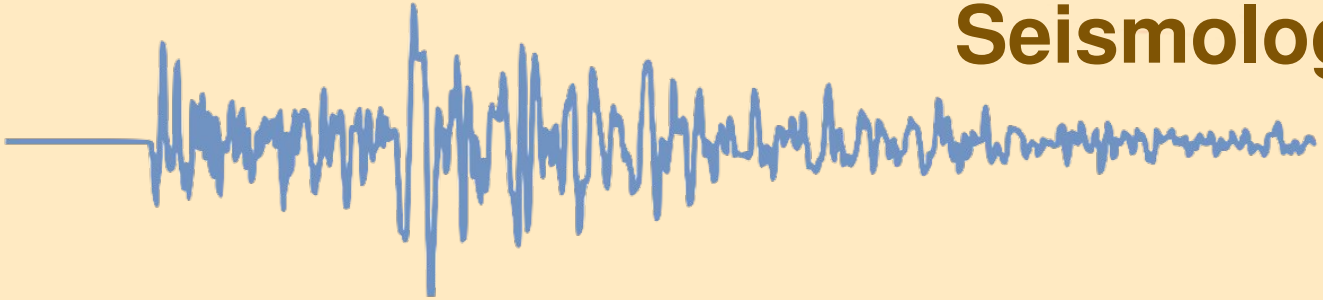
Newsletter of the Seismological Association of Australia Inc.

May-Jun 2019



Seismological Association of Australia Inc.

Newsletter of the
Seismological Association of Australia Inc.
PO Box 682, Mylor SA 5153

Your Committee

Chairperson - Blair Lade
m: 0407 189 061 e: blairl@bettanet.net.au

Chief Seismologist - David Love
p: 08 8336 8003 e: david@earthquake.net.au

Public Officer - Paul Hutchinson
m: 0419 829 216 e: windfarmer@bigpond.com

Secretary - Joe Grida
m: 0407 558 036 e: joe.grida@internode.on.net

Treasurer - Joe Grida
m: 0407 558 036 e: joe.grida@internode.on.net

Editor - Peter Gray
m: 0418 829 632 e: weaksignals@iinet.net.au

The SAA can be contacted by post to the address above, or by email to any member of Committee, as listed above

Membership of the SAA is open to all, with the only prerequisite being an interest in seismology. Membership applies for the calendar year (January through to December)

Membership fees are:
Full member $50

A Membership application form can be obtained from the Treasurer by email or download it here.

Member Submissions
Submissions for inclusion in the Newsletter are welcome from all members; please note that submissions may be held over for later editions. Wherever possible, text submissions should be sent via email 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 email to weaksignals@iinet.net.au

A word from the Editor
A week ago, it was touch & go that this edition was going to make it on time, having crashed my old notebook. Today, a new machine, the same old desktop publishing package and the same old two finger typist/editor. Strangely, this edition has been so much easier to prepare. Was it the larger screen? It helped, but the real boost was having material on hand to prepare for publication. A nice mix of articles from some new and past contributors helped make my job this month so much easier. Thank you to those who submitted articles for publication, I hope I have presented them to your satisfaction.
Please consider sending more (that goes for our other members too) so don't be shy.
We are still moving forward, slowly but surely and progress is being made, despite recent distractions. Problems are being addressed, failures are being repaired or replaced and our assets pay their way by being online and available 24/7. How our data is disseminated, used and interpreted is largely beyond our control, for the moment. Perhaps this is another way forward for the SAA in the future, having proved we can produce and sustain reliable, quality seismic data.

Peter Gray

SAA News and upcoming activities

Bunnings Fundraiser BBQ
Our second fundraiser was recently confirmed, it's one of the joys of being on the Bunnings emergency list. The SAA has been granted another opportunity to raise more much needed cash on (please take note)

Saturday, June 8th 2019 at Bunnings Mt. Barker (SA).

The times will be **8:00am thru 5:00pm** (normal opening hours).

If you are available to help out for a couple of hours or even the whole day, your time and effort will be appreciated.
Some of the items that will be required for the day include ice boxes/portable fridges for raw foods and drinks. You will need to bring an apron and perhaps BBQ utencils etc. This one should be a little busier than the last, being Saturday on a long weekend.
Again, the proceeds from the fundraising will probably go toward existing seismic station upgrades, new seismic site development or public liability insurance costs.

Science Alive 2019
An expression of interest to participate in this years Science Alive has been registered, following the positive feedback received from the 2018 event. The next SAA Committee meeting will be focusing on this event and how/what the association will present this year. Keep your calendars open, the dates are as follows:
Friday, August 2nd is a Schools only day
Saturday, August 3rd is general public day
Sunday, August 4th is a general public day

Circular MIL-Spec Connectors
Many of the seismometers and recorders we use rely on circular military connectors to provide weather resistant and reliable wired interfaces between equipment. If you have ever inquired about buying these items for new installations or upgrading with replacement cables, you probably got over it on receipt of a price quotation.
David Love has been collecting and recovering MIL-Spec connectors for some time, many of these items have recently been cataloged into a spreadsheet linked here, should you be interested. Our original intention was to put them on eBay and sell them. It is only fair to offer them to our members, all we ask is that you pay the postage and a donation to the SAA for the product. Just to whet your appetite, I have listed a few connector types here and where you might be able to use them:
Bayonet - MIL-DTL-26482 Series I
Cable Plug : Layout 12-10 : Socket Contact : S-6000 or CMG-6T
Cable Plug : Layout 14-18 : Socket Contact : Geotech BB-13
Box Mount Receptacle : Layout 12-10 : Pin Contact : S-6000 or CMG-6T
Jam Nut Receptacle : Layout 14-19 : Socket Contact : Echo or EchoPro
Threaded - MIL-DTL-5015
Cable Plug : Layout 14S-5 : Pin Contact : Ranger SS-1
Cable Plug : Layout : 14S-5 : Socket Contact : Ranger SS-1
Box Mount Receptacle : Layout 14S-5 : Pin Contact : Ranger SS-1
Box Mount Receptacle : Layout 14S-5 : Socket Contact : Ranger SS-1

A link from our Hungarian friends at GGKI
Marcell Szanto, a 5th year student of the Eötvös Loránd University (Budapest) has made 2 animations of tilt measurements of the recent Peru quake. http://www.ggki.hu/~papp/peru_quake_20190526
It is very demonstrative regarding how the surface is deformed during the arrival of different kinds of waves (P,S, Surface). Each download is 212Mb

PCEE2019

(substantially extracted from an AEES on-line report)

Article kindly submitted by Kevin McCue

The Pacific Conference on Earthquake Engineering is held every four years, mostly in New Zealand but occasionally in Australia. It is timed to occur between the four-yearly World Conferences on Earthquake Engineering.

This year from 3-6 April, 2019 the venue was Auckland NZ, and it doubled as the annual NZSEE conference. Some 470 delegates registered, most of them New Zealand engineers, with fewer than 15 from Australia. Two of the few seismologists in attendance were Australians Trevor Allen and Paul Somerville both presented papers, Trevor's one of five invited papers. Other attendees from this side of the ditch included Mark Edwards from Geoscience Australia, engineers George Walker, Nelson Lam and Martin Kusz, Geotechnical engineer Tim Mote and myself.

Delegates from Southwest Pacific countries PNG to Tonga were notable by their absence, a great pity as one of PCEE's main contributions is to reduce earthquake risk in Pacific countries. One from Fiji registered. Seismologists and engineering seismologist were few also, the intermingling of engineers and seismologists is a feature at AEES conferences.

One of the three keynotes discussed the 2018 Palu Indonesia earthquake, magnitude 7.4, and the resultant liquefaction and tsunami from a disaster mitigation viewpoint and there were about 20 papers relating to seismology or engineering seismology and earthquake hazard assessment. Nothing on instrumentation to excite members of SAA.

The central Auckland venue at Sky Convention Centre near the un-instrumented Sky Tower lent itself to audience participation, no one having to walk far between the three simultaneous themes, but still less desirable than our AEES single theme attended by all registrants across the disciplines. Lunches were a help-yourself standup affair at small tabletops dotted amongst the industry booths. Dinner too was at the venue, diners entertained with a short presentation by a Maori group, telling their story of survival and growth since European invasion.

Convenor Bruce Deam and his team are to be congratulated on a well attended successful conference. Regular attendees at the annual NZSEE conference enjoyed meeting up with colleagues again, I celebrated my 50th birthday at one of these meetings where I shared a (small) bottle of NZ red with David Dowrick, now quite unwell I am sad to say. NZSEE staff such as Lisa Moon (ex-Adelaide) were evident everywhere helping out speakers and registrants alike. Former NZSEE executive members and retired GNS scientists were still making their presence felt, meeting and greeting, leading discussion and story telling. Peter Smith, Dave Brunsdon, Andrew King, Graeme Beattie, Kelvin Berryman, Graeme McVerry, prominent amongst them, engineers and scientists who have also participated in AEES conferences.

Paper abstracts were bound and included in the conference bag but there was no usb or cd of papers which is disappointing, perhaps they can be downloaded on line. One paper that wouldn't and couldn't reflect the intensity of presentation was the story of Ruaumoko by Jason Ingham, well known to AEES audiences, and his two student co-presenters who performed an inaugural haka as part of the story. This was fantastic theatre that will never be forgotten by the rapt and fortunate audience.

If there was a theme it was that there has to be change in how earthquake engineering principles, founded famously in the thinking, writing and teachings of NZ legends Park and Paulay, need to be rethought and reapplied. Two buildings in downtown Wellington had to be demolished in the recent Kaikoura sequence of earthquakes and ever since Christchurch it has become clear that community resilience needs to be considered, not just life safety, for each building considered

separately and independently. That will be a real issue and must include domestic construction, pre-existing buildings and linking infrastructure. All buildings must be “good’ buildings according to Californian-based Speaker Professor Maryann Phipps for them to survive relatively undamaged and fit for purpose immediately after a damaging earthquake. Such buildings were lacking in Christchurch and probably don’t even exist in Australia.

Most of the papers were on structural engineering, reinforced concrete, steel and timber but there were also a few geotechnical speakers. Trevor Allen and Mark Edwards’ presentations were seen as complementary and well received, some parts of NZ are after all on the Australian Plate and far enough from the plate boundary to use intraplate loading code provisions albeit with a special need to consider large deep earthquakes. I think there are shortcomings in the results of GA’s hazard analysis of Australia due to some of the pervading assumptions and omissions but that will be tested at the AEES conference in November. The basic approach and analysis are not in dispute.

I arrived too late to join the pre-conference Auckland volcano tour but atoned with a tour of the White Island volcano in the Bay of Plenty re-named and re-discovered by Englishman James Cook in 1768. An impressive column of steam emanated from the island as we approached by boat from Whakatane and totally obscured the crater but there were plenty of very active fumaroles and fluid-building mounds dotted across the floor and walls of the breached valley. I spotted one of the seismograph sites by its telltale cable dangling down the crater wall which might detect and transmit local seismicity and harmonic tremor before it is obliterated in the next eruption. The ruins of a decade long sulphur mine were evident but rotting quickly in the corrosive environment where they had been abandoned following the miners deaths there in 1914. This as I discovered is a must-visit for seismologists visiting the shaky isles.

Kevin's image of White Island is on the cover page of this issue

Seismic site, prior to obliteration at the next eruption

GPS Week Number Rollover

Article kindly submitted by David Love & Blair Lade

BIG PROBLEMS - What is the problem? On 6th April this year, the second GPS week number rollover (WNRO) occurred.

What is this? The GPS satellite system was started in 1980 (6th Jan 1980) with a 10 bit number to represent the week. So when that number gets to 1023 weeks, then the next number is ZERO. In case you missed it, the first WNRO occurred in 1999. That means that on the 6th April 2019, many GPS units suddenly thought it was 21st August 1999 again. Unfortunately the Echo recorders operated by SAA all suffered from this problem, and all broke down. Most of our EchoPro recorders do not have the problem yet, but may break down at various later dates.

What have we done? Last year we received a number of EchoPro recorders from Geoscience Australia which were no longer required. We have been deploying these to sites where Echos have failed.
In South Australia, they have replaced Echo recorders installed at MRAT (Mount Rat) on Yorke Peninsula, PLMR (near Palmer), and TORR (Torrens Island). Another has gone to Arkaroola, and will be installed in the near future.
Interstate, one has been installed at the RNDA (Aranda, Canberra) station operated by Kevin McCue. Another went to Brisbane to be installed at BRSA (Mt Nebo), but it appears to have failed.

What else can we do? Blair is investigating several replacement GPS receivers from different manufacturers for these recorders.

uBlox Blair is happy to report that a uBlox NEO-6M gps unit has been tested on an EchoPro, but it's not a nice plug in solution, with wires soldered to the board. Timing has been checked on the record and it's excellent, rising edge of my IRIG H generator is within 1mS of the correct time on the EchoPro. You can't get any better with 1000sps! Tested with a GPS constellation simulator, the uBlox 6M is good until around October 2026 but fails after that.
The uBlox NEO-7M and NEO-M8P are more modern variants which will possibly last beyond 2026, but are considerably more expensive to buy.

If the Trimble GPS in your EchoPro looks like this Lassen IQ module, it should be ok - for a while.

Trimble The Lassen IQ (P/N 46240-25) and Condor C2626 (P/N 70896-00) modules are a nicer plugin solution for around $50 each, but it is not certain when they will fail. This needs to be tested. There are firmware updates available for the Condor.

At this time there is no hardware solution available for the Echo but testing continues

Old gear built right? We have one Kelunji D series recorder, built in the 1990s before the Echo model began. This jumped back to 1999, but did not break down. SRC have adjusted their software to alter the dates by 1024 weeks, and it continues to hum along happily.

Melbourne Uni Seismology News

Article kindly submitted by Gary Gibson

It has been quite a busy time for the University of Melbourne seismology group over the past few months.

Seismology Data Acquisition and Distribution

Usage of our eqServer system has increased significantly, and the original two computers purchased in 2011 have been starting to show their age and limitations. With increasing numbers of seismographs, the response times started to slow. The total storage capacity was limited to 20 terabytes each, but it was impractical to upgrade the old systems, and funding was not available for suitable new computers. The Faculty of Science IT department have a large and powerful mainframe, and suggested that we try running eqServer on this. The conversion was tested and showed potential for significant improvements in capacity, and the possibility of future changes to enable shorter response times.

The data acquisition system has now been running for several weeks and problems associated with the change to a much larger computer have been sorted out, mainly by Greg and Leanne at Seismic Research Centre (SRC). The data distribution system became operational last week, although it has not been fully tested yet. There may be problems over the next couple of weeks. Please let me know if you have any problems, or wish to suggest any change or new feature.

As funding comes available we will modify the system to separate functions such as earthquake triggers and alarms, and image preparation functions. For example, at present all telemetered data is displayed using stored images, but manually loaded data needs a “refresh” to create new images. Most of our UoM projects are mainly concerned with high resolution seismology (e.g. aftershock networks, induced seismicity, fault delineation, etc.), and often record small nearby earthquakes, so we need high sample rates (typically 250 samples per second or higher), on either three or six channels. This means that we often only telemeter the vertical motion, and manually collect the data from recorders at intervals from weeks to over a year. At present we don’t update the images after every field trip because of the time required.

Gippsland Seismology

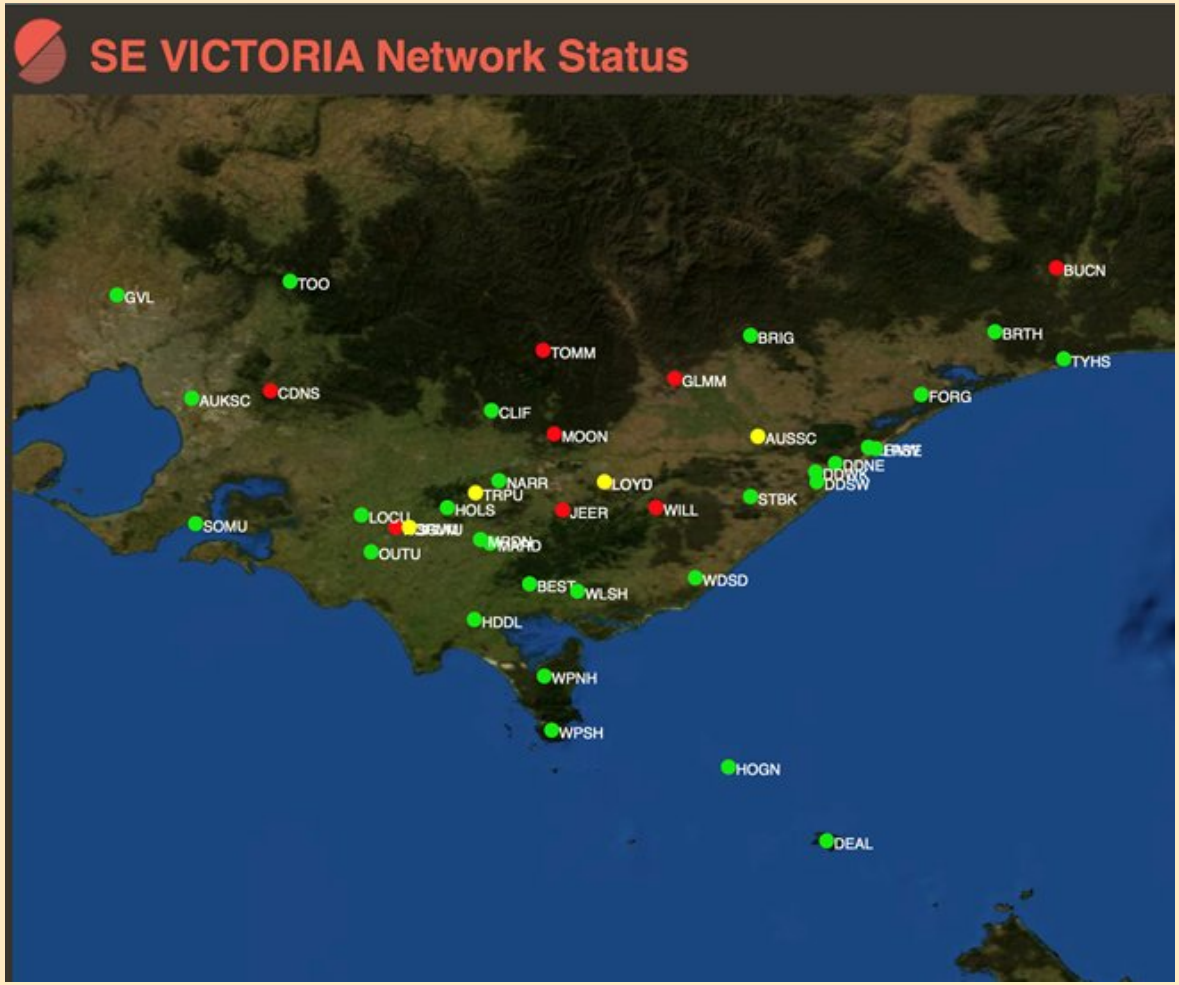
Our largest project at present is a relatively dense network in Gippsland, east of Melbourne. This complements the seismographs in West Gippsland that we have been operating since the Thorpdale earthquake in 2012, and existing SRC seismographs. A total of 24 seismographs are being installed to beyond Lakes Entrance in the east. We are locating many more earthquakes than in the past, mostly very small, with over 300 events during 2018 in an area that we used locate about 70 per year. More importantly the locations, especially depths, are much better constrained than in the past.

The active Strzelecki Ranges in Western Gippsland are largely Mesozoic sedimentary rock, and the focus of almost all earthquakes in that area are in the older, harder, Palaeozoic bedrock underneath the Mesozoic rock (usually deeper than 5km). The Gippsland Basin to the east has a considerable thickness of young Tertiary sediments overlying Mesozoic sediments or in some places Palaeozoic bedrock. The Tertiary sediments include unconsolidated sediments and relatively soft rock, so we do not expect any significant magnitude earthquakes originating in these, although large earthquakes originating in bedrock can rupture through the Mesozoic and Tertiary rocks, through to the surface, without much energy contribution from within the shallower rocks.

Impedance amplification will lead to higher surface ground motion at Mesozoic and especially Tertiary outcrop sites especially for medium to long period motion. These sites will also be more susceptible to noise from all sources such as wind and waves, traffic, etc. To complement the increase in noise on seismographs in the Gippsland Basin, the relatively

Melbourne Uni Seismology News

thick Tertiary rocks significantly attenuate seismic waves, especially the high frequency motion from small earthquakes, reducing signal levels recorded at the surface. Much of the seismic noise is surface waves which have amplitudes that decrease relatively quickly with depth, and even shallow boreholes for seismometers can give lower noise levels, but these can be very expensive to install.



One of the main aims of this project is to investigate the noise and attenuation issues, and to optimise the design of a network operating in this or a similar location. Since most earthquakes occur in bedrock, seismic waves will mainly travel at depth, and then be refracted to the surface relatively close to each seismograph, so it is only the last part of the wave motion that is seriously affected. Hard rock seismographs on Wilsons Promontory, Hogan Island and Deal Island are affected by wave noise but attenuation is low, and they have recorded very small earthquakes (below ML 1) at distances of over 100km. These will constrain earthquake epicentres, but not depths so soft sediment seismographs in the vicinity of the epicentre will be needed to determine accurate earthquake depths. Ideally the distance of the seismograph from the epicentre should be less than the depth of the earthquake. This would mean that if earthquakes are shallow (less than 5km) and can occur over a wide area, then a dense network would be needed.

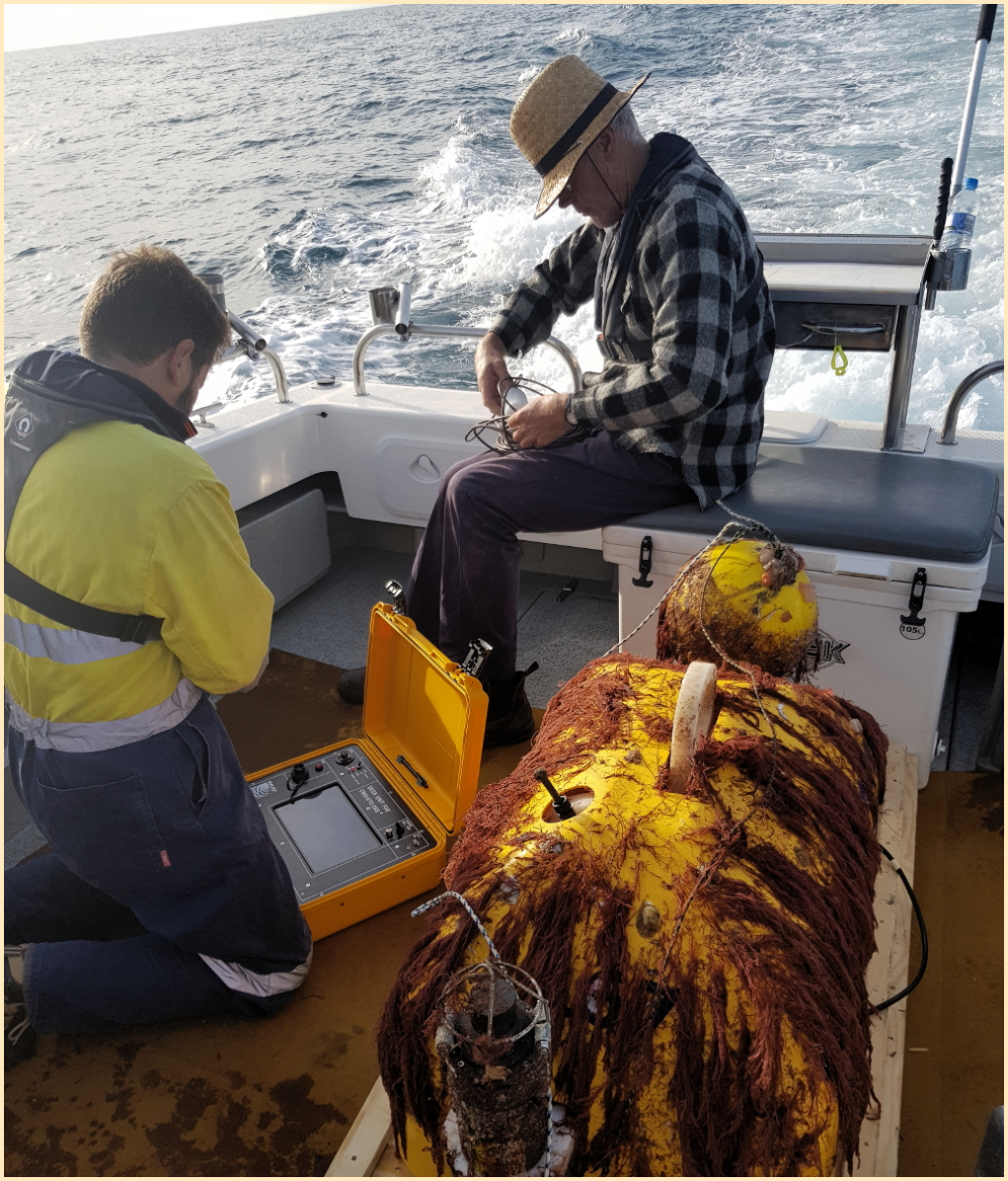
As found around much of the Australian coastline, a relatively large proportion of Gippsland Basin earthquakes occur offshore in a belt to about 20 to 30km from the coast. This means that for offshore earthquakes, the onshore seismographs may be too far from the coast to constrain earthquake depths, and ocean bottom seismographs (OBS) may be needed. In the past most OBS deployments have been far away from very noisy coastlines (breaking waves give very high levels of seismic noise), and at depths that are less affected by normal surface ocean waves.

Melbourne Uni Seismology News

The ground motion from even a very small earthquake, even less than magnitude 1.0, at close distances is well above most noise levels, so can be recorded. One of the main aims of our project is to quantify the minimum magnitudes that can expected to be recorded by the OBS well enough for depth constraint, depending on the earthquake depth and location, considering both noise and attenuation.

Another problem is that the GPS receivers that are used in almost all modern seismographs, and give very precise times (microsecond accuracy), cannot be used in OBS systems. These correct for clock time drift including variations with temperature, and the GPS can be continuously on or perhaps switched on every hour to correct the clock. OBS clocks may be deployed without time corrections for months or in some cases for more than a year. For deep OBS deployments the temperatures are unlikely to vary much, but at shallow depths this may not be the case. Standard practice is to synchronise the clock immediately before deployment, then immediately after recovery and then assume a uniform drift.

Our first OBS was deployed in Bass Strait last November, then recovered in May. The recovery mission involved leaving Lakes Entrance at 5 am, and after a series of problems, eventually returning to Lakes Entrance at 7 pm, with the OBS safely aboard. The data has been recovered, and translated into standard miniseed. Noise levels are indeed high, but their variations are yet to be studied in detail. The first earthquake we examined was a quite acceptable record of the 2018 December 05, 0418 UTC, Mww 7.6 event in the Loyalty Islands. No small, nearby earthquakes occurred during the deployment, but we hope to find some of the larger regional events that did occur.



Wayne Peck (SRC) and Ray de Graff (GA) with the OBS after recovery

SAA's TPSO Wiring Upgrade

Article submitted by Peter Gray

The potential capability of The Peters Seismological Observatory is attracting interest both here in Australia and overseas, more equipment is being installed on the seismic pier. More equipment generally means more power consumption. DC power systems offer some distinct advantages over 240VAC systems, particularly at remote sites. While the intention is not to totally isolate the equipment within from the mains power grid, running as much as possible from a battery backed-up DC system can simplify wiring requirements, reduce induced & conducted noise and avoid measurement system failures due to unexpected power interruptions.

With this goal in mind, Paul, Blair & I set out recently to vistit the farm and make a start on the wiring upgrade.

By rationalising the existing battery bank from 4 to 2 wet-cell 12V lead acid batteries, we cleared away some floor space, unprotected wiring and half of the hydrogen sources from the virtually sealed, underground structure. A dedicated 25A battery charger was fitted to the wall to keep the batteries in peak condition and provide power while the mains is present. As SAA finances permit, sealed AGM or SLA batteries will replace the wet-cells.

A 20 metre length of 10AWG shielded twisted pair cable was fed along one wall of the vault to bring +12VDC down to the pier chamber. Another safety feature was to add several marine grade DC fuse blocks, to be used as distribution points, at both ends of the structure. Service loops in the cable provide for additional fuse blocks, should they ever be required.

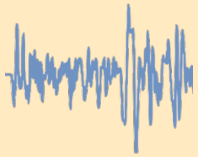
New cables and ring terminals, new network switch, new fuse blocks and fuses. Blair and Peter install the primary wiring infrastructure as a first step in the upgrade.

SAA's TPSO Wiring Upgrade

Two not so new batteries and a recycled battery charger.

Where possible, power hungry equipment was replaced by more efficient replacements but we're still working on replacing our laptops. Most modern PC's draw about 20W from an 19VDC supply but have the disadvantage of running Windows 10. This O/S has a nasty habit of running upgrades without much notice and we haven't found a way to disable this "feature", which tends to disrupt data collection. For PC operation during extended power outages, scaleable Lithium Ion battery pack(s) are currrently being built to provide additional back-up for the laptop's internal battery power banks.

Paul & Blair fixing one of the fuse blocks in the control chamber.



Resources & useful links

Description	URL / Webpage	Notes
SAA Membership Application	https://www.assa.org.au/media/74629/saa-membership-	Join up with the SAA using this form
SAA Flier	https://www.assa.org.au/media/74629/saa-membership-	Our current brochure - flier, saying what we do
SAA Newsletters	https://www.assa.org.au/resources/technical-special-	Download any SAA Newsletter from this site
SAA EqServer	http://ade-eqserver.dyndns.org:8080/eqserver/	South Australian miniseed seismometers
Melbourne University EqServer	http://meiproc.earthsci.unimelb.edu.au/eqserver/	Australian miniseed seismometers
Regional Seismic Network	http://www.regional-seismic.net/	PSN seismometers - Aust. Centre for Geomechanics
Regional Seismic Users Website	http://www.rsuw.daleh.id.au/index.html	PSN seismometers - RSUW
Recent SA Earthquakes	http://earthquakes.mappage.net.au/q.htm	Data & summaries of recent SA quakes
Central QLD Seismology Research Group	http://www.cqsrg.org/	CQSRG - Kevin McCue
Astronomical Society of SA	https://www.assa.org.au/resources/technical-special-	ASSA - Seismology page
Geoscience Australia	http://www.ga.gov.au/earthquakes/initRecentQuakes.do	Our national authority on seismic events
QLD Uni Environmental & Earth Sciences	https://sees.uq.edu.au/	The University of Queensland - Col Lynham
Seismic Research Centre	https://www.src.com.au/	OEM of seismic instruments & software
symCDC	http://symcdc.com/	OEM of seismic instruments & software
IRIS Seismic Monitor	http://ds.iris.edu/seismon/	Global seismic events
Joint Australian Tsunami Warning Centre	http://www.bom.gov.au/tsunami/	Bureau of Meteorology site
Australian Earthquake Engineers Society	https://aees.org.au/	An organisation with similar interests
Atlas of the Underworld	http://www.atlas-of-the-underworld.org/	Mapping the Earth's mantle
Atlas of Living Australia	https://www.ala.org.au/	A Citizen Science initiative