

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

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





.2 .4 .8 1.6 2.4 3.2 4.0 4.8

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.

Epicentral Region

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.

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

EARTHQUAKE SUMMARY MAP

Prepared in cooperation with Global Seismographic Network



Earthquake Red Shaking Red Alert												
M 6.3, SOUTH IS	IEW ZEALAND					ANSS		PAGER				
Origin Time: Mon 2011-02-2 Location: 43 60 ⁰ S 172 71 ⁰ E	1 23:51:43 Death: 5 ki	UTC (12:: m	51:43 local	1)					Ve	rsion 4		
Location: 40.00 5 172.11 E	Берик э м						c	created: 5 hours, 21	minutes aft	er earthquake		
Estimated Fatalit												
84%		u u	idespread.	Estimated eco	onomic losse	sare						
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	<image/>			36% 52%								
		Y	ellow alert i	level for shaki flor are possi	ng-related fai	talities.	$\overline{}$	_	7%			
i 199	10,000			illes alle pussi	ue.			i v	33 10	.000		
10 retelits	1,000 10	10,000						10 USD	1,000 Milliond	100,000		
Estimated Popula	ation E	xpose	d to E	arthqua	ke Sha	king						
ESTIMATED POPULATION EXPOSURE (k = x1000)	*	*	161k*	94k	54k	68k		245k	65k	0		
ESTIMATED MODIFIED MERCALLI INTENSITY	-	II-II	IV	٧	VI	VII		VIII	IX.	X+		
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Stro	ong	Severe	Violent	Extreme		
Resistant Structures	none	none	none	V. Light	Light	Moderat	ie	Moderate/Heavy	Heavy	V. Heavy		
DAMAGE Vuinerable Structures	none	none	none	Light	Moderate	Moderate/H	leavy	Heavy	V. Heavy	V. Heavy		
"Estimated exposure only includes pop	viation within t	he map area.					-			<u> </u>		
Population Expos	sure		P	opulation per-	~1 sq. km fro	m Landscan	Stru	ctures:				
0 5	50	100	500	1000	5000	10000	in st	rall, the population ructures that are h	i in this reg Jighly resis	jion resides tant to		
170°E	172°E	i		174°E		1	earth	nquake shaking, ti	ough som	e vulnerable		
	4.0		1 - 1 - 1 - 1 	1 . AS			structures exist. The predominant vulnerable building types are reinforced masonry and					
				<u>-</u>			cond	rete/cinder block	masonry c	onstruction.		
				4.			Historical Earthquakes (with MMI levels):					
121	· · ·							e Dist. Ma	o. Max	Shaking		
Greym	outh						(UT	C) (km)	MMI(#	f) Deaths		
Hokitika			11 31				199	4-08-19 90 5.	9 VIII(1)	2) 0		
		22.1	- 3 <mark>-</mark>			333751	198	4-06-24 159 6. 0.02.10 134 61		24% 36% 32% 35.460 32% 35.460 32% 35.460 32% ant Extreme vy V. Heavy avy Shaking MI(#) Deaths II(12) 0 II(18) 0 OSUTE Population 364k 3k 1k 3k <td< td=""></td<>		
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	9892 2		S.	44*S				from GeoNames.org				
A Start							MM	Christehursh		Population		
Pleasant					VII	Lincoln		2k				
~ 1 . We				VI	Woodend		3k					
		1 in		VI	Burnham		1k					
1 X				VI Rolleston			3k					
Camaru	16-	VI	Leeston		1k							
Ma. km	XII.	Δ		Westport		96						
								Blenheim		271		
0 50 100					6		IV	Oamaru		Exposure Population Solution Population Solution Population Solution		
							IV	Timaru		28k		
PAGER content is automatically Limitations of input data, shaking	generated, a estimates	and only co and loss m	nsiders lost odels may a	ses due to stru add uncertaint	ictural damag	je.	bold	cities appear on ma	р	(K - x1000)		
http://earthquake.usgs.gov/p	ager		,					Ever	nt ID: us	b0001igm		

INTENSITY	1	11-111	IV	V	VI	VII	VIII	IX	X+
EAK 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
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
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
SHAKING	NOT 1911	weak	ugni	Moderate	Strong	very strong	Severe	violent	Extreme

DATA SOURCES and REFERENCES

EARTHQUAKES AND SEISMIC HAZARD USGS, National Earthquake Information Center

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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** 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 regraded as having official signifiance.

Map prepared by U.S. Geological Survey National Earthquake Information Center 21 February 2011

http://earthquake.usgs.gov/ Map not approved for release by Director USGS