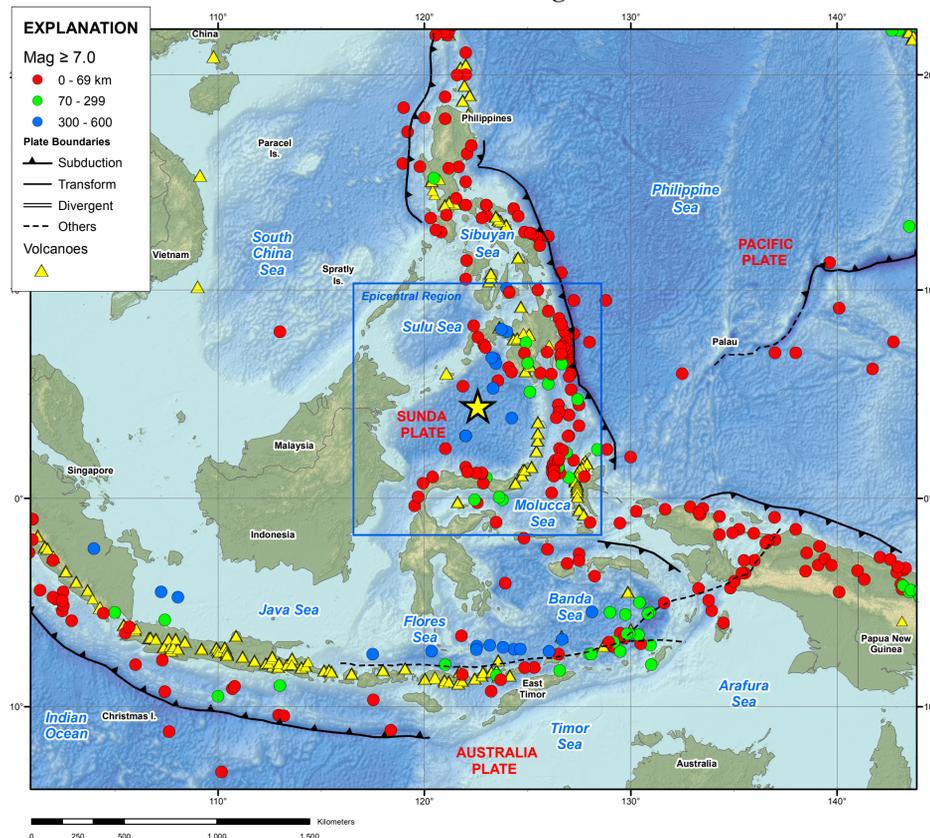


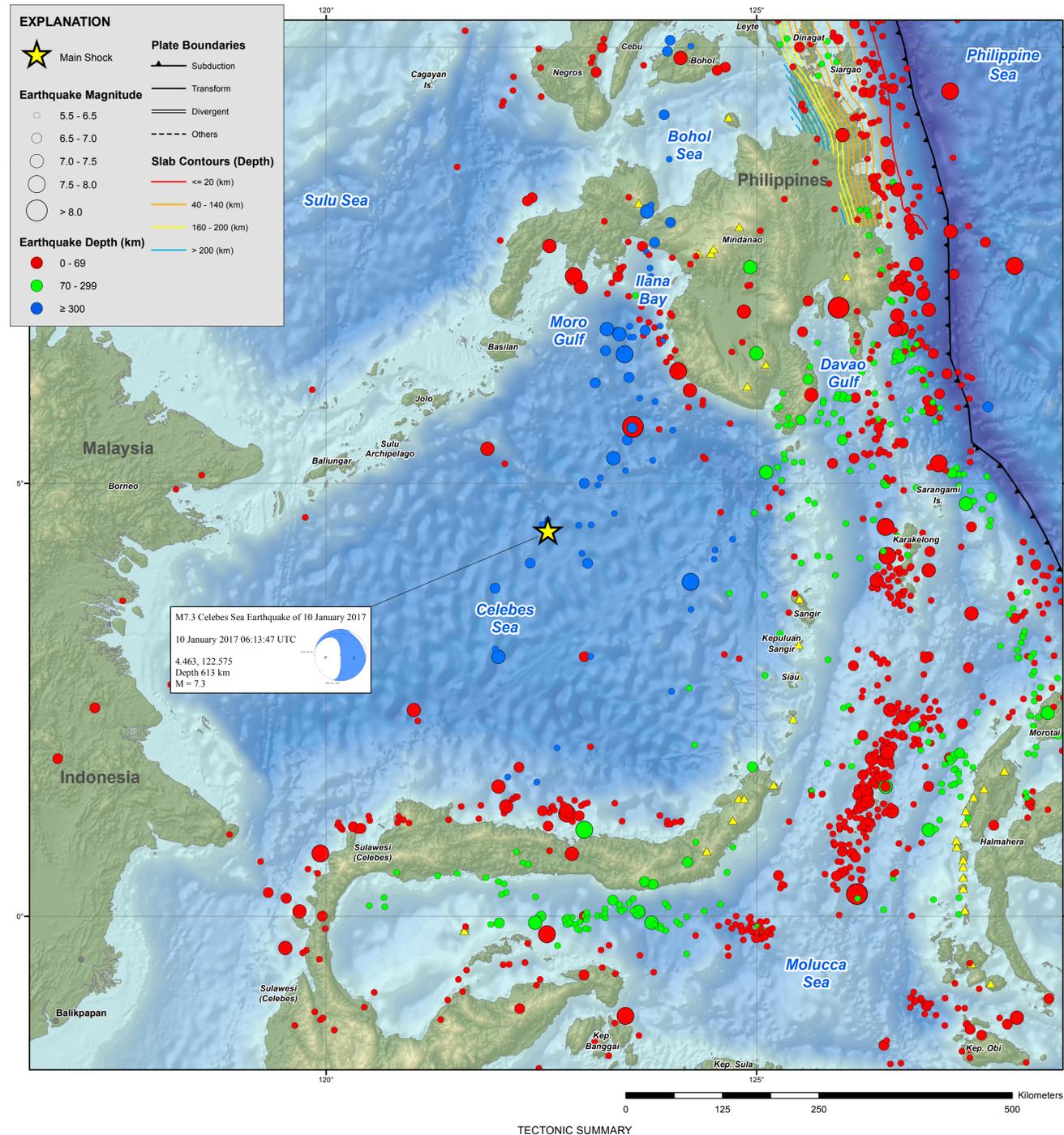
M7.3 Celebes Sea Earthquake of 10 January 2017



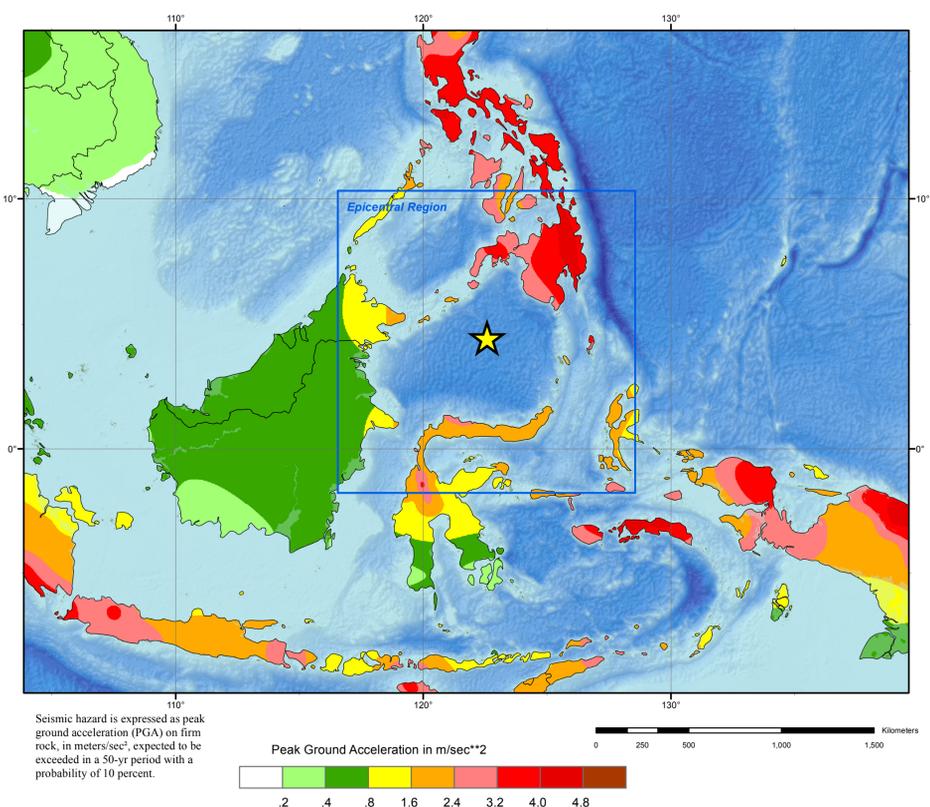
Tectonic Setting



Epicentral Region



Seismic Hazard



PAGER

USGS science for a changing world
Earthquake Shaking Green Alert

M 7.3, CELEBES SEA
Origin Time: Tue 2017-01-10 06:13:47 UTC (06:13:47 local)
Location: 4.46°N 122.58°E Depth: 612 km

Estimated Fatalities Green alert for shaking-related fatalities and economic losses. There is a low likelihood of casualties and damage.

Estimated Economic Losses Created: 2 hours, 3 minutes after earthquake

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (N = 3100)	I	II-III	IV	V	VI	VII	VIII	IX	X+
ESTIMATED MODIFIED MERCALLI INTENSITY	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
PERCEIVED SHAKING	None	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	None	None	None	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy	Very Heavy

Population Exposure

Overall, the population in this region resides in structures that are a mix of vulnerable and earthquake resistant construction.

Historical Earthquakes (with MMI levels):

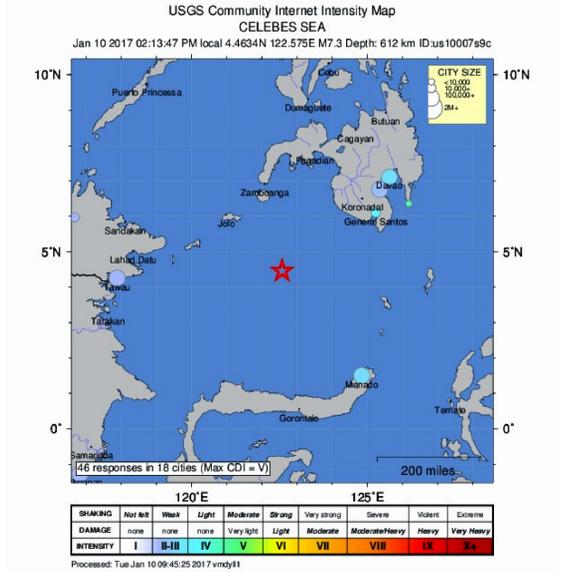
Date (UTC)	Dist (km)	Mag	Max Shaking (MMI)	Deaths
1999-05-18	189	5.9	V (75k)	0
2005-03-05	124	7.1	VIII (5.6k)	2
2002-03-05	248	7.5	VIII (25k)	15

Selected City Exposure

MMI City	Population
III Buayan	15k
III Katangawan	8k
III Lun Pequeno	12k
III Alabal	43k
III Tinaganan	5k
III Tabiauan	2k
III Budta	1,274k
III Maingao	1,122k
III Cotabato	175k
III Koronadal	126k
III Manado	452k

Processed: Tue Jan 10 09:45:25 2017 vmdy41

Did You Feel It?



The January 10, 2017, M 7.3 earthquake south of Mindanao, Philippines, occurred as the result of faulting within the inclined seismic zone defining the deep limit of the Molucca Sea microplate beneath the Celebes Sea Basin. Focal mechanism solutions indicate that the event occurred on either a near-vertical, north-south striking fault, or on a shallowly-dipping, east-west striking fault.

Northeastern Indonesia and southern Philippines are characterized by complex tectonics in which motions of numerous small plates accommodate the large-scale convergence between the Philippine Sea and Sunda plates. In the region of the January 10th earthquake, the Philippine Sea plate moves west-northwest with respect to the Sunda plate at a velocity that various models would place in the 60-110 mm/yr range. Locally, arc-arc collision is occurring between the Sangihe microplate and the Philippine Sea plate, wedging between them the Molucca Sea microplate, which subducts beneath both (to the east and west) and forms an inverted-U-shaped seismic zone. At the location of the January 10th earthquake, the top of the Molucca Sea microplate is at a depth of about 150 km beneath the Earth's surface. Seismicity within the Molucca Sea microplate is active to depths of approximately 260 km to the east and 650 km to the west. The tectonic setting of this region is unique in that it is the only global example of an active arc-arc collision consuming an oceanic basin via subduction in two directions.

The January 10th event occurred in response to stresses generated by the slow distortion of the Molucca Sea microplate at depth, rather than on one of the shallower interfaces with the overriding Sangihe and Philippine Sea plates. Slip on a fault aligned with either nodal plane of the focal mechanism solution is consistent with this intraplate setting.

Earthquakes that have focal depths greater than 300 km are commonly termed "deep-focus" earthquakes. Deep-focus earthquakes cause less damage on the ground surface above their foci than similar-magnitude shallow-focus earthquakes, but large deep-focus earthquakes may be felt at great distance from their epicenters. The largest recorded deep-focus earthquake to date was the M 8.3 event that occurred at a depth of 600 km within the subducted Pacific plate beneath the Sea of Okhotsk offshore of northeastern Russia in 2013. The M 8.3 Okhotsk earthquake was felt all over Asia, as far away as Moscow, and across the Pacific Ocean along the western seaboard of the United States (though at distant locations, individuals reporting having felt the event were likely very favorably situated for the perception of small ground motions). The M 8.2 Bolivian deep-focus earthquake in 1994 had similarly been reported by individuals in North America at great distance from the epicenter.

Over the past century, 93 earthquakes with a magnitude of M 7+ have occurred at depths greater than 300 km globally; six of these were located in the same region as the January 10, 2017, event. The largest nearby event at these depths was a M 7.1 earthquake in February 2005, 125 km to the northeast and 90 km shallower than the January 2017 event, with no associated damage or casualties. In July 2010, a series of three M 7.3-M 7.6 deep-focus earthquakes occurred in the same subducted slab segment, 250 km to the north of the January 2017 event.

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)
IHF (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)
B. 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 ESRRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models

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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.

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.

Map updated by U.S. Geological Survey National Earthquake Information Center
10 January 2017
http://earthquake.usgs.gov/
Map not approved for release by Director USGS