Accelerating Seismicity in the Indo-Himalayan Plate Boundary Zones and Implications for Tectonic Evolution

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Examination of global earthquake catalogs [1] during recent centennial period shows a remarkable temporal clustering of large earthquakes in the Indo-Himalayan collision zone and Tibet plateau. As for shallow earthquakes with M ≥7.5 in the broad active zone, there have been twenty five events during 1900-1957, no event throughout 1958-1996, and five events during recent 1997-2009. Among the latest events, the 2005/10/8 Kashmir Mw7.6 is the thrust type interplate earthquake, other fours are intraplate events away from the plate boundary (1997/11/9 Xizang Mw7.5, 2001/1/26 Bhuj Mw7.7, 2001/11/14 Qinghai Mw7.8, and 2008/5/12 Sichuan Mw7.9). Spatio-temporal distribution of Mw≥6.5 earthquakes based on the Harvard/Global CMT catalogs since 1976 demonstrate a systematic increase of magnitude, and their cumulative seismic moment release shows an accelerating tendency since mid 1990s.

Because these features suggest a non-stationary evolution of seismicity over broad area, we apply models of time-to-failure analysis [2] to the observed accelerating moment release (AMR), by calculating the curvature parameter [3] using the nonlinear least squares. Although the obtained model parameters and AMR area are not unique, possible solutions include the time-to-failure functions which predict further large event in near future in the area radius about 2200 km centered at the central Himalayan arc. The centered position locates in potential areas of great earthquakes along the Himalaya arc with potential slip accumulated since 1800[4]. To clarify the ongoing crustal activity associated with the strain energy stored underneath, detailed analysis of both the brittle and ductile behaviour of the fracture zone is important.

Keywords: long-term seismicity; time-to-failure analysis; Indo-Himalayan collision zone.

References

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