

Lamont-Doherty Earth Observatory

COLUMBIA UNIVERSITY | EARTH INSTITUTE



Located on a 157-acre campus on the Hudson River, the Lamont-Doherty Earth Observatory (LDEO) is one of the world's leading research centers seeking fundamental knowledge about the origin, evolution and future of the natural world. More than 300 research scientists study the planet from its deepest interior to the outer reaches of its atmosphere, on every continent and in every ocean. From global climate change to earthquakes, volcanoes, non-renewable resources, environmental hazards and beyond, Observatory scientists provide a rational basis for the difficult choices facing humankind in the planet's stewardship.

BUS FROM MORNINGSIDE HEIGHTS

Buses depart for the LDEO campus in Palisades, N.Y., from 120th Street (between Amsterdam and Broadway, in front of Teachers College) at 9:30 a.m., 10:00 a.m., 10:30 a.m., 11:00 a.m., 11:30 a.m., 12:00 p.m., 12:30 p.m. and 1:00 p.m. **Buses return** to 120th Street (between Amsterdam and Broadway, in front of Teachers College) from LDEO at 11:00 a.m., 11:30 a.m., 12:00 p.m., 12:30 p.m., 1:00 p.m., 1:30 p.m., 2:00 p.m., 3:00 p.m., 3:30 p.m., 4:00 p.m., 4:30 p.m. and 5:00 p.m.

SHUTTLE BUS FROM IBM PALISADES CONFERENCE CENTER, ROUTE 9W

People arriving in cars or vans should park at the IBM Palisades Conference Center on Route 9W just north of the LDEO campus. Shuttle buses run continuously from 10:00 a.m. to 4:00 p.m., arriving and departing from the Geoscience Building at LDEO. **Persons with special needs or questions should call the LDEO Development Office at (845) 365-8634.**

**PARKING IS COMPLIMENTARY THANKS TO THE GENEROUS SUPPORT OF
THE IBM PALISADES CONFERENCE CENTER.**

COACH USA SCHEDULE

Port Authority Terminal to Palisades, N.Y.: 9:15 a.m., 11:22 a.m., 12:22 p.m., and 2:22 p.m.

GW Bridge Station to Palisades, N.Y.: 9:40 a.m., 10:40 a.m., and 1:40 p.m.

Palisades, N.Y., to Port Authority Terminal: 10:58 a.m., 11:58 a.m., 1:58 p.m., 2:58 p.m., and 3:58 p.m.

Palisades, N.Y., to GW Bridge Station: 12:58 p.m. and 2:58 p.m.

LDEO AND COLUMBIA UNIVERSITY ALUMNI INFORMATION

All LDEO and Columbia faculty, staff, and alumni are invited to a special hospitality suite in the Joe Worzel Seminar Room in Lamont Hall, open from 10:00 a.m. until 4:00 p.m.

FOR THEIR SAFETY, IT IS ESSENTIAL THAT CHILDREN BE SUPERVISED AT ALL TIMES.



Indicates Children's Activities



1 WELCOME TENT

Receive campus maps and information on exhibits here. Sign up for walking tours of the LDEO campus. The 45-minute tours, limited to groups of 20 people each, depart from the front of the Geoscience Building at 10:30 a.m., 11:30 a.m., 2:00 p.m. and 3:00 p.m.

Dendro Eco-Hike: Exploring Lamont's Forest History through Tree-Ring Analysis

Lamont Tree Ring Laboratory scientists and E2C teachers will lead hikes that introduce you to our outdoor campus laboratory, the Lamont forest. Find out how we use dendrochronology (the study of tree rings) to understand environmental changes. Walks are approximately one hour in length and require shoes appropriate for the woods. Limited to groups of 15, the tour departs across from the front of the Geoscience Building every hour on the half-hour at 10:30, 11:30, 12:30, 1:30, and 2:30. Visit <http://www.earth2class.org/docs/lamont%20walk.pdf>

Children please pick up your Earth Explorer Quiz!

2 LDEO GIFT SHOP

Purchase LDEO T-shirts, baseball caps, knapsacks, mugs and more!

3 EARTH 2CLASS

"E2C" is a unique professional development program designed to improve the knowledge and teaching skills of teachers and students through interactive workshops with LDEO research scientists. E2C provides monthly Saturday sessions that focus on cutting-edge LDEO discoveries, curriculum integration and networking. Our website, <http://www.earth2class.org>, contains a wide variety of resources.

5 Mini-workshops that feature some E2C projects will be held at:

- 11:00 "Global Climate Change Education" with Mark Becker (CIESIN),
Visualization Lab (2nd Floor Geoscience)
- 12:00 "NASA's Summer of Innovation: Science/Technology/Engineering/Mathematics Activities for the Middle School" with Ruben Worrell (E2C Teacher) (1st Floor Geoscience)
- 1:00 "Global Climate Change Education" with Mark Becker (CIESIN),
Visualization Lab (2nd Floor Geoscience)
- 2:00 "South Africa: A Perspective on How the History of Apartheid has Influenced Efforts to Implement Modern Sustainable Solutions" with Natalie Macke (E2C Teacher)
(1st Floor Geoscience)
- 3:00 "Bringing the Earth to Your Classroom: School Year Opportunities for Teachers at Lamont" with Mike Passow (Earth2Class) (1st Floor Geoscience)



4

DEEP-SEA SAMPLE REPOSITORY/DIVISION OF BIOLOGY AND PALEO ENVIRONMENT (BPE)

LDEO's Deep-Sea Sample Repository stores thousands of cores and sediment taken from beneath the ocean floor. Deep-sea sediments contain microscopic fossils of marine animals, volcanic glass, sands originally from land (terrigenous material), cosmic material (micro tektites), and other unusual materials unique to a marine environment (such as manganese nodules). The microfossils -- foraminifera, radiolaria, diatoms, etc. -- are important as time and environmental indicators; they are very sensitive to slight changes in temperature and chemical changes in their environment. Volcanic glass is an important "time marker" and records instantaneous geological events. Sands can indicate the presence of ocean currents, tell of ancient shorelines, reveal a past dust storm, or record submarine land-slides which might indicate submarine earthquakes. Deep-sea samples hold a permanent record of magnetic history revealing to scientists the ever-changing magnetic orientation of the poles. See how we find evidence of climate change, cosmic impacts and earthquakes in these sediments.

The repository also contains organic sediment cores from lakes, bogs, and marshes throughout the globe. These sediments contain microfossils such as pollen, charcoal, and diatoms in addition to macrofossils which include seeds, needles, leaves, mosses, foraminifera and bryozoans as well as insect remains. When put together, the clues from these cores create vegetation histories which are augmented by isotopic and x-ray fluorescence of the sediments to refine the climate and sedimentological history of regions.



5

CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK (CIESIN)

CIESIN is a research and data center that studies human interactions with the environment. Our displays today include a 3-d visualization of global hurricane tracking, and a map showing how many people were affected by Hurricane Irene; an analysis of paved surfaces in the Jamaica Bay, New York, area; a poster depicting the proximity of nuclear reactors to high populations throughout the world; and another depicting impacts of climate change on urban areas of the U.S. Northeast. And kids can play a "CIESIN-blitz" game where they collect information on all our displays to win a critter-friendly prize. Over in the Remote Sensing and Visualization Lab of the Geoscience Building, visitors can receive "guided tours" of our new online mapping tool, "Change Viewer," that visualizes climate change prediction data and population information. Drop by the second floor (room 204) of the Geoscience building (directly in front of the bus stop) between 10–11am, 11:30–1:00, or 1:30–2pm.



6

DIVISION OF SEISMOLOGY, GEOLOGY AND TECTONOPHYSICS (SG&T)

Scientists and students in the SG&T division are at the forefront of theoretical and observational seismology, solid earth dynamics, rock mechanics, structural geology and tectonics, and sedimentary geology, and are making lasting contributions to the study of earthquakes, the structure of the Earth, and the large-scale motions and deformation of the tectonic plates. SG&T scientists also serve the nation and the world by applying their research to provide advice to national and international organizations in two critical areas: reducing society's vulnerability to natural hazards, and verifying international treaties governing nuclear weapons testing.

OCEAN BOTTOM SEISMOLOGY (OBS) LABORATORY: RECORDING EARTHQUAKES ON THE SEAFLOOR

Nine of the ten largest recorded earthquakes have occurred beneath or beside the ocean. Placing seismometers on the seafloor helps us to understand why and where these destructive earthquakes occur. Lamont-Doherty is home to the Ocean Bottom Seismology Laboratory, which designs, builds, and deploys a fleet of 35 broadband seismometers around the world. These complex instruments must be able to drop to the seafloor, record earthquakes for a year and then return to the surface on

command. An instrument on display illustrates how these instruments meet such challenges, and how the recorded data is used to study structures and processes deep in Earth's crust and mantle.

THE BAMBOO BIKE PROJECT

Learn about the efforts of scientists and engineers to design, build, and examine the feasibility of using bicycles made of bamboo as a sustainable form of transportation in Africa.

SEISMOLOGY BUILDING ROOM 108

SOUNDS OF SEISMOLOGY: Through sounds and animations, experience earthquakes as though you were deep inside the planet. Listen to and watch seismic waves move through and around the globe. This year, we focus on the devastating earthquake in Japan and the unusual one in Virginia.

SEISMOLOGY BUILDING ROOM 201

LAMONT-DOHERTY COOPERATIVE SEISMOGRAPHIC NETWORK (LCSN): How do humans trigger earthquakes? Learn about how Earth's crust responds to human actions like mining, reservoir impoundment, natural resources exploitation and long-term waste disposal from the Lamont-Doherty Cooperative Seismographic Network.

SEISMOLOGY BUILDING ROOM 214

ROCK TOUCHING: Rocks and minerals from around the world are available to be handled by children and adults alike. Several experienced geologists will be on hand to provide information about the rocks and minerals on display.

PLATE TECTONICS AND THE HAITI QUAKE OF 2010: Just weeks after the January 2010 quake in Haiti, Lamont scientists teamed up with researchers from Texas, California, Missouri and Haiti to mount a rapid-response sea-going expedition. Stop by to learn about their findings.

7 FOOD TENT



8 VOLCANOES

Experience explosive volcanic eruptions, see the inside of a volcano, and learn about the 2010 Iceland volcanic ash plume and other important volcanoes.



9 DIVISION OF GEOCHEMISTRY

The Gary C. Comer Geochemistry Building is Lamont-Doherty's new state-of-the-art laboratory building. Here you can meet and talk with scientists and graduate students to:

- Learn more about the race for *sufficient and safe water* in Rockland County and Bangladesh visit our website: superfund.ciesin.columbia.edu/Rocklandwater/
- *Identify rocks, minerals, and fossils*—bring your own and try to stump the experts!
- See demonstrations of materials used to *capture and store carbon*
- Participate in the popular kid-friendly *Carbon Cycle Game*
- Check out the *thermal ionization mass spectrometer* (TIMS) lab and find out what a mass spectrometer is, and how this essential equipment sheds light on many different Earth processes—from how volcanoes work, to ice ages and recent climate change
- Go to room 104 to tour the Argon Geochronology (AGES) lab—a premier facility where scientists explore *past climate, magmatic events, and deep earth time*
- Lamont-Doherty geochemists work with the international GEOTRACES program to identify processes that control the distribution of trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions.
- Explore the connections between climate, glaciers, and society

Lamont Doherty's Secondary School Field Research Program works with several New York City high schools on research projects in the Hudson-Raritan estuary. Teachers and students from The New York Harbor School, on Governor's Island and Curtis High School, on Staten Island, will present their work, which includes:

- * Rebuilding Oyster reefs in New York Harbor and Haverstraw Bay;
- * Monitoring plastic pollution in Raritan Bay and the lower Harbor;
- * Studying the ecology of LaTourette Park on Staten Island and
- * Measuring nutrient levels in the Harbor and the surrounding wetlands.

10 ACADEMIC RESOURCES

The Earth Institute's Office of Academic and Research Programs

Find out about the University's many degree and non-degree programs in earth systems, environmental policy and sustainable development. Learn about research opportunities and other ways for students to get involved with the Earth Institute, Columbia University.

11 EARTHQUAKE INSTRUMENT MUSEUM

Walk underneath the Lamont-Doherty cafeteria and see old and new earthquake monitoring seismographs. You can see your footsteps being detected and measured by sensitive seismometers.



12 DIVISION OF OCEAN AND CLIMATE PHYSICS

The Division of Ocean and Climate Physics (OCP) works to understand Earth's climate system and its natural and human-induced changes. Experience firsthand the salinity of the world's oceans through salt water tasting, see how important aspects of ocean circulation can be simulated in a tank of water, test how wind speed affects evaporation, learn about the instruments and techniques used to monitor our changing oceans, and hear more about Hurricane Irene and her impacts on our region.

13 COOPERATIVE INSTITUTE FOR CLIMATE APPLICATIONS AND RESEARCH (CICAR)

CICAR is a partnership between the National Oceanic and Atmospheric Administration (NOAA) and Columbia University. Learn how scientists from the Earth Institute's Lamont-Doherty Earth Observatory and NOAA's Office of Oceanic and Atmospheric Research (OAR) work together to advance climate research, education and outreach.

14 EARTH SCIENCE FEATURED LECTURES

Monell Building Auditorium



15 INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE AND SOCIETY (IRI)/ TROPICAL AGRICULTURE AND RURAL ENVIRONMENT PROGRAM/COLUMBIA WATER CENTER/CENTER FOR RESEARCH ON ENVIRONMENTAL DECISIONS

IRI scientists work to find new ways of using climate information and forecasts to help people cope with the risks of climate variability and change. Listen to presentations on how climate information can be used to improve practices in areas such as public health, water resources, and agriculture and food security. Activities are geared toward children ages 8 to 88, or younger, with their parents' assistance.

We will also have materials from Tropical Agriculture Program, Columbia Water Center and learn more about the psychology of climate change communication from the Center for Research on Environmental Decisions.



16 DIVISION OF MARINE GEOLOGY AND GEOPHYSICS (MG&G)

The Division of Marine Geology and Geophysics exhibits include mapping the structure of polar ice, finding glacial goo, learning how the solid earth flows, Alaskan earthquakes and volcanoes, melting arctic sea ice, and mapping the ocean floor.

**17****TREE-RING LABORATORY**

Tree-ring scientists will demonstrate how they use tree rings to learn about past climates and better understand the climate of today. For the past decade, scientists have been collecting tree-ring samples from around Asia (China, Mongolia, Southeast Asia, Philippines, Nepal, Taiwan, Indonesia, etc.) to better understand the Asian Monsoon. These rains, or lack thereof, can affect billions of people's lives.

Following up on last year's improvisational performance at Lamont Open House, the artists of Superhero Clubhouse return to the Palisades this year with a new original piece that promises to engage and stimulate children and adults alike. Arising from their collaboration with the scientists of Lamont's Tree Ring Lab, Superhero Clubhouse's new work will be a riff on 'cultural collapse' as discovered through *dendrochronology*, otherwise known as tree-ring dating. In this 15 minute long piece, performed several times throughout the day, audience members will discover how trees are stalwart witnesses to the cultures passing around them, and function as quiet participants in major climatic events throughout history, from the lost colonists at Roanoke to the mega droughts of Asia to the American dust bowl. The experimental piece will allow participants to engage with their new knowledge of tree ring science on a cultural and human level. Set on a scenic trail and incorporating natural elements into the work, this unique theatrical performance will be one you won't want to miss. Supported by **PositiveFeedback**, a consortium of the Earth Institute, Columbia University; the Center for Creative Research at NYU; and the CUNY Institute for Sustainable Cities, designed specifically to support the collaborations of artists and scientists focused on climate change.

**18****BATHTUB SCIENCE**

Learn how a bathtub full of cornstarch and water can be used to understand the dynamics of the solid Earth.

**19****BOREHOLE RESEARCH GROUP/ OFFICE OF MARINE OPERATIONS**

Like detectives in a mystery novel searching for clues, scientists in the Borehole Research Group deploy an assortment of geophysical tools in holes drilled deep into Earth's crust. The information they gather allows them to reconstruct the tectonic, climatic and biological history of the planet—and may provide insights to its future.

Since 1953 LDEO's Office of Marine Operations has operated distinguished research vessels—the *Vema*, the *Conrad*, the *Ewing* and the *Langseth*—which, collectively, have enabled the Observatory to conduct groundbreaking explorations of our planet's oceans and seafloor for over half a century. *R/V Marcus G. Langseth* serves as the principal active seismic research facility for the United States academic research community and also provides general purpose capabilities.

**20****LDEO CHILD DEVELOPMENT CENTER**

Hands-on activities for young children and information about on-site child care in the Bright Horizons day care center.

21**THE ROSE GARDEN**

Visit the Rose Garden, designed by the landscape architectural firm Olmsted Brothers, which was founded by sons of the world-renowned Frederick Law Olmsted. Learn about the history of the Rose Garden by an LDEO alum, a gardening enthusiast who has made Mrs. Lamont's Rose Garden a blooming showcase of flowers.

Lectures at Open House 2011

- 10:45 a.m.** **Jeffrey D. Sachs**, Director, The Earth Institute, Columbia University
Sustainable Development in the Lead-Up to the Rio+20 Conference
Monell Building Auditorium
- 11:00 a.m.** **Natalie T. Boelman**, Storke-Doherty Lecturer, Lamont-Doherty Earth Observatory
Climate Change in Arctic Tundra: From Wildfire to Songbirds
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 11:00 a.m.** **Klaus Jacob**, Special Research Scientist, Lamont-Doherty Earth Observatory
Update on Climate Change Impacts for the Metropolitan Region
Seismology Building, Second Floor Seminar Room
- 11:30 a.m.** **Mega Quakes Panel Discussion**
Moderated by: **Geoff Abers**, Associate Director of Seismology, Geology and Tectonophysics
Heather Savage, Lamont Assistant Research Professor
Donna Shillington, Lamont Assistant Research Professor
Michael Steckler, Lamont Research Professor
Monell Building Auditorium
- 11:45 a.m.** **Martin Stute**, Ann Whitney Olin Professor and Adjunct Senior Research Scientist
Arsenic in Groundwater, Causes, Health Effects and Solutions
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 11:45 a.m.** **John Mutter**, Professor, Department of Earth and Environmental Sciences
Bamboo Bikes: Sustainable Transportation Solutions
Seismology Building, Second Floor Seminar Room
- 12:00 p.m.** **Simon Mason**, Research Scientist
Drought in East Africa: A Famine Foretold?
IRI Exhibit Tent #15
- 12:30 p.m.** **Jerry McManus**, Professor, Department of Earth and Environmental Sciences
Uranium, Stopwatch of the Sea
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 12:30 p.m.** **Tony Barnston**, Head Forecast Operations
Everything You Want to Know About Seasonal Climate Forecasts
IRI Exhibit Tent #15
- 12:30 p.m.** **Tim Creyts**, Postdoctoral Research Scientist
The Fate of Mountains beneath the World's Glaciers and Great Ice Sheets
Seismology Building, Second Floor Seminar Room
- 12:45 p.m.** **Paul Richards**, Special Research Scientist
Monitoring for Nuclear Explosions-a Role for Seismology in Support of Nuclear Arms Control
Monell Building Auditorium
- 1:15 p.m.** **Elizabeth Pierce**, Graduate Student, Department of Earth and Environmental Sciences
Antarctica and the Integrated Ocean Drilling Program
Gary C. Comer Geochemistry Building, First Floor Seminar Room

- 1:15 p.m.** **Dallas Abbott**, Adjunct Research Scientist
Impacts of Comets and Meteorites Over the Last 5,000 Years
Seismology Building, Second Floor Seminar Room
- 1:45 p.m.** **Climate Change & Extreme Weather: Are They Connected?**
Moderated by: **Heidi Cullen**, Communications Director and Research Scientist, Climate Central
Kevin Anchukaitis, Lamont Assistant Research Professor
Suzana Camargo, Lamont Associate Research Professor
Richard Seager, Palisades Geophysical Institute, Lamont Research Professor,
Jason Smerdon, Lamont Assistant Research Professor
Monell Building Auditorium
- 2:00 p.m.** **Bärbel Hönisch**, Assistant Professor, Department of Earth and Environmental Sciences
Ocean Acidification in Earth History
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 2:00 p.m.** **Carlos Perez García-Pando**, Postdoctoral Research Fellow
Dust and Meningitis in sub Saharan Africa
IRI Exhibit Tent #15
- 2:00 p.m.** **Michael Steckler**, Lamont Research Professor
Sinking Delta, Shifting Rivers, Rising Floods and Earthquakes: Geohazards in Bangladesh
Seismology Building, Second Floor Seminar Room
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 2:45 p.m.** **Sidney Hemming**, Professor, Department of Earth and Environmental Sciences
Past Lake Levels at Mono Lake CA
Gary C. Comer Geochemistry Building, First Floor Seminar Room
- 3:00 p.m.** **Career Panel: Insight from Lamont-Doherty Alumni**
Moderated by: **Phil Orton**, Ph.D. '10, Postdoctoral Research Associate, Stevens Institute of Technology
Kerry Hegarty, Ph.D. '85, Managing Director, Sienna Cancer Diagnostics
Supria Ranade, M.S. '07, Vice President, Evolution Markets, Inc.
Kyla Simons, Ph.D. '09, Geoscientist, ExxonMobil Development Company
Kevin Wheeler, Ph.D. '07, Middle East Director, The Kaizen Company
Monell Building Auditorium

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