

The Editor AEES Newsletter
Kevin McCue
AGSO, GPO Box 378
Canberra ACT 2601
e-mail kmccue@agso.gov.au
fax: 61 (0)2 6249 9969



AEES is a Technical Society of the
Institution of Engineers Australia,
IEAust and is affiliated with the
International Association for
Earthquake Engineering, IAEE

1/99

AEES Newsletter

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President's Perambulations

There are many professional (and other) organisations and societies vying for your time and energy and we appreciate your decision to be a member of AEES. The Executive intends to continue to work hard to meet your needs and interests and values your feedback as to how this might be achieved most effectively.

I have received permission from the President of the Earthquake Engineering Research Institute, USA to use their recently adopted Mission Statement as a basis for formulating our own if members so agree. It seems to me that the statement encapsulates in a succinct but comprehensive manner the purpose of any national earthquake engineering society. I have reproduced it below with 'AEES' substituted for 'EERI'.

The objective of [AEES] is to reduce earthquake risk by advancing the science and practice of earthquake engineering, by improving understanding of the impact of earthquakes on the physical, social, economic, political and cultural environment, and by advocating comprehensive and realistic measures for reducing the harmful effects of earthquakes.

Please let me know what you think:

Fax 07 3368 9229
E-mail bill.boyce@halliburton.com

I wrote recently to the Premier of Queensland expressing concern about Queensland's substandard seismic network, emphasizing the need for an adequate earthquake program in the interest of public safety, and requesting that appropriate funding be provided to allow the program to continue and be improved. In his reply on behalf of the Premier, the Chief of Staff indicated that the Premier noted in particular the importance of earthquake monitoring and the implications for people of Queensland in the event of

a significant seismic event and gave an assurance that the budget submission will receive full and proper consideration within the Government's budget deliberations.

In closing let me congratulate our founding President and life member, Charles Bubb, on his election as an Emeritus Member of the Civil College of IEAust and also on the publication of his 1998 keynote address to the AEES Conference in the Bulletin of the New Zealand Society for Earthquake Engineering, March, 1999.

I look forward to seeing you at our 1999 Annual Conference in SYDNEY.

Bill Boyce

Your Society - AEES

Executive:

President: Bill Boyce¹
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Treasurer: Dr Steven Jaume²
Immediate Past President: Prof Graham Hutchinson³

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Michael Neville (NSW)
Dr Mike Griffith (SA) and
Kevin McCue (ACT)

¹ Kinhill Pty Ltd, Brisbane, Qld

² QUAKES, University of Queensland

³ Civil & Environmental Engineering, Melbourne Uni

AEES AGM/Conference 1999 - SYDNEY

Our Society's next AGM will be held in Sydney and hosted by Professor Steve Bakoss and Professor Bijan Samali at the Centre for Built Infrastructure Research located at the Australian Technology Park, University of Technology Sydney Broadway, NSW.

Proposed dates for the meeting 29 - 30th September. The theme of the conference '10th anniversary of the Newcastle earthquake'. Apologies for late notice but please send abstracts now to Barb Butler (see top p5 or b.butler@eng.unimelb.edu.au).

The Society Website/email list
Vaughan Wesson

Dear AEES Members,
The AEES web site is at "www.aees.org.au". Details of the 1999 AEES Conference will be added as they become available.

We are always looking for suggestions on other things to be included such as:

- copies of this newsletter
- details about relevant up coming conferences
- details of interesting recent publications
- significant research projects in earthquake engineering (in Australia?)
- links to other relevant Web sites

What other things do *you* think could be included?
The Australian Earthquake Engineering Society email list is operated by the Seismology Research Centre, Melbourne. If you would like to register or contribute to the development of the Web site please notify Vaughan Wesson by email at "vaughan@seis.com.au"

Cheers, Vaughan Wesson

**NUGGETS FROM THE NEWSGROUP -
A REGULAR FEATURE BY
CHARLES BUBB**

*Midwest's Earthquake Hazard Lower Than Thought,
Satellite Data Show*

EVANSTON, Ill. --- The risk posed by large earthquakes in the Midwest's New Madrid seismic zone to cities such as Memphis and St. Louis is much lower than previously thought, according to a new study that used the Global Positioning System (GPS) satellites to track the motions of the ground in the seismic zone.

The results, published in the April 23 issue of the journal *Science*, suggest the National Seismic Hazard maps, prepared by the U.S. Geological Survey to determine the appropriate level of earthquake-resistant construction, should be revised to reflect lower estimates of earthquake risk in the area. High hazard estimates could in the future lead to higher costs for new construction.

"There is an earthquake hazard there - it's not zero - but it's much lower than the maps say," says Seth Stein, professor of geological sciences at Northwestern University, who led the study. "The current hazard map says parts of the Midwest are more dangerous than L.A. or San Francisco. Most geologists would say that's unlikely, and that's exactly what our new data show."

Until now, it has been assumed that large earthquakes like those that struck the New Madrid area in 1811 and 1812 were magnitude 8 events, which should recur every 500 to 1,000 years. Because the hazard maps used this model, Stein said, the assumed seismic hazard in the mid-continent is quite high, in some ways higher than in California. The predicted peak

ground motion for the NMSZ exceeds that in Los Angeles, and the area of peak ground motion predicted in the NMSZ is larger than for either Los Angeles or San Francisco.

A different picture emerges from the new study, which was conducted by geologists from Northwestern University, the University of Missouri, the University of Miami and Grand Valley State University, with funding from NASA and technical assistance from the University NAVSTAR Consortium, a national consortium of universities supporting GPS research. Using GPS, the tiny movements of a network of geodetic markers in Missouri, Tennessee, Illinois, Arkansas and Kentucky were tracked since 1991 to accuracies of less than an inch.

"The results show little or no motion across the seismic zone," said Timothy Dixon, professor of marine geology and geophysics at the University of Miami, whose group processed the GPS data. "GPS sites all over eastern North America also show little if any motion across the seismic zone."

The small -- or zero -- motion observed implies that it would take a very long time to accumulate the stress needed to generate large earthquakes.

"More than 2,500 years would be needed for a future magnitude 8 earthquake, and at least 1,000 years would be needed before a future magnitude 7 earthquake," said Stein. Because magnitude 7 earthquakes are 10 times smaller than magnitude 8 earthquakes, the largest earthquakes in the New Madrid Zone are either 10 times smaller than assumed in the hazard maps or will occur much less frequently, he said.

The study also includes a new analysis of the earthquake history of the area, which agrees with the GPS data. In the 1950s, seismologists noted that in a given area, the time between earthquakes of a given size is about 10 times longer than the interval between earthquakes one magnitude smaller.

"Since 1816, the New Madrid zone has had earthquakes with magnitude greater than 5 about every 10 years, and earthquakes with magnitude greater than 6 about every 100 years," said Andrew Newman, a Northwestern graduate student and lead author on the new study. "So magnitude 7 earthquakes should occur about every 1,000 years, and magnitude 8 earthquakes should be about 10,000 years apart."

Earlier studies showed that earthquakes similar to those in 1811 and 1812 occurred in about 900 A.D. and 1300 A.D., said Joseph Engeln, professor of geological sciences at the University of Missouri.

Although these earthquakes have been thought to be magnitude 8 earthquakes, said Engeln, who was also an author on the study, "the GPS data and the earthquake history, together with fact that these were about 500 years apart, make it likely that the earlier earthquakes were smaller, probably magnitude 7."

(continued page 4)

The new results illustrate that estimates of seismic hazard in the area, such as the Seismic Hazard map, should be reduced, said Stein. "It will be important to assess how these new ideas might modify estimates of the expected building damage and financial loss from future earthquakes." Such estimates, he said, depend not only on the size of expected earthquakes, but also on the specifics of building construction and local geology.

The GPS results give important new insight not only into earthquake hazards in the Midwest, but into the fundamental mystery of why earthquakes occur in this region at all, Stein said.

"The New Madrid seismic zone is in the center of the North American plate," Stein said. "It's easy to see how earthquakes occur along the San Andreas fault; that's the boundary between the moving Pacific and North American plates. But it's hard to see why they occur within the plate." The GPS data, he said, show that the North American plate is "amazingly rigid." On average, parts of eastern North America move relative to each other by less than 1/25 of an inch per year. Somehow, this tiny motion adds up over geologic time to cause large earthquakes."

One intriguing possibility is that large New Madrid earthquakes may never happen again. This possibility is suggested, Stein said, by the GPS observations that little if any motion occurs today, and by the fact that the New Madrid area is very flat.

"Over time, fault motions typically build up impressive topography, as seen in the western U.S.," Stein said. "The New Madrid Seismic Zone may be a short-lived feature that turned on less than 10,000 years ago, and is now shutting off with a series of small earthquakes. We've got a lot to learn about New Madrid, but this is certainly a possibility."

Other authors on the study published in Science are John Weber of Grand Valley State University and Ailin Mao of the University of Miami. Seth Stein's homepage: <http://www.earth.nwu.edu/people/seth>

[Ed: Paleoseismological studies in Australia by Mike Machette, Tony Crone and Roger Bowman indicate that any previous large earthquakes on the Tennant Creek NT fault scarp must have occurred more than 10000 years ago. On the other hand near Echuca Victoria where large earthquake(s) offset the Murray River several thousand years ago, there is no evidence of current seismicity. This new interpretation of the New Madrid area seems to be that whilst places such as Meckering WA which have been struck by large earthquakes may be followed by higher than usual activity for several decades, they are not potential candidates for another large earthquake for several millenia.

On another matter, Gerard Fryer wrote:

Q 1 How far back do we have Richter scale data for the world?

Q 2 How far do we have other evidence of earthquakes?

Roger Musson answers:

Working in Japan, John Milne made the first practical seismograph in 1893. Before that it is just guesses, or inferences from surface effects. Richter's logarithmic magnitude scale dates to 1935, but for big earthquakes, if variation in seismometers is taken into account, it is possible to figure out magnitudes back to about 1895. What we really want, though, is moment magnitude, Mw, which involves consideration of energy at far lower frequencies than any early seismometers were capable of measuring. The best inferences of Mw from Ms, from aftershock distribution, or from surface deformation considerations, are in the Pacheco & Sykes catalog, which goes back to 1900.

"Inferences from surface effects" aka macroseismic magnitudes, can be very reliable, so long as you have good quality descriptive data. The latest Italian earthquake catalogue (the NT4.1 catalogue - <http://emidius.itim.mi.cnr.it/NT/home.html>) has excellent, consistent, numerate (ie including magnitudes) earthquake data back to about 1000AD.

One can have evidence of earthquakes in the geological record going back even before historical times. The study of such things is known as palaeoseismology. One can even estimate magnitudes from geological evidence sometimes, although this is much less accurate than using historical descriptive data. So the extreme answer to the original question is that we have some evidence of earthquakes that can be given approximate dates and approximate magnitudes for tens of thousands of years past or even longer - but such early data is sporadic and extremely incomplete.

Q 3: Does seismic activity increase or decrease in long cycles? For example, could it peak, then bottom out gradually 100 years later?

The three largest earthquakes of this century all occurred in the decade from 1955 to 1965, and there were many other big events then too. [Ed: 1957 Mw 9.1 Aleutians, 1960 Mw 9.5 Chile, 1964 Mw 9.2 Alaska]

Q 4: Was that the peak of a cycle or normal statistical fluctuation?

Dunno. The evidence for such cycles is tentative at best. I have heard claims for a long cycle in the seismicity in S China, but considering this is based on one trough and maybe two peaks, it's hardly conclusive.

The most convincing arguments are those involving specific tectonic settings, where two zones may alternately take the bulk of the seismic energy release. There is no strong evidence for any global cyclicity.

Charles

The AEES subscription year is from 1 Dec to 30 November. It is difficult and expensive to send each member an individual reminder that fees are due so please help us by sending your subscription for 1998/99 to AEES (attn: Barbara Butler, Civil and Environmental Engineering Dept, Melbourne University Parkville Vic 3052) or renew through IEAust's annual subscription system by marking AEES your preferred Society. If you change address or if you know a member who is not receiving the newsletter please advise the Secretary, many newsletters are returned.

EARTHQUAKE MODELLERS AT NOOSA - Earthquakes meet supercomputers at Queensland conference Col Lynam

Earthquake experts from around the world gathered for a special Workshop held in Brisbane and Noosa in late January and early February this year. The inaugural APEC Cooperation for Earthquake Simulation (ACES) workshop provided a forum to present and discuss the latest supercomputer simulation models of earthquake behaviour.

These include two projects which are part of a US\$400million Japanese program, known as "Earth Simulator", which aims for enhanced environmental management through supercomputer simulation of earth processes.

The Queensland University Advanced Centre for Earthquake Studies (QUAKES) was endorsed as ACES headquarters early last year at the inaugural meeting of the International Science Board.

The University's Deputy Vice-Chancellor (Research) Professor Paul Greenfield opened the workshop at 8.30am on February 1 with around 70 international scientists and a number of government agency representatives in attendance.

These include: Professor Jianmin Chen, Director of the Centre for Analysis and Prediction(CAP), China Seismological Bureau(CSB); Hisashi Nakamura, Director of the Department of Computational Science and Technology of the Japan Science and Technology Agency's Research Organisation for Information Science and Technology (RIST); and Professor Tom Henyey, Director of SCEC, the foremost earthquake centre in the United States, spanning some 20 major agencies and institutions including the US Geological Survey, UCLA, MIT, CalTech and Columbia University.

According to ACES executive director and QUAKES director, Professor Peter Mora, the realistic supercomputer simulations developed by ACES will provide a virtual laboratory for understanding earthquakes and developing forecasting capabilities.

He said ACES was important for Queensland as it offered a way of developing models to forecast and quantify the State's earthquake hazard. "Queensland is highly vulnerable to earthquakes despite previous

perceptions these were not a threat to public safety or infrastructure," he said.

"Furthermore, by hosting the headquarters of ACES in Queensland, the State is positioning itself as research leader in the Asia-Pacific region," Professor Mora said.

Further information is available from:
http://quakes.earthsciences.uq.edu.au/ACES_WS

Earthquakes in Australia, 1998, ML ≥ 4.0

Listed below and plotted p6 (with world earthquakes of magnitude 6 or more) are the magnitude 4 or greater earthquakes located by AGSO and State agencies, PIRSA, SRC, TasUni and UQ, that occurred in Australia during 1998 - not a single event of magnitude 5 or more. Each State except Tasmania had events of magnitude 4 or more. It was a quiet year following on a very active 1997.

DD	Time UTC	Lat	Long	ML	Place
February					
13	2320 51	25.70	150.62	4.0	Munduberra Qld
14	1823 34	35.37	148.60	4.2	Brindabella NSW
22	1753 44	31.52	122.16	4.0	Norseman WA
29	0350 17	12.40	139.12	4.9	G Carpentaria
March					
29	2006 45	14.28	129.28	4.0	SW Darwin NT
April					
10	0346 45	32.59	122.34	4.3	Norseman WA
May					
06	0529 33	34.15	136.88	4.3	Spencer Gulf SA
22	1901 15	34.58	147.91	4.0	Cootamundra NSW
June					
09	0100 50	27.94	135.84	4.4	Oodnadatta SA
22	0946 51	21.72	119.72	4.0	Marble Bar WA
25	0739 04	19.82	133.88	4.1	Tennant Ck NT
30	0258 22	21.25	152.65	4.1	Barrier Reef Qld
July					
17	0122 39	36.37	147.94	4.3	Corryong Vic
November					
02	0226 18	19.54	113.53	4.6	Exmouth WA
02	1709 3	22.81	151.15	4.7	Central Qld
12	1919 33	13.05	121.83	4.5	Scott Reef WA

SATELLITE DEMETER Bob Engdahl

The micro-satellite DEMETER (Detection of Electro-Magnetic Emissions Transmitted from Earthquake Regions) is a low-altitude satellite (< 800 km) with a nearly polar orbit. It will be the first scientific micro-satellite launched by CNES, the French National Space Agency. The expected launch date is mid-2001. The main scientific objectives of this project are related to the investigation of ionospheric perturbations due to seismic activity, and to the global study of the Earth electromagnetic environment.

The payload of DEMETER is composed of several sensors associated to a data processing unit and a large memory in order to record the information all around the Earth independently from a telemetry station. DEMETER will measure electromagnetic waves from DC up to 4 MHz, and plasma parameters.

The duration of the mission is two years.

Workshop purposes A workshop will focus on points related to the scientific objectives of DEMETER:

- First the workshop will provide a forum to describe new results in theory and ground or satellite observations of excitation of the ionosphere by seismic or tectonic processes, either before or after quakes and volcanic eruptions.
- Second, the workshop will discuss methods concerning statistical analysis of data recorded by a satellite or by another experiment, and which are correlated to specific events.
- Third, this workshop will bring together various groups of experimenters who will perform ground-based measurements close to seismic regions at the same time as DEMETER will be operating. These measurements may concern DC fields, electromagnetic noise in various frequency bands, ionospheric parameters, optical parameters,.... Contributions concerning Total Electron Content measurements with satellites are also especially encouraged.
- Fourth, the workshop will concern topics associated to the global electromagnetic environment of the Earth. This includes space weather, radio-communications, and particularly the ionospheric perturbations due to man-made activities.

Workshop Location The workshop will be held either in Paris or in Orleans. The final location will be given in the second Announcement.

Dates The workshop is planned to be on July 15-16, 1999 (just before the IUGG meeting in Birmingham, July 18-30). The second announcement will be issued shortly.

Sponsor: CNES There is no registration fee. All exchanges will be done by e-mail.

Michel Parrot, LPCE/CNRS, 3A, Avenue de la Recherche Scientifique, 45071 Orleans Cedex 02, FRANCE
Tel: (33) 02 38 25 52 91, Fax: (33) 02 38 63 12 34
e-mail: mparrot@cns-orleans.fr

Earthquake Prediction in China - apportioning responsibility

Our President noted that in the Time magazine of 15 February 1999 was the following comment in an article titled CHINA's RAGE: 'New regulations ensure that anyone who dares report an earthquake without official permission can now be arrested.'

We have obtained for the record a translation of the <PRC Act of Earthquake Mitigation> and have selectively extracted the following:

4: The state encourages and supports research and study on earthquake prediction to improve the standard of earthquake prediction. Those individuals and

organizations who have made contributions to the field of earthquake prediction will be rewarded.

Chapter 2 Earthquake Forecasting Report Process

5: The relevant agency within the state council and agencies within local government at and above county level should take responsibility for earthquake prediction.

6: Data and information regarding earthquakes forecasting should in the first instance be reported to government and not distributed to the general public.

No report could be given to foreign bodies except research on long and medium term earthquake trends.

Following this regulation, News reports of earthquake forecasting by the media should be based on a government proclamation.

17: If rumours of an impending earthquake circulate resulting in disturbance of normal social order, the earthquake department within the state council and local government at and above county level are responsible for taking prompt and appropriate actions to clarify the situation. Other relevant agencies should provide assistance and support.

Chapter 5 Legal Responsibility

18: Earthquake professionals who violate this regulation and disseminate an earthquake forecasting report or review of earthquake reports to the general public without approval will be dealt with by administrative disciplines.

19: Anyone who violates this regulation and circulates rumours about earthquakes and disturbs the normal social order will be dealt with according to the civil administrative regulations.

20: Those who violate this regulation and provided reports of earthquakes to foreign countries will be warned by the earthquake department of state council and will be disciplined by his/her working unit according to the consequence of his/her act.

21: Government employees who work as earthquake professionals and who are negligent of duty, committed crime and will be dealt with by criminal responsibility. If the negligence is not severe enough to become criminal activity, he/she will be given administrative punishment.

Forthcoming Conferences

- (Flyers for some conferences are available from Ed)
- **1999, 4-9 July Sydney NSW.** XIX Pacific Science Congress, University of New South Wales. e-mail reply@icmsaust.com.au
 - **1999 18-30 July IUGG Birmingham, England**

Further information about IUGG 1999 can be found on the World Wide Web at <http://www.bham.ac.uk/IUGG99/>

Convenors: Barry Parsons, Department of Earth Sciences, University of Oxford, Parks Road, Oxford OX1 3PR, UK
 Fax: 44-1865-272072, Phone: 44-1865-272017
 Email: Barry.Parsons@earth.ox.ac.uk
 Robert Reilinger, Department of Earth, Atmospheric, and Planetary Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139 USA
 Fax: 1-617-253-6385, Phone: 1-617-253-7860
 Email: reilinge@erl.mit.edu

1999 29 - 30th September 1999 AEES CONFERENCE

Abstracts/Papers are invited now for our annual conference. The venue has yet to be chosen but our generous hosts at UTS will no doubt provide an excellent facility and tour of their shake table, perhaps the largest in the country.

Newcastle is the theme - what have we learned/implemented in the last 10 years in Australia about the threat; ground shaking to structural performance, response to risk management. Will we perform better next time?

The Newcastle earthquake was after all the trigger for the establishment of our Society.

• 1999 SDEE'99, 9-12 August Bergen Norway: 9th International Conference on Soil Dynamics and Earthquake Engineering

The Ninth International Conference on Soil Dynamics and Earthquake Engineering (SDEE '99) is hosted by the University of Bergen in collaboration with the Norwegian Association for Earthquake Engineering.

Information regarding registration, accommodation and abstract submission can be obtained from the SDEE'99 Home Page at:
<http://www.ifjf.uib.no/seismo/sdee99.html>

1999, 1-3 November Australian Disaster Conference Disaster Prevention for the 21st Century
 Canberra, 1-3 November 1999
 National Convention Centre
<http://www.ema.gov.au/conferencefr.htm>

• 2000, 30 Jan - 4 Feb, 12th WCEE/PCEE Auckland New Zealand..

NEW (& OLD) BOOKS / REPORTS
 Focus on Australia

- Australian Seismological Report - 1996**
 Annual Reports from 1980 available from the AGSO Sales Centre
 ph: 06 249 9519, fax: 06 249 9982
- The Meckering and Calingiri earthquakes October 1968 and March 1970**
 Geological Survey of WA Bulletin 126
- The Cadoux earthquake 2 June 1979**
 Geological Survey of WA Report No 11

- Price \$31 and \$12 respectively. Postage \$10
 GSWA Cnr Adelaide Tce and Plain St Perth, 6000
 Phone (08) 9222 3333
- Acceptable Risks for Major Infrastructure. Eds P Heinrichs and R Fell, Balkema 1995. Proceedings of the Seminar on Acceptable Risks for Extreme Events in the Planning and Design of Major Infrastructure. Sydney NSW Australia, 26 - 27 April 1994.
- Report on the January 17, 1995 Great Hyogo-Ken Nambu (Kobe) Earthquake. Lam Pham & M Griffith. CSIRO DBCE 95/175(M).
- Isoseismal Atlas of Australian Earthquakes - Part 3 AGSO Record 1995/44, \$50 + pp. AGSO Sales Centre phone: 06 249 9519, fax: 06 249 9982
- Fundamentals of Earthquake Prediction by Cinna Lomnitz: John Wiley & Sons.
- The Geology of Earthquakes by R.S. Yeats, K.E. Sieh, and C.R. Allen: Oxford University Press, 576 p., price \$65.00.
- Paleoseismology, edited by James P. McCaLpin. Academic Press, 576 p., price \$89.95.
- Earthquakes and Geological Discovery by Bruce Bolt. W H Freeman and Co., 1993.
- Risks and Realities, Centre for Advanced Engineering University of Canterbury, Christchurch New Zealand. This book mainly presents the results of an investigation into the vulnerability of lifelines serving metropolitan Christchurch.

**WCEE 2000
 AUCKLAND NEW ZEALAND**

Please Note: The New Zealand National Society for Earthquake Engineering will host the next World Conference on Earthquake Engineering in Auckland
 30 January - 4 February 2000.

**SPECIAL OFFER ON
 CONFERENCE PROCEEDINGS**

Complete the form below and send to Barbara Butler:
 fax: 03 9348 1524
 Please send me the following publications at the special price listed, plus postage.

- Proceedings of the 1992, 1993 and 1994 Conferences \$20.00 / pack of three
- Proceedings of the 1995 Pacific Conference on Earthquake Engineering 3-Vol \$90.00 per set
- Adelaide Conference 1996 \$12 +p&p
- Brisbane Conference 1997 \$12 +p&p
- Perth Conference 1998 (limited no.) \$30 + p&p

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