

# EAR TO THE GROUND

Summer 2013  
NSF

The Division of Earth Sciences (EAR) is part of the Geosciences Directorate at the National Science Foundation.

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*Lava eruption at Tolbachik volcano, Russia (credit: Benjamin Edwards)*

## Update from the Division Director

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I am starting my division news by sharing with you some staffing changes in EAR. Teofilo “Jun” Abrajano, Section Head for Surface Earth Processes, left NSF for a position as Director of Research at KAUST. Paul Cutler is our acting Section Head and also manages the Geomorphology and Land Use Dynamics program. We currently have a position opening, which can be found [here](#), and we encourage you to consider this opportunity if you have interests in either temporary or permanent employment with an emphasis in science management at NSF.

Science Assistant Rachel Bernard starts the next phase of her career as a new graduate student at the Jackson School of Geosciences, University of Texas at Austin and our new science assistant, Rachel Thornton, will arrive this summer. We have also recently welcomed Dr. Jonathan Wynn as a program

officer in the Instrumentation and Facilities program.

The work of managing program proposals is made possible by our administrative staff. Felicia Means is the Program Support Manager and in this newsletter you can read an article about our hard-working, behind-the-scenes, division support staff.

Our budget uncertainties persist, although some closure is in sight with sequestration cuts now defined and a fiscal year base close to the FY12 enacted appropriation. With a unique year largely behind us we anticipate some semblance of budget normalcy for FY14. You can read the President's Request to Congress for FY14 for NSF/GEO [here](#).

I continue to appreciate the value of our partnerships with sister agencies bring to EAR's community of scientists and educators. Kevin Gallagher, Assistant Director for Core Science Programs at the USGS and Jill Baron, Director of the USGS Powell Center are working with us to renew a Memorandum of Understanding that describes each agency's involvement in the Powell Center. The Powell Center, located in Fort Collins, Colorado, is a center for analysis and synthesis enhancing scientific problem-solving and discovery through integrated research. We encourage you to read more about the opportunities to advance data synthesis through this program [here](#). Two of EAR's program officers – Chuck Estabrook and Tom Torgersen are members of the Powell Center advisory board and can address your questions.

In February, EAR had the attention of the National Science Board when we presented NSF's portfolio of water-related research and education for their review. Much of the technical detail in my overview was pulled together by Tom Torgersen, Jessica Robin, and Shemin Ge with Melissa Lane creating a polished presentation. Although there may be no immediate tangible benefit, visibility for EAR across the Foundation, as well as with the external community represented by the members of the National Science Board helps reinforce the pivotal role that our research plays in addressing the global challenges of providing clean water and food for a healthy population, in driving supplies of energy and therein the global economic engine.

*Wendy Harrison*  
*Director, Division of Earth Sciences*

### EAR Welcomes New Program Officer Dr. Jonathan Wynn

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Jonathan Wynn joins EAR as a new IPA program officer in the Instrumentation and Facilities program from his Associate Professor position in the Department of Geology, University of South Florida. Jonathan completed BS and MS degrees at the University of Utah, and a PhD from the University of Oregon, followed by postdocs at the Australian National University, USGS, and St. Andrews University. His research uses stable isotopes to understand processes involved in the carbon, nitrogen, sulfur, and water cycles. Recent applications of his research have included constraining paleodiets of early hominins from eastern Africa, understanding the role of freshwater in acidification of the Arctic Ocean, and modeling the fate of black carbon in Australian savannas. He looks forward to serving the EAR community while working at NSF.

## Meet the EAR Support Staff!



*Pictured (left to right): Una Alford-Solomon, Jackie Cooper, Nadine McKenzie-Proctor, Alicia Armstrong, Patty Brooking, Yasmin Adawi, Tina Hunter, and Chris Simmons*

The Program and Management Specialists and Assistants that work within EAR are crucial for our day-to-day operations. Without them, we wouldn't be able to manage our programs or keep up with NSF's ever-evolving policies and practices. Their work involves developing, analyzing, evaluating, advising on and improving the effectiveness of work methods, procedures and programs. **V. Yasmin Adawi** works with the Tectonics, Petrology & Geochemistry, and EarthScope programs. **Jackie Cooper** works with the Continental Dynamics, Instrumentation and Facilities, Geoinformatics and Integrated Earth Systems (IES) programs. **Tina Hunter** works with the Geophysics program as well as the Cooperative Studies of the Earth's Deep Interior (CSEDI) and Frontiers of Earth System Dynamics (FESD) programs. **Una Alford-Solomon** works with the Education and Human Resources, Geomorphology and Land Use Dynamics, and Postdoctoral Fellowships program. **Patty Brooking** works with the Geobiology and Low Temperature Geochemistry and Critical Zone Observatories (CZO) program, and provides support for the Division Director and Section Heads. **Chris Simmons** works with the Hydrologic Sciences program. **Alicia Armstrong** and **Nadine McKenzie-Proctor** work with the Sedimentary Geology and Paleobiology program.

## Broader Impacts – Examples from the Ground

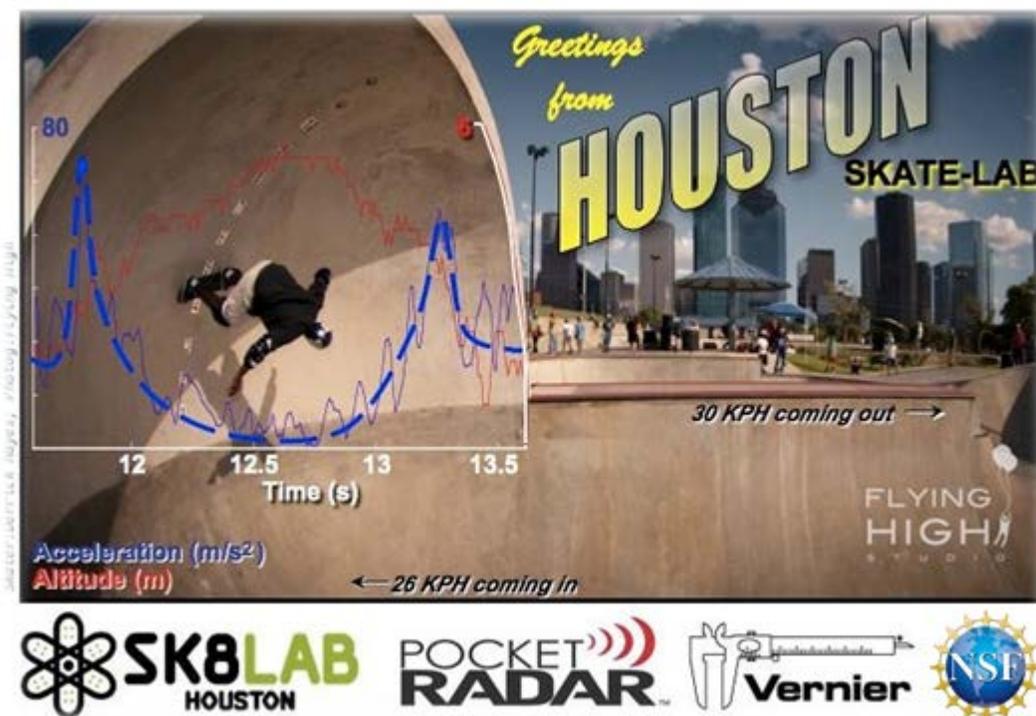
In collaboration with EAR program directors, we have compiled a great list of examples of broader impacts that we will share with you in coming issues of *EAR to the Ground*. These examples range in scope, audience, and approach. However, they share some common traits: engaging relevant partners during the planning of the activity, implementation focused on the audience, and follow up activities. These examples include broader impacts activities related to outreach to the scientific community, undergraduate education, instrumentation, international collaborations, broadening participation, K12 education, informal science education, and applications of research results. Our intent is not to have all the broader impacts in EAR look alike, but to have the broader impacts be as well informed, planned, and executed as the research projects.

### ***Collaborating with Athletes, Artists and Teachers to Engage Students in Science***

Award Number: 0448871  
*CAREER Development in Geomodeling: Seeing and  
 Creating Connections in Earth Science*  
 PI: Adrian Lenardic, Rice University

**Research:** This CAREER award was made to Adrian Lenardic to model coupled continental tectonics, mantle dynamics, and surface processes. Numerical simulations were conducted to explore coupled crust-mantle dynamics during continental collision.

**Broader Impact Activity:** Funding for this award allowed for the launch of sk8lab, a collective of Skaters, Scientists, Artists, and Educators whose mission is to promote the power of experiments for learning. Annotated images and movies are created that can be used by K-12 and University educators to present scientific ideas through an activity that students are interested in: skateboarding. Sports teaching modules about the physics of skateboarding are also created for these educators to use.



**Implementation:** The PI collaborates with Robb Gardner of Sony Picture Image Works, who is helping with video shoots and creating a Video lab book, which is being developed for future distribution to high schools. Gardner, who is also a sports photographer, has done the bulk of the video work, while the PI contributes the analysis and designs the actual labs. The PI also collaborated with William Church of the White Mountain Center of Applied Science. Church is an award-winning high school teacher who has helped the PI link to the K-12 community, and has already implemented several of their prototype activities into his senior high school physics class with very good success.

**Impact:** While the video labs are still being developed, the PI and his team have been doing live events/experiments to develop the materials and at the same time let children from K-12 partake. Hands on science experiments outside the classroom get students engaged in the process of doing an experiment that they can help design as well as run. The students are able to see the near real time data results after the experiments. Some events have attracted as many as 200-300 members of the public.

Learn more about sk8lab on Facebook: [www.facebook.com/Sk8labHouston](http://www.facebook.com/Sk8labHouston)

## News from the Board on Earth Sciences and Resources (BESR) of the National Research Council

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As the hub for Earth science activities at the National Research Council (NRC), the Board on Earth Sciences and Resources (BESR) is pleased to be marking its 25th anniversary this year through a series of activities focused on providing independent scientific and engineering information and advice to the nation on a broad range of Earth science topics. In addition to a short update on recent activities of the Board, this article outlines some of the upcoming activities associated with the Board's 25th anniversary.

Since the autumn of 2012, BESR and its standing committees have overseen the release of four National Research Council reports:

- [Advancing Strategic Science: A Spatial Data Infrastructure Roadmap for the U.S. Geological Survey](#)
- [Future U.S. Workforce for Geospatial Intelligence](#)
- [Underground Engineering for Sustainable Urban Development](#)
- [Emerging Workforce Trends in the U.S. Energy and Mining Industries: A Call to Action](#)

The Board and its standing committees also have [several studies in progress](#), a number of which will be released during 2013.

As an integrated part of its upcoming 2013 activities, [the Board's 17 members](#) have selected "communication" as a key, throughgoing theme. At the Board's spring meeting on May 7 in Washington, DC, the topic of "Effective communication of Earth science and engineering information" will be explored through panel discussions among invited experts from Earth science, policy, and communication fields. The communication theme will be developed further as the Board hosts a webinar series that will begin during the summer of 2013 and continue through the first part of 2014. Through a set of "Future of..." webinar topics, the Board will invite presentations from 2-3 key figures in various areas of Earth science to discuss science and engineering issues with policy relevance in each webinar forum. The Board's main anniversary event will be held in November 2013 in Washington, DC. Information and details about these and other meetings of the Board will be available [here](#) as the event dates approach.

Earth science and engineering information lies at the core of many current and future issues of importance to national policy including energy and natural resources, natural hazards, and the built and natural environment. BESR is continuing to work to focus its activities and communications in areas where Earth science and engineering can contribute toward important decisions made at federal, state, and local levels. BESR values its long-standing collaborative relationship with the National Science Foundation and other federal agencies in this regard and we look forward to continued engagement with the Earth science community this year.

The **National Academies** include the **National Academy of Sciences (NAS)**, **National Academy of Engineering (NAE)**, **Institute of Medicine**, and **National Research Council (NRC)**, all of which are private, nonprofit institutions. The NRC, under which the Board resides, is the operating arm of the NAS and NAE.

*Elizabeth A. Eide*  
*Director, Board on Earth Sciences and Resources*  
[eeide@nas.edu](mailto:eeide@nas.edu)

## Integrated Earth Systems

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The Summer 2012 edition of *EAR to the Ground* announced NSF's intent to revise and expand the solicitation for the Continental Dynamics Program (CD). A new Program, Integrated Earth Systems (IES), is the result and a new solicitation (NSF 12-613) has been issued which can be found [here](#). **The first proposals for IES are due on November 14, 2013.** A brief description of IES appears below:

Earth science research involves the study of physical, chemical, and biological processes that interact and combine in many ways to produce a wide range of dynamic Earth systems. These Earth systems are characterized by their complexity, their non-linearity, and their continuous evolution. They interact with one another over a wide variety of space and time scales and can produce multiple and diverse outcomes. These characteristics present significant hurdles to our ability to understand and forecast the behavior of a complex and evolving Earth, including the human impact or impact on humans.

IES is a program in the Division of Earth Sciences (EAR) that focuses specifically on the continental, terrestrial and deep Earth subsystems of the whole Earth system. Overall, the goals of IES are to:

- provide opportunity for collaborative, multidisciplinary research into the operation, dynamics and complexity of Earth systems at a budgetary scale between that of a typical project in the EAR Division's disciplinary programs and larger scale initiatives at the Directorate or Foundation level;
- support study of Earth systems that builds on process-oriented knowledge gained from EAR programmatic research and enables systems-level hypothesis testing and analysis of coupled processes;
- provide a "bridge" among the EAR disciplinary programs in order to foster the exchange of questions, ideas, and knowledge between disciplinary discovery and system-level investigations.

Specifically, IES will provide research opportunities for the study of Earth systems from the core of the Earth to the top of the critical zone with a specific focus on EAR subsystems that include continental, terrestrial and deep Earth subsystems at all temporal and spatial scales. IES will provide opportunities to focus on Earth systems connected to topics which include (but are not limited to) the continents; the terrestrial, surficial Earth systems including physical, chemical and biotic dimensions; linkages among tectonics, climate, landscape change, topography and geochemical cycles including core and mantle processes.

## Instrumentation and Facilities Highlight: COMPRES

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The [Instrumentation & Facilities Program](#) of the Division of Earth Sciences (EAR/IF) supports eighteen (18) national, multi-user facilities on behalf of the earth sciences research and education community. Although ranging widely in the scope and cost of their individual operations, all of the facilities share a common attribute. They provide to their respective basic research and education communities on a national or regional scale certain complex and expensive technical and logistical capabilities that would otherwise be impractical to make available to individual or small groups of investigators.

*EAR to the Ground* is continuing to highlight some of these facilities, to make the community aware of the incredible capabilities sponsored by EAR/IF. You can download the guide to multi-user facilities [here](#). In this issue, we bring you a highlight from **COMPRES, the Consortium for Materials Properties Research in Earth Sciences**.

COMPRES is a community-based organization whose goal is to enable Earth Science researchers to conduct the next generation of high-pressure science on world-class equipment and facilities. COMPRES supports the operation of synchrotron beam lines, the development of new technologies for high pressure research, and supports a variety of educational and outreach programs. COMPRES activities fall into the categories of Facilities, Infrastructure Development, and Education & Outreach, all specifically in support of research and education for the high-pressure Earth sciences community.

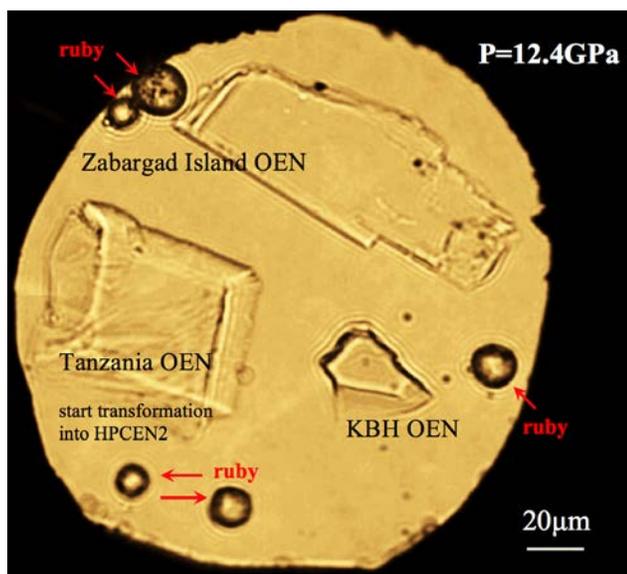


*Figure 1: The 1000 ton press at beamline X17B2 of the National Synchrotron Light Source. This apparatus is used for high-pressure studies of rheology, elasticity, and equations of state of mineral and rock samples at high P&T.*

**Facilities:** COMPRES provides support for 4 synchrotron beam lines, namely:

- Beamline X17B2 at the National Synchrotron Light Source (NSLS), Brookhaven National Laboratory, is used for experimentation with the large-volume multi-anvil apparatus and related devices. Experiments on rheology of Earth materials, equations of state, elasticity, and seismic attenuation are carried out to pressure and temperature conditions corresponding to the top of the lower mantle.
- Beamlines X17B3 and X17C at the NSLS are used for synchrotron X-ray experiments using the diamond-anvil cell. Experiments on equations of state, single-crystal and polycrystalline X-ray diffraction (XRD), pair distribution functions, and laser heating experiments are conducted at these beamlines.
- Beamline U2A at the NSLS, for infrared high-pressure experiments with the diamond-anvil cell. Experiments performed include studies of the water content of minerals, bonding, electronic transitions, and structural phase transitions.
- Beamline 12.2.2 at the Advanced Light Source, Lawrence Berkeley National Laboratory, is used for synchrotron X-ray experiments with the diamond-anvil cell. This beamline is especially well suited for studying the development of mineral textures using radial XRD, high-temperature resistance heating experiments, as well as equations of state, and XRD on polycrystalline and single-crystal samples with laser-heating capabilities.
- COMPTECH supports technology development for high-pressure research at a variety of synchrotron beamlines at the Advanced Photon Source (APS), Argonne National Laboratory. This activity aims to develop new capabilities for high-pressure experiments using synchrotron techniques not available at other COMPRES-supported beamlines.

Research at these facilities has led to a numerous groundbreaking discoveries. For example, using high-temperature radial X-ray diffraction at ALS beamline 12.2.2, Miyagi et al. (Science 2010 329, 1639-1641) studied the development of texture in MgSiO<sub>3</sub> post-perovskite, allowing them to explain shear wave splitting and seismic anisotropy in the D'' region above the core-mantle boundary. Li and Weidner (Nature 2008 454, 984-986) used the D-DIA apparatus at NSLS X17B2 to show that the interaction of seismic waves with mantle phase transitions can strongly affect the observed velocity jumps across seismic discontinuities.



**Figure 2:** Three orthopyroxene (OEN) samples with different chemical compositions, in the sample chamber of a diamond-anvil cell. Crystal structures, elasticity, electronic structure, and phase transitions of such tiny samples can be studied by a variety of synchrotron techniques at COMPRES-supported facilities. New structural transitions have been found in this major component of the upper mantle. KBH indicates a highly aluminous sample from Kilbourne Hole NM.

**Infrastructure Development:** This program aims to develop new instrumentation and methodologies that advance the capabilities of the COMPRES community. Also supported is hands-on education through workshops on emerging experimental techniques that offer new research opportunities. Personnel are supported to work with new users of highly specialized synchrotron capabilities. Current projects include:

- Inert gas loading for diamond-anvil cells at the Sector 13, GSECARS, at the APS. A service for loading diamond cells for remote users is also supported.

- High-resolution Inelastic X-ray Scattering at the APS: We provide training for new users of Nuclear Resonant Inelastic X-ray Scattering (NRIXS) and synchrotron Mossbauer spectroscopy. These novel experimental techniques are being increasingly exploited by high-pressure geoscientists for fundamental studies of lower mantle and core materials. This project also provides conventional Mossbauer spectroscopy facilities, which are in high demand by our community.

- Multi-Anvil Cell Development: This project provides high-quality cost-effective standard sample assemblies and other parts for Multi-Anvil Large-Volume Press research. New cell assemblies for novel experiments are also developed here.

**Education and outreach:** This activity includes instructional workshops aimed at graduate and upper-level undergraduate students and post-doctoral fellows, online courses, online content in the area of high-pressure science. Outreach includes the COMPRES Annual Meeting, which has become a primary scientific meeting for students in high-pressure Earth science. Current projects include:

- Hands-on training workshops in Focused Ion Beam/Scanning Electron Microscope techniques for fabrication and analysis of diamond-anvil cell samples. These techniques provide unique capabilities but there are few places where diamond cell practitioners can obtain the specialized training they need for such experiments.
- A Distinguished Lecturer Program, in which speakers present talks at colleges and universities, primarily undergraduate institutions, that do not have a mineral physicist on the faculty.
- Enhancing Diversity in Geosciences: A specialized Master's Degree program offered by Stony Brook University for students from historically black colleges. COMPRES facilities at the NSLS are used for training students in high technology skills.

## New GEO Innovation Newsletter

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From the newly launched GEO Innovation Newsletter:

*GEO is calling for its PIs to participate in the NSF's Innovation Call. We are looking for research ripe for commercialization, for PIs interested in having students co-advised with Industry, for PIs interested in working with their counterparts in Industry, for faculty members interested in creating new education curricula with innovation activities, and for much more. Some of these activities have been in place since the late 70s, but where are you? We know that GEO-related PIs have a lot to contribute, so please call us!*

Read the newsletter for the latest news about **GEO's Innovation Call**, including upcoming deadlines and opportunities: <http://www.nsf.gov/geo/innovation/2013-geo-innovation.pdf>

For more information please contact Program Officer Raffaella Montelli, [rmontell@nsf.gov](mailto:rmontell@nsf.gov)

## Upcoming Deadlines and Target Dates

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You can find the full list of active GEO funding opportunities [on the Directorate for Geosciences website](#), but here are some programs of particular interest to the EAR community:

### [Hydrologic Sciences](#)

(NSF 13-531) Full Proposal Deadline: June 3, 2013

### [Geophysics](#)

(NSF 12-598) Full Proposal Target Date: June 5, 2013

### [Innovation Corps Teams Program \(I-Corps Teams\)](#)

(NSF 12-602) Full Proposal Window: April 1, 2013 - June 17, 2013

### [Industry/University Cooperative Research Centers Program \(I/UCRC\)](#)

(NSF 12-516) Letter of Intent Deadline: June 28, 2013

### [Innovation Corps Sites Program \(I-Corps Sites\)](#)

(NSF 12-604) Full Proposal Deadline: July 1, 2013

### [Geoinformatics](#)

(NSF 11-581) Full Proposal Deadline: July 1, 2013

### [Petrology & Geochemistry](#)

(NSF 09-543) Full Proposal Window: June 6, 2013 - July 6, 2013

### [Tectonics](#)

(NSF 09-542) Full Proposal Window: June 6, 2013 - July 6, 2013

### [Geomorphology and Land Use Dynamics](#)

(NSF 09-537) Full Proposal Deadline: July 16, 2013

### [Geobiology and Low-Temperature Geochemistry](#)

(NSF 09-552) Full Proposal Deadline: July 16, 2013

[NSF Earth Sciences Postdoctoral Fellowships \(EAR-PF\)](#)

(NSF 13-548) Full Proposal Deadline: July 18, 2013

[Sedimentary Geology and Paleobiology](#) (Track 1 only)

(NSF 12-608) Full Proposal Deadline: July 18, 2013

[Faculty Early Career Development \(CAREER\) Program](#)

(NSF 11-690) Full Proposal Deadline (for GEO): July 24, 2013

[EarthScope](#)

(NSF 12-550) Full Proposal Deadline: August 23, 2013

[Research Experiences for Undergraduates \(REU\)](#)

(NSF 13-542) Full Proposal Deadline: August 28, 2013

[Critical Zone Observatory National Office \(CZO-NO\)](#)

(NSF 12-595) Full Proposal Deadline: September 16, 2013

[Instrumentation and Facilities](#): Full Proposals Accepted Anytime

**The revised version of the [NSF Proposal & Award Policies & Procedures Guide \(PAPPG\), NSF 13-1](#) is effective for proposals submitted, or due, on or after January 14, 2013.**



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[@NSF](#): News and highlights from all directorates at NSF

[@EarthScopeInfo](#): News, updates, and fun facts from the EarthScope Office

[@GeoPRISMS](#): News and updates from the GeoPRISMS Office



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This newsletter is designed to share information about NSF's Division of Earth Sciences. If you have comments or questions, please contact [Dr. Shemin Ge](#) at [sge@nsf.gov](mailto:sge@nsf.gov).

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