Geophysical Research Abstracts
Vol. 20, EGU2018-2453-3, 2018
EGU General Assembly 2018

Local Earthquake Tomography of Lower Assam Valley, India

Shushant Singh (1), Bharath Shekar (1), Mohan Gollapally (1), and Sunil K Singh (2)

(1) Indian Institute of Technology Bombay India, Department of Earth Sciences, Mumbai, India(shushantss@iitb.ac.in), (2) Oil and Natural Gas Corporation (ONGC), GEOPIC, KDMIPE Campus, Kaulagarh Road, Dehradun, India

Local earthquake tomography was carried out in the Lower Assam Valley in northeast India to image the 3D P wave velocity structure and delineate the structural features in the crust. The Lower Assam valley forms the easternmost projection of the Indian plate where convergence occurs between the Indian, Eurasian and the Sunda plates. The study area comprises thick sequences of sediments and several north south trending thrust faults which are characterized by moderate seismicity. A network of 6 broadband stations (0.025-50 Hz) and 70 shortband stations (0.2-100 Hz) were operated for about 11 months in an area of 65km x 45km to monitor the local seismicity. A total of about 148 local earthquakes in the magnitude range 0.5 – 3.5 were recorded. Preliminary hypocentral locations revealed that the microseismicity was scattered in the study region and extended from shallow crust to deeper parts of the crust till a depth of 40km. However, a majority of the earthquakes were in the depth range 0-20km. The local earthquake tomography was carried out using about 2601 P phase arrivals corresponding to local earthquakes which were recorded by atleast 5 stations. Initially, an optimum 1-dimensional P wave velocity model was obtained through an iterative scheme and the hypocenters located and the P wave residuals estimated with respect to the 1D velocity model. The 1D model is then extended to 3D, and ray tracing is performed to construct the tomographic matrix in 3 dimensions with simultaneous and iterative updates to the source locations and the P-wave velocity model. Validation of the results was done using checkboard tests with velocity perturbations of $\pm$10%, which shows a completely resolved 3D structure beneath the subsurface upto 25km. The inverted P-wave velocity structure shows a strong variation in both vertical and lateral direction associated with local geology of the area. Large variations of $\pm$8% in the P wave velocity perturbations are observed. Large positive and negative anomalies are associated with tight anticlines and thick alluvial deposits respectively. Interestingly, the lower crust is found to have a high velocity of 7.1km/s indicating extensive magmatic underplating. The velocities from near surface to a depth of 26km are observed to range from 2.0km/s to 5.5km/s. This low velocity zone extending upto mid crustal depths implies that the sediments in this region are unusually thick.