Expansion of ionospheric TEC observation from measurements of single frequency GPS signals

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Monitoring of the ionospheric total electron content (TEC) using observational networks of GNSS signals is now popular in many countries. Most of the networks are built in mid latitude regions. It is important to expand them in low latitudes where many interesting phenomena of ionospheric plasma exist. The purpose of this study is to develop an estimation method of the ionospheric TEC using not multi-frequency receiver but single frequency ones, and expand an observation network in low latitude region at low costs.
Two observables are obtained from single frequency GPS measurements; code pseudorange and carrier phase. In these observables, the ionospheric effect appears plus and minus, respectively. The ionospheric effect is, then, derived by their difference while it includes a bias error. For the estimation of the bias error, the TEC distribution is assumed to be represented by two-dimensional (latitude-longitude) model with a polynomial function in each dimension. A thin layer model is assumed for altitude distribution of the ionospheric plasma. Ranging errors except for the ionospheric effect and receiver clock error in code pseudorange measurements are removed using precise ephemeris and existing appropriate models. Accuracy of the bias estimation is a few TECU that is equivalent to standard deviation of measurement error of the code pseudorange.
We are now planning to build continuous observation site in a low latitude region.

Keywords: Single frequency GPS signal, Ionospheric TEC, Bias estimation

