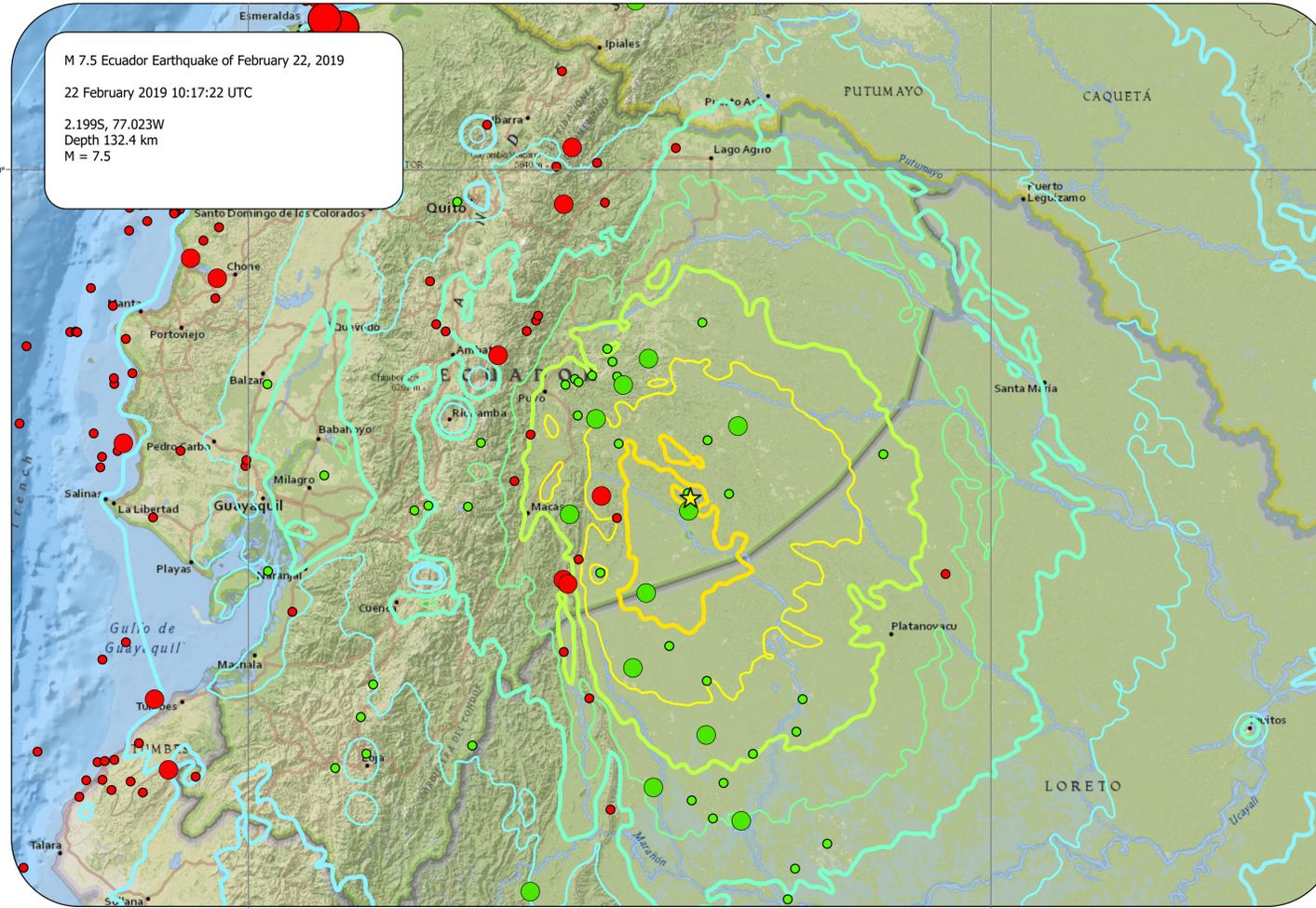


Tectonic Summary

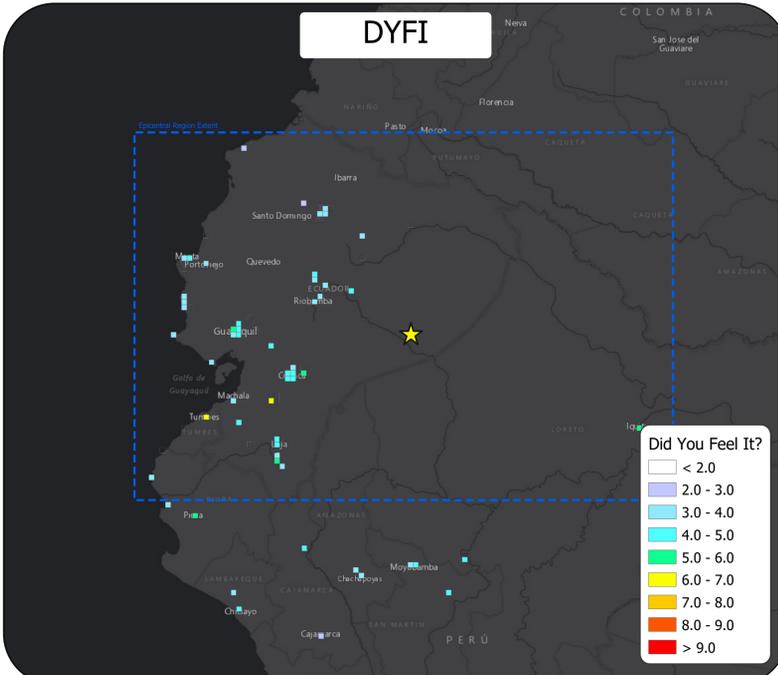
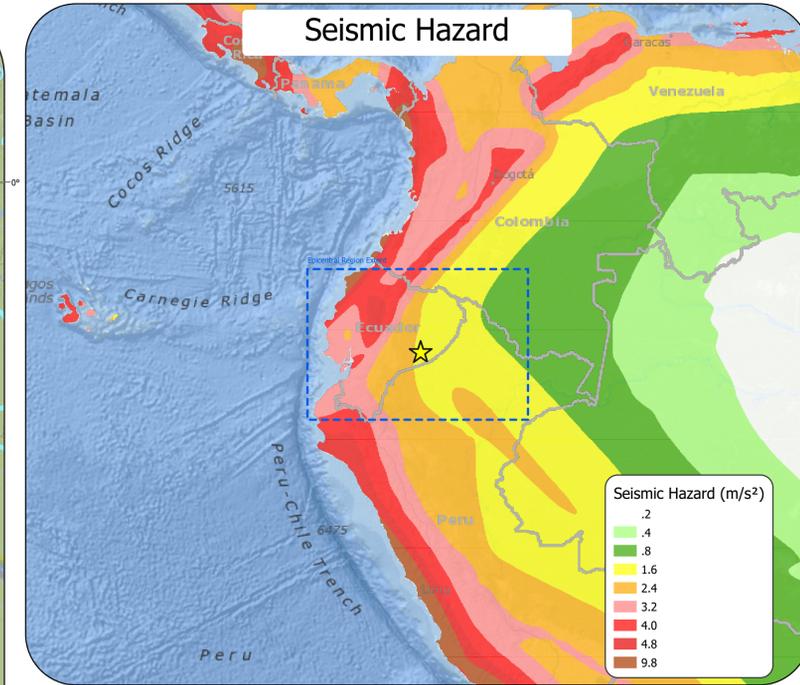
The February 22, 2019, M 7.5 Ecuador earthquake occurred as the result of normal faulting at an intermediate depth, approximately 130 km beneath western Ecuador within the lithosphere of the subducted Nazca plate. Focal mechanism solutions indicate that rupture occurred on either a steeply dipping normal fault or a shallowly dipping normal fault, both striking in an approximate NW-SE direction. Slip on a fault of either orientation would accommodate the down-dip extension of the Nazca slab. At the location of the earthquake, the oceanic Nazca plate moves east relative to the South America plate at a rate of about 70 mm/yr, subducting at the Peru-Chile Trench west of the Ecuadorian coast and sinking into the mantle beneath South America. Like most earthquakes of Ecuador and western South America, this event was caused by strains generated by the ongoing subduction process.

Earthquakes like this event, with focal depths between 70 and 300 km, are commonly termed "intermediate-depth" earthquakes. Intermediate-depth earthquakes represent deformation within subducted slabs rather than at the shallow plate interface between subducting and overriding tectonic plates. They typically cause less damage on the ground surface above their foci than is the case with similar-magnitude shallow-focus earthquakes, but large intermediate-depth earthquakes may be felt at great distance from their epicenters. "Deep-focus" earthquakes, those with focal depths greater than 300 km, also occur in the subducted Nazca plate farther east from the Peru-Chile Trench, beneath western Brazil and central Argentina. Earthquakes have been reliably located to depths of about 650 km in this region.

The Peru-Chile Trench is an area that hosts large earthquakes quite regularly. Within 500 km of the February 22nd earthquake, there have been 15 other intermediate depth earthquakes with magnitudes of 6.5+ over the preceding century. Today's earthquake is the largest of these; another M 7.5 event occurred about 400 km to the south-southeast beneath Peru in September 2005. A M 7.4 earthquake in the Peru-Ecuador border region in July 1971, 80 km to the southwest of the February 22, 2019, event at a depth of 120 km, was previously the largest known intermediate depth earthquakes in Ecuador since 1900. A M 7.1 earthquake about 110 km to the north-northwest of the February 22, 2019 event in August 2010 caused minor damage across Ecuador, including in the coastal city of Guayaquil.



M 7.5 Ecuador Earthquake of February 22, 2019
22 February 2019 10:17:22 UTC
2.199S, 77.023W
Depth 132.4 km
M = 7.5



M 7.5, 115km ESE of Palora, Ecuador
Origin Time: 2019-02-22 10:17:22 UTC (FM 05:17:22 local)
Location: 2.1990° S 77.0231° W Depth: 132.4 km
FOR TSUNAMI INFORMATION, SEE: tsunami.gov

PAGER Version 3
Created: 7 hours, 5 minutes after earthquake

Estimated Fatalities

Estimated Economic Losses

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k=1000)	I	II-III	IV	V	VI	VII	VIII	IX	X+
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures: None	None	None	V. Light	Light	Moderate	Mod./Heavy	Heavy	V. Heavy
	Vulnerable Structures: None	None	None	Light	Moderate	Mod./Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

Structures

Overall, the population in this region resides in structures that are highly vulnerable to earthquake shaking, though some resistant structures exist. The predominant vulnerable building types are mud wall and informal (metal, timber, GI etc.) construction.

Historical Earthquakes

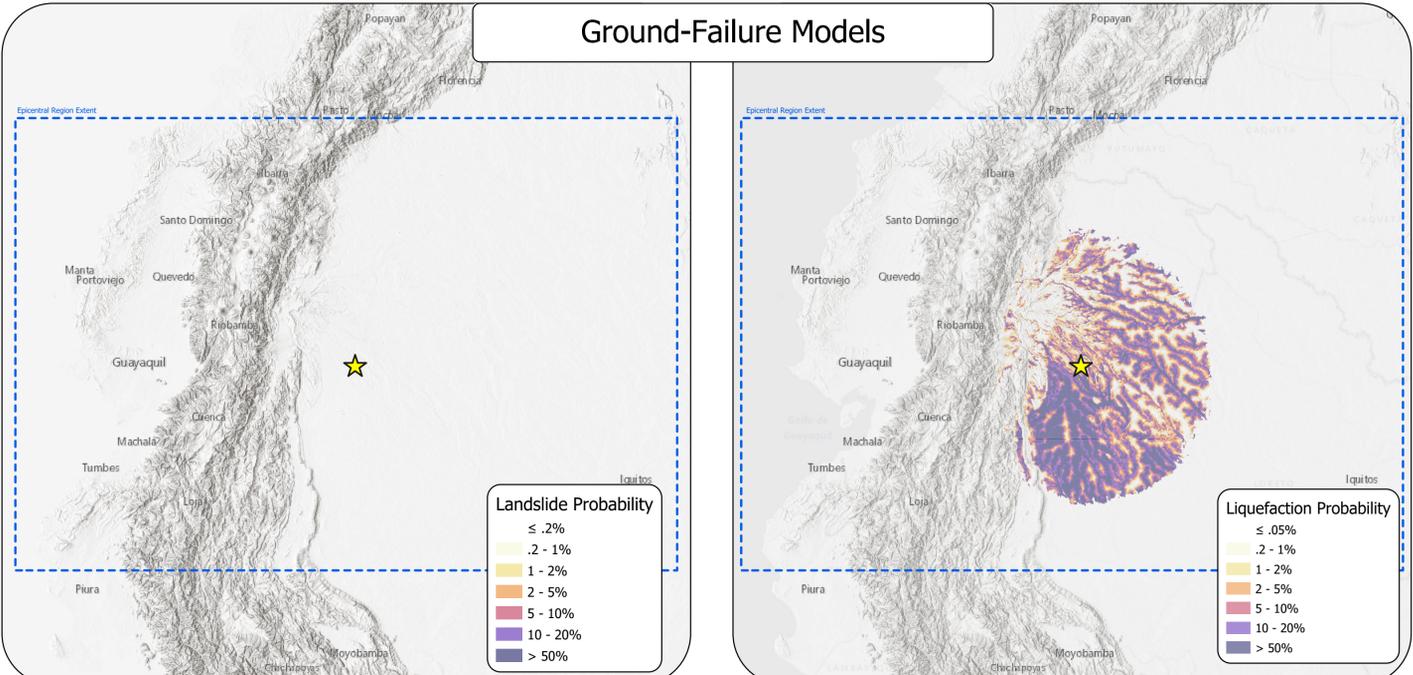
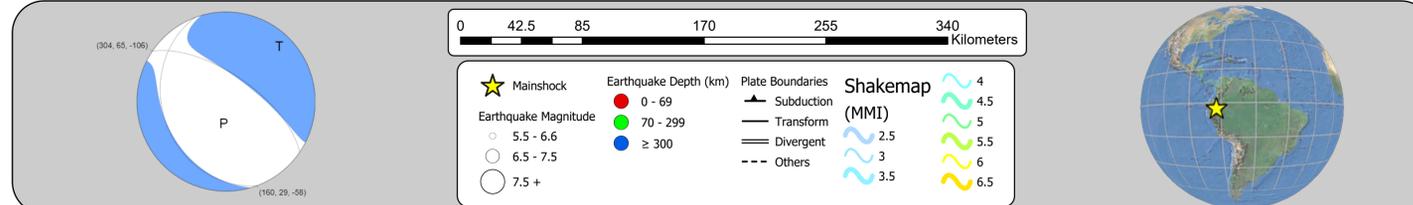
Date (UTC)	Dist. (km)	Mag.	MMI(1/2)	Shaking Deaths
1990-08-11	277	5.3	VIII(390k)	4
1976-10-06	251	5.7	VIII(2k)	9
1967-03-06	267	7.1	X(100k)	1k

Recent earthquakes in this area have caused secondary hazards such as landslides that might have contributed to losses.

Selected City Exposure

MMI City	Population
VII Tachira	<1k
VI Montalvo	<1k
VI Palora	6k
VI Susua	7k
VI Puyo	25k
VI Macas	24k
V Iquitos	439k
IV Guayaquil	1,952k
IV Pasto	382k
IV Quito	1,400k
III Chiclayo	577k

bold cities appear on map



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)

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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
30 November 2018
<http://earthquake.usgs.gov/>
Map not approved for release by Director USGS