Seismic body wave attenuation characteristics within the heterogeneous crust of Northeast India

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Local earthquakes that occurred during 2011-2013 are used to study body wave attenuation characteristics of Northeast India region. This region is seismically one of the most active zones in the world. The region comprises of tectonically and geologically diverse units like the Eastern Himalayas, Brahmaputra River Basin, Indo-Burma Ranges, Shillong Plateau, and Mikir Hills. The frequency-dependent attenuation of P and S wave has been estimated using the extended coda normalization method. A total of 93 local earthquake waveforms with a magnitude range of 2.8 to 4.5 recorded by the India Meteorological Department (IMD) using six broadband stations were analyzed for this study. The P, S and coda-wave spectra are analyzed for 5 seconds windows at the central frequencies of 1.5, 2, 3, 4, 6, 8, 10 and 12 Hz. Both Qp and Qs values increase with increasing frequency for Northeast India. Qp increases from 50 at 1.5 Hz to 496 at 12 Hz and Qs increases from 116 at 1.5 Hz to 1519 at 12 Hz. The obtained relations for P and S wave are $Qp=31\pm3f^{1.12\pm0.02}$ and $Qs=86\pm12f^{1.16\pm0.06}$. The results obtained for average Qp and Qs in this study show good agreement with those for other studies carried out for tectonically active regions, with high n (~1.0) values and low Q_0 (<200) values, which are characteristic of active regions in terms of seismicity and tectonics. The low values of Qp and Qs obtained for Northeast India and its surroundings correspond to seismically active areas with complex tectonics due to the ongoing underthrusting of the Indian plate below the Himalayas and subduction below the Indo-Burma Ranges that is manifested by the region's high seismicity too. The n values for both Qp and Qs are close to 1 or greater than 1, indicating that the region is highly heterogeneous. Station to station variation in Qp values for Northeast India region, are not exactly similar to that observed for Qs for all frequency range which indicates the presence of high degree of heterogeneities of the subsurface under the study region. The average values of Qs/Qp at different frequencies are greater than 2, which supports this observation.

Keywords: Body wave, Quality factor, Seismic attenuation, Northeast India

