

# National Report of New Zealand

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## 1. Introduction

New Zealand does not have a formal, nationally administered, network of sea-level gauges. Instead, sea-level gauges are mostly operated independently by various agencies, with some national coordination of daily downloads of data, post processing and archiving undertaken through voluntary partnerships with either Land Information NZ (LINZ) or National Institute of Water and Atmospheric Research Ltd (NIWA). NIWA has been funded in the past by the NZ Foundation for Research Science and Technology to support and coordinate an informal open-coast network. However, large funding cuts in 2004 have curtailed more extensive contributions of quality-assured datasets to New Zealand and international science and geodetic communities. This continues to be an issue but quality-assurance of past records up to 2006 was undertaken with a one-off funding from NIWA with on-demand processing up to 2010 as required.

The following brief report outlines activities in New Zealand associated with sea-level gauges and availability of data. The main developments since the last report have been: a) the completion of a network of tsunami monitoring sites (including offshore islands) around New Zealand; b) further cuts in operational budgets prompted a review of the open-coast network which will result in the closure of up to 5 gauge sites by NIWA in 2011/12.

## 2. Sea Level Stations

A large number of organisations own and operate sea level stations in New Zealand. These stations can be grouped into four categories; sites at major ports operated by the local port company or regional council, an open coast network managed by NIWA, a tsunami monitoring network being established by LINZ in partnership with the Crown-owned research organisation GNS Science's GeoNet Project, and other sites.

## 2.1 Stations at Major Ports

**Table 1:** Sea level stations whose data is used to produce daily tide predictions.

Station	Latitude	Longitude
Marsden Point	35° 50' S	174° 30' E
Auckland	36° 51' S	174° 46' E
Onehunga	36° 56' S	174° 47' E
Tauranga	37° 39' S	176° 11' E
Gisborne	38° 40' S	178° 02' E
Port Taranaki	39° 03' S	174° 02' E
Napier	39° 29' S	176° 55' E
Nelson	41° 16' S	173° 16' E
Wellington	41° 17' S	174° 47' E
Picton	41° 17' S	174° 00' E
Westport	41° 45' S	171° 36' E
Lyttelton	43° 36' S	172° 43' E
Timaru	44° 23' S	171° 15' E
Port Chalmers	45° 49' S	170° 39' E
Dunedin	45° 53' S	170° 30' E
Bluff	46° 36' S	168° 21' E

## 2.2 Open Coast Network

NIWA coordinates a loose nation-wide network of open-coast sea-level gauges in partnership with some port companies (counted above), regional and local councils and for one installation each, the National Tidal Centre, Bureau of Meteorology (Australia) and Antarctica New Zealand. There are currently 17 gauges that are coordinated and/or archived by NIWA, (excluding those stations counted above in Section 2.1), 10 of which are operated by NIWA itself. These stations complement the gauges operated by individual ports (section 2.1) and other local/regional councils (section 2.4). Details on sites and the characteristics of the 18 stations in the open-coast network are listed in Table 2.

**Table 2:** Sea level gauges in an open-coast network (excluding Standard Port Stations). Gauge type abbreviations are: B = gas bubbler with ParoScientific PS2 pressure sensor; SW = still-well float/counter weight + digital logger; US = ultrasonic in air; SEAFR = SEAFRAME acoustic gauge; R = radar.

*Agency abbreviations:* WRC [Waikato Regional Council]; ECan [Environment Canterbury]; NTC [National Tidal Centre, Bureau of Meteorology, Australia]; NRC [Northland Regional Council]; TDC [Tasman District Council]; ORC [Otago Regional Council].

Station (Agency)	Latitude	Longitude	Start date of NIWA archive	Record interval (min)	Gauge Type
Moturiki Is. [NIWA]	37° 38' S	176° 12' E	27-May-1971	1, 5	B+SW
Tararu [WRC]	37° 08' S	175° 31' E	1-Nov-1992	5	US

Sumner Head [NIWA, ECan]	43° 34' S	172° 46' E	3-Jun-1994	1	B
Kaikoura [NIWA]	42° 25' S	173° 42' E	10-Aug-1994	1	B
Jackson Bay [NTC, NIWA]	43° 57' S	168° 37' E	13-Dec-1996	1, 6	SEAFR
Dog Island [NIWA]	46° 39' S	168° 25' E	2-Feb-1997	1	B
Kapiti Is. [NIWA]	40° 51' S	174° 56' E	24-Jul-1997	1	B
Charleston [NIWA]	41° 54' S	171° 26' E	25-Apr-1998	1	B
Anawhata [NIWA]	36° 55' S	174° 28' E	19-Nov-1998	1	B
Whitianga [WRC]	36° 50' S	175° 43' E	13-Jul-1999	5	R
Little Kaiteriteri [TDC]	41° 03' S	173° 02' E	17-Jun-2000	1	B
Tarakohe [TDC]	40° 49' S	172° 54' E	28-Jan-2005	1	B
Kaingaroa [NIWA] (Chatham Island)	43° 44' S	176° 16' W	2-May-2002	1, 5	B
Scott Base [Antarctica NZ, NIWA]	77° 51' S	166° 46' E	15-Jan-2001	5	B
Poutu Point [NRC]	36° 22' S	174° 11' E	21-Apr-2002	5	B
Green Is. [NIWA, ORC]	45° 57' S	170° 23' E	4-Dec-2002	1	B
Kawhia Harbour [WRC]	38° 04' S	174° 49' E	29-Aug-2008	1	B

### 2.3 Tsunami Monitoring Network

LINZ has partnered with GeoNet to improve the system of sea level recorders around New Zealand and its off-shore islands to allow better detection and confirmation of tsunamis.

The establishment of a network of 17 sea level recorder stations was completed mid-2010.

The data from these sites is transmitted to GeoNet which is responsible for monitoring New Zealand's geophysical hazards (earthquakes, volcanoes, landslides and tsunamis). Real time data from this network is available via the Global Telecommunications System (GTS) and plots of the observed and de-tided data are updated every 5 minutes on the GeoNet web-site. Data is also archived and made freely available from the GeoNet and LINZ web-sites.

The Pacific Tsunami Warning Center (PTWC) has a tsunami monitoring station at Waitangi on Chatham Island.

**Table 3:** Operational sea level stations in the tsunami monitoring network.

Dates indicate when the LINZ/GeoNet sites commenced operation.

Station	Latitude	Longitude	Start date
Wellington	41° 17' S	174° 47' E	23-Mar-2007
Napier	39° 29' S	176° 55' E	20-Sept-2007
Owenga (Chatham Island)	44° 02' S	176° 22' W	7-Dec-2007
Gisborne	38° 40' S	178° 02' E	11-Mar-2008
Tauranga	37° 39' S	176° 11' E	6-Jul-2008
Lottin Point	37° 33' S	178° 10' E	10-Oct-2008

North Cape	34° 25' S	173° 03' E	24-Dec-2008
Devonport	36° 50' S	174° 47' E	26-Mar-2009
Boat Cove (Raoul Island)	29° 17' S	177° 54' W	29-May-2009
Fishing Rock (Raoul Island)	29° 55' S	177° 55' W	29-May-2009
Castlepoint	40° 55' S	176° 13' E	7-Oct-2009
Puysegur	46° 05' S	166° 35' E	14-Dec-2009
Port Chalmers	45° 49' S	170° 39' E	25-Feb-2010
Kaikoura	42° 25' S	173° 42' E	27-May-2010
Manukau	37° 03' S	174° 31' E	28-Jul-2010
Korotiti Bay (Great Barrier Is)	36° 11' S	175° 29' E	31-Jul-2010
Sumner	43° 34' S	172° 34' E	11-Aug-2010
Waitangi (Chatham Island)	43° 57' S	166° 33' W	

## 2.4 Other Sea-level Gauge Sites

In addition to the sites described above, continuous sea level measurements are also taken at sites at minor ports, supplementary gauges at major ports and several estuaries. Most of these stations are owned and operated by either local/regional councils or port companies.

LINZ operates a sea level station in Antarctica at Cape Roberts.

**Table 4:** Other sea-level gauge sites.

*Agency abbreviations:* NRC [Northland Regional Council]; BRC [Bay of Plenty Regional Council]; TCC [Tauranga City Council]; POT [Port of Tauranga]; PCC [Porirua City Council]; POL [Port Otago Ltd.]; WRC [Waikato Regional Council]

Station	Latitude	Longitude
Opua (Bay of Islands) [NRC]	35° 19' S	174° 07' E
Rangaunu Harbour (Awanui) [NRC]	35° 00' S	173° 15' E
Frenchman Is. (Marsden Point) [NorthPort–Marsden Pt.]	35° 52' S	174° 32' E
Dargaville [NRC]	35° 56' S	173° 52' E
Tauranga Harbour (Omokoroa) [BRC]	37° 40' S	176° 03' E
Tauranga Harbour (Sulphur Pt.) [POT]	37° 41' S	176° 10' E
Tauranga Harbour (Oruamatua) [TCC/BRC]	37° 42' S	176° 13' E
Tauranga Harbour (Hairini Bridge) [TCC/BRC]	37° 43' S	176° 10' E
Manu Bay (Raglan) [WRC]	37° 49' S	174° 49' E
Whakatane Town Wharf [BRC]	37° 57' S	177° 00' E
Ohiwa Harbour (Ohope Wharf) [BRC]	37° 59' S	177° 06' E
Opotiki Wharf [BRC]	38° 02' S	177° 14' E
Mana (Porirua Harbour) [PCC]	41° 06' S	174° 52' E
Havelock [Port Marlborough NZ]	41° 17' S	173° 46' E
Milford Sound [Environment Southland]	44° 40' S	167° 56' E
Spit Wharf (Otago Harbour) [POL]	45° 47' S	170° 43' E
Avon/Heathcote (Ferrymead) [CCC]	43° 33' S	172° 43' E
Cape Roberts (Antarctica) [LINZ]	77° 02' S	163° 12' E

## 2.5 GLOSS Stations

Five stations in the GLOSS Core Network are located within New Zealand.

GLOSS stations 101, 127 and 129 appear in Table 1, station 128 is included in Table 3 and station 134 is part of Table 2.

**Table 5:** New Zealand's GLOSS Core Network stations.

GLOSS ID	Station
101	Wellington
127	Auckland
128	Waitangi (Chatham Island)
129	Bluff
134	Scott Base (Antarctica)

## 3. Sea Level Measurement Technologies

### 3.1 Stations at Major Ports

Sea level data at all major ports (Table 1) is recorded digitally.

A variety of sea level measurement technologies are used, including sub-surface pressure transducers, float and stilling well, downward-looking radar and ultrasonic systems.

Data is recorded once every minute at half of the sites with the balance producing data at intervals of either 5 or 10 minutes.

### 3.2 Open Coast Network

As listed in Table 2, most of the sites operated by NIWA use a bubbler gauge technology with PS2 ParoScientific pressure sensors, while other installations use either radar, acoustic, ultrasonic or float/counter weight systems (see Table 2).

All sites record data in digital form, mostly at 1 minute recording intervals, with the remaining gauges recording at either 5 or 6 minute intervals.

### 3.3 Tsunami Monitoring Network

Each of the LINZ/GeoNet tsunami monitoring sites listed in Table 3 incorporates a pair of Druck PTX 1830 pressure sensors. The vented sensors have a range of 0 – 20 metres and output a 4-20mA signal. Sea level is measured at a rate of 10Hz and a record is output at 1 minute intervals.

### 3.4 Other Sea-level Gauge Sites

Details of equipment used at these sites has not been collated, however pressure sensors, ultrasonic, bubbler and float/counter weight technologies would be most likely.

#### 4. Continuous GPS (CGPS)

CGPS observations have been made at the major ports (Wellington, Lyttelton and Dunedin since late 1999 and Auckland since 2009). These stations are operated by GNS Science.

#### 5. Data Availability

##### 5.1 Hourly Data for GLOSS stations

- a) Wellington (101) and Bluff (129):  
Fast delivery of data for these GLOSS stations is forwarded to UHSLC each month.
- b) Auckland (127):  
The port company operating this site has refused to make this data available to the international community free of charge.
- c) Chatham Island (128):  
Near real-time data is provided through PTWC.
- d) Scott Base (134): The entire dataset up to the start of 2007 was quality-assured by PSMSL after receipt of data from NIWA and also submitted to UHSLC. Subsequent data for calendar years 2007 to 2010 have been provided to PSMSL by NIWA..

##### 5.2 Monthly and Annual Means (PSMSL)

Data held by PSMSL for other New Zealand stations is improving with new data being added annually. Data supplied to PSMSL since the last GE meeting are summarised in the following table.

**Table 6:** Stations for which monthly and annual mean sea level data has been submitted to PSMSL since the GE XI meeting in 2009.

Station	Data submitted to PSMSL	
	Start date	End date
Marsden Point	January 2008	December 2010
Tauranga	January 2008	December 2010
Napier	January 1989	December 2010
Port Taranaki	January 2008	December 2010
Nelson	January 2008	December 2010
Lyttelton	January 2008	December 2010
Timaru	January 2008	December 2010
Dunedin	January 2008	December 2010
Port Chalmers	January 1985	December 2010
Cape Roberts	January 1990	August 2009

### 5.3 Open Coast Network

The open-coast network data (Table 2) is processed nightly and uploaded to the internet in the form of plots from tide, storm surge and long-wave/tsunami analyses. The web site is:

<http://www.niwa.co.nz/our-services/online-services/sea-levels>

Processed and quality-assured datasets for the NIWA-operated gauges (9 sites) up to the start of 2007 are available by registering with the following web site: <http://edenz.niwa.co.nz/>

Requests for information or data not covered above can be made to the second author of this report – contact details shown on the first page.

### 5.4 Tsunami Monitoring Network

Data recorded by the tsunami monitoring sites is available for free download in the form of daily files. Metadata about the sites and the data can be accessed at the following web site: <http://www.linz.govt.nz/hydro/tidal-info/gauges/sea-level-data-downloads/index.aspx>

### 5.5 Other requests

Metadata for Antarctica gauges at Scott Base and Cape Roberts are listed at: [http://gcmd.nasa.gov/KeywordSearch/Home.do?Portal=amd\\_nz&MetadataType=0](http://gcmd.nasa.gov/KeywordSearch/Home.do?Portal=amd_nz&MetadataType=0) under the Oceans and Tide Gauges sub-sections.

Requests for information or data not covered above can be made to the authors of this report – contact details shown on the first page.

### SEA LEVEL SITES IN NEW ZEALAND

Major port sites (Table 1) are shown in **red**  
 Open coast sites (Table 2) are shown in **green**  
 Tsunami monitoring sites (Table 3) are shown in **purple**  
 Other sites (Table 4, except the Tauranga Harbour sites) are shown in **blue**

Names of GLOSS stations are appended with their GLOSS ID number

