

Temporal Land Displacement Map of Taiwan Using Sentinel-1 Data with Ionospheric Correction

Wan-Ting Liao (1), Chung-Pai Chang (1,2), Jui-Chi Lee (2), Jann-Yenq Liu (3), Kuo-Hsin Tseng (1,4)

(1) Center for Space and Remote Sensing Research, National Central University, Taoyuan City, Taiwan (coco83827@gmail.com cpchang@csrsr.ncu.edu.tw), (2) Department of Earth Sciences, National Central University, Taoyuan City, Taiwan (jclee@g.ncu.edu.tw), (3) Graduate Institute of Space Science, National Central University, Taoyuan City, Taiwan (jyliu@jupiter.ss.ncu.edu.tw), (4) Department of Civil Engineering, National Central University, Taoyuan City, Taiwan (khtseng@csrsr.ncu.edu.tw)

Taiwan is located at the convergent boundary between the Eurasian Plate and the Philippine Sea Plate. This tectonics produces high surface deformation rate and fault activities. In addition, due to the over pumping of groundwater in the western coastal plain of Taiwan, the agriculture and aquaculture induce extra land subsidence in the past 20 years. A systematic monitoring of land deformation using advanced remote sensing technology has been urgently needed.

The Interferometric Synthetic Aperture Radar (InSAR) technique has been proven applicable to analyze geohazards, i.e. earthquake, landslides, and surface displacement in an accurate and effective way. Sentinel-1 acquires images with various pre-defined scenarios to serve different thematic domains. It operates mostly in the Interferometric Wide Swath (IW) mode with dual polarization in east Asia, which provides a broad coverage with 250 km in width and 170 km in length. Therefore, it can be used to produce interferograms of the entire Taiwan effectively.

However, Taiwan is situated on the north edge of Equatorial Ionization Anomaly (EIA) Region. The Total Electron Content (TEC) irregularity between snapshots produce ionospheric effect on the interferograms. In the past, ionospheric effect may be ignored for a narrow latitudinal range of study area. But for EIA region, mostly the ionospheric residuals induce obvious fringes in the interferograms and will affect unwrapping and displacement result.

Here we utilize both global and regional ionospheric vertical TEC maps as produced by the International GNSS Service (IGS) and the Ionospheric Radio Science Laboratory of National Central University to compensate ionospheric phase in to the interferograms. A corrected displacement map of Taiwan and validated results with in situ GNSS measurements will be demonstrated also in this study.

Keywords: Taiwan, InSAR, Sentinel-1, Ionospheric effect, TEC, IGS