AEES NEWSLETTER

April 2011

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President's Report

In the last two months, world news has been dominated by the devastation caused by the destructive earthquakes in New Zealand and Japan. Most media coverage focused on the magnitude 6.3 earthquake on February 22, 2011 in New Zealand, and the magnitude 9.0 earthquake and tsunami on March 10 in Japan. There were in fact another two destructive earthquakes in March that also claimed lives but received less media attention: the magnitude 5.4 earthquake on March 9 in Yunnan, China which killed 26 people, and the magnitude 6.8 earthquake on March 23 in Burma that killed 120. According to the USGS webpage, there have been 935 magnitude 5 and above earthquakes since the beginning of 2011, a substantial increase in seismic activity around the world. The total death toll has gone beyond 20,000. The huge economic losses induced by these disasters are not possible to be estimated exactly, but certainly the associated long-term impacts will significantly affect many people around the world.

After the Christchurch earthquake, many of our members, including six USAR trained engineers, three from Adelaide and three from Melbourne, offered to go to Christchurch to assist in the rescue effort. We were also contacted by several engineers who volunteered to help. Among them is Rob Hanbury, a geotechnical engineer from Perth who happened to be in Christchurch at the time when the earthquake struck. Other members immediately contacted NZ colleagues to express our condolences and offer our support. I contacted Mr. Peter Wood, president of the NZ earthquake engineering society, and people in IPENZ and in Canterbury and Auckland universities, informing them that AEES members were standing by to provide whatever assistance we can in search and rescue, structure inspection and damage assessment. Some of our members including John Wilson and Peter McBean went to Christchurch with the Australian USAR task force. Kevin McCue, Gary Gibson, Helen Goldsworthy and I went on separate reconnaissance trips to Christchurch. These were very useful trips. We gained firsthand knowledge and met with many engineers and academics from all over the world. Helen and I also helped the Christchurch city council in inspection and assessment of building damage. The preliminary reconnaissance reports have been uploaded onto the AEES homepage. More detailed reports are currently being prepared. A special session will be organized in this year's annual conference to report our observations.

Photo from NZ (above) courtesy Helen Goldsworthy

I contacted a few Japanese colleagues after the earthquake and tsunami in Japan, sending our condolences and offering our services. From the information I gathered, the earthquake ground shaking amazingly did not cause much building damage, although many places along the Japanese coastline recorded a PGA in excess of 2g, and a PGV of more than 300 cm/s. The largest recorded PGA occurred at Kurihara, which reached 2.93g. The impressive strength of buildings in Japan to resist earthquake ground motions is clearly demonstrated. As I write, the nuclear crisis in Japan caused by the March earthquake and tsunami is still not fully under control. This significantly affects the damage inspection, assessment and recovery activities there. Despite the unclear situation, reconnaissance teams have begun going to the earthquake-affected areas in Japan. We await more detailed technical reports from these reconnaissance teams.

For members of AEES, the questions raised from these destructive earthquakes are: what we can learn from these events? and what are their implications for PSHA analysis, ground motion prediction and structural design in Australia? I believe there will be many studies around the world following these earthquakes. There is something I noticed that is in common in the New Zealand and Japan earthquakes. The ground motions from these two earthquakes are substantially larger than the 475-year design earthquakes. In fact, the same happened in the 2008 Wenchun earthquake in China. Yet many structures managed to survive ground shaking a lot higher than what they were designed to resist. Although unfortunately the earthquakes and the associated ground motions cannot be accurately predicted, a properly designed and constructed structure can survive ground shaking substantially larger than we would normally expect.

Earthquakes larger than the one in Christchurch have been recorded in Australia. For example, the 1968 Meckering earthquake in WA was magnitude 6.8. Both the Meckering and Lyttelton earthquake are intraplate events. Like the Lyttelton earthquake many earthquakes in WA are also shallow with a focal depth less than 10 km. Should an earthquake of similar magnitude as the Meckering event occur nearer to Perth, how would our structures perform?

People in Japan are always prepared for earthquakes and tsunamis. Many wave barriers exist along the coastline. The scale of the tsunami in March was clearly not expected. Since earthquakes cannot yet be accurately predicted, designing structures for earthquake protection is like buying insurances. How much society is willing to pay for earthquake protection in Australia is probably a political decision. However, it is our responsibility as professionals to inform our politicians and the general public about the potential risks. Australia is not immune from earthquakes. Although the seismic hazard is lower in Australia, the earthquake risk in our major cities is not necessarily lower than that of Christchurch since the structures in Christchurch are probably less vulnerable.

I would also like to update you on some recent activities in the Society:

1. The preparation of the annual conference in Barossa, SA is well underway. The conference venue has been booked. Sharon Anderson and Mike Griffith have finalized the conference brochures.

2. We have not yet decided if we will be bidding to host the 2016 WCEE, as we have not received feedback from the NZ and Indonesian Societies. Support from the NZ society is important. I was told that they would have discussed our proposal in their committee meeting scheduled in late February; however discussions had been postponed until April during PCEE in light of the recent earthquake. Helen Goldsworthy and Nelson Lam will attend PCEE, and they will talk to committee members of NZSEE regarding our proposal for bidding and hosting the 16WCEE in Australia. Information I received from the Chair of the 15WCEE in Portugal is that each committee member is expected to look after about 100 papers (review or organize the review, select oral and poster papers, etc) – this of course depends on how many papers will be submitted to the conference. It is a clear indication of the possible workload for organizing such a big conference.

3. I represented AEES at the Engineers Australia's Engineering Practice Advisory Committee and Consultative Chairs Board meeting on February at Sydney. This one-day meeting is held once a year. National President of EA, Merv Lindsay, National Deputy President David Hood, various EA office bearers and chairs of EA colleges, and chairs of EA Technical Societies attended the meeting. This year's meeting was chaired by David Hood. Many matters were discussed during the meeting. 2011 is EA's year of Humanitarian Engineering. The three main themes are: 1) Alleviation of global poverty; 2) Reconciliation in Australia, and 3) Building resilience, as well as a number of applied themes including healthcare, sustainability, skilling engineers, a reconciliation action plan, coordination of humanitarian engineering in the acute phase, building networks and ensuring community engagement in development decisions. The meeting discussed how Colleges, Technical Societies and Interest Groups can get involved and support the themes. The Southwest Pacific Earthquake Resilience Workshop organized by Kevin McCue and the NZ Earthquake Engineering Society, supported by AusAid, falls perfectly into these themes. The workshop will bring people from PNG, Solomon Is, Fiji, Samoa, Tonga, Cook Islands and Vanuatu for a two-day training course 22-24 August 2011 for discussions of Earthquake Resilience in the Southwest Pacific.

Hong Hao

AEES President

SW Pacific Earthquake Resilience Workshop

The Southwest Pacific Earthquake Resilience Workshop scheduled to precede the PCEE has been postponed and will now be held in Wellington on 22-24 August 2011.

http://pcee.nzsee.org.nz/Workshop.htm

This workshop will draw together lessons from recent earthquakes and tsunamis to develop a road map for improved regional resilience. An overview will be presented on recent earthquakes in the region and beyond. National representative and other delegates, from Southwest Pacific nations including Australia and New Zealand, in the areas of engineering, building control and disaster management, will be invited to contribute to the workshop. The aim is to build regional awareness and consensus on what are the perceived priorities for improving earthquake resilience in the region over the next 5 years.

This will include consideration of:

- Co-operative disaster management strategies
- Seismological studies
- Tsunami mitigation systems
- Earthquake engineering guidelines
- Joint codes and standards
- Education
- Continuing professional development
- Building control systems development.

With recent events there has never been a better time to get a clear direction for the region.

Australia to bid on WCEE 2016

AEES has decided to put in a bid to host the World Conference on Earthquake Engineering 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 time to make the final decision. If you have a comment, please contact the AEES Committee.

AEES2011 in the Barossa Valley, SA

The 2011 AEES annual conference will be held at the Novotel Barossa Valley Resort in South Australia from 18-20 November 2011. Authors are invited to submit papers in any of the related topics outlined below. The conference will include keynote speakers, oral and poster presentations. Accepted papers will be peer reviewed and published in the conference proceedings and on the AEES website at a later date).

Structural Engineering for Extreme Events

Col Lynam spotted this advert in the AE newsletter:

6th Asia Pacific Forum - "Structural Engineering for Extreme Events"

The Asia Pacific Forum is an annual one day event held in various centres around Asia. Based around a new theme each year, seven eminent speakers come and present at the forum.

Venue: Griffith University , Gold Coast,

Date: Thursday 7 July 2011

Contact: David Donnan

Email: david.donnan@arup.com

The following will be speaking on the topics:

- Dr Tom Connor (Aus) - Impact of climate change
- Des Bull (NZ) - Earthquake effects
- Justin Leonard (Aus) - Bush fires
- Prof Paul Grundy(Aus) - Storm surge and inundation / Disaster Limit State
- Prof Kenny Kwok(Aus and HK) - Wind and its effects
- Rade Musulin (Aus and US)- Risk, Insurance and the Building Envelope

Bullen on Rabaul

Rabaul's Earthquake Hazard

The Sydney Morning Herald Wednesday 6 May 1953 (from Australia Trove, Australian National Library)

By PROFESSOR K. E. BULLEN, Department of Applied Mathematics, University of Sydney.

JUDGING by a recent cable from Port Moresby, a state of considerable alarm exists in Rabaul as a result of the earthquake that occurred on April 24.

In view of suggestions that the present site of Rabaul should have been shifted, it is of interest to assess the dangers which Rabaul faces from earthquakes and related hazards.

Earthquakes are known to be caused by volcanic activity in every volcanic region of the earth. Thus it is to be expected that Rabaul will be subject to frequent earthquakes arising from the adjacent volcanic activity.

The earthquake ot April 24 appears to have been not a volcanic earthquake, but a tectonic earthquake - one caused by the sudden release of elastic strain that would have been slowly accumulating for a long time beforehand.

Such earthquakes are connected with the mechanics of the Earth's structure and are of the type that can cause great damage. In the greatest tectonic earthquakes, the released energy is many times greater than that released in an atom bomb, which in turn is many times that released in a volcanic earthquake.

There is a general correlation between the locations of the centres of tectonic earthquakes and the location of the world's volcanoes, but there is no immediate connection whatever between the two phenomena.

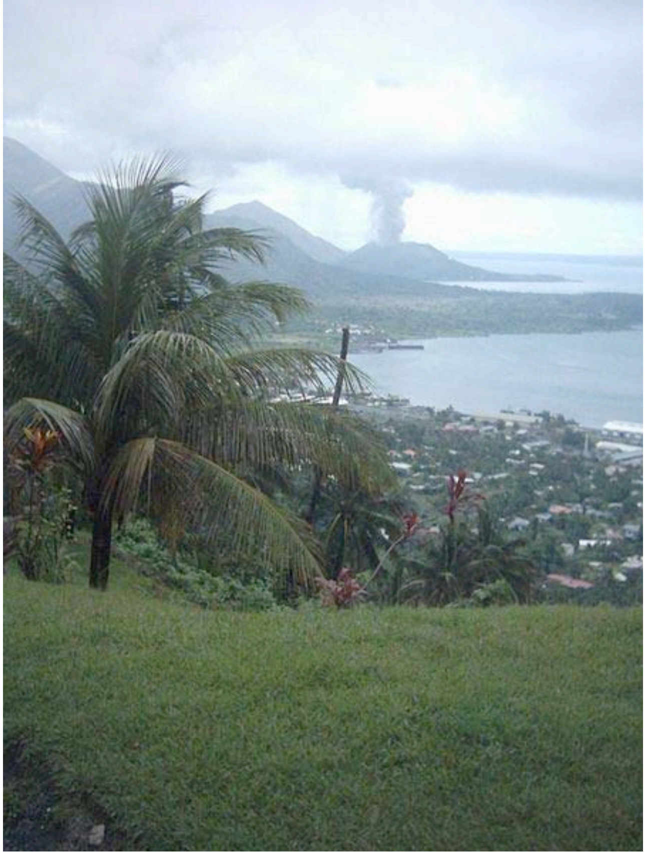
Thus the earthquake which took place near Rabaul on April 24 would have no immediate connection with the neighbouring volcano. In fact, the centre of the earthquake may have been up to 50 miles or more from Rabaul on present evidence.

Even when readings from the world's seismological observatories are assembled, it will still not be possible to place the centre within an uncertainty of less than 20 miles or so.

It is one thing to suggest moving the site of Rabaul because of the danger from volcanic eruption. But it is another question as to whether the site should he moved because of the earthquake danger.

When one examines earthquake statistics over the past fifty years one finds that, on present evidence, a tectonic earthquake is almost equally likely to be centred anywhere in New Britain.

In these circumstances, the occurrence of the earthquake of April 24 is not in itself a sufficient argument for shifting the site of Rabaul to elsewhere in New Britain.



I am not competent to discuss the danger to Rabaul from possible future volcanic activity; that is a matter for the field geologist.

There is, however, the possibility that a major earthquake could lead to lava flows on to Rabaul as a secondary consequence; these effects could possibly be serious since the earthquake would most probably occur without any warning, and the lava flow could start in a matter of seconds.

But it needs to be emphasised that the danger of Rabaul being destroyed directly by a tectonic earthquake is no greater than elsewhere in the same region.

It is of course desirable that the same precautions should be taken in designing structures to resist earthquakes in New Britain as are taken in other countries subject to strong earthquakes.

It may be remarked that New Britain lies on the world's main seismic belt which surrounds the Pacific Ocean.

In addition to the Solomon Islands, New Britain and New Guinea, the belt includes Alaska, the Aleutian Islands in the North Pacific, Japan, the Philippine Islands, New Zealand, the west coasts of Canada and the United Slates, Central America. Colombia, Ecuador, Peru, and Chile.

All these regions are subject to major earthquakes, and from this belt comes 80 per cent of the world's seismic activity.

Yunnan China Earthquake, 10 March 2011

From the Hindu News International:

The death toll from a magnitude 5.8 earthquake that hit Yingjiang County in southwest China's Yunnan Province, close to the Myanmar border on Thursday was 25 with 250 people injured, 134 of them seriously.

The earthquake toppled 1,264 houses or apartments and left 17,658 others seriously damaged, mainly in the county near the border with Myanmar.

Over 80 per cent of the homes in Lameng Village near the epicentre collapsed in the quake and some 127,100 people were evacuated to nearby shelters.

The epicentre, was at 24.7°N, 97.9°E, according to the China Earthquake Networks Centre (CENC), and seven aftershocks, measuring up to M4.7 jolted the quake-prone county since the first tremor.

Witnesses said people were buried under debris and part of a supermarket and a hotel caved in.

The tremor triggered a power outage but telecommunication service remained normal in Yingjiang.

Experts have not ruled out the possibility that stronger quakes might hit the region later and they could not say for sure that the first magnitude 5.8 tremor was the main quake, according to Gu Yishan, an expert with the Yunnan provincial earthquake bureau.

The M 5.8 tremor was the largest of more than 1,200 minor tremors over the last two months in the region, and the past tremors had already done some damage to buildings in the county, which might have worsened yesterday's disaster.

The shallow focus and proximity to densely populated areas were also factors behind the damage.

A M5.9 earthquake struck the county in August 2008, leaving three people dead and 106 injured, said CENC researcher Sun Shihong.

The provincial disaster-relief and civil affairs authorities launched an emergency response plan.

The 3-step Seismic Design Process

IPENZ Fact Sheet, March 2011

There are three main concepts which form the basis of modern seismic design.

1. The first of these was to recognise that it is not economical to design all buildings to resist the largest earthquake they will every experience and so buildings may experience larger seismic energy and forces than those they were designed to resist.

2. The second concept is that the excess energy imparted to a building by an earthquake needs to be absorbed in a controlled manner. This concept involved making essential elements of the building ductile (flexible), because as ductile elements yield they absorb energy without failing completely. If the energy imparted were to be large, then parts of the building were designed to be the primary places where the energy would be absorbed and possibly distort.

3. The third concept was to create a hierarchy of strength, known as "capacity design". This is a design approach in which those elements which must be protected from yielding are given an "overstrength". In simple terms, this results in a hierarchy of strong unyielding columns and weaker yielding beams which absorb the energy of the earthquake while preventing an undesirable collapse mechanism.

A consequence of this design approach is that controlled structural yielding (damage) is expected during a major earthquake.

(Ed. This goes a long way to explain why so much damage occurred in the M6.3 Christchurch aftershock, city buildings not designed for the high ground shaking and already having been driven to their yield capacity in the M7.1 mainshock.)

Christchurch was struck by a large M6.3 aftershock at 12:51 pm on 22 February 2011 local time causing widespread damage and multiple fatalities, and was far more destructive in Christchurch than the M7.1 mainshock on 4 September 2010 (see photos on the AEES website). More than 169 people were killed in the collapse of many buildings, the final death toll expected to be 182, making the earthquake the second most deadly natural disaster in New Zealand (after the 1931 Hawke's Bay earthquake). Nationals from more than 20 countries are among those killed. Insurance analysts estimated that the earthquake could cost insurers NZ$16 billion.

The New Zealand Government declared a state of national emergency that extended to 6 April.

The devastating magnitude 6.3 earthquake centred southeast of Christchurch was part of the aftershock sequence following the September magnitude 7.1 quake near Darfield, 40km west of the city, according to Natural Hazards Research Platform Manager at GNS Science, Kelvin Berryman. He added that it caused about 10km of subsurface rupture in an east-west direction between Halswell and Sumner on the coast.

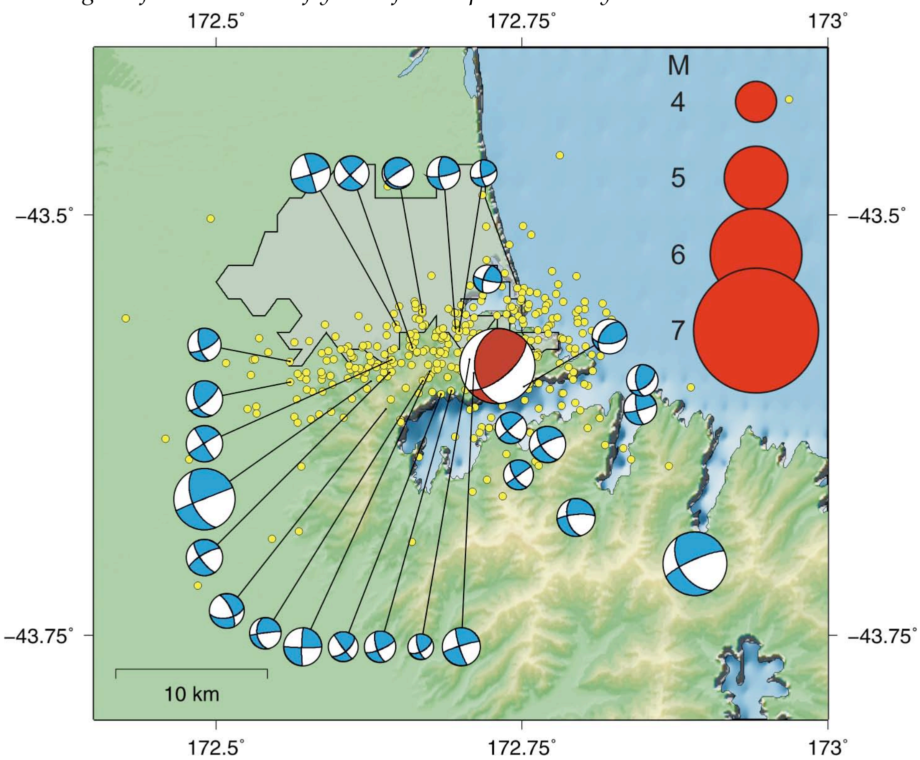
"There was no obvious underground structure directly connecting the subsurface rupture that produced Tuesday's earthquake with the Greendale Fault that ruptured in September's magnitude 7.1 earthquake.

Aftershocks have been spreading both west and east since the magnitude 7.1 Darfield earthquake in September and this has resulted in increased stresses in the earth's crust in the Canterbury region", Dr Berryman said.

"An expanding "cloud" of aftershocks, particularly at both ends of the main fault rupture, was a familiar pattern with large earthquakes worldwide", he said.

"Geologists had suspected for some time that there were buried and unrecognised faults in Canterbury. Some of these faults might not have moved for many thousands of years, but had been reactivated as stresses in the earth's crust had been redistributed since September 2010.

"If you strip away the sediment and gravels of Christchurch and the Canterbury plains you would see the bedrock looking like broken glass from millions of years of earthquake activity.



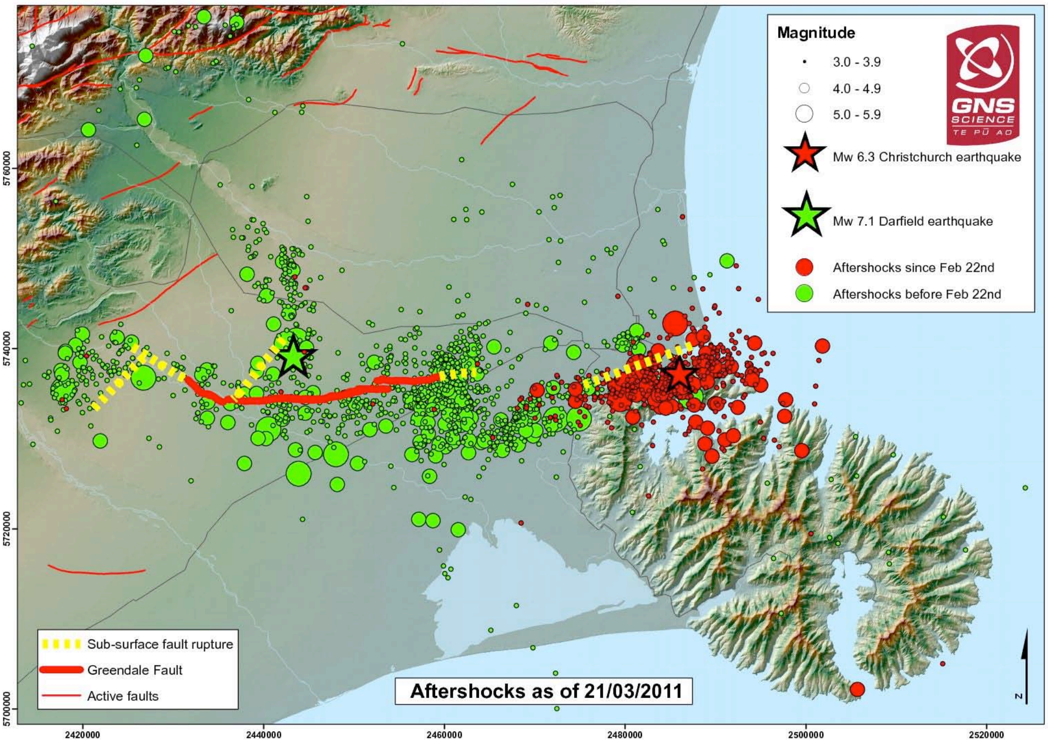
"The underlying geology of Canterbury was the western end of the Chatham Rise which was broken with many east-west trending faults. Many geologists believed that modern-day tectonic plate motions in the South Island had reawakened some of these very old faults, causing them to fail.

"The Greendale Fault that ruptured in September's earthquake was one of these very old faults." Dr Berryman said *"the magnitude 7.1 earthquake in September was an extraordinarily complex event with up to four interconnected faults rupturing almost simultaneously.*

"The pattern of aftershocks since September has also been complex, making it difficult for scientists to understand the stress-related mechanisms occurring in the earth's crust.

"The magnitude 6.3 earthquake appears to have been a less complex event with just one fault rupturing.

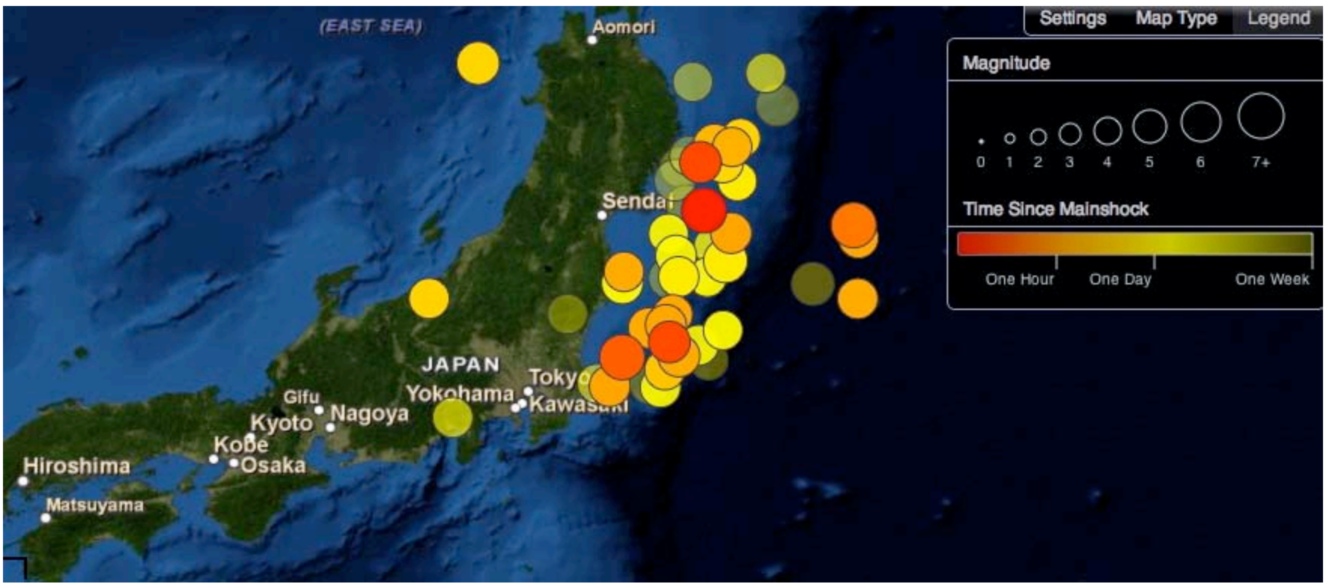
"The frequency of aftershocks would continue to decrease in the coming weeks. When viewed over periods of many weeks, this reduction tended to be fairly regular, but there were often anomalies, as the magnitude 6.3 earthquake had shown."



Ed. A few aftershocks of the 22nd February aftershock (red dots) extend west across aftershocks at the offset and unfaulted eastern end of the Darfield aftershock sequence (green dots) begging the question of what is going on there.

Tōhoku Earthquake Japan, 11 March 2011

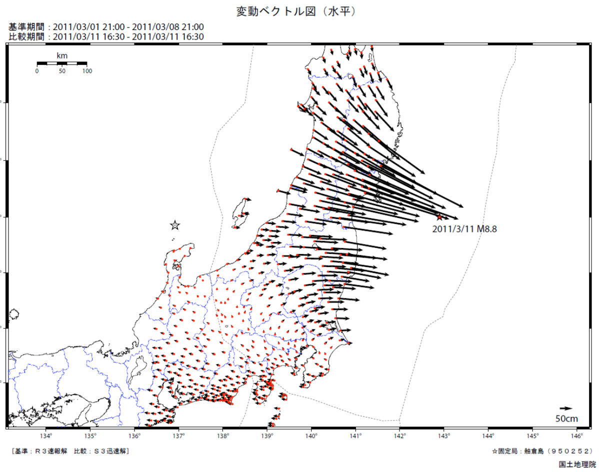
People were still reeling from the death and destruction in Christchurch NZ when a magnitude 9.0 megathrust earthquake occurred off the coast of Japan at 14:46 JST (05:46 UTC) on Friday, 11 March, 2011. The epicenter was approximately 70 kilometers east of the Oshika Peninsula of Tōhoku, 500km NE of Tokyo. The USGS initially reported the magnitude as 7.9 Mw but upgraded to 8.8, then again to 8.9 and finally to 9.0. This earthquake occurred where the Pacific Plate is subducting under northern Honshu on the Eurasian Plate at about 80 to 90 mm/year. The map below showing the mainshock and aftershocks above magnitude 6 in the 2 weeks following the mainshock, clearly defines the large fault area that ruptured in the mainshock.



The earthquake uplifed the sea floor triggering extremely destructive tsunami waves up to 29 m high that struck Japan some tens of minutes after the quake, in some cases traveling up to 10 km inland, the impact exacerbated by down warping of the coastal regions. Tsunami warnings were issued and evacuations ordered along Japan's Pacific coast and in at least 20 other countries, including the entire Pacific coast of the Americas. Chile's Pacific coast, 17,000 kilometers away, was later struck by 2 m high tsunami waves. Initial estimates indicated the tsunami would have taken 10 to 30 minutes to reach the areas first affected. Just over an hour after the earthquake at 15:55 JST, a tsunami was observed flooding Sendai Airport, which is located near the coast of Miyagi Prefecture, with waves sweeping away cars and planes and flooding various buildings as they travelled inland.

The Japanese National Police Agency has officially confirmed 11,938 deaths, 2,876 injured and 15,478 people missing across 18 prefectures, as well as over 125,000 buildings damaged or destroyed. The earthquake and tsunami caused extensive and severe structural damage in Japan, including heavy damage to roads and railways, fires in many areas and a dam collapse. Around 4.4 million households in northeastern Japan were left without electricity and 1.5 million without water.

The Fukushima I, Fukushima II, Onagawa Nuclear Power Plant and Tōkai nuclear power stations, consisting of eleven reactors, were automatically shut down following the earthquake. Higashidōri, also on the northeast coast, was already shut down for a periodic inspection. Cooling is needed to remove heat after a reactor has been shut down, and to cool pools of spent fuel rod. The cooling water is circulated by emergency diesel generators, at the power plants and the Rokkasho nuclear reprocessing plant. At Fukushima I and II tsunami waves overtopped seawalls and destroyed the diesel backup power systems, leading to severe problems at Fukushima I, including two large explosions and leakage of radioactive water and gas. Over 200,000 people were evacuated. Sea water was pumped onto the plant in an attempt to cool it. Many electrical generators were damaged, and three nuclear reactors suffered explosions due to hydrogen gas that had built up within their outer containment buildings after cooling system failure. Residents within a 20 km radius of the Fukushima I Nuclear Power Plant and a 10 km radius of the Fukushima II Nuclear Power Plant were evacuated.



This earthquake is the greatest known earthquake to have hit Japan, and one of the five greatest earthquakes in the world since seismographs were deployed worldwide in 1901. It moved portions of northeast Japan by as much as 2.4 meters to the east making portions of Japan's landmass "wider than before," according to geophysicist Ross Stein. Stein also noted that a 400-kilometer section of coastline dropped vertically by 0.6 m, allowing the tsunami to travel farther and faster onto land. The Pacific plate itself may have moved westwards by up to 20 m. Other estimates put the amount of slippage at as much as 40 m over an area about 300 to 400 km long by 100 km wide.

The earthquake is among the top 10 earthquakes recorded since we have had seismographs," said seismologist Susan Hough of the U.S. Geological Survey in Pasadena. "It's bigger than any known historic earthquake in Japan, and bigger than expectations for that area." Geologists had expected the portion of the Pacific "Ring of Fire" that produced this quake to yield a temblor on the order of magnitude 8 or perhaps 8.5, she said. "Something as big as a 9 is a bit of a surprise," she said. Some scientists did not expect such a big quake in the area because the plate boundary is not straight, but fairly irregular. According to Lucile Jones of the U.S. Geological Survey, a quake of that size would require a rupture zone at least 500 km long.

Japan's National Research Institute for Earth Science and Disaster Prevention (NIED) recorded a pga of 2.7g in the Miyagi Prefecture, 75 km from the epicentre; the highest pga in the Tokyo metropolitan area was 0.16g.

Early estimates placed insured losses from the earthquake alone at US$14.5 to $34.6 billion. On 21 March, the World Bank estimated damage between US$122 billion and $235 billion. The Japanese government said the cost of the earthquake and tsunami could reach $309 billion, making it the world's most expensive natural disaster on record. Japanese Prime Minister Naoto Kan said, "In the 65 years since the end of World War II, this is the toughest and the most difficult crisis for Japan."

Soil liquefaction was evident in areas of reclaimed land around Tokyo, particularly in Urayasu, Chiba. Nearby Haneda Airport, built mostly on reclaimed land, was not damaged.

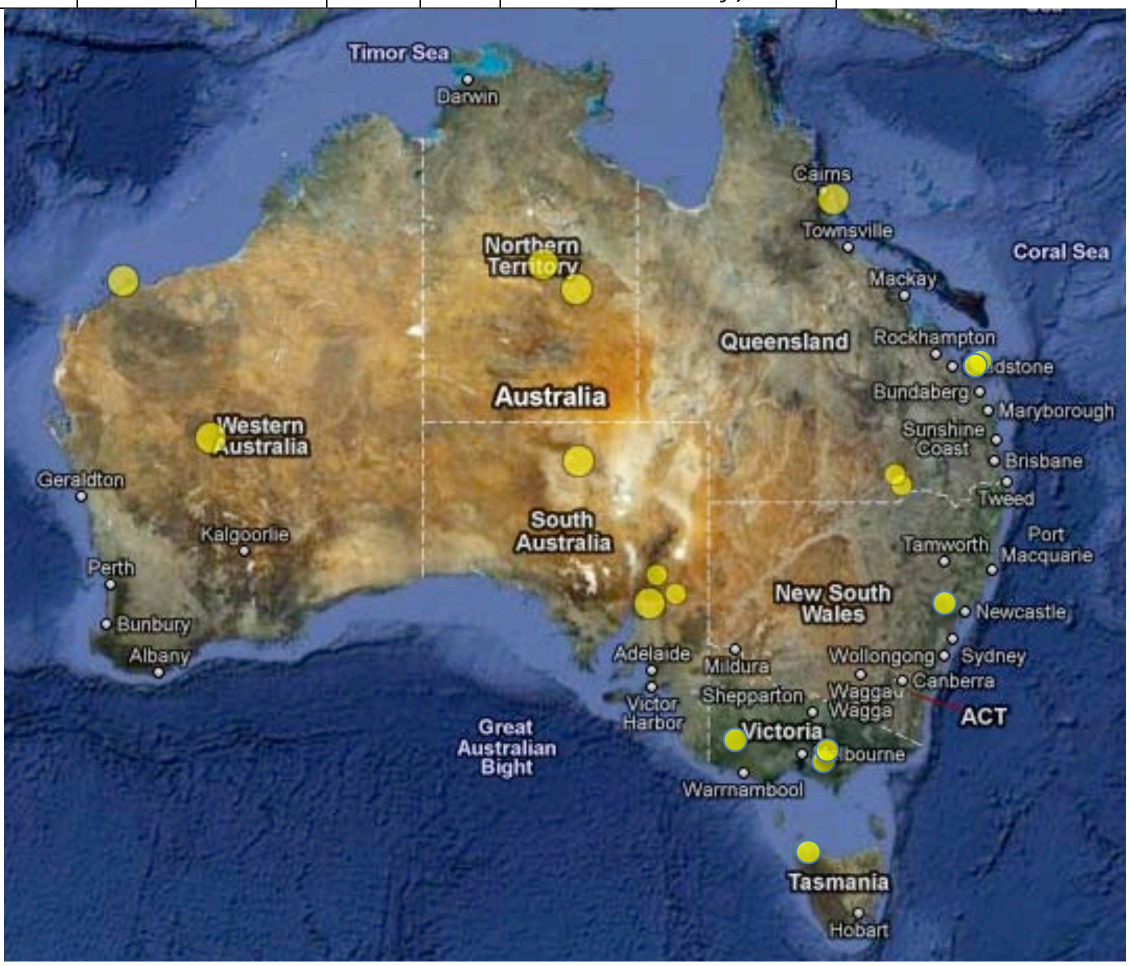
The speed of the Earth's rotation increased, shortening the day by 1.8 microseconds as faulting caused a small redistribution of the Earth's crustal mass which changed the planet's moment of inertia.

Australian earthquakes, 01 Feb – 31 Mar 2011

The largest earthquake in the two months, magnitude 4.4, occurred near Hatches Ck, NT. There were no injuries and no damage was reported. A map of GA located events is below.

Date	Time UTC	Lat °S	Long °E	Z km	ML	Place
10 Feb 2001	23:33	32.9	151.4	10	2.5	Cessnock, NSW
06 Feb 2011	08:05	28.4	148.9	10	2.6	St George, Qld
08 Feb 2011	16:03:26	32.22	139.57	8	2.5	North of Yunta, SA
08 Feb 2011	18:42	37.3	141.8	10	2.7	Balmoral, Vic
09 Feb 2011	14:41	32.8	151.4	10	2.5	Cessnock, NSW
19 Feb 2011	07:15:37	31.61	138.75	10	2.5	NE of Hawker, SA
20 Feb 2011	15:10	40.9	145.2	10	2.5	Smithton, Tas
20 Feb 2011	15:30:34	32.61	138.50	0	3.0	Coomooroo, SA
21 Feb 2011	22:43	23.8	153.0	10	3.8	Bundaberg, Qld
21 Feb 2011	21:59:36	20.90	135.42	1	4.4	Hatches Creek, NT
24 Feb 2011	02:26:20	26.56	120.08	10	3.0	Near Wiluna, WA
26 Feb 2011	00:46	37.6	146.5	8	2.8	Woods Pt, Vic
28 Feb 2011	16:31:09	20.56	116.33	6	3.4	NW of Dampier, WA
04 Mar 2011	19:00:00	27.90	148.80	10	2.5	St George, Qld
07 Mar 2011	04:20:37	19.89	134.07	8	3.6	Tennant Creek, NT
13 Mar 2011	03:32	23.9	152.7	10	3.0	Bundaberg, Qld
15 Mar 2011	06:07:59	17.33	146.25	0	3.6	Offshore Innisfail, Qld
21 Mar 2011	02:40	38.4	145.8	8	2.6	Korumburra, Vic
24 Mar 2011	07:20	23.7	153.7	10	2.6	Bundaberg, Qld
26 Mar 2011	19:22:46	27.48	135.49	10	3.4	NE of Coober Pedy, SA

Earthquakes in the Australian region, magnitude 3 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



Epicentre of earthquakes in the Australian region M≥2.5

Base map from Geoscience Australia, additions by ES&S

Conferences

- 7 July 2011 6th Asia Pacific Forum - "Structural Engineering for Extreme Events". Griffith university, Gold Coast, Qld (see earlier article).
- 9-20 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)
- 22-24 August, 2011 Wellington New Zealand Southwest Pacific Earthquake Resilience Workshop (see earlier article)
- 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 is something we could emulate in Australia/New Zealand).

Triggered earthquakes

A very large earthquake like the 2004 Sumatra earthquake and the 2010 Chile quake can trigger seismic activity potentially anywhere within the Earth, according to researcher Zhigang Peng, a seismologist at the Georgia Institute of Technology in Atlanta.

Peng and his colleagues suggest the Chilean quake triggered four earthquakes in California, the largest a magnitude 3.5 event in the Coso Volcanic Field about 9220 km away. This area is one of the most seismically active regions in California though the researchers estimated the chance of an earthquake swarm occurring there immediately following the Chilean earthquake was less than 1%.

The seismologists also detected a cluster of deep events along the Parkfield-Cholame section of the San Andreas Fault after the Chilean quake. That section of the San Andreas was the site of the largest known quake on that fault in the last few centuries, the M7.9 Fort Tejon earthquake in 1857.

The researchers suggest that Love waves from the Chilean quake could have triggered already stressed faults.

When a fault ruptures in a large earthquake, it releases stresses that have built up over hundreds or thousands of years and transfers some of that stress to nearby faults. In order for that tiny added stress to trigger a large earthquake on a nearby fault, that fault had to already be very near its breaking point, said seismologist Christopher Scholz of Columbia University in New York.

For the two faults to have been simultaneously near their breaking points requires them to be synchronized in their seismic cycles.

"All of a sudden bang, bang, bang, a whole bunch of faults break at the same time," Scholz said. That changes how future earthquake hazard will be assessed. Seismologists had assumed that when a fault ruptures, the risk of another large earthquake generally decreases.

"Now that we know that some faults may act in consort, our basic concept of seismic hazard changes," Scholz said. "When a large earthquake happens, it may no longer mean that the immediate future risk is lower, but higher."

The researchers analyzed earthquake patterns as far back as 15 000 years and identified strings of related earthquakes. Their work explains how closely spaced faults that rupture every few thousand years might align themselves to rupture almost simultaneously.

Southern California's Mojave Desert, the mountains of central Nevada and the south of Iceland each may have synchronized, or phase-locked faults in their respective immediate vicinities, according to their study published in the Bulletin of the Seismological Society of America.

When faults lie relatively close, between 10 and 50 km apart, and are moving at comparable speeds, they may break successively over time because their cycles may eventually fall in sync, Scholz said.

In the Mojave Desert, the Camp Rock fault ruptured in 1992 causing a magnitude 7.3 earthquake in the town of Landers. Seven years later, the Pisgah fault, 24 km away, broke causing a magnitude 7.1 quake at Hector Mine.

Scholz said his hypothesis of synchronized faults could make it easier to assess some earthquake hazards by showing that faults moving at similar speeds, and within roughly 50 km of each other, may break at similar times, while faults moving at greatly different speeds, and located relatively far apart, will not.

However, seismologists have yet to come up with a reliable method for predicting imminent earthquakes; the best they can do so far is to identify dangerous areas, and roughly estimate how often quakes of certain sizes may strike.

Earthsciences make it on tourism agenda

http://www.echucamoama.com/echuca-moama-tours

Volcanoes have featured on the Australian tourist agenda for some time, the Meckering railway-line-buckle and pipeline rupture are showcased in the Meckering WA museum but this is the first earthquake tour that I (Ed.) am aware of in Eastern Australia.

Cadell Fault

The Cadell Fault is a ridge running from Echuca to Deniliquin, close to Barmah and Mathoura. It was formed when the land was thrust upwards by earthquakes, tens of thousands or years ago.

This uplifted section of land diverted the Murray River's western flow, with the new western wall of earth holding back water in flood times, to create the new flood plains and a complex system of lakes and creeks, including the Moira and Barmah lakes.

The Cobb Highway runs along the uplifted portion, some 15 metres above land east of the fault, making it possible in some places to look directly over the canopy of trees growing on the lower level.

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