The Editor AEES Newsletter
Kevin McCue
AGSO, GPO Box 378
Canberra ACT 2601

fax: 61 (0)6 249 9969

AEES is a Technicalal Society of IEAust
The Institution of Engineers Australia

3/96

AEES Newsletter

Contents

Proceedings of the Pacific Conference on Earthquake Engineering held in Melbourne in November 1995 are available from Barbara Butler, Melbourne Uni, phone 61 3 9344 6712, fax 61 3 9348 1524.

The 1996 AEES AGM and Technical Seminar

The 1996 AGM and Technical Seminar of the Society will be held in Adelaide at the University of Adelaide campus.

The Seminar will run from 1:00pm to 5:00pm on Thursday, October 3 and from 8:30am to 1:00pm on Friday, October 4. Late registration will be held on campus from 11:30am on October 3.

The AGM will be held on the Thursday, starting at 5:15pm.

The Seminar Dinner will be held at the Magill Estate Restaurant on Thursday evening, October 3 (7 for 7:30). The restaurant, open less than 12 months, has already earned a reputation as being one of Adelaide's finest dinner venues, having won numerous culinary ands architectural awards. It is located at the foot of the Adelaide Hills on the grounds of the Penfold's Magill Estate Winery and offers superb views of the city. Seating for the dinner is strictly limited. In the event that demand for dinner tickets exceeds capacity, preference will be given to full seminar registrants on a first-come, first-served basis.

The Seminar Theme is "AS1170.4 - 3 years on: How is it working and what have we learned?" and is supported by our keynote speaker, Dr. Andrew Whittaker who is Associate Director of the Earthquake Engineering Research Centre at the University of California, Berkeley. Andrew Whittaker, an honours graduate from the University of Melbourne, worked for 7 years as a consulting engineer in Melbourne, Adelaide and Singapore with Connell Wagner before moving to Berkeley where he completed his PhD in 1988. He then worked with Forell Elsesser and Associates in San Francisco before taking up his current position at the University of California, Berkeley. His substantial design experience in Australia and outstanding academic background make him the ideal speaker for this year's seminar where he will speak on the development of the next generation of seismic design codes which is now underway in the US.

The technical program of 4 sessions will consist of paper presentations covering the seminar themes of Earthquake Codes, Earthquake Insurance, Unreinforced Masonry Construction and Seismology. The program has generated strong interest in Australia and New Zealand from representatives of the consulting, local government, constructiong, building services, insurance and seismology sectors.

The committee believes that the state-of-the-art information provided in the 8 hours of presentations represents outstanding value for money and encourages all members of the Society to attend.

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WCEE 2000 AUCKLAND NEW ZEALAND

The New Zealand National Society for Earthquake Engineering were successful in their bid at the recent WCEE in Acapulco to hold the next World Conference on Earthquake Engineering! The venue will be Auckland. Congratulations from the AEES!

In his letter of 3 August to Professor Graham Hutchinson, the NZNSEE President Professor Euan Smith advised that at the recent Management Committee meeting it was decided to amalgamate the PCEE and 12 th WCEE and hold the next stand-alone PCEE in 2003.

The steering committee for the 12th WCEE has already met and Euan expressed the hope that a larger than usual number of Australian earthquake engineers would attend the 2000 WCEE. The AEES executive endorses that hope. The contemperaneous Americas Cup challenge may help boost numbers.

There were jut six Australians at the 11 th WCEE in Acapulco Mexico including Kevin McCue, Gary Gibson, Robin Chowdhury, Jack Rynn and two expatriots now living in America; Paul Somerville and Paul Richards.

A Recent Strong Australian Earthquake

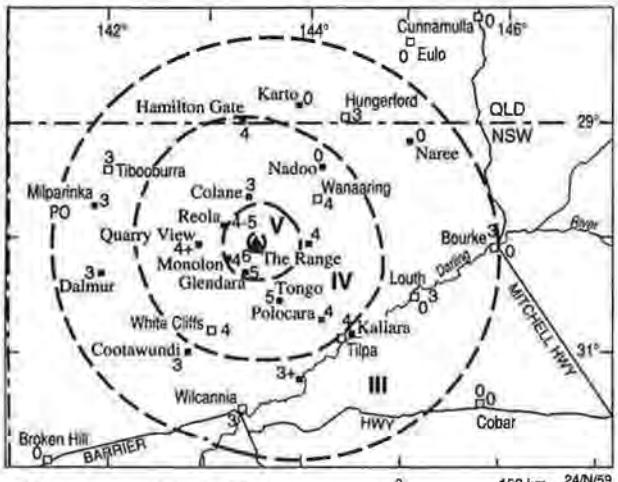
On 13 August last at 2:30 pm the earthquake warning system alerted seismologists at AGSO and SRC that a strong Australian earthquake had occurred. The earthquake epicentre was quickly located with data from the National Network, and Antarctica where it was recorded, telemetered in real time into the AGSO Office in Canberra. The epicentre was about 200 km west of Bourke NSW, in the least populated part of the State. No damage was reported, local station buildings are wood frame, clad with cement sheeting and iron roofs.

The computed magnitude averaged ML 5.1, only a smidgen smaller than the August 1994 Cessnock NSW earthquake.

After two days it became apparent that numerous aftershocks were happening, the largest ML 4.5, so AGSO's Dr Malcolm Somerville departed Canberra with five seismographs and an accelerograph. Near White Cliffs he linked up with Tony Corke from SRC and together they installed the instruments around the computed epicentre. They inspected a disused homestead on concrete footing which had suffered differential settlement so that the doors no longer shut - the only known damage.

As of 17 September the sequence has decreased to fewer than one microearthquake per day.

Questionnaires were distributed by the Bourke NSW SES and in addition intensities were solicited by AGSO, UQ and RMIT seismologists by phone to draw up the following map. The approximate route of the natural gas pipeline from the Cooper Basin SA to Sydney crosses the map from NW to SE within about 30 kmof the epicentre. Gas flow was not affected.



DATE: 13 AUGUST 1996
TIME: 04:30:11.3 UTC
MAGNITUDE: ML 5.1, mb 4.9
EPICENTRE: 30.08±(0.06)°S, 143.53±(0.06)°E

▲ *Epicentre*
IV *Zone intensity designation*
4 *Earthquake felt (MM)*
0 *Earthquake not felt*

On Risk

Extracted from EOS Vol 77 No 28 July 9, 1996
Book review: Engineering Risk Analysis of Water Pollution: Probabilities and Fuzzy Sets by Jacques Ganoulis, VCH Weinheim. Reviewer Slobodan P. Simonovic.

Risk addresses three questions:

What can go wrong?

What is the likelihood that it will go wrong?

What are the consequences?

To manage risk over time the following questions must also be addressed:

What can be done?

What options are available?

What are their associated trade-offs in terms of costs, benefits and risks?

What are the impacts of current management decisions on future options?

The book's author describes how to analyse risk using both the stochastic approach (where there is a large data set) and fuzzy set theory (where there is limited data or where statistical analysis fails). One of the book chapters covers the topic: fuzzy set theory for engineering risk analysis which is, according to the reviewer, one of its strengths. There should be a big market for this information in Earthquake Engineering.

Nuggets from the Newsgroup ..... an Occasional Feature by Charles Bubb

Previously, I have mentioned that IEAust provides a system called Engineering OnLine.

At my request on behalf of the Society, EOL provides access to one of the Usenet NewsGroups called "sci.geo.earthquakes". This newsgroup is currently available to anyone with basic access to the Internet worldwide for discussion of any topic related to the title. Usually I scan this newsgroup most days panning for gold in the way of useful information, ideas and any item that might be of interest to AEES.

There is a regular weekly report from USGS which concentrates on the USA but it does have a small section on Planet Earth. Usually I extract this and post it on to the Earthquake Folder in the EOL system. This is a Folder in the Societies Section of EOL which we have had established on EOL for all IEAust members interested in earthquakes and of course especially those who are also AEES members.

There is of course a lot of stuff from and about people trying or pretending to predict earthquakes and other disasters and I can now pick most of that which is rubbish, without actually having to read it.

There are also long discussions about matters which are not germane to us for various reasons, for example a current thread is on "slow earthquakes". Probably this does not interest us as intraplate dwellers, but it is still a good read.

Now and then the panning produces a "nugget" and with the help of the HonEditor one is reproduced below. This has been heavily cut back from a long item which was in the format of an FAQ, (frequently asked questions) prepared by, among others, USGS staff answering queries from the concerned public

about earthquake matters including of course questions about predictions. We thought it worth publishing it here for you. Please let us know what you think of it and if you would like to see more, either here or posted on to EOL in the Earthquakes folder or both.

I hope to see you all in Adelaide and I will have some information with me about EOL for you courtesy of IEAust. See you there and if you want to contact me at any time my email address with EOL is "Charles_T.J._Bubb@ieaust.org.au"

Cathy Smither (PhD, Caltech) asked that this post be dedicated to Alfred Wegener. A source for most general questions about earthquakes is the classic reference work on the subject:

Elementary Seismology by Charles F. Richter
W. H. Freeman Publishers 1958

Although this text was published before the theory of plate tectonics, it is quite readable by the general public (the extensive math being in the Appendix). It covers earthquake dynamics, questions like animals, weather, etc.

Some frequently asked questions on earthquakes:

On prediction: earthquakes happen practically everyday around the world. Any prediction must have epicentre date and time and magnitude. Richter specifically wrote: Amateur predictors are legion, and will continue to be, so long as it is an easy way to get one's name into the newspaper. Many of them are honestly self-deceived; they usually have

(1) no concept of the frequency of small earthquakes (100,000 a year is a good figure to think of, although it needs definition in terms of the lower limit of the magnitude included),

(2) no means of knowing what earthquakes have occurred or how large they are, beyond mention in the press and the space allotted there, and

(3) no effective training in scientific thinking. Some "predictors" select a large number of quakes through the year and then claim as predicted anything which happens within a few days of any such date – so that the earthquakes of half the year or even more are called in as "verification."...Predictions based on positions of the sun and moon have to be regarded a trifle more seriously, since there is evidence that tidal forces may occasionally act as triggers for earthquakes otherwise on the point of taking place; in this way the date and hours of occurrence may show a slight statistical correlation with the tides. (Richter p 386)

On earthquake preparedness.

+Preparing your home to prevent property damage and injury from falling objects (e.g. bolting houses to foundations, securing water heaters and bookcases, NOT having your bed under a window).

+Knowing what to do during (get under a doorway or desk, DO NOT run outside)
and after an earthquake (Do you know how to turn off your utilities?).

+Try to stay off of the telephone except in extreme emergencies. Emergency services personnel need the lines for disaster assistance. To contact family, set up a contact person in another city whom everyone can call. Calls out are given preference over calls into the damaged region.

+Learn First Aid and Remember to

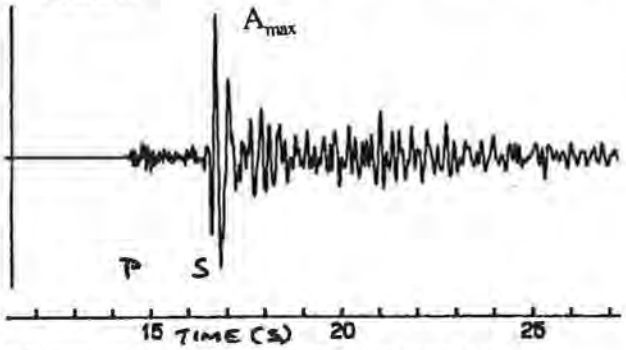
Stop Think Observe Plan

Q - Is the magnitude the magnitude of the total energy released, or the amount of shaking at it's worst point?

A. In short, Richter magnitude is none of the above.

Richter's definition of the local magnitude scale came about because he was looking for a quantitative way to compare earthquakes, based on instrumental recordings rather than statements of 'the quake felt like XX to me here'. Basically, he wanted to be able to say, based on instrumental recordings, 'This earthquake here on this date was larger (or smaller) than this earthquake over there on this other date.'

Richter borrowed the idea of a magnitude scale from astronomers, who use such to classify the brightness (either apparent or absolute) of stars. What he did was to define a magnitude scale based on the distance to the quake and maximum amplitude of that quake as recorded on the photographic Wood-Anderson instrument.



Seismogram of a small earthquake near Robe SA

Here's how it works: You have an earthquake and you have a Wood-Anderson instrument at some distance from that earthquake. You locate the quake and calculate the distance in kilometres from your instrument to the quake's location (or use the S - P time). Next, you get out your Wood-Anderson record and your ruler and measure the maximum amplitude of the earthquake's recording on that instrument. The formula for determining the Richter magnitude of an earthquake is:

$$ML = \log_{10}(\text{max. amplitude}) - \log_{10}(A_0)$$

The term $-\log_{10}(A_0)$ is a correction for the distance from the quake to the instrument, and is designed so that an earthquake 100 kilometres from your station will have a maximum amplitude of 1 millimetre if the quake's magnitude is 3.0. The important thing to note here is that that number, ML = 3.0, is completely arbitrary. Richter could have defined it to be anything he wanted it to be -- 0.0, 1.0, 10.0, whatever.

You have now read the maximum amplitude (in mm) from your record and have determined the distance from the quake to your location, so now you look up the distance correction factor, take the log (base 10) of the max amplitude, add those two numbers together, and you have your Richter magnitude.

Now, several important things about Richter magnitude:

1) Richter magnitude is physically meaningless. The Richter magnitude is based solely on how a specific type of instrument responds to the motion of a quake, and tells you nothing about the physical quake itself. But this is OK, because, and this is critical to keep in mind, the ONLY reason for having the Richter Scale is to have an objective means of comparing two quakes. It is NOT an inherent thing of quakes -- it is an arbitrarily designed scale created by Richter for his convenience.

There have been several papers written which attempted to find an equation linking energy release and Richter magnitude or any of several other physical parameters to Richter magnitude, but these are all EMPIRICAL relationships, not something inherent to the scale itself.

2) Richter magnitude is inaccurate, particularly for large quakes. This is due to the fact that, as quakes get larger, they release more and more energy into the ground, and this will eventually overwhelm the recording device's capabilities. For the Wood-Andersons, this happens at about ML=6.5 or so.

3) Richter magnitude does NOT depend on how people felt the quake. Posts on earthquakes often contain the statement, 'I am in city XX, and it felt like a YY. What was it in city ZZ?' These people are NOT describing magnitude. They are describing intensity -- in other words, how the quake affected people or objects near them. Intensity varies widely with distance, what the person was doing at the time, and what kind of soil were they on. Other factors enter into it, such as what kind of building they are in and how sensitive they are.

Magnitude, on the other hand, uses only distance and amplitude. From station A at a distance of, say, 20 km from the quake, we might get an ML=4.2, while at station B at a distance of, say, 100 kilometres in the other direction from the quake, we might get an ML=4.4, and at a third station at 50 km and along a third azimuth, we might get an ML=4.1. The magnitude for the quake would be given as a 4.2, and that would be it.

The intensity might vary drastically from place to place and distance to distance, but the magnitude would not.

4) Little differences in magnitude are meaningless. These little differences, such as those between AGSO and RMIT, are caused by two major factors. First, slight differences in the methods and instruments used to measure Richter magnitude, and second, variations in the earthquake's energy release (i.e. more energy might go north than would go south, which would cause the northern stations to give higher magnitudes than average, while southern stations might give lower than average magnitudes) as well as variations in the earth's crust. They are also due to slight differences in reading techniques from one person to the next. But all of this is really meaningless, especially considering that Richter himself recommended only using magnitudes to about 0.5 magnitude units. Basically, magnitude differences from one group to another of +/- 0.2 magnitude units are very common, and essentially meaningless.

5) The magnitude scale is logarithmic in amplitude. A very pompous way of saying that, for each whole unit increase (or decrease) in magnitude, the recorded maximum amplitude goes up (or down) by a factor of 10. So a quake with ML=4.0 has 10 times higher recorded amplitude than a quake with ML=3.0 and 10 times lower than a quake with ML=5.0.

An EMPIRICAL relationship between ML and energy release has been found and basically states that, for each increase (or decrease) in magnitude of a 1.0 unit, the energy released by the quake goes up (or down) by a factor of about 32. But keep in mind that this is something found by calculating the energy and magnitude individually, and then trying to connect them, not something inherent in the magnitude scale itself.

Now, to complicate the issue further, there are many different types of magnitudes in use by seismologists, each with its own purpose. The Richter magnitude is the most familiar to the public because it is the one that gets reported to the press for local quakes. And all of the scales, except one, give you no physical information about the quake, and are only designed to help compare one quake to the next.

That one exception is moment magnitude, which is based not on the instrumental recordings of a quake, but on the area of the fault that ruptured in the quake. This means that the moment magnitude does tell you something physical about a single quake. But that's another post, and there are others better suited than me to do that one.

Greg Anderson (provider of post)

IUGG INTERNATIONAL TSUNAMI COMMISSION - 18TH INTERNATIONAL TSUNAMI SYMPOSIUM (CTPS18)

Tsunamis: Observation and modeling for understanding and mitigation (IUGG Tsunami Commission/IAPSO/IASPEI)

Outline of symposium

The IUGG Tsunami Commission will hold its eighteenth International Tsunami Symposium in conjunction with the joint assemblies of IAMAS and IAPSO, which are to be held in Melbourne in July 1997. Papers are sought on all elements of tsunamis which address the above theme, including observations of generation, propagation and run-up, modeling of tsunami hydraulics, historical tsunami studies, risk analysis, mitigation programs, risk management, warning and education.

Papers focusing on the south-west Pacific are particularly sought and welcome.

A pre- (or post-) conference tour will inspect evidence of historical tsunami attacks at sites along the coast of New South Wales. This tour will be hosted by Dr. E. Bryant, who has spent considerable time researching historical tsunamis and the evidence.

Symposium convenor: R.D.Braddock, Environmental Science, Griffith University, Nathan, Qld, Australia (email: R.Braddock@ens.gu.edu.au)

International Conference on Environmental Management

The Second International Conference on Environmental Management (ICEM2) with focus on Environmental Engineering, Geotechnology and Mining Engineering. The first conference in this series, held at the University of Wollongong in February 1993, was very successful.

OBJECTIVE

This Conference will aim to provide a forum for academics, researchers, engineers and scientists working in the area of environmental management and sustainable development to exchange ideas and learn about recent advances.

The conference themes will embrace 21st century solutions to problems within the fields of Environmental Engineering, Geotechnology and Mining Engineering.

THEMES

21st Century solutions to Geo-Environment-Mine Engineering Problems:

- Sustainable development
- Environmental engineering for 21st century
- Water, wastewater and stormwater systems (monitoring, design, operation and management)
- Water quality modelling and management
- Hydrology and water resources
- Waste management
- Soil-water and total catchment management
- Environmental Geo-technology
- Slope stability and landslide management
- Uncertainties, risks and decision making
- Environmental hazards legislation and policies
- Environmental economics
- Environmental problems associated with third world countries
- Seismic risk and earthquake-resistant design
- Mine environmental engineering
- Mining rehabilitation
- Computer applications

CALL FOR PAPERS AND POSTERS

Intending authors should submit the title(s) of paper(s), indicate the relevant theme(s), names(s) of author(s), position in the organisation, contact details and one page abstract(s) (300 - 500 words) with three copies each before 1 November 1996.

Authors should submit your abstracts to:
Conference Secretary ICEM2
Department of Civil & Mining Engineering
University of Wollongong
Northfields Avenue Wollongong NSW 2522
AUSTRALIA

DEADLINES

Please observe the following deadlines:

One page abstract (3 copies): 1 November 1996
Abstract acceptance notice including format for paper preparation: 1 December 1996
Submission of manuscripts (Full papers and/or posters) (Original + 3 copies): 1 May 1997
Final paper acceptance: 1 July 1997

TECHNICAL ENQUIRIES

If you need any further information of a technical nature, please contact:
(Siva) M Sivakumar
Associate Professor in Environmental Engineering
Phone: 61-42-213055
Fax: 61-42-213238
Email: icem2@uow.edu.au
or visit our Official Web Site Address at:
http://www.uow.edu.au/eng/conf/icem2/

ORGANISING COMMITTEE

Executive
Robin N Chowdhury, (Siva) M Sivakumar, Denis Montgomery, Raghu Singh, Michael Boyd
Other Members
Richard Arenicz, Hagare Dharmappa, Buddhima Indraratna, Ian Porter, Ernest Baafi, Muhammad Hadi, Ric Morris.

CONFERENCE VENUE

The conference will be held at the University of Wollongong which has modern conference facilities. It is an hour drive from Sydney and is linked to capital cities by major freeways and electric train service. The campus is a short walk from North Wollongong Train Station. The city of Wollongong is the gateway to the NSW South Coast and the city has a superb location bordered on the west by mountains and rainforests, and on the east by spectacular beaches.

Wollongong is a microcosm of Australia in terms of cultural diversity and has a wide range of restaurants.

Enquiries to:
James Cook (Conference Manager)
ICEM2, University Union
University of Wollongong
WOLLONGONG NSW 2522
AUSTRALIA
Phone: +(61) 42-297 833
Fax: +(61) 42-264 250
Email: j.cook@uow.edu.au

CANCELLATION AND REFUNDS

Application must be made in writing to the Conference Manager. A 25% charge will be made if it occurs after 1 October 1997. No refunds will be made after 1 January 1998.

ACCOMMODATION

Hotel Accommodation will be made availablae at special ratges for Conference particupants and their partners. These will range from luxury international hotels, budget motels and University Colleges. Full details will be made available to all intending participants.

Tsunami Workshop, AGU - Western Pacific Meeting, Brisbane, Australia by Col Lynam

SUCCESSFUL WORKSHOP

I am pleased to report that the recent (July 24th) workshop on "tsunami hazard in SW Pacific & SE Asia", an agenda item of AGU-WP confernce, went very well.

It had a cross disciplinary awareness and education theme, between engineers, Government agencies, geomorphologists, tidal data facilities and researching seismologists. I counted 30 heads at one stage of the proceedings.

The geomorphologists, Jon Knott and Ted Bryant presented data confirming tsunami impacts in the Gulf of Carpentaria, Cairns (behind the Great Barrier reef) and coastal New South Wales.

Flinders University Tidal Facility Manager, Bill Mitchell showed a model of the 1994 Indonesian tsunami progressing across the North West shelf of W. Aust. with a focussing effect as it shoaled onto the Shark Bay locality.

The Australian Geological Survey organisation, (AGSO) announced its new database, containing 1060 observational records from 321 individual tsunamic events.

The Bureau of Meteorology, is the Australian government department representing us on the IOC and ITC committees. Chris Parker, (BoM, Melbourne) unfolded their plan for greater monitoring of the Indian Ocean, by utilising the seismographs from AGSO, tide gauges from Flinders, and its own communication and warning systems. An IDNDR tsunami risk assessment was presented by Mr Jim Davidson (BoM, Brisbane)

Thanks to Emile Okal, our guest International speaker, and my chairman Bruce Harper, from the IEAust Nationional Committee for Coastal and Ocean engineering Kenji Satake could not make it, but knows he can count on a warm welcome when he next ventures "downunder".

Any one interested in a copy of the workshop abstracts can write to

Convenor, 1996 Tsunami workshop
Institute of Engineers, Australia (Q'ld Div)
447 Upper Edward St, Brisbane, Queensland Australia 4001 Fax 07 3832 2101
Cost: $AUS6.00 (postage included)

Cheers
Col Lynam
Dept of Earth Sciences, Uni of Queensland
email: lynam@eartsciences.uq.edu.au).

Next AEES SEMINAR

Where: University of Adelaide, South Australia
When: Thursday & Friday, 3 & 4 October 1996

The organising committee comprising Dr M Griffith, J Woodside, L Noicos, P McBean and D Love have circulated a call for papers and expressions of interest. Sponsors are being sought to cover costs of keynote and after-dinner speakers.

The Society - AEES

AEES Executive:

President: Prof Graham Hutchinson
Secretary: Mr Gary Gibson
Treasurer: Mr John Wilson
Immediate Past President: Mr Charles Bubb

Committee:

Russell Cuthbertson (Qld)
Peter Gow (WA)
Vagn Jensen (Tas)
Bill Buckland (NSW)
Mike Griffith (SA) and
Kevin McCue (ACT) & Newsletter Editor.

The AEES subscription year is from 1 Dec to 30 November. It is difficult and expensive to send each of ~ 400 members an individual reminder that fees are due so please help us by sending your subscription for 1996/97 to AEES now (att: John Wilson, 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.

Conference Proceedings AEES

The main function of our Society is the Annual Seminar. You can keep informed about the latest developments in Earthquake Engineering and Engineering Seismology in Australia by purchasing the Proceedings. 1994 Proceedings $30.00, 1992 and 1993 Proceedings $25 and $35, or $45 for both. Postage within Australia is an additional $5.

Conference Proceedings PCEE

1995 Melbourne Proceedings $185 from Mrs Barbara Butler phone 03 9344 6712.
1987 & 1991 Proceedings NZ$50 plus P&P from Admin Sec NZNSEE, PO Box 312 Waikanae New Zealand

Forthcoming Conferences

(Flyers for some conferences are available from Ed)

• 1996, 6 - 8 November Manila Philippines
4th International Conference on Civil Engineering
Fax: 63 2 522 3524

Australian Seismological Report - 1994 AGSO Sales Centre ph: 06 249 99519, 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.

About some of the books

The Geology of Earthquakes is the first modern textbook in earthquake geology drawing from examples from many seismically active regions of the globe, including China, Japan, Mediterranean countries, New Zealand, and the U.S. Useful to engineers, geophysicists and planners as well as geologists, and should be an aid to the geotechnical community. The first seven chapters are background material on plate tectonics, structural geology, earthquake waves, geodesy, time scales and dating techniques, and tectonic geomorpholoy. This is followed by a discussion of earthquake environments: strike slip, reverse, normal, and subduction zones, plus a chapter on secondary effects. The final chapter covers seismic hazard assessment. The book includes a table of more than 300 historical earthquakes with surface rupture, a complete glossary, and personal vignettes of early pioneers including Gilbert, McKay, Koto, Darwin, and others.

Paleoseismology edited by James P. McCalpin. Academic Press, 576 p., price $89.95. This is the first book in English devoted solely to paleoseismology. It includes a comprehensive review of techniques currently used in paleoseismology, practical methods of data collection and field studies, followed by how field data are interpreted based on current theories on fault segmentation and recurrence cycles. Much of the book is written by McCalpin; other authors include W.R. Hackett, G.A. Carver, R.J. Weldon, S.F. Obermeier, and R.W. Jibson.

EARTHQUAKE ENGINEERING AND STRUCTURAL DYNAMICS

(Earthquake eng. struct. dyn.)

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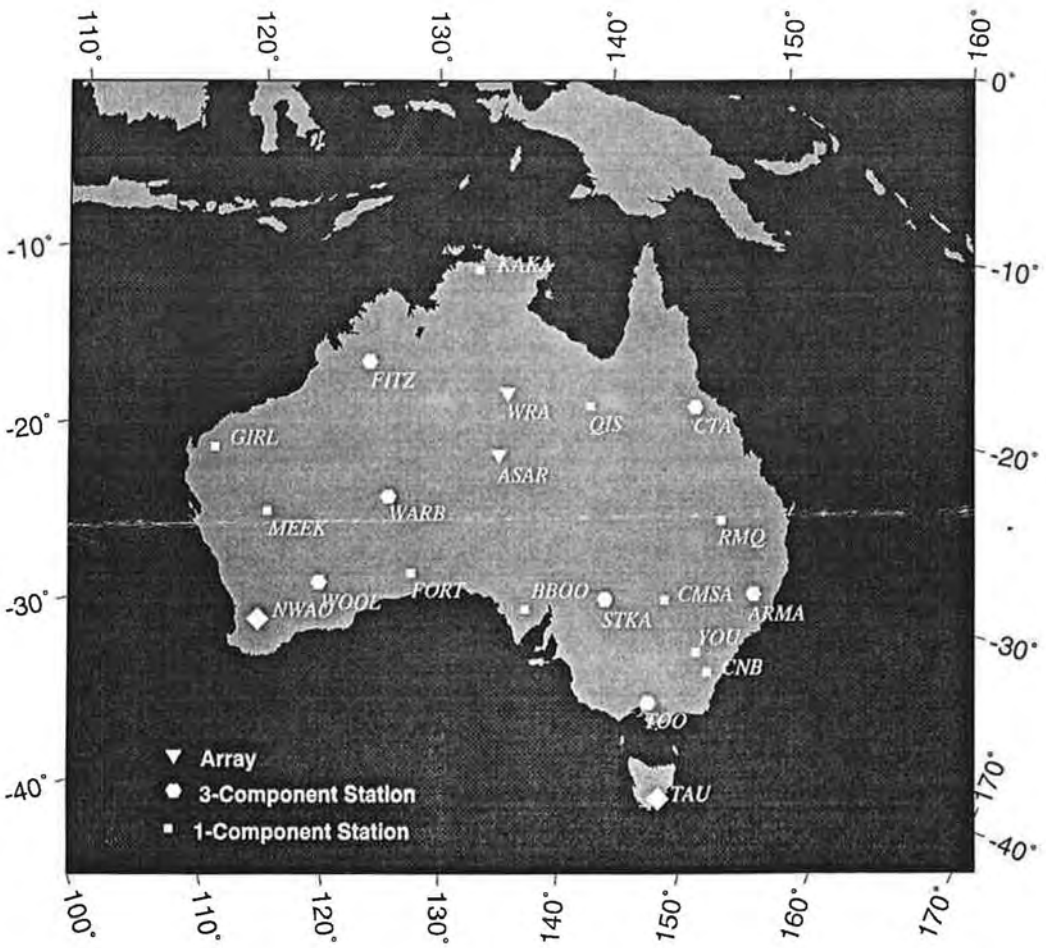
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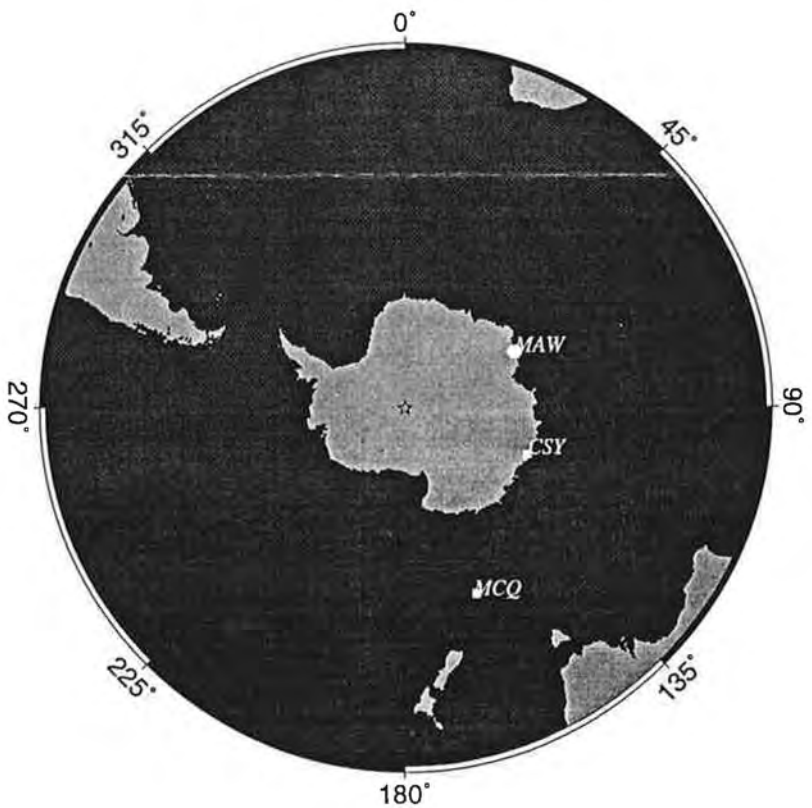
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