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Cross-correlation of optical satellite data for the detection and monitoring of slow-moving landslides in northwestern Argentina

Ariane Mueting and Bodo Bookhagen
University of Potsdam, Institute of Geosciences, Potsdam, Germany (mueting@uni-potsdam.de)

The increase in freely available optical satellite data with 10-15 m spatial resolution offers new opportunities to monitor slow-moving landslides and study their past movements through image cross-correlation in difficult-to-access regions around the world. Here, we explore this potential using Landsat-8 and Sentinel-2 optical satellite imagery to detect and quantify slope movements in the northwestern Argentine Andes over the past eight years. Our study takes advantage of the large spatial and temporal availability of optical satellite imagery, but we also show the caveats associated with cross-correlation for slow-moving targets. The northwestern Argentine Andes, particularly the mountain ranges that border the Central Andean Plateau (Altiplano-Puna Plateau), are predisposed to slope movements because of their steep hillslopes, weakened lithologies, sparse vegetation cover, and frequent rainfall events. Previous studies based on radar interferometry have identified several landslides moving at ~1 m/yr throughout our study area. We use these areas of known offset to identify optimal processing routines, evaluate their accuracy, and define the limitations of monitoring the movement of slow-moving landslides with optical imagery. We present approaches to pre- and post-correlation filtering to reduce noise and increase signal strength and further validate our results with high spatial resolution imagery (1-3 m). In this way, we aim to better constrain the distribution of slow-moving landslides throughout our study area and understand the driving factors of past and present slope movements at the regional scale.