

Responding to the Korumburra Earthquake Cluster 2009

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Summary

A magnitude 4.6 earthquake occurred near Korumburra, Victoria (Figure 1), on the 6th of March 2009, and aftershocks were felt widely throughout the south-east of the state. An automatic earthquake solution was determined within seven minutes of the origin time and immediately sent to emergency managers. A reviewed solution was available via the Geoscience Australia (GA) web site within 10 minutes. GA responded to many requests for information from emergency managers, government agencies and the media. Within 3 hours GA received in excess of 600 reports of the earthquake.

Within three days of the event six temporary stations were deployed in the epicentral region (GA - 4, Environmental Systems and Services (ES&S) - 1, Gary Gibson - 1). These recorded aftershocks, and a second magnitude 4.6 earthquake on the 18th of March. Felt reports have been compiled and used to produce an isoseismal map. Preliminary results show that the main shock was felt over 200km from the epicentre, well outside the expected felt radius.

More than 200 aftershocks have now been recorded with 5 having magnitude equal to or above 3.

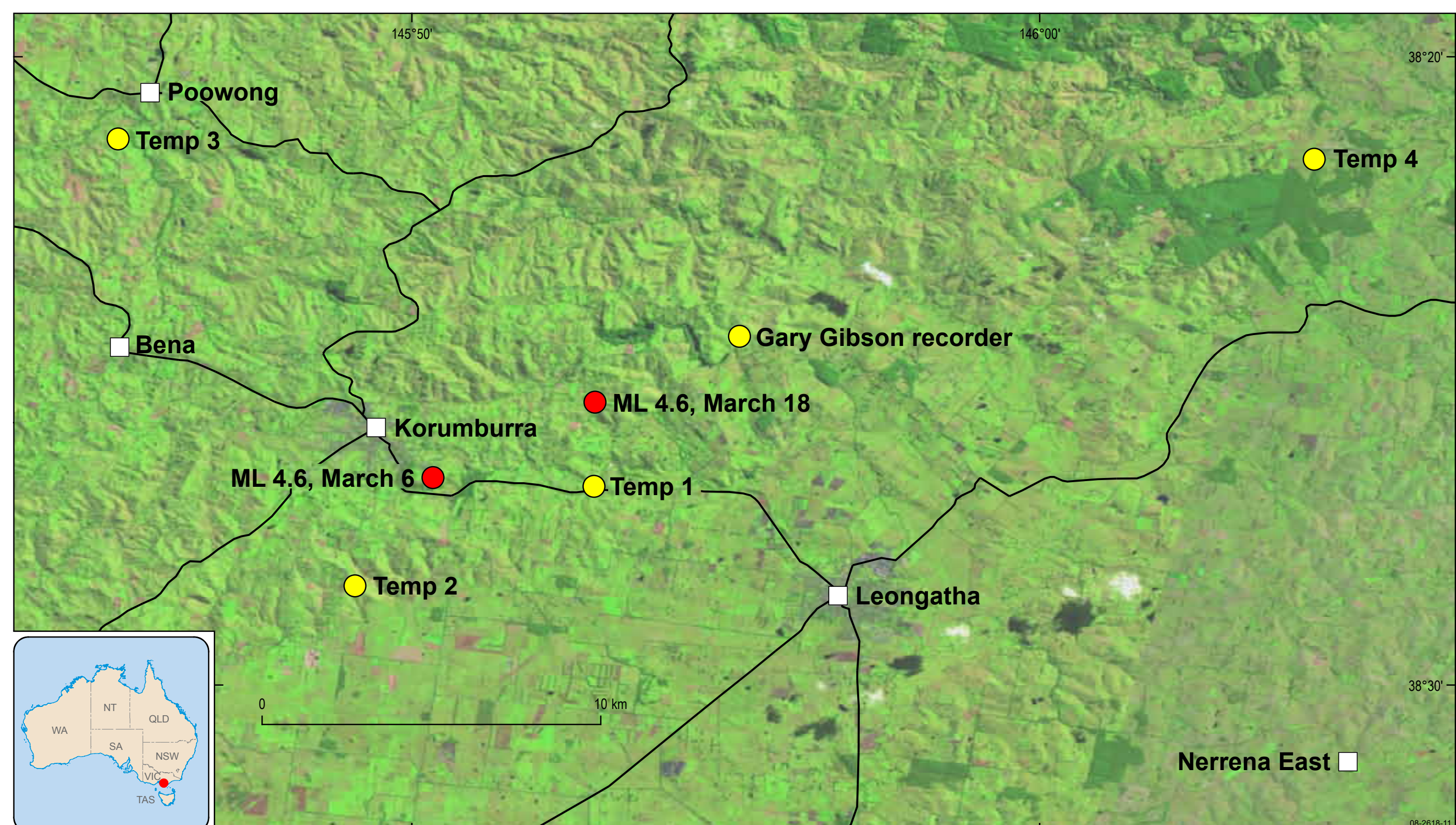


Figure 1: Location of the 6th and 18th March 2009 mainshocks. Permanent and temporary seismic stations are marked.

The Role of Geoscience Australia in Earthquake Detection

- Monitoring local and teleseismic (distant) earthquakes through the Australian Tsunami Warning System (ATWS).
- 24/7 operation is maintained by a roster of 7 Duty Seismologists (DS) in overlapping shifts.
- Verification and rapid analysis of earthquakes by the DS.
- Reporting to clients: Attorney Generals Department Coordination Centre, Bureau of Meteorology.
- Publishing earthquake details on GA website <http://www.ga.gov.au/earthquakes/>
- Conduct media interviews.
- Answering enquiries from Government agencies and the general public.



Figure 2: Duty Seismologists analysing an earthquake using real time data

ATWS/GA Response to the Korumburra earthquake

Origin Time* 6 March 2009 9:55:36 UTC (6 March 2009 20:55:36 EDST)

+ 4 minutes: First emails/phone calls received from public in the epicentral area

+ 7 minutes: Automated earthquake detection system alarm

+ 8 minutes: Duty Seismologist notifies AGDCC

+ 10 minutes: Earthquake parameters published on GA Recent Events webpage

+ 3 hours: Over 600 reports of the earthquake received via GA website

+ 2 days: Over a thousand earthquake reports have been received

+ 3 days: Deployment of 4 temporary seismic instruments that record numerous aftershocks and the second mainshock on 18th March (two other temporary seismometers were also deployed by ES&S and Gary Gibson)

*Origin Time: The time at which the earthquake occurred in Universal Time Convention

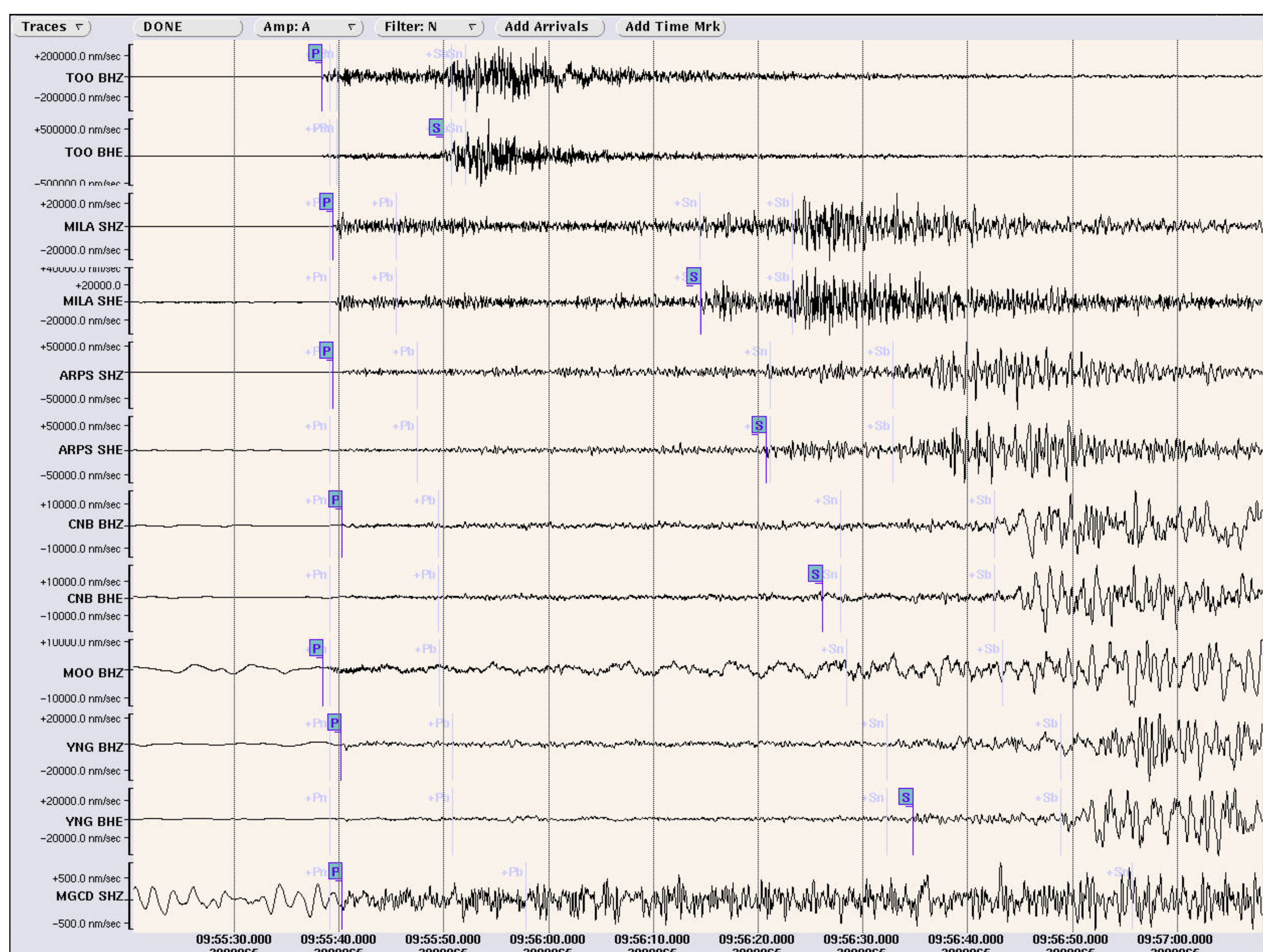


Figure 3: Interactive Graphic Analysis Tool showing arrivals on GA's permanent seismic stations

Temporary Seismometer Deployment

Within three days six temporary stations were deployed in the epicentral region (GA - 4, ES&S - 1, Gary Gibson - 1). Figure 1 shows some locations. These recorded many aftershocks, including a second magnitude 4.6 earthquake on the 18th of March.

The four temporary sites were chosen to maximise the azimuthal coverage at increasing distances from the epicentre of the first earthquake. Instruments were collected after four weeks.

Other Post Event Activities

- Ongoing media interviews and press releases.
- Answering a large number of enquiries from the public, local authorities and engineering and insurance sectors.
- Further analysis of the events in terms of local geology and tectonics as more aftershock locations became available.
- Analysis of felt reports to construct an Isoseismal Map.
- Intensive monitoring for aftershocks particularly using felt reports to identify small events.
- Retrieval of temporary instruments to refine earthquake locations (Figure 4).
- Post event review conducted by ATWS seismic analysts who scrutinise the data to refine preliminary solutions. Initial assessments were accurate to within 5 km of latitude and longitude and 6 km of depth.
- Increasing the portability of the aftershock kits for easier deployment.



Figure 4: Retrieval of a temporary seismometer deployed near Leongatha

Isoseismal Map

Following the first magnitude 4.6 earthquake over 1000 felt reports were submitted via felt report forms on the GA and the ES&S websites. Where possible, a Modified Mercalli Intensity** was determined for each report and the distribution of Intensities were then contoured to produce an Isoseismal map. Claire Quinn at ES&S produced preliminary response and isoseismal maps. GA also produced an isoseismal map shown in Figure 5. It shows the distribution of ground shaking, and illustrates the degree of attenuation of seismic energy with distance from the epicentre. The felt reports demonstrate that the earthquake was felt as far west as Ballarat (~200km from the epicentre) and as far North as Benalla (~208km from the epicentre). This distance is somewhat greater than the average felt radius for an earthquake of this size. Future improvements include the automated production of the isoseismal map.

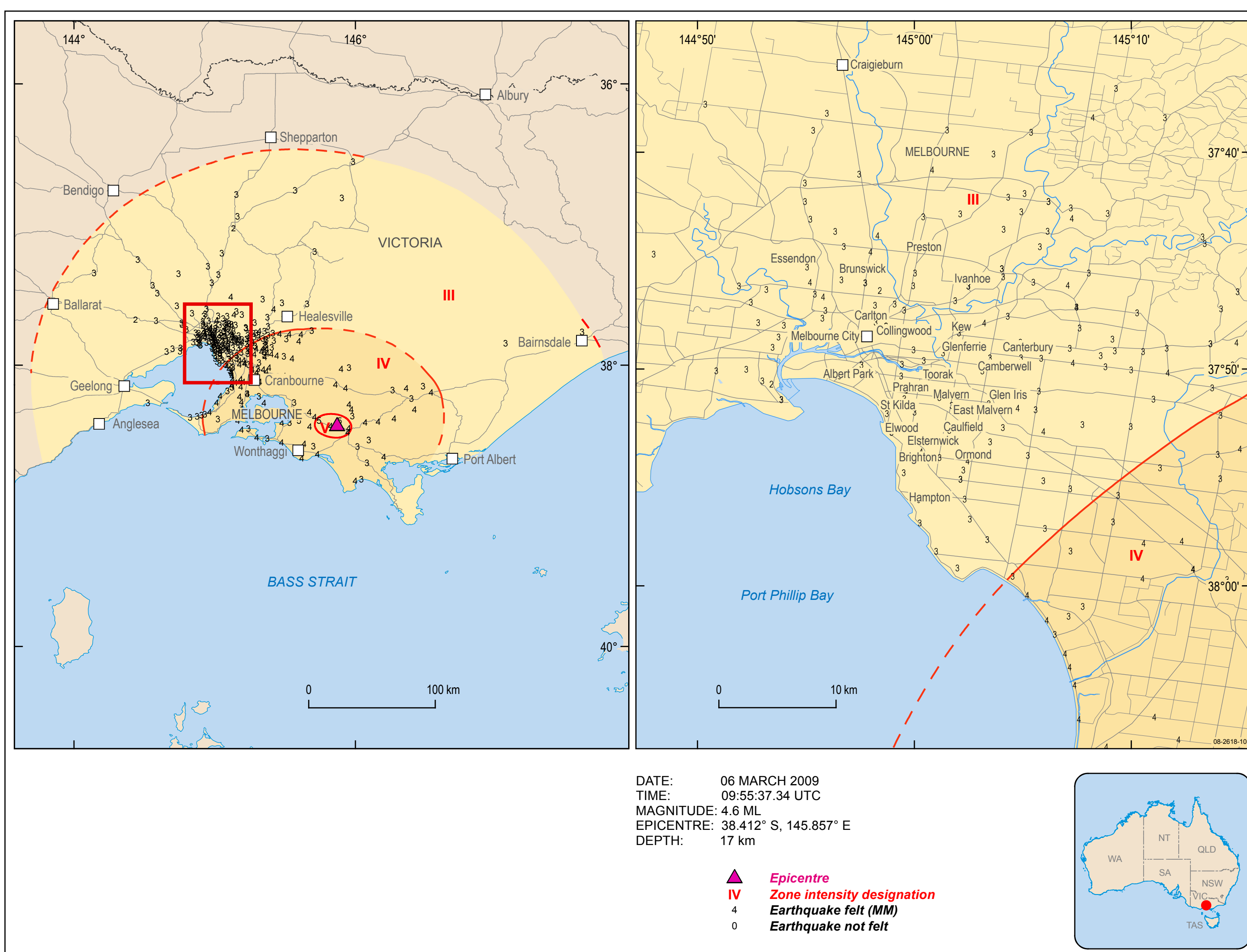


Figure 5: Isoseismal Map for the Korumburra mainshock 6th March 2009

**Modified Mercalli Intensity (MMI) is a descriptive measure of the effects of ground shaking at a location.

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Associations

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