CODA WAVES APPLICATION IN OBTAINING THE PATH AND SOURCE EFFECTS

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The source-receiver distance and the local geology conditions also affect coda duration. We performed a multiple regression analysis to get new duration magnitude relationships. The new magnitudes are calibrated with a local magnitude scale previously defined for the region. This scale would permit the use of clipped seismograms produced by large earthquakes occurring near the stations.

The data was used in the first part of study retrieved from short periods of vertical component Seismic Local Networks of the Iranian Seismological Center. In this part of the study earthquakes occurred in the longitude range of 50 to 54 degrees east and 34 to 37 degrees north latitude have been considerd. After removing poor quality data, 4122 seismographs of the magnitude range between $M_n = 2.9$ to $M_n = 5.5$ have been remained for final analysis from 401 events (Figure 1).

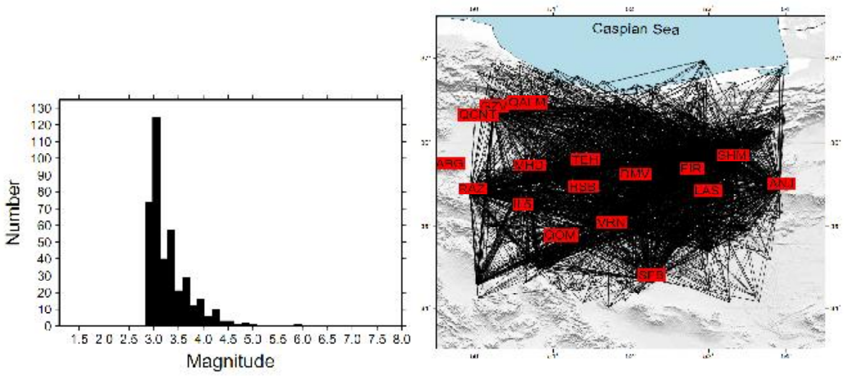

Figure 1. Location of the seismic stations used and seismic coverage ray path from the source to the receiver (right), magnitude distribution of the events (left)

Locations of earthquakes that were used in this study shown in the Figure 1. As seen, the epicenter coverage is ideal. The signal duration definition used in previous UUSS Mc calculations was the time from the P-wave onset to when the signal drops below the pre-event noise level. This definition, coupled with changes in noise levels and instrument gains, was largely responsible for the time dependence of the Mc -ML differences in the old catalogs. The seismic signal durations used to calculate the Mc are measured on records from short-period, vertical-component, and velocity sensors. Mc determinations from several stations are usually averaged to obtain the MC value for an earthquake that is calculated according to an empirical equation (Lee et al, 1972; Lahr et al., 1975; Bakun and Lindh, 1977) which can be adjusted to agree with the local magnitude scale. The Mc equation can be calibrated by solving the following system of equations for the constants a, b, and d: $M_{ni} = M_{Cij} \equiv a + b \log \tau_{ij} + d\Delta_{ij}$, where M_{ni} is the mean ML for earthquake i, M_{Cij} is the Mc for earthquake i from station j, τ_{ij} is the signal duration for earthquake i measured at station j, and Δ ij is the epicentral distance of station j from earthquake i. The Mc equation is a set of $\sum_{i=1}^{N} N_i$ linear equations, where is the number of earthquakes and N_i is the number of τ_{ij} measurements for earthquake i. We initially tried solving this system of equations using multiple linear regression.

To examine the influence of the recording distance and the signal duration, we prepared plots of these parameters at intervals of 0.5 units of magnitude. Finally, we get the following equation:

$$M_c = 2.341\log_{10}{}^{\tau} + 0.00208\Delta - 2.27$$

It was comparable to the local magnitude which will be explained in detail in the paper. In the second part , coda normalization (Aki, 1980) are used for determination of Qs. The quality factors of shear waves have been estimated from direct S-waves and coda waves from accelerograms recorded on the three-component strong motion array maintained by the Building and Housing Research Center (BHRC) that activated with Kojor earthquake. We select data from appropriate station converge around Tehran province with signal to noise ratio greater than 3, with epicentral distances less than 150 km. The coda normalization method introduced by Aki (1980) enables us to measure Qs^{-1} from a data set obtained at a single station. This method uses the normalization of direct S-wave spectral amplitude by the coda spectral amplitude measured at a fixed time t_c to eliminate the source spectral power, site effect, and instrument response from the observed spectral amplitude of the direct S waves. This equation enables us to estimate $Q_s^{-1}(f)$ from a linear regression of $Ln\{\frac{R_{\theta\varphi}^{-1} A_s(f,r) r^{\nu}}{A_c(f,t_c)}\}$ against hypocentral distance r by means of the least-squares method. The coda-normalized amplitude of S -waves has been plotted versus hypocentral distance to estimate Qs for central frequencies of 1.5, 3, 5, 7,10,13,15 and 17 Hz .We can the calculated values for the quality factor at different frequencies and then use the relationship of $Q = Q_0 f^{\alpha}$ to calculate the value of Q_0 and α. Finally we will achieved to the following equation for Q factor: $Q_s = 66(\pm 4) f^{1\pm(0.1)}$

In Figure 2, we compared estimated mean value of Q in this study and other studies for this region and other regions of the world.

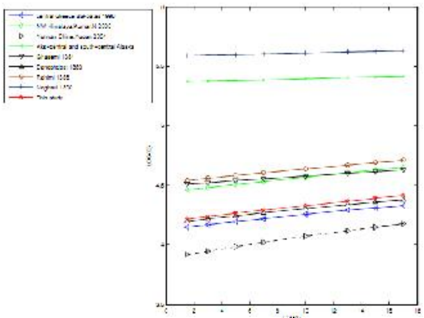

Figure 2. A comparison of coda Q with other studies for this region and other regions of the world.

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