U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

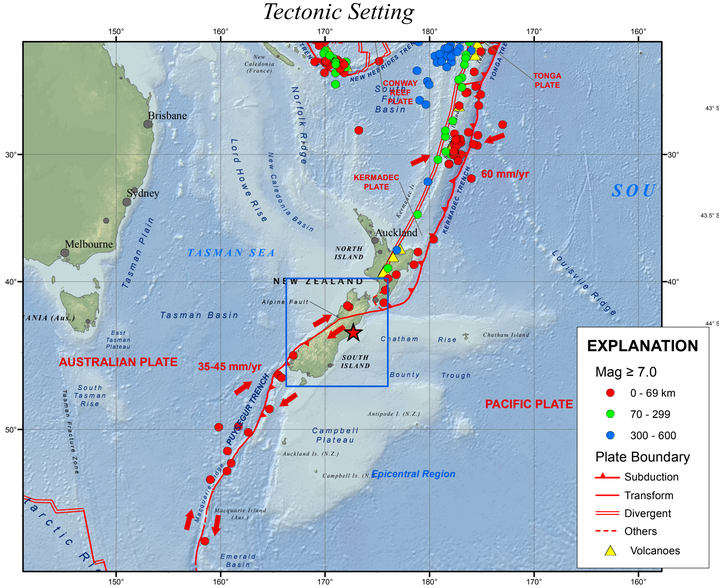
EARTHQUAKE SUMMARY MAP

M6.3 South Island, New Zealand Earthquake of 21 February 2011

Prepared in cooperation with the Global Seismographic Network

GSN

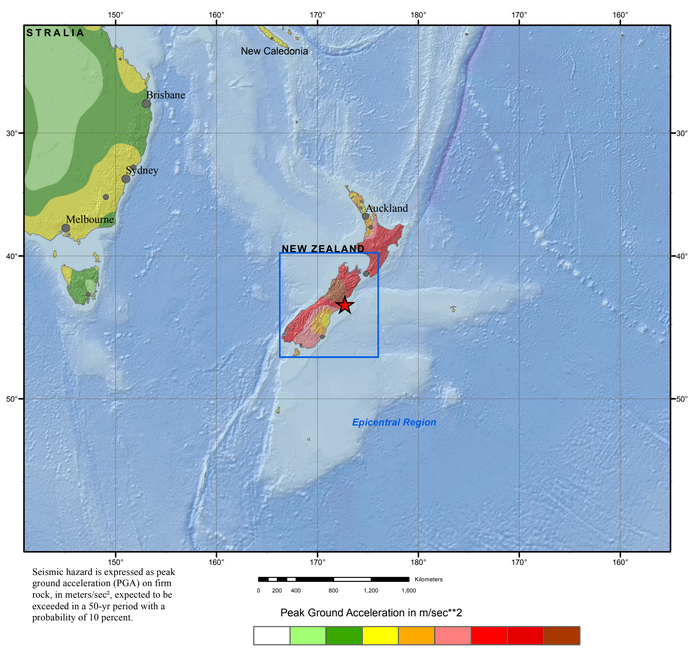
Tectonic Setting



RELATIVE PLATE MOTIONS

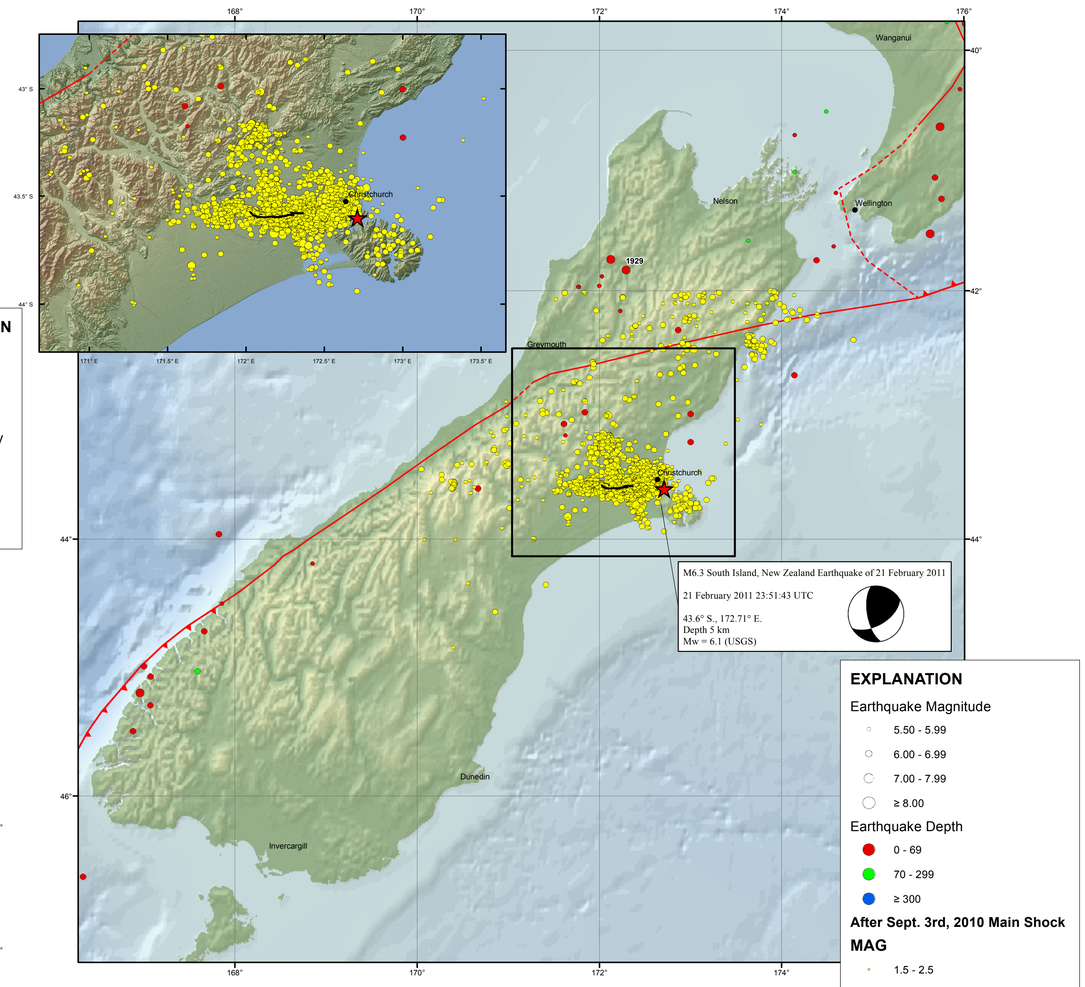
The broad red vectors represent the motion of tectonic plates relative to the adjacent plate. In the vicinity of this earthquake, the Australia Plate and Pacific Plate are converging at about 35-45 mm/yr.

Seismic Hazard



Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec^2, expected to be exceeded in a 50-yr period with a probability of 10 percent.

Epicentral Region



Tectonic Summary

The February 21, 2011 South Island, New Zealand earthquake occurred as part of the aftershock sequence of the M 7.0 September 3, 2010 Darfield, NZ earthquake. The February 21 earthquake involved oblique-reverse faulting at the easternmost limit of previous aftershocks, and like the mainshock itself is broadly associated with regional plate boundary deformation as the Pacific and Australia plates interact in the central South Island, New Zealand.

This latest shock is significantly closer to the main population center of Christchurch, NZ, than is the September 2010 mainshock, in the vicinity of several other moderate (M 4 - 5) sized aftershocks located east of the main rupture zone of the 2010 event. There is no specific structure directly linking this event to the main fault of the 2010 mainshock, although there have been numerous aftershocks along generally east-west linear trends extending east from the end of the previous rupture. The north or north-east trends to the possible fault planes and the oblique thrust faulting mechanism as seen in the focal mechanism solution may reflect an association with similarly- trending faults previously mapped in the Port Hills region, just to the south of Christchurch.

Since the September 3, 2010 mainshock, there have been approximately 6 M>=5.0 aftershocks in the Christchurch region. The February 21 earthquake represents the largest aftershock to date, more that half a magnitude unit larger than the previous largest aftershock.

Significant Earthquakes Mag >= 6.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1901	11	15	2015	-43.000	173.000	0	6.8
1929	03	09	1050	-43.227	173.002	15.2	6.9
1929	06	16	2247	-41.831	172.292	35	7.5
1938	12	16	1721	-45.503	166.880	25	6.9
1942	06	24	1116	-41.534	175.630	35	7.0
1942	08	01	1234	-41.066	175.684	35	6.9
1943	08	02	0046	-45.000	167.000	0	6.8
1960	05	24	1446	-43.962	167.824	35	6.7
1961	12	27	2348	-41.243	175.754	35	6.8
1968	05	23	1724	-41.743	172.123	46.7	7.2
1976	05	04	1356	-44.726	167.663	30.4	6.6
1988	06	03	2327	-45.039	167.587	74.8	6.7
1989	05	31	0554	-45.302	167.071	23.2	6.5
1993	08	10	0051	-45.207	166.958	28	7.0
1994	06	18	0325	-43.081	171.610	14	6.7
2003	08	21	1212	-45.104	167.144	28	7.2
2007	10	15	1229	-44.796	167.553	18	6.8
2009	07	15	0922	-45.762	166.562	12	7.8
2010	09	03	1635	-43.530	171.812	12	7.0

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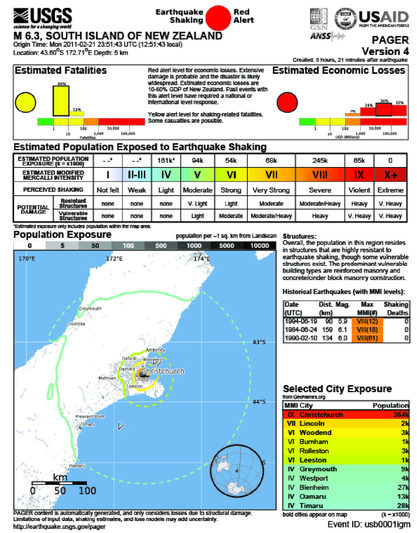
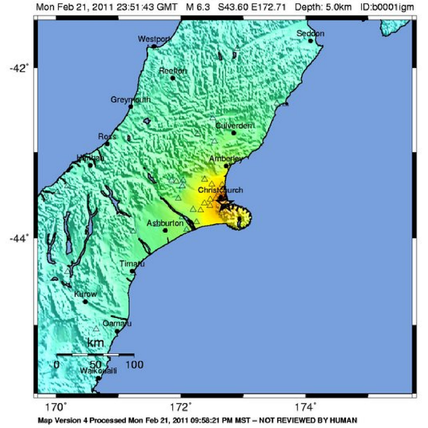


ShakeMap



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	*8.1-16*	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

DATA SOURCES and REFERENCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions Engdahl, E.R. and Villaseñor, A., 2002, Global Seismicity: 1900 - 1999, chap. 41 of Lee, W.H.K., and others,eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academeic Press, 932 p.
HDF (unpublished earthquake catalog) (Engdahl, 2003)
Global Seismic Hazard Assessment Program http://www.seismo.ethz.ch/GSHAP/
GNS Science New Zealand (Earthquakes since 09/03 mainshock)
EOS, transactions, American Geophysical Union, Vol.91 #49, p469-470 (Greendale Fault Trace)
NASA (SRTM 3-arc second imagery for inset), http://gcmd.nasa.gov/records/GCMD_DMA_DTED.html

PLATE TECTONICS
Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027- 80.

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models