

Large-Scale InSAR Processing and Machine Learning for Himalayan Slow-Moving Landslide Detection: Integrating Mass Data Processing, Climate Modeling, and High-Performance Computing

Quentin Glaude

¹UBLiege

Corresponding author: quentin.glaude@uliege.be

Abstract:

Mapping slow-moving landslides across the Himalayas to quantify their contribution to long-term erosion requires processing massive volumes of satellite radar data. SAR satellites like Sentinel-1 can measure ground displacement at millimeter precision, but analyzing thousands of freely available images spanning multiple orbital tracks presents computational challenges.

Multi-temporal InSAR techniques extract deformation signals from these archives, while modern deep learning architectures like U-Net and YOLOv8 enable automated landslide detection. High-performance computing infrastructure becomes essential: processing tens of thousands of interferograms demands parallel CPU workflows, while training neural networks requires GPU acceleration.

This presentation examines large-scale InSAR processing approaches and their integration with regional climate modeling (specifically MAR) to understand monsoon-driven landslide dynamics. I discuss how DInSAR expertise, climate modeling experience, and HPC infrastructure combine to address the challenge of systematic landslide mapping at broad scale the SML activity and velocity in central Nepal.