Nature of the Earthquake Pattern in the Kumaon Himalaya Derived from Joint Hypocenter and Velocity Modeling

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The seismological record and recent space geodetic measurements suggest significant seismic potential for the Kumaon Himalayan region in the state of Uttaranchal. The region has several recent, deadly, moderate sized earthquakes, the most prominent being the Uttarkashi (1991 Oct 20, 30.75ºN 78.86ºE, M 6.6) and Chamoli (1999 March 29, 30.41ºN 79.42ºE, M 6.8) earthquakes. The geodynamic complexities of the Himalaya are manifested in several surface features such as the Southern Tibetan Detachment (STD), the Main Central Thrust (MCT), the Main Boundary Thrust (MBT) and the Main Frontal Thrust (MFT). The Main Central Thrust in this region is a zone bounded by the Munsiari thrust (MT) in south and the Vaikrita thrust (VT) in the north. Apart from sporadic distribution, most of the seismicity in Himalaya is very well clustered in a narrow zone of MCT. With a view to understand the earth and earthquake in Kumaon Himalaya region, we operated a 40 state-of –the art broadband digital seismographs in this region from April 2005 to June 2008. Initially, 350 earthquakes each with at least 8P and 5S and gap <180° were used to generate a 1-D reference velocity model for the region. Using this velocity model we present here the nature of the seismic cloud derived from 1240 local earthquakes using only the earthquakes with at least 5P and 3S readings. Majority of earthquakes follow the trend of the Munsiari thrust though we also observed earthquakes to the north of the STD, between the MBT and the Munsiari thrust in the vicinity of the Tehri region and the Ganges basin. While earthquakes are mapped in both the upper and lower crust most of them have their genesis in the upper crust. Unlike the Nepal Himalaya, we have no reliable earthquake in the mantle suggesting a lateral division in the rheological property of the Indian lithosphere underthrusting the Himalaya.