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IONOSPHERE TOTAL ELECTRON CONTENT ESTIMATION BASED ON GNSS REGRESSION MODELS AT KNOWN POSITIONS

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Abstract. *In this paper, we present an ionosphere TEC (Total Electron Content) estimation method based on GNSS Regression models (abbreviated by GR models) and show to derive the ionospheric delay (or advance) local model in the sky over Japan using the Gps Earth Observation NETwork (GEONET) data provided from the Geographical Survey Institute (GSI) of Japan. By showing the GR models for GNSS observables in the case of known positions (in the reference stations), we derive a method to estimate the ionospheric delays (or advances) as well as the so-called integer ambiguities contained in L1 and L2 band carrier-phase data at the reference stations.*

Further, we derive the method of estimating the local model with power series for the vertical TEC (VTEC) at the ionospheric pierce points in the ionospheric single-layer model by using GPS receiver's data at many reference stations. Finally the estimated local model of the VTEC in the sky over Japan using GEONET data is shown comparatively with applying Klobuchar's model and with the Global Ionosphere Maps (GIMs) provided from the International GNSS Service (IGS).

Keywords: GNSS Regression Models, Ionospheric delay, VTEC, GEONET, Kalman filter

1. Introduction.

In this paper, we show the Ionosphere TEC (Total Electron Content) estimation method based on GNSS Regressive models (abbreviated by GR models) [1]-[4] and the estimated values of VTEC in the sky over Japan using the Gps Earth Observation NETwork (GEONET) data provided from the Geographical Survey Institute (GSI) of Japan [5].

We have already presented the very powerful model of observables in GPS/GNSS; called GR models. By applying GR models, we have already developed the precise point positioning (PPP) algorithm [1]-[3], and the very precise point positioning (VPPP) algorithm with multiple antennas [6]-[8]. These positioning algorithms achieved the positioning accuracy in decimeter level.

In Section 2, we show the GR models for GNSS observables in the case of known positions (in the reference stations). Then after several linear transformation of L1 and L2 band carrier phases, pseudoranges based on C/A code and P(Y) codes received at the reference stations, we show a method to estimate the ionospheric delays (or advances) as well as the integer ambiguities contained in L1 and L2 band carrier-phase data.

In Section 3, we discuss the local ionospheric model for the VTEC at the ionospheric pierce points in the single-layer ionospheric model so that we derive the estimation algorithm of VTEC models in the sky over Japan by using GEONET data.

Finally, we show the experimental results of estimated values of VTEC in the sky over Japan by using the real GEONET data provided from GSI such that we examine the