AEES NEWSLETTER

October 2010

Contents

President's Report...1
PCEE2011 Auckland NZ ...2
SW Pacific Earthquake Resilience Workshop ...2
Space Geodetic Data Improve Seismic Hazard Assessment in California ...2
Tsunami preparedness progress...2
Quarrying data for gems of knowledge...3
London England overdue for earthquake ...3
The Darfield Earthquake, Canterbury NZ...4
Australian earthquakes, August - September 2010...9
Conferences ...10
Citizen observers...10
National Observing System To Probe Earth ...10
AEES Contact Details ...10

President's Report

The two articles about New Zealand seismicity in the last Newsletter were rather prescient. Radio news of a major shallow earthquake striking the South Island raised visions of the Alpine Fault having finally ruptured, but it hadn't. Rather the earthquake occurred uncomfortably close to Christchurch, the 2nd largest city in New Zealand on a previously buried east-west fault trending at about 45° to, and 100 km east of, the Alpine Fault (see www.aees.org.au for links).

Ground shaking was very strong throughout Christchurch but the reported deaths were due to cardiac failure, not building collapse, in fact the damage due to shaking was strikingly similar to that in Newcastle NSW in 1989. Unique to Canterbury was the widespread liquefaction and lateral spreading causing extreme foundation stress and failure of infrastructure.

Certainly this earthquake was in our sphere of interest so first Professor Mike Griffith (see attached article), then I, flew across the Tasman to learn from the earthquake and help out if possible.

Years of planning by the New Zealand government and much research and application by engineers and seismologists paid off, the lack of collapse a tribute to the hazard mapping and loading code provisions. The response effort slid into gear immediately after the earthquake (see Mike Griffith's article), again thanks to years of educating and planning by NZSEE members led by Dr David Brunsdon.

EQC had received 64,274 building damage claims within 2 weeks of the earthquake. Of those, 2759 related to homes deemed uninhabitable and 3091 to homes no longer weatherproof. Two schools, St Pauls and Halswell Primary were seriously damaged, their students moved to other schools cf 14 in Newcastle.

Aftershocks were a serious concern even though the postulated magnitude 6 aftershock hasn't, or hasn't yet, eventuated. As you will see from reading Professor Griffith's article, the M5+ events were bad enough. Many people were unnerved by the earthquakes but reassured via the constant flow of information on the GeoNet website showing a slow reduction in their frequency. Cracks in the ground and buildings continued to open with time and settlement too seemed to worsen slowly whether from rheology, fluid dissipation or aftershocks is not clear.

GNS, EQC and NZSEE made all data public as soon as it became available – what a great example to everyone.

The Australian Loading Code might be expected to prevent the collapse of modern buildings designed and built for the current code but not pre-existing structures or modern un-reinforced masonry buildings, and not with the level of shaking measured in New Zealand. The liquefaction threat in the Christchurch region was well recognised and had been mapped in 1992, it would be well to do the same in urban areas here and then decide what to do about it. Liquefaction was observed in South Australia in 1897 and in Victoria in 1903 following earthquake there. The Meckering earthquake caused lateral spreading in Perth in 1968. These are not problems restricted to New Zealand.

Mike and I would recommend that others, seismologists and engineers, take the opportunity to learn from recent earthquakes but it is imperative to get there early. Take a hard hat, safety boots, a brightly coloured vest and identification. Personal contacts are invaluable so that you can be relatively independent and not a burden on professionals trying to respond to the emergency.

This is our 3rd response effort in 2010; Kalgoorlie, Chile and now Christchurch and the lessons are invaluable. The difficulty ahead is convincing governments that we should emulate our NZ colleagues by being prepared when the next damaging earthquake occurs in Australia, as it will. It would be very useful if members too could be prepared.

No doubt much will be said about this earthquake at AEES2010 in Perth in November so plan to be there.

Kevin McCue
President

P.S. Thanks to webmaster Adam Pascale for rapidly loading our blogs onto the AEES website

PCEE2011 Auckland NZ

The New Zealand Society for earthquake Engineering is hosting next year's Pacific Conference on Earthquake Engineering on 14-15 March 2011 in Auckland. 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.

SW Pacific Earthquake Resilience Workshop

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. Workshop dates: 11-13 April 2011

Space Geodetic Data Improve Seismic Hazard Assessment in California

Eos, Vol. 91, No. 38, 21 September 2010

Workshop on Incorporating Geodetic Surface Deformation Data Into UCERF3; Pomona, California, 1–2 April 2010

A workshop was held to begin scientific consideration of how to incorporate space geodetic constraints on strain rates and fault slip rates into the next generation Uniform California Earthquake Rupture Forecast, version 3 (UCERF3), due to be completed in mid-2012. Principal outcomes of the meeting were (1) an assessment of secure science ready for UCERF3 applications within the next year, and (2) an agenda of new research objectives for the Southern California Earthquake Center (SCEC), the U.S. Geo- logical Survey (USGS), and others in support of UCERF3 and related probabilistic seismic hazard assessments (PSHA).

A number of goals potentially achievable within a year were identified, including (1) slip rate and fault locking depth estimates, with uncertainties or ranges, for all major and some minor faults of the extended San Andreas system; (2) strain rate estimates or bounds on rates for selected regions lying off the major faults of the San Andreas system; and (3) corrections or bounds on perturbing effects of post-seismic deformation and elastic modulus heterogeneities on the observed Global Positioning System (GPS) velocity field (needed as input to models for estimating fault slip and strain rates in goals 1 and 2 above).

Longer-term research priorities for improving fundamental understanding and better contributing to PSHA objectives of the USGS, SCEC, and the international earthquake community were also identified. These include (1) new observations and modelling of earthquake cycle deformation, focusing especially on better constraining the duration and spatial distribution of post-seismic transient deformation; (2) more refined block models that consider uncertainties in fault slip and intra- block strain rates due to variations in block geometry, long-term post-seismic transients, and lower crust/upper mantle rheological heterogeneities; and (3) improved strain rate mapping methodologies and space geodetic measurements that better capture the spatial heterogeneity of the surface strain rate field.

For more details on the UCERF process and results of a previous study, see the Working Group on California Earthquake Probabilities website:

http://www.wgcep.org

http://pubs.usgs.gov/of/2007/1437/

Tsunami preparedness progress

Since the devastating Indian Ocean tsunami in 2004, the United States has made progress in several areas related to detecting and forecasting tsunamis, including the expansion of a sensor network and improvements to hazard and evacuation maps. However, many U.S. coastal communities "still face challenges in responding to a tsunami that arrives in less than an hour after the triggering event," according to a U.S. National Research Council report released on 16 September.

The report, Tsunami Warning and Preparedness: An Assessment of the U.S. Tsunami Program and the Nation's Preparedness Efforts, recommends that the U.S. National Oceanic and Atmospheric Administration and its National Tsunami Hazard Mitigation Program partners work to complete an initial assessment of tsunami risk, among other measures. The report also indicates research efforts to improve tsunami education, preparation, and detection. The report is available at:

http://www.nap.edu/catalog.php?record_id=12628

Quarrying data for gems of knowledge

submitted by Col Lynam

Predicting where Australia's next mineral boom will come from is serious business. Data collected using satellite sensing, airborne surveys, seismic crews and prospecting teams is immense and is piling up rapidly. But what use is all this data?

'This is a vast electronic resource and we need new methods to mine it for useful information,' said Professor Dietmar Müller of the University of Sydney.

Professor Müller and his team are developing electronic tools to access and compile the data so that the changes over geological time in the Earth's crust can be tracked and simulated. Known as the Virtual Geological Observatory, it is claimed to be one of the new-generation tools Australia will need for future mineral exploration.

Müller is a keynote speaker at the Theo Murphy High Flyers Think Tank starting at the Australian Academy of Science in Canberra.

The High Flyers Think Tank 2010, Searching the Deep Earth: The Future of Australian Resource Discovery and Utilisation, is gathering of about 60 bright early and mid-career research scientists from a range of disciplines relating to exploration and mining.

They will be discussing questions such as: How are we going to find the next giant deposits to mine? What new technologies will we need to exploit them in a low-carbon future?

For further information and program, visit:

http://www.science.org.au/events/thinktank/thinktank2010/index.html

London England overdue for earthquake

Edited from an article by Alok Jha, guardian.co.uk, Thursday 16 September 2010, with thanks to Clive Collins Geoscience Australia

A leading British seismologist warned that London is overdue for an earthquake that could cause billions of pounds worth of damage,.

Britain is at the north-eastern edge of the Eurasian plate, about 1000 km from the boundary that bisects Iceland through the middle of the Atlantic Ocean but small or moderate intraplate earthquakes can still cause damage.

In April 1580, a magnitude 5.5 earthquake caused extensive damage in the south-east of England and north-east of France. In London, two people were killed. The epicentre was in Dover Straits about 140 km from London.

"This earthquake can certainly happen again because even the quake in 1580 was a repeat of a previous one that occurred in 1382, with almost the same epicentre, size and results," said Roger Musson of the British Geological Survey at the British Science Festival in Birmingham.

Musson said that a precise prediction of the next damaging earthquake to hit London was difficult. "All we can do is say that something that has happened twice can and probably will happen three times, but as to whether it happens tomorrow or in two years time or in 20 or 50 years time, that is something we would love to know but we don't. What we can be sure of is that, in the years since 1580, the exposure of society to earthquakes has increased enormously. The same earthquake happening tomorrow will impact on far more people than was the case in the 16th century. The size of London in terms of population is about 50 times more today than it was in 1580."

British seismologists record a magnitude 3.5 earthquake once a year, a magnitude 2.5 quake once a month, and a magnitude 1.5 earthquakes twice a week, on average. Britains should expect to feel a magnitude 4.5 earthquake in any decade and a magnitude 5.5 event in any century.

The most widely known earthquake in Britain was that near the town of Colchester on 22 April 1884. The earthquake only lasted five to ten seconds or so but in that brief period, villages were wrecked and Colchester was reduced to chaos. Hundreds of chimney-stacks crashed through roofs. Tiles and slates cascaded to the ground as roofs collapsed. Walls buckled and cracked. Window glass shattered. And in places, gaping fissures opened up in the ground, some over 100 yards long. Old, poorly-maintained properties were hit the hardest, although timber-framed houses seemed to fare better than brick buildings, even some relatively new ones (www.catuk.org/doku.php?id=highlights:earthquake).

There are lots of cracks in any tectonic plate caused by ancient phases of tectonism. "Think of it as a dinner plate that has been broken several times and glued back together again and you're squeezing it," said Musson. "If one bit is not glued terribly well, then it can give a little."

The cost of an earthquake in the southeast of England would be huge. An equivalent sized earthquake in 1989 that hit the city of Newcastle in New South Wales, Australia, caused about £1bn of damage at today's prices, said Musson.

He said that a magnitude 5.5 earthquake would likely spare modern office buildings, but older Victorian buildings would be at risk. "What's tended to get damaged most was buildings of the Victorian period that are in bad repair. You'll remember there was a small earthquake in Folkestone in 2007. What was damaged most was old chimneys – they came down. Newer houses were not damaged at all ... It may not sound very dramatic compared to buildings collapsing but if people are walking in the street and a chimney falls on you, that's bad news."

The Darfield Earthquake

Canterbury New Zealand

4 September 2010 at 04:36 NZST

Professor Mike Griffith

School of Civil, Environmental & Mining Engineering, The University of Adelaide SA

Introduction

Compiled below are the notes on my experiences in Christchurch during first 72 hours after the "4/9/2010 Darfield Earthquake" where I spent 3 days working as a volunteer to conduct rapid damage assessment and assign "placards" (red, yellow or green) on buildings to let owners know whether or not their building was safe for the public to use.

8am, Saturday morning Adelaide (4/9/10)

I first heard a radio broadcast of an earthquake in Christchurch, NZ approximately 1 hour after its occurrence. After seeing TV news reports of damage to unreinforced masonry buildings I booked a flight leaving 11.40am and was met by Assoc. Professor Jason Ingham (Univ of Auckland) at 10pm at Auckland.

6.30am, Sunday morning (5/9/10)

We flew to Christchurch for 9am briefing at Disaster Command Centre (Christchurch City Council (CCC) Art Centre building). David Brunsdon, New Zealand Society for Earthquake Engineering (NZSEE), was advising CCC and coordinating rapid building assessment activity for CCC.

9.30am – 2.00pm

I was assigned to a building assessment team (consisting of one Urban Search and Rescue (USAR) technician, one local structural engineer, two CCC building officials and myself) to conduct Level 2 assessments of 160 Manchester Court, a 7-storey building on the SE corner of Manchester and Hereford street intersection with the upper 5 stories having load bearing unreinforced masonry piers around the two street front walls of the building (refer to images below). The masonry piers were badly cracked at levels 3 and 4. Local police and fire brigade assisted our team with entry to the building and offices inside.

Manchester Courts Building (from NW), 160 Manchester Street, Christchurch.
On the right is a close-up view of damage to masonry piers.

Inside plasterboard was stripped from piers to confirm that cracking went through the entire pier and that there was no internal reinforcement in the piers. The team gave the building a yellow tag with a Y2 rating which means 'no entry until parts repaired or demolished' (refer figure 2).

The building was subsequently given a red tag late on Sunday. I met USAR team leaders and engineers and city officials on Monday morning at 7.30am to discuss strategies for making the building safe enough for building contractors to carry out further work – either demolition or repair, a decision that at that time had not yet been made. For more details see: http://db.nzsee.org.nz:8080/web/lfe-darfield-2010/home

2.00pm – 5.30pm
After returning to the Command Centre our team was assigned Cashel Street buildings between Oxford Terrace (west end) and Madras Street (east end). All buildings were tagged along both sides of street by the team. Most buildings with observable damage from the exterior were unreinforced masonry (URM) buildings, or buildings adjacent to URM that suffered collateral damage such as parapet or chimney falling through roof. Almost every failure observed was some form of out-of-plane failure mechanism (refer Figures 3 & 4). More details are available at: http://db.nzsee.org.nz:8080/web/lfe-darfield-2010/home

8.30am – 5.00pm. Monday (6/9/10)
After briefing at Command Centre was assigned to assess all buildings on Tuam and St Asaph Streets in SE corner of CBD. Aim was to confirm rating of previous tagging and downgrade where possible after more detailed inspection. Key objective on 'day 2' was to mark where fencing barricades were needed to keep the public safe from falling hazards when the cordoned section of the city was reduced or removed. We experienced three M5.4 aftershocks during the night at our motel.

8.30am – 5.00pm. Tuesday (7/9/10)
After briefing at Command Centre, met briefly with USAR team leaders and technicians to plan strengthening scheme for Manchester Court building. Other assessment teams were sent out to revisit all buildings to determine whether the current tagging needed to be upgraded due to the large aftershocks overnight. For the afternoon I worked with Jason and a number of his PhD students to document damage to masonry buildings in the western side of the CBD before he left to return to Auckland.

8.00am – 1.30pm, Wednesday (8/9/10)
Experienced a M5.1 aftershock in café on way to Command Centre – pictures fell off walls and broken glass in café and parapets falling off hotel building across road! Brief 'exit interviews' with David Brunsdon (NZSEE) at Command Centre and Des Bull (NZ USAR). Stabilisation work at Manchester Court building stopped due to safety concerns for USAR technicians. Unfortunately, I had to leave before any resolution was found for the next step for this building. However, I was very glad to be back on 'solid ground'.

Final Comments

The experience as a structural engineer to help with building assessments in the initial 'response phase' of the disaster was extremely rewarding and educational. I feel that we really helped and that Christchurch officials were genuinely thankful for our help. I strongly encourage other structural/earthquake engineers to take the opportunity when it occurs in future. My observation was that the main focus for the first 72 hours was 'rapid response and building evaluation'. At the end of day 3 it became clear that the responsibility was shifting on to locals (engineers and building contractors) to engage with the owners of buildings to make decisions about repair and/or demolition, depending on the 'tag' for their building. This is clearly work that will occur over the longer term. As for scientific studies, I am sure that there would be benefit in further visits to document that extent of damage, especially as the greater Christchurch region has not received the attention that the CBD has. However, the cleanup of the city is well underway and I suspect that it will rapidly become difficult to see the full extent of damage to buildings in the city centre.

Acknowledgements

A big thanks to A. Prof. Jason Ingham at the University of Auckland for meeting me at the airport in Auckland, putting me up the first night, getting me to Christchurch and providing our accommodation there. Dr. Quincy Ma from the University of Auckland also provided logistical assistance for which I am grateful. Jason's PhD students also did much of the photography for us as we were occupied with the documentation associated with building assessments. Finally, I want to thank the Australian Earthquake Engineering Society for covering the cost of my airfare.

Thanks also to Peter Wood President of NZSEE and Dr Kelvin Berryman, Andrew King and Dr John Zhou from GNS Science who encouraged and greatly assisted Kevin McCue's visit.

USAR personnel applying an assessment notice (choice of green, yellow or red)

Building assessment notices

Examples of typical parapet failures

Multiple front wall parapet failure

Corner of Sandyford and Colombo Streets

Side wall parapet collapse onto

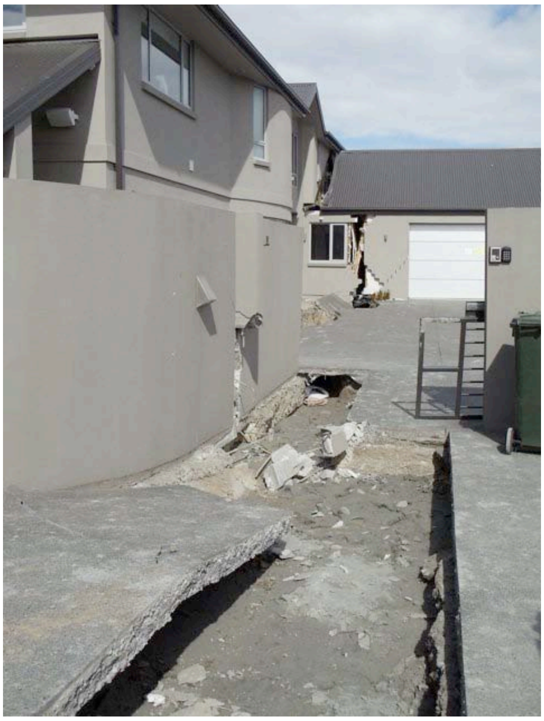
Corner of Colombo and Tuan Streets

Examples of out-of-plane failures in solid masonry walls

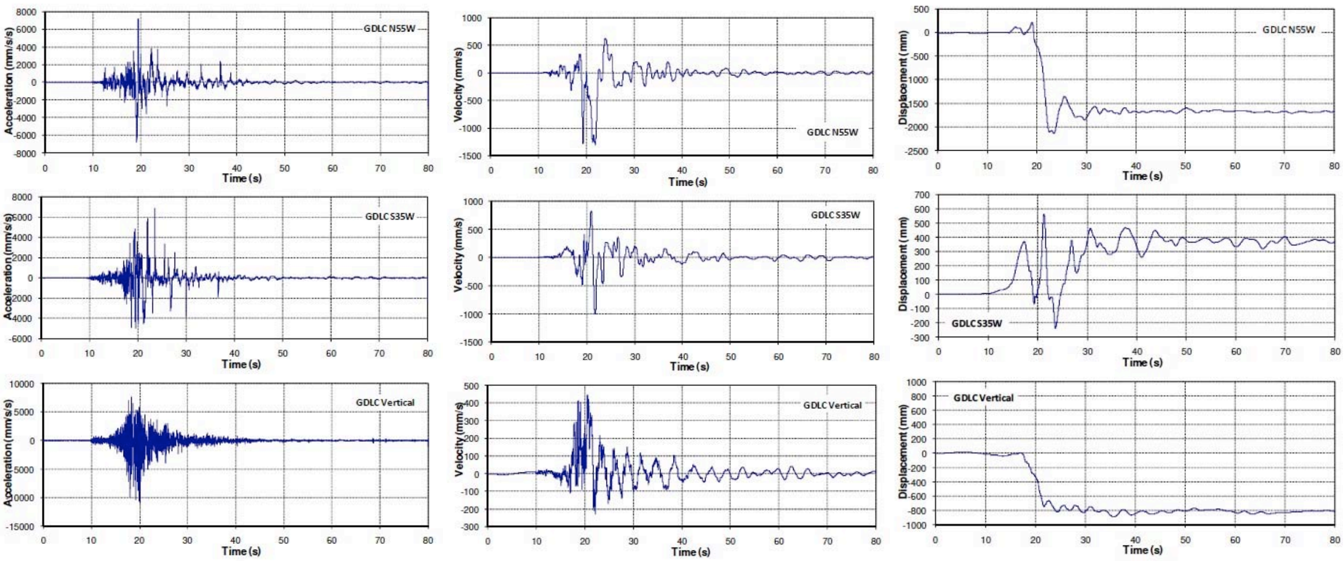
Corner of Worcester and Manchester Streets

118 Manchester St

179 Victoria St



Examples of liquefaction and lateral spreading damage at Kaiapoi NZ (photos by Kevin McCue)



Ground motion recorded at site GDLC, about 1km from the fault trace. Far left is acceleration, centre is velocity, and far right is displacement. The horizontal PGA is about 0.7g, the peak ground velocity about 1.2m/s and the permanent displacement of the ground about 2m (0.8m vertical). Note there was no liquefaction at this site. Strong shaking lasted more than 10s, the displacement was over in about 8s.

GNS Science engineering seismologist Dr John Zhou analysed the data and we thank him for making it widely available and for offering to guide Kevin McCue around in New Zealand.

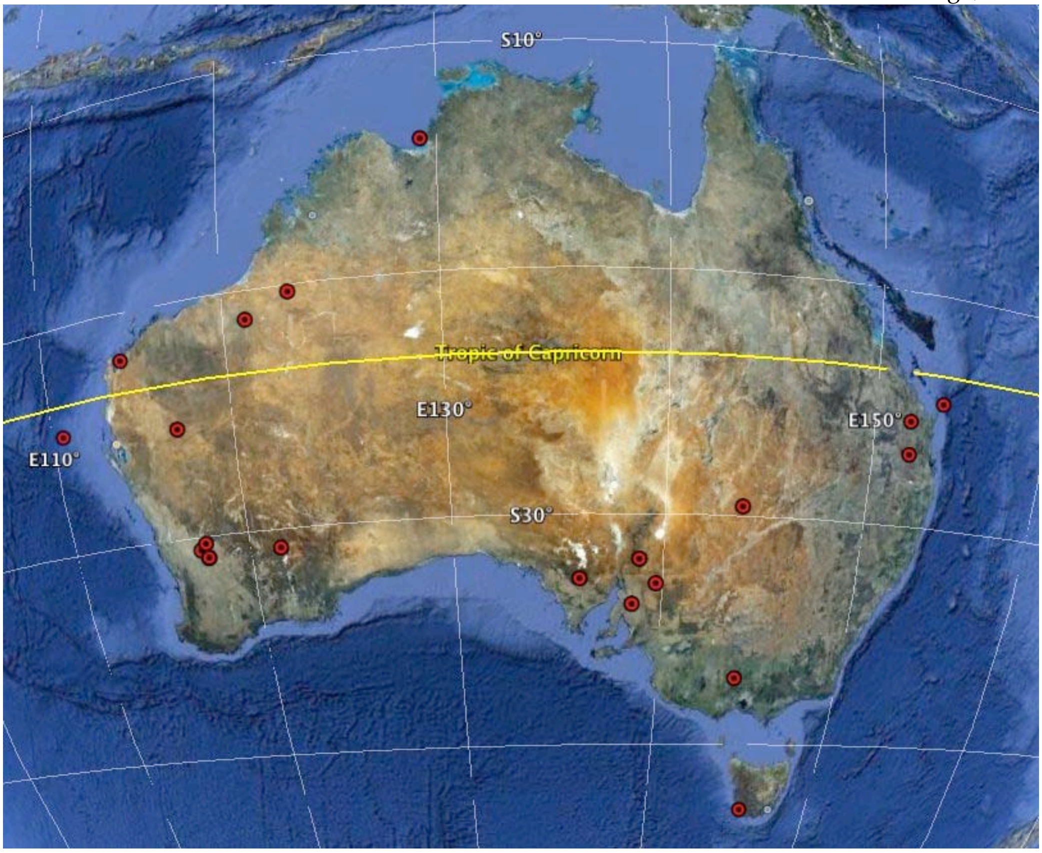
Photo at right is of a small sand volcano at Kaiapoi, north of Christchurch – a classical effect of liquefaction. Fine black volcanic sand has been ejected under strong pore water pressure.

Australian earthquakes, August - September 2010

Earthquakes in the Australian region, 10 August 2010 – 10 October 2010, magnitude 2.5 or greater. The implied accuracy in epicentral coordinates is fanciful, the best are located no better than 3km (.03º) horizontally and 5 km vertically. There were no injuries and no damage was reported. Events located by:

- PIRSA www.pir.sa.gov.au/minerals/earthquakes/recent_earthquakes_in_sa,
- Geoscience Australia www.ga.gov.au
- ES&S www.esands.com; and
- ASC (the Australian Seismological Centre)

Date (UTC)	Time (UTC)	Lat °S	Long °E	Depth (km)	Mag	Location
11-Aug	21:12:06	-43.17	145.77	0	3.5	SW Strathgordon,
15-Aug	08:56	-26.9	152.0		2.9	Blackbutt, Qld
17-Aug	03:27	-25.5S	151.9	10	2.7	Biggenden, Qld
18-Aug	20:54:01	-25.35	117.22	1	3.0	SW of Mt Clere, WA
19-Aug	08:47	-24.6	153.6	10	3.0	Hervey Bay, Qld
22-Aug	4:10:30	-24.78	110.80	10	3.4	W Carnarvon, WA
26-Aug	11:08:28	-21.22	121.15	0	3.0	E of Marble Bar, WA
29-Aug	08:02	-32.63	136.01		2.5	NW Kimba, SA
29-Aug	01:52	-36.9	144.2	3	2.5	Bradford Hills, Vic
31-Aug	9:52:32	-30.88	117.80	1	2.6	SW Bencubbin, WA
2-Sep	7:25:14	-14.31	129.35	0	3.1	NE Kununarra, WA
2-Sep	4:27:59	-30.86	117.80	0	2.6	Bencubbin, WA
3-Sep	15:05:01	-20.28	123.23	10	3.0	Gt Sandy Desert, WA
18-Sep	12:53:32	-22.05	114.65	0	2.9	SW of Onslow, WA
19-Sep	22:11	-31.82	138.87		2.7	E Hawker, SA
19-Sep	21:23:15	-30.75	121.64	1	2.6	East of Kalgoorlie,
26-Sep	22:59:35	-30.52	117.45	0	2.9	N of Koorda, WA
29-Sep	9:09:25	-29.57	143.75	0	4.0	NW of Bourke, NSW
5-Oct	7:15:31	-30.26	117.77	0	2.6	NW of Beacon, WA
8-Oct	10:53:50	-33.71	138.58	3	3.2	NW of Clare, SA
10-Oct	2:30:18	-32.84	139.72	0	4.3	E Peterborough, SA



Epicentre of earthquakes in the Australian region, M ≥ 2.5 as listed above. Map created using GoogleEarth.

Conferences

November 2010 AEES (see notice in this Newsletter).

01-03 December 2010

3rd Asia Conference on Earthquake Engineering, ACEE-2010, Bangkok, Thailand. acee3@gmail.com

12-14 December 2010

International Conference on Sustainable Built Environment. Faculty of Engineering, University of Peradeniya and Earl's Regency, Kandy, Sri Lanka http://www.icsbe.com/

14-15 March 2011 (see notice on page 2)

PCEE2011 Auckland NZ

11-13 April 2011 (see notice on page 2)

SW Pacific Earthquake Resilience Workshop

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, is conducting 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 will 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. Unfortunately the deadline has passed by the time you read this).

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 instrumentation 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 seismometers–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.

(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:

Bienvenue sur la station sismo CANB
Lycée franco-australien de Canberra

- latitude: -35.31°
- longitude: 149.13°
- altitude: 586m

AEES Contact Details

Post:	PO Box 4014, McKinnon P.O. VIC 3204
Email:	sgh2604@bigpond.com
Tel:	0414 492 210
Website:	www.aees.org.au