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

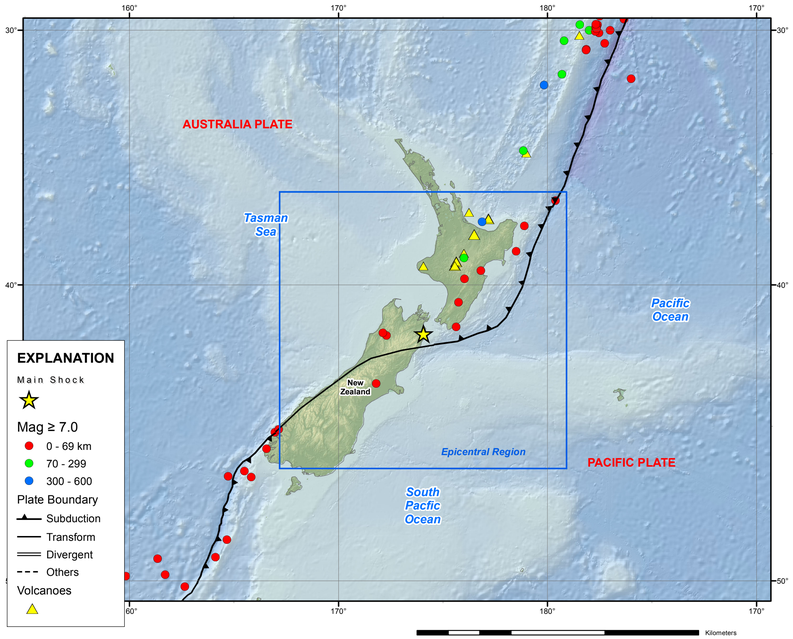
M6.5 New Zealand Earthquake of 16 August 2013

EARTHQUAKE SUMMARY MAP

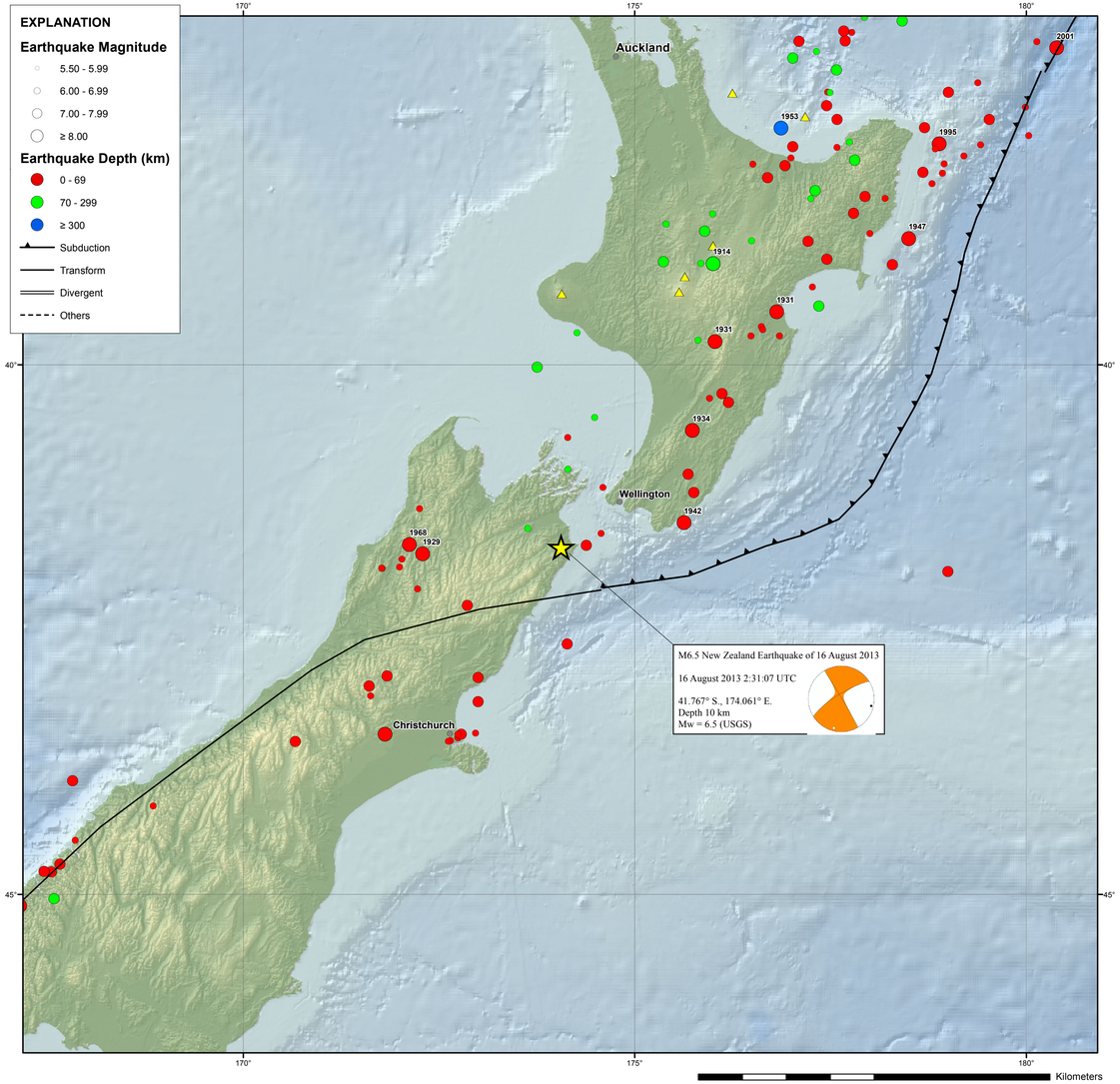
Prepared in cooperation with the Global Seismographic Network

GSN

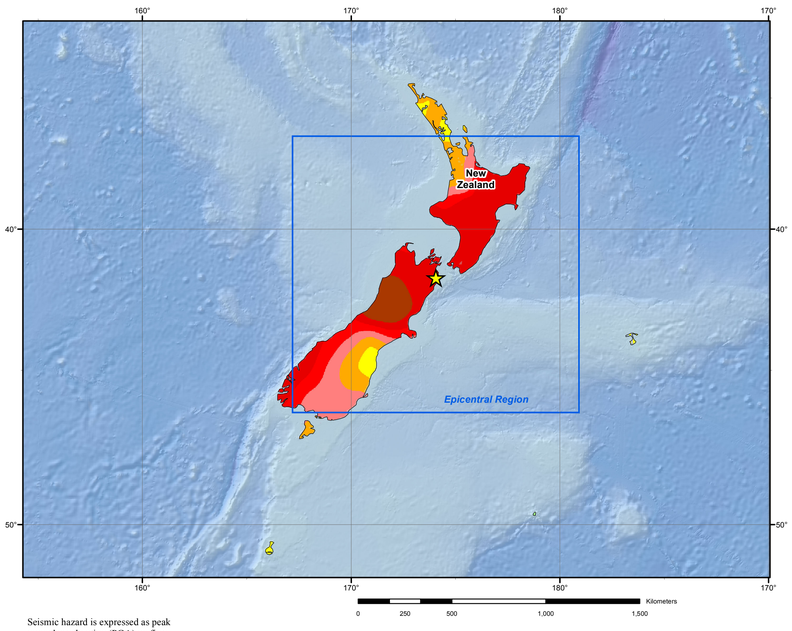
Tectonic Setting



Epicentral Region



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.

Peak Ground Acceleration in m/sec**2

.2 .4 .8 1.6 2.4 3.2 4.0 4.8

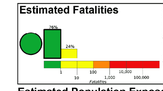
PAGER

M 6.5, COOK STRAIT, NEW ZEALAND
Origin Time: Fri 2013-08-16 02:31:07 UTC (14:31:07 local)
Location: 41.77°S 174.06°E Depth: 10 km

Earthquake Shaking — Orange Alert

PAGER Version 6
Created: 10 hours, 52 minutes after earthquake

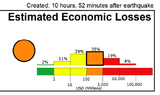
Estimated Fatalities



Orange alert level for economic losses. Significant damage is likely and the disaster is potentially widespread. Estimated economic losses are between 1% of GDP of New Zealand. Past events with this alert level have required a regional or national level response.

Green alert level for shaking-related fatalities. There is a low likelihood of casualties.

Estimated Economic Losses



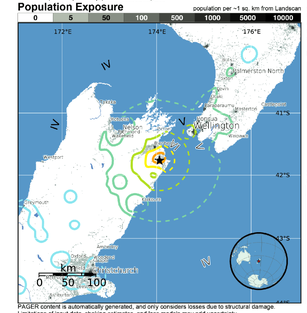
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	-.-*	428k*	435k*	403k	216k	2k	3k	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE: Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
POTENTIAL DAMAGE: Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan



Structures:
Overall, the population in this region resides in structures that are resistant to earthquake shaking, though some vulnerable structures exist.

Historical Earthquakes (with MMI levels):

Date (UTC)	Dist. (km)	Mag.	Max MMI(#)	Shaking Deaths
1984-06-24	330	6.1	VIII(18)	0
1990-02-10	103	6.0	VIII(61)	0
1990-05-13	253	6.4	VIII(440)	0

Selected City Exposure
from GeoNames.org

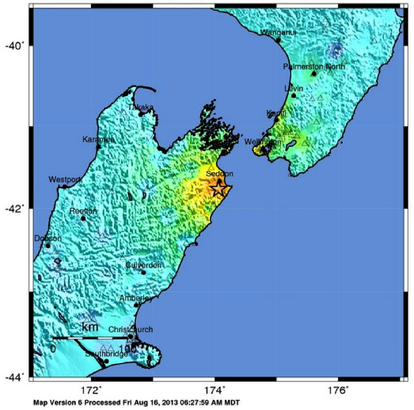
MMI	City	Population
VI	Blenheim	27k
VI	Kelburn	4k
VI	Wellington	382k
VI	Brooklyn	4k
VI	Karori	14k
V	Paraparaumu	25k
V	Palmerston North	76k
IV	Nelson	59k
IV	Richmond	14k
III	Greymouth	9k
III	Christchurch	364k

bold cities appear on map (k = x1000)

PAGER content is automatically generated, and only considers losses due to structural damage. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: usb000j4iz

ShakeMap



Map Version 6 Processed Fri Aug 16, 2013 06:27:59 AM MDT

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2011)

TECTONIC SUMMARY

The M 6.5 August 16, 2013 earthquake south of Blenheim, New Zealand, occurred as the result of strike-slip faulting on or near the plate boundary between the Pacific and Australia plates. At the latitude of this event, the Pacific plate moves towards the WSW with respect to Australia at a rate of approximately 41 mm/yr. Preliminary faulting mechanisms for the earthquake in concert with the location and faulting mechanisms of the larger aftershocks suggest it is related to NE-SW right-lateral strike-slip motion, consistent with plate motion oriented displacements.

This region of New Zealand has hosted a number of small-moderate sized earthquakes in recent weeks, including a M 6.5 earthquake approximately 40 km east of the August 16 event in the Cook Straight, on July 21, 2013. The July 21 event was preceded by several M 5.3-5.8 events and was followed by a dozen or more aftershocks between M 4.5-5.0, delineating shallow upper plate structures aligned NE-SW, and some deeper subduction-related activity, mostly offshore of the north coast of New Zealand's South Island.
In contrast to the earlier events, the August 16 earthquake is on land, near the eastern end of the complex Marlborough Fault System. The event is located approximately 10 km southeast of the Awatere Fault in the vicinity of Lake Grassmere. The Marlborough Fault system is characterized by a series of NE striking right-lateral strike slip faults that have dismembered the northern South Island into a series of crustal blocks that are being transported to the northeast. Although there is no specific mapped surface fault that can be linked to the August 16 event at this time, the NE trending fault plane is similarly oriented to the Awatere and Clarence faults of the Marlborough system. In 1966 a M 5.8 earthquake (interpreted to have occurred offshore to the NE of the August 16 event) was widely felt in this area, causing surface deformation of the main railroad line in the region. That event is interpreted to have occurred on a blind structure sub-parallel to and southeast of the Awatere fault.

Significant Earthquakes Mag >= 7.0

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1908	04	22	2345	-38.000	48.000	0	7.0
1914	11	22	0814	-39.000	176.000	100	7.0
1919	03	02	0326	-41.401	-72.222	15	7.2
1919	03	02	1145	-42.284	-76.452	15	7.1
1920	12	10	0425	-39.456	-74.988	35	7.2
1927	11	21	2312	-45.112	-73.622	15	7.1
1929	06	16	2247	-41.831	172.292	35	7.5
1931	02	02	2246	-39.772	176.025	35	7.7
1931	02	13	0127	-39.479	176.813	35	7.1
1934	03	01	2145	-40.925	-72.877	35	7.3
1934	03	05	1146	-40.643	175.738	35	7.3
1940	10	11	1841	-42.042	-73.933	15	7.0
1942	06	24	1116	-41.534	175.630	35	7.0
1947	03	25	2032	-38.750	178.500	0	7.0
1949	04	20	0329	-38.000	-73.500	70	7.1
1953	05	06	1716	-37.254	-72.920	68.4	7.5
1953	09	29	0136	-37.637	176.868	311	7.0
1960	05	21	1002	-37.872	-73.243	35	8.2
1960	05	22	1856	-38.147	-72.984	35	7.9
1960	05	22	1911	-38.235	-73.047	35	9.5
1960	06	06	0555	-45.727	-73.444	25	7.2
1960	06	20	0201	-38.254	-73.283	25	7.0
1960	06	20	1259	-39.218	-73.331	25	7.1
1962	02	14	0636	-38.091	-73.050	32.9	7.5
1967	03	13	1606	-40.193	-74.842	22.4	7.3
1968	05	23	1724	-41.743	172.123	46.7	7.2
1974	08	18	1044	-38.433	-73.462	8.4	7.1
1975	05	10	1427	-38.215	-72.999	28	7.7
1993	08	10	0051	-45.207	166.958	28	7.0
1995	02	05	2251	-37.795	178.889	21	7.1
2001	08	21	0652	-36.818	-179.612	46.7	7.1
2001	12	12	1402	-42.819	124.718	14.1	7.1
2003	08	21	1212	-45.104	167.144	28	7.2
2009	07	15	0922	-45.762	166.562	12	7.8
2010	09	03	1635	-43.530	171.812	12	7.0
2011	01	02	2020	-38.372	-73.349	24	7.1

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Ji, C., D.J. Wald, and D.V. Helmberger, Source description of the 1999 Hector Mine, California earthquake; Part I: Wavelet domain inversion theory and resolution analysis, Bull. Seism. Soc. Am., Vol 92, No. 4. pp. 1192-1207, 2002.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

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

REFERENCES

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

Engdahl, E.R., and Villasenor, 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 Academic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination,Bull. Seism. Soc. Amer., v. 88, p. 722-743.

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official signifiance.

Map updated by U.S. Geological Survey National Earthquake Information Center
19 August 2013
http://earthquake.usgs.gov/
Map not approved for release by Director USGS