

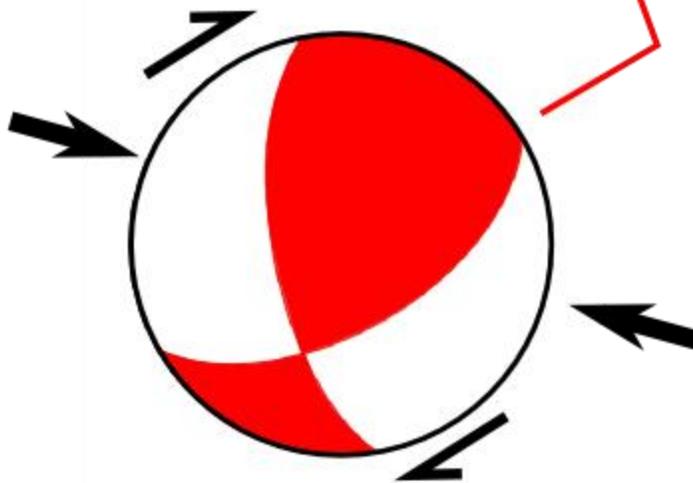


## Magnitude 6.3 earthquake rocks Christchurch

Posted on February 21, 2011 by Chris Rowan



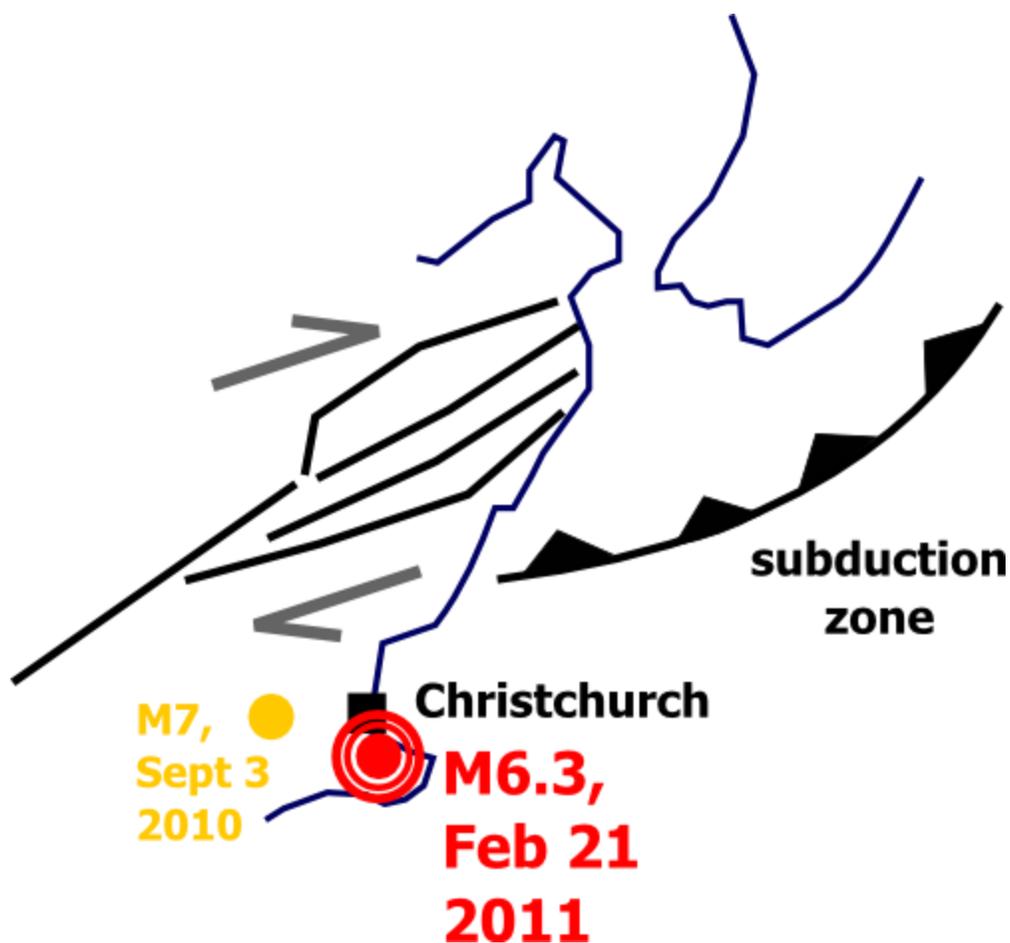
[Note: see the [bottom of this post](#) for the latest updates and links - last update **23rd February 8:30 GMT**]. A few hours ago, Christchurch, the largest city on the South Island of New Zealand, was once again shaken by a large earthquake. [The USGS page reports it as a magnitude 6.3](#), with the rupture occurring just 5 km beneath the surface near the port of Lyttelton, only a few kilometres south of Christchurch itself. This is significantly closer than [September's magnitude 7.0 earthquake](#), which was 45 km to the west; because the energy of seismic waves spreads out and dissipates the further away you are from the rupture point, the shaking experienced in Christchurch today was probably just as, if not more severe, than that experienced in September, even though the quake was smaller in magnitude. The proximity of the rupture, combined with the fact that many buildings in Christchurch had unrepaired damage from September's earthquake, the timing (in the middle of the day rather than the middle of the night) and the ever-looming spectre of [liquefaction](#), which severely magnifies the effects of shaking, have sadly resulted in [collapsed buildings](#), and at least some casualties. When it comes to the impact on people and infrastructure, earthquake magnitude is only part of the story.



Location and focal mechanism of the Feb 21 2011 M6.3 earthquake near Christchurch. The location and focal mechanism of the September 2010 M7 earthquake are also plotted for reference. Orange dots are >M5.5 aftershocks of today's quake.

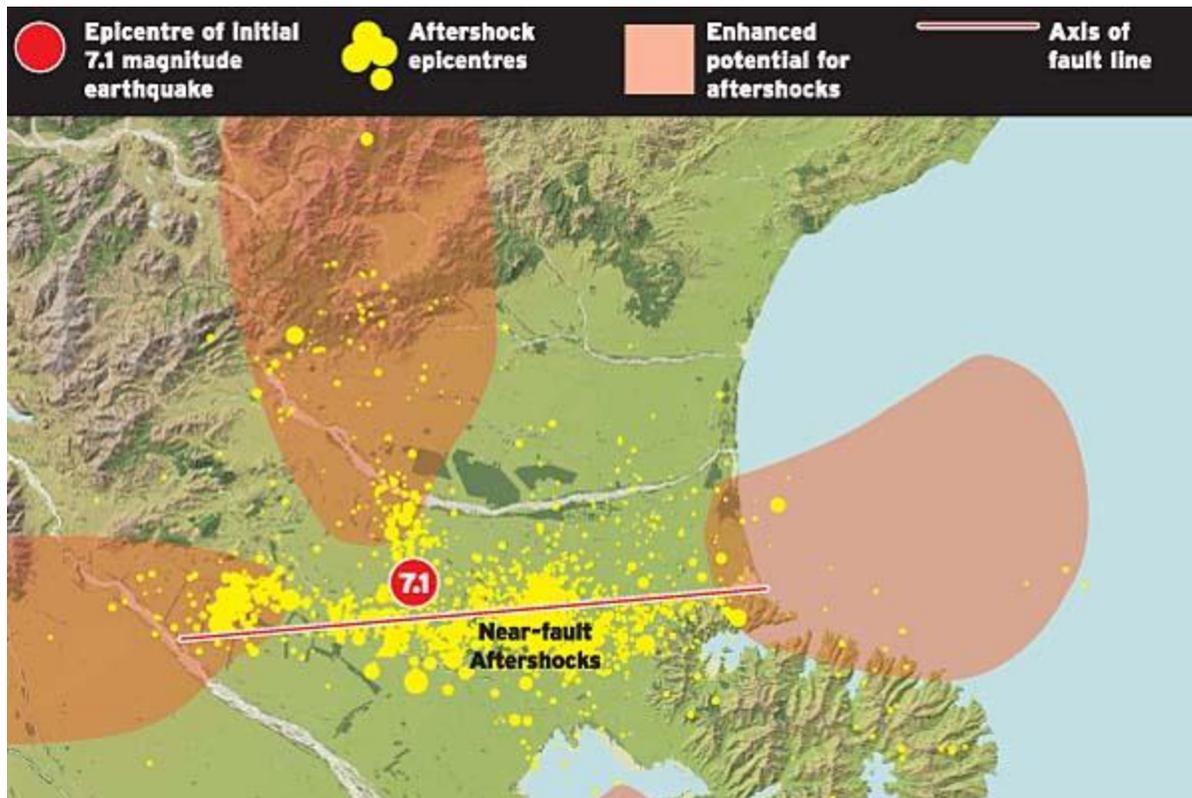
The [focal mechanism](#) for this earthquake plotted in the figure above, [courtesy of the USGS](#), shows that it is transpressional – a combination of mostly east-west compression, with some right-lateral strike slip motion mixed in – and on a north-south trending fault [**update**: what I really mean here is more N-S trending than the Darfield fault; [as Kim points out in the comments](#), if my interpretation above is right the actual fault plane is NE-SW oriented]. Superficially, this seems

very different from September's earthquake, which consisted of mainly right lateral motion on an east-west trending fault. However, strike slip on an east-west trending fault and compression on a north-south trending fault are in fact fairly equivalent in tectonic terms – they can be produced by pretty much the same regional tectonic forces. The transpressional deformation in today's earthquake is fairly consistent with the overall sense of motion across the plate boundary that bisects New Zealand.



Location of Christchurch earthquakes in relation to the plate boundary running through New Zealand.

The other thing worth noting is that today's rupture occurred in a region of crust that, according to modelling, saw a significant stress change as a result of last September's earthquake. This seems unlikely to be a coincidence. We're looking at a grey area between an 'aftershock' and a 'triggered earthquake', in that the Darfield earthquake probably helped to push the fault that ruptured today over the threshold, but that most of the stress released in this earthquake has been building up since long before six months ago.

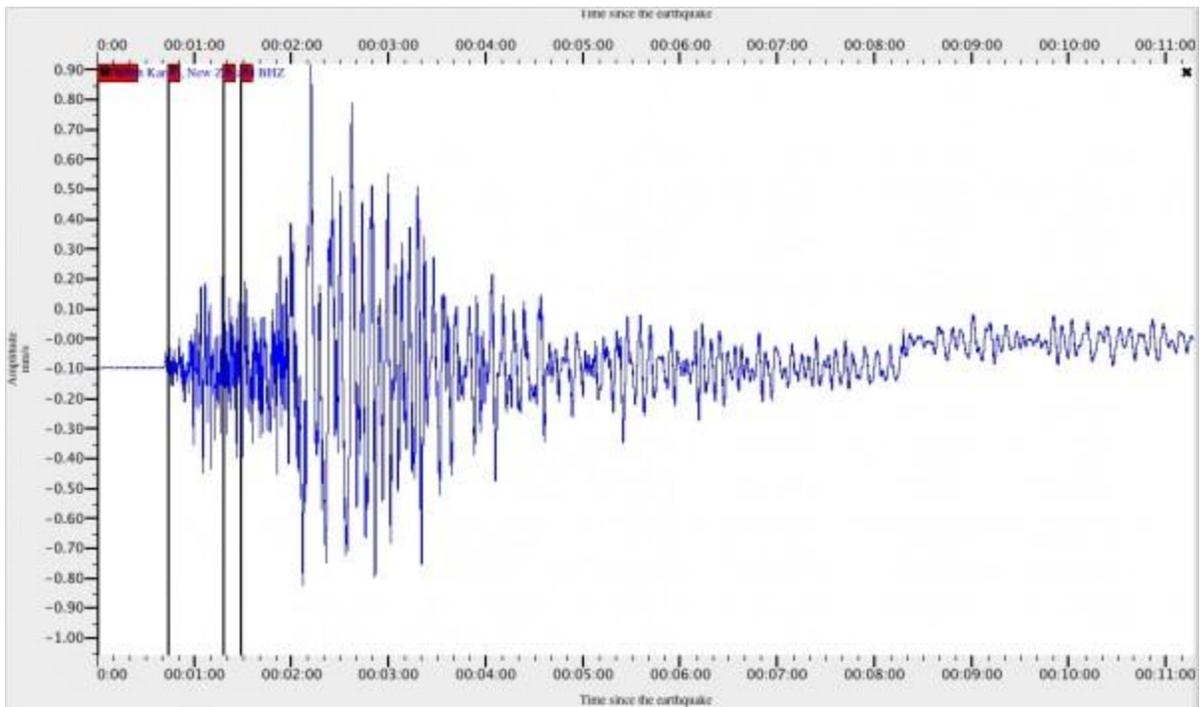


Aftershocks and changes in crustal stress due to the Darfield Earthquake in September 2010.  
Source: Stuff.co.nz

What does this mean for the seismic risks for the residents of Christchurch in the days and months ahead? Well, there are going to be more aftershocks, more than there would have been otherwise. Beyond that, I'm afraid to speculate: I can only hope that there aren't any more nasty seismic surprises lying in wait beneath the Canterbury Plains, and that Christchurch and New Zealand continue to show their characteristic resilience in the face of this latest disaster. I'll update this post as necessary, as more concrete information comes in: please feel free to add any relevant links and information in the comments.

**Update: 22 Feb 2011**

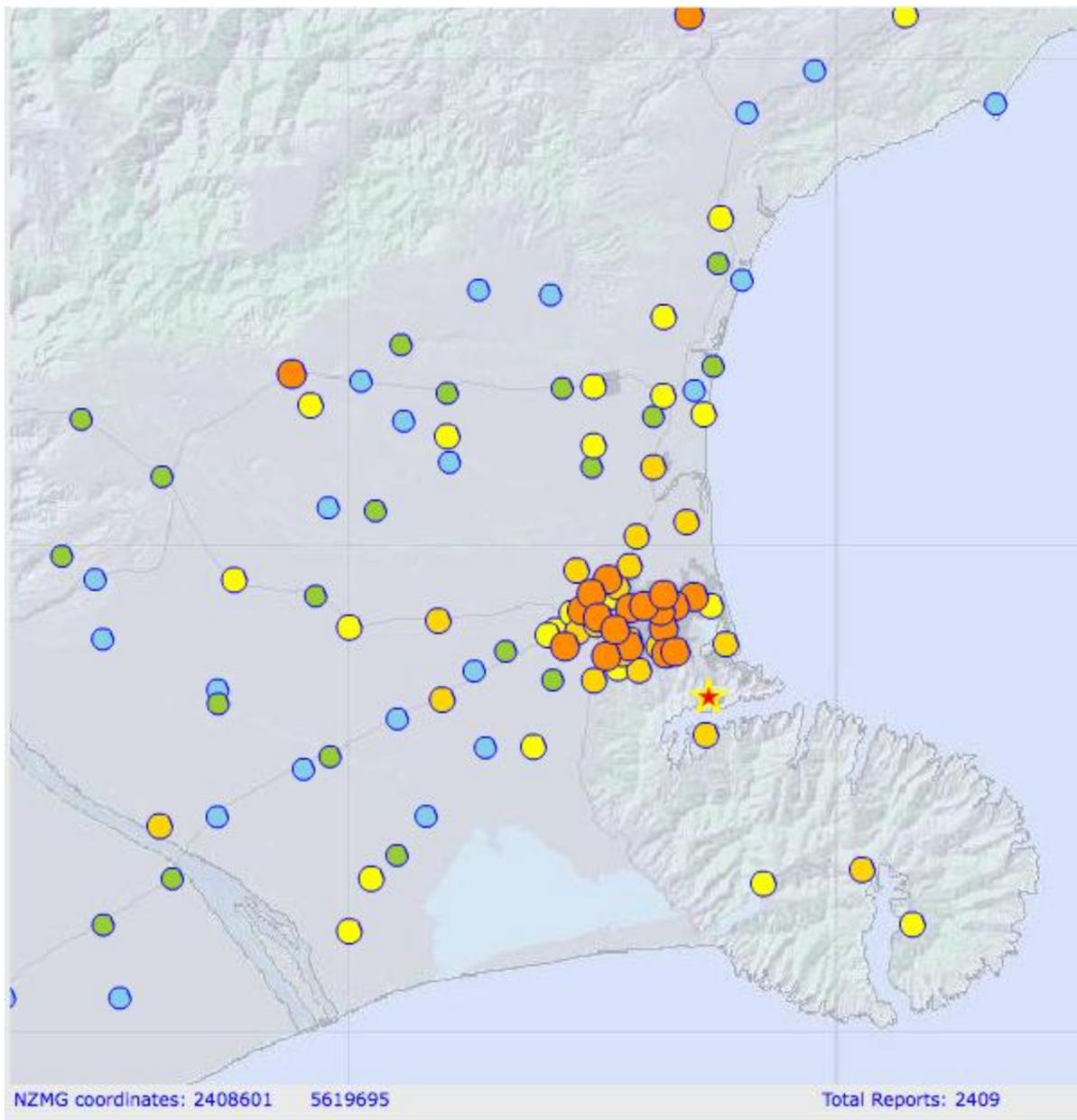
Here's the shaking recorded by a seismogram close to Wellington, on the Southern North Island, via [Shaking Earth](#):



Click for a larger version. Source: Shaking Earth

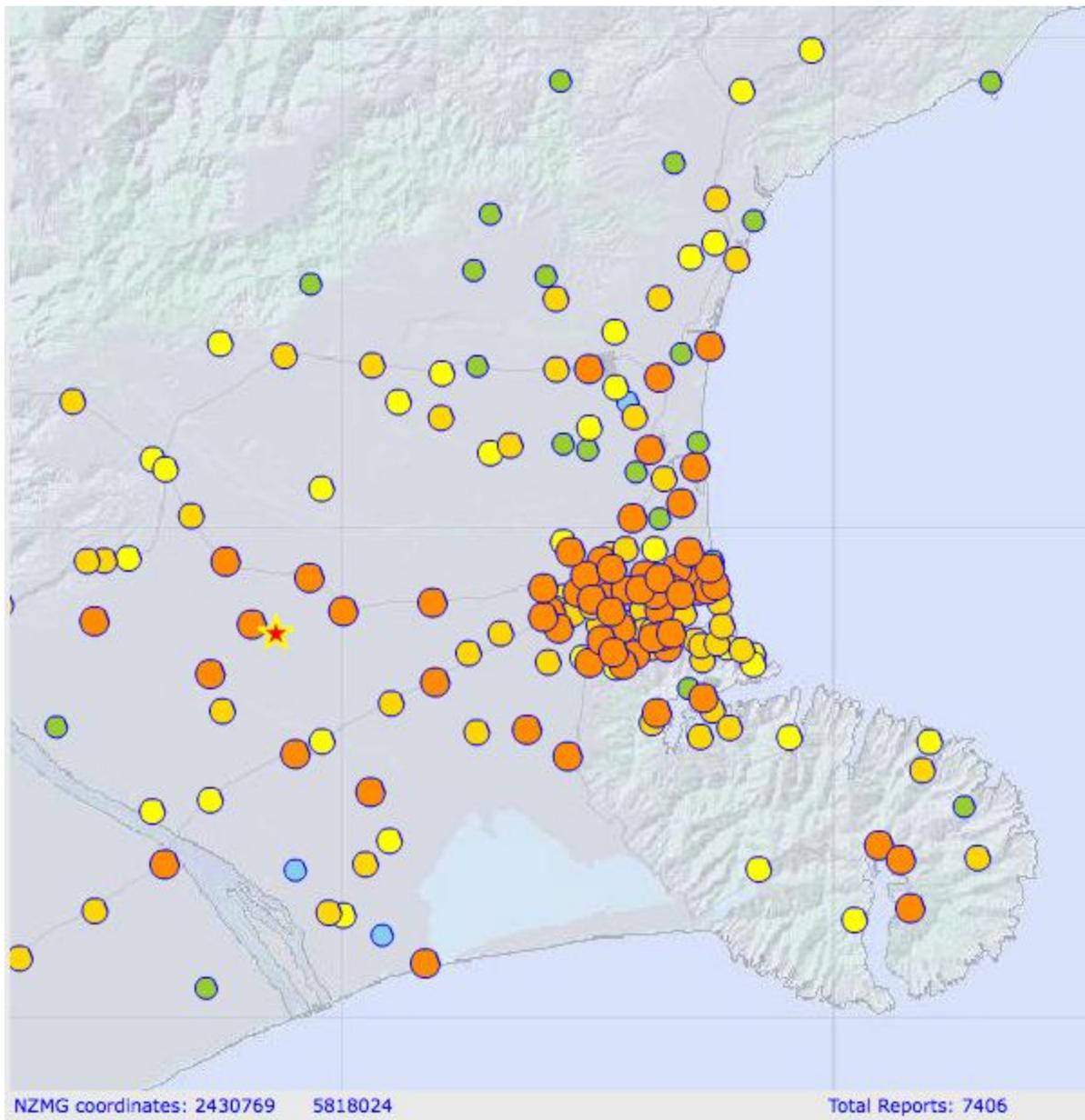
From this, the shaking lasted several minutes, peaking a minute or two into the earthquake.

From Geonet, you can view [a map of reported shaking intensity](#), coded according to the [Modified Mercalli Scale](#):



Reported shaking from the 21 February Earthquake, according the Mercalli Intensity Scale: 8 - orange; 7 - light orange; 6 yellow; 5 - green; 4 - blue. Source: Geonet

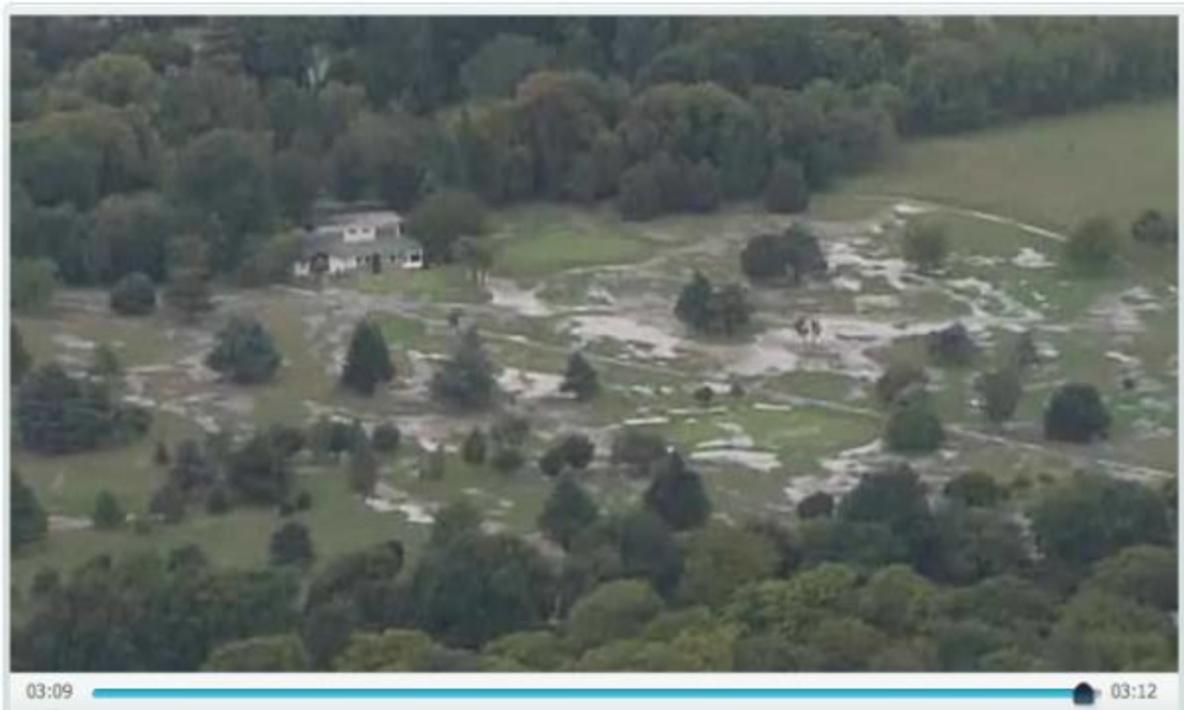
Note how the maximum values are clustered in Christchurch, close to the rupture, and fall away fairly quickly outside it. This contrasts with [the shakemap for September](#), where intense shaking was felt across a much wider region. This shows that yesterday's magnitude 6.3 quake released much less energy in total than September's magnitude 7, but due to its location the energy it did release was focussed on a built-up area.



Shakemap for the September 2010 M7 Earthquake. Colours as above. Source: Geonet

There are lots of [photos](#) coming out of the [damage in Christchurch](#), but [this video shot from a helicopter](#) provides a good overview. Obviously some buildings have collapsed completely, but it should be noted that many more structures have remained standing (although many of those will probably be in need of extensive repairs). It is cold comfort to those who have been trapped or injured, or the friends and families of the several hundred casualties, but New Zealand's stringent building codes have probably once more saved many lives.

At the end of the video I linked to above, there are also some shots of extensive liquefaction caused by the shaking, which probably had a strong influence in the distribution and magnitude of the damage.



Water forced to the surface by liquefaction. Source: TVNZ

### Update: 23 Feb 2011

New Zealand's geologists have once again been doing an excellent job of explaining this earthquake, and the risks going forward, to the media, and through them, the Kiwi public.

- GNS scientist Bill Fry talks about this earthquake in the context of the aftershocks of the Darfield earthquake last September:
- Another GNS scientist, seismologist Jon Ristau, does [a great job of explaining earthquake \(non-\) predictability](#).
- University of Canterbury geologist Mark Quigley continues to be [a great source of accurate information](#).

There have also been some compelling, often harrowing eyewitness accounts of the earthquake and its aftermath:

- The racing editor of the NZ Herald took 'a walk through sorrow' in the centre of Christchurch the evening after the earthquake hit:

*Everywhere I look buildings I have dined in with friends, bars I have visited, banks and shops I have been to are ruined. Not damaged, ruined.*

- A resident of Lyttelton, which was even closer to the epicentre of the quake than Christchurch, in [an interview with the Australian Broadcasting Corporation yesterday](#):

*really 80 per cent of the township, if you like, the heart of Lyttelton, I would say is lying in little pieces.*

*Now you're not talking everything levelled to the ground, but it's parts of buildings fallen off into the streets. And it's not just one, it's every second or third building, you look at it and go, "Well that's a write off. No business can operate there."*

- A journalist for the Christchurch paper the Pres, whose headquarters close to the Cathedral was heavily damaged in the earthquake:

*Outside the inner CBD looked like a war zone. Outside on the street strangers were holding each other and crying and gazing bewildered at the gutted ghetto surrounding us.*

(she also describes how one of the many areas overwhelmed by liquefaction "looks like [Rotorua](#)")

Some more photos and videos:

- supermarket CCTV footage of the moment the earthquake hit shows how the intensity of shaking ramped up over the space of about 10 seconds or so.
- A dramatic photo from the hills above Christchurch, showing dust rising from the city centre (click for a larger version).



- Liquefaction on the city streets (see more [here](#)):



- Cracks in the road:



Also worth reading is [Dave Petley's analysis](#) of the reasons why the damage to Christchurch was [much more severe](#) than that caused by last September's larger earthquake. Fortunately, it seems that New Zealand's Earthquake Commission can [cover the costs of further rebuilding](#). In a similar vein, I'm quoted in [this story by the Christian Science Monitor](#).