

# NIWA Natural Hazards

setting the foundation for a safer future

## Tsunami: how will you know one's coming?

First, GeoNet monitors earthquakes, volcanoes, and underwater landslides in the New Zealand region round the clock ([www.geonet.org.nz/](http://www.geonet.org.nz/)).

Second, a system of sea-level gauges is required to confirm whether there is a tsunami or not. For example, on Christmas Eve last year, there was a magnitude 8.1 quake to the west of Auckland Islands, but it generated only small waves up to 20 cm high which arrived at NIWA's Dog Island gauge in Foveaux Strait 3 hours later.

Tsunami from the other side of the Pacific are detected by the Pacific Tsunami Warning Center ([www.prh.noaa.gov/ptwc/](http://www.prh.noaa.gov/ptwc/)).



*NIWA team servicing a sea-level gauge at Anawhata on West Auckland coast.*

Closer to home, NIWA coordinates and disseminates data on tsunami, storm-tides, and other coastal hazards from a network of 21 gauges around New Zealand, including Chatham Islands and Antarctica (Scott Base). Over half of the gauges are operated by outside organisations who have partnered with us. Data are uploaded nightly and some sites are displayed at [www.niwa.co.nz/services/sealevels/](http://www.niwa.co.nz/services/sealevels/). Currently, any emergency response in detecting and confirming a tsunami is undertaken on a best-endeavours basis. Plans for the near future include upgrading the service so it can deliver a round-the-clock service to emergency managers.

Once a tsunami is confirmed, emergency managers can activate public warnings and evacuation plans. However, if a tsunami is generated very close to shore, it may take only a few minutes to reach the coast with little time for warnings. In vulnerable coastal areas, people need to be forewarned of the risk and move to safer ground when they feel a strong earthquake or notice unusual sea behaviour.

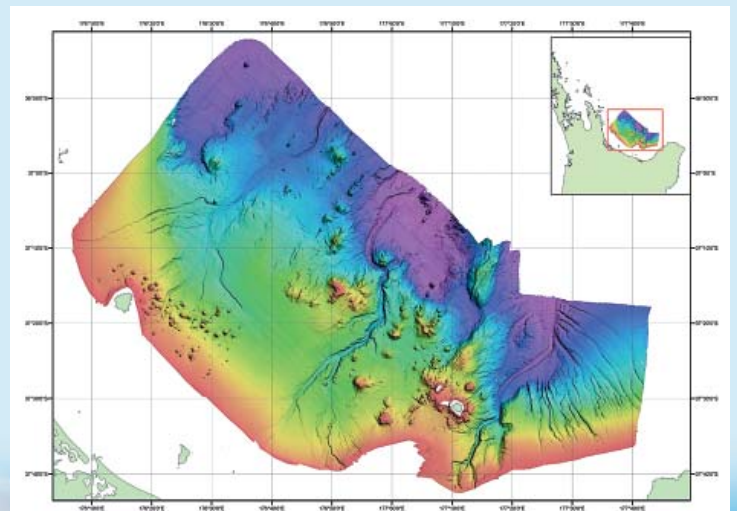
## Bay of Plenty tsunami hazard higher than thought

A study led by NIWA, with GeoEnvironmental Consultants and GNS, has found tsunamis pose a greater threat to the Bay of Plenty and eastern Coromandel coast than previously thought.

The work was commissioned by Environment Bay of Plenty and Environment Waikato to help them with civil defence planning for tsunamis.

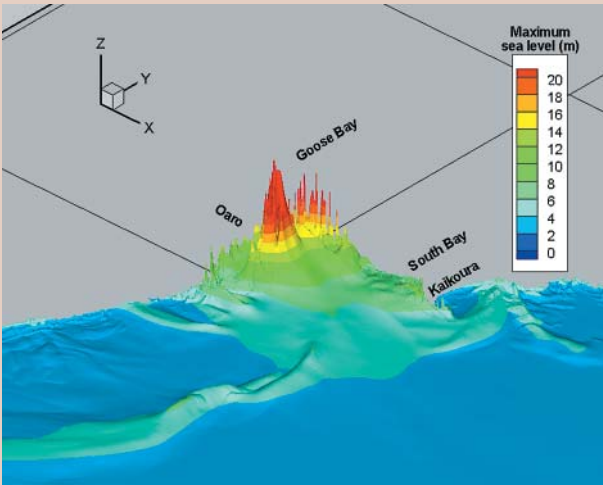
In the last 4000 years, the eastern coastline has experienced five or six local or regional tsunami that reached more than 5 m above the pre-tsunami sea-level. There have been at least 11 smaller tsunamis since historical records began, about 160 years ago.

Many of the tsunamis that have affected this coast have been generated from distant locations, most notably due to earthquakes along the coastline of Chile and Peru. Potential local tsunami sources include movement on one of the active undersea faults between Whakatane and Tauranga, or from a submarine landslide. Local tsunamis have short warning times – under 60 minutes. Regional tsunami sources, where a wave would take 2 to 3 hours to reach the coast, include some of the 23 undersea volcanoes along the southern Kermadec arc.



## How might a tsunami affect Kaikoura?

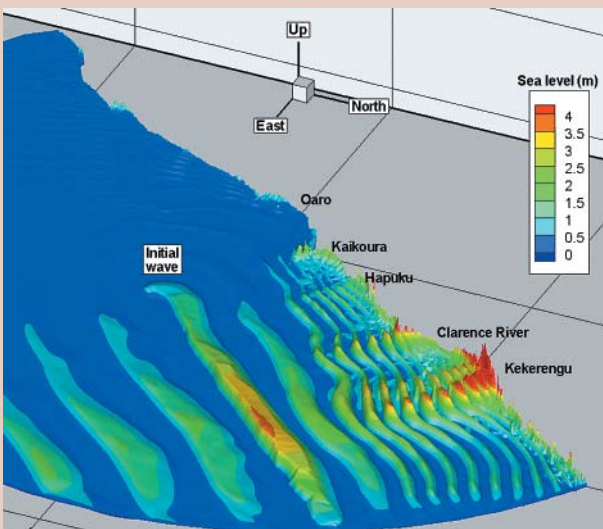
For the past two years, we have been working with Environment Canterbury to assess the potential impact of tsunamis on the Kaikoura coast, using a new form of computer modelling that can mimic a tsunami wave rushing over dry land and around obstacles.



*Predicted maximum water levels for a tsunami generated by a large submarine landslide at the head of Kaikoura Canyon.*

The image above shows a severe, but realistic, case where the tsunami coincides with a spring tide and a moderate storm surge. The first wave arrives at Goose Bay about 1 minute after the landslide starts. In places, the water goes over 20 m higher than the sea level before the tsunami.

Our seabed mapping shows the head of Kaikoura Canyon has become filled with sediment, and our analysis of sediment samples indicates that there have been large submarine landslides in the past, probably triggered by earthquakes. The return period for major earthquakes at Kaikoura has been estimated as a century or two. There has not been one at least since written records began in about 1840.



*Snapshots, taken 100 seconds apart, of the path of a tsunami generated by the rupturing of the Kekerengu Bank fault.*

The scenario shown here also assumes the tsunami coincides with a spring tide and storm surge. The initial wave arrives at the Clarence River just over 11 minutes after the quake. The worst damage to Kaikoura township does not occur until over an hour later, when a wave spreads south hugging the coast and overtops the roadway at the curve before the wharf.

## Lessons from Thailand

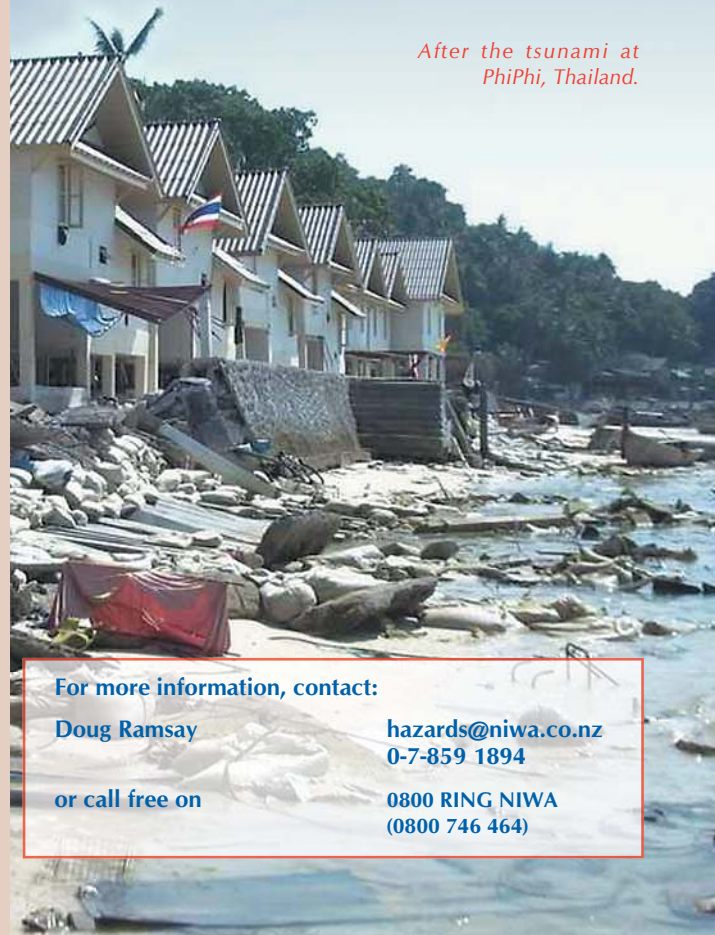
'The wall of water was up to 11 metres or three storeys high in places such as Khao Lak. The damage was catastrophic, and the backwash from the retreating water was as devastating as the incoming torrent' says NIWA tsunami expert, Dr Rob Bell.

Rob was part of the reconnaissance mission that went to Thailand after the Boxing Day tsunami to look at lessons for New Zealand.

'Coastal residents and visitors need not worry unduly about the tsunami threat, but everyone should know the quickest escape routes and the danger signs. In Thailand, people felt the earthquake and 2 hours later the sea drained out well below the normal low tide level for about 5 to 10 minutes before the tsunami struck.'

'We don't think building design and construction needs changing, but we think a review of planning requirements and evacuation procedures for low-lying coastal areas could save lives. We need a combination of systems for early detection of tsunamis, multiple ways of issuing consistent warnings, evacuation plans, plans for immediate response to the event, strengthening or relocating critical facilities that are close to beaches, and the coupling of long-term planning of coastal subdivisions with emergency management plans.'

The reconnaissance mission was sponsored by the N.Z. Society for Earthquake Engineering and the Earthquake Commission.



*After the tsunami at PhiPhi, Thailand.*

**For more information, contact:**

**Doug Ramsay**

**hazards@niwa.co.nz**  
**0-7-859 1894**

**or call free on**

**0800 RING NIWA**  
**(0800 746 464)**