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Climate controlled catchment erosion in the Himalaya during the late Quaternary

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The alluvial sediments deposited in the Indo-Gangetic Plains originated as a result of tectonic and climatic factors controlling the exhumation and erosion of the Hinterland Himalaya. However, erosion distribution over the Himalaya and sediment delivery to the plains, on a shorter millennial time scale, are primarily controlled by the climatic factors such as glacial cover over the Himalaya and intensity of Indian summer monsoon (ISM) precipitation. Therefore, these alluvial sediment archives record important information about the past climatic changes. Here, we report the geochemical record of $^{87}Sr/^{86}Sr$, $^{143}Nd/^{144}Nd$ (ε_{Nd}), and $\delta^{13}C$ of sediment organic matter ($\delta^{13}C_{SOM}$) in a ~45 m long drill-sediment core collected from a buried channel of the paleo-Yamuna River in the northwest Indo-Gangetic Plains, Haryana to infer variations in provenance, paleoclimate, and paleovegetation during the late Quaternary. The Sr–Nd isotopic compositions ($^{87}Sr/^{86}Sr$: 0.75144–0.79241, ε_{Nd}: –15.9 to –19.7) of the core sediments suggest their derivation from isotopically distinct Higher Himalaya and Lesser Himalaya end-member sources in the catchment. Down-core variability in the isotopic compositions show increased contribution from the Higher Himalaya during marine isotope stage (MIS) 1 and late MIS 3 interglacial periods due to receding glacial cover and intense ISM. The $\delta^{13}C_{SOM}$ values (−21.6‰ to −27.0‰, average: −25.6‰) in the core samples imply a C_3 dominant paleovegetation in the catchment. Down-core variability in the $\delta^{13}C_{SOM}$ exhibits significant correlation with the ISM precipitation intensity, implying an increased abundance of C_4 plant in response to the ISM intensification during MIS 1, and early and late MIS 3.