Magnitude 7.4 KERMADEC ISLANDS, NEW ZEALAND

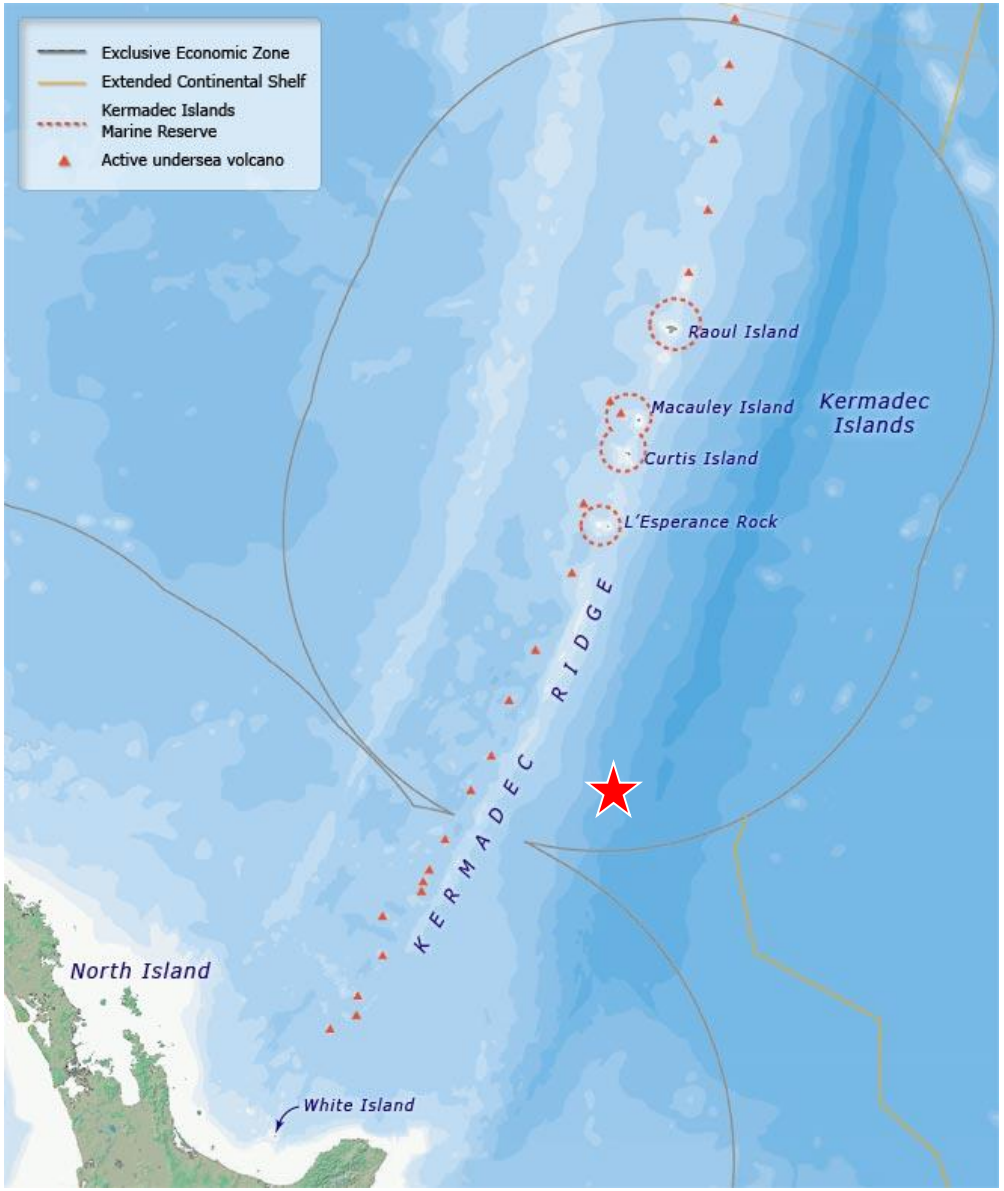
Thursday, June 18, 2020 at 12:49:53 UTC

A magnitude 7.4 earthquake occurred in the Kermadec Islands, about 730 km (454 miles) from Tauranga, New Zealand at a depth of 10 km. There is no tsunami threat from this earthquake.

The Kermadec Islands are the tiny emergent part of a chain of submarine volcanoes that define the Kermadec Ridge. There are no permanent settlements on the islands.

In political terms, the Kermadecs are important for New Zealand as they define the northern extent of the Exclusive Economic Zone (EEZ) and the Extended Continental Shelf (ECS).

Image courtesy: Simon Nathan, 'Kermadec Islands - Geology and climate', Te Ara - the Encyclopedia of New Zealand



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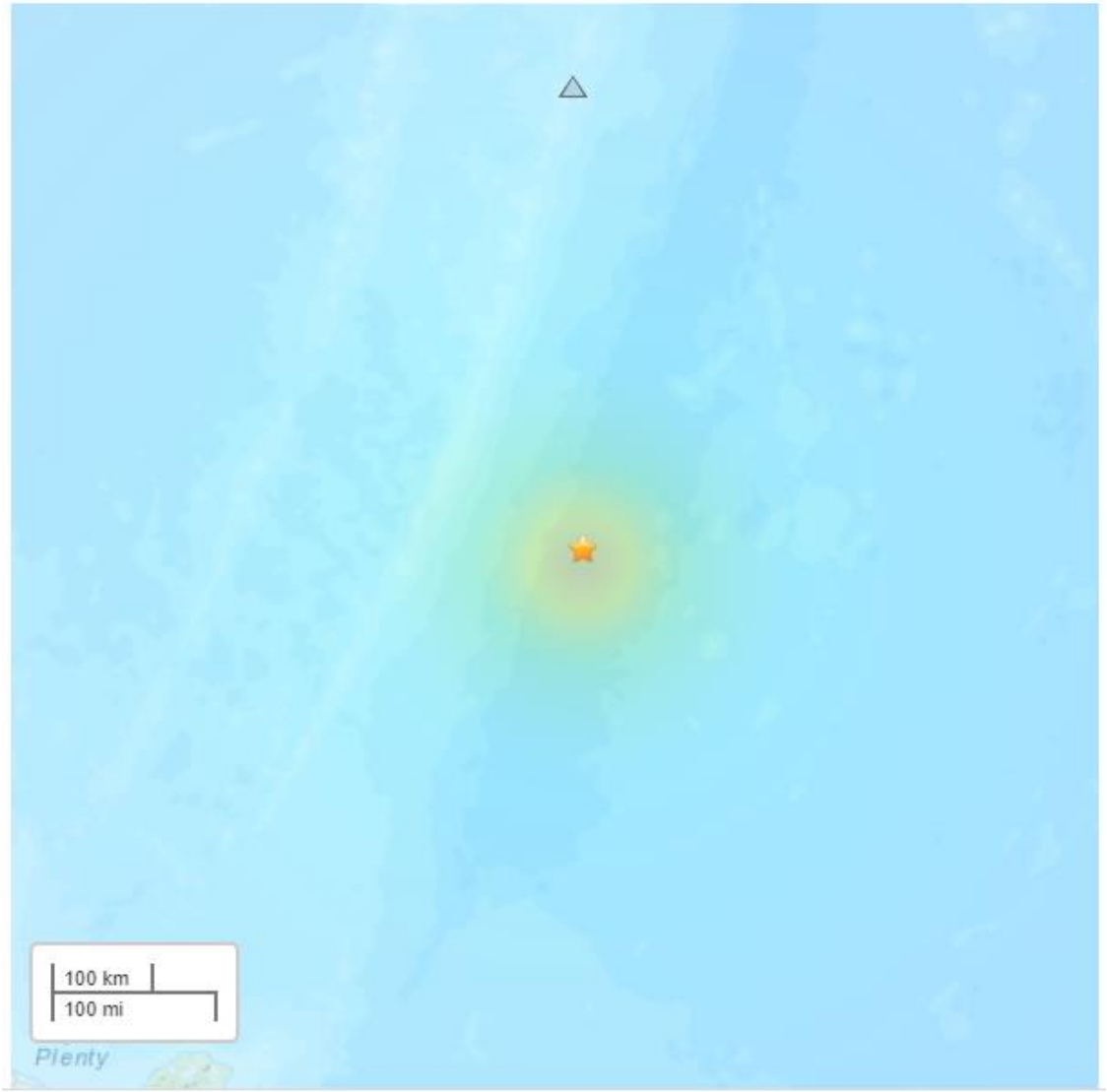
The Modified-Mercalli Intensity (MMI) scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

Shaking was felt across the east coast of North Island, New Zealand.

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



USGS Estimated shaking Intensity from M 7.4 Earthquake

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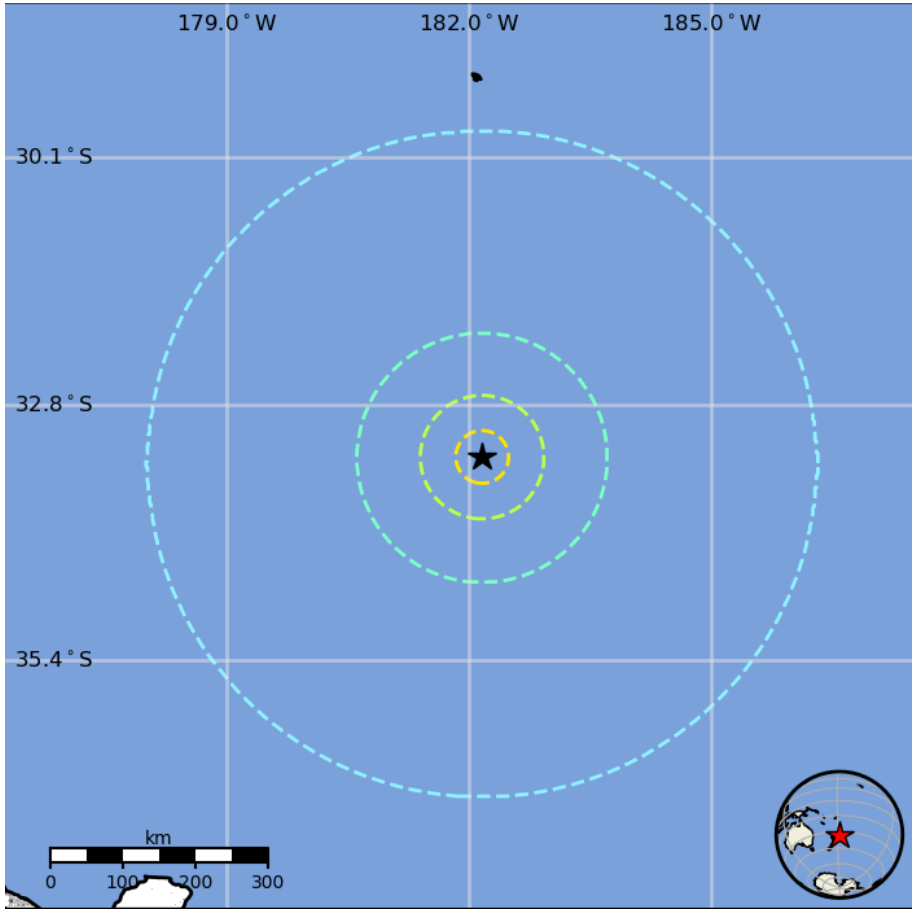
USGS PAGER

Population Exposed to Earthquake Shaking

The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS reported that 42,000 people felt weak shaking from this earthquake.

II-III	Weak	42 k*
IV	Light	0 k
V	Moderate	0 k
VI	Strong	0 k
VII	Very Strong	0 k
VIII	Severe	0 k
IX	Violent	0 k
X	Extreme	0 k



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.

Image courtesy of the US Geological Survey

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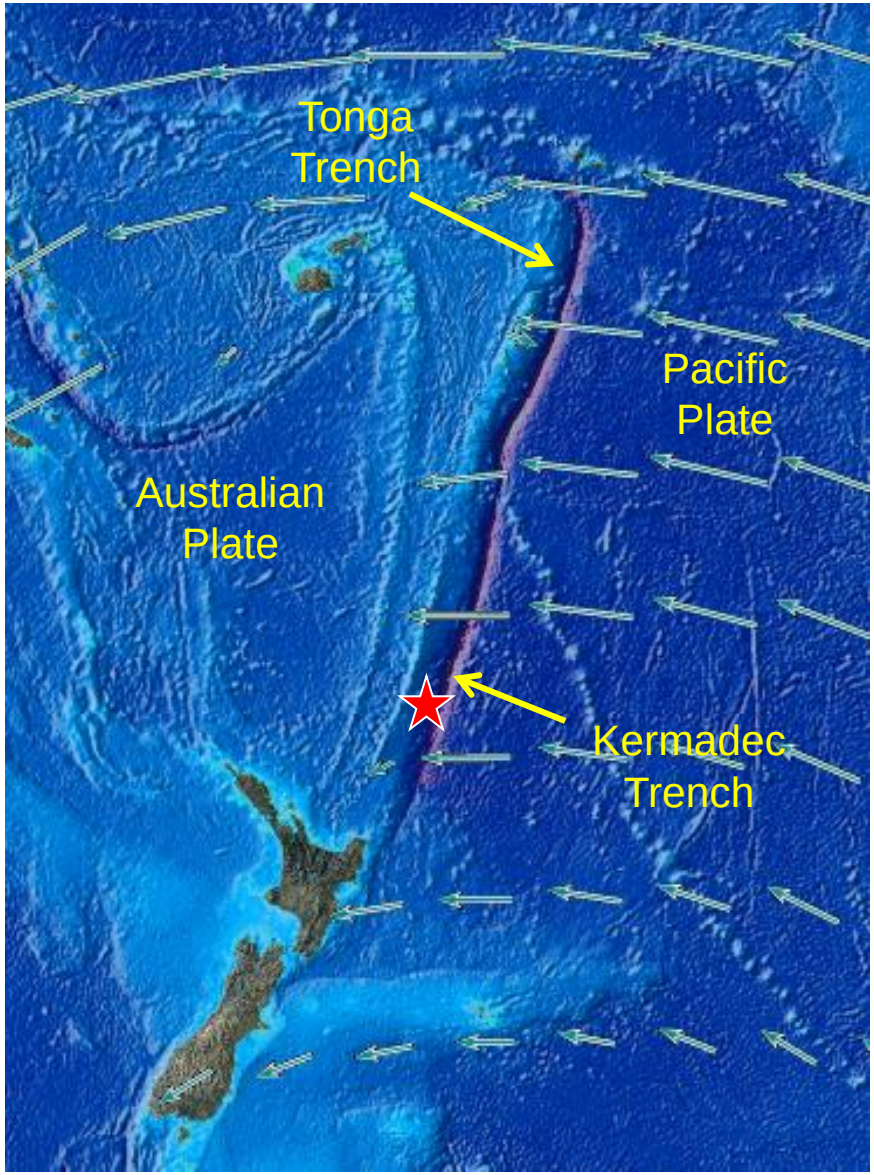
The blue arrows on this map show the motion of the Pacific Plate with respect to the Australian Plate. The epicenter of this earthquake is shown by the red star.

This earthquake occurred on or near the subduction zone boundary where the Pacific Plate subducts beneath the Australian Plate. The rate of convergence at the location of the earthquake is about 6.0 cm/yr.

Notice that the rate of motion of the Pacific Plate changes from 6 cm/yr in the Kermadec Trench to 9 cm/yr at the northern end of the Tonga Trench. These changes remind us that lithospheric plates are spherical shells, not flat plates. Plate motions are relative rotations of spherical shells rather than linear motions of flat plates. The 2500 km (over 1500 mile) length of this convergent plate boundary makes the spherical geometry of plate motions particularly clear.



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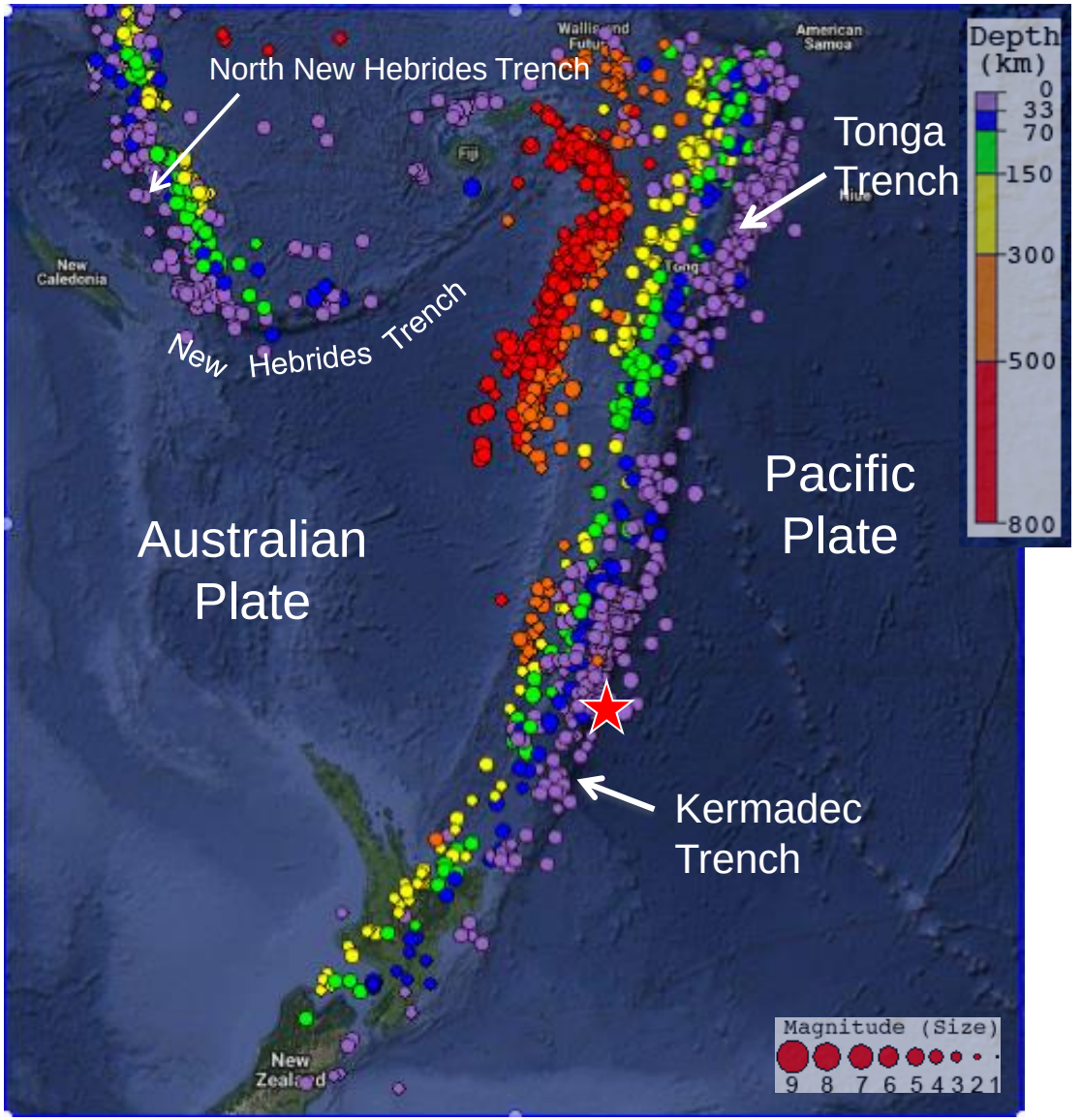
This earthquake is labeled with a star on this seismicity map showing the most recent 2000 magnitude 4 or larger earthquakes in this region of convergence between the Australian and Pacific Plates.

Across the Kermadec and Tonga trenches, earthquake depths increase from east to west as the the Pacific Plate subducts beneath the Australian Plate.

Notice that the depths of the deepest earthquakes increase from south to north along the Kermadec and Tonga trenches. The Pacific Plate subducts faster into the Tonga Trench than into the Kermadec Trench so it remains brittle and capable of generating deeper earthquakes in the northern part of the subduction zone.



Map created with the IRIS Earthquake Browser

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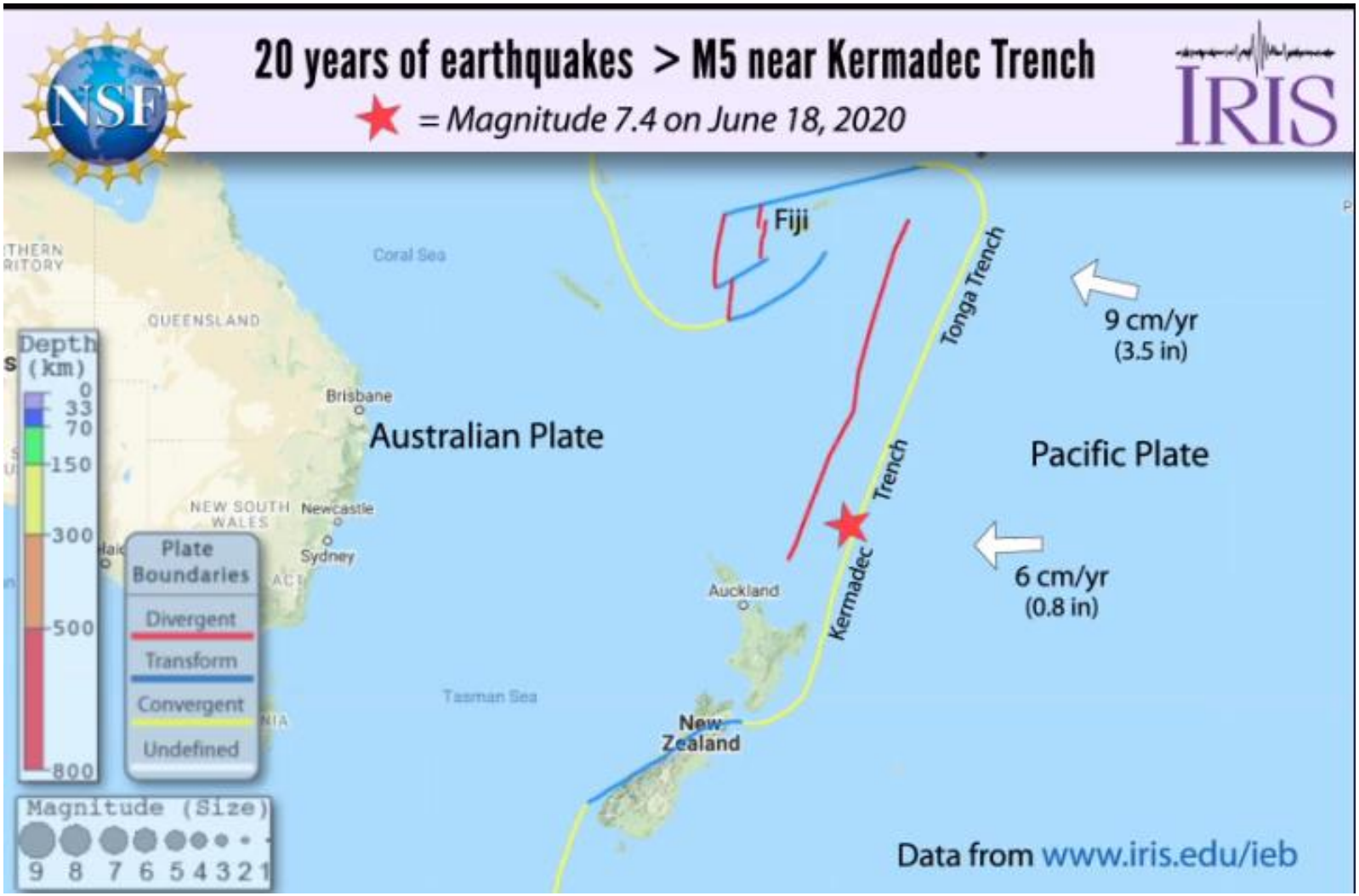
This animation explores historical seismicity in the region of this earthquake.



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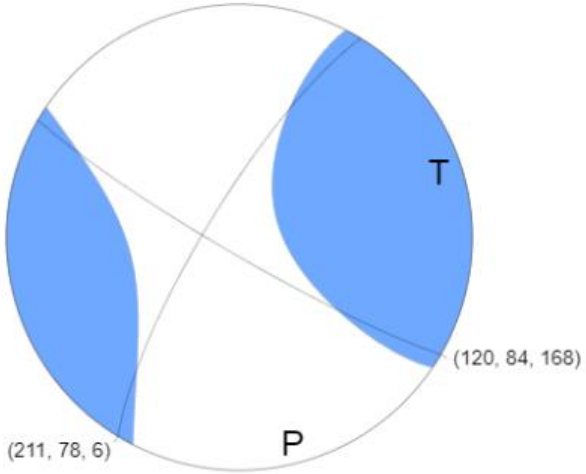
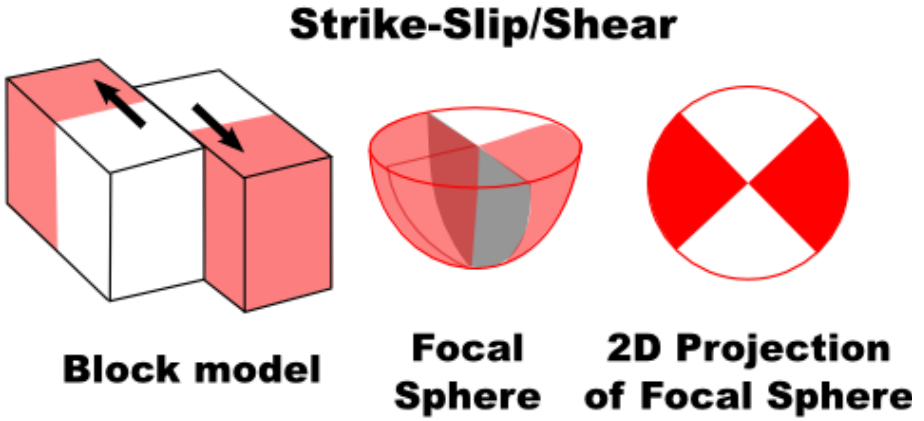
The focal mechanism is how seismologists plot the 3-D stress orientations of an earthquake. Because an earthquake occurs as slip on a fault, it generates primary (P) waves in quadrants where the first pulse is compressional (shaded) and quadrants where the first pulse is extensional (white). The orientation of these quadrants determined from recorded seismic waves determines the type of fault that produced the earthquake.



USGS W-phase Moment Tensor Solution



The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.

In this case, the focal mechanism indicates this earthquake occurred as the result strike-slip faulting on or near the plate boundary.

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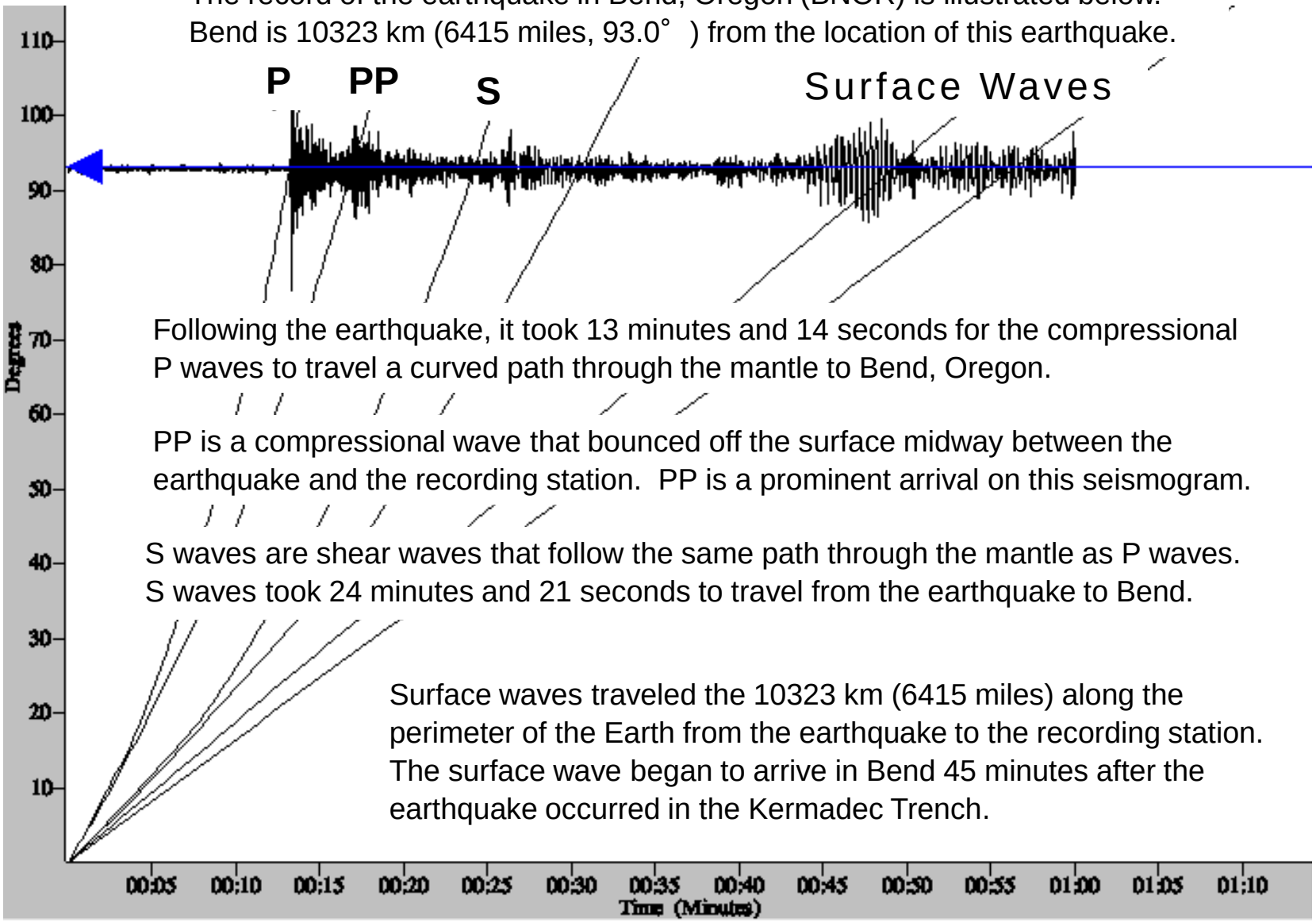
The record of the earthquake in Bend, Oregon (BNOR) is illustrated below.
Bend is 10323 km (6415 miles, 93.0˚) from the location of this earthquake.



Following the earthquake, it took 13 minutes and 14 seconds for the compressional P waves to travel a curved path through the mantle to Bend, Oregon.

PP is a compressional wave that bounced off the surface midway between the earthquake and the recording station. PP is a prominent arrival on this seismogram.

S waves are shear waves that follow the same path through the mantle as P waves. S waves took 24 minutes and 21 seconds to travel from the earthquake to Bend.

Surface waves traveled the 10323 km (6415 miles) along the perimeter of the Earth from the earthquake to the recording station. The surface wave began to arrive in Bend 45 minutes after the earthquake occurred in the Kermadec Trench.

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