

Magnitude 7.2 EASTERN TURKEY

Sunday, October 23, 2011 at 10:41:21 UTC



A 7.2-magnitude earthquake struck eastern Turkey on Sunday, killing at least 138 people and sparking widespread panic as it collapsed dozens of buildings into piles of twisted steel and chunks of concrete. (AP) The death toll was expected to rise as rescuers sifted through the rubble and reached outlying villages.

Local Time 1:41 PM
Latitude 38.628° N
Longitude 43.486° E
Depth 20 km

This earthquake occurred 16 km (9 miles) north-northeast of Van, Turkey (population 372,000).

Images courtesy of the US Geological Survey

Frequent aftershocks are hampering search efforts. The US Geological Survey recorded eight aftershocks within three hours of the quake, including two with a magnitude of 5.6.



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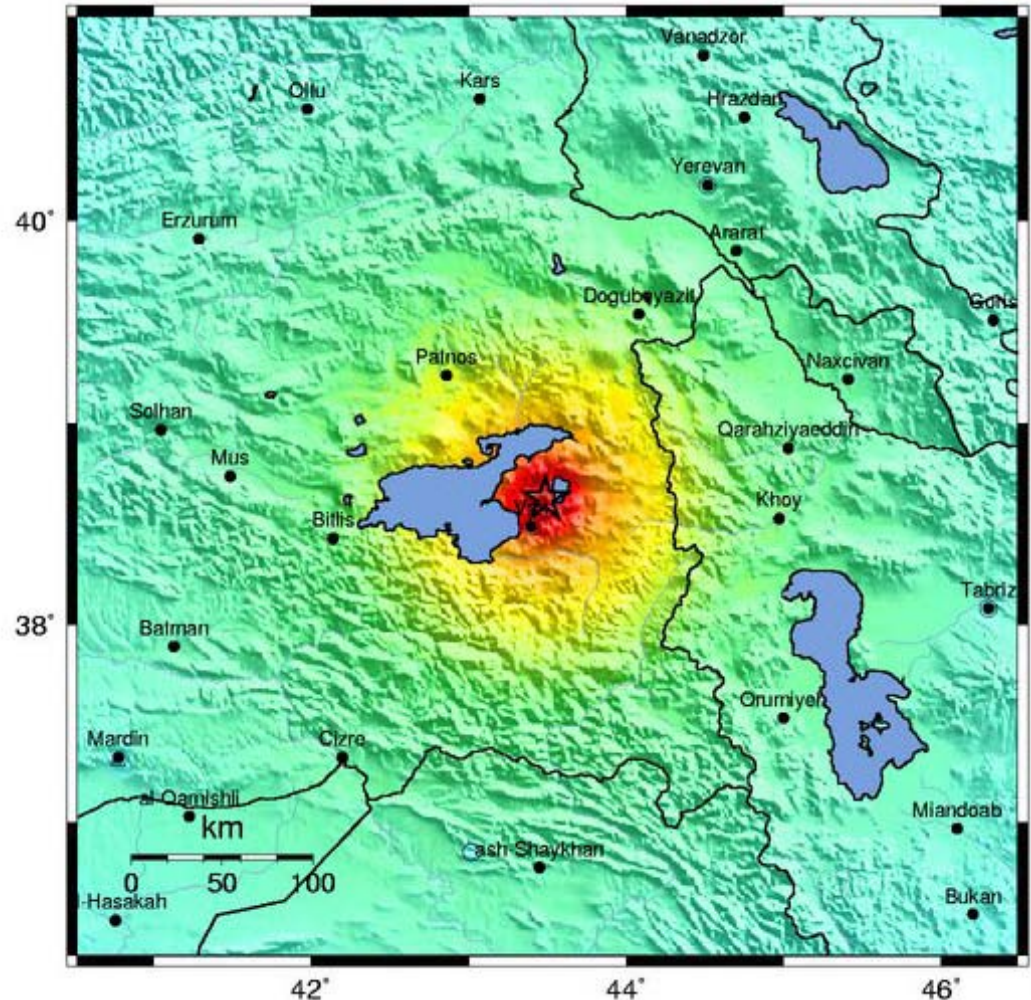
Shaking intensity scales were developed to standardize the measurements and ease comparison of different earthquakes. The Modified-Mercalli Intensity scale is a twelve-stage scale, numbered from I to XII. The lower numbers represent imperceptible shaking levels while XII represents total destruction. A value of IV indicates a level of shaking that is felt by most people.

Modified Mercalli Intensity

X
IX
VIII
VII
VI
V
IV
II-III
I

Perceived Shaking

Extreme
Violent
Severe
Very Strong
Strong
Moderate
Light
Weak
Not Felt



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USGS PAGER

Population Exposed to Earthquake Shaking

The USGS PAGER map shows the population exposed to different Modified-Mercalli Intensity (MMI) levels. MMI describes the severity of an earthquake in terms of its effect on humans and structures and is a rough measure of the amount of shaking at a given location.

Overall, the population in this region resides in structures that are a mix of vulnerable and earthquake resistant construction. The predominant vulnerable building types are unreinforced brick masonry and nonductile reinforced concrete frame construction.

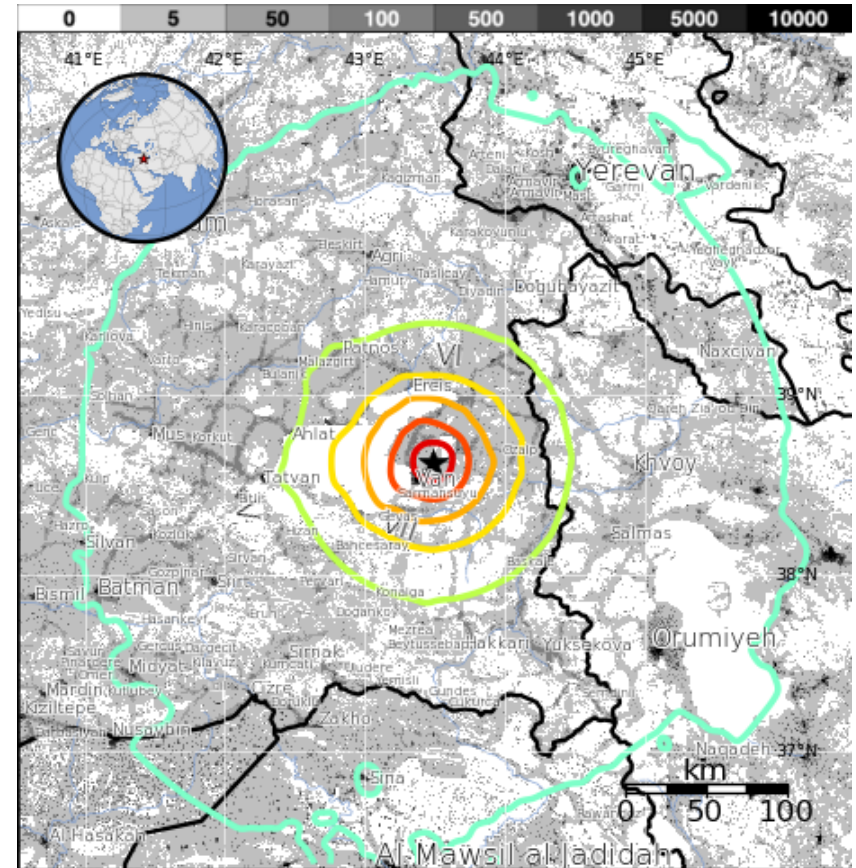


Image courtesy of the US Geological Survey

Estimated Modified Mercalli Intensity	I	II-III	IV	V	VI	VII	VIII	IX	X
Est. Population Exposure	---	357*	8,454k*	9,435k	482k	265k	67k	377k	29k
Perceived Shaking	Not Felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme

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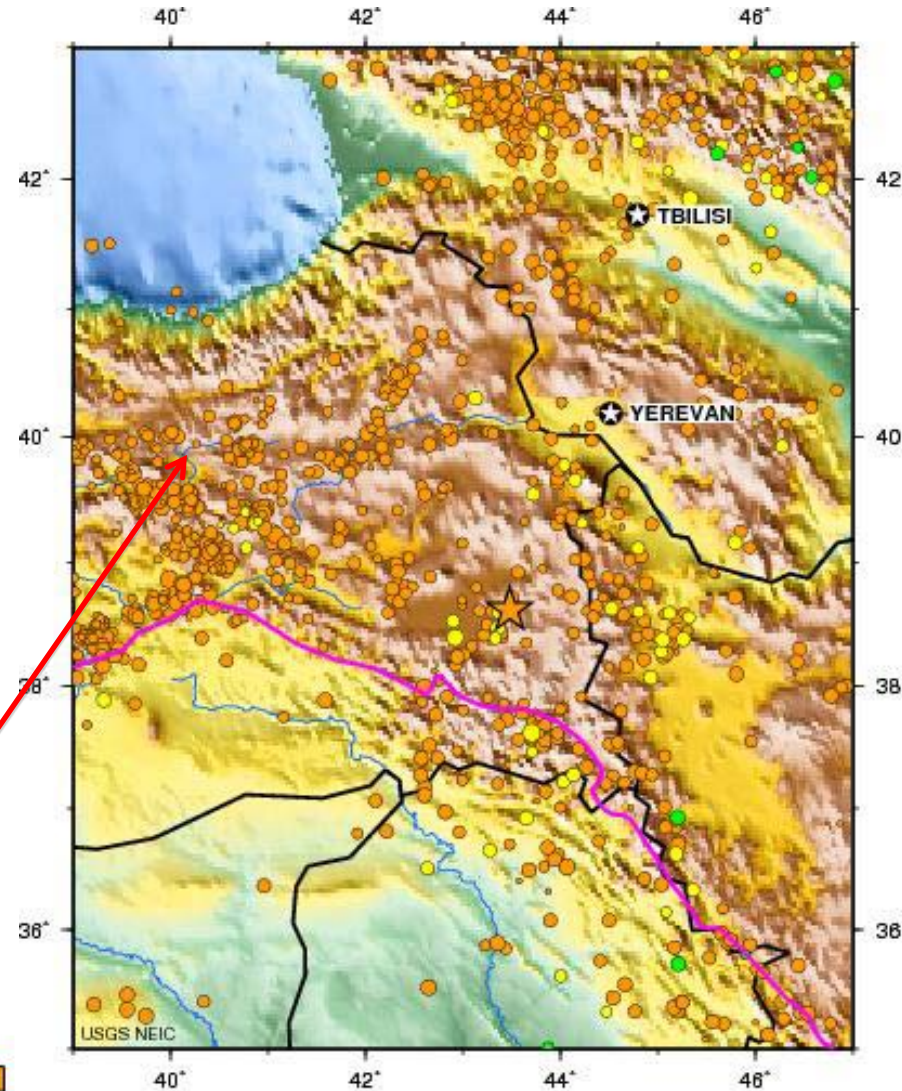
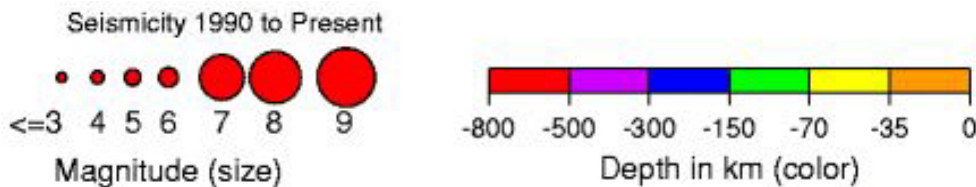
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Turkey is a tectonically active country that experiences frequent destructive earthquakes. This earthquake is a reminder of the many deadly seismic events that Turkey has suffered in the recent past.

Izmit earthquake of 1999 (M7.6), 1000 km to the west, 17,000 people killed, injured 50,000, and left 500,000 homeless.

Within about 70 km of the November 1976 M7.3 earthquake that destroyed several villages near the Turkey and Iran border and killed several thousand people.

A M7.8 earthquake struck Erzincan in 1939, killing an estimated 33,000 people.



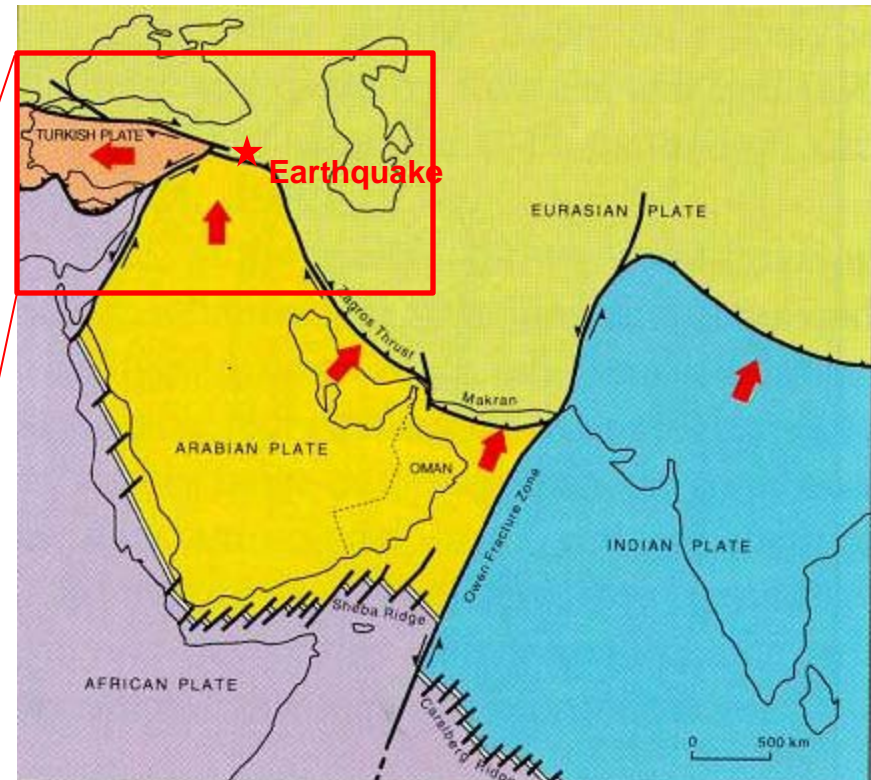
The map shows earthquakes recorded from 1990 to present in this region with this earthquake represented as an orange star.

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In the area of the earthquake, the Arabian Plate is colliding with Eurasia, and has built a complex mosaic of mountains by thrust and strike-slip faulting. Collision of the Arabian and Eurasian plates occurs in Eastern Turkey along the East Anatolian Fault Zone (EAFZ) and the Bitlis Suture, a large thrust fault, on which the October 23 earthquake occurred.

According to the USGS NEIC, “Large, translational fault systems extend across much of central and western Turkey and accommodate the western motion of the Anatolian block as it is being squeezed by the converging Arabian and Eurasian plates.”



Summary tectonic map of eastern Turkey. The large arrows are the approximate directions of motion of Turkey, Arabia, and central Iran relative to Eurasia. NAF=North Anatolian Fault; EAF=East Anatolian Fault; DSF=Dead Sea Fault (*Sandvol et al.*)

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The October 23, 2011 earthquake occurred in a broad region of convergence beyond the eastern extent of Anatolian strike-slip tectonics. The focal mechanism of today's earthquake is consistent with oblique-thrust faulting similar to mapped faults in the region.

In the area of Van, Turkey and further east, tectonics are dominated by the Bitlis Suture Zone (in eastern Turkey) and Zagros fold and thrust belt (toward Iran).

Reverse (or Thrust) Fault

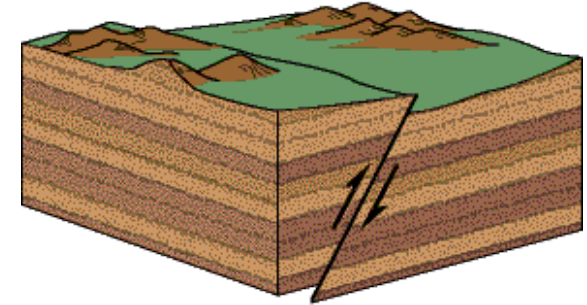
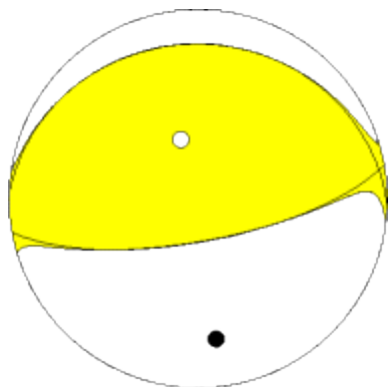
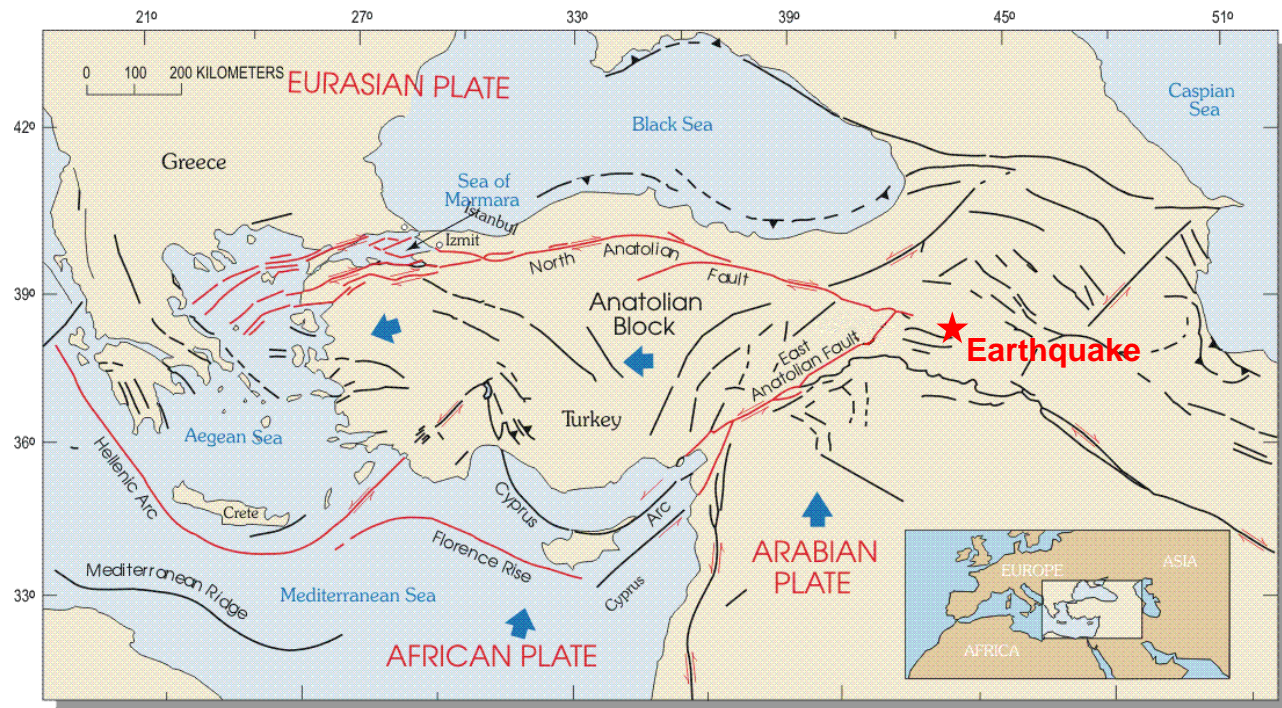


Image courtesy of the US Geological Survey



USGS WPhase Centroid Moment Tensor Solution

Shaded areas show quadrants of the focal sphere in which the P-wave first-motions are away from the source and unshaded areas show quadrants in which the P-wave first-motions are toward the source. The dots represent the axis of maximum compressional strain (in black, called the "pressure [P] axis") and the axis of maximum extensional strain (in white, called the "tension [T] axis") resulting from the earthquake.

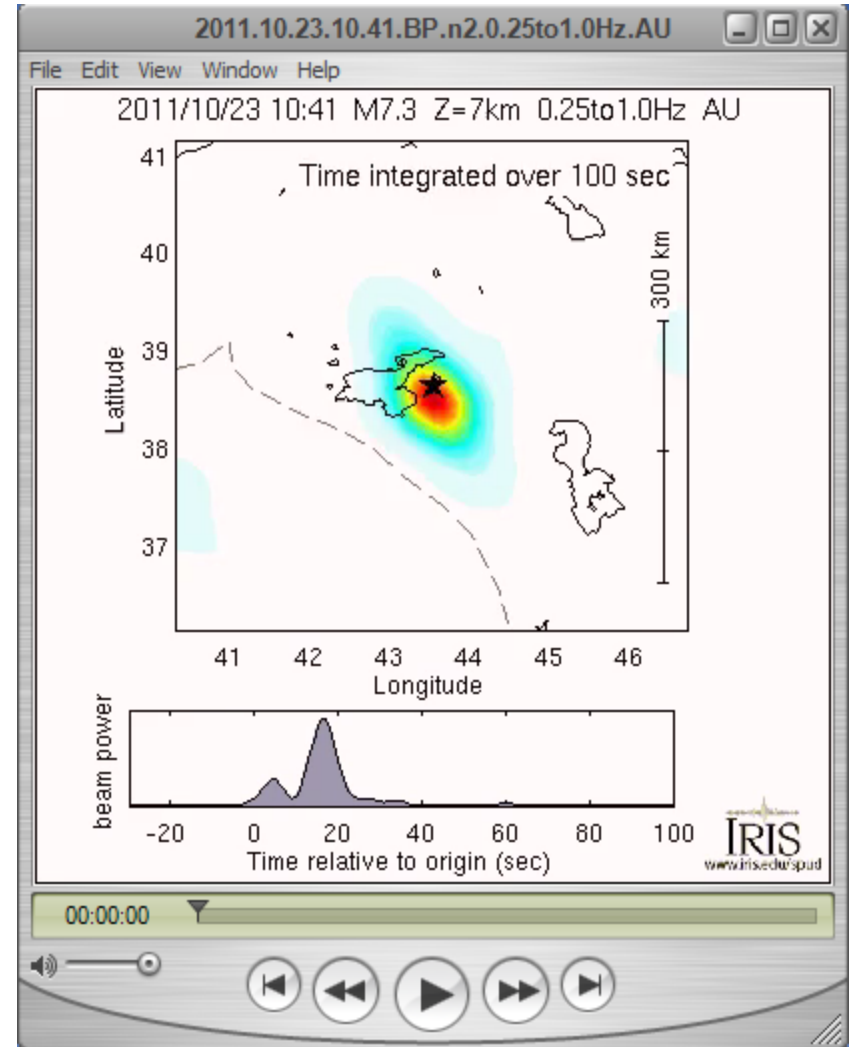
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Back Projections are movies created from an automated data processing sequence that stacks up P wave energy recorded on many seismometers on a flat grid around the source region. This grid is meant to be a fault surface and creates a time and space history of the earthquake.

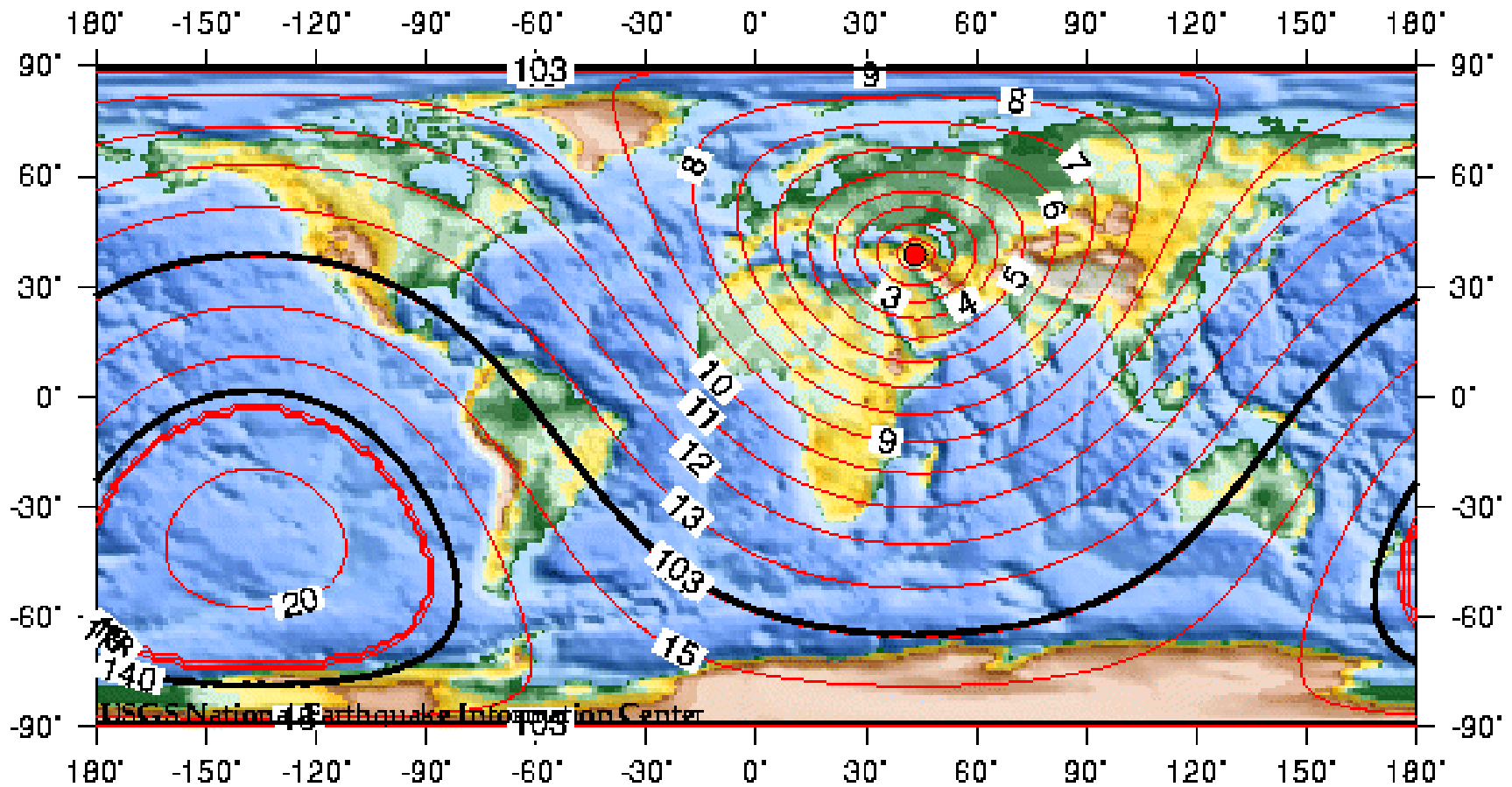
In the animated back projections, warmer colors indicate greater displacement on the fault.

The graph below the map shows the time distribution of rupture during the earthquake.



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The above map shows the predicted (theoretical) travel times, in minutes, of the first compressional (P) wave from the earthquake to points around the globe.

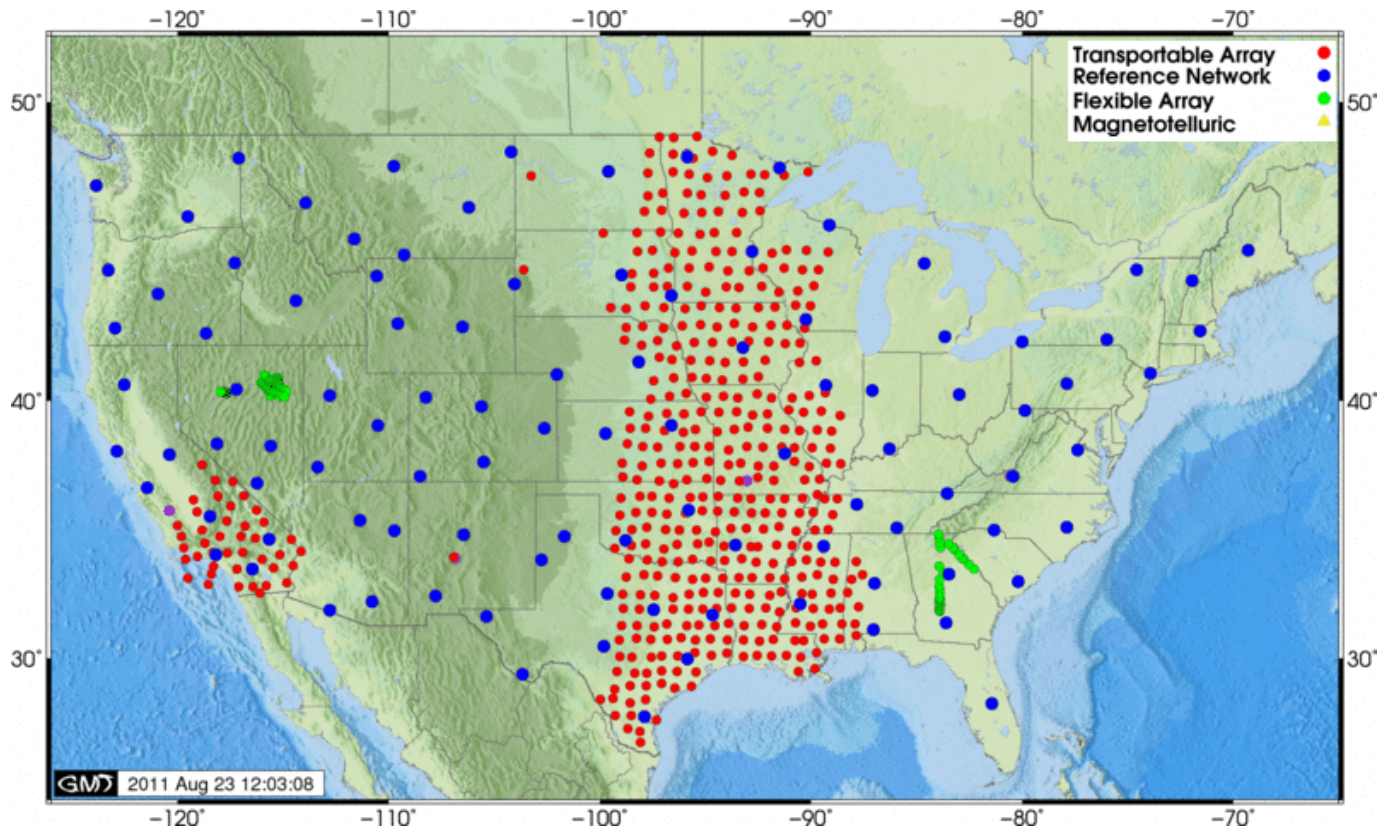
The heavy black lines shown are the approximate distances to the P-wave shadow zone (103 -140 degrees)

USArray: A Continental-Scale Seismic Observatory

USArray is a transportable grid of 400 high-quality broadband seismometers that are moving (every two years) across the United States from west to east.

The grid will move to Alaska after sweeping across the lower 48 states.

Resulting data are used to image the structure of the North American continent and the underlying mantle.



Operating USArray Stations. The 400 active transportable array stations are plotted in red. Permanent stations are plotted in blue.

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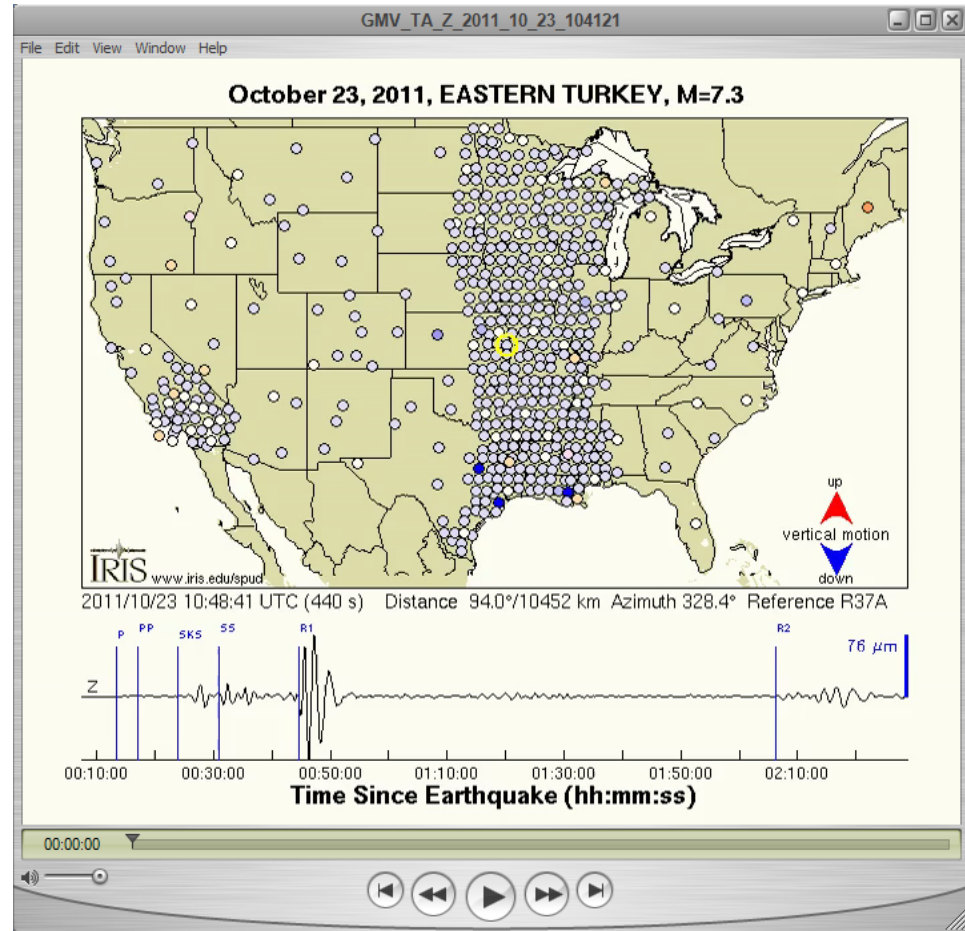
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As earthquake waves travel along the surface of the Earth, they cause the ground to move. With the 400 earthquake recording stations in EarthScope's Transportable Array, the ground motions can be captured and displayed as a movie, using the actual data recorded from the earthquake.

When circles turn red, the station is moving up; when circles turn blue, the station is moving down.

The seismogram along the bottom is from the station at the yellow circle.

As seismic waves sweep across USArray, the relative velocities of the fast P, slower S, and slowest surface waves can be observed.



Quick Time Required


Animation of the generalized paths of seismic waves traveling from Turkey to three stations at varied distances around the globe.

Turkey_M7.3_111023

File Edit View Window Help

Magnitude 7.3 earthquake in East Turkey

October 23, 2011



Van, Turkey

Simplified animation will show generalized wave paths recorded by the 3 seismic stations below at varying distances from the epicenter

- ~57° SFJD Sondre Stromfjord, Greenland
- ~90° L39A Vinton, IA, USA
- ~121° LVC Limon Verde, Chile

IRIS

Animated buildings will merely depict relative motion detected by the seismic station, not actual building motion, which is not felt at these distances from an earthquake.

00:00:00

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