Newsletter

of the Seismological Association of Australia Inc

Volume 1 No. 2
Sept-Oct 2017

Don't miss our first
Annual General Meeting
Monday, 30 October 2017
Full details page 2

In this issue:

Seismological Association of Australia Inc.

Newsletter of the

Seismological Association of Australia Inc

PO Box 682, Mylor SA 5153

Your Interim Committee

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The SAA can be contacted by post to the address above, or by e-mail to any of the Interim Committee, as listed above.

Membership of the SAA is open to all, with the only prerequisite being an interest in seismology.

Membership fees are:

Full Member	$75
Concessional Member	$60
Subscribe e-Bulletin only; discount	$20

Membership application form can be obtained from the Treasurer .

Member Submissions
Submissions for inclusion in The Newsletter are welcome from all members; submissions may be held over for later editions.

Wherever possible, text submissions should be sent via e-mail in almost any word processing format. Your name may be withheld only if requested at the time of submitting. Images should be high resolution and uncompressed, although high resolution JPEGs are acceptable.

All enquiries and submissions should be addressed to The Editor and preferably sent by e-mail to: joe.grida@internode.on.net

A word from the Chairman:

We've been an Association for just a few months, we have nearly 30 members, some interstate and some from overseas! A big thankyou to those who have worked hard to make the Association a going concern.

The first Annual general meeting (AGM) is upon us. We are required to have one to formally elect members of the 'Association' to form a Committee to guide us through the next 12 months.

From our Constitution, the 6 positions are

- **Chairman**, chairs meetings, is a 'signatory', currently takes and prepares the minutes of meetings.
- **Public Officer**, the 'official contact point' for matters relating to the Association, holder of the Seal.
- **Treasurer**, is a 'signatory', handles all finances and currently membership.
- **Secretary**, will handle the 'paper work' and keep the records for the Association.
- And (at least) 2 other officers.

We also require persons to take on the responsibilities of:

- **Editor**, who produces our Newsletter and other publicity material from the input you provide.
- **Web master / publicity officer**.
- **Chief Seismologist**, current spokesperson for SAA.

We have been busy, lots of things had to be done for the changeover from the SA Government run site to SAA run sites. We have new data contracts in place, have decommissioned a few sites and have done some repairs to existing sites.

We are concerned about our members interstate, and ask 'What we can do to assist those interstate and overseas'?

You are all welcome to send interesting and related news items, technical information / queries and suggestions to us all.

Blair Lade, Chairman

Notice of Annual General Meeting

Monday, 30 October 2017 @ 7:30pm
at the offices of Nova Systems
27-31 London Rd, Mile End South SA 5031

Election of officers, activity reports, talks….

Put the date in your diary now. Will you nominate for one of the SAA Committee positions? Full program will be sent via email closer to the date.

Cover photo:
The entrance to The Peters Seismological Observatory near Victor Harbor SA. For full details of this facility , see pages 5-8 of this issue. Photo supplied by Paul Hutchinson

Emergency repairs at MRAT station on Yorke Peninsula

During August 2017, the MRAT station suddenly stopped transmitting data. The 3G modem was contactable, but not the Echo recorder.

SAA Committee members, Blair Lade (Chairman) and David Love (Chief Seismologist) travelled to the station near Curramulka to investigate.

The recorder was failing during boot-up and needed to be replaced. Blair re-terminated most connectors. The station had earlier been on a wireless system using 3 solar panels and 2 batteries. One battery and solar panel were retrieved. The Styrofoam insulation was being eaten by large beetles, and the whole pit needed a good cleanout. The Echo was about 12 years old, and may not operate again…

Above: *Blair by the pit lid and 3G aerial at MRAT station. Photo by David Love*

A visit to CLV2 station

Public Officer and Committee Member, Paul Hutchinson, visited Kevin and Annette Elson at Cleve, on the Eyre Peninsula on September 9.

Kevin is pictured at right, next to his station.

Kevin is deeply involved in the local community, has been involved in the CFS for over 50 years, is on the Eyre Peninsula Field Day Committee as Safety Officer, and rosters on for the Driver Reviver on long weekends at Arno Bay.

Kevin helped David Love in locating/selecting the present CLV2 site, chosen because of the solid granite just below the surface, and being a quiet site located in farmland some 3 kms away from the township of Cleve.

CLV2 seismic station is solar powered, is in a 1 meter deep pit, containing an EchoPro, with a 1Hz 3D seismometer resting directly on the granite, so enabling good seismic coupling. Data is sent every minute via a Unimax modem.

(The original CLV station is about 2 km west, on the road north from Cleve. It is a small building and small vault, built in 1964 by the University, during Dr David Sutton's time.)

Did the earth move for you on September 2?

David Love reports on an event that woke many Adelaide residents

Many people were woken and rattled by a loud thunder early in the morning, thinking it was an earthquake. Geoscience Australia received nearly 900 replies on their website within 12 hours of the event.

The waveforms recorded did not have clear P and S arrivals, and the first arrivals were often emergent (rather messy). The time variation across the network was quite substantial, showing that the wave was travelling by air, and downhole or deep in-vault seismometers showed less response than surface ones.

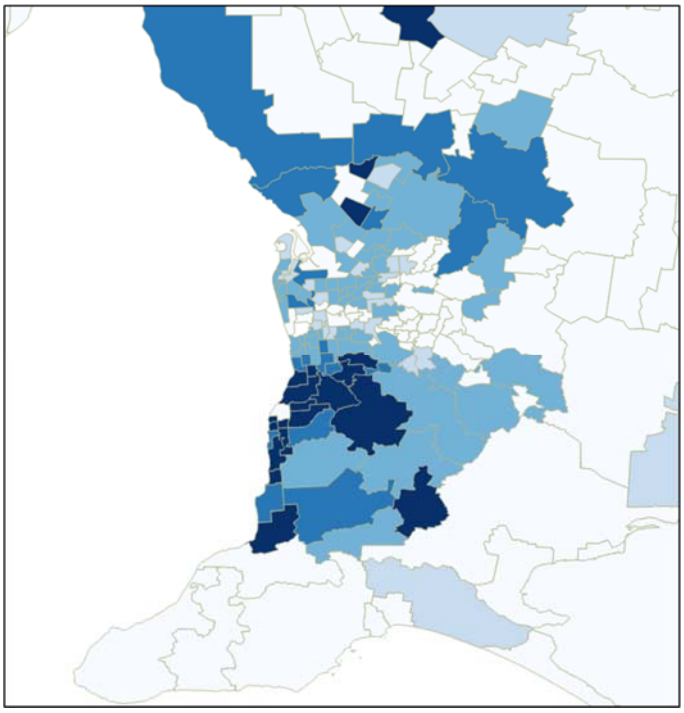
Using an airwave velocity of 340 m/s gave the following location:

```
EARTHQUAKE LOCATION        Printed on 2017-09-04 1640

EQ Date:     2017-09-01 1632 39.90 ±  0.68
Place:       Storm Adelaide 64 km W
Longitude:   137.9214  ±    0.83 km
Latitude:    -35.0179  ±    1.45 km
Depth:         2.00    ±   14.51 km (Constrained)

Nearest:      50.9 km (MRAT)      Gap:    198.7°
Program:     eqFocus 4.5.1    Earth Model: AIR1

ARRIVAL DATA

Active Arrivals:
site  phase  time        calc residual  dist travTime
 MRAT   S   1635 11.50   189.63    1.87  50.86  151.59
 BRTS   S   1635 26.69   203.80    2.90  55.68  166.79
 MPTV   S   1635 31.39   209.32    2.08  57.56  171.49
 TWOA   S   1635 39.29   216.36    2.94  59.95  179.39
 GHSS   S   1635 46.57   225.55    1.03  63.09  186.67
AUMAR   S   1635 58.38   237.53    0.85  67.16  198.47
 HMV1   S   1636 41.68   285.83   -4.14  83.59  241.78
 MBKR   S   1636 49.10   288.44    0.66  84.48  249.19
 LBTL   S   1636 54.90   294.79    0.11  86.62  254.99
 STR2   S   1637 01.45   303.37   -1.91  89.55  261.55
 HML1   S   1637 03.06   309.34   -6.27  91.58  263.16

Deferred Arrivals:
site  phase  time        calc residual  dist travTime
 MTON   S   1636 48.90   304.08  -15.18  89.79  248.99
```

The MRAT seismogram on Yorke Peninsula was very poor. While the solution says it is accurate to better than 2 km, given the poor MRAT arrival, and the wide angle (gap >180 deg), it is not nearly as good as it looks. Without MRAT, the gap would be greater than 270 deg, hence not very accurate. The MTON arrival was possibly related to a different thunder blast.

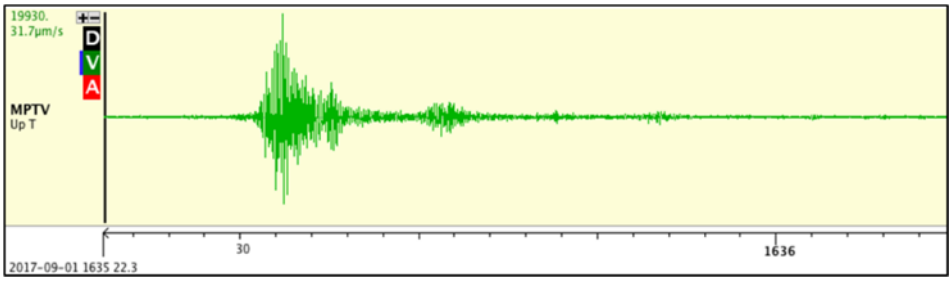
There were a number of similar, but smaller arrivals in the same hour. They were clear on HML1, HMV1 and MPTV, with similar time delays. This also matches with the number of reports mentioning other shocks.

The following map shows postcodes coloured by the number of reports normalised by population. Outside of this map, there were only 3 replies from Yorke Peninsula and Kangaroo Island. Most replies were from southern suburbs, with a moderate response north of Adelaide, but far fewer through Adelaide. There were plenty of responses nearer the coast, a moderate number into the hills, and just a few over the hills. This suggests that the wave guide phenomenon was only acting over particular areas; not to the west where the storm was coming from, and not strongly across the central Adelaide area.



Above: *Number of reports normalised by number of residents for each postcode. Credit: Eric Love*

On 20th October 1986 an aircraft exceeded the sound barrier, probably over Yorke Peninsula. The weather conditions again gave a wave guide effect in the easterly direction. Besides being heard very loudly from Curramulka to Yorketown, it also caused a significant response on Lefevre Peninsula, near the coast from Glenelg to Brighton, and along the hills face from Brighton to Tea Tree Gully.



Above: *The largest amplitude seismogram at MPTV Morphett Vale, showing the emergent arrival of vibration .*

There were just a few reports over the hills. ¤

Thanks to Jonathan Bathgate, Geoscience Australia for supplying the felt reports, and Eric Love for constructing the map.

The Peters Seismological Observatory

By Paul Hutchinson

TPSO is a seismic station located on farmland nearby the township of Victor Harbor, South Australia. The Seismological Association of Australia Inc. (SAA) now has sole access to TPSO by way of a Licence Agreement between the landowner and SAA. All requests for access are to be made to the SAA Executive Committee.

Naming of the seismic station

The seismic station was named after Professor Emeritus Randall Peters, Physics Department, Mercer University, Macon, Georgia, USA, a Founding Member of SAA, and being in recognition of the contributions he has made to the science of seismology. ***Professor Peters is pictured at right.***

Purpose of TPSO

TPSO was built to facilitate ongoing seismic research by both the amateur and the professional seismologist.

It can be said that both TPSO and SAA would not be here today, if the amateur and the professional seismologists of South Australia had not been working in close cooperation over the past decades.

It was this close cooperation that provided the motivation for TPSO to be built. On the 27th March 2015, at the official opening of TPSO, Prof. Peters in his statement that was read out to those attending, acknowledged the source of this cooperation:

> *"The seeds of **genesis** for this facility started more than two decades ago, with an unusual initiative by a prominent professional seismologist. **Dr. David Love** began at that time to reach out with selfless service to **amateur seismologists**. His support of them has persisted from then until the present without interruption. The seismic community that subsequently developed in South Australia is unique to the geoscience world. All those in attendance today are beneficiaries of his outstanding support. Thank you, Dr.Love !!"*

It was because of this close cooperation that 13 people meet at David and Heather Love's home on the 9th January 2017 and together agreed to form an association that would take on the momentous task of keeping the seismic network going following Minister Koutsantonis's announcement of the closure of the S.A. Government Seismological

Seismographs operating at TPSO

The diversity of seismographs presently operating in TPSO are listed below, being supplied by: an academic institution, an Australian manufacturer of seismic equipment, SAA Members who are professional seismologists, Members who are amateurs, the Association, and one hand -built by an amateur Member.

i) Guralp CMG 6T - 1	0.01 to 1 Second	Member Owned.
(ii) Trillium Compact 120	0.01 to 120 Seconds	Member Owned.
(iii) Kelungi Gecko Prism	0.0125 to 30 Seconds	Beta Testing - Seismic Research Centre.
(iv) Streckeisen STS-2	0.02 to 120 Seconds	Loan from ANU Canberra.
(v) VolksMeter	Displacement 1 second to DC	2 - Both owned by Members.
(vi) Sprengnether Vertical	20 Second period	Owned by Association.
(vii) 900 mm pendulum	3.6 seconds to DC	SDC displacement sensor - Built by Member.

Some seismographs are short-period instruments whilst others record very long-period Earth tides, which reflects the diversity of the Member's seismological interests.

Department.

And on the 29th March 2017, SAA was incorporated. Today we see both groups working seamlessly together towards achieving the goals of the newly established SAA. Today we see both groups utilising the facilities of TPSO. Truly a cooperation that is unique in the seismological world, truly a synergy that augurs well for advancements in the science of seismology.

Age-range of the seismometers located on the pier of TPSO

The Gecko Prism manufactured by the Seismology Research Centre (SRC) here in Australia, is state of the art, utilising laser optics and interferometry.

The Sprengnether long-period Vertical was built by master instrument makers in the early 1960's and was installed at Mt Bonython as part of the WWSSN, coincidentally detecting nuclear blasts over half a century ago. The Sprengnether is a passive instrument using a zero-length spring and coil/ magnet.

In the next SAA newsletter there will be an article that compares the vertical ground motion component of a P-wave that arrived from a large Japanese earthquake, as was recorded by the STS-2 and the Sprengnether, both located on TPSO pier.

Transmission of seismic data from TPSO

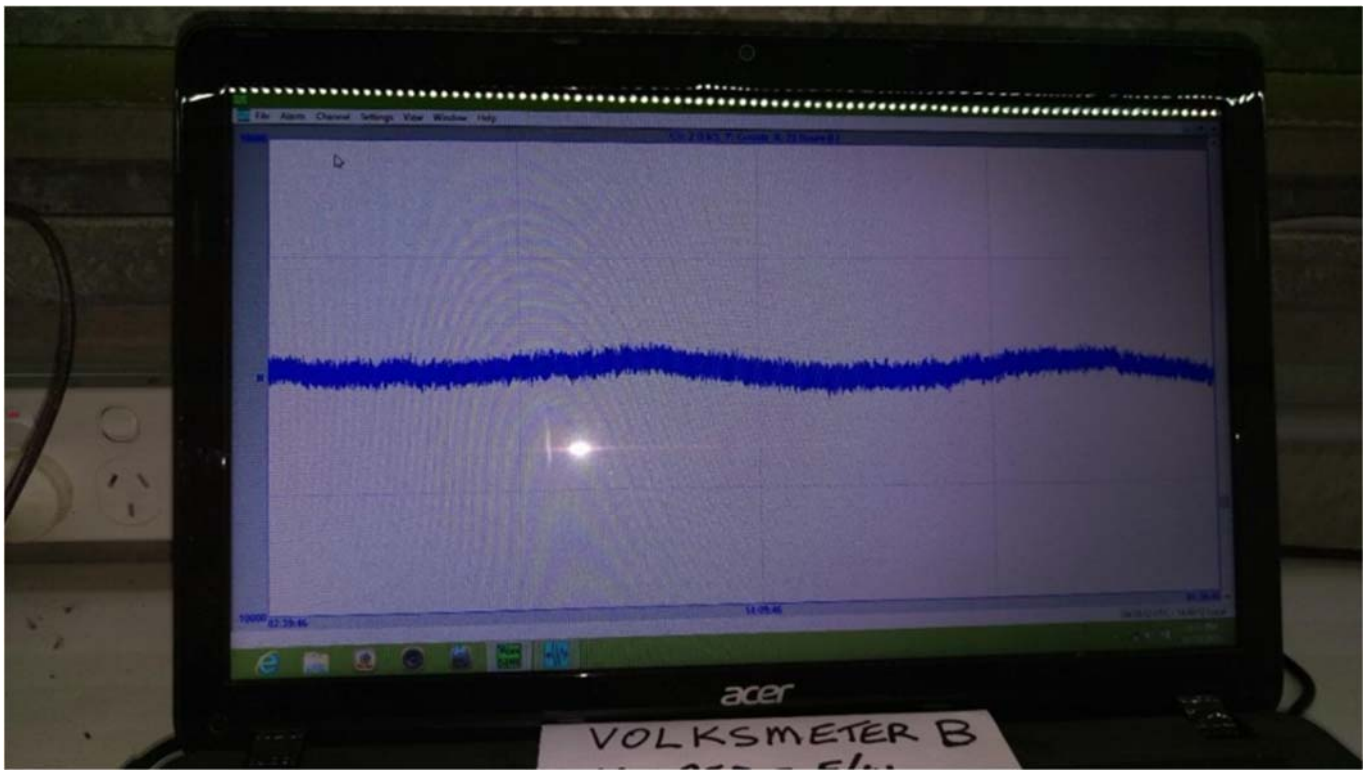
TPSO is presently transmitting data to a Melbourne University web page:

http://meiproc.earthsci.unimelb.edu.au/eqserver/eqlogger/current.jsp

Because of the high cost of transmitting data via the 3G mobile phone network, only the vertical motion components from the Guralp (HMV1), Trillium (TPSOz), and STS-2 (TPSOv) are being transmitted at this time.

These seismographs all use EchoPro digitizers. One-minute duration files are generated by the EchoPro, then transmitted, meaning that with a typical 45-second transmission delay the latency period of web-page data is approaching two minutes.

The three axes of the Prism (TPSOP) are transmitted directly to SRC in Melbourne, and to the Melbourne Uni web page above, using 3G (paid for by SRC). Unlike the EchoPro digitizer, the Gecko digitizer establishes two-way communication and then continuously streams small packages of GPS timed data to a computer hosting the



Above: *23-hour unfiltered N-S trace of Volksmeter B on TPSO pier showing 12½ hour Earth tides. The coarse thickness of the trace is due to background microseismic noise, which increases significantly with an approaching storm. Photo: Paul Hutchinson*

The Peters Seismological Observatory

By Paul Hutchinson

Kelunji Hub software, allowing the data to be displayed on-screen as it comes in, with a latency of 1-2 seconds. The Hub software stores the streamed data in one-minute zipped MiniSEED files along with station information.

Both Volksmeters (A and B), the Sprengnether (20-second vertical), and the 900mm pendulum (SDC Displacement Sensor) use Larry Cochran's PSN digitizers, with data logged on laptop computers on-site.

When the NBN Wireless Broadband is eventually made available (promised May 2017), then it is planned for TPSO to switch to NBN Wireless Broadband, which for the same monthly cost will allow all three axes of motion to be transmitted for all the instruments in TPSO.

Research at TPSO into eigenmodes and Earth Tides

TPSO was designed and built specifically to facilitate research into the constantly occurring eigenmodes of the Earth, (typically having periods of thousands of seconds) and to investigate the Earth tides (typically having periods of around 45,000 seconds), and to investigate the role that these very long period whole-of-Earth phenomena may play in the stability of the Earth's lithosphere.

To be able to measure whole-Earth eigenmodes and Earth tides (which cause the ground to tilt less than 70 nanoradians!!!) require a location with very low noise and extreme temperature stability. The seismic vault of TPSO is located nine metres underground and has a temperature variation of less than 0.3C in any one month of the year. The 3-tonne concrete seismic pier is made of high strength (50 MPa) mortar, (no gravel or aggregate and no steel reinforcing rods), and was poured directly onto extremely hard bedrock. The bedrock was excavated a metre and a half down to ensure good mechanical coupling. The 50 MPa mortar has provided an extremely smooth and a very hard surface for the instruments to be located upon. The seismic pier is isolated from the rest of the underground vault/tunnel structure by a 100mm airgap.

Above: *Blair Lade, Chairman of SAA, fine tuning a digitizer inside the computer room of TPSO.*

The Peters Seismological Observatory

By Paul Hutchinson

As such TPSO was designed and built to try and obtain the best possible conditions for the observation of eigenmodes and Earth tides.

Access into TPSO

Access into TPSO is via a lockable steel-plated doorway located in the side of a hill, which then leads into a 15-metre long horizontal underground tunnel.

The underground "computer room"

Upon entering through the external door of TPSO, one comes into the first underground compartment within the horizontal tunnel. This is a 5-metre long "computer room", which is fitted with a 4-metre long bench along one wall, where computers, power supplies, digitizers, and modems are placed.

Cable trays within TPSO

In the computer room, cables to radio communication and GPS antennas are routed along dedicated cable trays to vertical ducts extending above ground level. Cables from the various seismic sensors are typically 18-metres long, routed through four insulated doors along the tunnel.

Separation of the computer room from the seismic vault

From the computer room, a 10-metre long horizontal tunnel with four insulated doors along the way, leads to the seismic vault. These four insulated doors greatly enhance the temperature stability of the seismic vault itself. This wide separation also allows for work in the computer room to occur, without unduly disturbing the seismometers on the seismic pier.

To open the seismic vault door for a half a minute, (even without personally entering the seismic vault) allows outside air to enter the vault. This results in some of the more sensitive seismometers taking a half day or even more, to again regain their stability.

Why TPSO was chosen by Seismology Research Centre to test their new Gecko Prism seismometer

The Gecko Prism is a state of the art seismograph, manufactured by the Seismological Research Centre (SRC) here in Australia.

Adam Pascale, Chief Technology Officer SRC in Victoria, said,

> *"The Gecko Prism uses a broadband seismometer, and to get the best results this type of sensor needs to be tested in a seismically quiet location. Seismology Research Centre chose to install the equipment at TPSO, a station that has several other world-class broadband seismometers co-located on a pier that would provide a good sensor performance comparison in an isolated and temperature-stable environment."*

This direct comparison of the Gecko Prism, to the STS-2 and the Trillium broadband seismometers on the pier of TPSO, will be the first research project sponsored by SAA, with Professor Emeritus Randall Peters being the lead researcher. ¤

Above: *Access door into TPSO. The vertical white conduits contain various antenna.*

Squeaks from the vault

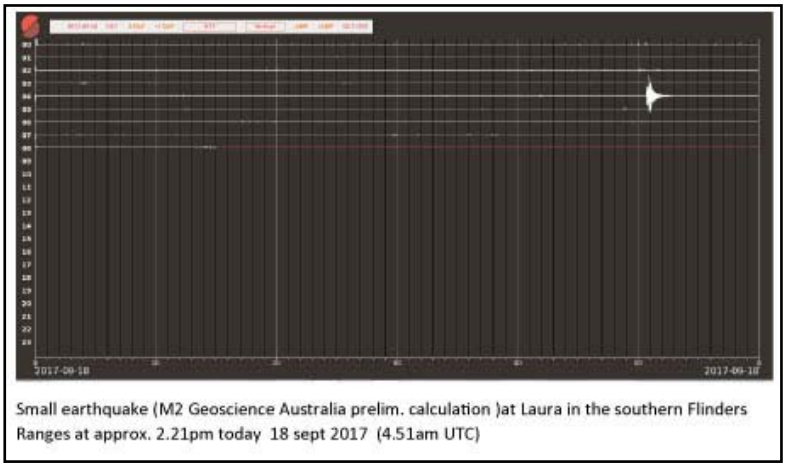
David Miller reports on the construction of his vault on Yorke Peninsula

There is a saying “Idle hands are the……” well a few years back I decided to build a bespoke geophysical vault at my small land holding at Wallaroo Yorke Peninsular.

As a professional geophysicist, I thought this was a great retirement project. The construction work commenced in 2015 with the installation of a 20 000L concrete underground tank placed on a solid granite outcrop. It was very fortunate that a portion of my property has Wallaroo granite subcrop at approximately 2m depth.

The geophysical vault has been designed to keep a fairly steady state temperature and has ample room for a number of geophysical instruments that need a quiet, underground location. Two openings in the floor of the vault allow the placement of instruments such as seismometers directly on to solid rock.

The vault is not designed for frequent access (only access is from the top through a 900mm access hole using confined space equipment). An insulated recorder box and 12V solar power is available alongside the vault. An external 12T concrete plinth was also installed as a gravity base station, again this rests on granite subcrop, but could be utilised for any instrument that needs a very stable base. A number of weather stations are installed on the property to measure surface meteorological conditions as well as the temperature inside the vault.



Small earthquake (M2 Geoscience Australia prelim. calculation)at Laura in the southern Flinders Ranges at approx. 2.21pm today 18 sept 2017 (4.51am UTC)

Commissioning of the vault has been delayed many times but in recent days a proton magnetometer has been installed to measure diurnal variations in the Earth’s magnetic field. At this stage data will be collected every 2 weeks, anyone interested in this can download it from www.integratedexplorationsolutions.com.au (*not active at the moment*)

My Trillium seismometer will eventually find its way into the vault once experiments at Paul Hutchinson’s vault are concluded. In the meantime, I have undertaken some simple experiments to gauge the impact of road noise from the Spencer Highway located 250 west of the vault.

The preliminary results indicate that the road noise from the Highway will have little or no impact on any instruments located in the vault.

The vault is available to anyone in the association that would like to deploy any geophysical or other scientific instruments.

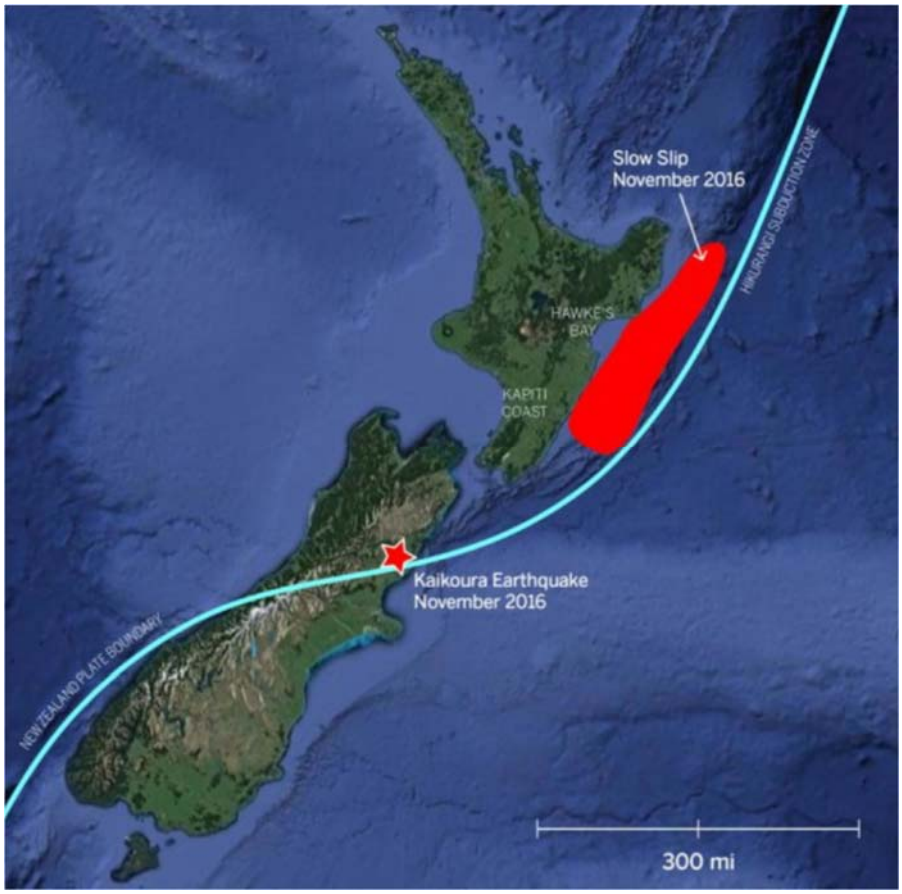
Earthquake triggers slow motion quakes in New Zealand

Slow slip events, a type of slow motion earthquake that occurs over days to weeks, are thought to be capable of triggering larger, potentially damaging earthquakes. In a new study led by The University of Texas at Austin, scientists have documented the first clear-cut instance of the reverse -- a massive earthquake immediately triggering a series of large slow slip events.

Some of the slow slip events occurred as far away as 300 miles from the earthquake's epicentre. The study of new linkages between the two types of seismic activity, published in *Nature Geoscience* on Sept. 11, may help promote better understanding of earthquake hazard posed by subduction zones, a type of fault responsible for some of the world's most powerful earthquakes.

"This is probably the clearest example worldwide of long-distance, large-scale slow slip triggering," said lead author Laura Wallace, a research scientist at the University of Texas Institute for Geophysics (UTIG). She also holds a joint position at GNS Science, a New Zealand research organization that studies natural hazards and resources.

Co-authors include other GNS scientists, as well as scientists from Georgia Tech and the University of Missouri. UTIG is a research unit of the UT Jackson School of Geosciences.



The 7.8 magnitude Kaikoura earthquake (marked by a red star) triggered a slow slip event (marked by red area) on New Zealand's North Island. The slow slip spanned an area comparable to the state of New Jersey. Both events occurred along a subduction zone, an area where a tectonic plate dives or "subducts" beneath an adjacent tectonic plate. This type of fault is responsible for causing some of the world's most powerful earthquakes.Credit: The University of Texas at Austin Jackson School of Geosciences

In November 2016, the second largest quake ever recorded in New Zealand -- the 7.8 magnitude Kaikoura quake -- hit the country's South Island. A GPS network operated by GeoNet, a partnership between GNS Science and the New Zealand Earthquake Commission, detected slow slip events hundreds of miles away beneath the North Island. The events occurred along the shallow part of the Hikurangi subduction zone that runs along and across New Zealand.

A subduction zone is an area where a tectonic plate dives or "subducts" beneath an adjacent tectonic plate. This type of fault is responsible for causing some of the world's most powerful earthquakes, which occur when areas of built-up stress between the plates rupture.

Slow slip events are similar to earthquakes, as they involve more rapid than normal movement between two pieces of Earth's crust along a fault. However, unlike earthquakes (where the movement occurs in seconds), movement in these slow slip events or "silent earthquakes" can take weeks to months to occur.

The GPS network detected the slow slip events occurring on the Hikurangi subduction zone plate boundary in the weeks

Story source: *University of Texas at Austin. "Earthquake triggers 'slow motion' quakes in New Zealand." ScienceDaily, 11 September 2017.* www.sciencedaily.com/releases/2017/09/170911122735.htm

and months following the Kaikoura earthquake. The slow slip occurred at less than 9 miles deep below the surface (or seabed) and spanned an area of more than 6,000 square miles offshore from the Hawke's Bay and Gisborne regions, comparable with the area occupied by the state of New Jersey. There was also a deeper slow slip event triggered on the subduction zone at 15-24 miles beneath the Kapiti Coast region, just west of New Zealand's capital city Wellington. This deeper slow slip event near Wellington is still ongoing today.

"The slow slip event following the Kaikoura earthquake is the largest and most widespread episode of slow slip observed in New Zealand since these observations started in 2002," Wallace said.

The triggering effect was probably accentuated by an offshore "sedimentary wedge" -- a mass of sedimentary rock piled up at the edge of the subduction zone boundary offshore from the North Island's east coast. This layer of more compliant rock is particularly susceptible to trapping seismic energy, which promotes slip between the plates at the base of the sedimentary wedge where the slow slip events occur.

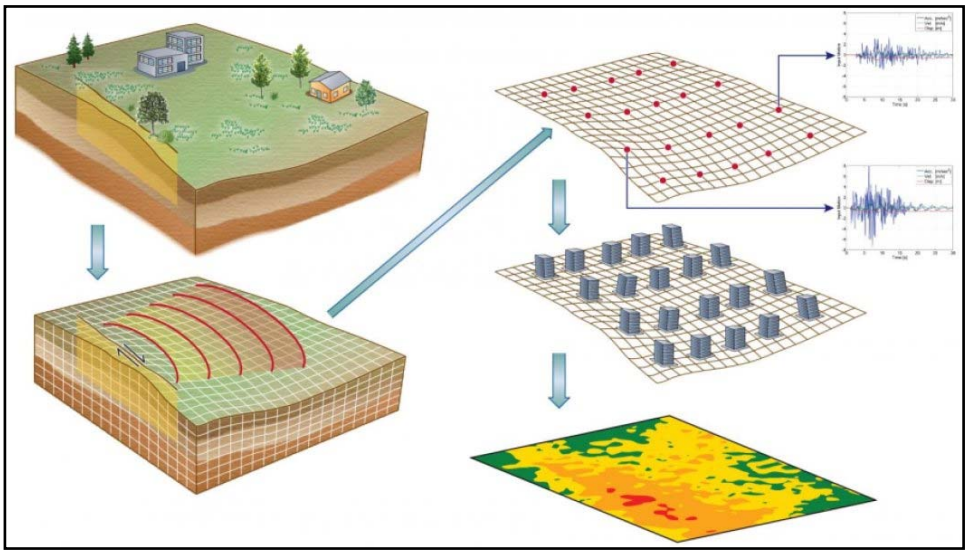
"Our study also suggests that the northward traveling rupture during the Kaikoura quake directed strong pulses of seismic energy towards the North Island, which also influenced the long-distance triggering of the slow slip events beneath the North Island," said Yoshihiro Kaneko, a seismologist at GNS Science.

Slow slip events in the past have been associated with triggering earthquakes, including the magnitude 9.0 Tohoku earthquake that struck Japan in 2011. The researchers have also found that the slow slip events triggered by the Kaikoura quake were the catalyst for other quakes offshore from the North Island's east coast, including a magnitude 6.0 just offshore from the town of Porangahau on Nov. 22, 2016.

Although scientists are still in the early stages of trying to understand the relationships between slow slip events and earthquakes, Wallace said that the study results highlight additional linkages between these processes.

Assessing regional earthquake risk and hazards in the age of exascale

With emerging exascale supercomputers, researchers will soon be able to accurately simulate the ground motions of regional earthquakes quickly and in unprecedented detail, as well as predict how these movements will impact energy infrastructure -- from the electric grid to local power plants -- and scientific research facilities.



Researchers at Berkeley Lab, LLNL and UC Davis are utilizing ground motion estimates from a regional-scale geophysics model to drive infrastructure assessments. Credit: Image Courtesy of David McCallen

To achieve this, the tool under development by the project team employs a discretization technique that divides Earth into billions of zones. Each zone is characterized with a set of geologic properties. Then, simulations calculate the surface motion for each zone. With an accurate understanding of surface motion in a given zone, researchers also get more precise estimates for how a building will be affected by shaking.

Read more of this story here:

DOE/Lawrence Berkeley National Laboratory. "Assessing regional earthquake risk and hazards in the age of ex-ascale: Researchers lead development of a workflow to accurately predict ground movement and its impact on structures." ScienceDaily, 4 October 2017. www.sciencedaily.com/releases/2017/10/171004120510.htm

The future of earthquake seismology in Queensland (in particular) and Australia (in General)

(received 27 August 2017)

Dear Editor,

I just spent an interesting day going through my CQSRG earthquake database and comparing it to the GA database over the same period, and within the same regional area.

The events counted in the table presented here all occurred within NW(-21.945, 150.640), SE(-27.111, 154.468).

In all years (except 2015, when GA deployed a temporary aftershock array near Mt Perry for a month in response to the M5.0) the CQSRG catalogue lists considerably more earthquakes than the GA database.

As would be expected, as you raise the magnitude count threshold, the CQSRG count converges to the GA count in all years. However, there are some notable instances where >M3.5 earthquakes have occurred that do not appear in the GA database . There is an M3.6 in 2010, an M4.0 in 2011, and an M4.5 in 2012 that are not in the online GA database. Additionally, I picked up three instances where GA has listed definite mine blasts as earthquakes (and that is just within the confined area I have defined above). I have sent Hugh emails about the misinterpreted blasts and, hopefully, the GA database will be adjusted accordingly by culling the entries. This highlights the advantage of local knowledge when interpreting seismograms. After 13 years of ogling CQ seismograms I can pretty much glance at the FS03 seismograms and send the blasts left and the earthquakes right.

I am aware of the GA practice of not entering earthquake events into the GA database unless they can be located to within set administrative parameters; however, I question this practice on the basis that it skews the actual earthquake count by ignoring earthquakes that are known to have occurred, but left out of the record because GA is unable to locate them with sufficient accuracy – or does not detect them at all. It may be a reasonable motive to omit them from the GA database if they are not detected – but it is another matter entirely to detect them but ignore that they occurred due to an administrative directive. It may be that a lack of human resources forces GA to draw a line in the sand, and I accept that GA has no remit to chase sub M3.5 events; but it is frustrating to see the GA database listing hundreds of sub M3.0 earthquakes from NSW, Vic, SA, and WA, when Qld is not afforded the same degree of assessment.

In my opinion, if it can be conclusively verified that an earthquake occurred, then that earthquake should be recorded in the national database regardless of whether it can be located precisely or not.

I, apparently, am able to access more seismogram records than GA can (for locating Queensland events); and I find this quite bizzarre. GA now has full operational control over the UMP sites; the Qld Govt has offered the data from SEQWater and Sunwater sites to GA – and it would only be a matter of organising a data feed from the Queensland eqServer to GA to access the data. Then there are the ANU seismographs in schools. They often provide critical data for getting locations – and that data is readily available off the IRIS web service. So it would seem that there is no impediment to GA getting access to pretty much the same data that I use.

Year	CQSRG >0.0	CQSRG >1.5	GA all
2004	13	9	5
2005	18	7	2
2006	16	4	0
2007	37	18	2
2008	9	2	1
2009	1	0	0
2010	24	14	1
2011	17	9	4
2012	16	10	2
2013	11	6	2
2014	6	6	0
2015	203	116	284
2016	46	25	5
2017	15	7	0

The problem is that State Governments all over Australia have washed their hands of any involvement in earthquake seismology – and I rather think that the Federal Government has done so too. It is a creeping seismological death. All of the Australian seismological "interest" has been devolved to GA by State and Federal Government – but I doubt that this situation has been recognised in the GA budget. Certainly any sign that GA is responding to this challenge is not apparent – not in Queensland anyway.

Letters to the Editor

from the Editor's mailbox . . . . .

In Queensland, CQSRG seems to be a voice in the wilderness. We operate on less than a personal shoe string budget, but can achieve significantly more detection and location of Queensland earthquakes than other publically funded State or National agencies. I have given up notifying GA of most earthquakes that I locate, because I know that GA will not include them in their database. I have 540 earthquake in my CQSRG database – recorded since 2004. I'm currently 68 years old; and getting older by the minute. If I can continue operating CQSRG for another 10, or maybe 20, years, I will probably have a catalogue of about 1500 earthquakes or more in the database. I have all of the seismograms and eqLOCL solutions for every event in the CQSRG catalogue on a hard drive that I keep backed up in triplicate.

What is going to happen to that data when I get hit by a bus or fall off my perch? None of my family are sufficiently familiar with my seismology work to know what to do with it – or even where to find it! Once I'm gone it will be as if I had never been here; which begs the question of why I bother to continue monitoring for earthquakes at all (it's because I love doing it, but I would like to think that my efforts will help future earthquake seismology and engineering in Queensland).

Ok ... that's my rant for this month; however, I do genuinely believe that the issues I have raised are serious enough to start a sober discussion on the future of earthquake seismology in Australia (if it has a future at all).

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Adjunct Research Fellow, CQUniversity Australia (CQU).
Member of the Australian Earthquake Engineering Society (Since 1997).
Horse Camp, Qld. 4671

Kevin McCue replied:

Point taken Mike. The same is true for the historical data. Not a single earthquake from publicly available lists of historical earthquakes on the AEES website has been added to the GA earthquake database, nor any of the very extensive study by Dix (2013) of SA earthquakes. I am hopefully presenting two papers on this deficiency at the AEES symposium in November.

More reason for you to keep your Qld earthquake database up to date and I recommend you make a copy of it available on the AEES website.

But the point has to be made that any earthquake hazard assessments made using just the GA database alone cannot be considered best practice and therefore not acceptable. What to do? Surely there is a role here for AEES to lobby the ABCB to put pressure on the government to fund GA adequately to monitor the whole country down to circa magnitude 2. As individuals we don't have much leverage.

Kevin
mccue.kevin@gmail.com
27 August 2017

And this from Russell Cuthbertson (SRC):

You are not the only non-GA person collected little Eqs. SRC has access to all the data you have (and then some). Our philosophy is to locate anything we can – down to whatever level – and we are generally fairly diligent in getting all available data for an event. So just because they are not on the GA list does not mean that they are not being documented by other people.

Our database even has fields for events that are recorded but not located although I must admit I'm not sure if unlocated events still make it onto it. We do keep all waveforms – even for the unlocated events just in case they prove useful down the track. I'm sure Gary's dbase also has unlocated events on it and he assiduously sucks in all events he can find.
So, if you provide your database I'm sure it would get incorporated and there would be less chance of it ending up getting taken to the dump!

Plenty of people will argue that the small events have no really influence on the resultant hazard (but hazard is only one of the end products). As to the larger ones that are missing from the GA database, that is more of a concern. Undoubtedly there will be modest-sized events missed in the more remote corners of Australia – including Queensland – but I wouldn't have thought it in SEQ. It would be interesting to see why they are not included. Can you give us dates/ times and I will check what we have.

As to miss-identifying blasts as natural events this is a continuing problem in the Bowen basin, the Hunter Valley and even more recently in Vic. Once the time passes it is a mammoth task going back to filter these out as the analysts with the local knowledge have often moved on (or passed on!).

A recent article in BSSA talked about analysing Canadian Eqs. They knew there was some blasts in their database so they simply ignored anything within 30km of a mine. I thought "why not go and check the records and use some human intelligence". It turns out that after deleting all events near mines they still had over 100,000 recordings to analyse. Not sure if we can afford the same luxury in Oz!

(Lack of space prevents printing more replies - Ed)