

AEES NEWSLETTER



April 2012

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President's Report

I'd like to welcome all AEES members and friends to the first newsletter of 2012. Compared to the same period last year when I prepared my first ever AEES President's report, or the year before, the media has been rather quiet in reporting earthquakes and earthquake-caused losses so far this year, despite many large earthquakes having already occurred in 2012. Fortunately these large earthquakes are not as destructive as those of the last two years in Haiti, Chile, Christchurch and Japan. Those events caused significant loss of life and damage and attracted great media attention and wide coverage.

Contrary to the public media cycle, there has been a significant increase in discussion among AEES members after Brian Gaull posted his comments on the trial of 6 seismologists/engineers in Italy after the L'Aquila (Abruzzo) Earthquake, and the remarkably higher PGA than that predicted with PSHA in Christchurch. From the comments and suggestions posted by many members, we generally agree that we need to let the public understand the existence of earthquake threats in Australia. However, with the current science and technology, earthquake

occurrence and intensity cannot be accurately predicted. One can at best predict the probability of earthquake occurrence, and the likely ground motions it would generate at various sites. It is not possible to exactly predict the consequences of an earthquake because structural damage depends not only on earthquake ground motion parameters (amplitude, frequency and duration), but also on inherent structural conditions (vibration frequencies, mass and stiffness distributions, connectivity, irregularities, and material strength, etc.). Thanks to Adam Pascale, an AEES blog was created in February. This allows our members to post their observations and experiences, which are then accessible by the general public. Hopefully the AEES blog will not only generate publicity for the society, but also educate the general public of earthquake threats in Australia and the current technology in designing structures to resist earthquake loadings.

Thanks to Sharon Anderson and Mike Griffith, and many others - including a number of non-AEES members - who helped in reviewing the papers, contributed papers and attended the annual conference in Barossa Valley last November which was a total success. Planning for the conference this year is well underway. Sharon and Russell Cuthbertson have been working very closely in search for the best venue for the event. During his trip to Queensland, Kevin McCue inspected a number of shortlisted venues by Sharon and Russell. Now the venue and dates for the 2012 conference have been finalized. Sharon will soon send the call for abstracts. I am looking forward to your support for the conference and hope to meet many of you in Queensland in December 2012.

The preparation for September's bid in Lisbon for AEES to host the 2016 World Conference on Earthquake Engineering is also well underway. A bidding committee was formed last December. The committee consists of Gary Gibson, Helen Goldsworthy, Mike Griffith, Nelson Lam, Kevin McCue, John Wilson, David McCarthy from the Melbourne Convention and Visitors Bureau, Jackie Caldwell from the Professional Conference Organizer, Arinex Pty limited, and myself. At this point, we have collected supporting letters from the vice chancellor of the University of Western Australia, from the president of Engineers Australia, the CEO of Engineers Australia, and the Lord Mayor of

Melbourne, amongst others. These letters, together with other supporting materials, will be submitted to the secretary general of IAEE in June. We have received quotes from the Melbourne Convention Centre. Jackie has worked out a budget for hosting the conference there. The budget is currently under review. Negotiation with Qantas also went smoothly and Qantas has agreed in principle to give discount to delegates attending the conference if our bid is successful. A booth at a very good location has been booked for the 15WCEE in Lisbon to promote AEES, Melbourne and Australia. I hope to collect names of our members who will attend the 15WCEE to work out a roster so that the booth will be attended by at least two people at any time during the conference. If you have any ideas or suggestions on promotion materials that we can send to IAEE committee members, distribute in the conference, and ideas on decoration of the booth, please let me know.

Some of us have already started contacting country representatives in IAEE, and we have obtained a few confirmations of countries that will support our bid. If you have a connection to any country representatives in IAEE, please do the same. The list of the country delegates in IAEE can be found at the link <http://www.iaee.or.jp/organization/delegates.html>

Representing AEES, I attended the EPAC meeting on 15 March in Canberra. Besides many things discussed during the meeting, I would like to bring to your attention the current EA review on the relationship between EA and technical societies. EA's new charter and by laws were approved by the Governor General last year, and this formally recognises technical societies as entities. The review will make clear the legal structure and relationship of technical societies with EA. There will be two streams of technical societies. Those who are incorporated can be formally affiliated with EA. The others who are not incorporated will be technical societies recognised by EA. This will make a difference in how EA relates to technical societies legally and financially, in relation to the terms of reference and governance. EA does not have legal control over the technical societies that are separately incorporated. Those societies will be affiliated by an affiliation agreement. Technical societies will be asked to make a decision which way they wish to go once the review is completed. I will keep you informed about this development and believe that we will need to discuss what our preferred relationship will be with EA.

I am looking forward to working with all of you for another successful year of AEES!

Hong Hao

Book review of Cascadia's Fault

by Jerry Thompson (article from Colin Lynam)

<http://uploading.com/files/9d1252b8/Cascadia>

This book tells the non-fictional story of the developing science of Seismology from the 1960's to present but mainly through the development of seismology in western USA. There is an elephant in the room and no one can see it; the coming tsunamagenic M9.6 earthquake, along the Cascadia fault that stretches offshore Oregon, Washington and British Columbia. The reader follows the developing argument from "no subduction trench so no subduction plate" through intergovernmental political stances to avoid interfering with the nuclear power station building program ("there are no faults"), with collateral evidence coming in from sedimentologists and foresters.

We arrive at 2009, where the question is; "If Cascadia's fault broke today, would it start as a magnitude 8.8 in Southern California and continue north with several more huge quakes over the next decade? Or would it slip all at once in a magnitude 9.2 mega-disaster?" Cascadia is recognised as the same mega-event type as Chile (1960) and Alaska (1964).

The author is an accomplished journalist and tells a flowing detective type story about tracking down the previous historic occurrence of Cascadia's 13 mega-thrust earthquakes. Reversing the geologist's maxim, we see here that "the past is the key to the future." The story is told in a true mystery fashion featuring named scientists from USGS, Canadian Geol Survey and university researchers, from many disciplines, who discover through observation, the tell tale evidence leading to a new awareness of the previously determined "aseismic" region.

The process of how a scientific body changes its collective opinion is informative. The collection of observational data from seismology, tectonics, sedimentology, forestry, oceanography, surveying and mathematical modelling, make one appreciate the true reliance we have developed on large earth systems datasets. The individual's inspiration is always the catalyst to the next paradigm. The press is essential to alert the public into preparation toward a new community hazard program.

The book comes with a collection of plates and diagrams and a chronologically listed "suggestions for further reading." This book would equally make an informative undergraduate text or a fascinating read for friends over Christmas.

Col Lynam

Volunteer Seismologist, Earth Science Systems
Computational Centre

The University of Queensland, Brisbane, Australia

Mobile: 0438 339 221

7th Gulf Seismic Forum – Jeddah, Saudi Arabia

By Dr Cvetan Sinadinovski

The Gulf Seismic Forum was established to encourage scientific and technical cooperation in the region of Arabia between seismologists, engineers and governmental organizations and to promote research in seismology, including reducing the risk of damage from earthquakes. Considerable earthquake activity occurs around the margins of the Arabian Plate along the Red Sea spreading axis, the Dead Sea and the Gulf towards Iran, that results in significant seismic risk. With the great increase in the development of infrastructure and economic activity in the region earthquake risk studies have become more important especially near the margins of the Arabian plate. There continues to be a rapid expansion of the seismograph networks in the region and large amount of data have been collected that help in better understanding of the causes of the seismicity.

The Seventh Gulf Seismic Forum was hosted by the Saudi Geological Survey in Jeddah from January 22-25, 2012 with some 500 seismologists, engineers and geoscientists participants. Opened by the Prince Mishaal bin Majed bin Abdulaziz, Governor of Jeddah Province, the Forum included keynote lectures, three workshops (in seismic inversion, hazard mitigation, and earthquake preparedness) and a field trip to the area near the city of Medinah that experienced recent volcanism.

The oral and poster technical sessions covered the topics of:

1. Seismicity and tectonics of the Middle East,
2. Seismic risk, disaster management and mitigation,
3. Seismic hazards and zoning studies,
4. Seismic networks, data processing and management of seismological data,
5. Earthquake engineering,
6. Early warning systems and seismic safety of critical facilities,
7. Induced seismicity and
8. Volcanic hazards

The full program and more detailed information can be found through <http://7gsf.info/> website.

AEES2011 Barossa Valley Report

On Friday 18th November, Professor Michael Griffith and the local organising committee welcomed delegates to the Barossa Valley, South Australia to attend the 2011 Australian Earthquake Engineering Society Conference. The conference was held at the Novotel Barossa Valley Resort over three half days commencing at 1pm on the Friday. The AEES AGM was held during the conference.

Fifty-two papers were presented on most aspects of earthquake engineering and ~80 delegates registered.

Keynote speakers were:

- Gary Gibson, ES&S Seismology Research Centre, The University of Melbourne
- Jason Ingham, The University of Auckland, NZ
- Peter McBean, Consulting Engineer, Director of Wallbridge & Gilbert, Adelaide
- John Wilson, Swinburne University, Victoria

The conference dinners on both Friday evening (at the Novotel Barossa Valley Resort) and Saturday evening (at the Murray Road Vineyards) were excellent.

The Saturday afternoon site visit to the Para Fault was interesting though the fault was not unearthed.

The conference was preceded by a meeting of Australian Seismologists in Adelaide Thursday.

Australian Seismologists' Meeting

Thursday 17 Nov 2011, by David Love (DMITRE)

In past decades, there was constant communication between groups doing earthquake recording. This was partly due to some commonalities of software and hardware, and also the small number of stations. There are now more stations, more diverse software, different purposes, but less communication. South Australia (DMITRE) now collects data on a regular basis from Geoscience Australia and the Australian Centre for Geomechanics, occasionally from Environmental Systems and Services, and last year received useful data from Australian National University deployments.

In conjunction with the AEES conference, a meeting was arranged for organisations and people interested in aspects of seismological recording. Twenty two people attended, from federal and state govt bodies, universities, private companies, and private individuals.

Topics discussed included networks (new and upgrades) and deployments, rapid deployment capability, waveforms, catalogues and data exchange, blasting, magnitude and calibration procedures. It is planned that a number of these topics will be covered by various groups and compiled by Geoscience Australia in the next Australian Seismological Report.

Natalie Balfour from the Australian National University gave a presentation on the new Seismometers in Schools program. Geoscience Australia presented information on a number of topics. Three rapid deployment instruments were brought for display.

The meeting room was a little cramped, booked when it was expected that only a dozen could attend. There was plenty of discussion, sometimes with considerably differing views. Following the meeting a number of participants enjoyed Pizza together, down Rundle Street.

Italian seismologists and PSHA on trial

<http://www.nature.com/news/new-twists-in-italian-seismology-trial-1.10049>

The former head of the Italian Department of Civil Protection turned from key witness into defendant

A panel of seismologists who met just days before the 2009 earthquake in L'Aquila, Italy are on trial over their reassurances to the public.

Those indicted took part in a meeting held in L'Aquila on 30 March 2009, during which they were asked to assess the risk of a major earthquake occurring in the near future in view of the many shocks that had hit the city in the previous few months. After the meeting, Bernardo De Bernardinis, deputy head of the Department of Civil Protection, told the press: "The scientific community tells me there is no danger because there is an ongoing discharge of energy," a statement that most seismologists consider to be scientifically incorrect.

On 6 April 2009, a magnitude-6.3 quake hit the city, killing 309 people. De Bernardinis and the six members of the scientific panel have been indicted for manslaughter because their false reassurances prompted many people not to evacuate.

Guido Bertolaso, former head of the Department of Civil Protection and De Bernardinis's direct superior, had not been indicted and was originally expected to appear as a witness. But a few weeks ago a wiretap revealed that he had apparently set up the meeting to convey a reassuring message, regardless of the scientists' opinion. He also seemed to be the source of the "discharge of energy" statement. He thus found himself under investigation and, at the beginning of the hearing, he was officially notified that he too may soon be formally indicted for manslaughter.

Bertolaso was asked by the prosecutor to explain that telephone conversation. He defended himself by saying that by defining the meeting as a "media move", he was not trying to downplay risks but rather to put some order into the contradictory information that was reaching the citizens in those days. In particular, he referred to Giampaolo Giuliani – a laboratory technician and amateur seismologist who was alarming the population with claims that a major shock was coming – and to a newspaper article that had misquoted some Civil Protection experts and stated that the shocks would soon be over. The meeting, he said, was meant to make clear that both were wrong and that no deterministic prediction could be made.

As for the idea that the smaller tremors reduce the risk by releasing energy, Bertolaso insisted that he had heard it from scientists at the Italian National Institute for Geophysics and Volcanology (INGV), and that he had used the same phrase in the past without being corrected by any of his seismology

consultants. Enzo Boschi, former INGV president and one of the defendants, has denied this. The issue will be clarified when Boschi takes the stand.

The hearing also included some true scientific debate when Lalliana Mualchin, former chief seismologist for the Department of Transportation in California, testified as an expert witness for the prosecution. In 2010, when news about the indictment broke, Mualchin was among the few experts who openly criticized – and refused to sign – a letter supporting the indicted seismologists signed by about 5,000 international scientists.

Mualchin said that seismic hazards were not properly assessed in L'Aquila. "Italy is one of the countries with the best seismic knowledge in the world. And yet look at what a 6.3 earthquake has done to this city. That knowledge was not used, and scientists are responsible for that. They were conscious of the high risk in the area, and yet did not advise the people to take any precaution whatsoever," he said.

The problem is in part a scientific one, Mualchin said. The Italian scientists based their analysis on the frequency of earthquakes in the area. This is known as the probabilistic seismic-hazard analysis (PSHA), a method that is state of the art in many countries, but that, in Mualchin's view, systematically underestimates seismic hazard because it does not consider extreme and rare events.

"Frequency is not important, what really matters is the largest earthquake we can expect, the strongest one that has happened in the past. Risk prevention should be based on that," he said. This is the philosophy behind deterministic seismic-hazard analysis, a method that Mualchin says has been mostly abandoned by the scientific community, to the point that younger seismologists do not even learn about it.

"PSHA is a bad model California has exported elsewhere, and we see the results here in L'Aquila," he told Nature after the hearing. Mualchin worries that the new building codes approved in Italy after the L'Aquila earthquake show no improvement. "They never consider the worst-case scenario for any particular area, and this can lead to new disasters in the future".

The case continues. As an aide memoire, from AEES 2011/4 we read:

"Many scientific organisations worldwide condemned the trial, the American Geophysical Union claim that it could put future earthquake research at risk. Litigation will discourage scientists and officials from advising their government or even working in the field of seismology and seismic risk assessment, the organisation said. Most of the deaths were attributed to the collapse of buildings that had not been constructed or strengthened according to local building standards, even relatively new hospitals and schools."

Fracking and earthquakes in Ohio, USA

From: Colin Lynam <lynam@uq.edu.au>

Date: 3 January 2012 7:56:13 AM AEDT

Obviously greater seismograph coverage and monitoring is needed and perhaps this is a "research" role that the mining & Energy companies could partner with University Geophysics groups to determine required outcomes?

Cheers, Col Lynam

<http://www.nytimes.com/2012/01/02/science/earth/youngstown-injection-well-stays-shut-after-earthquake.html>

Disposal Halted at Well After New Quake in Ohio

By HENRY FOUNTAIN

Published: January 1, 2012



An official in Ohio said on Sunday that the underground disposal of wastewater from natural-gas drilling operations would remain halted in the Youngstown area until scientists could analyse data from the most recent of a string of earthquakes there.

The New York Times

The latest quake, the 11th since mid-March, occurred Saturday afternoon and with a magnitude of 4.0 was the strongest yet. Like the others, it was centred near a well that has been used for the disposal of millions of gallons of brine and other waste liquids produced at natural-gas wells, mostly in Pennsylvania.

The waste, from the process called hydraulic fracturing that is used to unlock the gas from shale rock, had been

injected under pressure into the well, which is 9,200 feet deep. Scientists had suspected that some of the wastewater might have migrated into deeper rock formations, allowing an ancient fault to slip. Similar links between disposal wells and earthquakes have been suspected in Arkansas and Texas.

Andy Ware, deputy director of the Ohio Department of Natural Resources, which regulates gas drilling and disposal wells, said the state asked on Friday that injection at the well be halted after analysis of the 10th earthquake, a 2.7-magnitude temblor on Dec. 24, showed that it occurred less than 2,000 feet below the well. Because of a lack of data, depth estimates of earlier earthquakes had been far less precise.

The owner of the well, D&L Energy Group of Youngstown, stopped injection at 5 p.m. Friday, Mr. Ware said.

When the stronger quake occurred less than 24 hours later, Mr. Ware said, state officials decided to institute a moratorium on the injection of drilling waste within a five-mile radius of the well, "until we are able to take a closer look at the earthquake data that is available." There are no other disposal wells in operation in the area, Mr. Ware said, but four are under development "and would not come online until we're able to be sure."

With the increased production of gas from shale in the United States, the process of hydraulic fracturing, or fracking, has come under fire for its potential to pollute the air and contaminate drinking water. But the events in Youngstown – and a string of mostly small tremors in Arkansas, Oklahoma, Texas, British Columbia and other shale-gas-producing areas – suggest that the technique may lead, directly or indirectly, to a dangerous earthquake.

There have been no reports of significant damage from any of the Youngstown earthquakes, which until Saturday were about 2.1 to 2.7 in magnitude.

According to the United States Geological Survey, the more powerful earthquake on Saturday was felt throughout northeastern Ohio and northwestern Pennsylvania, and as far as Morgantown, W.Va., and even Toronto. One resident in the Youngstown area said that from the way his house shook, he had thought a tree had fallen on it.

The more precise data from the Dec. 24 quake came from instruments installed by scientists from Lamont-Doherty Earth Observatory, a part of Columbia University. John Armbruster, a seismologist with Lamont, said that the data from the Saturday quake should be available within a few days, and that analysis should help pinpoint the location of the fault that slipped.

"In our minds, we were already pretty convinced that these events were connected to the well," Mr. Armbruster said. "Having that many earthquakes fairly close to a well in Ohio, where there aren't a lot of earthquakes, was suspicious."

Conferences

19-24 Aug 2012 33rd General Assembly of the European Seismological Commission to be held in Moscow, Russia. The official language of the Assembly is English.

ON-LINE REGISTRATION is now available on the official website www.esc2012-moscow.org

Please address questions to the Technical Secretariat:

Ms. Anastasiya Devochkina
Tel./Fax: +7 (495) 726-5135
E-mail: esc2012@onlinereg.ru

IAEE Matters: - WCEE 2016

Australia bid for World Conference on Earthquake Engineering 2016

Work is proceeding on the AEES bid at the 2012 WCEE in Lisbon Portugal, to host WCEE2016. The Melbourne Convention and Visitors Bureau are cooperating with the AEES committee to produce a quality proposal.

The AEES Committee would appreciate offers of support and help from members.

Recent earthquake at Olympic Dam, South Australia

The Olympic Dam mine site is in the Stuart Shelf, a thin sequence of sediments on the basement of the Gawler Craton in South Australia. The Gawler Craton has been inactive earthquake-wise since state monitoring commenced in the late 1950s.

On 26th March 2012 a magnitude 4 earthquake strongly shook the Olympic Dam mine site enough to cause power to be shut down for half an hour. No other details are known of the impact at the mine.

It is likely that this event was induced by mining and all relevant data including seismic data should be released by the mining company BHP Billiton or the deposit owner, the South Australian Government, for scientific evaluation and for the public interest.

This and an earlier earthquake, the first recorded by the national network near the mine site, should lead to a re-evaluation of earthquake hazard there.

Adelaide seismologist shake up meeting.

On Sunday 1 April (no, not a joke), a group of seismologists, plus partners and relatives, met over a barbecue at the new Lobethal seismograph station. Jim Deer was our host and the latest owner of a seismograph. We discussed all matters seismological for the whole afternoon; instruments and their problems, quarries and noise problems, data, and tsunamis. Paul Hutchinson provided a travel time map for Victor Harbour. Blair Lade again brought his telescope with sun filter. There was discussion about possible additions to the Adelaide seismograph network.

President, AEES

The Daily News, Perth Saturday 16 July 1910 p9.

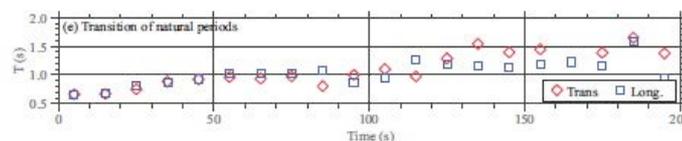
EARTHQUAKE-PROOF BUILDINGS.

A new method of rendering buildings earthquake-proof has been devised by Dr. Calantarientis, of Scarborough. In this method the foundations are laid in the usual manner, and faced with granite or iron. On this are placed layers of tale, mica, asbestos, or other slippery material. Slabs of granite, or iron, laid on this form the base of the superstructure. The idea, of course, is to allow the building to slide laterally on its foundation if shaken by earth tremors. In this way the straining and fracturing of the walls would be avoided. To meet the sliding of the house during the earthquake shocks the service pipes must be rendered flexible where they leave the ground.

Measuring Damage to Buildings Dynamically.

During the 1971 San Fernando earthquake, the natural period of the Millikan Library was found to have increased due to building damage. A graphic account of this loss of stiffness was observed in a 9-storey reinforced concrete building with embedded steel frames at Tohoku University. The peak acceleration at the 9th floor exceeded 0.9g during sustained strong shaking in the recent M9.1 Tohoku earthquake. The pre-quake fundamental period of the building was about 0.7s but this increased to about 1s after 40 seconds of shaking and then 1.2 to 1.5s after 90 seconds of strong shaking as shown in the figure below from a report on the Tohoku earthquake.

This doubling of the natural period represents a stiffness reduction to $\frac{1}{4}$ of the original stiffness according to the authors of the report.



Obviously pre and post-earthquake measurements of the natural period give a much better estimate of the state of the building post-earthquake than could ever be obtained during a hurried walk-through inspection.

Earthquake rattles New Zealand

<http://www.stuff.co.nz/national/6081992/Large-earthquake-rattles-both-Islands>

A magnitude 5.7 earthquake rattled central New Zealand on Saturday evening at 7.19pm on 3rd December 2011. The focus was 30km east of Picton in the Marlborough Sounds at a depth of 60km.



Minor damage was reported on Wellington's waterfront as shown in the photo of damaged louvers on the Meridian Energy building. The lift in The Dominion Post building was put out of action. The quake was felt strongly on both sides of Cook Strait in Marlborough and Wellington and also at Blenheim, Nelson, Westport, New Plymouth, Wanganui, Carterton and as far south as Christchurch.

Ornaments were knocked off shelves in Karori.

Passengers aboard a Cook Strait ferry just kilometres from the earthquake's epicentre, reported that the ship shuddered as the time of the earthquake.

People in Picton reported that the quake lasted at least 20 seconds and cafe goers ran out onto the streets.

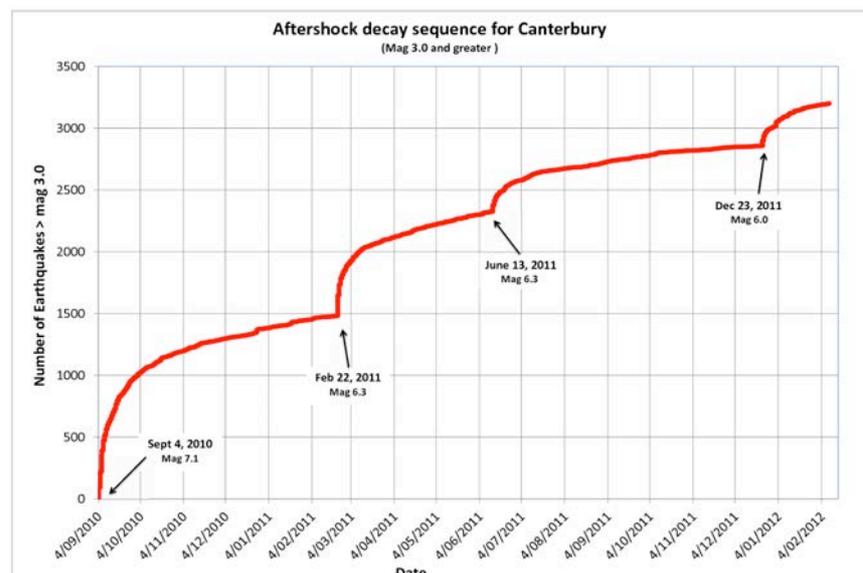
GNS said it was the biggest earthquake in the Marlborough region since a similar-sized shallow earthquake near Seddon in 1966 that caused significant damage.

Christchurch

The aftershock sequence in Christchurch seems to be slowing down with fewer and smaller events. The cumulative energy released since September 2010 is plotted in the adjacent figure from Chris Mance and NZSEE web site.

The risk of a magnitude 6+ earthquake in the next year to Feb 2013 is still rated by GEONET seismologists at about 1 in 6.

The following description of the effects of a magnitude 5.5 aftershock on 2nd January, located 20km east of Christchurch was sent by Celia Cameron to EPSO's Andre Phillips:



"I was at work and whoa! the sound was incredible - thousands and thousands of things falling off the shelves and breaking glass from all the wine bottles. There are huge windows at the front and they were rippling. It was so gross heaps of stuff broke open so the shop smelled really strongly of coffee, detergent and wine. The floors were all covered in juice and milk and coke and shampoo. Took ages to clean it but luckily our department was perfect! - not one loaf of bread out of position so we just kept working. Oh yeah and a big bit of roof broke off and all the pink insulation stuff was on the floor."

CTV building report "very thorough"

by KEVIN NORQUAY

<http://www.stuff.co.nz/the-press/news/christchurch-earthquake-2011/6395045/CTV-building-report-very-thorough>



NIGEL PRIESTLEY:
Unlike the CTV building, many buildings "performed very well" during an earthquake that far exceeded the shaking they were built to withstand.

A report into the collapse of the CTV building has been defended as "a very thorough piece of work" by the deputy chairman of the investigating panel, after it came under attack from the designers.

The Department of Building and Housing yesterday released a technical report on the collapse of the building in last February's Christchurch earthquake. Most of the 185 people who died were in the CTV building, where 115 perished after it collapsed in "seconds".

The long-awaited report, a key piece of evidence for the Canterbury earthquakes royal commission, found the building did not meet the standards of the day when it was built in 1986.

The report identified three "critical" factors in the collapse

The intense horizontal ground shaking.

Brittle columns, also concrete in the columns was significantly weaker than expected.

The asymmetrical layout of structural walls, causing the building to twist in the quake and place extra strain on the columns.

While the department found no fault, it referred the report to police and the Institution of Professional Engineers. Both bodies are considering further action.

Yesterday, Alan Reay, director of Alan Reay Consultants Ltd (ARCL) which designed the CTV building, disputed several of the report's findings. He said the report was technically inadequate and he was disappointed with the process and the conclusions. "Some of the assumptions made in the reports are highly questionable. As a consequence, the report's findings are not conclusive. In fact, in many areas they may be flawed."

Investigation deputy Nigel Priestley, a former Professor of Structural Engineering at the University of California and former senior lecturer at Canterbury University, told Radio New Zealand the inquiry was the best it could be given the information available.

"It's been a very through piece of work, and the causes of failure as defined in the report are correct, and well researched, and fully justified by the analyses that have been done." The CTV building did not meet the standards of the time, and many buildings constructed then "in general performed very well" during an earthquake that far exceeded the shaking they were built to withstand.

The inquiry looked at plans and compared them to what was required by law. From those it created structural models, which were analysed in great detail, with predictions of the response in an earthquake determined from that. "The detailing of various parts of the building were compared with the code requirements - and these did require some analysis to make these judgements - indicating that there were deficiencies in the design."

Detailed forensic investigation of the CTV building after the collapse was also carried out, with concrete and steel samples taken. What was found - in particular inflexible and brittle columns - had lead to a broader investigation by the Department of Building and Housing, Professor Priestley said.

"The major concern ... is of so-called non-ductile columns and the fact that these were in some circumstances permitted in buildings. The concern is that the requirements of the code as to when and where these could be used may not have been met in all cases." The report found the building's collapse was "almost certainly" initiated by the failure of one or more columns on the east wall.

Building department chief executive Katrina Bach said yesterday the investigation called into question the design, construction and consenting of the building. However, she said, the earthquake was an exceptional event and the CTV building had unique circumstances.

While a wide number of buildings were being investigated, the problem was not thought to affect many of those. The Department of Building and Housing had identified 352 buildings and inspected half of them which were found to be "reasonably OK", Building and Construction Minister Maurice Williamson said.

Earthquake - Ernabella South Australia

23 March 2012 at 8:30pm CST

ASC Location: 26.22°S, 131.94°E. The epicentral region is just south of the border with the Northern Territory, about 320 kilometres south-west of Alice Springs and 230 kilometres south-east of Uluru. This epicentre is about 50km west of the slightly larger earthquake at Marryat Ck on 30 March 1986 which produced a 13km long thrust fault scarp up to 0.6m high. See media including the ABC's Emma Sleath (Cross Media Reporter) <http://www.abc.net.au/local/stories/2012/03/26/3463765.htm>

Ernabella is an indigenous arts hub with about 500 Aboriginal residents and more in surrounding communities. Ernabella teacher Peter Ruwoldt said the quake lasted around 30 seconds and was a terrifying experience. "The place shook there was a huge loud rumble," he says. "We ran outside and there was a young girl pushing a pusher and she said 'I'm scared. Adults were running out yelling out for their children kids were running towards their home, it was pretty terrifying." No damage has been reported at Ernabella or elsewhere.



Photo Ground cracks (fault trace) following Ernabella's earthquake (Peter Ruwoldt).

"You can see some displacement of the ground, I reckon four or more inches raised," he says. ".....in other photos you can see rocks have been dislodged and tumbled down the hill."

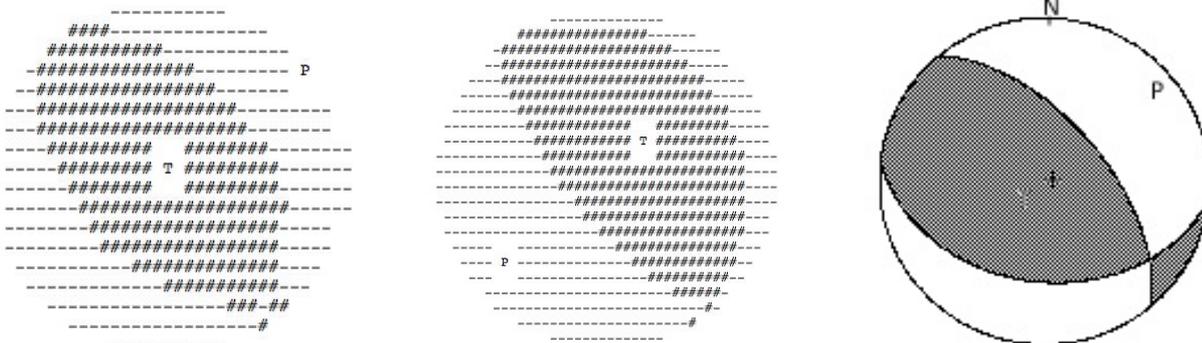
Ernabella Anangu School deputy principal Tony Nicholls said town residents rushed into streets as the quake struck. "I heard rumbling and then the wall started shaking, which lasted about 15 seconds," Mr Nicholls said. "It was shaking enough for me to think I'd rather be outside than inside."

Friday's mainshock followed two small earthquakes in the region the previous week. One on March 16 magnitude 4.3 and another on March 20 was magnitude 3.8. Only a few small aftershocks have been recorded.

Initially GA reported its magnitude at ML6.1 while the USGS had it as Mw5.3. GA have since downgraded their magnitude to ML 5.7. GA scientists Dan Clark and Andrew McPherson flew to the area to map the ground deformation and any faulting the following week. The focal depth is not well defined, GA have it as 7km, the USGS has it at 11km and my model gave it 5km.

Two mechanisms derived by inversion of seismic data were circulated the day after the earthquake. I used first motions in the traditional way, both nodal planes are well constrained using P, and the PG phase on AS11 and WRKA. The three solutions are reproduced below. All three show a predominantly thrust mechanism with a principal stress acting in a northeast - southwest direction.

There is a strong chance of another moderate earthquake in the region in the next 6 months, like the doublet at Marryat Creek in 1986. It would be prudent to install some strong motion instruments in the epicentral region.



Focal mechanisms: Ekstrom solution (left), Herrman solution (centre), McCue solution (right)

GA earthquake geologists Andrew McPherson and Dan Clark mapped a 1.5 km long fault scarp in the epicentral region and their study is being submitted for publication.

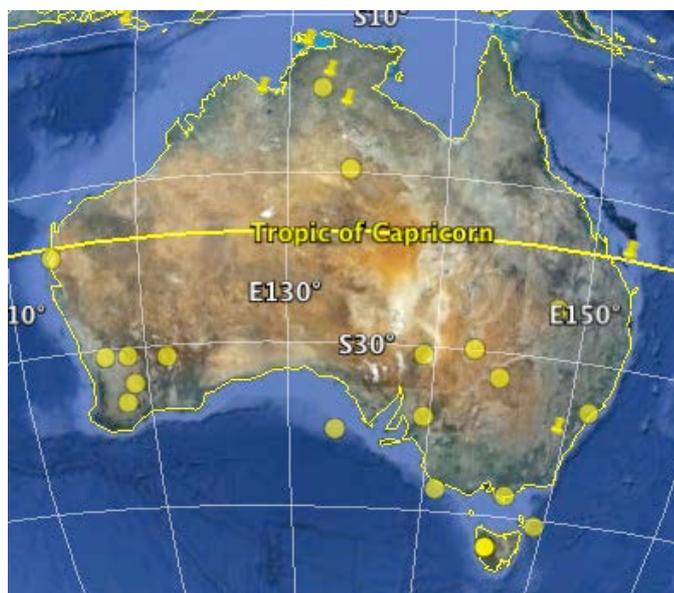
Major World Earthquakes 2012

Date	Place	Mw	Comment
January 10	Off the west coast of Northern Sumatra	7.2	Unusual location and mechanism within the Indo-Australian Plate.
February 02	Vanuatu	7.1	This shallow event had an unusual mechanism.
February 06	Cebu, Philippines	7.0	At least 48 people killed, 92 missing, 100 injured, many buildings damaged or destroyed and at least 11 bridges damaged by the earthquake and quake-triggered landslides in Negros Oriental.

Australian Earthquakes, Jan-Feb 2012

Date UTC	HMS	Latitude	Longitude	ML	Depth km	Location
2-Jan-12	12:46:51	-38.631	146.349	2.6	62	N of Toora Vic.
3-Jan-12	5:21:35	-29.945	142.648	3.1	3	SE Tibooburra NSW.
5-Jan-12	14:05	-22.0	152.5	4.2	5	Off Yeppoon Qld.
9-Jan-12	18:53:03	-30.516	139.247	2.8	10	SW of Arkaroola SA.
10-Jan-12	18:44:01	-33.308	118.222	3.3	0	NE of Nyabing WA.
11-Jan-12	3:37:04	-14.809	132.037	2.5	12	SW of Katherine, WA.
12-Jan-12	1:22:13	-38.566	140.929	3.3	19	Offshore S Mt Gambier SA
13-Jan-12	19:02:13	-30.681	121.554	2.7	4	Kalgoorlie WA.
13-Jan-12	20:46:28	-42.1	145.5	3.2	5	Near Queenstown Tas.
15-Jan-12	21:33:45	-31.502	144.599	2.8	11	W of Cobar NSW.
22-Jan-12	20:18:53	-42.1	145.5	3.5	11	Near Queenstown Tas.
24-Jan-12	11:42:03	-30.449	116.935	3	11	SW of Kalannie WA.
24-Jan-12	18:34:17	-42.035	145.53	2.8	10	Near Queenstown Tas.
27-Jan-12	19:18:46	-34.168	139.535	2.5	20	SW of Morgan, SA.
28-Jan-12	19:52:56	-19.784	133.926	2.9	16	SW Tennant Ck, NT.
29-Jan-12	13:45:02	-32.183	118.988	2.7	10	NE of Hyden, WA.
4-Feb-12	8:41:05	-34.87	133.13	4.0	10	W of Port Lincoln SA.
6-Feb-12	10:57:41	-32.97	151.51	2.5	4	Booleeroo NSW.
16-Feb-12	10:48:30	-27.054	147.98	3.3*	0	SW of Roma Qld.
18-Feb-12	4:02:15	-24.096	113.603	2.9	10	Lake Macleod WA.
23-Feb-12	22:16:36	-30.5	118.651	2.5	10	NE Bonnie Rock WA.
25-Feb-12	1:16:46	-40.408	149.228	2.8	18	E Flinders Island Tas.
26-Feb-12	10:29	-37.87	139.99	2.6	10	S Beachport SA.
26-Feb-12	14:25	-34.03	136.01	2.8	10	N Cummins SA.

* ML4.2 according to ES&S



Earthquakes in the Australian region, magnitude 2.5 or greater, located by Geoscience Australia, PIRSA, ES&S, and ASC. The implied accuracy in epicentral coordinates is no better than 3km (.03°) horizontally and 5 km vertically. The largest earthquake, ML 4.2, occurred offshore Yeppoon Qld (ES&S) on 5 January but didn't appear in the GA database (so isn't plotted). The focal depth of 62km for the Toora Vic earthquake is probably incorrect. The epicentre of the small earthquake near Booleeroo NSW on 6 February is near that of the 1989 Newcastle earthquake. Another small earthquake east of Flinders Is is near the supposed epicentres of the swarm of earthquakes in the late 19th century that rocked Tasmania and were felt 800km away at Kiama NSW.

Epicentres of earthquakes in Australia, January and February 2012 (from Geoscience Australia and Google Earth, epicentres not in the GA database are not plotted)

Earthquake hazard in Italy – known or unknown

For information, below are appended a copy of a seismicity map of Italy, earthquakes of magnitude 4.7 and above since 1000AD and two colour maps of earthquake hazard in Italy. These were published in 2000 and 2001 respectively, the references are listed below, public knowledge for anyone who cared to look. L'Aquila lies in the most hazardous earthquake zone in Italy and buildings ought to have been designed and built accordingly, ie so that they wouldn't collapse, the scope of Eurocode 8 and our own loading code.

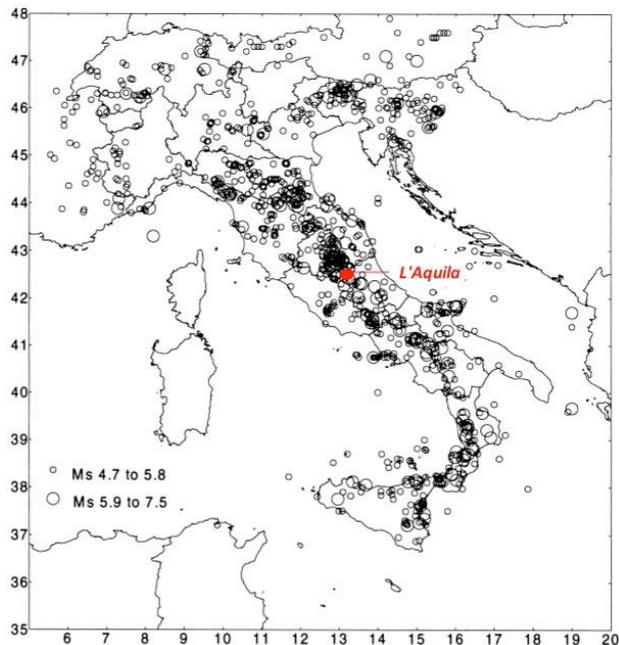


Fig. 4. NT4 seismic catalog: events above magnitude 4.7 since 1000 AD.

It wasn't the earthquake itself that killed people but the subsequent collapse of buildings. Why did the buildings collapse, especially the new ones? It wasn't a very large earthquake, magnitude 6.3, similar to that in Christchurch in February 2011 or Cadoux WA in 1979. Why aren't the Italians asking the same questions that are being posed in Christchurch New Zealand?

Who were the regulators charged with approving building plans and what was the local government role? Was there a requirement for vulnerable buildings to be strengthened each time the code was modified? Why didn't building owners and tenants inquire whether their building was designed and built according to the code, after all the area has a rich history of past earthquakes, more than 1000 years of written history, five times longer than the historical record in Australia.

It is on the public record that L'Aquila was struck by damaging earthquakes in 1315, 1349, 1452, 1501, 1646, 1703 and 1706. The earthquake of February 1703 virtually destroyed the city with about 5,000 deaths. Does the Italian school curriculum require that they teach young Italians

about their earthquake history? Do Italian engineers and architects learn about earthquakes and how to deal with them? It seems to me there is a wider societal problem here and the seismologists are being made the fall guys.

References

Romeo, R., Paciello, A., and Rinaldis, D., 2000. Seismic hazard maps of Italy including site effects. *Soil Dynamics and Earthquake Engineering* 20 (2000) 85-9.

Lucantoni A, Bosi V, Brammerini F, De Marco R, Lo Presti T, Naso G, Sabetta F (2001) Seismic risk in Italy, *Ing Sismica* XVII(1):5-36 (in Italian).

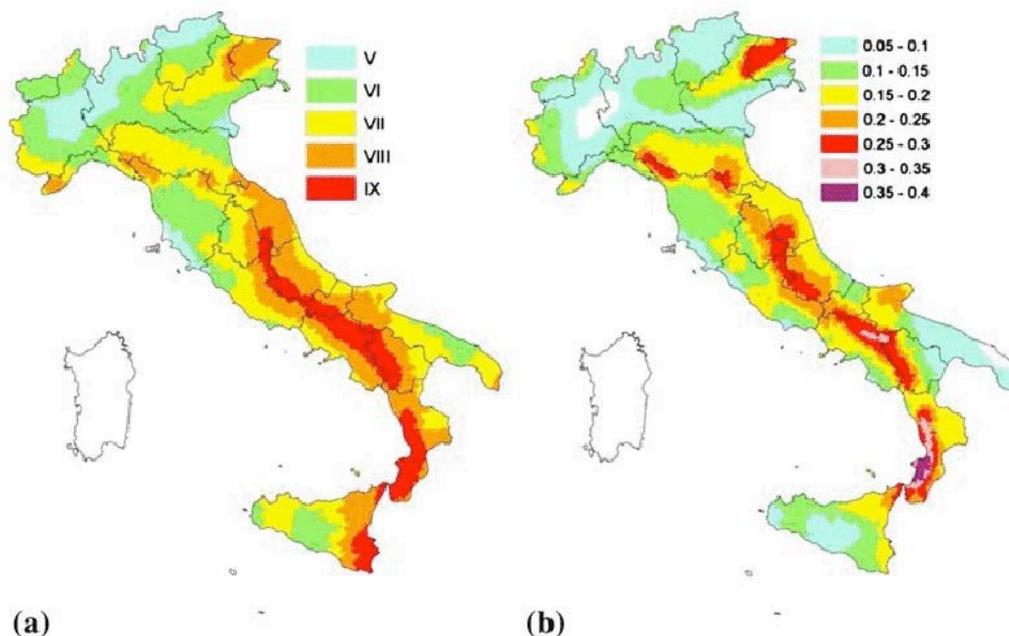


Fig. 2 Seismic hazard maps for a return period of 475 years in terms of a macroseismic intensity on the MCS scale, b peak ground acceleration (adapted from Lucantoni et al. 2001)

Reinsurance Programme 2012 announced

Insurance Australia Group Limited (IAG) today announced that it had finalised its catastrophe reinsurance programme for the period commencing 1 January 2012. The programme encompasses protection of up to \$4.7 billion, compared to \$4.1 billion in 2011.

IAG's catastrophe reinsurance protection runs to a calendar year and operates on an excess of loss basis. It covers all territories in which IAG operates. The integrated programme comprises the following key components:

A main catastrophe cover for losses up to \$4.2 billion, including one prepaid reinstatement. The Group retains the first \$250 million of each loss, with the lower layer of the main programme (\$250 million excess of \$250 million) fixed for a period of three years.

An upper layer, from \$4.2 billion to \$4.7 billion, providing earthquake cover in respect of Australia and New Zealand for a period of three years at agreed prices;

A buydown arrangement that reduces the maximum cost of a first event to \$150 million;

Subsequent event cover providing protection above \$150 million; and

An aggregate sideways cover of \$250 million excess of \$300 million, with qualifying events capped at a maximum contribution of \$125 million excess of \$25 million, per event.

The combination of covers in place at 1 January 2012 results in maximum first event retentions of \$150 million for Australia, \$130 million for New Zealand and \$50 million for the UK. For the financial year ended 30 June 2012 (FY12), the Group expects to report a total reinsurance expense, inclusive of catastrophe cover, casualty cover and expected facultative arrangements, of between \$700 million and \$720 million. This compares to a total reported reinsurance expense of \$620 million in FY11.

The programme outlined above, and the indicated FY12 reinsurance expense, exclude the AMI insurance business in New Zealand, the acquisition of which remains subject to regulatory approval. If acquired, the AMI business will initially carry specific reinsurance protection of up to NZ\$1.4 billion.

