Preliminary Results of Surface Deformation along the Qinghai-Tibet Railway in Beilu River Section Derived by Small Baseline SAR Interferometry

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ABSTRACT:

The project of Qinghai-Tibet Railway (QTR) runs through continuous and island permafrost. The properties of permafrost are unstable and sensitive to temperature. In general, the strength of permafrost is similar to rock; however, when it thaws, it lost almost all the bearing capacity. Consequently, the surface displacements due to seasonally freezing bulge and thawing subsidence are the main hazards to engineering construction and maintenance in the permafrost regions. Although there are some plentiful studies on QTR, large-scale, high-resolution surface deformation surveillance using SAR interferometry is still rare in public literatures. In this study, taking the Beilu river section as the experimental site, we implemented the time-series SAR interferometry for monitoring the surface deformation along the railway. In total, 38 Envisat ASAR SLC images in image swath 2 mode, spanning from 18 Nov. 2004 to 17 Dec. 2009, were used. Based on the small baseline interferometric combination (smaller than 300 m spatially and 175 days temporally), 49 high coherent interferograms were firstly generated minimizing the seasonal decorrelation effect. Then, the deformation rates derived by the stacking and PSI techniques were compared, revealing good agreement with 3~8 mm/yr dispersion. We found that the surface deformation along the embankment of Beilu river section was obvious in the 5 years observation span, particularly in ice-rich and warm permafrost regions, with values ranging from -30 mm/yr to +30 mm/yr; and the PSI-derived historical displacements indicated explicit seasonal trends. All of above information were significant for the maintenance and safety operation of QTR.