

Crustal Deformation Monitoring of the Japanese Islands by Space Geodetic Observations

Hiroshi Yarai

Geographical Survey Institute, Japan

E-mail : yarai@gsi.go.jp

Abstract

Space geodetic observation techniques, such as GPS and InSAR, have been playing an important role in monitoring the crustal deformation of Japan. GEONET (GPS Earth Observation NETwork) is the nationwide GPS array of Japan, which consists of 1240 GPS permanent stations, and is the largest GPS network of the world at present. This network, operated by Geographical Survey Institute (GSI), has been used for crustal-deformation monitoring and geodetic control. Since starting operation, GEONET have brought great contribution to geophysics. In particular, it brought a revolution to crustal deformation monitoring of the Japanese islands with its high spatial density (spacing about 20 km), high accuracy (a few mm) and continuity of observation, and has been providing new knowledge on tectonics and mechanisms of seismic events through detecting co- and post-seismic deformations. GEONET revealed also the constant deformation of Japanese Islands. The years of observation result shows the plate motion around Japan very clearly. Another notable discovery by GEONET is “slow slip event”, which is the very slow faulting without seismic signals but accompanied with crustal deformation. This type of crustal movement has not been able to be detected by traditional survey nor by seismometers. Slow slip event is important for understanding inter-plate coupling. In the last decade, the synthetic aperture radar interferometry (InSAR) has become a powerful tool to detect spatial surface displacement of the ground. There are some SAR satellites on the orbit. ENVISAT and RADARSAT have C-band (5.6-cm wave length) radar and ALOS “Daichi” has L-band (23.6-cm) radar. L-band radar wave can penetrate leaves and grasses and measure the ground movement directly, but C-band radar has difficulty in penetrating leaves and grasses. Therefore, L-band radar is much better for detecting crustal deformation in heavy vegetated areas like Japan. GSI has been monitoring surface displacement of Japan Islands using ALOS SAR data.