How earthquakes can trigger copycat quakes 1000 kilometres away

21/09/2015

That’s because they can shake up grains of rock wedged inside distant faults. According to computer models, even weak waves at the right frequency could be enough to start a new quake by vibrating that grist into a more slippery, liquid-like layer.

Earthquakes often happen when two tectonic plates that have been pressed together suddenly slip. But we’ve seen that major earthquakes like 1992’s Landers earthquake in California can also send out waves that spark copycat quakes 1000 kilometres away, even though the waves get weaker as they travel.

The mysterious remote triggering of quakes may have also played a role in events in Chile in 2014, and Japan in 2011.

“We were wondering: how could it happen that a very tiny wave with a very small amplitude could trigger earthquakes a thousand kilometres away?” says Lucilla de Arcangelis of the Second University of Naples in Italy.

One idea is that sound waves can lather up the grains between the two plates in a way that decreases friction, to make a slip easier. Now a team including de Arcangelis has built a computer model that shows the process as it happens.

They found that seismic waves could trigger an earthquake in the simulated fault only if they came in a narrow range of frequencies. If the fault was just about to slip, it would hasten the

process by starting vibrations in that range. Only the frequency really mattered – weak waves, or even waves that would actually push in the direction against a slip, could still induce an earthquake.

“Each fault will have its own acoustic resonance frequency,” de Arcangelis says. “If a signal arrives at this frequency, the fault that without perturbation would be quiet will trigger an earthquake.”

Combined with a 2005 lab experiment that also showed a resonant frequency could jiggle glass beads in a fake fault into slipping, this simulation could suggest that actual faults have specific frequencies they’re susceptible to. That hasn’t yet been observed in real earthquakes, though, says Emily Brodsky of the University of California, Santa Cruz.