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Deformation Monitoring of Landslide Based on Adapted Distributed Scatter Interferometric Synthetic Aperture Radar

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Abstract:

Landslide is a typical geological disaster, which may be caused by long-term heavy rainfall, human activities, and earthquakes. Landslides are extremely destructive so as to result in a serious threat to local public security. The deformation monitoring of landslide can provide an early warning and disaster prevention and mitigation measures. At present, the traditional landslide monitoring methods include absolute deformation monitoring, e.g. GPS surveying, total station and levelling， and relative deformation monitoring, e.g. displacement meter, crack meter and fiber optical sensors. Although these methods by ground measuring have the advantage of high precision, they can monitor only a limited number of points on the landslide body and need a large amount of field work and the high cost.

In order to improve the accuracy of potential hazard of landslide detection and achieve deformation information for landslide areas, we proposed an adaptive distributed scatterer interferometric Radar method (ADS-InSAR), which can automatically adjust the detection threshold according to the spatiotemporal coherence of different distributed scatterer (DS) so as to improve the density and reliability of spatial distribution of DS. After the time series network modelling and deformation solution of the ADS are achieved, the displacement deformation details of the landslide area are extracted. In this paper, the experimental area of Shuibuya Town, Enshi Prefecture, Hubei Province, China was selected and the Sentinal-1A radar images data were used from March 5, 2016 to April 5, 2017. The ADS-InSAR method was utilized to obtain the subsidence time series of the region. The deformation time series is finally analysed combined with hydro meteorological and related data. Experimental results indicated that the method proposed in this paper can effectively improve the density of DS distribution and can successfully detect the existing ancient landslide group and find multiple suspected landslide areas for disaster warning, and has high reliability and accuracy in landslide disaster prevention and mitigation.

