Physical and social impacts of past and future volcanic eruptions in New Zealand

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By

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ABSTRACT

The North Island of New Zealand contains a number of active and potentially active volcanoes. Although the probability of an eruption affecting a significant portion of the North Island is relatively low in any one year, the probability of one occurring in the future is high. The potential impacts of a large eruption are significant and the risk cannot be ignored. The timing of the next eruption cannot yet be determined but its probable effects can reasonably be assessed.

The 1945 eruption of Mount Ruapehu dispersed ash over a wide area of the North Island over a period of several months. Individual ash falls were only a few millimetres thick in communities closest to the volcano (< 50 km) and trace amounts in communities farther away. Ash falls were mostly of nuisance value in affected communities, causing minor eye and throat irritations, soiling interiors of houses and damaging paintwork. More significant impacts included crop damage, low wool quality on farms close to the mountain, disruption to skiing, the removal of army vehicles from Waiouru and numerous disruptions to water and electricity supplies. The 1995-1996 eruptions caused similar physical effects to the 1945 eruption but had considerably greater social and economic impacts. Over the past 50 years the risk has increased significantly due to an increased population, higher visitor usage and a more technologically advanced infrastructure. With increasing development and population growth the risk from similar or larger eruptions will continue to increase.

A community's infrastructure provides the services and linkages which allow society to function. These 'lifelines', involving electricity, water, sewerage and roading, are vulnerable to damage and/or disruption from a range of volcanic hazards. The most threatening hazards include pyroclastic falls, pyroclastic flows and surges, lava extrusions (flows and domes), lahars, debris avalanches and volcanic gases. Unfortunately there are very few quantitative measurements of the impacts of volcanic eruptions on community 'lifelines'. With direct observations of eruption impacts, combined with theoretical considerations, it is possible to form a conceptual model of the likely impacts of a given event. These can then be used to predict likely effects, which may then be utilised in risk analysis (and scenarios).

Two eruption scenarios are considered: 1) a 0.1 km^3 andesitic eruption of Ruapehu composite volcano during a northwesterly wind, affecting Hastings District; 2) a 4 km^3 rhyolitic eruption from the Okataina caldera during a westerly wind, affecting Whakatane District. The choice of scenarios is designed to illustrate the contrast between a disruptive moderate-sized eruption from a cone volcano (Ruapehu) and the destructive impacts of a large caldera eruption (Okataina). The Ruapehu scenario will have disruptive short term impacts on Hastings District, with the recovery process spontaneous, immediate and rapid. The infrastructure of Whakatane will be severely damaged by the Okataina eruption scenario and suffer effects for many years. The social and economic impacts of both scenarios will be determined not only by direct physical consequences but also by the interaction of social and economic factors.

Residents of both Whakatane and Hastings were surveyed in February 1995 to measure their understanding of volcanic hazards. This was repeated following the Ruapehu eruptions in November 1995. Few residents have copies of specific volcanic hazard information and few have undertaken any form of information searching prior to the 1995 Ruapehu eruption. The 1995 eruption resulted in a small increase in the numbers searching for information on volcanic hazards in both communities. Although some agencies are perceived as more credible than others as the source of volcanic hazard information, no one agency has a monopoly on perceived credibility (i.e. different people recognise different agencies as the best source of information on volcanic hazard information and warnings). During the 1995 Ruapehu eruption the media (TV, radio and newspaper) were the principal sources of information about what was happening. Different people rely on different channels for information and this should also be acknowledged when issuing warnings and releasing public information. Whakatane and Hastings supply interesting contrasts. Both were subjected to intense media coverage during the 1995 Ruapehu eruption, but Whakatane was spared any direct effects, whereas Hastings experienced the hazard directly, in the form of ash falls in September and October 1995. Only Hastings' respondents showed a significant change in the perceived volcanic threat. However, even though there was no significant change in the perception of volcanic threat in Whakatane, residents still continued to perceive the volcanic threat as being higher than Hastings residents. Experiencing the direct and indirect impacts of the 1995 Ruapehu eruption may make subsequent warnings and information releases more salient, thereby enhancing the likelihood of engaging in protective actions or other forms of response. This is likely to be the case for those individuals and organisations that experienced the greatest impacts. However, the relatively benign impacts may make many prone to a "normalisation bias", whereby individuals or organisations believe that the volcanic eruptions did not affect them negatively, therefore the negative impacts of future volcanic events will also avoid them. This may be prevalent in communities close to Ruapehu which escaped the direct ash falls as a consequence of favourable wind directions. This conclusion suggests that the 1995-1996 Ruapehu eruptions may have both improved and reduced individual, organisational and community preparedness for future volcanic events.

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