

# Development of Real-Time PPP Processing System of Japan and Its Evaluation by Comparison with Real-Time RTK System, Regard

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**Key words:** GNSS/GPS; real-time PPP; real-time RTK; crustal deformation monitoring

## SUMMARY

Precise Point Positioning (PPP) is outstanding positioning technique for GNSS real-time processing similar as GNSS real-time RTK positioning, which enables us to monitor crustal deformation in real-time. PPP is also extremely useful in variety of fields of applications, not only for surveying but also for navigations including several emerging fields like ICT construction, autonomous vehicle driving, smart agriculture and etc. GNSS real-time processing is also widely used for real-time monitoring of crustal deformation. Geospatial Information Authority of Japan (GSI) already developed a real-time monitoring system for GNSS CORS network of Japan (GEONET) by applying real-time RTK positioning. The system, Real-Time GEONET Analysis System for Rapid Deformation Monitoring (REAGARD) has been already fully operational and utilized for near real-time estimation of earthquake magnitude and source fault modeling at the time of large earthquakes. It is also utilized for rapid tsunami inundation simulation in collaboration with the Cabinet Office, Government of Japan. The system is highly beneficial for monitoring of crustal deformation and disaster mitigation. However, we still have a challenge on redundancy on the system. It adopts single baseline RTK as the main processing technique. This means the network completely depends on a single reference CORS and will stop in case of failure of the reference station. Another issue is computational cost of processing. In RTK processing, the computational cost will drastically increase corresponding with increase of the number of stations, and this will limit the number of stations which system can handle simultaneously. On the other hand, PPP can process each CORS data individually, and thus do not depends on reference station and can easily handle huge number of stations by dividing them into multiple CPU cores. Therefore, GSI has been developed the accurate PPP processing system which can handle over 1,300 GNSS CORS network of Japan in real-time. GSI already finished to develop a prototype system and started to evaluate its performance in test operation since 2018. We will report the performance of real-time PPP system through comparison with already operational real-time RTK system, REGARD.

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