



The Application of InSAR and Sentinel-1A data in Deformation Detection and GeoHazards Investigation along The Karakoram Highway, Pakistan part:Khunjerab Pass to Thakot.

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In this research we mainly focused the surface deformation detection and geohazards monitoring in a complex and dynamic environment using advanced SBAS-InSAR technique along the Karakoram Highway (KKH). For this purpose we applied 105 scenes of archived Sentinel-1A IW (Interferometric Wide-swath) mode SLC (single look complex) SAR products to monitor the surface deformation in the area. To eliminate the residual topographic phase and noise, three arc-second digital elevation model (DEM) data (with a pixel size of 30 m) generated by shuttle radar topography mission (SRTM) were adopted. The InSAR results were verified in the field and then geohazards inventory along the KKH from Khunjerab Pass to Thakot was generated.

From this research, it can be concluded that debris flow and landslide are the most frequent disasters, which are 224 and 180 in number, respectively. And there are also many unstable slopes were detected by SBAS-InSAR since the deformation information was obvious because of the movement of shattering and uncemented materials. The total area of geological hazards is approximately 845 km². Among them, debris flow disaster account for the largest area of 333.06 km² and the area of all unstable slopes is about 110 km². There are main three typical landslide types (landslide rockfall, rockslide) in this region and formed mostly in the slopes within 35°-45°. The rockfall and rockslide are mainly distributed along the Hunza valley and in deep canyons in the area north of Sost due to MKT. Because the impact of the multi-period tectonic movements made it more complex and fragile as there were tertiary deposits, quaternary deposits that were also subjected to severe weathering. The debris flow is developed in the region around Chilas and has the characteristic of large area and aggregation. And most of them are slope debris flow which can be formed on the huge fans of deposits and the terraces. From the present investigation, the debris flow is particular one geohazard caused the most serious damage to the KKH. Most of the debris flows were induced by the rain (in the south of Hunza valley) or the meltwater of glacier (in the north of Gulmit).

The SBAS-InSAR technique plays an important role in the detection and monitoring of the deformation in a very complex condition along the KKH. The distribution and attributes data of the main geohazards along KKH is the basic for further detailed investigation and research as well as it can provide scientific reference for the construction of the China-Pakistan Economic Corridor (CPEC).