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论文

基于多源SAR影像矿区三维形变场的监测

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摘要:

针对DInSAR (differential interferometric synthetic aperture radar) 技术仅能获取雷达视线向 (line of sight, LoS) 形变的不足, 研究了融合多卫星平台求解三维形变场的模型与算法。该算法基于多卫星轨道模式下具有不同成像几何的多源SAR影像联合求解矿区地表形变场。研究表明: 采用该算法反演的下沉值与水准测量结果相互吻合, 均方根误差为±4 mm, 吻合程度优于单一影像源反演结果; 垂直向位移场与等值线均表明下沉盆地向老采空区偏移, 说明老采空区可能活化; 东西向水平位移场与等值线符合开采沉陷地表移动规律, 而且对于不同的成像模式, 东西向水平移动的影响亦不同; 由于卫星航向角的正弦值近乎为0, 使得三维算法对南北向位移不敏感。

关键词: 合成孔径雷达; 多源影像; 雷达视线向; 水平移动; 开采沉陷

Three-dimensional deformation field detection based on multi-source SAR imagery in mining area

Abstract:

Only one dimensional displacement in the line of sight(LoS) can be detected using DInSAR technique. In order to overcome this limitation, the three-dimensional(3-D) model and algorithm which fusing multi-source SAR images acquired with different geometric parameters in different satellite platform was proposed and validated to determine the 3-D displacement due to underground mining. Comparing with leveling observation indicates that the displacement derives from the 3-D algorithm coincide with leveling data more closely, and the root mean square error(RMSE) is ±4 mm. May be due to the activation of old goafs, both the displacement and contour in vertical direction indicates that the subsidence basin extends to the old goaf. The displacement and contour in east-west direction accord with the law of surface movement caused by mining, and the effects on the displacement along LoS will be significantly different when imaging mode different. Due to the small sine value of heading angle, the 3-D algorithm is not sensitive to the displacement in the north-south direction.

Keywords: synthetic aperture radar; multi-source imagery; line of sight; horizontal displacement; mining subsidence

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