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## Rising Sea Level May Cause Decline of Fringing Coral Reefs

Coral reefs are major marine ecosystems and critical resources for marine diversity and fisheries. These ecosystems are widely recognized to be at risk from a number of stressors, and added to those in the past several decades is climate change due to anthropogenically driven increases in atmospheric concentrations of greenhouse gases. Most threatening to most coral reefs are elevated sea surface temperatures and increased ocean acidity [e.g., *Kleyvas et al.*, 1999; *Hoegh-Guldberg et al.*, 2007], but sea level rise, another consequence of climate change, is also likely to increase sedimentary processes that potentially interfere with photosynthesis, feeding, recruitment, and other key physiological processes (Figure 1). *Anderson et al.* [2010] argue compellingly that potential hazardous impacts to coastlines from 21st-century sea level rise are greatly underestimated, particularly because of the rapid rate of rise. The Intergovernmental Panel on Climate Change estimates that sea level will rise in the coming century (1990–2090) by 2.2–4.4 millimeters per year, when projected with little contribution from melting ice [Meehl et al., 2007]. New studies indicate that rapid melting of land ice could substantially increase the rate of sea level rise [Grinsted et al., 2009; Milne et al., 2009].

If the rate of rise is faster than many reefs can accrete, then coral habitats—specifically, shallow ones near terrestrial sources of sediment (fringing reefs)—may be at risk from enhanced sedimentation and turbidity, both of which are major stressors to coral reefs [Pandolfi et al., 2003; Fabricius, 2005]. The rise of even just 0.2 meter, and likely more, predicted this century has the potential to increase turbidity on many fringing coral reefs through two mechanisms: increased resuspension of fine sediment on reef flats (the inner portion of fringing reefs closer to sediment sources) and increased coastal erosion and advection of fine sediment to adjacent reefs.

### Impact of Sea Level Rise: Resuspension, Deposition, and Coastal Erosion

The fringing coral reef along the south coast of the island of Molokai, Hawaii (Figure 2), is a typical example of a reef under sediment stress [Field et al., 2008]. Erosion in adjacent watersheds and transport of fine-grained terrigenous sediment to the Molokai reef increased during the twentieth century because of a variety of human-induced changes in the watersheds on the south side of the island. The frequent resuspension of

injected terrigenous sediment on the reef is directly related to wind speed and tide-controlled water depth [Ogston and Field, 2010] (Figure 3a).

Careful examination of processes occurring on Molokai's coast may shed light on reef sedimentation happening elsewhere, particularly in light of the fact that both the duration and the intensity (suspended sediment concentration) of resuspension events are projected to increase with even small increases in sea level [Ogston and Field, 2010]. Given even a minimal rise of 0.2 meter in global sea level this century, the effect will be that critical water depths for sediment resuspension will be reached earlier during rising tides and will be maintained longer during a falling tide, resulting in longer and more intense turbidity conditions (Figure 3b).

Thus, wind, wave, and tide conditions at present that typically produce concentrations of suspended sediment assumed to be damaging to corals (roughly 10 milligrams per liter) [Rogers, 1983] will likely generate higher concentrations with higher mean water levels. Such effects can already be seen in Hawaii—suspended sediment concentrations on the middle to outer reef flat on Molokai are now less than 10 milligrams per liter and coral is present, but only minimally. However, periods of time when sediment concentrations are now subcritical (less than 10 milligrams per liter) will likely become, in this century, periods of time when sediment concentration levels are critical (greater than 10 milligrams per liter), thereby increasing the sediment stress to coral colonies.

If higher sea levels lead to diurnal increases in suspended sediment as tides ebb and flow, it follows that there will also be an increase in the amount of sediment temporarily settling on reef organisms each day when wind speed and tide height decrease. Direct sediment fallout on coral affects the feeding and energy partitioning by individual organisms [Fabricius, 2005]. Daily resuspension (and thus redeposition) events during the summer periods of coral spawning have a strong likelihood of constantly depositing sediment on hard surfaces that could serve as sites of new coral growth. This, combined with an increase in water turbidity, which limits light available for underwater photosynthesis, can adversely affect coral community structure and metabolic functions while potentially reducing coral growth and/or fecundity [Fabricius, 2005].

Coastal erosion on Hawaii is chronic at present [Fletcher et al., 2002], and many of the reef-protected shorelines are only thin sandy veneers capping older deposits of alluvium. Other tropical high islands

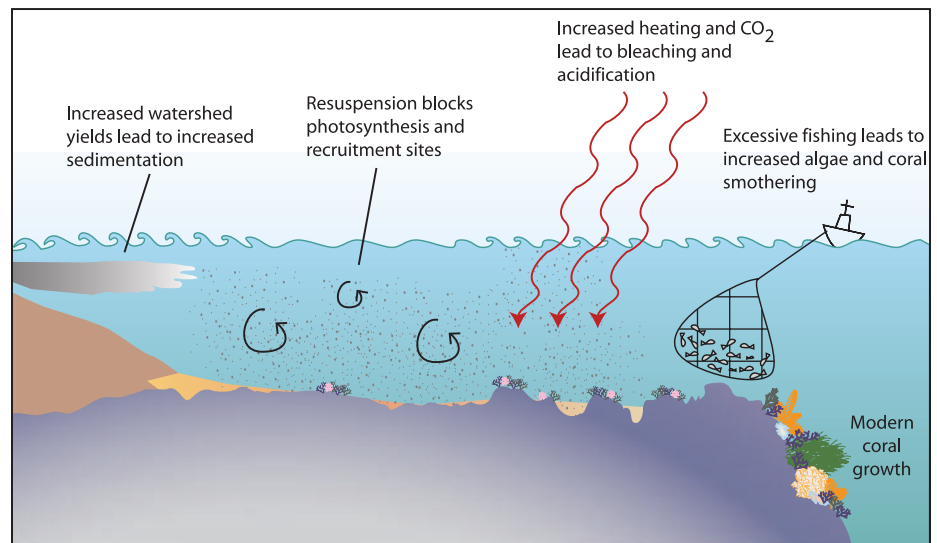


Fig. 1. Diagram of a fringing coral reef showing major anthropogenic stressors that affect the health and sustainability of reef habitats. In particular, resuspension of fine sediment as a function of sea level rise threatens new coral growth sites and existing corals' health.

have comparable settings. An increase of water level over the reef of 0.2–0.4 meter will increase the wave energy reaching the shoreline as less energy is dissipated by breaking waves on the seaward edge of the reef flat, likely resulting in coastal erosion and potentially releasing fine-grained terrigenous particles to adjacent reefs. The sediment released by coastal erosion will add to that being resuspended by waves on the reef flat, thereby compounding the problem for coral communities. Further, the increase in sediment adds to existing stressors such as excessive fishing, which leads to increased algae and smothering of corals.

### Can Coral Reefs Keep Pace With Sea Level Rise?

Coral growth and reef accretion at existing sites may not be sufficient in many areas of the world to keep pace with the rising sea level and its effects. Many corals are rapid growers, extending in length by an average of 2 to more than 30 millimeters per year, seemingly fast enough to keep pace with the 2–4 millimeters per year of estimated sea level rise. However, overall net vertical accretion of reefs is much slower, perhaps by a factor of 10, than the growth of individual coral colonies [Hubbard et al., 2008], and thus even reefs that are vertically accreting will do so at rates below the rate of sea level rise.

Further, reef accretion at present appears to be limited, at least in Hawaii, to a relatively few wave-sheltered areas [Grigg, 1998; Fletcher et al., 2008]. The impacts to coral reefs from ongoing stresses due to climate change, sediment runoff, disease, incursions of alien algae, and overfishing make sustained net reef accretion problematic everywhere [Pandolfi et al., 2003]. Indeed, a modeling study of Caribbean reefs showed that wave forces alone over a reef deepened by sea level rise would lead to a failure of reefs to keep up with that rise [Graus and Macintyre, 1998]. Projected increases in sea surface temperatures, dissolved carbon dioxide, and associated oceanic acidity will likely further stress reefs and inhibit their capability to accrete. Thus, although some reefs have the potential to keep pace with the average accelerated rates of sea level rise projected for this century, sustained vertical reef accretion is unlikely, and many existing reefs will not keep pace.

### Implications for Coral Reef Management

Tropical coral reefs are in decline because of climate change and other



Fig. 2. Photograph of the shoreline of south Molokai, Hawaii, during a spring high tide in May 2007. Waves during monthly high tide maxima routinely undercut trees and structures and erode the thin beaches armoring fine-grained deposits. Tidal conditions such as these serve as excellent proxies for predicted higher than present mean sea levels.

human-induced stresses [Bellwood et al., 2004], and the effect of accelerating sea level rise will be an increased risk from sediment pollution due to enhanced turbidity and coastal erosion. Many researchers have noted that at least 25% of the world's coral reefs are severely degraded and another 50% are at risk in the next half century. Fringing coral reefs in Hawaii, French Polynesia, Puerto Rico, the Marianas, and many other locations are already affected by land-based pollution, overfishing, and/or thermal stress. It is therefore critical to identify those reef areas that are at risk and, where practicable, to reduce the sediment delivery from adjacent watersheds and other local stressors to help mitigate other, more global, stresses.

### Acknowledgments

This research was supported by the U.S. Geological Survey's (USGS) Coastal and Marine Geology Program. C. Birke-land (University of Hawai'i) and J. Lacy (USGS) provided helpful and insightful review comments on an earlier version. S. Cochran and T. Fergoso assisted with the figures.

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BY M. E. FIELD, A. S. OGSTON,  
AND C. D. STORLAZZI



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## Coral Reefs

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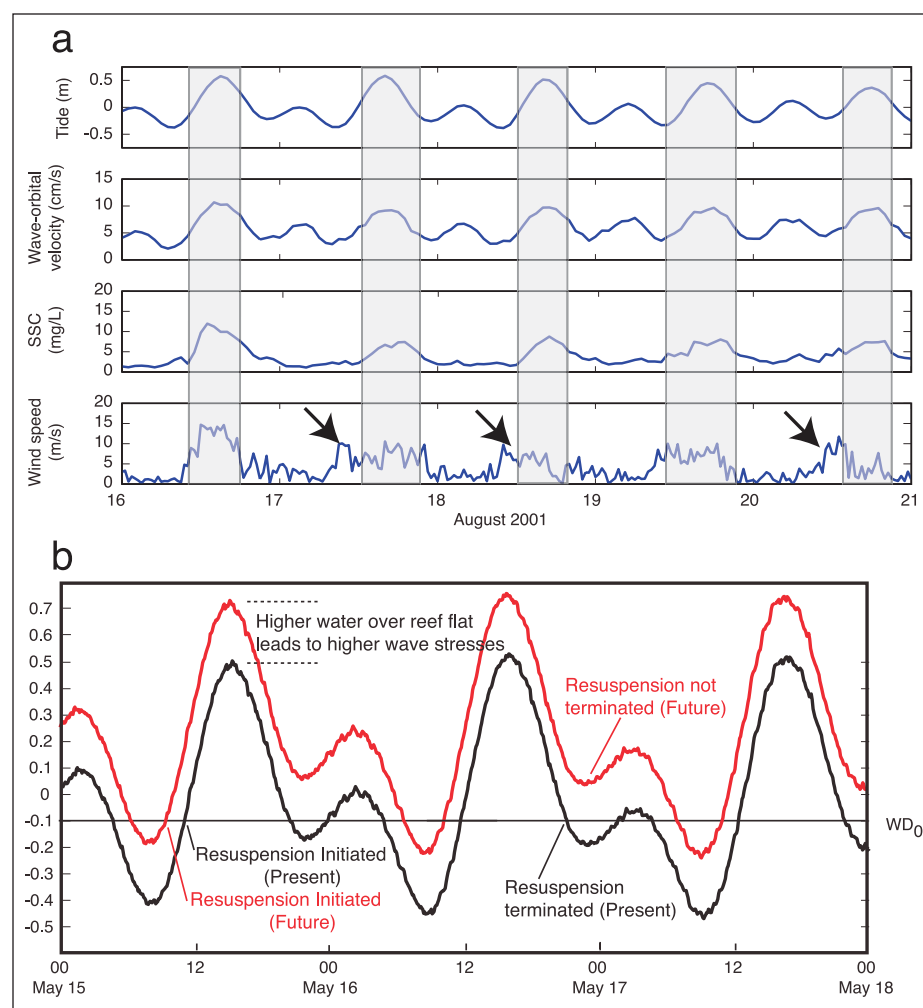
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## Greenland Elders and High School Students Offer Perspectives on Climate Change and Science

KANGERLUSSUAQ, GREENLAND—This small town in central western Greenland, which has a population of about 650 and a major airstrip dating from World War II, is a center for scientific research and a starting point for scientists working in the region and on Greenland's ice sheet to study climate change and other issues. The town, just north of the Arctic Circle, sits at the edge of the 190-kilometer-long Kangerlussuaq Fjord and straddles the Qinnuata Kuussua River estuary, whose source water is the Russell Glacier, about 20 kilometers to the east. Between Kanger—as some refer to the town—and the glacier, some Eskimo-Kalaallit elders held a traditional gathering last month and also offered their perspectives on climate change during an impromptu 14 July meeting with high school students and other visitors.

The evening before that meeting, Ole Olsvig, Kurt Olsen, Avaruna Mathaeussen, and other high schoolers from Greenland were in a makeshift classroom at the back of a renovated former U.S. Army barracks in Kanger, which had served as a U.S. military base. The students, who said they care deeply about their traditional culture and also are very aware of recent changes in climate, were helping to make presentations about their summer science projects. A total of 16 high schoolers from Greenland, 3 from Denmark, and 5 from the United States were there, participating in Joint Science Education Project (JSEP) activities; JSEP is an international collaborative polar science education effort between Greenland, Denmark, and the United States that receives



**Fig. 3.** Summary of data showing the effects of higher water elevations on levels and duration of suspended sediment concentrations. (a) Five-day time series of water level (tide), wave-orbital velocities (hourly estimates derived from statistically calculated velocity fluctuations around an 8-minute average velocity), suspended sediment concentration (SSC), and wind speed on the Molokai reef flat from a period of monitoring in 2001. Velocity and SSC data were measured at 20 centimeters above the reef bed (see Ogston and Field [2010] for details). Note the concurrence of elevated SSC values with elevated water levels; shaded areas mark elevated SSC from beginning of increase to the midpoint of decline. Increased wind alone during lower water levels (marked by arrows) does not result in increased SSC until the tide causes a higher water level. (b) A typical 3-day spring tidal cycle for the Hawaiian Islands. Average current speeds and wave-orbital velocities are dependent upon the water depth and are therefore modulated by the tide level. The line  $WD_0$  at  $-0.1$  meter marks the approximate depth at which water on the reef flat becomes deep enough for resuspension under typical wind and wave conditions at present sea level. The present tide is shown by the black line; an increase of 0.2 meter in sea level will have the effect of raising the tidal cycle (red line) above base by 0.2 meter. Assuming that reef accretion cannot keep pace, resuspension will occur earlier in the day and will last about 0.5–3 hours per day longer, enhancing turbidity during the period of optimum photosynthesis.

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## Author Information

Michael E. Field, U.S. Geological Survey, Santa Cruz, Calif.; E-mail: mfield@usgs.gov; Andrea S. Ogston, School of Oceanography, University of Washington, Seattle; and Curt D. Storlazzi, U.S. Geological Survey, Santa Cruz, Calif.

Lukes, an NSF Albert Einstein Distinguished Educator Fellow, said that she has learned about polar science; has become more motivated to research the impacts that field and research experiences have on students; and also has become more interested in Greenlandic language, culture, and traditions.

The next day, as Lukes guided the students and others across a glacially carved landscape populated with caribou and musk ox, Olsvig discussed tradition and climate change. The 17-year-old, from a small northwestern village near Upernavik, said he had recently harpooned his first narwhal, a rite of passage. He said older relatives had told him that Greenlandic traditions need to be maintained for the culture to survive. His grandfather also had told him that 30 years ago the sea ice, or siku, in his region would

**Greenland** cont. on next page

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Greenland

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last from September to June but now it comes in December or January and stays until only April or May. Olsvig said this change affects the use of dogsleds, snowmobiles, and boats and makes traditional seal hunting more difficult.

Other students also talked about Greenlandic traditions and environmental changes. Mathaeussen said that although climate change may be bad for others, it could allow for more vegetable growing in Greenland. Olsen commented that “the natural cycles of climate have been accelerated because of the CO<sub>2</sub> level.”

A Gathering of Elders

Following a stop at what is locally called the sea tomato lake, the group continued by car along a gravel and sand road to meet with elders at Long Lake, near Russell Glacier. There, Angaangaq, a shaman and elder who is Olsen’s great-granduncle, was conducting a ceremony on his ancestral land by the shores of what he referred to as Aajuitsup Tasersua, “the lake that hardly ever melts.” The nearby Russell Glacier is, as Angaangaq referred to it in the Kalaallisut, or West Greenlandic, language, an inu-  
giak of the Sermersuaq, a finger of the Big Ice—the ice sheet—that holds the land in its grip, he said. Angaangaq, who is from a town near Maniitsoq on Greenland’s west coast—though he now travels extensively—welcomed the students and others to the ceremonial circle. While intoning a chant he called “Melting the ice in the heart of man,” Angaangaq held up two black qilauts—flat drums that in this case were made with what he referred to as “rain-coated” nylon because bans prevent international travel with sealskins—to the sides of his head and momentarily engulfed each visitor between the elephant ear-sized instruments that he said “are from the Great Sky.”

Afterward, the visitors and others at the gathering went inside a large white tent nearby to listen, through a translator, to elders seated in a semicircle discussing climate change. Ole Kreutzmann, 69, from Maniitsoq and known as Ole, stated that the weather used to be more stable. He noted that over the past 2 years, since a similar gathering had been held at the same location, inland ice “has never melted so fast.” Joergen Jensen, 73, of Sisimiut and known as Juulut, explained that the sea near where

he lives does not freeze as deeply as in the past, which makes travel with sled dogs difficult.

Hansina Lyberth, known as Atsaarsuaq, 83, a great aunt of Angaangaq, said Greenlanders have always adapted to the weather and always knew how to survive the hard winters. “She thinks they were wiser than those professors today who study the weather, because they knew how to live,” the translator said. Atsaarsuaq, wearing a black visor and a red-and-black checkered shirt and gesturing with her hands, added that many people first noticed recent changes in climate around the 1980s, when there were warmer summers and more storms.

“She thinks that it is a circle of life. That’s the way that the world is, and maybe it has always been like that: that sometimes it becomes ice and sometimes it melts,” the translator said.

Enos Lyberth, 80—known as Akkaara, who is from Maniitsoq and is Angaangaq’s uncle and a nephew of Atsaarsuaq—said he agrees about the circle of life but that he also strongly believes that climate change has gotten worse because of factories and environmental pollution. He said through an interpreter that the climate has changed throughout his life and people have adapted their lives to these changes. Akkaara said changes have been especially apparent during the past 20 years; some mountains that had always been covered with snow or ice now have neither during summertime.

Concern About the Big Ice

In an interview with *Eos*, Angaangaq, silver-haired and in his 60s, was matter-of-fact about the fate of the Big Ice. He said that some Eskimo-Kalaallit hunters and elders in 1963 noticed the phenomenon of the Big Ice melting. Although Angaangaq has been speaking about the melting of the Big Ice for decades, he bemoaned, “Nobody heard the message.”

“Now the old people say it’s too late; it’s too late to stop the melting of the Big Ice. That’s what they say, that it’s a cycle which goes on which has been going on for millennia. But this time the difference is that it is too late to stop the melting of the ice,” he said. “You and I, our beliefs, our politics, our economy, cannot stop it anymore. It’s simply too late. The world did not react.”

Angaangaq added that another difference this time is the size of the global population. He said that people need to adapt to



A view of Russell Glacier, in Greenland. Photo by Randy Showstack.

climate change and also change their attitudes. “Only by melting the ice in the heart of man will man have a chance to change and begin using his knowledge wisely,” he said, referencing the name of his chant at the gathering.

He said that there are some positive aspects of climate change, including that “the land is now growing up.” He said the mountains in Greenland that have been pressed down by ice for so long now are getting bigger with less ice on top of them. “The other positive sign is that [climate change] is creating a new balance of the world. It’s just that you and I as human beings, we have not learned to live with it,” he said.

In addition, Angaangaq called for science and spirituality to go “hand in hand.” He said, “When we look at the wings of the bird, of the eagle, to the left, closest to the heart, is the spirit. To the right, far away from the heart, is the science. And they have to go hand in hand. If they don’t, it is mere knowledge, and we have so much knowledge, for we have not learned how to use [knowledge] wisely.” The message of his people “is that they think very much like the eagle, that everything has to be in balance,” he said. “They talk about it very often: that no birds can ever lift off with the wings [that] are not equal. Not even a big airplane can do that.”

“It is time that the scientists begin talking to the elders,” he continued, noting that the knowledge of the elders is valuable for science. “If we don’t talk together, the old people’s knowledge will disappear and we will have some new knowledge we don’t know how to use. So it has to go hand in hand. It has to be like the wings of an eagle, where spirit and the science go hand in hand.” He said that the elders’ message about climate change includes the hope that individuals will change and use knowledge wisely. In addition, Angaangaq said



Angaangaq, an Eskimo-Kalaallit shaman and elder. Photo by Randy Showstack.

he has hope in the Greenlandic high schoolers. He said he told the students at the gathering that “now that they are learning about science, they are now our hope. I told them that ‘I pray that you will be strong enough to be able to carry that responsibility, because through you, the world will realize who we are and the land we live on.’”

For more information, see <http://www.polartrec.com/expeditions/greenland-education-tour-2011> and <http://www.icewisdom.com>. Additional photos can be seen in the online supplement to this *Eos* news article ([http://www.agu.org/eos\\_elec/](http://www.agu.org/eos_elec/)).

—RANDY SHOWSTACK, Staff Writer

GEOFIZZ

Fall Meeting Abstract Submission Inspires Science Poetry

AGU receives some twenty thousand abstracts and a few haiku

When the 4 August deadline for submitting Fall Meeting abstracts passed, AGU had received more than 20,000 abstracts, a record-breaking number. The submission process had an unexpected by-product: It inspired some scientists to write haiku on Twitter. (Haiku is a form of Japanese poetry typically having three lines, the first with five syllables, the second with seven, and the third with five.) The following are examples of the haiku tweets, with the hashtag #AGU11AbstractHaiku. (For those who want to keep updated about the Fall Meeting on Twitter, the hashtag is #AGU11.)

For more information about the meeting, including registration and housing, visit <http://sites.agu.org/fallmeeting/>.

—ERNIE BALCERAK, Staff Writer

Vacation data  
but key has been left in lab  
return home and peek  
—mineraphys

Will data be cool?  
I connect key to the trend  
time to write abstract  
—mineraphys

Two hypotheses  
our data will discern them  
which one stands supreme?  
—mineraphys

Precession Monsoons  
Wet Tropical Pangaea  
And Also Dry It  
—WeatherOnMars

no research done yet  
writing a talk anyways  
hope research goes well  
—ZaneJobe

AGU is great,  
But abstracting is tough when,  
Science incomplete.  
—izzieday

Citizen science?  
Outreach gets a second talk!  
Share ed. AND research  
—CitSciCentral

Which session is best?  
completely different aspects  
yet another draft  
—meganpollock

Even AGU got in on the fun, posting this haiku:

Abstract deadline soon  
Scientists rush to summarize  
Science and beer in sight  
—theAGU

And after the deadline, one scientist tweeted:

Deadline is now passed  
Will my session be a “go”?  
Only time will tell.  
—guertin

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Sept 12, 2011; post-deadline submissions (posters only) till Oct 17

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with a copy to [dubey@lanl.gov](mailto:dubey@lanl.gov)

This conference will focus on climate change and variability from observational, theoretical, and modeling perspectives. Special emphasis will be on climate forcing and feedbacks on global and regional scale, with a special focus on polar regions. Contributions based on conventional as well as unconventional views on climate change and variability are welcome. Presented papers will be considered for publication in a special section of the Journal of Geophysical Research.

List of confirmed invited speakers includes many top climate experts.

For further details, to submit an abstract and to register, please, visit our website at <http://cnls.lanl.gov/climate>.



# MEETING

## Determining Critical Open Science Questions Regarding Biosphere-Atmosphere Interactions

**Measuring and Modeling at the Interface of Air Quality and Climate to Understand Biosphere-Atmosphere Interactions;**  
**New Brunswick, New Jersey, 26–27 May 2011**

The southeastern United States has not warmed like other U.S. regions in response to global climate change. This anomaly may be related to aerosols derived from biogenic volatile organic compounds (BVOCs) and the related aerosol direct and indirect radiative effects. To understand the causal relationships that result in this trend, the scientific community must ask, What sources and processes control the fate of biogenic compounds in anthropogenically influenced environments? What are the climate-relevant properties and air quality impacts?

Approximately 30 atmospheric scientists with experimental (field and laboratory) and modeling backgrounds met to discern the

most critical open science questions regarding biosphere-atmosphere interactions. An objective of the meeting was to formulate targeted science questions and broadly discuss the tools, approaches, and measurements needed to answer them.

The degree to which anthropogenic pollution alters biogenic emissions, fluxes, and their fate remains poorly understood. Conventional wisdom regarding biogenic emissions has been that BVOCs, most importantly, isoprene, react in the atmosphere to increase ozone (O<sub>3</sub>) while decreasing hydroxyl radicals (OH). However, current models cannot adequately describe oxidant concentrations in biogenically dominated areas, and the

oxidation pathways are still uncertain and hotly debated. Until recently, biogenic contributions to the atmospheric particulate matter (PM) burden were thought to arise largely from terpene oxidation with minor contribution from plant debris (e.g., cuticular waxes). Recently, isoprene has been shown to contribute to regional secondary organic aerosol (SOA), as have interactions between biogenic and anthropogenic emissions. Chemical tracers of BVOC contributions to SOA have been measured in a variety of environments, including the southeastern United States and the free troposphere. Yet adequate process level and regional level understandings of the coupled effects among BVOCs and the atmosphere's oxidative capacity and aerosol burden remain elusive.

Often, substantial leaps in progress require community-based efforts that rely on simultaneous colocated measurements, controlled laboratory studies, and openly distributed models. The workshop participants propose that as a community, scientists studying biosphere-atmosphere interactions focus their varied talents within the next few years on answering the following critical open science questions. Regional and global models, as well as satellites, indicate that the southeastern United States is a

good laboratory in which to address these questions:

1. How can existing biogenic emissions models be evaluated and improved to better describe fluxes of the thousands of BVOCs and oxygenated BVOCs?
2. What measurement techniques are critical to enhancing scientists' understanding of the gas phase chemistry of BVOCs and their role as oxidant and aerosol precursors? What is the optimal deployment?
3. To what extent do anthropogenic influences affect biogenic SOA formation?
4. To what extent is there aqueous or cloud processing of BVOCs, their oxidation products, and related aerosols?
5. What are the climate-relevant properties of biogenic aerosol (VOC of biogenic origin)?

The organizers gratefully acknowledge workshop support from the U.S. National Science Foundation (award AGS-1135038). Further information, including a list of participants, can be found at <http://climate.envsci.rutgers.edu/SOAS>. Interested parties may wish to attend an open Southern Oxidant and Aerosol Study town hall meeting this December at the AGU Fall Meeting.

—ANNMARIE G. CARLTON, Department of Environmental Science, Rutgers University, New Brunswick, N. J.; E-mail: [carlton@envsci.rutgers.edu](mailto:carlton@envsci.rutgers.edu)

# ABOUT AGU

## Thomson Reuters to Release Book Citation Index Later This Year

Thomson Reuters will launch its new Book Citation Index later this year. Projected to include 25,000 volumes from major publishers and university presses in science, social science, and the humanities, the Book Citation Index will cover scholarly books (both series and nonseries) that present original research or literature reviews. The current effort regarding the science section is focused on books published from 2005 to the present. AGU has sent copies of its catalog for inclusion in the Book

Citation Index, but the final selection will be made by Thomson Reuters, using its internal selection criteria, which may be found at [http://wokinfo.com/wok/media/pdf/BKCI-SelectionEssay\\_web.pdf](http://wokinfo.com/wok/media/pdf/BKCI-SelectionEssay_web.pdf).

AGU will continue to update its members regarding the details and launch of the Book Citation Index.

—MAXINE ALDRED, Assistant Director, Books and Publishing Services, AGU; E-mail: [maldred@agu.org](mailto:maldred@agu.org)

## G E O P H Y S I C A L Y E A R M E E T I N G S C A L E N D A R

*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.*

■ 30 August to 1 September 2011 **Open Science Meeting for an International Quiet Ocean Experiment**, Paris, France. Sponsors: Scientific Committee on Oceanic Research (SCOR); Partnership for Observation of the Global Oceans. (Ed Urban, SCOR, University of Delaware, Robinson Hall, Newark, DE 19716, USA; Tel.: +1-302-831-7011; Fax: +1-302-831-7012; E-mail: [ed.urban@scor-int.org](mailto:ed.urban@scor-int.org); Web site: <http://www.iqoe-2011.org>)

The meeting aims to develop a science plan for the International Quiet Ocean Experiment (IQOE). This initiative will represent the start of a focused international research effort that may last a decade or more. The plan will include background information to document the importance of the issue of sound in the ocean and its effects on marine organisms; identify information gaps; and describe research, observations, and modeling activities needed to fill these gaps.

■ 12–13 September 2011 **Workshop on Future Air Quality Model Development Needs**, Washington, D. C., USA. Sponsors: Electric Power Research Institute; Air and Waste Management Association; American Petroleum Institute; others. (Malissa Wood, Air and Waste Management Association; Tel.: +1-412-232-3444; Fax: +1-412-232-3450; E-mail: [mwood@awma.org](mailto:mwood@awma.org); Web site: <http://www.awma.org/Public/eventlinks/epriawma.aspx>)

Researchers from academia, government and private institutions, industry, and other stakeholders will brainstorm on various air quality model development needs and create a comprehensive research agenda that can be used by the com-

munity to help guide research plans and promote collaboration among researchers.


■ 25–28 October 2011 **North American Lake Management Society 31st International Symposium**, Spokane, Washington, USA. Sponsors: North American Lake Management Society; Washington State Lake Protection Association. (Philip Forsberg, 334 W. Spokane Falls Blvd., Spokane, WA 99201, USA; E-mail: [events@nalms.org](mailto:events@nalms.org); Web site: <http://www.nalms.org/>)

The symposium will address the interconnected effects of varying interests in lake management. Scientific and environmental professionals will offer a variety of relevant subjects to be covered in breakout educational sessions, and networking opportunities will allow for collaboration with lake property association members and other interested parties. Topics include invasive species, water governance, and paleolimnology and climate change.

■ 6–10 November 2011 **48th Oholo Conference: Emerging Remote Sensing Techniques and Associated Modeling for Air Pollution Applications**, Eilat, Israel. Sponsor: Israel Institute for Biological Research (IIBR). (Dorita Rostkier-Edelstein; E-mail: [doritar@iibr.gov.il](mailto:doritar@iibr.gov.il); Web site: <http://www.oholoconference.com>)

Topics at this conference will include detection and mapping of gaseous and aerosol plumes, aerosol and droplet measurement and characterization, networks and sensor and data fusion, and field campaigns and test beds.

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**ANTARCTIC SUBGLACIAL AQUATIC ENVIRONMENTS**

Martin J. Siebert, Mahlon C. Kennicutt II, and Robert A. Bindaschadler, Editors

By integrating a comprehensive picture of Antarctic subglacial lakes and environmental research, this volume bridges existing knowledge to future research. It contains up-to-date discussions about the history and background of subglacial aquatic environments and future exploration. Its uniqueness, breadth, and inclusiveness will appeal to microbiologists, paleoclimatologists, and those interested in extreme environments on Earth and in the solar system.

2011, 246 pp., hardbound, ISBN 978-0-87590-482-5  
 List Price \$110.00  
**AGU Member Price \$70.00**

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# BOOK REVIEW

## Climate Change Policy in the European Union: Confronting the Dilemmas of Mitigation and Adaptation?

 *Andrew Jordan, Dave Huitema, Harro van Asselt, Tim Rayner, Frans Berkhout, Editors*  
Cambridge University Press; 2010; xx + 284 pp.; ISBN 978-0-521-19612-3; \$105.

There is no doubt that climate change presents an exquisite dilemma to global society and our systems of governance. Either we accept our collective responsibility and adapt our energy systems, or our societies and many critical ecosystems may be swept away by climate extremes, food crises, and, eventually, rising seas. The European Union (EU) has emerged in a leading role in the international struggle to govern climate change. Climate change is an accepted part of the political agenda in the EU, so agreement on targets has been relatively easy compared to the actual implementation of policies to reduce emissions.

This book addresses in a historical context, from the late 1980s to 2010, the challenges

that climate change policy has presented to the EU and how policy has been developed. The risks posed by climate change have been known for several decades. The evolution of climate change policy in the EU has occurred in parallel with extensive expansion of the EU itself, which grew from 9 member countries in the 1980s to its present 27. The EU is a relatively large emitter of greenhouse gases, and with 27 countries, it represents a microcosm of the global community, albeit with a unique form of governance.

The 12 chapters of the book explore both the past and future challenges of climate change policy in the context of the EU system of governance. Although the chapters are written by different groups of authors, the

book is clearly organized, tightly edited, and well indexed. The broad frame is the interplay between difficult policy choices and the governance dilemmas they each present. The first three chapters are an introduction and a historical overview of both governance and climate policy in the EU. These are essential for North American readers unfamiliar with the political structure of the EU.

The heart of the book is chapters 4–8, which look back at five subareas of mitigation and adaptation policy: burden sharing, renewable energy development, emissions trading, adaptation policy, and water policy issues. Chapter 9 is a valuable synthesis of the evolution of climate change policy in the EU. These central chapters have a common thematic structure and a powerful conceptual framework that will be new to many readers. They look at dilemmas that arise through the choice of which problems to address in what sequence, how policy was enacted, the timing of action within the EU governance, what modes and instruments were used, how costs and benefits were allocated, and implementation and enforcement dilemmas. Chapters 10 and 11 look ahead to the decades 2020–2040 and revisit dilemmas for a matrix of four climate policy worlds. The two axes here are the degree of international collaboration and the relative roles of mitigation and adaptation.

The context is that the 2030 climate is insensitive to current mitigation efforts; but by the end of the 21st century, the climate will depend critically on what mitigation policies are actually implemented globally in the next few decades. If, for lack of global collaboration, the EU's 2°C warming target is unattainable, how will the world deal with increasingly difficult adaptation challenges? The final chapter is an excellent overview of the very significant policy choices the EU has made and an analysis of the paradoxes inherent in the EU system of governance.

The book is valuable on several levels. It provides detailed insight into the development of EU policy in relation to climate change, and the framing in terms of the dilemmas that climate change presents to policy is profound. To quote from the final remarks, "It is only by engaging in difficult policy decisions and confronting complex governance dilemmas that societies will come to appreciate what is really at stake and take the necessary steps to govern the environment more sustainably." What an honest assessment of the difficult challenges ahead! It is tragic that the United States is unwilling to face this challenge.

—ALAN BETTS, Atmospheric Research, Pittsford, Vt.; E-mail: akbetts@aol.com

 **FELLOWS** *Nomination Timeline*

**15 April 2011:** 2012 Fellows nomination submission cycle opens.

**15 July - 25 July:** AGU staff reviews nomination packages for eligibility and completeness and prepares nomination materials for Section and Focus Group Fellows Committee review.

**25 July:** Nomination materials are directed to Section and Focus Group Fellows committees based on (1) the nominee's primary affiliation and (2) up to three additional sections/focus groups selected by the nominator. Nominees who indicate a secondary section or focus group affiliation may be reviewed as well if the initial pool of nominees does not meet the primary evaluation criteria or if a low number of nominees were submitted for review.

**26 September - 2 December:** Union Fellows Selection Committee reviews and considers the nominees through a series of evaluations.

**February 2012:** AGU officially announces the Class of 2012 AGU Fellows.

**15 July 2011:** 2012 Fellows nomination submission cycle closes.

**21 July:** AGU and Union Fellows Selection Committee Chair host a teleconference with Section and Focus Group Fellows Committee Chairs to discuss the deliberation process.

**25 July - 22 September:** Section and Focus Group Fellows Committees review and consider the nominees. Each Section and Focus Group Fellows Committee is allocated a number of nominees that can move forward to the Union Fellows Selection Committee. The number of candidates allocated to each section and focus group is based on the percentage of AGU members with primary and secondary affiliations to their group. Section and Focus Group Fellows Committees submit their ranked list of nominees to move forward to the Union Fellows Selection Committee.

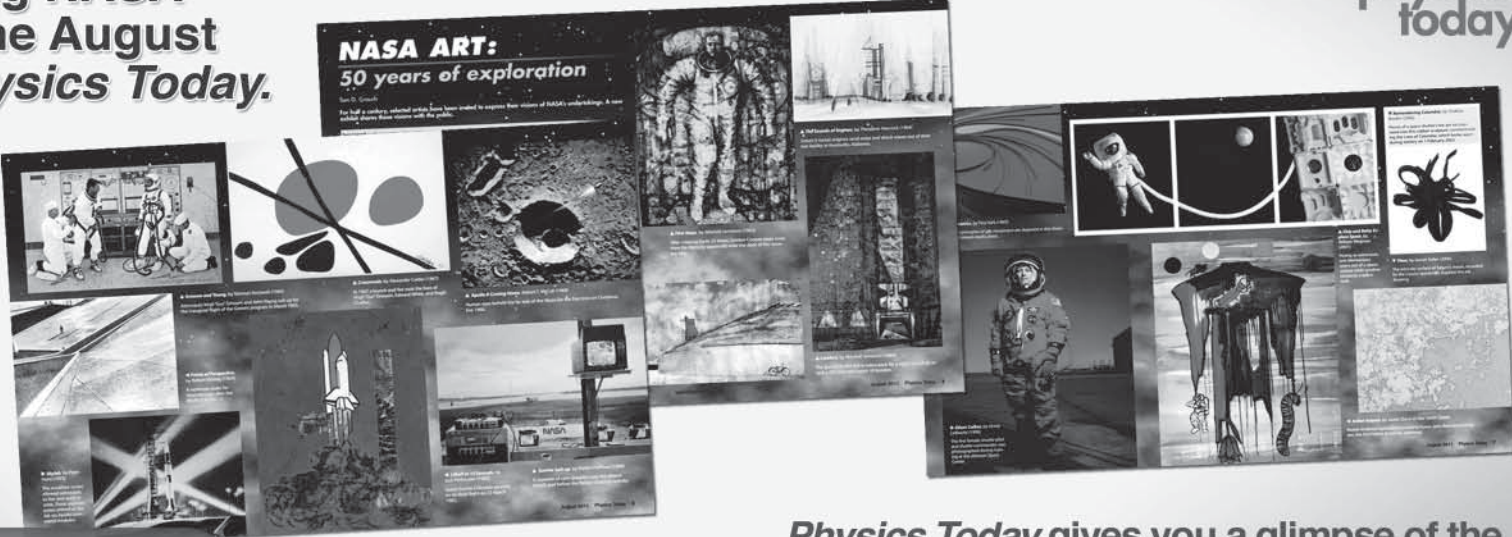
**3 December 2011:** The 2012 Fellows class are elected by the Union Fellows Selection Committee. This honor may be bestowed upon 0.1% of the membership in any given year.

**December 2012:** AGU formally recognizes the Class of 2012 Fellows during the Honors Tribute, held at the Fall Meeting.

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POSITIONS AVAILABLE

Atmospheric Sciences

**Atmospheric Scientist at Indiana University.** We invite applications for a tenure-track position of Assistant Professor in Geography with a specialization in atmospheric science. We seek candidates who can complement or expand departmental strengths. Research and teaching specialization is open, although applicants with expertise in mesoscale modeling and dynamics are particularly welcome. A new multidisciplinary science building has state-of-the-art laboratories for atmospheric-environmental scientists. The successful applicant will establish an independent, externally funded research program and will teach effectively at undergraduate and graduate levels. Applicants should have or expect to receive the doctoral degree by August 2012. Applications received by November 1, 2011 are guaranteed full consideration. The position will remain open until filled. Applicants should submit a letter of application describing research and teaching interests, c.v., and up to four representative publications. Three letters of reference should be sent separately. Apply: Dr. Scott Robeson, Chair, Department of Geography, Indiana University, 701 E Kirkwood Ave, Bloomington, IN 47405-6101, USA. Electronic materials are preferred and should be sent as pdf attachments to [geog@indiana.edu](mailto:geog@indiana.edu). Indiana University is an Equal Employment Opportunity/Affirmative Action Employer and we strongly encourage applications from women and minorities.

**Research Associate Position.** Combine cloud-resolving models radiative Transfer and A-Train satellite Observations for a better understanding of cloud microphysics. A Research Associate position is available to investigate the use of cloud-resolving models and cloud observations from NASA's A-Train satellite sensors for better understanding liquid water cloud optical and microphysical properties. Specific objectives will also involve improvements and evaluations of performance of operational satellite cloud retrieval algorithms. For best consideration, electronically submit a cover letter (indicating the specific position number above), a complete curriculum vitae, home address, visa status (if applicable) and names and telephone numbers of three references by August 30, 2011 (application materials for this position will be accepted until position is filled) to: Danita Eichenlaub, (applications\_GEST\_JCET@umbc.edu), Administrative Director, JCET, University of Maryland, Baltimore County, Suite 320, 5523 Research Park Drive, Baltimore, MD 21228. UMBC is an Equal Employment/Affirmative Action employer.

**Supervisory Research Physical Scientist-U.S. Environmental Protection Agency, Office of Research and Development, Atmospheric Modeling and Analysis Division (AMAD).** The U.S. Environmental Protection Agency invites applications for the position of Supervisory Research Physical Scientist located in Research Triangle Park, NC. The successful candidate would serve as Branch Chief for AMAD's Emissions & Model Evaluation Branch by leading a research program to develop and apply advanced methods for evaluating the performance of air quality simulation models. AMAD is part of the National Exposure Research Laboratory, which conducts research and development to improve methods, measurements, and models to assess and predict human and ecosystem exposure to harmful pollutants and other stressors in air, water, soil, and food. For details on the vacancy announcement, including specific qualification requirements and application procedures, go to <http://www.usajobs.gov/>. Refer to Vacancy Announcement: RTP-ORD-2011-0183. Applicants must be U.S. citizens to apply. The deadline for applications is September 2, 2011. The U.S. Environmental Protection Agency is an Equal Opportunity Employer.

**Visiting Assistant Professor.** The Department of Geography at Indiana University seeks applicants for a Visiting Assistant Professor position in Atmospheric Science to begin on January 1, 2012. Candidates must have a Ph.D., teaching experience, and research interests that complement or enhance current strengths of the department. The appointee will be expected to teach advanced courses in synoptic meteorology and introductory courses in atmospheric and environmental science. Specific teaching duties will be arranged based on candidate background and departmental needs. Instructional responsibilities will be two or three courses per semester, depending on research experience and agenda. Initial appointment will be for three semesters, with possibility of extension. Applicants should have or expect to receive the doctoral degree by December 2011. Applications received by October 1, 2011 are guaranteed full consideration. The position will remain open until filled. Applicants should submit a curriculum vitae, plus concise teaching and research statements (less than two pages each), and contact information for at least three referees. Apply to Dr. Scott Robeson, Chair, Department of Geography, Indiana University, 701 E Kirkwood Ave, Bloomington, IN 47405-6101, USA. Electronic materials are preferred and should be sent as pdf attachments to [geog@indiana.edu](mailto:geog@indiana.edu) with the message subject of "VAP Application". Indiana University is an Affirmative Action/Equal Opportunity Institution M/F/D. The university promotes cultural diversity with regard to gender, race, ethnicity, nationality, sexual orientation and religion.

Biogeosciences

**Assistant Professor and Curator of Paleontology.** The Department of Geological Sciences at California State University, Fullerton seeks a full-time, tenure-track Assistant Professor with expertise in vertebrate paleontology to join the faculty in Fall, 2012 and serve as the Curator of Paleontology for the newly established John D. Cooper Archaeology and Paleontology Curation Center. The successful candidate will have the following credentials and capabilities:

- o a Ph.D. in Geology or a related field with emphasis in Vertebrate Paleontology;
- o experience in vertebrate fossil curation, accession, and management;
- o a vigorous, research program in vertebrate paleontology that can involve undergraduate and graduate students;
- o a strong interest in teaching and achieving excellence in teaching; and
- o the interest and ability to interact effectively with an ethnically and culturally diverse campus community.

An important responsibility of the successful candidate's will be performing and directing research and curation of the paleontology collection at the Cooper Center, including oversight of an Associate Curator of Paleontology, interns, students, and volunteers. The Collection contains fossils in various stages of curation, from large jacketed specimens to fully curated fossils. Known strengths of the collection include Miocene marine mammals and reptiles, many from previously unrecognized taxa; numerous unprepared, jacketed blocks from an Eocene non-marine bone bed; and a paleobotanical collection of unknown extent. More information on the Cooper Center can be found at <http://coopercenter.fullerton.edu/>.

The successful candidate is expected to develop an externally funded research program focusing on specimens curated at the Cooper Center and resulting in peer-reviewed publications in refereed journals. Teaching responsibilities may include some of the following: physical geology, historical geology, paleontology, and upper-division and graduate courses in the new faculty member's area of expertise. Expected service activities include promotion of the Collection within the scientific community and outreach to the regional educational community. CSU Fullerton is a large urban university dedicated to the preeminence of learning. A designated Hispanic-Serving Institution, Cal State Fullerton is noted both for the diversity of its student body and its engagement of undergraduate

students in research. Located 22 miles southeast of metropolitan Los Angeles, Fullerton is a full-service city renowned for its unique mix of residential, commercial and industrial, educational, and cultural environments that provide residents with an outstanding quality of life. The Department has thirteen full-time faculty members with expertise in traditional and applied areas of the geological sciences. The nearby geological provinces provide abundant opportunities for field-based research, which the department emphasizes in its curriculum. There are over 100 undergraduate geology majors and approximately 20 MS students in the Department. Additional information is available from our web page at <http://geology.fullerton.edu/>.

To apply, please send the following: 1. a detailed curriculum vita including a record of your past external funding; 2. a letter of application that explains how you meet the qualifications outlined above and specifically addressing your qualifications as Curator of Paleontology for the Cooper Center; 3. a statement of your future research plans and goals as they relate to the collections in the Cooper Center; 4. a statement of your teaching philosophy including a list of courses you would feel comfortable teaching; 5. letters of recommendation from at least three references familiar with your research, curation, and teaching experience—referees should send their letters directly to the address below.

Send application to: Dr. Nicole Bonuso, Search Committee Chair, Department of Geological Sciences, California State University, PO Box 6850, Fullerton, California 92834-6850. Review of completed applications will begin on November 18, 2011. Applications received after this date will be reviewed only if the position is not filled from the original pool of applicants.

California State University, Fullerton is an Affirmative Action/Equal Opportunity Employer. All personnel policies conform to the requirements of Executive Order 11246, the Americans with Disabilities Act (ADA) of 1990, Title IX of the Higher Education Amendments of 1972 and other federal regulations regarding nondiscrimination.

**Environmental Geobiology.** The Department of Geology at Kansas State University invites applications for a tenure-track assistant professorship for the fall of 2012, in the field of Environmental Geobiology. For details of this advertisement, please visit our website at <http://www.ksu.edu/geology>. Questions about this position may be directed to Dr. Saugata Datta at [sdatta@ksu.edu](mailto:sdatta@ksu.edu), or (785)532 2241. Kansas State University is an equal opportunity/affirmative action employer and actively seeks diversity among its employees. A successful pre-employment background check is required before a job is offered.

Geochemistry

**Energy and Environment Research Position.** The Department of Civil and Environmental Engineering at Princeton University seeks a research scientist to develop a new research program at the nexus of energy and the environment, with particular emphasis on geologic sequestration of carbon dioxide. The research program should be experimental, with observation scales ranging from molecular to meters. The ideal candidate will hold a Ph.D. with expertise in geochemistry and interfacial chemistry. Preference will be given to candidates with experience in advanced synchrotron X-ray spectroscopic imaging of porous media. Applicants are encouraged to apply as soon as possible; the position will remain open until filled. Interested applicants must apply online at <http://jobs.princeton.edu>, requisition number 0110396. Applicants should fill out the online application and submit their CV and a 1 or 2 page statement about their research interests along with contact information for three references. Princeton University is an equal opportunity employer and complies with applicable EEO and affirmative action regulations.

**ICP-Laser Ablation Specialist.** The Department of Earth Sciences at Boston University invites applications for the permanently funded full-time technical position in support of the quadrupole ICP-MS (including Laser Ablation) and ICP-ES Analytical Geochemistry Laboratories. Responsibilities include training and analytical assistance for internal and external users, instrument operation, lab management, maintenance, development of new techniques, methodologies and data reduction techniques to streamline sample throughput, and the overall performance of all aspects of the ICP Analytical Laboratories in support of geologic, oceanographic, and environmental research and teaching. Participation in the initiation, interpretation, and dissemination of ICP-related departmental research in geochemistry is encouraged. Applicants should have a Ph.D. in any field of the geosciences, chemistry, or a related field, and a

strong background in geochemistry and/or analytical chemistry. Several years experience with ICP instrumentation and related sample preparation is required. Review of applications will begin immediately with a desired starting date as soon as September 1, 2011. To apply, please send electronically a letter of application, CV, and names and contacts of three references to Chair, LA-ICP Search Committee ([earth@bu.edu](mailto:earth@bu.edu)), Department of Earth Sciences, Boston University, 675 Commonwealth Ave., Boston MA, 02215. Interested candidates are also encouraged to contact either Prof. Rick Murray ([rickm@bu.edu](mailto:rickm@bu.edu)), Prof. Matt Jackson ([jacksonm@bu.edu](mailto:jacksonm@bu.edu)), Prof. Andy Kurtz ([kurtz@bu.edu](mailto:kurtz@bu.edu)), or Prof. Ethan Baxter ([efb@bu.edu](mailto:efb@bu.edu)) for additional information. Boston University is an equal opportunity/affirmative action employer.

**Isotope Geochemistry Laboratory Position.** Isotope Geochemistry Laboratory position in the Research School of Earth Sciences, The Australian National University. Our newly established Facility for Sensitive and Precise Isotopic Dating of Earth and Extraterrestrial Rocks (SPIDE2R) requires a Laboratory Technician/Laboratory Manager to oversee two thermal ionisation mass spectrometers including a new Triton Plus, and a clean laboratory. We seek an individual with experience in laboratory geochemical analysis, who is capable of working both independently and as part of a team in an exciting, dynamic university work environment exploring the secrets of the Universe. A candidate with an advanced degree and appropriate experience in isotope laboratory methods and isotope measurements using a multi-collector mass spectrometer and data interpretation is desirable. Active participation in research projects and in development of innovative techniques for earth and planetary studies is strongly encouraged. The ANU is an equal opportunity employer offering competitive salary and benefits packages. Applications should be submitted through the ANU website before 19 September 2011, Reference Number G376-11MY. For application procedures and further information see <http://jobs.anu.edu.au/PositionDetail.aspx?p=2143> or contact Yuri.Amelin@anu.edu.au or Vickie.Bennett@anu.edu.au.

Hydrology

**2 Research Fellows in Computational Geosciences.** Based at The University of New South Wales, the successful applicants will join a dynamic team whose research interests relate to quantitative earth processes modelling, development of algorithms for 3D geological imaging and uncertainty characterization. Research Fellow is equivalent to a Research Assistant Professor in the US system. Salary AUD\$83,262 to AUD\$92,198 per year, plus 17% pension, plus relocation costs. This is a full time position, fixed term for 2 years. Applications will be taken until the position is filled. UNSW is an equal opportunity employer. To apply and for additional information: <http://www.hr.unsw.edu.au/services/recruitment/jobs/22071102.html>. Address enquiries to [bryce.kelly@unsw.edu.au](mailto:bryce.kelly@unsw.edu.au) or [gregoire.mariethoz@unsw.edu.au](mailto:gregoire.mariethoz@unsw.edu.au).

Ocean Sciences

**Coastal and Deep-Ocean Water-Level data Professional Research Assistant.** The Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado, Boulder has an immediate opening for a motivated professional research assistant to lead the water-level activity with NOAA's National Geophysical Data Center (NGDC). The successful candidate will manage NGDC's coastal and deep-ocean water-level data, including acquisition, assessment, archive, and product development. To view complete announcement and apply: You must use [www.jobsatcu.com](http://www.jobsatcu.com) for this position 814031. [www.jobsatcu.com/applicants/Central?quickFind=65297](http://www.jobsatcu.com/applicants/Central?quickFind=65297).

**Head of the Coastal and Ocean Remote Sensing Branch, Naval Research Laboratory in Washington, D.C. Code 7230.** The Remote Sensing Division of the Naval Research Laboratory in Washington, D.C., is seeking applicants for a research leadership position as Head of the Coastal and Ocean Remote Sensing Branch. The Branch conducts a broad spectrum of basic and applied research centered on environmental remote sensing of the littoral zone (both land and in-water). Current Branch research programs include all aspects of littoral remote sensing including instrument design and fabrication, instrument calibration, conducting field experiments, both land and in-water in situ instrumentation for data validation and spectral library development, atmospheric correction algorithm development, data validation and spectral library development, atmospheric

*Classified* cont.on next page

TENURE-TRACK FACULTY POSITION AVAILABLE in APPLIED GEOPHYSICS  
Department of Geological Sciences and Geological Engineering, Queen's University

The Department of Geological Sciences and Geological Engineering at Queen's University, seeks individuals with outstanding research and teaching capabilities to apply for a tenure-track position, starting on January 1, 2012, or July 1, 2012, as an Assistant Professor in Applied Geophysics. The successful candidate will hold a P.Eng., or will be eligible to apply for a P.Eng., immediately by virtue of having graduated from an accredited engineering program. The candidate will build on the existing applied geophysics program which is focused in the Geological Engineering program, but is of interest to students in Geological Sciences and other departments at Queen's. The candidate is expected to carry on an active, externally funded research program of international calibre and to supervise graduate students at the M.Sc. and Ph.D. levels. A willingness to engage in collaborative research with Departmental colleagues will also be considered in the selection process. For more information about faculty research interests, the full range of undergraduate and graduate teaching programs, and our laboratory facilities, visit [www.geol.queensu.ca](http://www.geol.queensu.ca).

The University invites applications from all qualified individuals. Queen's University is committed to employment equity and diversity in the workplace and welcomes applications from women, visible minorities, aboriginal people, persons with disabilities, and persons of any sexual orientation or gender identity. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. Academic professionals at Queen's University are governed by the *Collective Agreement* between the Queen's University Faculty Association (QUFA) and the University, which is posted at <http://www.queensu.ca/vpac/FacultyRelations/CollectiveAgreements.html>. Remuneration will be in accordance with the *Collective Agreement*, which considers qualifications and experience.

Applications should include a complete and current curriculum vitae, letters of reference from three (3) referees of high standing, a statement of teaching experience, a statement of research interests and future plans, and samples of research writing. **Please arrange to have applications and supporting letters sent directly to: Dr. D.J. Hutchinson, Head, Department of Geological Sciences and Geological Engineering, Queen's University, Room 240 Bruce Wing, Kingston Ontario Canada K7L 3N6.** Applications will be accepted until August 26, 2011, or until a suitable candidate is identified. The final appointment is subject to budgetary approval.



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correction algorithm development, data exploitation and analysis algorithm development, and hydrodynamics research to understand, interpret, and exploit remote sensing signatures. Key facilities included the Hyperspectral Imager for the Coastal Ocean (HICO), currently operational on-board the International Space Station, an airborne sensor suite including VNIR and SWIR hyperspectral sensors, and thermal cameras, NIST traceable VNIR and IR calibration facilities, and an instrumented wave tank facility.

The Branch Head is responsible for the formulation of the scientific goals of the Branch, and works in collaboration with the Section Heads and other senior Branch members to conceive, plan, implement, and adjust short-term and long-range research goals of the program projects. The projects frequently entail collaboration with other parts of NRL, international research organizations. He/she is also encouraged to maintain an independent research program.

The Branch Head is responsible for assuring that the Branch research programs are adequately represented at national and international meetings, conferences and committees in order to further the exchange of ideas and advances in the field and to nurture fruitful collaborations. The Branch Head is also responsible for planning, directing and coordinating the effective administration of the Branch Programs, ensuring the modification and construction of new facilities as required, and assisting the recruitment of post-docs and scientists.

The Branch consists of approximately 25 primarily Ph.D. level scientists and engineers divided into four Sections, each with a Section Head reporting to the Branch Head. The Branch Head administers an annual budget of ~\$10M with the assistance of a Branch Secretary and additional budgeting and administrative support from the Division level.

This position offers the opportunity to lead and define a littoral remote sensing program at a major national Laboratory. The successful candidate will prefer have a Ph.D. in oceanography with background and expertise, demonstrated by peer-reviewed publications, representations on panels, history of successful proposal writing, etc., in littoral environmental research with an emphasis on optical oceanography. Demonstrated experience in leading scientific programs and in personnel management is also strongly preferred, and familiarity with Naval METOC requirements would be an important advantage. This federal government position is at the NP-IV level, which is equivalent to GS 14-15, with a salary range from \$103,536 to \$155.00 per annum, which includes the Washington, D.C. area locality adjustment.

Interested parties should transmit via e-mail a cover letter describing their interest in the position and a CV to Dr. Davidson Chen, NRL Remote Sensing Division Associate Superintendent and Head of the search committee [Davidson.chen@nrl.navy.mil; telephone (202)404-8127]. Applications will be considered until the position is filled.

The Naval Research Laboratory is an Equal Opportunity Employer.

**Postdoctoral Fellow 11-107.** The Cooperative Institute for Research in the Atmosphere (CIRA) at Colorado State University seeks to fill a postdoctoral fellowship position for its collaborative research as a Cooperative Institute with the National Oceanic and Atmospheric Administration (NOAA) National Information Services (NESDIS) in Camp Springs, Maryland (office will be in Camp Springs). The successful candidate will work as a member of the Sea Surface Temperature (SST) Team within the Satellite Oceanography and Climatology Division (SOCDD) of the Center for Satellite Applications and Research (STAR) of NOAA/NESDIS and develop improved SST products from the Advanced Very High Resolution Radiometer (AVHRR) flown onboard NOAA and MetOp satellites, and from

the future Advanced Baseline Imager (ABI) and Visible and Infrared Imager Radiometric Suite (VIIRS) sensors to be flown onboard geostationary GOES-R and polar-orbiting NPOESS platforms. Specifically, the individual in this position will develop improved cloud mask and SST algorithms for NPP/VIIRS with emphasis on bias correction and error characterization. Application deadline: Review of applications will begin on September 15, 2011 and may continue until the position is filled. For complete position description and qualification requirements, visit [http://www.cira.colostate.edu/personnel/employment\\_opportunities/requisition.php?id=41](http://www.cira.colostate.edu/personnel/employment_opportunities/requisition.php?id=41). Apply electronically by sending a resume, cover letter, and the names of three references to the attention of Human Resources Manager at the following e-mail address: [humanresources@cira.colostate.edu](mailto:humanresources@cira.colostate.edu). Please put your last name and 11-107 in the subject line of the e-mail. Colorado State University conducts background checks on all final candidates. CSU is an EO/EA/AA employer.

Postdoctoral Researcher-Measuring Sediment Transport in Coastal Environments.

Description: Memorial University and Dalhousie University have support for two Postdoctoral researchers to participate in the development of acoustic instruments capable of measuring sediment and fluid transport in coastal environments at turbulence resolving scales. For this purpose, multi-frequency Doppler sonar systems operating at MHz frequencies are being designed to probe the benthic boundary layer. The goal of the project is to enable measurements of both suspended sediment and "bed load" transport. The project provides opportunities in sonar design, scattering theory, computer modeling, laboratory trials, and field measurements.

Qualifications: The successful applicant will have a Ph.D. degree in Physical Oceanography, Coastal Engineering, or a related field. Experience in computer modeling, sonar system design and use, or sediment transport is desirable. Familiarity with the Matlab programming environment would be an asset.

Application: Please send a cover letter describing interests, a CV and contact information for three references to: Alex Hay ([alex.hay@dal.ca](mailto:alex.hay@dal.ca)), and Len Zedel ([zedel@mun.ca](mailto:zedel@mun.ca)). Review of applicants will begin immediately and continue until suitable candidates are found. The start date is flexible but ideally, the successful candidates would begin early in the fall of 2011.

Solid Earth Geophysics

**Post-Doctoral Position in Planetary Geophysics.** The Institut de Physique du Globe de Paris (IPGP) is inviting applications for a two year postdoctoral position in the field of planetary geophysics. This position aims to support the analysis of lunar gravity data that will be obtained by NASA's upcoming mission GRAIL, and possible research topics include the study of lunar impact craters, volcanic landforms, and the structure and evolution of the lunar crust.

With a launch in the fall of 2011, a start date in early 2012 is expected. To apply, please provide a CV, publication list, contact information of two references, and a 2-page letter that motivates the envisioned research project and that describes the applicant's research interests. Multidisciplinary research projects that utilize other remotely sensed data sets will be favored. Please respond by email to Mark Wiczeorek ([wieczor@ipgp.fr](mailto:wieczor@ipgp.fr)) before September 15.

**Visiting Professor/Post-Doc Position at ERI, the University of Tokyo.** The Earthquake Research Institute, the University of Tokyo, invites applications for Visiting Professor/Post-Doctoral Fellow positions in the research fields of earthquakes, volcanoes, and physics of the earth's interior. The period of each position will be three through twelve months during the period from April 1, 2012 to March 31, 2013.

Candidates are requested to submit the following set of documents as attached files to e-mail (address: [intl-office@eri.u-tokyo.ac.jp](mailto:intl-office@eri.u-tokyo.ac.jp)). (1) CV with birth date and detailed account of academic

activity; (2) List of academic publications; (3) Summary of research that the candidate has conducted (300-500 words); (4) Title of research and research proposal at ERI (300-500 words); (5) Desired length of stay; from three to twelve months .

Candidates are also requested to nominate a host researcher of ERI. If you need detailed information on host researchers, please visit our webpage at <http://www.eri.u-tokyo.ac.jp/eng/>.

The appointed candidates are expected to carry out research at ERI as an employee of the University of Tokyo. Monthly salary, ancillary expenses including partial housing costs and commuting allowance will be paid based on the rules of the University and ERI.

The deadline for this application is September 23 (Friday), 2011. If you need further information regarding this position, please feel free to contact Professor Teruyuki Kato, Teruyuki Kato Secretariat, International Research Promotion Office Earthquake Research Institute, the University of Tokyo 1-1, Yayoi 1, Bunkyo-ku, Tokyo 113-0032 Japan, Phone: +81-3-5841-5730, Fax: +81-3-5802-8644, E-mail: [intl-office@eri.u-tokyo.ac.jp](mailto:intl-office@eri.u-tokyo.ac.jp).

Space Physics

**Director of the Heliophysics Science Division (HSD).** The NASA Goddard Space Flight Center (GSFC) is recruiting for the Director of the Heliophysics Science Division (HSD) within the Sciences and Exploration Directorate (SED). The HSD is a major organizational entity of the Goddard Space Flight Center. Under the incumbent's direction and leadership, the mission of this Division is to carry out a broad program of experimental and theoretical scientific research by means of diversified studies of solar physics, heliospheric physics, geospace physics and space weather. As Director of the HSD, provides oversight of responding to Announcements of Opportunity from NASA Headquarters, is responsible for the construction and delivery of flight hardware to sounding rocket, satellite, and spacecraft projects, for the analyses of the data from these experiments, the comparison of this data with computer simulations and theoretical models, and the publication of results in the scientific literature. Participates in scientific meetings and represents the Agency at national and international research organizations and their meetings in the planning and implementation of Agency and national research programs. Exerts this leadership to enhance the recognition of the Division, Directorate, and the Center as the Agency's lead Center for Heliophysics Science and a world-class center of excellence for heliophysics science research. Supports GSFC flight projects in Heliophysics Science by providing qualified Project Scientists who ensure mission scientific success.

For application instructions, please see website <http://jobsearch.usajobs.opm.gov/> and perform a keyword search for vacancy announcement number GS11S0262. Scientific/technical inquiries about this position can be addressed to Dr. Nicholas White, Director of SED, at [Nicholas.E.White@nasa.gov](mailto:Nicholas.E.White@nasa.gov). The application deadline is September 16, 2011. US citizenship is required. NASA is an Equal Employment Opportunity employer and a diversity of candidates is sought.

**Space Sciences Assistant Professor.** The Department of Earth & Space Sciences at the University of Washington invites applications for a full-time (100%) 9-month tenure-track faculty member whose research focuses in space and planetary sciences. We are especially interested in scholars with expertise in the design, fabrication and operation of spacecraft or ground-based experiments associated with solar, planetary, magnetospheric, and ionospheric sciences, and/or aeronomy. The candidate will be expected to participate in the development of hardware/experiential learning courses within a space sciences and technology option in the BS program. Opportunities for collaboration exist with Aeronautics and Astronautics, Electrical Engineering and the Washington NASA Space Grant Consortium.

Applicants must hold a Ph.D. degree in space sciences [or a closely related field] by the start of appointment. University of Washington faculty are expected to participate in undergraduate and graduate teaching, independent research, and service. It is anticipated the position will be filled at the Assistant Professor level.

Applications, including a curriculum vitae, statement of research and teaching interests, and the names of four references, should be sent to: Space Science Search Committee, c/o Mr. Nathan Briley, Dept. of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA 98195-1310, 206-543-1190. Priority will be given to applicants received before November 1, 2011.

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

Interdisciplinary/Other

**Assistant Professor-Agricultural Micrometeorology.** Kansas State University seeks an individual to develop a research and teaching program on the transport of mass, heat and momentum in the soil-plant-atmosphere continuum. Potential research areas include: 1) air quality issues; 2) gas exchange between the land surface and atmospheric surface-layer; 3) global climate change; 4) measurement and modeling of evapotranspiration; and 5) instrumentation and methods for quantifying mass and energy fluxes. Development of a strong research program including the training of graduate students, publication of research results in peer-reviewed scientific journals, and securing extramural funding is expected. Teaching duties include a dual-level course in agricultural micrometeorology once per academic year, and a graduate-level course in agricultural micrometeorology in alternate years. The candidate must be able to work in a multi-cultural setting and create an environment that fosters collegiality, diversity, and teamwork. Required: Ph.D. in agronomy, soil science, atmospheric science, engineering, or related field; experience in measuring and modeling fluxes of mass, heat and radiation from vegetated surfaces; demonstrated excellence in oral and written communication skills in English; strong commitment to excellence in teaching; and strong commitment to fostering diversity in the department. This is a 12-month, tenure-eligible faculty position, 80% Research, 20% Teaching. A complete position description is available at: <http://www.agronomy.k-state.edu/DesktopDefault.aspx?tabid=633>. To apply, submit a letter of application, description of research goals, statement of philosophy for graduate teaching, curriculum vita, and official transcripts of all university degrees. Applicants must arrange for (and we must receive) four letters of reference. Refer to position # W0007395 when applying. Screening of applications begins November 1, 2011. Send application materials to Brittany Green, Administrative Specialist, Department of Agronomy, 2004 Throckmorton Hall, Kansas State University, Manhattan, KS 66506. Telephone: 785-532-0184. Email: [bdgreen@ksu.edu](mailto:bdgreen@ksu.edu). Background check required. Kansas State University is an Affirmative Action/Equal Opportunity employer.

**Crustal Materials Assistant Professor.** The Department of Earth and Space Sciences at the University of Washington invites applications for a full-time (100% FTE) 9-month tenure-track faculty position in the area of crustal materials. The successful candidate will have expertise in the theoretical, experimental or observational study of crustal materials. We encourage applicants with interests in integrating chemical/physical understanding with quantitative models of crust dynamics, surface processes and field geology. Collaboration with current departmental research is desirable.

Faculty members are expected to develop their own independent, externally funded research program and participate in departmental research, undergraduate and graduate teaching and independent research, and service.

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Integrated Ocean Drilling Program

Call for Proposals

Submission Deadline: 1 October 2011

The Integrated Ocean Drilling Program (IODP) invites drilling proposals for its planned successor – The International Ocean Discovery Program - expected to start October 2013. This program will offer three platform types: Riserless (*JOIDES Resolution*), riser drilling (*Chikyu*), and Mission Specific Platforms (MSP). Proposals for small projects in conjunction with already planned drilling operations, or proposals with significant co-funding by third party (Complementary Project Proposals) may also be considered for implementation within the current IODP ending September 30, 2013. The drilling vessel *JOIDES Resolution* (JR) is expected to operate in the western Pacific to Indian Ocean region towards the end of the current IODP. Proposals requiring JR drilling in this region therefore are expected to have the best chance of implementation during 2013-2014. *Chikyu* is planned to operate for IODP close to Japan until the end of IODP. The ship track of JR and the riser vessel *Chikyu* beyond this time is not known at this point, but will be decided based on proposal pressure. The science plan for 2013-2023 defines the themes of highest programmatic priority and can be found at [www.iodp.org/nsp](http://www.iodp.org/nsp). Information on already planned drilling activities, guidance for proposal submission and information on the platforms at: [www.iodp.org](http://www.iodp.org) Proposals can be submitted from September 15th, and information on technical submission details of the program's new proposal submission portal will be available September 1st (<http://www.iodp.org/drilling-proposals/>). Proposals will be evaluated by the new IODP Scientific Advisory Structure ([www.iodp.org/new-program](http://www.iodp.org/new-program)). Questions: [science@iodp.org](mailto:science@iodp.org).



UNIVERSITÄT POTSDAM



The Institute for Mathematics and the Institute of Earth & Environmental Science of the University of Potsdam, in a joint appointment with the GFZ - German Research Centre for Geosciences, invite applications for a tenured

W2-Professorship for the Earth's magnetic field in conjunction with the position as leading scientist at the GFZ in Potsdam, Germany (Successor of Prof. Dr. M. Manda)

The salary is based on the W2 scale, with additional remuneration due to the dual nature of the appointment between the University Potsdam and the GFZ. The position is preferably to be filled at the earliest opportunity.

A research focus in the field of **geomagnetism with emphasis on the internal field** and its interaction within System Earth is expected. Active cooperation with other sections in the GFZ and the University of Potsdam is required. In addition to research, an active participation in teaching at the University of Potsdam is desired.

The position includes **leading section 2.3 "Earth's magnetic field"** at the GFZ, where a strong background in data acquisition techniques is closely linked to studies of the magnetic field generated inside the Earth. It is expected that the successful candidate will be able to oversee data acquisition activities of the section (magnetic observatories, field campaigns and satellite missions like CHAMP and SWARM) and combine this with studies in geomagnetism. In particular, maintaining a close link between the research on internal and external fields is expected, including the provision of products, like space weather indices, to the public.

Prerequisites for the application are a doctoral degree and a record of research equivalent to the German "Habilitation". Scientific qualifications achieved in the private sector, outside Germany, or as Junior professor will also be considered (§ 39 BbgHG).

Appointment will be made according to the laws of Brandenburg (Brandenburgisches Hochschulgesetz - BbgHG §§ 38, 41). According to state law (§ 41 Abs. 1 BbgHG) the contract will be limited, in case it is the first appointment of the successful applicant as university professor, with the possibility of tenure after 2 years. Exceptions are possible, in particular if outstanding candidates from abroad or external to the university system cannot otherwise be acquired. In case of successful tenure review, there is no further appointment procedure.

Potsdam University and the GFZ are an equal opportunity employer. Information on the University of Potsdam and the GFZ are available under [www.uni-potsdam.de](http://www.uni-potsdam.de) and [www.gfz-potsdam.de](http://www.gfz-potsdam.de), respectively. For further information on the position contact Matthias Holschneider ([hols@math.uni-potsdam.de](mailto:hols@math.uni-potsdam.de)) Universität Potsdam or Michael Weber ([mhw@gfz-potsdam.de](mailto:mhw@gfz-potsdam.de)) GFZ Potsdam.

Send applications within **four weeks** after publication to **Potsdam University, Office of the President, Am Neuen Palais 10, 14469 Potsdam, Germany.**



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Applicants must hold a Ph.D. in geology/earth sciences or a closely related field at the time of appointment. It is anticipated the position will be filled at the Assistant Professor level.

Applicants should send a curriculum vitae, bibliography, description of research and teaching interests, and the names of four references. All materials should be sent to: Crustal Materials Search Committee, c/o Nathan Briley, Department of Earth and Space Sciences, University of Washington, Box 351310, Seattle, WA 98195-1310, 206-543-1190. Preference will be given to applications received prior to November 1, 2011.

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

**Postdoctoral Research Associate, Hydrology & Remote Sensing Lab.** The USDA, Agricultural Research Service (ARS), Animal and Natural Resources Institute's Hydrology and Remote Sensing Laboratory, in Beltsville, Maryland, is seeking a Postdoctoral Research Associate, Research Physical Scientist, for a two year appointment. This position requires a Ph.D in hydrology, remote sensing, meteorology, climatology or a related field of study. Salary is commensurate with experience and can range between \$62,467 to \$81,204 per annum, plus benefits. The incumbent will develop methods for incorporating, remotely sensed surface temperature and canopy light-use efficiency observations in hydrologic and agricultural applications, which include routine large area monitoring of evapotranspiration, net carbon exchange, and assessment of drought and crop yield. The incumbent will evaluate and refine model algorithms using field and remote sensing data collected from field experiments and flux monitoring sites. To apply refer to announcement RA-11-0068-L at: <http://www.afm.ars.usda.gov/hrd/jobs/postdocs/pd962.html> to obtain the full text announcement, complete application instructions, and further information on Postdoctoral Research Associate positions. Send application information, a statement of research interests and the names of two references to Dr. William Kustas, USDA/ARS/ANRI/HRSL Bldg. 007, Room 104, Beltsville, MD 20705 or e-mail (Bill.Kustas@ars.usda.gov) by September 12, 2011. USDA/ARS is an equal opportunity provider and employer.

**Post-Doctoral Research Associate, University of Illinois at Urbana-Champaign.** The Department of Atmospheric Sciences at the University of Illinois, Urbana-Champaign is seeking two postdoctoral research associates to conduct research aimed at improving our understanding of the interactions among earth's climate and terrestrial biogeochemical-biogeophysical systems. The candidates' research will focus on studying the role of carbon and nitrogen dynamics and land cover and land use changes and their impacts on atmospheric CO<sub>2</sub>, climate, carbon sequestrations in terrestrial ecosystems and soils using an earth system model.

We seek candidates with a Ph.D. in earth system science, climate science, or another related field in the sciences or engineering with a working

knowledge of global biogeochemistry model, an earth system model or similar complex model. A working experience in FORTRAN 90 is a must and parallel programming and running models on super computers is preferred. Demonstrated ability to produce quality research output, good oral and verbal communication skills and an interest in working with researchers from computer and other environmental sciences will be among the selection criteria.

The initial term will be for two years with the strong potential for renewal based on performance.

Applicants should send the following materials by email to Prof. Atul Jain at [jain1@illinois.edu](mailto:jain1@illinois.edu): (1) a cover letter describing research interests and experience, (2) curriculum vita, and (3) names and contact information for three references. The salary is commensurate with experience. For full consideration, applications must be received by August 31, 2011.

The University of Illinois is an Affirmative Action, Equal Opportunity Employer.

**Postdoctoral Researcher in Petrology of Planetary Materials.** The Lunar and Planetary Institute (LPI), part of the Universities Space Research Association, invites application for postdoctoral fellowship in petrology of planetary materials. Visit [www.lpi.usra.edu](http://www.lpi.usra.edu) for more details.

The candidate will work with Dr. Allan Treiman in NASA-funded efforts, focusing on planetary crusts and magmas, and their volatiles constituents; target materials include lunar highlands rocks, Martian meteorites, and terrestrial analogs. These efforts focus on planetary samples, starting with analyses by optical microscopy and electron microprobe; other instruments are available at nearby JSC or external collaborators. The candidates are encouraged to design and conduct their own research in planetary science, propose for external funding, participate in grant review panels and analysis groups, and become involved with spacecraft missions.

**Postdoctoral Researchers in Lunar Science.** Universities Space Research Association's Lunar and Planetary Institute (LPI) invites applicants for lunar science and exploration postdoctoral fellowships. See [www.lpi.usra.edu](http://www.lpi.usra.edu) for details:

Lunar Surface Geology/Remote Sensing-Use new LRO data; integrating it with existing lunar data to evaluate processes associated with impact cratering and/or planetary differentiation. Experience with orbital remote sensing methods, photometry of lunar materials, and photogeology of lunar or lunar-like terrains preferred.

Experimental and/or Analytical Petrology and Geochemistry-Using Apollo and lunar meteorite samples (or synthetic analogues) to evaluate processes associated with impact cratering and/or planetary differentiation. Experience with electron and ion microprobes, and/or LA-ICPMS techniques preferred.

Modeling of Impact Cratering Processes-Using hydrocodes and relevant analytical techniques to evaluate different cratering processes on the Moon, to model specific crater or basin-forming events, and potentially guide future exploration scenarios.

**Sustainability Solutions Initiative Postdoctoral Fellows Program.** The University of Maine is conducting a search for Sustainability Science Postdoctoral Fellows. Successful candidates will join Maine's Sustainability Solutions Initiative (SSI) funded by a

5-year, \$20 million NSF EPSCoR grant. SSI includes a team of 50+ faculty and 25 doctoral students from a range of disciplines and academic institutions statewide. SSI's research program integrates coupled natural and human systems modeling, stakeholder engagement, and solutions-oriented research activities. Organized under a theme of landscape change, SSI supports multiple research projects focused on urbanization, forest ecosystem management, and climate/energy challenges. A major thrust of SSI is to produce a new generation of scientists equipped to work across disciplinary boundaries and adept at collaborative, problem-solving work that spans research and practice. Tentative start dates range from Oct. 2011 to April 2012. Initial appointments are for a one-year with an opportunity for renewal, contingent on funding. Responsibilities: Fellows are expected to participate in ongoing team projects and SSI-wide research activities; core research responsibilities include planning/completion of research tasks, preparation of manuscripts for publication in collaboration with SSI researchers, presentation of research findings at public/professional meetings. Fellows will have opportunities to contribute to development and implementation of SSI curricula and mentoring programs for graduate/undergraduate students. Applications: Candidates must demonstrate the capacity to support their research programs, produce high-quality scholarship and publications, and advance the SSI research program. Detailed information available at <http://www.umaine.edu/sustainabilitysolutions>. Review of applications begins August 31, 2011. The University of Maine is an equal opportunity/affirmative action employer committed to maintaining an intellectually and culturally diverse faculty and staff.

**Teaching Specialist in Environmental Science at Princeton University.** The Council on Science and Technology (CST) at Princeton University seeks professional specialists to take leadership roles in the development and operation of the new Princeton Science and Engineering Education Initiative. The goal of the initiative is to prepare all Princeton students, irrespective of their majors, to become scientifically- and technologically-literate citizens and decision-makers. A series of lab and non-lab courses will be created or re-designed to teach our future leaders not only facts and skills but also the key roles that science and engineering play in society. Each specialist will be responsible for particular areas in science or engineering, depending on his or her field of expertise. Together, the team of specialists will be expected to implement the initiative, in close collaboration with Princeton's McGraw Center for Teaching and Learning and the Council on Science and Technology.

We have particular interests in adding a specialist with expertise in an environmentally focused field. The successful applicant will have a central role in crafting a pedagogically innovative model for educating the next generation of undergraduate students in environmental studies. Initially, the applicant will spearhead the development of a new "Real World Model" of environmental studies teaching that enables students to conduct experimental research in local ecosystems in partnership with local community agencies and stakeholders. This course will provide social context and civic engagement for the students and inspire them to

understand how science informs real-world environmental problem solving.

The principal responsibility of this position consists of direct and ongoing collaborative work with members of the faculty, to design and put into practice innovative laboratory exercises that meet the objectives of the initiative. Additional responsibilities include the design of course curricula; collaborative work to discover points of intersection among courses across the disciplines; the development of models and materials that facilitate interactive laboratory teaching and learning; the creation of protocols for assessment and evaluation; the evaluation of success of different pedagogical models; and the provision of pedagogical workshops for science and engineering assistants in instruction (TAs). It is expected that together the team of specialists will have expertise in key areas within science and engineering disciplines.

Essential Qualifications:

- Ph.D. in a field of science or engineering taught at Princeton
- Experience teaching at the undergraduate level at a U.S. college or university
- Demonstrated record of innovative teaching in the classroom and laboratory in undergraduate science and/or engineering
- Knowledge of current scholarship and practice in the fields of teaching and learning, to include large class instruction; small group/collaborative/ problem-based learning; creative uses of technology in the classroom and lab
- Excellent technical, communication, and organizational skills
- Demonstrated experience in leadership and mentoring roles, and in working successfully as part of a team

Interested applicants should submit a current CV, a cover letter describing specific areas of expertise and interest, and contact information for 3 references to [jobs@princeton.edu](mailto:jobs@princeton.edu), requisition number 0110446. Princeton University is an equal opportunity employer and complies with applicable EEO and affirmative action regulations.

For more information regarding the Princeton Environmental Institute ([www.princeton.edu/pei](http://www.princeton.edu/pei)) and the Grand Challenges Program ([www.princeton.edu/grandchallenges/](http://www.princeton.edu/grandchallenges/)), please visit the respective websites.

STUDENT OPPORTUNITIES

**Ph.D. Position: Separating GIA and Ice Mass Change Signals in Antarctica Using Satellite Data.** This Ph.D. project aims to develop new methodologies that will permit the simultaneous solution of glacial isostatic adjustment (GIA) and ice mass change in Antarctica, making use of several new (Cryosat-2) and improved data sets (GRACE, ICESat, GPS, climate models). To apply, send cover letter, CV, course lists with grades, and the names of two references to Dr. Brian Gunter ([b.c.gunter@tudelft.nl](mailto:b.c.gunter@tudelft.nl)). See AGU Career Center online ad for more details.

SERVICES, SUPPLIES, COURSES, & ANNOUNCEMENTS

**United States Polar Rock Repository.** Rock samples are available as no-cost loans for research, teaching & museum use. <http://bprc.osu.edu/emuwebuspr>.

# RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU Journals

## Chlorine radicals measured in Eyjafjallajökull volcanic plume

When the Icelandic volcano Eyjafjallajökull erupted in spring 2010, it disrupted commercial air travel, stranding passengers across Europe and beyond. In response to the lack of information on the volcanic ash load and dispersion, scientific instruments were deployed on a number of special flights to observe the composition and chemistry of the volcanic plume and included three deployments aboard a Lufthansa aircraft of the Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container (CARIBIC) observational instrument package. *Baker et al.* report on the first observation-based estimates of chlorine radical concentrations in the volcanic plume. Previous studies had suggested that



Ash from Eyjafjallajökull volcano was found to contain chlorine radicals, according to a new study.

chlorine radicals could exist in volcanic plumes. This study, the first to identify chlorine radical chemistry and quantify chlorine radicals in a volcanic plume, will help researchers to more fully understand volcanic chemistry, particularly halogen chemistry, and its effects on the atmosphere. (*Geophysical Research Letters*, doi:10.1029/2011GL047571, 2011) —EB

## Ozone depletion leading force for Southern Ocean change

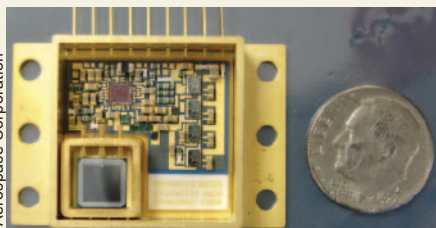
Previous studies have suggested that key aspects of the Southern Ocean are affected by elevated atmospheric carbon dioxide levels. Increasing greenhouse gas (GHG) concentrations, which strengthen surface winds over much of the Southern Ocean, may increase flow rates in the Antarctic Circumpolar Current (ACC), induce a temperature disparity between the northern and central Southern Ocean, and affect the strength of the meridional ocean circulation (MOC). But GHGs are not the only set of compounds arising from human activity that can trigger these changes. Stratospheric ozone depletion due to such ozone-depleting substances (ODSs) as chlorofluorocarbons, whose production and use were heavily regulated by the 1987 Montreal Protocol, results in similar changes.

Using an atmosphere-ocean coupled general circulation model that allows for detailed calculations of stratospheric chemistry, *Sigmond et al.* simulated past and future changes for the Southern Ocean due to both GHGs and ODSs. Their model calculations suggest that ODSs, which peaked in concentration in 1995, will be the dominant driver of changes in ACC until the second quarter of the 21st century, at which point the monotonically

## Miniature detector measures deep space radiation

The 1972 journey of Apollo 17 marked not only the last time a human walked on the Moon but also the most recent manned venture beyond the outer reaches of the Earth's atmosphere. With preparations being made for humans to once again explore deep space, important steps are under way to quantify the hazards of leaving low-Earth orbit. One significant risk for long-distance missions is the increased exposure to ionizing radiation—energetic particles that can strip electrons off of otherwise neutral materials, affecting human health and the functioning of spacecraft equipment. The deep space probes that are being sent to measure the risks from ionizing radiation and other hazards can be costly, so maximizing the scientific value of each launch is important.

With this goal in mind, *Mazur et al.* designed and developed a miniature dosimeter that was sent into lunar orbit aboard NASA's Lunar Reconnaissance Orbiter (LRO) in 2009. Weighing only 20 grams, the detector is able to measure fluctuations in ionizing radiation as low as 1 microrad (equivalent to  $1.0 \times 10^{-8}$  joules of energy deposited into 1 kilogram) while requiring minimal power and computer processing. The



A new microdosimeter, with its minimal space and power requirements, makes detailed measurements of ionizing radiation with its 5-square-millimeter silicon detector.

postage stamp-sized detector tracked radiation dosages for the first year of LRO's mission, with the results being confirmed by other onboard and near-Earth detectors.

The authors found that ionizing radiation levels were 30% lower in lunar orbit than when the spacecraft was in transit, with a total dosage roughly 22 times the annual background rate on Earth. They suggest that their detector, with its small footprint and low power demand, could be a staple for future deep space missions. (*Space Weather*, doi:10.1029/2010SW000641, 2011) —CS

increasing GHG levels will take over. Further, they found that the peak impact of ODSs on ACC will occur a few decades after their peak concentration. The authors suggest that future research needs to take into account the effects of ozone depletion—something not ordinarily

done in investigations of Southern Ocean behavior. (*Geophysical Research Letters*, doi:10.1029/2011GL047120, 2011) —CS

—ERNIE BALCERAK and COLIN SCHULTZ, Staff Writers