Published by Elsevier Science Ltd 1996
Paper No.2011. (quote when citing this article)
Eleventh World Conference on Earthquake Engineering
ISBN: 0 08 042822 3

ADVANCES IN SEISMOLOGY WITH IMPACT ON SEISMIC HAZARD ESTIMATION

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ABSTRACT

Critical elements in the estimation of seismic hazard are the knowledge of: (1) neotectonics of the region, characteristics of the seismic sources, and earthquake statistics over mapped active faults and seismic provinces , (2) propagation of seismic waves and estimation of ground-motion parameters, and (3) evaluation of site effects. Clearly almost all advances in seismology have a direct impact on seismic hazard estimation. Presently seismology and, hence, seismic hazard estimation are in a period of revolution. Recent years have witnessed a substantial improvement in the number and in the quality of seismic instrumentation. There has also been a corresponding advance in the theory and in numerical modeling techniques to interpret the data. Thanks to great improvements in communication, a quasi real-time seismology is now possible: quick estimation of source paramenters of important events is now routine and, in some cases, relevant strong-motion data become available within a short time after the event.

The improved quality of the data permits a more quantitative analysis of seismograms and, thus, more definitive results about source characteristics, tectonics, crustal structure, wave propagation, and attenuation relations. Advances in the theory and availability of broadband recordings of small events allow use of the empirical Green's function technique to simulate the expected ground motions from future large events. Even in regions with few strong-motion recordings, the application of seismic source theories, calibrated with available data, may provide reasonably reliable attenuation relations. The observations that site effects play a crucial role in damage during earthquakes have resulted in vigorous observational and theoretical research on this subject. Much effort is being made to find techniques which may permit quick and reliable estimation of the site effects. Seismologists have begun using microarrays to estimate dynamic deformations of soft sediments and their possible nonlinear behaviour during intense motions.

As historical seismic record is relatively short, in some cases a more reliable estimate of the seismic potential of a fault or a region is being obtained by trenching and field work. Although some have questioned the validity of the seismic gap hypothesis, it still remains useful in the evaluation of seismic hazard and long-term earthquake prediction. Indeed there is an increasing interest in quantifying the seismic potential of gaps by monitoring strains, a task which has been facilitated by the use of GPS receivers.

In this paper we will give some examples of the parallel advances in seismology and seismic hazard estimation. Our examples will mostly be drawn from Mexico.