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Application of Interferometric Radar techniques for survey and monitoring of unstable slopes in the Alps in the frame of the EC Framework 6 GMES project ASSIST

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ASSIST aims at improving the capabilities of risk warning and risk management in the alpine region by implementing an integrated preoperational service based on existing precursor services. The service integrates information from different sources including earth observation. The project focus is on risks typical to mountainous areas such as avalanches, landslides, floods. The initial validation of the system is performed in the alpine border region of Austria, Italy and Switzerland. The design target of the ASSIST architecture is generic, so that it can also be used for other mountain areas world-wide. ASSIST (Alpine Safety, Security and Information services and Technologies) is an EC FP 6 STREP project within the Global Monitoring for Environment and Security (GMES) activity. Within ASSIST two main landslide related information layers are of interest, a survey map of instable areas (landslide detection), and the monitoring of selected areas (landslide monitoring). The focus is on terrain motion information determined from satellite SAR data using differential SAR interferometry (DinSAR) and Interferometric Point Target Analysis (IPTA) techniques.

The evaluation of differential interferograms obtained at different observation geometry and different time intervals, allows to produce an inventory of moving areas. While the interpretation of a single differential interferograms often remains highly speculative a more robust interpretation is possible as soon as several differential interferograms as considered. Here we will present the results of the ERS and JERS-1 data

based landslides survey. In general the results demonstrate a good potential. The active zones identified are in good agreement with available geodetic data. A particularly active area was observed to the west of the Reschenpass.

The monitoring of selected areas is conducted using the IPTA technique. In the Point Target Analysis the temporal and spatial characteristics of prominent targets such as buildings, rocks, and poles are systematically analyzed using a typically large repeat-track SAR data stack. The interferometric processing of these points allows to map point wise surface deformation histories, terrain heights, and relative atmospheric path delays. The use of targets with point like scatter characteristics has the advantage that there is much less geometric decorrelation. This permits phase interpretation even for large baselines above the critical one. Consequently, more image pairs may be included in the analysis. Important advantages are the potential to find scatterers in low-coherence areas and that interferometric image pairs with large baselines may be included in the analysis. Finding usable points in low-coherence regions fills spatial gaps in the deformation maps while the ability to use large baselines improves the temporal sampling. From the available ERS data stack only the data acquired during the snow free period were used. In this alpine region the correction of an altitude dependent atmospheric phase delay was found a relevant improvement. The analysis showed linear displacements for some villages in the Unterengadin and confirmed the creeping slope west of the Reschenpass. These findings fit the general understanding based on the available geodetic data. A more detailed validation of the results is ongoing

In some cases, particularly in the frame of an operational service such as ASSIST, the data available from satellites are not sufficient for the landslide monitoring. Constraints such as data acquisition reliability, imaging geometry, topographic effects, data acquisition interval, spatial resolution affect the performance. If the monitoring of a selected slope is of interest, a Terrestrial Radar Interferometer can fill the gap. In our presentation we will also give a short overview on the ongoing development of a Terrestrial Radar Interferometer and discuss its expected performance.