

Integrated monitoring of dams and large ponds: the role of satellite radar interferometry and the European ground motion service

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Abstract

Satellite radar interferometry (InSAR) has become an invaluable tool for monitoring dams and large ponds, providing significant advantages when complemented with geotechnical and geodetic monitoring. InSAR uses radar signals from satellites to detect ground movements with millimeter precision by comparing phase differences between images taken at different times. This technique enables large-scale, continuous monitoring, which is critical for identifying potential structural problems and preventing catastrophic failures. Unlike traditional geotechnical and geodetic monitoring, which require extensive equipment and manual data collection, InSAR provides a non-intrusive, efficient solution that covers vast areas with high temporal frequency. The European Ground Motion Service (EGMS) exemplifies these advantages by providing standardized ground motion data across Europe, derived from Sentinel-1 satellite radar data. EGMS enables routine and comprehensive monitoring of ground stability and infrastructure integrity, assisting in the early detection of deformation patterns and supporting proactive maintenance and risk management. For dam managers, the integration of InSAR with traditional methods enhances the reliability of structural health assessments. Geotechnical sensors offer localized information on soil and material properties, while geodetic methods provide precise positional data; InSAR complements these by delivering comprehensive, continuous deformation maps. This synergy ensures robust monitoring and enhances the ability to predict and mitigate potential problems, significantly improving the effectiveness and efficiency of monitoring dams and large ponds, and contributing to safer and more resilient infrastructure management. This work presents several case studies from the SIAGUA project as examples, highlighting the practical applications and benefits of combining InSAR with traditional monitoring techniques.

Keywords: Radar interferometry, Dam monitoring, European Ground Motion Service (EGMS), Deformation, Measurements

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