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Relief distribution versus seismicity along the Sub-Himalayan belt, NW India: inferences for the seismic hazard of the region

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The frontal Himalayan region, India, represents a classical example of relief developed in a compressional tectonic setting. The major relief development processes are mainly related to dip-slip reverse faulting along major thrusts and the consequent uplift of the hanging-wall block(s). The southernmost of these major fault planes, i.e. the Himalayan Frontal Thrust (HFT), also marks the tectonic and topographic boundary between the Himalayan orogen and the Indo-Gangetic alluvial plain representing its foredeep basin. The hanging-wall block of the HFT comprises the so-called Sub-Himalayan mountain belt characterized by low-relief hills variably dissected by the ongoing erosion. This major tectonic unit is in turn delimited to the north by the Main Boundary Thrust (MBT). The relatively young age of the Sub-Himalayan hills provides an opportunity to investigate the thrust-related evolution of the relief, especially in the early stages of nucleation and propagation of a thrust as well as the relationships between large-scale topography and local seismicity. The new data presented in this paper mainly pertains to the first order topography of the uplifted hanging-wall block of the HFT. These data reveal a marked lateral variation along the strike of the Sub-Himalayan belt, in terms of both topographic features and mean topographic gradient. The main controlling factor seems to be the distance between the two major bounding thrust faults, i.e. the MBT and the HFT. In areas where thise distance is larger, the mean topographic gradient is generally lower, whereas it increases with decreasing distance between the two major thrusts. The relief distribution and associated topographic features characterizing the northwestern sector of the Sub-Himalayan belt also show a good correspondence with the peculiar macroseismic field of the M=8.4, 1905 Kangra earthquake, where the two distinct intensity maxima, separated by a distance of about 100 km, clearly overlap the two major tectonic reentrants. Also more recent instrumental records seems to support this relationships.