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# Generation of waterfalls at intermittently alluviated fault scarps releases tectonic forcing on a climatic beat.

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Normal or reverse faults bonding mountain catchments typically mark the transition from the erosional to the depositional domain where bedrock channels flow into alluvial fans. We show here that interactions between the two fluvial domains can result in knickpoints that convolve tectonic and climatic signals. Changes in the ratio of sediment and water fluxes (Qs/Qw) modify the equilibrium geometry of the system and in particular of the reactive alluvial reaches so that a larger Qs/Qw forces steepening of the fan, backfilling of the bedrock reach and a heightened base level. Under these conditions, slip on the fault — covered and shielded by alluvium — can accumulate over several seismic cycles before being released at once by incision of the alluvial fan back to a shallow geometry. We demonstrate in this study that climate-driven aggradation and incision of alluvial fans in the Death Valley area can account for otherwise unexplained waterfalls at the base of catchments manyfold the height of coseismic throw. As a consequence, in this common configuration, tectonic slip can accumulate and be released at once on a tempo set by climatic fluctuations. Such that the faster denudation rate that might follow from increased precipitations is accompanied by an important retreating knickpoint. We propose that this mechanism can increase catchment reactivity and broaden the range of external forcings potentially recorded in the stratigraphy.