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Detection and analysis of River course changes and lake formation – The RiCoLa Project

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Landslides are among the most serious threats to human lives and infrastructure in mountain ranges worldwide. Beyond the direct hazard posed by the moving mass, landslides (or their trigger events) can initiate natural hazard cascades by damming rivers and initiating catastrophic flash floods and debris flows. Such long-range effects render even unwitnessed landslides occurring in remote areas significant. Critically, insufficient information exists on landslide occurrence and recurrence intervals, and thus the hazard potential of landslide hazard cascades, as well as possible prediction and prevention measures. This lack of information is mostly due to the remoteness of many mountain regions as well as the complex dynamics of natural hazard cascades, even so the hazard posed by landslide dam failures is often orders of magnitudes greater than that of the initial landslide event. Better understanding of landslide-river interaction is hence crucial to assess and predict the resulting natural hazard.

In this project, we develop an interdisciplinary approach to build a solid statistical base for evaluating and understanding landslide-induced river course changes and lake formation, as well as flood risk resulting from landslide dam breaches. The project is tailored for long-term monitoring to better understand the role of extreme events in the interaction of the hillslope and channel systems.
Major outcomes of the project will be semi-automated and transferable techniques for detection of landslide-induced river course changes and lake formation and an inventory of automatically detected landslide-induced river course changes and lakes.

For this, we combine expert knowledge in high-mountain geomorphology and advanced remote sensing techniques to extract river courses and lakes on DEMs and optical satellite imagery. We detect and quantify river course changes by performing object-based change detection and time-series analysis over the past 30 years, and perform statistical analyses to determine spatio-temporal hotspots of landslide-induced river course changes and lake formation to evaluate their linkage to predisposing, preparatory and triggering factors.