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# ESTIMATION OF GROUND MOTION AT DEEP-SOIL SITES IN EASTERN NORTH AMERICA

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## Abstract

**The stochastic model used previously to estimate motions at hard-rock sites in eastern North America has been modified to include the effect of deep soils. We simulated motions for a number of distances and magnitudes for a representative soil column and used these motions to derive equations giving ground motion as a simple function of magnitude and distance. These new equations are intended for use in building codes and those engineering applications that do not require detailed site evaluations. The ground motions for which we derived equations include 5%-damped response spectra at 13 periods ranging from 0.05 to 4 sec, peak acceleration and the maximum pseudovelocity and maximum pseudoacceleration responses. The latter two quantities are introduced here for the first time. They represent the maxima over the period range 0.1 to 4 sec for a given magnitude and distance, and they may be useful as a basis for determining the seismic coefficient in building codes.**

## Introduction

Equations giving ground motion as a function of magnitude and distance were published by Boore and Atkinson (1987) for hard-rock sites in eastern North America. These equations were obtained by fitting a parametric model to synthetic ground motions computed from the stochastic model introduced by Hanks and McGuire (1981; see Joyner and Boore, 1988, for a recent summary of the method). The equations are for distances less than 100 km and are relatively complex. Recognizing the need for estimation of motions at greater distances and the desirability of a simpler functional form, particularly in probabilistic hazard analyses, Atkinson and Boore (1990) published new equations valid for distances up to 400 km. With a minor exception (resulting from different choices of the geometrical spreading and $Q$ functions for distances beyond about 100 km), the synthetic data to which the new equations were fit were the same as those used in Boore and Atkinson (1987). In this paper, we continue the evolutionary sequence by presenting equations for ground motions on generic deep-soil sites ("S2" soil conditions in the terminology of recent editions of the Uniform Building Code or the Building Seismic Safety Council Provisions). The equations give peak acceleration, response spectral values, and two newly defined quantities proposed as an alternative basis for building codes. These new equations are intended for use in building codes and those engineering applications that do not require detailed site evaluations. They are applicable over broad areas and are not intended for site-specific evaluations of ground motion.