REGIONAL MODELING OF IONOSPHERE SPATIAL DECORRELATION USING GNSS

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ABSTRACT

Analysis of ionospheric spatial decorrelation in Korea is performed in order to support differential global navigation satellite systems. The ionospheric spatial decorrelation is modeled using a plate approximation with GPS data. Annual variations of the spatial decorrelation are analyzed using GPS data from 2003 to 2005. Variation of the L1/L2 inter-satellite bias is analyzed and discussed. The decorrelation in north-south direction is larger than east-west direction. The ionospheric spatial decorrelation decreases from 2003 to 2005 as the solar activity decreases.

I. INTRODUCTION

Spatial decorrelation of ionospheric delay represents the variation of the global navigation satellite system (GNSS) signal delay due to ionosphere along geographical location. Ionospheric storm causes sudden increase of the ionospheric spatial decorrelation and increases the ionospheric delay difference between two locations on the ground. The high ionospheric decorrelation degrades the accuracy of GNSS augmentation information, and it is a most concern for aircraft precision approach with GNSS augmentation systems, e.g. GBAS or SBAS. Since the ionospheric spatial decorrelation varies with geographic location as well as ionosphere activity, it is necessary to get the statistics of the ionospheric decorrelation over a regional area.

II. METHODOLOGY

A plate model is used in this research to model ionosphere delay distribution over Korea. Raw ionospheric delay measurements are fit into a plate model, and its model coefficients provide the ionospheric gradient along the north-south and east-west directions directly. The effect of the receiver noise is not significant since the ionosphere delay of the plate model is already averaged values and it mitigates the noise.

III. ANALYSIS RESULTS

GPS observation data by Korea National Geodetic Institute (NGI) network of 14 stations in year 2003 through 2005 is used to compute the ionospheric gradient. The mean gradient in north-south direction is up to 1.0 mm/km, which is larger than the gradient in east-west direction, close to 0.1 mm/km. The mean gradient in different local times are analyzed and 4 UTC (13 KST) shows the largest gradient and it corresponds to the fact that the ionosphere delay has a largest value around 13~14KST.

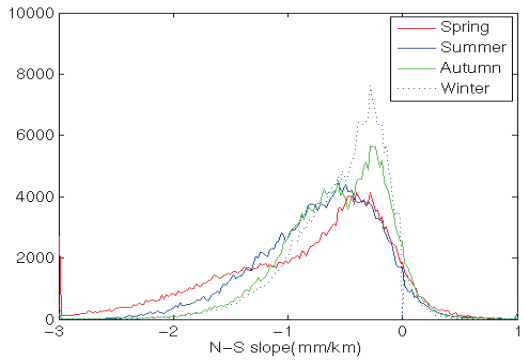

Figure 1 Seasonal variation of ionosphere gradient

Analysis of seasonal variation shows that summer shows a largest gradient and spring follows it as shown in Fig. 1.

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