

ABSTRACTS (MASTER THESIS)

Development of low-latitude ionosphere observation technique with dual-band beacon experiment from COSMIC-2 and TBEx satellites

(Graduate School of Informatics,
Laboratory of Radar Atmospheric Science, RISH, Kyoto University)

Nobuhiro Ujihara

In the low-latitude ionosphere, it is known that plasma bubbles, depletion of electron density, are generated. There are social needs for the studies to reveal mechanisms of plasma bubble generation, which can lead to the prediction of plasma bubble occurrences. The ionospheric Total Electron Content (TEC) measurement by satellite beacon is useful for studying the plasma bubble. In this study, we developed the TEC observation method using two different frequency beacon signals from COSMIC-2 and TBEx satellites which were launched on June 25, 2019. We conducted TBEx orbital simulation, developed signal analysis software, developed and set new beacon receiver, examined method estimating TEC by COSMIC-2 satellites. 400MHz/965MHz signals are used in beacon observation by COSMIC-2. As our old model the GRBR used 150MHz/400MHz signals, the signal processing was largely depending on integer frequency ratio of 3:8. We then developed a new signal processing for GRBR2 that is suitable to the COSMIC-2 beacon. There are two bias estimation method, single point method and multipoint method. Comparing the results, we found that the latter is better than the former in the point of estimation accuracy. We deployed three GRBR2 at three locations in Southeast Asia. We succeeded to find longitudinal TEC distribution like Figure 1 automatically by the above-mentioned observation scheme. Figure 2 is Average TEC distribution in October near Bangkok and Ho Chi Minh. We also showed TEC distribution at the solar eclipse event on December 26, 2019. TEC observation by TBEx satellites have not been done yet. However, observations using conventional satellites that use 150MHz/400MHz signals were successful without any problems.

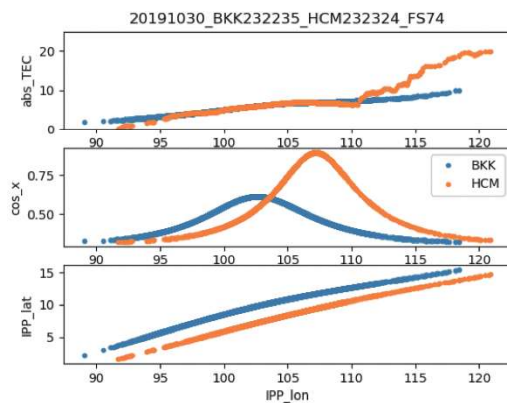


Figure 1. Longitudinal TEC distribution

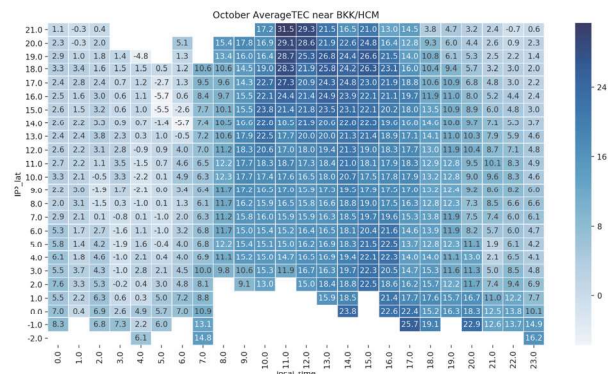


Figure 2. Average TEC distribution in October

As described above, in this study, we developed GRBR2 for TEC observation using dual frequency beacon signal using COSMIC-2 and TBEx satellites, and established a basic data analysis flow. We could not detect LSWS because of low solar activity. It is expected that LSWS is detected by TEC observation method developed in this study.