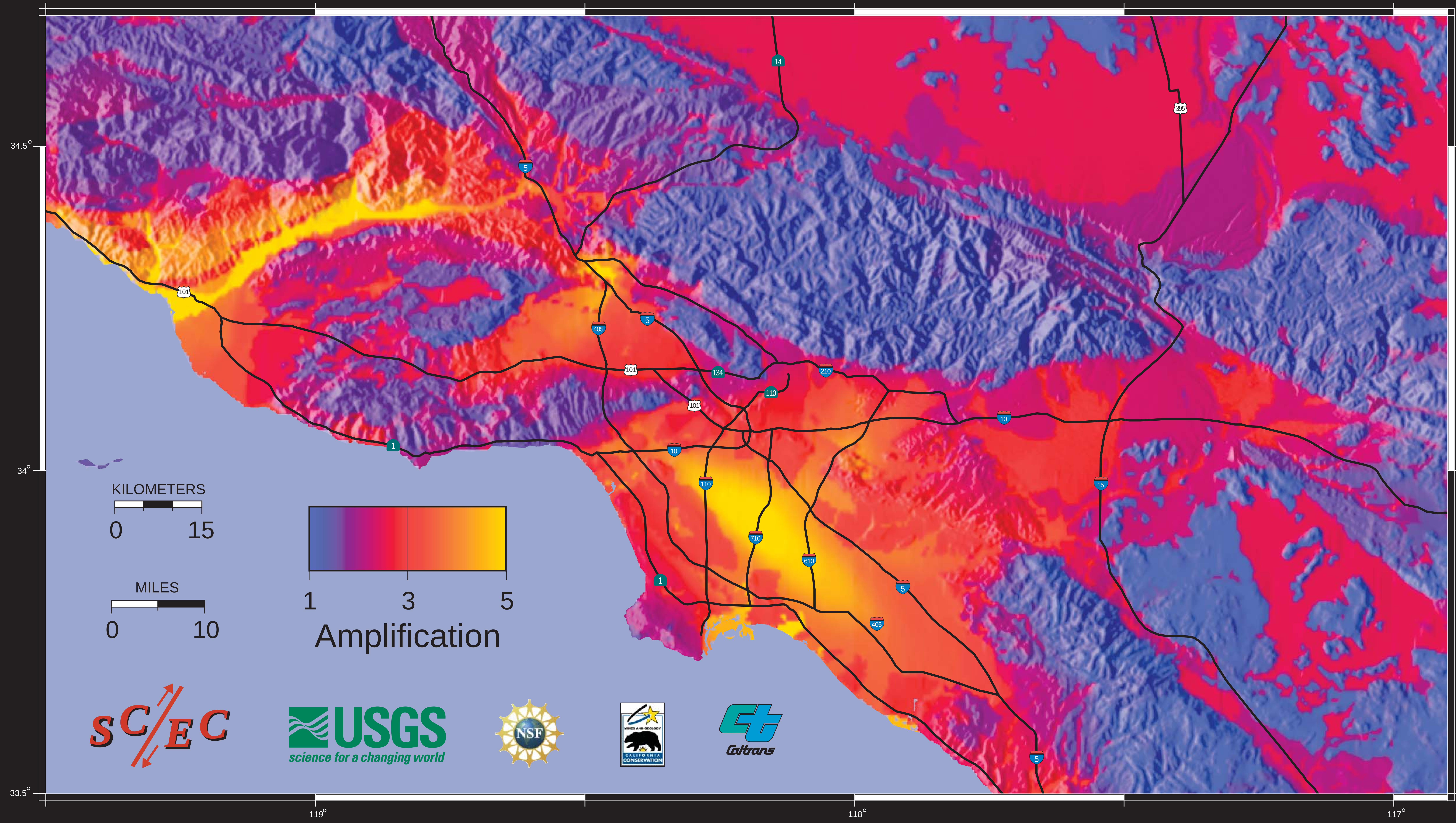

Earthquake Ground-Motion Amplification in Southern California

by
Edward H. Field
2001

Technical Details

This map is based on information in the Southern California Earthquake Center (SCEC) Phase-III Report, a collection of 14 papers published in a special issue of the *Bulletin of the Seismological Society of America* (2000, Volume 90, Number 6B). All of the papers cited below are in this special issue. The amplification is based on the attenuation relationship of Field (2000) for 1.0-second response-spectral acceleration. This relationship characterizes each site with two parameters. The first is the average shear-wave velocity in the upper 30 meters (V_{30}), as given in the map by the California Division of Mines and Geology (Wills and others, 2000). The second is the basin depth (B_depth) as defined by the 2.5 km/sec shear-wave velocity isosurface in the SCEC 3D velocity model for southern California (Magistrale and others, 2000). The degree of amplification is given by:

$$\text{Amplification} = (V_{30}/1000)^{-0.704} \cdot e^{(0.12 * \text{B\_depth})}$$

where V_{30} has units of m/sec and B_depth is positive and in km. Here, B_depth was capped at 6 km for sites where the actual value is greater; this prevents extrapolation beyond the basin depths in data used to constrain the attenuation relationship. Note that of all the ground motion parameters examined by Field (2000), the 1.0-second spectral acceleration shown here exhibited the maximum degree of amplification.

The two most important factors influencing the level of earthquake ground motion at a site are the magnitude and distance of the earthquake. This map shows the influence of a third important factor, the site effect: conditions at a particular location can increase (amplify) or decrease the level of shaking that is otherwise expected for a given magnitude and distance. Site effects at the areas shown in yellow will amplify ground motion by a factor of five, on average, relative to those shown in blue. Combining this information with where and how often earthquakes of various magnitudes are likely to occur should provide improved assessments of seismic hazard.

Caveats

Although this amplification map represents a significant step in our evolving scientific understanding of earthquake phenomena, it is also based on certain assumptions and on data that have inherent uncertainties. Therefore, any use of this map should be made with a clear understanding of these limitations. The map constitutes a working hypothesis that will be tested with additional data in the future. It is possible that future site-amplification maps will look significantly different from this one. Finally, in addition to the average amplification pattern shown here, each individual earthquake will exhibit unique areas of anomalous ground-motion. See Field and others (2000) for further discussion of this and other topics (such as seismic hazard implications). Any use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Acknowledgments

Research that contributed to this poster was conducted by SCEC, the United States Geological Survey (USGS), and the California Division of Mines and Geology (CDMG). Funding was provided by the National Science Foundation, USGS, California Department of Transportation, and CDMG. The image was made using the Generic Mapping Tools (http://www.soest.hawaii.edu/gmt/). This is SCEC Publication Number 584 and USGS Open-File Report 01–164.