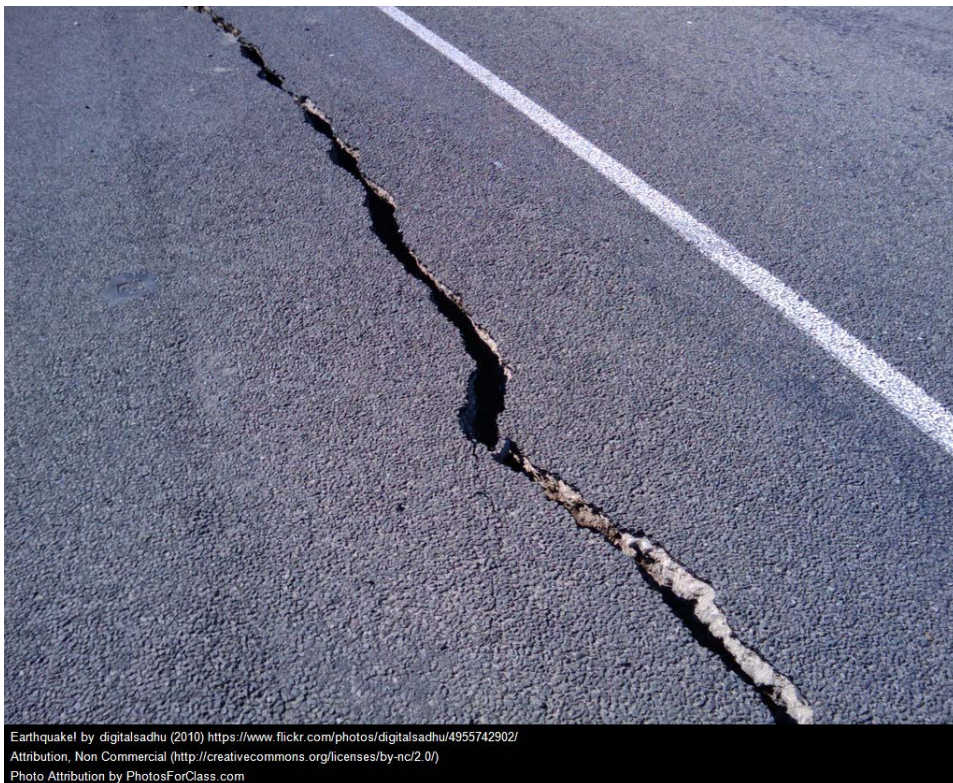


INGSA CASE STUDIES

TERREMOTIA: FOLK KNOWLEDGE AND THE UNDERSTANDING OF RISK

Tatjana Buklijas (INGSA/University of Auckland)



TERREMOTIA

FOLK KNOWLEDGE AND THE UNDERSTANDING OF RISK

Background and context

Terremotia is a parliamentary democracy with market economy. It is classified as a high-income country with upper middle to high rankings in indicators such as quality of life, media freedom, education and literacy. Education is compulsory for children aged 6 to 16. Terremotia's economy relies mainly on agriculture (forestry, fishing, dairy, cattle and wine) and mining, with tourism rapidly gaining importance. It has a population of 12 million and its largest city is the commercial centre, Mercator de Terremotia, with the population of 2.5 million, followed by the capital, Villa de Terremotia with a population of 1.8 million.

Terremotia occupies a large territory of varied landscape. While the landscape attracts international tourists, it is also characterized by high volcanic and seismic activity. Terremotia experiences one to two magnitude 6 earthquakes/year, one earthquake of magnitude 7 every 5 years and one of magnitude 8 or more every century. While the capital Villa de Terremotia is located in the area of high seismic activity, the business centre, Mercator de Terremotia, is situated in the area considered to have a low seismic risk. No earthquake of any magnitude has been recorded there in the last century.

From early age, Terremotians are educated to prepare for and protect themselves in earthquakes, through drills at schools, workplaces, information in newspapers, TV and other media channels. The central institution uniting research into earth sciences with a system of monitoring and planning for earthquakes is the National Geological Institute (NGI). Recently, NGI has set up TerraNet, a geological hazard monitoring system, comprising a network of geophysical instruments, software applications, and staff whose job is to detect, analyse and respond to earthquakes, volcanic activity, landslides, tsunamis, as well as processes preceding large earthquakes. TerraNet also runs a public interface to ensure good communication of natural hazards and related risks to Terremotians. Overall, Terremotia is considered to be well served regarding both earthquake science, with many internationally recognised scientists working at NGI, and its platforms for the communication of earthquake and volcanic eruption risk.

Problem

At 4.35 am on 4 December 2016, which happened to coincide with a full moon, a magnitude 6.7 earthquake struck about 30 kilometres west of Mercator de Terremotia, at a relatively shallow depth. The quake was caused by movement along a previously unrecognised minor fault line that had not been mapped. The fault line lies deep under alluvial soils laid down by a river coming out of a large mountain chain. The earthquake caused significant building damage to the city, especially to old masonry buildings, but no direct fatalities. In the subsequent months, many smaller aftershocks (generally < magnitude 4) followed.

Despite Terremotia's long history of earthquakes, good science and monitoring systems, the "Mercator earthquake" and its aftershocks caught everyone by surprise because the city had not been considered to be at high risk. The surprise opened the space for speculation, in which astrologers, psychics and other "alternative forecasters" moved in. Using social media platforms, such as YouTube channels and Facebook pages, these forecasters attracted dedicated followers. Some of them claimed that the earthquake was due to the full moon and predicted another and much larger earthquake in or near Mercator, would happen one day when other astrological features would be aligned to cause a "greater pull".

At the same time, scientists at NGI were providing updated information about risk of further earthquakes, the location and strength of aftershocks, as well as more detailed information about the type and features of earthquakes. They were using national TV, radio, newspapers, web-based channels, and giving public talks in schools, community halls and other places. In spite of their work, there was much appetite for "alternative" information, which the media delightedly promoted.

This all was happening in an atmosphere of pessimism and economic downturn. Although Terremotia had recovered from the effects of 2008 global financial crisis, the falling demand for the ore from its mines had a negative impact on employment and economy. There were growing fears that tourism would suffer because of earthquakes. Mercator Airport is the largest and busiest airport in Terremotia and its harbour an important hub for cruises, and the bookings are already dropping.

In April 2017, a local radio station aired a weekly programme in which a media celebrity Simon Forman predicted a much bigger earthquake would happen in the next few days. Forman had more authority than other "alternative forecasters", because he had long been known as the author and advocate of an "alternative weather" model and had a regular "alternative science" programme, focused on subjects such as astrology, on the radio. Forman maintains a subscription-based website through which he sells weather forecasts, consults businesses and publishes annual weather almanacs. He has an audience among farmers in his own province (close to Mercator) and among recreational fishermen.

Two days after Forman's radio show and his prediction, a strong earthquake (Magnitude 7.3) struck some 200 kilometres north of Mercator. It was mostly felt in the sparsely populated mountainous pastoral area bordered by a national park. The epicentre was in the area of known high earthquake risk: ruptures along several fault lines were observed, including some previously unknown ones. While again there were no human victims, and the infrastructural damage mostly affected regional roads, the earthquake dislocated hills, river and sea bed by several metres

The apparently successful prediction earned Forman major media attention. Major newspapers, TV, online media all give him space to discuss his model and communicate predictions. On 20 July he tweets a prediction of a major earthquake close to Mercator "around the full moon on 1 August". The earthquake, according to him, will be much worse than either of the large preceding ones and it is likely to cause large loss of life.

Forman's prediction attracts huge media attention. On 22 July he is invited to a high-profile talk-show. The popular interviewer tries to counter Forman's claims but his manner is perceived as aggressive and, contrary to the plans, Forman is perceived a sympathetic figure. Some public

personalities are now pointing to a study, published in *Nature* just a few weeks earlier, according to which tidal stresses can exert additional strain on geological faults and trigger small earthquakes. The full Moon on 1 August also coincides with the Moon's closest approach to earth (perigee). Scientists at TerraNet however state that the risk of earthquake is not increased. Many citizens of Mercator decide to leave the city ahead of the predicted earthquake and a sense of panic is emerging. The financial centre of the country is essentially shutting down. There is a huge public pressure on the government to order evacuation.

"I am not trying to undermine TerraNet" says the mayor of Mercator, who has background in economics, "But their modelling shows that following the Mercator Earthquake of December the risk remains increased for a while, even a year. We had another big earthquake not so far in the meantime. What if the next one does strike when Forman predicted?"

The Prime Minister is calling the science advisor to help with the assessment of available evidence regarding the risk: should he try and stop the evacuation or not, and if so how to manage the public perception of risk and science communication.

Notes for the mentors

Stakeholders from whose perspective the problem should/may be considered:

1. Government of Terremotia
2. Mayor/municipal administration of Mercator de Terremotia
3. Scientists working in NGI and in TerraNet
4. Media: national TV, radio, newspapers
5. Social media: YouTube, Facebook
6. Emergency services in Mercator
7. Businesses and large organizations in Mercator (including stock market, tourist board etc.).

Considerations:

1. Risk communication: Did TerraNet fail in their efforts to communicate risk of earthquakes following a large earthquake? Should the job of risk communication be entrusted to someone else? How is a top-down communication model replaced by one with more feedback? What is the role of media?
2. Trust in scientific expertise: is the main problem not the failed communication of risk but the lack of trust in scientific knowledge and scientists as experts? How do we increase the trust? Was the TV anchor right to invite Forman to the show?
3. Encountering/engaging with folk knowledge: scientific explanations of earthquakes not happening in a vacuum, but in a space densely populated by non-scientific, "folk" knowledge. The position and movement of celestial long used for understanding and predicting both the natural and social world.

4. Understanding scientific way of thinking and science as a process: consider the publication of the study in *Nature* with its conclusions that at first glance support Forman's argument.



*This work is licenced for non-commercial reuse,
with attribution to INGSA and named authors, and link to <http://ingsa.org>.
See <https://creativecommons.org/licenses/by-nc-sa/4.0/> for more info.*



ABOUT INGSA

INGSA provides a forum for policy makers, practitioners, academics, and academics to share experience, build capacity and develop theoretical and practical approaches to the use of scientific evidence in informing policy at all levels of government.

INGSA's primary focus is on the place of science in public policy formation, rather than advice on the structure and governance of public science and innovation systems. It operates through:

- Exchanging lessons, evidence and new concepts through conferences, workshops and a website;
- Collaborating with other organisations where there are common or overlapping interests;
- Assisting the development of advisory systems through capacity-building workshops;
- Producing articles and discussion papers based on comparative research into the science and art of scientific advice.

Anyone with an interest in sharing professional experience, building capacity and developing theoretical and practical approaches to government science advice is welcome to join INGSA.

By signing up to the INGSA Network you will receive updates about our news and events and learn of opportunities to get involved in collaborative projects.

Go to <http://www.ingsa.org> for more information.



INGSA operates under the auspices of ICSU. The INGSA secretariat is currently hosted by The Office of the Prime Minister's Chief Science Advisor, New Zealand
PO Box 108-117, Symonds Street, Auckland 1150, New Zealand.
Tel: +64 9 923 9270; Web: www.ingsa.org; Twitter: [@INGSciAdvice](https://twitter.com/INGSciAdvice)