



# Probabilistic models

## Understanding forecasts

Although we can't yet *predict* earthquakes, we can *forecast* earthquakes. A prediction would indicate an absolute – stating what will occur. This is not possible with the current knowledge about earthquakes. However, a forecast offers a range of possibilities – describing what might occur. Forecasts are useful as they tell us what is likely and, importantly, what is less likely to happen.

An **earthquake forecast** provides a probability or chance. It says *how likely it is* that an earthquake of a given magnitude range, within a given area, over a given time frame, will happen.

Our earthquake forecasts are generated from the world's best available science. Not only are they based on hundreds of years of international observations and measurements, they also use our latest knowledge of how earthquakes take place and cause shaking. All the calculations, or 'models', describing this are used to make forecasts which are reviewed and tested by a team of local and international scientists.

We use many different models to create our forecasts. We look at how past earthquakes have behaved, alongside our knowledge of how earthquakes occur and interact, to forecast what is likely to happen in future. We also consider the

<p>PROBABILISTIC MODEL</p> <p>Past earthquake events + applied statistical and physical science = what might happen in future</p>
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unique geology and tectonic processes occurring in the area of New Zealand we are forecasting for.

## There are two forecasting steps:

### Earthquake forecast

1. We forecast the earthquake magnitudes, frequency and where they might occur

### Hazard forecast

2. Based on the earthquake forecast, we then forecast the ground shaking hazard that might occur from those earthquakes

## Probability of exceedance (PoE)

The NSHM provides a **hazard forecast**. This forecast is an estimate of the level of ground shaking that might happen at any one location with a specified probability of exceedance.

For example, we might determine a level of ground shaking that has a 10% chance of being exceeded within the next 50 years.

In other words, it is 10% likely we will experience this level of shaking, or greater, within 50 years.

The NSHM calculates multiple probabilities of exceedance (such as 2% and 10%), so we can explore the range of potential hazard scenarios.

## What do the probability percentages mean in the NSHM?

At 10%, there is more chance of shaking but the shaking is forecast to be less severe.

At 2%, there is less of a chance of shaking but the shaking we experience is forecast to be more severe.

However, low probability does not mean *no* chance, so it's important to think about what we can do to make ourselves safer should an event occur. Visit the [NEMA Civil Defence](#) and [Toka Tū Ake EQC](#) websites.