

New Zealand National Seismograph Network

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Ken Gledhill (k.gledhill@gns.cri.nz), Peter McGinty (p.mcginity@gns.cri.nz) and
Mark Chadwick (m.chadwick@gns.cri.nz)
www.geonet.org.nz

GNS Science, Wellington, New Zealand

Introduction

During the last year the broadband New Zealand National Seismograph Network (NZNSN) has grown from 33 to 37 sites, leaving only a single installation to bring the total to the planned 38 stations. However, a major review last year recommended a return to the full scope of the GeoNet project (see below), and funding is now available to increase the planned number to 45, including a station on Chatham Island. The upgrade of the three-component regional short period networks continued during the year, and 39 are now operational. The increased funding will allow this number to grow to over 120 during the next four years. These regional stations provide extra coverage in the volcanic regions and above the Hikurangi subduction zone.

The NZNSN is operated by New Zealand GeoNet, a strongly integrated data collection and analysis project consisting of national seismograph, strong ground motion and continuous geodetic GPS networks combined regional seismic and CGPS networks, and an enhanced volcano-chemistry and remote monitoring capability. It is a 10-year project to design, install and maintain an enhanced geological hazard monitoring and data collection system for New Zealand. GeoNet is operated by GNS Science (a government owned research institute) and funded by the New Zealand Earthquake Commission (EQC), the organisation charged with providing natural disaster insurance in New Zealand.

GeoNet operates two data centres (at Gracefield near Wellington and Wairakei near Taupo) to provide backup in the event of a large earthquake near Wellington or an eruption in the Taupo volcanic region.

The New Zealand National Seismograph Network

The New Zealand National Seismograph Network (NZNSN) stations employ six-component (3D broadband and 3D strong motion) recording and are located throughout the country (see Figure 1) to provide a uniform location and data collection capability for the study of New Zealand and international tectonic problems. They are also used, along with the regional seismograph stations, to provide rapid earthquake locations for public information and responding agencies. The data is transported via IP telecommunications networks mainly based on a VSAT platform provided by Optus of Australia. The currently funded network, shown in Figure 1, has 45 stations with approximate station spacing of 100 km on land throughout New Zealand. The details of the 45 stations are given in Table 1.

Almost all of the NZNSN stations are of a similar physical design and include an instrument vault, equipment hut, and VSAT antenna pole (Figure 2). The sensor vault

is of solid concrete construction with additional insulation and a steel lid. The vault houses a Guralp CMG-3ESP or a Streckheisen STS2 broadband seismometer as well as a Kinemetics Episensor (2g) strong motion accelerometer (Figure 3). The equipment hut is of the “portacom” design made of pre-assembled insulated aluminium panels on a concrete pad. The VSAT dishes range in size from 1.2 m to 2.4 m in diameter. Some of the smaller 1.2 m dishes are mounted on the equipment huts rather than on a separate pad. Several of the stations have either co-located continuous GPS, or act as the communications hub for CGPS stations nearby.

The equipment hut houses the digitiser, VSAT indoor unit and backup power supply (Figure 4). The digitiser used is usually a Quanterra Q4120, although some of the newer sites are now using the six-channel version of the Quanterra Q330 and baler 14F data recording systems. The digitisers are operated at a sampling rate of 100 Hz, and this and a 1 Hz stream is sent in real time to the data centres. Data is also recorded on hard disks within either the Q4120 or the Baler 14F units and can be retrieved later if the data communications is lost.

Data Acquisition and Availability

The Optus VSAT system, which carries data from the remote NZNSN stations, is connected to the GeoNet data centres via an earth station at Belrose, just outside Sydney in Australia, and trans-Tasman terrestrial data connections. The NZNSN stations throughout New Zealand send continuous data to one of the two data centres via one VSAT hop and a terrestrial data link, with adjacent stations sending data to different data centres. As a backup, triggered strong motion data is sent to both data centres, via two VSAT hops, to the VSAT terminals at the data centres to guard against terrestrial network failures likely in a major earthquake.

Data from the NZNSN stations are acquired by computers at the two GeoNet data centres using a combination of COMSERV and SEEDLINK server software. Sites equipped with Quanterra Q4120 data loggers use the manufacturer supplied COMSERV routines to acquire the data which is then inserted into a SEEDLINK server, while sites with Q330 data loggers have their data streams fed directly into the SEEDLINK server using locally written software. The SEEDLINK server allows the continuous data to be transferred between the data centres. The data handling and processing system is based around clients written for SEEDLINK making extensive use of the LIBSLINK software library.

All of the continuous NZNSN data is kept on RAID hard disk arrays as well as backed up on DLT magnetic tape. New hard disk systems are purchased as required, with increases in disk sizes easily keeping up with the increase in data volume as more stations come on line.

The GeoNet web site (www.geonet.org.nz) provides a portal for GeoNet data and information. This site provides general GeoNet information, listings of recent earthquake locations and the status of active New Zealand volcanoes. It provides a facility to search the New Zealand Earthquake Catalogue, and makes NZNSN, CGPS, and strong ground motion data available for download. The GeoNet policy is to make all data collected by the project freely available for research purposes. Data from the NZNSN broadband stations are available using AutoDRM described on the web site.

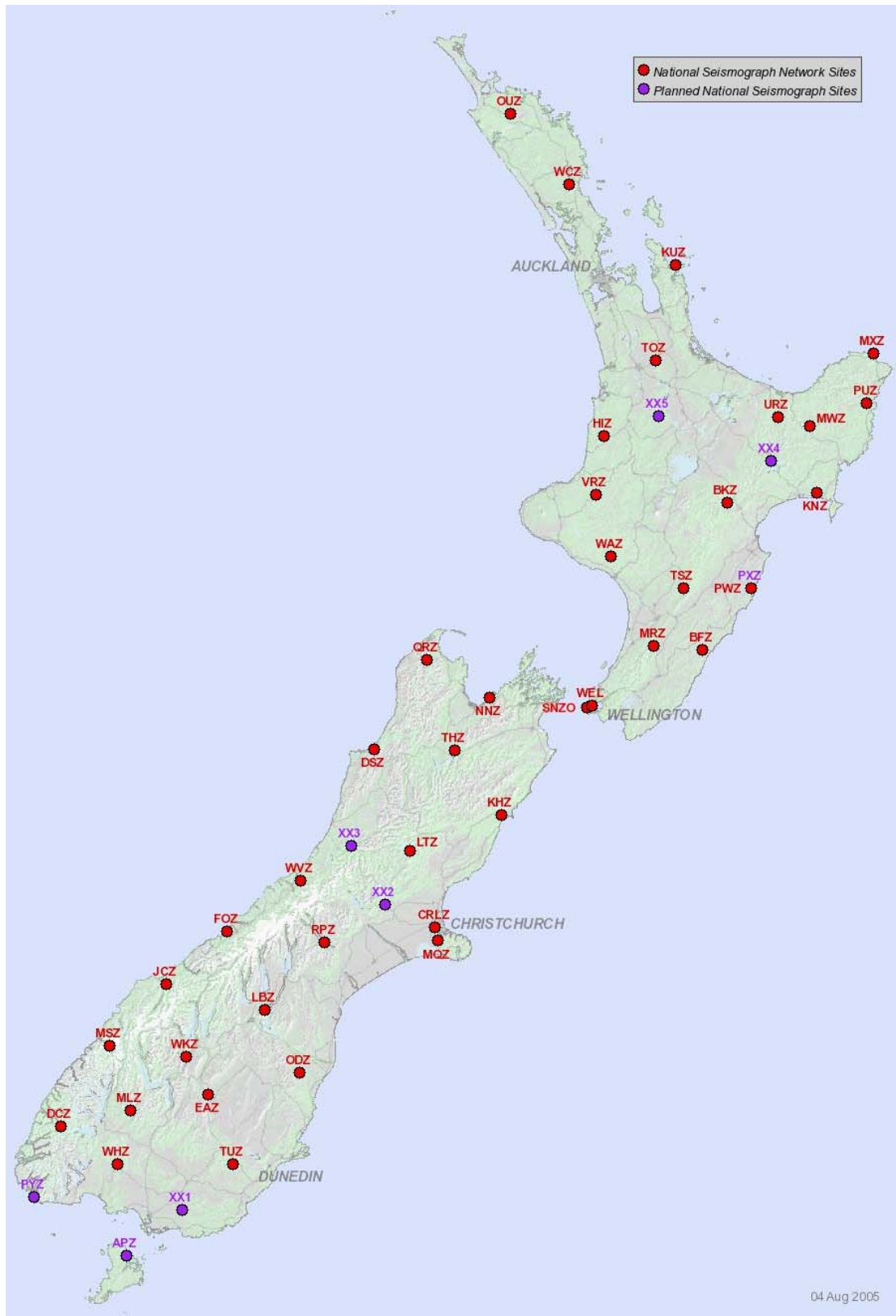


Figure 1. The New Zealand National Seismograph Network. Operational stations are red, while those that are still to be commissioned are purple. We expect to install three of the new stations at the bottom of the South Island within the next year.



Figure 2. A photograph of the NZNSN station MLZ showing the VSAT dish (on left) and equipment hut (far left). The sensor vault is located behind the rock outcrop to the right, and a GPS monument can be seen at the top of the rock outcrop.



Figure 3. A view of a NZNSN vault with a Streckheisen STS2 broadband seismometer and Kinematics Episensor installed.



Figure 4. A photograph of the inside of a NZNSN equipment hut showing the orange Quanterra Q4120 to the left and the VSAT indoor unit to the right on the bench. The digitiser and VSAT communications equipment have separate power supplies with backup batteries on the floor of the hut. This site also records the data from a CGPS station (using a Trimble NetRS) via a Freewave Ethernet Bridge radio to the left of the Quanterra.

Table 1. The details of the New Zealand National Seismograph Network stations. The digitisers are either Quanterra Q4120s or Quanterra Q330s. All sites have both broadband seismometers and accelerometers. The broadband sensors are made by Streckheisen (STS2), or Guralp (CMG-40T, CMG-3ESP, or CMG-3TB). The communications all use Internet protocols, over Ethernet radio bridges (Radio), Very Small Aperture Satellite Terminal (VSAT), and Frame Relay (FR). Stations marked with a “*” in the date installed column are still to be installed, and an approximate install date is given. The stations with XX* station codes do not yet have confirmed sites or station codes, and the locations given are approximate.

Station Name	Code	Latitude (deg.)	Longitude (deg.)	Altitude (m)	Digitiser	Sensors	Data Transfer	Date Installed
Omahuta	OUZ	-35.2214	173.5961	40	Q4120	STS2/Episensor	VSAT	26/08/2003
Waipu Caves	WCZ	-35.9411	174.3444	140	Q4120	3ESP/Episensor	VSAT	27/08/2003
Kuaotunu	KUZ	-36.7472	175.7200	40	Q330	3ESP/Episensor	VSAT	5/02/2004
Matakoa Point	MXZ	-37.5640	178.3066	126	Q330	3ESP/Episensor	VSAT	19/02/1004
Tahuroa Road	TOZ	-37.7308	175.5019	109	Q4120	40T/Episensor	VSAT	16/10/1998
Puketiti	PUZ	-38.0733	178.2572	420	Q4120	3ESP/Episensor	VSAT	20/08/2003
Urewera	URZ	-38.2603	177.1103	100	Q4120	3TB/Episensor	VSAT	25/05/2001
Ngaroma	(XX5)	-38.30	175.56	-	Q330	3ESP/Episensor	-	2008*
Matawai	MWZ	-38.3359	177.5275	600	Q330	3ESP/Episensor	VSAT	18/02/2004
Hauiti	HIZ	-38.5147	174.8555	266	Q4120	STS2/Episensor	VSAT	3/02/2004
Hopuruahine Landing	(XX4)	-38.72	177.05	-	Q330	3ESP/Episensor	-	2008*
Kokohu	KNZ	-39.0214	177.6736	49	Q4120	40T/Episensor	VSAT	19/10/1998
Vera Road	VRZ	-39.1263	174.7584	182	Q4120	3ESP/Episensor	VSAT	26/11/2003
Black Stump Farm	BKZ	-39.1675	176.4923	729	Q4120	STS2/Episensor	VSAT	11/02/2004
Wanganui	WAZ	-39.7563	174.9852	401	Q4120	3ESP/Episensor	VSAT	27/11/2003
Pawanui	PWZ	-40.0314	176.8617	65	Q4120	3ESP/Episensor	VSAT	22/03/2001
Takapari Road	TSZ	-40.0603	175.9610	547	Q4120	3ESP/Episensor	VSAT	27/01/2004
Mangatainoka River	MRZ	-40.6625	175.5792	320	Q4120	3ESP/Episensor	VSAT	31/07/2003
Birch Farm	BFZ	-40.6817	176.2461	318	Q4120	STS2/Episensor	VSAT	30/07/2003
Quartz Range	QRZ	-40.8275	172.5289	260	Q4120	STS2/Episensor	VSAT	11/08/2003
Nelson	NNZ	-41.2166	173.3666	145	Q4120	3ESP/Episensor	VSAT	12/08/2003
Denniston	DSZ	-41.7469	171.8025	661	Q4120	40T/Episensor	VSAT	31/08/1998

Top House	THZ	-41.7639	172.9036	760	Q4120	3ESP/Episensor	VSAT	8/08/2003
Kahutara	KHZ	-42.4181	173.5403	70	Q4120	STS2/Episensor	VSAT	6/08/2003
Inchbonnie	(XX3)	-42.72	171.46	-	Q330	3ESP/Episensor	-	2007*
Lake Taylor	LTZ	-42.7833	172.2667	640	Q4120	3ESP/Episensor	VSAT	27/02/2004
Waitaha Valley	WVZ	-43.0764	170.7361	75	Q4120	3ESP/Episensor	VSAT	6/09/2003
Springfield	(XX2)	-43.33	171.92	-	Q330	3ESP/Episensor	-	2007*
Fox Glacier	FOZ	-43.5655	169.6886	10	Q330	3ESP/Episensor	Radio/VSAT	13/10/2004
McQueen's Valley	MQZ	-43.7078	172.6522	61	Q4120	40T/Episensor	VSAT	31/08/1998
Rata Peaks	RPZ	-43.7192	171.0539	412	Q4120	3TB/Episensor	VSAT	6/06/2001
Chatham Islands	(XX6)	-43.95	-176.45	-	Q330	3ESP/Episensor	-	2007*
Jackson Bay	JCZ	-44.0750	168.7853	1072	Q330	3ESP/Episensor	Radio/VSAT	2/06/2004
Lake Benmore	LBZ	-44.3872	170.1842	423	Q330	3ESP/Episensor	VSAT	5/06/2004
Milford Sound	MSZ	-44.6753	167.9275	90	Q330	3ESP/Episensor	VSAT	1/06/2005
Wanaka	WKZ	-44.8285	169.0176	564	Q4120	3ESP/Episensor	VSAT	3/06/2004
Otahua Downs	ODZ	-45.0453	170.6444	270	Q4120	STS2/Episensor	VSAT	12/09/2003
Earnsclough	EAZ	-45.2327	169.3082	320	Q330	3ESP/Episensor	Radio/FR	5/11/2004
Mavora Lakes	MLZ	-45.3481	168.1728	640	Q4120	3ESP/Episensor	VSAT	9/09/2003
Deep Cove	DCZ	-45.4678	167.1542	50	Q330	3ESP/Episensor	VSAT	30/07/2005
Wether Hill Road	WHZ	-45.8939	167.9467	320	Q4120	40T/Episensor	VSAT	20/03/2001
Tuapeka	TUZ	-45.9561	169.6322	110	Q4120	3ESP/Episensor	VSAT	10/09/2003
Glenham	(XX1)	-46.40	168.85	-	Q330	3ESP/Episensor	VSAT	Q2 2006*
Puysegur Point	PYZ	-46.7778	166.6806	257	Q330	3ESP/Episensor	Radio/FR	Q2 2006*
The Paps (Stewart Island)	APZ	-46.8331	167.9889	573	Q330	3ESP/Episensor	Radio/FR	Q1 2006*