How can we communicate earthquake forecasts?

In 1854, an MP stood up in parliament and made the suggestion that recent scientific advances might allow the weather in the city to be known 'twenty-four hours in advance'. The House broke into uproar and laughter - the idea was considered utterly preposterous.

By 1861 however, the National Meteorological Office, charged with producing storm warnings to ships, also sent a 'weather forecast' to the newspapers, saying "Prophecies and predictions they are not...the term forecast is strictly applicable to such an opinion as is the result of scientific combination and calculation."

The father of the weather forecast, Robert Fitzroy, had to deal with scepticism from scientific colleagues about his methods, funding problems from government, and complaints from those who lost business as a result of false alarms in warnings or whenever bad weather had not been forecast. Tragically he killed himself as a result, only a few years after initiating the forecasting project, never seeing the weather forecast become a ubiquitous part of life worldwide.

Operational Earthquake Forecasting (OEF) today finds itself in a rather similar position. Seismologists have increasing knowledge and understanding of fault systems meaning that they can give some indications of the likelihoods of forecasts, albeit shrouded with uncertainties.

The 2009 L'Aquila earthquake in Italy, though, after which 6 scientists were convicted of manslaughter, has made them particularly concerned about communicating earthquake forecasts. In this project, then, we aimed to learn from the experience of fields such as meteorology and storm forecasting that have wrestled with many of the problems of communicating uncertain, dynamic, geographically variable, probabilistic information. We also carried out a series of experiments to identify how best to help different audiences understand such complex information.

We hope that our work can help the pioneers of earthquake forecasting through the difficult early stages experienced by those who first attempted weather forecasting.

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We carried out a review of how fields such as finance, epidemiology, meteorology, flood and storm forecasting all deal with the difficulties of communicating dynamic, geospatial and uncertain numbers.

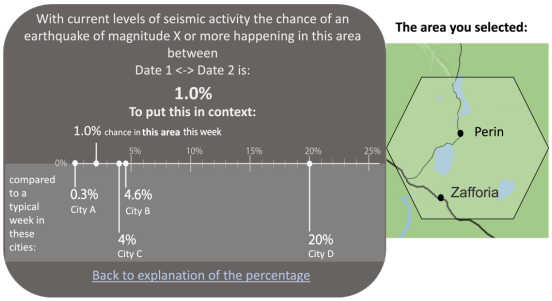
Lessons learned fell under four main headings:

1) Ensure that your audiences are as familiar as possible with what you are going to communicate, how to interpret it, and how to act on it.
2) Be aware of the psychology of risk: someone's perception of a risk is, quite rightly, influenced by far more than just the likelihood and severity of an event.
3) Test all potential communications with their intended audiences to try to maximise their ease of comprehension (and minimise the chance of misunderstandings).
4) Don't confuse 'everyday' forecast communications with warnings. The two have different aims (forecasts are providing regular information, warnings are there to trigger behaviour) and hence use very different communications strategies.

After carrying out:

65 semi-structured interviews with public in Iceland, Switzerland and Italy
2 focus groups with expert seismologists
4 focus groups with Italian public
30 semi-structured interviews with Italian civil protection, emergency responders, infrastructure managers, media, public & seismologists

during which we designed and tested various ways of communicating earthquakes forecasts, we undertook a series of online experiments to evaluate these communications in Italy, Switzerland and California. Below is our resulting recommendation:



It gives the forecast for a particular area, selected by the user, of an earthquake above a set magnitude. It gives the absolute risk as a percentage, and then puts that in the context of the same risk in other cities likely to be familiar to the audience.