# COSEISMIC SURFACE DEFORMATION CAUSED BY THE WENCHUAN M8 EARTHQUAKE FROM INSAR DATA ANALYSIS

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**Abstract:** Studies show that the India plate continues to move northward at 50mm/year after the India-Eurasia collision. As its consequence, the Tibetan Plateau has been rising rapidly with crustal shortening and lateral extrusion, resulting in intense motion and deformation of surrounding areas.. GPS measurements indicate that the directions of displacements in the eastern Tibetan Plateau change from north-south to northeast and nearly east-west and their sizes decrease gradually toward east and south. One of the most conspicuous features is major faults which have been very active since the Late Quaternary. For instance, there are three large-scale left-slip faults between the Qiangtang, Songpan and East Kunlun blocks, i.e. the Karakunlun-Jiali, Mani-Yushu-Xianshuihe and East Kunlun faults, which accommodate the intense motion towards east and southeast. In particular, the Songpan and East Kunlun blocks are moving to east and southeast, pushing the stable Yangze plate in east, forming the big thrust nappe structure on the Longmen Shan. In the Tibetan Plateau, most major earthquakes occurred along boundary faults, of which the Mani M7.9 on 8 November 1997 and Kunlunshan M8.1 on 14 November 2001 have probably accelerated the motion of the Songpan and East Kunlun blocks to east and southeast, and strain building up in the Longmen Shan fault that is in a locking state. The sudden release of it has finally led to the Wenchuan M8 event.

The epicenter of this quake lies in a mountainous area over 3000m above sea-level, which is characterized by rugged relief, changeable weather, poor transportation and adverse natural environment that make deformation measurement very difficult. And there are only a few GPS sites in this region. Thus we use the differential interferometric synthetic aperture radar (D-InSAR) technique to study the coseismic deformation field of the event. This technology has been developed in the recent 10 years, which has advantages of whole-weather, whole-time, good stability and strong dynamic property, and does not need observational sites constructed on the ground. Comparing with other conventional geodetic methods, it can cover a larger spatial range continuously. Since Massonnet et al. (1993) used D-InSAR to obtain the deformation field of the 1992 Landers earthquake successfully, this technology has been widely applied to geoscience researches such as earthquakes, volcanoes and subsurface magma migration.

We use the InSAR technology to analyze the ALOS/PALSAR satellite data of Japan before and after the Whechuan, Sichuan M8 earthquake of 12 May 2008. The result shows four belts of coseismic surface deformation that cover Wenchuan, Moxian, Beichuan and Qingchuan, each 500km in north-south and 70km in east-west. The investigation indicates that the surface rupture zone caused by the earthquake coincides the Beichuan-Yingxiu fault, extending from nearby the epicenter southwest of the Yingxiu town, Wenchuan county to north of the Suhe, Qingchuan county for about 230km. The northwest wall of the seismogenic fault has uplifted, and its southeast wall has also risen, exhibiting a dominant thrust motion. The maximum relative displacement at the epicenter reaches 260cm, and the overall vertical displacement between the two fault walls is up to 330cm. A swell of 120-180cm displacements is present from Beichuan to Pingtong, where the displacements at the Leigu town are 170-180cm equivalent to vertical displacements 220-230cm. Another uplifted belt of displacements 70-80cm occurs nearby north of Suhe, Qingchuan. Around Ya'an and Mount Emeishan, and from Shehong to north of Chongqing, there is a large area of subsidence. In Chongqing and its south is seen a small uplifted area of 20-30cm. From Qingchuan, eastward to Guangyuan and Ningqiang, uplift amplitudes are 60-70cm. The whole area of the deformation filed is fairly large, even in the Sichuan basin occurs surface deformation of different degrees.

**Keywords**: Wenchuan Earthquake, Earthquake Activity, D-InSAR, Co-seismic Deformation Field

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Supported by National Key Technology R&D Program of China(2008BAC35B04-3 and 2008BAC38B03-3) and Wenchuan Earthquake Scientific Investigation Programm