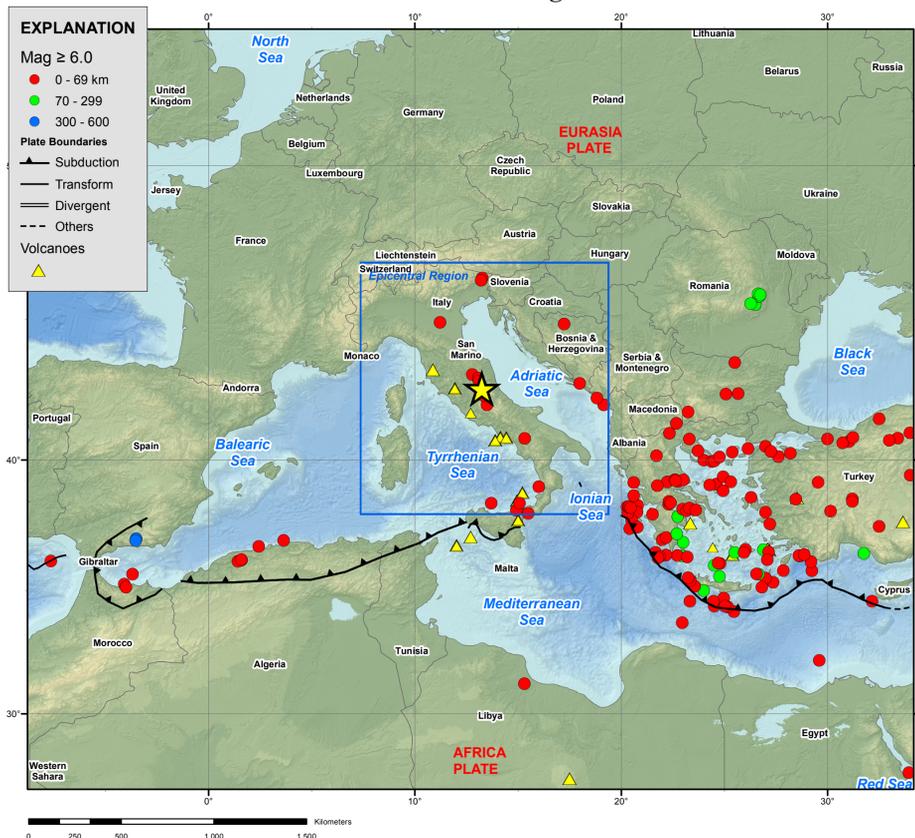


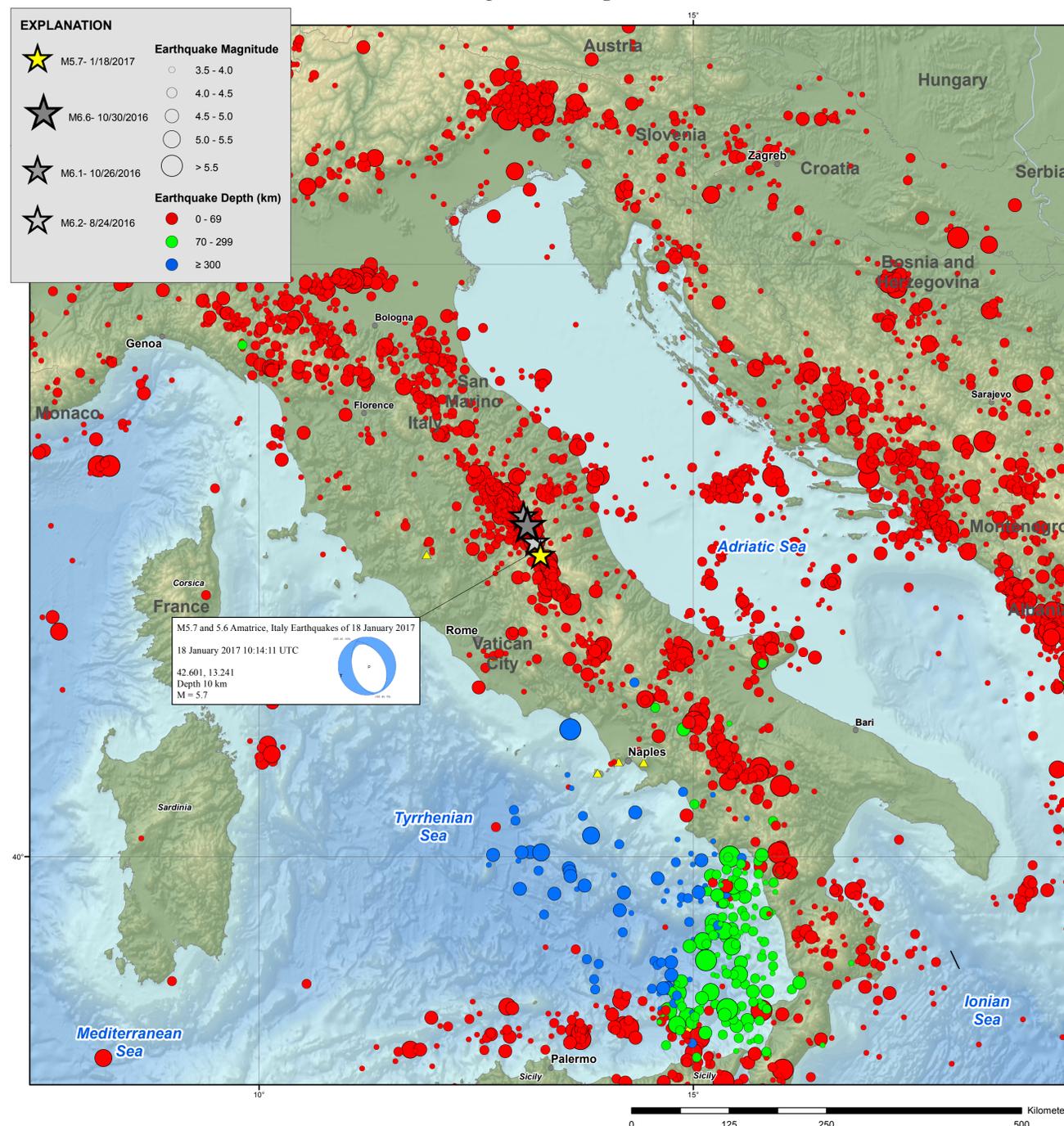
M5.7 and 5.6 Amatrice, Italy Earthquakes of 18 January 2017



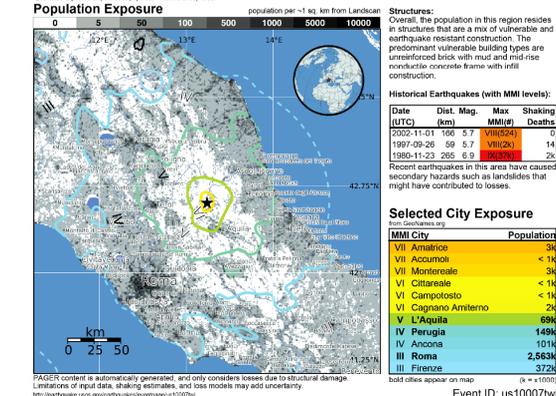
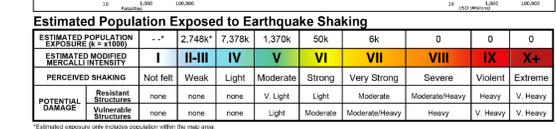
Tectonic Setting



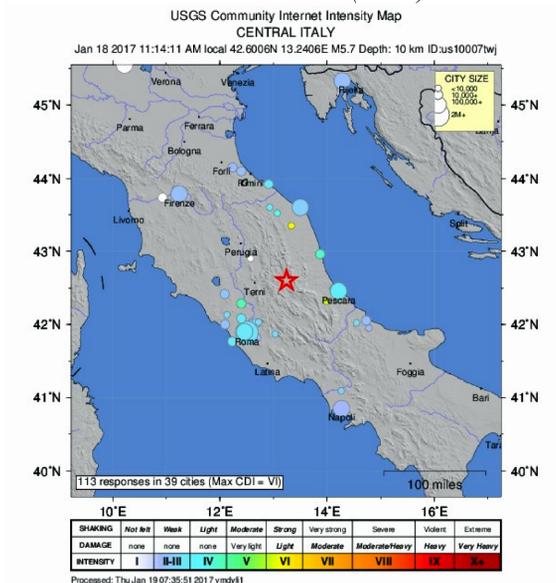
Epicentral Region



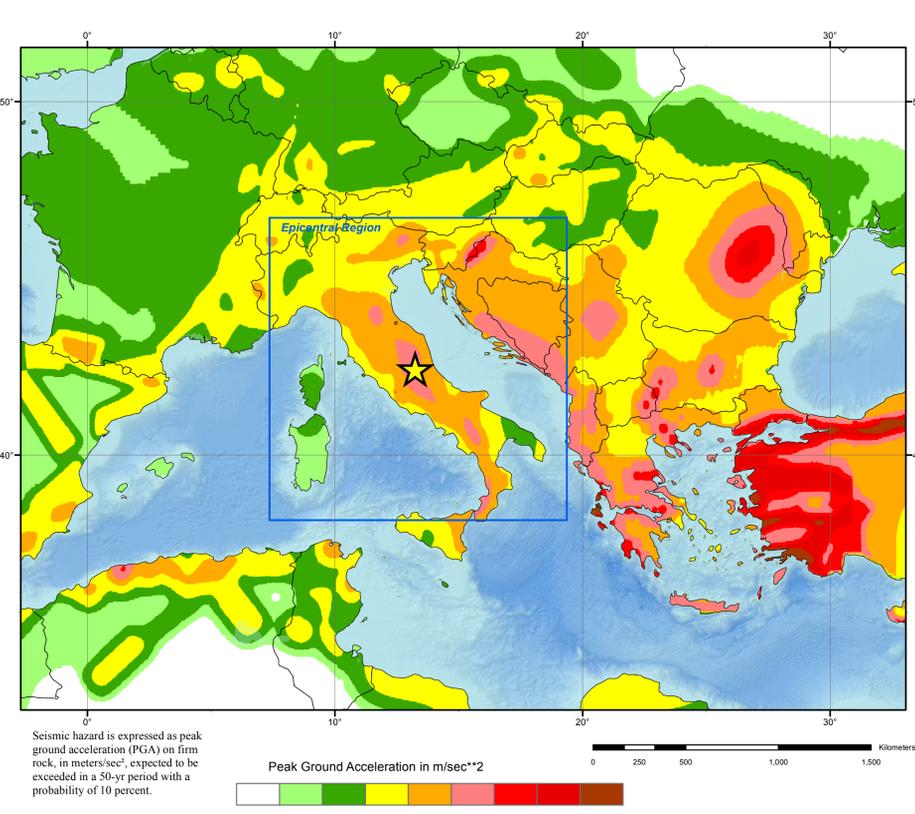
PAGER (M5.7)



Did You Feel It? (M5.7)



Seismic Hazard



The January 18, 2017 M 5.7 and M 5.6 earthquakes southwest of Amatrice, Italy, occurred as the result of shallow normal faulting on a NW-SE oriented fault (or faults) in the Central Apennines. The Apennines is a mountain range that runs from the Gulf of Taranto in the south to the southern edge of the Po basin in northern Italy. Geologically, the Apennines is largely an accretionary wedge formed as a consequence of subduction. This region is tectonically and geologically complex, involving subduction of the Adria micro-plate beneath Eurasia and the Apennines from east to west, continental collision between the Eurasia and Nubia (Africa) plates building the Alpine mountain belt further to the north, and the opening of the Tyrrhenian basin to the west (the latter of which is in turn related to Adria subduction and eastward trench migration). The evolution of this system has caused the expression of all different tectonic styles acting at the same time in a broad region surrounding Italy and the central Mediterranean. The January 18, 2017 normal faulting earthquakes are intraplate events, an expression of the east-west extensional tectonics that now dominate along the Apennine belt.

The January 18, 2017 earthquakes (09:25 UTC M 5.3; 10:14 UTC M 5.7; 10:25 UTC M 5.6) continue a sequence of damaging earthquakes that include:

- The August 24, 2016, M 6.2 central Italy (Amatrice) earthquake, which caused approximately 300 fatalities, and severely damaged the town of Amatrice.
- The October 26, 2016, M 6.1 central Italy earthquake, which was itself preceded by several hours by a M 5.5 earthquake. The M 6.1 earthquake resulted in damage to numerous buildings, but no fatalities.
- The October 30, 2016, M 6.6 central Italy earthquake, the largest event in the sequence to date. This event caused 20 injuries and left many homeless, and caused extensive damage, including destroying the Basilica of Saint Benedict.

Since the August 24, 2016 M 6.2 earthquake, and prior to January 18, 2017, the USGS has reported 75 events of M 4.0 and larger, including a M 5.6 earthquake within an hour of the August 24, 2016 shock, the two large events on October 26, 2016 – an M 5.5 event at 17:10 UTC, and the M 6.1 earthquake at 19:18 UTC – and the M 6.6 event on October 30, 2016. Both October 26, 2016 events were at the northern end of the aftershock sequence of the M 6.2 August 24, 2016 earthquake. The October 30, 2016, M 6.6 event occurred between the two prior largest earthquakes, approximately 10 km southeast of the October 26, 2016, M 6.1 event. The January 18, 2017 earthquakes occurred at the southern end of the sequence, about 15 km southeast of the M 6.2 August 24, 2016 earthquake.

The central Apennine region has experienced several significant earthquakes in recorded history. The largest instrumentally recorded earthquake within 100 km of the 2016-17 events was the January 13, 1915 M 6.7 earthquake, which was nearly 90 km to the south-southeast of the October 26, 2016 event, near Avezzano. The 1915 earthquake killed approximately 32,000 people. In September 1997, a Mw 6.0 earthquake 35 km west-northwest of the October 30, 2016 event killed 11, injured over 100 and destroyed approximately 80,000 homes in the Marche and Umbria regions. This 1997 event was part of a series of earthquakes known as the Umbria-Marche seismic sequence, which included eight events of magnitude greater than M5.0 in a two-month period between September and November of that year, including the events that substantially damaged the Basilica of St Francis in Assisi. In April 2009, a Mw 6.3 earthquake 60 km to the south-southeast of the October 30, 2016 event, near the town of L'Aquila, killed at least 295, injured over 1,000 and left 55,000 or more homeless. The L'Aquila earthquake resulted in significant landsliding in the local area, and was also followed by a vigorous aftershock sequence, including 5 other events of M 5.0 or larger. The location of the 2016-17 earthquake sequence is predominantly in a gap between the aftershock sequences of the 1997 and 2009 events; the January 18, 2017 events are just to the north of the northern extent of the 2009 sequence.

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)
Ji, C., D.J. Wald, and D.V. Helmenberger. 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: Geochim. 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. 68, 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
19 January 2017
http://earthquake.usgs.gov/
Map not approved for release by Director USGS