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An Equivalent Moment Magnitude Earthquake Catalogue for Western Turkey and its Quantitative Properties

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Abstract

Earthquake catalogues consist a basic product of seismology, resulting from complex procedures and suffering from natural and man-made errors. The accumulation of these problems over space and time lead to inhomogeneous catalogues which in turn lead to significant uncertainties in many kinds of analyses, such as seismicity rate evaluation and seismic hazard assessment. A major source of catalogue inhomogeneity is the variety of magnitude scales (i.e. M_w, m_b, M_S, M_L, M_d), reported from different institutions and sources. Therefore an effort is made in this study to compile a catalogue as homogenous as possible regarding the magnitude scale for the region of Western Turkey (26^oE – 32^oE longitude, 35^oN – 43^oN latitude), one of the most rapidly deforming regions worldwide with intense seismic activity, complex fault systems and frequent strong earthquakes. For this purpose we established new relationships to transform as many as possible available magnitudes into equivalent moment magnitude scale, M^*_w. These relations yielded by the application of the General Orthogonal Regression method and the statistical significance of the results was quantified. The final equivalent moment magnitude was evaluated by taking into consideration all the available magnitudes for which a relation was obtained and also a weight inversely proportional to their standard deviation. Once the catalogue was compiled the magnitude of completeness, M_c, was investigated in both space and time regime. The b-values and their accuracy were also calculated by the maximum likelihood estimate. The spatial and temporal constraints were selected in respect to seismicity recording level, since the state and evolution of the local and regional seismic networks are unknown. We modified and applied the Goodness of Fit test of Wiemer and Wyss (2000) in order to be more effective in datasets that are characterized by smaller sample size and higher $M_c$thresholds. The compiled catalogue and the $M_c$evaluation technique introduced in this study may constitute a useful tool for future seismicity research in Western Turkey.

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