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, renewable and 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 LDEO Events at 845-365-8998.**

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 1:00 p.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., 12:30 p.m. and 1:30 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 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!

LDEO GIFT SHOP

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

2

EARTH 2CLASS WORKSHOPS FOR TEACHERS AND STUDENTS

"E2C" is a unique professional development program designed to improve the knowledge and teaching skills of middle and high 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 educational and scientific resources.

5 Mini-workshops (20 minutes each) that spotlight selected E2C projects will be held at:

11:00 "Global Climate Change Education Project" with Mark Becker (CIESIN), Visualization Lab (2nd Floor Geoscience)

12:00 "How Can Temperature and Salinity Differences Keep the Oceans in Motion?" with Diana Soehl (E2C Teacher and AMS Maury Project Teacher) (1st Floor Geoscience)

1:00 "What Do You Need to Know about the Effects of El Nino and La Nina?" with Bill Reed (E2C Teacher and AMS Maury Project Teacher), (1st Floor Geoscience)

2:00 "The Global Climate Change Education Project" with Mark Becker (CIESIN), Visualization Lab (2nd Floor Geoscience)

3:00 "Bringing the Earth to Your Classroom: School Year Opportunities for Teachers and Students at Lamont" with Mike Passow (Earth2Class) (1st Floor Geoscience)

3

LAMONT-DOHERTY CORE REPOSITORY

The Lamont-Doherty Core Repository stores thousands of cores and sediments 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 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. Visit http://www.ldeo.columbia.edu/core-repository


4

CENTER FOR INTERNATIONAL EARTH SCIENCE INFORMATION NETWORK (CIESIN)

CIESIN is a research and data center that studies human interactions with the environment. In our tent you will find our online Superfund mapper that can map a wide range of population and environmental data near Superfund sites across the country. Teachers and students will be interested in the CHANGE Viewer, which uses CIESIN and NASA data to let you explore how climate change may affect human health and other socioeconomic issues in various parts of the world. We will also have poster versions of our popular map of the month series of posts from Columbia's *State of the Planet* blog highlighting our global and national research interests. Kids can play a "CIESIN-blitz" mapping game where they collect information on all our displays.


5

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. Our researchers study 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 and providing 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 102

ROCK MECHANICS LAB: Take a tour of the rock mechanics lab and see the high-pressure rigs that are used in experiments that demonstrate important earthquake concepts such as friction.

SEISMOLOGY BUILDING ROOM 108

SOUNDS OF SEISMOLOGY: Experience earthquakes through sounds and animations, as though you were deep inside the planet. Listen to and watch seismic waves move through and around the globe.

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.

6 **FOOD TENT**

7 **DIVISION OF BIOLOGY AND PALEO ENVIRONMENT (BPE)**

Life in the Ocean!

Explore how organisms adapt to life in the oceans, from the microscopic to those that endure extreme cold. Hands-on activities and demonstrations will allow kids and adults to become oceanographers for a day! Investigate plankton under the microscope. See state-of-the-art equipment that oceanographers use to help them learn about microscopic animals and plants. Test your ability to keep warm in cold ocean waters.

8 **DIVISION OF GEOCHEMISTRY**

The Gary C. Comer Geochemistry Building is Lamont-Doherty's 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.
- See a demonstration of a system that identifies carbon isotope 14C.
- Go to room 104 to tour the Argon Geochronology for the Earth Sciences (AGES) lab—a premier facility where scientists explore *past climate, magmatic events, and deep earth time.*
- Explore the connections between climate, glaciers, and society.
- Visit an exhibition of Arctic photography displaying the environment and our research close to the North Pole.
- See an Air Capture demonstration.

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 Young Women's Leadership School in East Harlem, The New York Harbor School on Governor's Island, and Curtis High School on Staten Island will present their work, which includes:

* Invasive plant species in Piermont Marsh;
* Fish Ecology, nutrients and soil carbon in Piermont Marsh;
* Nutrient and bacterial levels in the Hudson River and Sparkill Creek;
* Ecology in LaTourette Park on Staten Island
* Rebuilding Oyster reefs in New York Harbor and Haverstraw Bay.

9 **VOLCANOES**

Experience explosive volcanic eruptions, see the inside of a volcano, and learn about important volcanoes and the exploration of underwater volcanoes in the oceans.

10 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.

11 POSITIVEFEEDBACK-FIELD TRIP: A CLIMATE CABARET

In their third season at Lamont's Open House, the artists of Superhero Clubhouse continue to explore the intersection between environmentalism and theater. Don't miss this year's original piece, "**Field Trip: A Climate Cabaret**," a musical adventure celebrating seven extraordinary women of climate science and their world-changing research. **Performance times: 11:00am, 12:00pm, 2:00pm, 3:00pm** in the Oceanography building room 105. Limited seating, please arrive early.

The performance is supported by ***PositiveFeedback***, an initiative of The Earth Institute, Columbia University; Center for Creative Research, NYU; and the CUNY Institute for Sustainable Cities, designed specifically to support the research collaborations of artists and scientists focused on climate change.

12 EARTH SCIENCE FEATURED LECTURES

Monell Building Auditorium
See Lecture Schedule below

13 ACADEMIC RESOURCES

The Earth Institute's Office of Academic and Research Programs
The Earth Institute, Columbia University offers a unique suite of environmental and sustainability focused education programs, from undergraduate to masters, doctoral and certificate programs. Come learn about our education programs, research opportunities, and other ways to get involved.

14 INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE AND SOCIETY (IRI)/CENTER FOR RESEARCH ON ENVIRONMENTAL DECISIONS (CRED)

IRI scientists are trying to better lives through climate information and forecasts. They work throughout the world but focus on developing countries. Come see photos and videos from the field and listen to presentations on how scientists create forecasts and are using them to help improve public health, agriculture and food security. Join the IRI and one of its partners from the Red Cross/Red Crescent Climate Centre at 3pm to play a special game geared toward ages 18 and up that puts you in the shoes of a disaster manager.

Game: Farmers, Drought and Insurance - Making Decisions in an Uncertain Climate
In this simple 25-minute table game, you play the role of a farmer in Ethiopia who has to decide whether to use traditional seeds or buy high quality ones, and whether or not to buy drought insurance. Learn about the cost and benefits of making such decisions, which thousands of farmers have to do every growing season across the world. Ages 8 and up are welcome to participate.
Run times are 10:30 am, 11:00 am, 12:30 pm, 2:00 pm and 2:30 pm.

Take part in environmental decision-making activities to find out what affects your decisions, learn more about the psychology of climate change communication, and talk with researchers from the Center for Research on Environmental Decisions (CRED). Learn about PositiveFeedback, the first New York City inter-institutional consortium (Earth Institute, Columbia University; Center for Creative Research, NYU; Institute for Sustainable Cities, CUNY) designed specifically to support the collaborations of artists and scientists focused on climate change. Learn more about PositiveFeedback artists Superhero Clubhouse and today's Open House performance, "Field Trip: A Climate Cabaret" located in Oceanography room 105. *See Tent 11 description for more information.*

15 **DIVISION OF OCEAN AND CLIMATE PHYSICS (OCP)**

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 oceanic and atmospheric circulation can be simulated in a tank of water, test how wind speed affects evaporation, hear about the instruments and techniques used to monitor our changing oceans, and learn more about hurricanes and tornadoes.

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

The Division of Marine Geology and Geophysics exhibits include mapping the structure of polar ice, modeling mountain building and the breakup of continents, Hudson River research, understanding latitude and longitude, studies of the world's largest delta, and mapping the ocean floor.

Lecture: Assessing Climate Change: Slicing Through Polar Ice with Cutting-Edge Technology at 12:00, 1:00, 2:00 and 3:00.

17 **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 from a LDEO alumna and gardening enthusiast who has made Mrs. Lamont's Rose Garden a blooming showcase of flowers.

18 **TREE-RING LABORATORY**

Join tree-ring scientists to learn how they use ancient trees to learn about historical climate, geology, and ecology to better understand the changes happening today. For the past several decades, Tree-Ring Laboratory scientists have led expeditions to stunningly picturesque and remote places around the world in search of long-lived, sensitive trees. Visit the Tree-Ring Laboratory to meet the scientists, examine tree-ring samples and view a new of field photography. Dendro Eco-hikes will depart 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

19 **BATHTUB SCIENCE**

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

20 **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 that have, collectively, enabled LDEO to conduct groundbreaking explorations of our planet's oceans and seafloor. LDEO currently operates the *R/V Marcus G. Langseth* that serves as the national seismic research facility for the United States academic research community. The *R/V Langseth's* unique seismic capability allows it to provide both 2D and 3D maps of the earth's structure miles below the seafloor. Utilizing the *R/V Langseth's* other capabilities, expeditions have collected sediment cores for understanding climate variations throughout Earth's history, sampled seawater to determine physical and chemical properties of the oceans, and deployed remotely operated vehicles (ROVs) to study submarine volcanoes.

21 **LDEO CHILD DEVELOPMENT CENTER**

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

Lectures at Open House 2012

10:45 a.m. **Jeffrey D. Sachs,** Director, The Earth Institute, Columbia University
Monell Building Auditorium

11:00 a.m. **Suzana Camargo,** Lamont Associate Research Professor, Lamont-Doherty Earth Observatory
Hurricanes and Climate Change: What do we know? What can we expect?
Gary C. Comer Geochemistry Building, First Floor Seminar Room

11:00 a.m. **James Davis,** Lamont Research Professor, Lamont-Doherty Earth Observatory
How your GPS Navigation System Works (and why it sometimes doesn't)
Seismology Building, Second Floor Seminar Room

11:30 a.m. **Sean C. Solomon,** Director, Lamont-Doherty Earth Observatory
From plates, plumes and planets to personnel, programs, and promise
Monell Building Auditorium

11:30 a.m. **Pietro Ceccato,** Associate Research Scientist, International Research Institute for Climate and Society (IRI)
How Can We Manage Human Health, Agriculture and Desert Locust from Space?
IRI Exhibit Tent #14

11:45 a.m. **Amelia Paukert,** Graduate Student, Department of Earth and Environmental Sciences, Columbia University
Mitigating Climate Change: What Can We Do About CO2?
Gary C. Comer Geochemistry Building, First Floor Seminar Room

11:45 a.m. **John Mutter,** Professor, Department of Earth and Environmental Sciences, Columbia University
The Bamboo Bike Project: Sustainable Transportation for Africa's Rural Poor
Seismology Building, Second Floor Seminar Room

12:00 p.m. **Arthur Greene,** Associate Research Scientist, International Research Institute for Climate and Society (IRI)
Decadal Variability, Here to Stay: What We Can Do About It
IRI Exhibit Tent #14

12:30 p.m. **Kirsty Tinto,** Postdoctoral Research Scientist, Lamont Doherty Earth Observatory
Greenland and Antarctica: Mapping the Tricky Bits
Gary C. Comer Geochemistry Building, First Floor Seminar Room

12:30 p.m. **Nicholas Christie-Blick**, Professor, Department of Earth and Environmental Sciences, Columbia University
Earth's Ancient Climate
Seismology Building, Second Floor Seminar Room

12:30 p.m. **Panel Discussion: Fieldwork on Every Continent, Every Ocean**
Moderated by **Francesco Fiondella,** Senior Communications Officer, International Research Institute for Climate and Society, (IRI)
Natalie Boelman, Lamont Assistant Research Professor, Lamont-Doherty Earth Observatory
James Cochran, Lamont Research Professor, Lamont-Doherty Earth Observatory
Joaquim Goes, Lamont Research Professor, Lamont-Doherty Earth Observatory
Einat Lev, Postdoctoral Research Scientist, Lamont-Doherty Earth Observatory
Monell Building Auditorium

1:00 p.m. **Tony Barnston,** Chief Forecaster, International Research Institute for Climate and Society
Here's Our Forecast, Predicting Rain, Maybe
IRI Exhibit Tent #14

1:15 p.m. **Wade McGillis,** Lamont Associate Research Professor, Lamont Doherty Earth Observatory
NYC Urban Metabolism
Gary C. Comer Geochemistry Building, First Floor Seminar Room

1:15 p.m. **Dee Breger,** Photomicrographer and Founder, Micrographics Arts
Megatsunami from Extraterrestrial Bodies Hitting Earth
Seismology Building, Second Floor Seminar Room

1:45 p.m. **Panel Discussion: Fracking and Induced Seismicity**
Moderated by **Arthur Lerner-Lam,** Deputy Director, Lamont-Doherty Earth Observatory
Heather Savage, Lamont Assistant Research Professor, Lamont-Doherty Earth Observatory
Alberto Malinverno, Senior Research Scientist, Lamont-Doherty Earth Observatory
Roger Anderson, Senior Research Scientist, Lamont-Doherty Earth Observatory
Monell Building Auditorium

2:00 p.m. **Paul Olson,** Arthur D. Storke Memorial Professor, Columbia University
Dinosaurs! What They Were, What They Are, What They Mean
Gary C. Comer Geochemistry Building, First Floor Seminar Room

2:00 p.m. **Michael Wolovick**, Graduate Research Assistant, Department of Earth and Environmental Sciences, Columbia University
Ice Sheets and Glaciers: How Do They Work?
Seismology Building, Second Floor Seminar Room

2:45 p.m. **Sidney Hemming,** Professor, Department of Earth and Environmental Sciences, Columbia University
Toward a Paleo-Hydrologic Record for the Mono Basin, CA During the Last Glacial Cycle
Gary C. Comer Geochemistry Building, First Floor Seminar Room

2:45 p.m. **Michael Steckler,** Lamont Research Professor, Lamont-Doherty Earth Observatory
Natural Hazards in the World's Largest Delta
Seismology Building, Second Floor Seminar Room

3:00 p.m. **Career Panel: Insight from Lamont-Doherty Alumni**
Moderated by **Gregory Mountain,** Ph.D. '81, Professor, Rutgers University
Gina Gould, Ph.D. '97, Curator of Science, The Bruce Museum
Candace Major, Ph.D. '02, Program Director, The National Science Foundation (NSF)
Philip Orton, Ph.D. '10, Postdoctoral Research Associate, Stevens Institute of Technology
Stewart Wills, Ph.D. '00, Editorial Director, Web and New Media, Science Magazine/AAAS
Monell Building Auditorium

3:00 p.m. **Erin Coughlan,** Technical Advisor, Red Cross Red Crescent Climate Centre
Paying for Predictions: An Interactive Game with the Red Cross Climate Centre
IRI Exhibit Tent #14

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