



**Earthquakes in Tasmania:
a review of data holdings
and
potential for future analysis**

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Overview and Acknowledgement

This review aims to summarise earthquake location and magnitude information for Tasmania and the surrounding region. It has been compiled by Kyen Knight, as an UTas student vacation project, supported by KUTh Energy Ltd.

The review is targeted at catalogues of instrumental recordings of Tasmanian earthquakes. Such data could be used in future work to assess the incidence of earthquakes of different magnitudes in Tasmania, and hence, the underlying seismic risk. Tasmania had the benefit of a past programme of locally-managed seismic recording, however, this ended in 1997 and has left a potentially confusing impression of the seismicity with many features of the various catalogues being strongly influenced by changes in station distribution, and data analysis and archiving protocols. Such features have been emphasised in this review with the aim of maximising the utility of UTas and other seismic data holdings to future researchers.

The data catalogues that have been used in this review are the result of many years of observational effort by many people in Tasmania, elsewhere in Australia and internationally. At UTas, Vagn Jensen and June Pongratz are particularly acknowledged for their technical expertise and analysis over several decades, and also their assistance with compiling the information herein.

Glossary of Abbreviations and Terms

GA Geoscience Australia

IRIS Incorporated Research Institutions for Seismology

ISC International Seismological Centre

UTas University of Tasmania

Local Events Earthquakes occurring on land in Tasmania and in the ocean areas immediately adjacent to Tasmania

Regional Events Earthquakes occurring on land in south-eastern Australia and in the adjacent ocean area

* denotes data available in electronic format

Electronic data formats

.xls Spreadsheet

.shp Shapefile

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Part 2 - Maps

MAP 1: Tasmania: UTas and Geoscience Australia combined database

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MAP 3: ISC database

MAP 4: IRIS database

MAP 5: Southeast Australia: GA, 'EARTHQUAKE' database

MAP 6: Southeast Australia: IRIS 'Event Catalog'

MAP 7: Minimum earthquake magnitude of recorded events, GA catalogue

a) Historical Background and Regional overview

Instrumental records

Instrumental records in Tasmania began with the establishment of the Seismic Net (Carey & Newstead 1960 and Jensen 2000) by the University of Tasmania. This seismic station network enabled low-magnitude events to be detected and catalogued. The various aspects of the UTas management of the network and analysis of the recorded data ended in the period between 1995 and 2000 and are now carried out by the government agency, Geoscience Australia (www.ga.gov.au), and the Seismology Research Centre (www.seis.com.au) who have a focus on engineering applications and seismic monitoring. Modern seismological studies of Tasmanian earthquakes using instrumental records have been compiled by a number of authors including Shirley 1980; Michael-Leiba *et al.* 1989 and Gibson *et al.* 2000.

Historical records

Pre-instrumental examples of Tasmanian seismicity have been compiled by a number of authors including Ripper 1963, Michael-Leiba *et al.* 1989, Michael-Leiba and Jensen 1993. Such data is based on qualitative reports of felt-shaking and damage in local newspapers, diaries, logbooks and similar records. These data have not been included in the maps as they have very different coverage and accuracy to the instrumental records. Historical records do, however, provide a valuable chronicle of larger events in areas with a population with written or oral record keeping. A table of these events is given in Table 1 .

Palaeoseismic evidence

Evidence of significant seismicity in Tasmania's recent geological history, was initially presented by Carey & Newstead 1960 and later by McCue *et al.* 1996, from a case study conducted on a large fault scarp in south-western Tasmania, along Lake Edgar. Movement on this fault probably occurred a few centuries ago and would have resulted in a seismic event large enough to shake all of Tasmania.

Regional

Regional studies of Australian seismicity using Tasmanian pre-instrumental/instrumental records have been presented by a number of authors including Leonard *et al.* 2007. These studies show Tasmanian seismicity in the context of the seismicity distribution of the rest of South East Australia. The part of the Australian plate lies away from the obvious sources of lithospheric deformation associated with plate margins. This style of seismic activity is

termed ‘intraplate’ seismicity and is a subtle discipline, whereby the plate responds to the underlying stress field (e.g. Hillis and Reynolds 2003). The factors affecting the distribution of strain release, i.e. seismic activity, in response to a regional stress field are complex and hard to predict (Sandiford 2003). Suffice to say that several hundred years of seismic recording would be required to approach a complete record of the seismicity distribution. The much shorter recording intervals for which instrumental data are available indicate the level of lower magnitude seismicity but will not fully represent the incidence of higher magnitude events nor the occurrence of swarms of lower magnitude events.

TABLE 1: HISTORICAL EVENT RECORDS

DATE			LAT(S)	LONG	DEPTH	MAGNITUDE		SOURCE	COMMENTS
YYYY	MM	DD			km				
1859	11	21	40.7	145.2	-	MI	5.4	Michael-Leiba 1989	
1880	02	03	43	145.3	-	MI	5.5	Michael-Leiba 1989	
1884	07	-	41.15	148	-	MM	6	Ripper 1963	Goulds Country
1885	05	28	39.8	148.8	-	MI	6.8	Michael-Leiba 1989	
1888	05	28	-	-	-	MI	5-5.5	Michael-Leiba 1989	Felt E. Tas
1889	12	07	-	-	-	MI	4-4.5	Michael-Leiba 1989	Felt mag 3 Goulds Country
1890	04	29	-	-	-	MI	4-4.5	Michael-Leiba 1989	Felt mag 3 Goulds Country
1890	08	11	-	-	-	MI	4-4.5	Michael-Leiba 1989	Felt mag 3 Goulds Country
1891	05	30	-	-	-	MI	4.5-5	Michael-Leiba 1989	Felt mag 4 St. Marys
1891	07	02	-	-	-	MI	4-4.5	Michael-Leiba 1989	Felt mag 3 St. Helens
1892	01	26	40.3	149.5	-	MI	6.9	Michael-Leiba 1989	
1894	01	26	-	-	-	MI	4.5-5	Michael-Leiba 1989	Felt mag 3 Goulds Country
1894	11	22	-	-	-	MI	5-5.5	Michael-Leiba 1989	Felt E. Tas
1895	12	02	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 3 Goulds Country
1897	05	25	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 4 Eddystone
1897	08	11	-	-	-	MI	4.5-5	Michael-Leiba 1989	Felt NE.Tas
1903	12	31	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 4 St. Helens
1907	01	31	-	-	-	MI	5-5.5	Michael-Leiba 1989	Felt E. Tas
1908	05	04	42	145.4	-	MI	4.8	Michael-Leiba 1989	
1911	11	04	42.2	145.2	-	MI	4.8	Michael-Leiba 1989	
1924	03	01	41.7	145	-	MI	5.2	Michael-Leiba 1989	
1928	01	18	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 3 Scottsdale
1929	12	28	39.69	149.45	10	ML	5.4	Michael-Leiba 1989	
1946	09	14	40.2	149	33	ML	5.7	Michael-Leiba 1989	
1948	08	10	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 4 Flinders Island
1954	12	11	-	-	-	MI	4 -4.5	Michael-Leiba 1989	Felt mag 4 Flinders Island
1958	01	01	42.2	146.1	10	ML	5.3	Michael-Leiba 1989	
MI = Magnitude from isoseismal radii					MM = Modified Mercalli scale			ML = Magnitude instrumental	

b) Earthquake Catalogues Used in this Review

Tasmanian local earthquake events used in this review have been acquired from publicly available datasets compiled by the following local, national and international agencies

- University of Tasmania, School of Earth Sciences
- Geoscience Australia, Earthquake Database
- International Seismological Centre, ISC Bulletin
- Incorporated Research Institutions for Seismology, Event Catalog

It is important to note that while there is considerable overlap between the datasets, and some agencies report to others, these links are not constant over the whole data analysis period (approximately 1960 - mid 2009) further underlying the need for this review.

While this report was in the process of compilation, a significant earthquake event was recorded in eastern Tasmania, east of Oatlands, (see Table 2).

TABLE 2: LOCAL EVENT IN EASTERN TASMANIA

DATE			UTC	LAT	LONG	DEPTH	MAGNITUDE	COMMENTS
YYYY	MM	DD						
2009	12	07	1330	42.34°S	147.56°E,	-	ML 3.8	East of Oatlands

Source: SRC 2009.

c) The Tasmania Seismic Net

The first seismic station in Tasmania was established in 1957 at Fort Nelson, Sandy Bay by the University of Tasmania (Jensen 2000). In 1960 an array of three stations were installed at Tarraleah, Savage River and Moorlands, in response to potential seismic risk suggested by new geological evidence on existing hydro-electric installations (Carey 1960; Jensen 2000). Further stations were added later (figure 1) to improve the determination of hypocentre locations in relation to detecting weaker seismic disturbances (Carey 1960; Jensen 2000). From 1957 to 2000 local and regional seismic data acquired by the seismic net was interpreted by staff at the University of Tasmania. Following a contractual agreement in July 2000, interpretation of seismic data moved to the Seismology Research Centre (SRC) in Melbourne (Jensen 2000). A summary table of Tasmanian seismic stations is provided in Table 3.

TABLE 3: SUMMARY TABLE OF SEISMIC STATIONS IN TASMANIA

NAME	CODE	LAT	LONG	ELEVATION	REGION	OPENED (YYYY)	MM	DD	Comments
Tasmania University	TAU	-42.9099	147.32	132	Tasmania, Australia	1957			1962 addition of FNT seismometer
Moorlands	MOO	-42.4417	147.19	325	Tasmania, Australia	1960			
Savannah	SAV	-41.7208	147.189	180	Tasmania, Australia	1960			
Savage River	SVR	-41.4667	145.217		Tasmania, Australia	1960			Closed 13 March 1991
Tarraleah	TRR	-42.3042	146.45	579	Tasmania, Australia	1960			
Lemonthyme	LMT	-41.61	146.152	349	Tasmania, Australia	1969			Closed 6 August 1971
Sheffield	SFF	-41.3375	146.308	213	Tasmania, Australia	1969			
Tarraleah	LEAH	-42.30272	146.45158	590	Tasmania, Australia	1972	7	4	
Scotts Peak	SPK	-43.0383	146.275	425	Tasmania, Australia	1972	7		Closed 1997
Strathgordon	STG	-42.8483	146.207	350	Tasmania, Australia	1972	7		Closed 1997
Mount Read	MTRD	-41.8464	145.5436	108	Tasmania, Australia	1991	3	25	Closed 31 July 2003
Coronation Park	CORO	-41.45222	147.145		Tasmania, Australia	1995	1	5	
Gees Lookout	GEES	-41.44528	147.12361		Tasmania, Australia	1997	3	6	
Gladstone	GLAD	-40.98444	148.00861	146	Tasmania, Australia	1997	4		

Source: ISC, International Registry of Seismic Stations 2009 and Jensen 2000.

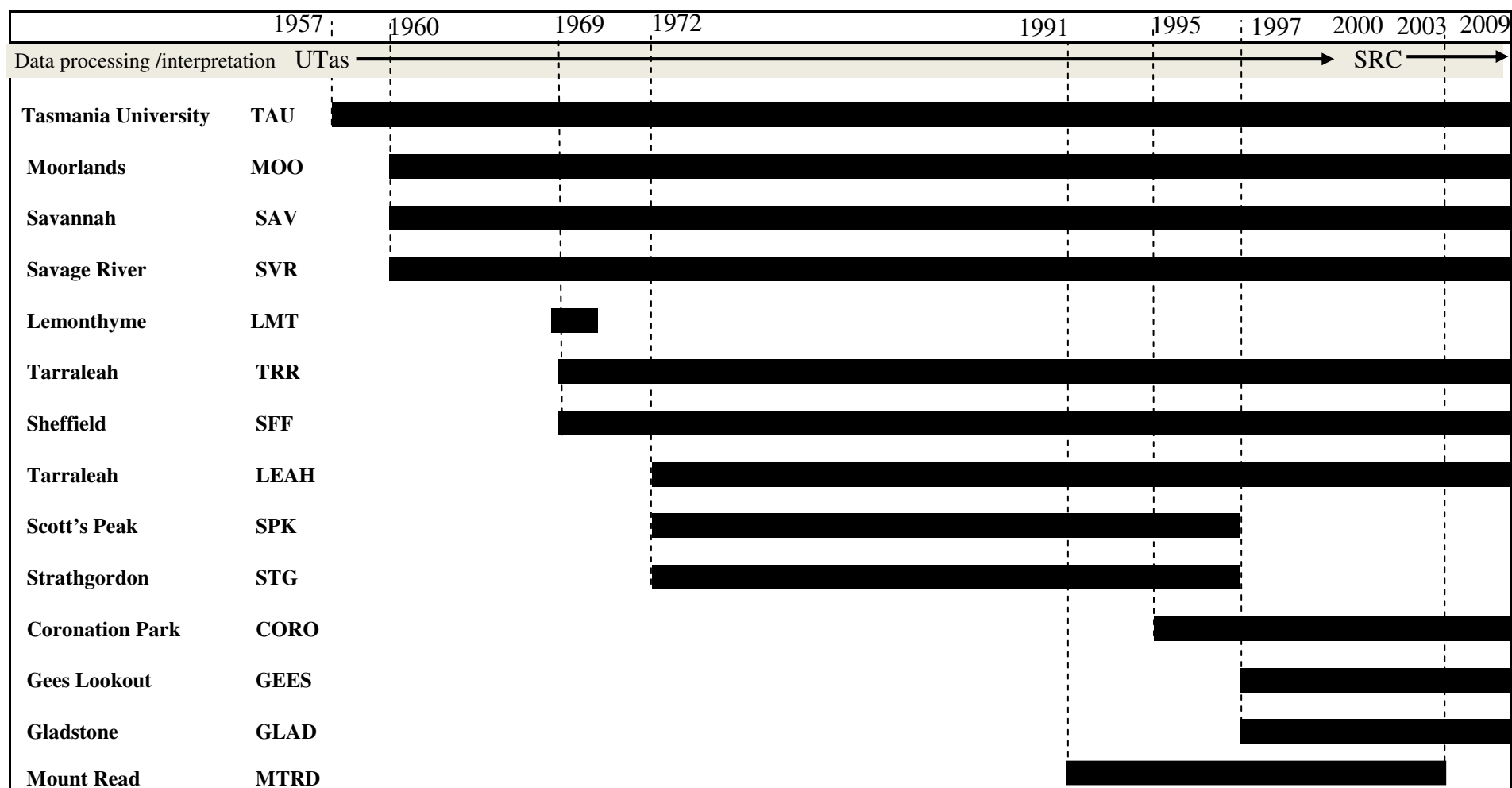


Figure 1: Seismic Stations operation and data processing/interpretation timeline.

University of Tasmania (UTas). Seismology Research Centre (SRC).

Source: ISC, I.R.S.S (2009); Jensen (2009).

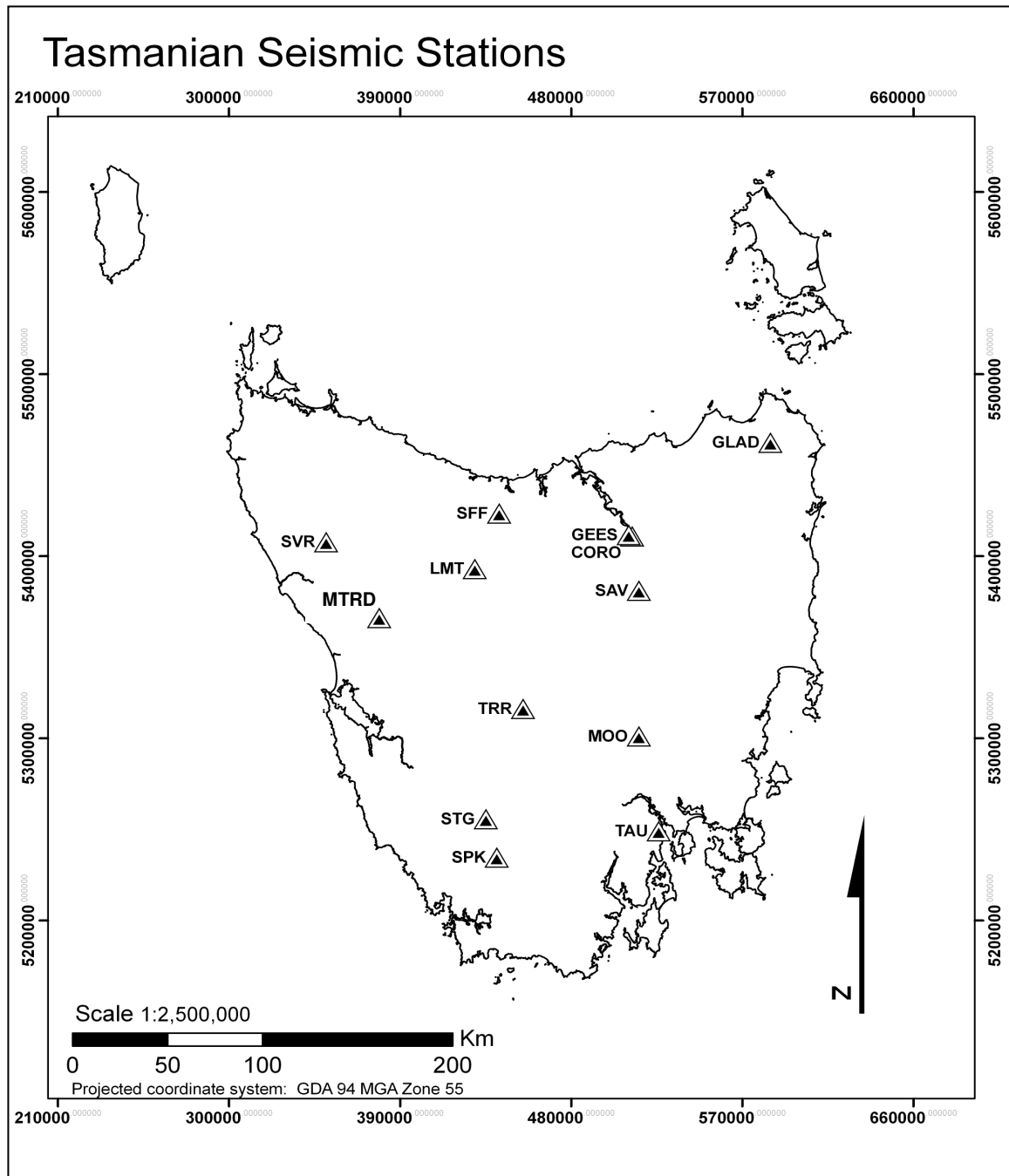


Figure 2: Spatial distribution of seismic stations.
Data source, ISC, International Registry of Seismic Stations 2009.
Base data DPIWE 1998.

TABLE 4: SUMMARY OF TASMANIAN EVENT RECORDS

	ISC*	IRIS*	GA*	UTAS*
Number of event records	316	538	860	1546
Event record period (years)	35	44	48	42
Start of event record	23/01/1973	8/03/1964	3/02/1961	28/10/1960
End of event record	8/05/2007	8/09/2007	29/11/2008	12/02/2001
Maximum no. event records per year	64	72	72	80
Minimum no. event records per year	0	0	0	1
Number of no data years	12	8	3	0
Average number of event records per year	9	12	18	37
Events with magnitude calculated	316	434	860	1350
Minimum magnitude	0.7	0.5	0.5	0.5
Maximum magnitude	4.2	5.5	4.7	5.5

* Summary data derived from event search 23/11/1959 - 23/11/2009

d) Data Appraisal

i) Tasmanian earthquake event record reported by The University of Tasmania.

Local earthquake events have been documented by the University of Tasmania from 1960 to 2001. During this recording period data has been processed and stored in a number of formats, with the earliest records (pre 1967) existing as paper copy only. An electronic format exists for period from 1967-1997, with event data post 1997 recorded as paper copy only. A complete account of UTas local event data holdings is supplied in appendix 1.

A compilation of hard copy and electronic copy, local event data was has been undertaken by the author for the purpose of this report, resulting in an electronic copy of 1546 events recorded from 1960 – 2001 (figure 3a). A total of 1350 events contain recorded magnitude values, ranging between a minimum of 0.5 to a maximum 5.5 (figure 3b and c).

Data Processing

An electronic copy in spreadsheet format of Local event data containing 1350 event entries (Tasmanian_seismic_events.xls) recorded by the University of Tasmania, was assessed and corrected against hard copy data and corrections to time, date and magnitude fields were

applied. Correlation of electronic data with data reported by Geoscience Australia (GA) was undertaken to assess data consistency.

Event entries differing greatly from the GA dataset were checked against hard copy data and corrections were made. A compilation of UTas local event data with an additional 85 events reported by GA was used to assess event data distribution (figures 4a and b), and to provide an event record covering the UTas non-reporting period 2001-2009.

Event data in spreadsheet format was imported (*UTAS_GA.xls) into a GIS software package (ESRI, Arc GIS 9.3), and shape files were generated (*UTAS_GA.shp). Spatial and temporal distribution of reported local events was assessed, and displayed as a summary map of reported local events (Map 1).

ARC GIS display parameters

- 1) Event data acquired in geographic coordinates of decimal-degrees, was projected to the coordinate system GDA94 MGA Zone 55.
- 2) Spatially located points were displayed using multiple attribute symbology, with graduated colour indicating event year and proportional symbol size representing magnitude value.
- 3) The event year range was subdivided into five classes with the arbitrary assignment of cut-off values 1970,1980,1989,1999 and 2008.
- 4) A magnitude scale with an interval size of 1 was chosen.

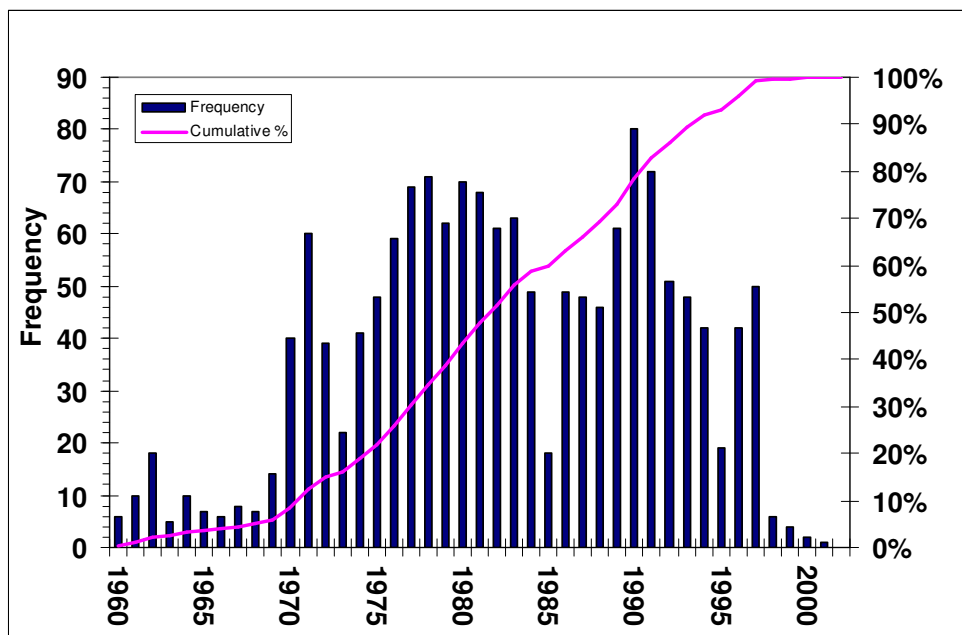


Figure 3a: UTAS Local event data recorded for 1960 - 2001.

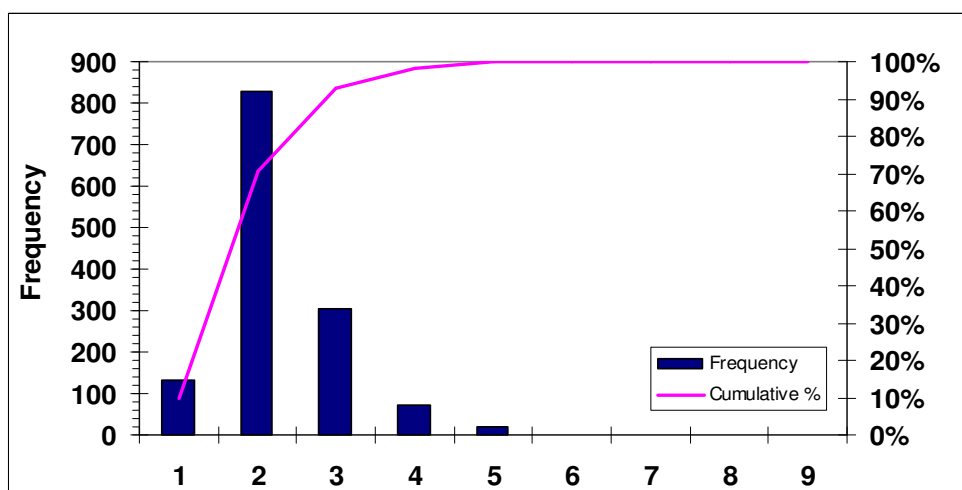


Figure 3b: UTAS local event magnitude, 1960 - 2001.

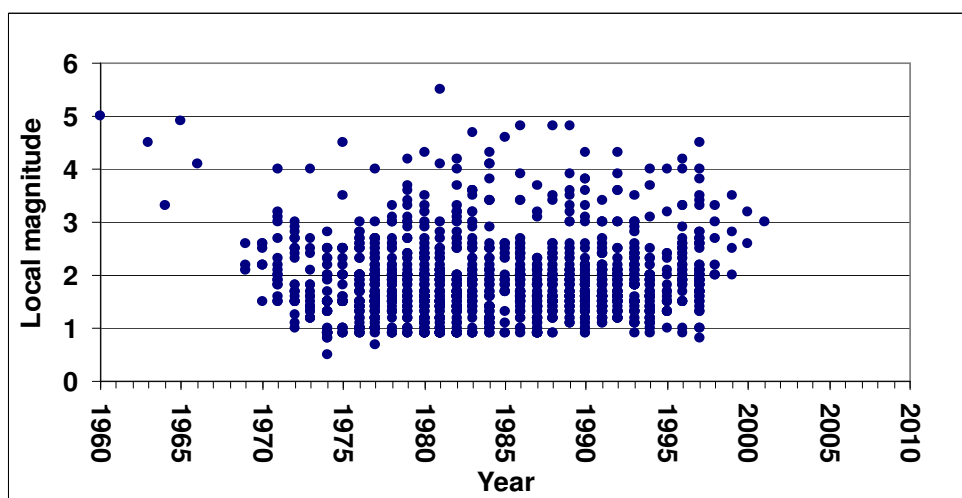


Figure 3c: Event magnitude through years of recording 1960 to 2001.

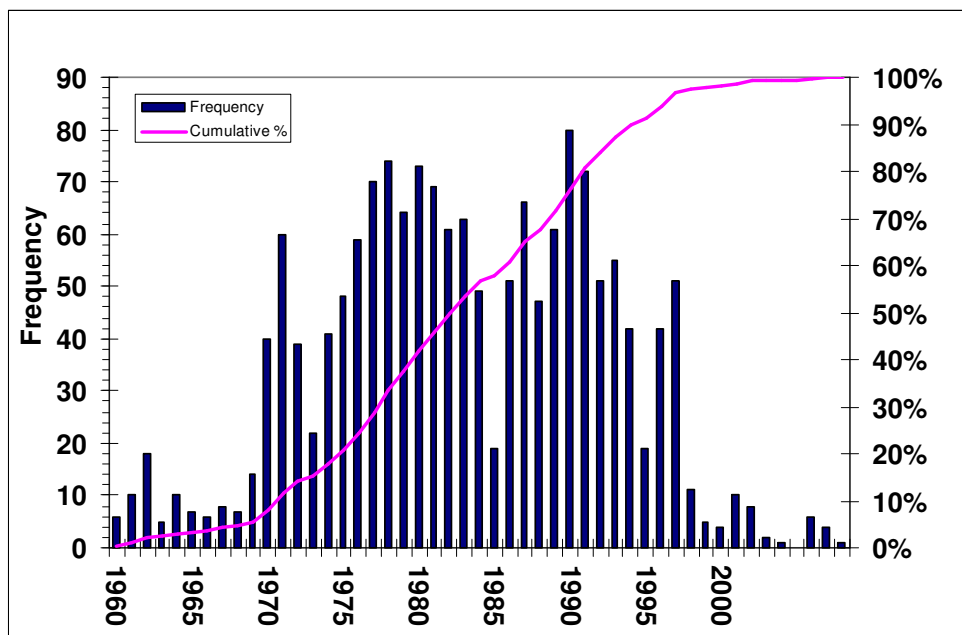


Figure 4a: Combination of UTAS and GA Local event data 1960 - 2008.

A total of 281 events reported by GA have been added to UTAS event data giving a total of 1631 records.

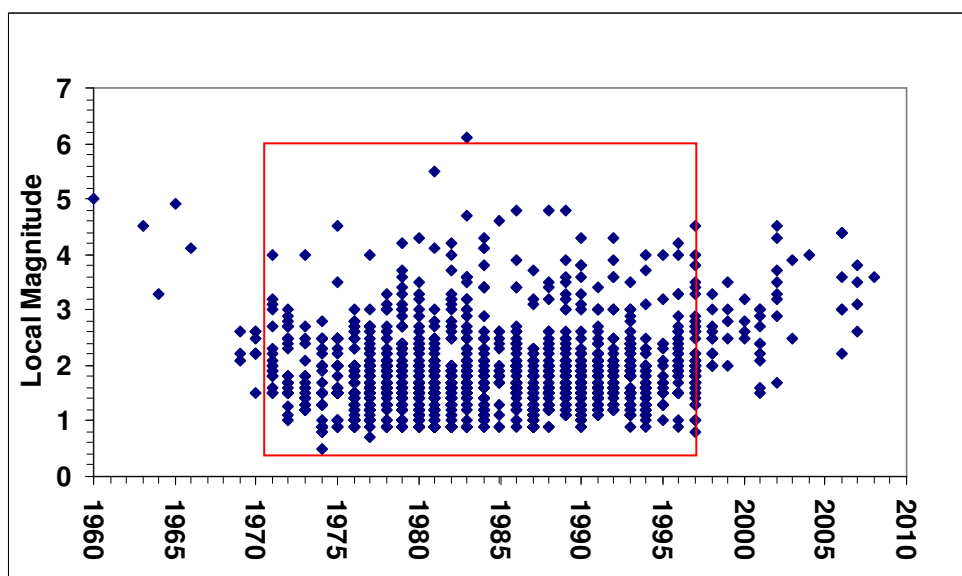


Figure 4b: UTAS and GA combined event magnitude records 1960 - 2008. The red box highlights a period from 1971 - 1997 of consistent recording of event magnitudes 1 and above.

ii) Tasmanian earthquake event records reported by Geoscience Australia (GA).

An earthquake event search of the GA, EARTHQUAKE Database was conducted using the following search criteria:

- Rectangular search from latitude -45 to -39 and longitude 143 to 150
- Date range 1960/01/01 to 2009/11/01

A total of 860 reported events were retrieved occurring from 1961 to 2008 and ranging from local magnitudes (ML) of 0.5 to 4.7 (Table 4). Plots showing the distribution of events over the date range and magnitude range are shown in figures 5 a, b and c.

Data processing and display

Event data in spreadsheet format was imported (*GA_L.xls) into a GIS software package (ESRI, Arc GIS 9.3), and shape files were generated (*GA_L.shp). Spatial and temporal distribution of reported local events was assessed, prior to the production of output summary map reported local events (Map 2). Events are displayed as outlined in d) i).

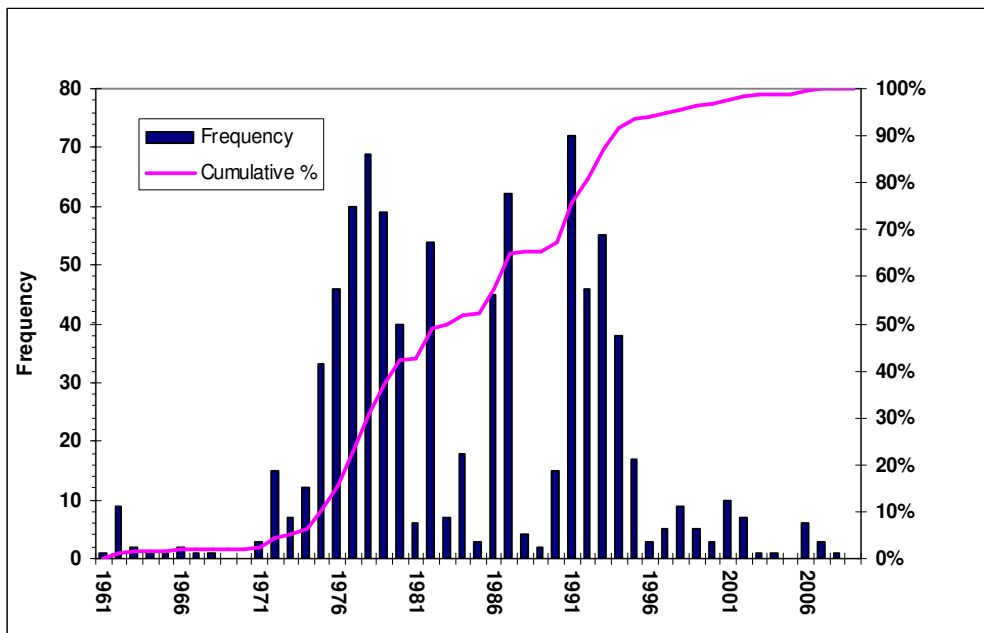


Figure 5a: GA Local event data recorded for 1961 - 2008.

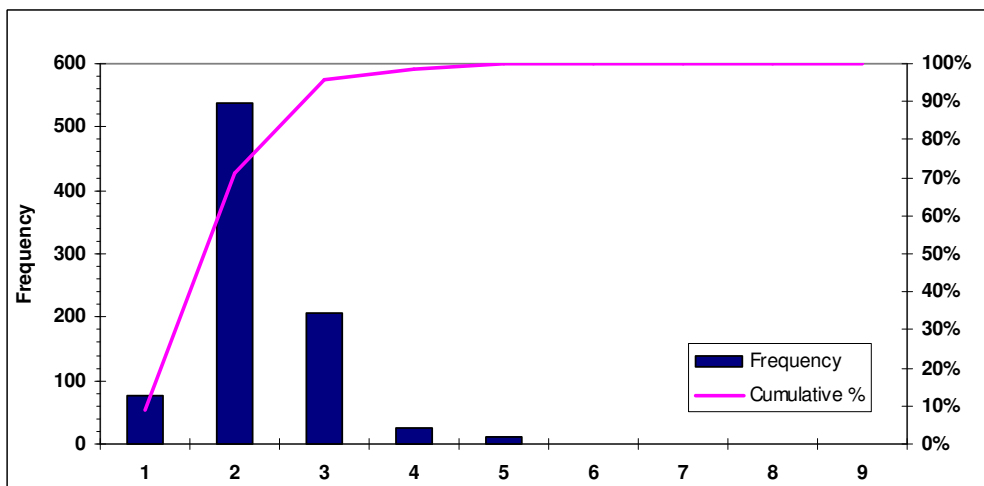


Figure 5b: GA Local event magnitude, 1961- 2008..

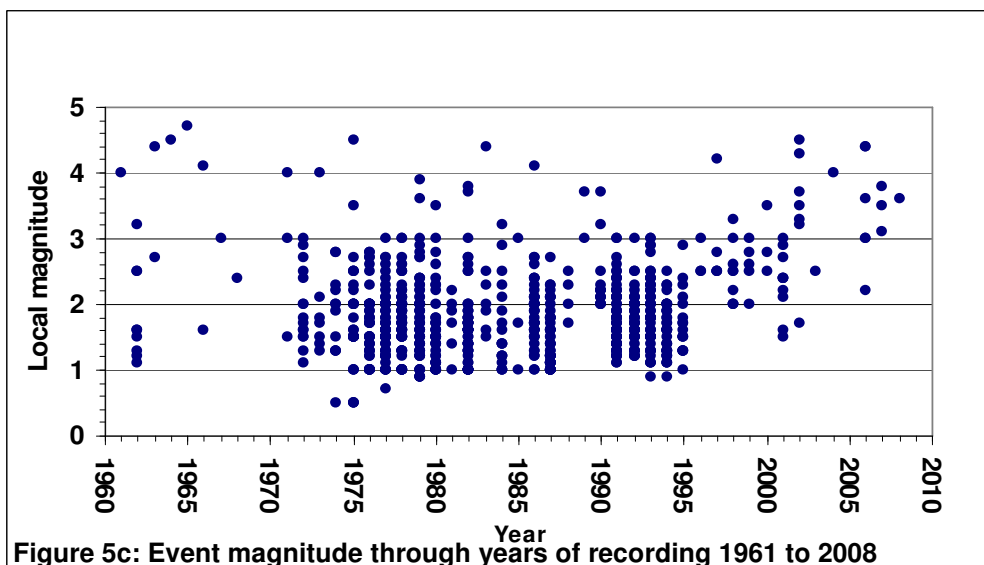


Figure 5c: Event magnitude through years of recording 1961 to 2008

iii) Tasmanian earthquake event records reported by the International Seismological Centre (ISC).

An earthquake event search of the ISC On-line Bulletin was conducted using the following search criteria:

- Rectangular Search from latitude -45 to -39 and longitude 143 to 150
- Date range 1960/01/01 to 2007/11/01

The ISC Bulletin was complete up to 2007/11/01 at the time of writing.

A total of 316 reported events were retrieved, occurring from 1973 to 2007 and ranging from local magnitudes (ML) of 0.7 to 4.2 (Table 4). Plots showing the distribution of events over the date range and magnitude range are shown in figures 6 a, b and c .

Data processing and display

Event data acquired in International Monitoring System 1.0 format (IMS.10), was filtered, sorted and edited to retain fields of event date, time, location, magnitude, depth and authority. Event data in spreadsheet format (*ISC.xls) was imported into a GIS software package (ESRI, Arc GIS 9.3), and shape files were generated (* ISC.shp). Spatial and temporal distribution of reported local events was assessed prior to the production of output summary map reported local events (Map 3). Events are displayed as outlined in d) i).

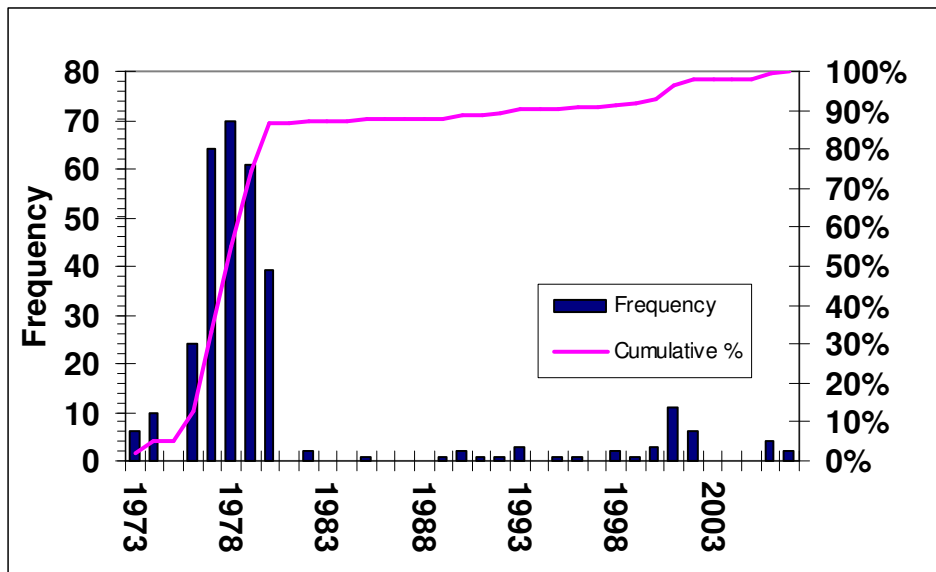


Figure 5a: ISC Local event data recorded for 1973 - 2007.

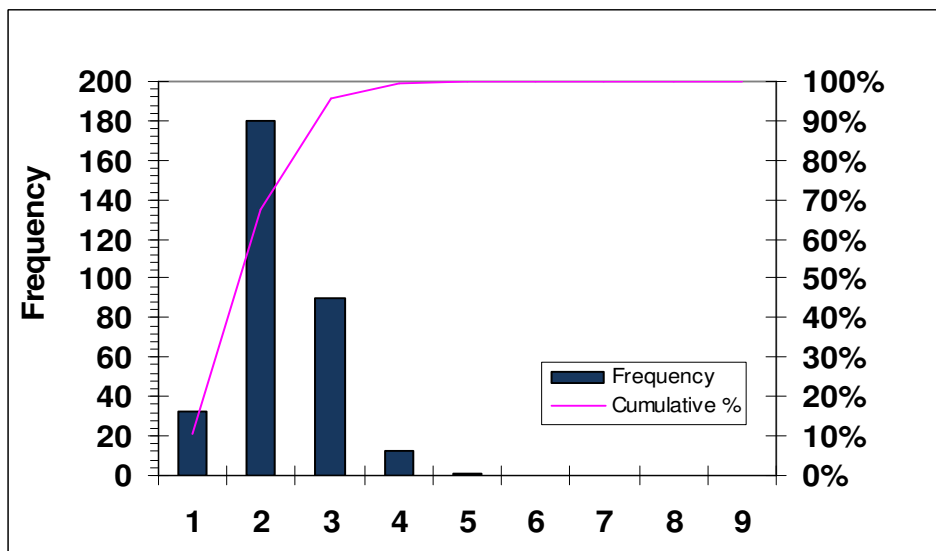


Figure 5b: ISC Local event magnitude, 1973 - 2007.

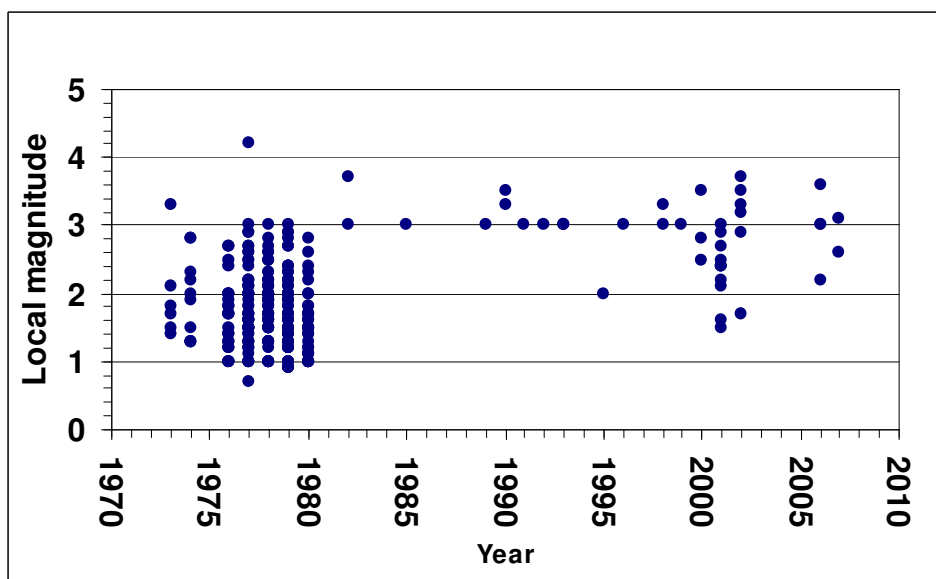


Figure 5c: Event magnitude through years of recording 1973 to 2007

iv) Tasmanian earthquake event record reported by Incorporated Research Institutions for Seismology (IRIS)

An earthquake event search of the IRIS, EVENT CATALOG was conducted using the following search criteria:

- Rectangular Search from latitude -30 to -50 and longitude 140 to 160
- Date range 1960/01/01 to 2009/11/01

A regional search of south-eastern Australia of the IRIS Event catalog, retrieved a total of 4433 reported events, including a total of 538 Tasmanian local events, occurring from 1964. The local magnitude (ML) of reported Tasmanian events ranged between a minimum of 0.5 to a maximum of 5.5 (Table 4). Plots showing the distribution of events over the date range and magnitude range are shown in figures 6 a, b and c .

Data processing and display

Regional south-eastern Australian event data was filtered, sorted to extract local Tasmanian events. Addition fields of year, month and day were derived from event records, were added to calculate event frequency.

Local event data in spreadsheet format (*IRIS_L.xls) was imported into a GIS software package (ESRI, ARC GIS 9.3), and shape files were generated (*IRIS_L.shp). Spatial and temporal distribution of reported local events was assessed using GIS software, prior to the production of output summary map (Map 4). Events are displayed as outlined in d) i).

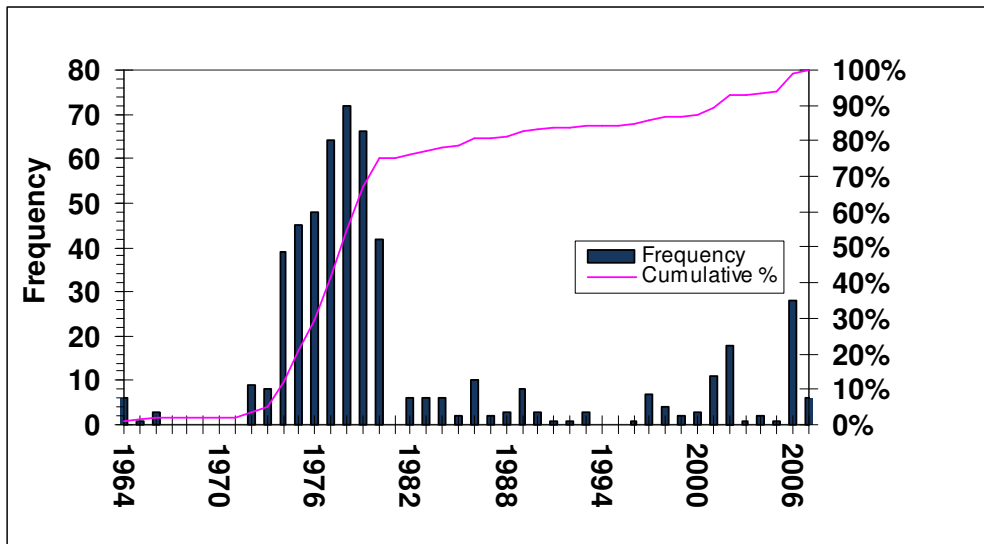


Figure 6a: IRIS Local event data recorded for 1964 and 2007.

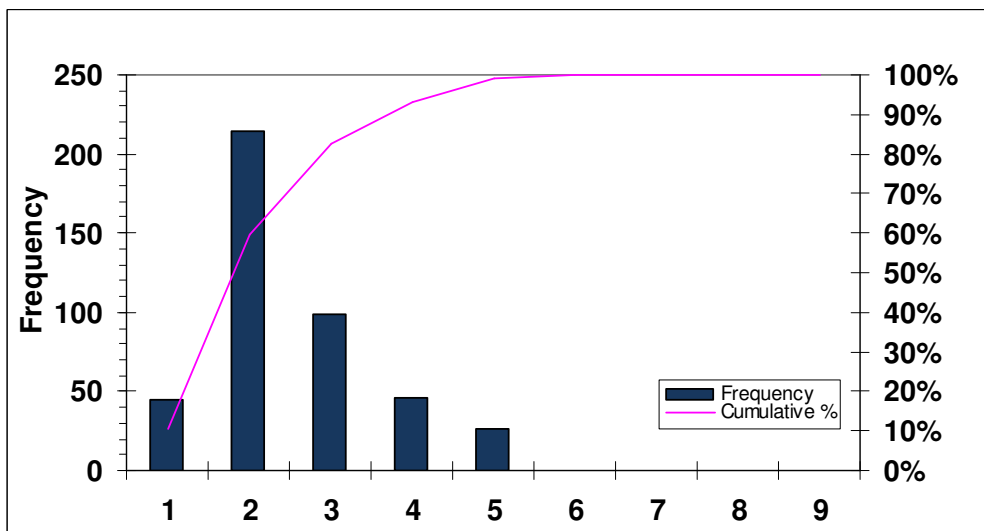


Figure 6b: IRIS Local event magnitude, 1964 and 2007.

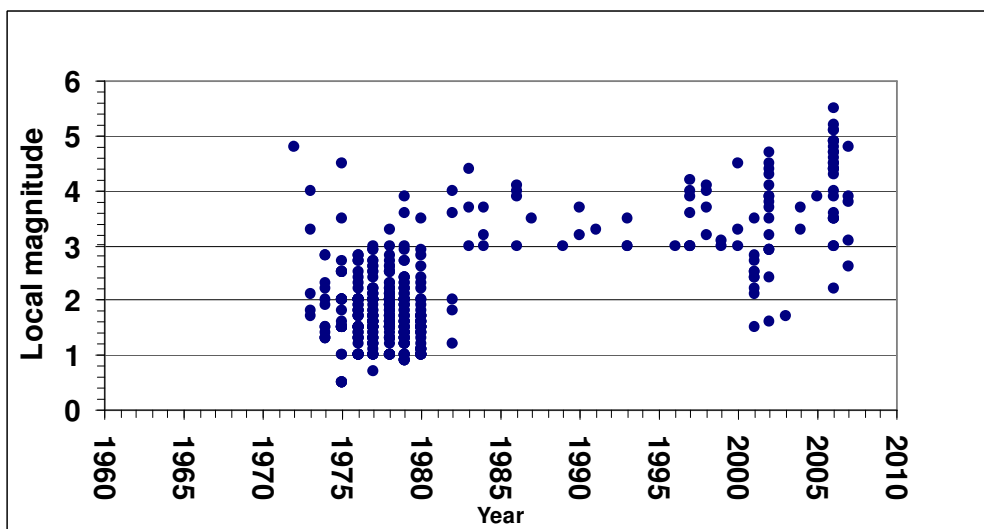


Figure 6c: IRIS Event magnitude through years of recording 1974 to 2007.

e) Seismicity distribution

Seismicity patterns combine both earthquake occurrences and effects relating reporting procedures and station proximity.

i) Event reporting

This section summaries database effects on the apparent distribution of earthquake occurrence. The distribution of earthquake events from 1959 to 2009 in Tasmania is strongly influenced by event reporting procedures, with event records over the last 50 years displaying periods of consistent and inconsistent reporting. Consistent reporting of low magnitude events occurs between agencies post 1970 until 1980. Event records of international agencies ISC and IRIS post 1980 show inconsistent reporting of events below magnitude 3. Event records from GA report low magnitude events until 1995, although local agency UTas reported low magnitude events until 1997. Limited reporting of lower magnitude events is shared by all agencies from 1997 to the present day.

ii) Event occurrence and station proximity

Records of local seismicity over the past 50 years (Maps 1- 4) indicate that the majority of events have occurred in western Tasmania, with events concentrated in the southwest and the northwest. In southwest and northwest regions events occur over a wide range of years, are of dominantly low magnitude and display spatial clustering.

Reported events in eastern Tasmania occur infrequently and appear spatially isolated.

A low frequency of earthquakes in eastern Tasmania commonly appears in all reported datasets (UTAS,GA,ISC and IRIS), although there is an isolated cluster of events occurring near the Tasman peninsula. In all reported datasets records of low magnitude (<2) events in the east are either absent or infrequent, this may be due to the distribution of recording stations with respect to event location.

Analysis of the spatial distribution of minimum magnitude events was undertaken on the GA event catalogue (Map 5), to assess the relation of recorded seismicity patterns to station distribution. Due to the low data density issues only broad scale trends have been addressed

This assessment displayed a strong correlation between the recording of low magnitude events and the distribution of recording stations. Low magnitude events (magnitude <1) occurring within the Seismic Net (surrounded by recording stations) appeared to have been well represented in event records, with low magnitude events occurring outside the Seismic Net exhibiting a magnitude recording threshold. This threshold level is particularly evident in eastern Tasmania with minimum recorded magnitudes of 1.5 - 2 ML.

f) Southeast Australian regional earthquake record

A regional perspective of southeast Australian seismicity from 1960 to 2009 has been included in this review to compare local Tasmanian seismic events with a regional seismic event distribution.

i) Regional earthquake event record reported by Geoscience Australia

An earthquake event search of the GA, EARTHQUAKE Database was conducted using the following search criteria:

- Rectangular search from latitude -30 to -50 and longitude 140 to 160
- Date range 1960/01/01 to 2009/11/01

A south-eastern Australian regional search of GA, EARTHQUAKE Database, retrieved a total of 1523 reported events occurring from 1960 to 2009 and ranging in magnitudes of 0.4 to 6. Plots showing the distribution of events over the date range and magnitude range are shown in figures 7 a, b and c.

Data processing

Event data in spreadsheet format (*GA_R.xls) was imported into a GIS software package (ESRI, ARC GIS 9.3), and shape files were generated (*GA_R.shp). Spatially located regional events were used to produce an output summary map (Map 6).

Event processing for display

The following section documents processing stages of event data, using Arc GIS software:

- i) Spatially located points were displayed using multiple attribute symbology, with graduated colour indicating event year and proportional symbol size representing magnitude value.
- ii) The event year range was subdivided into five classes with the arbitrary assignment of cut-off values 1973,1982,1991,2000 and 2009.
- iii) A magnitude scale with an interval size of 1 was chosen to account for difference in magnitude reporting between agencies and over time.

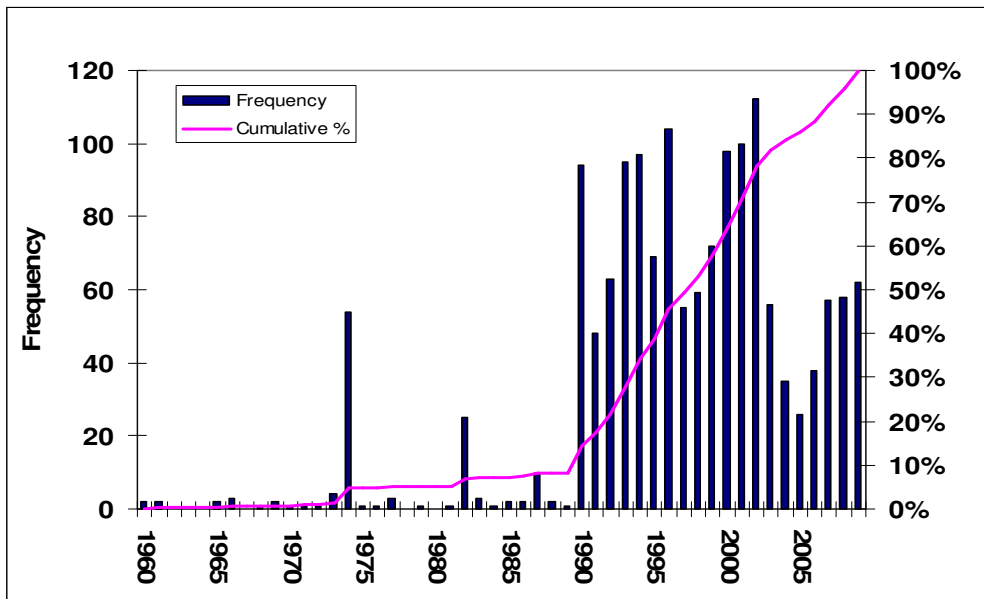


Figure 7a: GA regional event data recorded for 1960 and 2009.

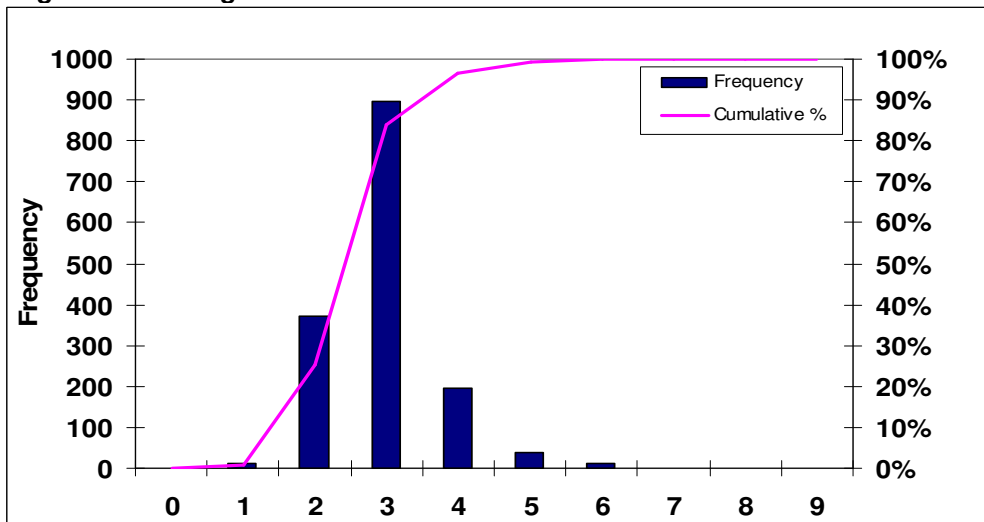


Figure 7b: GA event magnitude, 1960 and 2009.

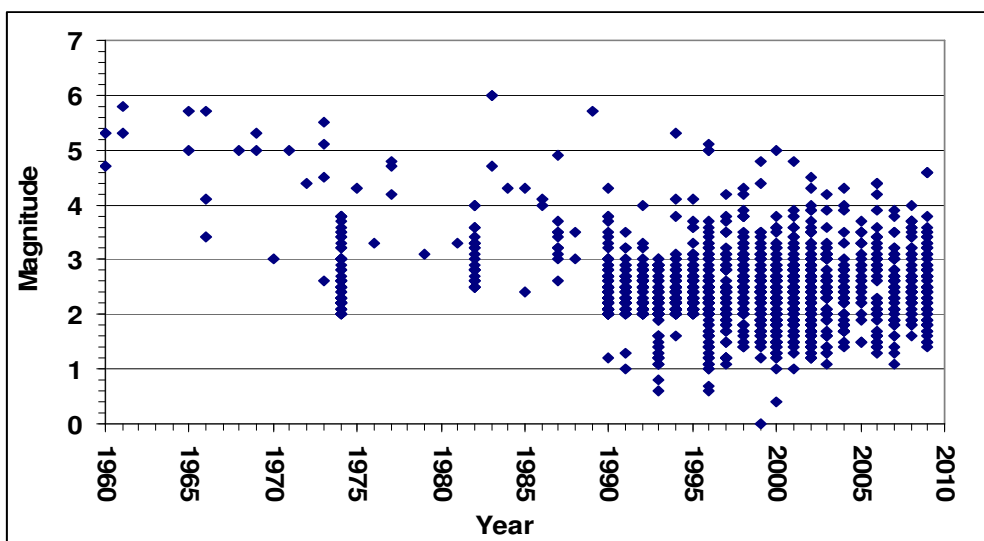


Figure 7c: GA event magnitude through years of recording 1960 to 2009.

**ii) Tasmanian earthquake event record reported by
Incorporated Research Institutions for Seismology (IRIS)**

An earthquake event search of the IRIS, EVENT CATALOG was conducted using the following search criteria:

- Rectangular Search from latitude -30 to -50 and longitude 140 to 160
- Date range 1960/01/01 to 2009/11/01

A regional search of south-eastern Australia of the IRIS Event catalog, retrieved a total of 4433 reported events from 1964 to 2009 and ranging in magnitudes of 0.3 to 8. Plots showing the distribution of events over the date range and magnitude range are shown in figures 8 a, b and c.

Data processing and display

Regional event data in spreadsheet format (*IRIS_R.xls) was imported into a GIS software package (ESRI, ARC GIS 9.3), and shape files were generated (*IRIS_R.shp). Spatial and temporal distribution of reported local events was assessed using GIS software, prior to the production of output summary map (Map 7). Events are displayed as outlined in f) i).

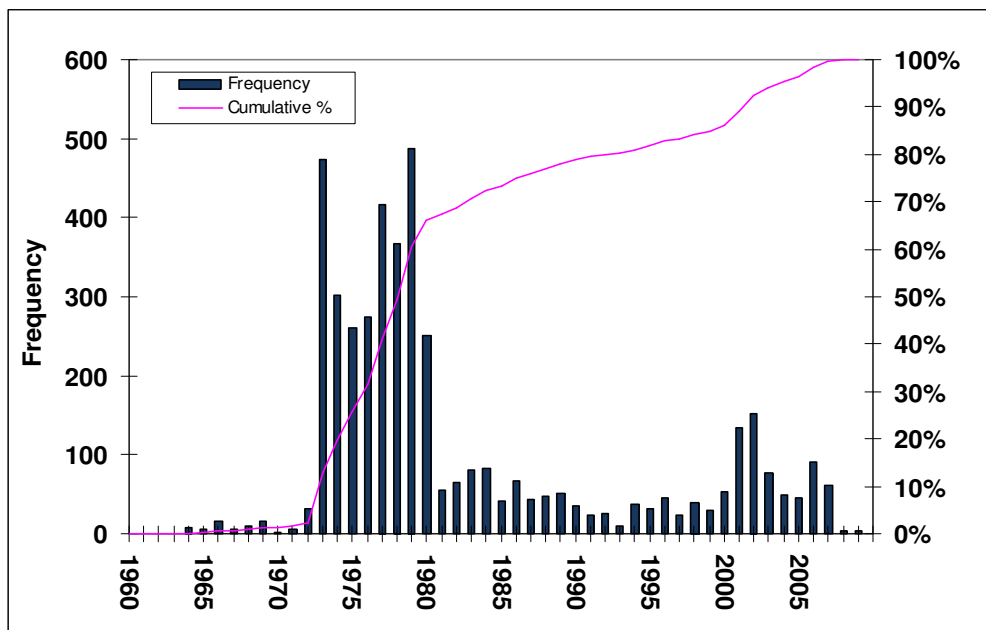


Figure 8a: IRIS regional event data recorded for 1964 and 2009.

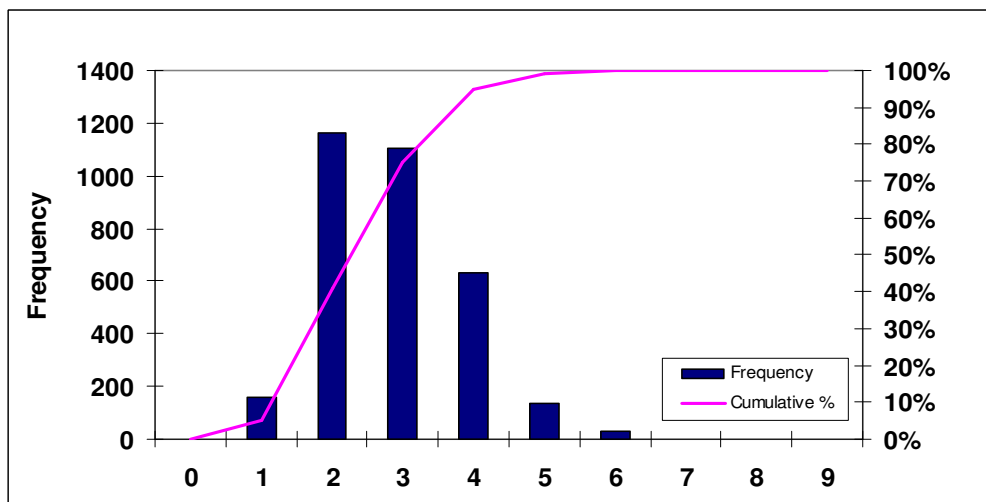


Figure 8b: IRIS event magnitude, 1964 and 2009.

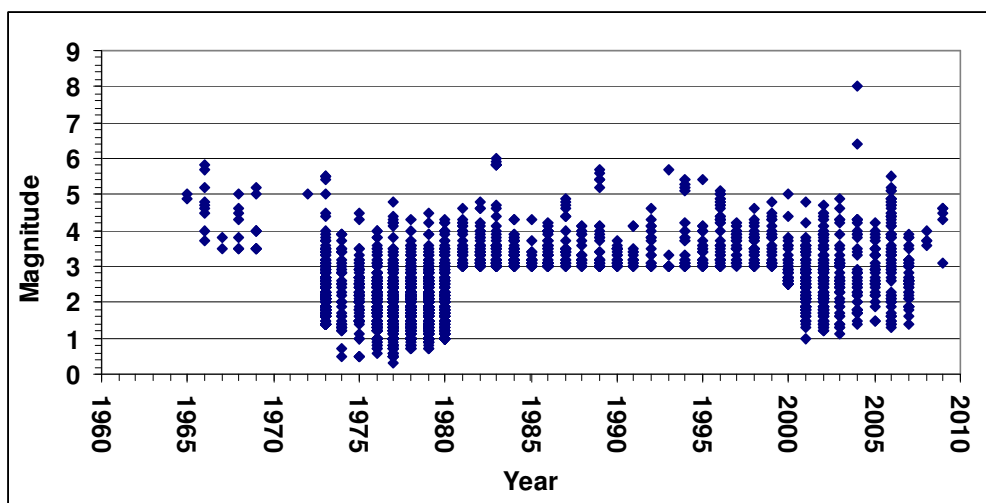


Figure 8c: IRIS event magnitude through years of recording 1964 to 2009.

g) Other seismic data monitoring agencies and available data

Geoscience Australia is now the lead agency for earthquake seismology in Tasmania, although they only interpret data from two stations (TAU and MOO) which is not sufficient for hypocentre determination. Hence, they now only include Tasmanian events in their catalogue which are also recorded in Victoria.

The following two agencies currently are involved in the collection and/or processing interpretation of local earthquake event data in Tasmania. The primary aim of this monitoring is to detect seismicity related to the hydroelectric dams in central and western Tasmania. Hence, the recorded data is not publicly available to the research seismology community. In addition to those listed below, some mine sites also carry out seismic monitoring.

- Environment Systems and Services, Seismological Research Centre (SRC), based in Melbourne, VIC, www.seis.com.au
- Hydro Tasmania, based in Hobart, TAS, www.hydro.com.au

While long-term monitoring is obviously essential for seismicity studies, a snap-shot may be obtained from short-term seismic deployments aimed at the determination of crustal structure. Two such deployments ran during 2003 (TIGGER) and 2006-2007 (SETA) in association with research projects led by Australian National University (Rawlinson et al. 2010). These deployments are currently being analysed for lower magnitude seismic activity.

h) Report Summary

This review of recorded Tasmanian earthquake highlights a number of features of the available catalogues with regard to the compilation of a complete local earthquake record for Tasmania. Of particular concern is

- The lack of availability to the research community of recently recorded lower-magnitude events (1997 – present day).
- The inconsistency of recorded low magnitude event data, which is needed, for example, to determine earthquake recurrence relations for the assessment of seismic risk.
- The lack of station coverage for eastern Tasmania

In the course of undertaking the study, the variability of the spatial accuracy of calculated epicentre locations and the variability of calculated magnitudes was also noted and should not be taken for granted in subsequent studies.

i) Future monitoring /analysis and comment

It would be of great benefit to the developing geothermal industry in Australia and also other activities that potentially drill into the Earth's crust, to gain a fuller understanding of intraplate seismicity in southeast Australia. In Tasmania, this would require the deployment of several more semi-permanent seismic stations throughout the state, particularly in the east and the coordination of this data with records from existing stations (mostly in the west). As well as a more comprehensive picture of the seismicity of the state, focal mechanisms for the few earthquakes that do occur could be determined, eventually constraining the crustal stress field. As it takes some decades to build the above dataset, measurements should be made, such as borehole breakout directions on drill holes, which contribute similar information.

The split of responsibility for seismic monitoring between Geoscience Australia and the commercial organisations has led to a situation where earthquake data for Tasmania is incomplete for basic monitoring purposes and the data that do exist are difficult to access. There is good reason for government agencies to monitor seismic activity to lower magnitudes, or coordinate such activities, and to maintain a quality network in order to do this effectively.

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APPENDIX 1

1 - UTas earthquake seismic data holdings: local event catalogue

CARD DATA

Card data 1960 – 2000 Number of Events ~2150

Contains following fields:

- Event No. YY-MM-DD
- Station arrival time HH-MM-SS.S
- Phase
- Component
- Per
- Amp
- Remarks/comments
- Source
- Origin time
- Epicentre location
- Depth
- Magnitude
- Location.

Cards from 2nd July 1974 Contain following additional fields:

Gain, T, R , B, Δ KM, MEWАНV

Estimated, Computed, Actual:

- Origin time
- Epicentre location,
- Depth
- Magnitude
- Δ Epicentral

Remarks: Incomplete and inconsistent record

Some magnitudes calculated, most locations calculated

Computed Epicentral locations and origin times of Local earthquakes

Paper copy only

Original data source Card data

1960/9/23-1989/12/6 Event Numbers 15 – 1586

1996/1/8 – 1997/12/30 Event Numbers 1980- 2077

- Missing: 1989/12/29 – 1995/12/26 Event Numbers 1588-1979

Not calculated from:

- 1998/1/1 - 2000 Event Numbers 2078 - 2143

Contains:

- One velocity Iterative epicentre locations
- Two velocity Iterative epicentre locations
- Epicentre plots

One velocity Iterative epicentre locations

1960/9/23-1989/12/6 Event Numbers 15 – 1586

(Volume 1: 15-659)

(Volume 2: 660- 1586)

Two velocity Iterative epicentre locations

1960/9/23-1989/12/6 Event Numbers 15 – 1586

(Volume 1: 15-659)

(Volume 2: 660- 1586)

Epicentre plots

1960/9/23-1989/12/6 Event Numbers 15 – 1586

(Volume 1: 15-525)

(Volume 2: 521-1000)

(Volume 3: 1001-1586)

One & Two velocity Iterative epicentre locations and epicentre plots

1996/1/8 – 1997/12/30 Event Numbers 1980 - 2077

(Volume 1: 1980-2026)

(Volume 2: 2027-2077)

Remarks: Most reliable data source computed from measured arrival times

Electronic Data: Tasmanian Seismic events

Form: Excel spreadsheet

Origin and author Unknown.

1967/1/27-1997/12/30 Event Numbers 109 – 2077

Total number of events 1332

Contains the following fields

- Event Number
- Year
- Month
- Day
- Hour
- Min
- Sec
- LONG
- LAT
- Magnitude

Remarks:

Contains events that mostly correlate with Geoscience Australia Earthquake database data

Some data entry problems.

2 - Contacts list

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