

Unstable Slopes and Shifting Landscapes: Slow-moving landslides in the East African Rift

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Abstract:

Human activities are transforming tropical mountain landscapes at unprecedented rates through deforestation, agricultural expansion, and urbanization. These changes amplify the frequency and magnitude of geo-hydrological hazards such as landslides. While shallow, rapid landslides are well documented, the controls on the activity and dynamics of large, slow-moving landslides (SML) remain much less understood, despite their persistent impacts on communities and sediment dynamics.

This study demonstrates how the combined use of radar and optical Earth observation data enables the detection, mapping, and monitoring of deep-seated landslides across vast and remote tropical regions such as the Albertine Rift. By mapping and comparing more than 100 active and 3,000 historical landslides distributed along the 1,500 km Rift branch, we reveal how climatic, lithological, tectonic, and anthropogenic factors jointly control their occurrence.

We further analyse multi-year landslide dynamics across contrasting environments, supported by unique ground-based validation datasets built on years of fieldwork in the region, and provide detailed insights into failure mechanisms of recent catastrophic landslides in the area. Altogether, this work delivers a unique regional-scale assessment of SML activity in tropical environments and highlights how human-driven land use changes can modulate their behaviour. It offers new perspectives on how environmental transformations shape landscape evolution, geo-hydrological hazards and sediment transfer in rapidly changing mountain regions.