Study of 3-D Velocity Structure by Seismic Tomography and Lg Wave Attenuation in Northeastern India

Abstract

The northeastern region of India is acted upon by a multiple tectonic regime which consequences in a highly stressed lithosphere. To ascertain the seismic hazard of the region in light of the current tectonics, it becomes imperative to comprehend the fundamental issues like the degree of crustal heterogeneity and the attenuating property of the crust which is gauged in terms of the variation of velocity of seismic waves and crustal quality factor “Q”. In this study an attempt has been made to decipher the 3-D velocity structure and the attenuating characteristics of the crust beneath northeast India. The 3-D velocity structure has been examined by first working out a 1-D P-wave velocity model employing the local earthquake tomographic (LET) technique of simultaneous inversion given by Thurber (1983) and modified by Eberhart-Phillips (1993) on well located 892 events. The inverted optimum 1-D velocity structure suggests six-layered crust beneath the region. This velocity model has been used as an apriori model for the 3-D velocity inversion by using the tomographic technique of tomoDD performed on the same 892 earthquakes. The 3-D velocity structure is well resolved for the Shillong-Mikir Plateau and the Assam valley area, which shows a dominant presence of intermediate to low velocity zones. The crustal attenuation has been studied in terms of Lg waves. The methodology adopted is the one given by Ottemöller et al. (2002). It is found that the entire region is strongly attenuating and highly dependent on the frequency which is indicative of the dominance of scattering mechanism. The study reveals a strong variation in the lateral heterogeneity of the crust beneath NE India and currently the entire region is tectonically very active with the Shillong-Mikir Plateau being the most attenuating. The study also reveals that the northeast India has the potential to trigger large earthquakes in the future with less widespread effect and the Shillong-Mikir Plateau has a high potential to source such eventful earthquakes. Both the studies accentuate the fact that the models of tomography and Lg attenuation are highly buttressed by the tectonics, geology and structure of the region which are manifested by the pronounced crustal heterogeneity and attenuation that enhances the seismic hazard posed for the future in this region.