# InSAR monitoring of landslide hazard to highways in Südtirol

Fakultät für
Bauingenieurwesen und
Geodäsie

Institut für
Photogrammetrie
und GeoInformation
Prof. Dr.-Ing. habil.
Christian Heipke

Dr.-Ing. Mahmud
Haghshenas Haghighi
Tel. +49 511 762 -
2567
E-Mail:
mahmud@ipi.uni-
hannover.de

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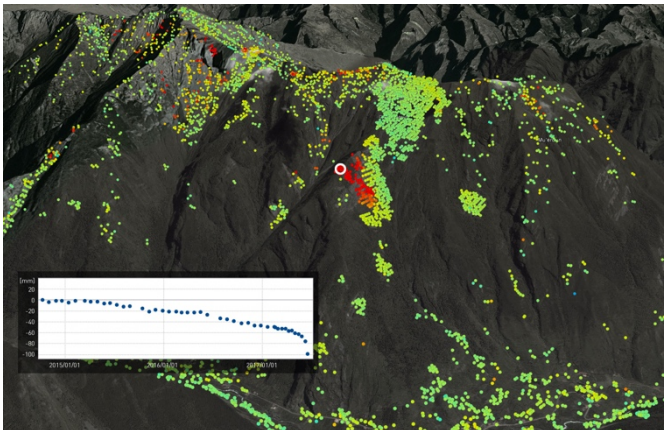
Landslides are a significant natural hazard to the civil infrastructure in the alpine regions. Due to the substantial uncertainty about the locations and time of occurrence of landslides, the responsible authorities have made considerable efforts in developing monitoring and warning systems. Geodetic measurements play a crucial role in this regard by collecting information about the stability of the landslides and raising alarms when acceleration is observed. However, repeating geodetic measurements in extreme alpine topographies is costly and labor-intensive. Interferometric Synthetic Aperture Radar (InSAR) can help obtain historical and up-to-date information about surface deformation and improve the spatial density and temporal resolution surface deformation measurements.

In this thesis, the hazard of landslide to highways in Austrian Südtirol will be investigated using advanced InSAR time series approaches of Persistent Scatterer InSAR and Small Baseline. The tasks include the following. First, different geometries of available SAR data and their suitability for landslide monitoring in the study area are studied. Then, eight years of Sentinel-1 and six months of TerraSAR-X data will be analyzed to assess the feasibility of medium and high-resolution SAR data in identifying pixels on the landslides close to selected highways. Different state-of-the-art pixel selection strategies will be assessed to identify the highest density of coherent pixels and colocate them with the available geodetic measurements. The impact of snow cover on the pixel selection will be analyzed to evaluate the possibility of continuous and seasonal InSAR analysis in the region. In the next step, the effect of tropospheric phase delays and their impact on the estimated deformations are analyzed. Finally, the results will be compared with precise geodetic measurements to estimate the uncertainty of the InSAR measurements.

In this thesis, the student will work with practical applications of InSAR time series analysis as a powerful tool for geodetic measurements. They will have a unique chance to work with commercial and open-access SAR data for real-world applications. An ideal candidate has good Matlab programming knowledge. Basic familiarity with Linux and the command line will be an advantage but can also be learned during the thesis.

This thesis will be supervised by Dr.-Ing. Mahmud Haghshenas Haghighi.

Figure 1:. InSAR time series analysis of precursory of the landslide that hit a village in Maoxian county in Sichuan province, China in June 2017. The landslide was triggered by heavy rains. Source: TRE ALTAMIRA.



Besucheradresse:
Nienburger Straße 1
30167 Hannover
www.ipi.uni-
hannover.de