

# Observations on the 2015 February ML 5.0 and July ML 5.4 Central Queensland Earthquake Sequences

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**ABSTRACT:** The main events and aftershocks of the February 2015 Mt Perry ML 5.0, and July 2015 Rainbow Beach ML 5.4 earthquake sequences are located and catalogued. Implications to the recurrence periods for earthquakes in the Central Queensland region are discussed. Three Central Queensland seismogenic areas are identified and their regional relationship is implied.

## 1 INTRODUCTION

### 1.1 Mt Perry Earthquake Sequence (MP 2015)

On February 15 2015 at 15:57 (UTC) an earthquake measured by the Central Queensland Seismology Research Group (CQSRG) as ML 4.9, occurred 11 km north-west of the small township of Mt Perry in Central Queensland, in the Yarrol Block (Ellis & Whitaker 1976). The magnitude of this event was subsequently moderated to ML 5.0, based on data obtained from other agencies, including Geoscience Australia and the USGS. Over the next six months more than 100 aftershocks, ranging in magnitude from ML 0.7 to 4.0, were recorded and located by CQSRG; designated the Mt Perry 2015 sequence (MP 2015). These events were mostly tightly clustered in a well-defined area north-west of Mt Perry, with a south-east excursion extending some 50 km, passing 6 km to the north of Paradise Dam. 214 days after the initial event, aftershocks were still being recorded of the order of ML 1.7; however, at the time of writing, 231 days after the main event, a hiatus of 17 days was ongoing.

### 1.2 Rainbow Beach Earthquake Sequence (RB 2015)

On July 29 2015 at 23:41 (UTC) an earthquake measured by CQSRG as ML 5.6, occurred out to sea, 115 km north-east of the small township of Rainbow Beach in Central Queensland; about 280 km east of the Mt Perry sequence. The magnitude of this event was subsequently moderated to 5.4, based on data obtained from other agencies, including Geoscience Australia and the USGS. 51 aftershocks have been recorded and located by CQSRG, designated the Rainbow Beach 2015 sequence (RB 2015), ranging in magnitude from ML 1.9 to 5.3. 76 days after the main event, aftershocks were still being recorded of the order of ML 3.5.

## 2 HISTORICAL SEISMIC CONTEXT

**Table 1: Historical Central Queensland Earthquakes ML 4.9 and Greater.** (Source: GA 2015)

| Magnitude (ML) | Year | Latitude | Longitude | Seismogenic Location                            |
|----------------|------|----------|-----------|---|
| 4.9            | 1985 | -25.12   | 153.62    | 100 km NE Rainbow Beach; 70 km NW of RB 2015.   |
| 5.0            | 1883 | -25.500  | 151.670   | 15 km N Gayndah; 40 km S MP 2015.               |
| 5.0            | 2015 | -25.114  | 151.398   | 26 km NW Mt Perry. Main shock of MP 2015.       |
| 5.1            | 2015 | -25.309  | 154.419   | 149 km NE Rainbow Beach. Aftershock of RB 2015. |
| 5.2            | 1978 | -23.55   | 152.14    | 85 km NW Lady Elliot Island; 290 km NW RB 2015. |
| 5.3            | 2015 | -25.316  | 154.414   | 146 km NE Rainbow Beach. Aftershock of RB 2015. |
| 5.4            | 2015 | -25.462  | 154.128   | 115 km NE Rainbow Beach. Main shock of RB 2015. |
| 5.5            | 1935 | -25.5    | 151.67    | 15 km N Gayndah; 40 km S MP 2015.               |
| 5.6            | 1883 | -25.500  | 151.670   | 15 km N Gayndah; 40 km S MP 2015.               |
| 5.7            | 1918 | -23.5    | 152.5     | 70 km N Lady Elliot Island; 280 km NW RB 2015.  |
| 6.0            | 1918 | -23.5    | 152.5     | 70 km N Lady Elliot Island; 280 km NW RB 2015.  |

All earthquakes of magnitude 4.9 and greater, recorded since 1878 in the Central Queensland region, as listed in the Geoscience Australia database, are listed in Table 1.

It should be noted that the locations of the 1918 events are very approximate; although the listed locations coincide with that of the 1978 ML 5.2, they may well have occurred in the RB 2015 area.

It should also be noted that, although in the recent past the 1918 main event was listed as ML 6.2 by Rynn (1985, 1986) and others (Rynn et al 1987), GA currently lists it as ML 6.0.

It would appear that there are two, perhaps three, historically active seismogenic areas in the Central Queensland region.

- The Yarrol Block; roughly bounded north of Gayndah, east of Monto, and west of Gin Gin; characterised by MP 2015. (Table 1, blue; also see Figure 3)
- The offshore Rainbow Beach area; characterised by RB 2015. (Table 1, green; also see Figure 3)
- The Elliot Island area; characterised (possibly) by the 1918 events, and the 1978 event. (Table 1, pink; also see Figure 3)

### 3 MAGNITUDE 6.0 EXCEEDANCE RECURRENCE PERIODS

In 2001, and again in 2006, the author determined the expected magnitude exceedance recurrence periods for earthquakes within the 3° by 3° geographic square, centred on Bundaberg. This was done using Gumbel statistics of extreme events, based on the Geoscience Australia catalogue from 1878 to the time of determination. In review the author notes that he made an error in methodology in the 2006 determination that incorrectly resulted in an approximate 20% increase in the recurrence periods over those correctly determined in the 2001 analysis. The ability of the Gumbel method to extract accurate Richter-Gutenberg parameters from historical extreme event catalogues was validated by the author in 2006 (Turnbull & Weatherley 2006).

The author's 2001 Gumbel analysis determined that the average recurrence period for the exceedance of an ML 6.0 event in Central Queensland was 84 years  $\pm$  4%.

Recent theoretical work done by Lasse Makkonen and colleagues (Makkonen 2006 & 2011, Makkonen et al 2013) has placed the statistics of extreme events on a solid theoretical footing. The work of Makkonen has been critically examined and found to be sound (Cook 2011, Makkonen 2011).

Makkonen proves that the correct methodology to be used when applying the statistics of extreme events to analyses, such as that of earthquake recurrence periods, is to use the Weibull formulation; without converting to a reduced variate, as was the case when using the Gumbel formulation. Makkonen warns that using the theoretically correct Weibull method will invariably produce lesser (but correct) recurrence periods than the empirical Gumbel method.

The author has analysed the GA earthquake catalogue, including the MP 2015 main event, using the Weibull analysis, and has determined the average recurrence period for the exceedance of an ML 6.0 event in Central Queensland as 66 years (Turnbull 2015 unpublished). The error range has yet to be calculated, but is expected to be of the order of 5%.

### 4 AFTERSHOCK SEQUENCE CHARACTERISTICS

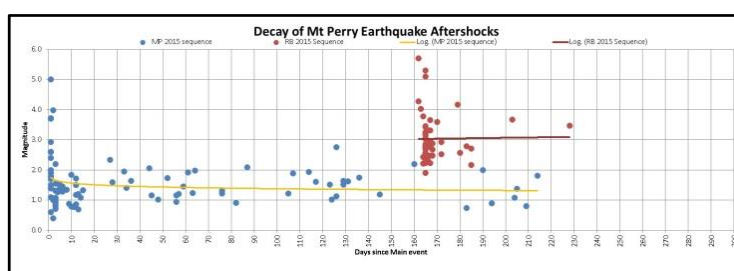


Figure 1: Decay of the MP 2015 and RB 2015 Aftershock Decay

Figure 1 shows the decay of the MP and RB 2015 sequences. The trend lines are log/linear approximations of the decays (with very poor correlation factors of 0.05). It is suggested that the sequences are, under normal circumstances, destined to continue for some further time, probably for several months.

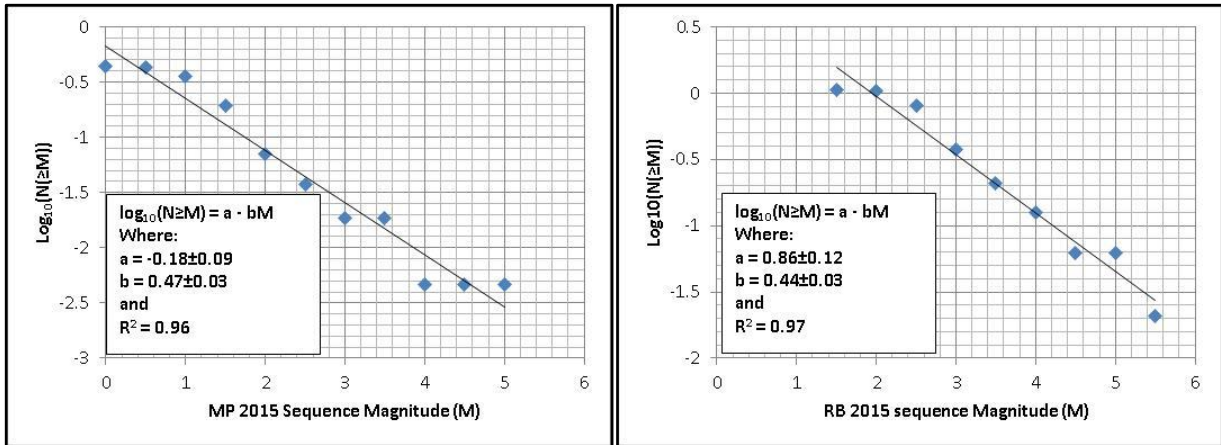


Figure 2: Gutenberg–Richter Magnitude/Frequency Plots

Analysis of the Mt Perry and Rainbow Beach sequences using Gutenberg-Richter Magnitude/Frequency regression (see Figure 2) indicates that both sequences are exhibiting the same b-value ( $0.45 \pm 0.05$ ); which may be typical of intraplate earthquakes in Central Queensland. In 2001 the author (Turnbull, 2001) calculated a b-value of 0.59 using Gumbel statistics of extreme events.

## 5 REGIONAL RELATION OF THE SEQUENCES

From the time that the Rainbow Beach main event occurred, a 23 day hiatus followed in aftershocks of the MP 2015 sequence. The author's initial interpretation of this observation was that the MP 2015 and RB 2015 sequences were related in that the RB sequence had shifted the regional geological stress expression from the Mt Perry area, and exhibited it in the offshore Rainbow Beach area. However, 22 days after the RB 2015 main event, the aftershocks of the MP 2015 sequence recommenced.

Figure 1 shows that the two sequences are proceeding concurrently, but independently.

Ellis & Whitaker (1976) noted three principle fault lines in the Bundaberg hinterland region. The MP 2015 events are associated with the Mt Perry Fault Zone, and the offshore events coincide with the drop off of the continental shelf. These features are shown in Figure 3.

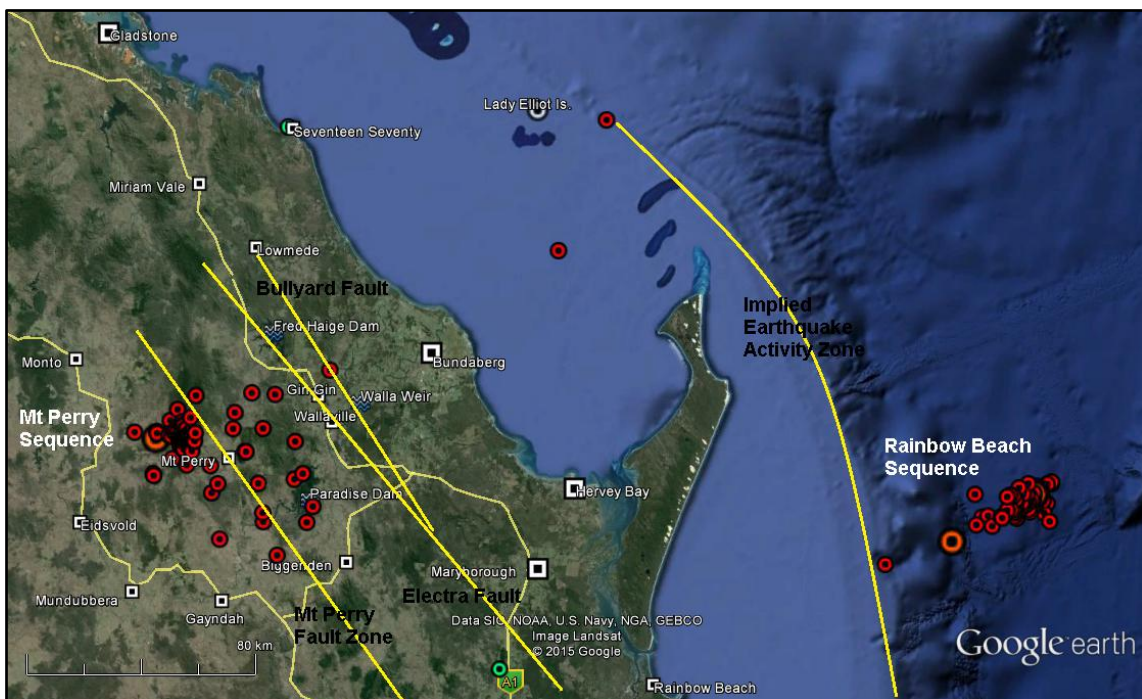
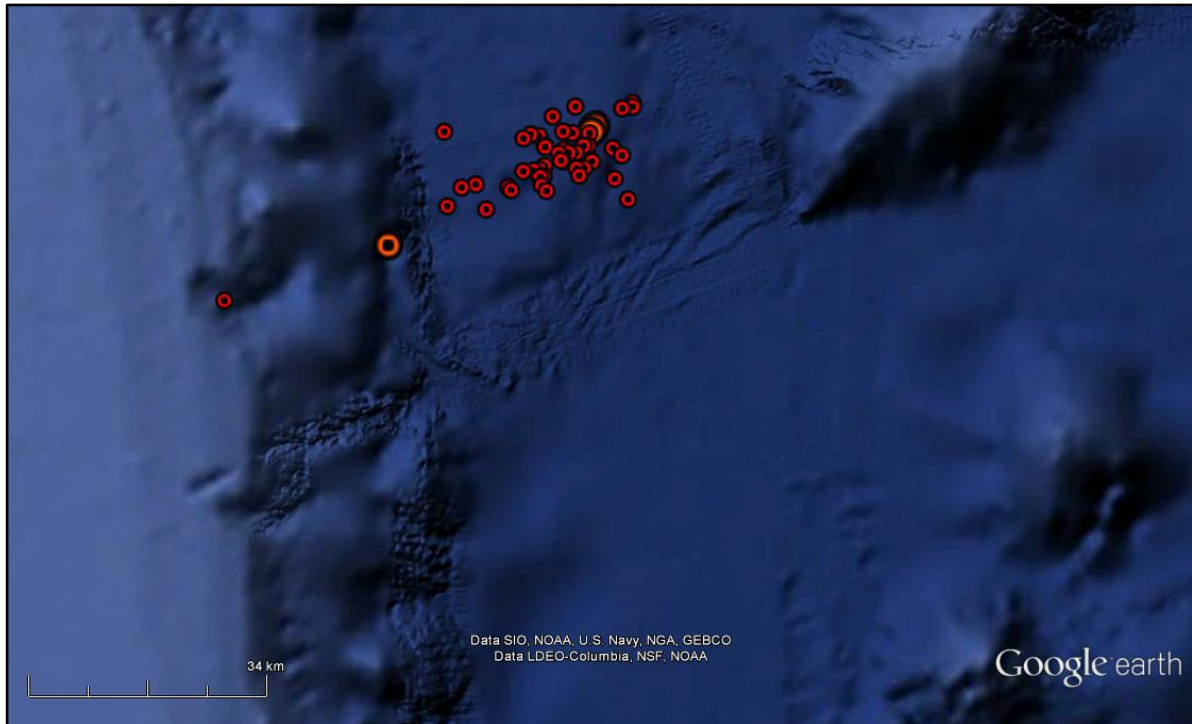


Figure 3: Map of MP and RB 2015, showing known faults and continental drop off.

Figure 3 shows all earthquakes detected by CQSRG in the 2015 calendar year to date. These events have been relocated using all available records to minimise uncertainties.

MP 2015, being associated with the known Mt Perry fault zone, indicates that that group of faults is active.

The RB 2015 sequence is occurring in a northeast/southwest lineation extending 70 km to the east of the continental shelf, and terminating about 20 km west of the north/south line of the Tasmanid Seamounts, with which they do not appear to be associated (see Figure 4).



**Figure 4: Focused view of the RB 2015 sequence.**

The RB 2015 sequence is positioned 15 to 20 km north of and parallel to what appears to be a relatively fresh turbidite flow, the material source of which is a narrow re-entrant in the continental drop off; which itself may be an ancient fluvial outflow.

## 6 CQSRG EARTHQUAKE CATALOGUE

The earthquakes shown in Figures 3 and 4, and listed in Appendix A, were located using CQSRG data augmented with additional data from Geoscience Australia, SEQWater, the Seismology Research Centre, and The University of Queensland.

CQSRG maintains a current earthquake catalogue online at <http://catalogue.cqsrq.org/>. A list of all earthquake events recorded in the MP 2015 and RB 2015 sequences (to date) is provided in Appendix A, below.

## 7 CONCLUSIONS

The occurrence of the MP 2015 and RB 2015 earthquake and aftershock sequences, being 97 years after the previous sequence of similar magnitudes, gives credence to a proposed average ML 6.0 exceedance recurrence period, in the Central Queensland region, of 50 to 100 years.

The locations of the MP 2015 and RB 2015 sequences support the observation that there are two, possibly three, principal active seismogenic areas within the Central Queensland region.

## REFERENCES:

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APPENDIX A: CQSRG CATALOGUE OF THE MP 2015 AND RB 2015 SEQUENCES

| Date (UTC) | Time (UTC)  | Longitude | Latitude | Magnitude | Place              |
|------------|-------------|-----------|----------|-----------|--------------------|
| 2015-10-11 | 03:24:40.19 | 154.104   | -25.485  | 3.4 ML    | Rainbow Beach      |
| 2015-09-27 | 15:59:24.82 | 151.504   | -25.090  | 1.7 ML    | Mt Perry           |
| 2015-09-22 | 15:25:26.93 | 151.486   | -25.084  | 0.7 ML    | Mt Perry           |
| 2015-09-18 | 22:04:04.39 | 151.514   | -25.121  | 1.4 ML    | Mt Perry           |
| 2015-09-17 | 21:08:16.77 | 151.52    | -25.122  | 1.1 ML    | Mt Perry           |
| 2015-09-16 | 23:37:28.62 | 154.469   | -25.284  | 3.6 ML    | Rainbow Beach      |
| 2015-09-07 | 20:02:34.17 | 151.502   | -25.099  | 0.9 ML    | Mt Perry           |
| 2015-09-05 | 03:08:18.93 | 150.466   | -25.625  | 1.7 ML    | Cracow             |
| 2015-09-04 | 15:23:17.72 | 152.952   | -24.152  | 2.1 ML    | Lady Elliot Island |
| 2015-09-03 | 19:34:46.47 | 151.81    | -24.986  | 1.0 ML    | Gin Gin            |
| 2015-08-28 | 06:17:25.00 | 151.932   | -25.335  | 1.9 ML    | Paradise Dam       |
| 2015-08-26 | 01:29:28.11 | 151.505   | -25.137  | 2.0 ML    | Mt Perry           |
| 2015-08-21 | 16:09:37.17 | 154.347   | -25.361  | 2.7 ML    | Rainbow Beach      |
| 2015-08-21 | 13:37:44.83 | 154.3     | -25.392  | 2.2 ML    | Rainbow Beach      |
| 2015-08-19 | 23:04:55.84 | 154.317   | -25.368  | 2.8 ML    | Rainbow Beach      |
| 2015-08-19 | 02:39:09.60 | 151.511   | -25.128  | 0.7 ML    | Mt Perry           |
| 2015-08-16 | 03:05:11.13 | 151.606   | -25.263  | 1.5 ML    | Mt Perry           |
| 2015-08-15 | 16:22:58.73 | 154.331   | -25.367  | 2.6 ML    | Rainbow Beach      |
| 2015-08-14 | 01:06:57.11 | 154.25    | -25.385  | 4.2 ML    | Rainbow Beach      |
| 2015-08-08 | 09:09:04.93 | 154.392   | -25.364  | 2.9 ML    | Rainbow Beach      |
| 2015-08-06 | 05:36:53.88 | 154.391   | -25.344  | 3.6 ML    | Rainbow Beach      |
| 2015-08-04 | 11:56:55.29 | 154.341   | -25.375  | 2.7 ML    | Rainbow Beach      |
| 2015-08-04 | 08:36:37.46 | 154.373   | -25.355  | 2.5 ML    | Rainbow Beach      |
| 2015-08-04 | 05:16:03.13 | 154.402   | -25.335  | 2.9 ML    | Rainbow Beach      |
| 2015-08-03 | 19:20:30.24 | 154.346   | -25.374  | 2.9 ML    | Rainbow Beach      |
| 2015-08-03 | 19:18:57.67 | 154.396   | -25.373  | 3.7 ML    | Rainbow Beach      |
| 2015-08-03 | 16:42:49.02 | 154.456   | -25.287  | 3.3 ML    | Rainbow Beach      |
| 2015-08-03 | 15:07:38.48 | 154.205   | -25.318  | 2.2 ML    | Rainbow Beach      |
| 2015-08-03 | 06:55:52.08 | 154.471   | -25.28   | 2.5 ML    | Rainbow Beach      |
| 2015-08-03 | 01:55:00.76 | 154.408   | -25.335  | 2.8 ML    | Rainbow Beach      |
| 2015-08-03 | 01:52:51.61 | 154.409   | -25.314  | 3.0 ML    | Rainbow Beach      |
| 2015-08-02 | 14:35:06.29 | 154.456   | -25.347  | 2.3 ML    | Rainbow Beach      |
| 2015-08-02 | 12:03:20    | 151.87    | -25.11   | 0.8 ML    | Horse Camp         |
| 2015-08-02 | 00:27:22.60 | 154.34    | -25.366  | 2.5 ML    | Rainbow Beach      |
| 2015-08-01 | 18:56:03.99 | 154.347   | -25.335  | 2.2 ML    | Rainbow Beach      |
| 2015-08-01 | 14:51:09.55 | 154.421   | -25.301  | 2.6 ML    | Rainbow Beach      |
| 2015-08-01 | 14:20:42.51 | 154.414   | -25.355  | 3.2 ML    | Rainbow Beach      |
| 2015-08-01 | 13:51:16.24 | 154.41    | -25.319  | 2.6 ML    | Rainbow Beach      |
| 2015-08-01 | 13:34:19.87 | 154.339   | -25.323  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 11:17:42.32 | 154.327   | -25.321  | 1.9 ML    | Rainbow Beach      |
| 2015-08-01 | 11:10:59.64 | 154.296   | -25.388  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 07:28:19.74 | 154.35    | -25.393  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 07:15:18.06 | 154.386   | -25.319  | 3.2 ML    | Rainbow Beach      |
| 2015-08-01 | 07:06:48.85 | 154.373   | -25.317  | 2.5 ML    | Rainbow Beach      |
| 2015-08-01 | 06:56:48.53 | 154.348   | -25.337  | 3.1 ML    | Rainbow Beach      |
| 2015-08-01 | 06:53:43.98 | 154.367   | -25.345  | 2.9 ML    | Rainbow Beach      |
| 2015-08-01 | 06:29:05.56 | 154.23    | -25.389  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 05:54:14.32 | 154.381   | -25.344  | 2.8 ML    | Rainbow Beach      |
| 2015-08-01 | 05:08:32.06 | 154.317   | -25.326  | 3.2 ML    | Rainbow Beach      |
| 2015-08-01 | 04:57:20.15 | 153.895   | -25.534  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 04:51:39.28 | 154.446   | -25.377  | 3.0 ML    | Rainbow Beach      |
| 2015-08-01 | 04:46:23.24 | 154.419   | -25.309  | 5.1 ML    | Rainbow Beach      |
| 2015-08-01 | 04:29:33.90 | 154.465   | -25.403  | 2.3 ML    | Rainbow Beach      |
| 2015-08-01 | 04:10:22.89 | 154.37    | -25.354  | 2.7 ML    | Rainbow Beach      |
| 2015-08-01 | 03:48:21.66 | 154.343   | -25.386  | 2.8 ML    | Rainbow Beach      |
| 2015-08-01 | 03:43:15.75 | 154.443   | -25.338  | 3.4 ML    | Rainbow Beach      |
| 2015-08-01 | 03:38:44.06 | 154.414   | -25.316  | 5.3 ML    | Rainbow Beach      |
| 2015-08-01 | 01:18:20.95 | 154.374   | -25.34   | 3.5 ML    | Rainbow Beach      |

| Date (UTC) | Time (UTC)  | Longitude | Latitude | Magnitude | Place         |
|------------|-------------|-----------|----------|-----------|---------------|
| 2015-07-31 | 22:05:11.27 | 154.21    | -25.413  | 2.2 ML    | Rainbow Beach |
| 2015-07-31 | 04:31:47.46 | 154.403   | -25.364  | 2.4 ML    | Rainbow Beach |
| 2015-07-31 | 04:11:53.19 | 154.265   | -25.417  | 3.8 ML    | Rainbow Beach |
| 2015-07-30 | 01:59:00.33 | 154.358   | -25.298  | 4.0 ML    | Rainbow Beach |
| 2015-07-29 | 23:44:58.42 | 154.39    | -25.285  | 4.3 ML    | Rainbow Beach |
| 2015-07-29 | 23:41:42.24 | 154.128   | -25.462  | 5.4 ML    | Rainbow Beach |
| 2015-07-27 | 12:52:00.44 | 151.496   | -25.093  | 2.2 ML    | Mt Perry      |
| 2015-07-21 | 05:05:54.17 | 151.913   | -28.794  | 3.1 ML    | Stanthorpe    |
| 2015-07-21 | 05:03       | 151.876   | -25.133  | 1.1 ML    | Horse Camp    |
| 2015-07-15 | 20:57:19.58 | 152.784   | -24.555  | 1.9 ML    | Bundaberg     |
| 2015-07-12 | 20:00:37.95 | 151.447   | -25.061  | 1.2 ML    | Mt Perry      |
| 2015-07-03 | 18:12:28.98 | 151.664   | -25.09   | 1.8 ML    | Mt Perry      |
| 2015-06-28 | 03:55:07.57 | 151.706   | -25.162  | 1.6 ML    | Mt Perry      |
| 2015-06-26 | 23:11:46.47 | 151.537   | -24.985  | 1.5 ML    | Mt Perry      |
| 2015-06-26 | 08:28:59.95 | 151.499   | -25.158  | 1.6 ML    | Mt Perry      |
| 2015-06-25 | 07:29:33.36 | 152.371   | -27.055  | 3.3 ML    | Toooloolawah  |
| 2015-06-23 | 07:29:46.54 | 151.501   | -25.107  | 1.1 ML    | Mt Perry      |
| 2015-06-23 | 07:10:18.02 | 151.487   | -25.119  | 2.8 ML    | Mt Perry      |
| 2015-06-21 | 19:03:55.88 | 151.584   | -25.287  | 1.0 ML    | Mt Perry      |
| 2015-06-20 | 10:06:56.50 | 151.493   | -25.093  | 1.5 ML    | Mt Perry      |
| 2015-06-18 | 23:08:53.65 | 151.759   | -25.352  | 1.2 ML    | Mt Perry      |
| 2015-06-14 | 04:02:03.55 | 151.746   | -25.261  | 2.6 ML    | Mt Perry      |
| 2015-06-14 | 03:50:34.47 | 151.491   | -25.073  | 1.6 ML    | Mt Perry      |
| 2015-06-11 | 16:33:34.90 | 151.543   | -25.146  | 1.9 ML    | Mt Perry      |
| 2015-06-05 | 10:13:50.27 | 151.608   | -25.432  | 1.9 ML    | Mt Perry      |
| 2015-06-04 | 22:48:28.09 | 151.498   | -25.095  | 1.9 ML    | Mt Perry      |
| 2015-06-02 | 23:53:00.98 | 151.526   | -25.124  | 1.2 ML    | Mt Perry      |
| 2015-05-24 | 02:42:22.73 | 151.805   | -25.485  | 1.3 ML    | Biggenden     |
| 2015-05-22 | 08:09:01.32 | 151.383   | -25.225  | 1.7 ML    | Mt Perry      |
| 2015-05-15 | 06:04:13.99 | 151.503   | -25.087  | 2.1 ML    | Mt Perry      |
| 2015-05-10 | 13:05:52.60 | 151.5     | -25.1    | 0.9 ML    | Mt Perry      |
| 2015-05-09 | 06:39       | 151.867   | -25.107  | 0.7 ML    | Horse Camp    |
| 2015-05-04 | 18:35:03.68 | 151.492   | -25.08   | 1.3 ML    | Mt Perry      |
| 2015-05-04 | 18:24:54.97 | 151.473   | -25.027  | 1.2 ML    | Mt Perry      |
| 2015-04-22 | 08:35:34.23 | 151.501   | -25.116  | 2.0 ML    | Mt Perry      |
| 2015-04-21 | 16:21:19.35 | 151.506   | -25.122  | 1.2 ML    | Mt Perry      |
| 2015-04-21 | 10:11:14.12 | 151.385   | -25.231  | 2.1 ML    | Mt Perry      |
| 2015-04-21 | 04:20:39.38 | 151.76    | -25.38   | 1.7 ML    | Mt Perry      |
| 2015-04-19 | 16:41:32.41 | 151.493   | -25.121  | 1.9 ML    | Mt Perry      |
| 2015-04-17 | 11:19:27.25 | 151.52    | -25.115  | 1.5 ML    | Mt Perry      |
| 2015-04-15 | 11:14:33.21 | 151.502   | -25.119  | 1.2 ML    | Mt Perry      |
| 2015-04-14 | 17:35:06.16 | 151.505   | -25.121  | 1.0 ML    | Mt Perry      |
| 2015-04-14 | 12:56:24.00 | 151.518   | -25.119  | 1.2 ML    | Mt Perry      |
| 2015-04-13 | 20:14:49.44 | 151.87    | -25.25   | 0.8 ML    | Mt Perry      |
| 2015-04-06 | 17:41:44.60 | 151.507   | -25.106  | 1.7 ML    | Mt Perry      |
| 2015-03-30 | 01:41:51.25 | 151.488   | -25.065  | 1.2 ML    | Mt Perry      |
| 2015-03-29 | 22:12:27.71 | 151.491   | -25.127  | 2.1 ML    | Mt Perry      |
| 2015-03-21 | 01:56:04.95 | 151.474   | -25.115  | 1.6 ML    | Mt Perry      |
| 2015-03-19 | 18:48:28.48 | 151.517   | -25.053  | 1.4 ML    | Mt Perry      |
| 2015-03-19 | 16:50:13.36 | 151.766   | -25.091  | 0.7 ML    | Mt Perry      |
| 2015-03-19 | 02:28:42.98 | 151.91    | -25.384  | 1.1 ML    | Biggenden     |
| 2015-03-18 | 14:41:32.84 | 151.482   | -25.111  | 2.0 ML    | Mt Perry      |
| 2015-03-13 | 18:48:22.91 | 151.485   | -25.124  | 1.6 ML    | Mt Perry      |
| 2015-03-13 | 02:19:13.92 | 151.506   | -25.132  | 2.3 ML    | Mt Perry      |
| 2015-03-01 | 00:46:42.06 | 151.523   | -25.109  | 1.3 ML    | Mt Perry      |
| 2015-02-28 | 17:57:08.05 | 151.529   | -25.126  | 1.1 ML    | Mt Perry      |
| 2015-02-27 | 16:18:02.26 | 151.508   | -25.111  | 1.2 ML    | Mt Perry      |
| 2015-02-27 | 07:23:19.50 | 151.524   | -25.126  | 0.7 ML    | Mt Perry      |
| 2015-02-26 | 23:21:55.52 | 151.496   | -25.111  | 1.7 ML    | Mt Perry      |
| 2015-02-26 | 22:06:08.70 | 151.458   | -25.095  | 0.9 ML    | Mt Perry      |

| Date (UTC) | Time (UTC)  | Longitude | Latitude | Magnitude | Place           |
|------------|-------------|-----------|----------|-----------|-----------------|
| 2015-02-26 | 20:45:04.27 | 151.501   | -25.114  | 1.2 ML    | Mt Perry        |
| 2015-02-26 | 02:08:15.83 | 151.502   | -24.124  | 1.5 ML    | Mt Perry        |
| 2015-02-25 | 17:34:56.67 | 151.525   | -25.109  | 0.8 ML    | Mt Perry        |
| 2015-02-24 | 14:15:45.08 | 151.464   | -25.093  | 0.8 ML    | Mt Perry        |
| 2015-02-24 | 14:02:41.30 | 151.505   | -25.109  | 1.8 ML    | Mt Perry        |
| 2015-02-23 | 18:10:02.89 | 151.507   | -25.113  | 0.9 ML    | Mt Perry        |
| 2015-02-22 | 23:11:08.71 | 151.498   | -25.103  | 1.3 ML    | Mt Perry        |
| 2015-02-21 | 12:37:02    | 151.73    | -24.98   | 0.8 ML    | Mt Perry        |
| 2015-02-20 | 18:51:39.17 | 151.47    | -25.104  | 1.3 ML    | Mt Perry        |
| 2015-02-20 | 07:58:10.06 | 151.513   | -25.126  | 1.5 ML    | Mt Perry        |
| 2015-02-19 | 21:57:56.19 | 151.489   | -25.111  | 1.5 ML    | Mt Perry        |
| 2015-02-19 | 07:17:19.74 | 151.49    | -25.11   | 1.4 ML    | Mt Perry        |
| 2015-02-19 | 06:32:14.37 | 151.999   | -24.914  | 0.7 ML    | Bullyard        |
| 2015-02-19 | 06:30:55.93 | 151.9     | -25.233  | 1.6 ML    | Goodnight Scrub |
| 2015-02-19 | 04:41:49.87 | 151.702   | -25.162  | 0.6 ML    | Mt Perry        |
| 2015-02-18 | 21:39:15.72 | 151.49    | -25.113  | 1.6 ML    | Mt Perry        |
| 2015-02-18 | 12:38:13.88 | 151.521   | -25.107  | 1.3 ML    | Mt Perry        |
| 2015-02-17 | 19:39:58.94 | 151.508   | -25.116  | 0.9 ML    | Mt Perry        |
| 2015-02-17 | 18:50:40.19 | 151.493   | -25.116  | 0.7 ML    | Mt Perry        |
| 2015-02-17 | 15:58:33.23 | 151.507   | -25.113  | 1.3 ML    | Mt Perry        |
| 2015-02-17 | 15:47:13.84 | 151.498   | -25.117  | 1.0 ML    | Mt Perry        |
| 2015-02-17 | 13:35:35.00 | 151.489   | -25.117  | 1.0 ML    | Mt Perry        |
| 2015-02-17 | 10:03:20    | 151.501   | -25.113  | 0.8 ML    | Mt Perry        |
| 2015-02-17 | 10:00:54.29 | 151.501   | -25.113  | 1.1 ML    | Mt Perry        |
| 2015-02-17 | 08:27:20.35 | 151.476   | -25.117  | 1.0 ML    | Mt Perry        |
| 2015-02-17 | 08:22:37.10 | 151.505   | -25.116  | 1.1 ML    | Mt Perry        |
| 2015-02-17 | 06:02:15.81 | 151.532   | -25.101  | 2.2 ML    | Mt Perry        |
| 2015-02-17 | 03:34:48.69 | 151.518   | -25.114  | 1.3 ML    | Mt Perry        |
| 2015-02-17 | 02:21:04.81 | 151.518   | -25.109  | 1.1 ML    | Mt Perry        |
| 2015-02-17 | 00:54:54.72 | 151.524   | -25.112  | 1.0 ML    | Mt Perry        |
| 2015-02-17 | 00:47:10.01 | 151.524   | -25.108  | 1.7 ML    | Mt Perry        |
| 2015-02-16 | 23:05:12.42 | 151.502   | -25.123  | 0.5 ML    | Mt Perry        |
| 2015-02-16 | 06:02:11.39 | 151.4     | -25.1    | 0.4 ML    | Mt Perry        |
| 2015-02-16 | 05:56:50.68 | 151.399   | -25.094  | 4.0 ML    | Mt Perry        |
| 2015-02-15 | 22:56:57.09 | 151.472   | -25.096  | 1.8 ML    | Mt Perry        |
| 2015-02-15 | 20:21:29.38 | 151.441   | -25.107  | 1.5 ML    | Mt Perry        |
| 2015-02-15 | 19:04:38    | 151.5     | -25.2    | 0.6 ML    | Mt Perry        |
| 2015-02-15 | 19:00:25.08 | 151.517   | -25.152  | 1.4 ML    | Mt Perry        |
| 2015-02-15 | 18:06:06.03 | 151.491   | -25.108  | 2.9 ML    | Mt Perry        |
| 2015-02-15 | 17:37:04.43 | 151.509   | -25.113  | 3.7 ML    | Mt Perry        |
| 2015-02-15 | 16:40:35.87 | 151.322   | -25.095  | 3.3 ML    | Mt Perry        |
| 2015-02-15 | 16:40:04.69 | 151.45    | -25.11   | 1.7 ML    | Mt Perry        |
| 2015-02-15 | 16:37:51.72 | 151.452   | -25.179  | 2.6 ML    | Mt Perry        |
| 2015-02-15 | 16:30:57.05 | 151.49    | -25.15   | 1.1 ML    | Mt Perry        |
| 2015-02-15 | 16:25:44.92 | 151.51    | -25.13   | 1.4 ML    | Mt Perry        |
| 2015-02-15 | 16:20:16.91 | 151.48    | -25.14   | 2.6 ML    | Mt Perry        |
| 2015-02-15 | 16:19:59.14 | 151.49    | -25.15   | 2.0 ML    | Mt Perry        |
| 2015-02-15 | 16:14:38.09 | 151.52    | -25.12   | 2.4 ML    | Mt Perry        |
| 2015-02-15 | 16:04:42.78 | 151.49    | -25.11   | 1.9 ML    | Mt Perry        |
| 2015-02-15 | 16:03:10.88 | 151.49    | -25.14   | 1.8 ML    | Mt Perry        |
| 2015-02-15 | 15:59:04.34 | 151.5     | -25.12   | 3.7 ML    | Mt Perry        |
| 2015-02-15 | 15:57:08.74 | 151.398   | -25.114  | 5.0 ML    | Mt Perry        |