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Toward a New Generation of Ice Sheet Models

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Sandy Signs of a Tsunami’s Onshore Depth and Speed

Tsunamis rank among the most devastating and unpredictable natural hazards to affect coastal areas. Just 3 years ago, in December 2004, the Indian Ocean tsunami caused more than 225,000 deaths. Like many extreme events, however, destructive tsunamis strike rarely enough that written records span too little time to quantify tsunami hazard and risk. Tsunami deposits preserved in the geologic record have been used to extract the story of past tsunami occurrence but not the magnitude of past events. To quantify tsunami hazard further, we asked the following question: Can ancient deposits provide guidance on the expectable water depth and speed at coastal locations?

It has been well documented in the past 20 years that tsunami deposits, both ancient and recent, act as natural recorders of tsunami waves [Tappon, 2007]. With reliable dating, such deposits enable us to quantify paleotsunami recurrence intervals but characterize both event frequency and magnitude, critical for assessing tsunami risk. Quantifying paleotsunami size by modeling onshore flow depth and speed from tsunami deposits would provide a key for determining the deadliness and destructiveness of past events. Ideally, such a key could also inform long-term hazard assessments based on tsunami source mechanisms (e.g., fault slip or submarine landslides) inverted from calibrated paleotsunami wave characteristics.

Developing quantitative tools to estimate flow depth and speed from tsunami deposits requires interdisciplinary collaboration among the coastal geomorphologic, sedimentary, geologic, sediment transport, hydrodynamic, remote-sensing, and seismology communities. This article presents a strategy for using “sedimentology benchmarks” to enhance this collaboration. Promising preliminary work, based on a tsunami sedimentology workshop held in spring 2007 in Friday Harbor, Wash., suggests that benchmarks will lead to an improved understanding of tsunami physical processes and advances our ability to quantify paleotsunami magnitudes by interpreting the geologic record.

The State of the Science

Tsunamis deliver highly energetic, sustained flows that can erode everything from large blocks to fine sediment and transport them up to thousands of meters across coastal plains. The long-period waves of a tsunami approach the shore at speeds of tens of kilometers per hour, causing nearshore water to increase in depth and amplitude of small waves common break offshore, where they form a bore or series of bores—ad-ditionally transforming the foreland with amplitudes of several tens of meters. The leading wave characteristic of the pattern of seafloor displacement in the source region—may arrive an ecking a breaking wave or an extreme event regular with wave onshore wave 577

traditionally, benchmarks rely on analytical solutions or controlled experiments of known initial conditions with which to test and compare models or laboratory equipment. Our working definition of a benchmark is somewhat different for several reasons. First, there is no adequate analytical solution available for “tsunami sediment” problems, even for a case with simplified boundary conditions (e.g., planar beach topography) and homogeneous sediment. Second, while initial conditions of laboratory experiments can be specified in detail, computing those small-scale experiments with data that nature is limited by scaling difficulties. Most important, while conventional benchmarks are used to rank model必须要 in well-established fields of study, tsunami sedimentology is at such an early stage that benchmarks serve instead to enhance collaboration in exploring physical processes and making improved model predictions. Such collaboration has already resulted from benchmark exercises that investigate the sediment-transport models on which tsunami runup models are based [Yeh et al., 1996].

Benchmarking tsunami sedimentology models entails developing test cases that can be treated using different approaches, allowing the modeling results to be compared and problems to be tackled in an efficient, coherent manner. Given the limitations of existing tsunami inundation and sediment transport models, two key challenges are well suited for such an approach: (1) closing the knowledge gap in linking modern events to their deposits with an improved understanding of tsunami sediment transport, and (2) adapting that relationship to interpret the geologic record.

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Benchmarking tsunami sedimentology requires agreed-upon goals that promote interdisciplinary collaboration and development of appropriate data sets. For example, the community must identify key parameters to be estimated (e.g., wave height and speed) and set sensitivity study targets (e.g., effect of grain size on runup thickness). These actions will ensure that the focus and scope of modeling studies are compatible. Identifying these parameters also helps to determine the minimum amount of information a benchmark data set must contain.

Proof of Concept

As a test of this approach, we performed pilot benchmark exercises on two data sets of tsunami deposits, one modern (1998 Papua New Guinea tsunami) and the other ancient (late Quaternary, Mutnaya Bay, Kamchatka, Russia). Detailed treatment of the modern case (Figure 1) was aimed at linking modern events to their deposits and improving the understanding of tsunami sediment transport. The application of the models to the ancient case allowed us to evaluate how this understanding might be adapted to interpret the geologic record.

Models were used to estimate tsunami characteristics such as flow depth, flow speed, number of waves, and where possible, tsunami source for each benchmark. The data sets included grain-size distributions, deposit thickness, topographic profiles, and bathymetry. In the case of the modern deposit, additional information (from field estimates and eyewitness accounts) on the tsunami was available [Gelfenbaum and Jaffe, 2003]. Paleotsunami modeling efforts were complicated by incomplete deposit preservation, lack of flow depth or inundation limit indicators, and poorly constrained pre-tsunami topography at Mutnaya Bay.

Forward modeling of tsunami inundation was based on high-resolution bathymetry and topography collected along the sample.

Fig. 1. Flow and speed estimates for the 1998 Papua New Guinea tsunami (a) Location and sample sites [Gelfenbaum and Jaffe, 2003]. (b–e) Data collected from tsunami deposit (red symbols), field-based estimates of tsunami flow elevation (sum of flow depth and land elevation, white circles) and speed (white triangles) predictions using hydraulic model of Linnan [2007] with incorporated transport model following Rakha et al. [1997] (bold blue lines), and inverse model predictions of Jaffe and Gelfenbaum [2007] (black symbols).
Toward a New Generation of Ice Sheet Models

Large ice sheets, such as those presently covering Greenland and Antarctica, are important in driving changes of global climate. Ice sheet models have been developed to predict climate change and ice sheet-driven sea level fluctuations have substantial values in national security and climate change policies. In the past decade, the ice sheet component (through modeling) has become an essential part of the Earth system model. The interest in understanding rapidly changing ice sheet behavior has been growing due to a warming climate. The large uncertainty in sea level predictions is partly due to the incomplete understanding of sea level rise by a warming climate. The results of the past uncertainty in sea level predictions, however, has been widely discussed since the publication of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) [IPCC, 2007]. The assessment process of ISMs do not include “the full effects of changes in ice sheet models, and the literature is lacking.” The report also notes that the understanding of rapid changes in ice sheet flow “is too limited to assess their likelihood or provide a best estimate or an upper bound for sea level rise.”

Credible predictions of ice sheet evolution and sea level change will require a new generation of ice sheet models (ISMs) coupled to atmosphere-ocean general circulation models (AOGCMs). Although the development of these new ISMs has been focused on physically based models, the “physically justifiable model assumptions” demands interaction between researchers in modeling, from Lawrence (2008) and their understanding of ironical and interdisciplinary research. This includes the integration of researchers working on numerical algorithm development, software engineering, and the analysis of model output.

However, ice sheet simulations assessed by the IPCC cannot reproduce these observations because the simulations fail to interact with global climate models. In addition, changes in ice volume and discharge occur rapidly enough to modify ice sheet bound-ary and ice sheet response to climate forcing are thus almost certainly biased against delivering fast to predict sea level rise. The rate at which the rate of sea level rise is an important aspect of the ice sheet response to climate forcing. Ice sheet models should be incorporated into models to make reliable predictions of future ice sheet change.

We therefore recommend increased publi-Date: 27 December 2007

Ice Sheet

Jennifer A. Barlet

Editors

American Geophysical Union

The Newspaper of the Earth and Space Sciences

American Geophysical Union

The Newspaper of the Earth and Space Sciences

American Geophysical Union

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In Brief
Protecting Louisiana’s coasts With numerous wetlands restoration and protection projects slated for Louisiana, a well-developed implementation strategy that can address a number of uncertainties is improving Louisiana’s coastal protection. For example, according to a 14 December report by the U.S. Government Accountability Office (GAO), (GAO) specifically urged maintaining the collaborative process that is used by Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) program agencies, with scientists, engineers, and others working together to plan and design restoration projects. The report also noted the need to address additional issues having as much as an integrated monitoring system to determine how threats and objectives are met as well as understanding that governments can face significant setbacks due to storms and hurricanes, landscape and structural causes, and spiraling project costs. Louisiana state officials anticipate the state could receive about $8.5 billion over the next 10 years for coastal restoration and protection. Nearly 40% of all coastal wetlands in the lower 48 U.S. states are located in Louisiana. For more information, visit the Web site: http://www.gao.gov/new.items/d08130.pdf.

MEETINGS

How can Integrated Ocean Drilling Program (IODP) drilling contribute to a better understanding of highly hazardous geologic events, such as great earthquakes, submarine landslides, and volcanic collapse, all of which can generate devasting tsunami, threaten big impacts and threaten huge parts of the Earth’s coastlines. Eighty-nine percent of all U.S. shoreline is from 28 countries grappled with this topic for 4 days near Portland, Ore., in late August and spawned a number of working groups focused on generating proposals to gain such understanding.

Ideas included potential scientific targets and locations for drilling, proposals, observations, to study active and potentially precursory processes, in situ measurement techniques, and methodologies for interpreting sedimentary records. A common theme was the unique opportunity afforded by IODP drilling to study active processes relevant to geohazards, especially at known points within the deformation cycle. The meeting also led to proposed additions to the IODP (Reid et al., 2008).

Meeting participants discussed how geohazards can be evaluated through drilling in several ways. One way is to understand the preconditioning for failure and the changes in physical properties that can occur at an event. Preconditioning includes diagnostic and geomorphologic changes that affect strength and stability as well as changes in spatial variability, seafloor features on fault surfaces, relocated landslides, and gas continuities. Triggering mechanisms include earthquakes, wave and tide action, rapid sedimentation, magmatic processes, destabilization of hydrates, groundwater seepage, and glaciation. The combination of drilling and ocean monitoring techniques, and methodologies for interpreting sedimentary records, is critical to many of these mechanisms. Understanding the second way to associate risk and geohazards is to focus on careful and meaningful understanding of their frequency and distribution, which can be established through drilling and dating the events. For example, conference sessions focused on the research that can improve our understanding and Earth observations in the Pacific Northwest region resulting from careful dating of turbidite sequences and examining the relationship with seafloor processes and data. Such studies should be expanded to many other settings.

The combination of drilling and ocean observations in research is important for understanding the processes that lead to slope and volcanic failure and earthquake rupture, and also for documenting the changes in movement, rate, and volume of volcanic eruptions and associated failures. A number of examples that were discussed at the meeting underscored the potential devastation that such events could have on coastal populations, remediation of the consequences of the Sumatra earthquake and tsunami. Collapse of Mount Etna, an active volcano on the coast of Sicily, could threaten much of the Mediterranean coastline, and failure of one of the Mediterranean volcanoes could affect huge portions of the Pacific coastline. A report of known landslides, submarine landslides, and tsunamis in 2002 or the Sheregesh slide of 1801 years ago, would also be devastating for the North Atlantic region. Large subaqueous impacts, fortunately very rare, could change the world as we know it.

Further details from this workshop can be found at http://www.iodp.org/geohazards/. See also J. Morgan and E. Silver (Addressing Geohazards through Ocean Drilling), EOS, v. 89, 5–6, 2007.

Acknowledgments

This report summarizes the conclusions and recommendations of participants on the topic of oceanic ice sheet modeling held at the NOAA Center for Oceanic and Atmospheric Research, 14 December 2006. For more information, visit the Web site: http://www.gao.gov/.

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development of the IODP (Reid et al., 2008).

MEETINGS

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Effect of Human Activities on the Atmosphere

Det ecting the Atmospheric Response to the Changing Face of the Earth: A Focus on Human-Caused Regional Climate Forcings, Land-Cover/ Land-Use Change, and Data Monitoring
Boulder, Colorado, 27–29 August 2007

Human activities continue to significantly modify the environment. The impacts of these changes are highlighted, for example, in local-, regional-, and global-scale trends in modern atmospheric temperature records and other relevant atmospheric indicators. Studies using both modeled and observed data have documented these impacts. It is essential that we detect these changes accurately to better understand the impacts on climate and provide improved assessment of the predictability of future climate. Therefore, one of the key goals of this National Science Foundation–funded workshop was to explore these effects.

First, the workshop highlighted land-use/land-cover and ecosystem change, and subsequent impacts on weather and climate. Participants discussed both long-term systemic change (e.g., agricultural land-use change, deforestation) and short-term abrupt change (e.g., rapid, small-scale urbanization).

Second, the workshop addressed new observing systems and issues associated with using the national data archive to monitor climate changes. Temperature is one key indicator of impacts of land-use/land-cover change, and hence this workshop featured issues related to temperature observation through land-use/land-cover and ecosystem changes, biases associated with precipitation were also discussed.

Papers were organized under three sessions to discuss recent developments, including (1) observations of land-cover/ecosystems function changes and their impacts on weather and climate; (2) modeling effects of land-use/land-cover change and ecological processes on weather and climate; and (3) monitoring and quantifying land-use/land-cover change and ecological processes on their impacts on observational data including multidiscural surface temperature trends and associated bias. Papers were organized under three main topics: impacts of land-use/land-cover change on temperatures and climatic parameters; precipitation, deforestation and soil moisture changes on the monsoon and mossoninon processes; vegetation change and subsequent modification of the effect of plant biophysical properties on climate, impacts of man-made lakes on weather, and model representation of land use. Several papers also discussed the role of station histories in identifying land-use change; the important role the Climate Reference Network (CRN) can play in detecting the impacts of land-use/land-cover changes; the effects of land-use on precipitation measurement and bias correction; biases associated with United States National Climate Assessment (USNCA) data and its use in land-change studies; and challenges associated with determining impacts of land-use/land-cover change on the Tibetan Plateau.

In total, 50 papers were presented, and the participants represented Australia, Canada, China, Colombia, India, Nether-

lands, Turkey, and the United States. A total of 16 graduate students and postdoctoral researchers were supported through travel grants from the NSF. A number of recommendations were made including a call for more accurate land-use/land-cover data for modeling and better understanding of the interactions between changed land-surface and the atmosphere; more studies on the impacts of wetlands, man-made lakes, agricultural land uses, and urbanization on weather and climate; the monitoring of soil moisture, and the use of the CIN in conjunction with land-use/land-cover change studies and assessment of data quality in different regions. Details of the recommendations will be published in the form of several journal papers. Participants also recommended publishing a journal special issue. Papers presented at the workshop can be found at http://www.colorado.edu/ department/Geographic_and_Human_Sciences/Sediment_Fluxes_and_Budgets_in_High-Latitude_Cold_Environments/SEDIBUD_manual (http://www.geomorphology.org/EG/6105/). This workshop will be held in Boulder, Colorado from 10–12 February 2008. A working group of the International Polar Year (IPY) research program was formed to address this key knowledge gap through the Sedimentary Source-to-Sink Fluxes in Cold Regions (SEDIBUD) program. SEDIBUD represents a continuation of the previous European Science Foundation SEDE- FLUX (Sedimentary Source-to-Sink Fluxes in Cold Environments) program. The central research question of the working group is to assess the contemporary and future effects of land-use/land-cover change in cold regions of the world. SEDIBUD has expanded to an international group of participants with research sites located in polar and alpine regions in the Northern and Southern hemispheres. Research can be conducted at each site vary by program, logistics, and available resources, but typically includes interdisciplinary collaborations of geomorphologists, hydrologists, ecologists, and permafrost scientists in addition to researchers with different levels of detail.

SEDIBUD has developed a key set of pri-
mary research goals to address the research goals and the field methods required to incorporate results from these varied projects and allow analysis across the network. This workshop will report on current and future climate conditions as well as total discharge and particulate and dissolved contributions to the Agulhao River. To support these efforts, the first edition of the SEDIBUD manual (http://www.nmg.edu/ SEDIBUD3/SEDIBUD3.pdf) has been produced to establish common methods and data standards. Ongoing review will continue to produce a series of updates to facilitate intercomparison of research results.

SEDIBUD currently has identified 37 sites worldwide with at least 40 sites expected to be added in the coming months. The workshop has expected that collaboration within the group will act as a catalyst to develop new sites and datasets through collaboration and with a number of international research groups, including International Tundra Experiment (ITEX), Circumpolar Active Layer Monitoring (CALM), and the International Tundra Dynamics (CAIDOCOACO) Net, will provide further opportunities for collaborative research to address broader polar environmental research issues.

The third SEDIBUD workshop will be held at the second SEDIBUD workshop at Abisko, Sweden, to pres- ent ongoing research efforts and discuss research goals and the field methods detailed in the SEDIBUD manual. The successful workshop brought together 22 participants from 12 countries and built on the first SEDIBUD workshop in Tromsø, Norway (2006), and previous SEDIBUD meetings in Durham, UK (2005), and Saodarkrokur, Iceland (2004).

The Sedimentary Source to Sink Fluxes in Cold Regions (SEDIBUD) program will take place 9–13 September 2008 at the Niwot Ridge Field Station, Boulder, Colo. Interested young researchers are encouraged to participate in this growing international ini-

tiation. Abstract deadline is 5 January 2009.

Continued from page 579
Whether you are interested in material flux from the continents to the oceans or whether the flow is set down in front of you when an oceanfront restaurant may have come from polluted waters, we know estuaries are important places. However, anyone attempting to summarize and synthesize the large and rich literature of estuarine research is presented with daunting tasks. This is why the concept of an estuary being the transition zone where “fresh” water meets “salt water” has defied—tend to be highly heterogeneous, in both space and time. Against this backdrop, Thomas Bianchi’s Biogeochemistry of Estuaries successfully tackles its subject matter and is an exciting addition to the field of estuarine research.

The way the author discusses topics should make this an excellent textbook for an upper level class in estuarine biochemistry. Assuming only some basic knowledge of chemistry and physics, Bianchi presents the material in a manner that makes it accessible to advanced undergraduates or beginning graduate students across a broad range of scientific disciplines. At the same time, because the material is presented with sufficient detail and scientific rigor, the book should also be useful to researchers who are more versed in different aspects of the study of estuarine environments. Such individuals will find this book to be a valuable contribution to their personal—and their institution's—libraries. Individuals involved in related fields such as oceanography or aquatic chemistry will also find much of interest and relevant to them in this book.

The book contains 16 chapters divided among seven sections. Each chapter concludes with a summary of concise statements that lay out the material in the chapter. Overall, I found this approach to be a great way to end the chapters of the book; a few pages where bigger concepts got lost among a chapter's details. The summary helped me get back on track.

After an introductory chapter that briefly defines the subject of the book, the first of the book's seven sections contains chapters that describe the geomorphology (physical structure) of estuaries and examine estuarine hydrodynamics (e.g., circulation, mixing, and salt balance). The next section describes the chemistry of estuarine waters, where important topics include assessing estuarine sediments and the use of raqioisopes to quantify the rates of estuarine processes. The fourth section presents a thorough discussion on organic matter sources and cycling, which in many ways sets the stage for the following sections of the book. The next section contains several chapters and sections on biogeochemistry in estuarine systems. These chapters generally go an excellent job examining those topics, although I found the book to be less coherent, general, particularly in comparison with the depth of the discussions in the other chapters in this section. The sixth section is a single chapter on anthropogenic inputs to estuarine systems. The chapter moves beyond traditional ideas on biogeochemistry and focuses on specific aspects concerning the issues of estuaries and the coastal ocean by examining the role of terrestrial inputs and the impacts of ENSO and other large-scale phenomena. Scattered throughout the book are references to key papers and reports that others may have missed, which, in general, also contribute to this book's overall value.

The book is thoroughly referenced, containing a large number of references. Thus, the book provides interested individuals a superb map to the important works in specific areas that are discussed in the book. The book also contains a series of short terms used in the book, as well as a series of relevant tables. All of these will be useful to researchers, policy makers, and other interested parties.

Overall, Biogeochemistry of Estuaries is a very well written book. It presents the subject in an organized and logical way. It also discusses the subject in an engaging and interesting way. I strongly recommend that anyone interested in estuarine research, from students to professionals, read this book. It is a valuable addition to the field of estuarine research.
candidates are encouraged to apply; however, people and persons with disabilities. All qualified women and men, visible minorities, aboriginal communities, and leading-edge teaching and research facilities, attracting a very safe, friendly city with great learning opportunities in St. John’s (http://www.stjohns.ca/index.jsp), a very safe, friendly city with great opportunities for learning in St. John’s (http://www.stjohns.ca/index.jsp). The Department of Earth Science participates in environmental science disciplines is highly desirable. The graduate school is an equal opportunity/affirmative action/Title VI/Title IX institution.

The Geophysical Laboratory is an equal opportunity employer; applications from women and minority candidates are encouraged. Please send application materials and reference letters to: J. Hemley, Director, Geophysical Laboratory, 5251 Cameron Laboratory, Carnegie Institution of Washington, 2001 K Street, NW, Washington, DC 20006, USA or the application deadline. For all positions, in the subject line, please indicate "electronics engineer position." Applications are encouraged from candidates with a minimum of four years of experience. Application materials should include a letter of interest, curriculum vitae, and a list of three references.

The application deadline is January 2, 2008. Candidates should submit a letter of application, curriculum vitae, a statement of research and teaching interests (including future research strengths in low temperature geochemistry, stable isotopes, and applied geochemistry), along with three letters of recommendation by email to: head@esd.mun.ca. Additional questions or queries should be addressed by email or telephone to: John King, Search Chair, refer to Req #EOS12026.

Applications must be received by February 15th, 2008. Candidates should submit a letter of application, curriculum vitae, a statement of research and teaching interests, and three letters of recommendation by email to: Dr. John M. Higham, Head, Dep. of Earth Sciences, Memorial University of Newfoundland, St. John’s, NL, Canada A1C 5S7. In addition, please submit a PDF file to: head@esd.mun.ca. Additional information is available at: www.mun.ca/earthsciences/aboutus/or by contacting Dr. John M. Higham, Head, Department of Earth Sciences, Memorial University of Newfoundland, St. John’s, NL, Canada A1C 5S7.

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The Department of Geology and Geophysics at Michigan Tech seeks applications for a Tenure-track Appointment at the Assistant Professor Level. A Ph.D. in engineering or science is required. Candidates with demonstrated accomplishments in research, with appointment at Associate or Full Professor will also be considered. The ideal candidate should conduct research in quantitative and/or engineering aspects of Earth Systems processes, including monitoring, forecasting, mitigation, or communication of hazards. He or she will develop outstanding undergraduate students who can contribute to the breadth of research conducted in the Department of Geology and Geophysics.

Michigan Tech has a total student population of about 15,580. It is located in Michigan’s Upper Peninsula, a pristine area on the south shore of Lake Superior. The department is a member of the Intelligent Systems Association, a strong educational focus and values basic and applied research. The University is an equal opportunity/affirmative action employer.

Applications materials and reference letters should be sent to: Director, Office of Interdisciplinary Postdoctoral Fellowship, Yale University, PO Box 208100, New Haven, CT 06520-8100. Yale University is an equal opportunity/affirmative action employer. Women and minority scientists are strongly encouraged to apply.

The University of Chicago Environmental Research Laboratory, and the National Oceanic and Atmospheric Administration’s Lakes Environmental Research Laboratory (GLERL) seeks an enthusiastic researcher to lead an innovative, multidisciplinary, and creative research program to examine physical-biological couplings of Lake Superior. The candidate will develop a program to couple multiple scales of surface and subsurface hydrology, biogeochemistry and biological transport. The program would involve multiple scale ecological models, coupled with other colleagues at GLERL and other research institutions, as well as university, and private industry, and to build active research programs employing collaborative and interdisciplinary approaches. It is desirable that the candidate have a Ph.D. in physical sciences, biological sciences, or related field, and strong quantitative skills. Letters of reference and communications are required to present results in peer-reviewed publications. A CV and three reference letters should be sent to: Doran.Mason@noaa.gov. For more information on NOAA GLERL, can be found at www.glerl.noaa.gov.

Applications should be e-mailed to: geosearch@uchicago.edu. The University of Chicago is an equal opportunity/affirmative action employer.

Department of Geology and Geophysics
University of Chicago, Department of Geology and Geophysics, 1101 East 58th Street, Chicago, IL 60637

Interested candidates should send a curriculum vitae, statements of research and teaching interests, and the names and complete contact information of at least three referees to: Michael Foote, Chairman, Department of Geology and Geophysics. E-mail a CV, statement of research interests, and names of at least three references to Michael Foote, paul_moorecroft@harvard.edu. Harvard University is an equal opportunity/affirmative action employer.

Water Quality and Risk to Human Health, The Department of Earth and Environmental Science at Indiana University Purdue University Indianapolis (IUPUI) is seeking candidates for a tenure-track position to support a new program in water research and public health. This position is part of a university-supported initiative in water resources research, and will be a key component of a newly created interdiscipliary PhD program in Earth Sciences. We are interested in candidates with research interests in the field of water quality and risk to human health.

Specific areas of interest may include aquatic toxicology/biology, cyanobacteria/taxonomy, limnology, organic geochemistry, and biogeochemical transport modeling. The successful candidate will be part of a team of environmental scientists and toxicologists working on cutting-edge detection and health impact studies. Candidates are expected to develop an independent research program, supported by close interactions with researchers in the basic sciences and in the multiple health-science programs on campus relating to qualitative and quantitative assessments of exposures to water-borne chemical or biological agents in order to assess the associated health effects.

Interested candidates should have a Ph.D. in strong research records, an interest in multidisciplinary research, and commitment to undergraduate and graduate education. We will begin reviewing applications on Jan. 15, 2008, but will continue accepting applications until the position is filled. The expected start date is August, 2008. But this is negotiable.

IUPUI is Indiana’s urban research and academic health sciences campus, and the focal point of IUPUI’s Life Sciences Initiative. Interested candidates should send a curriculum vitae, statements of research and teaching interests, and the names of at least three referees to Chair, Search and Screen Committee Department of Earth and Environmental Science, IUPUI.

723 West Michigan Street
Indianapolis, IN 46202

Electron submissions may be sent to: iupui_postdoc@iupui.edu

IUPUI is an equal opportunity/affirmative action employer.

STUDENT OPPORTUNITIES

Fundied Graduate Student Opportunity in Coastal Hydrodynamics. Teaching and Research assistantships are available to support a graduate student at Washington University in St. Louis. Students will work with advisor Steve Henderson (http://www.washington.edu/steve_henderson/index.html) to understand water flows and morphodynamics in a total inlet. The ideal candidate will have a strong background in physics or mathematics. A background in Oceanography is not essential. These work may include field measurements.

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U.S. Environmental Protection Agency Office of Research and Development
Athens, Georgia

EPA’s Office of Research and Development (ORD) seeks a nationally recognized multimedia modeler for a federal position in Athens, Georgia. This person will provide scientific leadership in the mathematical development and regulatory-based application of integrated multimedia fate and transport models and computer-based technologies for human and ecological exposure and risk assessment. The person filling this position will work within a multidisciplinary team structure to advance a new, dynamic paradigm in multimedia, multi-pathway, multi-receptor, multi-scale and multi-pollutant exposure and risk assessment modeling.

This position is located within the Ecosystems Research Division (ERD) of the National Exposure Research Laboratory. ERD conducts field and laboratory studies on the behavior of contaminants, microbes, and biota in environmental systems and develops mathematical models to assess the response of aquatic systems, watersheds and landscapes to stresses from natural and anthropogenic sources. ERD is committed to developing modeling-based approaches that require interdisciplinary solutions and collaboration across EPA, other Federal Agencies, academics, and non-governmental organizations.

The preferred candidate will have a Ph.D. or equivalent degree in environmental or chemical engineering, hydrology, ecology, mathematics or a closely related field. Qualified applicants should possess (1) extensive experience in mathematical modeling, algorithm development and proficiency in a variety of computer programming languages and architectures, including GIS; (2) a demonstrated ability to lead innovative research teams that have informed real world decisions; and, (3) a history of significant publications in internationally-recognized journals.

This is an interdisciplinary position that can be filled at the GS-14 or GS-15 level as either a Physical Scientist or Mathematician. Applications will be accepted November 5, 2007, through January 4, 2008. For qualification and application details, visit www.usajobs.gov. Applicants must be U.S. citizens.

Additional information may be found at www.epa.gov/athens

The U.S. EPA is an Equal Opportunity Employer

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tudial currents, data analyses, and theoretical flow modeling. The Vancouver area offers outstanding outdoor recreational opportunities, and easy access to the adjacent city of Portland, Oregon. For further information contact Dr. Stephen Henderson (shenderson@unh.edu). Other positions and future opportunities will be advertised when suitable candidates are available. The candidate will be enrolled in the graduate program in Marine Biomineralization – especially paleoenvironmental Geochemistry. Specifically, the micro-inclusions. Opportunities also exist in Environmental Geochemistry and stable isotope variations in melt and volcanic systems through the study of trace elements of ore deposits. This project could also incorporate a component of Fluid Dynamics Modelling of the magmatic system, and involves observation of magmatic element interactions and their impact on mineralisation. Applicants with academic and research background in geology, geochemistry, mineralogy or petrology, are encouraged to apply. Please send your CV to ji_yu@ncsu.edu, or contact Dr. Jie Yu at this email address for more information.

Graduate Student Opportunities, Ore Deposits Geochemistry/Geomechanics, Environmental Geochemistry, Memorial University, Newfoundland, Canada. Fully funded PhD and MSc opportunities are currently available in the Dept. of Earth Sciences, Memorial University of Newfoundland. The Department of Earth Sciences specifically offers a strong program in Geochemistry, which includes:

1. Trace element and stable isotope distributions within the Venus’ Bay Cu-Ni Deposit as a fundamental understanding of potential episodic processes of ore deposition and upgrading.
2. Observations into numerical models (e.g. data assimilation). to improve the estimation of smoke emissions from wildfires.
3. Aqueous processes of ore deposition and upgrading.
4. Hydrodynamics Modelling of the magmatic system.

For further information contact: Prof. Graham Laske (gny@mun.ca) or contact P.M. Dr. Nagyat Kinyanga (kinyanga@mun.ca). Research & Discover Undergraduate Summer Internships and Graduate Fellowships in Earth System Science. Join some of the nation’s top scientists at the Institute for the Study of Earth, Oceans, and Space (EOS) in research through the UNH-Goddard Joint Center for the Earth Sciences. As a Research & Discover awardee, you will be involved in ground-breaking research conducted jointly at University of New Hampshire and the NASA-Goddard Space Flight Center. Our interdisciplinary and environmental science research is among the most frequently cited in the world. Our scientists are engaged in:

1. Investigating the effects of human activities on the Earth, including the causes and effects of global climate change and deforestation;
2. Analyzing samples of ice, air, and precipitation to study climate change and chemical changes;
3. Exploring chemical, physical, and biological oceanography;
4. Studying dynamic processes in the Earth system using remote sensing, GIS, computer models, and other state-of-the-art tools.

All awards include a competitive stipend. Applications are due March 3, 2008. For more information, visit http://www.eos.unh.edu/ResearchAndDiscover.