

## The Role of Trace Gas Flux Networks in the Biogeosciences

Vast networks of meteorological sensors ring the globe, providing continuous measurements of an array of atmospheric state variables such as temperature, humidity, rainfall, and the concentration of carbon dioxide [New *et al.*, 1999; Tans *et al.*, 1996]. These measurements provide input to weather and climate models and are key to detecting trends in climate, greenhouse gases, and air pollution. Yet to understand how and why these atmospheric state variables vary in time and space, biogeoscientists need to know where, when, and at what rates important gases are flowing between the land and the atmosphere. Tracking trace gas fluxes provides information on plant or microbial metabolism and climate-ecosystem interactions.

The existence of trace gas flux networks is a relatively new phenomenon, dating back to research in 1984. The first gas flux measurement networks were regional in scope and were designed to track pollutant gases such as sulfur dioxide, ozone, nitric acid, and nitrogen dioxide. Atmospheric observations and model simulations were used to infer the depositional rates of these hazardous chemicals [Fowler *et al.*, 2009; Meyers *et al.*, 1991]. In the late 1990s, two additional trace gas flux measurement networks emerged. One, the United States Trace Gas Network (TRAGNET), was a short-lived effort that measured trace gas emissions from the soil and plants with chambers distributed throughout the country [Ojima *et al.*, 2000]. The other, FLUXNET, was an international endeavor that brought many regional networks together to measure the fluxes of carbon dioxide, water vapor, and sensible heat exchange with the eddy covariance technique [Baldocchi *et al.*, 2001]. FLUXNET, which remains active today, currently includes more than 400 tower sites, dispersed across most of the world's climatic zones and biomes, with sites in North and South America, Europe, Asia, Africa, and Australia. More recently, several specialized networks have emerged, including networks dedicated to urban areas (Urban Fluxnet), nitrogen compounds in Europe (NitroEurope), and methane (MethaneNet).

### Technical Aspects of Flux Networks

Eddy covariance flux measurements are the preferred method by which biogeoscientists measure trace gas exchange between ecosystems and the atmosphere [Baldocchi, 2003]. In the eddy covariance technique, trace gas fluxes are calculated from the instantaneous changes in the vertical wind velocity and atmospheric gas concentration.

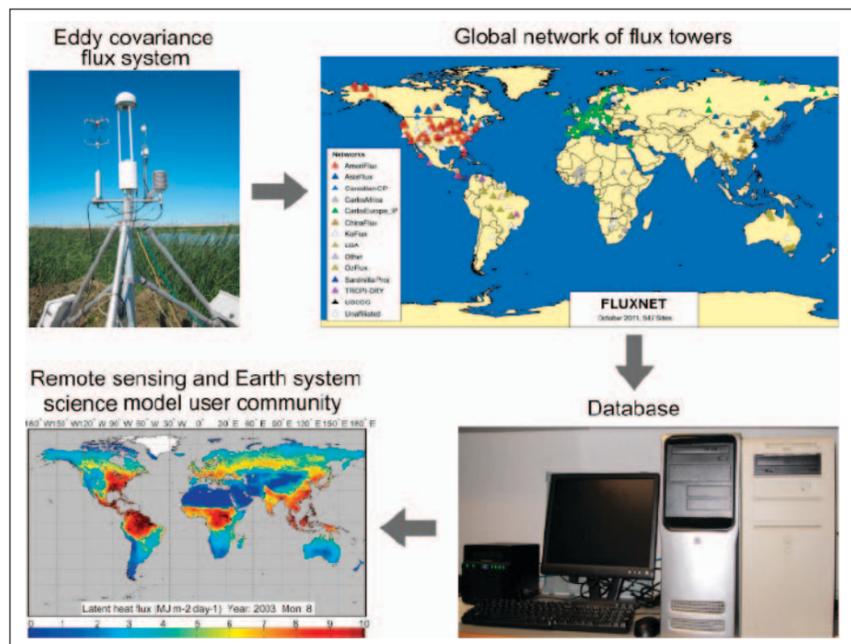
By D. BALDOCCHI, M. REICHSTEIN, D. PAPALE, L. KOTEEEN, R. VARGAS, D. AGARWAL, AND R. COOK

A key attribute of the eddy covariance method is its ability to measure fluxes in situ with minimal disturbance to the environment, at a spatial scale of hundreds of meters, and on time scales spanning hours, days, and years.

For the eddy covariance method to work, trace gas sensors must be able to respond to fluctuations in atmospheric gas concentrations over as little as a tenth of a second, maintain a stable calibration, possess a high signal-to-noise ratio, and, in cases where pumps are needed to move air to the sensor, have access to a power line. The current generation of carbon dioxide and water vapor sensors easily meets these criteria, and a revolution in instrument development is producing trace gas sensors capable of measuring a broad suite of compounds at high sampling rates with high sensitivity and precision. Those measuring stable isotopes of carbon, oxygen, and carbonyl sulfide can help partition fluxes between the vegetation and the soil. Those measuring methane and nitrous oxide can assess microbial activity in the soil. And measurements of hydrocarbons, ozone, and nitrogen oxides can assess pollutant loads on the atmosphere. For gases whose sensors are too slow, such as nitric acid and mercury vapor, one can rely on the relaxed eddy accumulation method or flux gradient techniques to measure their fluxes [Dabberdt *et al.*, 1993].

While many of these sensors can be operated unattended, the best data tend to come from sites where technicians, students, and postdoctoral researchers pay frequent visits to ensure the instruments are maintained and calibrated. Nevertheless, there will likely always be gaps in the observational record due to instrument malfunction or failure caused by disturbances from rain, snow, animals, insects, and vandalism. Other data gaps result from rejecting data when air travels from a wind direction that is not representative of the ecosystem under study. To test and validate models and construct trace gas budgets, data gaps need to be filled in systematic and vetted ways to compute integrated fluxes on daily and annual time scales [Falge *et al.*, 2001; Moffat *et al.*, 2007].

To interpret trace gas fluxes, it is critical that a suite of data that characterize meteorological conditions, land use and disturbance history, and the state of the vegetation and soil be measured concurrently. Some plant and soil variables, such as leaf area index and predawn water potential, must be measured manually and regularly, while others, including the dynamics of canopy structure, can be measured remotely and continuously with digital cameras and spectral radiometers. Wireless networks of soil moisture and temperature sensors can quantify the spatial and temporal variation of soil



The components of a flux network: (top left) An eddy covariance flux tower, which acts as one site in (top right) a global network (FLUXNET, a component of NASA's Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC)) that produces data that are merged and distributed through (bottom right) an integrative database. These data, used in conjunction with models and remote sensing information, produce (bottom left) high-resolution, spatially gridded maps of trace gas fluxes between the land and the atmosphere.

conditions within the area surrounding a flux measurement tower.

### What Information Do Networks of Flux Towers Produce?

Individual flux towers provide information on the daily, seasonal, annual, and interannual variations in trace gas fluxes for a given plant functional type in a specific climate region and biome. Such observations provide insight into how the flows of trace gases may respond to changes in biophysical drivers such as light, temperature, soil moisture, and leaf area index.

Groups of towers at the landscape, regional, continental, and global scales allow scientists to study a greater range of climate and ecosystem conditions such as the dominant plant functional type; biophysical attributes; biodiversity; time since the last disturbance from fire, logging, wind throw, flooding, or insect infestation; or the effect of management practices such as fertilization, irrigation, or cultivation. A global flux network has the potential to observe how ecosystems are affected by, and recover from, low-probability but high-intensity disturbances associated with rare weather events.

So far, flux measurement networks have revealed a number of new insights on the consequences of environmental change. They have yielded unique information on how annual sums of trace gas fluxes covary with climate, plant functional type, drought, heat spells, and nitrogen deposition [Law *et al.*, 2002; Magnani *et al.*, 2007; Reichstein *et al.*, 2007]. They have revealed how biophysical variables, including albedo and canopy height, vary with plant functional type and nutrition [Hollinger *et al.*, 2010; Simard *et al.*, 2011]. They are improving scientists' understanding of phenology, the study of how seasonal or climatic change affects the timing of plant behavior [Richardson *et al.*, 2012]. They are also monitoring the effect of pollution control efforts on deposition [Fowler *et al.*, 2009].

Networks that focus on measuring surface-atmosphere carbon dioxide exchange have produced new information on how the length of the growing season modulates annual photosynthesis; how peak photosynthesis acclimates with temperature

increases; how light use efficiency increases with the fraction of diffuse, rather than direct, sunlight; how photosynthetic capacity varies with season; how rain induces large pulses in ecosystem respiration; and how the net ecosystem-atmosphere carbon exchange varies with the time since the last disturbance [Amiro *et al.*, 2010; Baldocchi, 2008; Reichstein *et al.*, 2007].

There is also potential to apply flux networks toward problems associated with network theory [Newman, 2003]. Recently, flux networks were used to produce new information on feedbacks between carbon and water fluxes and meteorological and soil conditions using transfer entropy methods [Kumar and Ruddell, 2010].

### Attributes of Effective Networks

An effective flux network possesses a number of key attributes. Data are best when there are standards and protocols for instrument performance, data quality, and calibration; data gaps are minimized if redundant or replacement sensors are available.

Data are converted into information and knowledge when there is a shared and integrated database [Agarwal *et al.*, 2010; Papale *et al.*, 2012], with which researchers can merge flux measurements with a cohort of meteorological, ecological, and soil variables. A centralized database can harmonize data processing, produce value-added products such as daily or annual sums or averages, establish version control and sharing policies, and archive data. Databases can be queried to pull data for specific times, locations, or variables.

The success of a scientific flux network relies on creating a human network too. Data sharing depends on fostering trust among colleagues, crossing cultural and political obstacles and devising a fair use data sharing policy. Shared leadership and frequent communication through workshops, internet forums, and newsletters can also help to build trust.

### Current Activities and Future Opportunities

In research done in collaboration with the remote sensing and Earth system modeling

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## Trace Gas Flux

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communities, scientists are finding flux networks to be a critical tool in efforts to produce information on trace gas fluxes that are occurring everywhere, all of the time. Biophysical, biogeochemical, and ecological models that diagnose and forecast the state of the land's trace gas budgets depend on data from a network of "supersites" that measure a broad suite of site characteristics to identify or quantify important biophysical processes and develop parameterizations for mechanistic algorithms.

Other types of models need a dense network of less intensive flux measurement sites that are sampling representative climate and ecological spaces. These models digest flux, remote sensing, and climate data to produce maps of trace gas fluxes at regional, continental, and global scales using neural networks, regression trees, or genetic algorithms [Jung *et al.*, 2011]. Improvements in empirical machine learning models will require additional flux measurement instruments to be installed in clusters at sites that experience different types of ecosystem disturbances or that include underrepresented climate and ecological spaces such as the tropics and tundra, where spatial gaps in current flux measurement networks remain the greatest.

At present, data generated by flux measurement networks are being used to test and improve the land-atmosphere flux algorithms used in climate models [Bonan *et al.*, 2011]. They may also be used in the next generation of data assimilation models, which use Bayesian statistics and are coupled to climate and weather models [Williams *et al.*, 2009]. In addition, flux networks have the potential to supply data that will be used to validate maps of sources and sinks that are being generated by the global network of trace gas concentration monitors and those that will be generated from inverting the next generation of satellite-based carbon dioxide observations.

Sustained operation of flux networks, through programs such as the National Ecological Observation Network or the Integrated Carbon Observation System, has the potential to detect long-term and gradual ecological changes that are occurring against the background of faster physiological variations as carbon dioxide concentrations and air temperature continue to rise. Finally, there is potential to use information emerging from flux networks to better quantify carbon sources and sinks for carbon market valuation, to inform land use policy, and to provide information on pollutant deposition for assessing the efficacy of pollution control policies.

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# NEWS

## Senate Hearing Considers Law of the Sea Treaty

The U.S. Senate Committee on Foreign Relations is once again discussing the Law of the Sea Convention (LOS). The treaty, which was adopted in 1982 by parties to a United Nations Conference as a framework for governing uses of the world's oceans, has been ratified by more than 160 countries, but the United States is a notable exception. The treaty has been approved twice by the Foreign Relations Committee but has not made it to a full Senate vote because of opponents' concerns about potential loss of U.S. sovereignty and U.S. access to the deep seabed, among other reasons.

During a 23 May hearing of the committee, chairman John Kerry (D-Mass.), a strong supporter of the treaty, said U.S. ratification "is now more urgent than ever" and that to remain outside of the treaty "is fundamentally, directly counter to the best interests of the United States."

"Some may ask, Why now? Why consider a treaty that's been untouched by the Senate for the last 5 years and been hanging around for more than 25?" Kerry said of the treaty that was modified in 1994 to satisfy U.S. objections regarding deep-seabed mining provisions. "I think the real question is why we wouldn't have this discussion now, when today we have the worst of all worlds. We've effectively lived by the terms of the treaty for 30 years but, as a non-party, we're on the outside looking in. We live by the rules, but we don't shape the rules."

He said ratification is important for a number of reasons including locking in favorable navigational rights for U.S. military and shipping interests and strengthening the United States' hand against China and other

countries that "are staking out illegal claims in the South China Sea and elsewhere."

U.S. Secretary of State Hillary Clinton also testified at the hearing that it is urgent for the United States to sign the treaty. She said no other country would be better served by the treaty than the United States and that ratification could secure international recognition of an extended continental shelf equal to an area at least 1.5 times the size of Texas. This has led to some people calling the treaty "the U.S. land grab," she added.

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## News

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Clinton said four recent developments make U.S. participation in the treaty “a matter of utmost security and economic urgency.” She said American oil and gas companies are now technologically ready to explore an extended U.S. continental shelf provided they have the international legal certainty the treaty would provide before making substantial investments. Second, she said deep-seabed mining is no longer theoretical and that the convention offers “the only effective mechanism” for companies to gain a secure title to sites and minerals—possibly including rare earth elements—that they would recover.

Another recent development Clinton noted includes emerging navigation, resource exploration, and other opportunities in the Arctic as the region warms. “Russia and other Arctic states are advancing their continental shelf claims in the Arctic while we are on the outside looking in,” she said. Clinton added that the fourth development is that the convention’s bodies are up and running, with the body that makes recommendations about extended continental shelves actively considering submissions from more than 40 countries and the body addressing deep-seabed mining drawing up rules governing the extraction of minerals. “It simply should not be acceptable to us that the United States will be absent from either of those discussions,” she said.

At the hearing, U.S. Secretary of Defense Leon Panetta also called for treaty ratification. “We have without question the strongest navy in the world, but if we are going to continue to assert our role as a maritime power, it is essential that we accede to this important convention,” he said. “By joining

the convention, we would help lock in rules that are favorable to our freedom of navigation and our global mobility.”

Noting that the treaty is supported by past and present Republican and Democratic administrations and many other interests, Panetta disputed that the treaty would in any way restrict U.S. military operations and activities, harm intelligence collection activities, or cause any surrender of U.S. sovereignty to a foreign body.

Another witness, General Martin Dempsey, chairman of the U.S. Joint Chiefs of Staff, said the convention would provide a firmer, codified legal foundation for day-to-day U.S. maritime operations and would enable and strengthen U.S. military efforts rather than limit them. He also said that the convention would provide the United States with “an important tool to help stave off jurisdictional creep” in the Pacific, Arctic, and other regions and “to resolve future conflicts peacefully and with less risk of escalation.”

Opposition to the treaty has focused on potential loss of U.S. sovereignty to other countries that might be able to decide rules for U.S. military, industrial, and other interests through treaty governing bodies; concerns about U.S. access to deep-seabed mining; arguments about the convention imposing a royalty that some have called a tax on U.S. resource extraction; fear that some treaty language regarding pollution from atmospheric sources might be a backdoor way for the United States to agree to principles of the Kyoto Protocol to the United Nations Framework Convention on Climate Change; and a belief that bilateral treaties and reliance on customary international law are sufficient to protect U.S. interests.

At the hearing, Clinton acknowledged opposition to the treaty. “I am well aware that this treaty does have determined opposition, limited but nevertheless quite

vociferous. And it’s unfortunate because it’s opposition based in ideology and mythology, not in facts, evidence, or the consequences of our continuing failure to accede to the treaty,” Clinton said. “Whatever arguments may have existed for delaying U.S. accession no longer exist and truly cannot be even taken with a straight face.”

Indeed, Clinton smiled as committee ranking member Richard Lugar (R-Ind.), a treaty supporter, read part of an opinion piece by Frank Gaffney Jr., president of the Center for Security Policy, which appeared in the 23 May issue of the *Washington Times*. Gaffney called the treaty “a diplomatic dinosaur, a throwback to a bygone era when [United Nations] negotiations were dominated by communists of the Soviet Union and their fellow travelers in the Third World.”

Gaffney’s opinion, read by Lugar, continues, “These adversaries’ agenda was transparent and wholly inimical to American equities. They sought to establish control over 70% of the world’s surface, create an international governing institution that would serve as a model for bringing nation states like ours to heel and redistribute the planet’s wealth and technology from the developed world to themselves. [LOS] codifies such arrangements and would subject us to mandatory dispute resolution to enforce them via stacked-deck adjudication panels.”

Several Republican senators on the panel also raised concerns about the treaty. “My problem is with sovereignty,” said Sen. James Risch (R-Idaho). He said that “if we give up one scintilla of sovereignty this country has fought and bled for,” he cannot vote for the treaty. He and others also questioned language in the treaty regarding regulating pollution in the ocean from land-based sources. However, Clinton said the treaty “contains no

obligation to implement any particular climate change policies.”

Sen. Jim DeMint (R-S.C.) said most of the hearing dealt with navigation and related issues that take up about 10 pages of the treaty. “The concern I have is almost 300 other pages of the treaty that really have not been dealt with today,” DeMint said.

Sen. James Inhofe (R-Okla.) asked whether it would be better to use money for treaty-related fees for U.S. military needs instead, and he had concerns about a resource extraction royalty that would come into play after a certain time period of time.

However, Kerry responded, “You’re here protecting companies from paying a royalty that they want to pay. You’re here protecting companies from being able to drill when they can’t drill without this [treaty]. They’d rather have 93% of something than 0% of nothing. They can’t [drill] because there is no bilateral treaty that can apply to the extended [continental] shelf. It is only through the international rules that come through the Law of the Sea that you can do that.”

Kerry promised that the 23 May hearing would be the first of a series to examine the treaty and that additional hearings would include testimony from industry, business, and other interested parties. In addition, Kerry said he likely would not bring the treaty up for a vote until after the November U.S. presidential election so that the treaty does not get entangled in election politics.

For more information, see <http://www.foreign.senate.gov/> and “U.S. Senate may consider law of the sea treaty again” (*Eos*, 93(20), 194, doi:10.1029/2012EO200002, 2012).

—RANDY SHOWSTACK, Staff Writer

## In Brief

**Russia sets sights on lunar base** Vladimir Popovkin, director of Roscosmos, the Russian Federal Space Agency, said the agency is setting its sights on the Moon. “We strongly feel that it is time for us to start working toward being able to establish a permanent base on the Moon,” Popovkin said at a 22 May panel discussion and news briefing held in conjunction with the Global Space Exploration Conference in Washington, D. C.

Establishing a goal of lunar exploration does not mean that Roscosmos is giving up on other priorities such as exploration of Mars, asteroids, or the moons of Jupiter, Popovkin said. “We have much better chances to come up with very productive and tangible results while concentrating on Moon exploration,” he said, noting the findings of water in polar areas.

Popovkin said he hopes that other space-faring nations that are partners in the International Space Station will also embrace the idea of establishing permanent lunar bases,

which could set the stage for future endeavors in space, as well. “We want to work together,” he said. “We fully realize that this type of effort, the magnitude of this effort, could only be achieved based on the international cooperation.”

“When it comes to Moon exploration, we’re not talking about replicating what mankind has achieved 40 years ago, which is fly to [the Moon], and landing, and some time on the surface, collection of samples, and stuff like that,” he added. “We are rather talking about establishing permanent stationary bases on the surface of this planet, which is essentially a different approach to how exploration on the Moon should be achieved.”

**Group calls for space policies to transcend politics** At a 22 May briefing, the American Institute of Aeronautics and Astronautics (AIAA) called on Congress to “establish space exploration policy goals which transcend partisan political differences.”

AIAA president and former NASA administrator Michael Griffin said the “goal of establishing human capability to be a

space-faring species is not a short-term goal,” nor is it a goal that belongs to only one political party. “We will not reach long-term goals without a stable, coherent, sensible plan that transcends elections and leaders,” said Griffin, who has provided advice to Republican U.S. presidential candidate Mitt Romney.

Griffin pointed to NASA’s 2008 authorization as providing the kind of vision needed for NASA. The act called for human return to the Moon and preparation for the capability for permanent bases on the Moon, among other things, he said. “That’s the kind of thing that we need. All of the goals espoused by the 2008 act were long-term, generational, strategic in scope,” Griffin said, adding that the act, which had bipartisan support, demonstrated “the kind of societal support, rather than political support, that I believe our space program deserves.”

**White House nominates nuclear commissioner** Just 3 days after U.S. Nuclear Regulatory Commission chairman Gregory Jaczko announced his intention to resign (*Eos*, 93(22), 211, doi:10.1029/2012EO200005,

2012), President Barack Obama nominated Allison Macfarlane to serve out the remainder of Jaczko’s term, through June 2013. The White House announced that upon her appointment, Macfarlane would be designated as chair of the commission. Macfarlane is an associate professor of environmental science and policy at George Mason University. A member of the Blue Ribbon Commission on America’s Nuclear Future from March 2010 to January 2012, she is also the author of the 2006 book *Uncertainty Underground: Yucca Mountain and the Nation’s High-Level Nuclear Waste* and is an AGU member.

“I am confident that like her predecessor, Dr. Allison Macfarlane will make preserving the safety and security of American citizens her top priority as chair of the Nuclear Regulatory Commission,” U.S. Senate majority leader Harry Reid stated. “The nuclear industry has a perfect opportunity to demonstrate a commitment to safety by supporting Dr. Macfarlane’s nomination.”

—RANDY SHOWSTACK, Staff Writer

## LETTERS

## Reef Flat Growth

## Comment on “Rising Sea Level May Cause Decline of Fringing Coral Reefs”

M. E. Field et al. (*Eos*, 92(33), 273–274, doi:10.1029/2011EO330001, 2011) report that rising sea levels can mobilize sediments and damage coral. Many reef flats may have much less sediment on them than the reef on the south side of Molokai, Hawaii, which Field et al. use as a typical example of a reef under sediment stress. The reefs of the Red Sea and Ningaloo Reef off the west coast of Australia (which is the world’s largest fringing reef; fringing reefs are next to shorelines) are all adjacent to deserts and have no sediment runoff. Neither do thousands of atolls. So the Molokai situation is not universal.

Furthermore, the article gives a very conservative value for coral growth rates (2 to >30 millimeters per year). Coral growth rates are up to 100 millimeters per year on branch tips of fast growing *Acropora*. Although *Acropora* are absent from the main Hawaiian islands and nearly so from the Caribbean (a very small area compared to the Indo-Pacific), they are the largest genus of reef corals in the world and dominate many reefs; many are fast growing. Reefs do grow more slowly than corals, typically

3–6 millimeters per year. Many reef flats have relatively low coral cover because low tides kill the highest coral by exposing them to air in a process much like mowing a lawn. Deeper water on the reef flat allows coral cover to increase [Brown et al., 2011; Scopéllitis et al., 2011], and with it the rate of upward growth of the reef. Thus, many reef flats may keep up with sea level rise until bleaching kills most coral in a few decades.

## References

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- Scopéllitis, J., S. Andréfouët, S. Phinn, T. Done, and P. Chabanet (2011), Coral colonization of a shallow reef flat in response to rising sea level: Quantification from 35 years of remote sensing data at Heron Island, Australia, *Coral Reefs*, 30, 951–965, doi:10.1007/s00338-011-0774-y.

—DOUGLAS FENNER, Department of Marine and Wildlife Resources, Pago Pago, American Samoa; E-mail: douglasfenner@yahoo.com

## Reef Flats Likely Will Not Keep Up With Sea Level Rise

## Reply to Comment on “Rising Sea Level May Cause Decline of Fringing Coral Reefs”

We thank D. Fenner for continuing the important discussion about the potential impact of sea level rise on fringing coral reefs [Fenner, 2012]. He notes that not all reefs will be affected by sea level rise, i.e., “the Molokai situation is not universal.” We agree that increased turbidity on fringing reefs will not be universal, but the potential for it to be epidemic is clear. We provided numerous global examples of fringing reefs around high islands where sediment stress is likely to be exacerbated by sea level rise.

The heart of his comment, however, is about the accretion rate of reef flats. We strongly disagree with Fenner’s assertion that “many reef flats may keep up with sea level rise until bleaching kills most coral” for the following reasons:

1. Although *Acropora spp.* and other corals may be fast growers (>30 millimeters per year), growth rates are affected by sedimentation, temperature stress, and ocean pH. Globally, stressors are on the rise, and 75% of existing reefs are highly threatened, making it very unlikely that coral reefs will be able to accrete at optimum rates this century [Hoegh-Guldberg et al., 1999]. Further, not all reefs are dominated by the fast growing *Acropora spp.* In the Caribbean, a major reef-growing area, *Acropora spp.* have declined by 80%–90% since 1980 [Bruckner, 2003].

2. Rates of vertical accretion of coral reef flats are much lower [Montaggioni, 2005] than projected rates of sea level rise for this century; thus, there will likely be an increase in water depth over exposed fringing reef flats. The combined impacts of climate change are certain to slow or stop reef accretion in many locales.

## References

- Bruckner, A. W. (2003), Proceedings of the Caribbean *Acropora* workshop: Potential application of the U.S. endangered species act as a conservation strategy, *Tech. Memo. NMFS-OPR 24*, Natl. Oceanic and Atmos. Admin., Silver Spring, Md.
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- MICHAEL E. FIELD, U.S. Geological Survey (USGS), Santa Cruz, Calif.; E-mail: mfield@usgs.gov; ANDREA S. OGDON, School of Oceanography, University of Washington, Seattle; and CURT D. STORLAZZI, USGS

# MEETINGS

## Characterizing Atmospheric Waves on Venus, Earth, and Mars

**Atmospheric Waves Workshop;**  
Noordwijk, Netherlands, 9–10 November 2011

Experts in observations and modeling of atmospheric waves from the Earth and planetary atmospheric science communities came together at a November 2011 workshop held at the European Space Agency's (ESA) European Space Research and Technology Centre (ESTEC) site in the Netherlands to discuss the nature of waves observed in Venus's atmosphere and their comparison to those on Earth and Mars.

ESA's Venus Express (VEx) satellite and ground-based observers find atmospheric waves at many scales. Migrating solar tides and other planetary-scale waves are observed in cloud-tracking wind vectors and temperature fields. Mesoscale gravity waves (GWs) can also be seen at a variety of levels

from the cloud base up to the thermosphere, evident in imagery and in vertical profiles of temperature, density, and aerosol abundance. This workshop focused particularly on GWs, as their role in the atmospheric circulation is still poorly understood.

A review of the atmospheric waves and their classification was followed by presentations about observations of GWs on Earth, particularly using thermal infrared limb sounding and radio occultation. The Constellation Observing System for Meteorology, Ionosphere and Climate set of microsats orbiting Earth retrieves some 1000–2500 temperature profiles per day, providing a rich data set for the characterization of GWs. Similarly, limb

observations in the thermal infrared yield two-dimensional (latitude-altitude) plots of temperature, from which vertical GW momentum flux can be calculated.

Mars has been the subject of an intense campaign of spacecraft exploration in the past 2 decades, including ESA's Mars Express (MEx) satellite. GWs are observed in MEx observations at a range of altitudes, from surface pressure maps and cloud patterns up to the wave trains observed in the thermosphere. Mesoscale circulation models of the Martian atmosphere are well developed, allowing assimilation and reconstruction of observed atmospheric GW behavior.

Unfortunately, the spatial and temporal coverage and resolution of Venus observations is sparse; thus, Venus researchers cannot use all of the techniques used for analysis of Earth data. VEx obtained only a few hundred radio occultations in its 5-year mission to date, and because of its highly elliptical orbit, it has acquired only a relatively small number of thermal infrared limb observations with geometry suitable for GW detection.

Despite the difficulties of analyzing such a sparse data set, achievable objectives for VEx GW data analysis were set. First, more work is needed on characterizing the

wavelengths and spatial distribution of GWs in Venus data. Furthermore, there should be a renewed drive to search for correlations between wave occurrence and underlying topography. Although cloud-level turbulence and shear are likely to be a more important source of GW generation than topography, quantifying topographical GW generation would help scientists understand surface-atmosphere momentum exchange, a critical boundary condition for the atmospheric circulation.

The workshop, sponsored by ESA's Research and Scientific Support Department faculty, was attended by some 30 participants from nine countries, with an additional 10 scientists participating remotely via video link. Presentations from the workshop can be viewed at [http://www.rssd.esa.int/index.php?project=VENUSEXPRESS&page=atm\\_waves\\_intro](http://www.rssd.esa.int/index.php?project=VENUSEXPRESS&page=atm_waves_intro). Many of the detailed results from VEx are reported in a special issue of *Icarus*, published 1 February 2012.

—COLIN F. WILSON, Atmospheric, Oceanic and Planetary Physics, Department of Physics, University of Oxford, Oxford, UK; E-mail: wilson@atm.ox.ac.uk; and ARIANNA PICCIALI, ESTEC, ESA, Noordwijk, Netherlands

## Strategies to Deliver Information on Regional Climate Changes to Communities

**Regional Climate Services Workshop 2011;**  
Victoria, British Columbia, Canada, 21–23 November 2011

Recognizing that adaptation to both current and projected climate variability and change is best undertaken locally and regionally, a recent workshop was convened to analyze how regional climate services are delivered. Regional climate service organizations facilitate efficient adaptation by interacting with local and regional stakeholders. Regional and local contextualization of observed and projected climate change is an important issue in large federally organized countries like Canada and Germany (as opposed to centralized countries). Exchanging knowledge and needs on changing

climate regimes takes place in societal context within which scientific knowledge is challenged by various interest-led knowledge claims about climate change and its societal significance.

Various approaches to this bundle of tasks were presented, with examples from mostly Canada and Germany, along with the United States and the Netherlands. Practical examples as well as media analyses were examined and discussed.

In Canada, relatively large regional climate service institutions cooperate on specific projects with various regional and local stakeholders, ranging from conglomerates of

municipalities, park managers, and aboriginal communities to investors and industrial representatives. Examples of projects discussed at the meeting included strategies to mitigate the vulnerability of water resources to climate change in diverse drainage basins and support for adaptation planning for these changes in small interior British Columbia communities. In most cases the way in which information and climate mitigation strategies are delivered regionally is based on specific scientific questions that derive from practical management problems.

In Germany the work is generally focused on ad hoc dialogue between scientific institutions and scientific, economic, and political stakeholders. The dialogue includes social and cultural scientists who help to unravel the competitive coexistence of different knowledge claims. Presentations explained how regional climate services in Germany are provided by small "outlets" of larger research laboratories that integrate sectoral issues (such as coastal defense or agriculture) on regional scales. These small outlets use mostly the scientific knowledge available from their parent labs and report the public's and stakeholders' needs for actionable adaptation knowledge back to the parent labs.

Workshop participants engaged in detailed debates, often using examples

from British Columbia as case studies, on specific issues such as how to balance stakeholder perspectives with scientific evidence, the role of regional climate service providers, how to best communicate regional climate science, and the role of mass media in the public's perception of climate science. Other relevant elements involved practical issues, such as how best to divide labor between national and regional services and how to provide communities with regionalized and localized scenarios, projections, and assessments. Other mostly conceptual issues, which would benefit from a stronger engagement with the social and cultural sciences, relate to the dynamics and evolution of knowledge; its cultural conditioning; the role of knowledge gaps; demand and supply of knowledge; competition with other knowledge systems (such as philosophy, politics, or religion), including the ability to distinguish between accurate, inaccurate, and value judgment statements; and the role of communication and media.

—HANS VON STORCH, Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research, Geesthacht, Germany; E-mail: hvonstorch@web.de; and FRANCIS ZWIERS, University of Victoria, Victoria, British Columbia, Canada



### Longitude and Hemispheric Dependence of Space Weather

Addis Ababa, Ethiopia 12–16 November 2012

**ABSTRACT DEADLINE:**  
**12 July 2012, 23:59 Eastern Time**

This international conference expands upon the focus on longitude and hemispheric dependence of space weather by emphasizing its response to major solar events and by examining the Earth system response.

For complete meeting details, including information regarding abstract submission, housing, conveners, and more, visit  
[www.agu.org/SpaceWeatherChapman](http://www.agu.org/SpaceWeatherChapman).



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**Firat Y. Testik and Mekonnen Gebremichael, Editors**

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# ABOUT AGU

## Call for Nominations for 2012 William Kaula Award

The William Kaula Award recognizes unselfish service to the scientific community through extraordinary dedication to and exceptional efforts on behalf of AGU's publications program. Individuals may be recognized for contributions such as outstanding reviewing, editorial service beyond expectations, or innovative leadership.

In even numbered years the Publications Committee selects a recipient, who is recognized at the Editors' Evening at the Fall Meeting and in *Eos*. The Publications Committee is asking the community to help identify those who are deserving of this award. If you would like to nominate someone, please send an e-mail to [editors\\_relations@agu.org](mailto:editors_relations@agu.org) no later than 15 August 2012. Please outline

as clearly as possible why this particular individual is a worthy recipient of the award.

William Kaula gave unstintingly of his talents and energies to AGU's publications. He served as Editor of *Reviews of Geophysics* and *Journal of Geophysical Research-Solid Earth*, led the development of a number of policies and practices during his service on the Publications Committee, was a mentor to junior scientists serving as associate editors and editors, and always pressed for higher standards for AGU journals.

Past recipients of the award are George Hornberger, Karl Turekian, William Hinze, Marcia Neugebauer, and Alexander Dessler. —BARBARA MAJOR, Assistant Director, Journals, AGU; E-mail: [bmajor@agu.org](mailto:bmajor@agu.org)

## Keir Receives 2011 Jason Morgan Early Career Award

Derek Keir received the 2011 Jason Morgan Early Career Award at the 2011 AGU Fall Meeting, held 5–9 December in San Francisco, Calif. The award is for significant early-career contributions in tectonophysics.

### Citation

The AGU Tectonophysics section is pleased to present the third Jason Morgan Early Career Award to Derek Keir for discoveries resulting from his innovative and tireless efforts to elucidate the role of magma intrusion in large-scale strain accommodation prior to and during continental rapture, a stage of the Wilson Cycle that is very poorly understood. Keir is a consummate tectonophysicist; he uses state-of-the-art

seismic, structural, and other field geophysical techniques to study in detail a first-order tectonics problem: that of how continents break up as the Wilson Cycle is initiated. To address this problem, one has to go to the only place on Earth where the process is ongoing at this moment: northeastern Africa and the Arabian Peninsula. These are physically and logistically difficult places in which to do fieldwork; the work of many collaborators must be coordinated to collect the necessary high-quality

data, and, equally important, one must have excellent "people skills" to gain access to critical areas and to keep a project moving along, always with the target in mind. After the very large amounts of data are collected at great effort, the motivation must be maintained to ensure that the data are sifted and condensed into a coherent whole and published where large numbers of scientists of many disciplines will see them. Keir's astounding productivity in some of the world's best scientific journals in his fledgling scientific career attests to his possession of such motivation and the caliber of his writing skills. The equally impressive number of citations of these papers attests to his choice of important topics, the rigor of his analyses, and the quality of the results. His quiet, modest demeanor belies his strong commitment to teaching and outreach, and his career to date exemplifies AGU's aim to promote discovery in Earth and space science for the benefit of humanity.

—HARRY W. GREEN, University of California, Riverside

### Response

I am sincerely grateful to the Tectonophysics section of AGU for considering me as a recipient of this prestigious award. These days, early-career scientists face an ever increasing challenge navigating their way toward independent careers. The international science community is large and complex, and the standards are high. It is therefore very important for the community to continue supporting young scientists through opportunities in funding and resources, sound mentoring, and encouragement to contribute back to the community. I have been fortunate to have had all these ingredients in my career to date.

First, I am grateful to my Ph.D. advisor, Cindy Ebinger. Her enthusiasm, generosity, and unwavering determination in Earth science are truly inspirational. I also thank my closest established colleagues in Europe and

## What's on the Web?

Read the latest offerings from the AGU Blogosphere:

**Mountain Beltway:** "Fossil Falls fun" (<http://bit.ly/MD4Xai>)

**GeoSpace:** "Dead Sea rising: How the lowest place on Earth is getting (slightly) higher" (<http://bit.ly/LhTHRH>)

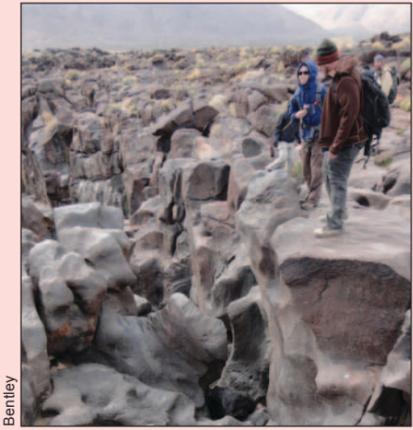
**The Landslide Blog:** "Understanding the Seti River landslide in Nepal" (<http://bit.ly/MGRwJ3>)

**Magma Cum Laude:** "Stages of numerical modeling" (<http://bit.ly/KRiCwo>)

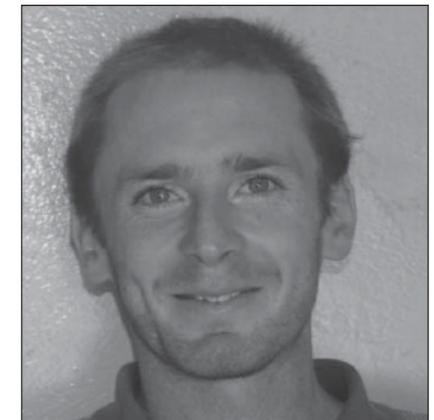
**The Martian Chronicles:** "SpaceX successfully launches Dragon capsule to ISS" (<http://bit.ly/KfSNDR>)

**Dan's Wild Wild Science Journal:** "Teaching students environmental science the right way" (<http://bit.ly/JcVUcY>)

**Georneys:** "Georneys with Dana—Part V: The Garnet Road" (<http://bit.ly/KAcHJJ>)



Mountain Beltway blogger Callan Bentley visited the dry Owens River in California.



Derek Keir

Ethiopia: Graham Stuart, Mike Kendall, Tim Wright, Sylvie Leroy, and Atalay Ayele, who continue to provide valuable mentoring and scientific collaboration. I have built a fledgling career on a core of seismic experiments in Ethiopia and Yemen. I am therefore indebted to Alex Brisbane and colleagues at SEIS-UK for the fabulous opportunities facilitated, as well as to collaborators at Addis Ababa University and the Yemen Seismological Observatory Center. In the United States the platforms provided to young scientists by AGU and the Geodynamic Processes at Rifting and Subducting Margins (GeoPRISMS) program to contribute to, and integrate with, the broader community have also been exceptionally important.

Young scientists are the future, and I have already worked with and learned from a suite of young and exceptionally talented seismologists, geodesists, geochemists, and volcanologists. I look forward to a future of collaborative, multidisciplinary, high-quality, fun, and ethical science from my new base at the National Oceanography Centre, Southampton.

—DEREK KEIR, National Oceanography Centre, Southampton, University of Southampton, Southampton, UK

## ABSTRACT SUBMISSIONS

Opening Date:  
**12 June**

Abstract Submissions Deadline:  
**8 August, 23:59 EDT**

For details on submission policies and guidelines, including membership requirements, visit [fallmeeting.agu.org](http://fallmeeting.agu.org).

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Deadline for application is **July 15, 2012**; decisions will be communicated by end of July. Preference will be given to applicants involved in ICDP drilling projects, applicants from ICDP member countries, developing countries, and those from countries considering ICDP membership. For the successful candidates, costs including those for travelling, visa, and accommodation will be covered by the ICDP. Applications should include a letter of interest, CV, and at least two letters of support.

Please send your application to: [icdp-outreach@gfz-potsdam.de](mailto:icdp-outreach@gfz-potsdam.de)

More information on ICDP training measures can be found at: [www.icdp-online.org/training](http://www.icdp-online.org/training)

**AGU Chapman Conference on Hydrogeomorphic Feedbacks and Sea Level Rise in Tidal Freshwater River Ecosystems**  
Reston, Virginia, USA 13–16 November 2012

**ABSTRACT DEADLINE: 12 July 2012 (23:59 ET)**

Tidal freshwater rivers link watersheds with estuaries and affect the flux of carbon, nutrients, sediment, and freshwater from land to the ocean. However, climate change is continually altering tidal river ecosystems as tides advance inland and watershed inputs change. This Chapman Conference will generate synthesis of feedbacks between geomorphic, biogeochemical and ecological processes in tidal rivers to better predict ecosystem changes in response to climate change.

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## POSITIONS AVAILABLE

### Biogeosciences

#### University of Waterloo

Department of Earth and Environmental Sciences.  
PhD Positions in Biogeochemistry and  
Ecohydrology

The ecohydrology group at the University of Waterloo focuses on water-related environmental issues of societal significance (<http://ecohydrology.uwaterloo.ca>). It is funded through the Canada Excellence Research Chair program ([www.cerc.gc.ca](http://www.cerc.gc.ca)), and includes a diverse team of geologists, biogeochemists, soil scientists, hydrologists, environmental engineers and microbiologists. The University of Waterloo (<http://uwaterloo.ca>) is located in Southern Ontario, approximately 100 km west of Toronto, and consistently ranks as the most innovative university in Canada.

PhD positions are open within the ecohydrology group, with research projects designed around (1) field and laboratory experiments to determine rates, mechanisms and products of biogeochemical transformations of nutrients and contaminants, (2) reactive transport modeling to simulate the fate and fluxes of nutrients and contaminants at key interfaces within the landscape, (3) ecohydrological river basin modeling to forecast the effects of anthropogenic pressures on ecosystem services along the aquatic continuum, including the coastal zone. Candidates will be actively involved in defining the actual scope, objectives and methodology of their project.

Applicants with degrees in any field of science or engineering are welcome to apply but preference will be given to candidates with demonstrated skills and experience in (environmental) chemistry, hydro(geo)logy, numerical and reactive transport modeling. Applications received before June 1 will be considered for a Fall 2012 start date, however, the positions will remain open until filled. Details of the application process can be found at [www.grad.uwaterloo.ca](http://www.grad.uwaterloo.ca). Preference will be given to Canadian applicants. Applicants are encouraged to send enquiries to [ecohydrology@uwaterloo.ca](mailto:ecohydrology@uwaterloo.ca) before starting the application process.

### Ocean Sciences

#### NOAA's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor Michigan.

Seeks an enthusiastic research scientist with experience in hydrodynamic modeling and field observation programs to examine three-dimensional lake-scale circulation, thermal structure, and physical-biological coupling in Great Lakes ecosystems. The candidate will be expected to use and further develop numerical models of Great Lakes hydrodynamics and couple to other's works in hydrologic modeling and ecology with particular emphasis on ecosystem forecasting. The incumbent will manage and design projects in coastal circulation modeling, simulation, and forecasting in support of daily, seasonal, and multi-year forecasts and simulations of hydrodynamic variables (including currents, temperatures, and water levels) for the entire Great Lakes and connecting channels. Experience in building or working with hydrodynamic models with structured and unstructured grids as well as a facility for working with others in linking models. The candidate should also have experience in

designing and executing field programs for model calibration and validation. The candidate will be expected to collaborate with other scientists at GLERL and outside GLERL (e.g., other federal laboratories, universities, private industry), and to build active research programs emphasizing collaborative and inter-disciplinary approaches. Background of the incumbent may be in oceanography, engineering, or physics.

The announcement will be coming soon to [www.usajobs.gov](http://www.usajobs.gov) for a GS-1301-13 Physical Scientist in Ann Arbor, Michigan. The position is open to all U.S. Citizens.

Postdoctoral Fellow Department of Marine Sciences  
Avery Point Campus University of Connecticut.

The Department of Marine Sciences at the University of Connecticut, Avery Point Campus, invites applications for a Postdoctoral Fellow. This is a one-year, full-time, grant funded position subject to annual renewal. The incumbent will assist Dr. James O'Donnell.

The incumbent's duties will include:

- Water quality and circulation model development
- Model evaluation employing quantitative skill and sensitivity analysis
- Implementation of data assimilation techniques
- Report preparation

Minimum Qualifications: Completion of the requirements of a Ph.D. in Oceanography, or closely related field; and experience with numerical models of circulation and mixing in the coastal ocean.

Preferred Qualifications: Experience with water quality/biogeochemistry models and methods of data assimilation are preferred.

Please visit Husky Hire at [www.jobs.uconn.edu](http://www.jobs.uconn.edu) to upload a cover letter, resume, and a list of three professional references as individual file attachments using Husky Hire. Screening of applications will begin immediately. The University of Connecticut is an EEO/AA employer. (Search # 2012538)

### Solid Earth Geophysics

#### Faculty position in Structural Geology-Active Tectonics.

The Department of Geology & Geophysics at the University of Utah invites applications for a tenure-track faculty position in structural geology and/or active tectonics available as early as spring semester 2013. We anticipate hiring at the Assistant Professor level but will consider exceptional candidates at the Associate Professor level. Applicants must have a Ph.D., and the successful candidate is expected to build a productive and internationally visible research program. Expertise in structural geology is desirable but a broad range of field-oriented tectonic specialties will be considered. For further details and to apply, please go to: <http://utah.peopleadmin.com/postings/13949>.

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commitment to improving access to higher education for historically underrepresented students.

### Space Physics

#### Tenure-Track Position, Planetary Atmospheric Physics, University of Houston.

The Department of Physics at the University of Houston invites applicants for a tenure track position among the areas of outer planetary atmospheres and exoplanets with experience in the modeling of atmospheric dynamics in support of current and future planetary missions, magnetospheric physics, radiation belt physics, aeronomy and/or solar physics. Candidates are required to have a Ph.D. and are expected to conduct an active and funded research program in a growing space physics program. Applications containing a current C.V., a cover letter describing research interests and the contact information of three potential references should be sent to:

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617 Science and Research Bldg. 1  
Houston, TX, 77204-5005.

...along with an electronic copy of all materials to [Atmospheric-Physics-Search@uh.edu](mailto:Atmospheric-Physics-Search@uh.edu). Review of applications will begin immediately, and will continue through July 1, 2012 or until the position is filled. The University of Houston is an equal opportunity/affirmative action employer. Minorities, women, veterans, and persons with disabilities are encouraged to apply.

### Interdisciplinary/Other

#### CLIMATE CHANGE ASSISTANT PROFESSOR.

Tufts University invites applications for a full-time, tenure-track position as an Assistant Professor of Earth and Ocean Sciences in the area of Climate Change, beginning September 1, 2013. This position resides in the Department of Earth and Ocean Sciences but is part of a multidisciplinary cluster-hiring initiative designed to deepen and broaden

the Environmental Studies program as well as to enhance traditional academic departments.

The successful candidate will be expected to teach an undergraduate introductory course in climate science, and one or more upper level courses in a field related to the person's expertise. At least 2 courses will count toward both the EOS and the Environmental Studies majors, and the successful candidate will work with others in the cluster hire to create a capstone experience for students in the program. We are particularly interested in those with research interests in the geological record of climate change, methods for interpreting climate change, or implications of climate change that may span a range of temporal scales.

Qualifications include: a Ph.D. by time of appointment in an Earth and Ocean Science discipline; demonstrated potential for research supported by external funding; and preferably teaching experience at the college level. The applicant should be able to fit into a small, well-equipped department where teaching diverse student populations is highly valued, and will be able to work with the Environmental Studies faculty to offer courses that also complement that interdisciplinary program.

A letter of application, statement of teaching and research interests, transcripts, CV, and the names and addresses of three references should be sent to Professor Jack Ridge, Chair, Department of Earth and Ocean Sciences, Tufts University, Medford, MA 02155 ([jack.ridge@tufts.edu](mailto:jack.ridge@tufts.edu)). Review of applications will begin September 15, 2012 and will continue until the position is filled. Tufts University is an Affirmative Action/Equal Opportunity employer. We are committed to increasing the diversity of our faculty. Members of underrepresented groups are strongly encouraged to apply.

#### Job Posting Title: Project Manager- Oak Ridge Climate Change Science Institute.

Purpose:

The Oak Ridge Climate Change Science Institute (CCSI) at the Oak Ridge National Laboratory seeks an

**Classified** cont. on next page

## Postdoctoral Investigator

The Physical Oceanography Department is searching for a Postdoctoral Investigator to join their team. The initial appointment is full-time for a year with the possibility of an extension based on funding. This position is eligible for benefits.

**JOB SUMMARY:** Seeking a Postdoctoral Investigator to study transport and mixing due to oceanic submesoscale processes. The research will involve studying lateral dispersal of tracers and momentum on scales of 0.1-10 km in the upper ocean. The effect of eddies, fronts and instabilities due to surface forcing will be explored using a numerical model, theory, and observations.

Knowledge in one or more areas that include fluid dynamics, physical oceanography, numerical (Lagrangian) modeling and data analysis is desirable. Funding is available for 1 year.

**Please attach your CV and research statement as one PDF document if interested. For detailed information, please contact Amala Mahadevan ([amahadevan@whoi.edu](mailto:amahadevan@whoi.edu))**

**EDUCATION DESIRED:** Ph.D.

WHOI is a member of the Higher Education Recruitment Consortium (HERC). We are sensitive to the issues of dual career candidates and we will work with applicants to address them. Please visit HERC - for more information.

**For a complete description and to apply, please visit: <http://jobs.whoi.edu>**

WHOI is an Affirmative Action/Equal Opportunity Employer M/F/D/V. Applications are reviewed confidentially



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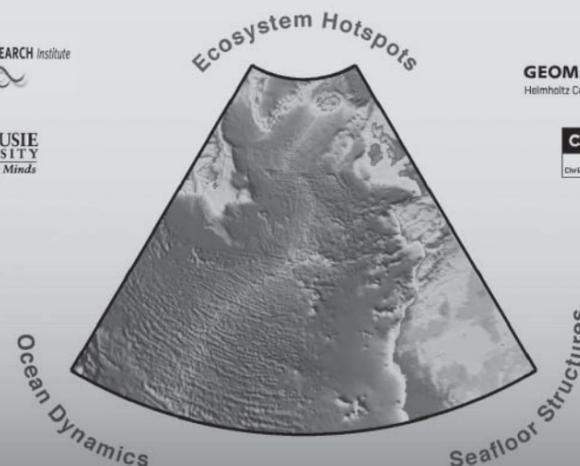
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HELMHOLTZ ASSOCIATION

GFZ

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HELMHOLTZ-ZENTRUM POTSDAM  
DEUTSCHES  
GEOFORSCHUNGSZENTRUM

The Helmholtz Centre Potsdam, German Research Centre for Geosciences (GFZ), is the national Research Centre for Geosciences in Germany and a member of the Helmholtz Association. The geodynamics group, Section 3.1 "Lithosphere Dynamics" at the GeoForschungsZentrum Potsdam seeks individuals with experience in active tectonics for

## 2 Research scientist positions (m/f) in the field of Active Tectonics

Vacancy No. 24/3/12 G

### Tasks:

Current research of the geodynamics group focuses on interdisciplinary system analysis of plate boundary zones with particular focus on the interaction of tectonic mass flux, earthquake deformation processes, and seismotectonics at GFZ's Earth System Observatories and in our own state-of-the-art tectonic analogue laboratory. The successful candidate is expected to participate in an integrated field and laboratory-based research program. In addition to experience in investigation of active deformation at plate boundary zones.

### Qualifications:

A PhD in geology, geophysics or related fields is required. We especially welcome candidates with expertise in modern quantitative methods in several of the following research fields: tectonic geomorphology and paleoseismology, seismotectonics, structural geology, instrumental methods of deformation analysis, simulation techniques and numerical methods. The applicant should have experience in field work and quantitative studies. The successful candidate should have a record of external funding and publications and is encouraged to contribute to existing projects and initiate own projects within our program. GFZ offers a unique opportunity to integrate research with a range of research groups and state-of-the-art facilities.

**Start:** As soon as possible

**Duration:** 3 years (with an option for extension)

**Salary:** EG 13/14 TVöD-O (depending on qualification)

**Contact:** Prof. Dr. O. Oncken (Tel.: +49 331 288 1310)

**Application Deadline:** Evaluation will begin 4 weeks after the announcement of the position and continues until position is filled.

Equal opportunity is part of our personnel policy. The GFZ encourages applications from qualified female candidates. There is a kindergarten service available. Handicapped applicants will be given preference in the case of equal qualifications.

The Geo.X platform ([www.geo-x.net](http://www.geo-x.net)) coordinates geosciences in the Berlin-Potsdam region in research, education, infrastructure, and promotion of young scientists. The GFZ is partner in Geo.X, thus offering excellent opportunities for cooperation across the partner institutions.

Please submit your applications with CV including a publication record and a research statement to: **Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum, Personal- und Sozialwesen, Telegrafenberg, 14473 Potsdam**

**Classified**

cont. from page 222

experienced project manager to help provide effective knowledge management of CCSI - including a basic understanding of the science conducted within the institute.

**Major Duties/Responsibilities:**

The successful candidate will support CCSI leadership in communication among staff and in coordinating, communicating, and promoting our climate change science within and external to ORNL.

Specific responsibilities of the position include, but are not limited to:

- Creating financial reports for principal investigators and CCSI leadership

- Managing content of CCSI overviews, websites, brochures, and other communications

- Assisting CCSI leadership in planning and implementing an annual science retreat for the CCSI Science Advisory Board

- Coordinating preparation of the CCSI annual report

- Managing subcontractors that provide technical support

- Supporting the ORNL Climate Change DOE Relationship Manager in budgets, proposal coordination, and technical communications to DOE

- Managing selected projects so they are on time, on budget, with acceptable quality

The Project Manager interacts directly with the CCSI Director, Deputy Director, and other CCSI leaders across ORNL. An important component of these interactions will be to report on the status of climate-related projects across the diverse laboratory portfolio of activities.

**Minimum Qualifications Required:**

- Bachelor's degree preferably in computer science, environmental science, or a geophysical science discipline.

- Minimum of 7 years' experience in managing projects and programs.

- At least five years of experience working in a scientific/research environment.

- Demonstrated experience managing the financial aspects of a multi-faceted scientific enterprise

- Knowledge of and experience in using modern IT tools for managing and communicating information.

- Demonstrated experience in managing or coordinating the proposal preparation processes.

- Effective written and oral communication skills as evidenced by publications, websites, and presentations.

**Preferred Qualifications:**

- An advanced degree in a computer science, geophysical science, or environmental science discipline.

- Ten years' experience in developing and managing projects and programs in basic scientific research environments is preferred.

- Experience in proposal preparation is highly desirable.

- Professional qualification in project management

For more information or to apply for this position, please contact Julianna Presley at [presleyj@ornl.gov](mailto:presleyj@ornl.gov)

**Postdoctoral Research Associate.**

The Department of Civil and Environmental Engineering at the University of Connecticut seeks a postdoctoral researcher to join an inter-disciplinary team working on understanding ecosystem-climate interactions at various time scales. Successful candidates should have a Ph.D. by time of appointment, and have interest and expertise in one or any combination of the following areas: (1) modeling the terrestrial ecosystem and biogeochemical cycles, (2) land use modeling and prediction, or (3) regional climate modeling. Experience with the NCAR community models or the ICTP regional climate model is desirable but not required. The initial appointment will be for one year, with future renewals based on performance. Further information is available at <http://www.engr.uconn.edu/~gwang> or by email to [gwang@engr.uconn.edu](mailto:gwang@engr.uconn.edu). Applicants should upload an application letter, CV, and contact information of three referees via Husky Hire ([www.jobs.uconn.edu](http://www.jobs.uconn.edu), Search # 2012523). Review of applications will begin on July 1, but the position will remain open until filled. The University of Connecticut is an EEO/AA employer.

**Classified** cont. on page 224

### Seeking world-class PhD students, post-doctoral research fellows and technical engineers in the field of volcanic and magmatic systems

The ClerVolc (Clermont-Ferrand Centre for Volcano Research) consortium involves six laboratories of Blaise Pascal University in Clermont-Ferrand, France (Laboratories of Volcanology 'Magmas et Volcans', Particle Physics, Physical Meteorology, Social and Cognitive Psychology, Mathematics, Computer Science), the Observatoire de Physique du Globe at Clermont-Ferrand, and the French Geological Survey (BRGM). The consortium, which is led by the Laboratoire Magmas et Volcans (director P. Schiano; scientific coordinator T. Druitt), has received funding for a ten-year collaborative research programme from the French government 'Laboratories of Excellence' initiative. The programme will address fundamental questions in the field of magma generation, volcano dynamics, volcanic hazards and volcanic risk.

We are seeking candidates for ten projects, to start in October of 2012. The projects are at post-doctoral (PDoc) and doctoral (PhD) levels. Postdoctoral projects are divided into those with that are strongly research-oriented (PDocRes), and those with important components of technical development (PDocTech).

Details of the projects, post profiles, salaries, contact addresses, application procedures and deadlines may be found at the following link: [http://www.obs.univ-bpclermont.fr/lmv/actu/ClerVolc\\_positions.pdf](http://www.obs.univ-bpclermont.fr/lmv/actu/ClerVolc_positions.pdf). In the event of additional enquiries or problems, please contact Socheata Sean ([Socheata.Sean@univ-bpclermont.fr](mailto:Socheata.Sean@univ-bpclermont.fr)).

- Physical development of magmatic inclusions in crystals. P. Schiano (LMV). **PDocRes.**
- Influence of mantle processes on volcanic behaviour O. Sigmarsson (LMV). **PDocRes.**
- Magnitude and style of explosive eruptions. J-L. Le Pennec (LMV). **PDocRes.**
- Physical vulnerability of urban buildings and infrastructures to lahar and pyroclastic flow impacts. J-C. Thouret (LMV) & A. Wagner (BRGM) **PDocRes.**
- Development of a volcano-dedicated InSAR data processing toolbox. J-L. Froger (LMV) **PDocTech.**
- Development of a portable instrument platform for volcano monitoring by muon tomography P. Labazuy (LMV-OPGC) and C. Carloganu (LPC) **PDocTech.**
- High pressure and high temperature experiments for the determination of thermochemical, physical, and kinetic constraints for the processes of magma genesis, evolution, and eruption K. Koga (LMV) **PDocTech.**
- Developing a platform for numerical modelling of volcanic tsunamis. R. Paris and K. Kelfoun, (LMV). **PDocTech.**
- Development of techniques of analysis and inversion of data from muon tomography – a new technique that uses cosmogenic muons to probe volcanic edifices C. Carloganu (LPC) & P. Labazuy (LMV) **PhD.**
- Modelling of dense, two-phase volcanic flows K. Kelfoun, O. Roche (LMV) & A. Chupin (LM). **PhD.**

LMV: Laboratoire Magmas et Volcans; LPC: Laboratory of Particle Physics; LM: Laboratory of Mathematics; BRGM: French Geological Survey.

**VICTORIA UNIVERSITY OF WELLINGTON**

Victoria University delivers internationally-acclaimed results in teaching and research, as well as programmes of national significance and international quality.

As one of Wellington's largest and most established employers, we're committed to providing our staff with opportunities for rewards, recognition and development, all within a dynamic and inclusive culture where innovation and diversity are highly valued.

**ASSOCIATE PROFESSOR /PROFESSOR IN GEOCHEMISTRY****School of Geography, Environment & Earth Sciences**

We seek outstanding candidates with expertise in Trace Element and Isotope Geochemistry who will lead our existing plasma-source Geochemistry Facility and programme. The successful candidate will be expected to enhance the School's wide-ranging and innovative research programme in Geochemistry, including working with and enhancing our existing strengths in igneous processes and Volcanology. The successful candidate will develop new or maintain existing research relationships with the Wellington-based Crown Research Institutes, as well as with other universities.

The successful candidate must have a proven track record of leading a significant and successful research programme and will undertake internationally recognized research in the Geochemistry of igneous, geothermal, surficial or (paleo-) environmental processes, early Earth, or Solar System processes. Candidates with a strong background in more than one of these fields, and with hands-on experience in plasma source isotope and trace element analysis, are preferred.

The School has a world-class Geochemistry facility including an ultra-clean laboratory and three plasma-source mass spectrometers, as well as a near-new JEOL JXA8230 electron microprobe, new rock preparation and mineral separation facilities, and fission track thermochronology facilities. A detailed list of the equipment available in the school's geochemistry facility and of recent and current research directions within the geochemistry group is available on request.

The successful candidate will be a member of the School's Earth Sciences programme, the members of which work closely with researchers in Antarctic Research Centre and the Geography programme including joint supervision of graduate students.

**Applications close 30 June 2012**

**Reference A107-12Q**

**RESEARCH FELLOW IN GEOCHEMISTRY**

**(2 year fixed-term)**

**School of Geography, Environment & Earth Sciences**

We seek outstanding candidates to join our diverse and dynamic Geochemistry, Volcanology & Petrology group within the Earth Sciences programme, to undertake internationally recognized research in geochemistry in an area complementary to existing staff expertise and interests. The appointment is for two years.

The successful candidate will share responsibility for the day-to-day operations of the School's Geochemistry Facility, including ensuring that the multi-collector and single-collector plasma source mass spectrometers and other equipment are well maintained and operating to the highest specifications. They will also assist in the training of graduate students and other users in use of the Geochemistry facilities, and be expected to play an active, collaborative role in projects leading to publications.

The School has a world-class Geochemistry facility including an ultra-clean laboratory and three plasma-source mass spectrometers, as well as a near-new JXA8230 electron microprobe, new rock preparation and mineral separation facilities, and fission track thermochronology facilities. A detailed list of the equipment in the school's Geochemistry facility and of Geochemistry research currently being undertaken within the group is available on request.

Members of the Earth Sciences programme work closely with researchers in Antarctic Research Centre and the Geography programme including joint supervision of graduate students.

**Applications close 30 June 2012**

**Reference A106-12Q**

Victoria University of Wellington is an EEO employer and actively seeks to meet its obligations under the Treaty of Waitangi.

For more information and to apply online visit <http://vacancies.vuw.ac.nz>



**Classified**

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**US Geological Survey, Program Coordinator, Volcano Hazards Program.**

The U.S. Geological Survey (USGS) invites applications for the position of Program Coordinator, Volcano Hazards Program, in Reston, VA. This Program has both domestic and international responsibilities and works closely with Federal, State, local and private-sector partners to ensure that hazards information and warnings are understood and effectively integrated into response plans and hazard mitigation and crisis response actions. The Program Coordinator plans, develops, and implements all volcano hazards activities and provides scientific leadership and funding guidance for these activities, which include maintaining the U.S. volcano monitoring network system, conducting fundamental research into volcanic processes, issuing hazard assessments and warnings, and working with responsible emergency and land management partners, as well as other affected public and private-sector groups (e.g., civilian and military air route authorities) on crisis response and aircraft/airport ash hazard response plans. The Incumbent facilitates the collaboration of activities relating to volcano hazards and their effects across the Bureau, including coordination for

implementation, reporting, and leveraging of both funding and expertise.

This is an interdisciplinary position that may be filled as either Geologist, GS-1350-15; Geophysicist, GS-1313-15; or Hydrologist, GS-1315-15. It is a full-time, permanent position and has a salary range of \$123,758 to \$155,500 commensurate with experience. The following announcement is open to all U.S. Citizens: ATL-2012-0434. The following announcement is open to all U.S. Citizens that are current or former Federal employees: ATL-2012-0435. Announcements are open from May 7 to June 11, 2012. Details are available at: <http://www.usajobs.opm.gov>. U.S. Citizenship is required. Contact: Office of Personnel 703-648-7296 or [vgarcia@usgs.gov](mailto:vgarcia@usgs.gov). The U.S. Geological Survey is an equal opportunity employer.

**Student Opportunities****PhD opportunities in hydrologic data assimilation, ensemble prediction and hydrologic applications of weather radar.**

The Department of Civil Engineering of the University of Texas at Arlington is seeking two PhD candidates in data assimilation for operational hydrologic and water quality forecasting, hydrologic ensemble forecasting, and hydrologic applications of weather radar with emphasis on radar

multisensor precipitation estimation and hydrologic modeling in urban areas. The anticipated start date is Aug 23, 2012, or when the positions are filled. For more information, contact Dr. Dong-Jun (DJ) Seo at [diseo@uta.edu](mailto:diseo@uta.edu). UT Arlington is an

Equal Opportunity/Affirmative Action Employer and does not discriminate on the basis of race, color, national origin, sex, religion, age, disability, veteran status or sexual orientation in employment or in provision of services.



*With a staff of 5000, Forschungszentrum Jülich – a member of the Helmholtz Association – is one of the largest interdisciplinary research centres in Europe and stands for the next generation of key technologies. Work with us on the grand challenges in the fields of health, energy & environment, and information technology, as well as on the many and varied tasks of research management.*

For our Institute of Bio- and Geosciences - Agrosphere (IBG 3) - we are seeking a

**PhD Student Geosciences / Physics for a three-year project**

The German ministry of research (BMBF) has funded a large research program on seamless climate prediction, MiKlip. This program aims at predicting the climatic changes for the coming decades, taking into account the current state of the climate. To be able to exploit the memory effects of the subsurface soil moisture a complete 3-dimensional hydrological model will be applied. The validation of the full modeling system will focus on the ability to predict the variability and trends in the climate observed during the last decades. A detailed validation will be done in close cooperation with the new TERENO program. Different data types recorded at several TERENO sites, including eddy covariance data, soil moisture data from sensor networks and cosmic ray probes, lysimeter data (evapotranspiration) and further hydrologically relevant measurements (e.g. discharge, groundwater level) will be used for a detailed validation of the model system.

**Main tasks of the position are:**

- Analysis of environmental data
- Hydrological modeling
- Development of a multi-source model validation approach
- Documentation of the results in peer-reviewed ISI refereed Journals.

For further information visit our websites at <http://www2.fz-juelich.de/icg/icg-4/>, <http://www.fona.de/de/10406> (MIKLIP) and [http://teodoor.icg.kfa-juelich.de/overview-en?set\\_language=en](http://teodoor.icg.kfa-juelich.de/overview-en?set_language=en) (TERENO) and/or contact Dr. Heye Bogena, Phone: +49 2461 61-6752, e-mail: [h.bogena@fz-juelich.de](mailto:h.bogena@fz-juelich.de).

**Requirements:**

- M.Sc. (or equivalent) in Geosciences, Physics or a related discipline with a good final grade (in the German system 2.0 or better)
- Competent knowledge in hydrology, statistics and programming (e.g. Matlab, C++, Python)
- Knowledge in hydrological modeling, validation techniques and environmental monitoring are eligible.

The candidate should be highly motivated, fluent in German or English, have good interpersonal communication skills, and be interested in working in an interdisciplinary and international team of scientists. We offer the candidate excellent research conditions within an interdisciplinary team.

Equal opportunities are a cornerstone of our staff policy for which we have received the "TOTAL E-QUALITY" award. Therefore applications from women and disabled persons are welcome. Payment of the PhD fellow will be based on salary grade 13/2 Collective Agreement for the Civil Service (TVöD). Depending on the candidate's profile and the subject of his/her PhD thesis an additional allowance may be granted (up to 75% TVöD EG 13).

Please send your application with the relevant documentation quoting the reference code **D049/2012ES** to:

**Institute for Bio- and Geosciences (IBG)**

Mr. K. Beumers  
Forschungszentrum Jülich GmbH  
52425 Jülich  
Germany  
e-mail: [k.beumers@fz-juelich.de](mailto:k.beumers@fz-juelich.de)

**Integrated Ocean Drilling Program****Call for Applications****Application deadline: 1 August 2012****IODP Asian Monsoon Expedition (346): 20 August to 28 September 2013**

The objective of this expedition (based on IODP Proposals 605-Full2, 605-Add, 605-Add2, and 605-Add3) is to core and log sites on a latitudinal transect in the Japan Sea, and one site in the northern East China Sea, to test the hypothesis that Pliocene-Pleistocene uplift of the Himalayan and Tibetan Plateau and the consequent emergence of the two discrete modes of westerly jet circulation caused the amplification of millennial scale variability of the Asian monsoon and tele-connection mechanism with Dansgaard-Oeschger Cycles.

Scientific objectives will (1) address the timing of the onset of orbital and millennial scale variability of the East Asian Monsoon, (2) reconstruct orbital and millennial-scale paleoceanographic changes in the Japan Sea during at least the last 5 m.y., (3) reconstruct the ventilation history of the Japan Sea, and its relation with the nature of the influx through the Tsushima Strait and/or the intensity of winter cooling; and (4) monitor the history of the Yangtze River discharge in the northern end of the East China Sea as it reflects variation and evolution in East Asian summer monsoon.

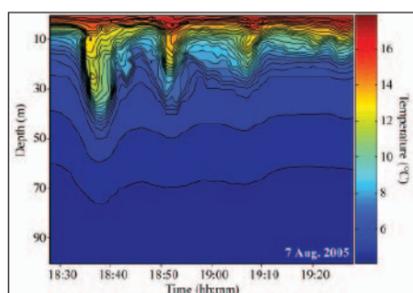
The expedition schedule is available at <http://iodp.tamu.edu/scienceops/>. The expedition web page at [http://iodp.tamu.edu/scienceops/expeditions/asian\\_monsoon.html](http://iodp.tamu.edu/scienceops/expeditions/asian_monsoon.html) provides the original IODP proposals and expedition planning information.

Applications for participation must be submitted to the appropriate IODP Program Member Office – see <http://www.iodp.org/program-member-offices>

**RESEARCH SPOTLIGHT****Highlighting exciting new research from AGU journals****Properties of solitary waves in Lake Constance**

Solitary waves—large individual waves that can travel long distances holding their shape, unlike normal waves that would tend to flatten out—occur in oceans and in lakes, both on the surface and as internal waves below the surface. In lakes, these waves can affect circulation and mixing and influence aquatic ecosystems, but many studies of the properties and effects of internal solitary waves in lakes are based on limited observations.

From observations recorded over 6 years in Lake Constance, in Germany, *Preusse et al.* studied seasonal changes in the properties of internal solitary waves. Their study, which included 219 wave trains with a range of numbers of waves per train, amplitude, propagation depth, and other properties, shows that internal solitary waves are a regular occurrence. They found that a substantial number of the solitary waves were strongly nonlinear and that solitary wave properties varied with



*Isotherms in 0.5°C distance showing an internal solitary wave train in Lake Constance, in Germany. The leading wave has the largest amplitude of all the solitary waves observed during the 6-year measurement campaign.*

the stratification of the lake, which changes with season. (*Journal of Geophysical Research-Oceans*, doi:10.1029/2011JC007403, 2012) —EB

**Measuring currents between North Atlantic and Nordic seas**

The fluxes of water from the North Atlantic to the Nordic seas provide a measure of the water that flows into and out of the global ocean as part of the meridional overturning circulation. The meridional overturning circulation, which carries warm water in the Atlantic from the tropics northward and brings cold dense water back southward, is a key part of global ocean circulation and a strong influence on climate; some research has suggested that the meridional overturning circulation could slow down as the global climate warms.

Using an acoustic Doppler current profiler mounted in the high seas ferry *Norröna* to repeatedly measure the currents in the Faroe-Shetland Channel and over the Iceland-Faroe Ridge, *Rosby and Flagg* report on 3 years of weekly measurements that provide a new, accurate measure of the exchange of water between the North Atlantic and Nordic seas. The observations will be useful in understanding the meridional overturning circulation. (*Geophysical Research Letters*, doi:10.1029/2012GL051269, 2012) —EB

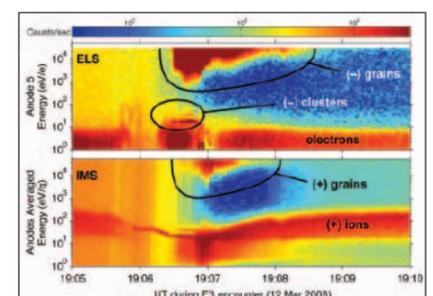
**Changing pressure drives lake methane emissions**

Within the fine-grained sediments of a lake bed, microbes feeding on carbon-rich organic matter can pump out substantial quantities of methane. Recent research has shown that this flow of methane, when combined with other forms of carbon emissions,

is enough to turn some lakes into net sources of atmospheric carbon. Investigations over the past decade have shown that ebullition—the propagation of bubbles up to the surface—is an important methane transport mechanism in lakes. Uncertainty remains, however, around figuring out the drivers behind, or the magnitude and frequency of, bubble-mediated methane emissions.

In a 6-month investigation of Upper Mystic Lake, in Massachusetts, *Varadharajan and Hemond* sought to answer these questions using a network of high-resolution gas bubble traps. The authors placed floating bubble traps below the water's surface at several locations around the lake, measuring captured gas volumes every 10 minutes. They also recorded the lake's water level, atmospheric pressure, and wind speed. The authors found that bubbling episodes tended to last from hours to days and that they took place at different locations around the lake simultaneously. Making up each bubbling episode, however, were a number of shorter-duration bursts lasting minutes to hours. For example, at one site the authors noted that 63% of the methane was released during just 3% of the time.

Using a mathematical technique based on wavelets, which are useful for interpreting observations that cross a range of frequencies and durations, the authors looked for links between bubbling onset and various environmental parameters. The authors found that the main trigger for a bubbling event is a drop in pressure at the lake bed, driven by a drop in the lake's water level or a shift in atmospheric pressure. However, they noted that the magnitude of each gas release was probably affected by the availability of methane within the lake bed sediment. (*Journal of Geophysical Research-Biogeosciences*, doi:10.1029/2011JG001866, 2012) —CS



*Cassini Plasma Spectrometer data for negatively (ELS) and positively (IMS) charged nanograins observed in the plume of Enceladus.*

**Charged nanograins in the Enceladus plume**

Enceladus, which orbits Saturn in the planet's E ring, is one of the few geologically active moons in the outer solar system. It emits a large plume that contains water-ice dust grains. *Hill et al.* used instruments on the Cassini spacecraft to observe charged nanometer sized grains of water ice emanating from Enceladus. The authors measured the charge-to-mass ratio of each grain and found that the most likely charge per grain is 1 electron charge. In addition, negatively charged grains outnumber positively charged ones by a factor of more than 2000. On the basis of their analysis, the researchers argue that the nanograins are not charged when they leave Enceladus but become charged as they encounter electrons in the plasma around Enceladus. (*Journal of Geophysical Research-Space Physics*, doi:10.1029/2011JA017218, 2012) —EB

—ERNE BALCERAK, Staff Writer, and COLIN SCHULTZ, Writer