Feasibility Study on the Integration of Low-cost GPS and Leica GNSS SpiderNET for Real Time Deformation Monitoring Applications

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ABSTRACT:

Dual frequency geodetic GPS receivers have been widely used for deformation monitoring that requires highly reliable and accurate data for analysing 3-D movements of man-made or natural objects. With the advance of GPS receiver technology, low-cost high sensitivity GPS receivers such as u-blox LEA-4T, EVK-6T and Leica GMX901 are available on the market. These types of GPS, in addition to providing code range data for meter level positioning, L1 carrier phase data can also be extracted for precise positioning. Investigations carried out by the authors on the performance of the u-blox LEA-4T and Leica GMX901 GPS receiver shows that centimeter level accuracy can generally be achieved with low-cost receivers available on the market for deformation monitoring applications. However, the reliability and accuracy can be easily affected by ionospheric and multipath effects. Further investigations were carried out by the authors to integrate these low-cost receivers into Leica's GNSS SpiderNET software which adopts Master Auxiliary Concept (MAC) Network Corrections to reduce ionospheric effects in real time.

In this paper, investigation results on the accuracy of u-blox and Leica low-cost GPS under different satellite visibility and data collection conditions are presented, followed by discussions on the integration of these GPS receivers into the GNSS SpiderNET. Comparison in terms of positioning accuracy and reliability of these receivers with the MAC GPS network and dual-frequency GPS RTK approaches were carried out. Our investigations show that low-cost GPS receivers can be successfully interfaced with the GNSS SpiderNET platform and achieve satisfactory real-time positioning performance under the GPS network approach. This will open an alternative approach for low-cost, accurate and reliable deformation monitoring applications.