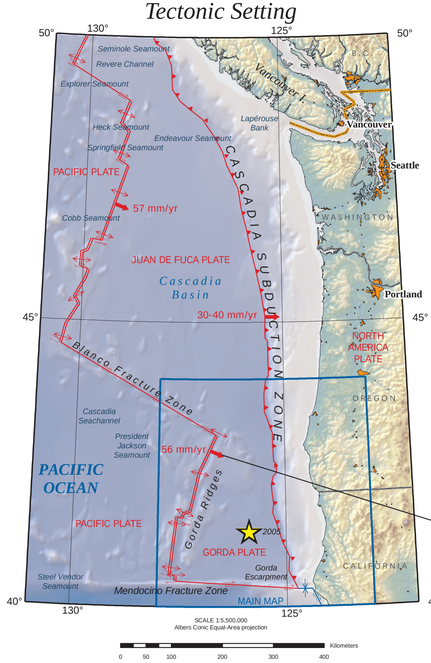
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

M7.2 Gorda Plate Earthquake of 15 June 2005

Tectonic Setting



EXPLANATION

Main Shock

15 June 2005

Plate Boundaries

- Continental Convergent
- Continental RL Transform
- Oceanic rift
- Oceanic LL Transform
- Oceanic RL Transform
- Subduction

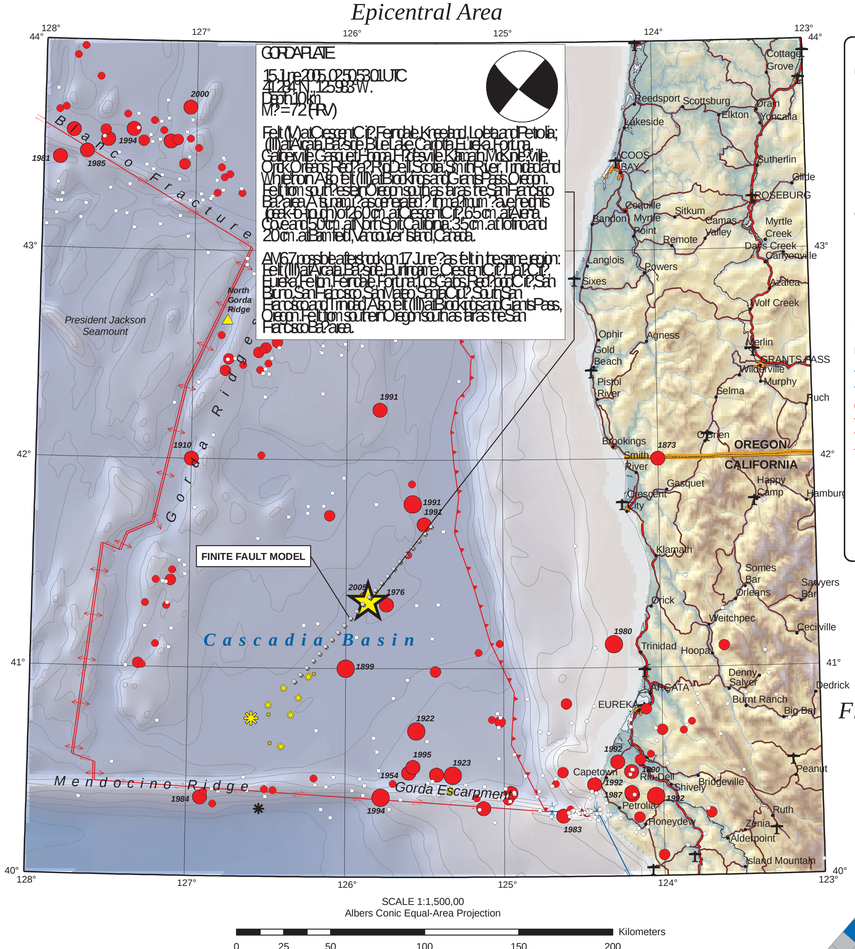
RELATIVE PLATE MOTIONS

The relative motion of adjacent tectonic plates is depicted on the map by short vectors shown at selected locations on the plate boundary. In this presentation, one of the plates is defined as the reference plate. The vector therefore represents the direction of motion of the adjacent plate relative to the reference plate. The rate of relative motion is labeled next to the vector.

The components of the vector perpendicular and parallel to the plate margin approximate convergent/divergent and transverse direction of motion between the plates, respectively. As viewed from the reference plate, an inward directed component suggests convergence at and near the plate boundary that may be expressed as crustal folding, uplift, thrust faulting, or plate subduction. Similarly, an outward directed component suggests plate divergence such as would be expected at a zone of crustal spreading. Transcurrent or transform faulting would be expected when the dominant vector component is parallel to the plate margin.

In the example shown in the Tectonic Setting map, the Gorda plate is moving ESE away from the Pacific plate at approximately 56 mm/yr and easterly toward the North America plate at a rate of 30 - 40 mm/yr.

Epicentral Area



EXPLANATION

Main Shock

15 June 2005

Earthquakes 15-19 June 2005

- M<4.0
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 7.0

Earthquakes 1853 - 2005

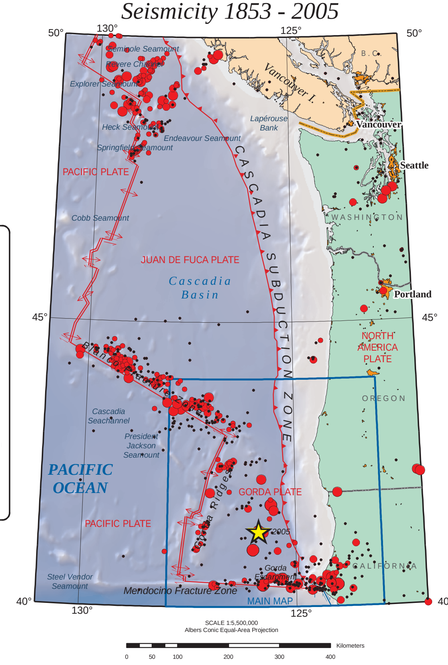
- M<4; no magnitude
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

Plate Boundaries

- Continental Convergent
- Continental RL Transform
- Oceanic Rift
- Oceanic LL Transform
- Oceanic RL transform
- Subduction

- Volcanic Center
- Urbanized Areas
- Populated Places
- Airports

Seismicity 1853 - 2005



EXPLANATION

Main Shock

15 June 2005

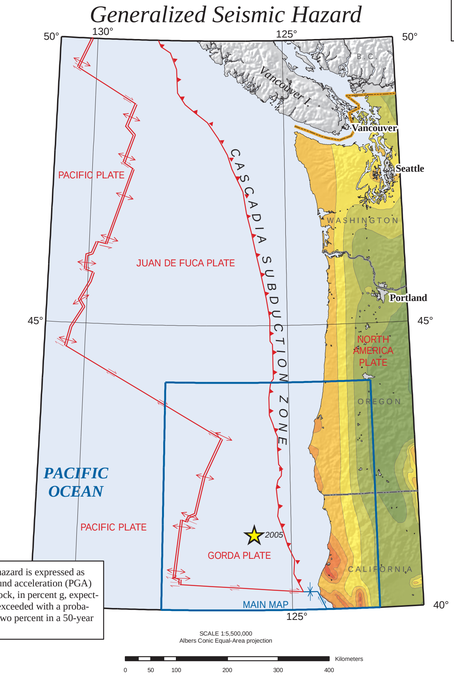
Earthquakes 1853 - 2005

- M<4; no magnitude
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

Plate Boundaries

- Continental Convergent
- Continental RL Transform
- Oceanic rift
- Oceanic LL Transform
- Oceanic RL Transform
- Subduction

Generalized Seismic Hazard



EXPLANATION

Main Shock

15 June 2005

Earthquakes 1964 - 2002

- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

Seismic Hazard

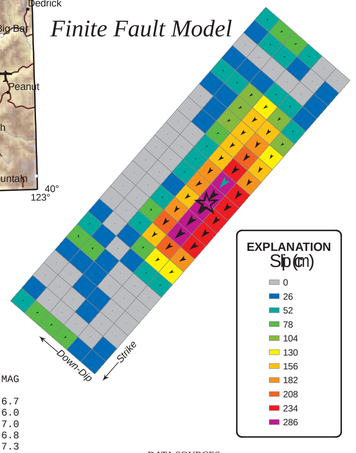
- 18% g
- 20%
- 30%
- 40%
- 50%
- 60%
- 80%
- 120%
- 160%

Plate Boundaries

- Continental Convergent
- Continental RL Transform
- Oceanic rift
- Oceanic LL Transform
- Oceanic RL Transform
- Subduction

Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in percent g, expected to be exceeded with a probability of two percent in a 50-year period.

Finite Fault Model



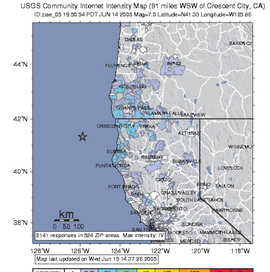
FINITE FAULT MODEL
(C. Ji, California Institute of Technology)

Distribution of the amplitude and direction of slip for subfault elements (small rectangles) of the fault rupture model are determined from the inversion of teleseismic body waveforms. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip amount is also color-coded as shown. The view is from above, perpendicular to the fault plane.

The fact that the orientation of the finite fault plane may differ from the corresponding best double couple nodal plane depicted in the focal mechanism diagram on the main map reflects differing methods of analysis and data sets.

The strike of the fault rupture plane is N221°E and the dip is 88°. The dimensions of the subfault elements are 5 km in the strike direction and 5.5 km in the dip direction.

USGS Community Internet Intensity Map (81 miles WSW of Crescent City, CA)
ID zdyc_89 18:56:54 PDT JUN 14 2005 Mag=7.0 Latitude=N41.20 Longitude=W125.88



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	Very heavy

COMMUNITY INTERNET INTENSITY MAP

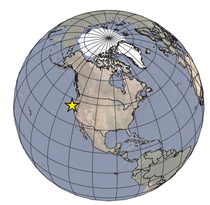
The Community Internet Intensity Map (CIIM) summarizes the online questionnaire responses provided by Internet users. An intensity number is assigned to each community from which a filled-out CIIM questionnaire was received; each intensity value reflects the effects of earthquake shaking on the people and structures in the community. The color-coded ZIP Code zone on the map represents the average of the individual intensity values in that ZIP Code zone.

DISCUSSION

This earthquake occurred in a deformed section of the southernmost Juan de Fuca plate that is commonly called the Gorda plate. The epicenter lies to the west of the Cascadia subduction zone. Light shaking from this earthquake was widely felt along the northern California - southern Oregon coastline.

Preliminary analysis of the quake indicates that it resulted from slip on a NE-striking, left-lateral, strike-slip fault; this type of mechanism has been documented for other earthquakes having locations in the interior of the Gorda plate. This earthquake did not produce a tsunami. Earthquakes with strike-slip mechanisms are less likely to produce tsunamis because they cause relatively little vertical ground displacement.

Earthquakes are common in the Gorda plate, which is subjected to north-south compression due to the northwest moving Pacific Plate that collides with the southern boundary of the Gorda Plate along the east-west Mendocino Fracture Zone. This quake occurred approximately 67 miles west of the epicenter of the M7.2 8 November 1980 earthquake. There have been three other quakes (16 and 17 August 1991 and 24 July 1996) of magnitude M>6 that have occurred within a 50 miles radius of the epicenter of the current earthquake.



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.

LARGEST EARTHQUAKES 1853 - 2005
EPICENTRAL AREA

YR	MO	DY	LAT	LON	DEPTH	MAG
1873	11	23	42.000	-124.000	0	6.7
1890	7	26	40.500	-124.200	0	6.0
1899	4	16	41.000	-126.000	0	7.0
1910	8	5	42.000	-127.000	0	6.8
1922	1	31	40.700	-125.553	15	7.3
1923	1	22	40.487	-125.324	15	7.2
1954	11	25	40.500	-125.600	0	6.7
1976	11	26	41.306	-125.743	15	6.7
1980	11	8	41.112	-124.299	16	7.4
1981	11	3	43.436	-127.895	8	6.4
1983	8	24	40.290	-124.630	21	6.2
1984	9	10	40.378	-126.912	6	6.6
1985	3	13	43.467	-127.720	10	6.5
1987	7	31	40.389	-124.196	18	6.0
1991	7	13	42.240	-125.788	14	6.8
1991	8	16	41.690	-125.503	15	6.3
1991	8	17	41.788	-125.576	17	7.1
1992	4	25	40.381	-124.048	15	7.2
1992	4	26	40.547	-124.286	20	6.5
1992	4	26	40.440	-124.433	22	6.7
1994	9	1	40.382	-125.777	10	7.1
1994	10	27	43.525	-127.581	23	6.3
1995	2	19	40.527	-125.573	21	6.6
2000	1	20	43.683	-127.043	10	6.1
2005	6	15	41.284	-125.983	10	7.2
2005	6	17	40.478	-126.595	10	6.7

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
PB2003 (Bird, 2003)

VOLCANOES
Smithsonian Institution, Global Volcano Program

BASE MAP
GLOBE (1999)
IOC, IHO, and BODC (2003)
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center

NEWS SOURCES

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 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.

GLOBE Task Team and others, 1999, The Global Land One-Kilometer Base Elevation (GLOBE) Digital Elevation Model, Version 1.0: National Oceanic and Atmospheric Administration, Boulder, Colo., USA.

IOC, IHO, and BODC, 2003, Centenary Edition of the GEBCO Digital Atlas: CD-ROM(2), British Oceanographic Data Centre, Liverpool, UK.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
28 June 2005 @1500 MDT
Map not approved for release by Director USGS