

# **PSI ANALYSES OF LAND SUBSIDENCE DUE TO ECONOMIC DEVELOPMENT NEAR THE CITY OF HANGZHOU, CHINA**

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## **ABSTRACT**

In this work we map the spatial and temporal patterns of the land subsidence near the city of Hangzhou, China by PSI analysis with more than 50 scenes of ERS-1/2 SAR images acquired from 1992 to 2006 to detect and retrieve the subsidence due to economic development. The main reason of land subsidence in Hangzhou is groundwater exploitation, which is necessary for the rapid economic development, especially in China. Xiaoshan (a district of Hangzhou) Economic and Technological Development Zone was approved as a state-level development zone by the State Council in May, 1993. Since then the zone has been suffering land subsidence from continuous pumping of groundwater, which is essential for industrial development. There have been more than 300 overseas-funded enterprises with investors from 26 countries and regions by the year 2006. The development of this area can be divided into three periods according to its pace: low-speed period (1993-1996), stable increase period (1996-2001) and high-speed period (2001-2006).

## **PSI TECHNIQUE**

Permanent Scatterers interferometry (PSI) is an advanced technique in comparison with the conventional InSAR technique and capable to retrieve surface deformation occurred in the past by exploring data archives.[1] This technique, which has been developed in the late 1990s by A. Ferretti, F.Rocca, and C.Prati (POLIMI)[2][3], was proved to be a powerful tool for exploring the slow movement of the earth's surface at local and at sub-regional scale.[4][5][6]. Since PSI overcomes the limitations of temporal and geometric decorrelation as well as atmospheric disturbance, it has become an operational tool for retrieve various kinds of displacement ranging from land subsidence, volcano motion to landslides[7]. PSs are those target preserve a good coherence and stable scatterer characters in a long time interval. Usually they are man-made or/and natural objects, i.e. statues, ventilating structures on the

roofs of buildings, utility poles, dams or rock outcrops etc[8]. DEM is important external data for PSI processing since it can compensate the topography and correct baseline effectively, so, in this study we used the ASTER derived DEM in the PSI processing since it provides with higher horizontal resolution compared with the current used SRTM DEM.

## **RESULT AND CONCLUSION**

This work is based on ERS-1/2 SAR data covering the period from 1992 to 2006 and the study area extends 6400 km<sup>2</sup>. To establish the relations between the development of economic and land subsidence PSI is applied, which can provide detailed and qualitative assessment of the subsidence evolution in the past. A comparison with published information based on the financial statement of the industry zone is performed. In order to increase the study's credibility, deformation out of the industry zone, which shows the nonlinear deformation due to the groundwater level seasonal changing, is considered as seasonal land subsidence correction for the results of the areas inside. Although, the Ch'ien-t'ang river is just across the all workspace, the suspend solid concentration of the river is too high to be used in industry, and the purification cost a lot comparing with groundwater exploitation. The review of 14 years of SAR data shows that the speed of economic development is responsible for the land subsidence of the industry zone.

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