Seismic Hazard due to Future Great Earthquake in the Central Seismic Gap of Himalaya

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The probabilistic hazard maps of the earthquakes do not model characteristics cycle of great earthquakes in the Himalaya. Nor does it model the source processes in terms of the fault plane solution or the stress drop involved in earthquakes. The seismic gaps, which are sections of the Himalaya plate boundary that have not experienced a great earthquake in the past several hundred years, are in the strain accumulation phase of this cycle (Khattri, 1999). The probability of occurrence of a gap filling great earthquake in such gaps increases with the time elapsed since the last great earthquake. The Central Seismic Gap (CSG) between the rupture zones of 1905 Kangra and 1934 Bihar-Nepal great earthquakes is one such section in Himalaya. The considerable urbanization and increase in population density as well as industrialization in the Himalaya and adjoining Ganga plains has raised the seismic risk substantially. The 100 year (starting from 1999) probability of occurrence of a great earthquake in the Central Seismic Gap is estimated to be 52% (Khattri, 1999). As the probability of occurrence of a future great gap filling earthquake is very high, it has been argued that one should make the seismic hazard and risk evaluation on the basis of the occurrence of the future great earthquakes in the regions of seismic gaps.

The seismic hazard due to a great earthquake (M_w 8.5) in the CSG has been evaluated. For this purpose the accelerograms have been synthesized at large number of sites distributed on a grid using a hybrid procedure. This procedure is the combination of the techniques of envelope function and composite source model. The parameters adopted for the great earthquake are based on the knowledge of geological process for the occurrence of great earthquakes in Himalaya. A bilateral mode of rupture propagation has been considered in the present study. The scenario hazard maps prepared in this study show the spatial distribution of peak ground acceleration (pga) values, Modified Meracalli Intensity (MMI) and spectral accelerations for different periods. The curve of pga values drops faster in the near distance range as compared to larger distance range. The pga value estimated as 0.3g in the Delhi region (~ 200 km from fault edge) that corresponds to MMI of VIII. The scenario hazard maps presented here may be used to augment the information available in the probabilistic seismic hazard maps of the region. The maps presented here provide a suitable basis to strengthen the built environment in the region to resist the effects of a future great earthquake and therefore to reduce the expected losses considerably.