SCEC

Southern California Earthquake Center

Quarterly Newsletter
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Volume 1, Number 2

Inside this Issue...
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Inquisitive reporters observe USGS scientists Tom Fumal and David Schwartz in trench near Thousand Palms, California.

USGS Scientists Trench Across San Andreas Fault

Dating results will provide new information for probability estimates of future earthquakes.

In May, geologists Tom Fumal and Michael Rymer of the United States Geological Survey (USGS) in Menlo Park, excavated two trenches across the San Andreas fault at an oasis and nature preserve just east of Thousand Palms, California. The fault forms a water barrier, which led to formation of the oasis. The Nature Conservancy manages the preserve and was supportive of the investigation.

The trenches expose a beautiful layered sequence of alluvial deposits and peats and contain evidence of the past two large magnitude earthquakes on this part of the fault (see photos, page 3). The older event produced intense warping of the peats and fissuring of the deposits in the lower part of the trenches. The most recent event extends to within 30 centimeters of the present ground surface and is expressed as a broad

See "Trenching" on Page 3

From the Center Directors...

A Changing of the Guard...

Keiiti Aki
Science Director

Thomas Henyey
Executive Director

*I*t's time to pass the baton! One of us (KA) is stepping down after five years as SCEC Director. Retirement from full-time academic responsibilities and the desire to pursue new frontiers are the reasons. These past five years have seen the Center develop into a nationally and internationally recognized enterprise, with science being practiced in a non-traditional, multi-disciplinary mode. Methods developed here may help change the way earthquake hazards research is done in southern California and elsewhere in the future.

We believe that the impending change in directorship represents a new opportunity for SCEC--an opportunity to meld early visions of the center with newer ones, at a time when perceptions of science and its role in modern society appear to be evolving. We must do more with less; re-orient to a more "applied" approach (which seems to imply shorter time-frames between ideas and "products"); and do an increasingly better job of reaching our "end-users". We find that the relevance of our science and our mission as currently structured is under greater scrutiny. These and other issues will provide challenges for the new director.

We hope to welcome a new director to the Center as soon as possible. During the transition, TH will remain as Executive Director, to ensure that day-to-day operations continue smoothly. Once a new director is in place, TH will serve in whatever capacity the Board and Director deem appropriate in the future.

Next year's budgeting process begins with the annual meeting in September and culminates with the funding of our FY 1996 program in February. The following June (our sixth year), we will submit our final five-year science plan to the NSF and USGS for review. These programs and plans will have the stamp of the new director. And we hope that by the next quarterly newsletter, this column will have the stamp of a new author!

A correction to a statement in this column in the last newsletter: Passing our third-year review did not guarantee us a full 11 years of funding from NSF. We must pass the sixth-year review first!

What Is the Southern California Earthquake Center?

*T*he Southern California Earthquake Center (SCEC) actively coordinates research on Los Angeles region earthquake hazards and focuses on applying earth sciences to earthquake hazard reduction. Founded in 1991, SCEC is a National Science Foundation (NSF) Science and Technology Center with administrative and program offices located at the University of Southern California. It is co-funded by the United States Geological Survey (USGS). The Education and Knowledge Transfer programs are co-funded by the Federal Emergency Management Agency (FEMA). The Center's primary objective is to develop a "Master Model" of earthquakes in southern California by integrating various earth science data through probabilistic seismic hazard analysis. The SCEC promotes earthquake hazard reduction by:

- Defining, through research, when and where future damaging earthquakes will occur in southern California;
- Calculating the expected ground motions; and,
- Communicating this information to the public.

To date, SCEC scientists have focused on the region's earthquake potential. Representing several disciplines in the earth sciences, these scientists are conducting separate but related research projects with results that can be pieced together to provide some answers to questions such as *where* the active faults are, *how often* they slip, and *what size* earthquakes they can be expected to produce. Future work will consider seismic wave path effects and local site conditions for developing a complete seismic hazard assessment of southern California.

Trenching...

warp and minor brittle vertical displacement of silts and sands.

The earthquake history of this part of the San Andreas fault is not well known. Previous work near Indio, California, by Kerry Sieh of Caltech, suggests the past two large earthquakes occurred around 1680 and 1450 AD. Radiocarbon dating of the peats and abundant charcoal in the new Thousand Palm trenches will put much tighter constraints on their timing. Is it possible that rupture from the 1812 earthquake, which is observed at Wrightwood, extends this far south? The dating results, which should be available in August, 1995, will provide critical new information for segmentation models, and probability estimates of future earthquakes for this part of the San Andreas fault.

David P. Schwartz
US Geological Survey
345 Middlefield Rd. MS 977
Menlo Park, CA 94025

Clockwise from above: 1) View looking South along San Andreas Fault at fenced-off trenches (foreground) and oasis palms. 2) Stratified trench deposits showing broad warp and vertical separation produced by most recent large earthquake on the southern San Andreas Fault. 3) View of trench wall showing evidence of the past two large magnitude earthquakes on the southern San Andreas Fault.

Quarter Fault

Each Issue of the SCEC Newsletter will feature a southern California fault. In this issue, we feature...

The Newport-Inglewood Fault

Warner Boulevard just north of Pacific Coast Highway in Huntington Beach. The right lateral Newport-Inglewood Fault runs at the foot of the hill, roughly where the cyclists are pedaling.

It's such an unlikely thought: that faults can create great wealth. But from west Newport in Orange County to the Cheviot hills near the northern end of the L.A. basin, billions of dollars worth of oil have pooled against the Newport-Inglewood's shale smears and under its associated anticlines. It's estimated that along the fault's 70 kilometer length, the sediments may yield as much as 3.2 billion barrels of oil.

In addition to trapping much of L.A.'s oil the Newport-Inglewood has also killed more people than any fault in the region so far this century. On 10 March 1933, the M_L 6.3 earthquake left 120 people dead. But of course, wherever there is active tectonics there is also always beauty.

Moving at a rate of 0.6 mm/yr. with a right-lateral post-Miocene offset of 1-2 km, the modern Newport-Inglewood has brought up a series of pleasant hills and plateaus along the southwestern edge of the Los Angeles Basin, along what otherwise would have been monotonously flat land. On the Costa Mesa plateau, model plane enthusiasts launch their buzzing plastic over the Santa Ana river, while on the Huntington Beach plateau surfers ride horses under eucalyptus and palm, on hot days when the sea has gone flat. The Newport-Inglewood is also responsible for other similar structures, such as Signal Hill, Dominguez Hills, and Baldwin Hills.

The photo shows the Newport-Inglewood fault crossing Warner Blvd. in Huntington Beach, beside the Bolsa Chica wetlands. The fault runs along the base of the hill (roughly where the cyclists are pedaling). For decades, local high schoolers have run down the fault scarp's edge at night (to the east of the photo), headed towards the wetland pools and hidden nooks to do what high schoolers do on warm summer nights, never suspecting that the Huntington Beach oil fields under their feet will probably yield 1.1 billion barrels of oil nor that they are running up and down an active fault. One usually has other much more important and serious things to think about at fifteen than to wonder about oil or the nature of hills.

Michael Forrest

Master Model Progress: the SCEC Phase III Report

The Center's Phase II report, "Seismic Hazards in Southern California: Probable Earthquakes, 1994 - 2024", was primarily concerned with the characterization of earthquake sources in southern California. For the Phase III report, we will include the source effect, the effects of local geologic and topographic site conditions, as well as the propagation path effect on strong ground motion. The report will be in two parts: One for producing probabilistic seismic hazard maps for the entire southern California area; and the other for developing consensus time histories for selected earthquake scenarios and recording sites in southern California.

The first part will rely on some available empirical formulas of attenuation relations, and will attempt to divide southern California into site classes, to be adopted into each formula. The site classification will be carried out by combining information on surface geology, seismic velocity profiles, and amplification factors for strong and weak ground motion that have been empirically determined for strong motion seismograph sites as well as numerous regional network stations. We shall use multiple empirical attenuation relations by various authors in order to find the range of variation in the hazard estimate.

The second part of the report will include computation of time series of ground motion by seismologists at a number of institutions (universities, governments and private consultants) for selected earthquake scenarios and recording sites. In general, a deterministic source modeling is used for periods longer than about one second, and a stochastic source modeling for shorter periods. Each institution uses different assumptions, parameterizations and ways of combining the deterministic part with the stochastic part. Each modeling approach will be validated using the data from recent earthquakes in southern California. The resulting range of predicted ground motion for future earthquake scenarios will represent the range of uncertainty in the current state-of-the-art.

The outcome of the second part can be used for a spot check of the map produced by the first part. The comparison of prediction between the empirical approach taken in the first part and the physical modeling approach taken in the second part, will offer another measure of uncertainty in our prediction. The target date for the completion of the Phase III report in the reviewable format is Spring, 1996.

We plan that the report will be the core of accomplishments presented in the next five-year renewal proposal to the National Science Foundation.

Keiiti Aki

NOVA Documentary Available

PBS recently aired a NOVA program covering the Northridge Earthquake and the future earthquake risk to the greater Los Angeles area, emphasizing blind thrust earthquakes. The program, entitled "Killer Quake," features several SCEC scientists. A video copy of the show can be ordered from NOVA by calling 1-800-255-9424, at a cost of $19.95. Footage of the Northridge, Long Beach, and other California earthquakes at the time of shaking or very soon thereafter is quite spectacular.

Earthquake Map Now Available from the U.S. Geological Survey

"Earthquakes in California and Nevada" depicts the epicenters of 300,000 earthquakes, including 49 of magnitude 6.5 or larger that have occurred in the two-state area since 1836. The earthquake epicenters are depicted by various sizes of open circles and red dots.

Different elevations, from two miles below sea level to the tallest peaks of the Sierra, all water courses such as rivers, streams, lakes and reservoirs, and all major highways are depicted. The map offers a ready reference for areas that have had few if any earthquakes during the past 160 years. California's great central valley, for instance, has only a few dots depicting earthquake epicenters.

The California-Nevada map contains new information, such as epicenters of the Loma Prieta, Landers, Big Bear and Northridge earthquakes that have occurred since the first California earthquake map in the series was published in 1988. The map, priced at $12 for a paper copy or $22 for a laminated copy, including shipping costs, is available by mail only from:

Earthquake Maps
U.S. Geological Survey
Box 25046, Federal Center, MS 967
Denver, CO 80225

Orders must include the name and number of the map "Earthquakes in California and Nevada; Open-File Report 94-647", and a check or money order, payable to DOI/USGS.

Satellite Infrastructure Centers

As part of its infrastructure, SCEC maintains a number of data and instrument centers at its core institutions. Each quarterly newsletter will highlight one or more individual centers. In this second newsletter we describe the Portable Broadband Instrument Center (PBIC) at the University of California, Santa Barbara, and the Geographical Information System (GIS) Facility at the University of California, Riverside.

The Portable Broadband Instrument Center (PBIC)

The Portable Broadband Instrument Center (PBIC) was established by SCEC to provide researchers with year–round access to a "pool" of high–resolution, digital seismic recording equipment. Since its establishment in 1991, the PBIC has been involved in three significant aftershock deployments and about 30 SCEC experiments (see figure this page). PBIC instruments have recorded gigabytes of data each year. Its technical personnel have provided valuable support to SCEC researchers and have significantly improved sensor calibration. The data collected by researchers using PBIC equipment has been used to investigate a number of problems relating directly to the SCEC Master Model.

The PBIC is managed by the Institute for Crustal Studies at the University of California's Santa Barbara Campus by Ralph Archuleta. Technical staff members are Aaron Martin and Peter Rodgers. Martin provides technical and support services for the SCEC equipment as well as software development and field support at the investigator's request. Rodgers provides a wide range of expertise in the area of seismic instrumentation from equipment specifications to calibration procedures. Rodgers and Martin, along with engineers from other California institutions, developed a procedure for calibrating that is now routinely used on all SCEC electromagnetic sensors. A paper describing the

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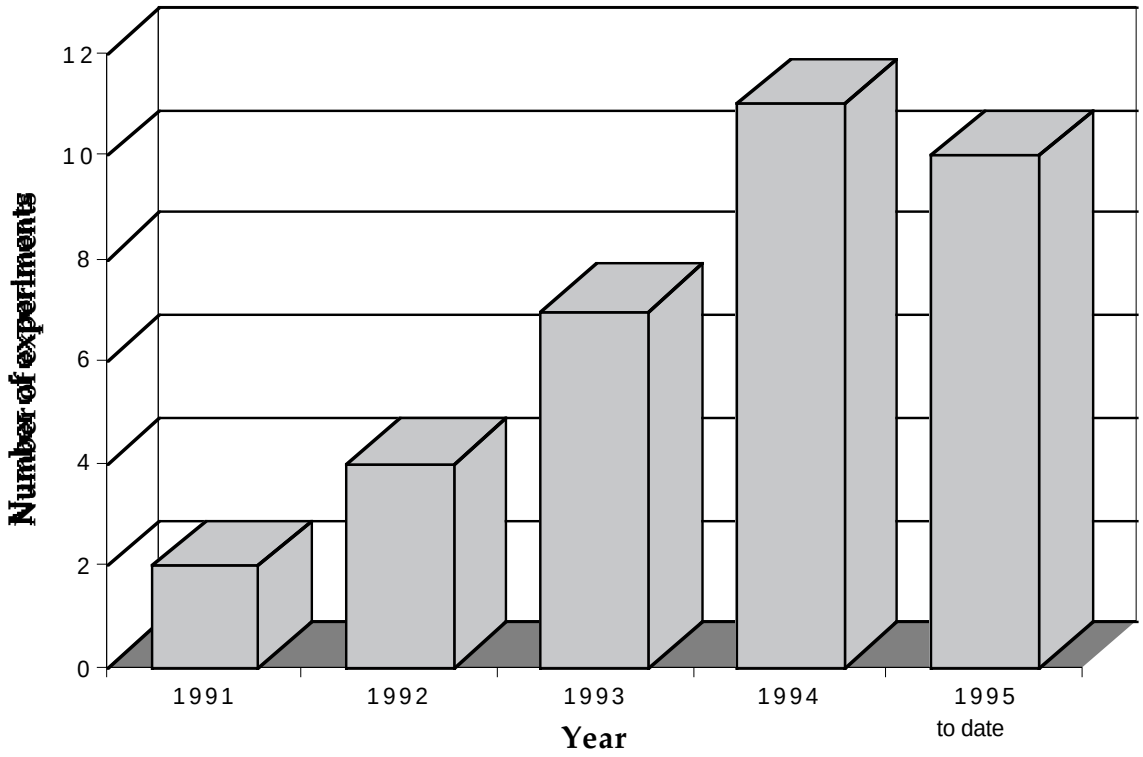
Experiments using PBIC equipment



Geographical Information System (GIS) Facility

The SCEC GIS Facility, located at the University of California, Riverside (UCR), provides GIS support and develops geologic databases for use by SCEC scientists and for the Center as a whole. The Facility also enhances knowledge transfer by providing SCEC databases in a GIS format for end users in government and industry, and provides education and training of GIS personnel within both SCEC and the USGS.

The SCEC GIS Facility has recently moved into a new computer lab on the UCR Campus. The new lab allows centralization of personnel and resources. Partnerships with the rapidly-expanding USGS SCAMP GIS project and the UCR Center for Visual Computing promote the combining of resources to produce quality GIS products in a more timely manner. (SCAMP is the USGS Southern California Areal Mapping Project. It is part of the National Geologic Mapping project, using a 1:100,000 scale, and will also produce geochemical, age dating, magnetics and gravity maps.)

Database Development

Advanced database development includes the active structures database, which has produced the popular Alquist-Priolo faults dataset for southern California. This fault dataset provided the base structure for development of a regional active structures database. Through sponsored workshops and a partnership with the USGS, scientists are identifying additional high quality data sources for this database. Beyond spatial extent of active structures, the SCEC GIS Facility is beginning to apply new tabular information to its database. Tables have been imported from Mark Peterson (USGS Menlo Park) and Steve Wesnousky (University of Nevada, Reno) into a database management system. Positional information within these tables will allow flexibility in connecting fault information in spatial format. This will facilitate future data input.

Also under construction is a dataset of the offshore active structures from maps supplied by Mark Legg, Senior Scientist, ACTA, Inc., and will be available as an independent dataset as well as integrated into the active structures database.

With SCEC GIS support, the SCAMP GIS project will produce a digitized version of southern California geology. This database and its future products are in the early stages of development. To develop GIS maps for the SCEC Phase III report, surficial geology maps for the Los Angeles and San Fernando basins are now under construction.

Database Access

Through the SCEC World Wide Web Page, the SCEC GIS Facility will make available well-developed GIS databases via an online point-and-click catalog. This will eliminate time currently spent providing copies of databases via magnetic media while allowing advertisement of the databases now available. An experimental SCEC GIS Facility WWW page featuring the Alquist-Priolo fault database is currently running (*http://vortex.ucr.edu*). A completed SCEC WWW Page will be ready by summer's end. For those who do not have access to WWW browsers, the GIS Facility will be developing a "smart" ftp server in parallel with the WWW Page. The "smart" ftp server will instruct users in accessing online databases with UNIX ftp.

Future Projects

The SCEC GIS Facility will be developing software tools for use with databases in order to facilitate the use of Arc/Info. The tools will also provide a mechanism for executing seismic hazard models with Arc/Info.

For more information:

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Eric Lehmer

PBIC...

procedure was recently published in the June 1995 issue of the *Bulletin of the Seismological Society of America*. (Reprints are available on request from the PBIC.)

The PBIC currently has 16 sets of equipment and should realize its original goal of 20-25 sets within a couple of years. A PBIC set includes: a REFTEK 72A-02 or 72A-08 Data Acquisition System (DAS), an FBA-23 triaxial force balanced accelerometer and an L4C-3D, high-output, triaxial velocity transducer, with high capacity gel cell batteries coupled to solar panels or smaller capacity gel cell batteries coupled to small AC chargers. Support equipment such as interface terminals and mass data transfer devices are provided as well. Equipment purchasing specifications are reviewed yearly by an ad hoc committee comprised of members from SCEC member institutions.

Suitable for a wide range of experiments, PBIC equipment has been used to record data for experiments in seismic refraction, site response, earthquake aftershock sequences, guided waves, empirical Green's functions and teleseismic recording. The SCEC equipment is in the field about 90% of the time. Many of the experiments are supported by agencies other than SCEC. The PBIC provides the instrumentation and its support, while funding for salary and analysis comes from other sources.

A typical example of the partnership between SCEC and other agencies is the UCSB/USC Los Angeles Microzonation experiment. This cooperative experiment, directed by Jamison Steidl (Assistant Research seismologist, UCSB ICS) and James Chin (USC), uses equipment from SCEC, Caltrans and PASSCAL and is funded by the USGS, SCEC, UCSB and Caltrans. While deployed for this experiment three of the PBIC FBAs recorded the Northridge mainshock (see figure this page).

One of the most important justifications for the PBIC equipment is SCEC's interest in responding quickly to aftershock sequences from significant earthquakes in southern California. In the case of the Joshua Tree and Landers/Big Bear earthquakes, the PBIC records supplement the phase information of the widely-spaced Southern California Seismic Network (SCSN) stations. In Northridge, sites were selected to complement the permanent strong motion stations, i.e., record aftershocks to be used later as empirical Green's functions, to compare weak and strong motion, and to determine site response, especially for the San Fernando and Los Angeles basins. The other high priority was to record strong motions as close to the source as possible. An excellent example is shown in the figure below where 0.81 g acceleration was recorded at the PBIC station BRCY from a M 5.1 aftershock. Note that the S-P time is about 0.75 s, indicating a distance of less than 6 km.

In a specific experiment to correlate ground motion and damage, SCEC and USGS personnel deployed 30 sets of instruments in a 2-km x 2-km area near the Northridge Fashion Center about one month after the Northridge mainshock. As part of the SCEC/USGS LARSE (Los Angeles Regional Seismic Experiment), the PBIC deployed all of its instruments, assisted in the deployment of the hundreds of PASSCAL recorders, and calibrated most of the sensors. In 1994 the PBIC collected more than 5.6 Gb of data; in 1995 the PBIC has already collected more than 3.9 Gb of data. All of the PBIC data are being fully integrated into the SCEC data center.

Aaron Martin

For more information about the PBIC contact Martin by phone at (805) 893-8415 or by email: aaron@crustal.ucsb.edu. The PBIC has established a WWW page: http://quake.crustal.ucsb.edu/scec/pbic/pbic.html.

SCEC Scientists' Publications, Spring 1995

The complete SCEC scientists' publications listing is updated and available on a continuous basis. Please contact the SCEC Administrative Office, 213/740-5843, to obtain updated listings. Selected publications may be available through the Center; however, to obtain authorized copies of preprints or reprints, please contact the authors directly. The Spring 1995 quarterly newsletter includes all publications; subsequent issues will include newly submitted papers only.

207. Davis, Paul M. and Leon Knopoff, The Elastic Modulus of Media Containing Strongly Interacting Antiplane Cracks, *Journal of Geophysical Research,* in press.

208. Manov, Derek V., Rachel E. Abercrombie, and Peter C. Leary, Reliable and Economical High Temperature Deep Borehole Seismic Recording, submitted to the *Bulletin of the Seismological Society of America*, March 1995.

209. Abercrombie, Rachel E., The Magnitude-Frequency Distribution of Earthquakes Recorded with Deep Seismometers at Cajon Pass, Southern California, submitted to *Tectonophysics*, March 1995.

210. McNeilan, T., Rockwell, T. K., and Resnick, G., 1995 in review, Sense and Rate of Holocene slip, Palos Verdes Fault, Southern California: submitted to *Journal of Geophysical Research*, March, 1995.

211. Lindvall, S. and Rockwell, T. K., 1995 in review, Holocene activity of the Rose Canyon Fault, San Diego, California: submitted to *Journal of Geophysical Research*, March, 1995.

212. Minster, Jean-Bernard H., Nadya P. Williams, T. Guy Masters, J. Freeman Gilbert and Jennifer S. Haase, Application of Evolutionary Programming to Earthquake Hypocenter Determination, *Edited Proceedings of the 4th Annual Conference on Evolutionary Programming*, MIT Press, 1995.

213. Nielsen, Stefan, Leon Knopoff and Albert Tarantola, Model of Earthquake Recurrence: Role of Elastic Wave Radiation, Relaxation of Friction and Inhomogeneity, *Journal of Geophysical Research*, in press, 1995.

214. Gao, S.; Liu, H; Davis, P. M.; and Knopoff, L., Localized Amplification of Seismic Waves and Correlation with Damage Due to the Northridge Earthquake, submitted to *Bulletin of Seismological Society of America,* February, 1995.

215. Abercrombie, Rachel E., D. Agnew, F. Wyatt, Testing a Model of Earthquake Nucleation, *Bulletin of Seismological Society of America,* in press, May, 1995.

Localized Amplification of Seismic Waves and Correlation With Damage Due to the Northridge Earthquake

UCLA seismologists, under the leadership of Paul Davis, deployed 98 seismic stations to record aftershocks of the January 17, 1994 Northridge earthquake.

The dense network was deployed in the area of heavy damage. The seismologists were fortunate in that the 98 REFTEK digital recorders just "happened" to be available from an independent Incorporated Research Institutions for Seismology (IRIS) research program when the Northridge earthquake occurred. They were also ingenious in their method of deployment. An advertisement was placed in the university newspaper for volunteers who would allow a seismograph to be placed in the back yards of their homes. They received more than 100 responses and were able to choose sites along two N-S profiles from the San Fernando Valley across the Santa Monica Mountain to the Los Angeles Basin, as well as two clusters covering the severely damaged areas in Sherman Oaks and Santa Monica.

Results of the preliminary analysis of the large amount of data collected will be described in a paper by S. Gao, H. Liu, P.M. Davis and L. Knopoff in the special issue of the Bulletin of the Seismological Society of America on the Northridge Earthquake (expected to appear in January, 1996). They found a significant correlation between peak ground motion of the aftershocks and damage patterns. The correlation in Santa Monica is greatest for events originating from a restricted focal zone. Seismic waves generated by these events focus in mid-Santa Monica where damage was greatest. This result highlights the usefulness of small earthquakes data for the estimation of strong ground motion due to large earthquakes.

Keiiti Aki

SCEC Activities...

SCEC Seminar Report: Magnitude Distributions

The question as to whether seismicity along a particular fault is described by the Gutenburg-Richter relationship or characteristic earthquake model is currently a hot topic, and so was the subject of a SCEC seminar held at the University of California, Los Angeles on 18 May. The seminar was hosted by David Jackson, SCEC scientist and principal author of the SCEC Phase II Report "Seismic Hazards in Southern California, Probable Earthquakes, 1994-2024." Seminar participants included a large group of scientists from the Los Angeles area and beyond. The speakers and subjects covered included:

- David Jackson, *Implications of the characteristic earthquake model*
- Arch Johnston, *Estimating the maximum earthquake magnitude*
- Yan Kagan, *Regional variations of maximum magnitude, b-value, and seismicity*
- Mark Stirling, *Magnitude-frequency distributions of strike-slip faults: a global survey*
- Charlie Rubin, *Evidence for very large earthquakes on not very large faults*
- Barbara Romanowicz, *Magnitude, fault length, and scaling relationships*
- Leon Knopoff, *Magnitude distributions on networks of faults*
- David Schwartz, *Field evidence for the characteristic earthquake model*

From the general discussion it was clear that the main arguments people have against the characteristic earthquake model are that (1) any fault could show seismicity consistent with the Gutenburg-Richter relationship if a large enough maximum-size earthquake were defined along it, and (2), that there is generally too much uncertainty in maximum earthquake size and recurrence rate on faults for the earthquakes to be considered truly characteristic.

However, it was shown that the maximum magnitudes necessary along many faults for magnitude distributions to be described by the Gutenburg-Richter relationship would have to be considerably greater than what we would normally estimate from fault length or area. The second argument highlighted the problem of how scientists are using the term characteristic earthquake model in different ways. The term has traditionally been used to infer regularity of earthquake size and recurrence rate, but is also now used more loosely to describe a magnitude-frequency distribution shape that is not log-linear at large magnitudes, and in which the moment release is dominated by the occurrence of large events.

The question therefore arises as to whether or not we should redefine the term "characteristic earthquake model," or use another term for the magnitude distribution shape that is commonly observed along individual faults. The discussion stimulated some hearty appetites among those present at the meeting, so the pizza session was well attended at the end of the day.

Mark Stirling

↓ Group discussion led by Jackson and Stirling

SCEC Activities...

James Dolan Leads Field Trip: Faults of Los Angeles

Dr. James Dolan led a group of 47 Caltech and Jet Propulsion Laboratory (JPL) Management Association members on a day-long SCEC-sponsored field trip on 8 May 1995. Titled "The Faults of Los Angeles," the field trip was designed to give participants an overview and technical discussion of a few major active faults in the Los Angeles Basin.

At about 8:30 am, the bus left the JPL parking lot and traveled west on the Ventura freeway. Crossing the Arroyo Seco, the group viewed Eagle Rock, a prominent rock outcrop on the right side of the freeway one mile west of the Arroyo. This rock, composed of Miocene Topanga Formation conglomerate, lends its name to the Eagle Rock fault, which runs along the steep slope along the south edge of the Ventura freeway. The fault passes through the middle of the Ventura and Glendale freeway interchange.

Along the Glendale freeway we came out of the hills into the broad, flat floodplain of the Los Angeles River. Dolan explained that researchers have long speculated that the Raymond fault system continues westward and merges with the Hollywood fault, west of the L.A. River. Unfortunately, fluvial processes have obliterated any possible scarps in the floodplain, and a possible Raymond fault-Hollywood fault connection cannot be either established or refuted by geomorphic evidence.

Above: Dolan exhibits trenching data from the Elysian Park Fault project on the grounds of the Veteran's Administration in Santa Monica.

Right: Dolan presents an overview of the field trip from Griffith Park Observatory, Los Angeles.

View of Los Angeles from Griffith Park Observatory.

As the bus turned north onto the Interstate-5 freeway, we saw the eastern edge of the Santa Monica Mountains ahead and to the left as we approached the Los Feliz exit. As we later saw at the Griffith Park Observatory stop (see photos), the Santa Monica Mountains are essentially a large fold that was formed above a deeply buried, shallowly north-dipping blind thrust fault ramp. Los Feliz Boulevard runs along the southern edge of the mountains, which are composed of a mixture of Cretaceous granodiorite and Miocene sedimentary and volcanic rocks.

Our first stop was the Griffith Park Observatory. We saw some of the many hills that ring the Los Angeles basin, as we had one of those perfectly clear, cool Los Angeles mornings. Most of the hills, including the one on which the Observatory stands, were formed during earthquakes on deeply buried blind thrust faults. The moderate Magnitude 5.9 1987 Whittier Narrows earthquake ruptured a small piece of one of these blind thrust faults. We were able to see the hills of East L.A., beyond and slightly to the left of the downtown highrise district. The southern edge of these hills near Montebello was uplifted about two inches during the 1987 earthquake. We then traveled within 20 kilometers southeast of the epicenter of the Northridge earthquake, which occurred on a previously unrecognized, south-dipping blind thrust fault beneath the northern San Fernando Valley. Most geologists now believe that the fault responsible for the Northridge earthquake is an eastern extension of the Oak Ridge fault system, which extends westward for about 50 kilometers, or at least as far as the Oxnard Plain near the City of Ventura.

After driving down the hill, we traveled west on Franklin. As we crossed Normandie, we looked right at a small hill. This is the easternmost geomorphic expression of the Hollywood fault, which we discussed in detail later on.

As we crossed over the 101 freeway, we looked toward the Cahuenga Pass, where the freeway goes through the mountains. Cahuenga Pass is an old L.A. River channel that was uplifted as the Santa Monica Mountains rose during successive earthquakes on the blind thrust fault beneath the mountains. As the mountains rose, it became harder and harder for the river channel to cut down quickly enough to maintain a southward gradient. Eventually this competition between uplift and downcutting resulted in abandonment of the Cahuenga Pass channel and the L.A. River flow switched eastward to its present course through downtown Los Angeles.

In downtown Hollywood the Hollywood fault, which exhibits several strands in this reach, is just north of, and parallel to, Hollywood Boulevard. It is especially prominent on Vine and Ivar Streets. Dolan explained that one of the nice things about studying active faults in Los Angeles is that, although the faults traverse one of the most densely urbanized areas in the world, most of this urbanization took place during the 1920s and 1930s, prior to the widespread use of mechanized grading equipment. Buildings and streets were simply built atop the ground surface, thus preserving the geomorphologic "signature" of active faulting for latter-day urban geologists.

Our next stop was Runyon Canyon Park, the former site of Errol Flynn's estate and the

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Faults of L.A. ...

best-studied part of the Hollywood fault zone. A combination of numerous Metro Rail continuously cored borings and two Los Angeles County storm drain trenches have allowed scientists to map the fault in detail here. Researchers have also been able to glean some preliminary paleoseismologic information about the Hollywood fault. Dolan discussed some of these paleoseismologic results in detail at this stop. The rather steep hill on Fuller that we walked up as we entered the park is a steep alluvial fan. Evidence for the most recent earthquake on the fault is buried beneath the recently-deposited alluvial fan sediments.

Dolan and other geologists believe that strike-slip faults such as the Hollywood fault may rupture co-seismically with the much larger blind thrust faults during large blind thrust earthquakes. This inference leads to the possibility of understanding the earthquake history of the blind thrust faults, which represent the most serious seismic hazards affecting metropolitan Los Angeles. Scientists may be able to use the earthquake history of the surficial faults (like the Hollywood fault) as a "proxy" for the earthquake behavior of the blind thrust faults, which, because they are so deeply buried, are not amenable to standard paleoseismologic trench analysis.

After leaving Runyon Canyon Park, we drove through portions of Beverly Hills and stopped for a picnic lunch at the Veteran's Administration Hospital grounds, where we heard more about the Santa Monica fault and paleoseismologic trench results from the site, as well as their implications for the seismic hazard posed by the fault.

Following lunch, we took the 405 freeway south to the Interstate 10 heading east. We were able to see the Baldwin Hills ahead of us and to the right. Dolan said these hills are the northernmost of a series of oil-bearing uplifts along the Newport-Inglewood structural zone (N-ISZ). Although the southern portion of the N-ISZ is well known as a right-lateral strike-slip fault because of the Magnitude 6.3 1933 Long

Feature: visit with a SCEC scientist

A Visit with Scott Lindvall

When the Northridge earthquake occurred, there was nothing that earthquake geologist Scott Lindvall wanted to do more than get out into the field and do some reconnaissance mapping with San Diego State Geology professor Tom Rockwell, who'd received some early reports about possible ground rupture.

"When you're out in the field mapping a surface rupture--it's like being a kid in a candy store. You read about things in textbooks, you read about things in journal articles about earthquakes, but when you can actually go out and walk along one that just happened and be in the process of documenting that--that's really fun," says Lindvall about fresh ruptures. "You're exploring."

Following the quake, however, Lindvall's wife Dana didn't want him to leave the house or their two children. "Earthquakes terrify Dana," says Lindvall. "She doesn't like earthquakes at all--even the aftershocks. I was champing at the bit to get out and see what was happening when Northridge hit," says Lindvall, who reluctantly had to tell Rockwell, "I need one more day at home and then I think my family can function." (The things we do for love.)

Fortunately for the Lindvall marriage, major earthquakes in southern California aren't a frequent occurrence, and Dana doesn't mind her husband being in the earthquake business. Just so long as the ground beneath her feet doesn't move.

Lindvall received his bachelor's degree in geology from Stanford in 1984 and his masters degree from San Diego State University in 1988. He is employed by Lindvall Richter Associates, a small earthquake sciences and engineering firm founded in 1971 following the San Fernando earthquake by his father, Eric Lindvall, and Charles Richter . The firm, whose clients include the City of Los Angeles Department of Water and Power, the Metropolitan Water District, The J. Paul Getty Museum, San Diego Gas & Electric, and SCEC, has recently merged with Harza Engineering Company.

"Our office specializes in seismic hazard assessments and a variety of earthquake engineering analyses of structures such as dams, pipelines, buildings, tanks, and even museum artifacts," says Lindvall. "Most of the work is engineering related. I concentrate on earthquake geology and seismic hazards."

Lindvall's first involvement with SCEC was in 1991 with Group C (Earthquake Geology), led by Kerry Sieh of Caltech. "Actually Sieh and I had worked on several projects together," says Lindvall, "and after the completion of the Center's first year, he asked me to submit a proposal to the Center. I proposed doing research on the Sierra Madre fault, but shortly after beginning that study, the Landers earthquake struck.

"For the next couple of weeks, I mapped the Landers rupture with the Caltech/SCEC group. The event delayed the planned Sierra Madre study and redirected my efforts to the eastern Mojave for two years. I worked with Tom Rockwell on paleoseismic trenching investigations of the southern three faults that ruptured in the Landers earthquake, while Sieh and Charlie Rubin (SCEC

Faults of L.A. ...

Beach earthquake, recent research by John Shaw and John Suppe at Princeton University indicates that the northern part of the N-ISZ, including the Baldwin Hills, is underlain by a large, previously unrecognized blind thrust fault, which they have named the Compton-Los Alamitos fault.

We then turned north onto the 110 freeway, which follows the channel of the ancestral Arroyo Seco. Just before the freeway turns into Arroyo Parkway, it makes a sweeping left turn up the south side of Raymond Hill. This is the fault scarp of the Raymond fault, which produced the Magnitude 4.9 Pasadena earthquake in 1988. This left-lateral fault was originally interpreted as a reverse fault based on the scarp. But the 1988 Pasadena earthquake, which showed pure left-lateral strike-slip motion on this fault, coupled with geomorphic evidence, indicates that it is a left-lateral fault. The scarp is here because this reach of the fault is in a restraining bend.

Next, we viewed Lacy Park in San Marino, just off Virginia Street. Lacy Park is dominated by a large bowl-shaped depression, which used to be a swampy lake. The lake was there because the Raymond fault, the scarp of which is visible just to the north, takes a bend to the left. This causes, Dolan said, what's called a releasing bend in the fault, which we see as the topographic depression. The Raymond fault is active.

For the last stop of the day, the bus headed back to the Jet Propulsion Laboratory. We discussed the nearby Sierra Madre fault zone, one of the largest faults within the Los Angeles metropolitan area. Hundreds of past earthquakes on this fault have uplifted the San Gabriel Mountains to the north.

Dolan's Ph.D. is from the University of California, Santa Cruz, where he studied the geologic evolution of the northern Caribbean. During these studies, he became interested in earthquakes, and is involved in ongoing studies of very large earthquakes in Hispaniola and Puerto Rico. For the past four years he has been studying seismic hazards in the Los Angeles region. He recently moved from Caltech to USC, where he continues his research.

Scott Lindvall

scientist at the University of Washington), as well as a group from the USGS, trenched the rupture at several other locations.

"This earthquake provided a great opportunity to test new ideas about fault segmentation. The paleoseismic studies are showing that previous ruptures involved multiple strands, as in the 1992 rupture, and that recurrence intervals for these and other eastern Mojave faults are on the order of several thousand years--and could be as many as ten thousand. Past earthquakes on some faults in the eastern Mojave shear zone also appear to have been temporally clustered."

As for Lindvall's current work: "Now I'm back to researching the Sierra Madre fault. We need to quantify the slip rate, slip per event, and the timing of past events. I'm now in the Sylmar area, attempting to quantify the rate of uplift of older stream terrace deposits by fault strands that extend into the Basin, some of which ruptured in the 1971 earthquake. I'm also working with Rubin on a trenching study in the Altadena area. "

It's not surprising that L.A. Geologists are eagerly awaiting the results of Lindvall's and Rubin's work on the Sierra Madre fault given its proximity to downtown Los Angeles. "As far as faults within the greater L.A. Basin go, it's possibly the most hazardous," says Lindvall. "It has a relatively high slip rate and is capable of large events." Lindvall has a healthy respect for the range front faults, given that he has twice found himself in an area of hard shaking during recent quakes.

"In 1971, we were living in Sand Canyon which was about three miles from the epicenter of the 9 February San Fernando quake. I was nine years old," says Lindvall. "We got out of the house after the main shock. Within several minutes there were major aftershocks. One of my most vivid memories was feeling the ground lunge in apparently random directions during the large aftershocks as my two younger brothers and I stood outside on the concrete patio. It was more spectacular than any ride at Disneyland. Dust was rising from each canyon in the mountains surrounding us. It was an amazing experience, but it didn't shake as violently as the Northridge earthquake did at our present house in Valencia.

It's somewhat amusing to think that I've come full circle - now studying the Sierra Madre fault zone, the fault responsible for generating the 1971 event, which interested my dad, and eventually me, in earthquake geology . . . "

Lindvall's voice trails off as he leans back in his chair, looks out the window and smiles.

Michael Forrest

More SCEC Activities...

Now Available: Report and Map of the SCEC GPS Workshop

The report and map of the SCEC workshop, "Geological and Design Issues of Continuous GPS Networks," is located on *sideshow.jpl.nasa.gov* in the anonymous ftp directory *~ftp/pub/SCEC*.

The goal of the late March workshop was to foster communications between the geologists, geodesists, and modelers working in southern California, and to plan the implementation strategy of a 250-station dense Global Positioning System (GPS) network in southern California.

The report is found in any of the following three files and is three pages long. The postscript files were generated on a Macintosh:

9856 May 16 14:39
Workshop_Report, Microsoft Word 5.1

1026900 May 16 14:39
Workshop_Report_PS, PostScript

7582 May 16 14:39
Workshop_Report_rtf, RTF interchange format

The network map is found in any of the following files and it is one page long:

1008694 May 16 14:39
Network_Map_PS, PostScript

282240 May 16 14:39
Network_Map, MacDraw Pro

For more information:
Andrea Donnellan
andrea@cobra.jpl.nasa.gov

Save the Date...

The 1995 Annual Symposium of the Association of Contingency Planners will be held October 23-24 at the Red Lion Inn, Culver City, CA.

Workshops scheduled are recommended to guide business resumption, loss prevention, and contingency planning managers, coordinators, and specialists in considering the alternatives to "protecting the bottom line." Instructors will provide innovative ideas and methodologies which will aid attendees in understanding disaster recovery and business resumption.

For more information, contact the ACP Symposium Chair:

John Bogner
Director, Fire/Life Safety
Sony Pictures Entertainment
10202 West Washington Blvd.
Culver City, CA 90232
310/280-5646

Natural Hazards Seminar Series Kickoff Presentation at the Jet Propulsion Laboratory

The first featured speaker for the Natural Hazards Seminar series on 15 June was Dr. John Rundle, Professor at the University of Colorado, Boulder, and Chairman of the SCEC Advisory Council. Dr. Rundle is a Distinguished Visiting Scientist at JPL. The topic he presented was "Complexity and Scaling in Natural Hazard Occurrences." Future seminars are scheduled for the first Thursday of each month, at 2:00 pm in the 167 cafeteria conference room. A schedule of speakers will be available from the SCEC office or Ron Blom (see end of article).

JPL is located in northwestern Pasadena at 4800 Oak Grove Drive. If you drive there, exit the 210 freeway at "Berkshire/Oak Grove Drive." Turn east upon exiting the freeway and make a left turn at Oak Grove Drive (T-intersection with Berkshire). Continue up Oak Grove 1/2 mile to JPL. Park in the visitor's lot and go to Visitor Control. Allow extra time to clear Visitor Control. JPL is a NASA facility operated by Caltech. Non-U.S. citizens wishing to attend please alert Ron Blom and he will aid in making arrangements.

For more information:
Ronald G. Blom, Ph.D.
Lead Scientist, Terrestrial Sciences Research Element
Jet Propulsion Laboratory
Mail Stop 183-501
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109-8099
Internet: Ronald.G.Blom@jpl.nasa.gov
Telephone 1-818-354-4681

Global Science Classroom Activities

Undergraduate Earthquake Education Workshop

This year's Annual Meeting of the California Academy of Sciences broke ground with a new and important community of earth science faculty from nearly 30 undergraduate institutions in southern California. The SCEC-sponsored workshop, "Teaching an Earthquake Course with the Punch of a M8.0," was conducted with support from the Federal Emergency Management Agency (FEMA). The one-day workshop, held at California State University, Fullerton, last 6 May, provided a forum for the group of enthusiastic scientists/educators from several community colleges, state and private universities and two high schools. The purpose of the meeting was to get acquainted, exchange resources and identify support needs. The workshop was preceded by a symposium on 5 May, "The Environmental Effects of Urban Earthquakes," which featured research reports from seismologists, social scientists and engineers.

Highlights of the workshop included an all-too-brief question and answer period on earthquake seismology, including how earthquake size is measured, and demonstrations of physical models that demonstrate earthquake-related processes. A resource table provided information on slide sets, maps, public domain software, internet addresses and texts. Participants also began the task of identifying key components of a one-semester general education earthquake course. These components could provide a guideline for instructors developing new earthquake courses and could be prioritized to aid those who teach earthquakes as one part of a geologic hazards or physical geology course.

Participants expressed interest in forming a continuing core group. The group would make additional recommendations on curriculum, establish multiple communications links between campuses (not all departments have internet access), set up an electronic mail forum for questions about earthquakes, and pool field trip guides and class exercises designed to engage students. Ways in which participants felt SCEC could support undergraduate educators included creating a World Wide Web home page whereby educators could exchange syllabi and other resources; serving as a "clearing house" to connect community colleges with researchers who want temporary student help or could conduct a tour of a field experiment; and facilitating a workshop on computer resources in earthquake education.

Mary Templeton

↓ Curt Abdouch leads classroom session

Global Science Classroom Activities...

SCEC Summer Intern Initiative: A Photo-Stop Report

↑ L-R standing: Michael Forrest, Andrew Byers, Mike Watkins, Ken Fowler (trip co-leader), Ryan Smith, Jason McKenna, Curt Abdouch, Carmen von Stein.
L-R sitting: Mandy Johnson, Donovan Stevens.

SCEC's second venture and adventure with undergraduate summer interns included a three-day Technical Orientation that transported the students through time from the Paleozoic to the present in the Owens Valley in the Sierra Nevada in California. A multi-stop/multi-experience event was captured by snapshots, 23-25 June. The SCEC Summer Intern Initiative focused on attracting and retaining undergraduates in the earth sciences, particularly in earthquake and active tectonics-related fields, is sponsoring the research projects of 11 students. The program takes special interest in underrepresented minorities and women in these fields. This yea'rs program will be summarized in the next issue of the SCEC Quarterly Newsletter.

Curt Abdouch

↓ Carmen von Stein, Central Washington University

↑ Mike Watkins,
UC Santa Barbara

↑ Andrew Byers
UC Santa Barbara

← Donovan Stevens,
Caltech

↑ Mandy Johnson, USC

← Ryan Smith, USC

← Jason McKenna,
UC Santa Barbara

Interns not pictured:

Windy Brimer, UC Santa Barbara
Heather Hodgetts, USC
Susannah Pazdral, Wellesley College
Isabelle Sacramento-Grilo Wicks, USC

↑ In the land of glass and snow. A respite from the heat of the valley floor, although the obsidian deposited by a volcano here was anything but cool when the eruption occurred.

SCEC Activities...

Preliminary Summary of Findings from the 16 June Workshop:

Workshop on Preparing a Digital Fault and Fold Map and Database for Southern California

Purpose

In a collaborative effort, scientists from the U.S. Geological Survey, the Southern California Earthquake Center (SCEC), the California Division of Mines and Geology, and industry are compiling a digital fault and fold map and database for southern California. The database will be an important product of research on active faults and earthquake potential in southern California. The database should be designed to be of maximum utility to users in research, industry, and the public.

To facilitate this goal, SCEC sponsored a workshop on 29 March 1995 to discuss organization and construction of the database. The workshop participants included the database compilers and potential endusers in research, industry, insurance, and local and state government. This diverse group of workshop participants contributed to discussions and submitted written comments on what should be included in the database and how it should be organized.

Preliminary Findings

The goals and interests of the potential database users can be divided into three main categories:

1) Scientific Research
2) Seismic Hazard
3) Public Interest

Members of the first two groups are sophisticated users of earth science information. They expressed very specific desires for the content of the database. The third group has diverse interests and information needs.

Scientific researchers expressed a strong interest in using GIS (Geographic Information Systems) technology to construct a Data Repository for active faults and folds in southern California. The researchers emphasized the importance of including all available information such as fault parameters, references, cross-sections, trench logs, and maps of faults at different scales. The scientists would use the database both as a research tool, and to identify areas where further research is needed. The researchers emphasized the importance of including uncertainties along with data, and clearly distinguishing between data and interpretation.

Seismic hazard analysts were also interested in using the database as a data repository for information such as fault location, subsurface fault geometry, and characteristics of sedimentary deposits. However, in addition to the raw data, these users want to obtain "consensus values" for many of the fault parameters. Consensus slip rate values were identified as being especially important for seismic hazard calculations. The consensus values should be clearly distinguishable from the raw data.

The third group of potential endusers expressed widely varying information needs. In general, this group wants to use the database as a tool for understanding and utilizing earthquake information. Many of these users would need assistance in interpreting and using information in the database. These users suggested that a resource center be established to manage the database and disseminate information. Some of the users expressed a strong interest in obtaining data in visual form, i.e. "pretty pictures" and maps.

Themes

Several themes emerged from the discussions and written comments. Participants recognized that development of the database is a major effort, with a potentially significant impact on earthquake research and seismic hazard mitigation. In order to accomplish this ambitious task, it is important to avoid trying to please every potential enduser. Rather, the compilers should focus on efforts that will have the broadest impact. The first priority should be to compile a digital fault map that will be accessible in a variety of formats. Workshop participants also emphasized the importance of including both data uncertainties, and consensus values for fault parameters. Data and interpretation should be clearly separated. The fault map, and other database information, should be updated on a regular basis to incorporate new research.

A more comprehensive summary of workshop findings will be compiled within a few months by Sally McGill and Lisa Grant. It will be available from SCEC.

Lisa B. Grant
Woodward-Clyde Consultants

Earthquake Faults in Southern California

The most recent source of information about faults in California is the "Fault Activity Map of California". Copies may be obtained by mailing a check in the amount of $20, which covers the map and shipping, with your written request for Map #GDM-006, to:

California Division of Mines and Geology
PO Box 2980
Sacramento, CA 95812-2980

Southern California Seismic Network
Earthquake Statistics: 1 January - 1 July 1995

Seismicity reports are issued every Thursday morning by the SCSN and are available via the SCEC Data Center's *anonymous ftp* site, its World Wide Web (WWW) interface (*http://scec.gps.caltech.edu*), and the Usenet *ca.earthquakes.newsgroup*.

Weekly reports consist of a map (e.g. postscript file 950209.*ps* or gif format file 950209.*gif*) and a commentary (950209.*txt*) at a level intended for the public.

Totals listed below apply to the area within a polygon bounded by the following latitude/longitude pairs: 35.0N, 121.0W; 37.0N, 119.0W; 37.0N, 115.0W; 32.5N, 115.0W; and 32.5N, 121.0W.

Kate Hutton

Year	1st quarter all	1st quarter 3.0+	2nd quarter all	2nd quarter 3.0+	3rd quarter all	3rd quarter 3.0+	4th quarter all	4th quarter 3.0+
1990	3,483	56	2,627	45	2,225	27	2,403	31
1991	2,041	11	2,218	32	2,445	23	2,651	29
1992	3,618	40	10,288	744	25,500+	801	10,700+	166
1993	4,939	43	5,370	61	5,298	48	4,583	35
1994	10,915	417	5,967	43	5,400	48	5,031	40
1995	3,815	28	3,982	39				

Northridge Earthquake,
17 January 1994 - 30 June 1995
Latitude 34.1 - 34.5 North,
Longitude 118.3 - 118.85 West

All events 11,866	(446 more this quarter)
3.0 - 3.9	378
4.0 - 4.9	48
5.0 and up	10

Landers/Big Bear Earthquakes,
23 April 1992 - 30 June 1995
Latitude 33.8 - 35.33 North,
Longitude 116.0 - 117.05 West

All events: 56,000+	(1,735 this quarter)
3.0 - 3.9	1,530
4.0 - 4.9	162
5.0 and up	21

Map of southern California showing the earthquakes recorded during the week of July 6-12, 1995. Source: Caltech/USGS Seismic Network, Kate Hutton.

SCEC Activities...

SCEC Participates in the City of Los Angeles Earthquake Fair

The citizens and denizens of Los Angeles, thanks to the Earthquake Center, were treated to a unique experience at the City of Los Angeles-sponsored Earthquake Festival held 21-23 April in observation of California's official Earthquake Awareness Month. SCEC's premier participation in this annual event featured its visually exciting and fully interactive Great Quake Awareness Game. Played on a colorful giant 400 square-foot game board, the game challenged players of all ages. A few of our favorite moments are captured here.

Curt Abdouch

Earthquake Information Resources

Under Construction: SCEC World Wide Web Home Page

SCEC WWW URL
http://www.usc.edu/dept/earth/quake/index.html

Want to see a list of all SCEC institutions and link to each of their WWW home pages?

Need to know the names and home institutions of the SCEC scientists currently studying blind thrust faults in the Los Angeles Basin?

Need quick access to the SCEC Scientists' Publications List, but can't find your copy of the SCEC newsletter?

By summer's end, internet users will be able to do all this and much more, through the new SCEC WWW Home Page. Thanks to the efforts of SCEC summer employee Srividhya Gopalan, many SCEC documents (including past and current issues of the quarterly newsletter) are in the process of HTML conversion and mounting on the new home page.

Here is a sample list of what you'll see:

Home Page:

"What is SCEC?"--a summary of the Center's history and purpose, including a description of the Master Model concept.
"Formal Mission"--Mission statement and list of Working Groups and Leaders, with links to more detailed descriptions of the research conducted by each of the groups.
"Organization"--a classic organizational chart which shows, at a glance, the structure of the Center.
"Research"--a layer accessible through the home page and the "Mission" page, with detailed descriptions of each Working Group's research to date.

The page also features links to:

- SCEC Core Institutions
- SCEC Infrastructure Facilities--such as the SCEC Data Center at Caltech; the SCEC GPS Centers at UCLA and Scripps Oceanographic Institute; and the Portable Broadband Instrument Center at UCSB.
- SCEC Outreach Programs
- SCEC Products--such as the earthquake hazard analysis map; the Quarterly Newsletter; and SCEC Publications List.
- "Surfing the Net for Earthquake Data"

Jill Andrews

Seismic Hazards Report Now Available

Reprints of Seismic Hazards in Southern California: "Probable Earthquakes, 1994 - 2024," published in the April edition of the *Bulletin of the Seismological Society of America*, is available through the SCEC Administrative Offices. Copies, which include color figures and maps, are $5 each.

Contact:
SCEC Knowledge Transfer
University of Southern California
Mail Code 0742
University Park
Los Angeles, CA 90089-0742
phone 213/740-5843
fax 213/740-0011
e-mail: jandrews@coda.usc.edu

HUD's Office of Policy Development Publishes Damage Survey Findings

New studies sponsored by the U.S. Department of Housing and Urban Development are now available free of charge via Internet at *gopher huduser.aspensys.com 73.*

"Assessment of Damage to Residential Buildings Caused by the Northridge Earthquake" presents findings of a damage survey of single-family detached houses and multifamily low-rise and single-family attached developments. Study results show that major structural damage to residential buildings was unusual, although many multifamily buildings that were built above an open-air parking garage were severely racked and some collapsed.

"Preparing for the 'Big One'--Saving Lives Through Earthquake Mitigation in Los Angeles, California" expands the scope of HUD's assessment to include schools, hospitals, utility "lifelines," roads, and dams. The report discusses an issue now confronting policymakers--how to undertake and sustain mitigation measures that will effectively minimize the human, physical, and economic toll of the next major earthquake.

These studies ($4 each) can also be requested by contacting:
HUD USER
P.O. Box 6091
Rockville, MD 20849
phone 1-800-245-2691

Earthquake Information Resources

Northridge Earthquake Data Release

Strong motion recordings of the Northridge earthquake (17 January 1994) at stations of the Los Angeles Strong Motion Netowrk are now available via anonymous ftp.

The main event was recorded by 65 stations. All the recordings are on 70 mm film. A summary of uncorrected peak accelerations at these stations (a table and contours of equal acceleration) can be found in a paper by Trifunac et al., published in Soil Dynamics and Earthquake Engineering, Volume 13, No. 3, pp. 187-196, July 1994. The title of the paper is "A note on Distribution of Uncorrected Peak Ground Accelerations during the Northridge, California, Earthquake of 17 January 1994."

All 65 accelerograms have been digitized. A preliminary release of Volume I data (uncorrected accelerations) is available on the Internet. The data can be copied via anonymous ftp. The user needs to connect to host

usc.edu

and go to the directory

ftp/pub/todorovs/northridge

Major funding for processingcame from the USGS and NSF. Other funding was provided by US Navy Engineering Facility Center (Port Hueneme), Dames & Moore, City of Los Angeles Department of Water and Power, University of Southern California, and USC Professor J. P. Bardet.

Volume II data (instrument and baseline corrected acceleration, velocity and displacement), and Volume III data (Fourier spectra and response spectra for five damping ratios) will be available at a later date.

Maria Todorovska
KAP 216A
Civil Engineering Dept.
University of Southern California
Los Angeles, CA 90089-2531

Earthquake Faults in Southern California

The most recent source of information about faults in California is the "Fault Activity Map of California." Copies may be obtained by mailing a check in the amount of $20, which covers the map and shipping, with your written request for Map #GDM-006, to:

California Division of Mines and Geology
PO Box 2980
Sacramento, CA 95812-2980

Available On Line: The Seismic Hazards Map, Probable Earthquakes, 1994-2024

The Phase II map is now online through the World Wide Web. The URL is:

http://scec.gps.caltech.edu/PhaseII.html

We have added explanatory text for end users.

...To Call or Write

For information about recent Southern California earthquakes, call 1-800/286-7233, or 818/395-6977.

For information on earthquakes in Northern California, call the U.S. Geological Survey in Menlo Park, 415/329-4011.

To offer or receive assistance from the Red Cross, call 213/739-4543.

For information on earthquakes outside of California, call the National Earthquake Information Center, 303/273-8516.

For phone numbers for emergency or service agencies:

To reach the Federal Emergency Management Agency (FEMA), call: 1-800/525-0321.

For information on earthquake preparedness, please consult your local yellow pages, or call the State Office of Emergency Services at 1-800/286-7233.

If you have been emotionally affected by an earthquake and need counseling, call the Los Angles County Department of Mental Health at 1-800/854-7771.

Earthquake Engineering Resource Materials

Earthquake Engineering Research Library
California Institute of Technology
National Information Service for Earthquake Engineering (NISEE)

Earthquake Engineering Librarian Jim O'Donnell and Library Assistant Philip Roche can be reached by phone, fax, or e-mail. The library features strong-motion accelerogram data, technical reports, a video and slide collection, conference proceedings and technical serials. The collection is available to the public on an in-house basis, and photocopying facilities are available. For more information, contact O'Donnell or Roche at:

Phone 818/395-4227
Fax 818/568-2719
e-mail: eerllib@caltech.edu

Technical Data on Earthquake Hazards

National Geophysical Data Center
NOAA E/GC1
325 Broadway
Boulder, CO 80303

The Center collects, analyzes and disseminates technical data on earthquake hazards. Included in the list of products: An Earthquake Data Base; an Earthquake Intensity File; a Significant Earthquake Data Base; a Strong-Motion Archive.

Phone 303/497-6084
Fax 303/497-6513
e-mail: info@mail.ngdc.noaa.gov

Other Information Resources

Natural Hazards Research
and Applications Information Center
Campus Box 482
University of Colorado
Boulder, CO 80309-0482

The Center is a national clearinghouse for data relating to economic loss, social disruption, and human response associated with natural disasters. The Center seeks to strengthen communication between researchers and individuals, organizations, and agencies responsible for reducing losses from disasters.

Phone 303/492-6818
Fax 303/492-2151
e-mail: hazctr@colorado.edu

Federal Emergency Management Agency (FEMA)
500 C Street SW
Washington, DC 20472

FEMA acts as the focal point for all levels of government to develop national emergency management capability. Publication lists are located on the FEMA World Wide Web site: http://www.fema.gov.

Phone 202/646-4600

Seismic Safety Commission
State of California
1900 K Street #100
Sacramento, CA 95814

The Commission concentrates on public policy, state legislation, and risk mitigation measures which lower earthquake risks to life and property in the State of California.

Phone 916/322-4917
Fax 916-322-9476
e-mail: sscbase@aol.com

U.S. Geological Survey
National Earthquake Inormation Center
Box 25046
Denver Federal Center
Denver, CO 80225

Products and services include an Earthquake Data Base System; an Earthquake Information Line (see page 24 of this newsletter); and an Online Information Program.

Phone 303/273-8500
303/273-8450
e-mail: sedas@gldts.cr.usgs.gov

SCEC Activities Calendar

July

16-19 SCEC Knowledge Transfer Director Jill Andrews will be a participant on a panel entitled "Community Outreach" at the 20th Annual Hazards Researchand Applications Workshop.

September

17-19 SCEC Annual Meeting, Ojai Valley Inn, Ojai, California

19 Robert S. Yeats, SCEC scientist and Professor, Departmenet of Geosciences, Oregon State University, will present the 1995 Richard H. Jahns Distinguished Lecture in Engineering Geology, sponsored by the Association of Engineering Geologists and the Engineering Geology Division of the Geological Society of America. "Thin-Skin and Thick-Skin Tectonics: The Earthquake Threat to the Ventura Region" will be the subject of the presentation, to take place at 8 pm at the Coast Geological Society in Ventura, CA.

27-October 5 SCEC representatives will present a session on Knowledge Transfer at the XI Course of the International School on Solid Earth Geophysics Conference, "Active Faulting Studies for Seismic Hazard Assessment," Erice, Sicily.

October

2-4 Association of Engineering Geologists Annual Symposium: Sponsored by SCEC Knowledge Transfer, session "Bringing the Earthquake Risk to the California State Legislature." Contact Eldon Gath, Leighton & Associates, phone 714/250-1421, fax 714/250-1114.

23-24 Association of Contingency Planners, Annual Symposium, Red Lion Hotel, Culver City, CA. See Page 16 for more information.

November

9-10 Insurance Industry Workshop, sponsored by SCEC Knowledge Transfer. Final agenda and venue to be announced. Contact Jill Andrews at SCEC (ph. 213/740-3459 or fax 213/740-0011) for more information.

13-15 NSF Science and Technology Center Administrators' and Education Coordinators' Meeting, Washington, D.C.

16 SCEC Seminar, subject and venue to be announced.

SCEC has added a new telephone number. You can now reach the SCEC offices by calling either 213/740-5843 or 213/740-1560.

SCEC Newsletter will accept calendar items for the October 1995 issue no later than September 15, 1995.

To Subscribe to the SCEC Quarterly Newsletter:

Write, Telephone, or fax this form to

Southern California Earthquake Center
University of Southern California
University Park
Los Angeles, CA 90089-0740
Tel: 213/740-5843
Fax: 213/740-0011

Online subscriptions are now available! To activate your on-line subscription, simply fill out the subscription form at:

http://www.usc.edu/dept/earth/quake/newsletter/subscribe.html

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