High-rate GPS Application in Dynamical Deformation Monitoring

Aizhi Guo

KEY WORDS: Monitoring Concepts for Static and Dynamic Deformations of Engineering and Geotechnical Structures
Applications in Geotechnical and Structural Engineering
Applications in Geosciences on Local and Regional Scales

ABSTRACT:

High-rate GPS(1Hz or higher) has wildly used as a powerful tool in Geo-science research, hazards monitoring and engineering application such as landslides, earthquakes, bridges structure monitoring, etc. Recent research shows that 1Hz GPS data aliased in near field of moderate-magnitude earthquake, so the data with higher sampling is needed. We investigate the PPP strategy in high-rate GPS data processing based on the GIPSY 6.0 and data source (1Hz and 50Hz) come from Crustal Movement Observation Network of China (CMONOC). The result of different sampling shows the nearly same stability and precision, 6mm and 4mm standard deviation for north and east component respectively after applying the ARTA, which has the same accuracy as differential approach. To investigate the frequency contributions present in the high-rate (1Hz and 50Hz) signals, we estimated and analysed the Power Spectral Density (PSD) of different sampling data. In the part of below 0.5Hz, the 50Hz result shows smoother than 1Hz ones, and the possible reason is that the square-root information filter of GISPY could get a well estimated state equation with shorter interval. By analysis the data before and after Mw 9.0 Tohoku Japan Earthquake，the result clearly show the large dynamical displacement of the S-wave, Love-wave and Rayleigh-wave even in the station XJBL, more than 5500km from the epicenter. In order to get the difference of long period signals of 50Hz and 1Hz in time and amplitude range, we computed the max and min peaks of 25 stations after applying low-pass filter, most the amplitude discrepancy are about or smaller than 1mm but 50 Hz result with higher time resolution. By comparing the high-rate GPS displacement with the one induced from broadband seismometers, it is shown that the two results are highly in agree with each other in sub-centimeter especially the east component.