ICG/PTWS XXIII
NATIONAL REPORT SUBMITTED BY:
NEW ZEALAND

PART 1: BASIC INFORMATION

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4. Tsunami Standard Operating Procedures for Local Tsunami

   Unlike distant source tsunami (more than 3 hours travel time) and regional source tsunami (1 to 3 hours travel time) official warning for local source tsunami is unlikely to be timely in all areas because of the close proximity of faulting, the continental plate subduction zone, and volcanoes along our coastline. The National Tsunami Advisory and Warning Plan (www.mcdem.govt.nz) recognises this reality with the following text:
SPECIAL CONSIDERATION – LOCAL SOURCE TSUNAMIS

A tsunami generated in conjunction with a nearby large earthquake or undersea landslide may not provide sufficient time to implement official warning procedures.

Persons in coastal areas who:

- experience strong earthquakes (hard to stand up);
- experience weak earthquakes lasting for a minute or more;
- observe strange sea behaviour such as the sea level suddenly rising and falling, or hear the sea making loud and unusual noises or roaring like a jet engine;

should not wait for an official warning. Instead, let the natural signs be the warning. They must take immediate action to evacuate predetermined evacuation zones, or in the absence of predetermined evacuation zones, go to high ground or go inland.

While the time constraint is recognised, the same procedures for warning as described below for distant source tsunami apply.

5. Tsunami Standard Operating Procedures for Distant Tsunami

5.1 Responsible Organisations

Ministry of Civil Defence & Emergency Management (MCDEM)

MCDEM maintains a National CDEM Warning System (NWS) for the purpose of the dissemination of national level warnings to local authorities, government departments, lifeline utilities and the public. For this purpose it maintains a 24/7 duty system. Via its duty system, MCDEM is responsible for identification and characterization of tsunamigenic events.

GNS Science (GeoNet)

GeoNet is a national geological hazards monitoring and data collection system operated by GNS Science. It incorporates dual data centres with duty officers on 20 minute 24/7 rapid response to earthquakes, volcanic events, landslides and tsunami. GeoNet is MCDEM’s official advisor for characterization of tsunamigenic events.

The GeoNet Project Director also coordinates a panel of tsunami experts across research and academic institutions in New Zealand. The panel (referred to as the Tsunami Experts Panel) can be activated at any time by GeoNet to assist with interpretation and assessment of data related to a tsunami event.

5.2 Criteria

Initial tsunami advisories or warnings are issued by MCDEM as a default action when information received meet or exceed specific thresholds, and when an event does not meet the thresholds but based on advice received from GeoNet/Tsunami Experts Panel, is considered to hold a potential threat for New Zealand. When an event does not to hold a threat for New Zealand but information otherwise available is considered to potentially lead to public concern a National Advisory- No Threat may be issued.

The thresholds for issuing default initial national tsunami advisories or warnings by MCDEM are described in the National Tsunami Advisory and Warning Plan and are as follows:
Table 1: Thresholds for default tsunami advisories and warnings

<table>
<thead>
<tr>
<th>Region</th>
<th>Location</th>
<th>Thresholds</th>
<th>Template to use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>South West Pacific (includes NZ local source)</td>
<td>Mw ≥9 and Depth &lt;50km or PTWC Warning for NZ</td>
<td>National Warning - Tsunami: Threat to NZ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mw ≥7 - ≤8.9 and Depth &lt;50km or PTWC Watch for NZ</td>
<td>National Advisory - Tsunami: Potential threat to NZ</td>
</tr>
<tr>
<td>2</td>
<td>South America</td>
<td>Mw ≥8.0 and Depth &lt;100 km or PTWC Watch or Warning for NZ</td>
<td>National Advisory - Tsunami: Potential threat to NZ</td>
</tr>
<tr>
<td>3</td>
<td>Central America</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Cascadia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Aelutians Rat Island</td>
<td>PTWC Watch or Warning for NZ</td>
<td>National Advisory - Tsunami: Potential threat to NZ</td>
</tr>
<tr>
<td>6</td>
<td>Kurile Islands Kamchatka</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Japan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Other seas/oceans</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Subsequent national advisories or warnings are issued by MCDEM based on assessment provided by GNS Science and the Tsunami Experts Panel.

5.3 Other Agencies Response
Following the issue of a national tsunami advisory or warning, local authorities are responsible for activating local public alerting mechanisms, following their own procedures, while national agencies activate response plans relevant to their areas of business. MCDEM maintains a Memorandum of Understanding with key media (radio and TV) for the public broadcasting of warnings.

5.4 Dissemination
National tsunami advisories and warnings are disseminated to all local authorities, key national agencies and the media. Information is communicated via the National CDEM Warning System, using SMS, e-mail and fax. The processes applied under the National CDEM Warning System are described in *The Guide to the National CDEM Plan* (www.mcdem.govt.nz).

5.5 Termination
All National tsunami advisories or warnings (except National Advisory- No Threat) are followed up by continuous subsequent advisories/warnings until a formal cancellation is issued via the National CDEM Warning System.

5.6 Response to warnings during intersessional period
During the intersessional period *National Tsunami Advisory- No Threat* notifications were issued by MCDEM for the following events:

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Mag</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.02.08</td>
<td>Indonesia</td>
<td>7.2</td>
</tr>
<tr>
<td>13.04.08</td>
<td>MacQuarrie Islands</td>
<td>7.2</td>
</tr>
<tr>
<td>03.01.09</td>
<td>Irian Jaya Region, Indonesia</td>
<td>7.5</td>
</tr>
<tr>
<td>03.01.09</td>
<td>Irian Jaya Region, Indonesia</td>
<td>7.5</td>
</tr>
<tr>
<td>15.01.09</td>
<td>Kuril Islands</td>
<td>7.5</td>
</tr>
<tr>
<td>19.01.09</td>
<td>Loyalty Islands</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Table 2: Tsunami Advisories issued: 2008- Jan 2009
6. National Sea Level Network

GNS Science and Land Information New Zealand (LINZ) are installing a network of real-time tsunami gauges around the New Zealand coasts and on nearby offshore islands. Upon completion, which is scheduled for mid-2010, the network will consist of 20 tsunami monitoring stations (Figure 1, Table 2). This will include 18 stations owned, designed and operated by New Zealand as part of the LINZ-GNS Science partnership. An additional two stations at Norfolk and Macquarie Islands, which will be owned, designed and operated by the Australians, will complete the network. To date, six New Zealand stations and one Australian station have been installed. These are located at North Cape, Tauranga, Gisborne, Napier, Wellington, Chatham Island and Macquarie Island.

Figure 1: New Zealand Tsunami Monitoring Network. The completed Network will consist of 20 tsunami monitoring stations including two stations on Raoul Island.

At each New Zealand station, sea level will be measured by two pressure sensors submerged in the ocean. Sea level measurements, sampled at 10 Hz, are transmitted to the GeoNet Data Management Centre in Lower Hutt. Data are available to tsunami warning centres in real-time via the GTS as well as over the Internet via Seedlink (a seismic data exchange protocol). Real-time raw and de-tided time series are displayed on the GeoNet website: http://www.geonet.org.nz/tsunami/gauges and freely available for download via the GeoNet ftp site: ftp://ftp.geonet.org.nz/tsunami.
<table>
<thead>
<tr>
<th>NAME</th>
<th>CODE</th>
<th>LATITUDE</th>
<th>LONGITUDE</th>
<th>DATE_OPENED</th>
<th>STATUS</th>
<th>SENSORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macquarie Island (Australian site)</td>
<td>300056</td>
<td>-54.5</td>
<td>158.93</td>
<td>23/12/1993</td>
<td>Operational</td>
<td>1 x Aquatrack &amp; 1 x Druck</td>
</tr>
<tr>
<td>Wellington</td>
<td>WLGT</td>
<td>-41.2846</td>
<td>174.7791</td>
<td>6/03/2007</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Napier</td>
<td>NAPT</td>
<td>-39.4757</td>
<td>176.9201</td>
<td>26/09/2007</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Chatham Island</td>
<td>CHIT</td>
<td>-44.0240</td>
<td>-176.3675</td>
<td>16/12/2007</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Gisborne</td>
<td>GIST</td>
<td>-38.6754</td>
<td>178.0229</td>
<td>10/03/2008</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Tauranga</td>
<td>TAUT</td>
<td>-37.6411</td>
<td>176.1812</td>
<td>21/05/2008</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>East Cape</td>
<td>LOTT</td>
<td>-37.5504</td>
<td>178.1590</td>
<td>10/10/2008</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>North Cape</td>
<td>NCPT</td>
<td>-34.4148</td>
<td>173.0487</td>
<td>23/12/2008</td>
<td>Operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Castlepoint</td>
<td>CPIT</td>
<td>-40.8993</td>
<td>176.2317</td>
<td>1/03/2009</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Boat Cove, Raoul Island</td>
<td>RBCT</td>
<td>-29.2798</td>
<td>-177.8938</td>
<td>1/06/2009</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Fishing Rock, Raoul Island</td>
<td>RFRT</td>
<td>-29.2519</td>
<td>-177.8999</td>
<td>1/06/2009</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Whareongaonga Bay</td>
<td>WHAT</td>
<td>-38.8621</td>
<td>177.9186</td>
<td>30/06/2009</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Auckland</td>
<td>AUCT</td>
<td>-36.8314</td>
<td>174.7865</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Kaikoura</td>
<td>KAIT</td>
<td>-42.4126</td>
<td>173.7028</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Christchurch</td>
<td>SUMT</td>
<td>-43.5696</td>
<td>172.7732</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Dunedin</td>
<td>OTAT</td>
<td>-45.8143</td>
<td>170.6294</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Puysegur</td>
<td>PUYT</td>
<td>-46.0848</td>
<td>166.5894</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Manukau</td>
<td>MNKT</td>
<td>-37.0466</td>
<td>174.5117</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Great Barrier Island</td>
<td>GBIT</td>
<td>-36.1890</td>
<td>175.4889</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>2 x Druck</td>
</tr>
<tr>
<td>Norfolk Island (Australian site)</td>
<td>200XXX</td>
<td>-29.04</td>
<td>167.96</td>
<td>30/06/2010</td>
<td>Non-operational</td>
<td>??</td>
</tr>
</tbody>
</table>

Table 3: New Zealand Tsunami Monitoring Network: site names, codes, locations, date opened (or planned to open), statuses, and deployed sensors. Stations are ordered according to date opened (or planned to open).

7. Information on Tsunami occurrences

Since the installation of the New Zealand tsunami monitoring network, two tsunamis have been detected on the gauges around New Zealand. The Solomon Island tsunami of 2 April 2007 and the Peru tsunami of 15 August 2007 were both detected on the Wellington Harbour tsunami gauge, which was the only tsunami gauge in the GeoNet system that was operating at the time of these events. Several gauges in the NIWA open-coast network (see location map Figure 6 below) detected the events as shown below.
**Solomon Island tsunami**

The Solomon Island tsunami resulted from an MW 8.1 earthquake that occurred at 20:39:56 UTC on 2 April 2007. The focus was located 45 km SSE of Gizo at a depth of 10 km.

Tsunami waves, arriving approximately 12 hours after the earthquake, were detected on the Wellington Harbour tsunami gauge (Figure 2). The maximum observed peak to crest wave height was 23 cm.

![Figure 2: Raw and de-tided data from the 2 April 2007 Solomon Island tsunami measured on the Wellington Harbour tsunami gauge. The vertical line indicates the time of the earthquake.](image)

The NIWA open-coast gauge network detected the Solomon Island tsunami at a number of sites as shown in Figure 3. The maximum observed peak to trough wave height was 110 cm recorded at Charleston on the west coast of the South Island.

![Figure 3: De-tided sea levels from the 2 April 2007 Solomon Islands tsunami measured by various gauges from the New Zealand open-coast network. The vertical line indicates the time of the earthquake.](image)
**Peru (Lima) tsunami**

The Lima tsunami resulted from an MW 8.0 earthquake that occurred at 23:40:57 UTC on 15 August 2007. The focus was located 50 km W of Chincha Alta at a depth of 39 km.

This tsunami was detected on the Wellington Harbour tsunami gauge (Figure 4). The tsunami waves arrived approximately 17 hours after the earthquake. The maximum observed peak to trough wave height was 21 cm.

![Figure 4: Raw and de-tided data from the 15 August 2007 Peru tsunami measured on the Wellington Harbour tsunami gauge. The vertical line indicates the time of the earthquake.](image)

The NIWA open-coast gauge network detected the Peru tsunami at a number of sites as shown in Figure 5. The maximum observed peak to trough wave height was 54 cm recorded at Sumner Head.

![Figure 5: De-tided sea levels from the 15 August 2007 Peru tsunami measured by various gauges on New Zealand’s east coast. The vertical line indicates the time of the earthquake.](image)
8. URL’s of national tsunami-related web sites

www.gns.cri.nz
www.geonet.org.nz/tsunami
www.niwa.co.nz
www.mcdem.govt.nz
PART 2: NATIONAL PROGRAMMES AND ACTIVITIES INFORMATION

9. EXECUTIVE SUMMARY

The Tsunami Risk Management Programme achieved significant progress towards tsunami mitigation in New Zealand during the intersessional period. The programme is led by the Ministry of Civil Defence & Emergency Management (MCDEM) and focuses on improving the quality and effectiveness of warnings, enhancing evacuation planning and standardising signage and public advice.

The work conducted under the Programme focuses on four strands, and is either completed or in the process of completion:

- Knowledge: Improving our understanding of tsunami sources relevant to New Zealand and their threat potential.
- Warning Systems: Upgrading of the National CDEM Warning System and providing guidance to local authorities on public alerting systems.
- Planning: Development of a National Tsunami Advisory and Warning Plan that formally states the warning system for tsunami. Also, providing guidance on tsunami evacuation zones and mass evacuation planning.
- Public Awareness: Setting national standards for tsunami signage and establishing consistent public education/messages.

The programme will continue into the next intersessional period with the focus mainly on further knowledge improvement, e.g. research on regional sources and further development of modelling.

Other tsunami research and monitoring work conducted in the intersessional period described in the Narrative (section 10) includes:

- In addition to the installation of a network of real-time tsunami gauges around the New Zealand coasts and on nearby offshore islands (described in section 6 above), NIWA continued to coordinate and operate an open-coast network of 21 sea-level gauges around New Zealand.
- In addition to a GNS-Science developed catalogue of pre-computed distant source tsunami scenarios likely to affect New Zealand, NIWA has completed several studies of potential coastal inundation from tsunami around the NZ coast using an advanced hydrodynamic computer model.
- Dr James Goff (NIWA–now at University of NSW) completed the compilation of a database of possible and probable paleotsunami events for New Zealand.
10. **NARRATIVE**

**NEW ZEALAND CAPABILITIES IN RELATION TO TSUNAMI MITIGATION**

This section is presented in two parts. Firstly, work conducted under the MCDEM sponsored Tsunami Risk Management Programme is described. Secondly work conducted individually or collectively by research agencies (in particular GNS Science and NIWA) is described as individual items.

### 10.1 Tsunami Risk Management Programme

The Tsunami Risk Management Programme is led by the Ministry of Civil Defence & Emergency Management (MCDEM). It was established late in 2007 to focus on improving the quality and effectiveness of warnings, enhancing evacuation planning and standardising signage and public advice.

To ensure inclusiveness in decisions and subsequent acceptance of outcomes under the programme by local authorities, MCDEM established a Tsunami Working Group to consider and approve a stream of work to improve tsunami resilience in New Zealand. The Working Group represents civil defence emergency management at national and local level and is chaired by MCDEM.

The Working Group agreed that to improve tsunami resilience, the following areas need to be addressed:

- **Knowledge**: Improving our understanding of tsunami sources relevant to New Zealand and their threat potential.
- **Warning Systems**: Upgrading of the National CDEM Warning System and providing guidance to local authorities on public alerting systems.
- **Planning**: Development of a National Tsunami Advisory and Warning Plan that formally states the warning system for tsunami. Also, providing guidance on tsunami evacuation zones and mass evacuation planning.
- **Public Awareness**: Setting national standards for tsunami signage and establish consistent public education/messages.

Work towards all the above areas is funded by MCDEM and has progressed significantly during the intersessional period. The programme will continue into the next intersessional period with the focus mainly on further knowledge improvement, e.g. research on regional sources and further development of modelling.

Individual strands of work conducted under the Tsunami Risk Management Programme are described below.

#### 10.1.1 Distant and Regional Source Modelling

To increase our understanding of distant sources, MCDEM contracted GNS Science to compile a catalogue of pre-computed distant and regional source tsunami scenarios likely to affect New Zealand. The completed catalogue will aim to include estimated near-shore water levels around New Zealand for all known Pacific distant and regional sources at three or more different magnitude levels. This will enable more accurate forecasting by reducing the degree of extrapolation needed to produce forecasts informed by model outputs.

Methodology will also be established to use the pre-calculated models in a real event, through which CDEM planning arrangements will be improved.

The completed catalogue is expected by December 2009.
10.1.2 Upgrade of the National CDEM Warning System

In December 2007 MCDEM started testing a modernised, multi media message dissemination system. The system was further refined in 2008 and is now fully functional as the primary means of disseminating national tsunami advisories and warnings. It has the following capabilities:

- Contact list management
- Warning message template management
- Simultaneously sending of warnings by SMS, e-mail and fax
- After sending a warning, collation of confirmations of receipt of warnings
- Production of delivery and confirmation of receipt reports

MCDEM also entered into an arrangement with the New Zealand Fire Service communications centre in Auckland to support the MCDEM duty team with dissemination of initial warning messages, using the new system.

10.1.3 Assessment of Public Alerting Options

To support local authorities with the selection of the most appropriate public alerting mechanisms, MCDEM commissioned GNS Science to:

- Assess all public alerting options currently available in New Zealand
- Assess and advise on public alerting options not currently available in New Zealand
- Develop an assessment tool that local authorities can apply to identify the most appropriate public alerting mechanisms for their specific circumstances, e.g. demographic, geographic, budget factors

A draft report was tabled and discussed in December 2008. The report is now being finalised, following which a guideline will be published by MCDEM by April 2009.

MCDEM also commissioned the NZ Centre for Advanced Engineering (NZCAE) to conduct a study of New Zealand based telecommunications public alerting systems technology. The objective was to assess the technological possibilities and constraints/barriers to the implementation of public alerting technologies on specific New Zealand telecommunications networks and to suggest potential pathways forward. A draft report was completed at the end of 2008.

10.1.4 National Tsunami Advisory and Warning Plan

A National Tsunami Advisory and Warning Plan was published by MCDEM in June 2008. The Plan states the following:

- Responsibilities (agencies) with regard to tsunami warning
- Processes for tsunami notifications
- Types of tsunami notifications
- Action guidelines
- Templates
- Tsunami categories and threat

The Plan is available on the MCDEM website: www.mcdem.govt.nz

10.1.5 Guideline on Tsunami Evacuation Zones

A standard for tsunami evacuation zones in New Zealand and guidelines for defining and mapping tsunami evacuation zones was published by MCDEM in December 2008. The guideline follows extensive research (looking at experiences elsewhere in the world) and consultation within the Tsunami Working Group.
The Guideline describes three evacuation zones:
- Red zone (a shore-exclusion zone that can be designated off limits in the event of any expected or probable tsunami)
- Orange zone (the area to be evacuated in most if not all distant and regional-source official warnings)
- Yellow zone (provides for local-source maximum credible events, based on locally determined risk. People should evacuate this zone in natural or informal warnings from a local source event)

The *Guideline on Tsunami Evacuation Zones* is available on the MCDEM website: www.mcdem.govt.nz

### 10.1.6 Guideline on Mass Evacuation Planning

A guideline on mass evacuation planning was published by MCDEM in June 2008. The intent of the guideline is to support local authorities with developing evacuation plans for their particular areas/evacuation zones.

The guideline addresses the following aspects related to evacuation:
- Putting evacuation in context
- Planning process
- Planning considerations
- Planning for decision making
- Planning the warning phase
- Planning the evacuation phase
- Planning the shelter phase
- Planning the return phase

The *Guideline on Mass Evacuation Planning* is available on the MCDEM website: www.mcdem.govt.nz

### 10.1.7 National Tsunami Signage Standard

A national technical standard for tsunami signage was published by MCDEM in May 2008 to facilitate consistent tsunami signage across the country. (Being a local authority responsibility there was previously inconsistent signage applied, causing a risk of public unfamiliarity or confusion). The standard is the result of extensive research of international best practice.

The technical standard provides specifications for the following signs:
- Evacuation zone
- Information board
- Evacuation route
- Evacuation-safe location
- Previous event (impact/elevation)

The *National Tsunami Technical Standard* is available on the MCDEM website: www.mcdem.govt.nz

### 10.1.8 Tsunami Public Education Brochure

A brochure aimed at public education on the aspects of tsunami risk, signage and warning (natural and official warnings; and what to do) was published by MCDEM in May 2008. The brochure also represents a standard for public advice in relation to tsunami to enhance consistency in this regard.
The brochure was distributed in large quantities to all local authorities for use when and as they deem fit.

The brochure is available on the MCDEM website: www.mcdem.govt.nz

10.1.9 Tsunami Seminars
A series of seven regional tsunami seminars were sponsored by MCDEM in June, July and November 2008 to introduce local authorities and national agencies to the work committed to and completed under the Tsunami Risk Management Programme (as described in 1.1-1.8 above). Each seminar covered the same topics but was held in a different region across New Zealand.

The presentations used at the seminars are available on the MCDEM website: www.mcdem.govt.nz

10.2 Other Work Conducted by Research Agencies

10.2.1 NIWA sea level network
NIWA continues to coordinate and operate an open-coast network of 21 sea-level gauges around New Zealand, (see Figure 6 below) mostly recording at 1-minute intervals. The system is not real-time, but loggers can be interrogated on demand. A daily update on sea levels, tides, storm surge and tsunami from selected sites can be found at:
http://www.niwa.co.nz/services/free/sealevels

Figure 6: NIWA Open coast sea level network
10.2.2 Paleotsunami Research

Dr James Goff (NIWA–now at University of NSW) completed the compilation of a database of possible and probable paleotsunami events for New Zealand. The database has 330 entries covering a range of information from: a) physical geological and archaeological sources; b) geomorphological evidence; c) cultural information from anthropological research and prehistoric Māori oral recordings. Within the database, the number of credible events probably numbers between 30 and 35 events. The reference is: Goff, J.R. (2008). The New Zealand paleotsunami database. NIWA technical Report No. 131, NIWA, Wellington, 24 p. ISBN 9780478232806

10.2.3 Tsunami Inundation Modelling

In recent years, NIWA has completed several studies of potential coastal inundation from tsunami around the NZ coast. Using an advanced hydrodynamic computer model RiCOM (developed by Dr Roy Walters), it is specifically designed to simulate the propagation and inundation of tsunamis. Combined with high-resolution LiDAR coastal topography, potential inundation at numerous communities from tsunamis of varying sources has been predicted. The sources of the modelled tsunamis were carefully selected as the most-likely worst-case events, and include remote events generated by earthquakes off South America, and local and regional events generated by landslides and earthquakes of varying magnitude in the Hikurangi Trough and the Tonga-Kermadec Trench. Areas of New Zealand modelled to date include communities in Northland and Auckland regions, the Bay of Plenty, Hawkes Bay, Canterbury, Otago and Fiordland.

27 January 2009

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