STRONG GROUND MOTION PARAMETERS OF FEBRUARY 22, 2005 DAHUIYEH (ZARAND) EARTHQUAKE IN CENTRAL IRAN

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ABSTRACT *We computed the Strong Ground motion parameters of Dahuiyeh earthquake of February 22, 2005 in Kerman province, Central Iran. These parameters include Peak Ground Acceleration (P.G.A), Duration, and Spectral Ordinates and so on. Firstly, accelerograms obtained by this earthquake were baseline corrected and filtered in order to eliminate undesired noisy signals both at low and high frequencies. Secondly the parameters were computed using Seismosignal software. Finally, to better understanding the behavior of rupture propagation we computed strike-normal and strike-parallel components of two stations located on either ends of the causative rupture. This study led to this conclusion that the rupture propagated from west to east. Although the mechanism of this event was determined as a thrust fault but the results of this study suggest a strike-slip component along the rupture.*

INTRODUCTION

On February 22, 2005 at 02:25:26 (GMT) a strong earthquake with estimated magnitude Mw 6.5 occurred east of Zarand city in Kerman province, Central Iran. The epicenter and the damaged area of Zarand earthquake are located at 30.76 N, 56.81 E in the Kuhbanan Fault zone. The earthquake ruptured an intramountain reverse fault, striking E-W and dipping north at ~60 to a depth of about 10 km (Talebian et al, 2006).

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27 set of SSA-2 digital accelerographs, provided by Building and Housing Research Center (BHRC), were triggered by the shock of this event. After processing and filtering the accelerograms in order to eliminate the effect of noise in our data, we computed the parameters of strong ground motion such as P.G.A., Duration, Spectral ordinates and Arias Intensity. In this study we used Seismosignal, Microsoft Excel and Matlab softwares for computing the parameters and plotting some of the figures. Duration for each component of the stations was measured as the time between 5-95 percent of the Arias Intensity and then the mean of duration in each station was computed. The results have been shown in Table 1. The table shows that the maximum P.G.A was occurred in Shirinrood Dam and Zarand stations where located on either sides of rupture. Other stations had lower values of P.G.A due to their distances or high attenuation in the region. The attenuation of the observed P.G.A for vertical (P.V.A) and mean of horizontal (P.H.A) components have been illustrated in Fig.1. For a better view we used logarithmic scales for axes. A line was fitted to each data series for P.H.A and P.V.A. As we can see in the figure the equations of the fitted line are power equations but due to logarithmic scale they are seen as a linear fit.

Table-1. Strong ground motion parameters of zarand eq

Station	duration (sec)	P.G.A (g)			Max. Acc. Response (g)			Arias Intensity (m/s)		
		L	V	T	L	V	T	L	V	T
Shirinrood Dam	8.83	0.51	0.24	0.22	0.994	0.942	0.741	0.5490	0.3664	0.2341
Zarand	18.4	0.31	0.31	0.25	1.025	0.870	0.728	1.0923	0.8477	0.9273
Ravar	21	0.11	0.04	0.06	0.453	0.112	0.221	0.2037	0.0399	0.0973
Chatrood	13.8	0.06	0.06	0.09	0.189	0.151	0.275	0.0433	0.0355	0.0873
DashteKhak	15.5	0.05	0.04	0.07	0.169	0.133	0.255	0.0503	0.0330	0.0614
Davaran	21.7	0.06	0.04	0.04	0.226	0.130	0.140	0.0471	0.0174	0.0275
Deh-Loulou	21.6	0.05	0.02	0.03	0.164	0.073	0.109	0.0254	0.0094	0.0182
Tarz	20.4	0.02	0.01	0.04	0.108	0.060	0.131	0.0184	0.0075	0.0309
Kerman 1	33.9	0.03	0.01	0.03	0.099	0.056	0.117	0.0493	0.0098	0.0408
Baghin	35	0.02	0.02	0.02	0.072	0.045	0.064	0.0141	0.0094	0.0132
Kerman 2	29.4	0.02	0.02	0.03	0.096	0.083	0.103	0.0336	0.0104	0.0205
Rafsanjan	49.9	0.02	0.01	0.02	0.106	0.039	0.087	0.0175	0.0042	0.0161
Mola Esmaeel	46.5	0.01	0.005	0.02	0.057	0.022	0.065	0.0867	0.0020	0.0129
Shahre Babak	19.1	0.01	0.01	0.02	0.065	0.063	0.087	0.0041	0.0017	0.0052
Anar	25.9	0.02	0.009	0.01	0.073	0.043	0.063	0.0052	0.0023	0.0045
Bahadoran	25	0.01	0.008	0.01	0.037	0.024	0.043	0.0019	0.0010	0.0026
Bahabad	38.1	0.01	0.007	0.01	0.048	0.025	0.044	0.0066	0.0022	0.0062
Bafgh	28.1	0.01	0.005	0.01	0.050	0.026	0.058	0.0055	0.0009	0.0060
Sirch	26.3	0.01	0.006	0.01	0.053	0.015	0.037	0.0032	0.0008	0.0023
Cheshmeh Sabz	22.4	0.01	0.004	0.01	0.038	0.019	0.048	0.0023	0.0006	0.0031
Bardsir	35.2	0.01	0.01	0.01	0.046	0.052	0.043	0.0048	0.0030	0.0044
Pariz	27.5	0.01	0.006	0.01	0.048	0.027	0.046	0.0025	0.0010	0.0023
Koohbanan	30.9	0.01	0.009	0.01	0.046	0.024	0.036	0.0060	0.0023	0.0041
Mehriz	24.3	0.01	0.004	0.01	0.038	0.016	0.055	0.0017	0.0003	0.0022
Bayaz	30.6	0.01	0.01	0.01	0.032	0.030	0.038	0.0021	0.0017	0.0026
Horjand	16.3	0.06	0.05	0.05	0.182	0.131	0.169	0.0350	0.0340	0.0408
Qadrooni Dam	14	0.21	0.1	0.14	0.753	0.349	0.538	0.7438	0.2635	0.4080

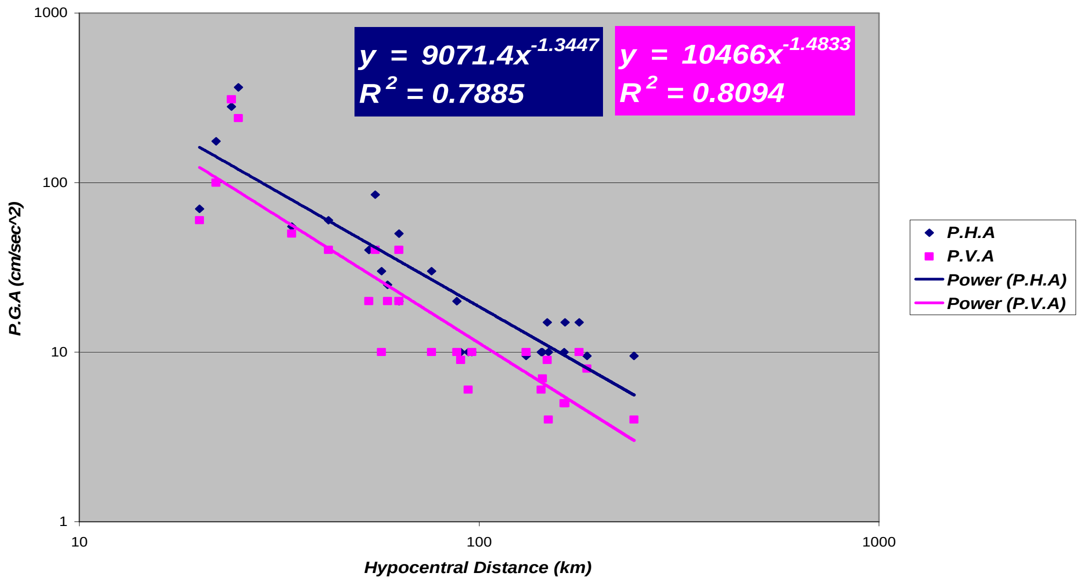

Fig-1. The attenuation of observed P.G.A versus Hypocentral Distance

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A near-fault study has been done in order to examine the presence of rupture directivity pulse in stations that are close to the rupture. We rotated the horizontal components, with having the azimuth of the components and the strike of the causative rupture, to obtain the strike-normal and strike-parallel components. According to Somerville et al. 1997, the directivity pulse can be seen in periods more than 0.6 seconds on the strike-normal component for a site which is aligned with the slip on the fault and experience the forward rupture propagation. This situation can be seen in Shirinrood dam station. The duration of the motion in this station is ~9 seconds and there is a peak in the period ~3.5 second on the displacement response spectra of the strike-normal component. On the contrary, in Zarand station, far a way from the other end of the rupture, the duration is ~17 second and there is no peak on the strike-normal component in long periods in comparison with Shirinrood Dam station. This shows that the rupture propagated from west to east. The next figures show the strike-normal components of displacement response spectra for Shirinrood Dam and Zarand stations and also the displacement time history of the strike-normal components of these stations.

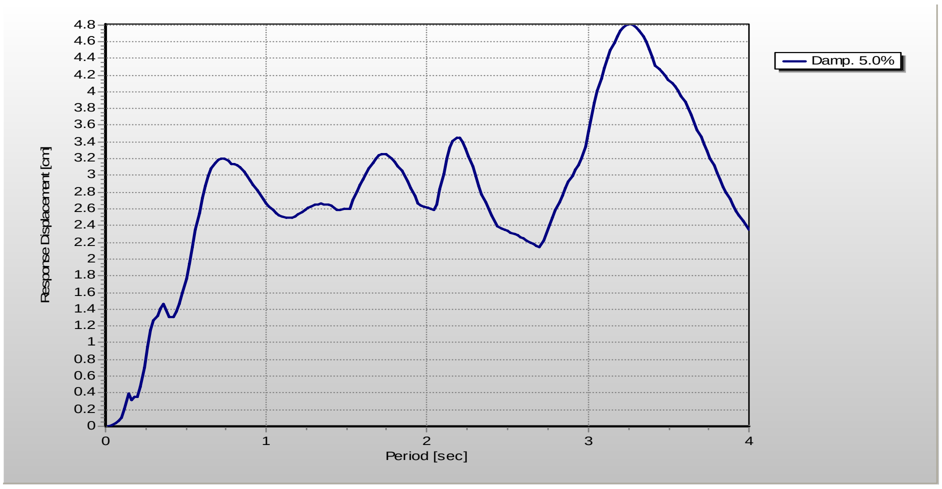

Fig-2. Displacement response spectra of strike-normal component of Shirinrood Dam station

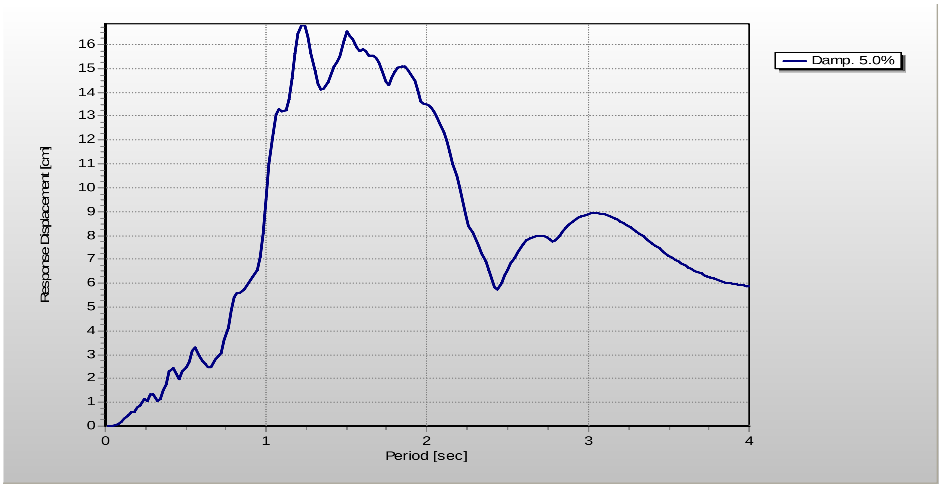

Fig-3. Displacement response spectra of strike-normal component of Zarand station

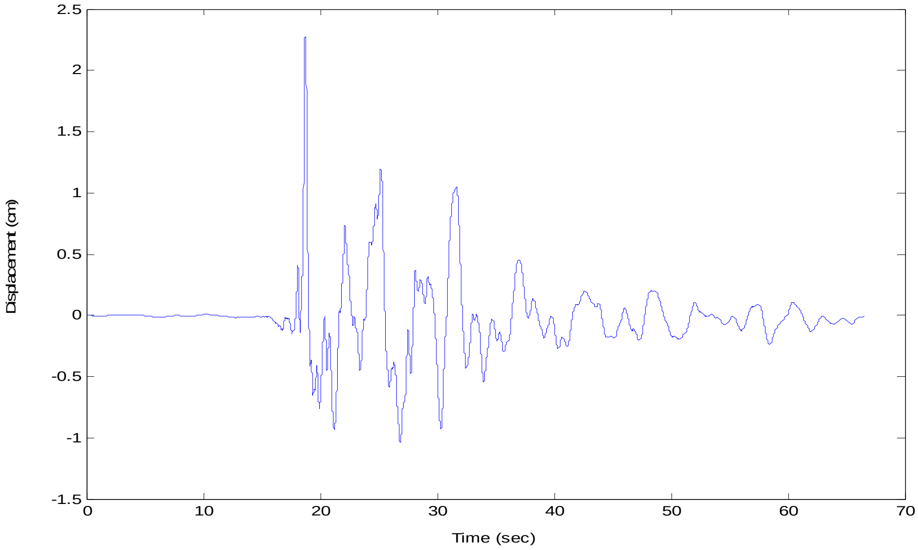

Fig-4. Displacement time history of strike-normal component of Shirinrood Dam station

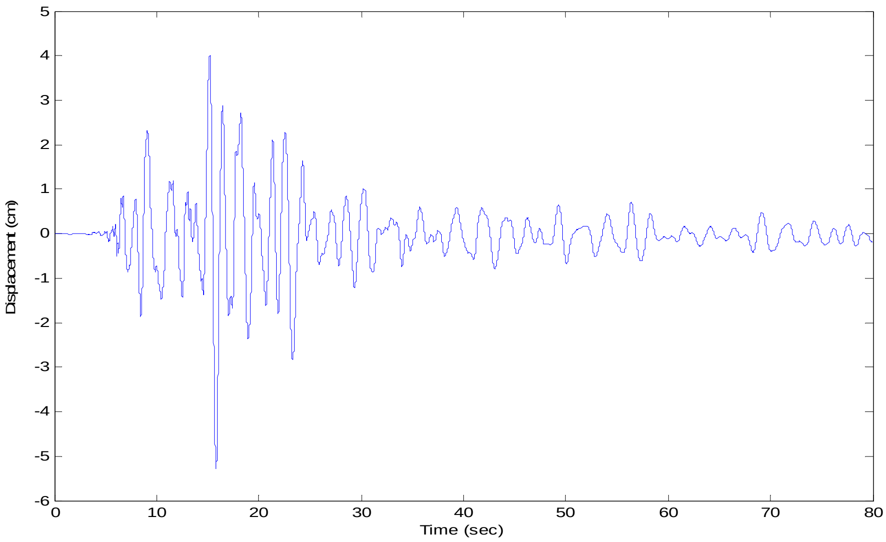

Fig-. Displacement time history of strike-normal component of Zarand station

CONCLUSIONS

The February 22, 2005 Dahuiyeh earthquake occurred on an east-west rupture with the dip of ~60 to the north. The mechanism of the event shows a reverse faulting with a minor right-lateral strike slip motion. The propagation of the rupture in the strike slip sense is west to east, according to the duration and the strike-normal component of Shirinrood Dam station.

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