Geophysical Research Abstracts
Vol. 12, EGU2010-12252, 2010
EGU General Assembly 2010

Monitoring Water Dams Related Geomorphologic Changes and Increased Ground Instability using SAR Interferometric Techniques

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Development of large infrastructure is always a trigger for changes in the geomorphological pattern of the surrounding areas. One such example is the development of a water dam; the heavy weight of this structure, combined with the one from the cumulated water represents an important factor leading to ground subsidence. As an effect, surrounding mountain slopes become active, leading to landslides threatening the water dam itself.
The subject of the paper is a case study in the Carpathian Mountains of Romania. The SIRIU water dam, developed in an active part of the mountains (thus with steep topography), generates land subsidence in the village downstream and heavy landslides activity on the slopes of the surrounding mountains, affecting the lake and the roads along it. This case study was designed as a pilot project for the Romanian Ministry of Environment without any prior knowledge of the area from ASRC side. A landslide was initially indicated as a prime target for monitoring. In the end, a large number of landslides, including very local ones, were detected and ground validation was done in the field. The deformation measurements obtained with InSAR are remarcable because of the high-resolution obtained using the 300 MHz bandwidth Spotlight mode of Terra-SAR X. The sub-meter resolution of the radar made possible to identify movement down to individual rocks level. Validation was easily done by visual identification of the moving rocks and concrete structures in the image and observations on the ground. In every area that was indicated by InSAR as unstable we found evidence of landslides, with metric precision.
As mentioned, the monitoring technology consisted in Interferometric Synthetic Aperture Radar techniques using the German Terra-SAR X data kindly provided by Infoterra Gmbh. Initially, Persistent Scatterers Interferometry was intended to be applied but because of the complicate topography of the region, ASRC decided to acquire multiple interferometric pairs as an initial step in order to identify the optimal acquisition geometry, that would illuminate the best the areas of interest. Out of 8 data pairs, one specific pair proved to be very useful in detecting motion in our area of interest. This paper will present results obtained with this pair. In the future, once we found out the optimal geometry, we will acquire data only in that mode and will apply Persistent Scatterers Interferometry for continuous monitoring.