Landslide weathering in threshold landscape: An important mechanism for 'uplift driven climate change' hypothesis

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It's widely accepted that the late Cenozoic tectonic uplift may have enhanced physical erosion and monsoonal rainfall, which finally helped the drawdown of atmospheric CO_2 by silicate weathering (Raymo et al., 1988; Raymo and Ruddiman, 1992). In this hypothesis, chemical weathering rate should couple with physical erosion rate all the time, which is not consistent with the weathering limitation regime, that is, chemical weathering rate would be limited by the climate factors such as temperature and runoff in high erosion rate region considering that there have been adequate weatherable fresh rocks (West et al., 2005). However, data compilation from all over the world shows that the chemical weathering rate is positive related to denudation rate (Larsen et al., 2014).

We find that landslide weathering is dominate in the threshold landscapes on the eastern margin of Tibetan Plateau based on the distinct isotopic ratios of $^{234}U/^{238}U$ and $^{87}Sr/^{86}Sr$ associated with different weathering mechanisms. The dominance of landslide weathering would break the kinetic weathering limitation in the rapid-eroding terrains and thus enables tectonic driven of climate cooling though the progressive response of weathering consumption of atmospheric CO_2 to mountain uplift.

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