Real-time monitoring of strong seismic waves with GPS precise point positioning

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Real-time monitoring system of strong seismic wave is considered as a complement system to current seismometric technique because a GPS estimate is not acceleration of coordinates but an instantaneous position at sampling epoch. Since GPS Earth Observation NETwork (GEONET) in Japan has a real-time streaming capability since 2003, it has made a real-time GPS processing possible with latency of a few seconds.

We estimated seismic motions of the 11 GEONET stations in the 2003 Tokachi-oki earthquake (Mj=8) occurred around 19:50 (UTC) of Sep. 25, 2003. The RTNet software with precise point positioning (PPP) strategy was used for the processing. The RTNet PPP estimate with IGS final products (satellite orbit and clock) showed seismic motion of GPS stations with clear delay of arrival of seismic waves depending on baseline length between epicenter and GEONET stations. The RTNet PPP estimate with predicted satellite orbit/clock products (IGU product) showed the similar variations with IGS's with a few offsets. The RTNet PPP estimate with an improved real-time satellite clock data from network estimation helped to reduce such biases.

The current sampling rate in GEONET station is 1 second, and the rate seems not to enough to track peak to peak variations of strong seismic wave. Future high rate GPS observation such as 5 or 10 Hz sampling should help to detect more details of the strong seismic wave.

We will also introduce the coordinate estimates from RTNet for a few other historical earthquakes in Japan.