Abstract

Attenuation characteristics of the crust in eastern Himalaya and southern Tibetan Plateau are investigated using high quality data recorded by Himalayan Nepal Tibet Seismic Experiment (HIMNT) during 2001-2003. The zone belongs to a seismically very active and tectonically very complex area and a very crucial region for seeking to understand the process of continental collision between the Indian and Eurasian plates. The present study aims to provide an attenuation model that can address the physical mechanism governing the attenuation characteristics in the underlying medium. Initially I have studied the Coda-wave (Q_c) and S-wave (Q_s) attenuation factors to see their frequency-dependent nature and thereafter the relative contribution of scattering and intrinsic attenuation is investigated to verify the source of attenuation in the medium below eastern Himalaya and southern Tibetan plateau. Lg Q tomography study is also attempted to provide a high resolution crustal attenuation model of the area.

The observed Q_c and Q_s are found to be strongly frequency-dependent and follow a similar trend as observed in other tectonically active parts of the Himalaya. The trend of variation of Q_c with lapse time and the corresponding apparent depths is also studied. Increase in Q_c values with the lapse time suggests that the deeper part of the study region is less heterogeneous than the shallower part. The observed values of Q_0 (Q_c at 1 Hz) and frequency parameter n indicate that the medium beneath the study area is highly heterogeneous and tectonically very active. A regionalization of the estimated Coda Q_0 is carried out and a contour map is prepared for the whole region. It suggests that the entire area is highly heterogeneous in nature and some of the high attenuation zones are identified. At all the frequencies intrinsic absorption is found to be predominant compared to scattering attenuation and seismic albedo (B_0) is lower than 0.5. It demonstrates that the intrinsic absorption controls the attenuation characteristics of the region which specifies the physical properties of the crust. The discrepancies found between the observed and theoretical models can be corroborated by the depth-dependent velocity and attenuation structure as well as the assumption of uniform distribution of scatterers. From Lg Q tomography study I have found two low Lg Q_0 pockets which correlate well with the low Q_p and Q_s below lesser Himalaya and southern Tibet reported by other studies and coincide with low Vp/Vs zones observed from velocity tomography study.

Our results correlate well with the existing geo-tectonic model of the area which may suggest the possible existence of trapped fluids in the crust or its thermal nature. The underlying cause of high attenuation in the crust of eastern Himalaya and southern Tibet makes this region distinct from its adjacent western Himalayan segment. The results are well comparable with the other regions reported globally.