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EARTHQUAKE HAZARDS PROGRAM

DEADLINES FOR FUTURE ISSUES

Spring 1986..................March 31,1986
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FLUCTUATIONS IN ARTESIAN AQUIFERS IN UTAH CAUSED BY EARTHQUAKES IN MEXICO

Ted Arnow, District Chief
Water Resources Division
U.S. Geological Survey
Salt Lake City, Utah

Mexican earthquakes:

- SEPT. 19, 1985...0722 Mountain Daylight Time
  Magnitude 8.1
- SEPT. 20, 1985...1942 Mountain Daylight Time
  Magnitude 7.3

Drilled artesian well, 162 feet deep, in Box Elder County, Utah, about one-quarter mile north of Locomotive Springs. Aquifer is basalt.
Recorder chart shows:

Sept. 19, between 0700 and 0830, a water-level fluctuation that lasted for more than one hour, with a maximum surge of 1.83 feet below static level and a maximum of 1.5 feet above static level for a total maximum fluctuation of 3.33 feet.

Sept. 20, between 1900 and 2000, a water-level fluctuation that lasted for about three quarters of an hour, with a maximum surge of 1.55 feet below static level and a maximum of 1.25 above static level for a total maximum fluctuation of 2.8 feet.

Drilled artesian well, 240 feet deep, in Utah County, Utah, in Lehi. Aquifer is unconsolidated valley fill.
Recorder chart shows:

Sept.19, a water-level fluctuation that lasted one half hour, with a maximum surge of 0.32 feet below static level and a maximum surge of 0.27 feet above static level for a total maximum fluctuation of 0.59 feet.

Sept. 20, a water-level fluctuation that lasted about 15 minutes, with a maximum surge of 0.07 feet below static level and a maximum surge of 0.06 feet above static level for a total maximum fluctuation of 0.13 feet.

By contrast, the great Alaskan earthquake of March 27, 1964, magnitude 8.5, resulted in a total maximum water-level fluctuation of 3.14 feet in the well at Lehi. (The well in Box Elder County did not exist in 1964.)

The gage at the Surplus Canal at 2100 South Street in Salt Lake City recorded a total fluctuation of 0.18 foot on September 19 at the time of the Mexican earthquake.

Fluctuations in water level were recorded at eight stream-gaging stations in Utah as a result of the Alaskan earthquake. Most analog well and stream gages have been replaced by digital recorders and only a few of the analog-type instruments capable of recording earthquake related events now remain in operation in Utah.

From Walter Hays
Coordinator
Regional Earthquake Hazards Assessment Program

The professional paper on "Assessment of Regional Earthquake Hazards and Risk along the Wasatch Front, Utah," is shaping up to reflect the major multidisciplinary effort of researchers and policymakers in Utah. The deadline for transmittal of manuscripts for the professional paper is April 1, 1986. The following is a preliminary table of contents.

Preliminary Table of Contents

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FEATURE ARTICLE

INTEGRATED STUDIES OF EARTHQUAKE SOURCE ZONE CHARACTERISTICS, HAZARDS, AND PREDICTION IN THE WASATCH FRONT URBAN CORRIDOR AND ADJACENT INTERMOUNTAIN SEISMIC BELT

USGS GRANT
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INVESTIGATIONS

1. Calibration of a seismic network for earthquake source studies using teleseisms and local earthquakes.
2. Tests using local blast data of a technique for determining relative earthquake locations by cross-correlation of waveforms.
3. Further studies of the M_L 4.0 Richfield earthquake of May 24, 1982, and associated seismicity.

RESULTS

1. We have developed and successfully tested an indirect approach to calibrating amplitude response for individual stations of our network by using amplitude displacement spectra of initial P-waves from deep focus teleseisms (M5.5 or greater). For a given teleseism the displacement spectra for a large set of stations, corrected for instrument frequency response, are combined in the 1.2 to 2.4 Hz frequency band to form an average, which is then compared with individual spectra to yield relative gain values. Knowledge of the absolute gain of one or more key stations allows calibration of the entire set.

An absolute gain value for the University of Utah network was calibrated using seismic moment measurements made by J. Boatwright of the U.S. Geological Survey for aftershocks of the October 28, 1983 Borah Peak, Idaho, earthquake. Boatwright's measurements were made using data from 12 GEOS digital event recorders deployed in the epicentral area following the mainshock. Fourteen of the aftershocks studies by Boatwright were examined, ranging in magnitude from M_L 2.0 to 4.0 (a range constrained by limitations of instrumental dynamic range for the U of U stations). Low-frequency P-wave spectral amplitudes for these events were determined using a suite of fourteen stations of the U of U network in southeastern Idaho and northern Utah. After establishing an absolute gain value for the U of U network using these data, the seismic moments calculated from the U of U data agree very well (within a factor of 3) over the entire range of moment values with those determined independently by Boatwright. It therefore appears that spectral data from regional seismic stations at distances greater than 100 km can provide accurate information on relative seismic moments, even though the assumptions on which the moment calculations are based are not valid at such large distances.

2. Geller and Mueller (1980) hypothesized that earthquakes producing nearly identical waveforms must have similar focal mechanisms and hypocenter within 1/4 of the shortest wavelength to which the similarity extends. Various investigators have subsequently applied this argument to studies of small-scale earthquake clustering before and after moderate to large earthquakes. We have recently tested the 1/4-wavelength argument of Geller and Mueller (1980) using seismograms of blasts in the Getty-Mercur Mine in the Oquirrh Mountains southwest of Salt Lake City. Seismograms from four different stations were filtered in four one-octave passbands with third-order recursive Butterworth filters. Cross correlations were then calculated for all possible event pairs from the filtered records for each station. The mean peak cross correlation values are plotted versus blast separation distance clearly demonstrating that the highest cross correlation values are found for nearby events. With very few exceptions, correlation values of 0.6 or greater correspond to event separation distances of less than 1/4 wavelength. Thus, these data support the hypothesis of Geller and Mueller (1980) that events with similar waveforms occur within one-quarter of the shortest wavelength for which the similarity is observed.

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* J.F. Peinado and B.S. Thorbjarnardottir also contributed significantly to this project during the report period.

Continued from Page 3

3. The waveform cross correlation technique was used to investigate preshocks and aftershocks of the M_L 4.0 Richfield earthquake that occurred on May 24, 1982 at 12:13. Four preshocks occurred in a location 5 km NW of the mainshock epicenter during a four-hour period on July 16, 1981. Clear dilatational first motions observed at some stations demonstrate that these events are not blasts. Seismograms of these four preshocks are extremely similar at frequencies up to at least 16 Hz, implying that the hypocenters cluster within about one quarter of the 16 Hz wavelength or 80 m. In contrast, none of the aftershocks show high cross correlations in the 8-16 Hz passband and only two pairs have cross correlation of 0.6 or greater in the 4-8 Hz passband. Likewise, no events highly correlated at 8-16 Hz and only one pair highly correlated at 4-8 Hz were found among a group of 11 preshocks centered 15 km SW of the mainshock epicenter. Thus, the four very similar preshocks near the mainshock epicenter appear to be fairly unusual. We suggest that these 4 events may have represented the breaking of a critical fault asperity, the failure of which resulted in a transfer of stress to the location of the mainshock.

Using the method of Frankel and Kanamori (1983), we estimate a fault radius for the mainshock of about 1.1 - 1.6 km. Combining this with a moment measurement of 1.3 x 10 dyne-cm determined from P-wave spectra yields a stress drop of 15-41 bars for this earthquake.

REPORTS AND PUBLICATIONS

Bruhn, R.L., R.B. Smith, W.T. Parry, D.S. Chapman, and M.D. Zoback, 1984, Proposed deep drilling of the Wasatch normal fault zone, Utah, Eos Trans. AGU 65, 1097.

Doser, D.I., and R.B. Smith, 1985, Source parameters of the October 28, 1983 Borah Peak, Idaho, earthquake from body wave analysis, submitted to Bull. Seismol. Soc. Am.

Pechmann, J.C., W.D. Richins, and R.B. Smith, 1984, Evidence for a "double moho" beneath the Wasatch front, Utah, Eos Trans.AGU,65,988.

Peinado, J.F., and W.J. Arabasz, 1985, "Size" estimates and source properties of selected earthquakes in southeastern Idaho, Geol. Soc. Am. Abstracts with Programs, 17, 260.

Richins, W.D., and W.J. Arabasz, 1985, Seismicity of southeastern Idaho based on seismic monitoring using regional and temporary local networks, Geol. Soc.Am, Abstracts with Programs, 17, 261.

Smith, R.B., W.D. Richins, D.I. Doser, J.C. Pechmann, L.L. Leu, and G.J. Chen, 1984, The 1983 M 7.3 Borah Peak, Idaho earthquake: a model for active crustal extension, Eos Trans.AGU, 65, 989.

Thorbjarnardottir, B.S., and J.C. Pechmann, 1985, Waveform analysis of local Utah earthquakes using digital data, Geol.Soc.Am. Abstracts with Programs, 17, 267.

RESEARCH SEPTEMBER 1985 INVESTIGATIONS

1. Moment-magnitude relations in the Utah-Idaho region and stress drop-versus-moment behavior.
2. Waveform analysis of Great Basin intraplate extension.
3. Kinematics of Great Basin intraplate extension.
4. Three-dimensional velocity structure of the 1983 Borah Peak, Idaho, earthquake area.
5. Seismicity of the Hansel Valley-Pocatello Valley area along the Utah-Idaho border.

RESULTS

1. Moment-magnitude (M_o - M_L) data for the southern Intermountain seismic belt (ISB) have been investigated along with stress-drop versus seismic-moment behavior for the corresponding earthquakes, following the analysis of Hanks and Boore (1984). Using P-wave spectra, a M_o - M_L relation of $\log M_o = 0.99 M_L + 17.8$ was determined for the magnitude range of $2.5 \leq M \leq 5.0$ from a set of 16 earthquakes in the southern ISB during 1981-1985 (Figure 1). Seismic moments were determined from a suite of 36 stations of the University of Utah seismic network that were calibrated indirectly using spectra of deep focus teleseismic earthquakes. The calibration was checked by comparison of moment values for 24 Borah Peak, Idaho, aftershocks ($\log M_o$ from 19.6 to 23.4) with those determined independently by Boatwright (1985). The slope of 0.99 is similar to that of the relation $\log M_o = 1.1 M_L + 18.4$ of Doser and Smith (1982), determined for an independent set of events in the range $3.7 \leq M_L \leq 6.0$. In contrast, M_o - M_L relations for California in this magnitude range, such as the relation $\log M = 1.5M + 16.0$ for $3.5 \leq M \leq 7.0$ of Thatcher and Hanks (1973); (see also Bakun, 1984), are generally steeper in slope than those for Utah. Slopes near unity are generally limited to smaller magnitudes for California events. This is a reflection of the essential non-linearity of M_o - M_L relations (Hanks and Boore, 1984).

Stress drops determined from P-wave pulse durations are basically constant with increasing M_o, whereas those determined from P-wave corner frequencies are affected by a non-instrumental frequency band limitation (similar to an f-max effect) causing an apparent increase of stress drop with moment. Such a band limitation is used to explain the persistence of the shallow slope (0.99) in the M_o - M_L relation to higher magnitudes in the Intermountain seismic belt.

2. Cross correlations of filtered waveforms for closely-spaced local earthquakes can be used to place strong constraints on their relative locations under the assumption that events producing very similar waveforms occur within one quarter of the shortest wavelength for which the similarity is observed (Geller and Mueller,1980). Tests using digital seismograms of quarry blasts with known locations, recorded by the University of Utah seismic network, support this "quarter wavelength" hypothesis. The waveform cross-correlation technique was applied to earthquakes during

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1981-1983 within 20 km of 1) an M_L 4.3 mainshock near Salt Lake City, Utah, on October 8, 1983, and 2) an M_L 4.0 mainshock that occurred on May 24, 1982 near Richfield, Utah. No unusual seismicity was observed prior to the Salt Lake City event during the time period studied. However, a cluster of 4 preshocks within 80-100m of each other, possibly representing the failure of a critical asperity, was observed 5 km NW of the Richfield event during a four-hour period ten months before the mainshock.

The aftershocks studied in both regions during the first 15 days after the mainshock occupy areas smaller than the rupture areas estimated for the mainshocks using the method of Frankel and Kanamori (1983). Both aftershock sequences showed a spatial migration of the initial events that could only be discerned from the waveform data. One possible explanation for this migration could be propagating stress changes caused by either the occurrence of the aftershocks themselves or else by some other process. Stress drop estimates of 1-2 bars and 2-6 bars were calculated for the Salt Lake City and Richfield mainshocks, respectively.

3. Strain rates assessed from brittle deformation associated with earthquakes have been compared to estimates of total brittle-ductile deformation for the intraplate Great Basin of the western United States. Strain and deformation rates were determined by the seismic moment tensor method using historic seismicity and fault plane solutions. By subdividing the Great Basin into areas of homogeneous strain it was possible to examine regional variations in the strain field. Contemporary deformation of the Great Basin occurs principally along the active seismic zones: the southern Intermountain Seismic Belt -- 4.7 mm/yr maximum deformation rate (including a large contribution from the 1872, M8.3 Owens Valley earthquake), and the west-central Nevada seismic belt -- 7.5 mm/yr maximum deformation rate. The earthquake-related strain shows that the Great Basin is characterized by regional E-W extension of 8.4 mm/yr in the north that diminishes to NW-SE extension of 3.5 mm/yr in the south (excluding the Owens Valley earthquake zone). These rates compare very well with the Great Basin opening rate of 9mm/yr estimated by Jordan et al. (1985) from the satellite geodesy and plate motion models. This result implies that most of the extension takes place by brittle fracture during earthquakes.

4. A geotomographic inversion method was used to derive the three-dimensional P-wave velocity distribution of the 1983, M 7.3 Borah Peak, Idaho, earthquake aftershock zone from local earthquake data. A data set of 3,963 P-wave travel-times from 260 earthquakes recorded by 72 stations with more than 6 recordings per station have been selected from the approximately 400 aftershocks. The velocity inversion used 220 discretized blocks in a seven layer-block configuration.

The results (Figure 2) suggest the presence of low P-velocity material west of the main surface break. A low velocity body with reductions of P-velocity up to 0.3 km/s, compared to a one-dimensional layered model, has a map projection which is elongated and parallel to the surface fault. The zone is 4-8 km wide and extends from near-surface to about 10 km -- roughly centered on the main fault plane that ruptured during the mainshock (rupture nucleation was at 16 km depth). The low velocity body extends well below the sedimentary layer and may represent a highly deformed volume or it may represent a dilatant body developed in response to deformation associated with large pre-historic events. Because of the small magnitude of the velocity changes, however, these results must be considered preliminary pending further testing with different starting velocity models.

5. The Utah-Idaho border region north of the Great Salt Lake is one of the most seismically active areas of Utah. Large historic earthquakes in this region include the 1934, M 6.6 Hansel Valley earthquake (with a 0.5 m of surface displacement) and the 1975 M 6.0 Pocatello Valley earthquake. Over 1600 earthquakes which occurred in this region during 1962-1963 were relocated by applying a master event technique to phase data from the University of Utah seismic network. Initial station delays were derived from a master event located by a dense 50-station temporary array (Cooperative Univ. of Utah - MIT special study, 1983). These delays were used to relocate five other nearby earthquakes that served as secondary master events.

The released epicenters show systematic shifts relative to the catalog epicenters of up to 5-10 km in some areas. However, the regional seismicity pattern is similar to the original pattern seen in the catalog data -- an inverted "Y" pattern centered on the Utah-Idaho border. A concentration of earthquakes trending northward from the state border includes aftershocks of the 1975 Pocatello Valley earthquake. Zones of activity extending SW and SE from the border began to develop several months after the 1975 main shock. The SW-trending zone encompasses the historically active Hansel Valley fault at the northern end of the Great Salt Lake.

REPORTS AND PUBLICATIONS

Doser, D.I., and R.B.Smith, Source parameters of the 28 October 1983 Borah Peak, Idaho, earthquake from body wave analysis, Bull. Seismol. Soc. Am., 75, 1041-1051, 1985.

Eddington, P.K., Kinematics of Great Basin intraplate extension, M.S. thesis, University of Utah,1985

Thorbjarnardottir, B.S., Relative earthquake locations by cross-correlation of waveforms: Application to pre-shock-mainshock-aftershock sequences in Utah, M.S. thesis, University of Utah 1985.

(figures on following page)

**Graduate students J.F. Peinado, P.K. Eddington, L.L. Leu, and G.J.Chen also contributed significantly to this project during the report period.

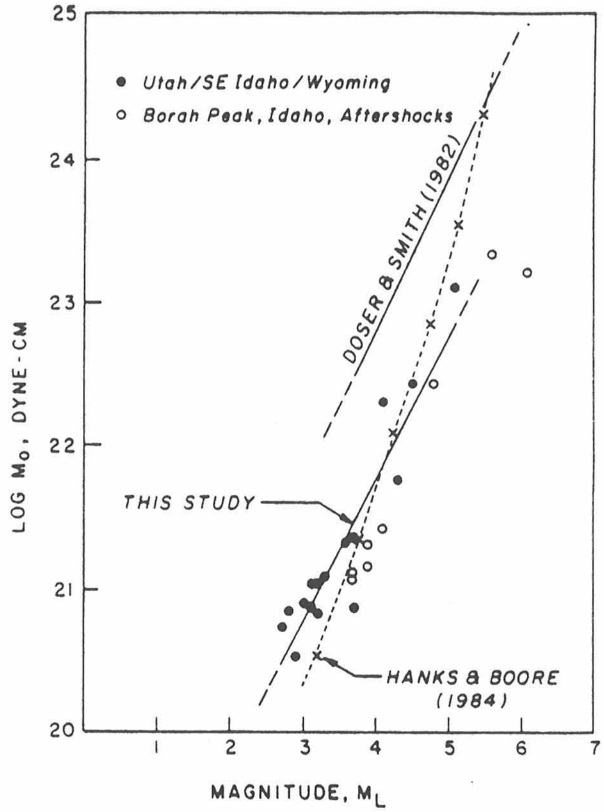

Figure 1. Moment-magnitude data for the southern Intermountain seismic belt. Solid circles represent data used to determine the relationship shown by the solid line (this study). Open circles represent Borah Peak aftershocks. The moment-magnitude relationships of Doser and Smith (1982) and Hanks and Boore (1984) are shown for reference.

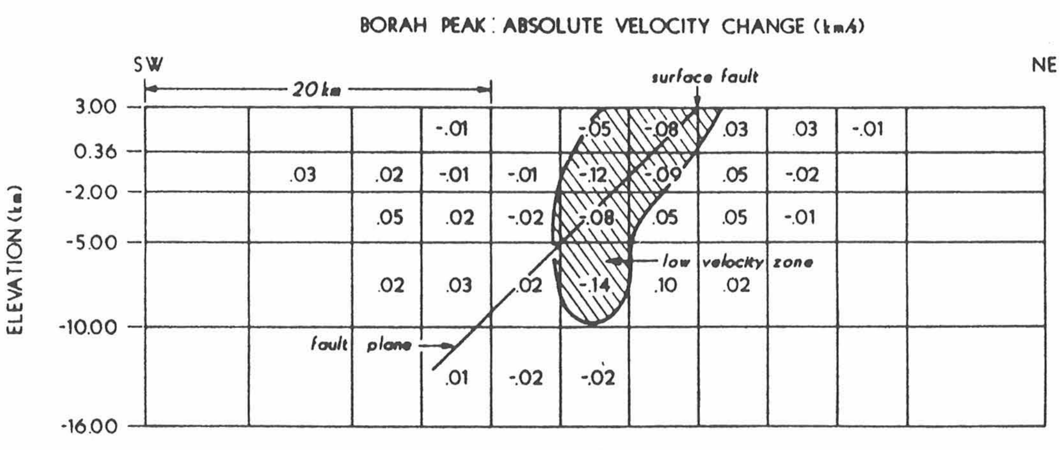

Figure 2. Cross section across the aftershock zone of the 1983 Borah Peak earthquake showing preliminary results of a geotomographic inversion of travel time data from aftershocks. Numbers show absolute velocity changes in km/sec relative to a horizontally-layered starting model. Numbers shown are average values from four grid elements extending 16 km along strike near the center of the surface break. Blank squares represent areas with no ray-path coverage.

INDUSTRY SCIENTISTS, ENGINEERS CAN DO RESEARCH AT USGS UNDER NEW PROGRAM

A new Industrial Research Associate program has been established by the U.S. Geological Survey under which scientists and engineers from private industry can do cooperative research with the USGS related to geology, water resources, mapping and other earth sciences.

USGS Director Dallas Peck said the main objectives of the new IRA program are to:

* Build stronger ties between research communities in the private and public sectors.

* Make the USGS and its parent agency, the Department of the Interior, more sensitive and responsive to scientific needs and programs of private industry.

* Better share the federal government's expertise with the public.

* Transfer some of private industry's expertise to the federal government.

In addition, Dr. Peck said private industry will benefit from the program by gaining access to USGS laboratory facilities and scientific expertise at the USGS National Center in Reston, Virginia and other Survey facilities across the nation.

Dr. Peck originally announced plans for the program in February 1985 in an address to a USGS-sponsored minerals symposium in Denver, but now says the program is in place and the USGS is accepting applications from private-sector scientists to participate. University scientists are also eligible.

The USGS director said salaries, fringe benefits and travel expenses of IRA researchers will be paid by private employers, while the USGS will provide office space, clerical support, technical supervision and laboratory facilities. He added, however, that if research requires special equipment or extensive use of major facilities, the sponsoring employer may be required to procure the special equipment or to reimburse the USGS for these extra expenses.

In order to qualify for the IRA program, Peck said research projects must advance research programs and objectives of the USGS and the Department of the Interior. Research assignments normally will be from six months to two years, but may be shorter or longer by mutual agreement.

Guidelines for research projects have been established to ensure that government impartiality is maintained, Peck added. These guidelines provide that results of research will be released to the public, research will be structured so that it does not preferentially benefit one individual or organization, and IRA researchers will not have access to confidential information that is held by the USGS under agreements with private firms.

Possible research topics span the entire range of earth sciences and related investigations conducted by the USGS. These include:

* Geological, geochemical, geophysical and hydrological investigations of energy, mineral and water resources; earth processes; natural hazards, such as earthquakes, volcanoes, landslides and floods; and environmental quality, natural variability and impacts of human activities.

* Application of aircraft and satellite remote sensing to geologic, hydrologic and cartographic problems.

* Cartography, cartographic engineering and digital cartography.

* Geographic information systems.

* Computing, simulation, knowledge engineering and data management for earth-science applications.

Peck said private-sector researchers are invited to discuss possible Industrial Research Associateships with the USGS research staff and to develop jointly proposals for research projects. More information is available from the Assistant Director for Research, U.S. Geological Survey, 104 National Center, Reston, Virginia 22092...telephone (703) 860-7488.

From NATURAL HAZARDS OBSERVER...

TENTH ANNUAL HAZARDS RESEARCH WORKSHOP

"Both natural and human-caused hazards were in the limelight at the tenth annual Hazards Research Workshop, as participants considered 'The Changing Face of Disaster--Increasing Catastrophe Potential and New Threats from Technology.' Held in Boulder, Colorado, July 7-10, 1985, the workshop was attended by 235 professionals involved in hazards management, mitigation, policy making, or research in the public and private sectors. Foremost among the questions posed to discussants by Information Center Director, William E. Riebsame, were: 1) to what degree will the lessons we have learned about coping with natural hazards help us deal with human-caused hazards?; and 2) will the benefits of technologically enhanced prediction and warning capacities be outweighed by increased legal liability and costly litigation?

An underlying theme at the workshop was the present need to reexamine the theories and practices that have governed our understanding and use of hazard adjustments over the past two decades. Can technological hazards or large-scale natural events in highly populated areas actually be mitigated through enforcement of codes or zoning regulations? How can a community prepare for the potential problems associated with, for instance, a toxic waste site when scientists and governmental officials cannot agree on what the problems are? We now have sophisticated equipment and communications devices to aid in disaster response, but how do agencies at all levels decide how much of their tight budgets to spend in order to acquire adequate response capabilities? How does the nature of the hazard event itself affect victims, and do the social and psychological recovery processes differ from one disaster agency to another?"

Materials provided to Workshop participants, as well as summaries of each of the concurrent sessions, can be gotten from the Natural Hazards Research and Applications Information Center, Institute of Behavioral Science #6, Campus Box 482, University of Colorado, Boulder, Colorado 80309. Abstracts are of

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three kinds: descriptions of new research projects; reviews of completed research and applications; and discussions of programs involving public education, hazard mitigation, preparedness planning, or disaster recovery in the U.S. and abroad. All abstracts include the name and address of the person to contact for further information. Individual abstracts or session summaries are free upon request to the Publications Clerk; a complete packet (all abstracts and summaries, a program, and a participant list) is 180 pages long and costs $10.00.

Some of the abstracts and session summaries of particular interest to FORUM readers are:

ABSTRACT OF RESEARCH IN PROGRESS

RP85-3 Media Coverage of Quick-Onset Natural Hazards, Lee Wilkins, University of Colorado

RP85-12 Physical Disability and Earthquake Hazard Mitigation, William J.Petak and others, University of Southern California

RP85-15 Attitudes and Attributes of influentials in Earthquakes and Other Natural Hazard Policy Processes, Elliott Mittler, University of Southern California

ABSTRACTS OF RESEARCH COMPLETED

CD85-6 Population Estimates in Time and Space (PETS), Jerry B. Schneider, University of Washington

CD85-10 An Evaluation of Ordinances and Approaches to Mitigating Hazards Posed by Unreinforced Masonry Buildings in Seismically Active Areas, D.A. Alesch, University of Wisconsin-Green Bay, W.J. Petak, University of Southern California

ABSTRACTS OF HAZARDS PROGRAMS AND PROJECTS

PRO85-4 Teaching Children about Natural Hazards, Anne Marie Santoro, Children's Television Workshop

PRO85-7 Pilot Project for Earthquake Hazard Assessment, T.Haney, Temjam Corporation

PRO85-14 Government Appears to be Failing in Enforcement, J. Slosson, Slosson and Assoc.

PRO85-17 Preparedness Outreach: Ensuring the Survival of the Entire Community, E.H. Young Jr., NOAA/National Weather Service

SUMMARIES OF CONCURRENT SESSIONS

SS85-3 BUILDING SAFETY: WHERE DO WE STAND IN REGARD TO EARTHQUAKES AND FLOODS?

SS85-8 IN WHAT WAYS CAN PLANNERS AND EMERGENCY MANAGERS USE COMPUTER TECHNOLOGY TO IMPROVE LOCAL EARTHQUAKE PREPAREDNESS PLANNING?

SS85-13 WHAT ARE THE RESPECTIVE ROLES OF VOLUNTARY AGENCIES, THE PRIVATE SECTOR, AND LOCAL EMERGENCY MANAGEMENT OFFICES IN RESPONDING TO DISASTERS?

SS85-19 WHAT TYPES OF TRAINING AND INFORMATION ARE NEEDED TO IMPROVE RESPONSE TO TODAY'S DISASTERS?

SS85-30 PROBABILISTIC APPROACH TO EARTHQUAKE FORECASTING

SS85-32 ATTITUDES AND ATTRIBUTES OF INFLUENTIALS IN EARTHQUAKES AND OTHER NATURAL HAZARD POLICY PROCESSES

SS85-34 HEALTH CARE STAFF ACTIONS IN EARTHQUAKES

NATURAL HAZARDS OBSERVER has prepared INDEX 5....which covers each issue of the NATURAL HAZARDS OBSERVER from Volume VIII, Number 3 (January 1984) through Volume IX, Number 6 (July 1985)....Each entry indicates the volume, number, and page on which the item can be found. The index is in three parts: subject index; author index--all personal authors and grant recipients; title index--all books, articles, grants, studies, periodicals, audio-visual materials, and maps.

PUBLICATIONS

PUBLICATIONS, ARTICLES OF INTEREST

(Information on obtaining the following USGS publications is available from any of the Public Inquiries Offices (Vol.1,No.4 for complete addresses, or by contacting the FORUM Editor at the PIO, 8105 Federal Building, 125 S. State, SLC, Utah 84138, 801-524-5652).

USGS OPEN FILE 84-763
Proceedings of Conference XXVI; a workshop on Evaluation of regional and urban earthquake hazards and risk in Utah, edited by W.W.Hays and P.L. Gori, 692 pages. Microfiche $4.00; Paper copy $104.00

USGS map I-1606
Geologic map of the North Ogden Quadrangle and part of the Ogden and Plain City quadrangles, Box Elder and Weber counties, Utah, by M.D. Crittenden, Jr.,and M.L. Sorenson, 1985. $3.10

USGS map MF-1491
Geologic map of the Bulls Pass Quadrangle, Box Elder County, Utah, by T.E. Jordan, 1985. $1.50

USGS map MF-1773
Complete Bouguer gravity anomaly map of Idaho, compiled by Viki Bankey, Michael Webring, D.R. Mabey, and M.D. Kleinkopf, U.S. Geological Survey, and E.H. Bennett, Idaho Geological Survey, 1985, 1:500,000, $2.40

USGS OPEN-FILE 85-397
Earthquake Data Archiving and Retrieval System: archived data sets in the standardized library, SL000001 to SL000100, D.M. Tottingham, J.T. Newberry and W.H. Lee, 291 pages. Microfiche $4; paper copy $43.75.

USGS OPEN-FILE 85-436
Earthquake Data Archiving and Retrieval System; archived data sets in the general library, GL 000001 to GL 000200, by T.M. Messier, M.E. O'Neill, and W.H.Lee, 317 pages, Microfiche $4; paper copy $47.75.

R.E. ENGDAHL, Documentation of earthquake algorithms. Report SE (World Data Center A for Solid Earth Geophysics), v. 35, July 1984. 44 pages

T.L. YOUD and D.K. KEEFER, Landslides caused by earthquakes. Geological Society of America Bulletin, v. 96, no. 8, August 1985. p. 1091-1094

W.H. BAKUN, Magnitudes and moments of duration (abstr), EOS Transactions, American Geophysical Union, v. 64, no. 45, November 8, 1983, p. 765

S.H. HARTZELL and T.H. HEATON, Strong ground motion for large subduction zone earthquakes (abstr.), Earthquake Notes, v. 55, no.1, January 1985, p.6

W.W. HAYS and K.W. KING, Evaluation of the ground shaking hazard in Utah urban areas (abstr.), Earthquake Notes, v.55, No. 1, January 1985, p.5

A. McGARR, Scaling of ground motion parameters, state of stress and focal depth (abstr.), EOS, Transactions, American Geophysical Union, v. 64, no. 45, November 8, 1983, p. 765

R.A. PAGE, Earthquake frequency and prediction; a critical examination (abstr.) Earthquake Notes, v. 55, no.1, January 1985, p.16.

R.RODRIGUES and A.F. ESPINOSA, The generation of "visible waves" by earthquakes (abstr.) Earthquake Notes, v. 55, no.1, January 1985, p.20

R.L. WESSON, Aftershocks and afterslip (abstr.) Eos Transactions, American Geophysical Union, v. 64, no. 45, November 8, 1983, p. 766

R.L. WHEELER, B.C. Van GOSEN, G.M. BEDINGER and K.J. WENRICH, Methods for evaluating alignments of epicenters and other mapped points (abstr.) Earthquake Notes, v. 55, no. 1, January 1985. p.19

NEW REPORT EVALUATES EARTHQUAKE HAZARDS OF LOS ANGELES REGION

The earthquake hazards of the Los Angeles region, improved methods for evaluating the distribution and severity of the hazards, and opportunities for reducing the hazards are described in a report published by the U.S. Geological Survey, Department of the Interior.

The 505-page USGS report presents the latest research on evaluating strong ground shaking, surface faulting, ground failure, and tsunamis (seismic sea waves) expected from future earthquakes. The report contains 16 chapters by 22 experts on the geologic and seismologic effects of earthquakes.

"The highly populated Los Angeles region has experienced more than 40 damaging earthquakes since 1800 and inevitably will be shaken by future major earthquakes of possibly catastrophic impact", said Dr. Joseph I. Ziony, USGS research geologist and editor and organizer of the report.

Among the significant findings of the USGS report are:

95 fault segments in the Los Angeles region are capable of generating damaging earthquakes and rupturing the land surface.

Future earthquakes as large as the following should be anticipated in planning for and designing ordinary structures: magnitude 8+ on the San Andreas fault, magnitude 7 on the San Jacinto fault, and magnitude 6.5 on other active faults.

Geographic variations in the severity of ground motion can be estimated for future earthquakes in the Los Angeles region by taking into account geologic characteristics near the Earth's surface and by applying various predictive methods.

Areas vulnerable to liquefaction can be identified from the physical and hydrologic characteristics of the sediments within the alluvial valleys. Earthquake-triggered landslides, particularly rockfalls, are a significant hazard in the populated upland areas. A new method for predicting the areal limits for landslides of various types from different-sized earthquakes has been developed.

COPIES OF THE REPORT, "EVALUATING EARTHQUAKE HAZARDS IN THE LOS ANGELES REGION--AN EARTH-SCIENCE PERSPECTIVE" ARE AVAILABLE FROM THE PUBLIC INQUIRIES OFFICES LISTED IN VOLUME 1, NUMBER 4 OF THE FORUM, OR FROM THE EDITOR OF THE FORUM. THE PUBLICATION, PROFESSIONAL PAPER 1360 IS AVAILABLE FOR $24.00 PER COPY.

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Meetings

EARTHQUAKE AWARENESS

A program consisting of two presentations by experts knowledgable in lessons learned from the recent Borah Peak, Idaho and Mexico City earthquakes and their relevance to the Wasatch Front.

This is the first meeting of a new interdisciplinary organization with the objective of communication of earthquake topics of interest to those in the Intermountain Seismic Belt.

DATE: THURSDAY, FEBRUARY 20, 1986

TIME: 5:30 TO 7:00 PM

PLACE: UTAH POWER & LIGHT BUILDING CAFETERIA
1407 West North Temple
Salt Lake City, Utah
Entrance and parking are on the west side of the building. Refreshments available

FEES, DUES, ADMISSION: NONE

ANTICIPATED AUDIENCE AND MEMBERSHIP: All individuals with a keen interest and/or employment in any aspect of earthquake hazard or earthquake risk reduction.

PLEASE MARK YOUR CALENDARS FOR FEBRUARY 20, 1986. CONTACT BRUCE N. KALISER, (801) 581-6831 FOR FURTHER INFORMATION.

THIRD U.S. NATIONAL CONFERENCE ON EARTHQUAKE ENGINEERING, EARTHQUAKE ENGINEERING RESEARCH INSTITUTE

Charleston, South Carolina, August 24-28, 1986. Contact James E. Beavers, Martin Marietta Energy Systems, Inc., Building 9733-4, M/S 2, P.O. Box Y, Oak Ridge, TN 37831, (615) 574-3117.

GEOLOGY AND THE ENVIRONMENT

Dr. Duncan Foley will be teaching this class winter and spring quarters at the University of Utah. The class will cover many aspects of geology that make headlines in Utah. This includes geologic hazards such as volcanoes, earthquakes, landslides, avalanches and floods. Geologic aspects of toxic and nuclear waste disposal will also be discussed. The class emphasizes Utah problems, but draws examples from around the world. Geology and the Environment is taught as Geology and Geophysics 398R, with registration through the Division of Continuing Education at the University of Utah. It will meet from 7 to 10 pm on Mondays during winter quarter and Tuesdays during spring quarter. Call Duncan Foley for more information at (801) 524-3431.

UTAH EARTHQUAKE ACTIVITY

July through September 1985

Ethan D. Brown
University of Utah Seismograph Stations
Department of Geology and Geophysics

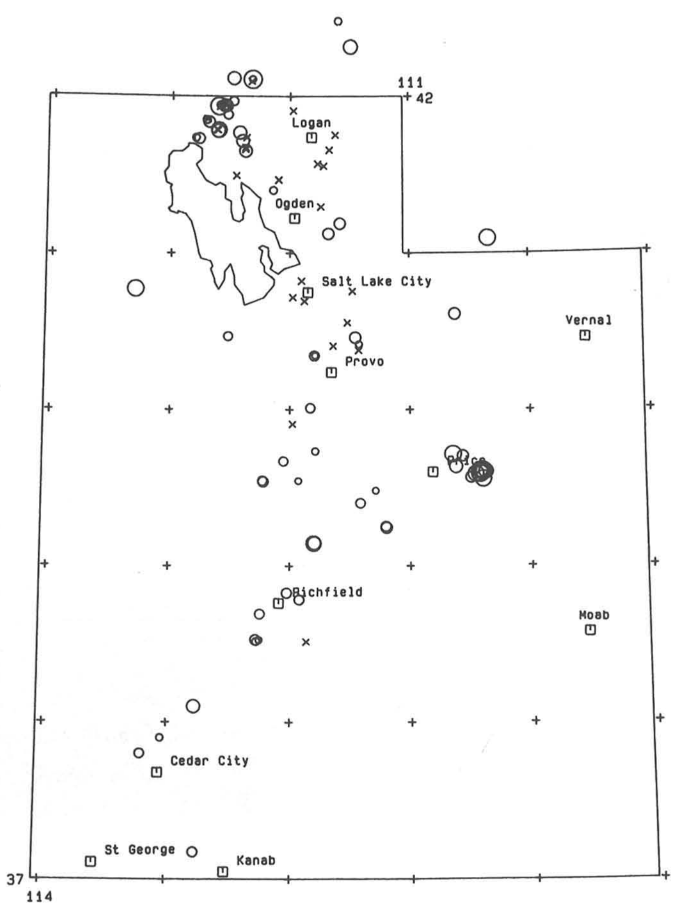
The University of Utah Seismograph Stations records an 80-station seismic network designed for local earthquake monitoring within Utah, southeast Idaho, and western Wyoming. During July 1 to September 30, 1985, 99 earthquakes were located within the Utah region (Figure 1). The largest earthquake during this time period, M_L 2.8 occurred just north of the Utah-Idaho border on August 7, 1985, and was felt at Samaria and Malad City, Idaho. During the report period, four larger felt earthquakes occurred within the University of Utah regional seismic network, but to the north of the Utah region near Alpine, Wyoming: M_L 4.3 on August 16; M_L 4.6 on August 21; M_L 4.3 on August 22 and M_L 4.3 on August 30.

Significant clusters of earthquake activity during the report period shown in Figure 1 include:

1) Thirty-two earthquakes north of the Great Salt Lake ($M_L \leq 2.8$).

2) Fourteen earthquakes east of Price in an area of active underground coal mining ($M_L \leq 2.8$).

Additional information on earthquakes within Utah is available from the University of Utah Seismograph Stations, Salt Lake City, Utah 84112, telephone (801) 581-6274.



Utah Earthquakes: July 1 - Sept 30, 1985

0 50 100 km

magnitude scale (ml): 6 4 2 1 <1.0

Wasatch Front Forum

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