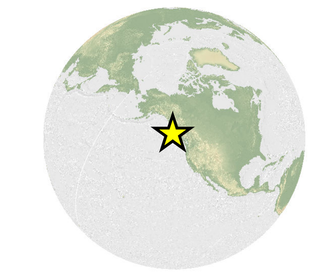
USGS

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

EARTHQUAKE SUMMARY MAP XXX

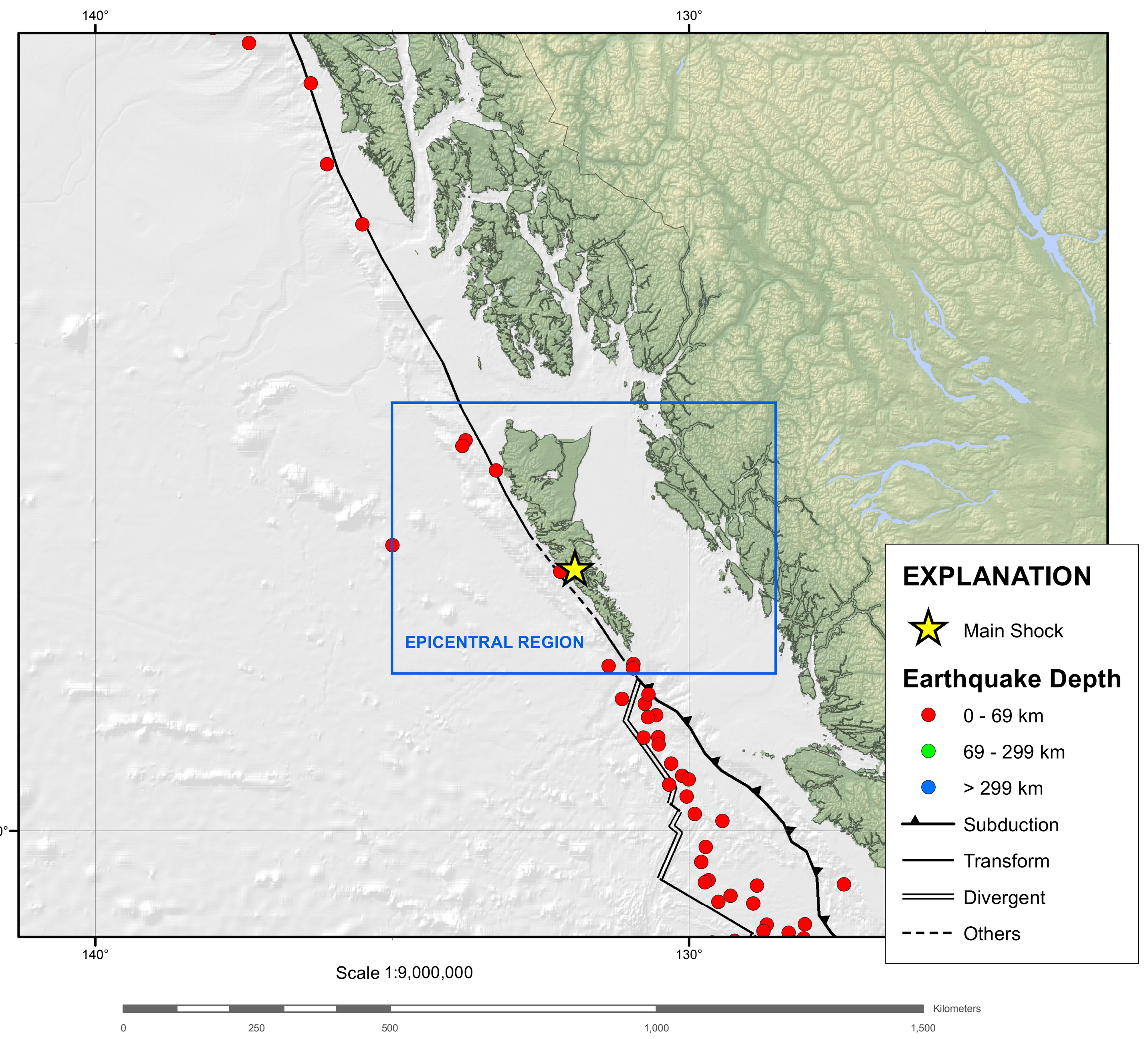


Prepared in cooperation with the Global Seismographic Network

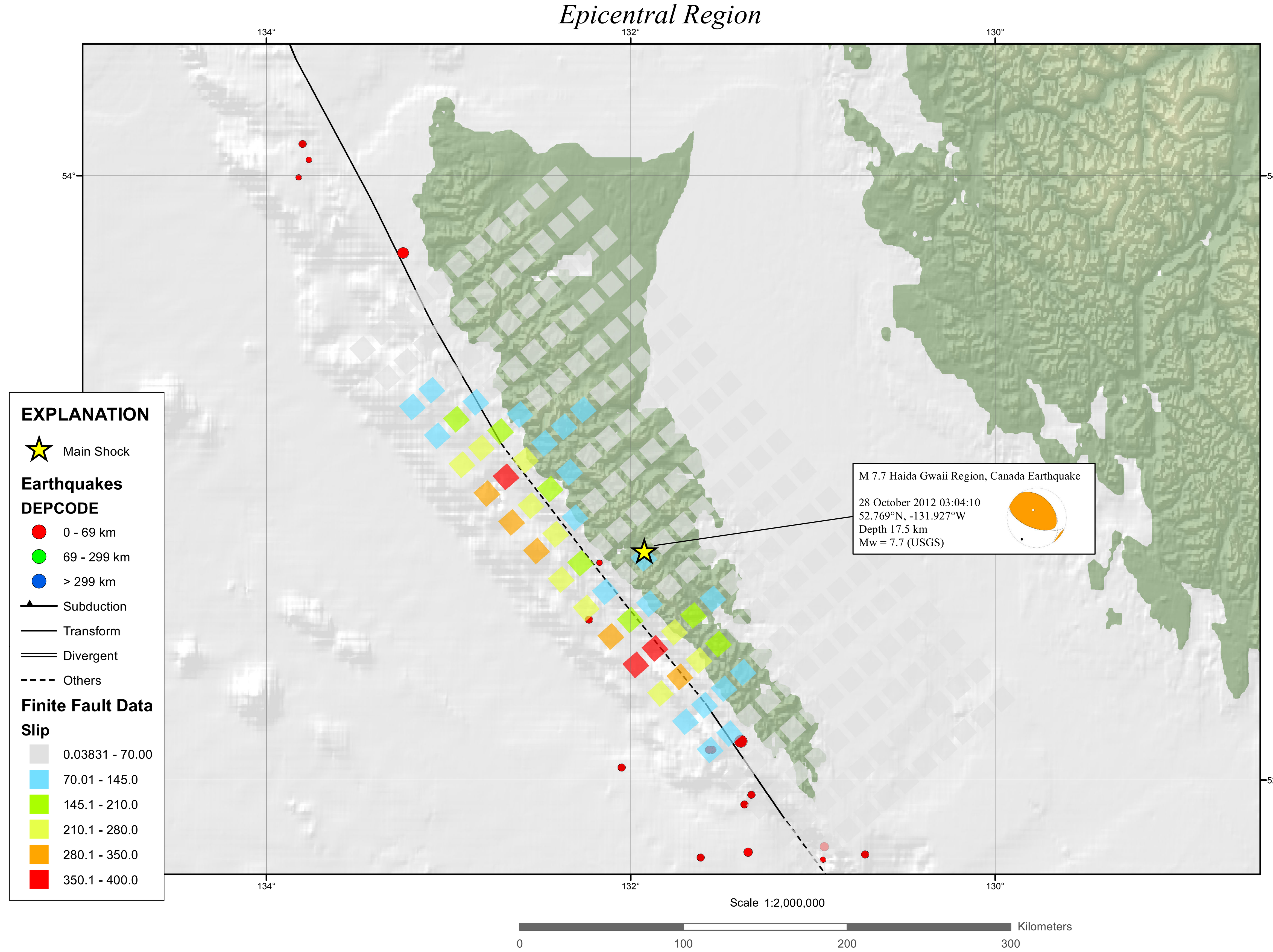
GSN

M7.7 Haida Gwaii Region, Canada Earthquake of 28 October 2012

Tectonic Setting



Epicentral Region



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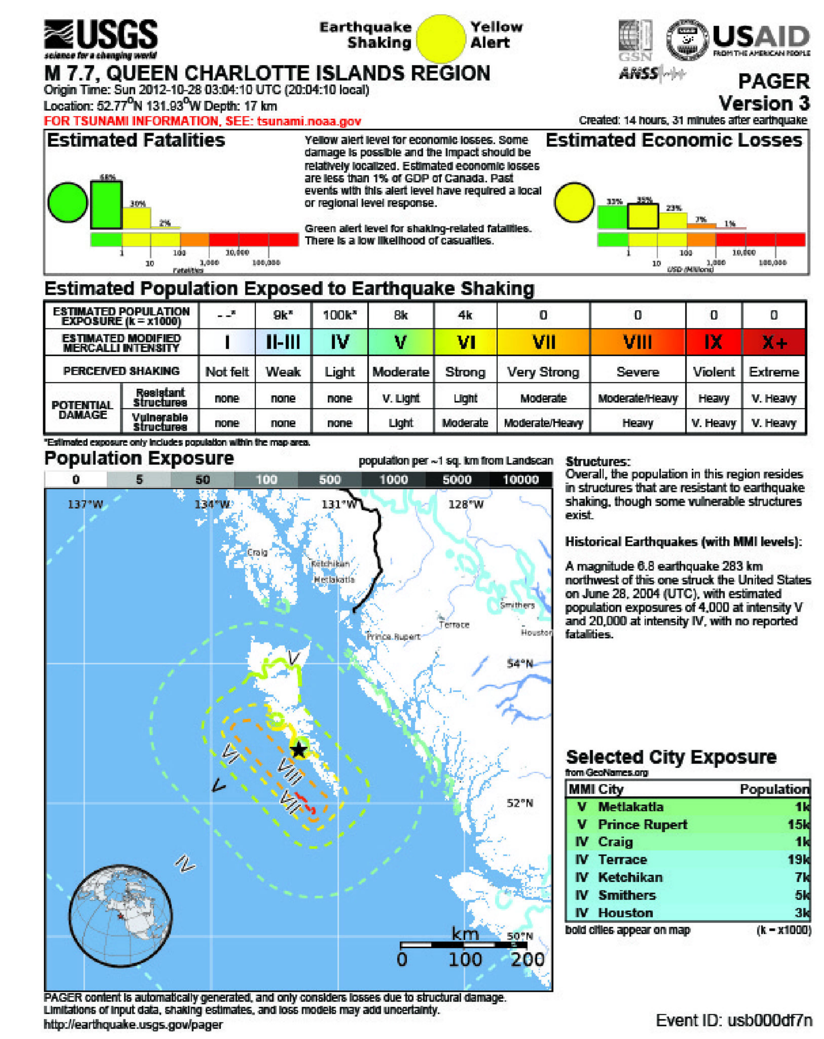
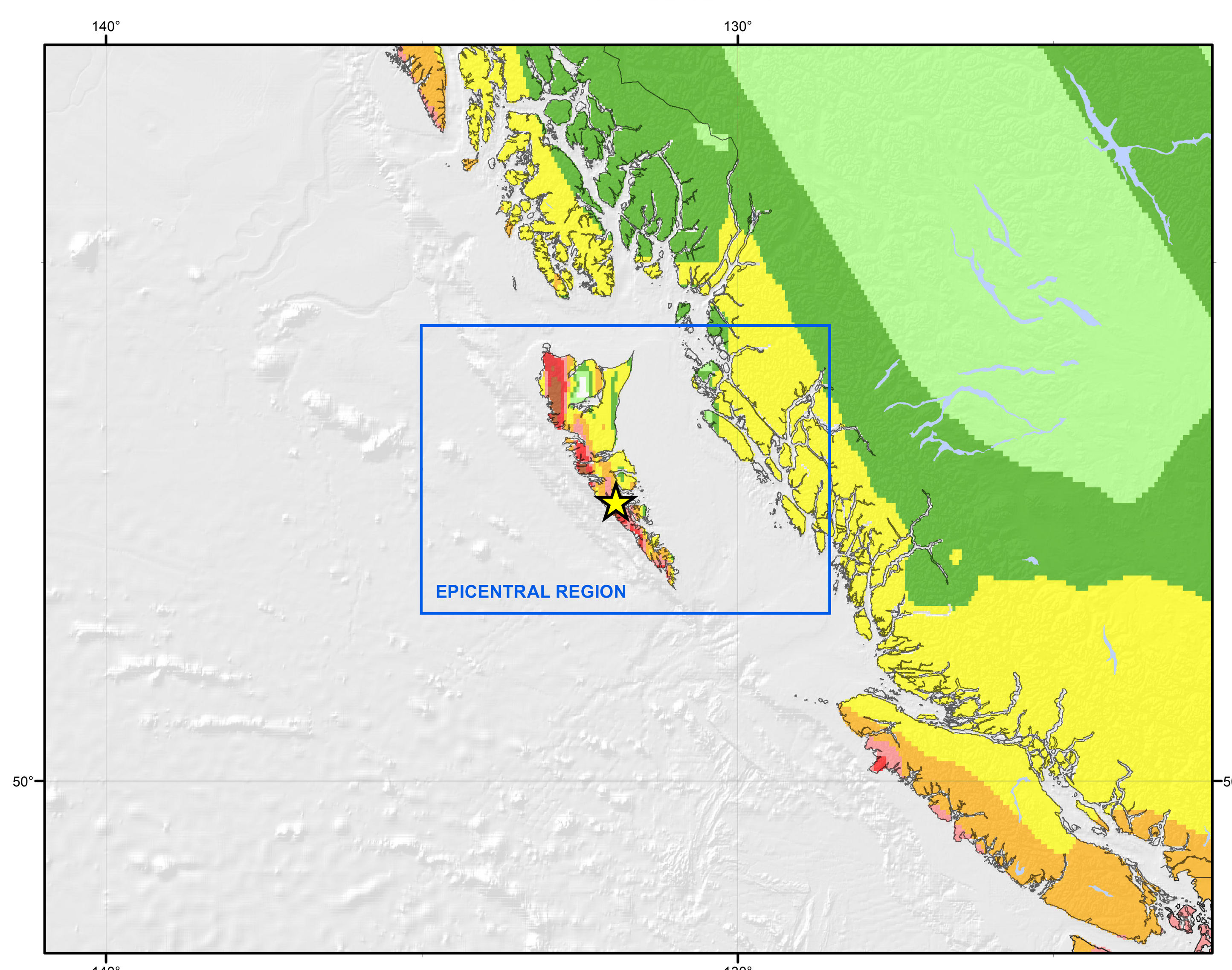
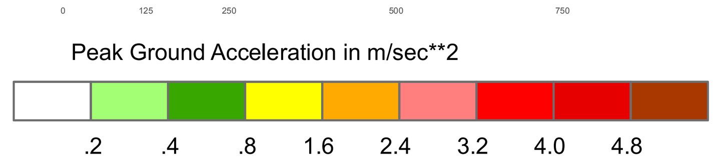


Seismic Hazard



Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.



TECTONIC SUMMARY

The October 28th, 2012 (October 27 at the location of the epicenter) M 7.7 earthquake south of Masset, Canada, occurred as a result of oblique-thrust faulting near the plate boundary between the Pacific and North America plates. At the location of this event, the Pacific plate moves approximately north-northwest with respect to the North America plate at a rate of approximately 50 mm/yr.

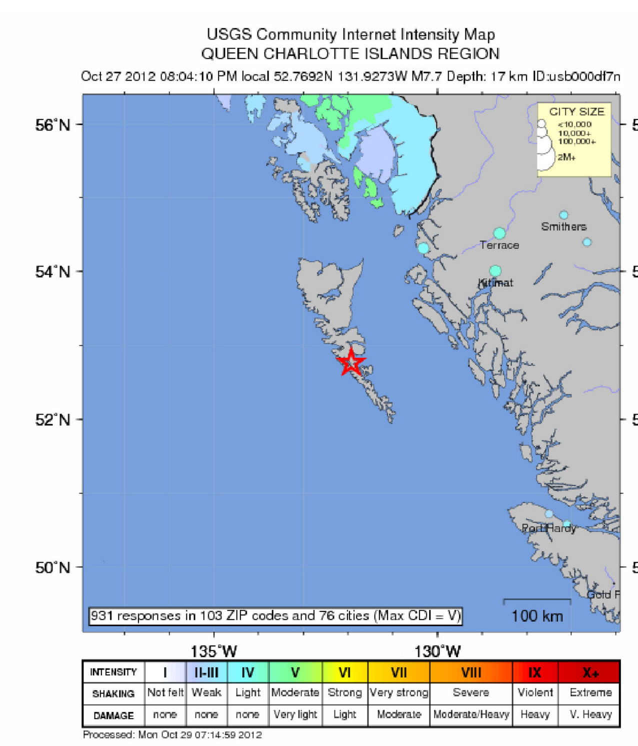
This earthquake is likely associated with relative motion across the Queen Charlotte fault system offshore of British Columbia, Canada. Studies of tectonics in this region suggest plate motions are taken up by strike slip faulting parallel to the plate boundary, accompanied by lesser amounts of thrust motion to accommodate the oblique nature of the plate motion vector between the two plates with respect to the orientation of the main plate boundary fault structure. This oblique component of plate motion may involve either underthrusting of the western edge of the Pacific Plate beneath North America, or be taken up on crustal faults within the North America plate. The October 28th earthquake is consistent with either scenario. Its rupture extended approximately 100-150 km along strike, along the shallow extent of the source fault. Slip amounts reached approximately 5m, in a patch to the south of the epicenter. Aftershocks delineate the rupture well, as shown here.

This region of the Pacific:North America plate boundary has hosted 7 earthquakes of magnitude 6 or greater over the past 40 years – the largest of which was a M 6.6 earthquake in 2009, 80 km to the south east of the 2012 earthquake. In 1949, a M 8.1 earthquake occurred closer to the Pacific:North America plate boundary, likely as a result of strike-slip faulting, approximately 100 km northwest of the October 28th earthquake, near the northern extent of Haida Gwaii region (formerly Queen Charlotte Islands).

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.

Did You Feel It?



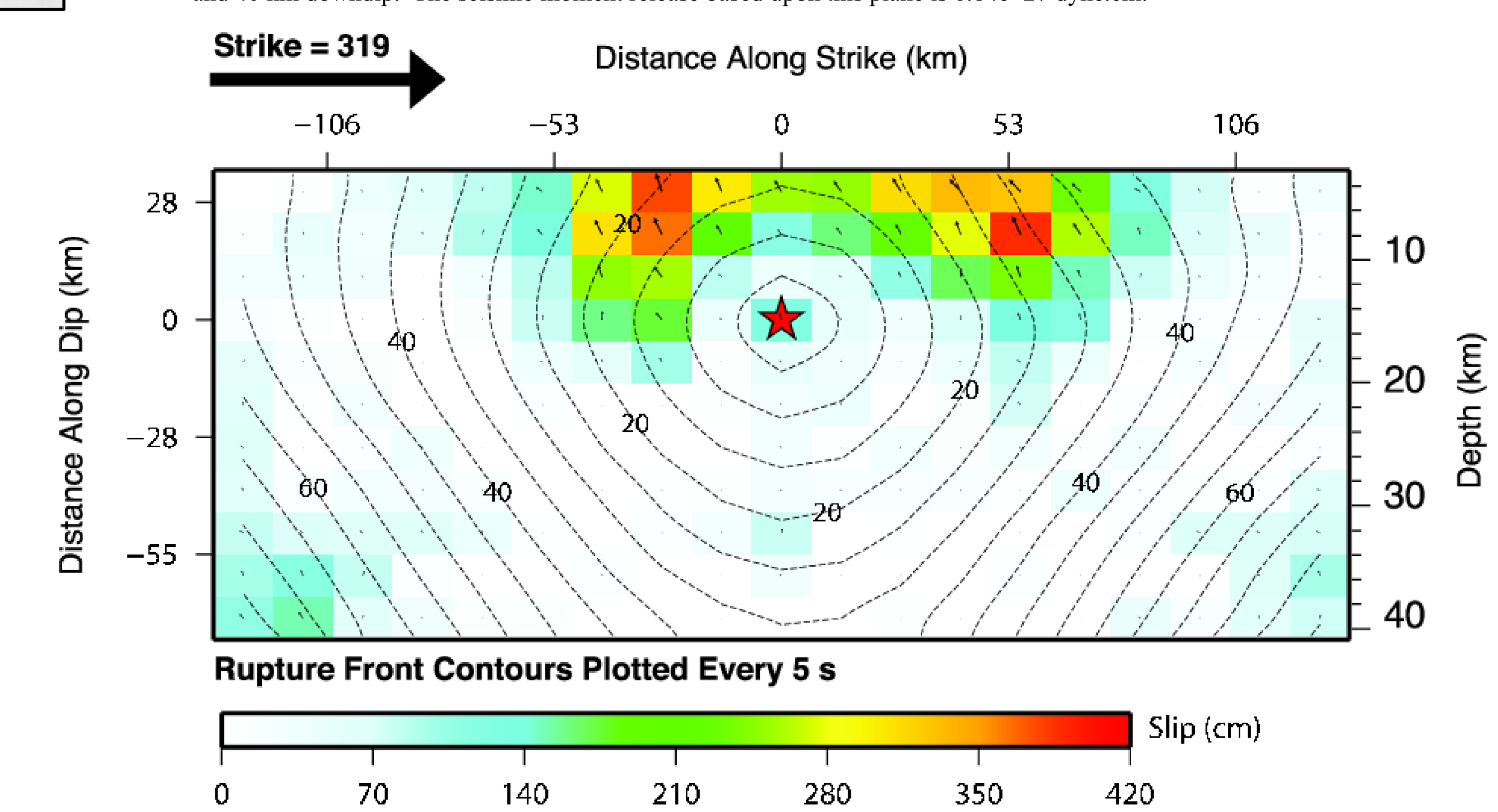
Significant Earthquakes Mag >= 6.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1910	11	06	2029	53.000	-135.000	0	6.8
1929	05	26	2240	51.235	-130.556	15	7.0
1949	08	22	0401	53.750	-133.250	0	8.1
1956	12	21	0858	51.356	-130.747	15	6.7
1960	07	04	0428	51.755	-131.357	35	6.7
1970	06	24	1309	51.774	-130.939	20.3	6.8
2004	06	28	0949	54.800	-134.250	20	6.8
2008	01	05	1101	51.254	-130.746	15	6.6
2009	11	17	1530	52.131	-131.397	3	6.6
2012	10	28	0304	52.769	-131.927	17.5	7.7

Finite Fault Model

Distribution of the amplitude and direction of slip for subfault elements of the fault rupture model are determined from the inversion of teleseismic body waveforms and long period surface waves. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip is also colored by magnitude. The view of the rupture plane is from above.

The strike of the fault rupture plane is N49W and the dip is 17 NE. The dimensions of the subfault elements are 14 km in the strike direction and 10 km in the dip direction. The rupture surface is approximately 130 km along strike and 40 km downdip. The seismic moment release based upon this plane is 6.84e+27 dyne.cm.



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)
Ji, C., D.J. Wald, and D.V. Helmberger, Source description of the 1999 Hector Mine, California earthquake; Part I: Wavelet domain inversion theory and resolution analysis, Bull. Seism. Soc. Am., Vol 92, No. 4. pp. 1192-1207, 2002.
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 teleseismic earthquake relocation with improved travel times and procedures for depth determination: Bull. Seism. Soc. Amer., v. 88, p. 722-743.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
28 October 2012
Map not approved for release by Director USGS