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Rakesh Singh, Ajay Paul, Arjun Kumar, Parveen Kumar, Y.P. Sundriyal

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Estimation and applicability of attenuation characteristics for source parameters and scaling relations in the Garhwal Kumaun Himalaya region, India

Rakesh Singh[1]*, Ajay Paul[1], Arjun Kumar[2], Parveen Kumar[1], Y.P. Sundriyal[3]

[1]*Geophysics Group, Wadia Institute of Himalayan Geology, Dehradun-248001, INDIA*

[2]*Department of Civil Engineering Arni University, Kathgarh (Indora) Himachal Pradesh, INDIA*

[3]*Department of Geology, HNB Garhwal University, Srinagar, Uttarakhand, INDIA*

*Correspondence to: *rakeshgosain@hotmail.com*

Abstract

Source parameters of the small to moderate earthquakes are significant for understanding the dynamic rupture process, the scaling relations of the earthquakes and for assessment of seismic hazard potential of a region. In this study, the source parameters were determined for 58 small to moderate size earthquakes ($3.0 \leq M_w \leq 5.0$) occurred during 2007 - 2015 in the Garhwal-Kumaun region. The estimated shear wave quality factor ($Q_\beta(f)$) values for each station at different frequencies have been applied to eliminate any bias in the determination of source parameters. The $Q_\beta(f)$ values have been estimated by using coda wave normalization method in the frequency range 1.5 to 16 Hz. A frequency-dependent S wave quality factor relation is obtained as $Q_\beta(f) = (152.9 \pm 7)\, f^{(0.82\pm0.005)}$ by fitting a power-law frequency dependence model for the estimated values over the whole study region. The spectral (low-frequency spectral level and corner frequency) and source (static stress drop, seismic moment, apparent stress and radiated energy) parameters are obtained assuming ω^{-2} source model. The displacement spectra are corrected for estimated frequency-dependent attenuation, site effect using spectral decay parameter "Kappa". The frequency resolution limit was resolved by quantifying the bias in corner frequencies, stress drop and radiated energy estimates due to finite-bandwidth effect. The data of the region shows shallow focused earthquakes with low stress drop. The estimation of Zúñiga parameter (ε) suggests the partial stress drop mechanism in the region. The observed low stress drop and apparent