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Monitoring dams structural stability from space using differential SAR interferometry

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Monitoring the deformation of large scale man-made structures is of vital importance for avoiding catastrophic loss of infrastructure and life. Many structures that require monitoring may span distances from few hundred meters, e.g. dams, to many tens of kilometers, e.g. dikes and levees. The widespread deterioration and some recent collapses of these man-made structures have highlighted the importance of developing effective structures monitoring strategies that can help identify structural problems before they become critical and endanger public safety. Moreover, the rapid pace of development has led to the establishment of a large number of linear-shaped structures such as reservoir dams. Spatial steadiness and operational security of these man-made facilities are becoming the focus of attention since deformation implies potential hazards or risks developing within or around these structures. Measuring and monitoring deformations of these man-made objects and structures is a key task of applied geodesy and geomatics engineering; however these deformation measurements techniques, though undeniably very accurate and reliable, are based on detecting the changes at specific points with the prior interest and

investments in human resources or special equipment. The deformation monitoring schemes may vary greatly since they are targeted towards different deformation scenarios and mechanisms. In the last years, significant efforts have been undertaken by international researchers to find an efficient way for deformation monitoring of man-made structures. However, dams monitoring is still being a challenging task. In the case of dams, due to the high risk they represent, the supervision is regulated by national authorities. The main goal of the public supervision is to ensure a uniform high level of dams and appurtenant structures safety, and thereby to ensure that these structures are not posing a threat to life, property or the environment. Despite the fact that only little attention has been given to remote sensing technologies, the rapid development of space technology, occurred in the last decades, has allowed the detection of the displacement of Earth surfaces from space with high precision and unexpected benefits for Earth observation and related global studies. This progress has been possible thanks to microwave images obtained through Synthetic Aperture Radars (SAR) mounted on satellites and the development of Multi-Temporal Interferometry (MTI) techniques. MTI has the potential to support the development of new and more effective means of monitoring and analyzing the health of dams and add redundancy, at low cost, for their monitoring to support and assist warning systems. With SAR Interferometry specific dams can be monitored to identify and investigate targets with suspicious displacement on a monthly or weekly time-scale. As a result, timely identification of potential problems can help mitigate their impact on structural health and lower infrastructure rehabilitation costs.This paper presents the current status of RemoDams project, which is devoted to the monitoring of dam structural stability from space using satellite radar interferometry.