

Automatic monitoring for continuous GPS tracking stations using the indices of GPS data quality

Abstract

Six indices are chosen to investigate the relationship between data quality and GPS positioning precision. They are the number of observations, multipath on L1, multipath on L2, occurrence of cycle slips, relative frequency offset, and frequency stability. The first four indices are evaluated by using the TEQC software and the last two indices by the Bernese software, which is also used to process the observations of three GPS tracking stations with ranges of 25 km (short baseline), 150 km (mediate baseline), and 2000 km (long baseline). To reduce common errors, seven types of GPS receivers were selected and set up at an Ultra-Short Distance Network of NML (National Measurement Laboratory, Taiwan) in the years 2002, 2003 and 2004. The results of this study indicate that the frequency stability is the most critical factor among the six indices of interest to influence the GPS positioning precision. The frequency instability may cause positioning error as much as 17.5 mm. The second and third critical error sources are the number of observations and the multipath effect, respectively, with a maximum error of 10.7 mm on the precision of coordinates. In contrast, for the method of parameter estimation, the cycle slips and relative frequency offset have minor effects on positioning precision with a few occasional exceptions. The findings of the current study will serve as a crucial basis to classify the positioning accuracy of the tracking stations for long term analysis.

Keywords: GPS, data quality, positioning precision, frequency stability