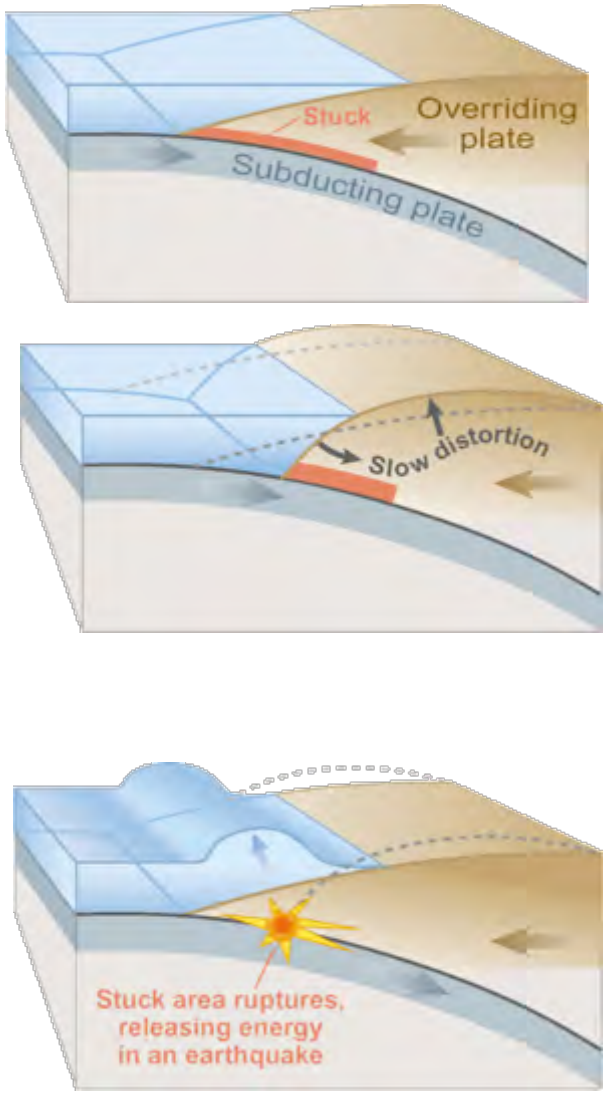
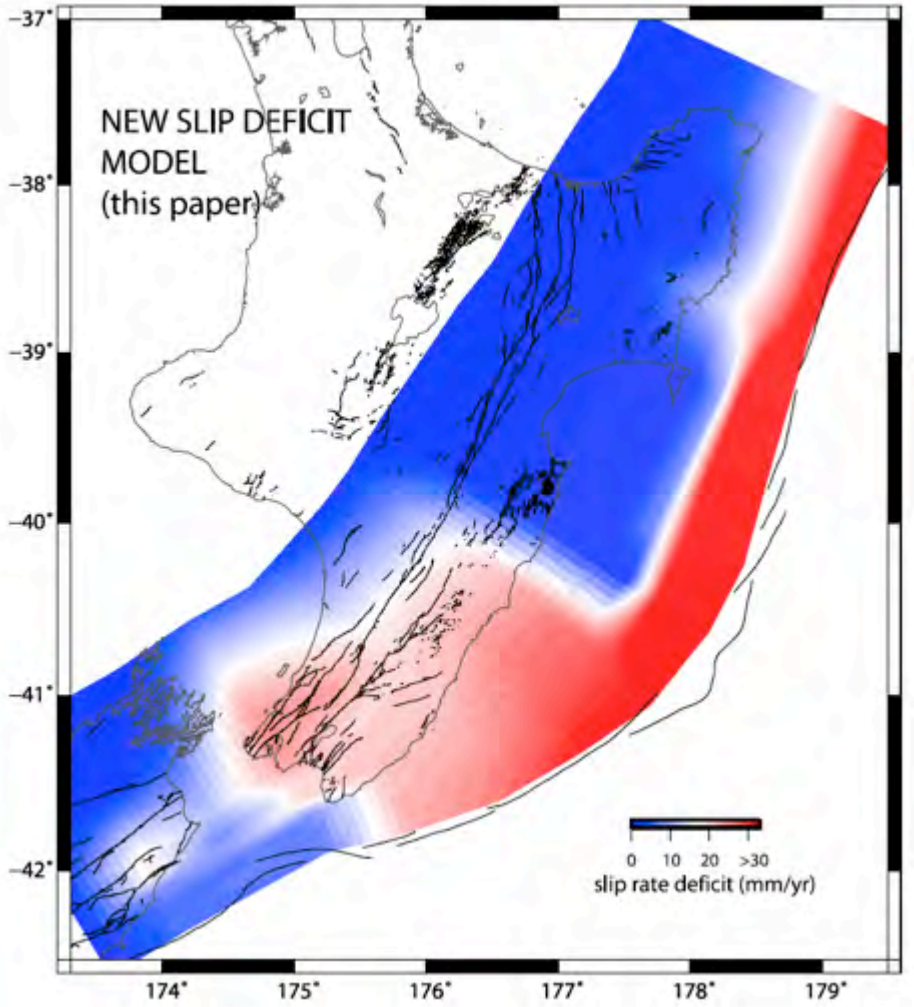
Developing an effective community response to the next "Great East Coast Subduction Zone Earthquake and Tsunami”

David Johnston and many others
Joint Centre for Disaster Research
Massey University - GNS Science

Why we should be worried about subduction zones?






MIYAKO

Understanding community responses to tsunami

Warnings

Figure 5.7 Curious Hilo residents await the first wave of the 1960 tsunami.

The response to warnings by individuals has been found to relate to:

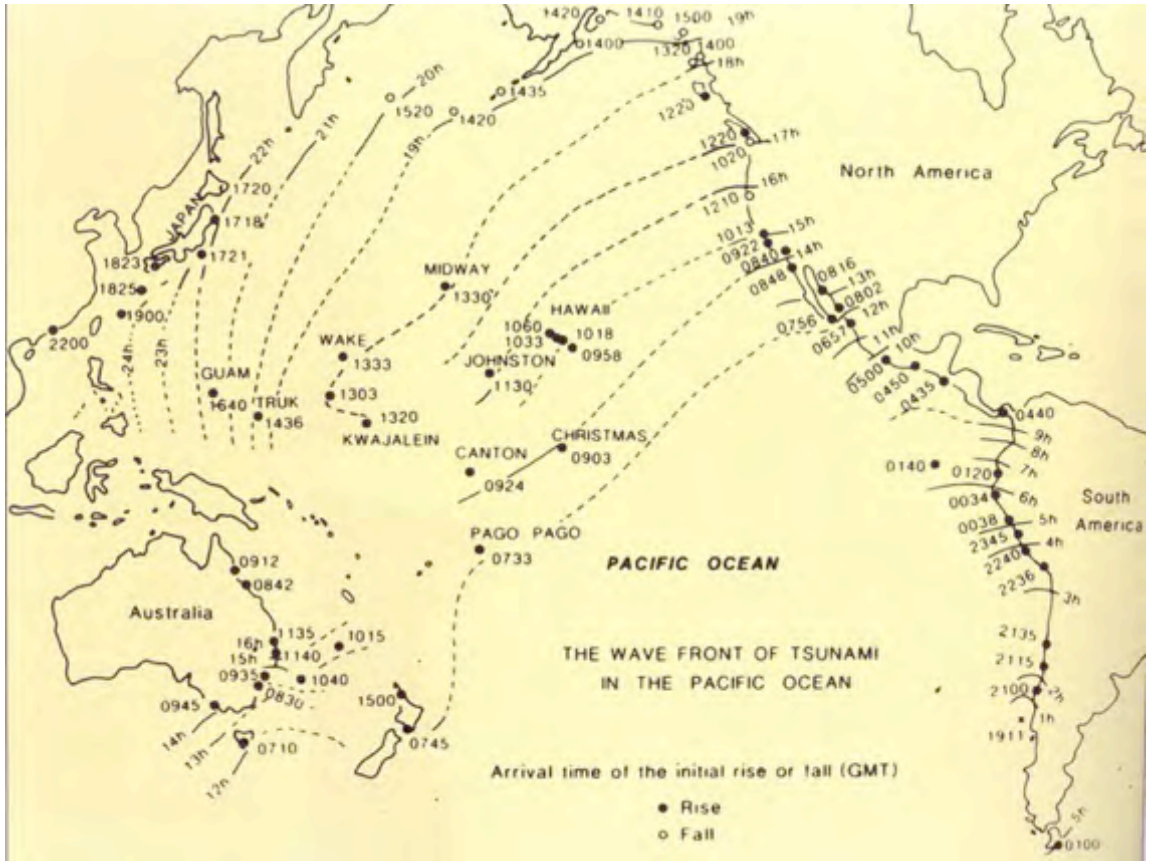
- individual risk perception
- the nature of the warning information
- the personal characteristics of the recipient

(Mileti & O'Brien 1993).

Figure 4.4 People searching for fish on the exposed reef near Hale'iwa, O'ahu, during the 1957 tsunami.

1960 Tsunami

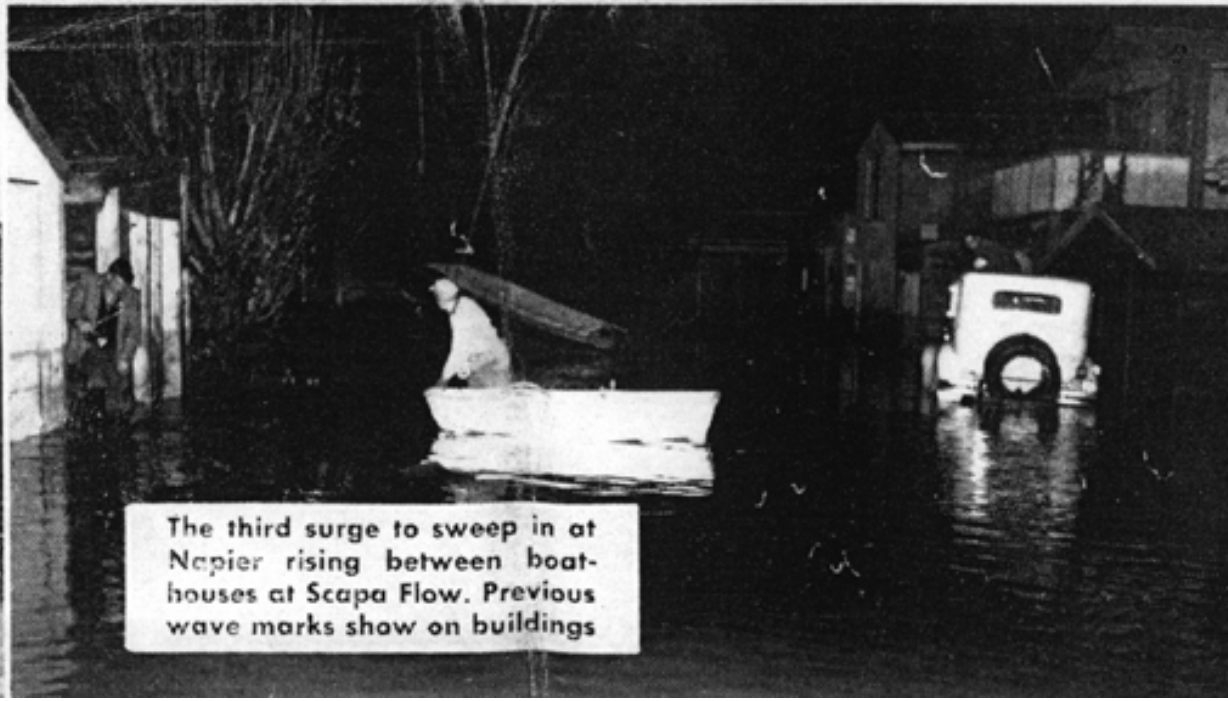
Despite the warnings, there was major loss of life in Chile, Hawaii and Japan.



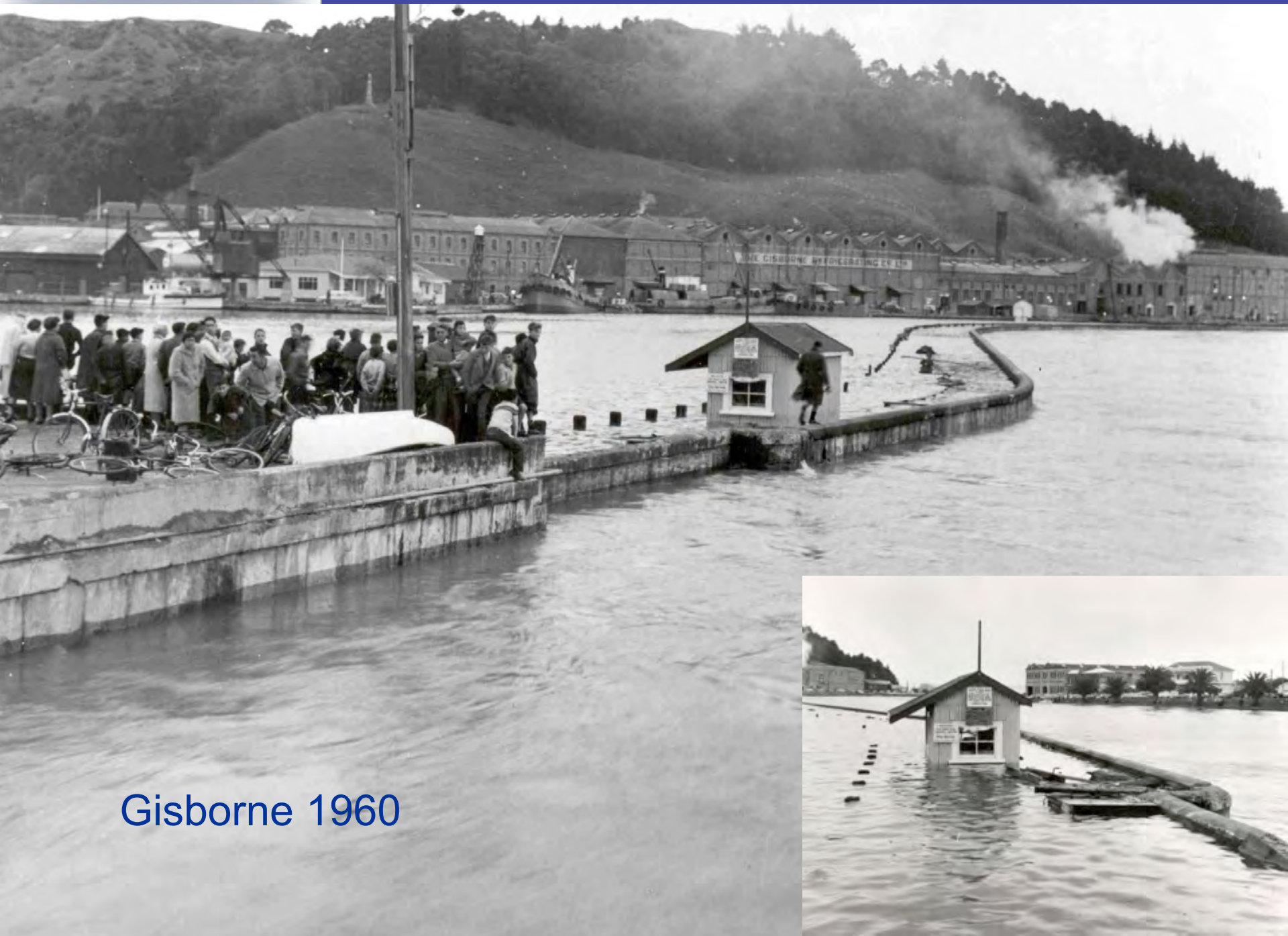
23 May 1960 – magnitude 9+ earthquake in Southern Chile generated a tsunami that swept across the Pacific.

Mr and Mrs W. Pendelbury and the caravan in which they were caught by a sweeping wave at Scapa Flow, Napier. The water rose almost to window level

People watching the abnormal rise and fall of the tide at Scapa Flow, Napier



The third surge to sweep in at Napier rising between boat-houses at Scapa Flow. Previous wave marks show on buildings



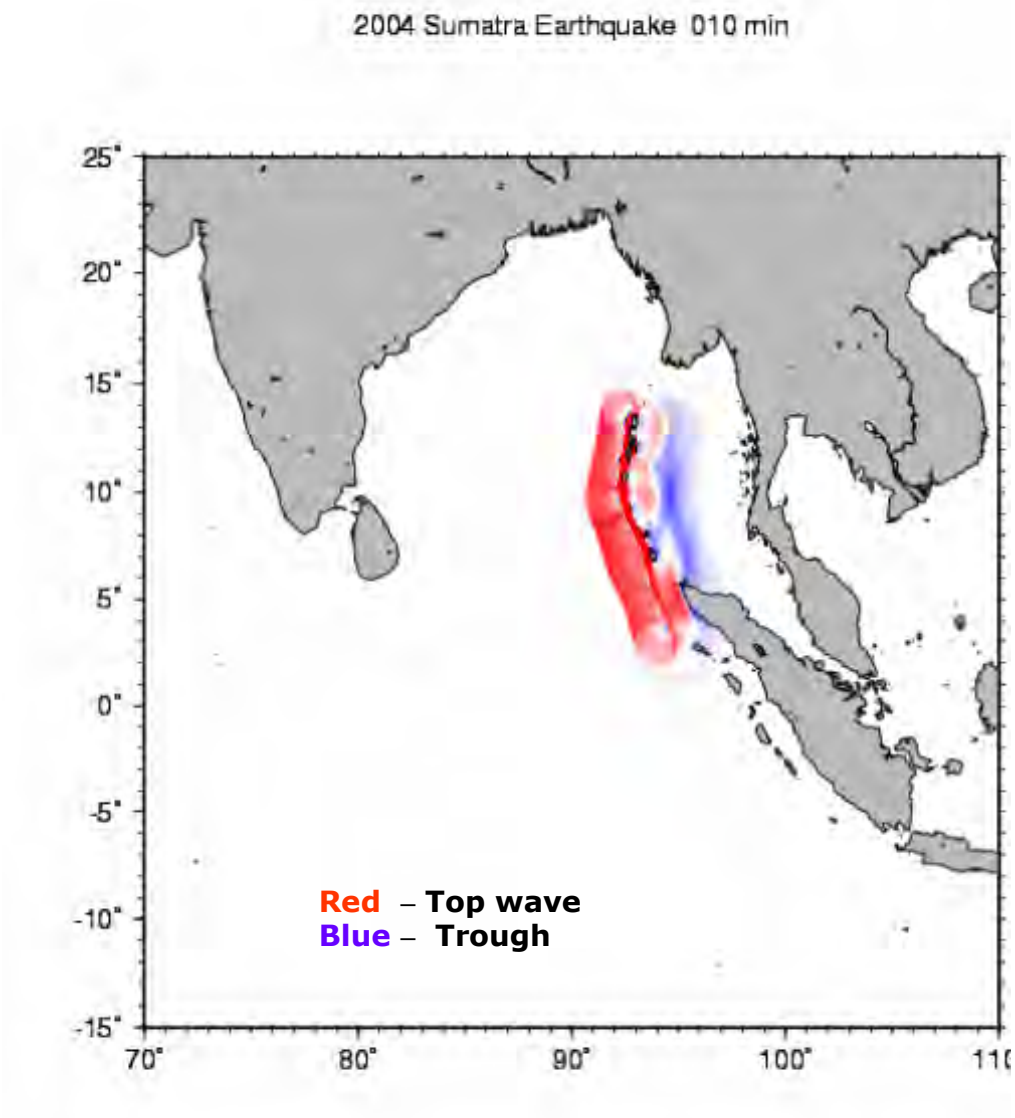
Gisborne 1960

"I'll never get a shot like this again!"

Since the mid 1990's the State of Washington in association with the U.S. National Tsunami Mitigation Program has undertaken a wide range of mitigation activities.

NTMP, NSF and NOAA funded NZ-US collaboration since 2001

2004 tsunami waves



from **USGS**

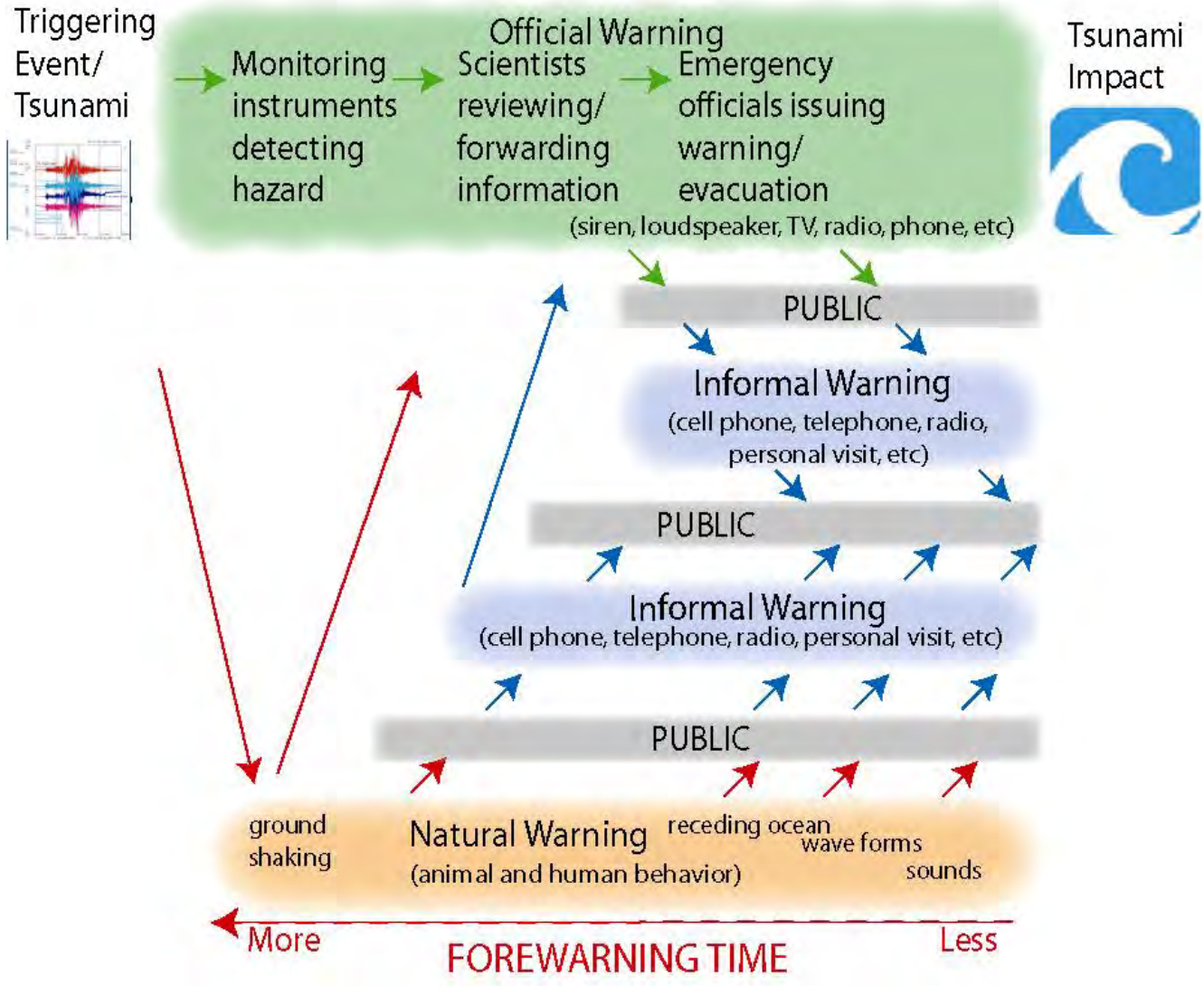
- 663 interviews
- April-May 2005
- 19 villages in 6 provinces
- questions about
  - experiences with and responses to the natural warning signs
  - informal and formal warnings

Incorporating social research evidence – Example:

2004 THAILAND

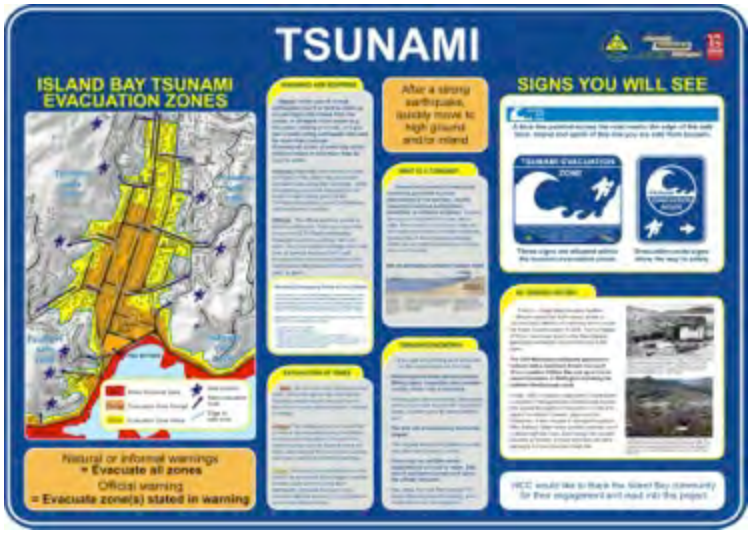
- No official alert BUT
- 22 % felt earthquake
- 70 % saw sea recede
- 55 % heard sounds
- 11 % evacuated

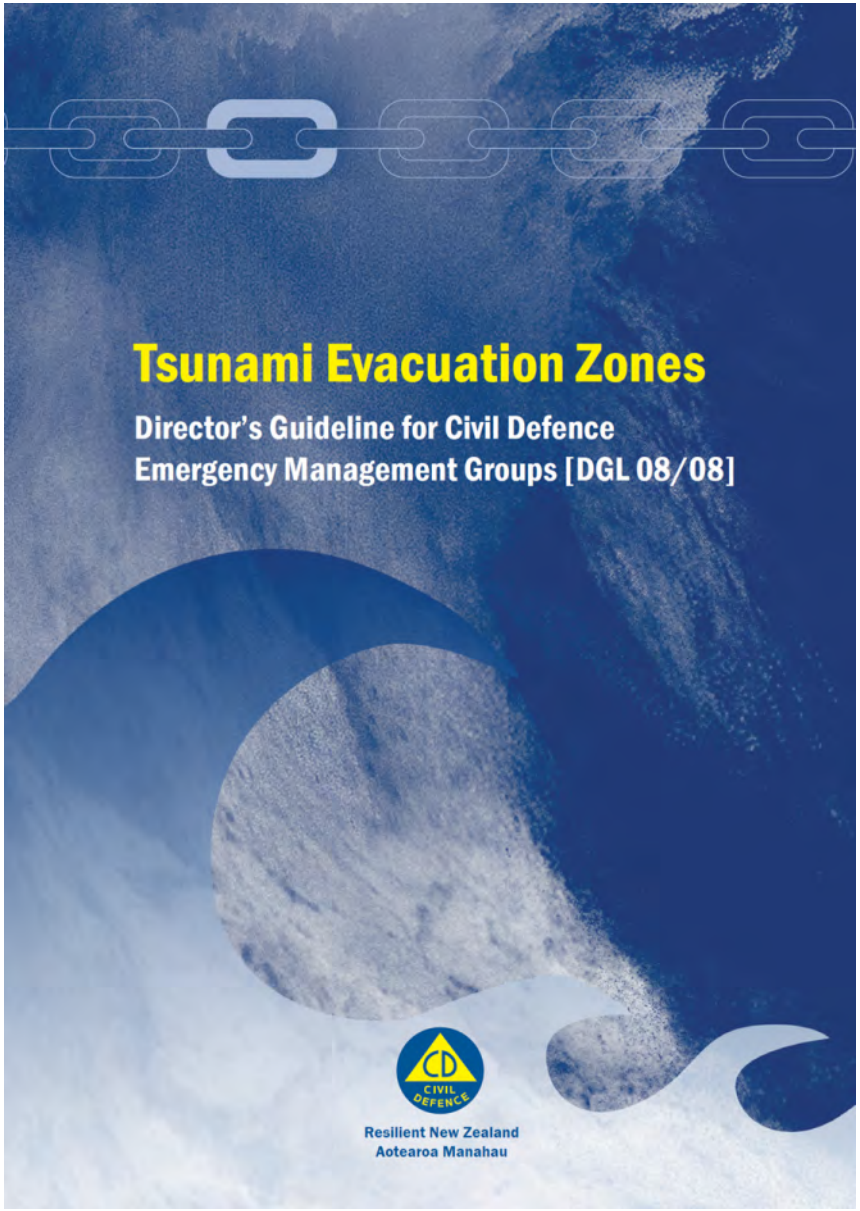
Warning sources



Tsunami preparedness in NZ

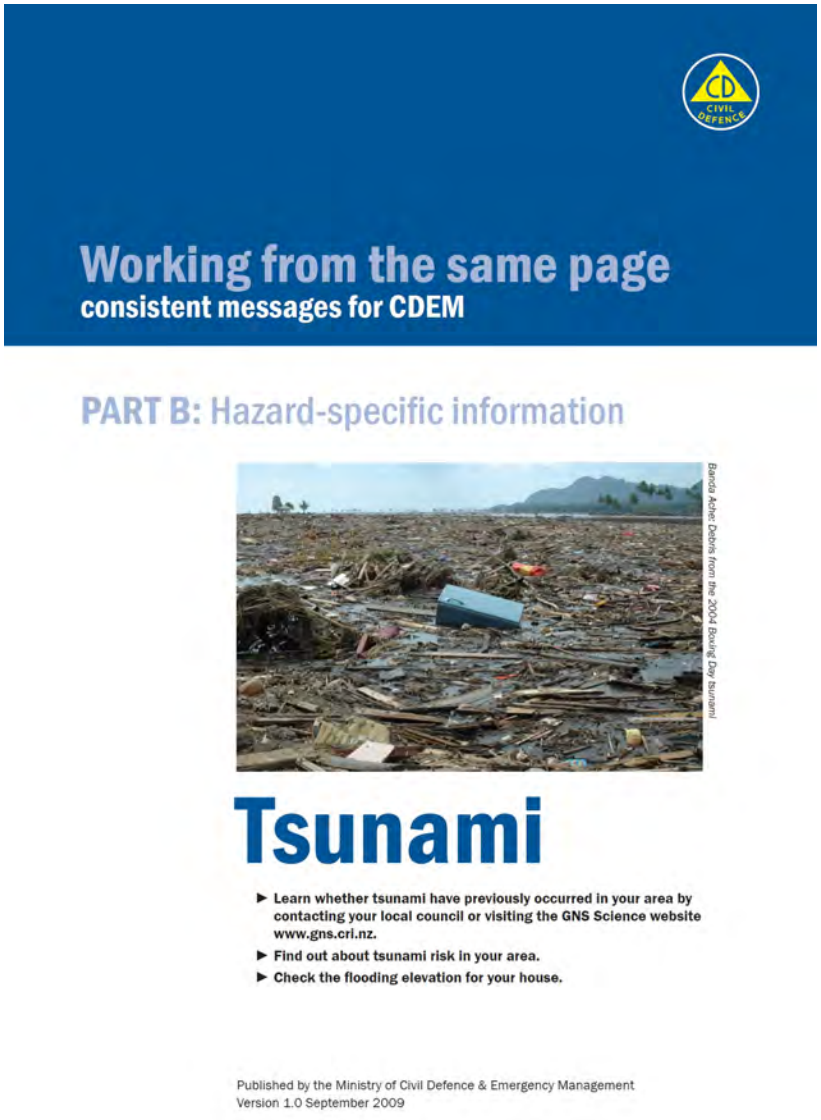
- National tsunami hazard review
- National standards
  - Consistent messaging, warnings
  - Evacuation mapping, signage
  - Community engagement, innovative projects
- Current preparedness gaps
  - Tsunami structural codes
  - Planning for short-term evacuation refuges
  - Options where no high ground




Tsunami Evacuation Zones
Director's Guideline for Civil Defence
Emergency Management Groups [DGL 08/08]
CIVIL DEFENCE
Resilient New Zealand
Aotearoa Manahau

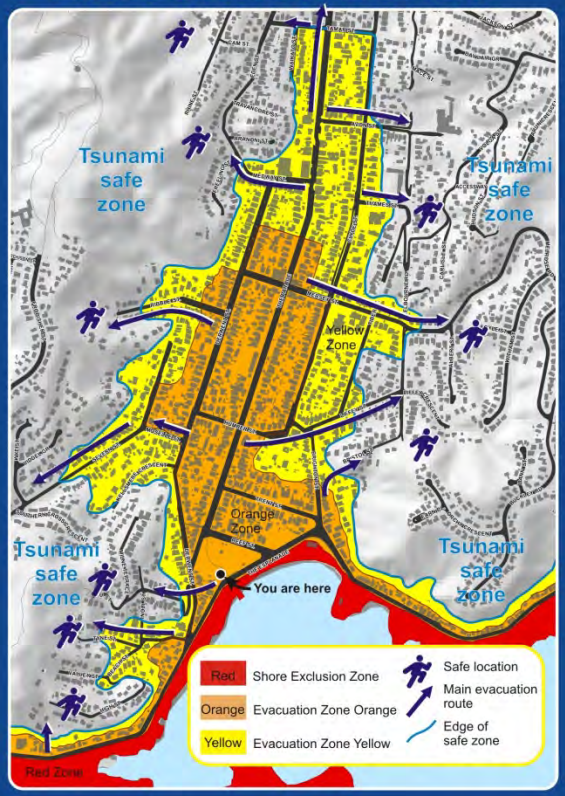

Technical Standard
National Tsunami Signage
CIVIL DEFENCE


Public Alerting: Options Assessment
INFORMATION FOR THE CDEM SECTOR [IS 10/09]
CD
CIVIL DEFENCE


CD
CIVIL DEFENCE
Working from the same page
consistent messages for CDEM
PART B: Hazard-specific information
Banda Aceh: Debris from the 2004 Boxing Day tsunami
Tsunami
► Learn whether tsunami have previously occurred in your area by contacting your local council or visiting the GNS Science website www.gns.cri.nz.
► Find out about tsunami risk in your area.
► Check the flooding elevation for your house.
Published by the Ministry of Civil Defence & Emergency Management
Version 1.0 September 2009

TSUNAMI

ISLAND BAY TSUNAMI EVACUATION ZONES



Natural or informal warnings
= Evacuate all zones

Official warning
= Evacuate zone(s) stated in warning

WARNINGS AND RESPONSE

Natural: In the case of a large earthquake (one it is hard to stand up in), jet engine-like noises from the ocean, or changes in the ocean (e.g. the ocean rushing in or out), or if you feel a weak rolling earthquake that lasts for more than a minute:
Evacuate all zones. A wave may arrive within minutes or take more than an hour to arrive.

Informal: Warnings from friends or other members of the public may be correct: Consider evacuating from all zones. Verify the warning only once evacuated or en route if it won't delay you (via NZ TV/Radio broadcasts, local Civil Defence and emergency services).

Official: The official warning source is local Civil Defence. Warnings may come to you via NZ TV/Radio broadcasts, emergency services, phone, text and siren. You may receive warnings from only one, or several sources. Don't wait: Evacuate from the zone(s) stated in the warning and stay out until the official 'all-clear' is given.

Receiving Emergency Alerts on Your Mobile

You can sign up to receive FREE Emergency Text Alerts direct to your mobile and hear about any large-scale emergency in Wellington (e.g., tsunami warning). You will receive 3 - 4 test messages a year and any other message will be a real alert. If you receive an emergency alert, forward it to your networks; re-tweet the message if you're on Twitter.

Signing Up: Wait for a reply after each text sent. If you already receive tweets to your mobile phone, go to step 5.

1. Text the word "start" to 8987.
2. Reply with the word "signup".
3. Think of a unique username. (You won't need it again).
4. Reply with your chosen username. (If you are already on Twitter, use your existing username and it will ask you for your password).
5. Send / Reply "follow wemonz" to 8987.

EXPLANATION OF ZONES

Red: The red zone is the shore-exclusion zone. This is the highest risk zone and the first place people should evacuate from in any sort of tsunami warning (natural, informal or official).

Orange: The orange zone is the area which is likely to be evacuated during most official warnings and evacuations. Tsunami from distant sources such as South America will rarely reach beyond this zone. Also evacuate this zone in natural and informal warnings.

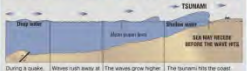
Yellow: The yellow zone identifies areas that need to be evacuated for the largest possible tsunami, such as from a large local earthquake. Evacuate this zone in any natural or informal warning, or if instructed to do so in an official warning.

After a strong earthquake, quickly move to high ground and/or inland

WHAT IS A TSUNAMI?

Tsunami are a series of waves most commonly generated by major disturbances of the sea floor, usually caused by undersea earthquakes, landslides, or volcanic eruptions. Tsunami can occur at any time of the year, day or night. Some tsunami can be very large and can rapidly and violently inundate coastlines, causing loss of life and property damage. Others can be small but dangerous to those near or in the water.

HOW AN EARTHQUAKE-GENERATED TSUNAMI FORMS



During a quake, the sea floor either rises or subsides along a faultline and a tsunami wave is created.

Waves rush away at high speed. In deep oceans tsunami can be as little as 60cm high but travel at about 700km/h.

The waves grow higher and slow down as they reach shallower water near coastal areas.

The tsunami hits the coast, devastating all in its path. Deaths occur not only from drowning, but also from being crushed by buildings and debris.

TSUNAMI EVACUATION

- If you get any warning at all evacuate via the routes drawn on this map.
- **Follow signed routes where present. Walk quickly if possible and consider cycling. Drive only if essential.**
- If driving (not recommended), keep going once you are well beyond all evacuation zones, to allow room for others behind you.
- **The first set of waves may not be the largest.**
- The largest waves from distant sources may take many hours to arrive.
- **There may be multiple waves separated by an hour or more. Stay out of evacuation zones until given the official 'all-clear'.**
- Stay away from the Red Zone for 24 hours after any tsunami warning, even small waves can be dangerous.

SIGNS YOU WILL SEE

A blue line painted across the road marks the edge of the safe zone. Inland and uphill of this line you are safe from tsunami.

These signs are situated within the tsunami evacuation zones

Evacuation route signs show the way to safety

NZ TSUNAMI HISTORY

There is a large plate-boundary faultline offshore east of the North Island, similar to the boundary offshore of Indonesia which caused the Indian Ocean tsunami in 2004. Run-up heights of 30 m+ have been found in the New Zealand geological (prehistoric) record of the last 6,000 years.

The 1855 Wairarapa earthquake generated a tsunami with a maximum known run-up of 10 m in eastern Palliser Bay and up to 5 m in several locations in Wellington and along the northern Marlborough coast.

In May 1960, a massive magnitude 9.5 earthquake in southern Chile generated a Pacific-wide tsunami that caused the deaths of thousands in Chile and several hundreds in Hawaii, Japan and the Philippines. It also resulted in damage throughout New Zealand. Water levels possibly reached over 4 m above high tide mark, even though this tsunami occurred at low tide. It would have been far more damaging if it had occurred at high tide.

Remains of a 4-room Gisborne area cottage, in which three people survived three large tsunami surges on 26 March 1947. In the distance, the tsunami reached 10 m vertically above sea-level, wrenching a bridge from its foundations, and driving it 500 m upstream. *(NZ Weekly News, 2 April 1947)*

A village near the coast of Sumatra, Indonesia, lays in ruin after the tsunami that struck South East Asia on December 26th, 2004. A similar plate boundary faultline lies offshore of New Zealand's North Island. *(US Navy Photographer's Mate 2nd Class Philip A McDaniel)*

WCC would like to thank the Island Bay community for their engagement and input into this project