From Norway to the World: Expanding Ground Motion InSAR for Landslide Hazard Assessment

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Abstract: In Norway, systematic use of satellite-based ground-motion monitoring has transformed our ability to detect, track, and respond to unstable rock slopes. Through integration of interferometric SAR (InSAR), field investigations, and numerical modelling, national authorities have established operational early-warning systems that protect communities from catastrophic landslides. The national InSAR Norway service, launched in 2018, delivers free, nationwide deformation maps derived from Sentinel-1 data and has become an operational component of landslide hazard management. Its success has relied on close collaboration between the Geological Survey of Norway (NGU), the Norwegian Water and Energy Directorate (NVE), the Norwegian Space Agency, and NORCE Norwegian Research Centre, who developed the processing systems and software that form the backbone of the service. These institutions together operate the system on a powerful high-performance computing cluster (HPCC) that ensures national-scale processing capacity and reliability.

Building on this experience, Norway has contributed to the development and implementation of the European Ground Motion Service (EGMS) under the Copernicus Land Monitoring Service, the first continental-scale InSAR programme. EGMS provides harmonized, GNSS-calibrated displacement products covering all participating European states, enabling cross-border analysis of slope deformation and subsidence with millimetre precision. The methods and operational models refined through InSAR Norway informed many aspects of the EGMS, alongside the contributions of numerous European partners, demonstrating how coordinated processing, validation, and open dissemination can be achieved on a continental scale.

Looking beyond Europe, the next challenge is to ensure that these proven methods benefit regions most exposed to large rock-slope failures yet lacking reliable deformation data. A Global Ground Motion Service could provide accessible, standardized, and freely available monitoring products by building on existing Sentinel and commercial SAR missions, high-performance computing infrastructures, and open-data policies. Such a service would empower local authorities and scientists in developing and mountainous countries to detect precursory motion, prioritize field mapping, and enhance resilience to climate-driven slope instability.

Achieving this vision will require cooperation between remote-sensing specialists, modellers, and hazard managers—the same communities represented at RSG 2025. By linking physical understanding of rock-mass behaviour with large-scale InSAR observation, we can move toward global, evidence-based forecasting of slope failures in a changing mountain environment.