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Time-dependent investigation of a slow-moving landslide in Los Angeles, CA, through SAR observations and numerical simulations

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As urbanized areas increasingly expand into mountainous terrains and climate change accentuates extreme weather conditions (rainfall or drought), slow-moving landslides increasingly threaten the resilience of infrastructure systems. Referred to as creeping landslides, these features may appear benign but can abruptly turn into catastrophic failures and debris flows during heavy rainfall or an earthquake. Because of the spatial extent and time evolution of ground deformation risk, conventional observation techniques such as site surveying, that rely on human resource availability and involve safety considerations, cannot be used to identify precursors of impending failures. Instead, remote sensing techniques for landslide monitoring such as differential SAR Interferometry (DInSAR) allow the spatiotemporal retrieval of surface changes with millimeter accuracy. We here test the reliability of repeat-pass interferometry techniques coupled with numerical models of creep to quantify the time-dependent deformations of a landslide in the Bel Air district of Los Angeles, USA. We validate our measurements and predictions by comparison with in-situ deformation profiles, and provide detailed representations of ground surface and subsurface displacements, along with the relationship between environmental factors and material properties. The wealth of in-situ measurements and site characterization data at the site improves our understanding of deformation precursors that can be used to minimize the risk posed to communities by slow-moving landslides.