The physics of earthquake forecasting

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One year on from the magnitude-9.0 earthquake that unleashed a devastating tsunami and caused a partial meltdown of the Fukushima Daiichi nuclear plant, this month's special issue of Physics World, on the theme of "Physics and the Earth", includes an investigation by journalist Edwin Cartlidge into the latest advances in earthquake forecasting.

In addition to the special issue, physicsworld.com hosts an exclusive video documentary reviewing the fundamental science behind earthquakes and assessing the current efforts that are being made around the world to forecast these events.

The huge responsibility that comes with assessing the likelihood of earthquakes was never more evident than in March 2009, when a group of 11 Italian scientists met to discuss the risk of a powerful earthquake striking the town of L'Aquila, after a swarm of small quakes had hit the area continuously for four months.

After concluding that there were no grounds for alarm, a devastating magnitude-6.3 earthquake struck the town on 6 April that year, leaving 308 people dead. Now, seven of those 11 scientists are on trial for manslaughter.

Thomas Jordan, chairman of the International Commission on Earthquake Forecasting (ICEF), argues in Physics World that the tragedy at L'Aquila highlights how vital it is for us to understand which are the most reliable types of forecasting, so that we have the best possible

information at our fingertips.

Finding specific, natural events that may flag up an impending earthquake has been given a lot of thought; for example, a long-standing idea is that animals flee a specific area after somehow sensing an upcoming quake.

These precursors are unconvincing, however; and while we are unlikely to ever be able to predict precisely when, where and with what magnitude particular earthquakes will strike, much can be gained from short-term "probabilistic" forecasting, which can give the odds that an earthquake above a certain size will occur within a given area and time.

Still, these short-term "probabilistic" methods have their limitations, as was demonstrated a year ago this month when even the most up-to-date models did not predict the Japanese earthquake.

"This approach is tricky because no-one can quite agree on which are the best models. So, we have uncertainty on uncertainty. But can we ignore the information that they give us? The earthquakes in L'Aquila and New Zealand taught us we don't have that luxury," says Jordan.

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