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Understanding continental megathrust earthquake potential through geological mountain building processes: an example in Nepal Himalaya

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How to reconcile continent megathrust earthquake characteristics, for instances, mapping the large-great earthquake sequences into geological mountain building process, as well as partitioning the seismic-aseismic slips, is fundamental and unclear. Here, we scope these issues by focusing a typical continental collisional belt, the great Nepal Himalaya. We first prove that refined Nepal Himalaya thrusting sequences, with accurately defining of large earthquake cycle scale, provide new geodynamical hints on long-term earthquake potential in association with, either seismic-aseismic slip partition up to the interpretation of the binary interseismic coupling pattern on the Main Himalayan Thrust (MHT), or the large-great earthquake classification via seismic cycle patterns on MHT. Subsequently, sequential limit analysis is adopted to retrieve the detailed thrusting sequences of Nepal Himalaya mountain wedge. Our model results exhibit apparent thrusting concentration phenomenon with four thrusting clusters, entitled as thrusting 'families', to facilitate the development of sub-structural regions respectively. Within the hinterland thrusting family, the total aseismic shortening and the corresponding spatio-temporal release pattern are revealed by mapping projection. Whereas, in the other three families, mapping projection delivers long-term large (M<8)-great (M>8) earthquake recurrence information, including total lifespans, frequencies and large-great earthquake alternation information by identifying rupture distances along the MHT. In addition, this partition has universality in continental-continental collisional orogenic belt with identified interseismic coupling pattern, while not applicable in continental-oceanic megathrust context.