of CO_2 ice in the seasonal caps. The major sources for heat that cannot be directly observed are atmospheric transport of heat and the fall/winter release of stored summertime heat from the regolith. Several presenters from Caltech, ARC, San Jose State, and USGS showed model results suggesting that the bulk of the excess energy is due to fall and winter sublimation from regolith stored heat. Atmospheric thermal transport may still play an important role in local and regional CO_2 deposition rates.

It was generally agreed that follow-on studies that combine GCM results and CO_2 ice and noncondensable gas column abundances determined from neutron and gamma ray spectroscopy are needed in order to constrain the local energy balance. In addition, GCMs need to be modified to include physical effects that are important at high latitudes such as cloud microphysics, the effect of ice-table depth on heat storage in the regolith, and improved treatment of dynamical processes. More laboratory experimental work is also needed to determine CO_2 ice properties under Martian conditions.

A follow-on meeting is being planned for the summer of 2005 to assess progress on studies identified by workshop participants. A separate series of workshops on the polar water cycle has also been proposed. For additional information about the workshop, contact the authors: tprettyman@lanl.gov and ttitus@usgs.gov.

The Workshop on the Polar Atmosphere and CO_2 Cycle of Mars was held 12–14 July 2004 at the Bishops Lodge in Santa Fe, New Mexico.

—Thomas H. Prettyman, Space and Atmospheric Sciences, Los Alamos National Laboratory, New Mex.; and Timothy N. Titus, U.S. Geological Survey, Astrogeology Team, Flagstaff, Ariz.

Multifacility, Multidisciplinary Earthquake Science and Engineering

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A workshop held last spring in Austin, Texas, launched a new era in earthquake science and engineering. Discussions at the workshop, sponsored by the Incorporated Research Institutions for Seismology (IRIS) are leading to the collaborative use of multiple major research facilities to solve challenging scientific and engineering problems related to Earth science and seismic hazards. These facilities included those of IRIS and the Network for Earthquake Engineering Simulation (NEES), both supported by the U.S. National Science Foundation (NSF), and the U.S. Geological Survey's (USGS) National Earthquake Program (NEP).

The collaborations discussed at the workshop have already turned into reality. With the added participation of the NSF-supported Mid-America Earthquake Center (MAEC), Southern California Earthquake Center (SCEC), Center for Embedded Network Sensing (CENS), High Performance Wireless Research and Education Network (HPWREN), and Los Alamos National Laboratory (LANL), a pilot field experiment was conducted to demonstrate (successfully!) the potential of such collaborative science.

This report first focuses on workshop discussions about scientific and engineering topics and how investigations may employ the facilities of IRIS, NEES, Earthscope (an NSF-supported initiative), and USGS to study these topics. Summaries of discussions about the operational aspects of the facilities, workshop minutes, and all presentations may be found on the Web site: http://www.ceri.memphis. edu/~gomberg/NEES_USGS/Index.htm. The report also discusses the pilot field experiment, concluded on 22 August 2004, that piggybacked on a NEES inaugural demonstration at the NEES Garner Valley Digital Array (GVDA) site in southern California.

Workshop Highlights

This report summarizes some of the topics discussed at the workshop, noting the obvious needs that combined facilities might meet, and a few examples of specific ideas for multifacility experiments.

Images of the deep crust and upper mantle structure characterize the Earth's composition and rheologic properties and their variations over scales of a few to hundreds of kilometers, and constrain models of crustal evolution and broad-scale tectonic deformation. Images are derived most often from measurements of seismic wave fields and are most useful when they include both compressional and shear waves. IRIS and USGS have a wide variety of recording instruments but lack adequate seismic sources. In only a few places are earthquake sources sufficiently abundant, and accurately known, for imaging. Mobile shakers can provide repeatable, accurately known sources of seismic wave energy; and the NEES shakers are unique in the amount of energy they can generate and in their ability to generate both compressional and shear waves. Unlike explosive sources, the shakers may be employed in a variety of environments. The need for artificial, nondestructive, safe sources will be increasingly acute as the USArray component of Earthscope moves into the relatively seismically quiet central and eastern United States.

An obvious experiment would compare the imaging capabilities of the NEES shakers to those of explosive sources. Both were employed this September in a wide-angle reflection/refraction experiment designed to image the crustal structure within the northwestern Basin and Range transition zone, with signals recorded using IRIS and Earthscope instrumentation. Another, perhaps more avant-garde suggested experiment would monitor continuous, low-level shaking signals to detect temporal changes in rheologic properties.

Characterization of shallow (tens to hundreds of meters) sedimentary basins is needed for seismic hazard assessments, groundwater modeling, pollution studies, energy exploration, and climate change studies. As noted above, seismic wave imaging provides primary constraints on basin structures and properties. Sedimentary basin structures can generate complex wave patterns that lead to shaking amplification and extended durations, and may also complicate imaging analyses and the prediction of earthquake ground motions. Basin characterization is most important in urban areas where the risks are greatest, and also where experimental logistical limitations are most severe. Experience using commercial vibrators has demonstrated their utility within such areas, but at high cost. Shakers available as a community resource, particularly those that generate shear waves, would make basin characterization feasible in many at-risk urban areas.

One suggested basin characterization study would map aquifers and possible faults, and assess the potential for earthquake ground shaking amplification, in the Portland sedimentary basin in Oregon. Another basin proposed for study is the increasingly urbanized Hueco Bolson in El Paso, Texas, which is bounded by a major fault capable of hosting a ~M7 earthquake.

Earthscope, USGS's Advanced National Seismic System (ANSS), and NEES clearly present opportunities for collaboration. The ANSS could employ NEES facilities to calibrate urban free-field station sites (3000 proposed), test and optimally locate sensors in structures (3000–9000 proposed), and improve ShakeMap accuracy. Ground motions vary locally due to shallow material and topographic complexities that focus, trap, and/or scatter wave energy.

Characterization of such "site effects" that is both comprehensive and uniform nationwide for ANSS and Earthscope installations could be accomplished using NEES shakers for seismic wave velocity profiling, and Cone Penatrometer Test (CPT) and laboratory facilities for geotechnical profiling. The long lifetime of ANSS and Earthscope monitoring stations should permit the capture of earthquake data in structures and at free-field sites, for comparison with NEES artificial seismic source data and validation of theoretical models of structural response and soil-structure interactions.

Dynamic sediment response to shaking is a research topic that bridges both the Earth science and engineering disciplines. The response of sediments, particularly when nonlinear effects may be significant, is a tremendous source of uncertainty in forecasts of earthquake ground motions. In situ observations of nonlinear sediment response using modern instruments are rare, and in many geographic areas laboratory observations of sediment response also do not exist. These gaps could be filled using the combined facilities of NEES, IRIS, USGS, and others.

The Pilot Experiment

The original plan for the demonstration experiment at the GVDA was to showcase NEES mobile shakers, a specially constructed and monitored structure and its surroundings, and a novel experimental approach in which the simulation of real-time data feeds back immediately to the experiment. The experiment expanded on this plan, adding four new studies. USGS provided the core funding for these studies, with additional resources from IRIS, NEES, USGS, MAEC, SCEC, CENS, HPWREN, and LANL. The timeliness of the endeavor was demonstrated by the fact that the experiment was planned in less than 4 months and the deployment and data collection were carried out in only 2 weeks, despite the diversity of participants and instrumentation and the newness of the technologies employed.

These new studies include the following:

1. Nonlinear sediment response. The artificial shaker truck (called T-Rex) and a temporary surface accelerometer micro-array and permanent GVDA down-hole accelerometers were employed to try to induce and measure (in 3-D, and for strains and displacements) nonlinear soil behavior as evident in the change in resonance frequency with shaking amplitude. If nonlinearity softening occurred, data was collected that will show whether the slow recovery process seen in the lab occurs in situ.

2. Ground motion site and basin effects. The relatively small scale of the Garner Valley basin (~4 km x 10 km, sediment depths <~25 m) makes its characterization feasible, while scalable to larger basins elsewhere. T-Rex signals were recorded at 20 temporary real-time, telemetered seismic stations deployed from the center to the edge of the basin. This array will be left in place long enough to record earthquake signals to validate extrapolating results from the artificial, surface source to those from natural earthquakes.

3. Basin and fault imaging. In addition to using the above array data for broad-scale shear and compressional wave tomographic imaging of basin structure, a high-resolution image will be constructed along a profile across the basin, using reflection data generated by T-Rex and densely spaced geophone strings. Additionally, it is hoped that the Hot Springs fault that is presumed buried beneath the sediments can be located, using the T-Rex data augmented with those from a sledgehammer source and denser geophone strings.

4. Broad-scale, deep imaging. The GVDA sits within the permanent regional ANZA network and the statewide California Integrated Seismic Network. "Chirps" emitted repeatedly every 22 s. from T-Rex for nearly an hour were recorded by these networks and will be stacked to assess the maximum distances to which signals from an artificial source like T-Rex may be observed.

The Austin workshop was motivated by the belief in the adage "the whole is greater than the sum of the parts"—that, when approached jointly, problems can be solved that would otherwise remain intractable. Workshop discussions and the ideas they generated suggest this indeed is true, and the field portion of the pilot experiment just completed begins to prove it.

What Are IRIS, NEES, and the USGS NEP?

The IRIS consortium facilitates the collection and distribution of seismic data for studies of the Earth's interior, and for education, earthquake hazard mitigation, and verification of the Comprehensive Test Ban Treaty. NEES focuses on earthquake engineering. It, too, is a consortium of universities that host shared-use equipment sites and computational centers, connected via advanced networking facilities. While this report focuses on the NEES "Large-Scale Mobile Shakers and Associated Instrumentation for Dynamic Field Studies of Geotechnical and Structural Systems" equipment site at the University of Texas at Austin, other NEES facilities also present opportunities for collaborative work. USGS supports the earthquake monitoring and hazard assessment elements of the National Earthquake Hazards Reduction Program. Of particular relevance is USGS's ANSS, a developing, permanent monitoring network designed to provide real-time earthquake recordings for engineering studies, earthquake response activities, and basic research.

The IRIS/NEES/USGS Workshop was held 29–30 April 2004, at the University of Texas at Austin.

—THE IRIS/NEES/USGS WORKSHOP and GARNER VALLEY EXPERIMENT PARTICIPANTS

For additional information, contact Joan Gomberg at gomberg@usgs.gov.

LETTERS

Are We Slighting Female Colleagues?

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There has been considerable discussion in *Eos*, and elsewhere, concerning gender imbalance in the geosciences. It is unfortunate that in choosing the 2004 AGU Fellows this imbalance was exacerbated by choosing only 7% women, significantly less than the proportion of women in the field. It seems that the "Old Boy Network" is perpetuating itself. If there are few models for women, we will have few women.

—STEVEN RUDNICK, University of Massachusetts, Boston

Reply

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The AGU Fellows Committee takes its role seriously and makes every effort to eliminate any bias in the Fellows selection process. Gender imbalance is an issue that continues to concern the committee. The following information may help put this problem into perspective.

The total number of Fellows selected in any year cannot exceed 0.1% of the membership at the end of the previous year. For 2004 this limit was 41 Fellows. Although women represent 17% of the total AGU membership, the percent of members over the age of 40 that are women is only 11% (most Fellows are over 40 at election). The total number of women nominated was 13 (7% of nominations). The total number of men nominated was 127 (93% of nominations).

Three women were elected to fellowship in 2004 (7% of the total class of 41, a 23% success rate) compared with 38 men (a 30% success rate).

Thus the percentage of women nominated for Fellowship in 2004 was less than the percentage of women members, even when the membership pool is adjusted for age. Although the nomination success rate for women is likely to fluctuate from year to year, given the small number of nominees, it is clearly more likely that women will be elected as Fellows if more women are nominated.

Fellow nominations for 2005 are now complete. Of 134 complete nominations received, 10 are for women (7.5%). Thus the trend (gender underrepresentation) continues. This trend can only be reversed by members. We urge your assistance.

Note that the deadline for 2006 Fellows nominations is 1 October 2005.

Eos previously published an article on this topic [84(10), 11 March 2003, p. 92].

—LINDA ABRIOLA, Fellows Committee Chair