Institute of GEOLOGICAL & NUCLEAR SCIENCES Limited

NIWA Taihoro Nukurangi

Natural Hazard Update

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Located in a tectonically active region in the roaring forties, New Zealand is vulnerable to a wide range of natural hazards. Our landscape and activities are to a large extent shaped by the impact of natural hazards, hence a working knowledge of them is vital for our continuing economic prosperity and environmental sustainability.

GNS and NIWA have established a Natural Hazards Centre to strengthen the links between scientists, policy makers, planners, and emergency managers by providing a focal point for science-based information on natural hazards. The key role of the Centre is to communicate research results, but it will also seek feedback to help formulate future research, and provide services, to ensure that hazards research is responsive to end-user needs. The Centre is a virtual centre, rather than a single location, encompassing the nationwide activities of GNS and NIWA. It is intended to be inclusive, combining information from other stakeholders where appropriate. In this way the Centre will provide integrated research-based information and tools to organisations and communities to help improve their resilience to natural hazards and better manage the risk through informed choice.

GNS and NIWA have significant public good hazard research programmes, and individual links with a range of end users. Our complementary research activities cover the spectrum of New Zealand hazards – storm, flood, drought, landslip, earthquake, volcano, storm surge, waves, coastal erosion, and tsunami. The research is supported by national monitoring networks (e.g., the climate network, hydrological network, sea-level network, the EQC-funded GeoNet network of seismic and volcanic recorders, and the GPS deformation network, part funded by LINZ). By working together through the Centre, we can make better progress towards increasing the resilience of New Zealand communities. The Centre will provide information based on existing data, and will provide warning systems and tools as they are developed. Key target audiences will be central government agencies responsible for hazard-related policy, regional and district councils, emergency response planners and practitioners, utilities operators, and the insurance industry.

This quarterly newsletter will be one of the vehicles used to disseminate information. Each issue will provide a review of recent hazards, news, information on coming events, and a focus on a particular natural hazard. The Centre has a website (www.naturalhazards.net.nz), and presentations and workshops will be given on specific hazards or regions.

We hope you find the establishment of the Natural Hazards Centre a useful initiative, and look forward to your feedback and support in its future development.

Alex Malahoff (Chief Executive, GNS)

Rick Pridmore (Chief Executive, NIWA)

Public response to emergency warnings: lessons from the warning of the 1960 Chile earthquake tsunami

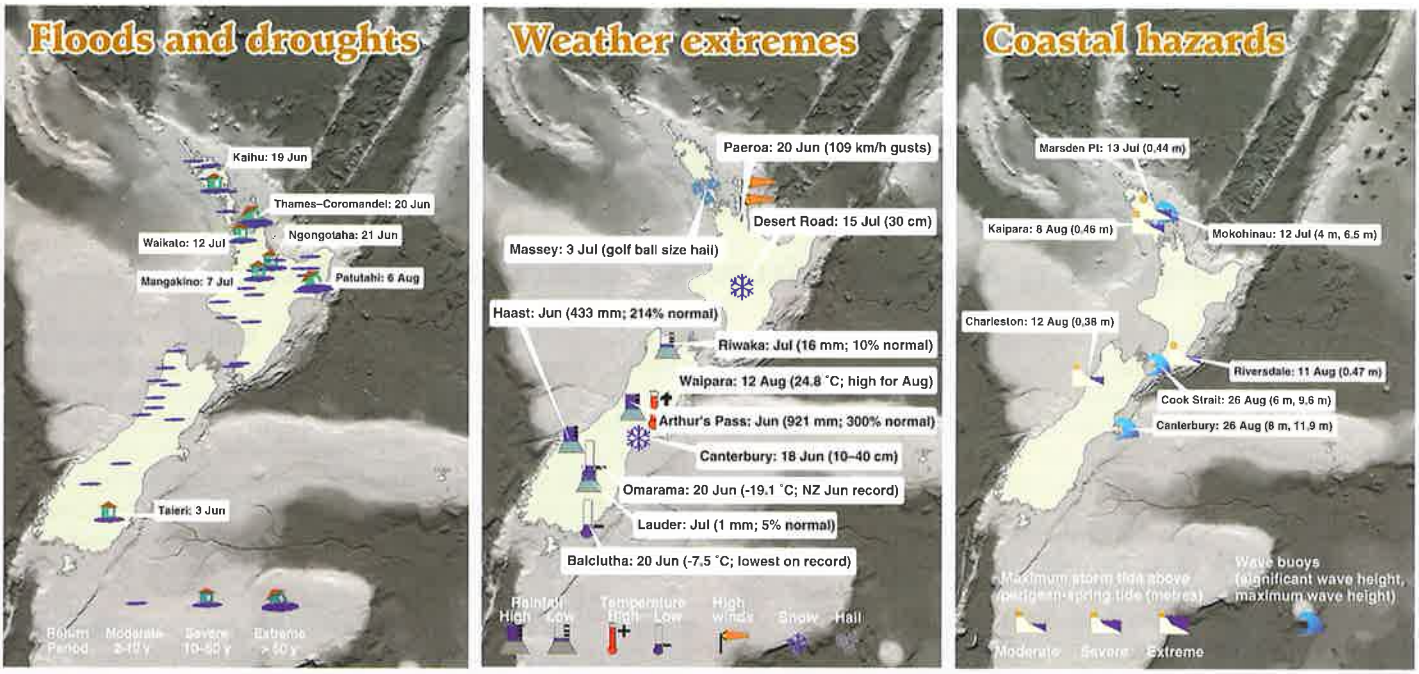
On 23 May 1960 a magnitude 8.5 earthquake in southern Chile generated a tsunami that swept across the Pacific. Despite the warnings, there was a major loss of life in Chile, Hawaii, and Japan. No deaths or injuries were recorded in New Zealand, but there was widespread damage to coastal facilities and small boats. A recent study by David Johnston (GNS) and Rylee Petterson (now at Wellington Regional Council) reviewed public responses to the tsunami warning.

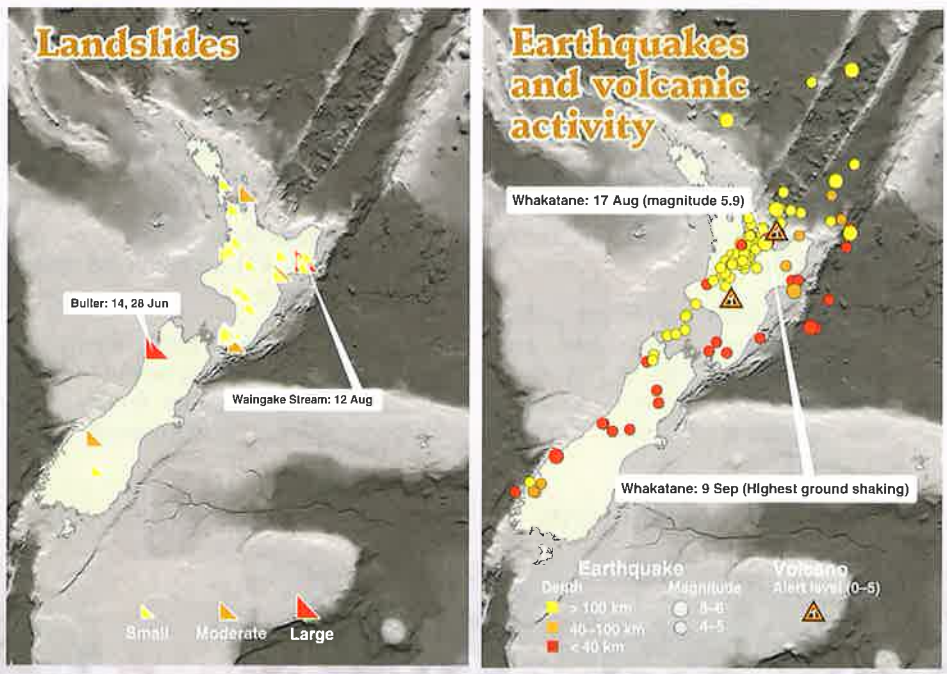
May 1960, the Chilean tsunami "seen" from the Gisborne Wharf.

The warning broadcast by nationwide radio led to the evacuation of several east coast towns. Newspapers reported that thousands of people were evacuated, making this the largest ever evacuation in New Zealand history. Almost the entire populations of Whitianga, Waihi Beach, Whakatane, Ohope, and Opotiki were moved to high ground for several hours, and in many other communities, people from coastal fringes were moved inland. Schools in low-lying coastal areas were closed, and children were sent home or to higher ground. However, there were widespread reports of people ignoring the warnings and moving to the coast to get a better view of the approaching tsunami. This could have been disastrous for the "spectators". After the event there was much discussion in the newspapers of the need to improve the warnings and public awareness of the threat. These issues are still relevant, and a survey of several coastal communities is planned this summer to explore public awareness of coastal hazards and the national tsunami warning system.

David Johnston (d.johnston@gns.cri.nz)

Natural hazards in winter 2002 (June–August)





This quarter in history ...

The BIG snow that hit Canterbury in 1945

13–14 July 1945

An exceptionally heavy mid-winter snowfall, accompanied by freezing, blizzard-like conditions, occurred down to sea level overnight throughout coastal areas of Canterbury. The snowfall in and around Christchurch, Ashburton, and Timaru was substantial, as much as 30–45 cm in many areas. Although the snowstorm lasted only a day, snow lay on the ground for at least 5 days, causing major disruptions, especially for traffic. This heavy snowfall was similar to that of 1903, but not as bad as 1895 in some places!

Cathedral Square on 14 July 1945 (*Christchurch Star*).

Spotlight on ...

tsunami

Tsunami are underrated hazards in New Zealand. The last major tsunami to hit our shores was caused by an earthquake in Chile in May 1960. A generation has since passed, with little awareness of what to do after a tsunami alert.

Tsunami is a Japanese word meaning "harbour wave or waves" and is now used internationally. In the past, people called them "tidal waves", but this is a misnomer because they have nothing to do with tides. Instead, they are generated by large seafloor earthquakes, submarine landslides (which may be triggered by an earthquake), undersea volcanic eruptions, large coastal or lakeside landslides (which is why the slip-prone shores of Lake Dunstan were strengthened), and very occasionally a meteorite splashdown.

In each case, a large volume of water is suddenly moved, generally as a column from the floor of the ocean to its surface, creating a train of waves radiating outwards until the waves either dissipate or collide with a shoreline (similar to the wave train produced by a pebble thrown into a lake). These waves can arrive at nearby shores within minutes, or travel across the deep ocean basins at speeds of more than 500 km/h. Large, remote earthquakes in the Americas can generate waves that are big enough to cause damage on our side of the Pacific Ocean. However, locally generated tsunami do not need such a large disturbance to be damaging.

Tsunami differ from the waves we see at the beach because the distance between successive wave crests (wavelength) is 20–400 km, rather than tens of metres, and the time between successive waves crests is several minutes to an hour, rather than a few seconds. A tsunami would not be noticed well out at sea because of these large wavelengths and small wave heights of less than 0.5 m. However, as they reach shallow coastal waters, they slow down and steepen rapidly, sometimes reaching heights of 10 m or more. Shallow bays and harbours tend to focus the waves and cause them to bounce around (or resonate), which is why the Japanese called them "harbour waves". Tsunami waves can surge considerable distances inland in low-lying areas because the whole ocean is behind them in the form of a long wave.

New Zealand has experienced damaging tsunami from both remote and local sources. For example, an earthquake off northern Chile/southern Peru in August 1868 produced a series of waves that disturbed seas around New Zealand for 36 hours, reaching a maximum of 3.1–3.5 m above the normal water levels at Lyttelton and 5–10 m at the Chatham Islands. The most recent notable local source tsunami was in March 1947, when an earthquake off Poverty Bay, probably accompanied by an underwater landslide, produced a 10 m high tsunami north of Gisborne.

So why worry about tsunami? Large tsunami (say 10 m high) may be infrequent, but they are usually catastrophic, which means the risk of damage and loss of life is considerable for low-lying coastal areas. Smaller tsunami of about 1 m are more frequent, occurring somewhere in New Zealand about once every 10 years on average, but if they coincide with a high spring tide or a local storm, significant damage from sea flooding can occur. GNS and NIWA have several tsunami research initiatives, including the numerical modelling of tsunami propagation and searching for historical and geological evidence of past large tsunami. Recent marine geological research by GNS and NIWA on our east coast continental shelf and north of the Bay of Plenty has produced some spectacular images of the seafloor and provided the means to identify potential local tsunami threats from submarine landslides, fault ruptures, and volcanoes. This research will be used to determine the tsunami risk for the Bay of Plenty and Coromandel (see back page).

The remains of a four-room Poverty Bay house destroyed by a tsunami in March 1947. Three people rode out the tsunami in the house while two others ran across the road and up the hill with the water at their heels. Pouawa, where the bridge was destroyed, is in the distance. (*Weekly News, 2 April 1947*)

A second wave was photographed by local farmer, Mr Williams. He felt the earthquake and saw a disturbance near Ariel Reef and the approach of the first wave. He ran inside to get his camera, missed the first wave, but photographed the second. The waves were 5–10 minutes apart. He then went down the hill and photographed the damage to his fences, stockyard, and woolshed. Seaweed was tangled in the wires of a private phoneline 3–3.5 m above the ground, and about 9 m above high tide. Waves went about 75 m inland at the woolshed (steep slope), and about 300 m at Tatapouri Hotel. Storm waves normally crossed the main road and reached his boundary fences, but the fence posts were snapped off by the tsunami. (W. de Lange, University of Waikato)

See also: www.pmel.noaa.gov/tsunami/ and www.nerc-bas.ac.uk/tsunami-risks/

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5th Natural Hazards Management Conference, Wellington (14–15 Aug 2002)

170 people attended the 5th New Zealand Natural Hazards Management Conference at Te Papa. The theme, "Science to Practice", echoed the original intent of the first conference in this series, held in Wellington in 1994. Four keynote addresses were given by Professor Russell Blong (*Dancing with risk*); Dr Harry Keys (*Integrating science and practice: lessons from Ruapehu's crater lake*); Murray Dudfield (*The art and science of wildland fire management*); and Professor Tony Taylor (*Disasters: the human element*). Key themes were: research, science to practice, geological hazards, atmospheric hazards, water hazards, hazard education, risk management, and "the way forward". Karen Stephens (Wellington Emergency Management Office) summed up the conference as an enjoyable event that covered a diverse range of interesting and informative topics. The Ministry of Civil Defence & Emergency Management encouraged student participation by sponsoring several students. The conference achieved its objectives: it illustrated current activities of applying natural hazards science to practice, mixed researchers with practitioners, shared numerous advances in hazard research, and, we hope, broadened minds.
Contact Dianne Tilyard for a copy of the proceedings (d.tilyard@gns.cri.nz). These conferences are held every 2 years; the next will be in 2004.

David Johnston, Peter Wood (d.johnston@gns.cri.nz) & Warren Gray (w.gray@niwa.co.nz)

Coastal & Storm Hazards Workshop, Hamilton (25–26 March 2002)

What is "coastal squeeze"? What effect will global warming have on our coast? Are storms likely to increase? What information is needed by coastal resource managers to better manage natural hazards? These questions and more were addressed at the Coastal & Storm Hazards Workshop, which was attended by over 90 people from a wide range of organisations. Brief research and sector perspectives on coastal and storm hazards were complemented by discussions on priorities for research and information/services to improve the assessment of risk and build resilient, sustainable communities.
Identified needs and priorities included:

- turning "hazard information" into "risk information";
- urgent development of a coastal margins topographic database; more open access to data;
- closer links between science providers and local/ regional authorities;
- better predictions on future storminess and climate effects on natural hazards;
- the huge planning issue of raising the public awareness of risks for seaside communities.

The proceedings are available as a pdf from:
www.niwa.co.nz/rc/prog/chaz/news/hazard

Rob Bell & Terry Hume (r.bell@niwa.co.nz)

Massive flood damage near Gisborne

Rain started to fall late in the evening of 5 August, dumping more than 300 mm of rain in the Gisborne ranges over the next 24 hours, causing rivers to rise and overflow their banks. Some 60 evacuations were made, and the floodwaters caused extensive damage to farms and roads. Homes were flooded at Ngatapa/Patutahi near Gisborne, and a driver who ignored roadblocks had to be rescued from the roof of his submerged car near Te Karaka. All in all, another "lucky escape" which gave us a reminder of our vulnerabilities and a reality check on some of our land-use activities.

Richard Steele (Gisborne District Council) & Ross Woods (r.woods@niwa.co.nz)

GeoNet

The New Zealand GeoNet project is a 10 year collaborative project involving the Earthquake Commission (EQC) and GNS. GeoNet will provide real-time monitoring and data collection for rapid response and research into earthquake, volcano, and landslide hazards. As part of the initiative, a major upgrade of the geological hazards monitoring network in New Zealand is under way. The funding arrangements mean open access to data generated from GeoNet. Check the website (www.geonet.org.nz/) for the latest earthquake events and the volcano cams.

Hugh Cowan (h.cowan@gns.cri.nz)

Development rides on 3 year tsunami study

Decisions on how coastal subdivisions develop in the Bay of Plenty and eastern Coromandel could be shaped by a new study assessing the tsunami risk. Two regional councils, Environment B·O·P and Environment Waikato, have joined forces and resources to commission research into pre-European and historic tsunami impacts on their coastlines, stretching from Cape Colville (Coromandel) through to Cape Runaway (near East Cape).

The task has been contracted to a consortium of tsunami experts from the Natural Hazards Centre (GNS & NIWA) and James Goff from GeoEnvironmental Consultants.

The main aims of the study are to determine how many major tsunami impacts have occurred over the past 6000 years, to identify particularly vulnerable localities, and to determine priorities for future investigation and action, if tsunami impacts are identified. The study will also assess the likely sources that may generate tsunami which could affect the study coastline.

If it is clear from past events that there are significant tsunami risks to the Bay of Plenty and eastern Coromandel coasts, the work will move on to suggest options for managing the risk, and assessing the most appropriate means of putting the best options into effect.

Russ Martin, Environment B·O·P, (Phone: 0800 368 267)

Natural Hazards Update

Natural Hazards Update is a quarterly newsletter from the joint GNS and NIWA Natural Hazards Centre.

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