Does stochastic modelling affect long baseline GPS positioning?

S. Jin (1, 2, 3), J. Park(1) and P. Park(1)

(1) Korea Astronomy and Space Science Institute, 61-1, Whaam-dong, Yusong-gu, Daejeon 305-348, South Korea, (2) Shanghai Astronomical Observatory, Chinese Academy of Sciences, Shanghai 200030, China, (3) School of Surveying & SIS, the University of New South Wales, Sydney, NSW 2052, Australia (sgjin@kasi.re.kr / Fax: 82-42-861-5610)

The global positioning system (GPS) has become an essential tool for the high-precision orbit determination, positioning and navigation. Traditionally, data processing for precise GPS positioning is invariably performed using the least squares (LS) method. The quality of LS solutions depends on the model's formulation regarding GPS observations, including both a functional model, which describes the mathematical relationships between the GPS measurements and unknown parameters, and a stochastic model, which tells us the statistical properties of the measurements. Over the past two decades, the functional models for GPS measurements have been investigated in considerable detail. However, the stochastic models of GPS observation data are simplified, assuming that all the GPS measurements have the same variance and are statistically independent. Such assumptions are unrealistic. Although there are a few studies about the effects of stochastic models on GPS relative positioning, they are restricted to short baselines and short session lengths. In this paper, the stochastic modeling for long-baseline positioning is analyzed using the residual-based stochastic model. Results show that using this stochastic model the precision of GPS baseline estimation is improved. Although the effect on horizontal GPS baseline components is not significant, there are 3-6 mm variations in the vertical baseline component.

Key words: Stochastic modelling, GPS, IGS, Baseline