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EVALUATION OF SOURCE, PATH AND SITE EFFECTS IN STOCHASTIC METHOD OF SIMULATING STRONG GROUND MOTION FOR SARPOL-E ZAHAB, IRAN EARTHQUAKE OF 2017

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In this study, simple and powerful method for simulating ground motions that often goes by the name ‘‘stochastic method’’ has been used for generating the strong ground motions. The stochastic method is useful for simulating the higher-frequency ground motions of most interest to engineers (generally, $f > 0.1$ Hz), and widely used in two ways: 1) point-source and 2) finite-source. Here point-source method has been used for predicting ground motions for some stations of strong ground motion Sarpol-e Zahab, Iran earthquake of 2017. Sarpol-e Zahab is a region of the world in which recordings of motion from potentially damaging earthquakes are not available, so stochastic method is useful for simulating strong ground motions of this region. For stochastic simulation, theoretically Fourier acceleration spectrum is into simple functional form and made of three following effects: 1) source-effect, 2) path-effect and 3) site-effect. Until now seismologists and earthquake engineers have developed numerous equations for these three effects. In this study, we have examined many equations to find out best Fourier acceleration spectra as frequency-domain results and subsequently acceleration, velocity and displacement response spectra as time-domain results, for some stations of Sarpol-e Zahab earthquake. From structural engineering point of view, the seismic influence of earthquake on structural and geotechnical damage is shown with acceleration, velocity and displacement seismic response spectra. Therefore, finally to compare between stochastic simulation results, NGA-West2 as GMPEs results and spectra from recorded acceleration as real results, we have used acceleration, velocity and displacement response spectra. For summarizing, see Boore (2003) for definitions of all the parameters used in Equation 3.

Figure 1 illustrates response spectrum of acceleration (S_a) for Javanrood station of Sarpol-e Zahab, NGA-west2 Spectra, Stochastic simulation by all model of source spectrum.

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Table 1. Summary of various models for shape source spectrum ($S(M_0,f)$).

Reference	Type of Model	Equation of Modulating
Atkinson and Boore (1995)	Double Corner Frequency-(DCF)	$S(M_0,f)=\frac{1-\varepsilon}{1+\left({f}/{f_a}\right)^2}\times\frac{\varepsilon}{1+\left({f}/{f_b}\right)^2}$ $log f_a=2.41-0.533M_w$ $log f_b=1.43-0.188M_w$ $log\varepsilon=2.52-0.637M_w$
Frankel et al. (1996)	Single Corner Frequency-(SCF)	$S(M_0,f)=\frac{1}{1+\left({f}/{f_c}\right)^2}$ $\xi=4.906\times10^6\beta_S, \qquad f_c=\xi\left(\frac{\Delta\sigma^*}{M_0}\right)^{1/3}$
Atkinson & Silva (2000)	Double Corner Frequency-(DCF)	$S(M_0,f)=\frac{1-\varepsilon}{1+\left({f}/{f_a}\right)^2}\times\frac{\varepsilon}{1+\left({f}/{f_b}\right)^2}$ $log f_a=2.181-0.496M_w$ $log f_b=2.41-0.408M_w$
		$log\varepsilon=0.605-0.255M_w$
Boore et al. (2014)	Additive Double Corner Frequency-(ADCF)	$S(M_0,f)=\frac{1-\varepsilon}{\left(1+\left({f}/{f_a}\right)^{pf_a}\right)^{pd_a}}\times\frac{\varepsilon}{\left(1+\left({f}/{f_b}\right)^{pf_b}\right)^{pd_b}}$ $log\varepsilon=1.04-0.33M_w$ $f_a=\min(10^{2.181-0.496M_w},f_c)$ $\Delta\sigma_{min}=M_0\left(\frac{\sqrt{1-\varepsilon}f_a}{\xi}\right)^3, \qquad pf_a\times pd_a=pf_b\times pd_b=2$

$*$ Stress parameter

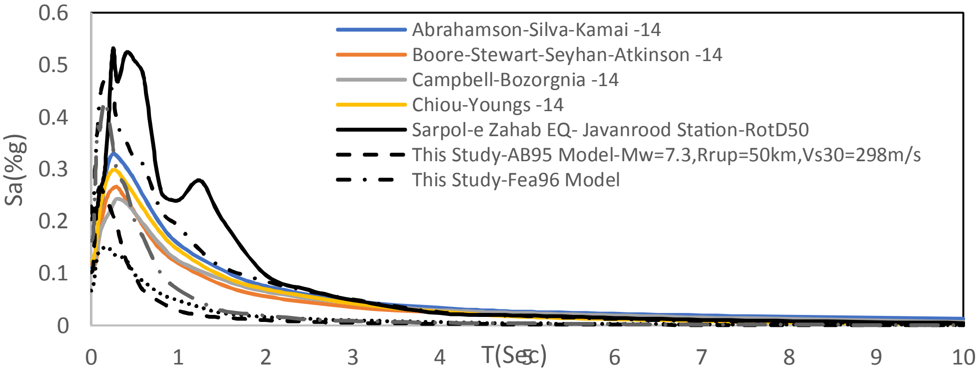

Figure 1. Comparison of response spectrum of acceleration (S_a) for Javanrood station of Sarpol-e Zahab, NGA-west2 Spectra, Stochastic simulation by all model of source spectrum.