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## SBAS-InSAR技术监测青藏高原季节性冻土形变

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### Investigation of the Seasonal oscillation of the permafrost over Qinghai-Tibet Plateau with SBAS-InSAR algorithm

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摘要

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#### 摘要

冻土的冻结和融化的反复交替会造成地质环境与结构的破坏,从而导致房屋和道路等地面工程建筑物的地基破裂或者塌陷,还会引起山体滑坡、洪水暴发以及冰川移动等。因此,监测冻土形变对确保冻土区工程建筑的稳定性和安全性,同时保证冻土区社会经济可持续发展具有重要的意义。目前,在冻土监测方面并没有能大面积监测冻土形变时间演化情况的有效方法,本文提出将InSAR技术中的小基线集方法(SBAS-InSAR)应用于监测冻土来获取其形变时间序列中。考虑到冻土形变呈现明显的季节性特征,本文提出利用周期形变模型来代替传统SBAS方法中的线性形变模型,从而更好地分离出高程残差和大气误差。利用ENVISAT卫星获取的21景ASAR影像图作为实验数据,采用改进的SBAS技术成功获取了青藏高原从羊八井站到当雄站铁路段冻土区的地表形变时间序列图,揭示了该冻土区从2007年到2010年的季节性形变演化情况。通过与研究地区温度变化的联合分析,发现所得到的地表形变结果与冻土的物理变化规律非常吻合,证明了SBAS-InSAR技术在冻土形变监测中具有良好的发展应用前景。

关键词 冻土, InSAR, SBAS (Small baseline subset), 青藏高原, 形变监测

#### Abstract:

The freezing-thawing processes of permafrost would destroy geological environment, and then result in rupture and collapses of buildings and roads, landslides, floods and the movement of glaciers, etc. Therefore, it is very important to monitor the ground deformation in the permafrost region for the stability and security of structures as well as development of economy. At present, there is no effective method for monitoring time deformation evolution of permafrost within large area. In this paper, we propose combination of small baseline subset (SBAS) technology for the measurements of deformation time series of permafrost. Considering that the deformation of permafrost is characterized by seasonal oscillation, a periodic model is introduced to replace the linear model in the conventional SBAS in order to better eliminate the effects of topographic residuals and atmospheric artifacts. 21 ASAR images acquired by the ENVISAT satellite are exploited by this method to monitor temporal evolutions of permafrost seasonal oscillation between 2007 and 2011 in the Qinghai-Tibet Plateau from Yangbajian to Damxung. By comparing with the field temperatures, it is found that the retrieved deformation sequences conform to physical characteristics of permafrost very well. The results demonstrate that SBAS-InSAR algorithm has good prospect in deformation monitoring over permafrost regions.

Keywords Permafrost, InSAR, SBAS, Qinghai-Tibet Plateau, Deformation monitoring

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