New model to predict rough size and location of future quakes

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A team of scientists has developed a new model that suggests a way to narrow size and location range of future earthquakes.

The forecasting model developed by Danijel Schorlemmer, of the USC (University of Southern California) College of Letters, Arts and Sciences, aims to predict the rough size and location of future quakes.

Testing of the model is underway.

According to Schorlemmer, one of the key aspects in forecasting of earthquakes is stresses and the new model helps identify locations that are highly stressed from readily available earthquake catalogs.

Seismologists believe that the buildup of stress deep in the earth causes earthquakes. Monitoring such stress has proven impossible to date.

Instead, Schorlemmer and his collaborators found a way to estimate the stress indirectly.

They started by observing that different types of earthquakes differ on average in the stresses needed for rupture.

Quakes from thrust faults, which push a large block of earth upward, require the largest stress.

Quakes on normal faults, in which two plates pull apart and a block of earth drops, require the least stress.

Quakes on strike-slip faults such as the San Andreas, where two plates slide past each other, fall somewhere in the middle.

The researchers then noticed that two laws of statistical seismology - those governing the relative frequency of big and small quakes, and the decay in time of aftershocks - differ slightly for each type of earthquake.

Regions with active thrust faults tend to have a greater proportion of large quakes than regions with normal faults, with strike-slip faults falling in the middle.

The number of aftershocks from quakes on thrust faults tends to start decaying sooner than the number of aftershocks near normal faults, with strike-slip faults again somewhere in between.

Schorlemmer realized that these differences could be applied predictively.

One could study the relative frequency and aftershock patterns of small to medium sized earthquakes - which occur regularly in every seismically active region - and infer the level of stress in different parts of that region.

That realization led to a new earthquake prediction model.

The model cannot predict the timing of a quake, but it may be the first to provide an indirect measure of the stress inside the earth, and therefore a reasonable estimate of the size and location of future quakes.

According to Thomas Jordan, director of the Southern California Earthquake Center based at USC, "This study provides new insights about how forces within Earth's crust control seismic processes, and we should be able to use this information to improve our ability to forecast earthquakes."