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

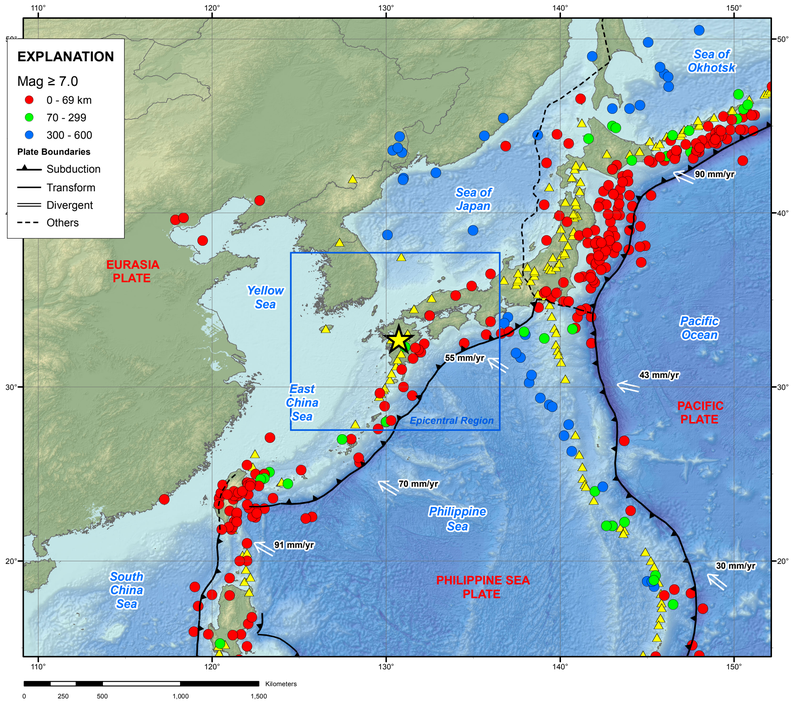
M7.0 Kyushu, Japan Earthquake of 15 April 2016

EARTHQUAKE SUMMARY MAP

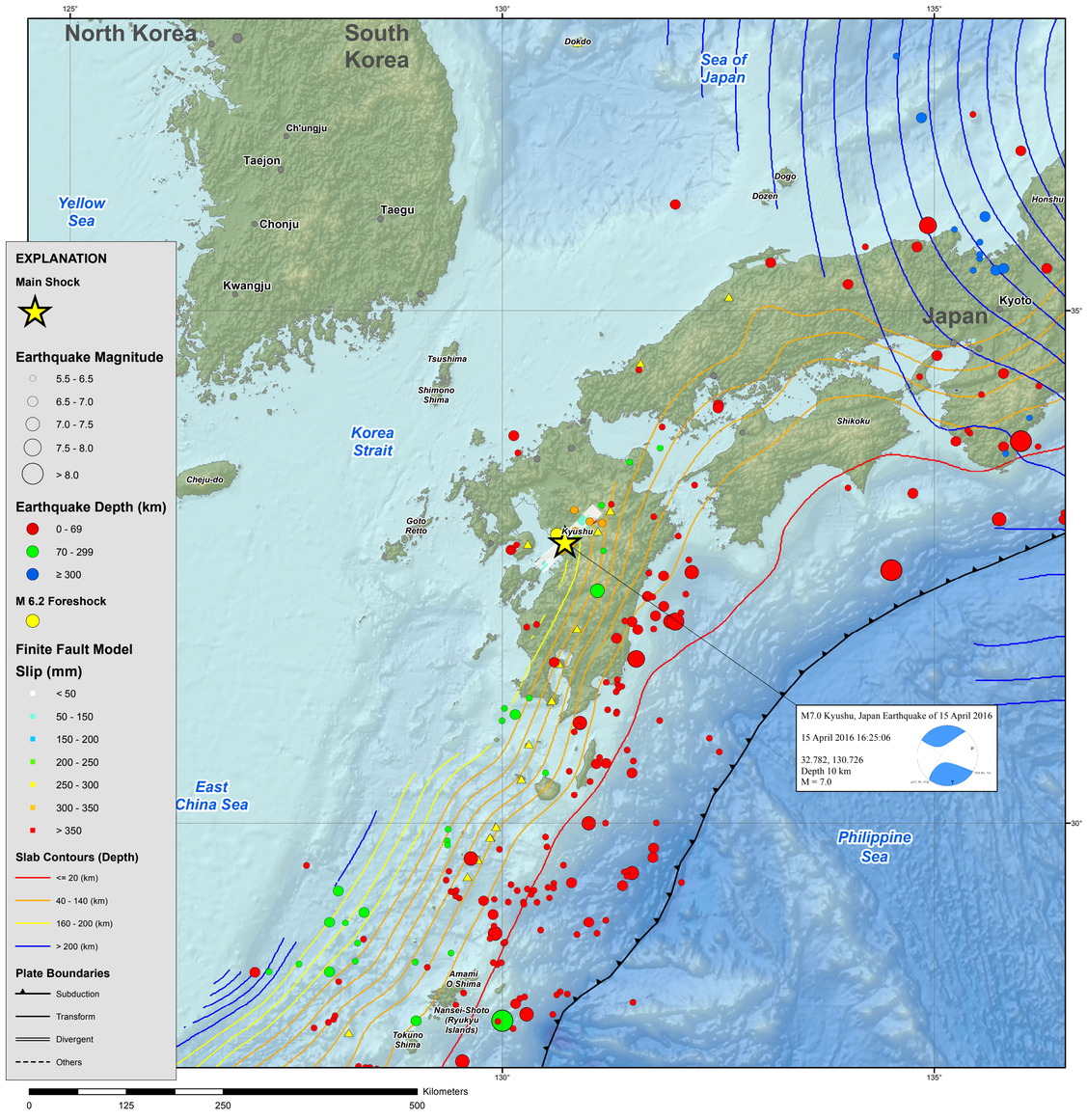
Prepared in cooperation with the Global Seismographic Network

GSN

Tectonic Setting



Epicentral Region



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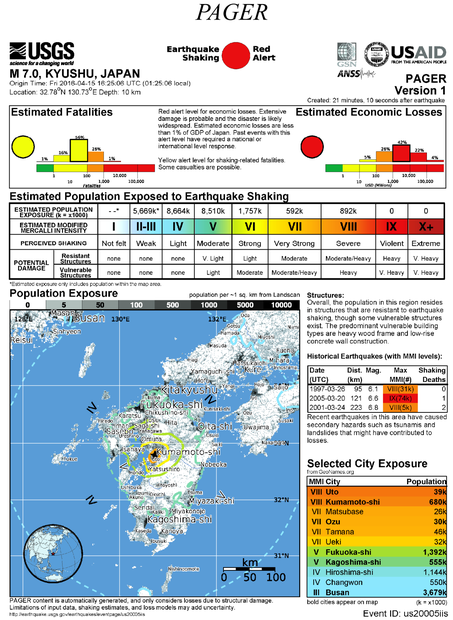
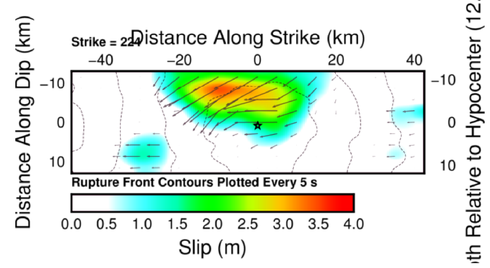
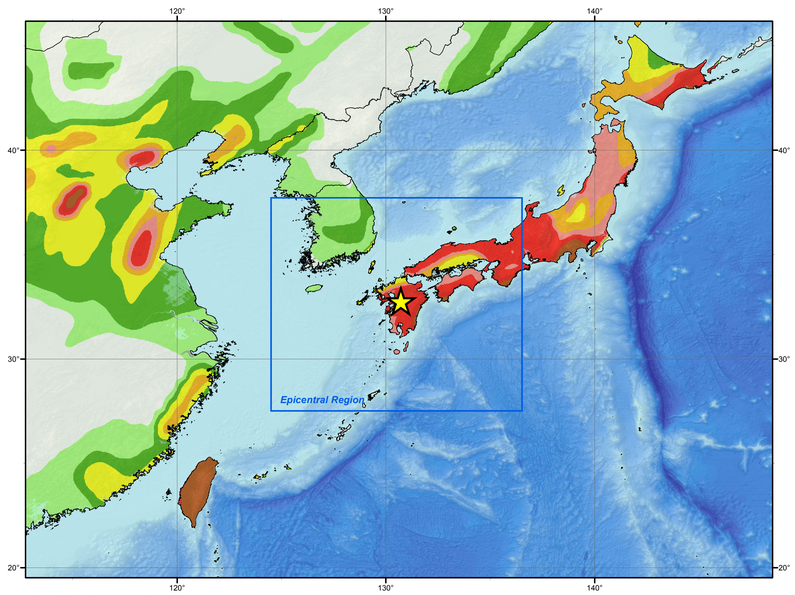


Finite Fault Model



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 224° and the dip is 66°NW. The dimensions of the subfault elements are 5 km in the strike direction and 2.9 km in the dip direction. The rupture surface is approximately 30 km along strike and 10 km along downdip. The seismic moment release based upon this plane is 4.7e+26 dyne.cm.

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 April 15, 2016 M 7.0 earthquake north of Kumamoto, on the island of Kyushu in southwest Japan, occurred as the result of strike-slip faulting at shallow depth. Focal mechanisms for the earthquake indicate slip occurred on either a left-lateral fault striking to the northwest, or on a right-lateral fault striking northeast. While the earthquake occurred several hundred kilometers northwest of the Ryukyu Trench, where the Philippine Sea plate begins its northwestward subduction beneath Japan and the Eurasia plate, the shallow depth and faulting mechanism of this earthquake indicate it occurred on a crustal fault within the upper Eurasia plate. At the location of this event, the Philippine Sea plate converges with Eurasia towards the northwest at a velocity of 58 mm/yr.

The April 15, 2016, M 7.0 event (UTC 16:25:06) occurred one day after a series of foreshocks in the same region, which included M 6.2 and M 6.0 earthquakes. The April 14 events resulted in at least 9 fatalities and over 800 injuries.

In contrast to this recent sequence of shallow earthquakes, most seismicity in the Kyushu region is related to the subduction of the Philippine Sea plate at depth. Just thirteen M 5+ earthquakes have occurred at shallow depths (> 50 km) within 100 km of the April 2016 events over the preceding century. In January and April of 1975, two shallow events with magnitudes of M 5.8 and M 6.1 - 40 km and 65 km to the northwest of the April 2016 earthquake, respectively – caused injuries, but no known fatalities. A shallow M 6.6 earthquake in March 2005, just off the north coast of Kyushu and 110 km north of the April 2016 event, caused over 1000 injuries and at least one fatality.

Mapped faults in the region generally trend east-west or northeast-southwest, in agreement with the right-lateral plane of preliminary focal mechanisms, and the trend of early aftershocks. Since the April 14, M 6.2 event (12:26:36 UTC), 19 other shocks have been located, including the latest M 7.0 earthquake.

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)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program
Volcanoes of the World (Siebert and Simkin, 2002)

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.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

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 Villasenor, 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.