Estimation of Coda wave attenuation for Delhi and its surrounding regions using local earthquakes

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The lapse time and frequency dependent coda wave attenuation of seismic wave energy of Delhi and its surrounding regions has been estimated using coda of local earthquakes recorded by Delhi Telemetry Network operated by the India Meteorological Department (IMD), Delhi that occurred between January 2001 and December 2014. The selected data include 175 local earthquakes with a magnitude range of 2.0 −4.3. This area lies in the seismic zone IV and is geologically confined to the Delhi Fold Belt (DFB). Most of the analyzed earthquake events epicenter lies to the west of Delhi, along north-south trending Sohna fault and at the tri-junction of Delhi-Haridwar ridge, Delhi-Lahore fault and along the axis of Delhi Fold Belt. The method used for this study uses a concept known as single back scattering model. In this study we consider 16 different lapse time window lengths between 15s and 90s in steps of 5s. All the seismograms are band pass filtered at central frequencies of 1.5, 2, 4, 8, 10, 12 and 16 Hz with bandwidths of 0.5, 1, 2, 4, 5, 6 and 8, respectively. The frequency dependent quality factor has been estimated for different lapse time window lengths and Q_c at 1 Hz frequency (Q_0) and frequency dependent parameter "n" have been estimated from the relationship . All coda windows begin at twice the S-wave travel time. The average estimated frequency dependent quality factor gives the relation, for the entire region for window length of 30 s, whereas the average value varies from 200 at 1.5 Hz to 1962 at 16 Hz. The and values vary from 73 to 453 and 0.97 to 0.63 for lapse time window lengths of 15 s to 90 s respectively.

These values show that the region is seismic and highly heterogeneous and the region is tectonically very active. Further, depth variation of coda Q is also examined. Rate of increase of Q_c with lapse time is more at lower lapse time compared to higher ones. As higher lapse time represent medium properties at greater depth, this shows that rate at which attenuation decreases with depth is more at shallower depths compared to deeper depths. The estimation of Q_c in Delhi and its surrounding regions will be an important parameter for the prediction of large earthquakes, seismic hazard assessment, engineering seismology and better understanding of source processes, tectonics and seismicity in the region.

Keywords: Coda wave, Quality factor, Attenuation, Delhi Region

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