

地球物理学报 » 2012, Vol. » Issue (10) : 3296-3306 doi: 10.6038/j.issn.0001-5733.2012.10.012

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引用本文(Citation):

刘云华, 屈春燕, 单新建. 基于SAR影像偏移量获取汶川地震二维形变场. 地球物理学报, 2012, (10): 3296-3306, doi: 10.6038/j.issn.0001-5733.2012.10.012

LIU Yun-Hua, QU Chun-Yan, SHAN Xin-Jian. Two-dimensional displacement field of the Wenchuan earthquake inferred from SAR intensity offset-tracking. Chinese J. Geophys. (in Chinese), 2012, (10): 3296-3306, doi: 10.6038/j.issn.0001-5733.2012.10.012

基于SAR影像偏移量获取汶川地震二维形变场

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Two-dimensional displacement field of the Wenchuan earthquake inferred from SAR intensity offset-tracking

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摘要

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摘要 本文以ALOS卫星PALSAR影像为数据源,采用强度图像偏移量方法获得的整个汶川地震地表二维形变场显示,整个映秀-北川地表破裂带全长约240 km,从西南端的虹口往北东方向一直延伸到青川县附近,在虹口及北川县城所在地为两个形变量最大区域,偏移量可达4~6 m,局部更是达到了6~8 m.在高川乡附近出现一斜列拉分阶区,宽约8~10 km.在映秀-北川断层的地表破裂迹线南侧约12 km处还有一条汉旺-白鹿次级破裂带,从漩口镇一直延伸到秀水镇,长度大约100 km,在白鹿附近形变量较大,可达3~4 m.另外在小鱼洞附近可见一个NW走向、长宽约10×5 km、形变幅度达3~4 m的连接以上两条破裂带的地表破裂带,性质为逆冲兼具左旋走滑.研究表明,利用SAR影像偏移量法能够获取近场几米量级的大形变量及客观揭示断层破裂迹线的真实形态和分段特征,可以成为野外观测、InSAR等手段的有益补充,综合以上几种观测手段,优势互补,我们可以构建更为真实的断层模型,进而对汶川地震的复杂破裂过程有更深入的了解.

关键词 SAR影像, 亚像素, 偏移量, 汶川地震, 地表形变

Abstract: In this paper, the sub-pixel offset-tracking method and ALOS image are used to map the Wenchuan earthquake rupture and to identify the faults activated by the earthquake. The results indicate that the Wenchuan earthquake produced at least two surface ruptures on the Longmenshan fault, the main rupture is named Beichuan-Yingxiu rupture (Longmenshan town-Gaochuan rupture in this map) and the secondary named Hanwang rupture. The former extends about 240 km along Longmenshan fault and is characterized by dextral-slip thrusting with horizontal displacement 4~6 m on average and a pull apart terrace about 8 km wide near Gaochuan town. The latter is 12 km south of the former, extending from Xuankou town to Xiushui town, about 100 km long. The maximum displacement about 3~4 m appears near Bailu town. A rupture named Xiaoyudong is located between the two ruptures before mentioned with NW-SE striking, and extends about 10 km, the maximum vertical displacement in this rupture is about 3~4 m. The research indicates that offset-tracking using SAR intensity image can be a powerful complement to differential radar interferometry and field research, which has severe limitations that are mainly due to data decorrelation and signal saturation, and it does not generally provide measurements in the near-fault area where large displacements occur. If we combine such methods together, a more realistic fault model can be established, which will contribute to the comprehension of the complicated rupture process in the Wenchuan earthquake.

Keywords SAR intensity image, Sub-pixel, Offset-tracking, Wenchuan earthquake, Ground displacements

Received 2012-01-09;

Fund: 国家自然科学基金(40874006); 中国地震局地质研究所基本科研业务专项(IGCEA1104)项目; 国家自然科学基金国际合作项目(41111140386)共同资助.

链接本文:

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