A GROUND MOTION PREDICTION EQUATION FOR CAV IN ZAGROS

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ABSTRACT

A study on estimation of a ground motion prediction equation for three versions of Cumulative Absolute Velocity (CAV) is conducted using 320 three-component strong motion records from 49 earthquakes with moment magnitude between 5.0 and 6.1. Earthquakes are occurred in Zagros and hypocentral distance ranges from 10 to 193 km. Three well-known definitions of CAV are calculated for each record. The versions of CAV are: 1- CAV obtained by integration of absolute acceleration over whole duration (CAV_{Total}), 2- CAV determined from sum of integrations of absolute acceleration over one second intervals with PGA greater than 0.025g (CAV_{STD}), and 3- CAV calculated by integration of absolute acceleration over portions with PGA greater than 0.005 (CAV_5). Calculation of CAV_{Total} and CAV_5 from all of records passing a primarily quality control leads to nonzero values. However, nonzero CAV_{STD} values are obtained from only 156 records with maximum hypocentral distance of 119 km. For the regression analysis we used two models; one a simple model with only magnitude and geometrical spreading terms, and in the other model we added the magnitude second power term and a term related to anelastic attenuation. The results show that the CAV_{Total} regression by the simplest model is the best model fit. Standard deviations of the attenuation coefficients as well as analysis of residuals demonstrate that CAV_{Total} is the most predictable version of CAV. On the other hand predictability of CAV_5 is less than others.

INTRODUCTION

PGA, PGV and response spectral ordinates are well-known ground motion parameters which are widely used for earthquake attenuation and seismic hazard studies. These parameters only describe the amplitude of ground shaking caused by an earthquake. Apart from amplitude, duration is also important for distinguishing between destructive and non-destructive impact of an earthquake. Cumulative Absolute Velocity (CAV), as a ground motion parameter, contains both of duration and amplitude effects of a strong motion record.

As well as the role of CAV in elimination of non-damaging earthquakes from results of probabilistic seismic hazard analysis (Klugel 2009), it is also able to predict the intensity of an earthquake and has been shown to have a significant correlation with damage to structures. Fahjan et al., (2011) discussed applications of CAV to urban early warning systems and Sadeghi-Bagherabadi et al., (2013) utilized attenuation relation of a special version of CAV in earthquake rapid magnitude determination for rapid