Estimate of Absolute TEC from Dual-Band Beacon Receiver Network in Southeast Asia

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There are several satellites in low-earth orbit (LEO) that transmit dual-band beacon of 150/400 MHz to the ground. The beacon signal is useful to measure total electron content (TEC) of the ionosphere. This is an old but still important technique to monitor spatial structure of the ionosphere along the satellite pass. We have developed a simple digital receiver called GRBR (GNU Radio Beacon Receiver) (M. Yamamoto, Earth Planets Space, 60, e21-e24, 2008), and deployed the GRBR network in wide area (S. Tulasi Ram, M. Yamamoto, R. T. Tsunoda, S. V. Thampi, and S. Gurubaran, Radio Sci., 47, RS2001, doi:10.1029/2011RS004870, 2012). Now the network grew to total about 30 sites including about 15 sites in Southeast Asia. Main research topic is Equatorial spread F (ESF). The ESF is intense ionospheric irregularity that occurs around the geomagnetic equator, and can cause problems to satellite-ground communications and/or GPS navigations. The ESF has been a hot research topic for long time, but its onset condition and/or day-to-day variability are not well understood. By using the GRBR network with several polar-orbiting satellites and C/NOFS satellites in the very low-inclination orbit, we can clarify ionospheric structures before and during ESF events along latitude and longitude, respectively. The observations are limited during each LEO satellite pass, but spatial resolution is much better than similar analysis based on TEC data from GPS receivers.

A problem in the dual-band beacon experiment is determination of the absolute value from relative TEC measurements. In this study we discuss techniques that we developed for longitudinal and latitudinal observations. For longitudinal observations, we developed an automated procedure only by using data from a single station with the low inclination C/NOFS satellite, which results agreed well with observations from a Digisonde (S. Tulasi Ram, M. Yamamoto, R. T. Tsunoda, S. V. Thampi, and S. Gurubaran, Radio Sci., 47, RS2001, doi:10.1029/2011RS004870, 2012). On the other hand, latitudinal observations are conducted along the Thailand/Indonesia region. We developed a technique to determine absolute TEC by comparing data from meridional chain of GRBR sites and TEC from nearby GPS receivers. In the presentation we introduce the GRBR network, discuss analysis technique for absolute TEC determination, and show selected results of analysis.