

Monitoring of Surface Deformation in Northern Taiwan Using DInSAR and PSInSAR Techniques

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Received 12 August 2008, accepted 20 November 2009

ABSTRACT

We investigated the surface deformation of the northern Taiwan area, including the Taipei basin and its surrounding mountainous areas of the last fifteen years using the ERS-1, ERS-2 and ENVISAT SAR images. Although the Taipei basin now is well developed and amenable to research gathering using the Differential Interferometric Synthetic Aperture Radar (DInSAR) technique, the mountainous areas surrounding the basin are densely covered with various vegetation throughout different seasons inducing high noise ratio in interferograms. Therefore the DInSAR technique is ineffective for observation of surface deformations of these areas. As a result, we developed the Persistent Scatterer (PS) InSAR technique to extract the phase signal of the chosen PS points for this study. Our analysis result shows that the atmospheric disturbance and DEM residual can be successfully reduced and the precise information of surface deformation can be effectively obtained by the PSInSAR technique not only in the basin but also in the mountainous areas. Integrating the DInSAR and PSInSAR results, we observed conspicuous deformation events in northern Taiwan including: (1) the slight uplift in the Western Foothills, the Tatun volcanoes, the Linkou Tableland and the Taoyuan area; (2) the subsidence at the border of the Taipei basin; and (3) relative slight uplift rebound in the center of Taipei basin. The displacements along the Shanchiao, Chinshan, and Kanchiao Faults are large enough to be observed; the Taipei, Hsinchuang, and Nankang Faults are too small and cannot be discerned. Further comparison between the DInSAR, PSInSAR, and their corresponding leveling data shows a very coincidental pattern and measurably improves the authenticity of radar interferometry.

Key words: DInSAR, PSInSAR, ERS, ENVISAT, Surface deformation, Taipei basin, Northern Taiwan

Citation: Chang, C. P., J. Y. Yen, A. Hooper, F. M. Chou, Y. A. Chen, C. S. Hou, W. C. Hung, and M. S. Lin, 2010: Monitoring of surface deformation in northern Taiwan using DInSAR and PSInSAR techniques. *Terr. Atmos. Ocean. Sci.*, 21, 447-461, doi: 10.3319/TAO.2009.11.20.01(TH)

1. INTRODUCTION

Taiwan is located between the southeastern periphery of the Eurasian plate and the Philippine Sea plate. These two converging plates produced very active tectonics, which is revealed by the high seismicity and high deformation rate (for example, Ho 1986; Tsai 1986; Yu et al. 1997). Taipei, the most densely populated area, center of politics and

economics in Taiwan, is located in the Taipei basin at the northern part of the island. North of the Taipei basin, the Tatun volcanoes are assumed to be products of extensional collapse during the Pleistocene (Fig. 1; Teng 1990) after the collision between the Luzon volcanic arc and Eurasian continental margin at about 5 Ma (Figs. 1a and b). In the 1990s, the Unzen volcano on the island of Kyushu in Japan and the Mount Pinatubo of the middle Luzon Island erupted (for example, Bautista 1996; Newhall et al. 1996; Spence et al. 1996; Nakada et al. 1999; Yamashina and Shimizu 1999).

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