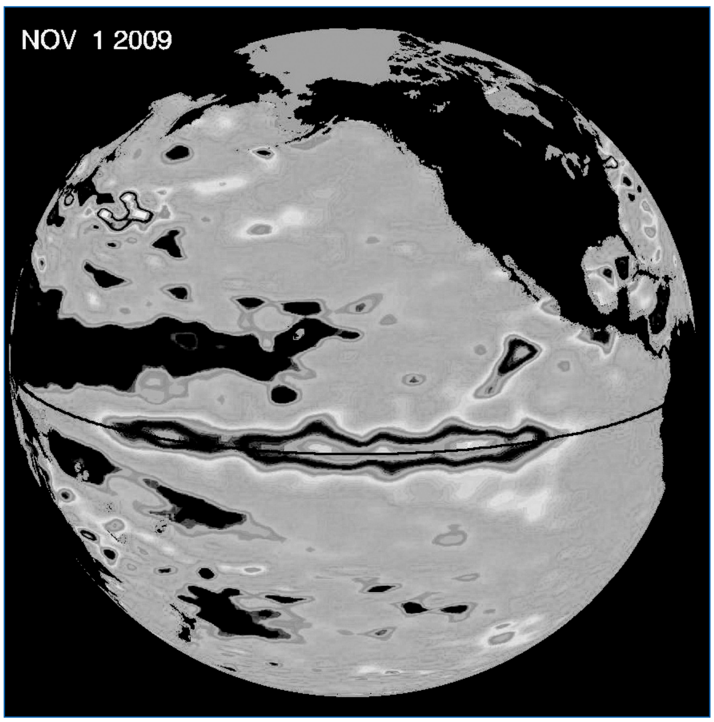
Global climate models can help answer another basic question: If increases in temperature occur in the next century, how might this interplay with seasonal cycles?

This yearly cyclical fluctuation between summer and winter is paired with weather patterns associated with monsoons. In the tropics, where the trade winds from the Northern Hemisphere meet the trade winds from the Southern Hemisphere, a band of thunderstorms forms, marking a region known as the Intertropical Convergence Zone (ITCZ). The ITCZ chases the warmer temperatures deeper into the Northern Hemisphere as northern summer approaches, pulling storms in its wake to generate wet and dry seasons in the tropics.

When seasonal cycles are reduced to simple oscillations between warm and cold and between wet and dry, scientists can detect specific patterns in the data of the greenhouse future from the IPCC AR4 climate models, explains Michela Biasutti, an associate research scientist at Lamont-Doherty. "In addition to overall warming, other anomalies appear to change the shape of seasonal cycles a little," she explains.

For example, people in the arid tropics rely on monsoons to support their agriculture. Using the African monsoon as a case study, Biasutti and Sobel found that, in general, climate models predict that the rainy season would be delayed by 5 to 8 days and be shorter by 3 to 5 days by the end of the century. "This does not sound like much, but it could really be important in its effect on the extremes. We calculated that a short rainy season that was a once in 10 years event could become a once in 5 years event by the late 21st century," she says.

Slower onset of monsoons does not necessarily mean that rainy seasons will be less intense, Biasutti notes. Nonetheless, such changes could have a profound impact on agriculture in these arid regions. "Soil will be even dryer and hotter in late spring—the hottest time of year—which could make planting more difficult and crops more likely to fail."



NASA/JPL

Satellite data shows a developing El Niño event, where weakening or even reversed trade winds over the Pacific Ocean can cause warm water to be pushed considerably east of normal conditions at the equator. The bright patch outlined in black depicts warmer waters on their way east.

TROPICAL CONNECTIONS TO DROUGHT IN THE U.S. SOUTHWEST

The ENSO cycle fluctuates from warm to cold and back again about every four years, but the tropical Pacific can often get locked into a decade or more of little change. Like their shorter but stronger counterparts in the ENSO cycle, these long-lived states impact global climate. For example, a cold eastern Pacific coupled with a prolonged concentration of warm waters and moist air in Asia causes drought in North America. The most recent of these droughts began in 1998 and reached peak severity in 2004, stressing water resources and increasing the occurrence of wildfires.

To study the impact of extended La Niña–like states within the climate record, Seager, along with colleagues Yochanan Kushnir and Mingfang Ting, used the U.S. National Center for Atmospheric Research's Community Climate Model version 3, a global atmospheric climate model.

Most studies had focused only on the period of observations that began once the use of weather balloons became pervasive in the middle of the twentieth century. But the navies and merchant marines of the world had begun routine sea surface observations as early as 1856. "They put a bucket over the side of the ship, brought the water up on deck, and put a thermometer in it," Seager explains. When these temperatures were fed into the atmosphere model, the model reproduced well-known episodes of drought in the West from 1856 to 1865, during the 1870s, the 1890s, during the 1930s "Dust Bowl," and during the 1950s.

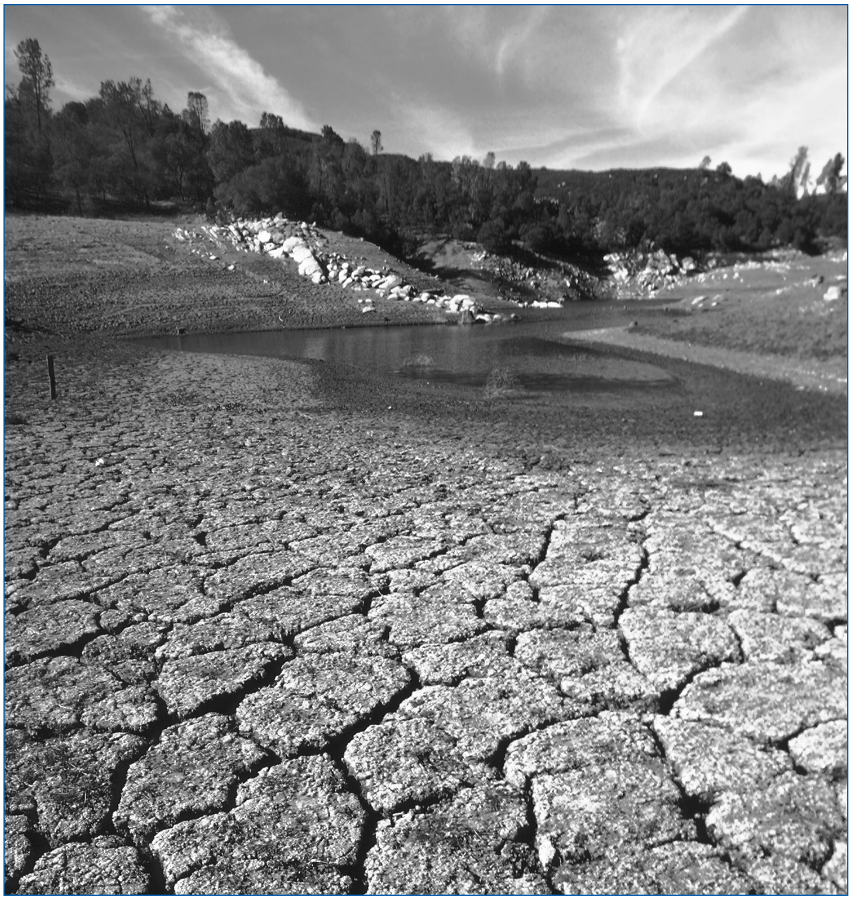
Seager and colleagues were the first to extend the correlation between sea surface temperatures and drought back to the 1850s. All of these droughts correspond to extended La Niña conditions in the tropical Pacific Ocean. They also found that for the Dust Bowl and 1950s droughts, warm sea surface temperature anomalies in the tropical North Atlantic Ocean forced atmosphere circulation anomalies that intensified the droughts over North America.

Tree ring data pieced together at Lamont-Doherty that span the last millennia suggest periods of severe and extended drought in North America from 900 to about 1500. Isotope ratios recorded in coral skeletons, which fluctuate depending on temperature due to biological processes, show that the tropical Pacific was colder during this time. Seager's research group took these coral records and used them to reconstruct the sea surface temperatures at various times between 900 and 1500, and then fed these temperatures into the atmosphere model. "Sure enough, it did produce much drier conditions over the Southwest than we have now, comparable to the aridity observed in the tree ring records," Seager says.

Seager notes that much more work needs to be done to refine uncertainties in their study on the medieval megadrought. But the facts are clear—extended periods of colder sea surface temperatures are correlated to long episodes of drought in North America.

And as the climate warms, drought conditions in the western United States—in fact, over much of the tropics—are expected to intensify, according to Seager. In partnership with scientists from the U.S. National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamics Laboratory, Seager's group took all 24 of the models used in the IPCC AR4. Using a middle-of-the-road scenario for greenhouse gas emissions, the researchers analyzed all 24 models and came to a surprising conclusion: "We found that 23 of the 24 models predict that the whole of southwest North America will gradually move over to a drier climate during the current century," Seager explains. "That's an area from northern California, across the interior Southwest to Texas, and down through all of Mexico."

Most of the models suggest that drier conditions should be happening already, with 10 to 15 percent reductions in precipitation occurring by the middle of the current century. "This is not an episodic drought—this is the whole climate system moving to a drier climate for the foreseeable future," says Seager. The drying in the Southwest is part of an overall drying (and poleward expansion) of the subtropical dry zones shown in climate models to be a result of future warming from greenhouse gases.



USDA NRCS

In 1991, after a drought of several years, this lake near San Luis Obispo, California, contained barely any water. Such conditions may be the norm in the years to come.

In the worst-case scenario, future warming could shift the tropical Pacific into a more La Niña–like state. This could induce a prolonged drought, similar to the megadrought in the medieval period, Seager says.

THE SEARCH FOR A SIMPLER PICTURE

The atmosphere and oceans are chaotic systems, and huge amounts of natural random variability make it difficult to know definitively whether patterns caused by greenhouse warming within global climate models will actually occur. "Worse yet, we do not have long enough observational data to verify long-term model results," Chen says. "Unlike ENSO forecasts, for which we do have plenty of data to train and validate our models, long-term climate projections are bound to be speculative in nature."

But Lamont-Doherty scientists have a plan to attempt to alleviate speculation. Relatively realistic models, like the IPCC models, are almost too complex to understand. "They look like nature but they are also complicated like nature," Sobel explains. "But if you make a simpler model behave like the complicated model, you understand processes better." And if that isn't simple enough, scientists can make a still simpler model all the while trying to keep the essence of the phenomena being studied. Repeating this process will eventually lead to a clearer understanding of the basic phenomena that drive climate change.

Armed with this knowledge, scientists will be in a better place to make recommendations on how society can manage impending climate problems, Cane notes. "One way or another, people will adjust to a certain amount of long-term climate change," he adds. "But it is the variation—the events that you don't expect to happen—that will be troublesome to society. So the faster we can make climate predictions as reliable and convincing as possible, the more likely we can get people to take action ahead of time."

Graduate Student Debra Tillinger: From the Classroom to the Poles

"Don't worry," writes physical oceanography graduate student Debra Tillinger on her blog, *Ms. T @ Sea.* "You don't need any experience, you don't need perfect grades, and you don't even need to be sure you want to be a scientist. You just need to be interested in learning more about the earth and in challenging yourself."

For the past year, Debra, a sixth-year graduate student in Columbia University's Department of Earth and Environmental Sciences, has surveyed her field through an unfamiliar lens. Debra is a participant in the National Science Foundation's (NSF's) outreach program "Learning through Ecology and Environmental Field Studies" (LEEFS). In that capacity she has been visiting science classes at New York City's Dual Language Middle School and interacting with some 200 students weekly. The program, run with the Earth Institute's Center for Environmental Research and Conservation, aims to promote an inquiry-based science education that is focused on field research and hands-on laboratory experimentation.

As a LEEFS fellow, Debra collaborates with two middle school teachers to devise an innovative science curriculum. On any given week, Debra conducts scientific experiments with her classes, leads field trips to inspect rock formations in Central Park (among other activities) for an after-school science club, and answers any science-related questions students might have.

She has found that her students are indeed full of questions. Recently, Debra's students wanted to know whether the world will in fact end in 2012 (as movie posters have proclaimed) and, particularly after the *Twilight* series craze, whether vampires do exist. In such instances, Debra encourages her students to evaluate these concerns independently, hoping to use such discussions as a chance to teach her classes about the difference between verified and unverified sources and the reasoning skills a scientist might employ to assess particular statements.

Because she is also fully involved in her own thesis-related research, Debra spends several months a year at sea, thousands of miles away from her students. Hence, the blog. Currently, Debra is participating in the NSF-funded LARISSA project, a two-month voyage to investigate the abrupt dissolution of the Antarctic's Larsen B Ice Shelf. The team of glaciologists, geologists, ecologists, and physical oceanographers are using helicopters and a remote underwater vehicle, among other instruments, to study previously impenetrable areas of the ocean floor.

Different time zones have not hindered Debra's interactions with her students. Since the cruise began, Debra has been in frequent contact with her students (and any other curious individual who wishes to read along) via her blog. Debra uploads photos of the vessel's captain and of frozen landscapes populated with penguins. She supplies updates on her current research—the successes and the upsets.

In one blog entry entitled "Hola, Amigos!" Debra explains that the amigos on her ship don't refer to any ordinary friends. They are Automated Meteorology-Ice-Geophysics Observing Stations (AMIGOS), and they assist the scientists in testing their hypothesis about what led to the collapse of the Larsen B Ice Shelf. Debra supplements her explanation with pictures of these instruments and of a fellow scientist tinkering with one of them. "Just so you know," Debra adds, "[my colleague] isn't only interested in how icebergs and ice shelves break apart. He's also monitoring what happens to glaciers after the ice shelves around them are gone. But we'll cover that in another post."

"The students love hearing from *Ms. T @ Sea,* and it has been so rewarding to watch their minds grow through the experience," says Lauren Brooks, one of the middle school teachers. "As a career scientist, Debra represents a profession my students have never been exposed to." Lauren explains that since Debra is often blogging from places her students have never seen, the blog entries lead to spirited discussions that activate the students' imaginations.

The stated goals of the LEEFS program are ambitious: to encourage young students from lower-income backgrounds to pursue a career in the sciences, to give career scientists the opportunity to practice methods of communicating their research to nonspecialists, and to provide teachers with updated scientific content.

Signs indicate that Debra's work is having the intended effect. After a year of interacting with a particular class, she noticed that one very shy and previously unresponsive young girl has become fascinated by Jupiter, often pulling Debra aside to discuss the distant planet.

And Debra believes that her skills as a communicator have been honed. "LEEFS has certainly improved my communication skills with other scientists. I was invited to speak at a conference in London in September, and the convener of the conference said that my lecture had been the only one that he, an outsider to the field, had understood."

Annie Blomberg, who teaches the sixth grade class that Debra visits, claims that she, too, has benefited. "There is no doubt in my mind that Debra has helped me improve my science skill set, and no matter the situation, content, or question, Ms. T has insight and examples to share." Both teachers said that Debra was instrumental last year in preparing her students for the school's inaugural science fair.

It is clear that in addition to conveying scientific facts and lines of inquiry, Debra communicates her love of the discipline. In one blog entry she writes, "One of the really wonderful things about being a scientist is that I'm allowed to forget everything else for a while to study just one thing. Imagine the most interesting thing you've done in school all year and getting to do that for as long as you like."

Visit *Ms. T @ Sea* at http://mstsea.blogspot.com/

K–12 Education Initiatives at Lamont

Kathy Gallone

Margie Turrin

Students take measurements along the Hudson River (r), and two others inspect a map during a daylong symposium on land-use issues (l).

Fundamental research helps us make wise decisions when it comes to the stewardship of our planet, but the dissemination of such knowledge depends upon quality education. The Observatory's strong connection with Columbia University's Department of Earth and Environmental Sciences—throughout the academic year Lamont-Doherty researchers mentor between 80 and 90 PhD students—has long made it an international center for undergraduate and graduate earth science education. Its summer intern program, co-sponsored with the National Science Foundation, attracts exceptionally talented junior and senior undergraduates from across the country to the Observatory's campus. In this highly successful program, some three dozen students work with Lamont-Doherty scientists on independent research projects over the course of an entire summer.

What attracts less notice, however, are the numerous K–12 education programs offered by Lamont-Doherty scientists to students and teachers alike. Below is a list of some current initiatives under way at the Observatory.

SECONDARY SCHOOL FIELD RESEARCH PROGRAM

Program director and Lamont-Doherty geochemist Robert Newton runs a six-week full-time summer internship program for secondary school teachers and students from neighboring communities. The initiative is run in collaboration with the University's Center for Environmental Research and Conservation, the Columbia Summer Research Program, and several New York City public high schools. Students and teachers work alongside Observatory scientists, joining them on field expeditions to the wetlands of the Hudson River estuary or in the laboratories of Lamont-Doherty's Rockland County campus. Past areas of investigation include the ecology of the Piermont Marsh, nutrient concentrations and sedimentary nutrient fluxes in Tappan Bay, particulate pollution in Harlem air, and a pilot oyster bed on Governors Island in New York Harbor. In the four years of its short existence, the program has worked with 50 students, 90 percent of whom were members of ethnic groups that are under-represented in the scientific professions. Newton reports that every graduate of the summer program has gone on to college and at least four are now majoring in environmental or marine science.

EARTH 2 CLASS

A series of weekend workshops, offered at Lamont-Doherty's campus throughout the year, brings together geoscientists, curriculum experts from the University's Teachers College, and classroom teachers from the New York and New Jersey area. The goal is to acquaint teachers with cutting-edge science by connecting them to researchers active in the field of earth science. Workshop topics range from the state of the carbon cycle in 2009 on the eve of the Copenhagen Climate Conference, with renowned carbon expert and Lamont-Doherty geochemist Taro Takahashi, to water quality and contamination in the Hudson River, with biologist and Lamont-Doherty researcher Andrew Juhl.

PLANNING LAND USE WITH STUDENTS (PLUS) PROGRAM

Margaret Turrin, education coordinator at Lamont-Doherty and director of the PLUS program, explains the reasoning behind this particular initiative. "In today's 'test prep' school curriculum, one of the casualties in student education is a connection of their academics to a real world experience. Science courses in particular are often focused on learning principles and theorems, and curriculums rarely convey their applicability outside of the classroom or laboratory."

Created as a way to address this problem, the PLUS program introduces high school and middle school students to pressing local land-use issues with the goal of engaging students on the topic of sustainable community planning. Students learn to analyze extensive source documents as they become familiar with particular case studies. The program, which is run with participation from educational and governmental agencies in Westchester and Rockland Counties, culminates in a daylong symposium during which students debate the impact a land policy decision might have on the environment, local economy, and community structure. Local professionals, such as town planners, water experts, and lawyers, mentor the students as they weigh the consequences of conflicting scenarios.

A DAY IN THE LIFE OF THE HUDSON RIVER

Together with the New York State Department of Environmental Conservation, Margaret Turrin also organizes this yearly event. Last fall, it involved 3,000 students and more than 60 participating schools. Students, assigned to different sites along the Hudson River estuary (from Troy, NY, to New York Harbor), collect data throughout the day about the river's currents, salinity levels, and vegetation, among other information. After analyzing and compiling their samples, students are able to construct a comprehensive picture of the dynamic estuary. This growing program connects students to their local environment, encouraging students to collect their own data, yet engaging them as part of a larger sampling group where their information is one piece in a larger "picture." Collected data are used afterward to develop curriculum pieces and learning activities for students and teacher workshops.

SCIENCE EDUCATION IN THE CLASSROOM

Lamont-Doherty's Kim Kastens, an oceanographer by training, is an innovator when it comes

continued on page 15

Letter from Steven Cande, Alumni Board President

Dear Alumni and Friends of Lamont,

Greetings from Southern California! I was in San Francisco this past December for the Fall AGU conference and, as always, one of the highlights was getting the chance to reconnect with several old friends at the Lamont-Doherty alumni reception. As a sign of the economic pinch on the Observatory, the fixings were understandably a bit lighter, but that didn't dampen anyone's enthusiasm or enjoyment in the least.

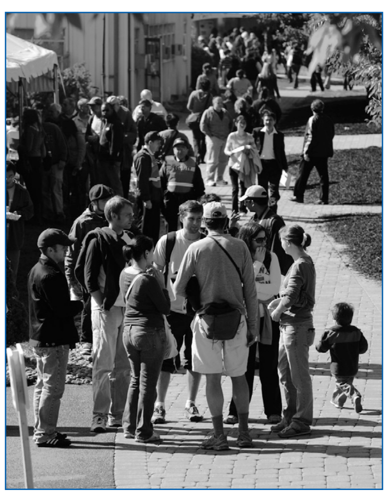
Of course, as nice (and convenient) as it is to talk with Lamonters in San Francisco during the geophysical union conference, I know many would love the chance to visit with alumni on the Lamont-Doherty campus—a place very dear to my heart. In the past, it was difficult to pick a time when a significant number of other alumni would also be there. To this end, one idea that has been bandied about by the Alumni Board is to invite alumni to return to Lamont-Doherty during its annual Open House. This daylong event is held in the fall when the leaves are changing color (an aspect of nature I do miss living here in Southern California) and the beauty of the Lamont-Doherty campus is at its peak. Open House is attended by thousands of individuals from the local community and metropolitan area. Scientists open up their labs, giving brief talks and demonstrations to people of all ages. It is a fantastic way to celebrate science and to share current research with the Observatory's friends and neighbors.

Last year, because of financial constraints, Open House was canceled, but the tradition will be reinstated in 2010. The Alumni Association will sponsor an official gathering that day for all Lamont-Doherty alumni, which we hope will be the first of many reunions to come. So please consider a trip to NYC the weekend of October 2.

For those of you who live in part of the world with seasons, may you have a very pleasant springtime. I look forward to seeing many of you on the East Coast in early autumn.

Sincerely,

Steven C. Cande, PhD '77
Alumni Board President



Fall's Open House attracts sizable crowds to the Observatory's campus.

Bruce Gilbert

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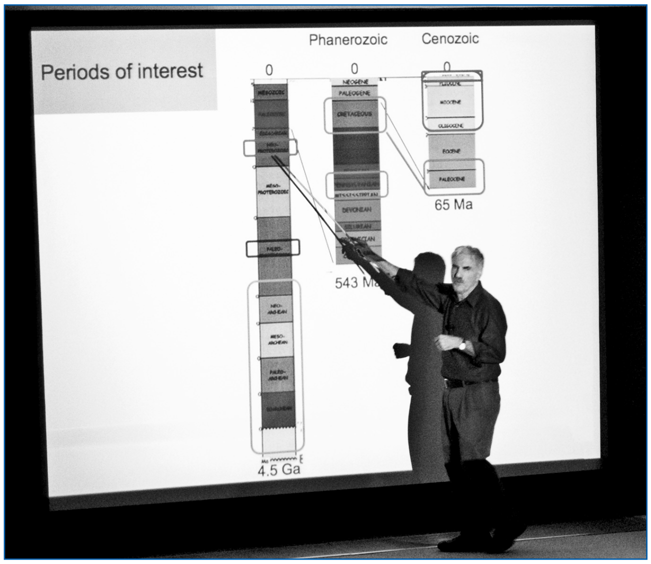
Alumni Association Sponsored Colloquium

Ronnie Anderson

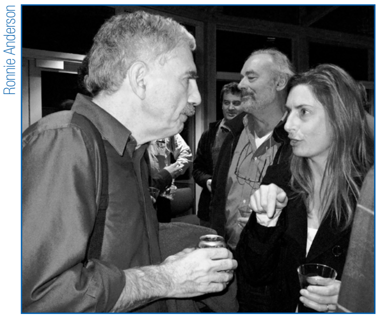


Michael Bender lectures on the history of Earth's climate.

Ronnie Anderson

Barbara Charbonnet converses with alumna Christa Farmer.

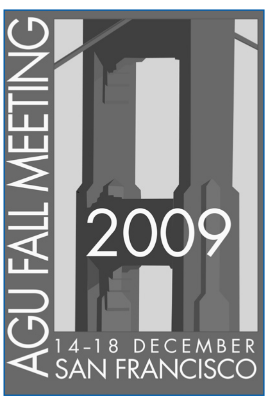
Ronnie Anderson



Michael Bender and Veronica Lance at the reception

In November, the Lamont-Doherty Alumni Association sponsored a colloquium with Michael Bender (Columbia, 1970), a professor in the Department of Geosciences at Princeton University. Bender's talk focused on whether or not the paleoclimate record indicates that changes in CO_2 levels throughout Earth's history have had a major influence on climate.

Annual Lamont-Doherty Alumni Reception at the American Geophysical Union Conference



In December, alumni and friends gathered for the annual Lamont-Doherty fête held each year in San Francisco during the week of the AGU conference.

Q & A with Candace Major, PhD ’02

By Ken Kostel

Candace Major *received her PhD from Columbia in 2002 for work she did at Lamont-Doherty on the paleoceanography of the Mediterranean and Black seas. Today, she is a program officer in the Marine Geology and Geophysics (MGG) Program at the National Science Foundation (NSF). In between, Candace was an NSF International Research Postdoctoral Fellow at the Laboratoire des Sciences du Climat et de l’Environnement in Paris and a Comer Postdoctoral Research Scholar and then visiting scientist at the Woods Hole Oceanographic Institution (WHOI). In 2008, before joining NSF, she participated in the American Meteorological Society Summer Policy Colloquium, which brought together scientists and policy makers for an immersion course in atmospheric and global climate change policy.*

How did you get interested in working at NSF?
I think the inclination to work outside of academia has always been there. I remember attending a Friday colloquium in my first year as a grad student at Lamont-Doherty that was given by a woman who had been a Congressional Science Fellow and who said that, of the people who finish the program, one-third continue with policy work, one-third go back to science, and one-third go on to something completely different. The idea that there are ways to impact science without being at the bench, in the field, or in the classroom stuck with me. Also, the more I thought about it, the more I felt that policy decisions could be improved by better and more direct input from the science community. After graduation, I continued on a fairly typical research trajectory until my last year at Woods Hole, when I decided I was ready for a change. Over the course of that year I talked to a lot of people who had connections with science policy. WHOI’s Congressional lobbyist said the divide between the funding agencies and policy makers was more porous than most people think, so I moved down to Washington DC and scheduled an informational interview at NSF. They called me a couple of months later with an opening and I started in August 2008.

What do you do as a program officer?
Before I started at NSF, I had the misperception this was a thankless job that largely involved declining scientists’ proposals. Now I have a much different perception—though sadly, we do need to say no to a lot of excellent projects because of funding limitations. My primary job is to coordinate the peer-review process for proposals and to decide on a portfolio of funding for the MGG Program and within the Paleo Perspectives on Climate Change (P2C2) program, taking into consideration all the information we get from the reviewers, plus issues of balance, risk, timeliness, and diversity. My other roles include getting a sense from the community of new directions to explore in science in order to help develop programs and deciding what kinds of calls for proposals would help move such initiatives forward.

Have you found the wall between science and policy to be as porous as was suggested?
I’ve only been here a year and a half, so in one sense I’m still getting up to speed. But one of the things I like about being at NSF is that there are lots of opportunities to contribute to policy discussions through interagency work and through task forces that directly inform policy decisions.

What do you see in the proposals you turn down that could have been improved?
Not that this is always missing from those we reject, but throughout NSF there is a push to fund science that is both relevant and transformative. Certainly, the case for societal relevance is easier to make for some projects than others, but with the level of competition for funding, it’s incumbent on principal investigators to make the best case they can. It doesn’t mean they have to change what they’re doing—everyone at NSF understands the need for basic research in all areas of the sciences. Still, scientists need to think expansively about the impacts of their work. Also, by expressing the relevance of their work, PIs are helping NSF make the case to Congress that basic research will eventually benefit society. The same is true of what we call transformative science. Incremental work is important and needs to receive funding, but it should always be in the back of a PI’s mind to consider how his/her work will change the way people think about a particular problem or the field in general.

Have things changed in your time at NSF and what do you see ahead?
The change in administration was a game-changer. We have new priorities and there has been a significant change in the amount of money Congress and the White House are willing to invest in the geosciences. Much of the budget growth is expected to be in priority fields through new programs that focus on areas related to global climate change. This will include interdisciplinary research on topics like ocean acidification that bring together a physical, chemical, biological, and ecosystem-level understanding of how changes are occurring and the impacts of those changes. To help lay the groundwork for more interdisciplinary science, we try to organize community development opportunities—workshops, special publications, conferences—to get people from different fields talking to each other. There will be even more of this in the coming months and years.

You were recently involved in producing a series of videos about climate change for young people (viewable at www.youngvoicesonclimatechange.com). Is there a connection between this and your interest in outreach to policy makers?
Absolutely. Just as there is a need to help inform policy makers, there needs to be a more direct conversation between scientists and the public—especially with children—about a big, scary issue like climate change, which they might not feel they can do anything about. Often, you see science filtered through the media’s understanding of what a study has found or why a piece of research is important. Even worse is the tendency for the media to report on the media’s coverage of science. That can only confuse things. As a result, I think people often misunderstand what scientists do or even what science is. The way to inform more people about science in general is to reach them at younger ages and to give them good, solid information. That will help everyone involved make better decisions.

K–12 Education

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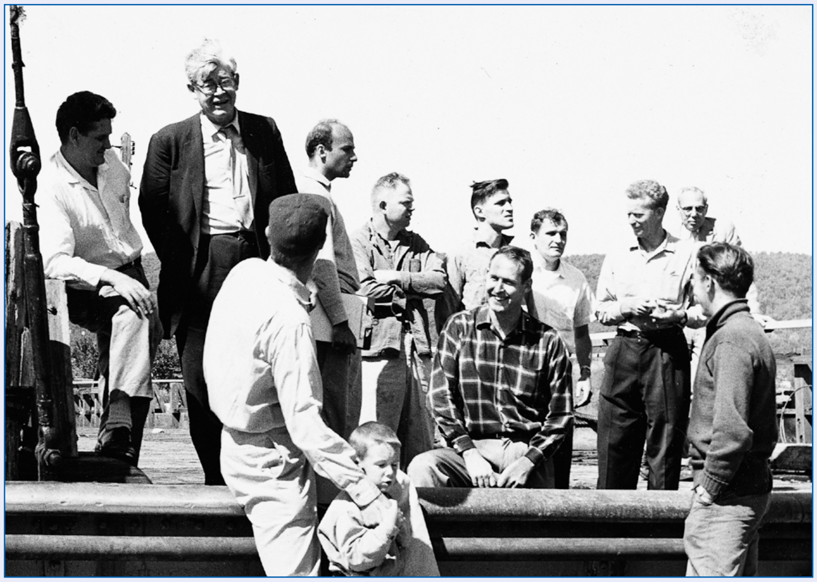
to researching the way students think and learn about the earth sciences. The interconnected processes that comprise the discipline involve magnitudes of time and physical space that often elude learners. Kastens has partnered with education researchers at Teachers College to determine how teachers might convey concepts like geologic time or three dimensional earth processes to their students. In a paper* she authored with Teachers College Professor Ann Rivet, Kastens presents common lines of inquiry—making inferences about process from sequence in time, or patterns over space, for example—that earth scientists employ. Kastens and Rivet then discuss how teachers might effectively introduce such modes of critical thinking into classroom curriculum.

In 2009, Kastens and Rivet received a grant from the National Science Foundation to investigate and improve how middle school students comprehend the analogical linkage between classroom models of Earth processes and the actual phenomena. Each spring, Kastens and Rivet co-teach a seminar entitled Teaching and Learning Concepts in Earth Science, which enrolls both future high school earth science teachers from Teachers College and future geoscience professors from Columbia's Department of Earth and Environmental Sciences.

A recipient of the American Geophysical Union's Excellence in Geophysical Education prize, Kastens also develops hands-on learning curricula, taking advantage of the geoscience data collected by her colleagues at the Observatory and around the world. Kastens has designed pedagogical content she refers to as Data Puzzles: questions pertaining to Earth processes that require the careful analysis of authentic data on the part of the student. Kastens supplements each puzzle with detailed information for teachers, providing them with effective ways to present the material in the classroom. The puzzles and accompanying pedagogical content are scheduled for publication by the National Science Teachers Association.

* "Multiple Modes of Inquiry in Earth Science," *The Science Teacher* (January 2008): 26–31.

In Memoriam
Sam Gerard (1926–2010)



Sam Gerard (top row, fifth from left) with the R/V *Vema* docked at the Piermont pier.

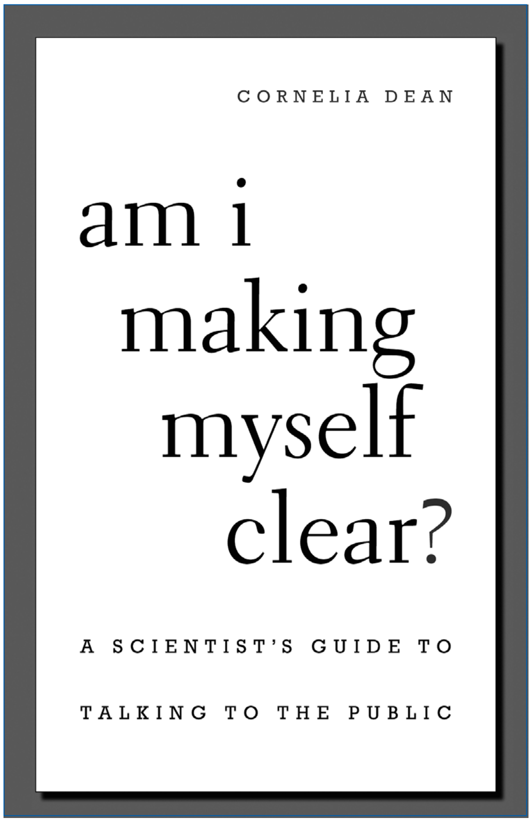
As this newsletter went to press, we learned of the unfortunate passing of Robert (Sam) Gerard, a much-admired researcher, engineer, and administrator who first came to the Observatory in 1954. Working with founding director Maurice "Doc" Ewing and Joe Worzel in the 1960s, Sam designed, built, and refined ocean floor and mid-water sampling equipment that was subsequently introduced onboard Lamont's research vessels, the R/V *Vema* and the R/V *Robert D. Conrad,* and later adopted by other scientific institutions. He was known for his mechanical creativity and for his elegant solutions to engineering problems. Among many accomplishments, Sam designed the famous "Gerard Barrel"—a water-sampling instrument—and he discovered a seamount off the coast of Africa, now named the Vema Seamount.

Combining his talent for building, testing, and operating oceanographic instruments with an organized approach to engineering and fiscal solutions, in the 1970s Sam joined LDEO's Marine Department, serving in critical roles as the marine superintendent and marine technical coordinator.

Sam's last major project before retiring from the Observatory in 1991 was to oversee the conversion of the R/V *Ewing* into a fully outfitted oceanographic ship and part of the U.S. fleet of academic research vessels.

He will be remembered fondly by the entire Lamont-Doherty community.

On Our Bookshelf: LDEO Science Writer Kim Martineau Interviews *Times* Veteran Cornelia Dean



You've spent an hour talking to a journalist. In the story that runs, you get no mention. Or your quote is taken out of context. Or your work is overhyped. What could you have done better? In a new book, *Am I Making Myself Clear?* (Harvard University Press), *New York Times* journalist Cornelia Dean offers some pointers for communicating more effectively with the public. Her concise guide is borne out of hundreds of interviews she has conducted with scientists, including Lamont-Doherty's Richard Seager.

How do I tell if the word I'm about to use is jargon?
I would say if you are asking the question, the word you are thinking of probably is jargon and you probably should avoid it. At *The Times* we talk often about whether a word is "a headline word"—i.e., if it appeared in a headline, would your readers know what it means. If you are in doubt, use a lay language equivalent.

If my project has a clever acronym, is it okay to use it?
Unless it's something like NASA or HIV, I'd say paraphrase. But this is a matter of taste. I think articles littered with acronyms look—littered.

What makes a good sound bite, and should I have one ready in case a journalist calls?
A sound bite is terse, short, accurate, and, if possible, engaging. You should prepare yours ahead of time. Think of conversations with friends, family members, and other nonscientists as chances to hone and practice your sound bites. Remember, there will be sound bites, whether you provide them or not. Yours will undoubtedly be better, so prepare them.

I'm afraid that a journalist is about to sensationalize my research. What can I do?
Be right up front about it. Say, "It is tempting to sensationalize this finding, but…." Or, "Some people may say this finding means X, but in fact…." In other words, confront the issue.

I'm an expert on a topic that often appears in the news. How do I improve my chances that an op-ed piece or letter to the editor will be published?
Be ready to submit your letter or op-ed immediately if your issue comes into the news. Be terse. Have an opinion.

What can I do to sound more articulate on radio and TV?
Think about your message and your sound bites, and practice delivering them.

What do you look for in a story? And what's the best way to get a journalist's attention?
As I say in my book, identifying news is like identifying pornography—it's the kind of thing people struggle to define even though we know it when we see it. I look for stories that change the way we think about things, or are cool, or have human interest, etc.—just like other journalists.

The best way to get a journalist's attention is to have a good story to tell. But a journalist may not always be able to sense intuitively why your story is good. Be prepared to tell her, in simple terms.

Help Build the World's Most Sophisticated Ultra Clean Lab

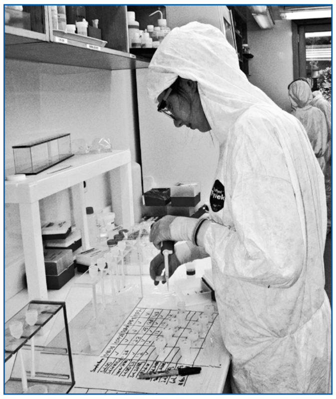
The Observatory has received a matching grant from the National Institute of Standards and Technology (NIST) to support the construction of a new laboratory in the Gary C. Comer Geochemistry Building. The Ultra Clean Lab will provide Lamont-Doherty scientists with the most state-of-the-art ultraclean facility in the world, where sophisticated chemical preparations—very sensitive to contamination by air-borne particles—will be used to conduct high-precision measurements.

The lab will support research in a wide variety of geoscience disciplines at the Observatory. In particular, it will have a dramatic impact on climate research, greatly enhancing our ability to analyze:

- windblown particulates in the geologic record
- abrupt changes in the past to deep ocean circulation
- modern ocean circulation processes, and
- the impacts of solar forcings related to sunspot cycles

LDEO investigators are leading experts in each of these areas. Their innovative research, in combination with the superior quality and capacity of this facility, will serve as a magnet for visiting researchers, postdocs, and graduate students from around the world.

The NIST grant requires Lamont-Doherty to match its contribution of $1.35 million for completion of the lab. This will be our highest fundraising priority over the coming year, and we will be asking all our friends to extend themselves in helping us meet this challenge. Once the new lab becomes operational and funding has been completed, a commemorative plaque will be installed in the Gary C. Comer Building to acknowledge all gifts of $5,000 and more.



Dave Pedlosky

A graduate student works in LDEO's existing makeshift clean lab.

For information on how you can help, please contact Barbara Charbonnet, director for development, at 845-365-8585 or bcharb@LDEO.columbia.edu.

Your Support Is Needed

Your support is essential to funding important outreach and research initiatives at Lamont-Doherty. To make a tax-deductible contribution, please visit our website (www.LDEO.columbia.edu) and click on the "support LDEO" icon.

To send a gift by check, make it out to "Trustees of Columbia University," with "LDEO" in the memo line, and mail it to: Development Office, LDEO, 61 Route 9W, Palisades, NY 10964. If you would like to make a restricted gift, planned gift, or a gift of stock, please contact the director for development, Barbara Charbonnet, at 845-365-8585.

Lamont-Doherty Earth Observatory
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FROM THE ARCHIVE

Two individuals inspect deep-sea sediment cores collected aboard the R/V *Vema.*

INSIDE