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World Ocean Assessment: Opportunities for Geoscientists

Global environmental assessments have many purposes: to measure changes, advance knowledge, and predict the future to enhance the scientific basis for policy making; to share data and improve management of resources for promotion of economic and social advancement; to strengthen peace, security, and cooperation in international relations; and to verify targets set by the international community on environmental variables and living resources.

To meet these goals, a number of initiatives exist to provide regular assessments of the many characteristics of the global integrated Earth system. For instance, the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer calls for regular assessments of ozone depletion in the stratosphere. In 1988 the United Nations Environment Programme (UNEP) and the World Meteorological Organization established the Intergovernmental Panel on Climate Change to prepare regular climate assessments. Since 2000 the UN World Water Assessment Program has monitored the world's freshwater resources through comprehensive reviews every 3 years. In December 2010 the UN General Assembly (UNGA) called for 5-year assessments of the global marine environment, including socioeconomic aspects. This project is known as the World Ocean Assessment (WOA), and the first WOA is scheduled to be completed in 2014.

Geoscientists have much knowledge to contribute to the first WOA. One example is sea level rise, which is not uniform throughout the global ocean, including coastal areas. Sea level along the west coast of the United States has been decreasing over the past 20 years [Bromirski *et al.*, 2012]. Much higher rates of sea level rise are occurring in the western tropical Pacific than in the wider Caribbean region [Merrifield and Maltrud, 2011], both areas of small-island developing states. Examples of other marine environmental vulnerabilities with important influences on regional integrated Earth system science are increasing deoxygenation [Falkowski *et al.*, 2011] and increasing acidification [National Research Council, 2010].

The ocean is immensely complex and heterogeneous in its responses to natural and anthropogenic forcings, including the mixing of these phenomena, which occur on time scales from seconds to millennia and on space scales from millimeters to the circumference of the Earth. What makes the study of the marine environment important is the commingling of space and time scales and its impact on cultural and socioeconomic aspects of society.

Evolution and Structure

UN actions following the 2002 World Conference on Sustainable Development

produced the Assessment of Assessments [UNEP and Intergovernmental Oceanographic Commission (IOC), 2009], which represented the first comprehensive overview of the marine assessment landscape and described a framework for WOA. In 2010, UNGA requested that the UN Division for Ocean Affairs and the Law of the Sea serve as the secretariat. Also, UNGA established a 25-member group of experts (GOE), composed of representatives from the five UN Regional Groups, to lead the preparation of the first WOA. More background on the evolution and structure of WOA can be found at http://www.un.org/Depts/los/global_reporting/global_reporting.htm.

The comprehensive outline for the first WOA report has nearly 50 topics grouped within four main themes: biophysical aspects of the marine environment, food security and safety, human activities that influence the ocean, and marine biological diversity and habitats. The first WOA report will include a technical summary showing interdisciplinary linkages between human impacts, ecosystem services, species, and habitats. The WOA report will not appraise marine policy and governance.

Pool of Experts and Workshops

In addition to GOE and the secretariat, two other integral components of the first WOA are a pool of experts (POE) and workshops. Approximately 1500–2000 experts will be needed to write and/or review segments of chapters of the first draft WOA report [Bernal, 2011]—this POE will consist of individual experts nominated by states. Nominations can continue until all the various requirements for expertise are met. GOE can select only people in the POE to participate as authors and reviewers of the first draft WOA, while reflecting equitable geographical representation and a desirable gender balance. The application process to become part of the POE is open to everyone. For more information, see http://www.un.org/Depts/los/global_reporting/global_reporting.htm and Showstack [2012].

Completed applications for individuals working in the United States should be sent to Elizabeth Tirpak of the U.S. Department of State's Office of Ocean and Polar Affairs at tirpakej@state.gov. Individuals working in other countries who wish to be nominated to the POE by the country where they work should consult the foreign affairs ministry. Scientists knowledgeable in ocean sciences, ocean policy, marine geology and geophysics, marine biogeochemistry, atmospheric sciences, air-sea interactions, social sciences, and other relevant disciplines can become part of the POE.

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Cascadia Fore Arc Seismic Survey: Open-Access Data Available

The Cascadia subduction zone (CSZ), where the Juan de Fuca and Gorda plates subduct obliquely beneath North America at a rate of about 35 millimeters per year, poses major geological hazards to population centers of the northwestern United States. Despite the importance of the subducting slab in these hazards, the plate boundary is poorly mapped and understood, especially offshore.

A new open-access marine seismic reflection data set has been acquired that will provide new images of the structure of the fore arc and subducting plate off central Washington. This area lies in a segment of the plate boundary that apparently ruptures only in large earthquakes and is approximately equidistant from the major population centers of Seattle and Portland. This data set, funded by the U.S. National Science Foundation, is freely available to help researchers map the position of the poorly understood plate boundary in this critical region.

Cascadia Initiative: Tectonic Context and Current Monitoring Efforts

Despite very limited and localized seismicity on the plate interface [Trehu *et al.*, 2008; Williams *et al.*, 2011], the Cascadia subduction zone is known to be subject to megathrust earthquakes [e.g., Atwater, 1987, 1996; Hyndman and Wang, 1995]. Extensive paleoseismic work illuminates a 10,000-year history of quakes with an average recurrence rate of about 500 years for roughly magnitude 9 events that rupture the entire subduction zone from northern California to the Nootka fault off Vancouver Island [e.g., Goldfinger *et al.*, 2003; Hyndman *et al.*, 2003, and references therein]. The paleoseismic

record indicates additional smaller, more frequent events south of 45°N, whereas the margin to the north appears to rupture only in the largest events [Goldfinger *et al.*, 2003, 2012].

The Cascadia margin has recently become the focus of an impressive array of new scientific initiatives and infrastructure investment, including activities by Earthscope's Transportable Array and Plate Boundary Observatory, the Ocean Observatories Initiative and Canada's Northeast Pacific Time-Series Undersea Networked Experiments project (NEPTUNE Canada) cable observatories, the SeaJade ocean bottom seismometer (OBS) program off Vancouver Island, and the Geodynamic Processes at Rifting and Subducting Margins (GeoPRISMs) Cascadia Initiative. The latter features OBS deployments and extensive onshore seismometers and geodetic stations, including a concentration of instruments off Grays Harbor, Washington.

Cascadia Initiative

In July 2012 researchers conducted an open-participation, open-access seismic reflection survey of the Cascadia margin off Grays Harbor, Washington (Figures 1a and 1b). The Cascadia Open-Access Seismic Transects (COAST) project consisted of a 2-week cruise of the R/V *Marcus G. Langseth*, the U.S. National Oceanographic Seismic Facility. Multichannel seismic reflection data were acquired on nine east-west transects that crossed the deformation front; data were also collected along a single along-strike line that linked the cross-margin

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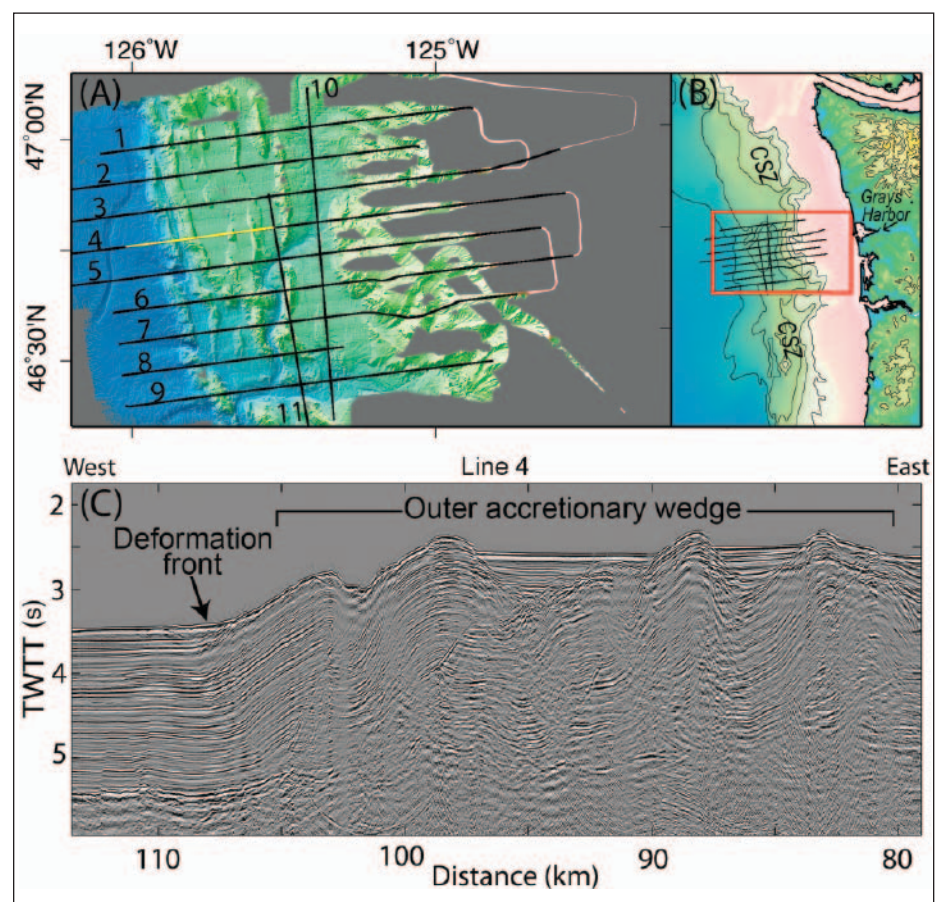


Fig. 1. (a) Map of track lines (labeled 1–11) surveyed on the Cascadia Open-Access Seismic Transect (COAST) project, plotted on a multibeam bathymetric grid. (b) Map showing the location of the COAST survey (red box) on the continental margin off Washington state. Bathymetry is contoured at 500-meter intervals. (c) Example of poststack time migration across the deformation front on line 4 (yellow line in Figure 1a). The arrow represents the deformation front; the section east of the deformation front is the outer accretionary wedge. Note the clear folding and landward directed thrust faults in the outer accretionary wedge.

Eos

TRANSACTIONS
AMERICAN GEOPHYSICAL UNION
The Newspaper of the Earth and Space Sciences

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Eos, Transactions, American Geophysical Union (ISSN 0096-3941) is published weekly except the last week of December by the American Geophysical Union, 2000 Florida Ave., NW, Washington, DC 20009, USA. Periodical Class postage paid at Washington, D. C., and at additional mailing offices. POSTMASTER: Send address changes to Member Service Center, 2000 Florida Ave., NW, Washington, DC 20009, USA. *Member Service Center:* 8:00 A.M.–6:00 P.M. Eastern time; Tel: +1-202-462-6900; Fax: +1-202-328-0566; Tel. orders in U.S.: 1-800-966-2481; E-mail: service@agu.org. Information on institutional subscriptions is available from the Member Service Center. Use AGU's Geophysical Electronic Manuscript Submissions system to submit a manuscript: <http://eos-submit.agu.org>.

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Workshops held under the auspices of the UN will catalyze communications between GOE and representatives and experts from states and intergovernmental organizations. Workshop objectives are to review, evaluate, and compile an inventory of all relevant assessments; to build an information network between GOE and regional experts; to identify capacity-building needs and start building capacity for integrative assessment; and to outline linkages between driving factors and the state of the marine environment in an underlying framework of drivers–pressures–status–impact–response. Workshops also will enhance the legitimacy, credibility, and relevancy of WOA. Thus far, workshops have been organized by Chile (13–15 September 2011 on the southeast Pacific), China (21–23 February 2012 on eastern and southeastern Asian seas), and Belgium (27–29 June 2012 on the North Atlantic and Baltic, Black, and Mediterranean seas). The United States, in partnership with UNEP and IOC, hosted a Wider Caribbean Region workshop in Miami, Fla., on 13–15 November 2012 (<http://www.woawcr.org>). Mozambique hosted a workshop for the western Indian Ocean on 5–7 December 2012. Other countries will host workshops such that the remaining ocean areas are considered.

Benefits of WOA

All countries will benefit from the regular release of WOA reports. WOA will promote sharing marine data to assist regional and specialized assessment processes to improve data analyses and future data collection. The expansion of knowledge of global and coastal marine areas will lead to improved identification of gaps in observations, modeling, and understanding, leading to improved scenarios for research and observations. WOA syntheses of ecological and biodiversity effects of increasing ocean temperature, acidification, hypoxia,

river runoff, and sea level will enhance sustainability of ocean and coastal economies, improve understanding and capacity to respond to change, and maintain and restore the health of the ocean. WOA attributes are similar to those promoted in national marine policy [e.g., *White House Council on Environmental Policy*, 2010] and marine assessments [e.g., *UK National Ecosystem Assessment*, 2011].

Geoscientists can contribute to the WOA process in two ways: participate in the pool of experts, as noted above, and encourage the foreign affairs ministries in their respective countries to establish an interagency group on WOA to broaden the participation of appropriate expertise and geographical diversity. An example of the latter group is the U.S. WOA Interagency Working Group, which is led by the Department of State, with members drawn from “marine” agencies, including the Department of the Navy, the Environmental Protection Agency, NASA, the National Oceanic and Atmospheric Administration of the Department of Commerce, the National Science Foundation, and the U.S. Fish and Wildlife Service and U.S. Geological Survey (USGS) of the Department of the Interior.

A successful outcome of the first WOA by 2014 will help scientists, engineers, policy makers, and other stakeholders make accurate, timely, and informed choices based on the latest scientific findings of all aspects of the marine environment, including identification of trends. The first WOA will also promote capacity building for conducting marine assessments and for utilizing knowledge acquired through assessments.

Acknowledgments

Review comments by David Helweg (USGS Pacific Island Ecosystems Research Center) and an anonymous reviewer improved an early version of this article.

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lines. While each line was intended to extend from the Juan de Fuca plate to the continental shelf, marine mammal sightings prevented landward completion of some lines, especially in shallow water (Figure 1a). In addition to the seismic data a full suite of gravity, magnetic, multibeam bathymetry, and acoustic backscatter data were acquired.

The primary scientific objective of COAST is to determine the position of the offshore plate boundary because every important question regarding subduction processes, earthquake nucleation, and societal hazards in the Cascadia subduction zone requires that knowledge. The COAST seismic data have the potential to address a range of additional questions arising recently in subduction margins, including downdip and along-strike variability in the character and roughness of the subduction interface [e.g., *Bangs et al.*, 2004; *Nedimovic et al.*, 2003], evidence (or lack thereof) of subducting sediment, locations of dewatering and pathways of fluid escape, the locations of potentially high pore pressure zones, and the geological controls on active methane systems related to subduction. Initial findings from shipboard-processed COAST data include (1) strong oceanic basement reflections seaward of the deformation front that become weaker beneath the outer accretionary wedge (Figure 1c; see also Figure S1 in the online supplement to this brief report (http://www.agu.org/journals/eo/v093/i050/2012EO500002/2012EO500002_suppl.pdf)), (2) an apparent change in slab dip from gently dipping beneath the outer wedge to steeper dips beneath the outer shelf, and (3) abundant slope failures on the deformation front that are particularly well imaged by the multibeam data (Figures 1a and S2).

A Commitment to Public Outreach and Availability

In addition to scientific objectives, the COAST project had unique educational and outreach goals. One was to conduct a cruise where the shipboard scientific staff except for the principle investigators (PIs) were selected via an application process open to students, postdoctoral candidates, and early-career scientists at any

U.S. institution. A major focus of the COAST cruise was to expand the user community of the R/V *Langseth* by exposing graduate students and early-career scientists to the complexities of marine operations and active seismic source seismology. Instruction was both formal and informal and from introductory to advanced levels, including formal daily lectures, seismic processing of freshly acquired data, hands-on experience with streamer operations, and active discussions while interpreting seismic data in the context of subduction tectonics. Of the 20 members of the science party, 8 had not previously been aboard a research vessel and an additional 5 (13 total) had never participated in a marine seismic reflection survey.

Another goal was to produce open-access data, meaning that all data were immediately publically available and that anyone is free to write proposals to work on the data. Further, PIs received no funding to work on the data and have to write data analysis proposals just like everyone else. This is different from the usual way that seismic reflection data have been handled in the past—in the past, PIs got money up front for analysis and a 2-year period with exclusive rights to all cruise data.

The cruise was the first entirely open-access expedition by the R/V *Langseth*, following the recommendations of a community workshop in March 2010 (<http://bit.ly/OdxfhZ>). Raw geophysical and seismic data can be downloaded from the Lamont-Doherty Earth Observatory Web site (<http://www.marine-geo.org/tools/search/entry.php?id=MGL1212>). Seismic sections processed shipboard through poststack time migration can be downloaded from the University of Texas Institute for Geophysics seismic data base (<http://www.ig.utexas.edu/sdc/cruise.php?cruiseIn=mgl1212>). Interested parties are encouraged to make use of the data, write proposals to process and analyze the data, integrate these data with other recent and ongoing Cascadia initiatives, and incorporate the data and images in the classroom.

Acknowledgments

We thank the officers and crew of the R/V *Langseth* and all COAST participants for a successful cruise. This work was funded by NSF grant OCE-1150628.

D. H. is indebted to Jack Kaye (NASA headquarters) for his support for participation in WOA. This research was carried out in part at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.

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NEWS

James Cameron Discusses Record Dive and Science Concerns

James Cameron, the explorer and filmmaker, led a 4 December panel at the AGU Fall Meeting in San Francisco to discuss his daring dive on 26 March to the bottom of the ocean in a one-person vertical "torpedo" submarine, the Deepsea Challenger, and to present some initial science findings from expedition samples and data. The dive touched the bottom of the Challenger Deep, a valley in the floor of the nearly 11-kilometer-deep Mariana Trench in the western Pacific Ocean. The vessel landed close to the same depth and at a location similar to where Don Walsh and Jacques Piccard descended in the Trieste bathyscaphe on 23 January 1960 at a then record-setting depth of 10,911 meters.

Cameron, probably best known as the director of *Titanic* and *Avatar*, is working on a three-dimensional feature film of his dive. He is also working on a documentary series about climate change and on *Avatar* sequels 2 and 3.

After the panel discussion, Eos interviewed Cameron.

Eos: What sparked your interest in ocean science?

Cameron: Jacques Cousteau. I was a kid growing up in a village in Canada that was 300 miles from the nearest ocean, but I was seeing this kind of—I don't know what you'd call it—like a renaissance or a heyday of ocean exploration in the 1960s...space exploration and ocean exploration simultaneously. I loved the idea that there was this alien world down there on this planet. Then I made the cognitive leap at the age of 16 that I could learn to scuba dive and I could go to that alien world. I couldn't go to other planets, but I could go to the one we've got here. So from that point on, I was a practitioner. I wasn't just dreaming; I was doing. I was diving. To me, all the stuff I've been doing in the last 16–17 years in the deep ocean has all just been an outgrowth of that early fascination with exploration.

Eos: You've said that exploration is "way more exciting than any made-up Hollywood special effects."

Cameron: It's more exciting because it's real. We can create anything with [computer graphics], anything we can imagine. I think *Avatar* proves that. We can create any ecosystem we want, any animal we want, but it's not real. And if you're working on a set, you can always do another take. When you're on an expedition, you're seeing things for the first time that maybe nobody has ever seen before. You don't have to imagine it; you're getting to bear witness to nature's infinite imagination. To me, that's at least as exciting as anything that Hollywood can offer. I mean, I love making movies, don't get me wrong, but it's a completely different kind of discipline.

Eos: How does exploration inform your filmmaking and vice versa?

Cameron: Almost not at all.

Eos: Really?

Cameron: Not when I'm making a fantasy film. It's not like things I see in the deep ocean make me want to run out and write a scene in *Avatar*. It doesn't work that way. I'm sorry. What the exploration does is it gives you this kind of respect for nature's resourcefulness. Nature has been at this in terms of the game of life, so to speak, for four billion

years, and everything we see around us is the end result of all that. But it had to start somewhere. This investigation now of the idea of subduction zones as being potential cradles of life on this planet, I think that's very interesting. I'm intrigued by the intellectual problems of where do things come from and how do they work. That's a whole separate thing from making movies. Everybody's always trying to connect the dots. They don't connect. Over here, I'm an explorer. Then I take that hat off, and I go over here and I make movies that are fantasies.

There's very little crossover. Everybody keeps thinking they're going to see something from the Challenger Deep in *Avatar*. It doesn't wash.

Science and the scientific method, empirical process, is the closest way that we have of understanding the truth of our world, how it works, where we came from, where the planets came from, where the universe came from, all of that. I have a deep respect for that, and it should not be clouded by this idea of Hollywood. I can make up any [bull] I want in Hollywood. I can make up any animal, any world, anything, and I don't cross-pollinate those things very much. To me, they're separate disciplines. My fascination with hardware and engineering influences the way in which I make movies, but it's not my inspiration for the story I'm telling.

Eos: What is your goal in terms of exploration?

Cameron: The metaphor I've used [is] thinking you've explored America if you walked with a flashlight for 2 miles across the plains of Kansas. We've seen so little of this. There's so much to continue to explore. Every time I talk to [scientific colleagues], we get fired up about a bunch of new possibilities, not just following up on where we've been already, but other places where we haven't looked yet. It's unending, and it should be. Science in general is unending. Every question that gets answered usually begs two more questions.

Eos: You seem to be opening doors for scientists in many different ways.

Cameron: I'm so in awe of scientists, people that have dedicated their lives to understanding our world better, and not chasing



James Cameron at the AGU Fall Meeting

the money dragon, not trying to be rock stars or whatever: all the things that our society seems to hold more dear. I just respect scientists, and I love being in their company and talking about these things and doing what I can to help them in their efforts. Frankly, if science—especially planetary science and deep ocean science—were funded properly, [scientists] wouldn't need me.

Eos: What advice do you have for scientists about communicating and inspiring others?

Cameron: Where I think it especially needs a lot of work is in climate science. Anyplace where you have a collision of science and policy and big industry and there are big economic interests at stake—with climate, you know, where you're going up against the fossil fuel industry, oil and gas and all of that, then I think scientists really need to work on their communication skills.

It's not really communication: it's being declarative. [Talk radio host] Rush Limbaugh can say any damn thing he wants with certainty. Scientists don't work that way. They have to qualify everything and say, "Well, this is what we know in this particular instance, but it doesn't necessarily mean we know." Everything becomes so qualified, the average person just tunes out. They have to say it's real, with the same force as the demagogues.

We are at a really precarious point in civilization right now. From the beginning of the Enlightenment on, the age of science has been all about this kind of idea of progressing, where we're going to continue to understand the world better and better and better. And people were constantly excited and hungry for the new discoveries.

Recently, we've reached a point where the economic and political interests of our civilization have diverged from what the scientists are telling us. Now people are in a situation where they're falling back into superstition, frankly. If they don't like the answer, they discredit the person, they discredit the researcher with ad hominem attacks. All you have to do to find out why they don't like the answer is follow the money. Who's making money off of this science not being true? You can drive a stake in the ground sometime in the last decade and say, "This is the point where human progress actually ended socially." Because from this point on, scientists are going to continue to find answers and society is going to cherry-pick

the answers they want, discard the answers they don't want, and do whatever they want based on economic and business interests.

Eos: How do you deal with that?

Cameron: You've got to teach people that there's only one truth. You can have 100 opinions, but you can only have one truth. You're not going to get your truth from religion. You're not going to get it from politics, you're not going to get it from demagoguery. You're not going to get your truth from talk radio. You're going to get your truth from the empirical process of science and scientific method and nowhere else. And there's no respect for that.

Maybe filmmaking, maybe doing stuff like this, maybe doing articles, maybe the way scientists embrace the media community and the education community. Education is a big part of it. You've got to teach kids to respect the scientific process.

Eos: Tell us about the upcoming *Years of Living Dangerously* climate change documentary.

Cameron: It will be hard-hitting, investigative reporting, and it's going to put a human face on the very present proximal issues of climate change. From that, you leverage what's it going to be like when the number of wildland fires doubles or triples over the next half century? What's it going to be like when we have these droughts? What's it going to be like when the 100-year event becomes the every-year event, which is what we're right on track [for].

The scientists have been consistently wrong about climate change in the following way: They've always been too conservative. The things that are really happening are happening faster than the predictions, than even some of the most pessimistic predictions. Scientists are human. They're going to have a denial mechanism. They're, in a way, almost hesitant to say how bad it could be because they don't want to be considered alarmists. But it's consistently coming out worse than even their dire case predictions. So when you've got the right-wing demagogues saying that the scientists are wrong? Yeah, they're wrong. They're wrong the other way. It's much worse than they're saying.

—RANDY SHOWSTACK and ERNIE BALCERAK, Staff Writers

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News

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Curiosity Analyzes Martian Soil Samples

NASA's Mars Curiosity rover has conducted its first analysis of Martian soil samples using multiple instruments, the agency announced at a 3 December news briefing at the AGU Fall Meeting in San Francisco.

"These results are an unprecedented look at the chemical diversity in the area," said NASA's Michael Meyer, program scientist for Curiosity.

However, there is "no definitive evidence for any organics that must come from Mars at this point in the mission," Curiosity project scientist John Grotzinger said at the briefing. "Even though this instrument detected organic compounds, first of all we have to demonstrate that they are indigenous to Mars."

While the results announced at the briefing were significant, they did not live up to the hype about a potentially much grander finding that some had hoped for following a 20 November National Public Radio (NPR) report that quoted Grotzinger as saying that "this data is going to be one for the history books."

At the briefing, Grotzinger backed away from any potentially grand announcement and said that he was surprised about the reaction to his comments to NPR. "We're doing science at the speed of science," he said, adding that the enthusiasm that he and the science team have about Curiosity's findings "was just misunderstood."

One of the main goals of the Curiosity mission is to determine whether Mars could have supported microbial life in the past.

Curiosity, which landed on Mars in Gale Crater on 6 August, had already found evidence of past flowing water on an ancient riverbed near the landing site. "We actually picked the right place" for the rover to land, said Meyer.

The rover has traveled to a location within Gale Crater known as the Rocknest wind drift and has now taken five scoops of

soil. The drift is about 4.5 inches high. The bulk of the material in the scoops is a fine, dry sand, with grain size about that of artificial sweetener: "finer than sugar but coarser than something like flour," Ken Edgett of Malin Space Science Systems in San Diego, Calif., said at the briefing. The fine sand was covered with a crust of coarser grains and a coating that was a layer of dust, indicating that the drifts were not active, said Edgett, who is principal investigator of Curiosity's Mars Hand Lens Imager instrument.

These soil samples, which were analyzed by the Soil Analysis at Mars (SAM) instrument, were typical Martian soils, the scientists emphasized at the press conference. "We had to do a lot of work to make sure that this was something that was a garden variety of Martian soil. We didn't want something that was adventurous," said Grotzinger.

The SAM instrument scoops soil into a chamber, heats the soil, and analyzes the gases emitted. The first scoops of fine sands helped to scrub the surfaces of the sample analysis instrument to remove possible contamination from compounds from Earth.

Among other gases identified in the new samples, oxygen and chlorinated methane compounds—the latter of which is a carbon-based compound—were detected. The oxygen and chlorine probably come from perchlorate, which has previously been detected on Mars.

The team confirmed that the chlorine was of Martian origin, but they said that further analysis is needed to make sure that the carbon did not come from Earth. To do so, the instrument will compare the Martian sample with test samples it carried from Earth. If the carbon is of Martian origin, isotope ratio analysis could then be used to help determine if the carbon-based compounds could possibly have been derived from biological activity.

SAM principal investigator Paul Mahaffy of NASA's Goddard Space Flight Center in Greenbelt, Md., said that the first sampling of Mars soil represents "the very first time that this type of experiment has been carried out on Mars." He continued, "We really consider this a terrific milestone."

Grotzinger said that after the NPR report raised expectations of a dramatic finding, "the first thing I thought was, 'Gosh, I have to be careful about what I say.' The great thing about it is, as the days went by and I thought about it further, my reaction was, 'I think it's terrific that this mission has such wide appeal and public interest.'" He went on, "And the mission has delivered an unbelievable wealth of data. We've had over 11,000 images returned that the public has enjoyed. We've had over 2.5 million observations by the weather station. I could go on and on. It's just been spectacular."

Grotzinger noted that the science team jumps up and down with excitement in a "hooting and hollering moment" when, for example, a rover instrument has turned on for the first time. He said that when the SAM instrument provided a repeat analysis and when the third sample configuration was almost the same as for the first sample, "you believe maybe this just might be one for the history books. That this is going to stand the [test of time] as legitimate analysis on the surface of Mars." He added, "That's basically where we were at with that excitement by the science team."

However, Grotzinger cautioned that Curiosity's middle name is "patience" and that people need to have a healthy dose of that. "What this mission is about is integrative science," he said. "There's not going to be one single moment where we all stand up and on the basis of a single measurement have a hallelujah moment."

The rover is now at a location known as Point Lake. The next goal is to find a site for drilling, which the team hopes to start by the end of this year, Grotzinger said. After that, the rover will head toward its goal of reaching Mount Sharp.

"Our car is ready to go," said Grotzinger. "This is a car that comes with a 10,000-page user manual that we also have to write as we read it. That's where the patience comes in."

John Grunsfeld, NASA associate administrator for science, told *Eos* that the results announced at the briefing are "remarkable."

"Consider that we've successfully sent this extremely complicated analytical laboratory to the surface of Mars that can rove around, dig in the dirt, and do this kind of detailed analysis. I find that earthshaking and remarkable myself, that it all works," he said. "The panel was somewhat reserved because they weren't reporting on some measurement that would portend answering this fundamental question of 'Are we alone in the universe?' That's what we're all after. But if you look at what they intended to do, they intended to drive to find the most boring place in the Gale Crater to clean the instruments and to test the workings of the instruments, and with that they were extremely successful. I'm very excited about the prospects."

Grunsfeld put the announcement into a broader context of other recent advances, including results from the Kepler mission that have substantially increased the catalog of extrasolar planet candidates and that show that other solar systems are common, and results from the Mercury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) mission to Mercury, which has detected the potential for water ice and organics on that planet. Grunsfeld said that these and other findings "say that the building blocks of life—what you've heard today—sources of carbon, water, and energy are prolific throughout the universe. To me, that makes it even more exciting in this quest to find out if we are alone in the universe. We're on our way. The Curiosity rover is an amazing step to a place in our solar system that I think has the highest probability of revealing whether life ever existed or whether at least habitable conditions existed on Mars."

—ERNIE BALCERAK and RANDY SHOWSTACK, Staff Writers

G E O P H Y S I C I S T S

John B. "Jack" Townshend (1927–2012)

Jack Townshend, geophysicist and dedicated public servant, died on 13 August 2012 in Fairbanks, Alaska. He was 85. Jack's career with the federal government, most of it with the national magnetic observatory program, spanned more than six solar cycles of time, and he retired only days before his death. The duration of Jack's career encompassed an important period in the history of the advancement of our understanding of the Earth. Jack's career of contributions, his life, and his personality are worthy of retrospective celebration.

Jack was born on 24 April 1927 in Brandywine, Maryland. His father, Samuel Townshend, was a geophysicist who worked at the nearby Cheltenham Magnetic Observatory, the headquarters for the U.S. Coast and Geodetic Survey's (CGS) national Geomagnetism Program. When his father retired in 1946, Jack applied for the open position. At first, this was not taken seriously: Jack only had a high school education. But he was persistent and persuasive, and eventually he got the job. Jack was a very hard worker; his duties at the observatory included operating the

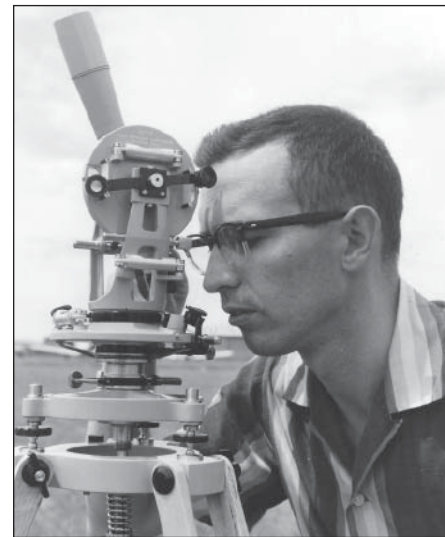
photographic analog magnetometers that were standard in those days, making calibration measurements, "hand-scaling" magnetic activity indices, and supporting magnetic surveys.

By the late 1940s, the growing responsibilities of the Geomagnetism Program began to exceed the physical capacities of the Cheltenham observatory. In 1953 the U.S. Congress appropriated funds for the construction of a new observatory and Program headquarters. A site near Fredericksburg, Va., was selected. Jack supervised the design of the observatory, and he managed its construction. The new Fredericksburg Magnetic Observatory was completed in 1956. As part of International Geophysical Year that soon followed, 1957–1958, Jack trained numerous domestic and foreign observatory workers, and he supervised the calibration of their magnetometers. With the arrival of the space age, Jack provided support for the operation of the coil facility at Fredericksburg for calibrating magnetometers used by NASA on early satellite missions. James A. Van Allen consulted with Jack on the interpretation of observatory

magnetograms. Today the Fredericksburg Observatory is operated by the U.S. Geological Survey (USGS), and it remains one of the world's most important magnetic monitoring stations.

The next important chapter in Jack's career began in April 1963, when he was appointed chief of the CGS College Magnetic and Seismological Observatory at the University of Alaska Fairbanks (UAF). Jack brought his high standards with him, and in the decades that he worked at the College Observatory, it produced magnetic data of extremely high quality. Jack promoted the use of observatory data by academic scientists, and, indeed, College data played an important role in the development of theories of magnetic storms and auroral substorms by Sydney Chapman and Syun-Ichi Akasofu (e.g., *Eos*, 74(29), 325, doi:10.1029/93EO00460).

The great *M* 9.2 Alaska earthquake occurred on the evening of 27 March 1964. Although the epicenter was near Anchorage, it was strong enough to disrupt the delicate seismometers and magnetometers at the observatory. Jack repaired his acquisition systems, and then, without seeking approval from CGS headquarters, he decided that he should make a damage



John B. "Jack" Townshend

assessment of the Anchorage area. The next morning he managed to get on a flight that had been chartered for doctors. The Anchorage airport had been damaged by the earthquake, but the charter eventually managed

Geophysicists cont. on next page

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Causes and Consequences of the Extended Solar Minimum Between Solar Cycles 23 and 24 (4CESM)

The most recent solar minimum provided the scientific community with an exceptional opportunity to assess the nature and structure of a very quiet Sun, a weak solar wind, and an upper atmosphere relatively devoid of solar influences.

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Geophysicists

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to land. Jack then flagged down a passing car that, by serendipity, was driven by an airline pilot whose flight had been temporarily grounded. After driving around the Anchorage area, they stopped at a small airstrip and, thanks to Jack’s legendary persuasiveness, they managed to borrow a small airplane! Jack’s aerial assessments and photographs formed part of a comprehensive study of the earthquake’s aftermath. Jack was an exemplary spokesman for the CGS on this important event. For many years thereafter, he was known as “Earthquake Jack,” even though his heart certainly remained with geomagnetism.

In 1965 the Geomagnetism Program became part of the short-lived Environmental Science Services Administration, and soon after the creation of NOAA in 1970, Geomagnetism was transferred to USGS. In

response to these bureaucratic changes and the evolving demands of the scientific community, the mission of the Geomagnetism Program also changed, with greater emphasis placed on real-time space weather monitoring and hazard assessment. But modern digital data acquisition systems did not provide Jack with the tangible satisfaction he obtained from analog systems. By the 1980s, he was not much involved with day-to-day observatory operation. Still, Jack kept himself relevant. Drawing upon his vast experience and personal skills, he coordinated special projects and promoted inter-agency cooperation. Jack’s participation in the U.S./U.S.S.R. Joint Nuclear Verification Experiment (1988) earned him an appreciative letter from President Bill Clinton. Under terms of a creative agreement that Jack initiated between USGS and UAF, in 1996 the College Observatory was moved to a new and larger site where high-quality geophysical data of many types could be collected. The facility is now known as the “Jack

Townshend College International Geophysical Observatory.”

Over the years, Jack’s contributions to science were appreciated by many individuals, and he received recognition from many different agencies. Jack’s AGU membership was sponsored, in 1949, by John A. Fleming, director of the Carnegie Institution’s Department of Terrestrial Magnetism. Jack maintained this membership for the rest of his life. The Secretary of Commerce recognized Jack twice: in 1962 with a Meritorious Silver Medal Service Award, and in 1967 with an award for Superior Service to the Public. In 1989 Jack received the Long Service Scientific Award from the International Association of Geomagnetism and Aeronomy. In 1995 Jack finally got a college degree, an Honorary Doctorate in Science from UAF. In 2012, he received the Meritorious Service Award from the Department of the Interior.

The greeting that Jack used to have on the answering machine of his office telephone was “Yesterday is history, tomorrow is

mystery, but today, the present moment, is a gift.” He certainly lived his life according to that sentiment. Jack was a member of The Explorers Club, dedicated to promoting the scientific exploration of land, sea, air, and space. He was an active member of the Fairbanks Kiwanis Club, and he served on the Alaska State Board of Education. Jack ran in numerous marathons and was a member of Running Club North. Jack loved to sing at restaurant karaoke nights. He sang the national anthem at UAF hockey games. And he even once sang with the Mormon Tabernacle Choir during one of their rehearsals.

Jack had an enormously positive influence on his community, but above all, Jack was a devoted and loving family man. He is survived by his wife, Frieda, whom he married in 1952; three children; eight grandchildren; and two great-grandchildren.

—JEFFREY J. LOVE and CAROL A. FINN, Geomagnetism Program, U.S. Geological Survey, Denver, Colo.; E-mail: jlove@usgs.gov

FORUM

Remote Sensing Atmospheric Trace Gases With Infrared Imaging Spectroscopy

Atmospheric pollution affects human health, food production, and ecosystem sustainability, causing environmental and climate change. Species of concern include nitrogen oxides, sulfur dioxide (SO₂), and the greenhouse gases (GHG) methane (CH₄) and carbon dioxide (CO₂). Trace gas remote sensing can provide source detection, attribution, monitoring, hazard alerts, and air quality evaluation.

Most passive trace gas remote sensing uses moderate to high spectral resolution (<0.1 to ~1 nanometer) instruments, such as the space-based Scanning Imaging Absorption Spectrometer for Atmospheric Cartography [Burrows *et al.*, 1995], or airborne sensors, such as the Methane Airborne Mapper (MAMAP) [Krings *et al.*, 2011]. High spectral resolution allows identification of gas spectral fingerprints, minimizing water vapor and aerosol interferences compared to lower-resolution multispectral instruments. For a sufficiently strong signal, even multispectral airborne and satellite systems have mapped trace gases (e.g., thermal infrared (TIR) mapping of volcanic SO₂ plumes [Real-muto *et al.*, 1997], reviewed in section S3 of the online supplement to this forum at http://www.agu.org/journals/eo/v093/i050/2012EO500006/2012EO500006_suppl.pdf).

Hyperspectral Imaging (HSI) provides important spectral and spatial contextual information by swath mapping with many spectral bands to disentangle spatiotemporal variability and trends. Until recently, HSI (100–1000 bands that are 5–10 nanometers wide in visible and shortwave infrared (SWIR) wavelengths and 50 nanometers wide in TIR wavelengths) has been inadequate for accurate derivation of column abundances of trace gases. Nevertheless, HSI can map surface composition with broadband absorption features to identify different minerals [Kruse *et al.*, 1993] and rapidly collect spatial data. Recent HSI measurements in the shortwave infrared (SWIR) [Roberts *et al.*, 2010] and TIR [Tratt *et al.*, 2011] have demonstrated the value of high spatial resolution (subdecimeter) information for detecting and mapping trace gas anomalies such as plumes, using diagnostic spectral features. We propose that combined TIR/SWIR trace gas remote sensing provides synergies that justify leveraging the information from these different spectral regimes.

One SWIR-HSI instrument is the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS), which has mapped CH₄, CO₂, and water vapor plumes for strong heterogeneous sources [Spinetti *et al.*, 2008; Roberts *et al.*, 1997, 2010; Bradley *et al.*, 2011]. One approach to retrieval of trace gas column abundance from AVIRIS data is to model surface albedo from nearby bands and then create a best fit to the spectra from water vapor, aerosols, etc. Trace gas column abundances then are derived by subtracting these components’ spectral contribution from the measured spectrum and fitting the trace gas’s spectrum to the residual. Another approach uses band ratios where a well-mixed gas such as CO₂ provides an atmospheric correction for CH₄ column abundance retrieval [Bradley *et al.*, 2011].

Although SWIR-HSI has been used for trace gas remote sensing, to date, few instruments have exploited the significant benefits of high spatial resolution TIR-HSI for trace gas remote sensing even though TIR is a well-acknowledged “spectral fingerprint” region for many important gases. Recent advances (see section S1 in the online supplement) in airborne TIR-HSI sensor capabilities [Hall *et al.*, 2011; Johnson *et al.*, 2009] promise to expand significantly this underutilized spectral region for many common trace gases (see Figure S1 in the online supplement) under wider conditions than SWIR, including nighttime and cloudy skies.

One issue with SWIR-HSI and TIR-HSI is determining how to derive gas column abundances from the passive observations. This requires accounting adequately for the effects of the ambient atmosphere, including cloudy skies, cirrus, aerosols, water vapor, and path radiance. At high latitudes, the low solar angle and low surface albedo of seawater, ice, and snow strongly affect SWIR retrievals, with low-albedo scenes affected far more strongly by cirrus and aerosols, necessitating careful radiative transfer modeling. Conversely, TIR retrieval requires thermal contrast between the ambient scene and the trace gas, which depends on the trace gas’s vertical distribution but not surface albedo. Thus, leveraging TIR/SWIR incorporates mutually distinct and complementary radiative transfer processes, yielding a wealth of information.

Gas plume spectroscopy can be compromised over areas where the scene has significant clutter, nonuniform emissivity or reflectance (see section S2 in the online supplement), or variable water vapor [Roberts *et al.*, 2010]. Thus, spectrally uniform scenes provide plume visualization advantages (see Figure S1 in the online supplement), while spectrally and thermally cluttered backgrounds complicate analysis (section S2 in the online supplement).

Accurate trace gas retrieval near detector noise levels requires fine spectral resolution, particularly to deconvolve trace gas spectral signatures from interferents such as water vapor, aerosols, and, for TIR, surface and atmospheric thermal structure. Broadband multispectral (2–100 bands) thermal instruments can map strong trace gases such as volcanic SO₂ (section S3 in the online supplement); however, separation of weak spectral signatures from continuum emission is impossible. Trace gas detection necessitates trade-offs between spatial, spectral, and temporal resolution, particularly near detection limits.

Current HSI instruments are mainly aircraft-based, but satellite-based HSI instruments could become a future possibility. Although satellite SWIR-HSI has been proposed (HyspIRI, 2012, hyspiri.jpl.nasa.gov), satellite TIR-HSI faces significant common and unique technological challenges, including derivation of the vertical temperature profile and interpretation of atmospheric absorptions and emissions. However, a TIR/SWIR instrument that remotely senses trace gases throughout the entire atmospheric column would add significant synergies, including nighttime and

high-latitude advantages, as is recognized by the spaceborne remote sensing community. As a critical first step, new airborne data sets are needed to better understand TIR radiative transfer and the potential of TIR/SWIR synergies.

Technological and retrieval technique advancements are opening new spectral frontiers of synergistic TIR/SWIR-HSI applications from GHG budgets to air quality to environmental response, with significant benefits arising from the richer information content. Ongoing developments will provide important and new capabilities to test scientists’ understanding of changing natural and anthropogenic sources contributing to Earth’s complex atmosphere.

Acknowledgments

Support in part from the National Science Foundation (award 1042894), NASA (award NNX12AQ16G), The Aerospace Corporation, the University and State of Bremen, German Aerospace (DLR), GFZ Potsdam, the European Space Agency (ESA), and the European Union Framework 7 is gratefully acknowledged. Views and conclusions expressed are solely those of the authors.

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WORKSHOP TO ASSESS RECENT CHANGES IN THE BIOGEOCHEMISTRY OF THE GREAT LAKES SYSTEM (BOGLS)

Wayne State University - March 11-13, 2013

The goal of the workshop is to identify the outstanding scientific needs for understanding pervasive changes in the biogeochemistry of the Great Lakes due to contemporaneous impacts attributed to: i) introduction of invasive species since the mid 1980s; ii) abatement of P loading and iii) climate changes that impacts the runoff, evapotranspiration, lake thermal structure and ice cover. Of special concern and interest are the realized and future impacts on micro- and macro nutrient cycling and their impact on the productivity of the lakes.

Interested participants should submit a one-page summary statement comprised of the following: i) area of expertise; ii) a 100–200 word abstract summarizing a five-minute advocacy talk to be presented at the workshop; and iii) whether travel support (or subsidy) will be needed to attend the workshop. Summary statement should be e-mailed to: bogls@sun.science.wayne.edu

Limited travel support is available and will take into account geographical, disciplinary, and other diversity factors. We encourage participation of graduate students, postdocs, and early career faculty.

Summary statements will be accepted until **January 25, 2013** and decisions on travel support will be announced by **February 1, 2013**. For further information about the workshop agenda and logistics, please visit our website at: <http://bogls.science.wayne.edu>

The workshop is sponsored by the National Science Foundation, NOAA, NASA, USGS, and a consortium of universities (Michigan State, Ohio State, Univ of Michigan, Univ of Minnesota-Duluth, Univ of Illinois-Urbana Champaign, Univ of Wisconsin-Milwaukee, Wayne State, and Yale University).

MEETINGS

Building a Diverse Geoscience Workforce

Preparing Students in Two-Year Colleges for Geoscience Degrees and Careers; Tacoma, Washington, 18–21 July 2012

Building a strong and diverse geoscience workforce is a critical national challenge. An important role is played by 2-year colleges (2YCs) in increasing both the number and diversity of geoscience graduates. At the workshop, called Preparing Students in Two-Year Colleges for Geoscience Degrees and Careers, faculty from 2YCs and 4-year colleges and universities (4YCs), as well as representatives from professional organizations, discussed the successes and challenges of programs, strategies, and activities that support career preparation of 2YC students for geoscience careers, either as geotechnician graduates or geoscience majors at 4YCs. The workshop program, which includes links to presentations and specific examples of these strategies, can be found at [http://](http://serc.carleton.edu/sage2yc/workforce2012/program.html)

serc.carleton.edu/sage2yc/workforce2012/program.html.

The workshop highlighted several successful partnerships between employers and 2YCs and between 2YCs and 4YCs, which could be replicated and adapted for local employment needs. Participants learned about specific 2YC workforce programs (e.g., geospatial, water and energy resources, and environmental technology) that are linked to local employment needs.

Participants also shared strategies for supporting 2YC students in their career paths. These strategies include internships, early research experiences (in classes, in collaboration with local 4YCs, and in early Research Experience for Undergraduates

programs), joint field trips with transfer institutions, and supportive curriculum alignment between 2YCs and 4YCs. Other ways to support career preparation include making connections between 2YCs and local employers, identifying geoscience transfer students earlier to help them build pretransfer relationships with 4YCs, establishing formal internship programs, supporting student geoscience clubs, and developing a collection of geoscience employment information targeted to 2YC students.

Professional organizations contribute to 2YC student career preparation by providing career resources, fostering networking and research opportunities, and sponsoring student technology competitions. At the workshop, representatives from AGU, American Geosciences Institute, Association of Environmental and Engineering Geologists, Incorporated Research Institutions for Seismology, and Marine Technology Society presented what their organizations have to offer 2YC faculty and students and solicited input on ways to better serve the 2YC geoscience community.

Participants emphasized the need for career resources at the local level because many 2YC students are place bound in their

employment outlook. They also noted that institutional governance, state regulations, and curricular demands at individual 2YCs can significantly restrict or limit reforms and new initiatives.

The workshop was a first step in establishing a broad network to promote and support activities that prepare 2YC students as geotechnicians and geoscience majors and to increase the number and diversity of geoscience professionals coming from 2YCs. The workshop was offered through the program Supporting and Advancing Geoscience Education in Two-year Colleges, which is sponsored by the National Association of Geoscience Teachers. This work is supported by the U.S. National Science Foundation Division of Undergraduate Education grants DUE 1122592, 1122640, 1122660, and 1122737 and Division of Ocean Sciences grant OCE-0731338. We thank Eric Baer of Highline Community College for convening the workshop with us.

—R. HEATHER MACDONALD, Department of Geology, College of William and Mary, Williamsburg, Va.; E-mail: rhmacd@wm.edu; ROBERT H. BLODGETT, Department of Physical Sciences, Austin Community College, Austin, Tex.; and JANET HODDER, Institute of Marine Biology, University of Oregon, Charleston

Applications of Real-Time GPS for Science and Hazard Monitoring

Real-Time GPS Position Data Products and Formats Boulder, Colorado, 26–28 March 2012

Recent advances in GPS technology and data processing are providing position solutions with centimeter-level precision at a high rate (1 hertz) and low latency (i.e., the time required for data to arrive for analysis, in this case less than 1 second). These data will have the potential to improve scientists' understanding in diverse areas of geophysics including properties of seismic, volcanic, magmatic, and tsunami sources, and profoundly transform rapid event characterization and warning. Scientific and

operational applications also include glacier and ice sheet motions, tropospheric modeling, and space weather. Processed Real-Time GPS (RT-GPS) data will require formats and standards that allow this broad community to utilize these data and associated metadata in existing research infrastructure.

A community workshop hosted by UNAVCO and funded by the U.S. National Science Foundation (NSF) brought together 70 participants from across the Western Hemisphere representing a spectrum of

research fields including geodesy, seismology, weather, space weather, and natural hazards. Various educational institutions and cooperatives as well as federal and state agencies including UNAVCO, Incorporated Research Institutions for Seismology (IRIS), NSF, NASA, International Global Navigation Satellite System Service (IGS), National Oceanic and Atmospheric Administration (NOAA), Natural Resources Canada (NR-CAN) and the U.S. Geological Survey (USGS) participated. The objective was to define a strategic plan for the current and future needs of these user communities for RT-GPS position data products, processing, formats, standards, analysis, and distribution.

The community recognized broad support for RT-GPS and, in particular, the scientific, societal (hazards), and operational value of data products derived from these streams. The workshop participants recommended that at least two focused working groups be formed with membership from the respective customer communities. Participants concluded that UNAVCO should serve as the primary coordinating agency for these working groups.

The first recommendation was that a working group on RT-GPS formats and metadata be formed that defines and identifies formats that suit each user community. For example, the seismic community has a deeply developed set of tools using the Standard for the Exchange of Earthquake Data (SEED) format and primarily requires only position time series. However, the nature of geodetic solutions and recent advances such as the availability of integrated geodetic and seismic time series may require expanded

formats that contain information about parameter uncertainty, covariance, and data quality.

The second recommendation was to form a working group to critically evaluate the robustness of RT-GPS position time series. Workshop participants presented multiple processing strategies and examples using various software packages. It was recognized that the best approach to employ depends on the application, with different strategies optimizing different parameters (e.g., precision, accuracy, completeness, or geographic coverage). This group will coordinate an open community exercise where data processors provide solutions based on common RT-GPS data sets. The results will be used to evaluate the effects of noise, displacement events, and data incompleteness (including the impact of communications failures) on the resulting solutions. This working group will engage NSF and NASA program managers to encourage support for this activity.

Workshop participants also recommended that a strategy be developed for producing these data products for existing large geodetic networks like the Plate Boundary Observatory.

A comprehensive workshop report that details the workshop discussions and recommendations will be made available at <http://www.unavco.org/>.

—DAVID MENCIN, UNAVCO, Inc., Boulder, Colo.; E-mail: mencin@unavco.org; WILLIAM C. HAMMOND, Nevada Bureau of Mines and Geology, University of Nevada, Reno; and JOHN LANGBEIN, U.S. Geological Survey, Menlo Park, Calif.



Snow Mountain Ranch, Colorado, USA | 8–13 June 2013

COMMUNICATING CLIMATE SCIENCE: A HISTORIC LOOK TO THE FUTURE

The conference will bring together scientists, social scientists, and journalists to discuss both the history and recent advances in the understanding of climate science and how to communicate that science to policy makers, the media, and society.

ABSTRACT SUBMISSION DEADLINE: 5 February, 11:59 p.m. EST

For more information on submission policies and guidelines, the program, conveners, registration, and housing details, visit:

chapman.agu.org/climate/science/



TR32-HOBE International Symposium on Patterns on Soil-Vegetation-Atmosphere-Systems: Monitoring, Modelling & Data Assimilation

11–14 March 2013, Bonn, Germany

The soil including shallow groundwater, vegetation and the lower atmosphere system is characterized by complex patterns, structures and processes that act at various time and space scales. We solicit contributions from scientists of all Earth sciences disciplines dealing with the integrated subsurface-land-surface-atmosphere system from the micro to meso-scale.

ABSTRACT SUBMISSION DEADLINE: 19 DECEMBER, 11:59 pm UTC

For more information on submission policies and guidelines, speakers, registration, and housing details, visit:

www.tr32meeting.uni-koeln.de

Paleoceanography Editor Search

Paleoceanography is seeking a dynamic, well-organized earth scientist with high editorial standards and strong leadership skills to join the Editorial Board of the journal and to work with Editor in Chief, Christopher Charles. Applicants should be respected leaders in the community, independent minded, and even handed.

The journal is specifically seeking applicants with interests that complement those of the existing editorial board. Expertise in areas such as pre-Quaternary paleoceanography, numerical or statistical modeling of past climate, or quantitative paleoecology would be especially welcome. However, a successful candidate will be someone who is able and willing to stretch beyond his/her own area of specialty so that the journal continues to be at the forefront of the full range of paleoceanographic themes.

As Editor you should be committed to further strengthening *Paleoceanography* as a leading journal in its field and be proactive in attracting innovative contributions in traditional disciplines and in emerging fields. The journal is interested in attracting papers in developing areas and ensuring that readers of *Paleoceanography* receive the best and most timely information possible.

As Editor you will

- Have full authority to accept or reject submitted papers
- Handle the review process
- Seek out stimulating papers for inclusion in the journal.

If you would like to be considered as an Editor of *Paleoceanography*, please send your curriculum vitae with a letter of interest via E-mail to pubmatters@agu.org. If you would like to nominate a highly qualified colleague, send a letter of recommendation to the same E-mail address. Please make sure to specify *Paleoceanography* in the subject line of the E-mail.



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GEOPHYSICAL YEAR

MEETINGS CALENDAR

This column announces upcoming meetings and symposia of interest to Earth and space scientists. To submit an announcement for the Geophysical Year Meetings Calendar, go to <http://www.agu.org/cgi-bin/geosoc/cal-submit?cal=gycal>. There is no fee for these brief listings.

- 6–8 January 2013 **Cryosphere Geophysics: Understanding a Changing Climate With Subsurface Imaging**, Boise, Idaho, USA. Sponsors: Society of Exploration Geophysicists; AGU. (Amy Watson, 8801 South Yale, Ste. 500, Tulsa, OK 74137-3575, USA; Tel.: +1-918-497-5500; Fax: +1-918-497-5557; E-mail: awatson@seg.org; Web site: <http://www.seg.org/events/upcoming-seg-meetings/cryo2013>).

■ 21–23 January 2013 **Gulf of Mexico Oil Spill and Ecosystem Science Conference**, New Orleans, Louisiana, USA. Sponsors: Gulf of Mexico Research Initiative; Gulf of Mexico University Research Collaborative; Federal Subcommittee on Ocean Science and Technology; others. (Kristen Yarincik, Gulf of Mexico Research Initiative Administrative Unit, Consortium for Ocean Leadership; E-mail: kyarincik@oceanleadership.org; Web site: <http://www.gulfresearchinitiative.org/news-and-events/gulf-of-mexico-oil-spill-ecosystem-science-conference/>)

■ 10–15 March 2013 **AGU Chapman Conference on Fundamental Properties and Processes of Magnetotails**, Reykjavik, Iceland. Sponsors: AGU; Institute of Geophysics and Planetary Physics; THEMIS; ARTEMIS; Space Sciences Laboratory, University of California, Berkeley; Laboratory for Atmospheric and Space Physics, University of Colorado Boulder. (AGU Meetings Department, 2000 Florida Ave. NW, Washington, DC 20009, USA; Tel.: +1-202-777-7330; Fax: +1-202-777-7385; E-mail: chapman-magnetotails@agu.org; Web site: <http://www.agu.org/meetings/chapman/2012/gcall/>)

■ 14–19 April 2013 **Coastal Processes and Environments Under Sea-Level Rise and**
- Changing Climate: Science to Inform Management**, Galveston, Texas, USA. Sponsors: Geological Society of America Penrose Conference; AGU Chapman Conference; Society of Sedimentary Geology; Geological Society of London. (John Anderson, Rice University, Houston, TX 77005, USA; E-mail: johna@rice.edu; Web site: <http://www.geosociety.org/penrose/13Texas.htm>). Application deadline is 23 January 2013.

■ 17–19 April 2013 **Seismological Society of America 2013 Annual Meeting**, Salt Lake City, Utah, USA. Sponsor: Seismological Society of America. (Katie Kadas, 400 Evelyn Ave., Ste. 201, Albany, CA 94706, USA; Tel.: +1-510-525-5474; Fax: +1-510-525-7204; E-mail: katie@seismosoc.org; Web site: <http://www.seismosoc.org/meetings/2013/>). Abstract deadline is 10 January 2013.

■ 17–19 June 2013 **Roof of the World**, Chengdu, China. Sponsors: Geological Society of China; Geological Society of America. (Melissa Cummiskey, 3300 Penrose Pl., Boulder, CO 80301, USA; Tel.: +1-303-357-1044; Fax: +1-303-357-1070; E-mail: mcummiskey@geosociety.org; Web site: <http://www.geosociety.org/meetings/2013china/>). Abstract deadline is 1 March 2013.

■ 8–12 September 2013 **American Chemical Society Astrochemistry Symposium**, Indianapolis, Indiana, USA. Sponsor: American Chemical Society. (Ralf I. Kaiser, Department of Chemistry and NASA Astrobiology Institute, University of Hawaii at Manoa, Honolulu, HI 96822, USA; Tel.: +1-808-956-5731; Fax: +1-808-956-5908; E-mail: ralfk@hawaii.edu; Web site: <http://www.chem.hawaii.edu/Bil301/ACSAstrochemistry.html>).

CLASSIFIED

ADVERTISING INFORMATION

Eos is published every Tuesday, except the last week of December. For a classified or display advertisement to be published in a future issue of *Eos*, electronic copy must reach us by 23:59 eastern time, 9 days prior (Sunday) to publication, except around certain holidays, which have earlier deadlines. No cancellations accepted after deadline.

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POSITIONS AVAILABLE

- Atmospheric Sciences**

Postdoctoral Associate - Atmospheric Aerosol Nucleation. Kent State University Atmospheric Chemistry group (<http://www.personal.kent.edu/~slee19/>) has an immediate opening of post-doctoral associate. Primary responsibilities will be to conduct field studies and laboratory experiments of aerosol nucleation, using particle sizing spectrometers and chemical ionization mass spectrometers, and publish science findings in peer-reviewed journals. PhD in chemistry, physics, or engineering is required and working experiences on aerosols and mass spectrometers are preferred. Work in a team collaboratively, as well as independently, is critical. This position will require intense travel for field studies, including SOAS 2013 campaign (<http://tinyurl.com/SOAS-logistics>). Contact Prof. Shanhu Lee (slee19@kent.edu; 330 672 3905), if you are interested. Please include your recent CV, three names of references, PDF copt of your
- representative publications, and research interests. KSU is an AAEO employer.

Postdoctoral position in atmospheric chemistry, Dept of Chemistry, University of California Irvine. Lab studies of the fundamental processes involved in formation and growth of particles and of interface processes in the atmosphere. Ph.D. required. Send CV and contact information for 3 references to Prof. B.J. Finlayson-Pitts, bjfinlay@uci.edu. UC Irvine is an equal opportunity employer committed to excellence through diversity.

Regional to Global-Scale Earth-System Dynamics.

In support of its unique program in climate and extreme weather, Purdue University's Department of Earth, Atmospheric, and Planetary Sciences (EAPS) invites applications for a tenure track faculty position, at the rank of Assistant Professor, in large-scale, Earth-system dynamics. We are particularly interested in candidates who investigate the spatial and/or temporal links between large-scale atmospheric processes and phenomena occurring at local scales. The expectation is that the successful candidate will work across scales, using novel integrative approaches that range from theoretical to statistical to numerical modeling.

The appointee must have completed a Ph.D. in, or a field related to, the Earth, Atmospheric, or Planetary Sciences at the time of employment. The appointee is expected to develop and maintain a vigorous, externally funded, internationally recognized research program and to teach and mentor students at the undergraduate and graduate levels. Applications will be accepted until March 1, 2013, with applicant screening beginning on January 1, 2013. Additional information on EAPS can be found at <http://www.eaps.purdue.edu>. To apply, submit: (1) a cover letter, including names of three people who may be asked to send letters of reference; (2) a curriculum vita; and (3) statements of research and teaching experience and interests, to thompso@purdue.edu with the subject line "Regional to Global-Scale Earth System Dynamics". A background check is required for employment in this position.

Purdue University is an Equal Opportunity/Equal Access/Affirmative Action employer fully committed to achieving a diverse workforce.

The UCLA Department of Atmospheric and Oceanic Sciences (AOS) seeks outstanding applicants for a tenure-track position in physical oceanography and/or marine biogeochemistry.

AOS is a vibrant and collaborative department whose faculty have long-standing strengths in the theory, modeling, data analysis, and measurements of weather, large-scale circulations, climate, mesoscale and microscale turbulence, atmospheric physics and chemistry, marine biogeochemistry, ecosystems, and space physics. AOS operates an instrumented 27-ft Zodiac for coastal ocean measurements. The appointee must hold a Ph.D (or equivalent) degree. The target starting date is Fall 2013 but is negotiable. An appointment may be made at any level of seniority. Please direct all applications and inquiries to: Professor James McWilliams Chair, Oceanic Search Committee, UCLA Atmospheric and Oceanic Sciences, Los Angeles, CA, 90095-1565, ocean_search@atmos.ucla.edu

In the electronic and/or paper application package, please include: (i) a statement of teaching and research interests; (ii) curriculum vitae; (iii) a list of 3-5 individuals who are familiar with your work and can serve as a reference; (iv) up to five publications.

Please reference job #0965-1112-01. UCLA is an Equal Opportunity/Affirmative Action employer.

ABOUT AGU

Journal of Geophysical Research Authors Receive Award

The authors of a paper published in AGU's *Journal of Geophysical Research-Atmospheres* have been selected by the executive council of the World Meteorological Organization as winners of the biennial Professor Dr. Vilho Väisälä Award for an Outstanding Research Paper. The 2010 paper, "Optimized fractional cloudiness determination from five ground-based remote sensing techniques" (R. Boers et al., *J. Geophys. Res.*, 115, D24116, doi:10.1029/2010JD014661), was coauthored by H. K.

Baltink, R. Boers, M. J. de Haij, M. Savenije, L. H. van Uift, and W. M. F. Wauben of the Royal Netherlands Meteorological Institute (De Bilt, Netherlands) and by C. N. Long of the Pacific Northwest National Laboratory, U.S. Department of Energy (Richland, Wash.). The award consists of a diploma and medal and an award of \$10,000 shared by the winners.

—BARBARA MAJOR, Assistant Director, Journals, AGU; E-mail: bmajor@agu.org

What's on the Web?

Read the latest offerings from the AGU Blogosphere:

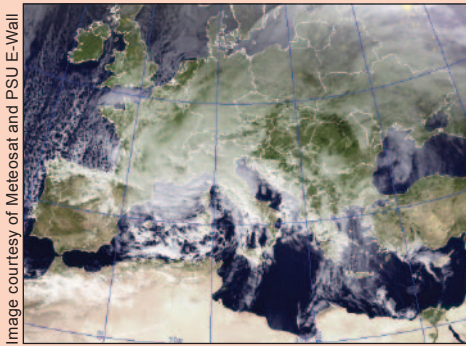
Mountain Beltway: "AW 52: Dream geology courses" (<http://goo.gl/Hd5qg>)

Georneys: "Monday geology picture: A dyke and a shipwreck" (<http://goo.gl/ZReli>)

The Landslide Blog: "Rockfall risk assessment reports for the Port Hills, Christchurch, New Zealand" (<http://goo.gl/mpi3Z>)

Magma Cum Laude: "Increased activity at Santiaguito" (<http://goo.gl/6lCEG>)

Dan's Wild Wild Science Journal: "Midwest style tornado hits southern Italy" (<http://goo.gl/ZCF1n>)



This Meteosat image shows the storm that flooded parts of Venice and produced a tornado in Italy.

The duration of each appointment is normally two years, contingent upon completion of the Ph.D. degree and good progress in the first year. Fellows are eligible to participate in Caltech's benefit programs, including health and dental plans.

This fellowship has been established to support the research of scientists typically within two years after receipt of the Ph.D. The intent of the program is to identify and support innovative and creative work in global environmental science, including areas such as biogeochemistry, glaciology, paleoclimatology, and the atmosphere and ocean sciences. It is expected that each fellowship recipient be hosted by one or more professors, who will provide mentorship and additional financial support.

To apply online, please visit: <http://www.gps.caltech.edu/employment>. Materials in support of an application should include a curriculum vitae, list of publications, a one-page statement of research interests, and three letters of reference. All applications and references are due by Thursday, January 17, 2013.

Caltech is an Affirmative Action/Equal Opportunity Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

Biogeosciences

Miami University (Middletown Campus)Geoscientist - Lecturer Faculty Position.

The Department of Geology and Environmental Earth Science at Miami University invites applications for a Lecturer faculty position on our campus in Middletown, Ohio. The successful candidate will teach at the undergraduate level, engage in outreach

with the surrounding community, provide other service to the university, and be willing to teach in the Bachelor of Integrative Studies degree program. The successful candidate's teaching and service agenda should complement existing department and regional campus strengths and ideally will benefit from the regional geologic setting, interdisciplinary interactions with department and campus colleagues, and existing facilities. Require: M.S. in geoscience by date of appointment; interests in advising and promoting undergraduate student research and educating students of earth and environmental sciences in the field. Desire: Ph.D. in geoscience.

You are invited to visit the following websites for information on the department (www.MiamiOH.edu/geology), the Middletown regional campus (www.mid.MiamiOH.edu), and the University (www.MiamiOH.edu).

Miami University Middletown, with 2700 students, is a commuter campus located in a suburban setting close to both Cincinnati and Dayton. The campus has a strong connection to the main campus in Oxford, 25 miles away, as well as to the communities it serves.

Interested candidates should submit a packet containing a letter of application, curriculum vitae, statement of teaching philosophy, and service objectives and accomplishments, transcripts; and arrange three letters of reference to be sent to: GeoLecturerMUM@MiamiOH.edu. Review of applications will begin in January 2013 and continue until the position is filled. The appointment will be effective August 12, 2013.

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ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

PhD Position
Environmental Assessment of Use of Geothermal Energy and Georesources

The Chair of Engineering Geology at ETH Zurich invites applications for a PhD position in the area of environmental assessment of geothermal energy production and use of georesources. The successful candidate must have an MSc in earth sciences, environmental sciences, or related field.

This position is part of a collaborative project on geothermal energy in Switzerland. The duration of the position is approximately 3 years and can be filled by the successful candidate in the beginning of 2013.

The goal of this research project is to elaborate a novel life cycle assessment (LCA) procedure for geothermal energy and georesources use. LCA is the standard framework for concerted evaluation and comparison of multiple environmental consequences. In each phase of LCA, the definition of the functional unit, life cycle inventory (LCI) and life cycle impact assessment (LCIA), we want to improve existing concepts. This involves substantial work on information research from multiple sources, statistical analysis and validation. We will adopt a prospective and geoscientific view, compare alternative methods, and discuss the expressiveness of available impact categories. We will enhance standard approaches, by incorporating prediction by geological models, and expect results will be applicable for selected case studies.

The ideal candidate should have knowledge and experience in geological and life cycle assessment methods. He/she should be a team player, have good communication skills and take on responsibility in an international and interdisciplinary research team. Detailed information about the Chair of Engineering Geology is available on the web: www.engineering-geology.ethz.ch. For further information regarding the advertised position please contact Dr. Peter Bayer, ETH Zurich (email: bayer@erdw.ethz.ch).

Complete applications should be sent by regular mail or email to Dr. Peter Bayer, Engineering Geology, ETH Zürich, Sonneggstrasse 5, 8092 Zurich, Switzerland, and must include the following, ideally in one pdf-file: 1) A short cover letter where you outline your motivation; 2) Curriculum vitae which describes your complete personal details and career history; 3) Complete course grades and transcripts; 4) Contact details of two referees or written reference letters. We will start with the invitation of potential candidates in December 2012 and plan to fill the position in February. However, later applications may also be considered until this position is filled.

Classified

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Miami University is an EOE/AA employer with smoke-free campuses. Right to Know-Consumer Information found at <http://www.miami.MiamiOH.edu/about-miami/publications-and-policies/student-consumer-info/>. Hard copy upon request.

Tenure Track Position: Mineralogy/Material Science.

The Department of Earth and Environmental Science at Temple University seeks applicants for a tenure-track position at the level of Assistant or Associate Professor in mineralogy and material science whose research emphasizes the emerging fields of Environmental Mineralogy, Medical Mineralogy, or Nanoscience to begin in August 2013. The successful candidate will have a Ph.D. degree, an established record of accomplishment in their discipline, a strong commitment to teaching and student mentoring, and a keen interest in collaboration with other faculty at Temple University to build a new Geoscience Ph.D. program. The candidate is expected to complement existing specialties in our department, including low-temperature aqueous geochemistry, hydrology, environmental geophysics, structural geology, mineralogy, coastal geomorphology, soils, sedimentology/stratigraphy, and paleoclimatology.

Available analytical instrumentation includes: X-ray fluorescence, magnetic susceptibility, electron microprobe, liquid chromatography/mass spectrometry, Raman spectroscopy, automated powder, single crystal, and thin film XRD, SEM and TEM with EDS, as well as access to high-performance computing.

The deadline for applications is January 7, 2013. Applications should include a CV, statement of research goals, description of potential classes and teaching philosophy, names and addresses of at least three references (five if applying at the Associate level), and copies of selected reprints. Applications should be submitted electronically via the link on the Department website: <http://www.temple.edu/geology> and letter of intent emailed to Jonathan Nyquist, Department chair (nyq@temple.edu).

Temple University is an affirmative action and equal opportunity employer committed to equal access and to achieving a diverse community. The department specifically invites and encourages applications from women and minorities. We will be available to meet with candidates at the 2012 Annual GSA and AGU meetings in Charlotte and San Francisco.

Geochemistry

Assistant Professor of Geosciences.

Tarleton State University in Stephenville, Texas seeks applicants for a tenure-track Assistant Professor position to start September 2013. Applicants must have a Ph.D. in geosciences. ABD will be accepted if degree will be completed by September

2014. Expertise preferred in field geology, structural geology, geophysics and/or petroleum geology. Ability to establish and maintain a research program at the undergraduate level expected. All submissions must be made electronically through Tarleton's Human Resources site, <http://www.tarleton.edu/hr/>. Review of applications will begin on March 1, 2013 and continue until the position is filled. Tarleton State University, an Equal Opportunity and Affirmative Action Employer and Educator, is committed to excellence through diversity. Tarleton State University is a proud member of the Texas A&M University system with an enrollment just over 10,000 students.

Assistant Professor Position in Paleoclimatology, Biogeochemistry, Environmental Geochemistry and Carbon Sequestration, Institute of Surficial Geochemistry(ISG), Nanjing University.

The ISG, a Ministry of Education Key Laboratory at Nanjing University, China, is seeking qualified candidates worldwide to fill multiple positions in geology/low temperature geochemistry/atmospheric sciences/marine sciences/environmental sciences/hydrology or any closely related fields. ISG provides a cutting-edge, multi-disciplinary research platform aiming at exploring and developing new approaches and theories, as well as methodologies and their applications to the research of earth's surface system. For assistant professor position, a salary package of 200 thousands RMB annual salary, startup funds and housing bonus is offered.

Applications include a letter of application, curriculum vitae, publication list, summary of academic achievements (within 500 words), statement of future work plans (within 1 page), and two references. For further information and submission of applications, please contact: Dr. Yang Chen (phone: 8625-83686042, email: chenyang@nju.edu.cn).

Hydrology

DEPARTMENT OF CIVIL, CONSTRUCTION, AND ENVIRONMENTAL ENGINEERING SAN DIEGO STATE UNIVERSITY 2013/2014 VPAA #2013/14-8.

The Department of Civil, Construction and Environmental Engineering at San Diego State University (SDSU) invites applications and nominations for a tenure-track faculty position in the water resources area, effective Fall 2013, at a rank commensurate with experience. A Ph.D. in Civil Engineering is required. Competitive candidates must have the ability to maintain a strong, extramurally funded, research program and demonstrated commitment to both undergraduate and graduate instruction, with a focus on hydrologic modeling and related water resource areas. The review of applications begins immediately and will continue until the position is filled. Full application guidelines are available at <http://affiliated.sdsu.edu/ColEng/civilconsteng.htm>.

SDSU is an Equal Opportunity/Title IX Employer.

Post Doc - Hydrologic Monitoring, Modeling, and GIS. The Warnell School of Forestry & Nat. Res. and USDA Forest Service Savannah River seek a Post-Doctoral Researcher to model and monitor watershed hydrology in small forested watersheds of the Savannah River Site, SC. The researcher will build and maintain climate, chemistry, soil, vegetation, LiDAR, geology, and GW data to support an on-going paired watershed study. The researcher will run and evaluate hydrologic models of critical flow paths, residence times, and streamflows to assess forest management scenarios at landscape scales. Experience needed in GIS, programming, and hydrologic modeling. Starting salary is \$45,000 with benefits. Funding is available for at least two years. Work will be based at the Savannah River Site with funded travel to Athens, GA and other locations. Contact: Dr. C. Rhett Jackson, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA 30603-2152, rjackson@warnell.uga.edu, 706-542-1772.

Postdoctoral Research in Mountain Hydrology and Water Sustainability.

The University of Colorado and National Center for Atmospheric Research invites applications for two full-time Postdoctoral Research Associates to work on projects related to observing and modeling the coupled hydrological, ecological, and engineered systems of the Colorado River Basin headwaters. Specific areas of research include the following areas:

- i) Snowpack Characterization from Modeling and Remote Sensing
- ii) Hydroclimatology of Mountainous Regions
- iii) Water Resource Management Optimization and Modeling

The projects involve collaboration between researchers at the University of Colorado (CU) and the National Center for Atmospheric Research (NCAR). The post-doctoral associates will be funded by NSF's Water Sustainability and Climate Program under a project which integrates Social, Biological, Hydrological, and Engineering dimensions of climate change and water sustainability. Successful applicants will work with the PI's (Dr. Noah Molotch and Dr. David Gochis) and project Co-investigators to synthesize information regarding water cycling in the Colorado River Basin headwaters.

The positions require a Ph.D. in hydrology or related physical science or engineering field. Candidates with skills in remote sensing, hydrologic modeling, and / or data assimilation are encouraged to apply. Outstanding oral and written communication skills are required. To learn more about potential research topics, go to <http://instaar.colorado.edu/research/labs-groups/mountain-hydrology-group/>.

The University of Colorado is an equal opportunity employer committed to excellence through diversity. All qualified candidates, including

women, minorities, veterans and disabled persons are encouraged to apply.

Appointment rank and compensation will be commensurate with background and experience and based on published CU and/or NCAR salary scales. Positions are open immediately and will remain open until filled.

Applicants should electronically submit a CV, cover letter, one-page description of research interests, and the names of three references, all in PDF format to:

Prof. Noah Molotch
Institute of Arctic and Alpine Research
University of Colorado at Boulder
noah.molotch@colorado.edu

The Department of Civil & Environmental Engineering & Earth Sciences (CEES) at University of Notre Dame invites applications at all tenure-track/tenured levels in the areas of environmental fluid mechanics, environmental hydraulics and hydrology. We are seeking candidates with potential for developing a vigorous, broad, externally funded research program that compliments existing departmental strengths while participating in integrative collaborative research within and outside the department. Current strengths of CEES are in the areas of computational hydraulics, environmental fluid mechanics, groundwater and surface hydrology, ocean and atmospheric fluid dynamics, stratified and rotating flows and coastal engineering. The presence of vibrant structures, environmental engineering and earth sciences groups within the department, large inter-departmental strategic research partnerships such as the Environmental Change Initiative as well as world class laboratory and computational facilities offer unparalleled opportunities for multidisciplinary research in a dynamic intellectual environment. The successful candidate is expected to exhibit enthusiasm, promise and dedication to undergraduate and graduate teaching, consistent with departmental academic goals, and commitment to professional service. Applicants must have earned a doctorate at the time of appointment, and post-doctoral experience is preferred. Exceptionally well qualified candidates may be considered for an endowed professorship. For more information on the department, visit <http://cees.nd.edu> and on the environmental fluid mechanics group www.nd.edu/~dynamics. Applicants should include in a single pdf document a copy of their curriculum vita, a letter describing their research and teaching interests and the names and contact information of four references. Applications should be uploaded directly, as a single PDF file, to the EFD position posted at http://cees.nd.edu/Positions_Available_Environmental_Fluid_Dynamics. Please direct any questions to Professor H.J.S. Fernando, Chair of the Environmental Fluid Dynamics Search Committee, Department of Civil and Environmental Engineering and Earth Sciences, 156 Fitzpatrick

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UNIVERSITY
of NEW HAMPSHIRE

Faculty Position in Earth System Science / Coupled Human and Natural Systems

The University of New Hampshire seeks outstanding applicants for an open-rank tenure/tenure track position that will enhance our existing strengths in earth and environmental sciences and engineering. The successful applicant will have demonstrated expertise in one or more of the following areas pertaining to Earth system science and the interface between human and natural systems: interactions between ecosystems and climate, human dimensions of global change, remote sensing and geospatial analysis, sustainability science, adaptation to climate change, social-ecological systems, land use/land cover dynamics, and process-based modeling of environmental change. Applicants coming from physical, ecological or social sciences and environmental engineering backgrounds are equally encouraged to apply, provided their interest is in working across traditional disciplinary boundaries to address pressing societal concerns involving human-driven environmental change. Applicants will be expected to join a state-wide team investigating "Interactions Among Climate, Land Use, Ecosystems Services and Society." It is anticipated that the network of collaborators participating in this project will provide abundant opportunity for the successful applicant to develop new initiatives in research and teaching and build a productive and rewarding career.

The position will be a joint appointment with a research program housed in UNH's Earth Systems Research Center and an academic appointment in the Department of Natural Resources and the Environment, Civil Engineering, or Earth Sciences (depending on the interests and strengths of the successful candidate). In addition to establishing an independent, externally funded research program, the successful applicant will supervise students, and contribute to the teaching mission of the home Department.

Applications, consisting of a current curriculum vitae, a statement of research interests, a teaching statement, and the names and contact information for three referees should be sent to:

Susan Higgins, Search Committee Coordinator
EPSCOR Program Office
Greg Hall, Room 216
35 Colovos Road
Durham, NH 03824

Electronic submission of application materials (preferred) in PDF format may be sent to susan.higgins@unh.edu. Questions about this position may be addressed to the Search Committee coordinator by email (susan.higgins@unh.edu) or phone (603 862 1804). Search committee members are also available to answer questions about this position and the University of New Hampshire: Jack Dibb (chair), Kevin Gardner, Jim Malley, Bill McDowell, Scott Ollinger, and Ruth Varner (firstname.lastname@unh.edu).

Rank is open and will be consistent with qualifications. Preferred starting date is September 2013. Review of applications will begin January 15, 2013 and continue until the position is filled.

The University of New Hampshire is an Equal Opportunity/Equal Access/Affirmative Action institution. The University seeks excellence through diversity among its administrators, faculty, staff, and students. The University prohibits discrimination on the basis of race, color, religion, sex, age, national origin, sexual orientation, gender identity or expression, disability, veteran status, or marital status. Application by members of all underrepresented groups is encouraged.

UNH is a land-grant institution and also a designated sea- and space-grant University, and is among the top-tier research institutions nationally.

For more information about UNH see: <http://www.unh.edu/unhedutop/about-unh>.

International Ocean Discovery Program

Call for Nominations, IODP Forum Chair

The next phase of scientific ocean drilling, the *International Ocean Discovery Program (IODP): Exploring the Earth under the Sea*, will begin in October 2013. The science plan *Illuminating Earth's Past, Present, and Future* is the program's guiding scientific document. An overarching international umbrella, the IODP Forum, will assess progress and foster coordination among the providers of the three drilling platforms (*JOIDES Resolution*, *Chikyu*, and mission-specific platforms) which will be operated independently by facility governing boards established by their respective countries or consortia. The IODP Forum serves as the custodian of the science plan and an international venue for exchanging ideas and views on the scientific progress of the program. Terms of Reference for the IODP Forum and other information can be found at iodp.org/new-program.

The Chair of the IODP Forum will be a well-recognized scientist selected for his/her scientific and managerial leadership. The Chair will be the face of the program and is expected to promote the program's scientific accomplishments at select scientific meetings, and to attend meetings of the platform facility boards and the Proposal Evaluation Panel (PEP). The Chair will require appropriate salary and logistical support (the TOR recommend a level of 0.5 Full-Time Equivalent (FTE)). The Chair will be in place by October 1, 2013 and will serve for two years. The first Chair of the IODP Forum will be recommended by secret ballot of the Board of Governors of the non-for-profit corporation IODP Management International, Inc (IODP-MI) for endorsement by the IODP funding agencies.

IODP-MI hereby calls for nominations for the Chair of the IODP Forum. Candidates can be self-nominated or nominated by a third party. Noting that Forum membership is open to all countries, consortia, or entities providing funds to platform operations, it is understood that the Chair of the IODP Forum has his/her primary scientific affiliation in one of the 26 nations that support IODP.

The nomination package will comprise:

- A statement describing the candidate's interest in leading the Forum and vision for ensuring that the Forum fulfills its mandate.
- An up-to-date CV with a recent photo, including standard CV contents, and indicating participation in scientific ocean drilling expeditions and any significant research carried out with data, samples, or results obtained via scientific ocean drilling programs (addressing scientific leadership) and indicating any participation in the program development, advisory structure, expedition leadership, or program management of scientific ocean drilling programs (addressing managerial leadership).
- Three letters of recommendation from individuals who endorse the candidate that address the candidate's personal, scientific, and managerial qualifications to lead the Forum in its mandate and be the face of the IODP. At least one letter from someone who has been involved with the science advisory or program management structure of the program (e.g. chair of SAS panel or committee; leaders of national program offices) is encouraged.
- A letter from a financial entity endorsing the candidate and agreeing to provide the necessary funds for salary and logistical support. It would be most natural for the Chair's salary and logistical support to be provided by the financial entity that supports IODP participation in his/her country of affiliation. However, other arrangements for financial support can be submitted in the nomination package.

Completed nomination packages must be submitted by email to chairprocess@iodp.org by **midnight January 31, 2013** in the submitter's local time. Nominators are completely responsible for ensuring that the nomination packages are complete. IODP-MI reserves the right to exclude incomplete packages from the selection process. Questions can be sent to chairprocess@iodp.org.

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Hall, University of Notre Dame, Notre Dame, IN 46556-0767 (efd@nd.edu). Review of applications will begin immediately, but the search will continue until the position is filled. The University of Notre Dame is committed to diversity and equality in education and employment, and women and members of underrepresented minority groups are strongly encouraged to apply.

Ocean Sciences

ASSISTANT PROFESSOR, CHEMICAL OCEANOGRAPHY The Florida State University.

The Department of Earth, Ocean and Atmospheric Science at Florida State University is seeking applications for a Ph.D.-level chemical oceanographer to fill a nine-month, tenure-earning appointment at the Assistant Professor level to begin as soon as August 2013.

The position involves research, teaching (at the graduate and undergraduate level), and service. The successful candidate will have completed a Ph.D. degree (or equivalent) in chemical oceanography, marine biogeochemistry, environmental chemistry, or a closely related field and will have had post-doctoral research experience. A well-qualified candidate will have a record that reflects their high level of research productivity.

We are particularly interested in a person who will complement our existing strengths in light stable isotopes, microbial biogeochemistry, and trace element cycling (see faculty research at <http://ocean.fsu.edu/Faculty.php>) and who will expand our curriculum by teaching in our Environmental Sciences undergraduate major and in our Chemical Oceanography and Biogeochemistry graduate programs, as described on these web sites:

<http://www.eoas.fsu.edu/Earth-Ocean-and-Atmospheric-Science/Undergraduate-Education/Environmental-Science-Undergraduate-Degrees>

<http://www.eoas.fsu.edu/Earth-Ocean-and-Atmospheric-Science/Graduate-Education>
<http://biogeochem.fsu.edu/>
Women and members of minority groups are especially encouraged to apply. The review of applications will begin immediately and continue until the closing date of January 18, 2013. Please send a pdf of your cover letter, curriculum vitae, research statement, teaching philosophy and contact information for three references to:

Prof. William Landing, Department of Earth, Ocean and Atmospheric Science, Florida State University, Tallahassee, FL 32306-4320; www.eoas.fsu.edu, wlanding@fsu.edu.

Florida State University is a Public Records Agency and an Equal Opportunity-Equal Access-Affirmative Action Employer.

Solid Earth Geophysics

Tenure Track Position in Solid Earth Geosciences (Earthquake Physics, Active Tectonics and Quantitative Geomorphology).

The Center for Earthquake Research and Information (CERI) at the University of Memphis invites applications for a tenure-track faculty position, with tenure in the Department of Earth Sciences, at the Assistant Professor level to begin August 2013. We seek an individual with research interests in the fields of Earthquake Physics, Quantitative Geomorphology, or Active Tectonics that complement our existing strengths in seismology, geodesy, tectonophysics, seismic hazard and geodynamics. We particularly encourage applicants with research interests related to fault zone processes and seismogenic crustal deformation. Applicants must have a Ph.D. at the time of employment, and show a demonstrated record or strong promise of research productivity. The successful candidate is expected to build a vigorous, externally funded research program, mentor M.S. and Ph.D. graduate students, and teach graduate courses in her or his specialty. CERI faculty are engaged in a variety of regional, national, and international research projects in seismology,

geodesy, geology, geophysics, and earthquake hazards (<http://www.ceri.memphis.edu>). More information about this position can be obtained by contacting the chair of the search committee, M. Beatrice Magnani (mmagnani@memphis.edu).

Applicants should submit an application letter, full curriculum vitae, statements of research and teaching interests, and the names and addresses (with phone numbers and email) of at least three references. To receive full consideration, applications must be submitted through the University of Memphis workForum online application system (<http://workforum.memphis.edu>) by February 1, 2013. The University of Memphis is an Equal Opportunity/Affirmative Action employer.

Interdisciplinary/Other

Assistant Professor at NMSU, Neotectonics/Thermochronology (Revised).

The Department of Geological Sciences seeks applications from neotectonicists/thermochronologists who are interested in teaching and research in a geologically and culturally diverse environment in the Rio Grande rift of southern New Mexico for a permanent, 9-month, tenure track position as Assistant Professor.

For more information, including application procedures, see the department web site at <http://www.nmsu.edu/~geology/> and the advertisement on the NMSU job web site at <http://www.nmsu.edu/~personel/postings/faculty/16554338.html>. NMSU is an EEO/AA employer.

Assistant Professor at NMSU, Sedimentology/Stratigraphy (Revised).

The Department of Geological Sciences seeks applications from sedimentologists/stratigraphers who are interested in teaching and research in a geologically and culturally diverse environment in the Rio Grande rift of southern New Mexico for a permanent, 9-month, tenure track position as Assistant Professor.

For more information, including application procedures, see the department web site at <http://www.nmsu.edu/~geology/> and the advertisement on the NMSU job web site at <http://www.nmsu.edu/~personel/postings/faculty/16501738.html>. NMSU is an EEO/AA employer.

Chair, Department of Geosciences The University of Akron Akron, OH.

The Dept. of Geosciences at the University of Akron invites applications from dynamic individuals for the position of Dept. Chair. We seek an academic leader who will help the department make major contributions to the university's Vision 2020 Strategic Plan by ensuring student success and enhancing its research performance. The department's 10 faculty currently serve 38 M.S. students and more than 130 undergraduates majoring in geology, geophysics, engineering geology, environmental science, geographic information systems and geography. There are opportunities to

supervise Ph.D. students through collaboration with the Integrated Biosciences Program, Department of Chemistry and the College of Engineering.

A Ph.D. in a field related to the earth sciences and the ability to work with and lead a department with expertise in geology, geography, environmental science and GIS is required. Candidates must have a record of achievement supporting appointment at the rank of professor with tenure at The University of Akron. Review of applications will begin February 15, 2013 and continue until the position is filled. For more information and to apply, visit: <http://www.uakron.edu/jobs.job#7637>. Inquiries should be addressed to Dr.

John Peck at jpeck@uakron.edu. EEO IAA

FACULTY CLUSTER-HIRE IN FRESHWATER SCIENCES AT THE UNIVERSITY OF WASHINGTON FOUR FULL-TIME ASSISTANT/ASSOCIATE PROFESSOR POSITIONS.

The University of Washington seeks four new full-time, nine-month, tenure track faculty members to develop high impact research, teaching, and outreach as part of a new Freshwater Sciences Initiative on the Seattle and Tacoma campuses. Humanity is facing a grand challenge in the future sustainability of freshwater resources. UW's Freshwater Sciences Initiative is intended to enhance our scientific, engineering, and educational capacity to answer this challenge by advancing the area of water resource management and conservation, and educating the next generation of scientists, managers, and policy makers. These hires are a key component of a larger initiative developed by the College of the Environment, the College of Engineering, and UW Tacoma's Environmental Science program to enhance and coordinate existing research and education strengths in freshwater sciences at UW. (<http://depts.washington.edu/coenv/freshwater>)

University of Washington faculty engage in teaching, research and service. Candidates should demonstrate strong disciplinary backgrounds in freshwater science sub-disciplines and show evidence of the potential to develop successful multi-disciplinary collaborations addressing pressing scientific and societal issues in freshwater resources. Their research records should reflect high scholarship, the ability to attract funding, relevance to socio-cultural or socio-economic impacts, and connections across scales and disciplines. We are particularly interested in candidates with expertise in the following sub-disciplines: eco-hydrology, watershed/river ecology and restoration, fluvial geomorphology, urban water quality, aquatic biogeochemistry, and continental hydrology, although we also encourage applications from other biological and physical sub-disciplines of freshwater sciences. Successful candidates will have a strong interest in teaching and mentoring, especially contributing to innovative undergraduate and graduate curricula that integrate across freshwater science

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UNIVERSITY of HOUSTON

Faculty Positions

The Department of Earth and Atmospheric Sciences of the University of Houston invites applicants for the following tenure track faculty positions. Candidates must have completed their PhD at the time of appointment. Successful candidates will be expected to build a vigorous externally-funded research program, and should be able to demonstrate productivity in peer-reviewed publication. Candidates will also be expected to teach at both the undergraduate and graduate levels and will be expected to mentor MS and PhD students. We expect to fill the positions by August, 2013. Candidate evaluation will begin **January 20, 2013** and continue until the position is filled.

Exploration Geophysics

Assistant to Full Professor level in the field of Exploration Geophysics, specializing in reflection seismic processing, imaging, and interpretation. We seek candidates of outstanding ability in signal processing, algorithm development, and seismic data analysis. Strength in subjects such as elastic-wave propagation, tomography, migration, and inversion will be especially valued. The successful candidate should have the ability to use high-performance computing to image, visualize, and interpret seismic data and will have use of our wide variety of seismic software packages, hardware systems, and geophysical data. The successful candidate will participate with an enthusiastic team of geophysics faculty and students in one of the leading energy communities in the world. Preference will be given to candidates with related industry experience.

Organic Geochemistry

Assistant to Full Professor level in the broad field of organic geochemistry. Applicants should have experience in the application of chemical principles to the study of the origin, migration, accumulation, and alteration of hydrocarbons and organic contaminants using a range of petroleum geochemical techniques, such as stable isotope geochemistry, hydrocarbon analysis of organic compounds and biomarkers with GC and GC-MS, vitrinite reflectance or other maturity indicators, laboratory pyrolysis, and/or kerogen typing. The successful candidate will also enjoy access to new major and sophisticated organic geochemical research equipment being delivered in the Fall of 2012 to the Department, including an Agilent GC-QQQ 7000, an Agilent GC-Q-TOF 7200, an Agilent GC-MS 5975, an Agilent GC 7890, a Finigan Delta 5 Gas Stable Isotope Mass Spectrometer coupled with a GC-C-IRMS, and a Rock Eval VI Pyrolysis Instrument. Research analytical expertise in these instruments and/or experience in related environmental organic fluid and rock geochemistry, especially aligned with studies of water quality, identifying natural water and rock contaminants and toxicity levels, carrying out epidemiologic environmental forensics studies, environmental remediation monitoring, and/or ground water quality studies in gas and oil shale fracking regions, is considered advantageous to the broad areas of research in the Department.

Sedimentary Geology

Assistant Professor level in the general field of Sedimentary Geology and Stratigraphy. Candidates may conduct research on ancient or modern systems and may have expertise in areas such as facies and stratigraphic architecture, sedimentary petrology, experimental or numerical modeling, and/or reservoir characterization. Ideally the candidate will have experience with field-based research to solve fundamental geological problems. This position is linked to the UH Energy initiative, and we encourage applications from candidates with some industry experience.

Information for Applicants

Candidates for each position should submit: 1) a letter of application including statements of teaching and research interests, 2) a curriculum vitae, and 3) three letters of reference (letters must be received before the applications will be considered) to:

Dr. Janok P. Bhattacharya, Chair,
Department of Earth and Atmospheric Sciences
College of Natural Sciences and Mathematics
Room 312 Science Research 1
University of Houston
4800 Calhoun Rd.
Houston, Texas 77204-5503.

Signed reference letters may be submitted by referees as attached files via email to Penny Maher: pjmaher@uh.edu. Further information can be obtained by viewing the departmental web page at <http://www.geosc.uh.edu/> or by calling the Department at (713) 743-3399.

The University of Houston is an Equal Opportunity/Affirmative Action Employer. Minorities, women, veterans, and persons with disabilities are encouraged to apply.

ETH

Edigengössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

For a new SNF-funded cooperative project, ETH's **Fluids and Mineral Deposits group** at the Department of Earth Sciences is seeking 3–4 highly motivated

PhD Students
Magmatic Hydrothermal Systems – Physical
Dynamics, Geochronology and Fluid Geochemistry

In these projects, you will receive advanced training in combinations of field geology by cooperating with international mining companies, fluid-inclusion techniques, microbeam analysis by SIMS and LA-ICPMS, mass-spectrometry and geochronology, and finite element modeling of hydrothermal fluid flow. You will use state-of-the-art laboratory techniques and be involved in the development of original code and new analytical methods with broad applications in geosciences. The positions will be funded for 3 years, to start within 12 months from April 2013.

The ideal candidates for these positions are students who already have some experience with either numerical modeling or analytical geochemistry. Furthermore, they are interested in ore formation, igneous petrology, hydrothermal geochemistry and geodynamics.

For further information about the position, please contact Mr. Christoph Heinrich by e-mail: christoph.heinrich@erdw.ethz.ch (no applications) and visit our website www.geopetro.ethz.ch/research/orefluids.

Applications with a resume, cover letter, statement of individual research interests and the names of two referees should be sent online via www.jobs.ethz.ch to: ETH Zurich, Ms. Maja Bügler, Human Resources, 8092 Zurich.

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disciplines. The provision of fresh water defines the rights and privileges of individuals, societies, and nations. We are particularly interested in candidates whose research, teaching and service has prepared them to contribute to our commitment to engagement and inclusion of culturally diverse audiences in the freshwater sciences, and in higher education more generally.

Appointments will be made at Assistant Professor or, in exceptional circumstances, Associate Professor, in the School of Aquatic and Fishery Sciences, the School of Environmental and Forest Sciences, the Department of Earth and Space Sciences, the School of Oceanography, the Department of Civil and Environmental Engineering, or in the Environmental Science program on UW's urban-serving campus in Tacoma, depending on the background of each candidate. Joint appointments between these partnering units will be developed to best suit the interests of successful candidates and to encourage multi-disciplinary research and teaching. Primary appointments will be made in one of the above academic units, but successful applicants are expected to closely collaborate and work as an interdisciplinary cluster.

The University of Washington provides a wide range of networking, mentoring and development opportunities for junior faculty and a comprehensive benefits package (details can be found at <http://www.washington.edu/admin/hr/benefits/index.html>).

A Ph.D. is required. Applicants should send the following to freshwtr@uw.edu with their name in the subject line of the email: 1) Curriculum vitae, 2) statement of research and teaching interests and philosophies not exceeding 4 pages in length total, 3) copies (PDF) of three representative publications, and 4) names and contact information for 3-4 professional references. Consideration of applications will begin immediately and continue until the position is filled. Priority will be given to applications received by January 4, 2013.

More information about the search and the Freshwater Sciences Initiative can be obtained by contacting the search committee co-chairs Joel Baker (UW Tacoma; jebaker@uw.edu), Dennis Lettenmaier (College of Engineering; dennisl@uw.edu), or Daniel Schindler (College of the Environment; deschind@uw.edu).

Individuals with disabilities desiring accommodations in the application process should contact the UW Disability Services Office at 206-543-6450 (TTY: 206-543-6452).

The University of Washington is an equal opportunity/affirmative action employer.

HEAD OF SCHOOL POSITION OSU BOONE PICKENS SCHOOL OF GEOLOGY.

The Boone Pickens School of Geology at Oklahoma State University invites applications for the School Head position. This is a tenured position at the rank of Associate Professor or Full Professor to be filled by July 1, 2013. Salary is competitive and commensurate with the experience and qualifications of the successful candidate. Applicants should have a PhD in geosciences or a related field, have an outstanding research and teaching record and be highly regarded and recognized by the national and international geoscientific community. A record of an established collaboration with the energy industry is desirable. Prior administrative experience is preferred and potential for academic leadership and mentoring is expected. The Boone Pickens School of Geology Head position is designated 50% administration and 50% academic. The successful candidate will be allowed to have reduced teaching load, but will maintain a research program through externally-funded projects, peer-reviewed publications and mentoring of graduate students. The specific research field is open but the successful candidate is expected to strengthen the School's research foci in conventional and unconventional hydrocarbons, continental tectonics and neotectonics, and surficial processes and environmental studies. Currently the School has 14 tenured and tenure-track faculty, 3 research scientists/post-doctoral fellows, 15 PhD students, 50 MS students, and 140 undergraduate students. The School has recently expanded and will continue growing in terms of student enrollment, additional faculty, and external resources. The School houses modern research and teaching facilities, including well-equipped geochemistry, geophysics, remote sensing, sedimentology, and tectonics laboratories, as well as technology-enabled classrooms and the Devon Visualization Laboratory. The School also maintains a Field Camp in Canon City, Colorado. The School's mission and activities are strongly supported by an extended network of alumni and an active advisory board. The School maintains a strong faculty-student-alumni relationship and active student chapters for professional organizations. Applicants should submit statements

detailing: (1) Leadership vision, (2) Research interests, and (3) Teaching philosophy, along with a Curriculum Vitae, and the names, addresses, e-mail addresses, and phone numbers of three references to: Boone Pickens School of Geology Head Search c/o Dr. Loren M. Smith, Department of Zoology, 501 Life Science West, Oklahoma State University, Stillwater, Oklahoma 74078, Phone: (405)-744-5555, Fax: (405) 744-7824. Screening of candidates will begin January 1, 2013 and continue until the position is filled. The filling of this position is contingent upon available funding. More information on Oklahoma State University and the Boone Pickens School of Geology can be found on the web at <http://go.okstate.edu> and <http://geology.okstate.edu>, respectively. OSU is an AA/EEO/E-Verify employer committed to diversity. OSU-Stillwater campus is a tobacco-free campus.

Multiple faculty positions in Limnology/Oceanography.

The University of Minnesota Duluth (UMD) invites applications for multiple tenure-track, assistant-professor positions in the general areas of limnology and oceanography, or related field. The positions are joint research and teaching appointments, shared between Large Lakes Observatory (LLO; www.d.umn.edu/llo) and appropriate academic departments (e.g. Biology or Physics), starting August 26, 2013. Areas of interest for research include, but are not limited to: biological remote sensing, aquatic ecology, physical limnology, and atmospheric dynamics in aquatic systems. Required qualifications include a Ph.D. (or foreign degree equivalent) in limnology, oceanography, or a related field from a university with at least the equivalent of regional accreditation in the US system at the time of the appointment. Evidence of potential for successful university-level teaching and externally funded research related to limnology or oceanography is also required. A complete position description and the required online application is available at <https://employment.umn.edu/applicants/central/quickFind-107362>

Complete applications will be reviewed starting the first week of January 2013 and will be accepted until the positions are filled.

The University of Minnesota is an equal opportunity educator and employer.

Senior Scientist/Engineer Position.

ASTRA LLC is a growing business in Boulder, CO. We are recognized worldwide for creative solutions in fundamental space research, and technology development. Our mission is to develop and exploit innovative concepts for industry and government by combining fundamental research, scientific expertise, and technology. ASTRA has a reputation for over-delivering to our customers.

Our existing research and engineering projects include modeling of the upper atmosphere, development and deployment of ground-based and space-based instruments for upper atmosphere/space weather applications, Cubesats, and Lidar applications.

There is now an opportunity to grow other divisions within the company. Candidates with a background in theory, modeling, instrument development or technology applications are invited to submit their resume, with a list of three professional references. ASTRA provides a dynamic team environment, and we envisage growing our team in the areas of solar, magnetosphere, and ionosphere-thermosphere science and applications. However, we welcome candidates with research interests in other areas (e.g. oceanography, seismology, lidar, radar). The ideal candidate must demonstrate a strong record of externally funded research, publications, and professional leadership. Successful candidates are expected to build a strong program of funded research.

ASTRA recognizes and rewards superior performance. We offer a competitive benefits package, which includes profit sharing, 401K, and medical insurance. Salary will depend on experience and qualifications. ASTRA is an equal opportunity employer with a diverse workforce.

Please send resumes to Dr. Geoff Crowley at gcrowley@astraspace.net

Spatial Ecologist.

The School of Earth, Environment and Society at Bowling Green State University invites applications for a tenure-track Assistant Professor in Spatial Ecology beginning August, 2013. The school is comprised of the Departments of Geography, Geology, and Environment and Sustainability. This position is closely aligned with the Department of Environment and Sustainability. We are seeking a person with research experience and teaching interests that are focused on the application of GIS techniques and remote sensing to the fields of ecology and conservation.

Applicants must be committed to teaching undergraduate and graduate courses related to geospatial technologies in ecology, sustainable ecosystems, and/or field-based ecology. Successful candidates are expected to develop a productive, externally funded research program. The School is committed to interdisciplinary research and opportunities exist for collaborations across the College. Salary for the position is competitive and commensurate with peer institutions and in keeping with candidate experience and credentials. Extensive facilities to support research and teaching in GIS/Remote Sensing can be found at <http://www.bgsu.edu/departments/sees/>.

Applicants must have a Ph.D. from an accredited university by time of appointment, at least one degree in ecology, and a record of scholarship. Candidates should send a single PDF file with the following: a letter of application, curriculum vitae, statements of research and teaching interests, and the names of three references to Dr. Enrique Gomezdelcampo, Chair, SEES-DES Faculty Search Committee, School of Earth, Environment and Society, Bowling Green State University, Bowling Green, OH 43403 or egomezd@bgsu.edu. Finalists must provide an official transcript for the highest degree. A background check is required for employment. Applications must be received by January 15, 2013. BGSU is an AA/EO institution.

Tenure Track Position in Engineering Seismology.

The Center for Earthquake Research and Information (CERI) and the Department of Civil Engineering (CE) at the University of Memphis invite nominations and applications for a tenure track position at the Assistant Professor level to begin August 2013. We seek a colleague to complement existing expertise in seismology, earthquake hazards, earthquake engineering, and structural engineering at both CERI and CE. Desired areas of research interest for this position include, but are not limited to, strong ground motion analysis, source characterization, wave propagation, site response characterization, and loss estimation. Applicants must have a strong engineering background, at least at the Bachelor's level, and a Ph.D. in engineering, geophysics, or closely related field, at the time of employment and show a demonstrated record of research productivity or strong promise in research. The successful candidate is expected to build a strong, externally funded research program, mentor M.S. and Ph.D. graduate students, and teach undergraduate and graduate courses in her or his specialty. The academic home for the successful candidate will be with the Department of Civil Engineering (<http://www.memphis.edu/ce>). CERI is a Tennessee Center of Excellence, and CERI faculty members are engaged in a variety of regional, national, and international research projects in geodesy, geology, geophysics, and earthquake hazards (<http://www.ceri.memphis.edu>).

Applicants should submit a complete curriculum vita, a letter expressing their research and teaching interests, and the names and contact information (phone numbers and email) of at least three references using the University of Memphis workForum online application system (<http://workforum.memphis.edu>). Screening of all applications will begin on January 1, 2013. The University of Memphis, a Tennessee Board of Regents Institution, is an Equal Opportunity/Affirmative Action Employer. Appointment will be based on qualifications as

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Announcement of Opportunity for Synthesis Activities in Earth System Science

The John Wesley Powell Center for Earth System Science Analysis and Synthesis fosters innovative thinking in Earth system science through collaborative synthesis activities. This mission is driven by the growing recognition that synthesis is critical to solving complex problems facing Society. We invite interdisciplinary Working Groups comprised of USGS researchers and their national and international colleagues in academia and government to submit proposals. Working Groups collaborate to promote understanding through analysis of existing data and information. Groups that submit successful proposals will receive computing and data management support, funding for a Fellow, opportunities for meetings in Fort Collins, CO, and between-meeting collaborative tools. Proposals are invited for projects that will begin on or after October 1, 2013.

Proposal Deadline: April 30, 2013

Some proposals may be jointly funded by USGS and NSF/GEO/EAR. Potential USGS/EAR proposals should follow Powell submission guidelines and will be processed through the Powell Center Science Advisory Board review process. Instructions for proposal preparation and submission are available at: <http://powellcenter.usgs.gov>.



The University of Texas at Dallas
Department of Physics and
the W. B. Hanson Center for Space Sciences

TENURE-TRACK FACULTY POSITION IN ATMOSPHERIC AND SPACE SCIENCES

The University of Texas at Dallas invites applications for a tenure-track faculty position in Atmospheric and Space Sciences in the Department of Physics and the W. B. Hanson Center for Space Sciences. A strong space-based and ground-based observational program in the ionosphere and thermosphere presently enables a robust research program in space sciences. We seek to expand the program capabilities with the addition of expertise in computational modeling, solar physics and solar wind-magnetosphere interactions. The successful candidate should have a PhD in space sciences or physics with an emerging record of research accomplishment and a strong commitment to teaching, at both the undergraduate and advanced graduate level. Interest and/or experience in instrument development is a plus. Appointment will be made at the assistant or associate professor level, appropriate to the experience of the candidate.

The University of Texas at Dallas, located just north of Dallas in Richardson, Texas now has an enrollment of nearly 20,000 students. It has been designated by the State of Texas as one of seven emerging universities to be encouraged to become major research campuses.

Questions can be addressed to the chair of the search committee, Phil Anderson at Phillip.Anderson1@utdallas.edu or 972-883-2975.

Evaluation of applications will begin immediately. Indication of gender and ethnicity for affirmative action statistical purposes is requested as part of the application.

Applicants should submit their current curriculum vitae with a complete publication record, a detailed research plan, a teaching plan, and five reference letters via the ONLINE APPLICATION FORM available at <http://go.utdallas.edu/pnj121102>

The University of Texas at Dallas is an Equal Opportunity / Affirmative Action Employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, disability, age, citizenship status, Vietnam era or special disabled veteran's status, or sexual orientation.



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

PhD Position Thermal Processes in Urban Aquifers

The Chair of Engineering Geology at ETH Zurich invites applications for a PhD position in the area of thermal processes in urban soil, rock and groundwater. The successful candidate must have an MSc in earth sciences, environmental engineering, or a related field.

This position is part of a collaborative project with the Karlsruhe Institute of Technology, Germany, on subsurface urban heat islands. We are funded by the Swiss National Science foundation (SNF) and the German Research Foundation (DFG). The duration of the position is approximately 3 years and can be filled by the successful candidate in the beginning of 2013.

The goal of this research project is to improve our understanding of thermal transport processes, heat flux and storage beneath cities. Urban environments commonly represent areas with their own microclimates and increased temperatures. Little is known about this "urban heat island" phenomenon in the subsurface. The governing processes and long-term consequences for elevated temperatures remain enigmatic. By studying cities such as Zurich, we will explore the long term evolution of subsurface urban heat islands at multiple scales. Coupled flow and heat transport models will be used for this. The work will also involve considerable data mining and benefit from continued field measurements, as well as temperature monitoring at selected locations.

The ideal candidate should have knowledge in quantitative hydrogeological or geophysical methods. She/he should be a team player, have good communication skills and take on responsibility in an international research team. Detailed information about the Chair of Engineering Geology is available on the web: www.engineering-geology.ethz.ch. For further information regarding the advertised position please contact Dr. Peter Bayer, Department of Earth Sciences, ETH Zurich (email: bayer@erdw.ethz.ch).

Complete applications should be sent by regular mail or email to Dr. Peter Bayer, Engineering Geology, ETH Zürich, Sonneggstrasse 5, 8092 Zurich, Switzerland, and must include the following, ideally in one pdf-file: 1) A short cover letter where you outline your motivation; 2) Curriculum vitae which describes your complete personal details and career history; 3) Complete course grades and transcripts; 4) Contact details of two referees or written reference letters. We will start with the invitation of potential candidates in December 2012 and plan to fill the position in January. However, later applications may also be considered until this position is filled.

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they relate to position requirements without regard to race, color, national origin, religion, sex, age, disability, or veteran status.

TENURE-TRACK FACULTY SEARCHES IN SCIENCE & MATHEMATICS EDUCATION in the School of Natural Sciences and Mathematics (SNSM) College of Arts and Sciences, University of South Florida, Tampa, FL 33620.

SNSM at USF invites applications for four tenure-track faculty positions in discipline-specific education research to expand and synergistically strengthen ongoing efforts in the School's Science Education research cluster. Current research areas include assessment of student learning and attitudes, evaluation of large-scale curricular change, psychometrics, investigation of problem-solving and metacognition, quantitative literacy and research-based curriculum design and

implementation. Each of these faculty positions will have a tenure home in one of six constituent departments in SNSM including Cell Biology, Microbiology & Molecular Biology; Chemistry; Geology; Integrative Biology; Mathematics and Physics. Joint appointments with two departments will be considered for applicants with interdisciplinary expertise. These positions are at the Assistant Professor level, but an Associate Professor appointment may be considered commensurate with qualifications and experience, and based on the availability of funding. Applicants will be expected to develop a vigorous, externally funded research program in the area of science education research.

The School of Natural Sciences and Mathematics has 120 full-time faculty members with external research funding of \$47M. Further information regarding SNSM is available at <http://sciences.cas.usf.edu>. The University of South Florida is a high-impact, global research university dedicated to student success. USF ranks 50th in the nation for federal expenditures in research and total expenditures in research among all U.S. universities, public

or private, according to the National Science Foundation. Serving more than 47,000 students, the USF System has an annual budget of \$1.5 billion and an annual economic impact of \$3.7 billion. USF is a member of the Big East Athletic Conference.

Application information: Applicants should use the Online Application Link given below to submit their letter of application, curriculum vita and publication record, a completed teaching and research questionnaire (found at: <http://sciences.cas.usf.edu/careers/>) The application letter should describe the relevance of the proposed research and teaching plan to national efforts in science education and indicate the desired departmental affiliation/affiliations for tenure. All applications completed by January 4, 2013 will be given full consideration, although the search will continue until the positions are filled. The applicants should also arrange to have at least three letters of recommendation sent to:

Charles Connor, Interim Associate Dean
Office of Research and Scholarship
College of Arts and Sciences
4202 E. Fowler Avenue, CIS1040
Tampa, FL 33620
Online Application Link: <https://employment.usf.edu/applicants/Central?quickFind=60540>

The University of South Florida is committed to the principle of equal education and employment opportunities without regard to race, color, marital status, sex, religion, national origin, disability, age, sexual orientation, gender identity or expression, genetic information, Vietnam or disabled veterans status as provided by law and in accordance with the University's respect for personal dignity. These principles are applied in the conduct of University programs and activities and the provision of facilities and services.

TENURE-TRACK FACULTY SEARCHES in the School of Natural Sciences and Mathematics (SNSM) College of Arts and Sciences, University of South Florida, Tampa, FL 33620.

SNSM at USF invites applications for six tenure-track faculty positions in the application of theory/computational science and/or mathematical/statistical modeling to biomedical sciences, global change sciences or materials science. These positions are directed at the enhancement of interdisciplinary research and teaching in ongoing School research clusters. Specifically, the positions will simultaneously strengthen the Computational Theory and Practices research cluster in SNSM, and provide interdisciplinary expansion of three additional research clusters in the areas of Biomedical Sciences, Global Change Sciences and Materials Science. Each of these faculty positions will have a tenure home in one or more of six constituent departments in SNSM including Cell Biology, Microbiology & Molecular Biology; Chemistry; Geology; Integrative Biology; Mathematics; and Physics. These positions are at the Assistant Professor level, but an Associate Professor appointment may be considered commensurate with qualifications and experience, and based on the availability of funding. Applicants will be expected to develop a vigorous, externally funded research program in one or more of the research cluster areas. It is anticipated that these interdisciplinary hires will leverage shared infrastructure and interactions in SNSM research clusters with existing computational and experimental research efforts, illustrative examples of which include but are not limited to:

Biomedical Sciences: Biomechanics, biotechnology, drug discovery and delivery, functional genomics, imaging science (including biomedical imaging), mathematical physics, metabolomics, numerical analysis, proteomics, statistical modeling of large data sets, structural and computational biology, systems biology;

Global Change Sciences: Biogeochemistry, coastal science, conservation biology, disease biology, environmental detection and monitoring, evolutionary biology, freshwater biology and pollution, global change biology, hydrogeology, invasive species, laser science, marine biology, numerical analysis, natural hazards, statistical modeling of large data sets;

Materials Science: Biomaterials, energy-related materials, magnetic materials, mathematical physics, metal-organic materials, nanomaterials, numerical analysis, photonic materials, polymers/soft condensed matter, structural crystallography, theory and simulations of materials.

Further information regarding these efforts is available on the SNSM departmental websites at <http://biology.usf.edu/cmmb>; <http://biology.usf.edu/ib>; <http://chemistry.usf.edu> ; <http://geology.usf.edu>; <http://math.usf.edu>; and <http://physics.usf.edu>.

The School of Natural Sciences and Mathematics has 120 full-time faculty members with external research funding of \$47M. Further information regarding SNSM is available at <http://sciences.cas.usf.edu>. The University of South Florida is a high-impact, global research university dedicated to student success. USF ranks 50th in the nation for federal expenditures in research and total expenditures in research among all U.S. universities, public or private, according to the National Science Foundation. Serving more than 47,000 students, the USF System has an annual budget of \$1.5 billion and an annual economic impact of \$3.7 billion. USF is a member of the Big East Athletic Conference.

Application information: Applicants should use the Online Application Link given below to submit their letter of application, curriculum vita and publication record, a completed teaching and research questionnaire (found at: <http://sciences.cas.usf.edu/careers/>The application letter should describe the relevance of the proposed research and teaching plan to existing SNSM research clusters and indicate the desired departmental affiliation/affiliations for tenure. All applications completed by January 4, 2013 will be given full consideration, although the search will continue until the positions are filled. The applicants should also arrange to have at least three letters of recommendation sent to:

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College of Arts and Sciences
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Online Application Link: <https://employment.usf.edu/applicants/Central?quickFind=60541>

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The Joseph P Obering Postdoctoral Fellowship. The Department of Earth Sciences at Dartmouth College seeks outstanding candidates for the Joseph P. Obering Postdoctoral Fellowship in Earth Sciences. This competitive fellowship provides two years of full-time salary and a research allowance, with a third year contingent upon performance and funding. In concert with Dartmouth's philosophy that scholarship and teaching are inseparable facets of academic life, this fellowship provides recent Ph.D. recipients the opportunity to pursue independent research as well as to develop a teaching portfolio. Candidates will be expected to collaborate with one or more Dartmouth Earth Sciences faculty members, taking advantage of existing resources and facilities, and will teach one course (under the quarter system) per year. The starting date is negotiable, but could be as early as July 1, 2013. Details about Dartmouth Earth Sciences may be found at www.dartmouth.edu/~earthsci.

Candidates should submit a CV, statements of research and teaching interests, and selected preprints/reprints by January 8, 2013. Applications should be sent to: Obering Postdoctoral Fellowship Committee, Department of Earth Sciences, Dartmouth College, 6105 Fairchild Hall, Hanover, NH 03755. In addition, applicants should arrange for three letters of recommendation to be sent directly

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VACANCY: Director, Climate Program Office

NOAA is looking for an innovative leader to serve as the Director for our Climate Program Office (CPO). Highly qualified candidates will have a combination of strong scientific credentials, experience leading large scientific programs, and a proven ability to collaborate with diverse climate stakeholders.

The CPO Director is responsible for the development of climate science, services, and information products for national, regional, and local users both within and external to NOAA. The Director allocates and controls annually appropriated funds in order to maintain high quality activities to meet society's climate information needs. In addition, the Director leads the development of strategy for NOAA's Climate Goal, serving as a spokesperson for NOAA in discussions leading to the identification of significant climate research projects and operational objectives. As NOAA's principal representative to the U.S. Global Change Research Program, the CPO Director also works closely with other agency leaders to coordinate climate research across the federal government.

This position, located in Silver Spring, MD, reports to the Deputy Assistant Administrator for Programs and Administration in NOAA's Office of Oceanic and Atmospheric Research.

This position is offered through USAJOBS as either a Permanent Federal position at the Senior Executive Service level (www.usajobs.gov/GetJob/ViewDetails/329856500) or as a two-year Intergovernmental Personnel Act (IPA) assignment with the possibility to extend for an additional two years (www.usajobs.gov/GetJob/ViewDetails/329857500). Additional information on IPA assignments is available on the Office of Personnel Management website (www.opm.gov/programs/ipa/assignf.asp).

The job announcement is open through December 28, 2012.

Direct questions about this position to:

Tim Ash (Timothy.K.Ash@noaa.gov, 301-713-6304).

USAJOBS job announcement numbers: OAR-AA-2013-0001 and OAR-AA-2013-0002

NOAA: A career that makes a world of difference!

Department of Geosciences
PRINCETON UNIVERSITY



HARRY HESS FELLOWS PROGRAM

The Department of Geosciences at Princeton University announces competition for the **2013-2014 Harry Hess Fellows Program**. This honorific postdoctoral fellowship program provides opportunities for outstanding geoscientists to work in the field of their choice. Research may be carried out independently or in collaboration with members of the Geosciences Department. One or more Hess Fellows may be appointed. Applicants must have obtained a Ph.D. at the time of the start of the fellowship, but not more than five years before. Current areas of research include:

- Biogeochemical Cycles
 - Environmental Chemistry
 - Geochemistry
 - Geodynamics
 - Geomicrobiology
 - Mineral Physics
 - Oceanography
- Paleoclimatology
 - Paleontology
 - Petrology
 - Seismology
 - Tectonics
 - Atmospheric Science
 - Planetary Science

Applications are due before February 1st, 2013, but will continue to be accepted until the available positions are filled. Evaluation of applications and interviews of candidates will begin immediately. Applicants should include a cover letter, a curriculum vitae including a publication list, a 1-2 page statement of research interests and goals, and name, address and email address of three referees familiar with their work by applying on the Princeton University jobsite at <https://jobs.princeton.edu>. Hess Fellowships provide a competitive annual salary, depending upon experience, along with a significant allowance for travel to meetings and for research support. Initial awards are for one year, with the possibility of renewal for additional years depending upon satisfactory performance and available funding. A preferred starting date is before September 1st, 2013. Applicants for the Hess Fellowship will also be considered for other available postdoctoral positions in the Geosciences Department.

Princeton University is an equal opportunity employer and complies with applicable Equal Employment Opportunity (EEO) and affirmative action regulations. For information about applying to Princeton and voluntarily self-identifying, please link to http://www.princeton.edu/dof/about_us/dof_job_openings/.

Information about the research activities of the Department of Geosciences may be viewed at <http://geoweb.princeton.edu>.



INSTITUTE FOR GEOPHYSICS
JACKSON SCHOOL OF GEOSCIENCES

RESEARCH ASSOCIATE POSITIONS

The University of Texas Institute for Geophysics (UTIG), which is part of the Jackson School of Geosciences, invites applications for several full-time, entry-level research positions (Research Associate). Successful candidates will be expected to develop an externally funded research program and a leadership role within their chosen field.

While all applicants with expertise allied with the research goals of UTIG will be considered, we are especially interested in applicants in the fields of:

Ice Sheet Dynamics — exploiting observational datasets to create three-dimensional, dynamic, predictive models, including those that examine lithosphere-ice, ocean-ice, and atmosphere-ice interactions.

Planetary Geophysics — utilizing existing planetary datasets, and organizing space-borne and surface-deployed geophysical experiments in future mission proposals.

Geofluids Research --- investigating geofluids in environments that can range from the deep crust to the atmosphere, using theoretical or experimental methods and/or field applications.

Coastal Processes — understanding the dynamics of coastal water column, seafloor and subsurface, utilizing either observations or numerical modeling.

Review of applicants will begin February 8, 2013, with expected starting dates on or after September 1, 2013. Following an initial year of full research support, Research Associates at UTIG currently receive 6 months of salary support annually, and are expected to raise the rest of their annual salary through externally funded projects. An application should include a cover letter, CV, list of publications, names of at least three references, and a statement of research interests. Application package should be submitted via <http://utdirect.utexas.edu/pnjobs/index.WBX>. Applications should use posting number 12-11-28-01-0708. More information on the hires can be found at <http://www.ig.utexas.edu/jobs/research.htm>.

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to the above address. Dartmouth College is an EO/AA Employer.

Two Remote Sensing of Global Croplands Scientist Positions plus a PhD student position: for NASA MEaSUREs Project: There are 2 remote sensing scientist positions based in Flagstaff Arizona to work on NASA Making Earth System Data Records for Use in Research Environments (MEaSUREs) funded (a 3.5 million dollar, 5 year) U.S. Geological Survey (USGS) led proposal on Global Cropland Area Database (GCAD30). First position for a period of 5 years at Research Scientist level with a starting salary of 69k and second position for a period of 4 years at post doctoral (or in exceptional cases Master's with substantial experience) with a starting salary of 62K. There will also be a PhD position affiliated to Northern Arizona University. The positions start from January 2013 (but no later than March 1, 2013). Full details of the positions are at: <https://powellcenter.usgs.gov/globalcroplandwater/> Please send all applications and/or inquiries to Dr. Prasad Thenkabail (pthenkabail@usgs.gov; thenkabail@gmail.com).

WESTERN MICHIGAN UNIVERSITY College of Arts and Sciences, Department of Geosciences Seeks Candidates for TENURE TRACK APPOINTMENT, PETROLOGY AND MINERALOGY. We seek a dynamic individual capable of teaching undergraduate courses in petrology/petrography, mineralogy, and general introductory geology. The ideal candidate will have some teaching experience in these areas. He/she will also be expected to demonstrate a successful record of research and research funding, and a capacity to contribute to our research mission and graduate programs. He/she will be expected to offer at least one graduate course in his/her area of expertise. Experience in the areas of igneous petrology, metamorphic petrology, or economic geology is desirable. A PhD at the time of employment is required. Western Michigan University (WMU), located in Southwest Michigan, is a vibrant, nationally recognized student-centered research institution with an enrollment of nearly 25,000. WMU delivers high-quality undergraduate instruction, has a strong graduate division, and fosters significant research activities. The Carnegie Foundation for the Advancement of Teaching has placed WMU among the 76 public institutions in the nation designated as research universities with high research activities. Our faculty is focused on delivering high-quality undergraduate and graduate instruction while fostering significant research activities. The Department of Geosciences is home to the Michigan Geological Survey and the Michigan Geological Repository for Research and Education. The candidate will be encouraged to participate in the

economic geology effort of the Survey, particularly as it relates to ore deposits. The department presently has 11 faculty members with active research programs spanning geochemistry, geophysics, hydrogeology, glacial geomorphology, geoscience education, petroleum geology, environmental geology, sedimentary systems, remote sensing, tectonics, and basin analysis. Salary is competitive and commensurate with qualifications and experience, with an excellent benefits package. The appointment will begin in August 2013. Applicants should submit online a cover letter, curriculum vitae, statement of teaching philosophy and interests, statement of research interests and goals. Email three letters of professional references to Dr. Mohamed Sultan, mohamed.sultan@wmich.edu. Review of applications will begin 1/7/13 and will continue until position is filled. Please visit www.wmich.edu/hr/careers-at-wmu.htm for detailed information and application procedures. Western Michigan University is an affirmative action/equal opportunity employer consistent with applicable federal and state law. All qualified applicants are encouraged to apply.

Student Opportunities

Graduate Fellowships and Assistantships: University of Illinois at Urbana-Champaign. Earn your graduate Geoscience degree at one of the nation's top public research universities, the flagship campus of the University of Illinois. Several fellowships and assistantships are available for students wishing to pursue Ph.D. or M.S. degrees beginning Fall, 2013. Students with interests in geodynamics, igneous geochemistry, geomorphology, geophysics, geomicrobiology, geomorphology, hydrogeology, and sedimentology are particularly encouraged to apply. Applications are due Jan. 15; for more information, visit <http://www.geology.illinois.edu>.

PhD opportunity in modeling forest disturbances. Funding is available for a student to study forest responses and vulnerability to future climate change and natural disturbances, emphasizing bark beetle outbreaks. Project goals include incorporating a predictive model of mountain pine beetle outbreaks into the Community Land Model and assessing effects of future climate change. Interested applicants should apply to Geography or Environmental Science. Contact Dr. Jeffrey Hicke for more information (jhicke@uidaho.edu; www.uidaho.edu/~jhicke/modeling_grad_ad.pdf).

PhD positions in Hydrology, Water Resources, Environmental Fate and Transport, and Atmospheric Chemistry. The Department of Chemical, Biochemical and Environmental Engineering at the University of Maryland, Baltimore County (UMBC) seeks PhD students to work on a variety of research projects. Students with backgrounds in chemistry, physics,

engineering, and Earth sciences are encouraged to apply. For more information on specific opportunities, visit <http://www.umbc.edu/cbe/> or contact Dr. Claire Welty (weltyc@umbc.edu).

Postdoctoral Fellowships. The Geophysical Laboratory, Carnegie Institution of Washington, invites applications for postdoctoral fellowships. The Geophysical Laboratory emphasizes interdisciplinary experimental and theoretical research in fields spanning geoscience, microbiology, chemistry, and physics. The Laboratory supports world-class facilities in high-pressure research; organic, stable isotope and biogeochemistry; mineral physics and petrology; and astrobiology. Please visit http://www.glcw.edu/employment/Postdoctoral_Positions to view a list of required materials and application instructions. Also, see <http://www.glcw.edu/> for a listing of personnel, current research interests, and major facilities. Completed applications for Carnegie fellowships should be submitted by January 15, 2013. The Geophysical Laboratory is an equal opportunity employer.

SUMMER 2013 RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU) at MIT HAYSTACK OBSERVATORY. Undergraduate science, mathematics, engineering, and computer science students are invited to apply for summer research positions at the MIT Haystack Observatory in Westford, MA. The program extends from June 3 to August 9, 2013 and carries a weekly stipend of \$500.00. Women, minorities and students with disabilities are encouraged to apply. See <http://www.haystack.mit.edu/edu/reu/> for detailed program/project information. Application deadline is 1 February 2013

Texas, College Station. Dr. Daniel W. Goldberg in the Department of Geography, at Texas A&M University (TAMU) invites applications for a Ph.D. Research Assistant position to begin in the fall of 2013. Qualified candidates should have a Masters degree in Geography, Computer Science, or a related discipline and expertise in geographic information systems (GIS); desktop, server, web, and mobile programming; and CyberGIS and very large spatial and spatiotemporal databases. Research assistant activities will include the development and evaluation of algorithms; the implementation, testing, and support of prototype and enterprise systems; and spatiotemporal analysis and modeling. Tasks will include software development; spatiotemporal data management and analysis; and the presentation and publication of research results. Experience with modern programming languages (Net, Python, R, C++, etc.), GIS software, and server-based systems is required. Preference will be given to applicants with strong programming backgrounds and excellent communication skills. Graduate funding is available for three years for highly qualified candidates. This includes a

stipend and 9 credit hours of tuition each semester. Review of applications will begin January 15, 2013, and will continue until a suitable candidate is identified. Applicants must apply and be accepted to the graduate program in Geography at TAMU to be considered for this position (<http://jakethenextstep.tamu.edu/geography/you-see-the-world>). Candidates should also submit (a) a cover letter that specifically addresses the job requirements, outlines qualifications, and highlights research interests and skill sets; (b) a resume/CV; and (c) two letters of recommendation to Dr. Daniel W. Goldberg, Department of Geography, Mailstop TAMU 3147, Texas A&M University, College Station, TX 77843-3147 (daniel.goldberg@tamu.edu). Texas A&M University is committed to employment equity. All qualified candidates are encouraged to apply.

Texas, College Station. Dr. Michael P. Bishop in the Department of Geography, at Texas A&M University (TAMU) invites applications for a Ph.D. Research Assistant position to begin in the fall of 2013. Qualified candidates should have a Masters degree in an Earth science related discipline and expertise in remote sensing, geographic information systems, and computer programming. Research assistant activities will include spatial analysis and modeling, geomorphometry and landform mapping, and alpine glacier assessment and mapping. This includes software development, data analysis, and presentation and publication of research results. Experience with C++ and remote sensing/GIS software is required. Preference will be given to applicants with computer programming and excellent communication skills. Graduate funding is available for three years for highly qualified candidates. This includes a stipend and 9 credit hours of tuition each semester. Review of applications will begin January 15, 2013, and will continue until a suitable candidate is identified. Applicants must apply and be accepted to the graduate program in Geography at TAMU to be considered for this position (<http://takethenextstep.tamu.edu/geography/you-see-the-world>). Candidates should also submit an application letter highlighting research interests and skill sets, resume, and two letters of recommendation to Dr. Michael P. Bishop, Department of Geography, Mailstop TAMU 3147, Texas A&M University, College Station, TX 77843-3147 (Michael.Bishop@tamu.edu). Texas A&M University is committed to employment equity. All qualified candidates are encouraged to apply.

University of Florida Water Institute Interdisciplinary PhD Fellowships. Impacts of Sea Level Change on Coastal Aquifers, Water Resources, and Ecosystems. This program will provide 4 years of support for PhD Fellows to work collaboratively addressing issues related to sea level changes including: ecology, geochemistry, aquifer dynamics, potable water supplies or other topics related to students' interests Link: <http://waterinstitute.ufl.edu/WIGF/>

RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

A probabilistic method of predicting landslides

Heavy rainfall events can lead to devastating landslides, but predicting when rainfall will cause a landslide is challenging. Most current landslide prediction methods consider past rainfall events that resulted in landslides, and then use that as input to provide a deterministic rainfall threshold for a landslide to occur. These methods simply predict either a landslide or no landslide for given rainfall conditions. In a new study, *Berti et al.* developed a probabilistic approach that returns a probability, from 0 to 1, of a landslide occurring for a given rainfall amount. They tested their approach on historical rainfall and landslide data from the Emilia-Romagna Region of Italy. They found that landslide occurrence was strongly related to duration, intensity, and total rainfall in a given event. The distribution of landslide probability showed a sharp increase at specific duration and intensity values, indicating a threshold where landslides become significantly more likely. However, antecedent rainfall, which had been thought to be an important factor in triggering landslides, was actually less important than the current rainfall event characteristics. The new probabilistic method could

help significantly improve landslide forecasting. (*Journal of Geophysical Research-Earth Surface*, doi:10.1029/2012JF002367, 2012) —EB

Simple formulas calculate cloud droplet concentration

Droplets in clouds form on atmospheric aerosols known as cloud condensational nuclei. More than 90% of cloud droplets nucleate within a few tens of meters above the base of clouds, where the air is supersaturated. The microphysical processes of drop formation within this thin layer above the cloud base determine the structure of the entire cloud, which can be 10–14 kilometers deep. Cloud structure in turn determines the cloud's effects on local and global weather and climate, so the accurate representation of droplet nucleation processes is important for modeling atmospheric processes on scales from single clouds to global scales. However, even with advanced supercomputers, cloud models cannot simulate the small-scale processes in the thin layer above the cloud base, so analytical solutions are needed. Under most circumstances, the concentrations of water droplets near the base of clouds are determined by just two factors: the magnitude of supersaturation and the properties of aerosols. *Pinsky et al.* performed an analytical investigation and developed simple formulas that make it possible to calculate the maximum degree of supersaturation and the cloud droplet concentration near the cloud base. They show that their formulas are universal and can be used for any type of aerosol, including both natural and anthropogenic aerosols, and for different thermodynamical conditions. These simple formulas could find wide applications in cloud modeling for local and global climate models, as well as for interpretation of experimental data obtained in situ in clouds. (*Journal of Geophysical Research-Atmospheres*, doi:10.1029/2012JD017753, 2012) —EB

Comparing secondary organic aerosol formation in two U.S. cities

Secondary organic aerosols (SOAs) form from the oxidation of volatile organic compounds (VOCs) in the atmosphere, and the composition and abundance of SOAs determine their effects on air quality, human health, and the planetary radiation budget. To investigate how the production of SOAs varies with location, *Zhang et al.* conducted a parallel set of experiments in Los Angeles, Calif., and Atlanta, Ga. Both cities see a large amount of volatile organic compounds thrown into the air because of anthropogenic emissions, largely stemming from vehicles. Atlanta, unlike Los Angeles, also sees a large amount of biogenic emissions from vegetation in the region. To understand how shifts in environmental conditions and the sources of VOCs can affect the resultant SOAs, the authors measured how water-soluble organic compounds partition between gas and particle phases in both Los Angeles and Atlanta. This partitioning reflects the prevalence of the various reaction mechanisms that turn volatile organics into secondary organic compounds. The authors found that in Los Angeles the overall abundance of secondary organics peaked during the day and fell during the night. In Atlanta, however, this diurnal shift was much more muted. By analyzing the gas/aerosol partitioning of nitrate, the authors estimated the effect of changing humidity on the partitioning of volatile organics. They found that in Atlanta, the particulate partition tracked changes in relative humidity, while in Los Angeles there was no such connection. They suggest that the differing sources of VOCs, with Los Angeles being primarily anthropogenic emissions and Atlanta being a mix of anthropogenic and biogenic, lead to the differing SOA daily cycles and partitioning mechanisms. (*Journal of Geophysical Research-Atmospheres*, doi:10.1029/2012JD017908, 2012) —CS

La Niña Caused Global Sea Level Drop

The 2011 La Niña was so strong that it caused global mean sea level to drop by 5 millimeters, a new study shows. Since the early 1990s, sea level has been rising by about 3 millimeters per year, satellite data show. But between the beginning of 2010 and the middle of 2011, sea level fell by 5 millimeters. This occurred concurrently with the La Niña phase of the El Niño–Southern Oscillation (ENSO). ENSO involves a shift in ocean surface temperatures in the tropical Pacific and changes in precipitation patterns around the world. Previous studies have shown that strong El Niño events can increase sea level temporarily. Using data from the Gravity Recovery and Climate Experiment (GRACE) satellite, which measures ocean mass, as well as

ocean temperature data from floating sensors and rainfall data, *Boening et al.* show that the change in sea level during the La Niña was due to water mass temporarily shifting from oceans to land as precipitation increased over Australia, northern South America, and Southeast Asia, while it decreased over the oceans. Rising sea level is already affecting populations near coasts, and most climate models predict that sea level will generally continue to rise as the Earth's climate warms. But sea level exhibits significant interannual variability, and it is important to be able to distinguish natural variability, such as changes due to ENSO, from changes caused by anthropogenic global warming. (*Geophysical Research Letters*, doi:10.1029/2012GL053055, 2012) —EB —ERNIE BALCERAK, Staff Writer, and COLIN SCHULTZ, Writer



The Scascoli rock fall in the Northern Apennines, Italy.