Magnitude 7.3 OFF THE EAST COAST OF HONSHU, JAPAN
Friday, December 7, 2012 at 08:18:24 UTC


USGS

A powerful earthquake struck off the northeast coast of Japan on Friday evening local time, rattling buildings in Tokyo and generating a small tsunami.

Some roads were closed and rail services suspended in the northeastern prefecture of Miyagi, where a one-meter (3-foot) tsunami rolled ashore. It was followed by four other waves ranging from eight to 16 inches. Only minor injuries were reported immediately, including five in Miyagi and five on the outskirts of Tokyo.

RIKUZENTAKATA, Japan - Firefighters call for evacuation from coastal areas in Rikuzentakata, Iwate Prefecture, at around 5:47 p.m. on Dec. 7, 2012, following a tsunami warning after an earthquake with a preliminary magnitude of 7.3 jolted northeastern and eastern Japan at 5:18 p.m. The Tohoku region of northeastern Japan was devastated by the March 2011 great earthquake and resulting tsunami. (*Kyodo via AP Images*)

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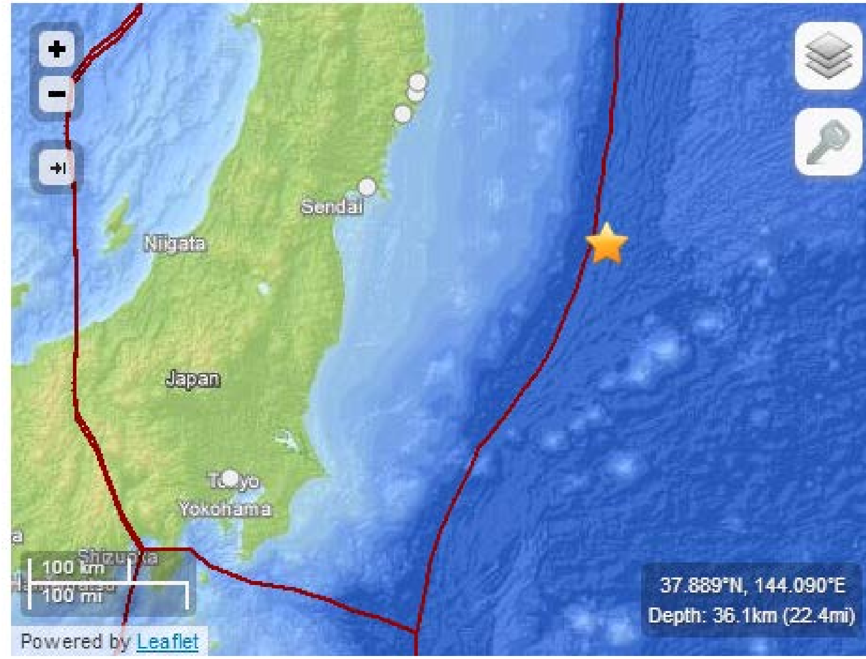
This earthquake occurred 245km (152mi) SE of Kamaishi, Japan and 462km (287mi) ENE of Tokyo, Japan.



Images courtesy of the US Geological Survey

This earthquake is within the rupture zone and aftershock distribution region of the March 11, 2011 M9.0 Tohoku earthquake. However, because the aftershock activity has largely tailed off, it is not clear whether this event is an aftershock of the M9.0 great earthquake or simply part of background seismic activity in this region.

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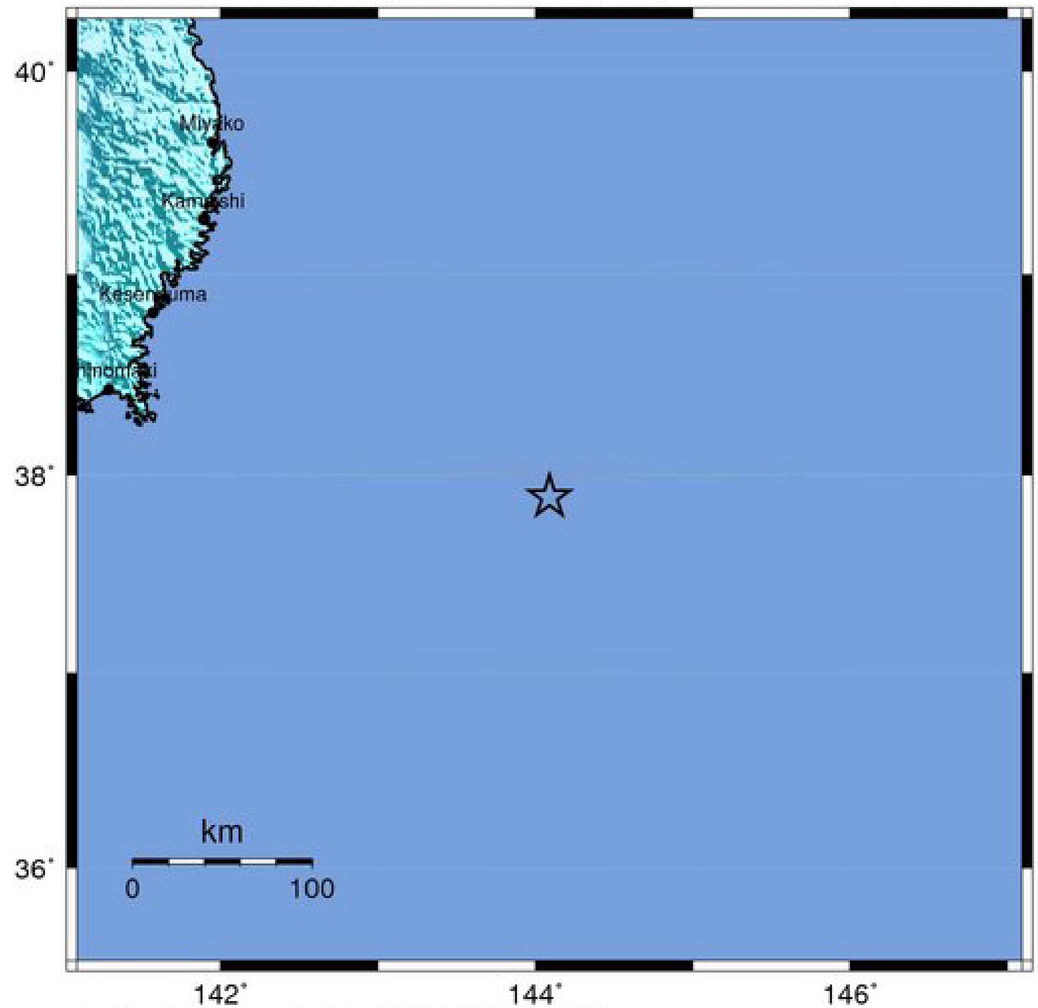
Shaking intensity scales were developed to standardize the measurements and ease comparison of different earthquakes. The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII. Lower numbers represent imperceptible shaking while XII represents total destruction. A value of IV, as experienced by areas closest to this earthquake indicates a level of shaking that is felt by most people.

Modified Mercalli Intensity	Perceived Shaking
X	Extreme
IX	Violent
VIII	Severe
VII	Very Strong
VI	Strong
V	Moderate
IV	Light
II-III	Weak
I	Not Felt

Image courtesy of the US Geological Survey



USGS Estimated shaking Intensity from M 7.3 Earthquake

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IRIS Teachable Moments

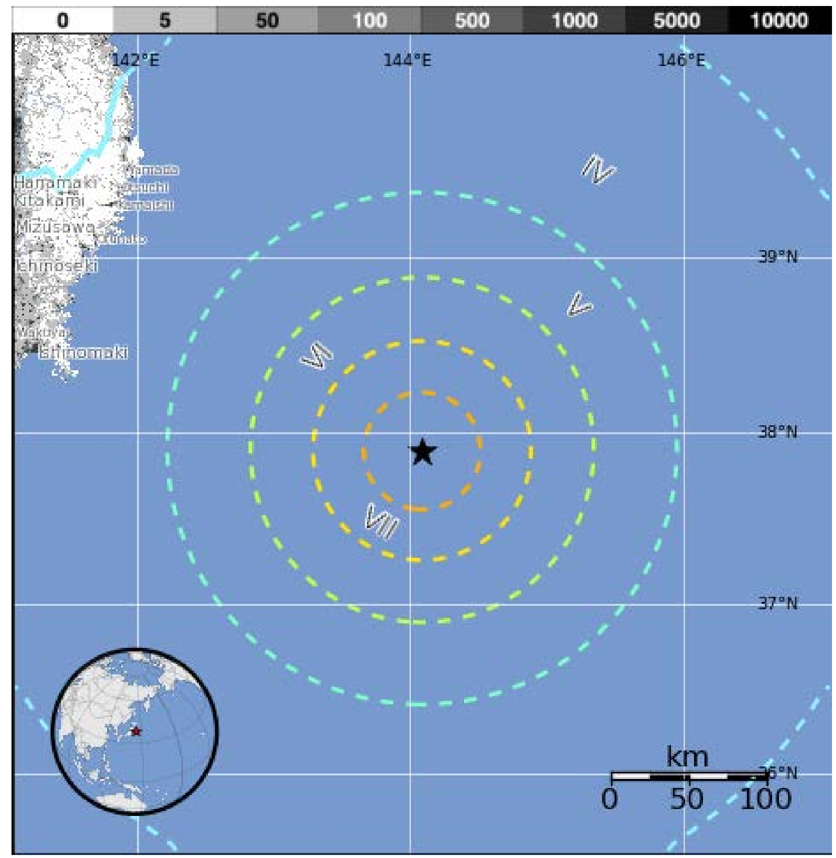
The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels. MMI describes the severity of an earthquake in terms of its effect on humans and structures and is a rough measure of the amount of shaking at a given location.

Overall, the structures in this region are resistant to earthquake shaking and only light shaking was experienced.

The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table below.

Image courtesy of the US Geological Survey

USGS PAGER
Population Exposed to Earthquake Shaking



Estimated Modified Mercalli Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Est. Population Exposure	--*	352k*	1,193k	0	0	0	0	0	0
Perceived Shaking	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme

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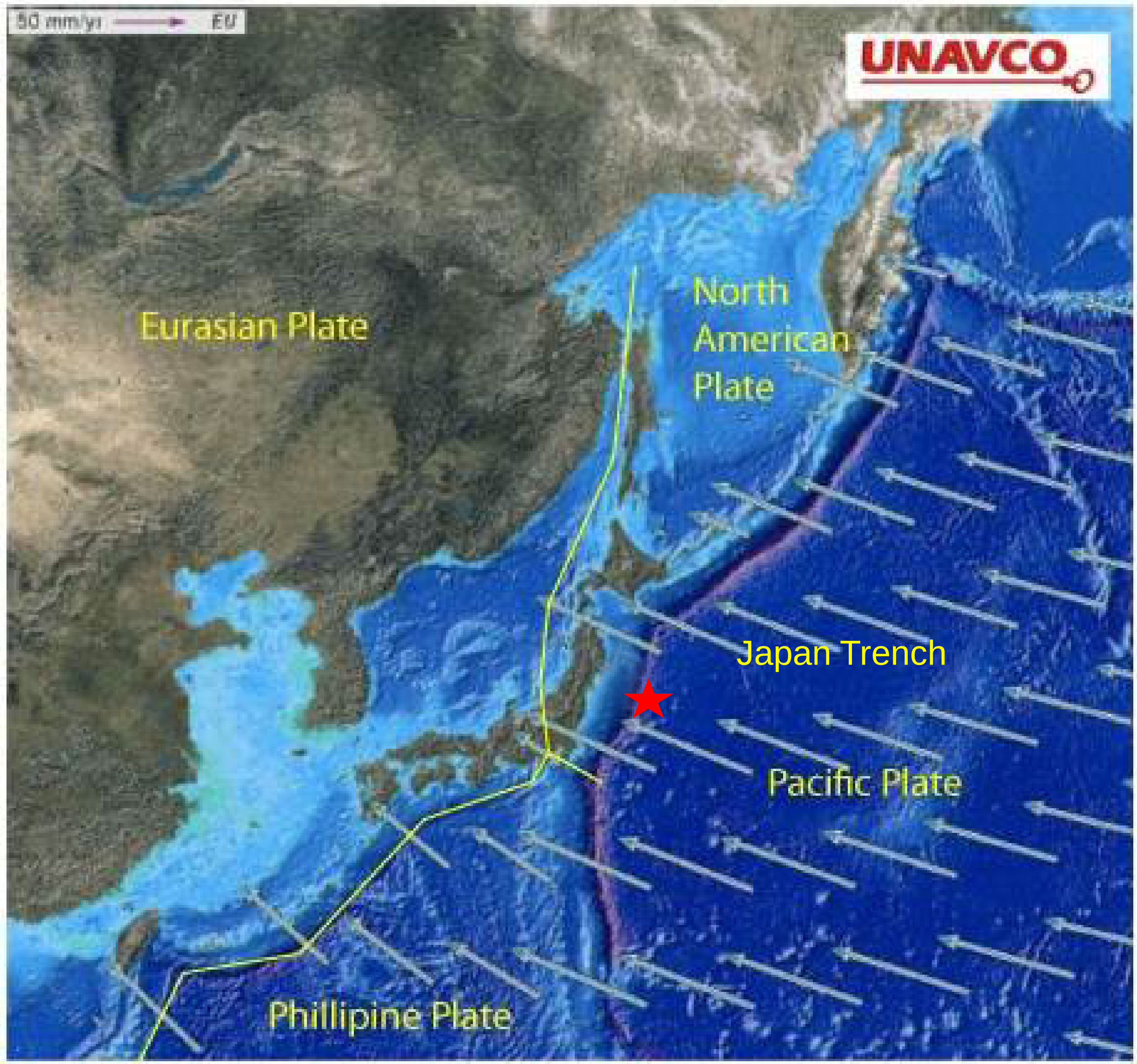
This map shows the rate and direction of motion of the Pacific Plate with respect to the Eurasian Plate near the Japan Trench. The rate of convergence at this plate boundary is about 83 mm/yr (8 cm/year).

This is a fairly high convergence rate and this subduction zone is very seismically active.



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Earthquake and Historical Seismicity

This earthquake epicenter (yellow star), is plotted on the map with regional seismicity since 1990.

This convergent plate boundary hosts moderate to large earthquakes fairly regularly – 12 events of M7 or larger have occurred within 250 km of this earthquake over the past 40 years.

These historic events include the M9.0 Tohoku earthquake of March 11, 2011 that ruptured a large area of the plate boundary west of the this earthquake.

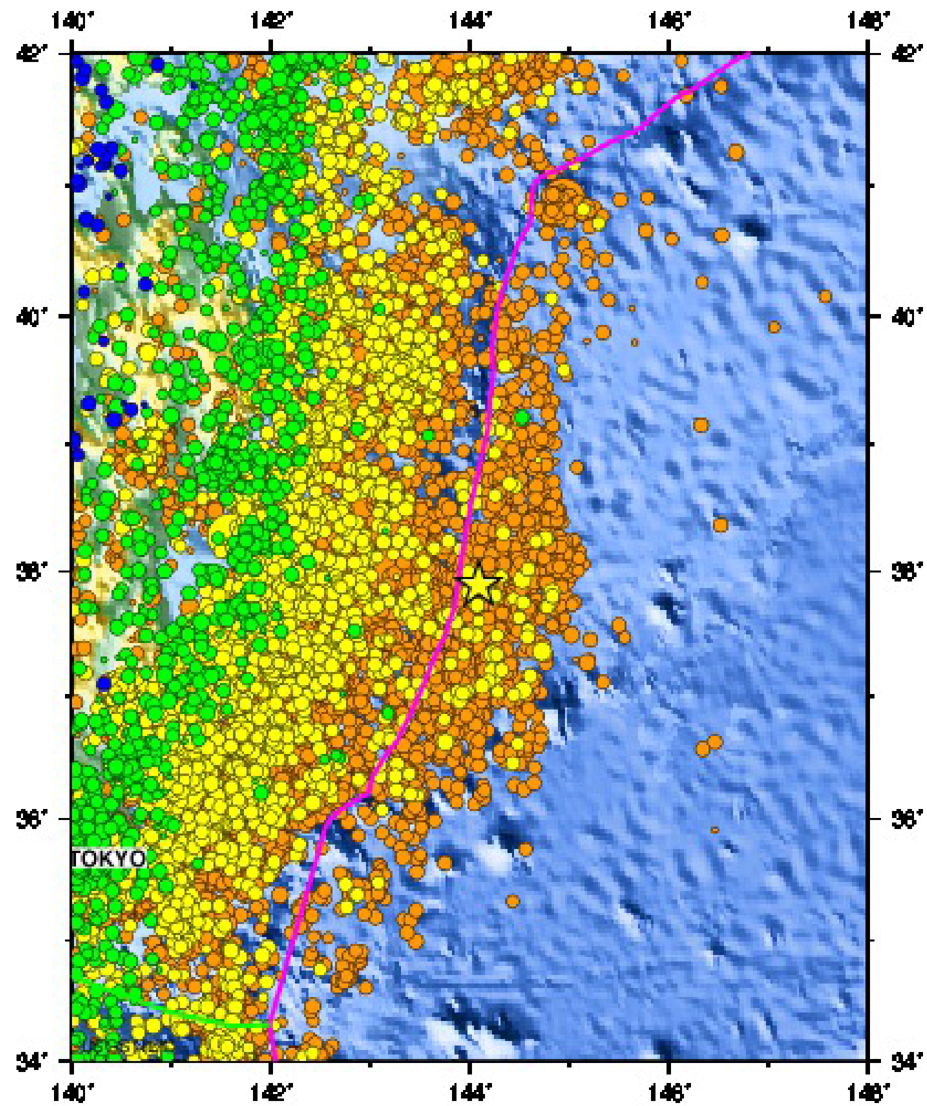

Image courtesy of the US Geological Survey

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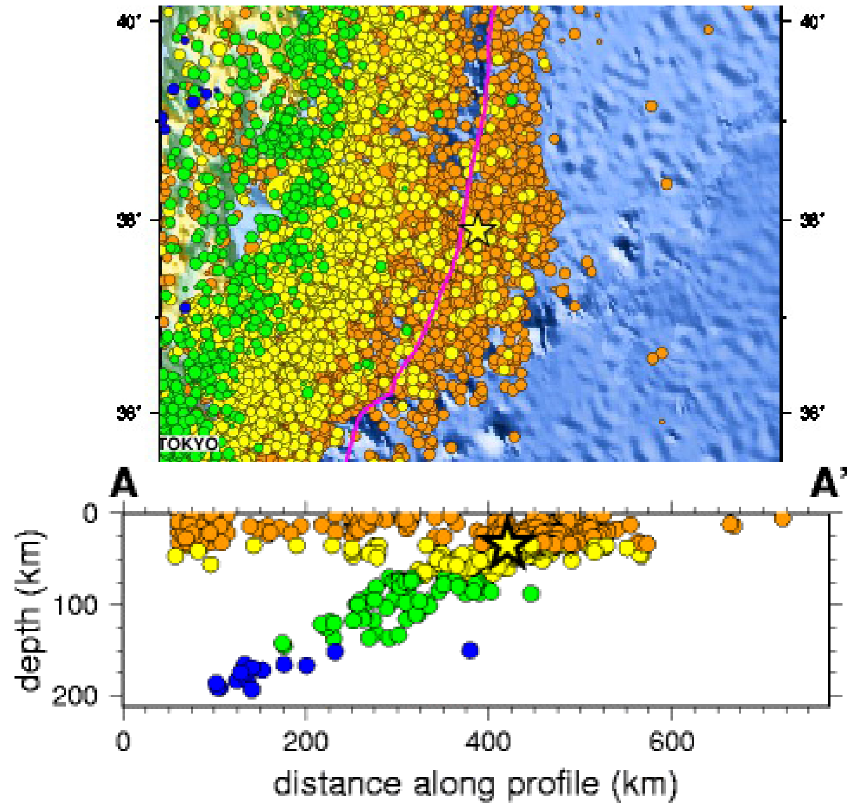
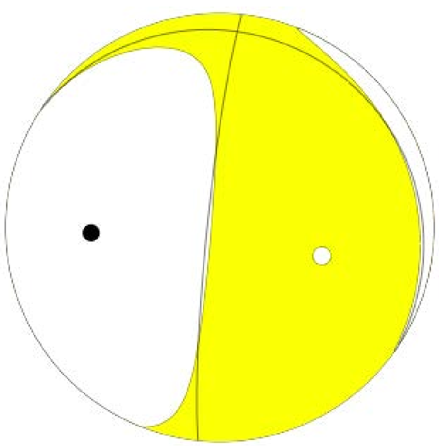
This earthquake occurred as a result of reverse (thrust) faulting within the oceanic lithosphere of the Pacific Plate, approximately 20 km east of the boundary between the Pacific and North America plates where the Pacific Plate subducts beneath Japan.

Seismicity Cross Section across the subduction zone showing the relationship between color and earthquake depth.





USGS Centroid Moment Tensor Solution

Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source, and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The dots represent the axis of maximum compressional strain (in black, called the "P-axis") and the axis of maximum extensional strain (in white, called the "T-axis") resulting from the earthquake.

Aftershocks

Aftershock sequences follow predictable patterns as a group, although the individual earthquakes are themselves not predictable. The graph below shows how the number of aftershocks and the magnitude of aftershocks decay with increasing time since the main shock. The number of aftershocks also decreases with distance from the main shock.

Aftershocks usually occur geographically near the main shock. The stress changes drastically on the fault where the main shock occurs so that fault produces most of the aftershocks. Sometimes the change in stress caused by the main shock is great enough to trigger aftershocks on other nearby faults.

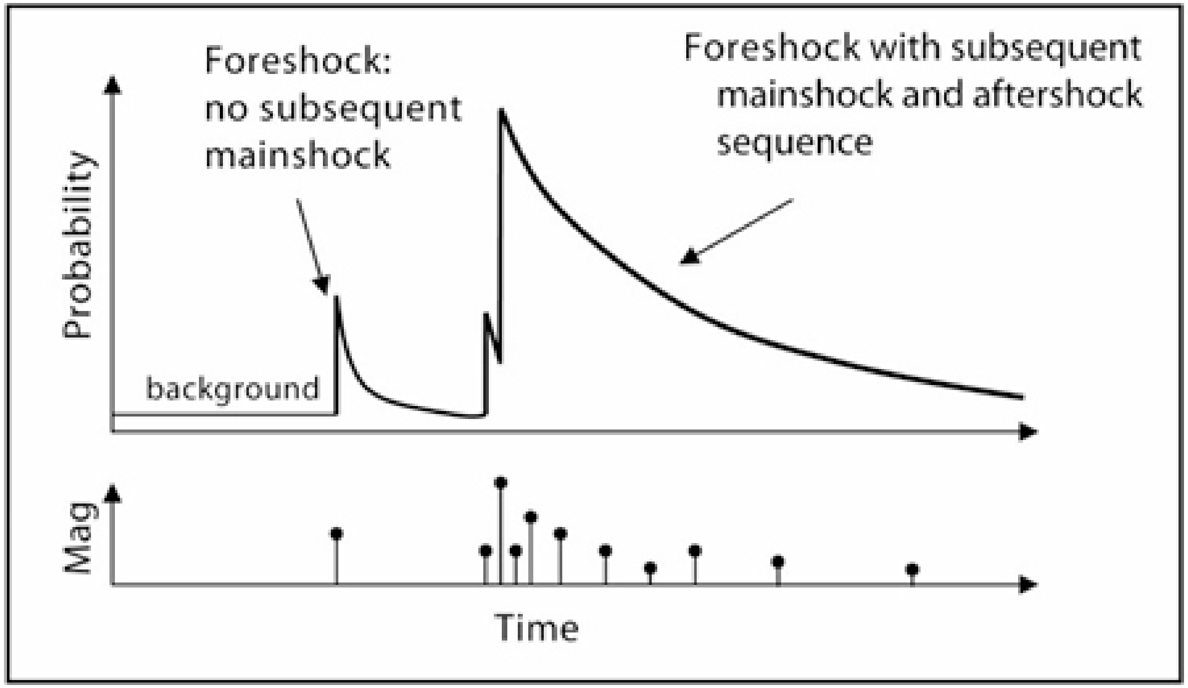


Image and text courtesy of the US Geological Survey

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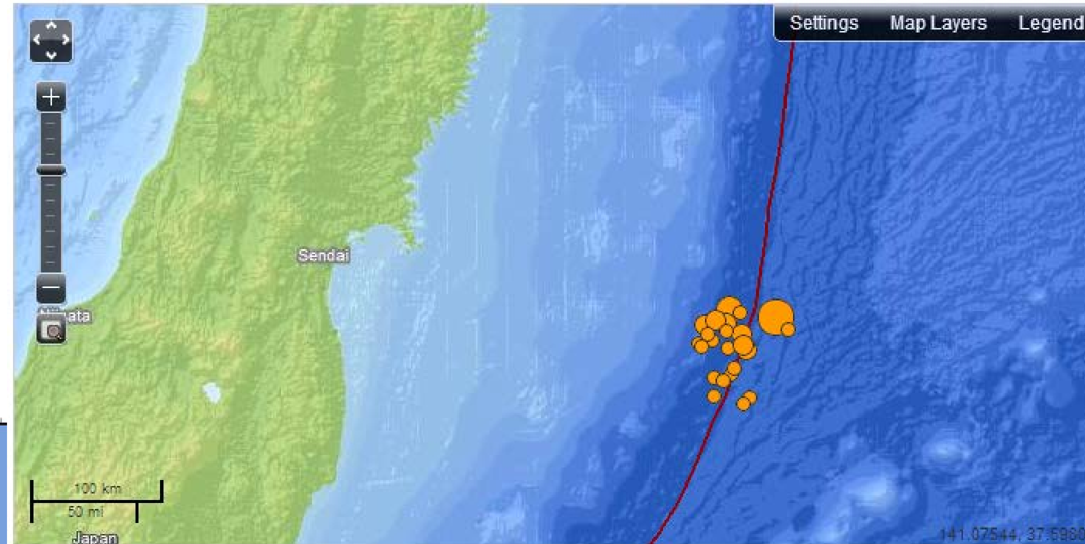
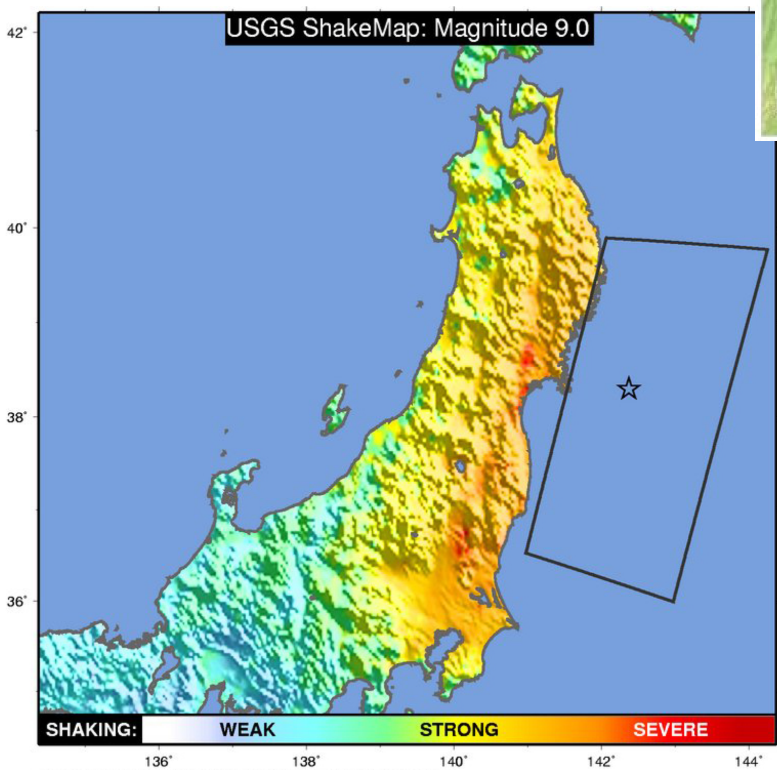
In the first 24 hours following the earthquake, there have been more than 23 aftershocks with the largest a magnitude 6.2. The pattern of aftershocks helps define the area that slipped during the main shock.



Aftershocks from M7.3 Earthquake



From 2011: The black rectangle outlines the approximate rupture zone of the March 11, 2011 M9.0 Tohoku earthquake. This outline is plotted on an estimated shaking intensity map.

Images courtesy of the US Geological Survey