WASATCH FRONT FORUM

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EARTHQUAKE HAZARDS PROGRAM

The Wasatch Front Forum is not to be quoted or cited as a publication because much of the material consists of reports of progress and research activities and may contain preliminary or incomplete data and tentative conclusions.

DEADLINES FOR FUTURE ISSUES

WINTER 1986..... FEBRUARY 28, 1987
SPRING 1987 ..... APRIL 30, 1987
SUMMER 1987..... JULY 30, 1987

Information, contributions, questions and suggestions may be sent to the Editor, or to any of the Associate Editors listed.

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DIGITAL MAPPING WORKSHOP

September 10, 1986

by Bob Alexander, USGS

A workshop on the applications of digital mapping and geographic information systems (GIS) technology to Wasatch Front earthquake hazard reduction was held at the State Capitol Building in Salt Lake City on September 10, 1986. The objectives of the workshop were (1) to present results of the U.S. Geological Survey's (USGS) Sugar House Quadrangle digital mapping demonstration project; (2) to seek feedback from potential users of information similar to that displayed in the demonstration; and (3) to recommend cooperative actions to meet the region's needs for digital data to mitigate earthquake and other natural and technological hazards.

The morning session was devoted to presentations by representatives of the three sponsoring agencies--the USGS National Mapping Division, Rocky Mountain Mapping Center; the Utah Geological and Mineral Survey (UGMS); and the Utah Automated Geographic Reference Center (AGR). The stage was set by Don Mabey, Deputy Director of UGMS, who outlined the nature of the earthquake threat along the Wasatch Front, and described the multi-agency cooperative program which is working to alleviate damage and loss of life from future earthquakes.

The Digital Mapping Workshop, an outgrowth of that multi-agency program, addressed the need to manage the large quantities of information required to define and cope with earthquakes and related natural and technological hazards. The workshop focused on the rapidly-developing technology of digital map data bases and related GIS, already adopted or being considered by many of the organizations represented at the workshop.

Computerized map data bases for the Sugar House Quadrangle in east-central Salt Lake County, compiled in a USGS research project, were displayed in several output formats by Bob Alexander, Tom DiNardo, Eldon Jessen, and Leanne Richardson of the USGS Denver Office. Aided by Mike Johnson, Gene Trobia, Brent Jones, and David James of AGR, several GIS operations were demonstrated on AGR equipment, using experimental data tapes that were transferred from USGS to Utah for this demonstration. The examples illustrated how the populations, homes, and critical emergency management facilities are spatially related to fault rupture, liquefaction, flooding, and other damaging processes that can result from earthquakes.

In the afternoon sessions, the 39 workshop participants responded to the materials presented in terms of the needs and capabilities of their organizations. Participants represented federal, state, county, and city agencies, plus private industry and universities.

Group discussions were facilitated by the county geologists of the four principally-impacted counties: Mike Lowe of Weber and Davis Counties, Craig Nelson of

Continued on next page

Salt Lake County, and Robert Robison of Utah County. Discussants considered three different categories of map scales for which hazard-management maps are needed: the standard USGS quadrangle scale 1:24,000 (used in the Sugar House Quadrangle demonstration); scales of 1:100,000 and smaller, which can convey at a glance the regional extent of earthquake hazards and their consequences; and scales of 1:4,800 and larger, which (Digital Workshop continued) can handle data on building characteristics and other data that are typically keyed to local government cadastral (land ownership) files.

For each map scale, many kinds of data were considered, ranging from the standard USGS digital data bases (e.g. topography, roads, boundaries, land use and land cover) to data on the geology, hydrology, hazards, lifelines, response facilities, building characteristics, and populations of the affected areas.

Recommendations included:

1. Link local government land parcel files, including building inventories, with geologic and other data available at quadrangle scale;

2. Develop smaller-scale (e.g., 1:100,000 to 1:500,000) digital map capability, to display geologic and population characteristics of whole counties or multi-county regions;

3. Extend digital coverage of lifelines and emergency response facilities, at the 1:24,000 scale used for the Sugar House demonstration, to other nearby quadrangles;

4. Develop standards for exchange of digital data;

5. Provide a forum for continued communication among those present, and extend communication to key groups not represented at the September 10 workshop; and

6. Use digital mapping and GIS technology to develop earthquake loss estimation data bases, and provide for updating of loss calculations by Utah officials.

After the workshop, the three sponsoring agencies collaborated on the submission of a proposal to USGS to support implementation of earthquake loss estimation in Utah, employing the kinds of data and technology demonstrated in the workshop. Such a project would involve parts of each of the above- mentioned recommended activities, and would imply a long-range, cooperative effort that would lead systematically to a future state or regional information management capability in support of actions to reduce the damage and loss of life from earthquakes.

For further information, or to make additional suggestions on moving forward with the utilization of digital mapping and geographic information systems technology, any of the following sponsoring agency representatives may be contacted:

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  Box 25046, MS 516
  Denver Federal Center
  Denver, Colorado 80225
  303-236-5838

UTAH EARTHQUAKE PREPAREDNESS PROJECT

By Jim Tingey

Utah Divison of
Comprehensive Emergency Management
State of Utah

Department of Public Safety

The Utah Earthquake Preparedness Project is administered through the auspices of the Federal Emergency Management Agency (FEMA) Region VIII, Denver, Colorado, and managed by the Utah Division of Comprehensive Emergency Management (CEM) (a Division of the Department of Public Safety). The Project funding, as with nearly all seismic related efforts in Utah, is through the National Earthquake Hazard Reduction Program. FEMA is designated as the lead agency under this program.

This specific Project's goals, as outlined by FEMA under the State and Local Earthquake Hazard Reduction Implementation Guidelines and some goals included in the CEM work efforts, are as follows:

1. The creation and support of a State Seismic Advisory Board or Boards. (NOTE: The Utah State Seismic Advisory Council (USSAC) which was State supported and functioned from 1977 to 1981 was exemplary of this type of group effort. The results of the Council are still being reiterated and used as models for seismic reduction concepts and practices in Utah. For review of the Council's completed reports and research projects contact CEM or the UGMS (Utah Geological and Mineral Survey).

2. Hazard Identification - This item involves identification of the greatest probable Richter magnitude events within a prescribed area and presumed epicentral locations for "model" earthquakes from which other data may be extrapolated. This other data includes ground shaking intensities preferably identified in terms of the Modified Mercalli Intensity Scale; associated geological hazards such as landslides, liquefaction and other soil or rock characteristics; the structural density, population density and critical facility locations; the interpretation and translation of this data into a usable form which delineates areas of hazards in terms such as LOW, MODERATE, or HIGH. The function of hazard identification will be carried out primarily by the Utah Geological and Mineral Survey, universities, USGS or other appropriate sources. The current status of hazard identification in Utah will be familiar to Wasatch Front Forum readers. The Charter of the Utah Division of Comprehensive Emergency Management specifically charges CEM with the "identification of areas particularly vulnerable to disasters". In this way CEM must not only coordinate closely with sister agencies such as the UGMS, but must also develop some expertise in this area to be effective managers and implementors in relation to public safety.

3. Vulnerability Assessments - The concept of vulnerability closely resembles and relies upon information resulting from loss estimation studies. To my knowledge five such studies have been completed using different methodologies and covering various facilities and geographic areas. They are:

   a) USGS Open File Report 76-89; A Study of Earthquake Losses in the Salt Lake City, Utah area, 1976.

   b) Seismic Hazard and Risk Assessment: Some Case Studies for the Salt Lake City Urban Area, 1984, by T.Algermissen and K.Steinbrugge. Published in the Geneva Papers on Risk and Insurance, Volume 9 Number 30, January 1984. (An expanded report will probably be contained in a USGS Professional Paper next summer).

   c) Economic Impact Analysis of an Earthquake in Ogden, Utah, March 1985. Study done for the CEM/Utah Multi-Hazards Project by the University of Utah, Bureau of Economic and Business Research.

d) A Systems Approach to Wasatch Front Seismic Risk Problems, C.Taylor, J.H. Wiggins, J. Haber and D. Ward of NTS Engineering, Redondo Beach, CA and Structural Facilities Inc., Salt Lake City, Utah, under a USGS Contract, 1986.

e) Earthquake Hazards to Domestic Water Distribution Systems in Salt Lake County, Utah by Lynn M. Highland; MA Thesis, University of Colorado, 1984.

In addition, the USSAC produced other vulnerability assessment type reports. Each of these studies in one way or another address and make statistical or empirically judgemental estimates of the eight important items listed by FEMA for vulnerability assessments.

a) Casualties and injuries

b) Loss or damage to critical facilities

c) Medical resources and vulnerability

d) Loss of utilities and replacement/repair time

e) Transportation losses

f) Building losses

g) State/local economic losses

h) Secondary impacts e.g., fire, dam or levee (think Great Salt Lake) failure, hazardous material or other toxic release (think of the string of oil refineries in North Salt Lake and South Davis County).

In the past, CEM has been satisfied with using the results of loss estimation studies whenever and wherever they could be applicable, whether it be for public education or actual mitigation strategies. However, with the creation of the Utah State Automated Geographic Reference Section (AGR) and the possibility of creating and contributing to a state wide data base which produces accessible products for emergency management use, CEM has planned to use AGR for data storage and some map production in 1987.

The effort will be concentrated in metropolitan Salt Lake County and focus on compilation and digitization of non-geological data. This will include critical facility locations, routes and lifeline locations such as water, gas and electrical systems. This project follows on the heels of the USGS pilot project on the Sugar House quadrangle which serves as an excellent example of what can be produced and how data can be manipulated for various purposes. A multi- hazards mitigation project in Utah County, managed through CEM in 1986, also utilized the AGR capability. Similar projects by the University of Utah, the USGS and FEMA will reduce the difficulty in obtaining the necessary data.

Hopefully this project will serve as a data base onto which can be added geological information and other extrapolated modeling showing ground motion amplification and zones of intensity related in terms of the Modified Mercalli Scale.

4. Preparedness and Response Planning - This component of the NEHRP was addressed by the compilation, integration and exercising of the State/Four County Earthquake Response Plan by CEM. The plan incorporates the response plans of Weber, Davis, Salt Lake and Utah counties, along with the plans of responsive state agencies. Military, corporate and volunteer agency plans are also integrated.

   The plan lists resources, telephone numbers, radio frequencies and outlines procedures which will take place in the event of a damaging earthquake along the Wasatch Front. The plan, in some modified form, would also go into effect when a damaging event occurred outside of the four county area and is not exclusively limited to the Wasatch Front.

   The purpose of preparedness and response planning is to expedite the recovery from such an event and focus resources in the most efficient manner to the areas in greatest need. Preparedness, results from acquiring a working knowledge of disaster reponse plans at all governmental levels, (federal, state and local) and by exercising those plans periodically via mock disaster drills or Table Top exercises. In 1985, mock earthquake exercises were held in each of the four counties and at the State level to test the plan and familiarize response personnel with procedures and resources.

   During 1985, mutual aid agreements were signed between the four contiguous counties and the State Division of CEM. These agreements outline how less affected counties may supply resources in an organized and monitored way to increase the ability of a more affected county to respond and recover. The agreements detail financial and liability responsibility and name CEM as the coordinating agency.

5. Mitigation Strategies - This element is the most difficult to address because the success of mitigation lies in a political arena where answers to geologic questions must be distilled into fiscal requirements, specific time frames and actual, verses presumed threat. Because of the perceived related infrequency of damaging earthquakes along the Wasatch Front and the enormous canyon of difference between the geologic time scale (even Holocene time) and the political life of an elected official, it is a tough job to get mitigation implemented at the State, County and local levels.

   The strategies and mitigation examples exist, proposed by the USSAC, CEM and others, but the key must be public support followed by legislative support followed by implementation of low cost or no cost ideas by concerned citizens, communities and higher government. Public support can best be intensified by the last item in the FEMA guidelines.

6. Public Awareness/Earthquake Education - Even though the ominous threat of a large earthquake on the Wasatch Front has been recognized since the end of the last century; most people do not recognize the implications such an event would have as related in the earthquake model/loss estimation reports.

   To get this message across CEM takes every opportunity and creates opportunities to deliver this sermon, through lectures and workshops' using pamphlets, brochures and manuals provided by our office, the UGMS, USGS, FEMA and the California preparedness organizations, which are distributed by the thousands. During 1986, CEM managed the production of a video, to be released soon, which describes the latest scientific findings and demonstrates the extent of damage that can be expected. We expect this program to be aired over network television and then be available for re-use in any setting conducive to public awareness. Measures to incorporate earthquake education in the public schools are also part of the 1987 CEM effort.

   In raising the public awareness and convincing them that the problem will not disappear with a change in the weather or a "it just won't ever happen here" attitude, we hope we can begin damage prevention measures before the event and pick up fewer broken pieces afterward.

Report on Eleventh Annual Hazards Research Workshop

July 20 - 23, 1986

"Risk Communication and Hazards Management" was the theme of the eleventh annual Hazards Research Workshop, held in Boulder, Colorado, July 20-23,1986. The workshop was attended by 213 public and private professionals involved in hazards management, mitigation, policy making, research, or emergency response. Over the past year, several severe natural and technological disasters have called attention to the need to reexamine and improve methods for communicating the facts about such hazards and for managing high-consequence/low-probability events.

Two questions which proved to be central to many of the discussions throughout the workshop were posed in plenary sessions on the first day: 1) How will better risk

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communication help public officials deal with natural and technological hazards? 2) What risk communication techniques and programs can improve public understanding of natural and technological hazards? Discussions of these two questions included a report on the U.S. Geological Survey warning procedures concerning the volcanic hazard around Mammoth Lakes; a presentation of a New Jersey state program for communicating the recently discovered risk posed by naturally occurring radon gas and examples from The Children's Television Workshop which included a song about hurricanes and an easy formula to remember when trying to differentiate among early preparation, watches and warnings: Get Ready, Get Set, Go!.

The final session focused on the Mexico City earthquake, ending with a presentation from a representative of the National Science Foundation who outlined the benefits derived from the earthquakes:

1) The convergence of short-term and long-term researchers upon Mexico City has already improved hazards research and will influence the next generation of researchers;

2) International cooperation was effective and impressive and has shown that cooperative hazards management can succeed;

3) The need to coordinate research efforts, both within the U.S. and internationally, was made obvious and steps are being taken to meet that need;

4) The credibility of warnings about the " Big One" in the U.S. has been increased, as has the level of Congressional interest in earthquake preparedness and mitigation programs; and

5) A caution has been delivered to researchers that findings from studies do not automatically get used--there are considerable social, economic, and political impediments to implementation that researchers must be aware of.

(see note on availability of abstracts from this workshop at the end of FORUM)

FROM NATURAL HAZARDS OBSERVER .....

"A bill requiring city and county building departments in seismically active parts of California to identify all potentially hazardous buildings was signed into law in California on July 3, 1986. SB 547, sponsored by Senator Alfred Alquist, is regarded as one of the most significant pieces of state earthquake legislation since the 1933 Field Act, which prescribed earthquake resistant design standards for new school building. The new law sets 1999 as the year by which local jurisdictions must have prepared building identification reports and hazard mitigation plans, and have notified the owners of the properties at risk. Although the new law does not empower local jurisdictions to require that private property owners take the recommended safety steps, it does lay the groundwork for clarifying who is responsible for the failure of a building in an eventual earthquake. The California Seismic Safety Commission, the lead state agency, will provide procedural guidelines to cities and counties by September 1, 1987."

GRANTS .....

Responses...."The Organizational and Public Response to the 19 September 1985 Mexico Earthquake" National Science Foundation, $100,000, 18 months. Principal Investigator: Russell R. Dynes, Disaster Research Center, University of Delaware, Newark, DE 19716, (302) 451-6618

Injuries...."The Physical Setting's Role in Earthquake Injuries: Mexico Experience." National Science Foundation, $50,000, 18 months. Principal Investigator: Michael E. Durkin, Michael E. Durkin and Associates, 22955 Leonora Drive, Woodland Hills, California 91364 (818) 704-1493

Nonstructural damage...."An Investigation of Nonstructural and Building Contents Damage in the 19 September 1985 Mexico Earthquake," National Science Foundation, $67,000, 12 months. Principal Investigator: Deane Evans, Steven Winter and Associates, 6100 Empire State Building, New York, NY, (212) 564-5800

Transportation...."Transportation Lessons Learned from the 1985 Mexico Earthquake," National Science Foundation, $60,000, 12 months. Principal Investigator: Antoine Hobeika, Department of Civil Engineering, Virginia Polytechnic Institute, Blacksburg, VA 24061, (703) 961-7407

Compilation...."Integration of the Mexico Earthquake Research Activities," National Science Foundation, $135,000, 24 months. Principal Investigator: Roger Scholl, Earthquake Engineering Research Institute, 6431 Fairmont Avenue, El Cerrito, California 94530 (415) 525-3668

USGS HISTORY ...VOLUME III

Following are some excerpts from two of the first three volumes ... "MINERAL, LANDS, AND GEOLOGY FOR THE COMMON DEFENCE AND GENERAL WELFARE', U.S. Geological Survey, Volume 2 (1879-1904) and Volume 3 (1904-1939).

It is interesting to note the development of concerns and programs relative to earthquakes within the U.S. Geological Survey.

"In the fall of 1884, another field of investigation was added to the Survey (USGS) program. Two light but widely felt earthquakes in the Eastern States in 1884 had called attention to the lack of any organized attempt to observe them in this country. SCIENCE, in its issue of October 3, 1884, suggested that the U.S. Geological Survey provide instruments and observers and that students of 'this branch of physical geography' form an earthquake club. In November the Director, with Gilbert and Dutton, met in conference with Professor C.C. Rockwood of Princeton, who had been collecting accidental records of earthquakes, Professor W.M. Davis of Harvard, Cleveland Abbe and C.F. Marvin of the Signal Service, and H.M. Paul of the Naval Observatory to consider the best way to arrange for systematic observations. They agreed that the only practicable scheme was to rely on voluntary cooperation and to work toward collection of non-instrumental observations by distributing circulars and blanks to be filled in and toward the establishment of stations for instrumental observations. Marvin undertook to design an instrument that would be simple and inexpensive and that would require a minimum of care and attention. Rockwood and Davis, and Abbe were constituted a committee to determine the best geographic distribution of stations. The Geological Survey was to furnish the instruments to observers and receive reports. The seismological investigations were made part of the work of the Division of Volcanic Geology under Captain Dutton."

"(W.J.) McGee was also pressed into service to begin the investigation of the earthquake in South Carolina that occurred on Tuesday, the 31st of August 1886, at 9:50 in the evening, while Dutton was somewhere in the Cascade Mountains. Communications between the Charleston area and the outside world was cut, the railways were made impassable, and the telegraph lines were down, so that word of the disaster was not spread until late Wednesday when a brief telegraph dispatch was sent out. The CHARLESTON NEWS COURIER sent an account to Summerville, whence it was telegraphed to Washington for publication on Thursday. McGee and a photographer arrived on Friday, September 3, and spent a week making observations in the most seriously shaken area. A more extensive study was reserved for Dutton's return in the fall."

(1887) "Dutton was fully occupied with his study of the Charleston earthquake."

(1905) "In the Yakutat Bay region, R.S. Tarr,assisted by B.S. Butler and Lawrence Martin, studied the occurrence of coal and gold but took time to study the glaciers and the remarkable deformation of the Earth's surface that occurred during the earthquake of September 1899."

(1906) "G.K. Gilbert had been appointed to the special commission to investigate the San Francisco earthquake and spent much of the summer studying that part of Marin County near Bolinas and Tomales Bays that was traversed by the San Andreas fault."

"In 1925, the Survey became more deeply involved in basic research on natural catastrophes. On July 1, the Survey took over responsibility for the Hawaiian Volcano Observatory established by the Hawaii Volcano Research Association in 1912. A few geologists were diverted from their mapping or other investigations for short periods to investigate some of the natural disasters that seemed unusually numerous in 1925. Arthur Keith studied the effects of the major earthquake of February 28, that centered in the St. Lawrence Valley, in the Northeastern United States, as well as several small shocks in New England. W.C.Alden investigated the landslide of June 23 in the valley of the Gros Ventre River, about 35 miles south of Yellowstone Park. The slide had formed a dam about 225 feet high and half a mile long that completely blocked the river and produced a lake that submerged much of three ranches and a ranger station in the Teton National Forest. Alden concluded that heavy rains and melting snow had saturated a clay shale, interbedded with the Carboniferous sandstones and limestones, which slipped and caused the slide. J.T. Pardee studied two earthquakes in the same general area, the first only four days after the Gros Ventre slide. Nearly all Montana and parts of the neighboring States and Provinces were shaken and considerable damage caused, especially in the villages of Three Forks, Logan, and Manhattan by the June 27 earthquake. Pardee concluded that the region was likely to experience an occasional severe shock and suggested that the inhabitants take "at least a few simple precautions toward the prevention of future damage". Pardee also studied the effects of the earthquake of November 17 in the Big Horn Mountains of Wyoming. Survey geologists, however, were not involved in the study of the Santa Barbara earthquake of June 29, which focused attention on earthquakes in the United States and the damage they could cause. Studies of the Santa Barbara shock by well-known geologists, among them Bailey Willis, and engineers led to the first serious attempt to establish building codes."

"The most intense earthquake in Western United States in many years and probably the second most severe shock in Nevada since its settlement occurred near Cedar Mountain on December 20, 1932. The shock was perceptible over an area of 400,000 square miles but did very little damage. It did, however, provide considerable geologic information because the pattern of faults and displacements indicated the direction of earth movement. Fortunately, Eugene Callaghan was still in the field in Nevada at the time and he was able to begin a field investigation within a few days. Unfortunately, heavy snows forced suspension of the field investigations after a few weeks."

NEW PUBLICATIONS

GUIDELINES FOR PREPARING CODE CHANGES BASED ON THE NEHRP RECOMMENDED PROVISIONS (1985 EDITION)

Building Seismic Safety Council, 1986. 120 pp. Single copies are available as FEMA Publication #98 (Earthquake Hazards Reduction Series 21) from the Federal Emergency Management Agency, P.O. Box 70274, Washington DC 20024.

IMPROVING SEISMIC SAFETY OF NEW BUILDINGS: A NON-TECHNICAL EXPLANATION OF THE NEHRP RECOMMENDED PROVISIONS.

Building Seismic Safety Council, 1986. 64 pp. FEMA Publication # 99 (Earthquake Hazards Reduction Series 20).

U.S. Geological Survey

CIRCULAR 971

Strong-motion program report. January-December 1983. R.L. Porcella, editor. 57 pages. No charge

OF 86-0285A

Catalog of first motion focal mechanisms, 1981- 1983, Volume 1, R.E.Needham 272 p. $37.50 paper,$4 fiche

OF 86-0285B

Catalog of first motion focal mechanisms, 1981- 83, Volume 2,R.E.Needham, $41 paper;$4 fiche
OF 86-0285C

Catalog of first motion focal mechanisms, 1981-1983,Volume 3,R.E.Needham,$36.50paper;$4 fiche

(Information on obtaining the above publications is available from the USGS,Public Inquiries Office, 8105 Federal Building, 125 South State, SLC, Utah 84138 801-524-5652)

R.E. ANDERSON AND T.P. BARNHARD

Genetic relationship between faults and folds and determination of Laramide and neotectonic paleostress, western Colorado Plateau-transition zone, central Utah. TECTONICS, v.5, no.2, April 1986, p. 1012-1023.

HEATON. T.H. AND S.H. HARTZELL

Source characteristics of hypothetical subduction earthquakes in the northwestern United States. Bulletin of the Seismological Society of America v.76,no.3, June 1986. p. 51- 62.

Announcenments from National Geophysical Data Center

The following may be ordered from:

National Geophysical Data Center
NOAA, Code E/GC4, Dept. LUC
325 Broadway
Boulder, Colorado 80303

PUBLICATIONS AVAILABLE...

EARTHQUAKE HISTORY OF THE UNITED STATES...catalog of all important U.S. earthquakes of historical record. Contains descriptions of each tremor,regional tables listing locations,affected areas,Modified Mercalli intensities for the period 1611-1980 $10.00

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SIGNIFICANT EARTHQUAKES WORLD MAP, 1900-79.. 54 X 41 inches, 1:32,000,000. Shows location of 1,277 significant earthquakes. $10.00

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EARTHQUAKE DAMAGE...GENERAL (color)..illustrates several kinds of effects caused by 11 earthquakes in 7 countries.

EARTHQUAKE DAMAGE, SAN FRANCISCO, CALIFORNIA, APRIL 18, 1906 (BLACK & WHITE)...includes a panoramic view of San Francisco in flames, damage scenes.

EARTHQUAKE DAMAGE, MEXICO CITY, SEPTEMBER 1985..(COLOR) different types of damaged buildings,structural failure.

EARTHQUAKE DAMAGE TO SCHOOLS...(B/W,COLOR)..13 destructive earthquakes in 7 countries from 1886 to 1980.

Continued on page 7

UTAH EARTHQUAKE ACTIVITY

By Ethan D. Brown

UNIVERSITY OF UTAH SEISMOGRAPH STATIONS
DEPARTMENT OF GEOLOGY AND GEOPHYSICS

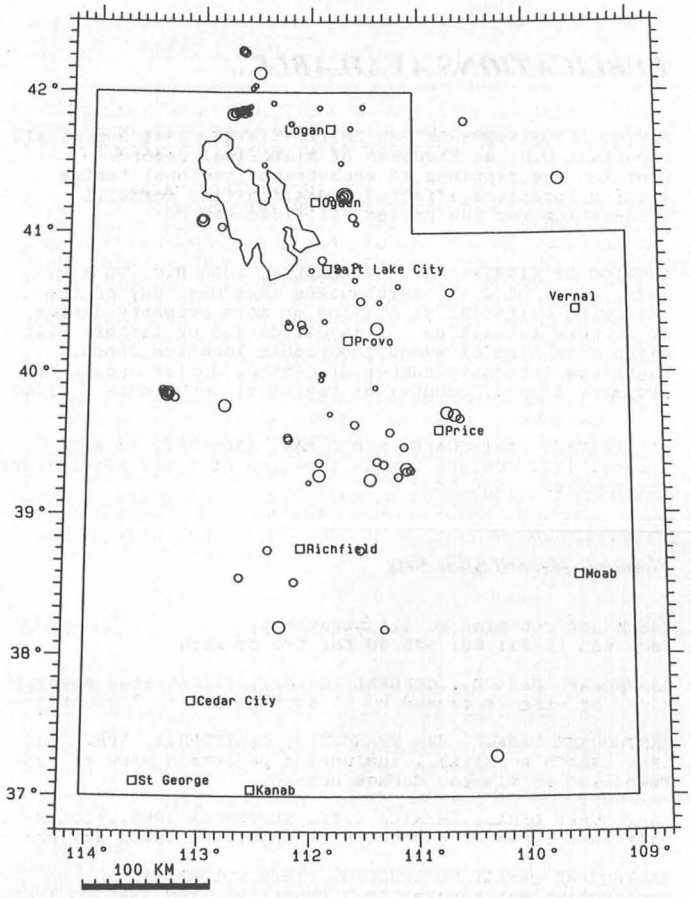
The University of Utah Seismograph Stations records an 81-station seismic network designed for local earthquake monitoring within Utah, southeast Idaho, and western Wyoming. During April 1 to June 30, 1986, 100 earthquakes were located within the Utah region including 18 greater than magnitude 2.0. The epicenters shown in Figure 1 reflect typical earthquake activity scattered throughout Utah's main seismic region. The largest earthquake during this time period, M_L 3.6, occurred about 25 km east of Ogden, Utah, on June 5. Although this earthquake was close to a populated area it was not reported felt.

Three clusters of epicenters in Figure 1 warrant mention. A cluster of nineteen earthquakes ($M_L \leq 2.3$) north of the Great Salt Lake occurred between April 5 and May 11. Spatial clusters in this area are common and have been observed since the 1975 Pocatello Valley earthquake. A cluster of five events located 25 km east of Ogden represents a sequence associated with the magnitude 3.6 earthquake mentioned above. All earthquakes in this group occurred on June 5, except for one preshock which occurred on May 24. A cluster of eight earthquakes ($M_L \leq 2.8$) shown in west-central Utah occurred between May 8 and May 28.

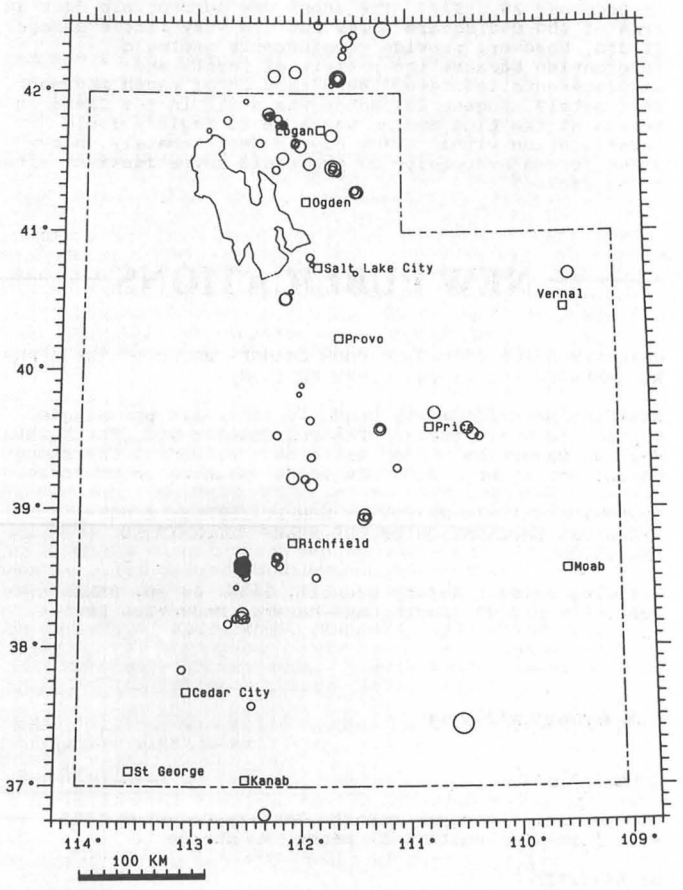
The University of Utah Seismograph Stations records an 81-station seismic network designed for local earthquake monitoring within Utah, southeast Idaho, and western Wyoming. During July 1 to September 30, 1986, 106 earthquakes were located within the Utah region, including 41 greater than magnitude 2.0. The epicenters shown in Figure 1 reflect typical earthquake activity scattered throughout Utah's main seismic region. The largest earthquake during this time period, M_L 4.0, occurred on August 22, and was located 32 km southeast of Bullfrog Basin in southern Utah. This earthquake was not reported felt, probably because the epicentral area is sparsely populated. In the northern part of the report area two earthquakes were felt during the July - September period. The first felt, M_L 3.2, event occurred on August 29 about 40 km north of Logan, Utah, and was felt in Preston, Idaho. The second earthquake, M_L 3.5, occurred on September 19 about 35 km northeast of Ogden, and was felt throughout southern Cache Valley.

Besides small clusters of earthquakes associated with the two described felt earthquakes, Figure 1 shows a significant cluster of activity 50 km southwest of Richfield. Activity there began on July 24 and continued intermittently to the end of the report period by which time a total of 18 earthquakes $M_L \leq 3.1$ had been located. These events are located near the Roosevelt geothermal area, although at this time it is uncertain whether or not the activity is related to the geothermal field.

April through June 1986



July through September 1986



MAGNITUDES

6.0+ 4.0+ 2.0+ 1.0+ 0.+

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

Searching for Earthquakes??????

EARTHQUAKE DATA SEARCH...Global file; 500,000 events 1897-1986, plus damaging events prior to 1897. Data retrievals are by .....geographic area...time period....magnitude range/depth....maximum intensity.

SIGNIFICANT EARTHQUAKE SEARCH...Global file; 2,500 destructive earthquakes, 2000 BC to 1986. Data retrievals are by....geographic area....dollar amount of damage....time period....number of deaths.

EARTHQUAKE EFFECT SEARCH...United States file; 140,000 intensity observations, 1638-1982 for 21,000 earthquakes. Data retrievals are by.....geographic area...city or state name...time period...intensity range.

$125 per data search, prepaid

Strong-Motion Earthquake Data

The Strong-Motion Earthquake Data Base at the National Geophysical Data Center/World Data Center-A holds the most significant strong-motion digital and analog records recorded worldwide. It now contains data on about 365 earthquakes from 1933-1986 that occurred in 16 different countries or island groups.

Strong-motion instruments record the horizontal and vertical acceleration of potentially damaging earthquakes. These instruments are triggered only by earth acceleration that is above a specific level (usually 2 percent of gravity). In contrast, observatory seismographs have magnifications of as much as 1 million and commonly record moderate earthquakes occurring throughout the world.

Most of the strong-motion records are available in digital format on 9-track magnetic tape at a density of 1,600 bpi; however, other tape densities are available on request. Please call 303-497-6591 (FTS 320-6591) for information on specific earthquakes and data formats, including floppy disks.

Listed are a few of the abstracts from the Hazards Workshop that will be of interest to FORUM readers. Up to six abstracts may be ordered at no cost; six to 12 cost $3.00, complete workshop packet is $10.00. Send all orders to: PUBLICATIONS CLERK, NATURAL HAZARDS OBSERVER, BOX 482, UNIVERSITY OF COLORADO, BOULDER, COLORADO 80309

Abstracts of Research in Progress

NR86-5 SEISMIC DESIGN GUIDELINES FOR ANY DATA PROCESSING FACILITIES AND SYSTEMS. R.A. OLSON, VSP ASSOCIATES

NR86-9 EMERGENCY EVACUATION PLANNING FOR DAM FAILURES. J. SORENSON AND D. NEAL, OAK RIDGE NATIONAL LABORATORY

NR86-16 DECISIONS AND NATURAL/TECHNOLOGICAL HAZARDS. T. EARLE, BATTELLE SEATTLE RESEARCH CENTER

NR86-19 EARTHQUAKE HAZARDS REDUCTION AND LAND USE PLANNING. P. BERKE, J. HINOJOSA, TEXAS A & M UNIVERSITY

NR86-22 LOCAL ECONOMIC EFFECTS OF NATURAL HAZARDS. T. DICKERT, UNIVERSITY OF CALIFORNIA

Abstracts of Research Completed

RC86-6 EVALUATION OF MITIGATION STRATEGIES FOR DISASTER EVENTS. P. GORDON, UNIVERSITY OF SOUTHERN CALIFORNIA

RC86-12 ATTITUDES AND ATTRIBUTES OF INFLUENTIALS IN EARTHQUAKES AND OTHER NATURAL HAZARD POLICY PROCESSES. E. MITTLER, UNIVERSITY OF SOUTHERN CALIFORNIA

RC86-15 REDUCING NONSTRUCTURAL EARTHQUAKE DAMAGE: A VIDEOTAPE FOR SCHOOLS. R. REITHERMAN, THE REITHERMAN COMPANY

Abstracts of Hazard Programs and Projects

PP86-5 WHAT HAVE WE LEARNED FROM MEXICO CITY? L. McCOY, NATIONAL ASSOCIATION FOR SEARCH AND RESCUE.

PP86-12 NATURAL HAZARD RISK ASSESSMENT AND DISASTER MITIGATION PILOT PROJECT. S. BENDER, ORGANIZATION OF AMERICAN STATES/DEPARTMENT OF REGIONAL DEVELOPMENT.

PP86-13 SUCCESSES OF THE NEW INTERAGENCY HAZARD MITIGATION TEAM. R. FREITAG, FEMA/REGION X

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