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

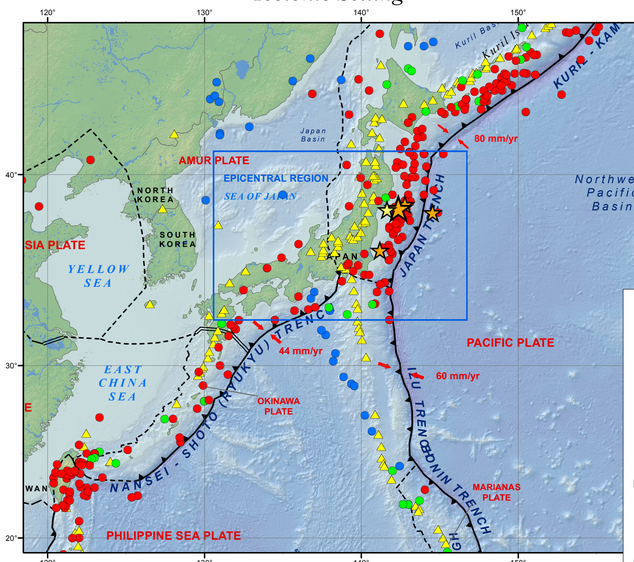
EARTHQUAKE SUMMARY MAP XXX

M7.1 Northeast Honshu, Japan Earthquake of April 7, 2011

Prepared in cooperation with the Global Seismographic Network

GSN

Tectonic Setting

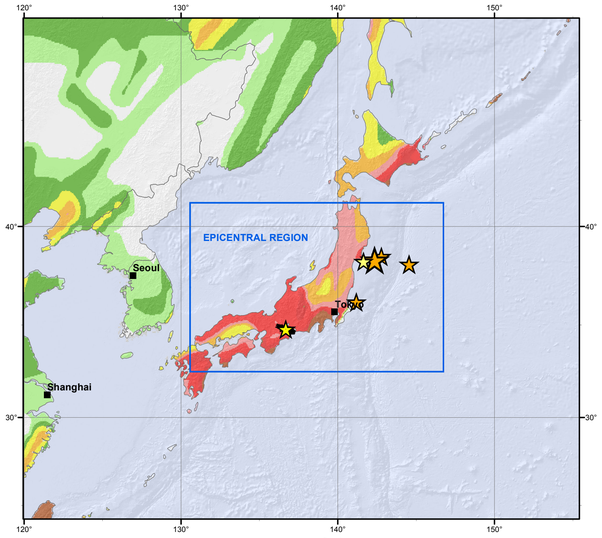


RELATIVE PLATE MOTIONS

The red vectors represents the motion of the Pacific Plate relative to the Philippine Plate, and the Philippine Plate relative to the Eurasia Plate in the region. The motion of the Pacific Plate is generally 60 mm/yr north westward with respect to the Philippine Plate. The motion of the Philippine Plate is generally 44 mm/yr north westward with respect to the Eurasia Plate.

Scale 1:20,000,000
0 125 250 500 750 1,000 Miles

Seismic Hazard



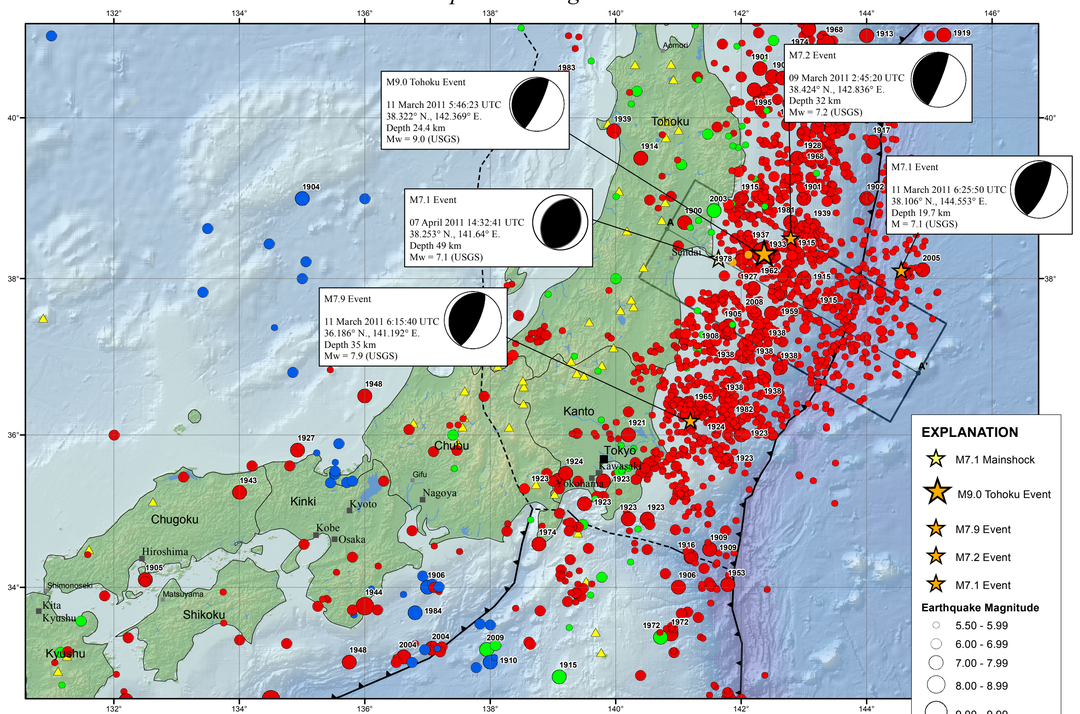
Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec^2, expected to be exceeded in a 50-yr period with a probability of 10 percent.

Scale 1:20,000,000
0 135 270 540 810 1,080 Miles

Peak Ground Acceleration in m/sec**2

.2 .4 .8 1.6 2.4 3.2 4.0 4.8

Epicentral Region



Scale 1:5,000,000
0 50 100 200 Kilometers

EXPLANATION

- M7.1 Mainshock
- M9.0 Tohoku Event
- M7.9 Event
- M7.2 Event
- M7.1 Event

Mag ≥ 7.0
- 0 - 69 km
- 70 - 299
- 300 - 600

Plate Boundaries
- Subduction
- Transform
- Divergent
- Others
- Active Volcanoes

EXPLANATION

- M7.1 Mainshock
- M9.0 Tohoku Event
- M7.9 Event
- M7.2 Event
- M7.1 Event

Earthquake Magnitude
- 5.50 - 5.99
- 6.00 - 6.99
- 7.00 - 7.99
- 8.00 - 8.99
- 9.00 - 9.99

Earthquake Depth
- 0 - 69
- 70 - 299
- 300 - 600
- Active Volcanoes

TECTONIC SUMMARY

The April 7, 2011 earthquake near the east coast of Honshu, Japan occurred as a result of thrust/reverse faulting on or near the subduction zone plate boundary between the Pacific and North America plates. At the latitude of this earthquake, the Pacific plate moves approximately westwards with respect to the North America plate at a rate of 83 mm/yr, and begins its westward descent beneath Japan at the Japan Trench. Note that some authors divide this region into several microplates that together define the relative motions between the larger Pacific, North America and Eurasia plates; these include the Okhotsk and Amur microplates that are respectively part of North America and Eurasia.

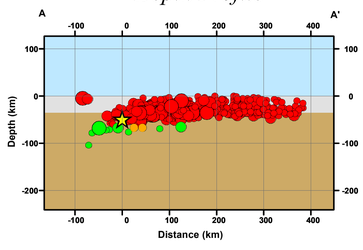
The epicenter and focal-depth of the April 7 earthquake are consistent with the event having occurred very close to the main interface thrust-fault of the subduction zone plate boundary. Preliminary focal-mechanisms, however, imply slip on a fault with steeper dip than that of the main interface thrust-fault, which may imply an intraplate source is more likely.

This earthquake can be considered an aftershock of the March 11, 2011 Mw 9.0 Tohoku earthquake. The aftershock sequence of that event has been ongoing since March 11, and has included 58 earthquakes of M 6 or greater up until April 7 2011, two of which were greater than M 7 (M7.7 and M7.9, both on March 11). Over the two days preceding the March 11 earthquake, a series of large foreshocks had occurred, beginning on March 9th with a M 7.2 event approximately 40 km from the epicenter of the March 11 earthquake, and continuing with another three earthquakes greater than M 6 on the same day. Prior to March 9 2011, the Japan Trench subduction zone had hosted nine events of magnitude 7 or greater since 1973.

Significant Earthquakes Mag >= 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1901	08	09	1833	40.600	142.300	35	7.5
1906	01	21	1349	34.000	137.000	350	7.7
1909	03	13	1429	34.500	141.500	35	7.6
1915	11	01	0724	38.300	142.900	35	7.5
1923	09	01	0258	35.405	139.084	35	7.9
1923	09	02	0246	34.900	140.200	35	7.6
1927	03	07	0927	35.802	134.924	9.6	7.6
1931	03	09	0348	40.484	142.664	35	7.7
1933	03	02	1731	39.224	144.622	35	8.4
1938	05	23	0718	36.458	141.755	35	7.7
1938	11	05	0843	37.009	142.045	35	7.9
1938	11	05	1050	37.108	142.081	35	7.8
1938	11	06	0853	37.287	142.283	35	7.7
1944	12	07	0435	33.750	136.000	0	8.1
1953	11	25	1748	34.034	141.786	35	7.9
1960	03	20	1707	39.871	143.435	2.1	7.8
1964	06	16	0401	38.434	139.226	13.1	7.5
1968	05	16	0049	40.903	143.346	25.8	8.3
1972	02	29	0923	33.377	140.881	58.8	7.5
1978	06	12	0814	38.224	142.009	53.3	7.7
1983	05	26	0300	40.468	139.080	20	7.7
1994	12	28	1219	40.530	143.403	29.2	7.8
2011	03	11	0546	38.320	142.351	32	9.0
2011	03	11	0615	36.270	141.145	35	7.9

Depth Profile



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 significance.

PAGER

USGS science for a changing world

Earthquake Shaking: Yellow Alert

USAID FROM THE AMERICAN PEOPLE

ANSS

M 7.1, NEAR THE EAST COAST OF HONSHU, JAPAN

Origin Time: Thu 2011-04-07 14:32:41 UTC (23:32:41 local)
Location: 38.25°N 141.64°E Depth: 49 km

PAGER Version 2

Created: 49 minutes, 17 seconds after earthquake

Estimated Fatalities

Yellow alert level for economic losses. Some damage is possible and the impact should be relatively localized. Estimated economic losses are less than 1% of GDP of Japan. Past events with this alert level have required a local or regional 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

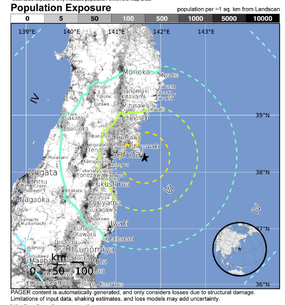
ESTIMATED POPULATION EXPOSURE (k = x1000)	- -*	990k*	10,511k	4,035k	2,475k	161k	0	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE: Resistant Structures	none	none	none	V. 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

0 5 50 100 500 1000 5000 10000



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

Structures:
Overall, the population in this region resides in structures that are resistant to earthquake shaking, though some vulnerable structures exist. The predominant vulnerable building types are heavy wood frame and ductile reinforced concrete frame construction.

Historical Earthquakes (with MMI levels):

Date (UTC)	Dist. (km)	Mag.	Max MMI(#)	Shaking Deaths
2000-06-03	316	6.1	VII(1,434k)	0
1994-12-28	297	7.7	VII(122k)	3
1983-05-26	330	7.7	VIII(174k)	104

Recent earthquakes in this area have caused secondary hazards such as tsunamis, landslides, and fires that might have contributed to losses.

Selected City Exposure

from GeoNames.org

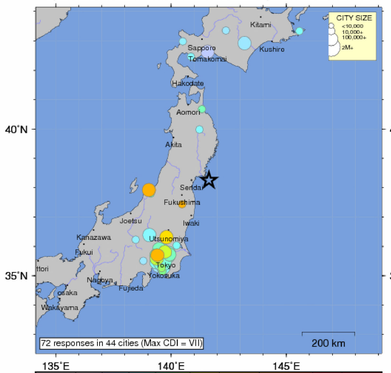
MMI	City	Population
VII	Ishinomaki	117k
VII	Yamoto	32k
VI	Wakuya	18k
VI	Shiogama	60k
VI	Kogota	20k
VI	Sendai	1,038k
V	Fukushima	294k
V	Morioka	295k
IV	Niigata	505k
IV	Utsunomiya	450k
IV	Maebashi	283k

bold cities appear on map (k = x1000)

Event ID: usc0002ksa

Did You Feel It?

USGS Community Internet Intensity Map
NEAR THE EAST COAST OF HONSHU, JAPAN
Apr 7 2011 23:32:41 local 38.253N 141.639E M7.1 Depth: 49 km ID:usc0002ksa



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Thu Apr 7 17:17:04 2011

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)
HDF (unpublished earthquake catalog) (Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Finite Fault Model, Gavin Hayes, USGS (2011)

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 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.

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

The GEBCO_08 Grid, version 20090202, http://www.gebco.net

Map prepared by U.S. Geological Survey
National Earthquake Information Center
7 April 2011
Map not approved for release by Director USGS