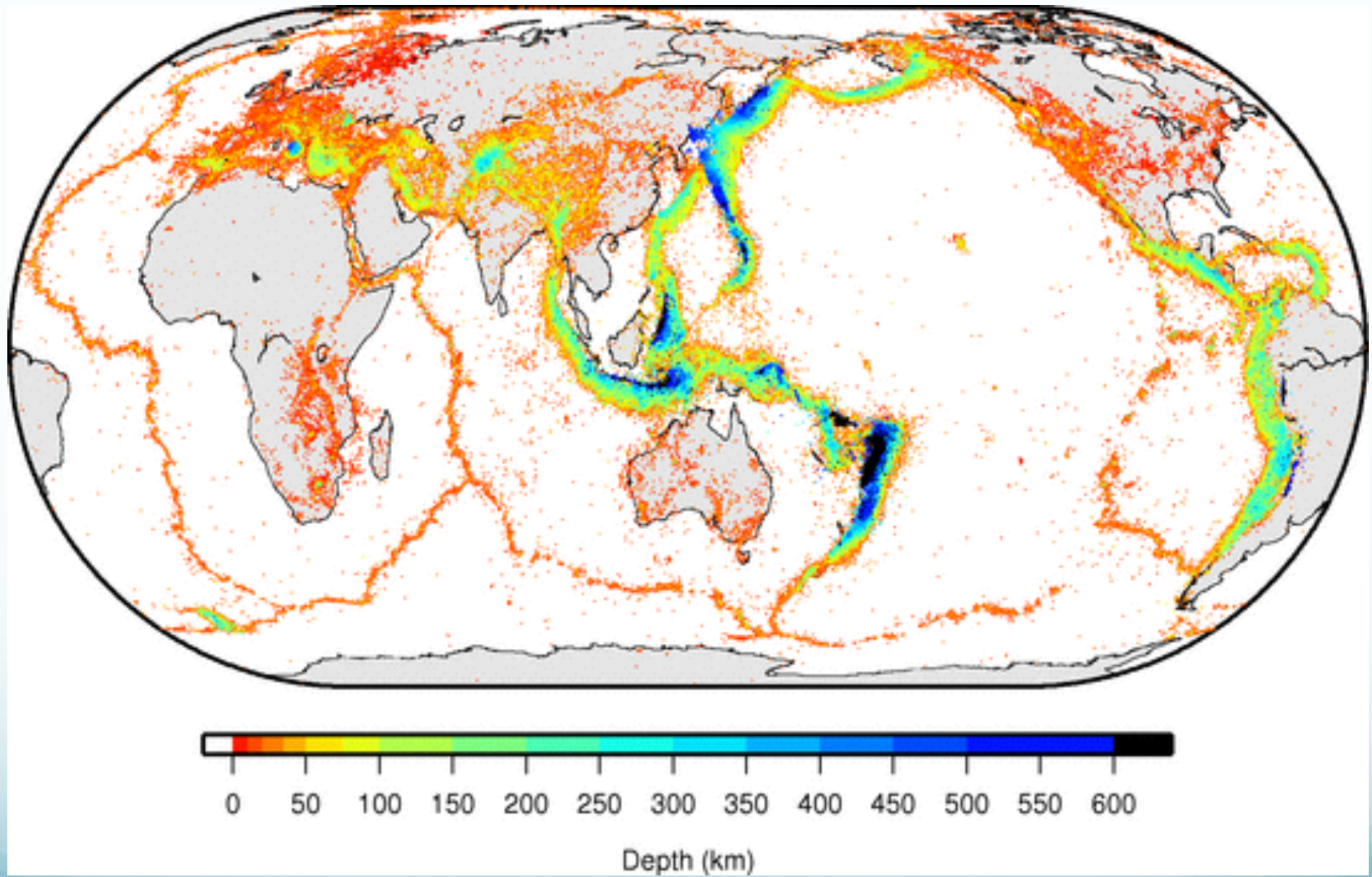


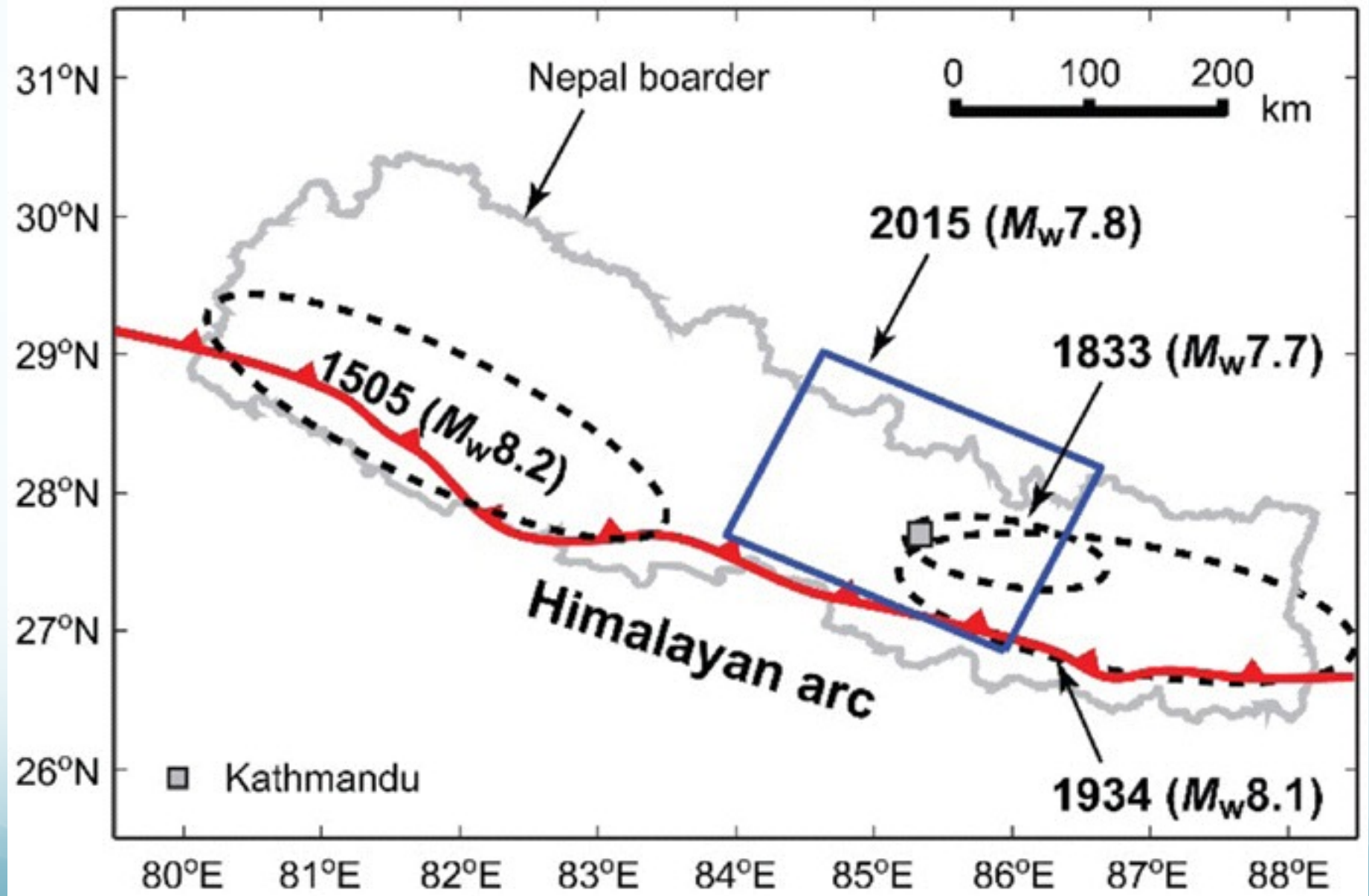
Earthquakes in NSW?

Kevin McCue FIEAust

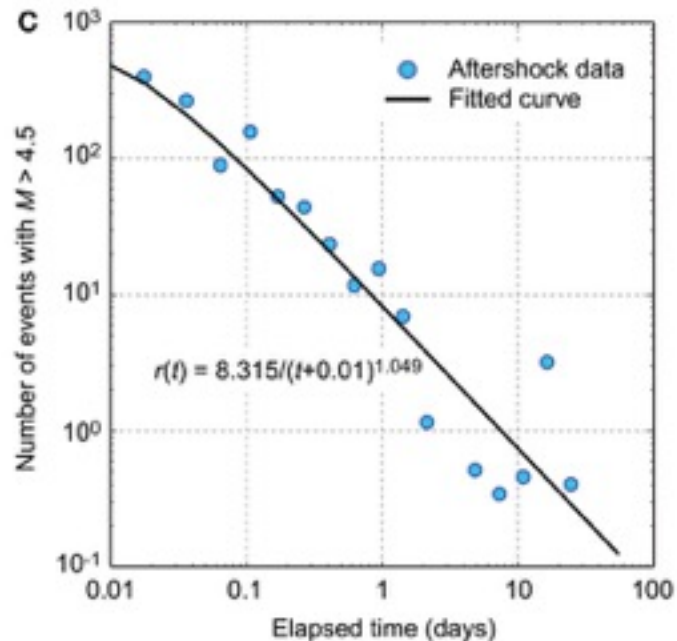
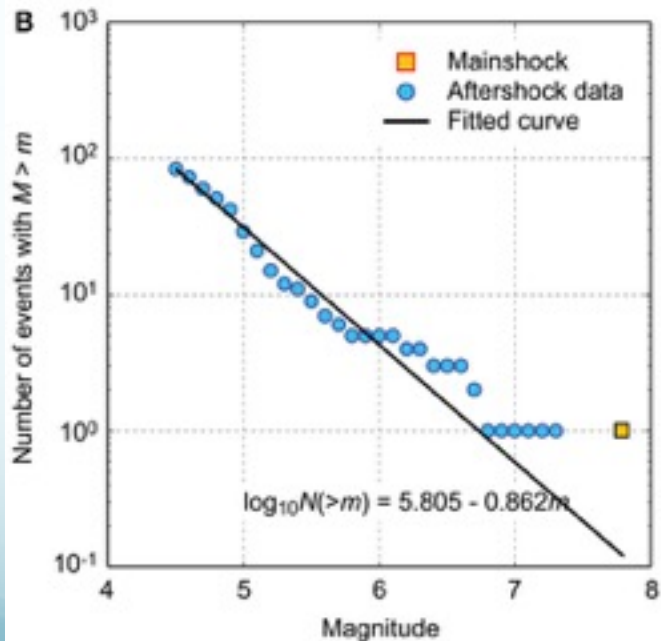
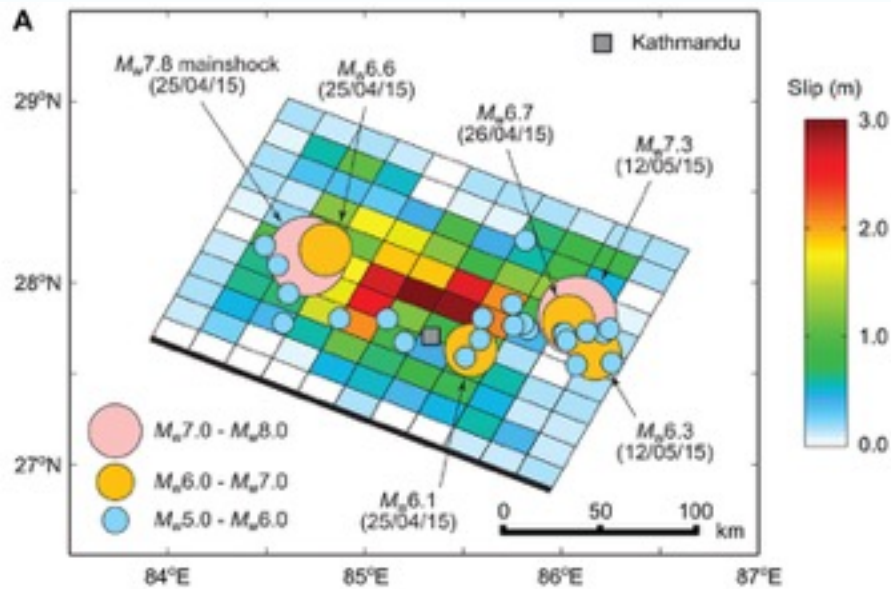
Australian Seismological Centre, Canberra



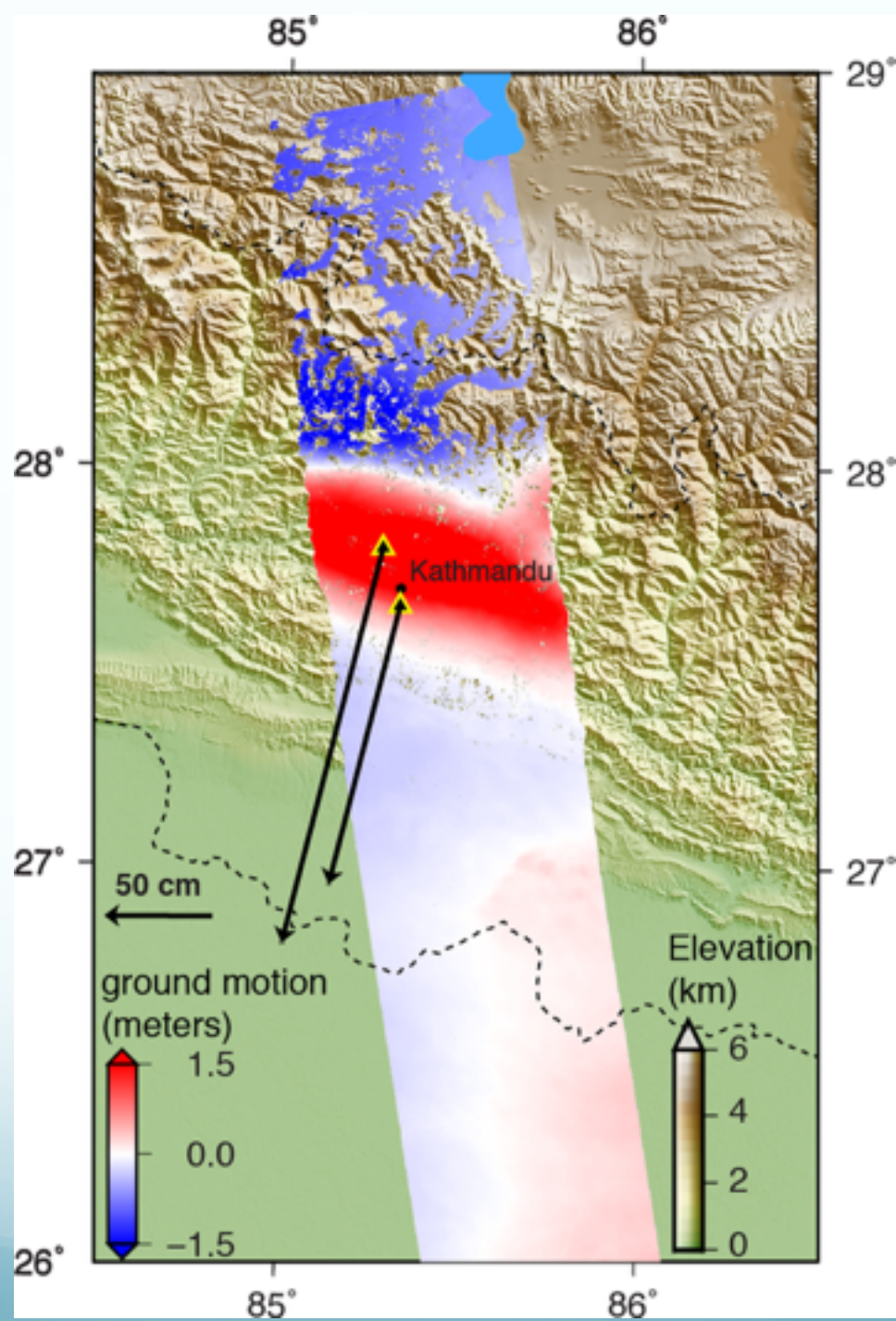
ISC database, epicentres from 1960 to 2013

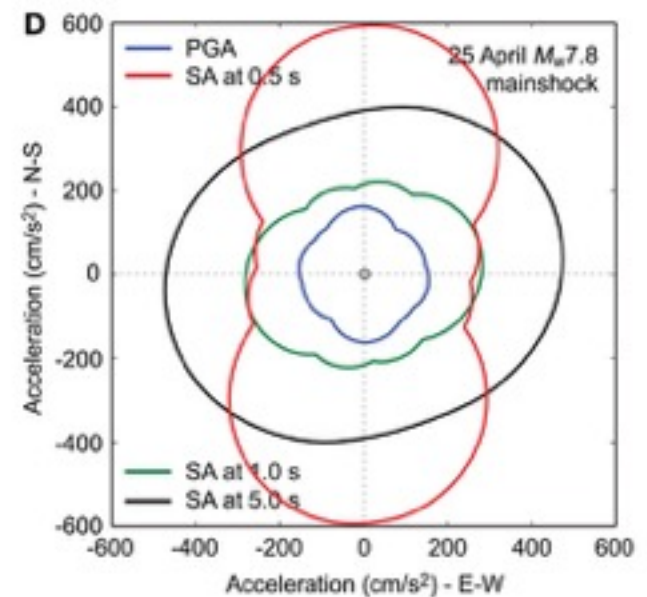
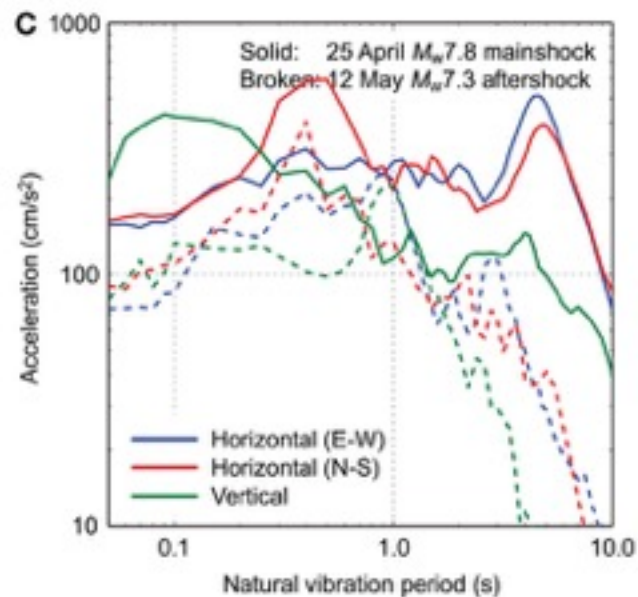
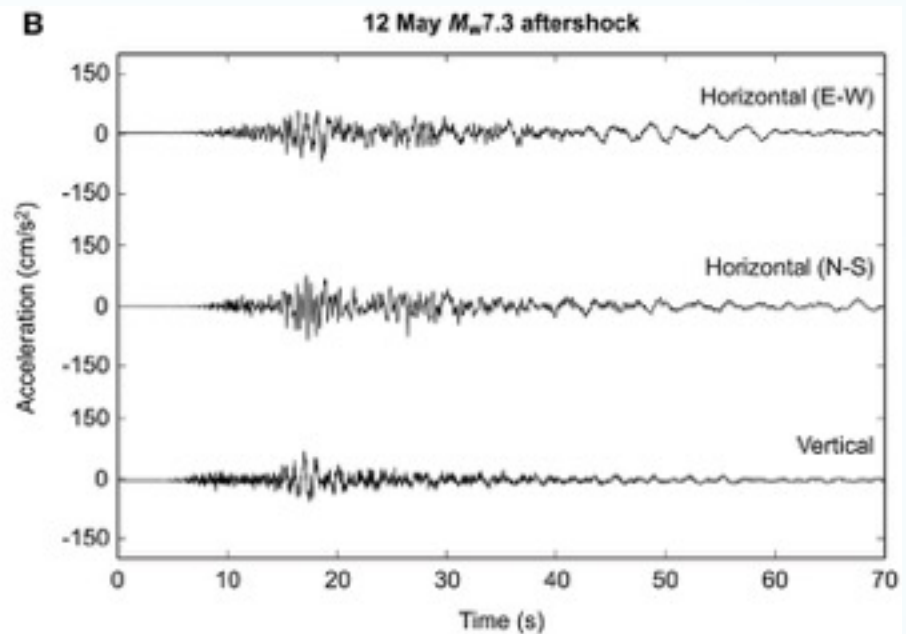
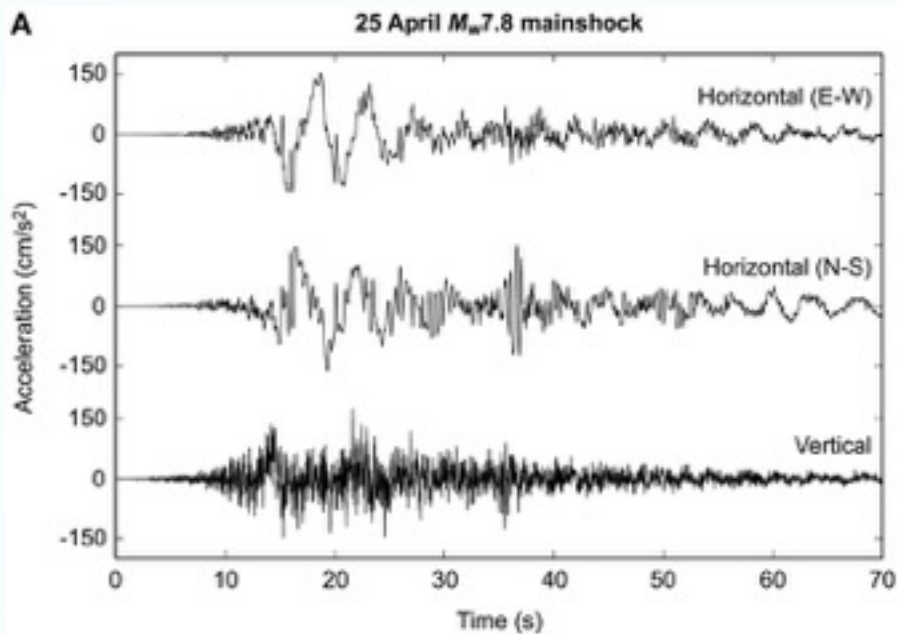


Goda and others, in *Frontiers in Built Environment*, 2015

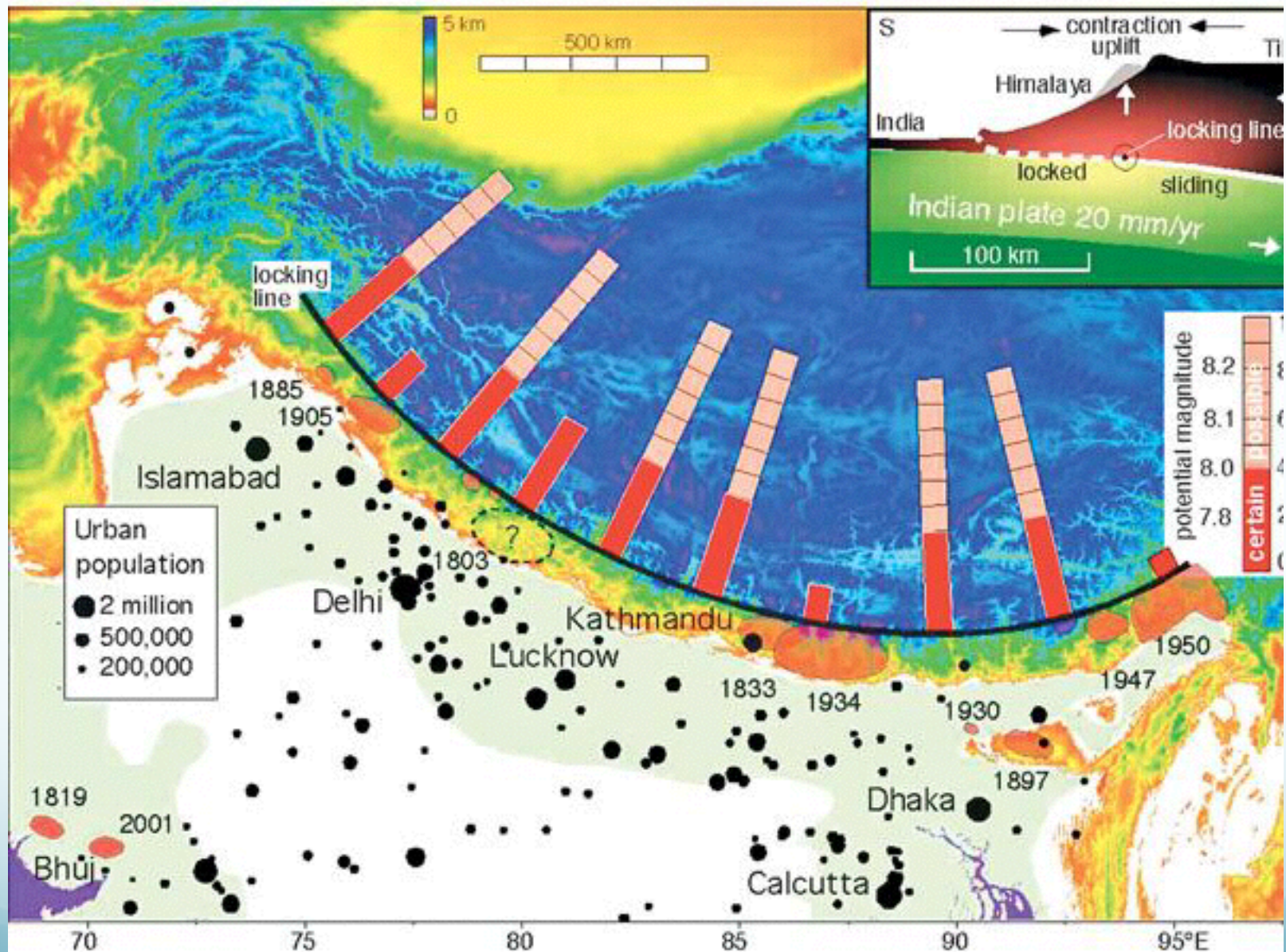


Goda and others, in Frontiers
in Built Environment, 2015

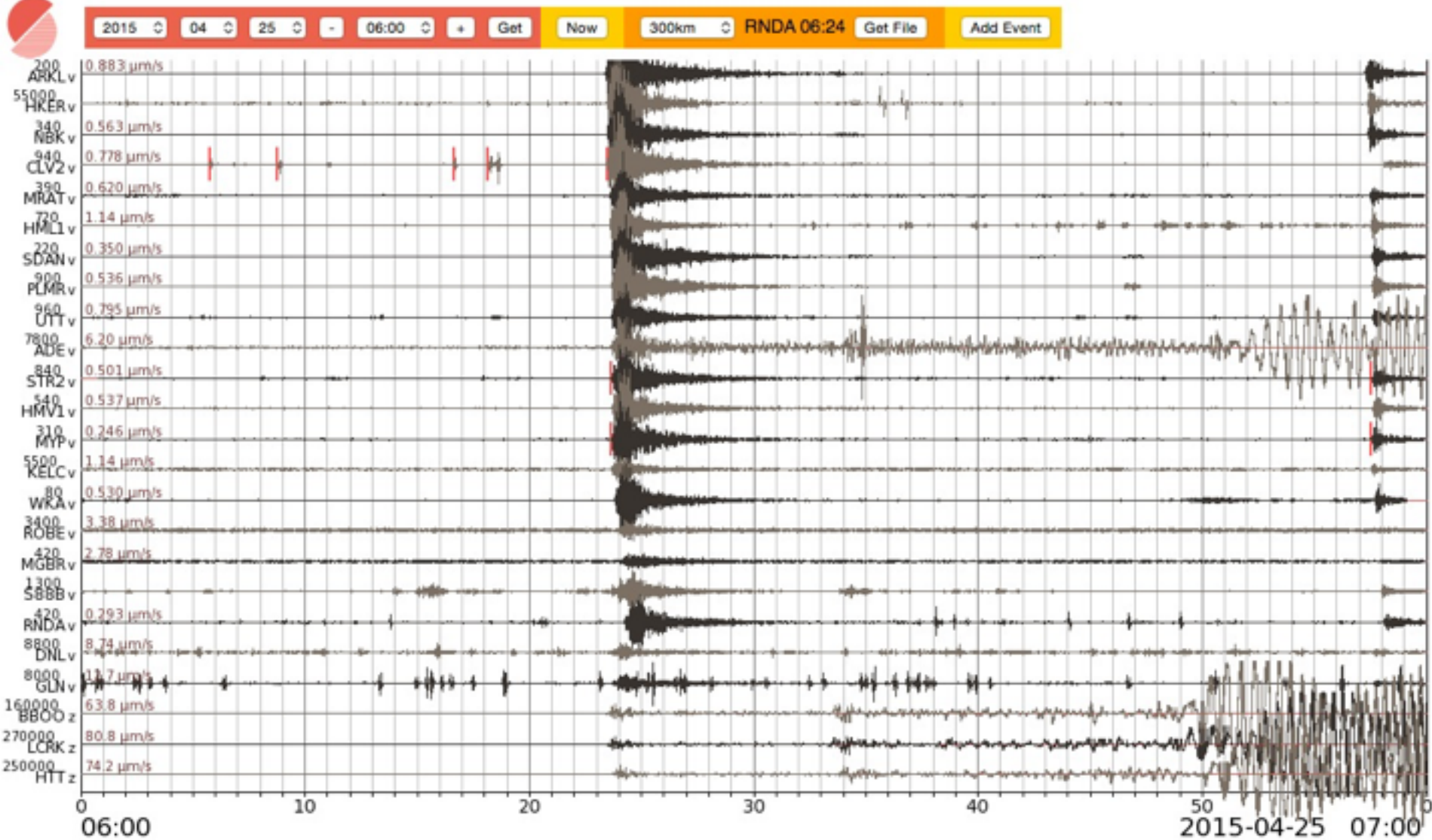


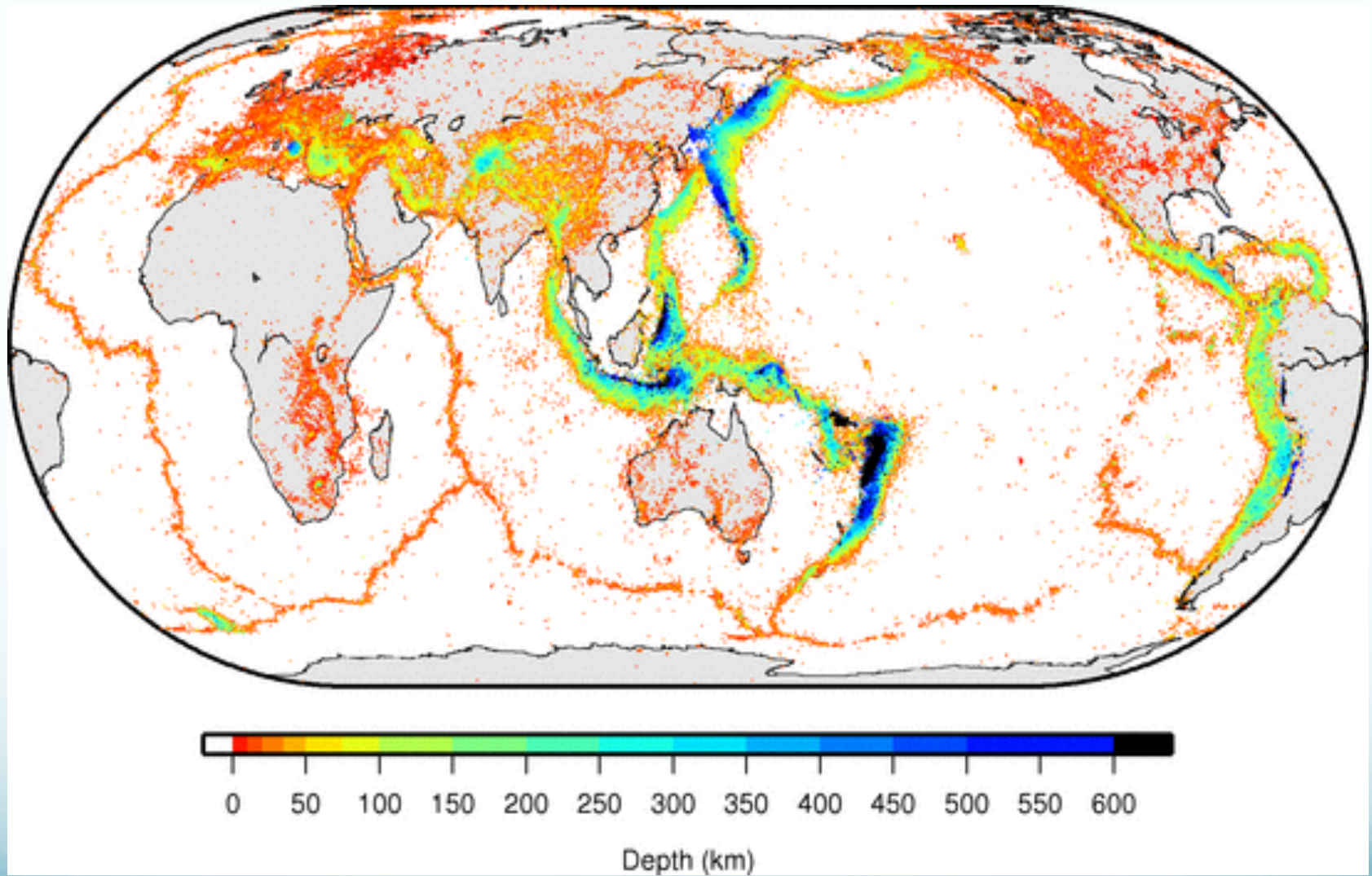


Goda and others, in *Frontiers in Built Environment*, 2015



A forecast from 2013





ISC database, epicentres from 1960 to 2013

What is an earthquake?





Earthquakes in NSW

The Media View of Australian Earthquakes

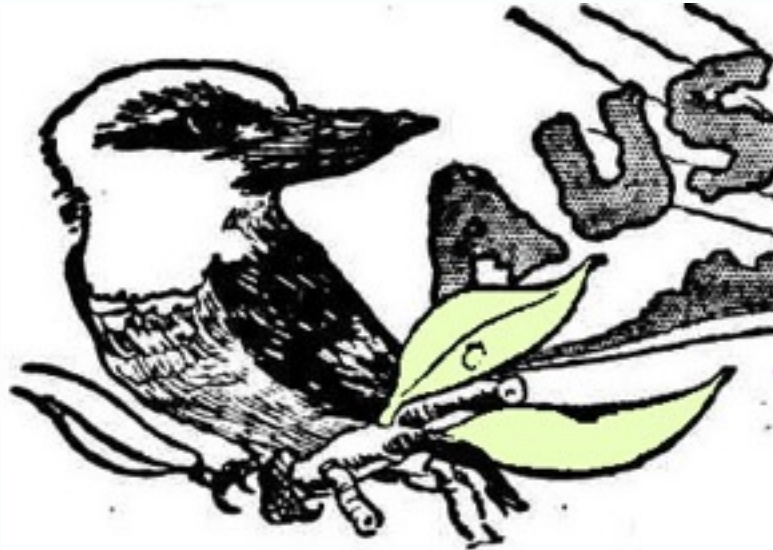


Canberra Times, 27
October 1930

Governor Phillip to Lord Sydney 1788

The 22nd of this Month (June) we had a slight Shock of an Earthquake: it did not last more than two or three Seconds; I felt the Ground shake under me, and heard a Noise that came from the South-west, which I at first took for the Report of Guns fired at a great distance.

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Earthquake Near Sydney

WE do not realise that in the early days of the colony considerable damage was caused by an earthquake quite close to Sydney. In 1823 an earthquake completely wrecked Howe's Bridge which spanned South Creek, Windsor, only 35 miles from Sydney. This bridge was built in 1810, and was, at the time, the largest bridge in the colony.—Eureka.

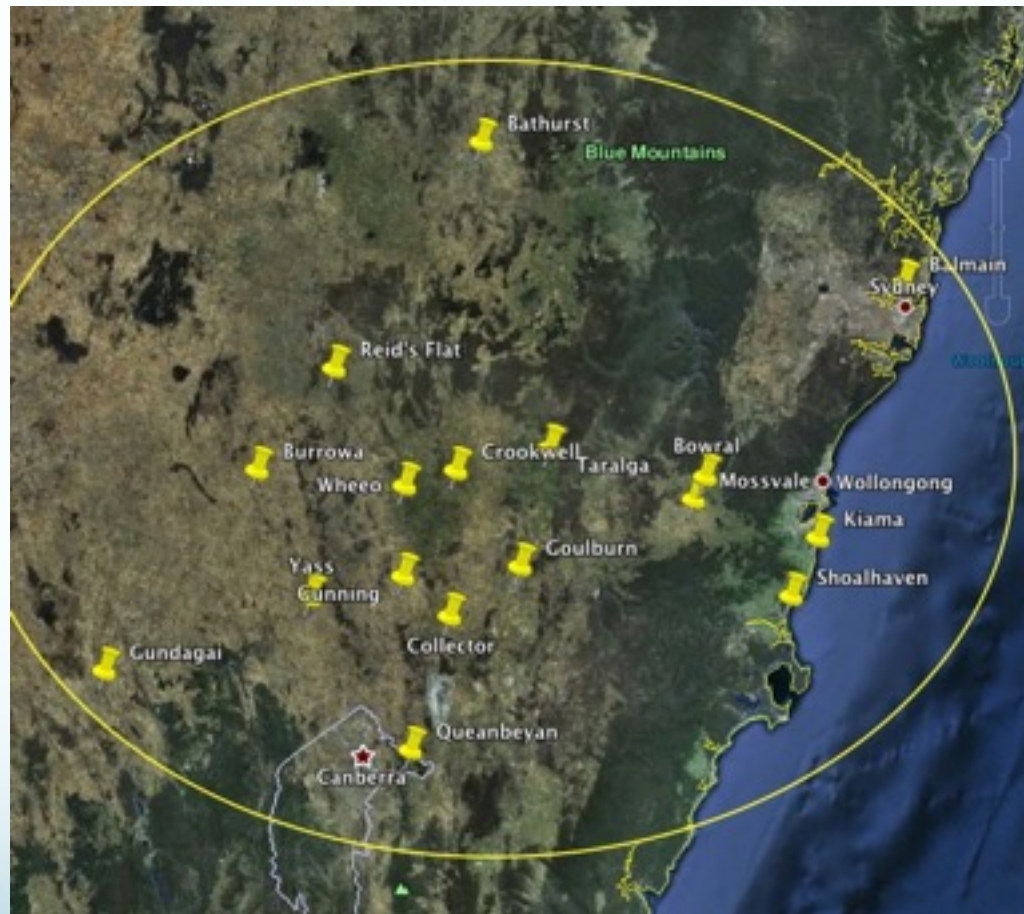
South Australian Register

Wednesday

12 September 1883 page 2S

- Earthquake in the Colonies.— Mr. Kemp, Stationmaster at Daly Waters, reports that a shock of earthquake was felt there on Sunday night week and Monday afternoon. *The noise and vibration continued on Monday for fifteen minutes*, and appeared to be travelling from west to east. The natives were very much alarmed, and explained that they thought it was a new 'billabong' being made.
- In New South Wales a shock was felt in the village of Taralga, near Goulburn ; and at Crookwell, another small township in the same vicinity, several substantial buildings were shaken by the same cause (*see next slide*).

Crookwell NSW 29 Aug 1883 at 14:00 UTC, Magnitude ~5.2



Location and magnitude
from the isoseismal map

The Sydney Gazette and New South Wales Advertiser Tuesday 8 March 1842 p2.

- BATHURST, EARTHQUAKE. – We have been informed by a gentleman who arrived here on Saturday from Bathurst, that on Thursday last, the inhabitants of that township were thrown into a state of great alarm by several awful shocks of an earthquake, which continued to be felt at intervals during a great portion of the day. Several houses have sustained considerable injury, amongst others the store of Mr. Lord, which has been laid in ruins. We have not heard the extent of property destroyed, or whether any lives have been lost. On Friday our informant experienced the shock of an earthquake as he was descending the Mountains. In our next publication we shall probably have it in our power to lay the full particulars before our readers. The public are doubtless aware that shocks of earthquakes are of frequent occurrence in the interior, but fortunately hitherto they have neither been violent nor of long duration.

The Cornwall Chronicle (Launceston, Tas.) Saturday 2 April 1842 p2.

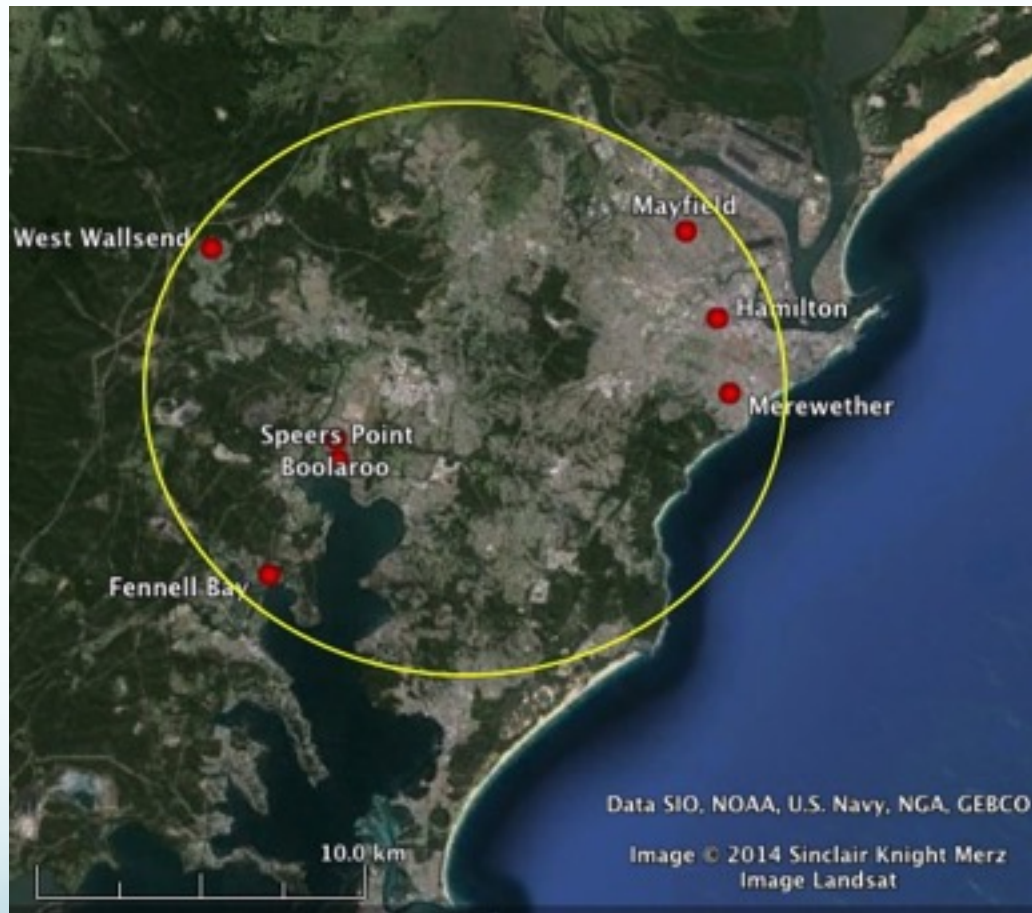
- A severe shock of an earthquake was felt at Bathurst, New South Wales, early in the last month, lasting from fifteen to twenty seconds. The inhabitants were much alarmed, and escaped from their houses, expecting to be overwhelmed in their ruins. No accident fortunately occurred. This is the first intimation of volcanic action experienced in that part of New Holland.

Gunning earthquake 11 Jan 1933 at 20:12 UTC, Magnitude 4.8



Location and magnitude from the isoseismal map

Newcastle earthquake 9 July 1951 at 04:45 UTC, Magnitude ~3



Location near
that of 1989

Seismicity of NSW 1909 BoM and 2010 SRC

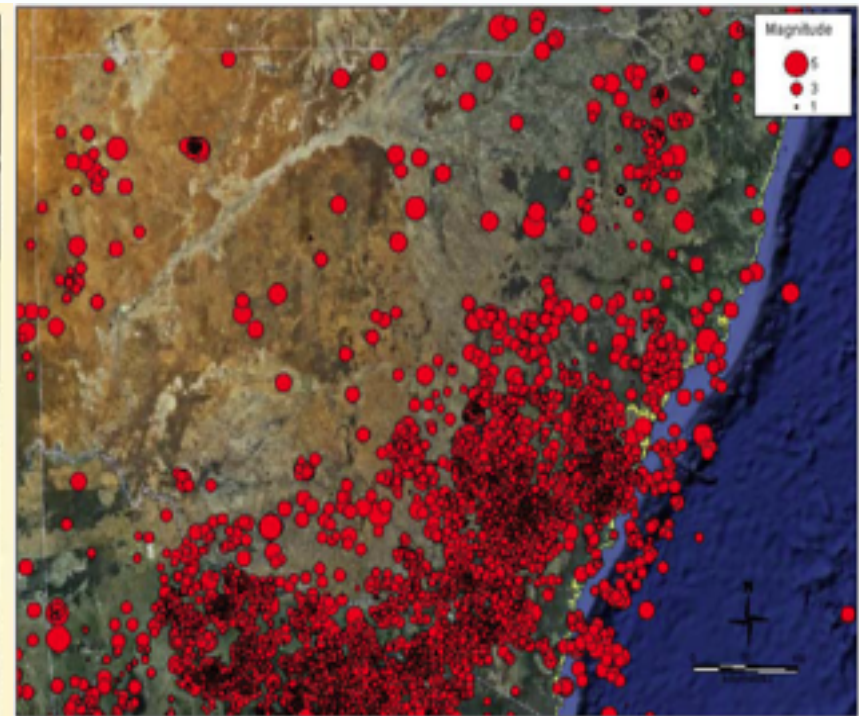
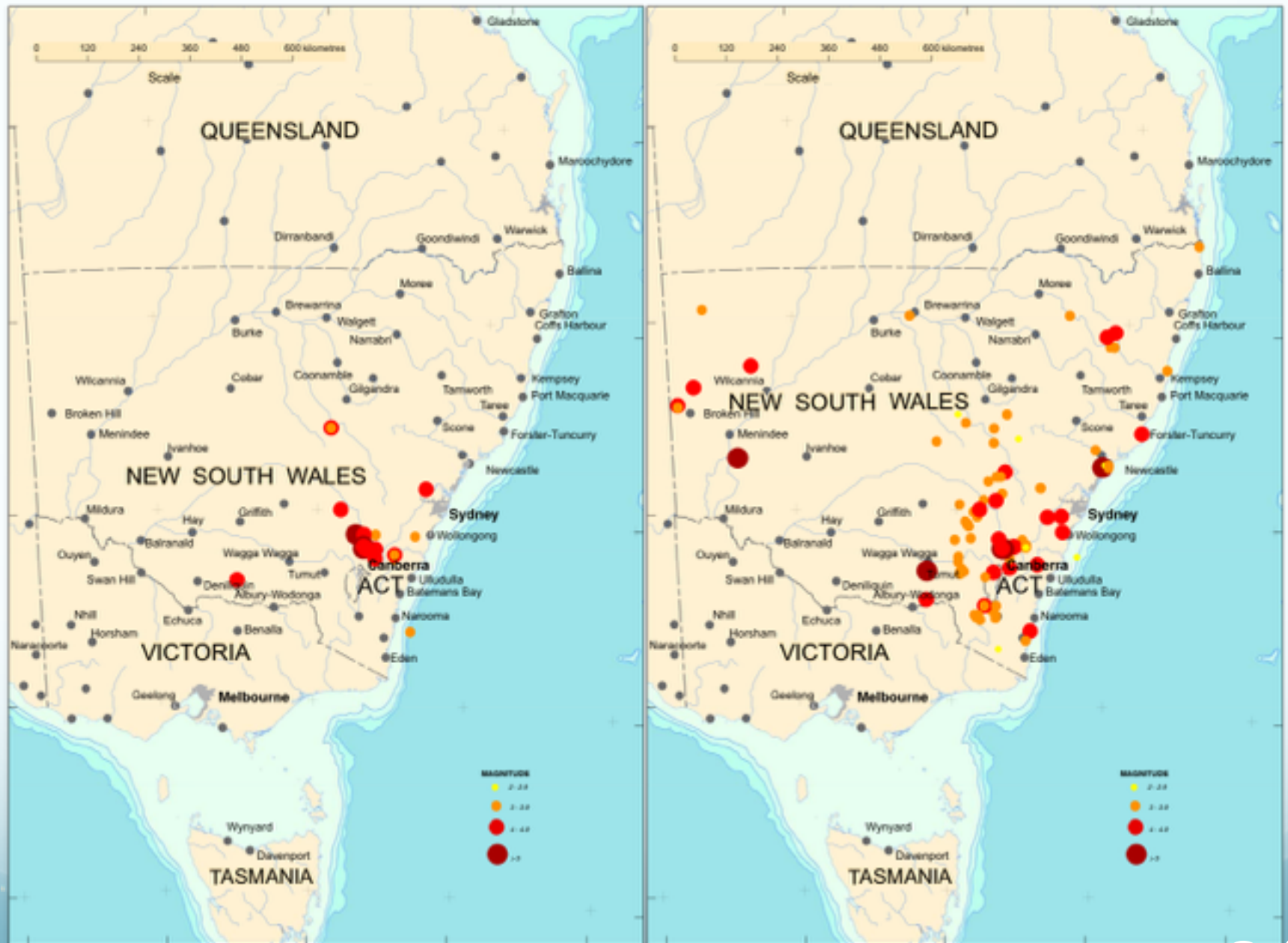


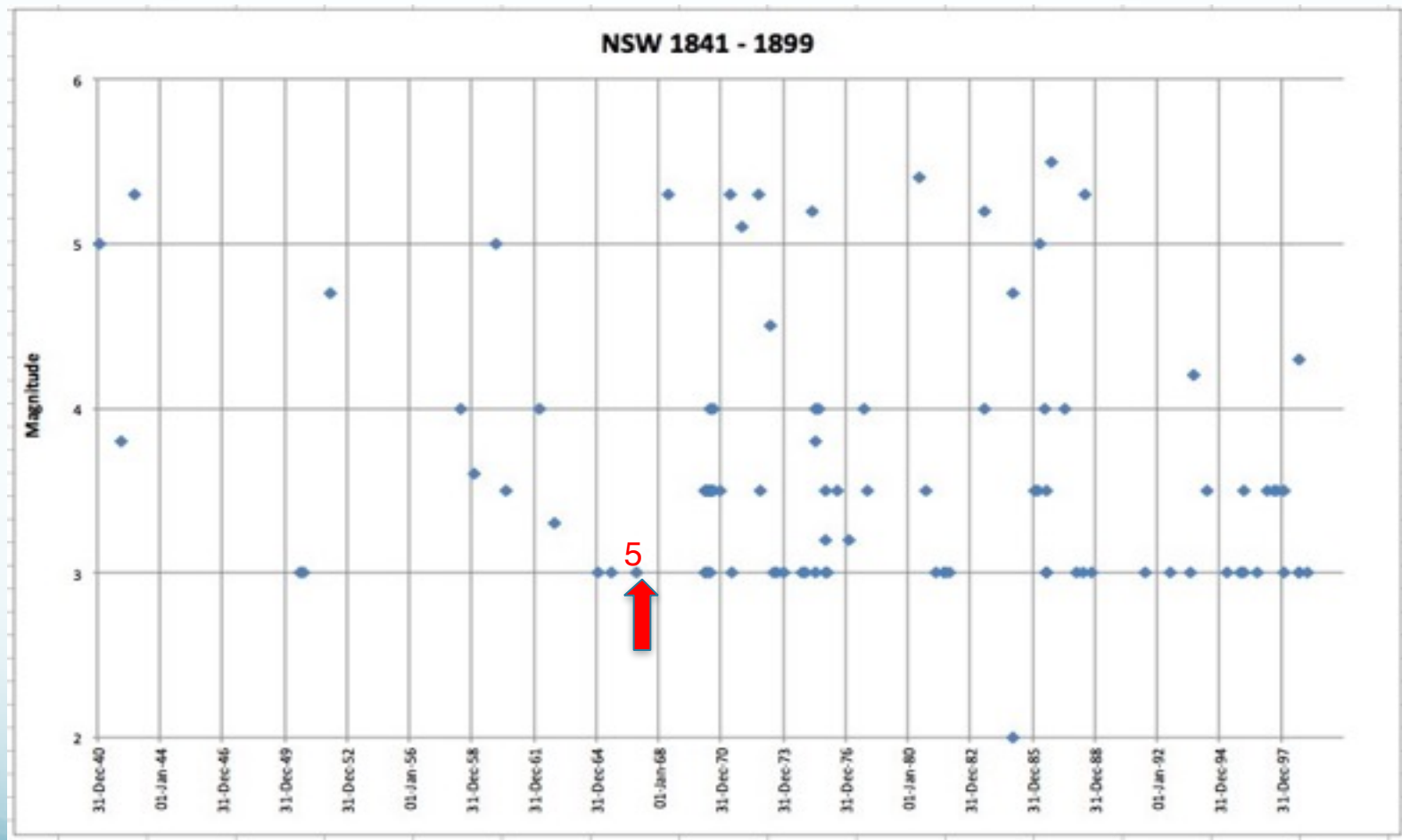
Figure 9: ES&S Earthquake Catalogue for New South Wales and surrounding region

left from Jose and others, 1912; right from Payne and others, 2010

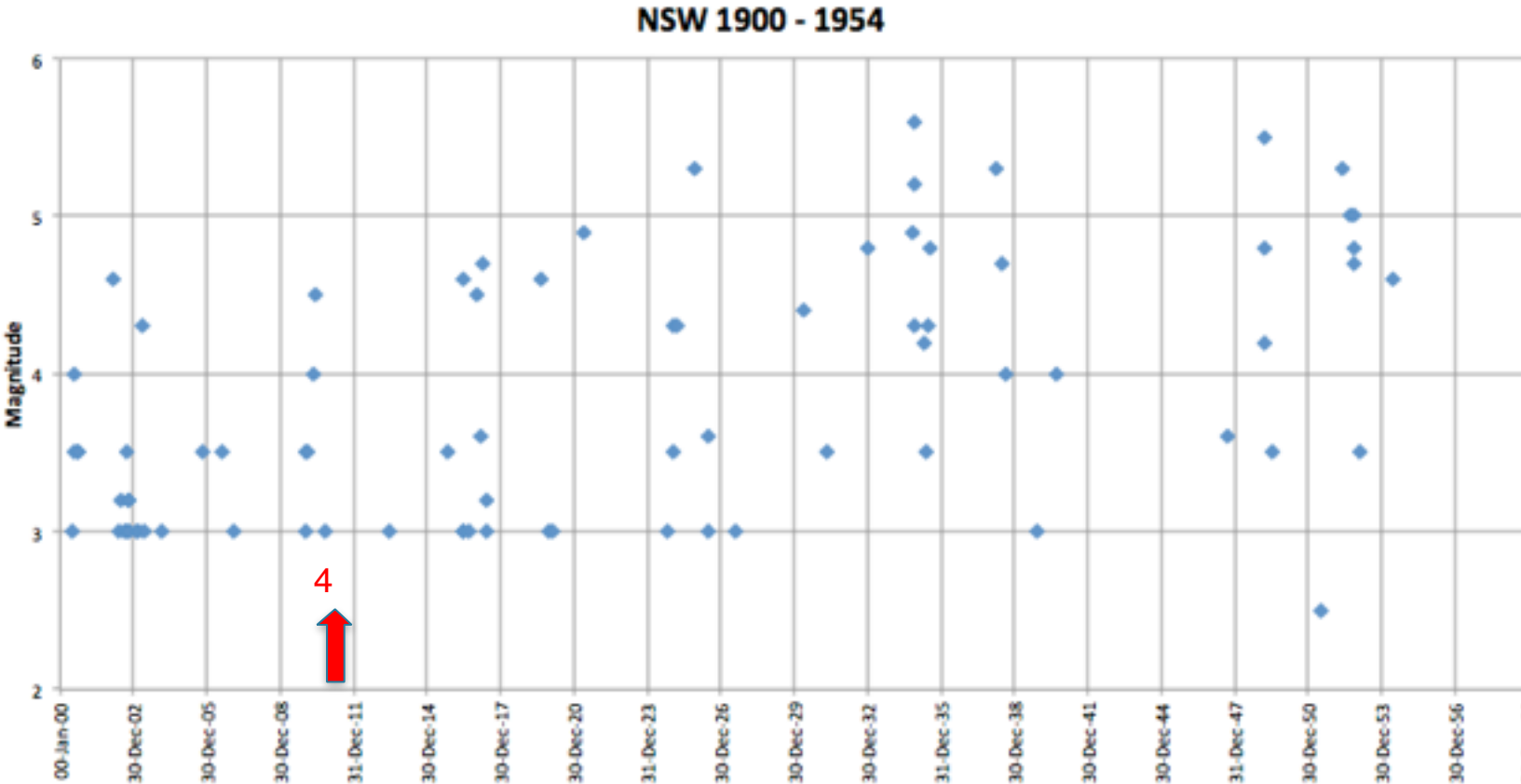




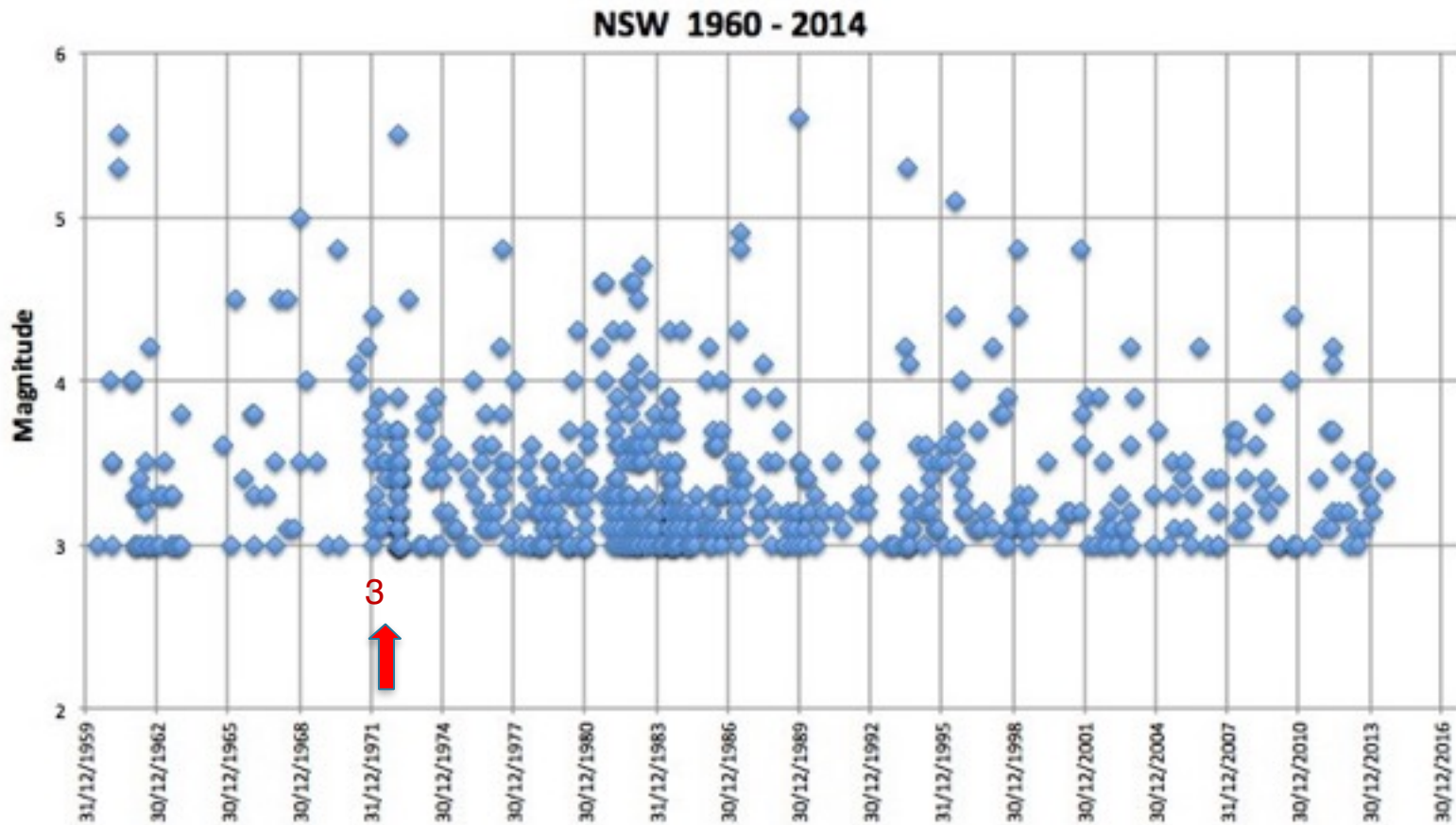
NSW Earthquakes 1841 — 1899



1900 — 1954

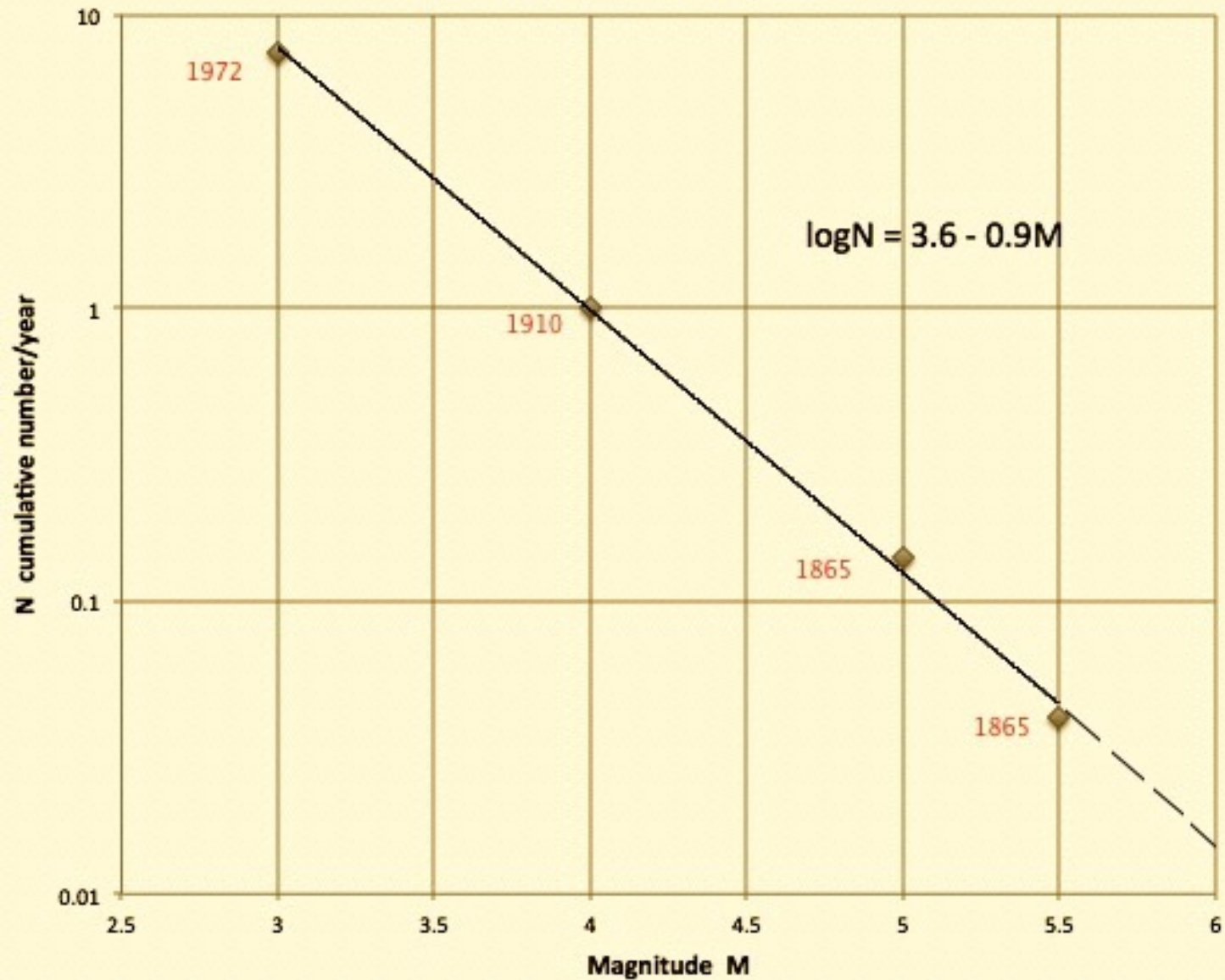


NSW Earthquakes 1960 — 2014



Completeness interval

NSW Recurrence Relation



NSW Seismicity

- More than 200 earthquakes have been catalogued in the period 1788 — 1954.
- Of these, 23 were of magnitude 5 or more.
- Included are a damaging earthquake near Yass in 1860 and another at Lithgow in 1886.
- A magnitude 4.7 earthquake in 1940 near Canberra may be the largest known ACT earthquake.
- The NSW once-per-year earthquake has a magnitude of 4.0, the once-per-decade magnitude 5.1.
- In NSW a large magnitude 6+ earthquake has a return period of 65 — 70 years and appears to be well overdue.

Earthquake Forecast #1

Geologist Professor Edgeworth David comments in *The Riverine Grazier (Hay)* Friday 21 April 1905, page 4:

“ There is no likelihood, however, of this mountain-building force in New South Wales becoming so accentuated in the near future as to cause earthquakes, such as would shatter buildings, and so endanger life.”

Gunning January 1933

Professor Sir Edgeworth David said that the shocks were not caused by any force acting at Gunning itself. The disturbances were probably due to some great pressure in the floor of the ocean to the east of Australia forcing itself against the New South Wales coast. Gunning was near the Great Dividing Range which was a line of special weakness in the earth's crust.



EARTHQUAKE SHOCK.—granite boulder at Templeton, in the Gunning district, split during last week's earth tremor, which left a trail of similarly broken rocks and earth fissures across a paddock.



Earthquake Forecast #2

The Canberra Times Wednesday 10 September 1952 Page 1

Earth Tremors At Gunning Not Serious
SYDNEY, Tuesday.

Experts from the N.S.W. Mines Department do not think the earth tremors at Gunning are likely to do any serious damage. The Minister for mines, Mr. Arthur said this to-night.

He said the Government Geologist, Mr. Mulholland had stated that there had been many tremors at Gunning, one in 1934, another in 1949, and eight tremors between these dates.

Mr. Mulholland did not know how intense the present tremors were but said there was no danger of a big earthquake.

Earthquake Forecast #3

Newcastle Morning Herald and Miners Advocate Monday 22 November 1952, page 1.

Tremors May Last Centuries CANBERRA, Sunday.—The earth tremors which continue to shake Gunning may recur intermittently for thousands of years. The Chief Geologist of the Bureau of Mineral Resources (Dr. N. H. Fisher) said this to night. Ultimately they would result probably in a change in the terrain, which may take the form even of a new range of hills.

Dr. Fisher said there was nothing to indicate any likelihood of a major earthquake at Gunning.

Gunning 1952

Older residents say the tremors are commonplace. Mr. Bill Lyell, a grazier, of Byalla Street, who is a lifelong resident, can, like many other people, point to cracked walls in nearly every room. "Yesterday's tremors opened cracks we had sealed and shook the roof back a couple of inches," he said. "We are used to these things now. We try to fix up the cracks, but each year they open up again."

Earthquakes near Mittagong

Mittagong NSW

- First event on record
- Largest event and most intense/damaging
- Most recent

1875 09 25 at 12:00 UTC, Bowral

The Australian Town and Country Journal Saturday 2 October 1875, page 9 reported:

EARTHQUAKE.—On Saturday evening last a slight shock of earthquake was felt by the residents of Nattai, Bowral, Kangaloon, and Burrawang. I happened to be stopping at Burrawang for the night, and was sitting at the table engaged in conversation with my host, when the shock came. We first heard a rumbling, like the noise of distant thunder, or like the rushing of a herd of cattle when frightened from the camp; and this was almost directly followed by the vibration, which seemed to strike the house with considerable force. The door of the room in which we sat faced the south, and it shook in its frame as if it were severed and violently shaken by the hand of man. The dogs were lying quietly at the back or north side of the house, but they ran, evidently alarmed and barking, in a southerly direction. The sound and the shock must have lasted eight or ten seconds; and, on looking at my watch, which I did within a few seconds after the vibration had ceased, I found that it wanted twenty-two minutes to 10 p.m.

On the same page it was also reported felt at Kiama, Shellharbour and Albion Park. Yet other papers say it was felt at Berrima and Mittagong. The felt area is consistent with an earthquake of magnitude 4.0.

Largest Earthquake

There were two earthquakes
near Mittagong of
magnitude 5.6 in
1961 and 1973

Robertson-Bowral earthquake 22 May 1961 at 07:40 EST DAMAGE (EMA) \$4.1M

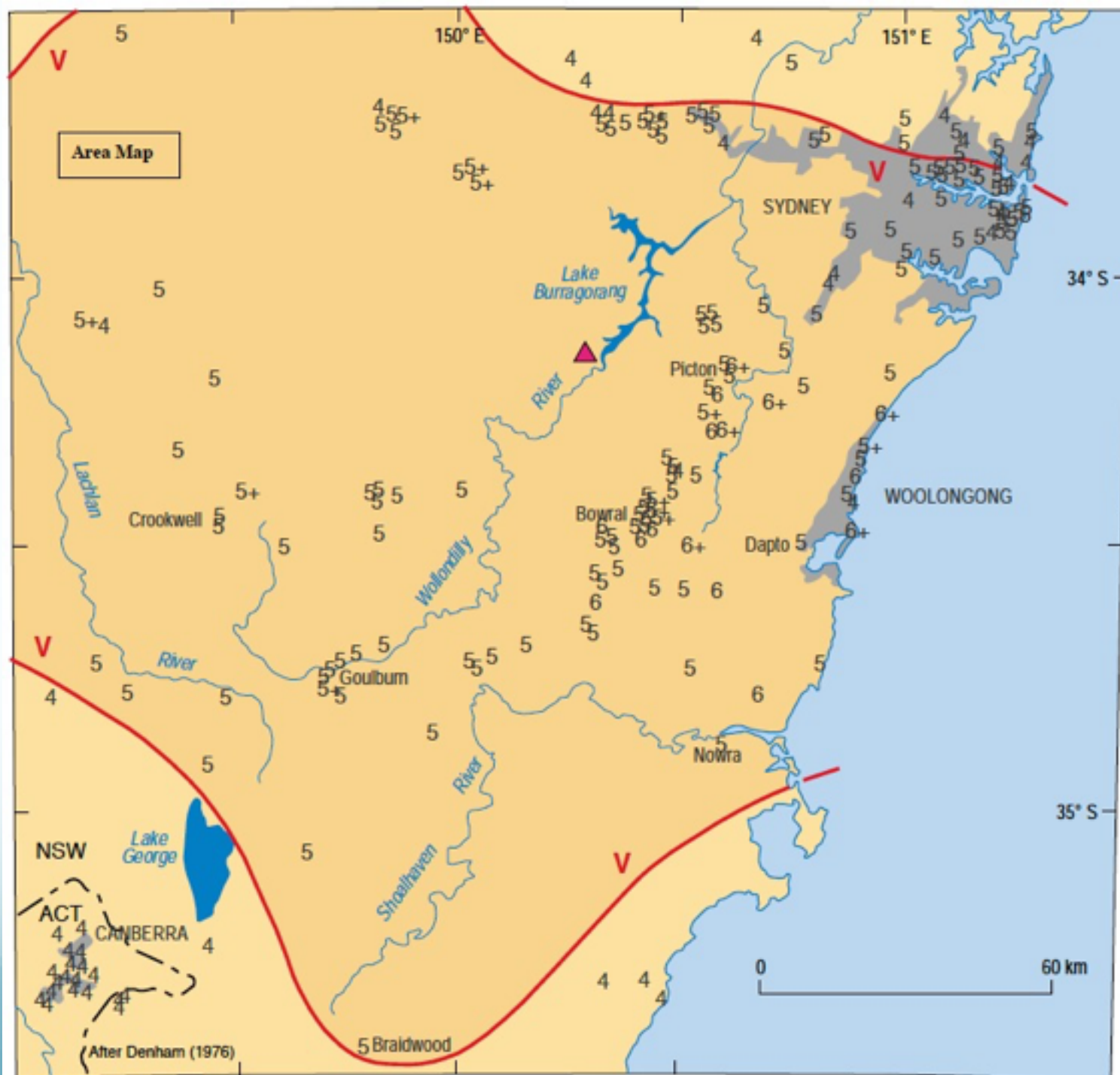
New South Wales was visited by an earthquake which, according to press reports, was felt over a region of some 50,000 square miles, extending from the Snowy Mountains to Newcastle and inland to Dubbo and Narrandera. The earthquake caused significant damage to buildings in the Moss Vale-Robertson-Bowral area, blockage of the Macquarie Pass road through rockfalls, and some power failures; it was noted for the sharpness with which it was felt in Sydney, where minor damage was done and considerable alarm caused. (Cooney, 1962)



Picton earthquake
10 March 1973 at 05:09 EST

Damage (EMA) \$2.8M

17 Insurance claims were made in Mitagong



Most recent earthquake

11 December 2003 at 09:19 pm

Magnitude 4.0

Epicentre near Bowral

No damage reported but felt Sydney and Canberra

Earthquake Forecast #4

Emergency managers and the public in NSW and Victoria should be prepared for a large magnitude 6 earthquake, such an event is overdue!

Recommendation

- The local councils should dust off the emergency management plans, and seek advice on local foundation conditions
- Schools, hospitals and ambulance stations should be checked to ensure their robustness to earthquake shaking, keeping in mind the lessons of Newcastle 1989
- A set of strong motion motion accelerographs ought to be installed in the region to monitor the strong shaking in the next earthquake
- If there are any 'special' structures in the region they too should be monitored, at least to check their natural period and damping should a response analysis be required.