Current status of the project to investigate ionospheric effects on GNSS in Southeast Asia

Takuya Tsugawa[1]; Kornyanat Hozumi[2]; Punyawi Jamjareegulgarn[3]; Pornchai Supnithi[3]; Susumu Saito[4]; Yuichi Otsuka[5]; Shinichi Hama[6]; Takahiro Naoi[1]; Mamoru Ishii[1]
[1] NICT; [2] NICT; [3] KMITL; [4] ENRI, MPAT; [5] ISEE, Nagoya Univ.; [6] NICT

NICT have started a research project to investigate ionospheric impacts on GNSS positioning/navigation including precise positioning technique using quasi-zenith satellite (QZSS) since 2017. In this project, we have studied ionospheric effects on individual positioning techniques (single frequency, DGPS, and RTK-PPP) and consider methods to mitigate and/or prevent the positioning errors under severe ionospheric conditions such as large ionospheric storm and plasma bubble. In the low-latitude region such as Southeast Asia, one of the most important ionospheric phenomena is plasma bubble. Plasma bubbles can cause ionospheric scintillation on GNSS signals which pass through the plasma bubble structures due to ionospheric plasma irregularities inside the structures. The GNSS scintillation would result in the loss-of-lock on GNSS signals in the worst case. Therefore, it is important to precise observation of the plasma bubble structures and identify which satellite-receiver path suffers from the structures for verifying the plasma babble impacts on GNSS positioning.

In this project, we have proceeded to install a VHF radar at Chumphon (Thailand) and multi-GNSS receivers (TEC and scintillation monitors) at Chumphon, Bac Lieu (Vietnam), and Cebu (Philippines) at the magnetic equator. The VHF radar consisting of 18 Yagi antennas will use the frequency of 39.65MHz with 25kHz bandwidth. The radio license in Thailand has been approved in June 2019 and will be installed in November-December in 2019. The multi-GNSS receiver, Septentrio PolaRx5S, have been installed in Chumphon in June 2019. The other two receivers will be installed in Bac Lieu and Cebu in August-September in 2019. In this presentation, we will report the current status of the project.