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# Assessment of the accuracy of PPP for very-high-frequency dynamic, satellite positioning and earthquake modeling

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With the advent of various GPS/GNSS Point Positioning techniques, it became possible to model the dynamic displacement history of specific points during large and rather moderate earthquakes using satellite positioning, 1Hz and occasionally 10Hz sampling data.
While there is evidence that the obtained data are precise, experience from monitoring of engineering structures like bridges, indicates that GPS/GNSS records are contaminated by coloured (mostly background noise) noise even in the cases of differential-type analysis of the satellite signals. This made the necessary the assessment of the results of different PPP processing using supervised learning techniques.
Our work was based on a modification of an experiment first made to assess the potential of GPS to measure oscillations of civil engineering structures. A 10Hz GNSS antenna-receiver unit was mounted on the top of a vertical rod, fixed on the ground and forced to controlled oscillations. Oscillations were also recorded by a robotic theodolite and an accelerometer, and the whole experiment was video-recorded. A second 10Hz GNSS antenna-receiver unit was left on stable ground, in a nearby position.
The rod was forced to semi-static motion (bending) and then was left to oscillate freely until still, and the whole movement was recorded by all sensors. GNSS data were analyzed both in kinematic mode and in PPP mode, using the GIPSY-OASIS II (http://gipsy-oasis.jpl.nasa.gov) (only GPS) and the PPP CRCS facility (GPS + GLONAS).
Recorded PPP and differential kinematic processing coordinates (apparent displacements) were found to follow the real motion, but to be contaminated by a long-period noise. On the contrary, the short-period component of the apparent PPP displacements, obtained using high-pass filtering, were very much consistent with the real motion, with sub-mm mean deviation, though occasionally contaminated by clipping.
The assessment of the very-high frequency GPS noise will provide useful information about the accuracy of such a type of measurement for earthquake source studies and earthquake engineering applications.