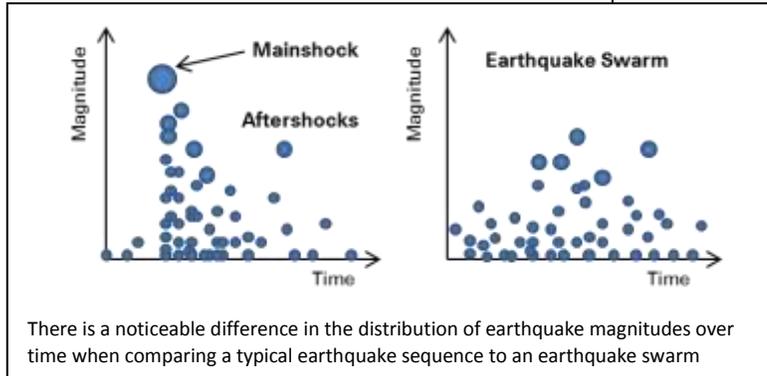


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Liberty Mutual**Earthquake Swarms Explained***Contributed by Iain Bailey – Swiss Re*

Perhaps Macaulay Caulkin's bee-allergy-related death at the end of "My Girl" has led you to associate swarms with a great sense of tragedy and an uncontrollable sadness, but as far as earthquakes are concerned, swarms are a relatively mild occurrence. An earthquake swarm is a name given to a sequence of earthquakes that doesn't fit the usual pattern of a sudden "mainshock" followed by a rapid decay of "aftershocks". Instead, this occasional phenomenon is more like the build-up and fading of traffic on the freeway around rush hour.



A recent cluster of more than 300 earthquakes over a couple of days south of the ¹Salton Sea in southern California has been termed a "swarm" by several USGS seismologists², with a few statements along the lines of "don't worry too much, but remember you should be prepared for earthquakes anyway, right?"³. They aren't so worried for a couple of reasons: firstly, because the earthquakes are not really getting bigger or smaller; if things look relatively stable, there's a good chance they will stay that way. Secondly, this particular area of southern California is known to be tectonically a little different. The Salton Sea, which is itself below sea level, sits on top of a relatively thin crust³ and lithosphere⁴. This leads

to a slightly higher rate of heat escaping from the earth than in surrounding regions. Higher heat flow has been linked to increased flow of fluids within the earth's crust as well as more stable styles of deformation, which have both been related by researchers to earthquake swarms.

So, should we be worried about the swarm in Southern California? Well there's no real reason to be any more worried than normal, since this type of thing happens a lot. However, there are also plenty of reasons to be cautious. Maybe you remember the 2009 L'Aquila earthquake in Italy that killed over 300 people. By some standards, this could have been termed part of an earthquake swarm as it was preceded by a period of increased seismic activity. A

statement made shortly before the earthquake by Italian scientists seeking to reassure the public was later used against them, and they are currently standing trial for manslaughter. No doubt the USGS scientists have been very careful with their words when explaining the Salton Sea swarm.

In addition to the lesson from Italy, we must also take into account that the Southern San Andreas Fault, just to the north of the current earthquake swarm, has been referred to as "ten months

pregnant"⁵ by one UCSD researcher. It's therefore easy to find reasons to err on the side of caution. Every earthquake shifts around the elastic forces that are stored in the Earth's crust. Sometimes this leads to nothing and sometimes this leads to larger earthquakes. One thing to bear in mind, though: the San Andreas fault cannot remain pregnant forever.



Map from the United States Geological Survey of earthquakes in the Salton Sea area recorded during the seven days prior to the 30th August, 2012. Red lines show the major active faults in the area.

¹A saltwater lake accidentally created when agricultural canals became blocked with silt in 1905 and diverted the entire Colorado River south for years.

²As an example, see: http://articles.cnn.com/2012-08-26/us/us_california-quake-swarm_1_quake-swarm-seismologist-san-andreas-faults - CNN website.

³The crust is the outer layer of the earth. It usually about 30-40 km thick beneath continents, and is made up of all of the earth's lighter minerals which over time have floated to the top. Beneath the Salton Sea the crustal thickness is 20-25 km.

⁴The lithosphere is the rigid outer shell of the earth, including the crust and the outer part of the earth's mantle. The notion of a rigid outer shell that does not flow is central to the theory of plate tectonics, which is the unifying theory of all earth science disciplines.

⁵ A quote given by Prof. Tom Rockwell to the San Diego Tribune