



Pattern of modern denudation in the Longmen Shan, eastern Tibetan plateau: Tectonic controls on focused erosion along plateau margin

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We use river sediment-load data to evaluate the magnitude and spatial pattern of modern denudation rate across the Longmen Shan margin of the Tibetan plateau, a region that experienced extensive landslides induced by strong shaking of the 2008 M8 Wenchuan earthquake. Decadal erosion is spatially heterogeneous. Relatively high denudation occur in a narrow band along the tectonically lower part of the Longmen Shan steep margin, and particularly near the active Longmen Shan and Min Shan fault zones, reaching 0.5 – 1 mm/yr. The rate decreases plateau-ward, to less than 0.05 mm/yr at a distance of 150 km northwest of the Longmen Shan. Thus, river sediment load data delineates high erosion rate zones where the active faults are located, a finding consistent with that of previous studies on the longer-term erosion rates (kyr- to Myr-timescale) of the region. The magnitude of denudation near active faults is similar to kyr-scale catchment-averaged erosion rates from cosmogenic nuclide inventory in river sand, but can be 2 times smaller than theomochronology-derived million-year-scale denudation rates. Monsoonal precipitation gradient across this steep plateau margin cannot explain the spatial one-order-of-magnitude difference in erosion, but monsoonal storms appear to play a role in the erosion process through modulating the frequency of high erosive events and causing the temporal fluctuation of sediment delivery. Focused erosion in a narrow stripe in the lower part of the Longmen Shan margin suggests that, if the pattern had been maintained over millions of years, the combination of erosional and tectonic processes would produce and maintain a steep plateau margin. In addition, spatially variable rates of erosion within the drainage basin of a single river indicates provenience studies targeting for long-term river drainage evolution at millions-year timescale should take into account of this natural spatially-biased sampling effect, especially for the large-drainage-basin Asian rivers draining off the plateau.