

NIWA Natural Hazards

setting the foundation for a safer future

Java tsunami: the lessons

On 17 July, there was a magnitude 7.7 earthquake about 200 kilometres south of the Indonesian island of Java. This triggered a severe tsunami which hit a stretch of Java's southern coastline about 200 kilometres long. More than 600 people died.

New Zealand's 'Riskscape'

'The media initially reported wave heights of one to two metres, but in some places the waves were actually seven or eight metres above mean sea level,' says Dr Stefan Reese of NIWA. Stefan was part of a GNS Science-led reconnaissance team to the area, along with scientists from the Institute of Disaster Mitigation Technology in Jakarta.



Photo: William Power, GNS Science

New Zealand's 'Riskscape' project (a publicly-funded joint venture between NIWA and GNS Science) is attempting to model the losses from potential hazards here: given a tsunami of a specified flood depth and flow velocity, what could we expect in terms of deaths, injuries, and damage? The research group have been developing 'fragility curves' to model the answers but these need to be 'ground-truthed' against real disasters – something which is hard for rare events like tsunamis.

Dr Stefan Reese of NIWA using the ground-based differential RTK-GPS to take detailed topographical measurements of tsunami damage in Java.

an assessment of the damage to each building, statistics on deaths and injuries, and other information to verify the New Zealand fragility curves.

The Earthquake Commission provided funding support for this trip.



Photo: James Goff, NIWA

Large trees up to 400 metres inland were shredded when the tsunami hit the high-security prison island of Nusa Kambangan. NIWA scientist Dr James Goff was part of an international tsunami survey team granted special permission to visit this restricted island.



A two storey solid brick building owned by foreigners is all that survived in this close neighbourhood. The surrounding buildings were either made of wood or non-reinforced brick. [Photo: Jim Cousins, GNS Science]

Rare access to prison island

Meanwhile, Dr James Goff of NIWA was part of an international tsunami survey team comprising scientists from the US, Indonesia, Norway, Greece, and New Zealand. The team surveyed more than 400 kilometres of coastline, collecting detailed measurements and eyewitness accounts.

For part of the survey, the team was given access to the restricted island Nusa Kambangan, which hosts several high-security prisons. The island took the brunt of the tsunami's impact and sheltered the main port on Java's south coast, Cilacap. 'At one point, the tsunami has carved a clear trimline at 10 to 21 metres up a hill behind a beach. We estimate the water flowed more than 8 metres deep across the coastal plain in some places,' says Dr Goff. The prisons are set further back, but 19 farmers were killed.

Māori environmental knowledge: valuable & neglected in natural hazard management

A group of Ngai Tara – some 40 canoes in all – went out fishing from Wai-iti, about 45 km north of New Plymouth. A violent storm drove the canoes south to Rangitoto (D’Urville) Island at the top of the South Island. The group found the island to their liking, and after fetching their wives and families from Taranaki, eventually settled at Moawhitu (Greville Harbour) on the western side of the island.

One version gives a date for this migration of some time in the 14th century, and adds that a ‘wave’ drowned all of the people on the island some time during the 16th century. Another version names this event Tapu-arero-utuutu, noting that the wave was utu because a woman broke a food tapu. Tapu-arero-utuutu is said to have drowned nearly everyone at Moawhitu, piling the bodies into the sand dunes.

NIWA scientists Darren King (Ngāti Raukawa) and James Goff have been looking at how Māori environmental knowledge can contribute to natural hazards management and mitigation. In a recent report for GNS Science, they say ‘Māori have developed a detailed knowledge of local natural hazards. This includes oral histories and traditions that record past catastrophic hazard events, place names that designate areas that are high hazard risk, and environmental indicators that inform about the safety and viability of activities linked to changes in the environment.’

In the case of the oral tradition of Ngai Tara recounted above, there is physical evidence pointing to a historical tsunami at Greville sand bar. This is just one example where Māori environmental knowledge can help inform local communities, hazard planners, and researchers of past events which might warrant further investigation. Such accounts can also help ground-truth scientific predictions and provide supporting evidence for broad-scale models.

Oral histories and traditions pose many challenges, so how do you go about it? The answer is carefully and – most essential – with active involvement of Māori. NIWA’s Māori Research and Development Unit, Te Kūwaha, has considerable expertise in the complementary use of Māori environmental knowledge and Western science. Both knowledge systems, when understood in their proper context, can add immense value to each other.

This work was conducted in partnership with GNS Science and funded by the Foundation for Research, Science & Technology.

Planning for a Volcano Crisis

9–10 November, Auckland

(with optional field trip to Rangitoto Island, 8 Nov)

How well will your organisation cope with a future volcano crisis?

This two day course will present a state-of-the-art assessment of volcanic hazards in New Zealand, and will help you better understand how your organisation can better prepare for, and mitigate against, a future volcanic crisis.

For more information, contact Daryl Barton

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Photo: David Johnston, GNS Science

Practical hazards management training



Photo: Mike Revel, NIWA

NIWA hydrologist Alistair McKerchar talks to participants on the Natural Hazard Centre’s ‘Managing Extreme Weather and Flooding’ short course in Christchurch last month. The centre ran a short course on ‘Understanding and Managing Landslides’ this month, with ‘Planning for a Volcano Crisis’ to take place in November, both led by GNS Science.

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