

Rapid Response Survey Gauges Sandy's Impact on Seafloor

In January 2013, approximately 2 months after Hurricane Sandy made landfall in the Mid-Atlantic Bight, scientists from the University of Texas Institute for Geophysics (UTIG), part of the Jackson School of Geosciences (JSG), partnered with local colleagues at Adelphi and Stony Brook universities and the U.S. Geological Survey (USGS) to conduct marine surveys both offshore and within inshore bays of Long Island, N. Y. (Figure 1a). The primary goal was to assess the storm's impact on the seabed.

Sandy made landfall as a post-tropical cyclone near Brigantine, N. J., with 70-knot (about 80 mph) maximum sustained winds. Its unusual shoreward trajectory and massive size created record storm surges along the heavily populated New Jersey and New York coastlines (http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf). Infrastructure in the New York City metropolitan area was heavily damaged, and the Long Island barrier island system was breached in places and seriously eroded [Hapke et al., 2013]. Surveys involved multibeam bathymetric swath mapping, compressed high-intensity sonar (formerly radar) pulse (CHIRP) high-resolution acoustic subbottom profiling, and surface sediment (grab) sampling to provide ground truth for the geophysical data.

Documenting Storm-Related Seafloor Impacts

Major storms can significantly influence coastal geomorphology and sediment distribution, eroding in some places while depositing in others; extensive resculping of shoreface, barrier islands, and estuaries can take place in hours to days. Understanding storm sediment budgets is critically important both for assessing storm damage and for predicting storm impact on coastal barrier systems and the communities/ecosystems they support and protect, on both short (single storm) and longer (multiple storm) time scales.

Documenting storm-related seafloor impacts is a challenge because prestorm data are required to establish a baseline for measuring storm-induced changes and because poststorm data must be collected within weeks to months to ensure that measured changes are related to the storm rather than to recurring natural processes. Acquiring prestorm data requires good luck as well as good planning, because landfall cannot be predicted more than a few days in advance. While land-based surveys (e.g., airborne lidar) can be mounted on such short time scales, marine-based surveys generally cannot. "Rapid response" post-storm surveys offshore require logistical preparedness, access to funding (e.g., to pay for ship time) that can be allocated quickly,

and mobilization of data acquisition assets in regions that may be hard-hit by a natural disaster.

Geophysical Surveying and Sampling

The UTIG survey included 10 days of geophysical surveying and sampling aboard Stony Brook University's R/V *Seawolf*, offshore of Long Beach and Fire Island, barriers south of Long Island (Figure 1a), complementing ongoing land-based studies of Sandy's impact on the New York–New Jersey barrier system [Hapke et al., 2013; J. Donnelly, personal communication, 2013]. By design, the survey covered regions that had been previously surveyed, by Stony Brook in 2001 and 2005 [Flood and Kinney, 2005] and by USGS most recently in 2011 [Schwab et al., 2013]. These prior surveys include shoreface-attached sand ridges that may be exchanging sand with the barrier island shoreface [Schwab et al., 2013].

The UTIG survey also targeted the area offshore of the Fire Island inlet opened by Sandy, which remains open today [Hapke et al., 2013]. This inlet may be a conduit for transferring barrier island sand offshore; the researchers saw cloudy water, visual evidence of such sediment movement, during the survey.

Mud Deposits

The data identified and mapped a surficial mud deposit (Figures 1b and 1c), up to 0.5 meter thick, where previously none had been observed [Schwab et al., 2000]. The survey scientists hypothesize that these are ephemeral deposits, eroded by the storm and then rapidly redeposited in the quiescent aftermath. A follow-up survey by R. Flood of some areas that had low backscatter (i.e., no mud deposits) in January found no areas of low backscatter on the seafloor in April.

Presumably the muddy sediments present in January were resuspended by subsequent wave activity and transported out of the area; the January samples therefore represent the only evidence of these ephemeral deposits. Continuing analyses will investigate the provenance of these muds and their implications for storm-induced sediment exchange between back-barrier estuaries and ocean and/or reworking of the inner shelf by this catastrophic storm.

Hummocky Bedforms

Another surprising observation was the widespread occurrence of hummocky bedforms on all rapid response offshore survey

Rapid Response Survey cont. on page 338

Large-Scale Blast Experiments Examine Subsurface Explosions

Volcanic craters are often formed by multiple subsurface explosions caused by the interaction of magma and groundwater [Lorenz, 1973; Valentine and White, 2012]. To understand the processes and products of such explosions, scientists spent 2 years conducting experiments that produced craters on the meter scale at the Geohazards Field Station in Ashford, N. Y.

These experiments were operated by the Center for GeoHazards Studies at the University at Buffalo in close cooperation with an interdisciplinary team of scientists from the Istituto Nazionale di Geofisica e Vulcanologica in Italy, the Institut National de la Recherche Scientifique in Canada, the University of Otago and the Massey University in New Zealand, the Physikalisch Vulkanologisches Labor of the Universität Würzburg and Ludwigs-Maximilians-Universität Munich in Germany, and the University of North Carolina, Boise State University, Georgia State University, and Michigan State University in the United States.

The Experiments

The experiments involved creating explosions of sufficient size (~1- to 2-meter-diameter craters with ejecta dispersed up to ~15 meters from the explosion location) and energy to scale well with natural explosions and to be monitored by a suite of instruments that are used to study real volcanic explosions. This year, 12 subsurface blasts were conducted in five pads of constructed "stratigraphy," building upon the experience gained during last year's scoping experiments [Valentine et al., 2012; Taddeucci et al., 2013; Ross et al., 2013].

The experiments were conducted to gain insight into processes of subsurface

explosions, to better understand the relationship between ballistic and depositional processes, and to investigate subsurface mixing caused by repeated explosions. In addition, the relatively well-controlled conditions of explosion energy, location, and timing provided an excellent test case for field monitoring and remote sensing equipment.

To create the explosions, Pentax booster charges with explosive energies roughly between 1 and 3 megajoules were detonated in layered, unconsolidated aggregates. The charges were buried at depths between 0.5 and 1 meter. Sequences of explosions at varying depths allowed data collection on the effects of pre-existing craters and scaled depth (the charges' depth of burial divided by the cube root of its total energy) on ejecta dynamics [Taddeucci et al., 2013]. Pre- and post-blast conditions were documented with manual and photogrammetric measurements before and after each blast, providing a three-dimensional model of the resulting craters. Ejected material of each blast was collected from 80 sampling stations.

After the blast series, each pad was excavated and the subsurface structures (analogous to natural diatremes [Ross et al., 2013]) were carefully analyzed. Ejecta and deposition processes were monitored with four high-speed cameras, a thermal camera, three high-definition cameras, microphones, infrasound microphones (including some attached to a weather balloon), electric field sensors, a pitot tube, and 127 ballistic tracers. The subsurface was monitored by seven seismometers, a geophone line, and an experimental high-frequency (> 10 kilohertz)

Explosions cont. on page 338

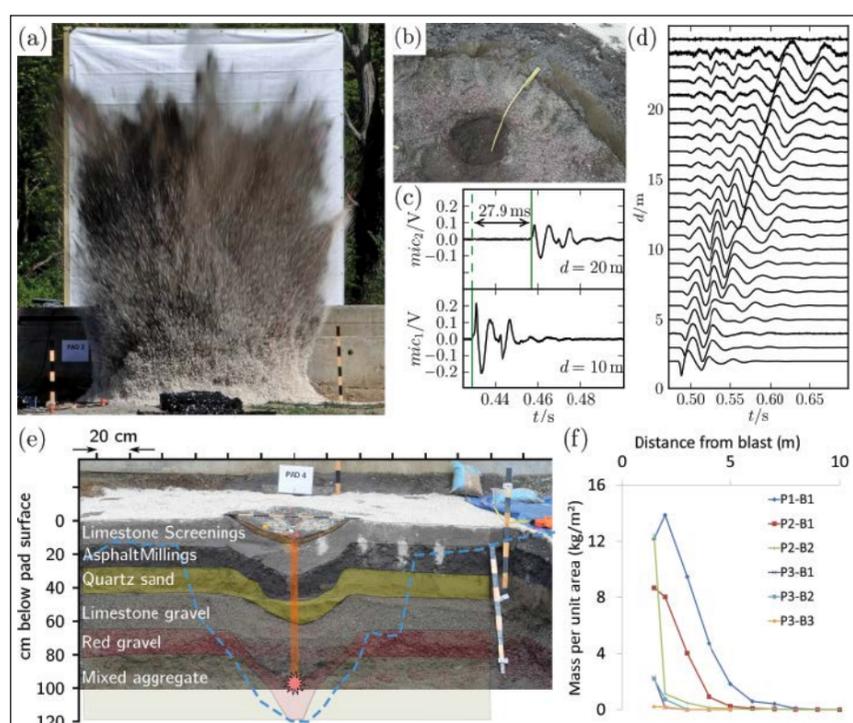


Fig. 1. First results from 2013 blast experiments showing some of the collected data sets. Data originate from different blast experiments. (a) Screen capture from video (relatively shallow charge depth). (b) Excavation of pads after blasts. (c) Microphone signals (in volts) showing the shockwave tail at 10- and 20-meter distances from the blast. (d) Geophone data showing the propagation of the blast energy through the ground (time is in seconds; distance is in meters). (e) Annotated stratigraphy of an excavated pad at the crater center of a deep blast, showing deformation in the subsurface. The blue line indicates extent of soft materials (fall-back plus some damage zone) recorded by penetrometer surveys. (f) Ejecta distribution in mass per unit area (in kilograms per square meter) with distance from the blast (in meters) measured after each blast.

EOS

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

Editors

Christina M. S. Cohen: California Institute of Technology, Pasadena, Calif., USA; cohen@srl.caltech.edu

José D. Fuentes: Department of Meteorology, Pennsylvania State University, University Park, Pa., USA; juf15@meteo.psu.edu

Wendy S. Gordon: University of Texas at Austin, Austin, Tex., USA; wgordon@mail.utexas.edu

David Halpern: Jet Propulsion Laboratory, Pasadena, Calif., USA; davidhalpern29@gmail.com

Carol A. Stein: Department of Earth and Environmental Sciences, University of Illinois at Chicago, Chicago, Ill., USA; cstein@uic.edu

Editor in Chief

Barbara T. Richman: AGU, Washington, D.C., USA; eos_brichman@agu.org

Editorial Advisory Board

M. Lee Allison Earth and Space Science Informatics

Lora S. Armstrong Volcanology, Geochemistry, and Petrology

Michael A. Ellis Earth and Planetary Surface Processes

Arlene M. Fiore Atmospheric Sciences

Nicola J. Fox Space Physics and Astronomy

Steve Frothingham Biogeosciences

Edward J. Garnero Study of the Earth's Deep Interior

Michael N. Gooseff Hydrology

Kristine C. Harper History of Geophysics

Keith D. Koper Seismology

John W. Lane Near-Surface Geophysics

Xin-Zhong Liang Global Environmental Change

Jian Lin Tectonophysics

Stefan Maus Geomagnetism and Paleomagnetism

Figen Mekik Paleoclimatology and Paleogeography

Jerry L. Miller Ocean Sciences

Michael A. Mischna Planetary Sciences

Thomas H. Painter Cryosphere Sciences

Roger A. Pielke Sr. Natural Hazards

Len Pietrafesa Societal Impacts and Policy Sciences

Michael Poland Geodesy

Eric M. Riggs Education

Adrian Tuck Nonlinear Geophysics

Sergio Vinciguerra Mineral and Rock Physics

Earle Williams Atmospheric and Space Electricity

Staff

Editorial and Production: Randy Showstack, Senior Writer; Ernie Balcerak and Mohi Kumar, Science Writers/Editors; Faith A. Ishii, Program Manager; Tricia McCarter-Joseph, Production Assistant; Liz Castenson, Editor's Assistant; Valerie Bassett, Electronic Graphics Specialist

Advertising: Tel: +1-202-777-7536; E-mail: advertising@agu.org; Christy Hanson, Manager; Robyn Bassett, Classified and Display Ad Sales; Marketing: Mirelle Moscovitch, Marketing Analyst

©2013, American Geophysical Union. All Rights Reserved. Material in this issue may be photocopied by individual scientists for research or classroom use. Permission is also granted to use short quotes, figures, and tables for publication in scientific books and journals. For permission for any other uses, contact the AGU Publications Office.

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

Views expressed in this publication do not necessarily reflect official positions of the American Geophysical Union unless expressly stated.

Christine W. McEntee, Executive Director/CEO

<http://www.agu.org/pubs/eos>



Rapid Response Survey

cont. from page 337

data (Figures 1b and 1d) where none had been observed prestorm. Hummocky cross-stratification is a diagnostic stratigraphic indicator of shallow, storm-dominated environments [Southard *et al.*, 1990]. However, modern observations are scarce, particularly in the natural environment, because this morphology is related to presumed high-velocity, oscillatory motions responsible for its formation [Southard *et al.*, 1990]. Therefore, Sandy presents a remarkable natural experiment in the formation of this morphology, which could also provide important clues to offshore sediment transport during the storm. As with the seafloor muds, these observations are likely ephemeral and would not have been observed without rapid response survey measurements.

Inshore Survey

Inshore survey/sampling in Jones Inlet and Hempstead Bay was subsequently conducted for 7 days aboard Stony Brook's smaller R/V *Pritchard* (Figure 1a). Results from this survey will be compared to a comprehensive Stony Brook survey conducted there in 2010–2011 (R. D. Flood, High-resolution bathymetric mapping of channels in Hempstead Bay: 2. New tide-adjusted bathymetry, manuscript in preparation, 2013) to identify Sandy-based washover deposits and to chart storm-induced sand wave migration.

Preliminary results from the inshore work indicate significant movement of bedforms within both inlet and proximal waterways, in both flood and ebb orientations. Future analyses of these features will help researchers to discern the net balance of sand transport through the inlet. Significant shoaling was also discovered in marked waterways, causing hazards to navigation.

The Next Hurricane

The post-Sandy survey work demonstrated the importance of timely data collection for observing key components of the storm's impact on the seabed and the coastal sedimentary system. Rapid response efforts for future storms would greatly benefit from greater preparedness and cross-institutional cooperative agreements; the more quickly surveys can be mobilized, the better chance researchers will have for identifying storm impact.

Acknowledgments

We thank Bill Schwab, USGS Woods Hole, for data sharing, advice, and helpful comments and the captains and crews of the

Explosions

cont. from page 337

near-field seismic sensor. The diversity of the resulting data set provides a rare opportunity to integrate results from different sensor types with geological observations on deposits and subsurface structures (Figure 1).

Future Work

The experiments were initially motivated by questions surrounding the formation of a type of volcano referred to as a maar. Maar volcanoes form craters that cut into the pre-eruptive landscape and are surrounded by low-profile ejecta rings. Superficially, they appear similar to impact craters, but they are instead the result of repeated subsurface explosions as rising magma interacts with groundwater.

However, the results of the experiments have broader implications for a range of volcanic activity where repeated explosions

take place within craters. The field-scale experiments present challenges in terms of setup and logistics but provide excellent opportunities for student training and for testing of monitoring equipment while also obtaining fundamental data. Future experiments will explore effects of different blast energies and spatial (lateral) locations on other configurations of geological materials of different density and cohesion.

References

- Flood, R. D., and J. Kinney (2005), Temporal variability in inner shelf morphology shown by repeat multibeam surveys off Long Island, *Eos Trans. AGU*, 86(52), Fall Meet. Suppl., Abstract OS23A-1530.
- Hapke, C. J., H. F. Stockdon, W. C. Schwab, and M. K. Foley (2013), Changing the paradigm of response to coastal storms, *Eos Trans. AGU*, 94(21), 189–190, doi:10.1002/2013EO210001.
- Schwab, W. C., E. R. Thiel, J. F. Denny, W. W. Danforth, and J. C. Hill (2000), Seafloor sediment distribution off southern Long Island, New York, *U.S. Geol. Surv. Open File Rep.*, 00-243.

Schwab, W. C., W. E. Baldwin, C. J. Hapke, E. E. Lentz, P. T. Gayes, J. F. Denny, J. H. List, and J. C. Warner (2013), Geologic evidence for onshore sediment transport from the inner continental shelf: Fire Island, New York, *J. Coastal Res.*, 29(3), 526–544.

Southard, J. B., J. M. Lambie, D. C. Federico, H. T. Pile, and C. R. Weidman (1990), Experiments on bed configuration in fine sands under bidirectional purely oscillatory flow, and the origin of hummocky cross-stratification, *J. Sediment. Petrol.*, 60(1), 1–17.

—JOHN A. GOFF and JAMES A. AUSTIN JR., Institute for Geophysics, Jackson School of Geosciences, University of Texas at Austin; email: goff@ig.utexas.edu; ROGER D. FLOOD, School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, N. Y.; BETH CHRISTENSEN, Environmental Studies Program, Adelphi University, Garden City, N. Y.; CASSANDRA M. BROWNE, Institute for Geophysics and Department of Geological Sciences, Jackson School of Geosciences, University of Texas at Austin; and STEFFEN SAUSTRUP, Institute for Geophysics, Jackson School of Geosciences, University of Texas at Austin

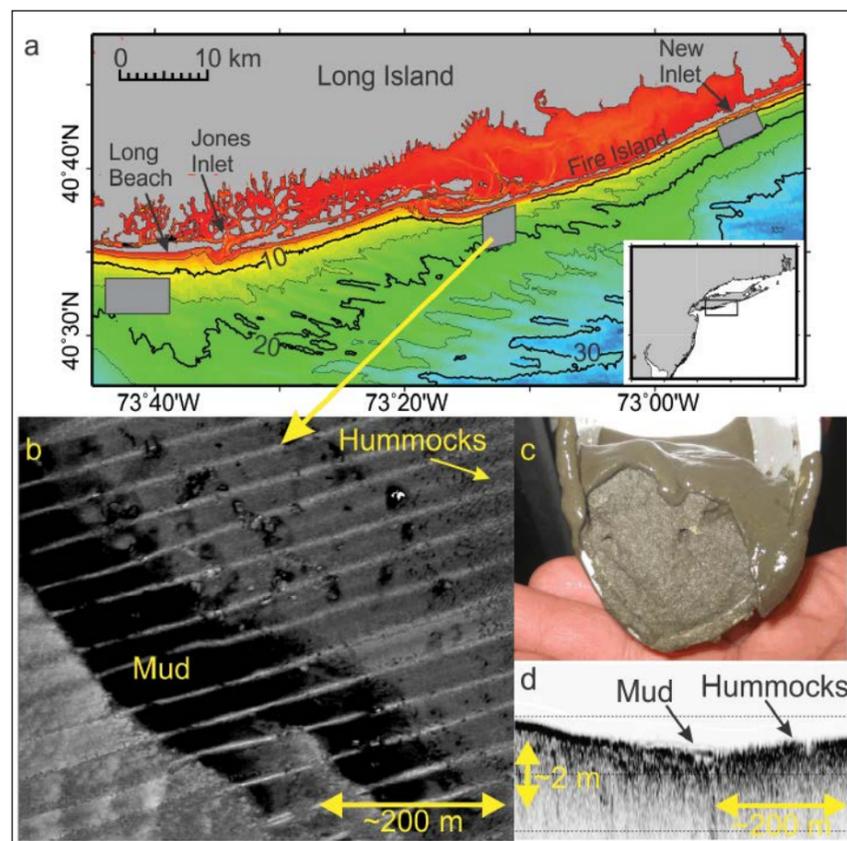


Fig. 1. (a) Location of offshore post-Sandy surveys (gray boxes). Regional bathymetry, in 5-meter contour intervals, is from a National Oceanic and Atmospheric Administration coastal relief model (<http://www.ngdc.noaa.gov/mgg/coastal/>). (b) Backscatter data (lighter shades denote higher backscatter) offshore of western Fire Island. (c) An example of the goopy mud, which the dark patches in Figure 1b were found to be, taken from the top of a grab sample. (d) An acoustic subbottom reflection profile shows the presence of ponded sediments up to approximately 0.5 meter thick in the same location as the mud shown in Figure 1b, as well as hummocky seafloor morphology.

the following for their key assistance in preparing for and executing the experiments: J. L. Ball, K. Bennet, D. M. Doronzo, D. Goral-ski, A. G. Harp, C. G. Hughes, P. Johnson, P. More, S. Pansino, D. Ruth, D. Schonwalder, and M. Sweeney.

The Geohazards Field Station is a user facility to enable researchers from various fields to design and conduct large-scale experiments like the ones described here. Anyone interested should contact I. Sonder at the Center for GeoHazards Studies.

References

- Lorenz, V., (1973), On the formation of maars, *Bull. Volcanol.*, 37(2), 183–204.
- Ross, P.-S., J. D. L. White, G. A. Valentine, J. Taddeucci, I. Sonder, and R. G. Andrews, (2013), Experimental birth of a maar-diatreme volcano, *J. Volcanol. Geotherm. Res.*, 260, 1–12.
- Taddeucci, J., G. A. Valentine, I. Sonder, J. D. L. White, P.-S. Ross, and P. Scarlato, (2013), The effect of pre-existing crater on the initial development of explosive volcanic eruptions: An experimental investigation, *Geophys. Res. Lett.*, 40(3), 507–510, doi:10.1002/grl.50176.
- Valentine, G. A., and J. D. L. White, (2012), Revised conceptual model for maar-diatremes: Subsurface processes, energetics, and eruptive products, *Geology*, 40, 1111–1114, doi:10.1130/G33411.1.
- Valentine, G. A., J. D. L. White, P.-S. Ross, J. Amin, J. Taddeucci, I. Sonder, and P. J. Johnson, (2012), Experimental craters formed by single and multiple buried explosions and implications for volcanic craters with emphasis on maars, *Geophys. Res. Lett.*, 39(20), L20301, doi:10.1029/2012GL053716

—INGO SONDER, ALISON GRAETTINGER, and GREG VALENTINE, Center for GeoHazards Studies, University at Buffalo, Buffalo, N. Y.; email: ingomark@buffalo.edu

Contribute to Eos!

Give the geophysics community an update on your project, program, or research experience: Contribute a brief report to *Eos*.

To learn more, visit [http://onlinelibrary.wiley.com/journal/10.1002/\(ISSN\)2324-9250/homepage/ForAuthors.html](http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)2324-9250/homepage/ForAuthors.html).

NEWS

Voyager 1 Has Entered Interstellar Space

"We made it," Voyager project scientist Ed Stone announced at a 12 September briefing at NASA headquarters in Washington, D. C. NASA's Voyager 1 spacecraft, the most distant human-made object, is now the first such object to enter interstellar space, the space between the stars. "The 36-year-old probe is now sailing the uncharted waters of a new cosmic sea, and it has brought us along for the journey," Stone said.

Stone compared Voyager 1's movement through the heliosphere and into interstellar space with other historic journeys of exploration, such as the first circumnavigation of Earth and the first footprint on the Moon. "This historic step is even more exciting because it marks the beginning of a new era of exploration for Voyager, the exploration of the space between the stars," he said.

The 722-kilogram spacecraft, which was launched on 5 September 1977 and has traveled about 13 billion miles, entered interstellar space on or about 25 August 2012, Don Gurnett, the principal investigator for the Voyager 1 plasma wave instrument, said at the briefing. Gurnett, a space physicist with the University of Iowa, which built and operates the instrument, is lead author of a 12 September *Science* article, "In situ observations of interstellar plasma with Voyager 1" (doi:10.1126/science.124168).

According to the paper, the first indication of the probe's possible encounter with the heliopause that separates solar plasma from much cooler interstellar plasma took place on 28 July 2012, with five similar boundary crossings observed, the last taking place on 25 August 2012. However, the question as to whether the boundary was in fact the heliopause was difficult to resolve because the plasma instrument on Voyager 1 had failed in 1980.

In August 2012, Voyager scientists "saw the energetic particles inside the [heliosphere] bubble leak out and disappear, and

that was where we saw for the first time the lowest-energy galactic cosmic rays, which are in the space outside," Stone said. He added that although it looked like Voyager 1 had crossed into interstellar space, scientists could not draw that conclusion at that time.

With the plasma instrument not working and thus unable to directly measure any differences between the heliospheric and interstellar plasma, the Voyager team could only analyze the magnetic field as it evolved over time. While the magnetic field strength jumped dramatically in August 2012, the field direction barely changed, suggesting that the probe was still within the solar bubble.

However, two 10-meter antennas that are part of the probe's plasma wave science instrument provided another way to sense the plasma. The antennas had not detected any plasma waves between 2004, when Voyager crossed the termination shock—a location where the speed of the solar wind drops abruptly as it begins to feel the effects of the interstellar wind—and April 2013, when a March 2012 coronal mass ejection from the Sun reached the spacecraft. When the solar storm hit Voyager 1, the readings provided key information.

The solar storm "caused the plasma to react in a way that it could be sensed, and we knew for the first time we were in the dense plasma of interstellar space, not in the rarer plasma of the outer part of the solar envelope. That's a major new piece of data. And I think it convinced most of us, at least, that we indeed are in interstellar space for first time," Stone said.

In essence, as the heliosphere behind the spacecraft deforms due to major solar storms, the interstellar space just beyond the heliosphere also gets disturbed. The 2012 storm "was a lucky gift from the Sun, and we hope that there will be more such eruptions

so we can measure the plasma as we continue," Stone added.

The 12 September announcement and *Science* paper follow a 15 August paper in *Astrophysical Journal*, "A porous layered heliopause" (M. Swisdak et al., 774, L8, doi:10.1088/2041-8205/774/1/L8), that stated that Voyager 1 had left the heliosphere and had entered interstellar space in 2012. The paper focused on how magnetic field lines from the Sun and from interstellar space may not be so different from each other and how the observation that the field direction had not changed was not an indication that Voyager 1 was still in the solar bubble.

In August 2013, the Voyager team was not ready to state that the probe had entered interstellar space, and NASA released a statement by Stone, which read in part that Swisdak et al.'s model "would mean that the interstellar magnetic field direction is the same as that which originates from our sun. Other models envision the interstellar magnetic field draped around our solar bubble and predict that the direction of the interstellar magnetic field is different from the solar magnetic field inside. By that interpretation, Voyager 1 would still be inside our solar bubble. The fine-scale magnetic connection model [in Swisdak et al.] will

become part of the discussion among scientists as they try to reconcile what may be happening on a fine scale with what happens on a larger scale."

The lead author of the *Astrophysical Journal* letter, Mark Swisdak, associate research scientist in the Institute for Research in Electronics and Applied Physics at the University of Maryland, College Park, told *Eos* that the basic conclusion of Gurnett et al. and of the 12 September announcement that Voyager 1 has passed the heliopause and is in interstellar space "agrees with what we concluded in the August study. At this point I think it would be very difficult to argue otherwise."

—RANDY SHOWSTACK, Staff Writer

Correction

In the 10 September issue of *Eos*, the Forum, "Lost science: Protecting data through improved archiving" (*Eos*, 94(37), 323, doi:10.1002/2013EO370006), gave an incorrect email address for author Karen Simmons. The correct email is karen.simmons@lasp.colorado.edu.

What's on the Web?

Read the latest offerings from the AGU Blogosphere:

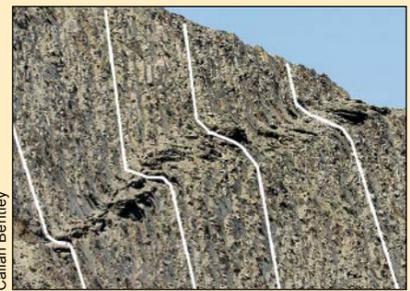
Dan's Wild Wild Science Journal: "Frogs in space. . . ." (<http://goo.gl/niiGMB>)

The Landslide Blog: "A video of riverbank collapses in Utah" (<http://goo.gl/VOT6Au>)

Mountain Beltway: "Friday fold: Kink band in Lodgepole Limestone, Sacagawea Peak, Bridger Range, Montana" (<http://goo.gl/JOFzNZ>)

Magma Cum Laude: "Interlude in Pittsburgh" (<http://goo.gl/RfY0qc>)

Dan's Wild Wild Science Journal: "Voyager 1, distance, and the CNN salute" (<http://goo.gl/5EYKu4>)



Callan Bentley

Search the GigaPan in blogger Callan Bentley's Mountain Beltway blog to find this kink band in the Lodgepole Limestone, exposed on the crest of the Bridger Range in Montana. The trace of the bedding is drawn in white.

2 · 0 · 1 · 4 OCEAN SCIENCES MEETING

23-28 February 2014

Hawaii Convention Center
Honolulu, Hawaii, USA

What better place to hold the meeting than an island in the middle of the Pacific Ocean, where there is emphasis on ridge to reef connection, the ultimate in ecosystem-based management; where there is interest in

Important Dates

15 August 2013 - Call for Abstracts, Tutorial Presentation Submission and Town Hall and Workshop Applications and Registration Opens

4 October 2013 - Deadline for Abstract Submission and Early Registration

November 2013 - Presenters Notified of Acceptance; Initial Program Schedule Posted

combining traditional knowledge with science-based understanding; where islands are in threat of disappearing from sea level rise; and where East and West can easily meet.

<http://www.sgmeet.com/osm2014>

Earth's Future

A Transdisciplinary Journal Exploring Global Change and Sustainability

Open Access

Publish Your Research in *Earth's Future*

Earth's Future is a new transdisciplinary open access journal, with a mission to help researchers, policy makers, and the public navigate the science. *Earth's Future* focuses on the state of the Earth and the prediction of the planet's future.

AGU is seeking top quality, original research, reviews, essays and commentaries that bridge the boundaries of the life, physical, and social sciences as they relate to Earth and environmental challenges. Papers will concentrate on the impact of human activities on Earth systems, including

- Population increase
- Industrial and agricultural development
- Urbanization
- Climate change
- Energy
- Food and water resources, sustainability, and security

Author fees will be waived for all submissions received before 1 October

earthsfuture.agu.org

Enrolment now open:
Constructing and Applying High Resolution Climate Scenarios

Advanced part-time study available online from the University of Oxford

This course is taught online over seven weeks by University of Oxford climate scientists. It is aimed at professionals, offering practitioners and policy-makers the opportunity to develop their understanding of the science behind complex climate systems.

Drawing upon the world-class knowledge and expertise in climate science at the University of Oxford and the UK MET Office, it is designed to equip participants with a better understanding of regional climate modelling and analysis of its outputs.

As an online course, it can be taken from anywhere in the world and is attractive to a global community. Participants are able to interact with one another and the course tutor online via our dedicated Virtual Learning Environment.

Enrolment is now open to commence study on 28th October 2013 and 17th February 2014.

To register and find out more please visit:
www.conted.ox.ac.uk/climatescience

Or contact us on
tel: +44 (0)1865 286953
email: climate@conted.ox.ac.uk

ABOUT AGU

2012 Editors' Citations for Excellence in Refereeing

One of the most important services performed for AGU is the conscientious reviewing of submitted papers. Because of the nature of the reviewing process, this service is also one of the least recognized. Every year editors are asked to select the outstanding reviewers from the previous year. The reviewers listed below have been cited by editors of AGU journals and Eos for excellence in refereeing. These individuals are to be commended for consistently providing constructive and thoughtful reviews.



Rashid Akmaev
Cited by Robert Lysak
JGR-Space Physics



Younes Alila
Cited by John Selker
Water Resources Research



James D. Allan
Cited by Joost de Gouw
JGR-Atmospheres



Leif Anderson
Cited by Andrey Proshutinsky
JGR-Oceans



David Baker
Cited by Geoffrey Tyndall
Geophysical Research Letters



Mikhail Balikhin
Cited by Robert Lysak
JGR-Space Physics



Koen Blanckaert
Cited by Graham Sander
Water Resources Research



Michael Bodeau
Cited by Louis Lanzerotti
Space Weather



Julien Boé
Cited by Noah Diffenbaugh
Geophysical Research Letters



William R. Boos
Cited by Eric Calais
Geophysical Research Letters



Julien Bouchez
Cited by Wolfgang Knorr
Geophysical Research Letters



Karl Braganza
Cited by Paul Williams
Geophysical Research Letters



Mark A. Cane
Cited by Yinon Rudich
JGR-Atmospheres



Michael Cardiff
Cited by John Selker
Water Resources Research



David Carlson
Cited by Paul Williams
Geophysical Research Letters



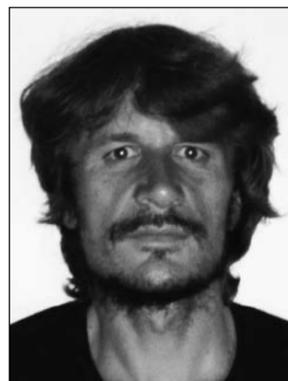
Andrea Castelletti
Cited by Hoshin Gupta
Water Resources Research



Don P. Chambers
Cited by Meric Srokosz
Geophysical Research Letters



Poul Christoffersen
Cited by Eric Rignot
Geophysical Research Letters



Francesco Comiti
Cited by Graham Sander
Water Resources Research



Lee W. Cooper
Cited by Andrey Proshutinsky
JGR-Oceans



Peter L. Croot
Cited by Peter Strutton
Geophysical Research Letters



Geoffrey Crowley
Cited by Louis Lanzerotti
Space Weather



Kurt M. Cuffey
Cited by Eric Rignot
Geophysical Research Letters



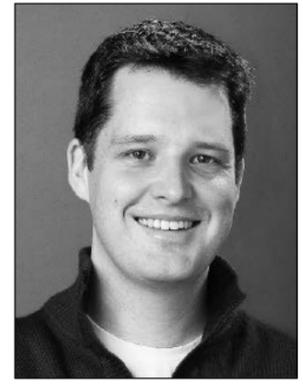
Colleen A. Dalton
Cited by Robert Nowack
JGR-Solid Earth



Roman A. DiBiase
Cited by Alexander Densmore
JGR-Earth Surface



John Dore
Cited by Peter Strutton
Geophysical Research Letters



Jonathan P. Eastwood
Cited by Benoit Lavraud
Geophysical Research Letters



Bethany Ehlmann
Cited by Michael Wysession
Geophysical Research Letters



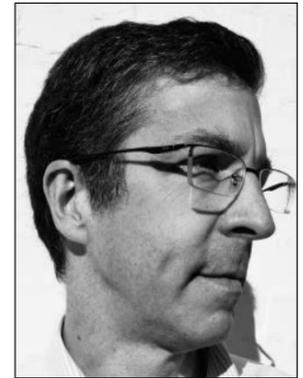
Julien Emile-Geay
Cited by Yinon Rudich
JGR-Atmospheres



John Thomas Farrar
Cited by Frank Bryan
JGR-Oceans



Caleb I. Fassett
Cited by Michael Wysession
Geophysical Research Letters



Kurt L. Feigl
Cited by Eric Calais
Geophysical Research Letters



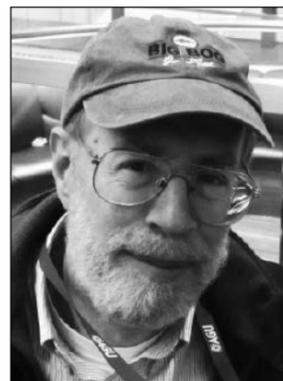
Alexandre O. Fierro
Cited by Paul Williams
Geophysical Research Letters



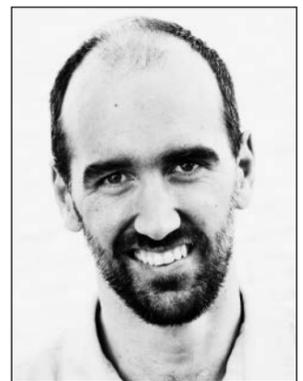
Stewart Fishwick
Cited by Robert Nowack
JGR-Solid Earth



Umberto Fracassi
Cited by Carol Stein
Eos



Paul Glaser
Cited by Dennis Baldochi
JGR-Biogeosciences



Tom Gleeson
Cited by Paolo D'Odorico
Geophysical Research Letters



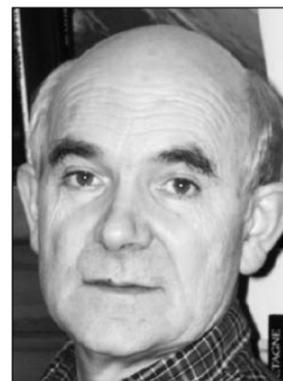
Alex Gonzalez
Cited by David Randall
Journal of Advances in Modern Earth Systems



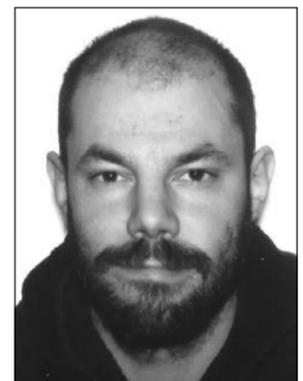
Raphael Grandin
Cited by Eric Calais
Geophysical Research Letters



Timothy J. Griffis
Cited by Sara Pryor
JGR-Atmospheres



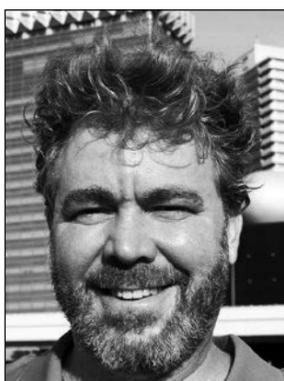
Yves Gueguen
Cited by Robert Nowack
JGR-Solid Earth



Alessio Gusmeroli
Cited by Alexander Densmore
JGR-Earth Surface



Hiroshi Hasegawa
Cited by Benoit Lavraud
Geophysical Research Letters



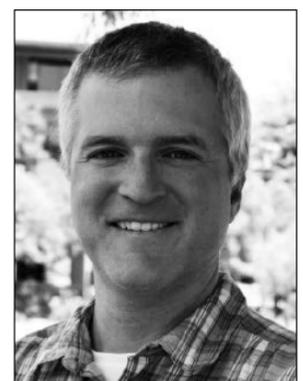
John W. Hernlund
Cited by Thorsten Becker
Geochemistry, Geophysics, Geosystems



Marc A. Hesse
Cited by Paolo D'Odorico
Geophysical Research Letters



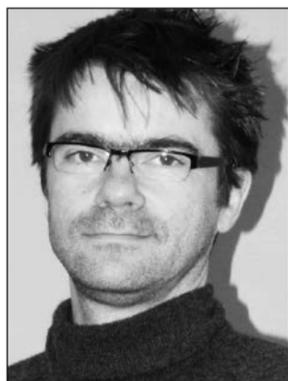
Thomas Hill
Cited by Mark Moldwin
Reviews of Geophysics



George E. Hilley
Cited by Todd Elhers
Tectonics



Paul R. Holland
Cited by Eric Rignot
Geophysical Research Letters



Peter M. Hoor
Cited by Joost de Gouw
JGR-Atmospheres



Matthew Huber
Cited by Noah Diffenbaugh
Geophysical Research Letters



Akimasa Ieda
Cited by Robert Lysak
JGR-Space Physics



Boris A. Ivanov
Cited by Mark Wieczorek
JGR-Planets



Mark Z. Jacobson
Cited by Joost de Gouw
JGR-Atmospheres



Yuto Katoh
Cited by Robert Lysak
JGR-Space Physics



Thorsten Knappenberger
Cited by Tissa Illangasekare
Water Resources Research



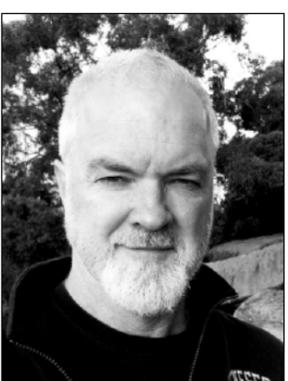
Jarmo Koistinen
Cited by John Selker
Water Resources Research



Fred Kucharski
Cited by Meric Srokosz
Geophysical Research Letters



Judith L. Lean
Cited by Yinon Rudich
JGR-Atmospheres



Jeffrey J. Love
Cited by William Peterson
Geophysical Research Letters



Nicole S. Lovenduski
Cited by Eric Sundquist
Global Biogeochemical Cycles



Gloria Manney
Cited by Renyi Zhang
JGR-Atmospheres



Daniela Matei
Cited by Noah Diffenbaugh
Geophysical Research Letters



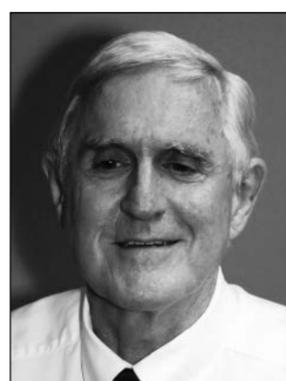
Katsumi Matsumoto
Cited by Eric Sundquist
Global Biogeochemical Cycles



Astrid Maute
Cited by Robert Lysak
JGR-Space Physics



Hilary K. McMillan
Cited by Hoshin Gupta
Water Resources Research



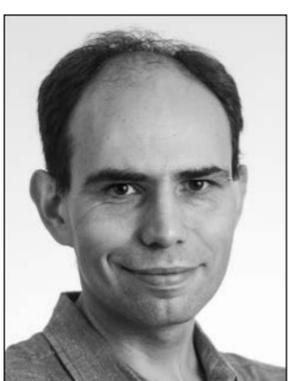
Leo F. McNamara
Cited by Paul Cannon
Radio Science



Stephan Mertes
Cited by Geoffrey Tyndall
Geophysical Research Letters



Chloé Michaut
Cited by David Baratoux
JGR-Planets



Laurent Montesi
Cited by Robert Nowack
JGR-Solid Earth



Stephen A. Montzka
Cited by Yinon Rudich
JGR-Atmospheres



Linda Mortsch
Cited by Ronald Griffin
Water Resources Research



Jeffrey A. Nittrouer
Cited by Graham Sander
Water Resources Research



Dirk Notz
Cited by Andrey Proshutinsky
JGR-Oceans



Paul O'Brien
Cited by Louis Lanzerotti
Space Weather



Frances C. O'Donnell
Cited by Dennis Baldochi
JGR-Biogeosciences



Eduardo Pantig Olaguer
Cited by Renyi Zhang
JGR-Atmospheres



Curtis M. Oldenburg
Cited by Tissa Illangasekare
Water Resources Research



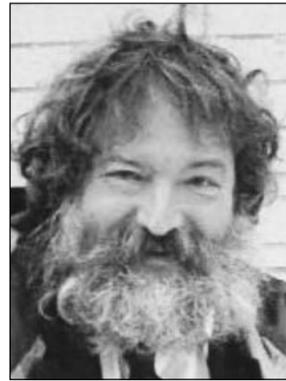
Mikki M. Osterloo
Cited by Michael Wyession
Geophysical Research Letters



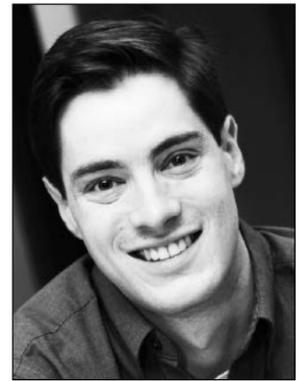
Chris Paola
Cited by Alexander Densmore
JGR-Earth Surface



Greg B. Pasternack
Cited by Graham Sander
Water Resources Research



Raymond T. Pierrehumbert
Cited by Yinon Rudich
JGR-Atmospheres



Matthew E. Pritchard
Cited by Thorsten Becker
Geochemistry, Geophysics,
Geosystems



Liying Qian
Cited by Louis Lanzerotti
Space Weather



Mark S. Raleigh
Cited by Praveen Kumar
Water Resources Research



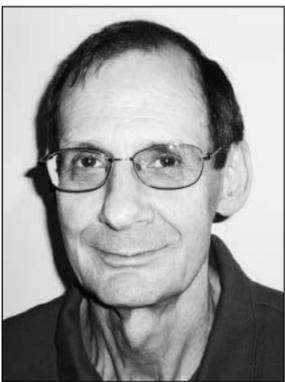
Gregory Ravizza
Cited by Thorsten Becker
Geochemistry, Geophysics,
Geosystems



Richard D. Ray
Cited by Meric Srokosz
Geophysical Research Letters



Benjamin Renard
Cited by Hoshin Gupta
Water Resources Research



Phil G. Richards
Cited by William Peterson
Geophysical Research Letters



Philippe Roux
Cited by Robert Nowack
JGR-Solid Earth



John W. Rudnicki
Cited by Robert Nowack
JGR-Solid Earth



Taylor F. Schildgen
Cited by Todd Elhers
Tectonics



Courtney Schumacher
Cited by José Fuentes
Eos



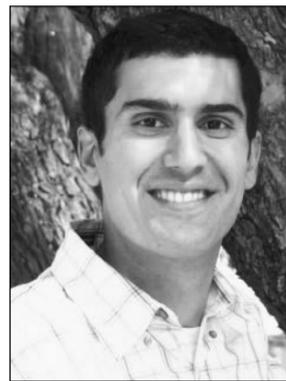
Sonia Seneviratne
Cited by Noah Diffenbaugh
Geophysical Research Letters



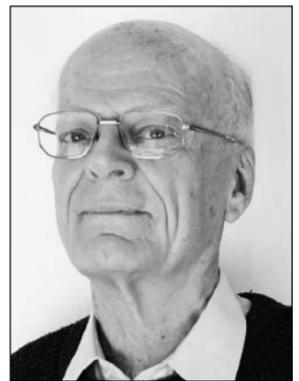
Nir J. Shaviv
Cited by Yinon Rudich
JGR-Atmospheres



Justin Sheffield
Cited by Paolo D'Odorico
Geophysical Research Letters



Armin Sorooshian
Cited by Joost de Gouw
JGR-Atmospheres



Robert Stening
Cited by Robert Lysak
JGR-Space Physics



Andreas Stracke
Cited by Thorsten Becker
Geochemistry, Geophysics,
Geosystems



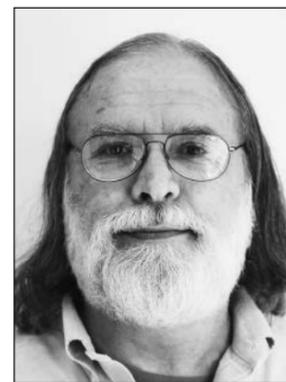
Leif Thomas
Cited by Frank Bryan
JGR-Oceans



Allan Tylka
Cited by Louis Lanzerotti
Space Weather



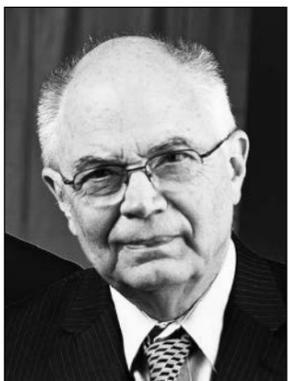
Matthijs C. van Soest
Cited by Thorsten Becker
Geochemistry, Geophysics,
Geosystems



Coerte Van Voorhies
Cited by Michael Wysession
Geophysical Research Letters



Laura Wallace
Cited by Andrew Newman
Geophysical Research Letters



Richard L. Walterscheid
Cited by Joost de Gouw
JGR-Atmospheres



Guihua Wang
Cited by Chunzai Wang
JGR-Oceans



Yuan Wang
Cited by Renyi Zhang
JGR-Atmospheres



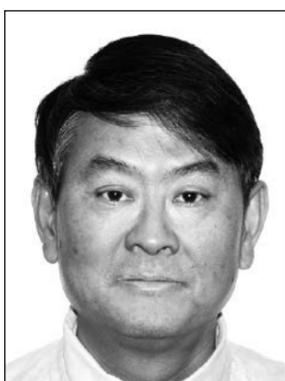
Markus Weiler
Cited by Praveen Kumar
Water Resources Research



Michael West
Cited by Andrew Newman
Geophysical Research Letters



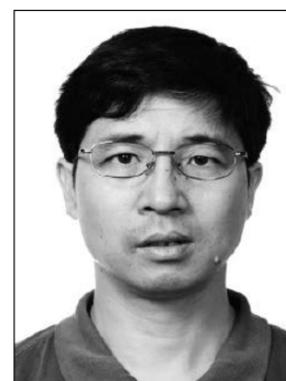
Georg Wohlfahrt
Cited by Dennis Baldochi
JGR-Biogeosciences



Xiaoping Wu
Cited by Robert Nowack
JGR-Solid Earth



Mark Zelinka
Cited by Steven Ghan
JGR-Atmospheres



Qiu-Gang Zong
Cited by Robert Lysak
JGR-Space Physics



Andreas Zünd
Cited by Geoffrey Tyndall
Geophysical Research Letters

**2012 Cited Referee
Not Pictured**

Huajian Yao
Cited by Robert Nowack
JGR-Solid Earth

About AGU cont. on next page

Download the *Journal of Geophysical Research: Space Physics* App for iPad

Available on the App Store

- Receive alerts when new issues are available
- Save your favorite articles for quick and easy access, including offline
- Dynamic References show references in context
- Full screen figure and table viewer
- Access your personal or institutional JGR-Atmospheres subscription on your iPad
- Free sample issue



AGU CHAPMAN CONFERENCE
Yosemite National Park, California, USA | 9-14 February 2014

Magnetosphere-Ionosphere Coupling in the Solar System
Abstract Submission Deadline: 9 October, 11:59 P.M. EDT
Housing Deadline: 19 December, 11:59 P.M. EST
<http://chapman.agu.org/magnetosphere/>

AGU Blogosphere
Connect to AGU's network of Earth and space science blogs

blogs.agu.org

Renew Your Membership Today!
membership.agu.org

About AGU

cont. from page 344

Public Lectures and Exhibits: Outreach Activities at the 2013 Meeting of the Americas

The 2013 Joint Assembly Meeting of the Americas (MOA), held 14–17 May in Cancun, Mexico, included an outreach program with public lectures, exhibits, and a planetarium dome show, all held in parallel to the sessions, plenary presentations, town halls, and other events. The outreach activities run by enthusiastic volunteers attracted local students, the public, and meeting attendees. The meeting was sponsored by 14 societies across the Americas, and the scientific program encompassed topics in all areas of Earth and space sciences.

AGU's mission and one of its major strategic goals focus on developing and nurturing future generations of Earth and space scientists. Education and outreach play an important role in AGU's mission, with programs reflected in its strategic plan (http://www.agu.org/about/strategic_plan.shtml). These programs are summarized on the website and reviewed in *Eos* (e.g., *Eos*, 92(41), 353, doi:10.1029/2011EO410012). Public outreach activities at meetings, particularly at the Fall Meeting, have been successful and constitute an important part of the activities held in parallel to the meeting programs.

The Joint Assemblies, held in collaboration with other geoscience societies, are well placed for building partnerships and reaching out to different communities that effectively enhance AGU's outreach efforts. Outreach activities at Joint Assemblies and Chapman Conferences fall within the goal of "exploring ways to strengthen the numbers

and diversity of the Earth and space science workforce" (e.g., *Eos*, 92(41), 353, doi:10.1029/2011EO410012).

In Cancun, the public lecture program, with six presentations on a wide range of themes, was well attended by students from local schools and the public (Figure 1). The presentations focused on planetary magnetospheres (X. Blanco-Cano), our Sun (C. Lopez-Portela), Earth evolution through geologic time (A. Rapalini), earthquakes (J. Yamamoto), natural hazards (J. C. Mora), and the Yucatan aquifer (L. Hernández-Terrones).

Some of the presentations focusing on groundwater, natural hazards, and environmental issues were particularly relevant to southern Mexico and Central America and of immediate concern to the population and decision makers. Therefore, lectures sparked lively discussions and interest from participants and the local media. The Yucatan aquifer and the extensive well-developed karstic system and numerous sinkholes were also major topics in the MOA scientific program. The Yucatan peninsula is one of the largest karstic areas characterized by the absence of surface waters in the world; with no lakes or rivers, the carbonate platform acts as a gigantic sponge.

The exhibits included a series of experiments and demonstrations of explosive and effusive volcanic eruptions using a scale stratovolcano model. The planetarium dome ("Discovery Dome") featured presentations



Fig. 1. Some of the attendees of the Public Outreach Lecture Program at the 2013 Joint Assembly Meeting of the Americas in Cancun, Mexico.

such as "Cosmic Mysteries," "Destination: Moon," and "Amazing Astronomers From Antiquity," among others. With several shows during the day, the dome was visited by young attendees as well as meeting participants.

Public outreach activities at meetings are an important component of AGU's strategic plan. At meetings like the Joint Assemblies and Chapman Conferences, which are held in different countries in partnership with other societies, outreach activities have the potential to reach diverse audiences, effectively promoting the Earth and space sciences beyond the scientific community.

Acknowledgments

The MOA outreach program was supported by the Yucatan Center for Scientific

Research (CICY), the Mexican Union for Quaternary Studies (UMEC), and the National University of Mexico. We thank Fanny de Gante, Patricia Reiff, Terri Hogue, J. Carlos Mora, and the AGU members who volunteered for the public lecture program and exhibits. Special acknowledgment is owed to the students assisting on the exhibits and planetarium dome: A. Ortega, A. Garcia, M. Martinez, M. Escorza, J. Pavon, A. Gil, K. Belmont, and S. Lovera.

—JAIME URRUTIA-FUCUGAUCHI, AGU Program Committee Co-Chair, Instituto de Geofísica, Universidad Autónoma de México (UNAM); email: juf@geofisica.unam.mx; LAURA HERNÁNDEZ-TERRONES, Centro de Investigación Científica de Yucatán (CICY), Mérida, Yucatán, Mexico; and LIGIA PÉREZ-CRUZ, AGU Program Committee Paleoclimatology and Paleoclimatology Chair, Instituto de Geofísica, UNAM

Update on AGU Publishing: A Focus on Open Access

In the 23 July 2013 issue of *Eos*, we provided a broad update on recent events in AGU publishing, focusing on the partnership with John Wiley & Sons (*Eos*, 94(30), 264–266, doi:10.1002/2013EO300009). Here we briefly comment on the latest developments in the partnership, but the main focus is on recent events regarding open access as it relates to AGU publishing.

AGU-Wiley Partnership

As of August, the median times from acceptance to online publication of a paper at Wiley have dropped to close to 1 month or less and close to 3 weeks for *Geophysical Research Letters* papers. These times are considerably faster than those for many non-AGU journals.

We are also working on a few other developments to ease and enrich submissions and papers. Most visible will be a new Web presence for AGU publishing, which should be available by the 2013 Fall Meeting. Soon we will integrate online researcher IDs (ORCID) into all papers and use FundRef IDs in all of them as well. ORCID provides a unique identifier for authors and a means to list all their publications in an online database. FundRef, which is associated with CrossRef, provides an official index of funders and will be important for meeting certain open access requirements.

Open Access

Over the past decade, efforts have increased to expand free access to scientific publications and their underlying data. At the same time, ensuring high-quality peer review is increasingly important for researchers, and the uses of peer-reviewed research in society have expanded.

These needs have been met in several ways. Many new journals across the publishing spectrum have been created as "open access," in which authors or funders pay a processing charge to publishers to allow everyone to have complete access immediately upon publication. This "gold" open access model now makes up about 15% of the scholarly literature. In a fairly small number of cases, subscription journals have changed to the open access model, and in more cases, subscription journals have added an open access option. In addition, some journals have made older papers freely available, typically after an "embargo" period of a year or more ("green" open access). One recent study concluded that

about half of the recent literature may now be freely available [Archambault et al., 2013].

Recent Policy Developments

Open access has dominated publishing news this year. On 1 April 2013, the Research Council UK (RCUK) put into effect a policy recommending gold open access publications for its grantees. The funds for such author payments are provided, through the host institutions, by the funding agencies. A recent U.K. Parliament report, however, raised concerns about the cost of this approach and instead recommended a green open access model with a short embargo period (<http://www.publications.parliament.uk/pa/cm201314/cmselect/cmbis/99/9902.htm>).

In February 2013, the U.S. White House Office of Science and Technology Policy (OSTP) issued initial guidelines in support of green open access for all federally funded research publications and data.

U.S. federal agencies are now submitting replies on how they would implement these guidelines, and it seems that they will propose or support a mix of models for compliance and perhaps a mix of embargo periods. OSTP will need to consider these approaches before making final recommendations. Furthermore, in May 2013, OSTP issued a guideline requiring all federal data to be open.

Several other countries are considering open access requirements similar to the OSTP or RCUK approach, and several states, including California and, recently, Illinois, have mandated deposition of research papers in university or government repositories. Congress is considering a variety of primarily green open access language in its funding bills. In most cases, proposed embargos are 6 to 12 months.

Open Access in AGU Journals

AGU is supportive of the principles behind these initiatives. For example, AGU is supporting the Clearinghouse for the Open Research of the United States (CHORUS), one proposed model to meet the OSTP requirements. This approach would provide funders with an index of their content and direct access to the final version of the paper on the publisher's website after an embargo period. One advantage is that the paper at the publisher's website is associated with related material and supplements, as well as errata and comments. Several agencies seem to support this approach or close

variants of it. AGU already allows authors to post published versions of papers to institutional repositories after 6 months. For many years now, AGU has also had a gold open access option for authors, and AGU adopted the Creative Commons license to comply with the RCUK policy.

AGU recently announced the launch of a new journal, *Earth's Future*, which is fully open access. This is the second open access AGU title (*Journal of Advances in Modeling Earth Systems* is also open access), and with Wiley we are exploring options for expanding open access in our other titles. Pricing is complicated, however, and needs to strike a balance between competitiveness of individual titles and the affordability of the entire portfolio and other needs of the society and researchers. For example, some journals, such as *Water Resources Research*, currently have no author fees.

Challenges for Open Access

The challenge is that subscription publications have supported many functions of scientific societies, and ensuring high-quality peer review of scientific content is expensive. For AGU, for example, the total cost of editor compensation alone exceeds

\$1,000,000 annually, and this is a fraction of the cost of AGU staff, technology, meetings, and production. Open access models of different kinds and different colors have been proposed, but without external forcing and incentives, implementation has been slow and inconsistent. Few established journals have become fully open access because the elimination of subscription fees would require a high per-paper price.

We will continue to explore ways to lead these developments. We feel that increasing access to research within constraints of a sound business model, ensuring quality peer review and timely publication, and ensuring access to and the integrity of the data are all high priority and should be complementary. Your comments and thoughts are welcome.

Reference

Archambault, E., D. Amyot, P. Deschamps, A. Nicol, L. Rebut, and G. Roberge (2013), Proportion of open access peer-reviewed papers at the European and world levels—2004–2011 *Rep. R TD-B6-PP-2011-2*, Science-Metrix Inc., Montreal, Quebec, Canada

—ROB VAN DER HILST, Chair, Publications Committee; email: hilst@mit.edu; and BROOKS HANSON, Director, Publications, AGU; email: bhanson@agu.org

- Receive alerts when new issues are available
- Save your favorite articles for quick and easy access, including offline
- Dynamic References show references in context
- Full screen figure and table viewer
- Access your personal or institutional *Geophysical Research Letters* subscription on your iPad



CLASSIFIED

ADVERTISING INFORMATION

Eos is published every Tuesday, except the last week of December. For a classified or display advertisement to be published in a future issue of *Eos*, electronic copy must reach us by 11:59 P.M. Eastern time, 9 days prior (Sunday) to publication, except around certain holidays, which have earlier deadlines. No cancellations accepted after deadline.

For inquiries on advertising pricing and availability:

E-mail: advertising@agu.org

Phone: +1-202-777-7536

Facsimile: +1-202-777-7478

POSITIONS AVAILABLE

Atmospheric Sciences

DIRECTOR, JOINT CENTER FOR EARTH SYSTEMS TECHNOLOGY University of Maryland, Baltimore County.

The University of Maryland, Baltimore County (UMBC) seeks a Director for its Joint Center for Earth Systems Technology (JCET), who will also qualify for appointment as a tenured full professor in an academic department at UMBC. JCET was established in 1995 and is funded primarily by a cooperative agreement with the NASA Goddard Space Flight Center (GSFC). JCET has a research staff of approximately 45 scientists and faculty, many of who collaborate with scientists at GSFC and other entities in research relating to the observation, analysis and modeling of physical processes within the Earth-Sun system, and to global climate change issues on the Earth. More information can be seen at <http://jcet.umbc.edu/>.

The Director provides the overall scientific vision for JCET, and is the center's principal interface to both GSFC and to the UMBC academic community. The Director is responsible for the overall management of the Center, and for the scientific quality and integrity of the research performed by the Center's research staff, who are located at both GSFC and UMBC. Up to full academic year salary is available and the Director will be expected to spend a significant amount of time on research and teaching at UMBC. The Director reports to the Vice President for Research.

The Director should possess a broad scientific and technical knowledge of Earth, atmospheric and oceanic sciences and should possess a distinguished research portfolio in one of these fields. A Ph.D. is required.

UMBC is a dynamic and fast growing institution that has been named by US News and World Report as the top up and coming university for four consecutive years. UMBC is classified by the Carnegie Foundation as a High Research Activity research

university. It is located in the Baltimore-Washington corridor close to BWI airport and many federal laboratories including GSFC. The university was founded in 1966 and has grown to approximately 14,000 students including approximately 3,000 graduate students.

Applications including a letter of interest, a current c.v., and the names, addresses, telephone numbers and email addresses for at least three references, should be sent electronically to allison@umbc.edu. In order to receive full consideration applications should be sent before October 21, 2013. The search will remain open until the position is filled. For further information and questions contact Dr Geoff Summers at gsummers@umbc.edu.

UMBC is an Equal Opportunity/Affirmative Action Employer.

Geochemistry

Environmental biogeochemistry/Geobiology-Dartmouth College.

The Department of Earth Sciences at Dartmouth College invites applications for a junior rank tenure-track position in the general areas of biogeochemistry and geobiology. We especially welcome applications from candidates with research interests that include microbially-mediated biogeochemical interactions in processes of mineralization, weathering, and sequestration of contaminants; hydrocarbon formation and degradation; biogeochemical cycling in fluvial and/or cold environments, including river-channel, floodplain, and lacustrine ecosystem response to environmental change. Particular attention will be given to candidates who combine a focus on understanding fundamental processes with state-of-the-art laboratory and/or field research programs that complement and contribute to ongoing research activities in the Department as well as in Dartmouth's Geisel School of Medicine and Thayer School of Engineering. The successful candidate will continue Dartmouth's strong traditions in graduate and undergraduate research and teaching. Teaching responsibilities

consist of three courses spread over three of four ten-week terms.

The Department of Earth Sciences is home to 11 tenured and tenure-track faculty members in the School of Arts and Sciences, and enjoys strong Ph.D. and M.S. programs and outstanding undergraduate majors. To create an atmosphere supportive of research, Dartmouth College offers new faculty members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence, and flexible scheduling of teaching responsibilities.

Dartmouth College, a member of the Ivy League, is located in Hanover, New Hampshire (on the Vermont border). Dartmouth has a beautiful, historic campus located in a scenic area on the Connecticut River. Recreational opportunities abound in all four seasons. To learn more about Dartmouth College and the Department of Earth Sciences, please visit <http://www.dartmouth.edu/~earthsci>.

To submit an application, send curriculum vitae, statements of teaching and research interests and objectives, reprints or preprints of up to three of your most significant publications, and the name, address (including street address), e-mail address and fax/phone numbers of at least three references to:

Environmental Biogeochemistry/Geobiology Search Committee

Department of Earth Sciences
Dartmouth College 6105 Fairchild Hall
Hanover, NH 03755

e-mail: earth.sciences@dartmouth.edu

Applications received by November 8, 2013 will receive first consideration. The appointment will be effective July 1, 2014.

With an even distribution of male and female students and over a quarter of the undergraduate student population members of minority groups, Dartmouth is committed to diversity and encourages applications from women and minorities. Dartmouth College is an equal opportunity and affirmative action employer.

The O.K. Earl Postdoctoral Fellowship and the Texaco Postdoctoral Fellowship.

The California Institute of Technology announces two one-year fellowships in Geological and Planetary Sciences beginning with the 2014-15 Fall term. The O.K. Earl and Texaco Postdoctoral Fellowships are awards funded by endowments from Orrin K. Earl, Jr. and the Texaco Philanthropic Foundation. Each fellowship carries an annual stipend of \$61,000 plus a research expense fund of \$5,000, and one-way travel costs to Pasadena. Completion of the Ph.D. is required. Fellows are eligible to participate in Caltech's health and dental program.

For fellowship details and to apply online, please visit: <http://www.gps.caltech.edu/employment>. Materials in support of an application should include curriculum vitae, list of publications, a one-page statement of research interests, and three letters of reference. Applications and references are due by December 1, 2013.

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

Hydrology

Postdoctoral Research Position in Hydrology McMaster University, Ontario, CANADA.

Applications are invited for postdoctoral research position in Water Monitoring Networks Design and Evaluation. Successful applicant will contribute in developing a decision support tool for integrated water monitoring networks design. A Ph.D. in hydrology, meteorology, or engineering is required at the time of appointment. Expertise with entropy methods and multi-objective optimization techniques will be an asset. Position requires proficiency in Matlab and/or Fortran programming. The position is offered initially for one-year period and may be renewed for one additional year. The successful candidate will be involved in a joint strategic research project with Water Survey Canada, Ontario Ministry of Environment, Hydro-Quebec

and BC-Hydro. Applicants should send a CV and contact information of two references to Dr. Paulin Coulibaly (coulibaly@mcmaster.ca) by Oct. 15, 2013.

Ocean Sciences

Research positions in Reconstructing Sea-Level Change.

The Institute of Marine and Coastal Sciences (IMCS) at Rutgers University invites applications for post-doctoral associates and graduate students (PhD level) in coastal evolution/Quaternary environmental change. This project is part of an ongoing program of field-based and computational research to reconstruct Quaternary sea levels and to apply the paleo-record to improve projections of future sea-level change.

For field-focused candidates: skills in micropaleontology/paleoenvironmental reconstructions and/or sedimentology of coastal systems are highly desirable. The field-focused projects are led by Ben Horton (IMCS) and Andrew Kemp (Tufts University). For computationally-focused candidates: a strong numerical or statistical background is highly desirable. The computational projects are led by Robert Kopp (IMCS/Rutgers Earth & Planetary Sciences).

Graduate Assistantships with the Rutgers University Graduate Program in Oceanography (GPO) are available to well qualified candidates (<http://marine.rutgers.edu/gpo>).

Post-doctoral associate applications should include a CV, list of publications, a short (1-page) synopsis of previous research achievements and research plans, and contact information for at least two referees. Inquiries and applications (single PDF file) should be sent to bp Horton@marine.rutgers.edu and robert.kopp@rutgers.edu.

Review of applications will begin on January 2014. Rutgers, the State University of New Jersey, is an Affirmative Action/Equal Opportunity Employer.

Solid Earth Geophysics

Sedimentary Geology.

The Department of Geological Sciences at California State University at Bakersfield (CSUB) announces a tenure track position in Sedimentology at the Assistant Professor level beginning in fall 2014. Preference will be given to candidates that demonstrate experience or at least strong interest in expertise relevant to petroleum geology and/or basin analysis. Applications received by December 20, 2013 will receive full consideration. Position remains open until it is filled. CSUB fosters and appreciates ethnic and cultural diversity among its faculty and students, and is committed to increasing the diversity of its faculty to reflect the diversity of the campus community. Applications from women, ethnic minorities, veterans, and individuals with disabilities are welcome. The full announcement and instructions on how to apply can be found at <http://www.csu.edu/geology/documents/Geology-Tenure-Track-Professor.pdf>

The Department of Earth & Planetary Sciences at Harvard University invites applications from prospective postdoctoral scholars for multiple positions in the broad fields of active tectonics and earthquake science.

Opportunities exist in, but are not limited to, the analytic and computational modeling of fault system behaviors as well as topographic evolution in response to changes in tectonic and climatic forcing. The duration of the fellowship is one year and renewable for up to two additional years with satisfactory progress and continued availability of funding. Applicants should send (1) a statement of experience and interests, (2) curriculum vitae, and (3) the names and addresses of three references electronically to Professor Brendan Meade (c/o Bridget Mastandrea, bmastandrea@fas.harvard.edu). Review of applications will begin on December 19th, 2013. Harvard University is an affirmative action/equal

Classified cont. on next page



Between the Earth and Ocean: Tier 2 Canada Research Chair in Seafloor Processes and Properties

The Faculty of Science at Memorial University seeks candidates for a tenure track Tier 2 Canada Research Chair in the area of seafloor processes and properties. Tier 2 chairs "are for exceptional emerging researchers acknowledged by their peers as having the potential to lead in their field", and normally restricted to those within 10 years of completing their PhD. This position is subject to budgetary approval.

The ideal candidate will have a background in some combination of the disciplines of Marine Sciences and Engineering. Research interests should address the study of biological, chemical, geological, and/or physical processes at the seafloor and in the water column. We seek an individual who can build on existing institutional research strengths of cold ocean research to develop a vigorous research program and foster collaborative multidisciplinary research across the faculties of science and engineering. Scientists with research interests and backgrounds in this broad scientific area are encouraged to apply. Appointment will be made at the rank of Assistant or Associate Professor.

Ocean research is one of the focus areas declared in Memorial's Strategic Plan and excellent opportunities for collaborative research exist within the University as well as with researchers working in the wider St. John's Ocean Science and Technology cluster. Memorial's Faculties of Science and Engineering and Applied Science host a diversity of researchers with a wide range of interests including: causes of climate change determined from the marine sedimentary record, monitoring environmental change, seismic imaging in sedimentary basins, determining fundamental controls on benthic ecology, and studying how sediment is dispersed in these settings. In addition, there is great potential to establish collaborative projects with researchers studying the effects of climate change on terrestrial ecosystems. State of the art facilities for collection of seafloor datasets and sediment characterization may be accessed through Memorial University's Marine Institute, Faculty of Engineering and Applied Science, Department of Earth Sciences, Department of Ocean Sciences, and Department of Physics and Physical Oceanography. World-class research infrastructure is available at the National Research Council's large-scale tow tank, ice tank and wave basin, as well as flume tanks at the Marine Institute and seawater flumes and the deep-sea facility at the Ocean Sciences Centre (see also <http://www.mun.ca/research/ocp/creait/>). The Research Chair will therefore be able to interact and collaborate with a broad base of researchers at the University and in the local community that have significant interest and expertise in the development of novel instrumentation for the collection of seafloor and water column data.

Memorial University is the largest university in Atlantic Canada. As the province's only university, Memorial plays an integral role in the educational and cultural life of Newfoundland and Labrador. Offering diverse undergraduate and graduate programs to almost 18,000 students, Memorial provides a distinctive and stimulating environment for learning in St. John's, a very safe, friendly city with great historic charm, a vibrant cultural life, and easy access to a wide range of outdoor activities.

Details of the Canada Research Chairs program can be found at www.chairs.gc.ca. The deadline for receipt of applications is October 30, 2013. Interested persons should send a statement of research interests, resume, and the names and addresses of three referees to the Dean of Science (deansci@mun.ca). Please use reference number VPA-EASC-2013-001.

All qualified candidates are encouraged to apply; however, Canadian Citizens and permanent residents will be given priority. Memorial University is committed to employment equity and encourages applications from qualified women, men, visible minorities, aboriginal people and persons with disabilities.



POSTDOCTORAL, RESEARCH AND VISITING RESEARCH SCIENTISTS AT ATMOSPHERIC AND OCEANIC SCIENCES PRINCETON UNIVERSITY/GFDL



In collaboration with NOAA's Geophysical Fluid Dynamics Laboratory (GFDL), the Atmospheric and Oceanic Sciences Program at Princeton University solicits applications to its Postdoctoral, Research and Visiting Research Scientist Program.

The AOS Program and GFDL offer a stimulating environment with significant computational and intellectual resources in which to conduct collaborative or independent research. We primarily seek applications from recent Ph.D.s for postdoctoral positions but will accept applications from more experienced researchers. Applications from independent researchers and more senior scientists who may need partial support for sabbatical or short visits may also be considered in exceptional circumstances. Postdoctoral appointments are initially for one year with the possibility of renewal for a second year based on satisfactory performance and continued funding. A competitive salary is offered commensurate with experience and qualifications.

We seek applications in all areas of the climate sciences. This includes research in basic processes in atmospheric and oceanic dynamics; climate dynamics; variability and prediction; atmospheric physics and chemistry; cloud dynamics and convection; boundary layer processes; land-sea-ice dynamics; continental hydrology and land processes; physical oceanography; ocean-atmosphere interaction; climate diagnostics and analysis. Applicants must hold a PhD in a relevant discipline.

Further information about the Program may be obtained from: <http://www.princeton.edu/aos/>. Applicants are encouraged to contact GFDL and Princeton University scientists prior to application.

Complete applications, including a CV, copies of recent publications, names and contact information for at least 3 references in order to solicit letters of recommendation, and a titled (about three page) research proposal should be submitted by October 1, 2013 for full consideration. Applicants should apply online to <http://jobs.princeton.edu>, Requisition # 1300583. Princeton University is an equal opportunity employer and complies with applicable EEO and affirmative action regulations.

Classified

cont. from page 346

opportunity employer and applications from women and minorities are encouraged.

Interdisciplinary/Other**Tenure-track Assistant Professor.**

The School of Arts and Sciences at the University of Pennsylvania seeks to add to the faculty of our newly formed Evolution Cluster. We invite applicants for a tenure-track assistant professor appointment in evolution, broadly interpreted. We are interested in exceptional scientists who will establish a research program to empirically study the evolution of dynamical processes using field or laboratory experiments or the construction and analysis of massive data sets. Areas of interest include, but are not limited to: the evolution of neural, social, ecological or linguistic dynamics and networks; evolution of early life or exobiology; biochemical, neuronal, or cooperative interactions and exchange of information at the molecular, cellular, human, or ecosystems scales; directed evolution of organisms or processes; analyzing extant structures and networks, from molecules to populations, along with their evolutionary trajectories, including the development of new modalities to extract data from the geologic, genetic, or linguistic historical records. The successful candidate's primary appointment will be in a single department in the natural sciences: Biology, Chemistry, Earth and Environmental Science, Linguistics, Mathematics, Physics and Astronomy, or Psychology. Secondary appointments in other departments can be arranged, as appropriate. The successful candidate will have a strong interest in building a program that generates interaction with researchers from other disciplines who are working within the overarching theme of evolution and will teach courses in his or her home department and participate in the development of curricula pertinent to the Evolution Cluster (See <http://evolutioncluster.sas.upenn.edu> for more information). The University of Pennsylvania is an Affirmative Action/Equal Opportunity Employer and is strongly committed to establishing a diverse faculty:

<http://www.upenn.edu/almanac/volumes/v58/n02/diversityplan.html>
Applications should be submitted on-line at <http://facultysearches.provost.upenn.edu/postings/23> and include a curriculum vitae, a research statement that includes the candidate's perspective on how she or he fits into one of the core departments, links to no more than three journal publications, and the contact information for three individuals who will provide letters of recommendation. Review of applications will begin 1 November 2013 and will continue until the position is filled.

Assistant Professor positions in Geology.

The Department of Geology at the American University of Beirut (AUB) invites applications for faculty positions in the areas of Carbonate Sedimentology and Seismology (Geophysics). Rank is normally at the Assistant Professor level; usual contracts are initially for four years, to begin September 1, 2014. The Department offers both bachelor and master's degrees.

Application documents should be received by December 15, 2013 at the latest. For more information on this position, please visit <http://www.aub.edu.lb/fas/pages/academic-employment.aspx>

The American University of Beirut is an Equal Opportunity Employer.

Department of Environmental Studies & Sciences Tenure Track Job Ad.

The Department of Environmental Studies & Sciences at Santa Clara University seeks a tenure-track Assistant Professor in Environmental Science for Fall 2014, in the area of climate science, renewable energy, or environmental technology. The full job ad is at www.scu.edu/cas/ess. EEO/AA employer.

Faculty Positions. The Department of Geophysical, Atmospheric and Planetary Science, Tel Aviv University, Israel, invites applications for 1-2 tenure-track faculty positions starting possibly in October 2014, or later.

We are looking for excellent candidates with proven research and teaching experience, to bring new areas of research and teaching to our growing department. We are looking for one new faculty member in Marine Sciences, with a focus on the

Mediterranean Sea. This could cover marine geophysics, oceanography, exploration geophysics, air-sea interaction, geochemistry, or other related fields. The other position will provide additional support for already existing research areas in our department. These could include exploration seismology, climate variability or weather extremes, and planetary sciences. Priority will be given to researchers that supply synergies between existing groups.

Applicants should e-mail their application letter describing research, teaching and career interests, CV, and the names and contact information of 3 referees to Prof. Colin Price, Head of Department, at cprice@flash.tau.ac.il by 15 October, 2013.

GDL Foundation Fellowships in Structure and Diagenesis.

The GDL Foundation supports study and research of chemical and mechanical interactions, structural diagenesis, in sedimentary basins. Practical applications are of particular interest.

We are currently seeking applications from M.S. and Ph.D. candidates, post-doctoral researchers, and scientists for fellowships, up to \$10,000, based on specific proposals for research and participation in meetings and conferences to share results.

Submit applications (available at: www.gdlfoundation.org) by October 25, 2013.

Hamilton College Visiting Assistant Professor of Environmental Studies.

Location: Clinton, NY 13323
Closes: Dec 1, 2013

The Environmental Studies Program at Hamilton College invites applications for a non-tenure track, two-year appointment at the Visiting Assistant Professor Level. Candidates will be expected to contribute to course offerings in global climate change and aspects of the Earth's climate system relevant to environmental studies. Areas of expertise could include climatology, paleoclimatology, meteorology, and alpine studies. The successful candidate will also contribute to an interdisciplinary course that focuses upon the Adirondack Mountains and will be expected to advise and mentor senior projects in Environmental Studies. The position will be hosted in the Geosciences Department but contribute to courses within the Environmental Studies Program. Interested candidates should send a letter of application (which outlines the candidate's expertise, teaching, and research interests), curriculum vitae, graduate transcripts, a list of courses the applicant is prepared to teach, evidence of teaching performance, a sample of scholarly work, and three letters of recommendation. Your cover letter should address the ways in which you would further the College's goal of building a diverse educational environment. Previous experience teaching or working with diverse student populations is an asset. Hamilton (www.hamilton.edu) is a residential liberal arts college located in upstate New York. Applicants with dual-career considerations can find other Hamilton and nearby academic job listings at www.upstatenyherc.org. Hamilton College is an affirmative action, equal opportunity employer and is committed to diversity in all areas of the campus community. Hamilton provides domestic partner benefits. Candidates from underrepresented groups in higher education are especially encouraged to apply. All application materials should be submitted to Interfolio at <http://apply.interfolio.com/22142>. Please address all questions to Eugene Domack, Professor of Geosciences and J.W. Johnson Family Professor of Environmental Studies, at edomack@hamilton.edu. The deadline for applications is December 1, 2013.

Multiple Tenure-Track Faculty Positions California State University, Fullerton Department of Geological Sciences.

The Department of Geological Sciences at California State University Fullerton <http://geology.fullerton.edu/> invites applications for two tenure-track Assistant Professorships to begin August 18, 2014. The successful candidates: 1) will be key members in establishing a College of Natural Sciences and Mathematics center for the environment, resources, and sustainability; 2) will be expected to develop active, field-based, externally funded research programs involving undergraduate and Master's students in the candidates' field of study; 3) be committed to excellence in teaching at the undergraduate and Master's levels; and 4) will have

the ability to communicate effectively with an ethnically and culturally diverse campus community.

Resource Geology
Research interests may include mineralogy, petrology, ore deposit/economic resource geology, or volcanology as they pertain to the environment, resources, and sustainability. The successful candidate must demonstrate interest and ability to teach Earth Materials (Mineralogy) and introductory-level geosciences and upper-division/graduate courses in the candidate's area of specialization. Preference will be given to candidates who also demonstrate the interest and ability to teach field geology. For a complete position description, see: http://diversity.fullerton.edu/jobs/ft/resource_geology.asp.

Coastal Sedimentology
Research interests may include the study of coastal processes or modern coastal marine systems as analogs for ancient environments and/or petroleum geology, as they pertain to the environment, resources, and sustainability. The successful candidate must demonstrate interest and ability to teach marine geology and oceanography. Preference will be given to applicants who have the ability to teach sedimentology/stratigraphy and/or field geology classes, introductory-level geosciences courses, and upper-division/graduate courses in the candidate's area of specialization. For a complete position description, see: http://diversity.fullerton.edu/jobs/ft/coastal_sedimentology.asp.

Application Procedures
For both searches, a Ph.D. in Geological Sciences or related field is required at the time of appointment. Send a single pdf document containing: 1) a detailed curriculum vita; 2) a letter of application; 3) a teaching statement that includes: a discussion of relevant course work and/or experience in preparation for teaching, a list of courses you are qualified to teach, and a statement of your teaching philosophy; and 4) a statement of your future research plans and goals. Letters of recommendation from at least three referees familiar with your teaching and research background should be sent separately. For the Coastal Sedimentology search, applicants and referees should email materials directly to Dr. Matthew Kirby at coastal_search@fullerton.edu. For the Resource Geology search, applicants and referees should email materials directly to Dr. David Bowman at resource_search@fullerton.edu.

Applications will be accepted until the position is filled. To ensure full consideration, submit all application materials by November 15, 2013. Cal State Fullerton is an Equal Opportunity/Title IX/503/504/VEVRA/ADA Employer.

Permanent Position available at the National Aeronautics and Space Administration, Goddard Space Flight Center, New York City Chief, Goddard Institute for Space Studies.

The Earth Sciences Division at the NASA Goddard Space Flight Center (GSFC) seeks qualified candidates for the position of Chief of the Goddard Institute for Space Studies (GISS), located on the Campus of Columbia University in New York City. The position will be a Career Senior Executive Service position.

The primary GISS mission is to conduct Earth systems sciences research with a strong focus on understanding the Earth's climate. Organizational goals include developing and improving climate models, including simulations of key processes such as cloud physics, radiation, dynamics, land surface, ocean processes, etc.; developing a better understanding of the forces driving natural and anthropogenic climate change; leading development of new space missions that improve measurements of aerosols and radiation; developing emissions scenarios that have policy-specific and socio-economic applications to human problems; performing paleo-climate reconstructions that can guide the development on improved climate models; applying earth system model capabilities to comparative planetary climatology; addressing high performance computing and huge dataset issues; and engaging in educational outreach that builds on GISS research activities. In order to achieve these goals, GISS works cooperatively with Goddard Modeling and Analysis Office (GMAO) and other Earth Science Laboratories at the GSFC, and with New York area universities and research organizations, especially with Columbia University on whose campus GISS is housed.

The successful applicant will lead a team of scientists, including NASA civil servants, support scientists and software developers; about 100 staff members in total. The Chief of GISS will supervise and direct the overall scientific program at GISS, including planning the program, working effectively with NASA HQ and Goddard programs to maintain the health and effectiveness of the program, and supervising and leading the highly effective GISS research team. The Chief will be expected to play a leading role in defining and initiating GISS and GSFC interdisciplinary earth climate research; to develop collaborative relationships with other climate researchers and organizations, nationally and internationally; and to strengthen

Classified cont. on page 348

PLACE YOUR EMPLOYMENT AD HERE!



agu.org/EosJobAds



 **MONASH University**

Academic Positions in Synchrotron Geoscience

Applications are invited for two positions as part of a strategic initiative in the Faculty of Science to strengthen its profile in the application of synchrotron methods to geoscience research. The successful candidates will carry out collaborative research within the School of Geosciences and at the Australian Synchrotron Facility, which is located adjacent to the Monash University Clayton campus.

The appointees will contribute to establishing a world-class synchrotron geosciences research group and help meet the demands created by dynamic and expanding undergraduate and postgraduate student enrolments. Candidates will be chosen by their ability to carry out transformative research in their field and will have a proven record of success in competitive research grant funding, peer-reviewed publication, and teaching and mentoring, relative to experience. The appointees will also be required to teach at the undergraduate level and to supervise student research at the Honours and postgraduate levels. Applications are sought from candidates with appropriate expertise in two broadly defined fields:

- **High Temperature Geological Processes - Lecturer/Senior Lecturer (Level B/C) (Job No. 515877)**
- **Low Temperature Geological Processes - Lecturer/Senior Lecturer (Level B/C) (Job No. 515877)**

Further information about the School of Geosciences is available from: <http://www.geosci.monash.edu.au>. Enquires should be addressed to Professor Sandy Cruden, Head, School of Geosciences, sandy.cruden@monash.edu

To view detailed Position Descriptions and to submit an application, please visit <http://www.monash.edu.au/jobs/>. Applications close 25 October 2013, 11:55pm Aus. Eastern Standard Time. The University reserves the right to appoint by invitation.

An Equal Opportunity Employer



Classified

cont. from page 347

science collaborations with Columbia University. The incumbent is expected to conduct independent research and to maintain an active role as a leading scientist in a field that is central to the core of the GISS mission.

Candidates having extensive experience in Earth system science, climate modeling, and in the design and utilization of space based measurements of the earth are highly desirable. A Ph.D., degree or the equivalent in training and experience in earth system science, climate modeling, or a closely related science discipline is desired. U.S. citizenship is required. To view the full vacancy announcement, which contains further information including qualification requirements and application instructions, go to <http://www.usajobs.gov/GetJob/ViewDetails/350430000>. Applications must be received by October 30, 2013, via the USAJobs website. For additional questions, please contact Dr. Peter Hildebrand, Director of the Earth Sciences Division, NASA Goddard Space Flight Center, at Peter.H.Hildebrand@nasa.gov. NASA GSFC is an Equal Opportunity Employer.

Post Doctoral Fellow, Geophysical Institute, University of Alaska Fairbanks.

The Geophysical Institute seeks a geoscientist to develop expertise for stereo photogrammetry with a range of Alaska and planetary data sets. This person will use some of those data sets to conduct analyses of terrestrial and planetary volcanic and impact-melt features. Position is funded for three years. Applicants should have a PhD in a relevant field. Experience in fluid mechanics, photogeology, volcanology, stereo photogrammetry, and using SOCT SET software are desired, but not required, job skills. Further inquiries can be directed to Robert Herrick (rherrick@gi.alaska.edu). Apply for this position at www.uakajobs.com, posting 0067258. Review of applications will begin September 23, 2013 and applications will be considered until the position is filled.

Postdoctoral Research Fellowships, American Museum of Natural History.

The Dept. of Earth & Planetary Sciences invites applications to carry out projects in collaboration with senior research staff. Fields include mineralogy, petrology/high-temperature geochemistry, volcanology, mineral deposits, and meteoritics/planetary sciences. Appointments are for six months to two years beginning Sept. 2014. Application guidelines are at <http://bit.ly/1dZaiZV>.

The application deadline is 11/15/13. Applicants are expected to discuss potential research projects with research staff. For questions please contact Dr. Denton Ebel, debel@amnh.org. For further information see <http://bit.ly/19EV8Up>.

The AMNH is an Equal Opportunity/Affirmative Action employer.

Sedimentary Systems-Dartmouth College.

The Department of Earth Sciences at Dartmouth College invites applications for a junior-rank, tenure-track position in the area of environmental change in sedimentary systems. We welcome applications from candidates with specific research interests in biogeochemical interactions in processes of mineralization in sedimentary systems, and/or quantitative analysis of evolving sedimentary systems on local environmental to basin-wide to global scales. Particular attention will be given to candidates who combine a focus on fundamental processes with state-of-the-art field and/or laboratory research programs that complement and contribute to ongoing research activities at Dartmouth. The successful candidate will continue Dartmouth's strong traditions in graduate and undergraduate research and teaching. Teaching responsibilities consist of three courses, including sedimentary geology and sedimentary petrology, spread over three of four ten-week terms.

The Department of Earth Sciences is home to 11 tenured and tenure-track faculty members in the School of Arts and Sciences, and enjoys strong Ph.D. and M.S. programs and outstanding undergraduate majors. To create an atmosphere supportive of research, Dartmouth College offers new faculty members grants for research-related expenses, a quarter of sabbatical leave for each three academic years in residence, and flexible scheduling of teaching responsibilities.

Dartmouth College, a member of the Ivy League, is located in Hanover, New Hampshire (on the Vermont border). Dartmouth has a beautiful, historic campus located in a scenic area on the Connecticut River. Recreational opportunities abound in all four seasons. To learn more about Dartmouth College and the Department of Earth Sciences, please visit <http://www.dartmouth.edu/~earthsci>.

To submit an application, send curriculum vitae, statements of teaching and research interests and objectives, reprints or preprints of up to three of your most significant publications, and the name, address (including street address), e-mail address and fax/phone numbers of at least three references to:

Sedimentary Systems Search Committee
Department of Earth Sciences
Dartmouth College 6105 Fairchild Hall
Hanover, NH 03755
e-mail: earth.sciences@dartmouth.edu

Applications received by November 8, 2013 will receive first consideration. The appointment will be effective July 1, 2014.

With an even distribution of male and female students and over a quarter of the undergraduate student population members of minority groups, Dartmouth is committed to diversity and encourages applications from women and minorities. Dartmouth College is an equal opportunity and affirmative action employer.

The Department of Geology at San José State University invites applications for a tenure-track position (Assistant Professor) in Neotectonics starting August 2014. A Ph.D. degree in the Geological Sciences is required, postdoctoral experience is desirable, and a proven record of excellence in research and teaching, or evidence of promise for excellence in teaching is expected. Research areas should complement departmental strengths in geomorphology and structural geology. The successful candidate will take a leadership role in teaching and curricular development of undergraduate and graduate courses in Neotectonics. Teaching in the field geology program and teaching non-majors is also expected. Research involving masters and undergraduate students is required, and external funding should be sought.

SJSU enrolls a highly diverse, large (~30,000) student population. The University is located in the tectonically active San Francisco Bay area, and in the Silicon Valley high-tech center.

For full consideration, send via mail and PDF a letter of application, curriculum vitae, university undergraduate and graduate transcripts, statement of teaching interests/philosophy and research objectives, and the contact information of three references by 15 November 2013 to: Robert Miller, Chair, Department of Geology, San José State University, San José, CA 95192-0102; robert.b.miller@sjsu.edu; tel 408-924-5050. Please include the Job Opening Identification (22675) on all correspondence. For a complete job announcement see: <http://www.sjsu.edu/geology/>. SJSU is an Equal Opportunity/Affirmative Action employer committed to the core values of inclusion, civility, and respect for each individual.

The Large Lakes Observatory at the University of Minnesota Duluth and the US EPA Mid-Continent Ecology Division in Duluth has a full time Post-Doctoral candidate position available.

The Post-Doc will be responsible for designing and executing an Autonomous Underwater Glider (AUG) field program in Lake Superior. Start date January 6th, 2014 is negotiable depending on the needs and commitments of the successful candidate. Required qualifications include a PhD in ocean engineering, physical and/or chemical oceanography, remote sensing, or closely related field. PhD must be completed by start date of appointment. Preferred qualifications include knowledge and/or research experience with oceanographic technology, especially AUG technology and operation; knowledge of coastal dynamics and ecological processes in estuarine, marine and/or freshwater (large Lake) environments, and some understanding of the interaction of physical and biogeochemical processes in aquatic ecosystems; quantitative analysis skills and related educational training; experience with GIS, visualization software, and mathematical modeling. For a complete Position Description and information on how to apply, please visit our web site at <https://employment.umn.edu/applicants/Central?quickFind=112994> or contact Dr. Jay Austin, jaustin@d.umn.edu, 2205 E 5th Street, Duluth, MN

55812, 218-726-8773. Complete applications will be reviewed beginning October 17th, 2013.

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

Student Opportunities**Graduate Student Fellowships in the Collaborative PhD Program of the American Museum of Natural History.**

The AMNH Dept. of Earth & Planetary Sciences seeks students for collaborative AMNH-Columbia U. and CUNY PhD programs. Areas of research include petrology/high-temperature geochemistry, volcanology, mineral deposits, and meteoritics/planetary sciences. Students must apply simultaneously to Columbia or CUNY and AMNH and are expected to conduct research under the direction of a museum scientist. Students in good standing receive a full 12-month stipend and tuition for 4 years. Applicants should discuss their interests and background with a potential advisor. For details see <http://bit.ly/19EV8Up>. Application deadline is 12/15/13. For questions contact Dr. Denton Ebel, debel@amnh.org.

Support is available for two PhD students in the area of climate science at Cornell University, Department of Earth and Atmospheric Sciences (<http://www.eas.cornell.edu/>).

Students will receive training in state-of-the-art climate modeling, data analysis and visualization, and benefit from significant mentorship in a vibrant, interdisciplinary research environment. Interested candidates should contact Prof. Toby R. Ault for more information (toby.ault@cornell.edu). Members of historically underrepresented groups in atmospheric science are especially encouraged to apply.

The Office of Science and Technology Policy is currently accepting applications for its Spring 2014 Internship Program. The application deadline is 11:59pm Friday, October 4, 2013. Students who are U.S. citizens and who will be actively enrolled during the Spring 2014 semester are welcome to apply.

More information and application instructions are available at <http://www.whitehouse.gov/ostp/about/student/>.

About OSTP. The Office of Science and Technology Policy advises the President on the effects of science and technology on domestic and international affairs. The office serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans and programs of the Federal Government.

About the Internship Program. Interns are accepted for one of three annual terms (Spring, Summer, or Fall), which each last no more than 90 days. While these positions are without compensation, the assignments provide educational enrichment, practical work experience, and network opportunities with other individuals in the science and technology policy arena.

For questions, please contact Rebecca Grimm rg Grimm@ostp.eop.gov.

RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

Gravity waves could explain powerful thermospheric cooling

For the past few decades the upper reaches of Earth's atmosphere have been cooling much faster than researchers anticipated. While the rising atmospheric concentration of carbon dioxide is heating the air near the ground, that same increase is expected to cool the thermosphere—the atmospheric band that stretches from around 80 kilometers altitude to the exosphere at 500 kilometers—by emitting heat into space. However, while carbon dioxide should theoretically cool the thermosphere by around 2 kelvins per decade, the observed cooling was around 10 times this rate. Building on recent theoretical and modeling work, *Oliver et al.* lay out a mechanism that could explain the observed cooling.

In the mid-1970s the climate regime went through a shift, possibly due to changing sea surface temperatures, that caused El Niño modes of the El Niño–Southern Oscillation to dominate. This change in the climate regime, the authors suggest, resulted in the production of westward propagating Rossby waves—large ocean waves that take months to decades to cross the ocean. These Rossby waves are a couple to a dozen centimeters high and span hundreds of kilometers from peak to peak, giving the surface of the ocean a gently corrugated surface. Wind blowing over these Rossby waves would trigger atmospheric gravity waves that can propagate from the surface to the thermosphere. When these gravity waves decay, they cause a flux of energy from the thermosphere, cooling it by as much as 100 kelvins.

The long duration for Rossby wave propagation means that this cooling would increase with time, persisting to this day. The authors note that while the link between the 1970s climate regime shift and the formation of Rossby waves is speculative, observational, theoretical, and

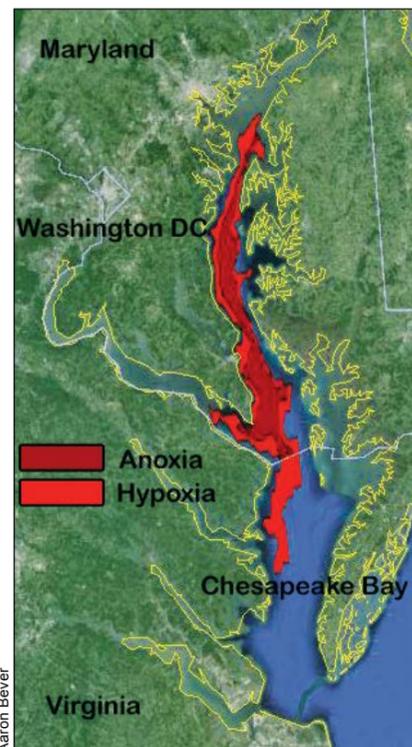
modeling work has confirmed that Rossby waves do trigger atmospheric gravity waves and that gravity waves can cause thermospheric cooling. (*Journal of Geophysical Research-Space Physics*, doi:10.1002/jgra.50370, 2013) —CS

Improving measurement of Chesapeake Bay's dead zone

In the 1930s, researchers first noticed that the Chesapeake Bay had a dead zone, an expanse of water with drastically reduced concentrations of oxygen. In the 1980s, hypoxia—low-oxygen conditions—gave way in some places to anoxia—a near-total depletion of dissolved oxygen. A lack of oxygen makes the water inhospitable for many marine organisms, and the Chesapeake Bay is the focus of major ecosystem rehabilitation efforts.

A network of 99 sensor stations around the bay is used to estimate and track the extent of the annual hypoxia. Despite the size of the observational network, properly measuring and tracking changes at the scale of the hypoxic zone are challenging because the widespread observation stations must be reached by boat, making it difficult to get a clear snapshot of the conditions at any one time. *Bever et al.* used water quality observations from these measurement stations and multiple numerical models to estimate the extent of the hypoxic zone from 1984 to 2012.

Rather than always using all of the observation stations' measurements, the authors also experimented with using only the observations from small sets of stations. In some of their calculations, they used observations from real measurement stations, while in others they calculated the extent of the hypoxic zone using information from hypothetical alternate observation stations, obtained from multiple three-dimensional models of the bay. The authors suggest that better measurements of the Chesapeake



Model-estimated extent of the near-bottom anoxia (dark red) and hypoxia (light red) in Chesapeake Bay for July 2004.

Bay hypoxic zone could be gathered if only 10 to 20 well-placed observation stations were used and if the measurements were made more frequently. (*Journal of Geophysical Research-Oceans*, doi:10.1002/jgrc.20331, 2013) —CS

Atlantic overturning circulation susceptible to tipping point shift

A sudden shift in the strength of the Atlantic meridional overturning circulation

(AMOC) is thought to be the most important mechanism behind several past abrupt changes in the climate. AMOC transports heat, salt, and nutrients throughout the Atlantic Ocean. Paleoclimate evidence has shown that changes in its strength affect the climate worldwide. Whether AMOC could suddenly shift again depends on whether the circulation can exist in more than one stable state.

By melting Greenland ice and the surrounding sea ice and by changing precipitation patterns, global warming is increasing the amount of fresh water flowing into the North Atlantic. This process weakens the strength of AMOC. If the circulation can exist in two stable states, this freshening could cause it to cross a tipping point, after which its strength would plummet into a stable weak state. If AMOC has only one stable state, then increased freshening will still cause it to weaken but at a slower rate and with a possibility to recover if freshening is reversed. Observations suggest that AMOC has the potential to cross into a second weaker state, but most modeling studies show it as having only a single strong stable state.

Using a new extremely high resolution global model, *Deshayes et al.* found that AMOC has two stable states, despite uncertainty in atmospheric forcing and model parameters. The new model is better able to factor in the effects of eddies and other medium-sized ocean behavior than lower-resolution models. In their simulations the authors found that AMOC is transporting more fresh water to the South Atlantic than it is returning to the North Atlantic. This disparity would cause a feedback loop that would amplify freshening of the North Atlantic as AMOC decreases, accelerating the slowdown of the overturning circulation. (*Geophysical Research Letters*, doi:10.1002/grl.50534, 2013) —CS

—COLIN SCHULTZ, Writer