



New Fennoscandian shield empirical ground motion characterization models

Tommi Vuorinen (1), Timo Tiira (1), and Björn Lund (2)

(1) Institute of Seismology, University of Helsinki, Helsinki, Finland (tommi.at.vuorinen@helsinki.fi), (2) Department of Earth Sciences, Uppsala University, Uppsala, Sweden

The Fennoscandian shield is a seismically quiet area with a scarcity of strong earthquakes and, consequently, an area lacking strong motion data. This lack of empirical strong motion data and the subsequent lack of advanced stochastic and theoretical models of seismic response limit the ground motion prediction equation (GMPE) development for the region. In order to create GMPEs targeted for the Fennoscandian shield, we take advantage of the comparatively large ground motion database and use a more direct empirical approach which does not rely on pre-existing models and simulations of the Fennoscandian seismicity.

We present here the resulting two GMPEs, which were created by applying the empirical ground motion data derived from 2239 earthquakes observed at 88 recording stations to an existing attenuation relationship. The first model developed is an empirical model which relies on an existing predetermined GMPE with the constant coefficients of the model fitted to our regional dataset by using a simple unweighted non-linear least-squares regression. The second model is a so-called referenced empirical model which relies on modifying the ground motion prediction produced by an existing GMPE by multiplying it with a function of certain seismological parameters. Within the magnitude-distance range of the dataset, the resulting equations model the peak ground accelerations (PGA) and spectral accelerations (SA) reasonably well. Residuals of the ground-motion prediction display no clear trend with regards to either magnitude or distance.

We further assess the limits of usability of the GMPEs by applying them to an independent regional earthquake and to various external events that have occurred in a similar stable continental area. We also discuss the limitations of the empirical methods used in creating the models and the constraints imposed by the available source data.