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Accuracy Analysis of Relative Position Using Single-Frequency GPS Receivers

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The accuracy of GPS (Global Positioning System) derived relative positions of stations depends on several factors such as the baseline length, duration of observation session, the methodology, the software for processing GPS data and employed single frequency GPS receivers used influence the results. The aim of this study is to obtain the usage of the single-frequency GPS receivers, which have much lower costs comparing with the dual-frequency GPS receivers and to analyze the usability of them, especially in the geodetic applications. Additionally, this study indicates the performance of the single-frequency GPS receivers comparing with the dual-frequency GPS receivers.

Our study investigates how the accuracy depends on baseline length (denoted L), on the duration of the observing session (denoted T) using the single-frequency GPS receivers. For the analysis, we selected seven days in 2009 from the GPS observations which provided by the 'National Geodetic Survey' archives. The data with 4h, 6h, 12 h and 24 h observing session duration in 2009 were analyzed with Bernese 5.2 GNSS software. The baseline length varies between 11 km and 110 km.

This study indicated that single-frequency GPS receiver can provide the root-means -square (RMS) that criterion for the accuracy of about 5 mm horizontally and 14 mm vertically for the average of all observation session and baseline length while dual-frequency GPS receiver can provide RMS values of about 1 to 3 mm horizontally and 4.5 mm vertically. It is evident that single-frequency GPS receiver would become an attractive alternative to the conventional dual frequency receiver in the geodetic applications.

Keywords: GPS accuracy analysis, Baseline length, Single frequency GPS receiver