Living with natural hazards in the Asia–Pacific region

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Many might say that it could not be a worse time to live in the Asia–Pacific region. In the past few years we have not only experienced the 2004 Indian Ocean tsunami, but also the 2006 Java, 2007 Solomon Islands, 2009 New Zealand, 2010 Chilean and the 2011 Tōhoku (Japan) earthquakes and tsunamis. We should not forget either the seemingly endless list of other natural hazards such as tropical cyclones and typhoons (e.g. 2010 Fiji and Philippines), volcanic eruptions (2010 Indonesia), river floods (2010 Pakistan), wildfires (2009 Australia), amongst many others.

For a variety of reasons, an increasing number of people in the Asia–Pacific region are either choosing to live, or are finding themselves living, at the coast (Sieh 2006). This in itself is not a problem except when they are exposed to hazards such as tsunamis and cyclones. It is in this coastal zone, though, that we have seen the recent effects of devastating natural hazards. The value of the work carried out by natural hazards researchers has recently been brought to the forefront of public awareness. It is not always easy to recognize the hazards that a low-lying coastal area faces either because there may be no previous historic records of large-magnitude, destructive tsunamis from which we might learn valuable lessons (Satake & Atwater 2007) or because people are, for various reasons, unaware of the area's geological past (Normile 2011).

As we write this editorial, the ongoing troubles faced by the Fukushima nuclear power plant are broadcast to us daily. While it is true that the first reactor was completed there in 1971, an expert panel reviewed the plant's sesimic resistance in 2008 (Normile 2011). By this time Japanese scientists were well aware of the Jogan tsunami of 869AD, an event that they concluded could recur at about 1000 year intervals. This had not been factored into the orginal design plans for the Fukushima plant, but the opportunity existed to address this issue in 2008 – it was not (Normile 2011). The people of Japan and the rest of the world are now living with the aftermath of that decision.

If there is one thing that is evident from the work that we do on geological hazards, it is that it is all too easy to base estimates of magnitude and frequency on extrapolations from historical data. These forecasts, based generally on a few centuries of data at best, are completely inadequate for the big events that have simply not occurred in historic time. For some types of climatic and hydrological hazards, homogenous and robust datasets are of much shorter duration, so any trends are difficult to identify with confidence (Terry & Gienko 2010; Terry & Wotling 2011).

The implications for such oversights have proven to be catastrophic and it is only through a combination of geological, climatic and numerical modelling research, combined with more traditional historical studies, that we can hope to guard against such events catching us off guard in the future. An interesting case in point relates to palaeotsunami work carried out in New Zealand over the past 10 years or so that has consistently pointed to there having been a large event affecting the northern coasts of the country in the fifteenth century (e.g. Nichol *et al.* 2003; Walters *et al.* 2006; Goff 2008; Goff *et al.* 2010). This signifcant body of literature was largely ignored until recent numerical modelling work found 'an intriguing similarity in distribution and scale' of modelled runup heights with those of the palaeotsunami data (Power *et al.* 2011). Why is this so important? Palaeotsunami researchers have long proposed that the most likely source for this event was from a large subduction zone event on the Tonga–Kermadec trench to the north of New Zealand. Until recently, however, numerical modellers and geophysicists did not feel that this was plausible despite warnings from key researchers that 'simple geophysical hypotheses about maximum earthquake size at subduction zones, and about patterns of earthquake recurrence, appear to be of limited value in the long-term forecasting of the time and size of great subduction zone earthquakes' (Satake & Atwater 2007, p. 368). This point has been re-emphasized

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following the 2011 Tōhoku earthquake and tsunami (Normile 2011).

How long do we have to wait for the next disaster to realize the truth in this statement?

Researchers of natural hazards have an obligation to work together, to consider *all* available data. It is not necessarily easy to work in multidisciplinary groups, but the ascendancy of one branch of natural hazards research does little to help our understanding of the big picture. We are entering a period of marked climate change and appear to be facing a time of increased seismic activity (Ammon *et al.* 2010). There is little time available for natural hazards researchers to recognize the need for, and value of, true multidisciplinary studies; but, in the absence of a combined physical and human sciences approach to our work, we will doubtless fail to deliver appropriate information effectively. Socially oriented hazards research demonstrates over and over that even where a community does have a better understanding of natural hazards, abandoning a particularly hazardous place may not be desirable or possible for a wide range of reasons (Ambler 2000). Following the 2011 Tōhoku tsunami, a vast number of Japanese communities will rebuild in exactly the same place – the challenge for natural hazards researchers is to provide useful and meaningful data to ensure that these communities are as safe as they can be.

This Special Publication represents a snapshot of the burgeoning natural hazards datasets emerging from the Asia–Pacific region. This is the kind of information that will prove vital to ensuring that humans can live safely with natural hazards into the future.

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