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ESTIMATION OF SOURCE PARAMETERS FROM STRONG MOTION DATA RECORDED IN ICELAND

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The main objective of work reported here is to obtain the source parameters from the most important strong motion data recorded in Iceland. The source parameters are then used for simulating accelerograms using the stochastic method. The strong motion data are obtained in a network of accelerographs, commonly called the Icelandic Strong Motion Network, and has been operated by the Earthquake Engineering Research Centre of the University of Iceland since 1986. The largest events recorded by the network are two earthquakes on June 17th and June 21st in the year 2000 with magnitudes M_w6.6 and M_w6.5. Then an earthquake with magnitude M_w6.3 occured on May 28th 2008. The acceleration records from the ground response part of the strong motion network are downloadable from the Internet Site for European Strong Motion Data (ISESD) database (http://www.isesd.hi.is). See Ambraseys et al. 2004 for a description of the database. The data used in this study are mostly recorded in shallow strike-slip earthquakes and are recorded within 100 km from the earthquake source.

The source parameters have bee estimated using Brune's point source model and follow a method similar to prior studies done with Icelandic strong motion data and were presented in Ólafsson et al. 1998 and Ólafsson 1999. The Brune model is extended with a term that accounts for spectral decay where the seismic Q is assumed to be frequency independent. A generalized inversion method where the parameters are estimated using joint optimization is also applied (see for example Hartzell and Heaton 1983 and Bootwright et al. 1991). The estimated parameters are the following: seismic moment M_0, stress drop σ, displacement u and a spectral decay parameter κ. Duration is also estimated here that is both strong motion duration and S-wave duration. The S-wave velocity v_s used were based on seismic refraction measurements mapping the crustal structure in Iceland.

A theoretical ground motion model based on seismic source models has been developed for Iceland (Ólafsson and Sigbjörnsson, 1999). This model is a GMPE (ground motion prediction equation) based on Brune's extended source model similar to the stochastic models described by Boore (2003). The estimated source parameters are applied to this theoretical model for simulation of ground motion records using the stochastic method (Boore, 2003). In addition to simulation of ground motion the theoretical GMPE gives us the attenuation curves. An advantage of the modelling approach used in this study is that the model parameters have direct physical meaning. This is however not the case for regression coefficients of empirical attenuation relations. An evalution of the quality of the model is done by comparing simulated ground motion with measured records. Furthermore an estimation of source parameters from simulated records gives us a check on the estimation and modelling approach.

Most of the measurements sites in the strong motion network (ISMN) are on stiff ground or rock. Recent measurments of H/V ratio are used to improve the estimation process and reduce the residual error. The source parameters estimated in this study are used as a basis for a tentative GMPE for Icelandic earthquakes in the magnitude range $M4 - M6.6$.

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