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A Comparison of ML/MW Relationship for Natural Earthquakes and Mining Explosions in Tehran Region

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Mining explosions cause several small earthquakes in mining areas around the world. In some cases there are small or large scale faults nearby these mining areas which can be a source of natural earthquakes potentially. Therefore, in the case of small earthquakes (predominantly with the magnitude of ML<3.0), there will be seismic records contain both events with natural and unnatural sources. Since existence of explosions records in a seismic data bank causes inaccuracy in seismicity studies, discrimination between seismic records of natural earthquakes and explosions is an important field of seismology. One of methods which can lead us to approach a reliable way to discriminate between these two kinds of events is studying on differences with magnitude scales relationships. Our focus is on the relationship between moment magnitude and local magnitude. Moment magnitude (Mw) is a magnitude scale base on seismic moment (M0) which is one of physical characteristics of seismic sources and to calculate it, we used modified seismic parameters (which contribute to the calculation of M0) for under study region (Tehran, northern Iran). Also, we have used Richter-Gutenberg reformed equation for northern Iran to calculate local magnitude of events. In this study, by using number of events contain explosions and natural earthquakes which were discriminated before, we tried to compare Mw/ML relationship between explosions and earthquakes. The data bank which used in this study contains 320 local events which were happened in Tehran region, northern Iran (Long. 50-53 deg. and Lat. 35-37 deg.) between 2006 and 2009 and recorded by Iranian Seismic Telemetry Network (ISTN). But since there was a lack of S/N ratio, we had to extract events with a reasonable S/N ratio and then 30 explosions and 69 earthquakes have been selected for the main analysis process. All of these events are local and in the magnitude range of 1<ML<4. By calculating local and moment magnitudes we found that Mw/ML relationship is MW =1.224Ln(ML)+1.760 with the R-squared value of R2=0.429 for explosions and MW =1.542Ln(ML)+1.689 with the R-squared value of R2=0.718 for earthquakes. This comparison was done again on a smaller magnitude range of 1.1<ML< 2.1 where the equation changed for earthquakes with MW = 0.771Ln(ML)+2.193 with the R-squared value of R2=0.324, and in the case of explosions, since all events were smaller than 2.1 (ML scale), the equation did not get changed.