

Neotectonic and seismic risk assessment of Central Salt Range, Potwar Plateau, Pakistan

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Abstract

This research investigates neotectonics and seismic risk assessment for the future development in the light of historic recorded earthquakes that caused enormous damage to human life and property. With the help of recent data, geological and neotectonic interpretations were carried out for the identification of areas of high seismicity of central Salt Range. Computer modeling studies with the use of historic and recent seismic data provided peak ground acceleration, peak ground velocity and maximum credible earthquake of the central Salt Range and Potwar Plateau. This study designates that Peak Ground Acceleration (PGA) for soil and rocks of the area is 0.16g.

An attempt has been made to study in detail the neotectonics and seismicity of the Central Salt Range and Potwar Plateau. Potwar Plateau is the lower part of North West Himalayan Thrust and Fold Belt (HTFB) developed due to, the continuing collision between the Eurasian and Indian plates. The study area is located between longitudes 72.66°E to 73.03°E and latitudes 32.61° N to 32.88°N.

Lithology, neotectonics and seismic behavior of the Central Salt Range was studied. For this purpose, the field analysis of complemented Geological, historical and instrumental earthquake data was carried out. Neotectonic features of the study area were studied using satellite image analysis and field observations. Tilting of recent sediment and stream flow patterns were used as indicators of neotectonic activity on satellite images. Field evidences of neotectonic activity along faults present in the study area include, tilting of Quaternary sediments, stream offset and dissected sedimentation bars. Another characteristic feature is the change in topographic relief across the trace of fault. Major lithological units of the study area include limestone, sandstone, marl, shale and dolomite having seismic velocities ranging from 3000-4300 m/s.

GIS and remote sensing provide inimitable opportunities for solving wide spectrum of problems regarding neotectonic and seismic behavior of prominent structures. For this rationale DSD (digital satellite data) sets Landsat ETM+15m, spot 2.5m and ASTER DEM 30m resolutions were integrated with geological maps of the study area. Satellite image enhancement techniques including False colour composite (FCC), RGB band combinations, Band ratio, IHS (Intensity, Hue, Saturation) and PCA (Principal Component Analysis) were applied for identification of neotectonic signatures and features.

The Central Salt Range experienced 220 earthquakes of magnitude 1 to 3.9, 12 earthquakes of magnitude 4.0 to 4.9 and only five events of magnitude from 5.0 to 5.9. On the basis of historical and instrumental records, the area has not experienced moderate to large earthquakes (during 0900-2015). The investigated area is the central slice of Salt Range and has a number of faults. The seismogenic sources and active faults of this zone are Salt Range Thrust Fault, Choa Sayyaidan Shah Fault, and KallarKahar Fault etc.