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QC tomography for the Eastern Indian Shield region

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Eastern Indian shield region has been investigated for frequency dependence of attenuation analyzing coda waves from 112 local earthquakes using the single backscattering model. The waveform of the 112 events of magnitude $M_W \geq 2.5$ were recorded during the period from 2007 to 2016 at broadband station lying at the premises of IIT(ISM), Dhanbad. The coda amplitude decay at a range of 0.33 to 14.66 Hz frequencies has been measured for 112 earthquake–receiver pairs. We have calculated Coda Q_C over four different coda window 30sec, 35sec, 40sec and 45sec to find the attenuation effect from shallower to deeper part. Combined measurements are analyzed to estimate the frequency dependency of coda Q in the form $Q(f) = Q_0 f^{\eta}$. The lateral variation of coda $Q_0$and η varies from 180-420 and 0.79-1.02 with an average of $Q_0 = 336f^{0.83}$ in the eastern Indian shield region. For 45s coda time window, Q_0 = 340-420and η = 0.79-0.86 with an average of $Q_0 = 394f^{0.81}$ for 40 sec window, Q_0 = 297-386, η = 0.79-0.88 with an average of $Q_0 = 310f^{0.79}$. Q_0 = 270-360, η = 0.79-0.89 with an average $Q_0 = 310f^{0.85}$ for 35 sec coda window and Q_0 = 180-255, η = 0.9-1.02 with an average $Q_0 = 236f^{0.90}$ for 30 sec coda window. Regionalization of the measured and combined Q values for all earthquake–receiver paths are made through a back projection algorithm. A single back-scatter model is considered for the coda waves with elliptical sampling and parameterized the sampled area using 0.1° square grids. Inversion is stabilized by applying a, spatial Gaussian filter like, nine-point spatial smoothening. This is done for every frequency to observe the spatial variation of Q (f) and subsequently combined for η variations. In the present study relatively moderate Q_C at the lower frequency range can be attributed to the loss of energy due to the presence of numerous heterogeneities with decreasing rock-strength. The widely varying coda Q possibly accounts for either higher heterogeneity distributed widely or concentrated subsurface deformation in the study area. The results of the present coda-Q tomography are important for computation of source parameters and assessment of seismic hazard for the study area.

Keywords: Q_C tomography; attenuation; time lapse; single back-scatter model; Eastern Indian Shield