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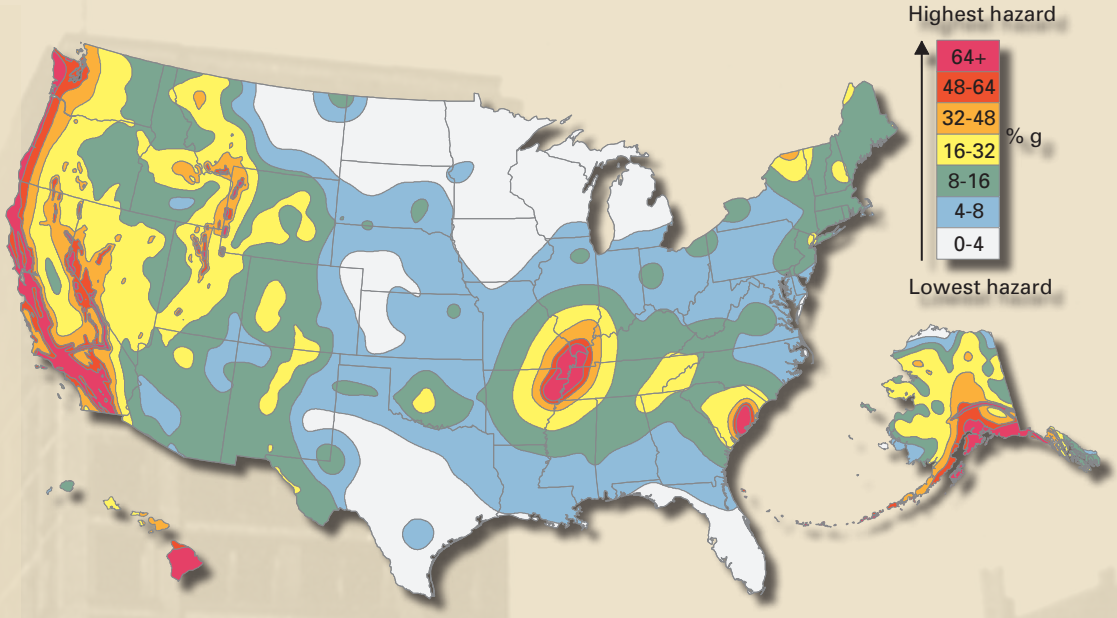
2008 United States National Seismic Hazard Maps

The U.S. Geological Survey's National Seismic Hazard Maps are the basis for seismic design provisions of building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land-use planning. Incorporating these hazard maps into designs of buildings, bridges, highways, and critical infrastructure allows these structures to withstand earthquake shaking without collapse. Properly engineered designs not only save lives, but also reduce disruption to critical activities following a damaging event. By estimating the likely shaking for a given area, the maps also help engineers avoid costs from over-design for unlikely levels of ground motion.



*Colors on this map show the levels of horizontal shaking that have a 2-in-100 chance of being exceeded in a 50-year period. Shaking is expressed as a percentage of **g** (**g** is the acceleration of a falling object due to gravity).*

The Update Process

The U.S. Geological Survey recently updated the National Seismic Hazard Maps by incorporating new seismic, geologic, and geodetic information on earthquake rates and associated ground shaking. These 2008 maps supersede versions released in 1996 and 2002. Updating the maps involved interactions with hundreds of scientists and engineers at regional and topical workshops. USGS also solicited advice from working groups, expert panels, State geological surveys, Federal agencies, and hazard experts from industry and academia. The Pacific Earthquake Engineering Research Center developed new crustal ground-motion models; the Working Group on California Earthquake Probabilities revised the California earthquake rate model; the Western States Seismic Policy Council submitted recommendations for the Intermountain West; and three expert panels were assembled to provide advice on best available science.

Changes to the Maps

The most significant changes to the 2008 maps fall into two categories, as follows:

1. Changes to earthquake source and occurrence rate models:
   - In California, the source model was updated to account for new scientific information on faults. For example, models for the southern San Andreas Fault System were modified to incorporate new geologic data. The source model was also modified to better match the historical rate of magnitude 6.5 to 7 earthquakes.
   - The Cascadia Subduction Zone lying offshore of northern California, Oregon, and Washington was modeled using a distribution of large earthquakes between magnitude 8 and 9. Additional weight was given to the possibility for a catastrophic magnitude 9 earthquake that ruptures, on average, every 500 years from northern California to Washington, compared to a model that allows for smaller ruptures.

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Fact Sheet 2008–3018
April 2008

- The Wasatch fault in Utah was modeled to include the possibility of rupture from magnitude 7.4 earthquakes on the fault.
- Fault steepness estimates were modified based on global observations of normal faults.
- Several new faults were included or revised in the Pacific Northwest, California, and the Intermountain West regions.
- The New Madrid Seismic Zone in the Central U.S. was revised to include updated fault geometry and earthquake information. In addition, the model was adjusted to include the possibility of several large earthquakes taking place within a few years or less, similar to the earthquake sequence of 1811–1812.
- Source models for the region near Charleston, S.C., have been modified to include offshore faults that are thought to be capable of generating earthquakes.
- A broader range of earthquake magnitudes was used for the Central and Eastern U.S.
- Earthquake catalogs and seismicity parameters were updated.

2. Changes to models of ground shaking (that show how ground motion decays with distance from an earthquake's source) for different parts of the U.S., based on new published studies:
   - New ground-motion prediction models developed by the Pacific Earthquake Engineering Research Center were adopted for crustal earthquakes beneath the Western U.S. These new models use shaking records from 173 global shallow crustal earthquakes to better constrain ground motion in western States.
   - Several new and updated ground-shaking models for earthquakes in the Central and Eastern U.S. were implemented in the maps. One of the new ground-shaking models accounts for the possibility that ground motion decays more rapidly from the earthquake source than was previously considered.
   - New ground-motion models were applied for earthquake sources along the Cascadia Subduction Zone.

Significance of Results

The new National Seismic Hazard Maps show, with some exceptions, similar or lower ground motion compared with the 2002 edition. For example, ground motion in the Central and Eastern U.S. has been generally lower by about 10–25 percent due to the modifications of the ground-motion models. Ground motion in the Western U.S. is as much as 30 percent lower for shaking caused by long-period (1-second) seismic waves, which affect taller multistory buildings, and ground motion is similar (within 10–20 percent) for shaking caused by short-period (0.2-second) waves, which affect structures of one or a few stories.

The new 2008 maps represent the best available science as determined by the USGS from an extensive information-gathering and review process. Changes will be made in future versions of the maps as new information on earthquake sources and resulting ground motion is gathered and processed.

San Francisco, Calif., Earthquake, April 18, 1906. Fault trace 2 miles north of the Skinner Ranch at Olema. View is north. 1906. Plate 10, U.S. Geological Survey Folio 193; Plate 3-A, U.S. Geological Survey Bulletin 324. (USGS Photo Library). Photograph by G.K. Gilbert.

For Further Information

To learn more about the National Seismic Hazard Mapping Project, go to URL *http://earthquake.usgs.gov/hazmaps/*; Working Group on California Earthquake Probabilities, go to URL *http://pubs.usgs.gov/of/2007/1437/*
Or you may also contact Mark Petersen: mpetersen@usgs.gov.