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Earthquake recurrence in the central Himalaya: Some outstanding issues

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Evaluation of the historic and geologic data from the central Himalaya suggests that the region experienced many significant earthquakes in the past. However, many questions remain on the pattern of earthquake recurrence, style of deformation and causative structures. A major question is when the last great earthquake in the central Himalaya was. While the renewal time of earthquakes originating on the detachment fault might match the expectations of the seismic gap models, the subsidiary faults within the wedge may localize strain leading to earthquakes events that need not maintain any temporal relation with the plate boundary breaking earthquakes and leading to surface slip due to the favorable geometry of the ramps. Observed temporal and spatial clustering of earthquakes along the Himalaya, nature of surface rupture and the amplified slip reported from geological section associated with the paleo-earthquakes may result from the dual nature of seismic sources along the Himalaya. This fundamental difference in source zones may be the key to understanding the temporal and spatial clustering of earthquakes along the Himalaya. The class of earthquakes that originate on the duplex zone propagate vertically on the steeply dipping faults and leading to surface ruptures, as observed in the 2005 Kashmir earthquake, that showed a peak surface offset of 7 m. Archaeo-seismological evidence point to a great earthquake in the central Himalaya occurred sometime between AD 1000 and AD 1290, suggesting a temporal gap of >800 years for great earthquakes in the region. Our studies also suggest that the source zone of the 1803 earthquake can be located close to Uttarkashi, on the duplex zone. The possible out-sequence-events like the 1803 Garhwal earthquake apparently suggest that the duplex zone south of the MCT is equally, if not more, active and capable of generating large/great earthquakes in the central Himalaya rather than the Himalayan frontal thrusts.. The age determinations of the paleoliquefaction features from the alluvial plain in Bihar and Uttar Pradesh suggest that previous great earthquakes in the respective segments may have occurred about 1000 years ago. These dates have some correlation with previous studies on the active faults on the Nepal side. We will present the results of our recent investigations of the geological proxies in the Himalaya and the Gangetic alluvial Plains along with a critical evaluation of the previous studies and discuss our strategy to address some of the outstanding questions on the earthquake recurrence in the central Himalaya.