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Characterization of large instabilities displacements using Ground-Based InSAR

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A master thesis in progress at the Lausanne University (IGAR) in cooperation with the Åknes/Tafjord Early Warning Centre in Norway aims to characterize various instabilities displacements using Ground-Based Interferometric Synthetic Aperture Radar system (GB-InSAR). The main goal is to evaluate the potential of GB-InSAR to determine displacement velocities and mechanical behaviours of several large rock instabilities in Norway.

GB-InSAR data are processed and interpreted for three case studies. The first test site is the unstable complex area of Mannen located in the Romsdalen valley (Møre og Romsdal county), threatening infrastructures and potentially able to cause a debacle event downstream. Its total volume is estimated to 15-25 mill m3. Mannen instability is monitored permanently with GB-InSAR since February 2010 and shows displacements towards the radar up to -8 mm per month during the most sensitive period. Børa area located on the southwest side of Mannen instability shows also some signs of activity. It monitored temporarily between August and October 2011 and could help to understand the behaviour of Mannen site. The second, Indre Nordnes rockslide in Lyngenfjord (Troms county), is directly located above an important fjord in North Norway causing a significant risk of tsunami. The volume is estimated to be around 10-15 mill m3. The site was monitored temporarily between June and August 2011. The data show displacements towards the radar up to -12 mm in 2 weeks. The third case concerns rock falls along the road between Oppdølsstranda and Sunndalsøra (Møre og Romsdal county). Even if the volume of rock is less important than the first two cases, rock falls are an important problem for the road 70 underneath. Several campaigns are done between beginning of 2010 and end of 2011. In June 2011 an important rock fall occurs in an area where significant movements were previously detected by GB-InSAR.

In order to understand the behaviour of these instabilities and compare the contributions of different techniques, data from other monitoring data such as GPS, extensometers, crackmeters, tiltmeters, laser reflectors and LiDAR are integrated in the analysis. This integration of data results in the production of a mechanical model of the instabilities.

These data are also used to improve the knowledge about the method (parameters setting, processing, accuracy control), its limitations and characteristics depending on different contexts of studies. The problems such as atmospheric effects, loss of coherence between acquisitions and fringe interpretations are explored in order to improve the quality of results.