Reconstruction of Geodetic Reference Frame After the 2011 off the Pacific Coast of Tohoku Earthquake

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SUMMARY

A huge earthquake struck wide areas of eastern part of Japan on March 11th 2011. The earthquake, named the 2011 off the Pacific coast of Tohoku Earthquake, occurred large coseismic crustal deformation over the area. GNSS Earth Observation Network System of Japan, GEONET, detected the crustal deformation soon after the earthquake. The deformation was so huge that all the positions of geodetic control points, including GEONET CORS stations, triangulation control points and leveling benchmarks, were largely changed. As a result, the coordinates were no more consistent with those of "Survey Results", which were authorized by the government for survey use. Responding this inconsistency, the Geospatial Information Authority of Japan (GSI) immediately decided to stop providing the Survey Results and publicly announced it on March 14, 2011.

The Survey Results were extremely important for prompt and safe reconstruction and rehabilitation works after the earthquake. Therefore, reconstruction of geodetic reference frame, which was prerequisite for revision of the Survey Results, was strongly required to revise the Survey Results as soon as possible. However, large postseismic deformation up to several tens of centimeters a day at maximum just after the earthquake was detected by GEONET. This deformation implied that if GSI reconstructed the geodetic reference frame of Japan just after the earthquake, it would become inconsistent with actual coordinates in a short time because of the continuing large postseismic deformation. In order to cope with the contradiction, GSI verified the optimal timing for calculation of the new coordinates by estimating the amount of the future accumulated postseismic deformation from coordinate time series of GEONET stations. Based on the estimation, GSI decided to publish the new Survey Results of GEONET stations on May 31, 2011 and those of triangulation control points and leveling bench marks were also published on October 31, 2011

respectively.

The detailed procedure of the reconstruction after the earthquake is reported in this paper.