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Differential synthetic aperture radar interferometry for landslide monitoring: a priori GIS based assessment of feasibility

S. Plank (1), J. Singer (1), Ch. Minet (2), and K. Thuro (1)

(1) Chair for Engineering Geology, Technische Universität München, Munich, Germany (simon.plank@mytum.de, singer@tum.de, thuro@tum.de), (2) Remote Sensing Technology Institute, German Aerospace Center (DLR), Germany (Christian.Minet@dlr.de))

In the last two decades differential radar interferometry (D-InSAR) has proven to be a powerful remote sensing technique for detection and deformation monitoring of landslides with an accuracy of a few millimeters.
However, due to the inclined imaging geometry, areas with a topographic relief (where landslides usually occur) appear heavily distorted in the radar image. Thereby slopes inclined towards the radar sensor appear shortened (foreshortening) and in extreme even can cause an overlapping of different radar signals (layover effect); slopes oriented away from the radar seem stretched (elongation) or even can be shadowed by a steep mountain (shadowing).
These effects limit or even prohibit the use of a radar image for interferometric applications.
Besides these geometric distortions, the land cover has great influence on the applicability of differential radar interferometry. For example vegetation-free areas such as buildings and rocks show high coherence values over a long time period (high stability of their backscattering properties), whereas areas covered by vegetation, especially forests, have varying backscattering properties at different times (e.g. due to wind; temporal decorrelation). Areas with high coherence values in the radar interferogram are better suited for D-InSAR applications.
To date prior to an investigation using D-InSAR these limiting effects usually are only roughly estimated, sometimes leading to disappointing results when the actual radar images are analyzed. Therefore we present a GIS routine, which based on freely available digital elevation model (DEM) data (SRTM) not only accurately predicts the areas in which layover and shadowing will occur, but also determines the percentage of measurability of the movement of a landslide (portion oriented in radar line of sight) for a given radar acquisition geometry. Additionally land cover classification data (e.g. CORINE) is used to evaluate the influence of the landslide's land cover on D-InSAR deformation measurements.
This GIS routine is very flexible as each type of DEM data and land cover data available for the area of interest can be used. For instance by using a high resolution lasercan DEM, we were able to show a very high accurate prediction of areas affected by layover and shadowing, even exceeding the accuracy of the layover/shadow calculations of DLR's standard method (Geocoded Incidence Angle Mask).
Thus by using this new GIS application, it is possible to assess the feasibility of D-InSAR landslide deformation measurements in a certain region quite accurately prior to the expensive actual radar data is ordered.