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Hillslope-channel connectivity and local sediment budget in a Himalayan Valley (Kali Gandaki, Nepal)

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In the confined Himalayan valleys and in a context of monsoon, contrasted climate, landslides interact with rivers immediately, causing channel diversions, short-lived dams and sediment traps. Yet, remnants of ancient landslides may play an important role in the location of present instabilities and sediment fluxes. We document here debris storages and interaction patterns with fluvial activity observed in the Middle Kali Gandaki river (Myagdi District, Nepal Himalayas). We focus on the Pairothapla-Talbagar landslide (about 10 x 10 exponent 6 m3) that dammed the Kali Gandaki probably a few centuries ago. On the basis of diachronic (1974-2000-2008) geomorphic surveys and mapping, and thanks to DEM facilities, we reconstructed the extent of the landslide deposits, characterized the material (debris avalanche, including >350 m3 blocks), estimated the volume of the resulting lake (9-14 x 10 exponent 6 m3), and of sedimentary wedges resulting from later superficial reworking and downstream redistribution of debris. We assess the recent evolution of the landslide mass. Current instabilities (rainfall triggered shallow landslides) are large enough to supply debris to the river and increase the density hence the transport capacity of the flow downstream; in turn armouring boulders may be set into motion again, hence accelerating erosion of the Talbagar landslide mass in a positive feedback. We estimate the volume of debris eroded and exported by the Kali Gandaki during the last three decades. We end up with the sedimentary budget related to this event. Comparison with other features, either older or more recent, observed along the middle Kali Gandaki valley suggests that landsliding plays the major role in the overall process of denudation and sediment transfer of the Higher Himalaya. When coupled with high fluvial activity, it considerably reduces the residence time of sediments in the temporary, spatially limited traps of the valley bottom and highly influences sediment fluxes outward from the mountain zone.