An Integrated Approach to Analyse the Shillong-Mikir Plateau Seismicity in Northeast India

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In this study we have analysed the intra-plate seismicity of the Shillong-Mikir plateau in northeast India region, which is bounded by the Himalayan arc to the north, Indo-Burma ranges to the east, Jamuna fault to the west and by the Bengal basin to the south. About 2000 seismic events recorded during the period 1993-99 (NGRI-RRL Jorhat Bulletin 1993-1999).are selected and reanalysed by the Hypo71, JHD (Joint Hypocenter Determination) and the LET (Local Earthquake Tomography) methods. Although the preliminary locations by the Hypo71 had been improved by the JHD relocation, it rejected a large volume of data set. The LET method, on the other hand, imaged the 3-D P-wave velocity structure beneath the plateau as well as relocated maximum events with much improved rms and epicentre errors by simultaneous inversion. In simultaneous inversion of the LET, we used high quality 3494 P- travel times and 3064 S-P travel time differences for about 1000 selected earthquakes that were recorded by about 55 temporary/permanent local seismic stations in the region. The reconstructed 3D Vp images reveal a strong heterogeneity in the upper and lower crust, that are in good correspondence to the known seismotectonics of the region. A prominent NW-SE trending low velocity structure is imaged between the Shillong plateau and Mikir hills at 20-30 km depth that corresponds to the Kopili fault. At the fault end a high Vp structure is imaged below the Mikir hills at 40 km depth, which is the source zone for intense seismic activity along this ~300 km long and 50 km wide fault zone. A circular seismic source zone with higher Vp is also imaged beneath the Shillong plateau. The Bengal basin to south of the Shillong plateau, on the other hand, is identified as a low Vp structure extending down to 20 km depth . This is in good agreement with the thick (~20 km) Tertiary sediments below this basin. Further, the relocated precise epicentres are used to map the spatial fractal correlation dimension Dc. The Dc of the entire study area ranges between 0.80 and 1.90, indicating that most of the earthquake associated fractures are approaching a two dimensional space. The fractal dimension contours reflect a circular source zone below the Shillong plateau and a linear long transverse structure below the Kopili fault zone with higher fractal dimensions (1.7-1.9). These images are in good agreement with the high Vp seismic source zones that are imaged by the LET method.