

# A STUDY ON HIGH FREQUENCY DECAY PARAMETER (KAPPA) FROM VARZAGHAN-AHAR DOUBLE EARTHQUAKES, NORTHWESTERN IRAN ( $M_W$ 6.5 & 6.3)

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**Keywords:** Varzaghan-Ahar Earthquakes, High Frequency, Kappa, Fourier Spectra

## ABSTRACT

The high frequency decay parameter, kappa and its variations in distance is evaluated using 114 three-component strong motion records from two moderate events in NW Iran. We show that in classical method of estimating kappa, the results are very sensitive to the choices of  $f_E$  and  $f_X$  and automated procedures for estimating kappa are likely to lead to a biased estimation. For the present database, we found an obvious concavity in dependency of kappa with distance. The kappa values in distance were regressed to a piecewise bilinear shape. Based on this piecewise bilinear shape the zero distance kappa are 0.044 and 0.023 for horizontal and vertical components respectively.

## INTRODUCTION

In stochastic ground motion simulations, one of the most important issues is knowledge about the shape of Fourier acceleration spectra. Fourier acceleration spectra decay rapidly at high frequencies. In strong ground motion generation computer programs like SMSIM (Boore, 2005) or ESXIM (Motazedian and Atkinson, 2005), this high frequency decay is incorporated into the program based on two models: first, the parameter  $f_{max}$  presented by Hanks (1982) and second, kappa developed by Anderson and Hough (1984). This study addresses the issues about the second model using a database of two recent moderate earthquakes in Iran.

On 2012 August 11th two destructive earthquakes occurred 11 minutes apart near two towns of Varzaghan and Ahar in Northwestern Iran; the first with moment magnitude of 6.5 at 12:23 UTC and the second with moment magnitude of 6.3 at 12:34 UTC (Iranian Seismological Center (IRSC) homepage), resulting in over 300 deaths and 3000 injuries. These earthquakes have two important aspects: first, they are the biggest events recorded in Northwestern Iran and second, they are very well recorded events, being recorded on more than 60 strong motion stations on Iran Strong Motion Network (ISMN) out to hypocentral distances of more than 200 km (Iran Strong Motion Network (ISMN) homepage)(Table 1 and Figure 1). These strong motion accelerograms have provided us with excellent database to study the earthquake parameters in the region.

Our goal in this paper is to estimate the values of kappa for observed strong ground motions and their behavior in distance. We also evaluate issues in extrapolating the estimated kappa values to zero distance.