PROBABILISTIC EARTHQUAKE ACCELERATION AND VELOCITY MAPS FOR THE UNITED STATES AND PUERTO RICO

By
S. T. Algermissen, D. M. Perkins, P. C. Thenhaus, S. L. Hanson, and B. L. Bender

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The ground-motion maps presented herein are derived from a probabilistic model of the distribution and magnitude of earthquakes in the United States and Puerto Rico. These maps provide a framework for estimating the probability of exceeding various levels of ground-motion parameters, such as horizontal acceleration and velocity, in different areas of the country. The probabilistic approach accounts for the uncertainty in earthquake occurrence and magnitude, thereby offering a more realistic assessment of seismic hazards.

The models used to generate these maps consider the geological and seismic activity within the region, including active faults and historical seismicity. Source zones and their associated seismic activity are identified, and the distribution of earthquakes and their magnitudes are estimated. The probabilistic model then takes into account these factors to calculate the likelihood of exceeding specific ground-motion parameters.

The ground-motion maps are provided for different probability levels, such as the 10 percent probability of being exceeded in 50 years (P10), the 10 percent probability of being exceeded in 50 years (P50), and the 10 percent probability of being exceeded in 50 years (P20). These maps can be used by engineers, architects, and planners in the design and development of structures to withstand seismic forces and to assess the potential for seismic damage.

The maps are based on the following key components:
- Source zones that define seismic activity and the potential for earthquake occurrence.
- Magnitude distributions for historical earthquakes, which provide insights into the frequency and size of past seismic events.
- Ground-motion attenuation relationships that describe how ground-motion parameters change with distance from the source.

The probabilistic models also account for the uncertainty in earthquake parameters, such as magnitude, source depth, and rupture dimensions, to provide a more robust estimation of seismic hazards.

These maps are an important tool for understanding and mitigating the effects of earthquakes on the built environment, helping to ensure the safety and resilience of structures in the face of seismic events.
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-2120
SHEET 2 OF 2


MAP C.—HORIZONTAL ACCELERATION (90 PERCENT PROBABILITY OF NOT BEING EXCEEDED IN 250 YEARS)

EXPLANATION
Contour—Horizontal acceleration expressed as percent of gravity. Some areas show acceleration values without contours. Hachures indicate closed area of lower acceleration. No data available for Hawaii and Puerto Rico.

MAP D.—HORIZONTAL VELOCITY (90 PERCENT PROBABILITY OF NOT BEING EXCEEDED IN 250 YEARS)

EXPLANATION
Contour—Horizontal velocity expressed as centimeters per second. Some areas show velocity values without contours. Hachures indicate closed area of lower velocity. No data available for Hawaii and Puerto Rico.

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