AEES NEWSLETTER

February 2011

Contents

The Christchurch Aftershock 22 February 2011

Professor Hong Hao

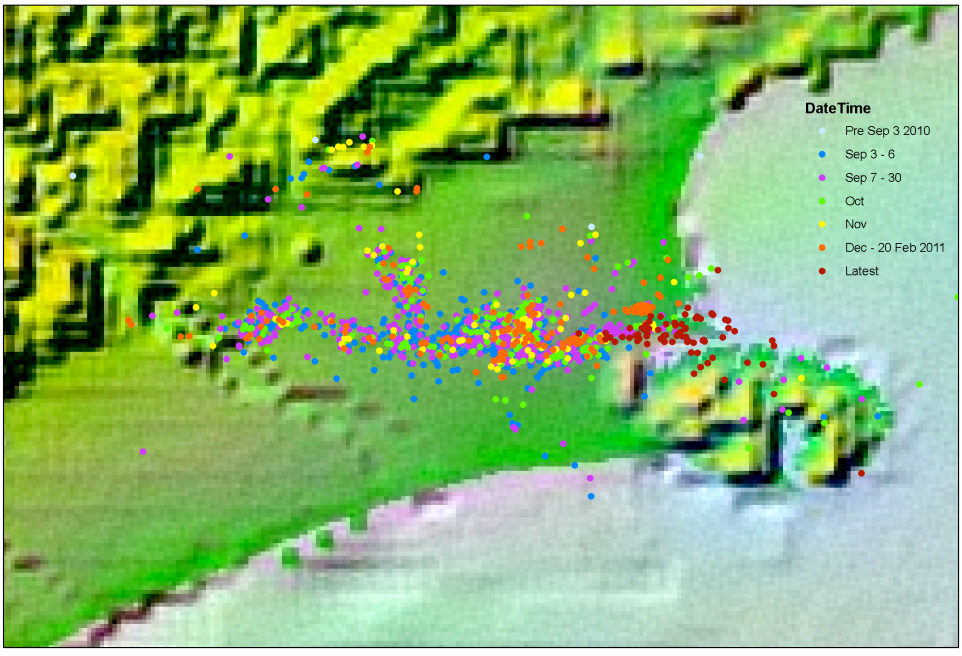
While in the final stage of completing this newsletter, another earthquake hit Christchurch, New Zealand. According to Gary Gibson, this is probably a 5000 year return period event. Analysis of the recorded ground motions by Brendon Bradley at Canterbury, circulated by Paul Somerville among AEES members, indicates that spectral acceleration at many stations significantly exceeds the current design specification. This will surely leads to studies of the earthquake ground motion prediction and structure design, and debates about the necessary levels of structure protections in the region.

Like many of you, I was shocked by the devastating loss of lives and damage to the structures. After the earthquake, many of our members offered their help. We immediately contacted colleagues in New Zealand and although we have not been called, 6 USAR trained engineers from AEES are ready to go to Christchurch. AEES also stands ready to offer assistance towards future recovery from this tragic event.

On behalf of AEES, I convey our deep sorrow and condolence to families and friends of those who have been killed in this terrible disaster.

Editor

At 12:50 pm local New Zealand Time, a magnitude 6.3 earthquake struck Christchurch. This was a delayed aftershock of the 4 September 2010 M7.1 earthquake west of the city that caused damage but no loss of life (see AEES Newsletter 4/2010). This time Cantabrians and many unwitting visitors to that beautiful city were not so lucky. More than 150 people died and 200 are still missing, some of them buried in the rubble of collapsed buildings.

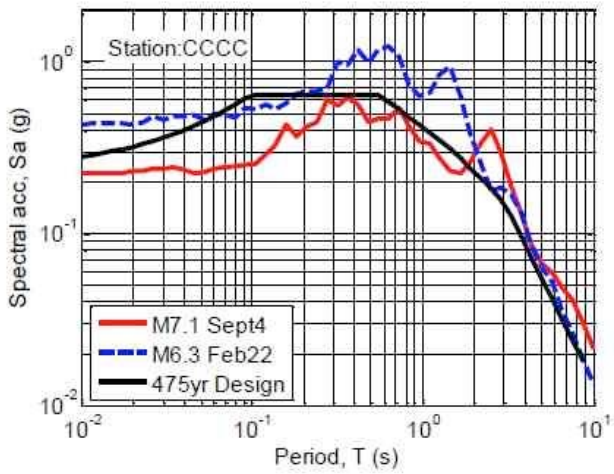


Many people are puzzled that the previous earthquake was much bigger, 10 times the energy release, so why should this earthquake cause such destruction. Was it an aftershock or an independent earthquake and was it really shallower that the September event?

An aftershock is a smaller earthquake that occurs after, and in the same area as, the mainshock. Aftershocks are smaller earthquakes occurring in response to the stress redistribution on or near the fault break of the main shock (Ed.).

The bigger the mainshock the larger the aftershocks and the longer their duration. As a rule of thumb, the largest expected aftershock has a magnitude about one unit less than the mainshock and the size and number of aftershocks decrease exponentially with time. David Love has produced an epicentre plot of Canterbury earthquakes since 4th September, the date of the mainshock, colour-coded to show the different time intervals. The deep red events to the east of the complex fault rupture are the large aftershock and its aftershocks. Most aftershock sequences are complex, they don't occur on a simple planar surface.

The area of the fault ruptured by this aftershock on 22 February is about 15kmx15km compared with the 60kmx15km that broke in the mainshock. The mainshock ruptured to the surface so you can't get shallower than that. The '5 km' depth quoted for the aftershock is just the depth to the point on the fault plane where rupture initiated. It is probable that the offest of the aftershock fault was not sufficient to penetrate the deep (~2km) overlying glacial sediments in the city area.



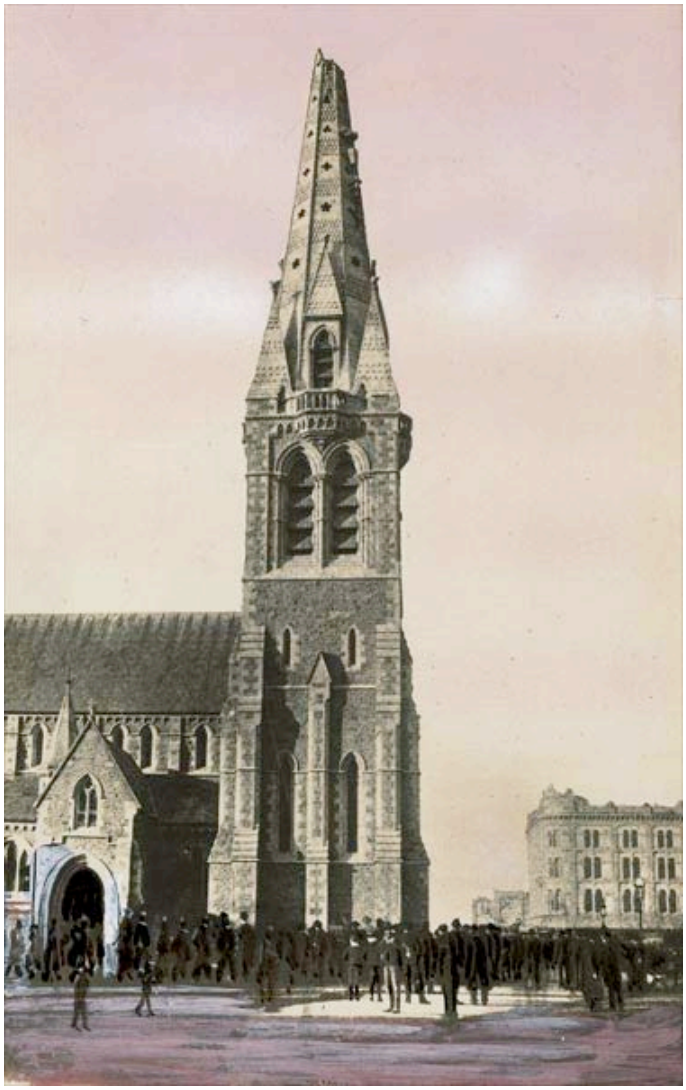
The reason why this earthquake (blueline) did so much more damage than the mainshock (redline) is clear from the above diagram and from the relative spectrum at a downtown Christchurch site provided by Dr Brendon Bradley (black line is the code spectrum).

Many of the buildings probably had little energy absorption capability (ductility) remaining following the September 4th earthquake so it didn't take much of a shake to bring them to the point of collapse. About 50% of the buildings were pre-code URM buildings and of these, 50% collapsed or were so badly damaged they will be demolished. No doubt foundation failure and liquefaction will be found to be a culprit in some failures. The spire of the Cathedral can be rebuilt using methods adopted to strengthen the Cathedral in Newcastle (see Bill Jordan and Barney Coffin's paper in the AEES2009 Proceedings).

It is a shock to see that some relatively modern buildings collaped but none of them would have been built according to the latest loading code NZS1170.5:2004 so new buildings will be more resilient.

As we discovered following the Newcastle earthquake of December 1989, people had forgotten about previous damaging earthquakes there in 1925 and 1868 (and others). Here is an interesting snippet from the TePapa website:

Damaged spire, Christchurch Cathedral



Looking from the south, this view of Christchurch Cathedral shows the damage after the top 7.8 metres of the stone spire toppled in the 1888 earthquake. It was repaired, but the top 1.5 metres fell off again in an earthquake in 1901.

AEES member Lisa Moon, a PhD candidate with Prof Mike Griffith, visited Christchurch with a team led by Professor Jason Ingham of Auckland University. We look forward to a brief report from her in due course.

Other AEES members are on standby to travel to Christchurch as USAR members or under our learning from earthquakes program.

President's Report

It is my great pleasure to write this report for the first time as AEES president. I appreciate the trust which AEES members have placed in me during the AGM last November. I look forward to working with you in seeking the advancement of the Society in my term as President.

For those members who did not attend the annual AEES conferences in the last 9 years, I would like to take this opportunity to introduce myself. I was born in China in 1962. In 1976, I was in high school in Southwestern China about 3500 km from Tangshan, when I was shocked by the devastating damage of the great Tangshan earthquake. It was this event that led to my decision to study earthquake-resistant designs of structures. I received my BEng degree in Civil Engineering from Tianjin University, China, in 1982, and MSc and PhD from the University of California at Berkeley, USA in 1985 and 1989, respectively under the supervision of Prof. Joe Penzien, one of the 13 earthquake engineering legends of the world honoured at the 2008 WCEE in Beijing. I majored in Structural Engineering, with mathematics and strong motion seismology as minors in my PhD study. After university, I worked for 8 months as a postdoctoral researcher in the Seismographic Station of the University of California under the supervision of the late Prof. Bruce Bolt. I moved to Singapore in 1990, taking up a lecturer position in Nanyang Technological University. My family and I migrated to Perth in 2002. Currently I am a Winthrop Professor and Chair of Structural Dynamics in the University of Western Australia. My research interests are structural dynamics and its application in earthquake engineering, blast engineering, and structural condition monitoring.

As the new president of AEES, I would like to thank Kevin McCue and the previous AEES committee for their hard work in leading the society through the last two years. I am especially grateful that all the previous committee members agreed to stay on to continue their services to the society. With Kevin as the immediate past president of the society and members of the previous committee serving in the current committee, I feel a lot more comfortable to be the new president of the society. The current executive committee includes: Kevin McCue, Paul Somerville, Mark Edwards, Gerhard Horoschun, Helen Goldsworthy, James Hengesh, Sharon Anderson, Gary Gibson, Adam Pascale, and state representatives: Colin Gurley, Russell Cuthbertson, David Love, and Angus Swindon. We look forward to working together to serve all members of the society, as well as the general community of Australia in earthquake-related matters. In writing this report, I also solicit your comments, and ask: how can AEES better serve you? Are there opportunities that you would like to connect us to? Please feel free to share your thoughts and ideas by writing to me, or any other members of the executive committee.

For those who did not attend the Annual Conference and AGM last November in Perth, I would also like to share with you some news.

1) Prof Mike Griffith and Prof John Wilson were both awarded life members of the society during the conference dinner by AEES President, Kevin McCue. I believe Mike and John need no introduction, as their work precedes them. In view of their great contributions to AEES, to the general Australian community in promoting earthquake awareness, emergency preparedness, and to engineering profession for their research work on earthquake-resistance design of structures, they well deserve the honor. Congratulations!

2) Prof Mike Griffith will host this year's annual conference in the Barossa Valley, South Australia from 18-20 November. Please mark your calendar and prepare for this event.

3) During the AGM at Perth, we also discussed the possibility of bidding and hosting the 16th World Conference on Earthquake Engineering (WCEE) in 2016 in Australia. Since the first WCEE in 1956 at Berkeley, USA, the Conference, which runs every four years, has been the biggest event amongst seismologists, geophysicists and engineers working in earthquake-related areas. The next, the 15th WCEE will be in Lisbon, Portugal on 24-28 September 2012. The WCEE has been in the Southern hemisphere only three times. New Zealand hosted the 3rd and 12th WCEE in 1965 and 2000, respectively, and Chile hosted the 4th WCEE in 1969. Having the WCEE in Australia will be a good opportunity to promote the AEES, and also to promote earthquake awareness among the greater Australian community. However, as it is a big event, usually with more than 2000 delegates, it will require tremendous dedication from many members. Although we can commission a Professional Conference Organizer (PCO) to look after all the logistics, we will need to organize the reviews, sessions, themes and topics, etc. For these reasons, some members suggested that we get regional societies involved to support us in bidding and organizing the event. I have contacted Earthquake Societies in Indonesia, New Zealand and Singapore, and have obtained the verbal confirmation from Prof. T C Pan, President of Singapore's Society that Singapore will support us in this effort. I am still waiting for the feedbacks from Indonesia and New Zealand. I will update you about any new development in the next newsletter.

I look forward to working with you all for another fruitful year.

Professor Hong Hao

President

Conferences News

PCEE2011 Auckland NZ, 14-16 April 2011

The New Zealand Society for earthquake Engineering is hosting next year's Pacific Conference on Earthquake Engineering in Auckland in March. Please keep checking the AEES and NZSEE http://pcee.nzsee.org.nz/ websites for details.

Attached to the PCEE is the following important workshop which we hope Australian and New Zealand consulting engineering companies working in the region will sponsor, and attend.

SW Pacific Earthquake Resilience Workshop 11-13 April 2011

This workshop, endorsed by the South Pacific Engineers Association (SPEA), will draw together lessons from recent earthquakes and tsunamis to develop a road map for improved regional resilience. This will include considerations of cooperative response strategies, seismological studies, earthquake engineering guidelines, standards, education, continuing professional development, and building control systems development.

World Conference on Earthquake Engineering 2016 Australia to bid

AEES has decided to put in a bid to host the WCEE in 2016, subject to support from neighbours such as the NZSEE (see President' report above). This is a bid that would be promoted at the 2012 WCEE in Lisbon Portugal so we have quite a bit of time to make the final decision.

Comparing Darfield NZ 2010 & Meckering WA 1968

In December 2010, the New Zealand Society for Earthquake Engineering published a substantial volume; Bulletin 43, No. 4. There are 439 pages about the magnitude Mw7.1 Darfield earthquake and its effects, just 3 months after it caused havoc, but no deaths or total building collapses, in Canterbury.

Congratulations on a fantastic effort!

One of the things that triggered my memory was the finding by NZ seismologists that the focal mechanism derived from local stations was quite different from that derived using distant overseas stations; a thrust solution compared to the USGS strike-slip solution. The nodal planes in the GNS solution strike approximately NE whereas the nodal planes of the USGS solution derived from long period motion are NS and EW, i.e at 45° to the GNS nodal planes.

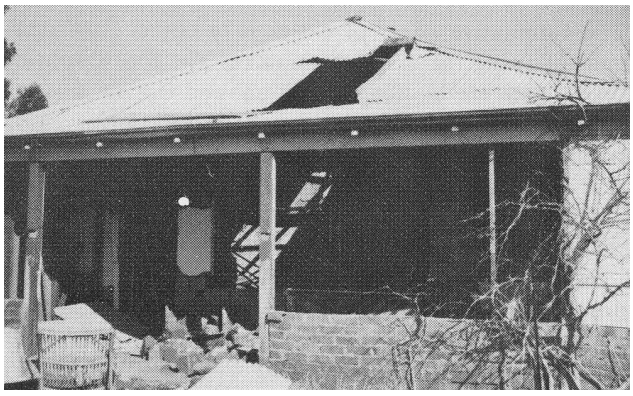
After the magnitude Ms6.8 Meckering WA earthquake in October 1968, Everingham (pers. comm.) derived a mechanism from short period first motions that showed a strike-slip earthquake with NE and NW striking nodal planes, quite dissimilar to the published focal mechanism derived from long period seismograms at distant stations; a thrust with NS striking nodal planes. The principal stress direction is the same in each mechanism; near horizontal east-west compression.

It is quite probable that the physics is the same for both earthquakes; they started off as slip on one fault that evolved into a different type of slip on a conjugate fault at approximately 45° to the original slip direction. A similar scenario for both earthquakes perhaps.

A detailed map of the surface faulting at Meckering by Gordon and Lewis (1980) shows a complex pattern of faults, an arcuate NS fault overall with some wrench segments trending NE and NW at the southern end, and near the centre and epicentre, faults parallel to Everingham's nodal planes.

In contrast to the Darfield example, the faulting in Meckering started as strike-slip motion on a vertical fault in a NE or NW direction and morphed into a shallow dipping thrust fault striking NS, at 45° strike to the initial slip. Perhaps such complications in the earthquake source are not so unusual. Some of the damage is eerily similar too as the following two photographs from Gordon and Lewis (1980) show.

Gordon, FR., and Lewis, JD., 1980. *The Meckering and Calingiri earthquakes October 1968 andMarch 1970*. Geol. Surv. WA, Bulletin 126.



Meckering dwelling, brick chimney broken off and fallen through steel roof.

Lateral spreading near Meckering with what looks like liquefaction in the creek bed.

AEES2010 Perth

Report on AEES2010 (by an unbiased observer)

The talks and posters were excellent, the venue and social functions perfect, the organization worked without a hitch. All that I can add is that if you weren't there then you should have been. The format of the three half days, a social outing, dinners and especially the single stream of mixed papers on earthquake engineering, seismology, insurance and geotechnical issues should never be tampered with. It has worked well for the last 18 years and will be just as appropriate at our 50th anniversary.

The annual get together of individuals from the various disciplines of industry, government and academia under the earthquake engineering banner is incredibly useful and couldn't and shouldn't be replaced by an internet conference or exchange of emails.

Perth is a lovely city but the expense of getting there probably dissuaded many people from attending, particularly students, who usually figure strongly in the attendances at eastern Australian destinations. Speakers from China, Taiwan and South Africa gave the conference an international flavour though we missed the usual representatives from New Zealand.

AEES President, Professor Hong Hao, at AEES2010

The papers were of high quality, the review process obviously works well and it is hard to single out particular papers. Scenes of the devastation at Seshuan, China particularly from the thousands of landslides triggered by the great 2008 earthquake, brought all conversation to a stop. I thought the work in Taiwan aimed at strengthening schools in Taiwan should be expanded to include hospitals and implemented worldwide, regardless of the level of hazard. Progress on the development of CATDAT was impressive and James Daniell was awarded the student prize for best paper for the 2nd year running. Likewise it was good to hear the reports of post-earthquake reconnaissance visits with clear directions for how our society must prepare for future missions in our region. The lesson of Chile and Christchurch 2010 is that collapse and lifeloss can be minimised in earthquakes with appropriate codes and supervised construction.

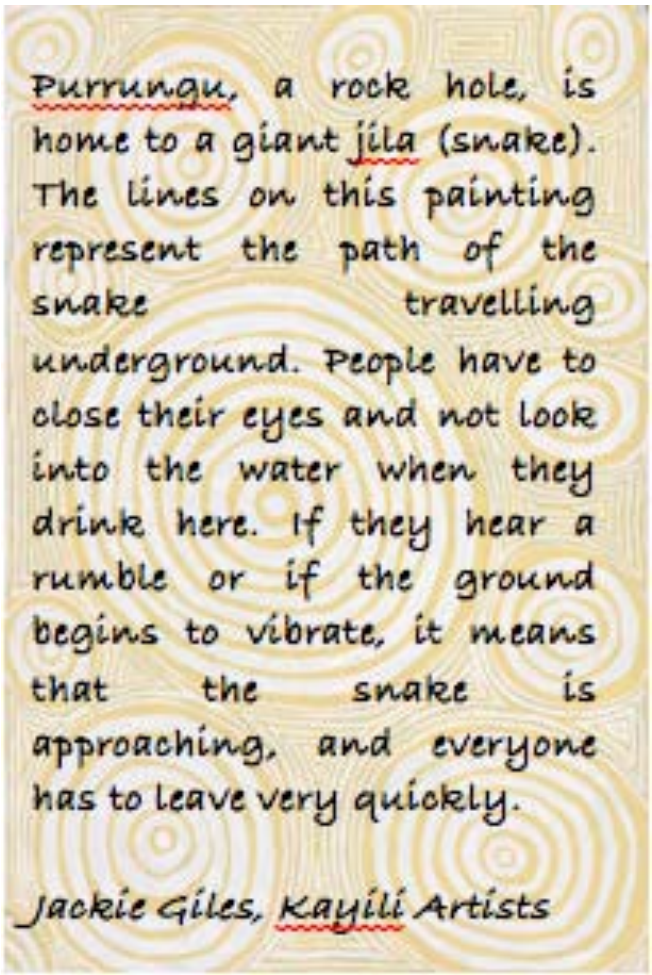
Professor Nick Haritos won the award in my book for the wow factor with his paper on the dynamic response of trees. Who would have thought the last branch was also the last straw, for the tree.

In the photo above, AEES2010 participants are quietly trying to win the outing competition; to estimate the natural period of the Leaning Tower of Gingin. The best estimate compared to the period measured by ES&S seismologist Adam Pascale was fittingly that by the host of the conference professor Hong Hao.

For interest, I compared the author lists of 2010 with that of our first meeting in Sydney at AEES1992 and there are many new faces. Mike Griffith, Gary Gibson and Kevin McCue are the only three to present papers at them both.

Hope to see you in November at AEES2012, in the Barossa Valley, South Australia.

About Australian earthquakes? – Purrungu, 2008



The text and underlying painting were on display at a wonderful exhibition about the Canning Stock Route held at the National Museum of Australia ()Canberra)and moving to Melbourne and Sydney soon (The Hon Ed. was rather struck by the story).

Earthquake Engineering Journal Links

Journal of Earthquake Engineering, Volume 15, Issue 2, 2011.

Contents:

Table: Earthquakes in the Australian region,11 October – 31 January 2011, magnitude 3 or greater, located by Geoscience Australia, PIRSA, ES&S, and ASC. The implied accuracy in epicentral coordinates is no better than 3km (.03º) horizontally and 5 km vertically.
Small earthquakes above ML 2.4 occurred in each State and Territory except Tasmania and the ACT. The largest earthquake in the four months was in the sparsely populated northwest of NSW, its magnitude 4.4. There were no injuries and no damage was reported. A map of GA located events is on the next page.

Date UTC	*Time*	*Lat*	*Long*	*Z km*	*ML*	*Place*
30 January 2011	08:57:03	30.535	118.105	0	2.5	Beacon area WA
29 January 2011	22:42:33	21.893	127.867	15	2.5	NW of Lake Mackay WA
29 January 2011	00:17	33.69	136.66	10	2.6	Cleve SA
29 January 2011	15:29:33	31.73	148.99	4	2.5	NE of Gilgandra NSW
28 January 2011	09:11:09	33.97	117.962	0	2.5	Gnowangerup area WA
25 January 2011	23:57:57	32.105	139.608	10	2.6	E of Hawker SA
25 January 2011	11:28:53	33.50	148.97	1	2.6	Near Cargo NSW*
24 January 2011	23:57	32.13	139.52	10	3.0	N Yunta SA
24 January 2011	13:05:49	35.097	143.984	10	2.7	Moulamein NSW
23 January 2011	19:40:07	28.39	148.47	22	3.5	Dirranbandi Qld
16 January 2011	06:26:39	21.872	120.609	10	3.1	SE of Marble Bar WA
15 January 2011	00:38	33.60	136.49	10	3.9	N Cleve SA
13 January 2011	07:26:00	36.911	122.615	0	2.6	Offshore S Esperance
11 January 2011	03:11:39	27.997	124.491	0	3.5	Lake Yeo WA
08 January 2011	12:57:19	14.771	128.795	10	2.7	N Kununurra WA
06 January 2011	10:00:54	35.489	144.623	0	2.6	West of Deniliquin NSW
06 January 2011	01:01:59	36.5	121.957	10	3.0	South of Esperance SA
04 January 2011	16:40:12	34.058	135.55	0	3.5	NW of Cummins SA
28 December 2010	08:51	38.3	147.2	10	3.3	Seaspray Vic
25 December 2010	12:01:31	22.197	129.721	15	3.2	E of Lake Mackay NT
25 December 2010	09:43:53	22.212	129.532	10	2.5	E of Lake Mackay NT
22 December 2010	22:53:12	30.661	117.782	5	2.5	SW of Beacon WA
22 December 2010	06:27:57	29.555	143.74	10	2.5	Wanaaring NSW
22 December 2010	05:45:10	29.556	143.728	10	3.0	Wanaaring NSW
21 December 2010	15:00:41	13.115	127.327	10	3.5	NW Kununurra WA
12 December 2010	12:26:12	26.965	114.607	10	2.5	N of Northampton WA
10 December 2010	22:10:49	14.842	129.11	10	2.7	N of Kununurra WA
10 December 2010	12:44:05	29.561	143.738	10	2.5	NW of Wanaaring NSW
09 December 2010	16:53:04	17.223	127.41	5	2.7	Near Bedford Downs WA
08 December 2010	09:10	38.2	149.0	10	2.6	E Lakes Entrance Vic
05 December 2010	13:25:29	14.885	128.9	30	3.6	N of Kununurra WA
04 December 2010	07:14	24.1	153.6	10	3.5	Fraser Is Qld
03 December 2010	14:24:26	33.04	151.70	0	2.8	Cessnock area NSW
03 December 2010	00:40:04	33.933	135.908	10	2.5	North of Cummins SA
02 December 2010	18:30:09	14.658	128.594	2	2.5	N of Kununurra WA
30 November 2010	16:02:18	32.893	151.315	13	2.5	NE of Ellalong NSW
29 November 2010	20:08:06	32.058	139.683	10	3.4	NW of Manna Hill SA
28 November 2010	08:11:41	31.99	141.44	1	2.6	Broken Hill NSW*
24 November 2010	17:44:54	17.094	121.321	10	3.1	NW of Broome WA
14 November 2010	16:29:15	27.001	140.374	10	2.8	N of Innamincka SA
13 November 2010	19:36:49	31.447	138.87	10	2.5	NE Wilpena Pound SA
10 November 2010	01:04:00	23.32	136.649	10	3.1	E of Alice Springs NT

09 November 2010	19:20:13	38.358	139.979	20	2.8	S of Beachport SA
08 November 2010	19:41:17	31.113	119.162	10	2.7	NW of Southern Cross
31 October 2010	03:40	34.4	148.3	10	2.5	Young NSW
30 October 2010	23:35:40	33.303	118.208	2	2.8	N of Nyabing WA
27 October 2010	15:14:03	29.652	143.805	0	3.0	NW of Bourke NSW
27 October 2010	15:13:09	29.599	143.756	0	3.0	NW of Bourke NSW
27 October 2010	14:18:02	29.438	143.594	7	4.4	NW of Bourke NSW
25 October 2010	04:48	37.0	144.2	10	2.5	Maldon Vic
24 October 2010	18:11:45	25.367	116.939	6	2.7	Landor area WA
24 October 2010	12:55:08	30.52	123.594	10	2.7	N of Zanthus WA
24 October 2010	10:17:23	30.582	124.228	31	2.9	NE of Zanthus WA
23 October 2010	03:40:19	34.14	135.914	0	2.6	E of Yeelanna SA
22 October 2010	04:45:43	33.31	149.57	12	3.3	N of Bathurst NSW
21 October 2010	08:30:14	29.424	113.972	0	2.5	SW of Geraldton WA
17 October 2010	10:53:10	30.209	117.759	0	2.9	N of Beacon WA
16 October 2010	18:20:44	38.108	146.319	0	2.6	N of Morwell Vic
16 October 2010	14:07	38.0	146.5	10	3.3	Walhalla Vic
15 October 2010	13:06:02	19.603	117.435	10	3.5	NW Port Hedland WA
14 October 2010	11:00:55	23.319	135.707	0	3.1	E Alice Springs NT

- Probable rockburst in mine

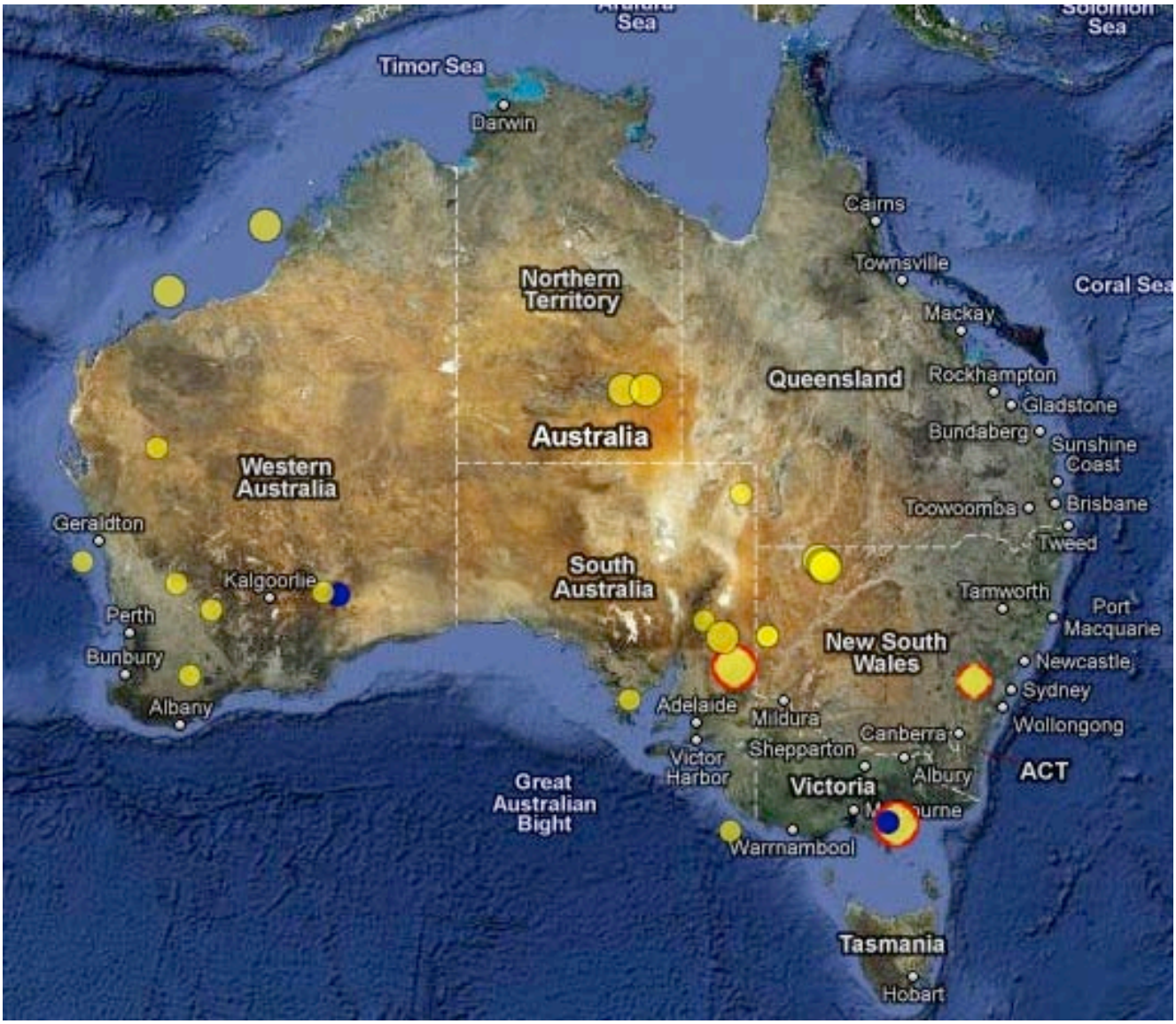


Figure: Epicentre of earthquakes in the Australian region, M ≥ 2.5 as listed above. Map created by Geoscience Australia.

Upcoming Conferences

14-15 April 2011 PCEE Auckland NZ (see earlier section on Conference News)

19-20 July 2011 The 2nd International Conference on Earthquake Engineering and Disaster Mitigation (ICEEDM) "Seismic Risk Reduction and Damage Mitigation for Advancing Earthquake Safety of Structures" Shangri-La Hotel, Surabaya, Indonesia.

Organized by Indonesian Earthquake Engineering Association (IEEA) Institut Teknologi Sepuluh Nopember (ITS)

Supported by International Association for Earthquake Engineering (IAEE), Indonesian Ministry of Public Works and World Seismic Safety Initiative (WSSI)

18-20 Nov 2011 AEES2011 Prof Mike Griffith will host this year's annual conference in the Barossa Valley, South Australia. Please mark your calendar and start preparing for this our 20th annual conference.

Citizen observers

Is it taking 'volunteering' a step too far or is this an appropriate role for non-fee charging services? There are quite a few 'citizen seismologists' in Australia though their data are not used by state or national agencies.

Earthzine, an online environmental journal, has conducted a competition to encourage students to creatively explore the benefits and challenges of the collaborative role citizen observers play in the collection and validation of Earth observations.

They may find citizen scientists on their campuses, in community chapters of national and non-governmental scientific organizations, among disaster responders and readiness planners, in the health care profession, in agriculture, forestry and fishing, among many other domains.

Winners were to share $1200 in prizes, with $500 for the first prize.

Eligibility: Enrolment in any (e.g. American, European, African, Asian, etc) undergraduate or graduate degree program at an accredited college or university attending full or part-time at the time of the contest.

(Ed. though the deadline has passed by the time you read this, perhaps it issomething we could emulate in Australia/New Zealand).

National Observing System To Probe Earth

On 29 Jun 2010, Senator the Hon Kim Carr and the Hon Maxine McKew MP announced that the Australian Government will invest $23 million in a new Australian Geophysical Observing System (AGOS) to increase understanding of the earth's crust and its resources.

AuScope Limited, a consortium of 23 universities, government bodies and research organisations, will develop the revolutionary system.

Australian Government funding is through the Education Investment Fund (EIF) Round 3.

The AGOS will have infrastructure across Australia. Key sites will include Macquarie University in North Ryde NSW, the University of Melbourne in Parkville and the Australian National University (ANU) in Canberra.

AuScope AGOS infrastructure will include:

The Geospatial Observatory – involving a GNSS intrumentation pool of including GPS stations, high precision monuments; corner cube reflectors; establishment of monitoring sites; library of remote sensed data and robotic antenna systems all designed for improved precision and accuracy for geospatial science.

The Earth Sounding Network - will build new generation seismic recorders, and purchase or build a pool of Ocean-Bottom Seismometers, Earth data recorders and electric field multichannel loggers. It will make available 100 new temporary seismometers and a host of other scientific instruments to provide new capability exploring new realms of the continent.

The Geophysical Education Observatory - will develop digital real time connection to existing teaching laboratories through the siesmometers–in-schools program to use the national observatory. It will, provide a unique opportunity for integrating scientific research and education by engaging students, teachers, and the public in a national experiment that is going on across the country.

Bienvenue sur le station sismo CANB

(Ed.) The French government has assisted the installation of a long period seismograph at Telopea High School in the middle of Canberra http://canb.telopea.act.edu.au/cgi-bin/ida. All data are publicly accessible but it helps if you can read French.
Lycée franco-australien de Canberra
latitude: -35.31° longitude: 149.13°
altitude: 586m